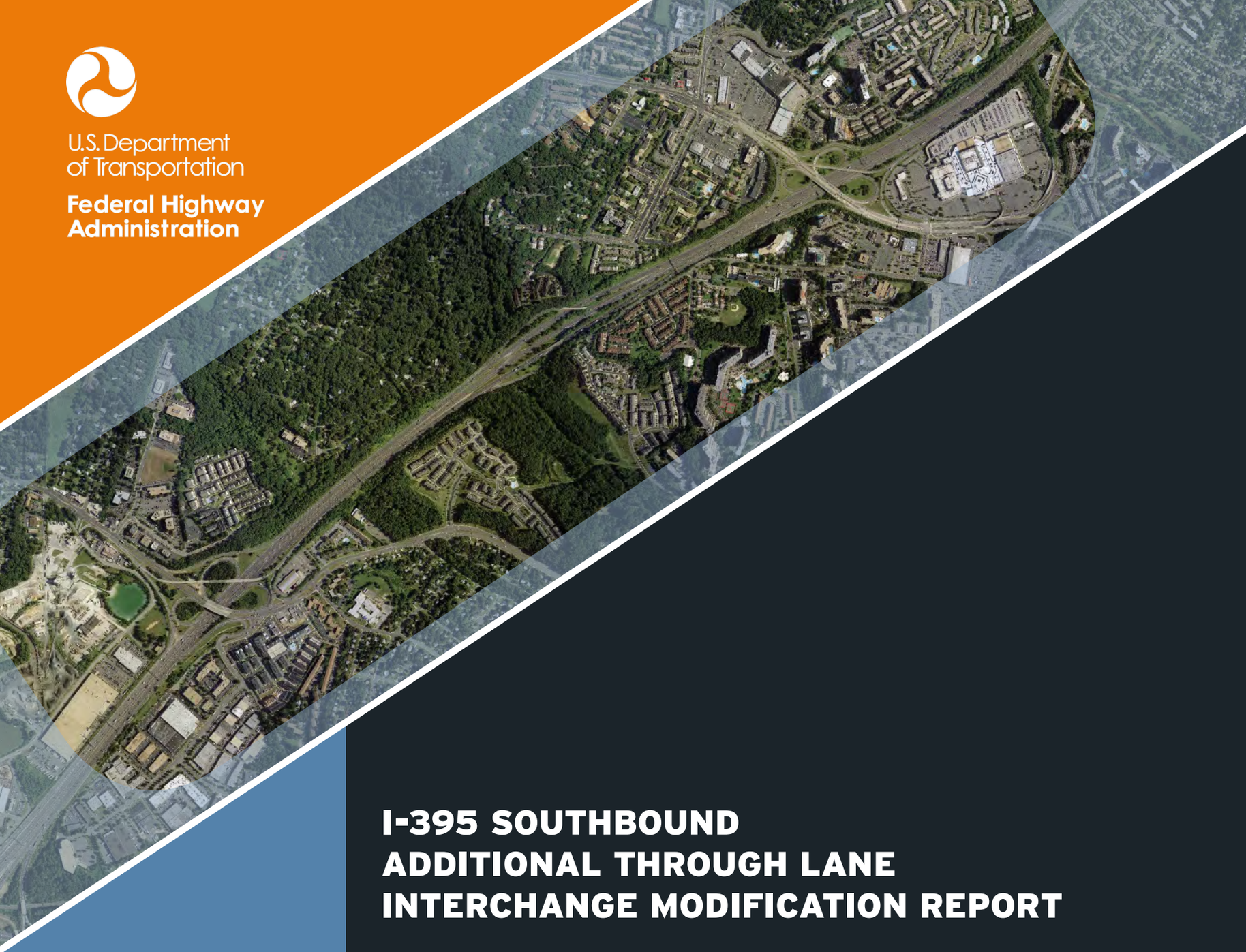
U.S. Department of Transportation

Federal Highway Administration



I-395 SOUTHBOUND ADDITIONAL THROUGH LANE INTERCHANGE MODIFICATION REPORT

APPENDICES

MAY 2017

VDOT

HNTB

Submitted to: U.S. Department of Transportation, Federal Highway Administration

Submitted by: Virginia Department of Transportation

Prepared by: HNTB Corporation

LIST OF APPENDICES

APPENDIX A

I-395 SOUTHBOUND BETWEEN DUKE STREET & EDSALL ROAD CONGESTION RELIEF FEASIBILITY STUDY: OPERATIONAL & GEOMETRICAL ANALYSIS TECHNICAL MEMORANDUM

APPENDIX B

INTERCHANGE MODIFICATION REPORT FRAMEWORK DOCUMENT

APPENDIX C

LETTERS OF SUPPORT FROM FAIRFAX COUNTY AND CITY OF ALEXANDRIA

APPENDIX D

TRAFFIC FORECASTING TECHNICAL MEMORANDUM AND CERTIFIED TRAFFIC VOLUMES

- VDOT APPROVAL LETTER
- TRAFFIC FORECASTING TECHNICAL MEMORANDUM
- PEAK HOUR TRAFFIC VOLUME DIAGRAMS
- AVERAGE DAILY TRAFFIC VOLUME DIAGRAMS

APPENDIX E

METHODOLOGY AND ASSUMPTIONS OF VISSIM ANALYSIS TECHNICAL MEMORANDUM

- FHWA APPROVAL LETTER
- METHODOLOGY AND ASSUMPTIONS OF VISSIM ANALYSIS TECHNICAL MEMORANDUM

APPENDIX F

INTERCHANGE IMPROVEMENTS ALTERNATIVES STUDY TECHNICAL MEMORANDUM AND CONCEPTUAL LAYOUTS

- VDOT APPROVAL MEETING MINUTES
- INTERCHANGE IMPROVEMENTS ALTERNATIVES STUDY TECHNICAL MEMORANDUM
- CONCEPTUAL LAYOUTS
- ALTERNATIVES CONSIDERED FOR ACCESS TO 395 SB EXPRESS LANES FROM EB ROUTE 236

APPENDIX G

CONCEPTUAL SIGNING PLAN FOR THE PREFERRED BUILD ALTERNATIVE

APPENDIX H

DETAILED TRAFFIC OPERATIONAL ANALYSIS RESULTS

APPENDIX A:
I-395 SOUTHBOUND BETWEEN DUKE STREET & EDSALL ROAD CONGESTION RELIEF FEASIBILITY STUDY:
OPERATIONAL & GEOMETRICAL ANALYSIS TECHNICAL MEMORANDUM

10306 Eaton Place, Willow Wood II, Suite 240, Fairfax, VA 22030 | P 703.246.0028 | F 703.246.0123 | www.rkk.com

July 17, 2012

Mr. Robert Jastrzebski
NOVA District Traffic Engineering
VDOT Northern Virginia District
4975 Alliance Drive
Fairfax, VA 22030

Dear Mr. Jastrzebski:

Please find attached the draft final technical memorandum for the I-395 Southbound Congestion Relief Feasibility Study. This report documents the operational analyses, conceptual geometric design, and conceptual cost estimates for improvements to the I-395 southbound general purpose lanes between Duke Street / Little River Turnpike and Edsall Road.

As discussed previously, because accurate survey was not available to confirm several of the existing geometric conditions, the report has not been signed and sealed at this time. RK&K is prepared to assist with updating the conceptual designs and cost estimates when updated survey information becomes available.

We look forward to opportunities to continue working with Northern Virginia District staff on this and other important transportation projects. If you have any comments or questions, please let me know.

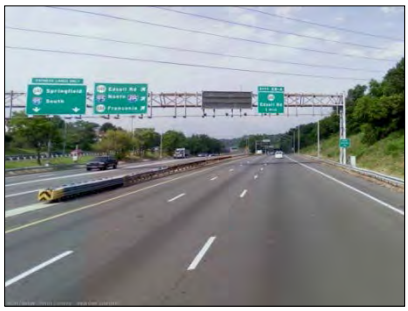
Sincerely,
Rummel, Klepper & Kahl, LLP

Thomas M. Heil
Director, Transportation

810-089
Enclosure

cc: project file

I-395 Southbound between Duke Street & Edsall Road: Congestion Relief Feasibility Study



Operational & Geometrical Analysis – Technical Memorandum

Task Order #92

July 17, 2012

Prepared by:

Rummel, Klepper & Kahl, LLP

Prepared for:

Virginia Department of Transportation

Rummel, Klepper & Kahl, LLP
Fairfax, Virginia
Traffic Engineer

Executive Summary

Rummel, Klepper & Kahl, LLP (RK&K) is assisting the Virginia Department of Transportation (VDOT) to evaluate the operational and geometric feasibility of various options to relieve recurring daily congestion within the southbound I-395 general purpose (GP) lanes between the Duke Street / Little River Turnpike (Route 236) and Edsall Road (Route 648) interchanges.

This feasibility study included a traffic operational analysis and the development preliminary design concepts and cost estimates for a number of potential improvements for the along I-395 Southbound and at the two interchanges along I-395 Southbound at Duke Street and Edsall Road. In coordination with Virginia Department of Transportation (VDOT), six (6) design options were identified for inclusion in the study:

1. I-395 SB Mainline – Provide New 4th Travel Lane and Full-Depth Shoulder
2. I-395 SB Mainline – Provide Full Depth Shoulder for Use as 4th Peak Period Travel Lane
3. Duke Street Interchange – NW Parclo
4. Duke Street Interchange – Diamond
5. Edsall Road Interchange – SW Parclo
6. Edsall Road Interchange – Diamond

The mainline options each would provide an additional general purpose lane along southbound I-395; either full-time or during the PM peak period only. The interchange options (Options 3 through 6) each involve the removal of one or both existing loop ramps along the I-395 Southbound GP lanes to eliminate existing weaving segments and reduce the potential impacts to bridges over I-395. The movements served by those loop ramps would be replaced by signalized left-turn movements along the cross-street.

Traffic Operational Analysis: I-395 Southbound is the peak direction of travel during the PM peak period. Hence, the operational analysis was focused on the PM peak hour conditions. The Highway Capacity Software (HCS 2010) Version 6.1 was used to perform operational analyses for existing, future No Build and Build conditions along the I-395 Southbound general purpose lanes. Synchro Version 8.0 was used to evaluate the operations of proposed signalized intersections along Duke Street and Edsall Road which are associated with Options 3 through 6. The results of the operational analysis indicate that most segments of I-395 southbound would operate at LOS D or better (assumed to be acceptable operations for the purposes of this study) in the PM peak hour with four (4) GP lanes. Additionally, lane configurations were identified which would provide acceptable operations for the proposed at-grade intersections along Duke Street and Edsall Road.

Conceptual Designs and Cost Estimates: Conceptual design options and cost estimates were prepared for each of the six (6) design options. These designs and cost estimates reflect the preferred lane configurations and other improvements identified during the traffic operational analysis. It is to be noted that a detailed survey of the Study Area is currently being conducted by VDOT. An updated survey is needed to verify the information used in the development of these design concepts. While developing the conceptual designs for the congestion relief along the study segment, a consistent set of design criteria was considered. **Table S-1** presents a summary of the design criteria used as part of this study. For each design option, potential deviations from these design criteria which would require a Design Exception or Design Waiver were identified.

Preliminary cost estimates were developed following a consistent procedure. These preliminary cost estimates include key unit cost items, allowances for critical elements (including Maintenance of Traffic), and contingencies. The cost estimates are intended to serve as overall project costs and thus include preliminary engineering, construction, and construction engineering and inspection.

Recommendations: Based on the findings of the operational and geometric evaluations, the Options in Table S-2 are recommended for more detailed evaluation. Additional options would also provide improved operations compared to the No Build conditions and were found to be geometrically feasible, but the three options in **Table S-2** represent the best combination of operations, safety, and value.

Table S-1: Summary of Design Criteria Used for This Study

Design Criteria	I-395 Mainline	Ramps
Functional Classification	Interstate –	Interchange Ramp
Geometric Design Standard	GS-5	GS-R
Terrain Type	Rolling	Rolling
Design Speed	60 mph	30 mph
Existing Posted / Advisory Speeds [As observed from Google Earth Street View Images]	55 mph	I-395 Southbound to Duke St WB: 35mph I-395 Southbound to Duke St EB: 20mph I-395 Southbound to Edsall Rd WB: 35mph I-395 Southbound to Edsall Rd EB: 25mph Edsall Rd WB to I-395 Southbound: 35mph
Min. Radius	1204 ft	251 ft
Min. Stopping Sight Distance	570 ft	200 ft
Min. Width of Lane (Min. Ramp Pvmt. Width)	12 ft	 (16 ft)
Min. Width of Graded Shoulders	14 ft	11 ft
Paved Shoulder Width RT	12 ft	8 ft
Min. Width of Ditch Front Slope	12 ft	10 ft
Slope	CS-4 or CS-4B	N/A

Reference: VDOT Road Design Manual, Appendix A

Table S-2: Recommended Options

Option	AM	PM	Cost
Option 1: I-395 SB Mainline – 4 Travel Lanes	LOS D or better	LOS D or better	$13.6M
Option 3b: Duke Street – Partial Cloverleaf NW with Double-Left Turn Lane from I-395 SB Off-Ramp	LOS C	LOS C	$19.8M
Option 5a: Edsall Road Partial Cloverleaf SW with Single Left-Turn Lane from WB Edsall Road	LOS C	LOS B	$15.8M
		Total	**$49.2M**

1.0 Background

Purpose of Study: As part of its open-end contract with the Northern Virginia Traffic Engineering Division, Rummel, Klepper & Kahl, LLP (RK&K) is assisting the Virginia Department of Transportation (VDOT) to evaluate the operational and geometric feasibility of various options to relieve recurring daily congestion within the southbound I-395 general purpose (GP) lanes between the Duke Street / Little River Turnpike (Route 236) and Edsall Road (Route 648) interchanges. The 2.5-mile study segment is primarily located in Fairfax County, with the northern terminus of the study area at the interchange of I-395 with Duke Street / Little River Turnpike (Route 236) partially located in the City of Alexandria. **Figure 1** presents the location map.

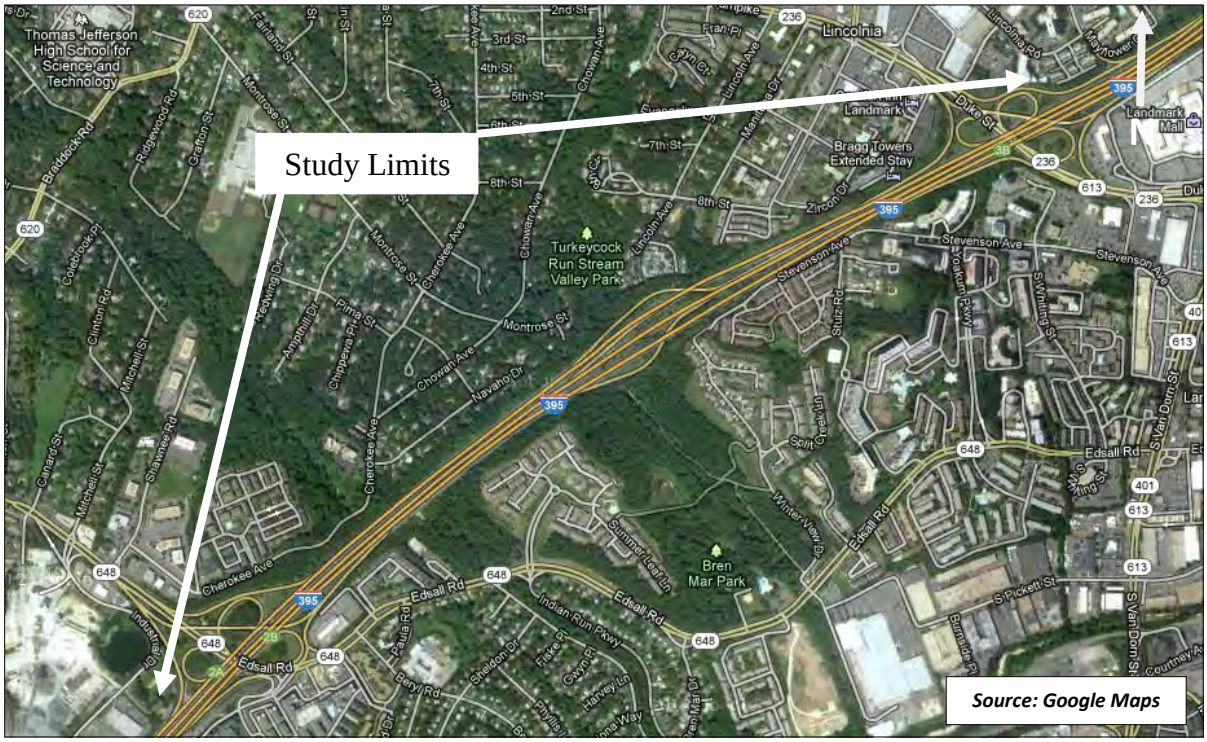


Figure 1: Location Map

The methodology of this feasibility study included existing and future traffic operational analysis, crash analysis and field observations along I-395 Southbound. The results of these analyses were used to develop conceptual design options for the I-395 Southbound general purpose lanes and at the two interchanges within the study area.

a. Traffic Volumes: The existing and future year traffic volumes utilized to conduct the operational analysis for this study were obtained from several sources:

- Existing (2009) and Design Year (2035) traffic volumes for I-395 Southbound and interchange ramp volumes were obtained from the I-95 HOV / HOT Lanes IJR prepared by VA Mega Projects staff.
- Existing (2009) and Design Year (2035) through traffic volumes along Duke Street were obtained from the I-395 / Seminary Road HOV Ramp Environmental Assessment (EA) traffic technical report.

- Existing (2010) traffic volumes along Edsall Road were obtained from VDOT's 2010 Traffic Summary publication for Fairfax County. Design Year (2035) volumes along Edsall Road were developed by applying a growth factor (1% per year) to the existing traffic volumes.

The volumes used in the analyses are summarized in **Figures 2, 3, and 4.**

b. Existing Operations:

Field Observations of Existing Traffic Operations: A windshield survey was performed along I-395 southbound during the PM peak period on a typical weekday in order to observe the existing traffic patterns and identify potential sources of congestion within the I-395 Southbound general purpose (GP) lanes. I-395 Southbound is the peak direction of travel during the PM peak period.

Overall, the traffic was observed to be moving substantially slower than the posted speed limit. The traffic in the right lanes was observed slowing down approaching the Duke Street interchange where there is a lane drop from four (4) lanes to three (3) GP lanes. This resulted in congested operations (reduced travel speeds, increased density) along I-395 north of the Duke Street interchange. These congested operations extended back at a minimum to the upstream Seminary Road interchange (field observations were not conducted north of this location for this study).

Additionally, friction between through traffic and exiting / entering traffic was observed during at Edsall Road interchange, particularly within the weaving segment between the on-ramp from westbound Edsall Road and the off-ramp to eastbound Edsall Road.

In addition to the field observations, INRIX travel time data for the study segment of I-395 SB between Route 236 (Duke St/Little River Turnpike Rd) and Route 648 (Edsall Rd) was obtained from the Regional Integrated Transportation Information System (RITIS) maintained by the University of Maryland CATT Lab. Hourly travel time data from October 11, 2011 through October 13, 2011 for the INRIX travel time segments covering the study area was reviewed for the purpose of this study.

Figure 5 and **Figure 6** present the hourly average travel time and hourly average speed, respectively, spread across three days for each of the three TMC locations in the study area. Analysis results indicate that the average weekday travel time is approximately 2.6 minutes for the study corridor, with a corresponding average speed of approximately 58 miles per hour. However, the average travel time during the PM peak period between 3:00 PM to 6:00 PM was observed as 3.2 minutes with a corresponding average speed of approximately 47 miles per hour. Additionally, the maximum travel time for the study corridor in the PM peak period was observed as 3.9 minutes between 5:00 PM and 6:00 PM, with an average speed of 39 miles per hour. **Table 1** provides a summary of the average speed and average travel time for the three TMC locations covering the study area.

Further, it may be noted that out of the data reviewed from the three TMCs covering the study area, the readings corresponding to TMC -110N04122 located near the Duke Street interchange indicate a thirty-five (35%) percent reduction in the speed during the PM peak periods. This combined with the field observations indicate that the effect of the bottleneck extends upstream i.e., further north of Duke Street interchange beyond the study area, increasing the average travel time of the commuters in the corridor during the PM peak period.

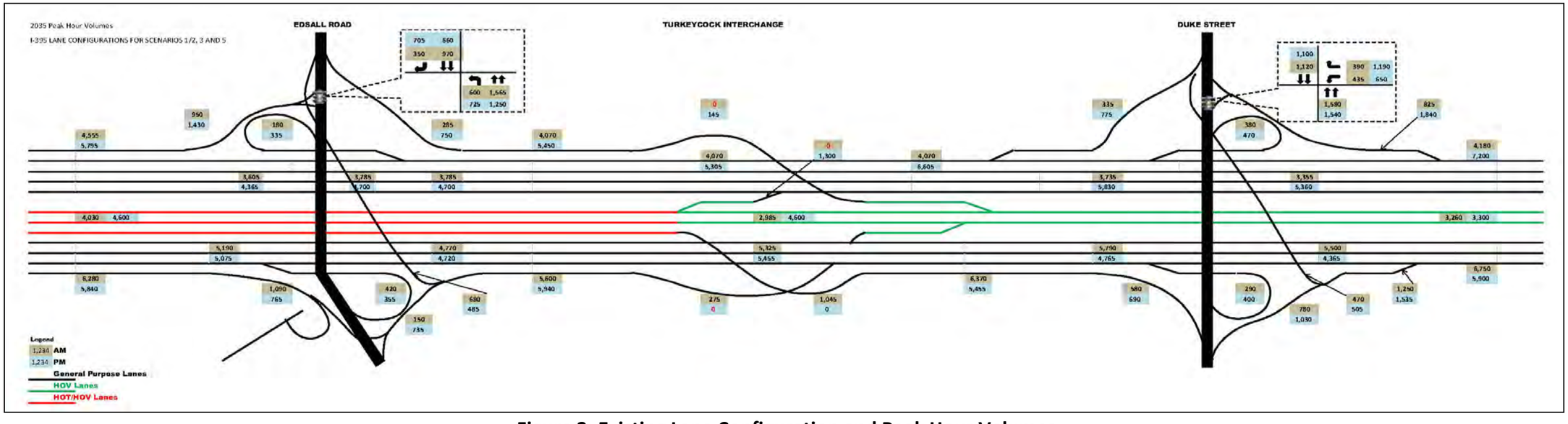


Figure 2: Existing Lane Configuration and Peak Hour Volumes

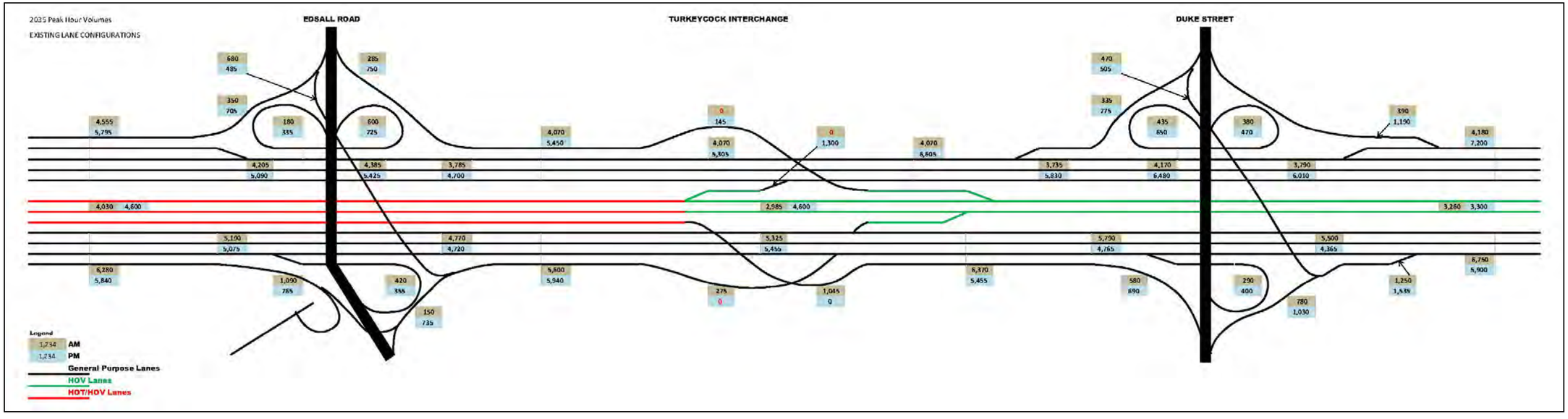


Figure 3: Design Year 2035 Peak Hour Volumes – Parclo Interchanges

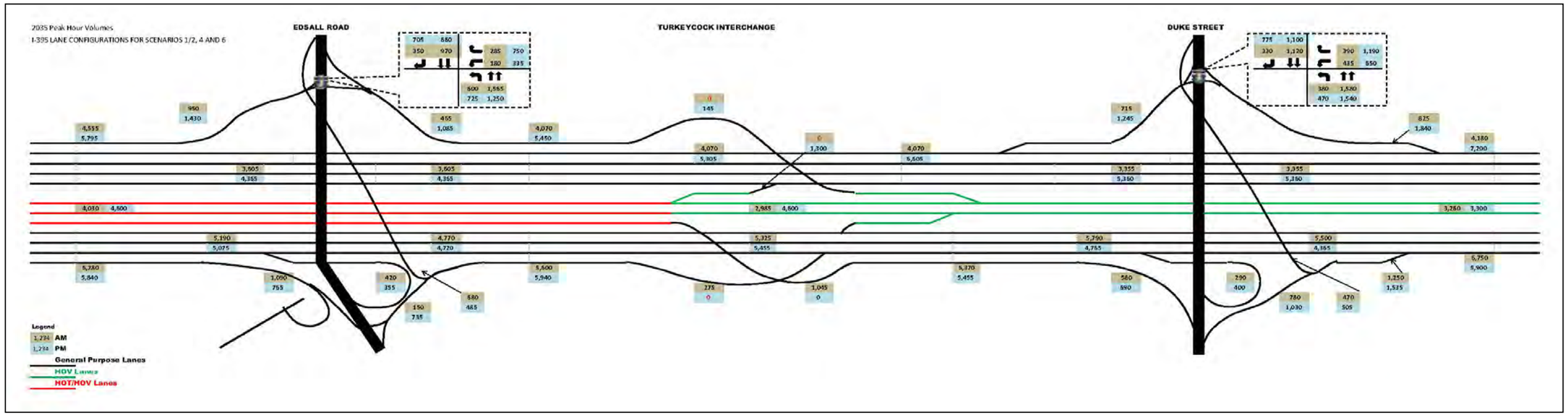


Figure 4: Design Year 2035 Peak Hour Volumes – Diamond Interchanges

Table 1 : Comparison Of Average Travel Time And Speed Per Segments In The Study Area									
TMC Location & Details	Day/Time*	10/11/2011		10/12/2011		10/13/2011		3 Day Average	
		Speed (mph)	Travel Time (mins)	Speed (mph)	Travel Time (mins)	Speed (mph)	Travel Time (mins)	Speed (mph)	Travel Time (mins)
110-04121 - 0.92 miles	Daily Average	58.4	0.9	59.8	0.9	59.5	0.9	59.2	0.9
Near Turkeycock Interchange	PM Peak Average	47.7	0.9	53.3	1.1	53.7	1.0	51.6	1.0
110N04121 - 0.64 miles	Daily Average	58.4	0.6	58.4	0.7	58.5	0.7	58.5	0.7
Near Edsall Rd Interchange	PM Peak Average	50.3	0.7	51.0	0.8	51.7	0.8	51.0	0.8
110N04122 - 0.85 miles	Daily Average	57.1	0.9	57.3	1.0	56.9	1.0	57.1	1.0
Near Duke St Interchange	PM Peak Average	37.3	1.4	38.0	1.7	36.7	1.4	37.3	1.5
Total Study Area - 2.41 miles (Approximately 2500 ft North of Duke St Interchange to 1000 ft South of Edsall Rd Interchange)	Daily Average	58.0	2.5	58.5	2.6	58.3	2.6	**58.3**	**2.6**
	PM Peak Average	45.1	3.0	47.4	3.6	47.3	3.1	**46.6**	**3.2**

** PM Peak period for the purpose of reviewing the travel time(s)/speed(s) in the study area was considered to be between 3:00 PM and 6:00 PM*

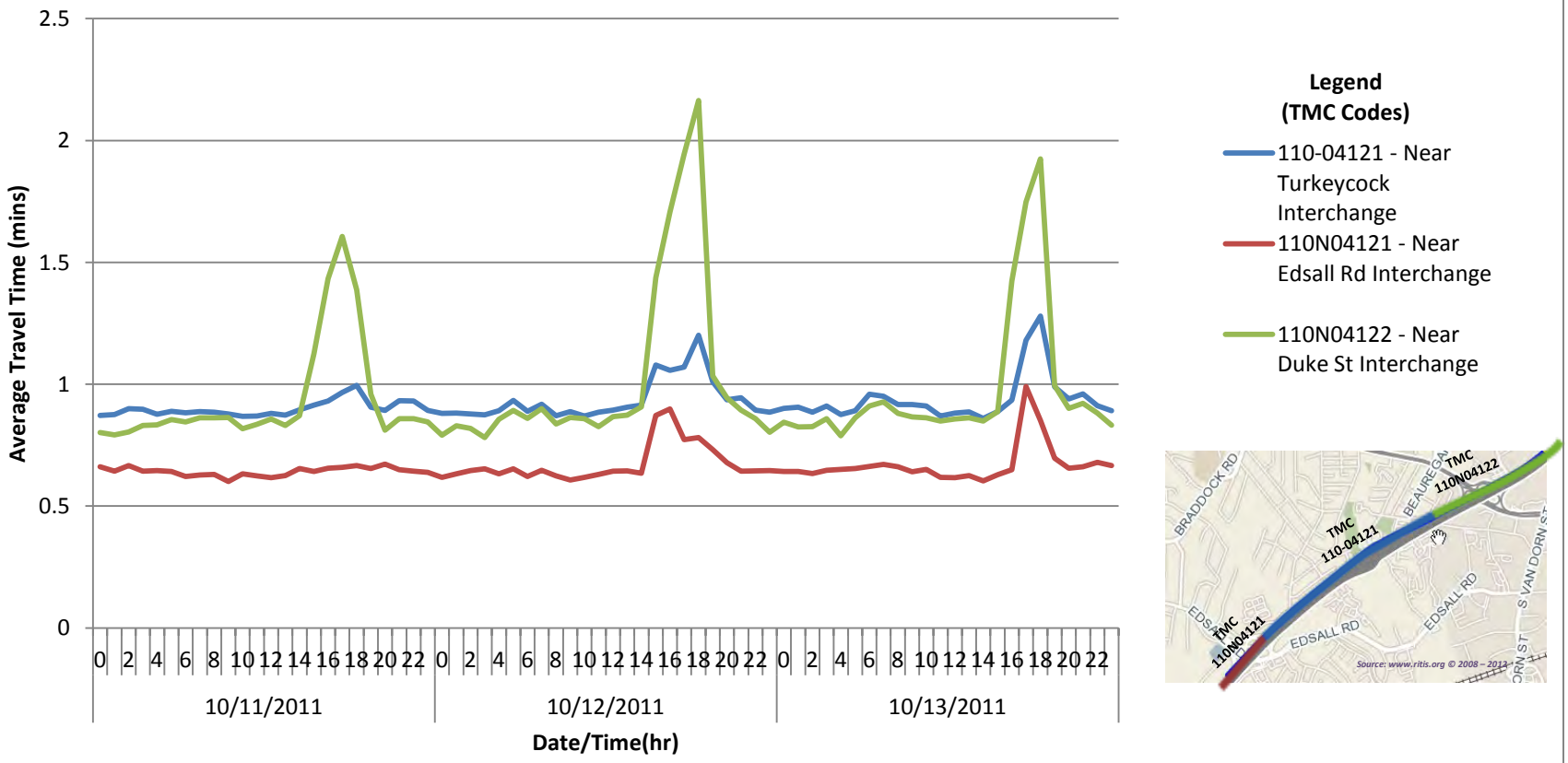


Figure 5: Average Travel Time for I-395 S between Duke St & Edsall Rd

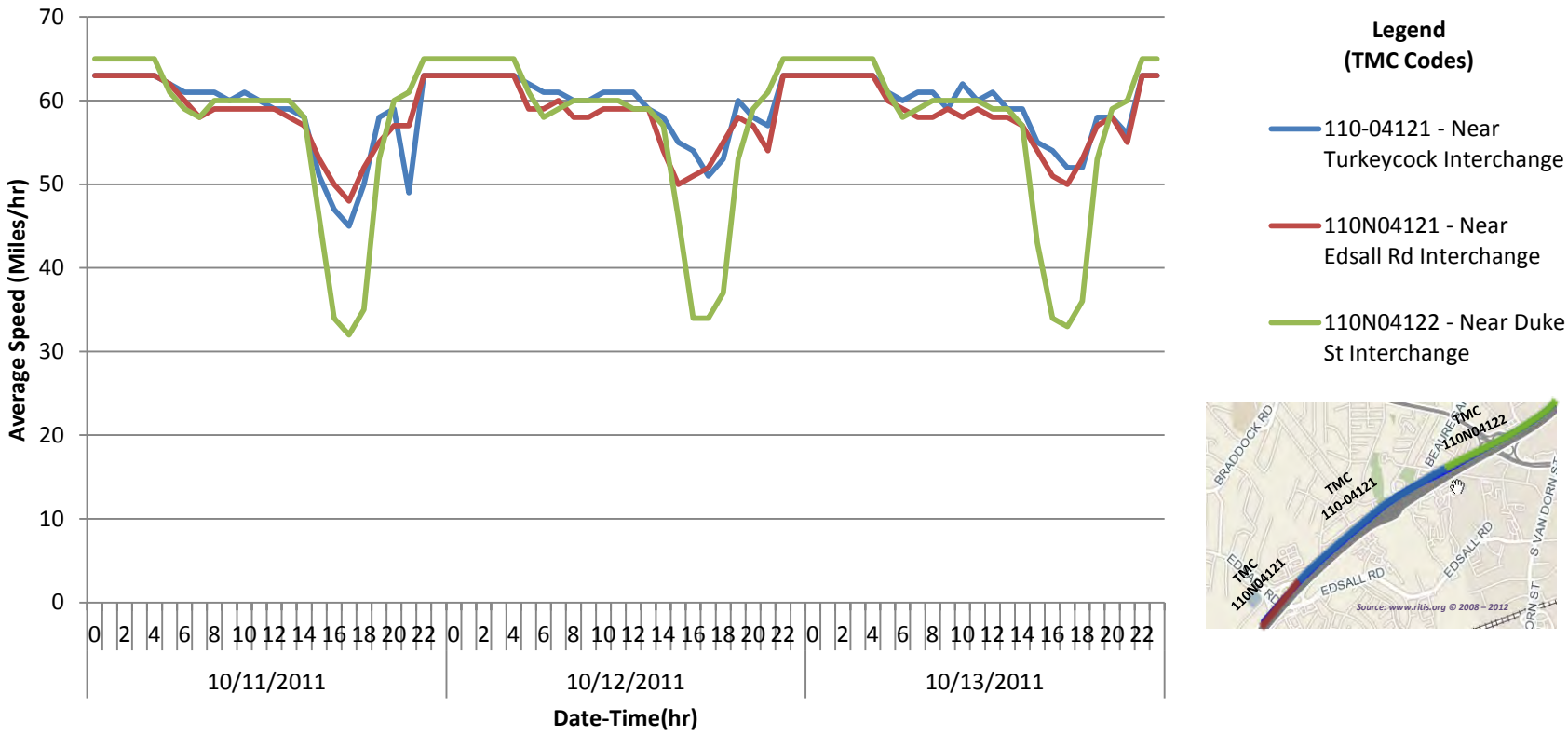


Figure 6: Average Speeds for I-395 S between Duke St & Edsall Rd

Existing Traffic Operations Analysis: The most recent version (6.1) of the *Highway Capacity Software* (*HCS*) was used to evaluate the mainline I-395 southbound operations based on the existing 2009 volumes obtained from the HOT Lanes IJR. I-395 southbound was divided into discrete analysis segments consisting of basic freeway segments, ramp junctions (merges and diverges), and weaving segments. These results are summarized in **Figure 7**. The results indicate that all the segments along study corridor operate at LOS D or better during AM peak hour. However, during the PM peak hour, multiple segments operate at LOS E and one weaving segment operates at LOS F. Based on the results, the problem areas during PM peak hour are listed below:

- At the interchange of Duke Street, the segments between the exit ramp to WB Duke Street and the on-ramp from EB Duke Street operate at LOS E. The majority of this segment consists of 3GP lanes currently and an additional GP lane could improve the operations.
- The weaving segment between the on-ramp from EB Duke Street to the left exit ramp to HOV/HOT lanes operates at LOS F.
- All segments south of the left exit on-ramp to HOV/HOT lanes within the study corridor operate at LOS E except for the basic freeway segment south of EB Edsall Road on-ramp which operates at LOS D. Within this segment, I-395 southbound widens to five (5) GP lanes approaching the interchange with I-95 / I-495.

Crash Summary: VDOT provided crash data reported during a 5-year year period from January, 2006 to December 2010 for this study section along I-395 Southbound. **Table 2** presents the crash summary of the intersection and **Figure 8** presents the crash diagram. The list of crashes is included in the Appendix.

Table 2: Reported Crash Summary (2006-2010)

Year	Light		Severity		Collision Type				Time/ Day			Total
	Day	Night	Injury	No Injuries	Rear End	Sideswipe	Fixed Object	Other	Weekday Peak*	Weekday Off-Peak	Weekend	
2006	28	29	19	38	34	13	5	12	12	35	10	57
2007	20	10	8	22	9	8	10	3	7	15	8	30
2008	17	13	9	21	12	3	9	6	3	20	7	30
2009	20	6	5	21	11	6	6	3	8	12	6	26
2010	23	9	9	23	17	2	5	8	12	10	10	32
Total	**108**	**67**	**50**	**125**	**83**	**24**	**43**	**25**	**42**	**92**	**41**	**175**

*Peak period defined as 6:00-9:00 and 15:30-18:00

Analysis of the crash data for the study section revealed the following trends during the 5-year study period from 2006-2010.

- One hundred and seventy five (175) crashes were reported along this section during the study period. There were no reported fatalities.

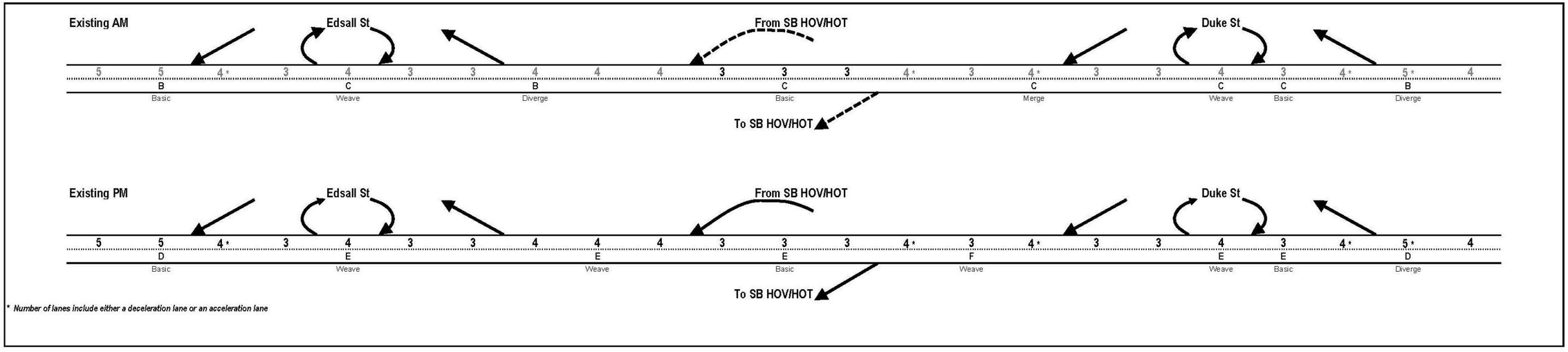
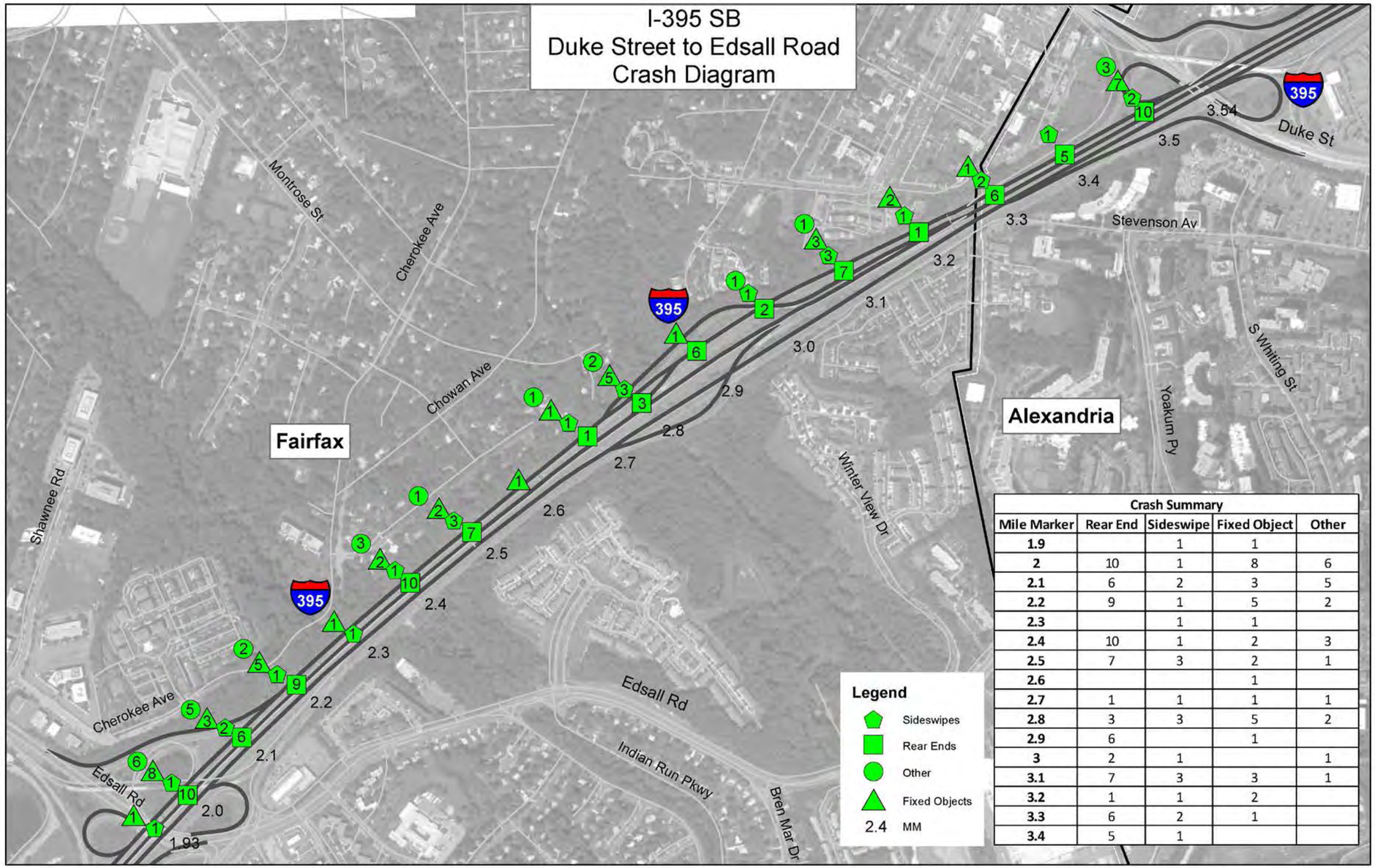


Figure 7: I-395 SB –Existing year Level of Service Information - AM and PM peak hours



Crash Summary				
Mile Marker	Rear End	Sideswipe	Fixed Object	Other
1.9		1	1	
2	10	1	8	6
2.1	6	2	3	5
2.2	9	1	5	2
2.3		1	1	
2.4	10	1	2	3
2.5	7	3	2	1
2.6			1	
2.7	1	1	1	1
2.8	3	3	5	2
2.9	6		1	
3	2	1		1
3.1	7	3	3	1
3.2	1	1	2	
3.3	6	2	1	
3.4	5	1		

Figure 8: Crash Diagram: I-395 SB Between Duke Street to Edsall Road

- One hundred and seventy five (175) crashes resulted in injuries to sixty-five (65) vehicle occupants.
- Thirty-eight percent (38%) of the crashes occurred at night and twenty-four percent (24%) occurred during the weekday peak period.
- Rear-end crashes accounted for forty-seven percent (47%) of all crashes. The second most common collision type was were fixed object crashes, accounting for twenty-five percent (25%). The remaining crashes were split equally between "other" crashes and sideswipes; each accounted for fourteen percent (14%).
- There were sixty (60) crashes, representing thirty-four percent (34%) of the total crashes in the corridor, which occurred in the vicinity of Edsall Road interchange:
    - Eighteen (18) of these crashes occurred within 550 ft north of the off-ramp to WB Edsall Road. Fifty-six percent (56%) of these crashes in the observed cluster are noted to be rear end crashes.
    - Another forty-two (42) crashes occurred between the off-ramp to WB Edsall Road and the EB off-ramp to Edsall Road. Thirty-six percent (36%) of these crashes were rear end crashes and twenty-nine percent (29%) were fixed object crashes.
- There were twenty-two (22) crashes reported within the immediate vicinity of Duke Street interchange:
    - Nine (9) of these crashes occurred between the on-ramp from WB Duke Street and the off-ramp to EB Duke Street; this weaving segment is approximately 500 feet in length.
    - Another thirteen (13) crashes occurred immediately south of the off-ramp to EB Duke Street; Sixty-two percent (62%) of these are rear-end crashes.
- Twenty-five (25) crashes were observed approximately within 200 to 700 feet north of the beginning of the exit only lane marking for the off-ramp to WB Edsall Road; Sixty-eight percent (68%) of these are observed to be rear end crashes.
- Seventeen (17) crashes were observed within 500 feet of the HOV off-ramp at the Turkeycock Interchange; Thirty-five percent (35%) of these are fixed object crashes.

2.0 Design Criteria

While developing the options to be considered and the conceptual designs for those options, a consistent set of criteria were applied.

Traffic Operations: The most recent version (6.1) of the *Highway Capacity Software* (*HCS*) was used to evaluate the mainline I-395 southbound operations. In addition, the most recent version (8) of *Synchro* was used to evaluate the operations of the proposed signalized intersections for the following configurations. The traffic operations were a key factor for this feasibility study in terms of identifying feasible options and ultimately determining which options should be recommended to be carried forward. The target level of service for each preferred option was LOS D or better for all segments/intersections studied. The details of the operational analysis for each option considered are discussed in Sections 3 through 5 of this report.

Geometric Design Criteria: **Table 3** presents the summary of the geometric design criteria used for this study. Generally, the concepts were developed to minimize the number of potential Design Exceptions and/or Design Waivers, but at certain locations, exceptions or waivers may be required to avoid right-of-way impacts and substantially reduce potential project costs. The potential DE/DWs have been identified in **Section 3.0** through **Section 5.0** in the detailed discussion of each design option. For the bridges within the study area, a preliminary structural review was undertaken to determine feasibility of

modifying existing bridge structures. It is important to note that a detailed survey of the study limits is currently being conducted by VDOT. An updated survey is needed to verify the information/ assumptions used in development of these design concepts. These conceptual designs should be reviewed and modified as necessary based on that updated information when it becomes available.

Cost Estimate Methodology: Cost estimates were developed for each of six design options evaluated for this study. The following section describes the methodology used to develop these cost estimates.

The unit costs used to develop the cost estimate were obtained from the VDOT District Averages dated October 2009 through December 2011. For each item, the average price in the NOVA district was used. Drainage and erosion control were assumed to be 5% each of the grading, pavement, and incidental items. Due to the likely long term and complex nature of construction, a lump sum MOT was estimated to be 100% of the grading, pavement and incidental items. A planning level cost of $350/sf was applied to bridge spans that would need to be rebuilt due to conflict with proposed interchange modifications. Each cost estimate includes a general contingency of 25%, a CEI of 19% and Engineering and Surveying cost of 15%.

Pavement Sections: For areas of full depth reconstruction, a pavement section was used consisting of 2" Asphalt Concrete Surface, Type SM-12.5E @ 236 lbs/sy; 2" Asphalt Concrete Intermediate, Type IM-19.0A @ 244 lbs/sy; 11" Asphalt Concrete Base, Type 25.0A (assumed 1210 lbs/sy); and 8" Aggregate Base Material, Type I, Size 21B (assumed 145 lbs/cf). Due to a lane shift that would likely be needed during construction, it was assumed that the mainline lanes throughout the limits of the project would need to be resurfaced following the completion of the interchange modifications. This resurfacing consists of milling and repaving with 2"of Asphalt Concrete Surface, Type SM-12.5E @ 236 lbs/sy.

Table 3: Design Criteria

Design Criteria	**I-395 Mainline**	**Ramps**
Functional Classification	Interstate – Divided	Interchange Ramp
Geometric Design Standard	GS-5	GS-R
Terrain Type	Rolling	Rolling
Design Speed	60 mph	30 mph
Existing Posted / Advisory Speeds [As observed from Google Earth Street View Images]	55 mph	I-395 Southbound to Duke St WB: 35 mph I-395 Southbound to Duke St EB: 20 mph I-395 Southbound to Edsall Rd WB: 35 mph I-395 Southbound to Edsall Rd EB: 25 mph Edsall Rd WB to I-395 Southbound: 35 mph
Min. Radius	1204 ft	251 ft
Min. Stopping Sight Distance	570 ft	200 ft
Min. Width of Lane (Min. Ramp Pvmt. Width)	12 ft	 (16 ft)
Min. Width of Graded Shldrs (w/ GR)	14 ft (17 ft)	11 ft
Paved Shoulder Width RT	12 ft	8 ft
Min. Width of Ditch Front Slope	12 ft	10 ft
Slope	CS-4 or CS-4B	

Reference: VDOT Road Design Manual, Appendix A

3.0 I-395 Mainline: Two design options (Options 1 and 2) were considered for upgrading the I-395 southbound general purpose lanes. The most recent version (6.1) of the *Highway Capacity Software* (*HCS*) was used to evaluate the mainline I-395 southbound operations. I-395 southbound was divided into discrete analysis segments consisting of basic freeway segments, ramp junctions (merges and diverges), and weaving segments. Additionally, conceptual designs were developed for each option, based on the available information, and critical design issues were identified. Lastly, preliminary project cost estimates (including preliminary engineering, construction, and CEI) were developed for each option.

The details of each Option are listed below along with the recommended configuration:

a. Option 1: Widen to Provide 4GP Lanes and a Full Width Shoulder - Option 1 would increase the number of GP lanes from three (3) to four (4) between the Duke Street / Little River Turnpike (Route 236) and Edsall Road (Route 648) interchanges by replacing the existing shoulder with a new general purpose travel lane and constructing a new full width / full depth shoulder along I-395 southbound.

Traffic Operations Summary: The mainline analysis results for I-395 are summarized in **Figures 9 and 10**. The results indicate that most segments of I-395 southbound would operate at LOS D or better in the PM peak hour with four (4) GP lanes. Two (2) locations were identified which the preliminary analyses indicated would operate at LOS E or worse:

- I-395 SB Diverge to Duke Street EB / WB: Maintaining the current single-lane parallel-type exit ramp at this location results in LOS E operations in the PM peak with either of the proposed configurations for the Duke Street interchange (Options 3 or 5). The total volume exiting at this location would be approaching 1,900 vehicles per hour during the Design Year PM peak hour. To achieve LOS D or better operations at this location, a two-lane exit ramp would need to be provided. This could be accomplished by providing an "option" lane (exit to Duke or through to I-395 Southbound) adjacent to the current deceleration lane. With this configuration, this diverge would operate at LOS B during the PM peak hour. The preliminary design concept for this project includes this "option" lane configuration.
- I-395 Southbound, Two-Sided Weave between On-Ramp from Duke Street and Off-Ramp to I-395 HOV / HOT Lanes (at Turkeycock Interchange): Analysis of this segment as a two-sided weave was conducted by assigning the ramp-to-ramp volumes proportionally based on the freeway and on-ramp flows. Based on this approach, this weaving segment is projected to operate at LOS E during the PM peak hour in the Design Year. A sensitivity analysis was conducted to determine if there was a level of ramp-to-ramp weaving traffic which resulted in LOS D operations. However, even if the ramp-to-ramp traffic volume was reduced to 0, the HCM weaving methodology still produced an LOS E result. For the sake of comparison, this segment was also analyzed as separate merge, freeway, and diverge segments. Each of those segments was found to operate at LOS D or better. *Note: No origin-destination data was acquired to determine the volume of traffic making the ramp-to-ramp movement through this two-sided weaving segment.*

Critical Design Issues: A roll plot of the conceptual design for Option 1 (combined with Options 3b and 5a) is provided in the Appendix. For this Option, the following critical design issues were identified:

- A Design Exception would be required to eliminate the shoulder on I-395 to avoid affecting the existing bridge structure for the flyover ramp near Turkeycock Run from the I-395 HOV Lanes to I-395 Southbound.

Estimated Cost: The estimated cost for this configuration is **$13.6M**, this cost includes:

- An additional 12' full depth travel lane and 12' partial depth shoulder.
- Replacement of 4 OH sign structures.

b. Option 2: Maintain the existing 3GP Lanes and rebuild the shoulder to provide a full-depth shoulder (Shoulder Lane Use in PM Peak): Operationally, Option 2 would maintain three (3) GP lanes throughout the day, except for the PM peak period, between the Duke Street / Little River Turnpike (Route 236) and Edsall Road (Route 648) interchanges. During the PM peak period, the shoulder lane would be used as an additional (4th) southbound general purpose travel lane. This configuration is similar to how I-66 currently operates between I-495 and Route 50. It should be noted that no examples of shoulder use segments could be identified which are similar in length (2.5 miles) to the study segment. Generally, part-time use of the shoulder lane is applied along longer project corridors where adding additional full-time capacity would be impractical.

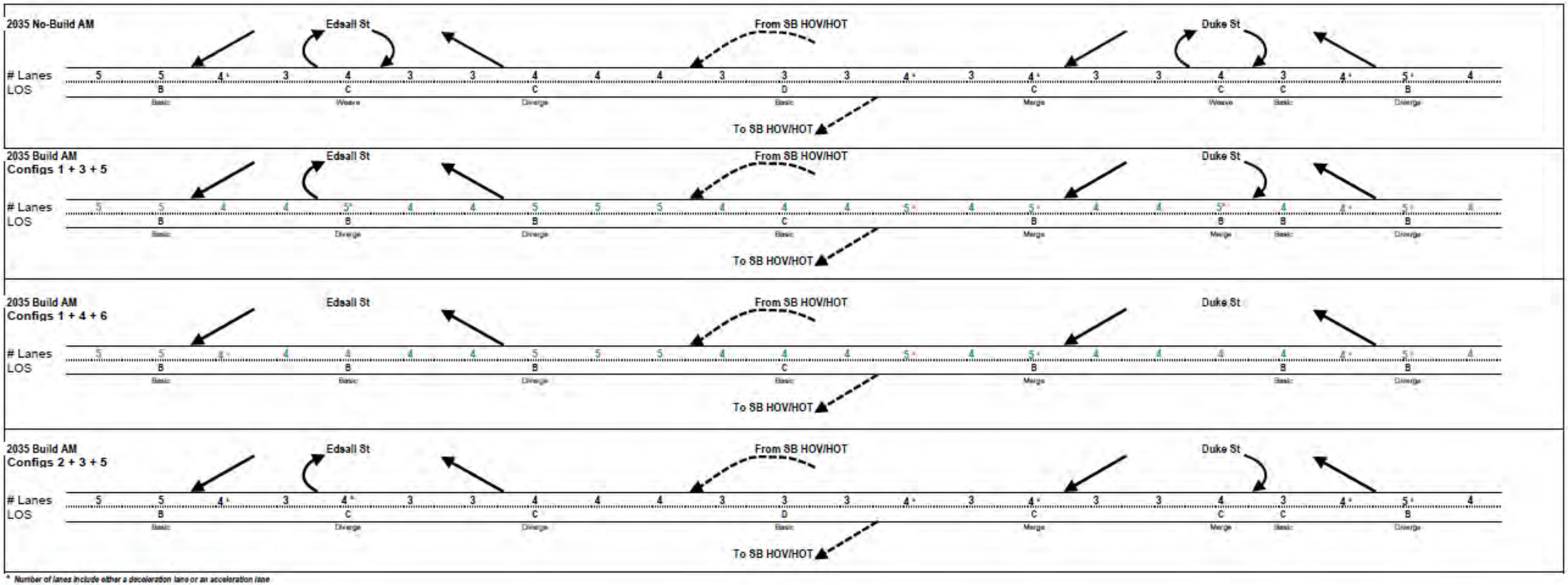
Traffic Operations Summary: The mainline analysis results for I-395 are summarized in **Figures 9 and 10**. The results indicate that most segments of I-395 southbound would operate at LOS D or better in the PM peak hour with four (4) GP lanes, including the shoulder use lane. The same two critical locations identified for Option 1 would also operate at LOS E for Option 2 in the Design Year. Critical Design Issues: The conceptual design for Option 2 is provided in the Appendix. For this Option, the following critical design issues were identified:

- A Design Exception would be required to eliminate the shoulder on I-395 to avoid affecting the existing bridge structure for the flyover ramp near Turkeycock Run from the I-395 HOV Lanes to I-395 Southbound.

Estimated Cost: The estimated cost for this configuration is **$11.0M**, this cost includes:

- An additional 12' full depth travel lane and 12' partial depth shoulder.
- Replacement of 2 OH sign structures.
- Note: This option would require the use of overhead lane control signs for, at a minimum, the shoulder travel lane. Given the complex lane use through this segment, which includes a continuous auxiliary lane between the flyover on-ramp from the I-395 HOV lanes and the off-ramp to Edsall Road westbound, it may ultimately be necessary to provide lane control signals spanning all the I-395 southbound GP lanes. This has not been assumed as part of this preliminary cost estimate. Additional evaluation would be needed if Option 2 is advanced.

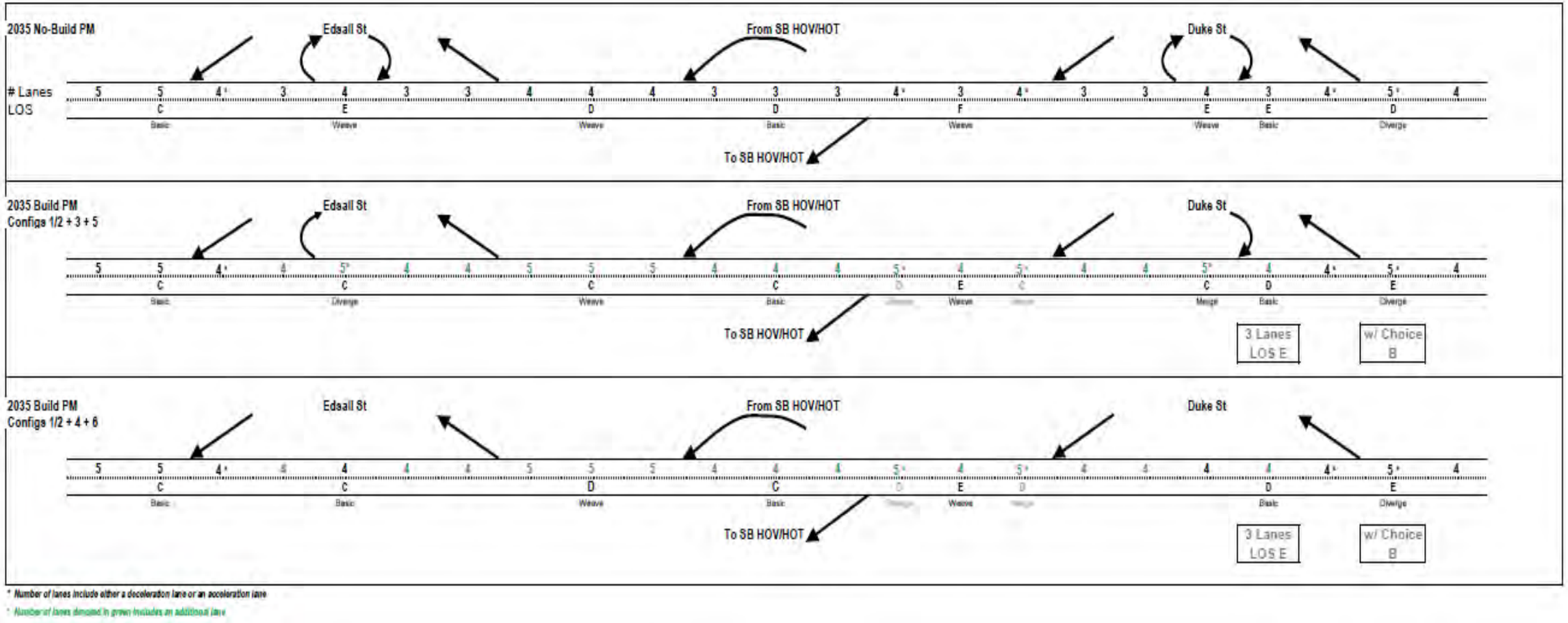
c. Recommended Configuration: The most beneficial design configuration which would enhance safety and operations along the study corridor is **Option 1: 4 Lanes and a Full Width Shoulder (Estimated Cost = $13.6 Million).**



* Number of lanes include either a deceleration lane or an acceleration lane

\# Number of lanes denoted in green includes an additional lane

Figure 9: I-395 SB – Capacity Analysis Results - AM Peak Hour



* Number of lanes include either a deceleration lane or an acceleration lane

* Number of lanes demand in green includes an additional lane

Figure 10: I-395 SB – Capacity Analysis Results - PM Peak Hour

4.0 Duke Street Interchange: Two design options (Options 3 and 4) were considered for modifying the Duke Street interchange to accommodate the proposed modifications to the I-395 mainline to provide additional capacity (particularly during the PM peak period). These options were developed to eliminate the existing weaving segment between the on-ramp from westbound Duke Street and the off-ramp to eastbound Duke Street and therefore reduce the number of lanes which need to be provided beneath the existing Duke Street overpass of I-395.

The most recent version (8) of *Synchro* was used to evaluate the operations of the proposed signalized intersections along Duke Street. All design options are discussed below:

a. Option 3 – Partial Cloverleaf (NW) Interchange: Removal of the existing Southbound to Eastbound loop-ramp and replacing it with a left-turn spur from the existing Southbound to Westbound directional ramp. A new signalized intersection (two-phase signal) would be created along Duke Street, west of I-395 to serve left-turns from the I-395 Southbound off-ramp to EB Duke Street.

Traffic Operations Summary: For this design alternative, two turn lane layouts were assumed for the ramp terminal intersection, Options 3a and 3b as follows:

a. Single-Left Turn Lane from I-395 Southbound Off-Ramp.
b. Double-Left Turn Lane from I-395 Southbound Off-Ramp.

The analysis results, including HCM delay, LOS, v/c-ratios, and Synchro 95th-percentile queues are summarized in **Table 4.** The results indicate that Option 3a would operate at LOS C overall, whereas Option 3b would operate at LOS B overall during PM peak hour. The critical movement at this signalized intersection is left-turn movement from the SB I-395 Off-ramp. The estimated delay for this movement under the design Options 3a and 3b are 70 seconds and 64 seconds per vehicle, respectively. However, the required 95th percentile queue length under Option 3a is approximately twice as high as Option 3b (approximately 400ft).

Supplementary Option: I-395 Southbound, between Off-Ramp to Duke Street EB/WB and On-Ramp from Duke Street – Option 3 would provide one exit from I-395 Southbound for all Duke Street traffic (1,800+ vph in the PM peak hour). With this volume of traffic exiting I-395 Southbound, an analysis was conducted to assess whether a short section of three (3) GP lanes could be provided between the exit ramp and the on-ramp from westbound Duke Street and provide satisfactory operations. This basic freeway segment was analyzed with both three (3) and four (4) GP lanes. Assuming a consistent free-flow speed (FFS) of 55 mph, the segment would operate at LOS E (Density = 35.1 pc/mi/ln) with three (3) GP lanes and LOS D with four (4) GP lanes. It should be noted that the density for the three (3) lane segment exceeds the LOS E threshold of 35 pc/mi/ln by only 0.1 pc/mi/ln.

Table 4: Configuration 3 - I-395 SB Ramps at Duke Street											
AM Peak Hour											
Option	**MOE**	**EB Duke Street**			**WB Duke Street**			**SB - I-395 Off-Ramp**			**Overall**
		L	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	
A	LOS	-	B	-	-	C	-	E	-	A	C
	Delay (sec)	-	18.4	-	-	25.2	-	70.8	-	0.4	25.9
	V/C-Ratio	-	0.55	-	-	0.78	-	0.9	-	0.27	n/a
	95th-Percentile Queue (Ft)	-	461	-	-	818	-	556	-	0	n/a
B	LOS	-	A	-	-	B	-	E	-	A	B
	Delay (sec)	-	8.3	-	-	11.2	-	69.9	-	0.4	16.4
	V/C-Ratio	-	0.46	-	-	0.65	-	0.8	-	0.27	n/a
	95th-Percentile Queue (Ft)	-	300	-	-	532	-	282	-	0	n/a
PM Peak Hour											
Option	**MOE**	**EB Duke Street**			**WB Duke Street**			**SB - I-395 Off-Ramp**			**Overall**
		L	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	
A	LOS	-	D	-	-	C	-	E	-	A	C
	Delay (sec)	-	45.2	-	-	30	-	69.6	-	4.8	34.3
	V/C-Ratio	-	0.93	-	-	0.67	-	0.97	-	0.82	n/a
	95th-Percentile Queue(Ft)	-	#981	-	-	536	-	#928	-	0	n/a
B	LOS	-	B	-	-	B	-	E	-	A	B
	Delay (sec)	-	17.6	-	-	13.3	-	64.1	-	4.8	19.9
	V/C-Ratio	-	0.7	-	-	0.5	-	0.85	-	0.82	n/a
	95th-Percentile Queue(Ft)	-	668	-	-	386	-	392	-	0	n/a

A = Single-left turn lane from I-395 SB Off-Ramp

B = Double Left turn lanes from I-395 SB Off-Ramp

- Volume for 95th- Percentile Exceeds Capacity

Critical Design Issues: The conceptual design for Option 3 is provided in the Appendix. For this Option, the following critical design issues were identified:

- An existing bridge pier would need to be removed to provide an integral straddle bent beam for existing flyover ramp for Duke Street EB to I-395 NB over the proposed spur ramp from I-395 Southbound. This option would need to be checked for adequate vertical clearance during design once more accurate survey information is available.
- A Design Exception would be required for 10' shoulder width on I-395 Southbound from the Duke Street overpass over I-395 to flyover ramp from Duke Street EB to I-395 Southbound.
- A Design exception would be required for reduced shoulder widths along loop ramp from Duke Street WB to I-395 Southbound under the existing Duke Street bridge over I-395 and the flyover ramp from Duke Street EB to I-395 NB.
- A 20 mph curve would be required on the loop ramp from Duke Street to I-395 Southbound (proposed DS = 30 mph).
- The 3 GP Supplementary Option would require a Design Exception for 10' shoulder width on I-395 Southbound from the Duke Street bridge over I-395 to the flyover ramp from Duke Street EB to I-395 Southbound, but would eliminate the need for the Design Exception for reduced shoulder widths along loop ramp from Duke Street WB to I-395 Southbound under the existing Duke Street bridge over I-395 and the flyover ramp from Duke Street EB to I-395 NB. This option not only eliminates the need for 20 mph curve on loop ramp from Duke Street to I-395 Southbound (proposed DS = 30 mph) but also the need to modify existing abutment and rebuild deck for Duke Street Bridge over I-395.

Estimated Cost: The estimated costs for the Options 3a and 3b are approximately $19.5M and $19.8M, respectively. The estimated cost for the 3GP lanes Supplementary Option is $14.1M which represents a savings of $5.4M and $5.7M, respectively, compared to the 4GP lane configuration (3a and 3b) assumed for this segment. These costs include the following:

- Removal of existing bridge pier and providing integral straddle bent beam for existing flyover ramp for Duke Street EB to I-395 NB over proposed spur ramp from I-395 Southbound.
- Modifying existing abutment and rebuilding deck for Duke Street Bridge over I-395.
- Replacement of 2 existing OH sign structures.

b. Option 4 – Diamond Interchange: Removal of existing SB to WB and WB to SB loop ramps and replacing them with new directional ramps to/from I-395 southbound. In addition, the existing EB to SB directional ramp would be removed and the EB to SB movement would be served by a right-turn movement at the proposed signalized intersection along Duke Street, west of I-395 to serve left-turns from the I-395 Southbound off-ramp to EB Duke Street.

Traffic Operations Summary: For this design alternative, three turn lane layouts were assumed for the ramp terminal intersection, Options 4a, 4b, and 4c as follows:

a. Single-Left Turn Lane from I-395 Southbound Off-Ramp + Single-Left Turn Lane from WB Duke Street
b. Double-Left Turn Lane from I-395 Southbound Off-Ramp + Single-Left Turn Lane from WB Duke Street
c. Double-Left Turn Lane from I-395 Southbound Off-Ramp + Double-Left Turn Lane from WB Duke Street

The analysis results, including HCM delay, LOS, v/c-ratios, and Synchro 95th-percentile queues are summarized in **Table 5.** The results indicate that Option 4a would operate at LOS E overall, whereas Option 4b and 4c would operate at LOS C overall during PM peak hour. All left-turn movements are critical at this signalized intersection, especially the left-turn from the SB I-395 Off-ramp. The estimated delay for this movement under the design Options 4a, 4b and 4c are 122sec, 80sec and 71sec, respectively. The 95th percentile queue length for the left-turn movement under Option 4c is the lowest (~420ft) compared to the other options.

Critical Design Issues: The conceptual design for Option 4 is provided in the Appendix. For this Option, the following critical design issues were identified:

- Removal of the existing bridge pier is needed to provide an integral straddle bent beam for the existing flyover ramp from Duke Street EB to I-395 NB over the proposed spur ramp. This option will need to be checked for adequate vertical clearance during design once more accurate survey information is available.
- A Design Exception would be required for the 10' shoulder width on I-395 Southbound from the Duke Street bridge over I-395 to the flyover ramp from Duke Street EB to I-395 northbound.
- The existing Duke Street bridge over I-395 should be investigated for additional loading due to addition of two left turn lanes from Duke Street WB to the on-ramp to I-395 Southbound.
- A Design Exception maybe required for reduced shoulder width on Duke Street near the existing bridge pier for the flyover ramp from Duke Street EB to I-395 NB.

Estimated Cost: The estimated costs for the three configurations 4a, 4b, and 4c are $17.6M, $ 17.8M, $18.0M, respectively. These costs include:

- Removal of existing bridge piers and providing integral straddle bent beam for existing flyover ramp for Duke Street EB to I-395 NB.
- Replacement of 2 existing OH sign structures.

c. Recommended Configuration: The most beneficial design configuration which would enhance safety and operations of the Duke Street Interchange along the study corridor is **Option 3b: Partial Cloverleaf with Double-Left Turn Lane from I-395 Southbound Off-Ramp (Estimated Cost = $19.8M).** This cost could potentially be reduced by approximately $5.7M if the 3 GP Supplementary Option were selected. Additional analysis, potentially including microsimulation, may be necessary to fully evaluate operations for that supplementary option.

Table 4: Configuration 5 - I-395 SB Ramps at Duke Street											
AM Peak Hour											
Option	**MOE**	**EB Duke Street**			**WB Duke**			**SB - I-395 Off-Ramp**			**Overall**
		L	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	
A	LOS	-	D	B	F	C	-	F	-	A	D
	Delay (sec)	-	51.7	13.3	83.9	21.8	-	83.8	-	0.4	39.0
	V/C-Ratio	-	0.88	0.47	0.97	0.76	-	0.96	-	0.27	n/a
	95th-Percentile Queue(Ft)	-	#695	176	#573	692	-	#668	-	0	n/a
B	LOS	-	C	A	D	B	-	E	-	A	C
	Delay (sec)	-	33.2	8.8	45	10.3	-	74.7	-	0.4	25.1
	V/C-Ratio	-	0.69	0.39	0.83	0.64	-	0.84	-	0.27	n/a
	95th-Percentile Queue(Ft)	-	636	144	382	466	-	294	-	0	n/a
C	LOS	-	C	A	E	B	-	E	-	A	C
	Delay (sec)	-	25.6	5.5	71.7	11.1	-	70.5	-	0.4	25.1
	V/C-Ratio	-	0.62	0.36	0.78	0.65	-	0.8	-	0.27	n/a
	95th-Percentile Queue(Ft)	-	564	104	254	522	-	284	-	0	n/a
PM Peak Hour											
Option	**MOE**	**EB Duke Street**			**WB Duke**			**SB - I-395 Off-Ramp**			**Overall**
		L	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	
A	LOS	-	F	D	F	C	-	F	-	A	E
	Delay (sec)	-	98.9	48.5	149.8	31.5	-	121.7	-	4.8	61.2
	V/C-Ratio	-	1.08	0.99	1.2	0.83	-	1.13	-	0.82	n/a
	95th-Percentile Queue(Ft)	-	#825	#737	#787	793	-	#1047	-	0	n/a
B	LOS	-	D	C	E	B	-	F	-	A	C
	Delay (sec)	-	49.1	25.9	78.1	14.3	-	80.3	-	4.8	33.3
	V/C-Ratio	-	0.86	0.88	0.98	0.67	-	0.95	-	0.82	n/a
	95th-Percentile Queue(Ft)	-	667	#650	#678	524	-	#472	-	0	n/a
C	LOS	-	C	B	E	B	-	E	-	A	C
	Delay (sec)	-	34.8	13.6	74.9	15.9	-	70.6	-	4.8	28.0
	V/C-Ratio	-	0.71	0.78	0.86	0.69	-	0.89	-	0.82	n/a
	95th-Percentile Queue(Ft)	-	598	396	317	578	-	418	-	0	n/a

A = Single left turn from I-395 SB Off-ramp + Single-left turn from WB Duke Street)
B = Double Left turn from I-395 SB Off-ramp + Single-left turn from WB Duke Street
C = Double Left turn from I-395 SB Off-ramp + Double-left turn from WB Duke Street
# - Volume for 95th- Percentile Exceeds Capacity

5.0 Edsall Road Interchange: Two design options were considered for Edsall Road interchange along the mainline I-395 Southbound. The most recent version (8) of *Synchro* was used to evaluate the operations of the proposed signalized intersections at this interchange.

a. Option 5: Partial Cloverleaf (SW) Interchange - Modify the interchange of I-395 at Edsall Road (Route 648) by removing of the existing WB to SB loop-ramp and replacing it with a left-turn spur from Edsall Road WB to the existing EB to SB directional ramp. In addition, the existing EB to SB directional ramp would be removed and the EB to SB movement would be served by a right-turn movement at the proposed signalized intersection (two-phase signal) along Edsall Road.

Traffic Operations Summary: For this design alternative, two turn lane layouts were assumed for the ramp terminal intersection, Options 5a and 5b as follows:

a. Single-Left Turn Lane from WB Edsall Road
b. Double-Left Turn Lane from WB Edsall Road

The analysis results, including HCM delay, LOS, v/c-ratios, and Synchro 95th-percentile queues are summarized in **Table 6.** The results indicate that Option 5a would operate at LOS B overall, whereas Option 5b would operate at LOS C during PM peak hour. The critical movement at this signalized intersection is the left-turn movement along WB Edsall Road. The estimated delay for this movement under the Options 5a and 5b is 25sec and 63sec, respectively, making Option 5a slightly better than Option 5b. The 95th percentile queue length under Option 5a is approximately 370ft.

Critical Design Issues: During the development of this design concept, the following critical design constraints were identified:

1. A Design Exception would be required for the 8' shoulders on I-395 between the Edsall Road bridge over I-395 and the flyover ramp for Edsall Road EB to I-395 NB.
2. A Design Exception may be required for reduced shoulder width on Edsall Road near the existing bridge pier for the flyover ramp from Edsall Road EB to I-395 NB.
3. A Design exception would be required for reduced shoulder width on the loop ramp from I-395 SB to Edsall Road EB to avoid existing bridge piers for the Edsall Road bridge over I-395 SB and the flyover ramp from Edsall Road EB to I-395 NB.
4. Modifications to the existing abutments maybe needed along with the replacement of the decks for the Edsall Road Bridge over I-395 EB to accommodate the modified loop ramp from I-395 SB to Edsall Road EB. The entire loop ramp needs to be reconstructed up to tie-in with Edsall Road in order to meet 30mph design speed.
5. Additional ROW may be required for the proposed ramp from Edsall Road to I-395 SB.
6. Existing Edsall Road Bridge over I-395 should be investigated for additional loading due to addition of left turn lane from Edsall Road WB to ramp to I-395 SB.

Table 6: Configuration 5 - I-395 SB Ramps at Edsall Road											
AM Peak Hour											
Option	**MOE**	**EB Edsall**			**WB Edsall**			**SB - I-395 Off-Ramp**			**Overall**
		L	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	
A	LOS	-	B	A	C	A	-				C
	Delay (sec)	-	19.8	7.2	27.9	0.5	-				11.2
	V/C-Ratio	-	0.49	0.36	0.82	0.48	-				n/a
	95th-Percentile Queue(Ft)	-	455	150	399	0	-				n/a
B	LOS	-	B	A	E	A	-				B
	Delay (sec)	-	11.7	8	63.2	0.5	-				15.1
	V/C-Ratio	-	0.43	0.34	0.82	0.48	-				n/a
	95th-Percentile Queue(Ft)	-	314	175	362	0	-				n/a
PM Peak Hour											
Option	**MOE**	**EB Edsall**			**WB Edsall**			**SB - I-395 Off-Ramp**			**Overall**
		L	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	
A	LOS	-	B	B	C	A	-				B
	Delay (sec)	-	11.9	16.5	25.3	0.3	-				11.4
	V/C-Ratio	-	0.3	0.67	0.91	0.38	-				n/a
	95th-Percentile Queue(Ft)	-	251	676	364	0	-				n/a
B	LOS	-	B	C	E	A	-				C
	Delay (sec)	-	12.2	22.6	62.6	0.3	-				20.9
	V/C-Ratio	-	0.31	0.73	0.86	0.38	-				n/a
	95th-Percentile Queue(Ft)	-	209	704	436	0	-				n/a

A = Single-left turn lane from WB Edsall Road

B = Double Left turn lanes from WB Edsall Road

- Volume for 95th- Percentile Exceeds Capacity

Estimated Cost: The estimated cost for configurations 5a and 5b are **$15.8M** and **$16.1M**, respectively. These costs include:

- Modifications to the existing bridge abutment and rebuild deck for Edsall Road Bridge over I-395 and flyover ramp from Edsall Road WB to I-395 NB.
- Replacement of 3 existing OH sign structures.
  Note: The estimated cost does not include cost for additional ROW for the ramp from Edsall Road to I-395 SB.

b. Option 6: Diamond Interchange - Remove the existing WB to SB loop-ramp and replace it with a left-turn spur from Edsall Road WB to the existing EB to SB directional ramp. In addition, the existing EB to SB directional ramp would be removed and the EB to SB movement would be served by a right-turn movement at the proposed signalized intersection along Edsall Road, west of I-395 to serve left-turns from WB Edsall Road to Southbound I-395. Also, eliminate the existing SB to WB loop ramp and replace it with a new left-turn spur from the existing WB to WB directional ramp.

Traffic Operations Summary: For this design alternative, three turn lane layouts were assumed for the ramp terminal intersection, Options 6a, 6b, and 6c as follows:

a. Single-Left Turn from I-395 Southbound Off-Ramp + Single-Left Turn Lane from Westbound Edsall Road
b. Single-Left Turn from I-395 Southbound Off-Ramp + Double-Left Turn Lane from Westbound Edsall Road
c. Double-Left Turn from I-395 Southbound Off-Ramp + Double-Left Turn Lane from Westbound Edsall Road

The analysis results, including HCM delay, LOS, v/c-ratios, and Synchro 95th-percentile queues are summarized in **Table 7.** The results indicate that Option 6c would operate at LOS C overall, where as Options 6a and 6b would operate at LOS D overall during PM peak hour. The critical movement at this signalized intersection is left-turn movement from SB I-395 off-ramp; estimated to operate at LOS F under all three design options. The 95th-percentile queue length under Option 6c is approximately 300ft with an estimated delay of 97sec, the lowest of all three options.

Critical Design Issues: The conceptual design for Option 6 is provided in the Appendix. For this Option, the following critical design issues were identified:

- Removal of an existing bridge pier would be needed along with providing an integral straddle bent beam for the existing flyover ramp from Edsall Road EB to I-395 NB over proposed spur ramp. This option will need to be checked for adequate vertical clearance during design once more accurate survey information is available.
- A Design Exception would be required for 8’ shoulders on I-395 SB between the Edsall Road bridge over I-395 and the flyover ramp for Edsall Road EB to I-395 NB.

- A Design Exception may be required for reduced shoulder widths on Edsall Road near the existing bridge pier for the flyover ramp from Edsall Road EB to I-395 NB.

Estimated Cost: The estimated costs for Options 6a, 6b and 6c are $10.3M, $11M and $14M, respectively. These costs include:

- Removal of existing bridge piers and providing integral straddle bent beam for existing flyover ramp for Edsall Road EB to I-395 NB over spur ramp from I-395 SB to Edsall Road.
- Replacement of 2 OH sign structures.

c. Recommended Configuration: The most beneficial design configuration which would enhance safety and operations of the Duke Street Interchange along the study corridor is **Option 5a: Partial Cloverleaf with Single-Left Turn Lane from Westbound Edsall Road (Estimated Cost = $15.8M)**

Table 7: Configuration 6 - I-395 SB Ramps at Edsall Road											
AM Peak Hour											
Option	**MOE**	**EB Edsall**			**WB Edsall**			**SB - I-395 Off-Ramp**			**Overall**
		L	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	
A	LOS	-	D	C	D	A	-	F	-	A	C
	Delay (sec)	-	44.9	24.1	52.7	7.7	-	93.9	-	0.3	28.5
	V/C-Ratio	-	0.76	0.53	0.91	0.61	-	0.85	-	0.2	n/a
	95th-Percentile Queue(Ft)	-	591	289	#717	374	-	#313	-	0	n/a
B	LOS	-	C	B	E	A	-	F	-	A	C
	Delay (sec)	-	29.1	17.4	65.4	9	-	81	-	0.3	25.9
	V/C-Ratio	-	0.58	0.43	0.84	0.62	-	0.77	-	0.2	n/a
	95th-Percentile Queue(Ft)	-	526	270	367	471	-	266	-	0	n/a
C	LOS	-	C	B	E	A	-	E	-	A	C
	Delay (sec)	-	23.1	17.6	64.6	5.4	-	74.3	-	0.3	22.6
	V/C-Ratio	-	0.53	0.41	0.83	0.58	-	0.62	-	0.2	n/a
	95th-Percentile Queue(Ft)	-	458	283	365	318	-	137	-	0	n/a
PM Peak Hour											
Option	**MOE**	**EB Edsall**			**WB Edsall**			**SB - I-395 Off-Ramp**			**Overall**
		L	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	
A	LOS	-	D	F	F	A	-	F	-	A	D
	Delay (sec)	-	35.4	110.6	90.3	9.5	-	134.8	-	1.2	50.6
	V/C-Ratio	-	0.51	1.12	1.10	0.52	-	1.10	-	0.51	n/a
	95th-Percentile Queue(Ft)	-	338	#1068	#923	320	-	#610	-	0	n/a
B	LOS	-	C	E	F	B	-	F	-	A	D
	Delay (sec)	-	28.5	73.4	100.3	10.5	-	112.8	-	1.2	44.1
	V/C-Ratio	-	0.44	1.01	1.04	0.53	-	1.03	-	0.51	n/a
	95th-Percentile Queue(Ft)	-	302	#1014	#559	338	-	#586	-	0	n/a
C	LOS	-	C	D	E	A	-	F	-	A	C
	Delay (sec)	-	22.2	49.2	76.4	5.2	-	97.2	-	1.2	32.7
	V/C-Ratio	-	0.39	0.92	0.95	0.48	-	0.94	-	0.51	n/a
	95th-Percentile Queue(Ft)	-	265	#958	#511	216	-	#284	-	0	n/a

A = Single left turn from I-395 SB Off-ramp + Single-left turn from WB Edsall Road
B = Double Left turn from I-395 SB Off-ramp + Single-left turn from WB Edsall Road
C = Double Left turn from I-395 SB Off-ramp + Double-left turn from WB Edsall Road
# - Volume for 95th- Percentile Exceeds Capacity

6.0 Conclusions and Recommendations:

Based on the findings of the operational and geometric evaluations, the Options in Table 8 are recommended for more detailed evaluation. Additional options would also provide improved operations compared to the No Build conditions and were found to be geometrically feasible, but the three options in Table 8 represent the best combination of operations, safety, and value.

Table 8: Recommended Configurations

Option	AM	PM	Cost
Option 1: I-395 SB Mainline – 4 Travel Lanes	LOS D or better	LOS D or better	$13.6M
Option 3b: Duke Street – Partial Cloverleaf NW with Double-Left Turn Lane from I-395 SB Off-Ramp	LOS C	LOS C	$19.8M
Option 5a: Edsall Road Partial Cloverleaf SW with Single Left-Turn Lane from WB Edsall Road	LOS C	LOS B	$15.8M
		Total	**$49.2M**

The recommended improvements would be expected to address the existing recurring congestion which occurs within this segment of I-395 southbound. The existing lane drop (from four lanes to three lanes) within the Duke Street interchange would be eliminated, as well as the weaving segments between the loop on and off-ramps at Duke Street and Edsall Road. The recommended improvements would also be expected to improve safety along this segment primarily by removing sources of congestion which are contributing to rear-end, sideswipe, and fixed object collisions. The recommended mainline configuration (4 travel lanes + full width shoulder) would provide shoulders throughout the project limits during all travel periods (including the PM peak) which would provide refuge for disabled vehicles and a recovery area for vehicles attempting to avoid collisions.

