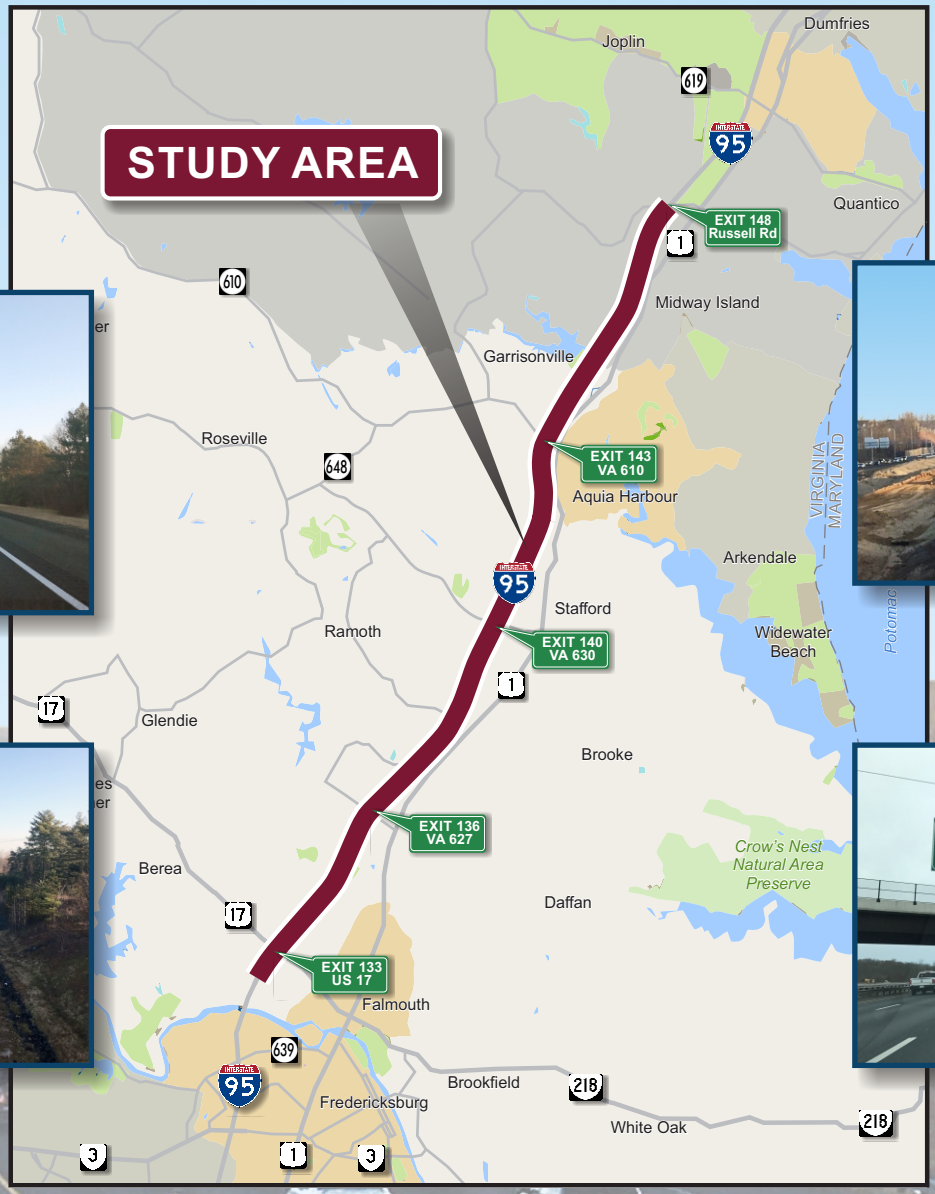
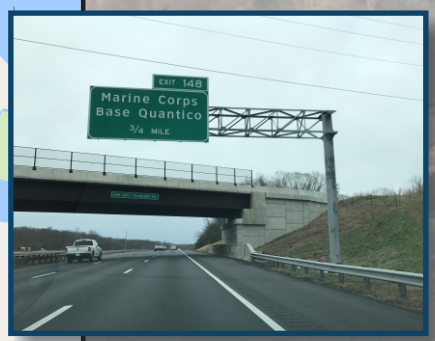
Interstate 95 Express Lanes
Fredericksburg Extension Study

INTERCHANGE JUSTIFICATION REPORT





VDOT Virginia Department of Transportation

U.S. Department of Transportation
Federal Highway Administration

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Interchange Justification Report

I-95 Express Lanes Fredericksburg Extension

Commonwealth of Virginia

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APPENDICES

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Appendix R: Stafford County Resolution of Support

Appendix S: Limited Access Revisions at Courthouse Road

LIST OF ACRONYMS

ADT	Average Daily Traffic
EA	Environmental Assessment
FAMPO	Fredericksburg Area Metropolitan Area Planning Organization
FBG	Fredericksburg Station
FHWA	Federal Highway Administration
FRED	Fredericksburg Regional Transit
GP	GP
HCS	Highway Capacity Software
HOT	High-Occupancy Toll
I-95	Interstate 95
IPF	Iterative Proportional Fitting
LOS	Level of Service
MCBQ	Marine Corps Base Quantico
MPH	Miles per Hour
MPO	Metropolitan Planning Organization
MVMT	Million Vehicle Miles Traveled
MWCOG	Metropolitan Washington Council of Governments
NCHRP	National Cooperative Highway Research Program
NEPA	National Environmental Policy Act
TRB	Transportation Research Board
VDOT	Virginia Department of Transportation
VRE	Virginia Railway Express

EXECUTIVE SUMMARY

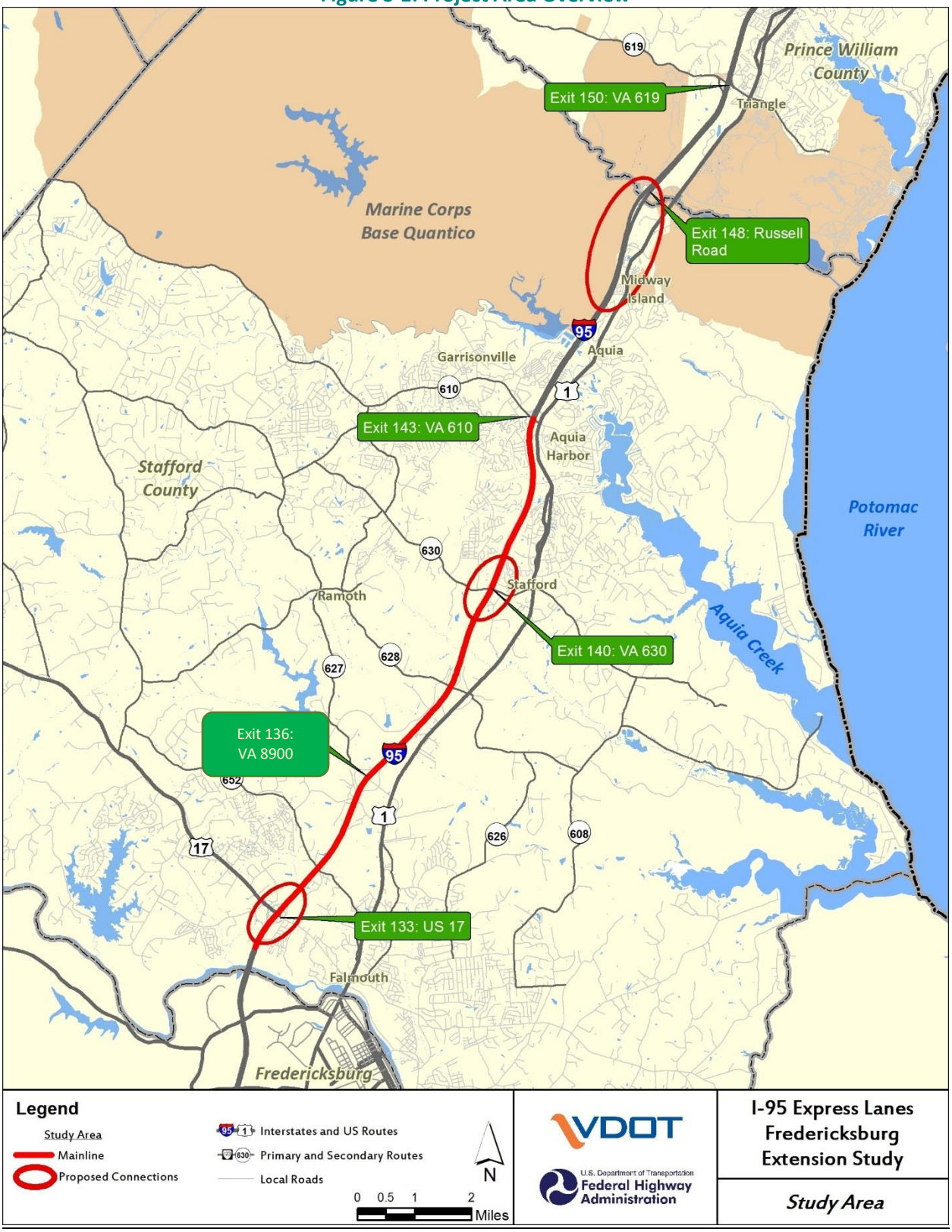
The Virginia Department of Transportation (VDOT), in coordination with the Federal Highway Administration (FHWA), has initiated an Interchange Justification Report for the I-95 Express Lanes Fredericksburg Extension Project (or the "Fredericksburg Extension Project") in Stafford County, Virginia. The project would extend two reversible High Occupancy Toll (HOT) lanes south from the current terminus of the I-95 Express Lanes located south of the I-95 / Route 610 interchange at Garrisonville Road (Exit 143) to south of the I-95 / US 17 North interchange at Warrenton Road (Exit 133). The proposed project also includes new access points between the existing I-95 Express Lanes and I-95 General Purpose (GP) lanes south of the I-95 / Russell Road interchange (Exit 148).

I-95 serves as the primary north-south corridor through Stafford County, serving a mix of local, commuter, and regional travel. The study segment is impacted daily by recurring congestion during the morning and evening peak periods. South of Exit 143, I-95 currently consists of three northbound and three southbound travel lanes, separated by a vegetated median. North of Exit 143, I-95 currently consists of three northbound and three southbound GP travel lanes; there are also two existing reversible HOT lanes within the median (branded as the I-95 Express Lanes). Use of the I-95 Express Lanes is restricted to transit vehicles and High Occupancy Vehicles (HOV) with 3 or more occupants equipped with an EZ-Pass Flex, or passenger vehicles with 1 or 2 occupants equipped with an EZ-Pass. On weekdays, the I-95 Express Lanes operate in the northbound direction between 2:30 AM and 11:00 AM and operate in the southbound direction between 1:00 PM and midnight.

Existing operations along I-95 are currently congested during peak periods. In the AM peak, congestion builds in the northbound direction, starting near the I-95 / VA-610 interchange at Garrisonville Road (Exit 143). This congestion spills back towards the I-95 / VA-630, I-95 / Centreport Parkway, and I-95 / US 17 interchanges to the south, resulting in reduced travel speeds and extended travel times. In the PM peak, two existing bottlenecks are noted along I-95 southbound. Traveling south, the first bottleneck occurs in the area north of the I-95 / VA-610 interchange (Exit 143). Traffic from the I-95 Express Lanes at the system's southern terminus must re-enter the I-95 GP lanes, resulting in congestion which spills back north towards the I-95 / Russell Road and I-95 / VA-619 interchange at Joplin Road/ Fuller Road (Exit 150). The second bottleneck occurs in the southbound direction at the I-95 / US 17 interchange at Warrenton Road (Exit 133). Heavy merging traffic from US 17 southbound enters the I-95 GP lanes, resulting in congestion which spills back north towards the I-95 / Centreport Parkway and I-95 / VA-630 interchanges. The operational analyses for No Build conditions indicate continued worsening of operations along the I-95 corridor due to increased demand projected in the Opening and Design Years. In the case of I-95 southbound, the proposed I-95 Southbound Rappahannock River Crossing project will serve to address the existing bottleneck at the I-95 / US 17 interchange, improving operations in the segment south of VA-630 (Courthouse Road). Existing and future traffic operations are summarized in Chapters 3 and 7.

The proposed Build Alternative would construct two reversible Express Lanes in the median of I-95 for approximately ten miles. The improvements would south of the I-95 / US 17 North Interchange at Warrenton Road (Exit 133) and continue north where they would tie into the I-95 Express Lanes Southern Extension Project, located south of I-95 / VA 610 Interchange at Garrisonville Road (Exit 143). The Express Lanes would be located in the median of I-95 and consist of two, 12-foot reversible lanes with 10-foot shoulders on each side. **Figure S-1** depicts the project area and the proposed connection locations between the I-95 general purpose lanes and I-95 Express Lanes.

Figure S-1: Project Area Overview



Various improvement concepts and configurations for access were evaluated for the I-95 Express Lanes. These concepts were evaluated in terms of traffic operations, safety, connectivity, environmental impacts, and costs. A preferred set of access points and configurations were identified which balanced these important factors. A summary of the alternatives considered for the study interchange is included in Chapter 4.

Access to and from the NB Express Lanes would occur as follows:

- North of the I-95/US 17 North Interchange (Exit 133), vehicles could enter the Express Lanes from the left lane (west side) of the NB I-95 GP lanes via a new slip ramp or from a new flyover entrance from the right lane (east side) of the NB I-95 GP lanes.
- At VA 630 / Courthouse Road (Exit 140), an entrance to the Express Lanes would come directly from Courthouse Road (this ramp is reversible and will serve both NB and SB travel).
- South of Russell Road (Exit 148), a new flyover ramp would provide an exit from the Express Lanes to enter the I-95 NB GP lanes from the right side.

Access to and from the SB Express Lanes would occur as follows:

- South of Russell Road (Exit 148), users in the I-95 SB GP lanes could enter the Express Lanes just south of VA-637 via a new flyover from the right lane (west side).
- At VA-630 / Courthouse Road (Exit 140), a new exit from the Express Lanes would connect directly to existing Courthouse Road (VA 630, Exit 140); this ramp is reversible and will serve both NB and SB travel.
- North of US 17 North (Exit 133), a new flyover ramp would provide an exit from the Express Lanes to access the VA-3 or US 17 interchanges, or SB travelers could access I-95 SB GP lanes via a new slip ramp which would enter on the left.

Analysis was conducted using the microsimulation tool *VISSIM*. A calibrated *VISSIM* model was developed for approximately 35-miles of the I-95 corridor. The model was updated to reflect several planned projects along the I-95 corridor and to account for projected future traffic growth. A multi-hour simulation period was used to evaluate operations in the morning and evening peak periods; a 3-hour period from 6 – 9 AM and a 4-hour period from 3 – 7 PM. Measures of effectiveness including travel times, travel speeds, vehicle throughput, and density were obtained for freeway segments. Measures of effectiveness including delay, throughput and queues were obtained for intersections along the arterial street network at each interchange.

The operational analysis results for Build conditions (summarized in Chapter 7) for the Opening Year indicate enhanced operations in the I-95 general purpose lanes compared to the No Build conditions. For the Design Year, enhanced operations in the I-95 general purpose lanes are anticipated during the AM peak for Build conditions; however, some degradation was noted during the PM peak under Build conditions. The results of the operational analysis found that total vehicle throughput along the I-95 corridor would increase in the peak periods under the Build Alternative. Additionally, while congestion would remain in the I-95 GP lanes, travel speeds and travel times would improve as traffic shifted to the I-95 Express Lanes (for all time periods other than the 2042 PM peak). Lastly, consistent, reliable travel times would be provided within the I-95 Express Lanes for toll, HOV, and transit users. This would serve to expand travel choices for users of the I-95 corridor by providing improved travel times and reliability for Express Lane users (including HOV-3+ and transit vehicles). Potential additional improvements (which have been identified which could be constructed to improve operations in the I-95 southbound GP lanes

in the PM peak in the Design Year. Additionally, increased demand for the I-95 Express Lanes (above the baseline projections provided in this report) would also result in improved operations in the southbound GP lanes. These additional analyses are summarized in Chapter 7.

In 2016, Transurban and VDOT entered a Preliminary Development Framework Agreement to develop the proposed extension of the I-95 Express Lanes to just north of the I-95 / US 17 North interchange at Warrenton Road. VDOT then initiated a Revised Environmental Assessment for the I-95 Express Lanes Fredericksburg Extension Study to update the findings of the 2011 EA based on the proposed improvements, along with the traffic operational and safety analyses to support the development of this IJR. VDOT currently anticipates obtaining FHWA concurrence for a Finding of No Significant Impact (FONSI) in early 2018. The project is anticipated to be procured through a Design-Build procurement method (administered by Transurban), with construction completed in 2020.

The National Capital Region Transportation Planning Board (NCRTPB) approved an amendment to add the I-95 Express Lanes Extension Study to the Fiscal Year 2017-2022 Transportation Improvement Plan (TIP) (MWCOG, 2017), the Fredericksburg Area Metropolitan Planning Organization (FAMPO) included a project to extend the Express Lanes from near VA 610 / Garrisonville Road (Exit 143) to Exit 126 in its *2040 Long Range Transportation Plan* (FAMPO, 2013), and the Stafford County Comprehensive Plan recommended reducing traffic congestion on I-95 by extending the Express Lanes from Garrisonville Road to Exit 126 (Stafford County, 2016).

To further demonstrate that the proposed modifications meet the threshold for FHWA, this section provides a summary of proposed responses to the Eight Policy Points. Details are provided in the IJR to support each of these statements.

FHWA POLICY POINTS SUMMARY

The following section of the report outlines the eight (8) policy requirements listed in the Federal Register (Vol. 74, August 27, 2009) as they apply to the I-95 Express Lanes Fredericksburg Extension. These criteria are reviewed by FHWA when approving requests for new or modified access points on the interstate:

1. *The need being addressed by the request cannot be adequately satisfied by existing interchanges to the Interstate, and/or local roads and streets in the corridor can neither provide the desired access, nor can they be reasonably improved (such as access control along surface streets, improving traffic control, modifying ramp terminals and intersections, adding turn bays or lengthening storage) to satisfactorily accommodate the design-year traffic demands (23 CFR 625.2(a)).*

I-95 currently suffers from daily, recurring congestion in the AM and PM peak periods due to traffic demand exceeding the available roadway capacity. Future traffic projections indicate continued growth in traffic demand along the I-95 corridor. The needs being addressed also include improved travel time reliability and expanding travel choices by increasing the attractiveness of ridesharing and transit usage. I-95 serves as the primary north-south corridor in Stafford County and continuing north into Prince William County. The proposed I-95 Express Lanes extension and associated access points along the I-95 corridor will provide additional roadway capacity in the Study Area by increasing the number of travel lanes from three lanes to five lanes in the peak direction, provide more reliable and predictable travel times for users through the use of dynamic pricing to control demand and support consistent highway speeds in the HOT lanes, and improve the attractiveness of ridesharing by providing a toll-free, highway speed option for transit and high-occupancy (HOV-3+) vehicles. These needs cannot be adequately satisfied by improving existing access points and / or the local roads and streets in the corridor.

2. *The need being addressed by the request cannot be adequately satisfied by reasonable transportation system management (such as ramp metering, mass transit, and HOV facilities), geometric design, and alternative improvements to the Interstate without the proposed change(s) in access (23 CFR 625.2(a)).*

A Transportation System Management (TSM) alternative was considered to address the needs of the corridor. TSM strategies focus on improving the operational efficiency of the roadway transportation system without major capacity improvements, such as adding new lanes or new ramps. While numerous TSM strategies currently exist along the I-95 corridor within the Study Area, including traveler information (including travel times), park-and-ride lots at various locations with transit service and "casual" carpooling alternatives, traffic detection and corridor monitoring capabilities, Safety Service Patrol (SSP) to respond to incidents, and the existing Express Lanes for HOV and toll service, the needs of the corridor cannot be adequately satisfied solely by a TSM alternative. The existing demand with these TSM measures in place exceeds the available capacity along the I-95 corridor, resulting in delays and poor travel reliability. Additional TSM measures would not be sufficient to address the identified needs.

3. *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 shall, 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, shall 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 must 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 must also include a conceptual plan of the type and location of signs proposed to support each design alternative (23 U.S.C. 109(d) and 23 CFR 655.603(d)).*

An operational analysis was conducted for existing, Opening Year and Design Year conditions. The relevant traffic operational analysis within the project area is summarized in Chapter 7. The operational analysis, conducting using the microsimulation tool *VISSIM,* includes an assessment of travel times, travel speeds and density within the existing I-95 GP lanes and within the proposed I-95 Express Lanes. In the Opening and Design Years, conditions would continue to deteriorate in the I-95 GP lanes through the Study Area, resulting in increased travel times and decreased reliability. The analysis found that the proposed Build Alternative, including the proposed access points, would not adversely impact operations within the I-95 GP lanes (for time periods other than the southbound PM peak in 2042) and free-flowing travel conditions would be provided in the I-95 Express Lanes. Even with the proposed Build Alternative, the I-95 GP lanes will likely remain congested for extended travel periods as the demand along the corridor will continue to exceed the overall capacity; however, travel times within the GP lanes will improve relative to the No Build conditions. Additionally, total vehicle throughput in the peak direction of travel will increase in the peak periods under the Build Alternative (by approximately 15 - 25 percent in the AM and by approximately 10-15 percent in the PM), directly addressing the need to provide additional capacity along the corridor. Additional potential improvements, specifically a southbound auxiliary lane

between the Garrisonville Road and Courthouse Road interchanges, were identified which could be constructed as part of a separate project to mitigate the potential impacts to the southbound I-95 GP lanes of the proposed Build Alternative. It should be noted that these impacts are related to additional traffic attempting to access the I-95 corridor and not a design or capacity issue within the proposed I-95 Express Lanes or the proposed connections between the Express Lanes and the GP lanes.

Based on the results of sensitivity analyses conducted for this report, potential additional improvements to the I-95 southbound GP lanes, specifically a continuous auxiliary lane between the on-ramp from Garrisonville Road (Exit 143) to the off-ramp to Courthouse Road (Exit 140) could substantially mitigate the impacts of this additional demand being attracted to the corridor. Additionally, a northbound continuous auxiliary lane between the same two interchanges would provide further operational benefits within the northbound I-95 GP lanes during the AM peak period, where substantial congestion is noted. Lastly, sensitivity analyses indicated that measures to shift additional demand from the I-95 GP lanes to the I-95 Express Lanes would also provide notable operational benefits within the I-95 GP lanes during the AM and PM peak periods.

Travel speeds within the I-95 Express Lanes are projected to be free-flowing, with highly reliable travel times for toll and HOV users. This will serve to address the reliability needs along the corridor (users who need a predictable travel time during peak periods could utilize the I-95 Express Lanes) as well making ridesharing a more attractive alternative compared to single occupant travel in the I-95 GP lanes.
Safety analyses are summarized in Chapter 8. The proposed improvements primarily consist of extending the existing two-reversible I-95 Express Lanes 10-miles south within the existing median. The safety performance within the existing I-95 Express Lanes from the current terminus at Garrisonville Road to the Russell Road interchange has been excellent, with a limited number of crashes (primarily rear-ends in the southbound direction) over the first two years of operation. Those rear-end crashes are associated with congestion at the current system terminus, which is projected to be alleviated by the proposed Build Alternative. The reversible I-95 Express Lanes system will be constructed to current standards (with a limited number of Design Exceptions and Waivers as noted below) and would be expected to have similar safety performance to the current portions of the system.

The proposed Build Alternative does include six (6) new access points between the I-95 GP Lanes and the I-95 Express Lanes. The location of these new access points along the I-95 GP lanes were assessed using the existing crash history. Most of the new access points are located in areas with below average crash rates relative to the Study Corridor and are not expected to negatively impact safety. Additionally, the direct connection between the I-95 Express Lanes and Old Courthouse Road would not be anticipated to negatively impact safety. The proposed ramp terminates at a single-lane roundabout which would help control traffic speeds as vehicles transition from the I-95 Express Lanes to the local and arterial street system. A quantitative safety analysis was performed to assess the potential impacts of the proposed Build Alternative in terms of the change in volumes using the I-95 GP lanes. This analysis predicts that a 5 percent reduction in crashes in the GP lanes could be achieved if the Build Alternative were constructed.

A conceptual signing plan has been developed for the proposed modifications and is included in **Appendix K**. A Technical Working Group (TWG) was established to review the signing plan for consistency with VDOT and FHWA requirements and ensure that the proposed signing is in accordance with the Manual on Uniform Traffic Control Devices.

4. *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 for 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)).

Most of the proposed new access points are between the I-95 Express Lanes and the I-95 GP lanes. One new direct access, in the form of a reversible ramp connection, is proposed from the local street network (Old Courthouse Road) to the proposed I-95 Express Lanes. This access will provide an enhanced connection from the relocated park-and-ride lot, to be located along Old Courthouse Road at the I-95 / VA-630 interchange at Courthouse Road.

The proposed improvements will be designed in accordance with AASHTO and VDOT standards, as appropriate. A summary of the Design Criteria for the project is included in **Appendix H**. One design exception for a reduced design speed along the reversible ramp to / from Old Courthouse Road is proposed. Three design waivers, one for reduced shoulder strength and width, one for spot shoulder width reductions, and one related to design vehicles and superelevation transitions, are also proposed.

5. *The proposal considers and is consistent with local and regional land use and transportation plans. Prior to receiving final approval, all requests for new or revised access must be included in an adopted Metropolitan Transportation Plan, in the adopted Statewide or Metropolitan Transportation Improvement Program (STIP or TIP), and the Congestion Management Process within transportation management areas, as appropriate, and as specified in 23 CFR part 450, and the transportation conformity requirements of 40 CFR parts 51 and 93.*

Locality plans from the National Capital Region Transportation Planning Board (NCRTPB), the FAMPO, Prince William County, and Stafford County all indicate the need for transportation improvements to ease commuter traffic issues. The NCRTPB approved an amendment to add the I-95 Express Lanes Extension Study to the Fiscal Year 2017-2022 Transportation Improvement Plan (TIP) (MWCOG, 2017), FAMPO included a project to extend the Express Lanes from near VA 610 / Garrisonville Road (Exit 143) to Exit 126 in its *2040 Long Range Transportation Plan* (FAMPO, 2013), and the Stafford County Comprehensive Plan recommended reducing traffic congestion on I-95 by extending the Express Lanes from Garrisonville Road to Exit 126 (Stafford County, 2016).

6. *In corridors where the potential exists for future multiple interchange additions, a comprehensive corridor or network study must accompany all requests for new or revised access with recommendations that address all of the proposed and desired access changes within the context of a longer-range system or network plan (23 U.S.C. 109(d), 23 CFR 625.2(a), 655.603(d), and 771.111).*

There are several other major projects currently planned or under construction within the study segment of I-95. These include the 2.2-mile extension of the I-95 Express Lanes at Garrisonville Road (nearing completion), the relocation and reconstruction of the I-95 / VA-630 interchange at Courthouse Road and widening of VA-630 from two lanes to four lanes (under construction), the I-95 / Route 3 Interchange Safety improvements at Exit 130 (under construction), the I-95 Southbound Rappahannock River Crossing project (design-build procurement underway), and the I-95 Northbound Rappahannock River Crossing project (planning underway). The geometric and access changes associated with each of these projects has been separately addressed in an operational analysis or Interchange Modification Report approved by VDOT and FHWA. The proposed improvements were assumed in the appropriate analysis years in the operational analysis contained in this IJR.

7. *When a new or revised access point is due to a new, expanded, or substantial change in current or planned future development or land use, requests must demonstrate appropriate*

coordination has occurred between the development and any proposed transportation system improvements (23 CFR 625.2(a) and 655.603 (d)). The request must describe the commitments agreed upon to assure adequate collection and dispersion of the traffic resulting from the development with the adjoining local street network and Interstate access point (23 CFR 625.2(a) and 655.603 (d)).

The proposed improvements are not intended to support any singular planned future development. Instead the improvements are intended to support the ongoing growth in traffic demand along I-95 corridor as growth in residential development and employment continues in Stafford County and points south. Proposed future land use along the corridor is summarized in Chapter 9.

8. *The proposal can be expected to be included as an alternative in the required environmental evaluation, review and processing. The proposal should include supporting information and current status of the environmental processing (23 CFR 771.111).*

The Virginia Department of Transportation (VDOT), in coordination with the Federal Highway Administration (FHWA) as the lead federal agency, has prepared a Revised Environmental Assessment (Revised EA) for the Interstate 95 (I-95) HOT Lanes Project, for which a Finding of No Significant Impact (FONSI) was issued by FHWA in 2011. The Revised EA, which has been completed for the I-95 Express Lanes Fredericksburg Extension Study, presents improvements identified in a portion of the 2011 FONSI-selected Alternative, from the I-95 / US 17 North interchange at Warrenton Road (Exit 133) to south of the I-95 / Russell Road interchange (Exit 148). The Revised EA also includes new access points along this portion of the 2011 FONSI-selected Alternative. As part of the study, environmental resources along the corridor have been updated according to the latest available data and information, and potential impacts that the project would have on social and environmental resources have been examined. A FONSI is anticipated in early 2018, after approval of air quality conformity analyses and updates to the National Capital Region Transportation Planning Board's Constrained Long-Range Plan (CLRP) and Transportation Improvement Program (TIP), as well as the Statewide Transportation Improvement Program (STIP). Additional details regarding the Revised EA can be found in Chapter 10.

1. INTRODUCTION

The Virginia Department of Transportation (VDOT), in coordination with the Federal Highway Administration (FHWA), has initiated an Interchange Justification Report for the I-95 Express Lanes Fredericksburg Extension Project (or the "Fredericksburg Extension Project") in Stafford County, Virginia. The project would extend two reversible High Occupancy Toll (HOT) lanes south from the current terminus of the I-95 Express Lanes located south of the I-95 / Route 610 interchange at Garrisonville Road (Exit 143) to south of the I-95 / US 17 North interchange at Warrenton Road (Exit 133). The proposed project also includes new access points between the existing I-95 Express Lanes and I-95 GP lanes south of the I-95 / Russell Road interchange (Exit 148).

I-95 serves as the primary north-south corridor through Stafford County, serving a mix of local, commuter, and regional travel. The study segment is impacted daily by recurring congestion during the morning and evening peak periods. South of Exit 143, I-95 currently consists of three northbound and three southbound travel lanes, separated by a vegetated median. North of Exit 143, I-95 currently consists of three northbound and three southbound GP travel lanes; there are also two existing reversible HOT lanes (branded as the I-95 Express Lanes). Use of the I-95 Express Lanes is restricted to transit vehicles and High Occupancy Vehicles (HOV) with 3 or more occupants equipped with an EZ-Pass Flex, or passenger vehicles with 1 or 2 occupants equipped with an EZ-Pass. On weekdays, the I-95 Express Lanes operate in the northbound direction between 2:30 AM and 11:00 AM and operate in the southbound direction between 1:00 PM and midnight.

1.1 PROJECT BACKGROUND

In 2011, VDOT completed an Environmental Assessment (EA) for a transportation improvement proposal submitted under the Public-Private Transportation Act (PPTA). The proposal, from Flour and Transurban, proposed expanding the existing High Occupancy Vehicle (HOV) system along the I-95 and I-395 corridors and converting the existing HOV lanes to HOT operation. The 2011 EA reviewed a study area that extended along I-95 from 1.1 miles south of the I-95 / US 17 South Interchange in Spotsylvania County (Exit 126) to just north of the I-95 / I-495 / I-395 Interchange in Springfield (Exit 169).

Since 2011, some sections of the proposed Express Lanes have been constructed or are under construction. Improvements proposed from the I-95 / Route 610 Interchange at Garrisonville (Exit 143) to the Turkeycock Run interchange on I-395, opened in December 2014. Following a National Environmental Policy Act reevaluation of the 2011 EA, completed in March 2016 (FHWA, 2016b), construction was recently completed to extend the Express Lanes approximately two miles south from the previous southern terminus located north VA 610 / Garrisonville Road (Exit 143). This project, called the I-95 Express Lanes Southern Extension, recently opened to traffic (but is not reflected in the existing conditions analysis for this report), and includes the addition of a reversible, single lane in the median of I-95, which splits into NB and SB merge ramps (VDOT, 2017b) south of Exit 143.

In 2015, VDOT completed the I-395 Express Lanes Northern Extension EA, followed by a Revised EA in 2016, which documented a preferred alternative that would extend the I-395 Express Lanes eight miles from the Turkeycock Run Interchange to the vicinity of Eads Street in Arlington (I-395, Exit 8). Two existing HOV lanes would be converted to three Express Lanes using a portion of the existing shoulder. Construction of the I-395 Northern Extension began in summer 2017, and is expected to be completed by summer 2020 (VDOT, 2016).

The remaining portion of the I-95 / I-395 Express Lanes system yet to be approved for construction extends from south of the VA 610/Garrisonville Road (Exit 143) to 1.1 miles south of the I-95 / US 17 South Interchange in Spotsylvania County (Exit 126).

In 2016, Transurban and VDOT entered a Preliminary Development Framework Agreement to develop an extension of the I-95 Express Lanes south to just north of the I-95 / US 17 North interchange at Warrenton Road. The proposed project also includes new access points between I-95 Express Lanes and I-95 GP lanes near the I-95 / Russell Road interchange. VDOT then initiated a Revised Environmental Assessment for the I-95 Express Lanes Fredericksburg Extension Study to update the findings of the 2011 EA based on the proposed improvements.

1.2 STUDY AREA / PROJECT LOCATION

The study area for this IJR extends approximately 22 miles, from approximately 1 mile south of the I-95 / VA-3 interchange at Plank Road (Exit 130) to north of the I-95 / Russell Road interchange (Exit 148). The study area includes a total of six interchanges with roadways with access to I-95. The study area includes all GP and Express Lanes ramps accessing I-95, and a minimum of two signalized or unsignalized intersections along the arterial street network at each interchange. **Figure 1-1** provides a high-level overview of the study area and proposed project location.

1.3 PURPOSE AND NEED

The purpose of the I-95 Express Lanes Fredericksburg Extension is to:

- Reduce daily congestion and accommodate travel demands more efficiently. Existing traffic volumes exceed available highway capacity, and the forecasts prepared using the regional travel demand models show continuing traffic growth in the corridor, with much of the Fredericksburg region's workforce continuing to commute north towards Washington, DC.
- Provide higher reliability of travel times. People place a high value on reaching their destinations in a timely manner, and in recent years, I-95 has become so congested that the existing I-95 facilities cannot provide reliable travel times during the peak periods.
- Expand travel choices by increasing the attractiveness and utility of ridesharing and transit usage while also providing an option for single-occupant vehicles to bypass congested conditions.

1.4 PROPOSED BUILD ALTERNATIVE

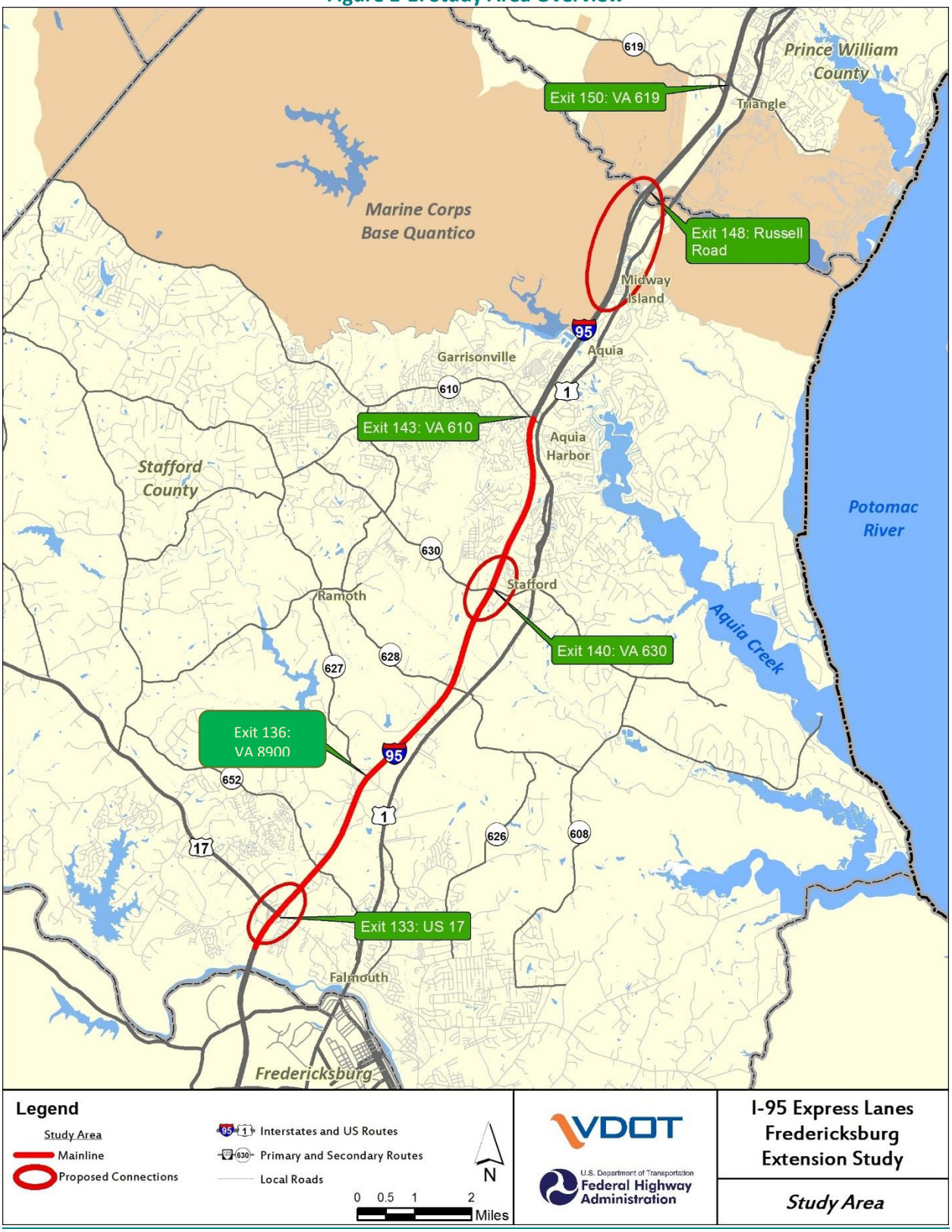
The Build Alternative would extend two reversible HOT lanes in the median of I-95 from south of the I-95 / US 17 North Interchange at Warrenton Road (Exit 133) to south of the I-95 / VA 610 Interchange at Garrisonville Road (Exit 143) to tie into the recently completed Southern Extension Project. It would also provide Express Lane access near the I-95 / US 17 North Interchange at Warrenton Road (Exit 133), the I-95 / VA 630 Interchange at Courthouse Road (Exit 140), and the I-95 / Russell Road Interchange (Exit 148).

1.5 REPORT ORGANIZATION

The purpose of this Interchange Justification Report is to document the data collection, traffic forecasting, and operational and safety analysis efforts performed to assess potential operational improvements for the study corridor. The report is organized in the following fashion.

- **Section 1** provides an overview of the study.
- **Section 2** outlines the methods used to assess traffic operations.
- **Section 3** describes existing conditions including an inventory of multimodal transportation infrastructure, as well as peak hour and daily traffic volumes, crash trends, vehicle speeds, and traffic operations along the Study Corridor.
- **Section 4** provides an overview of alternatives considered for the study.
- **Section 5** outlines the roadway geometric design criteria and other key design parameters for the project.
- **Section 6** summarizes the existing and projected traffic volumes within the study area.
- **Section 7** summarizes the traffic operational analysis for the I-95 GP lanes, I-95 Express Lanes, and arterial street intersections for existing, No Build, and Build conditions.
- **Section 8** summarizes the safety analysis for the project.
- **Section 9** outlines the existing land uses and future land use plans in the project area.
- **Section 10** provides a summary of the NEPA process for the project.

Figure 1-1: Study Area Overview



2. METHODOLOGY

This IJR was developed following both federal and VDOT guidance contained in the documents below:

- Interstate, NHS Non-Interstate and Non-NHS (IJR/IMR Guidance) – VDOT Instructional and Informational Memorandum – IIM-LD-200.9 (January 2017)
- VDOT Traffic Operations and Safety Analysis Manual (TOSAM) – Version 1.0 (November 2015)
- FHWA Interstate System Access Informational Guide (August 2010)

The approved IMR Framework Document (**Appendix F**) documents the agreement between VDOT and FHWA regarding the scope of work of the IJR, including study area, traffic forecasting and analysis methodologies, and other key study assumptions. This section summarizes the study area, data collection, traffic forecasting methodology, traffic operations analysis methodology, and safety analysis methodology as outlined in the Framework Document.

2.1 STUDY AREA

The traffic analysis study area extends along the mainline roadway segments, and includes the I_95 mainline and all interchange ramps within the interchanges at Exit 130, Exit 133, Exit 136, Exit 140, Exit 143, and Exit 148. Additionally, a minimum of two signalized intersections along the arterial street network were included for each interchange. The overall Study Area is depicted in **Figure 2-1**. **Table 2-1** summarizes the arterial intersections included in the operational analysis for this IJR; these are also depicted in **Figure 2-2** through **Figure** 2-7. In all cases, the study area includes at least the ramp terminal intersections at each interchange, and in some cases, includes one or more adjacent intersections.

Table 2-1: Study Area Intersections

Interchange	Exit	Intersection	Type	Existing/Proposed
Route 3 (Plank Rd)	130	130-T1 Route 3 at Gateway Blvd	Signalized	Existing
		130–T3 Route 3 WB at NB I-95 On-Ramp	Signalized	Proposed[1]
		130–T4 Route 3 WB at SB I-95 Off-Ramp	Signalized	Proposed[1]
		130-T2 Route 3 at Carl D Silver Pkwy	Signalized	Existing
US 17	133	133-T1 US 17 Business at Short Street	Signalized	Existing
		133-T2 US 17 at South Gateway Drive	Signalized	Existing
Centreport Pkwy	136	136-T1 I-95 NB Ramps at Centreport Pkwy	Signalized	Existing
		136-T2 I-95 SB Ramps at Centreport Pkwy	Signalized	Existing
		136-T3 Centreport Pkwy at US 1	Signalized	Existing
Route 630 (Courthouse Road)	140	140-T1 I-95 NB Ramps at Courthouse Rd	Signalized	Existing
		140-T2 I-95 SB Ramps at Courthouse Rd	Signalized	Existing
		140-T3 I-95 NB Ramps at Reloc Courthouse Rd	Signalized	Proposed[2]
		140-T4 I-95 SB Ramps at Reloc Courthouse Rd	Signalized	Proposed[2]
		140-T5 Reloc Courthouse Rd at Reloc Wyche Rd	Signalized	Proposed[2]
		140-T6 Relocated Courthouse Rd at US 1	Signalized	Proposed[2]
Route 610 (Garrisonville Road)	143	143-T1 I-95 NB Off-Ramp at Rte 1	Signalized	Existing
		143-T3 Route 610 at Rte 1	Signalized	Existing
		143-T4 Rte 1 at I-95 NB On-Ramp	Signalized	Existing
		143-T2 I-95 SB Off-Ramp at Rte 610	Signalized	Existing
Russell Rd	148	148-T2 I-95 NB Off-Ramp at Russell Rd	Signalized	Existing
		148-T1a I-95 NB On-Ramp at Russell Rd	Signalized	Existing
		148-T1b I-95 SB Ramps at Russell Rd	Signalized	Existing

1. Proposed as part of I-95 / Route 3 Safety Improvements
2. Proposed as part of I-95 Route 630 Interchange Improvements

Figure 2-1: Study Area

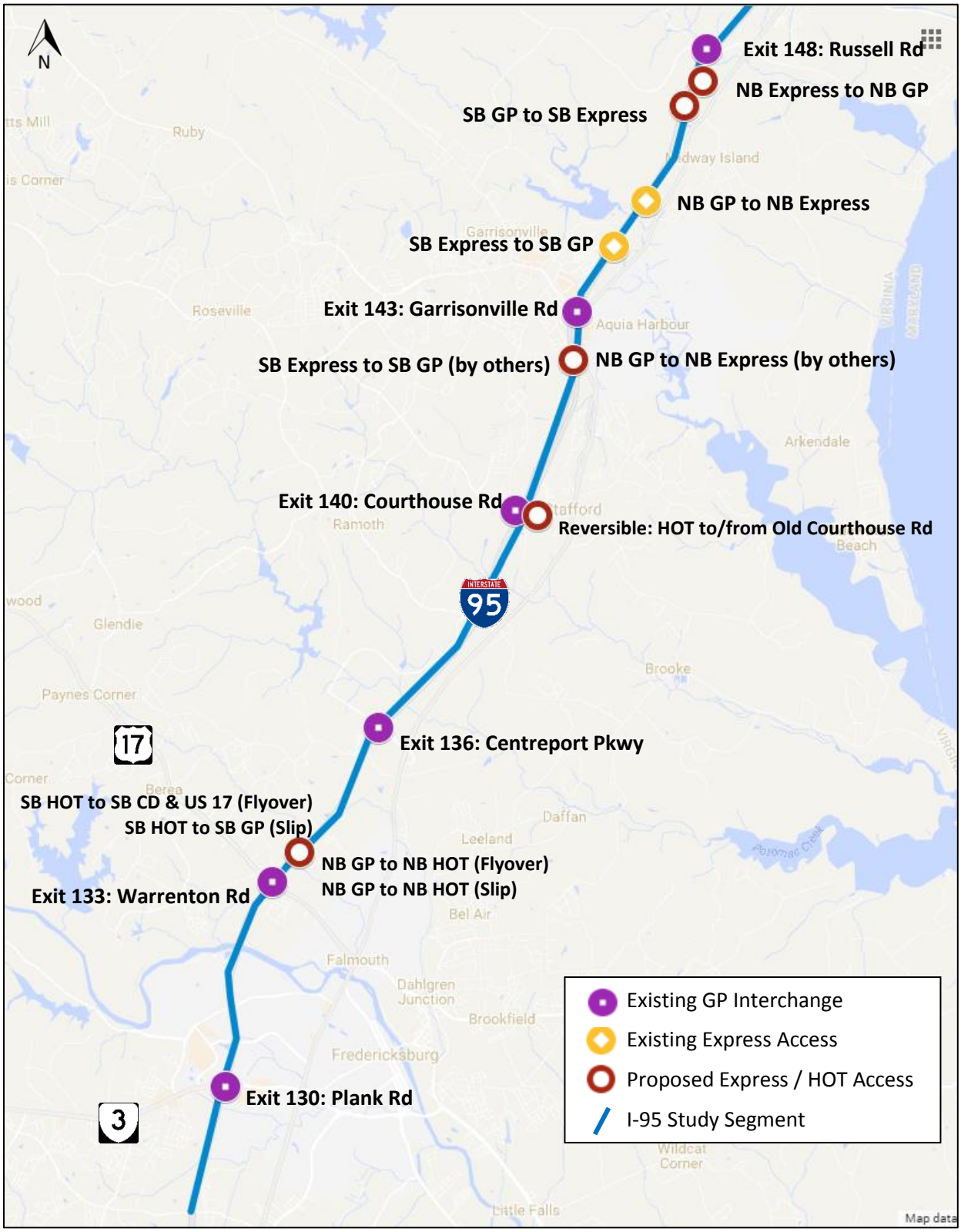


Figure 2-2: I-95 / VA-3 Interchange (Exit 130) Study Intersections

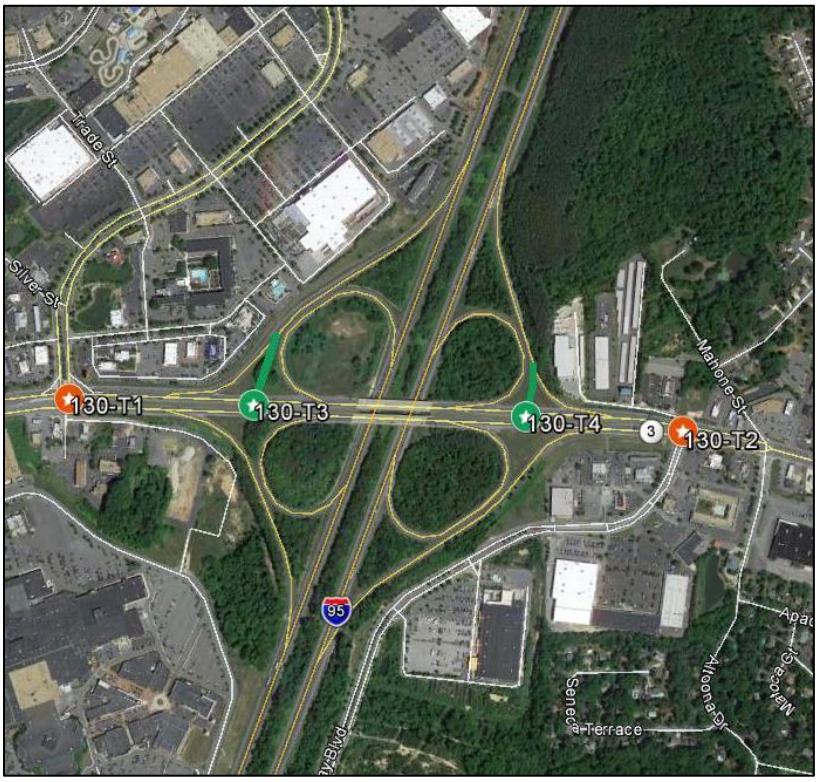


Figure 2-3: I-95 / US 17 Interchange (Exit 133) Study Intersections

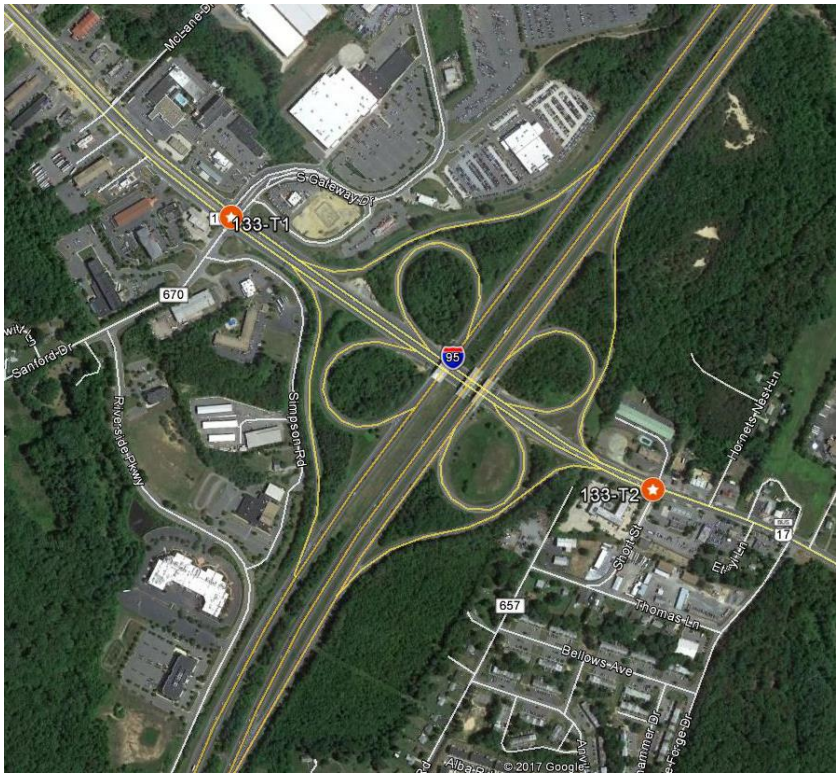


Figure 2-4: I-95 / Centreport Parkway Interchange (Exit 136) Study Intersections

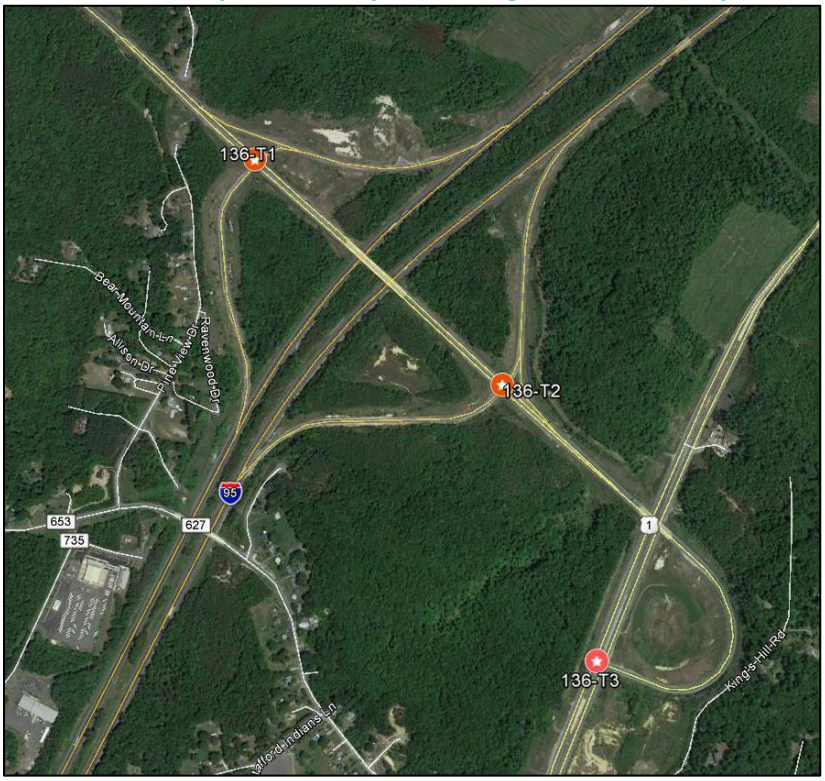
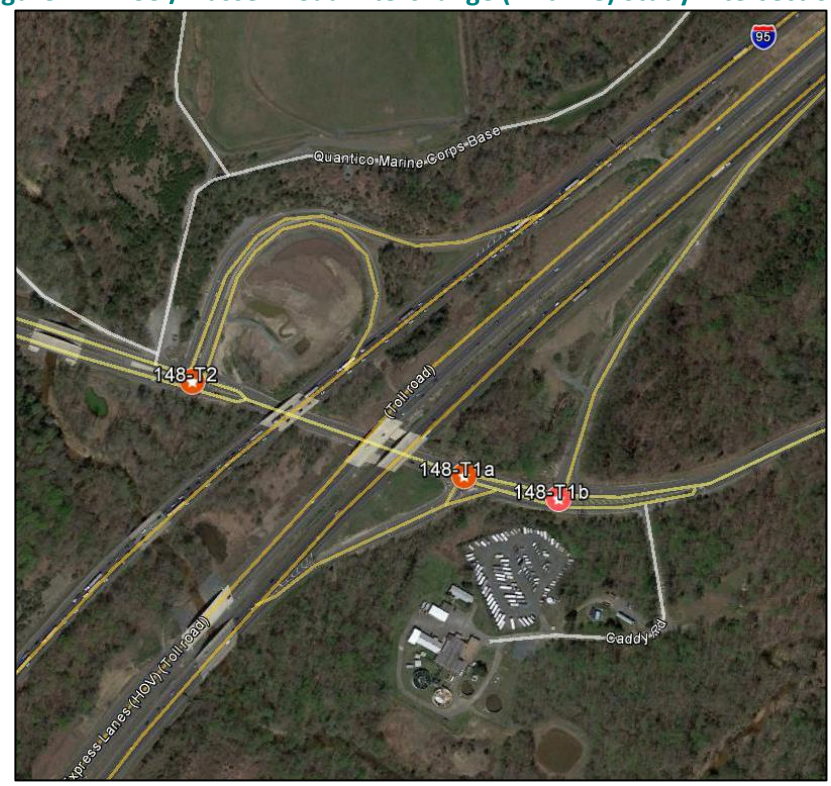


Figure 2-5: I-95 / VA 630 Interchange (Exit 140) Study Intersections

Figure 2-6: I-95 / VA 610 Interchange (Exit 143) Study Intersections

Figure 2-7: I-95 / Russell Road Interchange (Exit 148) Study Intersections



2.2 DATA COLLECTION

An extensive data collection effort was undertaken in September, November and December 2016 to establish baseline traffic conditions for the study area. To support the evaluation of future enhancements to the corridor, data collection was conducted for an extended corridor on I-95, from automatic ramp counts and manual intersection turning movement counts, to the data reviewed from VDOT's permanent count stations.

Ramp counts, including existing access points to the I-95 Express Lanes and mainline vehicle classification counts, were conducted for a minimum of 48 consecutive hours on non-holiday Tuesdays, Wednesdays, and Thursdays, and during typical school and non-holiday periods. Ramp and mainline counts were performed using tube and video count equipment. All turning movement counts were conducted on a typical, non-holiday Tuesday, Wednesday, or Thursday when schools were in session. Twelve-hour turning movement counts were performed manually by using video count equipment.

Ramp and mainline vehicle classification counts, along with intersection turning movement counts within the study area, were conducted between September 27 and 29, 2016. Supplemental ramp classification counts and turning movements counts were obtained at I-95 Exit 130 (Plank Road) in November 2016. Supplemental ramp classification counts were obtained at I-95 Exit 161 (US 1) in December 2016.

Table 2-2 provides the locations of the mainline and ramp vehicle classification counts and **Table 2-3** provides the locations of the intersection turning movement counts conducted within the study area for the Fredericksburg Extension Study. Volumes for additional data collection locations outside the proposed project limits are included in **Appendix A**.

Table 2-2: Mainline & Ramp Count Locations

Exit	Mainline / Ramp Movement			
	From		To	
130	I-95	SB	Route 3 (Plank Rd)	WB
130	I-95	SB	Route 3 (Plank Rd)	EB
130	Route 3 (Plank Rd)	WB	I-95	SB
130	Route 3 (Plank Rd)	EB	I-95	SB
130	I-95	NB	Route 3 (Plank Rd)	WB
130	I-95	NB	Route 3 (Plank Rd)	EB
130	Route 3 (Plank Rd)	WB	I-95	NB
130	Route 3 (Plank Rd)	EB	I-95	NB
133	I-95	SB	US 17	NB
133	I-95	SB	US 17 Bus	SB
133	US 17	SB	I-95	SB
133	US 17 Bus	NB	I-95	SB
133	I-95	NB	US 17 Bus	SB
133	I-95	NB	US 17	NB

Exit	Mainline / Ramp Movement			
	From		To	
133	US 17	SB	I-95	NB
133	US 17 Bus	NB	I-95	NB
I-95 Mainline	Centreport Pkwy	SB	US 17	
I-95 Mainline	US 17	NB	Centreport Pkwy	
136	I-95	SB	Centreport Pkwy	
136	Centreport Pkwy		I-95	SB
136	I-95	NB	Centreport Pkwy	
136	Centreport Pkwy		I-95	NB
140	I-95	SB	Courthouse Rd	
140	Courthouse Rd		I-95	SB
140	I-95	NB	Courthouse Rd	
140	Courthouse Rd		I-95	NB
143	I-95	SB	Garrisonville Rd	WB
143	I-95	SB	Garrisonville Rd	EB
143	Garrisonville Rd	WB	I-95	SB
143	Garrisonville Rd	EB	I-95	SB
143	I-95	NB	US 1	
143	I-95	NB	Garrisonville Rd	WB
143	US 1	NB	I-95	NB
143	Garrisonville Rd	EB	I-95	NB
I-95 Express	I-95	NB	I-95 Express Lanes (Slip)	
I-95 Express	I-95 Express Lanes (Flyover)		I-95	SB
148	I-95	SB	Russell Rd	
148	Russell Rd		I-95	SB
148	I-95	NB	Russell Rd	
148	Russell Rd		I-95	NB

Table 2-3: Intersection Turning Movement Count Locations

Exit	Location		
130	Route 3 (Plank Rd)	at	Carl D. Silver Pkwy
130	Route 3 (Plank Rd)	at	Gateway Blvd
133	US 17	at	South Gateway Dr
133	US 17 Bus	at	Short St
136	I-95 NB Ramps	at	Centreport Pkwy
136	I-95 SB Ramps	at	Centreport Pkwy
136	US 1	at	Centreport Pkwy
140	I-95 NB Ramps	at	Courthouse Rd
140	I-95 SB Ramps	at	Courthouse Rd
143	I-95 NB Off-Ramp	at	US 1
143	Garrisonville Rd	at	US 1
143	US 1	at	I-95 NB On-Ramp
143	I-95 SB Off-Ramp	at	Garrisonville Rd
148	I-95 NB Off-Ramp	at	Russell Rd
148	Russell Rd	at	I-95 NB On-Ramp
148	I-95 SB Ramps	at	Russell Rd

Permanent count data were obtained from VDOT permanent count stations along I-95 within the study area for 2016. The ramp, mainline, and intersection turning movement counts and data from VDOT's permanent count stations were analyzed to determine heavy vehicle percentages used in the operational analyses.

INRIX data were used to develop speed profiles of I-95 over the course of an average day to help identify recurring areas of congestion and quantify the level of congestion. The 2016 data were compared with 2013 data to evaluate whether traffic operations and congestion have changed over the past several years, particularly after the opening of the I-95 Express Lanes in late 2014.

Finally, crash data from VDOT's Tableau Crash Tool for the Study segment of I-95 were obtained to identify crash trends and crash hotspots, and to compare with crash rates on similar facilities within the state.

2.3 DEVELOPMENT OF BALANCED EXISTING TRAFFIC VOLUMES

To support the traffic analysis of alternatives for the I-95 Express Lanes Fredericksburg Extension, peak period and weekday Average Daily Traffic (ADT) volumes were developed for each alternative to provide a comprehensive assessment of operations during both the highest volume peak period conditions and over the course of a typical weekday.

2.3.1 Peak Period Volumes

Given the existing recurring congestion within the study segment, it was determined that multiple hours within the AM and PM peak periods should be evaluated to understand the operations of the corridor. Raw traffic counts were reviewed to identify the peak periods at each data collection location (mainline segments, ramps, intersections, and VDOT mainline permanent count stations). After reviewing the peak periods for the individual data collection locations, common peak periods for I-95 within the study segment were selected. The AM peak period was determined to be between 6:00 – 9:00 AM and the PM peak period was determined to be between 3:00 – 7:00 PM.

To properly model the congestion along the corridor, demand volumes needed to be developed for use in the simulation analysis. The hourly traffic volumes for each hour within the peak periods were extracted from the raw count data at each location. An entry demand volume for the I-95 mainline at the start of the model area was determined based on the available data and then individual ramp volumes along the corridor were added or subtracted to determine the balanced demand volumes for each segment along the corridor.

Heavy vehicle percentages were reviewed along the corridor and minimal variation was found within each hour within the peak periods. Therefore, a peak period heavy vehicle percentage was selected for each direction of I-95 for both the AM and PM peaks and applied during each hour of the analysis period.

The balanced 2016 demand volumes for each hour within the peak periods (6 – 9 AM and 3 – 7 PM) are provided in **Figures A-1** through **A-7** in **Appendix A.**

2.3.2 Daily Volumes

Development of the daily volumes followed the same approach as the development of peak hour volumes. The balanced daily volumes represent average weekday conditions, although higher weekend and seasonal volumes have been observed along I-95.

Two key reasonableness checks were performed on the final balanced peak hour and daily volumes. First, k-factors were re-computed using the balanced daily and peak hour volumes. These factors were then reviewed to ensure that there were no ramps or intersections where the ratio of peak-to-daily volume is beyond typical values, and that k-factors reflect existing traffic patterns. Second, the daily volumes were compared to the latest available (2015) traffic data published by VDOT to ensure 2016 volumes are generally consistent with the established 2015 average weekday traffic volumes.

Existing (2016) balanced daily traffic volumes are summarized in **Figure 6-1**.

2.4 FORECASTING PROCESS

2.4.1 Travel Demand Model

Year 2022 and 2042 travel demand forecasts were developed for both No-Build conditions and the Build Alternative using the latest adopted regional Travel Demand Forecast Model maintained by the Metropolitan Washington Council of Governments [Version 2.3.57a Travel Demand Model (MWCOG Model) with Round 8.4 Cooperative Land Use Forecasts]. A travel demand forecast model is a set of computer-based mathematical relationships that attempts to capture the interaction of travel activities and choices made by a population in a specific region given a proposed network (e.g., highway, transit, etc.) and demographic or land use inputs (e.g., population, employment, etc.). The latest approved model version was provided by MWCOG on October 11, 2016. The main inputs to the travel demand model are:

- Demographic and economic changes in the region, specifically the location of employment and housing; and
- Characteristics of the region's transportation system, including proposed changes in the transportation facilities and operating policies.

For this study, the land uses were not adjusted for either the base or future year condition from the original data provided as part of the Route 8.4 Cooperative Land Use Forecasts. The Existing and Future Year (2040) No-Build models were verified to assure that all current planned projects were accounted for. This verification was completed noting that no projects had been omitted and the base geometry was acceptable for this project. Upon completion of the geometric verification, the Existing (2015) model was run and the outputs were compared with existing field data to determine how the model was performing in relation to existing conditions. It was determined that the model was performing within acceptable tolerance for the existing conditions in most locations and therefore a re-calibration of the model was not deemed necessary. **Table 2-4** summarizes the results of this calibration evaluation. The locations at the far southern end of the study area were the worst performing when compared to the 2015 model, however, these locations are at the southern extents a very large regional network where the traffic analysis zone and link network is less robust than in the model's core. Thus, these differences were evaluated and accounted for as part of the post-processing. In summary, the model calibration was deemed sufficient for the proposed post-processing approach, which was reviewed by VDOT Central Office Transportation and Mobility Planning Division staff.

The most recently validated 2040 model with corresponding model networks is the last year for which MWCOG had forecasted land use data available at the time of this study. The 2040 MWCOG model was used to develop 2040 traffic forecasts which were then extrapolated to Year 2042 forecasts. The growth rate used to project 2042 daily volumes to 2040 daily volumes were based on the calculated annual linear growth rate from 2016 to 2040. The growth of 0.75 percent was applied to all study area roadways. The Interim Year (2022) volumes were produced using straight-line linear interpolation between 2016 and 2040.

Table 2-4: MWCOG %RSME Calibration Summary

Segment	2015 MWCOG Base Year Assignment	2015 Field AADT	%RSME
South of Exit 126	93,545	98,000	5%
Between Exit 126 and Exit 130	115,030	119,000	3%
Between Exit 130 and Exit 133	162,652	146,000	11%
Between Exit 133 and Exit 136	153,271	128,000	20%
Between Exit 136 and Exit 140	171,903	132,000	30%
Between Exit 140 and Exit 143	166,685	134,000	24%
Between Exit 143 and Exit 148	163,095	153,000	7%
Between Exit 148 and Exit 150	161,574	135,000	20%
Between Exit 150 and Exit 152	172,652	167,000	3%
Between Exit 152 and Exit 156	164,450	164,000	0%
Between Exit 156 and Exit 158	151,794	162,000	6%
Between Exit 158 and Exit 160	176,673	187,000	6%
Between Exit 160 and Exit 161	189,531	208,000	9%
		Corridor RSME%	**13%**
		Target RSME%	**19%**

1. Target %RSME for volume range greater than 60,000 per Table 10.5 from VDOT Travel Demand Modeling Policies and Procedures

2.4.2 Post-Processing

Post-processing refers to analyses performed after execution of the travel demand forecast model run. Post-processing activities are applied to the travel demand forecast model results to compensate for the limitations of the model. The model used for the study produced raw daily link volumes and raw AM (6:00 – 9:00 AM) and PM (4:00 – 7:00 PM) peak period link volumes. To develop daily and hourly volumes for the peak travel periods, the link-level model outputs were refined for the segments of interest. The freeway system included all mainline links, collector/distributor roads, and ramps. The arterial links included the approaches to each interchange within the study area.

For this study, all post-processing activities for refining the highway link volumes and developing turning movement volumes involved procedures outlined in the National Cooperative Highway Research Program (NCHRP), Report 255, *Highway Traffic Data for Urbanized Area Project Planning and Design* (Pedersen et al., 1982) and NCHRP Report 765, *Analytical Travel Forecasting Approaches for Project-Level Planning and Design* (Horowitz et al., 2014). These technical reports provide a set of procedures for refining "raw" link volumes output directly from the model.

The procedure outlined below was followed for both the daily and peak period volumes, for both the Future Year (2042) No-Build and Build scenarios:

Step 1. Determine 2015 Comparative Ratio

The existing (2016) volumes were compared to the 2015 model output to determine a comparative ratio. This ratio was calculated as follows:

2015_Ratio = 2015_NoBuildModel ÷ 2016_Count

This ratio was used to see where the 2016 counts (based on field data) varied the most from the 2015 model data. This comparison was used to select the appropriate fitting method for developing the future year estimates at each location.

Step 2. Compute Ratio and Difference Values

The 2040 volumes were then calculated using two different methodologies. First, they were estimated using a "ratio" methodology, by multiplying the 2016 volumes by the ratio of growth between the 2015 and 2040 No-Build models. These were computed using the following formula:

2040_r = 2016_Count X (2040_Model* ÷ 2015_NoBuildModel)

****Build or No-Build Model depending on scenario***

Second, they were calculated using a "difference" methodology. These were computed using the following formula:

2040_d = 2016_Count + (2040_Model* - 2015_NoBuildModel)

****Build or No-Build Model depending on scenario***

Step 3. Determine Unbalanced 2040 Volumes

To determine the 2040 volumes a three-tiered system was utilized based on the 2015_Ratio computed in Step 1:

- If *2015_Ratio* was between 0.5 and 2.0, then the 2040 volume was computed by averaging the two volumes calculated in Step 2.
- If *2015_Ratio* was less than 0.5 or between 2.0 and 5.0, then the 2040 volume was computed by using the *2040_d* value.
- If *2015_Ratio* was greater than 5.0, then the 2040 volume was computed by using the *2040_r* value.

These three different methods were used to normalize the inconsistencies of the model with respect to the actual counts. In most locations, the *2015_Ratio* value fell between 0.5 and 2.0, meaning that the model was assessing the existing conditions between 50% and 200% of the actual field collected count, therefore the 2040 volumes were based on the average of the ratio and difference fields. However, in some locations, it was found that the model output was either exceedingly high or exceedingly low – outside the 50% - 200% range - in comparison with the field collected counts. Therefore, to assure that unreasonably high or low growth rates were not applied at these locations, either the ratio or difference method was utilized to lessen the impact of the gap between the 2016 counts and modeled link volumes.

The specific thresholds identified above were selected using engineering judgment based on past experience on traffic forecasting projects, particularly with the MWCOG model. Using these values, growth rates on facilities (typically low volume facilities) where the Base Year model assignments vary substantially from the field collected data can be moderated to produce more realistic projected volumes. To better illustrate, consider the following examples. If the 2015 model assigned 100 vehicles and 2040 model assigned 200 vehicles to a certain location but the field count showed a volume of 500 (2015_Ratio of 0.2), simply using the model projected growth rate would create a volume in that location of 1,000 vehicles (500 x 100 percent) which would be unreasonably high for that specific corridor. Therefore, to account for such differences, the difference method was utilized to create a more reasonable estimated volume of 600 vehicles (500 + 100). In another example, if the 2015 model assigned 600 vehicles to a certain location and the 2040 model assigned 1,200 vehicles to the same location, but the field count showed a volume of 100 vehicles, the difference method would create a total volume of 700 vehicles on that link, which would be an unreasonably high growth rate of 700 percent. The ratio method would create a more reasonable estimated volume of 200 vehicles (100 x 200 percent). Averaging the two methods, would also result in an unreasonably high growth rate of 350 percent.

The post-processing methodology produced unbalanced daily and AM and PM peak period ramp and mainline volumes and total inflows and outflows at intersections. To account for the turning movement volumes, iterative proportional fitting (IPF) methods outlined in NCHRP 765 and Transportation Research Record 1287, *Model of Turning Movement Propensity* (Furth, 1990) were used. The existing (2016) volumes were used as the seed for the IPF procedure, and the post-processed 2040 link volumes were used as the target inflows and outflows. The IPF routine iteratively adjusted the existing turning movement volumes to balance the turns given the forecasted approach inbound and outbound link volumes.

The 2040 daily link volumes were manually adjusted as necessary to achieve volume balance between interchanges by holding volumes at key mainline I-95 locations constant and then proportionally adding and subtracting ramp volumes between these locations. The 2040 peak period link and turning movement volumes were manually adjusted as necessary to achieve volume balance between interchanges and intersections by holding volumes at key locations constant and then proportionally adding and subtracting ramp volumes, similar to the process completed for the 2040 daily link volumes. As previously noted, the southern extents of the model were not performing as strong when compared to existing data; therefore, to further smooth the future year forecasts for Exits 130 and 133, the Fredericksburg Area Metropolitan Planning Organization (MPO) Model, version 3.0—as directed by the MPO—was used to provide a more detailed understanding of the projected growth at the southern interchanges within the corridor. This data was used to make manual adjustments to the 2040 volumes which better reflected the anticipated growth at these locations.

Once the balanced 2040 peak period volumes were finalized, hourly factors were applied to the AM and PM peak period volumes at each location to generate volumes for each hour within the peak periods. **Table 2-5** summarizes the factors applied to estimate hourly future volumes within the peak period. These factors were based on guidance provided with the MWCOG model and verified based on existing count data within the study area.

Table 2-5: Peak Period to Hourly Factors

AM Peak Period			PM Peak Period		
Hour	Factor	Field Data	Hour	Factor	Field Data
-	-	-	3:00 – 4:00 PM	0.300 (90% of 4:00-5:00 PM volume)	0.304 (95% of 4:00-5:00 PM volume)
6:00 – 7:00 AM	0.330	0.334	4:00 – 5:00 PM	0.330	0.324
7:00 – 8:00 AM	0.340	0.347	5:00 – 6:00 PM	0.340	0.343
8:00 – 9:00 AM	0.330	0.319	6:00 – 7:00 PM	0.330	0.333

To generate volumes for the Future Year (2042), RK&K evaluated the growth rates of the balanced 2040 network from the 2016 balanced network and found a relatively consistent 0.75 percent per year rate. This rate was applied to the 2040 networks to develop the Future Year (2042) volumes. In a review of the projects within the model, it was found that within our study area the projects completed in the 2020, 2025, and 2040 networks were the same. As a result, the Interim Year (2022) volumes were produced using straight-line linear interpolation.

It should be noted that continuing advancements in technology, such as connected and autonomous vehicles (including commercial vehicles) and advanced traveler information, may result in changes in traffic demand and traffic operations in the future. These changes could include increased roadway capacity due to reduced vehicle headways for connected vehicles or changes in travel patterns due to improved traveler information, resulting in reduced congestion. Alternatively, travel demand could potentially increase as autonomous vehicles provide additional mobility choices. Since the impact of these technology advancements cannot reasonably be predicted, this report does not attempt to quantify their influence on operations along the I-95 corridor.

2.4.3 Toll Facilities and Managed Lanes

The study corridor along I-95 currently includes High-Occupancy Toll (HOT) Lanes (branded as the I-95 Express Lanes). North of Garrisonville Road (Exit 143), there are two reversible HOT lanes located in the median of I-95, which operate in the northbound direction in the AM and the southbound direction in the PM. The existing I-95 Express Lane system extends approximately 27 miles north to I-495 (Capital Beltway). The only access points within the study area for the Fredericksburg Extension Study are located between Exits 143 and 148; there is a left-hand slip ramp to enter the I-95 Express Lanes from the I-95 GP (GP) lanes in the northbound direction and a flyover which allows vehicles to exit the I-95 Express Lanes and enter the I-95 GP lanes in the southbound direction. The I-95 Express Lanes are a managed facility; managed facilities apply strategies, such as tolling, to balance demand and available capacity on the system. On the I-95 Express Lanes, dynamically-priced tolling is used to manage demand for the facility and maintain free-flow operations.

The No-Build condition would retain the current I-95 Express Lanes system, with an extension of a single reversible lane from north of Exit 143 to south of Exit 143.

The Build alternative would extend two reversible Express Lanes from Exit 143 to Exit 133 and provide access points at Exit 140 (Courthouse Road) and Exit 133 (US 17). New access points would also be provided near Exit 148 (Russell Road).

For existing conditions, weekday demand was estimated for I-95 Express Lanes based on existing field collected traffic counts and a VDOT permanent count station. Forty-eight-hour traffic counts were obtained in September 2016 for each of the access points to the I-95 Express Lanes between Exit 143 and Exit 160. Hourly volumes from a permanent VDOT count station located at the Occoquan River (just north of Exit 160) were also obtained for September and October 2016. The total entering/exiting volumes from the I-95 Express Lane ramps for the September 2016 ground counts and were compared to the total throughput volumes from VDOT's permanent count station. The existing ramp volumes were manually adjusted to reflect the total throughput at Exit 160. The refined Express Lane volumes were then incorporated into the overall volume balancing effort for the I-95 GP lanes.

For future conditions, the MWCOG model explicitly models managed lane / HOT facilities within the region. A subroutine within the traffic assignment step is used to iteratively load volumes to each managed lane / HOT facility within the model; toll rate structures are assumed and the demand is optimized to approximate minimum operating speeds within each facility. As part of the overall model calibration assessment discussed in **Section 2.4.1**, the model assignments for the I-95 Express Lanes in the base year travel demand model were compared to the existing field counts and it was determined that the MWCOG model was reasonably calibrated to the existing conditions. Like any other facility in the study area, the daily and peak period raw link volumes from the 2040 MWCOG model runs were extracted and post-processed based on the methodologies presented in Section 2.4.2. The hourly volumes for each access point and the total hourly demand within the HOT lanes was checked for reasonableness based on existing facilities and assumed maximum capacities of 1,700 to 1,800 vehicles per lane per hour to maintain acceptable operating speeds.

2.5 TRAFFIC OPERATIONAL ANALYSIS

2.5.1 Analysis Tools

The microsimulation software, *VISSIM*, from PTV America, was used as the primary analysis tool for this IJR. *VISSIM* was determined to be the best tool to model oversaturated conditions along the I-95 corridor and properly capture the interface between freeway and arterial street segments. *VISSIM* Version 8 (Build 8.00-15) was used for the traffic operational analysis.

Synchro Version 9 was utilized to develop optimized signal timings for the signalized intersections along the arterial network for all future scenarios. Existing signal timings were obtained from VDOT and the City of Fredericksburg and used in the existing analysis. For future analysis periods, existing cycle lengths were retained and phase splits optimized to reflect anticipated changes in traffic volumes. For new signals within a coordinated system, the cycle lengths and base timing parameters (minimum splits, yellow and all-red times) from the adjacent signals were used and phase splits and offsets optimized. Signal timing parameters from *Synchro* were then exported to *VISSIM* for use in the simulation.

2.5.2 *VISSIM* Model Extents

The *VISSIM* model for this study is being used to simulate the traffic operations of the I-95 corridor between the MM 128 and MM 162; this extends approximately 14 miles north of the northern terminus

of the study area for this IJR. The *VISSIM* network includes freeway segments, ramp-freeway junctions, and portions of the arterials adjacent to freeway interchanges. The entire modeled area from MM 128 to MM 162 was calibrated to match existing conditions and the model will be available to VDOT for future studies within this segment of the I-95 corridor. The outputs for the specific IJR study area identified in **Section 2.1** have been extracted and reported for this IJR. Where applicable, discussion related to simulated traffic conditions outside of the specific IJR study area has been provided when conditions outside the Study Area influence the results.

2.5.3 Analysis Periods

Two peak periods were evaluated for this study. Based on a review of the available existing traffic data and coordination with VDOT, it was determined the weekday AM and PM peak periods would be evaluated for this study. Microsimulation analysis was conducted for multiple hours during each of these peak periods (6 – 9 AM and 3 – 7 PM); these periods represent the periods of peak congestion along the corridor. For the AM peak period, a two-hour seeding period from 4 AM – 6 AM was utilized; this was followed by the three-hour analysis period from 6 AM – 9 AM. For the PM peak period, a one-hour seeding period from 2 PM – 3 PM was utilized and this was followed by a four-hour analysis period from 3 PM – 7 PM.

2.5.4 Number of Simulation Runs

A minimum number of model runs is required to produce accurate results. The VDOT TOSAM adopts the FHWA-developed statistical process for determining the appropriate number of simulation runs at a 95th percentile confidence level with a 10% tolerance.

Initially, ten initial model runs as recommended by VDOT TOSAM are performed to evaluate a critical measure of effectiveness (MOE) such as travel time or vehicular throughput. The initial model output is then evaluated using a standard statistical "t-test" to determine whether additional model runs are needed (up to 30) to meet confidence and tolerance requirements. The VDOT TOSAM provides a spreadsheet-based sample size determination tool which incorporates the FHWA methodology to determine the necessary number of model runs. Based on this evaluation, 10 simulation runs were determined to be sufficient to meet the requirements. During AM peak hour (7-8 AM), I-95 northbound corridor travel time, corridor average speed, and *VISSIM* throughput at south of Centreport Pkwy (Exit 136) were used to determine the appropriate sample size since I-95 northbound is the peak direction during AM peak. During PM peak hour (5-6 PM), I-95 southbound is the peak direction. Therefore, the calculations of I-95 southbound corridor travel time, corridor average speed, and *VISSIM* throughput at north of Warrenton Rd (Exit 133) were used to determine the appropriate sample size. Based on the results of this evaluation, all results presented in this memo are based on the output from 10 runs for both the AM and PM peak periods. The supporting information for the sample size determination can be found in **Appendix G**.

2.5.5 *VISSIM* Model Calibration and Validation

The existing conditions AM and PM peak period *VISSIM* models were calibrated and validated to ensure the models accurately depict existing field conditions to effectively evaluate future traffic operations along the I-95 corridor.

The goal of a calibration effort is to replicate the existing real-world conditions in the simulation model with minimally acceptable differences. The VDOT *Traffic Operations and Safety Analysis Manual, Version 1.0* (TOSAM, November 2015) recommends standard calibration thresholds (Table 5 of Section 5.3,

TOSAM page 33). However, based on the project purpose, size of the model area, and the complex nature of traffic operations within the I-95 corridor, a set of project specific calibration thresholds were developed for this project. These revised thresholds were submitted for VDOT's review and concurrence in a memorandum dated August 28, 2017. The VDOT District Traffic Engineer concurred with the revised thresholds, which are summarized in **Table 2-6** on August 28, 2017. A detailed summary of the calibration and validation process and results is contained in **Appendix G.**

Key calibration results for the I-95 mainline for travel times, speeds, and volumes are summarized for AM peak conditions in **Table 2-7** through **Table 2-9** and for PM peak conditions in **Table 2-9** through **Table 2-12**. Calibration results are presented for the entire *VISSIM* model area.

For travel time and speed calibration, all segments and the overall corridor satisfied the calibration thresholds for the AM peak conditions. One location along I-95 southbound did not satisfy the volume threshold in the AM peak hour (7-8 AM); the difference was 6% (just slightly exceeding the 5% threshold) and equates to approximately 30 vehicles in the peak hour; this deviation is not anticipated to have an impact on the overall simulation results or the evaluation of the proposed improvements along I-95.

Table 2-6: Project Specific *VISSIM* Model Calibration Thresholds – Approved 8/28/2017

Simulated Measure	Calibration Thresholds			
	Mainline I-95		Ramps	Intersections
Simulated Traffic Volume (vehicles per hour) vs. Field Measured Throughput Volumes	Overall Simulation Period: ±5% Peak Hour: ±5% *Note: Mainline Volumes will be compared to the thresholds at two screenlines per direction, where high-quality throughput data is available.* I-95 NB, between Exit 133 and 136 I-95 SB, between Exit 133 and 136 I-95 NB, between Exit 158 and 160 I-95 SB, between Exit 158 and 160		Overall Simulation Period: Greater than 1,000 vph: +5% Between 300 and 1,000 vph: +10% Less than 300 vph: +20% Peak Hour: Greater than 1,000 vph: +5% Between 300 and 1,000 vph: +10% Less than 300 vph: +20% Note: Top 85% of ramp links will be evaluated.	Overall Simulation Period (by Movement): Greater than 1,000 vph: +10% Less than 1,000 vph: +20% Peak Hour (by Movement): Greater than 1,000 vph: +10% Less than 1,000 vph: +20% Note: Top 85% of intersection movements will be evaluated.
Simulated Average Speed (mph) vs. Observed Average Travel Speeds	Overall Simulation Period: Corridor: ± 5 mph Segments: ± 10 mph	Individual Hours: Corridor: ± 5 mph Segments: ± 10 mph	n/a	n/a
Simulated Average Travel Time vs. Observed Average Travel Times	Overall Simulation Period: Corridor: ± 10% Segments: ± 20%	Individual Hours: Corridor: ± 15% Segments: ± 25%	n/a	n/a
Simulated Queues vs. Observed Maximum Queues	Backups at Bottlenecks compared to congestion mapping and field observations (maximum backup lengths ±35%). Speed and travel time data also quantitatively confirms extent of backups.		n/a	Maximum Queue Lengths (feet): ±25% *Note: Quantitative Comparison will be conducted the for the following critical locations and movements:* *WB SR-3 at Carl D. Silver Pkwy* *SB I-95 Off-Ramp to Route 3* *SB US 17 at Gateway Center Blvd & I-95 Off-Ramp* *NB Route 1 at Garrisonville Road* *EB Garrisonville Road at I-95 / US 1* *123 SB at Old Bridge Rd / Ramp to I-95 SB*

Table 2-7: I-95 Mainline AM Travel Time Calibration Results (Seconds)

	I-95 Section		INRIX				*VISSIM*				Difference				% Difference			
	From	To	6 AM	7 AM	8 AM	6-9 AM	6 AM	7 AM	8 AM	6-9 AM	6 AM	7 AM	8 AM	6-9 AM	6 AM	7 AM	8 AM	6-9 AM
I-95 NB	Rappahannock River	Warrenton Rd (Ex. 133)	97	104	99	100	96	97	96	96	-1	-7	-3	-4	-1%	-7%	-3%	-4%
	Warrenton Rd (Ex. 133)	Washington Dr (Ex. 143)	1,007	1,012	645	888	1,110	980	647	912	103	-32	1	24	10%	-3%	0%	3%
	Washington Dr (Ex. 143)	Russell Rd (Ex. 148)	278	270	257	268	251	250	249	250	-26	-20	-8	-18	-9%	-7%	-3%	-7%
	Russell Rd (Ex. 148)	Joplin Rd (Ex. 150)	116	118	120	118	116	116	116	116	0	-2	-4	-2	0%	-1%	-3%	-2%
	Joplin Rd (Ex. 150)	Dumfries Rd (Ex. 152)	133	134	135	134	129	129	129	129	-4	-5	-7	-5	-3%	-4%	-5%	-4%
	Dumfries Rd (Ex. 152)	Opitz Blvd (Ex. 156)	228	242	236	236	216	215	214	215	-12	-27	-22	-20	-5%	-11%	-9%	-9%
	Opitz Blvd (Ex. 156)	Gordon Blvd (Ex. 160)	550	623	458	544	678	674	411	588	128	51	-47	44	23%	8%	-10%	8%
	Rappahannock River	**Gordon Blvd (Ex. 160)**	**2,409**	**2,503**	**1,951**	**2,288**	**2,597**	**2,460**	**1,862**	**2,306**	**188**	**-42**	**-89**	**19**	**8%**	**-2%**	**-5%**	**1%**
I-95 SB	Gordon Blvd (Ex. 160)	SB Rest Area (Ex. 156)	319	271	269	286	277	283	284	281	-41	12	16	-5	-13%	4%	6%	-2%
	SB Rest Area (Ex. 156)	Dumfries Rd (Ex. 152)	166	167	162	165	155	157	157	156	-11	-10	-6	-9	-7%	-6%	-4%	-5%
	Dumfries Rd (Ex. 152)	Joplin Rd (Ex. 150)	132	131	129	131	128	131	131	130	-4	0	1	-1	-3%	0%	1%	-1%
	Joplin Rd (Ex. 150)	Washington Dr (Ex. 143)	365	363	356	361	353	356	358	356	-11	-7	3	-5	-3%	-2%	1%	-1%
	Washington Dr (Ex. 143)	Warrenton Rd (Ex. 133)	532	537	521	530	515	520	522	519	-16	-17	1	-11	-3%	-3%	0%	-2%
	Gordon Blvd (Ex. 160)	**Warrenton Rd (Ex. 133)**	**1,512**	**1,470**	**1,436**	**1,473**	**1,429**	**1,447**	**1,451**	**1,443**	**-83**	**-23**	**15**	**-30**	**-6%**	**-2%**	**1%**	**-2%**

Table 2-8: I-95 Mainline AM Speed Calibration Results (MPH)

	I-95 Section		INRIX				*VISSIM*				Difference			
	From	To	6 AM	7 AM	8 AM	6-9 AM	6 AM	7 AM	8 AM	6-9 AM	6 AM	7 AM	8 AM	6-9 AM
I-95 NB	Rappahannock River	Warrenton Rd (Ex. 133)	68	64	67	66	69	69	69	69	1	5	2	68
	Warrenton Rd (Ex. 133)	Washington Dr (Ex. 143)	34	34	54	41	31	35	54	40	-3	1	0	34
	Washington Dr (Ex. 143)	Russell Rd (Ex. 148)	59	61	64	61	66	66	66	66	6	5	2	59
	Russell Rd (Ex. 148)	Joplin Rd (Ex. 150)	70	69	68	69	70	70	70	70	0	1	2	70
	Joplin Rd (Ex. 150)	Dumfries Rd (Ex. 152)	67	66	66	66	69	69	69	69	2	3	3	67
	Dumfries Rd (Ex. 152)	Opitz Blvd (Ex. 156)	61	57	59	59	64	64	65	64	3	7	6	61
	Opitz Blvd (Ex. 156)	Gordon Blvd (Ex. 160)	25	22	31	26	21	21	34	25	-5	-2	3	25
	Rappahannock River	**Gordon Blvd (Ex. 160)**	**43**	**41**	**53**	**45**	**40**	**42**	**55**	**45**	**-3**	**1**	**3**	**43**
I-95 SB	Gordon Blvd (Ex. 160)	SB Rest Area (Ex. 156)	55	64	65	61	63	62	61	62	8	-3	-4	55
	SB Rest Area (Ex. 156)	Dumfries Rd (Ex. 152)	64	64	66	65	69	68	68	68	5	4	2	64
	Dumfries Rd (Ex. 152)	Joplin Rd (Ex. 150)	66	66	67	67	68	66	67	67	2	0	-1	66
	Joplin Rd (Ex. 150)	Washington Dr (Ex. 143)	68	68	70	69	70	69	69	70	2	1	0	68
	Washington Dr (Ex. 143)	Warrenton Rd (Ex. 133)	68	67	70	68	70	70	69	70	2	2	0	68
	Gordon Blvd (Ex. 160)	**Warrenton Rd (Ex. 133)**	**65**	**67**	**68**	**66**	**68**	**68**	**67**	**68**	**4**	**1**	**-1**	**65**

Table 2-9: I-95 Mainline AM Volume Calibration Results (veh)

	Location	Field Measured Throughput				*VISSIM* Simulated Throughput				Difference				% Difference			
		6 AM	7 AM	8 AM	6-9 AM	6 AM	7 AM	8 AM	6-9 AM	6 AM	7 AM	8 AM	6-9 AM	6 AM	7 AM	8 AM	6-9 AM
I-95 NB	South of Centreport Pkwy (Ex. 136)	4,021	3,563	2,932	10,516	4,005	3,543	2,920	10,468	-16	-20	-12	-48	0%	-1%	0%	0%
	South of Gordon Blvd (Ex. 160)	5,072	5,022	4,882	14,976	5,225	5,275	5,179	15,679	153	253	297	703	3%	5%	6%	5%
I-95 SB	North of Prince William Pkwy (Ex. 158)	2,168	4,152	4,357	10,677	2,387	4,160	4,346	10,893	219	8	-11	216	10%	0%	0%	2%
	North of Warrenton Rd (Ex. 133)	1,591	2,913	3,104	7,608	1,622	2,749	2,996	7,367	31	-164	-108	-241	2%	-6%	-3%	-3%

Table 2-10: I-95 Mainline PM Travel Time Calibration Results (Seconds)

	I-95 Section		INRIX					*VISSIM*					Difference					% Difference				
	From	To	3 PM	4 PM	5 PM	6 PM	3 - 7 PM	3 PM	4 PM	5 PM	6 PM	3-7 PM	3 PM	4 PM	5 PM	6 PM	3-7 PM	3 PM	4 PM	5 PM	6 PM	3-7 PM
I-95 NB	Rappahannock River	Warrenton Rd (Ex. 133)	96	98	95	98	97	96	96	96	96	96	1	-2	1	-2	0	1%	-2%	1%	-2%	-1%
	Warrenton Rd (Ex. 133)	Washington Dr (Ex. 143)	501	506	495	499	500	506	506	506	504	506	5	1	11	5	-5	1%	0%	2%	1%	1%
	Washington Dr (Ex. 143)	Russell Rd (Ex. 148)	239	243	236	238	239	242	242	241	240	241	2	-2	5	2	-2	1%	-1%	2%	1%	1%
	Russell Rd (Ex. 148)	Joplin Rd (Ex. 150)	117	121	115	117	117	120	121	120	119	120	3	0	5	2	-2	3%	0%	4%	2%	2%
	Joplin Rd (Ex. 150)	Dumfries Rd (Ex. 152)	133	137	129	131	132	131	132	130	129	131	-1	-5	2	-1	1	-1%	-4%	1%	-1%	-1%
	Dumfries Rd (Ex. 152)	Opitz Blvd (Ex. 156)	208	215	202	206	208	215	215	213	212	214	7	0	11	6	-6	3%	0%	6%	3%	3%
	Opitz Blvd (Ex. 156)	Gordon Blvd (Ex. 160)	212	215	211	208	212	232	232	231	229	231	20	17	20	21	-20	10%	8%	10%	10%	9%
	Rappahannock River	**Gordon Blvd (Ex. 160)**	1,506	1,535	1,482	1,496	1,505	1,543	1,544	1,538	1,529	1,538	37	9	56	33	-34	2%	1%	4%	2%	2%
I-95 SB	Gordon Blvd (Ex. 160)	SB Rest Area (Ex. 156)	281	289	300	287	289	297	299	299	298	298	16	10	0	11	-9	6%	3%	0%	4%	3%
	SB Rest Area (Ex. 156)	Dumfries Rd (Ex. 152)	162	161	164	161	162	158	159	159	159	159	-3	-2	-5	-2	3	-2%	-1%	-3%	-1%	-2%
	Dumfries Rd (Ex. 152)	Joplin Rd (Ex. 150)	129	129	129	128	129	130	131	131	130	130	1	2	2	2	-2	1%	1%	1%	2%	1%
	Joplin Rd (Ex. 150)	Washington Dr (Ex. 143)	411	580	503	369	466	380	454	568	451	463	-32	-126	66	83	2	-8%	-22%	13%	22%	-1%
	Washington Dr (Ex. 143)	Warrenton Rd (Ex. 133)	635	821	987	701	786	661	880	868	536	736	26	59	-119	-164	50	4%	7%	-12%	-23%	-6%
	Gordon Blvd (Ex. 160)	**Warrenton Rd (Ex. 133)**	1,617	1,980	2,082	1,644	1,831	1,626	1,922	2,025	1,574	1,787	9	-58	-57	-70	44	1%	-3%	-3%	-4%	-2%

Table 2-11: I-95 Mainline PM Speed Calibration Results (MPH)

	I-95 Section		INRIX					*VISSIM*					Difference				
	From	To	3 PM	4 PM	5 PM	6 PM	3 - 7 PM	3 PM	4 PM	5 PM	6 PM	3-7 PM	3 PM	4 PM	5 PM	6 PM	3-7 PM
I-95 NB	Rappahannock River	Warrenton Rd (Ex. 133)	69	68	70	68	69	69	69	69	69	69	-1	1	-1	1	0
	Warrenton Rd (Ex. 133)	Washington Dr (Ex. 143)	69	69	70	70	69	69	69	69	69	69	-1	0	-2	-1	-1
	Washington Dr (Ex. 143)	Russell Rd (Ex. 148)	69	68	70	69	69	68	68	68	69	68	-1	0	-2	-1	-1
	Russell Rd (Ex. 148)	Joplin Rd (Ex. 150)	69	67	71	69	69	67	67	68	68	68	-2	0	-3	-1	-1
	Joplin Rd (Ex. 150)	Dumfries Rd (Ex. 152)	67	65	69	68	67	68	67	68	69	68	1	3	-1	1	1
	Dumfries Rd (Ex. 152)	Opitz Blvd (Ex. 156)	67	65	69	68	67	65	65	65	66	65	-2	0	-4	-2	-2
	Opitz Blvd (Ex. 156)	Gordon Blvd (Ex. 160)	66	65	66	67	66	60	60	61	61	61	-6	-5	-6	-6	-6
	Rappahannock River	**Gordon Blvd (Ex. 160)**	68	67	69	69	68	67	67	67	67	67	-2	0	-3	-1	-2
I-95 SB	Gordon Blvd (Ex. 160)	SB Rest Area (Ex. 156)	62	60	58	61	60	59	58	58	59	58	-3	-2	0	-2	-2
	SB Rest Area (Ex. 156)	Dumfries Rd (Ex. 152)	66	66	65	67	66	67	67	67	67	67	1	1	2	1	1
	Dumfries Rd (Ex. 152)	Joplin Rd (Ex. 150)	67	67	68	68	68	67	67	67	67	67	-1	-1	-1	-1	-1
	Joplin Rd (Ex. 150)	Washington Dr (Ex. 143)	60	43	49	67	55	65	55	44	55	55	5	12	-6	-12	0
	Washington Dr (Ex. 143)	Warrenton Rd (Ex. 133)	57	44	37	52	47	55	41	42	68	51	-2	-3	5	16	4
	Gordon Blvd (Ex. 160)	**Warrenton Rd (Ex. 133)**	60	49	47	59	54	60	51	48	62	55	0	1	1	3	1

Table 2-12: I-95 Mainline PM Volume Calibration Results (veh)

	Location	Field Measured Throughput					*VISSIM* Simulated Throughput					Difference					% Difference				
		3 PM	4 PM	5 PM	6 PM	6 – 7 PM	3 PM	4 PM	5 PM	6 PM	6 – 7 PM	3 PM	4 PM	5 PM	6 PM	6 – 7 PM	3 PM	4 PM	5 PM	6 PM	6 – 7 PM
I-95 NB	South of Centreport Pkwy (Ex. 136)	3,561	3,582	3,405	3,119	13,667	3,613	3,594	3,451	3,203	13,861	52	12	46	84	194	1%	0%	1%	3%	1%
	South of Gordon Blvd (Ex. 160)	4,872	4,755	4,523	4,162	18,312	5,250	5,135	4,700	4,115	19,200	378	380	177	-47	888	8%	8%	4%	-1%	5%
I-95 SB	North of Prince William Pkwy (Ex. 158)	5,472	5,707	5,487	5,063	21,729	5,434	5,463	5,442	5,445	21,784	-38	-244	-45	382	55	-1%	-4%	-1%	8%	0%
	North of Warrenton Rd (Ex. 133)	4,853	4,890	4,327	3,792	17,862	5,168	5,060	4,537	3,886	18,651	315	170	210	94	789	6%	3%	5%	2%	4%

For the PM peak, all segments and the overall corridor satisfied the calibration thresholds for travel times and volumes. Three outlier speeds (highlighted in light red) were noticed for individual segments towards the southern project limits during the shoulder hours (particularly 4 PM and 6 PM). Travel times within each these segments satisfied the 25% requirement for the individual hours, so the travel speed deviation is not expected to substantially impact the results or the evaluation of the proposed build improvements.

Table 2-13 and **Table 2-14** summarize volume calibration results for ramps and intersections, respectively. The target was for 85 percent of the simulated volumes to fall within the allowable threshold within each volume grouping. For the AM peak period, this was achieved for both the overall simulation period and the peak hour (7-8 AM). For the PM peak period, the calibration thresholds were also satisfied for the intersection movements for both the peak hour and the overall simulation period. For ramps during the PM peak hour, the only grouping which did not meet the threshold was ramps with a total of less than 300 vehicles (combined across 3 hours) for the overall simulation period. These ramps are the lowest volume ramps within the network and represent a very small portion of the total volume accessing the I-95 corridor and do not impact the overall calibration of the model and would not impact the assessment of future operations along the I-95 corridor.

For most locations, the VISSIM queues were well within the project-specific calibration threshold. However, for the queue along westbound Route 3 at Carl D. Silver Parkway, VISSIM reported shorter queues than those observed in the field. The queue along westbound Route 3 is complex, with several intersections west of I-95 contributing to the overall queue. Based on field observations, the critical queue begins two intersections west of the modeled area, where Route 3 westbound reduces from four through lanes to 3 through lanes. Additionally, the queuing along the off-ramp from I-95 SB to Route 3 (which is primarily a rolling queue throughout the peak period) could not be adequately captured using VISSIM evaluation measures. From visual inspection, the simulated queue on this off-ramp was also less than field observed conditions; this queue is influenced by the same factors as the queue along westbound Route 3. It is important to note that the primary purpose of this VISSIM modeling was to evaluate the impacts of the I-95 Express Lanes Fredericksburg Extension project; the project itself terminates north of Exit 133, and the project would not involve changes to the Route 3 corridor. Additionally, the I-95 / Route 3 Safety Improvements are currently under construction; these improvements will substantially modify the existing conditions at this interchange and efforts to further calibrate this specific location would have had minimal benefits in terms of evaluating the I-95 Express Lanes Fredericksburg Extension project. Future studies could expand the model to the west if the intent of a future study is to evaluate operations along Route 3 in greater detail.

Table 2-13: I-95 Interchange Ramp Volume Calibration Summary

	AM		PM	
	Overall	Peak Hour	Overall	Peak Hour
Within 5% Volume >1,000	93% (43 Links)	86% (7 Links)	87% (55 Links)	100% (10 Links)
Within 10% 300 > Volume > 1000	90% (30 Links)	95% (43 Links)	100% (22 Links)	95% (42 Links)
Within 20% Volume < 300	80% (10 Links)	88% (33 Links)	40% (5 Links)	90% (35 Links)
Overall Summary	90% (83 Links)	92% (83 Links)	94% (87 Links)	94% (87 Links)

Table 2-14: Arterial Street Intersection Movement Volume Calibration Summary

	AM		PM	
	Overall	Peak Hour	Overall	Peak Hour
Within 10% Volume >1,000	97% (67 Movements)	91% (22 Movements)	96% (96 Movements)	88% (26 Movements)
Within 20% Volume < 1,000	97% (126 (Movements)	98% (171 Movements)	100% (97 Movements)	89% (167 Movements)
Overall Summary	97% (193 Movements)	97% (193 Movements)	98% (193 Movements)	89% (193 Movements)

2.5.6 Measures of Effectiveness

The following measures of effectiveness (MOEs) were used for the operational analysis of the roadway network under existing and future Build and No Build scenarios. Per the TOSAM, Level of Service (LOS) will not be reported for results from microsimulation models:

Freeway Mainline Segments:

- Volumes (vehicles per hour)
- Average density (vehicles per mile lane)
- Average speed (miles per hours) – by segment and for the overall corridor
- Average travel times (minutes) – by segment and for the overall corridor
- Duration of congestion – based on travel speeds
- Congestion extent (number of miles congested) – based on travel speeds

Freeway Ramp Junctions and Weaving Segments

- Volumes (vehicles per hour)
- Average density (vehicles per mile lane)
- Average speed (miles per hours)

Ramp Terminals / Arterial Intersections

- Volumes (vehicles per hour)
- Average control delay (sec/veh) by movement, approach, and overall intersection
- Average Queue Length (ft) by lane group
- Maximum Queue Length (ft) by lane group

Overall Network

- Travel time on network (veh-hours)
- Vehicle-miles traveled
- Average network speed (miles per hour)

2.6 SAFETY ANALYSIS METHODOLOGY

A detailed safety analysis has been included in the IJR. This analysis was conducted in accordance with the TOSAM. Historical crash data from 1/1/2011 to 12/31/2016 was obtained from VDOT and summarized for inclusion in the IJR. Crash trends were determined and crash hotspots (locations with crash rates higher than the critical crash rate within the Study Corridor) were identified.

No existing predictive analysis tools are available which explicitly account for the influence of reversible lanes. However, the Enhanced Interchange Safety Analysis Tool (ISATe), which applies the methodologies of the Highway Safety Manual (HSM), was utilized to assess the potential safety impacts of changes in GP lane traffic volumes between the No Build and Build Alternatives.

3. EXISTING CONDITIONS

Transportation facilities in the Fredericksburg region comprise all modes of surface and air transportation. In addition to the highway network, the region is also served by intercity passenger rail service provided by Amtrak as well as the Virginia Railway Express (VRE) commuter rail service. Local bus transit is provided within the study area by Fredericksburg Regional Transit (FRED). The region contains several general aviation airports, including the Stafford Regional Airport, located just west of I-95 between Exit 136 and 140. International air service is available from two locations in the neighboring Northern Virginia region and one location in the neighboring Richmond region.

3.1 EXISTING DEMOGRAPHICS

I-95 serves as the primary north-south route through Spotsylvania, Stafford and Prince William Counties. I-95 serves a mix of local, commuter and regional traffic within the study area. Per American Community Survey (ACS) 2011-2015 5-Year data, the resident population of the study area Census block groups (depicted in **Figure 3-1**) is approximately 35,600 persons. Of these, most residents live in Stafford County (**Table 3-1**).

Table 3-1: Resident Population of Study Geographic Areas

Geographic Area	Population	Percentage of Population within Study Census Block Groups
Study Area Block Groups Total Population	35,571	100.0%
Prince William County	437,271	0.6%
Stafford County	137,145	24.0%
Virginia	8,256,630	Less than 1.0%

Source: ACS 2011-2015 5-Year data

Between 1980 and 2015, the population of the two counties within the project area, Stafford County and Prince William County, grew by approximately 240 percent and 200 percent, respectively. During the same period, a 54.4 percent population increase occurred statewide. According to the 2011-2015 ACS 5-year estimates, within the studied Census block groups, approximately 70 percent of occupied housing units were owner-occupied and 30 percent were renter-occupied. Among the 12 studied Census block groups, there were a total of approximately 11,400 housing units.

Per the 2015 ACS data, approximately 95.6 percent of the labor force in the study Census block groups is employed (**Table 3-2**). This is higher than the proportion of employed labor force in Prince William County (94.7 percent), Stafford County (94.8 percent), and Virginia (93.7 percent).

Table 3-2: Study Census Block Group Employment Characteristics

Geographic Area	Total Population in Labor Force	Total Employed (Civilian and Military)	Total Percent Employed
Study Area Block Groups Total	18,402	17,586	95.6%
Prince William County	242,801	229,902	94.7%
Stafford County	72,937	69,155	94.8%
Virginia	4,376,786	4,100,756	93.7%

Source: ACS 2011-2015 5-Year data

Most commuters within the study Census block groups (66.1 percent) commute alone by car, truck, or van (VDOT, 2017h). In the study localities, the proportion of driving resident commuters who travel alone ranges from 77.5 percent statewide, to 72.7 percent in Stafford County, and 74.1 percent in Prince William County. These percentages are similar those seen in the localities at the time of the 2011 EA, with the proportion of driving resident commuters who travel alone ranging from 77.2 percent statewide, to 74.0 percent in Stafford County, and 71.5 percent in Prince William County. The total number of commuters between 2011 and 2015, though, has increased by roughly 10.9 percent in Prince William County, 7.9 percent in Stafford County, and 3.7 percent in Virginia.

3.2 EXISTING LAND USE

The most prominent land use (represented by the appropriate Stafford County zoning classifications) within 1,000 feet on either side of I-95 between Exits 133 and 143 is roadway right-of-way, followed by residential, agricultural, commercial, industrial, federal, and planned development (**Table 3-3**).

Growth in the Washington, DC metropolitan region and the Fredericksburg metropolitan area has resulted in substantial residential and commercial development in Northern Virginia, including Prince William and Stafford Counties. This intensified land use is evident along I-95, in places such as Midway Island, Garrisonville, Aquia, Stafford, and Berea.

As shown in **Figure 3-2** and **Table 3-3**, the most prominent land use within the study area as indicated by zoning is roadway right-of-way, followed by residential, agricultural, commercial, industrial, Federal and planned development.

