INTERSTATE 395
EXPRESS LANES
NORTHERN EXTENSION

TRAFFIC & TRANSPORTATION

TECHNICAL REPORT | SEPTEMBER 2016

VDOT

U.S. Department of Transportation
Federal Highway Administration

395
ExpressLanes

INTERSTATE 395 EXPRESS LANES NORTHERN EXTENSION

Traffic and Transportation Technical Report

City of Alexandria, and Arlington and Fairfax Counties
Project Number: 0395-969-205, P101; UPC: 108313
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Table of Contents

1. Introduction 1-1
1.1 Background 1-1
1.2 Study Area 1-2
2. Existing Conditions 2-1
2.1 I-395 Corridor 2-1
2.1.1 HOV Operations and Access Points 2-5
2.1.2 Ramp Metering 2-6
2.2 Interchanges 2-7
2.2.1 Edsall Road (Route 648) 2-7
2.2.2 Turkeycock Run 2-7
2.2.3 Little River Turnpike/ Duke Street (Route 236) 2-8
2.2.4 Seminary Road (Route 420) 2-8
2.2.5 King Street (Route 7) 2-8
2.2.6 Quaker Lane/ Shirlington Road (Route 402) 2-8
2.2.7 Glebe Road (Route 120) 2-9
2.2.8 Washington Boulevard (Route 27) 2-9
2.2.9 Eads Street 2-9
2.2.10 Jefferson Davis Highway (US Route 1) 2-9
2.2.11 Boundary Channel Drive/ Long Bridge Drive 2-9
2.2.12 George Washington Memorial Parkway 2-10
2.2.13 14th Street SW 2-10
2.3 Transit and Commuter Facilities 2-10
2.4 Traffic Volumes, Speeds, and Travel Patterns 2-11
2.4.1 Travel Patterns 2-11
2.4.2 Vehicle Occupancy 2-17
2.4.3 Data Collection 2-19
2.4.3.1 Traffic Volumes 2-19
2.4.3.2 Speeds 2-19
2.4.3.3 Travel Time Runs 2-25
2.4.4 Daily Traffic Volumes 2-28
2.4.5 Peak Period Traffic Volumes 2-35
2.5 Traffic Operations 2-44
2.5.1 Traffic Operations Model Development 2-44

2.5.2 Traffic Operations Results 2-44
2.5.2.1 Freeway Operations 2-44
2.5.2.2 Arterial Operations 2-57
2.5.2.3 Eads Street Interchange 2-59
3. Alternatives Considered 3-1
3.1 Alternatives Development and Screening Process 3-1
3.2 Alternatives Not Retained for Evaluation 3-3
3.3 Alternatives Retained for Evaluation 3-3
3.3.1 No Build Alternative 3-3
3.3.2 Build Alternative 3-3
3.3.2.1 Proposed Access Points to the HOT Lanes 3-10
3.3.2.2 Eads Street Interchange 3-11
3.3.2.2.1 Eads Street Initial Interchange Options Considered 3-11
3.3.2.2.2 Eads Street Refined Interchange Options Considered 3-13
3.3.2.3 Pentagon Interim Improvements 3-18
4. Safety and Crash Analysis 4-1
4.1 Qualitative Safety Analysis 4-1
4.1.1 I-395 General Purpose and HOV/HOT Lane Crashes 4-1
4.1.2 I-395 Ramp Crashes 4-25
4.2 Quantitative Safety Analysis 4-27
4.2.1 HOV Lane Conversion from Two to Three Lanes 4-27
4.2.2 Eads Street Interchange 4-30
5. Future Conditions 5-1
5.1 No Build Projects 5-1
5.1.1 I-395 HOV / Transit Ramp at Seminary Road 5-1
5.1.2 12th Street Extension 5-1
5.1.3 I-395 4th Lane South Widening – Duke Street to Edsall Road 5-1
5.1.4 Seminary Road and Beauregard Street Ellipse 5-2
5.1.5 Boundary Channel Drive Interchange 5-3
5.1.6 Army Navy Drive Complete Streets 5-3
5.1.7 Arlington National Cemetery Southern Expansion Project and Associated Roadway Realignment 5-3
5.1.8 Pentagon Master Plan South Parking Lot Improvements 5-3
5.2 Land Use and Socioeconomic Trends 5-6
5.3 Forecasting Methodology and Validation 5-9

5.4 Future Traffic Volumes....5-11
5.4.1 Overview of MWCOG Post Processor Forecasts....5-11
5.4.2 2040 No Build Peak Hour Traffic Volumes....5-11
5.4.3 2040 No Build Weekday Daily Traffic Volumes....5-19
5.4.4 2040 Build Peak Hour Traffic Volumes....5-26
5.4.5 2040 Build Weekday Daily Traffic Volumes....5-33
5.5 Future Traffic Operations....5-40
5.5.1 Freeway Operations....5-40
5.5.1.1 Travel Times and Speeds....5-40
5.5.1.2 Person Throughput....5-60
5.5.2 Arterial Operations....5-62
5.5.3 Eads Street Interchange....5-65
6. References....6-1

Table of Figures

Figure 1-1: NEPA Study Area....1-2
Figure 1-2: Traffic Study Areas....1-4
Figure 2-1: Existing Conditions Roadway Network....2-4
Figure 2-2: I-395 Historical Average Weekday Traffic Volumes....2-12
Figure 2-3: AM Peak Period (5 AM – 10 AM) Vehicle Trips – North of Glebe Road....2-18
Figure 2-4: AM Peak Period (5 AM – 10 AM) Person Trips – North of Glebe Road....2-18
Figure 2-5: Northbound I-395 General Purpose Lane Speeds....2-21
Figure 2-6: Southbound I-395 General Purpose Lane Speeds....2-22
Figure 2-7: Northbound I-395 HOT/HOV Lane Speeds....2-23
Figure 2-8: Southbound I-395 HOT/HOV Lane Speeds....2-24
Figure 2-9: Northbound I-395 General Purpose Lanes Travel Times – AM Peak Hour....2-26
Figure 2-10: Northbound I-395 HOV/HOT Lanes Travel Times – AM Peak Hour....2-26
Figure 2-11: Southbound I-395 General Purpose Lanes Travel Times – PM Peak Hour....2-27
Figure 2-12: Southbound I-395 HOV/HOT Lanes Travel Times – PM Peak Hour....2-27
Figure 2-13: Existing (2015) Average Weekday Daily Traffic Volumes – Northbound I-395....2-28
Figure 2-14: Existing (2015) Average Weekday Daily Traffic Volumes – Southbound I-395....2-29
Figure 2-15a: Existing (2015) Average Weekday Daily Traffic Volumes....2-30
Figure 2-15b: Existing (2015) Average Weekday Daily Traffic Volumes....2-31

Figure 2-15c: Existing (2015) Average Weekday Daily Traffic Volumes 2-32
Figure 2-15d: Existing (2015) Average Weekday Daily Traffic Volumes 2-33
Figure 2-15e: Existing (2015) Average Weekday Daily Traffic Volumes 2-34
Figure 2-16: Northbound I-395 General Purpose Lanes – South of Seminary Road AM Peak Period - Traffic Flow Patterns 2-35
Figure 2-17: Southbound I-395 General Purpose Lanes – North of King Street PM Peak Period - Traffic Flow Patterns 2-36
Figure 2-18: Existing (2015) Northbound AM Peak Hour Traffic Volumes 2-37
Figure 2-19: Existing (2015) Southbound PM Peak Hour Traffic Volumes 2-38
Figure 2-20a: Existing (2015) Peak Hour Traffic Volumes 2-39
Figure 2-20b: Existing (2015) Peak Hour Traffic Volumes 2-40
Figure 2-20c: Existing (2015) Peak Hour Traffic Volumes 2-41
Figure 2-20d: Existing (2015) Peak Hour Traffic Volumes 2-42
Figure 2-20e: Existing (2015) Peak Hour Traffic Volumes 2-43
Figure 2-21a: Existing AM Peak Period (6 - 7 AM) Travel Times 2-47
Figure 2-21b: Existing AM Peak Period (7 - 8 AM) Travel Times 2-48
Figure 2-21c: Existing AM Peak Period (8 - 9 AM) Travel Times 2-49
Figure 2-21d: Existing AM Peak Period (9 - 10 AM) Travel Times 2-50
Figure 2-22a: Existing PM Peak Period (3 - 4 PM) Travel Times 2-51
Figure 2-22b: Existing PM Peak Period (4 - 5 PM) Travel Times 2-52
Figure 2-22c: Existing PM Peak Period (5 - 6 PM) Travel Times 2-53
Figure 2-22d: Existing PM Peak Period (6 - 7 PM) Travel Times 2-54
Figure 2-23: Existing AM Peak Period Speed Comparison 2-55
Figure 2-24: Existing PM Peak Period Speed Comparison 2-56
Figure 3-1: Alternatives Development and Screening Process 3-1
Figure 3-2: Express Lanes Network in Northern Virginia 3-2
Figure 3-3: Build Alternative Section 1 3-4
Figure 3-4: Build Alternative Section 2 3-5
Figure 3-5: Build Alternative Section 3 3-6
Figure 3-6: Build Alternative Section 4 3-7
Figure 3-7: Build Alternative Section 5 3-8
Figure 3-8: Existing and Proposed Typical Section 3-9

Figure 3-9: Pentagon Master Plan South Parking Lot Improvements 3-12
Figure 3-10: Single Reversible Eads Street Ramp 3-13
Figure 3-11: Dedicated Bus Lane and Right Turn at Eads Ramp 3-14
Figure 3-12: Diverging Diamond at Eads Street 3-16
Figure 3-13: Dual Reversible Eads Ramps 3-17
Figure 3-14: Pentagon South Parking Lot Interim Improvements 3-19
Figure 4-1: Crashes by Year by Facility 4-5
Figure 4-2: Weekday (Monday – Friday) Crashes by Time of Day (2012 – 2015) 4-5
Figure 4-3: Crashes by 15-Minute Time Period Intervals (2012 – 2015) – 5:00 AM to 11:00 AM Northbound I-395 Crashes 4-6
Figure 4-4: Crashes by 15-Minute Time Period Intervals (2012 – 2015) – 2:30 PM to 8:00 PM Southbound I-395 Crashes 4-6
Figure 4-5: Crash Severity by Crash Type – General Purpose Lanes (Sheet 1 of 5) 4-8
Figure 4-5: Crash Severity by Crash Type – General Purpose Lanes (Sheet 2 of 5) 4-9
Figure 4-5: Crash Severity by Crash Type – General Purpose Lanes (Sheet 3 of 5) 4-10
Figure 4-5: Crash Severity by Crash Type – General Purpose Lanes (Sheet 4 of 5) 4-11
Figure 4-5: Crash Severity by Crash Type – General Purpose Lanes (Sheet 5 of 5) 4-12
Figure 4-6: Crash Severity by Crash Type – HOV/HOT Lanes (Sheet 1 of 5) 4-13
Figure 4-6: Crash Severity by Crash Type – HOV/HOT Lanes (Sheet 2 of 5) 4-14
Figure 4-6: Crash Severity by Crash Type – HOV/HOT Lanes (Sheet 3 of 5) 4-15
Figure 4-6: Crash Severity by Crash Type – HOV/HOT Lanes (Sheet 4 of 5) 4-16
Figure 4-6: Crash Severity by Crash Type – HOV/HOT Lanes (Sheet 5 of 5) 4-17
Figure 4-7: Total Crash Rate Summary by Mile Point 4-21
Figure 4-8: Total Injury Rate Summary by Mile Point 4-22
Figure 5-1: Pentagon Master Plan South Parking Lot Improvements 5-5
Figure 5-2: Population Growth by County / City within Traffic Study Area 5-6
Figure 5-3: Household Growth by County / City within Traffic Study Area 5-7
Figure 5-4: Employment Growth by County / City within Traffic Study Area 5-7
Figure 5-5: Existing (2015) and 2040 No Build AM Peak Hour – Northbound I-395 5-12
Figure 5-6: Existing (2015) and 2040 No Build PM Peak Hour – Southbound I-395 5-13
Figure 5-7a: 2040 No Build Peak Hour Traffic Volumes 5-14
Figure 5-7b: 2040 No Build Peak Hour Traffic Volumes 5-15

Figure 5-7c: 2040 No Build Peak Hour Traffic Volumes....5-16
Figure 5-7d: 2040 No Build Peak Hour Traffic Volumes....5-17
Figure 5-7e: 2040 No Build Peak Hour Traffic Volumes....5-18
Figure 5-8: Existing (2015) and 2040 No Build Weekday Daily Traffic Volumes–Northbound I-395..5-19
Figure 5-9: Existing (2015) and 2040 No Build Weekday Daily Traffic Volumes–Southbound I-395..5-20
Figure 5-10a: 2040 No Build Weekday Daily Traffic Volumes....5-21
Figure 5-10b: 2040 No Build Weekday Daily Traffic Volumes....5-22
Figure 5-10c: 2040 No Build Weekday Daily Traffic Volumes....5-23
Figure 5-10d: 2040 No Build Weekday Daily Traffic Volumes....5-24
Figure 5-10e: 2040 No Build Weekday Daily Traffic Volumes....5-25
Figure 5-11: Existing (2015), 2040 No Build and 2040 Build AM Peak Hour - Northbound I-395....5-26
Figure 5-12: Existing (2015), 2040 No Build and 2040 Build PM Peak Hour - Southbound I-395....5-27
Figure 5-13a: 2040 Build Peak Hour Traffic Volumes....5-28
Figure 5-13b: 2040 Build Peak Hour Traffic Volumes....5-29
Figure 5-13c: 2040 Build Peak Hour Traffic Volumes....5-30
Figure 5-13d: 2040 Build Peak Hour Traffic Volumes....5-31
Figure 5-13e: 2040 Build Peak Hour Traffic Volumes....5-32
Figure 5-14: Existing (2015), 2040 No Build Weekday and 2040 Build Daily Traffic Volumes – Northbound I-395....5-33
Figure 5-15: Existing (2015), 2040 No Build Weekday and 2040 Build Daily Traffic Volumes – Southbound I-395....5-34
Figure 5-16a: 2040 Build Weekday Daily Traffic Volumes....5-35
Figure 5-16b: 2040 Build Weekday Daily Traffic Volumes....5-36
Figure 5-16c: 2040 Build Weekday Daily Traffic Volumes....5-37
Figure 5-16d: 2040 Build Weekday Daily Traffic Volumes....5-38
Figure 5-16e: 2040 Build Weekday Daily Traffic Volumes....5-39
Figure 5-17: Northbound Overall Travel Time Summary - AM Peak Period....5-44
Figure 5-18: Southbound Overall Travel Time Summary - PM Peak Period....5-45
Figure 5-19a: AM Peak Period (6 – 7 AM) Travel Times....5-46
Figure 5-19b: AM Peak Period (7 – 8 AM) Travel Times....5-47
Figure 5-19c: AM Peak Period (8 – 9 AM) Travel Times....5-48
Figure 5-19d: AM Peak Period (9 – 10 AM) Travel Times....5-49

Figure 5-20a: PM Peak Period (3 – 4 PM) Travel Times 5-50
Figure 5-20b: PM Peak Period (4 – 5 PM) Travel Times 5-51
Figure 5-20c: PM Peak Period (5 – 6 PM) Travel Times 5-52
Figure 5-20d: PM Peak Period (6 – 7 PM) Travel Times 5-53
Figure 5-21a: AM Peak Period Speed Comparison – Northbound General Purpose Lanes 5-54
Figure 5-21b: AM Peak Period Speed Comparison – Southbound General Purpose Lanes 5-55
Figure 5-22: AM Peak Period Speed Comparison – HOV/HOT Lanes 5-56
Figure 5-23a: PM Peak Period Speed Comparison – Northbound General Purpose Lanes 5-57
Figure 5-23b: PM Peak Period Speed Comparison – Southbound General Purpose Lanes 5-58
Figure 5-24: PM Peak Period Speed Comparison – HOV/HOT Lanes 5-59
Figure 5-25: Northbound AM Peak Period Person Throughput Comparison 5-61
Figure 5-26: Southbound PM Peak Period Person Throughput Comparison 5-61
Figure 5-27: Pentagon South Parking Lot Interim Improvements 5-68

Table of Tables

Table 2-1: HOV Lane Operations 2-5
Table 2-2: HOV Lane Access Points 2-6
Table 2-3: Ramp Meter Locations 2-7
Table 2-4: Informal Rideshare/Slugging Demand Survey 2-11
Table 2-5: I-395 @ Turkeycock Run: Origins and Destinations on I-395 at Southern End of Corridor 2-13
Table 2-6: I-395 North of Glebe Road: Origins and Destinations on I-395 at Mid-Point of Corridor 2-14
Table 2-7: I-395 South of George Washington Memorial Parkway: Origins and Destinations on I-395 at Northern End of Corridor 2-15
Table 2-8: Destination and Origin of Trips by County / City on Northbound I-395 2-16
Table 2-9: Orgin and Destination of Trips by County / City of Southbound I-395 2-17
Table 2-10: Existing Travel Time Summary 2-25
Table 2-11: Level of Service Criteria for Intersections (HCM 2010) 2-57
Table 2-12: Existing (2015) Intersection LOS and Delay Summary 2-58
Table 3-1: Access Point Modifications 3-10
Table 4-1: I-395 Crash Summary 4-4
Table 4-2: Crash and Injury Rate (per 100 million VMT) Comparison by Quarter-Mile Segment 4-20
Table 4-3: I-395 Critical Crash Locations based on Crash Frequency 4-23

Table 4-4: I-395 Critical Crash Locations based on Crash Rate....4-24
Table 4-5: I-395 Ramp Crash Frequency Summary (January 2012 – December 2015)....4-26
Table 4-6: Predicted Crash Frequency/CMF Summary for I-395 HOV Lanes from Turkeycock Run to Eads Street....4-30
Table 5-1: No Build Improvements....5-2
Table 5-2: MWCOG Demographic Inputs (Source: MWCOG version 2.3.57a)....5-6
Table 5-3: Forecasted Population by Jurisdiction....5-8
Table 5-4: Forecasted Households by Jurisdiction....5-8
Table 5-5: Forecasted Employment by Jurisdiction....5-9
Table 5-5: 2040 No Build and Build Conditions Intersection LOS and Delay Summary....5-64
Table 5-6: 2020 No Build and Build Conditions Intersection LOS and Delay Summary – Eads Street Interchange....5-69

List of Appendices

Appendix A: Traffic Data Collection Locations

Appendix B: Existing (2015) Intersection Peak Hour Volumes

Appendix C: VISUM/VISSIM Calibration Memorandum

Appendix D: Existing Conditions Speed and Density Maps

Appendix E: Crash Frequency Histograms

Appendix F: Travel Demand Modeling Methodology and Assumptions Memorandum

Appendix G: Travel Demand Model Validation and Calibration Memorandum

Appendix H: 2040 No Build Intersection Peak Hour Traffic Volumes

Appendix I: 2040 No Build Conditions Speed and Density Maps

Appendix J: 2040 Build Intersection Peak Hour Traffic Volumes

Appendix K: 2040 Build Conditions Speed and Density Maps

ACRONYM LIST

American Association of State Highway and Transportation Officials	AASHTO
Average annual weekday traffic volumes	AAWDT
Capital Improvement Program	CIP
Closed circuit television cameras	CCTV
Constrained Long Range Plan	CLRP
Crash Modification Factor	CMF
Department of Defense	DoD
District of Columbia Department of Transportation	DDOT
Enhanced Interchange Safety Analysis Tool	ISATe
Environmental Assessment	EA
Federal Highway Administration	FHWA
Fiscal Year	FY
General Purpose	GP
High Occupancy Toll	HOT
High Occupancy Vehicle	HOV
Highway Capacity Manual	HCM
Highway Safety Manual	HSM
Interactive Highway Safety Design Model	IHSDM
Interchange Modification Report	IMR
Lane Use Management System	LUMS
Level of Service	LOS
Linear Referencing System	LRS
Measures of Effectiveness	MOEs
Metropolitan Washington Council of Governments	MWCOG
Mile Post	MP
Multiple Vehicle Crashes	MV
National Environmental Policy Act	NEPA
National Highway System	NHS
Northbound	NB
Pentagon Force Protection Agency	PFPA

Pentagon Transit Center	PTC
Property Damage Only	PDO
Public-Private Transportation Act	PPTA
Regional Integrated Transportation Information Systems	RITIS
Single Vehicle Crashes	SV
Six-Year Improvement Plan	SYIP
Southbound	SB
Strategic Highway Network	STRAHNET
Tableau-Crash Analysis Tool	T-CAT
Transit Development Plan	TDP
Transportation Demand Management	TDM
Traffic Management System	TMS
Traffic Operations and Safety Analysis Manual	TOSAM
Transportation Improvement Plan	TIP
Vehicle-Miles Traveled	VMT
Virginia Department of Transportation	VDOT

1. INTRODUCTION

The Virginia Department of Transportation (VDOT), in cooperation with the Federal Highway Administration (FHWA), has initiated a study for the Interstate 395 (I-395) Express Lanes Project (Northern High Occupancy Toll [HOT] Lanes) to extend the I-95 Express Lanes in the City of Alexandria, and Arlington and Fairfax Counties, Virginia. Pursuant to the National Environmental Policy Act of 1969, as amended, (NEPA) and in accordance with FHWA regulations, an Environmental Assessment (EA) has been prepared to analyze and document the potential social, economic, and environmental effects associated with the proposed transportation improvements.

To support the EA, this Traffic and Transportation Technical Report was prepared. The purpose of this report is to document:

- Existing traffic operations and safety conditions within the study area;
- Forecasted traffic volumes for the alternatives under consideration;
- Future traffic operations and safety conditions for the alternatives under consideration; and
- Technical information in support of the development of alternatives as discussed in the ***Alternatives Development Technical Report*** (VDOT, 2016).

1.1 BACKGROUND

In 1995, the Public-Private Transportation Act (PPTA) was signed into law and was amended and re-enacted in 2005. PPTA allows for private entities to solicit VDOT to develop and/or operate and maintain transportation facilities that VDOT determines demonstrates a need. In November 2005, the conceptual proposal submitted by Fluor and Transurban was selected by the PPTA Advisory Panel. As proposed at that time, the project improvements would expand the HOV system in the I-95/I-395 corridor and apply the HOT concept. As a result of this action, VDOT, in cooperation with FHWA, initiated environmental analysis on the following proposal:

- Convert the existing two-lane HOV facility to three HOT lanes along I-395 from Eads Street to just south of Route 234 Interchange near Dumfries;
- Construct two new HOT lanes in the median from the existing terminus south of Route 234 to just north of Route 610 (Garrisonville Road);
- Add new entry/exit points between the general purpose lanes and the HOT lanes and modify existing entry/exit points; and
- Build new structures associated with the Lorton Bus-rail transfer station, flyovers, and replace existing structures at Telegraph Road over I-95 and the Franconian-Springfield pedestrian bridge.

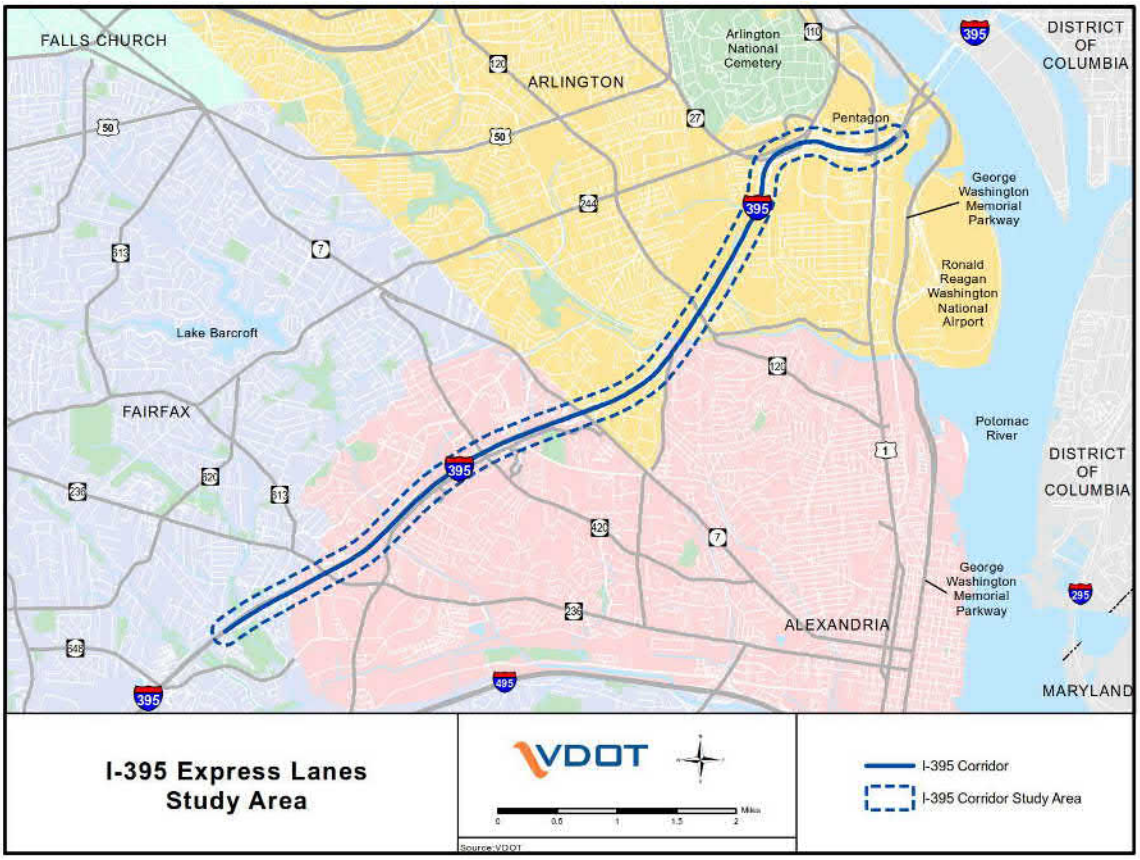
In January 2009, FHWA issued a Categorical Exclusion (CE) for the project. In February 2011, VDOT reduced the project scope by eliminating approximately 6 miles of HOT lanes on I-395 including modifications to the existing interchanges. Instead, to ease traffic on the I-95/I-395 corridor, VDOT announced plans for a new I-95 HOT Lanes Project in 2011. VDOT prepared an EA to assess HOT lanes on I-95 from Garrisonville Road in Stafford County to Edsall Road in Fairfax County and link those lanes directly to the new I-495 HOT lanes already under construction. Upon review of the Revised EA and supporting documentation, FHWA issued a Finding of No Significant Impact in December 2011.

In 2012, VDOT and 95 Express Lanes, LLC (95 Express) entered into a Comprehensive Agreement for the development of the I-95 Express Lanes. The I-95 Express Lanes project was completed in December 2014. The Comprehensive Agreement allows for the future development of the extension of the I-95 Express Lanes along the I-395 corridor similar to the limits originally proposed in 2005. In 2015, VDOT signed a Development Framework Agreement with 95 Express to extend the I-395 Express Lanes as a Concessionaire's Enhancement under the Comprehensive Agreement. The Development Framework Agreement outlined the responsibilities of both VDOT and the Concessionaire. The Agreement notes that improvements would be built largely within VDOT's existing right of way, VDOT and 95 Express would work together to finalize the scope, finance plan and agreement, and 95 Express would fund an annual transit payment.

1.2 STUDY AREA

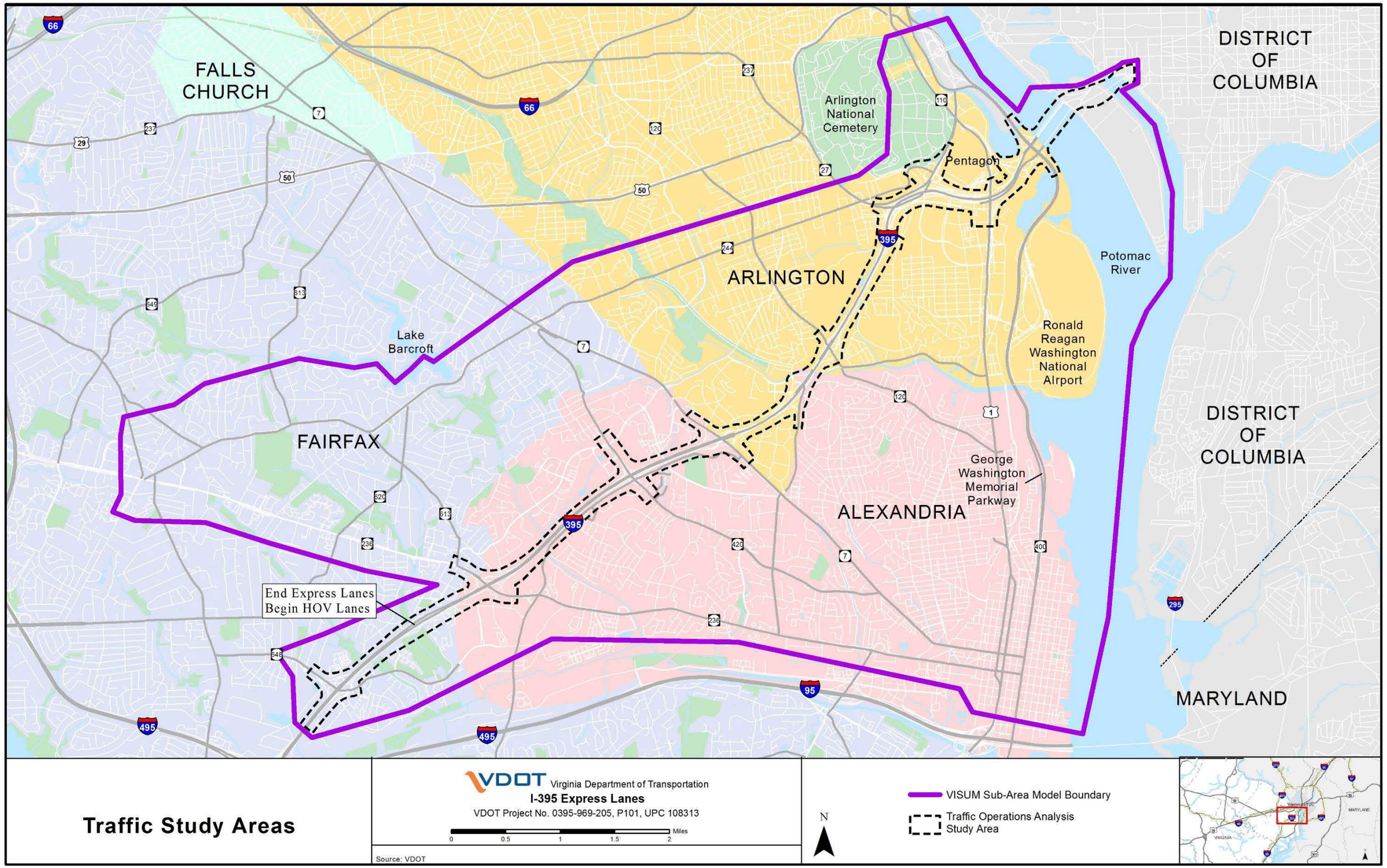
The study area for the Environmental Assessment encompasses approximately eight miles of the I-395 corridor from Turkeycock Run in Fairfax County to the vicinity of Eads Street near the Pentagon in Arlington County, as shown in **Figure 1-1**. Transition areas extending slightly beyond these termini are included in order to connect the proposed improvements with the existing facility on either end. Crossroads and interchange areas also are included in the study area, as well as lands adjacent to the corridor.

Figure 1-1: NEPA Study Area



The traffic study area encompasses approximately ten miles of existing I-395 from south of the Edsall Road interchange to the 12th Street Expressway in Washington, D.C. which is located just north of the entry and exit points of the existing HOV facility along I-395. The study area along the roadways with access to and from I-395 generally includes one major signalized intersection on either side of the interstate and all general purpose and HOV ramps serving I-395. **Figure 1-2** depicts the traffic operations analysis study area and the sub-area model boundary. **Appendix A** includes aerial mapping depicting the specific study area limits along each study area roadway.

Figure 1-2: Traffic Study Areas



Traffic Study Areas

2. EXISTING CONDITIONS

2.1 I-395 CORRIDOR

The I-395 corridor begins at the I-95 / I-495 Capital Beltway Interchange and ends at the New York Avenue NW (Route 50) intersection in northwest Washington, D.C., an approximate distance of 14 miles. I-395 is part of the National Highway System (NHS)[1] and the Strategic Highway Network (STRAHNET)[2]. Additionally, I-395 is the primary north-south interstate highway into Washington, D.C. from Virginia serving both local, commuter, and regional traffic.

I-395 within the study limits generally includes three or four northbound and southbound general purpose lanes and auxiliary lanes between interchanges and two reversible HOV lanes between the northbound and southbound general purpose lanes that extend to south of the Eads Street Interchange. South of the Eads Street Interchange, the HOV lanes transition to barrier-separated lanes that operate in both the northbound and southbound directions and continue into Washington, D.C. **Figure 2-1** depicts the existing I-395 speed limits and number of travel lanes along the study corridor including auxiliary lanes and collector-distributor roadways.

- **South of Edsall Road:** Northbound I-395 includes three general purpose lanes and an auxiliary lane between I-495 and Edsall Road. Southbound I-395 includes three through lanes and two auxiliary lanes between Edsall Road and I-495. The two rightmost southbound travel lanes exit to northbound I-495. Three barrier-separated reversible Express Lanes are located between the northbound and southbound general purpose lanes.

- **Edsall Road to Turkeycock Run:** Northbound I-395 includes three general purpose lanes and an auxiliary lane between Turkeycock Run and Edsall Road. Southbound I-395 includes three general purpose lanes and an auxiliary lane between Turkeycock Run and Edsall Road. Three barrier-separated reversible Express Lanes are located between the northbound and southbound general purpose lanes.

- **Turkeycock Run to Duke Street / Little River Turnpike (Route 236):** Northbound I-395 includes three general purpose lanes and an auxiliary lane between Turkeycock Run and Duke Street / Little River Turnpike. Southbound I-395 includes three general purpose lanes. Two barrier-separated reversible HOV lanes are located between the northbound and southbound general purpose lanes.

- **Duke Street / Little River Turnpike (Route 236) to Seminary Road (Route 420):** Northbound I-395 includes three general purpose lanes and an auxiliary lane between Duke Street / Little

[1] NHS consists of major roadways important to the nation's economy, defense, and mobility. The NHS includes the interstate highway system as well as other roads connecting to major ports, airports, public transportation facilities, or other intermodal transportation services (http://www.fhwa.dot.gov/planning/national_highway_system/).

[2] STRAHNET is a system of highways important to the United States' strategic defense policy providing defense access, continuity and emergency capabilities for defense purposes (http://www.fhwa.dot.gov/planning/national_highway_system/).

River Turnpike and Seminary Road. Southbound I-395 includes four general purpose lanes. Two barrier-separated reversible HOV Lanes are located between the northbound and southbound general purpose lanes.

- **Seminary Road (Route 420) to King Street (Route 7):** Northbound I-395 includes three general purpose lanes and an auxiliary lane between Seminary Road and King Street. Southbound I-395 includes four southbound general purpose lanes and an auxiliary lane between King Street and Seminary Road. Two barrier-separated reversible HOV lanes are located between the northbound and southbound general purpose lanes.

- **King Street (Route 7) to Quaker Lane / Shirlington Road (Route 402):** Northbound I-395 includes four general purpose lanes with the fourth lane added from the King Street Interchange. Southbound I-395 includes four southbound general purpose lanes and an auxiliary lane between Shirlington Road and King Street. Two barrier-separated reversible HOV lanes are located between the northbound and southbound general purpose lanes.

- **Quaker Lane / Shirlington Road (Route 402) to Glebe Road (Route 120):** Northbound I-395 includes four general purpose lanes and an auxiliary lane between Quaker Lane/ Shirlington Road and Glebe Road. Southbound I-395 includes three general purpose lanes and a barrier-separated, two-lane collector-distributor roadway. Two barrier-separated reversible HOV lanes are located between the northbound and southbound general purpose lanes.