APPENDIX

Crash Data Summary for I-395 SB between Duke St and Edsall Rd intersections

Number	Document Number	Physical Jurisdiction	Mile Post	Year	Crash Date	Crash Time	Probabale Light Conditions*	Time of Day	Day Of Week	Crash Severity	Non Pedestrian Fatality Count	Non Pedestrian Injury Count	Work Zone Related	Collision Type
1	93270024	Fairfax County	1.94	2009	8/19/2009	12:41	Daylight	Day	Wed	Property damage crash	0	0	2. No	9. Fixed Object - Off Road
2	80071958	Fairfax County	1.95	2007	12/23/2007	3:50	Daylight	Day	Sun	Injury crash	0	1	2. No	4. Sideswipe - Same Direction
3	70103692	Fairfax County	1.95	2006	12/18/2006	3:20	Daylight	Day	Mon	Property damage crash	0	0	2. No	9. Fixed Object - Off Road
4	91055323	Fairfax County	1.95	2008	8/29/2008	13:40	Daylight	Day	Fri	Property damage crash	0	0	2. No	2. Angle
5	91340845	Fairfax County	1.95	2008	10/20/2008	1:25	Daylight	Day	Mon	Property damage crash	0	0	2. No	10. Deer
6	92080369	Fairfax County	1.95	2009	2/10/2009	3:09	Daylight	Day	Tue	Property damage crash	0	0	2. No	10. Deer
7	102920555	Fairfax County	1.96	2010	9/21/2010	9:12	Daylight	Day	Tue	Injury crash	0	1	2. No	1. Rear End
8	62422382	Fairfax County	1.96	2006	8/18/2006	2:55	Daylight	Day	Fri	Property damage crash	0	0	1. Yes	9. Fixed Object - Off Road
9	93490684	Fairfax County	1.97	2009	10/14/2009	18:25	Dark	Dusk	Wed	Property damage crash	0	0	2. No	1. Rear End
10	82145141	Fairfax County	1.97	2008	4/8/2008	4:05	Daylight	Day	Tue	Property damage crash	0	0	2. No	9. Fixed Object - Off Road
11	82685047	Fairfax County	1.97	2008	4/17/2008	9:15	Daylight	Day	Thu	Property damage crash	0	0	2. No	2. Angle
12	92090344	Fairfax County	1.97	2009	2/13/2009	9:25	Daylight	Day	Fri	Property damage crash	0	0	2. No	1. Rear End
13	92880355	Fairfax County	1.97	2009	6/20/2009	18:50	Daylight	Day	Sat	Property damage crash	0	0	2. No	1. Rear End
14	101320408	Fairfax County	1.97	2010	3/9/2010	15:35	Daylight	Day	Tue	Injury crash	0	1	2. No	9. Fixed Object - Off Road
15	102590044	Fairfax County	1.97	2010	8/3/2010	14:09	Daylight	Day	Tue	Property damage crash	0	0	2. No	1. Rear End
16	93390567	Fairfax County	1.98	2009	9/8/2009	10:25	Daylight	Day	Tue	Property damage crash	0	0	2. No	9. Fixed Object - Off Road
17	60740514	Fairfax County	1.99	2006	2/21/2006	14:57	Daylight	Day	Tue	Property damage crash	0	0	2. No	1. Rear End
18	61580717	Fairfax County	1.99	2006	5/11/2006	17:17	Daylight	Day	Thu	Property damage crash	0	0	2. No	1. Rear End
19	93160943	Fairfax County	1.99	2009	8/6/2009	6:57	Daylight	Day	Thu	Property damage crash	0	0	2. No	9. Fixed Object - Off Road
20	63410315	Fairfax County	2.00	2006	11/12/2006	18:45	Dark	Dusk	Sun	Property damage crash	0	0	2. No	8. Non-Collision
21	62000854	Fairfax County	2.02	2006	7/11/2006	18:30	Daylight	Day	Tue	Property damage crash	0	0	2. No	1. Rear End
22	62701239	Fairfax County	2.02	2006	9/12/2006	22:45	Dark	Night	Tue	Property damage crash	0	0	2. No	4. Sideswipe - Same Direction
23	62701359	Fairfax County	2.02	2006	9/19/2006	20:05	Dark	Night	Tue	Injury crash	0	2	2. No	9. Fixed Object - Off Road
24	63451062	Fairfax County	2.02	2006	11/27/2006	22:30	Dark	Night	Mon	Property damage crash	0	0	1. Yes	1. Rear End
25	73112867	Fairfax County	2.02	2007	10/25/2007	7:35	Daylight	Day	Thu	Injury crash	0	1	2. No	9. Fixed Object - Off Road
26	110410298	Fairfax County	2.03	2010	12/18/2010	9:04	Daylight	Day	Sat	Injury crash	0	3	2. No	2. Angle
27	73510364	Fairfax County	2.04	2007	12/5/2007	14:08	Daylight	Day	Wed	Injury crash	0	1	2. No	1. Rear End
28	60950612	Fairfax County	2.05	2006	3/22/2006	21:42	Dark	Night	Wed	Injury crash	0	2	2. No	9. Fixed Object - Off Road
29	73371975	Fairfax County	2.05	2007	11/5/2007	21:50	Dark	Night	Mon	Property damage crash	0	0	2. No	2. Angle
30	81195003	Fairfax County	2.05	2008	3/22/2008	18:05	Daylight	Day	Sat	Property damage crash	0	0	2. No	2. Angle
31	81425055	Fairfax County	2.05	2008	4/3/2008	19:12	Dark	Dusk	Thu	Injury crash	0	1	2. No	9. Fixed Object - Off Road
32	90075159	Fairfax County	2.05	2008	12/12/2008	12:30	Daylight	Day	Fri	Property damage crash	0	0	2. No	1. Rear End
33	91800233	Fairfax County	2.05	2009	1/1/2009	8:50	Daylight	Day	Thu	Property damage crash	0	0	2. No	4. Sideswipe - Same Direction
34	101450759	Fairfax County	2.05	2010	4/10/2010	17:00	Daylight	Day	Sat	Property damage crash	0	0	2. No	1. Rear End
35	102320313	Fairfax County	2.05	2010	4/10/2010	17:00	Daylight	Day	Sat	Property damage crash	0	0	2. No	2. Angle
36	101960279	Fairfax County	2.05	2010	5/26/2010	16:30	Daylight	Day	Wed	Injury crash	0	1	2. No	16. Other
37	73180323	Fairfax County	2.06	2007	10/25/2007	19:10	Daylight	Day	Thu	Property damage crash	0	0	2. No	1. Rear End
38	90405089	Fairfax County	2.06	2008	7/2/2008	11:05	Daylight	Day	Wed	Property damage crash	0	0	2. No	9. Fixed Object - Off Road
39	91701191	Fairfax County	2.06	2008	12/27/2008	18:35	Dark	Night	Sat	Property damage crash	0	0	2. No	1. Rear End
40	102860081	Fairfax County	2.07	2010	9/9/2010	17:30	Daylight	Day	Thu	Property damage crash	0	0	2. No	1. Rear End
41	83375244	Fairfax County	2.10	2008	5/31/2008	16:51	Daylight	Day	Sat	Property damage crash	0	0	2. No	4. Sideswipe - Same Direction
42	63610186	Fairfax County	2.12	2006	12/7/2006	14:05	Daylight	Day	Thu	Property damage crash	0	0	2. No	16. Other
43	103350430	Fairfax County	2.15	2010	9/25/2010	20:05	Dark	Night	Sat	Property damage crash	0	0	2. No	1. Rear End
44	91195531	Fairfax County	2.15	2008	9/21/2008	13:28	Daylight	Day	Sun	Property damage crash	0	0	2. No	9. Fixed Object - Off Road
45	93360268	Fairfax County	2.15	2009	7/16/2009	14:59	Daylight	Day	Thu	Injury crash	0	1	2. No	4. Sideswipe - Same Direction
46	83235018	Fairfax County	2.16	2008	5/18/2008	9:30	Daylight	Day	Sun	Property damage crash	0	0	2. No	1. Rear End
47	92240467	Fairfax County	2.16	2008	2/20/2009	15:25	Daylight	Day	Fri	Injury crash	0	1	2. No	1. Rear End
48	61790476	Fairfax County	2.17	2006	6/7/2006	22:00	Dark	Night	Wed	Property damage crash	0	0	2. No	1. Rear End

Crash Data Summary for I-395 SB between Duke St and Edsall Rd intersections

Number	Document Number	Physical Jurisdiction	Mile Post	Year	Crash Date	Crash Time	Probabale Light Conditions*	Time of Day	Day Of Week	Crash Severity	Non Pedestrian Fatality Count	Non Pedestrian Injury Count	Work Zone Related	Collision Type
49	110120289	Fairfax County	2.17	2010	9/27/2010	11:40	Daylight	Day	Mon	Property damage crash	0	0	2. No	9. Fixed Object - Off Road
50	60180514	Fairfax County	2.18	2006	1/3/2006	22:15	Dark	Night	Tue	Injury crash	0	2	2. No	8. Non-Collision
51	62540373	Fairfax County	2.18	2006	8/24/2006	22:30	Dark	Night	Thu	Property damage crash	0	0	2. No	1. Rear End
52	70311984	Fairfax County	2.18	2007	1/18/2007	11:00	Daylight	Day	Thu	Property damage crash	0	0	2. No	1. Rear End
53	71431702	Fairfax County	2.18	2007	5/12/2007	22:25	Dark	Night	Sat	Injury crash	0	1	2. No	9. Fixed Object - Off Road
54	73110240	Fairfax County	2.18	2007	10/21/2007	8:40	Daylight	Day	Sun	Property damage crash	0	0	2. No	10. Deer
55	91115225	Fairfax County	2.21	2008	9/4/2008	15:10	Daylight	Day	Thu	Property damage crash	0	0	2. No	1. Rear End
56	61372433	Fairfax County	2.23	2006	4/23/2006	20:15	Dark	Night	Sun	Property damage crash	0	0	2. No	9. Fixed Object - Off Road
57	61580713	Fairfax County	2.23	2006	5/10/2006	0:00	Dark	Night	Wed	Property damage crash	0	0	2. No	9. Fixed Object - Off Road
58	63611398	Fairfax County	2.23	2006	12/7/2006	15:30	Daylight	Day	Thu	Injury crash	0	1	2. No	1. Rear End
59	70100426	Fairfax County	2.23	2006	12/15/2006	15:40	Daylight	Day	Fri	Injury crash	0	1	2. No	1. Rear End
60	70103500	Fairfax County	2.23	2006	12/15/2006	15:40	Daylight	Day	Fri	Property damage crash	0	0	2. No	1. Rear End
61	72820778	Fairfax County	2.33	2007	9/19/2007	10:20	Daylight	Day	Wed	Property damage crash	0	0	2. No	4. Sideswipe - Same Direction
62	80141715	Fairfax County	2.33	2007	12/27/2007	7:25	Daylight	Day	Thu	Property damage crash	0	0	2. No	9. Fixed Object - Off Road
63	80985055	Fairfax County	2.35	2008	2/13/2008	21:38	Dark	Night	Wed	Injury crash	0	1	2. No	9. Fixed Object - Off Road
64	93420916	Fairfax County	2.35	2009	9/20/2009	13:05	Daylight	Day	Sun	Property damage crash	0	0	2. No	2. Angle
65	91810928	Fairfax County	2.40	2009	1/7/2009	20:45	Dark	Night	Wed	Property damage crash	0	0	2. No	1. Rear End
66	60300920	Fairfax County	2.43	2006	1/10/2006	7:40	Daylight	Day	Tue	Injury crash	0	1	2. No	1. Rear End
67	60590764	Fairfax County	2.43	2006	2/13/2006	13:25	Daylight	Day	Mon	Injury crash	0	2	2. No	1. Rear End
68	60740516	Fairfax County	2.43	2006	2/17/2006	16:30	Daylight	Day	Fri	Property damage crash	0	0	2. No	1. Rear End
69	60672168	Fairfax County	2.43	2006	2/23/2006	19:00	Dark	Night	Thu	Injury crash	0	1	1. Yes	1. Rear End
70	60861680	Fairfax County	2.43	2006	3/1/2006	22:00	Dark	Night	Wed	Property damage crash	0	0	2. No	1. Rear End
71	61163625	Fairfax County	2.43	2006	4/7/2006	18:15	Daylight	Day	Fri	Injury crash	0	1	2. No	1. Rear End
72	62140706	Fairfax County	2.43	2006	7/19/2006	22:35	Dark	Night	Wed	Property damage crash	0	0	2. No	9. Fixed Object - Off Road
73	62540385	Fairfax County	2.43	2006	8/21/2006	18:10	Daylight	Day	Mon	Injury crash	0	1	2. No	1. Rear End
74	62910751	Fairfax County	2.43	2006	10/6/2006	20:00	Dark	Night	Fri	Property damage crash	0	0	2. No	1. Rear End
75	63101897	Fairfax County	2.43	2006	10/26/2006	3:00	Dark	Night	Thu	Property damage crash	0	0	2. No	10. Deer
76	63520134	Fairfax County	2.43	2006	11/29/2006	17:57	Dark	Night	Wed	Injury crash	0	1	2. No	4. Sideswipe - Same Direction
77	70100424	Fairfax County	2.43	2006	12/18/2006	17:45	Dark	Night	Mon	Property damage crash	0	0	2. No	1. Rear End
78	80090163	Fairfax County	2.43	2007	12/8/2007	22:35	Dark	Night	Sat	Injury crash	0	2	2. No	8. Non-Collision
79	93450775	Fairfax County	2.45	2009	9/29/2009	15:47	Daylight	Day	Tue	Property damage crash	0	0	2. No	4. Sideswipe - Same Direction
80	101400980	Fairfax County	2.45	2010	3/26/2010	17:55	Daylight	Day	Fri	Property damage crash	0	0	2. No	1. Rear End
81	101830186	Fairfax County	2.45	2010	5/18/2010	17:04	Daylight	Day	Tue	Property damage crash	0	0	2. No	1. Rear End
82	102530027	Fairfax County	2.45	2010	7/4/2010	13:04	Daylight	Day	Sun	Property damage crash	0	0	2. No	4. Sideswipe - Same Direction
83	102090444	Fairfax County	2.45	2010	6/24/2010	15:35	Daylight	Day	Thu	Property damage crash	0	0	2. No	1. Rear End
84	80655143	Fairfax County	2.46	2008	2/5/2008	21:42	Dark	Night	Tue	Property damage crash	0	0	2. No	1. Rear End
85	81225160	Fairfax County	2.46	2008	3/20/2008	17:59	Daylight	Day	Thu	Injury crash	0	1	2. No	4. Sideswipe - Same Direction
86	91940528	Fairfax County	2.46	2009	1/22/2009	20:53	Dark	Night	Thu	Property damage crash	0	0	2. No	1. Rear End
87	92330082	Fairfax County	2.46	2009	3/25/2009	3:15	Daylight	Day	Wed	Property damage crash	0	0	2. No	1. Rear End
88	92600594	Fairfax County	2.46	2009	5/8/2009	15:40	Daylight	Day	Fri	Property damage crash	0	0	2. No	1. Rear End
89	103640155	Fairfax County	2.47	2010	10/25/2010	20:45	Dark	Night	Mon	Property damage crash	0	0	2. No	10. Deer
90	70312182	Fairfax County	2.53	2007	1/18/2007	2:20	Dark	Night	Thu	Property damage crash	0	0	2. No	9. Fixed Object - Off Road
91	72971181	Fairfax County	2.53	2007	10/17/2007	1:10	Dark	Night	Wed	Property damage crash	0	0	2. No	9. Fixed Object - Off Road
92	101320376	Fairfax County	2.64	2010	3/8/2010	6:10	Dark	Dawn	Mon	Property damage crash	0	0	2. No	9. Fixed Object - Off Road
93	81445274	Fairfax County	2.71	2008	4/8/2008	21:40	Dark	Night	Tue	Injury crash	0	1	2. No	1. Rear End
94	82845274	Fairfax County	2.71	2008	5/29/2008	10:35	Daylight	Day	Thu	Injury crash	0	1	1. Yes	2. Angle
95	90635049	Fairfax County	2.71	2008	7/25/2008	15:14	Daylight	Day	Fri	Property damage crash	0	0	2. No	9. Fixed Object - Off Road
96	72340542	Fairfax County	2.73	2007	8/14/2007	3:30	Dark	Night	Tue	Property damage crash	0	0	2. No	4. Sideswipe - Same Direction

Crash Data Summary for I-395 SB between Duke St and Edsall Rd intersections

Number	Document Number	Physical Jurisdiction	Mile Post	Year	Crash Date	Crash Time	Probabale Light Conditions*	Time of Day	Day Of Week	Crash Severity	Non Pedestrian Fatality Count	Non Pedestrian Injury Count	Work Zone Related	Collision Type
97	110320693	Fairfax County	2.77	2010	11/27/2010	4:15	Dark	Night	Sat	Property damage crash	0	0	2. No	2. Angle
98	110390951	Fairfax County	2.77	2010	12/5/2010	15:04	Daylight	Day	Sun	Property damage crash	0	0	2. No	2. Angle
99	93010170	Fairfax County	2.83	2009	7/9/2009	20:55	Daylight	Dusk	Thu	Property damage crash	0	0	2. No	9. Fixed Object - Off Road
100	101020097	Fairfax County	2.84	2010	1/28/2010	15:40	Daylight	Day	Thu	Property damage crash	0	0	2. No	1. Rear End
101	62280132	Fairfax County	2.84	2006	8/2/2006	10:10	Daylight	Day	Wed	Property damage crash	0	0	2. No	4. Sideswipe - Same Direction
102	62282740	Fairfax County	2.84	2006	8/4/2006	12:45	Daylight	Day	Fri	Injury crash	0	2	2. No	1. Rear End
103	62421004	Fairfax County	2.84	2006	8/12/2006	8:55	Daylight	Day	Sat	Injury crash	0	1	2. No	1. Rear End
104	62861640	Fairfax County	2.84	2006	9/30/2006	14:15	Daylight	Day	Sat	Property damage crash	0	0	2. No	9. Fixed Object - Off Road
105	63540910	Fairfax County	2.84	2006	12/3/2006	3:28	Dark	Night	Sun	Property damage crash	0	0	2. No	9. Fixed Object - Off Road
106	71861458	Fairfax County	2.84	2007	6/12/2007	14:23	Daylight	Day	Tue	Property damage crash	0	0	2. No	4. Sideswipe - Same Direction
107	72470314	Fairfax County	2.84	2007	8/17/2007	15:30	Daylight	Day	Fri	Property damage crash	0	0	2. No	4. Sideswipe - Same Direction
108	91005226	Fairfax County	2.84	2008	8/23/2008	2:31	Dark	Night	Sat	Property damage crash	0	0	2. No	9. Fixed Object - Off Road
109	91205841	Fairfax County	2.84	2008	9/25/2008	1:49	Dark	Night	Thu	Property damage crash	0	0	2. No	9. Fixed Object - Off Road
110	70103197	Fairfax County	2.93	2006	12/16/2006	17:20	Dark	Night	Sat	Property damage crash	0	0	2. No	1. Rear End
111	70100417	Fairfax County	2.93	2006	12/22/2006	14:23	Daylight	Day	Fri	Property damage crash	0	0	2. No	1. Rear End
112	73390435	Fairfax County	2.93	2007	11/9/2007	18:39	Dark	Dusk	Fri	Property damage crash	0	0	1. Yes	1. Rear End
113	72690965	Fairfax County	2.94	2007	9/13/2007	15:20	Daylight	Day	Thu	Property damage crash	0	0	2. No	1. Rear End
114	93140542	Fairfax County	2.95	2009	8/1/2009	18:05	Daylight	Day	Sat	Property damage crash	0	0	2. No	9. Fixed Object - Off Road
115	101411207	Fairfax County	2.95	2010	3/30/2010	17:31	Daylight	Day	Tue	Property damage crash	0	0	2. No	1. Rear End
116	101820197	Fairfax County	2.95	2010	5/13/2010	23:01	Dark	Night	Thu	Property damage crash	0	0	2. No	1. Rear End
117	91700556	Fairfax County	2.96	2008	12/23/2008	18:07	Dark	Night	Tue	Injury crash	0	1	2. No	1. Rear End
118	92520063	Fairfax County	2.96	2009	4/24/2009	8:24	Daylight	Day	Fri	Injury crash	0	2	2. No	4. Sideswipe - Same Direction
119	102080729	Fairfax County	2.96	2010	6/23/2010	15:12	Daylight	Day	Wed	Injury crash	0	2	2. No	1. Rear End
120	110130458	Fairfax County	3.02	2010	11/11/2010	0:00	Dark	Night	Thu	Injury crash	0	1	2. No	2. Angle
121	60462263	Fairfax County	3.10	2006	2/3/2006	22:45	Dark	Night	Fri	Injury crash	0	3	2. No	9. Fixed Object - Off Road
122	61163633	Fairfax County	3.10	2006	4/7/2006	16:40	Daylight	Day	Fri	Property damage crash	0	0	2. No	1. Rear End
123	61560276	Fairfax County	3.10	2006	5/21/2006	6:30	Daylight	Day	Sun	Injury crash	0	1	2. No	4. Sideswipe - Same Direction
124	61862200	Fairfax County	3.10	2006	6/23/2006	0:15	Dark	Night	Fri	Property damage crash	0	0	2. No	9. Fixed Object - Off Road
125	62282732	Fairfax County	3.10	2006	8/4/2006	1:20	Dark	Night	Fri	Property damage crash	0	0	2. No	1. Rear End
126	71202048	Fairfax County	3.10	2007	4/13/2007	11:00	Daylight	Day	Fri	Property damage crash	0	0	2. No	4. Sideswipe - Same Direction
127	72971158	Fairfax County	3.10	2007	10/15/2007	17:53	Daylight	Day	Mon	Property damage crash	0	0	2. No	1. Rear End
128	80845101	Fairfax County	3.10	2008	1/8/2008	18:20	Dark	Night	Tue	Property damage crash	0	0	2. No	1. Rear End
129	90845383	Fairfax County	3.10	2008	8/9/2008	3:18	Dark	Night	Sat	Property damage crash	0	0	2. No	4. Sideswipe - Same Direction
130	91035130	Fairfax County	3.10	2008	8/25/2008	15:44	Daylight	Day	Mon	Injury crash	0	2	2. No	1. Rear End
131	91630177	Fairfax County	3.10	2008	12/8/2008	2:12	Dark	Night	Mon	Injury crash	0	1	2. No	9. Fixed Object - Off Road
132	92580137	Fairfax County	3.10	2009	4/19/2009	4:24	Dark	Night	Sun	Injury crash	0	2	2. No	1. Rear End
133	63312099	Fairfax County	3.11	2006	11/4/2006	1:40	Dark	Night	Sat	Property damage crash	0	0	2. No	10. Deer
134	100420069	Fairfax County	3.13	2010	1/4/2010	17:35	Dark	Night	Mon	Property damage crash	0	0	2. No	1. Rear End
135	70990890	Fairfax County	3.15	2007	3/29/2007	16:25	Daylight	Day	Thu	Injury crash	0	1	2. No	1. Rear End
136	62421742	Fairfax County	3.20	2006	8/8/2006	15:15	Daylight	Day	Tue	Injury crash	0	1	2. No	9. Fixed Object - Off Road
137	71360887	Fairfax County	3.20	2007	5/2/2007	7:55	Daylight	Day	Wed	Property damage crash	0	0	2. No	4. Sideswipe - Same Direction
138	62481732	Fairfax County	3.23	2006	8/20/2006	10:20	Daylight	Day	Sun	Injury crash	0	1	2. No	9. Fixed Object - Off Road
139	62260434	Fairfax County	3.25	2006	7/21/2006	16:46	Daylight	Day	Fri	Property damage crash	0	0	2. No	1. Rear End
140	63611411	Fairfax County	3.25	2006	12/11/2006	17:27	Dark	Night	Mon	Property damage crash	0	0	2. No	1. Rear End
141	62630138	City of Alexandria	3.27	2006	9/13/2006	5:28	Dark	Dawn	Wed	Property damage crash	0	0	1. Yes	1. Rear End
142	71431657	City of Alexandria	3.28	2007	4/14/2007	9:45	Daylight	Day	Sat	Injury crash	0	1	2. No	4. Sideswipe - Same Direction
143	92440144	City of Alexandria	3.30	2009	4/9/2009	22:43	Dark	Night	Thu	Injury crash	0	1	2. No	1. Rear End
144	60322468	City of Alexandria	3.33	2006	1/14/2006	5:20	Dark	Dawn	Sat	Property damage crash	0	0	2. No	4. Sideswipe - Same Direction

Crash Data Summary for I-395 SB between Duke St and Edsall Rd intersections

Number	Document Number	Physical Jurisdiction	Mile Post	Year	Crash Date	Crash Time	Probabale Light Conditions*	Time of Day	Day Of Week	Crash Severity	Non Pedestrian Fatality Count	Non Pedestrian Injury Count	Work Zone Related	Collision Type
145	61790449	City of Alexandria	3.33	2006	6/13/2006	23:30	Dark	Night	Tue	Property damage crash	0	0	2. No	1. Rear End
146	72040971	City of Alexandria	3.33	2007	7/9/2007	18:08	Daylight	Day	Mon	Property damage crash	0	0	2. No	1. Rear End
147	73530378	City of Alexandria	3.34	2007	12/8/2007	14:50	Daylight	Day	Sat	Property damage crash	0	0	2. No	9. Fixed Object - Off Road
148	91420850	City of Alexandria	3.36	2008	11/4/2008	15:13	Daylight	Day	Tue	Property damage crash	0	0	2. No	1. Rear End
149	92330087	City of Alexandria	3.36	2009	3/25/2009	8:45	Daylight	Day	Wed	Property damage crash	0	0	2. No	4. Sideswipe - Same Direction
150	102670068	City of Alexandria	3.36	2010	7/12/2010	10:00	Daylight	Day	Mon	Injury crash	0	1	2. No	1. Rear End
151	72040957	City of Alexandria	3.37	2007	7/3/2007	16:04	Daylight	Day	Tue	Property damage crash	0	0	2. No	1. Rear End
152	60320935	City of Alexandria	3.40	2006	1/6/2006	15:20	Daylight	Day	Fri	Property damage crash	0	0	2. No	1. Rear End
153	92990472	City of Alexandria	3.40	2009	7/6/2009	18:00	Daylight	Day	Mon	Injury crash	0	1	2. No	1. Rear End
154	70100415	City of Alexandria	3.47	2006	12/19/2006	19:40	Dark	Night	Tue	Property damage crash	0	0	1. Yes	1. Rear End
155	110460832	City of Alexandria	3.47	2010	12/19/2010	17:08	Dark	Night	Sun	Injury crash	0	1	2. No	2. Angle
156	93530585	City of Alexandria	3.48	2009	9/27/2009	14:00	Daylight	Day	Sun	Property damage crash	0	0	2. No	9. Fixed Object - Off Road
157	101020726	City of Alexandria	3.48	2010	1/30/2010	16:40	Daylight	Day	Sat	Property damage crash	0	0	2. No	9. Fixed Object - Off Road
158	101130188	City of Alexandria	3.48	2010	2/12/2010	3:30	Daylight	Day	Fri	Property damage crash	0	0	2. No	1. Rear End
159	60932090	City of Alexandria	3.50	2006	3/17/2006	14:13	Daylight	Day	Fri	Property damage crash	0	0	2. No	1. Rear End
160	62850030	City of Alexandria	3.50	2006	9/22/2006	15:15	Daylight	Day	Fri	Property damage crash	0	0	2. No	1. Rear End
161	63191186	City of Alexandria	3.50	2006	10/31/2006	15:00	Daylight	Day	Tue	Injury crash	0	1	2. No	1. Rear End
162	63312090	City of Alexandria	3.50	2006	11/10/2006	17:45	Dark	Night	Fri	Injury crash	0	1	2. No	1. Rear End
163	80675395	City of Alexandria	3.50	2008	1/15/2008	18:51	Dark	Night	Tue	Property damage crash	0	0	2. No	1. Rear End
164	80565213	City of Alexandria	3.50	2008	1/30/2008	17:15	Dark	Dusk	Wed	Property damage crash	0	0	2. No	2. Angle
165	92720771	City of Alexandria	3.50	2009	5/31/2009	3:10	Dark	Night	Sun	Property damage crash	0	0	2. No	10. Deer
166	92870203	City of Alexandria	3.50	2009	6/17/2009	14:44	Daylight	Day	Wed	Property damage crash	0	0	2. No	1. Rear End
167	92591483	City of Alexandria	3.52	2009	4/27/2009	15:50	Daylight	Day	Mon	Property damage crash	0	0	2. No	4. Sideswipe - Same Direction
168	102160360	City of Alexandria	3.53	2010	7/7/2010	8:10	Daylight	Day	Wed	Injury crash	0	1	2. No	9. Fixed Object - Off Road
169	110110058	City of Alexandria	3.54	2010	11/7/2010	7:15	Daylight	Day	Sun	Property damage crash	0	0	2. No	4. Sideswipe - Same Direction
170	110060396	City of Alexandria	3.54	2010	11/4/2010	20:03	Dark	Night	Thu	Property damage crash	0	0	2. No	1. Rear End
171	71360881	City of Alexandria	3.54	2007	4/22/2007	4:05	Dark	Night	Sun	Injury crash	0	2	2. No	9. Fixed Object - Off Road
172	72130613	City of Alexandria	3.54	2007	7/12/2007	2:58	Dark	Night	Thu	Property damage crash	0	0	2. No	9. Fixed Object - Off Road
173	72200620	City of Alexandria	3.54	2007	7/21/2007	7:50	Daylight	Day	Sat	Property damage crash	0	0	2. No	9. Fixed Object - Off Road
174	72531117	City of Alexandria	3.54	2007	8/21/2007	2:23	Dark	Night	Tue	Property damage crash	0	0	2. No	9. Fixed Object - Off Road
175	102140350	City of Alexandria	3.54	2010	6/30/2010	17:25	Daylight	Day	Wed	Property damage crash	0	0	2. No	1. Rear End

** Probable lighting conditions for the crashes have been estimated based on the website www.sunrisesunset.com from the recorded crash time*
Please Note: The pavement and weather conditions for the crashes were not available

TASK ORDER 92

CONGESTION RELIEF FEASIBILITY STUDY

I-395 SOUTHBOUND FROM LITTLE RIVER TURNPIKE/DUKE STREET TO EDSALL ROAD

Roadway Quantities - Configuration 1

7/17/2012

DESCRIPTION	Unit	Qty.	* Unit Cost	Total Cost
GRADING ITEMS				
Mobilization	LS	1	$ 429,712.11	$ 429,712.11
Construction Surveying	LS	1	$ 79,942.42	$ 79,942.42
Clearing & Grubbing	LS	1	$ 20,000.00	$ 20,000.00
Regular Excavation	CY	5,725	$ 20.26	$ 115,988.50
Borrow Excavation	CY	859	$ 20.24	$ 17,386.16
DRAINAGE ITEMS				
Lump Sum (5% of Grading, Pavement, Incidental)	LS	1	$ 142,102.12	$ 142,102.12
PAVEMENT ITEMS				
Aggr. Base Matl. Ty. I No. 21B	TON	7,474	$ 25.76	$ 192,530.24
Asphalt Concrete Ty. IM-19.0A	TON	2,096	$ 71.25	$ 149,340.00
Asphalt Consrete Ty. BM-25.0A	TON	10,390	$ 64.05	$ 665,479.50
Asphalt Concrete Ty. SM-12.5E (76-22)	TON	6,424	$ 83.26	$ 534,862.24
Flexible Pave. Planning 0"-2"	SY	27,218	$ 1.49	$ 40,554.82
Sawcut (Full Depth)	LF	5,854	$ 6.99	$ 40,919.46
INCIDENTAL ITEMS				
Guardrail GR-2	LF	5,925	$ 15.54	$ 92,074.50
Fixed Object Attach. GR-FOA-2 TY. I	EA	1	$ 2,100.44	$ 2,100.44
Fixed Object Attach. GR-FOA-2 TY. II	EA	1	$ 816.32	$ 816.32
Median Barrier MB-7F	LF	202	$ 66.54	$ 13,441.08
Conc. Class A3 Retaining Wall	CY	1,714	$ 558.08	$ 956,549.12
PROTECTIVE ITEMS				
Demo. Of Pavement (Flexible)	SY	1,327	$ 4.89	$ 6,489.03
Remove Existing Guardrail	LF	5,989	$ 3.25	$ 19,464.25
EROSION CONTROL ITEMS				
Lump Sum (5% of Grading, Pavement, Incidental)	LS	1	$ 142,102.12	$ 142,102.12
TRAFFIC ITEMS				
Lump Sum-Traffic Signal	LS	2	$ 200,000.00	$ 400,000.00
Lump Sum-Lighting	LS	1	$ 500,000.00	$ 500,000.00
Lump Sum-Pavement Markings	LS	1	$ 50,000.00	$ 50,000.00
Lump Sum-Signing	LS	1	$ 50,000.00	$ 50,000.00
Lump Sum-Signing (4 OH signs @ $250k/ea)	LS	1	$ 1,000,000.00	$ 1,000,000.00
Lump Sum-MOT (100% of Grading, Pavement, Incidental)	LS	1	$ 2,842,042.38	$ 2,842,042.38

TOTAL	**$ 8,503,896.81**
GENERAL CONTINGENCY (25%)	**$ 2,125,974.20**
CEI (19%)	**$ 1,615,740.39**
Survey and Design (15%)	**$ 1,275,584.52**
TOTAL CONSTRUCTION COST	**$ 13,600,000.00**

* Unit Cost Reference: http://www.virginiadot.org/business/resources/const/DistrictAverages.pdf

TASK ORDER 92

CONGESTION RELIEF FEASIBILITY STUDY

I-395 SOUTHBOUND FROM LITTLE RIVER TURNPIKE/DUKE STREET TO EDSALL ROAD

Roadway Quantities - Configuration 2

7/17/2012

DESCRIPTION	Unit	Qty.	* Unit Cost	Total Cost
GRADING ITEMS				
Mobilization	LS	1	$ 354,184.47	$ 354,184.47
Construction Surveying	LS	1	$ 64,836.89	$ 64,836.89
Clearing & Grubbing	LS	1	$ 30,000.00	$ 30,000.00
Regular Excavation	CY	3,871	$ 20.26	$ 78,426.46
Borrow Excavation	CY	581	$ 20.24	$ 11,759.44
DRAINAGE ITEMS				
Lump Sum (5% of Grading, Pavement, Incidental)	LS	1	$ 116,343.92	$ 116,343.92
PAVEMENT ITEMS				
Aggr. Base Matl. Ty. I No. 21B	TON	5,052	$ 25.76	$ 130,139.52
Asphalt Concrete Ty. IM-19.0A	TON	1,411	$ 71.25	$ 100,533.75
Asphalt Consrete Ty. BM-25.0A	TON	6,996	$ 64.05	$ 448,093.80
Asphalt Concrete Ty. SM-12.5E (76-22)	TON	4,569	$ 83.26	$ 380,414.94
Flexible Pave. Planning 0"-2"	SY	27,148	$ 1.49	$ 40,450.52
Sawcut (Full Depth)	LF	5,849	$ 6.99	$ 40,884.51
INCIDENTAL ITEMS				
Guardrail GR-2	LF	5,748	$ 15.54	$ 89,323.92
Fixed Object Attach. GR-FOA-2 TY. I	EA	3	$ 2,100.44	$ 6,301.32
Fixed Object Attach. GR-FOA-2 TY. II	EA	3	$ 816.32	$ 2,448.96
Median Barrier MB-7F	LF	182	$ 66.54	$ 12,110.28
Conc. Class A3 Retaining Wall	CY	1,713	$ 558.08	$ 955,991.04
PROTECTIVE ITEMS				
Demo. Of Pavement (Flexible)	SY	7,953	$ 4.89	$ 38,890.17
Remove Existing Guardrail	LF	5,989	$ 3.25	$ 19,464.25
EROSION CONTROL ITEMS				
Lump Sum (5% of Grading, Pavement, Incidental)	LS	1	$ 116,343.92	$ 116,343.92
TRAFFIC ITEMS				
Lump Sum-Traffic Signal	LS	2	$ 200,000.00	$ 400,000.00
Lump Sum-Lighting	LS	1	$ 500,000.00	$ 500,000.00
Lump Sum-Pavement Markings	LS	1	$ 50,000.00	$ 50,000.00
Lump Sum-Signing	LS	1	$ 50,000.00	$ 50,000.00
Lump Sum-Signing (2 OH signs @ $250k/ea)	LS	1	$ 500,000.00	$ 500,000.00
Lump Sum-MOT (100% of Grading, Pavement, Incidental)	LS	1	$ 2,326,878.46	$ 2,326,878.46

TOTAL	**$ 6,863,820.55**
GENERAL CONTINGENCY (25%)	**$ 1,715,955.14**
CEI (19%)	**$ 1,304,125.90**
Survey and Design (15%)	**$ 1,029,573.08**
TOTAL CONSTRUCTION COST	**$ 11,000,000.00**

* Unit Cost Reference: http://www.virginiadot.org/business/resources/const/DistrictAverages.pdf

TASK ORDER 92

CONGESTION RELIEF FEASIBILITY STUDY

I-395 SOUTHBOUND FROM LITTLE RIVER TURNPIKE/DUKE STREET TO EDSALL ROAD

Roadway Quantities - Configuration 3a

7/17/2012

DESCRIPTION	Unit	Qty.	* Unit Cost	Total Cost
GRADING ITEMS				
Mobilization	LS	1	$ 460,667.34	$ 460,667.34
Construction Surveying	LS	1	$ 86,133.47	$ 86,133.47
Clearing & Grubbing	LS	1	$ 10,000.00	$ 10,000.00
Regular Excavation	CY	12,399	$ 20.26	$ 251,203.74
Borrow Excavation	CY	1,860	$ 20.24	$ 37,646.40
DRAINAGE ITEMS				
Lump Sum (5% of Grading, Pavement, Incidental)	LS	1	$ 163,835.62	$ 163,835.62
PAVEMENT ITEMS				
Aggr. Base Matl. Ty. I No. 21B	TON	12,323	$ 25.76	$ 317,440.48
Asphalt Concrete Ty. IM-19.0A	TON	2,520	$ 71.25	$ 179,550.00
Asphalt Consrete Ty. BM-25.0A	TON	17,139	$ 64.05	$ 1,097,752.95
Asphalt Concrete Ty. SM-12.5E (76-22)	TON	5,607	$ 83.26	$ 466,838.82
Flexible Pave. Planning 0"-2"	SY	18,943	$ 1.49	$ 28,225.07
Sawcut (Full Depth)	LF	4,752	$ 6.99	$ 33,216.48
INCIDENTAL ITEMS				
STD. CURB CG-3	LF	50	$ 17.01	$ 850.50
Guardrail GR-2	LF	8,400	$ 15.54	$ 130,536.00
GUARDRAIL TERMINAL GR-11	EA	4	$ 673.68	$ 2,694.72
ALT.BREAKAWAY CABLE TERM.(GR-9)	EA	3	$ 2,261.26	$ 6,783.78
Fixed Object Attach. GR-FOA-2 TY. I	EA	7	$ 2,100.44	$ 14,703.08
Fixed Object Attach. GR-FOA-2 TY. II	EA	3	$ 816.32	$ 2,448.96
Median Barrier MB-7F	LF	1,312	$ 66.54	$ 87,300.48
Conc. Class A3 Retaining Wall	CY	1,049	$ 558.08	$ 585,425.92
IMPACT ATTEN.SER.TY.1A(TL-2,45 MPH MAX)	EA	2	$ 5,957.50	$ 11,915.00
IMPACT ATTEN.(TL-3,>45MPH DES.SP.)	EA	1	$ 12,180.00	$ 12,180.00
PROTECTIVE ITEMS				
Demo. Of Pavement (Flexible)	SY	19,371	$ 4.89	$ 94,724.19
Remove Existing Guardrail	LF	6,585	$ 3.25	$ 21,401.25
EROSION CONTROL ITEMS				
Lump Sum (5% of Grading, Pavement, Incidental)	LS	1	$ 163,835.62	$ 163,835.62
TRAFFIC ITEMS				
Lump Sum-Traffic Signal	LS	2	$ 200,000.00	$ 400,000.00
Lump Sum-Lighting	LS	1	$ 500,000.00	$ 500,000.00
Lump Sum-Pavement Markings	LS	1	$ 50,000.00	$ 50,000.00
Lump Sum-Signing	LS	1	$ 50,000.00	$ 50,000.00
Lump Sum-Signing (2 OH sign @ $250k/ea)	LS	1	$ 500,000.00	$ 500,000.00
Lump Sum-MOT (100% of Grading, Pavement, Incidental)	LS	1	$ 3,276,712.38	$ 3,276,712.38
BRIDGE ITEMS				
Integral Straddle Bent for I-395 Ramp over Duke Street	LS	1	$ 1,600,000.00	$ 1,600,000.00
Duke Street Abutment over I-395	LS	1	$ 1,600,000.00	$ 1,600,000.00

TOTAL	**$ 12,244,022.25**
GENERAL CONTINGENCY (25%)	**$ 3,061,005.56**
CEI (19%)	**$ 2,326,364.23**
Survey and Design (15%)	**$ 1,836,603.34**
TOTAL CONSTRUCTION COST	**$ 19,500,000.00**

* Unit Cost Reference: http://www.virginiadot.org/business/resources/const/DistrictAverages.pdf

TASK ORDER 92

CONGESTION RELIEF FEASIBILITY STUDY

I-395 SOUTHBOUND FROM LITTLE RIVER TURNPIKE/DUKE STREET TO EDSALL ROAD

Roadway Quantities - Configuration 3b

7/17/2012

DESCRIPTION	Unit	Qty.	* Unit Cost	Total Cost
GRADING ITEMS				
Mobilization	LS	1	$ 469,651.02	$ 469,651.02
Construction Surveying	LS	1	$ 87,930.20	$ 87,930.20
Clearing & Grubbing	LS	1	$ 10,000.00	$ 10,000.00
Regular Excavation	CY	12,652	$ 20.26	$ 256,329.52
Borrow Excavation	CY	1,898	$ 20.24	$ 38,415.52
DRAINAGE ITEMS				
Lump Sum (5% of Grading, Pavement, Incidental)	LS	1	$ 168,113.56	$ 168,113.56
PAVEMENT ITEMS				
Aggr. Base Matl. Ty. I No. 21B	TON	12,420	$ 25.76	$ 319,939.20
Asphalt Concrete Ty. IM-19.0A	TON	3,484	$ 71.25	$ 248,235.00
Asphalt Consrete Ty. BM-25.0A	TON	17,274	$ 64.05	$ 1,106,399.70
Asphalt Concrete Ty. SM-12.5E (76-22)	TON	5,605	$ 83.26	$ 466,672.30
Flexible Pave. Planning 0"-2"	SY	18,943	$ 1.49	$ 28,225.07
Sawcut (Full Depth)	LF	4,752	$ 6.99	$ 33,216.48
INCIDENTAL ITEMS				
STD. CURB CG-3	LF	50	$ 17.01	$ 850.50
Guardrail GR-2	LF	8,400	$ 15.54	$ 130,536.00
GUARDRAIL TERMINAL GR-11	EA	4	$ 673.68	$ 2,694.72
ALT.BREAKAWAY CABLE TERM.(GR-9)	EA	3	$ 2,261.26	$ 6,783.78
Fixed Object Attach. GR-FOA-2 TY. I	EA	7	$ 2,100.44	$ 14,703.08
Fixed Object Attach. GR-FOA-2 TY. II	EA	3	$ 816.32	$ 2,448.96
Median Barrier MB-7F	LF	1,312	$ 66.54	$ 87,300.48
Conc. Class A3 Retaining Wall	CY	1,049	$ 558.08	$ 585,425.92
IMPACT ATTEN.SER.TY.1A(TL-2,45 MPH MAX)	EA	2	$ 5,957.50	$ 11,915.00
IMPACT ATTEN.(TL-3,>45MPH DES.SP.)	EA	1	$ 12,180.00	$ 12,180.00
PROTECTIVE ITEMS				
Demo. Of Pavement (Flexible)	SY	19,371	$ 4.89	$ 94,724.19
Remove Existing Guardrail	LF	6,585	$ 3.25	$ 21,401.25
EROSION CONTROL ITEMS				
Lump Sum (5% of Grading, Pavement, Incidental)	LS	1	$ 168,113.56	$ 168,113.56
TRAFFIC ITEMS				
Lump Sum-Traffic Signal	LS	2	$ 200,000.00	$ 400,000.00
Lump Sum-Lighting	LS	1	$ 500,000.00	$ 500,000.00
Lump Sum-Pavement Markings	LS	1	$ 50,000.00	$ 50,000.00
Lump Sum-Signing	LS	1	$ 50,000.00	$ 50,000.00
Lump Sum-Signing (2 OH sign @ $250k/ea)	LS	1	$ 500,000.00	$ 500,000.00
Lump Sum-MOT (100% of Grading, Pavement, Incidental)	LS	1	$ 3,362,271.23	$ 3,362,271.23
BRIDGE ITEMS				
Integral Straddle Bent for I-395 Ramp over Duke Street	LS	1	$ 1,600,000.00	$ 1,600,000.00
Duke Street Abutment over I-395	LS	1	$ 1,600,000.00	$ 1,600,000.00

TOTAL	**$ 12,434,476.25**
GENERAL CONTINGENCY (25%)	**$ 3,108,619.06**
CEI (19%)	**$ 2,362,550.49**
Survey and Design (15%)	**$ 1,865,171.44**
TOTAL CONSTRUCTION COST	**$ 19,800,000.00**

* Unit Cost Reference: **http://www.virginiadot.org/business/resources/const/DistrictAverages.pdf**

TASK ORDER 92

CONGESTION RELIEF FEASIBILITY STUDY

I-395 SOUTHBOUND FROM LITTLE RIVER TURNPIKE/DUKE STREET TO EDSALL ROAD

Roadway Quantities - Configuration 3b - 3 Lane Alternative

7/17/2012

DESCRIPTION	Unit	Qty.	* Unit Cost	Total Cost
GRADING ITEMS				
Mobilization	LS	1	$ 375,227.38	$ 375,227.38
Construction Surveying	LS	1	$ 69,045.48	$ 69,045.48
Clearing & Grubbing	LS	1	$ 10,000.00	$ 10,000.00
Regular Excavation	CY	6,963	$ 20.26	$ 141,070.38
Borrow Excavation	CY	1,045	$ 20.24	$ 21,150.80
DRAINAGE ITEMS				
Lump Sum (5% of Grading, Pavement, Incidental)	LS	1	$ 129,772.86	$ 129,772.86
PAVEMENT ITEMS				
Aggr. Base Matl. Ty. I No. 21B	TON	9,913	$ 25.76	$ 255,358.88
Asphalt Concrete Ty. IM-19.0A	TON	2,780	$ 71.25	$ 198,075.00
Asphalt Consrete Ty. BM-25.0A	TON	13,786	$ 64.05	$ 882,993.30
Asphalt Concrete Ty. SM-12.5E (76-22)	TON	4,925	$ 83.26	$ 410,055.50
Flexible Pave. Planning 0"-2"	SY	18,943	$ 1.49	$ 28,225.07
Sawcut (Full Depth)	LF	4,752	$ 6.99	$ 33,216.48
INCIDENTAL ITEMS				
STD. CURB CG-3	LF	50	$ 17.01	$ 850.50
Guardrail GR-2	LF	7,234	$ 15.54	$ 112,416.36
GUARDRAIL TERMINAL GR-11	EA	3	$ 673.68	$ 2,021.04
ALT.BREAKAWAY CABLE TERM.(GR-9)	EA	1	$ 2,261.26	$ 2,261.26
Fixed Object Attach. GR-FOA-2 TY. I	EA	5	$ 2,100.44	$ 10,502.20
Fixed Object Attach. GR-FOA-2 TY. II	EA	3	$ 816.32	$ 2,448.96
Median Barrier MB-7F	LF	340	$ 66.54	$ 22,623.60
Conc. Class A3 Retaining Wall	CY	785	$ 558.08	$ 438,092.80
IMPACT ATTEN.SER.TY.1A(TL-2,45 MPH MAX)	EA	2	$ 5,957.50	$ 11,915.00
IMPACT ATTEN.(TL-3,>45MPH DES.SP.)	EA	1	$ 12,180.00	$ 12,180.00
PROTECTIVE ITEMS				
Demo. Of Pavement (Flexible)	SY	17,352	$ 4.89	$ 84,851.28
Remove Existing Guardrail	LF	5,290	$ 3.25	$ 17,192.50
EROSION CONTROL ITEMS				
Lump Sum (5% of Grading, Pavement, Incidental)	LS	1	$ 129,772.86	$ 129,772.86
TRAFFIC ITEMS				
Lump Sum-Traffic Signal	LS	2	$ 200,000.00	$ 400,000.00
Lump Sum-Lighting	LS	1	$ 500,000.00	$ 500,000.00
Lump Sum-Pavement Markings	LS	1	$ 50,000.00	$ 50,000.00
Lump Sum-Signing	LS	1	$ 50,000.00	$ 50,000.00
Lump Sum-Signing (1 OH sign @ $250k/ea)	LS	1	$ 250,000.00	$ 250,000.00
Lump Sum-MOT (100% of Grading, Pavement, Incidental)	LS	1	$ 2,595,457.13	$ 2,595,457.13
BRIDGE ITEMS				
Integral Straddle Bent for I-395 Ramp over Duke Street	LS	1	$ 1,600,000.00	$ 1,600,000.00
~~Duke Street Abutment over I-395~~	~~LS~~	~~1~~		$ -

TOTAL	**$ 8,846,776.60**
GENERAL CONTINGENCY (25%)	**$ 2,211,694.15**
CEI (19%)	**$ 1,680,887.55**
Survey and Design (15%)	**$ 1,327,016.49**
TOTAL CONSTRUCTION COST	**$ 14,100,000.00**

* Unit Cost Reference: http://www.virginiadot.org/business/resources/const/DistrictAverages.pdf

TASK ORDER 92

CONGESTION RELIEF FEASIBILITY STUDY

I-395 SOUTHBOUND FROM LITTLE RIVER TURNPIKE/DUKE STREET TO EDSALL ROAD

Roadway Quantities - Configuration 4a

7/17/2012

DESCRIPTION	Unit	Qty.	* Unit Cost	Total Cost
GRADING ITEMS				
Mobilization	LS	1	$ 474,336.75	$ 474,336.75
Construction Surveying	LS	1	$ 88,867.35	$ 88,867.35
Clearing & Grubbing	LS	1	$ 20,000.00	$ 20,000.00
Regular Excavation	CY	8,724	$ 20.26	$ 176,748.24
Borrow Excavation	CY	1,308	$ 20.24	$ 26,473.92
DRAINAGE ITEMS				
Lump Sum (5% of Grading, Pavement, Incidental)	LS	1	$ 172,836.84	$ 172,836.84
PAVEMENT ITEMS				
Aggr. Base Matl. Ty. I No. 21B	TON	12,058	$ 25.76	$ 310,614.08
Asphalt Concrete Ty. IM-19.0A	TON	3,192	$ 71.25	$ 227,430.00
Asphalt Consrete Ty. BM-25.0A	TON	15,828	$ 64.05	$ 1,013,783.40
Asphalt Concrete Ty. SM-12.5E (76-22)	TON	5,324	$ 83.26	$ 443,276.24
Flexible Pave. Planning 0"-2"	SY	18,943	$ 1.49	$ 28,225.07
Sawcut (Full Depth)	LF	4,752	$ 6.99	$ 33,216.48
INCIDENTAL ITEMS				
STD. CURB CG-3	LF	1,027	$ 17.01	$ 17,469.27
Guardrail GR-2	LF	8,775	$ 15.54	$ 136,363.50
ALT.BREAKAWAY CABLE TERM.(GR-9)	EA	2	$ 2,261.26	$ 4,522.52
Fixed Object Attach. GR-FOA-2 TY. I	EA	8	$ 2,100.44	$ 16,803.52
Fixed Object Attach. GR-FOA-2 TY. II	EA	4	$ 816.32	$ 3,265.28
Median Barrier MB-7F	LF	940	$ 66.54	$ 62,547.60
Conc. Class A3 Retaining Wall	CY	1,634	$ 558.08	$ 911,902.72
IMPACT ATTEN.SER.TY.1A(TL-2,45 MPH MAX)	EA	2	$ 5,957.50	$ 11,915.00
IMPACT ATTEN.(TL-3,>45MPH DES.SP.)	EA	1	$ 12,180.00	$ 12,180.00
PROTECTIVE ITEMS				
Demo. Of Pavement (Flexible)	SY	20,748	$ 4.89	$ 101,457.72
Remove Existing Guardrail	LF	8,040	$ 3.25	$ 26,130.00
EROSION CONTROL ITEMS				
Lump Sum (5% of Grading, Pavement, Incidental)	LS	1	$ 172,836.84	$ 172,836.84
TRAFFIC ITEMS				
Lump Sum-Traffic Signal	LS	2	$ 200,000.00	$ 400,000.00
Lump Sum-Lighting	LS	1	$ 500,000.00	$ 500,000.00
Lump Sum-Pavement Markings	LS	1	$ 50,000.00	$ 50,000.00
Lump Sum-Signing	LS	1	$ 50,000.00	$ 50,000.00
Lump Sum-Signing (2 OH sign @ $250k/ea)	LS	1	$ 500,000.00	$ 500,000.00
Lump Sum-MOT (100% of Grading, Pavement, Incidental)	LS	1	$ 3,456,736.84	$ 3,456,736.84
BRIDGE ITEMS				
Integral Straddle Bent for I-395 Ramp over Duke Street	LS	1	$ 1,600,000.00	$ 1,600,000.00

TOTAL	**$**	**11,049,939.19**
GENERAL CONTINGENCY (25%)	**$**	**2,762,484.80**
CEI (19%)	**$**	**2,099,488.45**
Survey and Design (15%)	**$**	**1,657,490.88**
TOTAL CONSTRUCTION COST	**$**	**17,600,000.00**

* Unit Cost Reference: http://www.virginiadot.org/business/resources/const/DistrictAverages.pdf

TASK ORDER 92

CONGESTION RELIEF FEASIBILITY STUDY

I-395 SOUTHBOUND FROM LITTLE RIVER TURNPIKE/DUKE STREET TO EDSALL ROAD

Roadway Quantities - Configuration 4b

7/17/2012

DESCRIPTION	Unit	Qty.	* Unit Cost	Total Cost
GRADING ITEMS				
Mobilization	LS	1	$ 480,719.99	$ 480,719.99
Construction Surveying	LS	1	$ 90,144.00	$ 90,144.00
Clearing & Grubbing	LS	1	$ 20,000.00	$ 20,000.00
Regular Excavation	CY	9,035	$ 20.26	$ 183,049.10
Borrow Excavation	CY	1,355	$ 20.24	$ 27,425.20
DRAINAGE ITEMS				
Lump Sum (5% of Grading, Pavement, Incidental)	LS	1	$ 175,876.48	$ 175,876.48
PAVEMENT ITEMS				
Aggr. Base Matl. Ty. I No. 21B	TON	12,058	$ 25.76	$ 310,614.08
Asphalt Concrete Ty. IM-19.0A	TON	3,307	$ 71.25	$ 235,623.75
Asphalt Consrete Ty. BM-25.0A	TON	16,393	$ 64.05	$ 1,049,971.65
Asphalt Concrete Ty. SM-12.5E (76-22)	TON	5,434	$ 83.26	$ 452,434.84
Flexible Pave. Planning 0"-2"	SY	18,943	$ 1.49	$ 28,225.07
Sawcut (Full Depth)	LF	4,752	$ 6.99	$ 33,216.48
INCIDENTAL ITEMS				
STD. CURB CG-3	LF	1,027	$ 17.01	$ 17,469.27
Guardrail GR-2	LF	8,775	$ 15.54	$ 136,363.50
ALT.BREAKAWAY CABLE TERM.(GR-9)	EA	2	$ 2,261.26	$ 4,522.52
Fixed Object Attach. GR-FOA-2 TY. I	EA	8	$ 2,100.44	$ 16,803.52
Fixed Object Attach. GR-FOA-2 TY. II	EA	4	$ 816.32	$ 3,265.28
Median Barrier MB-7F	LF	940	$ 66.54	$ 62,547.60
Conc. Class A3 Retaining Wall	CY	1,634	$ 558.08	$ 911,902.72
IMPACT ATTEN.SER.TY.1A(TL-2,45 MPH MAX)	EA	2	$ 5,957.50	$ 11,915.00
IMPACT ATTEN.(TL-3,>45MPH DES.SP.)	EA	1	$ 12,180.00	$ 12,180.00
PROTECTIVE ITEMS				
Demo. Of Pavement (Flexible)	SY	20,748	$ 4.89	$ 101,457.72
Remove Existing Guardrail	LF	8,040	$ 3.25	$ 26,130.00
EROSION CONTROL ITEMS				
Lump Sum (5% of Grading, Pavement, Incidental)	LS	1	$ 175,876.48	$ 175,876.48
TRAFFIC ITEMS				
Lump Sum-Traffic Signal	LS	2	$ 200,000.00	$ 400,000.00
Lump Sum-Lighting	LS	1	$ 500,000.00	$ 500,000.00
Lump Sum-Pavement Markings	LS	1	$ 50,000.00	$ 50,000.00
Lump Sum-Signing	LS	1	$ 50,000.00	$ 50,000.00
Lump Sum-Signing (2 OH sign @ $250k/ea)	LS	1	$ 500,000.00	$ 500,000.00
Lump Sum-MOT (100% of Grading, Pavement, Incidental)	LS	1	$ 3,517,529.58	$ 3,517,529.58
BRIDGE ITEMS				
Integral Straddle Bent for I-395 Ramp over Duke Street	LS	1	$ 1,600,000.00	$ 1,600,000.00

TOTAL	**$**	**11,185,263.83**
GENERAL CONTINGENCY (25%)	**$**	**2,796,315.96**
CEI (19%)	**$**	**2,125,200.13**
Survey and Design (15%)	**$**	**1,677,789.57**
TOTAL CONSTRUCTION COST	**$**	**17,800,000.00**

* Unit Cost Reference: http://www.virginiadot.org/business/resources/const/DistrictAverages.pdf

TASK ORDER 92

CONGESTION RELIEF FEASIBILITY STUDY

I-395 SOUTHBOUND FROM LITTLE RIVER TURNPIKE/DUKE STREET TO EDSALL ROAD

Roadway Quantities - Configuration 4c

7/17/2012

DESCRIPTION	Unit	Qty.	* Unit Cost	Total Cost
GRADING ITEMS				
Mobilization	LS	1	$ 484,956.67	$ 484,956.67
Construction Surveying	LS	1	$ 90,991.33	$ 90,991.33
Clearing & Grubbing	LS	1	$ 20,000.00	$ 20,000.00
Regular Excavation	CY	9,240	$ 20.26	$ 187,202.40
Borrow Excavation	CY	1,386	$ 20.24	$ 28,052.64
DRAINAGE ITEMS				
Lump Sum (5% of Grading, Pavement, Incidental)	LS	1	$ 177,893.95	$ 177,893.95
PAVEMENT ITEMS				
Aggr. Base Matl. Ty. I No. 21B	TON	12,058	$ 25.76	$ 310,614.08
Asphalt Concrete Ty. IM-19.0A	TON	3,382	$ 71.25	$ 240,967.50
Asphalt Consrete Ty. BM-25.0A	TON	16,770	$ 64.05	$ 1,074,118.50
Asphalt Concrete Ty. SM-12.5E (76-22)	TON	5,507	$ 83.26	$ 458,512.82
Flexible Pave. Planning 0"-2"	SY	18,943	$ 1.49	$ 28,225.07
Sawcut (Full Depth)	LF	4,752	$ 6.99	$ 33,216.48
INCIDENTAL ITEMS				
STD. CURB CG-3	LF	1,027	$ 17.01	$ 17,469.27
Guardrail GR-2	LF	8,775	$ 15.54	$ 136,363.50
ALT.BREAKAWAY CABLE TERM.(GR-9)	EA	2	$ 2,261.26	$ 4,522.52
Fixed Object Attach. GR-FOA-2 TY. I	EA	8	$ 2,100.44	$ 16,803.52
Fixed Object Attach. GR-FOA-2 TY. II	EA	4	$ 816.32	$ 3,265.28
Median Barrier MB-7F	LF	940	$ 66.54	$ 62,547.60
Conc. Class A3 Retaining Wall	CY	1,634	$ 558.08	$ 911,902.72
IMPACT ATTEN.SER.TY.1A(TL-2,45 MPH MAX)	EA	2	$ 5,957.50	$ 11,915.00
IMPACT ATTEN.(TL-3,>45MPH DES.SP.)	EA	1	$ 12,180.00	$ 12,180.00
PROTECTIVE ITEMS				
Demo. Of Pavement (Flexible)	SY	20,748	$ 4.89	$ 101,457.72
Remove Existing Guardrail	LF	8,040	$ 3.25	$ 26,130.00
EROSION CONTROL ITEMS				
Lump Sum (5% of Grading, Pavement, Incidental)	LS	1	$ 177,893.95	$ 177,893.95
TRAFFIC ITEMS				
Lump Sum-Traffic Signal	LS	2	$ 200,000.00	$ 400,000.00
Lump Sum-Lighting	LS	1	$ 500,000.00	$ 500,000.00
Lump Sum-Pavement Markings	LS	1	$ 50,000.00	$ 50,000.00
Lump Sum-Signing	LS	1	$ 50,000.00	$ 50,000.00
Lump Sum-Signing (2 OH sign @ $250k/ea)	LS	1	$ 500,000.00	$ 500,000.00
Lump Sum-MOT (100% of Grading, Pavement, Incidental)	LS	1	$ 3,557,878.90	$ 3,557,878.90
BRIDGE ITEMS				
Integral Straddle Bent for I-395 Ramp over Duke Street	LS	1	$ 1,600,000.00	$ 1,600,000.00

TOTAL	**$**	**11,275,081.41**
GENERAL CONTINGENCY (25%)	**$**	**2,818,770.35**
CEI (19%)	**$**	**2,142,265.47**
Survey and Design (15%)	**$**	**1,691,262.21**
TOTAL CONSTRUCTION COST	**$**	**18,000,000.00**

* Unit Cost Reference: http://www.virginiadot.org/business/resources/const/DistrictAverages.pdf

TASK ORDER 92

CONGESTION RELIEF FEASIBILITY STUDY

I-395 SOUTHBOUND FROM LITTLE RIVER TURNPIKE/DUKE STREET TO EDSALL ROAD

Roadway Quantities - Configuration 5a

7/17/2012

DESCRIPTION	Unit	Qty.	* Unit Cost	Total Cost
GRADING ITEMS				
Mobilization	LS	1	$ 363,245.91	$ 363,245.91
Construction Surveying	LS	1	$ 66,649.18	$ 66,649.18
Clearing & Grubbing	LS	1	$ 10,000.00	$ 10,000.00
Regular Excavation	CY	5,993	$ 20.26	$ 121,418.18
Borrow Excavation	CY	899	$ 20.24	$ 18,195.76
DRAINAGE ITEMS				
Lump Sum (5% of Grading, Pavement, Incidental)	LS	1	$ 112,792.29	$ 112,792.29
PAVEMENT ITEMS				
Aggr. Base Matl. Ty. I No. 21B	TON	7,821	$ 25.76	$ 201,468.96
Asphalt Concrete Ty. IM-19.0A	TON	2,194	$ 71.25	$ 156,322.50
Asphalt Consrete Ty. BM-25.0A	TON	10,876	$ 64.05	$ 696,607.80
Asphalt Concrete Ty. SM-12.5E (76-22)	TON	3,542	$ 83.26	$ 294,906.92
Flexible Pave. Planning 0"-2"	SY	12,030	$ 1.49	$ 17,924.70
Sawcut (Full Depth)	LF	2,877	$ 6.99	$ 20,110.23
INCIDENTAL ITEMS				
STD. CURB CG-3	LF	1,199	$ 17.01	$ 20,394.99
Guardrail GR-2	LF	5,193	$ 15.54	$ 80,699.22
GUARDRAIL TERMINAL GR-11	EA	2	$ 673.68	$ 1,347.36
ALT.BREAKAWAY CABLE TERM.(GR-9)	EA	1	$ 2,261.26	$ 2,261.26
Fixed Object Attach. GR-FOA-2 TY. I	EA	7	$ 2,100.44	$ 14,703.08
Fixed Object Attach. GR-FOA-2 TY. II	EA	6	$ 816.32	$ 4,897.92
Median Barrier MB-7F	LF	1,548	$ 66.54	$ 103,003.92
Conc. Class A3 Retaining Wall	CY	837	$ 558.08	$ 467,112.96
IMPACT ATTEN.SER.TY.1A(TL-2,45 MPH MAX)	EA	2	$ 5,957.50	$ 11,915.00
IMPACT ATTEN.(TL-3,>45MPH DES.SP.)	EA	1	$ 12,180.00	$ 12,180.00
FENCE FE-W1	LF	75	$ 5.00	$ 375.00
PROTECTIVE ITEMS				
Demo. Of Pavement (Flexible)	SY	15,068	$ 4.89	$ 73,682.52
Remove Existing Guardrail	LF	4,658	$ 3.25	$ 15,138.50
EROSION CONTROL ITEMS				
Lump Sum (5% of Grading, Pavement, Incidental)	LS	1	$ 112,792.29	$ 112,792.29
TRAFFIC ITEMS				
Lump Sum-Traffic Signal	LS	2	$ 200,000.00	$ 400,000.00
Lump Sum-Lighting	LS	1	$ 500,000.00	$ 500,000.00
Lump Sum-Pavement Markings	LS	1	$ 50,000.00	$ 50,000.00
Lump Sum-Signing	LS	1	$ 50,000.00	$ 50,000.00
Lump Sum-Signing (3 OH sign @ $250k/ea)	LS	1	$ 750,000.00	$ 750,000.00
Lump Sum-MOT (100% of Grading, Pavement, Incidental)	LS	1	$ 2,255,845.76	$ 2,255,845.76
BRIDGE ITEMS				
Edsall Road Abutment over I-395	LS	1	$ 2,200,000.00	$ 2,200,000.00
I-395 Ramp Abutment over I-395	LS	1	$ 700,000.00	$ 700,000.00

TOTAL	**$**	**9,905,992.20**
GENERAL CONTINGENCY (25%)	**$**	**2,476,498.05**
CEI (19%)	**$**	**1,882,138.52**
Survey and Design (15%)	**$**	**1,485,898.83**
TOTAL CONSTRUCTION COST	**$**	**15,800,000.00**

* Unit Cost Reference: **http://www.virginiadot.org/business/resources/const/DistrictAverages.pdf**

TASK ORDER 92

CONGESTION RELIEF FEASIBILITY STUDY

I-395 SOUTHBOUND FROM LITTLE RIVER TURNPIKE/DUKE STREET TO EDSALL ROAD

Roadway Quantities - Configuration 5b

7/17/2012

DESCRIPTION	Unit	Qty.	* Unit Cost	Total Cost
GRADING ITEMS				
Mobilization	LS	1	$ 370,932.47	$ 370,932.47
Construction Surveying	LS	1	$ 68,186.49	$ 68,186.49
Clearing & Grubbing	LS	1	$ 10,000.00	$ 10,000.00
Regular Excavation	CY	6,290	$ 20.26	$ 127,435.40
Borrow Excavation	CY	944	$ 20.24	$ 19,106.56
DRAINAGE ITEMS				
Lump Sum (5% of Grading, Pavement, Incidental)	LS	1	$ 116,452.56	$ 116,452.56
PAVEMENT ITEMS				
Aggr. Base Matl. Ty. I No. 21B	TON	8,208	$ 25.76	$ 211,438.08
Asphalt Concrete Ty. IM-19.0A	TON	2,304	$ 71.25	$ 164,160.00
Asphalt Consrete Ty. BM-25.0A	TON	11,414	$ 64.05	$ 731,066.70
Asphalt Concrete Ty. SM-12.5E (76-22)	TON	3,649	$ 83.26	$ 303,815.74
Flexible Pave. Planning 0"-2"	SY	12,030	$ 1.49	$ 17,924.70
Sawcut (Full Depth)	LF	2,877	$ 6.99	$ 20,110.23
INCIDENTAL ITEMS				
STD. CURB CG-3	LF	1,499	$ 17.01	$ 25,497.99
Guardrail GR-2	LF	5,193	$ 15.54	$ 80,699.22
GUARDRAIL TERMINAL GR-11	EA	2	$ 673.68	$ 1,347.36
ALT.BREAKAWAY CABLE TERM.(GR-9)	EA	1	$ 2,261.26	$ 2,261.26
Fixed Object Attach. GR-FOA-2 TY. I	EA	7	$ 2,100.44	$ 14,703.08
Fixed Object Attach. GR-FOA-2 TY. II	EA	6	$ 816.32	$ 4,897.92
Median Barrier MB-7F	LF	1,548	$ 66.54	$ 103,003.92
Conc. Class A3 Retaining Wall	CY	837	$ 558.08	$ 467,112.96
IMPACT ATTEN.SER.TY.1A(TL-2,45 MPH MAX)	EA	2	$ 5,957.50	$ 11,915.00
IMPACT ATTEN.(TL-3,>45MPH DES.SP.)	EA	1	$ 12,180.00	$ 12,180.00
FENCE FE-W1	LF	75	$ 5.00	$ 375.00
PROTECTIVE ITEMS				
Demo. Of Pavement (Flexible)	SY	15,068	$ 4.89	$ 73,682.52
Remove Existing Guardrail	LF	4,658	$ 3.25	$ 15,138.50
EROSION CONTROL ITEMS				
Lump Sum (5% of Grading, Pavement, Incidental)	LS	1	$ 116,452.56	$ 116,452.56
TRAFFIC ITEMS				
Lump Sum-Traffic Signal	LS	2	$ 200,000.00	$ 400,000.00
Lump Sum-Lighting	LS	1	$ 500,000.00	$ 500,000.00
Lump Sum-Pavement Markings	LS	1	$ 50,000.00	$ 50,000.00
Lump Sum-Signing	LS	1	$ 50,000.00	$ 50,000.00
Lump Sum-Signing (3 OH sign @ $250k/ea)	LS	1	$ 750,000.00	$ 750,000.00
Lump Sum-MOT (100% of Grading, Pavement, Incidental)	LS	1	$ 2,329,051.12	$ 2,329,051.12
BRIDGE ITEMS				
Edsall Road Abutment over I-395	LS	1	$ 2,200,000.00	$ 2,200,000.00
I-395 Ramp Abutment over I-395	LS	1	$ 700,000.00	$ 700,000.00

TOTAL	**$**	**10,068,947.34**
GENERAL CONTINGENCY (25%)	**$**	**2,517,236.83**
CEI (19%)	**$**	**1,913,099.99**
Survey and Design (15%)	**$**	**1,510,342.10**
TOTAL CONSTRUCTION COST	**$**	**16,100,000.00**

* Unit Cost Reference: **http://www.virginiadot.org/business/resources/const/DistrictAverages.pdf**

TASK ORDER 92

CONGESTION RELIEF FEASIBILITY STUDY

I-395 SOUTHBOUND FROM LITTLE RIVER TURNPIKE/DUKE STREET TO EDSALL ROAD

Roadway Quantities - Configuration 6a

7/17/2012

DESCRIPTION	Unit	Qty.	* Unit Cost	Total Cost
GRADING ITEMS				
Mobilization	LS	1	$ 333,162.55	$ 333,162.55
Construction Surveying	LS	1	$ 60,632.51	$ 60,632.51
Clearing & Grubbing	LS	1	$ 10,000.00	$ 10,000.00
Regular Excavation	CY	1,311	$ 20.26	$ 26,560.86
Borrow Excavation	CY	2,639	$ 20.24	$ 53,413.36
DRAINAGE ITEMS				
Lump Sum (5% of Grading, Pavement, Incidental)	LS	1	$ 106,268.44	$ 106,268.44
PAVEMENT ITEMS				
Aggr. Base Matl. Ty. I No. 21B	TON	7,223	$ 25.76	$ 186,064.48
Asphalt Concrete Ty. IM-19.0A	TON	2,027	$ 71.25	$ 144,423.75
Asphalt Consrete Ty. BM-25.0A	TON	10,046	$ 64.05	$ 643,446.30
Asphalt Concrete Ty. SM-12.5E (76-22)	TON	3,366	$ 83.26	$ 280,253.16
Flexible Pave. Planning 0"-2"	SY	11,892	$ 1.49	$ 17,719.08
Sawcut (Full Depth)	LF	2,876	$ 6.99	$ 20,103.24
INCIDENTAL ITEMS				
STD. CURB CG-3	LF	677	$ 17.01	$ 11,515.77
Guardrail GR-2	LF	4,903	$ 15.54	$ 76,192.62
GUARDRAIL TERMINAL GR-11	EA	3	$ 673.68	$ 2,021.04
ALT.BREAKAWAY CABLE TERM.(GR-9)	EA	4	$ 2,261.26	$ 9,045.04
Fixed Object Attach. GR-FOA-2 TY. I	EA	8	$ 2,100.44	$ 16,803.52
Fixed Object Attach. GR-FOA-2 TY. II	EA	5	$ 816.32	$ 4,081.60
Median Barrier MB-7F	LF	732	$ 66.54	$ 48,707.28
Conc. Class A3 Retaining Wall	CY	1,009	$ 558.08	$ 563,102.72
IMPACT ATTEN.SER.TY.1A(TL-2,45 MPH MAX)	EA	2	$ 5,957.50	$ 11,915.00
PROTECTIVE ITEMS				
Demo. Of Pavement (Flexible)	SY	17,120	$ 4.89	$ 83,716.80
Remove Existing Guardrail	LF	5,003	$ 3.25	$ 16,259.75
EROSION CONTROL ITEMS				
Lump Sum (5% of Grading, Pavement, Incidental)	LS	1	$ 106,268.44	$ 106,268.44
TRAFFIC ITEMS				
Lump Sum-Traffic Signal	LS	2	$ 200,000.00	$ 400,000.00
Lump Sum-Lighting	LS	1	$ 500,000.00	$ 500,000.00
Lump Sum-Pavement Markings	LS	1	$ 50,000.00	$ 50,000.00
Lump Sum-Signing	LS	1	$ 50,000.00	$ 50,000.00
Lump Sum-Signing (2 OH sign @ $250k/ea)	LS	1	$ 500,000.00	$ 500,000.00
Lump Sum-MOT (100% of Grading, Pavement, Incidental)	LS	1	$ 2,125,368.82	$ 2,125,368.82
BRIDGE ITEMS				
~~Integral Straddle Bent for I-395 Ramp over Edsall Road~~	~~LS~~	~~1~~		$ -

TOTAL	**$**	**6,457,046.14**
GENERAL CONTINGENCY (25%)	**$**	**1,614,261.53**
CEI (19%)	**$**	**1,226,838.77**
Survey and Design (15%)	**$**	**968,556.92**
TOTAL CONSTRUCTION COST	**$**	**10,300,000.00**

* Unit Cost Reference: http://www.virginiadot.org/business/resources/const/DistrictAverages.pdf

TASK ORDER 92

CONGESTION RELIEF FEASIBILITY STUDY

I-395 SOUTHBOUND FROM LITTLE RIVER TURNPIKE/DUKE STREET TO EDSALL ROAD

Roadway Quantities - Configuration 6b

7/17/2012

DESCRIPTION	Unit	Qty.	* Unit Cost	Total Cost
GRADING ITEMS				
Mobilization	LS	1	$ 353,024.79	$ 353,024.79
Construction Surveying	LS	1	$ 64,604.96	$ 64,604.96
Clearing & Grubbing	LS	1	$ 10,000.00	$ 10,000.00
Regular Excavation	CY	7,838	$ 20.26	$ 158,797.88
Borrow Excavation	CY	2,676	$ 20.24	$ 54,162.24
DRAINAGE ITEMS				
Lump Sum (5% of Grading, Pavement, Incidental)	LS	1	$ 115,726.65	$ 115,726.65
PAVEMENT ITEMS				
Aggr. Base Matl. Ty. I No. 21B	TON	7,546	$ 25.76	$ 194,384.96
Asphalt Concrete Ty. IM-19.0A	TON	2,117	$ 71.25	$ 150,836.25
Asphalt Consrete Ty. BM-25.0A	TON	10,495	$ 64.05	$ 672,204.75
Asphalt Concrete Ty. SM-12.5E (76-22)	TON	3,453	$ 83.26	$ 287,496.78
Flexible Pave. Planning 0"-2"	SY	11,892	$ 1.49	$ 17,719.08
Sawcut (Full Depth)	LF	2,876	$ 6.99	$ 20,103.24
INCIDENTAL ITEMS				
STD. CURB CG-3	LF	997	$ 17.01	$ 16,958.97
Guardrail GR-2	LF	4,903	$ 15.54	$ 76,192.62
GUARDRAIL TERMINAL GR-11	EA	3	$ 673.68	$ 2,021.04
ALT.BREAKAWAY CABLE TERM.(GR-9)	EA	4	$ 2,261.26	$ 9,045.04
Fixed Object Attach. GR-FOA-2 TY. I	EA	8	$ 2,100.44	$ 16,803.52
Fixed Object Attach. GR-FOA-2 TY. II	EA	5	$ 816.32	$ 4,081.60
Median Barrier MB-7F	LF	732	$ 66.54	$ 48,707.28
Conc. Class A3 Retaining Wall	CY	1,009	$ 558.08	$ 563,102.72
IMPACT ATTEN.SER.TY.1A(TL-2,45 MPH MAX)	EA	2	$ 5,957.50	$ 11,915.00
PROTECTIVE ITEMS				
Demo. Of Pavement (Flexible)	SY	17,120	$ 4.89	$ 83,716.80
Remove Existing Guardrail	LF	5,003	$ 3.25	$ 16,259.75
EROSION CONTROL ITEMS				
Lump Sum (5% of Grading, Pavement, Incidental)	LS	1	$ 115,726.65	$ 115,726.65
TRAFFIC ITEMS				
Lump Sum-Traffic Signal	LS	2	$ 200,000.00	$ 400,000.00
Lump Sum-Lighting	LS	1	$ 500,000.00	$ 500,000.00
Lump Sum-Pavement Markings	LS	1	$ 50,000.00	$ 50,000.00
Lump Sum-Signing	LS	1	$ 50,000.00	$ 50,000.00
Lump Sum-Signing (2 OH sign @ $250k/ea)	LS	1	$ 500,000.00	$ 500,000.00
Lump Sum-MOT (100% of Grading, Pavement, Incidental)	LS	1	$ 2,314,532.97	$ 2,314,532.97
BRIDGE ITEMS				
~~Integral Straddle Bent for I-395 Ramp over Edsall Road~~	~~LS~~	~~1~~		$ -

TOTAL	**$ 6,878,125.53**
GENERAL CONTINGENCY (25%)	**$ 1,719,531.38**
CEI (19%)	**$ 1,306,843.85**
Survey and Design (15%)	**$ 1,031,718.83**
TOTAL CONSTRUCTION COST	**$ 11,000,000.00**

* Unit Cost Reference: http://www.virginiadot.org/business/resources/const/DistrictAverages.pdf

TASK ORDER 92

CONGESTION RELIEF FEASIBILITY STUDY

I-395 SOUTHBOUND FROM LITTLE RIVER TURNPIKE/DUKE STREET TO EDSALL ROAD

Roadway Quantities - Configuration 6c

7/17/2012

DESCRIPTION	Unit	Qty.	* Unit Cost	Total Cost
GRADING ITEMS				
Mobilization	LS	1	$ 380,183.85	$ 380,183.85
Construction Surveying	LS	1	$ 70,036.77	$ 70,036.77
Clearing & Grubbing	LS	1	$ 10,000.00	$ 10,000.00
Regular Excavation	CY	18,084	$ 20.26	$ 366,381.84
Borrow Excavation	CY	2,713	$ 20.24	$ 54,911.12
DRAINAGE ITEMS				
Lump Sum (5% of Grading, Pavement, Incidental)	LS	1	$ 128,659.53	$ 128,659.53
PAVEMENT ITEMS				
Aggr. Base Matl. Ty. I No. 21B	TON	7,867	$ 25.76	$ 202,653.92
Asphalt Concrete Ty. IM-19.0A	TON	2,207	$ 71.25	$ 157,248.75
Asphalt Consrete Ty. BM-25.0A	TON	10,941	$ 64.05	$ 700,771.05
Asphalt Concrete Ty. SM-12.5E (76-22)	TON	3,538	$ 83.26	$ 294,573.88
Flexible Pave. Planning 0"-2"	SY	11,892	$ 1.49	$ 17,719.08
Sawcut (Full Depth)	LF	2,876	$ 6.99	$ 20,103.24
INCIDENTAL ITEMS				
STD. CURB CG-3	LF	997	$ 17.01	$ 16,958.97
Guardrail GR-2	LF	4,903	$ 15.54	$ 76,192.62
GUARDRAIL TERMINAL GR-11	EA	3	$ 673.68	$ 2,021.04
ALT.BREAKAWAY CABLE TERM.(GR-9)	EA	4	$ 2,261.26	$ 9,045.04
Fixed Object Attach. GR-FOA-2 TY. I	EA	8	$ 2,100.44	$ 16,803.52
Fixed Object Attach. GR-FOA-2 TY. II	EA	5	$ 816.32	$ 4,081.60
Median Barrier MB-7F	LF	732	$ 66.54	$ 48,707.28
Conc. Class A3 Retaining Wall	CY	1,009	$ 558.08	$ 563,102.72
IMPACT ATTEN.SER.TY.1A(TL-2,45 MPH MAX)	EA	2	$ 5,957.50	$ 11,915.00
PROTECTIVE ITEMS				
Demo. Of Pavement (Flexible)	SY	17,120	$ 4.89	$ 83,716.80
Remove Existing Guardrail	LF	5,003	$ 3.25	$ 16,259.75
EROSION CONTROL ITEMS				
Lump Sum (5% of Grading, Pavement, Incidental)	LS	1	$ 128,659.53	$ 128,659.53
TRAFFIC ITEMS				
Lump Sum-Traffic Signal	LS	2	$ 200,000.00	$ 400,000.00
Lump Sum-Lighting	LS	1	$ 500,000.00	$ 500,000.00
Lump Sum-Pavement Markings	LS	1	$ 50,000.00	$ 50,000.00
Lump Sum-Signing	LS	1	$ 50,000.00	$ 50,000.00
Lump Sum-Signing (2 OH sign @ $250k/ea)	LS	1	$ 500,000.00	$ 500,000.00
Lump Sum-MOT (100% of Grading, Pavement, Incidental)	LS	1	$ 2,573,190.67	$ 2,573,190.67
BRIDGE ITEMS				
Integral Straddle Bent for I-395 Ramp over Edsall Road	LS	1	$ 1,300,000.00	$ 1,300,000.00

TOTAL	**$ 8,753,897.57**
GENERAL CONTINGENCY (25%)	**$ 2,188,474.39**
CEI (19%)	**$ 1,663,240.54**
Survey and Design (15%)	**$ 1,313,084.64**
TOTAL CONSTRUCTION COST	**$ 14,000,000.00**

* Unit Cost Reference: **http://www.virginiadot.org/business/resources/const/DistrictAverages.pdf**

APPENDIX B:
INTERCHANGE MODIFICATION REPORT FRAMEWORK DOCUMENT

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE INTERCHANGE MODIFICATION REPORT PROJECT FRAMEWORK DOCUMENT

Project No.: 0395-029-015, P101

UPC: 103316

April 29, 2014

Submitted by:

Virginia Department of Transportation

I-395 Southbound Additional Through Lane

Interchange Modification Report
Project Framework Document

Introduction

The Virginia Department of Transportation (VDOT) is proposing to add an additional through lane on southbound I-395 from just north of the Duke Street/Little River Turnpike – Route 236 (City of Alexandria) interchange to just south of the Edsall Road – Route 648 (Fairfax County) interchange. Currently, there is a lane drop within the interchange at Duke Street/Little River Turnpike, which causes recurring congestion in the PM peak periods. The corridor is the primary commuter route for traffic from major employment centers of Washington DC, the Pentagon, Pentagon City and Crystal City to residential areas along the I-95 and I-495 corridors.

VDOT is proposing to widen this southbound I-395 segment to add a fourth through lane and modify the two interchanges at Duke Street and Edsall Road to accommodate the fourth lane widening. A conceptual drawing of the study alignment is shown in **Appendix A**.

This framework document outlines the understanding between the FHWA and VDOT in the development of the IMR. It outlines the study area, methodology, assumptions and screening criteria used in the preparation of an IMR for the proposed modification to I-395 to provide an additional through lane from Duke Street/Little River Turnpike to Edsall Road.

Purpose and Need

The purpose and need for the additional southbound through lane from the Duke Street Interchange to just south of the Edsall Road interchange is to address the recurring PM peak period congestion caused by the lane drop at this location. The southbound general-purpose lanes in this segment have a daily AADT between 77,000 and 82,000 and a daily AAWDT of 80,000 to 86,000. The combination of the lane drop and heavy PM peak period traffic is also a safety issue, as the combination results in frequent stop and go traffic and frequent lane changes, which results in rear-end and side-swipe crashes, respectively. Furthermore, there are short weaving segments at the Duke Street and Edsall Road interchanges which forces exiting vehicles to slow down in the through lane in preparation to exit, as well as entering vehicles to merge at less-than-desired speeds. This slowdown in the through lane impacts the flow of traffic in the southbound direction and results in

unexpected maneuvers and crashes.

The proposed additional through lane will help address these travel demand and safety-related issues. Also, the proposed modifications to the ramp access at both interchanges will improve the weave areas, which will allow traffic to merge and exit more effectively. The lane would carry through the Edsall Road interchange and tie into the roadway configuration just south of this interchange.

Regional Plans

MWCOG CLRP

The southbound additional through lane is listed on the Metropolitan Washington Council of Governments' 2013 Constrained Long Range Transportation Plan for the National Capital Region with an expected completion date of 2018.

Fairfax County Transportation Plan

The Fairfax County Transportation Plan[1] and (Transportation) Capital Projects[2] both list the proposed improvements as part of the desired transportation improvements for Fairfax County.

Project Schedule

The IMR work is to be conducted under a separate scope of work which is anticipated to begin at the completion of this framework document in March 2014. It is anticipated that a draft IMR document will be submitted within 12 months once work under the contract commences.

Project Location and Study Area

The project is located on I-395 on the interchanges immediately north of the Springfield Interchange (I-95/395/495), in Fairfax County and the City of Alexandria. The limits of the widening project are from the Little River Turnpike/Duke Street Interchange to the Edsall Road Interchange, and also include the ingress/egress ramps from the I-395 HOV lanes at Turkeycock Run. The project is to add an additional southbound through lane at the lane drop in the Duke Street interchange to the south side of Edsall Road.

Anticipated Areas of Influence

FHWA guidelines for conducting IMR studies and documentation indicate the need to

[1] Fairfax County Transportation Plan, dated September 2011.
http://www.fairfaxcounty.gov/maps/images/maps/handouts/pdf07/transplanmap.pdf
[2] Fairfax County Transportation Projects, accessed February 2014. http://www.fairfaxcounty.gov/fcdot/map.htm

examine and analyze traffic operations at the study interchange and the adjacent interchanges. The study area (shown in **Figure 1**) for operational and safety analysis will include the roadways and intersections listed below. See **Appendix B** for a detailed traffic data collection plan with graphical illustration of the locations of the wavetronic, tube and turning movement counts.

Figure 1: General Study Area Limits for Operational Analyses

Source: Google Maps

The following roadways, ramps and intersections in the area of influence are proposed to be a part of this study effort:

- I-395 general purpose and HOV lanes from just north of the Seminary Road Interchange to the I-495 interchange,
- Ramps serving the I-395 interchanges with Route 236 Duke Street, Route 648 Edsall Road, and Route 420 Seminary Road;
- I-395 HOV ingress/egress ramps at Turkeycock Run (the future condition will include the HOT ramp currently under construction);
- Ramps to/from the I-495 interchange that serve traffic entering or exiting I-395 on the north side of I-495;
- Route 420 Seminary Road with the following intersections:
    - Mark Center Drive
    - the five intersections within the interchange (four signalized, one unsignalized)
    - Kenmore Avenue intersection;
- Route 236 Duke Street/Little River Turnpike
    - Route 613 Beauregard Street
    - Oasis Drive, and Frontage Road Access
    - South Walker Street and adjacent ramps to/from Landmark Mall and driveway to the car dealership,
- Route 648 Edsall Road
    - Mitchell Street/Industrial Drive
    - Cherokee Avenue
    - Bren Mar Drive

- Sullivan Pl Drive
- Bloomfield Drive
- Beryl Road,

Full details on the determination of the proposed influence area limits, including the roadways, ramps and intersections to be analyzed in this project are included in **Appendix C**. The study area limits were determined by reviewing INRIX speed data and Google historic traffic data, as well as VDOT's data collection program at the Mark Center (BRAC) and the I-95 HOT Lanes IJR.

No new access points will be proposed as part of the Project. A goal of the Project will be to eliminate some access points on I-395 by combining ramps movements into single points (i.e. combine two off-ramps or two on-ramps into a single ramp). The Measures of Effectiveness (MOEs) that will be used as a part of the study are described in the "Operational and Safety Analysis Procedures" section below.

Analysis Years

The proposed analysis years for this study are the current year (2013), opening year (2020 assumed), and design year (2040). The IMR will include an assessment of typical weekday AM and PM peak hour operations. The following scenarios will be analyzed in this study:

- No-Build conditions
  - Analysis of current (2013) roadway conditions.
  - The opening year (2020) and design year (2040) analysis with planned and/or programmed improvements as defined in the Regional Constrained Long Range Plan (CLRP), excluding the additional southbound additional through lane.
- Build conditions for the opening (2020) and design (2040) year that include proposed improvements in addition to the planned/programmed improvements.

Travel Demand Forecasting Model

This task will follow the directions from the following guidance documents from VDOT and FHWA:

- FHWA Traffic Analysis Toolbox Volume III, Section 3.5 Traffic Demand Data,
- VDOT Traffic Operations Analysis Tool Guidebook (current version 1.1),
- Virginia Transportation Modeling (VTM) Policies and Procedures Manual for urban travel demand forecasting, and
- Guidance from VDOT's Location and Design Division's Instructional and Informational Memorandum (current version IIM-LD-200.7).

The travel demand forecasting will be performed using the National Capital Region Transportation Planning Board's (TPB) travel demand model (Model Version 2.3.52 and Land Use Round 8.2 Cooperative Forecasts), and the 2013 Constrained Long Range Transportation Plan.

Any modifications to the inputs such as the Metropolitan Washington Council of Governments' adopted demographic forecasts, or the TPB ' s transportation network or land use inputs will be documented and justified. Additionally, any changes to the technical methods within the TPB's model and/or use of other forecasting methodologies and tools (for pre-processing or post-processing of forecast volumes) widely used by the travel demand forecasting industry and accepted by the FHWA will be documented and explained. At this time, it is anticipated that the process defined in National Cooperative Highway Research Program report 255 (NCHRP 255) will be followed for post-processing the model outputs.

Traffic forecasts will be prepared for the scenarios listed in the preceding section for **Analysis Years**. The modeling and post-processing will include the Average Weekday Morning and Average Weekday Afternoon peak hour volumes for links and intersections within the study area. NCHRP 255 process will be followed to balance the volumes. Adjustments to the volumes will be made to the forecast upon review of previous studies within the study area or inputs from stakeholders.

The forecast will be reviewed by VDOT staff to demonstrate that the forecasts validate within acceptable measures to the travel pattern and traffic count information available for this study. The volumes will be reviewed by the stakeholders prior to commencing the traffic analysis tasks.

Data Collection Methodology

See **Appendix B** for the list of intersections proposed for the data collection efforts, as well as the vehicle classification counts. Intersection turning movement volumes were collected at 17 intersections for the AM and PM three-hour peak period in November 2013, prior to the change in traffic patterns around the Thanksgiving holiday. At the same time, classification counts for two (2) mainline locations and 31 ramps were also collected with 24-hour counts. The mainline and high-speed ramps within the Springfield interchange were collected using Wavetronix, while the other ramps were collected with tubes. The raw data from the counts will be post-processed and balanced using NCHRP 255 procedures to develop 2013 volumes.

Field observations will be performed during the identified morning and afternoon peak hours to assess queues, traffic patterns, driver behavior, and travel speeds for calibrating the microsimulation models. Travel time runs were also conducted within the study limits, described above; the travel time run plan is provided in **Appendix D**.

The collected data are consistent with the calibration methodology outlined in FHWA's Traffic Analysis Toolbox Volume III and VDOT's Traffic Operations Analysis Tool Guidebook.

Crash data for the three most recent years of available data will be used for evaluation. Crash data will be gathered from VDOT and other relevant reliable sources. Vehicular, bicycle, and pedestrian crash data will be evaluated to identify collision trends and areas of safety concerns.

Traffic Factors

FHWA's Traffic Analysis Toolbox Volume III and VDOT Traffic Operations Analysis Tool Guidebook will be followed for applying traffic factors (such as peak hour factors) for future traffic operations as appropriate. Any modifications to factors from the existing conditions or the requirements of the two toolboxes mentioned above will be reviewed and documented for changes.

Operational and Safety Analysis Procedures

Operations

Based on recent experience in preparing IMR documentation elsewhere in Virginia and guidance provided in the FHWA publication *Interstate System Access Informational Guide* (August 2010), Highway Capacity Software (HCS) and Synchro software by themselves are not suitable for analysis of heavily congested conditions in corridors with tightly spaced intersections. Accordingly, microsimulation will be used for evaluating traffic operations and performance of the interchange improvement alternatives. Microsimulation is proposed to analyze dynamic traffic flow between analysis points such as intersections, ramp termini and merge/diverge areas; and to assess the impacts of bottlenecks on adjacent components of the roadway network. Equivalent level of service will be calculated using the Highway Capacity Manual (HCM 2010) methodologies for the freeway segments and the intersections within the influence area.

Microsimulation provides network-wide performance measures in terms of delays, queues, and travel times. Among the two popular microsimulation software packages involving freeway components, VISSIM is preferred over CORSIM for this project because of the complexity of the elements of the corridor, the presence of HOT lanes in the future; the previous use of VISSIM for traffic operational analyses within this corridor and the ability to build upon previously developed models. VISSIM will be used to conduct microsimulation analyses for existing conditions, opening year and design year No-Build conditions, and the preferred build alternative for AM and PM peak hours. Synchro (Version 8) software will be used to develop optimized traffic signal timing.

FHWA's Traffic Analysis Toolbox Volume III (TAT) and VDOT Traffic Operations Analysis

Tool Guidebook will be followed for the use of the VISSIM microsimulation software. The existing conditions VISSIM model will be calibrated and validated in accordance to the two toolboxes. Model outputs involving travel times, average speeds, queue lengths, and intersection delay will be reported and compared to actual conditions in the field. The VDOT calibration targets (95% confidence interval with a 10% tolerance) will be used in this project as they are tighter target than those identified by FHWA (85%/15%). The VDOT Traffic Analysis Tool Guidebook lists the parameters for the seeding time, determination of the number of simulation runs, simulation resolution, vehicle parameters, car following model, lane changing parameters, vehicle fleet and measures of effectiveness (MOEs) output reporting.

Initial analysis work will focus on potential refinements to VDOT's previously developed alternative. The existing conditions PM peak hour will be evaluated for up to five refinement concepts, described in **Alternatives Analyzed** (see below). For each refinement concept, microsimulation (VISSIM) will be used to calculate density, delay, and queuing at locations relevant to each concept. The findings of these results will provide partial basis for determining potential refinements to the preferred alternative. Once refinements to the preferred alternative are identified, a detailed traffic operations and safety analyses will be conducted for this corridor on the preferred alternative as a part of the IMR development for future opening year and design year Build conditions.

Table 1 below identifies the scenarios that will be analyzed using microsimulation:

Table 1: Scenarios

	Existing (2013)		Opening Year (2020)		Design Year (2040)	
Scenario	AM	PM	AM	PM	AM	PM
Existing Conditions	Yes	Yes	-	-	-	-
No Build	-	-	Yes	Yes	Yes	Yes
Preferred Build Alternative	-	-	Yes	Yes	Yes	Yes

Table 2 lists the parameters that will be used for the VISSIM microsimulation analyses:

Table 2: VISSIM Simulation Parameters

Parameter	**Existing (2013)**	**2020 & 2040 No Build**	**2020 & 2040 Build**
VISSIM Version	ver 6 (latest build)	Same as Existing	Same as Existing
Simulation Resolution	10 time steps/sec	Same as Existing	Same as Existing
Seeding Time	TBD (based on VDOT guidance)	Same as Existing	Same as Existing
Recording Time	1 hr	Same as Existing	Same as Existing
# of Simulation Runs	TBD (based on VDOT guidance)	Same as Existing	Same as Existing
Random Seeds	Starting Seed #1000, random seed increment of 100	Same as Existing	Same as Existing
Vehicle Types	GP Car, HOV 3+ Car, HGV and Bus	GP Car, HOV 3+ Car, HGV, Bus and HOT Car	GP Car, HOV 3+ Car, HGV, Bus and HOT Car
Vehicle Compositions	From Existing Volumes	From Travel Demand Forecasts	From Travel Demand Forecasts
Arterial Car Following Model	Wiedemann 74	Same as Existing	Same as Existing
Freeway Car Following Model	Wiedemann 99	Same as Existing	Same as Existing
Driver Behavior	Default or Adjust for Calibration	If No Build improvement significantly changes segment, use engineering judgment to roll back calibration adjustment; otherwise same as Existing	If proposed design significantly changes segment, use engineering judgment to roll back calibration adjustment; otherwise same as No Build
Signal Controller Type	Based on timing sheet data (RBC)	Same as Existing; New/Modified intersections will assume actuated-coordinated (RBC)	Same as No Build; New/Modified intersections will assume actuated-coordinated (RBC)
Signal Controller Frequency	10	Same as Existing	Same as Existing
Signal Timings/Offsets	Existing signal timing data to be obtained from VDOT and/or the City (Synchro files or signal timing data)	Optimized from Synchro	Optimized from Synchro
Ramp Meters	Based on existing data or recon	Same as Existing; Metering rate set by VDOT	Same as Existing; Metering rate set by VDOT

Grade	Code grades for links with >1.5% grade	From future No Build improvements; otherwise Same as Existing	From proposed plans; otherwise Same as No Build
Intersection Turning Speed	Use Reduced Speed Areas for Right (11-13 mph) and Left (13-17 mph) turns. For Non-Standard radius use AASHTO Exhibit 3-16	For future No Build improvements use AASHTO Exhibit 3-16; otherwise same as Existing	For future No Build improvements use AASHTO Exhibit 3-16; otherwise same as No Build
Ramp Curve Speed	Use Reduced Speed Areas as per as-built plans; otherwise use AASHTO Exhibit 3-16	For future No Build improvements use AASHTO Exhibit 3-16; otherwise same as Existing	For future No Build improvements use AASHTO Exhibit 3-16; otherwise same as No Build
Speed Limits	Use Speed Decisions for Arterials based on posted speeds (+/- 3 mph based on recon) and for Freeways based on posted speeds (+10/-3 mph based on recon)	From future No Build improvement plans; otherwise same as Existing	From proposed Build plans; otherwise same as No Build
Vehicle Input	Exact Volume	Same as Existing	Same as Existing
Lane Change Distance	Freeways based on exit sign location and Arterials default 656 ft. Adjust for calibration.	If No Build improvement significantly changes segment, use engineering judgment to roll back calibration adjustment; otherwise same as Existing	If proposed design significantly changes segment, use engineering judgment to roll back calibration adjustment; otherwise same as No Build

Note: "recon" refers to information collected from field observations.

Table 3 lists the measures of effectiveness (MOEs) will be generated to assess the operations of the Existing, No-Build and Build conditions:

Table 3: Measures of Effectiveness from VISSIM

Area	**MOEs**	**Unit**
Network wide	Average Travel Times	seconds
Freeway Mainline	Average Travel Speed	mph
	Average Density	pcpmpl
Arterial Intersections	Average Movement Delay	sec/veh
	Intersection Delay	sec/veh
	Maximum queue	feet

Figures will be developed to show MOEs such as speeds, density and queue lengths overlaid on top of the aerial imagery of the study area.

Alternatives Analyzed

Previous studies conducted by VDOT will form the basis for the project's initial geometric layout and configuration, shown in **Appendix A**. Preliminary Development work will focus on refinements for this concept alternative, and will endeavor to improve long-term traffic operations, reduce overall construction costs, and develop a design that ultimately will gain approval by FHWA. The following are potential design refinements that will be reviewed:

- Duke Street Interchange - Closure of the WB-to-SB loop ramp in lieu of the SB-to-EB loop ramp.
- Duke Street Interchange - Realignment of the SB exit ramp terminal at Route 236 Little River Turnpike to avoid structural retrofit work and a straddle bent for the "Ramp C" flyover from EB Route 236 to NB I-395.
- Two design strategies to mitigate the merge-weave conditions on southbound I-395 between the entrance ramp from Route 236 Little River Turnpike and the entrance to the I-95 Express lanes in the Turkeycock area of the project.
- Edsall Road Interchange - Two configurations for the dual-lane exit from SB I-395.
- Edsall Road Interchange - Reconfiguration of the proposed new ramp from Route 648 Edsall Road to SB I-395 to avoid right-of-way impacts and simplify MOT requirements.

The operational analysis task will evaluate the PM peak for the above described design refinements, the results of the analysis will be a factor for the screening criteria. Once the design refinements are screened, the preferred alternative will be analyzed for AM and PM peak hour conditions.

Screening Criteria

The screening criteria used to evaluate the design refinements will include, but are not limited to, traffic operations, overall environmental impacts, right-of-way impacts, utility impacts, and construction cost.

Anticipated Exceptions

It is anticipated that design exceptions will likely be needed, which will be determined during the preliminary development phase.

Safety Analysis

Using data provided for the study area by VDOT, crash analysis will be performed for existing conditions to reflect the most recent three-year period for which data is available. Crash data will be analyzed based on location, type, severity, time, and day to identify

existing crash patterns and safety concerns in the study area. Computed crash rates will be compared with statewide rates for similar roadway types established and documented by VDOT. A composite map of reported crash locations will be developed.

Based on a review of historical crash experience, the methodologies presented in Highway Safety Manual (HSM) will be used to predict crash rates under projected Build conditions. Such predictions will be limited to the types of improvements for which crash modification factors have been developed and included in the HSM. The analysis will also identify potential improvements that are needed to reduce the potential for crashes under future conditions.

IMR Documentation

The IMR document will be prepared in a manner consistent with FHWA's *Interstate System Access Information Guide* (August 2010), and with VDOT's IIM-LD-200.7 guidelines. The report will address the eight policy points of the FHWA Standard Operating Procedure for New or Revised Interstate Access Points as part of the project.