Table 3-3: Study Area Land Use

Land Use	Total Acreage within Study Area	Percent of Total Acreage within Study Area
Agricultural	537	14%
Commercial	487	12%
Federal	270	7%
Planned Development	84	2%
Residential	814	21%
Industrial	342	9%
Right-of-way	1,305	35%
Total	**3,839**	**100%**

Figure 3-1: Census Block Groups

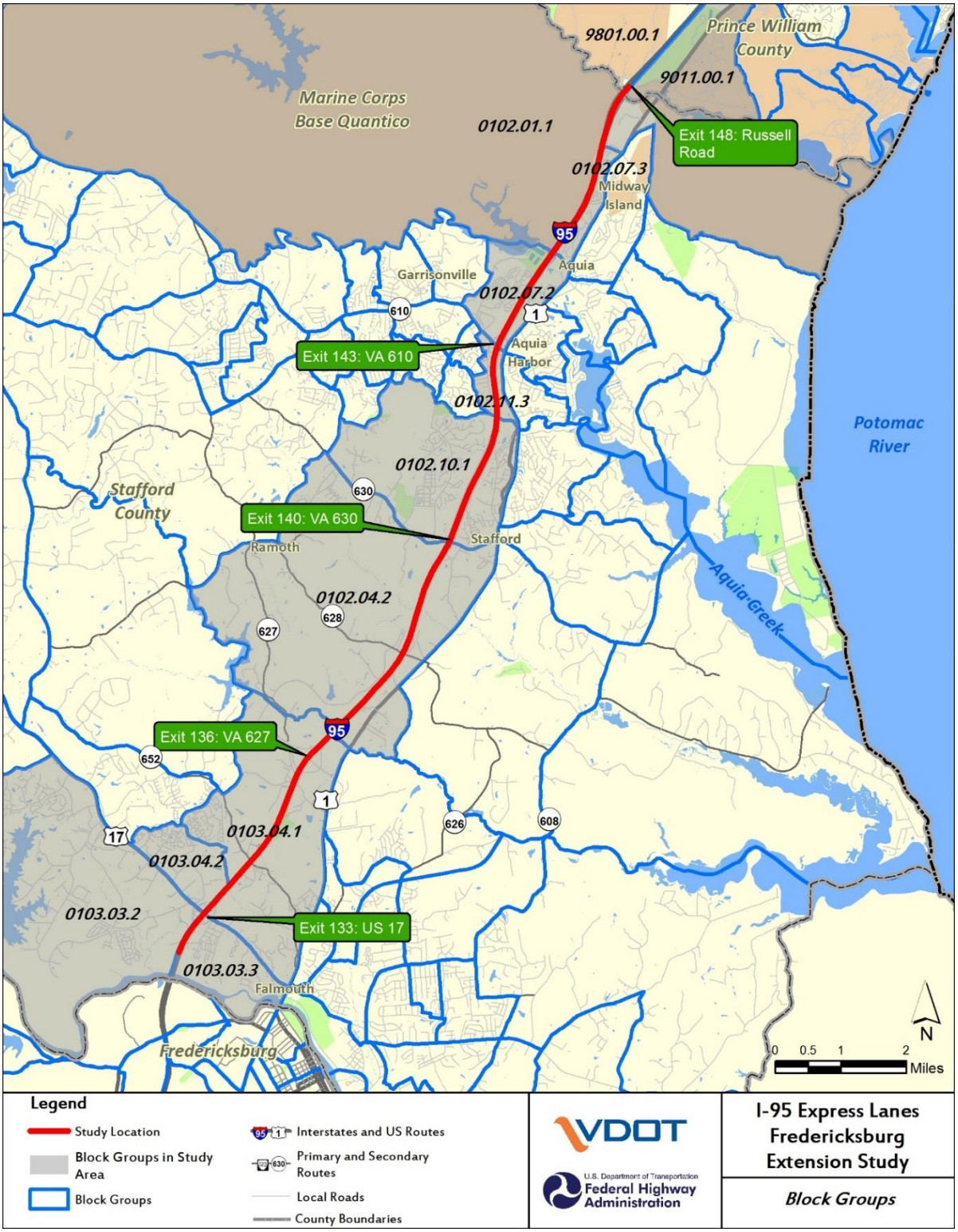
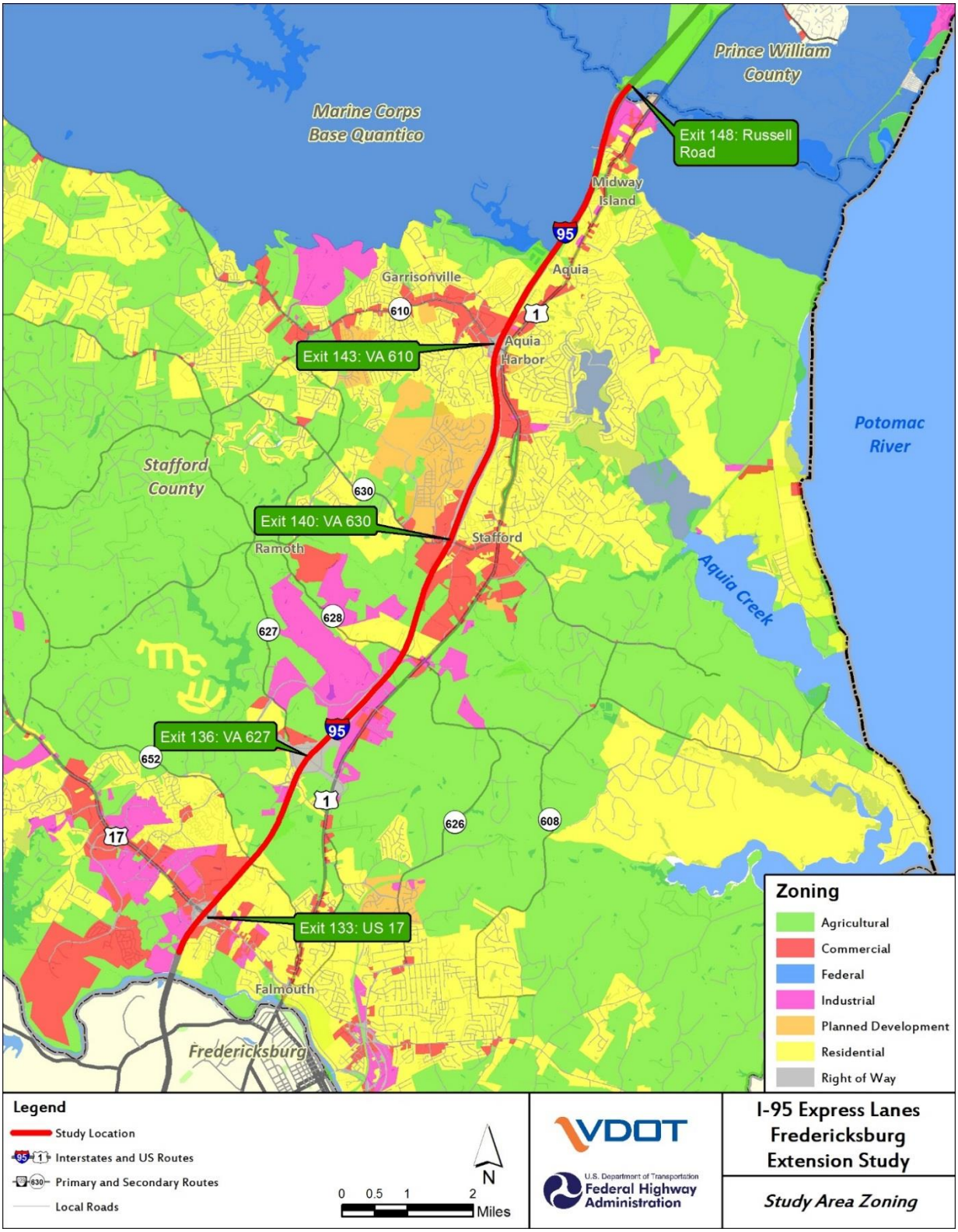


Figure 3-2: Study Area Zoning



3.3 LIMITED ACCESS HIGHWAYS

Interstate-95 is the only limited-access highway within the study area and is summarized in **Table 3-4**. This highway serves a critical transportation function for commuters, interstate and intrastate freight movement, national defense, and commercial activities.

Table 3-4: Limited Access Highways

Highway	Functional Classification	Description	Number of Lanes	Speed Limit
I-95	Interstate	Within the study area, I-95 extends from the US 17 (Warrenton Road) interchange (Exit 133) to just north of the Russell Road interchange (Exit 148), approximately 15 miles.	3 NB, 3 SB	65 MPH
I-95 Express Lanes	-	Within the study area, the I-95 Express Lanes extend from approximately 1 mile north of the Garrisonville Road interchange (Exit 143) to just north of the Russell Road interchange, approximately 5 miles.	2 (Reversible)	65 MPH

3.4 CONNECTING ARTERIAL ROADS

Arterial roads, including state primary and secondary roads and facilities maintained by Marine Corps Base Quantico (MCBQ) which link to I-95, are summarized in **Table 3-5**. US 1, which runs parallel to I-95 throughout the study areas is also included.

Table 3-5: Connecting Arterial Roads

Numerical Designation	Roadway Name	Functional Classification	Interchange/ Exit Number	Number of Lanes	Maintained By
SR 3	Plank Road	Other Principal Arterial	130	6	VDOT
US 17	Warrenton Road	Other Principal Arterial	133	6	VDOT
SR 8900	Centreport Parkway	Major Collector	136	2	VDOT
SR 630	Courthouse Road	Major Collector	140	2	VDOT
SR 610	Garrisonville Road	Major Collector	143	6	VDOT
-	Russell Road	Minor Arterial	148	4	MCBQ
US 1	Jefferson-Davis Highway	Other Principal Arterial	n/a	4	VDOT

3.5 TRANSIT ROUTES AND FACILITES

Public transportation in the region is provided by FRED. FRED serves Caroline, Spotsylvania, and Stafford Counties, as well as the City of Fredericksburg and Mary Washington University. FRED operates a total of 21 local fixed bus routes, including shuttle service to the Fredericksburg and Spotsylvania County VRE

stations. Service is provided from 4:30 AM to 8:30 PM, Monday through Friday. Accessible transportation is provided through deviated fixed route service. Based on 2009 data, annual ridership was approximately 550,000.

Commuter rail service within the Fredericksburg Region is provided by VRE. The Fredericksburg Line originates at the Spotsylvania Station with four additional stops in the region at the Fredericksburg, Leeland Road, Brooke, and Quantico stations. During the morning, only northbound service is provided, with a total of eight trains departing. During the afternoon and evening, only southbound service is provided, with eight trains arriving in the region. Daily passenger boardings at the Spotsylvania, Fredericksburg, Leeland Road, and Brooke stations were approximately 3,300 per day in 2016.

Commuter bus service is provided within the Study Area by MARTZ Group, a private transit provider. Commuter bus service is provided from Fredericksburg and Stafford to Crystal City, the Pentagon, and Washington, D.C. Service is provided from three park and ride locations in the Study Area: Route 610 (Garrisonville Road) North Lot, Route 17 and Falls Run Drive, and Route 3 and Salem Church Road. Scheduled morning service in the Study Area occurs between 4:30 AM and 6:30 AM. Scheduled afternoon return service in the Study Area occurs between 4:50 PM and 7:00 PM.

3.6 INTERCITY PASSENGER RAIL SERVICE (AMTRAK)

Intercity passenger rail service in the Fredericksburg region is provided by the National Railroad Passenger Corporation (Amtrak). Amtrak operates three routes with service to the Fredericksburg station (FBG): Northeast Regional, Carolinian/Piedmont, and Silver Service / Palmetto. The Northeast Regional route provides service north to Washington, DC; New York City; and Boston, Massachusetts; and south to Richmond, Newport News, and Norfolk, Virginia. Weekday service on the Northeast Regional route includes seven southbound trains and five northbound trains. Annual Amtrak ridership at the Fredericksburg station was approximately 120,275 passengers in 2016.

3.7 PARK AND RIDE FACILITIES & RIDESHARING

Carpooling and ridesharing is an important component of the transportation system in Fredericksburg. There are publicly owned and maintained park-and-ride facilities dispersed throughout the Fredericksburg Region. There are approximately 8,000 available commuter parking spaces within the available lots within the Study Area. This total includes over 3,000 spaces combined at the I-95/Route 630 (Exit 140) and I-95/Route 610 (Exit 143) interchanges which are currently 100 percent utilized on a typical weekday. As part of the Interstate 95 / Route 630 (Courthouse Road) Interchange Relocation and Route 630 Widening (UPC 13358, UPC 4632) project, the existing 534 space commuter lot (located west of I-95) will be relocated to two new lots to be constructed east of I-95. The two new lots will include approximately 1,100 spaces. The current FAMPO 2040 Long Range Transportation Plan projects the need for an additional 8,827 parking spaces in the region. **Table 3-6** summarizes the existing major commuter park and ride facilities near the study area.

GWRideConnect provides free ridesharing services for commuters within the Fredericksburg region and between the Fredericksburg region and major employment centers in Washington, DC, Northern Virginia, Richmond, and Dahlgren.

“Instant” or “Casual” carpooling, also known as “slugging,” is also a feature of the transportation system in the Fredericksburg region. This unique mode allows travelers to instantly form carpools to satisfy the two-person and three-person high occupancy requirements for the I-95 Express Lanes and other facilities. Slugging is available for destinations in Northern Virginia and Washington, DC at the Mine Road, Route

610, Route 630, Route 3 (Cordon Rd), Route 17, and Route 208 park-and-ride lots in Stafford County and the City of Fredericksburg.

Table 3-6: Park and Ride Facilities in Study Area

Name	Location	Jurisdiction	Capacity (Spaces)	Transit Service
Old Salem Church	Route 3 & Route 649	Spotsylvania County	672	FRED / MARTZ
Route 3 West	Route 3 & Route 627	Spotsylvania County	1,044	FRED
Fredericksburg VRE Commuter Lot	Fredericksburg VRE Station	City of Fredericksburg	631	FRED/VRE/Amtrak
Falmouth/Falls Run Drive	US 17 & Route 618	County of Stafford	1,024	FRED/MARTZ
Leeland Road VRE	Route 626 & Route 624	County of Stafford	825	FRED/VRE
Brook Road VRE	Route 608 & Route 629	County of Stafford	505	FRED/VRE
Courthouse Road	Route 630 & I-95	County of Stafford	534 (existing) / 1,100 (future)	FRED
Garrisonville South Commuter Lot (Mine Road)	Route 684 & Route 679	County of Stafford	890	FRED
Garrisonville North Commuter Lot	Route 684 & Route 1413	County of Stafford	1,824	FRED/MARTZ

Source: http://www.virginiadot.org/travel/parkride/home.asp

3.8 BICYCLE AND PEDESTRIAN NETWORK

There are no bicycle or pedestrian facilities along the study corridor of I-95. State law generally does not permit bicyclists to ride on Interstates and certain controlled access highways, unless the operation is limited to bicycle or pedestrian facilities that are barrier separated from the roadway and automobile traffic.

No pedestrian or bicycle facilities currently exist along any of the intersecting arterial streets within their interchanges with I-95. A shared-use path, crossing over I-95 on the same structure as relocated Courthouse Road, is proposed as part of the interchange improvements at Exit 140.

3.9 EXISTING TRAFFIC VOLUMES

Detailed information on existing traffic volumes is included in Chapter 6. Existing 2016 Average Daily Existing traffic volumes are summarized in **Chapter 6.**

3.10 CRASH ANALYSIS

Detailed information on the crash history within the study segment of I-95 is included in **Chapter 8**.

3.11 ASSESSMENT OF VEHICLE SPEEDS & TRAVEL TIMES

3.11.1 Vehicle Speeds

As part of the Fredericksburg Extension Study, INRIX speed data for the I-95 corridor within the study area was analyzed. INRIX provides average speed data for individual segments (generally between consecutive ramp terminals) in 15-minute increments. Corridor data from September and October 2016 were analyzed. The 16.1-mile northbound study segment extends from the Rappahannock River to the northbound on-ramp at Russell Road. The 17.8 southbound study segment extends from the southbound on-ramp at Joplin Road to the Rappahannock River. Speeds for each segment and each 15-minute period were averaged and cross-tabulated by mile point and time period. The results for northbound and southbound I-95 are shown in **Figure 3-3** and **Figure 3-4**, respectively. These figures show the average speed on Tuesdays, Wednesdays, and Thursdays along the I-95 corridor between 5:00 AM and 10:00 AM and 2:00 PM and 8:00 PM. In these figures, segments are shown on the vertical axis, and time of day is shown along the horizontal axis. The color gradations indicate average speed, with green being the highest and red being the lowest speed.

Additionally, INRIX data was analyzed for weekday periods in 2013, prior to the opening of the I-95 Express Lanes system. Speeds for each segment and each 15-minute period were averaged and cross-tabulated by mile point and time period. The results are shown in **Figure 3-5** and **Figure 3-6.**

As shown in **Figure 3-3**, there is a pronounced period of reduced speeds (below 40 MPH) along northbound I-95 during the AM peak period. Congestion (indicated by red and orange colors) begins to form along northbound I-95 beginning at Exit 143 (Garrisonville Road) in the early morning hours (approximately 5:15 AM) and extends upstream towards Exit 133 (US 17), peaking between 6-7 AM, before queues begin to dissipate between 8:30 and 9:30 AM. No notable periods of reduced speeds occur during the PM peak periods along northbound I-95. Comparing the 2013 and 2016 speeds along northbound I-95, the periods of low speeds (red and yellow areas) span a longer period of time and impact a longer portion of the corridor in 2016 during the AM period.

As shown in **Figure 3-4**, there is a pronounced period of reduced speeds (below 40 MPH) along southbound I-95 during the PM peak period. Two different areas are noted. Beginning at approximately 3:30 PM, congestion begins to form along southbound I-95 beginning north of Exit 143 (Garrisonville Road) and extends upstream towards Exit 148 (Russell Road), peaking between 4:30 – 5:30 PM, before queues begin to dissipate between 6:00 and 6:30 PM. Further south, congestion begins to form along southbound I-95 at Exit 133 (US 17) at approximately 4:30 PM and extends upstream towards Exit 143, peaking between 5:00 – 6:00 PM, before queues begin to dissipate between 6:30 and 7:30 PM.

No notable periods of reduced speeds occur during the AM peak periods along southbound I-95. Comparing the 2013 and 2016 speeds along southbound I-95 during the PM peak, the location and duration of congestion differs. In 2013, congestion was primarily limited to the area north of Exit 148 (Russell Road), with pronounced reductions in speeds between 3:30 and 6:30 PM in this area. There was a reduction in speeds (below 50 MPH) between Exits 148 and 143, but the intensity was less than observed in 2016. Further south, speeds reduced to below 40 MPH at Exit 133 (US 17) between 5:00 and 6:00 PM with reduced speeds (below 50 MPH) extending upstream towards Exit 140. The intensity and duration of the congestion in this area was less than that observed in 2016.

Figure 3-3: 2016 I-95 Northbound GP Lane Travel Speeds

2016 Northbound I-95 General Purpose Lane Speeds, AM Peak Hours

Segment	5:00	5:15	5:30	5:45	6:00	6:15	6:30	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	8:45	9:00	9:15	9:30	9:45	10:00
Rappahannock River to Exit 133 Off-Ramp	69	68	68	68	67	66	66	67	64	65	63	54	55	60	62	64	64	65	66	67	67
Exit 133 Off-Ramp to Exit 133 On-Ramp	71	69	69	70	68	68	66	64	64	67	67	65	62	64	66	67	64	62	65	69	69
Exit 133 On-Ramp to Exit 140 Off-Ramp	70	67	65	61	52	42	35	32	34	33	33	36	45	48	52	57	60	63	65	66	68
Exit 140 Off-Ramp to Exit 140 On-Ramp	67	63	55	37	28	23	18	17	17	17	19	24	31	37	43	54	58	65	63	62	61
Exit 140 On-Ramp to Exit 143 Off-Ramp	68	57	35	26	23	20	18	18	19	19	21	25	27	32	40	48	56	58	58	57	55
Exit 143 Off-Ramp to Exit 143 On-Ramp	62	38	25	24	21	19	18	20	20	20	22	24	24	28	33	40	50	50	50	55	57
Exit 143 On-Ramp to Exit 148 Off-Ramp	67	63	60	59	59	57	57	57	58	59	60	61	60	61	61	63	64	65	66	66	68
Exit 148 Off-Ramp to Exit 148 On-Ramp	68	68	68	70	68	68	68	69	69	69	70	71	69	69	68	68	68	69	69	68	69

2016 Northbound I-95 General Purpose Lane Speeds, PM Peak Hours

Segment	14:00	14:15	14:30	14:45	15:00	15:15	15:30	15:45	16:00	16:15	16:30	16:45	17:00	17:15	17:30	17:45	18:00	18:15	18:30	18:45	19:00	19:15	19:30	19:45	20:00
Rappahannock River to Exit 133 Off-Ramp	66	67	68	68	66	67	68	68	67	68	66	68	68	66	67	67	67	67	66	67	66	66	66	66	66
Exit 133 Off-Ramp to Exit 133 On-Ramp	68	68	69	69	69	69	70	70	69	70	69	69	70	69	69	66	68	69	69	68	68	66	67	68	68
Exit 133 On-Ramp to Exit 140 Off-Ramp	70	67	69	70	70	69	70	69	69	69	69	69	70	69	70	70	69	69	69	68	69	67	68	69	69
Exit 140 Off-Ramp to Exit 140 On-Ramp	70	69	70	69	70	70	70	70	69	70	69	69	70	69	70	69	69	69	70	69	70	68	68	69	70
Exit 140 On-Ramp to Exit 143 Off-Ramp	70	69	69	70	70	70	70	69	69	69	70	69	70	70	70	70	70	70	70	68	69	68	69	69	69
Exit 143 Off-Ramp to Exit 143 On-Ramp	67	66	67	67	67	68	69	67	67	67	68	67	68	68	68	69	68	68	68	67	67	65	66	66	67
Exit 143 On-Ramp to Exit 148 Off-Ramp	69	69	69	69	69	70	69	69	69	68	68	67	69	70	69	69	68	69	69	68	68	67	67	68	68
Exit 148 Off-Ramp to Exit 148 On-Ramp	69	70	69	69	69	70	70	70	68	65	66	64	65	68	69	69	69	69	69	69	68	68	69	68	68

Speed Color Scale (mph)

25	30	35	40	45	50	55	60	65

Figure 3-4: 2016 I-95 Southbound GP Lane Travel Speeds

2016 Southbound I-95 General Purpose Lane Speeds, AM Peak Hours

Segment	5:00	5:15	5:30	5:45	6:00	6:15	6:30	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	8:45	9:00	9:15	9:30	9:45	10:00
Exit 150 On-Ramp to Exit 148 Off-Ramp	68	69	70	70	69	69	68	68	68	69	69	68	69	69	69	69	69	69	70	69	68
Exit 148 Off-Ramp to Exit 148 On-Ramp	68	69	71	70	69	70	70	70	68	70	69	69	69	69	71	69	70	70	70	70	69
Exit 148 On-Ramp to Exit 143 Off-Ramp	67	68	69	68	68	68	68	68	67	69	69	68	68	68	69	69	69	69	69	69	69
Exit 143 Off-Ramp to Exit 143 On-Ramp	66	67	68	68	67	67	68	67	66	67	67	67	67	67	68	67	68	69	67	67	68
Exit 143 On-Ramp to Exit 140 Off-Ramp	67	68	69	69	69	69	69	68	68	68	69	68	68	68	69	68	69	70	68	69	69
Exit 140 Off-Ramp to Exit 140 On-Ramp	66	67	68	68	68	68	69	67	67	67	68	68	68	67	68	68	68	68	67	67	67
Exit 140 On-Ramp to Exit 133 Off-Ramp	66	67	68	68	67	68	69	68	67	67	69	68	67	67	68	68	69	68	68	68	68
Exit 133 Off-Ramp to Exit 133 On-Ramp	66	66	66	68	67	68	69	67	66	66	68	67	67	67	66	67	68	67	66	61	61
Exit 133 On-Ramp to Rappahannock River	66	66	68	69	68	68	69	68	66	67	68	67	66	67	68	68	68	66	63	60	60

2016 Southbound I-95 General Purpose Lane Speeds, PM Peak Hours

Segment	14:00	14:15	14:30	14:45	15:00	15:15	15:30	15:45	16:00	16:15	16:30	16:45	17:00	17:15	17:30	17:45	18:00	18:15	18:30	18:45	19:00	19:15	19:30	19:45	20:00
Exit 150 On-Ramp to Exit 148 Off-Ramp	70	69	66	64	65	61	55	47	44	40	35	32	29	38	40	48	56	63	62	67	68	68	67	67	64
Exit 148 Off-Ramp to Exit 148 On-Ramp	70	71	69	64	63	58	50	37	37	30	28	25	27	32	35	44	55	59	63	68	68	69	68	66	66
Exit 148 On-Ramp to Exit 143 Off-Ramp	66	66	63	60	55	52	43	38	34	31	30	29	32	32	34	34	38	49	60	64	66	66	66	65	66
Exit 143 Off-Ramp to Exit 143 On-Ramp	66	64	61	59	54	52	46	46	40	39	35	43	39	42	43	45	50	59	59	62	64	65	65	65	65
Exit 143 On-Ramp to Exit 140 Off-Ramp	65	62	60	57	56	51	51	47	43	41	42	42	40	38	39	39	48	53	60	61	64	67	67	66	67
Exit 140 Off-Ramp to Exit 140 On-Ramp	60	59	57	56	55	50	52	47	46	45	47	40	40	40	38	39	45	44	50	59	65	66	67	66	65
Exit 140 On-Ramp to Exit 133 Off-Ramp	59	59	56	57	55	55	54	50	50	50	48	42	40	37	35	34	34	36	43	53	60	65	67	66	66
Exit 133 Off-Ramp to Exit 133 On-Ramp	57	56	58	59	61	60	56	49	50	43	37	38	32	31	27	25	24	29	34	40	49	60	66	66	66
Exit 133 On-Ramp to Rappahannock River	57	57	59	60	63	61	56	52	50	46	42	42	38	37	33	30	30	34	35	39	48	58	66	67	67

Speed Color Scale (mph)

25	30	35	40	45	50	55	60	65

Figure 3-5: 2013 I-95 Northbound GP Lane Travel Speeds

2013 Northbound I-95 General Purpose Lane Speeds, AM Peak Hours

Segment	5:00	5:15	5:30	5:45	6:00	6:15	6:30	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	8:45	9:00	9:15	9:30	9:45	10:00
Rappahannock River to Exit 133 Off-Ramp	69	69	69	68	68	67	67	67	67	66	62	54	60	65	66	66	67	67	67	68	67
Exit 133 Off-Ramp to Exit 133 On-Ramp	70	70	70	69	69	69	69	69	69	67	65	64	66	67	68	68	68	69	69	69	68
Exit 133 On-Ramp to Exit 140 Off-Ramp	70	70	70	69	69	69	68	65	63	60	59	59	62	63	65	66	67	68	69	68	68
Exit 140 Off-Ramp to Exit 140 On-Ramp	71	70	70	70	70	69	65	58	56	53	49	49	55	59	61	64	67	67	68	68	69
Exit 140 On-Ramp to Exit 143 Off-Ramp	70	69	66	67	67	66	60	53	49	46	42	44	50	54	58	62	63	64	66	67	67
Exit 143 Off-Ramp to Exit 143 On-Ramp	67	57	48	55	56	54	47	40	37	34	33	34	38	42	47	52	56	57	58	59	57
Exit 143 On-Ramp to Exit 148 Off-Ramp	67	61	55	56	60	60	59	57	57	55	55	54	55	56	58	59	60	60	60	57	55
Exit 148 Off-Ramp to Exit 148 On-Ramp	67	63	58	59	63	65	65	66	66	66	66	65	65	65	65	65	64	64	64	62	61

2013 Northbound I-95 General Purpose Lane Speeds, PM Peak Hours

Segment	14:00	14:15	14:30	14:45	15:00	15:15	15:30	15:45	16:00	16:15	16:30	16:45	17:00	17:15	17:30	17:45	18:00	18:15	18:30	18:45	19:00	19:15	19:30	19:45	20:00
Rappahannock River to Exit 133 Off-Ramp	67	67	67	67	67	67	67	68	68	68	68	68	68	68	68	67	68	68	68	68	68	68	68	68	68
Exit 133 Off-Ramp to Exit 133 On-Ramp	69	69	69	68	68	68	69	69	69	69	69	69	69	69	69	69	69	69	68	69	68	69	69	69	69
Exit 133 On-Ramp to Exit 140 Off-Ramp	68	68	68	68	68	68	69	69	69	69	70	70	69	69	69	69	68	68	68	69	69	69	69	69	69
Exit 140 Off-Ramp to Exit 140 On-Ramp	69	69	69	69	68	69	69	69	69	69	69	70	70	69	69	69	69	69	69	69	70	70	70	69	69
Exit 140 On-Ramp to Exit 143 Off-Ramp	68	68	67	67	67	68	69	68	69	68	69	69	69	69	68	68	68	68	69	69	69	69	69	69	69
Exit 143 Off-Ramp to Exit 143 On-Ramp	61	60	60	61	62	63	64	65	65	66	66	67	66	66	66	65	65	66	66	66	67	67	66	67	66
Exit 143 On-Ramp to Exit 148 Off-Ramp	58	58	58	59	60	60	62	64	64	65	65	66	65	65	65	65	66	66	66	67	67	68	67	67	67
Exit 148 Off-Ramp to Exit 148 On-Ramp	61	61	60	60	60	60	61	61	62	62	63	63	62	62	61	63	64	65	65	66	67	67	67	67	67

Speed Color Scale (mph)

25	30	35	40	45	50	55	60	65

Figure 3-6: 2013 I-95 Southbound GP Lane Travel Speeds

2013 Southbound I-95 General Purpose Lane Speeds, AM Peak Hours

Segment	5:00	5:15	5:30	5:45	6:00	6:15	6:30	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	8:45	9:00	9:15	9:30	9:45	10:00
Exit 150 On-Ramp to Exit 148 Off-Ramp	67	67	67	67	67	67	67	66	66	66	66	65	65	65	65	65	65	66	66	65	64
Exit 148 Off-Ramp to Exit 148 On-Ramp	70	70	70	70	70	70	70	69	69	69	69	69	69	69	68	68	68	68	68	67	67
Exit 148 On-Ramp to Exit 143 Off-Ramp	67	67	67	67	67	68	68	67	67	67	66	67	66	65	65	65	65	64	64	63	63
Exit 143 Off-Ramp to Exit 143 On-Ramp	66	66	66	66	66	67	67	66	66	66	66	66	66	66	66	66	65	65	66	65	65
Exit 143 On-Ramp to Exit 140 Off-Ramp	67	67	68	68	68	68	68	68	68	68	68	68	68	67	67	67	68	68	68	68	68
Exit 140 Off-Ramp to Exit 140 On-Ramp	67	67	67	67	67	67	67	67	68	67	67	67	67	67	67	67	68	68	68	67	67
Exit 140 On-Ramp to Exit 133 Off-Ramp	67	67	67	67	67	67	67	67	68	67	67	67	67	67	67	67	68	67	67	67	67
Exit 133 Off-Ramp to Exit 133 On-Ramp	66	66	66	66	66	66	67	67	66	66	66	66	66	67	66	66	66	66	66	66	66
Exit 133 On-Ramp to Rappahannock River	67	68	68	68	68	68	68	68	68	68	68	67	67	68	68	68	68	68	67	67	67

2013 Southbound I-95 General Purpose Lane Speeds, PM Peak Hours

Segment	14:00	14:15	14:30	14:45	15:00	15:15	15:30	15:45	16:00	16:15	16:30	16:45	17:00	17:15	17:30	17:45	18:00	18:15	18:30	18:45	19:00	19:15	19:30	19:45	20:00
Exit 150 On-Ramp to Exit 148 Off-Ramp	53	55	55	55	53	47	39	31	29	29	28	28	27	29	29	32	36	42	48	55	60	62	63	65	65
Exit 148 Off-Ramp to Exit 148 On-Ramp	54	57	57	56	54	44	36	29	29	27	27	26	27	28	29	32	35	40	47	55	61	63	65	67	67
Exit 148 On-Ramp to Exit 143 Off-Ramp	58	58	59	59	57	54	50	50	50	49	49	49	49	49	49	50	50	53	55	59	60	62	64	64	64
Exit 143 Off-Ramp to Exit 143 On-Ramp	63	62	63	62	61	60	58	59	59	59	57	57	56	55	55	57	59	61	62	62	63	64	65	65	65
Exit 143 On-Ramp to Exit 140 Off-Ramp	65	65	65	63	62	60	60	60	60	59	55	53	51	52	53	56	59	61	63	64	65	66	67	67	67
Exit 140 Off-Ramp to Exit 140 On-Ramp	65	65	64	63	61	59	59	58	58	54	52	48	46	48	49	53	54	57	60	62	64	65	65	66	66
Exit 140 On-Ramp to Exit 133 Off-Ramp	65	65	64	63	62	61	61	60	58	56	53	50	48	49	49	49	51	54	57	60	62	64	65	66	66
Exit 133 Off-Ramp to Exit 133 On-Ramp	65	64	64	64	64	64	62	58	55	53	48	44	41	39	38	37	40	46	50	55	59	62	64	64	65
Exit 133 On-Ramp to Rappahannock River	66	65	65	66	65	64	62	58	56	54	50	46	44	42	40	39	41	46	51	55	60	63	65	66	66

Speed Color Scale (mph)

25	30	35	40	45	50	55	60	65

3.11.2 Travel Times

Corridor and segment travel times were also analyzed using the available INRIX data. The 2016 weekday corridor travel times for each hour during the peak periods for both northbound and southbound I-95 are summarized in **Table 3-7**. These travel times represent the overall weekday average for 2016. The 2013 weekday corridor travel times for the same time periods are summarized in **Table 3-8.**

Table 3-7: 2016 Average Corridor Travel Times

I-95 Northbound				I-95 Southbound			
Distance (miles)	Time Period	Average Travel Time (minutes)	Average Speed (mph)	Distance (miles)	Time Period	Average Travel Time (minutes)	Average Speed (mph)
16.1	5-6AM	17.1	56	17.8	5-6AM	15.8	68
	6-7AM	26.8	36		6-7AM	15.6	68
	7-8AM	27.6	35		7-8AM	15.7	68
	8-9AM	19.8	49		8-9AM	15.7	68
	9-10AM	15.4	63		9-10AM	15.6	68
	2-3PM	14.0	69		2-3PM	17.6	61
	3-4PM	13.9	69		3-4PM	20.8	51
	4-5PM	14.1	69		4-5PM	27.0	40
	5-6PM	13.9	69		5-6PM	29.9	36
	6-7PM	14.0	69		6-7PM	23.4	46
	7-8PM	14.2	68		7-8PM	16.5	65

Table 3-8: 2013 Average Corridor Travel Times

I-95 Northbound				I-95 Southbound			
Distance (miles)	Time Period	Average Travel Time (minutes)	Average Speed (mph)	Distance (miles)	Time Period	Average Travel Time (minutes)	Average Speed (mph)
16.1	5-6AM	14.7	66	17.8	5-6AM	15.9	67
	6-7AM	15.3	63		6-7AM	15.9	67
	7-8AM	17.7	54		7-8AM	15.9	67
	8-9AM	16.2	60		8-9AM	16.0	67
	9-10AM	15.0	65		9-10AM	16.1	66
	2-3PM	14.9	65		2-3PM	17.3	62
	3-4PM	14.7	66		3-4PM	19.3	55

I-95 Northbound				I-95 Southbound			
Distance (miles)	Time Period	Average Travel Time (minutes)	Average Speed (mph)	Distance (miles)	Time Period	Average Travel Time (minutes)	Average Speed (mph)
	4-5PM	14.3	68		4-5PM	22.3	48
	5-6PM	14.3	68		5-6PM	23.7	45
	6-7PM	14.3	68		6-7PM	19.9	54
	7-8PM	14.1	68		7-8PM	16.7	64

Segment and cumulative travel times for the peak hour within each peak period are summarized in **Figure 3-7** and **Figure 3-8** for 2013 conditions.

Figure 3-7: 2016 I-95 Northbound GP Lane AM Peak Hour Travel Times

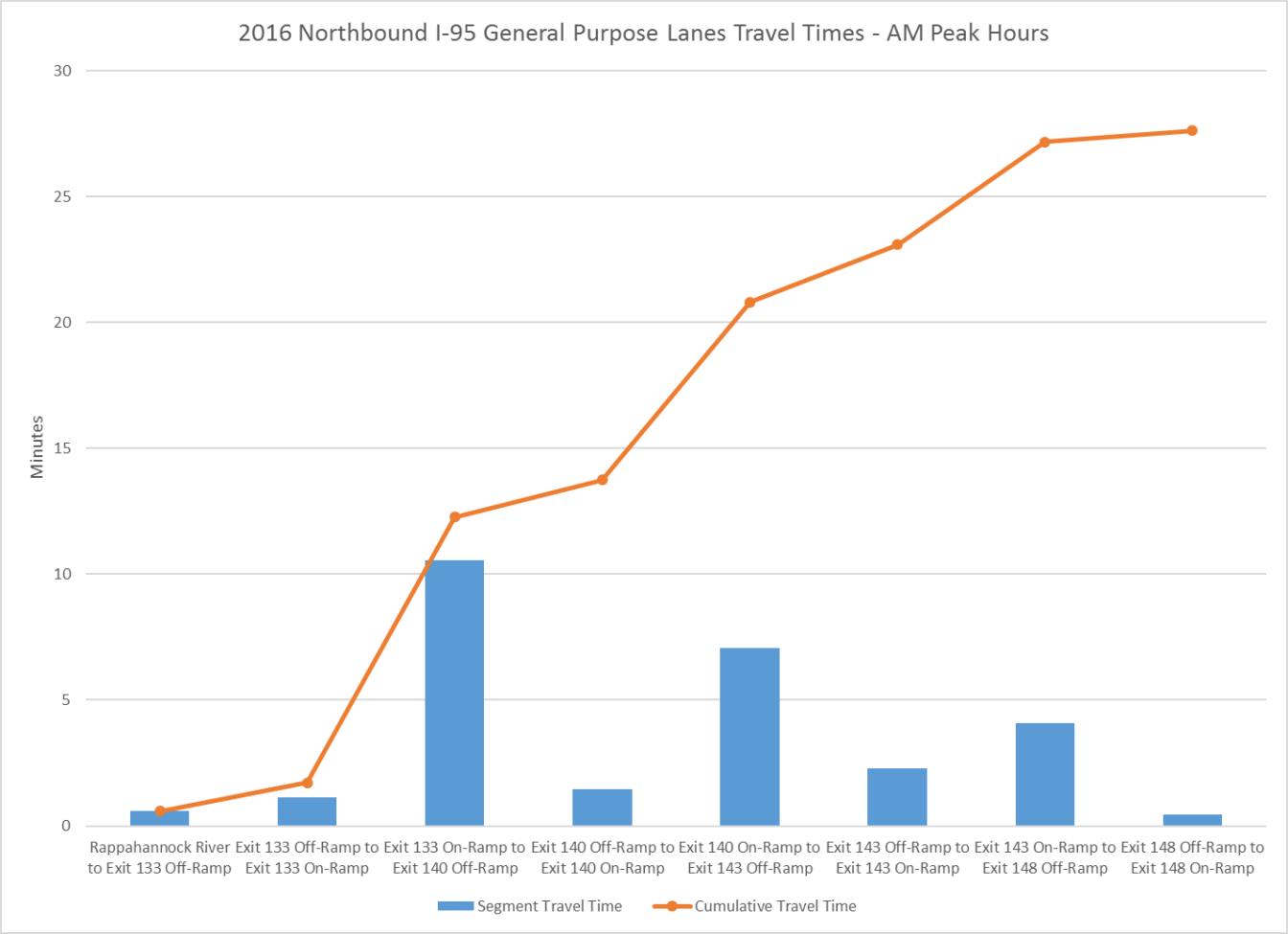
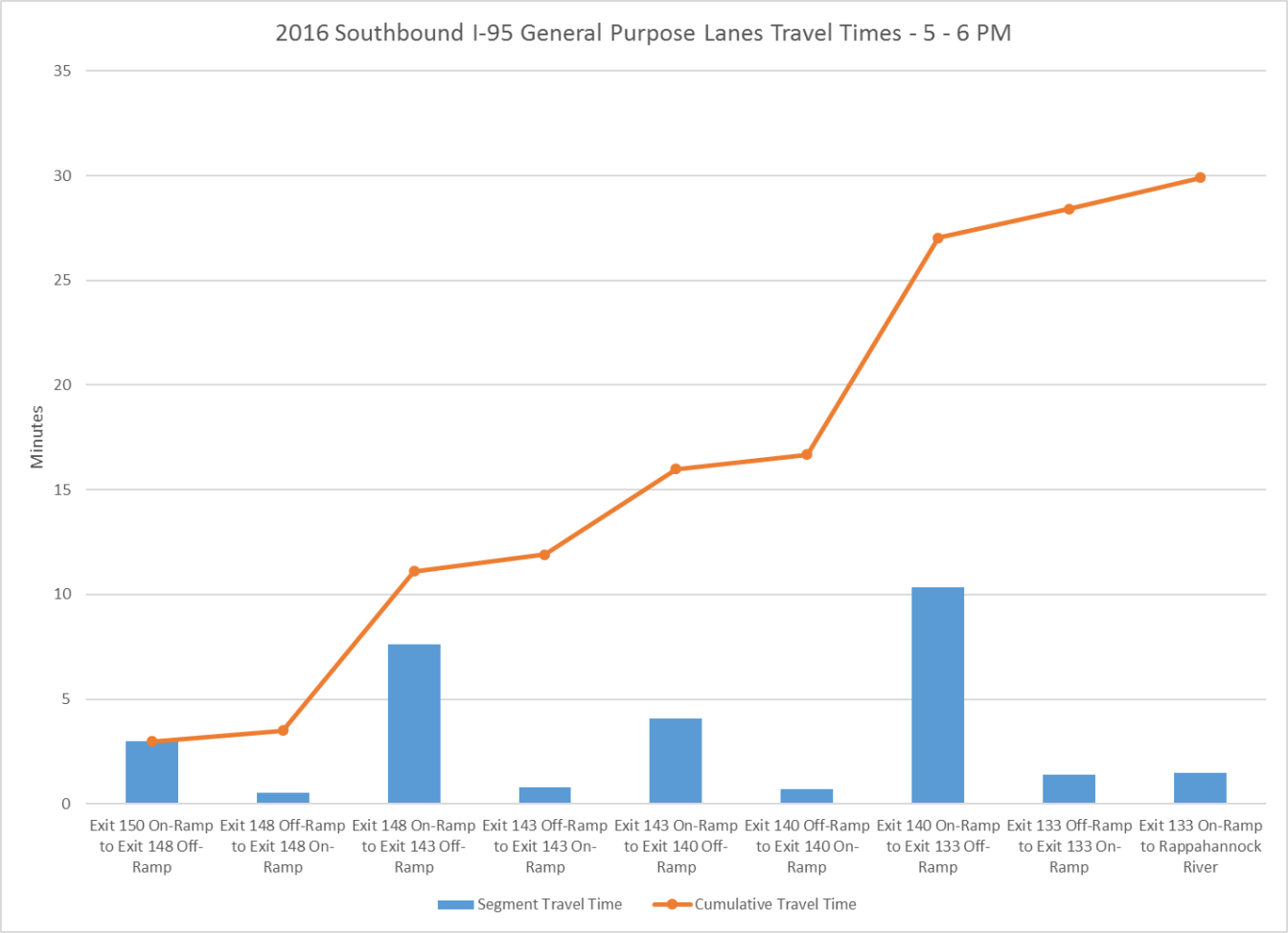


Figure 3-8: 2016 I-95 Southbound GP Lanes PM Peak Hour Travel Times



3.12 OPERATIONAL ANALYSIS

Detailed operational analysis results from the *VISSIM* model are included in **Chapter 7**.

4. ALTERNATIVES CONSIDERED

4.1 PREVIOUS STUDIES AND PROJECT HISTORY

The 2011 EA reviewed a study area that extended along I-95 from 1.1 miles south of the I-95 / US 17 South Interchange in Spotsylvania County (Exit 126) to just north of the I-95 / I-495 / I-395 Interchange in Springfield (Exit 169) (

Figure 4-1). The 2011 EA included a No-Build Alternative and a Build Alternative. Under the 2011 No-Build Alternative, the lane configurations of I-95 within the study area that existed in 2011 would remain. This included three to four GP travel lanes in each direction and two reversible high-occupancy vehicle (HOV) lanes within the median from Dumfries Road (Exit 152) to the Capital Beltway (Exit 169), with a variable width vegetated median ranging from 40 to 600 feet wide (FHWA, 2011a).

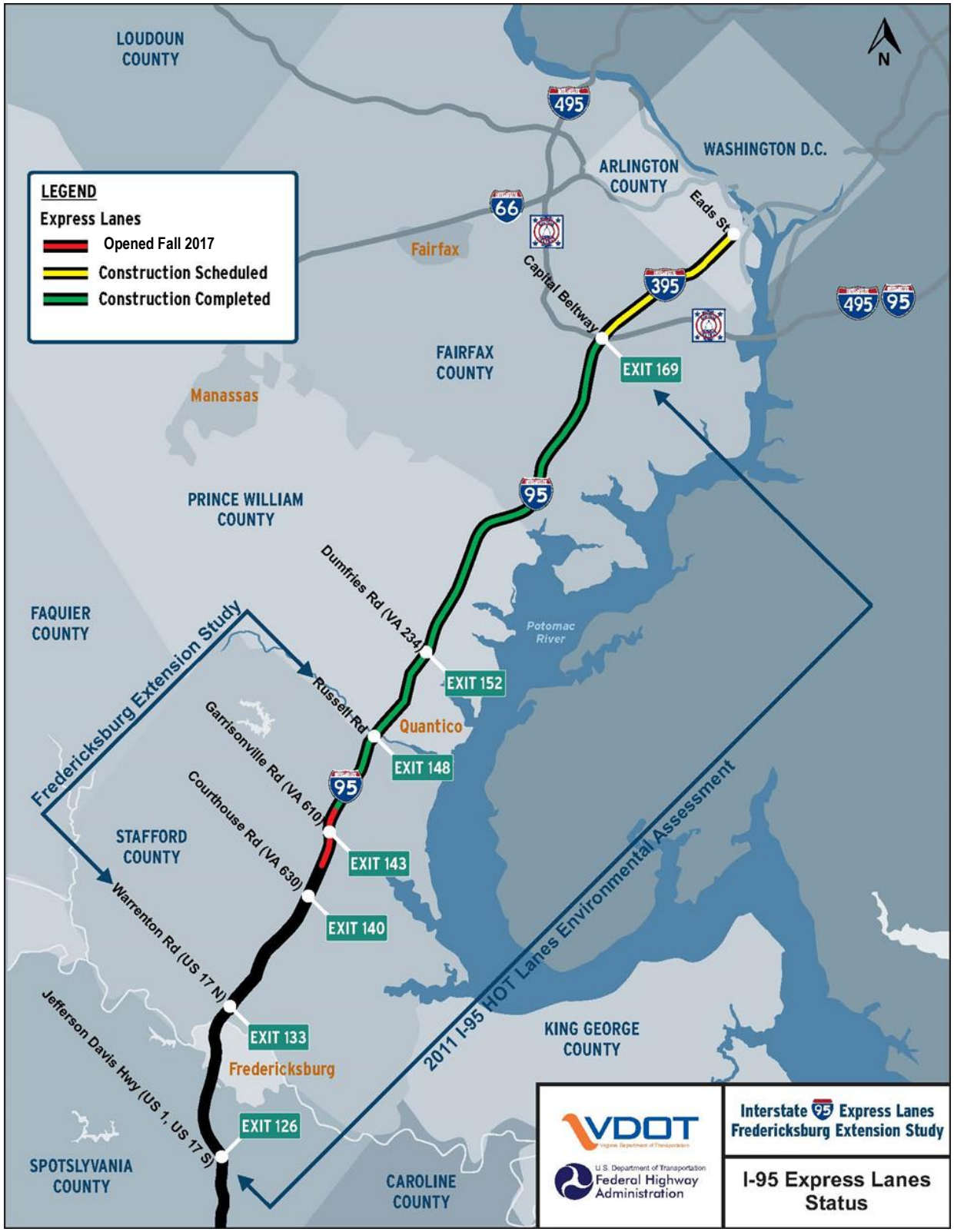
The 2011 FONSI-selected Alternative consisted of constructing new HOT lanes from one mile south of the I-95 / US 17 South interchange (Exit 126) to VA 234 / Dumfries Road, and converting existing HOV lanes to HOT (Express) lanes between VA 234 / Dumfries Road (Exit 152) to just north of Turkeycock Run. Per the 2011 EA, the HOT Lanes would generally consist of two, 11- to 12-foot-wide travel lanes and variable shoulder widths, in accordance with the American Association of State Highway and Transportation Officials (AASHTO) standards. The Express Lanes would be operated using all-electronic tolling and would be reversible based on peak travel times (FHWA, 2011a).

The 2011 FONSI-selected Alternative identified access points for entry to and exit from the Express Lanes via slip ramps or flyover ramps. Access points were proposed at locations where they would provide optimal access to the Express Lanes with minimal impacts to right-of-way and the I-95 GP lanes. Of the proposed access points connecting the GP lanes to the Express Lanes, 30 were proposed as at-grade slip ramps, and five were recommended as grade-separated flyover ramps.

Since 2011, some sections of the proposed Express Lanes have been constructed or are under construction. Improvements proposed in the northern section, from the I-95 / Route 610 Interchange at Garrisonville (Exit 143) to the Turkeycock Run interchange on I-395 at the Capital Beltway, opened in December 2014. All access points described in this northern section were implemented. Following a National Environmental Policy Act reevaluation of the 2011 EA, completed in March 2016 (FHWA, 2016b), construction nearing completion to extend the Express Lanes approximately two miles south from the current southern terminus north of VA 610 / Garrisonville Road (Exit 143). This project, called the I-95 Express Lanes Southern Extension, opened to traffic in October 2017, and includes the addition of a reversible, single lane in the median of I-95, which splits into NB and SB ramps to the I-95 GP lanes south of VA 610 / Garrisonville Road (VDOT, 2017b).

In 2015, VDOT completed the I-395 Express Lanes Northern Extension EA, followed by a Revised EA in 2016, which documented a preferred alternative that would extend the I-395 Express Lanes eight miles from the Turkeycock Run Interchange to the vicinity of Eads Street in Arlington (I-395, Exit 8). Two existing HOV lanes would be converted to three Express Lanes using a portion of the existing shoulder. Construction of the I-395 Northern Extension began in summer 2017, and is expected to be completed by summer 2020 (VDOT, 2016). **Figure 4-1** provides the current status of the various I-95 Express Lanes projects along the corridor.

Figure 4-1: I-95 Express Lanes Project Status



4.2 ALTERNATIVES DEVELOPMENT SUMMARY

Alternatives development for this project focused on refinements to a portion of the 2011 FONSI-selected Alternative that was not constructed: mainline improvements and Express Lane access points from the I-95 / US 17 North interchange at Warrenton Road (Exit 133) to the I-95 / Russell Road interchange (Exit 148). As a result, the alternatives development process began with a review of the Build Alternative from the 2011 *I-95 HOT Lanes Project EA*. This section presents the revisited southern portion of the 2011 FONSI-selected Alternative as well as the No-Build Alternative. During the Fredericksburg Extension Study, several locations were considered for access to the Express Lanes at the I-95 / US 17 North Interchange at Warrenton Road (Exit 133), the I-95 / VA 630 Interchange at Courthouse Road (Exit 140), and the vicinity of the Marine Corps Base Quantico. The access points at US 17 / Warrenton Road and VA 630 / Courthouse Road were included in the 2011 FONSI-selected Alternative. The access point at Marine Corps Base Quantico was not included in the 2011 FONSI-selected Alternative; however, it is included in this Revised EA because extending the Express Lanes south without providing additional access would leave a gap of roughly 24 miles between NB entry and exit points that would reduce user choice and accessibility. Potential access near the Base was evaluated at Joplin Road, Telegraph Road, and Russell Road; Russell Road was identified as the most appropriate location.

4.3 NO BUILD ALTERNATIVE

Under the No-Build Alternative, the Express Lanes would not be extended south beyond the southern terminus of the I-95 Express Lanes Southern Extension project (south of VA 610 / Garrisonville Road at Exit 143). There would be no change to existing access points due an extension of the Express Lanes and I-95 would remain in its present configuration (other than improvements planned under various ongoing projects). The No-Build Alternative was not identified as the preferred alternative but is retained as a baseline for comparison in this IJR.

Several other projects are currently under construction or planned for the I-95 corridor. These projects have a variety of planned completion dates and therefore, the Opening Year (2022) and Design Year (2042) No Build Alternatives are slightly different.

The Opening Year (2022) No-Build Alternative assumes completion of the following improvements within the study segment of I-95:

- **I-95 Express Lanes Southern Terminus Extension (UPC 108315)** – A two-mile extension of a single, reversible Express Lane (High Occupancy Toll – 3 Persons Per Vehicle) from the existing terminus of the system north of Garrisonville Road (Exit 143) to south of Garrisonville Road. This project opened to traffic on October 31, 2017. This project is not included in the existing year analysis (data collected in late 2016). Additional project information is located at: http://www.virginiadot.org/projects/fredericksburg/95_express_lanes_southern_terminus.asp (accessed October 30, 2017).
- **Interstate 95 / Route 630 (Courthouse Road) Interchange Relocation and Route 630 Widening (UPC 13358, UPC 4632)** – Relocation and reconstruction of the existing diamond interchange as a diverging diamond interchange with increased park-and-ride lot capacity. This project includes the widening of Route 630 (Courthouse Road) from two lanes to four lanes from Route 628 to Route 732. Anticipated completion by July 2020. Additional project information is located at: http://www.virginiadot.org/projects/fredericksburg/interstate_95-

route_630_courthouse_road_interchange_relocation_and_route_630_widening.asp (accessed October 30, 2017).

- **Interstate 95 Safety Improvements at Route 3 (UPC 107715)** – Interchange modifications to widen the I-95 southbound off-ramp to Route 3 westbound and provide a separate free-flow lane to Carl D. Silver Parkway. Project also will remove the existing loop ramp from Route 3 eastbound to I-95 northbound and replace this movement with a signalized triple-left turn. Anticipated completion by January 2019. Additional project information is located at: http://www.virginiadot.org/projects/fredericksburg/interstate_95_safety_improvements_at_route_3_exit_130.asp (accessed October 30, 2017).
- **I-95 Rappahannock River Crossing Southbound Project (UPC 101595, UPC 110595)** – Addition of three southbound lanes in the median between Exit 133 (US 17) and Exit 130 (Route 3); the three existing southbound lanes will be converted to serve local traffic to / from US 17 and Route 3. Anticipated completion by 2022. Additional project information is located at: http://www.virginiadot.org/projects/fredericksburg/i-95_southbound_collector-distributor_lanes_8722_rappahannock_river_crossing.asp (accessed October 30, 2017).

The Design Year (2042) No Build Alternative assumes completion of the four (4) projects identified above, as well as completion of one additional proposed project:

- **I-95 Rappahannock River Crossing Northbound Project** – While not currently funded for construction, this partner project for the southbound improvements is included in the FAMPO Long Range Transportation Plan. A conceptual design was identified in the March 26, 2015 I-95 Interchange Modification Report – Improvements to I-95 between Exit 133 and 130.

Schematics of each of the proposed improvements included in the No Build Alternative are included in **Appendix J**. All other projects that are contained in the region's Constrained Long-Range Transportation Plan are assumed to be in place. These roadway network modifications were retained for all scenarios.

4.4 BUILD ALTERNATIVE

The Build Alternative would extend two reversible Express Lanes in the median of I-95 from south of the I-95 / US 17 North Interchange at Warrenton Road (Exit 133) to south of I-95 / VA 610 Interchange at Garrisonville Road (Exit 143) to tie into the I-95 Southern Extension Project. It would also provide Express Lane access at several locations (further described below). The Express Lanes would be located in the median of I-95 and consist of two, 12-foot reversible lanes with 10-foot shoulders on each side.

One typical section was planned for the full Build Alternative: an open drainage section, which would convey stormwater from the roadway to an adequate outfall via open channels. The open section is shown in **Figure 4-2**. However, after reviewing the southern half of the study area, it was determined that a narrower section should be used in that half in order to avoid and minimize impacts to the Waters of the US. As a result, a narrower, closed drainage section was created. A closed drainage section is one that uses underground conduits to convey stormwater collected by inlets to an adequate outfall. The narrower, closed section would be applied from the I-95 / US 17 Interchange at Warrenton Road (Exit 133) to the vicinity of VA 628 / American Legion Road, and the open section would be applied from the vicinity of VA 628 / American Legion Road to south of VA 610 / Garrisonville Road at Exit 143.

In the open typical section, the grass median on the southbound side of the Express Lanes would range from 20 feet to 500 feet, and the grass median on the northbound side would range from 20 feet to 70

feet. In the closed typical section, the width of the median on the southbound side of the Express Lanes would range from 18 to 300 feet, and the width of the median on the northbound side would range from 12 to 70 feet. The width of the grass median in both sections is dependent upon the size of the existing median at a given location.

To accommodate the Express Lane improvements and associated entrance and exit access points, the existing GP lanes of I-95 would be widened or realigned in several locations. The NB GP lanes would be widened to include an auxiliary lane between a half-mile north of US 17 North and a half-mile north of VA 652 / Truslow Road. The SB GP lanes would be realigned between 0.3 miles north of Route 628 and 0.4 miles south of Route 628, and between 0.6 miles north of VA 652 / Truslow Road and the I-95 / US 17 North Interchange.

Express Lane Access

Because the access points to and from the Express Lanes will vary for NB and SB travel, the Build Alternative description is provided for each direction below. The Express Lanes would operate as reversible HOT lanes based on peak traffic flow.

Northbound Travel

Northbound access to the Express Lanes would begin south of the I-95 / US 17 North Interchange (Exit 133) and tie into the proposed Express Lanes approximately two miles north of VA 610 / Garrisonville Road (Exit 143). Access to and from the NB Express Lanes would occur as follows:

- North of the I-95/US 17 North Interchange (Exit 133), vehicles could enter the Express Lanes from the left lane (west side) of I-95 via a new slip ramp or from a new flyover entrance from the right lane (east side) of NB I-95.
- At VA 630 / Courthouse Road (Exit 140), an entrance to the Express Lanes would come directly from Courthouse Road (this ramp is reversible and will serve both NB and SB travel).
- South of Russell Road (Exit 148), a new flyover ramp would provide an exit from the Express Lanes to the GP lanes.

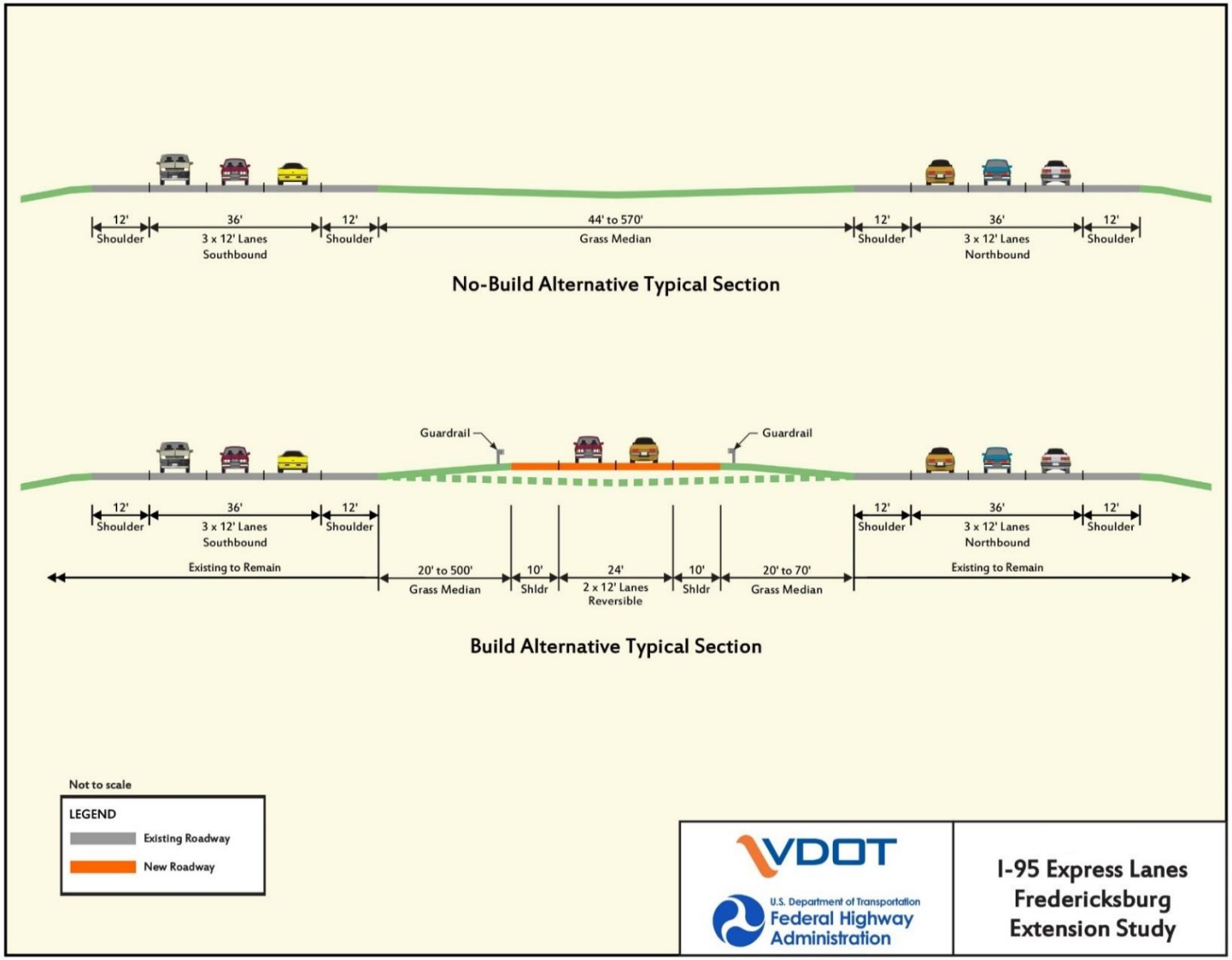
Southbound Travel

Southbound access to the Express Lanes would begin approximately one mile south of VA 610 / Garrisonville Road (Exit 143) where the current Express Lanes end and would continue to the proposed terminus of the Express Lanes which is just north of US 17 (Exit 133). Access to and from the SB Express Lanes would occur as follows:

- South of Russell Road (Exit 148), users in the GP lanes could enter the Express Lanes just south of VA 637 via a new flyover from the right lane (west side) of SB I-95.
- At VA 630 / Courthouse Road (Exit 140), a new exit from the Express Lanes would connect directly to existing Courthouse Road (VA 630, Exit 140); this ramp is reversible and will serve both NB and SB travel.
- North of US 17 North (Exit 133), a new flyover ramp would provide an exit from the Express Lanes to access the GP lanes or to access US 17, or SB travelers could access GP lanes via a new slip ramp.

A graphic of the complete Build Alternative is included in **Appendix I**.

Figure 4-2: Typical Section



As described above, the Build Alternative would include access points to and from the Express Lanes at various locations for NB and SB travel between Exit 133 and Exit 148. Detailed descriptions for access points at US 17 (Exit 133), VA 630 / Courthouse Road (Exit 140), and Russell Road (Exit 148) are provided below.

US 17 / Warrenton Road (Exit 133) – Southbound Access

The proposed access points from the I-95 Express Lanes to the southbound I-95 GP lanes at US 17 would interface with additional improvements being constructed as part of the I-95 Rappahannock River Crossing Southbound Project. That project will provide three new southbound lanes in the median of I-95 and convert the existing southbound lanes to a collector-distributor road system serving and VA 3 (Plank Road) interchange. A separate collector-distributor road will be created to serve the US 17 (Warrenton Road) interchange.

The proposed Build Alternative includes two connections from the I-95 Express Lanes to I-95 southbound. The first would consist of a dual-lane flyover from the I-95 Express Lanes, with one lane providing access to the existing I-95 southbound GP lanes (which will be converted to a collector-distributor road for access to the Route 3 interchange) and one lane allowing access to a second collector-distributor road system serving the ramps at US 17.

Additionally, a left entry slip ramp would be provided to the southbound I-95 "through" lanes being constructed in the existing median as part of the I-95 Rappahannock River Crossing Southbound Project. This ramp will allow Express Lanes traffic destined for points south of the VA-3 (Plank Road) interchange at Exit 130 to use the I-95 "through" lanes. The proposed improvements are depicted in **Figure 4-3**.

US 17 / Warrenton Road (Exit 133) – Northbound Access

The Build Alternative includes two proposed connections from the I-95 GP lanes to the I-95 Express Lanes. A left exit slip ramp would be provided from the I-95 northbound GP lanes; in the near-term this ramp will serve Express Lanes traffic originating from the VA-3 interchange and points further south along I-95. Additionally, a new single lane flyover would be constructed from the right side of the I-95 GP lanes north of Truslow Road. A continuous auxiliary lane would be constructed from the existing on-ramp from the US 17 interchange collector-distributor road to the proposed flyover, creating four northbound lanes in this segment. The fourth (outside) lane would feed directly onto the proposed flyover to the I-95 Express lanes. The proposed improvements are depicted in **Figure 4-4**.

Figure 4-3: US 17 / Warrenton Road (Exit 133) Southbound Access

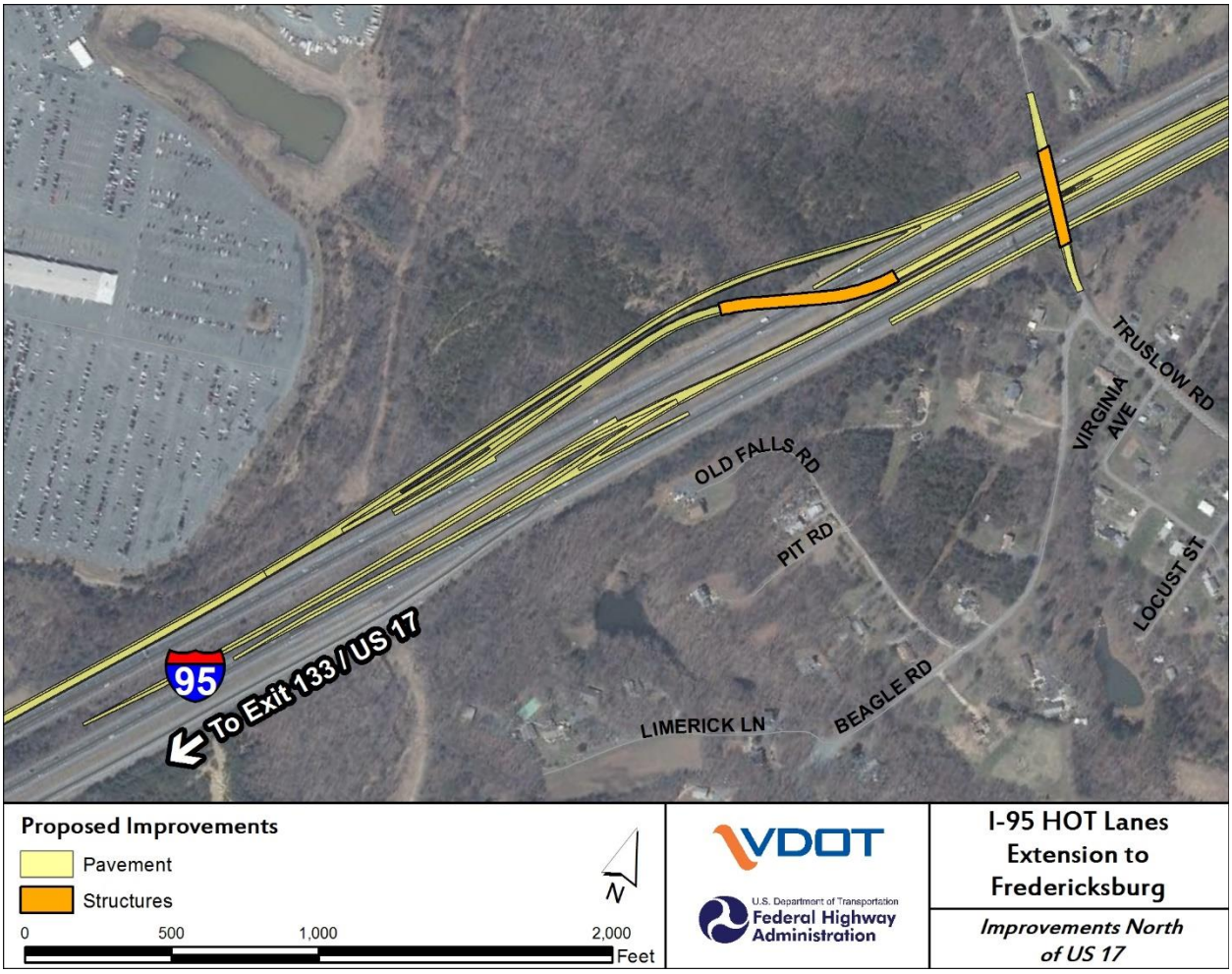
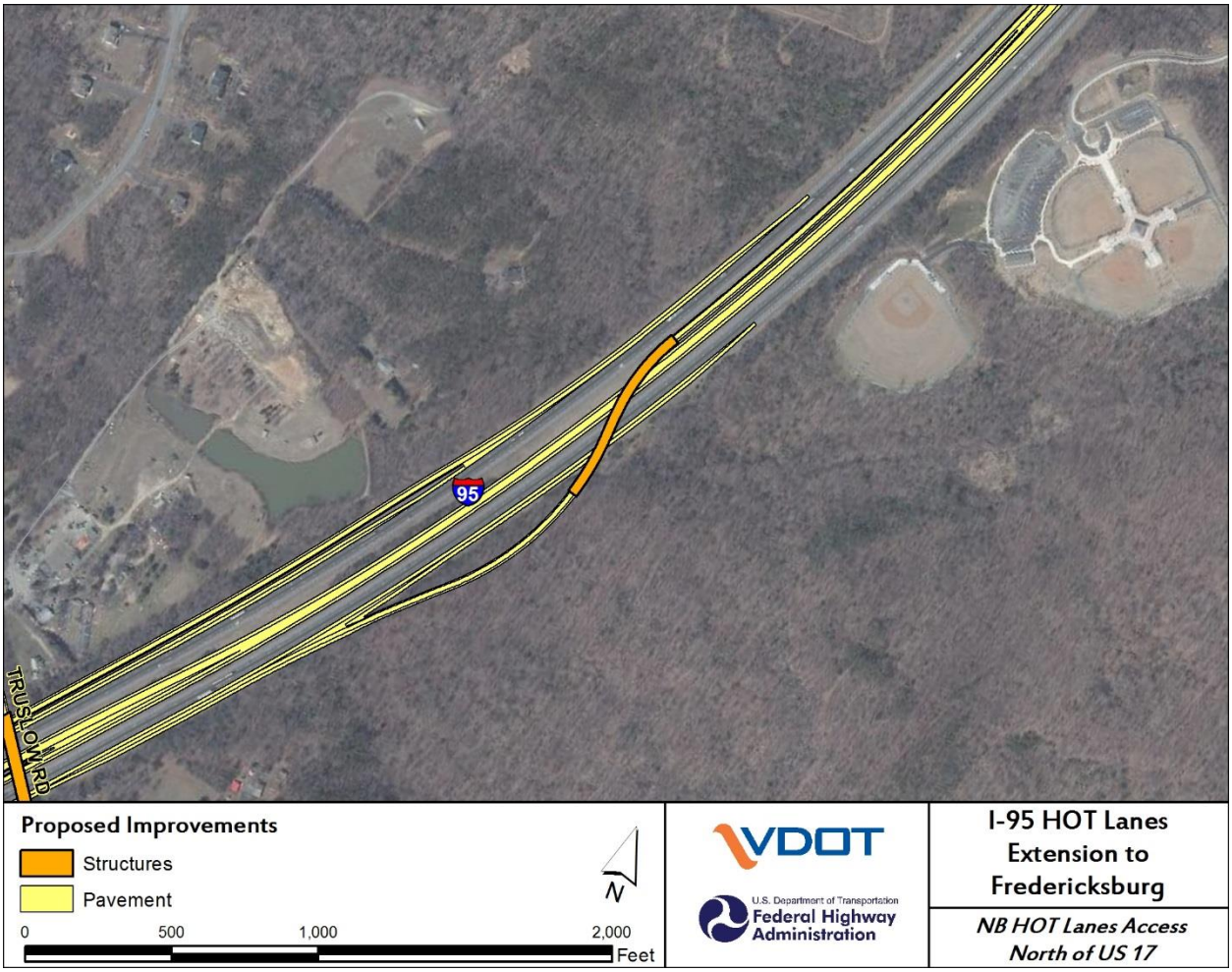


Figure 4-4: US 17 / Warrenton Road (Exit 133) Northbound Access



VA 630 / Courthouse Road (Exit 140)

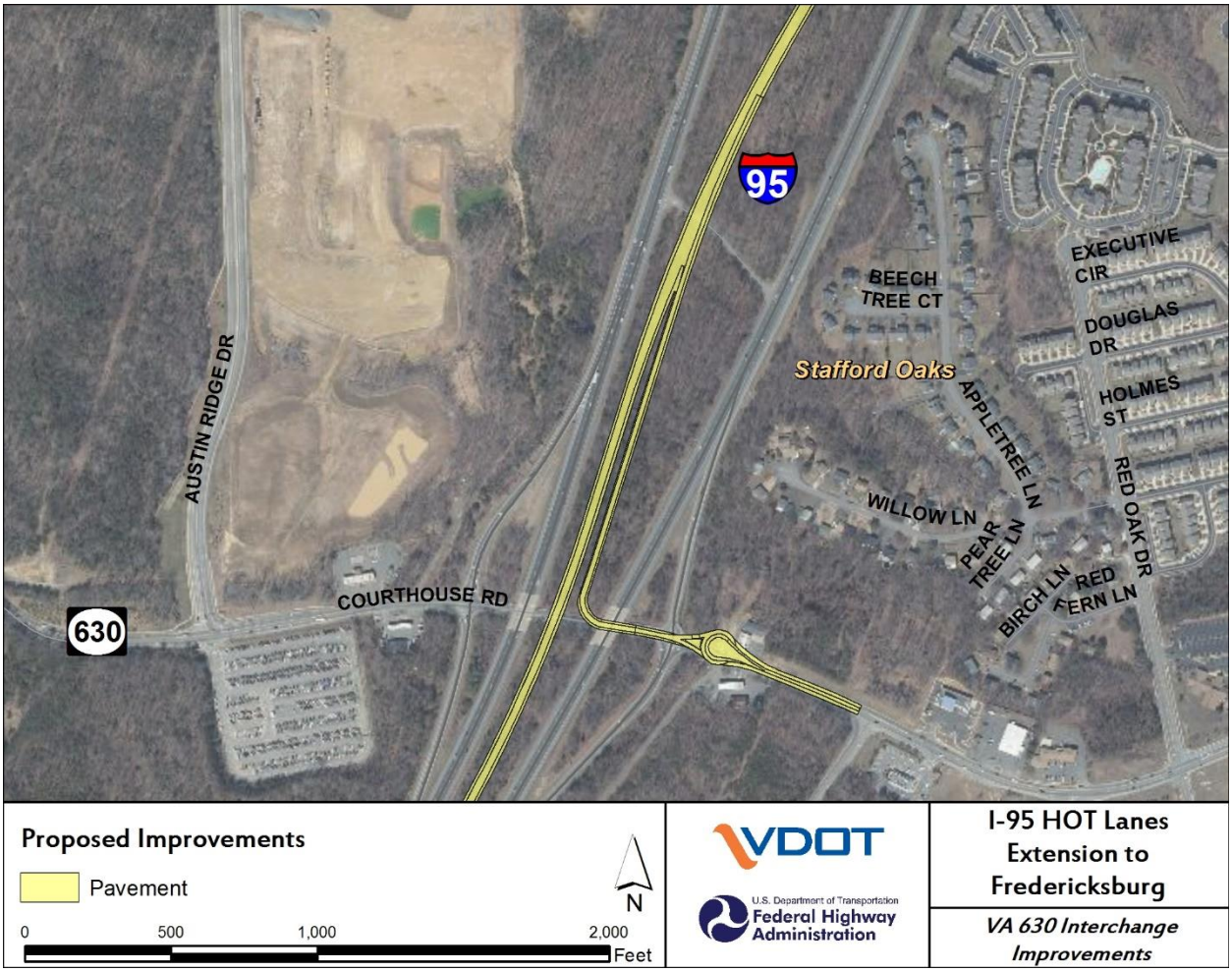
The proposed access point at Courthouse Road would be designed to complement VDOT's Route 630 Interchange Relocation and Route 630 Widening Project. Construction began in summer 2017, with estimated completion by summer 2020. VDOT will be rebuilding the Route 630 interchange as a diverging diamond interchange (DDI), widening Courthouse Road, and relocating the current Courthouse Road Park & Ride lot from its current location, west of I-95. The new Park & Ride lot will be located east of I-95 and the number of parking spaces will be expanded from 545 to 1,000 (VDOT, 2017c).

The proposed access to the Express Lanes that runs under the existing I-95 bridge would consist of a ramp utilizing a portion of the existing Courthouse Road that will no longer be part of the realigned DDI Courthouse Road. The ramp merges with the Express Lanes on the west side and would provide either an entrance to the NB Express Lanes or an exit from the SB Express Lanes, depending on the time of day.

The construction of this proposed access point would also involve the construction of a partial roundabout between the Express Lanes access ramp and the Park & Ride lot entrance. The partial roundabout would allow users to turn around if attempting to enter the Express Lane ramp when the direction of traffic has been reversed. The ramp would have gates and "Do Not Enter" signs that would be engaged when the

direction of traffic has been reversed. Signage indicating ramp closure would include a Dynamic Message Sign (DMS) in each direction on Route 1, as well as a DMS within or just before the roundabout. The DMS would have a message stating "Gates Closed, Do Not Enter" (see **Figure 4-5**).

Figure 4-5: VA 630 / Courthouse Road (Exit 140) Access



Marine Corps Base Quantico

Northbound Flyover Exit

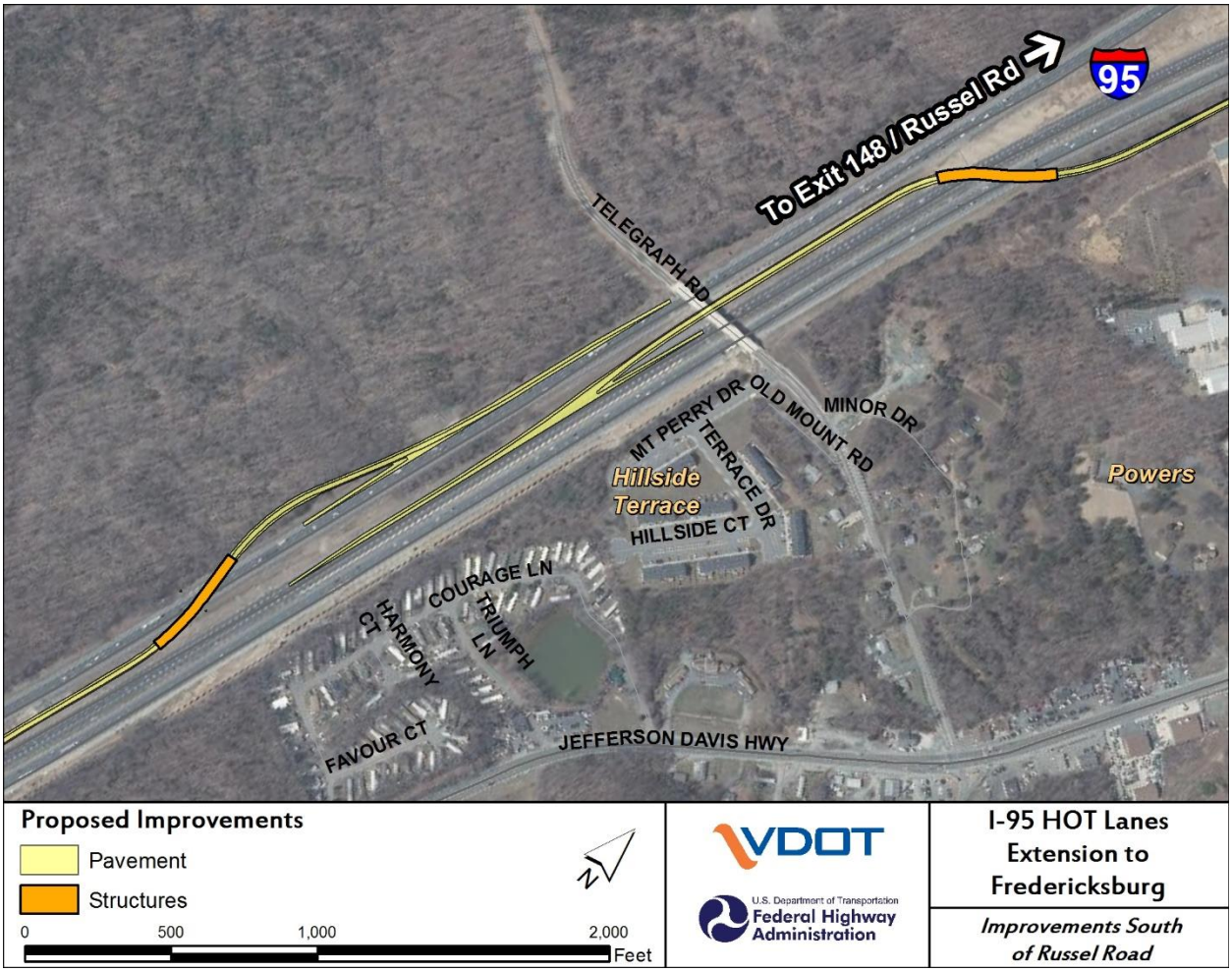
The proposed NB Express Lanes flyover ramp access point at Russell Road would consist of a ramp emerging from the west side of the existing Express Lanes at approximately mile marker (MM) 147.0, crossing over the Express Lanes and NB GP lanes at MM 147.6, and continuing approximately 0.2 miles before merging back onto the east side of I-95 NB GP lanes at MM 147.9, just south of Exit 148. The ramp provides an exit from NB Express Lanes to I-95 NB GP lanes and Russell Road (see **Figure 4-6**).

Southbound Flyover Entrance

This option would introduce a flyover ramp on the right side of the I-95 GP lanes to provide access to the Express Lanes. Under this option, traffic desiring to access the Express Lanes from Russell Road would merge into the right lane along the I-95 GP lanes and then would not need to make any additional lane changes to position themselves to exit onto the flyover ramp. The flyover ramp would also provide access

to the Express Lanes for other traffic in the I-95 GP lanes (from points north of Russell Road) (see **Figure 4-6**).

Figure 4-6: Marine Corps Base Quantico Access



4.5 ALTERNATIVES NOT RETAINED FOR EVALUATION

During the study, several options were considered for access to the Express Lanes at the I-95 / US 17 interchange at Warrenton Road (Exit 133), the I-95 / VA 360 interchange at Courthouse Road (Exit 140), and near the Marine Corps Base Quantico, but were dismissed for reasons described below.

4.5.1 US 17 Options

Option 1

The first option proposed at US 17 was a dual-lane flyover from the I-95 Express Lanes leading to I-95 GP lanes, with four GP lanes split into two through lanes: one choice lane and one local lane. This option was later modified as a result of modeling that showed severe congestion approaching the split. The modified option was changed to accommodate five GP lanes split into two through lanes: one choice lane and two local lanes. This option was ultimately dismissed when modeling showed that traffic weaving from the

Express Lanes to the GP lanes operated with some friction, and that another option could eliminate weaving and provide higher speeds.

Option 2

The second option proposed at US 17 was a single-lane flyover from the I-95 Express Lanes leading to local I-95 Lanes, with four GP lanes split into two through lanes: one choice lane and one local lane. This option was later modified as a result of modeling that showed severe congestion approaching the split. The modified option was changed to accommodate five GP lanes split into two through lanes: one choice lane and two local lanes. This option was ultimately dismissed when modeling showed that a two-lane flyover provided additional capacity for the Express Lane system, that traffic weaving from the Express Lanes to the GP lanes operated with some friction, and that another option could eliminate weaving and provide higher speeds.

4.5.2 Courthouse Road Options

Direct Access Ramp merging on the west side of Express Lanes

A direct access ramp from Courthouse Road to the Express Lanes was proposed to run under the existing I-95 NB bridge and under a new Express Lanes bridge, and merge with the Express Lanes on the west side. The ramp would provide either an entrance to the NB Express Lanes or an exit from the SB Express Lanes, depending on the direction of operation.

The construction of this access point would have needed a new Express Lanes bridge over this ramp, a retaining wall between the ramp and I-95 SB GP lanes, and rehabilitation of the existing I-95 bridge over Courthouse Road. This ramp would also have a roundabout interface to prohibit entrance access during SB peak traffic flow. This option was dismissed due to the need for excessive construction and the maintenance cost of the structures.

Direct Ramp at Courthouse Road without a Roundabout

This option consisted of a ramp providing access to and from the Express Lanes at Courthouse Road. There would be no roundabout with this option, and users would need to utilize the Park & Ride to turn around if the ramp gates were closed. The gates would be located beyond the commuter lot entrance to push traffic to the left if the gates were closed.

This option was dismissed amid concerns for driver confusion when the gates are closed. The option was thought to increase the chance that vehicles would continue forward on the ramp, despite the gates being closed, if the driver did not have a clear option to turn around.

Symmetrical Roundabout

This option consisted of a ramp with access to and from the Express Lanes at Courthouse Road, as well as a roundabout for drivers to turn around when the ramp gates are closed. The Symmetrical Roundabout option centered the roundabout on Courthouse Road. This option was dismissed because of the direct impacts that it would cause to the Park & Ride lot.

4.5.3 Marine Corps Base Quantico Options

Northbound Joplin Road Access

This option consisted of NB direct access to Joplin Road to and from the Express Lanes. Currently, there is not enough space in the median between GP lanes to develop a new single-ramp lane at the necessary

point in the I-95 corridor. In order to make this option viable, the NB GP lanes would need to be realigned for roughly one mile, which would include realigning the NB GP Lane overpass. A retaining wall would need to be used to accommodate the vertical elevation change between the new ramp and the existing Express Lanes facility.

This option was dismissed because the effort described above would be a complex structure with a large footprint and would require realignment of GP lanes, increasing impacts to right-of-way.

Northbound Telegraph Road Access

This option consisted of direct access to Telegraph Road to and from the Express Lanes and would require a widened bridge on the south side. This option was dismissed for three reasons. First, it does not provide direct access to Marine Corps Base Quantico. Vehicles would first have to merge with Route 1, enter a high volume of traffic, and maneuver to the right lane to get to Russell Road. Second, maintenance of traffic during construction of this option could be difficult. Third, there could be issues with acquiring the temporary or permanent right-of-way from Marine Corps Base Quantico that would be necessary to implement this option.

Northbound Russell Road Direct Access

This option consisted of direct access from Russell Road to the I-95 Express Lanes via a new T-intersection at Russell Road and the ramp crossing over Chopawamsick Creek to join the Express Lanes. The T-intersection would have reduced the number of westbound lanes along Russell Road from two through lanes to one through lane and one left-turn lane. In the eastbound direction, a taper exit to SB Express Lanes was proposed. This option was dismissed because of environmental impacts to resources located within the footprint of the ramp between the Express Lanes and SB I-95, and because of safety and operational impacts due to the reduction of through lanes at the T-Intersection in the westbound direction.

Southbound Slip Ramp

This option would introduce a slip ramp on the left side of the I-95 GP lanes to provide access to the Express Lanes. Under this option, traffic desiring to access the Express Lanes from Russell Road would merge into the right lane along the I-95 GP lanes, and then be required to make two additional lane changes to the left to position themselves to exit onto the slip ramp. The slip ramp would also provide access to the Express Lanes for other traffic in the I-95 GP lanes (from points north of Russell Road). This option was dismissed as a result of the number of additional lane changes users would need to make in order to utilize the slip ramp. Additionally, although the left-side exit to the Express Lanes would be consistent with other access points along the I-95 Express Lanes system, it is less common with other facilities and not as aligned with driver expectancy as other options.

4.6 TRANSPORTATION SYSTEMS MANAGEMENT (TSM) ALTERNATIVES

A Transportation System Management (TSM) alternative was considered to address the needs of the corridor. TSM strategies focus on improving the operational efficiency of the roadway transportation system without major capacity improvements, such as adding new lanes or new ramps. While numerous TSM strategies currently exist along the I-95 corridor within the Study Area including the traveler information (including travel times), park-and-ride lots at various locations with transit service and "casual" carpooling alternatives, traffic detection and corridor monitoring capabilities, Safety Service Patrol (SSP) to respond to incidents, and the existing Express Lanes for HOV and toll service, the needs of the corridor cannot be adequately satisfied solely by a TSM alternative. The existing demand with these TSM measures in place exceeds the available capacity along the I-95 corridor, resulting in delays and poor reliability. Therefore, the TSM alternative was eliminated from detailed study.

5. ROADWAY GEOMETRY

5.1 DESIGN CRITERIA

Design criteria for the Build Alternative are based on AASHTO's *A Policy on Geometric Design of Highways and Streets*, 2011 and *Roadside Design Guide*, 2011; and the VDOT *Road and Bridge Standards*, 2016 and *Road Design Manual*, 2016. These criteria determine the design speed for the roadway and associated design elements, such as minimum radii, lane width, roadway shoulder width, bridge shoulder width, median width, sight distance, and vertical clearance. Refer to **Appendix H** for specific design criteria for the Express Lanes, GP lanes, Interchange Ramps, and adjacent roadways.

5.2 GEOMETRIC CONFIGURATION

The alternatives considered during the design process and details of the preferred design alternative are discussed in detail in **Chapter 4**.

5.3 DESIGN EXCEPTIONS AND WAIVERS

The Build Alternative requires approval of one Design Exception (DE) and three Design Waivers (DW) for conditions which do not satisfy the approved design criteria for the project. These design exceptions and waivers are summarized in **Table 5-1** and **Table 5-2**. The approximate locations of the design exceptions and design waivers are summarized in **Figure 5-1**.

Table 5-1: Summary of Design Exceptions

Design Exception Number	Design Exception	Description	Date Approved (FHWA)
DE-1 to DE-14	Design Exceptions numbers assigned for those waivers previously used on other I-95 Express Lanes Projects. The following exception is the only one proposed for the I-95 Express Lanes Fredericksburg Extension Project.		
DE-15	Reduced Design Speed (20 MPH) on Ramp CHR	Addresses use of 20 mph Design Speed on Ramp CHR, which connects Old Courthouse Road to 95 Express Lanes, due to geometric constraints caused by existing infrastructure and terrain.	Pending

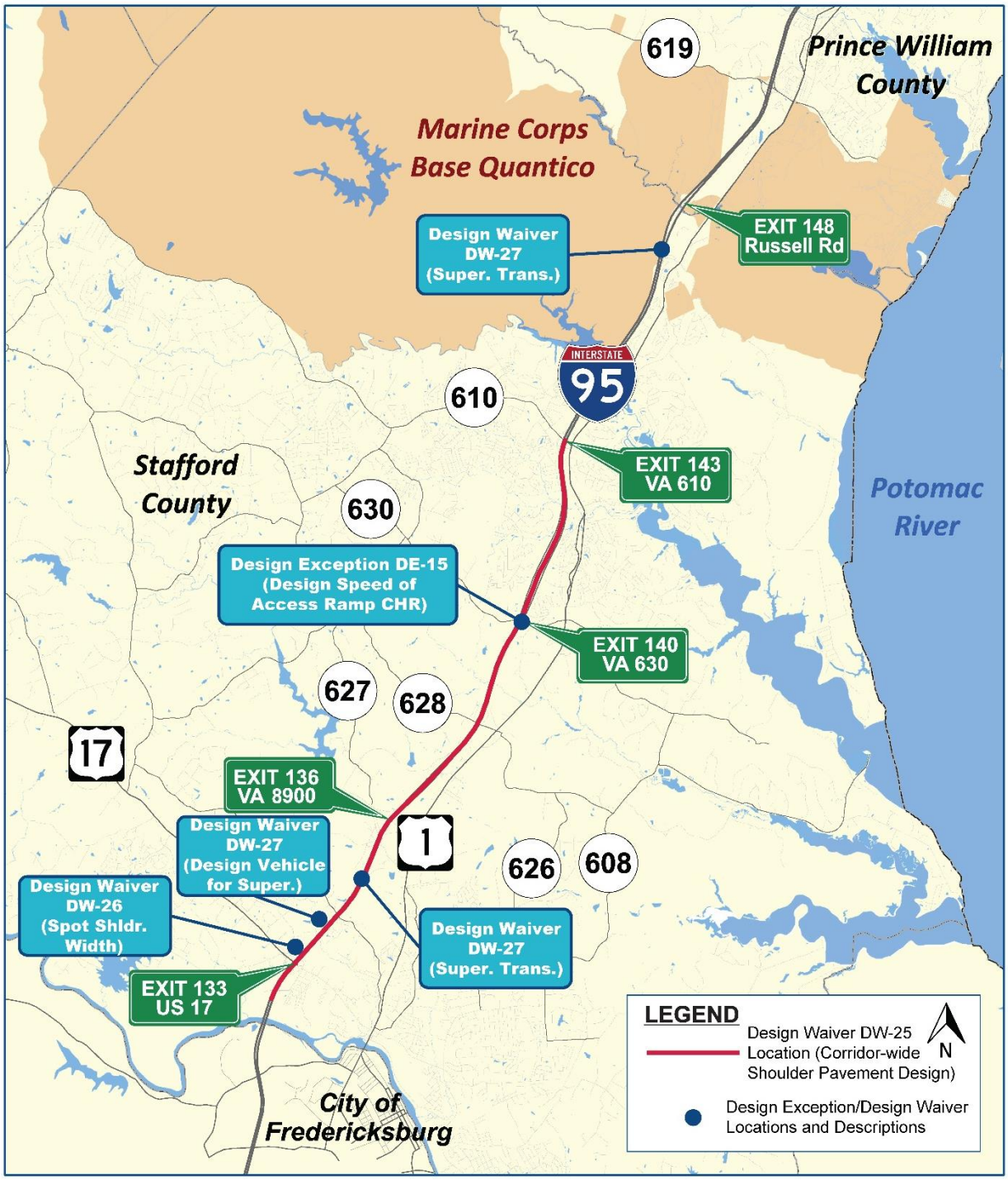
Table 5-2: Summary of Design Waivers

Design Waiver Number	Design Waiver	Description	Date Approved (FHWA)
DW-1 to DW-24	Design Waiver numbers assigned for those waivers previously used on other I-95 Express Lanes Projects. The following three waivers are the only waivers proposed for the I-95 Express Lanes Fredericksburg Extension Project.		
DW-25	Shoulder Pavement Width and Depth	Addresses use of reduced strength pavement design for paved shoulders and alternative MC-4 requirements on 95 Express Lanes facility.	Pending
DW-26	Spot Shoulder Width Reductions at Select Overhead Sign Structure Locations	Addresses reduced shoulder widths at multiple locations where localized shoulder width reductions are proposed due to the presence of overhead signs.	Pending
DW-27	Superelevation Variances from TC.11	Address variances from the superelevation standards in TC-5.11R at two locations: At Ramp WHS, the proposed waiver addresses the use of a 45' bus as the design vehicle. The TC-5.11R tables use a WB-62 as the design vehicle for the 40 mph superelevation table. This vehicle is not currently permitted to use the facility, so the DW requests use of the actual largest vehicle permitted on the facility, which is a 45' long bus. This will eliminate the curve widening requirement on the bridge and spiral geometrics. At Ramp HWN and HRS, the proposed waiver addresses changing the location of the superelevation transitions. TC-5.11R has specific prescriptions on where to place the superelevation transition relative to the PC/PT/PRC/PCC of the curve. Both flyover ramps have geometric constraints that do not allow for achieving all of the prescriptions of TC-5.11R. This DW addresses a variance in the transition locations while maintaining the standard relative gradient of the transition.	Pending

5.4 CONCEPTUAL SIGNING PLAN

A Technical Working Group (TWG) was established early in project development to develop an effective signage plan for the corridor. **Appendix K** contains a conceptual signing plan for the Build Alternative. The conceptual signing plan was developed using current design standards and guidelines including the *2009 Manual on Uniform Traffic Control Devices (MUTCD),* 2012 and the *2011 Virginia Supplement to the MUTCD, Revision 1*, 2016. Existing signing along the I-95 and I-495 Express Lanes facilities was also considered to provide consistent signing with the adjacent Express Lanes facilities already in operation.

Figure 5-1: Location of Design Exceptions and Waivers



6. TRAFFIC VOLUMES

6.1 ANALYSIS YEARS

The methodology utilized to develop Opening Year 2022 and Design Year 2042 traffic forecasts for the No Build and Build Alternatives is summarized in Section **2.4**. Traffic volumes were developed for the following scenarios:

- Existing Conditions (2016)
- Design Year (2042)
    - No Build Alternative – See Section 4.3 for included projects
    - Build Alternative – All improvements assumed for the No Build plus the 10-mile extension of two reversible HOT Lanes and new access points as described in **Section 4.4**.
- Opening Year (2022)
    - No Build Alternative – See Section 4.3 for included projects
    - Build Alternative – All improvements assumed for the No Build plus the 10-mile extension of two reversible HOT Lanes and new access points as described in **Section 4.4**.