- **Glebe Road (Route 120) to Washington Boulevard (Route 27):** Northbound I-395 includes four general purpose lanes with the rightmost lane exiting onto the second Washington Boulevard ramp. Southbound I-395 includes three general purpose lanes and an auxiliary lane between Washington Boulevard and Glebe Road. Two barrier-separated reversible HOV lanes are located between the northbound and southbound general purpose lanes.

- **Washington Boulevard (Route 27) to Eads Street:** Northbound and southbound I-395 each include three general purpose lanes. Two barrier-separated reversible HOV lanes are located between the northbound and southbound general purpose lanes. Collector-distributor roadways with a varying number of lanes are located on the east and west sides of the general purpose lanes serving the Washington Boulevard Interchange, Army Navy Drive, and Arlington Ridge Road.

- **Eads Street to Jefferson Davis Highway (US Route 1):** Northbound I-395 includes three general purpose lanes. Southbound I-395 includes three general purpose lanes and an auxiliary lane that exits to the collector-distributor road serving Washington Boulevard. Four barrier-separated HOV lanes are located between the northbound and southbound purpose lanes, with two lanes serving each of the northbound and southbound directions.

- **Jefferson Davis Highway (US Route 1) to Boundary Channel Drive:** Northbound I-395 includes three general purpose lanes and an auxiliary lane that is reduced just north of the Boundary Channel Drive Interchange. Southbound I-395 includes four general purpose lanes, an auxiliary lane on the left-hand side of the roadway between the ramp from the HOV lanes and Jefferson Davis Highway, and an auxiliary lane on the right-hand side of the roadway between Boundary Channel Drive and the Jefferson Davis Highway ramps. Four barrier-separated HOV

lanes are located between the northbound and southbound general purpose lanes, with two lanes serving each of the northbound and southbound directions.

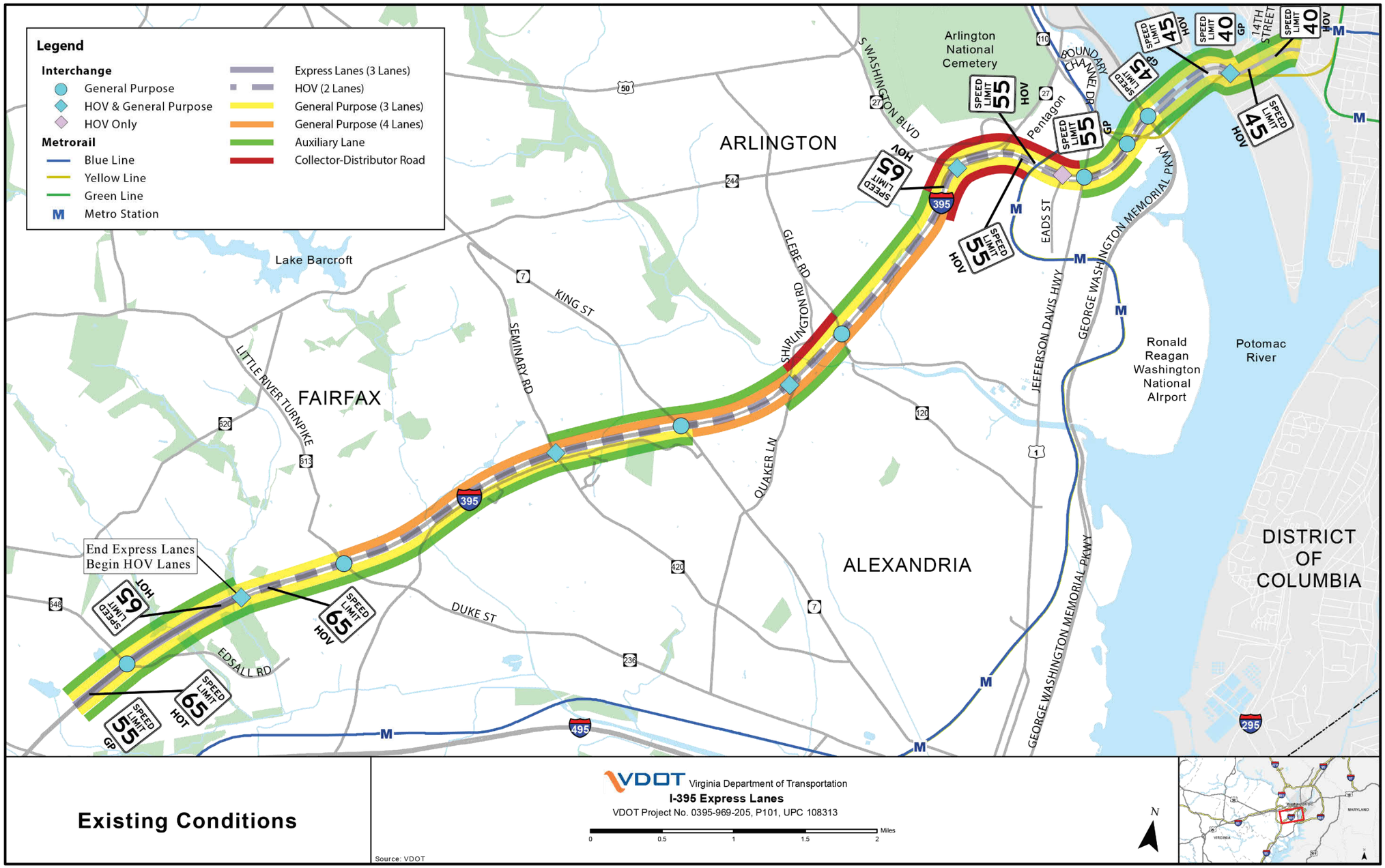
- **Boundary Channel Drive to George Washington Memorial Parkway:** Northbound I-395 includes three general purpose lanes. Southbound I-395 includes three general purpose lanes and an auxiliary lane between George Washington Memorial Parkway and Boundary Channel Drive. Four barrier-separated HOV lanes are located between the northbound and southbound general purpose lanes, with two lanes serving each of the northbound and southbound directions.

- **George Washington Memorial Parkway to 14th Street SW:** This segment of I-395 includes three northbound general purpose lanes and three southbound general purpose lanes with auxiliary lanes on both northbound and southbound I-395. Four barrier-separated HOV lanes are located between the northbound and southbound general purpose lanes, with two lanes serving each of the northbound and southbound directions.

- **North of 14th Street SW:** Northbound I-395 includes three general purpose lanes with one auxiliary lane between the ramp from Buckeye Drive and the 12th Street Expressway ramp. Southbound I-395 includes three general purpose lanes and one auxiliary lane.

The posted speed limit for the entire northbound I-395 general purpose lanes corridor is 55 MPH. The posted speed limit for the southbound I-395 general purpose lanes is 40 MPH north of the Potomac River and increases to 45 MPH at the George Washington Memorial Parkway Interchange. The southbound general purpose lanes speed limit then increases to 55 MPH south of the Boundary Channel Drive Interchange and continues through the southern study limits. The posted speed limits for the northbound HOT/HOV lanes are 65 MPH between the southern study limits and Washington Boulevard, 55 MPH between Washington Boulevard and 14th Street SW, and 45 MPH between 14th Street SW and the merge with the general purpose lanes. The posted speed limits for the southbound HOT/HOV lanes are 40 MPH between the diverge from general purpose lanes and 14th Street SW, 45 MPH between 14th Street SW and Eads Street, 55 MPH between Eads Street and Washington Boulevard, and 65 MPH between Washington Boulevard and the southern study limits.

Figure 2-1: Existing Conditions Roadway Network



2.1.1 HOV Operations and Access Points

The two-lane reversible, barrier-separated HOV lanes extend from the Turkeycock Run Interchange to south of Eads Street. South of Eads Street, the HOV lanes transition to barrier-separated lanes that operate in both the northbound and southbound directions and continue into Washington, D.C. to approximately 0.2-miles north of 14th Street SW where the lanes merge with the general purpose lanes. Although referred to as "HOV lanes" throughout this document, north of Eads Street and entering Washington, D.C., the barrier-separated lanes are not enforced as HOV lanes although in some locations the entry points and exit points are signed or marked as HOV lanes. South of Turkeycock Run, the HOV lanes transition to three-lane reversible Express Lanes that continue along I-395 to the I-95 Express Lanes extending to the Garrisonville Road (Route 610) Interchange in Stafford County.

Table 2-1 summarizes the operation of the reversible HOV lanes. In the two-lane reversible section, the HOV lanes operate in the northbound direction between 2:30 AM and 11:00 AM with HOV-3 restrictions in effect from 6:00 AM to 9:00 AM. The HOV lanes operate in the southbound direction from 1:00 PM to 12:00 AM with HOV-3 restrictions in effect from 3:30 PM to 6:00 PM. The following vehicle types are permitted in the lanes during the restricted periods:

- HOV-3
- Buses
- Motorcycles
- Hybrid vehicles (with clean fuel plates issued before July 1, 2006)
- Emergency vehicles
- Trucks (with 3 or more people)

During periods when the HOV-3 restrictions are not in effect, all vehicles are permitted in the HOV lanes. Between approximately 11 AM and 1 PM and between 12 AM and 2:30 AM the HOV lanes are closed to accommodate the safe reversal of the travel direction. During the summer months, the midday closure of the reversible HOV lanes to reverse the lanes from northbound to southbound travel occurs one hour earlier, beginning at 10:00 AM to accommodate higher traffic demands in both the general purpose, HOV, and Express Lanes. Nighttime closures remain the same during the summer months.

Table 2-1: HOV Lane Operations

Time Period	Travel Direction	HOV Lane Operation
12 AM – 2:30 AM	Closed	
2:30 AM – 6 AM	Northbound	All Vehicles Permitted
6 AM – 9 AM		HOV-3 Only
9 AM – 11 AM		All Vehicles Permitted
11 AM – 1 PM	Closed	
1 PM – 3:30 PM	Southbound	All Vehicles Permitted
3:30 PM – 6 PM		HOV-3 Only
6 PM – 12 AM		All Vehicles Permitted

Table 2-2 summarizes the existing access points to and from the HOV lanes including their operation during the AM and PM periods when the HOV lanes are open.

Table 2-2: HOV Lane Access Points

Access Point		Operation
Turkeycock Run (north of Edsall Road)		AM: NB access to and from HOV lanes PM: SB access to and from HOV lanes
Seminary Road – South Facing Ramp		AM: NB access from HOV lanes PM: SB access to HOV lanes (HOV at all times)
Seminary Road – North Facing Ramp		AM: NB access to HOV lanes PM: SB access from HOV lanes
Shirlington Road – North Facing Ramp		AM: NB access to HOV lanes PM: SB access from HOV lanes
Washington Boulevard – South Facing Ramp		AM: NB access from HOV lanes PM: SB access to HOV lanes
Eads Street Interchange	Ramp from SB HOV Lanes to SB GP Lanes (south of Eads Street)	AM & PM: SB access from HOV lanes
	Eads Street – NB Off Ramp from HOV	AM: NB access from HOV lanes PM: Closed
	Eads Street – SB On Ramp to HOV	AM & PM: SB access to HOV lanes
	Eads Street – NB On Ramp to HOV	AM & PM: NB access to HOV lanes
	Eads Street – SB Off Ramp from HOV	AM & PM: SB access from HOV lanes
NB Ramp from GP Lanes to HOV Lanes north of Eads Street		AM & PM: NB access to HOV lanes
SB Ramp from HOV Lanes to GP Lanes		AM & PM: SB access to GP lanes

2.1.2 Ramp Metering

Ramp meters are provided at several entrance ramps along the I-395 general purpose lanes as shown in **Table 2-3** to regulate traffic entering the corridor. The ramp meters are activated in the peak travel direction only. During the morning peak period, the northbound ramp meters operate from 6:30 AM to 9:00 AM. During the evening peak period, the ramp meters operate from 3:30 PM to 6:30 PM. The cycle length for the metering signals is 4 seconds (2-second red and 2-second green).

Table 2-3: Ramp Meter Locations

Ramp Location		Number of Ramp Lanes
I-395 NB General Purpose	EB / WB Edsall Rd	2
	Little River Tnpk / Duke St	2
	EB / WB Seminary Rd	2
	EB King St	1
	WB King Street	2
	NB Quaker Lane	2
	EB Glebe Rd	1
	WB Glebe Rd	1
	NB Jefferson Davis Hwy	2
	EB / WB Boundary Channel Dr	1
I-395 SB General Purpose	SB Shirlington Rd	2
	WB King St	1
	EB King St	1
	EB / WB Seminary Rd	2
	WB Duke St	1
	EB Little River Tnpk	1
	WB Edsall Rd	1
	EB Edsall Rd	1

2.2 INTERCHANGES

Within the study area, there are thirteen grade-separated interchanges that provide direct access to I-395, some of which are restricted to HOV use only during peak travel periods (see **Figure 2-1**). Eight additional roadways intersect the I-395 corridor but do not provide direct access to the interstate. The following are descriptions of the roadways that interchange with I-395, presented from south to north.

2.2.1 Edsall Road (Route 648)

Edsall Road (Route 648) is oriented in an east-west direction and is a four-lane divided roadway classified as a Minor Arterial. Its interchange with I-395 is located approximately 0.9 miles north of I-495 (Capital Beltway) and consists of a partial cloverleaf interchange with a single directional flyover ramp serving the eastbound Edsall Road to northbound I-395 movement. Edsall Road also provides access to northbound I-395 via a ramp originating from the traffic signal controlled intersection of Edsall Road and Bren Mar Drive. The remaining ramps at this interchange are free flow movements. The posted speed limit on Edsall Road is 35 MPH in the vicinity of I-395.

2.2.2 Turkeycock Run

Turkeycock Run is an interchange between the I-395 HOT, HOV, and I-395 general purpose lanes, is located approximately 0.9 miles north of the Edsall Road Interchange, and is the transition point between the three reversible HOT lanes south of Turkeycock Run and the two reversible HOV lanes north of Turkeycock Run. The interchange consists of single-lane directional ramps and flyovers to move vehicular traffic between the HOV/HOT lanes and general purpose lanes along I-395. The two northbound ramps are open to traffic during periods when the HOV/HOT lanes are operating in the northbound direction and the two southbound ramps are open to traffic during periods when the

HOV/HOT lanes are operating in the southbound direction. The interchange does not provide access to other roadways.

2.2.3 Little River Turnpike/ Duke Street (Route 236)

Little River Turnpike / Duke Street (Route 236) is oriented in an east-west direction and is a four-lane divided roadway classified as an Other Principal Arterial. Its interchange with I-395 is located approximately 0.7 miles north of the Turkeycock Run Interchange and consists of a partial cloverleaf interchange with a single directional flyover ramp serving eastbound Little River Turnpike to northbound I-395. All ramps at this interchange are free flow movements. The posted speed limit on Little River Turnpike / Duke Street is 35 MPH in the vicinity of I-395.

2.2.4 Seminary Road (Route 420)

Seminary Road (Route 420) is oriented in a northwest-southeast direction and is a four-lane divided roadway classified as a Minor Arterial. Its interchange with I-395 is located approximately 1.7 miles north of the Little River Turnpike / Duke Street Interchange and consists of a three-level interchange in a rotary arrangement. The second level of the interchange provides full access to and from the northbound and southbound general purpose lanes at four signalized intersections to distribute traffic to and from Seminary Road. In addition, the second level of the interchange accommodates traffic to and from the I-395 HOV lanes to and from the north via a north-facing reversible ramp. The third level of the interchange accommodates through traffic on Seminary Road in addition to the reversible I-395 HOV south-facing ramp on the south side of Seminary Road which opened to traffic in January 2016. The HOV ramp intersects Seminary Road at a traffic signal and is designated as HOV-3 at all times of the day. The posted speed limit on Seminary Road is 35 MPH in the vicinity of I-395.

2.2.5 King Street (Route 7)

King Street (Route 7) is oriented in a northwest-southeast direction and is a four-lane divided roadway classified as an Other Principal Arterial. Its interchange with I-395 is located approximately 0.9 miles north of the Seminary Road Interchange and consists of a partial cloverleaf interchange with a single directional flyover ramp serving the eastbound King Street to northbound I-395 movement and a single directional flyover ramp serving the westbound King Street to southbound I-395 movement. All ramps at this interchange are free flow movements. The posted speed limit on King Street is 35 MPH in the vicinity of I-395.

2.2.6 Quaker Lane/ Shirlington Road (Route 402)

Quaker Lane / Shirlington Road (Route 402) is oriented in a north-south direction and is a four-lane divided roadway classified as a Minor Arterial. Its interchange with I-395 is located approximately 0.8 miles north of the King Street Interchange and consists of a rotary interchange with all ramps at this interchange being free flow movements, except for southbound I-395 to Shirlington Road, which is controlled at a traffic signal. A north-facing ramp serving the HOV lanes is located at the north side of the rotary and provides access to and from the HOV lanes. The posted speed limit on Quaker Lane / Shirlington Road is 30 MPH in the vicinity of I-395.

2.2.7 Glebe Road (Route 120)

Glebe Road (Route 120) is oriented in a northwest-southeast direction and is a four-lane divided roadway classified as an Other Principal Arterial. Its interchange with I-395 is located approximately 0.5 miles north of the Quaker Lane/ Shirlington Road Interchange and consists of a partial cloverleaf interchange. The ramp from northbound I-395 to eastbound Glebe Road is signal controlled as well as the ramp from southbound I-395 to Glebe Road. All other ramps and loop ramps are free flow movements. Southbound general purpose traffic traveling to the Quaker Lane/ Shirlington Road Interchange exit at the Glebe Road interchange and travel on a collector-distributor road between the two interchanges. The posted speed limit on Glebe Road is 35 MPH in the vicinity of I-395.

2.2.8 Washington Boulevard (Route 27)

Washington Boulevard (Route 27) is oriented in an east-west direction in the vicinity of I-395 and is a four-lane divided roadway classified as an Other Freeway or Expressway. Its interchange with I-395 is located approximately 1.5 miles north of the Glebe Road Interchange and consists of a directional ramp interchange with free flow ramp movements to and from I-395 and Washington Boulevard with collector-distributor roadways along both northbound and southbound I-395. The interchange and series of collector-distributor roadways also provide access to Army Navy Drive, South Rotary Road and Arlington Ridge Road. A north-facing reversible HOV ramp provide access to and from the north on Washington Boulevard. The posted speed limit on Washington Boulevard is 45 MPH in the vicinity of I-395.

2.2.9 Eads Street

Eads Street is oriented in a north-south direction and is a two-lane divided roadway classified as a Major Collector. Its interchange with the I-395 HOV lanes is located approximately 0.6 miles north of the Washington Boulevard Interchange and consists of a diamond interchange. The posted speed limit on Eads Street is 25 MPH in the vicinity of I-395. The Eads Street Interchange and surrounding roadways is discussed in more detail in **Section 2.5.2.3**.

2.2.10 Jefferson Davis Highway (US Route 1)

Jefferson Davis Highway (US Route 1) is oriented in a north-south direction and is a six-lane divided roadway classified as an Other Freeway or Expressway. Its interchange with I-395 is located approximately 0.2 miles north of the Eads Street Interchange and consists of a partial cloverleaf interchange with partial access between Jefferson Davis Highway and I-395. There is no access provided between the I-395 northbound general purpose lanes and Jefferson Davis Highway and no access provided between Jefferson Davis Highway and the I-395 southbound general purpose lanes. Access from the southbound general purpose lanes to southbound Jefferson Davis Highway is provided by a directional flyover ramp that exits on the left-hand side of southbound I-395 and enters on the left-hand side of southbound Jefferson Davis Highway. The posted speed limit on Jefferson Davis Highway is 45 MPH in the vicinity of I-395.

2.2.11 Boundary Channel Drive/ Long Bridge Drive

Boundary Channel Drive is oriented in an east-west direction and is a four-lane divided roadway classified as a Minor Collector. Long Bridge Drive has a north-south orientation and is a two-lane

undivided roadway in the vicinity of Boundary Channel Drive and classified as a Major Collector. Its interchange with I-395 is located approximately 0.4 miles north of the Jefferson Davis Highway Interchange and consists of a full cloverleaf interchange. All ramps and loop ramps are free flow except the ramp from southbound I-395 to Boundary Channel Drive that intersects Boundary Channel Drive at an unsignalized intersection. The posted speed limit on Boundary Channel Drive / Long Bridge Drive is 25 MPH in the vicinity of I-395.

2.2.12 George Washington Memorial Parkway

George Washington Memorial Parkway is oriented in a north-south direction and is a four-lane divided roadway classified as an Other Freeway or Expressway north of I-395 and an Other Principal Arterial south of I-395. Its interchange with I-395 is located approximately 0.2 miles north of the Boundary Channel Drive/ Long Bridge Drive Interchange and consists of a partial cloverleaf interchange with a directional ramp from northbound I-395 to westbound George Washington Memorial Parkway located in the median of I-395. All ramps and loop ramps at this interchange are free flow movements. The posted speed limit on George Washington Memorial Parkway is 40 MPH in the vicinity of I-395.

2.2.13 14th Street SW

14th Street SW is oriented in a north-south direction and is a six-lane divided roadway. Its interchange with I-395 is located approximately 0.6 miles north of the George Washington Memorial Parkway Interchange just north of the Potomac River and consists of directional ramps serving both the general purpose and HOV lanes to and from the south. Access to and from I-395 to the north is not provided from 14th Street SW.

2.3 TRANSIT AND COMMUTER FACILITIES

The I-395 corridor is a heavily traveled commuter route with a high percentage of transit and HOV usage. The corridor provides direct access to the Pentagon Transit Center (PTC) which is a regional transit and commuter hub serving the Metrorail's Yellow and Blue lines, regional and local commuter buses, formal ridesharing, and informal ridesharing (also known as slugging). The PTC accommodates eight transit bus service providers, 27 bus lines, nearly 850 bus trips per day and approximately 160 bus trips in the AM and PM peak hours. Over 19,000 bus passengers travel through the PTC daily from 6 AM to 9 AM and from 3 PM to 6 PM with over 5,600 peak period passengers using the Pentagon Metrorail Station (Washington Headquarters Service, 2015).

An important component of travel in the I-395 corridor is the informal ridesharing referred to as "slugging." Slugging is a form of carpooling from designated pickup and drop off points located in close proximity to the HOV facility. The incentive to the driver and the passenger is ability to the use the HOV facility. Because of the proximity of the Pentagon Reservation and the PTC to the I-395 corridor, it functions as a regional transit hub providing a linkage for commuters. Designated drop-off / pick-up locations are provided for eight origins / destinations:

- Burke / Springfield
- Horner Road / Potomac Mills
- Montclair / Route 234
- Rt. 17 Stafford

- Rt. 3 Fredericksburg Gordan Road
- Rt. 610 Mine Road
- Rt. 610 Stafford
- Tackett's Mill / Lorton / VRE

In 2010, when a survey was conducted as part of data collection efforts for the preparation of the Pentagon Transportation Management Plan, approximately 2,455 riders were picked up at the designated locations during the PM peak period from 3 PM to 6 PM carried by 1,240 vehicles (Washington Headquarters Service, 2015).

Table 2-4: Informal Rideshare/Slugging Demand Survey

Location	Vehicles	Passengers
Burke / Springfield	130	275
Horner Road / Potomac Mills	315	600
Montclair / Route 234	245	480
Rt. 17 Stafford	95	195
Rt. 3 Fredericksburg Gordan Road	45	90
Rt. 610 Mine Road	130	250
Rt. 610 Stafford	165	320
Tackett's Mill / Lorton / VRE	115	245
Total	**1,240**	**2,455**

Source: Pentagon Transportation Master Plan, Table 2-1

The I-95/I-395 Transit/Transportation Demand Management (TDM) Plan (Plan) is currently under development to identify a range of transit and TDM recommendations for the I-95 and I-395 corridors with a focus on optimizing person throughput. The Plan will provide recommendations to the Commonwealth and regional decision-makers regarding how the Annual Transit Investment to be funded by Express Lane toll revenues might be used. The Plan will document relevant data for existing transit service providers in the corridor, approved Transit Development Plans (TDP), and transit and commuter patterns in the study area.

2.4 TRAFFIC VOLUMES, SPEEDS, AND TRAVEL PATTERNS

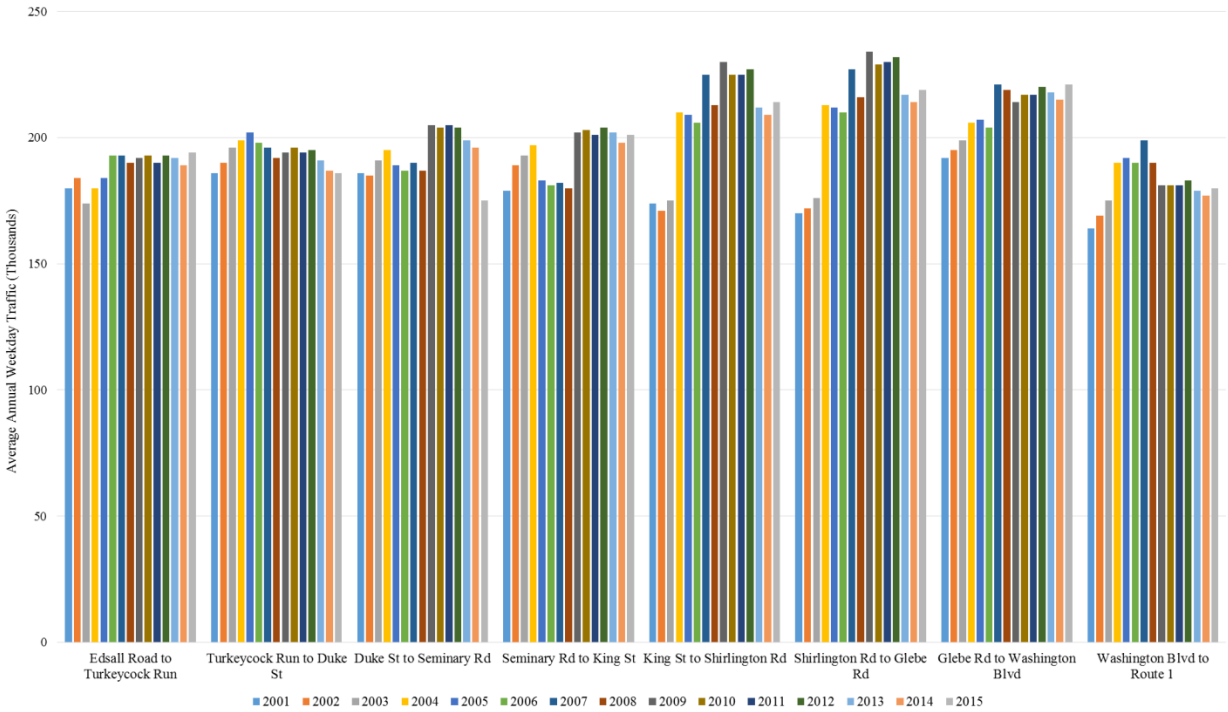
2.4.1 Travel Patterns

I-395 serves primarily as a commuter route that connects the southern suburban areas of Northern Virginia to the urbanized regional employment core of Washington, D.C. at the northern end of the study area. I-395 also connects to several regional corridors including Washington Boulevard (Route 27), US Route 1 (Jefferson Davis Highway) and George Washington Memorial Parkway at the northern portion of the study area before entering Washington, D.C. The corridor also serves as a local travel route for residents of Fairfax and Arlington Counties and the City of Alexandria. The I-395 corridor provides access to the Pentagon which is a regional transit hub serving the Metro system's Yellow and Blue lines, regional commuter and local buses, formal ridesharing, and informal ridesharing.

Figure 2-2 depicts historic average annual weekday traffic volumes (AAWDT) obtained from the VDOT Traffic Count publications (VDOT TED, 2016). AAWDT traffic volumes are shown for 2001 through 2015 along I-395 within the study area. As shown, daily traffic volumes in the general purpose lanes

remained relatively unchanged between 2001 and 2015 in the southern portion of the study area between Edsall Road and King Street. Moderate growth has occurred between King Street and Washington Boulevard with a 15 to 30 percent increase (1% to 2% annually) in daily traffic volumes between 2001 and 2015. From north of Washington Boulevard to Jefferson Davis Highway, traffic volumes have grown by 7 to 10 percent between 2001 and 2015 (less than 1% annually).

Figure 2-2: I-395 Historical Average Weekday Traffic Volumes



The origin and destination of trips along the I-395 corridor at three locations was obtained from the Metropolitan Washington Council of Governments (MWCOG) Travel Demand Forecasting Model, Version 2.3 Build 57a used to produce the forecasts for the project (see **Section 5.3**):

- North of Turkeycock Run
- North of the Glebe Road Interchange
- South of George Washington Memorial Parkway

The distribution of traffic at each location was summarized by direction to understand the points of entry to and exit from the corridor. The following entry / exit regions were defined:

- I-95 (south of I-495)
- I-495 (west and east of I-395)
- Edsall Road
- Little River Turnpike / Duke Street to Seminary Road
- King Street to Glebe Road
- Washington Boulevard to Boundary Channel Drive
- George Washington Memorial Parkway
- Washington, D.C. line (Potomac River)

The following tables provide the distribution of traffic in the northbound and southbound directions for the points of entry to the specific location along the corridor and the destination or exit points from the corridor.

At the southern end of the corridor at Turkeycock Run, in the northbound direction, nearly 70% of the traffic on the corridor is entering from I-95 south of I-495 with 25% entering from I-495. The destination of those trips is split evenly between the Duke Street to Seminary Road area, King Street to Glebe Road area and finally the Pentagon area between Washington Boulevard and Boundary Channel Drive. Of the traffic at Turkeycock Run, 31% continues through the entire corridor crossing into the District. The pattern of traffic in the southbound direction at Turkeycock Run is very similar with the same percentage entering from the District, but a higher proportion entering the corridor in the Pentagon area between Washington Boulevard and Boundary Channel Drive. Destinations in the southbound direction mirror the northbound direction with 71% traveling to I-95 and the remainder to I-495 and Edsall Road.

Table 2-5: I-395 @ Turkeycock Run: Origins and Destinations on I-395 at Southern End of Corridor

Entry / Exit Region		Northbound
Points of Entry	I-95	68%
	I-495	25%
	Edsall Road	7%
I-395 @ Turkeycock Run		**100%**
Points of Exit	Duke Street to Seminary Road	25%
	King Street to Glebe Road	19%
	Washington Boulevard to Boundary Channel Drive	25%
	George Washington Memorial Parkway	0%
	Washington, D.C.	31%

Entry / Exit Region		Southbound
Points of Exit	I-95	71%
	I-495	21%
	Edsall Road	8%
I-395 @ Turkeycock Run		**100%**
Points of Entry	Duke Street to Seminary Road	22%
	King Street to Glebe Road	18%
	Washington Boulevard to Boundary Channel Drive	29%
	George Washington Memorial Parkway	0%
	Washington, D.C.	31%

At the middle portion of the corridor, the distribution of traffic origins in the northbound direction is 40% from I-95, but the majority is from locations along the corridor including over 40% from Duke Street to Glebe Road suggesting a high proportion of local movements on the corridor. Destinations are nearly evenly split between the Washington Boulevard to Boundary Channel Drive area (Pentagon area) and those traveling across the Potomac River into Washington, D.C. The southbound flow of traffic is very similar with a split of entries to the corridor entering from the Pentagon area and those from the District. Destinations are similarly distributed to locations along the corridor with 40% continuing south to I-95.

Table 2-6: I-395 North of Glebe Road: Origins and Destinations on I-395 at Mid-Point of Corridor

Entry / Exit Region		Northbound
Points of Entry	I-95	42%
	I-495	13%
	Edsall Road	4%
	Duke Street to Seminary Road	22%
	King Street to Glebe Road	19%
I-395 North of Glebe Road		**100%**
Points of Exit	Washington Boulevard to Boundary Channel Drive	45%
	George Washington Memorial Parkway	0%
	Washington, D.C.	54%

Entry / Exit Region		Southbound
Points of Exit	I-95	43%
	I-495	12%
	Edsall Road	4%
	Duke Street to Seminary Road	24%
	King Street to Glebe Road	17%
I-395 North of Glebe Road		**100%**
Points of Entry	Washington Boulevard to Boundary Channel Drive	50%
	George Washington Memorial Parkway	0%
	Washington, D.C.	50%

At the northern end of the corridor, nearly 100% of the traffic is entering from the District in the southbound direction. The distribution pattern shows the importance of local destinations along the corridor with only a combined 31% of the traffic going beyond Edsall Road to I-95 and I-495. Nearly half of the trips in the southbound direction exit the corridor in the Pentagon area. The points of entry to the corridor in the northbound direction are very similar with almost half of the traffic entering the corridor in the Pentagon area and approximately 30% entering from points south of Edsall Road.

Table 2-7: I-395 South of George Washington Memorial Parkway: Origins and Destinations on I-395 at Northern End of Corridor

Entry / Exit Region		Northbound
Points of Entry	I-95	22%
	I-495	8%
	Edsall Road	2%
	Duke Street to Seminary Road	12%
	King Street to Glebe Road	9%
	Washington Boulevard to Boundary Channel Drive	46%
I-395 South of George Washington Memorial Parkway		**100%**
Points of Exit	George Washington Memorial Parkway	2%
	Washington, D.C.	98%

Entry / Exit Region		Southbound
Points of Exit	I-95	23%
	I-495	8%
	Edsall Road	2%
	Duke Street to Seminary Road	13%
	King Street to Glebe Road	8%
	Washington Boulevard to Boundary Channel Drive	47%
I-395 South of George Washington Memorial Parkway		**100%**
Points of Entry	George Washington Memorial Parkway	0%
	Washington, D.C.	100%

This origin-destination data indicates that traffic along the corridor is serving local destinations for both trips coming from south of I-495 along I-95 and those coming from the District. As expected, the Pentagon area between Washington Boulevard and Boundary Channel Drive is a significant origin and destination for trips along the corridor because of the many employment opportunities and linkages to surrounding areas served by Washington Boulevard, Jefferson Davis Highway, and Boundary Channel Drive.

The origin-destination data was also aggregated to the County and City boundaries for both the origins and destinations of trips using the corridor at the same three locations. The tables below show the percent of origins and destinations within each County and City along the corridor for the three locations (I-395 at Turkeycock Run, I-395 north of Glebe Road, and I-395 south of George Washington Memorial Parkway).

At the southernmost end of the corridor (Turkeycock Run), over 90% of both the origins and destinations are within the defined counties and cities with the largest source of trips coming from Fairfax followed by Prince William and the remainder from Stafford, and Spotsylvania. As anticipated and consistent with the traffic in the corridor, the largest destinations are Arlington, the District of Columbia and Alexandria. At the midpoint of the corridor (north of Glebe Road), more local trips are observed with a decrease in origins from points south of I-495. Arlington and the District represent the major destinations with approximately 20% of the trips destined for locations outside the listed destinations in the table. At the northernmost end of the corridor (George Washington Memorial Parkway), over 50% of the trips have destinations within the District of Columbia coming from Alexandria, Arlington and Fairfax.