As required by FHWA, the draft report will contain a qualitative discussion on the TSM alternative, which can include elements such as HOV/HOT lanes, ITS initiatives, ramp metering, and expansion of transit services. The purpose of this discussion is to describe such elements that could be implemented and potential benefits to improve operations. However note that HOT lanes are being implemented on the I-95 corridor, and the I-95 HOT lanes IJR indicated that the southbound approach to Duke Street interchange will remain congested. Key components of the document are:

- Discussion on the eight policy requirements per FHWA guidelines.
- Operational and safety analysis of the Existing conditions, No-Build conditions, and the preferred Build alternative.
- Documentation of the screening process used by VDOT in identifying the preferred Build alternatives from a larger set of alternatives.
- Documentation to address the potential refinements to the preferred alternative identified by VDOT on the basis of screening work completed for this project.
- A concept-level highway signing plan.
- An exhibit showing limited access and proposed changes.
- A chart showing existing and proposed alternative roadway geometrics.
- Roadway geometry, anticipated design exception/waivers and access management waivers.
- Land-use coordination.
- Environmental compliance.
- Letters of commitment from localities.

Conclusion

VDOT requests FHWA's concurrence on the assumptions and methodology for the preparation of an IMR for the I-395 Southbound additional through lane and associated interchanges modifications as defined in this document. Currently, there is a lane drop within the interchange at Duke Street/Little River Turnpike, which causes recurring congestion in the PM peak periods. The corridor is the primary commuter route for traffic from major employment centers of Washington DC, the Pentagon, Pentagon City and Crystal City to residential areas along the I-95 corridor to the south. VDOT respectfully requests that FHWA allow the Project to enter into the second step of the FHWA's Standard Operating Procedure process to determine if the proposed designs would adequately address the recurring congestion and safety issues at this location.

APPENDIX C:
LETTERS OF SUPPORT
FROM FAIRFAX COUNTY
AND CITY OF ALEXANDRIA

County of Fairfax, Virginia

To protect and enrich the quality of life for the people, neighborhoods and diverse communities of Fairfax County

March 22, 2017

Ms. Helen Cuervo
Northern Virginia District Administrator
Virginia Department of Transportation
4975 Alliance Drive
Fairfax, Virginia 22030

Subject: Interchange Modification Report for the I-395 Southbound Widening Project
VDOT Project Number 0395-029-015, P101, UPC Number 103316

Dear Ms. Cuervo:

On December 5, 2016, the Fairfax County Department of Transportation (FCDOT) sent a letter to the Virginia Department of Transportation (VDOT), requesting integration of the County's Edsall Road Walkway project into the I-395 Southbound Widening project. FCDOT is in the process of facilitating an agreement with VDOT to transfer funds for this project.

The 2.5-mile segment along I-395 is primarily located in Fairfax County, with the northern terminus at the interchange of I-395 with Duke Street and Little River Turnpike (Route 236) partially located in the City of Alexandria. As presently configured, southbound I-395 operates with four through lanes upstream of the Duke Street interchange and downstream of the Edsall Road Interchange. However, only three lanes exist between the Duke Street and Edsall Road Interchanges. This constriction causes heavy congestion on southbound I-395 during weekday PM peak hour periods.

In addition, the Duke Street and Edsall Road Interchanges each have two closely spaced loop ramps that operate at low speeds. This "merge-weave" area between the loop ramps at each interchange contributes to congestion in the through travel lanes on southbound I-395, and is also the source of many crashes. Existing traffic volumes on I-395 are expected to increase more than 40% by the year 2040, resulting in more congestion and more traffic safety concerns. The project will add a continuous southbound lane on I-395 between the Duke Street and Edsall Road Interchanges to relieve the recurring daily congestion and the associated safety concerns in this segment of the I-395 corridor. The proposed project is consistent with Fairfax County's Comprehensive Plan.

Fairfax County continues to support I-395 Southbound Widening Lane project as a congestion mitigation initiative for travelers on I-395. Please contact Smitha Chellappa at (703) 877-5761 or Smitha.Chellappa@fairfaxcounty.gov if you have any questions or need additional information. Thank you for your assistance, and we look forward to working with VDOT to develop needed transportation improvements for the residents of Fairfax County and the Commonwealth.

Fairfax County Department of Transportation
4050 Legato Road, Suite 400
Fairfax, VA 22033-2895
Phone: (703) 877-5600 TTY: 711
Fax: (703) 877-5723
www.fairfaxcounty.gov/fcdot

FCDOT
Serving Fairfax County for 30 Years and More

Sincerely,

p.p. Bruce Petersen
for: Tom Biesiadny

Tom Biesiadny
Director, FCDOT

cc: Eric M. Teitelman, Chief, Capital Projects and Traffic Engineering Division, FCDOT
Karyn Moreland, Chief, Capital Projects Section, FCDOT
Michael Guarino, Transportation Planner IV, FCDOT
Abi Lerner, Associate Manager of Special Project Development, VDOT
Calvin Britt, VDOT Project Manager

DEPARTMENT OF TRANSPORTATION
AND ENVIRONMENTAL SERVICES
P.O. Box 178 - City Hall
Alexandria, Virginia 22313
703.746.4025

alexandriava.gov

March 23, 2017

Ms. Helen Cuervo, P.E.
Virginia Department of Transportation
4975 Alliance Drive
Fairfax, VA 22030

Subject: I-395 South Widening - Duke Street to Edsall Road

Dear Ms. Cuervo:

Thank you for the opportunity to provide feedback regarding the Commonwealth's 395 South Widening, Duke Street to Edsall Road. I would like to extend our thanks to the staff from Virginia Department of Transportation (VDOT) who provided updates to the Alexandria Transportation Commission and City Council.

I am writing to express support for the Commonwealth's 395 South Widening, Duke Street to Edsall Road project. I am also writing to reiterate that we are pleased that the Commonwealth has committed to a minimum of $15 million per year through the 395 Express Lanes project to fund transit and Transportation Demand Management (TDM) projects along the I-395/95 corridor and that the funding could grow over time. We believe the best way to mitigate congestion along the I-395 corridor and within host jurisdictions is to invest in transit and alternative travel options, which is in line with the goals of this project.

Thank you again for the opportunity to be involved and to provide comments. We look forward to working with you, and please do not hesitate to contact me on this matter.

Sincerely,

Yon Lambert, AICP
Director

cc: Mark B. Jinks, City Manager
Emily A. Baker, Deputy City Manager

APPENDIX D:
TRAFFIC FORECASTING MEMORANDUM AND CERTIFIED TRAFFIC VOLUMES

Yuan (George) Lu

Subject: FW: I-395 SB Widening IMR - Existing & Future Volumes

From: Pardo, Valerie (VDOT) [mailto:Valerie.Pardo@VDOT.Virginia.gov]
Sent: Monday, July 14, 2014 11:59 AM
To: Raj Paradkar
Cc: Josef, Robert (VDOT); Srikanth, Kanathur N. (VDOT)
Subject: FW: I-395 SB Widening IMR - Existing & Future Volumes

Raj-
Please use this email as official approval to use the volumes shared with us on June 30, 2014, for the I-395 IMR project.

Thanks,
Valerie

Valerie Pardo
Transportation Planning Manager
VDOT NOVA Transportation Planning
703-259-1736

From: Josef, Robert (VDOT)
Sent: Monday, July 14, 2014 11:52 AM
To: Pardo, Valerie (VDOT)
Subject: RE: I-395 SB Widening IMR - Existing & Future Volumes

Hi, Valerie,
These volumes are acceptable.
Thanks,
Bob

From: Raj Paradkar [mailto:rparadkar@HNTB.com]
Sent: Monday, July 14, 2014 11:26 AM
To: Josef, Robert (VDOT)
Subject: RE: I-395 SB Widening IMR - Existing & Future Volumes

No problem. If you have any other questions, please let me know. Otherwise, can you provide us with an official approval to go ahead and use these volumes for the I-395 IMR project?

Thanks and best regards

Raj

Raj Paradkar, P.E.
Transportation Project Manager
HNTB Corporation
2900 South Quincy Street, Suite 200, Arlington, VA 22206
(W) 703.253.5816
(C) 703.346.4847

Please consider the environment before printing this email.

HNTB Corporation
Engineers Architects Planners

2900 South Quincy Street
Suite 200
Arlington, VA 22206

Telephone (703) 824-5100
Facsimile (703) 671-6210
www.hntb.com

TECHNICAL MEMORANDUM
I-395 SOUTHBOUND ADDITIONAL THROUGH LANE PROJECT

TRAFFIC AND TRAVEL DEMAND FORECASTING MEMORANDUM

April 2014

Purpose

The purpose of this memorandum is to document the data collection, assumptions, and methodology used in developing traffic demand volumes for the I-395 southbound additional through lane project.

Study Area

Figure 1 shows the study area for the project. The study area generally extends on I-395 from the Seminary Road Interchange in the north and Springfield Interchange in the south. The study area also includes adjacent intersections on each side of the Interchanges shown below.

Figure 1: General Study Area Limits for Operational Analyses

Source: Google Maps

Traffic forecast years

Traffic forecasts were prepared for existing conditions (2013), opening year (2020) and design year (2040) No-Build and Build conditions.

Data Collection

To understand traffic patterns along the corridor, a comprehensive data collection program was undertaken. The data collection program included:

- Wavetronix classification counts on the northbound and southbound I-395 mainline
- Wavetronix classification counts at 7 ramps within the Springfield interchange

- Tube classification counts at 24 study area ramps.
- Intersection turning movement counts at 15 intersections.
- Travel time runs of the study corridor.

Traffic data was collected on weekdays during the first two weeks in November 2013. A series of travel time runs were also performed during the same period to ensure that the data is for the same set of traffic conditions. Electronic versions of the collected traffic data have been as attachments to the memo.

Peak Hour Determination

From the collected data, peak hours were identified for each roadway segment during the AM and PM periods. As the southbound movement of I-395 just north of Duke Street Interchange is the critical location impacted by the project, this roadway segment was used to establish the peak hour for all segments. Based on the above, the AM peak hour was determined to be 7:30-8:30 AM.

The procedure used for the PM peak hour is similar to AM with one exception – the data collected after 6 pm was not used since the HOV restrictions end are lifted after this time. As a result, the system peak was determined based on the counts from 4:00 pm to 6:15 pm only. The PM peak hour was determined to be 5:15-6:15 PM.

Volume Balancing

Peak hour determination was followed by volume balancing using NCHRP 255[1] procedures. Using the count data on I-395 mainline and the ramps, volumes on the freeway throughout the study area were developed. Volumes on the mainline and all ramps of I-395 were held constant and traffic volumes at the intersections adjacent to the interchanges were adjusted proportionally to match the traffic on the ramps. Volumes were not decreased at intersections when balancing between adjacent intersections, volumes were only increased upwards. The finalized 2013 existing volumes are shown in the figures at the end of this memo.

Truck Percentages

Truck percentages were compiled from the vehicle classification data collected on all the ramps and I-395 mainline in the study area. For arterials, truck percentages were developed using a combination of the count data on the ramps for each interchange, land use around each intersection, and field counts. Truck percentages on major roadways are listed below:

- Northbound I-395: 4 % (AM and PM peak hour)
- Southbound I-395: 6 % (AM peak hour) and 5 % (PM peak hour)

[1], National Cooperative Highway Research Report (NCHRP) 255, Highway Traffic Data for Urbanized Area Project Planning and Design, Transportation Research Board, February 1992.

- Edsall Road: 5 % (AM peak hour) and 3 % (PM peak hour)
- Duke Street: 2 % (AM peak hour) and 1 % (PM peak hour)

Peak Hour Factor (PHF)

The PHF on all the ramps in the peak direction of travel and mainline I-395 were taken into account to determine the overall level of saturation for the network. Majority of these locations have a PHF of 0.92 or higher during the peak hours which is suggestive of saturated traffic conditions. When the PHF is greater than or equal to 0.92, it implies that the flow of traffic is constant throughout the hour.

Travel Demand Forecasting

The Metropolitan Washington Council of Governments (MWCOG) maintains the region's travel demand model, which includes the cooperative land use forecasts for the region. HNTB requested and obtained the latest model from COG on August 29, 2013. Model Version 2.3.52 and Land Use 8.2 were used for the purpose of preparing forecasts. VDOT obtained permission in mid-April 2014 from MWCOG to use this version of the model for this study.

Model Information

VDOT obtained permission from MWCOG in mid-April 2014 to use this model for the I-395 Southbound Additional Thru Lane project MWCOG provided the National Capital Region Transportation Planning Board (TPB)'s travel demand forecasting model Version 2.3, Build 52 (model version 2.3.52). The land use input files for the Version 2.3.52 Travel Model uses Round 8.2 Cooperative Forecasts. The model was approved by TPB on July 17, 2013. The current model was validated to 2010 conditions, with an emphasis on the model highway assignment results[2]. The current version of the model contain the following forecast years: 2010, 2015, 2017, 2020, 2025, 2030 and 2040.

Within the documentation of the model, includes the assumptions of the transportation network and its improvements, the National Capital Region's Financially Constrained Long-Range Transportation Plan (CLRP). The list of projects specifies the type of improvements, limits and the year assumed to be completed, and these projects are listed in **Table 1.** Fairfax County has developed its own list of proposed improvements for the County, including the study area. The City of Alexandria has its own comprehensive plan, including transportation plans. Only those projects identified in the CLRP are considered for the forecasting and subsequent traffic operational analysis. The other projects would be considered as beyond the CLRP, or the unfunded aspiration/vision projects.

[2] Draft User's Guide for the MWCOG/TPB Travel Forecasting Model, Version 2.3, Build 52, September 2013, MWCOG.

Table 1: CLRP Projects within the Study Area

Facility	Completion Date	Description
I-395 NB	2015	Auxiliary lane between northbound Duke St. on ramp and Seminary Rd off ramp
I-395 HOV	2015	Reversible Ramp - NB HOV off-ramp to Seminary Rd. & Seminary Rd. on-ramp to SB HOV
I-395 NB and HOV	2015	Ramp from I-395 Express lanes to I-395 NB GP
I-395/95 Express	2015	Widening of I-95/395 HOV from 2 to 3 between VA 294 and Turkeycock Run
Little River Turnpike	2025	Widening Little River Turnpike from 4 to 6 lanes
Seminary Road	2020	Convert this signalized intersection into an ellipse

Model Runs

The selected model run years are 2010, 2020 and 2040. The 2010 model run is used as it is the base (validation) run of the model, to which the forecasts pivot off from. Five (5) model runs were performed as part of the forecasting process and are as follows:

- Year 2010 (base year)
- Year 2020 No-Build, in which all CLRP projects are considered, except for the proposed additional through lane on I-395
- Year 2020 Build, in which all CLRP projects are considered including the proposed additional through lane on I-395
- Year 2040 No-Build, in which all CLRP projects are considered, except for the proposed additional through lane on I-395
- Year 2040 Build, in which all CLRP projects are considered including the proposed additional through lane on I-395

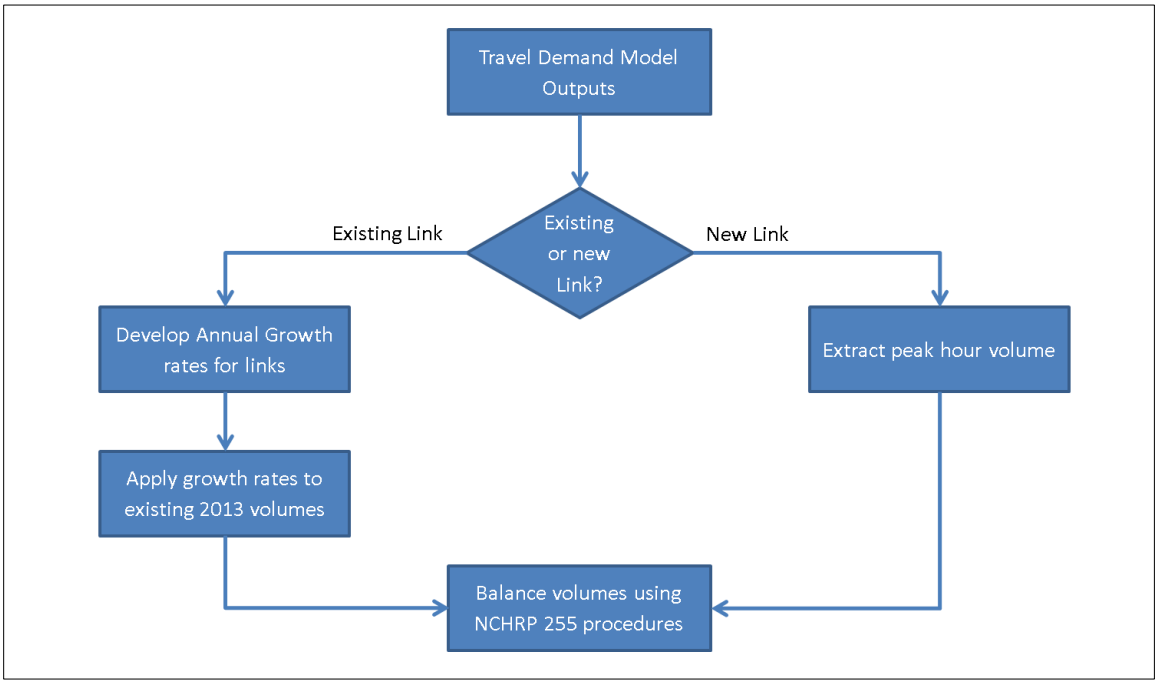
In reviewing the raw model output for AM conditions, comparing the alternatives (i.e. 2020 No-Build versus 2020 Build), the model outputs were virtually identical for the mainline links and arterials. This is to be expected, as the proposed improvement is for the southbound direction and it is not capacity-constrained during the AM peak period (i.e. it is uncongested). As such, the volumes were assumed to be the same between the No-Build and Build Alternatives for 2020 as well as 2040.

Post-Processing Methodology for Volume Forecasts

The methodology used to develop the volumes for the future years is consistent between all alternatives. The NCHRP 255[3] process was used to develop the balanced forecasts. A flowchart depicting the steps shown in Figure 1 and are described in detail below:

[3] National Cooperative Highway Research Program (NCHRP) Report 255, Highway Traffic Data for Urbanized Area Project Planning and Design, Transportation Research Board, December 1982.

Figure 2: Post-Processing Methodology for Volume Forecasts



1. Extracted the raw model volumes for the study area links for all alternatives.
    a. Each run has AM peak (3 hours), PM peak (4 hours), midday and off-peak
    b. Each period has six user classifications: SOV, HOV2, HOV3, commercial vehicles (CV), medium and heavy trucks (TRK), and airport traffic (APX).
    c. The key links for data extraction: Mainline links between interchanges/ramps, all ramps, cross arterials and side streets within the study limits
2. Developed an annual growth rate (computed linearly) link from 2010 conditions for each of the future alternatives of all study area links. Then applied the annual growth rate (applied linearly) to the 2013 existing link volumes to develop future raw link volumes. Some adjustments were made to the raw growth rates as follows
    a. In some cases, growth rates were modified if model output shows negative growth
    b. For the mainline control point, used a combine total of the HOV and GP raw model volumes for the peak period to develop the growth rate across both facilities. This was done to balance future unconstrained demand across both facilities.
    c. Ramp growth rates were set to the adjacent mainline segment, so that all off-ramps used the upstream mainline growth rate, while the on-ramps used the downstream mainline growth rates.

d. Model outputs for new links in 2020 and 2040 (i.e. future Express ramp at Turkeycock Run, and new HOV ramp at Seminary Road) were used as an initial seed, including model outputs for the turning movements for the new Seminary Road HOV ramp termini.

3. Using existing and future link volumes, and the existing intersection turning movement volumes, used NCHRP 255 procedures to develop initial intersection turning movement forecasts.
4. The next step was to balance the volumes throughout the study area:
    a. The mainline at the control point was held constant, the remaining mainline was balanced from the control point, accounting for the ramp traffic (on-ramps and off-ramps).
    b. The process to balance the cross-street intersection volumes was as follows
        i. At ramp termini, adjusted turn movements to/from ramps to balance with ramp volumes.
        ii. Balanced through volumes within the interchanges, always increasing the volumes.
        iii. Balanced cross-street volumes and adjacent intersections, always increasing the volumes.
        iv. Steps ii and iii were repeated if necessary, as the changes at one of the intersections adjacent to the interchange may create an imbalance with the rest of the cross-street intersections.
        v. The volumes were then reassigned for the Build Alternatives based on specific configuration for the two interchanges.
    c. Throughout the process, volumes were compared to other recent studies (the I-95 Express Lanes IJR and the Seminary ROAD HOV Ramp IJR) to ensure relative consistency between the studies. However, it should be noted that there will be differences in volumes as the peak hour for each study is different. If necessary, forecasts were adjusted.

Table 2 presents the annual growth rates (computed linearly) for key study area roadways. Key element is that the Express Lanes facility, including the ramps at Turkeycock Run opens to non-HOV traffic in 2015. This contributes to a shift of traffic from the General Purpose Lanes into the Express Lanes.

Table 2: Annual Growth Rates for Traffic Forecasts

Roadway	2040 No-Build AM	2040 Build AM	2040 No-Build PM	2040 Build PM
I-395 northbound	-0.1% to 0.4% *	-0.1% to 0.4% *	0.7% to 0.8%	0.7% to 0.8%
I-395 southbound	0.8% to 0.9%	0.8% to 0.9%	-0.1% to 0.4%	0.4% to 1.0%
I-395 HOV lanes	1.0% to 2.6% **	1.0% to 2.6% **	0.7% to 1.6%	0.7% to 1.7%
Duke Street	1.6%	1.6%	1.3%	1.3%
Edsall Road	0.6%	0.6%	1.6% to 1.9%	1.6% to 1.9%

Notes: rates were computed linearly

* growth is negative in the GP lanes south of the EXPRESS Lanes egress at Turkeycock Run

** growth rate drops from 2.6% south of to 1.0% north of the EXPRESS Lanes egress at Turkeycock Run, as all non-HOV vehicles must egress at this point

Comparisons to Other Studies

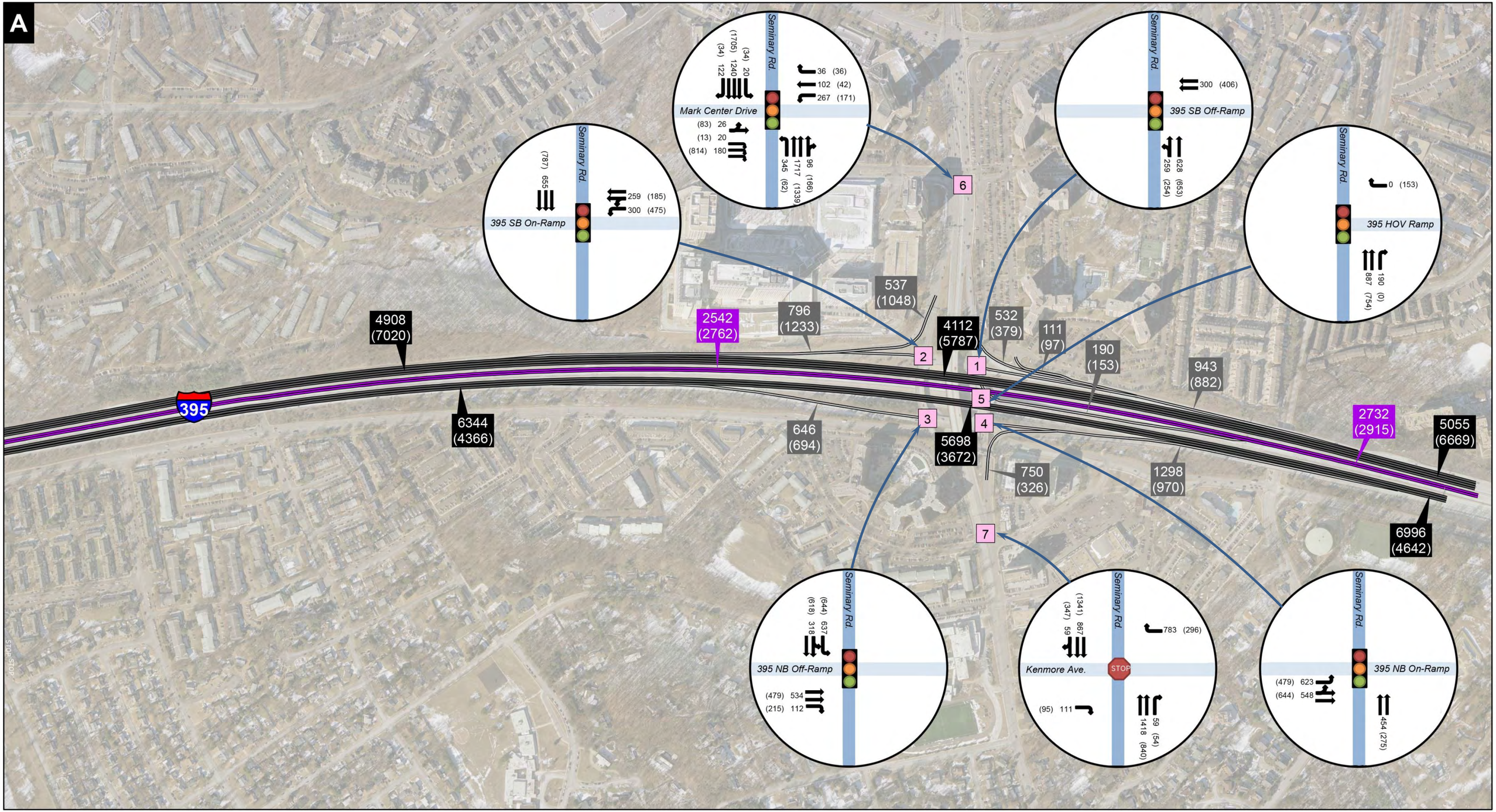
Throughout the process, volumes were compared to other recent studies (the I-95 Express Lanes IJR and the Seminary Road HOV Ramp IMR) to ensure relative consistency between the studies. Several factors exist why the volumes are not an exact match:

- Each study developed forecasts from their existing conditions volumes, which were conducted at different dates. Even over a short duration, travel patterns can change if large-scale developments occur. For example, the Seminary Road HOV Ramp IMR had an existing conditions year of 2009, while the I-95 Express Lanes IJR had an existing conditions year of 2011. The Mark Center on Seminary Road opened in 2011, with a transition period to full occupancy. This study conducted its existing conditions data collection in November 2013, well after the full occupancy and equilibrium period (meaning once a building is occupied, there is a period where traffic patterns re-establish as employees adjust to their new work location.

- Studies have different horizon years. The other two studies have a horizon year of 2035, while this study has a horizon year of 2040.

- Each study may have a different peak hour. The Seminary Road HOV Ramp IMR was focused solely on operations of Seminary Road and at the interchange, while the I-95 Express Lanes IJR was focus on a corridor nearly 30 miles long with multiple interchanges. This study was examining the peak hour of the southbound direction of I-395 from Seminary Road to the Capital Beltway. Each study had a different study area or limits; as such, the dynamics of travel pattern varies between each study focus.

A



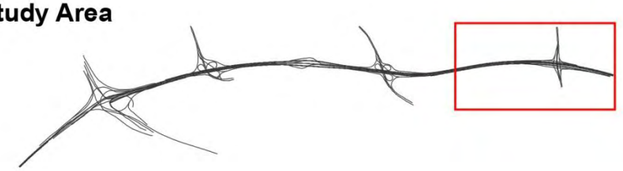
Legend

- General Purpose Lane
- HOV Lane
- Ramp
- XXXX (XXXX) — AM Peak Hour Volume (PM Peak Hour Volume)
- 1 — Intersection
- Signalized Control
- STOP — Unsignalized Control

NORTH

0 0.05 0.1 0.2 Miles

Study Area

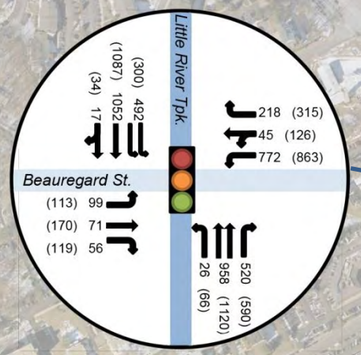


VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

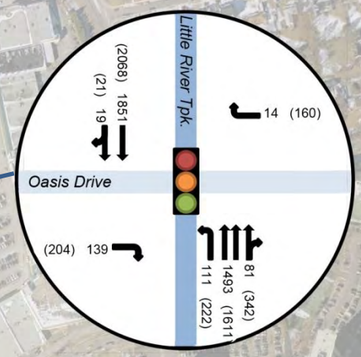
Existing (2013) Peak Hour Volumes

B

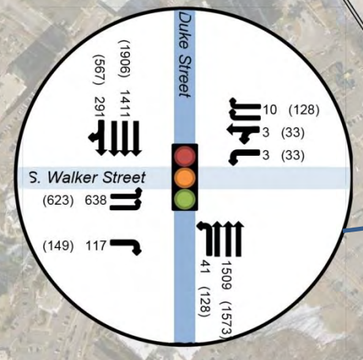


8

9



4894 (5885)
0 (686)
0 (123)
4894 (6571)
5656 (4114)
101 (0)
395
4464 (6079)
430 (492)
497 (682)
4961 (6761)
528 (485)
4433 (6276)
86 (144)
475 (744)
247 (450)
5409 (3664)
278 (368)
5131 (3296)
1213 (1070)
6344 (4366
602 (439)
611 (631)



10

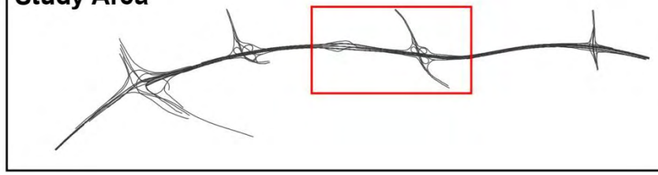
Legend

- General Purpose Lane
- HOV Lane
- Ramp
- XXXX (XXXX) AM Peak Hour Volume (PM Peak Hour Volume)
- 1 Intersection
- Signalized Control
- STOP Unsignalized Control

NORTH

0 0.05 0.1 0.2 Miles

Study Area

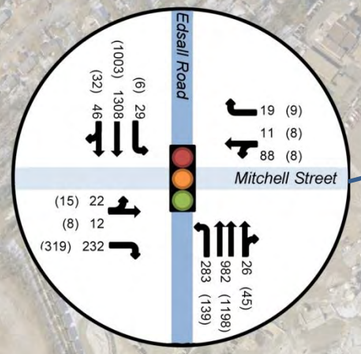


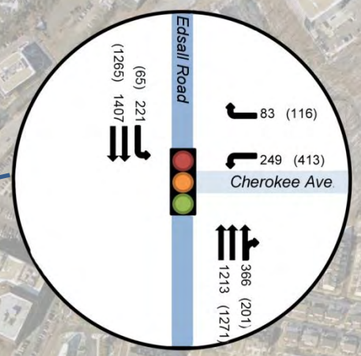
VDOT HNTB

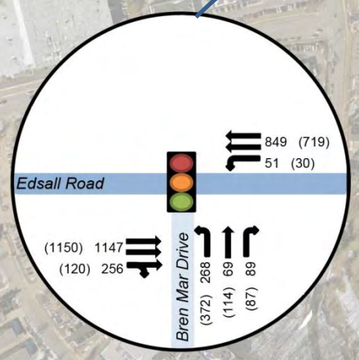
I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

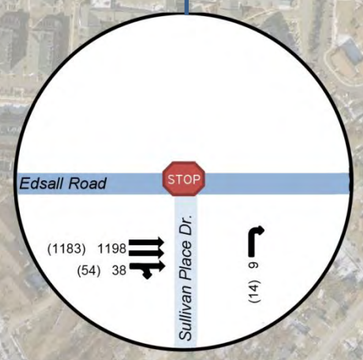
Existing (2013) Peak Hour Volumes

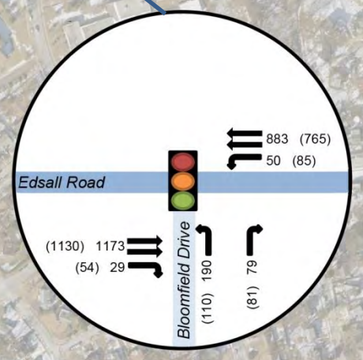
C

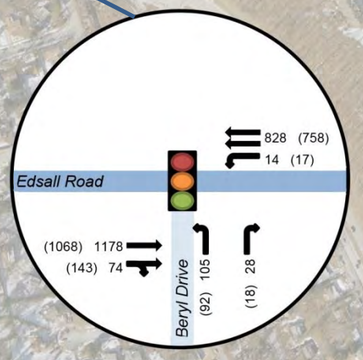












11 12 13 14 15 16

4894 (6008)
5757 (4114)
4507 (5522)
5052 (6079)
545 (557)
477 (447)
387 (486)
456 (726)
4855 (5903)
197 (176)
5311 (6629)
2441 (3325)
3486 (4214)
6486 (4582)
5658 (3879)
828 (703)
620 (452)
5038 (3427)
719 (687)
242 (240)
483 (589)
345 (114)
528 (968)
1297 (1447)
91 (88)
1128 (1683)
4804 (2286)
554 (613)

Legend

General Purpose Lane
HOV Lane
Ramp

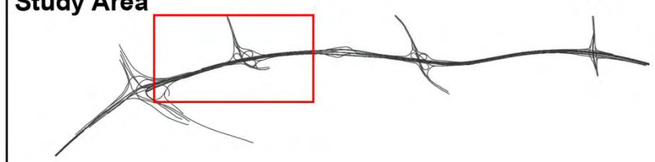
XXXX AM Peak Hour Volume
(XXXX) (PM Peak Hour Volume)

1 Intersection
Signalized Control
STOP Unsignalized Control

NORTH

0 0.05 0.1 0.2 Miles

Study Area



VDOT
HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Existing (2013) Peak Hour Volumes

D

5311
(6629)

3486
(4214)

6486
(4582)

528
(968)

2350
(3237)

1297
(1447)

2448
(2607)

1038
(1607)

91
(88)

1626
(2122)

4804
(2286)

353
(451)

554
(613)

1128
(1683)

1900
(1897)

2703
(3688)

4074
(4729)

5974
(6626)

NO AERIAL IMAGERY AVAILABLE

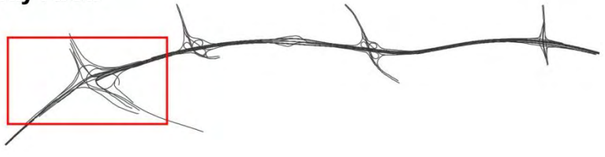
Legend

- General Purpose Lane
- HOV Lane
- Ramp
- **XXXX** AM Peak Hour Volume
- **(XXXX)** (PM Peak Hour Volume)
- 1 Intersection
- Signalized Control
- STOP Unsignalized Control

NORTH

0 0.05 0.1 0.2 Miles

Study Area

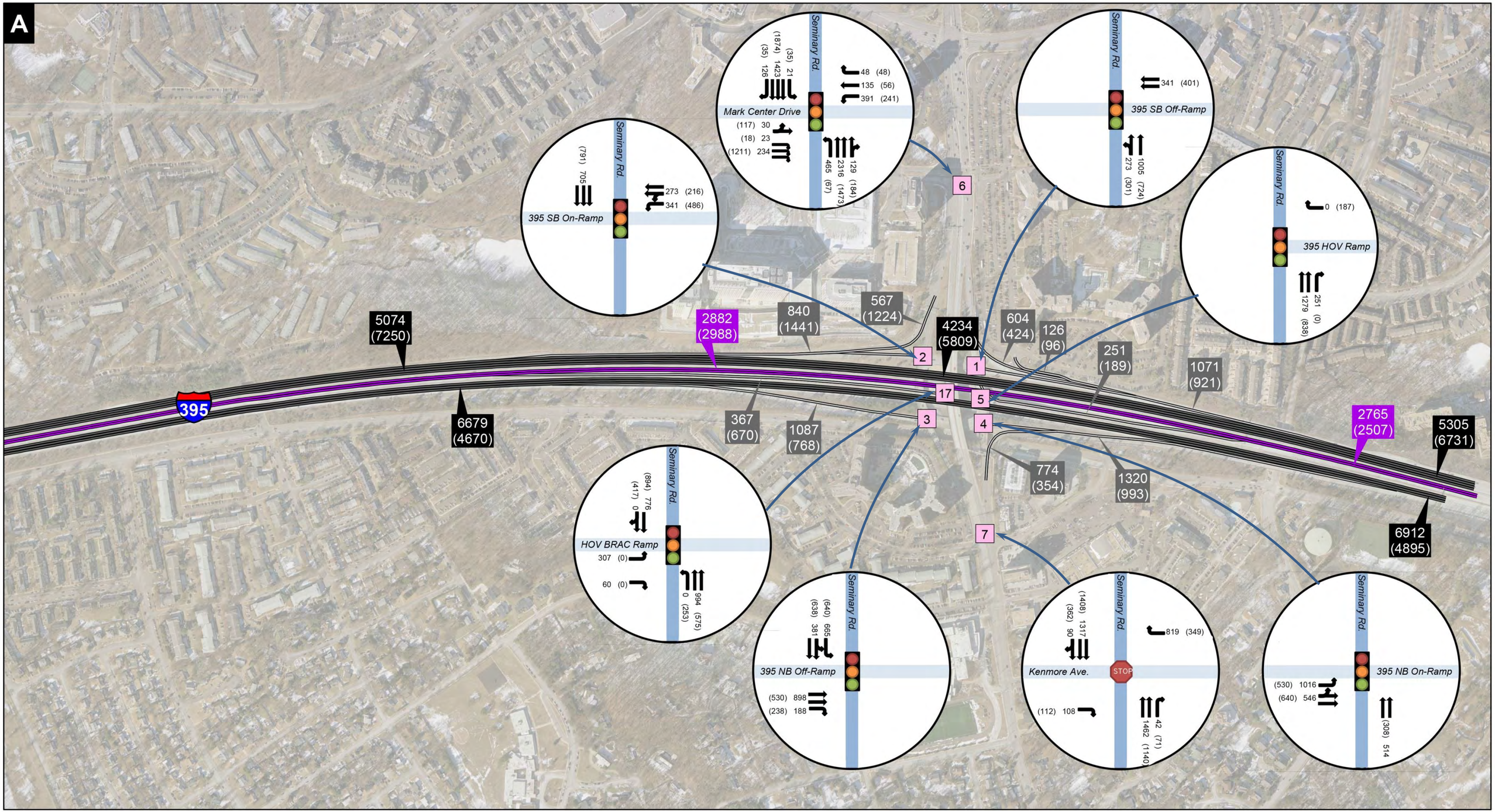


VDOT
HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Existing (2013) Peak Hour Volumes

A



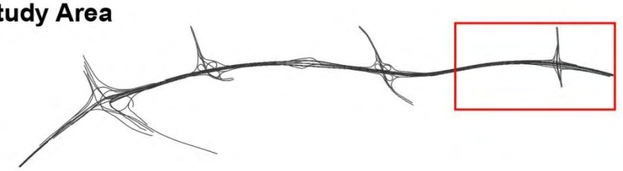
Legend

- General Purpose Lane
- HOV Lane
- Ramp
- XXXX (XXXX): AM Peak Hour Volume (PM Peak Hour Volume)
- 1: Intersection
- Signalized Control
- STOP: Unsignalized Control

NORTH

0 0.05 0.1 0.2 Miles

Study Area

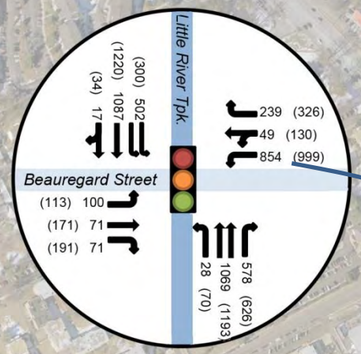


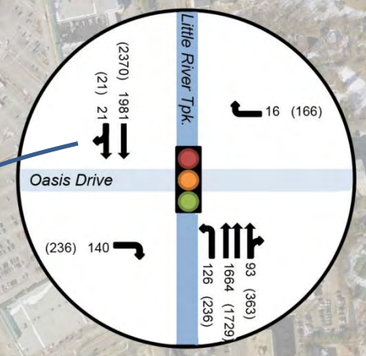
VDOT HNTB

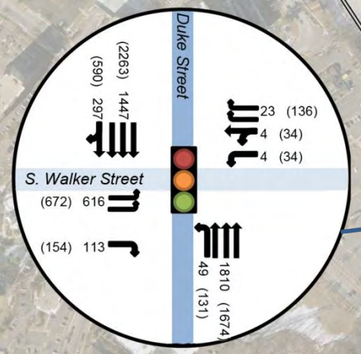
I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

No Build (2020) Peak Hour Volumes

B







8

9

10

3655 (4196)

5081 (5350)

0 (1374)

0 (166)

5081 (6724)

103 (0)

876 (0)

5834 (4384)

4625 (6144)

456 (579)

2882 (2988)

514 (721)

5139 (6866)

559 (508)

402 (744)

92 (148)

495 (892)

713 (478)

278 (583)

313 (396)

1436 (1265)

723 (786)

395

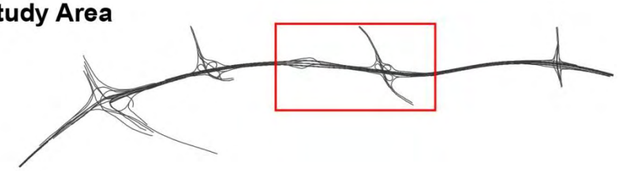
Legend

- General Purpose Lane
- HOV Lane
- Ramp
- XXXX (XXXX) AM Peak Hour Volume (PM Peak Hour Volume)
- 1 Intersection
- Signalized Control
- STOP Unsignalized Control

NORTH

0 0.05 0.1 0.2 Miles

Study Area

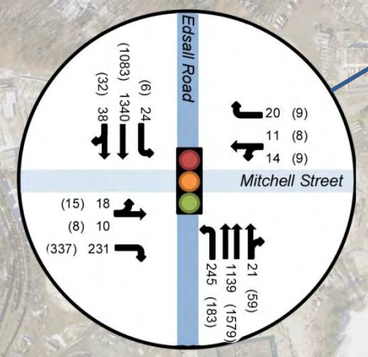


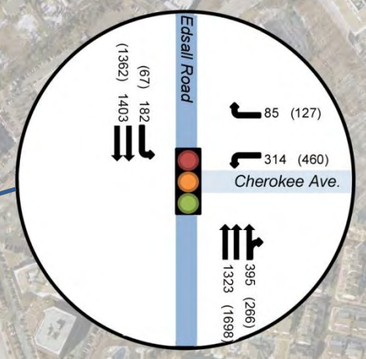
VDOT HNTB

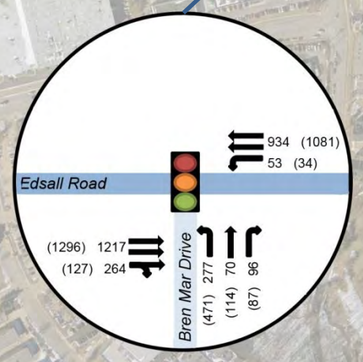
I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

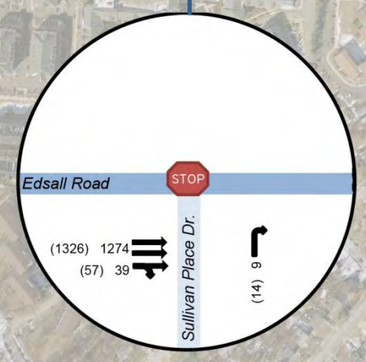
No Build (2020) Peak Hour Volumes

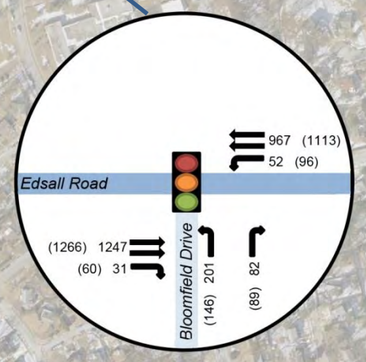
C

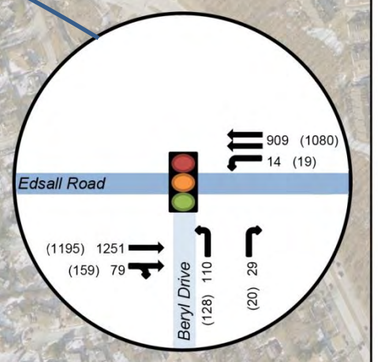












11 12 13 14 15 16

487 (481)
410 (513)
5225 (5584)
554 (581)
465 (734)
209 (187)
5081 (5516)
5061 (4384)
5481 (6132)
652 (481)
738 (739)
251 (259)
3655 (4196)
870 (750)
362 (121)
507 (628)
3605 (3901)
5844 (4876)
543 (750)
1333 (1482)
3104 (3276)
4138 (2426)
536 (663)
1171 (1787)

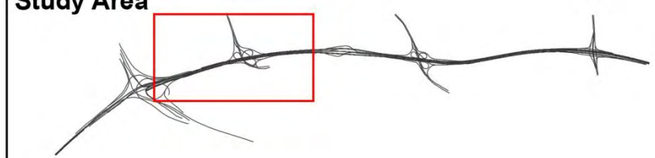
Legend

- General Purpose Lane
- HOV Lane
- Ramp
- XXXX (XXXX): AM Peak Hour Volume (PM Peak Hour Volume)
- 1: Intersection
- Signalized Control
- STOP: Unsignalized Control

NORTH

0 0.05 0.1 0.2 Miles

Study Area



VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

No Build (2020) Peak Hour Volumes

D

5481
(6132)

3605
(3901)

1067
(1696)

543
(750)

1333
(1482)

5844
(4876)

3104
(3276)

2538
(2205)

551
(919)

1967
(2500)

4138
(2426)

536
(663)

1122
(1276)

1171
(1787)

1932
(1732)

4226
(4553)

4505
(4705)

6437
(6437)

NO AERIAL IMAGERY AVAILABLE

Legend

- General Purpose Lane
- HOV Lane
- Ramp
- XXXX (XXXX) AM Peak Hour Volume (PM Peak Hour Volume)
- 1 Intersection
- Signalized Control
- STOP Unsignalized Control

NORTH

0 0.05 0.1 0.2 Miles

Study Area

VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

No Build (2020) Peak Hour Volumes

A

Seminary Road
705 (782)
395 SB On-Ramp
273 (233)
341 (486)

Seminary Road
126 (35)
1423 (1937)
21 (35)
48 (48)
135 (56)
391 (249)
Mark Center Drive
30 (117)
23 (18)
234 (1249)
465 (67)
2316 (1473)
129 (184)

Seminary Road
341(401)
395 SB Off-Ramp
273 (318)
1005 (724)

Seminary Road
0 (187)
395 HOV Ramp
1279 (855)
251 (0)

5074 (7875)
6679 (4670)
2882 (2988)
840 (1566)
567 (1331)
4234 (6309)
604 (424)
126 (96)
251 (189)
1071 (921)
367 (670)
1087 (768)
774 (354)
1320 (993)
2765 (2507)
5305 (7230)
6912 (4895)
395
1
2
3
4
5
6
7
17

Seminary Road
0 (417)
776 (906)
HOV BRAC Ramp
307 (0)
60 (0)
0 (253)
994 (575)

Seminary Road
381 (624)
665 (640)
395 NB Off-Ramp
898 (530)
188 (238)

Seminary Road
90 (362)
1317 (1406)
819 (355)
Kenmore Avenue
STOP
108 (112)
1462 (1151)
42 (71)

Seminary Road
395 NB On-Ramp
1016 (530)
546 (640)
514 (325)

Source: Esri, DigitalGlobe, GeoEy... ...NES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

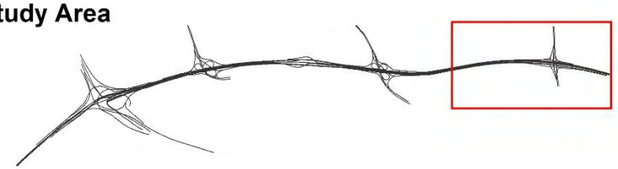
Legend

- General Purpose Lane
- HOV Lane
- Ramp
- XXXX (XXXX) — AM Peak Hour Volume (PM Peak Hour Volume)
- 1 — Intersection
- Signalized Control
- STOP — Unsignalized Control

NORTH

0 0.05 0.1 0.2 Miles

Study Area

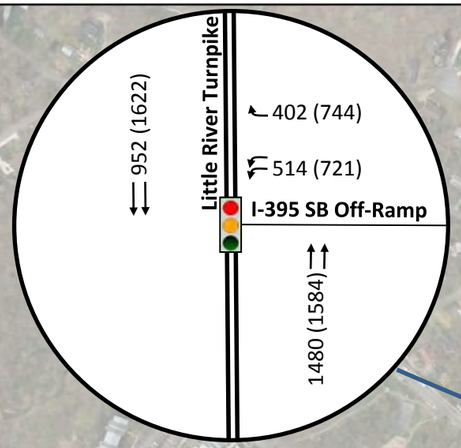


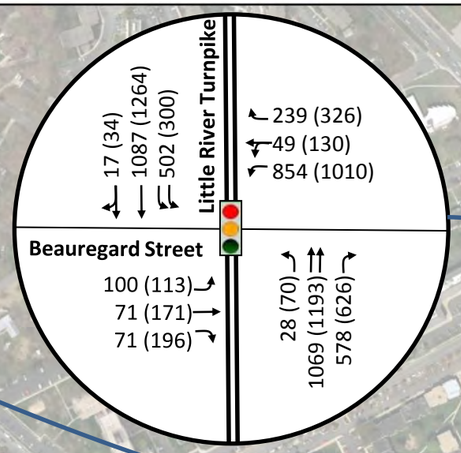
VDOT HNTB

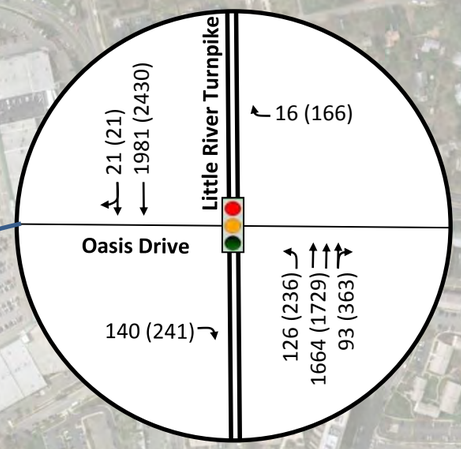
I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Build (2020) Peak Hour Volumes

B







Source: Esri, Digi... Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

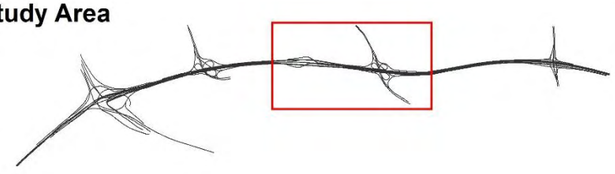
Legend

- General Purpose Lane
- HOV Lane
- Ramp
- XXXX (XXXX) — AM Peak Hour Volume (PM Peak Hour Volume)
- 1 — Intersection
- Signalized Control
- STOP — Unsignalized Control

NORTH

0 0.05 0.1 0.2 Miles

Study Area



VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Build (2020) Peak Hour Volumes

2 of 4

C

Edsall Road
Mitchell Street
38 (32)
1340 (1082)
24 (6)
20 (9)
11 (8)
14 (9)
18 (15)
10 (8)
231 (337)
245 (193)
1139 (1617)
21 (64)

Edsall Road
Cherokee Avenue
1403 (1361)
182 (67)
85 (127)
314 (459)
1323 (1751)
395 (281)

Edsall Road
I-395 SB On-Ramp
465 (734)
765 (605)
554 (581)
1308 (1452)

Edsall Road
Ben Mar Drive
934 (1081)
53 (34)
1217 (1311)
264 (135)
96 (87)
70 (114)
277 (471)

Edsall Road
Sullivan Place Drive
STOP
987 (1115)
1274 (1338)
39 (60)
9 (14)

Edsall Road
Bloomfield Drive
967 (1113)
52 (96)
1247 (1276)
31 (62)
82 (89)
201 (146)

Edsall Road
Beryl Drive
909 (1080)
14 (19)
1251 (1203)
79 (161)
29 (20)
110 (128)

11
12
13
14
15
16
19

410 (581)
209 (211)
4671 (5444)
487 (481)
1019 (1315)
4462 (5444)
5081 (6236)
5061 (4384)
5481 (6759)
652 (481)
738 (739)
362 (121)
870 (750)
251 (259)
3655 (4231)
507 (628)
3605 (4300)
1333 (1633)
543 (827)
5844 (4876)
3104 (3311)
(919)
4138 (2426)
536 (663)
1171 (1787)

Source: Esri, DigitalGlobe, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Basemapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User

Legend

- General Purpose Lane
- HOV Lane
- Ramp
- XXXX (XXXX) AM Peak Hour Volume (PM Peak Hour Volume)
- 1 Intersection
- Signalized Control
- STOP Unsignalized Control

NORTH

0 0.05 0.1 0.2 Miles

Study Area

VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Build (2020) Peak Hour Volumes

3 of 4

D

5481 (6759)
3605 (4300)
5844 (4876)
1067 (1867)
543 (827)
1333 (1633)
3104 (3311)
2538 (2432)
1967 (2500)
551 (919)
4138 (2426)
536 (663)
1122 (1276)
1171 (1787)
1932 (1732)
4226 (4588)
4505 (4932)
6437 (6665)

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

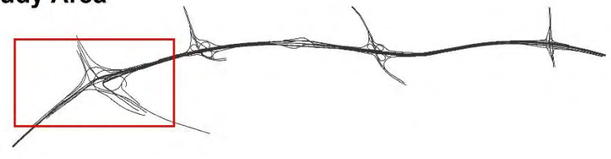
Legend

- General Purpose Lane
- HOV Lane
- Ramp
- XXXX (XXXX) AM Peak Hour Volume (PM Peak Hour Volume)
- 1 Intersection
- Signalized Control
- STOP Unsignalized Control

NORTH

0 0.05 0.1 0.2 Miles

Study Area



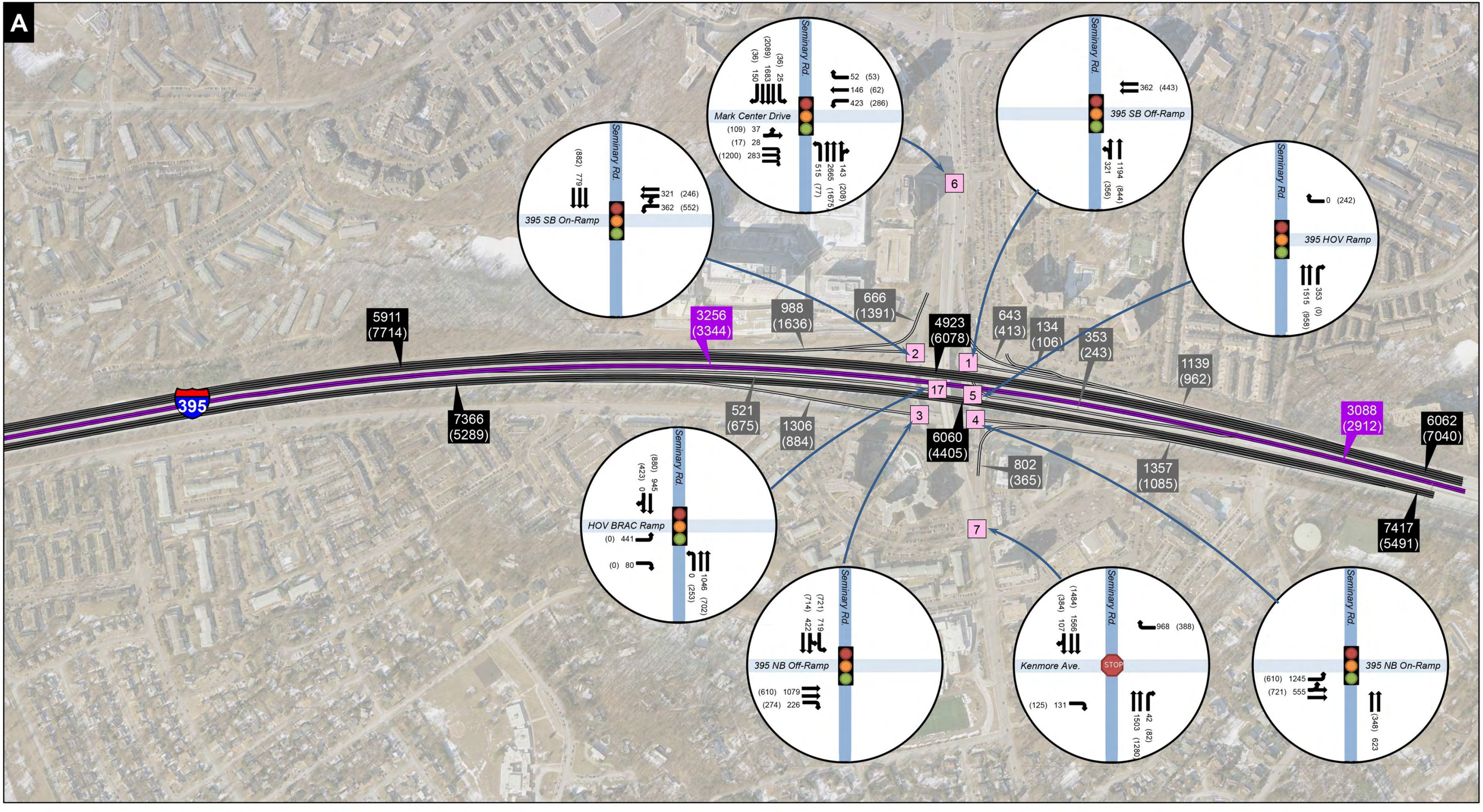
VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Build (2020) Peak Hour Volumes

4 of 4

A



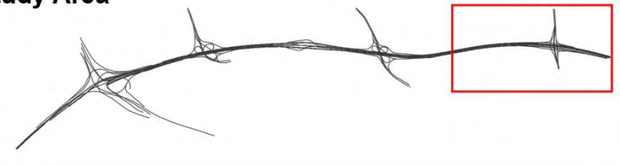
Legend

- General Purpose Lane
- HOV Lane
- Ramp
- XXXX (AM Peak Hour Volume)
- (XXXX) (PM Peak Hour Volume)
- 1 Intersection
- Signalized Control
- STOP Unsignalized Control

NORTH

0 0.05 0.1 0.2 Miles

Study Area

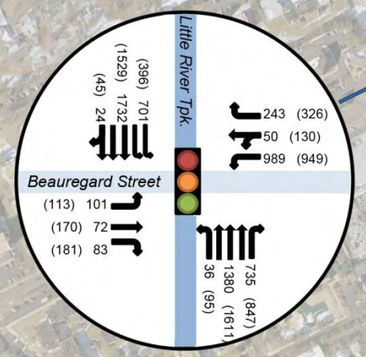


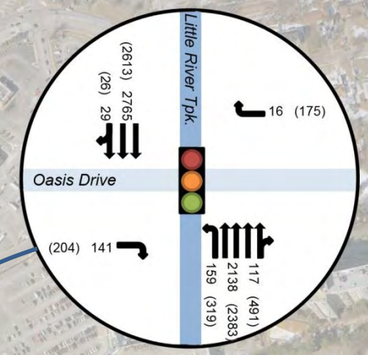
VDOT HNTB

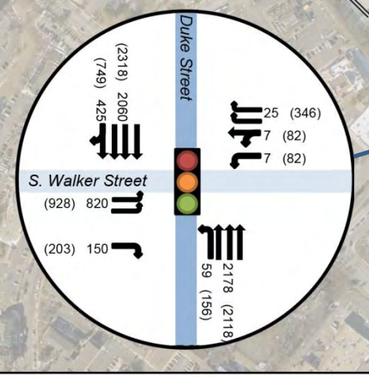
I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

No Build (2040) Peak Hour Volumes

B







8

9

10

4185 (4807)

6010 (5484)

0 (1664)

0 (201)

6010 (7148)

155 (0)

1083 (0)

6418 (4928)

3256 (3344)

5476 (6563)

534 (585)

709 (549)

676 (514)

558 (746)

6034 (7310)

471 (766)

81 (152)

553 (918)

313 (439)

6140 (4290)

278 (637)

711 (889)

1539 (1438)

5827 (3851)

7366 (5289

395

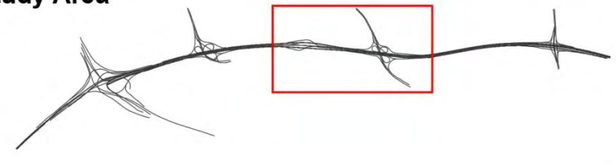
Legend

- General Purpose Lane
- HOV Lane
- Ramp
- XXXX (XXXX) AM Peak Hour Volume (PM Peak Hour Volume)
- 1 Intersection
- Signalized Control
- STOP Unsignalized Control

NORTH

0 0.05 0.1 0.2 Miles

Study Area

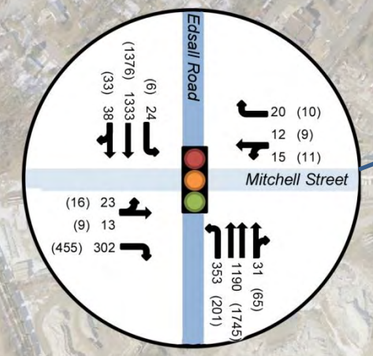


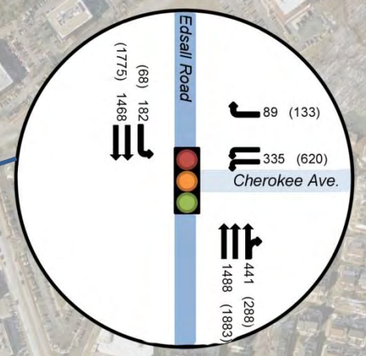
VDOT HNTB

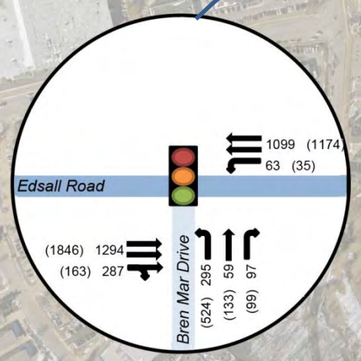
I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

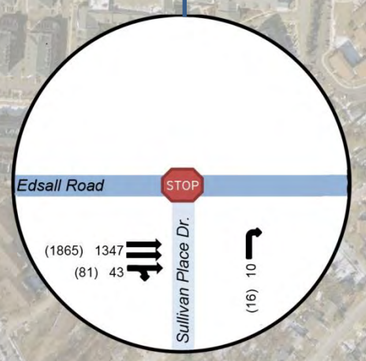
No Build (2040) Peak Hour Volumes

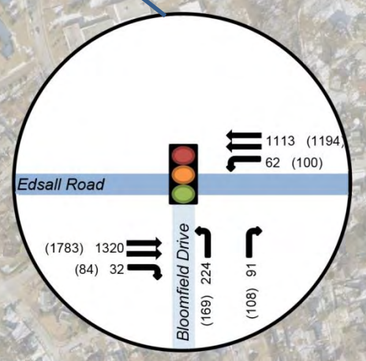
C

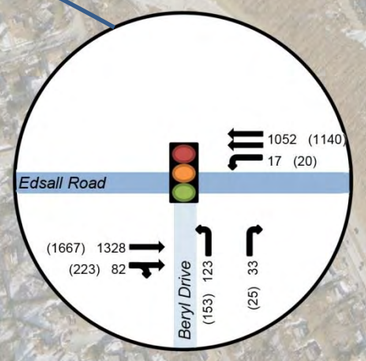












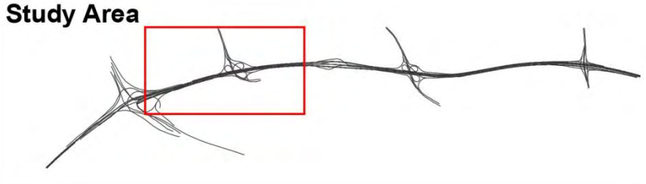
Legend

- General Purpose Lane
- HOV Lane
- Ramp
- XXXX AM Peak Hour Volume
- (XXXX) (PM Peak Hour Volume)
- 1 Intersection
- Signalized Control
- STOP Unsignalized Control

NORTH

0 0.05 0.1 0.2 Miles

Study Area



VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

No Build (2040) Peak Hour Volumes

D

6427
(6314)

4099
(3993)

1275
(1810)

649
(662)

1679
(1658)

6251
(5492)

3195
(3856)

2823
(2183)

990
(951)

2254
(3045)

4579
(2646)

483
(783)

1292
(1736)

1189
(2064)

1664
(1570)

4487
(5592)

5077
(5229)

6741
(6799)

NO AERIAL IMAGERY AVAILABLE

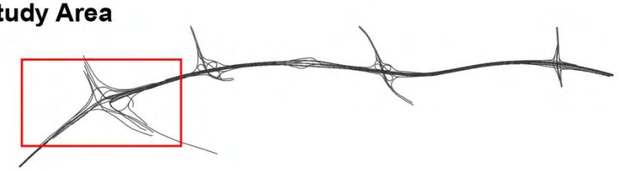
Legend

- General Purpose Lane
- HOV Lane
- Ramp
- XXXX (XXXX) AM Peak Hour Volume (PM Peak Hour Volume)
- 1 Intersection
- Signalized Control
- STOP Unsignalized Control

NORTH

0 0.05 0.1 0.2 Miles

Study Area



VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

No Build (2040) Peak Hour Volumes

A

Seminary Road
779 (882)
321 (278)
362 (552)
395 SB On-Ramp

Seminary Road
150 (36)
1683 (2200)
25 (36)
52 (53)
146 (62)
423 (299)
Mark Center Drive
37 (109)
28 (17)
283 (1253)
515 (77)
2665 (1675)
143 (208)

Seminary Road
362 (443)
395 SB Off-Ramp
321 (388)
1194 (844)

Seminary Road
0 (243)
395 HOV Ramp
1515 (990)
353 (0)

5938 (8676)
7163 (5289)
3256 (3344)
988 (1846)
666 (1569)
4950 (6830)
643 (413)
134 (106)
353 (243)
1139 (962)
521 (675)
1306 (884)
5857 (4405)
802 (365)
1357 (1085)
3088 (2912)
6089 (7791)
7214 (5491)

1 2 3 4 5 6 7 17

Seminary Road
0 (423)
945 (880)
HOV BRAC Ramp
441 (0)
80 (0)
0 (253)
1046 (702)

Seminary Road
422 (714)
719 (721)
395 NB Off-Ramp
1079 (610)
226 (274)

Seminary Road
107 (384)
1566 (1484)
968 (395)
Kenmore Avenue
STOP
131 (125)
1503 (1305)
42 (82)

Seminary Road
395 NB On-Ramp
1245 (610)
555 (721)
623 (380)

Source: Esri, DigitalGlobe, Geo… CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

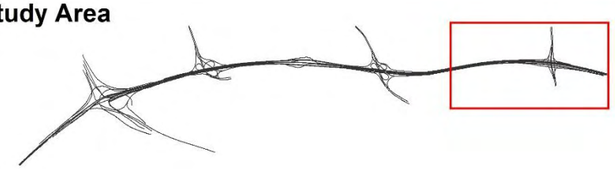
Legend

- General Purpose Lane
- HOV Lane
- Ramp
- XXXX (XXXX) AM Peak Hour Volume (PM Peak Hour Volume)
- 1 Intersection
- Signalized Control
- STOP Unsignalized Control

NORTH

0 0.05 0.1 0.2 Miles

Study Area



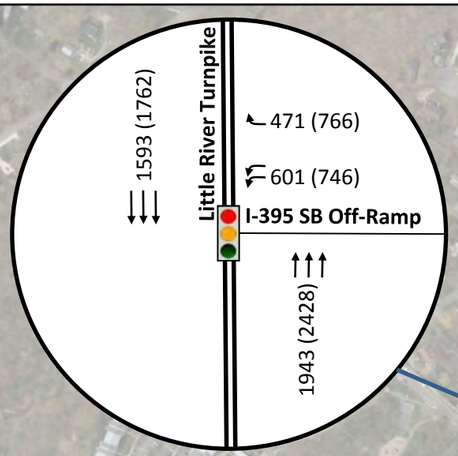
VDOT HNTB

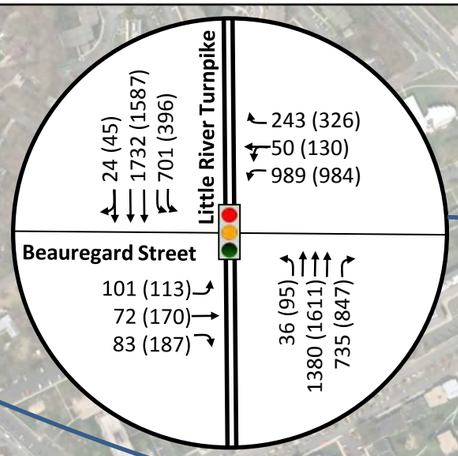
I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

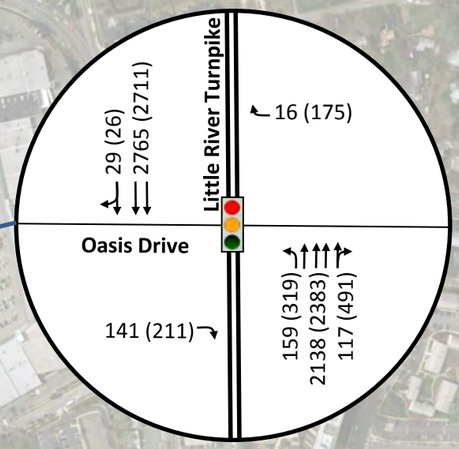
Build (2040) Peak Hour Volumes

1 of 4

B







Source: Esri, Dig Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

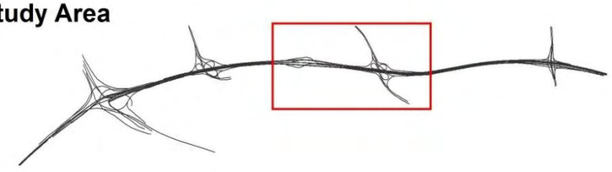
Legend

- General Purpose Lane
- HOV Lane
- Ramp
- XXXX (XXXX) — AM Peak Hour Volume (PM Peak Hour Volume)
- 1 — Intersection
- Signalized Control
- STOP — Unsignalized Control

NORTH

0 0.05 0.1 0.2 Miles

Study Area



VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Build (2040) Peak Hour Volumes

2 of 4

C

Edsall Road & Mitchell Street
38 (33)
1333 (1372)
24 (6)
20 (10)
12 (9)
15 (11)
23 (16)
13 (9)
302 (454)
353 (212)
1190 (1812)
31 (69)

Edsall Road & Cherokee Avenue
1468 (1770)
182 (68)
89 (133)
335 (618)
1488 (1965)
441 (310)

Edsall Road & I-395 SB On-Ramp
539 (748)
802 (1106)
643 (592)
1435 (1649)

Edsall Road & Beryl Drive
1052 (1152)
17 (20)
1328 (1682)
82 (225)
123 (146)
33 (25)

Edsall Road & Ben Mar Drive
1099 (1174)
63 (35)
1294 (1872)
287 (168)
59 (133)
295 (524)
97 (99)

Edsall Road & Sullivan Place Drive (STOP)
1162 (1209)
1347 (1885)
43 (86)
10 (16)

Edsall Road & Bloomfield Drive
1113 (1199)
62 (100)
1320 (1800)
32 (87)
224 (164)
91 (108)

11 12 13 14 15 16 19

252 (228)
494 (626)
461 (534)
5516 (6196)
6010 (6822)
1182 (1340)
5264 (5969)
6446 (7309)
4185 (4842)
903 (843)
684 (542)
376 (137)
233 (287)
694 (820)
4083 (4622)
6251 (5492)
1679 (1920)
990 (951)
1189 (2064)
483 (783)

Source: Esri, Community

Legend
- General Purpose Lane
- HOV Lane
- Ramp
- XXXX (XXXX): AM Peak Hour Volume (PM Peak Hour Volume)
- 1: Intersection
- Signalized Control
- STOP: Unsignalized Control

NORTH
0 0.05 0.1 0.2 Miles

Study Area

VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Build (2040) Peak Hour Volumes

3 of 4

D

6446 (7309)

4083 (4622)

6251 (5492)

1679 (1920)

1275 (2096)

3195 (3891)

684 (766)

2808 (2527)

990 (951)

2438 (3045)

4579 (2646)

1292 (1736)

483 (783)

1189 (2064)

1903 (1570)

4487 (5627)

5247 (5572)

7150 (7142)

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

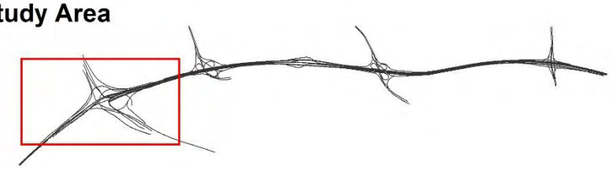
Legend

- General Purpose Lane
- HOV Lane
- Ramp
- XXXX (XXXX) AM Peak Hour Volume (PM Peak Hour Volume)
- 1 Intersection
- Signalized Control
- STOP Unsignalized Control

NORTH

0 0.05 0.1 0.2 Miles

Study Area



VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Build (2040) Peak Hour Volumes

4 of 4

A

NORTH

85,300
32,000
13,000
72,300
12,000
79,000
12,000
67,000
2,500
12,000
84,300
34,500
79,000
395
SEMINARY ROAD
420

Annual Average Daily Traffic (AADT)

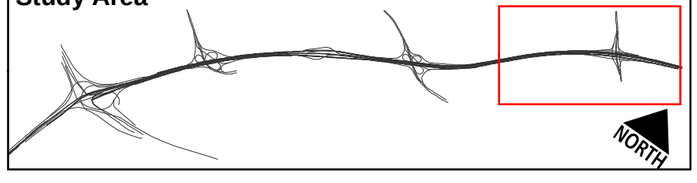
GP Lane AADT

HOV Lane AADT

Ramp AADT

0 0.05 0.1 Miles

Study Area



VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Existing (2013) Average Daily Traffic

B

NORTH

LITTLE RIVER TURNPIKE

77,000
31,600
73,900
3,700
3,100
74,700
1,000
73,700
77,600
32,000
8,100
6,700
66,300
11,600
82,500
7,600
7,400
2,200
Quantrell Avenue
74,900
10,400
5,800
60,500
32,000
10,400
236
DUKE STREET

Annual Average Daily Traffic (AADT)

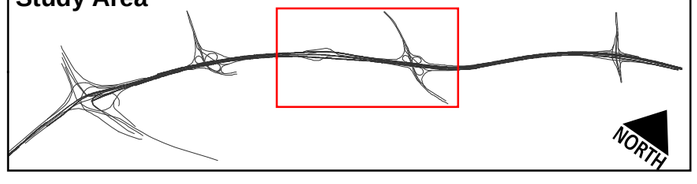
GP Lane AADT

HOV Lane AADT

Ramp AADT

0 0.05 0.1 Miles

Study Area



VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Existing (2013) Average Daily Traffic

C

NORTH

EDSALL ROAD

6,100

8,000

6,200

7,900

31,600

77,000

78,700

3,200

74,700

65,100

7,600

83,500

72,700

3,500

31,600

9,300

Bren Mar Drive

648

82,000

Annual Average Daily Traffic (AADT)

GP Lane AADT

HOV Lane AADT

Ramp AADT

0 0.05 0.1 Miles

Study Area

NORTH

VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Existing (2013) Average Daily Traffic

A

NORTH

14,000
75,200
89,200
35,000
31,900
12,300
3,100
13,500
70,800
84,300
2,900
12,700
87,500
34,800
83,500

395

SEMINARY ROAD

420

Annual Average Daily Traffic (AADT)

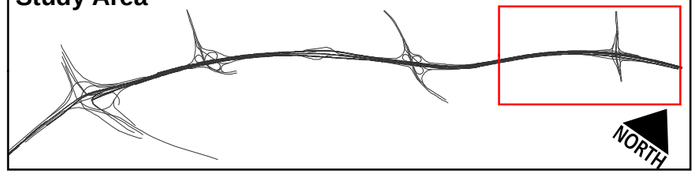
GP Lane AADT

HOV Lane AADT

Ramp AADT

0 0.05 0.1 Miles

Study Area



VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

No-Build (2020) Average Daily Traffic

B

NORTH

LITTLE RIVER TURNPIKE

80,000
36,800
76,800
4,200
3,200
78,300
1,000
78,600
1,800
81,000
79,100
35,000
8,600
7,400
12,600
86,200
8,300
2,400
77,900
Quantrell Avenue
11,300
71,000
8,100
6,400
64,600
35,000
11,100
236
DUKE STREET

Annual Average Daily Traffic (AADT)

GP Lane AADT

HOV Lane AADT

Ramp AADT

0 0.05 0.1 Miles

Study Area

NORTH

VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

No-Build (2020) Average Daily Traffic

C

NORTH

EDSALL ROAD

6,100

8,300

6,300

80,000

36,800

8,200

81,900

3,200

78,300

68,600

7,800

87,000

76,400

3,600

36,800

9,600

Bren Mar Drive

648

86,000

Annual Average Daily Traffic (AADT)

GP Lane AADT

HOV Lane AADT

Ramp AADT

0 0.05 0.1 Miles

Study Area

NORTH

VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

No-Build (2020) Average Daily Traffic

A

NORTH

90,000
35,000
14,400
75,600
31,900
12,300
84,300
3,100
13,500
70,800
2,900
12,700
87,900
34,800
83,500
395
SEMINARY ROAD
420

Annual Average Daily Traffic (AADT)

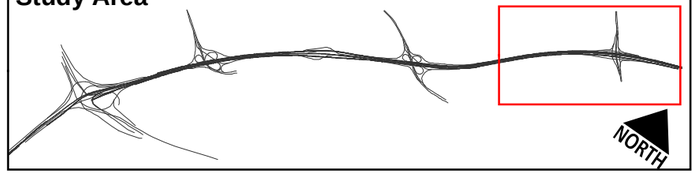
GP Lane AADT

HOV Lane AADT

Ramp AADT

0 0.05 0.1 Miles

Study Area



VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Build (2020) Average Daily Traffic

B

NORTH

LITTLE RIVER TURNPIKE

80,900
36,900
70,200
4,300
3,200
74,500
8,700
7,500
2,400
Quantrell Avenue
78,300
1,000
77,300
1,800
79,100
35,000
8,400
66,100
23,900
71,000
8,100
6,400
35,000
64,600
DUKE STREET
236
11,000

Source: Esri, DigitalGlobe, GeoEye Community

Annual Average Daily Traffic (AADT)

GP Lane AADT

HOV Lane AADT

Ramp AADT

0 0.05 0.1 Miles

Study Area

NORTH

VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Build (2020) Average Daily Traffic

C

EDSALL ROAD

NORTH

6,100

16,500

3,300

74,500

6,400

80,900

36,900

68,600

78,300

7,800

87,700

76,400

3,600

36,900

9,600

Bren Mar Drive

648

86,000

Source: Esri, DigitalGlobe, GeoEye Community

Annual Average Daily Traffic (AADT)

GP Lane AADT

HOV Lane AADT

Ramp AADT

0 0.05 0.1 Miles

Study Area

NORTH

VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Build (2020) Average Daily Traffic

A

NORTH

102,100
37,600
97,500
17,500
6,100
18,500
84,600
79,000
31,500
13,400
4,200
15,100
98,000
35,700
94,100
395
420
SEMINARY ROAD

Annual Average Daily Traffic (AADT)

GP Lane AADT

HOV Lane AADT

Ramp AADT

0 0.05 0.1 Miles

Study Area

NORTH

VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

No-Build (2040) Average Daily Traffic

B

NORTH

LITTLE RIVER TURNPIKE

90,200
42,200
86,500
5,900
3,700
90,600
1,200
89,400
3,600
92,400
93,000
37,600
10,600
9,600
15,800
98,600
10,700
82,400
10,600
8,400
3,000
Quantrell Avenue
87,900
14,200
37,600
74,000
12,900
DUKE STREET
236

Annual Average Daily Traffic (AADT)

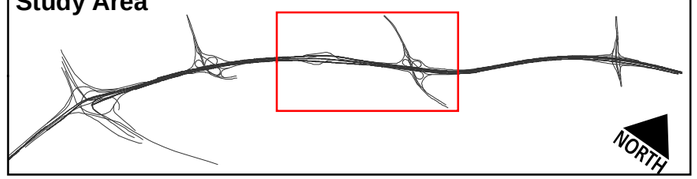
GP Lane AADT

HOV Lane AADT

Ramp AADT

0 0.05 0.1 Miles

Study Area



VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

No-Build (2040) Average Daily Traffic

C

NORTH

EDSALL ROAD

6,300

9,100

6,600

90,200

42,200

9,000

92,600

3,400

90,600

80,600

8,500

98,300

89,100

3,700

42,200

10,400

Bren Mar Drive

648

99,500

Annual Average Daily Traffic (AADT)

GP Lane AADT

HOV Lane AADT

Ramp AADT

0 0.05 0.1 Miles

Study Area

NORTH

VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

No-Build (2040) Average Daily Traffic

A

NORTH

105,600

37,600

97,500

19,200

6,100

18,500

86,400

79,000

31,500

13,400

4,200

15,100

99,800

35,700

94,100

395

SEMINARY ROAD

420

Annual Average Daily Traffic (AADT)

GP Lane AADT

HOV Lane AADT

Ramp AADT

0 0.05 0.1 Miles

Study Area

NORTH

VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Build (2040) Average Daily Traffic

B

NORTH

LITTLE RIVER TURNPIKE

94,200
42,400
80,500
6,100
3,700
86,600
10,600
10,000
3,000
Quantrell Avenue
90,600
1,200
89,400
3,600
93,000
37,600
11,000
75,600
30,000
82,400
10,600
8,400
37,600
74,000
12,900
236
DUKE STREET

Source: Esri, DigitalGlobe, GeoEye Community

Annual Average Daily Traffic (AADT)

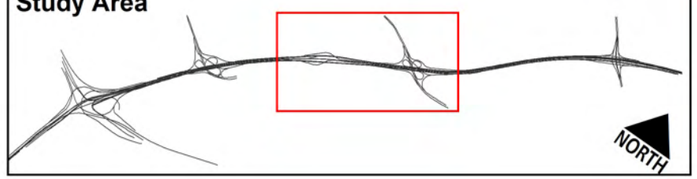
GP Lane AADT

HOV Lane AADT

Ramp AADT

0 0.05 0.1 Miles

Study Area



VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Build (2040) Average Daily Traffic

C

EDSALL ROAD

NORTH

6,300

18,100

7,000

94,200

42,400

87,200

3,700

90,600

80,600

8,500

101,600

89,100

3,700

42,400

10,400

Bren Mar Drive

648

99,500

Source: Esri, DigitalGlobe, GeoEye Community

Annual Average Daily Traffic (AADT)

GP Lane AADT

HOV Lane AADT

Ramp AADT

0 0.05 0.1 Miles

Study Area

NORTH

VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Build (2040) Average Daily Traffic

APPENDIX E:
VISSIM MODEL CALIBRATION AND ASSUMPTION MEMORANDUM

Yuan (George) Lu

Subject: FW: I-395 SB Additional Through Lane - Meeting Minutes 8-13-14

From: Elliott.Moore@dot.gov [mailto:Elliott.Moore@dot.gov]
Sent: Friday, September 05, 2014 1:06 PM
To: Daniel Staron; Calvin.Britt@VDOT.Virginia.gov; Theron.Knouse@VDOT.Virginia.gov; robert.josef@vDOT.virginia.gov; Xuejun.Fan@vdot.virginia.gov; Stephen.Bates@VDOT.Virginia.gov; Eugene.Weldon@VDOT.Virginia.gov; David.Beardsley@VDOT.virginia.gov; Randy.Dittberner@VDOT.Virginia.gov
Cc: Shaun Fielding; Raj Paradkar; Kevin Mentz; Peter Bonaccorsi; Yuan (George) Lu
Subject: RE: I-395 SB Additional Through Lane - Meeting Minutes 8-13-14

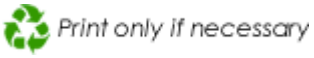
In regards to my action item, I checked with Chung and we agree in general with the approach for developing the VISSIM model.

S. Elliott Moore, PE
Area Engineer for Fredericksburg and NoVA

FHWA - Virginia Division
400 N. 8th Street, Room 750
Richmond, VA 23219

(804) 775-3338 (desk)
(804) 775-3356 (fax)

http://www.fhwa.dot.gov/vadiv/



From: Daniel Staron [mailto:DStaron@HNTB.com]
Sent: Wednesday, August 20, 2014 11:51 AM
To: 'Britt, William C., P.E. (VDOT) (Calvin.Britt@VDOT.Virginia.gov)'; Moore, Elliott (FHWA); 'Knouse, Theron I., P.E. (VDOT) (Theron.Knouse@VDOT.Virginia.gov)'; 'robert.josef@vDOT.virginia.gov'; 'Fan, Xuejun (VDOT) (Xuejun.Fan@vdot.virginia.gov)'; 'Bates, Stephen L., P.E. (Stephen.Bates@VDOT.Virginia.gov)'; 'Weldon, Gene , P.E. (VDOT)'; 'David.Beardsley@VDOT.virginia.gov'; Dittberner, Randy (VDOT)
Cc: Shaun Fielding; Raj Paradkar; Kevin Mentz; Peter Bonaccorsi; Yuan (George) Lu
Subject: RE: I-395 SB Additional Through Lane - Meeting Minutes 8-13-14

All,
Attached are the meeting minutes and associated attachments from our August 13th progress meeting. Please let me know if you have any comments.
Thanks,
Dan

Daniel Staron, P.E.
Structural Department Manager
Tel (703) 824-5100 **Direct** (703) 253-5908 **Cell** (703) 565-4394

HNTB Corporation
2900 South Quincy Street, Suite 200, Arlington, VA 22206 | www.hntb.com

100 YEARS OF INFRASTRUCTURE SOLUTIONS

HNTB Corporation
Engineers Architects Planners

2900 South Quincy Street
Suite 200
Arlington, VA 22206

Telephone (703) 824-5100
Facsimile (703) 671-6210
www.hntb.com

TECHNICAL MEMORANDUM
I-395 SOUTHBOUND ADDITIONAL THROUGH LANE PROJECT

METHODOLOGY AND ASSUMPTIONS OF VISSIM ANALYSIS

This memorandum provides an overview of the methodologies and assumptions being used for VISSIM simulation model development and calibration procedures as a part of the traffic operational analysis for the I-395 Southbound Additional Through Lane project. Specifically, it identifies the analysis years, alternative scenarios, the limits of the study, data collection, peak-hour demand estimates, and operational parameters and proposed methodologies for model development and calibration.

1. ANALYSIS YEARS AND SCENARIOS

The analysis years for this project are current year (2013), opening year (2020) and design year (2040). Based on discussions with Virginia Department of Transportation (VDOT), the following scenarios were analyzed in this study:

- No-Build conditions
  - Analysis of current (2013) roadway conditions.
  - The opening year (2020) and design year (2040) analysis with planned and/or programmed improvements as defined in the Regional Constrained Long Range Plan (CLRP), excluding the additional southbound additional through lane.
- Build conditions for the opening (2020) and design (2040) year that include proposed improvements in addition to the planned/programmed improvements.

Both AM and PM peak periods were analyzed for each scenario. In all, 10 models are built in this study.

2. STUDY AREA LIMITS

The following roadways, ramps and intersections in the area of influence were included in the VISSIM modeling efforts. **Figure 1** shows the study area limits as well as intersection numbers.

- I-395 freeway, interchange and ramps:
  - I-395 general purpose (GP) and high-occupancy vehicle (HOV) lanes from just north of the Seminary Road Interchange to the I-495 interchange
  - Ramps serving the I-395 interchanges with Route 236 Duke Street, Route 648 Edsall Road, and Route 420 Seminary Road
  - I-395 HOV ingress/egress ramps at Turkeycock Run (the future condition will include the HOT ramp currently under construction)

    - Ramps to/from the I-495 interchange that serve traffic entering or exiting I-395 on the north side of I-495
- Seminary Road (Route 420) with the following intersections:
    - 1-5: Five (5) intersections within the Seminary Road rotary interchange
    - 6: Mark Center Drive
    - 7: Kenmore Avenue
- Duke Street/Little River Turnpike (Route 236) with the following intersections:
    - 8: Beauregard Street (Route 613)
    - 9: Oasis Drive, and Frontage Road Access
    - 10: South Walker Street and adjacent ramps to/from Landmark Mall and driveway to the car dealership
- Edsall Road (Route 648) with the following intersections:
    - 11: Mitchell Street/Industrial Drive
    - 12: Cherokee Avenue
    - 13: Bren Mar Drive
    - 14: Sullivan Pl Drive
    - 15: Bloomfield Drive
    - 16: Beryl Road

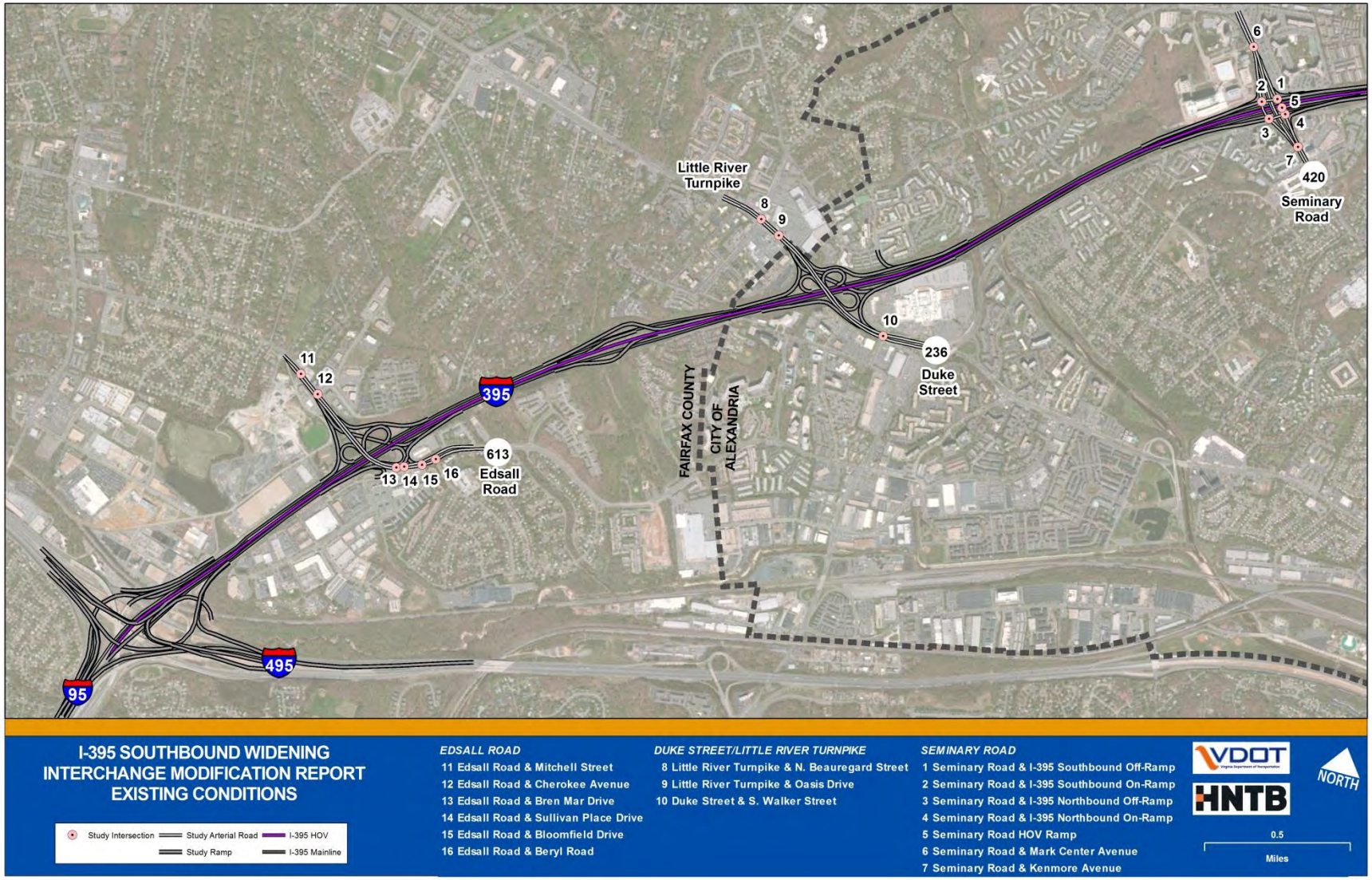


Figure 1: VISSIM Network Study Area

3. VISSIM MODEL DEVELOPMENT

The FHWA's Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software was used as a guideline for the development of the VISSIM models.

Measures of Effectiveness (MOEs)

The following MOEs were used for the operational analysis of the roadway network under existing and future build and no-build scenarios:

Table 1: VISSIM Measures of Effectiveness

Facility Type	MOEs	Unit
Network wide	Average Travel Times	Seconds per Vehicle
Freeway Mainline	Average Travel Speed	Miles per Hour (mph)
	Average Density	pcpmpl
Arterial Intersections	Average Movement Delay	sec/veh
	Intersection Delay	sec/veh
	Maximum queue	Feet

Setup of VISSIM Simulation Parameters

Detailed VISSIM simulation parameters used in the VISSIM models as listed in **Table 2**. The selections of seeding time, simulation time and number of runs are discussed in the section followed.

Table 2: VISSIM Simulation Parameters

Parameter	Existing (2013)	2020 & 2040 No Build	2020 & 2040 Build
VISSIM Version	Version 6 – Build 12		
Simulation Resolution	10 time steps/second		
Seeding Time	2700 seconds		
Recording Time	3600 seconds		
# of Simulation Runs	6 for AM model and 7 for PM model		
Random Seeds	Starting Seed #100, with an increment of 100		
Vehicle Types	Car, HGV and Bus		
Vehicle Compositions	From Existing Volumes	From Travel Demand Forecasts	From Travel Demand Forecasts
Arterial Car Following Model	Wiedemann 74		
Freeway Car Following Model	Wiedemann 99		

Parameter	Existing (2013)	2020 & 2040 No Build	2020 & 2040 Build
Driver Behavior	Default or Adjust for Calibration	If No Build improvement significantly changes segment, use engineering judgment to roll back calibration adjustment; otherwise same as Existing	If proposed design significantly changes segment, use engineering judgment to roll back calibration adjustment; otherwise same as No Build
Signal Controller Type	Based on timing sheet data (RBC)	Same as Existing; New/Modified intersections will assume actuated-coordinated (RBC)	
Signal Controller Frequency	10		
Signal Timings/Offsets	Existing signal timing data to be obtained from VDOT and/or the City (Synchro files or signal timing data)	Optimized from Synchro	
Ramp Meters	Based on existing data or recon	Same as Existing; Metering rate set by VDOT	
Grade	Code grades for links with >1.5% grade	From future No Build improvements; otherwise same as Existing	From proposed plans; otherwise Same as No Build
Desired Speed	For Arterials based on posted speeds (+/- 3 mph based on recon) and for Freeways based on posted speeds (+10/-3 mph based on recon)	From future No Build improvement plans; otherwise same as Existing	From proposed Build plans; otherwise same as No Build
Intersection Turning Speed	Use Reduced Speed Areas for Right (11-13 mph) and Left (13-17 mph) turns. For Non-Standard radius use AASHTO Exhibit 3-16	For future No Build improvements use AASHTO Exhibit 3-16; otherwise same as Existing	For future No Build improvements use AASHTO Exhibit 3-16; otherwise same as No Build
Ramp Curve Speed	Use Reduced Speed Areas as per as-built plans; otherwise use AASHTO Exhibit 3-16	For all future improvements use AASHTO Exhibit 3-16; otherwise same as Existing	
Vehicle Input	Exact Volume		
Lane Change Distance	Freeways based on exit sign location and Arterials default 656 ft. Adjust for calibration.	If No Build improvement significantly changes segment, use engineering judgment to roll back calibration adjustment; otherwise same as Existing	If proposed design significantly changes segment, use engineering judgment to roll back calibration adjustment; otherwise same as No Build

Note: “recon” refers to information collected from field observations.