6.2 EXISTING 2016 VOLUMES

Existing (2016) daily traffic volumes are summarized in **Figure 6-1**. The balanced 2016 demand volumes for each hour within the peak periods (6 – 9 AM and 3 – 7 PM) are provided in **Figures A-1** through **A-7** in **Appendix A.**

Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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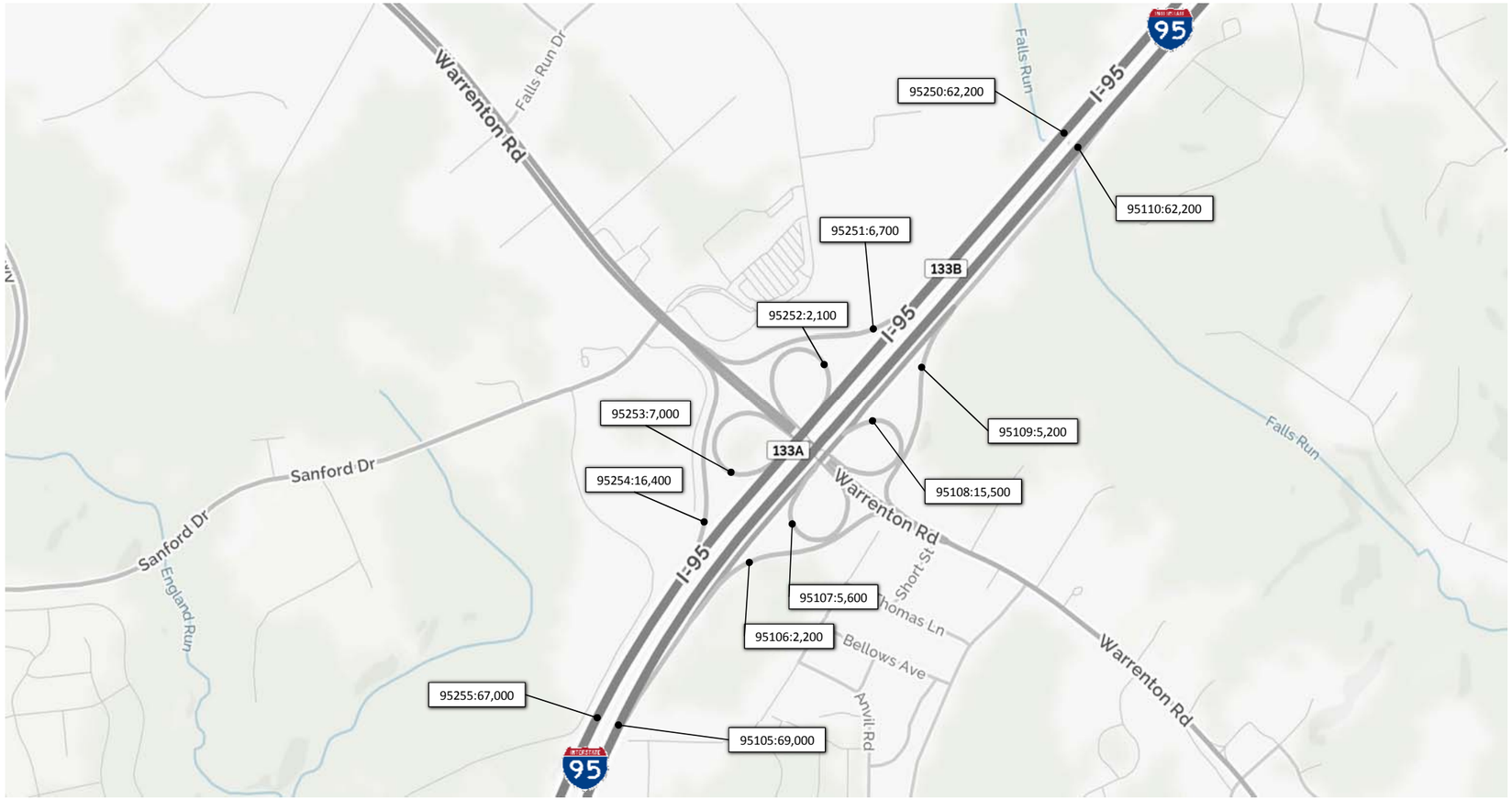
I-95 Express Lanes Fredericksburg Extension Study

2016 Existing Weekday Daily Volumes I-95 Corridor

February 2018

Figure 6.1-1



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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I-95 Express Lanes Fredericksburg Extension Study

2016 Existing Weekday Daily Volumes I-95 Corridor

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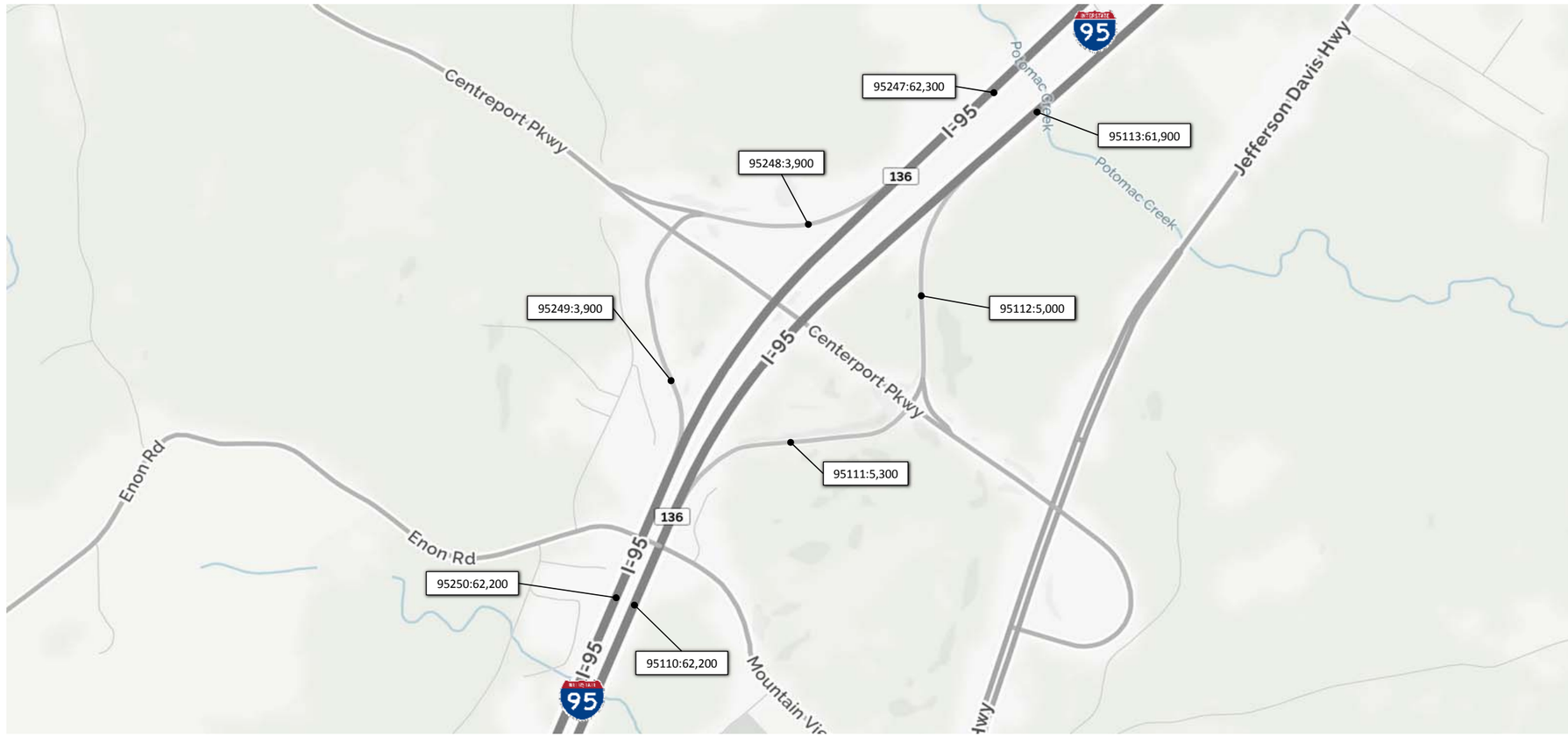
Figure 6.1-2



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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2016 Existing Weekday Daily Volumes I-95 Corridor

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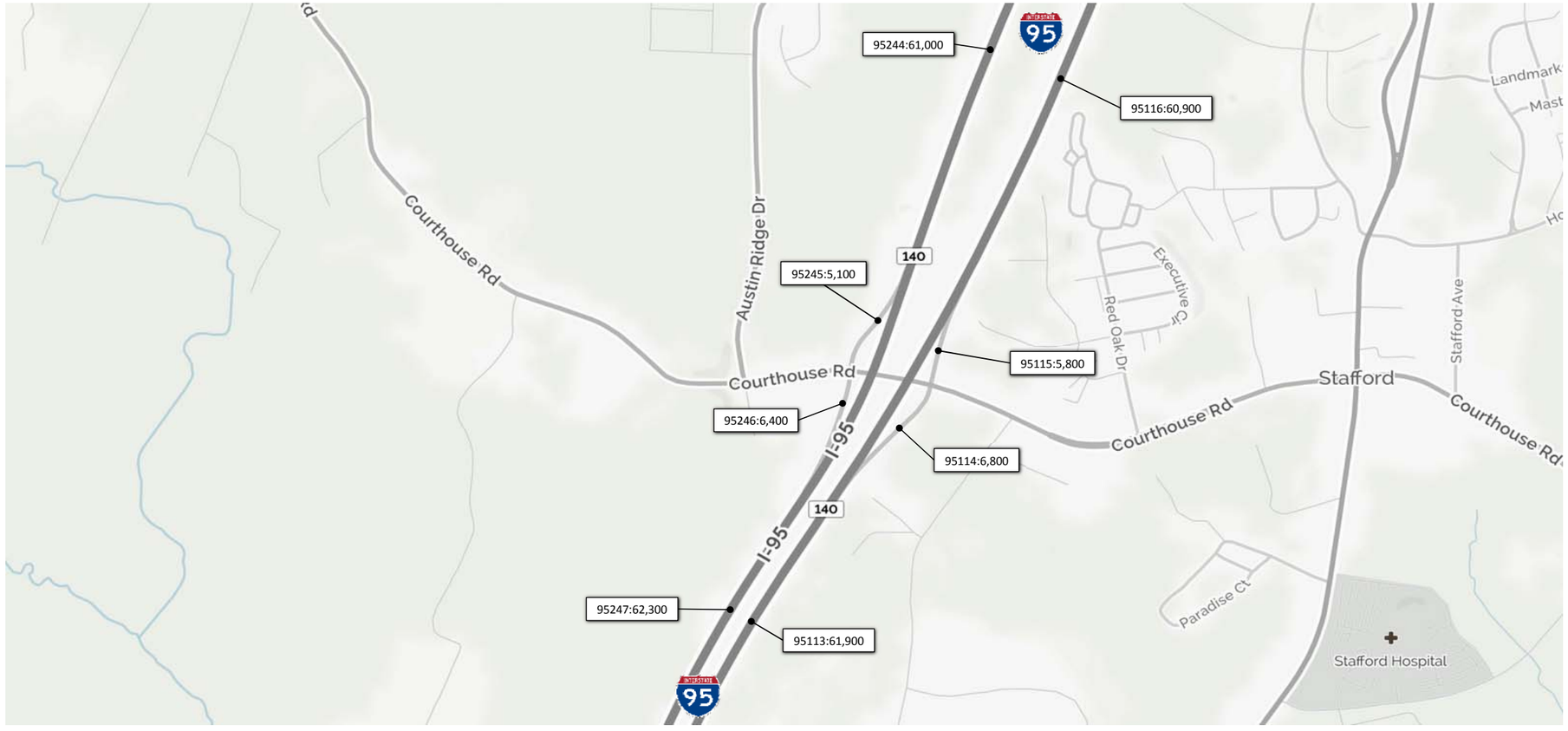
Figure 6.1-3



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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I-95 Express Lanes Fredericksburg Extension Study

2016 Existing Weekday Daily Volumes I-95 Corridor

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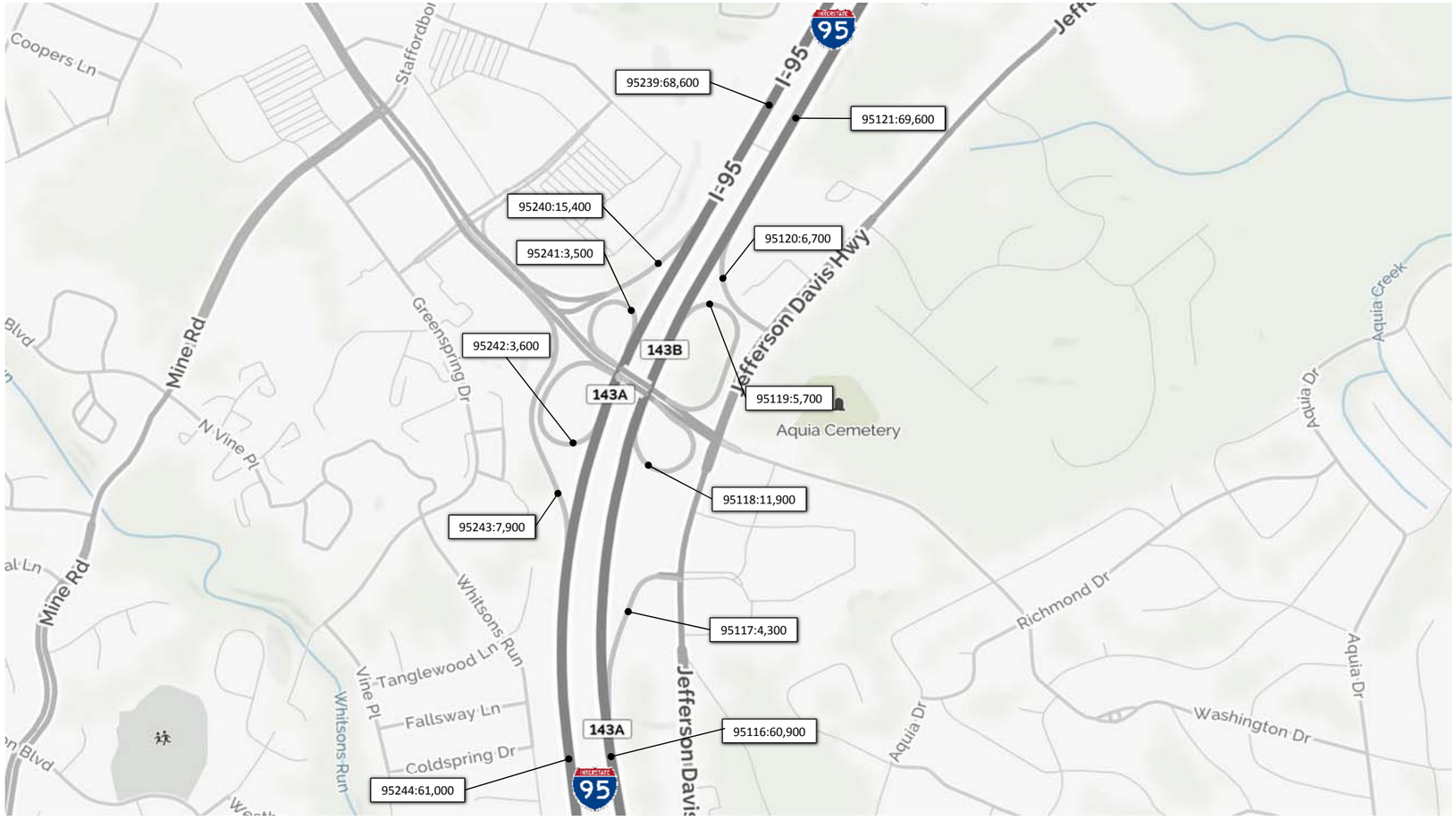
Figure 6.1-4



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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I-95 Express Lanes Fredericksburg Extension Study

2016 Existing Weekday Daily Volumes I-95 Corridor

February 2018

Figure 6.1-5

Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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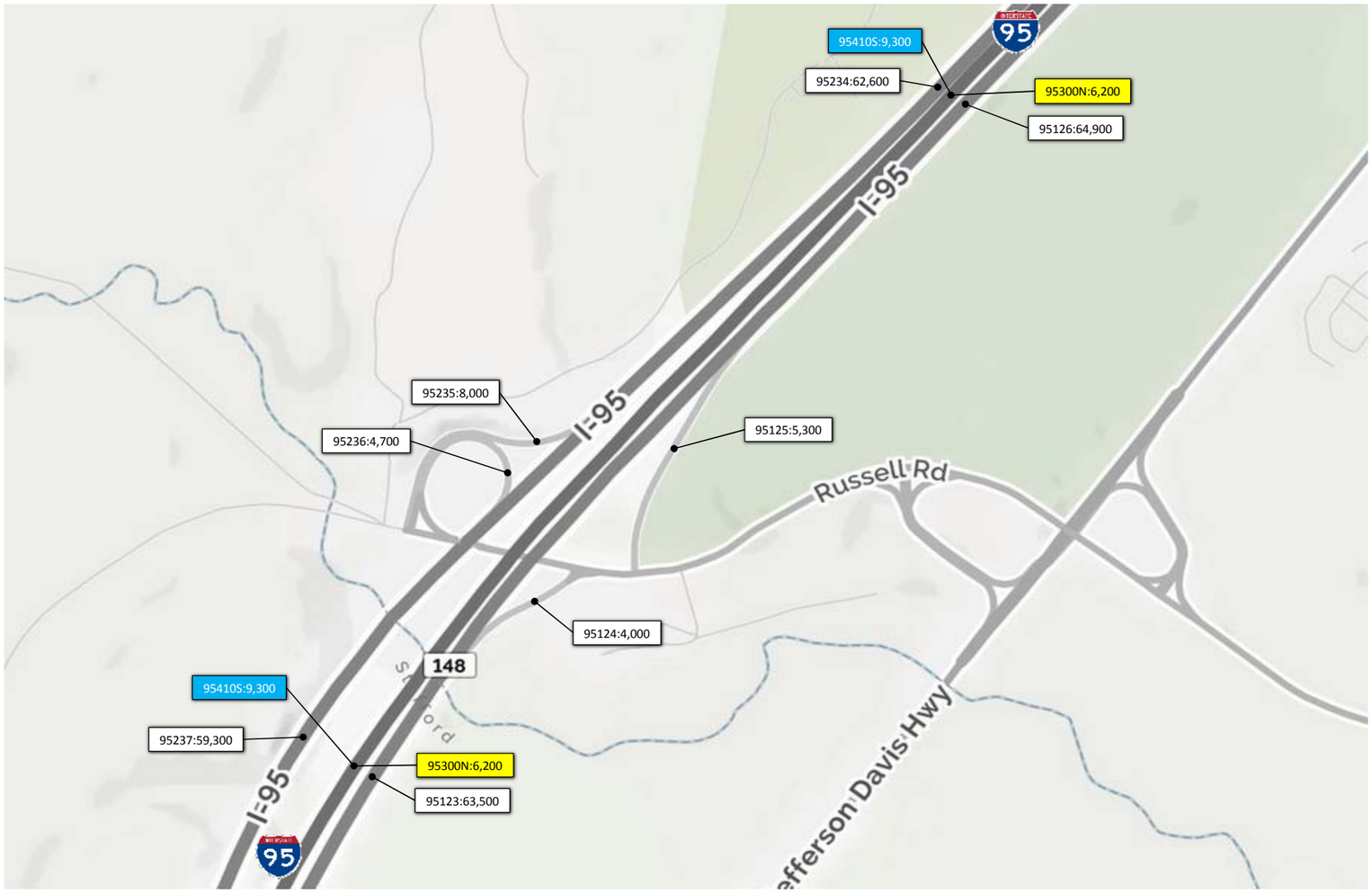
I-95 Express Lanes Fredericksburg Extension Study

2016 Existing Weekday Daily Volumes I-95 Corridor

February 2018

Figure 6.1-6



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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I-95 Express Lanes Fredericksburg Extension Study

2016 Existing Weekday Daily Volumes I-95 Corridor

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Figure 6.1-7

Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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I-95 Express Lanes Fredericksburg Extension Study

2016 Existing Weekday Daily Volumes I-95 Corridor

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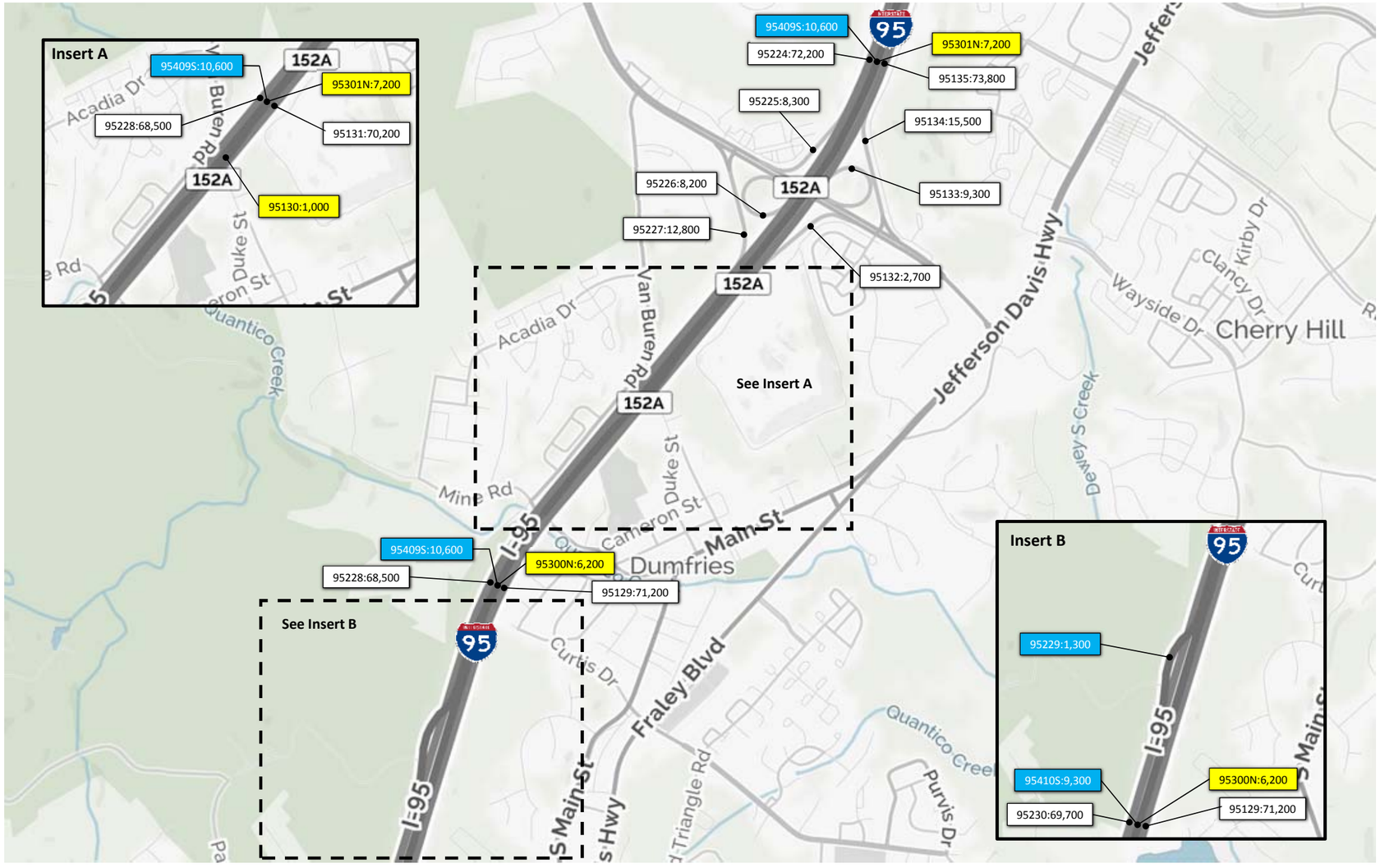
Figure 6.1-8



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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I-95 Express Lanes Fredericksburg Extension Study

2016 Existing Weekday Daily Volumes I-95 Corridor

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Figure 6.1-9

Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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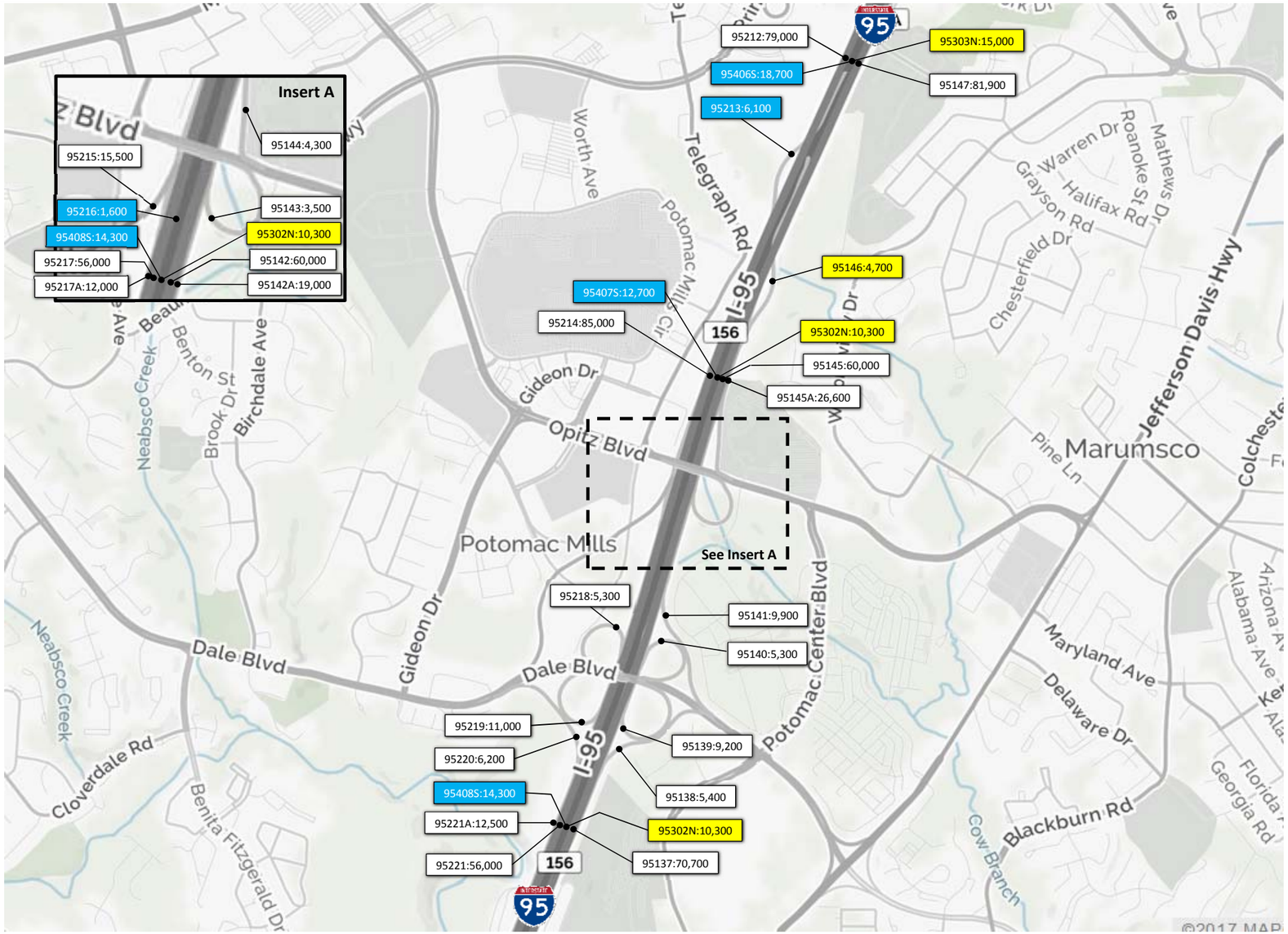
I-95 Express Lanes Fredericksburg Extension Study

2016 Existing Weekday Daily Volumes I-95 Corridor

February 2018

Figure 6.1-10



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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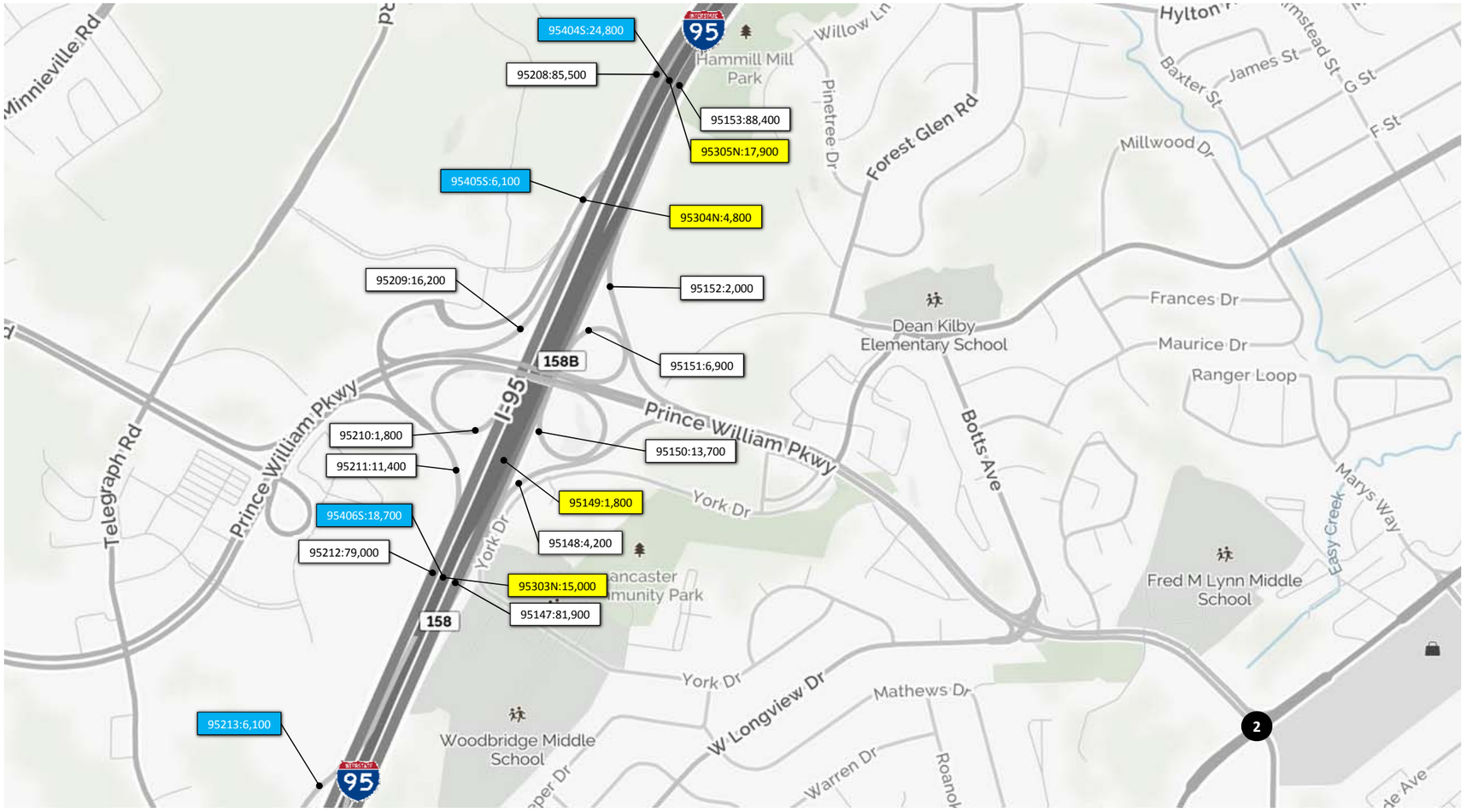
I-95 Express Lanes Fredericksburg Extension Study

2016 Existing Weekday Daily Volumes I-95 Corridor

February 2018

Figure 6.1-11



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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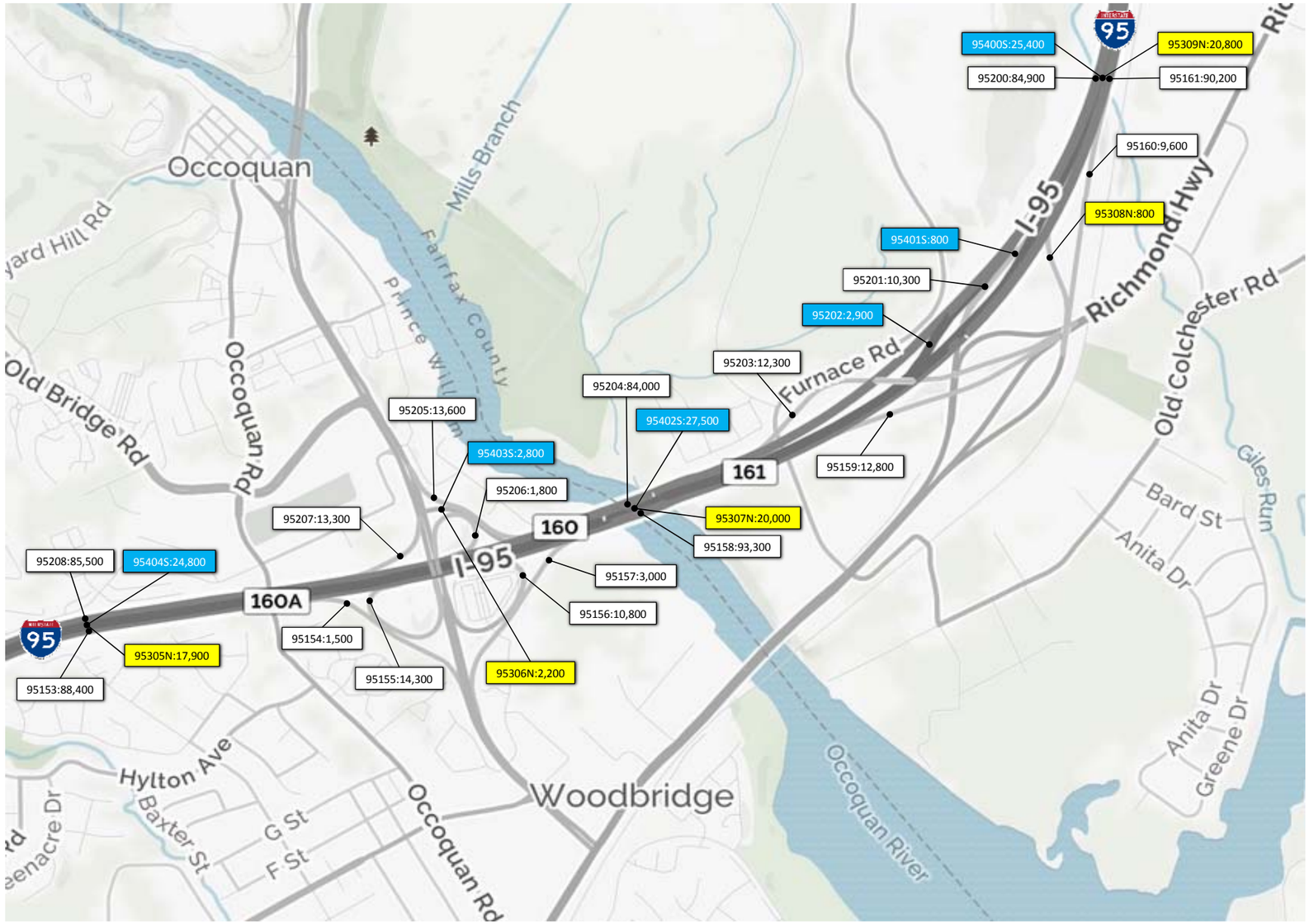
I-95 Express Lanes Fredericksburg Extension Study

2016 Existing Weekday Daily Volumes I-95 Corridor

February 2018

Figure 6.1-12



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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I-95 Express Lanes Fredericksburg Extension Study

2016 Existing Weekday Daily Volumes I-95 Corridor

February 2018

Figure 6.1-13

6.3 DESIGN YEAR (2042) SUMMARY

A summary of daily traffic volumes for each major segment of I-95 (defined as segments between interchanges) within the study area is provided in **Table 6-1.** A summary of projected total AM (6-9 AM) and PM (4-7 PM) peak period volumes is provided in **Table 6-2.** A summary of projected AM (7-8 AM) and PM (5-6 PM) peak hour volumes are provided in **Table 6-3** and **Table 6-4**, respectively.

The operational analysis results for each alternative are discussed in detail in **Section 7**.

Table 6-1: I-95 Daily Volumes by Segment

Location on I-95	Direction	2016 Daily Volumes			2042 No-Build Daily Volumes			2042 Build Daily Volumes		
		GP	Express	Total	GP	Express	Total	GP	Express	Total
North of Jefferson Davis Highway (US 1, Exit 126)	NB	52,000	-	**105,100**	75,500	-	**151,400**	77,400	-	**156,000**
	SB	53,100	-		75,900	-		78,600	-	
North of Plank Road (Route 3, Exit 130)	NB	69,000	-	**136,000**	88,300	-	**173,800**	91,100	-	**180,100**
	SB	67,000	-		85,500	-		89,000	-	
North of Warrenton Road (US 17, Exit 133)	NB	62,200	-	**124,400**	80,700	-	**157,800**	76,200	13,300	**171,100**
	SB	62,200	-		77,100	-		68,400	13,200	
North of Centreport Parkway (Route 8900, Exit 136)	NB	61,900	-	**124,200**	78,200	-	**154,400**	76,000	13,300	**170,000**
	SB	62,300	-		76,200	-		67,500	13,200	
North of Courthouse Road (Route 630, Exit 140)	NB	60,900	-	**121,900**	81,400	-	**158,000**	76,400	15,300	**175,500**
	SB	61,000	-		76,600	-		67,900	15,900	
North of Garrisonville Road (Route 610, Exit 143)	NB	69,600	6,200	**153,700**	85,300	12,500	**188,800**	81,500	20,500	**199,800**
	SB	68,600	9,300		75,000	16,000		75,500	22,300	
North of Russell Road (Exit 148)	NB	64,900	6,200	**143,000**	77,600	12,500	**175,400**	76,100	20,500	**183,100**
	SB	62,600	9,300		69,300	16,000		70,200	16,300	

Table 6-2: I-95 Peak Period Volumes by Segment

Location on I-95		2016 Peak Period Volumes			2042 No-Build Peak Period Volumes			2042 Build Peak Period Volumes		
		SB	NB	Express Lanes	SB	NB	Express Lanes	SB	NB	Express Lanes
North of Russell Road (Exit 148)	AM	9,350	10,260	2,675 NB	9,915	14,150	3,200 NB	9,585	11,470	4,775 NB
	PM	12,110	13,605	4,508 SB	18,980	13,440	4,665 SB	18,660	13,325	5,405 SB
North of Garrisonville Road (Route 610, Exit 143)	AM	6,120	11,370	2,675 NB	7,170	18,160	3,200 NB	6,935	17,275	4,775 NB
	PM	12,820	10,325	3,925 SB	21,925	12,025	4,665 SB	21,595	12,720	5,405 SB
North of Courthouse Road (Route 630, Exit 140)	AM	6,570	9,790	-	7,515	20,655	-	8,350	15,950	3,695 NB
	PM	14,130	10,020	-	25,155	11,790	-	23,525	15,950	6,840 SB
North of Centreport Parkway (Route 8900, Exit 136)	AM	7,200	9,450	-	8,185	16,865	-	8,435	16,500	3,155 NB
	PM	14,080	10,530	-	20,315	11,510	-	21,825	11,575	5,925 SB
North of Warrenton Road (US 17, Exit 133)	AM	7,590	10,530	-	8,705	15,865	-	9,105	15,255	3,155 NB
	PM	14,025	10,420	-	18,785	11,505	-	20,655	11,785	5,925 SB
North of Plank Road (Route 3, Exit 130)	AM	8,085	13,100	-	10,215	18,220	-	10,200	18,790	-
	PM	14,705	11,400	-	20,365	13,250	-	25,435	13,430	-

AM Peak Period from 6 AM – 9 AM; PM Peak Period from 4 PM – 7 PM

Table 6-3: I-95 AM Peak Hour Volumes by Segment

Location on I-95	2016 7-8 AM Volumes			2042 No-Build 7-8 AM Volumes			2042 Build 7-8 AM Volumes		
	SB	NB	Express Lanes	SB	NB	Express Lanes	SB	NB	Express Lanes
North of Russell Road (Exit 148)	3,470	3,305	760 NB	3,400	4,400	1,100 NB	3,300	4,600	1,700 NB
North of Garrisonville Road (Route 610, Exit 143)	2,095	3,670	760 NB	2,500	6,200	1,100 NB	2,400	5,700	1,900 NB
North of Courthouse Road (Route 630, Exit 140)	2,500	3,155	-	2,600	7,100	-	2,900	6,900	1,300 NB
North of Centreport Parkway (Route 8900, Exit 136)	2,750	3,035	-	2,800	5,800	-	2,900	5,700	1,100 NB
North of Warrenton Road (US 17, Exit 133)	2,915	3,575	-	3,000	5,400	-	3,100	5,200	1,100 NB
North of Plank Road (Route 3, Exit 130)	3,075	4,680	-	1,600 GP 1,850 CD	4,400 GP 2,600 CD	-	1,500 GP 1,900 CD	4,600 GP 2,600 CD	-

Table 6-4: I-95 PM Peak Hour Volumes by Segment

Location on I-95	2016 5-6 PM Volumes			2042 No-Build 5-6 PM Volumes			2042 Build 5-6 PM Volumes		
	SB	NB	Express Lanes	SB	NB	Express Lanes	SB	NB	Express Lanes
North of Russell Road (Exit 148)	3,930	4,120	1,230 SB	6,500	4,600	1,600 SB	6,400	4,800	1,900 SB
North of Garrisonville Road (Route 610, Exit 143)	4,530	3,500	1,230 SB	7,500	4,200	1,600 SB	7,400	4,400	2,500 SB
North of Courthouse Road (Route 630, Exit 140)	4,850	3,385	-	8,600	4,100	-	8,300	4,200	2,300 SB
North of Centreport Parkway (Route 8900, Exit 136)	4,790	3,645	-	7,000	4,000	-	7,500	4,000	2,000 SB
North of Warrenton Road (US 17, Exit 133)	4,705	3,595	-	6,400	4,000	-	7,000	4,100	2,000 SB
North of Plank Road (Route 3, Exit 130)	4,975	3,875	-	3,450 GP 3,475 CD	3,600 GP 1,000 CD	-	3,725 GP 4,925 CD	3,600 GP 1,000 CD	-

6.3.1 2042 No-Build Alternative

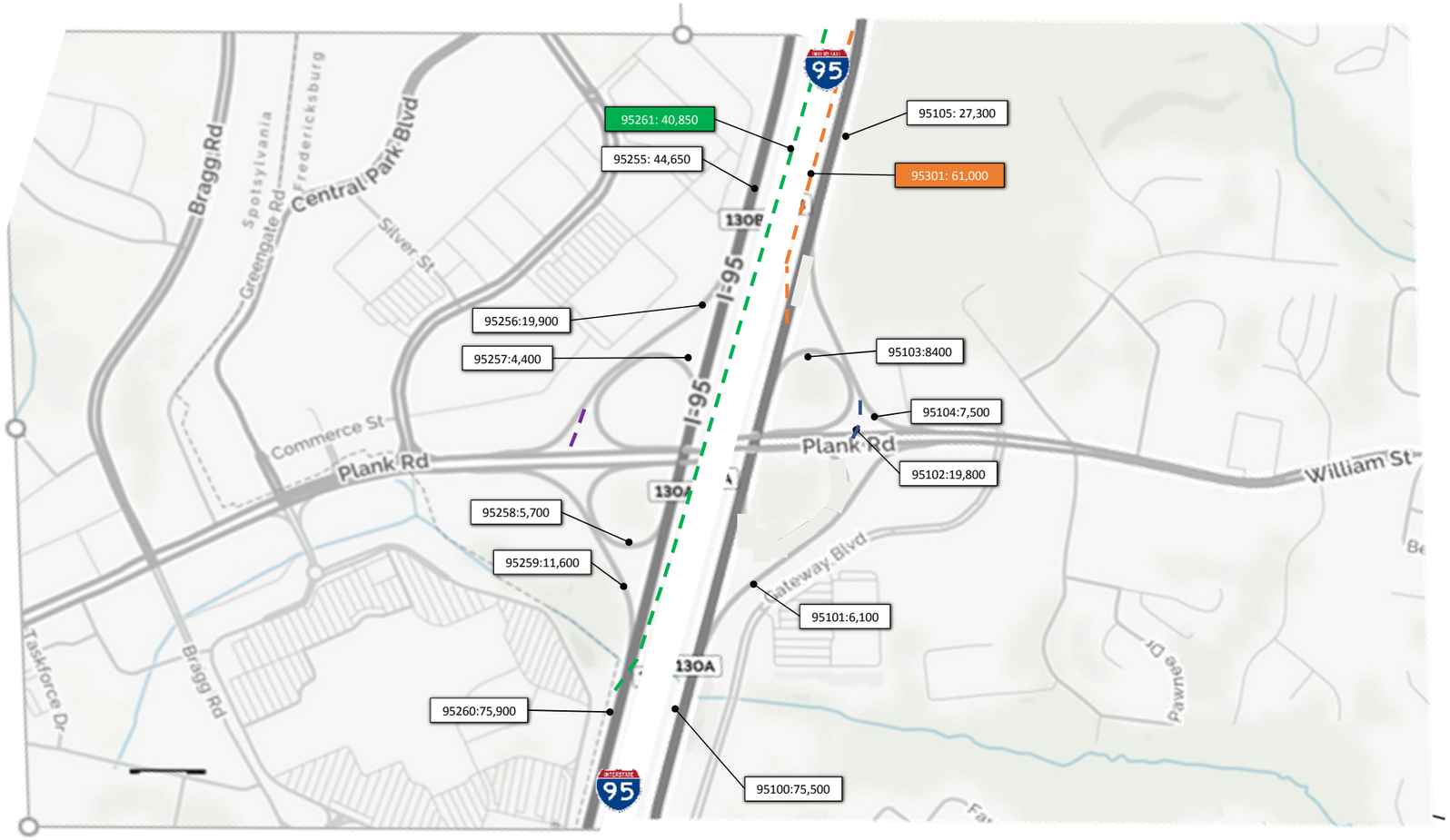
The 2042 No-Build forecast shows continuing growth in traffic volumes along the I-95 corridor. Daily traffic volumes on I-95 are projected to increase by approximately 25 to 30 percent (from approximately 122,000 to 158,000 vehicles per day) between 2016 and 2042 for the segments between Exit 133 and Exit 143. North of Exit 143, daily traffic volumes are projected to increase by approximately 23 percent (from approximately 154,000 to 189,000 vehicles per day).

The three-hour peak period and peak hourly demand volumes also show continuing growth along the I-95 corridor. During the AM peak period, northbound I-95 volumes are projected to increase by approximately 50 percent between Exit 133 and Exit 143 and by approximately 59 percent north of Exit 143.

During the PM peak period, southbound I-95 volumes are projected to increase by approximately 34 percent between Exit 140 and Exit 133, 78 percent between Exit 143 and Exit 140, and by approximately 71 percent north of Exit 143.

Detailed daily volumes for 2042 No-Build conditions are provided in **Figure 6-2**.

Detailed AM and PM peak period hourly volumes for 2042 No-Build conditions, including turning movement volumes at intersections, are provided in **Appendix B** in **Figures B-1** through **B-7**.



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)
	Proposed SB I-95 GP Thru Lanes (Separated from CD Lanes Serving US 17 and SR 3)
xxxx: yy,yyy	Location Number: Weekday GP Thru Lane Volume (SB)
	Proposed I-95 / Route 3 Safety Improvements (under construction)
	Proposed NB I-95 GP Thru Lanes (Separated from CD Lanes Serving US 17 and SR 3) Plus Associated Improvements
xxxx: yy,yyy	Location Number: Weekday GP Thru Lane Volume (NB)

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2042 No Build
Weekday Daily Volumes
I-95 Corridor

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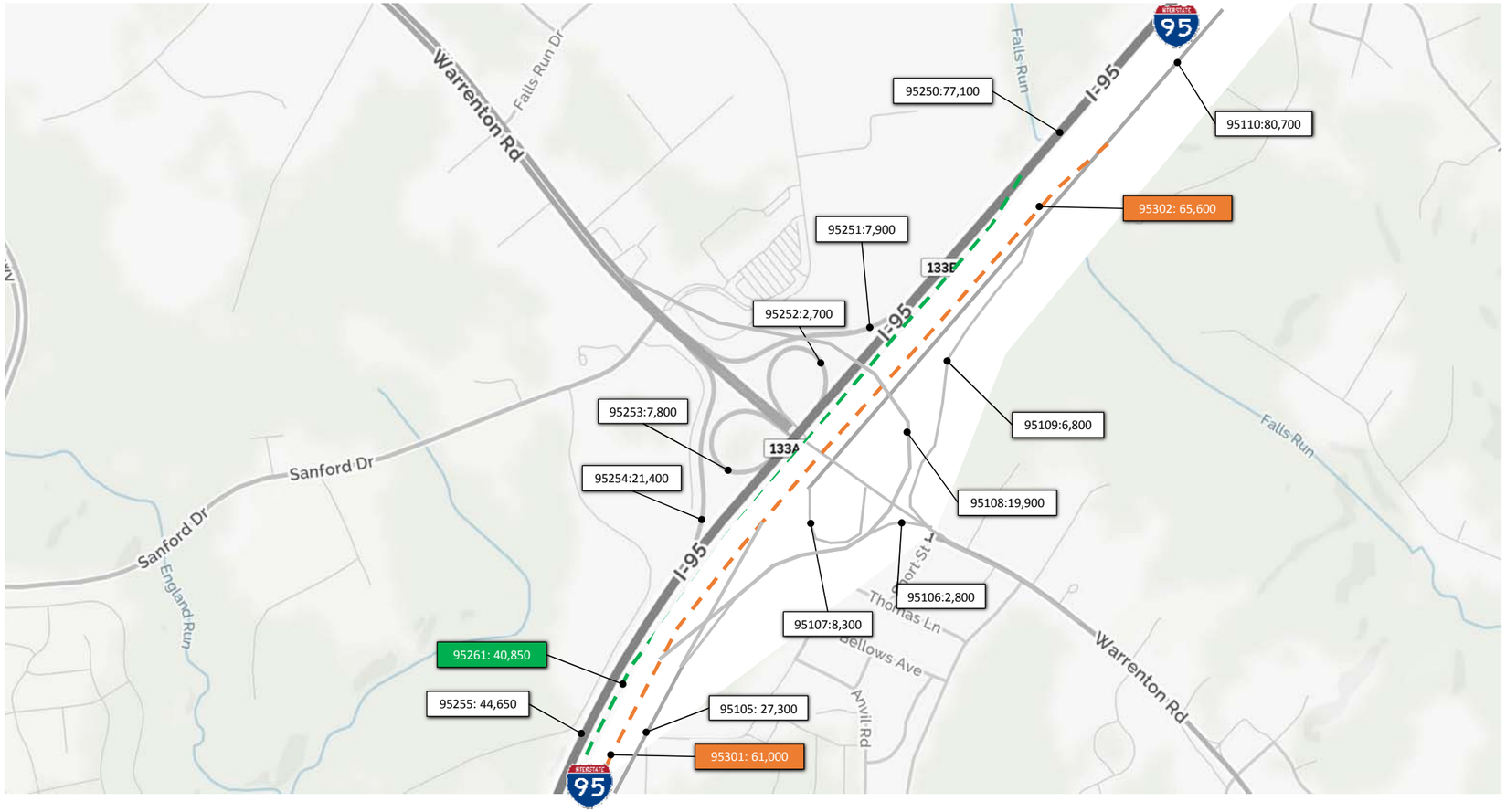
Figure 6.2-1



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)
	Proposed I-95 GP Thru Lanes (Separated from CD Lanes Serving US 17 and SR 3)
xxxx: yy,yyy	Location Number: Weekday GP Thru Lane Volume (SB)
	Proposed NB I-95 GP Thru Lanes (Separated from CD Lanes Serving US 17 and SR 3) Plus Associated Improvements
xxxx: yy,yyy	Location Number: Weekday GP Thru Lane Volume (NB)

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I-95 Express Lanes Fredericksburg Extension Study

2042 No Build

Weekday Daily Volumes

I-95 Corridor

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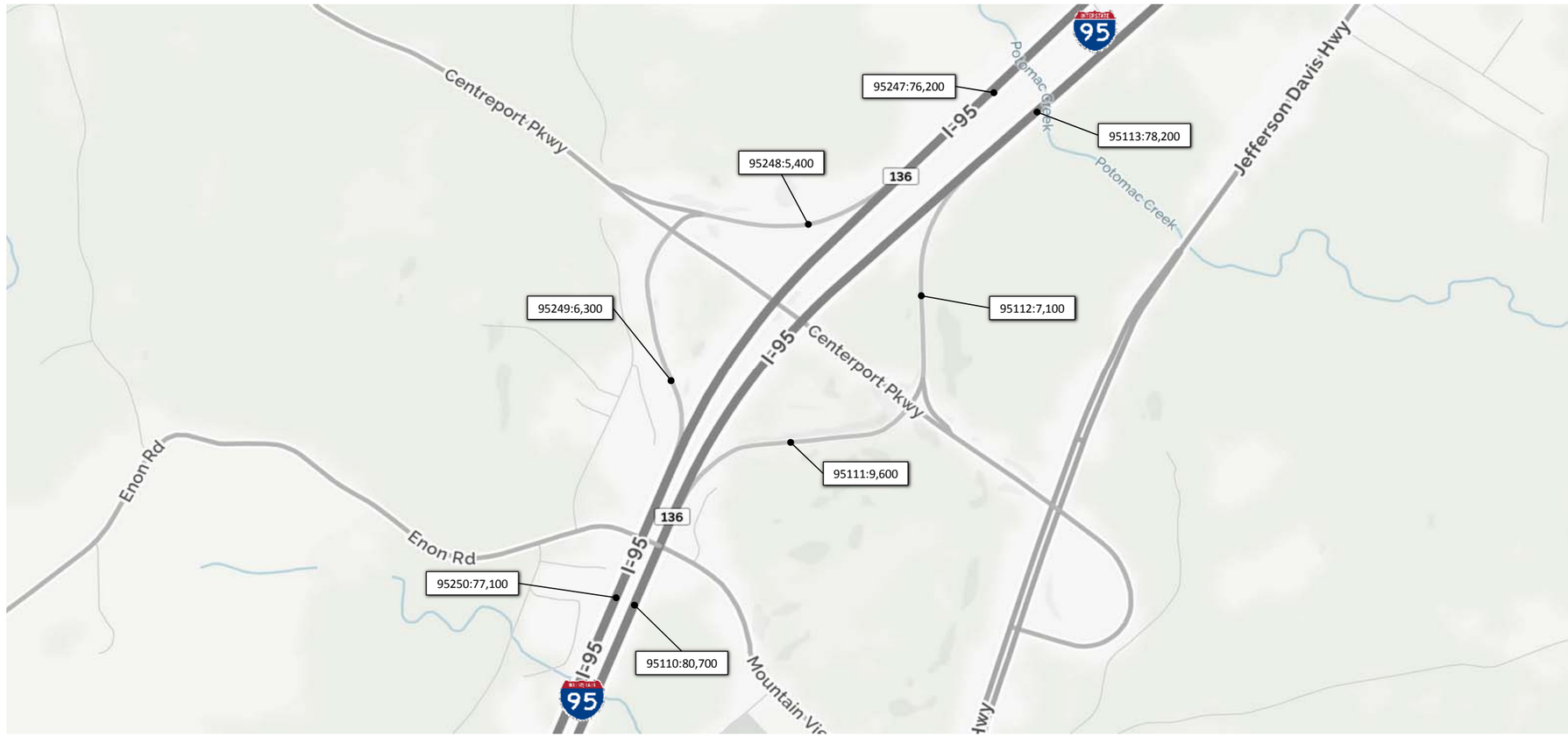
Figure 6.2-2



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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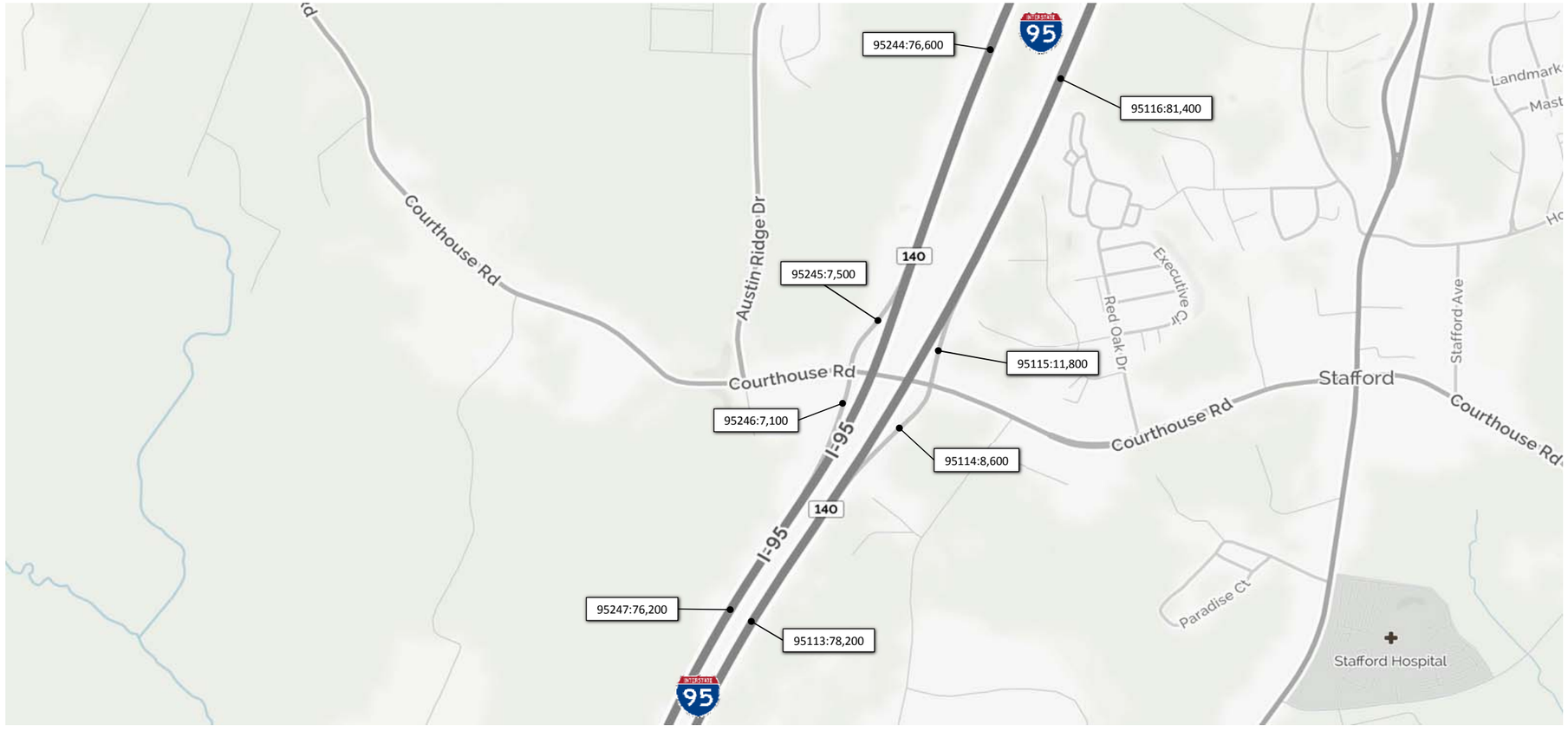
I-95 Express Lanes Fredericksburg Extension Study

2042 No Build
Weekday Daily Volumes
I-95 Corridor

February 2018

Figure 6.2-3



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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I-95 Express Lanes Fredericksburg Extension Study

2042 No Build

Weekday Daily Volumes

I-95 Corridor

February 2018

Figure 6.2-4

Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)
■ ■ ■ ■ ■	Proposed Express Lane Extension

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I-95 Express Lanes Fredericksburg Extension Study

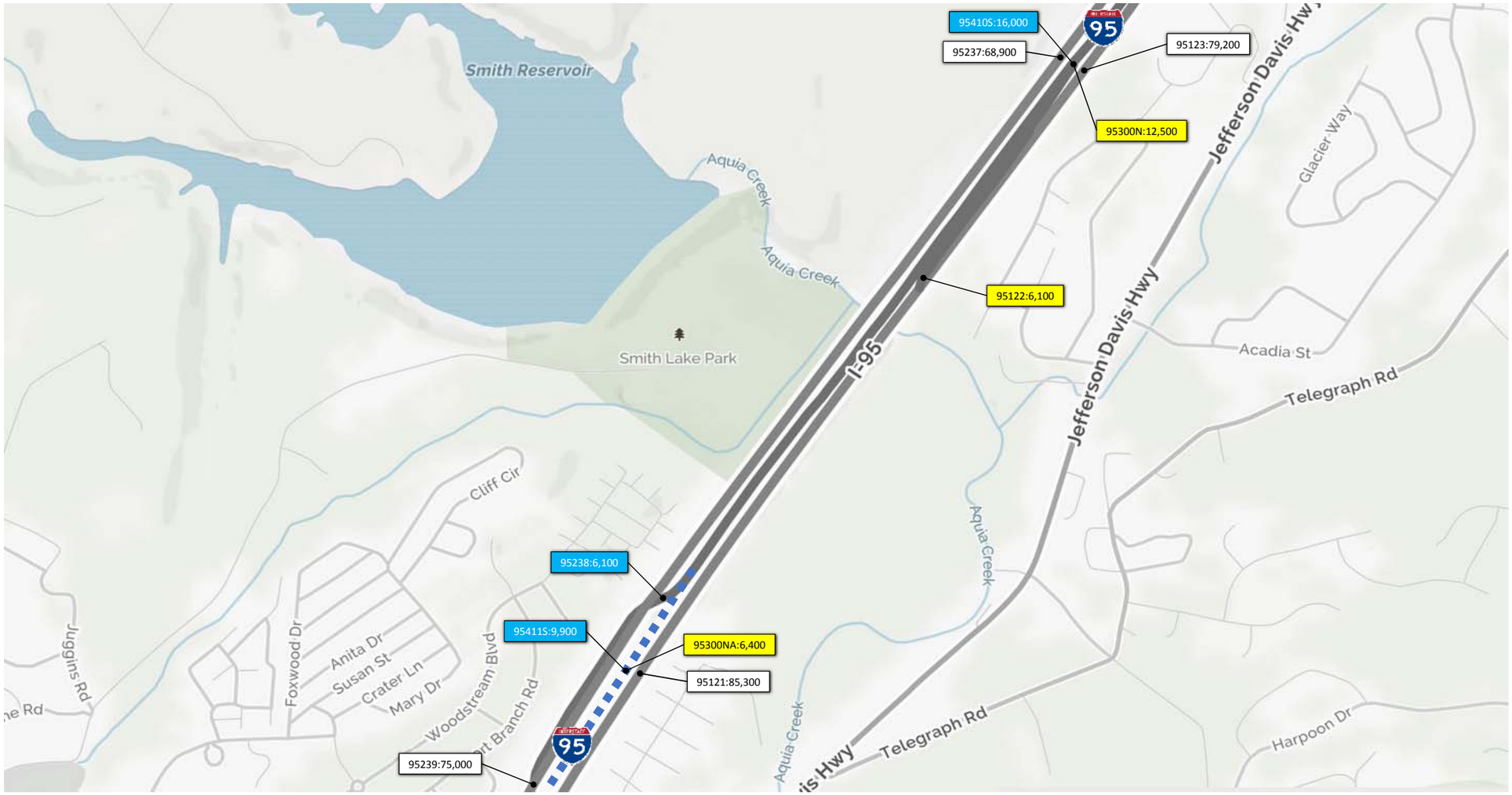
2042 No Build

Weekday Daily Volumes

I-95 Corridor

February 2018

Figure 6.2-5



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)
■ ■ ■ ■ ■	Proposed Express Lane Extension

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I-95 Express Lanes Fredericksburg Extension Study

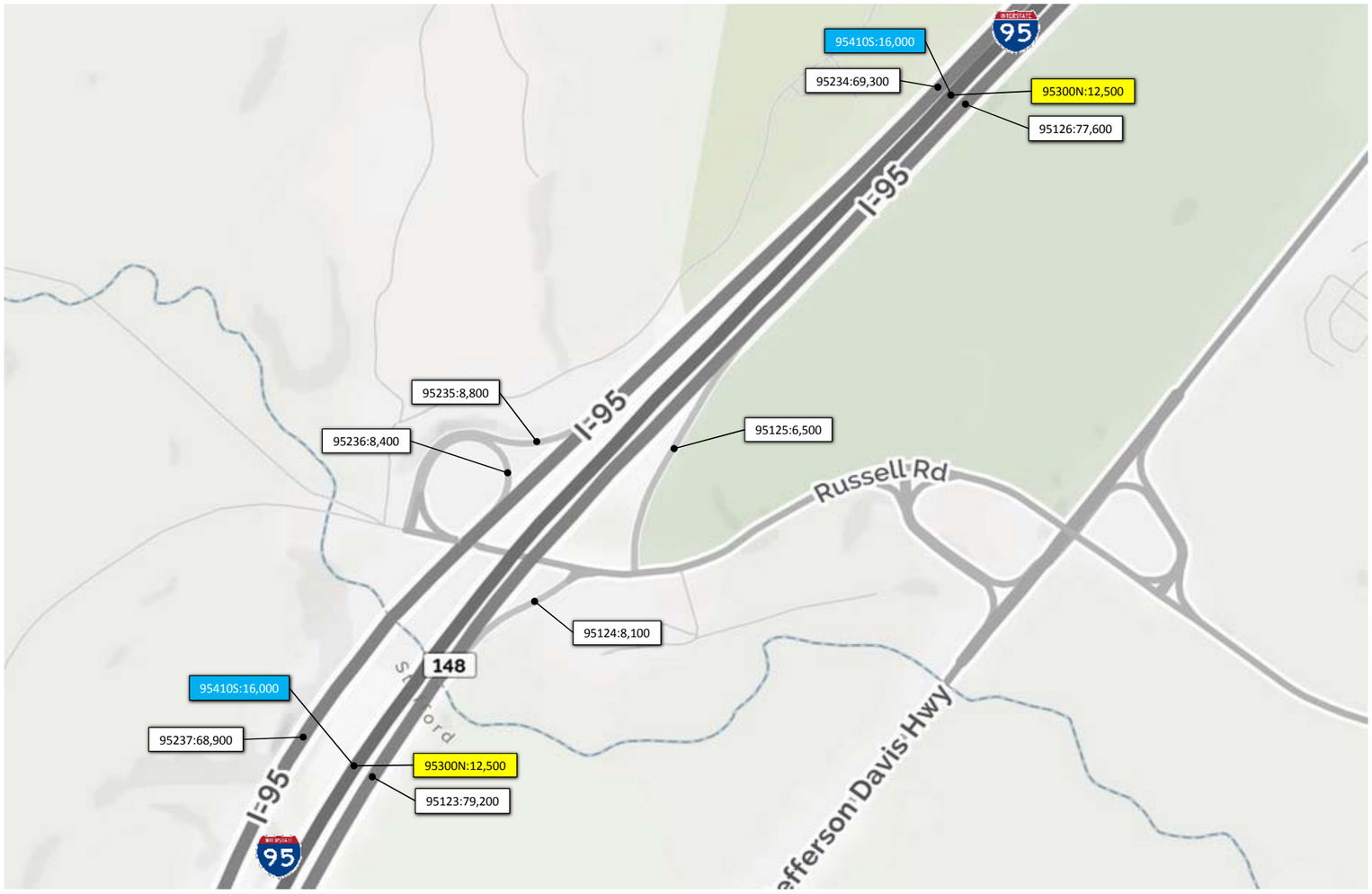
2042 No Build

Weekday Daily Volumes

I-95 Corridor

February 2018

Figure 6.2-6



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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I-95 Express Lanes Fredericksburg Extension Study

2042 No Build
Weekday Daily Volumes
I-95 Corridor

February 2018

Figure 6.2-7

Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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I-95 Express Lanes Fredericksburg Extension Study

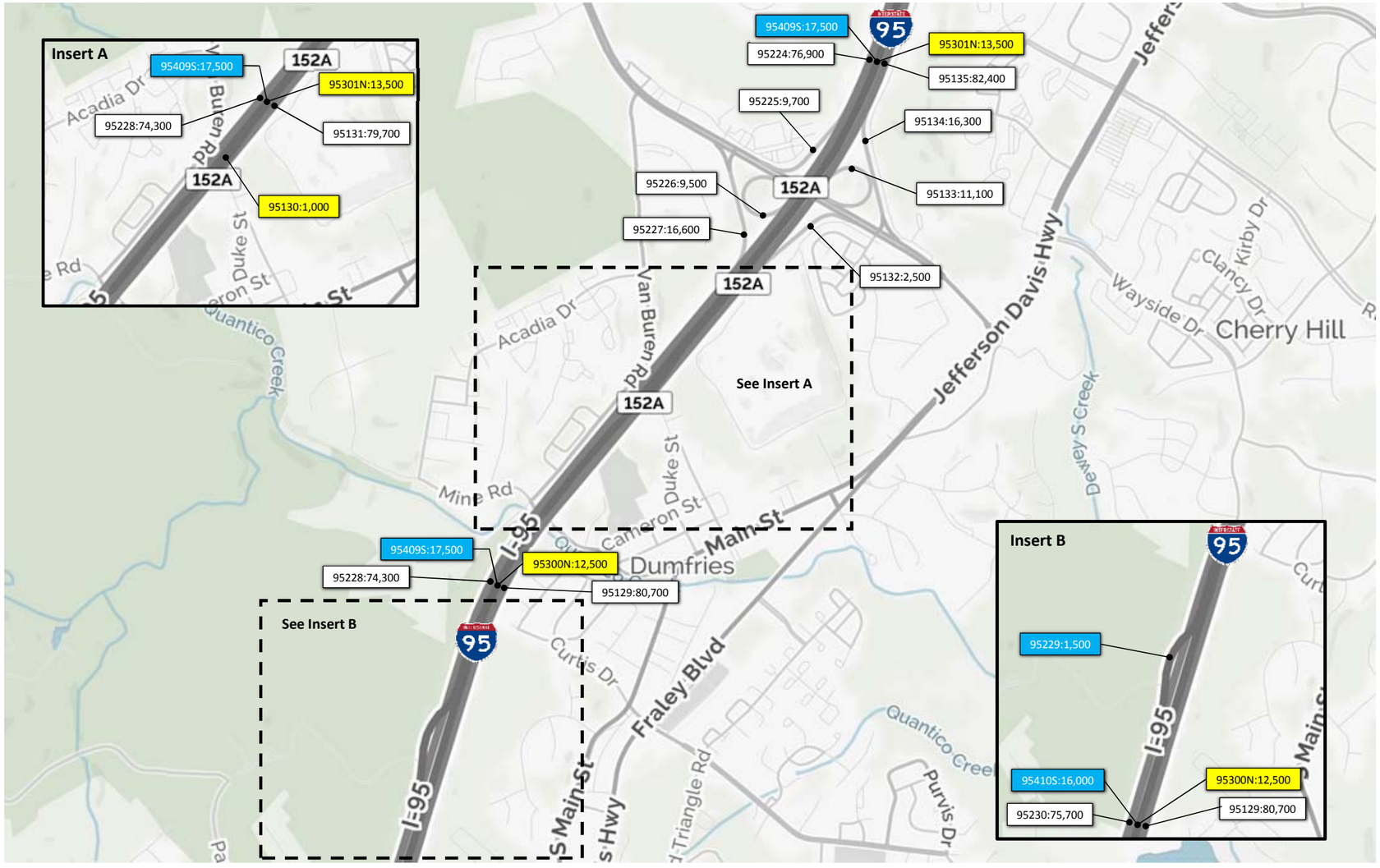
2042 No Build

Weekday Daily Volumes

I-95 Corridor

February 2018

Figure 6.2-8



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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I-95 Express Lanes Fredericksburg Extension Study

2042 No Build Weekday Daily Volumes I-95 Corridor

February 2018

Figure 6.2-9

Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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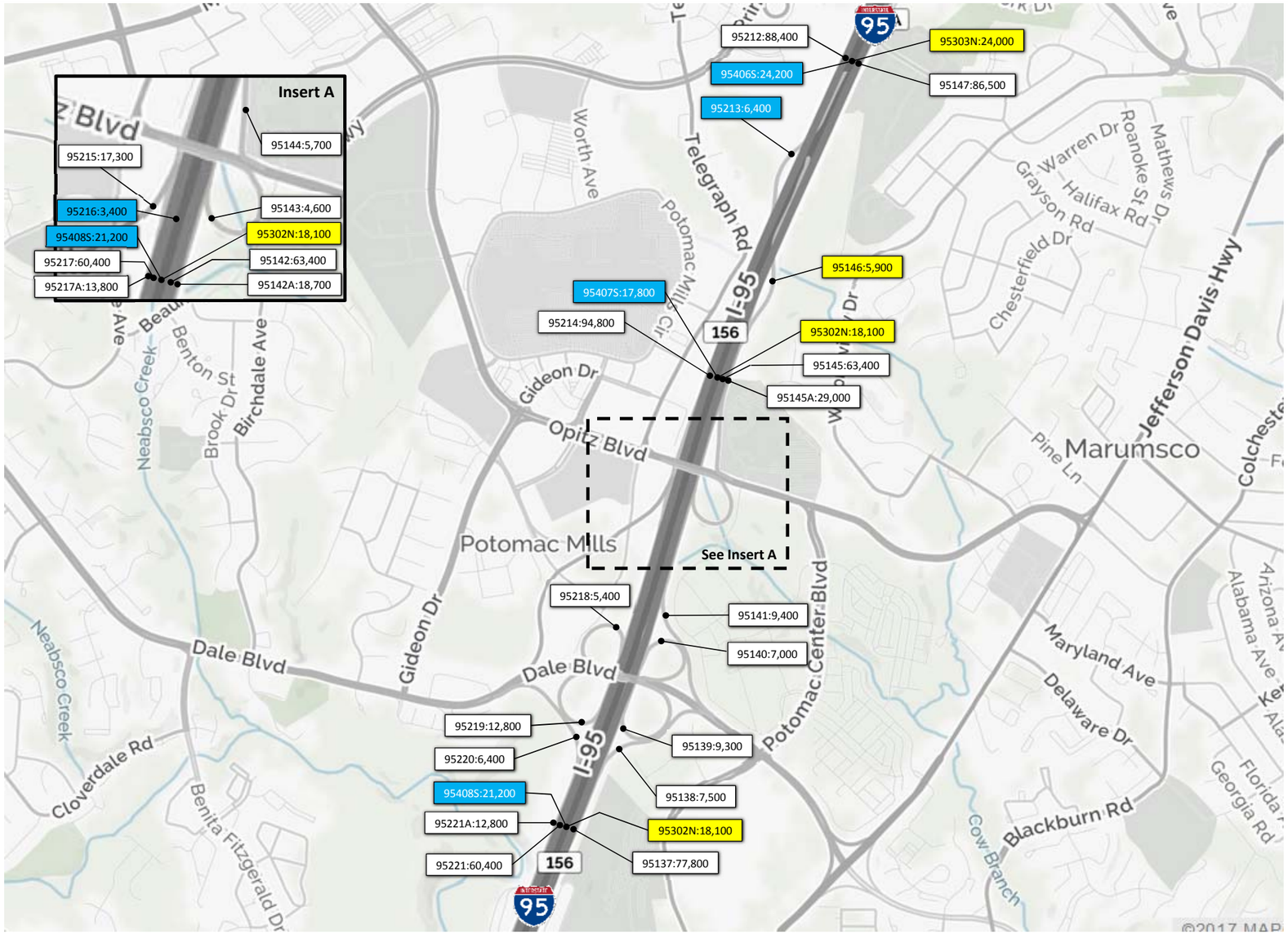
2042 No Build Weekday Daily Volumes I-95 Corridor

February 2018

Figure 6.2-10



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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I-95 Express Lanes Fredericksburg Extension Study

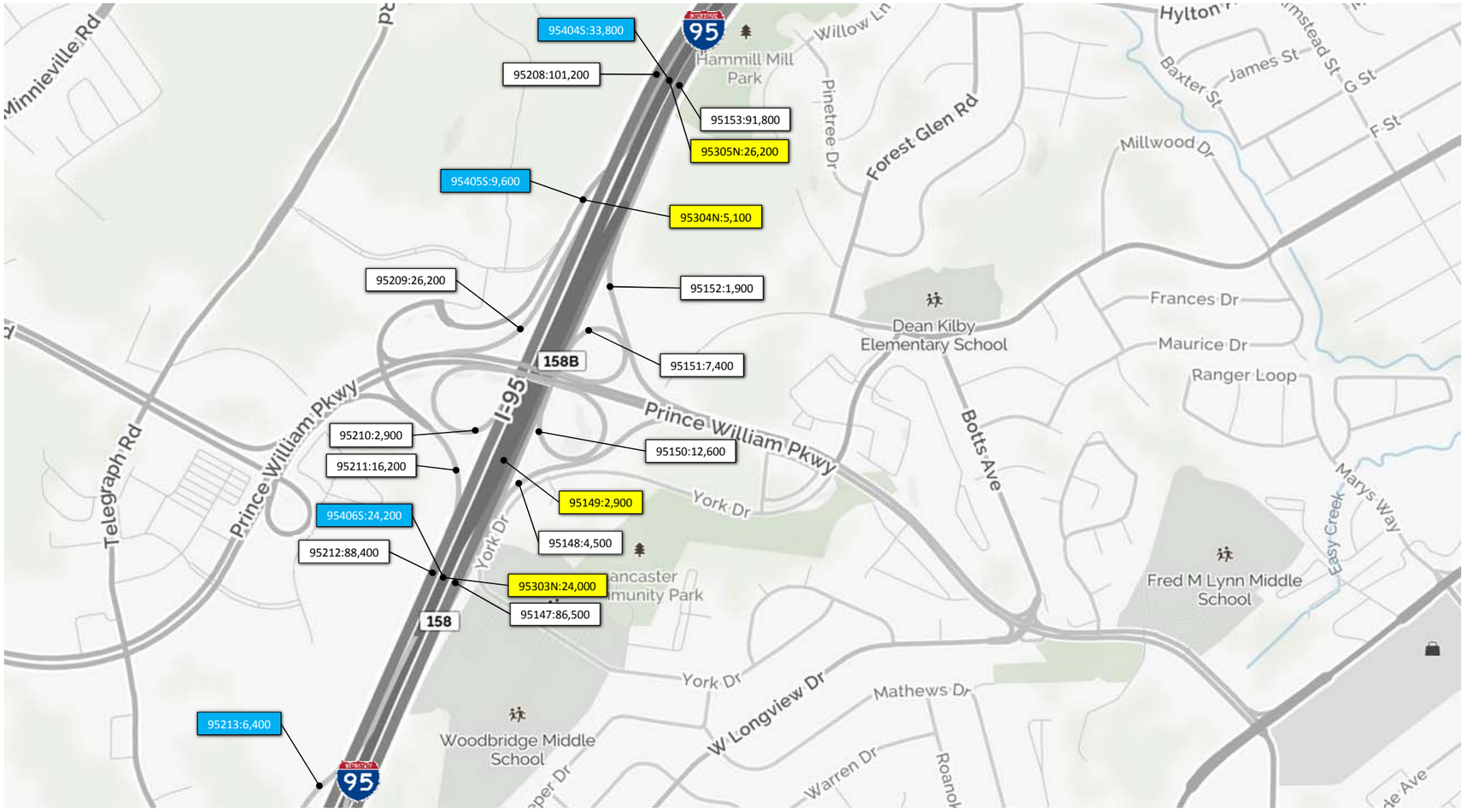
2042 No Build

Weekday Daily Volumes

I-95 Corridor

February 2018

Figure 6.2-11



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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I-95 Express Lanes Fredericksburg Extension Study

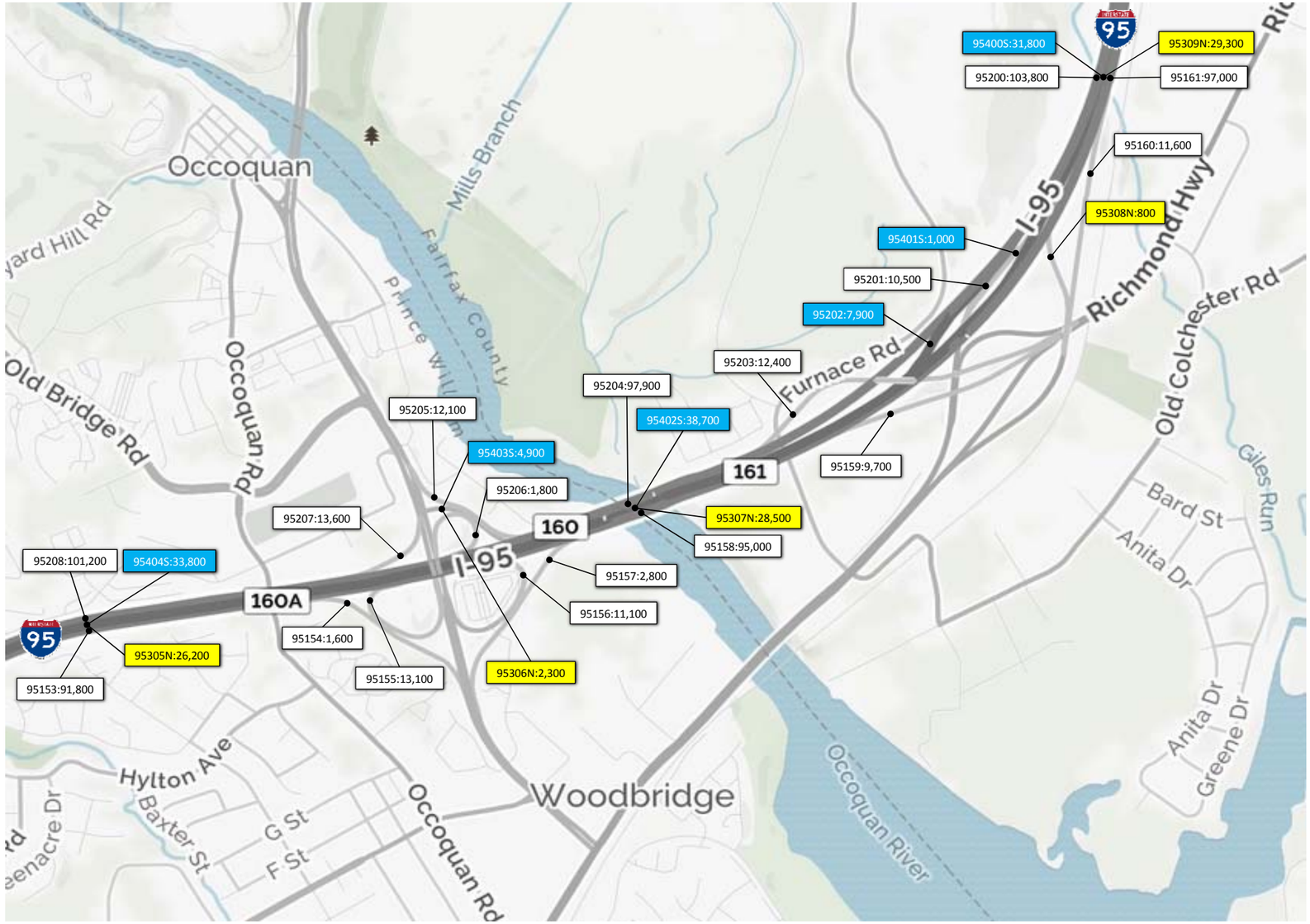
2042 No Build

Weekday Daily Volumes

I-95 Corridor

February 2018

Figure 6.2-12



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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I-95 Express Lanes Fredericksburg Extension Study

2042 No Build

Weekday Daily Volumes

I-95 Corridor

February 2018

Figure 6.2-13

6.3.2 2042 Build Alternative

As described in **Section 4.4**, the Build Alternative would extend the I-95 Express Lanes from the current terminus at Garrisonville Road (Exit 143) to Route 17 (Exit 133) in Stafford County north of Fredericksburg. It would also provide Express Lane Access Points near US 17 (Exit 133), VA 630 (Exit 140 at Courthouse Road), and Marine Corps Base Quantico (Exit 148 at Russell Road). The Build Alternative would provide a direct connection with the Southbound and Northbound Rappahannock River Crossing Projects.

The proposed new segments of the I-95 Express Lanes, along with the proposed connections to the I-95 GP lanes near Exit 133 and Exit 148 and the proposed direction connection to Old Courthouse Road, were coded into the MWCOG travel demand model, and the raw model output was processed as described in Section 2.4. The resulting daily, peak period, and AM and PM peak hourly volumes are summarized in **Table 6-1, Table 6-2, Table 6-3, and Table 6-4**, respectively.

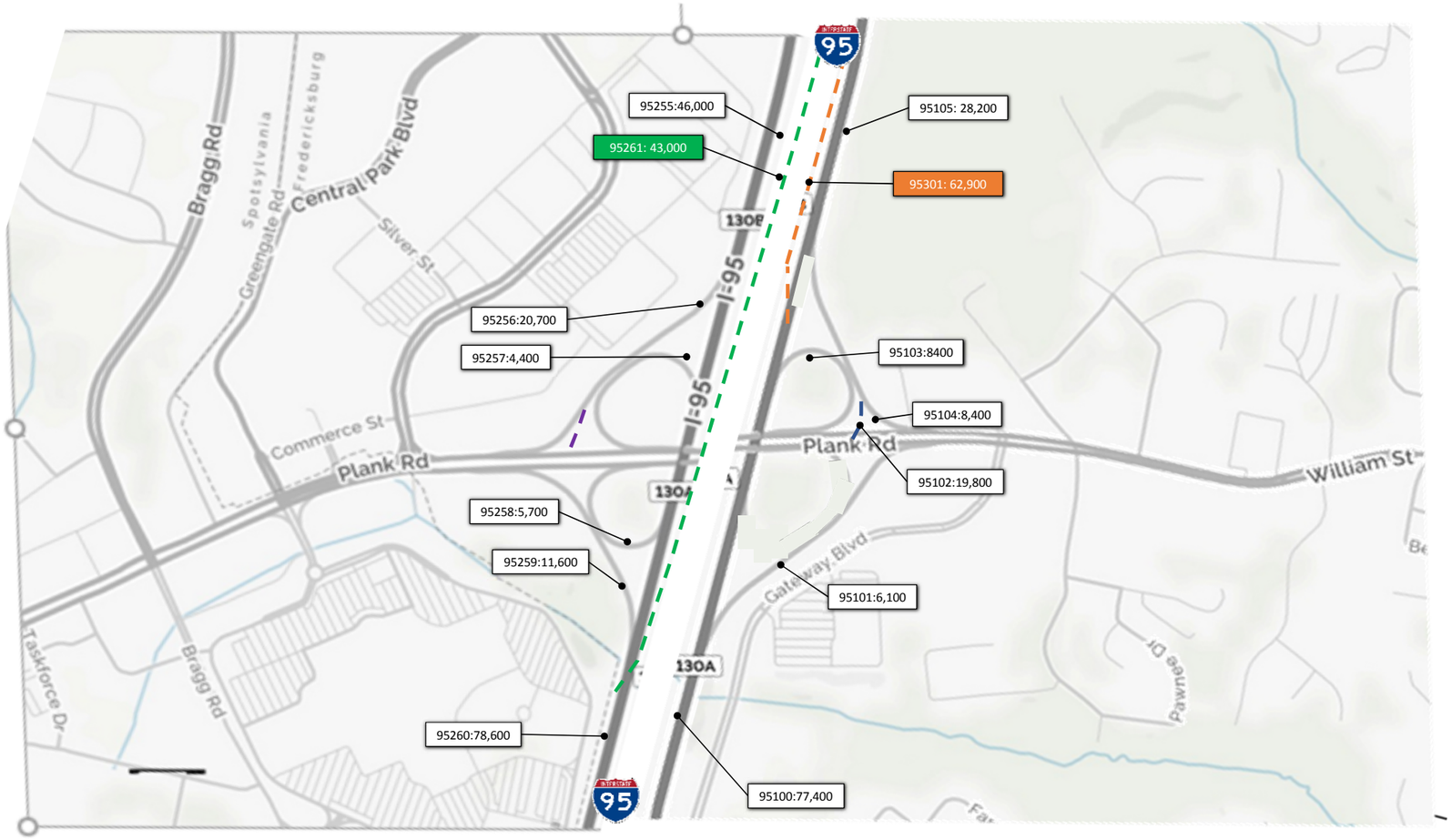
As shown in **Table 6-1** compared to 2042 No-Build conditions, the proposed I-95 Express Lane extension would increase the total daily volumes along I-95 within the study corridor. Projected daily traffic volumes would increase by approximately six percent (8,000 to 11,000 vehicles per day) north of Exit 143 and approximately eight to ten percent (15,000 to 17,000 vehicles per day) between Exits 133 and 143. North of Exit 143, the daily volumes in the I-95 GP lanes would decrease by approximately 4,000 vehicles per day, while the Express Lane volumes would increase by approximately 14,000 vehicles per day. Between Exits 133 and 143, the daily I-95 GP volumes would decrease by approximately 14,000 vehicles per day and the proposed I-95 Express Lanes would carry approximately 26,000 vehicles per day.

The three-hour peak period and peak hourly demand volumes also show increased traffic along I-95 compared to 2042 No-Build conditions. During the AM peak period (6 – 9 AM), north of Exit 143, total northbound I-95 volumes are projected to increase by approximately three percent (700 vehicles); the I-95 Express Lanes volume would increase by approximately 1,500 vehicles and the GP volume would decrease by approximately 800 vehicles. Between Exits 133 and 140, total northbound I-95 volumes are projected to increase by approximately 16 percent; the GP lane volumes would essentially remain unchanged, but an additional 3,200 vehicles would be served by the proposed I-95 Express Lanes.

During the PM peak period (4 – 7 PM), north of Exit 143, total southbound volumes are projected to increase by approximately two percent (500 vehicles); the GP lane volumes would decrease by approximately 300 vehicles, but the I-95 Express Lanes would carry an additional 800 vehicles. Between Exits 140 and 133, total southbound volumes are projected to increase by approximately 7,500 vehicles; the I-95 GP lane volume would increase by approximately 1,500 vehicles and the proposed I-95 Express Lanes would carry approximately 6,000 vehicles in this segment.

Detailed daily volumes for 2042 Build conditions are provided in **Figure 6-3**.

Detailed AM and PM peak period hourly volumes for 2042 Build conditions, including turning movement volumes at the ramp terminal intersections, are provided in **Appendix C** in **Figures C-1** through **C-7**.



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)
	Proposed I-95 GP Thru Lanes (Separated from CD Lanes Serving US 17 and SR 3)
xxxx: yy,yyy	Location Number: Weekday GP Thru Lane Volume
	Proposed I-95 / Route 3 Safety Improvements (under construction)
	Proposed NB I-95 GP Thru Lanes (Separated from CD Lanes Serving US 17 and SR 3) Plus Associated Improvements
xxxx: yy,yyy	Location Number: Weekday GP Thru Lane Volume (NB)

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I-95 Express Lanes Fredericksburg Extension Study

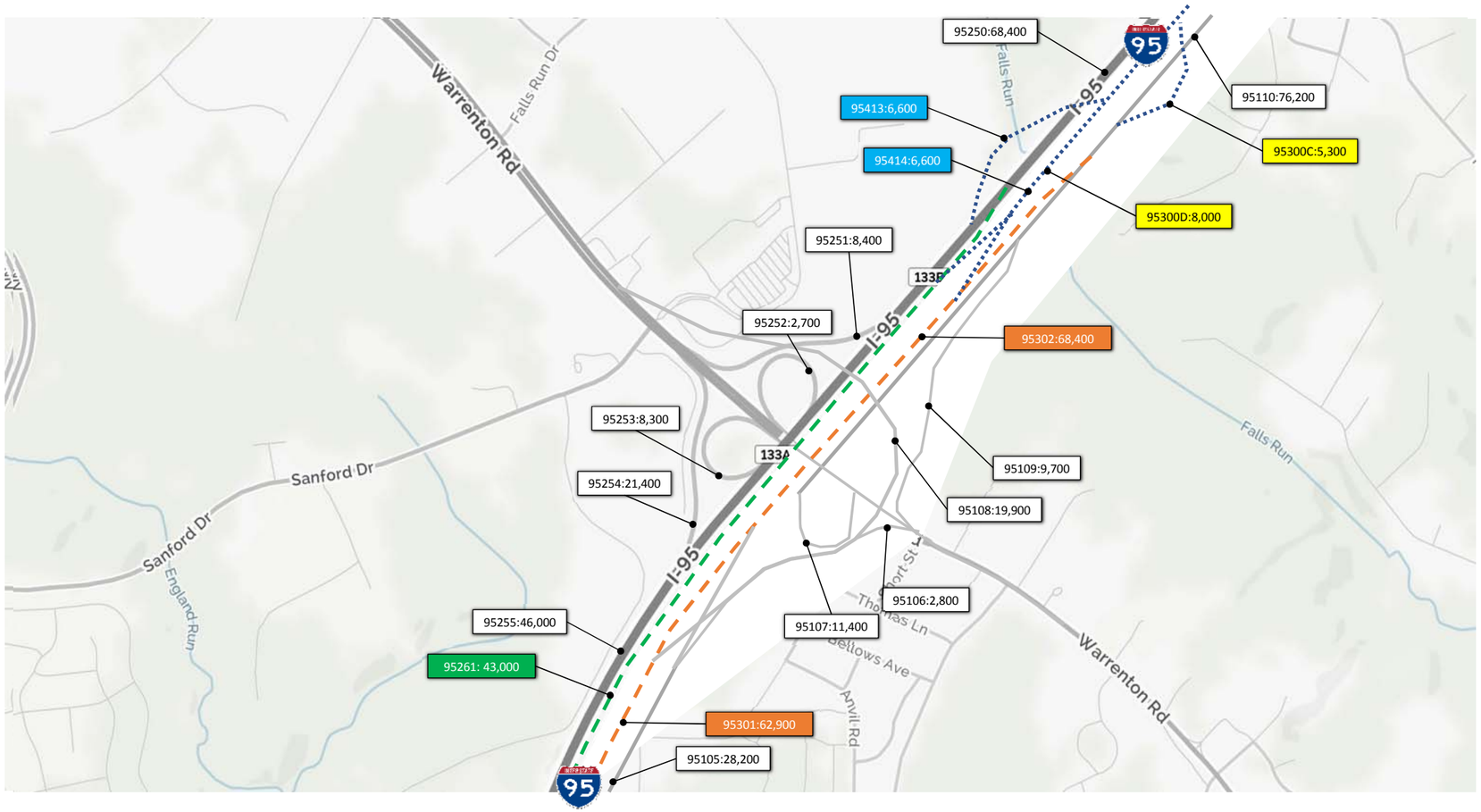
2042 Build

Weekday Daily Volumes

I-95 Corridor

February 2018

Figure 6.3-1



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
	Proposed Express Lane Extension
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)
	Proposed I-95 GP Thru Lanes (Separated from CD Lanes Serving US 17 and SR 3)
xxxx: yy,yyy	Location Number: Weekday GP Thru Lane Volume
	Proposed NB I-95 GP Thru Lanes (Separated from CD Lanes Serving US 17 and SR 3) Plus Associated Improvements
xxxx: yy,yyy	Location Number: Weekday GP Thru Lane Volume (NB)

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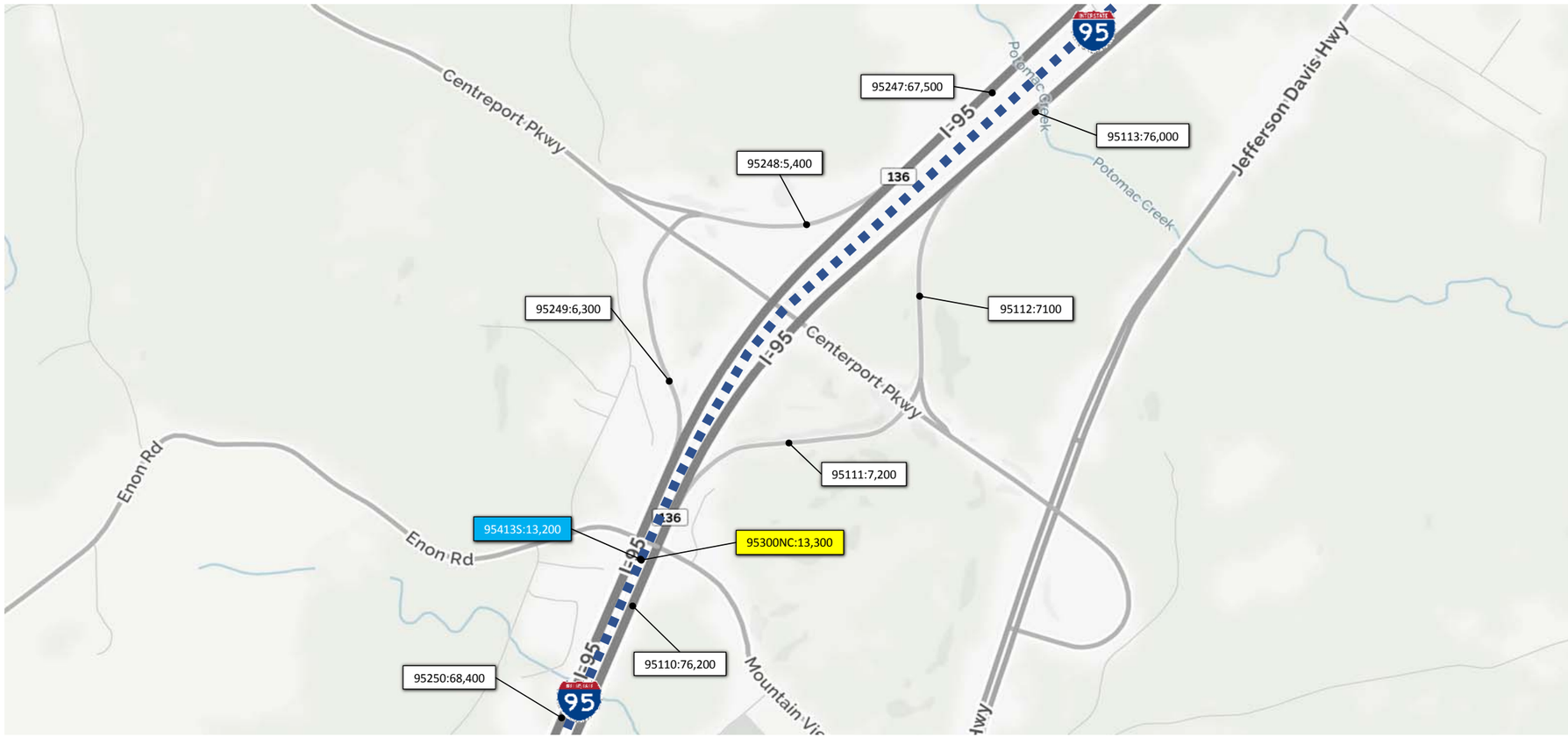
I-95 Express Lanes Fredericksburg Extension Study

2042 Build
Weekday Daily Volumes
I-95 Corridor

February 2018

Figure 6.3-2



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
	Proposed Express Lane Extension
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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I-95 Express Lanes Fredericksburg Extension Study

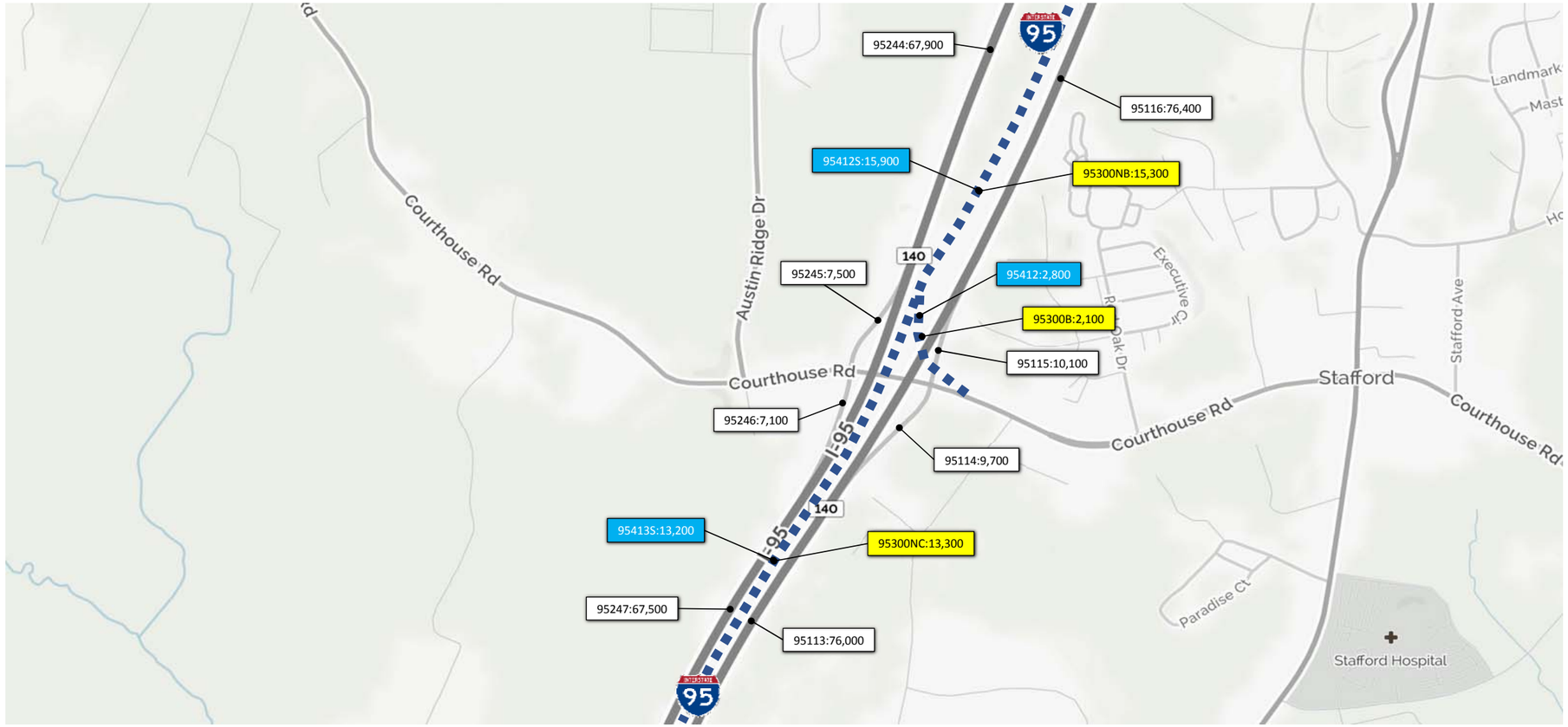
2042 Build

Weekday Daily Volumes

I-95 Corridor

February 2018

Figure 6.3-3



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
	Proposed Express Lane Extension
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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I-95 Express Lanes Fredericksburg Extension Study

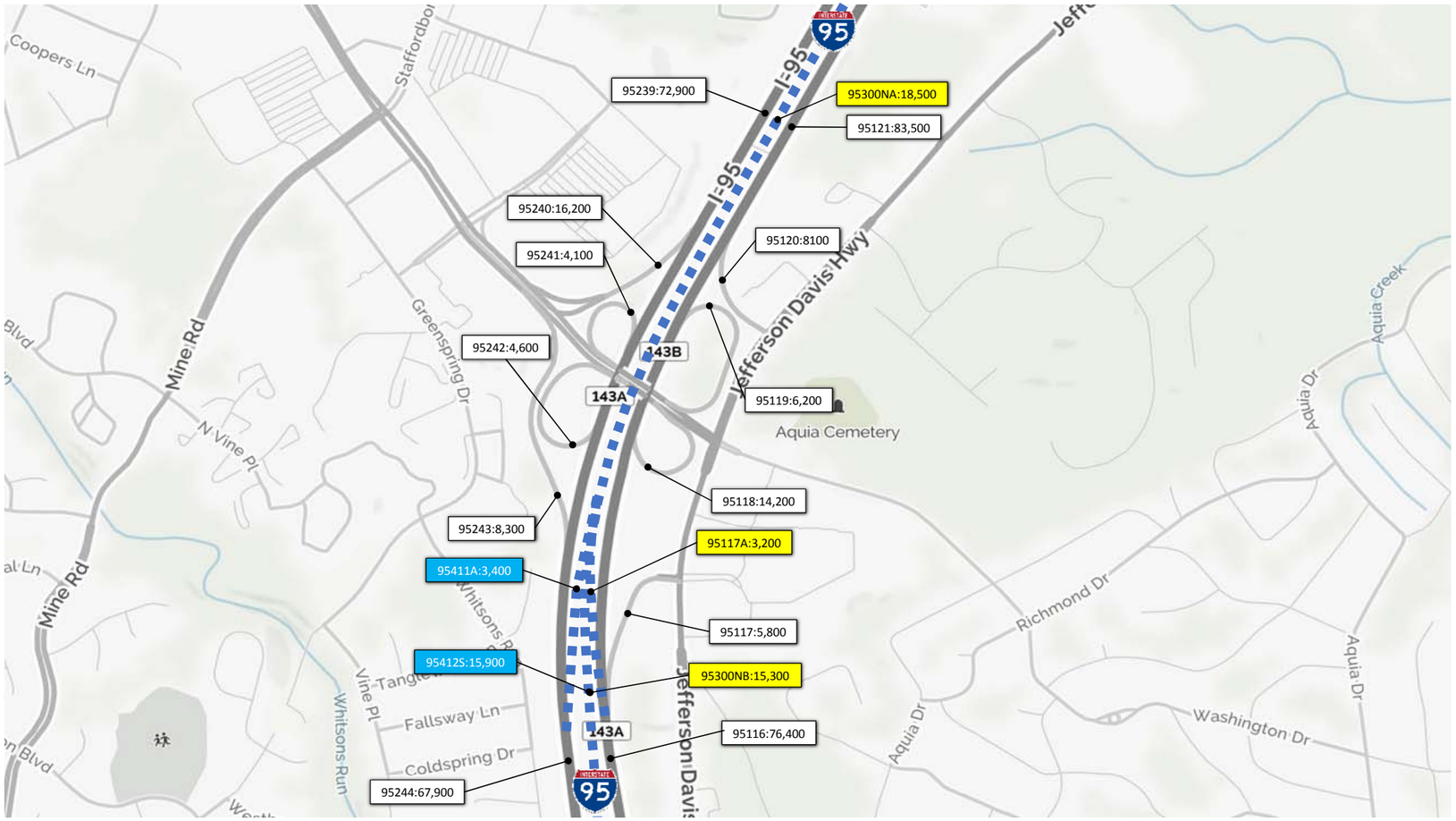
2042 Build

Weekday Daily Volumes

I-95 Corridor

February 2018

Figure 6.3-4



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
	Proposed Express Lane Extension
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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I-95 Express Lanes Fredericksburg Extension Study

2042 Build

Weekday Daily Volumes

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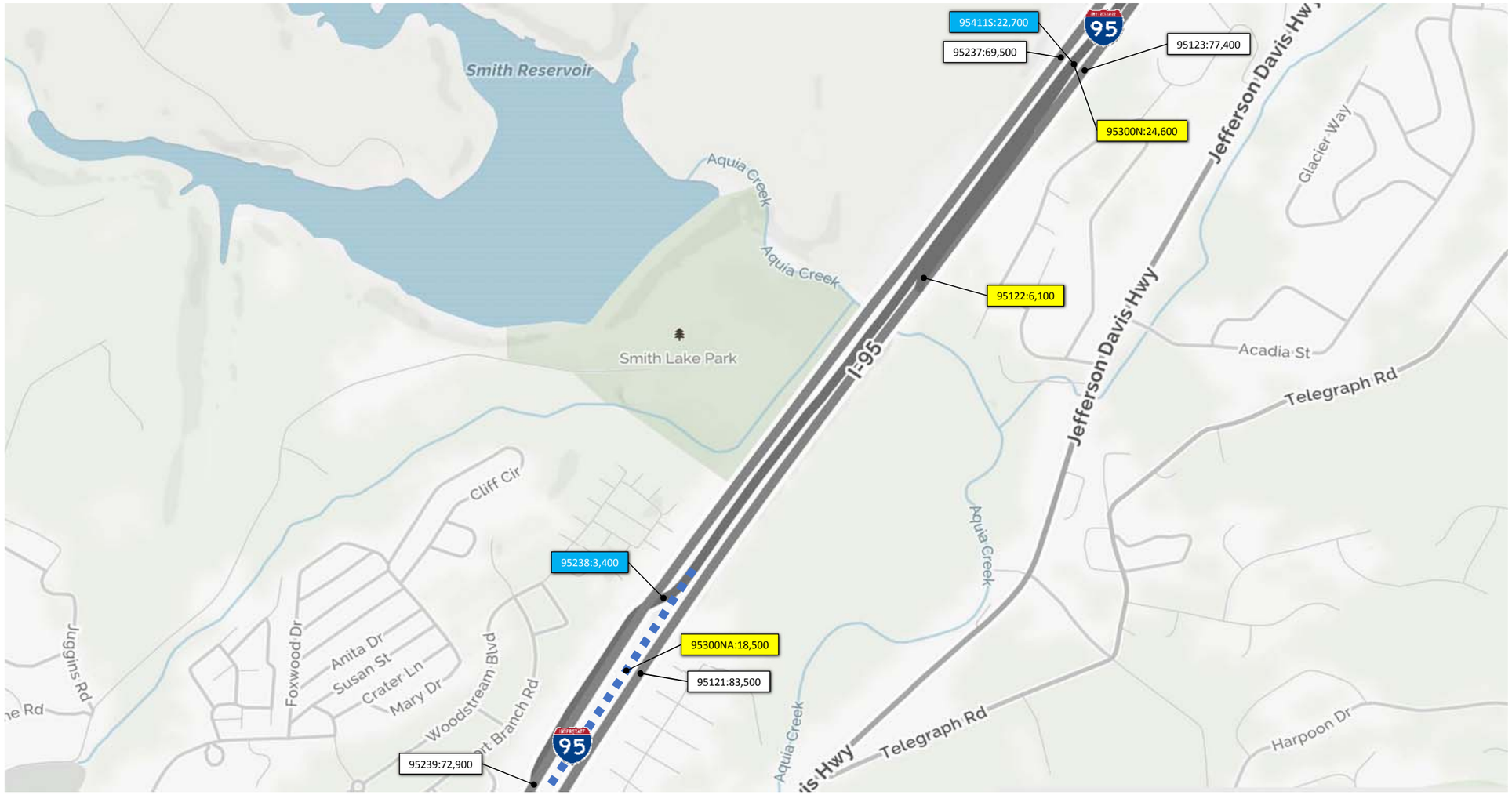
February 2018

Figure 6.3-5



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
	Proposed Express Lane Extension
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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I-95 Express Lanes Fredericksburg Extension Study

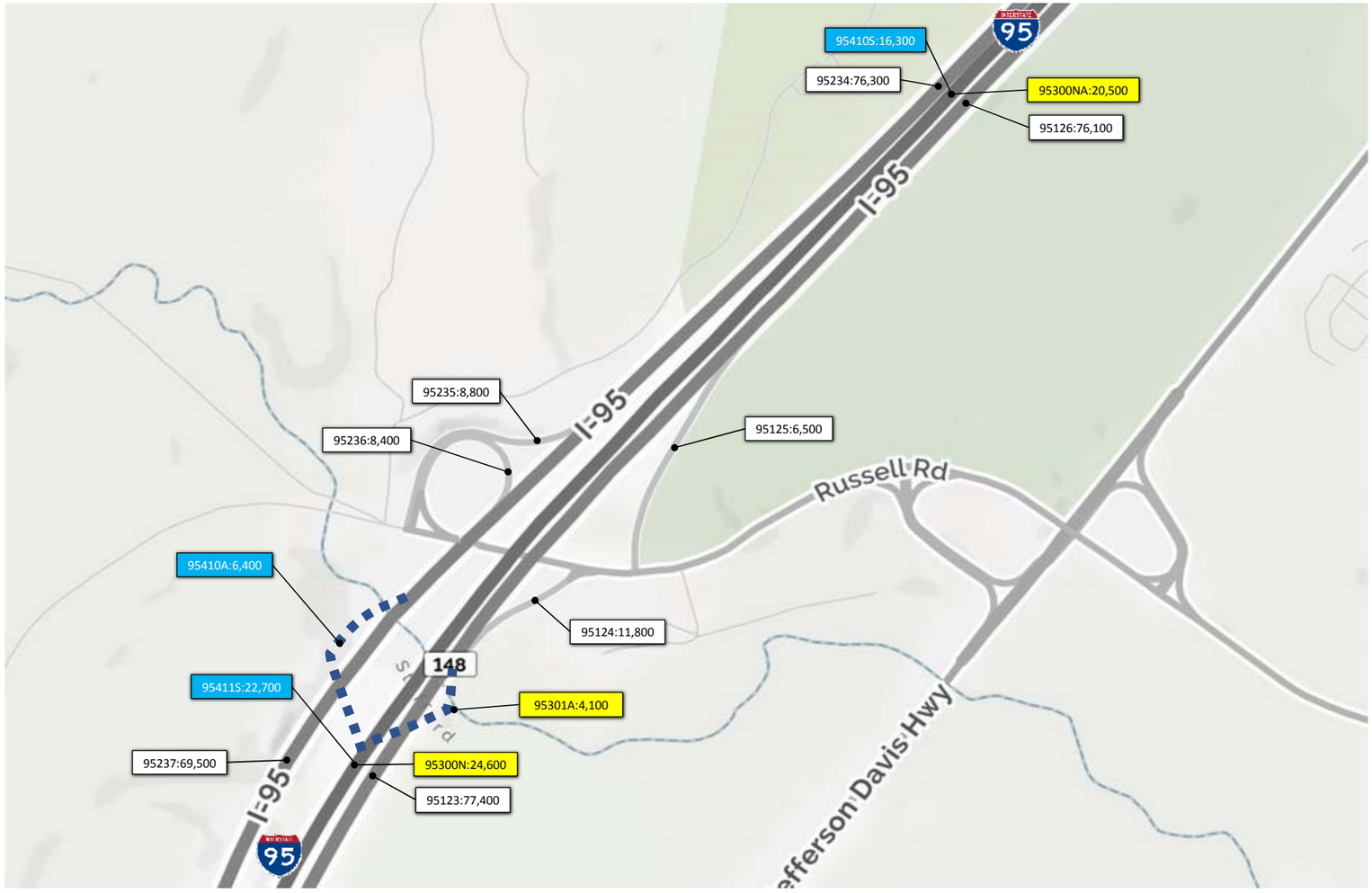
2042 Build

Weekday Daily Volumes

I-95 Corridor

February 2018

Figure 6.3-6



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)
■ ■ ■ ■ ■	Proposed Express Lane Ramps

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I-95 Express Lanes Fredericksburg Extension Study

2042 Build

Weekday Daily Volumes

I-95 Corridor

February 2018

Figure 6.3-7

Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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I-95 Express Lanes Fredericksburg Extension Study

2042 Build

Weekday Daily Volumes

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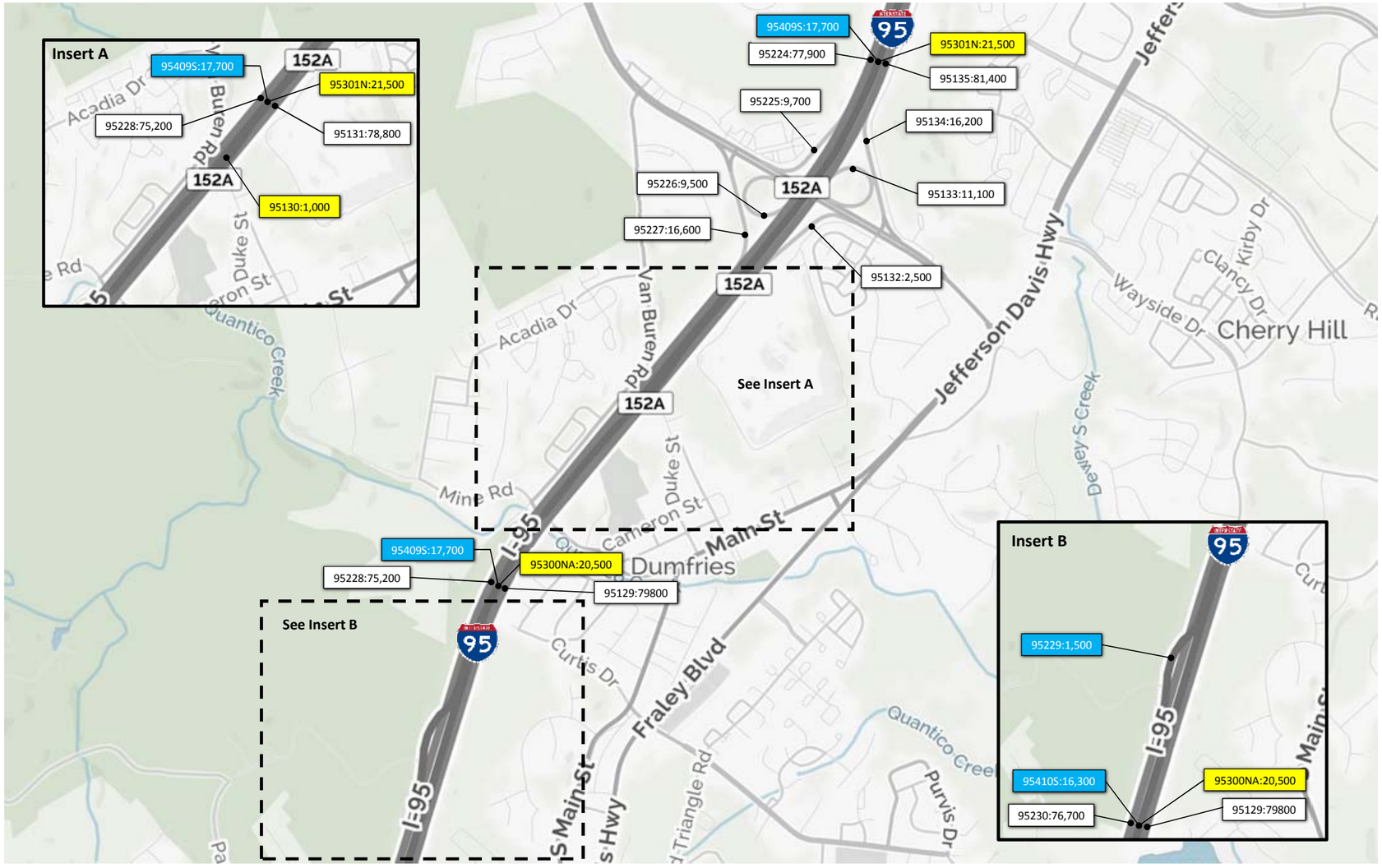
February 2018

Figure 6.3-8



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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2042 Build

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Figure 6.3-9

Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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I-95 Express Lanes Fredericksburg Extension Study

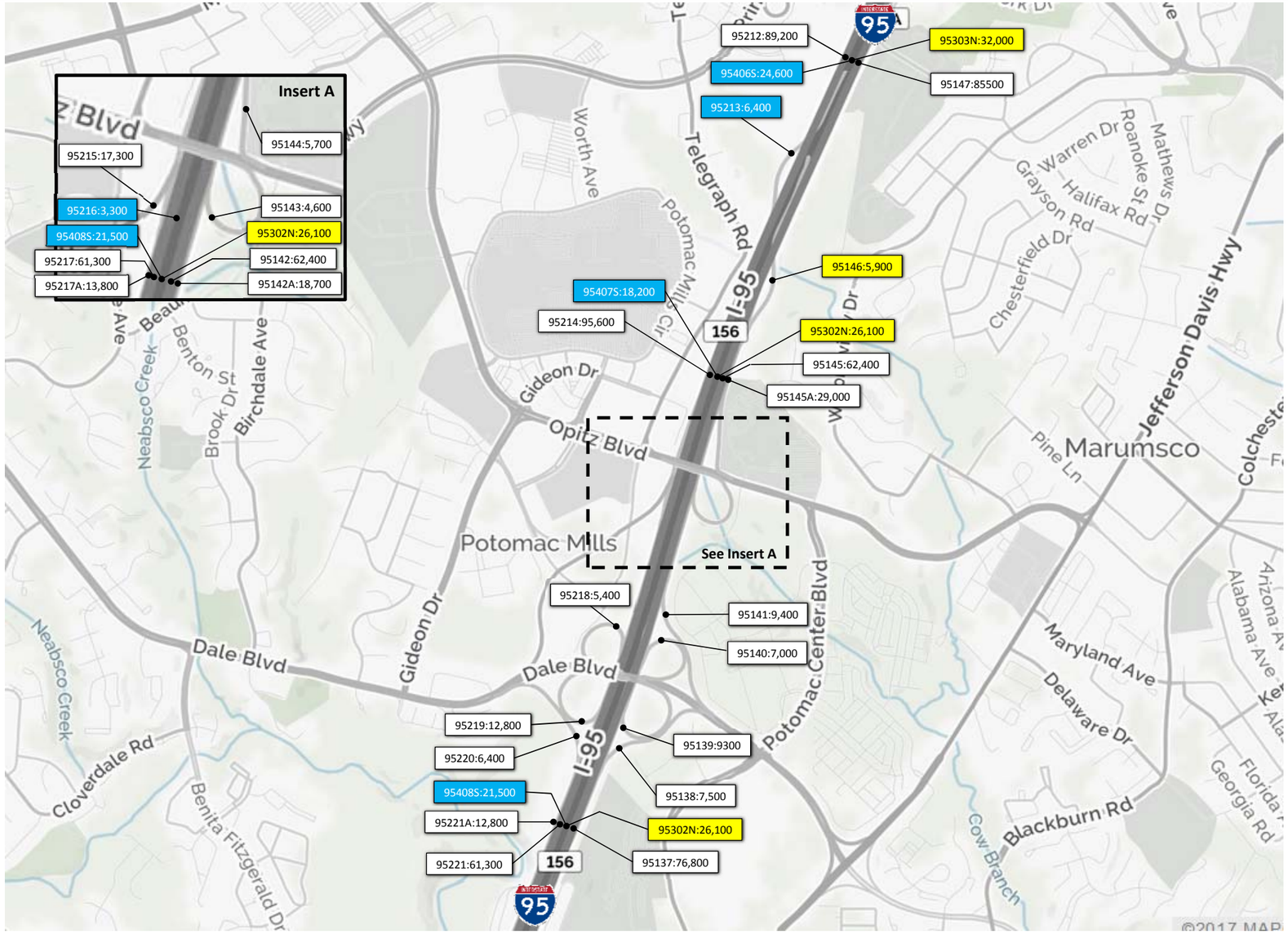
2042 Build

Weekday Daily Volumes

I-95 Corridor

February 2018

Figure 6.3-10



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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I-95 Express Lanes Fredericksburg Extension Study

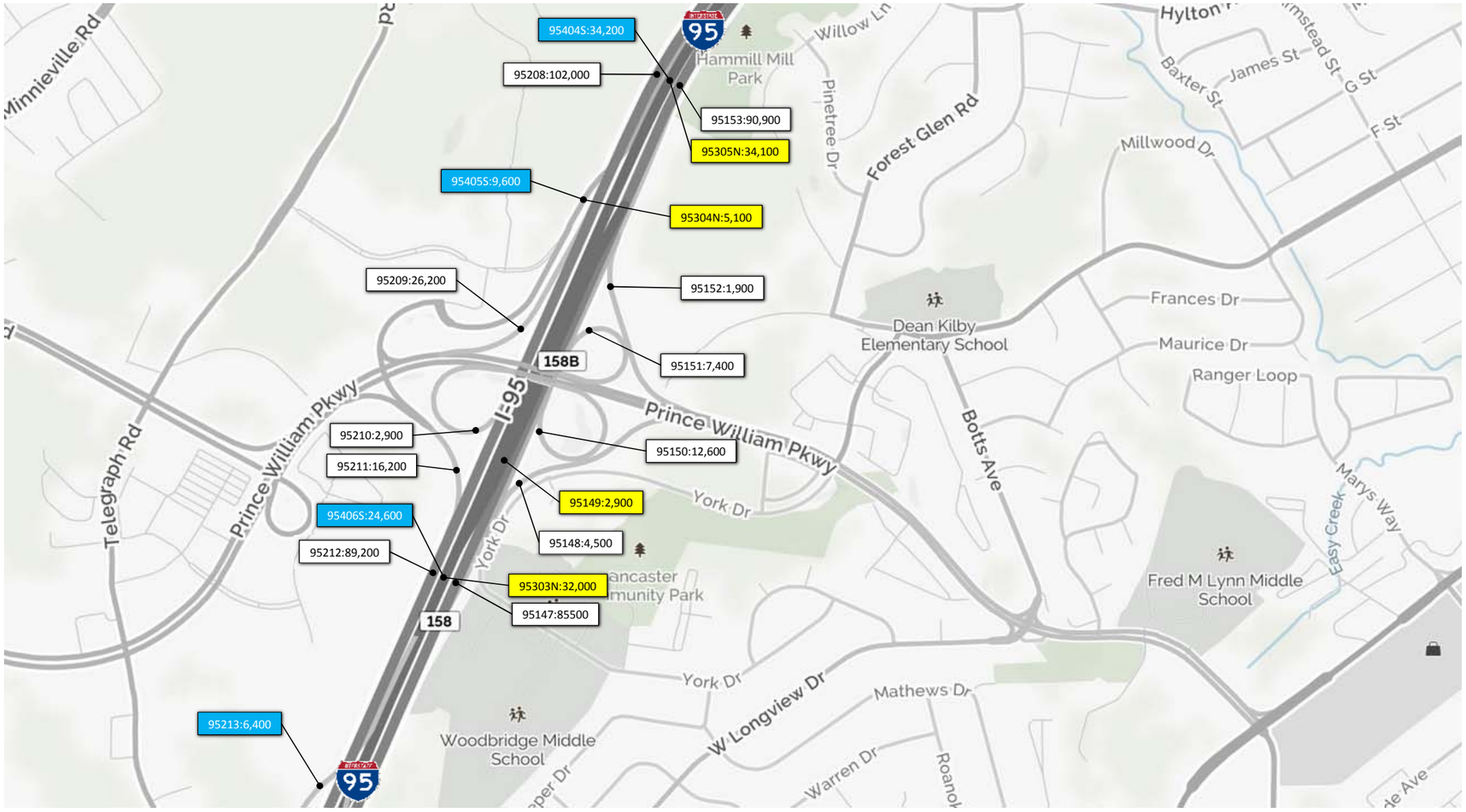
2042 Build

Weekday Daily Volumes

I-95 Corridor

February 2018

Figure 6.3-11



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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2042 Build

Weekday Daily Volumes

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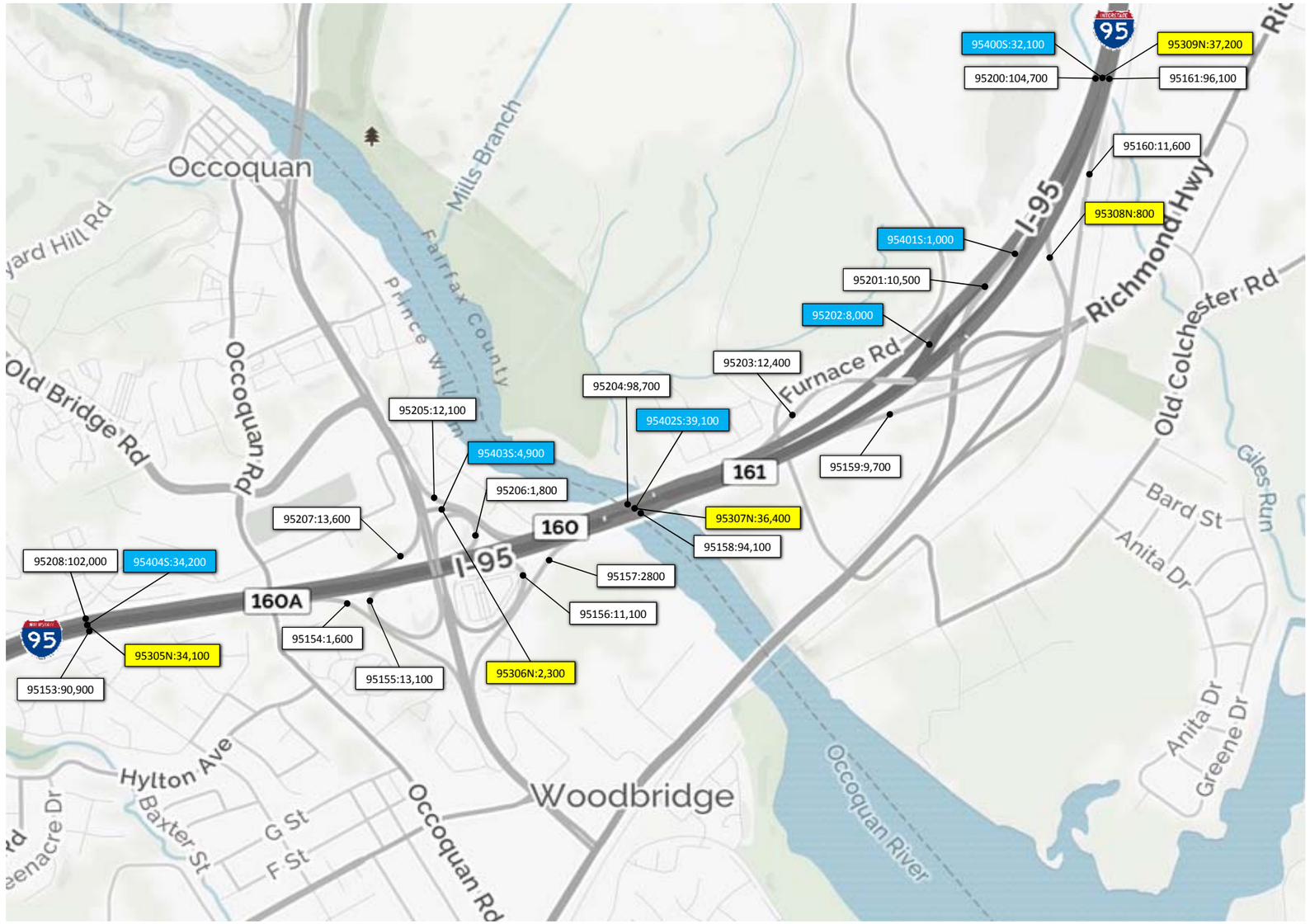
Figure 6.3-12



Legend

xxxx: yy,yyy	Location Number: Weekday GP Lanes Daily Volume
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (NB)
xxxx: yy,yyy	Location Number: Weekday Express Lanes Daily Volume (SB)

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2042 Build

Weekday Daily Volumes

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Figure 6.3-13

6.4 OPENING YEAR 2022 FORECASTS

A summary of daily traffic volumes on key roadway links for 2022 No-Build and Build conditions within the study area is provided in **Table 6-5**. A summary of projected total AM (6-9 AM) and PM (4-7 PM) peak period volumes is provided in **Table 6-6.** A summary of projected AM (7-8 AM) and PM (5-6 PM) peak hour volumes are provided in **Table 6-7** and **Table 6-8**, respectively.