Table 2-8: Destination and Origin of Trips by County / City on Northbound I-395

Location	Turkeycock Run		North of Glebe Rd		George Wash. Mem Pkwy	
	Origin	Destination	Origin	Destination	Origin	Destination
Alexandria	0.1%	22.0%	25.0%	0.3%	16.1%	0.5%
Arlington	0.0%	35.4%	4.7%	34.6%	36.2%	1.7%
District of Columbia	0.0%	28.8%	0.0%	45.3%	0.0%	55.4%
Fairfax	61.1%	5.9%	47.0%	0.8%	33.8%	0.2%
Falls Church	0.0%	0.0%	0.0%	0.0%	0.6%	0.0%
Prince William	20.0%	0.0%	12.4%	0.0%	6.0%	0.0%
Stafford VA	4.2%	0.0%	3.0%	0.0%	1.4%	0.0%
Fredericksburg	0.5%	0.0%	0.0%	0.0%	0.1%	0.0%
Spotsylvania	8.0%	0.0%	5.6%	0.0%	3.5%	0.0%
Total	**93.9%**	**92.3%**	**97.6%**	**81.1%**	**97.8%**	**57.8%**

In the southbound direction, origins for trips at the southernmost end of the corridor are predominantly from Arlington, the District of Columbia and Fairfax. The highest destination area is Fairfax followed by points along I-95 south of the corridor including Prince William, Stafford and Spotsylvania. The middle portion of the corridor has the majority of origins from Arlington and the District with destinations in Fairfax and Alexandria consistent with the local nature of trips. Trips entering the corridor in the southbound direction are destined for points along the corridor with the majority traveling to Arlington, Fairfax and Alexandria.

Table 2-9: Origin and Destination of Trips by County / City of Southbound I-395

Location	Turkeycock Run		North of Glebe Rd		George Wash. Mem Pkwy	
	Origin	Destination	Origin	Destination	Origin	Destination
Alexandria	0.4%	0.0%	0.0%	23.3%	0.0%	13.6%
Arlington	43.0%	0.0%	36.4%	5.0%	3.8%	36.3%
District of Columbia	35.3%	0.0%	43.8%	0.0%	52.9%	0.2%
Fairfax	10.2%	58.6%	1.0%	47.2%	0.7%	34.3%
Falls Church	0.0%	0.0%	0.0%	0.0%	0.0%	0.7%
Prince William	0.0%	21.5%	0.0%	12.4%	0.0%	6.3%
Stafford	0.0%	4.9%	0.0%	3.0%	0.0%	1.5%
Fredericksburg	0.0%	0.5%	0.0%	0.3%	0.0%	0.2%
Spotsylvania	0.0%	9.9%	0.0%	6.3%	0.0%	4.3%
Total	**88.9%**	**95.5%**	**81.1%**	**97.4%**	**57.4%**	**97.3%**

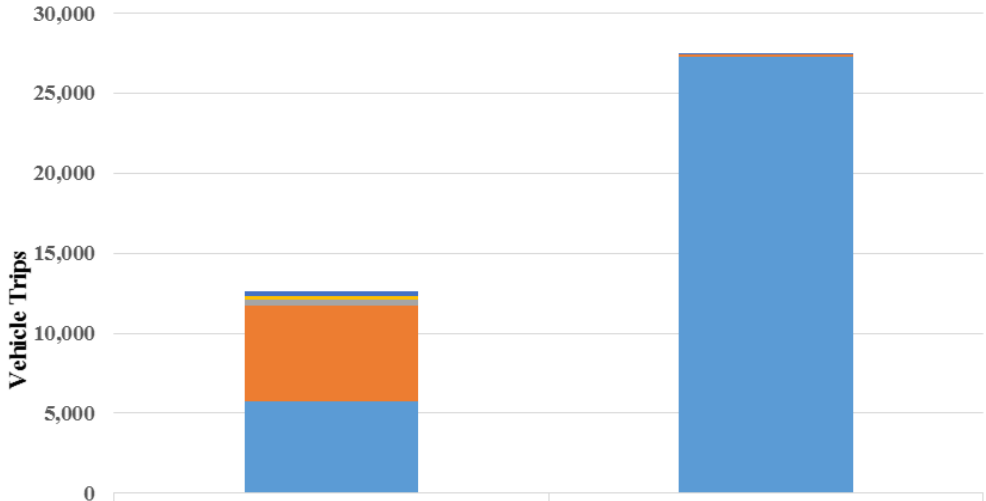
The distribution of origins and destinations is consistent with the traffic patterns along the corridor and shows that the corridor is serving a large number of local trips along the corridor while also providing a route to the District of Columbia for areas along the corridor and serving trips from areas south of I-495 to destinations along the corridor.

2.4.2 Vehicle Occupancy

Vehicle occupancy and classification counts were conducted as part of the *2014 Performance of High-Occupancy Vehicle Facilities on Freeway in the Washington Region* (NCRTPB, 2015) report. The data was collected along northbound I-395 north of the Glebe Road Interchange in May 2014. All vehicles were classified by vehicle type and vehicle occupancy was recorded for automobiles. Classification and occupancy data were recorded within both the general purpose and HOV lanes for a five hour period between 5 AM and 10 AM.

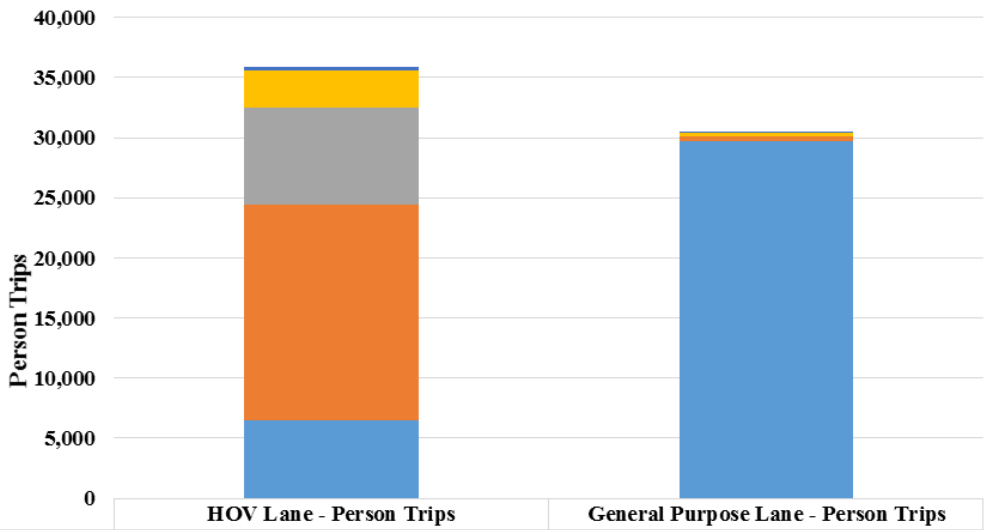
Figure 2-3 depicts AM peak period vehicle trips by vehicle type in both the HOV lanes and the general purpose lanes. As shown, there are more than two times as many vehicles travel in the general purpose lanes compared to the HOV lanes; however, almost all vehicle trips (99 percent) in the general purpose lanes are motorcycles, single, and two-person vehicles. Approximately 52 percent of the vehicles in the HOV lanes are buses, vans, or vehicles with three or more persons.

Figure 2-3: AM Peak Period (5 AM – 10 AM) Vehicle Trips – North of Glebe Road



	HOV Lane - Vehicle Trips	General Purpose Lane - Vehicle Trips
Trucks	262	77
Vans	255	24
Buses	328	0
3+ Persons	5,980	135
Motorcycles, 1 and 2 Persons	5,759	27,260

Figure 2-4: AM Peak Period (5 AM – 10 AM) Person Trips – North of Glebe Road



	HOV Lane - Person Trips	General Purpose Lane - Person Trips
Trucks	262	77
Vans	3,060	288
Buses	8,062	0
3+ Persons	18,009	432
Motorcycles, 1 and 2 Persons	6,442	29,675

Figure 2-4 depicts person trips by vehicle type for both the HOV lanes and the general purpose lanes. Although there are more than two times as many vehicles in the general purpose lanes compared to the HOV lanes and four general purpose lanes compared to two HOV lanes, there are 18 percent more person trips in the HOV lanes compared to the general purpose lanes. When considering the number of person-trips per lane, approximately 17,900 persons per lane travel in the HOV lanes compared to 7,600 persons per lane in the general purpose lanes during the five hour period between 5 AM and 10 AM. The average auto occupancy in the HOV lanes is 2.8 persons per vehicle and the average auto occupancy in the general purpose lanes is 1.1 persons per vehicle.

2.4.3 Data Collection

2.4.3.1 Traffic Volumes

Traffic volume data was collected throughout the study area network during October and November 2015. Additional data collection efforts occurred in February, March, and April 2016 following the opening of the I-395 HOV / Transit Ramp at Seminary Road and following the expansion of the study area to include the Pentagon South Parking Lot. Hourly counts were collected for a minimum of 48 hours on a Tuesday, Wednesday, or Thursday. Turning movement counts were collected for a 12-hour period from 5:00 AM to 11:00 AM and 2:00 PM 8:00 PM.

Appendix A contains a summary of the turning movement count locations and 48-hour classification count locations.

2.4.3.2 Speeds

INRIX® speed data was obtained from the Regional Integrated Transportation Information System (RITIS) database for the I-395 corridor. RITIS provides mean speed data for individual roadway segments established by INRIX® (generally between ramp terminals). Speed data was obtained in 15-minute intervals for weekdays (Tuesday, Wednesdays and Thursdays) during September and October 2015 (excluding holidays) and averaged. Mean speeds for each segment were tabulated based upon location and time of day to generate speed contour plots. Speed contour plots for northbound and southbound I-395 general purpose and HOV/HOT lanes are shown in **Figures 2-5 through 2-8**. It should be noted that due to the severely over-capacity conditions, on a daily basis there are frequently high variations in the speeds and travel times experienced by motorists along the corridor, especially traveling in the peak direction of the general purpose lanes. The following is a review of the average speed data and a summary of locations with recurring congestion during a typical weekday.

Northbound I-395 General Purpose Lanes (see Figure 2-5): During the morning peak period, heavy congestion and low travel speeds occur beginning at approximately 6:15 AM in the southern portion of the study area near Edsall Road and extend through approximately 11:00 AM through the northern end of the study area. Congestion is most severe and speeds are lowest for the longest duration in the northern portion of the corridor between Washington Boulevard and approaching the Potomac River where there are increases in traffic volumes as motorists enter the corridor from Washington Boulevard, Route 1, and George Washington Memorial Parkway.

During the evening peak period, there is heavy congestion and low travel speeds between Washington Boulevard and the northern study limits due to downstream congestion in Washington, D.C. that limits the flow of traffic entering the City.

Southbound I-395 General Purpose Lanes (see Figure 2-6): During the evening peak period, heavy congestion and low travel speeds occur beginning at approximately 3:00 PM exiting Washington, D.C. to the George Washington Memorial Parkway. Moderate congestion occurs between George Washington Memorial Parkway and Washington Boulevard due to the reduction in southbound traffic volumes as traffic exits the corridor at George Washington Memorial Parkway, Route 1, and Washington Boulevard. Heavy congestion continues along southbound I-395 from Washington Boulevard to Turkeycock Run beginning at approximately 4:00 PM and extending beyond 7:00 PM in some areas. South of Turkeycock Run within the limits of the existing Express Lanes, travel speeds drop to approximately 40 to 45 MPH from 3:00 to 4:00 PM and from 6:15 PM to 7:15 PM; however, travel speeds generally operate near free-flow conditions south of Turkeycock Run.

During the morning peak period, travel speeds are reduced to less than 45 MPH north of the George Washington Memorial Parkway, but exceed 45 MPH along southbound I-395 throughout the remainder of the study limits.

Northbound I-395 HOV/HOT Lanes (see Figure 2-7): During the morning peak period, heavy congestion and low travel speeds occur beginning at approximately 7:00 AM at Washington Boulevard and continue into Washington, D.C. until approximately 10:15 AM. From approximately 9:05 to 9:45 AM, low travel speeds and congestion within the northbound HOV lanes extend to approximately King Street due to downstream congestion approaching and within Washington, D.C. that limits the capacity of the HOV lanes.

During the evening peak period, travel speeds less than 45 mph are experienced along the northbound HOV lanes from Boundary Channel Drive and entering the District due to the high traffic volumes entering from Eads Street and the ramp from the general purpose lanes to the HOV lanes located north of Eads Street.

Southbound I-395 HOV/HOT Lanes (see Figure 2-8): During the evening peak period, travel speeds drop to approximately 45 to 50 MPH between 5:00 and 6:00 PM and 20 to 35 MPH between 6:00 and 7:15 PM along the southbound HOV lanes in the vicinity of the Eads Street on-ramp and the ramp from the HOV lanes to the general purpose lanes approaching Washington Boulevard.

Figure 2-5: Northbound I-395 General Purpose Lane Speeds

	I-495		Turkeycock Run			Seminary Rd		King St			Shirlington Rd	Glebe Rd			Washington Blvd					Boundary Channel Dr			Potomac River		14th St			12th St	
2:30	59	58	57	58	57	57	58	59	59	59	57	56	56	54	55	55	55	52	51	50	48	49	46	44	44	45	45	46	
2:45	59	58	57	58	56	57	59	58	61	61	59	56	57	54	56	54	54	52	51	51	49	49	47	45	45	45	45	46	
3:00	58	59	57	58	56	58	60	60	60	59	58	56	56	56	56	57	56	55	53	52	51	51	49	46	45	45	45	48	
3:15	60	60	58	58	56	57	59	60	60	60	58	57	58	56	56	56	56	54	53	52	50	51	47	45	43	44	43	44	
3:30	61	60	60	61	59	59	62	62	61	61	57	56	58	57	57	57	57	55	54	52	51	51	49	46	47	47	47	47	
3:45	61	62	60	61	60	58	62	62	62	63	60	58	60	58	57	58	57	55	53	52	51	51	48	45	45	47	46	47	
4:00	61	61	61	61	60	60	62	62	62	63	60	58	59	58	58	60	58	57	55	54	52	52	49	46	46	47	46	47	
4:15	62	62	62	63	60	60	62	61	60	62	59	58	59	58	57	58	57	58	55	53	52	53	49	47	46	48	47	48	
4:30	63	64	63	64	63	61	64	64	63	64	62	60	61	59	59	59	58	57	55	53	52	52	50	48	46	48	47	49	
4:45	63	64	64	65	62	61	64	65	65	65	63	61	62	60	61	60	60	58	56	55	54	52	50	48	47	49	48	49	
5:00	63	63	64	65	63	63	65	65	64	65	62	61	62	60	60	59	58	58	56	55	53	52	50	47	47	49	48	49	Seeding 5 - 6 AM
5:15	62	62	62	63	62	62	65	65	64	65	63	60	61	60	60	59	58	57	55	54	52	52	50	47	46	48	47	48	
5:30	59	59	58	58	58	60	62	63	62	63	61	60	62	61	60	58	57	57	55	53	51	51	49	45	45	46	46	47	
5:45	57	55	55	57	55	56	59	60	60	61	59	57	60	58	58	56	56	54	52	51	49	50	48	44	44	45	43	44	
6:00	55	54	53	51	50	52	55	57	59	60	59	58	59	58	58	57	57	54	51	51	48	45	45	43	42	43	42	44	
6:15	51	44	39	37	38	46	50	53	55	55	56	54	56	55	56	54	51	48	41	39	36	35	39	38	38	37	37	39	
6:30	46	33	28	29	33	40	43	47	51	52	52	52	54	54	53	45	39	34	27	25	25	26	30	31	30	30	32	36	
6:45	42	27	25	25	29	33	34	38	47	48	51	51	51	52	43	32	29	25	20	20	21	24	25	25	28	28	28	30	
7:00	40	25	23	23	27	32	33	35	44	46	47	46	47	47	34	25	22	19	17	19	21	25	25	29	28	29	31	35	Peak Hour 7 - 8 AM
7:15	37	23	21	22	25	27	28	32	37	38	36	35	36	43	31	22	21	19	19	20	22	26	26	30	30	30	31	34	
7:30	37	21	19	20	22	23	23	26	30	30	28	30	34	41	27	20	18	18	17	18	19	23	24	28	29	30	31	33	
7:45	31	20	19	20	22	23	23	25	28	28	26	29	33	36	23	20	17	17	17	18	20	23	25	28	29	29	31	35	
8:00	31	22	20	20	20	22	23	24	25	26	23	26	27	31	20	18	16	14	16	17	19	23	24	28	28	28	31	35	Peak Period 6 - 10 AM
8:15	32	25	20	19	19	20	21	23	25	25	22	23	24	28	18	20	18	16	17	18	19	23	24	27	27	29	31	35	
8:30	33	27	22	19	19	21	22	24	25	26	24	24	25	26	16	18	15	15	16	17	19	20	22	25	25	26	29	32	
8:45	39	33	27	24	23	24	24	25	27	27	24	24	24	22	13	16	15	15	17	17	18	20	22	24	24	25	27	30	
9:00	45	46	41	35	29	32	32	31	30	30	25	24	24	23	14	18	16	16	17	17	18	19	20	23	22	23	25	29	
9:15	50	52	51	49	42	43	42	40	39	38	33	30	29	27	15	19	18	17	18	18	18	20	21	23	23	24	26	29	
9:30	50	52	54	50	48	49	50	47	47	47	44	41	38	36	17	19	18	18	19	20	19	19	21	25	24	26	27	31	
9:45	54	55	53	48	47	50	52	49	50	51	50	48	48	47	25	24	22	18	18	20	21	21	21	24	25	27	27	31	
10:00	55	56	53	48	48	51	55	53	53	54	53	51	51	50	41	33	29	25	22	23	23	25	23	26	26	28	30	34	
10:15	54	55	54	48	49	53	58	60	58	58	55	52	53	52	49	47	44	38	34	33	32	32	31	33	33	34	35	38	
10:30	54	54	52	47	48	53	59	60	60	58	55	54	53	52	51	47	45	42	39	40	37	36	37	37	36	37	36	38	
10:45	57	53	51	44	48	53	59	60	59	58	56	53	54	53	52	50	48	46	42	42	40	39	40	39	39	39	38	41	
11:00-13:00																													
13:00	59	57	56	53	52	55	59	60	59	59	57	57	58	57	59	57	56	54	52	51	47	45	44	42	42	42	41	43	
13:15	60	57	55	54	53	56	60	60	59	58	57	56	57	56	58	56	55	52	51	50	46	44	44	42	42	42	41	43	
13:30	60	58	54	52	52	55	60	61	59	59	58	57	58	57	57	55	52	51	50	49	45	44	43	42	41	42	40	42	
13:45	60	59	56	53	51	54	59	61	61	60	60	58	59	58	58	57	54	52	50	50	45	44	44	44	43	43	42	44	
14:00	59	59	56	54	51	55	59	59	59	59	58	57	58	56	56	54	52	51	49	49	44	43	44	43	42	42	40	42	Seeding 2 - 3 PM
14:15	59	59	55	55	53	55	58	59	59	58	57	56	57	56	57	55	53	51	48	47	43	42	41	40	39	39	38	39	
14:30	59	58	58	55	53	56	58	60	60	59	59	58	58	57	58	56	56	52	48	44	42	41	42	41	40	40	38	39	
14:45	60	59	59	55	51	56	59	61	61	61	59	58	58	56	57	55	55	50	47	46	44	43	43	43	41	40	38	38	
15:00	59	60	57	55	52	56	60	60	61	61	60	58	59	58	58	55	54	49	47	46	44	43	43	43	42	41	40	41	Peak Period 3 - 7 PM
15:15	59	59	57	56	54	57	60	60	60	60	59	57	58	56	57	55	51	48	44	43	40	38	39	40	39	36	36	37	
15:30	59	58	56	57	55	57	60	60	59	59	59	57	58	57	58	56	51	48	43	42	40	37	38	37	35	34	32	33	
15:45	59	57	57	57	55	57	58	59	60	59	58	56	58	56	57	55	51	49	44	43	40	38	38	37	34	33	31	32	
16:00	61	58	58	58	55	58	60	61	61	61	59	57	59	58	58	53	52	49	45	45	41	37	37	33	30	29	29	31	
16:15	58	57	57	59	57	57	60	60	60	59	58	56	57	57	58	53	52	48	42	39	36	34	35	34	32	30	29	32	
16:30	57	56	57	59	58	57	58	61	59	58	57	54	57	56	58	54	53	49	42	39	34	32	33	31	28	28	27	30	
16:45	55	54	55	56	54	56	58	59	58	57	56	54	56	56	57	51	49	44	41	40	34	32	32	30	27	27	26	29	
17:00	52	52	54	56	55	56	59	60	58	57	55	54	56	55	56	50	47	43	40	38	32	31	31	29	27	25	24	27	Peak Hour 5 - 6 PM
17:15	47	47	52	56	54	54	57	57	54	54	52	51	54	52	55	48	46	41	34	32	28	27	26	24	23	21	21	23	
17:30	41	46	50	54	52	52	56	55	52	53	52	50	54	52	53	46	46	39	31	29	25	24	23	22	21	20	20	23	
17:45	41	46	50	54	51	52	57	56	54	55	54	53	55	54	51	46	45	41	34	33	28	26	26	25	23	22	22	25	
18:00	45	52	54	57	53	53	58	57	56	57	56	54	55	54	53	48	47	43	37	36	31	30	28	27	25	25	24	27	
18:15	52	54	56	59	55	55	59	57	57	58	57	54	56	55	54	49	47	44	37	35	30	29	28	28	27	27	26	29	
18:30	55	55	57	60	55	56	59	59	59	60	57	56	58	56	57	53	52	46	39	36	31	31	30	29	28	27	27	29	
18:45	56	55	55	59	53	55	59	58	59	57	55	56	55	57	55	53	48	43	41	36	34	35	33	32	31	30	32		
19:00	57	58	57	56	54	55	59	60	59	59	56	54	56	55	57	55	54	51	48	46	41	38	38	35	34	33	32	33	
19:15	59	59	58	58	56	56	59	59	59	60	57	55	56	55	56	54	54	52	49	48	45	43	41	37	36	37	35	35	
19:30	59	59	59	60	57	56	59	60	59	59	57	55	57	54	56	55	55	55	51	49	47	46	44	40	38	40	37	38	
19:45	58	59	58	59	57	56	60	61	60	61	58	56	57	55	56	56	55	52	51	50	47	47	43	41	40	40	39	40	
20:00	58	58	58	59	57	57	60	61	61	60	58	55	58	56	57	56	56	54	51	50	47	47	45	41	41	42	40	41	
20:15	57	60	59	60	58	58	61	61	60	60	58	56	59	57	57	56	56	54	52	50	49	47	46	42	42	44	42	42	
20:30	57	59	58	60	57	57	60	61	61	62	59	57	59	58	57	56	55	54	52	50	48	49	46	43	43	44	43	44	
20:45	57	58	59	61	58	57	60	60	60	61	59	56	58	57	56	56	56	54	52	51	50	48	47	44	44	44	43	45	
21:00	57	58	59	60	57	56	60	61	60	62	59	57	58	57	57	56	56	54	52	51	49	49	47	44	43	45	44	44	
21:15	56	57	57	59	58	57	61	61	60	61	58	55	58	55	55	56	56	54	53	51	49	48	46	43	42	45	44	44	
21:30	58	59	57	59	57	57	60	61	60	60	58	56	57	55	56	56	55	54	51	49	48	47	45	42	42	45	43	45	
21:45	59	58	59	58	56	57	61	61	61	61	59	57	58	56	57	57	56	54	53	51	49	49	46	44	43	44	43	45	
22:00	60	60	60	60	58	58	61	61	60	61	59	56	57	56	57	56	56	54	53	51	49	48	47	44	44	45	43	44	
22:15	58	59	59	59	58	58	61	61	60	61	59	57	59	57	58	57	56	56	54	54	50	49	47	44	43	45	44	45	
22:30	58	60	59	59	58	57	61	60	60	62	59	57	59	57	56	56	55	55	53	52	50	49	47	44	44	45	44	45	
22:45	59	60	59	59	57	57	60	61	60	61	59	56	59	56	57	57	56	54	52	50	49	50	47	45	44	46	44	46	
23:00	59	59	59	59	57	56	59	60	61	61	59	57	58	56	55	58	57	54	54	53	51	51	48	47	46	47	46	47	
23:15	59	58	58	58	57	56	59	59	59	60	58	57	57	55	56	56	56	54	53	51	50	50	46	44	44	46	46	47	
23:30	59	59	59	60	57	58	61	62	62	63	60	58	59	56	57	56	55	55	53	53	50	51	47	44	45	46	45	46	
23:45	60	61	60	60	58	57	61	62	61	62	59	58	58	55	57	58	57	55	54	52	51	51	48	45	45	46	45	47	

Speed Color Scale (mph)

25 35 45 55 65

Figure 2-6: Southbound I-395 General Purpose Lane Speeds

	I-495		Turkeycock Run			Seminary Rd		King St		Shirlington Rd		Glebe Rd			Washington Blvd				Boundary Channel Dr				Potomac River			14th St		12th St	
2:30	59	58	58	56	56	57	56	56	55	56	57	58	57	55	53	53	52	51	49	49	51	50	48	47	46	45	43	47	47	
2:45	59	58	58	56	57	57	56	57	56	57	59	59	59	57	53	52	52	51	50	50	50	50	49	48	46	46	47	48	49	
3:00	60	59	59	56	56	57	56	56	56	57	59	60	60	58	53	51	51	50	50	48	49	50	50	49	48	48	48	49	49	
3:15	59	58	59	57	56	58	56	56	56	56	58	59	59	59	54	54	53	53	50	49	49	49	50	50	50	50	50	50	51	
3:30	59	58	59	57	57	59	57	57	57	57	59	60	60	58	55	54	54	54	52	52	53	52	51	52	51	51	51	52	55	
3:45	60	58	59	56	56	57	55	56	55	56	58	59	59	57	53	53	52	52	49	50	52	52	52	51	49	49	50	50	52	
4:00	59	57	58	55	56	58	57	57	56	56	59	59	60	59	55	55	54	53	51	51	50	52	50	51	49	50	51	51	52	
4:15	59	56	57	55	56	58	57	57	56	56	58	58	57	57	53	54	53	53	50	51	51	51	50	50	48	49	49	50	52	
4:30	60	58	59	56	57	58	57	57	56	58	60	59	59	59	56	56	56	55	51	52	54	52	51	51	49	50	50	52	53	
4:45	59	59	59	57	58	59	57	57	57	58	60	60	61	59	56	53	54	55	53	54	55	54	53	52	51	51	52	52	55	
5:00	60	58	58	57	58	58	57	57	57	58	60	59	60	60	56	53	54	54	52	53	54	54	52	51	50	50	51	52	53	Seeding 5 - 6 AM
5:15	60	58	59	57	58	58	57	57	56	57	59	59	60	60	55	55	55	56	53	54	54	54	52	52	50	50	52	52	54	
5:30	61	59	59	58	59	60	58	57	56	57	60	61	60	60	56	55	55	55	52	53	54	53	52	51	49	49	49	51	53	
5:45	61	59	59	58	59	61	59	58	56	57	60	60	61	59	55	55	54	54	52	52	53	52	50	50	48	48	48	50	53	
6:00	61	61	61	59	60	61	59	58	57	57	60	61	60	59	55	54	54	55	54	51	52	52	53	51	50	48	48	48	51	
6:15	60	59	60	59	60	61	59	58	56	57	59	60	59	58	55	54	54	54	51	51	52	53	51	50	48	48	48	48	50	
6:30	60	60	61	59	60	60	56	57	56	57	59	59	59	58	55	55	54	54	52	51	52	53	51	49	47	47	45	45	47	
6:45	59	59	60	59	58	60	58	57	57	57	59	60	59	59	56	55	55	54	51	51	51	52	50	48	45	45	43	41	43	
7:00	60	60	60	58	58	59	58	58	56	57	59	60	59	59	55	54	54	53	51	51	52	52	50	48	45	44	40	37	40	Peak Hour 7 - 8 AM
7:15	61	60	61	59	58	59	57	58	57	57	59	60	59	59	55	54	54	54	52	52	53	52	49	46	44	42	35	30	27	
7:30	60	59	61	58	58	58	56	57	56	56	58	59	59	59	56	54	55	54	51	50	51	52	49	46	42	42	34	29	25	
7:45	60	58	61	59	59	57	56	56	56	57	59	60	58	58	56	56	55	53	51	51	50	51	48	45	43	42	35	30	26	
8:00	59	58	61	58	59	58	56	58	58	58	60	60	60	60	56	56	55	53	50	50	51	51	49	46	44	43	37	32	29	
8:15	60	60	61	59	61	62	60	59	59	58	60	60	60	60	55	55	54	54	50	51	52	52	49	46	43	42	35	30	28	
8:30	61	61	61	60	62	61	59	59	58	58	60	61	59	59	56	55	55	54	51	50	50	50	47	45	42	42	35	30	28	
8:45	61	61	62	60	62	61	59	59	57	58	60	60	60	60	56	56	55	53	50	50	50	49	46	43	41	41	36	32	32	Peak Period 6 - 10 AM
9:00	61	60	62	60	61	62	60	59	57	58	60	60	59	60	56	55	54	52	49	49	50	49	45	41	41	41	38	35	36	
9:15	61	60	62	61	63	62	60	59	57	58	60	61	60	60	56	55	54	51	49	49	50	50	45	42	42	43	39	38	39	
9:30	61	60	62	61	62	62	59	59	57	58	61	61	61	60	57	56	56	53	50	49	50	50	47	44	43	43	40	39	41	
9:45	61	61	62	60	61	61	59	59	57	58	60	60	60	60	57	56	55	54	49	50	50	51	49	47	44	44	41	40	42	
10:00	61	60	62	60	61	61	60	60	58	59	61	61	61	61	57	56	54	53	51	51	53	52	48	46	44	44	42	40	43	
10:15	60	59	61	59	59	59	57	57	56	58	60	60	60	60	56	55	54	53	50	50	50	50	47	47	44	44	42	41	44	
10:30	59	58	61	58	59	59	59	58	56	58	60	61	61	61	57	57	55	55	51	50	50	51	48	47	44	44	44	44	47	
10:45	57	59	60	58	60	60	59	58	57	58	60	61	61	60	56	55	54	54	49	50	50	51	49	48	45	45	44	44	46	
11:00-13:00																														
13:00	61	58	60	56	59	60	59	59	56	58	61	61	61	60	56	55	54	53	51	51	51	52	50	48	45	45	44	44	47	
13:15	60	58	59	54	58	60	59	58	57	58	60	61	61	61	56	55	54	53	51	51	51	52	49	48	46	45	43	43	45	
13:30	60	59	59	55	59	60	59	58	56	57	59	60	60	60	56	54	54	53	50	50	51	51	48	45	43	42	40	39	42	
13:45	59	57	59	55	58	60	58	57	55	57	59	60	60	61	56	55	54	53	50	50	51	51	48	45	42	42	40	40	42	
14:00	59	56	58	54	57	60	58	58	56	57	59	60	60	60	56	56	54	53	50	51	51	51	48	46	43	43	41	40	43	Seeding 2 - 3 PM
14:15	59	54	56	53	55	56	57	57	55	56	57	59	60	60	56	55	54	52	50	49	50	50	47	45	43	42	39	37	37	
14:30	57	48	51	50	49	50	52	53	52	54	56	58	60	60	56	55	53	52	50	50	51	51	48	46	42	41	37	34	33	
14:45	56	46	45	43	43	44	49	52	51	53	56	58	59	60	56	55	54	53	50	50	51	51	48	44	42	41	36	32	29	
15:00	54	43	39	38	41	43	46	51	51	52	55	56	56	57	54	55	55	52	49	50	51	51	47	43	41	39	36	30	25	Peak Period 3 - 7 PM
15:15	53	39	35	31	34	40	46	49	49	50	54	55	54	55	54	56	56	53	49	50	51	50	47	43	40	40	35	28	21	
15:30	54	42	37	30	29	35	41	45	44	45	47	48	47	48	49	55	54	51	48	50	49	49	45	40	37	37	31	25	20	
15:45	56	48	45	33	27	28	34	37	37	37	38	41	37	35	43	50	52	50	48	49	50	48	43	38	35	35	29	24	21	
16:00	59	54	53	37	29	28	32	35	34	33	33	34	30	25	34	48	49	48	47	49	51	49	44	40	36	35	30	25	22	
16:15	57	53	51	32	23	24	30	34	34	33	33	33	28	22	28	48	49	48	46	48	49	46	42	37	33	33	29	25	21	
16:30	59	55	52	32	22	21	26	30	30	29	31	34	29	22	26	47	48	48	47	48	48	46	39	36	32	32	26	22	18	
16:45	59	54	51	32	24	21	26	30	30	30	30	30	26	21	22	43	46	46	45	46	46	44	39	37	32	31	26	23	18	
17:00	59	55	52	32	24	21	24	27	28	27	27	28	25	21	22	39	45	46	44	45	45	44	41	36	33	32	27	23	19	Peak Hour 5 - 6 PM
17:15	58	55	51	29	21	21	24	27	27	25	22	23	23	19	20	36	42	45	43	45	45	44	40	34	30	30	26	21	18	
17:30	59	55	51	31	23	19	23	26	25	21	19	20	18	15	19	35	40	42	42	44	45	42	37	32	28	28	25	21	18	
17:45	60	55	51	31	24	22	24	26	25	23	21	22	20	15	16	32	38	40	41	44	44	42	38	31	27	26	24	21	18	
18:00	58	55	51	32	24	22	25	29	29	28	27	26	24	19	22	39	42	42	43	44	44	41	36	32	28	27	25	21	18	
18:15	56	45	43	31	26	25	29	33	32	30	29	31	29	26	31	46	48	47	45	46	47	43	39	33	29	29	27	23	19	
18:30	56	42	38	31	28	29	35	40	37	35	36	38	35	30	36	48	49	48	46	45	46	44	40	35	31	31	28	23	20	
18:45	57	43	39	32	31	37	41	45	42	40	40	42	40	37	40	50	50	48	46	46	46	45	42	37	32	31	29	25	21	
19:00	57	46	44	38	38	42	46	47	44	43	44	45	45	45	47	50	50	48	46	46	46	45	42	38	34	34	32	28	24	
19:15	56	48	48	40	37	42	46	48	45	44	47	51	53	53	52	52	51	50	47	47	47	47	43	41	38	37	34	32	30	
19:30	57	50	50	39	39	45	48	49	46	47	50	53	55	56	53	53	52	50	47	46	46	45	44	44	42	39	37	36	33	
19:45	58	53	54	43	45	50	52	52	50	51	55	57	57	57	53	51	50	49	47	47	46	46	44	43	41	41	40	40	39	
20:00	60	57	56	48	49	52	52	53	51	52	55	57	57	58	54	52	51	51	48	48	48	49	45	45	43	42	42	43	44	
20:15	60	57	57	51	50	52	51	52	52	53	56	57	58	58	54	52	52	51	49	49	50	50	48	46	44	43	44	45	46	
20:30	61	58	58	51	49	51	50	51	51	53	56	58	58	57	54	53	52	51	48	48	50	51	48	46	44	43	44	45	47	
20:45	60	57	57	51	49	51	51	52	52	54	57	58	58	57	52	53	52	52	48	49	50	50	48	47	45	45	45	46	48	
21:00	60	58	58	51	51	52	53	54	54	55	58	59	59	57	53	52	52	51	48	49	49	49	47	46	45	44	45	46	47	
21:15	60	57	56	53	56	58	57	55	54	55	58	58	58	57	53	53	52	51	49	49	48	49	47	47	45	45	46	46	48	
21:30	61	56	57	55	57	58	57	55	54	56	59	59	58	57	53	53	52	51	48	48	49	50	47	47	44	44	45	46	48	
21:45	60	55	58	56	57	58	57	56	54	55	57	57	58	58	55	54	53	51	49	49	48	47	45	45	44	43	44	46	48	
22:00	60	56	58	58	59	59	57	57	55	55	57	57	59	58	55	53	53	52	49	49	51	51	49	48	46	44	45	45	47	
22:15	59	58	59	58	59	59	57	55	52	53	54	55	58	58	54	52	52	51	48	49	49	49	47	47	45	44	45	45	47	
22:30	59	58	59	57	57	56	55	54	51	52	54	55	58	57	52	52	51	51	49	49	48	48	46	46	45	44	45	44	46	
22:45	59	58	59	58	58	55	54	53	52	53	55	56	59	57	52	51	51	51	49	48	49	48	46	46	45	44	45	45	47	
23:00	61	60	60	58	59	56	53	52	51	52	54	55	59	57	53	52	52	50	49	48	49	49	47	47	45	45	46	47	50	
23:15	61	60	60	58	58	58	53	52	51	52	54	57	60	58	53	53	52	51	49	50	50	51	48	48	45	46	46	47	49	
23:30	60	60	61	58	57	56	52	52	51	52	55	58	59	59	53	52	52	51	49	49	49	49	47	47	46	46	46	47	49	
23:45	59	59	60	59	59	56	54	53	51	53	56	59	60	59	54	52	52	51	49	51	53	52	52	50	48	48	49	49	50	