Seeding Time, Simulation Time and Number of Runs

Seeding Time

A VISSIM model starts with zero vehicles on the network, which is not how the peak hour actually begins in the field. Therefore, time must be added onto the beginning of the simulation period to allow vehicles to be on the network by the time data collection begins. The seeding time is determined based on three (3) criteria:

- Travel time through the corridor
- Network equilibrium conditions
- Congestion level or queuing conditions at the beginning of peak hours

The guidance from FHWA[1] and VDOT[2] suggests that seeding time should be determined based on either the existing peak hour travel time to traverse between the farthest points of the study network in the peak direction of travel or twice the off-peak travel time between the network study limits.

Based on distance and average travel speeds, it took approximately 300 – 370 seconds to travel the freeway sections under free flow conditions (65 mph). The average recorded travel times in the peak direction of travel are about 900 seconds in northbound direction in the AM peak hour and 1000 seconds for southbound direction in the PM peak hour.

Using these assumptions, seeding time would be at least 900 seconds for AM and 1000 seconds for PM peak hour. However, at the beginning of the peak hour this corridor operates under saturated traffic conditions. To achieve saturated conditions at the beginning of the peak hour in the microsimulation model, it would require a longer seeding time. Based on the VISSIM model runs of the existing PM peak hour conditions, the time it took for the model to reach equilibrium conditions (entering volumes = exiting volumes) was between 1200 – 1800 simulation seconds (see **Figure 2**). Therefore, the actual seeding time should be longer than 1200 seconds.

Moreover, the congestion level and queuing conditions were also taken into the consideration of seeding time. The level of congestion in simulation should reach the peak hour conditions in the field after the seeding time, especially at the key bottleneck location. Based on a sensitivity analysis conducted to estimate when the the queues at the southbound lane drop location reached the Seminary Road interchange, it was determined that after 2700 simulation seconds the simulation conditions matched the field conditions during PM peak hour. Similarly, the saturation flow and queuing conditions on I-395 northbound could be archived in the AM peak hour simulation network after 2700 seconds.

Therefore, a seeding time period of **45 minutes (2700 seconds)** was selected for this study.

[1] Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software; FHWA
[2] Traffic Operations Analysis Tool Guidebook, June 2013; VDOT

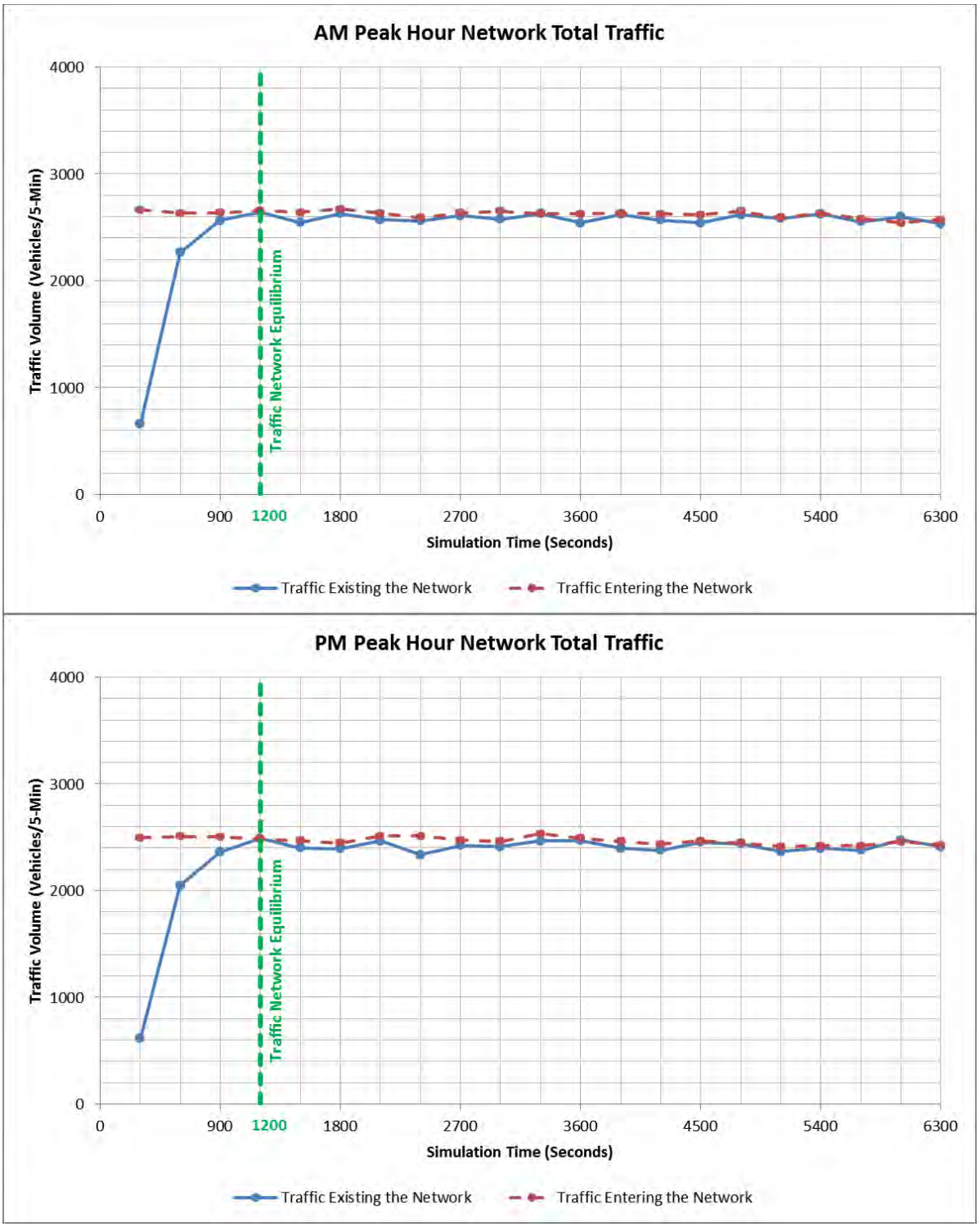


Figure 2: Entering and Existing Traffic in the PM Peak Hour Simulation Network

Simulation Time

Based on the size of the network, and field observations and traffic counts on I-395 and local arterials within the project limits, the models were run for **one hour (3600 seconds)** to capture and document the traffic performance data representative of the conditions during peak hour for the entire network.

Number of Runs

Given the stochastic nature of the microsimulation, VISSIM models need to be run with several different random seeds. The results need to be post-processed and averaged to determine the representative state of traffic operations in the study network. To obtain a statistically valid result, the number of runs necessary for the analysis will be determined based on the calculation of confidence interval after conducting the preliminary model results. The following equation provides the method recommended by VDOT's Guidebook[3].

$$N = \frac{Z^2 (S_s)^2}{E^2}$$

Where,

N = the necessary sample size,

Z = the number of standard deviations away from the mean corresponding to the required confidence level (assuming a normal distribution and confidence interval of 95th percentile, which corresponds to a value of 1.96),

S_s = the sample standard deviation, and

E = the tolerable error in terms of the sample mean.

In this study, the procedure was applied on two MOEs, namely, link volumes and freeway average travel time from the VISSIM calibrated models. Initially, the standard deviations of these two calibratiion MOEs were determined from the preliminary 12 simulation runs. As suggested by FHWA and VDOT's guidelines, a 10 percent error allowance at a 95 percent confidence level is required in model calibration for all links with volumes greater than 100 vehicles. Calculated from the results from initial 12 model runs, the numbers of runs required for AM peak hour and PM peak hour models at 95 percent confidence level are six (6) and five (5) respectively. To be conservative, the numbers of runs were decided to be **seven (7) for all AM models and six (6) for all PM models**. Therefore, the final calibration results from the existing conditions models were reported using the average of seven (7) runs in the AM model and six (6) runs in the PM model.

[3] *Traffic Operations Analysis Tool Guidebook Version 1.1,* p.23. VDOT Traffic Engineering Division, August 2013.

4. VISSIM MODEL CALIBRATION

Calibration MOEs and Criteria

In this study, three (3) measures of effectiveness (MOEs) were used to verify the adequacy of the calibration:

- Capacity Calibration MOE:
  - Throughput volumes served on I-395 freeway segments, interchange ramps and local arterials, including each turning movement at all study intersections
- System Performance Calibration MOE:
  - Travel time along the I-395 freeway mainlines
  - Travel speed on I-395 freeway mainline

Table 3 shows the detailed criteria and acceptance targets used.

Table 3: Calibration Criteria[4]

Criteria and Measures	Calinration
Hourly Flows, Model vs. Observed	
Individual Link Flows	
Within 15%, for 700 veh/h < Flow < 2700 veh/h	> 85% of cases
Within 100 veh/h, for Flow < 700 veh/h	> 85% of cases
Within 400 veh/h, for Flow > 2700 veh/h	> 85% of cases
Sum of All Link Flows	Within 5% of sum of all link counts
GEH Statistics* < 5 for Individual Link Flows	> 85% of cases
GEH Statistics for Sum of All Link Flows	GEH < 4 for sum of all link counts
Travel Times, Model vs. Observed	
Journey Time, Network	
Within 15% (or 1 min, if higher)	> 85% of cases
Visual Audit	
Individual Link Speeds	
Visually Acceptable Speed-Flow Relationship	To analyst's satisfaction
Bottlenecks	
Visually Acceptable Queuing	To analyst's satisfaction

Note: $= \sqrt{\frac{(E-V)^2}{(E+V)/2}}$,

where E = model estimated volume, V =field count.

[4] Source: *Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software*, p. 63. Federal Highway Administration, June 2004.

Model Calibration Methodology

Model calibration is a process used to achieve adequate reliability or validity of the model by establishing suitable parameter values so that the model replicates local traffic conditions as closely as possible. The FHWA's Toolbox recommended a three-step strategy for calibration[5], (1) capacity calibration, (2) route choice calibration, and (3) system performance calibration.

As mentioned in the previous section, two field measurements: throughput volumes on all links and freeway mainline travel time were used as the key targets in the base model calibration procedure for this study. Throughput volumes were used as the primary capacity target. Travel time and speed profiles on freeway mainlines were used as the system performance target.

1. Capacity calibration: VISSIM model parameters were adjusted to meet the calibration criteria of the throughput volume target. These candidate parameters include driving behavior parameters (car-following parameters and lane-changing parameters), and lane change distance for different facilities.

2. System performance calibration: Travel time and speed profiles from VISSIM model results were then compared to field measurements. Link free-flow speed and capacity related parameters were further refined to better match the field conditions.

3. Visual review: VISSIM simulation animation was reviewed to check queuing and congestion conditions at key bottleneck locations (southbound lane drop at Duke Street interchange) between the model and those observed in the field.

The model parameters were adjusted to reflect actual network performance and driver behaviors in an iterative process. The model was run with adjusted parameters, and the outputs were examined against field measurements. The parameter adjustments continued incrementally within reasonable ranges until the calibration targets were reached.

Calibration Results

Link Throughputs

The comparisons between field volumes and calibration results of VISSIM link throughputs are presented in **Figure 3**. Overall, the graphic indicates link throughputs from both VISSIM AM and PM peak hour models match with the field counts well. Detailed freeway mainline volumes and GEH are listed in **Tables 4 and 5**. Throughputs on all calibrated freeway link throughputs are within five (5) percent difference of the field measurements, and the GEH calculations for all links were less than four (4). The calibration results for the ramp volumes and intersection turning movements are shown in **Tables 6 through 9**. The differences between throughput and demand are under 10 percent in most cases, and GEH for all links was calculated to be under

[5] *Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software*, Chapter 5 Calibration of Microsimulation Models. Federal Highway Administration, June 2004.

five (5). The overall GEH for sum of all link volumes is 0.38. Therefore, it can be concluded that the capacity calibration of the AM and PM models has been achieved.

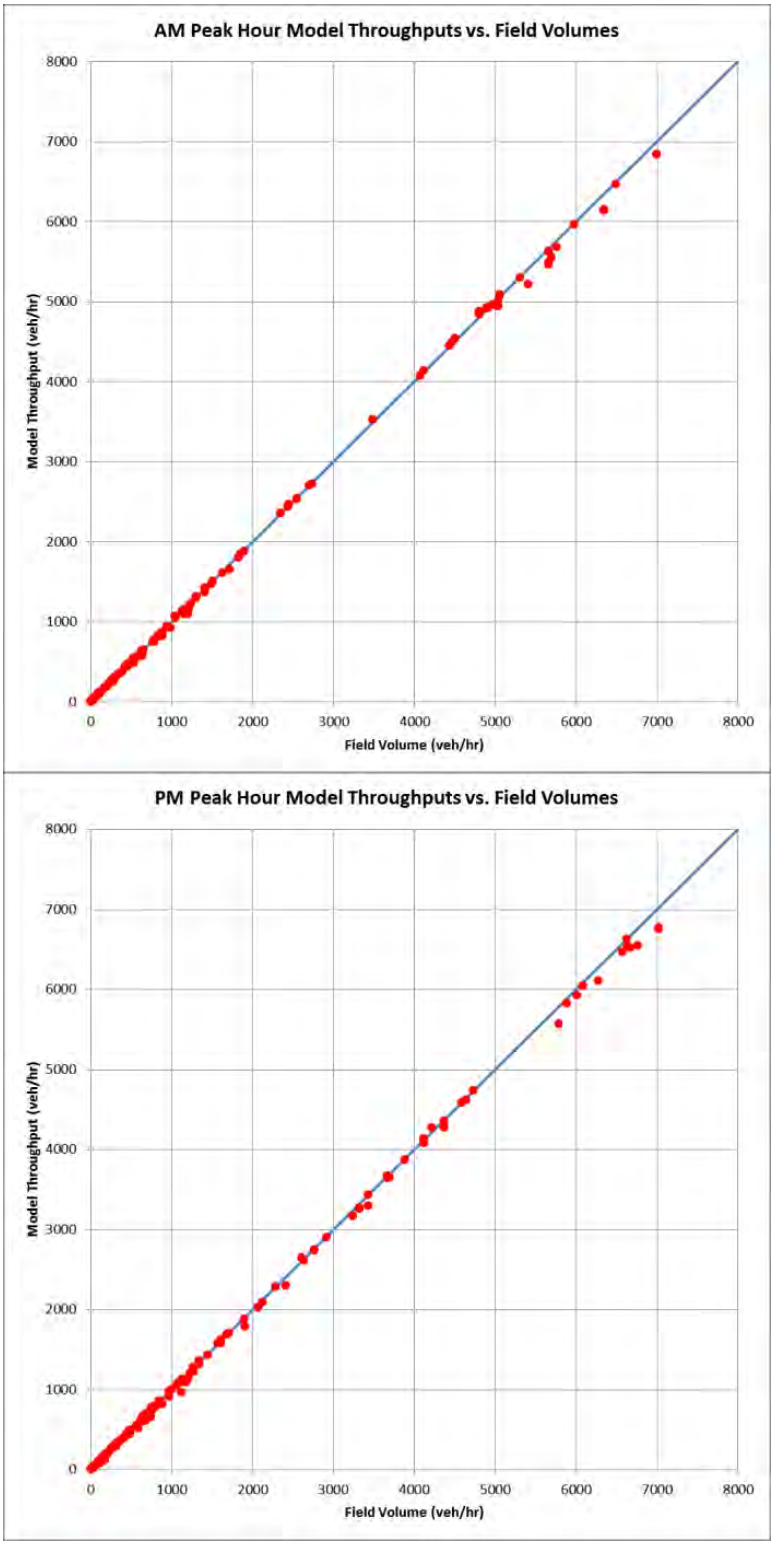


Figure 3: VISSIM Models Link Throughputs Calibration Results

Table 4: AM Model Link Throughput Calibration Results – Freeway

Freeway	Segment ID	Field Volume	VISSIM Throughput	Δ	Δ %	GEH
Southbound I-395 GP	S01-D	5055	5071	16	0%	0.23
	S02-B	4112	4138	26	1%	0.40
	S03-M	4908	4922	14	0%	0.21
	S04-B	4908	4925	17	0%	0.25
	S05-D	4908	4923	15	0%	0.22
	S06-B	4433	4448	15	0%	0.23
	S07-W	4961	4956	-5	0%	0.07
	S08-B	4464	4491	27	1%	0.41
	S08-M	4894	4912	18	0%	0.26
	S09-B	4894	4920	26	1%	0.37
	S10-D	4894	4914	20	0%	0.28
	S11-B	4507	4536	29	1%	0.43
	S11-W	5052	5085	33	1%	0.47
	S12-W	5311	5300	-11	0%	0.15
	S12-D	1825	1801	-24	-1%	0.57
	S13-D	3486	3524	38	1%	0.65
	S14-B	2448	2465	17	1%	0.34
	S15-M	4074	4072	-2	0%	0.03
	S16-M	5974	5966	-8	0%	0.11
Southbound I-395 HOV	H01-M	2732	2724	-8	0%	0.16
	H02-B	2542	2541	-1	0%	0.02
	H04-M	2542	2530	-12	0%	0.24
	H05-B	2441	2443	2	0%	0.04
	H06-B	2441	2452	11	0%	0.22
	H07-M	2441	2441	0	0%	0.00
	H08-B	2350	2359	9	0%	0.18
	H09-D	2703	2702	-1	0%	0.02
Northbound I-395 GP	N01-B	4804	4881	77	2%	1.11
	N02-B	4804	4841	37	1%	0.54
	N03-W	6486	6462	-24	0%	0.30
	N04-D	5658	5630	-28	-1%	0.38
	N05-B	5038	5001	-37	-1%	0.53
	N06-W	5757	5682	-75	-1%	0.99
	N08-B	5656	5493	-163	-3%	2.19
	N09-D	5656	5462	-194	-3%	2.60
	N10-D	5409	5213	-196	-4%	2.69
	N11-B	5038	4942	-96	-2%	1.36
	N12-M	6344	6133	-211	-3%	2.67
	N13-B	6344	6143	-201	-3%	2.55
	N14-D	6344	6142	-202	-3%	2.56
	N15-B	5698	5554	-144	-3%	1.93
	N16-M	6996	6842	-154	-2%	1.85

Table 5: PM Model Link Throughput Calibration Results – Freeway

Freeway	Segment ID	Field Volume	VISSIM Throughput	Δ	Δ %	GEH
Southbound I-395 GP	S01-D	6669	6518	-151	-2%	1.86
	S02-B	5787	5574	-213	-4%	2.82
	S03-M	7020	6760	-260	-4%	3.13
	S04-B	7020	6767	-253	-4%	3.05
	S05-D	7020	6763	-257	-4%	3.10
	S06-B	6276	6106	-170	-3%	2.17
	S07-W	6761	6551	-210	-3%	2.57
	S08-W	6571	6468	-103	-2%	1.28
	S09-B	5885	5826	-59	-1%	0.77
	S10-W	6008	5928	-80	-1%	1.04
	S11-W	6079	6041	-38	-1%	0.48
	S12-W	6629	6541	-88	-1%	1.08
	S12-D	2415	2306	-109	-5%	2.25
	S13-D	4214	4272	58	1%	0.90
	S14-B	2607	2650	44	2%	0.85
	S15-M	4729	4738	9	0%	0.13
	S16-M	6626	6632	6	0%	0.07
Southbound I-395 HOV	H01-D	2915	2903	-12	0%	0.23
	H02-B	2762	2748	-14	-1%	0.26
	H03-D	2762	2744	-18	-1%	0.34
	H04-B	2639	2614	-25	-1%	0.49
	H05-M	3325	3260	-65	-2%	1.13
	H06-B	3325	3272	-53	-2%	0.92
	H07-D	3325	3269	-56	-2%	0.97
	H08-B	3237	3172	-65	-2%	1.14
	H09-M	3688	3653	-35	-1%	0.58
Northbound I-395 GP	N01-B	2286	2282	-4	0%	0.08
	N02-B	2286	2280	-6	0%	0.13
	N03-W	4582	4588	6	0%	0.10
	N04-D	3879	3873	-6	0%	0.09
	N05-B	3427	3434	7	0%	0.12
	N06-M	4114	4133	19	0%	0.30
	N07-B	4114	4083	-31	-1%	0.49
	N08-B	4114	4131	17	0%	0.27
	N09-D	4114	4127	13	0%	0.21
	N10-D	3664	3676	12	0%	0.20
	N11-B	3427	3302	-125	-4%	2.16
	N12-M	4366	4278	-88	-2%	1.34
	N13-B	4366	4355	-11	0%	0.17
	N14-D	4366	4353	-13	0%	0.20
	N15-B	3672	3642	-30	-1%	0.49
	N16-M	4642	4620	-22	0%	0.33

Table 6: AM Model Link Throughput Calibration Results – Freeway Ramps

Interchange	Ramp	Field Volume	VISSIM Throughput	Δ	Δ %	GEH
Seminary Road Interchange	I-395 NB Off-Ramp at Seminary Road	646	591	-55	-8%	2.21
	I-395 NB On-Ramp at Seminary Road	1298	1297	-1	0%	0.04
	I-395 SB Off-Ramp at Seminary Road	943	941	-2	0%	0.08
	I-395 SB On-Ramp at Seminary Road	796	789	-7	-1%	0.25
	I-395 SB HOV On-Ramp at Seminary Road	190	184	-6	-3%	0.43
Duke Street/Little River Turnpike Interchange	I-395 NB to EB Duke Street	247	239	-8	-3%	0.50
	I-395 NB to WB Duke Street	278	254	-24	-8%	1.44
	EB Little River Turnpike to I-395 NB	602	592	-10	-2%	0.40
	WB Duke Street to I-395 NB	611	607	-4	-1%	0.16
	I-395 SB to EB Little River Turnpike	497	496	-1	0%	0.05
	I-395 SB to WB Little River Turnpike	475	478	3	1%	0.12
	EB Little River Turnpike to I-395 SB	430	440	10	2%	0.48
	WB Little River Turnpike to I-395 SB	528	541	13	3%	0.58
Turkeycock Ramp	I-395 NB GP to I-395 NB HOV	101	98	-3	-3%	0.26
Edsall Road Interchange	I-395 NB to EB Edsall Road	828	811	-17	-2%	0.59
	I-395 NB to WB Edsall Road	620	582	-38	-6%	1.56
	EB Edsall Road to I-395 NB	477	484	7	1%	0.30
	WB Edsall Road to I-395 NB	242	239	-3	-1%	0.20
	I-395 SB to EB Edsall Road	197	194	-3	-1%	0.19
	I-395 SB to WB Edsall Road	387	371	-16	-4%	0.81
	EB Edsall Road to I-395 SB	456	463	7	1%	0.31
	WB Edsall Road to I-395 SB	545	536	-9	-2%	0.38
Springfield Interchange	I-495 Outer GP to I-95 SB GP	1626	1607	-19	-1%	0.46
	I-495 Outer GP to I-395 NB GP	1128	1130	2	0%	0.07
	I-495 Outer HOT to I-95 SB HOV	177	177	0	0%	0.03
	I-495 Inner GP to I-95 SB GP	1900	1886	-14	-1%	0.32
	I-495 Inner GP to I-395 NB GP	554	555	1	0%	0.03
	I-395 SB GP to I-495 Inner GP	1297	1311	14	1%	0.38
	I-395 SB GP to Franconia	1038	1066	28	3%	0.88
	I-395 SB GP to I-495 Outer GP	528	522	-6	-1%	0.24
	I-395 SB HOV to I-495 (inner and outer)	91	93	2	3%	0.24

Table 7: PM Model Link Throughput Calibration Results – Freeway Ramps

Interchange	Ramp	Field Volume	VISSIM Throughput	Δ	Δ %	GEH
Seminary Road Interchange	I-395 NB Off-Ramp at Seminary Road	694	708	14	2%	0.52
	I-395 NB On-Ramp at Seminary Road	970	981	11	1%	0.34
	I-395 SB Off-Ramp at Seminary Road	882	824	-58	-7%	1.99
	I-395 SB On-Ramp at Seminary Road	1233	1211	-22	-2%	0.63
	I-395 SB HOV Off-Ramp at Seminary Road	153	165	12	8%	0.93
Duke Street/Little River Turnpike Interchange	I-395 NB to EB Duke Street	450	450	0	0%	0.01
	I-395 NB to WB Duke Street	368	379	11	3%	0.58
	EB Little River Turnpike to I-395 NB	439	423	-16	-4%	0.75
	WB Duke Street to I-395 NB	631	635	4	1%	0.14
	I-395 SB to EB Little River Turnpike	682	611	-71	-10%	2.79
	I-395 SB to WB Little River Turnpike	744	660	-84	-11%	3.18
	EB Little River Turnpike to I-395 SB	492	483	-9	-2%	0.41
	WB Little River Turnpike to I-395 SB	485	490	5	1%	0.23
Turkeycock Ramps	I-395 SB GP to I-395 SB HOV	686	638	-48	-7%	1.85
	I-395 SB HOV to I-395 SB GP	123	122	-1	-1%	0.11
Edsall Road Interchange	I-395 NB to EB Edsall Road	703	712	9	1%	0.35
	I-395 NB to WB Edsall Road	452	440	-12	-3%	0.59
	EB Edsall Road to I-395 NB	447	452	5	1%	0.24
	WB Edsall Road to I-395 NB	240	243	3	1%	0.20
	I-395 SB to EB Edsall Road	176	162	-14	-8%	1.11
	I-395 SB to WB Edsall Road	486	450	-36	-7%	1.65
	EB Edsall Road to I-395 SB	726	724	-2	0%	0.06
	WB Edsall Road to I-395 SB	557	546	-11	-2%	0.47
Springfield Interchange	I-495 Outer GP to I-95 SB GP	2122	2094	-28	-1%	0.62
	I-495 Outer GP to I-395 NB GP	1683	1687	4	0%	0.11
	I-495 Outer HOT to I-95 SB HOV	226	232	6	3%	0.41
	I-495 Inner GP to I-95 SB GP	1897	1880	-17	-1%	0.38
	I-495 Inner GP to I-395 NB GP	613	615	2	0%	0.08
	I-395 SB GP to I-495 Inner GP	1447	1433	-15	-1%	0.39
	I-395 SB GP to Franconia	1607	1625	18	1%	0.44
	I-395 SB GP to I-495 Outer GP	968	916	-52	-5%	1.69
	I-395 SB HOV to I-495 (inner and outer)	88	90	2	2%	0.17

Table 8: AM Model Link Throughput Calibration Results – Arterial Intersections

Intersection	Movement	Field Volume	VISSIM Throughput	Δ	Δ %	GEH
Seminary Rd & I-395 SB Off-Ramp	WBL	259	255	-4	-1%	0.23
	WBT	628	571	-57	-9%	2.33
	SBT	300	305	5	2%	0.30
Seminary Rd & I-395 SB On-Ramp	EBT	655	654	-1	0%	0.05
	SBL	300	304	4	1%	0.21
	SBT	259	255	-4	-1%	0.23
Seminary Rd & I-395 NB Off-Ramp	EBL	637	636	-1	0%	0.05
	EBT	318	319	1	0%	0.08
	NBT	534	486	-48	-9%	2.14
	NBR	112	103	-9	-8%	0.84
Seminary Rd & I-395 NB On-Ramp	WBT	454	440	-14	-3%	0.66
	NBL	623	570	-53	-8%	2.16
	NBT	548	551	3	1%	0.12
Seminary Rd & I-395 HOV Ramp	WBT	887	826	-61	-7%	2.08
	WBR	190	184	-6	-3%	0.45
Seminary Rd & Mark Center Ave	EBL	20	19	-1	-4%	0.16
	EBT	1240	1222	-18	-1%	0.52
	EBR	122	113	-9	-7%	0.83
	WBL	345	345	0	0%	0.00
	WBT	1717	1657	-60	-4%	1.47
	WBR	96	93	-3	-3%	0.32
	NBL	26	26	0	-2%	0.08
	NBT	20	21	1	3%	0.13
	NBR	180	183	3	2%	0.20
	SBL	267	273	6	2%	0.35
	SBT	102	101	-1	-1%	0.06
	SBR	36	33	-3	-8%	0.51
Seminary Rd & Kenmore Ave	EBT	867	862	-5	-1%	0.17
	EBR	59	60	1	2%	0.15
	WBT	1418	1424	6	0%	0.16
	WBR	59	54	-5	-8%	0.61
	NBR	95	114	19	20%	1.90
	SBR	783	747	-36	-5%	1.32
Little River Tpk & Beauregard St	EBL	492	473	-19	-4%	0.88
	EBT	1052	1048	-4	0%	0.12
	EBR	17	21	4	23%	0.89
	WBL	26	25	0	-1%	0.07
	WBT	958	940	-18	-2%	0.58
	WBR	520	497	-23	-4%	1.01
	NBL	99	98	-1	-1%	0.12
	NBT	71	70	-1	-1%	0.10
	NBR	56	54	-2	-3%	0.23
	SBL	772	754	-18	-2%	0.64
	SBT	45	42	-3	-8%	0.52
	SBR	218	207	-11	-5%	0.74
Little River Tpk & Oasis Dr	EBT	1851	1845	-5	0%	0.12
	EBR	19	21	1	7%	0.32
	WBL	111	104	-7	-7%	0.70
	WBT	1493	1470	-23	-2%	0.61
	WBR	81	81	0	-1%	0.05
	NBR	139	135	-4	-3%	0.32
	SBR	14	13	-1	-5%	0.19

Intersection	Movement	Field Volume	VISSIM Throughput	Δ	Δ %	GEH
Duke St & S Walker St	EBT	1411	1367	-44	-3%	1.17
	EBR	291	284	-7	-2%	0.40
	WBL	41	44	3	6%	0.40
	WBT	1509	1507	-2	0%	0.05
	NBL	638	637	-1	0%	0.05
	NBR	117	110	-7	-6%	0.64
	SBL	3	2	-1	-38%	0.73
	SBT	3	5	2	52%	0.81
	SBR	10	8	-2	-23%	0.80
Edsall Rd & Mitchell St	EBL	29	29	0	1%	0.05
	EBT	1308	1315	7	0%	0.18
	EBR	46	44	-2	-4%	0.26
	WBL	283	271	-11	-4%	0.69
	WBT	982	927	-55	-6%	1.79
	WBR	26	26	0	0%	0.01
	NBL	22	25	3	12%	0.53
	NBT	12	10	-2	-14%	0.51
	NBR	232	233	1	1%	0.10
	SBL	88	88	1	1%	0.07
	SBT	11	13	2	14%	0.46
	SBR	19	17	-2	-8%	0.37
Edsall Rd & Cherokee Ave	EBL	221	218	-3	-1%	0.19
	EBT	1407	1418	12	1%	0.31
	WBT	1213	1158	-55	-5%	1.60
	WBR	366	354	-12	-3%	0.61
	SBL	249	252	3	1%	0.16
	SBR	83	81	-2	-3%	0.25
Edsall Rd & Bren Mar Dr	EBT	1147	1099	-48	-4%	1.45
	EBR	256	256	0	0%	0.03
	WBL	51	51	0	1%	0.06
	WBT	849	838	-11	-1%	0.37
	NBL	268	264	-4	-2%	0.26
	NBT	69	69	0	0%	0.02
	NBR	89	87	-2	-2%	0.17
Edsall Rd & Sullivan Pl Dr	EBT	1198	1099	-99	-8%	2.93
	EBR	38	35	-3	-9%	0.57
	NBR	9	9	0	-2%	0.05
Edsall Rd & Bloomfield Dr	EBT	1173	1158	-15	-1%	0.44
	EBR	29	30	1	5%	0.26
	WBL	50	49	-1	-3%	0.18
	WBT	883	872	-11	-1%	0.37
	NBL	190	188	-2	-1%	0.14
	NBR	79	76	-3	-4%	0.39
Edsall Rd & Beryl Rd	EBT	1178	1164	-14	-1%	0.40
	EBR	74	71	-3	-4%	0.37
	WBL	14	14	0	1%	0.04
	WBT	828	821	-7	-1%	0.24
	NBL	105	100	-5	-4%	0.45
	NBR	28	29	1	4%	0.21

Table 9: PM Model Link Throughput Calibration Results – Arterial Intersections

Intersection	Movement	Field Volume	VISSIM Throughput	Δ	Δ %	GEH
Seminary Rd & I-395 SB Off-Ramp	WBL	254	265	11	4%	0.67
	WBT	653	675	22	3%	0.83
	SBT	406	390	-16	-4%	0.81
Seminary Rd & I-395 SB On-Ramp	EBT	787	795	8	1%	0.27
	SBL	475	463	-13	-3%	0.58
	SBT	185	194	9	5%	0.68
Seminary Rd & I-395 NB Off-Ramp	EBL	644	659	15	2%	0.58
	EBT	618	598	-20	-3%	0.80
	NBT	479	491	12	2%	0.54
	NBR	215	218	3	1%	0.17
Seminary Rd & I-395 NB On-Ramp	WBT	275	283	8	3%	0.48
	NBL	479	498	19	4%	0.84
	NBT	644	652	8	1%	0.32
Seminary Rd & I-395 HOV Ramp	WBT	754	780	26	3%	0.94
	SBR	153	165	12	8%	0.95
Seminary Rd & Mark Center Ave	EBL	34	35	1	2%	0.11
	EBT	1705	1711	6	0%	0.15
	EBR	34	29	-5	-15%	0.89
	WBL	62	67	5	8%	0.64
	WBT	1339	1360	21	2%	0.57
	WBR	166	163	-4	-2%	0.27
	NBL	83	72	-11	-13%	1.27
	NBT	13	16	3	22%	0.75
	NBR	814	797	-17	-2%	0.59
	SBL	171	171	0	0%	0.03
	SBT	42	45	3	6%	0.41
	SBR	36	34	-2	-5%	0.31
Seminary Rd & Kenmore Ave	EBT	1341	1320	-21	-2%	0.58
	EBR	347	339	-8	-2%	0.44
	WBT	840	858	18	2%	0.62
	WBR	54	52	-3	-5%	0.34
	NBR	95	100	5	5%	0.49
	SBR	296	302	6	2%	0.35
Little River Tpk & Beauregard St	EBL	300	286	-14	-5%	0.80
	EBT	1087	1088	1	0%	0.03
	EBR	34	35	1	2%	0.14
	WBL	66	60	-6	-10%	0.80
	WBT	1120	973	-147	-13%	4.54
	WBR	590	523	-67	-11%	2.84
	NBL	113	84	-29	-25%	2.90
	NBT	170	124	-46	-27%	3.82
	NBR	119	84	-35	-29%	3.47
	SBL	863	857	-7	-1%	0.22
	SBT	126	124	-2	-2%	0.21
	SBR	315	299	-16	-5%	0.90
Little River Tpk & Oasis Dr	EBT	2068	2028	-40	-2%	0.88
	EBR	21	20	-1	-5%	0.22
	WBL	222	216	-7	-3%	0.46
	WBT	1611	1579	-33	-2%	0.82
	WBR	342	336	-6	-2%	0.34
	NBR	204	199	-5	-2%	0.35
	SBR	160	163	3	2%	0.21

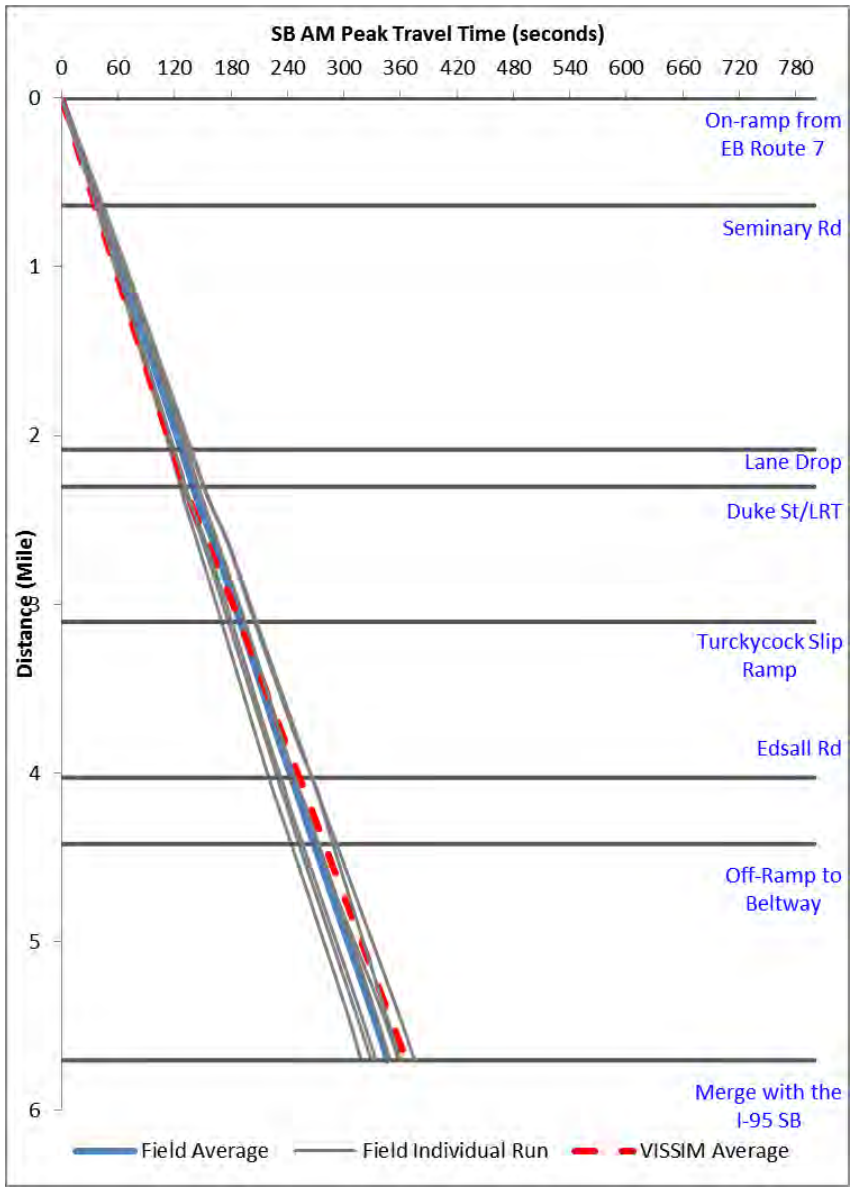
Intersection	Movement	Field Volume	VISSIM Throughput	Δ	Δ %	GEH
Duke St & S Walker St	EBT	1906	1788	-118	-6%	2.75
	EBR	567	562	-5	-1%	0.22
	WBL	128	123	-5	-4%	0.43
	WBT	1573	1585	12	1%	0.31
	NBL	623	614	-9	-1%	0.35
	NBR	149	145	-4	-3%	0.32
	SBL	33	32	-1	-4%	0.20
	SBT	33	31	-3	-8%	0.44
	SBR	128	131	3	2%	0.28
Edsall Rd & Mitchell St	EBL	6	8	2	25%	0.58
	EBT	1003	1003	0	0%	0.01
	EBR	32	34	2	7%	0.38
	WBL	139	130	-9	-7%	0.78
	WBT	1198	1143	-55	-5%	1.62
	WBR	45	45	0	0%	0.02
	NBL	15	15	0	-1%	0.04
	NBT	8	7	-1	-13%	0.37
	NBR	319	326	7	2%	0.40
	SBL	8	8	-1	-6%	0.18
	SBT	8	10	2	19%	0.51
	SBR	9	10	1	9%	0.27
Edsall Rd & Cherokee Ave	EBL	65	62	-3	-5%	0.41
	EBT	1265	1277	12	1%	0.32
	WBT	1271	1226	-46	-4%	1.29
	WBR	201	196	-5	-2%	0.33
	SBL	413	413	0	0%	0.00
	SBR	116	111	-5	-5%	0.50
Edsall Rd & Bren Mar Dr	EBT	1150	1100	-51	-4%	1.51
	EBR	120	118	-2	-2%	0.21
	WBL	30	30	-1	-2%	0.09
	WBT	719	711	-8	-1%	0.31
	NBL	372	368	-4	-1%	0.22
	NBT	114	117	3	2%	0.26
	NBR	87	87	0	0%	0.02
Edsall Rd & Sullivan Pl Dr	EBT	1183	1100	-84	-7%	2.47
	EBR	54	46	-8	-14%	1.08
	NBR	14	14	0	-1%	0.04
Edsall Rd & Bloomfield Dr	EBT	1130	1137	7	1%	0.21
	EBR	54	50	-4	-7%	0.55
	WBL	85	85	0	0%	0.02
	WBT	765	758	-8	-1%	0.27
	NBL	110	112	2	1%	0.14
	NBR	81	75	-6	-7%	0.64
Edsall Rd & Beryl Rd	EBT	1068	1064	-5	0%	0.14
	EBR	143	149	6	4%	0.46
	WBL	17	17	0	-2%	0.08
	WBT	758	753	-5	-1%	0.19
	NBL	92	90	-2	-2%	0.17
	NBR	18	19	1	3%	0.12

Travel Time

For performance calibration, the end-to-end freeway travel times from the VISSIM models versus field speed data are listed in **Table 10**. **Figure 4** and **Figure 5** present the average travel time trajectories during peak hours by segments. The comparison results showed that overall travel times through the freeway network are within six (6) percent between VISSIM outputs and field measurements. The travel time trajectories in AM and PM VISSIM models largely well match with the field measurements.

Table 10: I-395 Freeway Mainline Travel Time Model Calibration Results

Direction	Section	Distance (Mile)	Free Flow Travel Time (Sec)	Field Travel Time (Sec)	VISSIM Travel Time (Sec)	Δ (%)
AM Peak Hour						
Northbound	From Beltway to Route 7	5.0	304.2	576.8	583.8	1.2%
Southbound	From Route 7 to I-95 SB	5.7	365.2	346.1	366.7	5.9%
PM Peak Hour						
Northbound	From Franconia to Route 7	5.0	327.9	393.0	381.0	-3.1%
Southbound	From Route 7 to I-95 SB	5.7	365.2	756.3	767.6	1.5%



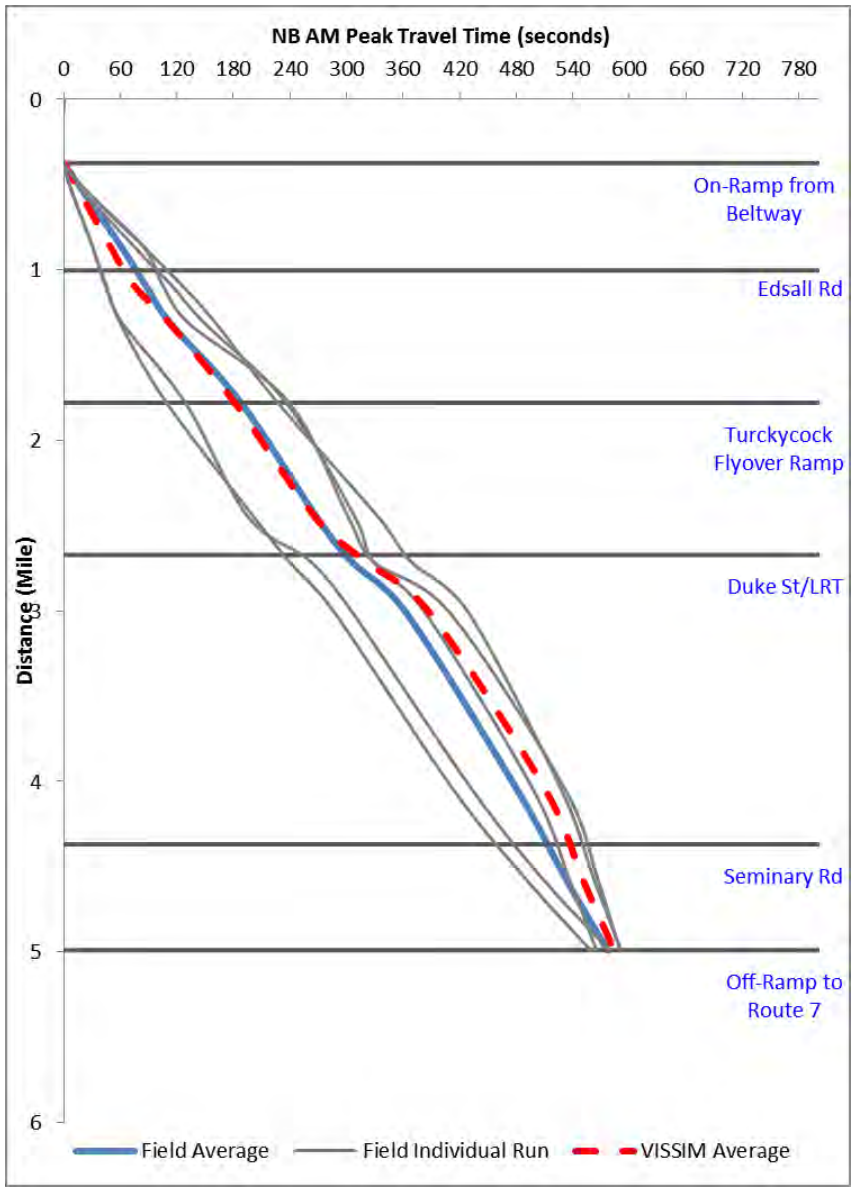
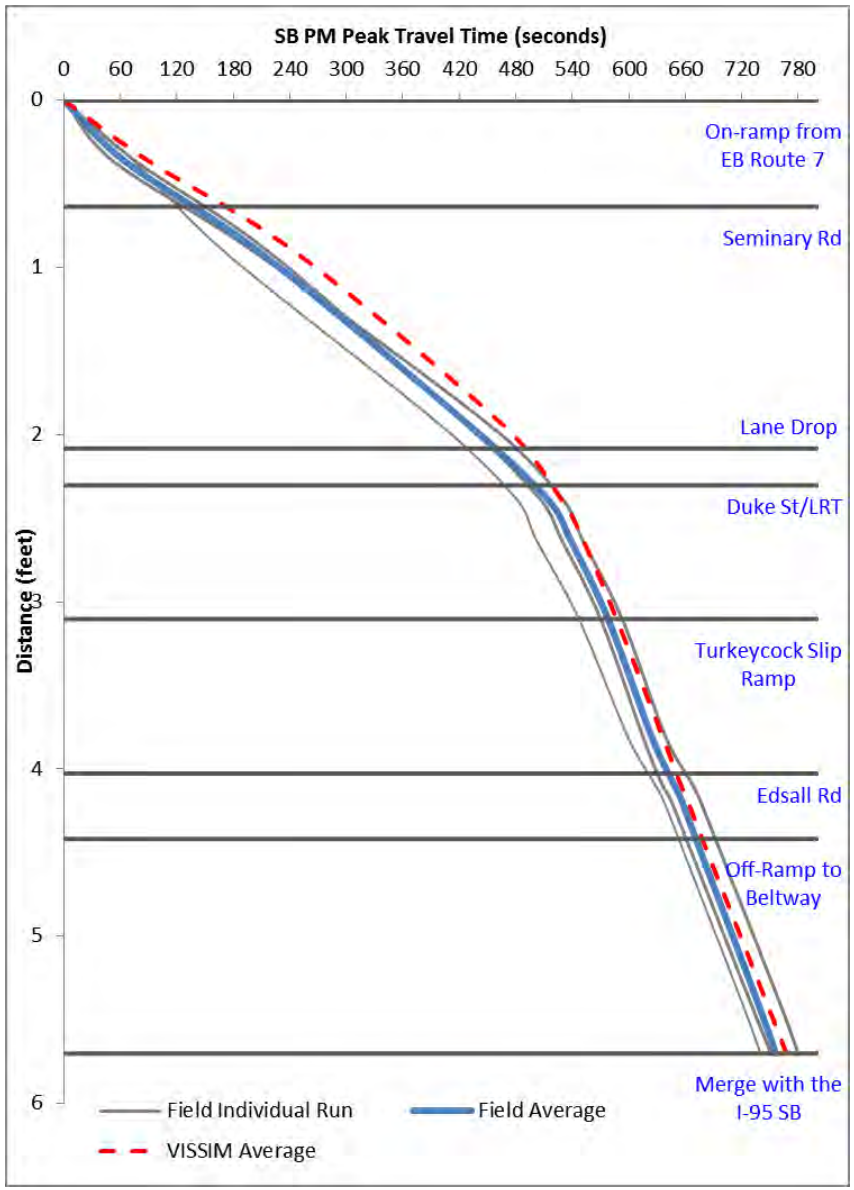


Figure 4: AM Peak Hour Model Travel Time Calibration Results



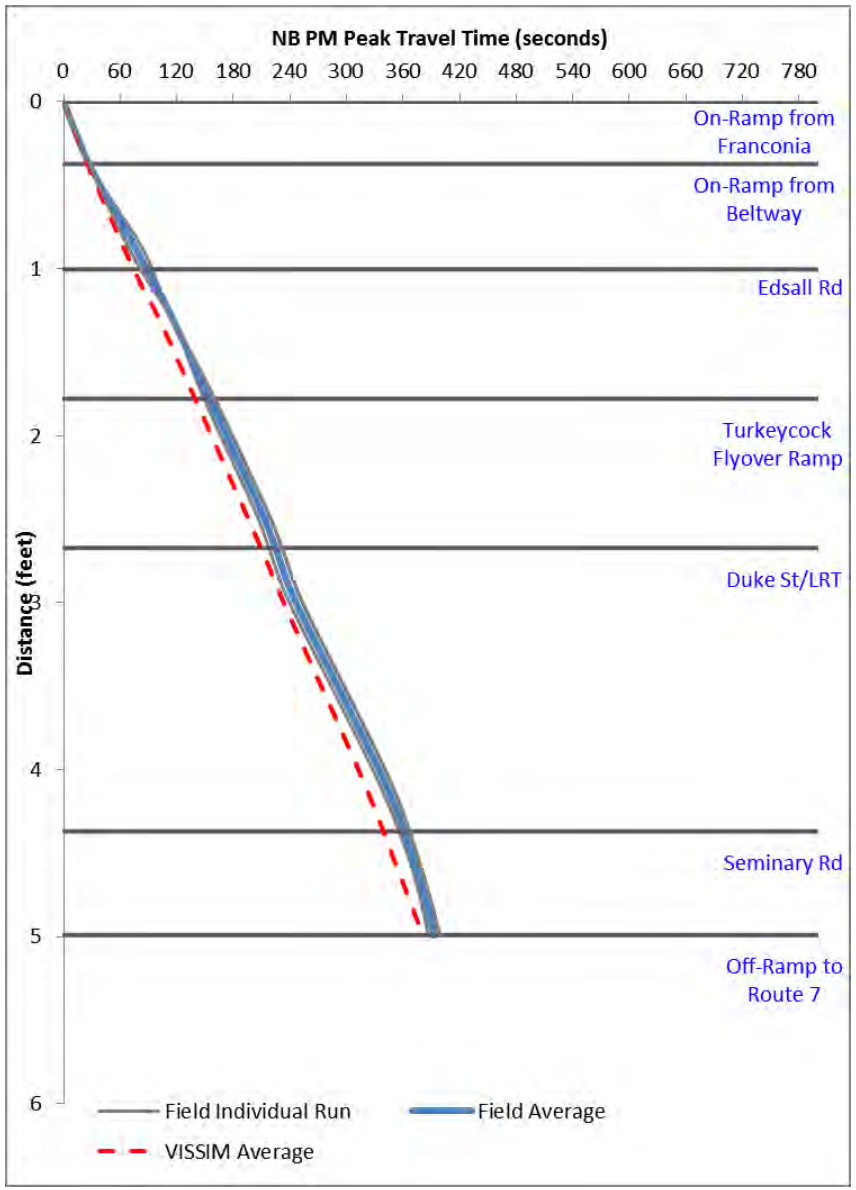
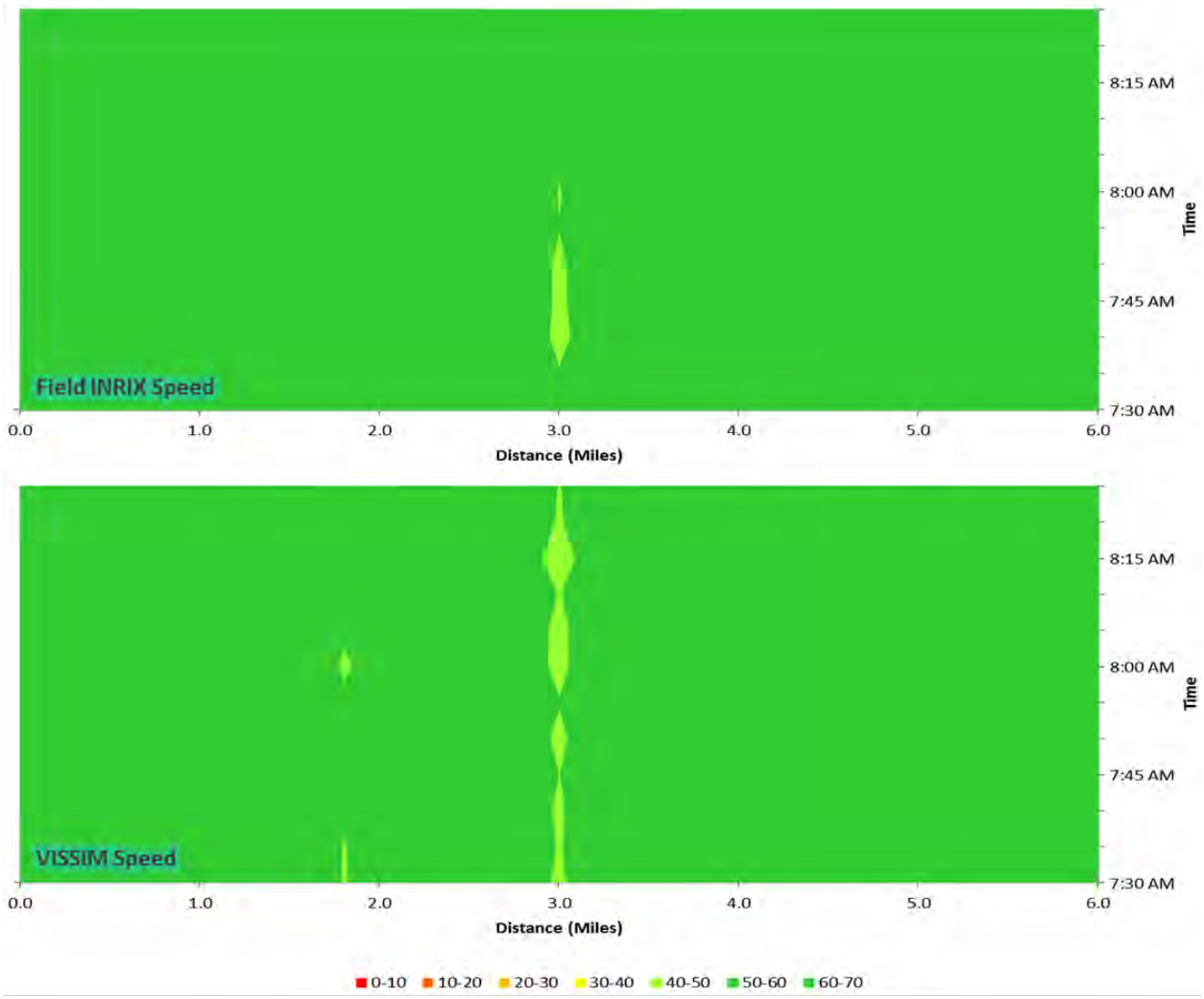


Figure 5: PM Peak Hour Model Travel Time Calibration Results

Freeway Speed Contours

Freeway speed is another performance calibration MOE. To better compare the calibration results, the speed contours by time and distance were plotted using field data and VISSIM speed outputs. Field speed data for the same time period of traffic counts were collected by INRIX and provided by VDOT. They were continuously collected using probe-vehicle-based technology. For this study, the proposed improvements will primarily benefit the I-395 southbound. Also, during the time of field data collection, there were multiple major construction activities on I-395 northbound that significantly impacted mainline capacity and driving speeds, especially during the AM peak hour. Therefore, in this study, we only used the southbound speed data for comparison.

The speed contour maps using INRIX field data versus VISSIM model outputs for I-395 southbound in the AM and PM peak hours are illustrated in **Figure 6** and **Figure 7**, respectively. A major difference between field data and models is that the field contour maps show more fluctuations than the simulation speeds. This is mainly because the traffic demand in the field is more dynamic and the field conditions are more complicated. However, the calibrated VISSIM models generally replicated the field speed profiles on freeway mainlines, especially the speed changes and queuing conditions at the key southbound bottleneck in the PM peak hour.



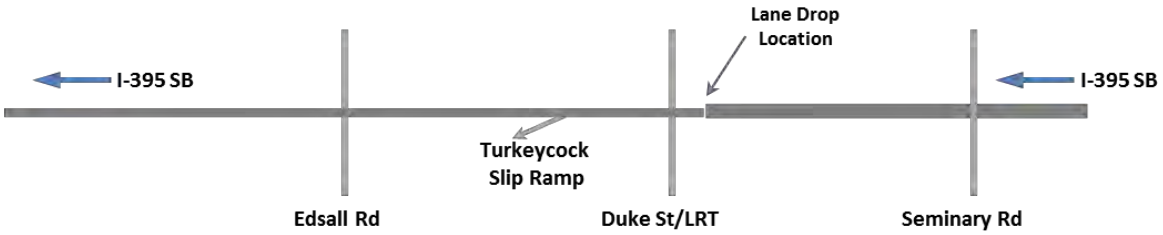
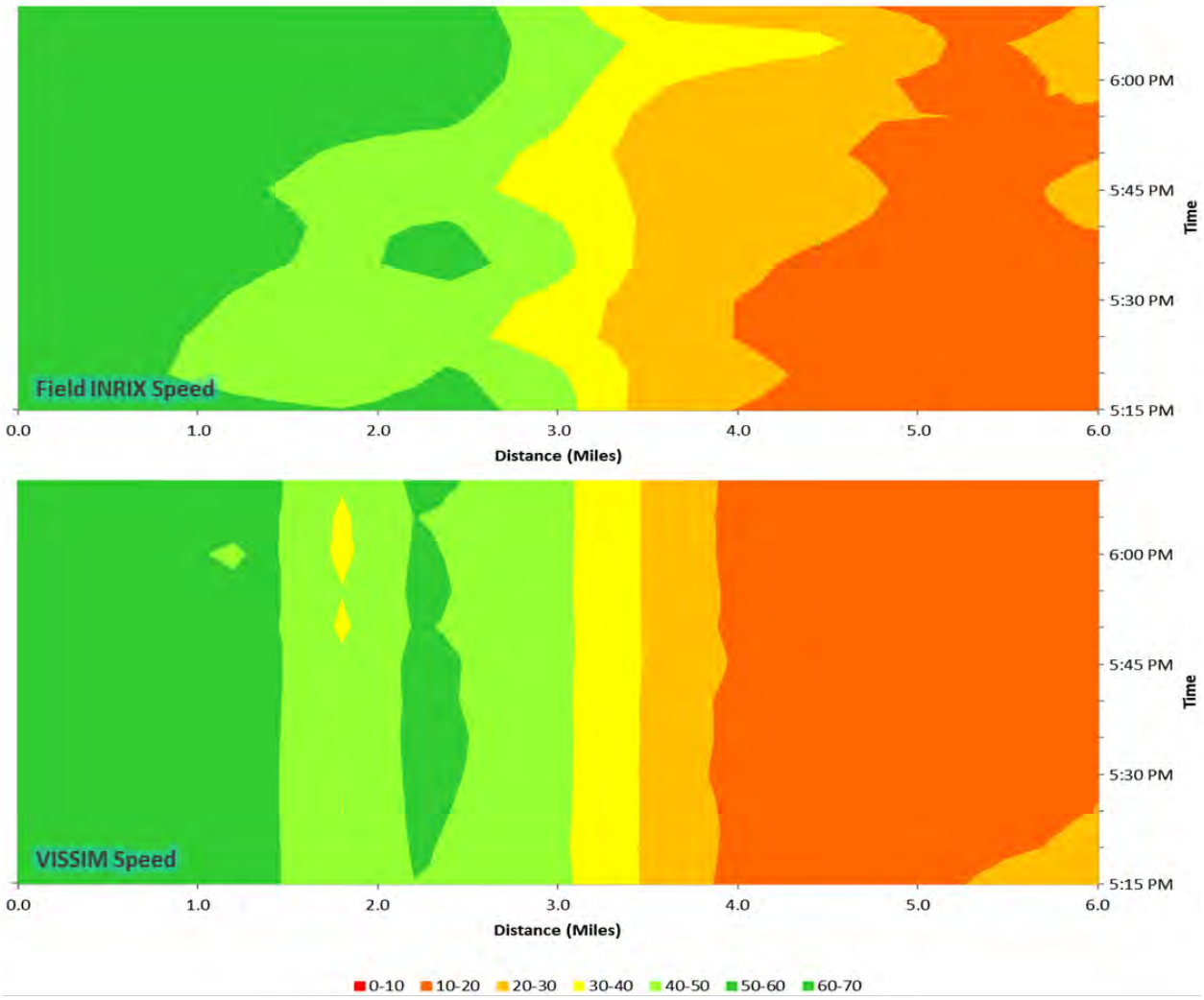


Figure 6: I-395 GP Southbound Speed Contour in AM Peak Hour (Field vs. VISSIM)



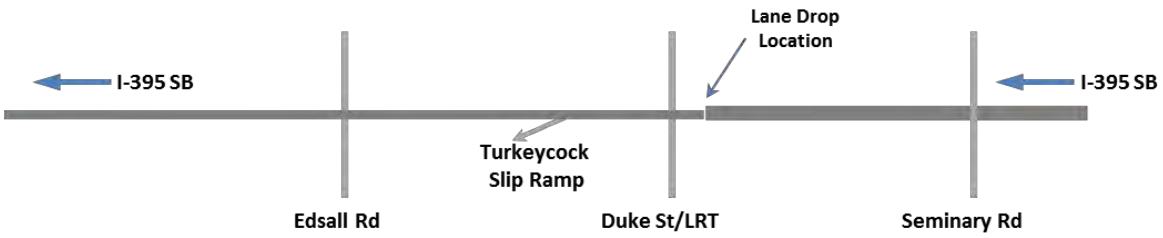


Figure 7: I-395 GP Southbound Speed Contour in PM Peak Hour (Field vs. VISSIM)

PM Peak Hour Bottlenecks

By comparing the field data and model outputs of travel times and speed profiles, the calibrated VISSIM model replicates bottleneck locations during existing PM peak hour conditions. In the southbound direction, there are three (3) major bottleneck locations shown in the speed contour diagrams, which are located at:

- Seminary Road on-ramp merge section
- Southbound lane reduction location near Duke Street/Little River Turnpike interchange
- Turkeycock slip ramp

Seminary Road On-Ramp Merge Section

The first bottleneck is the southbound merge section from the on-ramp of Seminary Road interchange. In the PM peak hour, more than 1200 vehicles per hours from the City of Alexandria use this ramp to enter into already congested I-395 southbound mainline. There are constantly intense competitions between merging vehicles and mainline traffic. The result is frequent accelerating/decelerating and aggressive lane changing that lead to slow moving vehicles and queuing during the PM peak. The average traveling speed is around 10-20 mph in this section. Moreover, the downstream queues from the lane drop at Duke Street interchange quickly reach to this location once the PM peak hour starts, which increases the severity of the bottleneck. Queues from both bottlenecks combine and traffic operations are regularly stop-and-go. In the existing PM model, the links in this merge section were coded with aggressive driving behaviors to reflect the field conditions.

I-395 SB Lane Drop near Duke Street/Little River Turnpike Interchange

Currently, the number of lanes on southbound I-395 mainline drops from four (4) to three (3) at the Duke Street/Little River Turnpike (Route 236), resulting in significant freeway capacity reduction. This location is the primary focusing point for improvements of this project. Based on the INRIX data and field observation, it is the most severe bottleneck location on the I-395 corridor within the study area in PM peak hour. High southbound traffic demand is metered due to the capacity reduction, and traffic flows frequently break down at this location in the PM peak hour. On an average weekday, combined with other upstream bottlenecks, the queue starting from this location varies from two (2) to five (5) miles in length. At a minimum, it consistently spills back beyond Seminary Road interchange, and could extend as far back as the Glebe Road interchange. Based on INRIX field data, the average travel speed is 10 to 20 mph throughout most of this section. In addition to lane reduction, the close spacing of multiple interchanges was found to further impede the traffic operations in this section. In order to replicate the field conditions at this location, link driving behavior parameters in the existing PM VISSIM model were modified based on the field observation of driving behaviors. It was observed that drivers were aggressive when changing lanes and merging at the lane drop location. But they became more defensive in following cars, keeping bigger gaps between vehicles. Therefore, the lane changing behaviors were adjusted to be more aggressive, and the car-following behaviors to be relatively conservative on the links at this location.

Turkeycock Slip Ramp

The third bottleneck is located immediate north of the lane drop location between Duke Street/Little River Turnpike interchange and the Turkeycock slip ramp. After being discharged from the lane drop bottleneck, instead of accelerating back to the desired speeds, drivers are usually slowed down again in this section mainly for two reasons. First, the close spacing of Duke Street on-ramp and Turkeycock slip ramp results in frequent merging, diverging and weaving maneuvers. Second, vertical profile changes along this section make drivers conservative in high traffic demand. Thus, drivers tend to control more comfortable gaps in the car following behaviors and not to fully accelerate to desired speeds. The average traveling speed is around 20-30 mph in this section, and gradually goes back to normal after the diverging point of the slip ramp.

Future Models

To maintain a consistent base for traffic operational analyses of all the scenarios, driver behavior parameters in the calibrated base models were largely retained in the future No-Build and Build models. New roadway geometry, lane configurations, and future traffic volumes were updated in 2020 and 2040 No-Build and Build models. Initial model assessments were performed by reviewing of simulation outputs and visually inspecting simulation animations to ensure that the future models generated reasonable outputs.

APPENDIX F:
INTERCHANGE IMPROVEMENTS ALTERNATIVES STUDY TECHNICAL MEMORANDUM AND CONCEPTUAL LAYOUTS

Technical Memorandum
Interchange Improvements Alternatives Study

Southbound I-395 Additional Through Lane
State Project No. 0395-029-015, P-101, R-201, C-501 / UPC 103316
June 2014

Project Background

VDOT Northern Virginia District has retained HNTB to provide preliminary engineering services to widen southbound I-395 to add a fourth through lane from the Route 236 Duke Street/Little River Turnpike Interchange to the Route 648 Edsall Road Interchange. Study activities regarding traffic operations conducted by VDOT in 2012 identified the basic preferred alternative to be advanced into preliminary design. Current preliminary engineering activities focus on detailed operational study and geometric layout of potential refinements to the VDOT Preferred Alternative.

The refinements reflect the need for changes to existing ramp and arterial roadway geometry along Route 236 Duke Street and Route 648 Edsall Road. In general, the interchange improvements will eliminate merge-weave conditions where tight radius loop ramps join and depart the southbound I-395 mainline. Select free-flow ramp movements will be replaced with signalized at-grade intersection movements at the arterial side roads.

VDOT's objectives for the project are to increase capacity and reduce crash potential on southbound I-395 through the following:

- Add one additional through lane to southbound I-395; and,
- Eliminate short mainline merge-weave areas that are presently served by closely spaced loop ramps that operate with low travel speeds.

To reduce overall construction cost, MOT impacts, and construction duration, the project seeks to avoid replacement of existing bridges.

Memorandum Contents and Format

This technical memorandum will present several alternative proposals for improvements to the Duke Street and Edsall Road interchanges. The document is formatted to present the following information:

- Criteria by which alternatives are evaluated
- Existing conditions, proposed conditions, construction cost, and traffic operations for each of the following
  - Southbound I-395 Mainline
  - I-395/Route 648 Edsall Road Interchange
  - I-395/Route 236 Duke Street Interchange
- Structural design issues
- Summary and recommendations

Existing 2013 and projected traffic volumes for 2040 weekday PM peak hour conditions are presented in Appendix A. Exhibits illustrating the horizontal layout of each interchange improvement alternative are compiled in Appendix B. Construction cost estimates are compiled in Appendix C. Appendix D contains concept-level illustrations of retaining wall sections and minimum clearances.

Evaluation Criteria

Criteria used to evaluate interchange improvement alternatives are those identified in the scope of services for Preliminary Development activities - compliance with design criteria, construction cost, right-of-way impacts, and traffic operations. Improvement concepts were developed to reflect

operational safety and constructability considerations.

Design Criteria - Improvements to I-395, Route 648 Edsall Road, Route 236 Duke Street, and interchange ramps will be designed pursuant to AASHTO and VDOT guidance as established in the following documents:

- VDOT Road Design Manual Vol. 1, 2005, including revisions through May 2014.
- VDOT Road and Bridge Standards Vol. 1 and Vol. 2, 2008, including revisions through May 2014.
- A Policy on Geometric Design of Highways and Streets (AASHTO, 2011).
- VDOT Drainage Manual, 2002, including revisions through May 2014.

Table 1 summarizes major design criteria used for the preliminary development of alternative improvements to I-395 and interchanges within the project limits.

Table 1 – Roadway Inventory and Major Design Criteria

	I-395	Route 648 Edsall Road	Route 236 Duke Street	Interchange Ramps
Functional Classification	Urban Principal Arterial - Freeway	Urban Minor Arterial	Urban Principal Arterial - Other	Interchange Ramp
VDOT Standard	GS-5	GS-6	GS-5	GS-R
Design Speed (mph)	60	35	35	30 (minimum) [1]
Superelevation Standard	TC-5.11R	TC-5.11U	TC-5.11U	TC-5.11R
Vertical Clearance	16.5 ft	16.5 ft	16.5 ft	16.5 ft
Minimum Lane Width	12 ft	12 ft	12 ft	16 or 18 ft [2]
Min. Shoulder Width, Left	14 ft [3]	1 ft [4]	1 ft [4]	6 ft [5]
Min. Shoulder Width, Right	14 ft [3]	2 ft [4]	2 ft [4]	10 ft [5]
Minimum Profile Grade	0.5%	0.5%	0.5%	0.5%

[1] Minimum design speed is 25 mph where ramp is served by a C/D ramp roadway.

[2] Width of a single ramp is dependent on design speed. Per VDOT GS-R standards, multilane ramps shall accommodate widths given in table 3-29 in AASHTO's "A Policy on Geometric Design of Highways and Streets", 2011 Edition.

[3] Truck volumes exceed 250 vph, and warrant use of a 12 ft width shoulder. Minimum shoulder width shown is for locations adjacent to guardrail or concrete barrier, conditions which predominate within the project limits.

[4] Value represents offset to vertical curbing left, or width of gutter pan right.

[5] Minimum shoulder width shown is for locations adjacent to guardrail or concrete barrier, conditions which predominate within the project limits.

Each alternative was evaluated to identify design exceptions and/or design waivers that would be required. The exceptions and waivers identified in this document constitute preliminary findings, and are limited to the extent of detailed design performed to date. Exceptions and/or waivers beyond those identified in this document may be needed to advance any given alternative into final design and construction.

Compliance with design criteria, as an evaluation criterion used in this document, relates to the relative number of design exceptions and waivers associated with each improvement alternative. Tables throughout this document identify the minimum values provided as part of each design.

Construction Costs - For each improvement alternative, a construction cost estimate was prepared using the most recent unit price data for Northern Virginia District, as published by VDOT. A construction cost estimate was prepared for required improvements to mainline southbound I-395 that would be needed regardless of which interchange improvements are advanced. The cost for mainline improvements represents a "base" cost to be added to the construction cost of each alternative considered. This approach allows comparison of the relative cost of each alternative, and also yields a total estimated cost for the entire project under each improvement scenario.

All construction costs are presented in 2014 dollars, with no inflation to address construction in a future year. Estimates include a 35% contingency, commensurate with the current status of design progress. Estimates include VDOT-prescribed factors for mobilization and construction survey, and factored costs for MOT and erosion control measures. The estimates are based on limited development of roadway profiles and reflect professional judgment regarding the extent and size of retaining walls, sound wall replacement, and earthwork required for each alternative. Estimates also reflect an assumed pavement depth equal to that recently used for the widening if I-66 in Falls Church ("Spot 2" Widening, UPC 78828). Estimated construction costs included in this document do not include environmental remediation, right-of-way acquisition, or CEI services.

The construction cost evaluation criterion is based on the relative cost of each improvement alternative.

Right-of-Way Impacts – Right-of-way requirements associated with each refinement alternative were determined based on a review of existing right-of-way and property lines versus slopes limits derived from preliminary surface modeling for potential improvements. Where possible, right-of-way impacts are assumed to be limited with the use of retaining walls. The need for additional right-of-way (acquired land, permanent easements, or temporary easements) was determined using engineering judgment regarding possible construction methods and long-term maintenance and inspection interests of the Department.

Potential right-of-way impacts, as defined in this technical memorandum, are subject to change as design activities generate more refined information regarding roadway edge conditions, drainage requirements, sloping, and retaining wall limits. Future design activities will seek to reduce or eliminate right-of-way impacts in the interest of reducing overall projects costs and schedule.

The right-of-way impacts criterion is subjective and reflects the number of affected parcels and the preliminary estimate of area affected.

Traffic Operations - Each of the refinement alternatives considered eliminates the merge-weave areas associated with tight-radius loop ramps along the southbound I-395 mainline facility at the Edsall Road and Duke Street Interchanges. Each alternative also reflects the addition of one additional mainline through travel lane within the project limits. As basic objectives of the project, improvements identified for each interchange will reduce operational friction along the mainline I-395 travel lanes at existing loop ramp locations, and increase capacity of the roadway. These advantages are inherent with each alternative, and are not restated in the following portions of the document that address traffic operations at each interchange.

This document contains a qualitative review of traffic operational issues associated with each improvement alternative, including the merge-weave conditions and signal operations at ramp terminal intersections, and the potential impact of the proposed alternatives on peak hour traffic operations. Analysis results presented in this document were developed using Synchro and HCS analysis tools. The issues identified in this document are subject to refinement based on detailed microsimulation modeling of the I-395 corridor, to be performed later in the project development process. While preliminary analyses presented in this document focus on weekday PM peak hour conditions, IMR documentation will address traffic operations during the weekday AM and PM peak hour periods.

The traffic operations criterion is subjective, and reflects the nature and severity of anticipated operational issues identified for each improvement alternative.

Southbound I-395

Existing Conditions - I-395 has a functional classification as an Urban Principal Arterial Freeway and operates with a design speed of 60 mph and a posted speed limit of 55 mph. The majority length of the southbound facility provides four travel lanes measuring 11 to 12 ft wide, exclusive of auxiliary lanes serving entrance or exit ramps. The roadway segment between the Duke Street interchange and the Edsall Road interchange provides only three southbound travel lanes. This condition represents a

capacity constraint in the I-395 corridor, resulting in recurring daily congestion during peak travel periods. Southbound I-395 provides a right shoulder measuring 9.0 - 11.5 ft wide and a left shoulder width measuring 2.1 - 6.0 ft.

The existing southbound roadway provides substandard cross slope and/or superelevation rate at several locations. The left two travel lanes have a typical cross slope of 1% throughout the project limits. North of the Duke Street overpass, at approximately station 134+00, the superelevation of the left most (inside) travel lane has a reverse slope of 1.0 to 1.5%.

Proposed Conditions - Proposed improvements to the southbound facility include widening to provide one additional through lane between the Duke Street and Edsall Road interchanges, resulting in a consistent four-lane roadway section with 12 ft travel lanes. Widening will provide a left shoulder measuring 6 ft wide, with narrower widths provided at overhead sign support foundations, the Turkeycock HOV ramp overpass, and at the beginning and end project tie-in locations. Widening will also provide a consistent 12 ft right shoulder width throughout the corridor, except at the Turkeycock HOV ramp overpass where the right shoulder width will narrow to 2 ft.

The existing mainline substandard cross slopes and superelevation rate will be corrected through the mill and overlay of the pavement section along southbound I-395. Pavement wedge courses and MB-8A barrier will be used to modify the cross slope as needed to meet current standards.

While existing superelevation transition lengths are adequate for the existing three-lane roadway section, the transition lengths would not be adequate for a four-lane roadway section. VDOT has advised that correction of the superelevation transition lengths is beyond the scope of this project, and that a Design Waiver will be needed to address this deficiency.

Table 2 summarizes the Design Exceptions and Design Waivers associated with proposed improvements to southbound I-395 within the project limits.

Table 2 – Southbound I-395, Design Exceptions and Design Waivers

Design Exception	Guidance	Required Value	Value Provided	Measure(s) Required to Avoid DE
Shoulder Width Left Shoulder, throughout project limits	VDOT RDM Std. GS-5	14.0 ft	2.0 - 6.0 ft	Replace bridges carrying Edsall Road and Duke Street over I-395; replace bridge carrying HOV exit ramp over SB I-395
	AASHTO Green Book (p. 10-102)	14.0 ft		
Shoulder Width Right Shoulder, Edsall Road Overpass	VDOT RDM Std. GS-R	14.0 ft	10.0 ft	Reconstruct the bridge carrying Duke Street over I-395. Widen the shoulder to provide required width.
	AASHTO Green Book (p. 10-102)	14.0 ft		
Shoulder Width Right Shoulder, SB I-395 at Turkeycock Ramp	VDOT RDM Std. GS-5	14.0 ft	2.0 ft	Reconstruct the bridge carrying the HOV ramp over SB I-395. Widen the shoulder to provide required width.
	AASHTO Green Book (p. 10-102)	14.0 ft		
Shoulder Width Right Shoulder, Duke Street Overpass	VDOT RDM Std. GS-5	14.0 ft	10.0 ft	Reconstruct the bridge carrying the HOV ramp over SB I-395. Widen the shoulder to provide required width.
	AASHTO Green Book (p. 10-102)	14.0 ft		
Design Waiver	**Guidance**	**Required Value**	**Value Provided**	**Measure(s) Required to Avoid DW**
Superelevation Transition Length (multiple locations)	VDOT Road and Bridge Std. TC-5.11R	varies	varies	Mill and variable depth overlay on SB I-395 to achieve required superelevation runoff and runout lengths
	AASHTO Green Book (p. 3-61)	varies		

Construction Cost - The construction cost for improvements to the southbound I-395 mainline has been estimated separately from the cost of each interchange improvement alternative. This cost is

estimated at $31.5M, and includes the following:

- Milling and variable-depth overlay to correct normal pavement cross slope and superelevation rate;
- Full depth pavement widening to provide one additional through lane right of the existing travel lanes;
- Full depth widening to provide a full-width (outside) right shoulder;
- Removal of existing dual-faced guardrail and raised concrete median pavement separating the HOT/HOV lanes from the southbound general purpose travelway, and construction of concrete median barrier north of the Turkeycock HOV ramp overpass;
- Improvements that are common among all interchange improvement alternatives, including portions of ramp reconstruction, and retaining walls;
- New sound walls, assuming that noise mitigation will be required in the corridor where adjacent land use is subject to noise impacts;
- Relocated sound walls, assuming that precast concrete panels can be salvaged from recently constructed sound walls and reused; and,
- Storm water management facilities.

The costs for the following items are included in the estimate, and are assumed to be the same for all interchange improvement alternatives:

- Landscaping (allowance for restoration and replacement of trees lost near developed areas along Edsall Road and Duke Street);
- Replacement of existing overhead sign structures and ground-mounted signs;
- Replacement of lighting system components affected by the project, including poles, arms, luminaires, conduit, pull boxes, and cabinets; and,
- Relocation of existing ITS facilities affected by the project.

Traffic Operations – Under existing conditions southbound I-395 experiences saturated conditions in the PM peak period. The existing lane drop on southbound I-395 north of the Duke Street Interchange constrains traffic flow. As a result, the demand in this corridor is higher than the service volumes observed during peak periods. It is anticipated that widening the three-lane segment to four lanes and providing wider shoulders and travel lanes will increase capacity and increase service volumes on southbound I-395.

By 2040 the demand for the 4 lane segment will be greater than 8600 vehicles during the PM peak hour, which is close to the theoretical capacity of a typical four-lane freeway segment. Based on a review of upstream traffic volumes and observations of traffic operations during peak periods, projected demand is expected to continue to exceed the capacity of the southbound roadway even after widening to four travel lanes. This project will relieve congestion prior to and following the peak period, but will not eliminate congestion during the peak period itself.

Based on preliminary analyses using HCS software, the merge-weave area along southbound I-395 situated between the entrance ramp from Edsall Road and the diverge to eastbound and westbound I-495 operates at LOS F under existing conditions. None of the refinement alternatives considered in this study includes improvements that will correct or improve this deficient condition under projected 2040 conditions. The extent of physical improvements necessary to correct this deficient operating condition is beyond the scope of this project.

I-395 / Route 648 Edsall Road Interchange

Existing Conditions - Edsall Road has a functional classification as an Urban Principal Arterial and operates with a posted design speed of 35 mph. Each directional roadway provides two 12 ft travel lanes, a 1 ft offset to median curbing, and a paved right shoulder measuring 7.9 - 8.7 ft. The current layout is a partial cloverleaf with an eastbound-to-northbound semi-direct connection.

Refinement Alternative 1

Alternative 1 replaces the existing westbound-to-southbound loop ramp with a signalized left turn movement from westbound Edsall Road onto a new ramp (Ramp C) oriented to southbound I-395. The westbound left turn lane on Edsall Road will be constructed in the existing median and will provide a maximum storage length of 770 ft. Ramp C will merge into the existing eastbound-to-southbound entrance ramp (Ramp A), which will undergo a minor alignment shift.

Under existing conditions, the interchange provides two separate exit ramps oriented to eastbound and westbound Edsall Road. Alternative 1 combines these into a single two-lane exit ramp that forms a C/D roadway, from which Ramp B and Ramp D access eastbound and westbound Edsall Road, respectively. The two-lane exit ramp is configured as a taper departure from the I-395 mainline, with one exclusive exit lane and one choice lane. See the attached plan exhibit for full geometry and layout.

The existing interchange layout limits the nature and extent of geometric improvements that are possible without impacting major elements of existing bridges or acquiring additional right-of-way. Accordingly, design exceptions and waivers identified in Table 2 would be required to advance this alternative.

Table 2 – Edsall Road Alternative 1, Design Exceptions and Design Waivers

Design Exception	Guidance	Required Value	Value Provided	Measure(s) Required to Avoid DE
Shoulder Width Left Shoulder, SB I-395 to EB Edsall Rd. Exit Ramp	VDOT RDM Std. GS-R	6.0 ft	2.0 ft	Reconstruct bridge carrying Edsall Road over I-395; Widen ramp shoulders to provide additional pavement width.
	AASHTO Green Book (p. 10-102)	6.0 ft		
Shoulder Width Right Shoulder, SB I-395 to EB Edsall Rd. exit ramp	VDOT RDM Std. GS-R	10.0 ft	2.0 ft	Reconstruct bridge carrying Edsall Road over I-395; Widen ramp shoulders to provide additional pavement width.
	AASHTO Green Book (p. 10-102)	10.0 ft		
Design Waiver	**Guidance**	**Required Value**	**Value Provided**	**Measure(s) Required to Avoid DW**
Ramp Terminal Spacing EB/WB Edsall Rd. to SB I-395 Ramp	AASHTO Green Book (p. 10-106)	2000 ft	1220 ft	Full interchange reconstruction or closure of the Edsall Road interchange.

Construction Cost - Refinement Alternative 1 has an overall estimated construction cost of $9.2M.

Right-of-Way – Refinement Alternative A1 is anticipated to require a temporary construction easement from the property owned by Mule Pen Quarry Corporation, north or and adjacent to Curve A1 along the southbound entrance ramp from Edsall Road. Improvements along this segment of the ramp under Alternative 1 include minor widening of the ramp shoulder, installation of new guardrail, and fill embankment grading. The grading is anticipated to be as steep as 1:1 and may require slope paving to avoid impacts to an existing parking lot on the subject parcel. The size of the temporary construction easement is estimated at less than 0.1 acre.

Based on the preliminary design work completed to date, no other right-of-way impacts are associated with this design alternative.

Traffic Operations - This refinement alternative concentrates all traffic entering I-395 from Edsall Road into a single entrance ramp which is coincident with the existing eastbound-to-southbound entrance ramp. The downstream distance to the I-495 N/S diverge is not affected by this refinement alternative. However, improvements under this alternative will reapportion entering traffic within the lanes provided, and the fourth lane widening will increase service volumes entering the merge-weave area. Further detailed analysis is needed to fully assess these changes in operating conditions.

The westbound-to-southbound movement will be served by a single left turn lane located in the Edsall Road median, and which will operate under signal control. The projected volume for this movement

under 2040 PM peak hour conditions is 592 vph. This is higher than the 300 vph threshold established by VDOT for consideration of dual left turn lanes. This concern is mitigated by the two-phase operation of the signal, which is expected to provide favorable operations for all movements based on preliminary Synchro analyses. Refer to Table 3.

Table 3 – Traffic Operations, Edsall Road at I-395 Ramp Terminals, Alternative 1 (2040 Weekday PM)

	Edsall Road EB Through	Edsall Road WB Left Turn	Edsall Road WB Through
Volume (vph)	1106	592	1649
Delay (sec/vehicle)	27.8	23.9	0.8
LOS	C	C	A
95th Percentile Queue Length (ft)	473	450	211

The alternative will place low-speed traffic (20 mph) departing the signalized intersection via new Ramp C adjacent to higher speed traffic (35 mph) on existing Ramp A. This difference in operating speeds is not ideal in that it can make merge operations more difficult by forcing greater adjustments in travel speeds among merging traffic. Additional signage and enhanced lighting could be provided as mitigation measures.

This alternative (like all others considered at this interchange) concentrates all exit movements from southbound I-395 to Edsall Road into a single two-lane exit ramp. The two-lane exit ramp provided as part of this refinement alternative will reduce the merge-weave distance between the Edsall Road Interchange and the Turkeycock HOV exit ramp to the east. Analysis of this merge-weave area along southbound I-395 is addressed as part of the narrative for the I-395/Duke Street Interchange.

Refinement Alternative 2

This alternative is similar to Refinement Alternative 1 but replaces both the existing westbound-to-southbound loop ramp and the eastbound-to-southbound ramp with a new ramp (Ramp A) and signalized intersection at Edsall Road. Access to the southbound I-395 entrance ramp from eastbound Edsall Road will be provided by an exclusive right turn lane. Access to southbound I-395 from westbound Edsall Road will be provided from an exclusive left turn lane constructed in the Edsall Road median. The turn lane will provide a maximum storage length of 770 ft.

Proposed improvements to the southbound I-395 exit ramps are identical to those provided as part of Edsall Road Interchange Refinement Alternative 2.

Table 4 identifies the Design Exceptions and Design Waivers associated with Edsall Road Interchange Refinement Alternative 2.

Table 4 – Edsall Road Alternative 2, Design Exceptions and Design Waivers

Design Exception	Guidance	Required Value	Value Provided	Measure(s) Required to Avoid DE
Shoulder Width Ramp Left Shoulder Width, SB I-395 to EB Edsall Rd.	VDOT RDM Std. GS-R	6.0 ft	2.0 ft	Replace existing west abutment and one span of bridge carrying Edsall Road over I-395. Widen ramp shoulders to provide additional pavement width.
	AASHTO Green Book (p. 10-102)	6.0 ft		
Shoulder Width Ramp Right Shoulder Width, SB I-395 to EB Edsall Rd.	VDOT RDM Std. GS-R	10.0 ft	2.0 ft	Replace existing west abutment and one span of bridge carrying Edsall Road over I-395. Widen ramp shoulders to provide additional pavement width.
	AASHTO Green Book (p. 10-102)	10.0 ft		
Design Waiver	**Guidance**	**Required Value**	**Value Provided**	**Measure(s) Required to Avoid DW**
Ramp Terminal Spacing EB/WB Edsall Rd. to SB I-395 Ramp	AASHTO Green Book (p. 10-106)	2000 ft	1320 ft	Full interchange reconstruction or closure of the Edsall Road interchange.

Construction Cost – Refinement Alternative 2 has an estimated construction cost of $6.5M.

Right-of-Way – Based on the preliminary design work completed to date, this refinement alternative would not have any right-of-way impacts.

Traffic Operations - The potential traffic operational issues associated with this refinement alternative are the same as those identified above for Refinement Alternative 1. An exception is the speed differential for merging traffic on Ramp A, which is not an issue with Refinement Alternative 2 because both movements would operate under signal control at an at-grade intersection along Edsall Road. Preliminary analysis of this intersection was performed using Synchro software, and analysis results are summarized in Table 5.

Table 5 – Traffic Operations, Edsall Road at I-395 Ramp Terminals, Alternative 2 (2040 Weekday PM)

	Edsall Road EB Through	Edsall Road EB Right Turn	Edsall Road WB Left Turn	Edsall Road WB Through
Volume (vph)	1106	592	592	1649
Delay (sec/vehicle)	17.6	37.5	50.5	0.8
LOS	B	D	D	A
95th Percentile Queue Length (ft)	548	448	483	384

Additional analyses will be performed to balance delay among all intersection movements with the objective of achieving LOS C or better for each movement. VDOT will seek approval from FHWA to design to LOS D for specific intersection movements for which LOS C cannot be achieved.

Refinement Alternative 3

This alternative replaces the existing southbound-to-eastbound loop ramp with a new connection (Ramp B) from the existing southbound-to-westbound exit ramp (Ramp D), and a new signalized intersection at Edsall Road. The existing single-lane southbound-to-westbound ramp is widened to provide a two-lane taper exit ramp and, beyond the ramp gore, provide exclusive ramp lanes oriented to westbound and eastbound Edsall Road. The existing eastbound-to-southbound diagonal ramp is relocated (Ramp A) to maximize the separation along southbound I-395 between the Ramp A terminal and the downstream I-95/I-495 diverge. See the attached plan exhibit for full geometry and layout.

Table 6 on the following page summarizes the design exceptions and design waivers associated with Edsall Road Interchange Refinement Alternative 3.

Table 6 – Edsall Road Alternative 3, Design Exceptions and Design Waivers

Design Exception	Guidance	Required Value	Value Provided	Measure(s) Required to Avoid DE
Shoulder Width Ramp Left Shoulder Width, SB I-395 to EB Edsall Rd.	VDOT RDM Std. GS-R	6.0 ft	2.0 ft	Replace existing west abutment and one span of bridge carrying Edsall Road over I-395. Widen ramp shoulders to provide additional pavement width.
	AASHTO Green Book (p. 10-102)	6.0 ft		
Shoulder Width Ramp Right Shoulder Width, SB I-395 to EB Edsall Rd.	VDOT RDM Std. GS-R	10.0 ft	2.0 ft	Replace existing west abutment and one span of bridge carrying Edsall Road over I-395. Widen ramp shoulders to provide additional pavement width.
	AASHTO Green Book (p. 10-102)	10.0 ft		
Design Waiver	**Guidance**	**Required Value**	**Value Provided**	**Measure(s) Required to Avoid DW**
Ramp Terminal Spacing EB/WB Edsall Rd. to SB I-395 Ramp	AASHTO Green Book (p. 10-106)	2000 ft	1320 ft	Full interchange reconstruction and relocation of Edsall Road.
Ramp Terminal Spacing EB/WB Edsall Rd. to SB I-395 Ramp	AASHTO Green Book (p. 10-106)	240 ft	600 ft	Full interchange reconstruction and relocation of Edsall Road.

Construction Cost – Refinement Alternative 3 has an estimated construction cost of $8.1M.

Right-of-Way – Refinement Alternative 3 adds one auxiliary lane to SB I-395 south of the Ramp A terminal. This results in the edge of shoulder pavement located within 7 ft of the existing right-of-way along property owned by Mule Pen Quarry Corporation, located north of I-395 and west of Edsall Road. Given the elevation difference between the existing parking lot on the property and the southbound I-395 pavement, a retaining wall would be needed at this location. It is likely that this refinement alternative would require a permanent easement on the subject parcel for construction and perpetual inspection and maintenance of the retaining wall. The size of the easement would measure less than 0.1 acre, but would encumber portions of the property's parking lot.

Traffic Operations - The two-lane exit ramp from southbound I-395 has the same potential issues as those associated with Refinement Alternatives 1 and 2.

The southbound-to-eastbound movement is proposed to access Edsall Road at a new signalized at-grade intersection. The new ramp spur serving this movement is limited to a single lane because the pier spacing for the overhead ramp structure is not long enough to accommodate the width of a two-lane exit ramp. The subject movement has a projected traffic volume of 228 vph, which is below the 300 vph threshold at which a dual turn lane movement should be considered. Projected traffic operations at the intersection are summarized in Table 7 on the following page.

Table 7 – Traffic Operations, Edsall Road at I-395 Ramp Terminals, Alternative 3 (2040 Weekday PM)

	Edsall Road EB Through	Edsall Road WB Through	I-395 Exit Ramp SB Left Turn
Volume (vph)	1106	1649	228
Delay (sec/vehicle)	6.0	8.3	33.7
LOS	A	A	C
95th Percentile Queue Length (ft)	200	204	415

Refinement Alternative 3 introduces a two-lane entrance ramp onto southbound I-395, whereas the other two alternatives each provide single-lane entrance ramps. The additional ramp auxiliary lane associated with Refinement Alternative 3 is expected to degrade merge-weave operations south of the Edsall Road interchange as compared with existing or 2040 no-build conditions.

I-395 / Route 236 Duke Street Interchange

Existing Conditions - Within the project limits, Duke Street has a functional classification as an Urban Principal Arterial and operates with a posted speed limit of 35 mph. Route 236 is identified on the current FHWA website as a MAP-21 Principal Arterial on the National Highway System. Each directional roadway provides two 12 ft travel lanes, a 1 ft offset to median curbing, and a paved right shoulder measuring 8.0 – 9.0 ft. The current layout is a partial cloverleaf with an eastbound-to-northbound semi-direct connection.