Table 6-5: 2022 Daily Volumes by Segment

Location on I-95	Direction	2016 Daily Volumes			2022 No-Build Daily Volumes			2022 Build Daily Volumes		
		GP	Express	Total	GP	Express	Total	GP	Express	Total
North of Jefferson Davis Highway (US 1, Exit 126)	NB	52,000	-	**105,100**	57,400	-	**115,800**	66,500	-	**134,100**
	SB	53,100	-		58,400	-		67,600	-	
North of Plank Road (Route 3, Exit 130)	NB	69,000	-	**136,000**	73,400	-	**144,600**	78,300	-	**154,800**
	SB	67,000	-		71,200	-		76,500	-	
North of Warrenton Road (US 17, Exit 133)	NB	62,200	-	**124,400**	66,400	-	**132,000**	65,500	11,400	**147,000**
	SB	62,200	-		65,600	-		58,800	11,300	
North of Centreport Parkway (Route 8900, Exit 136)	NB	61,900	-	**124,200**	65,600	-	**131,100**	65,400	11,400	**146,200**
	SB	62,300	-		65,500	-		58,100	11,300	
North of Courthouse Road (Route 630, Exit 140)	NB	60,900	-	**121,900**	65,600	-	**130,100**	65,700	13,200	**151,000**
	SB	61,000	-		64,500	-		58,400	13,700	
North of Garrisonville Road (Route 610, Exit 143)	NB	69,600	6,200	**153,700**	73,200	7,600	**161,700**	70,100	17,600	**169,600**
	SB	68,600	9,300		70,000	10,900		65,300	16,600	
North of Russell Road (Exit 148)	NB	64,900	6,200	**143,000**	67,800	7,600	**150,400**	65,500	17,700	**162,800**
	SB	62,600	9,300		64,100	10,900		65,600	14,000	

Table 6-6: Opening Year I-95 Peak Period Volumes by Segment

Location on I-95		2016 Peak Period Volumes			2022 No-Build Peak Period Volumes			2022 Build Peak Period Volumes		
		SB	NB	Express Lanes	SB	NB	Express Lanes	SB	NB	Express Lanes
North of Russell Road (Exit 148)	AM	9,350	10,260	2,675 NB	9,500	11,200	2,800 NB	9,500	10,800	4,100 NB
	PM	12,110	13,605	4,500 SB	13,200	12,400	4,500 SB	14,500	12,400	4,700 SB
North of Garrisonville Road (Route 610, Exit 143)	AM	6,120	11,370	2,675 NB	6,400	12,900	2,800 NB	6,400	13,400	4,100 NB
	PM	12,820	10,325	3,925 SB	14,900	10,800	4,100 SB	15,400	10,800	6,500 SB
North of Courthouse Road (Route 630, Exit 140)	AM	6,570	9,790	-	6,800	12,300	-	6,800	11,300	3,200 NB
	PM	14,130	10,020	-	16,700	10,500	-	13,600	10,500	5,800 SB
North of Centreport Parkway (Route 8900, Exit 136)	AM	7,200	9,450	-	7,500	10,800	-	7,500	10,100	2,700 NB
	PM	14,080	10,530	-	15,600	11,510	-	12,900	11,510	5,100 SB
North of Warrenton Road (US 17, Exit 133)	AM	7,590	10,530	-	7,800	11,800	-	7,800	9,900	2,700 NB
	PM	14,025	10,420	-	15,200	10,700	-	11,900	10,700	5,100 SB
North of Plank Road (Route 3, Exit 130)	AM	8,085	13,100	-	8,600	14,800	-	8,600	14,800	-
	PM	14,705	11,400	-	16,000	11,800	-	17,500	11,800	-

AM Peak Period from 6 AM – 9 AM; PM Peak Period from 4 PM – 7 PM

Table 6-7: Opening Year I-95 AM Peak Hour Volumes by Segment

Location on I-95	2016 7-8 AM Volumes			2022 No-Build 7-8 AM Volumes			2022 Build 7-8 AM Volumes		
	SB	NB	Express Lanes	SB	NB	Express Lanes	SB	NB	Express Lanes
North of Russell Road (Exit 148)	3,470	3,305	760 NB	3,500	3,600	1,100 NB	3,500	3,600	1,400 NB
North of Garrisonville Road (Route 610, Exit 143)	2,095	3,670	760 NB	2,200	4,300	1,100 NB	2,200	4,100	1,700 NB
North of Courthouse Road (Route 630, Exit 140)	2,500	3,155	-	2,600	4,000	-	2,600	3,800	1,100 NB
North of Centreport Parkway (Route 8900, Exit 136)	2,750	3,035	-	2,800	3,700	-	2,800	3,400	900 NB
North of Warrenton Road (US 17, Exit 133)	2,915	3,575	-	3,000	4,000	-	3,000	3,400	900 NB
North of Plank Road (Route 3, Exit 130)	3,075	4,680	-	1,200 GP 2,000 CD	5,200	-	1,200 GP 2,000 CD	5,300	-

Table 6-8: Opening Year I-95 PM Peak Hour Volumes by Segment

Location on I-95	2016 5-6 PM Volumes			2022 No-Build 5-6 PM Volumes			2022 Build 5-6 PM Volumes		
	SB	NB	Express Lanes	SB	NB	Express Lanes	SB	NB	Express Lanes
North of Russell Road (Exit 148)	3,930	4,120	1,230 SB	4,500	4,200	1,300 SB	4,900	4,200	1,600 SB
North of Garrisonville Road (Route 610, Exit 143)	4,530	3,500	1,230 SB	5,200	3,700	1,300 SB	5,100	3,700	2,400 SB
North of Courthouse Road (Route 630, Exit 140)	4,850	3,385	-	5,700	3,500	-	4,700	3,500	2,000 SB
North of Centreport Parkway (Route 8900, Exit 136)	4,790	3,645	-	5,275	3,700	-	4,400	3,700	1,700 SB
North of Warrenton Road (US 17, Exit 133)	4,705	3,595	-	5,100	3,675	-	4,100	3,675	1,700 SB
North of Plank Road (Route 3, Exit 130)	4,975	3,875	-	2,600 GP 2,900 CD	4,025	-	2,150 GP 3,825 CD	4,025	-

6.4.1 2022 No-Build Alternative

The 2022 No-Build forecast shows continuing growth in traffic volumes along the I-95 corridor. Daily traffic volumes on I-95 are projected to increase by approximately 6 to 10 percent (approximately 7,000 to 10,000 vehicles per day) between 2016 and 2022. Detailed daily volumes for 2022 No-Build conditions are provided in **Appendix D** in **Figure D-1**. Detailed AM and PM peak period hourly volumes for 2022 No-Build conditions, including turning movement volumes at the study intersections, are provided in **Appendix D** in **Figures D-2** through **D-8**.

6.4.2 2022 Build Alternative

The Opening Year 2022 Build forecast shows similar trends as 2042 when compared to the No Build conditions. Total daily volumes including both the GP lanes and HOT lanes would increase relative to 2022 No Build conditions. This increase would range from 10,000 to 20,000 vehicles per day depending on the specific segment, with the largest increase seen in the area between US 17 (Exit 133) and Garrisonville Road (Exit 143). GP lane volumes would decrease relative to 2022 No Build conditions, while the I-95 Express Lanes are projected to carry approximately 22,000 vehicles per day in the proposed 10-mile extension.

Detailed daily volumes for 2022 Build conditions are provided in **Appendix E** in **Figure E-1**. Detailed AM and PM peak period hourly volumes for 2022 Build conditions, including turning movement volumes at the study intersections, are provided in **Appendix E** in **Figures E-2** through **E-8**.

7. TRAFFIC ANALYSES

Traffic analysis for the study corridor was conducted using the microsimulation tool *VISSIM*. Within this chapter, key results for freeway facilities and intersections are color coded to correspond to varying congestion levels. **Table 7-1** and **Table 7-2** summarize the thresholds for freeway segment and signalized intersection measures of effectiveness. Because the results presented were developed using microsimulation, level of service (LOS) is no reported as a measure of effectiveness.

Table 7-1: Freeway Measures of Effectiveness

Congestion Levels	Average Density (veh/mi/ln)
Light	≤ 26
Moderate	> 26-35
Heavy	> 35-45
Severe	>45

Table 7-2: Signalized Intersection Measures of Effectiveness

Congestion Levels	Average Delay (sec/veh)
Light	≤ 35
Moderate	> 35 - 55
Heavy	> 55 – 80
Severe	>80

Other measures of effectiveness reported include travel times (by segment and corridor), travel speeds (by link), vehicle throughput (by link), and intersection throughput, delays and queues by movement. Travel speeds are also color coded in this report, with colors ranging from red for speeds under 25 MPH, orange for speeds between 25 MPH and 35 MPH, yellow for speeds between 35 and 45 MPH, light green for speeds between 45 and 55 MPH, and dark green for speeds over 55 MPH (representing free flow conditions).

7.1 EXISTING CONDITIONS TRAFFIC OPERATIONS

7.1.1 Freeway Operational Analysis

AM Peak Period

Summaries of I-95 northbound and southbound GP lane travel speeds for the 3-hour AM peak modeling period are provided in **Figure 7-1** and **Figure 7-2**. A summary of travel speeds for the 3-hour AM peak modeling period are provided in **Figure 7-3** for the I-95 Express Lanes. A summary of overall freeway operations (density, speeds, and throughput) for the AM peak hour (7-8 AM) is provided in **Figure 7-4** for northbound I-95, in **Figure 7-5** for southbound I-95, and in **Figure 7-6** for the I-95 Express Lanes. These include all freeway segments, ramp junctions, and weaving segments. Similar summaries for the other two hours in the AM analysis period are provided in **Appendix L**.

Table 7-3 provides a summary of northbound GP lane travel times by segment and cumulative for the entire study corridor averaged over the PM peak period. **Table 7-4** provides a summary of southbound GP lane travel times by segment averaged over the PM peak period.

Figure 7-1: Existing 2016 AM Period I-95 General Purpose Lane Speeds – Northbound

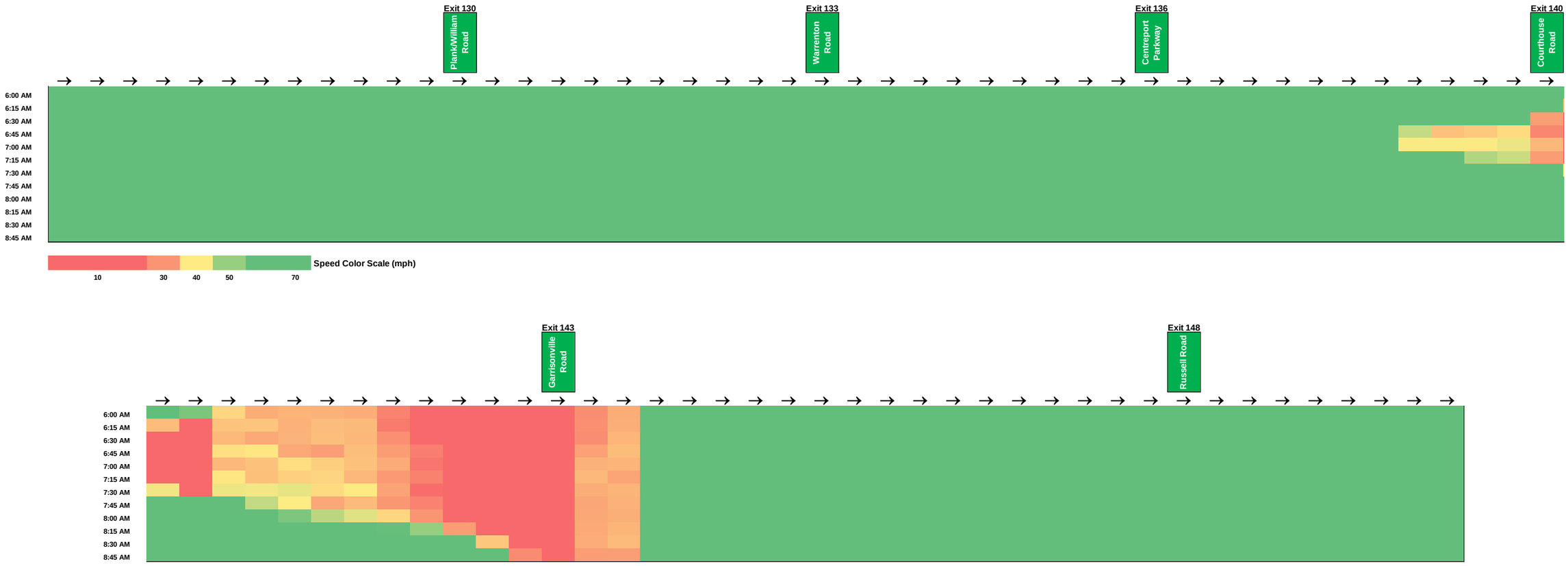


Figure 7-2: Existing 2016 AM Period I-95 General Purpose Lane Speeds – Southbound

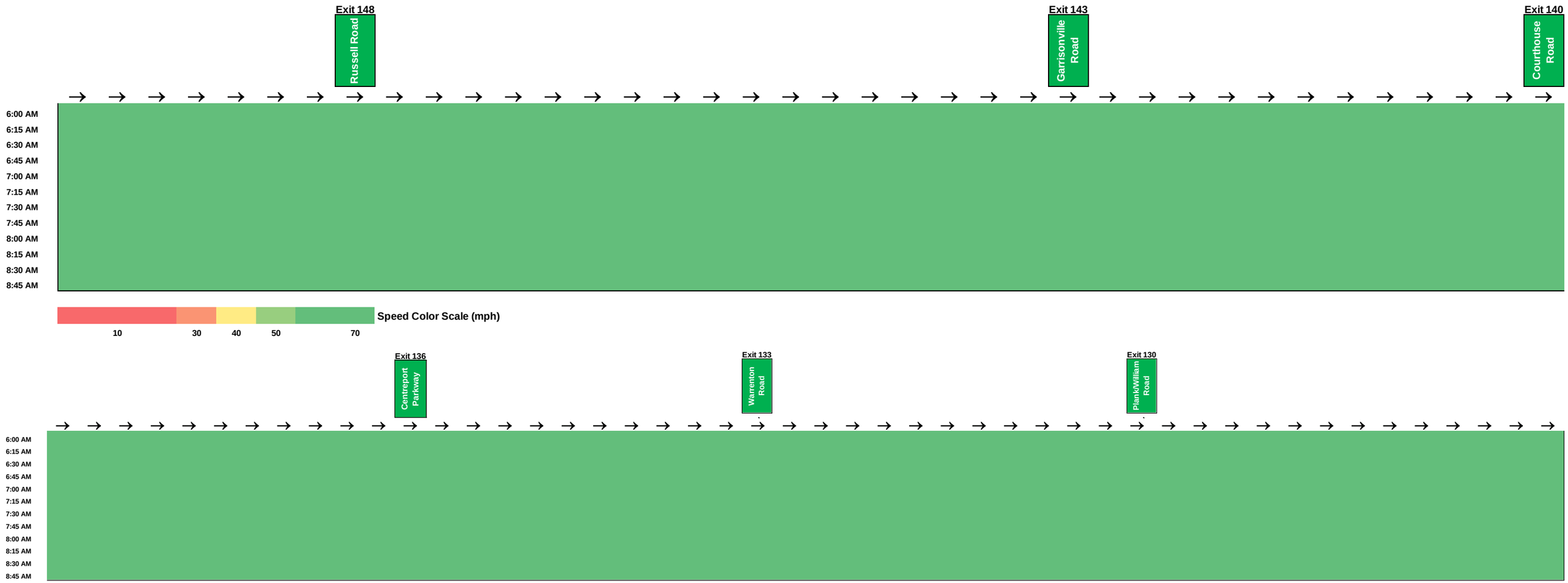


Figure 7-3: Existing 2016 AM Period I-95 Express Lane Speeds – Northbound

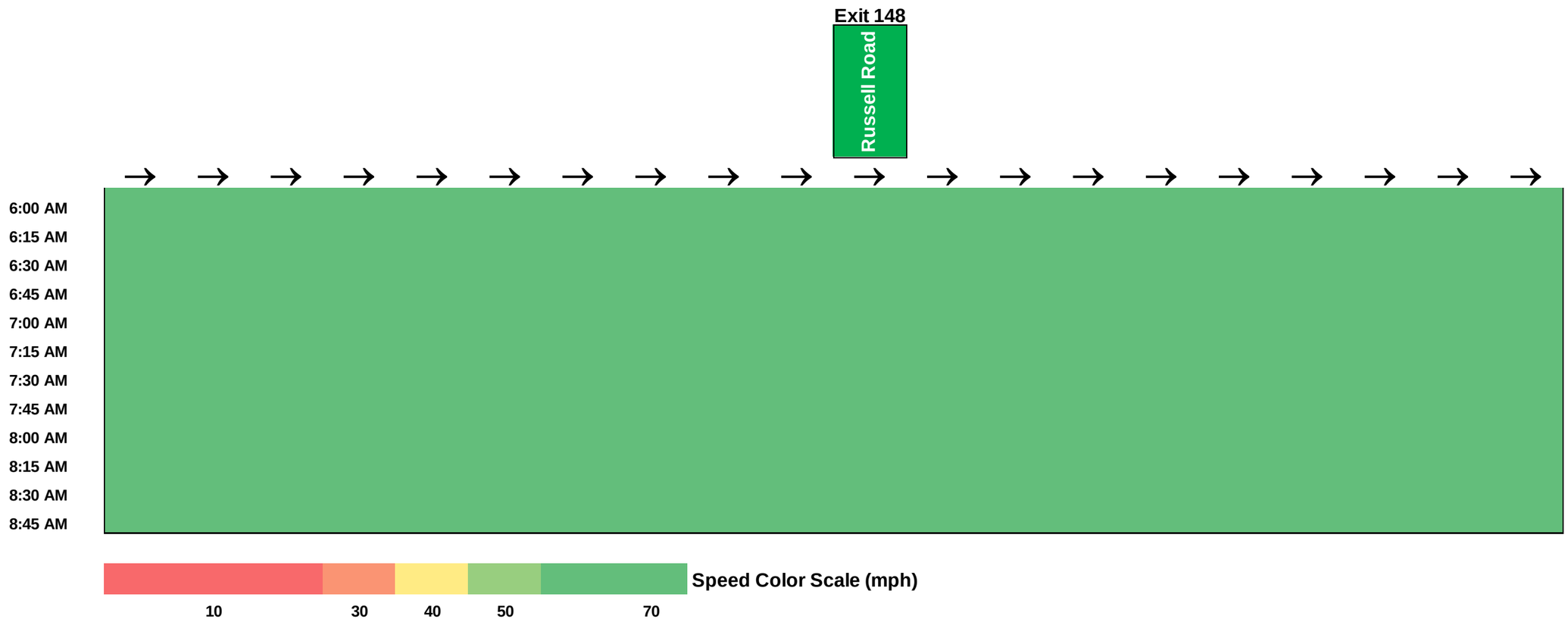


Figure 7-4: Existing 2016 AM Peak Hour I-95 General Purpose Lane Operations – Northbound

Exit 130 Plank/William Road; Exit 133 Warrenton Road; Exit 136 Centreport Parkway

Speed	69	70	70	70	69	69	69	69	69	69	66	68	51	61	66	68	69	69	68	67	66	62	68	69	69	69	66	69	69	69	69	67	68	69
Density	16	16	16	16	16	16	16	16	16	16	12	14	21	22	17	23	23	23	23	23	23	19	15	15	15	15	14	18	18	18	18	13	14	13
Volume	3189	3194	3205	3201	3194	3191	3195	3196	3207	3213	3208	2895	4344	3907	4536	4538	4544	4533	4546	4553	4548	4544	2915	2920	2928	2934	3434	3441	3443	3446	3447	3446	2537	2534
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	4	3	3	3	3	3	3	4	3	3	3	3	4	3	3	3	3	4	3	3
Length	2000	2000	2000	2000	2000	2000	2000	2000	2000	716	640	1177	790	1104	1208	2000	2000	2000	2000	2000	714	866	2000	2000	2000	190	1601	2000	2000	2000	1313	792	2000	1610

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road; Exit 143 Garrisonville Road

Speed	62	66	68	68	69	68	57	41	38	34	30	24	24	11	26	25	24	23	23	23	23	10	8	8	8
Density	13	16	16	16	16	16	18	25	27	32	27	40	39	81	46	48	50	51	51	51	52	85	131	128	125
Volume	3006	3007	3012	3011	3013	3014	3014	3016	3027	3027	3030	2651	2658	3201	3213	3241	3296	3332	3343	3363	3373	3368	3201	3102	4052
Lanes	4	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3	3	4	3	3	4
Length	579	2000	2000	2000	2000	2000	2000	2000	2000	778	905	2000	5	1471	2000	2000	2000	2000	1546	415	582	825	2000	162	855

Exit 148 Russell Road

Speed	28	35	66	69	69	68	62	69	69	69	68	68	68	67	68	68	67	63	69	69	67	68	69	69	69	69	69
Density	48	33	24	23	23	23	19	19	19	19	19	19	19	19	19	19	19	15	16	16	13	17	17	17	17	17	17
Volume	3960	4583	4575	4585	4588	4586	4558	3665	3662	3656	3658	3650	3656	3666	3665	3665	3648	3631	3174	3173	3306	3300	3301	3302	3304	3294	3315
Lanes	3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
Length	759	1503	2000	2000	675	1193	295	2000	416	2000	563	1445	2000	731	2000	881	942	519	2000	455	1083	394	2000	1484	789	685	1711

Figure 7-5: Existing 2016 AM Peak Hour I-95 General Purpose Lane Operations – Southbound

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	69	69	69	68	67	61	70	69	70	70	69	69	69	70	69	70	70	70	70	70	70	70	70	70	70	63
Density	17	17	17	17	17	15	10	8	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	7	8	9
Volume	3468	3461	3455	3449	3445	3440	2073	2129	2133	2133	2128	2091	2116	2098	2108	2106	2102	2096	2090	2086	2075	2067	2046	2051	1592	2257
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1943	1467	2000	1888	838	602	851	968	492	1598	2000	237	2000	780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

Speed	69	69	70	70	70	70	70	70	70	70	70	70	69	70	70	70	70	70	70	70	70	70	70	70	70
Density	10	9	11	11	11	11	11	11	11	8	10	10	9	12	12	12	12	12	12	12	12	12	12	9	12
Volume	2157	2363	2354	2359	2349	2351	2349	2349	2345	2337	2101	2100	2593	2590	2587	2583	2584	2584	2583	2583	2581	2576	2579	2461
Lanes	3	4	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3	3	3	3	4	3
Length	928	1408	1613	782	2000	2000	2000	2000	1436	855	2000	34	1732	2000	2000	2000	2000	2000	2000	2000	2000	2	861	2000

Exit 133 Warrenton Road

Exit 130 Plank/William Road

Speed	70	68	69	70	70	70	69	69	68	69	69	70	65	69	69	70	70	69	70	69	69	61	68	68	70	69	70	70	70	70	70	70	70	70	70	70
Density	12	10	13	13	13	13	13	13	10	12	8	10	11	14	14	14	11	14	11	14	14	12	11	8	9	8	9	9	9	9	9	9	9	9	9	9
Volume	2460	2746	2745	2745	2745	2744	2740	2736	2723	2389	2282	2100	2951	2945	2941	2942	2942	2943	2937	2933	2931	2922	2143	2256	1842	2239	1932	1931	1927	1924	1922	1917	1911	1907	1908	1907
Lanes	3	4	3	3	3	3	3	3	4	3	4	3	4	3	3	3	4	3	4	3	3	4	3	4	3	4	3	3	3	3	3	3	3	3	3	3
Length	844	614	2000	2000	2000	2000	2000	741	857	1087	1117	516	1360	2000	2000	1820	411	1119	1651	2000	1139	678	1159	750	1027	1267	2000	2000	2000	2000	2000	2000	2000	2000	2000	292

Figure 7-6: Existing 2016 AM Peak Hour I-95 Express Lane Operations – Northbound

Exit 148
Russell Road

	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→
Speed	68	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	70	70	70
Density	13	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
LOS	**B**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**
Volume	866	867	864	864	869	870	871	872	873	873	875	877	877	878	872	879	880	881	882	883
Lanes	1	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Length	1733	1084	373	1650	1415	2000	735	2000	968	1497	2000	1348	1567	789	693	1550	2000	2000	2000	1285

Speed Color Scale (mph) **Density (veh/mi/ln)** **Volume (vph)** **Lanes (#)** **Length (ft)**

Table 7-3: 2016 Existing AM Peak Period – Northbound Travel Times

Segment	Length	Segment Travel Time	Cumulative Travel Time	Segment Speed
	(miles)	(minutes)	(minutes)	(mph)
Start to N of Exit 130	4.3	3.7	3.7	68.9
N of Exit 130 to S of Exit 133	1.8	1.5	5.3	68.1
S of Exit 133 to N of Exit 133	1.9	1.6	6.9	68.1
N of Exit 133 to N of Exit 136	2.7	2.3	9.2	68.4
N of Exit 136 to N of Exit 140	3.3	3.6	12.8	55.1
N of Exit 140 to N of Exit 143	3.2	12.7	25.6	17.5
N of Exit 148	4.6	4.2	29.7	65.7
Total	21.7	29.7		44.6

Table 7-4: 2016 Existing AM Peak Period – Southbound Travel Times

Segment	Length	Segment Travel Time	Cumulative Travel Time	Segment Speed
	(miles)	(minutes)	(minutes)	(mph)
S of Exit 148 to S of Exit 143	4.7	4.1	4.1	69.7
S of Exit 143 to S of Exit 140	3.1	2.7	6.7	70.0
S of Exit 140 to S of Exit 136	4.3	3.7	10.4	69.8
S of Exit 136 to S of Exit 133	2.7	2.3	12.7	69.7
S of Exit 133 to N of Exit 130	0.9	0.8	13.5	68.8
N of Exit 130 to S of Exit 130	2.4	2.1	15.6	69.4
S of Exit 130 to End	3.5	3.0	18.5	70.2
Total	21.5	18.5		69.8

The results in the aforementioned figures and tables highlight the existing congestion along northbound I-95 during the AM peak period. Specifically, a bottleneck forms approaching the I-95 / VA-610 interchange at Garrisonville Road (Exit 143), leading to a substantial reduction in speeds extending upstream beyond the I-95 / VA-610 interchange at Courthouse Road (Exit 140); consistent with field observations and INRIX data. Modeled average travel speeds for the 22-mile study corridor are approximately 44 MPH, with generally free-flowing conditions south of I-95 / Centreport Parkway interchange and north of the I-95 / VA-610 interchange.

Along the southbound I-95 GP lanes, traffic operations are free flowing during the AM peak period. Average travel speeds approaching 70 MPH for the 22-mile study corridor.

PM Peak Period

A summary of I-95 northbound and southbound GP lane travel speeds for the 4-hour PM peak modeling period are provided in **Figure 7-7** and **Figure 7-8**. A summary of travel speeds for the 4-hour PM peak modeling period are provided in **Figure 7-9** for the I-95 Express Lanes. A summary of overall freeway operations (density, speeds, and throughput) for the PM peak hour (5-6 PM) is provided in **Figure 7-10** for northbound I-95, in **Figure 7-11** for southbound I-95, and in **Figure 7-12** for the I-95 Express Lanes. These include all freeway segments, ramp junctions, and weaving segments. Similar summaries for the other three hours in the PM peak analysis period are provided in **Appendix L**.

Table 7-5 provides a summary of northbound GP lane travel times by segment and cumulative for the entire study corridor averaged over the PM peak period. **Table 7-6** provides a summary of southbound GP lane travel times by segment averaged over the PM peak period.

Figure 7-7: Existing 2016 PM Period I-95 General Purpose Lane Speeds – Northbound

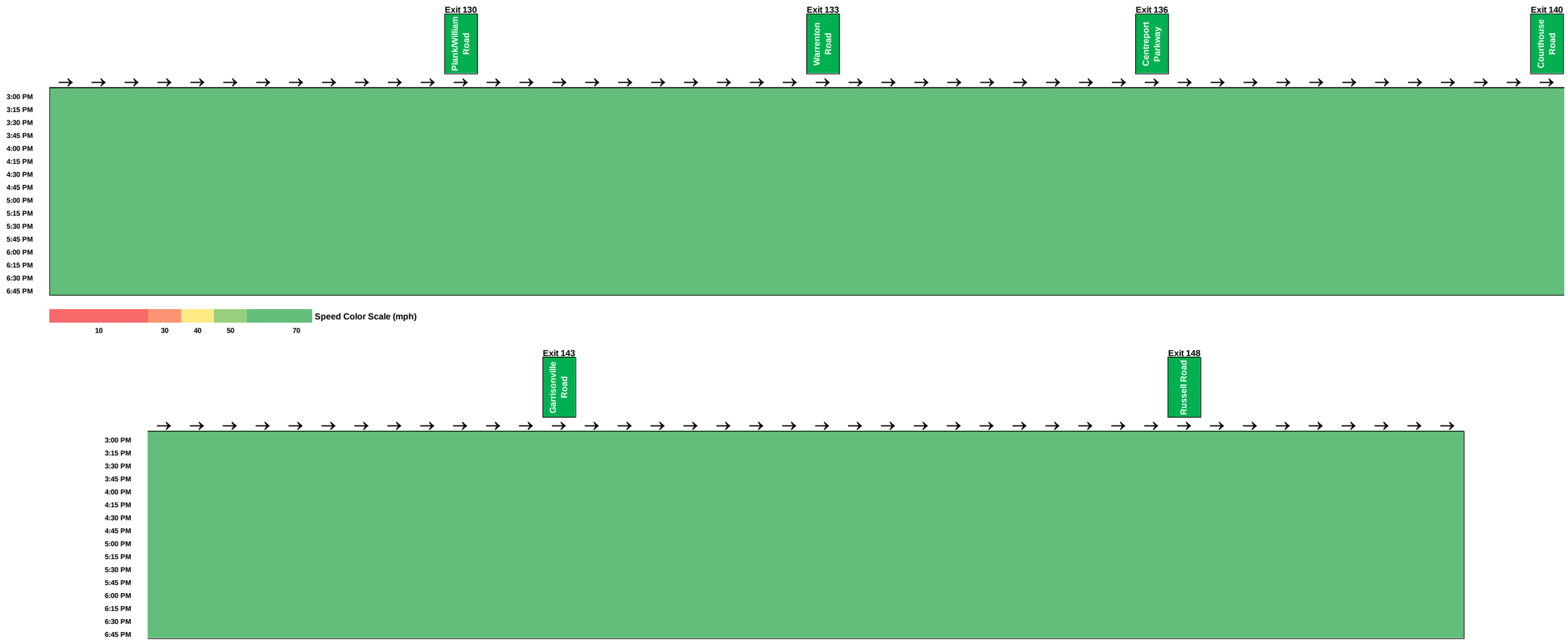


Figure 7-8: Existing 2016 PM Period I-95 General Purpose Lane Speeds – Southbound

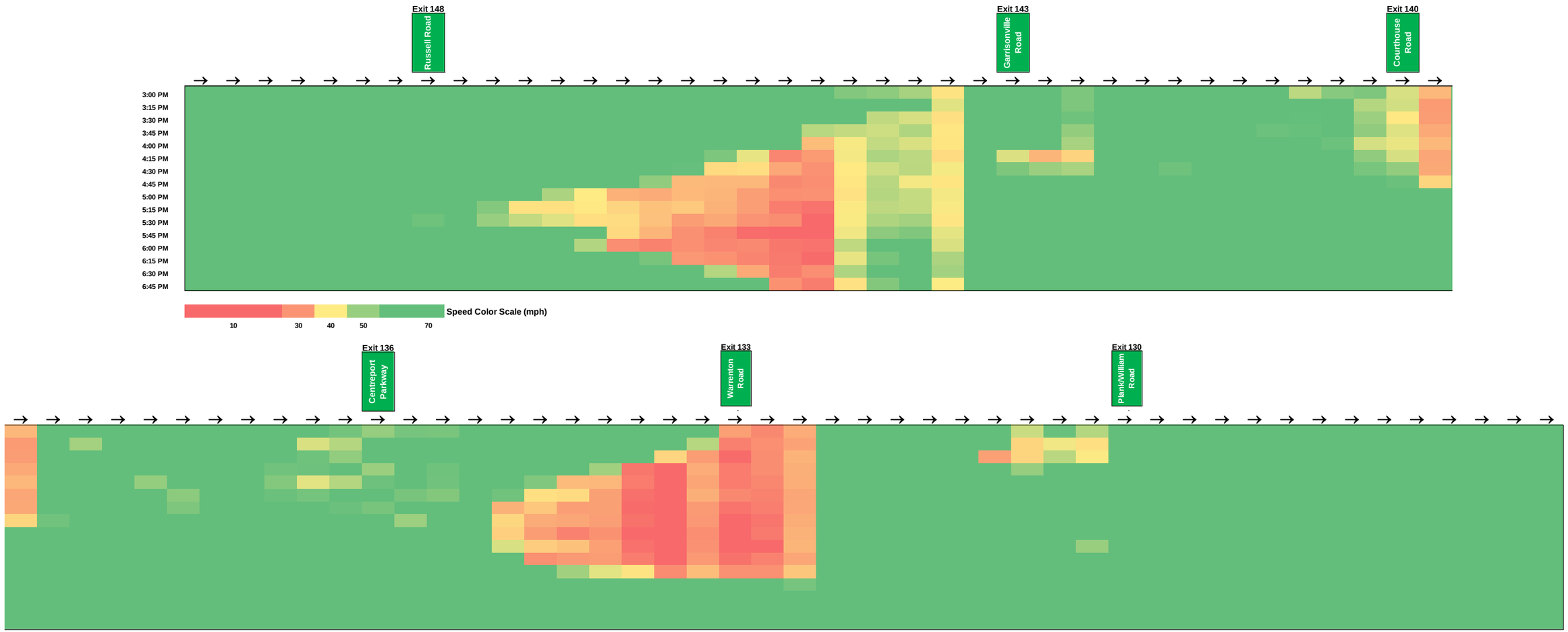


Figure 7-9: Existing 2016 PM Period I-95 Express Lanes Speeds - Southbound

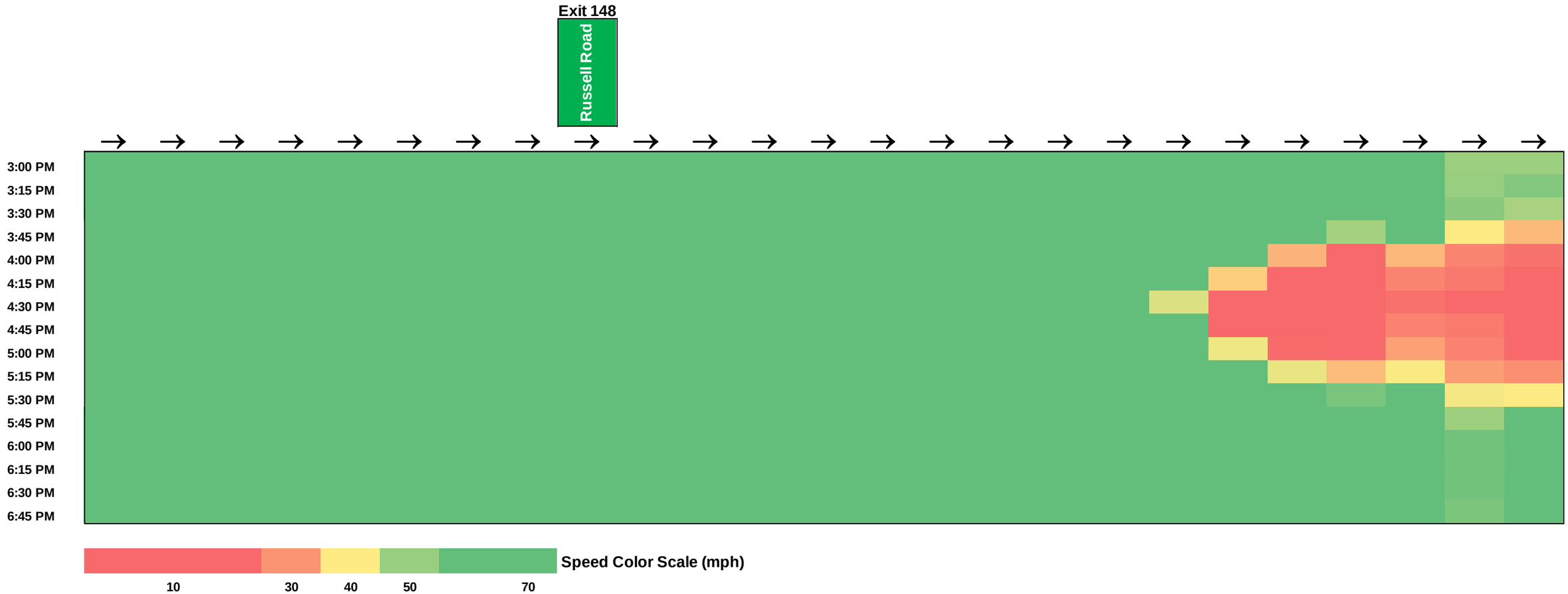


Figure 7-10: Existing 2016 PM Peak Hour I-95 General Purpose Lane Operations - Northbound

Exit 130 Plank/William Road; Exit 133 Warrenton Road; Exit 136 Centreport Parkway

Speed	69	70	70	70	69	69	69	69	69	69	69	69	63	66	68	68	69	69	69	68	68	69	69	69	69	69	67	68	69	69	69	70	69	69
Density	15	14	14	15	15	15	15	15	15	15	11	14	15	18	15	20	20	20	20	20	20	15	14	14	14	14	14	18	17	17	17	13	17	17
Volume	3026	3027	3027	3029	3031	3031	3032	3034	3035	3036	3032	2834	3793	3557	4021	4023	4020	4023	4025	4023	4021	4009	2960	2961	2965	2966	3596	3600	3600	3601	3600	3601	3421	3421
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	4	3	3	3	3	3	3	4	3	3	3	3	4	3	3	3	3	4	3	3
Length	2000	2000	2000	2000	2000	2000	2000	2000	2000	716	640	1177	790	1104	1208	2000	2000	2000	2000	2000	714	866	2000	2000	2000	190	1601	2000	2000	2000	1313	792	2000	1610

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road; Exit 143 Garrisonville Road

Speed	69	68	69	69	69	69	69	69	68	68	70	69	69	68	68	69	69	69	69	69	69	70	69	69	65
Density	13	18	18	18	18	18	18	18	18	18	13	16	16	13	17	17	17	17	17	17	17	12	16	15	15
Volume	3636	3633	3634	3637	3641	3644	3638	3637	3635	3633	3631	3220	3222	3516	3521	3518	3511	3507	3502	3501	3492	3459	3257	3158	3763
Lanes	4	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3	3	4	3	3	4
Length	579	2000	2000	2000	2000	2000	2000	2000	2000	778	905	2000	5	1471	2000	2000	2000	2000	1546	415	582	825	2000	162	855

Exit 148 Russell Road

Speed	68	69	69	69	69	69	70	69	69	68	67	68	67	66	67	68	68	68	68	67	62	63	67	68	68	67	68
Density	17	13	17	17	17	17	13	17	17	17	18	17	18	18	18	17	17	13	17	17	17	23	22	21	21	21	21
Volume	3377	3556	3551	3554	3554	3556	3541	3555	3556	3555	3552	3545	3547	3549	3547	3546	3533	3517	3434	3435	4309	4309	4310	4306	4302	4288	4300
Lanes	3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
Length	759	1503	2000	2000	675	1193	295	2000	416	2000	563	1445	2000	731	2000	881	942	519	2000	455	1083	394	2000	1484	789	685	1711

Figure 7-11: Existing 2016 PM Peak Hour I-95 General Purpose Lane Operations - Southbound

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	69	69	69	69	69	69	69	61	63	63	60	58	58	57	51	42	36	29	24	22	34	40	41	37	60	62
Density	18	18	18	18	18	14	17	17	22	22	24	25	26	28	31	38	45	53	61	62	41	34	34	38	22	18
Volume	3767	3768	3771	3777	3779	3777	3538	4085	4101	4109	4118	4059	4123	4103	4130	4131	4134	4129	4127	4136	4147	4158	4134	5505	3972	4344
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1943	1467	2000	1888	838	602	851	969	499	1598	2000	237	2000	780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

Speed	65	65	66	67	68	68	68	67	67	68	68	68	67	67	67	67	67	67	67	67	67	67	67	65	67
Density	20	17	23	22	22	22	22	22	22	16	20	20	17	22	22	22	22	22	22	22	22	22	22	17	20
Volume	3991	4474	4468	4477	4469	4485	4487	4492	4497	4489	4045	4048	4455	4460	4467	4474	4479	4483	4485	4490	4495	4490	4499	4055	
Lanes	3	4	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3	3	3	3	4	3	
Length	928	1408	1613	782	2000	2000	2000	2000	1436	855	2000	34	1732	2000	2000	2000	2000	2000	2000	2000	2000	2	861	2000	

Exit 133 Warrenton Road

Exit 130 Plank/William Road

Speed	67	65	68	61	51	45	42	40	31	32	27	29	36	63	67	68	69	68	69	65	64	61	68	68	68	69	69	69	69	69	69	69	69	69	69	69	69
Density	20	17	21	26	35	42	48	50	50	48	40	47	36	27	26	26	19	26	19	27	27	21	18	14	17	15	17	17	17	17	17	17	17	17	17	17	17
Volume	4055	4388	4391	4405	4436	4482	4529	4571	4584	4146	4095	3875	5165	5184	5189	5193	5193	5200	5205	5212	5217	5206	3656	3895	3526	4049	3545	3546	3550	3556	3560	3563	3567	3573	3578	3579	
Lanes	3	4	3	3	3	3	3	3	4	3	4	3	4	3	3	3	4	3	4	3	3	4	3	4	3	4	3	3	3	3	3	3	3	3	3	3	
Length	844	614	2000	2000	2000	2000	2000	741	857	1087	1117	516	1360	2000	2000	1820	411	1119	1651	2000	1139	678	1159	750	1027	1267	2000	2000	2000	2000	2000	2000	2000	2000	2000	292

Figure 7-12: Existing 2016 PM Peak Hour I-95 Express Lanes Operations – Southbound

Exit 148

Russell Road

Speed	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	64	36	22	19	26	20	19
Density	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	6	28	49	54	56	68	73
Volume	1132	1135	1136	1134	1136	1134	1129	1137	1140	1143	1143	1144	1140	1145	1144	1146	1148	1146	1154	1183	1219	1240	1280	1311	1342
Lanes	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	1	1	1
Length	2000	2000	2000	1285	1550	693	789	1567	2000	1348	1497	2000	968	2000	735	1415	1650	373	1084	2000	511	476	2000	2000	1762

Speed Color Scale (mph)

10 30 40 50 70

Density (veh/mi/ln) **Volume (vph)** **Lanes (#)** **Length (ft)**

Table 7-5: 2016 Existing PM Peak Period – Northbound Travel Times

Segment	Length	Segment Travel Time	Cumulative Travel Time	Segment Speed
	(miles)	(minutes)	(minutes)	(mph)
Start to N of Exit 130	4.3	3.7	3.7	69.4
N of Exit 130 to S of Exit 133	1.8	1.5	5.2	68.7
S of Exit 133 to N of Exit 133	1.9	1.6	6.8	69.1
N of Exit 133 to N of Exit 136	2.7	2.3	9.2	68.8
N of Exit 136 to N of Exit 140	3.3	2.9	12.0	68.7
N of Exit 140 to N of Exit 143	3.2	2.8	14.9	68.6
N of Exit 148	4.6	4.0	18.9	68.3
Total	21.7	18.9		68.8

Table 7-6: 2016 Existing PM Peak Period – Southbound Travel Times

Segment	Length	Segment Travel Time	Cumulative Travel Time	Segment Speed
	(miles)	(minutes)	(minutes)	(mph)
S of Exit 148 to S of Exit 143	4.7	9.8	9.8	28.9
S of Exit 143 to S of Exit 140	3.1	2.8	12.6	67.1
S of Exit 140 to S of Exit 136	4.3	3.9	16.4	66.7
S of Exit 136 to S of Exit 133	2.7	7.0	23.4	22.9
S of Exit 133 to N of Exit 130	0.9	1.0	24.5	50.9
N of Exit 130 to S of Exit 130	2.4	2.2	26.7	65.8
S of Exit 130 to End	3.5	3.0	29.7	68.9
Total	21.5	29.7		43.6

The results in the aforementioned figures and tables indicate free flow conditions within the northbound I-95 GP lanes during the PM peak. Average travel speeds for the corridor are approximately 68 MPH.

Along the southbound I-95 GP lanes, the simulation results reflect the existing congestion along the corridor with two bottlenecks identified. The first bottleneck occurs north of the I-95 / VA-610 (Garrisonville Road) interchange within the weaving segment between the current I-95 Express Lanes southern terminus and the off-ramp to VA-610 westbound. This results in congestion spilling back north towards I-95 / Russell Road. The second bottleneck occurs at the I-95 / US 17 interchange, at the merge from US 17 southbound. This results in congestion spilling back towards I-95 / Centreport Parkway.

Overall travel speeds average approximately 43 MPH, with generally free flowing conditions south of Exit 130 and some pockets of higher speeds between Exits 140 (Courthouse Road) and Exit 136 (Centreport Parkway).

As shown in **Figure 7-9**, the results also indicate existing congestion at the existing southern terminus of the I-95 Express Lanes. Reduced speeds are noted over the last 1.5 miles of the system. These reduced speeds are the result of the downstream congestion within the weaving segment in the I-95 southbound GP lanes between the I-95 Express Lanes flyover the ramp to VA-610 westbound. This is also consistent with existing field-observed conditions.

7.1.2 Arterial Intersection Analysis

Measures of effectiveness (MOEs) from the *VISSIM* outputs were used to document operations for existing conditions at the signalized intersections along the study segment of I-95. Overall intersection delay, average delay by movement, throughput by movement, and average and maximum queue lengths by movement were reported. **Table 7-7** provides a summary of the overall intersection delay by intersection for the AM and PM peak hours. Overall average delay values are color-coded to reflect various congestion levels as shown in **Table 7-2.** Summaries of the remaining intersection MOEs, including delay by movement, throughput by movement, average queues and maximum queues are provided in **Appendix L**.

AM Peak Period

The results in **Table 7-7** indicate that during the AM peak hour (7-8 AM), none of the sixteen existing study intersections operate with severe or heavy congestion overall. The remaining intersections would operate with light (green shading) to moderate (yellow shading) traffic.

PM Peak Period

The results in **Table 7-7** indicate that during the PM peak hour (5-6 PM), none of the sixteen existing study intersections operate with severe or heavy congestion overall. The remaining intersections would operate with light (green shading) to moderate (yellow shading) traffic.

Table 7-7: Existing (2016) Intersection Operations

Intersection	AM (7 – 8 AM)	PM (5 – 6 PM)
	Delay (sec/veh)	Delay (sec/veh)
Route 3 at Carl D. Silver Pkwy	16	29
Route 3 at Gateway Blvd	16	14
US 17 at Gateway Dr	19	48
US 17 at Short St	7	6
Centreport Pkwy at I-95 SB Ramps	7	18
Centreport Pkwy at I-95 NB Ramps	12	6
US 1 at Centreport Pkwy	22	21
Courthouse Rd at I-95 SB Ramps	8	14
Courthouse Rd at I-95 NB Ramps	15	25
Courthouse Rd at US 1[1]	89	83
Garrisonville Rd at I-95 SB Ramps	24	13
US 1 at I-95 NB Off-Ramp	20	18
US 1 at I-95 NB On-Ramp	2	24
US 1 at Route 610	38	53
Russell Rd at I-95 SB Ramps	24	14
Russell Rd at I-95 NB Off-Ramp	32	4
Russell Rd at I-95 NB On-Ramp	2	13

Green = Light Congestion; Yellow = Moderate Congestion, Red = Severe Congestion

1. Results for this location from Synchro (HCM)

7.2 2022 NO BUILD TRAFFIC OPERATIONS

7.2.1 Freeway Operational Analysis

AM Peak Period

Summaries of I-95 northbound and southbound GP lane travel speeds for the 3-hour AM peak modeling period for 2022 No Build conditions are provided in **Figure 7-13** and **Figure 7-14.** A summary of travel speeds for the 3-hour AM peak modeling period are provided in **Figure 7-15** for the I-95 Express Lanes. A summary of overall freeway operations (density, speeds, and throughput) for the AM peak hour (7-8 AM) is provided in **Figure 7-16** for northbound I-95, in **Figure 7-17** for southbound I-95, and in **Figure 7-18** for the I-95 Express Lanes. These include all freeway segments, ramp junctions, and weaving segments. Similar summaries for the other two hours in the AM peak analysis period are provided in **Appendix M**.

Table 7-8 provides a summary of northbound GP lane travel times by segment and cumulative for the entire study corridor averaged over the AM peak period. **Table 7-9** provides a summary of southbound GP lane travel times by segment averaged over the AM peak period.

Figure 7-13: No Build 2022 AM Period I-95 General Purpose Lane Speeds – Northbound

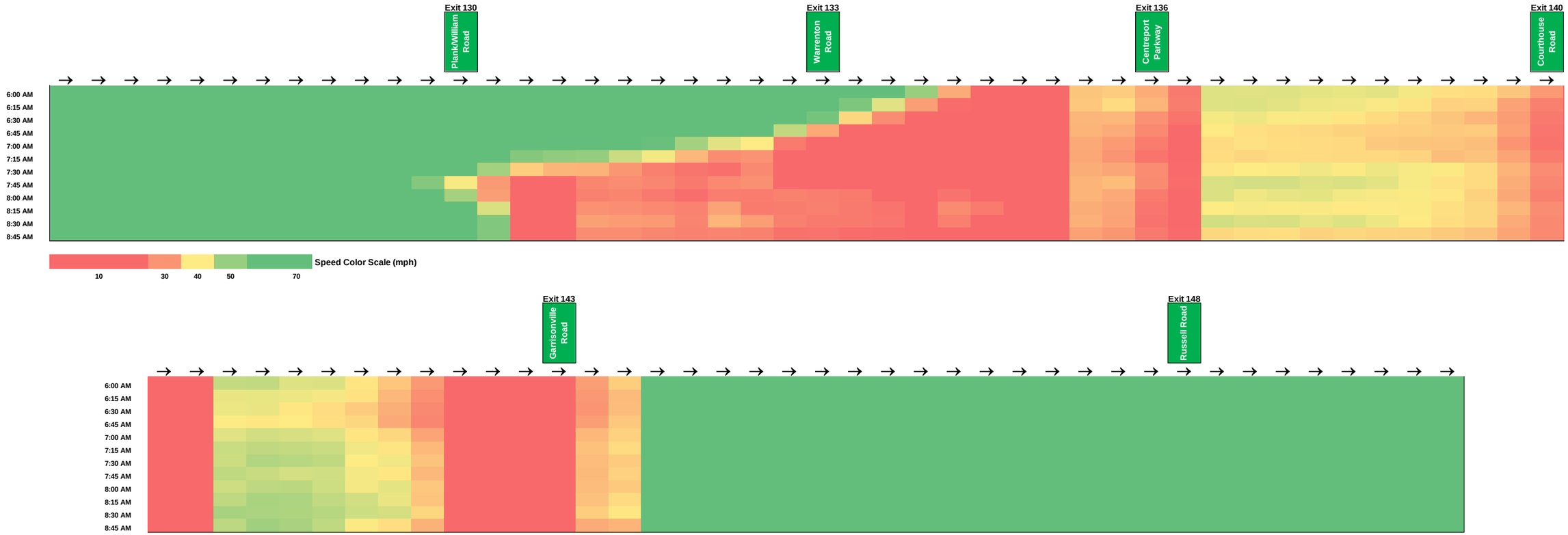


Figure 7-14: No Build 2022 AM Period I-95 General Purpose Lane Speeds – Southbound

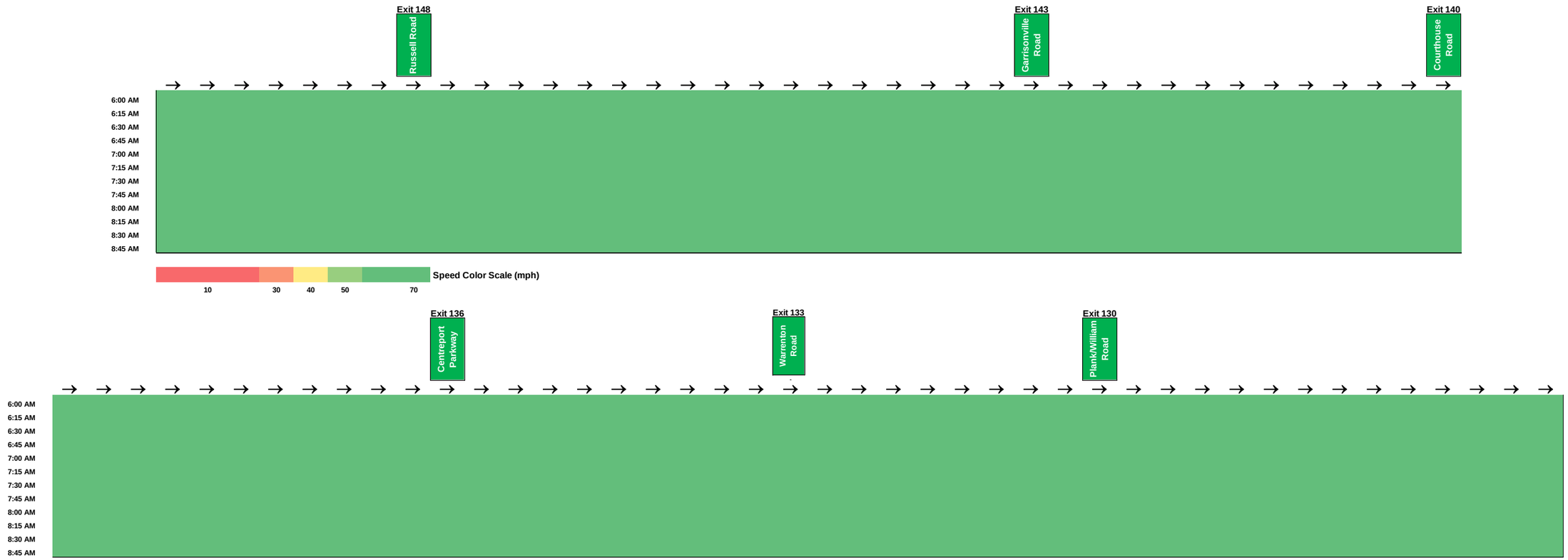


Figure 7-15: No Build 2022 AM Period I-95 Express Lane Speeds – Northbound

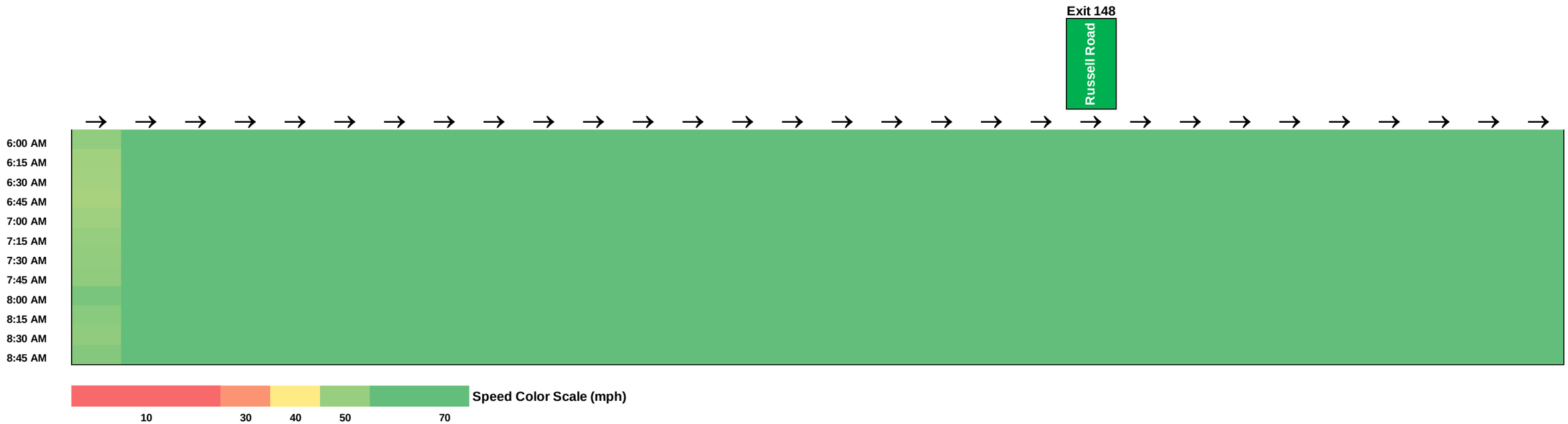


Figure 7-16: No Build 2022 AM Peak Hour I-95 General Purpose Lane Operations – Northbound

Exit 130 Plank/William Road; Exit 133 Warrenton Road; Exit 136 Centreport Parkway

Speed	69	70	69	69	69	69	69	69	67	64	58	50	36	24	13	14	17	16	14	15	14	9	6	6	6	6	6	8	8	8	8	13	11	11
Density	19	18	18	18	18	19	19	19	19	21	17	27	31	54	77	83	88	96	101	96	99	108	146	152	152	151	141	133	131	136	134	61	77	73
Volume	3835	3838	3840	3839	3839	3839	3840	3841	3840	3828	3809	3450	3422	2850	4547	4423	4340	4234	4138	4057	4011	3969	2534	2528	2554	2562	3189	3204	3216	3214	3206	3209	2459	2477
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	5	4	3	3	3	3	3	4	3	3	3	3	4	3	3	3	3	4	3	3
Length	2000	2000	2000	2000	2000	2000	2000	2000	2000	716	640	1177	790	983	1197	1104	2000	2000	2000	2000	1585	866	2000	2000	2000	190	1601	2000	2000	2000	1313	792	2000	1610

Speed Color Scale (mph): 10, 30, 40, 50, 70 — Density (veh/mi/ln) — Volume (vph) — Lanes (#) — Length (ft)

Exit 140 Courthouse Road; Exit 143 Garrisonville Road

Speed	12	18	18	18	18	18	18	18	19	18	15	15	17	8	27	28	28	28	28	27	25	11	9	9	9
Density	64	60	60	60	60	60	60	59	57	58	48	63	58	124	46	45	45	45	44	44	48	81	129	125	121
Volume	3173	3160	3191	3189	3191	3200	3200	3211	3235	3048	2886	2895	2900	3749	3758	3772	3777	3792	3729	3623	3614	3578	3295	3198	4148
Lanes	4	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3	3	4	3	3	4
Length	579	2000	2000	2000	2000	2000	2000	2000	2000	767	905	2000	4	1471	2000	2000	2000	2000	1546	415	582	825	2000	162	855

Exit 148 Russell Road

Speed	28	36	66	69	69	68	64	69	69	69	68	68	68	67	68	68	67	63	69	69	68	68	69	69	69	69	69
Density	48	32	23	22	22	23	18	19	19	19	19	19	19	19	19	19	19	15	16	16	13	17	16	16	16	16	16
Volume	3966	4622	4617	4624	4623	4623	4593	3926	3925	3924	3924	3917	3923	3926	3925	3923	3908	3890	3245	3245	3386	3387	3385	3382	3381	3372	3382
Lanes	3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
Length	759	1503	2000	2000	675	1193	295	2000	416	2000	563	1445	2000	731	2000	881	942	519	2000	455	1083	394	2000	1484	789	685	1711

Figure 7-17: No Build 2022 AM Peak Hour I-95 General Purpose Lane Operations - Southbound

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	69	69	69	68	68	64	70	69	70	70	69	69	69	70	69	70	70	70	70	70	70	70	70	70	70	63
Density	16	16	16	17	16	13	10	8	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	7	8	9
Volume	3402	3397	3394	3389	3384	3377	2096	2162	2167	2166	2160	2124	2150	2133	2142	2137	2133	2131	2125	2116	2111	2106	2088	2095	1666	2261
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1943	1467	2000	1888	838	602	851	968	492	1598	2000	237	2000	780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

Speed	69	69	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
Density	11	9	11	11	11	11	11	11	11	8	10	10	10	9	12	12	12	12	12	12	12	12	12	9	12
Volume	2169	2382	2375	2380	2370	2373	2372	2370	2367	2362	2122	2090	2110	2589	2587	2584	2585	2587	2586	2588	2587	2587	2586	2471	
Lanes	3	4	3	3	3	3	3	3	3	4	3	3	3	4	3	3	3	3	3	3	3	3	4	3	
Length	928	1408	1613	782	2000	2000	2000	2000	1436	830	2000	27	1727	1711	2000	2000	2000	2000	2000	2000	2000	288	861	2000	

Exit 133 Warrenton Road

Exit 130 Plank/William Road

Speed	70	68	69	70	70	70	70	69	70	70	70	70	70	70	70	70	70	70	70	70	70	70	69	69	70	70	70	70	69	69	69
Density	12	10	13	13	13	13	10	8	10	10	9	9	9	9	9	9	9	9	9	9	9	9	11	15	15	15	15	15	15	15	15
Volume	2469	2723	2721	2724	2722	2719	2718	2717	1999	1998	1995	1993	1986	1981	1978	1973	1973	1971	1972	1969	1965	3080	3076	3076	3075	3070	3070	3068	3063	3060	3061	3059
Lanes	3	4	3	3	3	3	4	5	3	3	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3	3
Length	844	614	2000	2000	2000	29	1258	1549	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1287	868	1099	225	1954	2000	2000	2000	2000	2000	2000	739

Figure 7-18: No Build 2022 AM Peak Hour I-95 Express Lane Operations – Northbound

Exit 148 Russell Road

Speed	47	68	71	71	71	71	70	70	71	71	71	71	71	71	71	71	71	71	71	71	70	70	70	70	70	70	70	70	70	70
Density	4	2	2	2	2	2	2	2	1	1	1	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
LOS	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Volume	169	168	168	168	168	168	168	168	167	168	167	866	863	864	868	867	867	867	867	867	869	870	869	869	863	870	870	871	872	873
Lanes	1	1	1	1	1	1	1	1	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Length	250	2000	2000	2000	2000	2000	2000	737	473	2000	511	1084	373	1650	1415	2000	735	2000	968	1497	2000	1348	1567	789	693	1550	2000	2000	2000	1285
LinkID	130131	130129	130129	130129	130129	130129	130129	130129	653	654	654	656	657	672	682	683	683	684	684	685	686	686	687	673	670	671	688	688	688	688
SegmentID	1	1	2	3	4	5	6	7	1	1	2	1	1	1	1	1	2	1	2	1	1	2	1	1	1	1	1	2	3	4

Speed Color Scale (mph) 10 30 40 50 70

Density (veh/mi/ln) **Volume (vph)** **Lanes (#)** **Length (ft)**

Table 7-8: 2022 No Build AM Peak Period – Northbound Travel Times

Segment	Length	Segment Travel Time	Cumulative Travel Time	Segment Speed
	(miles)	(minutes)	(minutes)	(mph)
Start to N of Exit 130	4.3	4.7	4.7	54.5
N of Exit 130 to S of Exit 133	1.8	5.0	9.7	21.0
S of Exit 133 to N of Exit 133	1.9	9.1	18.9	12.2
N of Exit 133 to N of Exit 136	2.7	13.9	32.8	11.5
N of Exit 136 to N of Exit 140	3.3	9.2	42.0	21.4
N of Exit 140 to N of Exit 143	3.2	12.7	54.6	17.6
N of Exit 148	4.6	4.2	58.8	65.9
Total	21.7	58.8		22.1

Table 7-9: 2022 No Build AM Peak Period – Southbound Travel Times

Segment	Length	Segment Travel Time	Cumulative Travel Time	Segment Speed
	(miles)	(minutes)	(minutes)	(mph)
S of Exit 148 to S of Exit 143	4.7	4.1	4.1	69.6
S of Exit 143 to S of Exit 140	3.1	2.7	6.7	70.0
S of Exit 140 to S of Exit 136	4.3	3.7	10.4	69.8
S of Exit 136 to S of Exit 133	2.7	2.3	12.7	69.8
S of Exit 133 to N of Exit 130	0.9	0.7	13.4	70.1
N of Exit 130 to S of Exit 130	2.4	2.1	15.5	70.0
S of Exit 130 to End	3.5	3.0	18.5	69.7
Total	21.5	18.5		69.8

The results in the aforementioned figures and tables indicate a substantial degradation within the northbound I-95 GP lanes compared to existing conditions. Travel times are projected to increase substantially with severe congestion originating near Garrisonville Road (Exit 143) with congestion propagating south towards Exit 133. Additional bottlenecks are noted at the merge points for the VA-630 (Courthouse Road) and Centreport Parkway on-ramps, where higher volumes of traffic try to enter the I-95 GP lanes. This merging traffic competes with increasing traffic arriving from the south (from the VA-3 and US 17 interchanges, as well as traffic entering the study corridor from Spotsylvania County) for the limited capacity in the northbound direction. North of Garrisonville Road, volumes are metered due to congestion further south and the I-95 GP lanes would operate under free flow conditions for the duration

of the AM peak period. Average travel speeds for the 22-mile study corridor would be approximately 25 MPH.

Along the southbound I-95 GP lanes, traffic operations would continue to be free flow during the AM peak period.

PM Peak Period

Summaries of I-95 northbound and southbound GP lane travel speeds for the 4-hour PM peak modeling period are provided in **Figure 7-19** and **Figure 7-20**. A summary of travel speeds for the 4-hour PM peak modeling period are provided in Figure **7-21** for the I-95 Express Lanes. A summary of overall freeway operations (density, speeds, and throughput) for the PM peak hour (5-6 PM) is provided in **Figure 7-22** for northbound I-95, in **Figure 7-23a** for southbound I-95, and in **Figure 7-23b** for the southbound collector-distributor road between Exits 133 and 130, and in **Figure 7-24** for the I-95 Express Lanes. These include all freeway segments, ramp junctions, and weaving segments. Similar summaries for the other three hours in the PM peak analysis period are provided in **Appendix M**.

Table 7-10 provides a summary of northbound GP lane travel times by segment and cumulative for the entire study corridor averaged over the PM peak period. **Table 7-11** provides a summary of southbound GP lane travel times by segment averaged over the PM peak period.

Figure 7-19: No Build 2022 PM Period I-95 General Purpose Lane Speeds – Northbound

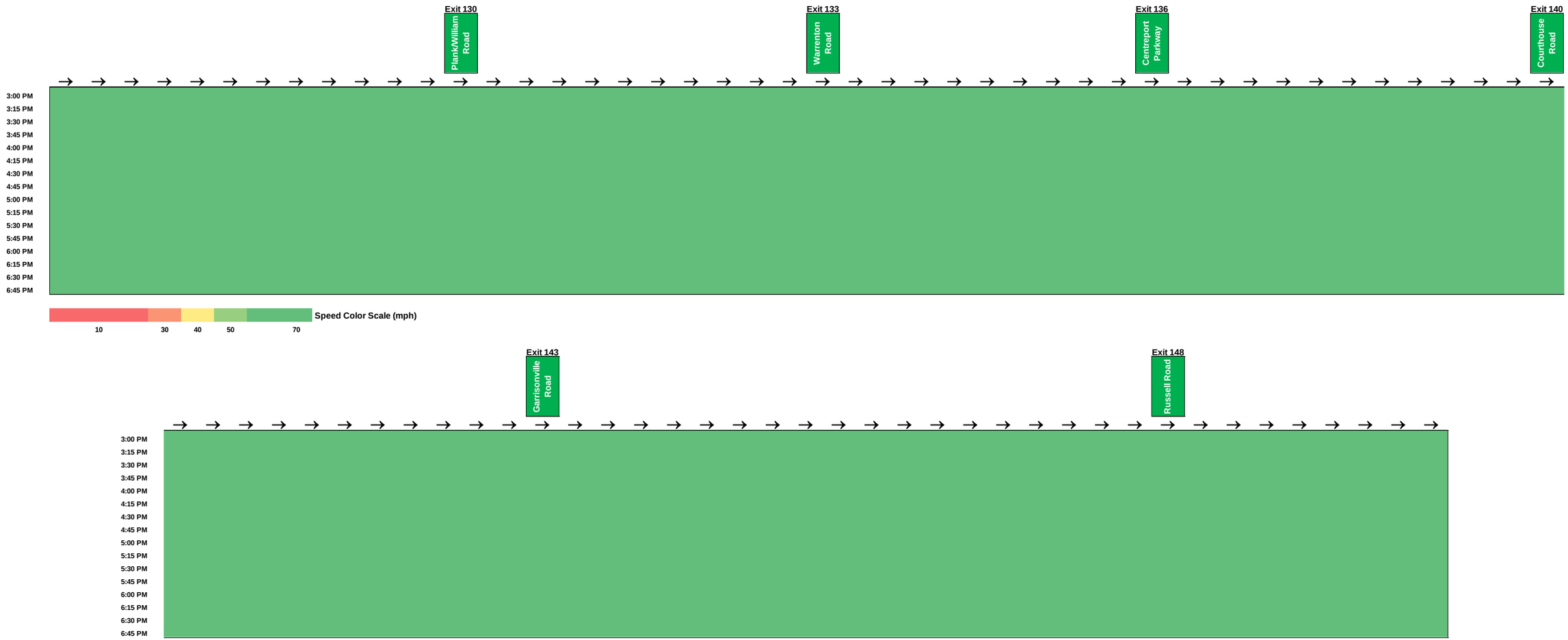


Figure 7-20: No Build 2022 PM Period I-95 General Purpose Lane Speeds – Southbound

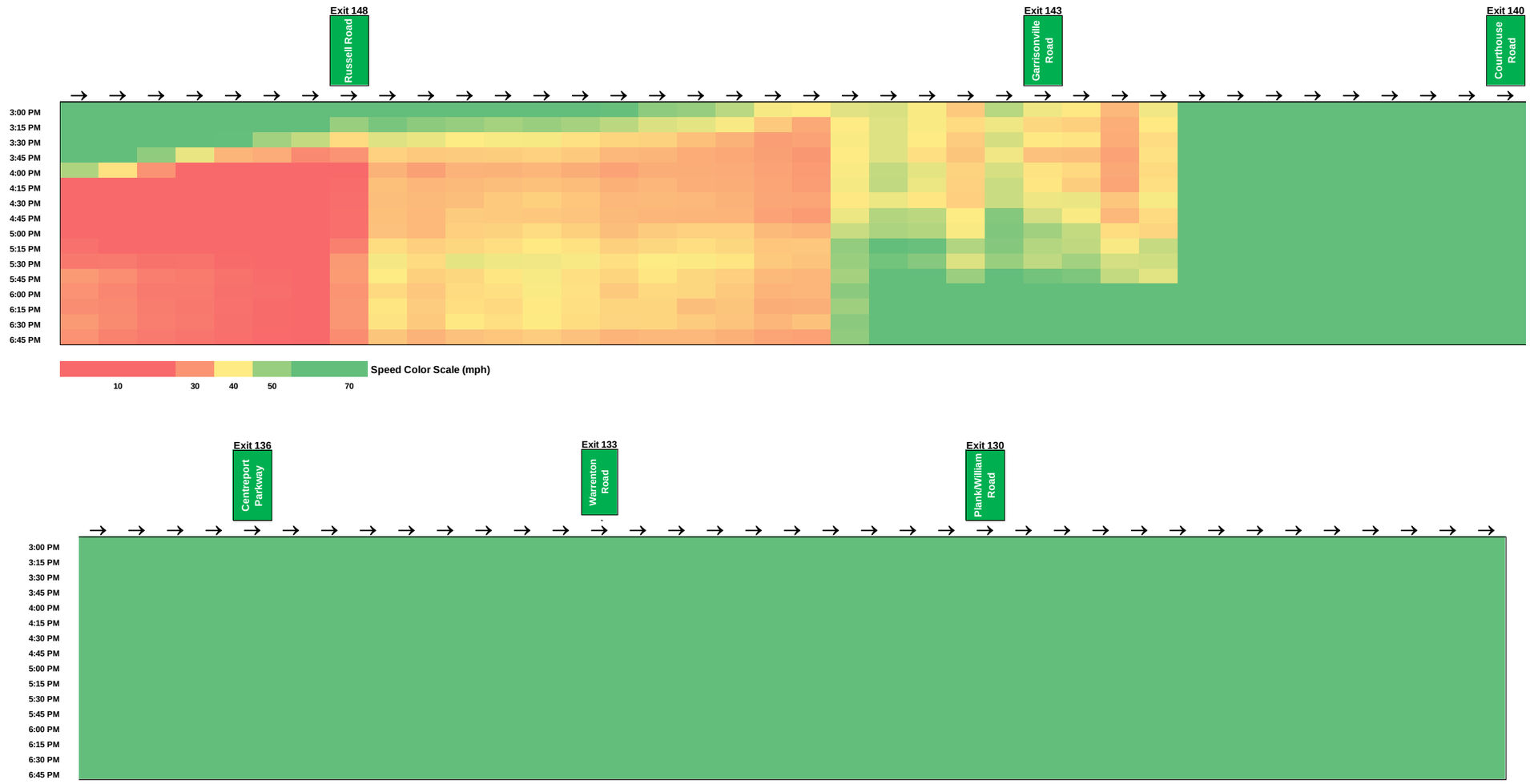


Figure 7-21: No Build 2022 PM Peak Hour I-95 Express Lane Operations – Southbound

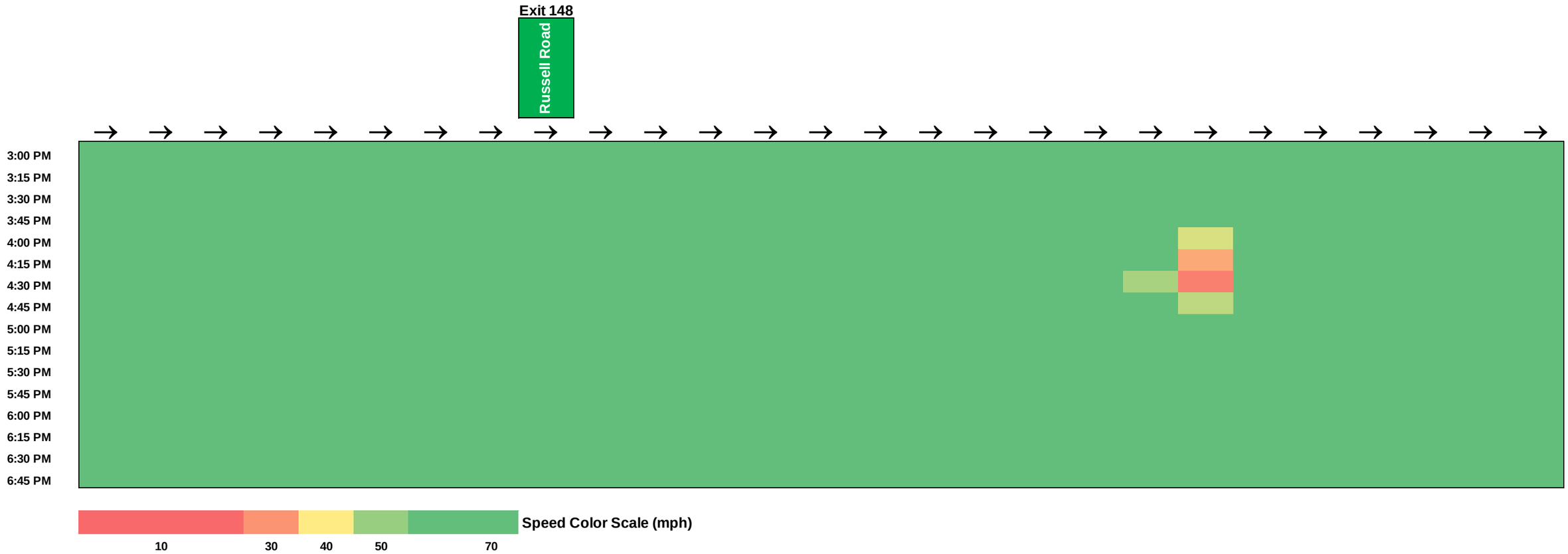


Figure 7-22: No Build 2022 PM Peak Hour I-95 General Purpose Lane Operations - Northbound

Exit 130 Plank/William Road; Exit 133 Warrenton Road; Exit 136 Centreport Parkway

Speed	69	70	70	70	69	69	69	69	69	69	68	69	70	69	63	66	68	69	69	68	68	69	69	70	70	70	66	69	69	69	69	70	69	69
Density	15	15	15	15	15	15	15	15	15	15	11	13	10	12	12	15	19	19	19	19	19	14	13	13	13	13	13	16	16	16	16	12	15	15
Volume	3069	3068	3065	3063	3061	3059	3058	3058	3054	3053	3047	2772	2770	2543	3889	3879	3886	3871	3861	3867	3874	3864	2735	2731	2727	2726	3354	3363	3362	3354	3346	3340	3109	3113
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	5	4	3	3	3	3	3	4	3	3	3	3	4	3	3	3	3	4	3	3
Length	2000	2000	2000	2000	2000	2000	2000	2000	2000	716	640	1177	790	983	1197	1104	2000	2000	2000	2000	1585	866	2000	2000	2000	190	1601	2000	2000	2000	1313	792	2000	1610

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road; Exit 143 Garrisonville Road

Speed	68	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	70	69	69	65
Density	12	16	16	16	16	16	16	16	16	14	14	14	12	16	16	16	16	16	16	16	12	15	14	14
Volume	3376	3371	3365	3358	3355	3357	3359	3358	3359	2978	2953	2976	3322	3325	3320	3314	3313	3315	3314	3305	3271	3041	2949	3554
Lanes	4	3	3	3	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	4	3	3	4
Length	579	2000	2000	2000	2000	2000	2000	2000	1331	519	905	1998	1471	2000	2000	2000	2000	1546	415	582	825	2000	162	855

Exit 148 Russell Road

Speed	68	69	69	69	69	69	70	69	69	68	68	68	68	67	67	68	68	68	68	68	63	64	67	68	68	68	68
Density	16	12	16	16	16	16	12	16	16	16	17	17	17	17	17	16	16	12	16	16	16	21	20	20	20	20	20
Volume	3179	3377	3372	3378	3377	3377	3364	3375	3371	3370	3371	3364	3371	3372	3372	3371	3357	3341	3217	3215	4114	4113	4110	4105	4099	4087	4100
Lanes	3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
Length	759	1503	2000	2000	675	1193	295	2000	416	2000	563	1445	2000	731	2000	881	942	519	2000	455	1083	394	2000	1484	789	685	1711

Figure 7-23a: No Build 2022 PM Peak Hour I-95 General Purpose Lane Operations - Southbound

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	12	12	12	12	12	12	12	18	25	25	26	26	25	25	25	25	25	25	25	26	38	42	40	33	40	38
Density	107	106	104	106	105	81	106	63	61	61	59	58	60	61	61	60	61	61	61	60	40	38	39	43	38	33
Volume	3829	3849	3875	3888	3910	3925	3738	4449	4471	4485	4503	4447	4515	4495	4529	4539	4549	4554	4566	4566	4579	4587	4556	5602	4119	4514
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1943	1467	2000	1888	838	602	851	969	499	1598	2000	237	2000	780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

Speed	36	34	35	59	65	66	67	67	66	68	68	68	68	69	65	65	67
Density	43	37	37	29	26	26	26	26	26	19	21	21	21	17	25	18	21
Volume	4194	4792	5099	5115	5100	5115	5116	5119	5118	5108	4381	4317	4382	4719	4742	4743	4207
Lanes	3	4	4	3	3	3	3	3	3	4	3	3	3	4	3	4	3
Length	928	999	1613	782	2000	2000	2000	2000	1436	830	2000	27	1717	1712	922	861	2000

Exit 133 Warrenton Road

Exit 130 Plank/William Road

Speed	68	65	68	69	68	68	69	46	65	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
Density	21	17	22	22	22	22	17	20	10	9	9	9	9	9	9	9	9	9	9	9	9	10	10	10	10	10	10	10	10	10	10	10
Volume	4208	4563	4563	4565	4564	4562	4563	4562	1866	1866	1868	1869	1871	1873	1874	1877	1879	1882	1884	1884	1884	3661	2807	2033	2033	2035	2034	2037	2037	2037	2038	2040
Lanes	3	4	3	3	3	3	4	5	3	3	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3	3
Length	844	614	2000	2000	2000	29	1258	1549	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1287	868	1099	225	1954	2000	2000	2000	2000	2000	2000	739

Figure 7-23b: No Build 2022 PM Peak Hour I-95 Collector Distributor Lane Operations - Southbound between Exits 133 and 130

Exit 133 Warrenton Road

Exit 130 Plank/William Road

Speed	61	69	69	66	69	64	69	69	69	69	70	69	70	69	69	67	68	65	68	69	68	70
Density	15	10	11	8	9	9	11	14	14	14	11	14	11	14	15	11	12	10	12	12	11	13
Volume	2692	2679	2203	2175	1914	2979	2989	2991	2994	2996	2995	2999	3002	3000	3001	2995	1647	1963	1630	1632	2265	1773
Lanes	3	4	3	4	3	5	4	3	3	3	4	3	4	3	3	4	2	3	2	2	3	2
Length	1809	857	1087	1117	507	1361	1255	2000	2000	494	411	1119	1651	2000	1139	671	1080	736	753	256	1256	1221

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) **Volume (vph)** **Lanes (#)** **Length (ft)**

Figure 7-24: No Build 2022 PM Peak Hour I-95 Express Lane Operations –Southbound

Exit 148 Russell Road

	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→
Speed	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	63	69	69	69	68	68	60
Density	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	6	9	10	4	4	4	4	4	5
Volume	1241	1242	1245	1244	1246	1245	1241	1249	1253	1253	1254	1260	1254	1260	1259	1261	1261	1256	1264	1263	1263	292	292	293	295	296	281
Lanes	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	1	1	1	1	1	1
Length	2000	2000	2000	1285	1550	693	789	1567	2000	1348	1497	2000	968	2000	735	1415	1650	373	1084	2000	1056	2000	2000	2000	2000	2000	241

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) **Volume (vph)** **Lanes (#)** **Length (ft)**

Table 7-10: 2022 No Build PM Peak Period – Northbound Travel Times

Segment	Length	Segment Travel Time	Cumulative Travel Time	Segment Speed
	(miles)	(minutes)	(minutes)	(mph)
Start to N of Exit 130	4.3	3.7	3.7	69.3
N of Exit 130 to S of Exit 133	1.8	1.6	5.3	67.8
S of Exit 133 to N of Exit 133	1.9	1.6	6.9	69.0
N of Exit 133 to N of Exit 136	2.7	2.3	9.2	68.8
N of Exit 136 to N of Exit 140	3.3	2.9	12.1	68.9
N of Exit 140 to N of Exit 143	3.2	2.8	14.9	68.4
N of Exit 148	4.6	4.0	18.9	68.3
Total	21.7	18.9		68.7

Table 7-11: 2022 No Build PM Peak Period – Southbound Travel Times

Segment	Length	Segment Travel Time	Cumulative Travel Time	Segment Speed
	(miles)	(minutes)	(minutes)	(mph)
S of Exit 148 to S of Exit 143	4.7	10.7	10.7	26.4
S of Exit 143 to S of Exit 140	3.1	3.3	14.0	56.8
S of Exit 140 to S of Exit 136	4.3	3.8	17.9	66.9
S of Exit 136 to S of Exit 133	2.7	2.4	20.3	65.3
S of Exit 133 to N of Exit 130	0.9	0.7	21.0	70.0
N of Exit 130 to S of Exit 130	2.4	2.1	23.1	69.9
S of Exit 130 to End	3.5	3.0	26.1	69.8
Total	21.5	26.1		49.5

The results in the aforementioned figures and tables indicate continuing free flow conditions within the northbound I-95 GP lanes during the PM peak under 2022 No Build conditions. Average travel speeds for the corridor are approximately 69 MPH.

Along the southbound I-95 GP lanes, the simulation results indicated a moderate improvement in operations for the study corridor compared to existing conditions. As noted in **Section 4.3**, four key projects are anticipated to be completed within the study segment of I-95 prior to 2022. Specifically, the I-95 Express Lanes Southern Terminus Extension and the I-95 Southbound Rappahannock River Crossing project are intended to help mitigate the two bottlenecks in the I-95 southbound GP lanes noted for

existing conditions. Overall travel times are projected to improve by approximately 3 minutes (10 percent) relative to existing conditions. The analysis indicates that the first bottleneck (currently located north of the I-95 / VA-610 interchange) would shift south by 2022, with congestion projected to begin where the new I-95 Express Lanes Southern Terminus extension would merge from the left into the I-95 GP lanes (at approximately the same location where the on-ramp from VA-610 merges on the right); this congestion would spill back north towards and beyond the I-95 / Russell Road interchange. Travel times in this northern segment would degrade by 1-2 minutes north of Exit 140. South of Exit 140, the analysis indicates that the second existing bottleneck located at the I-95/ US 17 interchange at Warrenton Road (Exit 133) would be mitigated by the I-95 Southbound Rappahannock River Crossing improvements. South of Exit 140, the southbound I-95 GP lanes are projected to operate nearly free flow under 2022 No Build conditions.

The results for the I-95 Express Lanes (traveling southbound during the PM peak period) indicate generally free flowing conditions with an isolated reduction in speed where the Express Lanes flyover to the GP lanes north of Exit 143 is located. This is due to some continued spillback from the congestion along the I-95 GP lanes in this area.

7.2.1 Arterial Intersection Operational Analysis

Measures of effectiveness (MOEs) from the *VISSIM* outputs were used to document operations for 2022 No Build conditions at the signalized intersections along the study segment of I-95. Overall intersection delay, average delay by movement, throughput by movement, and average and maximum queue lengths by movement were reported.

Table 7-12 provides a summary of the overall intersection delay by intersection for the AM and PM peak hours. Overall average delay values are color-coded to reflect various congestion levels based on delay as shown in **Table 7-2**. Summaries of the remaining intersection MOEs, including delay by movement, throughput by movement, average queues and maximum queues are provided in **Appendix M**.

AM Peak Period

The results in **Table 7-12** indicate that during the AM peak hour (7-8 AM), all study intersections would operate with light to moderate traffic.

PM Peak Period

The results in **Table 7-12** indicate that during the PM peak hour (5-6 PM), none of the nineteen study intersections would operate with severe congestion. Two intersections would operate with moderate traffic. The remaining intersections would operate with light to moderate traffic.

Table 7-12: Opening Year 2022 Intersection Analysis Results

Intersection	2022 No-Build		2022 Build	
	AM (7 – 8 AM)	PM (5 – 6 PM)	AM (7 – 8 AM)	PM (5 – 6 PM)
	Delay (sec/veh)	Delay (sec/veh)	Delay (sec/veh)	Delay (sec/veh)
Route 3 at I-95 SB Off-Ramps	9	15	5	16
Route 3 at I-95 NB Off-Ramps	25	9	12	9
Route 3 at Carl D. Silver Pkwy	18	26	15	26
Route 3 at Gateway Blvd	18	14	16	14
US 17 at Gateway Dr	19	43	19	44
US 17 at Short St	7	8	7	8
Centreport Pkwy at I-95 SB Ramps	6	16	7	19
Centreport Pkwy at I-95 NB Ramps	9	6	11	7
US 1 at Centreport Pkwy	21	19	38	21
Courthouse Rd at I-95 SB Ramps	26	20	26	21
Courthouse Rd at I-95 NB Ramps	16	13	16	13
Relocated Courthouse Rd at US 1/Hospital Center Blvd	28	32	28	31
Courthouse Rd at US 1[1]	35	35	34	38
Garrisonville Rd at I-95 SB Ramps	21	8	1	11
US 1 at I-95 NB Off-Ramp	28	17	22	17
US 1 at I-95 NB On-Ramp	3	22	2	22
US 1 at Route 610	40	49	39	48
Russell Rd at I-95 SB Ramps	22	11	29	18
Russell Rd at I-95 NB Off-Ramp	29	7	31	9
Russell Rd at I-95 NB On-Ramp	2	16	3	18

Green = Light Congestion; Yellow = Moderate Congestion

1. Results for this location from Synchro (HCM) Methodology

7.3 2042 NO BUILD TRAFFIC OPERATIONS

7.3.1 Freeway Operational Analysis

AM Peak Period

Summaries of I-95 northbound and southbound GP lane travel speeds for the 3-hour AM peak modeling period for 2042 No Build conditions are provided in **Figure 7-25** and **Figure 7-26**. A summary of travel speeds for the 3-hour AM peak modeling period are provided in **Figure 7-27** for the I-95 Express Lanes. A summary of overall freeway operations (density, speeds, and throughput) for the AM peak hour (7-8 AM) is provided in **Figure 7-28** for northbound I-95, in **Figure 7-29** for southbound I-95, and in **Figure 7-30** for the I-95 Express Lanes. These include all freeway segments, ramp junctions, and weaving segments. Similar summaries for the other two hours in the AM peak analysis period are provided in **Appendix N**.

Table 7-13 provides a summary of northbound GP lane travel times by segment and cumulative for the entire study corridor averaged over the AM peak period. **Table 7-14** provides a summary of southbound GP lane travel times by segment averaged over the AM peak period.

Figure 7-25: No Build 2042 AM Period I-95 General Purpose Lane Speeds - Northbound

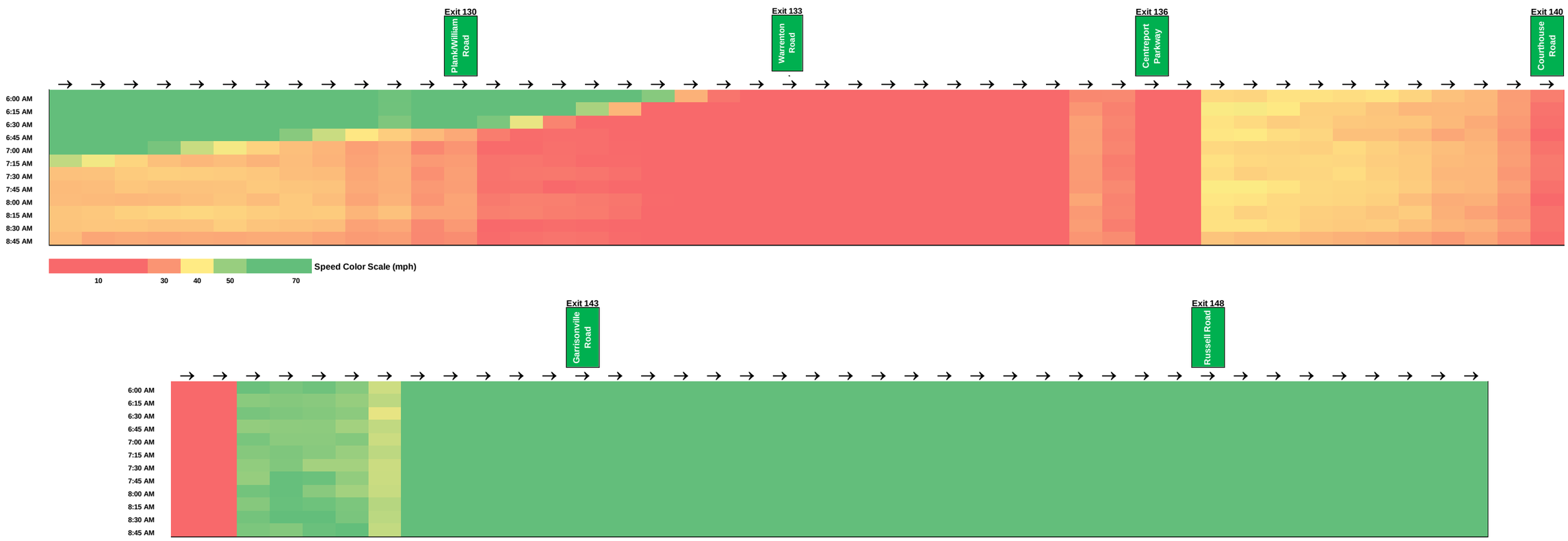
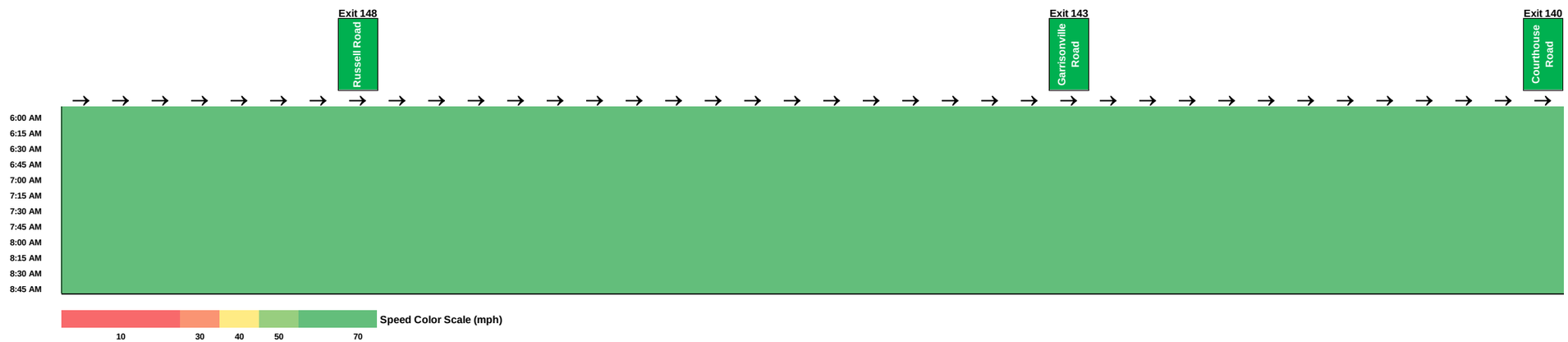


Figure 7-26: No Build 2042 AM Period I-95 General Purpose Lane Speeds - Southbound



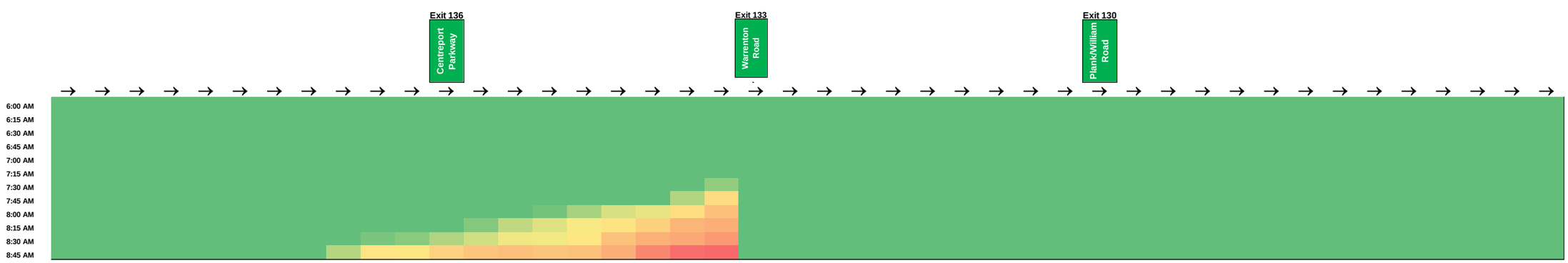


Figure 7-27: No Build 2042 AM Period I-95 Express Lane Speeds - Northbound

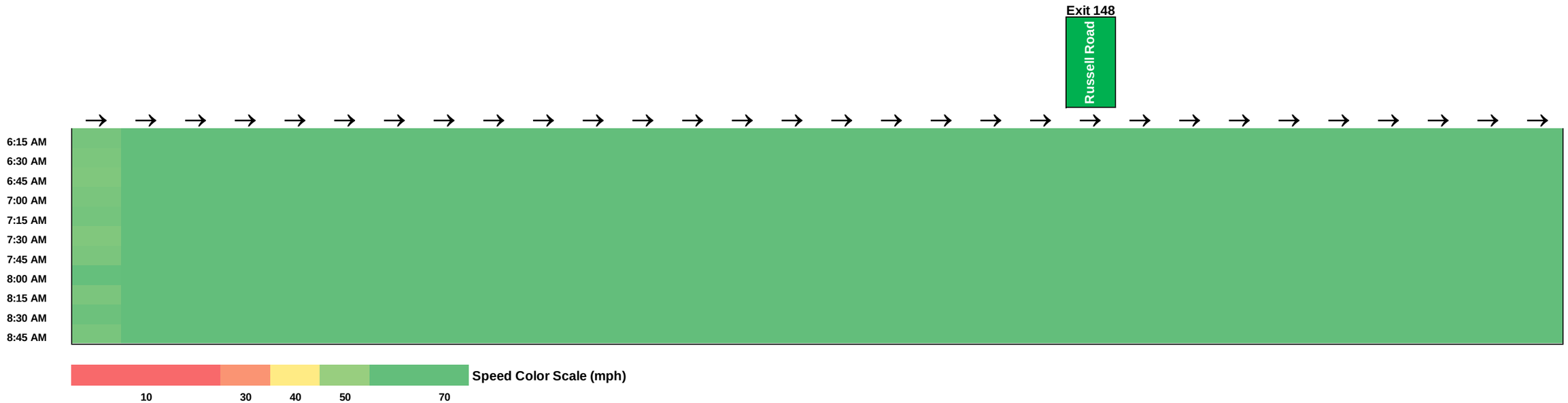


Figure 7-28: No Build 2042 AM Peak Hour I-95 General Purpose Lane Operations - Northbound

Exit 130 Plank/William Road | Exit 133 Warrenton Road | Exit 136 Centreport Parkway

Speed	19	17	16	15	14	13	13	13	13	14	13	11	10	8	8	8	8	8	8	9	7	4	4	3	4	5	5	7	7	7	7	12	10	11
Density	87	92	97	103	108	112	110	112	109	107	85	120	102	135	138	138	138	136	135	123	111	154	155	171	159	153	146	137	137	140	137	61	77	73
Volume	4860	4766	4677	4576	4501	4426	4397	4367	4365	4362	4356	3950	3946	3188	3269	3288	3295	3309	3315	3179	3251	2010	2029	2340	2324	2342	2969	2981	2984	2996	2994	2983	2403	2393
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	4	3	3	5	4	3	4	3	3	3	3	4	3	3
Length	2000	2000	2000	2000	2000	2000	2000	2000	2000	716	640	1177	790	926	2000	2000	2000	2000	2000	707	1234	1164	1770	1754	1206	1273	1601	2000	2000	2000	1313	792	2000	1610

Speed Color Scale (mph): 10 | 30 | 40 | 50 | 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road | Exit 143 Garrisonville Road

Speed	13	19	19	19	19	19	19	19	19	18	16	16	17	9	39	42	40	39	41	62	65	69	70	70	61
Density	63	56	58	58	58	57	57	57	56	57	47	61	59	121	36	33	35	36	32	20	19	13	16	15	16
Volume	3262	3270	3269	3275	3273	3275	3273	3274	3280	3103	2960	2963	2964	4129	4135	4147	4153	4156	4002	3728	3720	3684	3329	3230	3842
Lanes	4	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3	3	4	3	3	4
Length	579	2000	2000	2000	2000	2000	2000	2000	2000	767	905	2000	4	1471	2000	2000	2000	2000	1546	415	582	825	2000	162	855

Exit 148 Russell Road

Speed	62	61	69	70	69	69	68	69	69	69	68	69	68	67	68	68	66	61	69	69	68	69	69	69	69	69	69
Density	19	16	19	19	19	19	15	18	18	18	18	18	19	19	19	19	19	15	14	14	11	15	14	14	14	14	14
Volume	3512	3958	3953	3961	3962	3962	3944	3788	3788	3790	3790	3784	3790	3791	3792	3790	3776	3759	2851	2855	2990	2990	2986	2986	2983	2974	2986
Lanes	3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
Length	759	1503	2000	2000	675	1193	295	2000	416	2000	563	1445	2000	731	2000	881	942	519	2000	455	1083	394	2000	1484	789	685	1711

Figure 7-29: No Build 2042 AM Peak Hour I-95 General Purpose Lane Operations - Southbound

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	69	69	69	69	69	68	70	69	70	69	69	69	69	69	69	69	70	70	70	70	70	70	70	70	70	66
Density	15	15	15	16	16	12	11	8	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	8	9	9
Volume	3206	3207	3208	3208	3209	3206	2204	2304	2312	2318	2323	2290	2322	2309	2324	2325	2325	2326	2328	2327	2324	2324	2307	2316	1941	2331
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1943	1467	2000	1888	838	602	851	968	492	1598	2000	237	2000	780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

Speed	69	69	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	69	70
Density	11	9	11	11	11	11	11	11	11	9	10	10	10	9	12	12	12	12	12	12	12	12	12	9	12
Volume	2253	2403	2400	2405	2398	2407	2406	2403	2404	2399	2145	2113	2134	2568	2571	2570	2572	2576	2579	2579	2578	2579	2577	2481	
Lanes	3	4	3	3	3	3	3	3	3	4	3	3	3	4	3	3	3	3	3	3	3	3	4	3	
Length	928	1408	1613	782	2000	2000	2000	2000	1436	830	2000	27	1727	1711	2000	2000	2000	2000	2000	2000	2000	288	861	2000	

Exit 133 Warrenton Road

Exit 130 Plank/William Road

Speed	70	68	69	62	55	53	51	29	67	70	70	70	70	70	70	70	70	70	70	70	70	70	69	70	70	70	70	70	70	70	70	70
Density	12	10	13	16	22	26	25	39	10	9	9	9	9	9	9	9	9	9	9	9	9	7	9	12	12	12	12	12	12	12	12	12
Volume	2471	2720	2718	2697	2652	2625	2600	2505	1929	1934	1937	1939	1940	1943	1945	1949	1949	1951	1954	1958	1961	2465	2465	2467	2469	2472	2480	2486	2491	2494	2494	2497
Lanes	3	4	3	3	3	3	4	5	3	3	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3	3
Length	844	614	2000	2000	2000	29	1258	1549	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1277	868	1099	225	1954	2000	2000	2000	2000	2000	2000	739

Figure 7-30: No Build 2042 AM Peak Hour I-95 Express Lane Operations - Northbound

Exit 148 Russell Road

Speed	49	68	71	70	70	70	69	69	70	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71
Density	8	6	6	6	6	6	6	6	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
LOS	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Volume	416	415	415	415	415	416	417	417	415	417	417	584	582	582	585	584	584	585	585	583	585	586	586	586	582	586	585	585	585	586
Lanes	1	1	1	1	1	1	1	1	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Length	250	2000	2000	2000	2000	2000	2000	737	473	2000	511	1084	373	1650	1415	2000	735	2000	968	1497	2000	1348	1567	789	693	1550	2000	2000	2000	1285
LinkID	130131	130129	130129	130129	130129	130129	130129	130129	653	654	654	656	657	672	682	683	683	684	684	685	686	686	687	673	670	671	688	688	688	688
SegmentID	1	1	2	3	4	5	6	7	1	1	2	1	1	1	1	1	2	1	2	1	1	2	1	1	1	1	1	2	3	4

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) **Volume (vph)** **Lanes (#)** **Length (ft)**

Table 7-13: 2042 No Build AM Peak Period – Northbound Travel Times

Segment	Length	Segment Travel Time	Cumulative Travel Time	Segment Speed
	(miles)	(minutes)	(minutes)	(mph)
Start to N of Exit 130	4.3	12.3	12.3	20.9
N of Exit 130 to S of Exit 133	1.8	9.1	21.4	11.6
S of Exit 133 to N of Exit 133	1.9	19.7	41.1	5.6
N of Exit 133 to N of Exit 136	2.7	21.3	62.4	7.5
N of Exit 136 to N of Exit 140	3.3	10.4	72.9	18.9
N of Exit 140 to N of Exit 143	3.2	6.9	79.8	32.2
N of Exit 148	4.6	4.0	83.8	68.4
Total	21.7	83.8		15.5

Table 7-14: 2042 No Build AM Peak Period – Southbound Travel Times

Segment	Length	Segment Travel Time	Cumulative Travel Time	Segment Speed
	(miles)	(minutes)	(minutes)	(mph)
S of Exit 148 to S of Exit 143	4.7	4.1	4.1	69.4
S of Exit 143 to S of Exit 140	3.1	2.7	6.7	69.8
S of Exit 140 to S of Exit 136	4.3	4.5	11.3	56.9
S of Exit 136 to S of Exit 133	2.7	6.6	17.8	24.4
S of Exit 133 to N of Exit 130	0.9	0.7	18.6	69.9
N of Exit 130 to S of Exit 130	2.4	2.1	20.6	69.8
S of Exit 130 to End	3.5	3.0	23.6	69.6
Total	21.5	23.6		54.6

The results in the aforementioned figures and tables indicate a substantial degradation within the northbound I-95 GP lanes compared to existing conditions. Travel times are projected to increase substantially with severe congestion originating at the merge from the VA-630 (Courthouse Road) on-ramp to I-95 northbound at Exit 140 and congestion extending back approximately 10 miles to the VA-3 (Plank Road) interchange to Exit 130. North of Courthouse Road, volumes are metered due to congestion further south and the I-95 GP lanes would operate under free flow conditions for the duration of the AM peak period. North of Courthouse Road, the results do indicate an improvement relative to 2022 No Build conditions. With the assumed completion by 2042 of the Northbound Rappahannock River crossing improvements, additional northbound GP traffic demand is served in the segment between Exit 130 and

Exit 133. As this additional demand moves north, it triggers more congestion in the area between Exit 133 and Exit 140, which meters the volume traffic which reaches the segment between Exit 140 and Exit 143; the reduced traffic volumes served north of Exit 140 result in higher vehicle speeds compared to 2022 No Build conditions. However, overall conditions in the NB GP lanes during the AM peak are substantially worse in 2042 compared to 2022 conditions. Average travel speeds for the 22-mile study corridor would be approximately 15 MPH. Average speeds for the segment south of the VA-630 / Courthouse Road interchange would be approximately 11 MPH.