Speed Color Scale (mph)

25 35 45 55 65

Figure 2-7: Northbound I-395 HOT/HOV Lane Speeds

	I-495					Turkeycock Run			Seminary Rd		King St		Shirlington Rd		Glebe Rd		Washington Blvd	Eads St			Boundary Channel Dr				Potomac River	14th St	
2:30	51	50	52	53	54	54	60	61	56	57	60	63	63	63	65	65	62	58	57	56	55	54	54	54	54	50	48	
2:45	50	49	52	52	54	53	59	61	57	57	60	63	63	61	65	65	62	58	58	56	56	55	55	56	55	55	50	48	
3:00	65	66	65	65	65	65	63	64	62	59	64	66	66	65	66	65	63	59	58	56	56	56	55	56	56	55	50	49	
3:15	64	66	65	65	65	65	63	64	62	61	63	67	67	65	66	66	64	59	58	56	56	55	55	55	54	53	49	48	
3:30	64	65	65	64	65	65	63	64	63	61	65	67	66	65	65	64	64	60	60	58	58	56	55	55	54	54	52	51	
3:45	66	67	66	67	66	65	65	66	64	61	66	67	68	66	66	65	65	61	62	61	61	59	59	58	57	56	53	52	
4:00	66	67	66	66	66	66	66	68	65	66	68	68	68	67	67	66	66	61	62	61	60	59	58	58	56	57	54	50	
4:15	65	66	65	66	66	65	65	66	65	66	68	68	68	67	66	66	64	60	61	59	59	57	57	57	57	57	55	50	
4:30	66	67	66	67	66	66	66	67	66	67	69	68	69	68	68	67	66	60	61	59	59	56	56	56	56	55	53	50	
4:45	68	68	68	69	68	68	67	68	67	68	70	69	70	70	69	68	67	63	63	62	62	60	60	60	59	58	55	51	
5:00	69	69	70	70	69	71	68	70	70	70	71	71	72	72	70	70	68	64	65	64	64	62	62	61	59	59	56	52	Seeding 5 - 6 AM
5:15	70	69	69	70	69	69	67	68	68	70	70	70	71	70	69	69	68	62	63	62	62	61	60	60	59	58	55	51	
5:30	72	71	72	72	71	71	69	70	70	70	71	71	71	71	68	68	67	62	63	63	63	61	59	59	59	58	54	49	
5:45	71	71	72	72	71	71	67	68	67	67	70	70	70	69	67	67	66	61	62	61	60	59	57	57	56	56	52	47	
6:00	70	71	70	70	70	69	67	67	66	67	68	69	69	68	66	66	65	59	60	60	60	58	58	57	55	54	51	45	
6:15	70	70	69	69	68	66	64	64	61	63	65	66	66	66	65	65	64	56	56	58	58	54	54	53	52	51	46	41	
6:30	70	71	69	69	68	68	65	65	61	66	65	68	69	68	66	67	65	55	53	53	53	45	42	41	38	39	34	30	
6:45	69	70	69	69	68	68	65	65	63	64	62	66	66	66	64	64	63	45	46	45	43	28	26	26	26	27	26	25	
7:00	68	69	68	68	66	66	64	63	63	62	63	67	67	66	63	63	60	33	39	33	36	25	23	23	24	24	25	25	
7:15	68	69	68	68	67	67	64	63	61	63	60	65	65	64	61	61	58	32	36	35	32	23	22	23	23	24	24	26	Peak Hour 7 - 8 AM
7:30	67	69	68	67	65	67	62	64	62	63	59	61	61	59	55	55	52	27	30	29	25	22	23	24	25	25	26	26	
7:45	65	68	67	66	61	63	63	63	61	63	59	59	60	58	56	56	54	30	31	29	24	21	24	25	26	26	27	27	
8:00	66	68	64	62	58	64	61	60	56	59	56	57	60	59	57	57	57	32	29	28	24	20	24	25	25	25	25	25	
8:15	63	67	63	63	59	66	63	60	52	59	55	57	58	59	58	59	57	32	27	26	22	19	24	25	26	26	26	26	
8:30	65	67	65	62	59	64	60	59	53	61	57	57	59	60	57	58	57	34	24	20	16	18	23	24	25	25	25	25	
8:45	64	66	65	64	59	61	54	52	47	61	56	54	54	54	52	54	52	39	25	20	13	15	20	22	23	23	22	22	
9:00	66	67	64	64	61	57	55	56	54	60	53	57	57	52	49	51	53	47	26	23	17	17	20	21	23	23	25	24	
9:15	66	68	65	65	65	61	59	59	51	47	42	37	33	34	38	38	42	29	14	13	12	14	18	20	21	21	23	25	
9:30	64	66	65	63	65	65	63	63	55	53	51	44	38	39	39	40	36	22	18	16	15	15	18	19	19	19	21	24	
9:45	65	64	62	63	64	64	61	62	57	62	61	59	56	55	53	53	46	30	18	16	16	16	19	20	20	21	21	25	
10:00	64	65	64	65	65	65	62	61	57	63	63	61	61	59	59	59	55	43	25	21	19	19	21	22	22	22	23	27	
10:15	66	67	66	66	65	63	62	62	56	62	64	64	63	61	60	60	58	50	44	43	41	36	35	32	31	31	29	32	
10:30	64	65	65	66	64	66	64	63	57	61	65	64	65	62	61	60	59	53	50	48	49	44	44	43	43	41	39	37	
10:45	66	65	65	66	64	66	64	63	57	64	66	65	65	63	61	61	60	52	50	49	48	45	45	45	46	44	42	41	
11:00-13:00	HOV/ HOT REVERSAL PERIOD																											
13:00																		55	55	50	54	54	53	52	50	44	
13:15																		55	55	47	52	51	51	51	48	43	
13:30																		56	56	50	53	53	53	53	49	45	
13:45																		57	56	51	54	53	53	53	49	45	
14:00																		55	55	49	54	53	54	53	49	44	Seeding 2 - 3 PM
14:15																		54	54	49	54	52	52	51	49	41	
14:30																		54	54	49	55	53	53	54	50	41	
14:45																		54	54	51	55	53	53	53	49	41	
15:00																		55	56	53	57	57	56	55	50	42	Peak Period 3 - 7 PM
15:15																		53	53	53	54	55	54	53	48	39	
15:30																		53	53	52	53	52	52	50	44	36	
15:45																		53	53	49	51	49	49	49	43	36	
16:00																		50	52	51	52	51	50	50	45	33	
16:15																		51	52	53	54	53	52	51	44	32	
16:30																		52	52	51	52	51	49	48	42	28	
16:45																		50	51	48	48	48	47	46	38	30	
17:00																		47	49	47	47	44	45	44	35	28	Peak Hour 5 - 6 PM
17:15																		48	50	46	48	45	44	41	34	22	
17:30																		49	49	43	44	43	42	41	31	20	
17:45																		45	47	43	44	43	43	42	35	24	
18:00																		46	47	43	42	41	41	40	35	28	
18:15																		46	47	43	44	45	44	42	37	30	
18:30																		47	49	45	46	45	45	44	39	30	
18:45																		50	51	49	50	50	49	49	43	32	
19:00																		51	51	52	52	53	52	51	48	37	
19:15																		51	52	53	52	53	52	52	48	40	
19:30																		51	52	53	52	52	52	52	49	41	
19:45																		51	51	52	51	52	51	51	48	41	
20:00																		51	51	53	52	53	52	52	49	44	
20:15																		51	52	53	52	52	52	52	50	45	
20:30																		51	52	53	53	54	54	54	50	47	
20:45																		51	52	53	53	53	53	53	50	46	
21:00																		51	52	53	53	53	53	53	50	47	
21:15																		51	52	54	53	53	53	52	50	46	
21:30																		51	52	52	52	53	53	52	49	46	
21:45																		50	51	53	53	53	53	52	49	46	
22:00																		53	53	54	55	54	55	54	51	47	
22:15																		54	55	55	55	55	54	54	52	48	
22:30																		52	53	54	54	55	55	55	52	48	
22:45																		51	53	54	55	55	55	54	52	48	
23:00																		51	51	54	54	54	54	53	51	48	
23:15																		51	52	54	54	52	52	52	50	47	
23:30																		49	50	53	54	53	53	53	50	48	
23:45																		52	52	54	54	54	54	54	52	49	

Speed Color Scale (mph)

25 35 45 55 65

Figure 2-8: Southbound I-395 HOT/HOV Lane Speeds

	I-495					Turkeycock Run				Seminary Rd				Shirlington Rd				Washington Blvd	Eads St			Boundary Channel Dr				14th St	
2:30																			54	53	52	52	51	51	51	50	49	
2:45																			53	53	51	51	51	51	52	50	49	
3:00																			55	54	53	53	52	52	52	51	50	
3:15																			55	53	53	53	53	53	53	53	50	
3:30																			56	54	54	54	54	54	55	53	51	
3:45																			56	55	55	54	53	53	53	52	50	
4:00																			57	56	55	54	54	54	54	53	51	
4:15																			56	54	54	54	53	52	53	52	50	
4:30																			56	54	54	54	53	54	54	53	52	
4:45																			57	56	55	55	54	54	54	53	52	
5:00																			57	55	55	55	55	55	55	54	52	Seeding 5 - 6 AM
5:15																			57	55	56	56	55	56	56	55	53	
5:30																			57	56	56	55	55	56	56	54	53	
5:45																			57	54	55	55	55	55	55	54	52	
6:00																			57	56	56	56	55	54	54	53	51	
6:15																			57	57	57	57	56	54	55	53	51	
6:30																			57	59	58	57	56	54	54	52	49	
6:45																			56	58	57	56	55	53	53	52	48	
7:00																			56	57	57	57	55	53	53	52	48	Peak Hour 7 - 8 AM
7:15																			54	54	55	58	56	53	53	51	44	
7:30																			56	56	56	56	55	53	53	51	43	
7:45																			57	57	57	56	55	53	53	51	43	
8:00																			56	56	56	57	55	52	52	50	43	Peak Period 6 - 10 AM
8:15																			56	56	56	55	54	53	52	49	42	
8:30																			56	57	57	57	55	53	53	50	41	
8:45																			58	59	58	57	55	51	51	49	42	
9:00																			58	56	55	55	52	51	50	49	43	
9:15																			58	55	54	53	51	51	51	49	45	
9:30																			57	54	53	52	51	51	51	49	46	
9:45																			57	54	54	54	52	52	52	51	47	
10:00																			58	56	54	53	52	52	52	50	47	
10:15																			57	56	54	52	52	52	52	50	47	
10:30																			57	56	54	52	52	53	52	51	49	
10:45																			58	55	54	53	52	52	52	50	48	
11:00-13:00	HOV/ HOT REVERSAL PERIOD																											
13:00	64	64	65	65	65	66	64	63	65	67	65	65	66	66	65	65	65	58	60	57	55	55	53	53	53	50	48	
13:15	65	66	66	65	65	68	65	63	66	68	66	65	66	66	65	65	65	58	59	57	56	55	53	52	51	49	47	
13:30	65	65	66	67	66	67	65	65	67	69	66	65	67	67	66	66	65	58	60	58	56	56	53	52	52	50	46	
13:45	64	61	64	65	66	67	64	64	65	68	65	64	67	67	66	66	65	58	59	57	55	54	52	51	51	49	46	
14:00	63	61	64	65	65	67	65	65	66	68	66	66	68	68	66	66	66	58	59	57	56	55	53	53	53	51	47	Seeding 2 - 3 PM
14:15	65	64	66	65	65	67	65	64	65	64	64	66	68	67	66	66	66	58	60	59	58	58	55	54	54	51	46	
14:30	66	65	67	66	65	67	65	64	64	60	60	62	66	66	65	65	63	57	61	59	58	56	53	53	53	50	45	
14:45	67	68	68	69	67	68	66	65	64	62	60	61	64	64	64	64	65	58	60	58	58	58	56	54	54	50	44	
15:00	66	68	67	67	64	65	63	63	63	62	61	60	63	63	63	62	63	52	60	60	60	59	55	54	53	49	40	Peak Period 3 - 7 PM
15:15	65	67	66	64	63	66	60	60	63	61	58	56	58	59	60	59	60	50	61	62	61	59	57	55	54	49	40	
15:30	66	68	68	67	66	66	58	55	58	60	58	58	59	58	58	57	58	49	57	61	59	57	54	52	51	47	38	
15:45	68	70	70	69	68	69	68	67	66	65	59	61	61	63	64	64	63	50	59	60	59	58	55	53	52	48	38	
16:00	70	70	71	71	72	72	69	69	66	67	59	62	65	65	66	65	62	52	58	60	59	57	55	53	52	48	38	
16:15	67	69	68	68	69	69	67	67	65	66	63	62	65	65	66	66	63	51	59	61	60	59	55	53	52	48	37	
16:30	65	68	69	69	68	69	66	66	64	61	62	62	65	65	65	64	63	49	56	59	58	58	54	52	52	47	36	
16:45	65	67	67	68	68	68	66	65	66	63	62	63	67	67	65	64	62	49	56	58	57	56	53	50	50	46	35	
17:00	67	68	68	69	68	68	64	64	64	60	58	62	64	65	62	60	58	44	55	60	58	56	53	50	49	45	35	Peak Hour 5 - 6 PM
17:15	67	68	68	68	67	65	64	64	61	60	58	60	62	62	57	58	57	49	55	58	57	56	53	50	49	44	34	
17:30	66	68	68	67	67	67	65	63	60	58	56	59	63	63	62	61	59	46	55	58	57	55	51	48	47	42	33	
17:45	66	67	67	67	67	66	64	62	60	60	58	59	62	62	62	61	60	45	53	56	55	54	50	47	46	41	32	
18:00	67	67	65	65	65	66	64	61	61	58	54	54	59	60	60	59	59	36	46	50	50	50	48	45	45	40	30	
18:15	64	65	64	62	62	64	60	59	59	59	54	50	51	52	50	50	36	22	36	41	43	47	47	46	45	40	31	
18:30	63	64	64	63	61	63	60	59	59	57	54	50	50	50	46	46	34	22	35	38	40	43	44	44	43	39	33	
18:45	64	64	64	64	64	65	59	57	60	58	56	54	55	54	50	50	36	25	41	45	47	49	48	47	46	42	35	
19:00	64	63	64	62	62	64	59	56	61	60	58	56	58	57	54	54	43	36	51	53	54	52	51	48	48	44	37	
19:15	63	62	63	61	61	63	60	57	60	61	60	58	59	59	58	58	54	48	57	56	56	54	52	49	49	45	37	
19:30	62	62	62	60	61	62	61	59	59	61	60	60	62	62	61	61	57	49	57	56	56	54	52	49	49	47	42	
19:45	63	64	64	62	61	63	61	61	62	62	61	61	64	64	64	63	60	50	57	57	56	54	52	49	50	48	43	
20:00	64	64	64	63	63	65	63	62	61	62	63	63	65	65	64	64	61	51	57	56	55	55	53	51	52	50	47	
20:15	63	64	64	64	63	64	61	60	56	56	55	59	62	62	62	63	58	49	56	56	56	55	53	51	51	49	46	
20:30	64	63	63	63	62	60	58	56	55	55	54	56	62	63	63	64	59	49	57	56	56	55	53	51	51	49	47	
20:45	63	62	62	62	62	63	60	59	56	59	56	56	61	62	64	65	60	50	57	56	56	55	53	51	52	50	47	
21:00	63	62	64	63	63	63	61	61	57	59	57	58	62	62	63	63	60	48	56	55	56	54	53	52	52	50	47	
21:15	62	61	62	61	61	61	59	59	58	59	59	59	62	61	62	62	58	49	57	57	57	56	54	53	54	51	47	
21:30	62	60	60	58	58	62	60	60	61	62	61	61	61	60	62	61	59	50	57	56	57	56	53	51	52	50	48	
21:45	62	61	60	59	59	62	61	60	61	62	61	59	59	59	62	62	59	50	57	57	56	55	54	52	52	51	48	
22:00	64	61	63	62	61	64	61	61	62	63	60	58	61	61	59	59	57	48	56	55	55	54	53	51	51	50	47	
22:15	62	61	62	63	62	64	62	62	62	62	60	57	58	58	58	59	57	49	56	55	56	55	52	49	50	49	46	
22:30	61	61	63	62	62	65	62	61	62	64	62	60	60	60	61	62	58	49	57	57	56	56	54	52	52	50	47	
22:45	62	62	62	61	61	64	62	61	61	63	58	58	60	60	61	61	59	49	57	56	56	55	53	51	51	49	47	
23:00	62	62	62	62	62	63	60	61	62	63	59	58	62	60	59	59	57	49	56	56	57	56	55	53	53	52	50	
23:15	62	62	62	64	61	62	59	61	62	64	57	56	61	60	60	61	57	49	58	58	58	57	55	53	52	50	49	
23:30	61	60	60	61	59	62	59	61	61	63	56	55	60	59	61	61	59	49	57	56	56	56	54	52	52	50	48	
23:45	60	61	61	62	60	63	59	60	62	64	59	58	61	61	61	62	60	49	57	56	56	55	54	51	52	51	49	

Speed Color Scale (mph)

25 35 45 55 65

2.4.3.3 Travel Time Runs

Travel time runs were performed along northbound and southbound I-395 in both the general purpose and HOV/HOT lanes during both the AM and PM peak hours. Travel time runs were completed during January, April and May 2016 and were performed on Tuesday, Wednesday, or Thursday using the floating car method where the drivers traveled with the average speed of traffic. GPS devices were used to record vehicle speeds. The speeds and travel times were generally segmented at each on-ramp and off-ramp along the corridor.

Table 2-10 depicts the average travel times, speeds and lengths for the overall corridor for the AM and PM peak hours for each facility. **Figures 2-9 through 2-12** depict the travel time runs by segment for the northbound and southbound I-395 general purpose and northbound and southbound I-395 HOV/HOT lanes in the peak direction (i.e., northbound in the AM peak hour and southbound in the PM peak hour).

The HOV/HOT lane peak direction travel times are approximately 2.5 times lower in the AM peak hour and about 3.5 times lower in the PM peak hour than the general purpose lanes. This is due to the high traffic volumes and congestion in the general purpose lanes traveling northbound in the AM peak period toward the Pentagon vicinity and the District and southbound in the PM peak period leaving the District and the Pentagon vicinity. The travel speeds in the off-peak direction of the general purpose lanes are significant greater than the peak direction speeds (28 MPH greater in the AM and 36 MPH greater in the PM).

During the AM period, traffic in the southbound HOV lanes must exit the corridor south of Eads Street and merge into the general purpose lanes. During the PM period, the first opportunity to enter the northbound HOV lanes occurs at Eads Street. These shorter HOV lane travel distances are reflected in the **Table 2-10.**

Table 2-10: Existing Travel Time Summary

Period	Segment		Distance (miles)	Travel Time (minutes)	Average Speed (MPH)
AM	NB	General Purpose	10.2	33.1	19
		HOV/HOT	9.9	13.1	45
	SB	General Purpose	10.3	11.9	52
		HOV/HOT	2.0	2.3	52
PM	NB	General Purpose	10.2	13.0	47
		HOV/HOT	1.5	3.1	29
	SB	General Purpose	10.3	39.5	16
		HOV/HOT	9.9	10.7	55

Figure 2-9: Northbound I-395 General Purpose Lanes Travel Times – AM Peak Hour

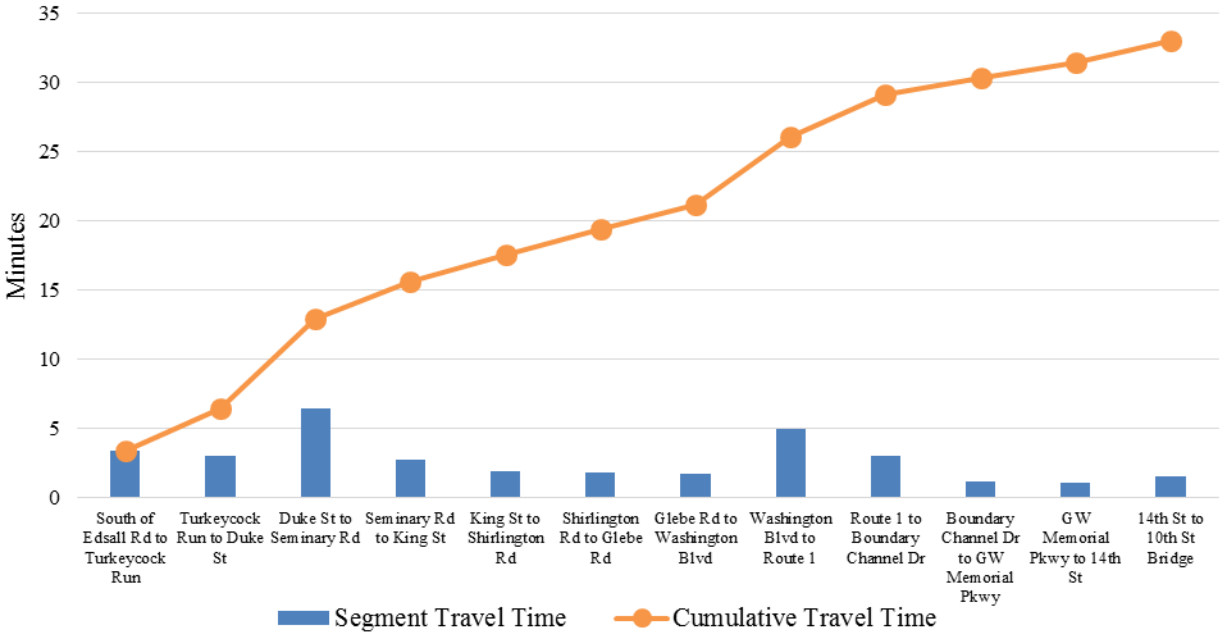


Figure 2-10: Northbound I-395 HOV/HOT Lanes Travel Times – AM Peak Hour

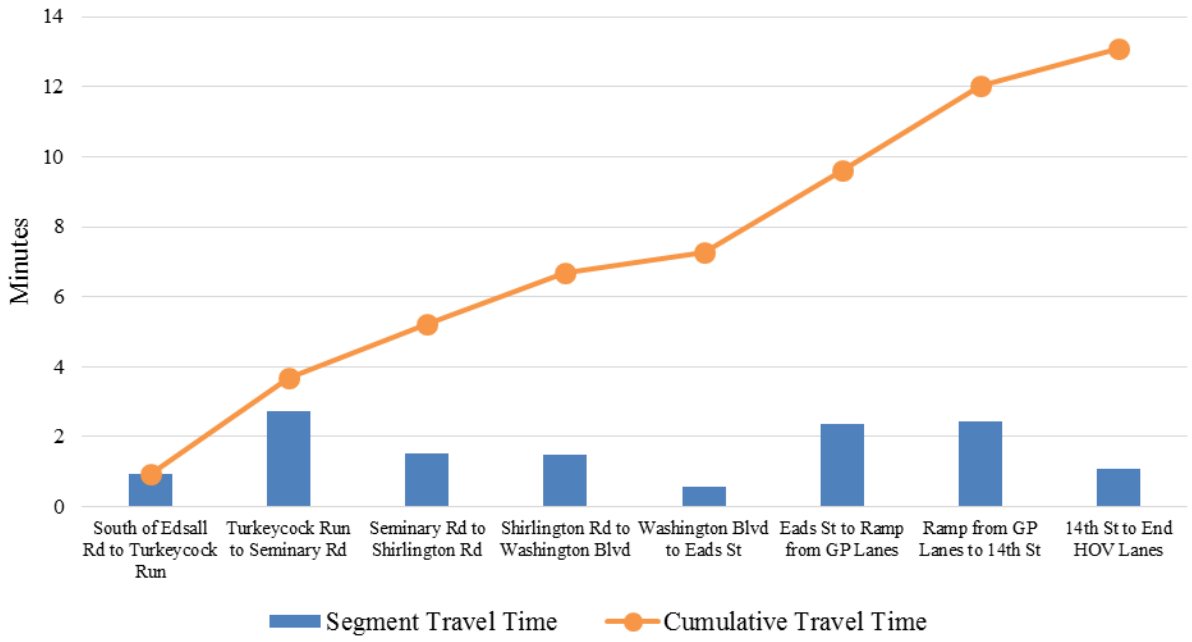


Figure 2-11: Southbound I-395 General Purpose Lanes Travel Times – PM Peak Hour

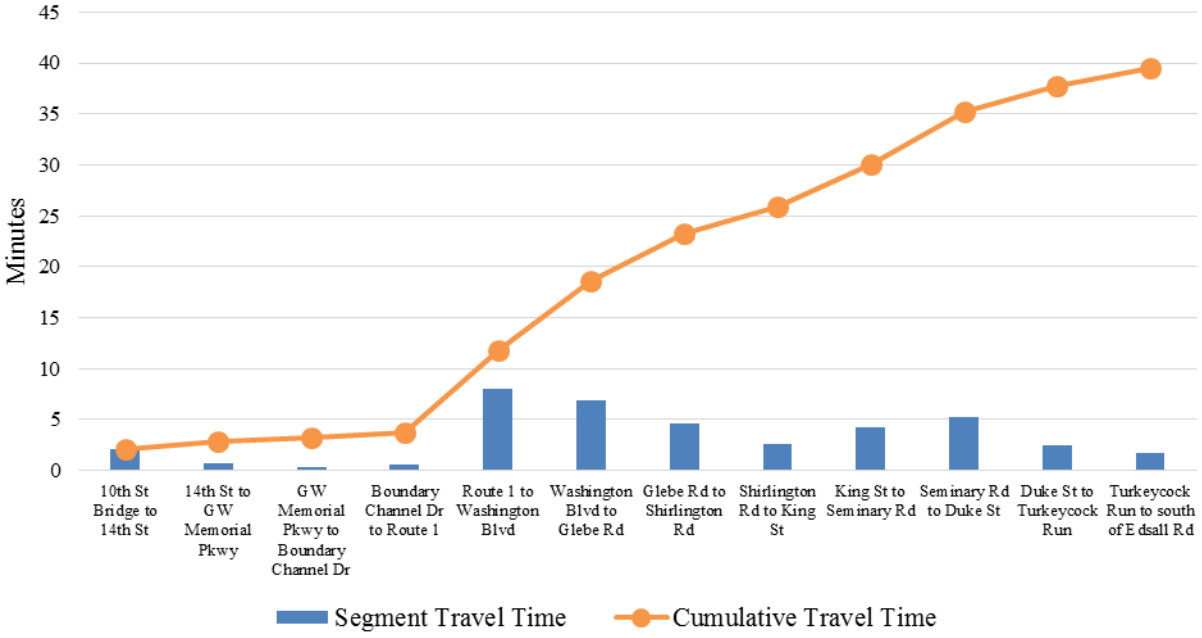
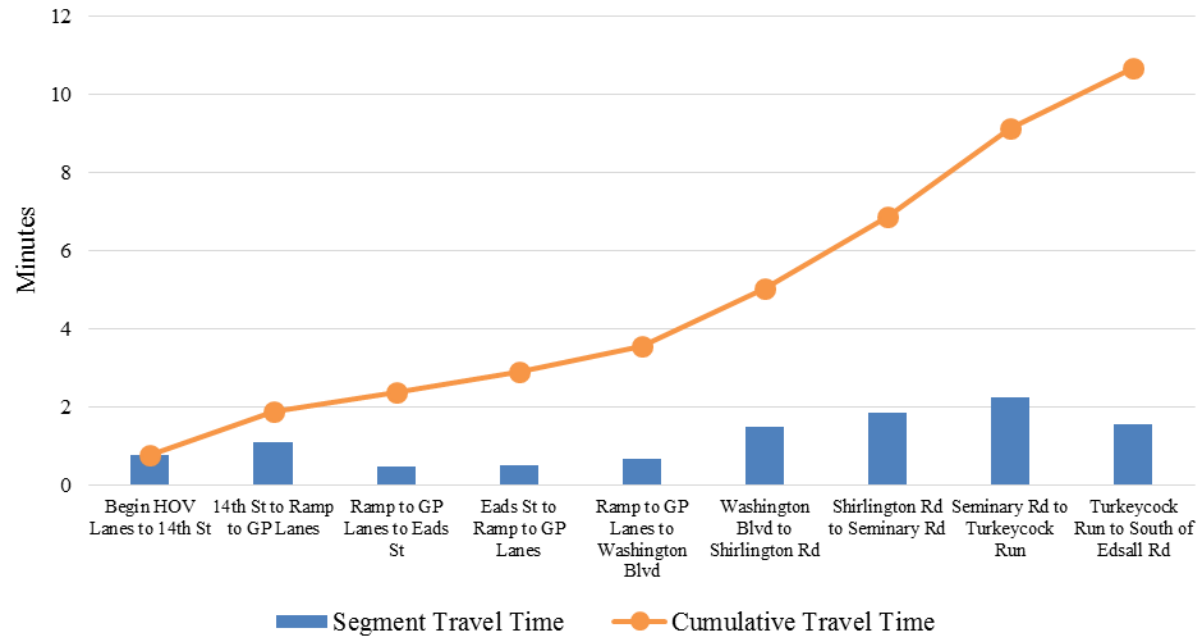


Figure 2-12: Southbound I-395 HOV/HOT Lanes Travel Times – PM Peak Hour



2.4.4 Daily Traffic Volumes

Existing weekday daily traffic volumes are summarized in **Figures 2-15a through 2-15e.** The daily volumes were developed based on a review of the traffic data collected in 2015 and 2016. Daily traffic volumes were balanced along the corridor and rounded to the nearest 100 vehicles.

Figures 2-13 and 2-14 depict daily traffic volumes along northbound and southbound I-395 including both the general purpose and HOV/HOT lanes, respectively. Daily traffic volumes gradually increase from 195,000 to 227,000 between Edsall Road and Glebe Road where there is a reduction in traffic volumes due to a large portion of motorists that enter (traveling southbound) and exit (traveling northbound) the corridor at that interchange. Traffic volumes along the general purpose lanes at the Hayes Street bridge within Washington Boulevard Interchange are the lowest in the corridor (58,700 northbound and 51,800 southbound) due to the high volume of traffic on the parallel collector-distributor roadways. The highest daily traffic volumes are at the Potomac River with an average weekday daily traffic volume of 261,900.