Refinement Alternative 1A

This alternative replaces the existing southbound-to-eastbound loop ramp with a new signalized intersection at Duke Street and the new spur (Ramp P) off of the southbound-to-westbound exit ramp (Ramp Q). The existing southbound-to-westbound taper exit ramp is widened to provide a two-lane exit ramp. The westbound-to-southbound loop ramp (Ramp M) and the eastbound-to-southbound entrance ramp (Ramp K) are realigned to form a two-lane entrance ramp to southbound I-395.

Table 8 on the following page identifies Design Exceptions and Design Waivers associated with Refinement Alternative 1A.

Construction Cost – Refinement Alternative 1A has an estimated construction cost of $9.6M.

Right-of-Way – Refinement Alternative 1A will widen and realign portions of the exit ramp from southbound I-395 to westbound Duke Street (Ramp Q). The minimum radius alignment of the westbound-to-southbound loop ramp (Ramp M) limits the degree to which Ramp Q can be shifted away

Table 8 – Duke Street Alternative 1A, Design Exceptions and Design Waivers

Design Exception	Guidance	Required Value	Value Provided	Measure(s) Required to Avoid DE
Shoulder Width Right Shoulder, Ramp WB Duke St. to SB I-395	VDOT RDM Std. GS-R	10.0 ft	3.0 ft	Reconstruct west abutment and one span of bridge carrying Duke Street over I-395. Widen the shoulder to provide additional width.
	AASHTO Green Book (p. 10-102)	10.0 ft		
Shoulder Width Left Shoulder, Ramp WB Duke St. to I-395	VDOT RDM Std. GS-R	6.0 ft	2.0 ft	Reconstruct west abutment and one span of bridge carrying Duke Street over I-395. Widen the shoulder to provide additional width.
	AASHTO Green Book (p. 10-102)	6.0 ft		
Horizontal Alignment Curve M2 - Minimum radius, WB Duke Street to SB I-395 entrance ramp	VDOT RDM Std. GS-R	135 ft	102 ft	Acquire additional right-of-way; reconstruct Ramp K along new alignment; reconstruct approach to flyover ramp
	AASHTO Green Book (p. 3-32)	135 ft		
Design Waiver	**Guidance**	**Required Value**	**Value Provided**	**Measure(s) Required to Avoid DW**
Ramp Terminal Spacing SB I-395 Entrance Ramps	VDOT RDM Std. GS-R	600 ft	295 ft	Partial interchange reconstruction or further reduce length of auxiliary lanes serving entrance ramp to SB I-395.
	AASHTO Green Book (p. 10-121 thru 10-122)	600 ft		
Auxiliary Lane Length SB I-395 Entrance Ramps	VDOT RDM Std. GS-R	2500 ft	2154 ft	Reconstruct the Turkeycock HOV ramp bridge over SB I-395. Increase length of entrance ramp auxiliary lane.
	AASHTO Green Book (p. 10-106)	2500 ft		

from the existing right-of-way line. As a result, the improvements to Ramp Q may require additional right-of-way from two properties.

Between curves Q1 and Q2, the ramp right shoulder is expected to extend within 6 ft of the right-of-way along property owned by BRE/ESA P Portfolio LLC, which is occupied by an Extended Stay America Hotel. Given the elevation difference between the proposed ramp pavement and existing ground on the adjacent portion of the subject property, a cut retaining wall and embankment grading will likely be needed. Partial acquisition or a permanent easement is anticipated for construction and perpetual placement of retaining wall elements. The size of the property interest to be acquired is anticipated to measure less than 0.1 acre, and is not expected to impact any developed feature of the hotel site.

Further east, the a cut retaining wall is anticipated to be needed along Curve Q3 where the ramp widening extends the new pavement surface within 12 ft of the property line. A temporary easement for construction of the wall and earthwork grading may be needed from the property owned by CP III LINC, LLC, upon which is located the Carmel residential apartment building. The size of the easement is anticipated to be less than 0.1 acre.

Traffic Operations - This refinement alternative concentrates all traffic entering southbound I-395 onto a single ramp that is located upstream of the left exit ramp to the HOV facility. The entrance ramp will provide two auxiliary lanes along southbound I-395 that will be dropped before the Turkeycock ramp overpass, a distance of 2,154 ft. This distance is less than the 2,500 ft required to satisfy AASHTO guidance, but is the maximum possible without reconstruction of the Turkeycock ramp overpass structure. The reduced lane drop distance will force entering traffic to assimilate mainline travel speeds faster, and may afford motorists less time than recommended to merge into mainline traffic.

The additional auxiliary lane and the additional through lane will result in changed merge-weave conditions as compared with existing conditions:

- The merge-weave distance is increased by approximately 100 ft.
- The traffic volume entering from Duke Street is increased and concentrated at a single location.

- The number of lanes required for the weaving maneuver (from entrance ramp to exit ramp) increases from three to four or five (depending on which entrance ramp lane the maneuver originates from).
- The additional through lane increases the service volume on southbound I-395.

Preliminary analyses performed using HCS software indicate that this merge-weave condition operates at LOS F with a v/c ratio of 1.03 under existing 2013 PM peak hour conditions, and LOS F with a v/c ratio of 1.11 under projected 2040 PM peak hour conditions with Refinement Alternative 1A in place.

The merge-weave area located along southbound I-395 between the Turkeycock HOV ramp and the Edsall Road interchange is unaffected by improvements associated with Alternative 1A, and is expected to operate at LOS C with a v/c ratio of 0.66 under projected 2040 PM peak hour conditions.

Traffic operations at the new signalized intersection along Duke Street are summarized in Table 9.

Table 9 – Traffic Operations, Duke Street at I-395 Ramp Terminals, Alternative 1A (2040 Weekday PM)

	Duke Street EB Through	Duke Street WB Through	I-395 Exit Ramp SB Left Turn
Volume (vph)	1683	2428	746
Delay (sec/vehicle)	10.2	12.2	42.0
LOS	B	B	D
95th Percentile Queue Length (ft)	469	468	538

Refinement Alternative 1B

Alternative 1B incorporates much of the same geometry as Alternative 1A for the exit ramp from southbound I-395, signalized intersection at Duke Street, and modifications to the westbound-to-southbound and eastbound-to-southbound ramps. The two alternatives differ in that Alternative 1B merges Ramp M and Ramp K, which remain barrier-separated from the southbound I-395 mainline in order to eliminate the merge-weave movements between the entrance ramps from Duke Street and the downstream left exit ramp to the HOT lanes. Ramp M/K traffic remains barrier-separated as it joins the Turkeycock HOV exit ramp, accessing mainline I-395 north of the Edsall Road interchange.

Table 10 identifies Design Exceptions and Design Waivers associated with Refinement Alternative 1B.

Table 10 – Duke Street Alternative 1B, Design Exceptions and Design Waivers

Design Exception	Guidance	Required Value	Value Provided	Measure(s) Required to Avoid DE
Shoulder Width Right Shoulder, Ramp WB Duke St. to SB I-395	VDOT RDM Std. GS-R	10.0 ft	3.0 ft	Reconstruct the bridge carrying Duke Street over I-395. Widen the shoulder to provide required width.
	AASHTO Green Book (p. 10-102)	10.0 ft		
Shoulder Width Left Shoulder, Ramp WB Duke St. to I-395	VDOT RDM Std. GS-R	6.0 ft	2.0 ft	Reconstruct the bridge carrying Duke Street over I-395. Widen the shoulder to provide required width.
	AASHTO Green Book (p. 10-102)	6.0 ft		
Horizontal Alignment Curve M2 - Minimum radius, WB Duke Street to SB I-395 entrance ramp	VDOT RDM Std. GS-R	135 ft	102 ft	Acquire additional right-of-way; reconstruct Ramp K along new alignment; reconstruct approach to flyover ramp
	AASHTO Green Book (p. 3-32)	135 ft		
Design Waiver	**Guidance**	**Required Value**	**Value Provided**	**Measure(s) Required to Avoid DW**
(none)	--	--	--	--

Based on VDOT's review of the HOT Lanes concessionaire agreement, this alternative would not be characterized as a "compensation event" requiring payment to the concessionaire. Further, VDOT characterizes this project to widen southbound I-395 as an operational improvement project that is

exempt from the tenets of the agreement.

Construction Cost – Refinement Alternative 1B has an estimated construction cost of $15.3M.

Right-of-Way – Refinement Alternative 1B is expected to have the same right-of-way impacts as identified above for Alternative 1A. In addition, improvements associated with Ramp J are expected to require partial right-of-way acquisition from a parcel owned by Wesley Lincolnia, LLC, occupied by a residential townhome complex. The acquired area is needed for construction and maintenance of a retaining wall, and is expected to measure approximately 0.2 acres.

Traffic Operations - Refinement Alternative 1B eliminates the merge-weave conditions on the southbound I-395 between the entrance ramp from the Duke Street Interchange and the exit ramp to the HOT lanes facility. This improvement is expected to streamline traffic operations and increase capacity and service volumes on this segment of southbound I-395.

Resulting traffic volumes on the lower segment of the Turkeycock HOV ramp will increase substantially because this ramp will now be serving all entrance ramp traffic from the Duke Street Interchange. Total traffic volumes on this ramp as it merges with southbound I-395 are projected to be approximately 1,500 vph under 2040 PM peak hour conditions with Refinement Alternative 1B in place. Preliminary analyses indicate that the merge-weave area between this ramp and the exit ramp to the Edsall Road Interchange will operate at LOS F under projected 2040 PM peak hour conditions.

Motorists originating from the Duke Street corridor destined for the HOT lanes will need to divert their trips to either the future Seminary Road HOV entrance ramp, or travel in the southbound I-395 general purpose travel lanes to access the future HOT lanes entrance ramp south of I-495.

Traffic operations at the new signalized intersection along Duke Street are the same as those summarized in Table 9, above, for Alternative 1A.

Refinement Alternative 1C

Refinement Alternative 1C is identical to Alternative 1B regarding the geometry for the exit ramp from southbound I-395, the signalized intersection at Duke Street, and modifications to the westbound-to-southbound and eastbound-to-southbound ramps. Alternative 1C varies from Alternative 1B in the configuration of the entrance ramps to southbound I-293. Ramp M is modified to merge with the I-395 southbound mainline just south of Duke Street, but Ramp K remains barrier-separated from both the I-395 mainline and Ramp M as it joins the Turkeycock HOV exit ramp, and accesses mainline I-395 north of the Edsall Road Interchange.

Table 11 identifies Design Exceptions and Design Waivers associated with Refinement Alternative 1C.

Table 11 – Duke Street Alternative 1C, Design Exceptions and Design Waivers

Design Exception	Guidance	Required Value	Value Provided	Measure(s) Required to Avoid DE
Shoulder Width Right Shoulder, Ramp WB Duke St. to SB I-395	VDOT RDM Std. GS-R	10.0 ft	3.0 ft	Reconstruct the bridge carrying Duke Street over I-395. Widen the shoulder to provide required width.
	AASHTO Green Book (p. 10-102)	10.0 ft		
Shoulder Width Left Shoulder, Ramp WB Duke St. to I-395	VDOT RDM Std. GS-R	6.0 ft	2.0 ft	Reconstruct the bridge carrying Duke Street over I-395. Widen the shoulder to provide required width.
	AASHTO Green Book (p. 10-102)	6.0 ft		
Horizontal Alignment Curve M2 - Minimum radius, WB Duke Street to SB I-395 entrance ramp	VDOT RDM Std. GS-R	135 ft	102 ft	Acquire additional right-of-way; reconstruct Ramp K along new alignment; reconstruct approach to flyover ramp
	AASHTO Green Book (p. 3-32)	135 ft		
Design Waiver	**Guidance**	**Required Value**	**Value Provided**	**Measure(s) Required to Avoid DW**
(none)	--	--	--	--

As with Alternative 1B, VDOT has determined that Refinement Alternative 1C is not subject to the limitations or other terms of the agreement with the 95 Express HOT lanes concessionaire.

Construction Cost – Refinement Alternative 1C has an estimated construction cost of $15.3M.

Right-of-Way – Refinement Alternative 1C is expected to have the same right-of-way impacts as identified above for Alternatives 1A and 1B, and is expected to measure approximately 0.2 acres.

Traffic Operations - This refinement alternative allows traffic from westbound Duke Street to merge onto southbound I-395 (via Ramp M), north of the Turkeycock HOV ramp overpass, and provides adequate distance for the merge operations to occur. Preliminary analyses indicate that this merge-weave area will operate at LOS E with a v/c ratio of 0.99. These results are nominally better than those associated with Alternatives 1A or 1B.

Alternative 1C also reduces the volume of traffic that would be diverted into the merge-weave area along southbound I-395 between the Turkeycock HOV ramp and the Edsall Road Interchange under Alternative 1B. Preliminary analyses indicate that this merge-weave area would operate at LOS D with a v/c ratio of 0.71. These results are significantly better than those anticipated for Refinement Alternatives 1A or 1B.

Traffic operations at the new signalized intersection along Duke Street are the same as those summarized above for Alternatives 1A and 1B.

Refinement Alternative 2 - I-395 at Duke Street

Different from the other two Duke Street interchange alternatives, Alternative 2 replaces the existing westbound-to-southbound loop ramp with a signalized left turn movement from westbound Edsall Road. The left turn lane will be constructed in the existing Duke Street median and in order to maximize storage capacity, it will extend across the bridge carrying Duke Street over I-395. The left turn movement will use a new ramp spur (Ramp L), which merges with the eastbound-to-southbound ramp (Ramp K) to form a two-lane entrance ramp. To reduce the number of successive exit ramps from southbound I-395, the alternative provides a single southbound two-lane taper exit ramp that serves three destinations – Quantrell Avenue, westbound Duke Street, and eastbound Duke Street.

The Design Exceptions and Design Waivers associated with Refinement Alternative 2 are summarized in Table 12.

Table 12 – Duke Street Alternative 2, Design Exceptions and Design Waivers

Design Exception	Guidance	Required Value	Value Provided	Measure(s) Required to Avoid DE
Shoulder Width Right Shoulder, WB Duke St. to SB I-395 Entrance Ramp	VDOT RDM Std. GS-R	10.0 ft	2.0 ft	Reconstruct west abutment and one span of the bridge carrying Duke Street over I-395. Widen the shoulder to provide additional width.
	AASHTO Green Book (p. 10-102)	10.0 ft		
Shoulder Width Left Shoulder, Ramp WB Duke St. to I-395	VDOT RDM Std. GS-R	6.0 ft	2.0 ft	Reconstruct west abutment and one span of the bridge carrying Duke Street over I-395. Widen the shoulder to provide additional width.
	AASHTO Green Book (p. 10-102)	6.0 ft		
Horizontal Alignment Curve N1 - Minimum radius, SB I-395 entrance ramp to EB Duke Street	VDOT RDM Std. GS-R	135 ft	108 ft	Acquire additional right-of-way; reconstruct Ramp K along new alignment; reconstruct approach to flyover ramp
	AASHTO Green Book (p. 3-32)	135 ft		

Table 12 (continued) – Duke Street Alternative 2, Design Exceptions and Design Waivers

Design Waiver	Guidance	Required Value	Value Provided	Measure(s) Required to Avoid DW
Superelevation Transition Length, WB Duke St. to I-395 SB Ramp - L_r from Curve L1 to Curve K2	VDOT Road and Bridge Std. TC-5.11R	122 ft	100 ft	Acquire additional right-of-way to shift Ramp K away from Ramp L to create earlier separation.
	AASHTO Green Book (p. 3-61)	122 ft		
Ramp Terminal Spacing SB I-395 Entrance Ramps	VDOT RDM Std. GS-R	600 ft	430 ft	Partial interchange reconstruction or further reduced length of auxiliary lanes serving entrance ramp to SB I-395.
	AASHTO Green Book (p. 10-121 thru 10-106)	600 ft		
Ramp Terminal Spacing SB I-395 Entrance Ramps	VDOT RDM Std. GS-R	600 ft	343 ft	Partial interchange reconstruction or further reduced length of auxiliary lanes serving entrance ramp to SB I-395.
	AASHTO Green Book (p. 10-121 thru 10-106)	600 ft		
Auxiliary Lane Length Duke Street to SB I-395 Entrance Ramp	VDOT RDM Std. GS-R	2500 ft	2410 ft	Reconstruct the Turkeycock HOV ramp bridge over SB I-395. Increase length of entrance ramp auxiliary lane.
	AASHTO Green Book (p. 10-106)	2500 ft		

Construction Cost – Refinement Alternative 2 has an estimated construction cost of $8.1M.

Right-of-Way – Refinement Alternative 2 is not expected to have any right-of-way impacts.

Traffic Operations - The westbound-to-southbound movement will be served by a single left turn lane located in the Duke Street median, and which will operate under signal control. The projected volume for this movement under 2040 PM peak hour conditions is 619 vph. This is higher than the 300 vph threshold established by VDOT for consideration of dual left turn lanes. This concern is offset by the two-phase operation of the signal, which is expected to provide favorable operations for all movements based on preliminary Synchro analyses. Refer to Table 13.

Table 13 – Traffic Operations, Duke Street at I-395 Ramp Terminals, Alternative 2 (2040 Weekday PM)

	Duke Street EB Through	Duke Street WB Left Turn	Duke Street WB Through
Volume (vph)	1683	619	2428
Delay (sec/vehicle)	18.7	35.7	0.8
LOS	B	D	A
95th Percentile Queue Length (ft)	455	468	110

Similar to Refinement Alternative 1A, Alternative 2 concentrates all traffic entering southbound I-395 onto a single ramp that is located upstream of the left exit ramp to the HOV facility. The entrance ramp will provide two auxiliary lanes along southbound I-395 that will be dropped before the Turkeycock ramp overpass, a distance of 2,410 ft. This distance is nominally less than the 2,500 ft required to satisfy AASHTO guidance, but is the maximum possible without reconstruction of the Turkeycock ramp overpass structure.

The additional auxiliary lanes and the additional through lane will result in changed merge-weave conditions as compared with existing conditions:

- The merge-weave distance is increased by approximately 650 ft.
- The traffic volume entering from Duke Street is increased and concentrated at a single location.
- The number of lanes required for the weaving maneuver (from entrance ramp to exit ramp) increases from three to four or five (depending on which entrance ramp lane the maneuver originates from).
- The through service volume on southbound I-395 is increased as a result of the additional through lane.

This condition is expected to operate similar to Duke Street Refinement Alternative 1, at LOS F under 2040 PM peak hour conditions.

Summary and Recommendations – Interchange Refinement Alternatives

Geometric improvements for each interchange improvement alternative were evaluated for compliance with design standards, construction cost, right-of-way impacts, and traffic operations. Table 14 presents the summary comparison of alternatives for the Edsall Road Interchange and the Duke Street Interchange, and identifies preliminary recommendations for each location.

Table 14 – Summary Evaluation of Interchange Refinement Alternatives

Evaluation Criteria	Edsall Road Interchange Refinement Alternatives			Duke Street Interchange Refinement Alternatives			
	1	2	3	1A	1B	1C	2
Compliance with Standards							
No. of Design Exceptions	2	2	2	2	2	2	2
No. of Design Waivers	2	1	2	2	0	0	4
Construction Cost							
Partial Cost for Alternative	$9.2M	$6.5M	$8.1M	$9.6M	$15.3M	$15.3M	$8.1M
Right-of-Way Impacts							
No. of Affected Parcels	1	0	1	2	3	3	0
Total Area of Impact	>0.1 acres	0.0 acres	>0.1 acres	0.2 acres	0.4 acres	0.4 acres	0.0 acres
Traffic Operations							
		RECOMMENDED				RECOMMENDED	

The number of design exceptions and/or design waivers is similar among the three improvement alternatives considered for each of the Edsall Road and Duke Street Interchanges. As a result, this criterion does not significantly influence the selection of the recommended alternative. The same is true for right-of-way impacts, which are anticipated to be minor in nature and extent.

The construction cost for the mainline I-395 improvements is estimated at $31.5M. The cost of all recommended improvements totals $53.3M, including improvements at the Edsall Road and Duke Street Interchanges.

Even if the least expensive refinement alternative were selected for each of the two interchange areas, the construction cost of the entire project would total $46.1M. The current anticipated funding for the project is estimated by VDOT at $50M; projected funding would therefore be sufficient for construction, but not sufficient to address the cost of CEI services which are estimated at an additional 18-20% of construction cost. Forthcoming design activities will continue to refine the design concepts selected by VDOT as the aggregate preferred alternative. Preliminary and final design activities will need to focus on ways to reduce overall projected construction costs associated with recommended improvements toward the $50M budget established by VDOT.

Although it appears possible to avoid right-of-way impacts at the Edsall Road Interchange, the recommended improvements at the Duke Street Interchange will require VDOT to acquire additional right-of-way. Therefore, it is not possible to eliminate the need to acquire right-of-way for the project as a whole. Refinement Alternative 2 at the Edsall Road Interchange is not anticipated to require any additional right-of-way, which supports its selection as the preferred refinement alternative. While Refinement Alternative 2 at the Duke Street Interchange would avoid the need for right-of-way, that alternative is not preferred because it does not provide any improvement to the merge-weave conditions along southbound I-395 between Duke Street and the Turkeycock HOV ramp.

Each of the concepts studied would remove merge-weave operations between the tight loop ramps that are currently in serve at the Edsall Road and Duke Street Interchanges. However, none of alternatives

will completely alleviate congestion on southbound I-395, and none will correct operational deficiencies associated with all individual merge, diverge, or merge-weave areas. Refinement Alternative 2 at the Edsall Road Interchange limits is expected to have the lease effect on the existing merge-weave operations upstream of the I-495 interchange, and will allow for acceptable traffic operations on Edsall Road at the new signalized ramp terminal intersection. Refinement Alternative 1C at the Duke Street Interchange provides the most favorable means of access to southbound I-395, and provides acceptable operations on Duke Street at the ramp terminal intersections.

On the basis of the overall findings presented above, Edsall Road Interchange Refinement Alternative 2 and Duke Street Interchange Refinement Alternative 1C are recommended.

Evaluation of Structural Alternatives at Bridge Underpass Locations

Introduction

Preliminary structural studies on the I-395 SB widening project have primarily focused on identification of structural alternatives for bridge underpass locations that will require either Design Exceptions or Design Waivers to address substandard roadway horizontal footprint. This section provides an overview of studies conducted to date in order to gain feedback from VDOT regarding desired path forward. The following is provided to document studies conducted to date:

- Locations evaluated
- Description of alternatives
- Resultant underpass geometrics
- Preliminary recommendations

Locations Evaluated

Preliminary concept developments have identified a need for an additional travel lane beneath existing bridge end spans which currently consist of paved slope protection at the following locations:

- Edsall Road bridge over I-395
- Ramp C over Ramp E and I-395 (at Edsall Road Interchange)
- Duke Street over I-395

Additionally, preliminary concept developments have identified the need to add an additional travel lane beneath the middle span for the three-span Ramp B bridge flyover at Turkeycock.

Pier Protection Alternatives

Three pier protection alternatives have been identified which comply with AASHTO LRFD Bridge Design Specifications Section 3.6.5.1, Protection of Structures. The intent of the multiple alternatives was to identify methods to maximize shoulder width without compromising safety. A brief description of these alternatives follows:

1. Standard VDOT F-Shape TL-5 Pier Protection Barrier - This alternative consists of a structurally independent TL-5 barrier consistent with VDOT Standard Drawings BPPS-1 through BPPS-3. The height and length of barrier would be in compliance with provisions in the VDOT Bridge Design Aids, Volume V – Part 2 File No. 15.06. This barrier features a horizontal offset from face of barrier curb to face of column of 2.0 ft. The barrier is supported on a continuous 2 ft x 2 ft footing set 2'-3" below existing ground line and would be easy to construct using slip-form techniques. One potential problem with this barrier type is conflict between the barrier footing and column footings. Similar problems recently surfaced on the 95 Express Project. It is understood that VDOT will be taking test pits at pier locations to verify the depth available for barrier footing placement.
2. 9.1° Single-Slope TL-5 Pier Protection Barrier - This alternative consists of a structurally independent TL-5 barrier in compliance with "Constant Slope Barrier" standards as approved by the Federal Highway Administration in Report 350, "Nonproprietary Guardrails and Median

Barriers." Reference Appendix C, sheet 5 for details. The acceptability of this detail for use as a TL-5 rated barrier was discussed with and confirmed by Mr. Nicholas Artimovich, from FHWA's Office of Safety Technologies. This barrier features a horizontal offset from face of barrier curb to face of column of 1'-4⅝" (reduction of 7⅜" compared to Alternative 1). The barrier detail is prepared in accordance with details provided in TF-13, standard SGM10b, approved by AASHTO. A nominal 3" vertical embedment is required below existing ground line for most of its length with anchoring 10" vertical embedment at the end of barrier. The height and length of barrier would match provisions in the VDOT Bridge Design Aids, Volume V – Part 2 File No. 15.06. This barrier would likely have to be custom formed and would be more labor intensive than the Standard VDOT barrier. One advantage to this barrier type is the limited embedment depth if space is found to be limited for barrier placement above the column footing.

3. Pier In-Fill Wall (Monolithic Vertical Face Barrier) - This alternative consists of strengthening the multi-column pier by use of a solid "in-fill" wall to provide structural resistance in accordance with AASHTO LRFD 3.6.5.1 (equivalent static force of 600 kip, oriented in a direction of 0-15° measured from edge of pavement at a height of 5.0 ft above ground). A representative structural analysis was prepared for Pier 2 at the Ramp B flyover bridge at Turkeycock. From this analysis, structural details were identified to achieve the required resistance. These details include a solid reinforced CIP in-fill wall with top elevation set 5.0 ft above existing ground line and bottom elevation set at the base column-footing interface elevation. The wall would be anchored monolithically to the existing columns either by drilling holes and placing reinforcing through the column or attaching to the column using drilled embedded anchors. No modifications to or strengthening of the existing pier foundations are required as it is assumed the footings/pile foundations are adequate to resist the lateral collision load. It is assumed the passive soil pressure, friction, pile structural capacity and any unusual displacement under extreme event limit state are acceptable as long as collapse is averted. The vertical face wall would transition to F-shape or single-slope outside the limits of the pier and would match length and height provisions in the VDOT Bridge Design Aids, Volume V – Part 2 File No. 15.06. This detail for pier protection was also discussed with Mr. Artimovich from FHWA's Office of Safety Technologies, who confirmed that the vertical face in-fill wall concept is acceptable and is not an unusual application. This alternative features a face of barrier curb flush to the face of column (reduction of 2.0 ft compared to Alternative 1).

Abutment Retaining Wall Alternatives at End Slope Removals

Two alternatives are provided for retaining walls at bridge end span locations where existing end slope protection will need to be removed and the abutment embankments retained. Alternative 1 consists of a soil nail wall and Alternative 2 consists of a post and panel wall. To date, soil borings have yet to be taken for all of the proposed bridge underpass locations involving placement of retaining walls. Further evaluations will be performed once this data is available. Information presented for wall concepts below is conceptual and is provided to identify the roadway opening geometry. A brief description of the alternatives follows:

1. Soil Nail Wall - This wall alternative consists of placement of closely spaced steel bars, "nails" into the existing end slope to be retained to provide reinforcing and strengthening of the existing ground. The top down construction methods used for this wall type are relatively simple and well suited for the tight working space available beneath the bridge end spans. Wall construction involves placement of a series of excavation lifts wherein holes are drilled for the nails, the nails are installed and grouted, drainage strips are placed, and the initial shotcrete layer placed with bearing plates and nuts. At the completion of all lifts, a CIP facing is placed. The details provided for this alternative, with vertical face wall and F-shape barrier shape integrated into the CIP facing, are similar to details recently used on the 495 Express Lanes project. The following assumptions were used to define the horizontal geometrics of the wall relative to the existing abutment and subsurface abutment features:
    - Soil nail walls fronting stub abutments on spread footing: For stability, wall location has been established using a 1:1 slope from front base of abutment footing element to base of tie-back

assembly.

- Soil nail wall fronting stub abutment with battered steel piling: Wall location has been established with a 3 ft minimum clearance identified between back side of soil nail wall facing and closest pile element.

2. Post and Panel Wall - The post and panel wall option is offered as an alternative to the soil nail wall, but its use is only recommended if soil conditions preclude the use of the soil nail wall alternative or if the roadway opening provided using a soil nail wall is considered to be prohibitive. For this wall option, soil loads are transferred to steel posts through precast concrete panels and partially through soil arching. The wall construction would consist of placement of galvanized steel posts into drilled holes filled with lean concrete. This type of construction does not lend itself to the tight working space and tight overhead constraints which exist beneath the bridge end spans. Construction would likely involve several post splices and lagging would be required to retain a significant portion of the existing slope.

   Due to strength in the embedded posts, it may be possible to position this type of wall slightly closer to the buried abutment foundation elements than is possible for the soil nail alternative. The horizontal geometrics of the wall relative to the existing abutment are a function of the construction methods employed. Layouts provided assume a 4 foot minimum vertical gap between the bridge girder soffit line and the top of post elevation as a limiting geometric constraint.

Resultant Underpass Geometry

To date, the three bridge end span underpass locations have been fully 3-D modeled in CADD based on survey information provided by VDOT for this project. These models include bridge overhead elements and bridge subsurface elements including stub abutments, piles, and pier footings. All subsurface features are based on as-built plans. These features will be refined as further information is developed from upcoming bridge situation survey activities.

- Bridge End Span Underpass Locations - The minimum acceptable horizontal roadway footprint for a single lane passage beneath existing bridge end spans has been identified as consisting of a 2.0 ft left shoulder, a 16.0 ft travel lane, and a 2.0 ft right shoulder. The minimum acceptable vertical clearance for these passages is 16'-6"per VDOT geometrics standards (S&B Design Aids, Volume V, Part 2, File No. 06.02-1). The resultant bridge underpass geometrics for the combination of pier protection and abutment retaining wall alternatives can be found in Appendix C. The tables in Appendix C show comparative values for shoulder widths for the different options. All bridge end span underpass locations have been confirmed to have acceptable vertical clearance.
- Span 2 Roadway Underpass at Ramp B Flyover (Turkeycock) - The minimum acceptable horizontal roadway footprint for the four lane passage beneath span 2 has been identified as consisting of a 2.0 ft left shoulder, four 12.0 ft travel lanes, and a 2.0 ft right shoulder. The table in Appendix C shows comparative values for shoulder widths for the different pier protection options. The bridge underpass vertical clearance for the additional through lane is acceptable.

Preliminary Recommendations

Due to the lack of soil boring information, it is considered premature to offer up any conclusive recommendations regarding retaining wall alternatives. As stated previously, these walls will be further evaluated once soil boring information is available.

Regarding pier protection and preliminary wall geometry, the following preliminary recommendations are offered:

- Edsall Road Bridge over I-395 - Due to the proximity of this underpass location relative to the Ramp C over Ramp E and I-395 underpass, it is recommended that the barrier type and detail match at both locations. Since the Ramp C location is more constrictive with regards to underpass opening, recommendations for Edsall Road should match those offered below for Ramp C.

A preliminary comparison of wall types indicates the post and panel wall option does not provide any geometric advantage with regards to roadway footprint compared with the soil nail option. As such, it is recommended to use the post and panel option only if future borings indicate the soil nail wall is problematic.

- Ramp C over Ramp E and I-395 (Edsall Road Interchange) - Due to the height of fill slope at this bridge location, using the soil nail wall option it appears the roadway opening will be restricted to the minimal opening identified for the project (2.0 ft shoulders). The in-fill wall would provide an additional 2.0 ft opening or 3.0 ft shoulders. As such, it is recommended that the desirability of this increased opening be weighed against the additional cost and additional constructability/MOT impacts associated with the in-fill wall option. For the two bridges at Edsall combined, a cost delta of approximately $80,000 has been identified between F-shape and in-fill wall options. The single slope barrier option is only recommended if test pitting indicates the footing elevation is too high to accommodate the VDOT barrier footing.

  A preliminary comparison of wall types indicates the post and panel wall option may allow for some slight increase in roadway opening. Further refinement of these wall concepts is forthcoming once boring information is available.

- Duke Street over I-395 - An achievable roadway underpass section with 3'-6" shoulders has been identified for the soil nail wall alternative with standard VDOT F-Shape TL-5 pier protection barrier. As such, this is the recommended alternative. The single slope barrier option should only be considered if test pitting indicates the footing elevation is too high to accommodate the VDOT barrier footing. The in-fill wall option does provide 4'-6" shoulders, however, this option would come with additional cost and with additional constructability/MOT impacts. A cost delta of $60,000 has been identified between F-shape barrier and in-fill wall options.

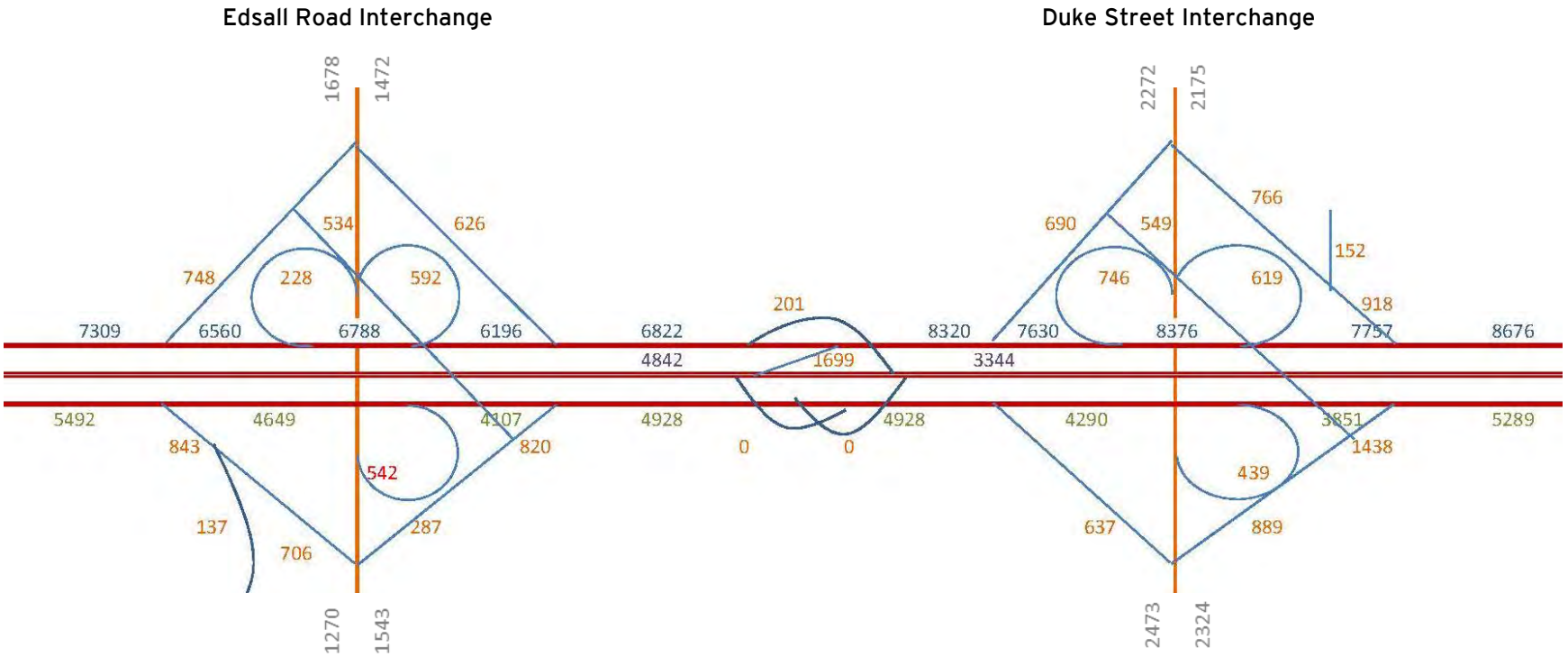
  A preliminary comparison of wall types indicates the post and panel wall option does not provide any geometric advantage with regards to roadway footprint compared with the soil nail option. As such, it is recommended to use the post and panel option only if future borings indicate the soil nail wall is problematic.

- Ramp B Flyover at Turkeycock - An achievable roadway underpass section with 2'-2 7/8" shoulders has been identified for the standard VDOT F-Shape TL-5 pier protection barrier. Use of the in-fill wall option would provide for an additional 4 ft of opening, or 4'-2 7/8" shoulders. As such, it is recommended that the desirability of this increased opening be weighed against the additional cost and additional constructability/MOT impacts associated with the in-fill wall option. A cost delta of $65,000 has been identified between F-shape and in-fill wall options. The single slope barrier option is only recommended if test pitting indicates the footing elevation is too high to accommodate the VDOT barrier footing. Using the as-built plans, preliminary geometric studies have indicated potential barrier to pier footing conflicts.

APPENDIX A

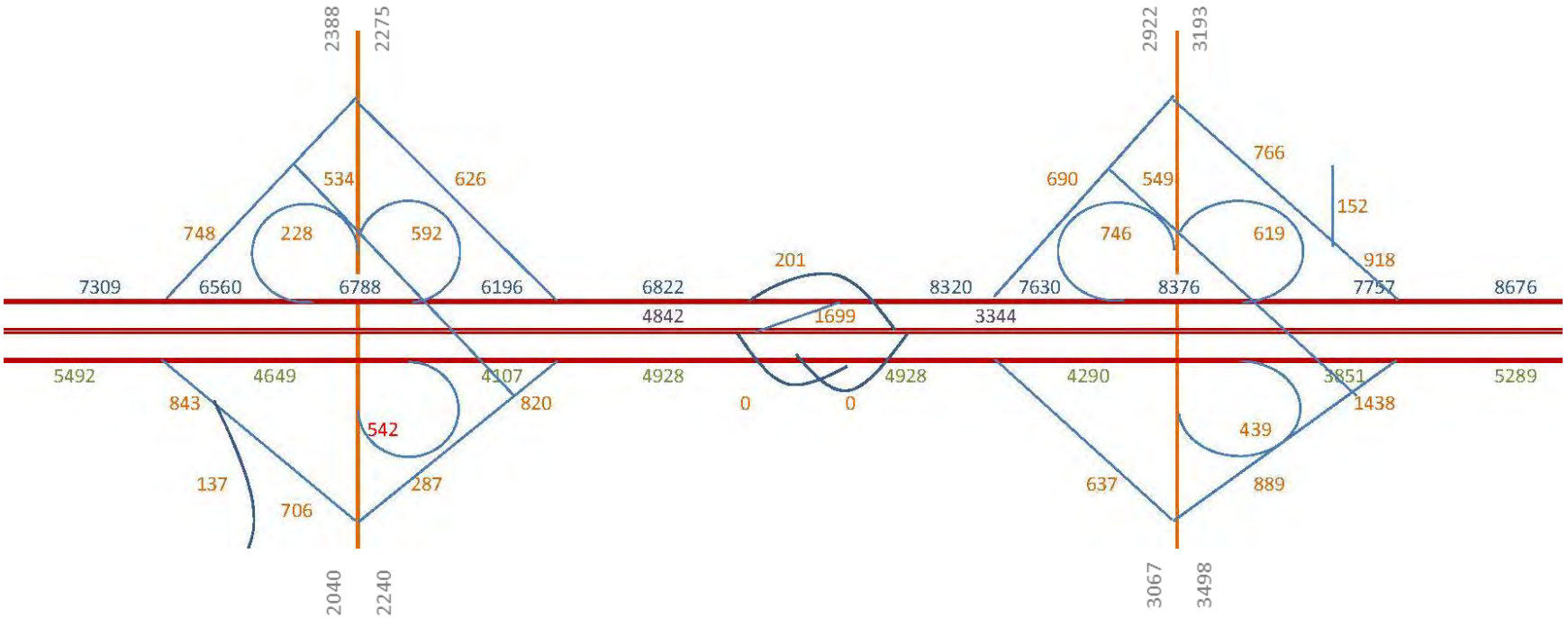
EXISTING 2013 WEEKDAY PM PEAK HOUR TARFFIC VOLUMES
PROJECTED 2040 WEEKDAY PM PEAK HOUR TRAFFIC VOLUMES

Existing 2013
Weekday PM Peak Hour Traffic Volumes



Projected 2040 Build
Weekday PM Peak Hour Traffic Volumes

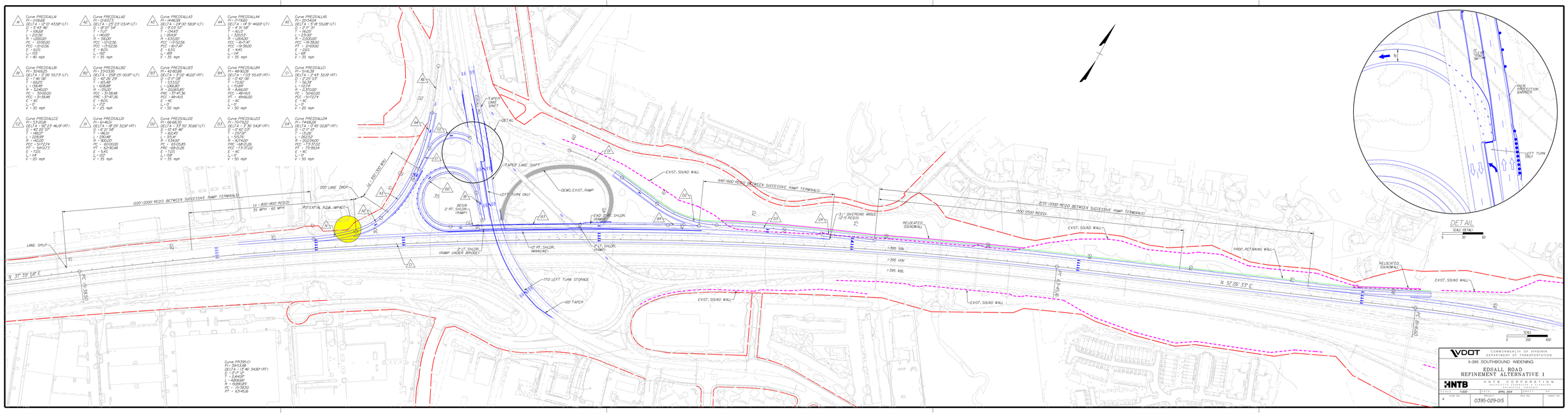
Edsall Road Interchange

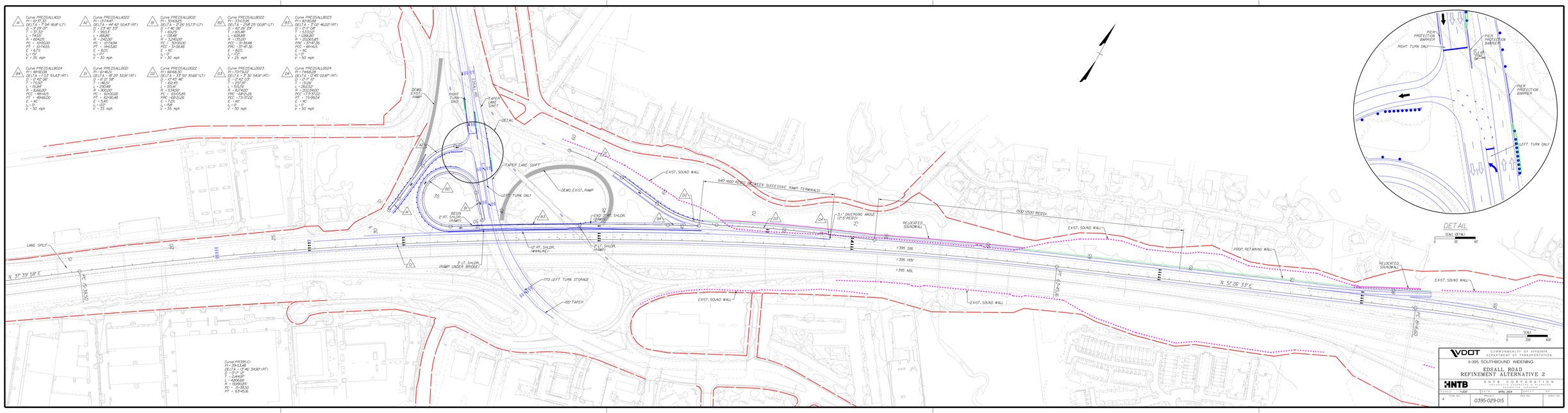


Duke Street Interchange

APPENDIX B

CONCEPTUAL LAYOUTS FOR INTERCHANGE IMPROVEMENT ALTERNATIVES


Curve PREDSALL4
PI= 0+17.82
DELTA = 4° 31' 44.69" (LT)
D = 1° 31.58'
T = 40.91'
L = 1055.11'
R = 1,264.00'
PCC = 16+17.47
PCT = 26+68.00
E = 1.48'
L = 1.48'
V = 35 mph
Curve PREDSALL5
PI= 20+54.04
DELTA = 5° 08' 55.08" (LT)
D = 1° 16.25'
T = 36.25'
L = 213.30'
R = 1,350.00'
PCC = 19+18.00
PCT = 21+69.92
E = 1.21'
L = 1.68'
V = 35 mph
Curve PREDSALL1A
PI= 0+08.68
DELTA = 1° 14' 00.58" (LT)
D = 1° 45.52'
T = 3.44'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL2
PI= 13+03.55
DELTA = 2° 58' 25.00" (LT)
D = 1° 40' 30.09"
T = 1.65.48'
L = 3.30.00'
R = 1,710.01'
PCC = 11+38.48
PCC = 11+47.36
E = 1.01'
L = 1.72'
V = 25 mph
Curve PREDSALL3
PI= 4+08.68
DELTA = 1° 14' 00.58" (LT)
D = 1° 45.52'
T = 3.44'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL4
PI= 0+17.82
DELTA = 4° 31' 44.69" (LT)
D = 1° 31.58'
T = 40.91'
L = 1055.11'
R = 1,264.00'
PCC = 16+17.47
PCC = 16+38.00
PCT = 26+68.00
L = 1.48'
V = 35 mph
Curve PREDSALL5
PI= 20+54.04
DELTA = 5° 08' 55.08" (LT)
D = 1° 16.25'
T = 36.25'
L = 213.30'
R = 1,350.00'
PCC = 19+18.00
PCT = 21+69.92
E = 1.21'
L = 1.68'
V = 35 mph
Curve PREDSALL6
PI= 13+03.55
DELTA = 2° 58' 25.00" (LT)
D = 1° 40' 30.09"
T = 1.65.48'
L = 3.30.00'
R = 1,710.01'
PCC = 11+38.48
PCC = 11+47.36
E = 1.01'
L = 1.72'
V = 25 mph
Curve PREDSALL7
PI= 4+08.68
DELTA = 1° 14' 00.58" (LT)
D = 1° 45.52'
T = 3.44'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL8
PI= 49+90.08
DELTA = 1° 03' 55.43" (RT)
D = 1° 17.58'
T = 21.58'
L = 43.16'
R = 4,866.01'
PCC = 48+46.15
PCT = 49+46.00
E = NC
L = 0'
V = 50 mph
Curve PREDSALL9
PI= 49+90.08
DELTA = 1° 03' 55.43" (RT)
D = 1° 17.58'
T = 21.58'
L = 43.16'
R = 4,866.01'
PCC = 48+46.15
PCT = 49+46.00
E = NC
L = 0'
V = 50 mph
Curve PREDSALL10
PI= 5+16.38
DELTA = 1° 43' 32.01" (RT)
D = 1° 27.05' 03"
T = 56.36'
L = 112.66'
R = 3,370.00'
PCC = 5+60.00
PCT = 5+72.74'
E = NC
L = 0'
V = 20 mph
Curve PREDSALL11
PI= 5+16.38
DELTA = 2° 43' 32.01" (RT)
D = 1° 27.05' 03"
T = 56.36'
L = 112.66'
R = 3,370.00'
PCC = 5+60.00
PCT = 5+72.74'
E = NC
L = 0'
V = 20 mph
Curve PREDSALL12
PI= 12+20.00
DELTA = 90° 00' 00.00" (RT)
D = 1° 45' 50.37"
T = 20.00'
L = 31.42'
R = 3,245.00'
PCC = 11+00.00
PCT = 12+31.42
E = 6.07'
L = 0'
V = 50 mph
Curve PREDSALL13
PI= 12+20.00
DELTA = 90° 00' 00.00" (RT)
D = 1° 45' 50.37"
T = 20.00'
L = 31.42'
R = 3,245.00'
PCC = 11+00.00
PCT = 12+31.42
E = 6.07'
L = 0'
V = 50 mph
Curve PREDSALL14
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL15
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL16
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL17
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL18
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL19
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL20
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL21
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL22
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL23
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL24
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL25
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL26
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL27
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL28
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL29
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL30
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL31
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL32
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL33
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL34
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL35
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL36
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL37
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL38
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL39
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL40
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL41
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL42
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL43
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL44
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL45
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL46
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL47
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL48
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL49
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL50
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL51
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL52
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL53
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL54
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL55
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL56
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL57
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL58
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL59
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL60
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL61
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL62
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL63
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL64
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL65
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL66
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL67
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL68
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL69
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL70
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL71
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL72
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL73
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL74
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL75
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL76
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL77
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL78
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL79
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL80
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL81
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL82
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL83
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL84
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL85
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL86
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL87
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL88
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL89
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL90
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL91
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL92
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL93
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL94
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL95
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL96
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL97
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL98
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL99
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL100
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL101
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL102
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL103
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL104
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL105
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL106
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL107
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL108
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL109
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL110
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL111
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL112
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL113
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL114
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL115
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL116
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL117
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL118
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL119
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL120
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PREDSALL121
PI= 0+27.29
DELTA = 4° 29' 32.58" (RT)
D = 1° 31.58'
T = 40.91'
L = 1.04.49'
R = 1,632.00'
PCC = 1+51.56
PCC = 1+51.56
PCT = 2+56.05
L = 1.89'
V = 35 mph
Curve PRE



VDOT COMMONWEALTH OF VIRGINIA DEPARTMENT OF TRANSPORTATION

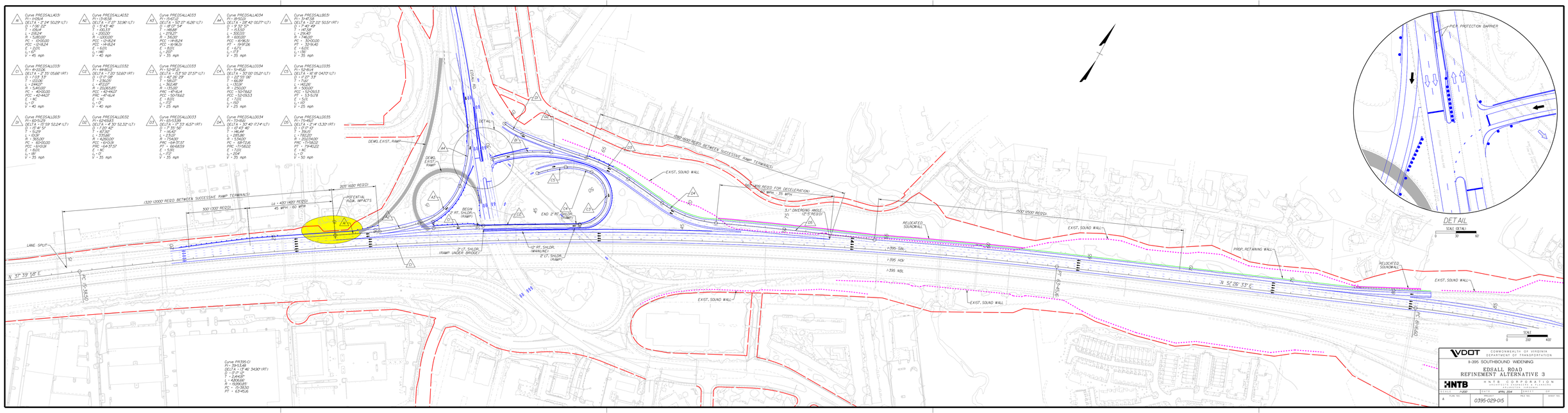
I-395 SOUTHBOUND WIDENING

EDSALL ROAD
REFINEMENT ALTERNATIVE 2

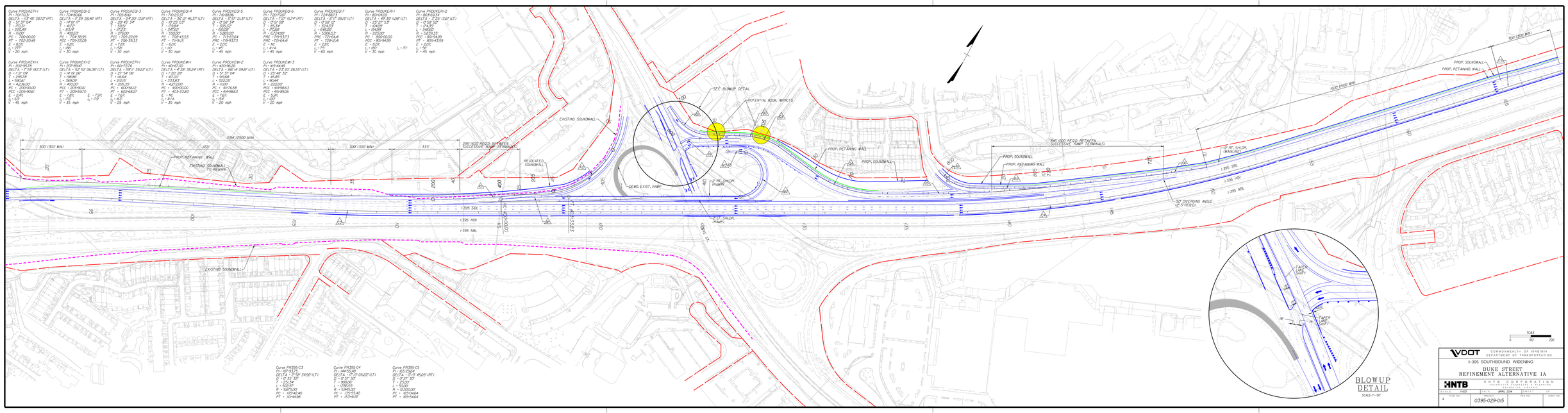
HNTB HNTB CORPORATION
ARCHITECTURE | ENGINEERING | PLANNING
RICHMOND, VIRGINIA

SCALE: AS NOTED	DATE: APRIL 2014	DESIGNED:	CK:
SHEET NO. A	CLIENT NO. 0395-029-015	FILE NO.	SHEET NO.

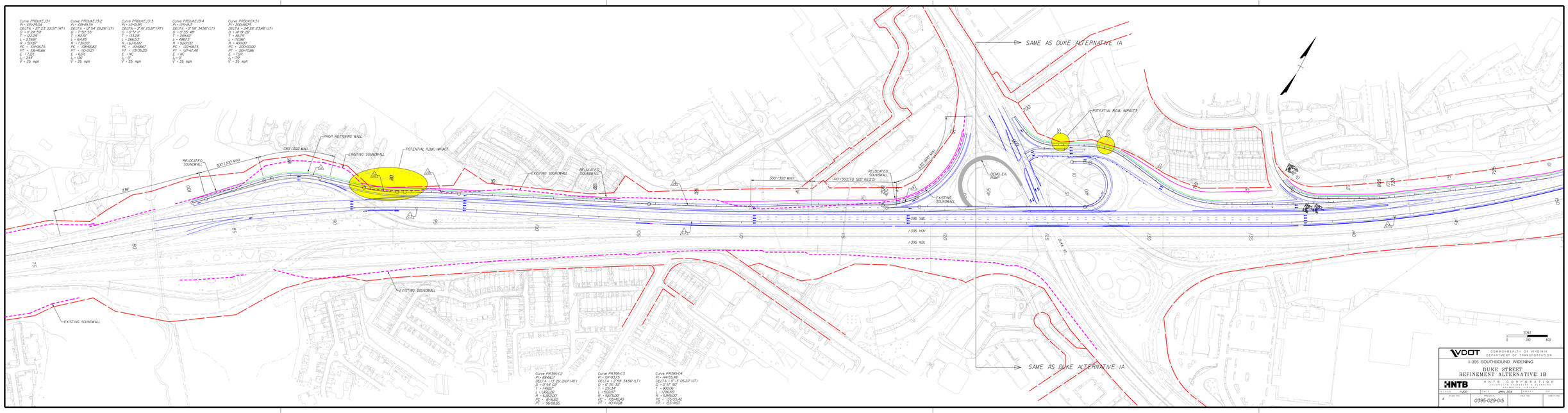
Edsall-Alt 2.ilx40_Rollup 3.46.02 PM
6/5/2014
Pen Table - HNT_I-95.tbl



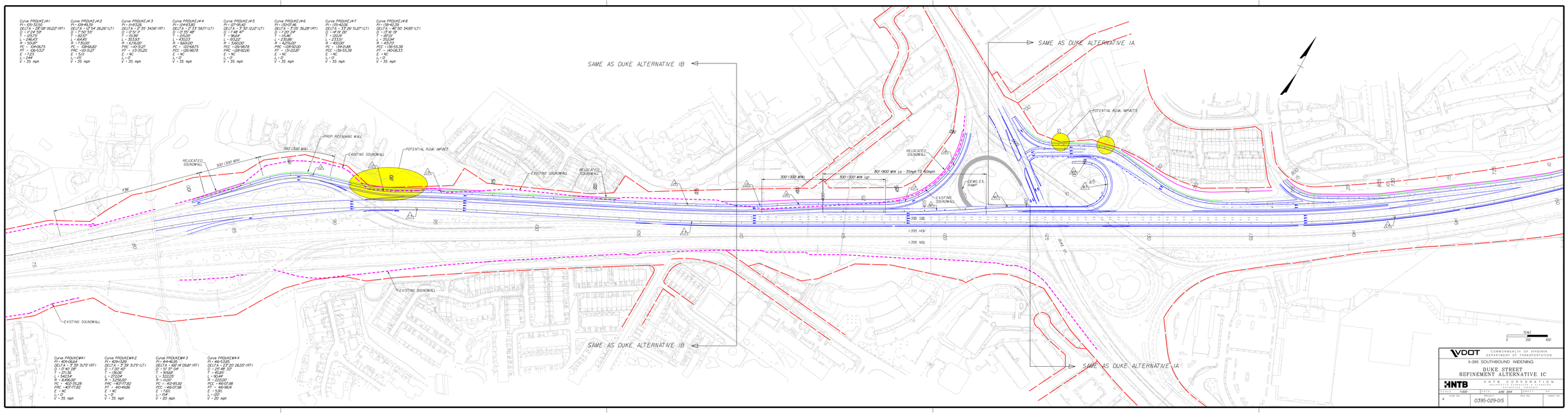
Edsall-Alt 3.ilx40_Rollup
6/5/2014 3:46:56 PM
Pen Table - Half_95.tbl



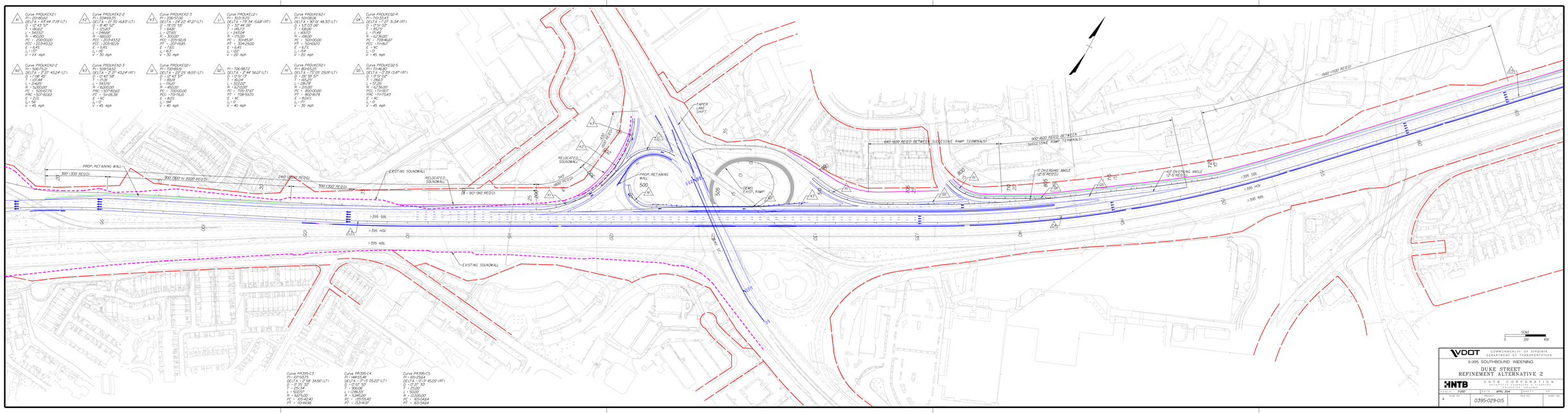
Duke Alt 1A (4).dgn
6/27/2014 9:03:33 AM
Pen Table - Half_95.tbl



Duke Alt (B-1).dgn
6/27/2014 - 9:09:46 AM
Pen Table - Half_395.tbl



Duke Alt IC (v4D).Paltadgn
6/27/2014 9:23:51 AM
Pen Table - Half_95.tbl


Curve PRDUKEX2-1
R = 350.49.00
DELTA = 45° 44' 17.29" (LT)
D = 16° 43' 57"
T = 150.02'
L = 279.81'
R = 343.00'
PCC = 1003+43.52
PCC = 1003+43.52
E = 5.4%
L = 0°
V = XX mph
Curve PRDUKEX2-2
R = 1246.00.35
DELTA = 12° 35' 16.83" (LT)
D = 4° 35' 52"
T = 1258.11'
L = 2453.01'
R = 1432.00'
PCC = 1003+43.52
PCC = 1015+62.09
E = 5.4%
L = 45°
V = 30 mph
Curve PRDUKEX2-3
R = 1126.57.00
DELTA = 24° 22' 47.21" (LT)
D = 5° 05' 55"
T = 1348'
L = 2672.01'
R = 1132.00'
PCC = 1015+62.09
PT = 1027+09.05
E = 7.6%
L = 4.5
V = 30 mph
Curve PRDUKEX2-1
PI = 353+31.70
DELTA = 79° 34' 15.68" (RT)
D = 32° 44' 26"
T = 1457.71'
L = 2431.01'
PC = 1014+73.99
PT = 1039+05.00
E = 6.4%
L = 102'
V = 20 mph
Curve PRDUKEX2-1
PI = 504+09.06
DELTA = 90° 00' 48.30" (LT)
D = 5° 57' 09"
T = 1310.16'
L = 1570.73'
R = 1100.00'
PCC = 1001+00.00
PT = 1016+70.73
E = 6.2%
L = 154'
V = 20 mph
Curve PRDUKEX2-4
R = 750.52.43
DELTA = 7° 07' 31.34" (RT)
D = 7° 54' 02"
T = 187.71'
L = 374.39'
R = 724.56.00'
PCC = 1019+46.67
PCC = 1+74.97
E = .1%
L = 0°
V = 45 mph
Curve PRDUKEX2-2
PI = 506+54.26
DELTA = 2° 27' 45.24" (LT)
D = 1° 47' 52"
T = 107.44'
L = 214.85'
R = 1100.00'
PC = 1015+67.76
PT = 1016+82.61
E = 2.2%
L = 56'
V = 45 mph
Curve PRDUKEX2-3
PI = 509+54.52
DELTA = 2° 27' 43.24" (RT)
D = 1° 47' 52"
T = 171.12'
L = 343.76'
R = 1100.00'
PRC = 1017+82.62
PT = 1014+38.38
E = .1%
L = 0°
V = 45 mph
Curve PRDUKEX2-1
PI = 709+99.19
DELTA = 15° 25' 18.55" (LT)
D = 5° 45' 51"
T = 153.91'
L = 176.61'
R = 1000.00'
PCC = 1000+76.10
PT = 1002+52.71
L = 194'
V = 40 mph
Curve PRDUKEX2-1
PI = 706+98.72
DELTA = 27° 44' 56.01" (LT)
D = 5° 57' 13"
T = 162.04'
L = 322.02'
R = 1270.00'
PCC = 705+97.67
PT = 709+19.70
E = NC
L = 0'
V = 40 mph
Curve PRDUKEX2-1
PI = 804+06.75
DELTA = 90° 00' 00.00"
T = 1100.00'
L = 1570.79'
R = 1000.00'
PCC = 800+00.00
PT = 815+70.79
E = 6.04%
L = 177'
V = 30 mph
Curve PRDUKEX2-5
PI = 711+46.85
DELTA = 11° 29' 13.47" (RT)
D = 2° 57' 07"
T = 1361.71'
L = 57.26'
R = 1276.00'
PCC = 711+97.57
PT = 713+70.43
E = NC
L = 0'
V = 45 mph
Curve PR395-C3
PI = 1019+53.75
DELTA = 2° 58' 34.58" (LT)
D = 1° 35' 32"
T = 215.34'
L = 429.70'
R = 1329.00'
PC = 1015+40.40
PT = 1019+40.38
Curve PR395-C4
PI = 1144+55.48
DELTA = 1° 13' 05.22" (LT)
D = 1° 51' 32"
T = 900.06'
L = 1800.00'
R = 1540.00'
PC = 1135+55.42
PT = 1153+40.39'
Curve PR395-C5
PI = 1032+29.64
DELTA = 13° 13' 45.05" (RT)
D = 12° 27' 30"
T = 1520'
L = 2652.01'
R = 1230.00'
PC = 1011+04.64
PT = 1037+56.64
PROP. RETAINING WALL
300' (300' REQ'D)
900 (800' to 2000' REQ'D)
340' (250' REQ'D)
500' (300' REQ'D)
EXISTING SOUNDWALL
RELOCATED SOUNDWALL
DB = 910' (790' REQ'D)
RELOCATED SOUNDWALL
1000' (1000' REQ'D)
PROP. RETAINING WALL
500
DEMO. EXIST. RAMP
TAPER LANE SHIFT
640' (600' REQ'D) BETWEEN SUCCESSIVE RAMP TERMINALS)
900 (800' REQ'D) BETWEEN SUCCESSIVE RAMP TERMINALS)
12° DIVERGING ANGLE (12° R REQ'D)
45° DIVERGING ANGLE (12° R REQ'D)
1100 (1000' REQ'D)
I-395 SBL
I-395 HOV
I-395 NBL
EXISTING SOUNDWALL
I-395 SBL
I-395 HOV
I-395 NBL
SCALE
0 200 400
VDOT COMMONWEALTH OF VIRGINIA DEPARTMENT OF TRANSPORTATION
I-395 SOUTHBOUND WIDENING
DUKE STREET
REFINEMENT ALTERNATIVE 2
HNTB HNTB CORPORATION
ARCHITECTURE | ENGINEERING | PLANNING
ALEXANDRIA, VIRGINIA
SCALE: 1:400
DATE: APRIL 2014
SHEET NO.
REVISION NO. A
PROJECT NO. 0.395-029-015
FILE NO.
SHEET NO.
Duke Alt 2 (HR)_Rollsign
6/27/2014 9:26:07 AM
Pen Table - HNT_v95.tbl

APPENDIX C

CONSTRUCTION COST ESTIMATES FOR SB MAINLINE I-395 WIDENING AND INTERCHANGE IMPROVEMENT ALTERNATIVES

Concept-Level Construction Cost Estimate for SB I-395 Improvements

June 2014

Technical Memorandum - Improvements Alternatives Study

Southbound I-395 Additional Through Lane

State Project No. 0395-029-015, P-101, R-201, C-501 / UPC 103316

	Unit	Unit Price	I-395 Mainline Improvements	
Mobilization	LS		1	$ 1,125,000
Construction Surveying	LS		1	$ 219,000
MOT	LS		1	$ 657,000
Erosion Control	LS		1	$ 219,000
Wedge	CF		790	
Milling	SY	$ 33	73,378	$ 2,421,458
Full Depth	SY		53,163	
2" SM 9.5D	TON	$ 91	16,539	$ 1,505,047
2" IM-19.0D	TON	$ 88	6,247	$ 549,703
6" BM-25.0A	TON	$ 78	19,617	$ 1,530,130
12" Aggr. NO. 21A	TON	$ 27	39,473	$ 1,065,780
Pavement Demo	SF	$ 10	-	$ -
Guardrail	LF	$ 30	-	$ -
Pier Protection Barrier	LF	$ 750	152	$ 114,349
Barrier	LF	$ 130	8,221	$ 1,068,731
Curb and Gutter	LF	$ 25	-	$ -
Impact Attenuator	EA	$ 7,655	2	$ 15,310
New Noise Wall	LF	$ 1,200	3,320	$ 3,983,570
Relocate Noise Wall	LF	$ 840	1,313	$ 1,102,828
Landscaping	LS	$ 500,000	1	$ 500,000
Earthwork	CY	$ 30		$ 200,000
Underdrain UD-4	LF	$ 9	34,476	$ 310,287
Comb. Underdrain CD-1	LF	$ 15	1,040	$ 15,600
Outlet pipe	LF	$ 19	986	$ 18,734
ITS	LS		1	$ 500,000
Signing	LS		1	$ 1,500,000
Lighting	LS		1	$ 1,500,000
Storm Water Management	LS		1	$ 2,150,944
Structures	LS		1	$ -
Retaining Wall	SF	$ 60	27,849	$ 1,670,945
Subtotal				**$ 23,300,000**
Contingency (35%)				$ 8,155,000
Total				**$ 31,500,000**

Notes:

Pavement depth for ramps and mainline will be the same as to the pavement section used on the I-66 Spot Improvements Project (UPC 78828)
Shoulder cross slope corrections on southbound I-395 were estimated using full depth pavement.
Sound wall heights are assumed to be 20 ft.
Costs do not include right-of-way, utility relocations, environmental remediation, or CEI services, and are based on work products as of May 2014.
All costs are 2014 dollars, based on the most recent district-specific unit price data published by VDOT.

Concept-Level Construction Cost Estimate for Edsall Road Interchange Idesign Alternatives

June 2014

Technical Memorandum - Improvements Alternatives Study

Southbound I-395 Additional Through Lane

State Project No. 0395-029-015, P-101, R-201, C-501 / UPC 103316

	Unit	Unit Price	Edsall Road Interchange Design Alternative					
			1		2		3	
Mobilization	LS		1	$ 345,000		$ 255,000		$ 310,000
Construction Surveying	LS		1	$ 63,000		$ 45,000		$ 56,000
MOT	LS		1	$ 189,000		$ 135,000		$ 168,000
Erosion Control	LS		1	$ 63,000		$ 45,000		$ 56,000
Wedge	CF							
Milling	SY	$ 33	7,799	$ 257,370	9,500	$ 313,506	13,074	$ 431,434
Full Depth	SY		14,210		13,485		18,223	
2" SM 9.5D	TON	$ 91	2,586	$ 235,335	2,701	$ 245,765	3,677	$ 334,636
2" IM-19.0D	TON	$ 88	1,670	$ 146,934	1,584	$ 139,431	2,141	$ 188,421
6" BM-25.0A	TON	$ 78	5,244	$ 409,000	4,976	$ 388,113	6,724	$ 524,482
12" Aggr. NO. 21A	TON	$ 27	10,551	$ 284,881	10,012	$ 270,332	13,530	$ 365,317
Pavement Demo	SF	$ 10	23,314	$ 25,905	37,996	$ 42,217	29,140	$ 32,378
Guardrail	LF	$ 30	1,470	$ 44,090	2,528	$ 75,848	3,518	$ 105,529
Pier Protection Barrier	LF	$ 750	515	$ 385,924	515	$ 385,924	601	$ 450,376
Barrier	LF	$ 130	2,741	$ 356,384	2,036	$ 264,744	3,141	$ 408,266
Curb and Gutter	LF	$ 25	1,600	$ 40,004	1,570	$ 39,250	960	$ 24,012
Impact Attenuator	EA	$ 7,655	2	$ 15,310	2	$ 15,310	5	$ 38,275
New Noise Wall	LF	$ 1,200		$ -		$ -		$ -
Relocate Noise Wall	LF	$ 840	497	$ 417,871	497	$ 417,871	511	$ 429,357
Landscaping	LS	$ 500,000	-	$ -	-	$ -	-	$ -
Earthwork	CY	$ 30		$ 400,000		$ 200,000		$ 200,000
Underdrain UD-4	LF	$ 9	4,475	$ 40,276	3,798	$ 34,181	5,039	$ 45,352
Comb. Underdrain CD-1	LF	$ 15	269	$ 4,035	228	$ 3,420	303	$ 4,545
Outlet pipe	LF	$ 19	128	$ 2,432	109	$ 2,071	144	$ 2,736
ITS	LS			$ -		$ -		$ -
Signing	LS			$ -		$ -		$ -
Lighting	LS			$ -		$ -		$ -
Storm Water Management	LS		1	$ 357,531		$ 369,972		$ 433,198
Structures	LS		1	$ -		$ -		$ -
Retaining Wall	SF	$ 60	44,238	$ 2,654,305	19,860	$ 1,191,582	23,224	$ 1,393,415
Subtotal				**$ 6,800,000**		**$ 4,800,000**		**$ 6,000,000**
Contingency (35%)				$ 2,380,000		$ 1,680,000		$ 2,100,000
Total				**$ 9,200,000**		**$ 6,500,000**		**$ 8,100,000**

Notes:

Pavement depth for ramps and mainline will be the same as to the pavement section used on the I-66 Spot Improvements Project (UPC 78828)

Shoulder cross slope corrections on southbound I-395 were estimated using full depth pavement.

Sound wall heights are assumed to be 20 ft.

Costs do not include right-of-way, utility relocations, environmental remediation, or CEI services, and are based on work products as of May 2014.

All costs are 2014 dollars, based on the most recent district-specific unit price data published by VDOT.

Concept-Level Construction Cost Estimate for Duke Street Interchange Design Alternatives

June 2014

Technical Memorandum - Improvements Alternatives Study

Southbound I-395 Additional Through Lane

State Project No. 0395-029-015, P-101, R-201, C-501 / UPC 103316

	Unit	Unit Price	Duke Street Interchange Design Alternative							
			1A		1B		1C		2	
Mobilization	LS		1	$ 360,000		$ 560,000		$ 560,000		$ 310,000
Construction Surveying	LS		1	$ 66,000		$ 106,000		$ 106,000		$ 56,000
MOT	LS		1	$ 198,000		$ 318,000		$ 318,000		$ 168,000
Erosion Control	LS		1	$ 66,000		$ 106,000		$ 106,000		$ 56,000
Wedge	CF									
Milling	SY	$ 33	4,424	$ 145,984	5,474	$ 180,657	5,940	$ 196,006	5,562	$ 183,549
Full Depth	SY		16,915		21,762		22,275		13,018	
2" SM 9.5D	TON	$ 91	2,507	$ 228,160	3,200	$ 291,226	3,315	$ 301,685	2,183	$ 198,671
2" IM-19.0D	TON	$ 88	1,987	$ 174,897	2,557	$ 225,019	2,617	$ 230,324	1,530	$ 134,609
6" BM-25.0A	TON	$ 78	6,241	$ 486,837	8,030	$ 626,354	8,219	$ 641,120	4,804	$ 374,693
12" Aggr. NO. 21A	TON	$ 27	12,559	$ 339,096	16,158	$ 436,274	16,539	$ 446,559	9,666	$ 260,984
Pavement Demo	SF	$ 10	12,352	$ 13,725	13,008	$ 14,454	13,008	$ 14,454	12,987	$ 14,430
Guardrail	LF	$ 30	934	$ 28,032	1,125	$ 33,747	1,125	$ 33,747	567	$ 17,021
Pier Protection Barrier	LF	$ 750	738	$ 553,387	738	$ 553,387	738	$ 553,387	714	$ 535,758
Barrier	LF	$ 130	3,545	$ 460,790	7,099	$ 922,932	6,790	$ 882,670	1,879	$ 244,222
Curb and Gutter	LF	$ 25	619	$ 15,464	474	$ 11,843	474	$ 11,843	1,243	$ 31,066
Impact Attenuator	EA	$ 7,655	4	$ 30,620	4	$ 30,620	4	$ 30,620	2	$ 15,310
New Noise Wall	LF	$ 1,200	603	$ 724,091	603	$ 724,091	603	$ 724,091	603	$ 724,091
Relocate Noise Wall	LF	$ 840	1,017	$ 854,450	2,475	$ 2,079,280	2,475	$ 2,078,726	988	$ 829,657
Landscaping	LS	$ 500,000		$ -		$ -		$ -	-	$ -
Earthwork	CY	$ 30		$ 500,000		$ 900,000		$ 900,000		$ 300,000
Underdrain UD-4	LF	$ 9	6,470	$ 58,230	8,981	$ 80,833	9,455	$ 85,095	4,922	$ 44,300
Comb. Underdrain CD-1	LF	$ 15	389	$ 5,835	539	$ 8,085	568	$ 8,520	296	$ 4,440
Outlet pipe	LF	$ 19	185	$ 3,515	257	$ 4,883	271	$ 5,149	141	$ 2,679
ITS	LS			$ -		$ -		$ -		$ -
Signing	LS			$ -		$ -		$ -		$ -
Lighting	LS			$ -		$ -		$ -		$ -
Storm Water Management	LS			$ 1,284,888		$ 1,711,904		$ 1,711,904		$ 1,048,315
Structures	LS			$ -		$ -		$ -		$ -
Retaining Wall	SF	$ 60	9,880	$ 592,792	25,494	$ 1,529,617	25,494	$ 1,529,617	7,635	$ 458,077
Subtotal				**$ 7,100,000**		**$ 11,300,000**		**$ 11,300,000**		**$ 6,000,000**
Contingency (35%)				$ 2,485,000		$ 3,955,000		$ 3,955,000		$ 2,100,000
Total				**$ 9,600,000**		**$ 15,300,000**		**$ 15,300,000**		**$ 8,100,000**

Notes:

Pavement depth for ramps and mainline will be the same as to the pavement section used on the I-66 Spot Improvements Project (UPC 78828)

Shoulder cross slope corrections on southbound I-395 were estimated using full depth pavement.

Sound wall heights are assumed to be 20 ft.

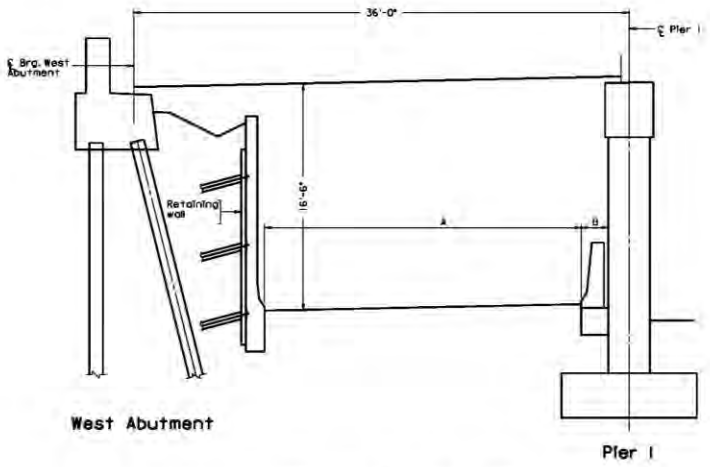
Costs do not include right-of-way, utility relocations, environmental remediation, or CEI services, and are based on work products as of May 2014.

All costs are 2014 dollars, based on the most recent district-specific unit price data published by VDOT.

APPENDIX D

ABUTMENT RETAINING WALL ALTERNATIVES - DETAILS

STATE	FEDERAL AID		STATE		SHEET NO.
	ROUTE	PROJECT	ROUTE	PROJECT	
VA.	—		95		3



SOIL NAIL WALL ALTERNATIVE

SOIL NAIL WALL ALTERNATIVE LANE DIMENSIONS UNDER DUKE STREET SPAN 1			
BARRIER OPTION	A	B	RESULTANT ROADWAY SECTION
VDOT STANDARD BPPS	23'-0"	2'-0"	3'-6" shldr, 16'-0" lane, 3'-6" shldr
SINGLE SLOPE TL-5	23'-7 1/8"	1'-4 7/8"	3'-9 1/2" shldr, 16'-0" lane, 3'-9 1/2" shldr
INFILL WALL	25'-0"	0'-0"	4'-6" shldr, 16'-0" lane, 4'-6" shldr

PRELIMINARY PLANS
THESE PLANS NOT TO BE USED FOR CONSTRUCTION

HNTB CORPORATION
ARLINGTON, VA
STRUCTURAL ENGINEER

© 2014, Commonwealth of Virginia

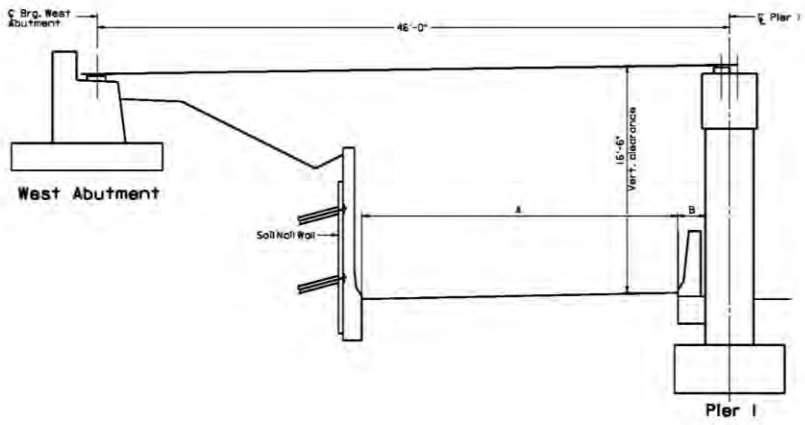
No.	Description	Date
	Revisions	

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF TRANSPORTATION
STRUCTURE AND BRIDGE DIVISION

DUKE STREET BRIDGE
UNDERPASS ALTERNATIVES

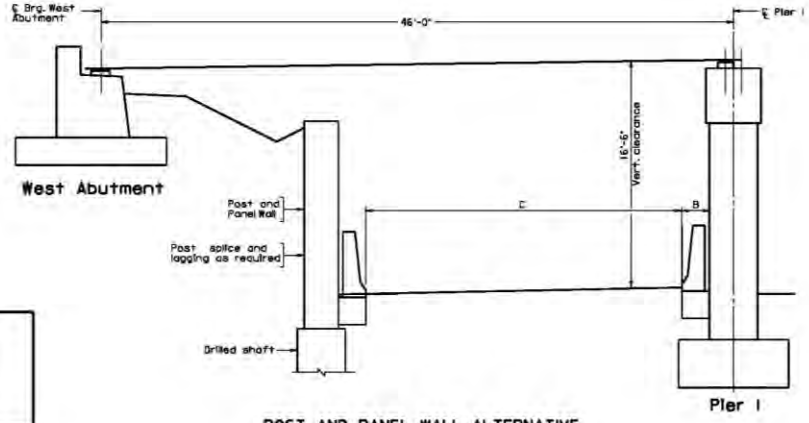
Designed:	Date	Plan No.	Sheet No.
Drawn:	MAY, 2014		3
Checked:			

STATE	FEDERAL AID		STATE		SHEET NO.
	ROUTE	PROJECT	ROUTE	PROJECT	
VA.	—		95		1



SOIL NAIL WALL ALTERNATIVE

SOIL NAIL WALL LANE DIMENSIONS UNDER SPAN 1 OF EDSALL			
BARRIER OPTION	A	B	RESULTANT ROADWAY SECTION
VDOT STANDARD BPPS	23'-0"	2'-0"	3'-6" shldr, 16'-0" lane, 3'-6" shldr
SINGLE SLOPE TL-5	23'-7 1/8"	1'-4 7/8"	3'-9 1/2" shldr, 16'-0" lane, 3'-9 1/2" shldr
INFILL WALL	25'-0"	0'-0"	4'-6" shldr, 16'-0" lane, 4'-6" shldr



POST AND PANEL WALL ALTERNATIVE

POST AND PANEL WALL LANE DIMENSIONS UNDER SPAN 1 OF EDSALL			
BARRIER OPTION	C	B	RESULTANT ROADWAY SECTION
VDOT STANDARD BPPS	23'-0"	2'-0"	3'-6" shldr, 16'-0" lane, 3'-6" shldr
SINGLE SLOPE TL-5	23'-7 1/8"	1'-4 7/8"	3'-9 1/2" shldr, 16'-0" lane, 3'-9 1/2" shldr
INFILL WALL	25'-0"	0'-0"	4'-6" shldr, 16'-0" lane, 4'-6" shldr

PRELIMINARY PLANS
THESE PLANS NOT TO BE USED FOR CONSTRUCTION

HNTB CORPORATION
ARLINGTON, VA
STRUCTURAL ENGINEER

© 2014, Commonwealth of Virginia

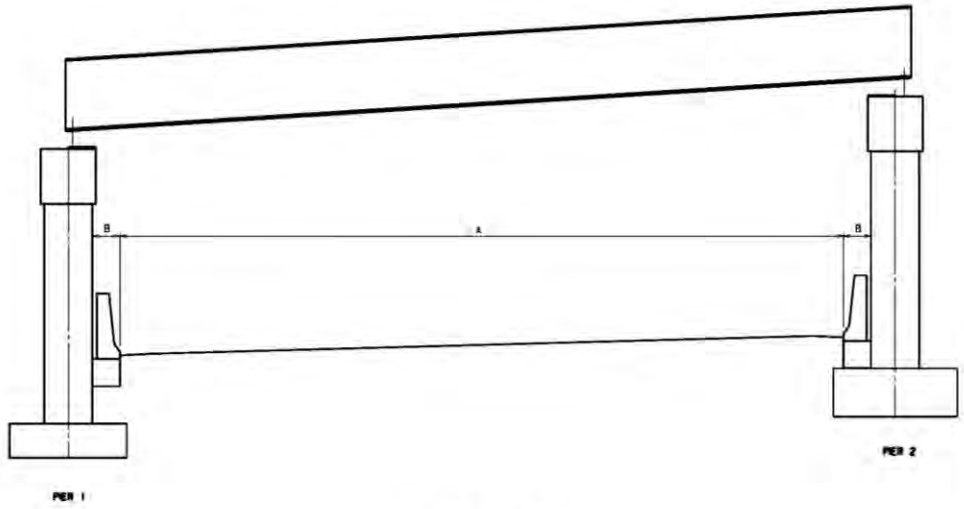
No.	Description	Date
	Revisions	

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF TRANSPORTATION
STRUCTURE AND BRIDGE DIVISION

EDSALL ROAD BRIDGE
UNDERPASS ALTERNATIVES

Designed:	Date	Plan No.	Sheet No.
Drawn:	MAY, 2014		1
Checked:			

STATE	FEDERAL AID		STATE		SHEET NO.
	ROUTE	PROJECT	ROUTE	PROJECT	
VA.	—		95		4



RAMP B GEOMETRY

LANE DIMENSIONS UNDER SPAN 2 OF RAMP B			
BARRIER OPTION	A	B	RESULTANT ROADWAY SECTION
VDOT STANDARD BPPS	52'-5¾"	2'-0"	2'-2⅜" shldr, 4- 12'-0" lanes, 2'-2⅜" shldr
SINGLE SLOPE TL-5	53'-8"	1'-4⅞"	2'-10" shldr, 4- 12'-0" lanes, 2'-10" shldr
INFILL WALL	56'-5¾"	0'-0"	4'-2⅜" shldr, 4- 12'-0" lanes, 4'-2⅜" shldr

PRELIMINARY PLANS
THESE PLANS NOT TO BE USED FOR CONSTRUCTION

HNTB CORPORATION
ARLINGTON, VA
STRUCTURAL ENGINEER

© 2014, Commonwealth of Virginia

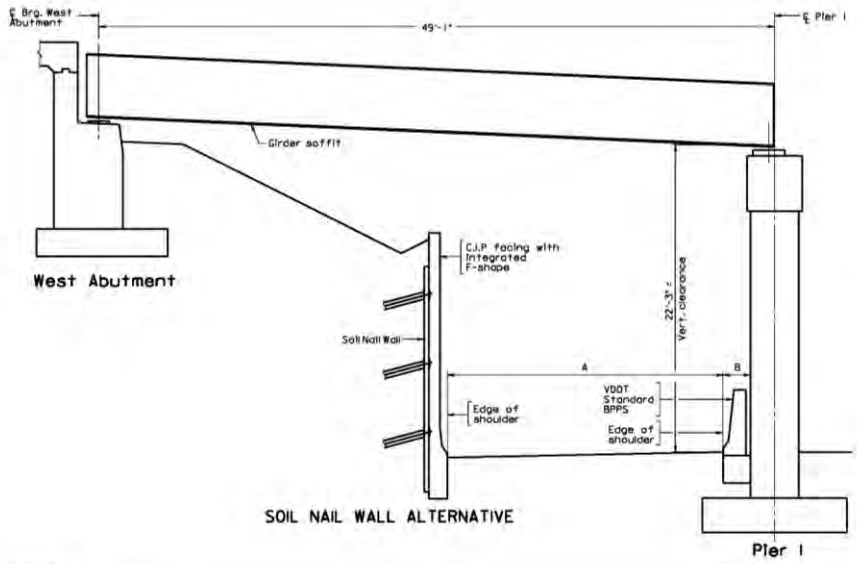
No.	Description	Date
	Revisions	

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF TRANSPORTATION
STRUCTURE AND BRIDGE DIVISION

RAMP B BRIDGE UNDERPASS ALTERNATIVES

Designed:	Date	Plan No.	Sheet No.
Drawn:	MAY, 2014		4
Checked:			

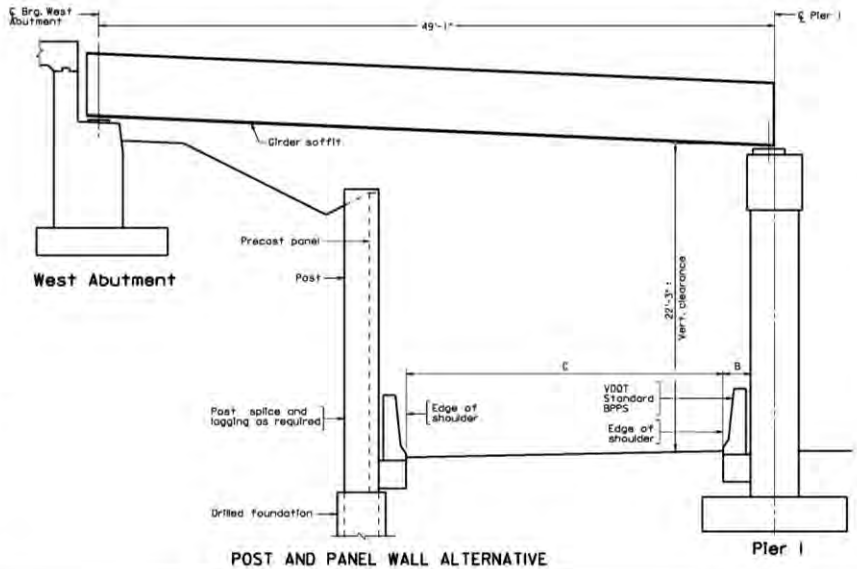
STATE	FEDERAL AID ROUTE	FEDERAL AID PROJECT	STATE ROUTE	STATE PROJECT	SHEET NO.
VA.	---				2



NOTE:

VDOT Standard BPPS Pier Protection Barrier System is shown. For details of Single Slope TL-5 and In-fill Wall alternatives, see sheet 5.

SOIL NAIL WALL ALTERNATIVE LANE DIMENSIONS UNDER SPAN 1 OF RAMP C OVER RAMP E AND I-95			
BARRIER OPTION	A	B	RESULTANT ROADWAY SECTION
VDOT STANDARD BPPS	20'-0"	2'-0"	2'-0" shldr, 16'-0" lane, 2'-0" shldr
SINGLE SLOPE TL-5	20'-7 1/8"	1'-4 1/8"	2'-3 1/2" shldr, 16'-0" lane, 2'-3 1/2" shldr
IN-FILL WALL	22'-0"	0'-0"	3'-0" shldr, 16'-0" lane, 3'-0" shldr



POST AND PANEL WALL ALTERNATIVE LANE DIMENSIONS UNDER SPAN 1 OF RAMP C OVER RAMP E AND I-95			
BARRIER OPTION	C	B	RESULTANT ROADWAY SECTION
VDOT STANDARD BPPS	23'-0"	2'-0"	3'-6" shldr, 16'-0" lane, 3'-6" shldr.
SINGLE SLOPE TL-5	23'-7 1/8"	1'-4 1/8"	3'-9 1/2" shldr, 16'-0" lane, 3'-9 1/2" shldr.
IN-FILL WALL	25'-0"	0'-0"	4'-6" shldr, 16'-0" lane, 4'-6" shldr.

PRELIMINARY PLANS

THESE PLANS NOT TO BE USED FOR CONSTRUCTION

HNTB CORPORATION
ARLINGTON, VA
STRUCTURAL ENGINEER

© 2014, Commonwealth of Virginia

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF TRANSPORTATION
STRUCTURE AND BRIDGE DIVISION

RAMP C OVER RAMP E AND I-95 (AT EDSALL) UNDERPASS ALTERNATIVES

No.	Description	Date
	Revisions	

Designed:	Date	Plan No.	Sheet No.
Drawn:	MAY, 2014		2
Checked:			

Alternatives Considered for Access to 395 SB Express Lanes from EB Route 236

1) Two-Lane Entrance Ramp to SB I-395 GP Lanes - Involves one ramp from each WB and EB Route 236 to the SB I-395 GP lanes. The location and clear width of the Turkeycock overpass constrains the design such that it is substantially short of the distance required by AASHTO guidance to drop two ramp lanes (2,154 ft available, 2,500 ft required). This layout was modeled and is predicted to operate at LOS F. The resulting geometry would require motorists to execute four or five lane changes in order to access the Express Lanes. This alternative provides neither safe nor efficient traffic operations for GP and Express Lanes users.

2) Single-Lane Entrance Ramp to SB I-395 GP Lanes - A single-lane entrance ramp was considered, involving merging the individual ramps from WB and EB Route 236 into a single lane before joining the SB I-395 GP lanes. This layout was modeled and is predicted to operate at LOS F. The resulting geometry would provide only 1,100 ft for motorists to execute four lane changes in order to access the Express Lanes. This alternative provides neither safe nor efficient traffic operations for GP and Express Lanes users.

3) Overpass of SB I-395 GP Lanes - This involves construction of a direct connection between the entrance ramp from Route 236 to the Express Lanes via a new overpass of the SB I-395 GP lanes. Geometry is favorable near the upstream ramp terminal, but required vertical clearance over the GP lanes results in very steep profile grades (14-15%) in order to touch down along the left side of the GP lanes and thread through the left end span of the Turkeycock ramp overpass. Excessive profile grades on the ramp preclude this as a viable design alternative.

4) Underpass of I-395 SB GP Lane - This involves construction of a direct connection between the entrance ramp from Route 236 to the Express Lanes via a new underpass of the SB I-395 GP lanes. Geometry is favorable near the upstream ramp terminal, but geometry of the crossing of the GP lanes results in acute angle structure that is infeasible. Further, construction would require a long-term lane reduction on the SB I-395 GP lanes, which is infeasible from a traffic operations standpoint. The structural design and MOT considerations preclude this as a viable design alternative.