Along the southbound I-95 GP lanes, traffic operations would generally be free flow during the AM peak period. There is some minor congestion noted near the I-95 / US 17 interchange towards the end of the analysis period. Based on a review of the simulations, this is due to the congestion along the I-95 northbound GP lanes. Spillback along I-95 northbound and the associated on-ramps at US 17 and VA-3 eventually impacts operations along the arterial streets at these locations. Later in the analysis period, queues along the arterial streets due to traffic queuing to access I-95 spills back and impacts the off-ramps from I-95 southbound, resulting in minor congestion in a short segment of the southbound I-95 GP lanes.

PM Peak Period

Summaries of I-95 northbound and southbound GP lane travel speeds for the 4-hour PM peak modeling period for 2042 No Build conditions are provided in **Figure 7-31** and **Figure 7-32**. A summary of travel speeds for the 4-hour PM peak modeling period are provided in **Figure 7-33** for the I-95 Express Lanes. A summary of overall freeway operations (density, speeds, and throughput) for the PM peak hour (5-6 PM) is provided in **Figure 7-34** for northbound I-95, in **Figure 7-35a** for southbound I-95, in **Figure 7-35b** for the southbound I-95 collector-distributor road between Exit 133 and Exit 130**,** and in **Figure 7-36** for the I-95 Express Lanes. These include all freeway segments, ramp junctions, and weaving segments. Similar summaries for the other three hours in the PM peak analysis period are provided in **Appendix N**.

Table 7-15 provides a summary of northbound GP lane travel times by segment and cumulative for the entire study corridor averaged over the PM peak period. **Table 7-16** provides a summary of southbound GP lane travel times by segment averaged over the PM peak period.

Figure 7-31: No Build 2042 PM Period I-95 General Purpose Lane Speeds - Northbound

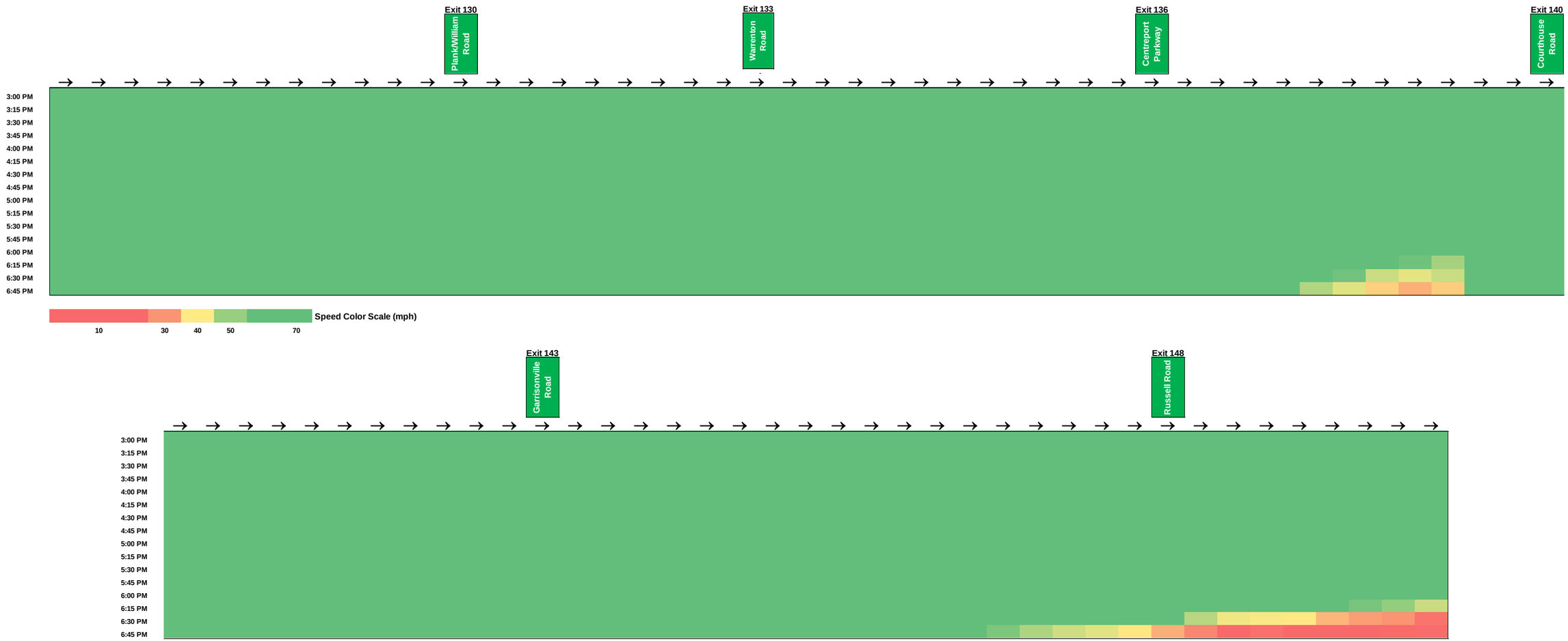


Figure 7-32: No Build 2042 PM Period I-95 General Purpose Lane Speeds - Southbound

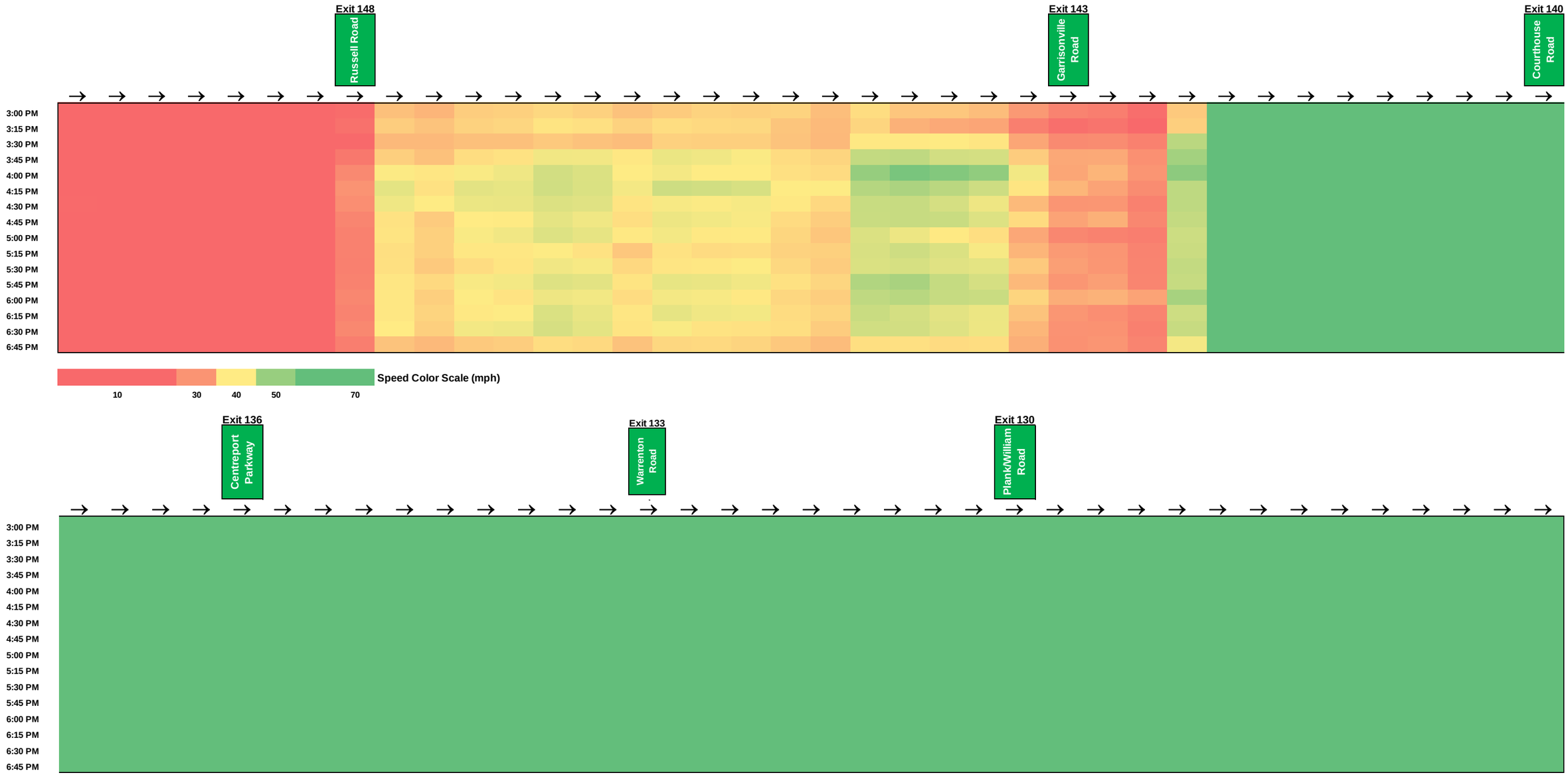


Figure 7-33: No Build 2042 PM Period I-95 Express Lane Speeds – Southbound

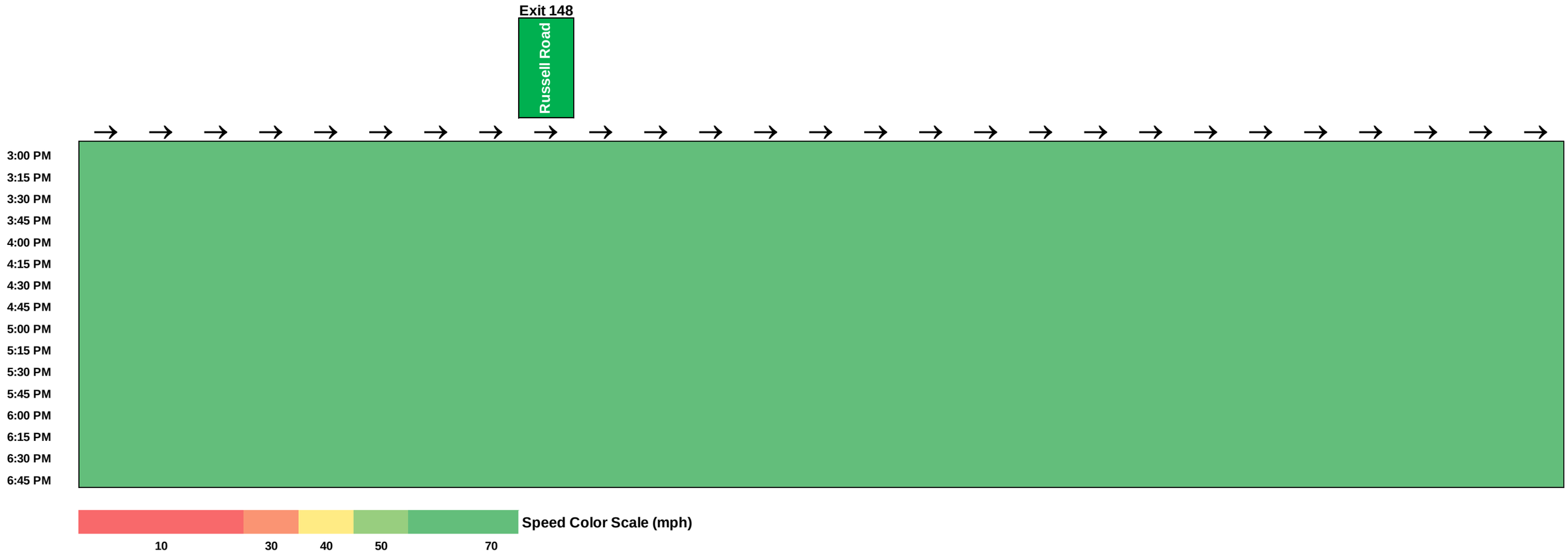


Figure 7-34: No Build 2042 PM Peak Hour I-95 General Purpose Lane Operations - Northbound

Exit 130 Plank/William Road; Exit 133 Warrenton Road; Exit 136 Centreport Parkway

Speed	67	69	69	69	69	69	68	68	68	68	61	65	69	69	69	69	69	69	69	69	65	68	70	69	69	69	66	68	69	68	68	69	69	69
Density	22	21	21	21	21	21	21	21	21	22	18	20	14	16	17	17	17	17	17	16	13	12	11	10	12	17	15	20	20	20	20	15	17	17
Volume	4380	4379	4383	4387	4388	4391	4392	4395	4397	4399	4394	3807	3805	3351	3422	3435	3437	3436	3437	3309	3364	2348	2373	3383	3366	3406	4074	4074	4075	4085	4091	4088	3551	3545
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	4	3	3	5	4	3	4	3	3	3	3	4	3	3
Length	2000	2000	2000	2000	2000	2000	2000	2000	2000	716	640	1177	790	926	2000	2000	2000	2000	2000	707	1234	1164	1770	1754	1206	1273	1601	2000	2000	2000	1313	792	2000	1610

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road; Exit 143 Garrisonville Road

Speed	67	68	69	69	69	69	67	63	60	66	68	69	69	68	69	69	69	68	68	68	69	68	68	64
Density	15	20	19	19	19	19	20	23	25	18	18	18	15	20	20	20	20	20	20	20	14	18	17	17
Volume	3976	3971	3973	3978	3981	3979	3968	3966	3957	3617	3587	3618	4032	4039	4045	4048	4052	4050	4050	4041	4000	3694	3584	4254
Lanes	4	3	3	3	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	4	3	3	4
Length	579	2000	2000	2000	2000	2000	2000	2000	1331	519	905	1998	1471	2000	2000	2000	2000	1546	415	582	825	2000	162	855

Exit 148 Russell Road

Speed	67	69	68	69	69	69	70	69	68	68	67	67	67	65	66	68	67	66	68	67	62	63	67	68	68	67	68
Density	19	15	19	19	19	19	14	19	19	20	20	20	20	20	20	20	20	15	18	19	18	23	22	21	22	22	21
Volume	3775	3985	3981	3990	3993	3993	3976	3996	3997	3997	3999	3993	3995	3995	3994	3993	3979	3962	3725	3726	4369	4367	4365	4365	4363	4350	4365
Lanes	3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
Length	759	1503	2000	2000	675	1193	295	2000	416	2000	563	1445	2000	731	2000	881	942	519	2000	455	1083	394	2000	1484	789	685	1711

Figure 7-35a: No Build 2042 PM Peak Hour I-95 General Purpose Lane Operations - Southbound

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	9	9	9	9	9	9	9	14	21	21	21	21	21	21	21	21	21	21	21	21	26	24	23	19	15	16
Density	119	118	116	118	118	90	118	75	68	68	66	66	67	68	69	67	68	68	68	67	55	60	63	59	75	60
Volume	3264	3258	3263	3263	3263	3262	3139	4174	4197	4215	4225	4158	4223	4206	4235	4248	4254	4265	4283	4270	4254	4239	4204	4423	3375	3807
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1943	1467	2000	1888	838	602	851	969	499	1598	2000	237	2000	780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

Speed	17	20	38	53	60	62	62	63	62	67	69	69	68	69	67	66	68
Density	70	55	35	33	29	29	28	28	28	20	20	20	20	16	22	16	18
Volume	3565	4476	5263	5275	5261	5274	5274	5278	5285	5277	4139	4078	4137	4316	4333	4333	3724
Lanes	3	4	4	3	3	3	3	3	3	4	3	3	3	4	3	4	3
Length	928	999	1613	782	2000	2000	2000	2000	1436	830	2000	27	1717	1712	922	861	2000

Exit 133 Warrenton Road

Exit 130 Plank/William Road

Speed	68	65	68	69	68	69	69	54	67	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
Density	18	17	21	21	21	21	15	16	10	10	10	10	10	10	10	10	10	10	10	10	10	13	12	11	11	11	11	11	11	11	11	11
Volume	3727	4274	4272	4271	4270	4267	4268	4269	2019	2018	2016	2018	2017	2015	2014	2014	2017	2018	2018	2018	2019	4437	3305	2290	2289	2290	2291	2293	2295	2295	2297	2295
Lanes	3	4	3	3	3	3	4	5	3	3	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3	3
Length	844	614	2000	2000	2000	29	1258	1549	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1277	868	1099	225	1954	2000	2000	2000	2000	2000	2000	739

Figure 7-35b: No Build 2042 PM Peak Hour I-95 Collector-Distributor Lane Operations – Southbound between Exit 133 and Exit 130

Exit 133 — Warrenton Road

Exit 130 — Plank/William Road

Speed	64	70	69	64	69	62	68	69	69	69	70	69	70	69	69	67	68	63	66	68	67	69
Density	12	8	9	8	8	10	12	15	15	15	11	15	11	15	15	12	15	14	17	16	16	18
Volume	2251	2239	1794	1958	1748	3172	3179	3172	3162	3159	3157	3158	3159	3167	3175	3171	2017	2560	2196	2198	3235	2418
Lanes	3	4	3	4	3	5	4	3	3	3	4	3	4	3	3	4	2	3	2	2	3	2
Length	1809	857	1087	1117	507	1361	1255	2000	2000	494	411	1119	1651	2000	1139	671	1080	736	753	256	1256	1221

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) **Volume (vph)** **Lanes (#)** **Length (ft)**

Figure 7-36: No Build 2042 PM Peak Hour I-95 Express Lane Operations – Southbound

Exit 148 Russell Road

Speed	69	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	69	68	58	64	66	66	66	62	46
Density	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	5	7	9	12	12	12	12	13	17
Volume	986	986	987	985	984	982	977	986	989	989	988	989	984	986	982	983	983	979	985	984	982	776	782	787	792	793	752
Lanes	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	1	1	1	1	1	1
Length	2000	2000	2000	1285	1550	693	789	1567	2000	1348	1497	2000	968	2000	735	1415	1650	373	1084	2000	1056	2000	2000	2000	2000	2000	241

Speed Color Scale (mph) 10 30 40 50 70

Density (veh/mi/ln) **Volume (vph)** **Lanes (#)** **Length (ft)**

Table 7-15: 2042 No Build PM Peak Period – Northbound Travel Times

Segment	Length	Segment Travel Time	Cumulative Travel Time	Segment Speed
	(miles)	(minutes)	(minutes)	(mph)
Start to N of Exit 130	4.3	3.8	3.8	68.2
N of Exit 130 to S of Exit 133	1.8	1.5	5.3	69.0
S of Exit 133 to N of Exit 133	1.9	1.6	6.9	68.7
N of Exit 133 to N of Exit 136	2.7	2.4	9.3	67.5
N of Exit 136 to N of Exit 140	3.3	3.7	13.0	54.6
N of Exit 140 to N of Exit 143	3.2	2.9	15.8	67.9
N of Exit 148	4.6	4.4	20.2	62.8
Total	21.7	20.2		64.5

Table 7-16: 2042 No Build PM Peak Period – Southbound Travel Times

Segment	Length	Segment Travel Time	Cumulative Travel Time	Segment Speed
	(miles)	(minutes)	(minutes)	(mph)
S of Exit 148 to S of Exit 143	4.7	13.7	13.7	20.7
S of Exit 143 to S of Exit 140	3.1	3.6	17.3	51.8
S of Exit 140 to S of Exit 136	4.3	3.8	21.1	67.6
S of Exit 136 to S of Exit 133	2.7	2.4	23.5	66.9
S of Exit 133 to N of Exit 130	0.9	0.7	24.2	70.0
N of Exit 130 to S of Exit 130	2.4	2.1	26.3	69.9
S of Exit 130 to End	3.5	3.0	29.3	69.7
Total	21.5	29.3		44.2

The results in the aforementioned figures and tables indicate similar results in 2022 No Build conditions. There is severe congestion projected beginning south of the I-95 / VA-610 interchange at Garrisonville Road (Exit 143). At this location, the righthand merge from Garrisonville Road eastbound on-ramp and the left-hand merge from the I-95 Express Lanes (Southern Terminus Extension project) would occur at essentially the same point. This creates an initial bottleneck which extends north towards Russell Road. A second bottleneck was noted due to the merge from the on-ramp from Russell Road at Exit 148. One difference from existing conditions under the projected 2042 No Build conditions is that the bottleneck near the I-95 / US 17 interchange at Warrenton Road (Exit 133) is not present. The proposed I-95 Southbound Rappahannock River Crossing improvements provide 3 additional lanes of southbound

capacity in this area and separate US 17 and VA-3 traffic from through traffic along southbound I-95. This improved capacity combined with the effects of upstream metering resulted in free-flow operations for the I-95 GP lane segments south of the I-95 / VA-630 interchange at Courthouse Road (Exit 140).

It should be noted that there is substantial congestion within the southbound I-95 GP lanes further north in the *VISSIM* model area (which extends north to the I-95 / US 1 interchange at Exit 161). The congestion further north in the model meters the volume of southbound traffic which enters the study area under 2042 No Build conditions.

The northbound I-95 GP lanes are projected to continue to operate with free-flow conditions under 2042 No Build PM peak conditions.

7.3.2 Arterial Intersection Operational Analysis

Measures of effectiveness (MOEs) from the *VISSIM* outputs were used to document operations for 2042 No Build conditions at the signalized intersections along the study segment of I-95. Overall intersection delay, average delay by movement, throughput by movement, and average and maximum queue lengths by movement were reported. **Table 7-17** provides a summary of the overall intersection delay by intersection for the AM and PM peak hours. Overall average delay values are color-coded to reflect various congestion levels based on delay as shown in **Table 7-2**. Summaries of the remaining intersection MOEs, including delay by movement, throughput by movement, average queues and maximum queues are provided in **Appendix N**.

AM Peak Period

The results in **Table 7-17** indicate that during the AM peak hour (7-8 AM), six of the nineteen study intersections, or 32 percent, would operate with severe congestion. One additional intersection would operate with heavy congestion. The remaining intersections would operate with light to moderate traffic. Five of the six intersections which would operate with severe congestion are located at the US 17 (Exit 133) or VA-3 (Exit 130) interchanges. These intersections are impacted by the severe congestion noted along the I-95 northbound GP lanes. Mainline I-95 congestion would spill back to the ramps at these intersections, impeding traffic flow along the arterial streets and resulting in poor operations at these intersections.

PM Peak Period

The results in **Table 7-17** indicate that during the PM peak hour (5-6 PM), none of the nineteen study intersections would operate with severe congestion. Two intersections would operate with heavy congestion. The remaining intersections would operate with light to moderate traffic. Particularly at the southern end of the model area at Exit 133 and Exit 130, the upstream congestion along I-95 meters the arriving volumes during the peak period.

Table 7-17: Design Year 2042 Intersection Analysis Results

Intersection	2042 No-Build		2042 Build	
	AM (7 – 8 AM)	PM (5 – 6 PM)	AM (7 – 8 AM)	PM (5 – 6 PM)
	Delay (sec/veh)	Delay (sec/veh)	Delay (sec/veh)	Delay (sec/veh)
Route 3 at I-95 SB Off-Ramp	100	15	26	16
Route 3 at I-95 NB On Ramp	433	6	33	6
Route 3 at Carl D. Silver Pkwy	251	31	45	26
Route 3 at Gateway Blvd	291	16	17	15
US 17 at Gateway Dr	123	44	152	44
US 17 at Short St	24	11	33	9
Centreport Pkwy at I-95 SB Ramps	5	24	6	20
Centreport Pkwy at I-95 NB Ramps	26	13	23	13
US 1 at Centreport Pkwy	42	23	37	23
Courthouse Rd at I-95 SB Ramps	20	18	103	22
Courthouse Rd at I-95 NB Ramps	15	21	25	14
Relocated Courthouse Rd at US 1 / Hospital Center Blvd	139	62	121	41
Old Courthouse Rd at US 1[1]	48	53	38	43
Garrisonville Rd at I-95 SB Ramps	36	8	45	8
US 1 at I-95 NB Off-Ramp	50	32	25	32
US 1 at I-95 NB On-Ramp	22	17	15	17
US 1 at Route 610	66	67	61	63
Russell Rd at I-95 SB Ramps	20	31	18	27
Russell Rd at I-95 NB Off-Ramp	24	22	13	16
Russell Rd at I-95 NB On-Ramp	1	39	5	27

Green = Light Congestion

Yellow = Moderate Congestion

Orange = Heavy Congestion

Red = Severe Congestion

1. Results for this location from Synchro (HCM)

7.4 2022 BUILD TRAFFIC OPERATIONS

7.4.1 Freeway Operational Analysis

AM Peak Period

Summaries of I-95 northbound and southbound GP lane travel speeds for the 3-hour AM peak modeling period are provided in **Figure 7-37** and **Figure 7-38**. A summary of travel speeds for the 3-hour AM peak modeling period are provided in **Figure 7-39** for the I-95 Express Lanes. A summary of overall freeway operations (density, speeds, and throughput) for the AM peak hour (7-8 AM) is provided in **Figure 7-40** for northbound I-95, in **Figure 7-41** for southbound I-95, and in **Figure 7-42** for the I-95 Express Lanes. These include all freeway segments, ramp junctions, and weaving segments. Similar summaries for the other two hours in the AM peak analysis period are provided in **Appendix O**.

Table 7-18 provides a summary of northbound GP lane travel times by segment and cumulative for the entire study corridor averaged over the AM peak period. **Table 7-19** provides a summary of southbound GP lane travel times by segment and cumulative for the entire study corridor averaged over the AM peak period. **Table 7-20** provides a summary of the northbound I-95 Express Lanes travel times by segment and cumulative for the entire study corridor averaged over the AM peak period.

Figure 7-37: Build 2022 AM Period I-95 General Purpose Lane Speeds – Northbound

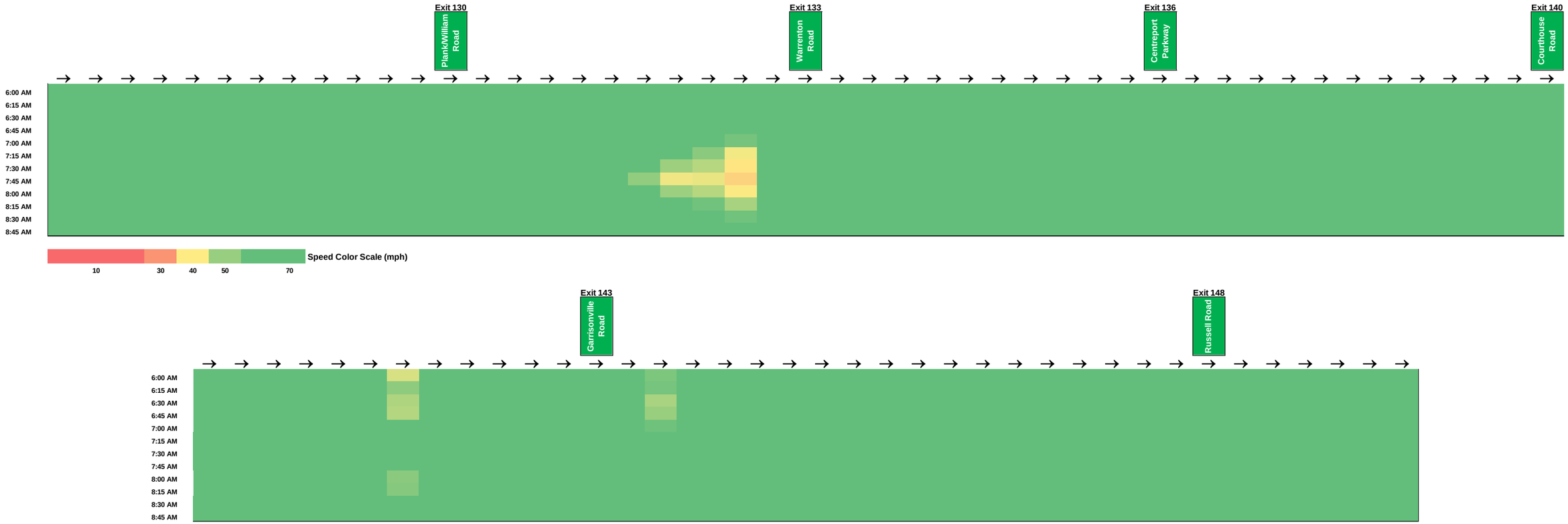
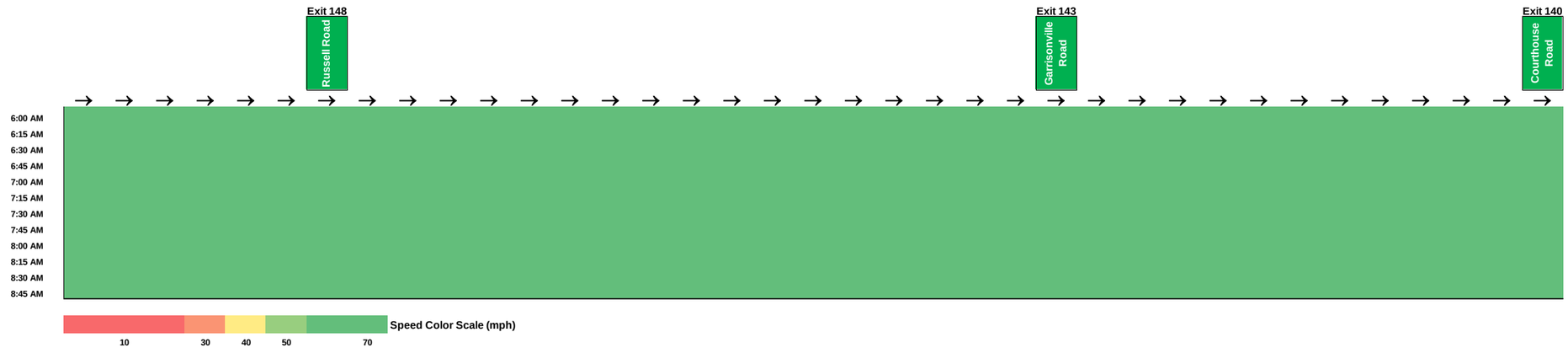


Figure 7-38: Build 2022 AM Period I-95 General Purpose Lane Speeds – Southbound



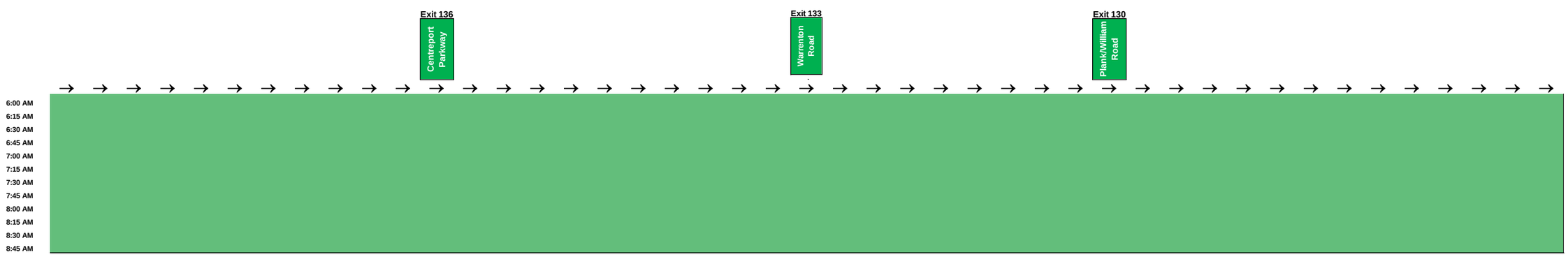


Figure 7-39: Build 2022 AM Period I-95 Express Lane Speeds – Northbound

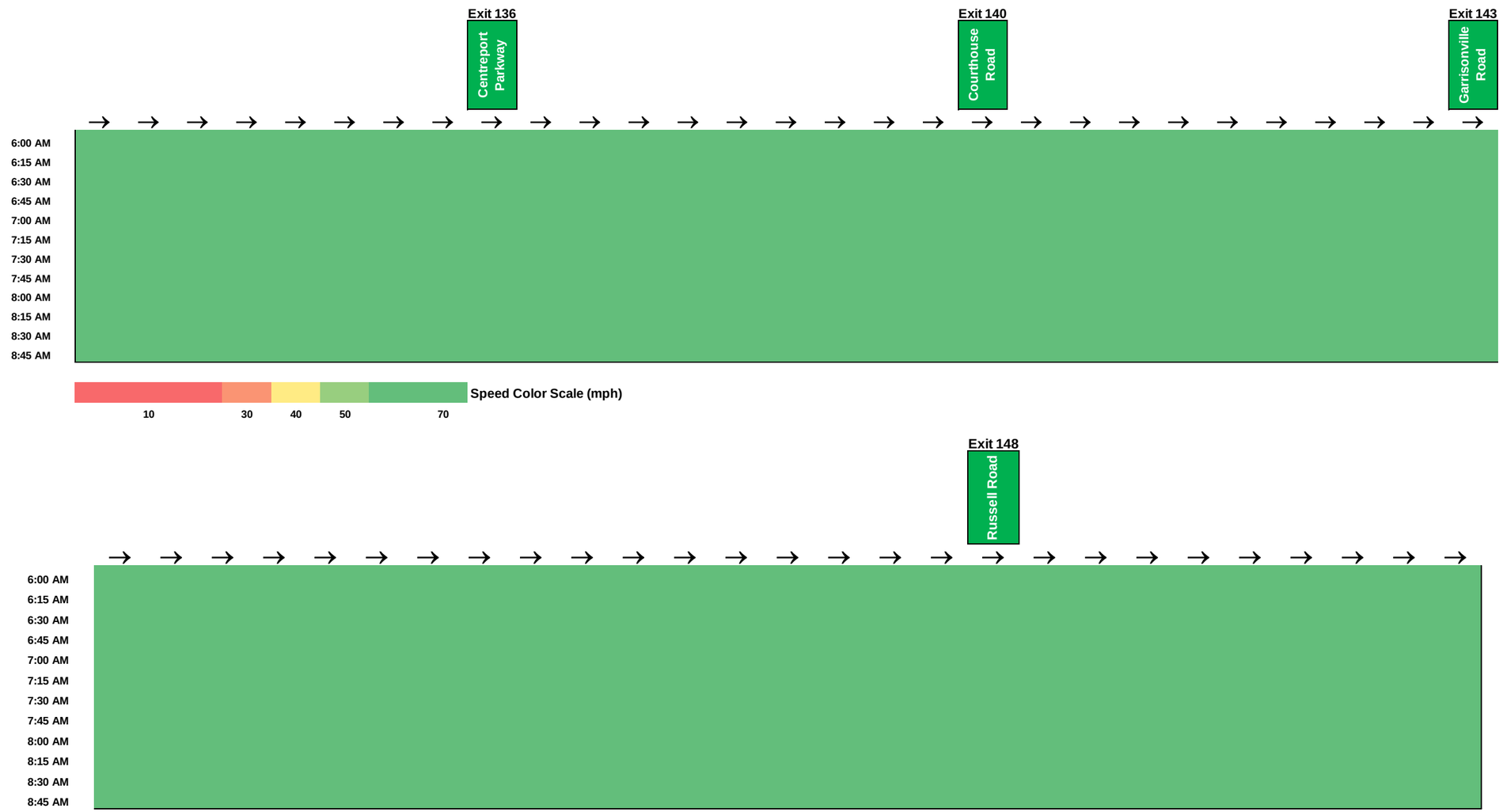


Figure 7-40: Build 2022 AM Peak Hour I-95 General Purpose Lane Operations - Northbound

Exit 130 Plank/William Road; Exit 133 Warrenton Road; Exit 136 Centreport Parkway

Speed	69	70	69	69	69	69	69	69	69	69	66	68	69	69	56	60	61	56	49	41	37	23	64	69	69	66	68	65	68	68	69	69	67	69	69
Density	19	19	19	19	19	19	19	19	19	19	15	18	13	15	19	23	30	35	43	49	52	66	17	16	16	12	13	14	13	16	16	16	13	11	11
Volume	3927	3930	3933	3931	3932	3932	3933	3934	3937	3941	3932	3585	3587	3050	5193	5180	5200	5188	5159	5116	5078	5042	3268	3265	3263	3191	2724	3692	3691	3319	3327	3328	3321	2369	2368
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	5	4	3	3	3	3	3	4	3	3	3	4	3	4	4	3	3	3	4	3	3
Length	2000	2000	2000	2000	2000	2000	2000	2000	2000	716	640	1177	790	983	1197	1104	2000	2000	2000	2000	1585	866	2000	2000	871	757	529	1596	1525	2000	2000	1767	792	2000	1610

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road; Exit 143 Garrisonville Road

Speed	61	66	68	69	69	69	69	69	68	68	69	69	69	70	66	67	68	67	58	65	67	69	70	69	57
Density	14	16	15	15	15	15	15	15	15	14	10	13	13	13	17	17	17	17	19	17	16	12	14	14	17
Volume	3291	3135	3135	3135	3131	3127	3126	3125	3125	2874	2674	2672	2671	3482	3483	3486	3483	3482	3408	3272	3265	3235	2921	2837	3818
Lanes	4	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3	3	4	3	3	4
Length	579	2000	2000	2000	2000	2000	2000	2000	2000	767	905	2000	4	1471	2000	2000	2000	2000	1546	415	582	825	2000	162	855

Exit 148 Russell Road

Speed	59	56	68	69	69	69	68	69	69	69	68	68	68	67	67	68	69	68	69	68	67	68	69	69	69
Density	21	19	21	20	21	21	16	20	20	20	20	20	20	20	20	20	16	16	18	18	14	19	18	18	18
Volume	3623	4257	4256	4262	4262	4265	4246	4106	4106	4107	4109	4103	4110	4110	4112	4114	4302	4295	3632	3633	3757	3757	3760	3765	3761
Lanes	3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	4	4	3	3	4	3	3	3	3
Length	759	1503	2000	2000	675	1193	295	2000	416	2000	563	1445	2000	731	2000	734	1101	523	2000	455	1083	394	2000	1484	789

Figure 7-41: Build 2022 AM Peak Hour I-95 General Purpose Lane Operations - Southbound

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	69	69	68	66	55	69	69	70	70	69	69	69	70	69	70	70	70	70	70	70	70	70	70	70	64
Density	16	16	17	17	17	10	8	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	7	8	9
Volume	3388	3385	3379	3372	3366	2089	2155	2161	2161	2156	2120	2146	2129	2138	2134	2128	2125	2121	2115	2109	2104	2087	2094	1664	2255
Lanes	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1467	2000	1888	838	602	851	968	492	1598	2000	237	2000	780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

Speed	69	69	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
Density	10	9	11	11	11	11	11	11	11	9	10	10	10	10	13	13	13	13	13	13	13	13	9	12	
Volume	2163	2413	2409	2412	2402	2405	2404	2402	2398	2393	2149	2116	2145	2649	2617	2617	2619	2614	2613	2614	2615	2613	2613	2495	
Lanes	3	4	3	3	3	3	3	3	3	4	3	3	3	4	3	3	3	3	3	3	3	3	4	3	
Length	928	1408	1613	782	2000	2000	2000	2000	1436	830	2000	27	1727	1711	2000	2000	2000	2000	2000	2000	2000	288	861	2000	

Exit 133 Warrenton Road

Exit 130 Plank/William Road

Speed	70	68	69	70	69	64	69	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	69	70	70	70	70	70	70	70	70
Density	12	10	13	13	13	11	10	7	7	10	10	10	10	10	10	10	10	10	10	10	10	10	8	10	12	12	12	12	12	12	12	12	12
Volume	2494	2769	2767	2768	2768	2736	2036	2019	2027	2033	2032	2030	2027	2023	2021	2019	2014	2011	2007	2005	2000	1999	2881	2686	2525	2523	2519	2519	2517	2516	2512	2511	2507
Lanes	3	4	3	3	3	4	3	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3	3
Length	844	614	2000	2000	395	598	1017	1253	1549	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1287	868	1099	225	1954	2000	2000	2000	2000	2000	2000	739

Figure 7-42: Build 2022 AM Peak Hour I-95 Express Lane Operations – Northbound

Exit 136 Centreport Parkway; Exit 140 Courthouse Road; Exit 143 Garrisonville Road

Speed	69	70	70	71	71	71	71	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
Density	8	7	7	4	4	4	4	6	6	6	6	6	6	6	6	6	6	6	6	6	5	8	8	8	8	8	8	8	6
Volume	522	523	518	522	523	522	890	894	895	896	895	895	897	898	899	899	899	898	898	899	1043	1057	1057	1059	1057	1056	1057	1051	1255
Lanes	1	1	1	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	3
Length	2000	2000	309	2000	2000	275	1097	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1211	618	2000	2000	2000	2000	2000	2000	1368	1220

Speed Color Scale (mph) Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 148 Russell Road

Speed	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
Density	9	9	9	9	9	9	9	7	10	10	10	10	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Volume	1262	1265	1260	1260	1256	1262	1261	1423	1416	1416	1422	1421	1420	1172	1172	1172	1172	1174	1176	1176	1177	1169	1178	1178	1178	1177	1179		
Lanes	2	2	2	2	2	2	2	3	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2		
Length	2000	2000	2000	1600	473	2000	511	1084	373	1650	1415	961	782	979	2000	968	1497	2000	1348	1567	789	693	1550	2000	2000	2000	1285		

Table 7-18: 2022 Build AM Peak Period – Northbound Travel Times

Segment	Length	Segment Travel Time	Cumulative Travel Time	Segment Speed
	(miles)	(minutes)	(minutes)	(mph)
Start to N of Exit 130	4.3	3.7	3.7	69.3
N of Exit 130 to S of Exit 133	1.8	1.9	5.6	55.0
S of Exit 133 to N of Exit 133	1.9	1.9	7.5	58.9
N of Exit 133 to N of Exit 136	2.7	2.3	9.9	68.2
N of Exit 136 to N of Exit 140	3.3	2.9	12.8	67.9
N of Exit 140 to N of Exit 143	3.2	3.6	16.3	62.0
N of Exit 148	4.6	4.1	20.4	67.5
Total	21.7	20.4		63.8

Table 7-19: 2022 Build AM Peak Period – Southbound Travel Times

Segment	Length	Segment Travel Time	Cumulative Travel Time	Segment Speed
	(miles)	(minutes)	(minutes)	(mph)
S of Exit 148 to S of Exit 143	4.7	4.1	4.1	69.6
S of Exit 143 to S of Exit 140	3.1	2.7	6.7	69.9
S of Exit 140 to S of Exit 136	4.3	3.7	10.4	69.8
S of Exit 136 to S of Exit 133	2.7	2.3	12.7	69.8
S of Exit 133 to N of Exit 130	0.9	1.7	14.4	70.1
N of Exit 130 to S of Exit 130	2.4	2.1	16.4	70.0
S of Exit 130 to End	3.5	3.0	19.4	69.8
Total	21.5	19.4		69.8

Table 7-20: 2022 Build AM Peak Period – Northbound I-95 Express Lanes Travel Times

Segment	Length	Segment Travel Time	Cumulative Travel Time	Segment Speed
	(miles)	(minutes)	(minutes)	(mph)
Start to N of Exit 136	2.7	2.3	2.3	70.4
N of Exit 136 to N of Exit 140	3.3	2.8	5.0	70.4
N of Exit 140 to N of Exit 143	3.7	3.1	8.2	70.2
N of Exit 143 to N of Exit 148	4.6	3.9	12.2	69.9
N of Exit 148 to N of Exit 150	2.2	1.9	14.1	69.9
Start to N of Exit 136	16.4	14.1		70.1

The results in the aforementioned figures and tables indicate a notable improvement relative to existing and 2022 No Build AM peak conditions. With the proposed I-95 Express Lanes in place, the northbound I-95 GP Lanes are projected to operate nearly free flow in 2022 with travel times approaching 21 minutes and overall speeds averaging 64 MPH. This is compared to 58 minutes and 22 mph for 2022 No Build conditions. Several short segments with reduced speeds were noted along northbound I-95; specifically, reduced speeds (approximately 60 - 65 MPH) were noted in the segment between the VA-630 (Courthouse Road) and VA-610 (Garrisonville Road) interchanges. This area is the primary northbound bottleneck observed under existing and 2022 No Build conditions; with the I-95 Express Lanes in place, the analysis results indicate that a sufficient volume of traffic would shift from the I-95 GP lanes to the I-95 Express Lanes, allowing for improved operations within the GP lanes.

The I-95 Express Lanes, serving northbound traffic during the AM peak, would operate free-flow with an average travel time of 14 minutes and average speeds exceeding 70 MPH.

The southbound I-95 GP lanes are projected to continue to operate under free flow conditions under 2022 Build conditions. A slight increase in the travel time (1 minute) relative to 2022 No Build conditions was noted; this minor difference (approximately 5 percent) is simply variation in the simulation results.

PM Peak Period

Summaries of I-95 northbound and southbound GP lane travel speeds for the 4-hour PM peak modeling period for 2022 Build conditions are provided in **Figure 7-43** and **Figure 7-44**. A summary of travel speeds for the 4-hour PM peak modeling period are provided in **Figure 7-45** for the I-95 Express Lanes. A summary of overall freeway operations (density, speeds, and throughput) for the PM peak hour (5-6 PM) is provided in **Figure 7-46** for northbound I-95, in **Figure 7-47a** for southbound I-95, and in **Figure 7-47b** for the southbound I-95 collector-distributor road between Exits 133 and 130, and in **Figure 7-48** for the I-95 Express Lanes. These include all freeway segments, ramp junctions, and weaving segments. Similar summaries for the other three hours in the PM peak analysis period are provided in **Appendix O**.

Figure 7-43: Build 2022 PM Period I-95 General Purpose Lane Speeds – Northbound

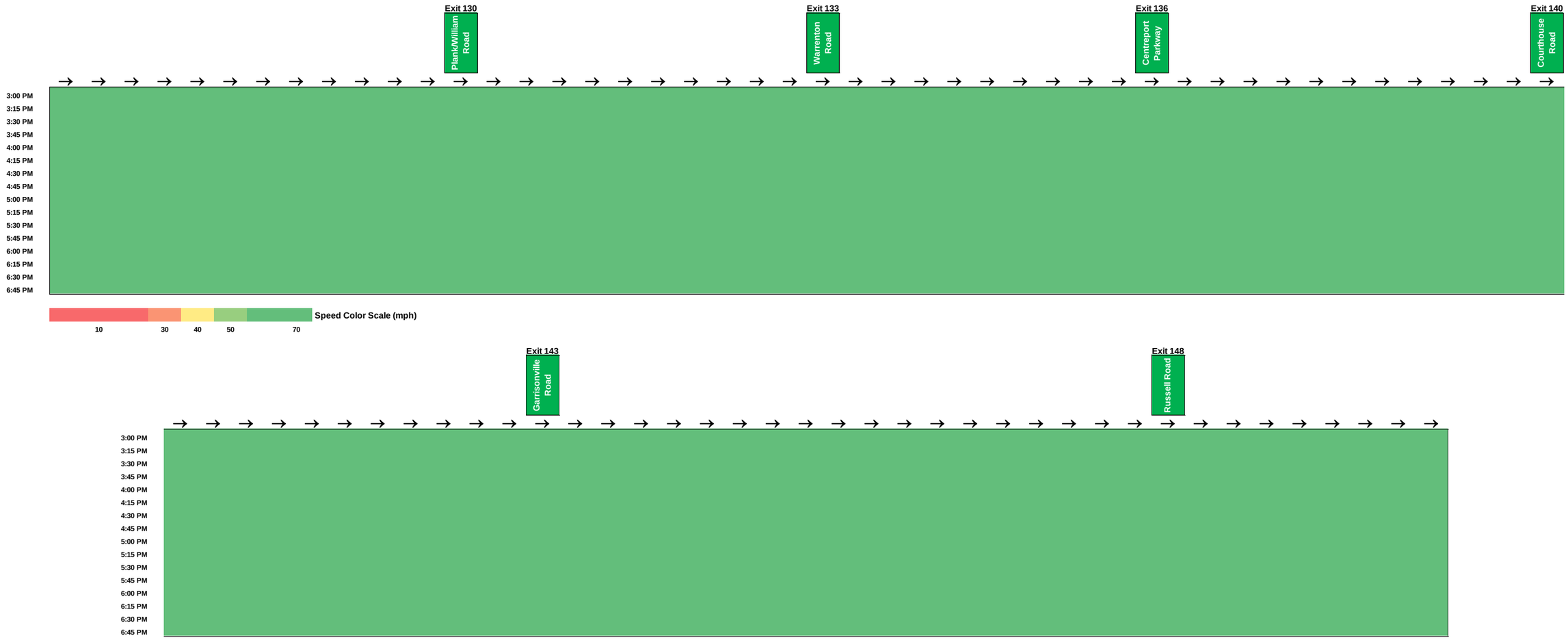


Figure 7-44: Build 2022 PM Period I-95 General Purpose Lane Speeds – Southbound

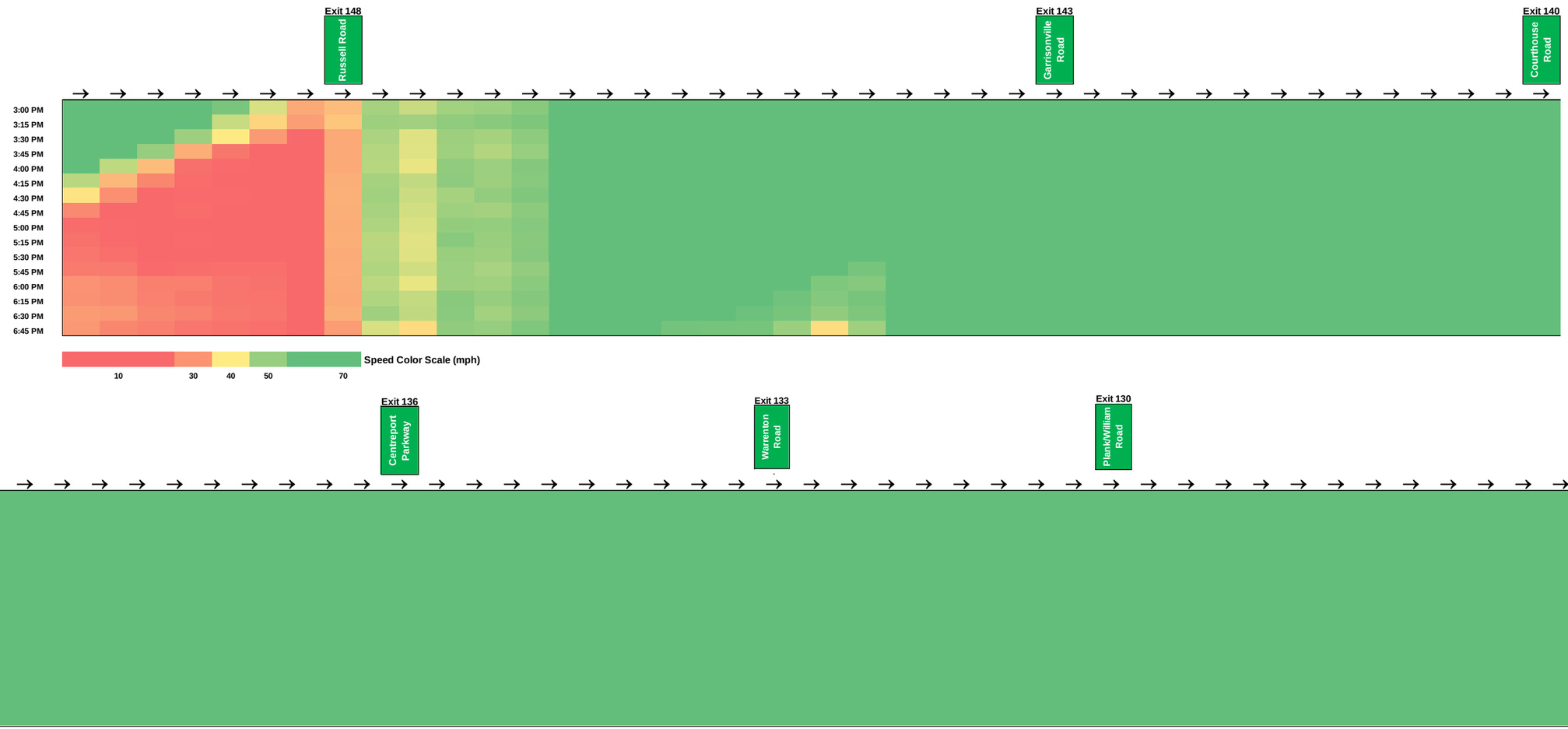


Figure 7-45: Build 2022 PM Period I-95 Express Lane Speeds – Southbound

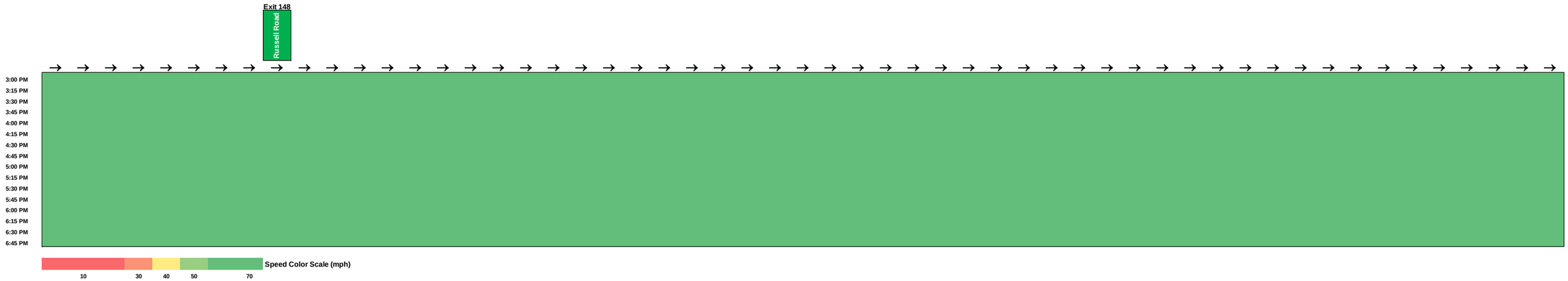


Figure 7-46: Build 2022 PM Peak Hour I-95 General Purpose Lane Operations - Northbound

Exit 130 Plank/William Road; Exit 133 Warrenton Road; Exit 136 Centreport Parkway

Speed	69	70	70	70	69	69	69	69	69	69	68	69	70	69	63	66	68	69	69	68	67	68	69	69	69	69	66	68	69	69	69	70	69	69
Density	15	15	15	15	15	15	15	15	15	15	12	14	10	13	12	15	19	19	19	19	19	14	14	13	13	13	13	17	17	17	17	12	15	15
Volume	3150	3152	3155	3159	3160	3162	3164	3165	3166	3168	3164	2878	2877	2699	3899	3886	3909	3916	3917	3908	3895	3884	2800	2803	2800	2800	3432	3431	3438	3443	3445	3444	3202	3200
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	5	4	3	3	3	3	3	4	3	3	3	3	4	3	3	3	3	4	3	3
Length	2000	2000	2000	2000	2000	2000	2000	2000	2000	716	640	1177	790	983	1197	1104	2000	2000	2000	2000	1585	866	2000	2000	2000	190	1601	2000	2000	2000	1313	792	2000	1610

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road; Exit 143 Garrisonville Road

Speed	68	68	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	70	69	69	65
Density	13	17	17	17	17	17	17	17	17	15	15	15	12	16	16	16	16	16	16	16	12	15	15	14
Volume	3488	3490	3498	3502	3502	3494	3485	3493	3502	3085	3061	3087	3370	3375	3380	3384	3385	3383	3377	3368	3336	3102	3013	3549
Lanes	4	3	3	3	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	4	3	3	4
Length	579	2000	2000	2000	2000	2000	2000	2000	1331	519	905	1998	1471	2000	2000	2000	2000	1546	415	582	825	2000	162	855

Exit 148 Russell Road

Speed	68	69	69	69	69	69	70	69	69	68	67	68	68	66	67	68	68	68	68	67	63	65	67	68	68	68	68
Density	16	12	16	16	16	16	12	16	16	17	17	17	17	17	17	17	17	12	16	16	15	20	19	19	19	19	19
Volume	3166	3372	3368	3370	3371	3374	3361	3374	3378	3380	3384	3378	3384	3388	3387	3389	3380	3366	3252	3253	3861	3859	3856	3860	3860	3851	3867
Lanes	3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
Length	759	1503	2000	2000	675	1193	295	2000	416	2000	563	1445	2000	731	2000	881	942	519	2000	455	1083	394	2000	1484	789	685	1711

Figure 7-47a: Build 2022 PM Peak Hour I-95 General Purpose Lane Operations - Southbound

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	14	14	15	14	15	14	14	25	43	41	46	47	49	56	65	66	65	67	67	66	61	54	62	66	64	69	64
Density	99	99	97	98	97	75	99	52	41	43	38	37	36	23	23	23	23	22	22	23	25	28	24	23	18	15	13
Volume	4228	4237	4231	4239	4249	4249	4055	5231	5257	5271	5280	5198	5256	5271	4479	4491	4488	4486	4488	4492	4478	4464	4464	4430	4643	3077	3463
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1943	1467	2000	1888	838	602	851	969	499	1598	2000	237	240	739	1780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

Speed	68	67	69	69	68	68	68	68	68	68	69	69	69	69	69	68	68	68	68	68	68	68	67	67	68
Density	15	14	11	14	19	19	19	19	19	19	14	16	16	16	14	18	18	18	18	18	18	12	19	14	15
Volume	3156	3716	3879	3911	3922	3910	3922	3926	3930	3931	3924	3387	3338	3390	3732	3751	3754	3759	3762	3765	3771	2367	3774	3777	3176
Lanes	3	4	5	4	3	3	3	3	3	3	4	3	3	3	4	3	3	3	3	3	3	3	3	4	3
Length	928	999	403	1613	782	2000	2000	2000	2000	1436	830	2000	27	1717	1712	2000	2000	2000	2000	2000	2000	2000	922	861	2000

Exit 133 Warrenton Road

Exit 130 Plank/William Road

Speed	69	67	69	69	69	70	57	65	70	70	70	70	70	70	70	70	70	70	70	70	70	68	68	66	68	69	69	69	69	69	69	69
Density	15	13	17	17	17	12	12	10	6	6	6	8	8	8	8	8	8	8	8	8	8	11	14	20	19	19	19	19	19	19	19	19
Volume	3177	3530	3533	3534	3538	3466	3446	2732	1350	1361	1666	1666	1670	1672	1671	1672	1675	1678	1679	1682	1681	1682	3902	3898	3900	3904	3911	3915	3919	3922	3921	3931	3931
Lanes	3	4	3	3	3	4	5	4	3	3	4	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3	3
Length	844	614	2000	2000	1406	862	1277	1247	2000	103	1797	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1368	868	1099	225	1954	2000	2000	2000	2000	2000	2000	739

Figure 7-47b: Build 2022 PM Peak Hour I-95 Collector-Distributor Lane Operations – Southbound between Exit 130 and Exit 133

Exit 133 Warrenton Road

Exit 130 Plank/William Road

Speed	69	70	69	69	68	69	68	66	66	68	69	69	69	70	69	69	68	67	64	67	65	68	69	67	68
Density	10	10	11	17	17	17	13	20	14	13	18	18	18	13	18	13	18	18	14	13	11	12	11	11	16
Volume	1363	1394	2355	2337	2304	2337	2587	2689	3606	3640	3651	3642	3643	3641	3648	3657	3667	3675	3668	1762	2076	1570	1572	2205	2218
Lanes	2	2	3	2	2	2	3	2	4	4	3	3	3	4	3	4	3	3	4	2	3	2	2	3	2
Length	347	535	937	860	1089	1000	597	599	696	1255	2000	2000	494	411	1119	1651	2000	1139	671	1080	736	753	256	1256	1221

Speed Color Scale (mph)

10 30 40 50 70

Figure 7-48: Build 2022 PM Peak Hour I-95 Express Lane Operations – Southbound

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	67	68	69	68	68	69	68	68	68
Density	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	16	15	10	15	15	14	14	14	14
Volume	1429	1428	1427	1423	1424	1422	1414	1422	1423	1420	1416	1416	1407	1415	1412	1415	2094	2104	2095	2103	2100	2101	1912	1912	1912	1912
Lanes	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	3	2	2	2	2	2	2
Length	2000	2000	2000	1285	1550	693	789	1567	2000	1348	1497	2000	968	2000	735	891	1207	986	373	1084	2000	1053	2000	2000	2000	2000

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

Speed	68	68	68	68	68	68	68	68	68	68	69	69	69	69	69	69	69	69	69	69	69	69	69	69	68	70	69	69
Density	14	9	13	13	13	13	13	13	13	8	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	4	4	4
Volume	1898	1882	1741	1742	1738	1738	1739	1739	1737	1726	1502	1509	1508	1505	1505	1505	1506	1505	1503	1504	1506	1504	1501	1500	1496	1496	273	274	266
Lanes	2	3	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1
Length	439	761	2000	2000	2000	2000	2000	2000	907	808	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1807	2000	2000	225

Table 7-21 provides a summary of northbound GP lane travel times by segment and cumulative for the entire study corridor averaged over the PM peak period. **Table 7-22** provides a summary of southbound GP lane travel times by segment and cumulative for the entire study corridor averaged over the PM peak period. **Table 7-23** provides a summary of southbound I-95 Express Lanes travel times by segment and cumulative for the entire study corridor averaged over the PM peak period.

Table 7-21: 2022 Build PM Peak Period – Northbound Travel Times

Segment	Length	Segment Travel Time	Cumulative Travel Time	Segment Speed
	(miles)	(minutes)	(minutes)	(mph)
Start to N of Exit 130	4.3	3.7	3.7	69.3
N of Exit 130 to S of Exit 133	1.8	1.6	5.3	67.8
S of Exit 133 to N of Exit 133	1.9	1.6	6.9	69.0
N of Exit 133 to N of Exit 136	2.7	2.3	9.2	68.9
N of Exit 136 to N of Exit 140	3.3	2.9	12.1	68.9
N of Exit 140 to N of Exit 143	3.2	2.8	14.9	68.4
N of Exit 148	4.6	4.0	18.9	68.4
Total	21.7	18.9		68.7

Table 7-22: 2022 Build PM Peak Period – Southbound Travel Times

Segment	Length	Segment Travel Time	Cumulative Travel Time	Segment Speed
	(miles)	(minutes)	(minutes)	(mph)
S of Exit 148 to S of Exit 143	4.7	5.0	5.0	56.3
S of Exit 143 to S of Exit 140	3.1	2.7	7.8	68.2
S of Exit 140 to S of Exit 136	4.3	3.8	11.5	68.1
S of Exit 136 to S of Exit 133	2.7	2.3	13.9	68.6
S of Exit 133 to N of Exit 130	0.9	0.7	14.6	70.2
N of Exit 130 to S of Exit 130	2.4	2.1	16.7	70.1
S of Exit 130 to End	3.5	3.0	19.7	68.9
Total	21.5	19.7		65.6

Table 7-23: 2022 Build PM Peak Period – Southbound I-95 Express Lanes Travel Times

Segment	Length	Segment Travel Time	Cumulative Travel Time	Segment Speed
	(miles)	(minutes)	(minutes)	(mph)
Exit 148 to S of Exit 143	4.7	4.2	4.2	68.0
S of Exit 143 to S of Exit 140	3.1	2.8	6.9	68.1
S of Exit 140 to S of Exit 136	4.3	3.8	10.7	68.4
S of Exit 136 to End	2.0	1.7	12.4	69.2
Total	14.1	12.4		68.3

The results in the aforementioned figures and tables indicate a notable improvement relative to existing and 2022 No Build PM peak conditions. With the proposed I-95 Express Lanes in place, the southbound I-95 GP Lanes are projected to operate nearly free flow in 2022 with travel times approaching 20 minutes and overall speeds averaging 65 MPH. This is compared to 26 minutes and 49 mph for 2022 No Build conditions. Congestion is primarily limited to the area north of the I-95 / Russell Road interchange where heavy traffic volumes merging into the I-95 GP Lanes result in reduced speeds. Traffic speeds increase again after additional traffic enters the I-95 Express Lanes via the proposed southbound flyover south of Russell Road. With the I-95 Express Lanes, the bottleneck observed in the southbound GP lanes south of Exit 143 (at the righthand merge for the VA-610 eastbound and the left-hand merge from the Express Lanes) for 2022 No Build conditions is not projected to recur for 2022 Build conditions. Sufficient traffic is projected to travel in the I-95 Express Lanes to minimize potential congestion in this area.

The I-95 Express Lanes, serving southbound traffic during the PM peak, would operate free-flow with an average travel time of 12 minutes and average speeds exceeding 70 MPH.

The northbound I-95 GP lanes are projected to continue to operate under free flow conditions under 2022 Build conditions.

Proposed I-95 Express Lane Access Points

There are a number existing and proposed ramps providing access for vehicles to enter or exit the I-95 Express Lanes during the AM and PM peak periods. Of particular focus is whether these ramps would negatively impact operations in the areas of the proposed connections to the I-95 GPs lanes. **Table 7-24** and **Table 7-25** summarize the density and average travel speed for the AM peak hour and PM peak hour for each existing and proposed I-95 Express Lane access point south of the Russell Road interchange for 2022 Build conditions.

Table 7-24: 2022 Build AM Peak Hour – Express Lane Ramp Junction Operations

Access Point	Type	Link Density (veh/mi/ln)	Link Speed (mph)
I-95 Northbound Express Lanes to I-95 GP Lanes at Russell Road - **Proposed**	HOT Lane Diverge	7	70
	GP Lane Weave	16	68
I-95 Northbound GP Lanes to I-95 Express Lanes, north of VA-610- **Existing**	GP Lane Diverge	16	68
	HOT Lanes Merge	7	70
I-95 Northbound GP Lanes to I-95 Express Purpose Lanes, south of VA 610 (Left Entry Slip Ramp) – **Opened to Traffic Late 2017**	GP Lane Diverge	12	69
	HOT Lane Merge	6	70
I-95 Southbound Express Lanes Direct Ramp to Old Courthouse Road - **Proposed**	HOT Lane Merge	5	70
I-95 Northbound GP Lanes to I-95 Express Lanes, north of US 17 (Flyover) - **Proposed**	GP Lane Weave	14	65
	HOT Lane Merge	4	71
I-95 Northbound GP Lanes to I-95 Express Lanes, north of US 17 (Slip Ramp) - **Proposed**	GP Lane Diverge	12	66
	HOT Lane Link	8	69
Green = Light Congestion			

Table 7-25: 2022 Build PM Peak Hour – Express Lane Ramp Junction Operations

Access Point	Type	Link Density (veh/mi/ln)	Link Speed (mph)
I-95 Southbound GP to I-95 Express Lanes, South of Russell Road - **Proposed**	GP Lane Diverge	23	56
	HOT Lane Merge	11	68
I-95 Southbound Express Lanes to I-95 GP Lanes, at VA 610 (Flyover) - **Existing**	HOT Lane Diverge	10	68
	GP Lanes Weave	18	64
I-95 Southbound Express Lanes to I-95 GP Lanes, south of VA 610 (Left Entry Slip Ramp) – **Opens to Traffic Late 2017**	HOT Lane Diverge	9	68
	GP Lanes Merge	11	69
I-95 Southbound Express Lanes Direct Ramp to Old Courthouse Road - **Proposed**	HOT Lane Diverge	9	68
I-95 Southbound Express Lanes to I-95 GP Lanes (Left Entry Slip Ramp), at US 17 - **Proposed**	GP Lane Merge	6	70
	HOT Lane Terminus	4	69
I-95 Southbound Express Lanes to US 17 Collector-Distributor Road, at US 17 (Flyover) – **Proposed**	C-D Lane Weave	8	68
	HOT Lane Split	12	68
I-95 Southbound Express Lanes to VA-3 Collector-Distributor Road, at US 17 (Flyover) – **Proposed**	C-D Lane Merge	11	69
	HOT Lane Split	12	68
Green = Light Congestion			

The results in **Table 7-24** and **Table 7-25** indicate that under 2022 Build conditions, all the existing and proposed I-95 Express Lanes access points within the Study Area would operate well with low densities and free-flow travel speeds. As noted, there is congestion in the southbound I-95 GP lanes near the I-95/Russell Road interchange during the PM peak. This is due to heavy merging traffic entering I-95 from Russell Road, which was also a condition observed under 2022 No Build conditions.

7.4.2 Arterial Intersection Operational Analysis

Measures of effectiveness (MOEs) from the *VISSIM* outputs were used to document operations for 2022 Build conditions at the signalized intersections along the study segment of I-95. Overall intersection delay, average delay by movement, throughput by movement, and average and maximum queue lengths by movement were reported.

Table 7-12 provides a summary of the overall intersection delay by intersection for the AM and PM peak hours. Overall average delay values are color-coded to reflect various congestion levels based on delay as shown in **Table 7-2**. Summaries of the remaining intersection MOEs, including delay by movement, throughput by movement, average queues and maximum queues are provided in **Appendix O**.

AM Peak Period

The results in **Table 7-12** indicate that during the AM peak hour (7-8 AM), none of the nineteen study intersections would operate with severe congestion. One intersection would operate with heavy moderate. The remaining intersections would operate with light traffic overall.

PM Peak Period

The results in **Table 7-12** indicate that during the PM peak hour (5-6 PM), none of the nineteen study intersections would operate with severe or heavy congestion overall. Two intersections would operate with moderate traffic. The remaining intersections would operate with light traffic. These results are very similar to the 2022 No Build conditions with slight differences in delay noted at individual intersections.

7.5 2042 BUILD TRAFFIC OPERATIONS

7.5.1 Freeway Operational Analysis

AM Peak Period

Summaries of I-95 northbound and southbound GP lane travel speeds for the 3-hour AM peak modeling period are provided in **Figure 7-49** and **Figure 7-50.** A summary of travel speeds for the 3-hour AM peak modeling period are provided in **Figure 7-51** for the I-95 Express Lanes. A summary of overall freeway operations (density, speeds, and throughput) for the AM peak hour (7-8 AM) is provided in **Figure 7-52** for northbound I-95, in **Figure 7-53** for southbound I-95, and in **Figure 7-54** for the I-95 Express Lanes. These include all freeway segments, ramp junctions, and weaving segments. Similar summaries for the other two hours in the AM peak analysis period are provided in **Appendix P**.

Table 7-26 provides a summary of northbound GP lane travel times by segment and cumulative for the entire study corridor averaged over the AM peak period. **Table 7-27** provides a summary of southbound GP lane travel times by segment and cumulative for the entire study corridor averaged over the AM peak period. Table **7-28** provides a summary of the northbound I-95 Express Lanes travel times by segment and cumulative for the entire study corridor averaged over the AM peak period.

Figure 7-49: Build 2042 AM Period I-95 General Purpose Lane Speeds – Northbound

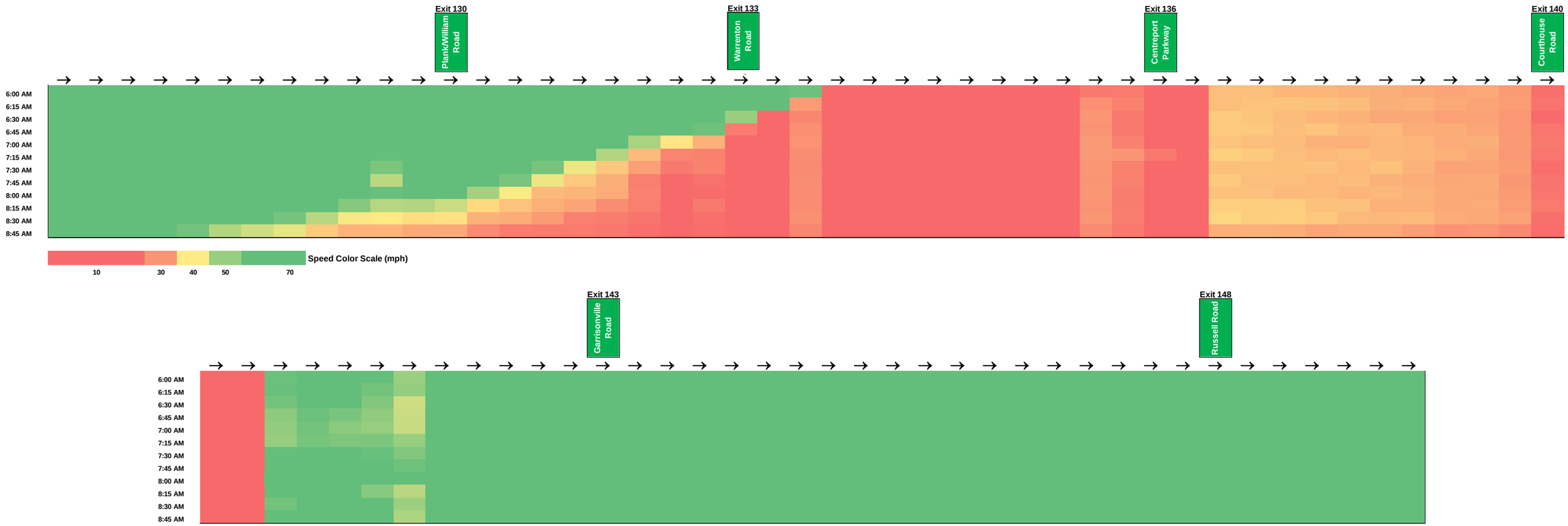


Figure 7-50: Build 2042 AM Period I-95 General Purpose Lane Speeds – Southbound

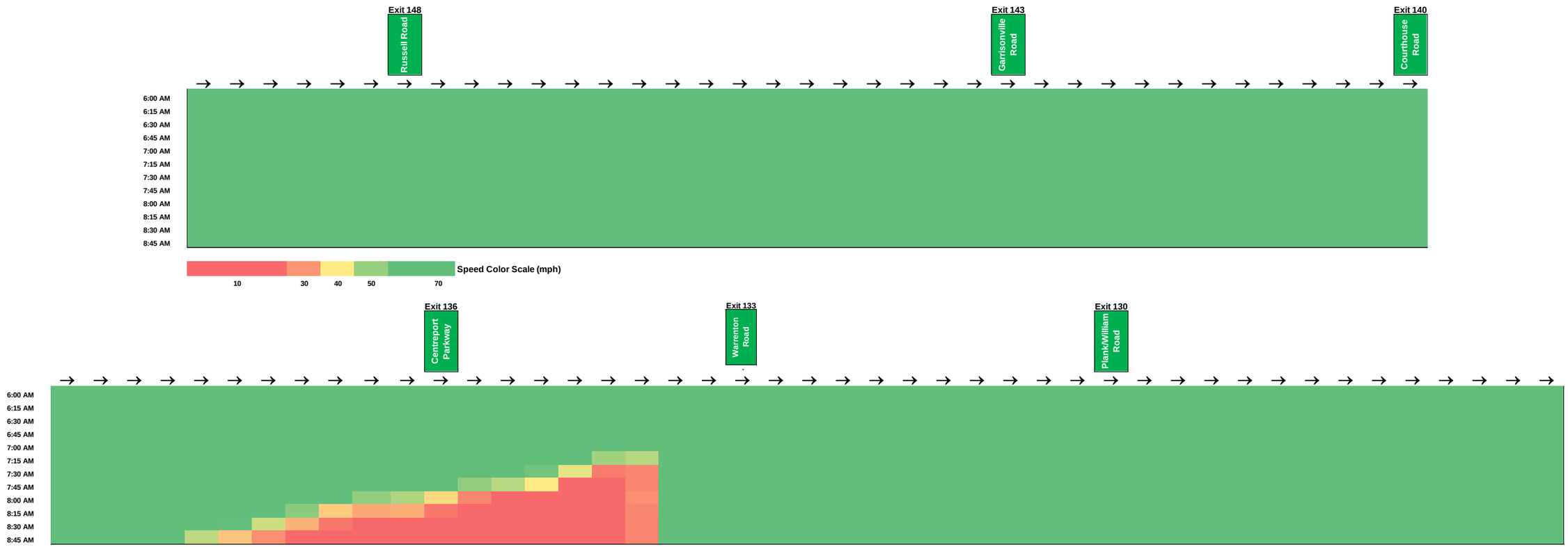


Figure 7-51: Build 2042 AM Period I-95 Express Lane Speeds – Northbound

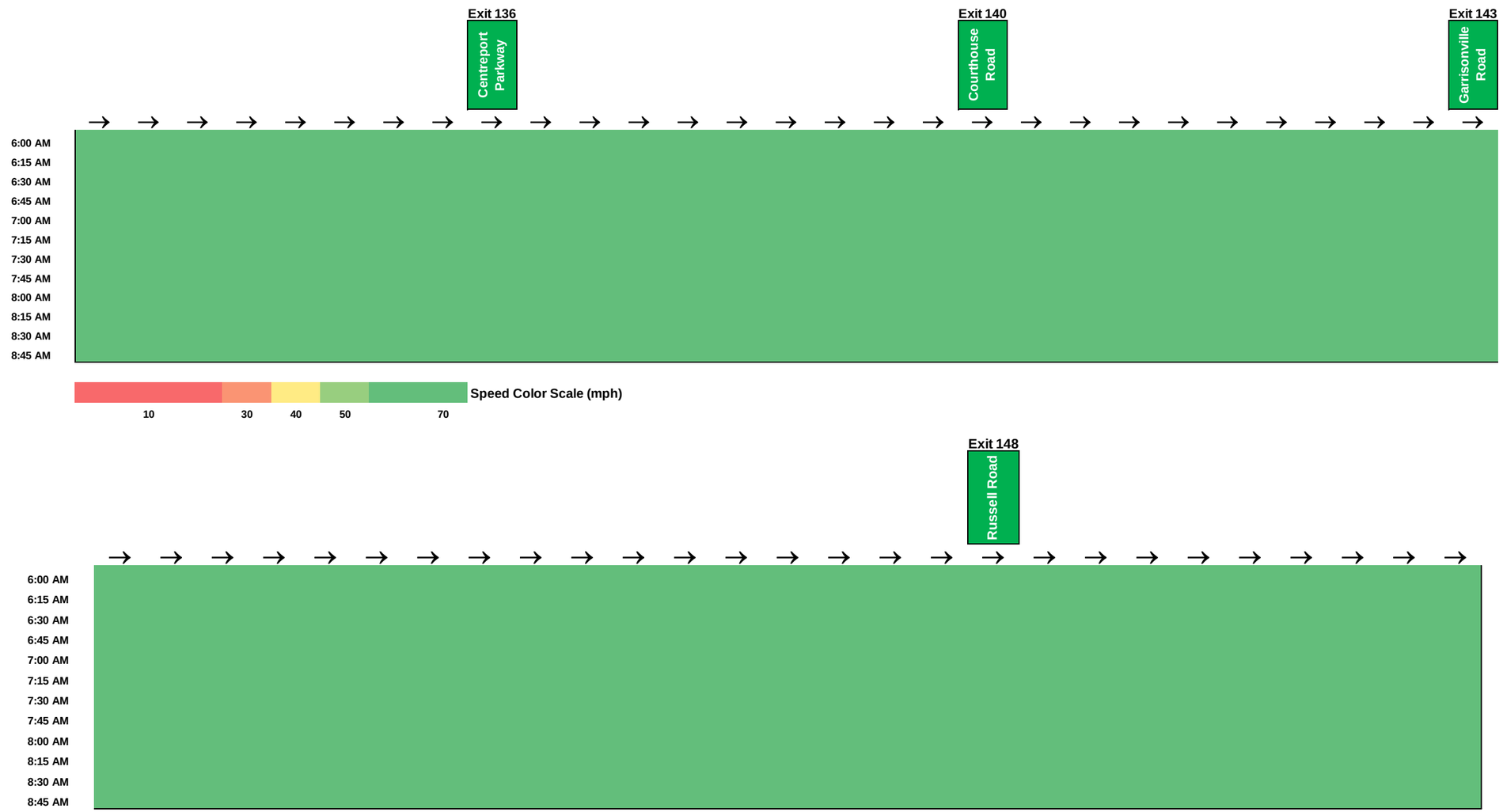


Figure 7-52: Build 2042 AM Peak Hour I-95 General Purpose Lane Operations – Northbound

Exit 130 Plank/William Road; Exit 133 Warrenton Road; Exit 136 Centreport Parkway

Speed	66	68	68	68	68	68	68	67	60	51	40	55	59	57	49	36	27	22	15	14	10	6	6	6	4	5	5	5	5	7	6	7	11	10	10
Density	29	29	29	29	29	29	29	29	33	40	37	34	24	30	36	50	67	82	99	100	96	147	149	129	145	144	153	153	142	140	143	140	61	78	75
Volume	5835	5839	5839	5837	5837	5836	5837	5837	5818	5808	5799	5331	5317	4398	4449	4394	4291	4186	4090	3888	3912	2567	2590	3699	2607	2616	2235	2946	2951	2769	2775	2780	2771	2313	2323
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	4	3	3	5	4	4	3	4	4	3	3	3	4	3	3
Length	18716	18716	18716	18716	18716	18716	18716	18716	18716	18716	640	1177	790	926	10707	10707	10707	10707	10707	10707	1234	1153	1583	1754	1178	646	529	1596	1525	5767	5767	5767	792	3610	3610

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road; Exit 143 Garrisonville Road

Speed	12	17	17	17	17	17	17	17	17	17	16	17	17	9	41	48	47	44	46	60	63	68	70	70	65
Density	66	61	62	61	62	61	61	61	60	60	46	59	58	119	34	29	30	32	30	22	21	14	16	16	14
Volume	3246	3074	3070	3070	3061	3065	3066	3075	3078	3034	2983	2989	2990	4156	4157	4165	4179	4190	4132	4007	3997	3957	3408	3305	3644
Lanes	4	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3	3	4	3	3	4
Length	579	16767	16767	16767	16767	16767	16767	16767	16767	16767	905	2004	2004	1471	9546	9546	9546	9546	9546	415	582	825	2162	2162	855

Exit 148 Russell Road

Speed	66	65	70	70	69	69	67	69	69	69	68	68	68	67	67	68	69	68	69	69	67	68	69	69	69
Density	17	14	18	18	18	18	14	17	17	17	17	17	17	17	17	17	13	13	13	13	11	15	14	14	14
Volume	3366	3712	3704	3703	3699	3699	3681	3516	3516	3512	3510	3501	3505	3507	3507	3507	3644	3637	2684	2685	2973	2970	2968	2968	2968
Lanes	3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	4	4	3	3	4	3	3	3	3
Length	759	1503	4675	4675	4675	1193	295	2416	2416	2563	2563	1445	2731	2731	2734	2734	1101	523	2455	2455	1083	394	3484	3484	789

Figure 7-53: Build 2042 AM Peak Hour I-95 General Purpose Lane Operations – Southbound

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	70	69	69	69	68	70	69	70	70	69	69	69	70	69	70	70	70	70	70	70	70	70	70	70	65
Density	15	15	15	15	11	10	8	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	8	9	9
Volume	3097	3096	3098	3097	3095	2146	2226	2233	2237	2241	2207	2240	2228	2241	2241	2243	2244	2243	2243	2241	2239	2220	2228	1908	2401
Lanes	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1467	2000	1888	838	602	851	968	492	1598	2000	237	2000	780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

Speed	69	69	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	66	60	58	58	57	50
Density	11	9	12	12	12	12	12	12	12	9	11	11	11	9	12	12	12	12	12	14	18	20	21	16	27
Volume	2319	2586	2584	2589	2579	2585	2585	2586	2588	2581	2242	2209	2231	2585	2585	2584	2585	2586	2588	2582	2560	2540	2537	2527	2396
Lanes	3	4	3	3	3	3	3	3	3	4	3	3	3	4	3	3	3	3	3	3	3	3	3	4	3
Length	928	1408	1613	782	2000	2000	2000	2000	1436	830	2000	27	1727	1711	2000	2000	2000	2000	2000	2000	2000	288	35	861	2000

Exit 133 Warrenton Road

Exit 130 Plank/William Road

Speed	45	36	27	13	9	7	62	69	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	69	70	70	70	70	70	70	70	70	70
Density	35	38	54	76	89	87	9	6	6	8	8	8	8	8	8	8	8	8	8	8	8	8	7	8	10	10	10	10	10	10	10	10	10
Volume	2344	2573	2475	2301	2200	2131	1638	1628	1639	1651	1659	1667	1674	1677	1680	1686	1694	1702	1707	1711	1714	1718	2335	2231	2155	2156	2160	2164	2169	2173	2178	2181	2184
Lanes	3	4	3	3	3	4	3	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3	3
Length	844	614	2000	2000	395	598	1017	1253	1549	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1281	868	1099	225	1954	2000	2000	2000	2000	2000	739

Figure 7-54: Build 2042 AM Peak Hour I-95 Express Lanes Operations – Northbound

Exit 136 Centreport Parkway; Exit 140 Courthouse Road; Exit 143 Garrisonville Road

Speed	62	69	69	70	71	71	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
Density	6	5	5	3	3	3	2	4	4	4	4	4	4	4	4	4	4	4	4	4	3	5	5	5	5	5	5	5	4
Volume	366	365	360	363	365	366	523	523	525	525	525	525	526	526	526	529	528	527	524	524	696	705	704	705	705	706	706	703	899
Lanes	1	1	1	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	3
Length	4309	4309	4309	4275	4275	4275	1097	25211	25211	25211	25211	25211	25211	25211	25211	25211	25211	25211	25211	25211	618	13368	13368	13368	13368	13368	13368	13368	1220

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 148 Russell Road

Speed	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
Density	6	6	7	6	6	7	7	5	8	8	8	8	5	6	6	6	6	7	7	7	7	6	7	7	7	7	7	7	7
Volume	908	912	913	913	909	913	914	1098	1093	1094	1101	1099	1099	909	909	910	910	913	914	915	916	910	917	918	919	921	923		
Lanes	2	2	2	2	2	2	2	3	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2		
Length	7600	7600	7600	7600	473	2511	2511	1084	373	1650	1415	961	782	979	2968	2968	1497	3348	3348	1567	789	693	1550	7285	7285	7285	7285		

Table 7-26: 2042 Build AM Peak Period – Northbound Travel Times

Segment	Length	Segment Travel Time	Cumulative Travel Time	Segment Speed
	(miles)	(minutes)	(minutes)	(mph)
Start to N of Exit 130	4.3	5.0	5.0	51.7
N of Exit 130 to S of Exit 133	1.8	4.5	9.5	23.4
S of Exit 133 to N of Exit 133	1.9	15.2	24.7	7.3
N of Exit 133 to N of Exit 136	2.7	22.5	47.2	7.1
N of Exit 136 to N of Exit 140	3.3	11.7	58.8	16.9
N of Exit 140 to N of Exit 143	3.2	6.5	65.3	34.3
N of Exit 148	4.6	4.0	69.3	68.8
Total	21.7	69.3		18.8

Table 7-27: 2042 Build AM Peak Period – Southbound Travel Times

Segment	Length	Segment Travel Time	Cumulative Travel Time	Segment Speed
	(miles)	(minutes)	(minutes)	(mph)
S of Exit 148 to S of Exit 143	4.7	4.1	4.1	69.4
S of Exit 143 to S of Exit 140	3.1	2.7	6.8	69.6
S of Exit 140 to S of Exit 136	4.3	8.4	14.6	32.7
S of Exit 136 to S of Exit 133	2.7	6.1	20.9	25.4
S of Exit 133 to N of Exit 130	0.9	1.7	22.6	69.8
N of Exit 130 to S of Exit 130	2.4	2.1	24.7	69.7
S of Exit 130 to End	3.5	3.0	27.7	69.5
Total	21.5	27.7		49.0

Table 7-28: 2042 Build AM Peak Period – Northbound I-95 Express Lanes Travel Times

Segment	Length	Segment Travel Time	Cumulative Travel Time	Segment Speed
	(miles)	(minutes)	(minutes)	(mph)
Start to N of Exit 136	2.7	2.3	2.3	70.3
N of Exit 136 to N of Exit 140	3.3	2.8	5.1	71.0
N of Exit 140 to N of Exit 143	3.7	3.1	8.2	70.9
N of Exit 143 to N of Exit 148	4.6	3.9	12.1	70.5
N of Exit 148 to N of Exit 150	2.2	1.9	14.0	70.3
Start to N of Exit 136	16.4	14.0		70.6

Even with the proposed I-95 Express Lanes in place, the northbound I-95 GP Lanes are projected to operate poorly in 2042 with lengthy travel times and overall speeds averaging 18 MPH. However, this compares favorably to average speeds of 15 mph for 2042 No Build conditions. Speeds between Exits 133 and Exit 140 are slightly lower under 2042 Build conditions; with the Express Lanes in place, some traffic diverts from the GP lanes just north of Exit 133, that alleviates some of the congestion and metering south of this point which occurs under 2042 No Build conditions. Additional demand is served in the GP lanes and results in slightly reduced speeds between Exit 133 and Exit 140 (approaching the next Express Lane access point). Overall, the backups along the I-95 northbound GP lanes would be reduced compared to 2042 No Build conditions; this is most apparent for the segments south of Exit 133, where average speeds would nearly double compared to 2042 No Build conditions. As noted for 2042 No Build conditions, the key bottleneck is the merge into the I-95 GP lanes from the on-ramp from VA-630 (Courthouse Road). High merging volumes combine with high mainline volumes and result in severe congestion extending upstream to and beyond Exit 133 (Warrenton Rd/US 17). Consideration could be given to future improvements to provide additional capacity in the segment between Courthouse Road and Garrisonville Road.

The I-95 Express Lanes, serving northbound traffic during the AM peak, would operate free-flow with an average travel time of 14 minutes and average speeds exceeding 70 MPH.

Along the southbound I-95 GP lanes, traffic operations would generally be free flow during the AM peak period. Similar to the 2042 No Build conditions, there is some congestion noted near the I-95 / US 17 interchange towards the end of the analysis period. Based on a review of the simulations, this is due to the congestion along the I-95 northbound GP lanes. Spillback along I-95 northbound and the associated on-ramps at US 17 eventually impacts operations along US 17. Later in the analysis period, queues along US 17 due to traffic queuing to access I-95 spills back and impacts the off-ramps from I-95 southbound, resulting in congestion in a short segment of the southbound I-95 GP lanes. Build 2042 AM peak travel times are projected to be slightly worse along the southbound direction; this is likely due to higher demand attempting to access I-95 at the US 17 interchange with the addition of the Express Lanes, resulting in an increase in congestion along US 17. The arterial analysis results bear this out, with some increase in delay at the US 17 / Gateway Drive intersection; queuing from this intersection could also impact the I-95 southbound GP lanes during the AM Peak hour. Any future Improvements to mitigate the

northbound GP lane congestion would be expected to also help address the issues identified along I-95 southbound during the AM peak period.

It should also be noted that the projected I-95 Express Lane volumes during the AM peak hour are approximately 1,100 to 1,900 vehicles. This compared to projected I-95 Express Lane volumes during the PM peak hour of approximately 1,900 to 2,500 vehicles. Given the levels of congestion observed in the I-95 northbound GP lanes during the AM peak period, it may be reasonable to assume that higher volumes (similar to those projected during the PM peak hour) may use the northbound I-95 Express Lanes. The projections for the Express Lanes are based on the MWCOG model assignments which indicated the trends with higher Express Lanes volumes during the PM peak period. It is important to remember that the volume assigned to the Express Lanes is a function of the congestion in the GP lanes and the toll pricing for the facility. The localized congestion within the Study Area is higher northbound, but the Express Lanes assignments consider total trip lengths and the presence of congestion north of the study area when determining the route assignment. North of the study area, southbound I-95 GP lane congestion during the PM peak period is worse than northbound congestion during the AM peak period, this contributes to the volume assignment pattern noted.

PM Peak Period

Summaries of I-95 northbound and southbound GP lane travel speeds for the 4-hour PM peak modeling period for 2022 Build conditions are provided in **Figure 7-55** and **Figure 7-56**. A summary of travel speeds for the 4-hour PM peak modeling period are provided in **Figure 7-57** for the I-95 Express Lanes. A summary of overall freeway operations (density, speeds, and throughput) for the PM peak hour (5-6 PM) is provided in **Figure 7-58** for northbound I-95, in **Figure 7-59a** for southbound I-95, in **Figure 7-59b** for the southbound I-95 collector-distributor road between Exits 133 and 130, and in **Figure 7-60** for the I-95 Express Lanes. These include all freeway segments, ramp junctions, and weaving segments. Similar summaries for the other three hours in the PM peak analysis period are provided in **Appendix P**.

Table 7-29 provides a summary of northbound GP lane travel times by segment and cumulative for the entire study corridor averaged over the PM peak period. **Table 7-30** provides a summary of southbound GP lane travel times by segment and cumulative for the entire study corridor averaged over the PM peak period. **Table 7-31** provides a summary of southbound I-95 Express Lanes travel times by segment and cumulative for the entire study corridor averaged over the PM peak period.

Figure 7-55: Build 2042 PM Period I-95 General Purpose Lane Speeds – Northbound

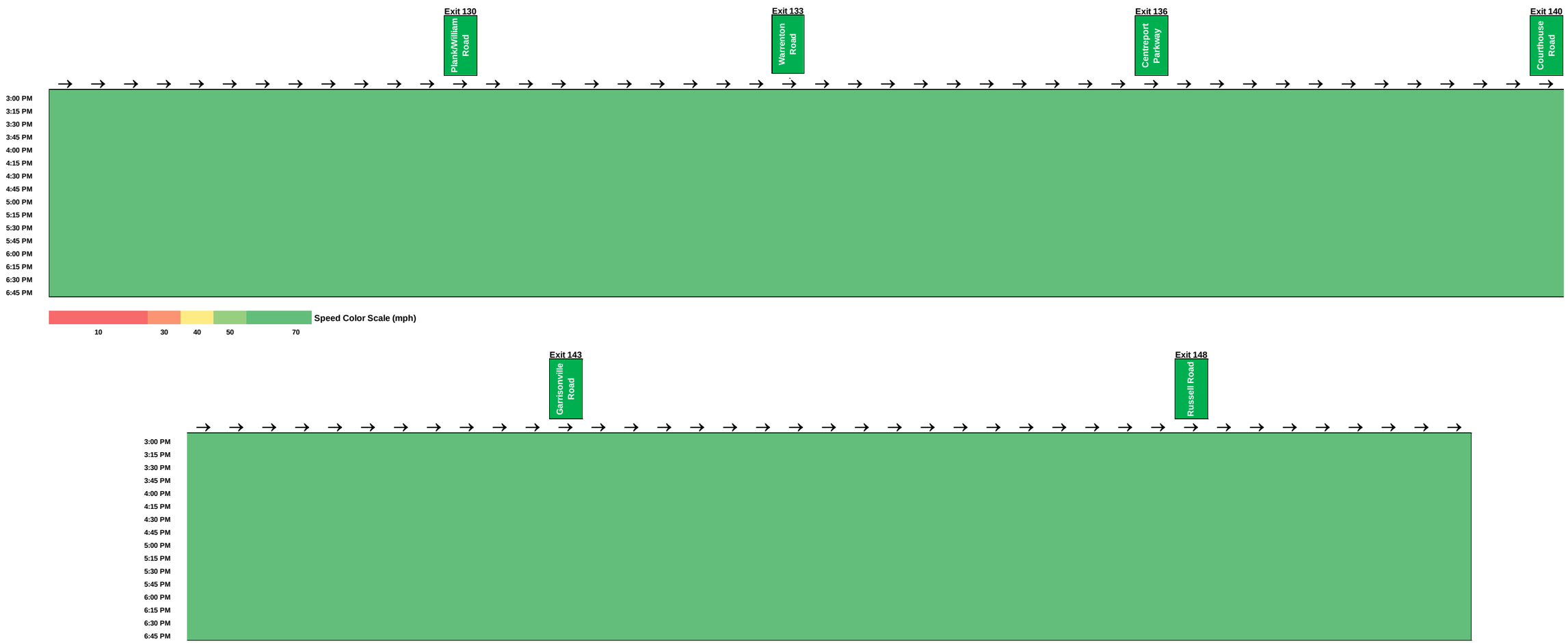
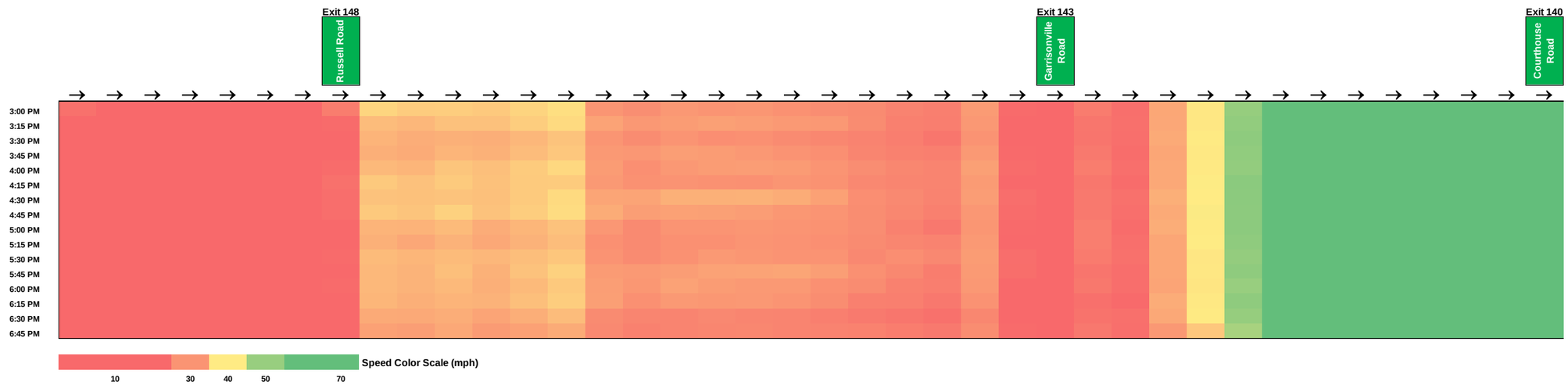


Figure 7-56: Build 2042 PM Period I-95 General Purpose Lane Speeds – Southbound



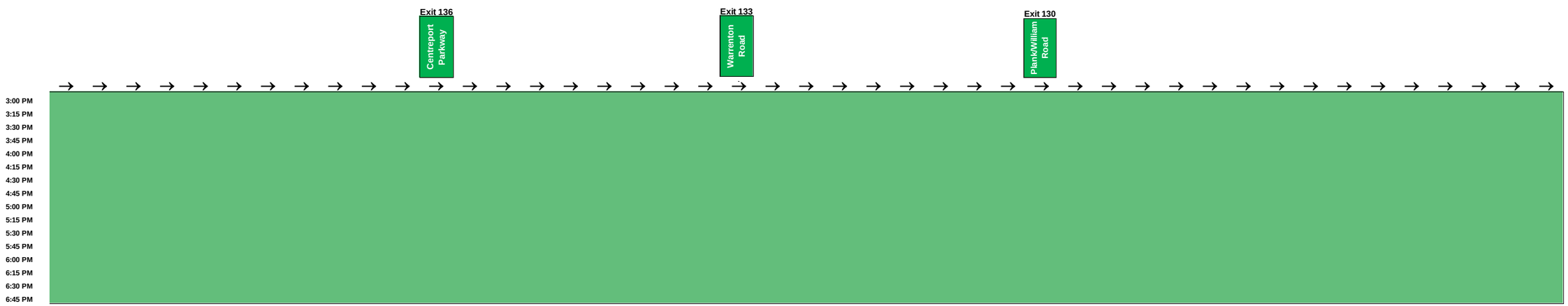


Figure 7-57: Build 2042 PM Period I-95 Express Lane Speeds – Southbound

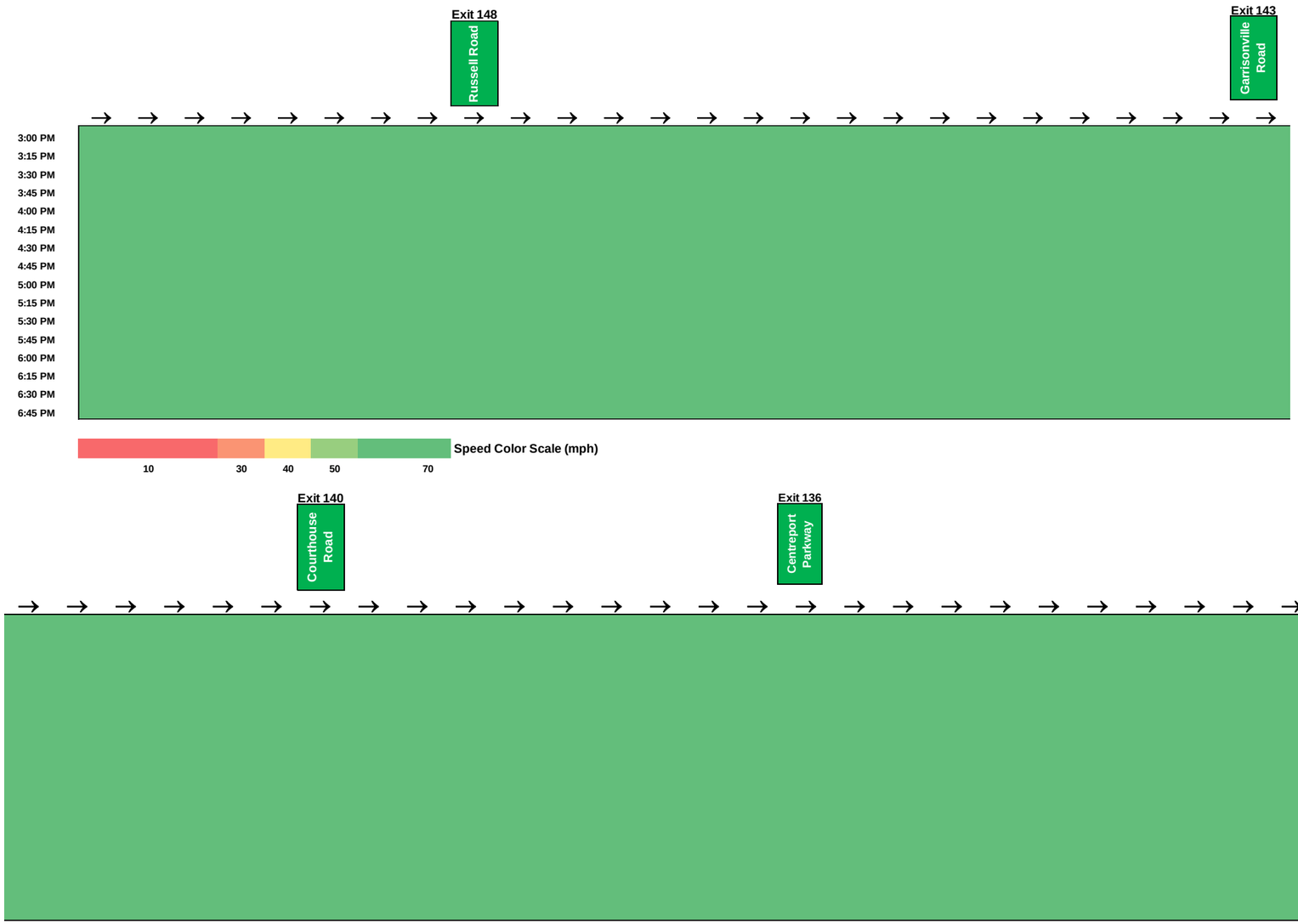


Figure 7-58: Build 2042 PM Peak Hour I-95 General Purpose Lane Operations – Northbound

Exit 130 Plank/William Road; Exit 133 Warrenton Road; Exit 136 Centreport Parkway

Speed	68	69	69	69	69	69	69	68	68	68	63	66	69	69	69	69	69	69	69	69	67	69	70	69	69	69	66	68	69	68	68	69	69	69
Density	21	20	20	20	20	20	20	20	20	20	16	18	13	15	16	16	16	16	16	15	12	11	11	9	12	16	15	19	19	19	19	14	17	17
Volume	4173	4170	4168	4165	4163	4159	4158	4154	4153	4152	4143	3589	3589	3184	3248	3257	3258	3254	3252	3132	3203	2346	2370	3272	3246	3276	3931	3939	3940	3932	3924	3913	3425	3428
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	4	3	3	5	4	3	4	3	3	3	3	4	3	3
Length	18716	18716	18716	18716	18716	18716	18716	18716	18716	18716	640	1177	790	926	10707	10707	10707	10707	10707	10707	1234	1164	1770	1754	1206	1273	1601	7313	7313	7313	7313	792	3610	3610

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road; Exit 143 Garrisonville Road

Speed	68	68	69	69	69	69	69	68	68	69	69	69	69	68	69	69	68	68	68	69	70	69	69	65
Density	14	19	18	18	18	18	18	18	18	16	16	16	14	19	19	19	19	19	19	19	14	17	16	16
Volume	3783	3784	3783	3778	3772	3773	3779	3778	3775	3397	3369	3399	3939	3946	3942	3930	3924	3925	3926	3916	3880	3499	3393	4059
Lanes	4	3	3	3	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	4	3	3	4
Length	579	15331	15331	15331	15331	15331	15331	15331	15331	519	905	1998	1471	9546	9546	9546	9546	9546	415	582	825	2162	2162	855

Exit 148 Russell Road

Speed	67	69	68	69	69	69	70	69	68	68	67	67	67	65	66	68	67	66	68	67	63	63	67	68	68	67	68
Density	18	14	19	19	19	19	14	19	19	19	20	19	20	20	20	19	19	15	18	18	17	23	21	21	21	21	21
Volume	3698	3947	3938	3944	3948	3949	3936	3951	3947	3943	3942	3933	3938	3941	3941	3936	3918	3899	3652	3652	4280	4281	4281	4282	4282	4268	4284
Lanes	3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
Length	759	1503	4675	4675	4675	1193	295	2416	2416	2563	2563	1445	2731	2731	2881	2881	942	519	2455	2455	1083	394	3484	3484	789	685	1711

Figure 7-59a: Build 2042 PM Peak Hour I-95 General Purpose Lane Operations – Southbound

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	8	8	8	8	8	8	8	11	16	16	17	17	17	16	13	13	13	12	13	13	13	13	13	13	13	11	14
Density	124	123	121	123	123	94	124	83	77	77	76	74	74	61	87	88	88	89	89	89	88	87	88	88	70	86	65
Volume	2939	2938	2943	2940	2929	2932	2822	3785	3798	3799	3800	3737	3781	3799	3321	3332	3331	3337	3346	3335	3335	3331	3334	3311	3515	2874	3583
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1943	1467	3888	3888	838	602	851	969	499	1598	2237	2237	240	739	1780	1403	2551	2551	8765	8765	8765	8765	8765	635	820	1026	707

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

Speed	17	17	26	32	47	64	66	67	67	67	68	68	68	68	69	67	68	68	68	68	68	68	66	65	67
Density	70	70	38	44	35	26	25	25	25	25	18	21	21	21	17	23	22	22	22	22	22	14	23	18	20
Volume	3497	4770	4891	4932	4944	4930	4944	4944	4943	4942	4932	4297	4234	4294	4544	4562	4559	4561	4563	4561	4563	2863	4562	4563	4061
Lanes	3	4	5	4	3	3	3	3	3	3	4	3	3	3	4	3	3	3	3	3	3	3	3	4	3
Length	928	999	403	1613	782	9436	9436	9436	9436	9436	830	2027	2027	1717	1712	14142	14142	14142	14142	14142	14142	14142	922	861	2844

Exit 133 Warrenton Road

Exit 130 Plank/William Road

Speed	68	65	68	68	68	69	69	69	70	70	70	70	70	70	70	70	70	70	70	70	70	70	66	64	60	66	68	68	68	68	68	68	68
Density	20	17	22	22	22	16	13	12	9	9	8	10	10	10	10	10	10	10	10	10	10	10	15	19	28	25	24	24	24	24	24	24	24
Volume	4062	4521	4519	4515	4517	4428	4403	3367	1911	1926	2174	2173	2176	2176	2174	2174	2175	2173	2173	2171	2171	2171	4956	4951	4952	4952	4950	4949	4952	4948	4947	4949	4946
Lanes	3	4	3	3	3	4	5	4	3	3	4	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3	3
Length	2844	614	5406	5406	5406	862	1277	1247	2103	2103	1797	21368	21368	21368	21368	21368	21368	21368	21368	21368	21368	21368	868	1099	225	1954	12739	12739	12739	12739	12739	12739	12739

Figure 7-59b: Build 2042 PM Peak Hour I-95 Collector-Distributor Lane Operations – Southbound between Exit 133 and Exit 130

Exit 133 Warrenton Road

Exit 130 Plank/William Road

Speed	70	70	70	69	68	69	69	67	65	67	68	69	69	69	68	69	68	67	61	66	59	65	68	66	65
Density	10	10	11	16	16	16	12	19	15	15	19	19	19	14	19	14	19	20	16	15	15	15	14	14	21
Volume	1433	1465	2270	2252	2221	2253	2432	2528	3865	3906	3916	3907	3904	3901	3904	3908	3918	3927	3920	1977	2554	1961	1963	2773	2785
Lanes	2	2	3	2	2	2	3	2	4	4	3	3	3	4	3	4	3	3	4	2	3	2	2	3	2
Length	347	550	921	860	1089	1000	597	599	696	1255	4494	4494	4494	411	1119	1651	3139	3139	671	1080	736	753	256	1256	1221

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) **Volume (vph)** **Lanes (#)** **Length (ft)**

Figure 7-60: Build 2042 PM Peak Hour I-95 Express Lane Operations –Southbound

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	69	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	67	67	69	68	67	68	68
Density	10	10	11	11	11	11	11	11	11	11	11	11	11	11	11	11	9	14	14	9	14	14	13	13
Volume	1429	1433	1436	1436	1440	1441	1436	1447	1450	1451	1449	1452	1445	1448	1443	1446	1911	1919	1911	1919	1911	1908	1725	1730
Lanes	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	3	2	2	2	2
Length	7285	7285	7285	7285	1550	693	789	1567	3348	3348	1497	2968	2968	2735	2735	891	1207	986	373	1084	3053	3053	8439	8439

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

Speed	68	68	68	68	68	68	68	68	68	68	68	68	69	69	68	68	68	68	68	68	68	68	68	68	68	68	68	68	69	69	69
Density	13	13	13	8	11	11	11	11	11	11	11	8	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	4	4	3
Volume	1728	1728	1717	1703	1556	1560	1557	1560	1561	1564	1565	1556	1355	1363	1366	1367	1368	1370	1370	1372	1371	1371	1373	1377	1380	1376	1372	1367	247	248	241
Lanes	2	2	2	3	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1
Length	8439	8439	8439	761	12907	12907	12907	12907	12907	12907	12907	808	31807	31807	31807	31807	31807	31807	31807	31807	31807	31807	31807	31807	31807	31807	31807	31807	4225	4225	4225

Table 7-29: 2042 Build PM Peak Period – Northbound Travel Times

Segment	Length	Segment Travel Time	Cumulative Travel Time	Segment Speed
	(miles)	(minutes)	(minutes)	(mph)
Start to N of Exit 130	4.3	3.8	3.8	68.2
N of Exit 130 to S of Exit 133	1.8	1.5	5.3	69.0
S of Exit 133 to N of Exit 133	1.9	1.6	6.9	68.6
N of Exit 133 to N of Exit 136	2.7	2.3	9.3	68.3
N of Exit 136 to N of Exit 140	3.3	2.9	12.2	68.5
N of Exit 140 to N of Exit 143	3.2	2.9	15.1	67.0
N of Exit 148	4.6	4.1	19.1	68.2
Total	21.7	19.1		67.6

Table 7-30: 2042 Build PM Peak Period – Southbound Travel Times

Segment	Length	Segment Travel Time	Cumulative Travel Time	Segment Speed
	(miles)	(minutes)	(minutes)	(mph)
S of Exit 148 to S of Exit 143	4.7	21.5	21.5	13.2
S of Exit 143 to S of Exit 140	3.1	3.9	25.4	48.3
S of Exit 140 to S of Exit 136	4.3	3.8	29.2	67.5
S of Exit 136 to S of Exit 133	2.7	2.3	31.5	69.5
S of Exit 133 to N of Exit 130	0.9	0.7	32.2	70.0
N of Exit 130 to S of Exit 130	2.4	2.1	34.3	69.9
S of Exit 130 to End	3.5	3.1	37.4	68.0
Total	21.5	37.4		34.6

Table 7-31: 2042 Build PM Peak Period – Southbound I-95 Express Lanes Travel Times

Segment	Length	Segment Travel Time	Cumulative Travel Time	Segment Speed
	(miles)	(minutes)	(minutes)	(mph)
Exit 148 to S of Exit 143	4.7	4.2	4.2	67.7
S of Exit 143 to S of Exit 140	3.1	2.8	6.9	68.5
S of Exit 140 to S of Exit 136	4.3	3.8	10.7	68.5
S of Exit 136 to End	2.0	1.7	12.4	68.1
Total	14.1	12.4		68.2

The results in the aforementioned figures and tables indicate similar results to the 2042 No Build conditions. There is severe congestion projected beginning south of the I-95 / VA-610 interchange at Garrisonville Road (Exit 143). At this location, the righthand merge from Garrisonville Road eastbound on-ramp and the left-hand merge from the I-95 Express Lanes (Southern Terminus Extension project) would occur at essentially the same point. This creates an initial bottleneck which extends north towards Russell Road. Under 2042 Build conditions, higher traffic volumes were projected to access I-95 southbound from VA-610 compared to No Build conditions. This increased on-ramp traffic appears to worsen this projected bottleneck with a further reduction in speeds relative to 2042 No Build conditions. Additionally, with increased I-95 Express Lane traffic, additional traffic is able to enter the study area from the north (compared to No Build conditions) due to a lesser upstream metering effect; this additional traffic worsens the congestion at the bottleneck between Exits 143 and 140.