Figure 2-13: Existing (2015) Average Weekday Daily Traffic Volumes – Northbound I-395

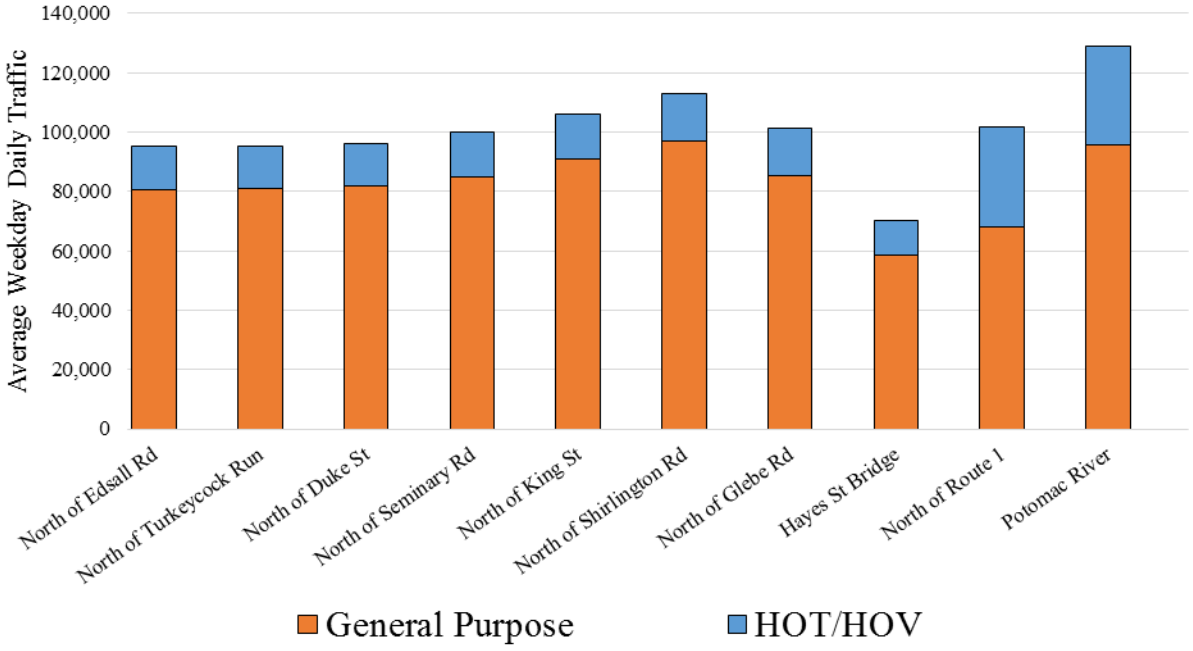


Figure 2-14: Existing (2015) Average Weekday Daily Traffic Volumes – Southbound I-395

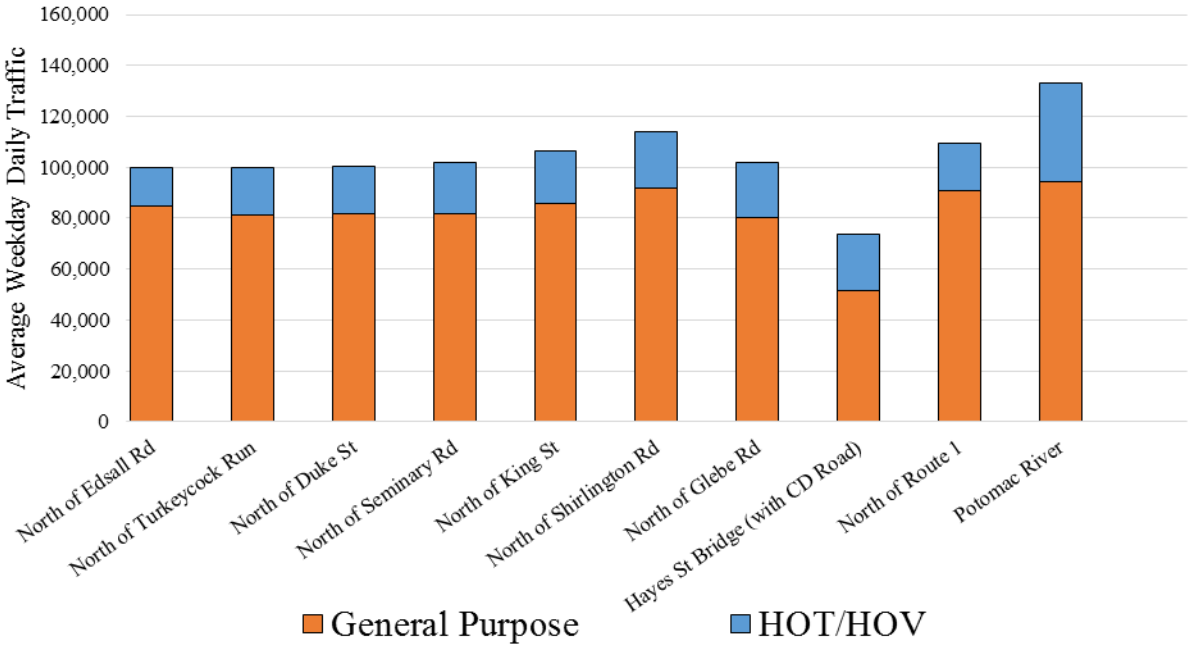


Figure 2-15a: Existing (2015) Average Weekday Daily Traffic Volumes

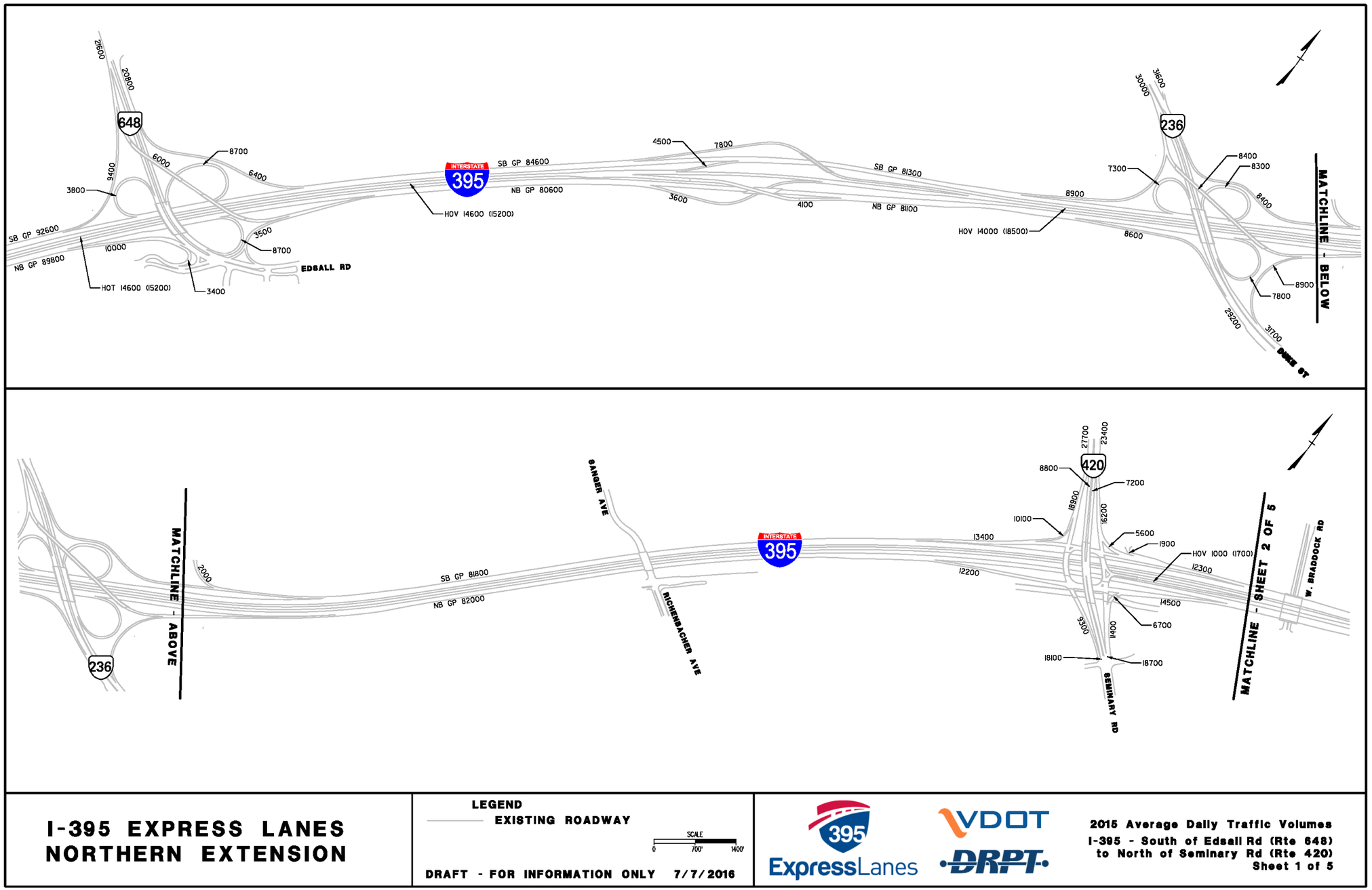
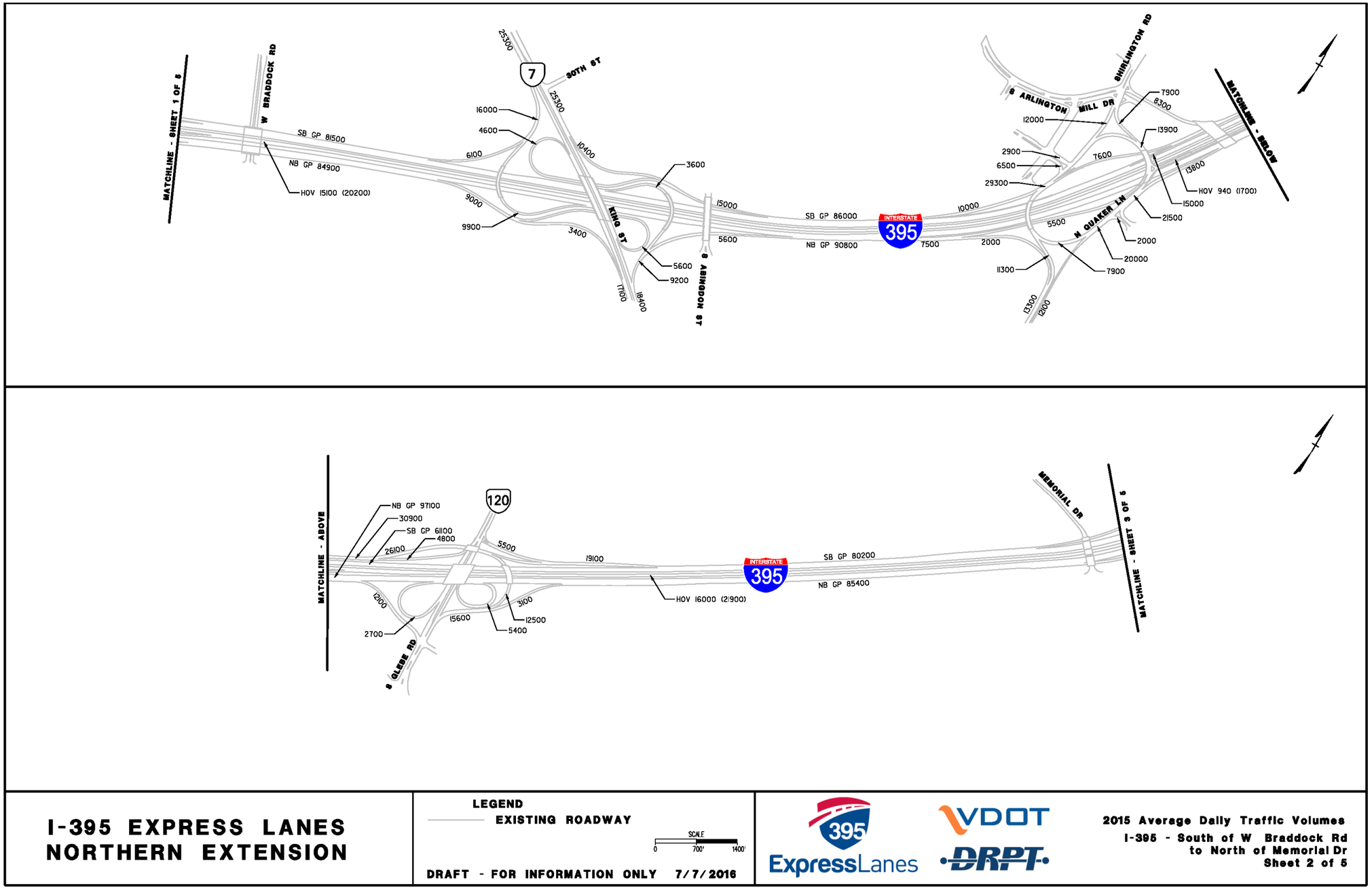


Figure 2-15b: Existing (2015) Average Weekday Daily Traffic Volumes



I-395 EXPRESS LANES NORTHERN EXTENSION

LEGEND
EXISTING ROADWAY

SCALE 0 700' 1400'

DRAFT - FOR INFORMATION ONLY 7/7/2016

395 ExpressLanes VDOT DRPT

2015 Average Daily Traffic Volumes
I-395 - South of W Braddock Rd to North of Memorial Dr
Sheet 2 of 5

Figure 2-15c: Existing (2015) Average Weekday Daily Traffic Volumes

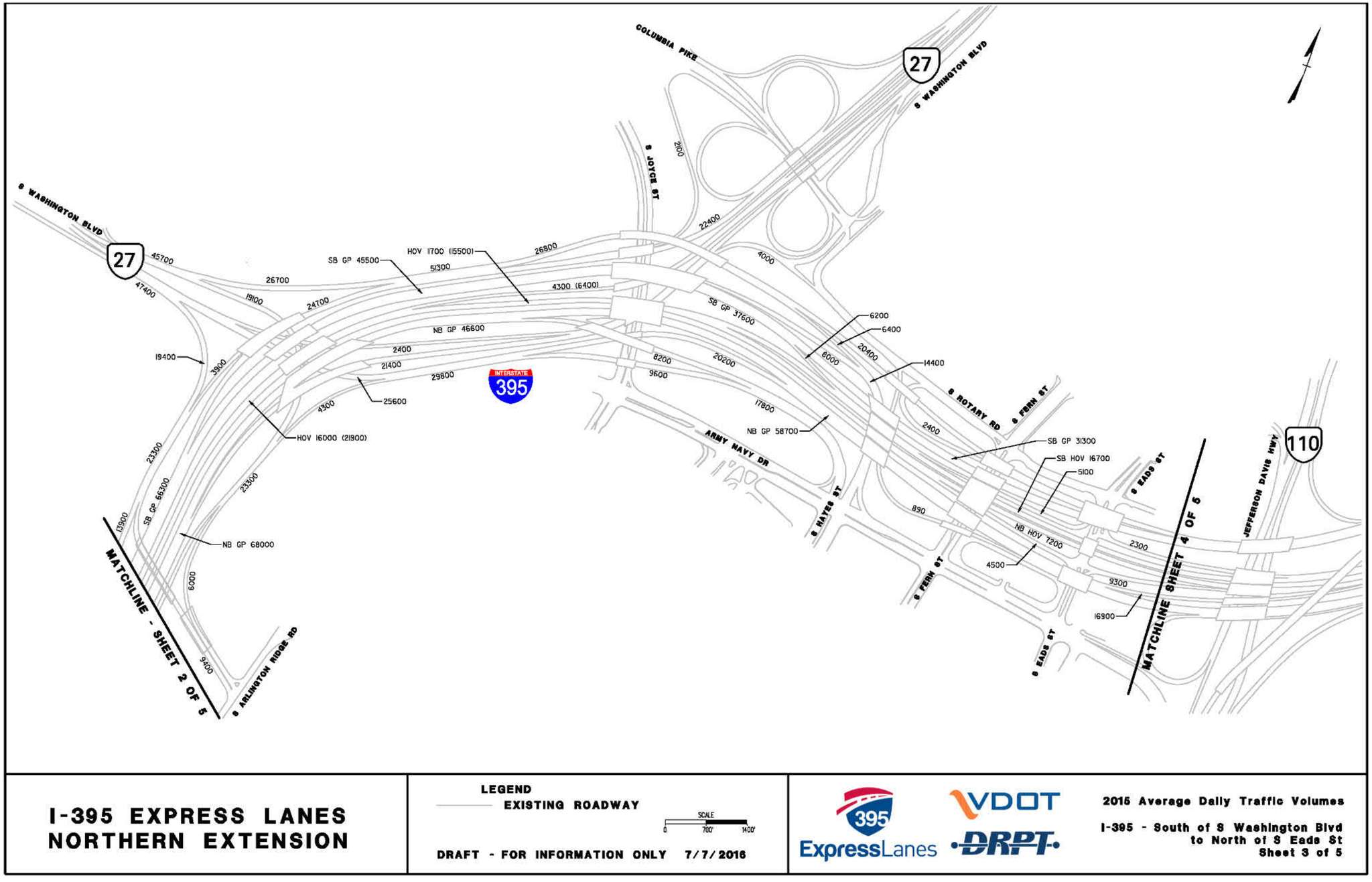
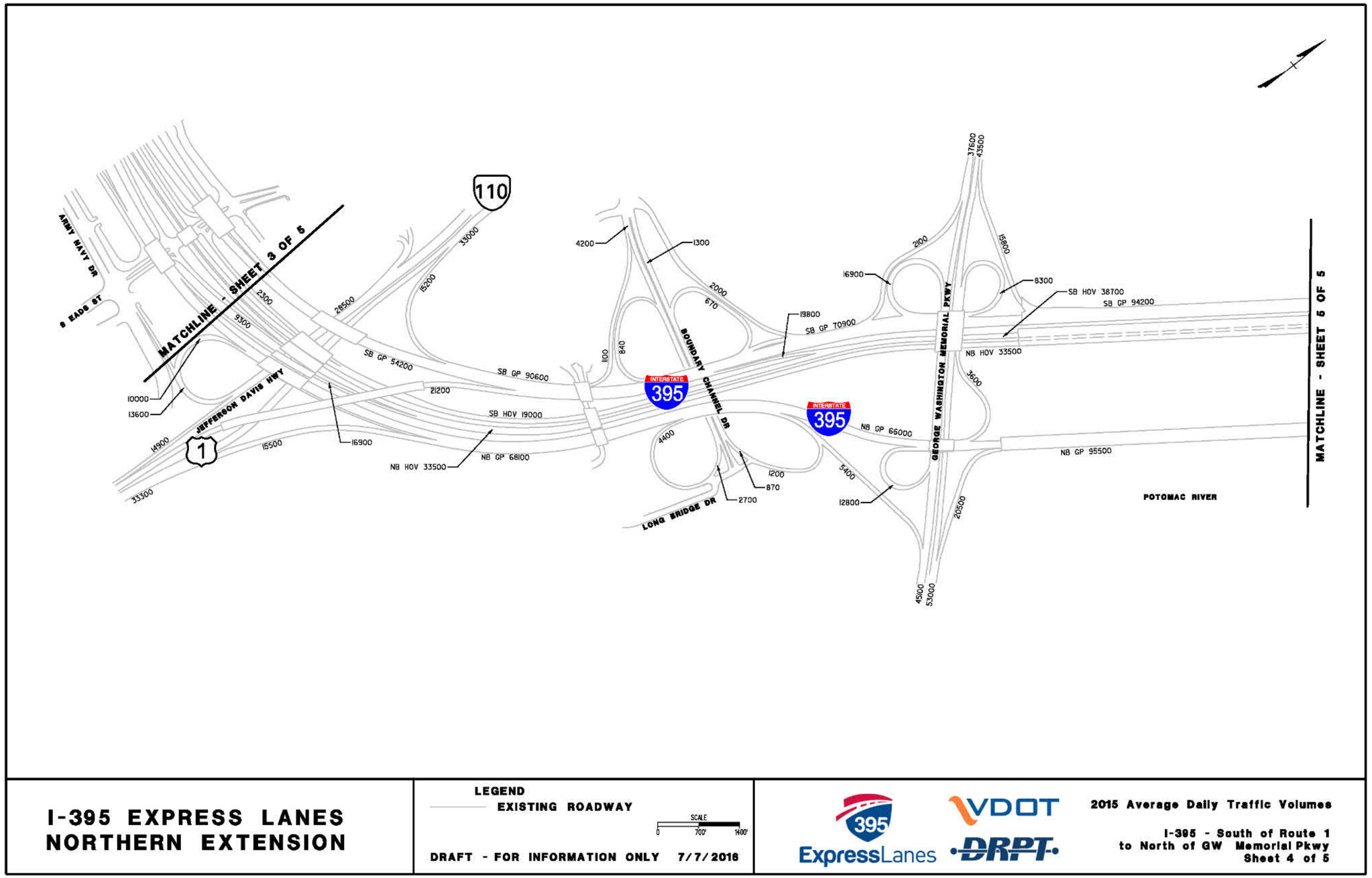
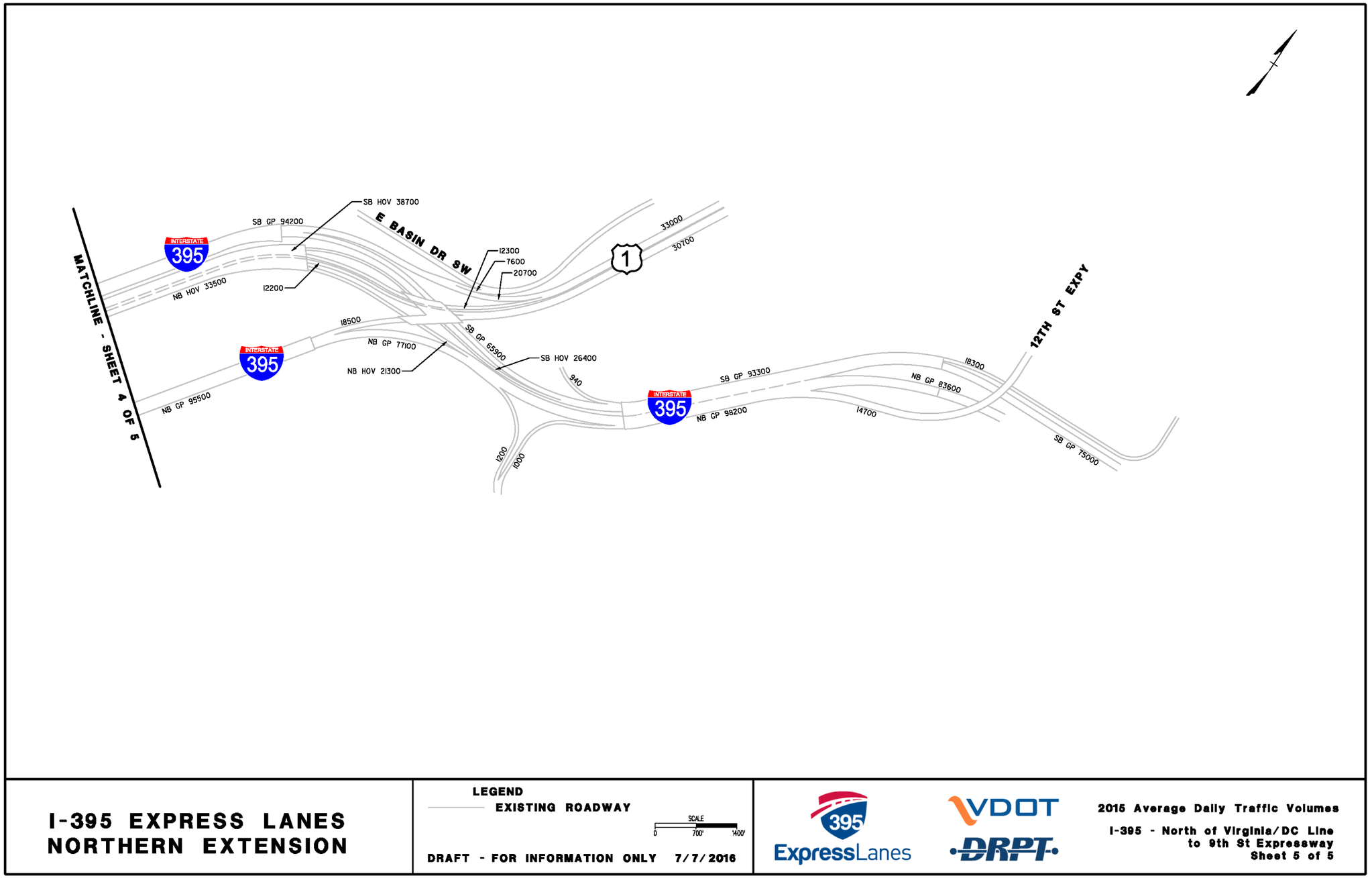


Figure 2-15d: Existing (2015) Average Weekday Daily Traffic Volumes



I-395 EXPRESS LANES NORTHERN EXTENSION	LEGEND EXISTING ROADWAY SCALE 0 700' 1400' DRAFT - FOR INFORMATION ONLY 7/7/2016	2015 Average Daily Traffic Volumes I-395 - South of Route 1 to North of GW Memorial Pkwy Sheet 4 of 5

Figure 2-15e: Existing (2015) Average Weekday Daily Traffic Volumes



2.4.5 Peak Period Traffic Volumes

Due to over-capacity conditions along I-395 that are experienced for several hours during the morning and evening peak periods, speed data in combination with diurnal traffic volume data along I-395 was used to establish morning and evening peak periods and hours corresponding to the most congested conditions along I-395 rather than when volumes are highest. During the highest-volume periods, downstream bottlenecks have not yet reached their capacity allowing for higher flow rates through the study area.

Figures 2-16 and 2-17 depict the traffic volumes in 15-minute intervals along northbound and southbound I-395 in the general purpose lanes in addition to corresponding travel speeds. This data was used to determine the duration of the operational analysis to be conducted during the AM and PM peak periods. Based on a review of the traffic volumes in combination with speeds along northbound and southbound I-395, the AM peak period was evaluated for four hours from 6:00 AM to 10:00 AM and the PM peak period was evaluated for four hours from 3:00 PM to 7:00 PM. The identified peak hours for the traffic analysis are 7:00 AM to 8:00 AM and 5:00 PM to 6:00 PM. **Figures 2-16 and 2-17** depict the HOV-restricted periods, peak hours and peak analysis periods. The speed contour plots depicted in **Figures 2-16 through 2-17** also graphically depict the speed data in 15-minute intervals and the selected analysis periods including a one-hour seeding period prior to the four-hour analysis period for each peak period.

Figure 2-16: Northbound I-395 General Purpose Lanes – South of Seminary Road
AM Peak Period - Traffic Flow Patterns

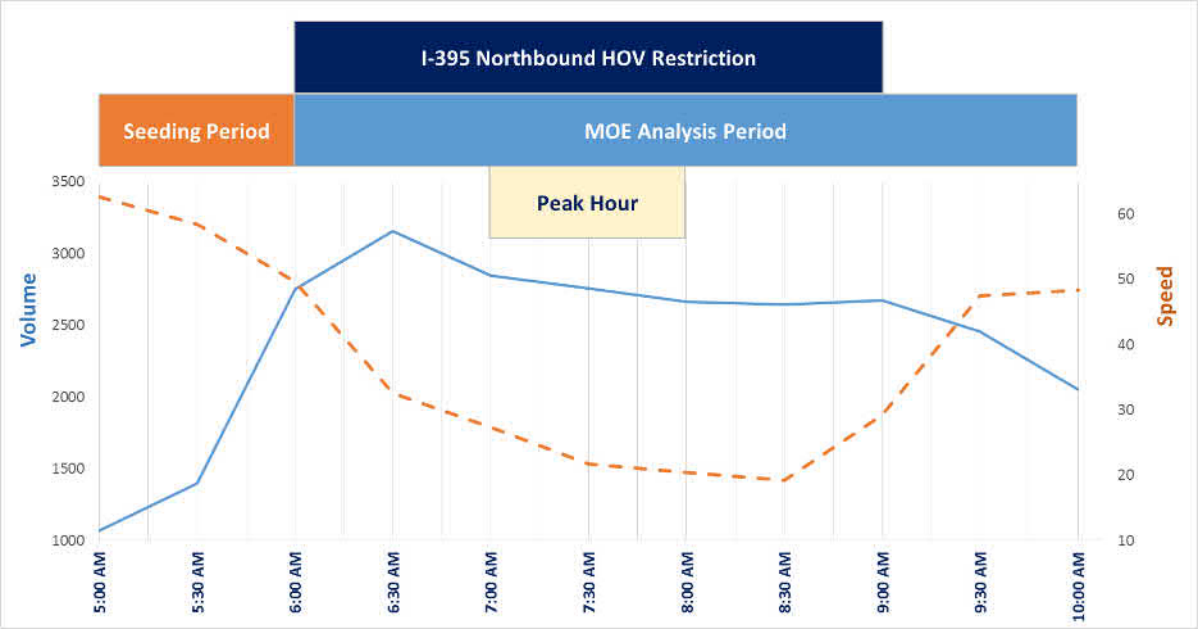
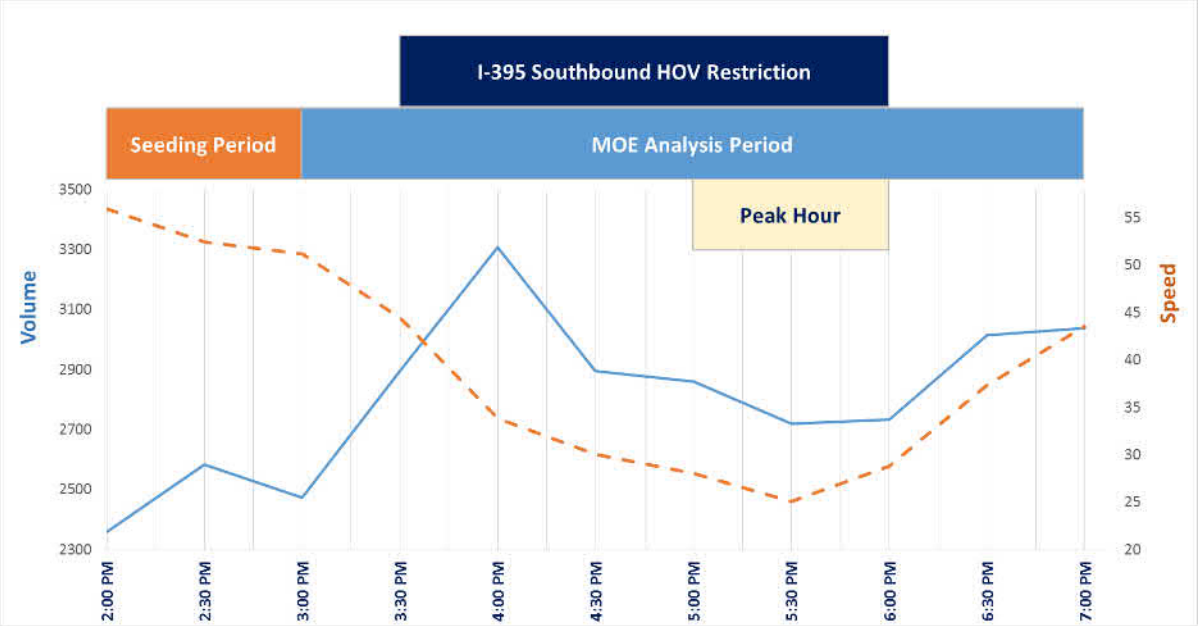


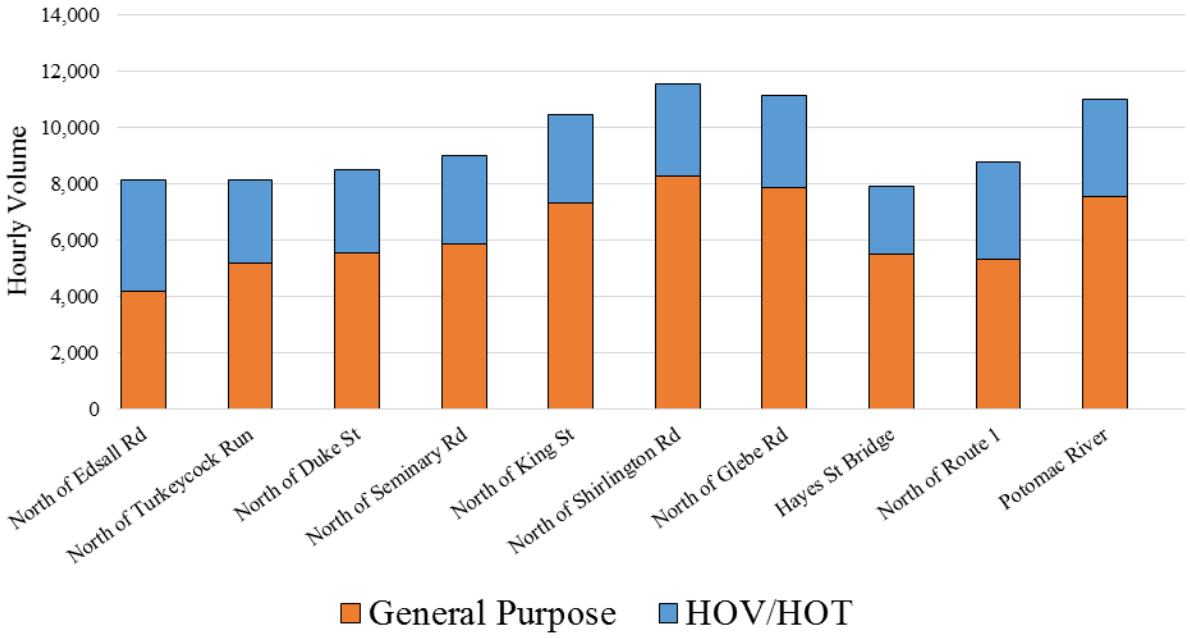
Figure 2-17: Southbound I-395 General Purpose Lanes – North of King Street
PM Peak Period - Traffic Flow Patterns



Existing traffic volumes were developed for the five-hour AM and PM peak period analysis periods based on a review of the traffic data collected in 2015 and 2016. Diurnal curves were reviewed at each count location to eliminate data for days and/or hours with atypical volume patterns. Traffic volumes were balanced along the I-395 corridor and then balanced along the arterials intersecting I-395.

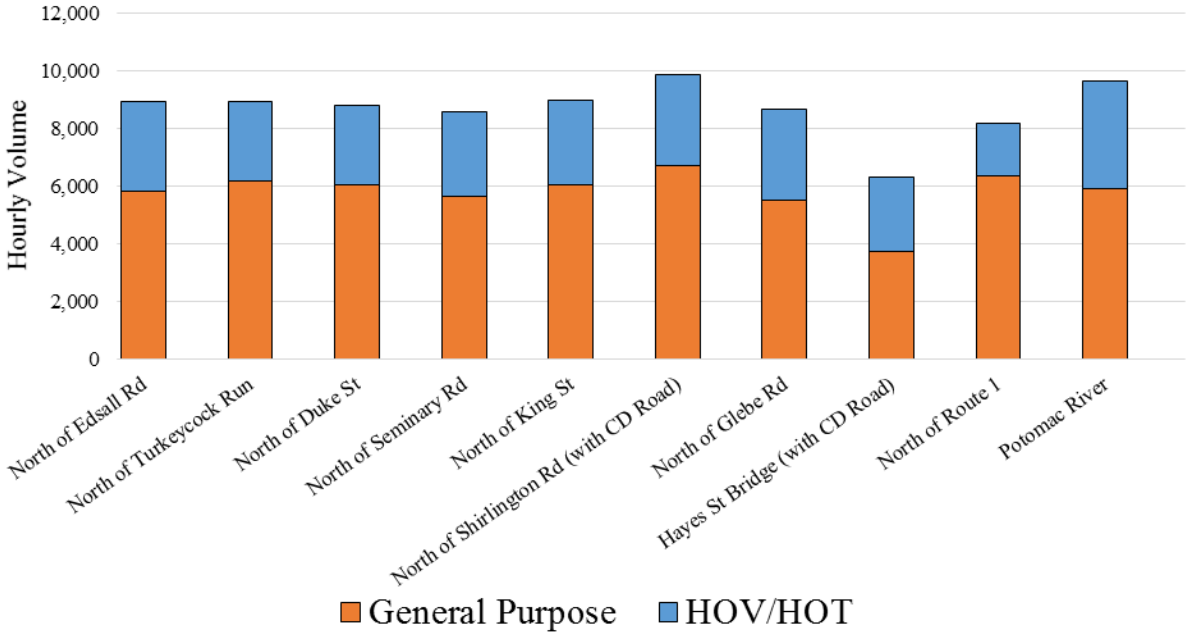
Existing AM and PM peak hour traffic volumes by segment along northbound and southbound I-395 are summarized in **Figures 2-18 and 2-19**, respectively. **Figures 2-20a through 2-20e** summarize the existing traffic volumes along the corridor, ramps, and intersecting roadways within the study area. Peak hour traffic volumes at the intersections within the study area are contained in **Appendix B.**

Figure 2-18: Existing (2015) Northbound AM Peak Hour Traffic Volumes



Northbound AM peak hour traffic volumes in the I-395 general purpose lanes gradually increase from 4,200 to 8,300 between Edsall Road and Glebe Road. The traffic volumes reduce to 5,500 over the Hayes Street Bridge due to the large amount of vehicles exiting the corridor and traveling to Washington Boulevard, Army Navy Drive, and other destinations in the Pentagon vicinity. General purpose traffic volumes increase to 7,600 over the Potomac River due to the traffic entering the corridor at George Washington Memorial Parkway. In the HOV/HOT lanes, traffic volumes decreases from 3,900 vehicles north of Edsall Road to 2,900 vehicles north of Turkeycock Run due to vehicles traveling from the HOT lanes to the general purpose lanes during the HOV-restricted period. Similar to the general purpose lanes, the HOV volumes decrease to 2,400 over the Hayes Street Bridge due to the traffic exiting the corridor to Washington Boulevard. At the Potomac River, the HOV volumes increase to 3,500 vehicles due to the traffic entering the HOV lanes from Eads Street and north of Eads Street (from the general purpose lanes) and traveling into the District.

Figure 2-19: Existing (2015) Southbound PM Peak Hour Traffic Volumes



Southbound PM peak hour traffic volumes in the general purpose lanes leaving the District decreases at the Hayes Street bridge due to the traffic exiting the corridor at Route 1 and George Washington Memorial Parkway. PM peak hour volumes then gradually increase from 3,700 over the Hayes Street bridge to 6,700 at Shirlington Road due to the traffic entering the corridor at Washington Boulevard and Glebe Road. The volume then stays relatively consistent between Shirlington Road and Edsall Road averaging approximately 5,900 vehicles. Traffic volumes in the HOV lanes volumes leaving the District southbound are approximately 3,700 vehicles and decrease to 1,800 vehicles north of Route 1 due to traffic traveling from the HOV lanes to general purpose lanes during the HOV-restricted period. Traffic volumes in the HOV lanes then gradually increases to 3,100 north of Shirlington Road due to traffic entering the corridor from Eads Street and Washington Boulevard. Traffic then remains relatively constant until south of Turkeycock Run where the HOT lanes begin and the volumes increase from 2,700 to 3,100 due to single occupancy vehicles being permitted to travel in the HOT lanes.