5) Direct Connection to THN Ramp - This alternative would involve several new structures to span the SB I-395 GP lanes, the Turkeycock HOV exit ramp, the exiting HOV lanes, the HOV entrance ramp from NB I-395, and the NB I-395 GP lanes. In addition, the alternative would require construction of a new bridge to join existing ramp THN in mid-span, in mid-SE transition. Investigation of this alternative yielded no viable geometric design solution, and was therefore considered infeasible.

6) Barrier-separated Entrance Ramp from Route 236 - This involves carrying all traffic from WB and EB Route 236 on an entrance ramp that is barrier-separated from the SB I-395 GP lanes, and providing entry to the GP lanes for all ramp traffic via a widened Turkeycock ramp. This would prevent all traffic from Route 236 from direct entry into the Express Lanes at the Turkeycock slip ramp. While this alternative is predicted to operate at a favorable LOS, at least partial access to the Express Lanes was preferred by VDOT.

7) Proposed design - Allows for continued partial access to the Express Lanes at Turkeycock (from WB Route 236 only), requiring a reduced number of vehicles to execute four lane changes over a distance of 2,500 ft.

APPENDIX G:
CONCEPTUAL SIGNING PLAN
FOR THE PREFERRED ALTERNATIVE

LEGEND

- EXISTING RIGHT OF WAY
- EXISTING EDGE OF PAVEMENT
- EXISTING PAVEMENT MARKINGS
- PREFERRED BUILD
- I-95 EXPRESS LANES
- I-395 - NB AUXILIARY LANE

SCALE 0 250' 500'

VDOT COMMONWEALTH OF VIRGINIA DEPARTMENT OF TRANSPORTATION

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

CONCEPTUAL SIGNING PLAN

PREFERRED BUILD ALTERNATIVE

HNTB — HNTB CORPORATION, ARCHITECTS ENGINEERS & PLANNERS, ARLINGTON, VIRGINIA

SCALE	DATE April, 2017	SHEET OF	
PLAN NO. A	PROJECT 0395-029-015	FILE NO.	SHEET NO.

Image_Preferred Alt Signage C.dgn 4/4/2017 10:57:30 AM Pen Table - Half_v95.tbl

APPENDIX H:
DETAILED TRAFFIC OPERATIONAL ANALYSIS RESULTS

2013 Existing AM Peak Hour

Congestion Level

0 250 500 Feet

Light to moderate traffic

Heavy traffic

Congested traffic

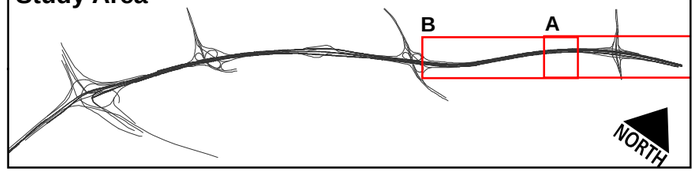
Severely congested traffic

GP Lane Segment ID
Peak Hour Density

HOV Lane Segment ID
Peak Hour Density

1 Matchline

Study Area

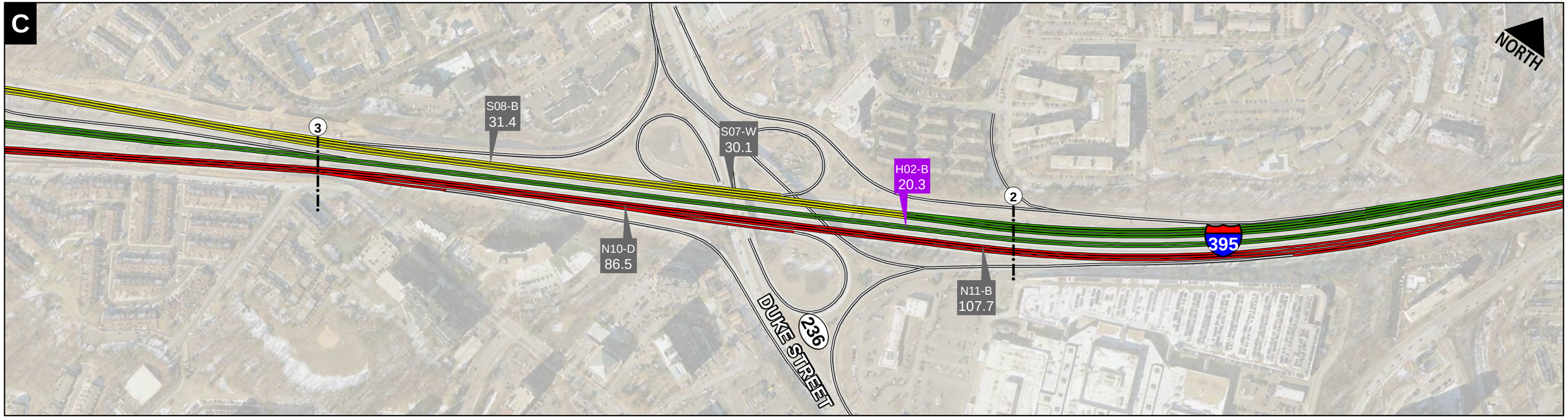


VDOT HNTB

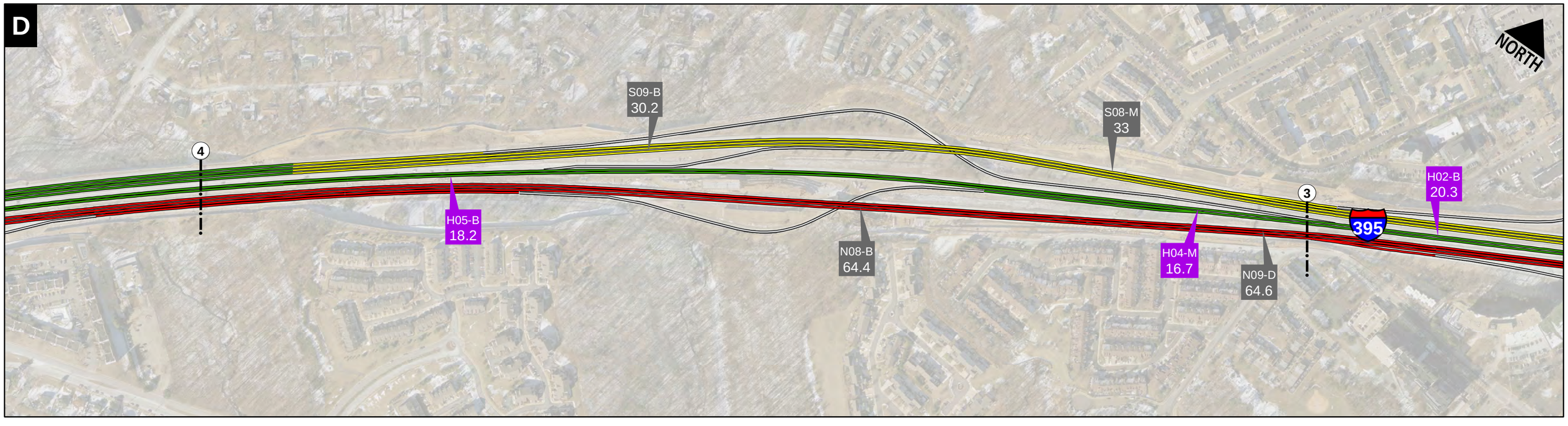
I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Existing (2013) AM Freeway Congestion Level

C



D



Congestion Level

Light to moderate traffic | Heavy traffic | Congested traffic | Severely congested traffic

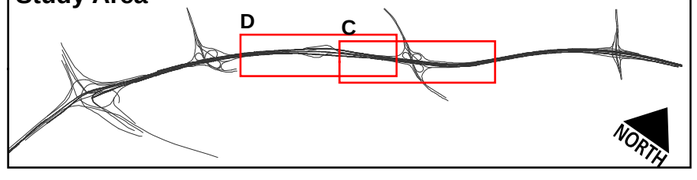
GP Lane Segment ID
Peak Hour Density

HOV Lane Segment ID
Peak Hour Density

1 Matchline

0 250 500 Feet

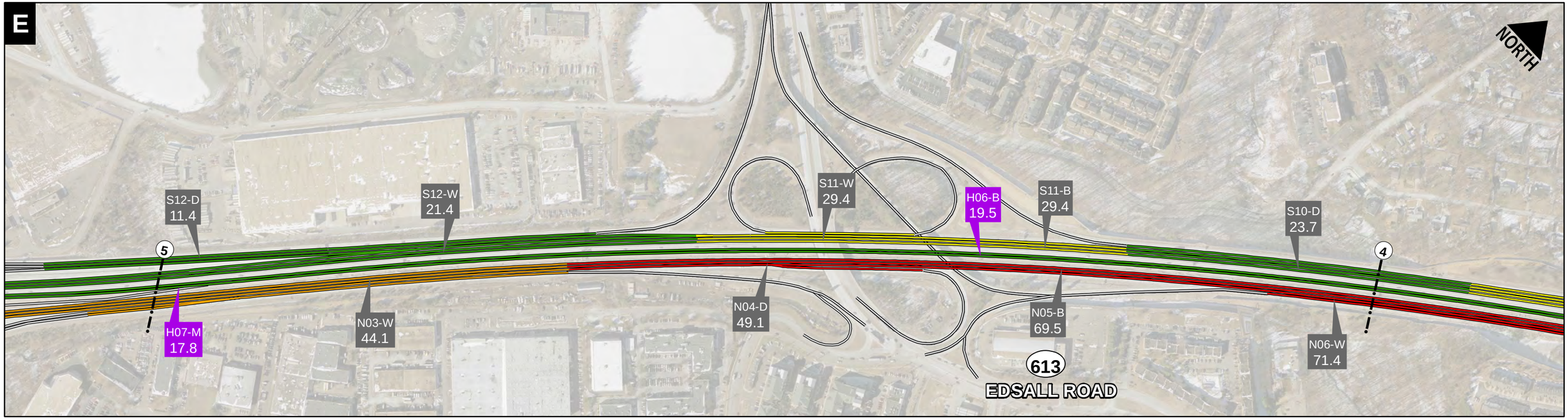
Study Area

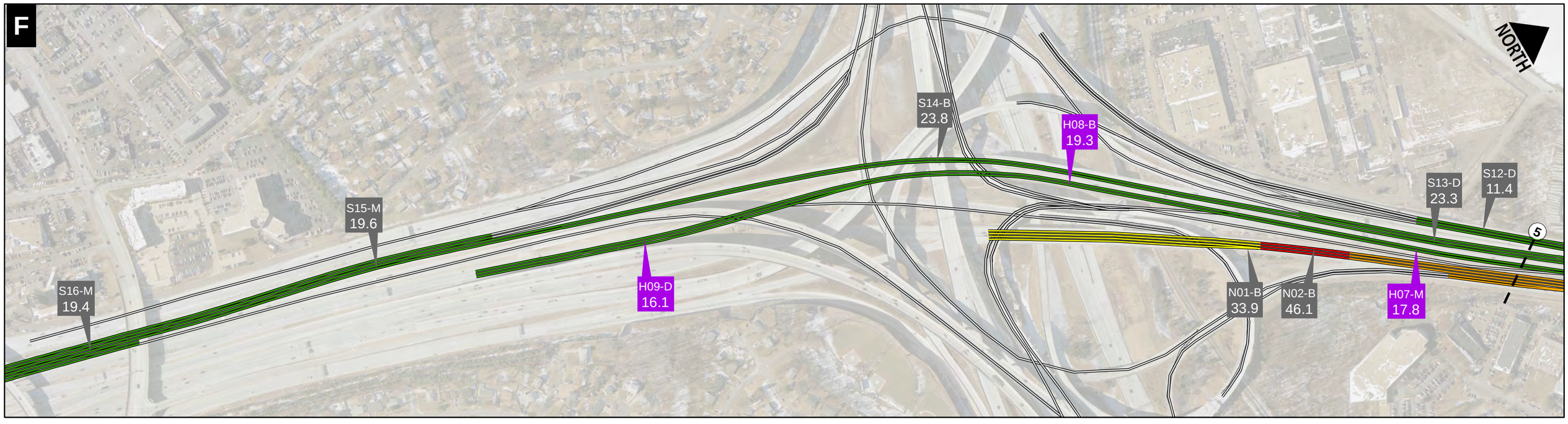


VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Existing (2013) AM Freeway Congestion Level





Congestion Level

Light to moderate traffic | Heavy traffic | Congested traffic | Severely congested traffic

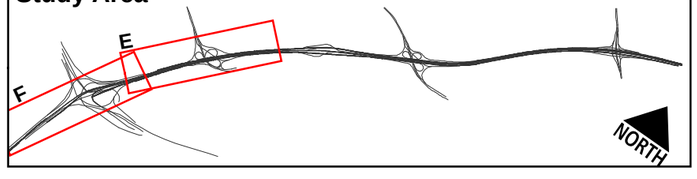
GP Lane Segment ID
Peak Hour Density

HOV Lane Segment ID
Peak Hour Density

1 Matchline

0 250 500 Feet

Study Area



VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Existing (2013) AM Freeway Congestion Level

Freeway Mainline (2013 Existing AM)

Direction	Segment	Location	Operation Type	Length (ft)	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Speed (mph)	Density (pc/ln/mi)
Southbound I-395 GP	S01-D	North of Seminary Road Off-Ramp	Diverge	1499	5055	5071	16	0%	63.9	16.3
	S02-B	Between Seminary Road Off-Ramp and On-Ramp	Basic	3891	4112	4138	26	1%	64.1	16.7
	S03-M	Merge Area at Seminary Road On-Ramp	Merge	1455	4908	4922	14	0%	63.4	17.7
	S04-B	Between Seminary Road On-Ramp and Duke Street Off-Ramp	Basic	1366	4908	4925	17	0%	63.9	19.8
	S05-D	Diverge Area at WB Duke Street Off-Ramp	Diverge	1500	4908	4923	15	0%	63.2	20.0
	S06-B	Between WB Duke Street Off-Ramp and On-Ramp	Basic	1984	4433	4448	15	0%	60.7	18.9
	S07-W	Between WB Duke Street On-Ramp and EB On-Ramp	Weave	1445	4961	4956	-5	0%	47.8	30.1
	S08-B	Between EB Duke Street Off-Ramp and WB Edsall Road On-Ramp	Basic	882	4464	4491	27	1%	48.9	31.4
	S08-M	Merge Area at EB Duke Street On-Ramp	Merge	1497	4894	4912	18	0%	48.3	33.0
	S09-B	Between EB Duke Street On-Ramp and WB Edsall Road Off-Ramp	Basic	2883	4894	4920	26	1%	51.6	30.2
	S10-D	Diverge Area at WB Edsall Road Off-Ramp	Diverge	1499	4894	4914	20	0%	53.1	23.7
	S11-B	Between WB Edsall Road Off-Ramp and EB On-Ramp	Basic	498	4507	4536	29	1%	52.7	29.4
	S11-W	Between WB Edsall Road On-Ramp and EB Off-Ramp	Weave	1404	5052	5085	33	1%	50.2	29.4
	S12-W	Between Edsall Road and I-495 Ramp	Weave	1953	5311	5300	-11	0%	53.2	21.4
	S12-D	Diverge Area at I-495 Inner Loop Ramp	Diverge	1141	1825	1801	-24	-1%	57.2	11.4
	S13-D	Diverge Area at Franconia Ramp	Diverge	1447	3486	3524	38	1%	52.1	23.3
	S14-B	I-95 SB Mainline through Springfield Interchange	Basic	3255	2448	2465	17	1%	53.3	23.8
	S15-M	Merge Area with I-495 Outer Loop Ramp	Merge	1568	4074	4072	-2	0%	53.5	19.6
	S16-M	Merge Area with I-495 Inner Loop Ramp	Merge	1506	5974	5966	-8	0%	53.3	19.4
Northbound I-395 HOV	H01-M	Seminary Road HOV On-Ramp	Merge	1498	2732	2724	-8	0%	62.9	18.6
	H02-B	Between Turkeycock HOV On-Ramp and Seminary Road HOV On-Ramp	Basic	12081	2542	2541	-1	0%	63.5	20.3
	H04-M	Turkeycock HOV On-Ramp	Merge	1340	2542	2530	-12	0%	63.2	16.7
	H05-B	Between I-495 HOV On-Ramp and Turkeycock HOV On-Ramp	Basic	3021	2441	2443	2	0%	63.7	18.2
	H06-B	Between I-495 HOV On-Ramp and Turkeycock HOV On-Ramp	Basic	3021	2441	2452	11	0%	63.8	19.5
	H07-M	I-495 HOV On-Ramp	Merge	1553	2441	2441	0	0%	63.2	17.8
	H08-B	Between I-495 HOV Off-Ramp and HOV On-Ramp	Basic	2276	2350	2359	9	0%	62.0	19.3
	H09-D	I-495 HOV Off-Ramp	Diverge	2170	2703	2702	-1	0%	54.7	16.1
Northbound I-395 GP	N01-B	I-95 NB Mainline through Springfield Interchange	Basic	684	4804	4881	77	2%	40.3	33.9
	N02-B	I-95 NB Mainline through Springfield Interchange	Basic	1048	4804	4841	37	1%	37.9	46.1
	N03-W	Between Springfield Interchange and Edsall Road	Weave	2492	6486	6462	-24	0%	35.4	44.1
	N04-D	Diverge Area at Edsall Road WB Off-Ramp	Diverge	1492	5658	5630	-28	-1%	35.3	49.1
	N05-B	Between Edsall Road WB Off-Ramp and On-Ramp	Basic	972	5038	5001	-37	-1%	24.1	69.5
	N06-W	Between Edsall Road On-Ramp and Turkeycock HOV Ramp	Weave	2777	5757	5682	-75	-1%	22.9	71.4
	N08-B	Between Turkeycock Ramp and Duke Street EB Off-Ramp	Basic	1912	5656	5493	-163	-3%	29.3	64.4
	N09-D	Diverge Area at Duke Street EB Off-Ramp	Diverge	1494	5656	5462	-194	-3%	26.5	64.6
	N10-D	Diverge Area at Duke Street WB Off-Ramp	Diverge	1490	5409	5213	-196	-4%	18.0	86.5
	N11-B	Between Duke Street WB Off-Ramp and On-Ramp	Basic	2086	5131	4942	-189	-4%	15.6	107.7
	N12-M	Merge Area at Duke Street WB On-Ramp	Merge	560	6344	6133	-211	-3%	19.6	79.6
	N13-B	Between Duke Street and Seminary Road	Basic	2679	6344	6143	-201	-3%	33.4	62.2
	N14-D	Diverge Area at Seminary Road Off-Ramp	Diverge	1470	6344	6142	-202	-3%	48.2	39.9
	N15-B	Between Seminary Road Off-Ramp and On-Ramp	Basic	2987	5698	5554	-144	-3%	47.1	40.2
	N16-M	North of Seminary Road On-Ramp	Merge	1498	6996	6842	-154	-2%	43.8	35.8

Severely congested condition | Heavily congested condition | Moderate traffic condition | Light traffic condition

Interchange Ramps (2013 Existing AM)

Interchange	Ramp	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %
Seminary Road Interchange	I-395 NB Off-Ramp at Seminary Road	646	591	-55	-8%
	I-395 NB On-Ramp at Seminary Road	1298	1297	-1	0%
	I-395 SB Off-Ramp at Seminary Road	943	941	-2	0%
	I-395 SB On-Ramp at Seminary Road	796	789	-7	-1%
	I-395 SB HOV On-Ramp at Seminary Road	190	184	-6	-3%
Duke Street/Little River Turnpike Interchange	I-395 NB to EB Duke Street	247	239	-8	-3%
	I-395 NB to WB Duke Street	278	254	-24	-8%
	EB Little River Turnpike to I-395 NB	602	592	-10	-2%
	WB Duke Street to I-395 NB	611	607	-4	-1%
	I-395 SB to EB Little River Turnpike	497	496	-1	0%
	I-395 SB to WB Little River Turnpike	475	478	3	1%
	EB Little River Turnpike to I-395 SB	430	440	10	2%
	WB Little River Turnpike to I-395 SB	528	541	13	3%
Turkeycock Run Ramp	I-395 NB GP to I-395 NB HOV	101	98	-3	-3%
Edsall Road Interchange	I-395 NB to EB Edsall Road	828	811	-17	-2%
	I-395 NB to WB Edsall Road	620	582	-38	-6%
	EB Edsall Road to I-395 NB	477	484	7	1%
	WB Edsall Road to I-395 NB	242	239	-3	-1%
	I-395 SB to EB Edsall Road	197	194	-3	-1%
	I-395 SB to WB Edsall Road	387	371	-16	-4%
	EB Edsall Road to I-395 SB	456	463	7	1%
	WB Edsall Road to I-395 SB	545	536	-9	-2%
Springfield Interchange	I-495 Outer GP to I-95 SB GP	1626	1607	-19	-1%
	I-495 Outer GP to I-395 NB GP	1128	1130	2	0%
	I-495 Outer HOT to I-95 SB HOV	177	177	0	0%
	I-495 Inner GP to I-95 SB GP	1900	1886	-14	-1%
	I-495 Inner GP to I-395 NB GP	554	555	1	0%
	I-395 SB GP to I-495 Inner GP	1297	1311	14	1%
	I-395 SB GP to Franconia	1038	1066	28	3%
	I-395 SB GP to I-495 Outer GP	528	522	-6	-1%
	I-395 SB HOV to I-495 (inner and outer)	91	93	2	3%

Intersections (2013 Existing AM)

Node	Intersection	Movement	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Avg. Delay (sec/veh)	Approach LOS	Intersection Delay (sec/veh)	Intersection LOS	Storage (ft)	Avg. Queue (ft)	Max. Queue (ft)
1	Seminary Rd & I-395 SB Off-Ramp	WBL	259	255	-4	-1%	0.7	A	17.8	B	200	0	0
		WBT	628	571	-57	-9%	0.1	A			200	0	0
		SBT	300	305	5	2%	69.7	E			1970	24	80
2	Seminary Rd & I-395 SB On-Ramp	EBT	655	654	-1	0%	55.0	E	30.2	C	580	50	185
		SBL	300	304	4	1%	1.9	A			267	0	5
		SBT	259	255	-4	-1%	0.2	A			230	0	5
3	Seminary Rd & I-395 NB Off-Ramp	EBL	637	636	-1	0%	1.7	A	21.6	C	275	1	53
		EBT	318	319	1	0%	2.9	A			275	1	53
		NBT	534	486	-48	-9%	58.7	E			750	31	119
		NBR	112	103	-9	-8%	10.6	B			112	0	11
4	Seminary Rd & I-395 NB On-Ramp	WBT	454	440	-14	-3%	71.9	E	21.0	C	290	45	179
		NBL	623	570	-53	-8%	1.6	A			205	1	71
		NBT	548	551	3	1%	0.9	A			205	0	71
5	Seminary Rd & I-395 HOV Ramp	WBT	887	826	-61	-7%	0.2	A	---	---	---	---	---
		WBR	190	184	-6	-3%	0.0	A			125	0	0
6	Seminary Rd & Mark Center Ave	EBL	20	19	-1	-4%	63.0	E	34.1	C	195	2	22
		EBT	1240	1222	-18	-1%	39.6	D			605	34	120
		EBR	122	113	-9	-7%	30.2	C			380	27	111
		WBL	345	345	0	0%	55.0	D			2200	39	165
		WBT	1717	1657	-60	-4%	23.6	C			950	0	10
		WBR	96	93	-3	-3%	15.4	B			800	0	10
		NBL	26	26	0	-2%	65.5	E			650	10	43
		NBT	20	21	1	3%	65.9	E			650	10	43
		NBR	180	183	3	2%	36.2	D			650	10	43
		SBL	267	273	6	2%	45.0	D			200	28	97
		SBT	102	101	-1	-1%	46.1	D			200	28	97
		SBR	36	33	-3	-8%	9.1	A			200	28	97
7	Seminary Rd & Kenmore Ave	EBT	867	862	-5	-1%	---	---	---	---	---	---	---
		EBR	59	60	1	2%	---	---			---	---	---
		WBT	1418	1424	6	0%	---	---			---	---	---
		WBR	59	54	-5	-8%	---	---			---	---	---
		NBR	111	114	3	3%	9.8	A			1320	2	31
		SBR	783	747	-36	-5%	34.1	D			510	95	218
8	Little River Tpk & Beauregard St	EBL	492	473	-19	-4%	115.0	F	58.7	E	385	77	300
		EBT	1052	1048	-4	0%	48.1	D			670	72	310
		EBR	17	21	4	23%	46.2	D			670	72	310
		WBL	26	25	0	-1%	124.3	F			225	53	133
		WBT	958	940	-18	-2%	42.2	D			315	6	30
		WBR	520	497	-23	-4%	13.3	B			150	6	30
		NBL	99	98	-1	-1%	76.5	E			145	15	82
		NBT	71	70	-1	-1%	82.1	F			750	14	75
		NBR	56	54	-2	-3%	82.9	F			750	14	75
		SBL	772	754	-18	-2%	86.6	F			500	206	365
		SBT	45	42	-3	-8%	95.4	F			640	206	365
		SBR	218	207	-11	-5%	28.9	C			510	206	365
9	Little River Tpk & Oasis Dr	EBT	1851	1845	-5	0%	2.5	A	9.3	A	300	12	111
		EBR	19	21	1	7%	1.7	A			300	12	111
		WBL	111	104	-7	-7%	22.5	C			235	1	26
		WBT	1493	1470	-23	-2%	15.9	B			500	12	107
		WBR	81	81	0	-1%	2.4	A			500	1	53
		NBR	139	135	-4	-3%	27.0	C			145	5	56
		SBR	14	13	-1	-5%	0.4	A			250	0	12

Intersections (2013 Existing AM)

Node	Intersection	Movement	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Avg. Delay (sec/veh)	Approach LOS	Intersection Delay (sec/veh)	Intersection LOS	Storage (ft)	Avg. Queue (ft)	Max. Queue (ft)
10	Duke St & S Walker St	EBT	1411	1367	-44	-3%	21.6	C	19.8	B	615	21	114
		EBR	291	284	-7	-2%	2.7	A			615	0	0
		WBL	41	44	3	6%	55.8	E			615	22	128
		WBT	1509	1507	-2	0%	16.2	B			990	22	128
		NBL	638	637	-1	0%	31.5	C			340	21	103
		NBR	117	110	-7	-6%	4.6	A			470	0	15
		SBL	3	2	-1	-38%	57.8	E			230	1	16
		SBT	3	5	2	52%	60.6	E			210	1	16
		SBR	10	8	-2	-23%	32.0	C			205	1	16
11	Edsall Rd & Mitchell St	EBL	29	29	0	1%	14.1	B	17.2	B	120	0	11
		EBT	1308	1315	7	0%	24.5	C			330	23	168
		EBR	46	44	-2	-4%	4.0	A			330	0	12
		WBL	283	271	-11	-4%	20.5	C			200	5	103
		WBT	982	927	-55	-6%	6.2	A			300	4	70
		WBR	26	26	0	0%	7.1	A			300	4	70
		NBL	22	25	3	12%	39.9	D			195	3	28
		NBT	12	10	-2	-14%	47.3	D			195	3	28
		NBR	232	233	1	1%	2.1	A			225	0	13
		SBL	88	88	1	1%	51.2	D			100	9	48
		SBT	11	13	2	14%	43.8	D			100	9	48
		SBR	19	17	-2	-8%	10.7	B			100	9	48
12	Edsall Rd & Cherokee Ave	EBL	221	218	-3	-1%	23.3	C	11.6	B	90	8	147
		EBT	1407	1418	12	1%	6.4	A			220	12	152
		WBT	1213	1158	-55	-5%	10.5	B			500	10	89
		WBR	366	354	-12	-3%	6.1	A			500	0	0
		SBL	249	252	3	1%	44.8	D			215	16	70
		SBR	83	81	-2	-3%	6.8	A			215	0	17
13	Edsall Rd & Bren Mar Dr	EBT	1147	1099	-48	-4%	12.3	B	13.4	B	670	10	99
		EBR	256	256	0	0%	5.0	A			670	3	85
		WBL	51	51	0	1%	52.0	D			275	5	34
		WBT	849	838	-11	-1%	4.5	A			300	3	47
		NBL	268	264	-4	-2%	41.6	D			540	23	108
		NBT	69	69	0	0%	35.9	D			540	23	108
		NBR	89	87	-2	-2%	11.2	B			240	23	108
14	Edsall Rd & Sullivan Pl Dr	EBT	1198	1099	-99	-8%	12.3	---	---	---	---	---	---
		EBR	38	35	-3	-9%	11.7	---			---	---	---
		NBR	9	9	0	-2%	5.3	A			220	0	8
15	Edsall Rd & Bloomfield Dr	EBT	1173	1158	-15	-1%	5.1	A	7.8	A	250	6	110
		EBR	29	30	1	5%	2.7	A			250	6	110
		WBL	50	49	-1	-3%	21.6	C			200	0	15
		WBT	883	872	-11	-1%	6.1	A			200	6	78
		NBL	190	188	-2	-1%	26.0	C			170	10	80
		NBR	79	76	-3	-4%	14.7	B			170	1	31
16	Edsall Rd & Beryl Rd	EBT	1178	1164	-14	-1%	3.4	A	7.2	A	195	5	48
		EBR	74	71	-3	-4%	2.7	A			195	5	48
		WBL	14	14	0	1%	6.0	A			165	0	8
		WBT	828	821	-7	-1%	9.5	A			165	6	66
		NBL	105	100	-5	-4%	33.5	C			290	7	53
		NBR	28	29	1	4%	19.5	B			290	7	53

2013 Existing PM Peak Hour

Congestion Level

Light to moderate traffic

Heavy traffic

Congested traffic

Severely congested traffic

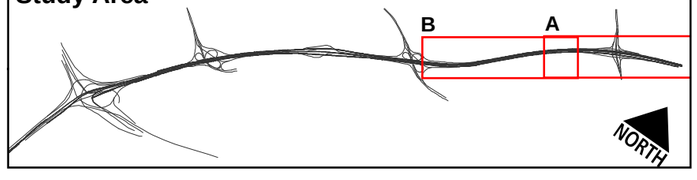
GP Lane Segment ID
Peak Hour Density

HOV Lane Segment ID
Peak Hour Density

1 Matchline

0 250 500 Feet

Study Area



VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Existing (2013) PM Freeway Congestion Level

C

NORTH

H03-D
21.9

S07-W
44.3

3

2

N10-D
23.4

395

N11-B
23.1

H02-B
21.9

DUKE STREET

236

D

NORTH

S09-B
37.5

S10-W
32.6

H05-M
23.3

S08-W
43.8

4

3

N06-M
24.4

N08-B
31.7

H04-B
20.8

395

N09-D
28.4

Congestion Level

Light to moderate traffic

Heavy traffic

Congested traffic

Severely congested traffic

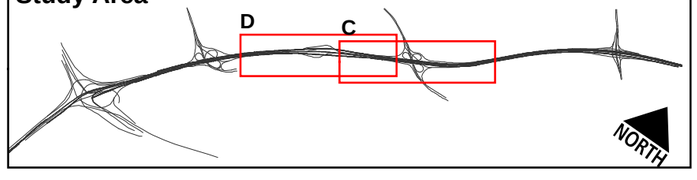
GP Lane Segment ID
Peak Hour Density

HOV Lane Segment ID
Peak Hour Density

1 Matchline

0 250 500 Feet

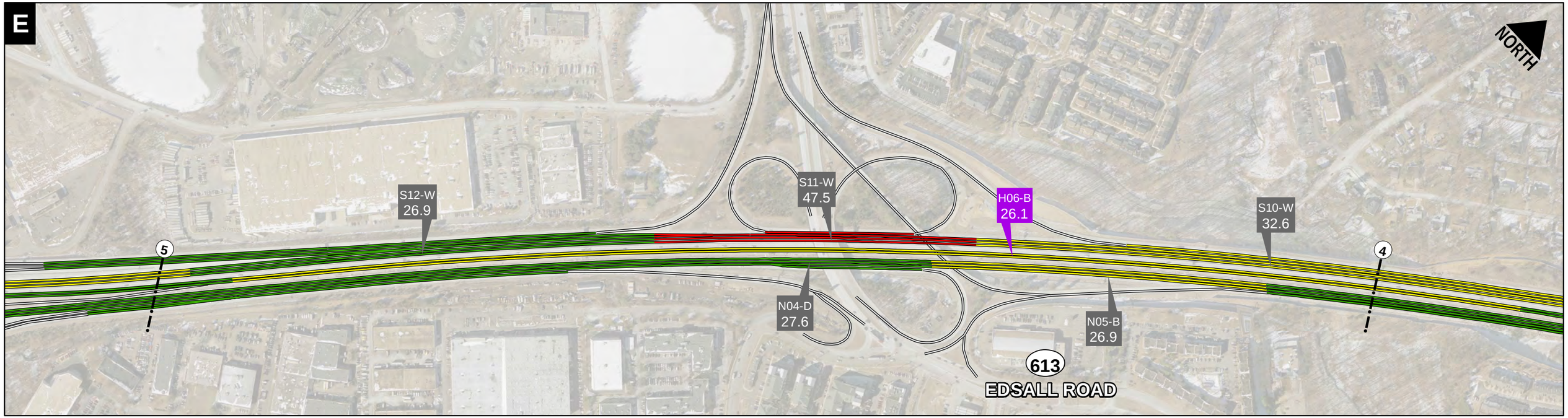
Study Area

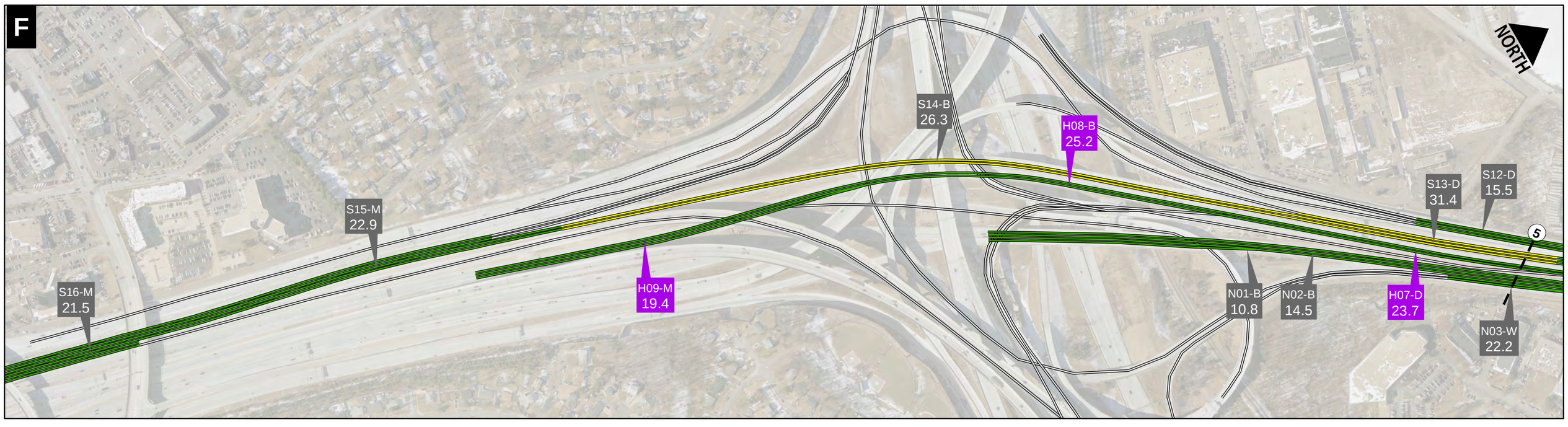


VDOT
HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Existing (2013) PM Freeway Congestion Level





Congestion Level

Light to moderate traffic | Heavy traffic | Congested traffic | Severely congested traffic

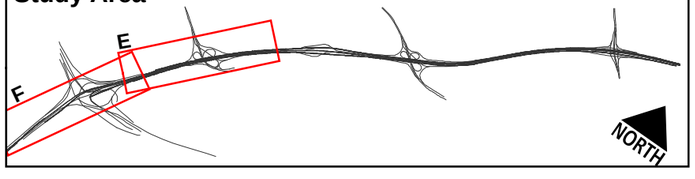
GP Lane Segment ID
Peak Hour Density

HOV Lane Segment ID
Peak Hour Density

1 Matchline

0 250 500 Feet

Study Area



VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Existing (2013) PM Freeway Congestion Level

Freeway Mainline (2013 Existing PM)

Direction	Segment	Location	Operation Type	Length (ft)	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Speed (mph)	Density (pc/ln/mi)
Southbound I-395 GP	S01-D	North of Seminary Road Off-Ramp	Diverge	1499	6669	6518	-151	-2%	15.9	84.3
	S02-B	Between Seminary Road Off-Ramp and On-Ramp	Basic	3891	5787	5574	-213	-4%	12.1	118.2
	S03-M	Merge Area at Seminary Road On-Ramp	Merge	1455	7020	6760	-260	-4%	14.7	107.7
	S04-B	Between Seminary Road On-Ramp and Duke Street Off-Ramp	Basic	1366	7020	6767	-253	-4%	16.9	102.5
	S05-D	Diverge Area at WB Duke Street Off-Ramp	Diverge	1500	7020	6763	-257	-4%	17.2	100.7
	S06-B	Between WB Duke Street Off-Ramp and On-Ramp	Basic	1984	6276	6106	-170	-3%	20.7	75.8
	S07-W	Between WB Duke Street On-Ramp and EB Off-Ramp	Weave	1445	6761	6551	-210	-3%	43.7	44.3
	S08-W	Between EB Duke Street On-Ramp and Turkeycock Slip Ramp	Weave	3227	6571	6468	-103	-2%	47.6	43.8
	S09-B	Between Turkeycock Slip Ramp and Flyover Ramp	Basic	770	5885	5826	-59	-1%	53.2	37.5
	S10-W	Between Turkeycock Flyover Ramp and Edsall Road Off-Ramp	Weave	3263	6008	5928	-80	-1%	50.7	32.6
	S11-W	Between WB Edsall Road On-Ramp and EB Off-Ramp	Weave	1404	6079	6041	-38	-1%	38.8	47.5
	S12-W	Between Edsall Road and I-495 Ramp	Weave	1953	6629	6541	-88	-1%	51.7	26.9
	S12-D	Diverge Area at I-495 Inner Loop Ramps	Diverge	1141	2415	2306	-109	-5%	53.5	15.5
	S13-D	Diverge Area at Franconia Ramp	Diverge	1447	4214	4272	58	1%	47.2	31.4
	S14-B	I-95 SB Mainline through Springfield Interchange	Basic	3255	2607	2650	44	2%	52.8	26.3
	S15-M	Merge Area with I-495 Outer Loop Ramp	Merge	1568	4729	4738	9	0%	53.4	22.9
	S16-M	Merge Area with I-495 Inner Loop Ramp	Merge	1506	6626	6632	6	0%	53.2	21.5
Southbound I-395 HOV	H01-D	North of Seminary Road HOV Off-Ramp	Diverge	1498	2915	2903	-12	0%	63.5	19.6
	H02-B	Between Seminary Road HOV Off-Ramp and Turkeycock Flyover Ramp	Basic	10570	2762	2748	-14	-1%	63.6	21.9
	H03-D	Diverge Area at Turkeycock Flyover Ramp	Diverge	1501	2762	2744	-18	-1%	63.5	21.9
	H04-B	Between Turkeycock Flyover Ramp and Slip Ramp	Basic	2861	2639	2614	-25	-1%	63.6	20.8
	H05-M	Merge Area at Turkeycock Slip Ramp	Merge	1501	3325	3260	-65	-2%	61.6	23.3
	H06-B	Between Turkeycock Slip Ramp and Off-Ramp to I-495 HOT Lanes	Basic	4738	3325	3272	-53	-2%	63.5	26.1
	H07-D	Diverge Area at Off-Ramp to I-495 HOT Lanes	Diverge	1523	3325	3269	-56	-2%	62.9	23.7
	H08-B	Between I-495 HOT Off-Ramp and On-Ramp	Basic	2276	3237	3172	-65	-2%	63.5	25.2
	H09-M	Merge Area at On-Ramp from I-495 HOT Lanes	Merge	2170	3688	3653	-35	-1%	63.6	19.4
Northbound I-395 GP	N01-B	I-95 NB Mainline through Springfield Interchange	Basic	684	2286	2282	-4	0%	53.9	10.8
	N02-B	I-95 NB Mainline through Springfield Interchange	Basic	1048	2286	2280	-6	0%	53.8	14.5
	N03-W	Between Springfield Interchange and Edsall Road	Weave	2492	4582	4588	6	0%	50.4	22.2
	N04-D	Diverge Area at Edsall Road WB Off-Ramp	Diverge	1496	3879	3873	-6	0%	43.1	27.6
	N05-B	Between Edsall Road WB Off-Ramp and On-Ramp	Basic	1469	3427	3434	7	0%	43.4	26.9
	N06-M	Merge Area at Edsall Road On-Ramp	Merge	1500	4114	4133	19	0%	43.1	24.4
	N07-B	Between Edsall Road On-Ramp and Turkeycock Flyover Ramp	Basic	290	4114	4083	-31	-1%	43.4	23.9
	N08-B	Between Turkeycock Flyover Ramp and Duke Street EB Off-Ramp	Basic	2411	4114	4131	17	0%	44.2	31.7
	N09-D	Diverge Area at Duke Street EB Off-Ramp	Diverge	1494	4114	4127	13	0%	46.2	28.4
	N10-D	Diverge Area at Duke Street WB Off-Ramp	Diverge	1490	3664	3676	12	0%	47.6	23.4
	N11-B	Between Duke Street WB Off-Ramp and On-Ramp	Basic	2086	3296	3302	6	0%	48.6	23.1
	N12-M	Merge Area at Duke Street WB On-Ramp	Merge	560	4366	4278	-88	-2%	51.7	21.1
	N13-B	Between Duke Street and Seminary Road	Basic	2679	4366	4355	-11	0%	52.9	28.0
	N14-D	Diverge Area at Seminary Road Off-Ramp	Diverge	1470	4366	4353	-13	0%	49.8	26.7
	N15-B	Between Seminary Road Off-Ramp and On-Ramp	Basic	2987	3672	3642	-30	-1%	51.6	24.0
	N16-M	North of Seminary Road On-Ramp	Merge	1498	4642	4620	-22	0%	52.6	19.9

Severely congested condition Heavily congested condition Moderate traffic condition Light traffic condition

Interchange Ramps (2013 Existing PM)

Interchange	Ramp	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %
Seminary Road Interchange	I-395 NB Off-Ramp at Seminary Road	694	708	14	2%
	I-395 NB On-Ramp at Seminary Road	970	981	11	1%
	I-395 SB Off-Ramp at Seminary Road	882	824	-58	-7%
	I-395 SB On-Ramp at Seminary Road	1233	1211	-22	-2%
	I-395 SB HOV Off-Ramp at Seminary Road	153	165	12	8%
Duke Street/Little River Turnpike Interchange	I-395 NB to EB Duke Street	450	450	0	0%
	I-395 NB to WB Duke Street	368	379	11	3%
	EB Little River Turnpike to I-395 NB	439	423	-16	-4%
	WB Duke Street to I-395 NB	631	635	4	1%
	I-395 SB to EB Little River Turnpike	682	611	-71	-10%
	I-395 SB to WB Little River Turnpike	744	660	-84	-11%
	EB Little River Turnpike to I-395 SB	492	483	-9	-2%
	WB Little River Turnpike to I-395 SB	485	490	5	1%
Turkeycock Run Ramps	I-395 SB GP to I-395 SB HOV	686	638	-48	-7%
	I-395 SB HOV to I-395 SB GP	123	122	-1	-1%
Edsall Road Interchange	I-395 NB to EB Edsall Road	703	712	9	1%
	I-395 NB to WB Edsall Road	452	440	-12	-3%
	EB Edsall Road to I-395 NB	447	452	5	1%
	WB Edsall Road to I-395 NB	240	243	3	1%
	I-395 SB to EB Edsall Road	176	162	-14	-8%
	I-395 SB to WB Edsall Road	486	450	-36	-7%
	EB Edsall Road to I-395 SB	726	724	-2	0%
	WB Edsall Road to I-395 SB	557	546	-11	-2%
Springfield Interchange	I-495 Outer GP to I-95 SB GP	2122	2094	-28	-1%
	I-495 Outer GP to I-395 NB GP	1683	1687	4	0%
	I-495 Outer HOT to I-95 SB HOV	226	232	6	3%
	I-495 Inner GP to I-95 SB GP	1897	1880	-17	-1%
	I-495 Inner GP to I-395 NB GP	613	615	2	0%
	I-395 SB GP to I-495 Inner GP	1447	1433	-15	-1%
	I-395 SB GP to Franconia	1607	1625	18	1%
	I-395 SB GP to I-495 Outer GP	968	916	-52	-5%
	I-395 SB HOV to I-495 (inner and outer)	88	90	2	2%

Intersections (2013 Existing PM)

Node	Intersection	Movement	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Avg. Delay (sec)	Approach LOS	Intersection Delay (sec)	Intersection LOS	Storage (ft)	Avg. Queue (ft)	Max. Queue (ft)
1	Seminary Rd & I-395 SB Off-Ramp	WBL	254	265	11	4%	2.9	A	23.7	C	200	0	16
		WBT	653	675	22	3%	0.6	A			200	2	40
		SBT	406	390	-16	-4%	73.8	E			1970	32	113
2	Seminary Rd & I-395 SB On-Ramp	EBT	787	795	8	1%	71.7	E	40.6	D	580	134	407
		SBL	475	463	-13	-3%	4.0	A			267	2	42
		SBT	185	194	9	5%	2.5	A			230	2	45
3	Seminary Rd & I-395 NB Off-Ramp	EBL	644	659	15	2%	1.9	A	18.2	B	275	5	83
		EBT	618	598	-20	-3%	5.8	A			275	5	83
		NBT	479	491	12	2%	58.1	E			750	34	138
		NBR	215	218	3	1%	14.0	B			112	0	18
4	Seminary Rd & I-395 NB On-Ramp	WBT	275	283	8	3%	66.8	E	13.8	B	290	27	112
		NBL	479	498	19	4%	1.5	A			205	0	31
		NBT	644	652	8	1%	0.3	A			205	0	31
5	Seminary Rd & I-395 HOV Ramp	WBT	754	780	26	3%	0.4	A	---	---	---	---	---
		SBR	153	165	12	8%	4.6	A			125	1	37
6	Seminary Rd & Mark Center Ave	EBL	34	35	1	2%	74.5	E	45.8	D	195	4	29
		EBT	1705	1711	6	0%	46.1	D			605	46	168
		EBR	34	29	-5	-15%	37.3	D			380	39	159
		WBL	62	67	5	8%	69.2	E			2200	9	50
		WBT	1339	1360	21	2%	33.5	C			950	0	12
		WBR	166	163	-4	-2%	17.6	B			800	0	12
		NBL	83	72	-11	-13%	86.5	F			650	61	203
		NBT	13	16	3	22%	91.6	F			650	61	203
		NBR	814	797	-17	-2%	65.7	E			650	61	203
		SBL	171	171	0	0%	47.7	D			200	15	73
		SBT	42	45	3	6%	43.7	D			200	15	73
		SBR	36	34	-2	-5%	6.4	A			200	15	73
7	Seminary Rd & Kenmore Ave	EBT	1341	1320	-21	-2%	---	---	---	---	---	---	---
		EBR	347	339	-8	-2%	---	---			---	---	---
		WBT	840	858	18	2%	---	---			---	---	---
		WBR	54	52	-3	-5%	---	---			---	---	---
		NBR	95	100	5	5%	14.4	B			1320	2	35
		SBR	296	302	6	2%	12.7	B			510	4	52
8	Little River Tpk & Beauregard St	EBL	300	286	-14	-5%	104.5	F	68.9	E	385	32	92
		EBT	1087	1088	1	0%	44.0	D			670	62	258
		EBR	34	35	1	2%	44.4	D			670	62	258
		WBL	66	60	-6	-10%	124.2	F			225	56	138
		WBT	1120	973	-147	-13%	33.5	C			315	14	57
		WBR	590	523	-67	-11%	19.4	B			150	14	57
		NBL	113	84	-29	-25%	325.7	F			145	103	217
		NBT	170	124	-46	-27%	327.7	F			750	175	217
		NBR	119	84	-35	-29%	213.5	F			750	175	217
		SBL	863	857	-7	-1%	81.0	F			500	414	560
		SBT	126	124	-2	-2%	87.9	F			640	414	560
		SBR	315	299	-16	-5%	56.7	E			510	414	560
9	Little River Tpk & Oasis Dr	EBT	2068	2028	-40	-2%	2.0	A	9.7	A	300	7	109
		EBR	21	20	-1	-5%	1.8	A			300	7	109
		WBL	222	216	-7	-3%	39.2	D			235	8	83
		WBT	1611	1579	-33	-2%	13.9	B			500	12	137
		WBR	342	336	-6	-2%	4.4	A			500	1	88
		NBR	204	199	-5	-2%	37.4	D			145	13	81
		SBR	160	163	3	2%	3.7	A			250	8	72

Intersections (2013 Existing PM)

Node	Intersection	Movement	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Avg. Delay (sec)	Approach LOS	Intersection Delay (sec)	Intersection LOS	Storage (ft)	Avg. Queue (ft)	Max. Queue (ft)
10	Duke St & S Walker St	EBT	1906	1788	-118	-6%	24.5	C	23.6	C	615	31	175
		EBR	567	562	-5	-1%	6.0	A			615	0	0
		WBL	128	123	-5	-4%	58.5	E			615	27	131
		WBT	1573	1585	12	1%	16.3	B			990	27	131
		NBL	623	614	-9	-1%	47.6	D			340	32	133
		NBR	149	145	-4	-3%	6.4	A			470	1	19
		SBL	33	32	-1	-4%	53.0	D			230	12	54
		SBT	33	31	-3	-8%	51.1	D			210	12	54
		SBR	128	131	3	2%	33.4	C			205	12	54
11	Edsall Rd & Mitchell St	EBL	6	8	2	25%	11.1	B	4.7	A	120	0	6
		EBT	1003	1003	0	0%	7.4	A			330	2	59
		EBR	32	34	2	7%	0.9	A			330	0	0
		WBL	139	130	-9	-7%	12.1	B			200	0	21
		WBT	1198	1143	-55	-5%	0.6	A			300	0	24
		WBR	45	45	0	0%	1.6	A			300	0	24
		NBL	15	15	0	-1%	49.1	D			195	2	20
		NBT	8	7	-1	-13%	49.3	D			195	2	20
		NBR	319	326	7	2%	2.9	A			225	0	30
		SBL	8	8	-1	-6%	49.4	D			100	1	22
		SBT	8	10	2	19%	44.0	D			100	1	22
		SBR	9	10	1	9%	11.7	B			100	1	22
12	Edsall Rd & Cherokee Ave	EBL	65	62	-3	-5%	19.8	B	12.5	B	90	2	80
		EBT	1265	1277	12	1%	7.8	A			220	16	136
		WBT	1271	1226	-46	-4%	9.6	A			500	9	91
		WBR	201	196	-5	-2%	5.9	A			500	0	0
		SBL	413	413	0	0%	39.0	D			215	25	118
		SBR	116	111	-5	-5%	8.0	A			215	1	20
13	Edsall Rd & Bren Mar Dr	EBT	1150	1100	-51	-4%	17.7	B	18.1	B	670	21	207
		EBR	120	118	-2	-2%	7.3	A			670	11	187
		WBL	30	30	-1	-2%	54.9	D			275	3	19
		WBT	719	711	-8	-1%	7.9	A			300	5	57
		NBL	372	368	-4	-1%	36.7	D			540	27	116
		NBT	114	117	3	2%	31.0	C			540	27	116
		NBR	87	87	0	0%	12.1	B			240	27	116
14	Edsall Rd & Sullivan Pl Dr	EBT	1183	1100	-84	-7%	17.7	---	---	---	---	---	---
		EBR	54	46	-8	-14%	17.4	---			---	---	---
		NBR	14	14	0	-1%	4.9	A			220	0	8
15	Edsall Rd & Bloomfield Dr	EBT	1130	1137	7	1%	2.9	A	5.7	A	250	2	89
		EBR	54	50	-4	-7%	2.7	A			250	2	89
		WBL	85	85	0	0%	15.1	B			200	0	19
		WBT	765	758	-8	-1%	2.9	A			200	2	42
		NBL	110	112	2	1%	42.3	D			170	9	62
		NBR	81	75	-6	-7%	12.6	B			170	1	27
16	Edsall Rd & Beryl Rd	EBT	1068	1064	-5	0%	0.7	A	1.19	A	195	1	77
		EBR	143	149	6	4%	0.8	A			195	1	77
		WBL	17	17	0	-2%	1.4	A			165	0	7
		WBT	758	753	-5	-1%	1.8	A			165	1	40
		NBL	92	90	-2	-2%	1.6	A			290	0	20
		NBR	18	19	1	3%	10.1	B			290	0	20

2020 No-Build AM Peak Hour

A

S03-M 18.2

1

N14-D 31.4

S02-B 17.1

N15-B 46.8

H01-B 20.4

SEMINARY ROAD

420

395

S01-D 17.2

H00-M 18.8

N16-M 40.1

NORTH

B

S06-B 19.4

2

H02-B 23.1

S05-D 20.6

N12-M 33.1

S04-B 20.5

395

N13-B 33.1

H02-D 23.7

1

NORTH

Congestion Level

Light to moderate traffic

Heavy traffic

Congested traffic

Severely congested traffic

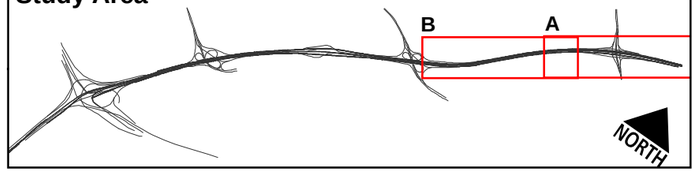
GP Lane Segment ID
Peak Hour Density

Express Lane Segment ID
Peak Hour Density

1 Matchline

0 250 500 Feet

Study Area



VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

No-Build (2020) AM Freeway Congestion Level

C

NORTH

3

S07-W
31.2

H04-M
18.9

N10-D
28.4

DUKE STREET

236

2

N11-B
34.7

H02-B
23.1

395

D

NORTH

S09-B
31.3

S08-M
34.6

4

H06-B
19.5

N08-B
35.9

H05-B
20.6

3

N09-D
29.7

395

H04-M
18.9

0 250 500 Feet

Peak Hour Volume

GP Lane Segment ID
Peak Hour Demand

Express Lane Segment ID
Peak Hour Demand

Ramp
Peak Hour Demand

1 Matchline

Study Area

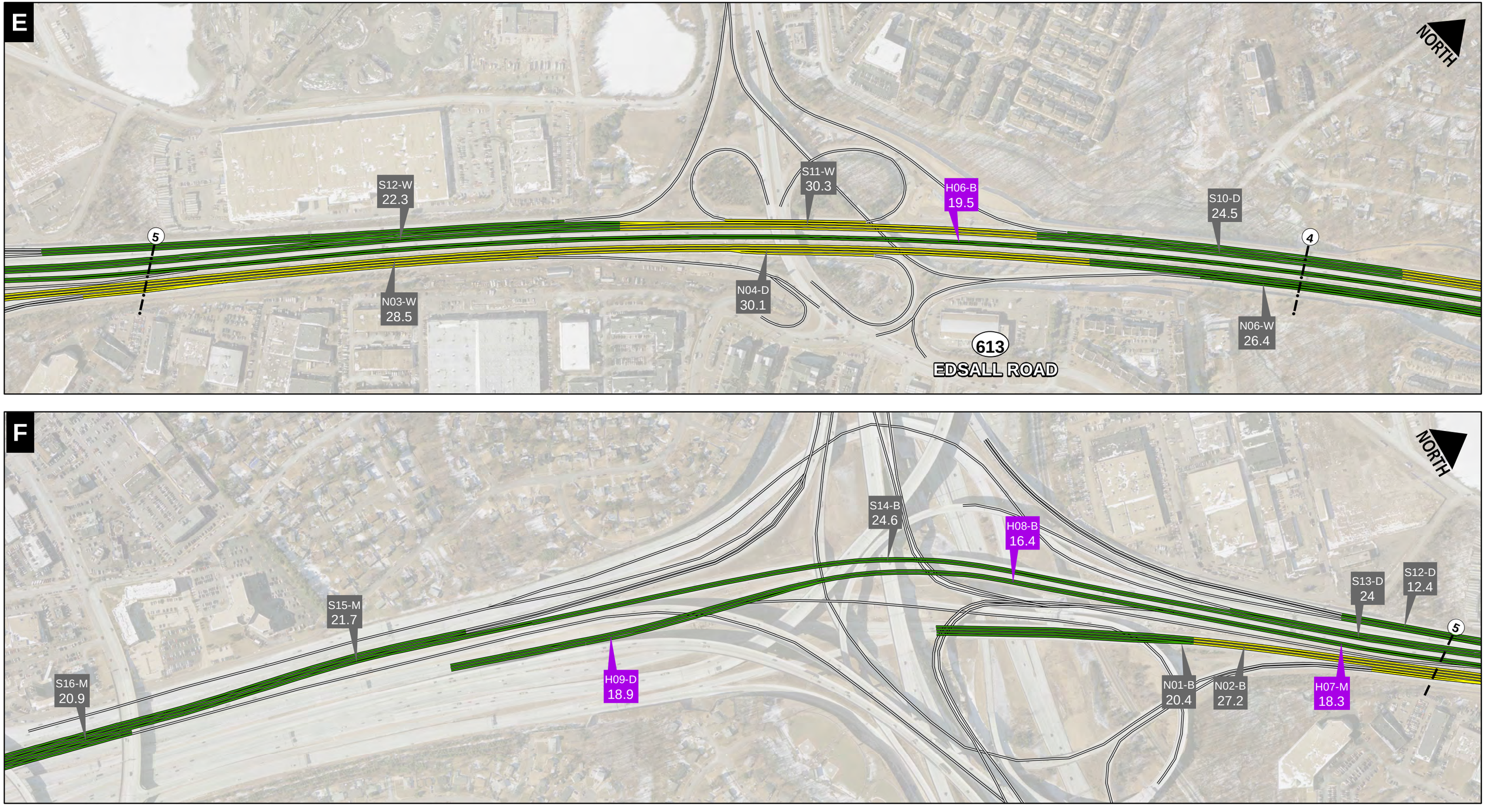
D C

NORTH

VDOT
HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

No-Build (2020) AM Freeway Congestion Level



Congestion Level

Light to moderate traffic | Heavy traffic | Congested traffic | Severely congested traffic

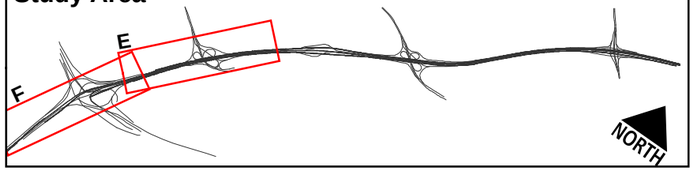
GP Lane Segment ID
Peak Hour Density

Express Lane Segment ID
Peak Hour Density

1 Matchline

0 250 500 Feet

Study Area



VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

No-Build (2020) AM Freeway Congestion Level

Freeway Mainline (2020 No-Build AM)

Direction	Segment	Location	Operation Type	Length (ft)	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Speed (mph)	Density (pc/ln/mi)
Southbound I-395 GP	S01-D	North of Seminary Road Off-Ramp	Diverge	1,499	5305	5318	13	0%	63.7	17.2
	S02-B	Between Seminary Road Off-Ramp and On-Ramp	Basic	3,891	4234	4251	17	0%	64.1	17.1
	S03-M	Merge Area at Seminary Road On-Ramp	Merge	1,455	5074	5075	1	0%	63.4	18.2
	S04-B	Between Seminary Road On-Ramp and Duke Street Off-Ramp	Basic	1,366	5074	5079	5	0%	63.8	20.5
	S05-D	Diverge Area at WB Duke Street Off-Ramp	Diverge	1,500	5074	5078	4	0%	63.3	20.6
	S06-B	Between WB Duke Street Off-Ramp and On-Ramp	Basic	1,984	4579	4573	-7	0%	60.7	19.4
	S07-W	Between WB Duke Street On-Ramp and EB On-Ramp	Weave	1,445	5139	5103	-36	-1%	47.4	31.2
	S08-M	Between EB Duke Street On-Ramp and Turkeycock Slip Ramp	Merge	1,497	5081	5085	4	0%	47.8	34.6
	S09-B	Between Turkeycock Slip Ramp and Flyover Ramp	Basic	2,883	5081	5088	7	0%	51.5	31.3
	S10-D	Between Turkeycock Flyover Ramp and Edsall Road Off-Ramp	Diverge	1,499	5081	5081	0	0%	53.0	24.5
	S11-W	Between WB Edsall Road On-Ramp and EB Off-Ramp	Weave	1,404	5225	5230	5	0%	50.1	30.3
	S12-W	Between Edsall Road and I-495 Ramp	Weave	1,953	5481	5436	-45	-1%	52.7	22.3
	S12-D	Diverge Area at I-495 Inner Loop Ramp	Diverge	1,141	1876	1850	-26	-1%	53.8	12.4
	S13-D	Diverge Area at Franconia Ramp	Diverge	1,447	3605	3615	10	0%	51.7	24.0
	S14-B	I-95 SB Mainline through Springfield Interchange	Basic	3,255	2538	2536	-2	0%	53.1	24.6
	S15-M	Merge Area with I-495 Outer Loop Ramp	Merge	1,568	4505	4483	-22	0%	53.4	21.7
	S16-M	Merge Area with I-495 Inner Loop Ramp	Merge	1,506	6437	6411	-26	0%	53.3	20.9
Northbound I-395 HOV/ Express	H00-M	Seminary Road HOV On-Ramp	Merge	1,498	2765	2751	-14	-1%	62.8	18.8
	H01-B	Between Seminary Road HOV Off-Ramp andHOV On- Ramp	Basic	4,141	2514	2514	-1	0%	62.5	20.4
	H02-D	Seminary Road HOV Off-Ramp	Diverge	1,495	2882	2896	14	0%	52.4	23.7
	H02-B	Between Seminary Road HOV Off-Ramp and Turkeycock Flyover Ramp	Basic	6,446	2882	2828	-54	-2%	60.7	23.1
	H04-M	Between Turkeycock Flyover HOV Off-Ramp and On-Ramp	Merge	1,340	2779	2877	98	4%	63.4	18.9
	H05-B	Between Turkeycock Ramps	Basic	2,080	2779	2844	65	2%	61.9	20.6
	H06-B	Between Turkeycock Off-Ramp to I-495	Basic	5,675	3655	3666	11	0%	63.0	19.5
	H07-M	I-495 Express Lanes On-Ramp	Merge	1,555	3655	3669	14	0%	62.6	18.3
	H08-B	Between I-495 Express Lanes Ramps	Basic	2,273	3104	3121	17	1%	64.0	16.4
	H09-D	I-495 Express Lanes Off-Ramp	Diverge	3,236	4226	4242	16	0%	63.7	18.9
Northbound I-395 GP	N01-B	I-95 NB mainline through Springfield Interchange	Basic	684	4138	4275	138	3%	53.3	20.4
	N02-B	I-95 NB mainline through Springfield Interchange	Basic	1,048	4138	4271	134	3%	53.1	27.2
	N03-W	Between Springfield Interchange and Edsall Road	Weave	2,492	5844	5995	152	3%	51.1	28.5
	N04-D	Diverge Area at Edsall Road WB Off-Ramp	Diverge	1,492	4974	5140	166	3%	52.4	30.1
	N05-B	Between Edsall Road WB Off-Ramp and On-Ramp	Basic	972	4322	4495	173	4%	53.4	28.5
	N06-W	Weave Area at Edsall Road On-Ramp	Weave	2,280	5061	5230	170	3%	52.3	26.4
	N08-B	Between Turkeycock Flyover Ramp and Duke Street EB Off-Ramp	Basic	2,269	5061	5121	60	1%	48.5	35.9
	N09-D	Diverge Area at Duke Street EB Off-Ramp	Diverge	1,602	5834	6013	179	3%	50.7	29.7
	N10-D	Diverge Area at Duke Street WB Off-Ramp	Diverge	1,490	5556	5730	174	3%	51.2	28.4
	N11-B	Between Duke Street WB Off-Ramp and On-Ramp	Basic	2,086	5243	5415	172	3%	52.8	34.7
	N12-M	Merge Area at Duke Street WB On-Ramp	Merge	560	6679	6815	136	2%	52.5	33.1
	N13-B	Between Duke Street and Seminary Road	Basic	2,671	6679	6824	145	2%	52.5	33.1
	N14-D	Diverge Area at Seminary Road Off-Ramp	Diverge	1,458	6679	6814	135	2%	50.3	31.4
	N15-B	Between Seminary Road Off-Ramp and On-Ramp	Basic	2,987	5592	5741	149	3%	42.5	46.8
	N16-M	North of Seminary Road On-Ramp	Merge	1,498	6912	7005	93	1%	40.5	40.1

Severely congested condition | Heavily congested condition | Moderate traffic condition | Light traffic condition

Interchange Ramps (2020 No-Build AM)

Interchange	Ramp Description	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %
Seminary Road Interchange	I-395 NB Off-Ramp at Seminary Road	1087	1070	-17	-2%
	I-395 NB On-Ramp at Seminary Road	1320	1270	-50	-4%
	I-395 SB Off-Ramp at Seminary Road	1071	1075	4	0%
	I-395 SB On-Ramp at Seminary Road	840	826	-14	-2%
	I-395 SB HOV Off-Ramp at Seminary Road	251	243	-8	-3%
Duke Street/Little River Turnpike Interchange	I-395 NB to EB Duke Street	278	282	4	1%
	I-395 NB to WB Duke Street	313	320	7	2%
	EB Little River Turnpike to I-395 NB	713	699	-13	-2%
	WB Duke Street to I-395 NB	723	711	-12	-2%
	I-395 SB to EB Little River Turnpike	514	507	-6	-1%
	I-395 SB to WB Little River Turnpike	495	508	14	3%
	EB Little River Turnpike to I-395 SB	456	473	18	4%
	WB Little River Turnpike to I-395 SB	559	566	6	1%
Turkeycock Run Ramps	I-395 NB GP to I-395 NB HOV	103	105	2	2%
	I-395 NB HOV to I-395 NB GP	876	884	8	1%
Edsall Road Interchange	I-395 NB to EB Edsall Road	870	862	-7	-1%
	I-395 NB to WB Edsall Road	652	643	-9	-1%
	EB Edsall Road to I-395 NB	487	496	9	2%
	WB Edsall Road to I-395 NB	251	249	-3	-1%
	I-395 SB to EB Edsall Road	209	211	2	1%
	I-395 SB to WB Edsall Road	410	406	-5	-1%
	EB Edsall Road to I-395 SB	465	470	5	1%
	WB Edsall Road to I-395 SB	554	547	-7	-1%
Springfield Interchange	I-495 Outer GP to I-95 SB GP	1967	1949	-18	-1%
	I-495 Outer GP to I-395 NB GP	1171	1170	0	0%
	I-495 Outer HOT to I-95 SB HOV	561	558	-3	0%
	I-495 Inner GP to I-95 SB GP	1932	1917	-15	-1%
	I-495 Inner GP to I-395 NB GP	536	538	2	0%
	I-395 SB GP to I-495 Inner GP	1333	1344	10	1%
	I-395 SB GP to Franconia	1067	1082	15	1%
	I-395 SB GP to I-495 Outer GP	543	541	-2	0%
	I-395 SB HOV to I-495 (inner and outer)	551	557	6	1%

Intersections (2020 No-Build AM)

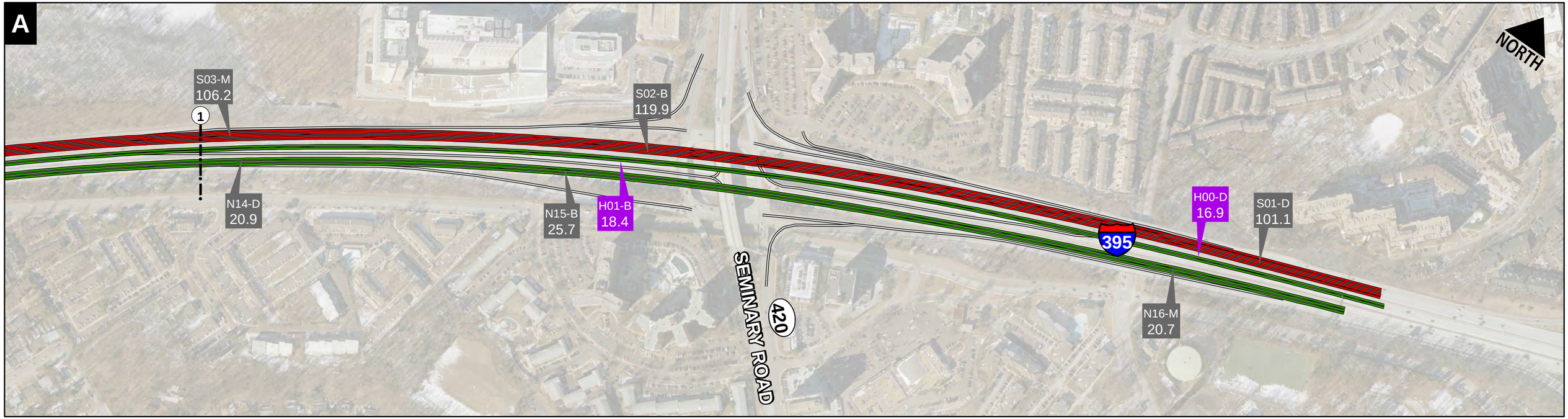
Node	Intersection	Movement	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Avg. Delay (sec)	Approach LOS	Intersection Delay (sec)	Intersection LOS	Storage (ft)	Avg. Queue (ft)	Max. Queue (ft)
1	Seminary Rd & I-395 SB Off-Ramp	WBL	273	253	-20	-7%	0.8	A	18.3	B	200	0	0
		WBT	1005	866	-140	-14%	0.2	A			200	0	4
		SBT	341	345	4	1%	76.5	E			1970	29	96
2	Seminary Rd & I-395 SB On-Ramp	EBT	705	708	3	0%	59.4	E	32.8	C	580	48	193
		SBL	341	345	4	1%	2.1	A			267	0	8
		SBT	273	254	-19	-7%	0.2	A			230	0	8
3	Seminary Rd & I-395 NB Off-Ramp	EBL	665	667	2	0%	1.9	A	20.2	C	275	3	64
		EBT	381	384	3	1%	4.8	A			275	3	64
		NBT	898	890	-8	-1%	43.6	D			750	42	191
		NBR	188	188	-1	0%	6.2	A			112	0	16
4	Seminary Rd & I-395 NB On-Ramp	WBT	514	358	-156	-30%	110.5	F	22.0	C	290	76	195
		NBL	1016	1004	-12	-1%	1.8	A			205	1	75
		NBT	546	549	3	1%	1.2	A			205	1	75
5	Seminary Rd & I-395 HOV Ramp	WBT	1279	1119	-160	-13%	0.2	A	---	---	---	---	---
		WBR	251	243	-8	-3%	0.0	A			125	0	0
6	Seminary Rd & Mark Center Ave	EBL	21	21	0	0%	78.1	E	36.5	D	195	3	21
		EBT	1423	1423	0	0%	43.3	D			605	39	136
		EBR	126	113	-14	-11%	31.8	C			380	32	127
		WBL	465	436	-29	-6%	60.7	E			2200	65	283
		WBT	2316	2268	-48	-2%	23.8	C			950	0	8
		WBR	129	120	-9	-7%	18.9	B			800	0	8
		NBL	30	30	-1	-2%	79.3	E			650	13	52
		NBT	23	24	1	2%	80.7	F			650	13	52
		NBR	234	235	1	0%	36.1	D			650	13	52
		SBL	391	397	5	1%	53.0	D			200	41	127
		SBT	135	129	-6	-4%	58.5	E			200	41	127
		SBR	48	44	-4	-8%	15.0	B			200	41	127
7	Seminary Rd & Kenmore Ave	EBT	1317	1312	-5	---	---	---	---	---	---	---	---
		EBR	90	90	1	---	---	---			---	---	---
		WBT	1462	724	-738	---	---	---			---	---	---
		WBR	42	41	-1	---	---	---			---	---	---
		NBR	108	112	4	4%	11.02	B			1320	2	29
		SBR	819	314	-505	-62%	43.69	E			510	133	218
8	Little River Tpk & Beauregard St	EBL	502	489	-13	-3%	94.3	F	59.1	E	385	57	277
		EBT	1087	1079	-8	-1%	47.8	D			670	75	345
		EBR	17	21	3	20%	48.4	D			670	75	345
		WBL	28	29	0	0%	115.0	F			225	71	134
		WBT	1069	1062	-7	-1%	46.4	D			315	6	34
		WBR	578	564	-14	-2%	18.9	B			150	6	34
		NBL	100	99	-1	-1%	91.3	F			145	19	90
		NBT	71	71	0	0%	90.5	F			750	17	79
		NBR	71	72	0	0%	98.1	F			750	17	79
		SBL	854	855	2	0%	95.1	F			500	119	284
		SBT	49	47	-3	-6%	85.8	F			640	119	284
		SBR	239	232	-7	-3%	14.0	B			510	119	284
9	Little River Tpk & Oasis Dr	EBT	1981	1992	11	1%	2.0	A	13.8	B	300	11	118
		EBR	21	23	2	10%	1.9	A			300	11	118
		WBL	126	122	-4	-3%	36.1	D			235	3	49
		WBT	1664	1668	5	0%	25.4	C			500	28	205
		WBR	93	94	1	1%	4.9	A			500	9	154
		NBR	140	137	-3	-2%	32.6	C			145	7	58
		SBR	16	16	0	0%	0.7	A			250	1	23

Intersections (2020 No-Build AM)

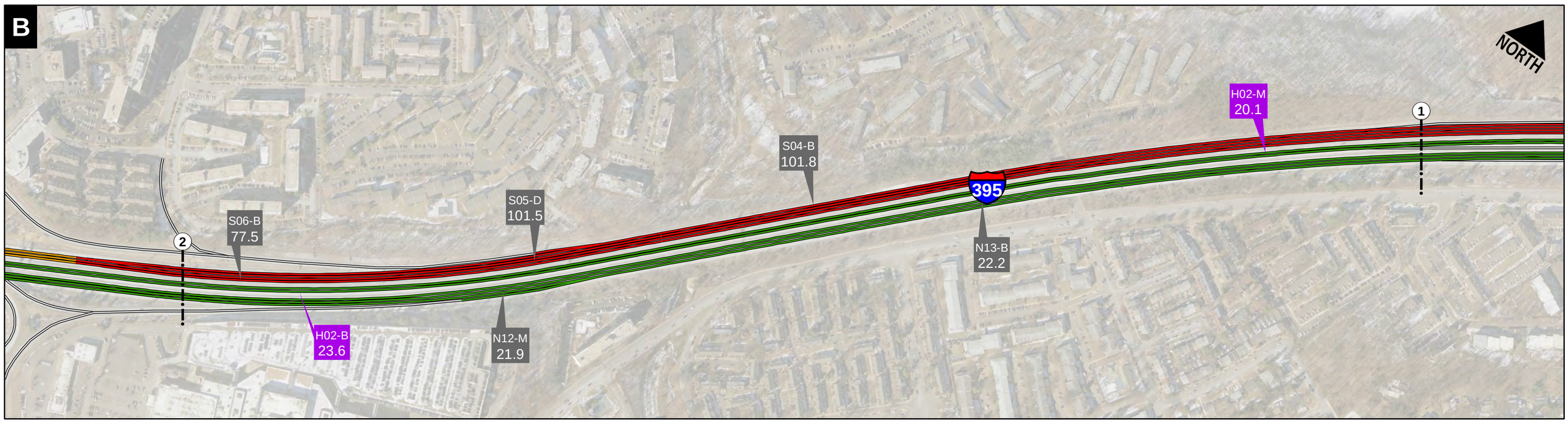
Node	Intersection	Movement	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Avg. Delay (sec)	Approach LOS	Intersection Delay (sec)	Intersection LOS	Storage (ft)	Avg. Queue (ft)	Max. Queue (ft)
10	Duke St & S Walker St	EBT	1447	1416	-31	-2%	14.3	B	18.9	B	615	15	110
		EBR	297	293	-4	-1%	2.2	A			615	0	0
		WBL	49	48	-1	-2%	67.5	E			615	19	147
		WBT	1810	1795	-15	-1%	10.6	B			990	19	147
		NBL	616	616	0	0%	58.0	E			340	40	161
		NBR	113	110	-3	-3%	7.4	A			470	0	19
		SBL	4	3	-1	-14%	88.2	F			230	3	23
		SBT	4	6	2	60%	65.8	E			210	3	23
		SBR	23	20	-3	-14%	37.3	D			205	3	23
11	Edsall Rd & Mitchell St	EBL	24	26	2	7%	12.3	B	11.6	B	120	0	11
		EBT	1340	1348	7	1%	17.5	B			330	14	143
		EBR	38	36	-2	-4%	2.4	A			330	0	3
		WBL	245	242	-3	-1%	18.7	B			200	4	75
		WBT	1139	1112	-27	-2%	3.6	A			300	3	56
		WBR	21	22	1	7%	2.8	A			300	3	56
		NBL	18	20	2	11%	45.5	D			195	3	27
		NBT	10	10	0	2%	43.5	D			195	3	27
		NBR	231	231	0	0%	2.2	A			225	0	28
		SBL	14	12	-2	-11%	49.7	D			100	2	20
		SBT	11	13	1	12%	46.1	D			100	2	20
		SBR	20	20	0	1%	11.4	B			100	2	20
12	Edsall Rd & Cherokee Ave	EBL	182	176	-6	-3%	28.0	C	12.3	B	90	8	149
		EBT	1403	1415	12	1%	5.8	A			220	10	151
		WBT	1323	1307	-16	-1%	11.8	B			500	14	106
		WBR	395	398	3	1%	7.8	A			500	0	4
		SBL	314	316	1	0%	41.8	D			215	18	72
		SBR	85	83	-3	-3%	6.4	A			215	0	16
13	Edsall Rd & Bren Mar Dr	EBT	1217	1175	-42	-3%	20.4	C	17.7	B	670	16	139
		EBR	264	259	-6	-2%	5.8	A			670	6	119
		WBL	53	52	0	-1%	52.2	D			275	5	35
		WBT	934	929	-5	-1%	7.5	A			300	7	106
		NBL	277	273	-4	-1%	40.2	D			540	23	101
		NBT	70	72	2	3%	34.4	C			540	23	101
		NBR	96	95	0	0%	21.0	C			240	23	101
14	Edsall Rd & Sullivan Pl Dr	EBT	1274	1175	-99	-8%	20.4	---	---	---	---	---	---
		EBR	39	40	1	2%	18.0	---			---	---	---
		NBR	9	9	0	-3%	5.4	A			220	0	8
15	Edsall Rd & Bloomfield Dr	EBT	1247	1243	-5	0%	16.4	B	15.8	B	250	28	196
		EBR	31	28	-2	-8%	9.1	A			250	28	196
		WBL	52	50	-2	-4%	20.5	C			200	1	20
		WBT	967	961	-6	-1%	10.0	B			200	11	83
		NBL	201	199	-1	-1%	37.1	D			170	17	111
		NBR	82	77	-5	-6%	20.9	C			170	2	54
16	Edsall Rd & Beryl Rd	EBT	1251	1239	-12	-1%	1.9	A	5.8	A	195	6	92
		EBR	79	81	2	3%	1.8	A			195	6	92
		WBL	14	16	1	9%	2.6	A			165	0	9
		WBT	909	905	-4	0%	6.1	A			165	3	56
		NBL	110	106	-4	-3%	45.0	D			290	10	61
		NBR	29	29	-1	-2%	29.9	C			290	10	61
17	Seminary Rd & HOV BRAC Ramp	EBT	776	768	-9	-1%	8.1	A	10.6	B	1050	5	83
		WBT	994	1037	43	4%	7.6	A			700	5	47
		NBL	307	319	12	4%	24.3	C			1900	15	76
		NBR	60	60	0	-1%	20.4	C			1900	15	75

2020 No-Build PM Peak Hour

A



B



Congestion Level

Light to moderate traffic

Heavy traffic

Congested traffic

Severely congested traffic

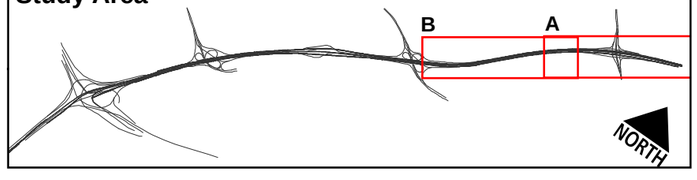
GP Lane Segment ID
Peak Hour Density

Express Lane Segment ID
Peak Hour Density

1 Matchline

0 250 500 Feet

Study Area



VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

No-Build (2020) PM Freeway Congestion Level

C

NORTH

S08-W
43.9

S07-W
44.5

3

2

H03-D
23.5

N10-D
18.5

N11-B
21.8

395

DUKE STREET

236

D

NORTH

S09-B
34

S10-W
28.4

H05-M
19.6

S08-W
43.9

4

3

N06-M
21.4

N07-B
21.1

N08-B
28.4

H04-B
22.1

395

N09-D
21.5

Congestion Level

Light to moderate traffic

Heavy traffic

Congested traffic

Severely congested traffic

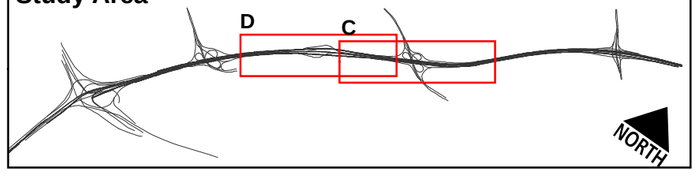
GP Lane Segment ID
Peak Hour Density

Express Lane Segment ID
Peak Hour Density

1 Matchline

0 250 500 Feet

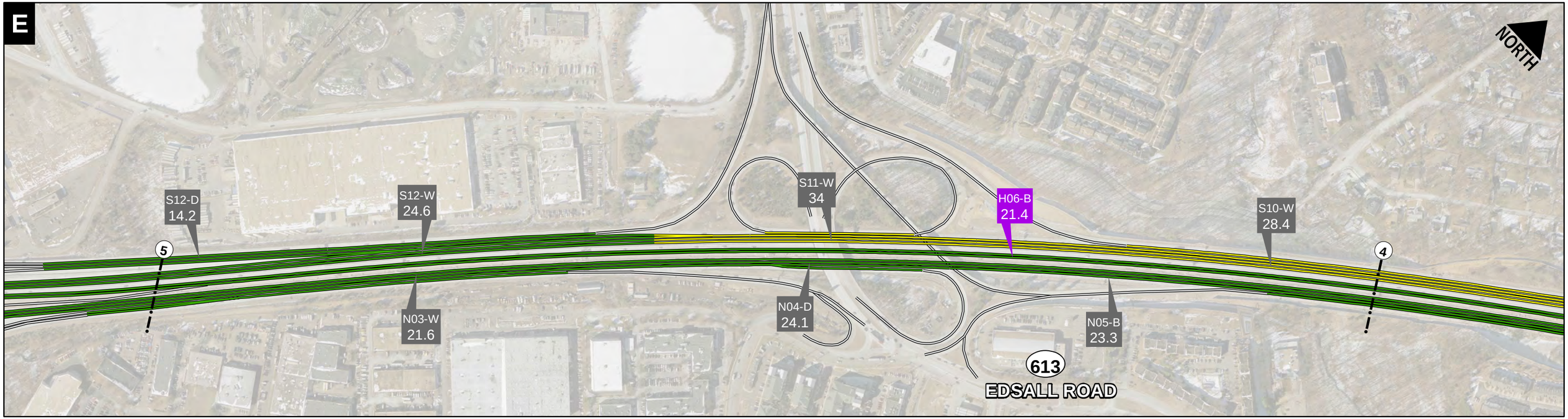
Study Area

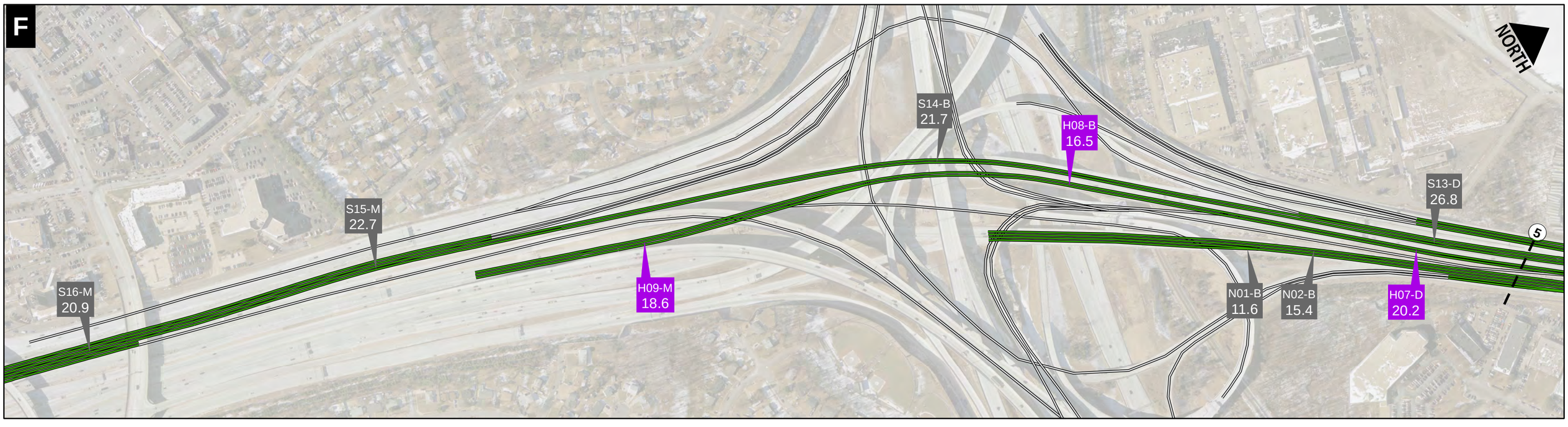


VDOT
HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

No-Build (2020) PM Freeway Congestion Level





Congestion Level

Light to moderate traffic | Heavy traffic | Congested traffic | Severely congested traffic

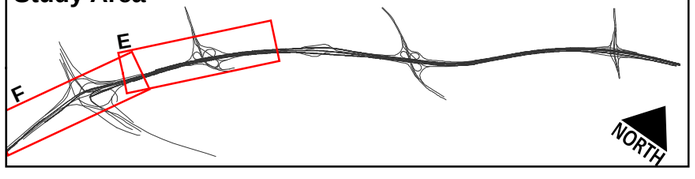
GP Lane Segment ID
Peak Hour Density

Express Lane Segment ID
Peak Hour Density

1 Matchline

0 250 500 Feet

Study Area



VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

No-Build (2020) PM Freeway Congestion Level

Freeway Mainline (2020 No-Build PM)

Direction	Segment	Location	Operation Type	Length (ft)	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Speed (mph)	Density (pc/ln/mi)
Southbound I-395 GP	S01-D	North of Seminary Road Off-Ramp	Diverge	1,499	6731	6548	-182	-3%	13.4	101.1
	S02-B	Between Seminary Road Off-Ramp and On-Ramp	Basic	3,891	5809	5620	-189	-3%	12.1	119.9
	S03-M	Merge Area at Seminary Road On-Ramp	Merge	1,455	7250	6889	-361	-5%	15.3	106.2
	S04-B	Between Seminary Road On-Ramp and Duke Street Off-Ramp	Basic	1,366	7250	6893	-357	-5%	17.4	101.8
	S05-D	Diverge Area at WB Duke Street Off-Ramp	Diverge	1,500	7250	6878	-371	-5%	17.4	101.5
	S06-B	Between WB Duke Street Off-Ramp and On-Ramp	Basic	1,984	6358	6094	-263	-4%	20.3	77.5
	S07-W	Between WB Duke Street On-Ramp and EB On-Ramp	Weave	1,445	6866	6539	-326	-5%	43.5	44.5
	S08-W	Between EB Duke Street On-Ramp and Turkeycock Slip Ramp	Weave	3,227	6724	6505	-218	-3%	47.2	43.9
	S09-B	Between Turkeycock Slip Ramp and Flyover Ramp	Basic	770	5350	5287	-63	-1%	53.4	34.0
	S10-W	Between Turkeycock Flyover Ramp and Edsall Road Off-Ramp	Weave	3,263	5516	5433	-83	-2%	52.9	28.4
	S11-W	Between WB Edsall Road On-Ramp and EB Off-Ramp	Weave	1,404	5584	5541	-44	-1%	48.1	34.0
	S12-W	Between Edsall Road and I-495 Ramp	Weave	1,953	6132	6038	-94	-2%	52.4	24.6
	S12-D	Diverge Area at I-495 Inner Loop Ramp	Diverge	1,141	2231	2120	-111	-5%	53.7	14.2
	S13-D	Diverge Area at Franconia Ramp	Diverge	1,447	3901	3947	46	1%	50.5	26.8
	S14-B	I-95 SB Mainline through Springfield Interchange	Basic	3,255	2205	2265	60	3%	53.3	21.7
	S15-M	Merge Area with I-495 Outer Loop Ramp	Merge	1,568	4705	4709	5	0%	53.4	22.7
	S16-M	Merge Area with I-495 Inner Loop Ramp	Merge	1,506	6437	6439	3	0%	53.2	20.9
Southbound I-395 HOV/ Express	H00-D	North of Seminary Road HOV Off-Ramp	Diverge	1,498	2507	2495	-12	0%	63.6	16.9
	H01-B	Between Seminary Road HOV Off-Ramp and HOV On- Ramp	Basic	4,156	2318	2314	-4	0%	63.9	18.4
	H02-M	Merge from Seminary Road HOV On-Ramp	Merge	1,503	2988	2936	-52	-2%	62.2	20.1
	H02-B	Between Seminary Road HOV On-Ramp and Turkeycock Flyover Ramp	Basic	4,919	2988	2786	-202	-7%	63.1	23.6
	H03-D	Diverge Area at Turkeycock Flyover Ramp	Diverge	1,501	2988	2942	-46	-2%	63.4	23.5
	H04-B	Between Turkeycock Flyover Ramp and Slip Ramp	Basic	2,855	2822	2773	-49	-2%	63.6	22.1
	H05-M	Merge Area at Turkeycock Slip Ramp	Merge	1,501	4196	3985	-210	-5%	62.3	19.6
	H06-B	Between Turkeycock Slip Ramp and Off-Ramp to I-495 HOT Lanes	Basic	4,739	4196	4009	-187	-4%	63.6	21.4
	H07-D	Diverge Area at Off-Ramp to I-495 HOT Lanes	Diverge	1,525	4196	4006	-190	-5%	62.1	20.2
	H08-B	Between I-495 HOT Off-Ramp and On-Ramp	Basic	2,275	3276	3102	-174	-5%	63.8	16.5
	H09-M	Merge Area at On-Ramp from I-495 HOT Lanes	Merge	2,168	4553	4624	71	2%	63.5	18.6
Northbound I-395 GP	N01-B	I-95 NB mainline through Springfield Interchange	Basic	684	2426	2423	-3	0%	53.9	11.6
	N02-B	I-95 NB mainline through Springfield Interchange	Basic	1,048	2426	2420	-7	0%	53.8	15.4
	N03-W	Between Springfield Interchange and Edsall Road	Weave	2,492	4876	4883	8	0%	52.5	21.6
	N04-D	Diverge Area at Edsall Road WB Off-Ramp	Diverge	1,496	4126	4129	3	0%	52.7	24.1
	N05-B	Between Edsall Road WB Off-Ramp and On-Ramp	Basic	1,469	3645	3664	19	1%	53.5	23.3
	N06-M	Merge Area at Edsall Road On-Ramp	Merge	1,500	4384	4404	20	0%	52.6	21.4
	N07-B	Between Edsall Road On-Ramp and Turkeycock Flyover Ramp	Basic	290	4384	4351	-33	-1%	52.6	21.1
	N08-B	Between Turkeycock Flyover Ramp and Duke Street EB Off-Ramp	Basic	2,269	4384	4404	20	0%	52.6	28.4
	N09-D	Diverge Area at Duke Street EB Off-Ramp	Diverge	1,733	4384	4407	23	1%	51.9	21.5
	N10-D	Diverge Area at Duke Street WB Off-Ramp	Diverge	1,326	3801	3814	13	0%	52.6	18.5
	N11-B	Between Duke Street WB Off-Ramp and On-Ramp	Basic	2,086	3405	3405	-1	0%	53.2	21.8
	N12-M	Merge Area at Duke Street WB On-Ramp	Merge	560	4670	4543	-127	-3%	52.9	21.9
	N13-B	Between Duke Street and Seminary Road	Basic	2,677	4670	4624	-46	-1%	53.2	22.2
	N14-D	Diverge Area at Seminary Road Off-Ramp	Diverge	1,447	4670	4618	-52	-1%	51.0	20.9
	N15-B	Between Seminary Road Off-Ramp and On-Ramp	Basic	2,987	3901	3845	-56	-1%	51.2	25.7
	N16-M	North of Seminary Road On-Ramp	Merge	1,498	4895	4781	-114	-2%	52.5	20.7

Severely congested condition | Heavily congested condition | Moderate traffic condition | Light traffic condition

Interchange Ramps (2020 No-Build PM)