South of this bottleneck, travel speeds and travel times are similar between the 2042 No Build and Build conditions. Overall vehicle throughput traveling southbound would also be expected to substantially higher (see **Section 7.7**) for 2042 Build conditions. As was noted under 2042 No Build conditions, the existing bottleneck near the I-95 / US 17 interchange at Warrenton Road (Exit 133) is not present. The proposed I-95 Southbound Rappahannock River Crossing improvements provide 3 additional lanes of southbound capacity in this area and separate US 17 and VA-3 traffic from through traffic along southbound I-95. This improved capacity combined with the effects of upstream metering resulted in free-flow operations for the I-95 GP lane segments south of the I-95 / VA-630 interchange at Courthouse Road (Exit 140).

There is an additional southbound bottleneck which forms at the merge to the southbound I-95 GP lanes from Russell Road (Exit 143). A portion of this entering traffic from Russell Road utilizes the downstream ramp to access the I-95 Express Lanes; a direct connection between Russell Road and the I-95 Express Lanes was considered (see Chapter 4 – Alternatives Analysis), but this connection was determined not to be feasible due to potential impacts to natural and cultural resources and engineering constraints with the connection to Russell Road. The bottleneck at Russel Road is consistent with 2042 No Build conditions; however, the congestion along southbound I-95 is worse in this area due to the downstream bottleneck at Garrisonville Road (Exit 143).

A supplemental analysis (see Section 7.6.2) was conducted to determine if improvements to the I-95 southbound GP lanes would mitigate the issues identified for the Build Alternative.

The I-95 Express Lanes, serving southbound traffic during the PM peak, would operate free-flow with an average travel time of 14 minutes and average speeds exceeding 70 MPH.

Along the northbound I-95 GP lanes, traffic operations would generally operate free flow during the PM peak period. One segment, between Exit 136 (Centreport Parkway) and Exit 140 (Courthouse Road) shows an improvement relative to 2042 No Build conditions. In this segment, some minor spillback from the off-ramp to Courthouse Road impacts the northbound I-95 GP lanes under 2042 No Build conditions. This appears to result from heavy demand utilizing Courthouse Road to access US 1 and other parallel routes. Under Build conditions, this condition is addressed and free-flow conditions are noted throughout the GP lanes in the northbound direction.

Proposed I-95 Express Lane Access Points

There are a number existing and proposed ramps providing access for vehicles to enter or exit the I-95 Express Lanes during the AM and PM peak periods. Of particular focus is whether these ramps would negatively impact operations in the areas of the proposed connections to the I-95 GP lanes. **Table 7-32** and **Table 7-33** summarize the density and average travel speed for the AM and PM peak hours for I-95 Express Lane access point south of the Russell Road interchange for 2042 Build conditions.

Table 7-32: 2042 Build AM Peak Hour – Express Lane Ramp Junction Operations

Access Point	Type	Link Density (veh/mi/ln)	Link Speed (mph)
I-95 Northbound Express Lanes to I-95 GP Lanes at Russell Road - **Proposed**	HOT Lane Diverge	5	70
	GP Lane Weave	13	68
I-95 Northbound GP Lanes to I-95 Express Lanes, north of VA-610- **Existing**	GP Lane Diverge	14	67
	HOT Lanes Merge	5	70
I-95 Northbound GP Lanes to I-95 Express Lanes, south of VA 610 (Left Entry Slip Ramp) – **Opened to Traffic Late 2017**	GP Lane Diverge	14	68
	HOT Lane Merge	3	71
Old Courthouse Road Direct Ramp to I-95 Express Lanes - **Proposed**	HOT Lane Merge	3	70
I-95 Northbound GP Lanes to I-95 Express Lanes, north of US 17 (Flyover) - **Proposed**	GP Lane Weave	142	5
	HOT Lane Merge	2	70
I-95 Northbound GP Lanes to I-95 Express Lanes, north of US 17 (Slip Ramp) - **Proposed**	GP Lane Diverge	95	10
	HOT Lane Link	6	62
Green = Light Congestion; Yellow = Moderate Congestion; Orange = Heavy Congestion; Red = Severe Congestion			

Table 7-33: 2022 Build PM Peak Hour – Express Lane Ramp Junction Operations

Access Point	Type	Link Density (veh/mi/ln)	Link Speed (mph)
I-95 Southbound GP to I-95 Express Lanes, South of Russell Road - **Proposed**	GP Lane Diverge	61	16
	HOT Lane Merge	9	68
I-95 Southbound Express Lanes to I-95 GP Lanes, at VA 610 (Flyover) - **Existing**	HOT Lane Diverge	9	69
	GP Lanes Weave	70	13
I-95 Southbound Express Lanes to I-95 GP Lanes, south of VA 610 (Left Entry Slip Ramp) – **Opens to Traffic Late 2017**	HOT Lane Diverge	8	68
	GP Lanes Merge	44	32
I-95 Southbound Express Lanes Direct Ramp to Old Courthouse Road - **Proposed**	HOT Lane Diverge	8	68
I-95 Southbound Express Lanes to I-95 GP Lanes (Left Entry Slip Ramp), at US 17 - **Proposed**	GP Lane Merge	8	70
	HOT Lane Terminus	3	69
I-95 Southbound Express Lanes to US 17 Collector-Distributor Road, at US 17 (Flyover) – **Proposed**	C-D Lane Weave	11	67
	HOT Lane Split	10	68
I-95 Southbound Express Lanes to VA-3 Collector-Distributor Road, at US 17 (Flyover) – **Proposed**	C-D Lane Merge	11	69
	HOT Lane Split	10	68

Green = Light Congestion

Yellow = Moderate Congestion

Orange = Heavy Congestion

Red = Severe Congestion

The results in **Table 7-32** and **Table 7-33** confirm adequate operations within the I-95 Express Lanes in both the morning and afternoon peaks under 2042 Build conditions. In the AM, there are three locations noted where the junction along the I-95 northbound GP lanes would operate poorly. In each of these cases, the cause of this poor operation is spillback from the downstream bottleneck north of the I-95 / VA-630 interchange (Exit 140). As noted in previous sections, this bottleneck results in queuing which extends nearly 10 miles upstream under projected 2042 traffic conditions (both No Build and Build), which negatively impacts the operations of all roadway segments in these areas. The analysis of the existing and

proposed I-95 Express Lanes ramp junctions for 2022 Build conditions indicated that the ramp junctions along I-95 northbound would operate well when not impacted by downstream congestion.

In the PM, there are three locations noted where the junction along the I-95 southbound GP lanes would operate poorly. The first two locations travelling southbound are upstream of the primary southbound I-95 bottleneck in the study area under 2042 No Build conditions. The poor operations within these segments is consistent with the adjacent segments of the I-95 southbound GP lanes and is due to the downstream congestion severely impacting vehicle speeds through this area. The third location is located at the bottleneck itself and the poor operations are caused by the combination of heavy merging traffic from the right from VA-610 and the merging traffic from the left from the I-95 Express Lanes. The analysis of the existing and proposed I-95 Express Lanes ramp junctions for 2022 Build conditions indicated that the ramp junctions along I-95 southbound would operate well when not impacted by downstream congestion.

7.5.2 Arterial Intersection Operational Analysis

Measures of effectiveness (MOEs) from the VISSIM outputs were used to document operations for 2042 Build conditions at the signalized intersections along the study segment of I-95. Overall intersection delay, average delay by movement, throughput by movement, and average and maximum queue lengths by movement were reported. **Table 7-17** provides a summary of the overall intersection delay by intersection for the AM and PM peak hours. Overall average delay values are color-coded to reflect various congestion levels based on delay as shown in **Table 7-2**. Summaries of the remaining intersection MOEs, including delay by movement, throughput by movement, average queues and maximum queues are provided in **Appendix P**.

AM Peak Period

The results in **Table 7-17** indicate that during the AM peak hour (7-8 AM), three of the nineteen study intersections, or 16 percent, would operate with severe congestion. One additional intersection would operate with heavy congestion. This compares to six study intersections operating with severe congestion under 2042 No Build AM conditions. The remaining intersections would operate with light to moderate traffic. One of three intersections which would operate with severe congestion is located at the US 17 (Exit 133) interchange. This intersection is impacted by the severe congestion noted along the I-95 northbound GP lanes. Mainline I-95 congestion would spill back to the ramps at Exit 133, impeding traffic flow along the arterial streets and resulting in poor operations. Due to the reduced congestion overall in the northbound I-95 GP lanes, the intersections at the VA-3 interchange (Exit 130) would operate better under 2042 Build conditions than under 2042 No Build conditions. Another intersection which degrades under 2042 Build conditions is the SB I-95 Ramps at Courthouse Road; additional traffic attempts to access I-95 northbound at this interchange under Build conditions and spillback from the merge along the I-95 northbound GP lanes results increased delay at this location.

PM Peak Period

The results in **Table 7-17** indicate that during the PM peak hour (5-6 PM), none of the nineteen study intersections would operate with severe congestion. One intersection would operate with heavy congestion. The remaining intersections would operate with light to moderate traffic. Particularly at the southern end of the model area at Exit 133 and Exit 130, the upstream congestion along I-95 meters the arriving volumes during the peak period.

7.6 ADDITIONAL IMPROVEMENT OPTIONS

7.6.1 Northbound I-95 General Purpose Lanes

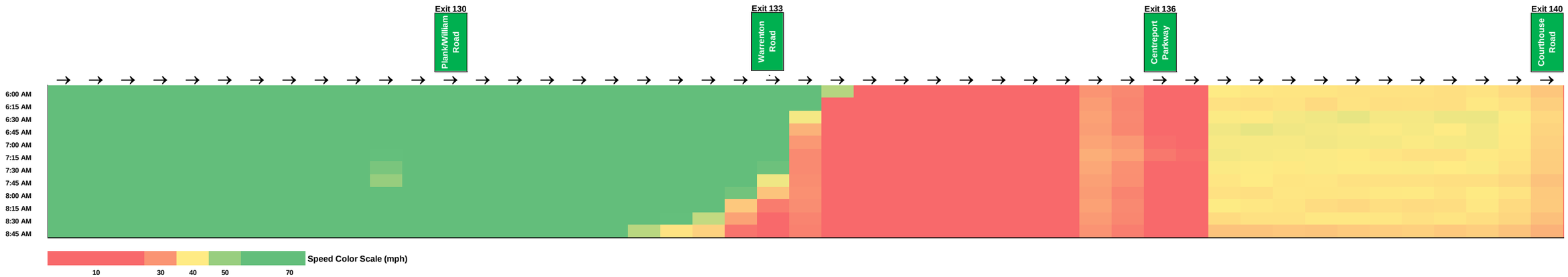
As noted in Section 7.5.1, with the Build Alternative in place in 2042, there remains substantial congestion in the northbound I-95 GP lanes during the AM peak. The proposed Build Alternative results in a 15 percent improvement in northbound general purpose lane travel times compared to 2042 No Build conditions, but overall operations in the GP lanes would be poor. A critical bottleneck was identified at the I-95 interchange with Route 630 / Courthouse Road (Exit 140). The northbound on-ramp serves a high volume of entering traffic, which must merge into a high volume of mainline traffic. This merge fails during the AM peak and results in spillback in the I-95 northbound GP lanes. That northbound congestion is severe enough in the simulations to spillback to the US 17 interchange at Exit 133.

It was posited that some of these issues could be mitigated by additional improvements within the northbound GP lanes. A supplemental analysis was undertaken to assess the potential benefits of adding a continuous auxiliary lane along northbound I-95, between Courthouse Road (Exit 140) and Garrisonville Road (Exit 143). This scenario also assumes a corresponding auxiliary lane is provided in the southbound direction between the same two interchanges.

Summaries of I-95 northbound and southbound GP lane travel speeds for the 3-hour AM peak modeling period are provided in **Figure 7-61** and **Figure 7-62.** A summary of travel speeds for the 3-hour AM peak modeling period are provided in **Figure 7-63** for the I-95 Express Lanes. A summary of overall freeway operations (density, speeds, and throughput) for the AM peak hour (7-8 AM) is provided in **Figure 7-64** for northbound I-95, in **Figure 7-65** for southbound I-95, and in **Figure 7-66** for the I-95 Express Lanes. These include all freeway segments, ramp junctions, and weaving segments.

Table 7-34 provides a summary of northbound GP lane travel times by segment and cumulative for the entire study corridor averaged over the AM peak period for No Build, Build, and Build with GP Improvements.

Figure 7-61: Build+ 2042 AM Period I-95 General Purpose Lane Speeds – Northbound



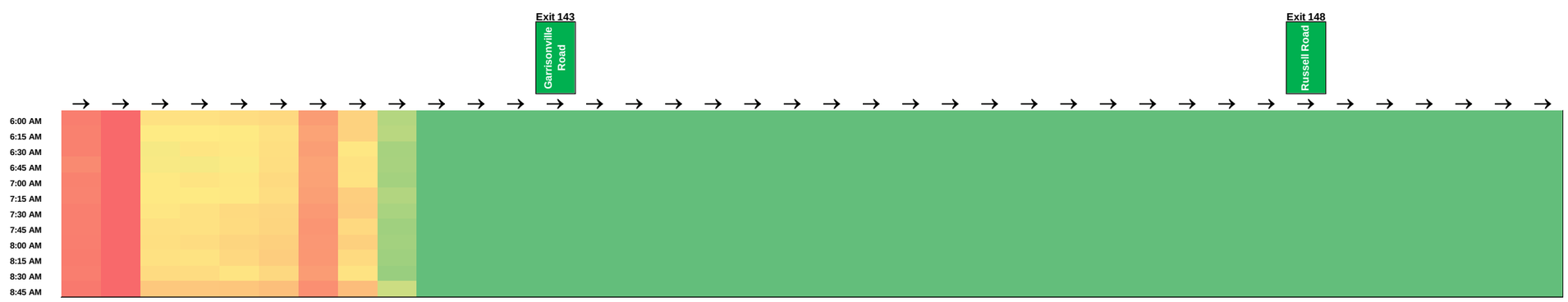


Figure 7-62: Build+ 2042 AM Period I-95 General Purpose Lane Speeds – Southbound

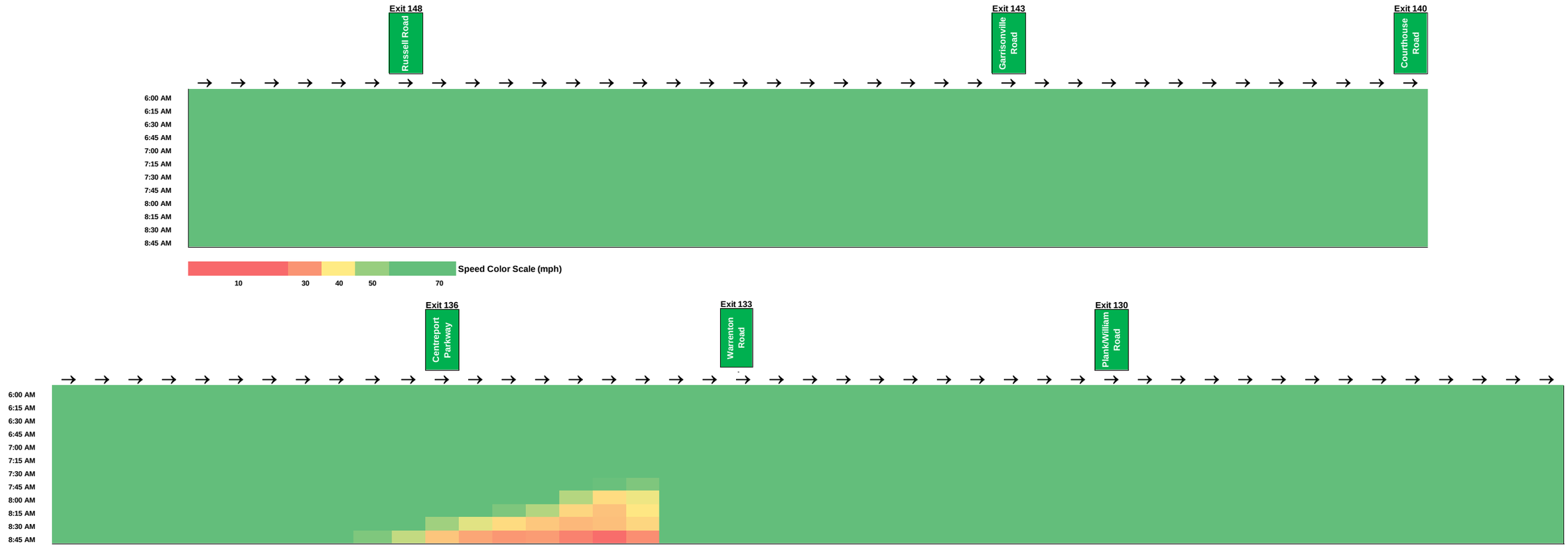


Figure 7-63: Build+ 2042 AM Period I-95 Express Lane Speeds – Northbound

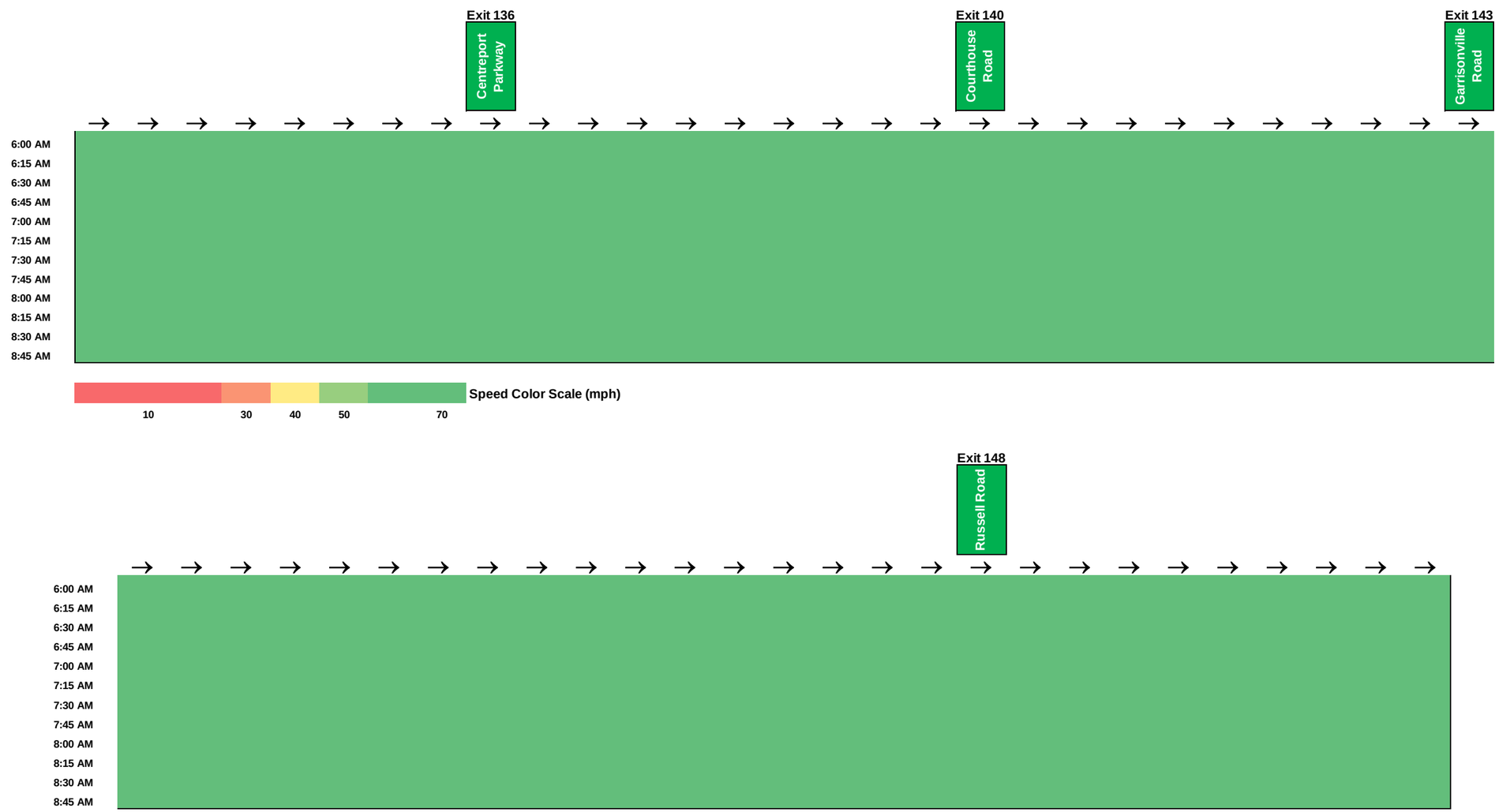


Figure 7-64: Build+ 2042 AM Peak Hour I-95 General Purpose Lane Operations – Northbound

Exit 130 Plank/William Road; Exit 133 Warrenton Road; Exit 136 Centreport Parkway

Speed	66	68	68	68	68	68	68	67	63	54	42	60	67	68	68	69	69	69	69	69	63	56	32	7	5	5	6	6	6	8	7	8	13	12	12
Density	29	29	29	29	29	29	29	29	31	37	35	30	20	22	22	22	22	22	22	21	18	21	49	113	140	137	147	148	137	134	137	134	57	72	69
Volume	5835	5839	5839	5837	5837	5836	5837	5840	5842	5844	5840	5374	5371	4460	4551	4565	4561	4562	4564	4394	4469	2957	2947	3939	2885	2907	2483	3274	3267	3076	3074	3066	3063	2564	2555
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	4	3	3	5	4	4	3	4	4	3	3	3	4	3	3
Length	18716	18716	18716	18716	18716	18716	18716	18716	18716	18716	640	1177	790	926	10707	10707	10707	10707	10707	10707	1234	1153	1583	1754	1178	646	529	1596	1525	5767	5767	5767	792	3610	3610

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road; Exit 143 Garrisonville Road

Speed	15	21	21	20	21	20	20	20	20	20	19	19	20	9	21	21	21	21	22	33	46	62	69	69	66
Density	60	53	54	55	55	55	55	55	55	55	42	57	54	119	55	55	55	54	49	32	23	17	18	17	15
Volume	3562	3376	3370	3360	3366	3354	3358	3350	3349	3286	3233	3232	3230	4530	4532	4513	4507	4500	4415	4285	4274	4232	3646	3536	3873
Lanes	4	3	3	3	3	3	3	3	3	3	4	3	3	4	4	4	4	4	4	4	4	4	3	3	4
Length	579	16767	16767	16767	16767	16767	16767	16767	16767	16767	905	2004	2004	1471	9549	9549	9549	9549	9549	415	582	825	2162	2162	855

Exit 148 Russell Road

Speed	67	65	70	70	69	69	68	69	69	69	68	68	68	67	67	68	69	68	69	69	67	68	69	69	69
Density	18	15	19	19	19	19	14	18	18	18	18	18	18	19	19	18	14	14	14	14	12	16	15	15	15
Volume	3574	3926	3921	3929	3931	3931	3911	3753	3752	3751	3751	3744	3748	3749	3748	3749	3899	3891	2888	2888	3178	3179	3178	3178	3175
Lanes	3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	4	4	3	3	4	3	3	3	3
Length	759	1503	4675	4675	4675	1193	295	2416	2416	2563	2563	1445	2731	2731	2734	2734	1101	523	2455	2455	1083	394	3484	3484	789

Figure 7-65: Build+ 2042 AM Peak Hour I-95 General Purpose Lane Operations – Southbound

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	70	69	69	69	68	70	69	70	70	69	69	69	70	69	70	70	70	70	70	70	70	70	70	70	65
Density	14	14	14	14	11	10	8	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	8	9	9
Volume	2919	2922	2928	2928	2926	2024	2109	2116	2122	2128	2097	2132	2124	2138	2141	2144	2146	2147	2150	2148	2147	2129	2137	1831	2316
Lanes	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1467	3888	3888	838	602	851	968	492	1598	2237	2237	2780	2780	1403	2551	2551	8765	8765	8765	8765	8765	635	820	1026	707

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

Speed	69	69	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	69	70
Density	11	9	9	9	9	9	9	9	9	9	10	10	10	9	12	12	12	12	12	12	12	12	12	9	12
Volume	2240	2506	2503	2507	2501	2509	2512	2516	2519	2515	2184	2152	2174	2562	2564	2563	2564	2565	2564	2561	2560	2561	2562	2476	
Lanes	3	4	4	4	4	4	4	4	4	4	3	3	3	4	3	3	3	3	3	3	3	3	4	3	
Length	928	1408	1612	781	9434	9434	9434	9434	9434	830	2027	2027	1727	1711	14288	14288	14288	14288	14288	14288	14288	14288	861	2844	

Exit 133 Warrenton Road

Exit 130 Plank/William Road

Speed	70	68	66	57	50	43	68	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	69	70	70	70	70	70	70	70	70	70
Density	12	10	14	19	24	24	10	7	7	10	10	10	10	10	10	10	10	10	10	10	10	8	9	12	12	12	12	12	12	12	12	12	12
Volume	2476	2773	2767	2738	2707	2658	2029	2014	2025	2031	2033	2034	2034	2040	2042	2045	2044	2042	2040	2042	2046	2048	2743	2627	2538	2539	2545	2548	2556	2560	2560	2564	2566
Lanes	3	4	3	3	3	4	3	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3	3
Length	2844	614	4395	4395	4395	598	1017	1253	1549	25281	25281	25281	25281	25281	25281	25281	25281	25281	25281	25281	25281	25281	868	1099	225	1954	12739	12739	12739	12739	12739	12739	12739

Figure 7-66: Build+ 2042 AM Peak Hour I-95 Express Lane Operations – Northbound

Exit 136 Centreport Parkway | Exit 140 Courthouse Road | Exit 143 Garrisonville Road

Speed	62	69	69	70	71	71	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
Density	7	6	6	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	6	6	6	6	6	5	5
Volume	411	412	408	411	413	413	594	596	597	597	598	600	602	603	602	602	601	602	603	601	771	781	778	778	777	777	776	772	975
Lanes	1	1	1	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	3
Length	4309	4309	4309	4275	4275	4275	1097	25211	25211	25211	25211	25211	25211	25211	25211	25211	25211	25211	25211	25211	618	13368	13368	13368	13368	13368	13368	13368	1220

Speed Color Scale (mph) 10 30 40 50 70

Density (veh/mi/ln) **Volume (vph)** **Lanes (#)** **Length (ft)**

Exit 148 Russell Road

Speed	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
Density	7	7	7	7	7	7	7	6	8	8	8	8	6	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Volume	984	990	992	993	989	995	998	1177	1173	1174	1178	1178	1179	974	975	976	975	978	979	981	982	976	987	989	989	992	995		
Lanes	2	2	2	2	2	2	2	3	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2		
Length	7600	7600	7600	7600	473	2511	2511	1084	373	1650	1415	961	782	979	2968	2968	1497	3348	3348	1567	789	693	1550	7285	7285	7285	7285		

Table 7-34: 2042 AM Peak Period – Northbound Travel Time Comparison

Segment	Length	2042 No Build		2042 Build		2042 Build + GP Improvements		2042 Build + Increased Express Lane Demand	
		Segment Travel Time	Cumulative Travel Time	Segment Travel Time	Cumulative Travel Time	Segment Travel Time	Cumulative Travel Time	Segment Travel Time	Cumulative Travel Time
	(miles)	(minutes)	(minutes)	(minutes)	(minutes)	(minutes)	(minutes)	(minutes)	(minutes)
Start to N of Exit 130	4.3	12.3	12.3	5.0	5.0	3.9	3.9	3.8	3.8
N of Exit 130 to S of Exit 133	1.8	9.1	21.4	4.5	9.5	1.6	5.5	1.5	5.3
S of Exit 133 to N of Exit 133	1.9	19.7	41.1	15.2	24.7	9.7	15.2	4.0	9.3
N of Exit 133 to N of Exit 136	2.7	21.3	62.4	22.5	47.2	18.7	33.9	19.2	28.5
N of Exit 136 to N of Exit 140	3.3	10.4	72.9	11.7	58.8	9.8	43.7	11.2	39.7
N of Exit 140 to N of Exit 143	3.2	6.9	79.8	6.5	65.3	9.4	53.1	6.6	46.3
N of Exit 148	4.6	4.0	83.8	4.0	69.3	4.0	57.1	4.0	50.3
Total	21.7	83.8		69.3		57.1		50.3	

The results for this option indicate improvement in the Northbound I-95 GP lane operations for all segments south of the I-95 / Courthouse Road interchange (Exit 140). Corridor travel times would be reduced 30 percent compared to 2042 No Build conditions. A slight increase in travel times is noted between Courthouse Road (Exit 140) and Garrisonville Road (Exit 143) compared to the Build Alternative; this occurs because additional traffic (compared to No Build and Build conditions) is able to proceed past the northbound on-ramp merge point resulting in an increase in density and reduced speeds in this segment. Some minor congestion within the southbound I-95 general purpose lanes is still observed, but that congestion is reduced compared to 2042 Build conditions. Severe congestion also remains south of the I-95 interchange with Centreport Parkway (extending south towards the US 17 interchange); however, travel times in this segment would be reduced by 10 minutes compared to the Build Alternative. Additional improvements along the northbound I-95 general purpose lanes between Exit 133 and Exit 140 could be investigated as part of the Northbound Rappahannock Crossing improvements project.

It should also be noted that the addition of an auxiliary lane or other GP lane improvements in the Study Area would potentially provide benefits for travel along northbound I-95 during periods when the I-95 Express Lanes are pointed southbound, including Saturday morning and early afternoon, but there remains high demand along northbound I-95.

7.6.2 Southbound I-95 General Purpose Lanes

As noted in Section 7.5.1, with the Build Alternative in place in 2042, an increase in congestion with the I-95 southbound GP lanes is projected within the Study Area. A review of the simulations and forecasts indicated that this was due to additional traffic attempting to access southbound I-95 via the southbound on-ramps at Garrisonville Road. Travel times within the Study Area were projected to increase from No Build to Build conditions in 2042 by approximately 8 minutes.

It was posited that some of these issues could be mitigated by additional improvements within the southbound GP lanes. A supplemental analysis was undertaken to assess the potential benefits of adding a continuous auxiliary lane along southbound I-95, between Garrisonville Road (Exit 143) and Courthouse Road (Exit 140). This scenario also assumes a corresponding auxiliary lane is provided in the northbound direction between the same two interchanges.

Summaries of I-95 northbound and southbound GP lane travel speeds for the 4-hour PM peak modeling period are provided in **Figure 7-67** and **Figure 7-68.** A summary of travel speeds for the 4-hour PM peak modeling period are provided in **Figure 7-69** for the I-95 Express Lanes. A summary of overall freeway operations (density, speeds, and throughput) for the PM peak hour (5-6 PM) is provided in **Figure 7-70** for northbound I-95, in **Figure 7-71** for southbound I-95, and in **Figure 7-72** for the I-95 Express Lanes. These include all freeway segments, ramp junctions, and weaving segments.

Table 7-35 provides a summary of southbound GP lane travel times by segment and cumulative for the entire study corridor averaged over the PM peak period for No Build, Build, and Build with GP Improvements.

Figure 7-67: Build+ 2042 PM Period I-95 General Purpose Lane Speeds – Northbound

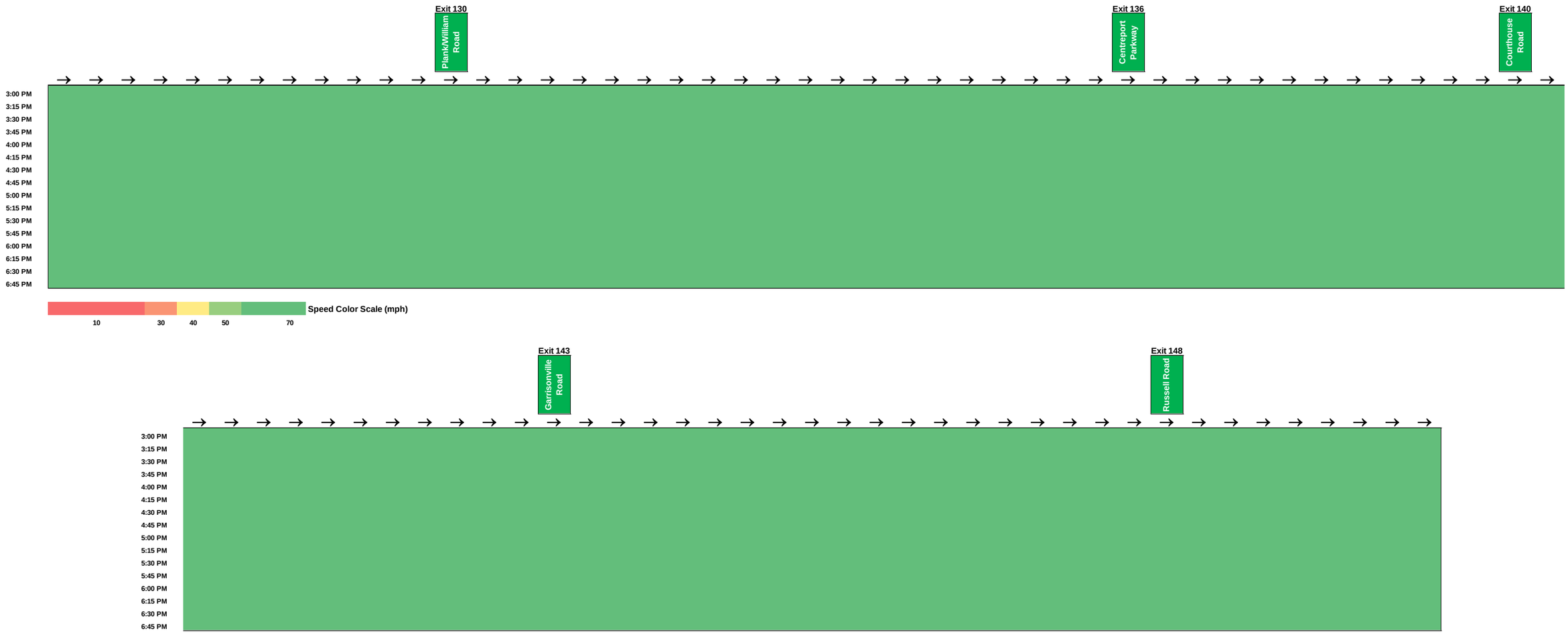


Figure 7-68: Build+ 2042 PM Period I-95 General Purpose Lane Speeds – Southbound

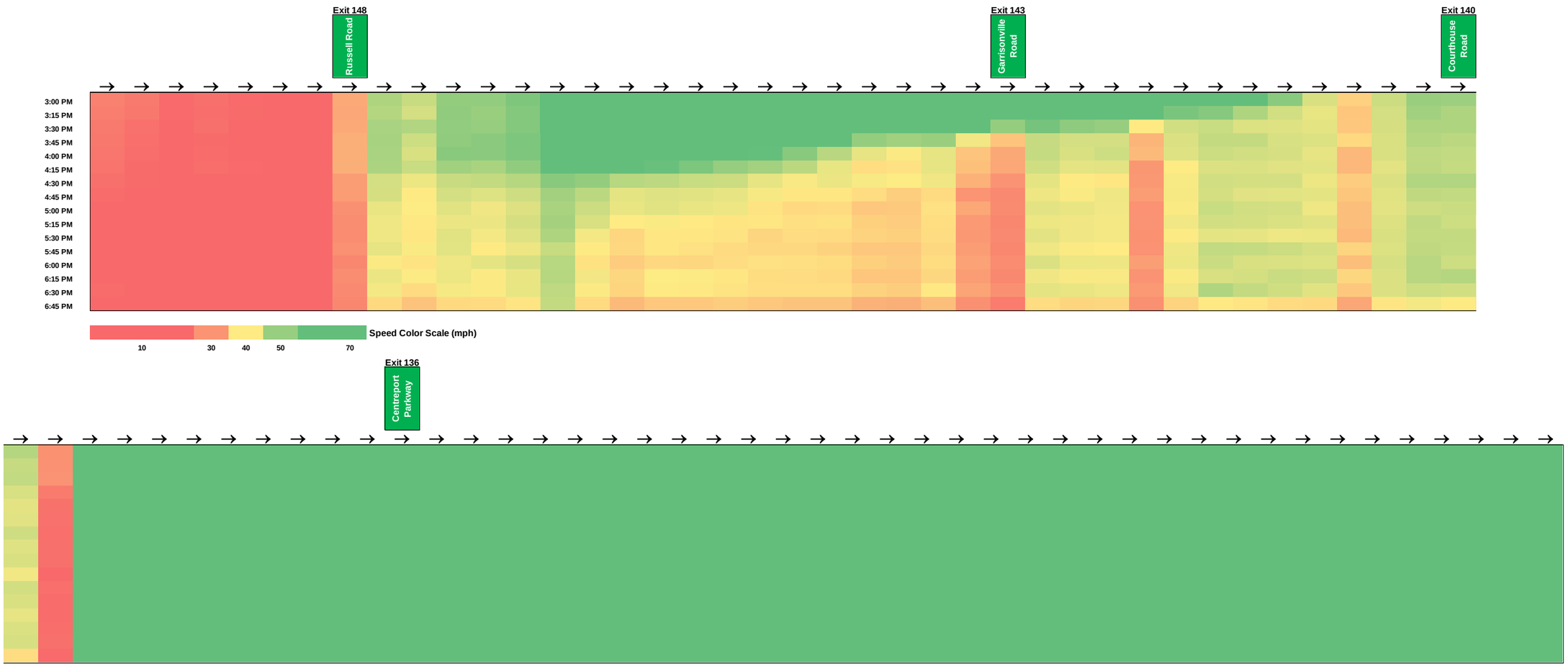
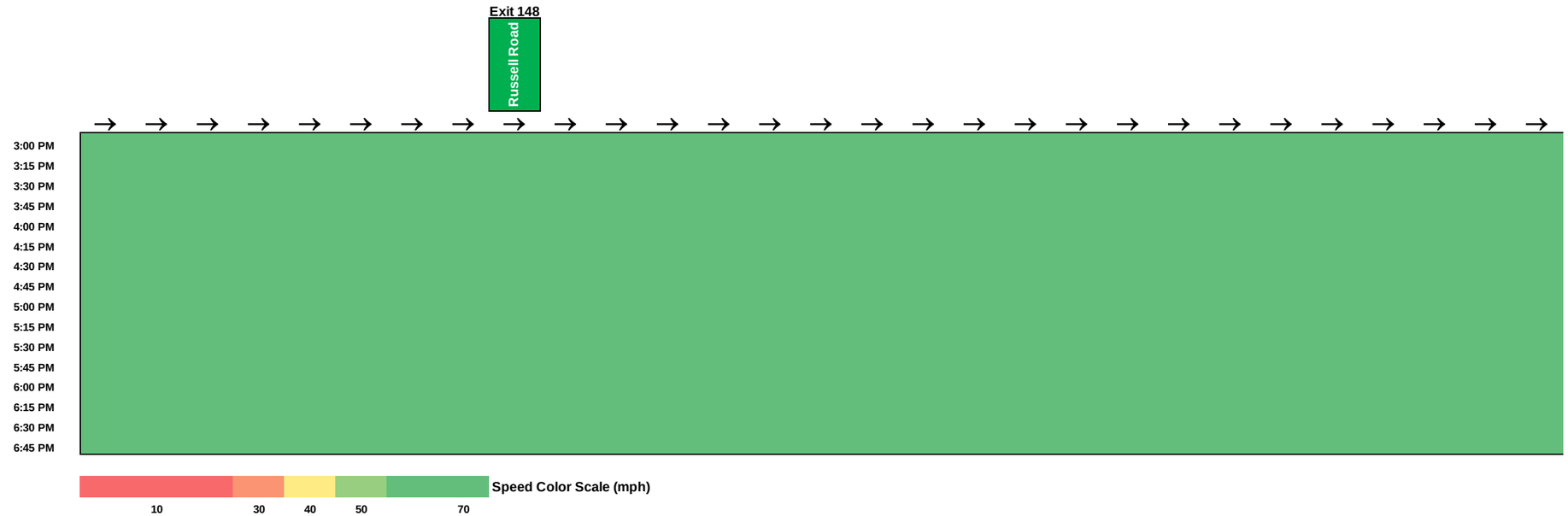


Figure 7-69: Build+ 2042 PM Period I-95 Express Lane Speeds – Southbound



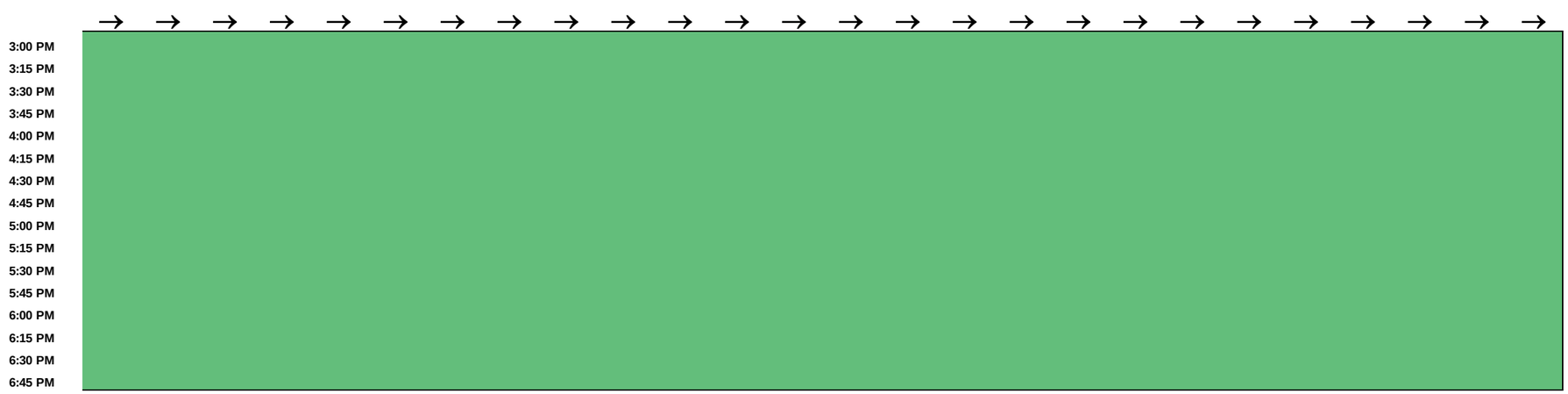


Figure 7-70: Build+ 2042 PM Peak Hour I-95 General Purpose Lane Operations – Northbound

Exit 130 Plank/William Road

Exit 136 Centreport Parkway

Speed	67	69	69	69	69	69	68	68	68	68	61	65	69	68	69	69	69	69	69	69	65	67	69	69	69	68	66	67	68	68	67	64	68	69
Density	22	22	22	22	22	22	22	22	22	22	18	20	14	17	17	17	17	17	17	16	13	12	12	10	13	17	16	21	21	21	21	19	18	18
Volume	4443	4443	4445	4451	4453	4455	4458	4459	4461	4465	4457	3875	3875	3424	3497	3512	3510	3507	3507	3375	3454	2524	2551	3520	3502	3542	4229	4228	4228	4237	4244	4239	3712	3704
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	4	3	3	5	4	3	4	3	3	3	3	4	3	3
Length	2000	2000	2000	2000	2000	2000	2000	2000	2000	716	640	1177	790	926	2000	2000	2000	2000	2000	707	1234	1164	1770	1754	1206	1273	1601	2000	2000	2000	1313	792	2000	1610

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road

Exit 143 Garrisonville Road

Speed	68	68	68	69	69	69	68	68	68	68	68	69	70	69	69	69	69	69	69	67	62	67	68	64
Density	15	20	20	20	20	20	20	20	20	18	18	18	15	15	15	15	15	15	15	16	19	19	18	17
Volume	4074	4072	4075	4081	4080	4074	4066	4069	4071	3688	3656	3688	4238	4239	4249	4254	4254	4243	4245	4233	4191	3782	3672	4354
Lanes	4	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	3	3	4
Length	579	2000	2000	2000	2000	2000	2000	2000	1331	519	905	1998	1471	2000	2000	2000	2000	1549	415	582	825	2000	162	855

Exit 148 Russell Road

Speed	67	68	68	69	69	69	69	68	68	68	67	67	67	65	66	67	67	66	67	66	61	62	66	68	68	67	68
Density	20	15	20	20	20	20	15	20	21	21	21	21	21	22	21	21	21	16	19	20	19	25	23	22	23	23	23
Volume	3959	4206	4197	4199	4201	4202	4186	4206	4207	4209	4209	4200	4203	4206	4209	4212	4196	4177	3904	3905	4576	4574	4573	4574	4575	4565	4582
Lanes	3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
Length	759	1503	2000	2000	675	1193	295	2000	416	2000	563	1445	2000	731	2000	881	942	519	2000	455	1083	394	2000	1484	789	685	1711

Figure 7-71: Build+ 2042 PM Peak Hour I-95 General Purpose Lane Operations – Southbound

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	11	11	11	11	11	11	10	17	27	26	27	27	28	27	20	18	18	17	17	17	17	18	17	17	17	14	17
Density	113	112	110	111	111	85	111	66	58	59	57	57	55	43	67	74	74	76	77	78	77	74	77	76	61	78	60
Volume	3621	3615	3633	3632	3624	3620	3470	4576	4598	4605	4599	4531	4584	4598	3913	3900	3897	3884	3883	3865	3884	3875	3879	3860	4086	3303	4017
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1943	1467	2000	1888	838	602	851	969	499	1598	2000	237	240	739	1780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

Speed	22	21	20	15	22	22	21	21	22	23	32	33	33	32	21	58	66	67	67	67	67	67	66	64	67	
Density	59	63	52	73	62	62	64	64	62	59	42	47	46	48	57	28	25	25	24	24	24	15	25	19	22	
Volume	3915	5194	5321	5368	5375	5374	5394	5385	5386	5379	5366	4667	4597	4672	4913	4932	4931	4931	4932	4933	4934	3095	4932	4933	4383	
Lanes	3	4	5	5	4	4	4	4	4	4	4	3	3	3	4	3	3	3	3	3	3	3	3	4	3	
Length	928	999	403	1612	780	2000	2000	2000	2000	1434	830	2000	27	1717	1712	2000	2000	2000	2000	2000	2000	2000	922	861	2000	

Speed	68	64	68	68	68	69	69	69	70	70	70	70	70	70	70	70	70	70	70	70	70	66	59	56	64	68	68	68	68	68	68	68
Density	22	19	24	24	24	17	14	13	10	10	8	11	11	11	11	11	11	11	11	11	11	16	22	31	27	25	25	25	25	25	25	25
Volume	4383	4843	4842	4841	4841	4746	4722	3623	2051	2067	2363	2361	2363	2364	2364	2363	2363	2363	2363	2362	2363	2360	5187	5184	5182	5180	5183	5182	5184	5187	5190	5196	5195
Lanes	3	4	3	3	3	4	5	4	3	3	4	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3	3
Length	844	614	2000	2000	1406	862	1277	1247	2000	103	1797	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1368	868	1099	225	1954	2000	2000	2000	2000	2000	2000	739

Figure 7-72: Build+ 2042 PM Peak Hour I-95 Express Lane Operations – Southbound

Exit 148
Russell Road

	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→
Speed	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	67	68	69	68	67	68	68	68	68	68
Density	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	17	16	11	16	17	15	15	15	15	15
Volume	1563	1563	1561	1554	1553	1550	1542	1553	1556	1554	1551	1553	1549	1556	1555	1559	2215	2230	2226	2237	2233	2232	2026	2030	2030	2035	2021
Lanes	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	3	2	2	2	2	2	2	2
Length	2000	2000	2000	1285	1550	693	789	1567	2000	1348	1497	2000	968	2000	735	891	1207	986	373	1084	2000	1053	2000	2000	2000	2000	439

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) **Volume (vph)** **Lanes (#)** **Length (ft)**

	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→
Speed	68	68	68	68	68	68	68	68	68	69	69	68	68	68	68	68	68	68	68	68	69	69	69	68	68	69	69	69
Density	10	13	14	14	14	14	14	14	9	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	4	4	4
Volume	2003	1842	1847	1845	1845	1847	1847	1847	1837	1600	1606	1607	1604	1602	1601	1602	1606	1606	1606	1603	1598	1596	1599	1600	1597	295	296	288
Lanes	3	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1
Length	761	2000	2000	2000	2000	2000	2000	907	808	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1807	2000	2000	225

Table 7-35: 2042 PM Peak Period – Southbound Travel Time Comparison

Segment	Length	2042 No Build		2042 Build		2042 Build + GP Improvements		2042 Build + Increased Express Lane Demand	
		Segment Travel Time	Cumulative Travel Time	Segment Travel Time	Cumulative Travel Time	Segment Travel Time	Cumulative Travel Time	Segment Travel Time	Cumulative Travel Time
	(miles)	(minutes)	(minutes)	(minutes)	(minutes)	(minutes)	(minutes)	(minutes)	(minutes)
S of Exit 148 to S of Exit 143	4.7	13.7	13.7	21.5	21.5	12.0	12.0	8.1	8.1
S of Exit 143 to S of Exit 140	3.1	3.6	17.3	3.9	25.4	8.1	20.1	3.5	11.6
S of Exit 140 to S of Exit 136	4.3	3.8	21.1	3.8	29.2	4.8	24.9	3.8	15.5
S of Exit 136 to S of Exit 133	2.7	2.4	23.5	2.3	31.5	2.3	27.2	2.3	17.8
S of Exit 133 to N of Exit 130	0.9	0.7	24.2	0.7	32.2	0.7	28.0	0.7	18.5
N of Exit 130 to S of Exit 130	2.4	2.1	26.3	2.1	34.3	2.1	30.1	2.1	20.6
S of Exit 130 to End	3.5	3.0	29.3	3.1	37.4	3.1	33.2	3.8	24.4
	21.5	29.3		37.4		33.2		24.4	

The results for this option indicate improvement in the southbound I-95 GP lane operations relative to the Build Alternative conditions. Travel times would be improved by approximately 10 percent for the entire Study Segment compared to the Build Alternative and fall within approximately 10 percent (3-4 minutes) for the No Build Alternative travel times. Substantial improvements in travel times north of Exit 143 were noted with travel times improved by approximately 9 minutes (12 minutes versus 21 minutes) compared to the Build Alternative. However, there is a projected increase in travel times for the segment between Exit 143 and Exit 140. This is similar to the northbound direction in the AM peak; once the metering effect of the bottleneck at the on-ramp from Garrisonville Road is removed, more traffic enters the segment approaching Courthouse Road and travel times would increase. Based on a review of results for segments north of the Study Area (but included in the overall VISSIM model), the addition of the southbound auxiliary lane also would reduce travel times north of Russell Road, with total I-95 southbound GP lane travel times from Joplin Road (Exit 150) to south of Exit 130 matching those achieved under No Build conditions.

Overall, the results indicate that an auxiliary lane between the southbound on-ramp from Garrisonville Road and the off-ramp to Courthouse Road would provide improved GP lane performance and mitigate much of the potential impacts of the Build Alternative (impacts associated with an increase in demand along the corridor, rather than a design or capacity issue with the I-95 Express Lanes or the proposed new connections to the GP lanes).

It should also be noted that the addition of an auxiliary lane or other GP lane improvements in the Study Area would potentially provide benefits for travel along southbound I-95 during periods when the I-95 Express Lanes are pointed northbound, including Saturday afternoons and Sunday, but there remains high demand along southbound I-95.

7.6.3 Express Lane Volume Sensitivity Analysis

As noted in Section 7.5.1, with the Build Alternative in place in 2042, there remains substantial congestion in the northbound I-95 GP lanes during the AM peak and in the southbound I-95 GP lanes during the PM peak. In addition to the analyses conducted to assess the impacts of physical improvements constructed in the GP lanes, an additional sensitivity analysis was conducted to assess the impact on GP and Express Lanes operations if usage of the I-95 Express Lanes in the Design Year exceeds the baseline projections developed for this IJR.

To test this, demand was shifted from the I-95 GP Lanes to the I-95 Express Lanes. Total demand on the corridor was held constant with the baseline Build conditions. During the AM peak period, the demand volumes for the I-95 Express Lanes were increased by approximately 20 percent starting at the initial access point between the Route 3 and Route 17 interchanges. The additional volume was then routed back to the GP lanes via the flyover from the Express Lanes south of Russell Road (so there was no change in volumes in the GP or Express lanes or north of Russell Road). For the PM peak period, the demand volumes for the I-95 Express Lanes were increased by approximately 15 percent. Additional volume was loaded into the Express Lanes at the flyover south of Russell Road; the volume traveled to the southern terminus of the system and was distributed proportionally to Route 17, Route 3, and I-95 southbound departing the study area.

Summaries of I-95 northbound and southbound GP lane travel speeds for the 3-hour AM peak modeling period are provided in **Figure 7-73** and **Figure 7-74.** A summary of travel speeds for the 3-hour AM peak modeling period are provided in **Figure 7-75** for the I-95 Express Lanes. A summary of overall freeway operations (density, speeds, and throughput) for the AM peak hour (7-8 AM) is provided in **Figure 7-76**

for northbound I-95, in **Figure 7-77** for southbound I-95, and in **Figure 7-78** for the I-95 Express Lanes. These include all freeway segments, ramp junctions, and weaving segments.

Table 7-34 provides a summary of northbound GP lane travel times by segment and cumulative for the entire study corridor averaged over the AM peak period for this volume sensitivity analysis.

Summaries of I-95 northbound and southbound GP lane travel speeds for the 4-hour PM peak modeling period are provided in **Figure 7-79** and **Figure 7-80.** A summary of travel speeds for the 4-hour PM peak modeling period are provided in **Figure 7-81** for the I-95 Express Lanes. A summary of overall freeway operations (density, speeds, and throughput) for the PM peak hour (5-6 PM) is provided in **Figure 7-82** for northbound I-95, in **Figure 7-83** for southbound I-95, and in **Figure 7-84** for the I-95 Express Lanes. These include all freeway segments, ramp junctions, and weaving segments.

Table 7-35 provides a summary of southbound GP lane travel times by segment and cumulative for the entire study corridor averaged over the PM peak period for this volume sensitivity analysis

Figure 7-73: Build (Increased Express Demand) 2042 AM Period I-95 General Purpose Speeds – Northbound

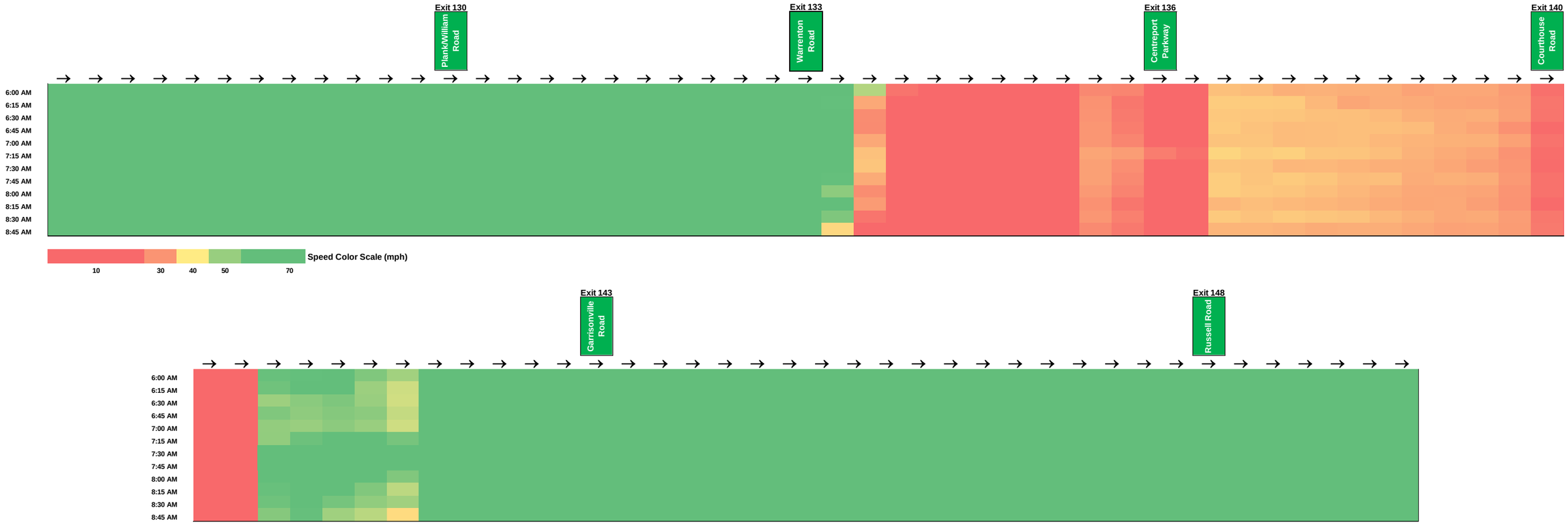


Figure 7-74: Build (Increased Express Demand) 2042 AM Period I-95 General Purpose Speeds –Southbound

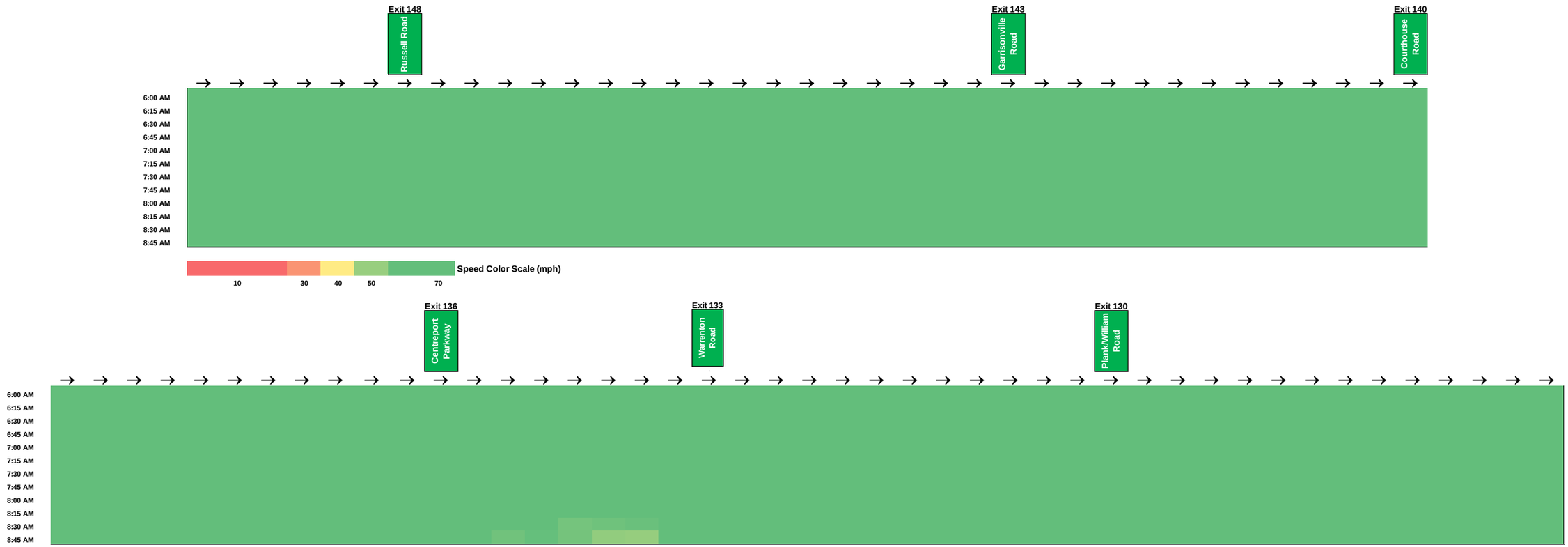


Figure 7-75: Build (Increased Express Demand) 2042 AM Period I-95 Express Lane Speeds – Northbound

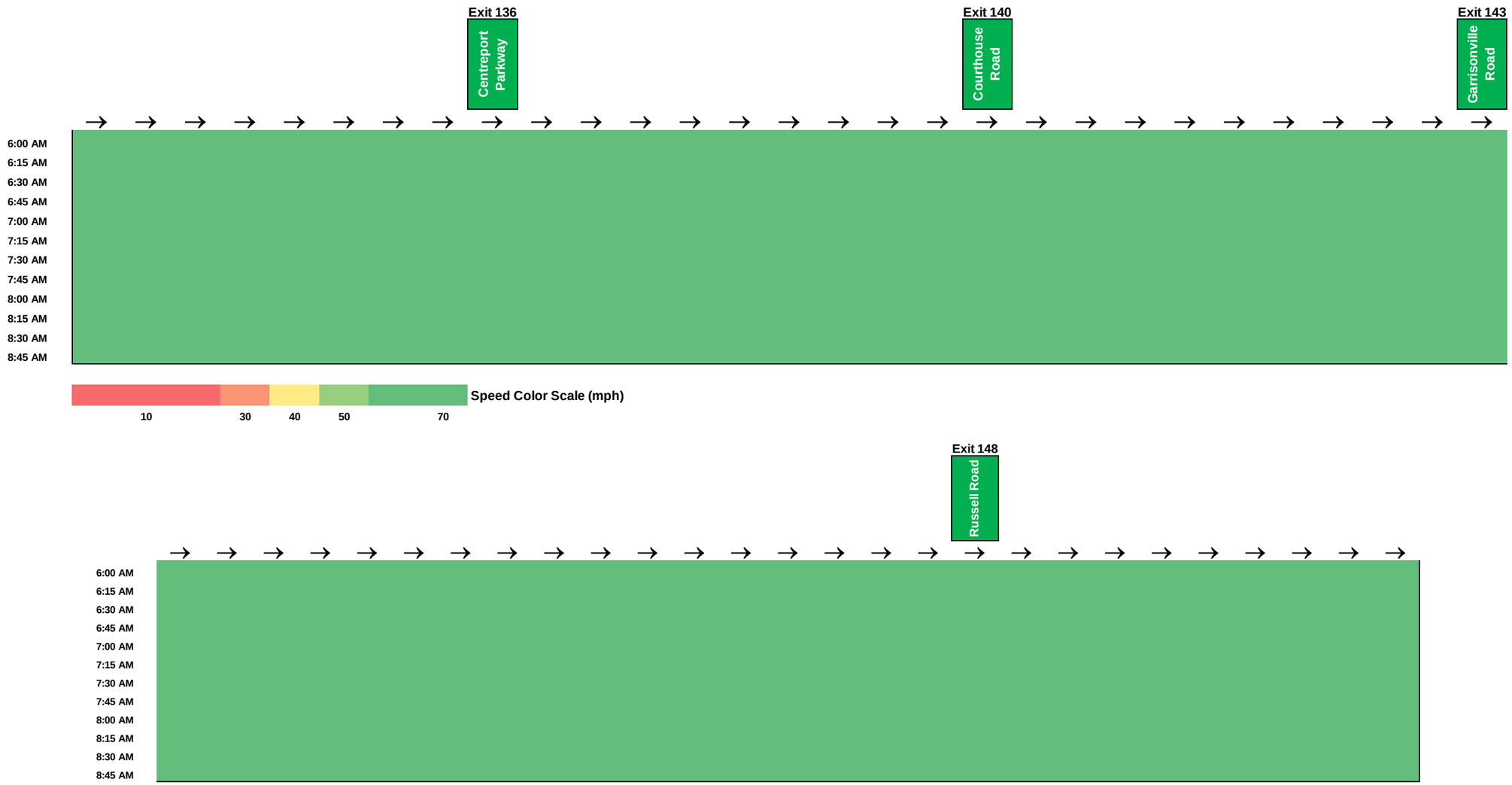


Figure 7-76: Build (Increased Express Demand) 2042 AM Peak Hour I-95 General Purpose Lane Operations - Northbound

Exit 130 Plank/William Road; Exit 133 Warrenton Road; Exit 136 Centreport Parkway

Speed	67	69	69	69	68	68	68	68	68	67	56	64	68	69	69	69	69	69	69	69	66	68	70	68	33	13	6	5	6	7	7	7	12	10	11
Density	25	25	25	25	25	25	25	25	25	26	23	24	17	19	19	19	19	19	19	19	15	13	13	11	37	86	133	148	134	136	140	138	61	77	74
Volume	5087	5091	5091	5090	5089	5089	5088	5092	5095	5093	5087	4678	4679	3890	3974	3991	3992	3990	3994	3848	3912	2611	2634	3629	2944	2944	2324	3109	3107	2826	2819	2817	2832	2336	2338
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	4	3	3	5	4	4	3	4	4	3	3	3	4	3	3
Length	18716	18716	18716	18716	18716	18716	18716	18716	18716	18716	640	1177	790	926	10707	10707	10707	10707	10707	10707	1234	1153	1583	1754	1178	646	529	1596	1525	5767	5767	5767	792	3610	3610

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road; Exit 143 Garrisonville Road

Speed	13	17	17	17	17	17	17	17	17	17	16	17	17	9	42	49	50	48	48	60	63	68	70	70	67
Density	66	61	61	61	61	61	60	60	60	60	45	59	57	118	33	28	28	29	28	22	21	14	16	16	13
Volume	3301	3050	3050	3057	3057	3062	3066	3068	3070	3015	2973	2969	2969	4142	4147	4161	4170	4183	4122	3993	3980	3942	3370	3269	3578
Lanes	4	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3	3	4	3	3	4
Length	579	16767	16767	16767	16767	16767	16767	16767	16767	16767	905	2004	2004	1471	9546	9546	9546	9546	9546	415	582	825	2162	2162	855

Exit 148 Russell Road

Speed	67	65	70	70	70	69	68	69	69	69	68	68	68	67	67	68	69	68	69	69	67	68	69	69	69
Density	16	14	17	17	17	17	13	17	17	17	17	17	17	17	17	17	14	14	14	14	11	15	15	15	15
Volume	3284	3620	3613	3614	3615	3612	3593	3454	3451	3447	3446	3440	3445	3445	3443	3442	3803	3794	2834	2833	3070	3068	3066	3066	3063
Lanes	3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	4	4	3	3	4	3	3	3	3
Length	759	1503	4675	4675	4675	1193	295	2416	2416	2563	2563	1445	2731	2731	2734	2734	1101	523	2455	2455	1083	394	3484	3484	789

Figure 7-77: Build (Increased Express Demand) 2042 AM Peak Hour I-95 General Purpose Lane Operations – Southbound

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	70	69	69	69	68	70	69	70	70	69	69	69	70	69	69	70	70	70	70	70	70	70	70	70	65
Density	13	13	13	13	10	9	7	10	10	10	10	10	10	10	10	10	10	10	10	10	10	9	7	8	8
Volume	2790	2788	2789	2790	2788	1929	2001	2008	2010	2010	1979	2009	1996	2007	2010	2009	2010	2010	2010	2009	2008	1992	1999	1713	2155
Lanes	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1467	3888	3888	838	602	851	968	492	1598	2237	2237	2780	2780	1403	2551	2551	8765	8765	8765	8765	8765	635	820	1026	707

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

Speed	69	69	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
Density	10	9	11	11	11	11	11	11	11	8	10	10	10	9	11	11	11	11	11	11	11	11	11	9	11
Volume	2084	2350	2343	2350	2346	2354	2352	2354	2351	2348	2041	2010	2030	2370	2369	2372	2371	2370	2369	2368	2366	2366	2368	2285	
Lanes	3	4	3	3	3	3	3	3	3	4	3	3	3	4	3	3	3	3	3	3	3	3	4	3	
Length	928	1408	1613	782	9436	9436	9436	9436	9436	830	2027	2027	1727	1711	14288	14288	14288	14288	14288	14288	14288	14288	861	2844	

Exit 133 Warrenton Road

Exit 130 Plank/William Road

Speed	70	68	70	70	69	64	69	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	69	70	70	70	70	70	70	70	70	70
Density	11	9	12	12	12	10	9	7	7	9	9	9	9	9	9	9	9	9	9	9	9	9	7	9	11	11	11	11	11	11	11	11	11	11
Volume	2286	2535	2537	2536	2537	2507	1914	1901	1912	1916	1917	1915	1915	1914	1914	1915	1917	1918	1919	1918	1917	1916	2573	2456	2375	2374	2373	2374	2375	2372	2372	2372	2373	
Lanes	3	4	3	3	3	4	3	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3	3	
Length	2844	614	4395	4395	4395	598	1017	1253	1549	25281	25281	25281	25281	25281	25281	25281	25281	25281	25281	25281	25281	25281	868	1099	225	1954	12739	12739	12739	12739	12739	12739	12739	

Figure 7-78: Build (Increased Express Demand) 2042 AM Peak Hour I-95 Express Lane Operations - Northbound

Exit 136 Centreport Parkway | Exit 140 Courthouse Road | Exit 143 Garrisonville Road

Speed	65	69	69	71	71	71	71	71	71	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
Density	9	9	9	4	4	4	4	6	6	6	6	6	6	6	6	6	6	6	6	6	5	8	8	8	8	8	8	8	6
Volume	599	600	595	600	602	603	883	881	884	886	886	886	885	886	888	886	885	884	885	886	1099	1112	1114	1116	1117	1117	1117	1109	1308
Lanes	1	1	1	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	3
Length	4309	4309	4309	4275	4275	4275	1097	25211	25211	25211	25211	25211	25211	25211	25211	25211	25211	25211	25211	25211	618	13368	13368	13368	13368	13368	13368	13368	1220

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 148 Russell Road

Speed	70	70	70	70	70	70	70	70	70	70	70	70	69	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
Density	9	9	9	9	9	10	10	7	11	11	11	11	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Volume	1313	1320	1323	1324	1320	1329	1329	1483	1473	1476	1482	1483	1481	1070	1069	1070	1068	1072	1073	1075	1075	1068	1078	1081	1081	1082	1083		
Lanes	2	2	2	2	2	2	2	3	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2		
Length	7600	7600	7600	7600	473	2511	2511	1084	373	1650	1415	961	782	979	2968	2968	1497	3348	3348	1567	789	693	1550	7285	7285	7285	7285		

Figure 7-79: Build (Increased Express Demand) 2042 PM Period I-95 General Purpose Speeds – Northbound

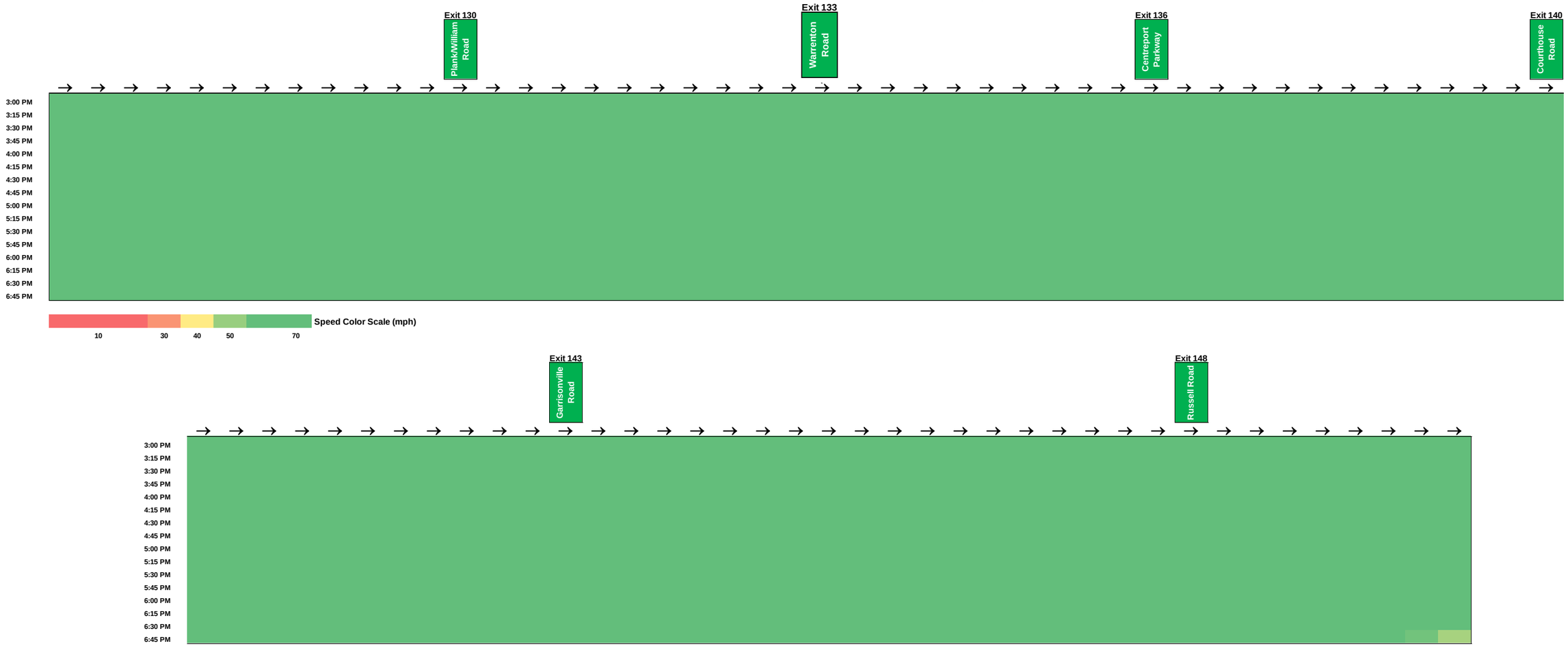
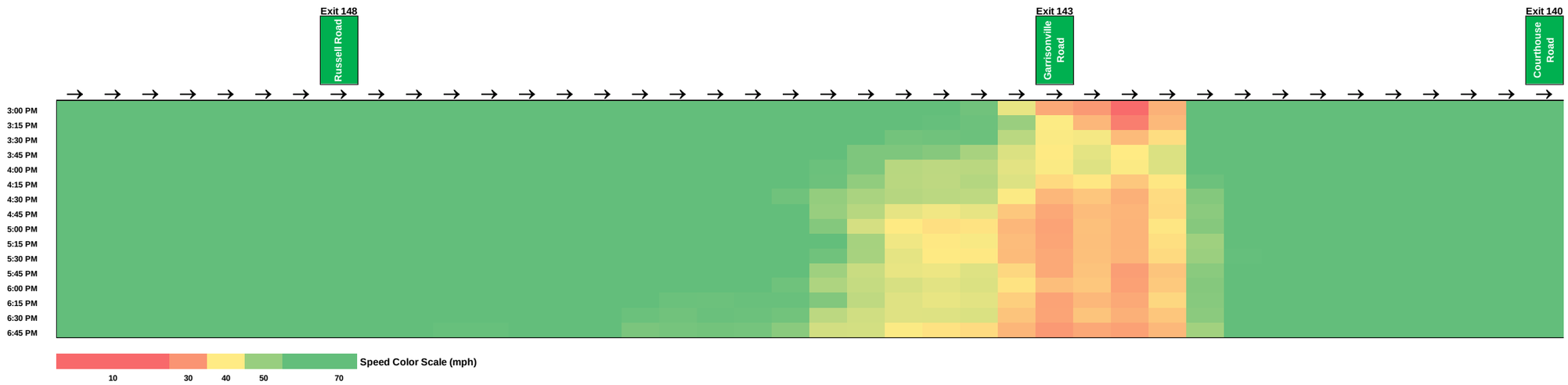


Figure 7-80: Build (Increased Express Demand) 2042 PM Period I-95 General Purpose Speeds –Southbound



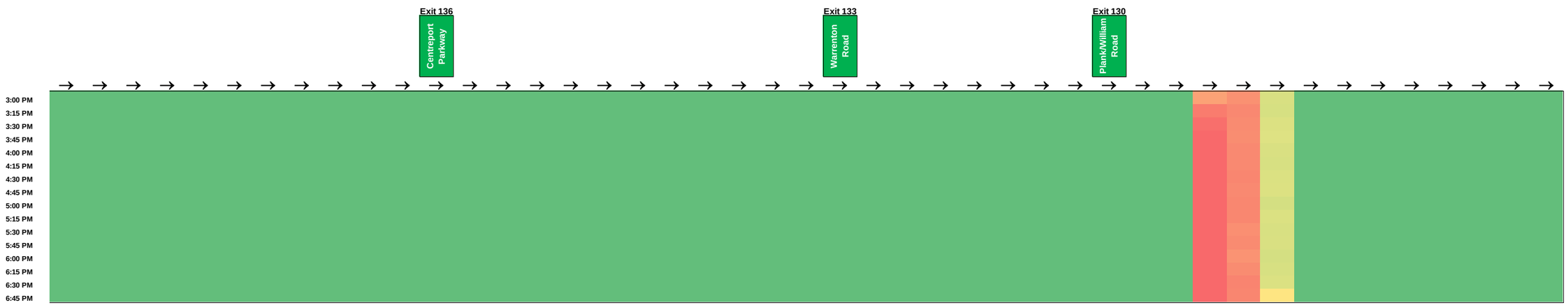


Figure 7-81: Build (Increased Express Demand) 2042 PM Period I-95 Express Lane Speeds – Southbound

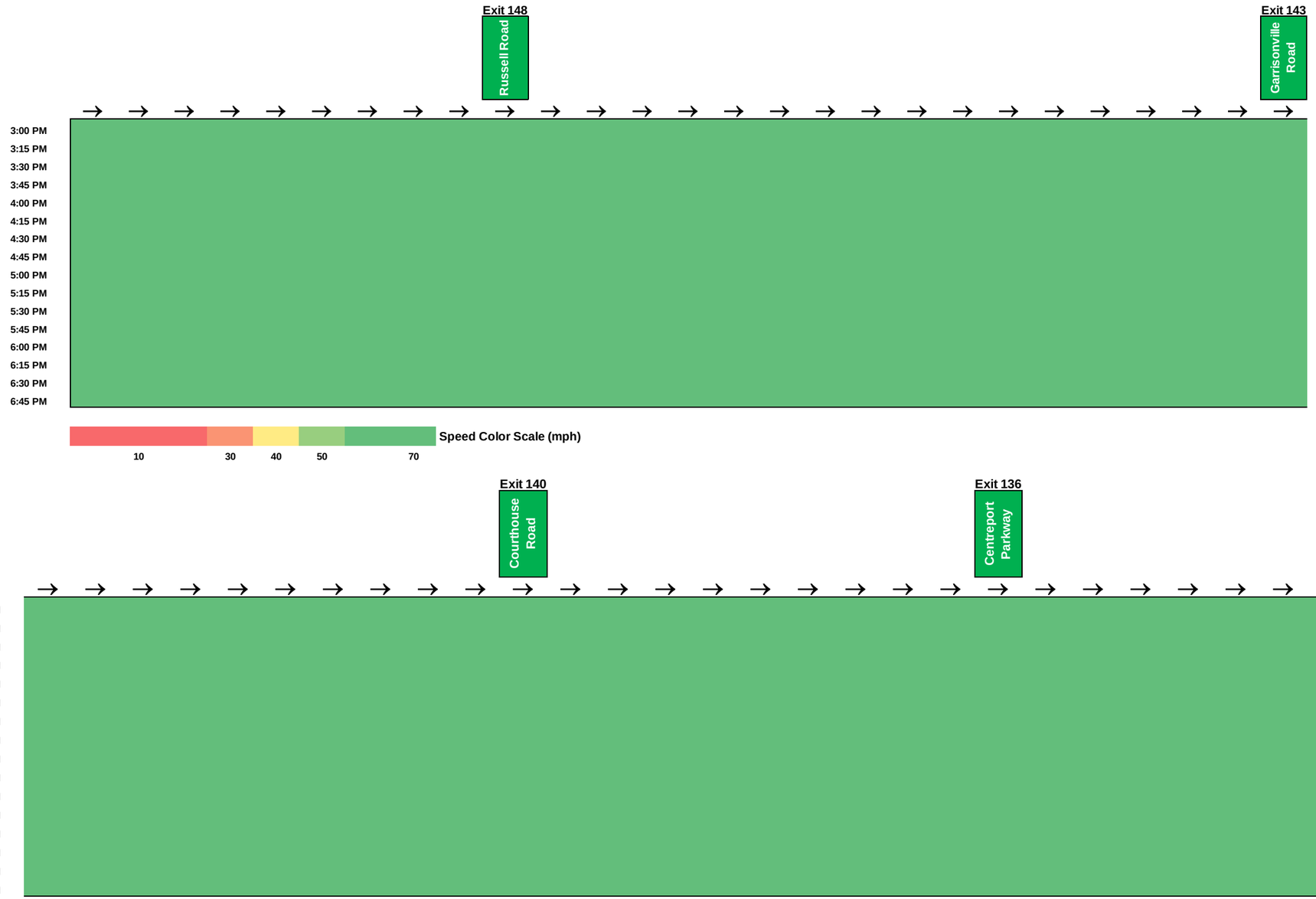


Figure 7-82: Build (Increased Express Demand) 2042 PM Peak Hour I-95 General Purpose Lane Operations - Northbound

Exit 130 Plank/William Road; Exit 133 Warrenton Road; Exit 136 Centreport Parkway

Speed	67	69	69	69	69	69	68	68	68	68	61	65	69	68	69	69	69	69	69	69	65	67	69	69	69	68	66	68	68	68	68	69	69	69
Density	22	22	22	22	22	22	22	22	22	22	18	20	14	17	17	17	17	17	17	16	13	12	12	10	13	17	16	21	21	21	21	15	18	18
Volume	4443	4443	4445	4451	4453	4455	4458	4459	4461	4465	4457	3875	3875	3424	3497	3512	3510	3507	3507	3375	3454	2524	2551	3519	3501	3542	4230	4231	4231	4241	4248	4245	3717	3710
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	4	3	3	5	4	3	4	3	3	3	3	4	3	3
Length	18716	18716	18716	18716	18716	18716	18716	18716	18716	18716	640	1177	790	926	10707	10707	10707	10707	10707	10707	1234	1164	1770	1754	1206	1273	1601	7313	7313	7313	7313	792	3610	3610

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road; Exit 143 Garrisonville Road

Speed	68	68	68	68	69	69	68	68	68	68	68	69	69	68	68	68	68	68	68	68	61	67	68	64
Density	15	20	20	20	20	20	20	20	20	18	18	18	15	21	21	21	21	21	21	21	18	19	18	17
Volume	4078	4075	4078	4083	4080	4076	4070	4076	4078	3692	3662	3692	4242	4245	4251	4257	4258	4254	4249	4237	4196	3783	3671	4351
Lanes	4	3	3	3	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	4	3	3	4
Length	579	15331	15331	15331	15331	15331	15331	15331	15331	519	905	1998	1471	9546	9546	9546	9546	9546	415	582	825	2162	2162	855

Exit 148 Russell Road

Speed	66	68	68	69	68	69	69	68	68	68	67	67	67	65	66	67	67	66	67	66	64	64	67	68	68	67	68
Density	20	15	21	20	20	20	15	21	21	21	21	21	21	22	21	21	21	16	19	20	17	22	21	21	21	21	21
Volume	3956	4205	4198	4203	4203	4204	4189	4209	4211	4208	4207	4196	4202	4206	4208	4210	4194	4177	3900	3901	4247	4246	4243	4246	4246	4234	4251
Lanes	3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
Length	759	1503	4675	4675	4675	1193	295	2416	2416	2563	2563	1445	2731	2731	2881	2881	942	519	2455	2455	1083	394	3484	3484	789	685	1711

Figure 7-83: Build (Increased Express Demand) 2042 PM Peak Hour I-95 General Purpose Lane Operations – Southbound

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	68	67	65	64	63	61	59	56	56	57	56	55	55	56	57	57	57	58	57	53	41	34	30	29	27	24	24
Density	21	21	23	25	27	22	31	23	30	31	31	31	31	24	31	31	31	31	31	33	41	47	57	59	54	67	53
Volume	4231	4225	4214	4205	4203	4205	4039	4198	4209	4217	4222	4151	4196	4215	4005	4015	4006	4009	4003	3994	3986	3985	3978	3950	4183	3005	3716
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1943	1467	3888	3888	838	602	851	969	499	1598	2237	2237	240	739	1780	1403	2551	2551	8765	8765	8765	8765	8765	635	820	1026	707

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

Speed	27	25	32	44	54	63	66	67	67	67	68	68	68	68	69	67	68	68	68	68	68	67	66	65	67
Density	58	59	34	33	32	26	25	25	25	25	18	21	21	21	16	23	22	22	22	22	22	14	23	18	20
Volume	3548	4830	4907	4949	4959	4945	4957	4959	4959	4961	4952	4272	4210	4271	4516	4533	4533	4533	4530	4527	4528	2844	4534	4537	4053
Lanes	3	4	5	4	3	3	3	3	3	3	4	3	3	3	4	3	3	3	3	3	3	3	3	4	3
Length	928	999	403	1613	782	9436	9436	9436	9436	9436	830	2027	2027	1717	1712	14142	14142	14142	14142	14142	14142	14142	922	861	2844

Exit 133 Warrenton Road

Exit 130 Plank/William Road

Speed	68	65	68	68	68	69	69	69	70	70	69	69	69	69	69	69	69	69	69	69	69	65	15	18	40	58	65	67	67	67	67	67	67
Density	20	17	22	22	22	16	13	12	14	14	12	16	16	16	16	16	16	16	16	16	16	17	83	83	51	35	31	30	30	30	30	30	30
Volume	4054	4512	4513	4516	4515	4422	4397	3440	2911	2934	3339	3334	3339	3340	3339	3336	3337	3339	3339	3339	3338	3333	6061	6057	6055	6053	6054	6050	6051	6053	6054	6054	6057
Lanes	3	4	3	3	3	4	5	4	3	3	4	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3	3
Length	2844	614	5406	5406	5406	862	1277	1247	2103	2103	1797	21368	21368	21368	21368	21368	21368	21368	21368	21368	21368	21368	868	1099	225	1954	12739	12739	12739	12739	12739	12739	12739

Figure 7-84: Build (Increased Express Demand) 2042 PM Peak Hour I-95 Express Lane Operations - Southbound

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	69	68	68	69	68	68	68	68
Density	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	9	13	13	9	13	14	12	12	12	12	12
Volume	1618	1620	1620	1617	1617	1615	1608	1618	1621	1621	1619	1623	1616	1621	1617	1622	1820	1828	1823	1832	1832	1833	1620	1622	1622	1625	1615
Lanes	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	3	2	2	2	2	2	2	2
Length	7285	7285	7285	7285	1550	693	789	1567	3348	3348	1497	2968	2968	2735	2735	891	1207	986	373	1084	3053	3053	8439	8439	8439	8439	8439

Speed Color Scale (mph): 10, 30, 40, 50, 70

Density (veh/mi/ln) Volume (vph) Lanes (#) Length (ft)

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

Speed	68	69	68	68	68	68	68	68	68	69	69	69	69	69	69	69	69	69	69	69	69	69	69	68	69	69	69
Density	8	11	11	11	11	11	11	11	7	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	6	6	6
Volume	1601	1491	1493	1494	1494	1494	1498	1499	1492	1327	1330	1330	1329	1328	1328	1327	1325	1328	1329	1331	1335	1336	1334	1330	1329	404	406	394
Lanes	3	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1
Length	761	12907	12907	12907	12907	12907	12907	12907	808	31807	31807	31807	31807	31807	31807	31807	31807	31807	31807	31807	31807	31807	31807	31807	31807	4225	4225	4225

The results for the volume sensitivity tests indicate notable improvement in the northbound I-95 GP lane operations during the AM peak and in the southbound I-95 GP lane operations relative to the Build Alternative conditions. During the AM peak hour, travel times in the northbound GP lanes would be improved by approximately 36 percent compared to No Build conditions. Travel times would be improved in each GP segment between interchanges, with the most substantial travel time savings noted between Exits 130 and Exit 136. There remains a bottleneck at the merge from the northbound on-ramp from Courthouse Road at Exit 140, but the impacts are reduced due to the increased demand assigned to the I-95 Express Lanes. Operations in the I-95 Express Lanes would remain free flow even with the increased demand assumed.

In the PM peak period, travel times in the southbound GP lanes would be improved by approximately 17 percent compared to No Build conditions. Under Base Build conditions, the travel times increased in the southbound GP lanes due to increased demand entering the corridor from Route 610 (Garrisonville Rd) at Exit 143, so the results of this analysis represent a substantial improvement relative to the baseline Build conditions.

7.6.4 Planning of Future Improvements

The I-95 Express Lanes Fredericksburg Extension would provide faster and more reliable travel times for high-occupancy vehicle (HOV-3+) riders, commuter bus users, and toll-paying single and double occupancy vehicles along the I-95 corridor. VDOT recognizes that the analysis results indicate there will continue to be congestion in the I-95 General Purpose lanes during peak periods in the Design Year. Several sensitivity analyses were conducted to evaluate alternatives to further mitigate the congestion within the I-95 GP lanes. The future changes which were assessed included additional GP travel lanes (auxiliary lanes) between specific interchanges and increased use of the Express Lanes compared to the baseline traffic projections. In both cases, congestion in the I-95 General Purpose would be substantially reduced compared to the baseline conditions documented in this IJR.

Due to the proposed funding arrangements for this project (where a private partner will build and operate and I-95 Express Lanes), there are constraints regarding the timing of any future physical improvements to the I-95 GP lanes. However, as the sensitivity analysis has demonstrated, other alternatives, such as measures to encourage higher use of the I-95 Express Lanes would have a similar or greater impact on reducing congestion within the I-95 GP lanes than alternatives which include physical improvements along the corridor. Measures to increase use of the I-95 Express Lanes could include continued expansion of the Park and Ride lot system in Stafford County, enhanced commuter bus services, and additional support for ridesharing. VDOT will continue to work with local partners, including the Fredericksburg Area Metropolitan Planning Organization, to identify potential supporting projects to mitigate future congestion within the I-95 GP lanes.

7.7 SUMMARY

An operational analysis using *VISSIM* to evaluate existing conditions along the I-95 corridor and compare future projected operations for the No Build and Build Alternatives. The elements of the purpose and need for the I-95 Express Lanes Fredericksburg Extension Study include:

- Reduce congestion and provide additional capacity to address recurring congestion on I-95 during peak periods.

The proposed Build Alternative addresses this element of the purpose and need. Travel time comparisons between the No Build and Build Alternatives indicate that the Build Alternative, while not eliminating congestion in the I-95 GP lanes, would reduce the extent of the congestion and provide improved travel times for Express Lane and GP lane users. The only time period when I-95 GP travel times are not projected to improve (within the study segment of I-95) relative to the No Build condition is in 2042 during the PM peak period. A combination of higher volumes accessing I-95 from Garrisonville Road and reduced metering upstream combine to generate moderately greater congestion at the bottleneck south of Garrisonville Road. However, potential additional improvements to the I-95 southbound GP lanes, specifically a continuous auxiliary lane between the on-ramp from Garrisonville Road (Exit 143) to the off-ramp to Courthouse Road (Exit 140) could substantially mitigate the impacts of this additional demand being attracted to the corridor. Additionally, a northbound continuous auxiliary lane between the same two interchanges would provide further operational benefits within the northbound I-95 GP lanes during the AM peak period, where substantial congestion is noted. Lastly, sensitivity analyses indicated that measures to shift additional demand from the I-95 GP lanes to the I-95 Express Lanes would also provide notable operational benefits within the I-95 GP lanes during the AM and PM peak periods.

The proposed Build Alternative also addresses the need for additional capacity along the corridor. **Table 7-36** and **Table 7-37** compare vehicular throughputs in the peak direction for 2022 and 2042 conditions for the No Build and Build conditions. The total vehicular throughput is the combination of the GP lane throughput and the I-95 Express Lane throughput. The comparison was conducted for the peak direction of travel for the peak hour in the AM (7-8 AM) and PM (5-6 PM). The results in **Table 7-36** and **Table 7-37** indicate that the Build Alternative would increase overall vehicle throughput in the peak periods in both the Opening and Design Years when compared to the No Build Conditions.

- Provide improved reliability in travel times along the corridor.

The proposed Build Alternative would extend the I-95 Express Lanes 10-miles south while providing additional access points to these dynamically priced lanes. The operational analysis results indicate highly consistent and reliable travel times within the I-95 Express Lanes for the Build Alternative. These consistent, predictable travel times would be available for toll users, HOV-3+ users, and transit vehicles along the corridor.

While travel time reliability cannot be specifically measured using microsimulation, some general trends can be gleaned from the various simulation runs (10 runs, in this case) conducted to generate the results. The variation (expressed as a percentage of the average travel time) for the travel times in the I-95 Express Lanes, in the northbound direction in the AM peak period, was less than a percent, indicating very consistent travel time results. The travel times within the GP lanes during this time period, in addition to being substantially longer (nearly an hour), were also more variable (variation between the minimum and maximum average times from the 10 simulation runs of was up to five minutes).

The option of a consistent, reliable travel time will allow users of the I-95 corridor to better plan their trips

- Improve travel choices by increase the attractiveness and utility of ridesharing and transit usage along the I-95 corridor.

By providing consistent, reliable travel times which are faster than those available to GP lane users, the Build Alternative would make ridesharing and transit usage a more attractive choice for residents in Stafford County and points south. The HOV-3 users and transit riders would be able to utilize the I-95 Express Lanes without paying a toll and would benefit from reduced travel times and more reliable trip lengths. In both the AM and the PM peak periods, the I-95 Express Lanes would provide substantial travel time benefits to users compared to the I-95 GP lanes. The travel time savings in the Design Year 2042 range from 23 minutes during the PM peak to nearly an hour in the AM peak. This would provide a notable incentive to utilize transit and ridesharing options which would glean the benefits of the Express Lanes without having to pay a toll. The current projections for the Design Year indicate that HOV-3+ traffic would make up approximately 30-35 percent of the total I-95 Express Lane volumes during the AM peak period and approximately 40-45 percent of the total I-95 Express Lane volumes during the PM peak period.

The operational analysis results indicate that the proposed Build Alternative would satisfy the project purpose and need and not adversely impact operations of the existing I-95 corridor or existing access points.

Table 7-36: I-95 Northbound AM Peak Hour Throughput Comparison

Segment	2022 No Build			2022 Build			2042 No Build			2042 Build		
	GP	Express	Total	GP	Express	Total	GP	Express	Total	GP	Express*	Total
Exit 143 to Exit 148	3,900	850	4,750	4,100	1,450	5,550	3,800	600	4,400	3,500	1,100	4,600
Exit 140 to Exit 143	3,700	150	3,850	3,300	1,075	4,350	3,700	400	4,100	4,000	750	4,750
Exit 136 to Exit 140	3,200	-	3,200	3,100	900	4,025	3,300	-	3,300	3,000	550	3,550
Exit 133 to Exit 136	3,200	-	3,200	3,400	900	4,325	3,000	-	3,000	2,700	550	3,250

Table 7-37: I-95 Southbound PM Peak Hour Throughput Comparison

Segment	2022 No Build			2022 Build			2042 No Build			2042 Build		
	GP	Express	Total	GP	Express	Total	GP	Express	Total	GP	Express	Total
Exit 148 to Exit 143	4,600	1,250	5,850	4,500	2,100	6,600	4,300	1,000	5,300	3,300	1,900	5,200
Exit 143 to Exit 140	5,100	-	5,100	3,900	1,700	5,600	5,300	-	5,300	4,900	1,700	6,600
Exit 140 to Exit 136	4,700	-	4,700	3,800	1,500	5,300	4,300	-	4,300	4,600	1,600	6,200
Exit 136 to Exit 133	4,600	-	4,600	3,500	1,500	5,000	4,300	-	4,300	4,500	1,600	6,100

*Express Lanes throughputs are less than the projected Express Lanes demand during the AM peak period. There is no congestion in the Express Lanes themselves, but the volume of traffic which can access the Express Lanes is metered by the congestion in the I-95 northbound GP lanes. Demand volumes for the I-95 Express Lanes presented in Table 6-3.

8. SAFETY ANALYSIS

Both qualitative and quantitative safety analyses were conducted in accordance with the approved IJR Framework document.

8.1 QUALITATIVE SAFETY ANALYSIS

Crash data for the period from January 1, 2011 through December 31, 2016 were obtained from VDOT's Tableau Crash Tool for the following roadway segments:

- I-95 Northbound, from milepost 128.5 to 149
- I-95 Southbound, from milepost 149 to 128.5
- I-95 Express Lanes, from milepost 13 to 17.5

Crash data were analyzed by quarter-mile segments. Crash data were tabulated by crash type, severity, pavement condition and time of day. Crash rates (calculated per 100 Million Vehicle Miles Traveled) were calculated for each quarter-mile segment. The analysis summaries for each section are presented in **Figure 8-1** through **Figure 8-2.**

The overall crash rates on I-95 northbound and I-95 southbound within the study area during the study period were 82 and 82 crashes per 100 Million Vehicle Miles Traveled (MVMT), respectively. The 2014 statewide average crash rate on the Interstate system was 72 crashes per 100 MVMT.

The overall injury and fatality rates on I-95 northbound were 30 injuries and 0.54 fatalities per 100 MVMT, respectively. The overall injury and fatality rates on I-95 southbound were 29 injuries and 0.19 fatalities per 100 MVMT, respectively. The 2014 statewide average injury and fatality rates on the Interstate system were 30 injuries and 0.35 fatalities per 100 MVMT.

Rear-end crashes are most prevalent along both directions of I-95, representing 59 percent of all crashes within the study area. Additional details on the crash analyses are provided below.

8.1.1 I-95 Northbound Crash Analysis

A total of 2,583 crashes were reported along northbound I-95 during the six-year study period. As shown in **Figure 8-1**, crashes were predominantly rear-end crashes (59 percent), with fixed object off-road (17 percent), and sideswipe collisions (12 percent) being the next most frequent types.

A total of 613 crashes (24 percent) resulted in 742 injuries with 15 crashes resulting in 17 fatalities. The remaining 1,955 crashes resulted in property damage only.

Approximately 20 percent of all crashes occurred during the AM peak period for northbound travel between 6 AM – 9 AM. Approximately 77 percent of all crashes occurred on dry pavement.

The average crash rate along northbound I-95 is 82 crashes per 100 Million Vehicle Miles Traveled; there are twelve quarter-mile segments along northbound I-95 that experience a crash rate more than 50 percent higher than the average crash rate. The critical segments are for the most part located in the vicinity of Exit 143 (Garrisonville Road) and near Exit 136 (Centreport Parkway). In the northbound direction, congestion typically begins near Garrisonville Road with queues propagating upstream towards Courthouse Road and Centreport Parkway.

8.1.2 I-95 Southbound Crash Analysis

A total of 2,547 crashes were reported along southbound I-95 during the six-year study period. As shown in **Figure 8-2**, crashes were predominantly rear-end crashes (59 percent), with fixed object off-road (17 percent), and sideswipe collisions (14 percent) being the next most frequent types.

A total of 560 crashes (22 percent) resulted in 890 injuries with six crashes resulting in six fatalities. The remaining 1,981 crashes resulted in property damage only.

Approximately 29 percent of all crashes occurred during the PM peak period for southbound travel between 3 PM – 6 PM. An additional 22 percent of all crashes occurred between 12 PM – 3 PM. Approximately 80 percent of all crashes occurred on dry pavement.

The average crash rate along southbound I-95 is 82 crashes per 100 Million Vehicle Miles Traveled; there are ten quarter-mile segments along southbound I-95 that experience a crash rate more than 50 percent higher than the average crash rate. The critical segments are for the most part located in the vicinity of Exit 148 (Russell Road). In the southbound direction, congestion typically begins just north of Garrisonville Road with queues propagating upstream towards Russell Road during PM peak periods.