Figure 2-20a: Existing (2015) Peak Hour Traffic Volumes

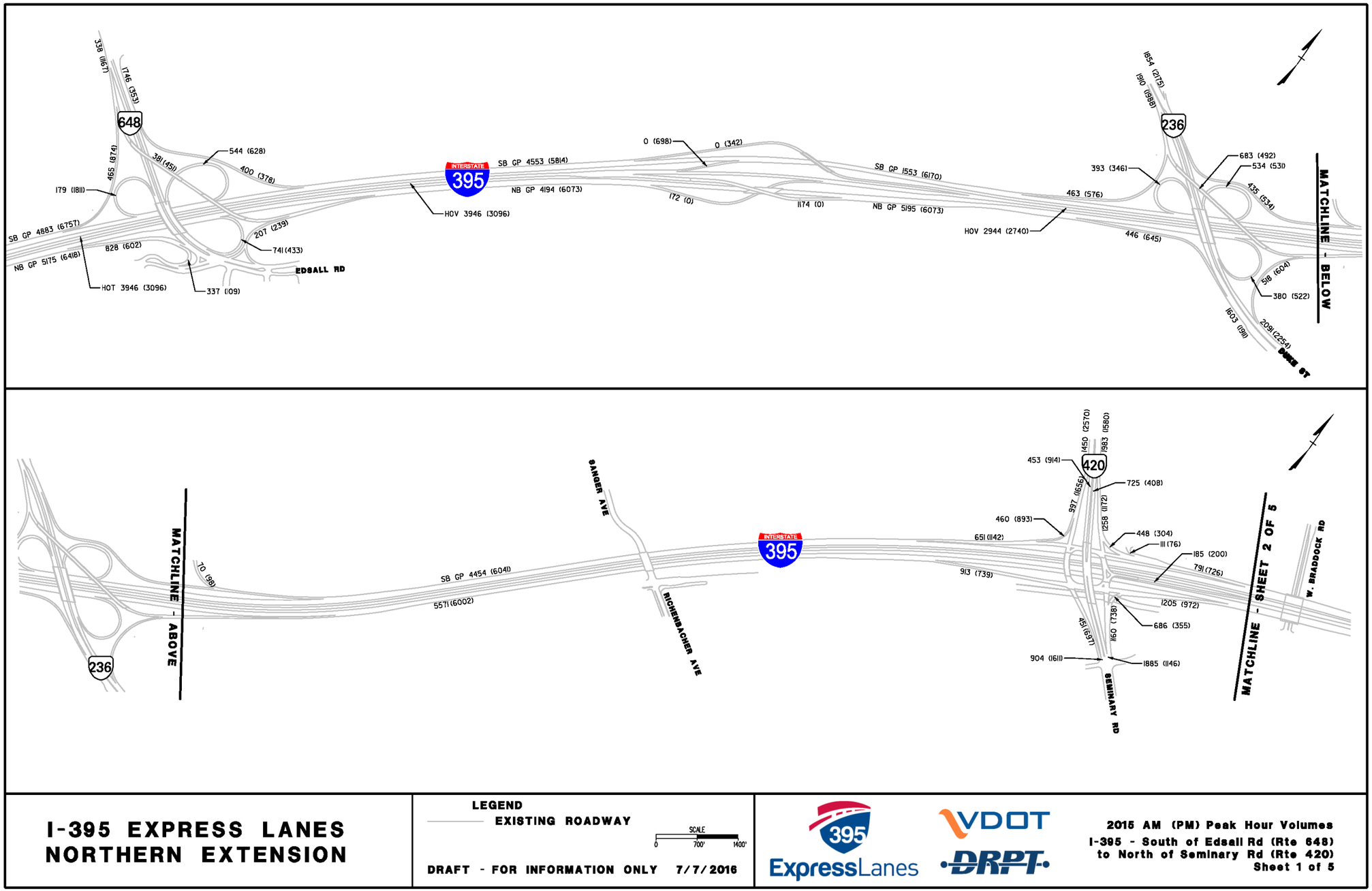


Figure 2-20b: Existing (2015) Peak Hour Traffic Volumes

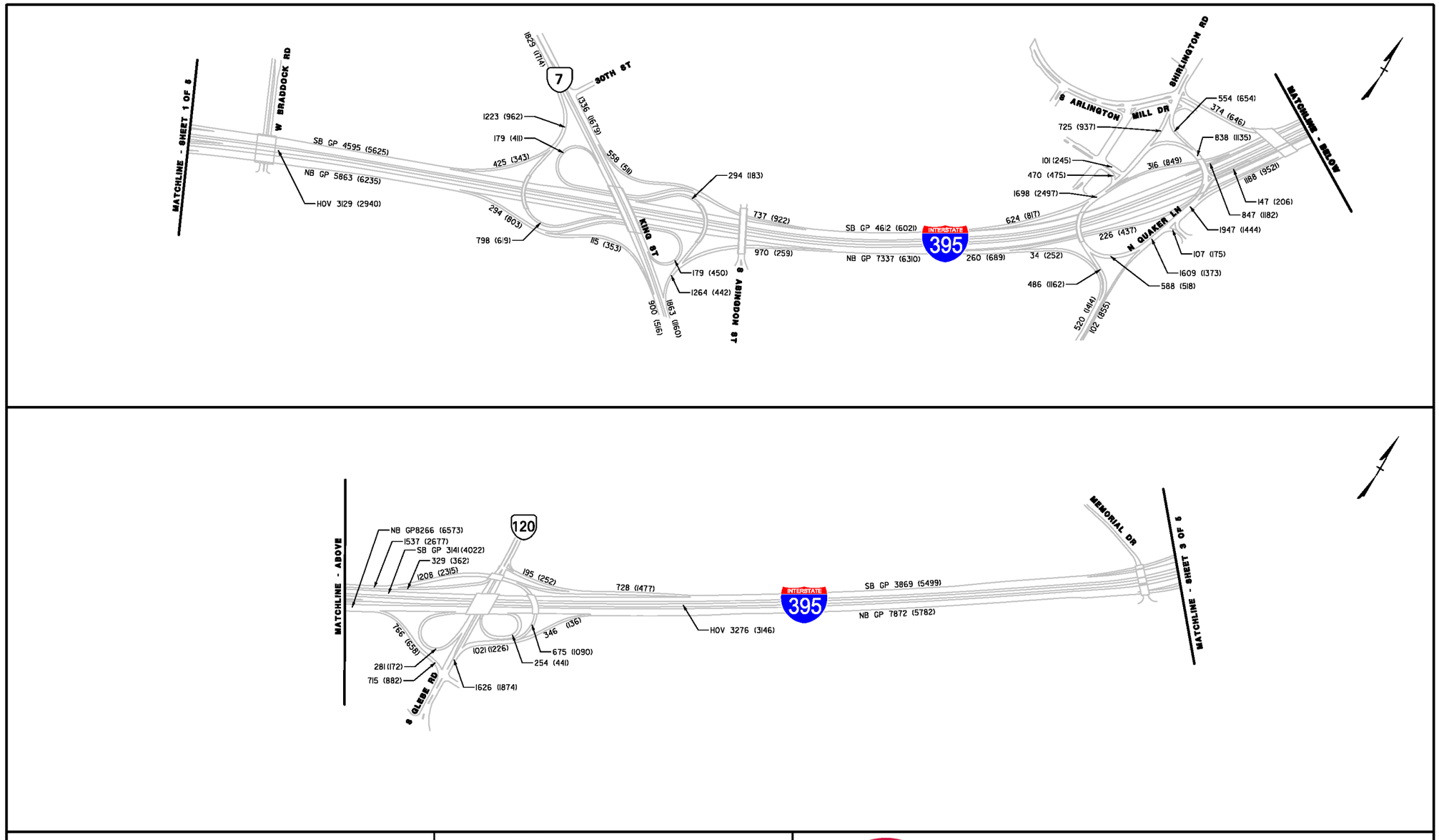


Figure 2-20c: Existing (2015) Peak Hour Traffic Volumes

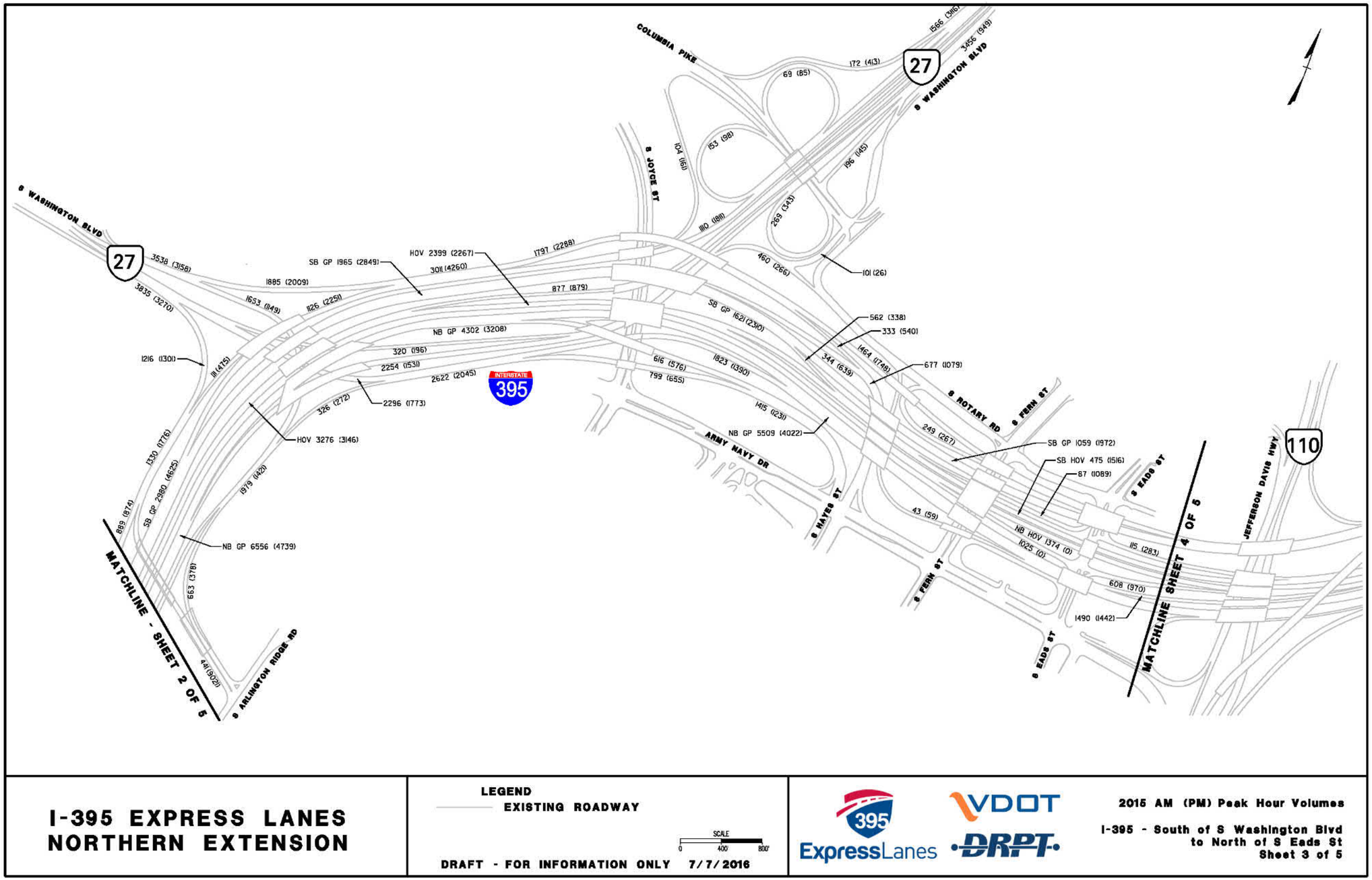


Figure 2-20d: Existing (2015) Peak Hour Traffic Volumes

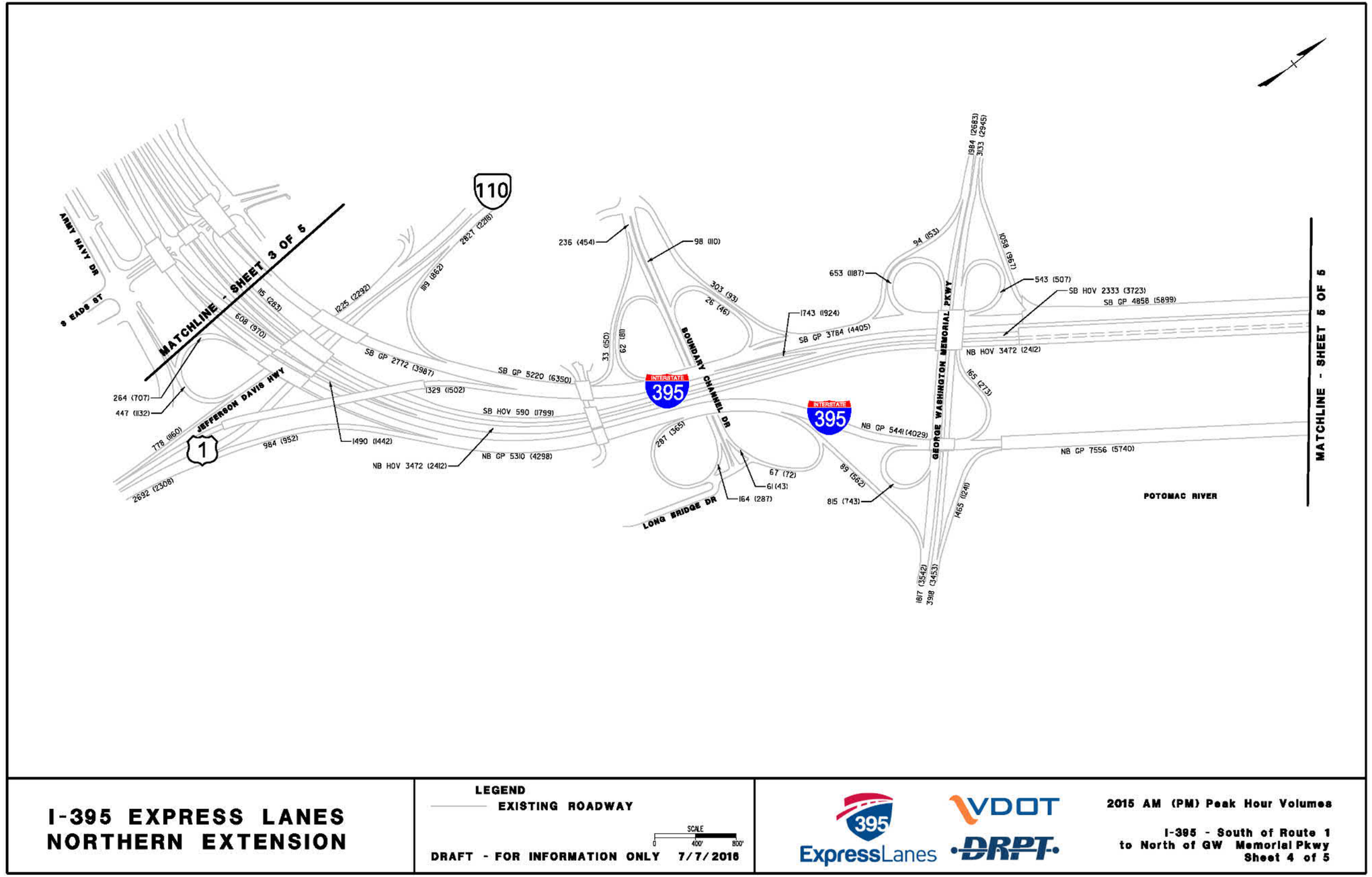
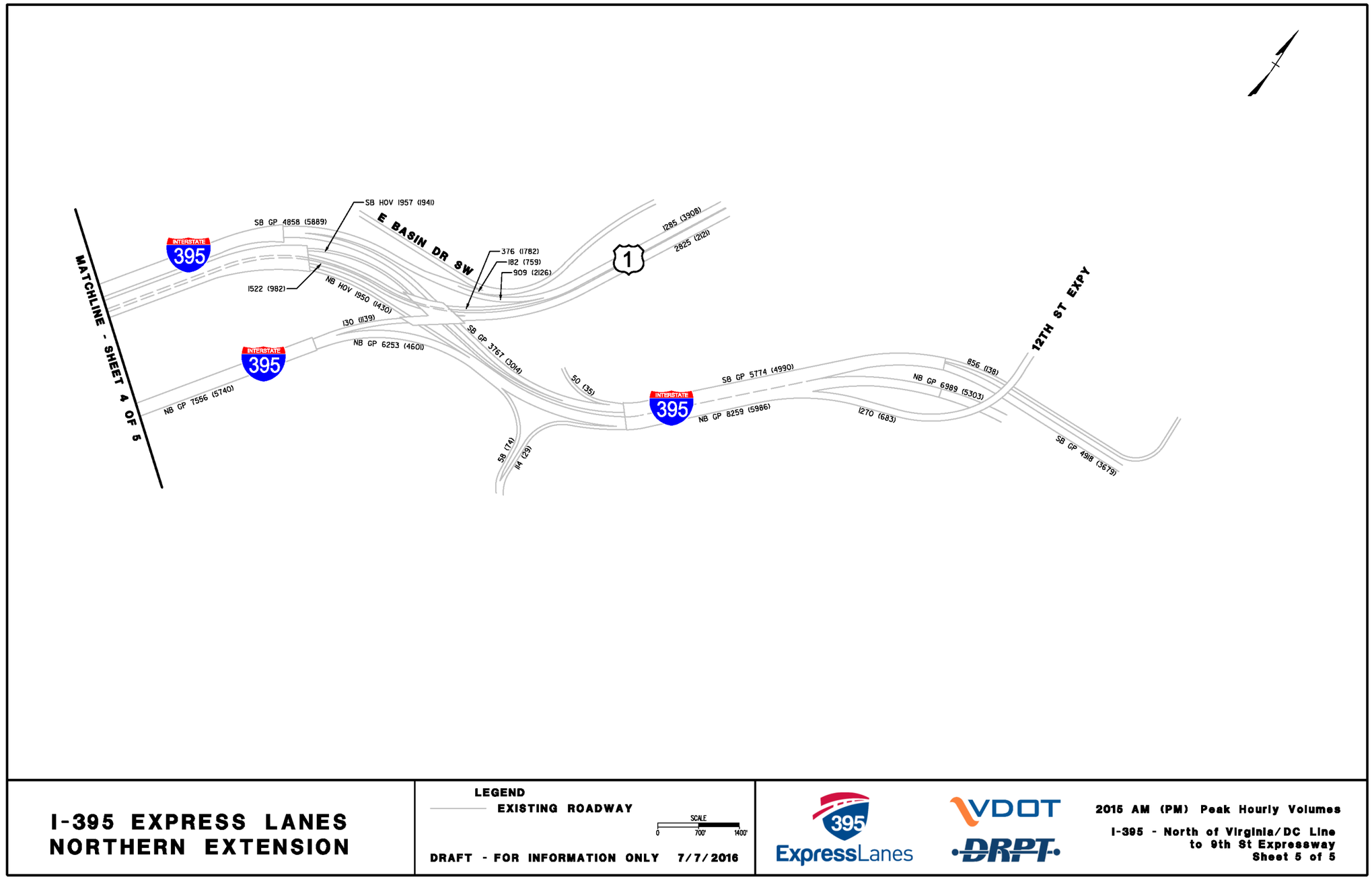


Figure 2-20e: Existing (2015) Peak Hour Traffic Volumes



2.5 TRAFFIC OPERATIONS

2.5.1 Traffic Operations Model Development

VISUM Model Development: A VISUM model was established to produce the AM, and PM peak period traffic volume input files needed for the operations analysis. The VISUM study area was extended beyond the traffic analysis study area to account for potential future shifts in traffic between competing roadways within the project area vicinity as shown in **Figure 1-2**. A memorandum summarizing the VISUM model development and validation is contained in **Appendix C**. Following validation of the VISUM peak hour models, the finalized demand matrices were imported into PTV's VISSIM 8 mesoscopic simulation software.

VISSIM Model (Mesoscopic Module) Development: VISSIM's mesoscopic module was used to produce the freeway measures of effectiveness along the I-395 mainline corridor. This methodology is more robust than traditional HCS freeway analysis, but significantly reduces the processing time and calibration parameters (compared to VISSIM microsimulation). It also allows the ability to simulate multiple hours during a peak period, which is necessary in an over-capacity corridor such as I-395 to appropriately reflect congestion levels and identify benefits in periods outside the peak hour. The use of traffic analysis tools other than microsimulation models is typical for NEPA documentation purposes and is supported by VDOT's Traffic Operations and Safety Analysis Manual (TOSAM).

The VISSIM mesoscopic model was developed along the I-395 mainline freeway corridor for the AM and PM peak periods identified in **Section 2.4.5**. The O-D matrices that produced the calibrated VISUM assignment for each hour were imported into the VISSIM model. A memorandum summarizing the VISSIM mesoscopic model development, calibration, validation and number of runs performed is contained in **Appendix C**. **Figures 2-16 and 2-17** in **Section 2.4.5** depict the analysis and seeding periods. The AM peak period consists of five hours of simulation from 5 AM to 10 AM including a one-hour seeding period from 5 AM to 6 AM and a four-hour analysis period from 6 AM to 10 AM. Similarly, the PM peak period consists of five hours of simulation from 2 PM to 7 PM including a one-hour seeding period from 2 PM to 3 PM and a four-hour analysis period from 3 PM to 7 PM.

2.5.2 Traffic Operations Results

2.5.2.1 Freeway Operations

Figures 2-21a through 2-22d summarize the travel times for the northbound and southbound I-395 general purpose and HOV/HOT lanes for each of the four analysis hours during the AM and PM peak periods by segment along the corridor. Travel times for each segment and cumulative travel times are shown based on the outputs of the VISSIM mesoscopic model. **Figures 2-23 and 2-24** depict the travel speeds for each of the eight analysis periods during the AM and PM peak periods along the northbound and southbound I-395 general purpose and HOV lanes. Figures depicting freeway segment average speeds and densities from the VISSIM mesoscopic models for the northbound and southbound I-395 general purpose and HOV lanes for each of the eight analysis hours are included **Appendix D**. The speeds and density levels are color-coded corresponding to congestion levels reported from the VISSIM model. The following is a summary of the key findings of the existing operations analysis.

AM Peak Period – Northbound General Purpose Lanes (Peak Direction)

Existing corridor travel times along the northbound I-395 general purpose lanes for the four hours during the AM peak period range from 19 to 31 minutes with average travel speeds ranging from 20 to 34 MPH, respectively. The 7 to 8 AM hour has the longest corridor travel time (31 minutes) among the four AM peak hours due to higher congestion levels and lower speeds during this hour between Edsall Road and King Street. The 8 to 9 AM hour has the second longest corridor travel time (28 minutes) and the 9 to 10 AM hour has the shortest corridor travel time (18 minutes) due to the decrease in traffic demand and congestion in the southern portion of the corridor south of Washington Boulevard.

AM Peak Period – Northbound HOV/HOT Lanes (Peak Direction)

Existing corridor travel times along the northbound I-395 HOV/HOT lanes range from 10 to 12 minutes with average travel speeds of 51 to 58 MPH. The 8 to 9 AM hour has the longest corridor travel time (11.5 minutes) among the four AM peak hours primarily due to higher levels of congestion and lower speeds during this hour between the northbound Eads Street off-ramp and 14th Street. The 7 to 8 AM hour has the second longest corridor travel time (11 minutes), and the 6 to 7 AM hour has the shortest corridor travel time (10 minutes) because the corridor has not yet become as congested as in subsequent hours. Travel times in the northbound HOV/HOT lanes are two to three times shorter than the travel time in the northbound general purpose lanes.

AM Peak Period – Southbound General Purpose Lanes (Off-Peak Direction)

Existing corridor travel times along the southbound I-395 general purpose lanes range from 11 to 12 minutes with average travel speeds of 50 to 54 MPH.

AM Peak Period – Southbound HOV Lanes (Off-Peak Direction)

Existing corridor travel times along the southbound I-395 HOV/HOT lanes range from 2 to 3 minutes with average travel speeds of 47 MPH. Each of the four AM peak period hours have similar corridor travel times (2.5 minutes) due to the relatively short southbound I-395 HOV corridor distance during the AM period. The southbound HOV segment between the north end of the I-395 HOV corridor and the 14th Street Interchange has the lowest travels speeds (40 MPH) during the AM peak period.

PM Peak Period – Southbound General Purpose Lanes (Peak Direction)

Existing corridor travel times along the southbound I-395 general purpose lanes range from 27 to 42 minutes with average travel speeds of 14 to 22 MPH. Travel times from 4 to 6 PM hour have the longest corridor travel time with an average of 40 minutes. The 3 to 4 PM hour has the shortest corridor travel time (27 minutes) because the corridor has not yet become as congested as in subsequent hours.

PM Peak Period – Southbound HOV/HOT Lanes (Peak Direction)

Existing corridor travel times along the southbound I-395 HOV/HOT lanes are approximately 10 minutes with average travel speeds of 57 MPH. Travel times in the southbound HOV/HOT lanes are three to four times shorter than the travel time in the southbound general purpose lanes.

PM Peak Period – Northbound General Purpose Lanes (Off-Peak Direction)

Existing corridor travel times along the northbound I-395 general purpose lanes range from 13 to 14 minutes with average travel speeds of 42 to 46 MPH. The 4 to 5 PM and 5 to 6 PM hours have the longest corridor travel times (14.2 minutes) and the 6 to 7 PM peak hour has the shortest travel time (13 minutes) due to the higher volumes and slower speeds between Boundary Channel Drive and 14th Street from 4 to 6 PM.

PM Peak Period – Northbound HOV Lanes (Off-Peak Direction)

Existing corridor travel times along the northbound I-395 HOV/HOT lanes are approximately 3 minutes with average travel speeds of 32 MPH. Each of the four PM peak period hours have similar corridor travel times (2.8 minutes) due to the relatively short northbound HOV corridor distance during the PM period.