Interchange	Ramp Description	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %
Seminary Road Interchange	I-395 NB Off-Ramp at Seminary Road	768	785	16	2%
	I-395 NB On-Ramp at Seminary Road	993	945	-48	-5%
	I-395 SB Off-Ramp at Seminary Road	921	843	-78	-8%
	I-395 SB On-Ramp at Seminary Road	1441	1275	-166	-11%
	I-395 SB HOV Off-Ramp at Seminary Road	189	195	7	3%
Duke Street/Little River Turnpike Interchange	I-395 NB to EB Duke Street	583	587	4	1%
	I-395 NB to WB Duke Street	396	407	11	3%
	EB Little River Turnpike to I-395 NB	478	463	-15	-3%
	WB Duke Street to I-395 NB	786	765	-21	-3%
	I-395 SB to EB Little River Turnpike	721	655	-67	-9%
	I-395 SB to WB Little River Turnpike	892	790	-103	-11%
	EB Little River Turnpike to I-395 SB	579	577	-2	0%
	WB Little River Turnpike to I-395 SB	508	487	-21	-4%
Turkeycock Run Ramps	I-395 SB GP to I-395 SB HOV	1374	1209	-164	-12%
	I-395 SB HOV to I-395 SB GP	166	165	-1	-1%
Edsall Road Interchange	I-395 NB to EB Edsall Road	750	754	5	1%
	I-395 NB to WB Edsall Road	481	467	-14	-3%
	EB Edsall Road to I-395 NB	481	480	-1	0%
	WB Edsall Road to I-395 NB	259	256	-2	-1%
	I-395 SB to EB Edsall Road	187	174	-12	-6%
	I-395 SB to WB Edsall Road	513	470	-42	-8%
	EB Edsall Road to I-395 SB	734	733	-1	0%
	WB Edsall Road to I-395 SB	581	571	-10	-2%
Springfield Interchange	I-495 Outer GP to I-95 SB GP	2500	2448	-51	-2%
	I-495 Outer GP to I-395 NB GP	1787	1791	4	0%
	I-495 Outer HOT to I-95 SB HOV	638	641	3	0%
	I-495 Inner GP to I-95 SB GP	1732	1719	-13	-1%
	I-495 Inner GP to I-395 NB GP	663	665	3	0%
	I-395 SB GP to I-495 Inner GP	1482	1456	-25	-2%
	I-395 SB GP to Franconia	1696	1685	-11	-1%
	I-395 SB GP to I-495 Outer GP	750	699	-50	-7%
	I-395 SB HOV to I-495 (inner and outer)	919	898	-21	-2%

Intersections (2020 No-Build PM)

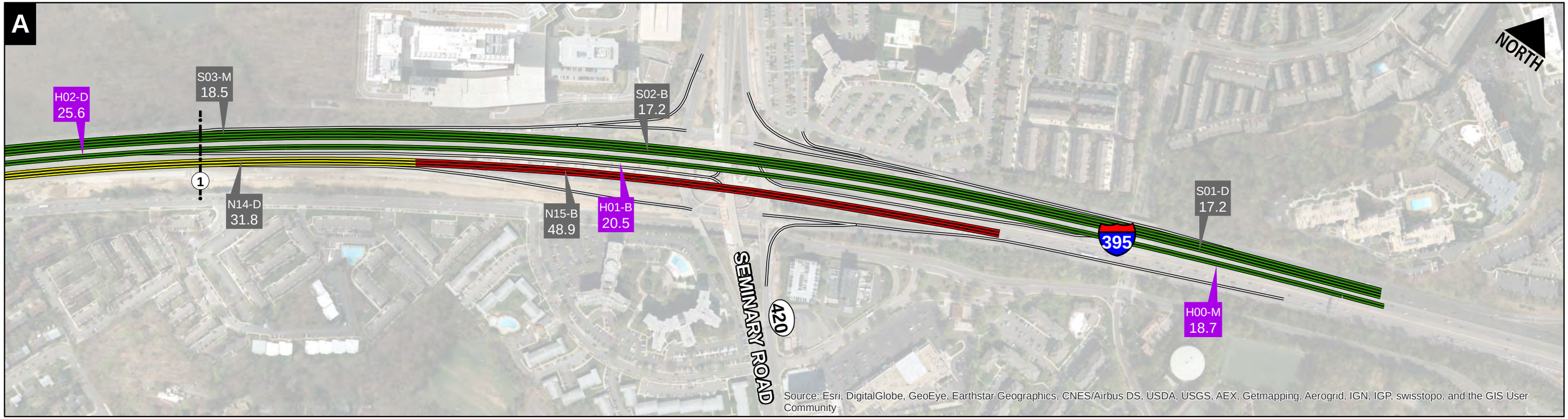
Node	Intersection	Movement	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Avg. Delay (sec)	LOS	Intersection Delay (sec)	Intersection LOS	Storage (ft)	Avg. Queue (ft)	Max. Queue (ft)
1	Seminary Rd & I-395 SB Off-Ramp	WBL	301	316	15	5%	4.3	A	20.4	C	200	0	20
		WBT	724	742	17	2%	1.1	A			200	4	71
		SBT	401	379	-22	-5%	71.7	E			1970	29	108
2	Seminary Rd & I-395 SB On-Ramp	EBT	791	725	-66	-8%	70.4	E	39.0	D	580	389	793
		SBL	486	462	-24	-5%	5.7	A			267	3	43
		SBT	216	232	16	7%	6.7	A			230	2	43
3	Seminary Rd & I-395 NB Off-Ramp	EBL	640	590	-49	-8%	8.8	A	23.2	C	275	7	93
		EBT	638	595	-43	-7%	5.0	A			275	7	93
		NBT	530	550	20	4%	64.6	E			750	37	141
		NBR	238	241	3	1%	8.5	A			112	1	31
4	Seminary Rd & I-395 NB On-Ramp	WBT	308	310	2	1%	86.1	F	19.8	B	290	30	105
		NBL	530	553	23	4%	3.0	A			205	0	17
		NBT	640	589	-51	-8%	0.6	A			205	0	24
5	Seminary Rd & I-395 HOV Ramp	WBT	838	864	26	3%	1.4	A	---	---	---	---	---
		SBR	187	197	9	5%	8.2	A			125	3	48
6	Seminary Rd & Mark Center Ave	EBL	35	33	-2	-6%	89.2	F	62.1	E	195	5	27
		EBT	1874	1834	-40	-2%	68.1	E			605	82	258
		EBR	35	31	-5	-13%	59.1	E			380	74	249
		WBL	67	75	8	12%	79.9	E			2200	12	58
		WBT	1473	1464	-10	-1%	29.6	C			950	0	12
		WBR	184	177	-7	-4%	18.1	B			800	0	12
		NBL	117	79	-38	-32%	117.5	F			650	309	504
		NBT	18	12	-7	-37%	111.8	F			650	309	504
		NBR	1211	948	-263	-22%	86.3	F			650	309	504
		SBL	241	239	-2	-1%	115.7	F			200	46	111
		SBT	56	55	-1	-2%	135.0	F			200	46	111
		SBR	48	46	-2	-5%	8.2	A			200	46	111
7	Seminary Rd & Kenmore Ave	EBT	1408	1308	-100	-7%	---	---	---	---	---	---	---
		EBR	362	341	-21	-6%	---	---			---	---	---
		WBT	1140	725	-415	-36%	---	---			---	---	---
		WBR	71	66	-5	-8%	---	---			---	---	---
		NBR	112	119	7	6%	15.0	B			1320	3	38
		SBR	349	121	-228	-65%	15.5	C			510	6	70
8	Little River Tpk & Beauregard St	EBL	300	278	-23	-7%	156.6	F	78.8	E	385	50	182
		EBT	1220	1184	-36	-3%	106.0	F			670	462	642
		EBR	34	31	-3	-10%	110.3	F			670	462	642
		WBL	70	59	-11	-16%	185.0	F			225	97	137
		WBT	1193	1022	-171	-14%	50.7	D			315	24	90
		WBR	626	542	-85	-13%	37.3	D			150	24	90
		NBL	113	115	2	2%	101.1	F			145	25	162
		NBT	171	173	2	1%	99.6	F			750	52	201
		NBR	191	182	-9	-5%	110.1	F			750	52	201
		SBL	999	972	-28	-3%	64.2	E			500	394	548
		SBT	130	124	-7	-5%	70.9	E			640	394	548
		SBR	326	325	-1	0%	59.2	E			510	394	548
9	Little River Tpk & Oasis Dr	EBT	2370	2336	-34	-1%	2.6	A	43.0	D	300	17	127
		EBR	21	22	2	8%	1.3	A			300	17	127
		WBL	236	208	-28	-12%	85.5	F			235	270	578
		WBT	1729	1633	-97	-6%	71.1	E			500	390	734
		WBR	363	339	-23	-6%	40.7	D			500	345	686
		NBR	236	234	-2	-1%	52.2	D			145	22	105
		SBR	166	123	-43	-26%	363.8	F			250	135	160

Intersections (2020 No-Build PM)

Node	Intersection	Movement	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Avg. Delay (sec)	LOS	Intersection Delay (sec)	Intersection LOS	Storage (ft)	Avg. Queue (ft)	Max. Queue (ft)
10	Duke St & S Walker St	EBT	2263	2137	-126	-6%	33.3	C	45.3	D	615	91	430
		EBR	590	588	-2	0%	14.8	B			615	0	0
		WBL	131	123	-8	-6%	104.1	F			615	62	224
		WBT	1674	1677	4	0%	35.0	D			990	62	224
		NBL	672	599	-73	-11%	132.8	F			340	115	276
		NBR	154	135	-20	-13%	46.0	D			470	1	22
		SBL	34	30	-4	-11%	65.7	E			230	15	65
		SBT	34	34	0	1%	64.0	E			210	15	65
		SBR	136	140	4	3%	44.7	D			205	15	65
11	Edsall Rd & Mitchell St	EBL	6	7	1	19%	12.5	B	6.1	A	120	0	6
		EBT	1083	1085	1	0%	10.3	B			330	5	81
		EBR	32	35	2	7%	0.9	A			330	0	0
		WBL	183	185	2	1%	16.9	B			200	1	46
		WBT	1579	1514	-65	-4%	1.5	A			300	1	32
		WBR	59	58	-1	-2%	1.8	A			300	1	32
		NBL	15	15	0	1%	51.9	D			195	2	20
		NBT	8	8	0	3%	49.8	D			195	2	20
		NBR	337	343	6	2%	2.7	A			225	0	33
		SBL	9	9	-1	-6%	55.6	E			100	1	17
		SBT	8	10	2	20%	43.1	D			100	1	17
		SBR	9	11	1	12%	7.2	A			100	1	17
12	Edsall Rd & Cherokee Ave	EBL	67	63	-4	-6%	26.5	C	13.3	B	90	1	61
		EBT	1362	1371	8	1%	7.6	A			220	16	139
		WBT	1698	1646	-52	-3%	11.3	B			500	14	112
		WBR	266	268	1	0%	8.4	A			500	0	0
		SBL	460	454	-6	-1%	39.2	D			215	27	120
		SBR	127	126	-2	-1%	10.6	B			215	1	25
13	Edsall Rd & Bren Mar Dr	EBT	1296	1238	-57	-4%	17.7	B	19.0	B	670	23	236
		EBR	127	123	-4	-3%	7.3	A			670	13	217
		WBL	34	35	1	4%	58.6	E			275	4	30
		WBT	1081	1088	8	1%	7.9	A			300	8	83
		NBL	471	459	-12	-2%	44.8	D			540	44	161
		NBT	114	113	0	0%	40.7	D			540	44	161
		NBR	87	87	0	0%	14.2	B			240	44	161
14	Edsall Rd & Sullivan Pl Dr	EBT	1326	1238	-87	-7%	17.7	C	---	---	---	23	236
		EBR	57	49	-8	-14%	18.8	C			---	23	236
		NBR	14	14	0	-2%	5.8	A			220	0	8
15	Edsall Rd & Bloomfield Dr	EBT	1266	1268	1	0%	2.8	A	6.3	A	250	2	38
		EBR	60	60	-1	-1%	1.1	A			250	2	38
		WBL	96	94	-2	-2%	14.0	B			200	0	19
		WBT	1113	1121	8	1%	3.1	A			200	2	43
		NBL	146	148	2	1%	51.3	D			170	16	96
		NBR	89	82	-7	-7%	19.3	B			170	1	44
16	Edsall Rd & Beryl Rd	EBT	1195	1188	-8	-1%	1.9	A	5.9	A	195	3	67
		EBR	159	163	3	2%	1.2	A			195	3	67
		WBL	19	17	-3	-15%	3.2	A			165	0	8
		WBT	1080	1089	9	1%	4.4	A			165	3	52
		NBL	128	126	-3	-2%	59.2	E			290	16	73
		NBR	20	20	0	-2%	37.7	D			290	16	73
17	Seminary Rd & HOV BRAC Ramp	EBT	894	810	-84	-9%	7.1	A	4.7	A	1050	6	100
		EBR	417	377	-40	-10%	6.0	A			700	6	100
		WBL	253	262	9	4%	6.0	A			1900	1	36
		WBR	575	585	10	2%	0.0	A			1900	0	0

2020 Build AM Peak Hour

A



B

Congestion Level

0 250 500 Feet

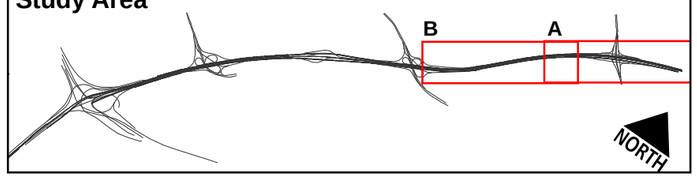
Light to moderate traffic | Heavy traffic | Congested traffic | Severely congested traffic

GP Lane Segment ID
Peak Hour Density

Express Lane Segment ID
Peak Hour Density

1 Matchline

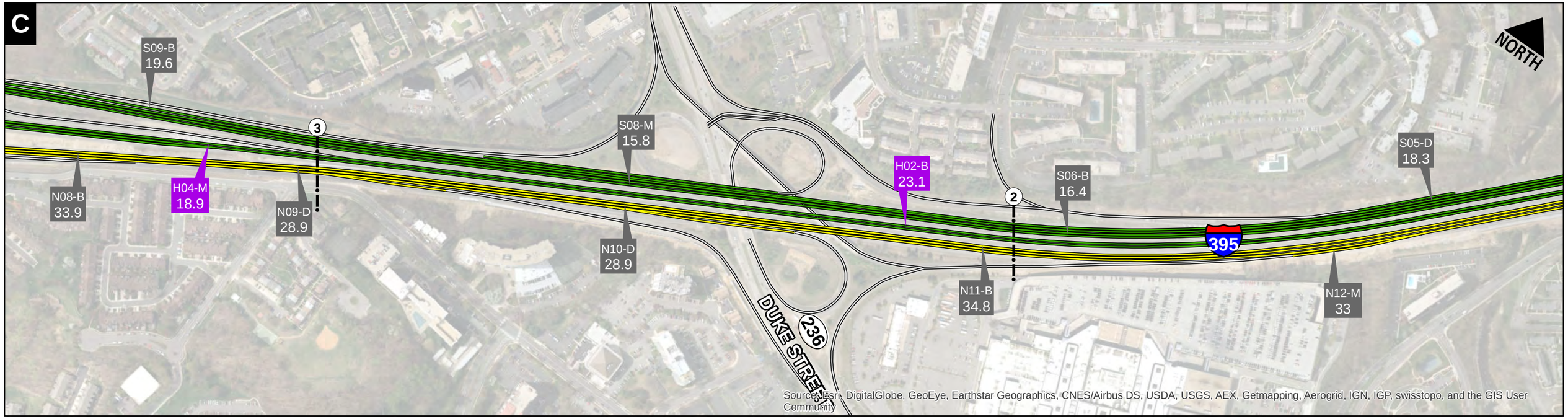
Study Area

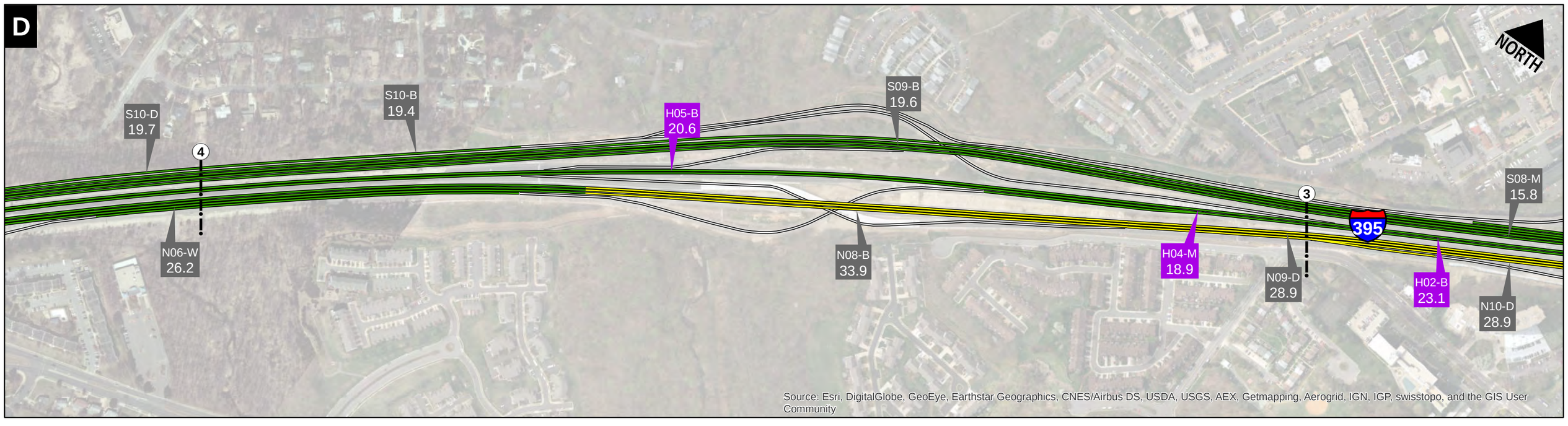


VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Build (2020) AM Peak Hour Volume





Congestion Level

0 250 500 Feet

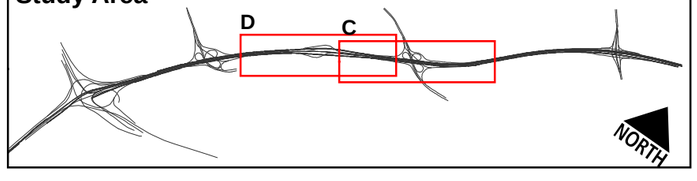
Light to moderate traffic | Heavy traffic | Congested traffic | Severely congested traffic

GP Lane Segment ID
Peak Hour Density

Express Lane Segment ID
Peak Hour Density

1 Matchline

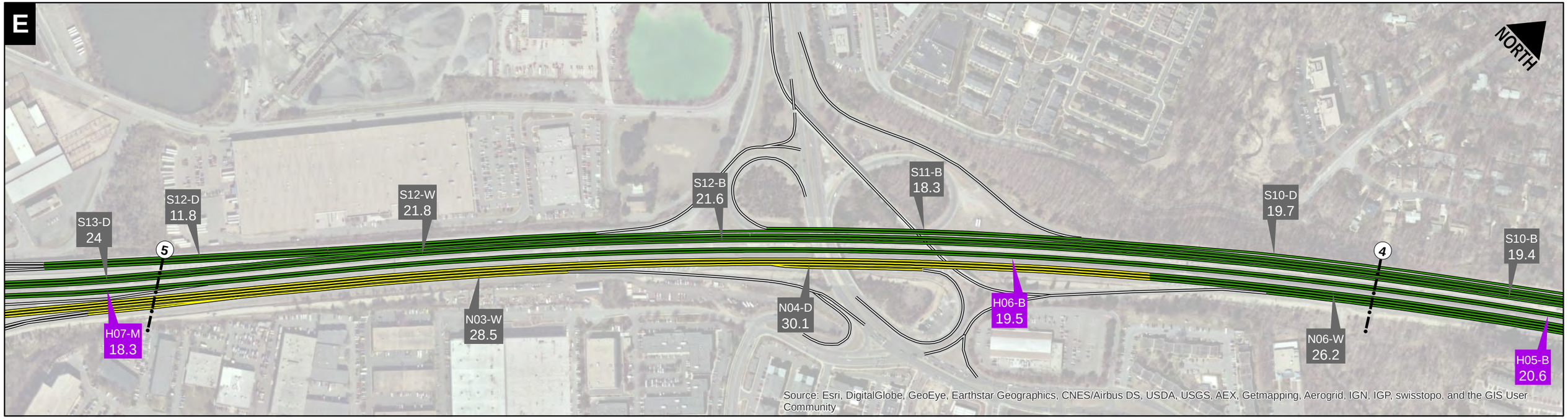
Study Area

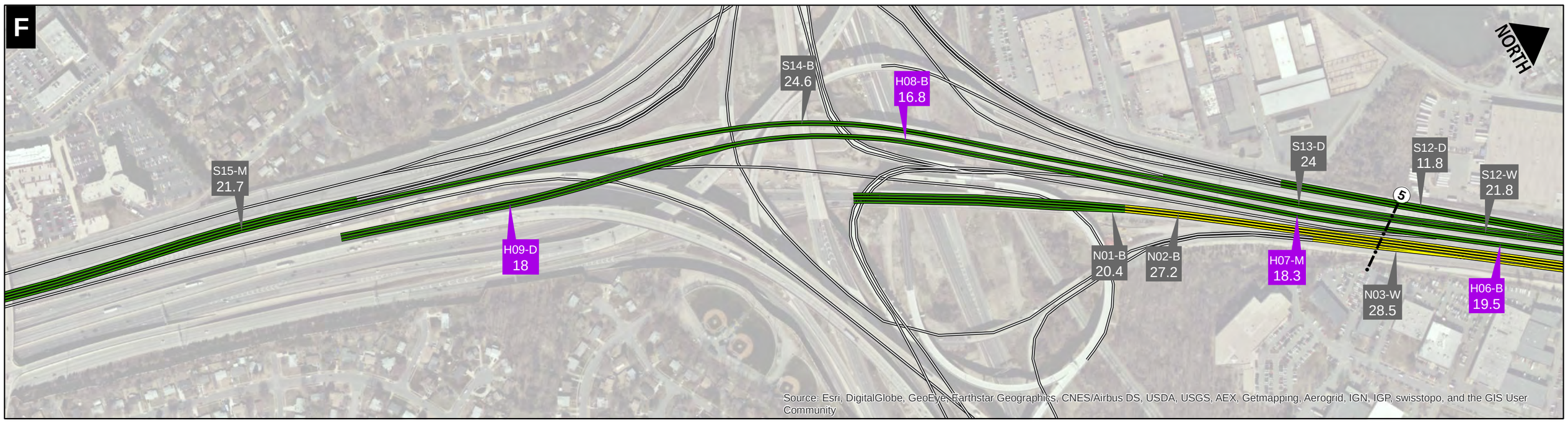


VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Build (2020) AM Peak Hour Volume





Congestion Level

0 250 500 Feet

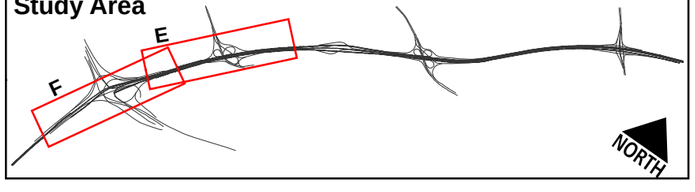
Light to moderate traffic | Heavy traffic | Congested traffic | Severely congested traffic

GP Lane Segment ID
Peak Hour Density

Express Lane Segment ID
Peak Hour Density

1 Matchline

Study Area



VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Build (2020) AM Peak Hour Volume

Freeway Mainline (2020 Build AM)

Direction	Segment	Location	Operation Type	Length (ft)	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Speed (mph)	Density (pc/ln/mi)
Southbound I-395 GP	S01-D	North of Seminary Road Off-Ramp	Diverge	1,499	5305	5319	13	0%	63.6	17.2
	S02-B	Between Seminary Road Off-Ramp and On-Ramp	Basic	3,891	4234	4251	17	0%	64.0	17.2
	S03-M	Merge Area at Seminary Road On-Ramp	Merge	1,455	5074	5079	5	0%	62.5	18.5
	S04-B	Between Seminary Road On-Ramp and Duke Street Off-Ramp	Basic	1,892	5074	5074	0	0%	63.8	20.5
	S05-D	Diverge Area at Duke Street Off-Ramp	Diverge	1,504	5074	5083	8	0%	63.9	18.3
	S06-B	Between Duke Street Off-Ramp and WB On-Ramp	Basic	1,944	4066	4057	-8	0%	63.5	16.4
	S08-M	Merge Area at WB Duke Street On-Ramp	Merge	1,506	4625	4637	12	0%	63.4	15.8
	S09-B	Between Duke WB On-Ramp and Flyover Ramp	Basic	3,526	5081	4623	-458	-9%	58.6	19.6
	S10-B	After Turkeycock Flyover Ramp	Basic	1,279	5081	5068	-13	0%	53.5	19.4
	S10-D	Diverge at Edsall Road WB Off-Ramp	Diverge	1,511	5081	5092	11	0%	52.4	19.7
	S11-B	Between Edsall Road WB Off-Ramp and EB Off-Ramp	Basic	1,461	4671	4686	16	0%	52.6	18.3
	S12-B	Between Edsall EB Off Ramp and On Ramp	Basic	383	4462	4455	-7	0%	53.1	21.6
	S12-W	Between Edsall Road and I-495 Ramp	Weave	1,941	5481	5430	-52	-1%	52.8	21.8
	S12-D	Diverge Area at I-495 Inner Loop Ramps	Diverge	1,141	1876	1848	-28	-2%	56.8	11.8
	S13-D	Diverge Area at Franconia Ramp	Diverge	1,447	3605	3613	8	0%	51.6	24.0
	S14-B	I-95 SB Mainline through Springfield Interchange	Basic	3,255	2538	2538	0	0%	53.3	24.6
	S15-M	Merge Area with I-495 Outer Loop Ramp	Merge	1,568	4505	4488	-17	0%	53.4	21.7
	S16-M	Merge Area with I-495 Inner Loop Ramp	Merge	1,506	6437	6417	-20	0%	53.3	20.9
Southbound I-395 HOV/ Express	H00-M	Seminary Road HOV On-Ramp	Merge	1,498	2765	2745	-20	-1%	62.8	18.7
	H01-B	Between Seminary Road HOV Off-Ramp and HOV On- Ramp	Basic	4,141	2514	2511	-4	0%	62.3	20.5
	H02-D	Seminary Road HOV Off-Ramp	Diverge	1,495	2882	2893	11	0%	50.3	25.6
	H02-B	Between Seminary Road HOV Off-Ramp and Turkeycock Flyover Ramp	Basic	6,446	2882	2834	-47	-2%	60.1	23.1
	H04-M	Between Turkeycock Flyover HOV Off-Ramp and On-Ramp	Merge	1,340	2779	2878	99	4%	63.3	18.9
	H05-B	Between Turkeycock Ramps	Basic	2,080	2779	2842	63	2%	61.8	20.6
	H06-B	Between Turkeycock Off-Ramp to I-495	Basic	5,675	3655	3668	13	0%	62.6	19.5
	H07-M	I-495 Express Lanes On-Ramp	Merge	1,555	3655	3671	16	0%	62.4	18.3
	H08-B	Between I-495 Express Lanes Ramps	Basic	2,273	3104	3121	16	1%	62.2	16.8
	H09-D	I-495 Express Lanes Off-Ramp	Diverge	2,169	4226	4231	5	0%	57.9	18.0
Northbound I-395 GP	N01-B	I-95 NB mainline through Springfield Interchange	Basic	684	4138	4275	138	3%	53.3	20.4
	N02-B	I-95 NB mainline through Springfield Interchange	Basic	1,048	4138	4271	134	3%	53.1	27.2
	N03-W	Between Springfield Interchange and Edsall Road	Weave	2,492	5844	5995	152	3%	51.1	28.5
	N04-D	Diverge Area at Edsall Road WB Off-Ramp	Diverge	1,492	4974	5140	166	3%	52.4	30.1
	N05-B	Between Edsall Road WB Off-Ramp and On-Ramp	Basic	972	4322	4487	165	4%	53.6	28.4
	N06-W	Merge Area at Edsall Road On-Ramp	Weave	2,280	5061	4988	-73	-1%	52.6	26.2
	N08-B	Between Turkeycock Flyover Ramp and Duke Street EB Off-Ramp	Basic	2,269	5061	5122	61	1%	51.3	33.9
	N09-D	Diverge Area at Duke Street EB Off-Ramp	Diverge	1,602	5834	6016	182	3%	52.3	28.9
	N10-D	Diverge Area at Duke Street WB Off-Ramp	Diverge	1,490	5556	5735	179	3%	50.4	28.9
	N11-B	Between Duke Street WB Off-Ramp and On-Ramp	Basic	2,086	5243	5414	171	3%	52.5	34.8
	N12-M	Merge Area at Duke Street WB On-Ramp	Merge	560	6679	6800	121	2%	52.5	33.0
	N13-B	Between Duke Street and Seminary Road	Basic	2,671	6679	6810	131	2%	52.7	33.0
	N14-D	Diverge Area at Seminary Road Off-Ramp	Diverge	1,458	6679	6800	121	2%	49.2	31.8
	N15-B	Between Seminary Road Off-Ramp and On-Ramp	Basic	2,987	5592	5734	142	3%	40.4	48.9
	N16-M	North of Seminary Road On-Ramp	Merge	1,498	6912	7025	113	2%	39.6	41.3

Severely congested condition | Heavily congested condition | Moderate traffic condition | Light traffic condition

Interchange Ramps (2020 Build AM)

Interchange	Ramp Description	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %
Seminary Road Interchange	I-395 NB Off-Ramp at Seminary Road	1087	1071	-15	-1%
	I-395 NB On-Ramp at Seminary Road	1320	1297	-22	-2%
	I-395 SB Off-Ramp at Seminary Road	1071	1075	4	0%
	I-395 SB On-Ramp at Seminary Road	840	832	-9	-1%
	I-395 SB HOV Off-Ramp at Seminary Road	251	245	-6	-2%
Duke Street/Little River Turnpike Interchange	I-395 NB to EB Duke Street	278	282	4	1%
	I-395 NB to WB Duke Street	313	318	5	1%
	EB Little River Turnpike to I-395 NB	713	690	-23	-3%
	WB Duke Street to I-395 NB	723	711	-12	-2%
	I-395 SB to Little River Turnpike	1008	1022	13	1%
	EB Little River Turnpike to I-395 SB	456	462	7	1%
	WB Little River Turnpike to I-395 SB	559	565	5	1%
Turkeycock Run Ramp	I-395 NB GP to I-395 SB HOV	103	105	3	3%
	I-395 NB HOV to I-395 NB GP	876	882	6	1%
Edsall Road Interchange	I-395 NB to EB Edsall Road	870	862	-7	-1%
	I-395 NB to WB Edsall Road	652	643	-9	-1%
	EB Edsall Road to I-395 NB	487	497	10	2%
	WB Edsall Road to I-395 NB	251	251	-1	0%
	I-395 SB to EB Edsall Road	209	210	1	1%
	I-395 SB to WB Edsall Road	410	407	-4	-1%
	Edsall Road to I-395 SB	1019	1008	-12	-1%
Springfield Interchange	I-495 Outer GP to I-95 SB GP	1967	1949	-18	-1%
	I-495 Outer GP to I-395 NB GP	1171	1170	0	0%
	I-495 Outer HOT to I-95 SB HOV	561	559	-2	0%
	I-495 Inner GP to I-95 SB GP	1932	1917	-15	-1%
	I-495 Inner GP to I-395 NB GP	536	538	2	0%
	I-395 SB GP to I-495 Inner GP	1333	1341	8	1%
	I-395 SB GP to Franconia	1067	1081	14	1%
	I-395 SB GP to I-495 Outer GP	543	541	-2	0%
	I-395 SB HOV to I-495 (inner and outer)	551	557	7	1%

Intersections (2020 Build AM)

Node	Intersection	Movement	Demand (veh/hr)	VISSIM Thruput	Δ	Δ %	Avg. Delay (sec)	LOS	Intersection Delay (sec)	Intersection LOS	Storage (ft)	Avg. Queue (ft)	Max. Queue (ft)
1	Seminary Rd & I-395 SB Off-Ramp	WBL	273	259	-15	-5%	0.7	A	18.0	B	200	0	0
		WBT	1005	960	-45	-4%	0.3	A			200	0	7
		SBT	341	350	10	3%	79.4	E			1970	105	410
2	Seminary Rd & I-395 SB On-Ramp	EBT	705	716	11	2%	74.8	E	41.1	D	580	228	725
		SBL	341	350	10	3%	2.3	A			267	0	72
		SBT	273	259	-15	-5%	0.2	A			230	0	71
3	Seminary Rd & I-395 NB Off-Ramp	EBL	665	677	12	2%	2.0	A	24.6	C	275	5	190
		EBT	381	391	9	2%	3.9	A			275	5	190
		NBT	898	874	-25	-3%	54.9	D			750	190	761
		NBR	188	186	-3	-1%	8.3	A			112	0	66
4	Seminary Rd & I-395 NB On-Ramp	WBT	514	477	-37	-7%	70.1	E	17.9	B	290	147	558
		NBL	1016	989	-27	-3%	2.0	A			205	5	252
		NBT	546	559	13	2%	1.5	A			205	5	252
5	Seminary Rd & I-395 HOV Ramp	WBT	1279	1219	-60	-5%	0.2	---	---	---	---	---	---
		WBR	251	245	-5	-2%	0.0	A			125	0	0
6	Seminary Rd & Mark Center Ave	EBL	21	21	0	0%	76.4	E	37.9	D	195	9	69
		EBT	1423	1423	0	0%	44.3	D			605	131	452
		EBR	126	113	-13	-11%	32.6	C			380	107	424
		WBL	465	446	-19	-4%	63.9	E			2200	225	894
		WBT	2316	2290	-26	-1%	25.8	C			950	0	28
		WBR	129	121	-8	-7%	20.4	C			800	0	28
		NBL	30	29	-2	-5%	79.6	E			650	43	173
		NBT	23	24	0	2%	80.9	F			650	43	173
		NBR	234	235	1	0%	35.6	D			650	43	173
		SBL	391	397	5	1%	52.9	D			200	133	399
		SBT	135	129	-6	-4%	57.1	E			200	133	399
		SBR	48	44	-4	-8%	13.0	B			200	133	399
7	Seminary Rd & Kenmore Ave	EBT	1317	1317	0	0%	1.1	---	---	---	---	---	---
		EBR	90	91	1	1%	1.8	---			---	---	---
		WBT	1462	1463	1	0%	0.3	---			---	---	---
		WBR	42	41	-1	-3%	0.7	---			---	---	---
		NBR	108	111	4	4%	12.6	B			1320	8	116
		SBR	819	707	-112	-14%	38.2	E			510	374	712
8	Little River Tpk & Beauregard St	EBL	502	487	-15	-3%	91.0	F	58.8	E	385	172	721
		EBT	1087	1080	-7	-1%	41.2	D			670	200	923
		EBR	17	21	3	19%	45.3	D			670	200	923
		WBL	28	29	1	2%	105.5	F			225	177	447
		WBT	1069	1066	-3	0%	35.1	D			315	17	111
		WBR	578	570	-8	-1%	16.8	B			150	17	111
		NBL	100	99	-1	-1%	91.1	F			145	63	319
		NBT	71	71	0	0%	87.7	F			750	55	240
		NBR	71	72	0	1%	99.8	F			750	55	240
		SBL	854	818	-35	-4%	110.7	F			500	1130	1646
		SBT	49	45	-5	-10%	123.3	F			640	1130	1646
		SBR	239	224	-15	-6%	50.5	D			510	1130	1646

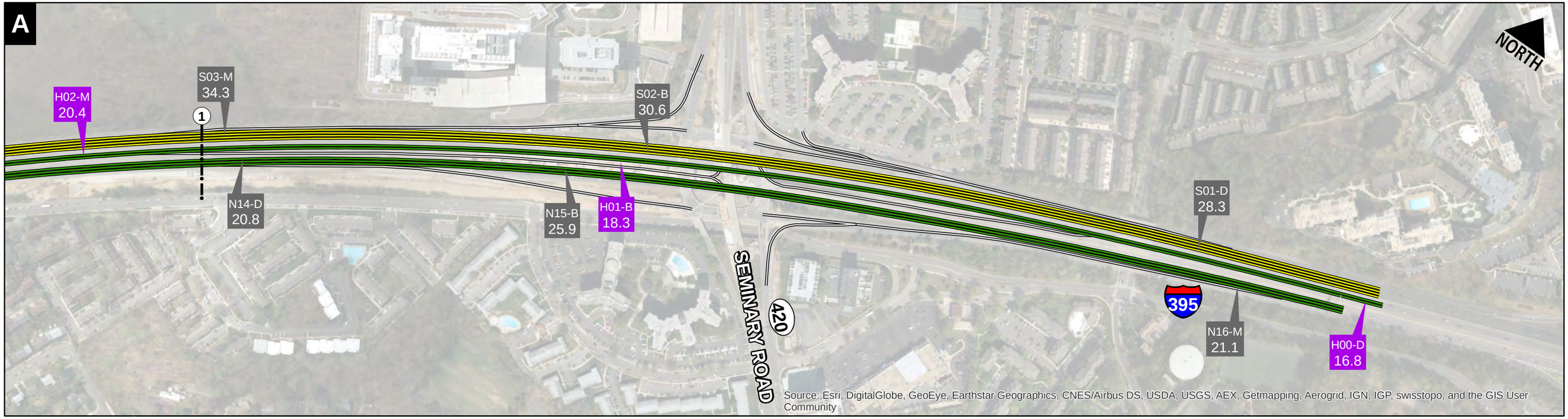
Intersections (2020 Build AM)

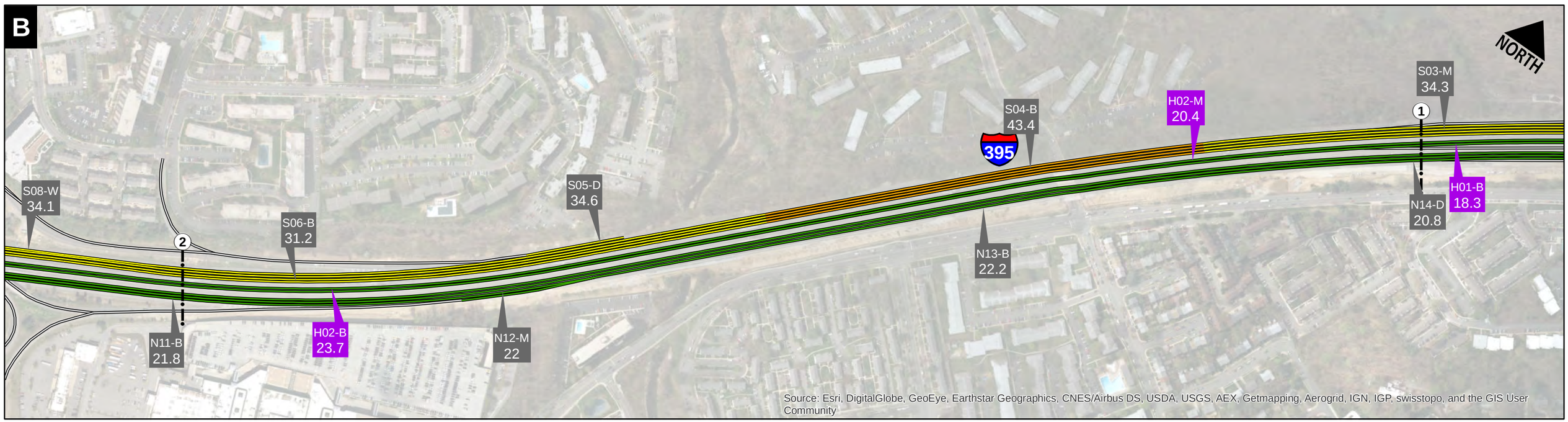
Node	Intersection	Movement	Demand (veh/hr)	VISSIM Thruput	Δ	Δ %	Avg. Delay (sec)	LOS	Intersection Delay (sec)	Intersection LOS	Storage (ft)	Avg. Queue (ft)	Max. Queue (ft)
9	Little River Tpk & Oasis Dr	EBT	1981	1447	-534	-27%	4.8	A	11.9	B	300	26	382
		EBR	21	22	1	6%	1.0	A			300	26	382
		WBL	126	122	-4	-3%	25.3	C			235	6	147
		WBT	1664	1675	11	1%	16.3	B			500	47	563
		WBR	93	95	2	2%	4.0	A			500	8	392
		NBR	140	137	-3	-2%	31.2	C			145	20	194
		SBR	16	16	0	0%	0.5	A			250	1	52
10	Duke St & S Walker St	EBT	1447	1404	-43	-3%	14.3	B	18.9	B	615	48	369
		EBR	297	289	-8	-3%	2.5	A			615	0	0
		WBL	49	48	-1	-2%	67.5	E			615	63	481
		WBT	1810	1795	-15	-1%	10.6	B			990	63	481
		NBL	616	616	0	0%	58.0	E			340	132	528
		NBR	113	110	-3	-3%	7.4	A			470	2	63
		SBL	4	3	-1	-14%	88.2	F			230	10	75
		SBT	4	6	2	60%	65.8	E			210	10	75
		SBR	23	20	-3	-14%	37.3	D			205	10	75
11	Edsall Rd & Mitchell St	EBL	24	26	2	7%	12.7	B	11.3	B	120	0	36
		EBT	1340	1347	7	1%	16.6	B			330	45	418
		EBR	38	36	-2	-4%	2.3	A			330	0	0
		WBL	245	243	-2	-1%	19.3	B			200	12	279
		WBT	1139	1114	-24	-2%	3.7	A			300	9	212
		WBR	21	22	1	7%	2.9	A			300	9	212
		NBL	18	20	2	11%	44.8	D			195	8	89
		NBT	10	10	0	2%	42.3	D			195	8	89
		NBR	231	231	1	0%	2.0	A			225	0	38
		SBL	14	12	-2	-11%	48.5	D			100	7	65
		SBT	11	13	1	12%	46.1	D			100	7	65
		SBR	20	20	0	1%	11.2	B			100	7	65
12	Edsall Rd & Cherokee Ave	EBL	182	177	-5	-3%	27.0	C	11.9	B	90	24	472
		EBT	1403	1414	11	1%	4.8	A			220	30	490
		WBT	1323	1307	-17	-1%	12.0	B			500	48	370
		WBR	395	398	3	1%	7.8	A			500	0	0
		SBL	314	316	1	0%	41.5	D			215	58	218
		SBR	85	83	-3	-3%	6.7	A			215	1	53
13	Edsall Rd & Bren Mar Dr	EBT	1217	1184	-32	-3%	16.0	B	16.0	B	670	33	345
		EBR	264	259	-5	-2%	5.2	A			670	7	301
		WBL	53	53	0	-1%	52.2	D			275	16	125
		WBT	934	935	1	0%	8.0	A			300	25	320
		NBL	277	273	-4	-1%	40.4	D			540	76	331
		NBT	70	72	2	3%	34.4	C			540	76	331
		NBR	96	96	0	0%	20.1	C			240	76	331
14	Edsall Rd & Sullivan Pl Dr	EBT	1274	1184	-89	-7%	16.0	---	---	---	---	---	---
		EBR	39	40	1	2%	12.7	---			---	---	---
		NBR	9	9	0	-3%	6.5	A			220	0	26

Intersections (2020 Build AM)

Node	Intersection	Movement	Demand (veh/hr)	VISSIM Thruput	Δ	Δ %	Avg. Delay (sec)	LOS	Intersection Delay (sec)	Intersection LOS	Storage (ft)	Avg. Queue (ft)	Max. Queue (ft)
15	Edsall Rd & Bloomfield Dr	EBT	1247	1261	14	1%	15.0	B	15.3	B	250	77	649
		EBR	31	29	-2	-7%	7.1	A			250	77	649
		WBL	52	50	-2	-4%	19.7	B			200	2	64
		WBT	967	964	-3	0%	9.9	A			200	36	273
		NBL	201	199	-2	-1%	40.6	D			170	60	357
		NBR	82	77	-5	-6%	21.1	C			170	6	106
16	Edsall Rd & Beryl Rd	EBT	1251	1255	5	0%	1.7	A	5.6	A	195	19	303
		EBR	79	82	3	4%	1.8	A			195	19	303
		WBL	14	16	1	9%	2.6	A			165	0	27
		WBT	909	905	-4	0%	5.9	A			165	11	197
		NBL	110	107	-3	-3%	45.8	D			290	35	202
		NBR	29	29	0	-1%	29.3	C			290	35	202
17	Seminary Rd & HOV BRAC Ramp	EBT	776	771	-5	-1%	7.7	A	11.0	B	1050	17	272
		WBT	994	957	-37	-4%	7.5	A			700	17	170
		NBL	307	318	10	3%	27.1	C			1900	51	233
		NBR	60	60	0	0%	24.4	C			1900	50	231
18	Little River Tpk & I-395 SB Off-Ramp	EBT	952	937	-15	-2%	4.8	A	11.9	B	780	0	0
		WBT	1480	1475	-5	0%	13.2	B			950	68	508
		SBL	514	508	-5	-1%	30.9	C			660	54	274
		SBR	402	413	11	3%	0.0	A			920	---	---
19	Edsall Rd & I-395 SB On-Ramp	EBT	765	763	-3	0%	13.1	B	9.3	A	975	29	221
		EBR	465	470	5	1%	1.1	A			650	0	0
		WBL	554	551	-4	-1%	32.3	C			650	133	707
		WBT	1308	1300	-8	-1%	0.2	A			900	0	0

2020 Build PM Peak Hour





0 250 500 Feet

Congestion Level

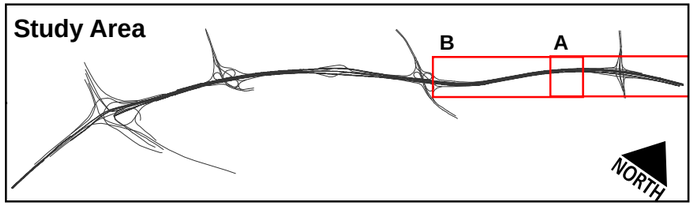
Light to moderate traffic | Heavy traffic | Congested traffic | Severely congested traffic

GP Lane Segment ID
Peak Hour Density

Express Lane Segment ID
Peak Hour Density

1 Matchline

Study Area

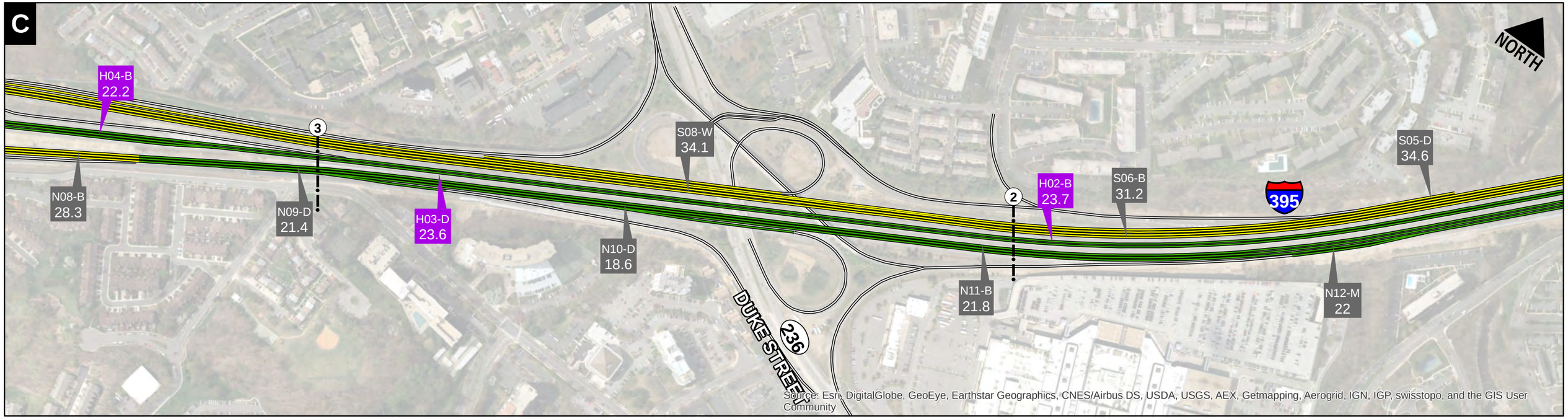


VDOT HNTB

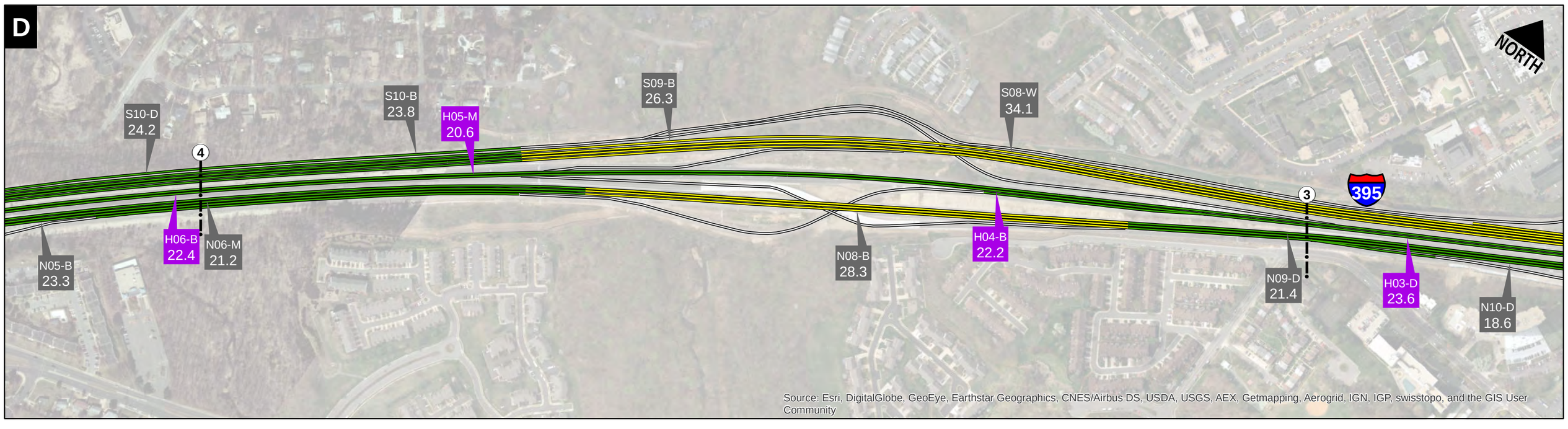
I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Build (2020) PM Peak Hour Density

C



D



Congestion Level

- Light to moderate traffic
- Heavy traffic
- Congested traffic
- Severely congested traffic

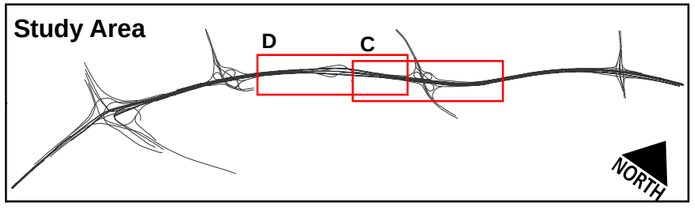
GP Lane Segment ID
Peak Hour Density

Express Lane Segment ID
Peak Hour Density

1 Matchline

0 250 500 Feet

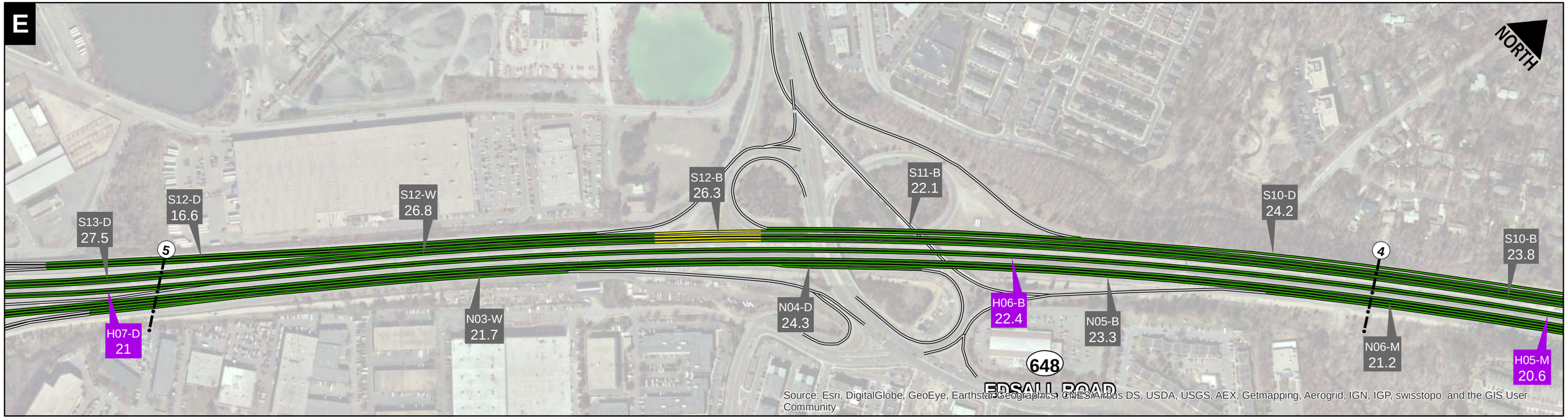
Study Area

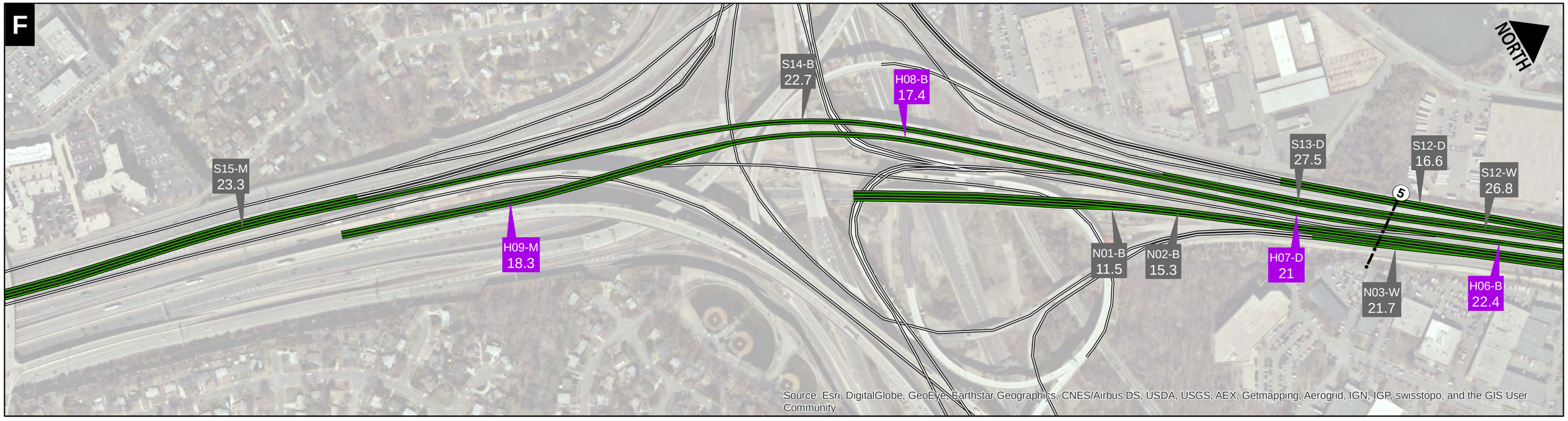


VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Build (2020) PM Peak Hour Density





Congestion Level

Light to moderate traffic | Heavy traffic | Congested traffic | Severely congested traffic

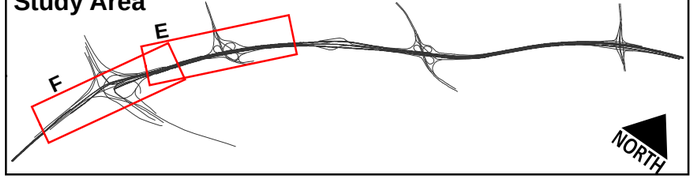
GP Lane Segment ID
Peak Hour Density

Express Lane Segment ID
Peak Hour Density

1 Matchline

0 250 500 Feet

Study Area



VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Build (2020) PM Peak Hour Density

Freeway Mainline (2020 Build PM)

Direction	Segment	Location	Operation Type	Length (ft)	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Speed (mph)	Density (pc/ln/mi)
Southbound I-395 GP	S01-D	North of Seminary Road Off-Ramp	Diverge	1,499	7230	7198	-32	0%	52.3	28.3
	S02-B	Between Seminary Road Off-Ramp and On-Ramp	Basic	3,891	6309	6274	-35	-1%	53.0	30.6
	S03-M	Merge Area at Seminary Road On-Ramp	Merge	1,455	7875	7825	-50	-1%	51.9	34.3
	S04-B	Between Seminary Road On-Ramp and Duke Street Off-Ramp	Basic	1,882	7875	7887	13	0%	48.2	43.4
	S05-D	Diverge Area at Duke Street Off-Ramp	Diverge	1,505	7875	7799	-75	-1%	51.7	34.6
	S06-B	Between Duke Street Off-Ramp and WB On-Ramp	Basic	1,468	6261	6218	-43	-1%	51.4	31.2
	S08-W	Between Duke Street WB On-Ramp and Turkeycock Slip Ramp	Weave	4,685	6908	6873	-35	-1%	47.6	34.1
	S09-B	Between Turkeycock Slip Ramp and Flyover Ramp	Basic	792	5499	5475	-25	0%	53.5	26.3
	S10-B	After Turkeycock Flyover Ramp	Basic	1,392	6236	6179	-57	-1%	53.3	23.8
	S10-D	Diverge at Edsall Road WB Off-Ramp	Diverge	1,401	6236	6165	-71	-1%	51.7	24.2
	S11-B	Between Edsall Road WB Off-Ramp and EB Off-Ramp	Basic	1,454	5655	5583	-73	-1%	52.1	22.1
	S12-B	Between Edsall EB Off Ramp and On Ramp	Basic	384	5444	5341	-103	-2%	52.3	26.3
	S12-W	Between Edsall Road and I-495 Ramp	Weave	1,953	6759	6642	-117	-2%	51.8	26.8
	S12-D	Diverge Area at I-495 Inner Loop Ramps	Diverge	1,141	2459	2449	-10	0%	52.8	16.6
	S13-D	Diverge Area at Franconia Ramp	Diverge	1,447	4373	4230	-143	-3%	52.7	27.5
	S14-B	I-95 SB Mainline through Springfield Interchange	Basic	3,255	2506	2377	-129	-5%	53.4	22.7
	S15-M	Merge Area with I-495 Outer Loop Ramp	Merge	1,568	4978	4837	-141	-3%	53.4	23.3
	S16-M	Merge Area with I-495 Inner Loop Ramp	Merge	1,506	6710	6581	-129	-2%	53.2	21.3
Southbound I-395 HOV/ Express	H00-D	North of Seminary Road HOV Off-Ramp	Diverge	1,498	2507	2484	-23	-1%	63.7	16.8
	H01-B	Between Seminary Road HOV Off-Ramp and On-Ramp	Basic	4,156	2318	2296	-22	-1%	63.9	18.3
	H02-M	Merge Area at Seminary Road HOV On-Ramp	Merge	1,519	2988	2962	-26	-1%	62.0	20.4
	H02-B	Between Seminary Road HOV On-Ramp and Turkeycock Flyover Ramp	Basic	4,906	2988	2733	-255	-9%	63.4	23.7
	H03-D	Diverge Area at Turkeycock Flyover Ramp	Diverge	1,501	2988	2948	-40	-1%	63.4	23.6
	H04-B	Between Turkeycock Flyover Ramp and Slip Ramp	Basic	2,855	2822	2785	-37	-1%	63.6	22.2
	H05-M	Merge Area at Turkeycock Slip Ramp	Merge	1,501	4231	4166	-65	-2%	62.1	20.6
	H06-B	Between Turkeycock Slip Ramp and Off-Ramp to I-495 HOT Lanes	Basic	4,739	4231	4181	-50	-1%	63.6	22.4
	H07-D	Diverge Area at Off-Ramp to I-495 HOT Lanes	Diverge	1,525	4231	4172	-58	-1%	62.1	21.0
	H08-B	Between I-495 HOT Off-Ramp and On-Ramp	Basic	2,275	3311	3251	-61	-2%	63.8	17.4
	H09-M	Merge Area at On-Ramp from I-495 HOT Lanes	Merge	2,168	4588	4544	-44	-1%	63.6	18.3
Northbound I-395 GP	N01-B	I-95 NB mainline through Springfield Interchange	Basic	684	2426	2416	-10	0%	53.9	11.5
	N02-B	I-95 NB mainline through Springfield Interchange	Basic	1,048	2426	2412	-15	-1%	53.8	15.3
	N03-W	Between Springfield Interchange and Edsall Road	Weave	2,492	4876	4902	26	1%	52.5	21.7
	N04-D	Diverge Area at Edsall Road WB Off-Ramp	Diverge	1,496	4126	4148	22	1%	52.6	24.3
	N05-B	Between Edsall Road WB Off-Ramp and On-Ramp	Basic	1,469	3645	3654	9	0%	53.5	23.3
	N06-M	Merge Area at Edsall Road On-Ramp	Merge	1,500	4384	4391	6	0%	52.7	21.2
	N07-B	Between Edsall Road On-Ramp and Turkeycock Flyover Ramp	Basic	290	4384	4338	-47	-1%	52.6	21.0
	N08-B	Between Turkeycock Flyover Ramp and Duke Street EB Off-Ramp	Basic	2,269	4384	4390	6	0%	52.7	28.3
	N09-D	Diverge Area at Duke Street EB Off-Ramp	Diverge	1,733	4384	4391	7	0%	52.0	21.4
	N10-D	Diverge Area at Duke Street WB Off-Ramp	Diverge	1,326	3801	3816	15	0%	52.5	18.6
	N11-B	Between Duke Street WB Off-Ramp and On-Ramp	Basic	2,086	3645	3411	-234	-6%	53.2	21.8
	N12-M	Merge Area at Duke Street WB On-Ramp	Merge	560	4670	4545	-124	-3%	52.9	22.0
	N13-B	Between Duke Street and Seminary Road	Basic	2,677	4670	4627	-43	-1%	53.2	22.2
	N14-D	Diverge Area at Seminary Road Off-Ramp	Diverge	1,447	4670	4614	-56	-1%	51.1	20.8
	N15-B	Between Seminary Road Off-Ramp and On-Ramp	Basic	2,987	3901	3875	-27	-1%	51.2	25.9
	N16-M	North of Seminary Road On-Ramp	Merge	1,498	4895	4862	-33	-1%	52.4	21.1

Severely congested condition | Heavily congested condition | Moderate traffic condition | Light traffic condition

Interchange Ramps (2020 Build PM)

Interchange	Link ID	Ramp Description	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %
Seminary Road Interchange	16	I-395 NB Off-Ramp at Seminary Road	768	748	-20	-3%
	49	I-395 NB On-Ramp at Seminary Road	993	994	1	0%
	46	I-395 SB Off-Ramp at Seminary Road	921	932	11	1%
	37	I-395 SB On-Ramp at Seminary Road	1566	1556	-10	-1%
	44	I-395 SB HOV Off-Ramp at Seminary Road	189	203	14	8%
Duke Street/Little River Turnpike Interchange	140020	I-395 NB to EB Duke Street	583	572	-11	-2%
	140018	I-395 NB to WB Duke Street	396	404	8	2%
	140015	EB Little River Turnpike to I-395 NB	478	451	-27	-6%
	140035	WB Duke Street to I-395 NB	786	776	-10	-1%
	140011	I-395 SB to Little River Turnpike	1614	1594	-20	-1%
	137	EB Little River Turnpike to I-395 SB	571	530	-42	-7%
	140014	WB Little River Turnpike to I-395 SB	646	636	-10	-2%
Turkeycock Run Ramps	140055	I-395 SB GP to I-395 SB HOV	1409	1381	-28	-2%
	140201	I-395 SB HOV to I-395 SB GP	166	159	-7	-4%
	134	I-395 SB HOV and Duke Ramp to I-395 SB GP	737	692	-45	-6%
Edsall Road Interchange	140050	I-395 NB to EB Edsall Road	750	755	5	1%
	140049	I-395 NB to WB Edsall Road	481	499	17	4%
	140061	EB Edsall Road to I-395 NB	481	480	-1	0%
	140288	WB Edsall Road to I-395 NB	259	253	-6	-2%
	140048	I-395 SB to EB Edsall Road	211	204	-7	-3%
	140041	I-395 SB to WB Edsall Road	581	570	-11	-2%
	140286	Edsall Road to I-395 SB	1315	1326	11	1%
Springfield Interchange	140190	I-495 Outer GP to I-95 SB GP	2500	2466	-34	-1%
	140157	I-495 Outer GP to I-395 NB GP	1787	1806	19	1%
	160109	I-495 Outer HOT to I-95 SB HOV	638	640	2	0%
	140296	I-495 Inner GP to I-95 SB GP	1732	1724	-8	0%
	375	I-495 Inner GP to I-395 NB GP	663	679	16	2%
	140102	I-395 SB GP to I-495 Inner GP	1633	1664	32	2%
	140082	I-395 SB GP to Franconia	1867	1855	-12	-1%
	140110	I-395 SB GP to I-495 Outer GP	827	828	2	0%
	160119	I-395 SB HOV to I-495 (inner and outer)	919	912	-8	-1%

Intersections (2020 Build PM)

Node	Intersection	Movement	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Avg. Delay (sec)	LOS	Intersection Delay (sec)	Intersection LOS	Storage (ft)	Avg. Queue (ft)	Max. Queue (ft)
1	Seminary Rd & I-395 SB Off-Ramp	WBL	318	321	3	1%	4.1	A	21.3	C	200	0	70
		WBT	724	742	18	2%	1.3	A			200	17	263
		SBT	401	412	11	3%	70.6	E			1970	100	343
2	Seminary Rd & I-395 SB On-Ramp	EBT	782	792	11	1%	66.3	E	36.8	D	580	174	720
		SBL	486	489	3	1%	6.2	A			267	7	193
		SBT	233	244	11	5%	2.5	A			230	7	191
3	Seminary Rd & I-395 NB Off-Ramp	EBL	640	652	13	2%	10.3	B	22.3	C	275	35	339
		EBT	624	627	3	1%	6.1	A			275	35	339
		NBT	530	520	-10	-2%	63.5	E			750	114	408
		NBR	238	226	-12	-5%	7.5	A			112	1	72
4	Seminary Rd & I-395 NB On-Ramp	WBT	325	338	13	4%	86.1	F	20.7	C	290	105	399
		NBL	530	527	-3	-1%	3.3	A			205	1	134
		NBT	640	647	8	1%	0.7	A			205	1	134
5	Seminary Rd & I-395 HOV Off-Ramp	WBT	855	865	10	1%	---	---	---	---	---	---	---
		SBR	187	204	17	9%	9.7	A			125	13	171
6	Seminary Rd & Mark Center Ave	EBL	35	38	2	7%	70.8	E	38.5	D	195	15	104
		EBT	1937	1921	-17	-1%	29.3	C			605	131	504
		EBR	35	33	-2	-7%	26.5	C			380	111	476
		WBL	67	69	2	2%	79.1	E			2200	36	174
		WBT	1473	1521	48	3%	29.4	C			950	0	45
		WBR	184	184	0	0%	18.5	B			800	0	45
		NBL	117	113	-4	-4%	86.8	F			650	427	924
		NBT	18	18	-1	-3%	90.4	F			650	427	924
		NBR	1249	1250	0	0%	45.4	D			650	427	924
		SBL	249	245	-3	-1%	93.3	F			200	160	433
		SBT	56	60	4	6%	115.9	F			200	160	433
		SBR	48	47	-1	-2%	10.0	B			200	160	433
7	Seminary Rd & Kenmore Ave	EBT	1406	1390	-16	-1%	---	---	---	---	---	---	---
		EBR	362	358	-4	-1%	---	---			---	---	---
		WBT	1151	1178	26	2%	---	---			---	---	---
		WBR	71	73	2	3%	---	---			---	---	---
		NBR	112	119	7	6%	19.2	C			1320	13	155
		SBR	355	364	9	2%	17.5	C			510	29	331
8	Little River Tpk & Beauregard St	EBL	300	273	-28	-9%	161.4	F	77.8	E	385	294	924
		EBT	1264	1122	-142	-11%	111.5	F			670	1784	2114
		EBR	34	33	-2	-4%	114.3	F			670	1784	2114
		WBL	70	65	-5	-8%	202.0	F			225	201	450
		WBT	1193	1071	-122	-10%	37.7	D			315	98	333
		WBR	626	569	-57	-9%	14.5	B			150	98	333
		NBL	113	113	0	0%	134.6	F			145	130	646
		NBT	171	162	-9	-5%	132.8	F			750	241	699
		NBR	196	188	-8	-4%	136.7	F			750	241	699
		SBL	1010	988	-23	-2%	65.0	E			500	1430	2066
		SBT	130	130	-1	-1%	69.8	E			640	1430	2066
		SBR	326	318	-8	-3%	67.2	E			510	1430	2066

Intersections (2020 Build PM)

Node	Intersection	Movement	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Avg. Delay (sec)	LOS	Intersection Delay (sec)	Intersection LOS	Storage (ft)	Avg. Queue (ft)	Max. Queue (ft)
9	Little River Tpk & Oasis Dr	EBT	2430	1933	-497	-20%	8.6	A	19.9	B	300	68	420
		EBR	21	18	-2	-11%	1.4	A			300	68	420
		WBL	236	230	-6	-2%	67.9	E			235	78	506
		WBT	1729	1731	2	0%	26.0	C			500	108	915
		WBR	363	368	5	2%	8.7	A			500	35	739
		NBR	241	237	-4	-2%	50.2	D			145	73	343
		SBR	166	163	-3	-2%	5.2	A			250	28	240
10	Duke St & S Walker St	EBT	2279	2186	-93	-4%	29.0	C	29.6	C	615	228	1263
		EBR	590	566	-24	-4%	8.5	A			615	0	0
		WBL	131	133	3	2%	106.8	F			615	154	567
		WBT	1739	1747	8	0%	20.0	B			990	154	567
		NBL	683	672	-11	-2%	58.3	E			340	148	596
		NBR	154	156	2	1%	8.8	A			470	2	74
		SBL	34	32	-2	-7%	62.3	E			230	49	200
		SBT	34	35	1	3%	64.5	E			210	49	200
		SBR	141	142	0	0%	41.8	D			205	49	200
11	Edsall Rd & Mitchell St	EBL	6	6	-1	-9%	18.2	B	5.1	A	120	0	16
		EBT	1082	1078	-4	0%	8.2	A			330	15	245
		EBR	32	35	2	7%	0.9	A			330	0	0
		WBL	193	201	7	4%	15.0	B			200	4	146
		WBT	1617	1590	-28	-2%	1.5	A			300	5	123
		WBR	64	67	3	5%	2.0	A			300	5	123
		NBL	15	15	0	1%	45.1	D			195	6	75
		NBT	8	8	0	-3%	47.6	D			195	6	75
		NBR	337	346	9	3%	2.0	A			225	0	59
		SBL	9	10	1	7%	42.0	D			100	5	67
		SBT	8	9	1	6%	46.2	D			100	5	67
		SBR	9	8	-1	-15%	14.2	B			100	5	67
12	Edsall Rd & Cherokee Ave	EBL	67	70	2	3%	29.1	C	12.5	B	90	5	174
		EBT	1361	1367	6	0%	5.9	A			220	31	401
		WBT	1751	1749	-3	0%	11.2	B			500	52	470
		WBR	281	282	0	0%	8.7	A			500	0	0
		SBL	459	460	0	0%	37.6	D			215	74	294
		SBR	127	123	-4	-3%	9.7	A			215	3	73
13	Edsall Rd & Bren Mar Dr	EBT	1311	1257	-54	-4%	22.0	C	20.4	C	670	115	909
		EBR	135	134	-1	0%	10.6	B			670	75	843
		WBL	34	35	1	3%	61.8	E			275	13	104
		WBT	1081	1071	-9	-1%	9.2	A			300	33	331
		NBL	471	473	3	1%	39.9	D			540	128	530
		NBT	114	111	-3	-3%	32.5	C			540	128	530
		NBR	87	83	-4	-4%	13.1	B			240	128	530
14	Edsall Rd & Sullivan Pl Dr	EBT	1338	1257	-80	-6%	22.0	---	---	---	---	---	---
		EBR	60	53	-7	-12%	23.1	---			---	---	---
		NBR	14	13	-1	-10%	5.3	A			220	0	28

Intersections (2020 Build PM)

Node	Intersection	Movement	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Avg. Delay (sec)	LOS	Intersection Delay (sec)	Intersection LOS	Storage (ft)	Avg. Queue (ft)	Max. Queue (ft)
15	Edsall Rd & Bloomfield Dr	EBT	1276	1271	-5	0%	2.3	A	6.1	A	250	5	199
		EBR	62	67	5	8%	1.2	A			250	5	199
		WBL	96	92	-4	-4%	15.9	B			200	2	63
		WBT	1113	1108	-5	0%	3.6	A			200	12	249
		NBL	146	142	-4	-2%	47.2	D			170	47	266
		NBR	89	91	2	2%	17.6	B			170	5	96
16	Edsall Rd & Beryl Rd	EBT	1203	1208	4	0%	0.8	A	6.0	A	195	5	216
		EBR	161	156	-5	-3%	0.8	A			195	5	216
		WBL	19	16	-3	-17%	4.5	A			165	0	30
		WBT	1080	1074	-6	-1%	4.4	A			165	11	186
		NBL	128	128	0	0%	68.1	E			290	63	276
		NBR	20	20	0	-2%	44.7	D			290	63	276
17	Seminary Rd & HOV BRAC Ramp	EBT	906	891	-15	-2%	8.9	A	6.1	A	1050	4	151
		EBR	417	420	3	1%	8.2	A			700	4	151
		WBL	253	251	-2	-1%	7.3	A			1900	32	405
		WBR	575	599	24	4%	0.0	A			1900	0	0
18	Little River Tpk & I-395 SB Off-Ramp	EBT	1622	1562	-60	-4%	8.6	A	13.7	B	780	79	619
		WBT	1584	1597	13	1%	15.3	B			950	92	601
		SBL	721	705	-16	-2%	35.2	D			660	85	366
		SBR	744	737	-7	-1%	0.8	A			920	3	226
19	Edsall Rd & I-395 SB On-Ramp	EBT	605	602	-3	-1%	5.0	A	4.1	A	925	9	140
		EBR	734	742	8	1%	1.6	A			650	0	0
		WBL	581	586	4	1%	16.0	B			650	31	359
		WBT	1452	1460	8	1%	0.2	A			950	0	0
20	Duke St U-turn	EB U-turn	57	47	-10	-18%	48.7	E	2.0	A	180	7	106
		WBT	1777	1778	1	0%	0.8	A			550	0	66

2040 No-Build AM Peak Hour

Congestion Level

Light to moderate traffic | Heavy traffic | Congested traffic | Severely congested traffic

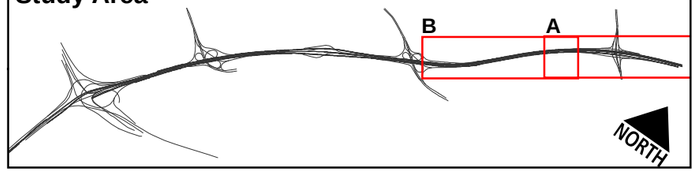
GP Lane Segment ID
Peak Hour Density

Express Lane Segment ID
Peak Hour Density

1 Matchline

0 0.05 0.1 Miles

Study Area



VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

No-Build (2040) AM Freeway Congestion Level

C

NORTH

3

S07-W
37.9

H04-M
21.5

N10-D
32.5

DUKE STREET

236

2

N11-B
37.2

H02-B
26.2

395

D

NORTH

S09-B
36.5

S08-M
40.5

4

H06-B
22.7

N08-B
49.8

H05-B
23.6

3

N09-D
33.6

395

H04-M
21.5

Congestion Level

Light to moderate traffic

Heavy traffic

Congested traffic

Severely congested traffic

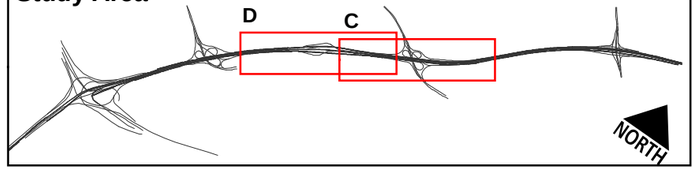
GP Lane Segment ID
Peak Hour Density

Express Lane Segment ID
Peak Hour Density

1 Matchline

0 0.05 0.1 Miles

Study Area



VDOT
HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

No-Build (2040) AM Freeway Congestion Level

E

NORTH

S12-W
25.7

S11-W
44.2

H06-B
22.7

S10-D
29.5

5

4

N03-W
32.3

N04-D
34.1

N05-B
31.1

N06-W
49

648
EDSALL ROAD

F

NORTH

S14-B
26.1

H08-B
17.6

S15-M
24.7

S13-D
27

S12-D
15.4

5

S16-M
22.9

H09-D
20.1

N01-B
22.7

N02-B
30.4

H07-M
21.2

Congestion Level

Light to moderate traffic

Heavy traffic

Congested traffic

Severely congested traffic

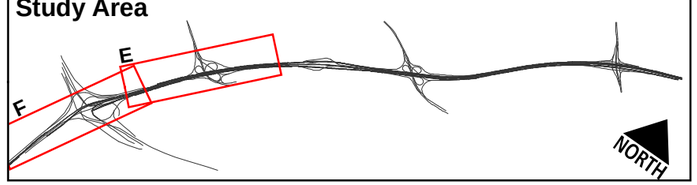
GP Lane Segment ID
Peak Hour Density

Express Lane Segment ID
Peak Hour Density

1 Matchline

0 0.05 0.1 Miles

Study Area



VDOT
HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

No-Build (2040) AM Freeway Congestion Level

Freeway Mainline (2040 No-Build AM)

Direction	Segment	Location	Operation Type	Length (ft)	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Speed (mph)	Density (pc/ln/mi)
Southbound I-395 GP	S01-D	North of Seminary Road Off-Ramp	Diverge	1,499	6089	6112	23	0%	63.5	19.8
	S02-B	Between Seminary Road Off-Ramp and On-Ramp	Basic	3,891	4950	4969	19	0%	64.0	20.1
	S03-M	Merge Area at Seminary Road On-Ramp	Merge	1,455	5938	5874	-64	-1%	63.2	21.1
	S04-B	Between Seminary Road On-Ramp and Duke Street Off-Ramp	Basic	1,366	5938	5878	-60	-1%	63.6	23.7
	S05-D	Diverge Area at WB Duke Street Off-Ramp	Diverge	1,500	5938	5877	-61	-1%	63.1	23.9
	S06-B	Between WB Duke Street Off-Ramp and On-Ramp	Basic	1,984	5385	5331	-54	-1%	57.5	23.8
	S07-W	Between WB Duke Street On-Ramp and EB On-Ramp	Weave	1,445	6061	5967	-94	-2%	45.6	37.9
	S08-M	Between EB Duke Street On-Ramp and Turkeycock Slip Ramp	Merge	1,497	6010	5901	-109	-2%	47.4	40.5
	S09-B	Between Turkeycock Slip Ramp and Flyover Ramp	Basic	2,883	6010	5901	-108	-2%	51.2	36.5
	S10-D	Between Turkeycock Flyover Ramp and Edsall Road Off-Ramp	Diverge	1,499	6010	5898	-112	-2%	51.4	29.5
	S11-W	Between WB Edsall Road On-Ramp and EB Off-Ramp	Weave	1,404	6159	6061	-98	-2%	40.8	44.2
	S12-W	Between Edsall Road and I-495 Ramp	Weave	1,953	6446	6294	-153	-2%	52.1	25.7
	S12-D	Diverge Area at I-495 Inner Loop Ramp	Diverge	1,141	2363	2307	-56	-2%	53.6	15.4
	S13-D	Diverge Area at Franconia Ramp	Diverge	1,447	4083	4015	-69	-2%	51.0	27.0
	S14-B	I-95 SB Mainline through Springfield Interchange	Basic	3,255	2808	2690	-118	-4%	53.1	26.1
	S15-M	Merge Area with I-495 Outer Loop Ramp	Merge	1,568	5247	5099	-148	-3%	53.3	24.7
	S16-M	Merge Area with I-495 Inner Loop Ramp	Merge	1,506	7150	7004	-146	-2%	53.1	22.9
Southbound I-395 HOV/ Express	H00-M	Seminary Road HOV On-Ramp	Merge	1,498	3088	3064	-24	-1%	62.2	21.2
	H01-B	Between Seminary Road HOV Off-Ramp and HOV On- Ramp	Basic	4,141	2736	2733	-3	0%	63.5	21.9
	H02-D	Seminary Road HOV Off-Ramp	Diverge	1,495	3256	3262	6	0%	61.8	22.5
	H02-B	Between Seminary Road HOV Off-Ramp and Turkeycock Flyover Ramp	Basic	6,446	3256	3187	-70	-2%	62.6	26.2
	H04-M	Between Turkeycock Flyover HOV Off-Ramp and On-Ramp	Merge	1,340	3256	3245	-12	0%	62.9	21.5
	H05-B	Between Turkeycock Ramps	Basic	2,080	3102	3182	81	3%	59.4	23.6
	H06-B	Between Turkeycock Off-Ramp to I-495	Basic	5,675	4185	4198	13	0%	60.5	22.7
	H07-M	I-495 Express Lanes On-Ramp	Merge	1,555	4185	4185	0	0%	61.2	21.2
	H08-B	Between I-495 Express Lanes Ramps	Basic	2,273	3195	3202	7	0%	61.3	17.6
	H09-D	I-495 Express Lanes Off-Ramp	Diverge	2,073	4487	4470	-17	0%	58.0	20.1
Northbound I-395 GP	N01-B	I-95 NB mainline through Springfield Interchange	Basic	684	4579	4718	138	3%	53.0	22.7
	N02-B	I-95 NB mainline through Springfield Interchange	Basic	1,048	4579	4713	134	3%	52.6	30.4
	N03-W	Between Springfield Interchange and Edsall Road	Weave	2,492	6251	6393	141	2%	48.8	32.3
	N04-D	Diverge Area at Edsall Road WB Off-Ramp	Diverge	1,492	5348	5492	144	3%	49.9	34.1
	N05-B	Between Edsall Road WB Off-Ramp and On-Ramp	Basic	972	4664	4795	131	3%	51.6	31.1
	N06-W	Weave Area at Edsall Road On-Ramp	Weave	2,280	5359	5499	140	3%	36.2	49.0
	N08-B	Between Turkeycock Flyover Ramp and Duke Street EB Off-Ramp	Basic	2,269	5204	5324	121	2%	36.7	49.8
	N09-D	Diverge Area at Duke Street EB Off-Ramp	Diverge	1,602	6287	6429	141	2%	47.9	33.6
	N10-D	Diverge Area at Duke Street WB Off-Ramp	Diverge	1,490	5996	6136	140	2%	48.0	32.5
	N11-B	Between Duke Street WB Off-Ramp and On-Ramp	Basic	2,086	5624	5761	137	2%	52.6	37.2
	N12-M	Merge Area at Duke Street WB On-Ramp	Merge	560	7163	7210	47	1%	52.2	35.2
	N13-B	Between Duke Street and Seminary Road	Basic	2,671	7163	7210	47	1%	52.2	35.3
	N14-D	Diverge Area at Seminary Road Off-Ramp	Diverge	1,458	7163	7196	33	0%	47.6	35.1
	N15-B	Between Seminary Road Off-Ramp and On-Ramp	Basic	2,987	5857	5914	57	1%	33.9	61.2
	N16-M	North of Seminary Road On-Ramp	Merge	1,498	7214	7126	-87	-1%	38.4	43.8

Severely congested condition | Heavily congested condition | Moderate traffic condition | Light traffic condition

Interchange Ramps (2040 No-Build AM)

Interchange	Ramp Description	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %
Seminary Road Interchange	I-395 NB Off-Ramp at Seminary Road	1306	1291	-15	-1%
	I-395 NB On-Ramp at Seminary Road	1357	1215	-142	-10%
	I-395 SB Off-Ramp at Seminary Road	1139	1148	9	1%
	I-395 SB On-Ramp at Seminary Road	988	909	-79	-8%
	I-395 SB HOV Off-Ramp at Seminary Road	353	339	-13	-4%
Duke Street/Little River Turnpike Interchange	I-395 NB to EB Duke Street	291	293	2	1%
	I-395 NB to WB Duke Street	372	373	1	0%
	EB Little River Turnpike to I-395 NB	763	687	-76	-10%
	WB Duke Street to I-395 NB	776	773	-3	0%
	I-395 SB to EB Little River Turnpike	601	601	0	0%
	I-395 SB to WB Little River Turnpike	553	552	-1	0%
	EB Little River Turnpike to I-395 SB	550	516	-33	-6%
	WB Little River Turnpike to I-395 SB	676	673	-2	0%
Turkeycock Run Ramps	I-395 NB GP to I-395 NB HOV	155	153	-2	-1%
	I-395 NB HOV to I-395 NB GP	1083	1095	12	1%
Edsall Road Interchange	I-395 NB to EB Edsall Road	903	899	-4	0%
	I-395 NB to WB Edsall Road	684	666	-18	-3%
	EB Edsall Road to I-395 NB	461	460	-1	0%
	WB Edsall Road to I-395 NB	233	225	-8	-4%
	I-395 SB to EB Edsall Road	252	249	-2	-1%
	I-395 SB to WB Edsall Road	494	483	-11	-2%
	EB Edsall Road to I-395 SB	539	543	4	1%
	WB Edsall Road to I-395 SB	643	634	-9	-1%
Springfield Interchange	I-495 Outer GP to I-95 SB GP	2438	2413	-26	-1%
	I-495 Outer GP to I-395 NB GP	1189	1192	4	0%
	I-495 Outer HOT to I-95 SB HOV	646	641	-5	-1%
	I-495 Inner GP to I-95 SB GP	1903	1892	-11	-1%
	I-495 Inner GP to I-395 NB GP	483	484	0	0%
	I-395 SB GP to I-495 Inner GP	1679	1681	2	0%
	I-395 SB GP to Franconia	1275	1329	53	4%
	I-395 SB GP to I-495 Outer GP	684	674	-10	-1%
	I-395 SB HOV to I-495 (inner and outer)	990	985	-4	0%

Intersections (2040 No-Build AM)

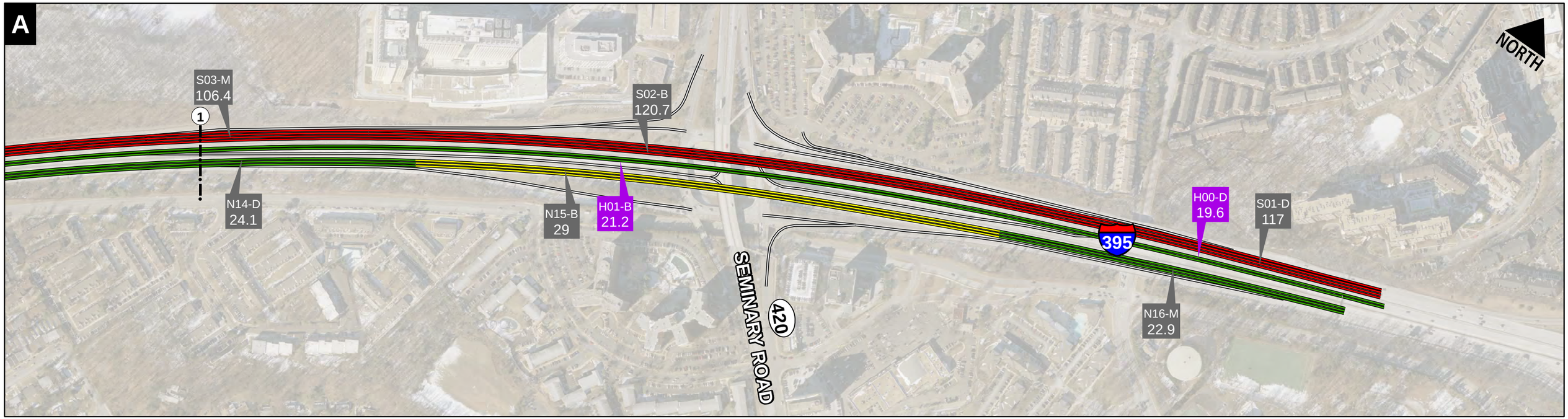
Node	Intersection	Movement	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Avg. Delay (sec)	Approach LOS	Intersection Delay (sec)	Intersection LOS	Storage (ft)	Avg. Queue (ft)	Max. Queue (ft)
1	Seminary Rd & I-395 SB Off-Ramp	WBL	321	243	-78	-24%	0.9	A	19.2	B	200	0	14
		WBT	1194	1118	-76	-6%	0.9	A			200	0	47
		SBT	362	374	12	3%	86.0	F			1970	44	166
2	Seminary Rd & I-395 SB On-Ramp	EBT	779	769	-10	-1%	57.2	E	32.4	C	580	54	198
		SBL	362	376	13	4%	2.3	A			267	0	24
		SBT	321	242	-79	-25%	0.2	A			230	0	23
3	Seminary Rd & I-395 NB Off-Ramp	EBL	719	715	-4	-1%	2.1	A	22.5	C	275	4	71
		EBT	422	433	11	2%	6.6	A			275	4	71
		NBT	1079	1058	-21	-2%	45.7	D			750	62	261
		NBR	226	228	2	1%	9.1	A			112	0	17
4	Seminary Rd & I-395 NB On-Ramp	WBT	623	493	-130	-21%	138.1	F	31.6	C	290	130	280
		NBL	1245	1215	-30	-2%	2.2	A			205	2	92
		NBT	555	557	2	0%	1.6	A			205	2	92
5	Seminary Rd & I-395 HOV Ramp	WBT	1515	1366	-149	-10%	0.3	A	---	---	---	---	---
		WBR	353	340	-13	-4%	0.0	A			125	0	0
6	Seminary Rd & Mark Center Ave	EBL	25	25	1	3%	85.5	F	40.5	D	195	3	24
		EBT	1683	1683	-1	0%	53.2	D			605	57	178
		EBR	150	136	-14	-9%	41.0	D			380	49	170
		WBL	515	435	-80	-16%	59.3	E			2200	65	273
		WBT	2665	2508	-158	-6%	24.9	C			950	0	10
		WBR	143	138	-5	-3%	16.7	B			800	0	10
		NBL	37	38	1	2%	93.1	F			650	17	62
		NBT	28	29	1	2%	95.7	F			650	17	62
		NBR	283	282	-2	-1%	36.8	D			650	17	62
		SBL	423	425	2	0%	57.7	E			200	43	129
		SBT	146	139	-8	-5%	61.9	E			200	43	129
		SBR	52	50	-2	-3%	14.7	B			200	43	129
7	Seminary Rd & Kenmore Ave	EBT	1566	1565	-1	0%	---	---	---	---	---	---	---
		EBR	107	110	3	3%	---	---			---	---	---
		WBT	1503	703	-800	-53%	---	---			---	---	---
		WBR	42	39	-3	-6%	---	---			---	---	---
		NBR	131	134	3	2%	12.5	B			1320	3	35
		SBR	968	487	-480	-50%	69.5	F			510	160	222
8	Little River Tpk & Beauregard St	EBL	701	598	-103	-15%	165.1	F	74.7	E	385	825	884
		EBT	1732	1499	-233	-13%	84.7	F			670	828	886
		EBR	24	18	-7	-27%	92.0	F			670	828	886
		WBL	36	35	-2	-5%	114.4	F			225	74	137
		WBT	1380	1356	-24	-2%	52.6	D			315	7	36
		WBR	735	731	-5	-1%	20.6	C			150	7	36
		NBL	101	100	-1	-1%	89.0	F			145	18	91
		NBT	72	70	-2	-3%	87.6	F			750	18	84
		NBR	83	82	0	-1%	103.3	F			750	18	84
		SBL	989	961	-28	-3%	76.4	E			500	341	491
		SBT	50	41	-9	-18%	78.3	E			640	341	491
		SBR	243	232	-12	-5%	40.0	D			510	341	491
9	Little River Tpk & Oasis Dr	EBT	2765	2527	-238	-9%	2.9	A	15.4	B	300	13	114
		EBR	29	25	-4	-13%	1.9	A			300	13	114
		WBL	159	159	0	0%	47.5	D			235	7	87
		WBT	2138	2133	-5	0%	26.6	C			500	29	190
		WBR	117	114	-3	-3%	10.4	B			500	2	90
		NBR	141	139	-3	-2%	42.0	D			145	9	79
		SBR	16	16	0	-3%	1.2	A			250	0	22

Intersections (2040 No-Build AM)