8.1.3 I-95 Express Lanes Crash Analysis

The I-95 Express Lanes opened to traffic in December 2014 for a two-week toll-free period and then tolling operations began just prior to the start of 2015. Therefore, crash data for I-95 Express Lanes segment within the study area, approximately 4.5 miles, is limited to a two-year period from January 1, 2015 through December 31, 2016.

A total of 17 crashes were reported during this time period. Crashes were predominantly rear-end crashes (58 percent), with fixed object off-road (11 percent) and sideswipe collisions (11 percent) being the next most frequent types.

A total of three crashes resulted in three injuries and no fatalities were reported during the two-year study period. Thirteen of the crashes, including all ten rear-end crashes, involved vehicles travelling in the southbound direction. Approximately 53 percent of the southbound crashes occurred between 3 PM – 6 PM, during the peak period for southbound travel.

Crashes were dispersed throughout the 4.5 study segment. The average crash rate was 54.99 crashes per 100 Million Vehicles Miles Traveled. There was one quarter-mile segment with a crash rate more than 50 percent higher than the average crash rate; that segment experienced a total of three crashes during the two-year study period.

8.1.4 Relationship to Proposed Improvements

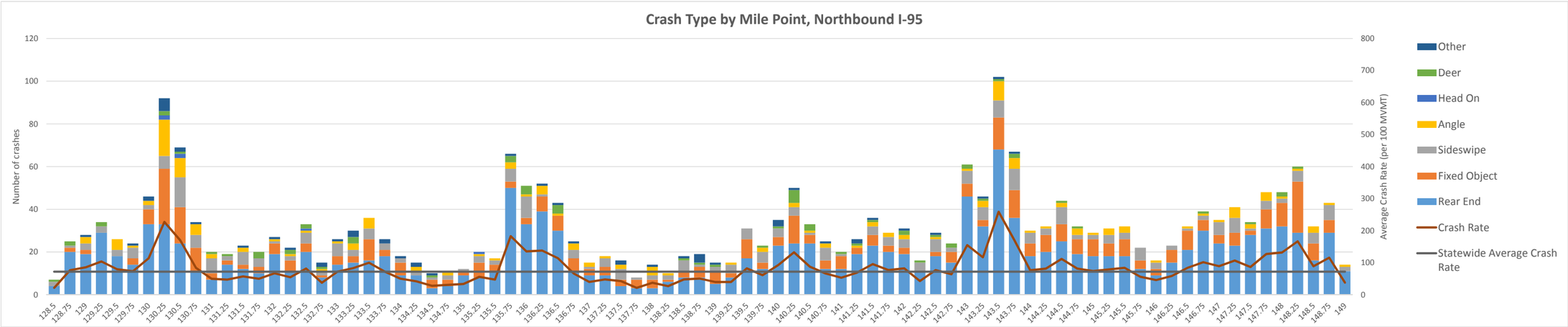
The proposed Build Alternative would provide several new access points along the existing I-95 GP lanes. These include:

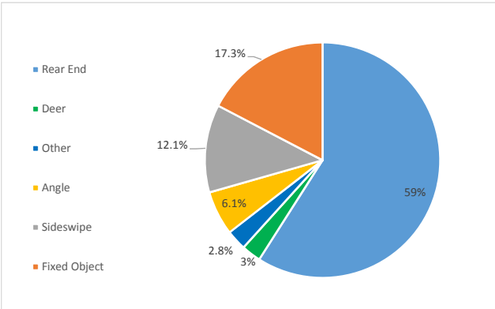
- A new flyover ramp from the I-95 southbound GP lanes to I-95 Express Lanes would be constructed at approximately MP 146.5 to 147. The existing crash rate along the southbound I-95 GP lanes in this section is approximately 15 percent lower than the corridor average. The addition of a deceleration lane to allow traffic to access the proposed flyover would not be anticipated to increase crash risk substantially in this location.
- A new flyover ramp from I-95 Express Lanes to I-95 northbound GP lanes would be constructed at approximately MP 147.5 to 148. A continuous auxiliary lane would be provided from the touch

down point of the proposed flyover to the existing off-ramp to Russell Road at Exit 148. The existing crash rates along the northbound I-95 GP lanes in this segment range from 5 percent to 55 percent higher than the study corridor average. It should be noted that improved access to MCBQ was identified during the project development as a desirable element by project stakeholders. Russell Road serves as the primary access to MCBQ for employees from Stafford County and points south. However, these employees cannot use the existing I-95 Express Lanes for their trip due to the lack of access in the vicinity of MCBQ. Several alternatives were evaluated to provide access in this area (see Section 4.5.3) and the flyover option was determined to the most desirable connection type. The proposed Build Alternative would introduce a new weaving segment (Type A weave) along the I-95 GP lanes; while this may introduce additional lane changing, it would also provide additional area for stopped / slowing vehicles outside the through lanes when there are incidents or enhanced security checks at Marine Corps Base Quantico (MCBQ). The location of the flyover was selected to minimize impacts to adjacent properties while providing sufficient weaving distance. When enhanced security protocols are in effect at MCBQ, traffic queues along Russell Road can extend back to the I-95 interchange and impact the I-95 northbound off-ramps. This occurs irregularly, but may increase the risk of crashes, particularly rear-end crashes in this area. The proposed off-ramp would not increase the likelihood of backups from MCBQ and would provide additional storage in the auxiliary lane area (outside the of through lanes). Additionally, supplemental dynamic warning signage with flashing beacons which activate when queued traffic is detected along the I-95 northbound off-ramp to Russell Road could be considered along both the I-95 GP lanes and the flyover ramp from the I-95 Express Lanes to help mitigate crash risk at this location.

- A new left slip ramp from the I-95 northbound GP lanes to I-95 Express Lanes would be constructed at approximately MP 134 to 134.5. Existing crash rates in this area are approximately 40 to 65 percent lower than the study corridor average crash rate. The introduction of a new deceleration lane and slip ramp to the I-95 Express Lanes at this location would not be anticipated to substantially increase crash risk at this location.
- A new flyover from the I-95 northbound GP lanes to the I-95 Express would be constructed at approximately 134.25 to 134.75. A new continuous auxiliary lane would be installed between the existing on-ramp from the US 17 (Warrenton Road) interchange and the proposed flyover ramp. The existing crash rates in this area are approximately 50 to 65 percent lower than the study corridor average crash rate. The introduction of a new continuous auxiliary lane would provide additional merge area for the high merging volumes from US 17 and would eliminate the need for traffic from US 17 to merge into the I-95 GP lanes prior to accessing the I-95 Express Lanes. The proposed improvements would not be expected to substantially increase crash risk at this location.

The remaining two access points would tie to newly constructed improvements along southbound I-95 approaching the US 17 (Warrenton Road) interchange at Exit 133. Therefore, a qualitative analysis of these specific areas based on existing crash history would provide little benefit.





Severity By Crash Type

	Fatal	Injury	PDO	Total
Rear End	5	372	1,148	1,525
Deer		3	66	69
Other Animal		1	3	4
Backed Into		0	2	2
Other		4	13	17
Angle		52	105	157
Head On	1	2	3	6
Sideswipe	2	50	260	312
Fixed Object	6	112	330	448
Non-Collision	1	16	25	42
Ped	0	1	0	1
Grand Total	15	613	1,955	2,583

Time of Day by Crash Type

	0AM TO 3AM	3AM TO 6AM	6AM TO 9AM	9AM TO 12PM	12PM TO 3PM	3PM TO 6PM	6PM TO 9PM	9PM TO 12AM	Total
Rear End	28	87	350	204	345	309	155	47	1,525
Deer	9	15	8	5	5	5	9	13	69
Other Animal	1	2	1						4
Backed Into			1				1		2
Other		1		4	6	3	1	2	17
Angle	6	15	21	26	36	23	16	14	157
Head On		2		1		1	1	1	6
Sideswipe	20	33	58	44	55	43	31	28	312
Fixed Object	38	52	64	68	67	65	55	39	448
Non-Collision	2	5	8	4	4	7	7	5	42
Ped	1								1
Grand Total	105	212	511	356	518	456	276	149	2,583

Severity by Pavement Condition

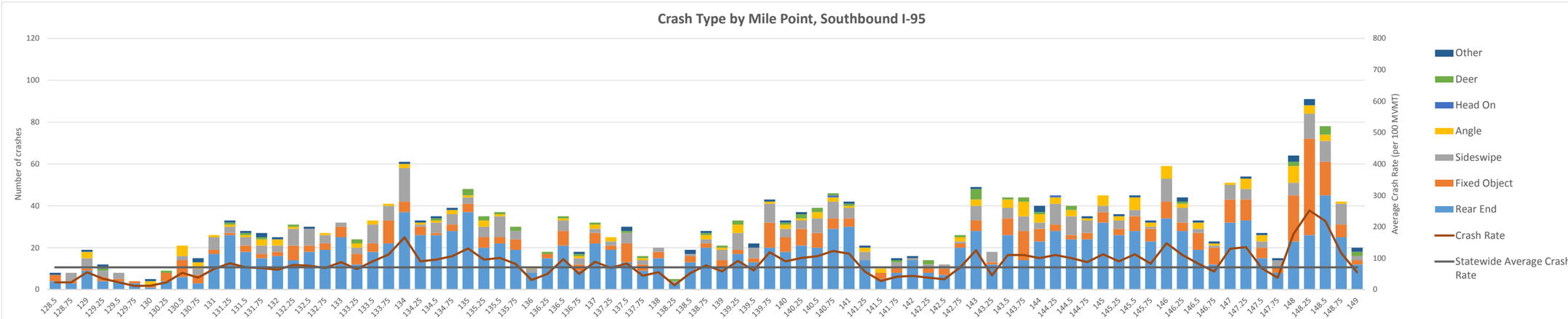
	Fatal	Injury	PDO	Total
Dry	13	483	1,484	1,980
Fog		5	1	6
Mist	1	8	36	45
Rain	1	107	377	485
Snow		9	50	59
Sleet/Hail		1	7	8
Grand Total	15	613	1,955	2,583

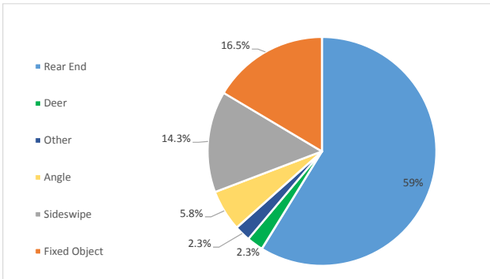
I-95 Express Lanes Fredericksburg Extension Study

Crash Summary
Jan. 1, 2011 - Dec. 31, 2016
Northbound I-95

February 2018

Figure 8.1





Severity By Crash Type

	Fatal	Injury	PDO	Total
Rear End	1	336	1,161	1,498
Deer		1	58	59
Ped		2	1	3
Backed Into			5	5
Other	1	3	10	14
Angle	1	41	106	148
Head On		1		1
Sideswipe		52	313	365
Fixed Object	3	103	313	419
Non-Collision		21	14	35
Grand Total	6	560	1,981	2,547

Time of Day by Crash Type

	0AM TO 3AM	3AM TO 6AM	6AM TO 9AM	9AM TO 12PM	12PM TO 3PM	3PM TO 6PM	6PM TO 9PM	9PM TO 12AM	Total
Rear End	34	22	47	187	389	573	205	41	1,498
Deer	16	6	12	5	4	1	5	10	59
Other Animal		2						1	3
Ped					1	1	1		3
Backed Into	2		1			1	1		5
Other		1	2	2	1	2	1	2	11
Angle	12	2	20	18	30	30	28	8	148
Head On		1							1
Sideswipe	22	22	31	53	71	85	53	28	364
Fixed Object	57	46	72	62	53	41	36	52	419
Non-Collision	3	3	5	3	5	8	4	4	35
Grand Total	146	105	190	330	554	742	334	146	2,547

Severity by Pavement Condition

	Fatal	Injury	PDO	Total
Dry	3	437	1,587	2,027
Fog		1	4	5
Mist	1	12	27	40
Rain	2	102	324	428
Snow		5	31	36
Sleet/Hail		1	8	9
Other		2		2
Grand Total	6	560	1,981	2,547

I-95 Express Lanes Fredericksburg Extension Study

Crash Summary
Jan. 1, 2011 - Dec. 31, 2016
Southbound I-95

February 2018

Figure 8.2

8.2 QUANTITATIVE SAFETY ANALYSIS

AASHTO's Highway Safety Manual (HSM), published in 2010, presents a variety of quantitative methods for estimating crash frequency or severity for various facility types. In 2014, a supplement for the HSM was released which includes two new chapters to estimate crash frequency for both freeways and ramps. There are two tools available for implementing the predictive method of the HSM for freeway facilities the Interactive Highway Safety Design Model (IHSDM) and Enhanced Interchange Safety Analysis Tool (ISATe). The Traffic Operations Analysis Tool Selection Matrix included in Appendix D of the Traffic Operations and Safety Analysis Manual (TOSAM), Version 1.0 (VDOT TOSAM, 2015) specifies the use of the IHSDM or ISATe; however, according to Chapter 18 of the HSM and the ISATe User's Manual, "the predictive method for freeways does not account for the influence of reversible lanes." Therefore, ISATe and the predictive method cannot be used to assess the potential crash frequency within the proposed I-95 Express Lanes Extension.

The I-95 GP lanes could be analyzed using either the ISATe or IHSDM. However, both tools are intended to assess the differences in safety performance for substantive changes in geometric elements (lane widths, shoulder widths, clear zone widths, etc) and the vast majority of the improvements proposed under this project involve converting a vegetated median to two reversible HOT lanes. However, the HSM methodologies as implemented in the ISATe do account for changes in total daily traffic volumes along the corridor. Since the proposed I-95 Express Lanes are projected to reduce daily traffic volumes in the I-95 GP lanes, a comparison could be conducted to assess the potential influence on expected crashes due to the changes in volumes.

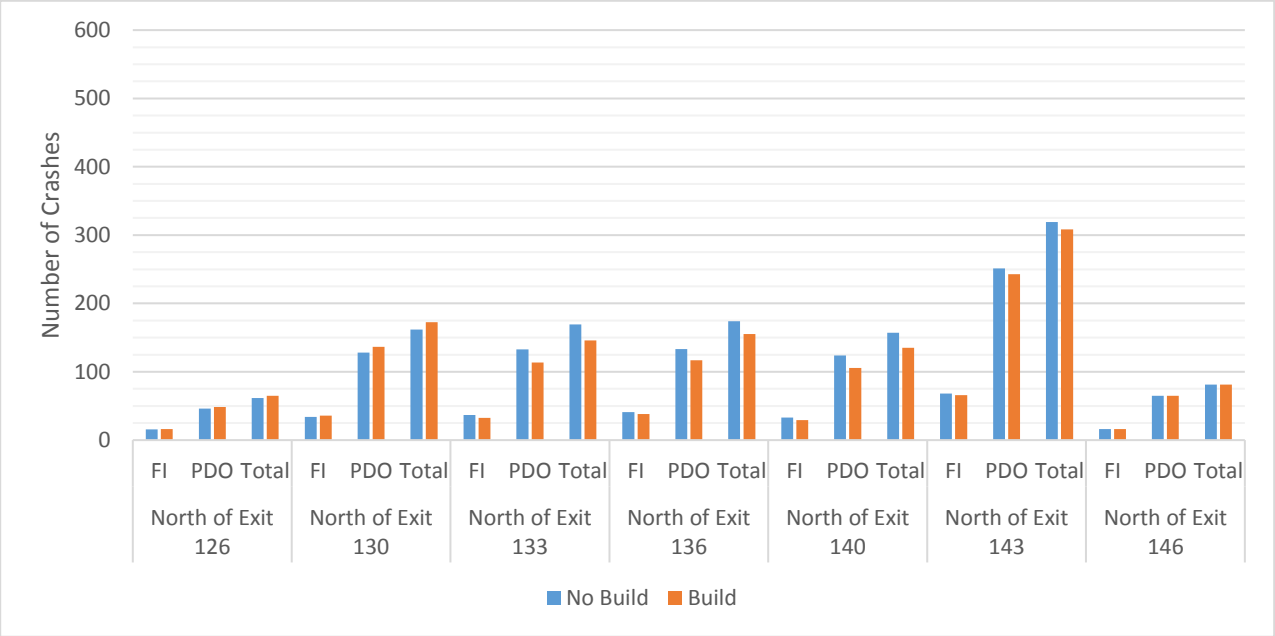
For this simplified analysis, the geometric parameters along the I-95 GP lanes were held constant between the No Build and Build Alternatives and the average daily traffic volumes were adjusted to reflect the projected daily volumes for each alternative. Some minor geometric changes are proposed to the I-95 GP lanes under the Build Alternative; these include acceleration and deceleration lanes for the new proposed access points to the reversible I-95 Express Lanes; however, because of the specific limitations of the ISATe methodology, it was determined that this tool should not be used to attempt to assess the influence of ramps serving a reversible lane facility. The ISATe methodology utilizes daily volumes which anticipates traffic throughout a typical 24-hour period. With a reversible lane system, the daily volumes for the entry and exit ramps are condensed into shorter time period. Additionally, the vehicle mix for the entry and exit ramps to a reversible lane system does not match a traditional vehicle mix for a freeway facility. These ramps do not serve truck traffic. Because of this differing vehicle mix and the condensed nature of the daily volumes into shorter time periods, the results from ISATe may not be representative of the expected conditions for the proposed reversible lane access points. Therefore, it was determined that these access points would not be analyzed using ISATe.

For the analysis, the corridor was divided into seven freeway segments and the existing crash history for each segment was compiled in accordance with the ISATe methodology. An analysis year of 2035 was selected (this was the maximum allowable analysis year based on the ISATe methodology) if existing crash data and volumes were utilized.

By 2035, 1,124 total annual crashes are predicted within the I-95 GP Lanes for the No-Build Alternative. The Build Alternative is predicted to have 1,068 total crashes; this represents a reduction in predicted annual crashes of approximately 4.9 percent under the Build Alternative. Generally, reductions are predicted north

of Exit 133 where the new I-95 Express Lanes would be installed; a slight increase in crashes is predicted south of Exit 133, where daily volumes increase under the Build Alternative due to the improved capacity to the north, allowing more traffic to use the I-95 corridor. **Figure 8-3** shows the crash comparison between the No-Build and Build alternatives by segment.

Figure 8-3: ISATe Expected Annual Crashes by Segment



9. LAND USE

9.1 EXISTING LAND USE

Existing land use is discussed in **Section 3.2**. Existing land uses within the Study Area are depicted in **Figure 3-2.**

9.2 FUTURE LANE USE PLANS

9.2.1 National Capital Region Transportation Planning Board

The National Capital Region Transportation Planning Board is the metropolitan planning organization for the Washington, DC metropolitan area. The Board is responsible for developing the TIP, which identifies regionally significant transportation projects that are approved for funding and likely to be implemented within six years of the publication date. On February 3, 2017, the Board approved an amendment to add the I-95 Express Lanes Extension Study to the Fiscal Year 2017-2022 TIP.

9.2.2 Prince William County

Prince William County, located north of Stafford County and south of Fairfax County along I-95, is part of the Washington, DC Metropolitan Region. As such, it has experienced significant population growth over the last several decades and it is currently the second most populous county in Virginia per the 2010 US Census (US Census Bureau, 1980-2010).

Prince William County's urban and suburban land uses surround the I-95 corridor in the eastern portion of the county, as well as the City of Manassas. Further from these dense centers, the remainder of the county is composed of semi-rural and rural/agricultural land uses, as well as large parks and public lands, such as Manassas National Battlefield Park and Prince William Forest Park. The northern portion of the Marine Corps Base Quantico is also located in Prince William County.

The *Prince William County 2008 Comprehensive Plan* (including the 2012 update of the *Long-Range Land Use Plan*) identifies general land use goals that mirror Smart Growth principles. These principles believe that by concentrating population, employment, and public infrastructure within mixed-use and transit- oriented centers, development pressure on existing communities, cultural resources, open space, and environmentally-sensitive areas will be reduced.

Prince William County is divided into two general geographic planning areas: Development Area and the Rural Area. The Development Area includes urban, suburban, and semi-rural sub-areas; and features established residential, commercial, and industrial areas, as well as underdeveloped areas designated for future growth. The Rural Area features low-density residential, agricultural or estate, and convenience retail land uses. Per the Comprehensive Plan, higher density development should not be directed to the Rural Area.

The Comprehensive Plan acknowledges that a well-functioning transportation system within Prince William County is key to economic growth, because it allows for the efficient movement of people and goods and provides an attractive quality of life for residents and employers. Transportation improvements recommended by the Plan include the construction of a fourth GP lane along I-95 from the Fairfax County line to the Stafford County line to ease commuter traffic issues stemming from neighboring jurisdictions.

9.2.3 Stafford County

Stafford County, located approximately 40 miles south of Washington, DC, is affected by the rapid growth of both the Washington, DC metropolitan region and the Fredericksburg metropolitan area. Historically rural and agricultural Stafford County has become increasingly suburban since the construction of I-95 in the 1960s. Residences and businesses are clustered most densely around the I-95 corridor, just south of Marine Corps Base Quantico and north of the City of Fredericksburg.

The *Stafford County Comprehensive Plan*, 2016-2036, directs future development into the Urban Services Area, a growth boundary that envelops the length of the I-95 corridor through Stafford County. The Urban Services Area has been delineated to include available vacant and underutilized land along the corridor that will accommodate the County's projected population growth over the next 20 years. By encouraging compact and infill development patterns within the Urban Services Area, and by focusing government and community services and infrastructure within this area, the Comprehensive Plan aims to preserve agricultural and rural areas located further from the interstate.

Within the larger Urban Services Area boundary are Planning Areas. Planning Areas indicate locations where significant commercial and residential development/redevelopment is anticipated. Planning Areas feature either Targeted Growth Areas (TGAs) or Redevelopment Areas (RDAs). TGAs designate an area for concentrated urban or higher density suburban development patterns located near primary road networks, transportation hubs, and the rail corridor. RDAs focus on economic revitalization via the development of mixed-use projects.

The *Stafford County Comprehensive Plan* identifies I-95 as a "major north-south transportation route for commuters, vacationers, business travelers, residents who use the facilities for local trips, and trucks traveling within and through the County." To reduce traffic congestion on I-95, the Plan supports several proposed transportation improvements to the Interstate, including the Express Lane extension from Garrisonville Road to Exit 126.

9.3 CONSISTENCY WITH PLANS AND POLICY

Locality plans from the National Capital Region Transportation Planning Board (NCRTPB), the FAMPO, Prince William County, and Stafford County all indicate the need for transportation improvements to ease commuter traffic issues. The NCRTPB approved an amendment to add the I-95 Express Lanes Extension Study to the Fiscal Year 2017-2022 Transportation Improvement Plan (TIP) (MWCOG, 2017), FAMPO included a project to extend the Express Lanes from near VA 610 / Garrisonville Road (Exit 143) to Exit 126 in its *2040 Long Range Transportation Plan* (FAMPO, 2013), and the Stafford County Comprehensive Plan recommended reducing traffic congestion on I-95 by extending the Express Lanes from Garrisonville Road to Exit 126 (Stafford County, 2016).

10. ENVIRONMENTAL COMPLIANCE

The Virginia Department of Transportation (VDOT), in coordination with the Federal Highway Administration (FHWA) as the lead federal agency, has prepared a Revised Environmental Assessment (Revised EA) for the Interstate 95 (I-95) HOT Lanes Project, for which a Finding of No Significant Impact (FONSI) was issued by FHWA in 2011. The Revised EA, which has been completed for the I-95 Express Lanes Fredericksburg Extension Study, presents improvements identified in a portion of the 2011 FONSI-selected Alternative, from the I-95 / US 17 North interchange at Warrenton Road (Exit 133) to south of the I-95 / Russell Road interchange (Exit 148). The Revised EA also includes new access points along this portion of the 2011 FONSI-selected Alternative. As part of the study, environmental resources along the corridor have been updated according to the latest available data and information, and potential impacts that the project would have on social and environmental resources have been examined.

A summary of the Revised EA is included in **Appendix Q**. Permits that are likely needed include: the Section 404 permit from the USACE, a Virginia Water Protection Individual Permit from the Virginia Department of Environmental Quality (VDEQ) (which serves as the Section 401 certification), a subaqueous bottomland permit from Virginia Marine Resources Commission (VMRC), and registration under the VDEQ General Permit for Discharges of Stormwater from Construction Activities with a project specific Stormwater Pollution Prevention Plan (SWPPP). Compensatory mitigation would be required for permanent impacts to streams and wetlands resulting from the project. All areas with temporary impacts would be required to be restored to the areas' original contours and re-vegetated with the same or similar species, per existing regulations and standard permit conditions.

A FONSI is anticipated in early 2018, after approval of air quality conformity analyses and updates to the National Capital Region Transportation Planning Board's Constrained Long-Range Plan (CLRP) and Transportation Improvement Program (TIP), as well as the Statewide Transportation Improvement Program (STIP).

11. RESOLUTION OF LOCAL SUPPORT

The proposed improvements for this project are located entirely within Stafford County. On November 21, 2017, the Stafford County Board of Supervisors passed a resolution of support for the I-95 Express Lanes Fredericksburg Extension Project. A copy of this resolution is included in this IJR in **Appendix R**.

12. REFERENCES

American Community Survey (ACS). 2016. *American Community Survey 5-year 2011-2015.* American FactFinder. Accessed February 2017: http://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t.

Federal Highway Administration (FHWA). 2011a. *Environmental Assessment: I-95 HOT Lanes Project*. Accessed November 2016: https://web.archive.org/web/20160507151404/http://www.vamegaprojects.com/tasks/sites/default/assets/File/pdf/95HOVHOT/110908_I-95HOTLanesEA_ApprovedbyFHWA.pdf.

Federal Highway Administration (FHWA). 2011b. *Federal Highway Administration Finding of no Significant Impact for Interstate 95 HOT Lanes Project*. Accessed October 2016: https://web.archive.org/web/20160507151350/http://www.vamegaprojects.com/tasks/sites/default/assets/File/pdf/95HOVHOT/I-95%20HOT%20Lanes%20FONSI.pdf.

Federal Highway Administration (FHWA). 2016a. Information: Level of Service on the National Highway System [Memorandum]. US Department of Transportation Federal Highway Administration. Office of Program Administration. HIPA-20. Accessed April 2017: https://www.fhwa.dot.gov/design/standards/160506.pdf.

Federal Highway Administration (FHWA). 2016b. *Reevaluation of 2011 Environmental Assessment (EA) for I-95 Express Lanes Southern Terminus Extension, Stafford County, Virginia.* Accessed April 2017: http://www.virginiadot.org/projects/resources/NorthernVirginia/Reevauation_of_2011_Environmental_Assessment_for_95_Express_Lanes_Extension.pdf.

Fredericksburg Area Metropolitan Planning Organization (FAMPO). Constrained Long Range Plan. Accessed March 2017: https://www.fampo.gwregion.org/long-range-transportation-planning/.

Furth, Peter G. 1990. *Model of Turning Movement Propensity*. Transportation Research Record, Issue 1287, Transportation Research Board.

Horowitz, Alan; Creasey, Tom; Pendyala, Ram; Chen, Mei. 2014. *Analytical Travel Forecasting Approaches for Project-Level Planning and Design*. NCHRP Report, CDM Smith, Issue 765.

Marine Corps Base Quantico. Fast Facts. Accessed May 2017: http://www.quantico.marines.mil/Portals/147/Docs/Fast%20Facts%202015-2016.pdf.

Metropolitan Washington Council of Governments (MWCOG). 2017. Transportation Improvement Plan. Accessed March 2017. https://www.mwcog.org/transportation/plans/transportation-improvement-program/.

Pedersen, N J; Samdahl, D R. 1982. *Highway Traffic Data for Urbanized Area Project Planning and Design*. NCHRP Report, Transportation Research Board, Issue 255.

Prince William County. Prince William County 2008 Comprehensive Plan. Accessed March 2017. http://www.pwcgov.org/government/dept/planning/pages/comprehensive-planning.aspx.

Stafford County Planning Commission. 2016. Stafford County Comprehensive Plan, 2016-2036. Accessed March 2017. http://staffordcountyva.gov/DocumentCenter/View/9317.

Transportation Research Board. 2010. *Highway Capacity Manual 2010*.

Virginia Department of Transportation. June 2014. *Travel Demand Modeling Policies and Procedures, Version 2.00*.

Virginia Department of Transportation (VDOT). 2017a. Interstate 95 Express Lanes Fredericksburg Extension Study Revised Environmental Assessment. Richmond, Virginia: Virginia Department of Transportation. August 2017.

Virginia Department of Transportation (VDOT). 2016. *I-395 Express Lanes Extension*. Accessed April 2017: http://www.virginiadot.org/projects/northernvirginia/395_express.asp.

Virginia Department of Transportation (VDOT). 2017a. *Express Lanes*. Accessed April 2017: https://www.expresslanes.com/using-the-lanes.

Virginia Department of Transportation (VDOT). 2017b. *I-95 Express Lanes Southern Extension*. Accessed April 2017: http://www.virginiadot.org/projects/fredericksburg/95_express_lanes_southern_terminus.asp.

Virginia Department of Transportation (VDOT). 2017c. *Interstate 95/Route 630 (Courthouse Road) Interchange Relocation and Route 630 Widening*. Accessed April 2017: http://www.virginiadot.org/projects/fredericksburg/interstate_95-route_630_courthouse_road_interchange_relocation_and_route_630_widening.asp.

http://www.greatamericanstations.com/stations/fredericksburg-va-fbg/

http://www.slug-lines.com/Index.htm

APPENDIX A:
2016 EXISTING
TRAFFIC VOLUMES

APPENDIX B:
2042 NO-BUILD
TRAFFIC VOLUMES

APPENDIX C:
2042 BUILD
TRAFFIC VOLUMES

APPENDIX D:
2022 NO-BUILD
TRAFFIC VOLUMES

APPENDIX E:
2022 BUILD
TRAFFIC VOLUMES

APPENDIX F:

APPROVED FRAMEWORK DOCUMENT

APPENDIX G:
VISSIM CALIBRATION MEMORANDUM

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EXISTING CONDITIONS (2016) DETAILED ANALYSIS RESULTS

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2016 Existing AM Intersection Average Delay (seconds per vehicle) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	Route 3 at I-95 SB Off-Ramps							-		-			-	
1302	Route 3 at I-95 NB Off-Ramps								-				-	-
1303	Route 3 at Carl D. Silver Pkwy		69	86	6	77	68	6	74	9	6	83	11	11
1304	Route 3 at Gateway Blvd		46	53	1	67	55	8	81	13	4	49	10	2
1333	US 17 at Gateway Dr		65	72	48	62	49	11	21	17	6	16	15	16
1338	US 17 at Short St		40	5	9	-	-	13	8	6	-	8	5	4
1363	Centreport Pkwy at I-95 SB Ramps					20		(0)		9	-	-	5	
1366	Centreport Pkwy at I-95 NB Ramps		15		-				21	24			24	
1368	US 1 at Centreport Pkwy			24	13	25	-					34		29
1403	Courthouse Rd at I-95 SB Ramps					39		-		7	5	7	5	
1406	Courthouse Rd at I-95 NB Ramps		-		4				-	6			13	10
1408	Courthouse Rd at US 1													
1431	Garrisonville Rd at I-95 SB Ramps							-		42	28		0	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	0			3	2						
1438	US 1 at Route 610		-	-	4	85	40	15	56	41	17	57	59	9
1483	Russell Rd at I-95 SB Ramps					36		25	52	20			5	3
1486	Russell Rd at I-95 NB Off-Ramp		8		-					53			22	
1488	Russell Rd at I-95 NB On-Ramp								48	1			2	2

2016 Existing AM Intersection Throughput (veh/hour) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	Route 3 at I-95 SB Off-Ramps							-		-			-	
1302	Route 3 at I-95 NB Off-Ramps								-				-	-
1303	Route 3 at Carl D. Silver Pkwy		1	3	10	303	2	39	149	2,863	39	14	1,117	396
1304	Route 3 at Gateway Blvd		264	1	134	5	2	14	67	1,331	257	94	1,034	6
1333	US 17 at Gateway Dr		9	9	58	173	-	15	19	1,065	10	53	1,342	53
1338	US 17 at Short St		97	2	18	-	-	5	3	916	-	5	1,142	1
1363	Centreport Pkwy at I-95 SB Ramps					46		-		73	-	-	290	
1366	Centreport Pkwy at I-95 NB Ramps		133		-				4	114			219	
1368	US 1 at Centreport Pkwy			1,186	563	73	-					74		198
1403	Courthouse Rd at I-95 SB Ramps					99		-		456	347	100	770	
1406	Courthouse Rd at I-95 NB Ramps		-		151				-	423			594	353
1408	Courthouse Rd at US 1													
1431	Garrisonville Rd at I-95 SB Ramps							-		2,171	140		1,385	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	1,636			1,325	87						
1438	US 1 at Route 610		-	-	3	52	348	936	1,016	51	181	87	299	388
1483	Russell Rd at I-95 SB Ramps					176		201	7	241			318	46
1486	Russell Rd at I-95 NB Off-Ramp		45		-					412			319	
1488	Russell Rd at I-95 NB On-Ramp								44	581			316	84

2016 Existing AM Intersection Average Queue (feet) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	Route 3 at I-95 SB Off-Ramps							-		-			-	
1302	Route 3 at I-95 NB Off-Ramps								-				-	-
1303	Route 3 at Carl D. Silver Pkwy		2	2	2	110	110	71	143	143	71	28	24	17
1304	Route 3 at Gateway Blvd		58	58	55	3	3	1	59	59	35	48	48	48
1333	US 17 at Gateway Dr		30	30	30	32	19	16	23	31	21	19	22	19
1338	US 17 at Short St		23	23	23	-	1	2	13	13	-	14	16	17
1363	Centreport Pkwy at I-95 SB Ramps					5		-		2	-	-	3	
1366	Centreport Pkwy at I-95 NB Ramps		10		-				4	4			7	
1368	US 1 at Centreport Pkwy			21	10	4	-					55		63
1403	Courthouse Rd at I-95 SB Ramps					27		-		13	0	12	12	
1406	Courthouse Rd at I-95 NB Ramps		-		68				-	12			63	61
1408	Courthouse Rd at US 1													
1431	Garrisonville Rd at I-95 SB Ramps							-		69	69		-	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	-			17	19						
1438	US 1 at Route 610		-	-	153	141	147	128	1,007	1,007	1,007	29	63	5
1483	Russell Rd at I-95 SB Ramps					49		49	6	6			0	0
1486	Russell Rd at I-95 NB Off-Ramp		1		-					53			28	
1488	Russell Rd at I-95 NB On-Ramp								13	13			1	0

2016 Existing AM Intersection Max Queue (feet) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	Route 3 at I-95 SB Off-Ramps							-		-			-	
1302	Route 3 at I-95 NB Off-Ramps								-				-	-
1303	Route 3 at Carl D. Silver Pkwy		32	32	32	368	368	335	863	863	335	244	222	250
1304	Route 3 at Gateway Blvd		249	249	255	62	62	74	282	282	281	360	360	360
1333	US 17 at Gateway Dr		181	181	181	144	132	142	280	285	276	237	240	237
1338	US 17 at Short St		175	175	175	-	36	53	256	256	-	293	286	293
1363	Centreport Pkwy at I-95 SB Ramps					95		-		96	-	-	133	
1366	Centreport Pkwy at I-95 NB Ramps		304		-				102	102			142	
1368	US 1 at Centreport Pkwy			246	257	91	-					401		420
1403	Courthouse Rd at I-95 SB Ramps					202		-		420	82	348	348	
1406	Courthouse Rd at I-95 NB Ramps		-		573				-	230			654	651
1408	Courthouse Rd at US 1													
1431	Garrisonville Rd at I-95 SB Ramps							-		516	516		-	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	-			316	339						
1438	US 1 at Route 610		-	-	553	718	718	710	1,604	1,604	1,604	164	252	206
1483	Russell Rd at I-95 SB Ramps					452		450	96	96			48	15
1486	Russell Rd at I-95 NB Off-Ramp		51		-					585			165	
1488	Russell Rd at I-95 NB On-Ramp								79	79			70	11

6 – 7 AM

NB GP Lanes

Exit 130 Plank/William Road | Exit 133 Warrenton Road | Exit 136 Centreport Parkway

Speed	69	70	70	70	70	70	70	70	69	69	68	69	52	62	66	68	69	69	68	68	67	67	69	69	69	69	66	68	68	68	69	66	66	68
Density	14	13	13	13	13	13	13	13	13	13	10	12	21	21	17	22	22	22	22	22	23	17	16	16	16	16	15	20	20	20	20	15	16	15
Volume	2766	2766	2767	2763	2759	2758	2755	2749	2746	2742	2738	2508	4245	3834	4447	4446	4443	4433	4418	4417	4415	4406	3281	3283	3289	3289	3932	3930	3937	3945	3958	3962	3001	3001
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	4	3	3	3	3	3	3	4	3	3	3	3	4	3	3	3	3	4	3	3
Length	2000	2000	2000	2000	2000	2000	2000	2000	2000	716	640	1177	790	1104	1208	2000	2000	2000	2000	2000	714	866	2000	2000	2000	190	1601	2000	2000	2000	1313	792	2000	1610

Speed Color Scale (mph): 10 | 30 | 40 | 50 | 70

Exit 140 Courthouse Road | Exit 143 Garrisonville Road

62	65	68	68	68	68	62	46	42	38	35	25	23	10	19	18	18	18	19	19	19	9	8	8	8
14	18	17	17	17	17	19	25	27	30	24	40	42	86	57	59	60	59	57	57	56	89	134	130	127
3365	3366	3373	3379	3378	3377	3380	3383	3380	3370	3365	2936	2902	3294	3225	3220	3185	3212	3213	3217	3213	3183	3013	2932	3808
4	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3	3	4	3	3	4
579	2000	2000	2000	2000	2000	2000	2000	2000	778	905	2000	5	1471	2000	2000	2000	2000	1546	415	582	825	2000	162	855

Exit 148 Russell Road

24	33	66	69	69	68	62	69	70	69	68	68	68	67	68	69	68	65	69	69	67	68	69	69	69	69	69
51	34	23	22	22	23	18	18	18	18	18	18	18	18	18	18	18	14	16	16	13	17	17	16	16	16	16
3701	4521	4509	4513	4514	4509	4478	3629	3623	3622	3629	3617	3624	3626	3628	3627	3611	3588	3216	3219	3327	3324	3321	3327	3328	3318	3325
3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
759	1503	2000	2000	675	1193	295	2000	416	2000	563	1445	2000	731	2000	881	942	519	2000	455	1083	394	2000	1484	789	685	1711

8 – 9 AM

NB GP Lanes

Exit 130 Plank/William Road

Exit 133 Warrenton Road

Exit 136 Centreport Parkway

Speed	69	70	70	70	70	69	69	69	69	69	65	69	56	64	67	69	69	69	69	67	67	64	69	70	70	70	67	69	69	69	69	68	68	69
Density	15	14	14	14	15	15	15	15	15	15	11	13	17	18	15	19	19	19	19	20	20	16	12	12	12	12	11	14	14	14	14	11	12	12
Volume	2980	2977	2979	2972	2972	2983	2982	2982	2987	2987	2984	2716	3810	3377	3858	3859	3868	3864	3863	3881	3880	3869	2361	2366	2366	2366	2861	2859	2856	2853	2852	2844	2340	2346
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	4	3	3	3	3	3	3	4	3	3	3	3	4	3	3	3	3	4	3	3
Length	2000	2000	2000	2000	2000	2000	2000	2000	2000	716	640	1177	790	1104	1208	2000	2000	2000	2000	2000	714	866	2000	2000	2000	190	1601	2000	2000	2000	1313	792	2000	1610

Speed Color Scale (mph)

10 30 40 50 70

Exit 136 Centreport Parkway

Exit 140 Courthouse Road

Exit 143 Garrisonville Road

69	63	66	69	69	69	69	68	68	68	68	68	68	69	68	67	63	54	48	42	41	40	19	12	9	8
12	12	15	15	15	15	15	15	15	15	15	11	13	13	12	16	17	20	23	26	27	28	43	89	111	122
2346	2929	2936	2933	2933	2935	2939	2934	2925	2924	2920	2917	2581	2578	3098	3101	3109	3123	3113	3121	3131	3121	3089	2823	2740	3956
3	4	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3	3	4	3	3	4
1610	579	2000	2000	2000	2000	2000	2000	2000	2000	778	905	2000	5	1471	2000	2000	2000	2000	1546	415	582	825	2000	162	855

Exit 148 Russell Road

27	35	66	69	69	68	62	69	69	69	68	69	68	67	68	68	67	64	69	69	67	68	69	69	69	69	69
49	33	23	22	22	23	18	19	19	19	19	19	19	19	19	19	19	15	16	16	13	17	17	17	17	17	17
3842	4519	4520	4531	4540	4541	4510	3709	3710	3705	3706	3697	3709	3714	3708	3712	3700	3688	3185	3186	3327	3325	3330	3336	3332	3313	3324
3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
759	1503	2000	2000	675	1193	295	2000	416	2000	563	1445	2000	731	2000	881	942	519	2000	455	1083	394	2000	1484	789	685	1711

6 – 7 AM

SB GP Lanes

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	70	70	70	69	69	68	70	70	70	70	69	69	70	70	70	70	70	70	70	70	70	70	70	70	71	65
Density	10	10	10	10	10	8	6	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	4	4	5
Volume	2094	2091	2088	2082	2077	2073	1170	1195	1198	1201	1201	1180	1196	1188	1194	1192	1190	1188	1188	1183	1178	1177	1169	1173	897	1221
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1943	1467	2000	1888	838	602	851	968	492	1598	2000	237	2000	780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

70	69	70	70	70	70	70	70	70	70	70	70	69	70	70	70	70	70	70	70	70	70	70	70	
6	5	6	6	6	6	6	6	6	5	6	6	6	7	7	7	7	7	7	7	7	7	5	7	
1189	1359	1353	1354	1349	1351	1348	1343	1341	1337	1235	1234	1539	1537	1536	1534	1530	1529	1527	1526	1525	1523	1527	1467	1
3	4	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3	3	3	3	4	3	
928	1408	1613	782	2000	2000	2000	2000	1436	855	2000	34	1732	2000	2000	2000	2000	2000	2000	2000	2000	2	861	2000	

Exit 133 Warrenton Road

Exit 130 Plank/William Road

70	69	70	70	70	70	70	70	70	70	69	70	66	70	70	70	70	70	70	70	70	67	70	69	70	69	71	71	71	71	71	71	71	71	71	70	71
7	6	8	8	8	8	8	8	6	7	5	6	7	9	9	9	7	9	7	9	9	7	6	5	5	5	6	6	6	6	6	6	6	6	6	6	6
1467	1617	1616	1615	1614	1614	1614	1614	1610	1445	1415	1331	1863	1864	1863	1859	1854	1855	1855	1855	1854	1850	1298	1380	1087	1414	1180	1178	1180	1182	1181	1182	1184	1184	1180	1178
3	4	3	3	3	3	3	3	4	3	4	3	4	3	3	3	4	3	4	3	3	4	3	4	3	4	3	3	3	3	3	3	3	3	3	3
844	614	2000	2000	2000	2000	2000	741	857	1087	1117	516	1360	2000	2000	1820	411	1119	1651	2000	1139	678	1159	750	1027	1267	2000	2000	2000	2000	2000	2000	2000	2000	2000	292

8 – 9 AM

SB GP Lanes

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	69	69	69	68	69	68	70	69	69	69	68	68	69	69	69	69	69	69	69	70	69	69	69	70	70	66
Density	18	18	19	19	19	14	13	10	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	10	11	10
Volume	3810	3813	3813	3814	3815	3810	2725	2815	2828	2835	2837	2797	2842	2829	2844	2843	2843	2844	2840	2838	2844	2847	2828	2838	2287	2570
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1943	1467	2000	1888	838	602	851	968	492	1598	2000	237	2000	780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

69	69	70	70	70	70	70	70	70	70	70	70	69	70	70	70	70	69	69	69	69	69	69	69
12	10	13	13	13	13	13	13	13	10	12	12	11	14	14	14	14	14	14	14	14	14	10	13
2403	2701	2695	2698	2690	2697	2695	2695	2695	2687	2424	2422	2901	2901	2898	2895	2894	2891	2888	2881	2875	2867	2871	2735
3	4	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3	3	3	3	4	3
928	1408	1613	782	2000	2000	2000	2000	1436	855	2000	34	1732	2000	2000	2000	2000	2000	2000	2000	2000	2	861	2000

Exit 133 Warrenton Road

Exit 130 Plank/William Road

69	68	69	69	69	69	69	69	67	69	68	70	65	69	69	69	70	69	69	69	69	57	67	68	70	69	70	70	70	70	70	70	70	70	70	70
13	11	14	14	14	14	14	14	11	13	9	11	12	15	15	15	11	15	11	15	15	14	11	9	9	9	10	10	10	10	10	10	10	10	10	10
2733	3006	3006	3004	2998	2995	2992	2995	2988	2612	2463	2230	3128	3136	3137	3132	3127	3130	3129	3126	3122	3112	2228	2329	1945	2367	2046	2045	2044	2041	2038	2040	2043	2045	2044	2044
3	4	3	3	3	3	3	3	4	3	4	3	4	3	3	3	4	3	4	3	3	4	3	4	3	4	3	3	3	3	3	3	3	3	3	3
844	614	2000	2000	2000	2000	2000	741	857	1087	1117	516	1360	2000	2000	1820	411	1119	1651	2000	1139	678	1159	750	1027	1267	2000	2000	2000	2000	2000	2000	2000	2000	2000	292

6 – 7 AM

NB HOT Lanes

Exit 148

Russell Road

Speed	68	70	71	71	71	71	71	71	71	71	71	71	71	71	70	70	70	70	70	70
Density	13	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Volume	893	891	886	886	889	888	887	888	888	886	887	887	887	887	879	885	884	884	884	884
Lanes	1	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Length	1733	1084	373	1650	1415	2000	735	2000	968	1497	2000	1348	1567	789	693	1550	2000	2000	2000	1285

Speed Color Scale (mph)

10 **30** **40** **50** **70**

8-9 AM

NB HOT Lanes

Exit 148

Russell Road

Speed	68	70	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71
Density	12	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Volume	827	826	822	824	826	825	824	825	824	822	823	822	822	823	817	823	823	824	824	824
Lanes	1	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Length	1733	1084	373	1650	1415	2000	735	2000	968	1497	2000	1348	1567	789	693	1550	2000	2000	2000	1285

Speed Color Scale (mph)

10 **30** **40** **50** **70**

2016 Existing PM Intersection Average Delay (seconds per vehicle) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	Route 3 at I-95 SB Off-Ramps							-		-			-	
1302	Route 3 at I-95 NB Off-Ramps								-				-	-
1303	Route 3 at Carl D. Silver Pkwy		78	84	6	92	126	10	80	16	10	86	24	8
1304	Route 3 at Gateway Blvd		44	57	1	1	1	4	52	13	6	53	9	3
1333	US 17 at Gateway Dr		388	436	216	322	345	131	15	9	2	9	5	9
1338	US 17 at Short St		46	5	11	-	-	11	8	6	-	8	4	2
1363	Centreport Pkwy at I-95 SB Ramps					22		0		25	-	-	12	
1366	Centreport Pkwy at I-95 NB Ramps		16		-				7	7			6	
1368	US 1 at Centreport Pkwy			22	8	21	-					35		32
1403	Courthouse Rd at I-95 SB Ramps					49		-		12	7	11	5	
1406	Courthouse Rd at I-95 NB Ramps		-		25				-	14			9	7
1408	Courthouse Rd at US 1													
1431	Garrisonville Rd at I-95 SB Ramps							-		37	24		0	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	0			33	47						
1438	US 1 at Route 610		-	-	4	66	35	38	58	58	38	100	105	8
1483	Russell Rd at I-95 SB Ramps					48		44	55	4			1	7
1486	Russell Rd at I-95 NB Off-Ramp		39		-					5			3	
1488	Russell Rd at I-95 NB On-Ramp								40	(0)			9	4

2016 Existing PM Intersection Throughput (veh/hour) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	Route 3 at I-95 SB Off-Ramps							-		-			-	
1302	Route 3 at I-95 NB Off-Ramps								-				-	-
1303	Route 3 at Carl D. Silver Pkwy		12	8	6	733	8	274	226	1,886	274	20	2,032	891
1304	Route 3 at Gateway Blvd		312	1	179	11	4	14	26	1,421	357	165	1,525	4
1333	US 17 at Gateway Dr		30	9	262	331	16	46	83	1,762	7	63	1,572	63
1338	US 17 at Short St		85	3	17	-	-	8	7	1,319	-	16	1,118	2
1363	Centreport Pkwy at I-95 SB Ramps					420		31		193	-	-	222	
1366	Centreport Pkwy at I-95 NB Ramps		120		-				3	611			206	
1368	US 1 at Centreport Pkwy			390	354	97	-					639		66
1403	Courthouse Rd at I-95 SB Ramps					289		-		522	300	109	707	
1406	Courthouse Rd at I-95 NB Ramps		-		166				-	716			503	159
1408	Courthouse Rd at US 1													
1431	Garrisonville Rd at I-95 SB Ramps							-		1,635	451		1,830	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	803			1,936	34						
1438	US 1 at Route 610		-	-	139	177	760	1,007	425	405	709	85	207	61
1483	Russell Rd at I-95 SB Ramps					167		54	97	512			199	455
1486	Russell Rd at I-95 NB Off-Ramp		9		-					682			640	
1488	Russell Rd at I-95 NB On-Ramp								379	408			639	192

2016 Existing PM Intersection Average Queue (feet) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	Route 3 at I-95 SB Off-Ramps							-		-			-	
1302	Route 3 at I-95 NB Off-Ramps								-				-	-
1303	Route 3 at Carl D. Silver Pkwy		8	8	8	724	724	688	128	128	688	152	140	70
1304	Route 3 at Gateway Blvd		50	50	49	0	0	1	48	48	34	55	55	55
1333	US 17 at Gateway Dr		228	228	228	498	486	512	90	99	32	8	20	8
1338	US 17 at Short St		26	26	26	-	3	4	34	34	-	15	17	19
1363	Centreport Pkwy at I-95 SB Ramps					34		0		30	-	-	11	
1366	Centreport Pkwy at I-95 NB Ramps		8		-				10	10			4	
1368	US 1 at Centreport Pkwy			18	4	25	-					158		164
1403	Courthouse Rd at I-95 SB Ramps					78		-		58	2	18	18	
1406	Courthouse Rd at I-95 NB Ramps		-		75				-	55			31	30
1408	Courthouse Rd at US 1													
1431	Garrisonville Rd at I-95 SB Ramps							-		49	49		-	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	-			515	521						
1438	US 1 at Route 610		-	-	105	547	546	535	291	291	291	38	62	3
1483	Russell Rd at I-95 SB Ramps					53		51	46	46			5	5
1486	Russell Rd at I-95 NB Off-Ramp		4		-					79			3	
1488	Russell Rd at I-95 NB On-Ramp								103	103			36	30

2016 Existing PM Intersection Max Queue (feet) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	Route 3 at I-95 SB Off-Ramps							-		-			-	
1302	Route 3 at I-95 NB Off-Ramps								-				-	-
1303	Route 3 at Carl D. Silver Pkwy		75	75	75	914	914	881	577	577	881	691	668	684
1304	Route 3 at Gateway Blvd		196	196	201	11	11	36	347	347	346	335	335	335
1333	US 17 at Gateway Dr		636	636	636	553	541	567	817	819	730	195	212	195
1338	US 17 at Short St		188	188	188	-	45	66	384	384	-	307	300	307
1363	Centreport Pkwy at I-95 SB Ramps					388		122		436	-	-	176	
1366	Centreport Pkwy at I-95 NB Ramps		196		-				381	381			128	
1368	US 1 at Centreport Pkwy			176	184	270	-					1,433		1,450
1403	Courthouse Rd at I-95 SB Ramps					472		-		766	61	336	336	
1406	Courthouse Rd at I-95 NB Ramps		-		1,312				-	676			427	424
1408	Courthouse Rd at US 1													
1431	Garrisonville Rd at I-95 SB Ramps							-		643	643		-	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	-			1,865	1,888						
1438	US 1 at Route 610		-	-	612	939	939	931	1,614	1,614	1,614	229	280	77
1483	Russell Rd at I-95 SB Ramps					347		345	208	208			229	213
1486	Russell Rd at I-95 NB Off-Ramp		59		-					220			240	
1488	Russell Rd at I-95 NB On-Ramp								360	360			295	285

3-4 PM

NB GP Lanes

Exit 130 Plank/William Road

Exit 133 Warrenton Road

Exit 136 Centreport Parkway

Speed	69	70	70	70	69	69	69	69	69	69	69	69	63	66	68	68	69	69	69	68	68	69	69	69	69	69	67	68	69	69	69	70	69	69
Density	15	14	14	15	15	15	15	15	15	15	11	14	15	18	15	20	20	20	20	20	20	15	14	14	14	14	14	18	17	17	17	13	17	17
LOS	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	C	C	C	C	C	B	B	B	B	B	B	B	B	B	B	B	B	B
Volume	3026	3027	3027	3029	3031	3031	3032	3034	3035	3036	3032	2834	3793	3557	4021	4023	4020	4023	4025	4023	4021	4009	2960	2961	2965	2966	3596	3600	3600	3601	3600	3601	3421	3421
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	4	3	3	3	3	3	3	4	3	3	3	3	4	3	3	3	3	4	3	3
Length	2000	2000	2000	2000	2000	2000	2000	2000	2000	716	640	1177	790	1104	1208	2000	2000	2000	2000	2000	714	866	2000	2000	2000	190	1601	2000	2000	2000	1313	792	2000	1610

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 143 Garrisonville Road

69	68	69	69	69	69	69	69	68	68	70	69	69	68	68	69	69	69	69	69	69	70	69	69	65
13	18	18	18	18	18	18	18	18	18	13	16	16	13	17	17	17	17	17	17	17	12	16	15	15
B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
3636	3633	3634	3637	3641	3644	3638	3637	3635	3633	3631	3220	3222	3516	3521	3518	3511	3507	3502	3501	3492	3459	3257	3158	3763
4	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3	3	4	3	3	4
579	2000	2000	2000	2000	2000	2000	2000	2000	778	905	2000	5	1471	2000	2000	2000	2000	1546	415	582	825	2000	162	855

Exit 148 Russell Road

68	69	69	69	69	69	70	69	69	68	67	68	67	66	67	68	68	68	68	67	62	63	67	68	68	67	68
17	13	17	17	17	17	13	17	17	17	18	17	18	18	18	17	17	13	17	17	17	23	22	21	21	21	21
B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	C	C	C	C	C
3377	3556	3551	3554	3554	3556	3541	3555	3556	3555	3552	3545	3547	3549	3547	3546	3533	3517	3434	3435	4309	4309	4310	4306	4302	4288	4300
3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
759	1503	2000	2000	675	1193	295	2000	416	2000	563	1445	2000	731	2000	881	942	519	2000	455	1083	394	2000	1484	789	685	1711

4-5 PM

NB GP Lanes

Exit 130 Plank/William Road | Exit 133 Warrenton Road | Exit 136 Centreport Parkway

Speed	69	70	70	70	70	70	69	69	69	69	69	69	64	67	68	68	69	69	69	68	68	69	69	69	69	69	66	68	69	69	69	70	69	69
Density	14	14	14	14	14	14	14	14	14	14	10	13	14	17	14	19	19	19	19	19	19	14	14	14	14	14	13	17	17	17	17	13	16	16
LOS	B	B	B	B	B	B	B	B	B	B	A	B	B	B	B	C	C	C	C	C	C	B	B	B	B	B	B	B	B	B	B	B	B	B
Volume	2899	2899	2900	2899	2901	2900	2900	2900	2899	2900	2895	2683	3655	3465	3916	3915	3921	3923	3925	3924	3922	3912	2858	2859	2856	2855	3574	3573	3572	3572	3576	3573	3372	3370
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	4	3	3	3	3	3	3	4	3	3	3	3	4	3	3	3	3	4	3	3
Length	2000	2000	2000	2000	2000	2000	2000	2000	2000	716	640	1177	790	1104	1208	2000	2000	2000	2000	2000	714	866	2000	2000	2000	190	1601	2000	2000	2000	1313	792	2000	1610

Speed Color Scale (mph): 10, 30, 40, 50, 70

Exit 140 Courthouse Road | Exit 143 Garrisonville Road

68	68	69	69	69	69	69	69	69	69	70	69	69	69	69	69	69	69	69	69	69	70	69	69	65
13	18	18	18	18	18	18	18	18	18	13	15	15	13	17	17	17	17	17	17	17	12	16	15	14
B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
3623	3623	3621	3624	3625	3625	3632	3631	3631	3631	3629	3180	3179	3474	3480	3483	3488	3494	3499	3499	3489	3455	3215	3120	3695
4	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3	3	4	3	3	4
579	2000	2000	2000	2000	2000	2000	2000	2000	778	905	2000	5	1471	2000	2000	2000	2000	1546	415	582	825	2000	162	855

Exit 148 Russell Road

67	69	69	69	69	69	70	69	69	68	67	68	68	66	67	68	68	68	68	67	62	63	67	68	68	67	68
16	13	17	17	17	17	13	17	17	17	17	17	17	18	17	17	17	13	17	17	17	23	21	21	21	21	21
B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	C	C	C	C	C
3297	3502	3498	3509	3507	3504	3487	3501	3500	3501	3502	3496	3508	3514	3514	3514	3499	3485	3376	3378	4294	4293	4294	4299	4298	4287	4304
3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
759	1503	2000	2000	675	1193	295	2000	416	2000	563	1445	2000	731	2000	881	942	519	2000	455	1083	394	2000	1484	789	685	1711

6-7 PM

NB GP Lanes

Exit 130 Plank/William Road

Exit 133 Warrenton Road

Exit 136 Centreport Parkway

Speed	69	70	70	70	70	70	70	70	69	69	69	69	66	68	69	69	69	69	69	68	68	69	69	70	69	69	67	69	69	69	69	70	69	69	68
Density	13	13	13	13	13	13	13	13	13	13	10	12	13	16	13	17	17	17	17	17	17	13	13	13	13	13	12	16	15	15	15	11	15	14	12
Volume	2679	2680	2679	2677	2677	2674	2676	2673	2670	2668	2664	2509	3321	3216	3542	3537	3535	3534	3531	3535	3536	3527	2702	2704	2701	2698	3201	3200	3195	3193	3192	3191	3005	3006	3225
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	4	3	3	3	3	3	3	4	3	3	3	3	4	3	3	3	3	4	3	3	4
Length	2000	2000	2000	2000	2000	2000	2000	2000	2000	716	640	1177	790	1104	1208	2000	2000	2000	2000	2000	714	866	2000	2000	2000	190	1601	2000	2000	2000	1313	792	2000	1610	579

Speed Color Scale (mph): 10, 30, 40, 50, 70

Exit 140 Courthouse Road

Exit 143 Garrisonville Road

69	69	69	69	69	69	69	69	69	69	70	69	69	69	69	69	69	69	69	69	69	70	69	69	65
16	16	16	16	16	16	16	16	16	16	12	13	13	11	15	15	15	15	15	15	15	11	14	13	12
3226	3226	3219	3214	3212	3216	3220	3221	3220	3219	2800	2796	3058	3063	3059	3059	3059	3057	3061	3053	3024	2824	2738	3254
3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3	3	4	3	3	4
2000	2000	2000	2000	2000	2000	2000	2000	778	905	2000	5	1471	2000	2000	2000	2000	1546	415	582	825	2000	162	855

Exit 148 Russell Road

69	69	69	69	69	70	69	69	68	68	68	68	67	68	68	69	69	68	67	65	66	68	69	68	68	69
11	15	15	15	15	11	15	15	15	15	15	15	16	15	15	15	11	15	15	13	17	17	17	17	17	17
3112	3106	3111	3111	3112	3099	3111	3113	3117	3119	3114	3121	3122	3120	3119	3109	3098	3051	3051	3425	3425	3424	3422	3420	3408	3422
4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
1503	2000	2000	675	1193	295	2000	416	2000	563	1445	2000	731	2000	881	942	519	2000	455	1083	394	2000	1484	789	685	1711

3-4 PM

SB GP Lanes

Exit 148 Russell Road

Exit 143 Garrisonville Road

Exit 140 Courthouse Road

Speed	69	69	69	69	69	69	69	61	63	65	63	63	65	67	66	66	67	68	68	65	58	54	49	37	59	60	63	59	63	66	66	66	65	64	63	62	56	53
Density	18	18	18	18	18	13	17	17	22	22	22	22	22	21	21	21	21	21	21	22	24	26	29	38	24	19	23	21	27	25	25	25	26	26	27	20	28	31
Volume	3651	3651	3650	3651	3651	3648	3416	4190	4206	4214	4218	4151	4211	4186	4211	4211	4207	4204	4202	4202	4196	4185	4149	5629	4192	4576	4307	5005	4992	5002	4984	4996	4994	4991	4990	4978	4607	4603
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4	3	4	3	3	3	3	3	3	3	4	3	3
Length	1943	1467	2000	1888	838	602	851	969	499	1598	2000	237	2000	780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707	928	1408	1613	782	2000	2000	2000	2000	1436	855	2000	34

Speed Color Scale (mph)

10 30 40 50 70

Exit 136 Centreport Parkway

48	60	63	64	64	63	62	60	59	57	56	61	62	61	67	68	68	68	65	61	50	47	38	35	38	63	67	67	69	67	64
29	28	27	26	27	27	28	28	29	30	23	26	26	21	26	25	25	25	26	29	27	35	32	42	36	29	27	27	20	27	22
5107	5101	5100	5100	5100	5101	5096	5088	5088	5077	5086	4780	4777	5154	5155	5156	5156	5151	5140	5130	5100	4607	4511	4288	5429	5428	5429	5429	5424	5428	5427
4	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3	4	3	4	3	4	3	3	3	4	3	4
1732	2000	2000	2000	2000	2000	2000	2000	2000	2	861	2000	844	614	2000	2000	2000	2000	2000	741	857	1087	1117	516	1360	2000	2000	1820	411	1119	1651

57	56	43	64	67	68	69	69	69	69	69	69	69	69	69	69	69
33	33	32	19	15	17	15	17	17	17	17	17	17	17	17	17	17
5426	5426	5414	3734	3958	3455	4097	3525	3523	3524	3521	3521	3519	3518	3517	3512	3507
3	3	4	3	4	3	4	3	3	3	3	3	3	3	3	3	3
2000	1139	678	1159	750	1027	1267	2000	2000	2000	2000	2000	2000	2000	2000	2000	292

4-5 PM

SB GP Lanes

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	69	69	69	69	69	69	69	60	62	64	62	62	64	66	64	61	59	55	47	38	37	38	37	35	59	60	
Density	19	19	19	19	19	14	18	19	24	24	24	24	23	23	24	25	27	29	35	43	40	38	39	42	24	19	
Volume	3840	3840	3839	3835	3833	3831	3651	4453	4476	4486	4491	4425	4495	4473	4492	4485	4476	4467	4439	4393	4363	4358	4323	5783	4266	4560	4
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4	
Length	1943	1467	2000	1888	838	602	851	969	499	1598	2000	237	2000	780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707	

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

61	59	63	66	66	66	66	65	64	63	60	58	53	62	64	64	64	63	62	61	60	59	58	61	
24	21	26	25	25	25	25	25	26	20	26	27	25	27	26	26	26	27	27	27	28	28	22	25	
259	4880	4875	4889	4878	4895	4898	4903	4905	4895	4444	4450	4938	4948	4952	4954	4959	4963	4971	4980	4983	4978	4989	4617	4
3	4	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3	3	3	3	4	3	
928	1408	1613	782	2000	2000	2000	2000	1436	855	2000	34	1732	2000	2000	2000	2000	2000	2000	2000	2000	2	861	2000	

62	61	66	59	50	39	31	26	18	23	21	23	32	62	67	67	69	68	69	65	65	64	69	67	68	69	69	69	69	69	69	69	69	69	69	69	69
25	21	26	31	39	51	63	72	74	65	52	60	43	29	27	27	20	27	20	28	28	21	19	16	19	16	18	18	18	19	19	19	19	19	19	19	19
4624	5038	5042	5039	5016	4981	4952	4930	4915	4465	4406	4197	5414	5421	5419	5419	5414	5420	5419	5419	5420	5406	3935	4212	3796	4439	3829	3830	3827	3826	3826	3828	3829	3831	3830	3830	
3	4	3	3	3	3	3	3	4	3	4	3	4	3	3	3	4	3	4	3	3	4	3	4	3	4	3	3	3	3	3	3	3	3	3	3	
844	614	2000	2000	2000	2000	2000	741	857	1087	1117	516	1360	2000	2000	1820	411	1119	1651	2000	1139	678	1159	750	1027	1267	2000	2000	2000	2000	2000	2000	2000	2000	2000	292	

6-7 PM

SB GP Lanes

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	69	69	69	69	69	68	69	65	66	67	66	65	65	64	64	61	57	53	47	43	49	56	58	43	63	61
Density	18	18	18	18	18	14	17	14	19	19	19	19	20	20	21	22	25	28	35	38	27	23	22	28	17	16
Volume	3738	3744	3746	3746	3746	3742	3438	3742	3758	3766	3772	3714	3767	3746	3770	3784	3797	3814	3846	3874	3889	3892	3864	4806	3299	3814
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1943	1467	2000	1888	838	602	851	969	499	1598	2000	237	2000	780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

66	66	68	68	68	68	68	68	68	69	69	69	67	68	68	68	68	68	68	68	68	68	67	68	
17	15	19	19	19	19	19	19	19	14	17	17	14	19	19	19	19	19	19	19	19	19	14	17	
3433	3863	3859	3868	3857	3868	3870	3871	3870	3864	3456	3454	3850	3854	3854	3853	3850	3847	3848	3848	3848	3841	3848	3483	
3	4	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3	3	3	3	4	3	
928	1408	1613	782	2000	2000	2000	2000	1436	855	2000	34	1732	2000	2000	2000	2000	2000	2000	2000	2000	2	861	2000	

68	66	69	69	69	69	68	68	69	68	65	67	61	67	68	68	69	68	69	67	67	67	69	69	69	69	70	70	69	69	69	69	69	69	69	69
17	14	18	18	18	18	18	18	14	16	12	15	17	21	20	20	15	21	15	21	21	16	14	11	14	12	14	14	14	14	14	14	14	14	14	14
3485	3762	3763	3760	3758	3758	3762	3761	3747	3265	3211	3003	4190	4195	4201	4207	4203	4207	4207	4208	4209	4197	2990	3142	2897	3359	2941	2947	2950	2948	2947	2946	2945	2943	2944	2947
3	4	3	3	3	3	3	3	4	3	4	3	4	3	3	3	4	3	4	3	3	4	3	4	3	4	3	3	3	3	3	3	3	3	3	3
844	614	2000	2000	2000	2000	2000	741	857	1087	1117	516	1360	2000	2000	1820	411	1119	1651	2000	1139	678	1159	750	1027	1267	2000	2000	2000	2000	2000	2000	2000	2000	2000	292

3-4 PM

SB HOT Lanes

Exit 148

Russell Road

Speed	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	69	68	61	43	48	34	26
Density	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	7	11	13	18	32	45	59
Volume	1554	1554	1553	1548	1547	1547	1539	1548	1549	1548	1543	1545	1538	1542	1535	1536	1536	1532	1538	1535	1518	1512	1516	1497	1481
Lanes	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	1	1	1
Length	2000	2000	2000	1285	1550	693	789	1567	2000	1348	1497	2000	968	2000	735	1415	1650	373	1084	2000	511	476	2000	2000	1762

Speed Color Scale (mph)

10 30 40 50 70

4-5 PM

SB HOT Lanes

Exit 148

Russell Road

Speed	69	69	69	68	68	69	68	68	68	68	68	68	68	68	68	68	68	68	36	11	6	6	15	14	14
Density	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	25	85	121	121	100	103	102
Volume	1521	1525	1526	1527	1529	1528	1523	1535	1541	1542	1542	1549	1544	1552	1554	1558	1560	1555	1560	1529	1471	1452	1456	1452	1451
Lanes	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	1	1	1
Length	2000	2000	2000	1285	1550	693	789	1567	2000	1348	1497	2000	968	2000	735	1415	1650	373	1084	2000	511	476	2000	2000	1762

Speed Color Scale (mph)

10 30 40 50 70

6-7 PM

SB HOT Lanes

Exit 148 Russell Road

Speed	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	67	64	60	51	62
Density	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	4	7	7	7	15	18	15
Volume	927	926	926	925	926	925	921	926	926	926	926	928	924	928	926	927	926	923	927	927	918	917	928	927	929
Lanes	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	1	1	1
Length	2000	2000	2000	1285	1550	693	789	1567	2000	1348	1497	2000	968	2000	735	1415	1650	373	1084	2000	511	476	2000	2000	1762

Speed Color Scale (mph)

10 30 40 50 70

APPENDIX M:

NO BUILD 2022 DETAILED ANALYSIS RESULTS

2022 No Build - Contents

1. AM Peak Hour Intersection Delays by movement
2. AM Peak Hour Intersection Volumes by movement
3. AM Peak Hour Intersection Average Queue by movement
4. AM Peak Hour Intersection Maximum Queue by movement
5. NB Link Results 6-7 AM
6. NB Link Results 8-9 AM
7. SB Link Results 6-7 AM
8. SB Link Results 8-9 AM
9. NB HOT Link Results 6-7 AM
10. NB HOT Link Results 8-9 AM
11. PM Peak Hour Intersection Delays by movement
12. PM Peak Hour Intersection Volumes by movement
13. PM Peak Hour Intersection Average Queue by movement
14. PM Peak Hour Intersection Maximum Queue by movement
15. NB Link Results 3-4 PM
16. NB Link Results 4-5 PM
17. NB Link Results 6-7 PM
18. SB Link Results 3-4 PM
19. SB Link Results 4-5 PM
20. SB Link Results 6-7 PM
21. SB HOT Link Results 3-4 PM
22. SB HOT Link Results 4-5 PM
23. SB HOT Link Results 6-7 PM

2020 No Build Intersection Average Delay (seconds per vehicle) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	oute 3 at I-95 SB Off-Ramp							66		7			4	
1302	oute 3 at I-95 NB Off-Ramp								54				-	28
1303	oute 3 at Carl D. Silver Pkw		61	85	6	76	70	5	81	12	5	80	9	-
1304	Route 3 at Gateway Blvd		48	32	1	62	71	27	67	13	4	50	15	3
1333	US 17 at Gateway Dr		62	66	53	61	48	10	19	17	6	12	14	12
1338	US 17 at Short St		40	6	7	-	-	11	9	6	-	8	5	4
1363	treport Pkwy at I-95 SB Ra					20		(0)		7	-	-	5	
1366	treport Pkwy at I-95 NB Ra		14		-				19	18			20	
1368	US 1 at Centreport Pkwy			20	16	23	-					36		30
1403	urthouse Rd at I-95 SB Ram					-		-		-	-	-	-	
1406	urthouse Rd at I-95 NB Ran		4		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	risonville Rd at I-95 SB Ran							-		34	25		0	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	0			4	3						
1438	US 1 at Route 610		-	-	7	149	42	10	51	34	15	63	62	10
1483	Russell Rd at I-95 SB Ramp					31		24	53	19			5	4
1486	ssell Rd at I-95 NB Off-Ran		8		-					53			22	
1488	ssell Rd at I-95 NB On-Ran								51	0			2	2

2020 No Build Intersection Throughput (veh/hour) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	oute 3 at I-95 SB Off-Ramp							245		2,472			1,129	
1302	oute 3 at I-95 NB Off-Ramp								1,335				-	604
1303	oute 3 at Carl D. Silver Pkw		2	4	9	294	4	51	162	2,591	51	11	1,019	-
1304	Route 3 at Gateway Blvd		253	1	165	4	3	16	54	1,236	221	119	1,096	10
1333	US 17 at Gateway Dr		30	18	153	280	29	43	45	1,505	30	237	2,135	237
1338	US 17 at Short St		106	3	23	-	-	5	4	1,182	-	10	1,375	2
1363	treport Pkwy at I-95 SB Ra					111		3		95	-	-	449	
1366	treport Pkwy at I-95 NB Ra		344		-				21	184			182	
1368	US 1 at Centreport Pkwy			1,235	752	92	-					186		415
1403	urthouse Rd at I-95 SB Ram					-		-		-	-	-	-	
1406	urthouse Rd at I-95 NB Ran		255		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	risonville Rd at I-95 SB Ran							-		2,171	205		930	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	1,969			1,354	89						
1438	US 1 at Route 610		-	-	6	75	398	884	1,056	83	231	92	271	358
1483	Russell Rd at I-95 SB Ramp					574		693	10	261			341	65
1486	ssell Rd at I-95 NB Off-Ran		102		-					828			305	
1488	ssell Rd at I-95 NB On-Ran								52	1,353			304	89

2020 No Build Intersection Average Queue (feet) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	oute 3 at I-95 SB Off-Ramp							56		139			8	
1302	oute 3 at I-95 NB Off-Ramp								442				-	149
1303	oute 3 at Carl D. Silver Pkw		3	3	3	75	75	35	252	252	35	26	24	-
1304	Route 3 at Gateway Blvd		57	57	55	5	5	5	52	52	33	93	93	93
1333	US 17 at Gateway Dr		53	53	53	68	56	64	111	121	109	61	63	61
1338	US 17 at Short St		25	25	25	-	1	2	18	18	-	21	22	24
1363	treport Pkwy at I-95 SB Ra					12		-		4	-	-	9	
1366	treport Pkwy at I-95 NB Ra		83		-				18	18			20	
1368	US 1 at Centreport Pkwy			97	92	16	-					202		209
1403	urthouse Rd at I-95 SB Ram					-		-		-	-	-	-	
1406	urthouse Rd at I-95 NB Ran		6		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	risonville Rd at I-95 SB Ran							-		340	340		-	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	-			17	19						
1438	US 1 at Route 610		-	-	413	148	146	127	1,241	1,241	1,241	35	62	4
1483	Russell Rd at I-95 SB Ramp					147		146	15	15			5	0
1486	ssell Rd at I-95 NB Off-Ran		3		-					643			27	
1488	ssell Rd at I-95 NB On-Ran								13	13			2	0

2020 No Build Intersection Max Queue (feet) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	oute 3 at I-95 SB Off-Ramp							185		726			181	
1302	oute 3 at I-95 NB Off-Ramp								1,427				-	697
1303	oute 3 at Carl D. Silver Pkv		40	40	40	232	232	198	1,410	1,410	198	252	222	-
1304	Route 3 at Gateway Blvd		265	265	270	75	75	87	289	289	292	593	593	593
1333	US 17 at Gateway Dr		227	227	227	261	249	270	701	702	697	490	493	490
1338	US 17 at Short St		170	170	170	-	31	49	320	320	-	357	356	363
1363	treport Pkwy at I-95 SB Ra					130		-		148	-	-	191	
1366	treport Pkwy at I-95 NB Ra		1,039		-				194	194			170	
1368	US 1 at Centreport Pkwy			587	600	138	-					1,152		1,159
1403	urthouse Rd at I-95 SB Ram					-		-		-	-	-	-	
1406	urthouse Rd at I-95 NB Ran		114		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	risonville Rd at I-95 SB Ran							-		635	635		-	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	-			352	375						
1438	US 1 at Route 610		-	-	1,011	670	670	662	1,606	1,606	1,606	178	220	193
1483	Russell Rd at I-95 SB Ramp					918		916	133	133			90	47
1486	ssell Rd at I-95 NB Off-Ran		70		-					997			165	
1488	ssell Rd at I-95 NB On-Ran								104	104			70	27

6 – 7 AM

NB GP Lanes

Exit 130 Plank/William Road | Exit 133 Warrenton Road | Exit 136 Centreport Parkway

Speed	69	70	70	69	69	69	69	69	69	69	66	68	70	69	58	64	67	68	67	62	58	52	40	24	14	12	10	10	10	9	9	16	13	13
Density	17	17	17	17	17	17	17	17	17	17	13	15	11	13	17	20	25	25	25	27	30	27	39	57	83	98	100	119	123	128	126	54	68	68
Volume	3473	3471	3467	3466	3462	3459	3456	3453	3449	3447	3441	3141	3139	2636	5074	5048	5059	5061	5061	5035	4996	4948	3432	3309	3159	3073	3697	3592	3561	3553	3557	3539	2762	2732
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	5	4	3	3	3	3	3	4	3	3	3	3	4	3	3	3	3	4	3	3
Length	2000	2000	2000	2000	2000	2000	2000	2000	2000	716	640	1177	790	983	1197	1104	2000	2000	2000	2000	1585	866	2000	2000	2000	190	1601	2000	2000	2000	1313	792	2000	1610

Speed Color Scale (mph): 10, 30, 40, 50, 70

Exit 140 Courthouse Road | Exit 143 Garrisonville Road

14	20	19	19	19	19	19	18	18	17	15	15	16	7	23	23	23	23	23	22	21	10	8	8	8
59	55	57	58	58	58	58	58	58	60	49	64	58	124	51	51	52	52	51	52	53	86	132	128	124
3320	3316	3289	3273	3268	3249	3249	3229	3204	3004	2845	2839	2833	3567	3553	3529	3510	3501	3443	3350	3343	3308	3062	2975	3835
4	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3	3	4	3	3	4
579	2000	2000	2000	2000	2000	2000	2000	2000	767	905	2000	4	1471	2000	2000	2000	2000	1546	415	582	825	2000	162	855

Exit 148 Russell Road

23	33	66	69	69	68	64	69	70	69	68	69	68	68	68	69	67	64	69	69	68	68	69	69	69	69	69
52	34	23	22	22	22	18	18	18	18	18	18	18	19	18	18	18	14	15	15	12	16	16	16	16	16	16
3658	4536	4528	4533	4534	4534	4505	3749	3750	3750	3750	3744	3748	3750	3749	3749	3734	3718	3161	3161	3266	3266	3266	3270	3267	3257	3273
3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
759	1503	2000	2000	675	1193	295	2000	416	2000	563	1445	2000	731	2000	881	942	519	2000	455	1083	394	2000	1484	789	685	1711

8 – 9 AM

NB GP Lanes

Exit 130 Plank/William Road

Exit 133 Warrenton Road

Exit 136 Centreport Parkway

Speed	66	65	64	64	64	63	63	63	62	61	58	57	45	18	6	9	13	13	13	15	16	11	12	12	12	11	9	10	9	9	9	15	12	13
Density	19	20	22	24	25	26	27	28	29	29	23	31	30	63	138	124	111	113	112	97	91	105	132	134	134	133	120	124	124	130	130	57	72	69
Volume	3628	3626	3625	3624	3615	3610	3598	3591	3589	3596	3598	3274	3296	2792	4377	4370	4390	4385	4389	4401	4412	4406	2759	2750	2735	2752	3399	3387	3377	3378	3375	3372	2624	2619
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	5	4	3	3	3	3	3	4	3	3	3	3	4	3	3	3	3	4	3	3
Length	2000	2000	2000	2000	2000	2000	2000	2000	2000	716	640	1177	790	983	1197	1104	2000	2000	2000	2000	1585	866	2000	2000	2000	190	1601	2000	2000	2000	1313	792	2000	1610

Speed Color Scale (mph): 10, 30, 40, 50, 70

Exit 140 Courthouse Road

Exit 143 Garrisonville Road

14	22	21	21	21	21	21	21	22	20	17	17	18	8	31	32	32	31	32	31	28	12	9	9	9
61	53	55	54	55	54	54	54	53	54	45	60	57	118	42	41	41	42	40	40	45	79	127	123	119
3379	3394	3392	3410	3409	3417	3420	3428	3424	3207	3034	3046	3051	3899	3912	3916	3926	3923	3873	3780	3767	3729	3387	3288	4260
4	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3	3	4	3	3	4
579	2000	2000	2000	2000	2000	2000	2000	2000	767	905	2000	4	1471	2000	2000	2000	2000	1546	415	582	825	2000	162	855

Exit 148 Russell Road

28	37	66	69	69	68	65	69	69	69	68	68	68	67	68	68	67	63	69	69	68	68	69	69	69	69	69
47	31	23	22	22	23	18	19	19	19	20	20	20	20	20	20	20	16	16	16	13	17	17	17	17	17	17
4028	4641	4634	4641	4641	4643	4616	4025	4024	4024	4021	4013	4017	4017	4017	4017	4002	3983	3305	3303	3450	3449	3449	3450	3447	3437	3449
3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
759	1503	2000	2000	675	1193	295	2000	416	2000	563	1445	2000	731	2000	881	942	519	2000	455	1083	394	2000	1484	789	685	1711

6 – 7 AM

SB GP Lanes

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	70	70	70	69	69	68	70	70	70	70	69	69	70	70	70	70	70	70	70	70	70	70	70	70	65
Density	11	11	11	11	11	8	7	5	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	5	6
Volume	2326	2324	2323	2321	2319	2315	1389	1435	1440	1443	1443	1420	1441	1432	1437	1433	1432	1432	1431	1431	1427	1425	1413	1418	1126	1480
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1943	1467	2000	1888	838	602	851	968	492	1598	2000	237	2000	780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

70	69	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
7	6	8	8	8	8	8	8	8	6	7	7	7	6	8	8	8	8	8	8	8	8	6	8
1434	1619	1614	1615	1609	1613	1612	1607	1603	1599	1460	1437	1450	1771	1772	1770	1767	1767	1766	1768	1769	1768	1769	1701
3	4	3	3	3	3	3	3	3	4	3	3	3	4	3	3	3	3	3	3	3	3	4	3
928	1408	1613	782	2000	2000	2000	2000	1436	830	2000	27	1727	1711	2000	2000	2000	2000	2000	2000	2000	288	861	2000

Exit 130 Plank/William Road

70	69	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
8	7	9	9	9	9	7	5	7	7	7	7	7	7	7	7	7	7	7	7	7	7	8	11	11	11	11	11	11	11	11
1702	1871	1872	1872	1872	1872	1873	1873	1458	1458	1458	1460	1461	1463	1461	1459	1459	1459	1459	1459	1459	2323	2323	2324	2325	2326	2329	2331	2328	2328	2328	2329
3	4	3	3	3	3	4	5	3	3	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3
844	614	2000	2000	2000	29	1258	1549	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1287	868	1099	225	1954	2000	2000	2000	2000	2000	739

8-9 AM

SB GP Lanes

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	69	69	69	68	69	68	70	69	70	69	68	68	69	69	69	69	69	69	70	70	69	69	69	70	70	66
Density	18	18	18	18	18	13	12	10	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	10	10	9
Volume	3643	3647	3648	3648	3650	3646	2586	2677	2687	2693	2698	2658	2700	2688	2705	2705	2705	2703	2704	2704	2704	2706	2686	2697	2190	2491
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1943	1467	2000	1888	838	602	851	968	492	1598	2000	237	2000	780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

69	69	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	69	69	69
11	10	12	12	12	13	13	13	13	9	11	11	11	10	13	13	13	13	13	13	13	13	10	13
2347	2617	2611	2617	2608	2616	2616	2614	2615	2607	2343	2308	2330	2795	2795	2793	2793	2793	2788	2785	2782	2780	2780	2652
3	4	3	3	3	3	3	3	3	4	3	3	3	4	3	3	3	3	3	3	3	3	4	3
928	1408	1613	782	2000	2000	2000	2000	1436	830	2000	27	1727	1711	2000	2000	2000	2000	2000	2000	2000	288	861	2000

Exit 130 Plank/William Road

70	68	69	70	69	70	70	69	69	70	70	70	70	70	70	70	70	70	70	70	70	70	69	69	69	70	70	69	69	69	69	69
13	11	14	14	14	14	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10	9	11	15	15	15	15	15	15	15	15	15
2649	2922	2922	2920	2919	2918	2917	2918	2078	2077	2077	2076	2076	2077	2077	2075	2076	2078	2077	2076	2077	3172	3172	3172	3171	3166	3160	3151	3148	3151	3149	3148
3	4	3	3	3	3	4	5	3	3	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3	3
844	614	2000	2000	2000	29	1258	1549	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1287	868	1099	225	1954	2000	2000	2000	2000	2000	2000	739

6-7 AM

NB HOT Lanes

Exit 148 Russell Road

Speed	46	67	71	71	70	70	70	70	70	71	71	70	71	71	71	71	71	71	71	71	70	70	70	70	70	70	70	70	70	70
Density	3	2	2	2	2	2	2	2	1	1	1	4	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Volume	141	141	141	141	141	141	141	141	141	142	142	926	921	922	926	925	925	924	925	924	926	925	923	924	917	924	923	924	924	924
Lanes	1	1	1	1	1	1	1	1	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Length	250	2000	2000	2000	2000	2000	2000	737	473	2000	511	1084	373	1650	1415	2000	735	2000	968	1497	2000	1348	1567	789	693	1550	2000	2000	2000	1285

Speed Color Scale (mph)

10 30 40 50 70

8-9 AM

NB HOT Lanes

Exit 148 Russell Road

Speed	48	68	71	71	71	71	70	70	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71
Density	3	2	2	2	2	2	2	2	1	1	1	4	5	5	5	5	5	5	5	5	5	5	6	6	5	6	6	6	6	6
Volume	153	152	153	153	153	154	154	154	153	154	154	773	768	769	773	774	774	774	774	773	775	775	777	778	772	777	779	780	780	780
Lanes	1	1	1	1	1	1	1	1	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Length	250	2000	2000	2000	2000	2000	2000	737	473	2000	511	1084	373	1650	1415	2000	735	2000	968	1497	2000	1348	1567	789	693	1550	2000	2000	2000	1285

Speed Color Scale (mph)

10 30 40 50 70

2022 No Build PM Intersection Average Delay (seconds per vehicle) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	Route 3 at I-95 SB Off-Ramps							43		0			17	
1302	Route 3 at I-95 NB Off-Ramps								39				-	0
1303	Route 3 at Carl D. Silver Pkwy		84	75	6	68	70	11	80	13	11	90	19	5
1304	Route 3 at Gateway Blvd		44	41	1	1	1	5	55	13	7	53	9	3
1333	US 17 at Gateway Dr		487	489	230	306	345	125	15	11	2	26	9	26
1338	US 17 at Short St		49	5	8	-	-	12	10	7	-	19	5	7
1363	Centreport Pkwy at I-95 SB Ramps					22		0		28	-	-	13	
1366	Centreport Pkwy at I-95 NB Ramps		17		-				8	8			8	
1368	US 1 at Centreport Pkwy			24	8	20	-					35		30
1403	Courthouse Rd at I-95 SB Ramps					-		-		-	-	-	-	
1406	Courthouse Rd at I-95 NB Ramps		5		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	Garrisonville Rd at I-95 SB Ramps							-		31	21		0	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	0			32	42						
1438	US 1 at Route 610		-	-	10	67	36	35	59	59	38	132	128	11
1483	Russell Rd at I-95 SB Ramps					51		49	52	3			2	7
1486	Russell Rd at I-95 NB Off-Ramp		43		-					5			3	
1488	Russell Rd at I-95 NB On-Ramp								39	(0)			9	4

2022 No Build PM Intersection Throughput (veh/hour) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	Route 3 at I-95 SB Off-Ramps							880		2,052			1,509	
1302	Route 3 at I-95 NB Off-Ramps								834				-	374
1303	Route 3 at Carl D. Silver Pkwy		12	8	6	765	8	294	237	1,922	294	17	1,933	472
1304	Route 3 at Gateway Blvd		321	2	208	12	4	15	27	1,420	376	185	1,685	4
1333	US 17 at Gateway Dr		32	9	321	354	22	54	79	2,006	17	113	1,792	113
1338	US 17 at Short St		96	3	24	-	-	7	78	1,762	-	21	1,360	2
1363	Centreport Pkwy at I-95 SB Ramps					473		66		185	-	-	267	
1366	Centreport Pkwy at I-95 NB Ramps		152		-				12	646			223	
1368	US 1 at Centreport Pkwy			512	396	105	-					666		79
1403	Courthouse Rd at I-95 SB Ramps					-		-		-	-	-	-	
1406	Courthouse Rd at I-95 NB Ramps		236		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	Garrisonville Rd at I-95 SB Ramps							-		1,719	554		1,848	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	1,072			1,989	28						
1438	US 1 at Route 610		-	-	139	162	816	1,008	484	380	702	97	222	87
1483	Russell Rd at I-95 SB Ramps					129		46	107	529			210	613
1486	Russell Rd at I-95 NB Off-Ramp		16		-					659			804	
1488	Russell Rd at I-95 NB On-Ramp								405	385			803	195

2022 No Build PM Intersection Average Queue (feet) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	Route 3 at I-95 SB Off-Ramps							138		-			50	
1302	Route 3 at I-95 NB Off-Ramps								90				-	1
1303	Route 3 at Carl D. Silver Pkwy		8	8	8	153	153	119	98	98	119	107	96	3
1304	Route 3 at Gateway Blvd		51	51	49	0	0	1	47	47	31	61	61	61
1333	US 17 at Gateway Dr		593	593	593	356	344	368	105	110	40	34	36	34
1338	US 17 at Short St		28	28	28	-	3	4	62	62	-	22	23	24
1363	Centreport Pkwy at I-95 SB Ramps					47		0		43	-	-	15	
1366	Centreport Pkwy at I-95 NB Ramps		13		-				15	15			7	
1368	US 1 at Centreport Pkwy			29	10	37	-					211		210
1403	Courthouse Rd at I-95 SB Ramps					-		-		-	-	-	-	
1406	Courthouse Rd at I-95 NB Ramps		5		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	Garrisonville Rd at I-95 SB Ramps							-		197	197		-	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	-			1,602	1,625						
1438	US 1 at Route 610		-	-	233	614	614	604	670	670	670	58	72	5
1483	Russell Rd at I-95 SB Ramps					37		35	46	46			2	3
1486	Russell Rd at I-95 NB Off-Ramp		3		-					64			1	
1488	Russell Rd at I-95 NB On-Ramp								122	122			50	43

2022 No Build PM Intersection Max Queue (feet) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	Route 3 at I-95 SB Off-Ramps							716		-			372	
1302	Route 3 at I-95 NB Off-Ramps								365				-	124
1303	Route 3 at Carl D. Silver Pkwy		74	74	74	493	493	459	416	416	459	661	631	212
1304	Route 3 at Gateway Blvd		212	212	221	28	28	57	300	300	304	360	360	360
1333	US 17 at Gateway Dr		704	704	704	515	503	529	844	847	788	334	334	334
1338	US 17 at Short St		169	169	169	-	59	81	879	879	-	395	389	395
1363	Centreport Pkwy at I-95 SB Ramps					334		70		387	-	-	206	
1366	Centreport Pkwy at I-95 NB Ramps		192		-				313	313			144	
1368	US 1 at Centreport Pkwy			194	195	269	-					968		989
1403	Courthouse Rd at I-95 SB Ramps					-		-		-	-	-	-	
1406	Courthouse Rd at I-95 NB Ramps		108		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	Garrisonville Rd at I-95 SB Ramps							-		638	638		-	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	-			1,867	1,889						
1438	US 1 at Route 610		-	-	638	942	942	934	1,606	1,606	1,606	221	259	111
1483	Russell Rd at I-95 SB Ramps					234		232	232	232			301	280
1486	Russell Rd at I-95 NB Off-Ramp		48		-					531			219	
1488	Russell Rd at I-95 NB On-Ramp								365	365			352	343

3-4 PM

NB GP Lanes

Exit 130 Plank/William Road | Exit 133 Warrenton Road | Exit 136 Centreport Parkway

Speed	69	70	70	70	69	69	69	69	69	69	68	69	70	69	63	66	68	69	69	68	68	69	69	70	70	70	66	69	69	69	69	70	69	69
Density	15	15	15	15	15	15	15	15	15	15	11	13	10	12	12	15	19	19	19	19	19	14	13	13	13	13	13	16	16	16	16	12	15	15
Volume	3069	3068	3065	3063	3061	3059	3058	3058	3054	3053	3047	2772	2770	2543	3889	3879	3886	3871	3861	3867	3874	3864	2735	2731	2727	2726	3354	3363	3362	3354	3346	3340	3109	3113
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	5	4	3	3	3	3	3	4	3	3	3	3	4	3	3	3	3	4	3	3
Length	2000	2000	2000	2000	2000	2000	2000	2000	2000	716	640	1177	790	983	1197	1104	2000	2000	2000	2000	1585	866	2000	2000	2000	190	1601	2000	2000	2000	1313	792	2000	1610

Speed Color Scale (mph): 10, 30, 40, 50, 70

Exit 140 Courthouse Road | Exit 143 Garrisonville Road

68	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	70	69	69	65
12	16	16	16	16	16	16	16	16	14	14	14	12	16	16	16	16	16	16	16	12	15	14	14
3376	3371	3365	3358	3355	3357	3359	3358	3359	2978	2953	2976	3322	3325	3320	3314	3313	3315	3314	3305	3271	3041	2949	3554
4	3	3	3	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	4	3	3	4
579	2000	2000	2000	2000	2000	2000	2000	1331	519	905	1998	1471	2000	2000	2000	2000	1546	415	582	825	2000	162	855

Exit 148 Russell Road

68	69	69	69	69	69	70	69	69	68	68	68	68	67	67	68	68	68	68	68	63	64	67	68	68	68	68
16	12	16	16	16	16	12	16	16	16	17	17	17	17	17	16	16	12	16	16	16	21	20	20	20	20	20
3179	3377	3372	3378	3377	3377	3364	3375	3371	3370	3371	3364	3371	3372	3372	3371	3357	3341	3217	3215	4114	4113	4110	4105	4099	4087	4100
3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
759	1503	2000	2000	675	1193	295	2000	416	2000	563	1445	2000	731	2000	881	942	519	2000	455	1083	394	2000	1484	789	685	1711

4-5 PM

NB GP Lanes

Exit 130 Plank/William Road

Exit 133 Warrenton Road

Exit 136 Centreport Parkway

Speed	69	70	70	69	69	69	69	69	69	69	68	69	70	69	63	66	68	69	69	68	67	68	69	69	69	69	66	68	69	69	69	70	69	69
Density	16	15	16	16	16	16	16	16	16	16	12	14	10	13	13	15	20	20	20	20	20	15	14	14	14	14	13	17	17	17	17	13	16	16
Volume	3240	3240	3240	3241	3241	3241	3241	3240	3241	3239	3234	2933	2933	2705	4033	4017	4025	4032	4046	4046	4043	4026	2843	2842	2849	2853	3545	3540	3530	3530	3534	3535	3300	3300
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	5	4	3	3	3	3	3	4	3	3	3	3	4	3	3	3	3	4	3	3
Length	2000	2000	2000	2000	2000	2000	2000	2000	2000	716	640	1177	790	983	1197	1104	2000	2000	2000	2000	1585	866	2000	2000	2000	190	1601	2000	2000	2000	1313	792	2000	1610

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 143 Garrisonville Road

68	68	69	69	69	69	69	69	69	69	69	69	69	68	69	69	69	69	69	69	70	69	69	65	
13	18	17	17	17	17	17	17	17	15	15	15	13	17	17	17	17	17	17	17	12	16	15	14	
3595	3596	3591	3594	3600	3601	3597	3590	3585	3190	3165	3193	3520	3515	3514	3513	3517	3519	3520	3511	3477	3232	3138	3736	3
4	3	3	3	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	4	3	3	4	
579	2000	2000	2000	2000	2000	2000	2000	1331	519	905	1998	1471	2000	2000	2000	2000	1546	415	582	825	2000	162	855	

Exit 148 Russell Road

58	69	69	69	69	69	70	69	69	68	67	68	68	66	67	68	68	68	68	67	62	63	67	68	68	67	68
16	13	17	17	17	17	13	17	17	17	18	17	17	18	18	17	17	13	17	17	17	22	21	21	21	21	21
328	3539	3537	3545	3542	3539	3521	3537	3536	3539	3542	3537	3538	3537	3536	3535	3522	3506	3374	3377	4240	4243	4246	4251	4248	4237	4255
3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
59	1503	2000	2000	675	1193	295	2000	416	2000	563	1445	2000	731	2000	881	942	519	2000	455	1083	394	2000	1484	789	685	1711

6-7 PM

NB GP Lanes

Exit 130 Plank/William Road

Exit 133 Warrenton Road

Exit 136 Centreport Parkway

Speed	69	70	70	70	69	69	69	69	69	69	69	69	70	69	64	67	68	69	69	68	68	69	69	70	69	69	67	69	69	69	69	70	69	69
Density	15	15	15	15	15	15	15	15	15	15	11	14	10	13	12	14	18	18	18	18	18	14	13	13	13	13	12	16	16	16	16	12	15	15
Volume	3061	3061	3060	3057	3057	3055	3057	3054	3052	3049	3042	2794	2795	2628	3720	3718	3727	3728	3725	3726	3738	3739	2750	2750	2743	2738	3265	3265	3268	3269	3266	3262	3024	3023
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	5	4	3	3	3	3	3	4	3	3	3	3	4	3	3	3	3	4	3	3
Length	2000	2000	2000	2000	2000	2000	2000	2000	2000	716	640	1177	790	983	1197	1104	2000	2000	2000	2000	1585	866	2000	2000	2000	190	1601	2000	2000	2000	1313	792	2000	1610

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 143 Garrisonville Road

68	69	69	69	69	69	69	69	69	69	69	69	70	69	69	69	69	69	69	69	70	69	69	65
12	16	16	16	16	16	16	16	16	14	14	14	11	16	15	15	15	15	15	15	11	14	14	13
3287	3292	3294	3290	3284	3283	3290	3293	3293	2902	2877	2898	3191	3199	3197	3195	3193	3199	3201	3193	3161	2947	2863	3409
4	3	3	3	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	4	3	3	4
579	2000	2000	2000	2000	2000	2000	2000	1331	519	905	1998	1471	2000	2000	2000	2000	1546	415	582	825	2000	162	855

Exit 148 Russell Road

68	69	69	69	69	69	70	69	69	68	68	68	68	67	68	68	68	68	68	67	64	66	68	69	68	68	69
15	12	16	16	16	16	12	16	16	16	16	16	16	16	16	16	16	12	15	15	14	18	18	17	17	18	17
063	3257	3249	3250	3251	3252	3241	3255	3253	3252	3253	3248	3253	3251	3250	3252	3239	3224	3129	3129	3583	3584	3582	3585	3586	3578	3591
3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
59	1503	2000	2000	675	1193	295	2000	416	2000	563	1445	2000	731	2000	881	942	519	2000	455	1083	394	2000	1484	789	685	1711

3-4 PM

SB GP Lanes

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	64	57	52	41	33	29	26	27	33	32	30	29	28	27	26	25	24	23	21	21	27	27	25	25	26	25
Density	22	25	29	38	46	39	56	44	48	49	50	51	53	55	57	59	61	63	65	65	51	51	55	54	51	44
Volume	4069	4040	3996	3924	3858	3817	3605	4440	4437	4424	4385	4291	4334	4279	4276	4224	4196	4176	4143	4130	4109	4106	4075	5349	4004	4373
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1943	1467	2000	1888	838	602	851	969	499	1598	2000	237	2000	780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

25	27	32	59	65	66	67	67	66	68	68	68	68	68	64	63	66
55	45	40	29	26	26	26	26	26	19	22	21	22	18	25	19	22
4104	4841	5097	5106	5092	5105	5104	5104	5103	5094	4447	4382	4447	4842	4858	4859	4452
3	4	4	3	3	3	3	3	3	4	3	3	3	4	3	4	3
928	999	1613	782	2000	2000	2000	2000	1436	830	2000	27	1717	1712	922	861	2000

Exit 130 Plank/William Road

67	63	68	68	68	68	69	42	64	70	70	70	70	70	70	70	70	70	70	70	70	70	69	70	70	70	70	70	70	70	70
22	19	24	24	24	24	18	23	12	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
4454	4873	4871	4871	4869	4869	4869	4869	2203	2204	2204	2203	2201	2201	2201	2201	2201	2198	2197	2197	2196	4006	3141	2350	2349	2347	2348	2347	2348	2348	2348	2349
3	4	3	3	3	3	4	5	3	3	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3	3
844	614	2000	2000	2000	29	1258	1549	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1287	868	1099	225	1954	2000	2000	2000	2000	2000	2000	739

4-5 PM

SB GP Lanes

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	11	11	10	10	10	9	9	14	20	20	20	20	19	19	19	20	19	19	20	20	28	29	27	27	29	26
Density	104	108	111	115	116	88	115	73	70	70	69	69	71	71	70	70	71	71	70	68	50	48	51	51	48	42
Volume	3460	3397	3346	3318	3310	3298	3153	4066	4085	4091	4094	4030	4083	4064	4082	4098	4099	4099	4102	4115	4123	4128	4101	5447	4059	4410
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1943	1467	2000	1888	838	602	851	969	499	1598	2000	237	2000	780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

25	27	32	59	65	66	67	67	66	68	68	68	68	68	64	64	66
55	45	40	29	26	26	25	26	26	19	22	21	22	18	25	19	22
4119	4806	5084	5094	5080	5094	5095	5096	5097	5089	4413	4350	4414	4808	4829	4830	4376
3	4	4	3	3	3	3	3	3	4	3	3	3	4	3	4	3
928	999	1613	782	2000	2000	2000	2000	1436	830	2000	27	1717	1712	922	861	2000

Exit 130 Plank/William Road

67	64	68	68	68	68	69	42	64	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
22	19	24	23	23	23	17	23	11	10	10	10	10	10	10	10	10	10	10	10	10	11	11	11	11	11	11	11	11	11	11	11
4375	4792	4796	4799	4801	4803	4804	4806	2119	2123	2124	2127	2129	2130	2132	2133	2135	2138	2139	2139	2141	3989	3100	2298	2297	2298	2300	2300	2303	2306	2307	2307
3	4	3	3	3	3	4	5	3	3	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3	3
844	614	2000	2000	2000	29	1258	1549	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1287	868	1099	225	1954	2000	2000	2000	2000	2000	2000	739

6-7 PM

SB GP Lanes

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	15	15	15	15	15	14	13	20	26	26	27	27	27	26	26	26	26	26	26	26	45	58	59	46	62	59
Density	97	97	95	96	97	76	99	56	58	58	56	56	57	58	59	58	59	59	60	58	34	26	26	29	21	18
Volume	4289	4287	4288	4297	4291	4288	4007	4513	4538	4553	4559	4488	4559	4545	4577	4576	4579	4581	4588	4582	4581	4584	4552	5356	3828	4323
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1943	1467	2000	1888	838	602	851	969	499	1598	2000	237	2000	780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

63	63	64	64	66	67	67	67	66	68	68	68	68	69	66	65	67
21	18	19	25	24	24	24	24	24	18	20	20	20	16	22	17	20
3946	4493	4777	4795	4783	4801	4801	4798	4800	4791	4082	4024	4084	4416	4452	4454	3966
3	4	4	3	3	3	3	3	3	4	3	3	3	4	3	4	3
928	999	1613	782	2000	2000	2000	2000	1436	830	2000	27	1717	1712	922	861	2000

Exit 130 Plank/William Road

68	66	69	69	69	69	69	50	66	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
20	16	21	21	21	21	15	17	8	8	8	8	8	8	8	8	8	8	8	8	8	9	9	9	9	9	9	9	9	9	9	9
3968	4273	4276	4277	4279	4281	4282	4286	1637	1640	1639	1640	1639	1639	1640	1641	1641	1641	1641	1645	1647	3327	2522	1797	1798	1799	1800	1798	1798	1800	1800	1800
3	4	3	3	3	3	4	5	3	3	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3	3
844	614	2000	2000	2000	29	1258	1549	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1287	868	1099	225	1954	2000	2000	2000	2000	2000	2000	739

3-4 PM

SB HOT Lanes

Exit 148 Russell Road

Speed	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	69	68	53	68	69	69	68	68	61
Density	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	8	12	16	4	4	4	4	4	4
Volume	1610	1614	1612	1612	1612	1610	1602	1611	1611	1613	1611	1614	1606	1610	1606	1609	1607	1602	1607	1605	1596	266	267	267	267	267	253
Lanes	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	1	1	1	1	1	1
Length	2000	2000	2000	1285	1550	693	789	1567	2000	1348	1497	2000	968	2000	735	1415	1650	373	1084	2000	1056	2000	2000	2000	2000	2000	241

Speed Color Scale (mph)

10 30 40 50 70

4-5 PM

SB HOT Lanes

Exit 148

Russell Road

Speed	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	69	40	20	63	68	68	68	68	55
Density	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	12	11	8	29	66	5	4	4	4	4	5
Volume	1550	1554	1555	1551	1553	1553	1547	1558	1562	1564	1562	1562	1557	1564	1565	1568	1570	1567	1573	1572	1572	293	293	292	291	290	275
Lanes	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	1	1	1	1	1	1
Length	2000	2000	2000	1285	1550	693	789	1567	2000	1348	1497	2000	968	2000	735	1415	1650	373	1084	2000	1056	2000	2000	2000	2000	2000	241

Speed Color Scale (mph)

10 30 40 50 70

6-7 PM

SB HOT Lanes

Exit 148

Russell Road

Speed	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	67	69	69	69	69	68	68
Density	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	5	8	8	4	4	4	4	4	4
Volume	1060	1061	1062	1058	1058	1057	1052	1059	1062	1062	1062	1062	1055	1059	1057	1059	1061	1058	1063	1061	1059	276	276	275	274	274	260
Lanes	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	1	1	1	1	1	1
Length	2000	2000	2000	1285	1550	693	789	1567	2000	1348	1497	2000	968	2000	735	1415	1650	373	1084	2000	1056	2000	2000	2000	2000	2000	241

Speed Color Scale (mph)

10 30 40 50 70

APPENDIX N:

NO BUILD 2042 DETAILED ANALYSIS RESULTS

2042 No Build - Contents

1. AM Peak Hour Intersection Delays by movement
2. AM Peak Hour Intersection Volumes by movement
3. AM Peak Hour Intersection Average Queue by movement
4. AM Peak Hour Intersection Maximum Queue by movement
5. NB Link Results 6-7 AM
6. NB Link Results 8-9 AM
7. SB Link Results 6-7 AM
8. SB Link Results 8-9 AM
9. NB HOT Link Results 6-7 AM
10. NB HOT Link Results 8-9 AM
11. PM Peak Hour Intersection Delays by movement
12. PM Peak Hour Intersection Volumes by movement
13. PM Peak Hour Intersection Average Queue by movement
14. PM Peak Hour Intersection Maximum Queue by movement
15. NB Link Results 3-4 PM
16. NB Link Results 4-5 PM
17. NB Link Results 6-7 PM
18. SB Link Results 3-4 PM
19. SB Link Results 4-5 PM
20. SB Link Results 6-7 PM
21. SB HOT Link Results 3-4 PM
22. SB HOT Link Results 4-5 PM
23. SB HOT Link Results 6-7 PM

2042 No Build Intersection Average Delay (seconds per vehicle) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	oute 3 at I-95 SB Off-Ramp							66		259			2	
1302	oute 3 at I-95 NB Off-Ramp								540				-	1,409
1303	oute 3 at Carl D. Silver Pkv		77	79	5	807	555	8	215	581	8	76	6	-
1304	Route 3 at Gateway Blvd		1,643	-	424	3,828	3,440	3,909	63	10	3	160	1,213	3
1333	US 17 at Gateway Dr		331	362	362	396	451	111	18	183	166	10	11	10
1338	US 17 at Short St		50	18	6	-	56	66	21	7	-	9	31	24
1363	treport Pkwy at I-95 SB Ra					17		(0)		6	-	-	4	
1366	treport Pkwy at I-95 NB Ra		13		-				14	15			19	
1368	US 1 at Centreport Pkwy			44	76	24	-					42		33
1403	urthouse Rd at I-95 SB Ram					-		-		-	-	-	-	
1406	urthouse Rd at I-95 NB Rar		2		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	risonville Rd at I-95 SB Rar							-		63	9		0	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	0			50	35						
1438	US 1 at Route 610		-	-	24	571	71	7	92	72	14	61	60	11
1483	Russell Rd at I-95 SB Ramp					29		23	50	16			6	4
1486	ssell Rd at I-95 NB Off-Rar		8		-					52			23	
1488	ssell Rd at I-95 NB On-Rar								67	0			1	2

2042 No Build Intersection Throughput (veh/hour) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	oute 3 at I-95 SB Off-Ramp							101		483			737	
1302	oute 3 at I-95 NB Off-Ramp								318				-	77
1303	oute 3 at Carl D. Silver Pkw		5	4	10	229	5	61	24	297	61	6	592	-
1304	Route 3 at Gateway Blvd		45	-	37	1	1	5	25	501	103	12	111	1
1333	US 17 at Gateway Dr		35	14	201	257	19	25	18	829	13	94	1,355	94
1338	US 17 at Short St		129	1	30	-	2	3	2	823	-	15	1,763	2
1363	treport Pkwy at I-95 SB Ra					92		3		134	-	-	285	
1366	treport Pkwy at I-95 NB Ra		303		-				57	168			25	
1368	US 1 at Centreport Pkwy			743	714	116	-					215		248
1403	urthouse Rd at I-95 SB Ram					-		-		-	-	-	-	
1406	urthouse Rd at I-95 NB Ran		263		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	risonville Rd at I-95 SB Ran							-		1,969	137		910	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	2,155			1,494	73						
1438	US 1 at Route 610		-	-	6	93	666	722	1,092	109	287	88	121	305
1483	Russell Rd at I-95 SB Ramp					478		518	19	265			267	89
1486	ssell Rd at I-95 NB Off-Ran		102		-					744			253	
1488	ssell Rd at I-95 NB On-Ran								31	1,548			252	103