Figure 2-21a: Existing AM Peak Period (6 - 7 AM) Travel Times

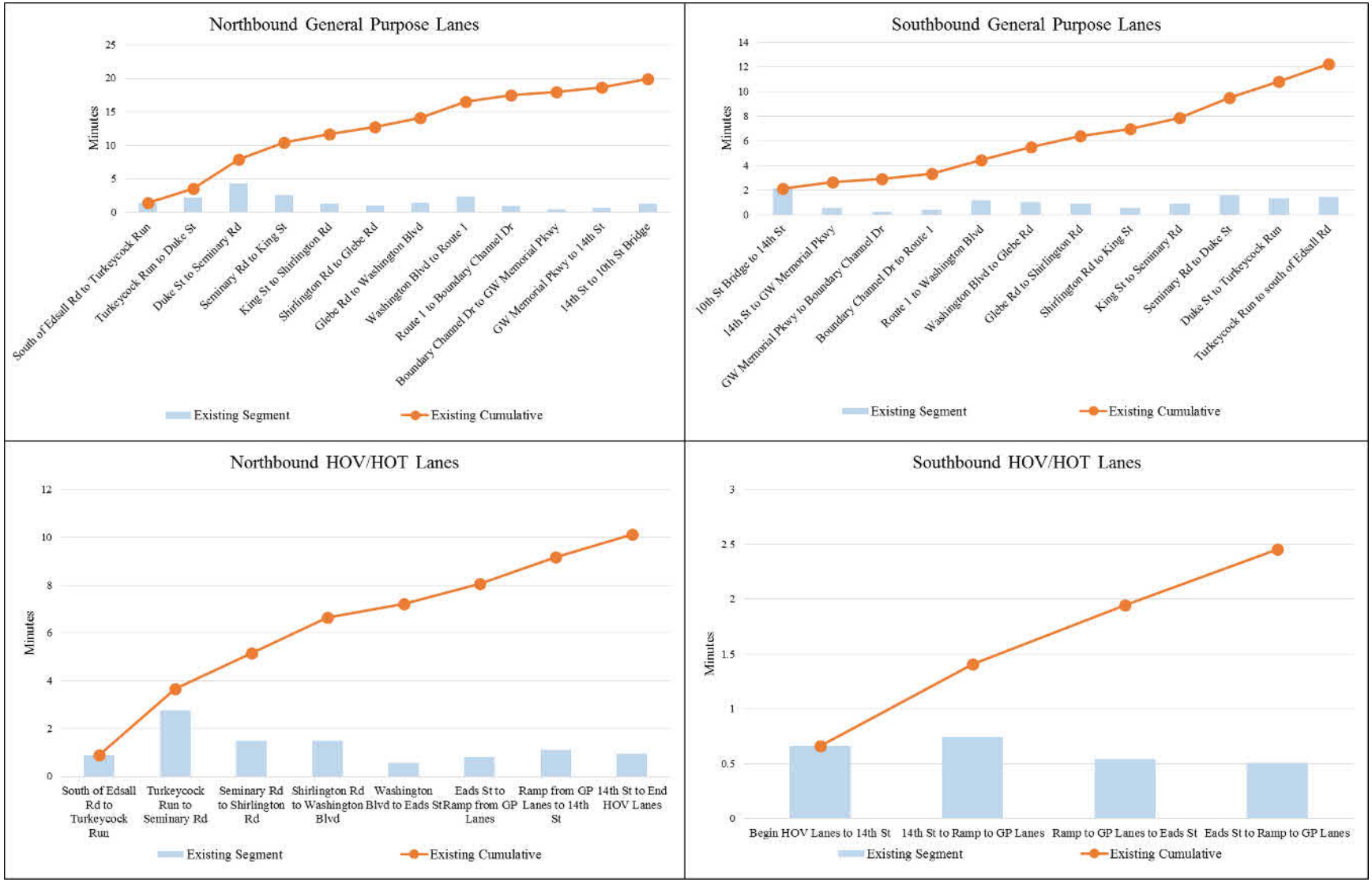


Figure 2-21b: Existing AM Peak Period (7 - 8 AM) Travel Times

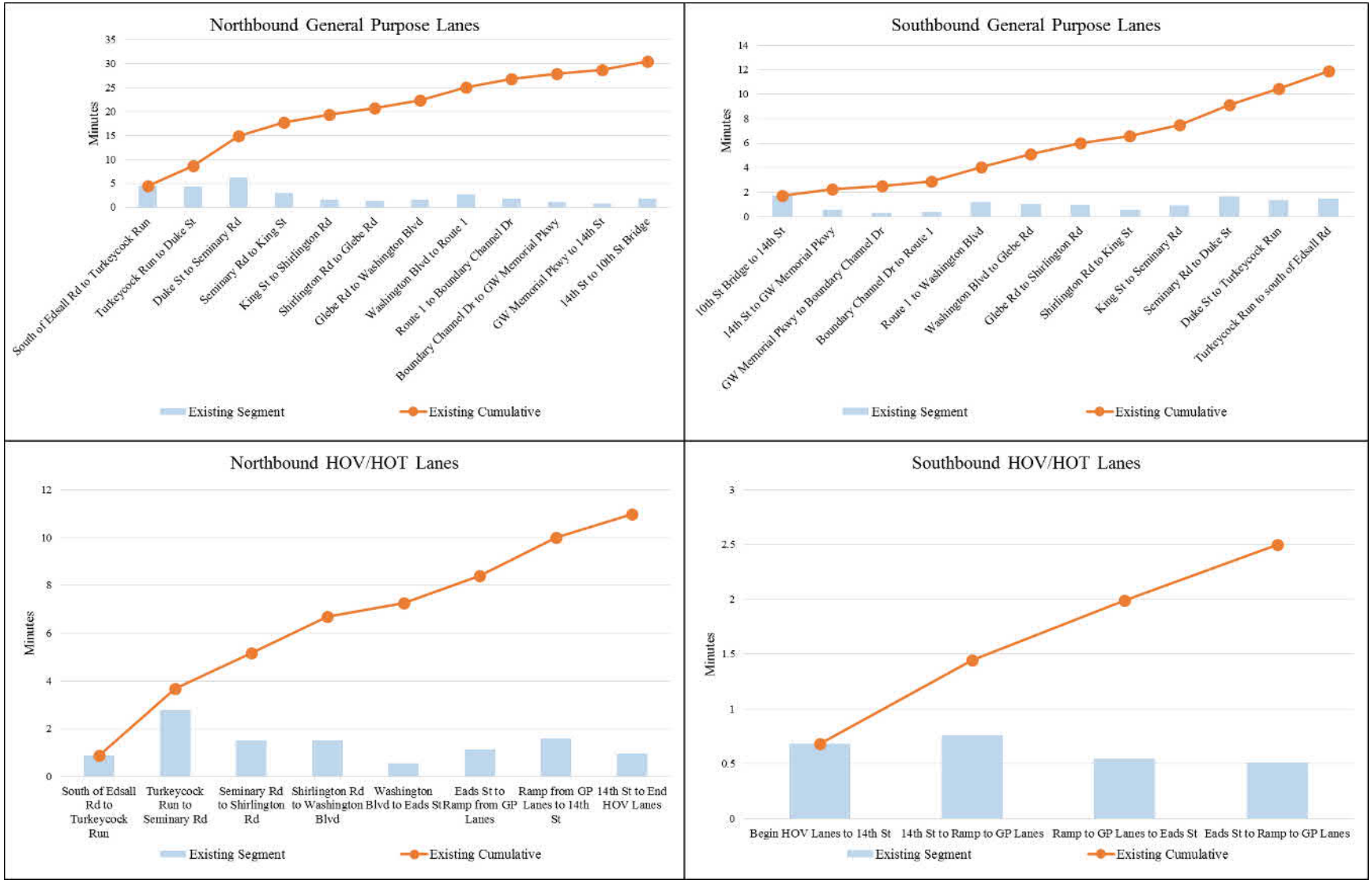


Figure 2-21c: Existing AM Peak Period (8 - 9 AM) Travel Times

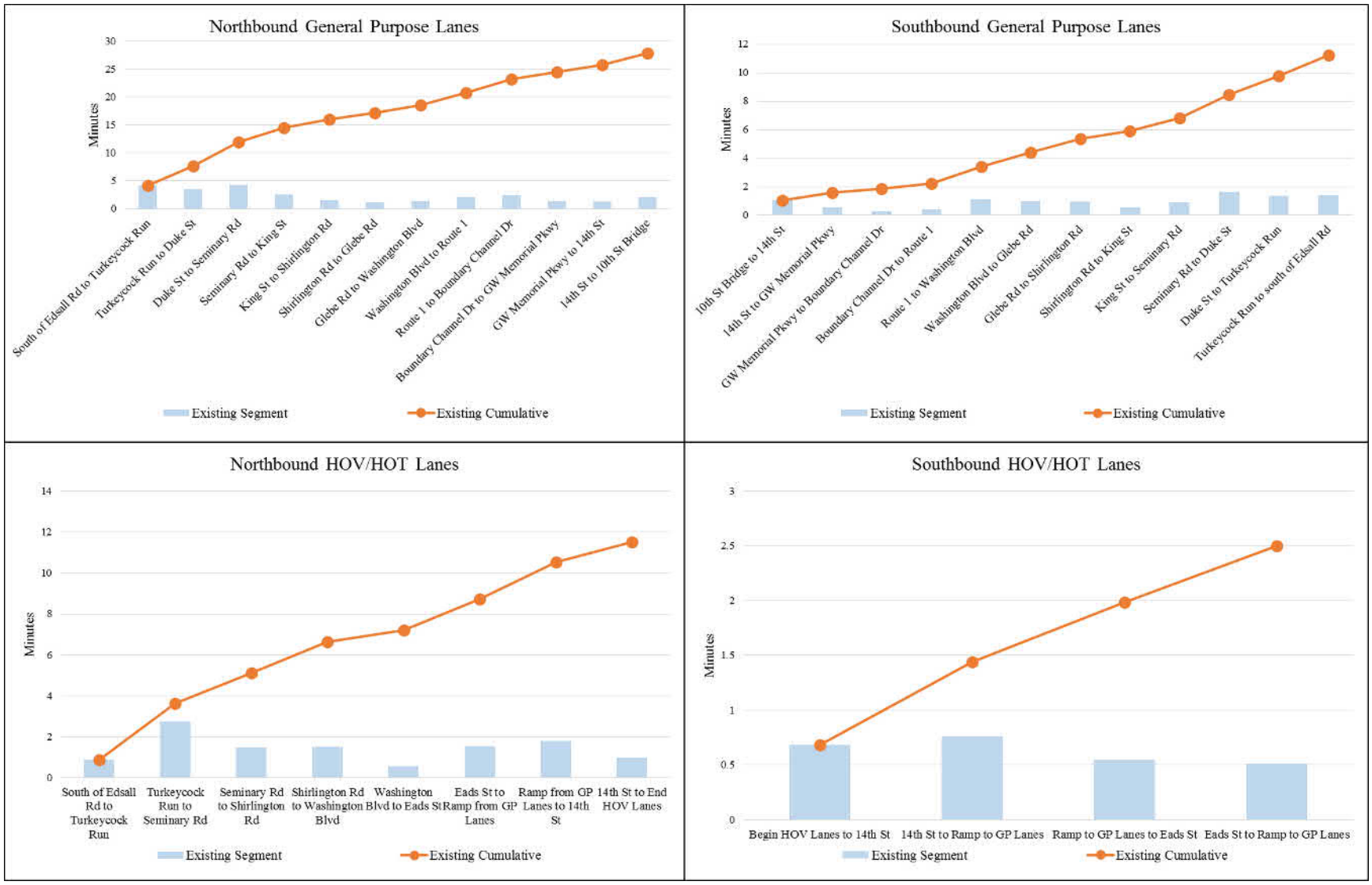


Figure 2-21d: Existing AM Peak Period (9 - 10 AM) Travel Times

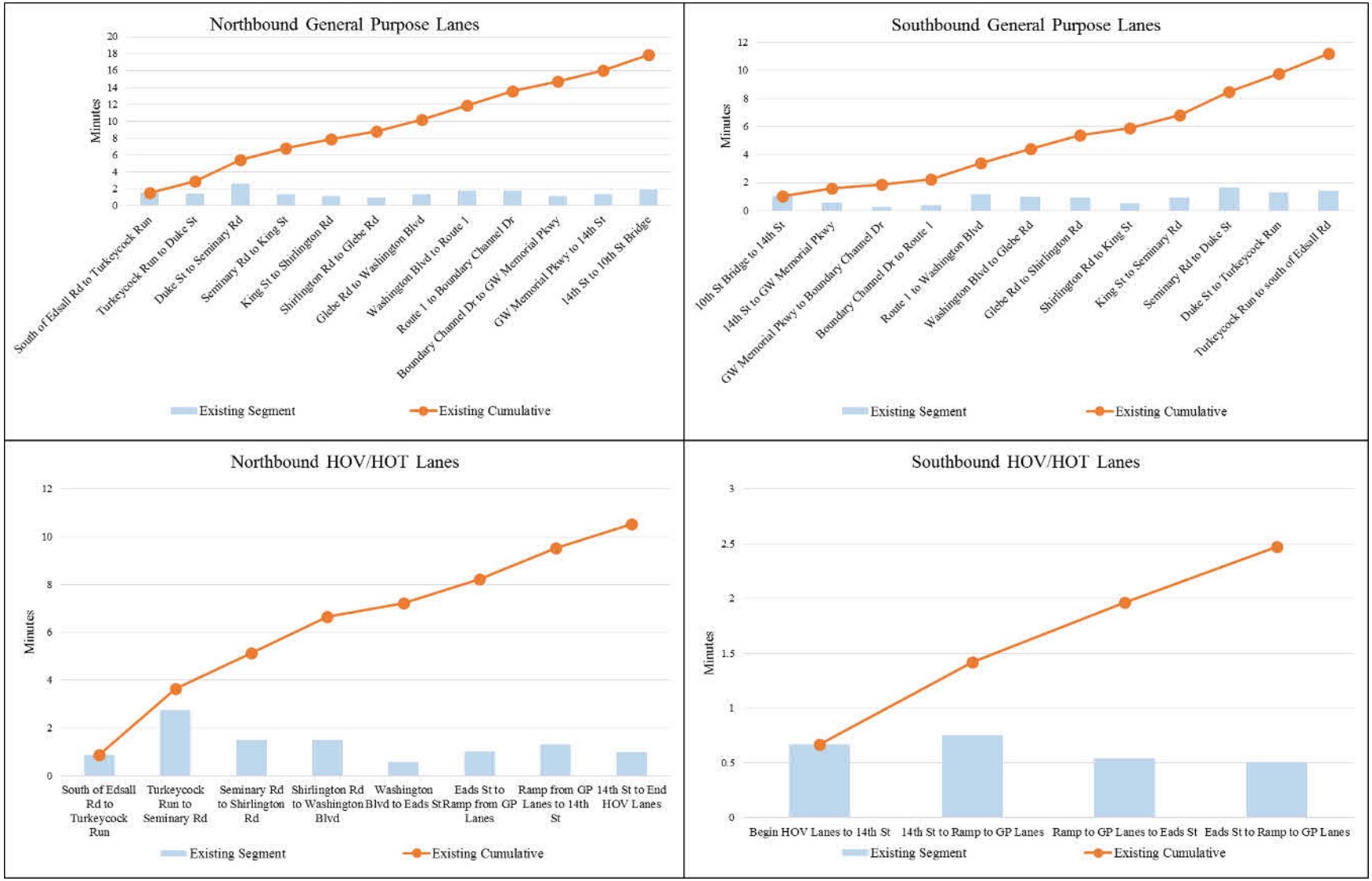


Figure 2-22a: Existing PM Peak Period (3 - 4 PM) Travel Times

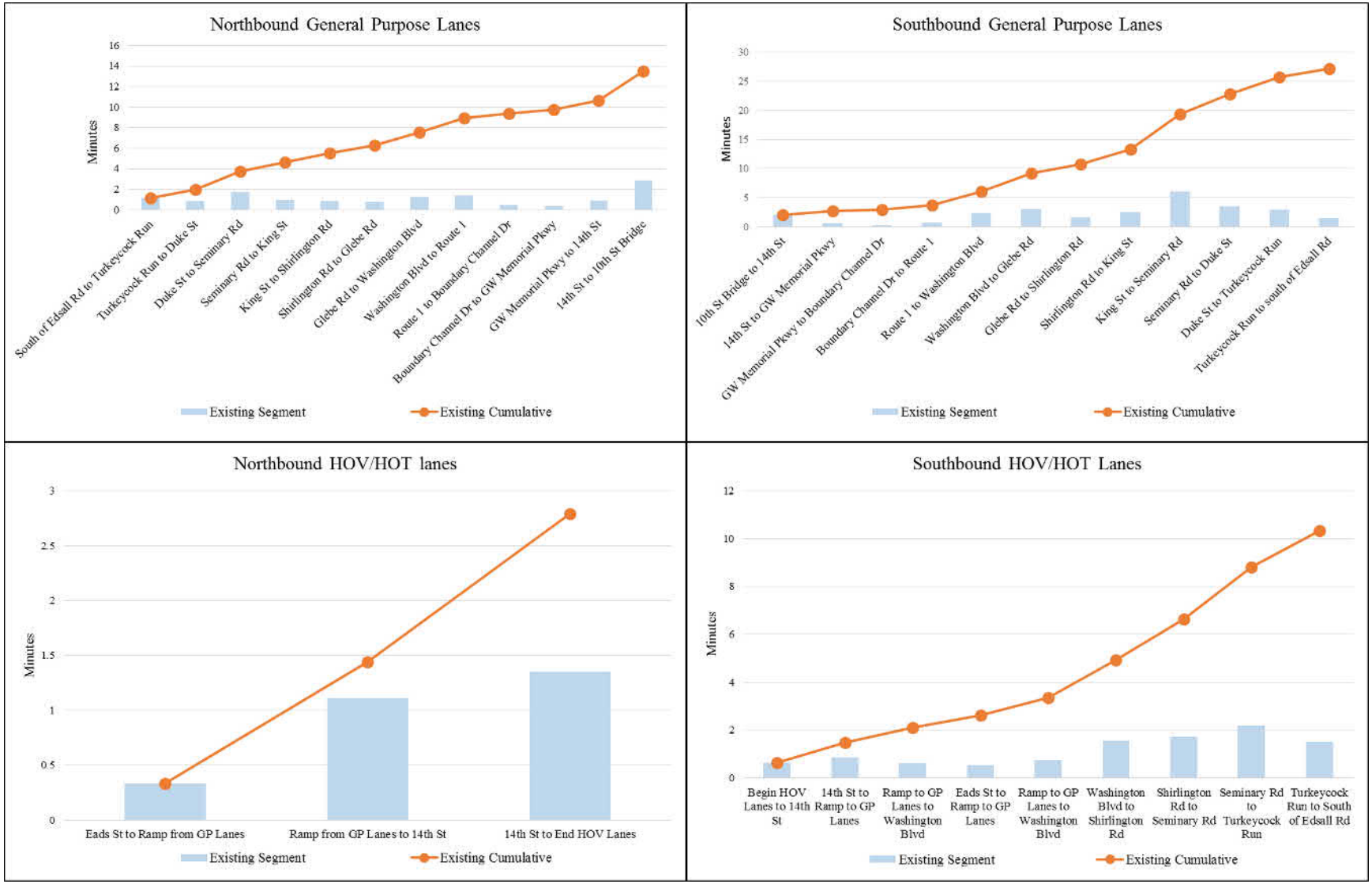


Figure 2-22b: Existing PM Peak Period (4 - 5 PM) Travel Times

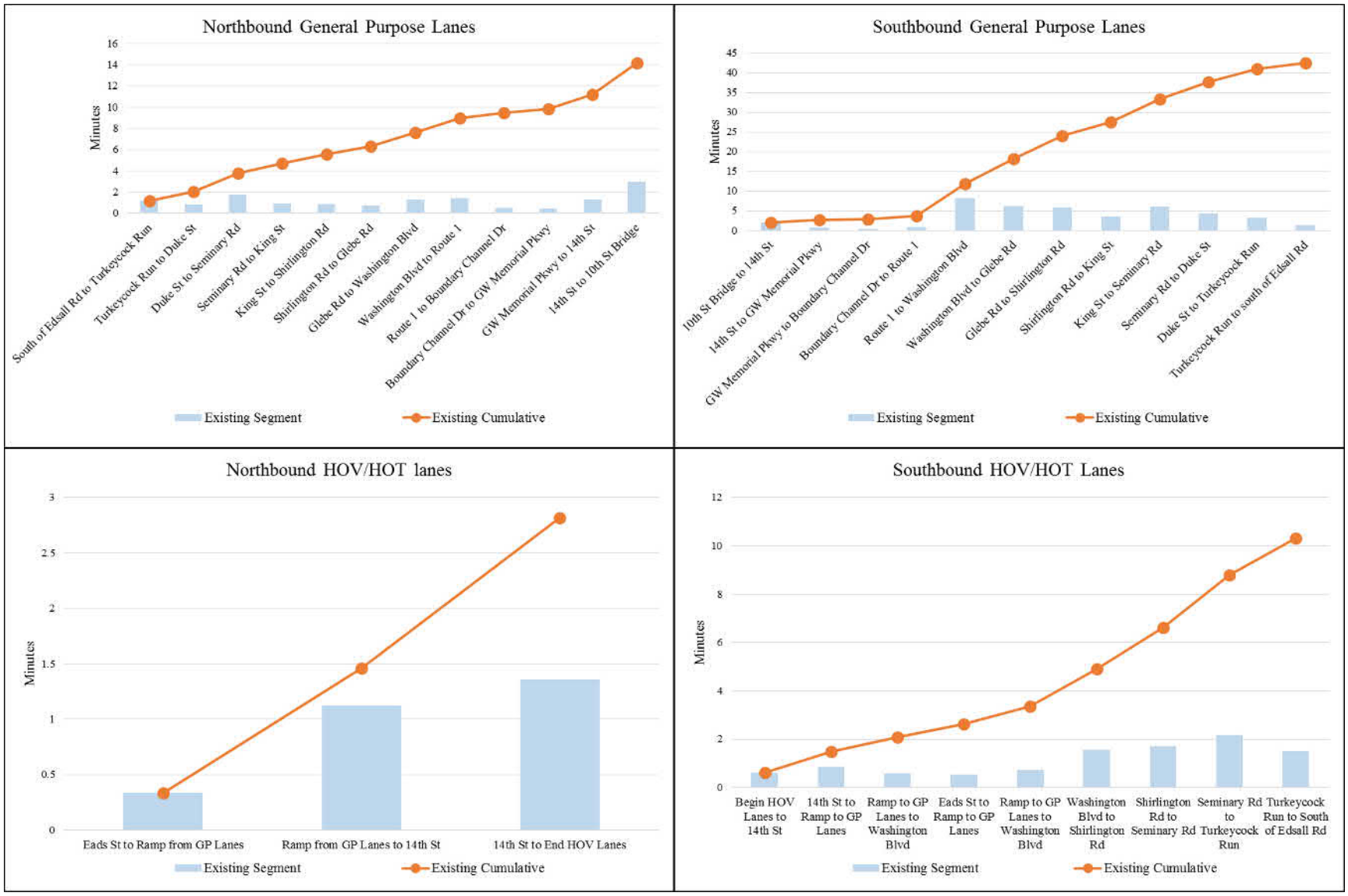


Figure 2-22c: Existing PM Peak Period (5 - 6 PM) Travel Times

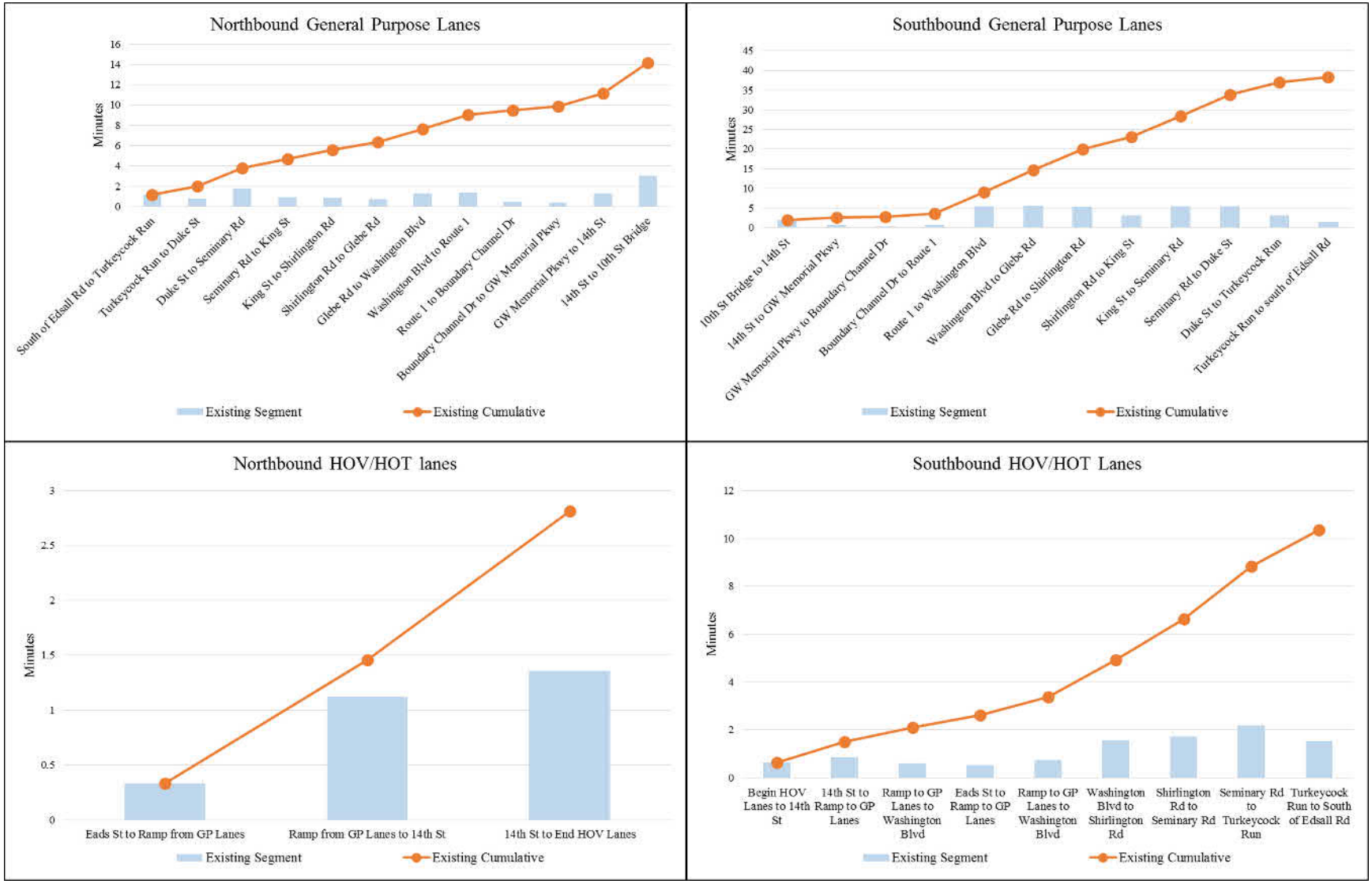


Figure 2-22d: Existing PM Peak Period (6 - 7 PM) Travel Times

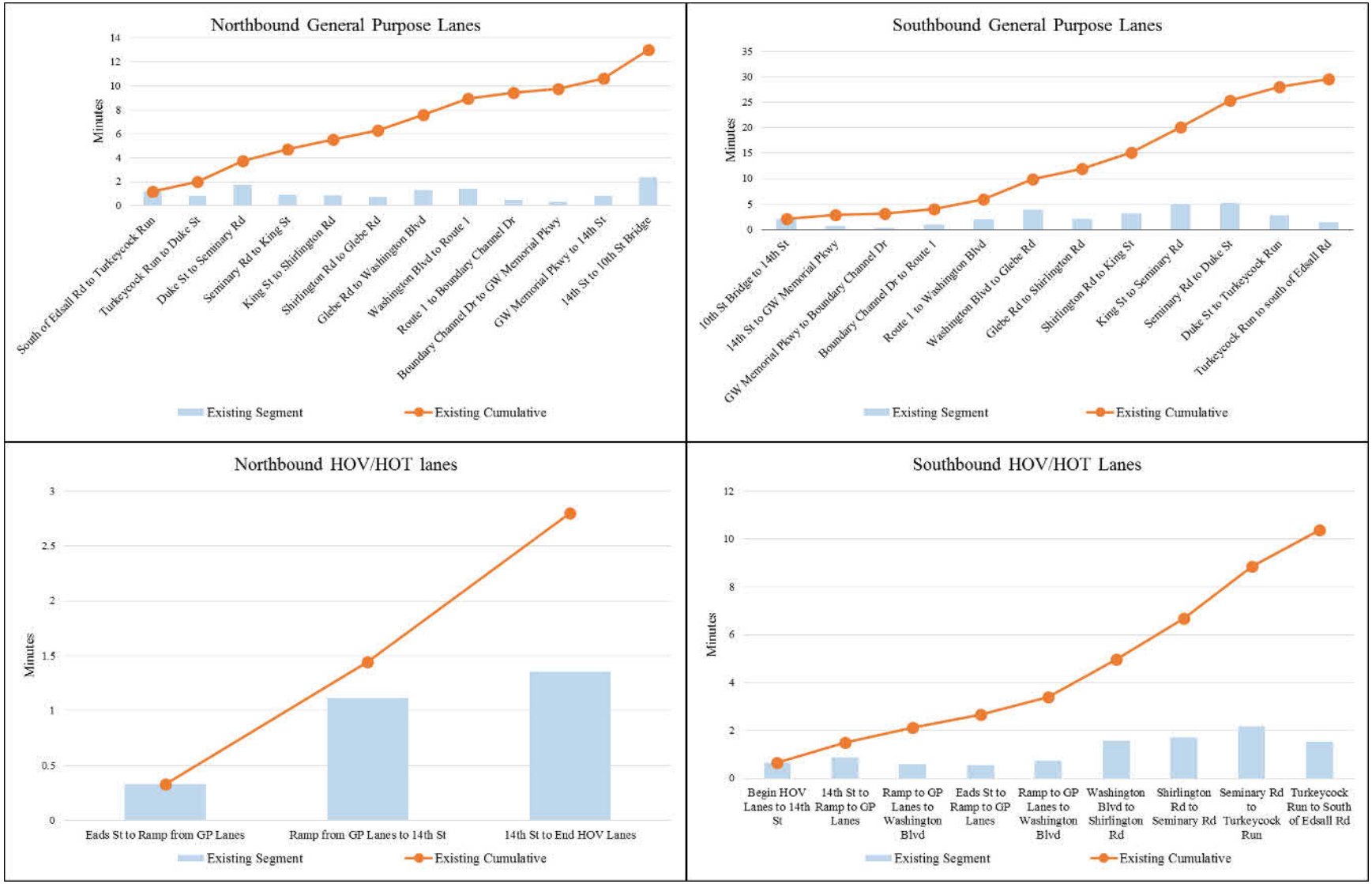
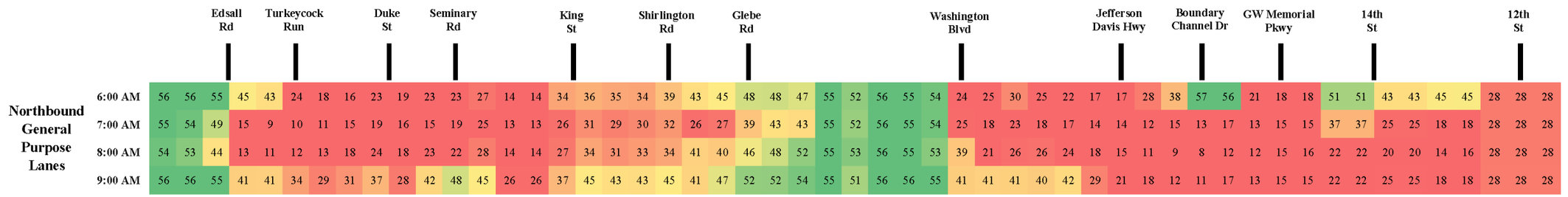
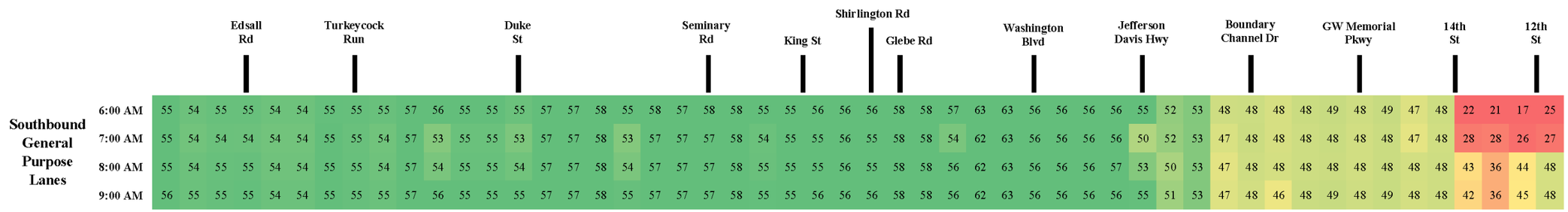
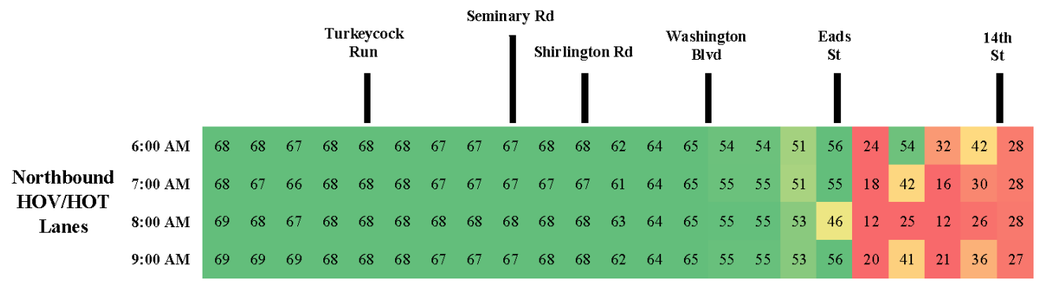
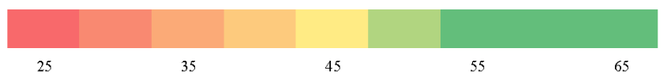


Figure 2-23: Existing AM Peak Period Speed Comparison









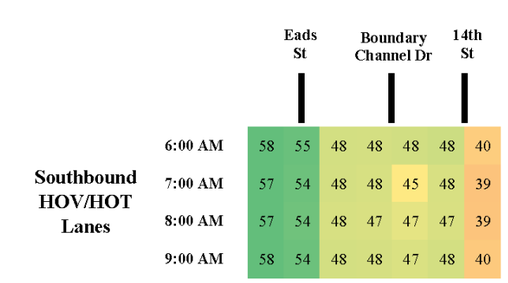
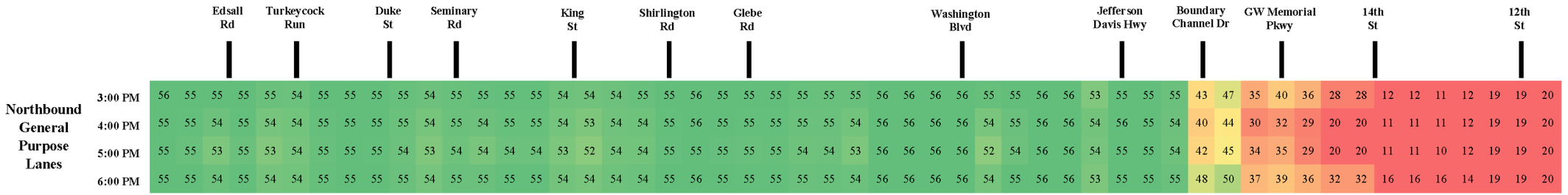
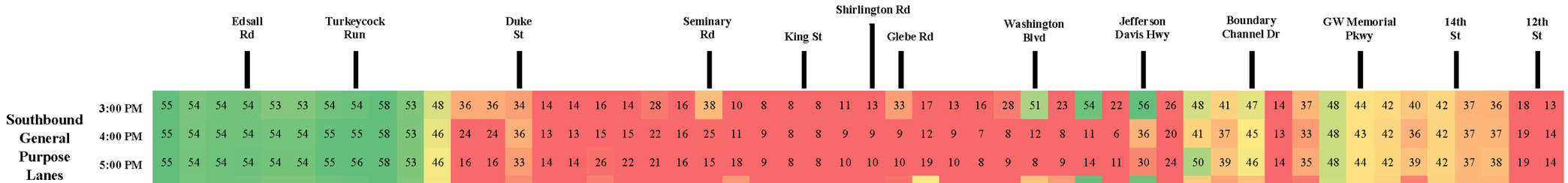
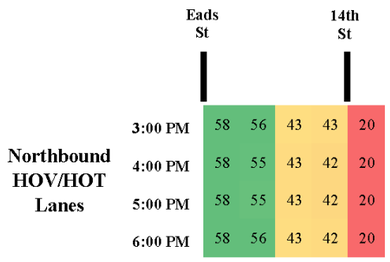
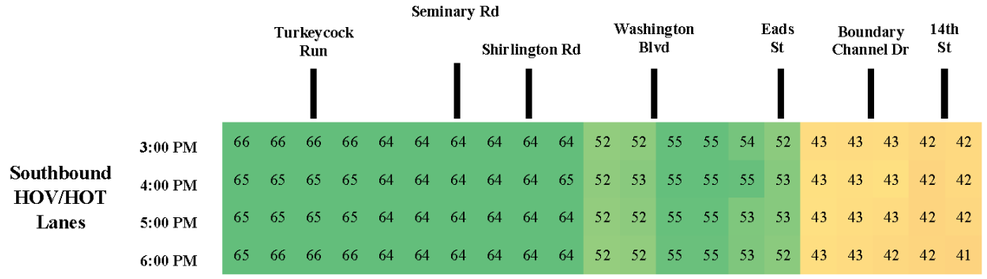


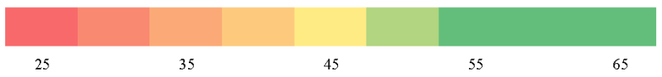
Figure 2-24: Existing PM Peak Period Speed Comparison











2.5.2.2 Arterial Operations

Intersection traffic analysis was performed at signalized and unsignalized intersections along the I-395 study corridor. Standard methodologies described in the Highway Capacity Manual (HCM) were utilized, using the software package *Synchro Version 9* (Build 907, Revision 6). Reported Measures of Effectiveness (MOEs) from Synchro were developed by applying HCM methodologies to the analysis outputs for both signalized and unsignalized intersections.

For signalized and unsignalized intersections, level of service (LOS) is defined in terms of the average total vehicle delay of all movements traveling through an intersection. LOS quantifies several qualitative factors including driver discomfort, frustration, and lost travel time. LOS criteria are depicted in terms of average delay per vehicle during a specific time interval. Average vehicle delay is measured based on several variables including signal phasing, signal timing, signal cycle length, and traffic volumes with respect to intersection capacity.

Existing traffic signal timings for signalized intersections along the I-395 study corridor were obtained from several sources including the City of Alexandria, Arlington County, Fairfax County, and the Virginia Department of Transportation (VDOT). The timings were provided in a combination of formats, including Synchro analysis files and traffic signal controller timing outputs.

For unsignalized intersections LOS criteria applies to two intersection types: two-way, stop-controlled and all-way, stop-controlled. Two-way, stop-controlled intersection LOS is defined in terms of the average vehicle delay of an individual movement(s), typically the approach or movement with the highest delay. All-way, stop-controlled intersection LOS is expressed in terms of the average vehicle delay of all of the movements, similar to that of a signalized intersection. **Table 2-11** depicts LOS criteria for both signalized and unsignalized intersections (both all-way and two-way, stop controlled) as described in the Highway Capacity Manual 2010.

It should be noted that the HCM-based *Synchro* software does not take into account the interactions between closely spaced intersections and that delays associated with queue interactions may result in higher delay values than reported. The HCM methodology also does not take into account downstream congestion constraints, for example on-ramps to I-395 that may spill back onto the arterial network at some intersections during peak periods. The development of a VISSIM model to support the Interchange Modification Report for both the I-395 freeway facility and the arterial network serving I-395 will further examine and document operations along the arterial network serving I-395.

Table 2-11: Level of Service Criteria for Intersections (HCM 2010)

LOS	Control Delay (seconds / vehicle)	
	Signalized Intersections	Unsignalized Intersections
A	< 10	< 10
B	> 10 < 20	> 10 < 15
C	> 20 < 35	> 15 < 25
D	> 35 < 55	> 25 < 35
E	> 55 < 80	> 35 < 50
F	> 80	> 50

Table 2-11 depicts LOS for both signalized and unsignalized intersections for the AM and PM peak hours for both No Build and Build conditions. Thirty-two (73 percent) of the 44 intersections operate at LOS C or better during both the AM and PM peak periods. This can be primarily attributed to congestion along I-395 during peak periods that meters traffic flow entering the arterials intersecting the corridor. Six intersections operate at LOS D during one or more peak hours and two intersections operate at LOS E during one or more peak hours. The Eads Street at the northbound I-395 HOV ramps intersection operates at LOS F during both peak hours as discussed further in **Section 2.5.2.3**.

Table 2-12: Existing (2015) Intersection LOS and Delay Summary

Intersection Number	Intersection Control	Intersection Name	AM Peak Hour (7-8 AM)		PM Peak Hour (5-6 PM)	
			Average Delay (sec)	Level of Service	Average Delay (sec)	Level of Service
1	Signalized	Edsall Rd at Cherokee Ave	11.1	B	16.1	B
2	Signalized	Edsall Rd at Bren Mar Dr	16.0	B	25.1	C
3	Signalized	Edsall Rd at Bloomfield Dr	11.0	B	8.4	A
4	Signalized	Little River Turnpike at Beauregard St	57.2	E	74.5	E
5	Signalized	Little River Turnpike at Oasis Dr	9.2	A	13.4	B
6	Signalized	Duke St at S Walker St	25.4	C	29.5	C
7	Signalized	Seminary Rd at Beauregard North	38.4	D	38.6	D
8	Signalized	Seminary Rd at Mark Center Dr	23.5	C	22.7	C
9	Signalized	EB Seminary Rd at SB I-395 ramps	28.0	C	26.3	C
10	Signalized	WB Seminary Rd at SB I-395 ramps	13.1	B	17.8	B
11	Signalized	EB Seminary Rd at NB I-395 ramps	44.7	D	29.4	C
12	Signalized	WB Seminary Rd at NB I-395 ramps	15.3	B	21.8	C
13	Unsignalized	WB Seminary Rd at I-395 HOV Ramp	-[1]	-[1]	12.7	B (SB R)
14	Unsignalized	Seminary Rd at Kenmore Ave	16.7	C (WB R)	16.2	C (EB R)
15	Signalized	Seminary Rd at Library Ln	12.7	B	11.2	B
16	Signalized	King St at Park Center Dr	23.6	C	19.3	B
17	Unsignalized	King St at 30th St	13.4	B (WB L)	13.8	B (WB L)
18	Signalized	King St at Menokin Dr	19.3	B	10.1	B
19	Signalized	S Shirlington Rd at S Arlington Mill Dr/ Four Mile Run Trail	38.2	D	49.2	D
22	Signalized	S Shirlington Rd at Campbell Ave	16.5	B	16.3	B
27	Unsignalized	Martha Custis Dr at Gunston Rd	11.1	B (WB LTR)	9.8	A (EB LTR)
30	Signalized	N Quaker Ln at Preston Rd	24.4	C	20.6	C
31	Signalized	S Glebe Rd at 24th Rd S (north)	30.1	C	21.7	C
32	Signalized	S Glebe Rd at 24th Rd S (south)	21.7	C	19.6	B
33	Signalized	S Glebe Rd at SB I-395 off-ramp	2.1	A	23.4	C
34	Signalized	S Glebe Rd at NB I-395 off-ramp	40.7	D	45.4	D
36	Signalized	Columbia Pike at Southgate Rd/S Joyce St	15.2	B	48.3	D
37	Unsignalized	Columbia Pike at Rotary Rd	21.8	C (NB L)	13.5	B (NB L)
38	Signalized	Army Navy Dr at S Joyce St	22.3	C	23.2	C
39	Signalized	Army Navy Dr at parking lot/garage	13.9	B	14.8	B
40	Signalized	Army Navy Dr at S Hayes St	33.3	C	27.4	C
41	Signalized	Army Navy Dr at S Fern St	18.8	B	24.7	C
42	Unsignalized	S Eads St at I-395 SB HOV Ramps	27.5	D (WB L)	14.5	B (WB L)
43	Unsignalized	S Eads St at I-395 NB HOV Ramps	-[2]	F (SB TL)	-[2]	F (SB TL)
44	Signalized	Army Navy Dr at S Eads St	22.7	C	17.2	B
45	Signalized	S Eads St at 12th St S	8.8	A	12.0	B
46	Unsignalized	Army Navy Dr at 12th St S	29.0	D (SB L)	36.8	E (SB L)
47	Signalized	12th St S at S Clark Pl / Long Bridge Dr	11.5	B	13.0	B
50	Unsignalized	Connector Rd at North Rotary Rd	11.3	B (SB R)	9.4	A (SB R)
51	Unsignalized	S Fern St at North Rotary Rd	-[1]	-[1]	-[1]	-[1]
52	Unsignalized	S Fern St at South Rotary Rd	8.1	A	9.3	A
53	Unsignalized	S Eads St at North Rotary Rd	-[3]	-[3]	-[3]	-[3]
54	Unsignalized	S Eads St at South Rotary Rd	-[3]	-[3]	-[3]	-[3]
55	Unsignalized	Connector Rd at Boundary Channel Dr	23.6	C (NB L)	21.8	C (NB L)

Notes: 1: Intersection does not utilize signal, stop, or yield control during this time period, therefore no results given
2: Delays exceed Highway Capacity Manual methodology, therefore no results given
3: Intersection control configuration not accomodated by the Highway Capacity Manual, therefore no results given
4: Movements shown in parenthesis for unsignalized intersections are for the worst case approach at the intersection

2.5.2.3 Eads Street Interchange

The Eads Street Interchange is a critical location in the I-395 HOV lanes system as Eads Street serves the Pentagon Reservation and the Pentagon Transit Center as well as serving as a primary origin and destination for informal ridesharing vehicles (slugs). The interchange is a traditional diamond configuration with unsignalized intersections at the ramp terminals along Eads Street. For the purposes of this study, I-395 and the corresponding on and off-ramps are referred to as north-south roadways, Eads Street is referred to as a north-south roadway, and North and South Rotary Roads are referred to as east-west roadways. The following is a summary of the configuration of the key intersections and roadways in the vicinity of the I-395 at Eads Street Interchange:

- **Eads Street at Northbound I-395 HOV ramps:** The northbound I-395 HOV off-ramp is free-flow onto Eads Street for both left and right turns and includes a left-turn lane and a shared through/right-turn lane. Northbound and southbound through traffic along Eads Street is stop-controlled at the ramp junction and only buses are permitted to travel northbound through the intersection via signing.
- **Eads Street at Southbound I-395 HOV ramps:** The southbound I-395 HOV Off-Ramp is stop-controlled at Eads Street with Eads Street operating free flow at the ramp junction in both the northbound and southbound directions. Northbound Eads Street left turns onto the on-ramp to the southbound I-395 HOV lanes are not accommodated at the intersection. Southbound Eads Street right turns to the southbound HOV lanes are channelized and operate freely.
- **Eads Street at South Rotary Road:** Eads Street at South Rotary Road is an all-way stop-controlled intersection with S. Rotary Road operating one-way eastbound. Eastbound South Rotary Road has three eastbound lanes at the intersection including a shared left/through, shared through/right, and a right-turn lane. Northbound Eads Street consists of a through and shared through/right-turn lane. Southbound Eads Street consists of a shared left/through lane and a through lane. Pedestrians are not accommodated at this intersection and are directed to Fern Street to cross under I-395.
- **Eads Street at North Rotary Road:** Eads Street at North Rotary Road is an all-way stop-controlled intersection with North Rotary Road operating one-way westbound. Westbound North Rotary Road has two lanes at the intersection including a left-turn lane and a shared left/through lane. Northbound Eads Street consists of a left-turn lane and shared left/through lane to the Pentagon Transit Center. Southbound Eads Street from the Pentagon Transit Center consists of a shared through/right-turn lane. Pedestrian crosswalks are provided on the north, east, and west legs of the intersection.
- **Eads Street at Army Navy Drive:** This signalized intersection operates with protected/permissive left-turn phasing on the eastbound Army Navy Drive approach and concurrent phasing on northbound and southbound Eads Street. The eastbound approach includes a shared left/through lane and a shared through/right lane. The northbound Eads Street approach includes a left turn lane and a shared through/right-turn lane and the southbound Eads Street approach includes a single shared left/through/right-turn lane.