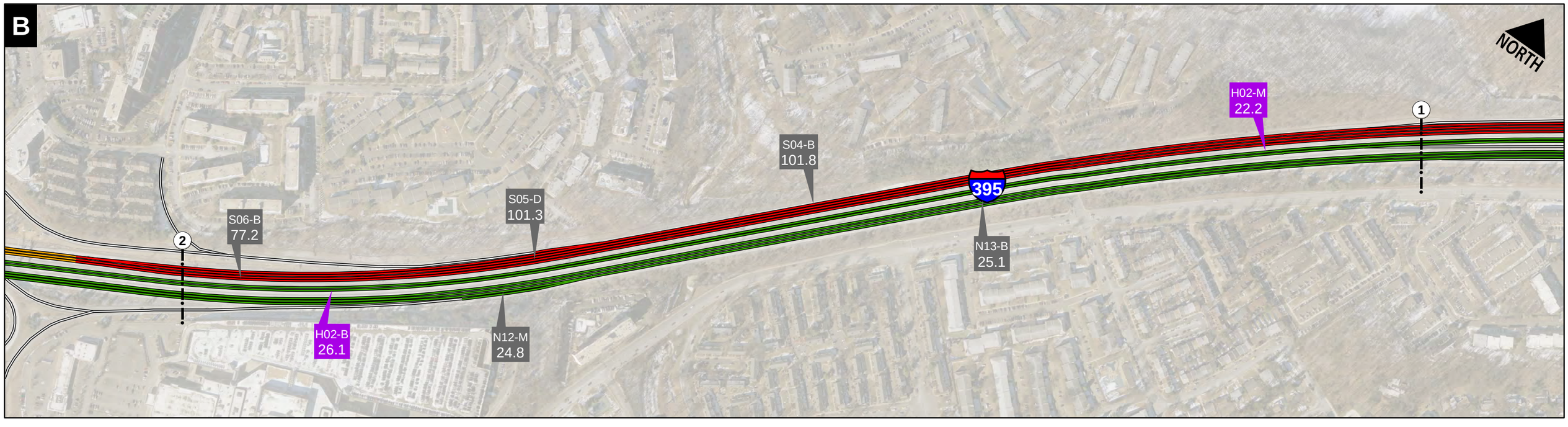
Node	Intersection	Movement	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Avg. Delay (sec)	Approach LOS	Intersection Delay (sec)	Intersection LOS	Storage (ft)	Avg. Queue (ft)	Max. Queue (ft)
10	Duke St & S Walker St	EBT	2060	1887	-173	-8%	22.5	C	25.0	C	615	35	192
		EBR	425	416	-9	-2%	10.1	B			615	0	0
		WBL	59	59	0	-1%	68.6	E			615	34	188
		WBT	2178	2151	-27	-1%	15.9	B			990	34	188
		NBL	820	819	-1	0%	59.5	E			340	57	199
		NBR	150	149	-1	-1%	12.3	B			470	1	19
		SBL	7	9	1	16%	72.5	E			230	4	23
		SBT	7	6	-1	-14%	81.8	F			210	4	23
		SBR	25	24	-1	-6%	48.9	D			205	4	23
11	Edsall Rd & Mitchell St	EBL	24	25	1	4%	17.93	B	17.7	B	120	0	11
		EBT	1333	1339	5	0%	29.1	C			330	28	183
		EBR	38	37	-1	-2%	4.8	A			330	0	4
		WBL	353	344	-9	-2%	29.5	C			200	14	131
		WBT	1190	1152	-38	-3%	3.4	A			300	3	68
		WBR	31	27	-4	-12%	3.5	A			300	3	68
		NBL	23	24	1	4%	58.0	E			195	4	32
		NBT	13	13	0	1%	60.9	E			195	4	32
		NBR	302	306	4	1%	2.8	A			225	0	39
		SBL	15	14	-1	-6%	61.7	E			100	3	24
		SBT	12	12	1	5%	55.8	E			100	3	24
		SBR	20	19	-1	-5%	15.8	B			100	3	24
12	Edsall Rd & Cherokee Ave	EBL	182	174	-8	-5%	39.5	D	15.8	B	90	17	156
		EBT	1468	1479	11	1%	7.2	A			220	19	155
		WBT	1488	1450	-38	-3%	15.3	B			500	21	161
		WBR	441	447	6	1%	10.1	B			500	0	0
		SBL	335	339	5	1%	52.8	D			215	24	96
		SBR	89	89	0	0%	8.3	A			215	1	19
13	Edsall Rd & Bren Mar Dr	EBT	1294	1242	-52	-4%	16.6	B	18.5	B	670	20	193
		EBR	287	286	0	0%	8.8	A			670	11	173
		WBL	63	66	3	5%	76.7	E			275	9	43
		WBT	1099	1087	-12	-1%	8.0	A			300	9	88
		NBL	295	297	1	0%	58.0	E			540	38	149
		NBT	59	62	2	3%	43.1	D			540	38	149
		NBR	97	95	-2	-2%	13.6	B			240	38	149
14	Edsall Rd & Sullivan Pl Dr	EBT	1347	1242	-105	-8%	16.6	---	---	---	---	---	---
		EBR	43	36	-7	-16%	14.1	---			---	---	---
		NBR	10	10	0	-3%	4.9	A			220	0	8
15	Edsall Rd & Bloomfield Dr	EBT	1320	1312	-7	-1%	4.8	A	10.5	B	250	9	145
		EBR	32	29	-3	-9%	3.4	A			250	9	145
		WBL	62	61	-1	-2%	26.7	C			200	1	24
		WBT	1113	1100	-13	-1%	8.8	A			200	13	90
		NBL	224	228	3	2%	43.0	D			170	23	133
		NBR	91	88	-3	-4%	22.3	C			170	1	26
16	Edsall Rd & Beryl Rd	EBT	1328	1317	-11	-1%	0.7	A	6.6	A	195	1	68
		EBR	82	82	1	1%	1.0	A			195	1	68
		WBL	17	18	1	3%	3.7	A			165	0	8
		WBT	1052	1047	-5	0%	7.2	A			165	4	66
		NBL	123	119	-3	-3%	62.3	E			290	16	82
		NBR	33	36	3	9%	36.5	D			290	16	82
17	Seminary Rd & HOV BRAC Ramp	EBT	945	945	1	0%	9.0	A	19.9	B	1050	7	96
		WBT	1046	861	-186	-18%	8.7	A			700	5	48
		NBL	441	449	8	2%	57.6	E			1900	57	153
		NBR	80	74	-6	-7%	61.7	E			1900	57	153

2040 No-Build PM Peak Hour

A



B



Congestion Level

Light to moderate traffic

Heavy traffic

Congested traffic

Severely congested traffic

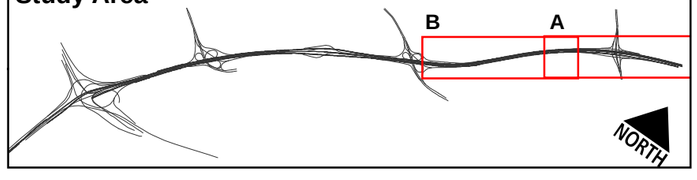
GP Lane Segment ID
Peak Hour Density

Express Lane Segment ID
Peak Hour Density

1 Matchline

0 0.05 0.1 Miles

Study Area



VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

No-Build (2040) PM Freeway Congestion Level

C

NORTH

S08-W
44.4

S07-W
44.3

3

2

H03-D
26

N10-D
20.8

N11-B
24.5

395

DUKE STREET

236

D

NORTH

S09-B
32.8

S08-W
44.4

S10-W
27.6

H05-M
21.9

4

3

N06-M
24.1

N07-B
23.8

N08-B
32

H04-B
24.3

N09-D
24.1

395

Congestion Level

Light to moderate traffic

Heavy traffic

Congested traffic

Severely congested traffic

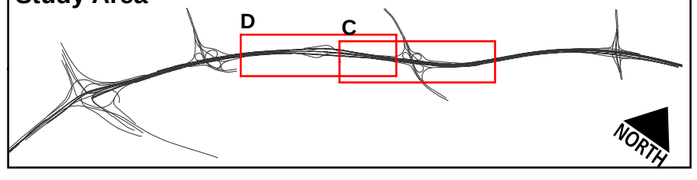
GP Lane Segment ID
Peak Hour Density

Express Lane Segment ID
Peak Hour Density

1 Matchline

0 0.05 0.1 Miles

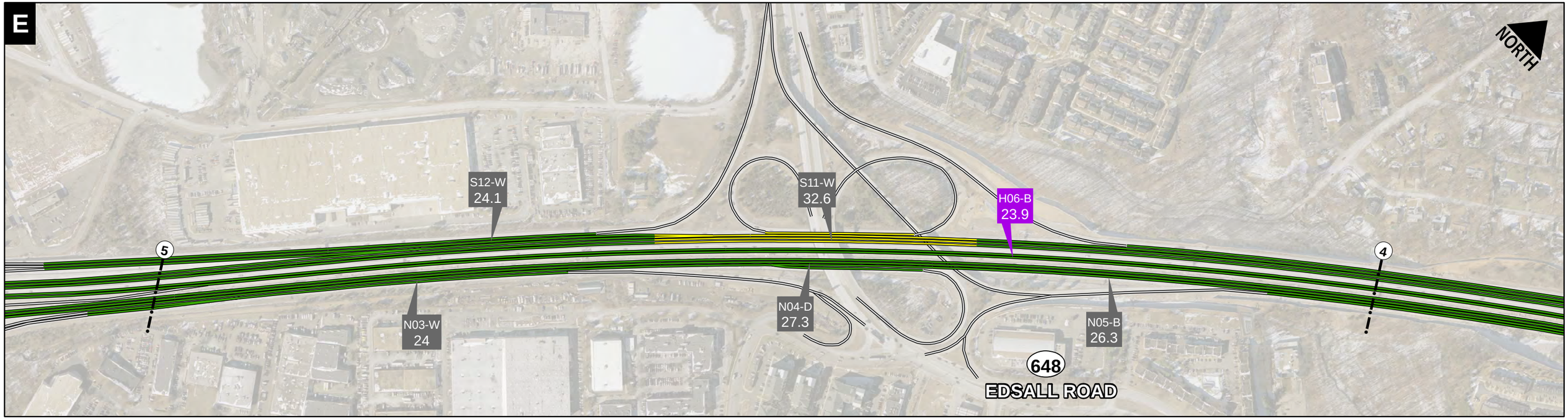
Study Area

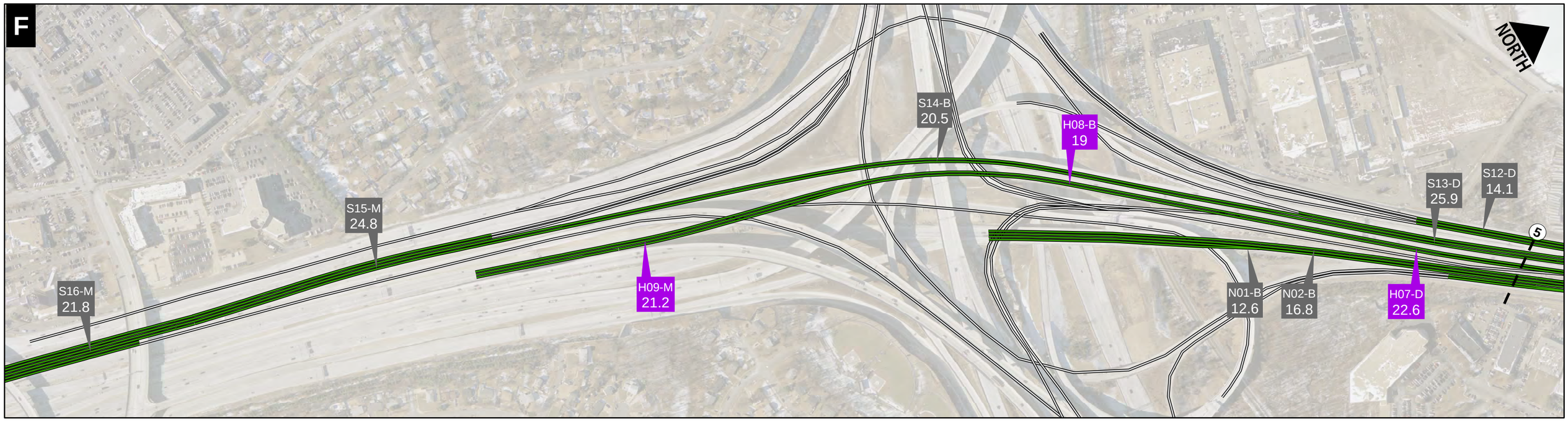


VDOT
HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

No-Build (2040) PM Freeway Congestion Level





Congestion Level

Light to moderate traffic

Heavy traffic

Congested traffic

Severely congested traffic

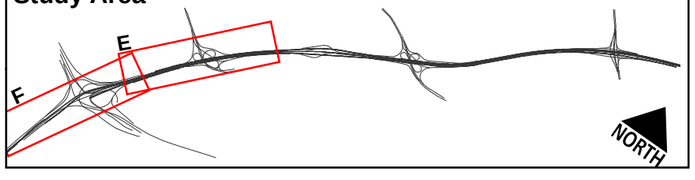
GP Lane Segment ID
Peak Hour Density

Express Lane Segment ID
Peak Hour Density

1 Matchline

0 0.05 0.1 Miles

Study Area



VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

No-Build (2040) PM Freeway Congestion Level

Freeway Mainline (2040 No-Build PM)

Direction	Segment	Location	Operation Type	Length (ft)	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Speed (mph)	Density (pc/ln/mi)
Southbound I-395 GP	S01-D	North of Seminary Road Off-Ramp	Diverge	1,499	7040	6406	-633	-9%	11.3	117.0
	S02-B	Between Seminary Road Off-Ramp and On-Ramp	Basic	3,891	6078	5613	-465	-8%	12.0	120.7
	S03-M	Merge Area at Seminary Road On-Ramp	Merge	1,455	7714	6874	-840	-11%	15.1	106.4
	S04-B	Between Seminary Road On-Ramp and Duke Street Off-Ramp	Basic	1,366	7714	6878	-836	-11%	17.3	101.8
	S05-D	Diverge Area at WB Duke Street Off-Ramp	Diverge	1,500	7714	6876	-838	-11%	17.4	101.3
	S06-B	Between WB Duke Street Off-Ramp and On-Ramp	Basic	1,984	6796	6096	-700	-10%	20.3	77.2
	S07-W	Between WB Duke Street On-Ramp and EB On-Ramp	Weave	1,445	7310	6542	-768	-11%	43.6	44.3
	S08-W	Between EB Duke Street On-Ramp and Turkeycock Slip Ramp	Weave	3,227	7148	6526	-622	-9%	46.6	44.4
	S09-B	Between Turkeycock Slip Ramp and Flyover Ramp	Basic	770	5484	5111	-373	-7%	53.4	32.8
	S10-W	Between Turkeycock Flyover Ramp and Edsall Road Off-Ramp	Weave	3,263	5685	5286	-399	-7%	53.0	27.6
	S11-W	Between WB Edsall Road On-Ramp and EB Off-Ramp	Weave	1,404	5755	5395	-360	-6%	48.7	32.6
	S12-W	Between Edsall Road and I-495 Ramp	Weave	1,953	6314	5934	-379	-6%	52.4	24.1
	S12-D	Diverge Area at I-495 Inner Loop Ramps	Diverge	1,141	2321	2114	-207	-9%	53.7	14.1
	S13-D	Diverge Area at Franconia Ramp	Diverge	1,447	3993	3849	-144	-4%	51.0	25.9
	S14-B	I-95 SB Mainline through Springfield Interchange	Basic	3,255	2183	2148	-35	-2%	53.3	20.5
	S15-M	Merge Area with I-495 Outer Loop Ramp	Merge	1,568	5229	5154	-75	-1%	53.4	24.8
	S16-M	Merge Area with I-495 Inner Loop Ramp	Merge	1,506	6799	6726	-73	-1%	53.1	21.8
Southbound I-395 HOV/ Express	H00-D	North of Seminary Road HOV Off-Ramp	Diverge	1,498	2912	2900	-11	0%	63.4	19.6
	H01-B	Between Seminary Road HOV Off-Ramp and HOV On- Ramp	Basic	4,156	2669	2662	-7	0%	63.8	21.2
	H02-M	Merge from Seminary Road HOV On-Ramp	Merge	1,503	3344	3244	-101	-3%	62.0	22.2
	H02-B	Between Seminary Road HOV On-Ramp and Turkeycock Flyover Ramp	Basic	4,919	3344	3103	-241	-7%	62.9	26.1
	H03-D	Diverge Area at Turkeycock Flyover Ramp	Diverge	1,501	3344	3249	-96	-3%	63.3	26.0
	H04-B	Between Turkeycock Flyover Ramp and Slip Ramp	Basic	2,855	3143	3049	-94	-3%	63.5	24.3
	H05-M	Merge Area at Turkeycock Slip Ramp	Merge	1,500	4807	4458	-349	-7%	62.2	21.9
	H06-B	Between Turkeycock Slip Ramp and Off-Ramp to I-495 HOT Lanes	Basic	4,739	4807	4477	-330	-7%	63.5	23.9
	H07-D	Diverge Area at Off-Ramp to I-495 HOT Lanes	Diverge	1,525	4807	4466	-341	-7%	61.1	22.6
	H08-B	Between I-495 HOT Off-Ramp and On-Ramp	Basic	2,275	3856	3550	-306	-8%	63.5	19.0
	H09-M	Merge Area at On-Ramp from I-495 HOT Lanes	Merge	2,168	5592	5297	-296	-5%	63.5	21.2
Northbound I-395 GP	N01-B	I-95 NB mainline through Springfield Interchange	Basic	684	2646	2646	0	0%	53.8	12.6
	N02-B	I-95 NB mainline through Springfield Interchange	Basic	1,048	2646	2643	-3	0%	53.7	16.8
	N03-W	Between Springfield Interchange and Edsall Road	Weave	2,492	5492	5491	-1	0%	52.0	24.0
	N04-D	Diverge Area at Edsall Road WB Off-Ramp	Diverge	1,496	4649	4646	-3	0%	52.3	27.3
	N05-B	Between Edsall Road WB Off-Ramp and On-Ramp	Basic	1,469	4107	4135	27	1%	53.4	26.3
	N06-M	Merge Area at Edsall Road On-Ramp	Merge	1,500	4928	4945	18	0%	52.2	24.1
	N07-B	Between Edsall Road On-Ramp and Turkeycock Flyover Ramp	Basic	290	4928	4885	-42	-1%	52.3	23.8
	N08-B	Between Turkeycock Flyover Ramp and Duke Street EB Off-Ramp	Basic	2,269	4928	4942	15	0%	52.4	32.0
	N09-D	Diverge Area at Duke Street EB Off-Ramp	Diverge	1,733	4928	4945	18	0%	51.8	24.1
	N10-D	Diverge Area at Duke Street WB Off-Ramp	Diverge	1,326	4290	4286	-4	0%	52.5	20.8
	N11-B	Between Duke Street WB Off-Ramp and On-Ramp	Basic	2,086	4107	3834	-273	-7%	53.1	24.5
	N12-M	Merge Area at Duke Street WB On-Ramp	Merge	560	5289	5126	-163	-3%	52.8	24.8
	N13-B	Between Duke Street and Seminary Road	Basic	2,677	5289	5218	-72	-1%	53.0	25.1
	N14-D	Diverge Area at Seminary Road Off-Ramp	Diverge	1,447	5289	5202	-87	-2%	49.5	24.1
	N15-B	Between Seminary Road Off-Ramp and On-Ramp	Basic	2,987	4405	4331	-74	-2%	50.8	29.0
	N16-M	North of Seminary Road On-Ramp	Merge	1,498	5491	5258	-233	-4%	52.1	22.9

Severely congested condition | Heavily congested condition | Moderate traffic condition | Light traffic condition

Interchange Ramps (2040 No-Build PM)

Interchange	Ramp Description	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %
Seminary Road Interchange	I-395 NB Off-Ramp at Seminary Road	884	880	-3	0%
	I-395 NB On-Ramp at Seminary Road	1085	937	-148	-14%
	I-395 SB Off-Ramp at Seminary Road	962	776	-185	-19%
	I-395 SB On-Ramp at Seminary Road	1636	1262	-374	-23%
	I-395 SB HOV Off-Ramp at Seminary Road	243	252	9	4%
Duke Street/Little River Turnpike Interchange	I-395 NB to EB Duke Street	637	653	16	3%
	I-395 NB to WB Duke Street	439	451	12	3%
	EB Little River Turnpike to I-395 NB	549	519	-30	-5%
	WB Duke Street to I-395 NB	889	871	-18	-2%
	I-395 SB to EB Little River Turnpike	746	646	-100	-13%
	I-395 SB to WB Little River Turnpike	918	781	-137	-15%
	EB Little River Turnpike to I-395 SB	585	585	1	0%
	WB Little River Turnpike to I-395 SB	514	493	-21	-4%
Turkeycock Run Ramps	I-395 SB GP to I-395 SB HOV	1664	1404	-260	-16%
	I-395 SB HOV to I-395 SB GP	201	194	-8	-4%
Edsall Road Interchange	I-395 NB to EB Edsall Road	843	849	6	1%
	I-395 NB to WB Edsall Road	542	517	-25	-5%
	EB Edsall Road to I-395 NB	534	529	-5	-1%
	WB Edsall Road to I-395 NB	287	278	-9	-3%
	I-395 SB to EB Edsall Road	190	154	-35	-19%
	I-395 SB to WB Edsall Road	521	467	-54	-10%
	EB Edsall Road to I-395 SB	748	754	6	1%
	WB Edsall Road to I-395 SB	592	578	-14	-2%
Springfield Interchange	I-495 Outer GP to I-95 SB GP	3045	3006	-39	-1%
	I-495 Outer GP to I-395 NB GP	2064	2058	-6	0%
	I-495 Outer HOT to I-95 SB HOV	868	862	-6	-1%
	I-495 Inner GP to I-95 SB GP	1570	1554	-16	-1%
	I-495 Inner GP to I-395 NB GP	783	783	1	0%
	I-395 SB GP to I-495 Inner GP	1658	1558	-101	-6%
	I-395 SB GP to Franconia	1810	1709	-101	-6%
	I-395 SB GP to I-495 Outer GP	662	592	-70	-11%
	I-395 SB HOV to I-495 (inner and outer)	951	909	-42	-4%

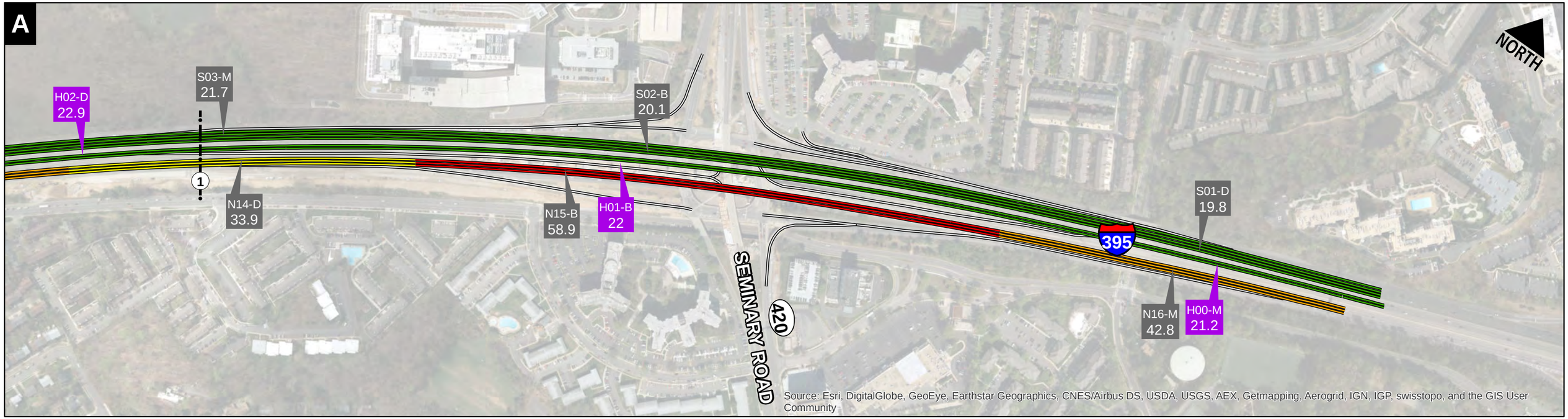
Intersections (2040 No-Build PM)

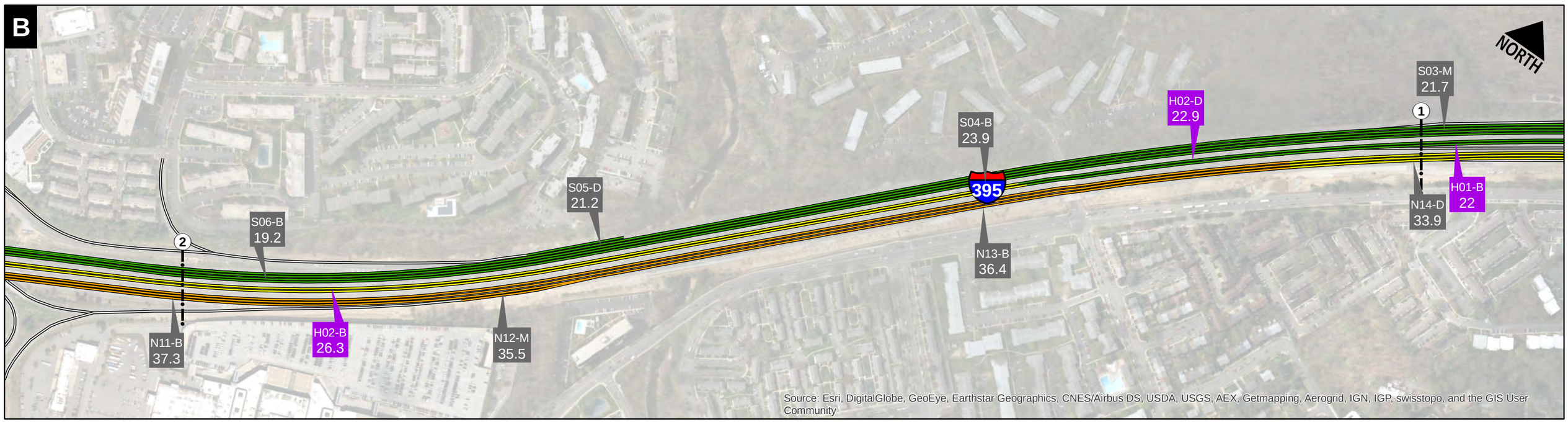
Node	Intersection	Movement	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Avg. Delay (sec)	LOS	Intersection Delay (sec)	Intersection LOS	Storage (ft)	Avg. Queue (ft)	Max. Queue (ft)
1	Seminary Rd & I-395 SB Off-Ramp	WBL	356	343	-13	-4%	11.7	B	44.1	D	200	2	20
		WBT	844	822	-23	-3%	3.7	A			200	18	94
		SBT	443	319	-124	-28%	183.3	F			1970	265	821
2	Seminary Rd & I-395 SB On-Ramp	EBT	882	706	-177	-20%	72.5	E	67.1	E	580	520	793
		SBL	552	422	-131	-24%	6.7	A			267	33	100
		SBT	246	229	-16	-7%	161.4	F			230	33	99
3	Seminary Rd & I-395 NB Off-Ramp	EBL	721	583	-137	-19%	9.9	A	35.6	D	275	8	104
		EBT	714	539	-174	-24%	5.3	A			275	8	104
		NBT	610	599	-11	-2%	96.0	F			750	84	297
		NBR	274	265	-9	-3%	17.2	B			112	2	49
4	Seminary Rd & I-395 NB On-Ramp	WBT	348	327	-21	-6%	146.0	F	37.3	D	290	72	249
		NBL	610	605	-5	-1%	13.6	B			205	6	92
		NBT	721	579	-142	-20%	0.6	A			205	6	92
5	Seminary Rd & I-395 HOV Ramp	WBT	958	928	-30	-3%	7.4	A	---	---	---	---	---
		SBR	242	242	0	0%	74.8	F			125	56	216
6	Seminary Rd & Mark Center Ave	EBL	36	30	-6	-17%	143.9	F	112.7	F	195	5	32
		EBT	2089	1699	-391	-19%	155.8	F			605	425	456
		EBR	36	26	-10	-29%	153.5	F			380	417	448
		WBL	77	81	3	4%	74.7	E			2200	12	55
		WBT	1675	1572	-103	-6%	30.0	C			950	0	11
		WBR	208	185	-23	-11%	20.5	C			800	0	11
		NBL	109	71	-38	-35%	171.3	F			650	467	503
		NBT	17	10	-7	-42%	176.8	F			650	467	503
		NBR	1200	854	-346	-29%	121.9	F			650	467	503
		SBL	286	247	-39	-14%	324.7	F			200	138	191
		SBT	62	53	-9	-15%	322.6	F			200	138	191
		SBR	53	49	-4	-7%	87.9	F			200	138	191
7	Seminary Rd & Kenmore Ave	EBT	1484	1202	-282	-19%	1.7	---	---	---	---	---	---
		EBR	384	299	-85	-22%	3.2	---			---	---	---
		WBT	1280	833	-447	-35%	0.4	---			---	---	---
		WBR	82	80	-2	-2%	4.3	---			---	---	---
		NBR	125	133	8	7%	13.5	B			1320	3	39
		SBR	388	127	-261	-67%	41.5	E			510	44	182
8	Little River Tpk & Beauregard St	EBL	396	377	-19	-5%	118.1	F	69.2	E	385	57	237
		EBT	1529	1494	-36	-2%	68.8	E			670	113	387
		EBR	45	39	-6	-13%	75.4	E			670	113	387
		WBL	95	86	-9	-9%	131.4	F			225	58	138
		WBT	1611	1412	-198	-12%	39.1	D			315	22	88
		WBR	847	756	-92	-11%	16.1	B			150	22	88
		NBL	113	73	-40	-35%	382.8	F			145	123	218
		NBT	170	109	-61	-36%	375.1	F			750	182	218
		NBR	181	110	-71	-39%	224.8	F			750	182	218
		SBL	949	953	4	0%	61.4	E			500	191	415
		SBT	130	129	-2	-1%	57.1	E			640	191	415
		SBR	326	338	12	4%	54.6	D			510	191	415
9	Little River Tpk & Oasis Dr	EBT	2613	2550	-63	-2%	3.2	A	18.5	B	300	19	123
		EBR	26	28	2	6%	1.4	A			300	19	123
		WBL	319	314	-5	-2%	57.6	E			235	31	199
		WBT	2383	2284	-99	-4%	23.2	C			500	41	293
		WBR	491	474	-17	-3%	13.7	B			500	17	232
		NBR	204	203	-2	-1%	37.3	D			145	15	87
		SBR	175	177	2	1%	103.6	F			250	65	148

Intersections (2040 No-Build PM)

Node	Intersection	Movement	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Avg. Delay (sec)	LOS	Intersection Delay (sec)	Intersection LOS	Storage (ft)	Avg. Queue (ft)	Max. Queue (ft)
10	Duke St & S Walker St	EBT	2318	2188	-130	-6%	36.3	D	54.9	D	615	69	298
		EBR	749	725	-24	-3%	12.4	B			615	0	3
		WBL	156	143	-14	-9%	222.6	F			615	104	289
		WBT	2118	2138	20	1%	33.3	C			990	104	289
		NBL	928	851	-77	-8%	144.1	F			340	274	338
		NBR	203	189	-13	-7%	79.4	E			470	1	29
		SBL	82	79	-2	-3%	73.3	E			230	55	123
		SBT	82	85	3	3%	116.3	F			210	55	123
		SBR	346	341	-5	-2%	75.1	E			205	55	123
11	Edsall Rd & Mitchell St	EBL	6	6	0	1%	35.1	D	21.0	C	120	0	6
		EBT	1376	1366	-10	-1%	47.0	D			330	75	249
		EBR	33	29	-4	-11%	15.8	B			330	7	83
		WBL	201	202	1	0%	30.3	C			200	4	58
		WBT	1745	1656	-89	-5%	1.7	A			300	2	38
		WBR	65	60	-5	-7%	2.0	A			300	2	38
		NBL	16	17	1	4%	54.8	D			195	2	24
		NBT	9	9	0	6%	55.4	E			195	2	24
		NBR	455	461	5	1%	8.5	A			225	3	80
		SBL	11	11	-1	-6%	61.8	E			100	2	17
		SBT	9	11	2	23%	48.2	D			100	2	17
		SBR	10	11	1	12%	8.6	A			100	2	17
12	Edsall Rd & Cherokee Ave	EBL	68	66	-2	-3%	35.7	D	16.7	B	90	8	132
		EBT	1775	1774	-1	0%	13.1	B			220	57	155
		WBT	1883	1801	-82	-4%	12.5	B			500	18	153
		WBR	288	291	3	1%	9.8	A			500	0	0
		SBL	620	618	-1	0%	41.5	D			215	33	130
		SBR	133	133	0	0%	13.9	B			215	1	36
13	Edsall Rd & Bren Mar Dr	EBT	1846	1746	-100	-5%	22.3	C	25.6	C	670	57	341
		EBR	163	159	-4	-2%	16.4	B			670	43	321
		WBL	35	38	2	7%	55.4	E			275	4	26
		WBT	1174	1179	5	0%	8.2	A			300	8	95
		NBL	524	506	-19	-4%	66.2	E			540	78	219
		NBT	133	129	-4	-3%	68.2	E			540	78	219
		NBR	99	99	0	0%	30.4	C			240	78	219
14	Edsall Rd & Sullivan Pl Dr	EBT	1865	1746	-119	-6%	22.3	---	---	---	---	---	---
		EBR	81	70	-11	-13%	24.6	---			---	---	---
		NBR	16	16	0	0%	5.8	A			220	0	8
15	Edsall Rd & Bloomfield Dr	EBT	1783	1772	-11	-1%	5.5	A	8.7	A	250	6	124
		EBR	84	76	-8	-9%	1.5	A			250	6	124
		WBL	100	99	-1	-1%	19.7	B			200	1	26
		WBT	1194	1197	3	0%	3.6	A			200	3	44
		NBL	169	169	0	0%	58.8	E			170	23	113
		NBR	108	105	-2	-2%	34.9	C			170	5	84
16	Edsall Rd & Beryl Rd	EBT	1667	1651	-16	-1%	2.3	A	7.0	A	195	8	89
		EBR	223	225	2	1%	2.1	A			195	8	89
		WBL	20	17	-3	-15%	3.1	A			165	0	9
		WBT	1140	1145	5	0%	5.0	A			165	3	59
		NBL	153	150	-3	-2%	73.6	E			290	25	104
		NBR	25	24	-1	-3%	58.3	E			290	25	104
17	Seminary Rd & HOV BRAC Ramp	EBT	880	697	-182	-21%	6.3	A	3.8	A	1050	4	72
		EBR	423	339	-84	-20%	4.7	A			700	4	72
		WBL	253	260	8	3%	5.9	A			1900	1	41
		WBR	702	698	-4	-1%	0.1	A			1900	0	0

2040 Build AM Peak Hour





Congestion Level

0 250 500 Feet

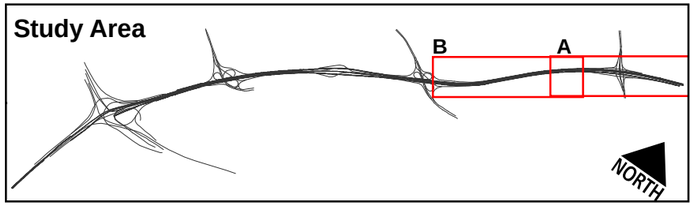
Light to moderate traffic | Heavy traffic | Congested traffic | Severely congested traffic

GP Lane Segment ID
Peak Hour Density

Express Lane Segment ID
Peak Hour Density

1 Matchline

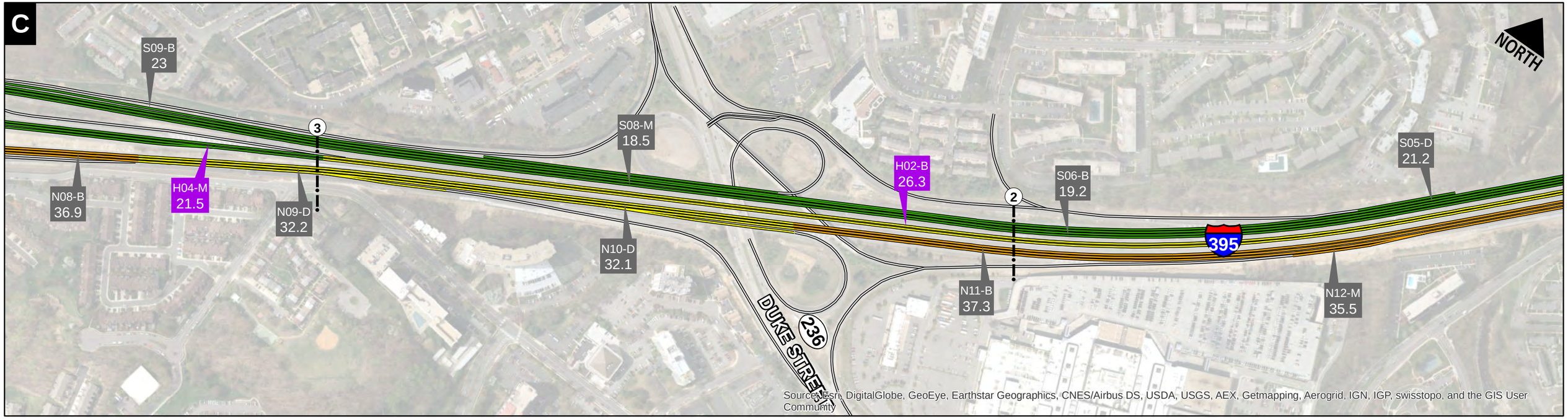
Study Area

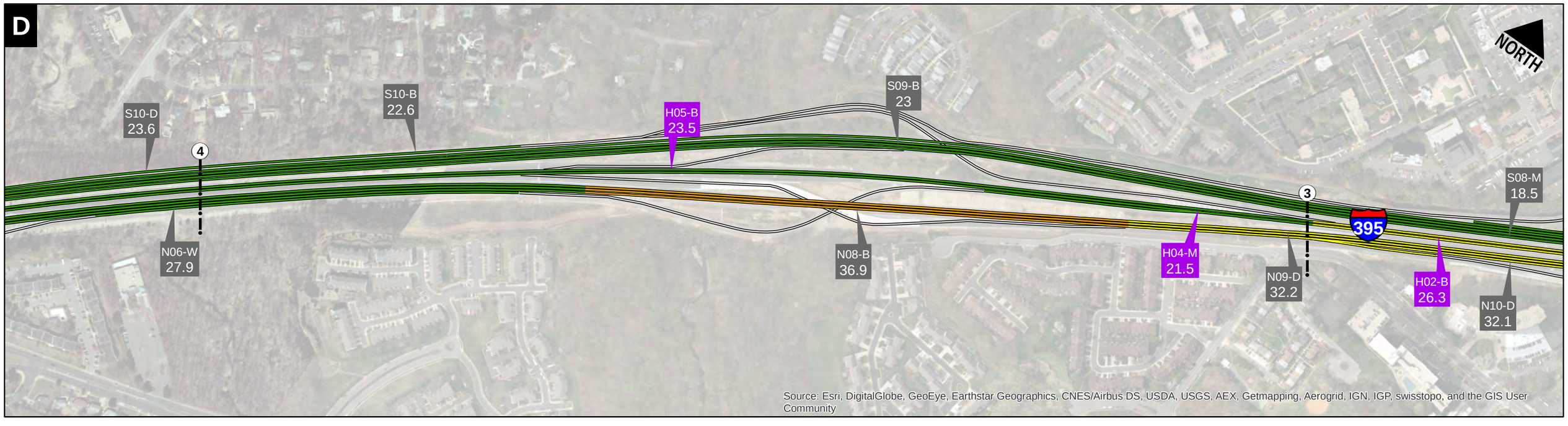


VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Build (2020) AM Peak Hour Volume





Congestion Level

0 250 500 Feet

Light to moderate traffic

Heavy traffic

Congested traffic

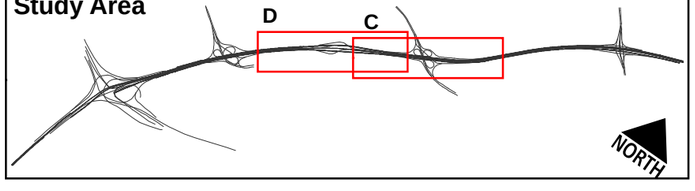
Severely congested traffic

GP Lane Segment ID
Peak Hour Density

Express Lane Segment ID
Peak Hour Density

1 Matchline

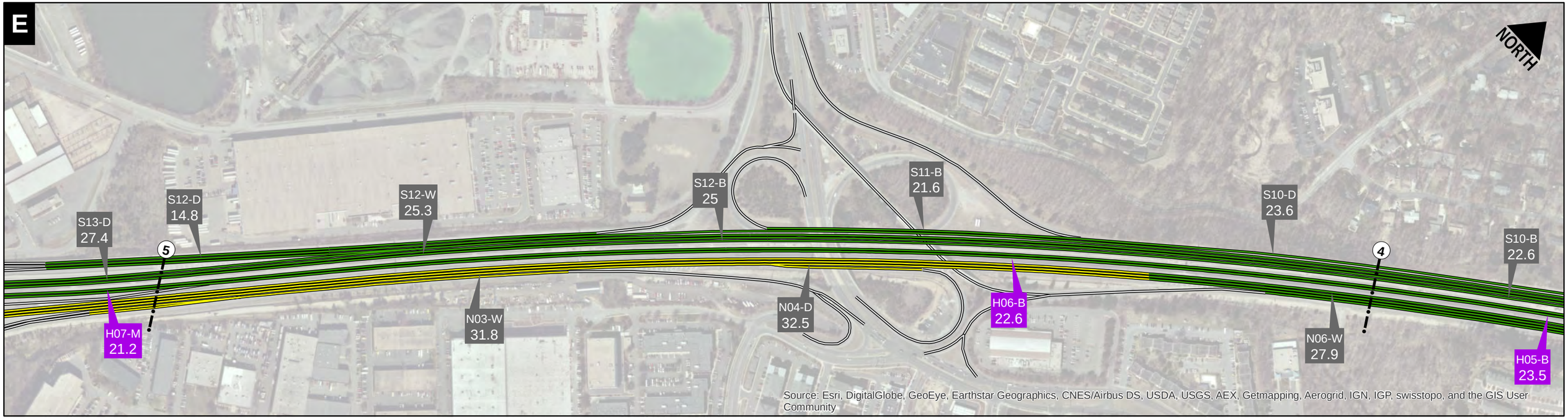
Study Area

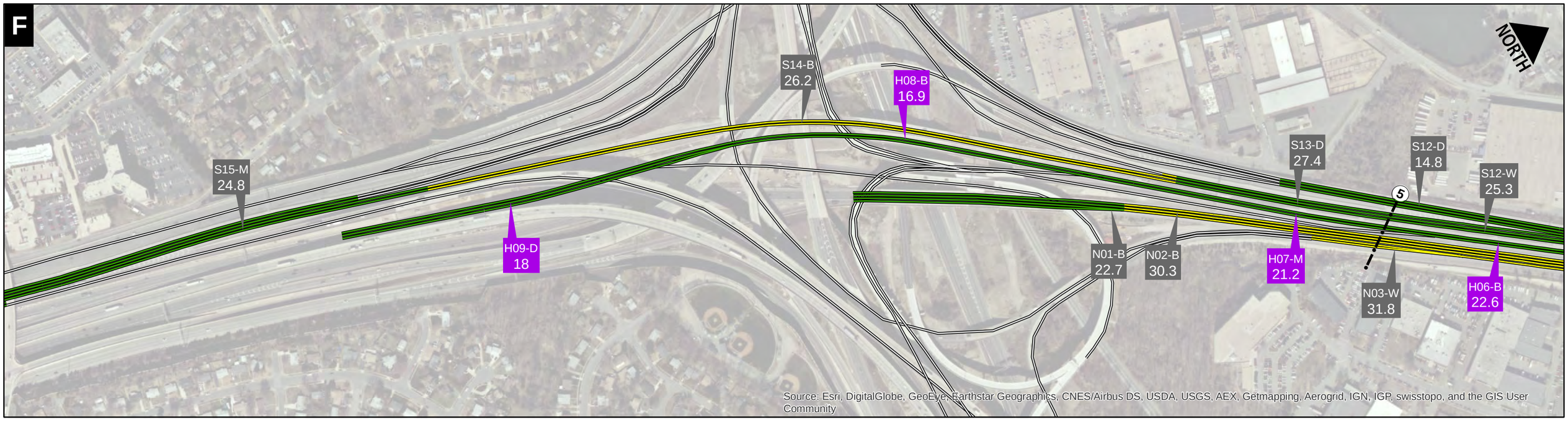


VDOT
HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Build (2020) AM Peak Hour Volume





Congestion Level

Light to moderate traffic | Heavy traffic | Congested traffic | Severely congested traffic

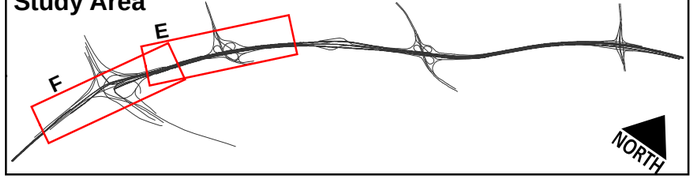
GP Lane Segment ID
Peak Hour Density

Express Lane Segment ID
Peak Hour Density

1 Matchline

0 250 500 Feet

Study Area



VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Build (2020) AM Peak Hour Volume

Freeway Mainline (2040 Build AM)

Direction	Segment	Location	Operation Type	Length (ft)	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Speed (mph)	Density (pc/ln/mi)
Southbound I-395 GP	S01-D	North of Seminary Road Off-Ramp	Diverge	1,499	6089	6106	16	0%	63.5	19.8
	S02-B	Between Seminary Road Off-Ramp and On-Ramp	Basic	3,891	4950	4968	18	0%	63.8	20.1
	S03-M	Merge Area at Seminary Road On-Ramp	Merge	1,455	5938	5885	-53	-1%	61.7	21.7
	S04-B	Between Seminary Road On-Ramp and Duke Street Off-Ramp	Basic	1,868	5938	5889	-49	-1%	63.6	23.9
	S05-D	Diverge Area at Duke Street Off-Ramp	Diverge	1,503	5938	5882	-56	-1%	63.7	21.2
	S06-B	Between Duke Street Off-Ramp and WB On-Ramp	Basic	1,946	4784	4741	-44	-1%	63.2	19.2
	S08-M	Merge Area at WB Duke Street On-Ramp	Merge	1,502	5460	5417	-43	-1%	63.2	18.5
	S09-B	Between Duke WB On-Ramp and Flyover Ramp	Basic	3,530	5460	5408	-52	-1%	58.5	23.0
	S10-B	After Turkeycock Flyover Ramp	Basic	1,284	6010	5901	-109	-2%	53.4	22.6
	S10-D	Diverge at Edsall Road WB Off-Ramp	Diverge	1,502	6010	5911	-99	-2%	50.4	23.6
	S11-B	Between Edsall Road WB Off-Ramp and EB Off-Ramp	Basic	1,464	5516	5427	-89	-2%	50.9	21.6
	S12-B	Between Edsall EB Off Ramp and On Ramp	Basic	379	5264	5139	-125	-2%	52.7	25.0
	S12-W	Between Edsall Road and I-495 Ramp	Weave	1,941	6446	6304	-143	-2%	52.3	25.3
	S12-D	Diverge Area at I-495 Inner Loop Ramps	Diverge	1,141	2363	2307	-56	-2%	56.1	14.8
	S13-D	Diverge Area at Franconia Ramp	Diverge	1,447	4083	4030	-53	-1%	50.5	27.4
	S14-B	I-95 SB Mainline through Springfield Interchange	Basic	3,255	2808	2697	-111	-4%	53.2	26.2
	S15-M	Merge Area with I-495 Outer Loop Ramp	Merge	1,568	5247	5114	-133	-3%	53.3	24.8
	S16-M	Merge Area with I-495 Inner Loop Ramp	Merge	1,506	7150	7012	-138	-2%	53.1	22.9
Northbound I-395 HOV/ Express	H00-M	Seminary Road HOV On-Ramp	Merge	1,498	3088	3069	-20	-1%	62.2	21.2
	H01-B	Between Seminary Road HOV Off-Ramp and HOV On- Ramp	Basic	4,141	2736	2738	3	0%	63.4	22.0
	H02-M	Seminary Road HOV Off-Ramp	Merge	1,495	3256	3276	20	1%	60.8	22.9
	H02-B	Between Seminary Road HOV Off-Ramp and Turkeycock Flyover Ramp	Basic	6,446	3256	3181	-75	-2%	62.2	26.3
	H04-M	Between Turkeycock Flyover HOV Off-Ramp and On-Ramp	Merge	1,340	3256	3250	-7	0%	63.0	21.5
	H05-B	Between Turkeycock Ramps	Basic	2,080	3102	3175	74	2%	59.7	23.5
	H06-B	Between Turkeycock Off-Ramp to I-495	Basic	5,675	4185	4193	8	0%	61.0	22.6
	H07-M	I-495 Express Lanes On-Ramp	Merge	1,555	4185	4183	-2	0%	61.1	21.2
	H08-B	Between I-495 Express Lanes Ramps	Basic	2,273	3195	3203	8	0%	63.8	16.9
	H09-D	I-495 Express Lanes Off-Ramp	Diverge	2,061	4487	4477	-10	0%	63.0	18.0
Northbound I-395 GP	N01-B	I-95 NB mainline through Springfield Interchange	Basic	684	4579	4722	142	3%	53.0	22.7
	N02-B	I-95 NB mainline through Springfield Interchange	Basic	1,048	4579	4716	137	3%	52.8	30.3
	N03-W	Between Springfield Interchange and Edsall Road	Weave	2,492	6251	6405	154	2%	49.7	31.8
	N04-D	Diverge Area at Edsall Road WB Off-Ramp	Diverge	1,492	5348	5512	164	3%	52.2	32.5
	N05-B	Between Edsall Road WB Off-Ramp and On-Ramp	Basic	972	4664	4815	150	3%	53.5	30.7
	N06-W	Merge Area at Edsall Road On-Ramp	Weave	2,280	5359	5297	-62	-1%	52.6	27.9
	N08-B	Between Turkeycock Flyover Ramp and Duke Street EB Off-Ramp	Basic	2,269	5204	5361	157	3%	49.6	36.9
	N09-D	Diverge Area at Duke Street EB Off-Ramp	Diverge	1,602	6287	6457	170	3%	50.1	32.2
	N10-D	Diverge Area at Duke Street WB Off-Ramp	Diverge	1,490	5996	6168	172	3%	48.8	32.1
	N11-B	Between Duke Street WB Off-Ramp and On-Ramp	Basic	2,086	5624	5794	170	3%	52.7	37.3
	N12-M	Merge Area at Duke Street WB On-Ramp	Merge	560	7163	7250	87	1%	52.1	35.5
	N13-B	Between Duke Street and Seminary Road	Basic	2,671	7163	7254	91	1%	51.2	36.4
	N14-D	Diverge Area at Seminary Road Off-Ramp	Diverge	1,458	7163	7214	51	1%	41.7	33.9
	N15-B	Between Seminary Road Off-Ramp and On-Ramp	Basic	2,987	5857	5903	46	1%	28.5	58.9
	N16-M	North of Seminary Road On-Ramp	Merge	1,498	7214	7116	-98	-1%	37.7	42.8

Severely congested condition | Heavily congested condition | Moderate traffic condition | Light traffic condition

Interchange Ramps (2040 Build AM)

Interchange	Link ID	Ramp Description	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %
Seminary Road Interchange	16	I-395 NB Off-Ramp at Seminary Road	1306	1290	-16	-1%
	49	I-395 NB On-Ramp at Seminary Road	1357	1236	-121	-9%
	46	I-395 SB Off-Ramp at Seminary Road	1139	1147	7	1%
	37	I-395 SB On-Ramp at Seminary Road	988	922	-66	-7%
	44	I-395 SB HOV Off-Ramp at Seminary Road	353	339	-14	-4%
Duke Street/Little River Turnpike Interchange	140020	I-395 NB to EB Duke Street	291	294	2	1%
	140018	I-395 NB to WB Duke Street	372	373	1	0%
	140015	EB Little River Turnpike to I-395 NB	763	696	-67	-9%
	140035	WB Duke Street to I-395 NB	776	770	-6	-1%
	140011	I-395 SB to Little River Turnpike	1153	1159	6	0%
	10159	EB Little River Turnpike to I-395 SB	550	526	-24	-4%
	140014	WB Little River Turnpike to I-395 SB	676	677	1	0%
Turkeycock Run Ramps	140062	I-395 NB GP to I-395 SB HOV	155	158	3	2%
	132	I-395 NB HOV to I-395 NB GP	1083	1091	7	1%
Edsall Road Interchange	140050	I-395 NB to EB Edsall Road	903	901	-2	0%
	140049	I-395 NB to WB Edsall Road	684	670	-14	-2%
	140061	EB Edsall Road to I-395 NB	461	465	4	1%
	140288	WB Edsall Road to I-395 NB	233	230	-3	-1%
	140048	I-395 SB to EB Edsall Road	252	254	2	1%
	140041	I-395 SB to WB Edsall Road	494	487	-7	-1%
	140286	Edsall Road to I-395 SB	1182	1171	-12	-1%
Springfield Interchange	140190	I-495 Outer GP to I-95 SB GP	2438	2416	-22	-1%
	140157	I-495 Outer GP to I-395 NB GP	1189	1190	2	0%
	160109	I-495 Outer HOT to I-95 SB HOV	646	638	-8	-1%
	140296	I-495 Inner GP to I-95 SB GP	1903	1889	-14	-1%
	375	I-495 Inner GP to I-395 NB GP	483	482	-1	0%
	140102	I-395 SB GP to I-495 Inner GP	1679	1679	0	0%
	140082	I-395 SB GP to Franconia	1275	1339	63	5%
	140110	I-395 SB GP to I-495 Outer GP	684	670	-13	-2%
	160119	I-395 SB HOV to I-495 (inner and outer)	990	983	-6	-1%

Intersections (2040 Build AM)

Node	Intersection	Movement	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Avg. Delay (sec)	LOS	Intersection Delay (sec)	Intersection LOS	Storage (ft)	Avg. Queue (ft)	Max. Queue (ft)
1	Seminary Rd & I-395 SB Off-Ramp	WBL	321	248	-73	-23%	0.9	A	23.1	C	200	0	47
		WBT	1194	1098	-97	-8%	1.7	A			200	4	206
		SBT	362	369	7	2%	101.4	F			1970	323	980
2	Seminary Rd & I-395 SB On-Ramp	EBT	779	781	1	0%	60.8	E	34.7	C	580	203	788
		SBL	362	369	7	2%	2.4	A			267	0	69
		SBT	321	247	-75	-23%	0.2	A			230	0	65
3	Seminary Rd & I-395 NB Off-Ramp	EBL	719	729	10	1%	2.4	A	22.9	C	275	15	277
		EBT	422	423	1	0%	6.7	A			275	15	277
		NBT	1079	1050	-30	-3%	46.8	D			750	212	840
		NBR	226	228	1	1%	8.9	A			112	1	68
4	Seminary Rd & I-395 NB On-Ramp	WBT	623	479	-144	-23%	132.6	F	30.1	C	290	390	863
		NBL	1245	1212	-33	-3%	2.7	A			205	10	317
		NBT	555	569	14	3%	2.0	A			205	10	318
5	Seminary Rd & I-395 HOV Ramp	WBT	1515	1348	-166	-11%	---	---	---	---	---	---	---
		WBR	353	341	-12	-3%	0.1	A			125	0	0
6	Seminary Rd & Mark Center Ave	EBL	25	25	1	2%	86.6	F	43.8	D	195	11	81
		EBT	1683	1679	-4	0%	52.3	D			605	179	572
		EBR	150	135	-15	-10%	35.7	D			380	152	544
		WBL	515	449	-66	-13%	66.3	E			2200	300	1125
		WBT	2665	2527	-138	-5%	32.0	C			950	0	33
		WBR	143	137	-7	-5%	28.5	C			800	0	33
		NBL	37	37	0	1%	97.9	F			650	59	209
		NBT	28	29	1	2%	98.9	F			650	59	209
		NBR	283	283	0	0%	37.4	D			650	59	209
		SBL	423	426	3	1%	56.0	E			200	138	417
		SBT	146	139	-7	-5%	59.2	E			200	138	417
		SBR	52	49	-3	-5%	13.6	B			200	138	417
7	Seminary Rd & Kenmore Ave	EBT	1566	1549	-17	-1%	1.0	---	---	---	---	---	---
		EBR	107	108	2	2%	1.5	---			---	---	---
		WBT	1503	1500	-3	0%	0.8	---			---	---	---
		WBR	42	39	-3	-6%	2.4	---			---	---	---
		NBR	131	135	4	3%	13.0	B			1320	9	118
		SBR	968	549	-418	-43%	58.2	F			510	492	716
8	Little River Tpk & Beauregard St	EBL	701	612	-89	-13%	164.3	F	76.2	E	385	2328	2614
		EBT	1732	1545	-187	-11%	86.4	F			670	2336	2620
		EBR	24	20	-4	-18%	89.6	F			670	2336	2620
		WBL	36	37	0	1%	101.8	F			225	172	448
		WBT	1380	1373	-7	-1%	41.6	D			315	22	131
		WBR	735	732	-3	0%	15.2	B			150	22	131
		NBL	101	101	0	0%	88.9	F			145	61	308
		NBT	72	72	0	0%	88.7	F			750	61	290
		NBR	83	82	0	0%	101.9	F			750	61	290
		SBL	989	962	-28	-3%	102.2	F			500	1133	1610
		SBT	50	41	-9	-18%	118.4	F			640	1133	1610
		SBR	243	238	-5	-2%	35.6	D			510	1133	1610

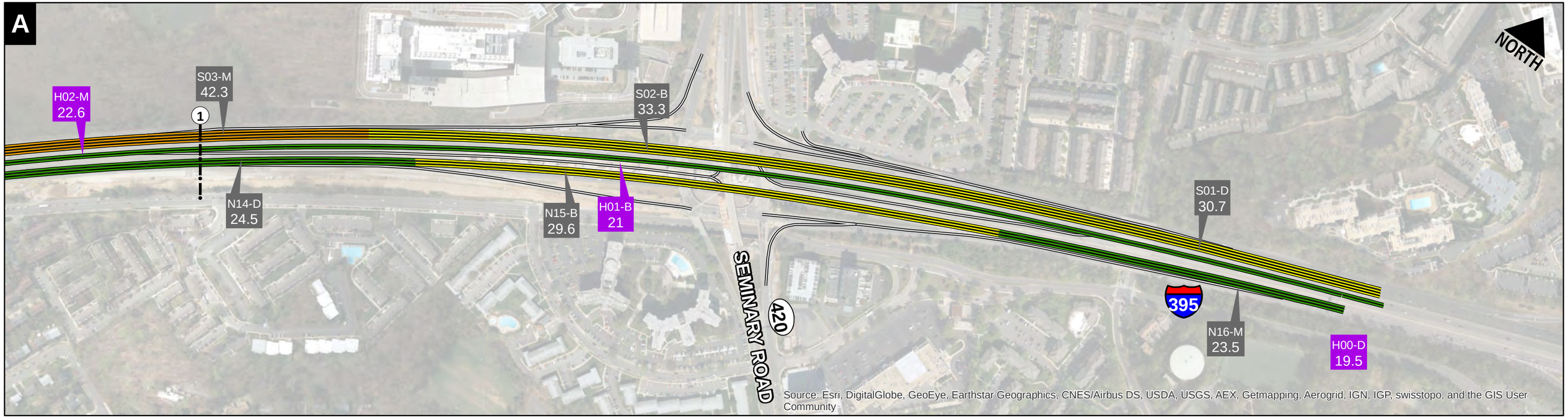
Intersections (2040 Build AM)

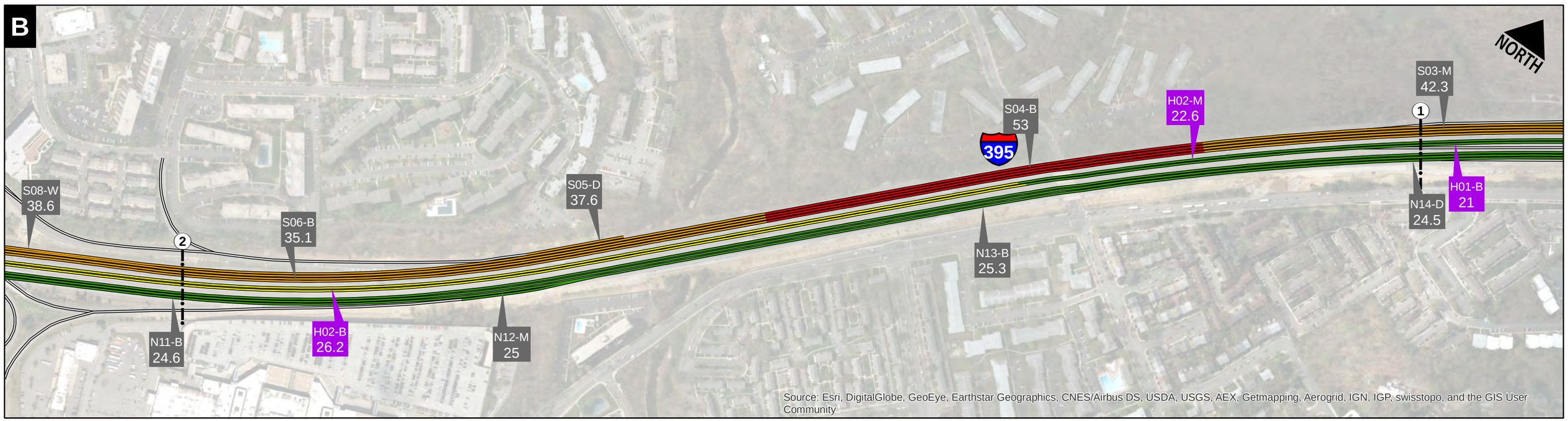
Node	Intersection	Movement	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Avg. Delay (sec)	LOS	Intersection Delay (sec)	Intersection LOS	Storage (ft)	Avg. Queue (ft)	Max. Queue (ft)
9	Little River Tpk & Oasis Dr	EBT	2765	2032	-732	-26%	6.6	A	15.2	B	300	40	379
		EBR	29	26	-3	-12%	1.5	A			300	40	379
		WBL	159	161	2	1%	40.0	D			235	20	231
		WBT	2138	2146	8	0%	18.1	B			500	56	479
		WBR	117	114	-3	-2%	5.9	A			500	9	316
		NBR	141	138	-3	-2%	82.3	F			145	86	343
		SBR	16	16	-1	-3%	0.5	A			250	3	68
10	Duke St & S Walker St	EBT	2060	1921	-139	-7%	20.9	C	24.0	C	615	103	563
		EBR	425	422	-2	-1%	3.7	A			615	0	0
		WBL	59	56	-3	-5%	71.0	E			615	113	625
		WBT	2178	2156	-22	-1%	16.0	B			990	113	625
		NBL	820	823	3	0%	60.2	E			340	192	676
		NBR	150	146	-4	-3%	12.8	B			470	2	62
		SBL	7	9	1	17%	74.8	E			230	13	75
		SBT	7	6	-1	-16%	77.2	E			210	13	75
		SBR	25	23	-2	-8%	47.9	D			205	13	75
11	Edsall Rd & Mitchell St	EBL	24	25	1	3%	13.5	B	13.2	B	120	0	39
		EBT	1333	1340	7	1%	16.9	B			330	62	491
		EBR	38	38	0	1%	3.4	A			330	0	0
		WBL	353	345	-8	-2%	20.4	C			200	27	372
		WBT	1190	1165	-25	-2%	4.5	A			300	12	227
		WBR	31	27	-4	-12%	4.0	A			300	12	227
		NBL	23	24	1	5%	50.1	D			195	12	122
		NBT	13	14	1	10%	47.3	D			195	12	122
		NBR	302	305	3	1%	16.4	B			225	24	308
		SBL	15	13	-2	-14%	50.2	D			100	7	73
		SBT	12	14	2	15%	45.4	D			100	7	73
		SBR	20	21	1	4%	10.9	B			100	7	73
12	Edsall Rd & Cherokee Ave	EBL	182	174	-8	-4%	33.3	C	13.0	B	90	31	455
		EBT	1468	1483	15	1%	4.0	A			220	30	461
		WBT	1488	1460	-28	-2%	14.5	B			500	68	494
		WBR	441	453	12	3%	10.4	B			500	0	27
		SBL	335	333	-1	0%	41.3	D			215	61	234
		SBR	89	87	-2	-2%	7.2	A			215	1	57
13	Edsall Rd & Bren Mar Dr	EBT	1294	1264	-30	-2%	19.6	B	18.4	B	670	54	506
		EBR	287	286	0	0%	10.2	B			670	28	440
		WBL	63	65	2	3%	54.7	D			275	21	126
		WBT	1099	1106	6	1%	9.6	A			300	36	360
		NBL	295	295	0	0%	41.6	D			540	84	387
		NBT	59	63	3	5%	36.1	D			540	84	387
		NBR	97	95	-2	-2%	20.0	B			240	84	387
14	Edsall Rd & Sullivan Pl Dr	EBT	1347	1264	-83	-6%	19.6	---	---	---	---	---	---
		EBR	43	39	-4	-10%	14.3	---			---	---	---
		NBR	10	10	0	2%	5.4	A			220	0	28

Intersections (2040 Build AM)

Node	Intersection	Movement	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Avg. Delay (sec)	LOS	Intersection Delay (sec)	Intersection LOS	Storage (ft)	Avg. Queue (ft)	Max. Queue (ft)
15	Edsall Rd & Bloomfield Dr	EBT	1320	1344	25	2%	15.0	B	15.6	B	250	89	685
		EBR	32	29	-3	-9%	7.9	A			250	89	685
		WBL	62	61	-1	-1%	22.2	C			200	3	84
		WBT	1113	1111	-1	0%	10.3	B			200	48	351
		NBL	224	220	-4	-2%	42.2	D			170	73	410
		NBR	91	86	-5	-6%	24.6	C			170	6	126
16	Edsall Rd & Beryl Rd	EBT	1328	1348	20	2%	1.9	A	6.5	A	195	22	306
		EBR	82	82	1	1%	1.6	A			195	22	306
		WBL	17	17	0	1%	3.9	A			165	0	28
		WBT	1052	1054	3	0%	7.5	A			165	15	238
		NBL	123	117	-5	-4%	46.9	D			290	39	243
		NBR	33	33	1	2%	30.3	C			290	39	243
17	Seminary Rd & HOV BRAC Ramp	EBT	945	938	-6	-1%	12.4	B	14.6	B	1050	34	334
		WBT	1046	911	-135	-13%	14.1	B			700	33	236
		NBL	441	454	13	3%	19.8	B			1900	49	251
		NBR	80	77	-3	-3%	17.0	B			1900	48	250
18	Little River Tpk & I-395 SB Off-Ramp	EBT	1593	1491	-102	-6%	6.6	A	12.8	B	780	34	293
		WBT	1943	1944	1	0%	16.3	B			950	84	541
		SBL	601	607	6	1%	26.7	C			660	56	280
		SBR	471	472	1	0%	0.0	A			920	---	---
19	Edsall Rd & I-395 SB On-Ramp	EBT	802	810	8	1%	17.1	B	9.7	A	975	44	263
		EBR	539	543	4	1%	1.3	A			650	0	0
		WBL	643	643	0	0%	28.5	C			650	152	825
		WBT	1435	1428	-7	-1%	0.2	A			900	0	0

2040 Build PM Peak Hour





0 250 500 Feet

Congestion Level

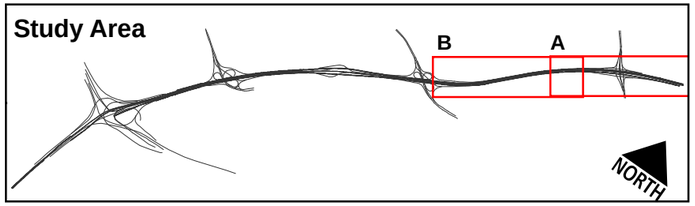
Light to moderate traffic | Heavy traffic | Congested traffic | Severely congested traffic

GP Lane Segment ID
Peak Hour Density

Express Lane Segment ID
Peak Hour Density

1 Matchline

Study Area

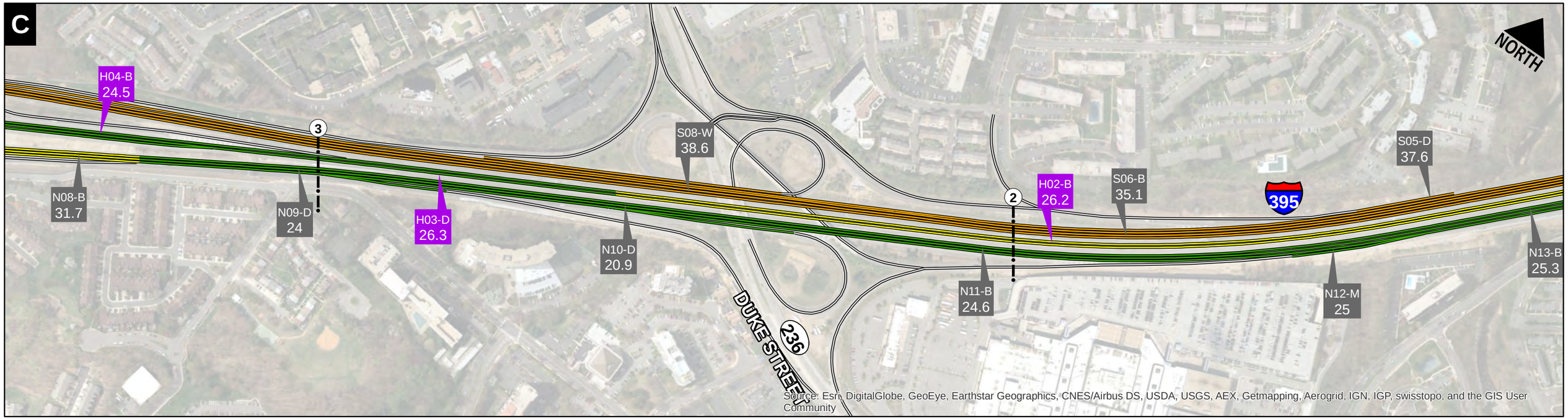


VDOT HNTB

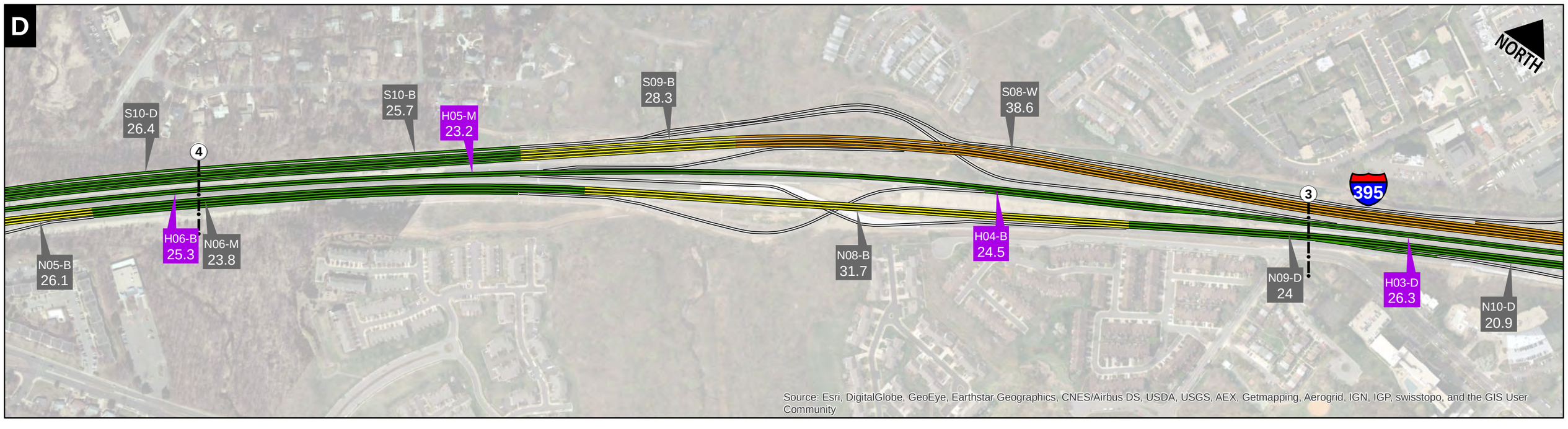
I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Build (2040) PM Peak Hour Density

C



D



Congestion Level

Light to moderate traffic	Heavy traffic	Congested traffic	Severely congested traffic

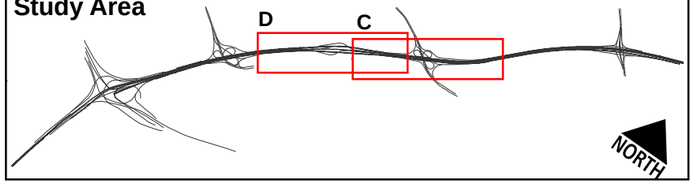
GP Lane Segment ID
Peak Hour Density

Express Lane Segment ID
Peak Hour Density

1 Matchline

0 250 500 Feet

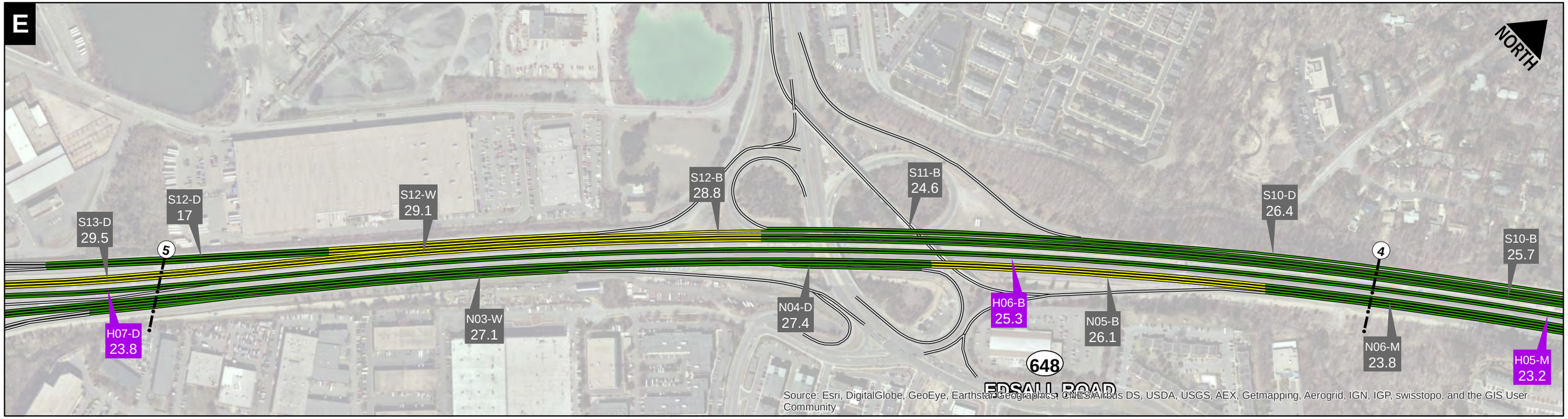
Study Area

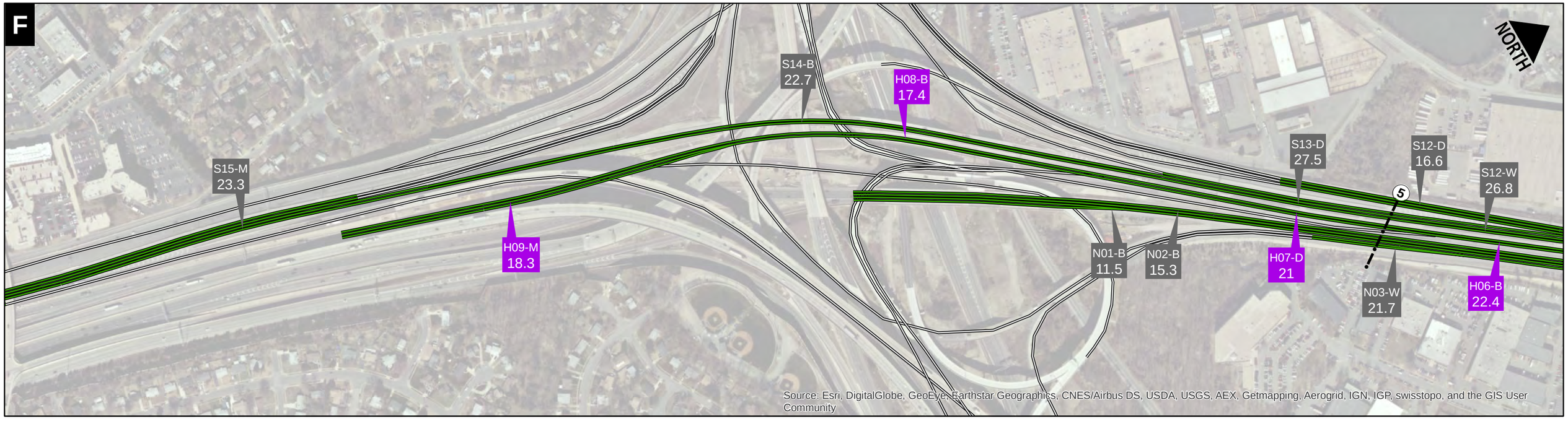


VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Build (2040) PM Peak Hour Density





Congestion Level

Light to moderate traffic | Heavy traffic | Congested traffic | Severely congested traffic

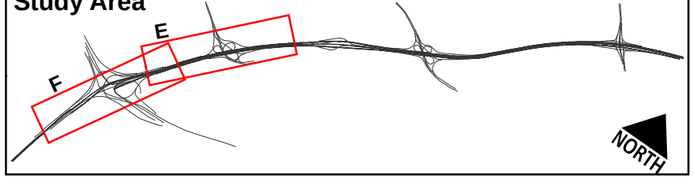
GP Lane Segment ID
Peak Hour Density

Express Lane Segment ID
Peak Hour Density

1 Matchline

0 250 500 Feet

Study Area



VDOT HNTB

I-395 SOUTHBOUND ADDITIONAL THROUGH LANE

Build (2040) PM Peak Hour Density

Freeway Mainline (2040 Build PM)

Direction	Segment	Location	Operation Type	Length (ft)	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Speed (mph)	Density (pc/ln/mi)
Southbound I-395 GP	S01-D	North of Seminary Road Off-Ramp	Diverge	1,499	7791	7750	-41	-1%	51.9	30.7
	S02-B	Between Seminary Road Off-Ramp and On-Ramp	Basic	3,891	6830	6796	-33	0%	52.8	33.3
	S03-M	Merge Area at Seminary Road On-Ramp	Merge	1,455	8676	8503	-173	-2%	45.4	42.3
	S04-B	Between Seminary Road On-Ramp and Duke Street Off-Ramp	Basic	1,873	8676	8517	-159	-2%	45.2	53.0
	S05-D	Diverge Area at Duke Street Off-Ramp	Diverge	1,502	8676	8477	-198	-2%	51.3	37.6
	S06-B	Between Duke Street Off-Ramp and WB On-Ramp	Basic	1,478	7011	6853	-158	-2%	50.3	35.1
	S08-W	Between Duke Street WB On-Ramp and Turkeycock Slip Ramp	Weave	4,680	7709	7555	-154	-2%	46.0	38.6
	S09-B	Between Turkeycock Slip Ramp and Flyover Ramp	Basic	754	6010	5894	-116	-2%	53.5	28.3
	S10-B	After Turkeycock Flyover Ramp	Basic	1,294	6822	6683	-139	-2%	53.3	25.7
	S10-D	Diverge at Edsall Road WB Off-Ramp	Diverge	1,504	6822	6656	-166	-2%	50.9	26.4
	S11-B	Between Edsall Road WB Off-Ramp and EB Off-Ramp	Basic	1,454	6196	6053	-143	-2%	51.0	24.6
	S12-B	Between Edsall EB Off Ramp and On Ramp	Basic	383	5969	5789	-180	-3%	51.8	28.8
	S12-W	Between Edsall Road and I-495 Ramp	Weave	1,953	7309	7116	-193	-3%	51.3	29.1
	S12-D	Diverge Area at I-495 Inner Loop Ramps	Diverge	1,141	2686	2629	-57	-2%	52.9	17.0
	S13-D	Diverge Area at Franconia Ramp	Diverge	1,447	4622	4521	-101	-2%	52.5	29.5
	S14-B	I-95 SB Mainline through Springfield Interchange	Basic	3,255	2527	2462	-65	-3%	53.3	23.6
	S15-M	Merge Area with I-495 Outer Loop Ramp	Merge	1,568	5572	5488	-84	-2%	53.3	26.5
	S16-M	Merge Area with I-495 Inner Loop Ramp	Merge	1,506	7142	7071	-71	-1%	53.0	23.0
Southbound I-395 HOV/ Express	H00-D	North of Seminary Road HOV Off-Ramp	Diverge	1,498	2912	2881	-30	-1%	63.5	19.5
	H01-B	Between Seminary Road HOV Off-Ramp and On-Ramp	Basic	4,156	2669	2644	-25	-1%	63.8	21.0
	H02-M	Merge Area at Seminary Road HOV On-Ramp	Merge	1,519	3344	3285	-60	-2%	61.9	22.6
	H02-B	Between Seminary Road HOV On-Ramp and Turkeycock Flyover Ramp	Basic	4,906	3344	3062	-282	-8%	63.3	26.2
	H03-D	Diverge Area at Turkeycock Flyover Ramp	Diverge	1,501	3344	3265	-80	-2%	63.0	26.3
	H04-B	Between Turkeycock Flyover Ramp and Slip Ramp	Basic	2,855	3143	3067	-76	-2%	63.5	24.5
	H05-M	Merge Area at Turkeycock Slip Ramp	Merge	1,501	4842	4713	-129	-3%	61.9	23.2
	H06-B	Between Turkeycock Slip Ramp and Off-Ramp to I-495 HOT Lanes	Basic	4,739	4842	4727	-115	-2%	63.5	25.3
	H07-D	Diverge Area at Off-Ramp to I-495 HOT Lanes	Diverge	1,525	4842	4717	-125	-3%	61.6	23.8
	H08-B	Between I-495 HOT Off-Ramp and On-Ramp	Basic	2,275	3891	3784	-107	-3%	63.5	20.2
	H09-M	Merge Area at On-Ramp from I-495 HOT Lanes	Merge	2,168	5627	5547	-80	-1%	63.5	22.2
Northbound I-395 GP	N01-B	I-95 NB mainline through Springfield Interchange	Basic	684	2646	2636	-10	0%	53.8	12.6
	N02-B	I-95 NB mainline through Springfield Interchange	Basic	1,048	2646	2632	-14	-1%	53.7	16.7
	N03-W	Between Springfield Interchange and Edsall Road	Weave	2,492	5492	5512	19	0%	50.2	27.1
	N04-D	Diverge Area at Edsall Road WB Off-Ramp	Diverge	1,496	4649	4661	12	0%	52.3	27.4
	N05-B	Between Edsall Road WB Off-Ramp and On-Ramp	Basic	1,469	4107	4107	-1	0%	53.4	26.1
	N06-M	Merge Area at Edsall Road On-Ramp	Merge	1,500	4928	4915	-13	0%	52.5	23.8
	N07-B	Between Edsall Road On-Ramp and Turkeycock Flyover Ramp	Basic	290	4928	4853	-75	-2%	52.5	23.5
	N08-B	Between Turkeycock Flyover Ramp and Duke Street EB Off-Ramp	Basic	2,269	4928	4915	-13	0%	52.5	31.7
	N09-D	Diverge Area at Duke Street EB Off-Ramp	Diverge	1,733	4928	4926	-2	0%	51.9	24.0
	N10-D	Diverge Area at Duke Street WB Off-Ramp	Diverge	1,326	4290	4288	-2	0%	52.3	20.9
	N11-B	Between Duke Street WB Off-Ramp and On-Ramp	Basic	2,086	3851	3846	-6	0%	53.1	24.6
	N12-M	Merge Area at Duke Street WB On-Ramp	Merge	560	5289	5168	-121	-2%	52.7	25.0
	N13-B	Between Duke Street and Seminary Road	Basic	2,677	5289	5257	-32	-1%	53.0	25.3
	N14-D	Diverge Area at Seminary Road Off-Ramp	Diverge	1,447	5289	5243	-46	-1%	49.1	24.5
	N15-B	Between Seminary Road Off-Ramp and On-Ramp	Basic	2,987	4405	4395	-10	0%	50.5	29.6
	N16-M	North of Seminary Road On-Ramp	Merge	1,498	5491	5412	-79	-1%	52.1	23.5

Severely congested condition | Heavily congested condition | Moderate traffic condition | Light traffic condition

Interchange Ramps (2040 Build PM)

Interchange	Link ID	Ramp Description	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %
Seminary Road Interchange	16	I-395 NB Off-Ramp at Seminary Road	884	864	-20	-2%
	49	I-395 NB On-Ramp at Seminary Road	1085	1028	-58	-5%
	46	I-395 SB Off-Ramp at Seminary Road	962	963	2	0%
	37	I-395 SB On-Ramp at Seminary Road	1846	1707	-140	-8%
	44	I-395 SB HOV Off-Ramp at Seminary Road	243	257	14	6%
Duke Street/Little River Turnpike Interchange	140020	I-395 NB to EB Duke Street	637	636	-1	0%
	140018	I-395 NB to WB Duke Street	439	446	6	1%
	140015	EB Little River Turnpike to I-395 NB	549	544	-5	-1%
	140035	WB Duke Street to I-395 NB	889	873	-16	-2%
	140011	I-395 SB to Little River Turnpike	1664	1648	-17	-1%
	137	EB Little River Turnpike to I-395 SB	611	583	-28	-5%
	140014	WB Little River Turnpike to I-395 SB	698	685	-13	-2%
Turkeycock Run Ramps	140055	I-395 SB GP to I-395 SB HOV	1699	1644	-55	-3%
	140201	I-395 SB HOV to I-395 SB GP	201	191	-10	-5%
	134	I-395 SB HOV and Duke Ramp to I-395 SB GP	812	779	-33	-4%
Edsall Road Interchange	140050	I-395 NB to EB Edsall Road	843	852	9	1%
	140049	I-395 NB to WB Edsall Road	542	560	18	3%
	140061	EB Edsall Road to I-395 NB	534	529	-4	-1%
	140288	WB Edsall Road to I-395 NB	287	277	-9	-3%
	140048	I-395 SB to EB Edsall Road	228	213	-14	-6%
	140041	I-395 SB to WB Edsall Road	626	609	-17	-3%
	140286	Edsall Road to I-395 SB	1340	1365	25	2%
Springfield Interchange	140190	I-495 Outer GP to I-95 SB GP	3045	3030	-15	-1%
	140157	I-495 Outer GP to I-395 NB GP	2064	2078	14	1%
	160109	I-495 Outer HOT to I-95 SB HOV	868	875	6	1%
	140296	I-495 Inner GP to I-95 SB GP	1570	1563	-7	0%
	375	I-495 Inner GP to I-395 NB GP	783	797	15	2%
	140102	I-395 SB GP to I-495 Inner GP	1920	1917	-2	0%
	140082	I-395 SB GP to Franconia	2096	2067	-28	-1%
	140110	I-395 SB GP to I-495 Outer GP	766	759	-8	-1%
	160119	I-395 SB HOV to I-495 (inner and outer)	951	927	-24	-3%

Intersections (2040 Build PM)

Node	Intersection	Movement	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Avg. Delay (sec)	LOS	Intersection Delay (sec)	Intersection LOS	Storage (ft)	Avg. Queue (ft)	Max. Queue (ft)
1	Seminary Rd & I-395 SB Off-Ramp	WBL	388	386	-2	-1%	4.7	A	22.0	C	200	0	69
		WBT	844	861	17	2%	1.6	A			200	26	308
		SBT	443	447	5	1%	76.1	E			1970	118	383
2	Seminary Rd & I-395 SB On-Ramp	EBT	882	809	-73	-8%	79.7	E	42.4	D	580	1928	2599
		SBL	552	547	-5	-1%	8.0	A			267	10	203
		SBT	278	285	7	2%	2.2	A			230	9	200
3	Seminary Rd & I-395 NB Off-Ramp	EBL	721	666	-55	-8%	10.3	B	25.1	C	275	41	340
		EBT	714	686	-28	-4%	6.7	A			275	41	340
		NBT	610	607	-3	-1%	68.2	E			750	145	572
		NBR	274	261	-13	-5%	11.2	B			112	5	142
4	Seminary Rd & I-395 NB On-Ramp	WBT	380	381	0	0%	123.1	F	30.2	C	290	205	738
		NBL	610	612	2	0%	4.4	A			205	1	185
		NBT	721	663	-58	-8%	0.7	A			205	2	185
5	Seminary Rd & I-395 HOV Ramp	WBT	990	993	3	0%	2.2	---	---	---	---	---	---
		SBR	243	257	15	6%	15.4	C			125	26	261
6	Seminary Rd & Mark Center Ave	EBL	36	34	-3	-8%	124.8	F	89.6	F	195	17	103
		EBT	2200	2139	-62	-3%	104.9	F			605	1423	2224
		EBR	36	31	-6	-15%	110.0	F			380	1395	2195
		WBL	77	78	0	0%	80.1	F			2200	41	189
		WBT	1675	1719	44	3%	32.8	C			950	0	36
		WBR	208	201	-7	-3%	22.0	C			800	0	36
		NBL	109	88	-21	-20%	141.2	F			650	1375	1649
		NBT	17	14	-3	-16%	135.5	F			650	1375	1649
		NBR	1253	1067	-186	-15%	88.4	F			650	1375	1649
		SBL	299	249	-50	-17%	304.0	F			200	517	636
		SBT	62	47	-15	-24%	339.0	F			200	517	636
		SBR	53	44	-9	-17%	276.1	F			200	517	636
7	Seminary Rd & Kenmore Ave	EBT	1484	1397	-87	-6%	---	---	---	---	---	---	---
		EBR	384	367	-17	-4%	---	---			---	---	---
		WBT	1305	845	-459	-35%	---	---			---	---	---
		WBR	82	83	1	1%	---	---			---	---	---
		NBR	125	131	6	5%	22.9	C			1320	18	183
		SBR	395	133	-263	-66%	30.1	D			510	93	494
8	Little River Tpk & Beauregard St	EBL	396	390	-5	-1%	116.8	F	69.2	E	385	208	905
		EBT	1587	1556	-31	-2%	71.7	E			670	435	1431
		EBR	45	44	-1	-1%	75.8	E			670	435	1431
		WBL	95	99	4	4%	144.1	F			225	166	449
		WBT	1611	1479	-132	-8%	31.9	C			315	100	361
		WBR	847	760	-87	-10%	12.5	B			150	100	361
		NBL	113	71	-42	-37%	378.0	F			145	480	717
		NBT	170	106	-64	-38%	381.1	F			750	599	715
		NBR	187	115	-72	-38%	237.5	F			750	599	715
		SBL	984	980	-4	0%	68.1	E			500	1028	1683
		SBT	130	131	1	1%	60.7	E			640	1028	1683
		SBR	326	327	2	1%	56.4	E			510	1028	1683

Intersections (2040 Build PM)

Node	Intersection	Movement	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Avg. Delay (sec)	LOS	Intersection Delay (sec)	Intersection LOS	Storage (ft)	Avg. Queue (ft)	Max. Queue (ft)
9	Little River Tpk & Oasis Dr	EBT	2711	2648	-62	-2%	6.7	A	18.2	B	300	83	416
		EBR	26	26	0	-1%	3.7	A			300	83	416
		WBL	319	312	-8	-2%	61.5	E			235	120	758
		WBT	2383	2367	-17	-1%	24.7	C			500	120	846
		WBR	491	492	0	0%	14.2	B			500	49	687
		NBR	211	209	-2	-1%	40.3	D			145	56	324
		SBR	175	174	-1	0%	14.0	B			250	55	344
10	Duke St & S Walker St	EBT	2314	2242	-72	-3%	38.7	D	57.2	E	615	268	1034
		EBR	749	737	-12	-2%	10.9	B			615	0	0
		WBL	156	148	-8	-5%	225.6	F			615	553	1191
		WBT	2182	2175	-7	0%	46.2	D			990	553	1191
		NBL	956	918	-38	-4%	128.8	F			340	819	1108
		NBR	203	188	-15	-7%	70.8	E			470	4	79
		SBL	82	81	-1	-1%	67.3	E			230	160	397
		SBT	82	83	1	1%	95.6	F			210	160	397
		SBR	356	345	-11	-3%	63.9	E			205	160	397
11	Edsall Rd & Mitchell St	EBL	6	5	-1	-18%	23.7	C	9.8	A	120	0	16
		EBT	1372	1373	1	0%	18.3	B			330	42	441
		EBR	33	33	1	2%	2.3	A			330	0	22
		WBL	212	216	4	2%	27.9	C			200	13	176
		WBT	1812	1767	-45	-2%	1.6	A			300	5	111
		WBR	69	64	-5	-7%	2.4	A			300	5	111
		NBL	16	16	0	-2%	50.1	D			195	6	70
		NBT	9	8	0	-2%	48.4	D			195	6	70
		NBR	454	462	8	2%	4.8	A			225	4	227
		SBL	11	11	-1	-6%	54.8	D			100	6	67
		SBT	9	10	1	9%	47.8	D			100	6	67
		SBR	10	8	-2	-18%	10.7	B			100	6	67
12	Edsall Rd & Cherokee Ave	EBL	68	64	-4	-6%	34.8	C	14.8	B	90	14	368
		EBT	1770	1782	12	1%	8.7	A			220	84	505
		WBT	1965	1941	-24	-1%	12.2	B			500	65	597
		WBR	310	310	0	0%	10.4	B			500	0	0
		SBL	618	618	0	0%	40.9	D			215	100	391
		SBR	133	124	-9	-6%	12.7	B			215	3	91
13	Edsall Rd & Bren Mar Dr	EBT	1872	1798	-74	-4%	35.1	D	33.1	C	670	593	1740
		EBR	168	161	-8	-5%	35.0	D			670	540	1674
		WBL	35	38	2	7%	62.4	E			275	14	94
		WBT	1174	1171	-3	0%	8.2	A			300	30	272
		NBL	524	512	-12	-2%	69.2	E			540	270	729
		NBT	133	129	-4	-3%	77.8	E			540	270	729
		NBR	99	99	-1	-1%	31.0	C			240	270	729
14	Edsall Rd & Sullivan Pl Dr	EBT	1885	1798	-87	-5%	35.1	---	---	---	---	---	---
		EBR	86	79	-7	-9%	39.9	---			---	---	---
		NBR	16	15	-1	-7%	7.2	A			220	0	28

Intersections (2040 Build PM)

Node	Intersection	Movement	Demand (veh/hr)	Thruput (veh/hr)	Δ	Δ %	Avg. Delay (sec)	LOS	Intersection Delay (sec)	Intersection LOS	Storage (ft)	Avg. Queue (ft)	Max. Queue (ft)
15	Edsall Rd & Bloomfield Dr	EBT	1800	1805	5	0%	5.0	A	8.0	A	250	23	588
		EBR	87	90	3	3%	1.7	A			250	23	588
		WBL	100	94	-6	-6%	23.6	C			200	3	63
		WBT	1199	1195	-3	0%	3.6	A			200	11	207
		NBL	164	162	-2	-1%	53.7	D			170	64	364
		NBR	108	109	2	2%	29.4	C			170	13	226
16	Edsall Rd & Beryl Rd	EBT	1682	1696	14	1%	1.2	A	6.0	A	195	15	301
		EBR	225	218	-7	-3%	1.3	A			195	15	301
		WBL	20	17	-3	-14%	3.5	A			165	0	28
		WBT	1152	1146	-6	-1%	4.5	A			165	12	204
		NBL	146	144	-2	-1%	74.5	E			290	78	284
		NBR	25	25	1	2%	52.2	D			290	78	284
17	Seminary Rd & HOV BRAC Ramp	EBT	880	827	-53	-6%	8.0	A	5.0	A	1050	3	93
		EBR	423	391	-32	-8%	6.9	A			700	3	93
		WBL	253	251	-2	-1%	6.6	A			1900	24	357
		WBR	702	726	24	3%	0.1	A			1900	0	0
18	Little River Tpk & I-395 SB Off-Ramp	EBT	1762	1733	-29	-2%	6.7	A	14.4	B	780	39	361
		WBT	2428	2415	-13	-1%	17.9	B			950	170	871
		SBL	746	730	-16	-2%	34.4	C			660	87	341
		SBR	766	764	-3	0%	1.7	A			920	14	622
19	Edsall Rd & I-395 SB On-Ramp	EBT	1106	1108	2	0%	13.1	B	7.9	A	975	43	380
		EBR	748	763	14	2%	1.5	A			650	0	0
		WBL	592	603	12	2%	27.4	C			650	84	567
		WBT	1649	1643	-6	0%	0.2	A			900	0	0
20	Duke St U-turn	EB U-turn	83	80	-3	-4%	47.4	D	5.7	A	180	21	155
		WBT	2604	2576	-28	-1%	4.4	A			550	21	394

HNTB Corporation
2900 South Quincy Street
Suite 600
Arlington, VA 22206