2042 No Build Intersection Average Queue (feet) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	oute 3 at I-95 SB Off-Ramp							26		1,182			3	
1302	oute 3 at I-95 NB Off-Ramp								1,778				-	914
1303	oute 3 at Carl D. Silver Pkw		4	4	4	818	818	783	2,403	2,403	783	9	11	-
1304	Route 3 at Gateway Blvd		937	937	945	480	480	492	23	23	7	1,227	1,227	1,227
1333	US 17 at Gateway Dr		702	702	702	399	388	412	6,087	6,089	6,084	32	35	32
1338	US 17 at Short St		37	37	37	-	2	3	7,158	7,158	-	513	524	530
1363	treport Pkwy at I-95 SB Ra					9		-		4	-	-	4	
1366	treport Pkwy at I-95 NB Ra		37		-				14	14			2	
1368	US 1 at Centreport Pkwy			796	807	17	-					136		140
1403	urthouse Rd at I-95 SB Ram					-		-		-	-	-	-	
1406	urthouse Rd at I-95 NB Ran		4		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	risonville Rd at I-95 SB Ran							-		411	411		-	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	-			1,706	1,727						
1438	US 1 at Route 610		-	-	715	718	719	711	1,436	1,436	1,436	33	30	5
1483	Russell Rd at I-95 SB Ramp					95		94	16	16			4	0
1486	ssell Rd at I-95 NB Off-Ran		3		-					601			24	
1488	ssell Rd at I-95 NB On-Ran								10	10			1	0

2042 No Build Intersection Max Queue (feet) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	oute 3 at I-95 SB Off-Ramp							144		1,252			108	
1302	oute 3 at I-95 NB Off-Ramp								1,832				-	958
1303	oute 3 at Carl D. Silver Pkw		48	48	48	1,146	1,146	1,113	2,444	2,444	1,113	184	155	-
1304	Route 3 at Gateway Blvd		976	976	984	505	505	518	154	154	144	1,260	1,260	1,260
1333	US 17 at Gateway Dr		746	746	746	520	508	534	6,139	6,140	6,135	332	335	332
1338	US 17 at Short St		212	212	212	-	38	55	8,682	8,682	-	922	915	922
1363	treport Pkwy at I-95 SB Ra					114		-		138	-	-	175	
1366	treport Pkwy at I-95 NB Ra		579		-				161	161			82	
1368	US 1 at Centreport Pkwy			926	939	161	-					736		761
1403	urthouse Rd at I-95 SB Ram					-		-		-	-	-	-	
1406	urthouse Rd at I-95 NB Ran		98		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	risonville Rd at I-95 SB Ran							-		634	634		-	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	-			1,863	1,885						
1438	US 1 at Route 610		-	-	1,083	936	936	928	1,624	1,624	1,624	189	124	162
1483	Russell Rd at I-95 SB Ramp					472		470	149	149			86	44
1486	ssell Rd at I-95 NB Off-Ran		92		-					992			149	
1488	ssell Rd at I-95 NB On-Ran								103	103			64	11

6 – 7 AM

NB GP Lanes

Exit 130 Plank/William Road

Exit 136 Centreport Parkway

Speed	66	68	68	68	65	61	55	50	43	37	30	31	27	22	18	15	12	10	9	8	7	4	4	2	3	5	5	6	6	6	6	11	11	11
Density	29	28	28	28	29	32	35	39	45	51	46	53	45	60	71	84	97	108	121	119	112	156	158	174	163	157	152	145	144	146	142	61	77	72
Volume	5711	5710	5709	5706	5682	5645	5571	5509	5411	5357	5316	4761	4704	3770	3738	3608	3476	3340	3218	3028	3033	1860	1887	2154	2136	2160	2738	2738	2746	2746	2750	2750	2416	2425
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	4	3	3	5	4	3	4	3	3	3	3	4	3	3
Length	2000	2000	2000	2000	2000	2000	2000	2000	2000	716	640	1177	790	926	2000	2000	2000	2000	2000	707	1234	1164	1770	1754	1206	1273	1601	2000	2000	2000	1313	792	2000	1610

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 143 Garrisonville Road

13	20	19	19	19	19	20	20	20	18	16	16	17	9	40	42	40	39	41	61	65	69	70	70	64
62	55	57	57	56	57	56	56	56	57	46	60	58	120	35	34	35	36	33	20	19	13	16	15	15
3302	3301	3303	3298	3296	3293	3294	3291	3285	3100	2953	2962	2962	4144	4145	4135	4135	4126	3971	3689	3679	3645	3287	3189	3757
4	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3	3	4	3	3	4
579	2000	2000	2000	2000	2000	2000	2000	2000	767	905	2000	4	1471	2000	2000	2000	2000	1546	415	582	825	2000	162	855

Exit 148 Russell Road

65	62	69	69	69	69	68	69	69	69	68	68	68	67	67	68	66	61	69	69	68	68	69	69	69	69	69
18	16	19	19	19	19	14	18	18	18	18	18	18	19	18	18	19	15	14	14	11	14	14	14	14	14	14
3427	3893	3887	3893	3894	3893	3876	3732	3733	3731	3731	3723	3728	3731	3731	3734	3722	3706	2809	2806	2939	2939	2941	2942	2942	2933	2943
3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
759	1503	2000	2000	675	1193	295	2000	416	2000	563	1445	2000	731	2000	881	942	519	2000	455	1083	394	2000	1484	789	685	1711

8-9 AM

NB GP Lanes

Exit 130 Plank/William Road

Exit 136 Centreport Parkway

Speed	13	13	13	13	13	13	14	14	14	15	14	12	10	9	9	9	9	9	9	9	8	4	4	3	4	5	5	7	7	7	7	12	10	11
Density	113	113	113	113	113	112	108	109	105	103	81	115	98	131	134	134	134	133	133	120	110	154	155	172	160	153	146	138	136	140	138	61	77	73
Volume	4524	4507	4504	4492	4505	4515	4530	4531	4533	4545	4534	4090	4094	3333	3416	3442	3434	3436	3421	3311	3356	2040	2077	2368	2341	2362	2998	2998	3007	3011	3011	3013	2402	2396
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	4	3	3	5	4	3	4	3	3	3	3	4	3	3
Length	2000	2000	2000	2000	2000	2000	2000	2000	2000	716	640	1177	790	926	2000	2000	2000	2000	2000	707	1234	1164	1770	1754	1206	1273	1601	2000	2000	2000	1313	792	2000	1610

Speed Color Scale (mph): 10, 30, 40, 50, 70

Exit 140 Courthouse Road

Exit 143 Garrisonville Road

13	19	19	19	19	19	19	19	19	18	16	16	17	9	41	45	44	42	43	62	65	69	70	70	60
63	57	58	58	58	57	57	57	57	58	47	61	59	120	34	32	33	34	32	20	19	13	16	16	16
3268	3269	3269	3265	3268	3269	3271	3269	3265	3090	2949	2952	2954	4169	4171	4161	4159	4166	4021	3761	3751	3714	3348	3251	3881
4	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3	3	4	3	3	4
579	2000	2000	2000	2000	2000	2000	2000	2000	767	905	2000	4	1471	2000	2000	2000	2000	1546	415	582	825	2000	162	855

Exit 148 Russell Road

62	62	69	69	69	69	68	69	69	69	68	68	68	67	67	68	66	61	69	69	68	69	69	69	69	69
19	16	19	19	19	19	15	18	18	18	19	19	19	19	19	19	19	15	14	14	11	15	15	14	15	14
3542	3965	3962	3971	3971	3972	3953	3812	3814	3813	3814	3805	3810	3810	3805	3804	3790	3772	2877	2877	3006	3006	3008	3010	3011	3002	3010
3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
759	1503	2000	2000	675	1193	295	2000	416	2000	563	1445	2000	731	2000	881	942	519	2000	455	1083	394	2000	1484	789	685	1711

6 – 7 AM

SB GP Lanes

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	69	69	69	69	69	68	70	69	70	69	69	68	69	69	69	69	70	70	70	70	70	70	70	70	70	66
Density	15	15	15	15	15	11	10	8	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	8	9	8
Volume	3138	3138	3135	3131	3133	3128	2135	2243	2251	2255	2255	2222	2253	2238	2250	2251	2249	2247	2245	2243	2239	2239	2222	2231	1880	2223
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1943	1467	2000	1888	838	602	851	968	492	1598	2000	237	2000	780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

69	69	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
10	8	11	11	11	11	11	11	11	8	10	10	10	9	12	12	12	12	12	12	12	12	9	11
2149	2319	2313	2318	2308	2312	2310	2307	2305	2300	2062	2030	2051	2489	2492	2493	2492	2491	2494	2500	2499	2498	2499	2403
3	4	3	3	3	3	3	3	3	4	3	3	3	4	3	3	3	3	3	3	3	3	4	3
928	1408	1613	782	2000	2000	2000	2000	1436	830	2000	27	1727	1711	2000	2000	2000	2000	2000	2000	2000	288	861	2000

Exit 130 Plank/William Road

70	68	69	70	70	70	70	69	69	70	70	70	70	70	70	70	70	70	70	70	70	70	69	69	70	70	70	70	70	70	70
11	10	13	13	13	13	9	8	10	10	10	10	10	10	10	10	10	10	10	10	10	8	10	13	13	13	13	13	13	13	13
2404	2628	2631	2632	2631	2629	2631	2634	2046	2047	2046	2044	2044	2042	2038	2036	2038	2039	2039	2039	2041	2656	2655	2656	2660	2665	2669	2674	2675	2678	2682	2686
3	4	3	3	3	3	4	5	3	3	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3
844	614	2000	2000	2000	29	1258	1549	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1277	868	1099	225	1954	2000	2000	2000	2000	2000	2000	739

8-9 AM

SB GP Lanes

Exit 148 Russell Road

Exit 143 Garrisonville Road

69	69	69	69	69	68	70	69	70	69	69	69	69	70	69	69	70	70	70	70	70	70	70	70	66
15	15	15	15	15	12	10	8	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	8	9	9
3139	3143	3144	3144	3146	3143	2141	2250	2257	2262	2267	2235	2269	2254	2266	2267	2267	2268	2267	2267	2270	2272	2256	2266	1900	2272
3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4
1943	1467	2000	1888	838	602	851	968	492	1598	2000	237	2000	780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

69	69	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	62	58	50	47	45	37	
11	9	11	11	11	11	11	11	11	8	10	10	10	9	12	12	12	12	15	21	29	34	28	47	
2196	2365	2361	2367	2359	2367	2366	2368	2368	2362	2117	2086	2106	2536	2539	2538	2538	2537	2522	2483	2429	2390	2367	2202	
3	4	3	3	3	3	3	3	3	4	3	3	3	4	3	3	3	3	3	3	3	3	4	3	
928	1408	1613	782	2000	2000	2000	2000	1436	830	2000	27	1727	1711	2000	2000	2000	2000	2000	2000	2000	288	861	2000	

Exit 130 Plank/William Road

32	28	22	15	9	7	4	3	63	70	70	70	70	70	70	70	70	70	70	70	70	70	69	70	70	70	70	70	70	70	70	70
59	59	79	101	118	126	136	140	7	6	6	6	6	6	6	6	6	6	6	6	6	5	7	9	9	9	9	9	9	9	9	9
2126	2310	2212	2078	1973	1923	1873	1773	1336	1337	1341	1342	1343	1345	1346	1346	1349	1353	1352	1348	1346	1884	1881	1880	1877	1875	1873	1874	1873	1873	1875	1877
3	4	3	3	3	3	4	5	3	3	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3	3
844	614	2000	2000	2000	29	1258	1549	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1277	868	1099	225	1954	2000	2000	2000	2000	2000	2000	739

6-7 AM

NB HOT Lanes

Exit 148

Russell Road

Speed	49	68	70	70	70	70	69	69	70	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71
Density	9	6	6	6	6	6	6	6	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Volume	434	433	434	434	433	433	432	432	430	432	432	598	595	596	597	597	596	595	595	593	594	594	593	593	588	592	592	591	591	592
Lanes	1	1	1	1	1	1	1	1	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Length	250	2000	2000	2000	2000	2000	2000	737	473	2000	511	1084	373	1650	1415	2000	735	2000	968	1497	2000	1348	1567	789	693	1550	2000	2000	2000	1285

Speed Color Scale (mph)

10 30 40 50 70

8-9 AM

NB HOT Lanes

Exit 148

Russell Road

Speed	50	68	71	70	70	70	70	69	70	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71
Density	8	6	6	6	6	6	6	6	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Volume	402	402	402	403	402	403	402	402	401	403	403	565	563	564	568	567	567	567	568	567	569	569	570	570	566	570	571	571	571	571
Lanes	1	1	1	1	1	1	1	1	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Length	250	2000	2000	2000	2000	2000	2000	737	473	2000	511	1084	373	1650	1415	2000	735	2000	968	1497	2000	1348	1567	789	693	1550	2000	2000	2000	1285

Speed Color Scale (mph)

10 30 40 50 70

2042 No Build PM Intersection Average Delay (seconds per vehicle) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	Route 3 at I-95 SB Off-Ramps							42		0			17	
1302	Route 3 at I-95 NB Off-Ramps								41				-	0
1303	Route 3 at Carl D. Silver Pkwy		79	91	7	78	109	14	78	16	14	85	26	4
1304	Route 3 at Gateway Blvd		43	49	1	2	2	10	53	14	7	60	11	3
1333	US 17 at Gateway Dr		213	217	86	312	337	140	16	21	13	58	9	58
1338	US 17 at Short St		49	19	13	-	-	31	26	11	-	31	8	7
1363	Centreport Pkwy at I-95 SB Ramps					27		0		50	-	-	14	
1366	Centreport Pkwy at I-95 NB Ramps		20		-				18	13			19	
1368	US 1 at Centreport Pkwy			26	13	26	-					36		33
1403	Courthouse Rd at I-95 SB Ramps					-		-		-	-	-	-	
1406	Courthouse Rd at I-95 NB Ramps		12		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	Garrisonville Rd at I-95 SB Ramps							-		18	15		0	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	0			29	44						
1438	US 1 at Route 610		-	-	10	65	37	30	62	55	39	350	228	51
1483	Russell Rd at I-95 SB Ramps					53		45	54	3			25	43
1486	Russell Rd at I-95 NB Off-Ramp		57		-					6			35	
1488	Russell Rd at I-95 NB On-Ramp								39	(1)			59	9

2042 No Build PM Intersection Throughput (veh/hour) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	Route 3 at I-95 SB Off-Ramps							835		1,865			2,018	
1302	Route 3 at I-95 NB Off-Ramps								623				-	410
1303	Route 3 at Carl D. Silver Pkwy		12	9	9	880	8	362	277	2,024	362	18	2,197	317
1304	Route 3 at Gateway Blvd		348	3	320	16	4	16	33	1,742	420	237	2,233	6
1333	US 17 at Gateway Dr		38	8	443	331	35	44	74	2,757	40	172	1,571	172
1338	US 17 at Short St		147	3	42	-	-	7	28	2,289	-	27	2,165	3
1363	Centreport Pkwy at I-95 SB Ramps					484		129		171	-	-	435	
1366	Centreport Pkwy at I-95 NB Ramps		403		-				48	607			276	
1368	US 1 at Centreport Pkwy			903	546	116	-					658		83
1403	Courthouse Rd at I-95 SB Ramps					-		-		-	-	-	-	
1406	Courthouse Rd at I-95 NB Ramps		20		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	Garrisonville Rd at I-95 SB Ramps							-		1,884	881		1,919	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	1,610			2,068	20						
1438	US 1 at Route 610		-	-	110	128	935	1,011	652	199	693	119	235	143
1483	Russell Rd at I-95 SB Ramps					91		22	149	576			217	898
1486	Russell Rd at I-95 NB Off-Ramp		42		-					667			1,079	
1488	Russell Rd at I-95 NB On-Ramp								485	414			1,078	159

2042 No Build PM Intersection Average Queue (feet) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	Route 3 at I-95 SB Off-Ramps							122		-			73	
1302	Route 3 at I-95 NB Off-Ramps								67				-	3
1303	Route 3 at Carl D. Silver Pkwy		9	9	9	327	327	294	122	122	294	198	190	1
1304	Route 3 at Gateway Blvd		55	55	52	0	0	1	69	69	53	102	102	102
1333	US 17 at Gateway Dr		256	256	256	498	486	512	2,420	2,422	2,236	65	64	65
1338	US 17 at Short St		44	44	44	-	2	3	398	398	-	90	90	92
1363	Centreport Pkwy at I-95 SB Ramps					85		4		180	-	-	40	
1366	Centreport Pkwy at I-95 NB Ramps		69		-				52	52			30	
1368	US 1 at Centreport Pkwy			72	57	64	-					514		512
1403	Courthouse Rd at I-95 SB Ramps					-		-		-	-	-	-	
1406	Courthouse Rd at I-95 NB Ramps		1		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	Garrisonville Rd at I-95 SB Ramps							-		203	203		-	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	-			1,547	1,570						
1438	US 1 at Route 610		-	-	658	562	563	552	631	631	631	989	998	987
1483	Russell Rd at I-95 SB Ramps					32		28	49	49			613	627
1486	Russell Rd at I-95 NB Off-Ramp		12		-					12			185	
1488	Russell Rd at I-95 NB On-Ramp								82	82			654	645

2042 No Build PM Intersection Max Queue (feet) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	Route 3 at I-95 SB Off-Ramps							565		-			505	
1302	Route 3 at I-95 NB Off-Ramps								255				-	127
1303	Route 3 at Carl D. Silver Pkwy		71	71	71	720	720	686	483	483	686	807	777	141
1304	Route 3 at Gateway Blvd		219	219	228	20	20	49	403	403	406	544	544	544
1333	US 17 at Gateway Dr		545	545	545	547	535	561	1,815	1,818	1,821	326	326	326
1338	US 17 at Short St		218	218	218	-	54	79	1,517	1,517	-	788	781	788
1363	Centreport Pkwy at I-95 SB Ramps					400		134		620	-	-	341	
1366	Centreport Pkwy at I-95 NB Ramps		515		-				519	519			262	
1368	US 1 at Centreport Pkwy			314	327	335	-					1,812		1,824
1403	Courthouse Rd at I-95 SB Ramps					-		-		-	-	-	-	
1406	Courthouse Rd at I-95 NB Ramps		57		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	Garrisonville Rd at I-95 SB Ramps							-		635	635		-	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	-			1,861	1,884						
1438	US 1 at Route 610		-	-	1,142	933	933	925	1,596	1,596	1,596	891	892	610
1483	Russell Rd at I-95 SB Ramps					278		276	227	227			989	960
1486	Russell Rd at I-95 NB Off-Ramp		102		-					193			363	
1488	Russell Rd at I-95 NB On-Ramp								358	358			1,186	1,176

3-4 PM

NB GP Lanes

Exit 130 Plank/William Road

Exit 136 Centreport Parkway

Speed	68	69	69	69	69	69	69	69	68	68	62	66	69	69	69	69	69	69	69	69	66	68	70	69	69	69	66	68	69	69	69	69	69	69
Density	20	20	20	20	20	20	20	20	20	20	16	18	13	15	15	15	15	15	15	15	12	11	11	9	11	15	14	19	18	18	18	14	16	16
Volume	4110	4108	4105	4101	4100	4097	4094	4093	4092	4091	4081	3524	3525	3115	3176	3186	3185	3185	3182	3062	3114	2179	2200	3140	3120	3151	3792	3801	3801	3792	3784	3777	3282	3285
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	4	3	3	5	4	3	4	3	3	3	3	4	3	3
Length	2000	2000	2000	2000	2000	2000	2000	2000	2000	716	640	1177	790	926	2000	2000	2000	2000	2000	707	1234	1164	1770	1754	1206	1273	1601	2000	2000	2000	1313	792	2000	1610

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 143 Garrisonville Road

67	68	69	69	69	69	69	69	69	69	69	69	69	68	69	69	69	68	68	68	69	68	69	63
14	18	18	18	18	18	18	18	18	16	16	16	13	18	18	18	18	18	18	18	13	16	16	15
3692	3691	3689	3682	3673	3674	3678	3674	3670	3348	3319	3352	3742	3744	3746	3744	3736	3735	3735	3724	3687	3356	3253	3917
4	3	3	3	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	4	3	3	4
579	2000	2000	2000	2000	2000	2000	2000	1331	519	905	1998	1471	2000	2000	2000	2000	1546	415	582	825	2000	162	855

Exit 148 Russell Road

67	69	69	69	69	69	70	69	69	68	67	67	67	66	67	68	67	67	68	67	63	64	67	68	68	68	68
17	13	18	18	18	18	13	18	18	18	18	18	18	19	19	18	18	14	17	17	16	21	20	20	20	20	20
3481	3705	3698	3711	3715	3716	3701	3713	3711	3709	3708	3705	3711	3710	3710	3706	3689	3671	3452	3451	4060	4060	4059	4055	4053	4040	4052
3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
759	1503	2000	2000	675	1193	295	2000	416	2000	563	1445	2000	731	2000	881	942	519	2000	455	1083	394	2000	1484	789	685	1711

4-5 PM

NB GP Lanes

Exit 130 Plank/William Road

Exit 136 Centreport Parkway

Speed	67	69	69	69	69	69	68	68	68	68	62	66	69	69	69	69	69	69	69	69	65	68	70	69	69	69	66	68	69	68	68	69	69	69
Density	22	21	21	21	21	21	21	21	21	22	18	19	14	16	16	16	16	17	17	16	13	11	11	10	12	16	15	20	20	20	20	15	17	17
Volume	4378	4377	4376	4376	4375	4376	4377	4374	4373	4370	4361	3772	3770	3335	3405	3415	3413	3413	3413	3283	3334	2330	2352	3351	3331	3377	4044	4041	4035	4030	4031	4031	3513	3513
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	4	3	3	5	4	3	4	3	3	3	3	4	3	3
Length	2000	2000	2000	2000	2000	2000	2000	2000	2000	716	640	1177	790	926	2000	2000	2000	2000	2000	707	1234	1164	1770	1754	1206	1273	1601	2000	2000	2000	1313	792	2000	1610

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 143 Garrisonville Road

67	68	69	69	69	69	69	68	68	69	68	69	69	68	69	69	69	68	68	68	69	68	68	64
15	19	19	19	19	19	19	19	19	18	17	17	15	20	20	19	20	20	20	20	14	18	17	16
3943	3945	3942	3945	3951	3952	3951	3943	3936	3613	3583	3613	4023	4021	4012	4010	4014	4019	4019	4007	3967	3658	3549	4217
4	3	3	3	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	4	3	3	4
579	2000	2000	2000	2000	2000	2000	2000	1331	519	905	1998	1471	2000	2000	2000	2000	1546	415	582	825	2000	162	855

Exit 148 Russell Road

67	69	68	69	69	69	70	69	68	68	67	67	67	66	67	68	67	66	68	67	63	64	67	68	68	67	68
19	14	19	19	19	19	14	19	19	19	20	19	20	20	20	19	19	15	18	18	17	23	22	21	21	21	21
3745	3966	3958	3959	3955	3953	3934	3949	3949	3949	3949	3938	3944	3942	3939	3940	3926	3910	3667	3669	4332	4332	4332	4335	4330	4318	4332
3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
759	1503	2000	2000	675	1193	295	2000	416	2000	563	1445	2000	731	2000	881	942	519	2000	455	1083	394	2000	1484	789	685	1711

6-7 PM

NB GP Lanes

Exit 130 Plank/William Road

Exit 136 Centreport Parkway

Speed	67	69	69	69	69	69	69	68	68	68	62	65	69	69	69	69	69	69	69	69	65	68	70	69	69	69	66	68	69	68	67	67	64	60
Density	21	21	21	21	21	21	21	21	21	21	17	19	14	16	16	16	16	16	16	16	13	11	11	10	12	16	15	20	20	20	20	15	19	22
Volume	4324	4327	4324	4321	4320	4317	4317	4315	4311	4308	4296	3731	3734	3306	3372	3386	3385	3386	3388	3262	3316	2321	2345	3353	3331	3366	4015	4010	4018	4019	4009	3996	3448	3428
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	4	3	3	5	4	3	4	3	3	3	3	4	3	3
Length	2000	2000	2000	2000	2000	2000	2000	2000	2000	716	640	1177	790	926	2000	2000	2000	2000	2000	707	1234	1164	1770	1754	1206	1273	1601	2000	2000	2000	1313	792	2000	1610

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 143 Garrisonville Road

57	57	55	54	49	43	37	30	27	61	66	68	69	68	69	69	69	69	69	69	69	69	69	64
22	27	30	33	38	44	53	62	67	17	16	15	13	17	17	17	17	17	17	17	13	16	15	15
3827	3810	3774	3733	3686	3614	3548	3463	3410	3122	3096	3123	3532	3538	3539	3543	3544	3545	3548	3538	3507	3240	3147	3773
4	3	3	3	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	4	3	3	4
579	2000	2000	2000	2000	2000	2000	2000	1331	519	905	1998	1471	2000	2000	2000	2000	1546	415	582	825	2000	162	855

Exit 148 Russell Road

67	69	69	69	69	69	70	68	67	63	61	59	55	51	48	44	41	37	28	23	19	21	20	19	18	17	16
17	13	17	17	17	17	13	18	18	20	21	22	25	28	32	36	38	32	48	58	63	68	71	78	82	85	91
3348	3565	3564	3573	3574	3579	3565	3576	3569	3559	3538	3509	3477	3440	3389	3334	3270	3217	2956	2875	3356	3293	3212	3107	3034	2984	2917
3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
759	1503	2000	2000	675	1193	295	2000	416	2000	563	1445	2000	731	2000	881	942	519	2000	455	1083	394	2000	1484	789	685	1711

3-4 PM

SB GP Lanes

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	8	8	8	8	8	8	7	11	16	16	17	16	17	17	17	17	17	17	18	18	21	19	19	16	14	15
Density	128	127	125	127	126	95	125	84	79	79	77	77	78	77	77	76	76	76	76	74	63	69	71	65	78	61
Volume	2892	2878	2892	2908	2925	2930	2809	3768	3780	3792	3821	3767	3849	3860	3912	3923	3936	3951	3961	3971	3982	3999	3983	4254	3265	3731
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1943	1467	2000	1888	838	602	851	969	499	1598	2000	237	2000	780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

16	20	36	55	63	64	65	64	64	67	69	69	68	69	67	67	68
72	55	36	32	28	27	27	27	28	20	20	20	20	16	22	16	18
3502	4422	5265	5279	5261	5274	5273	5268	5266	5255	4128	4068	4127	4293	4309	4307	3692
3	4	4	3	3	3	3	3	3	4	3	3	3	4	3	4	3
928	999	1613	782	2000	2000	2000	2000	1436	830	2000	27	1717	1712	922	861	2000

Exit 130 Plank/William Road

68	65	68	69	68	69	69	54	67	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
18	16	21	20	20	20	15	15	10	9	9	9	9	9	9	9	9	9	9	9	9	12	11	11	11	11	11	11	11	11	11	11
3692	4200	4199	4199	4200	4201	4201	4200	1985	1986	1988	1989	1989	1988	1988	1986	1987	1986	1983	1983	1985	4310	3217	2240	2240	2237	2239	2241	2243	2241	2238	2236
3	4	3	3	3	3	4	5	3	3	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3	3
844	614	2000	2000	2000	29	1258	1549	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1277	868	1099	225	1954	2000	2000	2000	2000	2000	2000	739

4-5 PM

SB GP Lanes

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	10	11	11	11	11	10	10	17	25	25	26	26	25	25	24	24	24	23	23	23	30	28	27	23	18	18
Density	114	113	111	113	112	86	113	68	60	61	59	59	60	61	63	62	63	64	65	64	50	53	55	52	67	57
Volume	3552	3566	3565	3570	3570	3566	3423	4500	4521	4528	4530	4472	4533	4495	4493	4481	4478	4470	4464	4462	4466	4468	4428	4662	3557	3974
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1943	1467	2000	1888	838	602	851	969	499	1598	2000	237	2000	780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

18	22	39	55	61	63	64	63	62	67	69	69	68	69	66	65	68
68	53	34	33	29	28	28	28	29	20	20	20	20	16	22	17	19
3714	4589	5339	5348	5331	5346	5345	5344	5341	5330	4193	4134	4195	4371	4389	4390	3766
3	4	4	3	3	3	3	3	3	4	3	3	3	4	3	4	3
928	999	1613	782	2000	2000	2000	2000	1436	830	2000	27	1717	1712	922	861	2000

Exit 130 Plank/William Road

68	64	68	69	69	69	69	51	66	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
18	17	21	21	21	21	16	17	10	10	10	10	10	10	10	10	10	10	10	10	10	13	12	11	11	11	11	11	11	11	11	11
3764	4304	4305	4304	4305	4305	4306	4305	2041	2042	2041	2039	2040	2041	2042	2040	2039	2039	2039	2039	2036	4447	3319	2307	2306	2306	2304	2301	2299	2300	2300	2302
3	4	3	3	3	3	4	5	3	3	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3	3
844	614	2000	2000	2000	29	1258	1549	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1277	868	1099	225	1954	2000	2000	2000	2000	2000	2000	739

6-7 PM

SB GP Lanes

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	10	10	10	10	10	10	9	15	23	23	23	23	23	22	22	23	22	22	22	22	27	26	25	21	17	17
Density	116	115	114	115	115	88	115	71	64	65	63	63	64	65	66	65	66	66	67	66	53	57	59	55	70	58
Volume	3400	3403	3397	3397	3400	3397	3265	4322	4352	4355	4341	4272	4333	4322	4356	4345	4335	4335	4324	4333	4347	4355	4323	4559	3480	3904
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1943	1467	2000	1888	838	602	851	969	499	1598	2000	237	2000	780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

18	21	39	56	61	63	64	64	63	67	69	68	68	69	66	65	68
69	53	34	32	29	28	28	28	28	20	20	20	20	16	22	17	19
3651	4537	5320	5330	5314	5331	5332	5327	5325	5315	4180	4119	4181	4352	4373	4372	3761
3	4	4	3	3	3	3	3	3	4	3	3	3	4	3	4	3
928	999	1613	782	2000	2000	2000	2000	1436	830	2000	27	1717	1712	922	861	2000

Exit 130 Plank/William Road

68	64	68	69	68	68	69	54	67	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
18	17	21	21	21	21	16	16	10	10	10	10	10	10	10	10	10	10	10	10	10	13	12	11	11	11	11	11	11	11	11	11
3759	4302	4306	4310	4312	4313	4312	4310	2022	2024	2025	2024	2025	2026	2027	2028	2026	2024	2024	2023	2024	4449	3323	2302	2302	2302	2302	2301	2299	2299	2297	2296
3	4	3	3	3	3	4	5	3	3	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3	3
844	614	2000	2000	2000	29	1258	1549	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1277	868	1099	225	1954	2000	2000	2000	2000	2000	2000	739

3-4 PM

SB HOT Lanes

Exit 148

Russell Road

Speed	69	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	69	68	63	65	67	66	66	65	57
Density	7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	5	8	8	13	12	13	13	13	14
Volume	1012	1020	1025	1027	1027	1027	1024	1031	1035	1036	1037	1041	1036	1042	1041	1044	1044	1042	1047	1047	1046	819	824	829	832	836	795
Lanes	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	1	1	1	1	1	1
Length	2000	2000	2000	1285	1550	693	789	1567	2000	1348	1497	2000	968	2000	735	1415	1650	373	1084	2000	1056	2000	2000	2000	2000	2000	241

Speed Color Scale (mph)

10 30 40 50 70

4-5 PM

SB HOT Lanes

Exit 148 Russell Road

Speed	69	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	67	57	64	66	66	65	61	44
Density	8	8	8	7	8	8	7	8	8	8	8	8	7	8	7	7	7	7	5	7	9	12	12	12	12	13	17
Volume	1033	1029	1026	1022	1022	1022	1017	1020	1021	1021	1019	1020	1016	1017	1014	1014	1012	1006	1007	1003	1000	774	771	765	760	756	716
Lanes	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	1	1	1	1	1	1
Length	2000	2000	2000	1285	1550	693	789	1567	2000	1348	1497	2000	968	2000	735	1415	1650	373	1084	2000	1056	2000	2000	2000	2000	2000	241

Speed Color Scale (mph)

10 30 40 50 70

6-7 PM

SB HOT Lanes

Exit 148

Russell Road

Speed	68	68	68	68	68	68	68	68	67	68	68	68	68	67	67	67	67	67	68	67	58	63	66	66	65	61	44
Density	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	8	8	8	5	8	9	13	12	12	12	13	18
Volume	992	993	994	992	993	993	989	997	1000	1001	1001	1004	1000	1007	1010	1014	1019	1018	1023	1022	1019	803	804	803	800	797	756
Lanes	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	1	1	1	1	1	1
Length	2000	2000	2000	1285	1550	693	789	1567	2000	1348	1497	2000	968	2000	735	1415	1650	373	1084	2000	1056	2000	2000	2000	2000	2000	241

Speed Color Scale (mph)

10 30 40 50 70

APPENDIX O:

BUILD 2022 DETAILED ANALYSIS RESULTS

2022 Build - Contents

1. AM Peak Hour Intersection Delays by movement
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21. SB HOT Link Results 3-4 PM
22. SB HOT Link Results 4-5 PM
23. SB HOT Link Results 6-7 PM

2022 Build AM Intersection Average Delay (seconds per vehicle) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	Route 3 at I-95 SB Off-Ramps							70		0			3	
1302	Route 3 at I-95 NB Off-Ramps								30				-	0
1303	Route 3 at Carl D. Silver Pkwy		85	0	5	72	78	5	75	6	5	74	10	8
1304	Route 3 at Gateway Blvd		46	-	1	81	85	6	69	11	4	48	8	3
1333	US 17 at Gateway Dr		82	79	82	60	29	8	15	16	6	11	13	11
1338	US 17 at Short St		41	-	7	-	13	20	16	6	-	11	6	-
1363	Centreport Pkwy at I-95 SB Ramps					17		(0)		9	-	-	6	
1366	Centreport Pkwy at I-95 NB Ramps		12		-				8	8			9	
1368	US 1 at Centreport Pkwy			15	16	20	-					44		32
1403	Courthouse Rd at I-95 SB Ramps					-		-		-	-	-	-	
1406	Courthouse Rd at I-95 NB Ramps		7		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	Garrisonville Rd at I-95 SB Ramps							-		2	3		0	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	0			33	18						
1438	US 1 at Route 610		-	-	2	625	69	11	62	39	6	61	63	11
1483	Russell Rd at I-95 SB Ramps					33		32	48	5			2	3
1486	Russell Rd at I-95 NB Off-Ramp		8		-					24			22	
1488	Russell Rd at I-95 NB On-Ramp								51	(0)			3	2

2022 Build AM Intersection Throughput (veh/hour) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	oute 3 at I-95 SB Off-Ramp							232		2,641			1,164	
1302	oute 3 at I-95 NB Off-Ramp								1,485				-	670
1303	oute 3 at Carl D. Silver Pkw		2	4	9	310	4	51	175	2,709	51	11	1,034	270
1304	Route 3 at Gateway Blvd		267	1	165	5	3	17	56	1,328	240	121	1,128	11
1333	US 17 at Gateway Dr		30	18	153	280	29	43	46	1,685	30	265	2,367	265
1338	US 17 at Short St		114	3	23	-	-	5	4	1,233	-	10	1,505	2
1363	treport Pkwy at I-95 SB Ra					110		3		103	-	-	482	
1366	treport Pkwy at I-95 NB Ra		421		-				29	185			158	
1368	US 1 at Centreport Pkwy			1,042	850	126	-					229		494
1403	urthouse Rd at I-95 SB Ram					-		-		-	-	-	-	
1406	urthouse Rd at I-95 NB Ran		307		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	risonville Rd at I-95 SB Ran							-		2,363	236		947	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	2,080			1,351	101						
1438	US 1 at Route 610		-	-	5	76	398	883	1,191	91	261	92	271	358
1483	Russell Rd at I-95 SB Ramp					557		676	10	361			349	64
1486	ssell Rd at I-95 NB Off-Ran		109		-					908			305	
1488	ssell Rd at I-95 NB On-Ran								71	1,451			304	54

2022 Build AM Intersection Average Queue (feet) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	oute 3 at I-95 SB Off-Ramp							56		-			8	
1302	oute 3 at I-95 NB Off-Ramp								114				-	4
1303	oute 3 at Carl D. Silver Pkw		3	3	3	75	75	37	77	77	37	27	25	5
1304	Route 3 at Gateway Blvd		56	56	54	3	3	1	58	58	37	54	54	54
1333	US 17 at Gateway Dr		54	54	54	68	56	63	120	128	114	79	82	79
1338	US 17 at Short St		27	27	27	-	1	2	20	20	-	27	29	30
1363	treport Pkwy at I-95 SB Ra					13		-		5	-	-	10	
1366	treport Pkwy at I-95 NB Ra		191		-				24	24			22	
1368	US 1 at Centreport Pkwy			688	698	23	-					287		288
1403	urthouse Rd at I-95 SB Ram					-		-		-	-	-	-	
1406	urthouse Rd at I-95 NB Ran		8		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	risonville Rd at I-95 SB Ran							-		2	2		-	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	-			17	19						
1438	US 1 at Route 610		-	-	277	142	139	119	348	348	348	35	62	4
1483	Russell Rd at I-95 SB Ramp					678		677	33	33			5	0
1486	ssell Rd at I-95 NB Off-Ran		4		-					754			27	
1488	ssell Rd at I-95 NB On-Ran								15	15			2	0

2022 Build AM Intersection Max Queue (feet) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	oute 3 at I-95 SB Off-Ramp							179		-			176	
1302	oute 3 at I-95 NB Off-Ramp								615				-	158
1303	oute 3 at Carl D. Silver Pkw		43	43	43	235	235	201	525	525	201	245	216	180
1304	Route 3 at Gateway Blvd		275	275	280	63	63	74	293	293	297	362	362	362
1333	US 17 at Gateway Dr		222	222	222	261	249	270	711	712	707	633	636	633
1338	US 17 at Short St		182	182	182	-	31	49	353	353	-	440	434	440
1363	treport Pkwy at I-95 SB Ra					135		-		140	-	-	207	
1366	treport Pkwy at I-95 NB Ra		1,317		-				204	204			199	
1368	US 1 at Centreport Pkwy			941	953	156	-					1,256		1,281
1403	urthouse Rd at I-95 SB Ram					-		-		-	-	-	-	
1406	urthouse Rd at I-95 NB Ran		118		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	risonville Rd at I-95 SB Ran							-		178	178		-	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	-			324	332						
1438	US 1 at Route 610		-	-	972	695	696	688	967	967	967	179	220	193
1483	Russell Rd at I-95 SB Ramp					2,496		2,494	182	182			100	54
1486	ssell Rd at I-95 NB Off-Ran		70		-					1,005			166	
1488	ssell Rd at I-95 NB On-Ran								152	152			71	27

6 – 7 AM

NB GP Lanes

Exit 130 Plank/William Road | Exit 133 Warrenton Road | Exit 136 Centreport Parkway

Speed	69	70	70	69	69	69	69	69	69	69	67	69	70	69	58	64	67	68	68	67	66	62	68	69	69	66	68	65	68	68	69	69	67	68	69
Density	17	17	17	17	17	17	17	17	17	17	13	15	11	13	17	19	25	24	24	24	25	20	17	17	17	13	14	15	14	17	17	17	13	13	13
Volume	3505	3502	3498	3497	3493	3489	3486	3482	3478	3476	3470	3169	3168	2664	4961	4933	4944	4948	4956	4951	4940	4921	3435	3437	3443	3371	2901	3927	3923	3555	3558	3561	3556	2615	2615
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	5	4	3	3	3	3	3	4	3	3	3	4	3	4	4	3	3	3	4	3	3
Length	2000	2000	2000	2000	2000	2000	2000	2000	2000	716	640	1177	790	983	1197	1104	2000	2000	2000	2000	1585	866	2000	2000	871	757	529	1596	1525	2000	2000	1767	792	2000	1610

Speed Color Scale (mph): 10, 30, 40, 50, 70

Exit 140 Courthouse Road | Exit 143 Garrisonville Road

60	64	68	68	68	68	68	68	68	68	69	69	69	69	65	64	63	57	44	62	65	69	70	69	56
15	18	17	17	17	17	17	17	17	16	11	15	15	14	19	20	20	23	28	18	17	12	14	14	18
3469	3438	3439	3443	3446	3448	3444	3440	3435	3205	3025	3031	3033	3751	3765	3772	3782	3792	3632	3338	3331	3299	2981	2893	3782
4	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3	3	4	3	3	4
579	2000	2000	2000	2000	2000	2000	2000	2000	767	905	2000	4	1471	2000	2000	2000	2000	1546	415	582	825	2000	162	855

Exit 148 Russell Road

53	47	67	69	69	69	68	69	69	68	68	68	68	67	67	68	69	68	68	68	67	67	68	69	69
23	24	22	21	21	21	16	21	21	21	21	21	21	21	21	21	16	17	19	19	15	20	20	19	19
3562	4412	4404	4410	4410	4410	4390	4263	4265	4266	4266	4259	4271	4275	4274	4274	4513	4505	3883	3882	4005	4008	4006	4007	4004
3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	4	4	3	3	4	3	3	3	3
759	1503	2000	2000	675	1193	295	2000	416	2000	563	1445	2000	731	2000	734	1101	523	2000	455	1083	394	2000	1484	789

8-9 AM

NB GP Lanes

Exit 130 Plank/William Road

Exit 133 Warrenton Road

Exit 136 Centreport Parkway

Speed	69	70	70	69	69	69	69	69	69	69	67	69	70	69	57	62	60	55	53	47	44	31	65	69	69	66	68	65	69	69	69	69	68	68	69
Density	18	18	18	18	18	18	18	18	18	18	14	16	12	14	17	20	29	36	40	43	43	50	15	14	14	11	12	13	12	14	14	14	11	11	11
Volume	3716	3714	3713	3713	3714	3715	3712	3713	3714	3713	3708	3372	3370	2832	4634	4642	4668	4690	4716	4753	4787	4794	2986	2991	2990	2922	2430	3359	3357	2993	2996	2998	2993	2319	2318
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	5	4	3	3	3	3	3	4	3	3	3	4	3	4	4	3	3	3	4	3	3
Length	2000	2000	2000	2000	2000	2000	2000	2000	2000	716	640	1177	790	983	1197	1104	2000	2000	2000	2000	1585	866	2000	2000	871	757	529	1596	1525	2000	2000	1767	792	2000	1610

Speed Color Scale (mph): 10, 30, 40, 50, 70

Exit 140 Courthouse Road

Exit 143 Garrisonville Road

59	65	68	68	68	68	68	68	68	68	69	69	69	69	65	67	67	61	50	64	66	69	70	70	59
13	16	16	16	16	16	16	16	16	15	10	13	13	13	18	18	18	20	24	17	16	12	14	13	17
3183	3189	3191	3192	3191	3191	3195	3195	3195	2968	2790	2794	2793	3610	3613	3613	3612	3612	3498	3282	3274	3243	2892	2808	3900
4	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3	3	4	3	3	4
579	2000	2000	2000	2000	2000	2000	2000	2000	767	905	2000	4	1471	2000	2000	2000	2000	1546	415	582	825	2000	162	855

Exit 148 Russell Road

58	56	68	69	69	69	68	69	69	69	68	68	68	67	67	68	69	69	69	68	67	68	69	69	69
21	19	21	21	21	21	16	20	20	20	20	20	20	21	20	20	16	16	18	18	14	19	18	18	18
3665	4286	4280	4287	4286	4285	4265	4138	4139	4138	4137	4128	4134	4135	4134	4135	4350	4342	3654	3653	3772	3771	3773	3775	3771
3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	4	4	3	3	4	3	3	3	3
759	1503	2000	2000	675	1193	295	2000	416	2000	563	1445	2000	731	2000	734	1101	523	2000	455	1083	394	2000	1484	789

6 – 7 AM

SB GP Lanes

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	70	70	69	69	68	70	70	70	70	69	69	70	70	70	70	70	70	70	70	70	70	70	70	70	65
Density	11	11	11	11	8	7	5	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	5	5	6
Volume	2328	2325	2323	2322	2317	1389	1439	1443	1446	1448	1424	1445	1435	1439	1438	1439	1437	1434	1432	1429	1427	1416	1420	1128	1489
Lanes	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1467	2000	1888	838	602	851	968	492	1598	2000	237	2000	780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

#REF! #REF!

Exit 136 Centreport Parkway

70	69	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
7	6	8	8	8	8	8	8	8	6	7	7	7	6	9	9	9	9	9	9	9	8	8	6	8
1442	1651	1643	1644	1638	1642	1637	1634	1633	1627	1486	1463	1481	1799	1795	1795	1791	1792	1793	1793	1789	1787	1788	1788	1717
3	4	3	3	3	3	3	3	3	4	3	3	3	4	3	3	3	3	3	3	3	3	3	4	3
928	1408	1613	782	2000	2000	2000	2000	1436	830	2000	27	1727	1711	2000	2000	2000	2000	2000	2000	2000	288	35	861	2000

Exit 130 Plank/William Road

70	69	70	70	70	68	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
8	7	9	9	9	7	7	5	5	7	7	7	7	7	7	7	7	7	7	7	7	7	6	7	9	9	9	9	9	9	9	9
1719	1898	1902	1902	1901	1882	1479	1469	1477	1482	1481	1480	1480	1481	1482	1482	1482	1480	1481	1483	1483	1482	2144	2014	1920	1921	1921	1923	1926	1927	1930	1929	1931
3	4	3	3	3	4	3	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3
844	614	2000	2000	395	598	1017	1253	1549	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1287	868	1099	225	1954	2000	2000	2000	2000	2000	2000	739

8-9 AM

SB GP Lanes

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	69	69	68	69	68	70	69	69	69	68	68	69	69	69	69	69	69	70	70	69	69	69	70	70	66
Density	18	18	18	18	13	12	10	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	10	10	9
Volume	3636	3636	3638	3640	3634	2577	2671	2682	2686	2690	2650	2694	2681	2697	2696	2697	2698	2698	2696	2698	2700	2678	2688	2181	2487
Lanes	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1467	2000	1888	838	602	851	968	492	1598	2000	237	2000	780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

#REF! #REF!

Exit 136 Centreport Parkway

69	69	70	70	70	70	70	70	70	70	70	70	70	69	70	70	69	69	69	69	69	69	69	69	69
11	10	13	13	13	13	13	13	13	10	11	11	11	10	14	14	14	14	14	14	14	14	14	10	13
2342	2679	2675	2682	2673	2680	2679	2679	2681	2675	2404	2368	2403	2857	2859	2856	2851	2853	2851	2850	2846	2842	2842	2842	2715
3	4	3	3	3	3	3	3	3	4	3	3	3	4	3	3	3	3	3	3	3	3	3	4	3
928	1408	1613	782	2000	2000	2000	2000	1436	830	2000	27	1727	1711	2000	2000	2000	2000	2000	2000	2000	288	35	861	2000

Exit 130 Plank/William Road

69	68	69	69	68	61	68	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	69	70	70	70	70	70	70	70	70
13	11	14	14	14	12	10	7	8	10	10	10	10	10	10	10	10	10	10	10	10	10	9	10	13	13	13	13	13	13	13	13
2713	2979	2979	2975	2971	2939	2115	2099	2107	2113	2112	2110	2110	2110	2111	2110	2112	2113	2113	2110	2111	2111	3024	2824	2657	2659	2663	2658	2653	2650	2649	2650	2655
3	4	3	3	3	4	3	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3	3
844	614	2000	2000	395	598	1017	1253	1549	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1287	868	1099	225	1954	2000	2000	2000	2000	2000	2000	739

6 – 7 AM

NB HOT Lanes

Exit 136 Centreport Parkway

Exit 140 Courthouse Road

Exit 143 Garrisonville Road

Speed	69	70	70	71	71	71	71	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
Density	8	8	8	4	4	4	4	6	6	6	6	6	6	6	6	6	6	6	6	6	5	7	7	7	7	7	7	7
Volume	531	532	526	530	531	531	888	892	896	897	897	895	895	895	893	891	891	890	889	887	1027	1039	1037	1036	1036	1036	1034	1025	1477
Lanes	1	1	1	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	3
Length	2000	2000	309	2000	2000	275	1097	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1211	618	2000	2000	2000	2000	2000	2000	1368	1220

Speed Color Scale (mph)

10 30 40 50 70

Exit 148 Russell Road

70	70	70	70	70	70	70	70	69	70	70	69	69	70	70	70	70	70	70	70	70	70	70	70	70	70	70
11	11	11	11	11	11	11	8	12	12	12	12	8	9	9	9	9	9	9	9	9	9	9	9	9	9	9
1486	1491	1493	1490	1483	1489	1488	1636	1627	1626	1630	1626	1623	1320	1319	1319	1315	1315	1315	1313	1311	1300	1308	1307	1306	1305	1302
2	2	2	2	2	2	2	3	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2000	2000	2000	1600	473	2000	511	1084	373	1650	1415	961	782	979	2000	968	1497	2000	1348	1567	789	693	1550	2000	2000	2000	1285

8-9 AM

NB HOT Lanes

Exit 136 Centreport Parkway

Exit 140 Courthouse Road

Exit 143 Garrisonville Road

Speed	69	70	70	71	71	71	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
Density	8	8	8	4	4	4	4	6	7	7	7	7	7	7	7	7	7	7	7	6	5	8	8	8	8	8	8	8	7
Volume	544	547	542	547	549	551	908	912	916	917	920	921	920	919	919	918	917	915	913	912	1048	1061	1061	1058	1058	1059	1059	1051	1393
Lanes	1	1	1	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	3
Length	2000	2000	309	2000	2000	275	1097	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1211	618	2000	2000	2000	2000	2000	2000	1368	1220

Speed Color Scale (mph)

10 30 40 50 70

Exit 148 Russell Road

70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
10	10	10	10	10	10	10	7	11	11	11	11	7	9	9	9	9	9	9	9	9	9	9	9	9	9	9
1401	1402	1405	1403	1395	1403	1403	1548	1540	1542	1548	1546	1545	1266	1265	1265	1263	1266	1264	1265	1265	1256	1267	1266	1266	1265	1264
2	2	2	2	2	2	2	3	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2000	2000	2000	1600	473	2000	511	1084	373	1650	1415	961	782	979	2000	968	1497	2000	1348	1567	789	693	1550	2000	2000	2000	1285

2022 Build PM Intersection Average Delay (seconds per vehicle) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	Route 3 at I-95 SB Off-Ramps							34		0			22	
1302	Route 3 at I-95 NB Off-Ramps								39				-	0
1303	Route 3 at Carl D. Silver Pkwy		85	76	6	68	70	13	81	14	13	103	21	5
1304	Route 3 at Gateway Blvd		44	41	1	1	1	5	55	13	7	53	9	2
1333	US 17 at Gateway Dr		105	102	22	302	331	131	26	51	47	42	10	42
1338	US 17 at Short St		48	5	8	-	-	12	12	8	-	16	5	7
1363	Centreport Pkwy at I-95 SB Ramps					24		0		29	-	-	15	
1366	Centreport Pkwy at I-95 NB Ramps		19		-				7	9			8	
1368	US 1 at Centreport Pkwy			25	9	21	-					35		33
1403	Courthouse Rd at I-95 SB Ramps					-		-		-	-	-	-	
1406	Courthouse Rd at I-95 NB Ramps		5		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	Garrisonville Rd at I-95 SB Ramps							-		33	22		0	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	0			32	42						
1438	US 1 at Route 610		-	-	13	67	36	37	57	56	38	132	128	11
1483	Russell Rd at I-95 SB Ramps					51		48	53	4			18	29
1486	Russell Rd at I-95 NB Off-Ramp		45		-					5			24	
1488	Russell Rd at I-95 NB On-Ramp								39	(0)			38	7

2022 Build PM Intersection Throughput (veh/hour) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	Route 3 at I-95 SB Off-Ramps							1,257		2,051			1,513	
1302	Route 3 at I-95 NB Off-Ramps								834				-	375
1303	Route 3 at Carl D. Silver Pkwy		12	8	6	765	8	294	237	1,921	294	21	2,363	645
1304	Route 3 at Gateway Blvd		321	2	208	12	4	15	27	1,637	375	185	1,685	4
1333	US 17 at Gateway Dr		35	8	297	360	22	55	68	1,799	18	133	1,830	133
1338	US 17 at Short St		96	3	24	-	-	7	6	1,814	-	21	1,360	2
1363	Centreport Pkwy at I-95 SB Ramps					536		69		184	-	-	267	
1366	Centreport Pkwy at I-95 NB Ramps		151		-				12	703			223	
1368	US 1 at Centreport Pkwy			512	396	105	-					723		64
1403	Courthouse Rd at I-95 SB Ramps					-		-		-	-	-	-	
1406	Courthouse Rd at I-95 NB Ramps		237		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	Garrisonville Rd at I-95 SB Ramps							-		1,660	536		1,848	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	1,006			1,972	28						
1438	US 1 at Route 610		-	-	141	162	809	1,003	444	352	705	97	222	87
1483	Russell Rd at I-95 SB Ramps					127		46	157	530			223	1,025
1486	Russell Rd at I-95 NB Off-Ramp		17		-					658			1,213	
1488	Russell Rd at I-95 NB On-Ramp								406	384			1,200	202

2022 Build PM Intersection Average Queue (feet) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	Route 3 at I-95 SB Off-Ramps							186		-			61	
1302	Route 3 at I-95 NB Off-Ramps								84				-	2
1303	Route 3 at Carl D. Silver Pkwy		9	9	9	142	142	108	99	99	108	149	138	8
1304	Route 3 at Gateway Blvd		53	53	52	0	0	0	57	57	45	62	62	62
1333	US 17 at Gateway Dr		52	52	52	498	486	512	6,074	6,077	6,099	57	55	57
1338	US 17 at Short St		28	28	28	-	2	2	60	60	-	18	19	20
1363	Centreport Pkwy at I-95 SB Ramps					83		5		62	-	-	23	
1366	Centreport Pkwy at I-95 NB Ramps		20		-				55	55			8	
1368	US 1 at Centreport Pkwy			38	16	50	-					1,153		1,160
1403	Courthouse Rd at I-95 SB Ramps					-		-		-	-	-	-	
1406	Courthouse Rd at I-95 NB Ramps		7		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	Garrisonville Rd at I-95 SB Ramps							-		338	338		-	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	-			1,584	1,607						
1438	US 1 at Route 610		-	-	774	619	619	610	869	869	869	87	113	5
1483	Russell Rd at I-95 SB Ramps					43		41	51	51			366	399
1486	Russell Rd at I-95 NB Off-Ramp		4		-					9			133	
1488	Russell Rd at I-95 NB On-Ramp								67	67			395	387

2022 Build PM Intersection Max Queue (feet) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	Route 3 at I-95 SB Off-Ramps							1,182		-			371	
1302	Route 3 at I-95 NB Off-Ramps								346				-	145
1303	Route 3 at Carl D. Silver Pkwy		79	79	79	454	454	420	419	419	420	720	690	337
1304	Route 3 at Gateway Blvd		209	209	216	6	6	33	377	377	381	343	343	343
1333	US 17 at Gateway Dr		262	262	262	550	538	564	6,140	6,143	6,165	397	397	397
1338	US 17 at Short St		191	191	191	-	41	64	912	912	-	368	361	368
1363	Centreport Pkwy at I-95 SB Ramps					439		173		439	-	-	229	
1366	Centreport Pkwy at I-95 NB Ramps		262		-				580	580			172	
1368	US 1 at Centreport Pkwy			220	221	275	-					2,528		2,553
1403	Courthouse Rd at I-95 SB Ramps					-		-		-	-	-	-	
1406	Courthouse Rd at I-95 NB Ramps		122		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	Garrisonville Rd at I-95 SB Ramps							-		637	637		-	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	-			1,861	1,884						
1438	US 1 at Route 610		-	-	1,142	941	941	933	1,609	1,609	1,609	315	346	102
1483	Russell Rd at I-95 SB Ramps					298		295	251	251			976	948
1486	Russell Rd at I-95 NB Off-Ramp		56		-					181			352	
1488	Russell Rd at I-95 NB On-Ramp								362	362			1,140	1,130

3-4 PM

NB GP Lanes

Exit 130 Plank/William Road

Exit 133 Warrenton Road

Exit 136 Centreport Parkway

Speed	69	70	70	70	69	69	69	69	69	69	68	69	70	69	63	66	68	69	69	68	68	69	69	70	70	70	67	69	69	69	69	70	69	69
Density	15	15	15	15	15	15	15	15	15	15	11	13	10	12	12	15	19	19	19	19	19	14	13	13	13	13	13	16	16	16	16	12	15	15
Volume	3069	3068	3065	3063	3061	3059	3058	3058	3054	3053	3047	2772	2770	2543	3888	3878	3887	3873	3861	3867	3874	3863	2734	2729	2725	2724	3335	3345	3342	3334	3323	3317	3091	3097
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	5	4	3	3	3	3	3	4	3	3	3	3	4	3	3	3	3	4	3	3
Length	2000	2000	2000	2000	2000	2000	2000	2000	2000	716	640	1177	790	983	1197	1104	2000	2000	2000	2000	1585	866	2000	2000	2000	190	1601	2000	2000	2000	1313	792	2000	1610

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 143 Garrisonville Road

68	69	69	69	69	69	69	69	69	69	69	69	70	69	69	69	69	69	69	69	70	69	69	65
12	16	16	16	16	16	16	16	16	14	14	14	12	16	16	16	16	16	16	16	12	15	14	14
3360	3358	3353	3346	3341	3341	3343	3340	3344	2968	2943	2968	3315	3316	3312	3300	3299	3303	3305	3296	3265	3036	2944	3519
4	3	3	3	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	4	3	3	4
579	2000	2000	2000	2000	2000	2000	2000	1331	519	905	1998	1471	2000	2000	2000	2000	1546	415	582	825	2000	162	855

Exit 148 Russell Road

68	69	69	69	69	69	70	69	69	68	68	68	68	67	68	68	68	68	68	67	62	64	67	68	68	68	68
15	12	16	16	16	16	12	16	16	16	16	16	16	17	16	16	16	12	16	16	16	21	20	20	20	20	20
3142	3336	3327	3332	3333	3332	3319	3335	3335	3334	3332	3328	3339	3338	3338	3338	3323	3306	3187	3183	4081	4081	4077	4071	4063	4049	4062
3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
759	1503	2000	2000	675	1193	295	2000	416	2000	563	1445	2000	731	2000	881	942	519	2000	455	1083	394	2000	1484	789	685	1711

4-5 PM

NB GP Lanes

Exit 130 Plank/Miliam Road

Exit 133 Warrenton Road

Exit 136 Centreport Parkway

Speed	69	70	70	69	69	69	69	69	69	69	68	69	70	69	63	66	68	69	69	68	67	68	69	69	69	69	66	68	69	69	69	70	69	69
Density	16	15	16	16	16	16	16	16	16	16	12	14	10	13	13	15	20	20	20	20	20	15	14	14	14	14	13	17	17	17	17	13	16	16
Volume	3240	3240	3240	3241	3241	3241	3241	3240	3241	3239	3234	2933	2933	2705	4032	4016	4020	4027	4042	4043	4041	4025	2842	2843	2851	2853	3513	3509	3501	3499	3505	3509	3275	3273
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	5	4	3	3	3	3	3	4	3	3	3	3	4	3	3	3	3	4	3	3
Length	2000	2000	2000	2000	2000	2000	2000	2000	2000	716	640	1177	790	983	1197	1104	2000	2000	2000	2000	1585	866	2000	2000	2000	190	1601	2000	2000	2000	1313	792	2000	1610

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 143 Garrisonville Road

68	68	69	69	69	69	69	69	69	69	69	69	69	68	69	69	69	69	69	69	70	69	69	65
13	17	17	17	17	17	17	17	17	15	15	15	13	17	17	17	17	17	17	17	12	16	15	14
3567	3564	3560	3563	3570	3573	3573	3562	3554	3159	3134	3160	3486	3485	3483	3489	3492	3491	3490	3481	3447	3201	3105	3689
4	3	3	3	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	4	3	3	4
579	2000	2000	2000	2000	2000	2000	2000	1331	519	905	1998	1471	2000	2000	2000	2000	1546	415	582	825	2000	162	855

Exit 148 Russell Road

67	69	69	69	69	69	70	69	69	68	68	68	68	67	67	68	68	68	68	67	62	64	67	68	68	68	68
16	13	17	17	17	17	12	17	17	17	17	17	17	17	17	17	17	13	16	16	17	22	21	20	21	21	21
3287	3497	3497	3504	3501	3499	3483	3494	3491	3490	3491	3487	3489	3488	3489	3488	3474	3457	3324	3326	4180	4183	4189	4195	4196	4184	4198
3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
759	1503	2000	2000	675	1193	295	2000	416	2000	563	1445	2000	731	2000	881	942	519	2000	455	1083	394	2000	1484	789	685	1711

6-7 PM

NB GP Lanes

Exit 130 Plank/William Road

Exit 133 Warrenton Road

Exit 136 Centreport Parkway

Speed	69	70	70	70	69	69	69	69	69	69	69	69	70	69	64	67	68	69	69	68	68	69	69	69	69	69	67	69	69	69	69	70	69	69
Density	15	15	15	15	15	15	15	15	15	15	11	14	10	13	12	14	18	18	18	18	18	14	13	13	13	13	12	16	16	16	16	12	15	14
Volume	3061	3061	3060	3057	3057	3055	3057	3054	3052	3049	3042	2794	2795	2628	3721	3719	3727	3729	3724	3725	3739	3738	2751	2750	2744	2739	3248	3245	3250	3255	3255	3251	3013	3012
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	5	4	3	3	3	3	3	4	3	3	3	3	4	3	3	3	3	4	3	3
Length	2000	2000	2000	2000	2000	2000	2000	2000	2000	716	640	1177	790	983	1197	1104	2000	2000	2000	2000	1585	866	2000	2000	2000	190	1601	2000	2000	2000	1313	792	2000	1610

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 143 Garrisonville Road

68	69	69	69	69	69	69	69	69	69	69	69	70	69	69	69	69	69	69	69	70	69	69	65
12	16	16	16	16	16	16	16	16	14	14	14	11	15	15	15	15	15	15	15	11	14	14	13
3273	3277	3278	3272	3266	3269	3278	3282	3280	2892	2865	2885	3181	3186	3188	3186	3186	3187	3192	3185	3151	2934	2848	3379
4	3	3	3	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	4	3	3	4
579	2000	2000	2000	2000	2000	2000	2000	1331	519	905	1998	1471	2000	2000	2000	2000	1546	415	582	825	2000	162	855

Exit 148 Russell Road

68	69	69	69	69	69	70	69	69	68	68	68	68	67	68	68	68	68	68	68	64	65	68	69	68	68	69
15	12	16	16	16	16	12	16	16	16	16	16	16	16	16	16	16	12	15	15	14	18	17	17	17	17	17
3036	3228	3222	3227	3227	3227	3214	3229	3228	3226	3224	3218	3223	3221	3222	3221	3206	3190	3095	3093	3548	3549	3549	3552	3552	3544	3557
3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
759	1503	2000	2000	675	1193	295	2000	416	2000	563	1445	2000	731	2000	881	942	519	2000	455	1083	394	2000	1484	789	685	1711

3-4 PM

SB GP Lanes

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	68	64	52	34	25	19	16	26	44	42	46	47	49	56	65	65	65	67	67	67	67	61	64	66	65	69	65
Density	22	24	34	52	66	60	86	51	39	41	38	37	35	23	23	23	23	23	23	22	23	25	24	23	18	16	14
Volume	4393	4387	4361	4308	4261	4236	4043	5213	5236	5243	5243	5161	5217	5233	4534	4546	4548	4550	4549	4549	4553	4557	4557	4522	4727	3275	3652
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1943	1467	2000	1888	838	602	851	969	499	1598	2000	237	240	739	1780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

68	66	68	68	67	67	68	68	68	67	68	69	69	69	69	67	68	68	68	68	68	68	67	66	68
17	15	12	16	21	21	21	21	21	21	15	18	18	18	15	20	20	20	20	20	20	13	20	16	18
3377	4064	4189	4225	4234	4221	4230	4231	4231	4227	4217	3701	3649	3702	4096	4113	4114	4116	4118	4118	4116	2581	4113	4113	3618
3	4	5	4	3	3	3	3	3	3	4	3	3	3	4	3	3	3	3	3	3	3	3	4	3
928	999	403	1613	782	2000	2000	2000	2000	1436	830	2000	27	1717	1712	2000	2000	2000	2000	2000	2000	2000	922	861	2000

68	65	69	69	69	69	52	63	70	70	70	70	70	70	70	70	70	70	70	70	70	68	66	63	67	69	69	69	69	69	68	69
18	15	20	20	20	14	15	13	8	8	7	9	9	9	9	9	9	9	9	9	9	13	16	23	22	21	21	21	21	21	21	21
3618	4039	4042	4037	4034	3951	3928	3231	1690	1704	1975	1972	1974	1971	1968	1967	1966	1966	1966	1967	1967	1968	4326	4326	4328	4329	4330	4335	4337	4336	4334	4328	4325
3	4	3	3	3	4	5	4	3	3	4	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3
844	614	2000	2000	1406	862	1277	1247	2000	103	1797	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1368	868	1099	225	1954	2000	2000	2000	2000	2000	2000	739

4-5 PM

SB GP Lanes

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	25	19	16	15	14	14	14	25	44	42	46	47	50	57	65	65	65	67	67	67	67	60	64	66	65	69	65
Density	66	82	89	97	97	75	98	52	40	42	38	37	35	23	23	23	23	23	23	23	23	26	24	23	18	16	14
Volume	4340	4274	4230	4206	4203	4199	4031	5241	5265	5276	5280	5200	5259	5275	4572	4583	4585	4586	4586	4584	4583	4580	4577	4542	4761	3262	3601
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1943	1467	2000	1888	838	602	851	969	499	1598	2000	237	240	739	1780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

68	67	68	68	68	68	68	68	68	68	69	69	69	69	69	67	68	68	68	68	68	68	67	66	68
16	15	12	15	21	20	20	20	20	21	15	18	17	18	15	20	20	20	20	20	20	12	20	15	17
3317	3979	4124	4157	4164	4155	4169	4167	4165	4169	4163	3636	3585	3639	4038	4055	4053	4052	4052	4050	4047	2540	4052	4055	3511
3	4	5	4	3	3	3	3	3	3	4	3	3	3	4	3	3	3	3	3	3	3	3	4	3
928	999	403	1613	782	2000	2000	2000	2000	1436	830	2000	27	1717	1712	2000	2000	2000	2000	2000	2000	2000	922	861	2000

68	66	69	69	69	69	57	64	70	70	70	70	70	70	70	70	70	70	70	70	70	70	68	66	64	67	69	69	69	69	69	68	69
17	15	19	19	19	14	14	12	8	8	7	9	9	9	9	9	9	9	9	9	9	9	13	16	23	21	21	21	21	21	21	21	21
3511	3927	3929	3936	3938	3862	3843	3163	1618	1632	1919	1918	1921	1925	1931	1933	1936	1937	1937	1935	1937	1937	4344	4342	4341	4337	4333	4332	4334	4336	4341	4341	4342
3	4	3	3	3	4	5	4	3	3	4	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3	3
844	614	2000	2000	1406	862	1277	1247	2000	103	1797	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1368	868	1099	225	1954	2000	2000	2000	2000	2000	2000	739

6-7 PM

SB GP Lanes

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	17	17	18	17	17	17	16	26	43	42	47	47	50	57	63	60	56	55	53	49	41	47	61	64	64	69	63
Density	91	91	89	90	91	71	94	50	40	42	37	37	35	23	24	25	28	30	33	38	42	32	24	23	18	14	14
Volume	4662	4667	4676	4676	4676	4672	4387	5254	5276	5286	5296	5219	5278	5295	4491	4489	4477	4468	4453	4428	4408	4395	4393	4359	4566	2973	3466
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1943	1467	2000	1888	838	602	851	969	499	1598	2000	237	240	739	1780	1403	2000	551	2000	2000	2000	2000	765	635	820	1026	707

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

67	67	69	69	68	68	68	68	68	68	69	69	69	69	69	68	68	68	68	68	68	68	68	67	69
16	14	11	14	19	19	19	19	19	19	14	16	16	16	13	18	18	18	18	18	18	11	18	14	15
3123	3649	3803	3835	3844	3834	3847	3848	3846	3843	3838	3303	3254	3300	3634	3645	3644	3638	3638	3638	3639	2284	3641	3637	3069
3	4	5	4	3	3	3	3	3	3	4	3	3	3	4	3	3	3	3	3	3	3	3	4	3
928	999	403	1613	782	2000	2000	2000	2000	1436	830	2000	27	1717	1712	2000	2000	2000	2000	2000	2000	2000	922	861	2000

69	67	69	69	69	70	59	66	70	71	70	70	70	70	70	70	70	70	70	70	70	68	68	67	69	69	69	69	69	69	69	69	69
15	13	16	16	16	12	11	10	6	6	5	7	7	7	7	7	7	7	7	7	7	11	13	18	18	17	17	17	17	17	18	17
3070	3375	3375	3373	3376	3311	3291	2535	1225	1236	1537	1536	1536	1534	1534	1533	1531	1530	1531	1532	1535	1536	3627	3631	3634	3633	3629	3623	3615	3615	3621	3622	3625
3	4	3	3	3	4	5	4	3	3	4	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3	3
844	614	2000	2000	1406	862	1277	1247	2000	103	1797	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1368	868	1099	225	1954	2000	2000	2000	2000	2000	2000	739

3-4 PM

SB HOT Lanes

Exit 148

Russell Road

| | | |

4-5 PM

SB HOT Lanes

Exit 148 Russell Road

| | | |

6-7 PM

SB HOT Lanes

Exit 148

Russell Road

| | | |

APPENDIX P:

BUILD 2042 DETAILED ANALYSIS RESULTS

2042 Build - Contents

1. AM Peak Hour Intersection Delays by movement
2. AM Peak Hour Intersection Volumes by movement
3. AM Peak Hour Intersection Average Queue by movement
4. AM Peak Hour Intersection Maximum Queue by movement
5. NB Link Results 6-7 AM
6. NB Link Results 8-9 AM
7. SB Link Results 6-7 AM
8. SB Link Results 8-9 AM
9. NB HOT Link Results 6-7 AM
10. NB HOT Link Results 8-9 AM
11. PM Peak Hour Intersection Delays by movement
12. PM Peak Hour Intersection Volumes by movement
13. PM Peak Hour Intersection Average Queue by movement
14. PM Peak Hour Intersection Maximum Queue by movement
15. NB Link Results 3-4 PM
16. NB Link Results 4-5 PM
17. NB Link Results 6-7 PM
18. SB Link Results 3-4 PM
19. SB Link Results 4-5 PM
20. SB Link Results 6-7 PM
21. SB HOT Link Results 3-4 PM
22. SB HOT Link Results 4-5 PM
23. SB HOT Link Results 6-7 PM

2042 Build AM Intersection Average Delay (seconds per vehicle) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1303	oute 3 at Carl D. Silver Pkv		83	83	6	88	73	6	94	67	6	74	11	11
1304	Route 3 at Gateway Blvd		48	-	1	42	43	9	71	12	5	52	11	3
1333	US 17 at Gateway Dr		388	383	389	335	350	73	14	198	207	9	10	9
1338	US 17 at Short St		73	5	7	-	76	125	11	10	-	15	70	55
1363	treport Pkwy at I-95 SB Ra					17		(0)		7	-	-	4	
1366	treport Pkwy at I-95 NB Ra		11		-				12	11			13	
1368	US 1 at Centreport Pkwy			37	63	27	-					41		32
1403	urthouse Rd at I-95 SB Ran					-		-		-	-	-	-	
1406	urthouse Rd at I-95 NB Rar		4		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	risonville Rd at I-95 SB Rar							-		74	7		0	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	0			41	23						
1438	US 1 at Route 610		-	-	9	550	67	6	81	76	15	62	59	9
1483	Russell Rd at I-95 SB Ramp					28		25	47	9			6	3
1486	ssell Rd at I-95 NB Off-Rar		9		-					25			20	
1488	ssell Rd at I-95 NB On-Rar								49	(0)			3	3

2042 Build AM Intersection Throughput (veh/hour) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1303	oute 3 at Carl D. Silver Pkv		5	3	10	281	6	63	171	2,032	63	12	1,215	78
1304	Route 3 at Gateway Blvd		310	-	209	5	3	18	51	945	200	186	1,537	15
1333	US 17 at Gateway Dr		25	14	195	272	17	27	14	789	9	73	824	73
1338	US 17 at Short St		100	2	27	-	2	3	11	1,481	-	13	1,085	1
1363	treport Pkwy at I-95 SB Ra					82		2		133	-	-	189	
1366	treport Pkwy at I-95 NB Ra		190		-				30	186			40	
1368	US 1 at Centreport Pkwy			884	805	134	-					220		227
1403	urthouse Rd at I-95 SB Ran					-		-		-	-	-	-	
1406	urthouse Rd at I-95 NB Rar		58		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	risonville Rd at I-95 SB Rar							-		1,757	249		627	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	2,428			1,376	54						
1438	US 1 at Route 610		-	-	2	90	713	560	1,219	80	251	83	134	357
1483	Russell Rd at I-95 SB Ramp					403		488	9	264			302	76
1486	ssell Rd at I-95 NB Off-Rar		134		-					668			244	
1488	ssell Rd at I-95 NB On-Rar								170	1,377			243	121

2042 Build AM Intersection Average Queue (feet) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1303	oute 3 at Carl D. Silver Pkw		4	4	4	71	71	31	2,188	2,188	31	41	38	1
1304	Route 3 at Gateway Blvd		66	66	65	2	2	1	46	46	24	82	82	82
1333	US 17 at Gateway Dr		703	703	703	291	279	302	6,086	6,088	6,083	17	20	17
1338	US 17 at Short St		34	34	34	-	2	4	426	426	-	689	694	701
1363	treport Pkwy at I-95 SB Ra					8		-		17	-	-	3	
1366	treport Pkwy at I-95 NB Ra		19		-				10	10			2	
1368	US 1 at Centreport Pkwy			734	744	18	-					130		134
1403	urthouse Rd at I-95 SB Ram					-		-		-	-	-	-	
1406	urthouse Rd at I-95 NB Ran		2		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	risonville Rd at I-95 SB Ran							-		491	491		-	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	-			1,076	1,088						
1438	US 1 at Route 610		-	-	406	672	672	664	1,512	1,512	1,512	32	33	3
1483	Russell Rd at I-95 SB Ramps					77		77	11	11			5	0
1486	ssell Rd at I-95 NB Off-Ran		5		-					91			19	
1488	ssell Rd at I-95 NB On-Ran								33	33			3	0

2042 Build AM Intersection Max Queue (feet) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1303	oute 3 at Carl D. Silver Pkv		52	52	52	224	224	190	2,447	2,447	190	329	299	84
1304	Route 3 at Gateway Blvd		271	271	279	64	64	77	269	269	271	436	436	436
1333	US 17 at Gateway Dr		746	746	746	493	482	507	6,136	6,138	6,133	289	292	289
1338	US 17 at Short St		198	198	198	-	36	53	1,749	1,749	-	926	920	926
1363	treport Pkwy at I-95 SB Ra					111		-		298	-	-	112	
1366	treport Pkwy at I-95 NB Ra		457		-				156	156			95	
1368	US 1 at Centreport Pkwy			934	946	162	-					714		730
1403	urthouse Rd at I-95 SB Ran					-		-		-	-	-	-	
1406	urthouse Rd at I-95 NB Rar		56		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	risonville Rd at I-95 SB Rar							-		645	645		-	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	-			1,749	1,772						
1438	US 1 at Route 610		-	-	1,022	944	944	936	1,638	1,638	1,638	178	136	167
1483	Russell Rd at I-95 SB Ramp					435		433	111	111			94	53
1486	ssell Rd at I-95 NB Off-Rar		94		-					605			131	
1488	ssell Rd at I-95 NB On-Rar								172	172			83	45

6 – 7 AM

NB GP Lanes

Exit 130 Plank/William Road

Exit 136 Centreport Parkway

Speed	66	68	68	68	68	68	68	68	66	60	47	61	67	68	69	69	69	68	64	60	49	23	11	7	4	4	4	4	5	6	6	6	10	9	10
Density	29	28	28	28	28	28	28	28	29	32	30	28	19	21	22	22	22	22	23	25	24	51	84	107	147	146	156	156	145	144	147	144	62	79	75
Volume	5716	5715	5712	5712	5711	5709	5706	5703	5703	5702	5690	5212	5214	4338	4427	4445	4448	4445	4429	4238	4285	2781	2696	3549	2410	2414	2058	2700	2700	2558	2558	2557	2559	2251	2247
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	4	3	3	5	4	4	3	4	4	3	3	3	4	3	3
Length	18716	18716	18716	18716	18716	18716	18716	18716	18716	18716	640	1177	790	926	10707	10707	10707	10707	10707	10707	1234	1153	1583	1754	1178	646	529	1596	1525	5767	5767	5767	792	3610	3610

10 30 40 50 70 Speed Color Scale (mph)

Exit 140 Courthouse Road

Exit 143 Garrisonville Road

12	17	17	17	17	17	17	17	17	17	16	17	17	9	42	49	45	42	43	60	63	68	70	70	67
65	60	61	61	61	60	61	60	60	60	46	59	58	118	33	29	31	33	31	21	20	14	15	15	13
3064	3064	3073	3073	3075	3074	3070	3062	3062	3013	2966	2973	2975	4137	4138	4133	4127	4121	3997	3788	3777	3740	3234	3139	3451
4	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3	3	4	3	3	4
579	16767	16767	16767	16767	16767	16767	16767	16767	16767	905	2004	2004	1471	9546	9546	9546	9546	9546	415	582	825	2162	2162	855

Exit 148 Russell Road

68	66	70	70	70	69	68	69	69	69	68	68	68	67	67	68	69	68	69	69	67	68	69	69	69
16	13	17	17	17	17	13	16	16	16	17	16	17	17	17	17	13	13	12	13	11	14	14	14	14
3189	3526	3523	3531	3532	3531	3515	3377	3378	3379	3380	3376	3385	3384	3387	3388	3526	3521	2588	2588	2877	2876	2875	2874	2872
3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	4	4	3	3	4	3	3	3	3
759	1503	4675	4675	4675	1193	295	2416	2416	2563	2563	1445	2731	2731	2734	2734	1101	523	2455	2455	1083	394	3484	3484	789

8-9 AM

NB GP Lanes

Exit 130 Plank/William Road

Exit 136 Centreport Parkway

Speed	60	59	57	54	48	44	41	36	31	28	25	24	22	17	13	12	11	11	11	11	9	6	6	6	4	4	5	5	5	6	6	6	11	9	10
Density	33	34	36	39	45	50	55	60	65	69	57	77	68	97	109	118	119	121	122	113	103	149	149	130	146	144	154	155	145	142	145	143	63	80	76
Volume	5633	5610	5590	5554	5499	5447	5379	5313	5264	5226	5190	4725	4692	3903	3938	3913	3903	3891	3882	3739	3811	2523	2540	3603	2504	2524	2166	2833	2830	2684	2672	2681	2675	2251	2251
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	4	3	3	5	4	4	3	4	4	3	3	3	4	3	3
Length	18716	18716	18716	18716	18716	18716	18716	18716	18716	18716	640	1177	790	926	10707	10707	10707	10707	10707	10707	1234	1153	1583	1754	1178	646	529	1596	1525	5767	5767	5767	792	3610	3610

Speed Color Scale (mph): 10, 30, 40, 50, 70

Exit 140 Courthouse Road

Exit 143 Garrisonville Road

12	17	17	17	17	17	17	17	17	17	16	17	17	9	46	56	53	48	46	61	64	69	70	70	67
65	60	61	61	61	61	61	60	60	61	46	60	58	118	31	26	27	30	30	22	21	14	16	16	14
3111	3109	3102	3103	3113	3104	3108	3105	3099	3041	2997	2999	2999	4227	4231	4228	4220	4218	4122	3960	3950	3912	3373	3275	3609
4	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3	3	4	3	3	4
579	16767	16767	16767	16767	16767	16767	16767	16767	16767	905	2004	2004	1471	9546	9546	9546	9546	9546	415	582	825	2162	2162	855

Exit 148 Russell Road

67	65	70	70	69	69	68	69	69	69	68	69	68	67	68	68	69	68	69	69	67	68	69	69	69
17	14	18	18	18	18	14	17	17	17	17	17	17	17	17	17	13	13	13	13	11	15	14	14	14
3332	3673	3670	3680	3682	3683	3666	3506	3506	3509	3510	3505	3511	3508	3506	3505	3638	3633	2705	2704	2985	2986	2989	2990	2986
3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	4	4	3	3	4	3	3	3	3
759	1503	4675	4675	4675	1193	295	2416	2416	2563	2563	1445	2731	2731	2734	2734	1101	523	2455	2455	1083	394	3484	3484	789

6-7 AM

SB GP Lanes

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	70	69	69	69	68	70	69	70	69	69	69	69	70	69	69	70	70	70	70	70	70	70	70	70	65
Density	15	15	15	15	11	10	8	10	10	11	10	10	10	10	10	10	10	10	10	10	10	10	8	9	9
Volume	3032	3031	3029	3027	3022	2082	2157	2164	2168	2170	2137	2169	2156	2168	2170	2170	2170	2170	2169	2171	2170	2153	2163	1854	2341
Lanes	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1467	3888	3888	838	602	851	968	492	1598	2237	2237	2780	2780	1403	2551	2551	8765	8765	8765	8765	8765	635	820	1026	707

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

69	69	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	69	69
11	9	12	12	12	12	12	12	12	9	11	10	10	9	12	12	12	12	12	12	12	12	12	9	12
2266	2538	2534	2539	2533	2540	2540	2543	2541	2537	2209	2178	2202	2523	2526	2529	2533	2541	2547	2554	2556	2559	2561	2474
3	4	3	3	3	3	3	3	3	4	3	3	3	4	3	3	3	3	3	3	3	3	4	3
928	1408	1613	782	9436	9436	9436	9436	9436	830	2027	2027	1727	1711	14288	14288	14288	14288	14288	14288	14288	14288	861	2844

Exit 130 Plank/William Road

70	68	69	70	69	64	68	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	69	69	70	70	70	70	70	70	70
12	10	13	13	13	11	10	7	7	10	10	10	10	10	10	10	10	10	10	10	10	10	8	10	13	13	13	13	13	13	13	13	13	13
2475	2747	2751	2758	2762	2736	2088	2076	2090	2099	2102	2105	2107	2108	2112	2112	2114	2117	2120	2130	2134	2138	2779	2694	2632	2630	2632	2635	2641	2645	2647	2651	2654
3	4	3	3	3	4	3	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3	3
2844	614	4395	4395	4395	598	1017	1253	1549	25281	25281	25281	25281	25281	25281	25281	25281	25281	25281	25281	25281	25281	868	1099	225	1954	12739	12739	12739	12739	12739	12739	12739

8-9 AM

SB GP Lanes

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	70	69	69	69	69	70	69	70	70	69	69	69	70	70	70	70	70	70	70	70	70	70	70	70	64
Density	13	13	13	13	10	9	7	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	7	8	8
Volume	2674	2673	2671	2672	2670	1827	1913	1923	1927	1929	1901	1930	1923	1935	1939	1941	1942	1943	1944	1944	1946	1930	1940	1661	2171
Lanes	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1467	3888	3888	838	602	851	968	492	1598	2237	2237	2780	2780	1403	2551	2551	8765	8765	8765	8765	8765	635	820	1026	707

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

69	69	70	70	70	70	70	70	70	70	66	65	64	63	63	63	60	49	39	23	14	9	7	5
10	9	11	11	11	11	11	11	11	8	11	12	14	17	23	25	27	37	50	67	91	105	86	136
2101	2366	2363	2369	2363	2370	2370	2371	2370	2365	2058	2020	2029	2344	2322	2308	2291	2261	2203	2091	1943	1860	1811	1628
3	4	3	3	3	3	3	3	3	4	3	3	3	4	3	3	3	3	3	3	3	3	4	3
928	1408	1613	782	9436	9436	9436	9436	9436	830	2027	2027	1727	1711	14288	14288	14288	14288	14288	14288	14288	14288	861	2844

Exit 130 Plank/William Road

4	3	3	3	4	3	58	69	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	69	70	70	70	70	70	70	70	70	70
154	161	164	164	150	129	7	4	4	6	6	6	6	6	6	6	6	6	6	6	6	6	5	6	8	8	8	8	8	8	8	8	8	8
1530	1668	1625	1592	1588	1562	1193	1184	1189	1187	1181	1181	1180	1178	1176	1175	1177	1178	1177	1176	1178	1179	1833	1750	1687	1687	1685	1683	1680	1680	1683	1685	1686
3	4	3	3	3	4	3	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3	3	3
2844	614	4395	4395	4395	598	1017	1253	1549	25281	25281	25281	25281	25281	25281	25281	25281	25281	25281	25281	25281	25281	868	1099	225	1954	12739	12739	12739	12739	12739	12739	12739

6 – 7 AM

NB HOT Lanes

Exit 136 Centreport Parkway | Exit 140 Courthouse Road | Exit 143 Garrisonville Road

Speed	62	69	69	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	70	71	71	71	71	71	71	70
Density	6	5	5	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	5	5	5	5	5	5	5
Volume	351	352	348	351	350	349	484	486	489	488	486	485	483	482	482	480	478	477	477	476	646	654	652	649	649	649	649	643	955
Lanes	1	1	1	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	3
Length	4309	4309	4309	4275	4275	4275	1097	25211	25211	25211	25211	25211	25211	25211	25211	25211	25211	25211	25211	25211	618	13368	13368	13368	13368	13368	13368	13368	1220

Speed Color Scale (mph): 10 30 40 50 70

Exit 148 Russell Road

70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
7	7	7	7	7	7	7	5	8	8	8	8	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6
957	958	957	956	952	956	955	1109	1102	1101	1104	1102	1101	910	910	910	907	908	907	907	906	898	904	903	902	901	900
2	2	2	2	2	2	2	3	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2
7600	7600	7600	7600	473	2511	2511	1084	373	1650	1415	961	782	979	2968	2968	1497	3348	3348	1567	789	693	1550	7285	7285	7285	7285

8-9 AM

NB HOT Lanes

Exit 136 Centreport Parkway

Exit 140 Courthouse Road

Exit 143 Garrisonville Road

Speed	61	69	69	70	71	71	70	70	70	70	70	70	70	70	70	70	70	70	70	71	70	71	71	70	70	70	70	70	70
Density	6	5	5	3	3	3	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	5	5	5	5	5	5	4
Volume	350	353	350	354	353	354	499	503	506	507	508	509	507	507	505	503	504	506	509	510	678	689	689	688	688	688	690	685	929
Lanes	1	1	1	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	3
Length	4309	4309	4309	4275	4275	4275	1097	25211	25211	25211	25211	25211	25211	25211	25211	25211	25211	25211	25211	25211	618	13368	13368	13368	13368	13368	13368	13368	1220

Speed Color Scale (mph)

10 30 40 50 70

Exit 148 Russell Road

70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
7	7	7	7	7	7	7	5	8	8	8	8	5	7	7	7	7	7	7	7	7	7	7	7	7	7	7
934	937	936	935	931	935	934	1112	1106	1105	1109	1109	1109	923	923	924	921	922	921	920	921	914	922	921	921	919	917
2	2	2	2	2	2	2	3	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2
7600	7600	7600	7600	473	2511	2511	1084	373	1650	1415	961	782	979	2968	2968	1497	3348	3348	1567	789	693	1550	7285	7285	7285	7285

2042 Build PM Intersection Average Delay (seconds per vehicle) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	Route 3 at I-95 SB Off-Ramps							38		0			21	
1302	Route 3 at I-95 NB Off-Ramps								41				-	0
1303	Route 3 at Carl D. Silver Pkwy		77	90	7	72	83	12	82	14	12	101	24	7
1304	Route 3 at Gateway Blvd		44	55	1	2	2	7	50	14	9	58	11	2
1333	US 17 at Gateway Dr		133	140	31	312	330	139	16	30	23	81	11	81
1338	US 17 at Short St		48	8	10	-	-	17	13	10	-	22	6	8
1363	Centreport Pkwy at I-95 SB Ramps					25		0		30	-	-	14	
1366	Centreport Pkwy at I-95 NB Ramps		19		-				15	15			16	
1368	US 1 at Centreport Pkwy			27	14	27	-					34		31
1403	Courthouse Rd at I-95 SB Ramps					-		-		-	-	-	-	
1406	Courthouse Rd at I-95 NB Ramps		6		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	Garrisonville Rd at I-95 SB Ramps							-		13	14		0	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	0			30	45						
1438	US 1 at Route 610		-	-	7	67	37	33	53	50	14	323	270	67
1483	Russell Rd at I-95 SB Ramps					54		47	52	3			24	50
1486	Russell Rd at I-95 NB Off-Ramp		56		-					5			35	
1488	Russell Rd at I-95 NB On-Ramp								39	(1)			55	8

2042 Build PM Intersection Throughput (veh/hour) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	Route 3 at I-95 SB Off-Ramps							1,097		1,969			1,725	
1302	Route 3 at I-95 NB Off-Ramps								596				-	401
1303	Route 3 at Carl D. Silver Pkwy		12	8	9	826	9	319	252	1,958	319	15	2,392	845
1304	Route 3 at Gateway Blvd		325	3	307	16	4	16	32	2,016	497	233	1,984	5
1333	US 17 at Gateway Dr		42	7	427	283	53	37	54	2,325	53	258	1,359	258
1338	US 17 at Short St		147	3	40	-	-	7	6	2,030	-	25	1,541	3
1363	Centreport Pkwy at I-95 SB Ramps					453		53		185	-	-	420	
1366	Centreport Pkwy at I-95 NB Ramps		387		-				10	628			292	
1368	US 1 at Centreport Pkwy			986	538	120	-					657		102
1403	Courthouse Rd at I-95 SB Ramps					-		-		-	-	-	-	
1406	Courthouse Rd at I-95 NB Ramps		80		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	Garrisonville Rd at I-95 SB Ramps							-		1,605	1,250		1,572	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	1,665			2,043	29						
1438	US 1 at Route 610		-	-	133	156	889	1,006	496	186	435	115	243	172
1483	Russell Rd at I-95 SB Ramps					78		27	177	628			341	803
1486	Russell Rd at I-95 NB Off-Ramp		20		-					706			1,130	
1488	Russell Rd at I-95 NB On-Ramp								462	533			1,130	210

2042 Build PM Intersection Average Queue (feet) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	Route 3 at I-95 SB Off-Ramps							168		-			63	
1302	Route 3 at I-95 NB Off-Ramps								64				-	2
1303	Route 3 at Carl D. Silver Pkwy		9	9	9	179	179	145	105	105	145	183	173	25
1304	Route 3 at Gateway Blvd		54	54	51	0	0	1	79	79	66	85	85	85
1333	US 17 at Gateway Dr		92	92	92	501	489	515	5,278	5,281	5,303	132	129	132
1338	US 17 at Short St		43	43	43	-	2	2	112	112	-	31	32	34
1363	Centreport Pkwy at I-95 SB Ramps					73		2		58	-	-	39	
1366	Centreport Pkwy at I-95 NB Ramps		61		-				58	58			25	
1368	US 1 at Centreport Pkwy			80	61	49	-					818		825
1403	Courthouse Rd at I-95 SB Ramps					-		-		-	-	-	-	
1406	Courthouse Rd at I-95 NB Ramps		3		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	Garrisonville Rd at I-95 SB Ramps							-		137	137		-	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	-			1,527	1,549						
1438	US 1 at Route 610		-	-	578	581	581	571	101	101	101	975	984	1,018
1483	Russell Rd at I-95 SB Ramps					28		24	54	54			667	662
1486	Russell Rd at I-95 NB Off-Ramp		5		-					10			192	
1488	Russell Rd at I-95 NB On-Ramp								77	77			603	593

2042 Build PM Intersection Max Queue (feet) by Movement

ID	Name	Type	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1301	Route 3 at I-95 SB Off-Ramps							1,278		-			413	
1302	Route 3 at I-95 NB Off-Ramps								258				-	137
1303	Route 3 at Carl D. Silver Pkwy		76	76	76	546	546	513	441	441	513	846	816	692
1304	Route 3 at Gateway Blvd		207	207	212	25	25	53	497	497	500	459	459	459
1333	US 17 at Gateway Dr		301	301	301	554	542	568	6,004	6,007	6,029	425	425	425
1338	US 17 at Short St		234	234	234	-	51	73	1,065	1,065	-	454	447	454
1363	Centreport Pkwy at I-95 SB Ramps					398		131		422	-	-	343	
1366	Centreport Pkwy at I-95 NB Ramps		474		-				524	524			248	
1368	US 1 at Centreport Pkwy			405	402	281	-					2,137		2,162
1403	Courthouse Rd at I-95 SB Ramps					-		-		-	-	-	-	
1406	Courthouse Rd at I-95 NB Ramps		67		-				-	-			-	-
1408	Courthouse Rd at US 1													
1431	Garrisonville Rd at I-95 SB Ramps							-		621	621		-	
14382	US 1 at I-95 NB Off-Ramp													
1434	US 1 at I-95 NB On-Ramp		-	-			1,858	1,881						
1438	US 1 at Route 610		-	-	1,127	936	936	928	408	408	408	1,225	1,233	1,267
1483	Russell Rd at I-95 SB Ramps					235		233	246	246			994	966
1486	Russell Rd at I-95 NB Off-Ramp		68		-					188			361	
1488	Russell Rd at I-95 NB On-Ramp								359	359			1,177	1,167

3-4 PM

NB GP Lanes

Exit 130 Plank/William Road

Exit 136 Centreport Parkway

Speed	68	69	69	69	69	69	69	68	68	68	63	66	69	69	69	69	69	69	69	69	67	69	70	69	69	69	66	68	69	68	68	69	69	69
Density	21	20	20	20	20	20	20	20	20	20	16	18	13	15	16	16	16	16	16	15	12	11	11	9	12	16	15	19	19	19	19	14	17	17
Volume	4173	4170	4168	4165	4163	4159	4158	4154	4153	4152	4143	3589	3589	3184	3248	3257	3258	3254	3252	3132	3203	2346	2370	3272	3246	3276	3931	3939	3940	3932	3924	3913	3425	3428
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	4	3	3	5	4	3	4	3	3	3	3	4	3	3
Length	18716	18716	18716	18716	18716	18716	18716	18716	18716	18716	640	1177	790	926	10707	10707	10707	10707	10707	10707	1234	1164	1770	1754	1206	1273	1601	7313	7313	7313	7313	792	3610	3610

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 143 Garrisonville Road

68	68	69	69	69	69	69	68	68	69	69	69	69	68	69	69	68	68	68	69	70	69	69	65
14	19	18	18	18	18	18	18	18	16	16	16	14	19	19	19	19	19	19	19	14	17	16	16
3783	3784	3783	3778	3772	3773	3779	3778	3775	3397	3369	3399	3939	3946	3942	3930	3924	3925	3926	3916	3880	3499	3393	4059
4	3	3	3	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	4	3	3	4
579	15331	15331	15331	15331	15331	15331	15331	15331	519	905	1998	1471	9546	9546	9546	9546	9546	415	582	825	2162	2162	855

Exit 148 Russell Road

67	69	68	69	69	69	70	69	68	68	67	67	67	65	66	68	67	66	68	67	63	63	67	68	68	67	68
18	14	19	19	19	19	14	19	19	19	20	19	20	20	20	19	19	15	18	18	17	23	21	21	21	21	21
3698	3947	3938	3944	3948	3949	3936	3951	3947	3943	3942	3933	3938	3941	3941	3936	3918	3899	3652	3652	4280	4281	4281	4282	4282	4268	4284
3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
759	1503	4675	4675	4675	1193	295	2416	2416	2563	2563	1445	2731	2731	2881	2881	942	519	2455	2455	1083	394	3484	3484	789	685	1711

4-5 PM

NB GP Lanes

Exit 130 Plank/William Road

Exit 136 Centreport Parkway

Speed	67	69	69	69	69	69	68	68	68	68	62	65	69	68	69	69	69	69	69	69	65	68	69	69	69	68	66	67	68	68	68	69	69	69
Density	22	22	22	22	22	22	22	22	22	22	18	20	14	17	17	17	17	17	17	16	13	12	12	10	13	17	16	21	21	21	21	15	18	18
Volume	4449	4447	4445	4445	4444	4445	4445	4445	4442	4440	4430	3848	3845	3410	3481	3493	3492	3490	3489	3357	3437	2516	2540	3496	3476	3525	4221	4220	4214	4209	4211	4213	3701	3702
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	4	3	3	5	4	3	4	3	3	3	3	4	3	3
Length	18716	18716	18716	18716	18716	18716	18716	18716	18716	18716	640	1177	790	926	10707	10707	10707	10707	10707	10707	1234	1164	1770	1754	1206	1273	1601	7313	7313	7313	7313	792	3610	3610

Speed Color Scale (mph)

Exit 140 Courthouse Road

Exit 143 Garrisonville Road

68	68	68	68	68	68	68	68	68	68	68	69	69	67	68	68	68	68	68	68	60	67	68	64
15	20	20	20	20	20	20	20	20	18	18	18	15	21	21	21	21	21	21	21	19	19	18	17
4077	4076	4074	4074	4082	4084	4077	4068	4062	3668	3639	3672	4225	4219	4213	4218	4226	4226	4224	4210	4168	3753	3638	4313
4	3	3	3	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	4	3	3	4
579	15331	15331	15331	15331	15331	15331	15331	15331	519	905	1998	1471	9546	9546	9546	9546	9546	415	582	825	2162	2162	855

Exit 148 Russell Road

66	68	68	69	69	69	69	68	68	68	67	67	67	65	66	68	67	66	68	67	62	62	67	68	68	67	68
20	15	20	20	20	20	15	20	20	21	21	21	21	21	21	20	21	16	19	19	18	24	23	22	22	22	22
3918	4166	4163	4170	4166	4164	4144	4162	4163	4163	4163	4155	4158	4155	4155	4154	4141	4123	3833	3833	4520	4519	4515	4513	4505	4491	4505
3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
759	1503	4675	4675	4675	1193	295	2416	2416	2563	2563	1445	2731	2731	2881	2881	942	519	2455	2455	1083	394	3484	3484	789	685	1711

6-7 PM

NB GP Lanes

Exit 130 Plank/William Road

Exit 136 Centreport Parkway

Speed	67	69	69	69	69	68	68	68	68	68	63	65	69	68	69	69	69	69	69	69	65	68	69	69	69	68	66	68	68	68	68	69	69	69
Density	22	21	21	21	21	21	21	21	21	22	17	19	14	16	17	17	17	17	17	16	13	12	12	10	12	17	16	20	20	20	20	15	18	18
Volume	4389	4393	4389	4384	4382	4379	4380	4378	4377	4372	4365	3803	3803	3377	3444	3456	3458	3462	3461	3329	3407	2483	2509	3473	3452	3490	4155	4149	4154	4159	4160	4155	3624	3623
Lanes	3	3	3	3	3	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	4	3	3	5	4	3	4	3	3	3	3	4	3	3
Length	18716	18716	18716	18716	18716	18716	18716	18716	18716	18716	640	1177	790	926	10707	10707	10707	10707	10707	10707	1234	1164	1770	1754	1206	1273	1601	7313	7313	7313	7313	792	3610	3610

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 143 Garrisonville Road

68	68	68	69	69	68	68	68	68	69	68	69	69	68	68	68	68	68	68	68	69	68	68	64
15	20	19	19	19	19	19	20	20	18	17	17	15	20	20	20	20	20	20	20	15	18	17	17
3991	3997	3999	3993	3987	3986	3993	3996	3999	3598	3565	3589	4131	4139	4136	4130	4127	4128	4127	4117	4081	3681	3572	4245
4	3	3	3	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	4	3	3	4
579	15331	15331	15331	15331	15331	15331	15331	15331	519	905	1998	1471	9546	9546	9546	9546	9546	415	582	825	2162	2162	855

Exit 148 Russell Road

67	68	68	69	69	69	69	68	68	68	67	67	67	65	66	68	67	66	68	67	62	62	66	68	68	67	68
19	15	20	20	20	20	15	20	20	20	20	20	20	21	21	20	20	15	19	19	18	24	22	22	22	22	22
3859	4104	4095	4104	4103	4106	4091	4107	4104	4101	4099	4091	4098	4098	4099	4099	4081	4063	3789	3786	4477	4480	4478	4476	4472	4457	4473
3	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3
759	1503	4675	4675	4675	1193	295	2416	2416	2563	2563	1445	2731	2731	2881	2881	942	519	2455	2455	1083	394	3484	3484	789	685	1711

3-4 PM

SB GP Lanes

Exit 148 Russell Road

Exit 143 Garrisonville Road

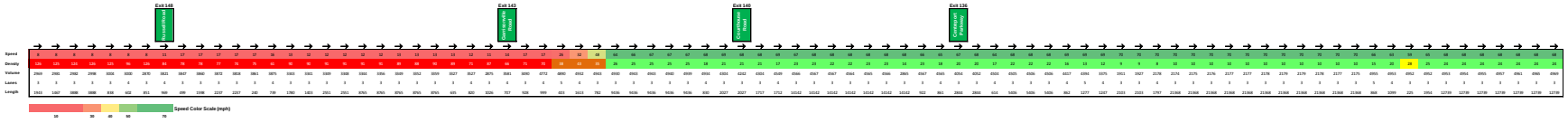
Speed	9	9	9	9	8	8	8	12	17	17	17	17	17	16	12	12	12	12	12	12	12	12	12	12	12	12	11	14
Density	121	120	119	122	122	93	122	80	76	76	76	75	75	61	90	90	91	92	91	91	89	88	90	89	70	86	66	
Volume	3208	3176	3146	3107	3087	3075	2937	3890	3890	3875	3847	3764	3804	3810	3280	3295	3287	3271	3277	3263	3286	3286	3281	3258	3497	2845	3565	
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	4	
Length	1943	1467	3888	3888	838	602	851	969	499	1598	2237	2237	240	739	1780	1403	2551	2551	8765	8765	8765	8765	8765	635	820	1026	707	

Speed Color Scale (mph): 10, 30, 40, 50, 70

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

16	17	25	32	47	64	66	67	67	67	68	68	68	68	69	67	68	68	68	68	68	68	66	65	67	
71	70	38	44	35	26	25	24	24	25	18	21	20	21	16	22	22	22	22	22	22	14	23	17	20	
3457	4740	4866	4905	4913	4898	4912	4914	4918	4920	4909	4260	4198	4260	4484	4501	4500	4499	4500	4502	4502	2824	4501	4500	3986	
3	4	5	4	3	3	3	3	3	3	4	3	3	3	4	3	3	3	3	3	3	3	3	4	3	
928	999	403	1613	782	9436	9436	9436	9436	9436	830	2027	2027	1717	1712	14142	14142	14142	14142	14142	14142	14142	922	861	2844	



68	65	68	68	68	69	69	69	70	70	70	70	70	70	70	70	70	70	70	70	70	70	67	64	60	66	68	68	68	68	68	68	68
20	17	22	22	22	16	12	12	9	9	8	10	10	10	10	10	10	10	10	10	10	15	19	27	25	24	24	24	24	24	24	24	24
3988	4416	4419	4419	4417	4326	4300	3290	1894	1909	2192	2191	2192	2191	2191	2192	2192	2191	2192	2194	2193	2195	4858	4856	4859	4858	4858	4863	4865	4866	4861	4852	4847
3	4	3	3	3	4	5	4	3	3	4	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3	3
2844	614	5406	5406	5406	862	1277	1247	2103	2103	1797	21368	21368	21368	21368	21368	21368	21368	21368	21368	21368	21368	868	1099	225	1954	12739	12739	12739	12739	12739	12739	12739

4-5 PM

SB GP Lanes

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	8	8	8	8	8	8	8	11	17	17	17	17	17	16	13	12	12	12	12	12	13	13	13	13	12	11	14
Density	126	125	124	126	125	96	126	84	78	78	77	74	75	61	90	90	91	91	91	91	89	88	90	89	71	87	66
Volume	2969	2981	2982	2998	3004	3000	2870	3821	3847	3860	3872	3818	3861	3875	3343	3341	3349	3348	3344	3356	3349	3352	3359	3327	3527	2875	3581
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1943	1467	3888	3888	838	602	851	969	499	1598	2237	2237	240	739	1780	1403	2551	2551	8765	8765	8765	8765	8765	635	820	1026	707

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

17	17	26	32	48	64	66	67	67	67	68	69	68	68	69	67	68	68	68	68	68	68	66	65	67
71	70	38	43	35	26	25	25	25	25	18	21	21	21	17	23	23	22	22	23	23	14	23	18	20
3490	4772	4890	4932	4943	4930	4943	4943	4940	4939	4934	4304	4242	4304	4549	4566	4567	4567	4564	4565	4566	2865	4567	4565	4054
3	4	5	4	3	3	3	3	3	3	4	3	3	3	4	3	3	3	3	3	3	3	3	4	3
928	999	403	1613	782	9436	9436	9436	9436	9436	830	2027	2027	1717	1712	14142	14142	14142	14142	14142	14142	14142	922	861	2844

68	64	68	68	68	69	69	69	70	70	70	70	70	70	70	70	70	70	70	70	70	70	66	63	59	65	68	68	68	68	68	68	68
20	17	22	22	22	16	13	12	9	9	8	10	10	10	10	10	10	10	10	10	10	10	15	20	28	25	24	24	24	24	24	24	24
4052	4504	4505	4506	4506	4417	4394	3375	1911	1927	2178	2174	2175	2176	2177	2177	2178	2179	2179	2178	2177	2175	4955	4953	4952	4952	4953	4954	4955	4957	4961	4965	4969
3	4	3	3	3	4	5	4	3	3	4	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3	3
2844	614	5406	5406	5406	862	1277	1247	2103	2103	1797	21368	21368	21368	21368	21368	21368	21368	21368	21368	21368	21368	868	1099	225	1954	12739	12739	12739	12739	12739	12739	12739

6-7 PM

SB GP Lanes

Exit 148 Russell Road

Exit 143 Garrisonville Road

Speed	8	8	8	8	8	8	7	11	16	16	16	16	16	15	12	12	12	12	12	12	12	13	12	12	12	11	14
Density	125	124	123	125	124	95	125	84	79	79	78	75	76	62	89	89	89	90	90	90	88	88	89	88	70	86	65
Volume	2893	2885	2887	2890	2890	2878	2750	3700	3719	3738	3745	3692	3729	3734	3285	3279	3298	3305	3295	3285	3295	3298	3282	3258	3457	2837	3569
Lanes	3	3	3	3	3	4	3	4	3	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	4
Length	1943	1467	3888	3888	838	602	851	969	499	1598	2237	2237	240	739	1780	1403	2551	2551	8765	8765	8765	8765	8765	635	820	1026	707

Speed Color Scale (mph)

10 30 40 50 70

Exit 140 Courthouse Road

Exit 136 Centreport Parkway

17	17	26	32	47	63	66	67	67	67	68	69	68	68	69	67	68	68	68	68	68	68	67	65	67
70	70	38	43	35	26	25	24	24	25	18	21	20	21	16	23	22	22	22	22	22	14	23	17	20
3477	4771	4874	4913	4920	4907	4920	4921	4923	4922	4912	4268	4204	4267	4518	4535	4538	4538	4538	4537	4535	2843	4533	4533	4045
3	4	5	4	3	3	3	3	3	3	4	3	3	3	4	3	3	3	3	3	3	3	3	4	3
928	999	403	1613	782	9436	9436	9436	9436	9436	830	2027	2027	1717	1712	14142	14142	14142	14142	14142	14142	14142	922	861	2844

68	65	68	68	68	69	69	69	70	70	70	70	70	70	70	70	70	70	70	70	70	70	66	62	59	65	68	68	68	68	68	68	68
20	17	22	22	22	16	13	12	9	9	8	10	10	10	10	10	10	10	10	10	10	10	15	20	28	26	24	24	24	24	24	24	24
4047	4508	4510	4514	4511	4416	4391	3376	1926	1941	2196	2192	2196	2194	2198	2198	2196	2195	2195	2196	2197	2196	4982	4988	4992	4993	4993	4989	4981	4983	4990	4988	4988
3	4	3	3	3	4	5	4	3	3	4	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	3	3
2844	614	5406	5406	5406	862	1277	1247	2103	2103	1797	21368	21368	21368	21368	21368	21368	21368	21368	21368	21368	21368	868	1099	225	1954	12739	12739	12739	12739	12739	12739	12739

3-4 PM

SB HOT Lanes

Exit 148

Russell Road

| | | |

4-5 PM

SB HOT Lanes

Exit 148 Russell Road

| | | |

6-7 PM

SB HOT Lanes

Exit 148 Russell Road

| | | |

APPENDIX Q:
ENVIRONMENTAL DOCUMENT SUMMARY

APPENDIX R:

STAFFORD COUNTY RESOLUTION OF SUPPORT

APPENDIX S:
LIMITED ACCESS REVISIONS AT COURTHOUSE ROAD