As shown in **Table 2-12**, the intersection of Eads Street at the ramp from the northbound I-395 HOV lanes operates at LOS F during both the AM and PM peak hours and Eads Street at the ramp from the southbound I-395 HOV lanes operates at LOS D in the AM peak hour when considering the worst case approach at these unsignalized intersections. However, the operational deficiencies at the interchange can be further illustrated based on a summary of key observations and operational issues observed within the

vicinity of the Eads Street Interchange and the Pentagon South Parking Lot during several peak periods during the AM and PM peaks:

AM Peak Period

- Heavy left turn traffic volumes along the I-395 northbound HOV off-ramp operate free flow on the approach to Eads Street but then encounter the police-controlled, four-way stop-controlled intersection at Eads Street and South Rotary Road as discussed below. Although vehicles on the ramp from the northbound I-395 HOV lanes have the right of way, when there is downstream congestion on northbound Eads Street approaching South Rotary Road and motorists are not able to make a left turn, motorists on the ramp often leave a gap for southbound Eads Street motorists to continue to Army Navy Drive or to make a left-turn onto the ramp to the northbound HOV lanes.

- Pentagon Force Protection Agency (PFPA) officers control intersection operations at four locations during the AM peak period: South Rotary at Eads Street, North Rotary at Eads Street, North Rotary at Connector Road, and the Pentagon Transit Center Emergency Bus Access at Connector Road. At the Eads Street and South Rotary Road intersection, the officer alternates the right of way between eastbound South Rotary Road and northbound and southbound Eads Street; however, due to heavy demands on both the northbound and eastbound approaches, queues build on both approaches with northbound Eads Street queues extending onto the HOV ramp from northbound I-395 and eastbound South Rotary Road queues extending beyond Fern Street.

- Northbound queues along Eads Street extend through the Army Navy Drive due to congestion on the ramp from Eads Street to the northbound I-395 HOV lanes resulting from downstream congestion in the HOV lanes approaching the District.

- During the AM peak period from 7:00 AM to 9:00 PM, the majority of bus traffic exiting the Pentagon Transit Center is directed out through the bollard-controlled exit onto northbound Connector Road as a results of a Pilot Program that began on January 4, 2016. Three bus routes are approved to exit the Pentagon Transit Center onto Eads Street including WMATA Routes 9A, 10A, and 7Y. This reduces the amount of bus traffic along Eads Street south of North Rotary Road during the AM peak period.

- On multiple occasions, it was observed that incidents along either the northbound I-395 HOV or northbound I-395 general purpose lanes north of the interchange caused severe congestion and gridlock on the surface streets in the vicinity of the Eads Street Interchange including Army Navy Drive.

- Police officers controlling the intersection of North Rotary Road at Eads Street frequently stopped vehicular traffic on the north and east legs of the intersection to allow pedestrians to safely cross the intersection.

- The drop off area for informal ridesharing (slugging) is located in the parking lot between Eads Street and Fern Street on the south side of North Rotary Road. During the AM peak period, westbound North Rotary Road motorists dropping off slugs enter the drop off area just west of Fern Street in a gap in the barrier just west of Connector Road.

- There is heavy pedestrian activity crossing North Rotary Road west of Fern Street. Although the pedestrians have the right of way at this location due to the stop control on westbound North Rotary Road, based on observations, pedestrians and motorists alternate the right of way.

PM Peak Period

- Heavy traffic volumes exiting the Pentagon South Parking lot along eastbound South Rotary Road and southbound Eads Street destined for the ramp to southbound I-395 HOV lanes create queues that regularly extend along eastbound South Rotary Road to Fern Street. Motorists exiting the slug pick up area along the east side of Fern Street often weave through queues along eastbound South Rotary Road to access the ramp to the southbound I-395 HOV lanes.

- Along the southbound I-395 HOV lanes, southbound motorists entering from the ramp from Eads Street encounter congestion within the weave between the entrance ramp from Eads Street and the exit ramp to the general purpose lanes which is further degraded due to downstream congestion in the general purpose lanes.

- Slug passengers are staged for eight specific destinations along the north side of North Rotary Road east of Eads Street and in the parking lot between Eads Street and Fern Street along the east side of Fern Street.

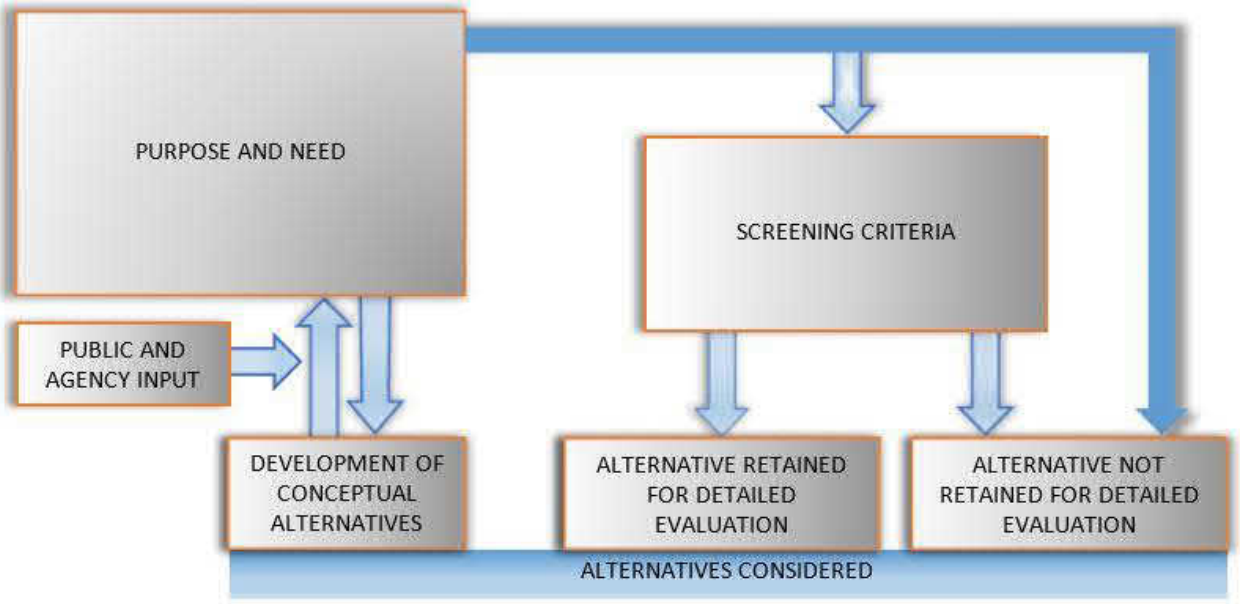
- Police officers control intersection operations at two locations during the PM peak period: South Rotary at Eads Street and North Rotary at Eads Street. Police control at the two Eads Street intersections helps to facilitate outbound traffic from both the Pentagon Transit Center and the slug lines along North Rotary Road.

3. ALTERNATIVES CONSIDERED

3.1 ALTERNATIVES DEVELOPMENT AND SCREENING PROCESS

The alternatives development process typically involves developing conceptual alternatives that address the Purpose and Need of the project. Public and agency coordination is then conducted to receive input on the conceptual alternatives. **Figure 3-1** illustrates the general process used to identify and screen alternatives.

Figure 3-1: Alternatives Development and Screening Process

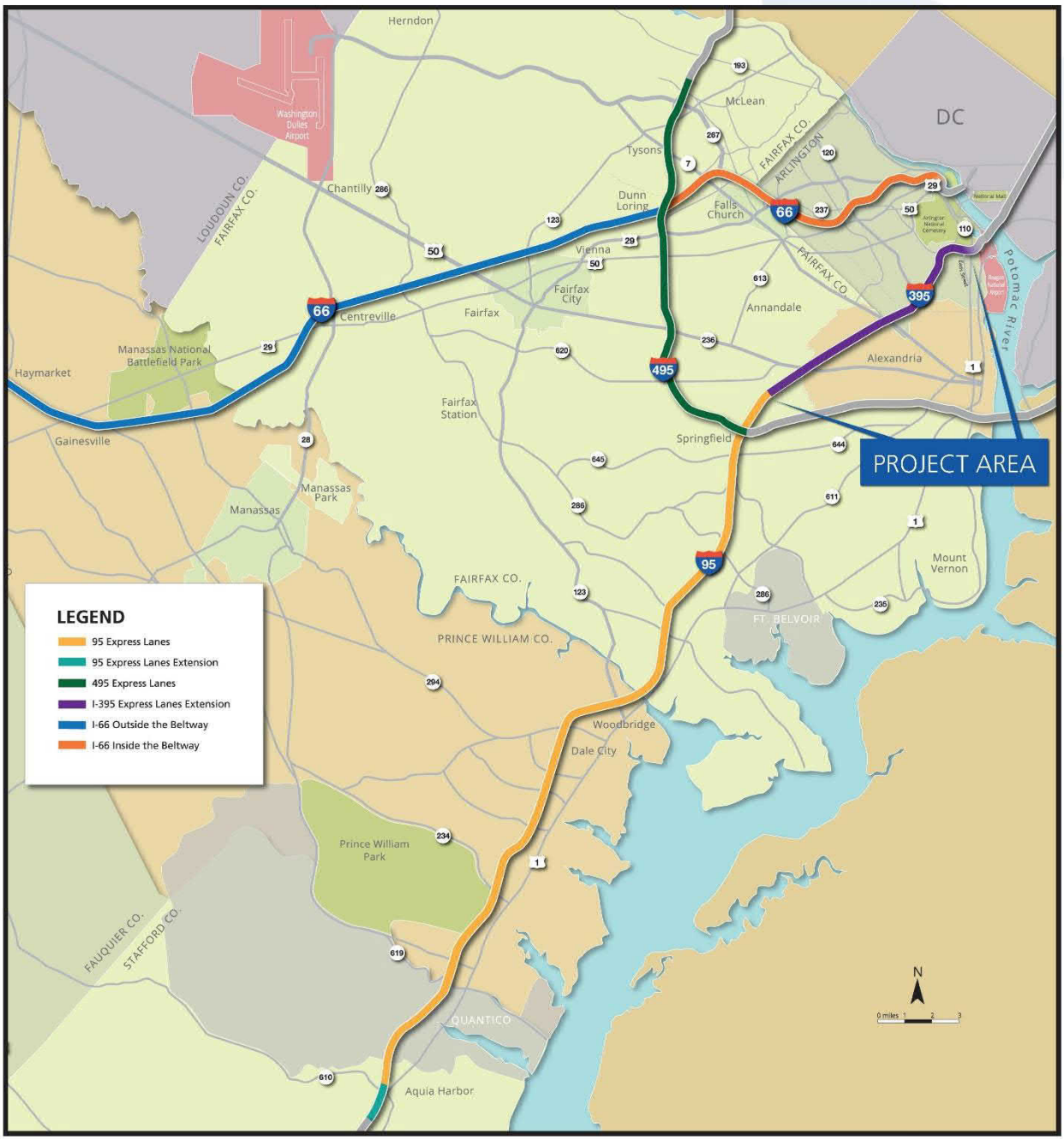


The process of developing alternatives to address the transportation needs along the I-395 corridor has been ongoing for several years as discussed in **Section 1.1**. While Express Lanes were only constructed on I-95 from Garrisonville Road in Stafford County to Edsall Road in Fairfax County, congestion north of the Express Lanes has continued to increase along I-395. Consultation among VDOT, FHWA, District of Columbia Department of Transportation (DDOT), Department of Defense (DoD), Resource Agencies, Local Governments, and Stakeholders has resulted in the decision to evaluate alternatives that would address the identified needs along the I-395 corridor.

Similar to the process shown in **Figure 3-1**, a conceptual alternative was developed that would address the identified purpose and need of the project – which is to reduce congestion, provide additional travel choices, improve travel reliability, and improve roadway safety. Public and agency coordination were then initiated to further inform the development and refinement of the conceptual alternative.

Figure 3-2 illustrates the existing and planned Express Lanes (HOT lanes) network within Northern Virginia. The Express Lanes network is critical to the Northern Virginia region because the network provides additional travel choices and improves travel reliability for a variety of users. Due to the desire to address the needs of the project along the I-95 / I-395 corridor, converting the existing HOV facility to a HOT lanes facility was the only alternative identified for evaluation.

Figure 3-2: Express Lanes Network in Northern Virginia



Since Express Lanes already exist within the median of I-95 from Garrisonville Road in Stafford County to Edsall Road in Fairfax County, making the change from HOV to HOT lanes within the median of I-395 would minimize and reduce impacts by not requiring future improvements to the existing general purpose travel lanes beyond what has already been planned regionally. Furthermore, an additional build alternative that did not involve the conversion of the HOV lanes to HOT lanes was not considered as the travel choices and reliability are dependent on connecting the existing HOV facility to the regional Express Lanes network. In order to provide a baseline for comparison, a No Build Alternative is also being evaluated.

3.2 ALTERNATIVES NOT RETAINED FOR EVALUATION

As discussed above, only one proposed Build Alternative was considered for evaluation. No other alternatives were developed; therefore, no alternatives have been eliminated from detailed study.

3.3 ALTERNATIVES RETAINED FOR EVALUATION

3.3.1 No Build Alternative

The No Build Alternative has been included for evaluation as a benchmark for the comparison of future conditions and impacts. The No Build Alternative would retain the existing two reversible HOV lanes, existing general purpose lane configuration, and the associated interchanges, and allow for routine maintenance and safety upgrades. This alternative also assumes that the projects currently programmed and funded in VDOT's Fiscal Year (FY) 2016-2021 Six-Year Improvement Program (SYIP) and the Metropolitan Washington Council of Governments (MWCOG) Constrained Long-Range Transportation Plan (CLRP) for the National Capital Region will be implemented as discussed in **Section 5.1**.

3.3.2 Build Alternative

The Build Alternative, shown in **Figures 3-3 through 3-7**, converts the two existing reversible HOV lanes within the existing median along the I-395 corridor to three HOT lanes within the existing footprint of the existing HOV facility from the current I-395 HOT lanes terminus at Turkeycock Run to Eads Street near the Pentagon. The expansion of the existing reversible HOV lanes facility located in the median of I-395 is an extension of the existing I-95 Express Lanes (HOT) to the south. For the majority of the project, the existing reversible HOV lanes are separated from the general purpose lanes by guardrail barriers mounted on a 4 to 6-foot wide concrete island. The existing guardrail and the concrete island would be replaced with double face concrete barriers.

By maximizing the width between the general purpose lanes and reconstructing the existing paved shoulders, the proposed three HOT lanes would largely be accommodated within the footprint of the existing HOV facility. The typical available width for the three-lane HOT lanes facility is approximately 45 feet (variable) as shown in **Figure 3-8**. The Build Alternative provides a typical section of three 11-foot wide travel lanes with a minimum 2-foot shoulder on the west side and a minimum 10-foot shoulder on the east side.

Figure 3-3: Build Alternative Section 1

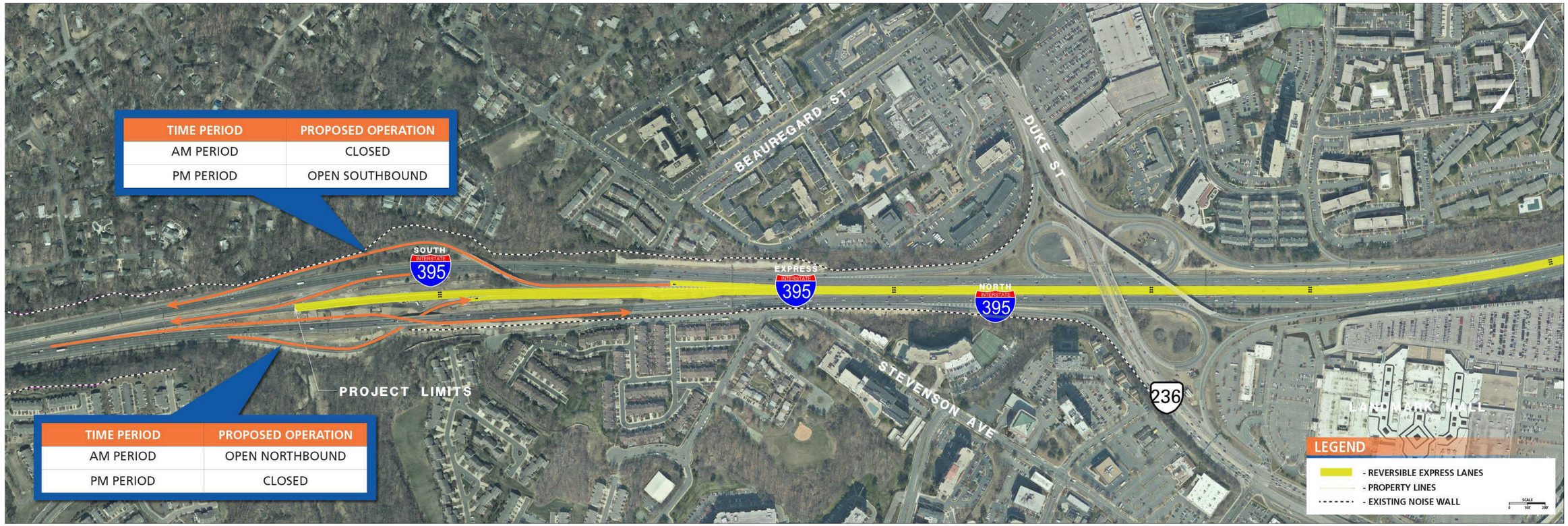


Figure 3-4: Build Alternative Section 2

Figure 3-5: Build Alternative Section 3

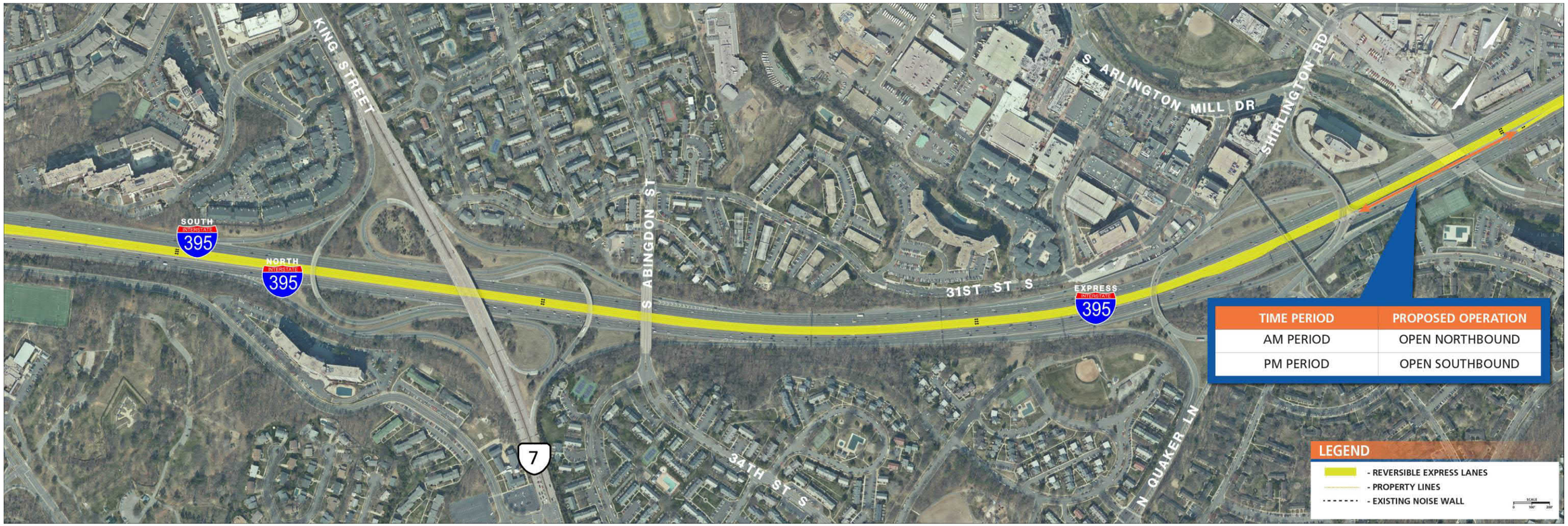


Figure 3-6: Build Alternative Section 4

Figure 3-7: Build Alternative Section 5

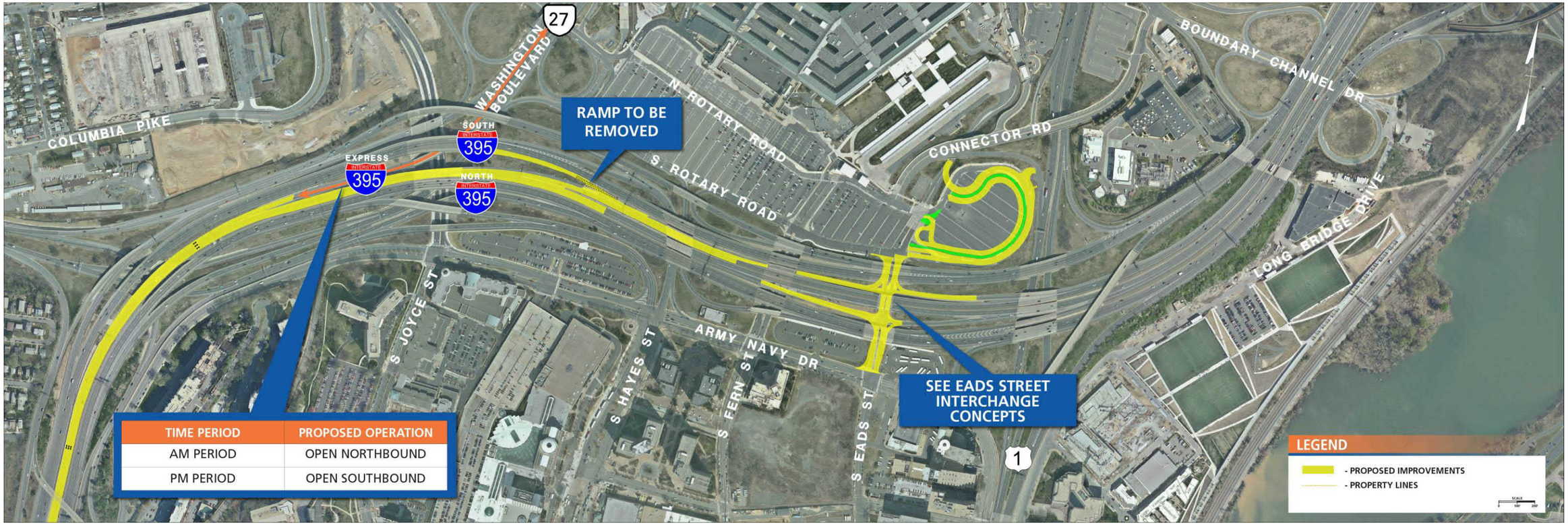
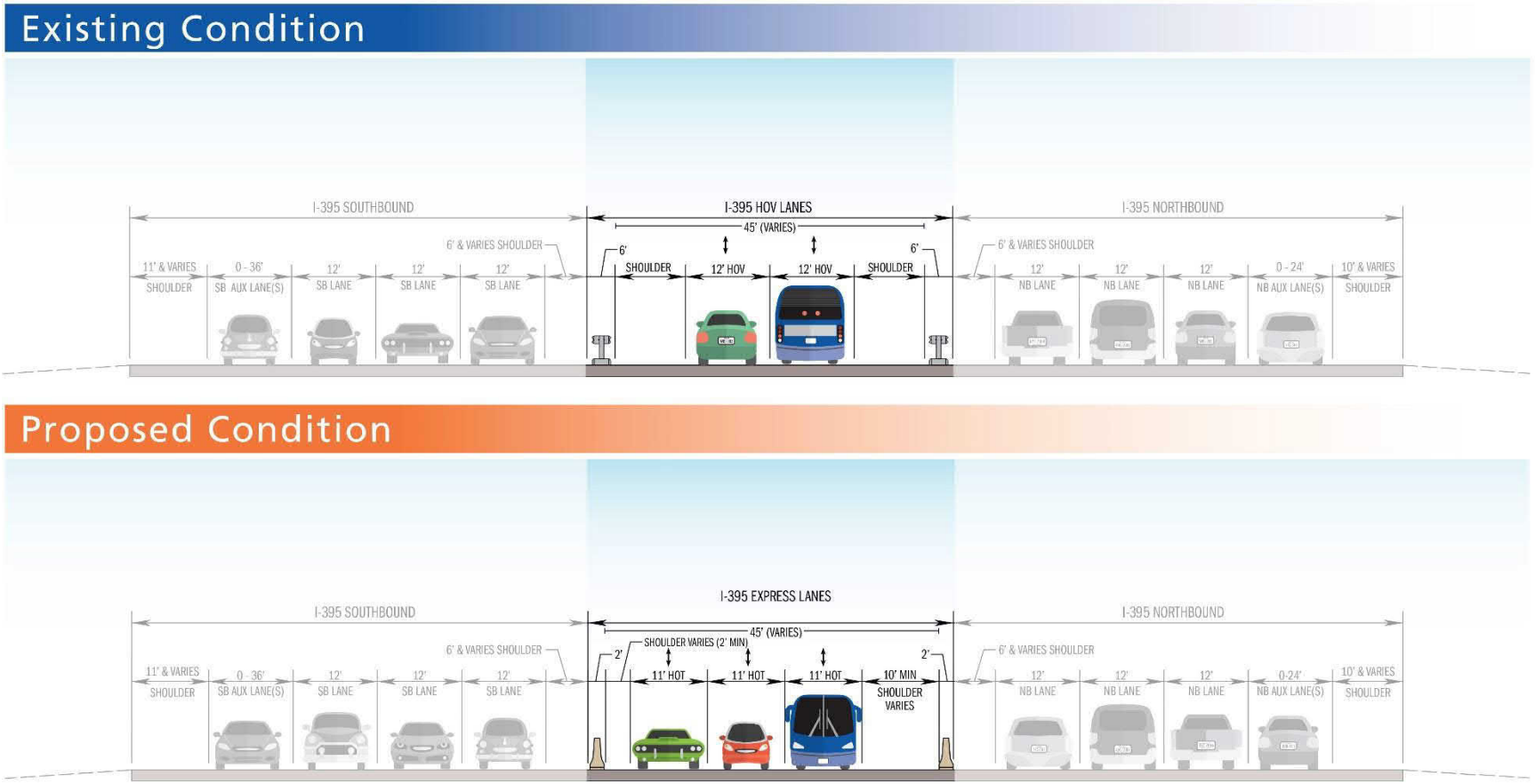


Figure 3-8: Existing and Proposed Typical Section



3.3.2.1 Proposed Access Points to the HOT Lanes

Table 3-1 summarizes the proposed access modifications along the I-395 study corridor associated with the Build Alternative. With the exception of the Eads Street Interchange, all existing access points would remain in their current geometric configuration. Traffic operations at the northern terminus of the proposed I-395 HOT lanes in the vicinity of the Eads Street Interchange are a critical component of the proposed improvements as discussed in **Section 3.3.2.2**.

With the exception of the south facing ramp at the Seminary Road Interchange which would remain an HOV ramp at all times, all other access points to and from the proposed I-395 HOT lanes would be converted to HOT ramps.

Table 3-1: Access Point Modifications

Access Point		Access	
		Existing	Build Alternative
Turkeycock Run (north of Edsall Road)		AM: Full access between NB HOV/HOT lanes and GP lanes PM: Full access between SB HOV/HOT lanes and GP Lanes	AM: Full access between NB HOT lanes and GP lanes PM: Full access between SB HOT lanes and GP Lanes
Seminary Road – South Facing Ramp		AM: NB access from HOV lanes PM: SB access to HOV lanes (HOV at all times)	No change (would remain HOV at all times)
Seminary Road – North Facing Ramp		AM: NB access to HOV lanes PM: SB access from HOV lanes	AM: NB access to HOT lanes PM: SB access from HOT lanes
Shirlington Road – North Facing Ramp		AM: NB access to HOV lanes PM: SB access from HOV lanes	AM: NB access to HOT lanes PM: SB access from HOT lanes
Washington Boulevard – South Facing Ramp		AM: NB access from HOV lanes PM: SB access to HOV lanes	AM: NB access from HOT lanes PM: SB access to HOT lanes
Eads Street Interchange	Ramp from SB HOV Lanes to SB GP Lanes (south of Eads Street)	AM & PM: SB access from HOV lanes	Capacity and operational improvements to be evaluated as part of the Interchange Modification Report (see Section 3.3.2.2.2)
	Eads Street – NB Off Ramp from HOV	AM: NB access from HOV lanes PM: Closed	
	Eads Street – SB On Ramp to HOV	AM & PM: SB access to HOV lanes	
	Eads Street – NB On Ramp to HOV	AM & PM: NB access to HOV lanes	
	Eads Street – SB Off Ramp from HOV	AM & PM: SB access from HOV lanes	
NB Ramp from GP Lanes to HOV Lanes north of Eads Street		AM & PM: NB access to HOV lanes	AM & PM: NB access to HOT lanes

3.3.2.2 Eads Street Interchange

3.3.2.2.1 Eads Street Initial Interchange Options Considered

The Build Alternative includes modifications to the Eads Street Interchange at the proposed northern terminus of the I-395 HOT lanes. This interchange is a critical location in the I-395 HOT lanes facility as Eads Street serves the Pentagon Reservation and the Pentagon Transit Center, a major transit hub for the Washington, D.C. Region, and is a primary origin and destination for transit providers and motorists using the existing I-395 HOV lanes.

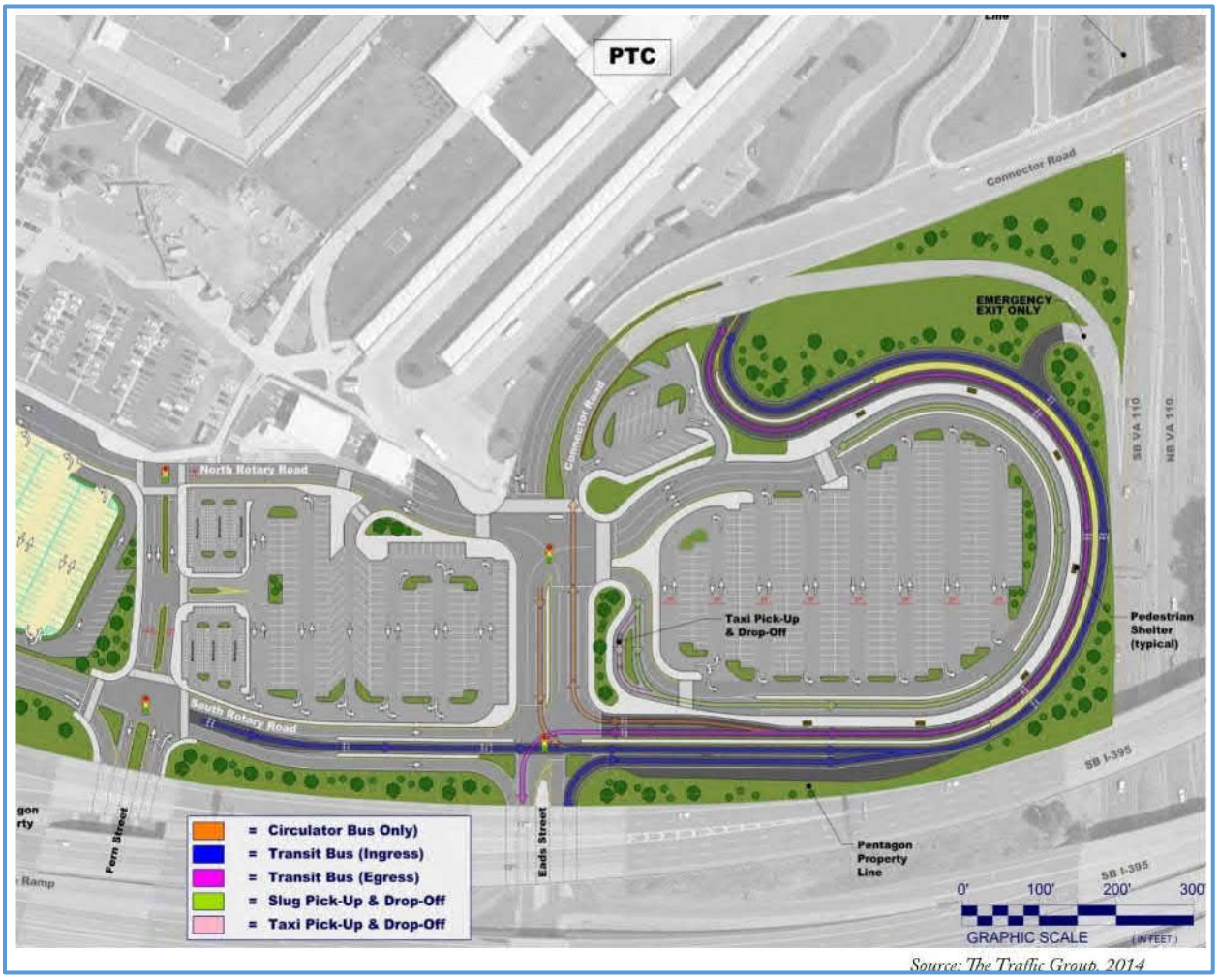
As discussed below, several options have been considered for the northern terminus of the project at the Eads Street Interchange. Accessibility and congestion reduction in this area are critical elements for future use of the I-395 HOT lanes. The Eads Street Interchange poses challenges in balancing the needs of all transportation users including transit vehicles, HOV motorists, and pedestrians. A key challenge at the Eads Street Interchange is managing traffic between general purpose and HOT lanes in a congested and constrained area with limited opportunity for expansion. Maintaining free-flowing and safe traffic operations on the HOT lanes at the northern terminus and the Eads Street Interchange approach is imperative in order to ensure high quality service for transit vehicles, HOVs, and toll-paying customers.

Another key component of the Eads Street Interchange is the compatibility with improvements proposed on the Pentagon Reservation. The 2015 Master Plan Update for the Pentagon Reservation establishes a long-term vision for the Pentagon and surrounding facilities and includes a reconfiguration of the Pentagon South Parking Lot as shown in **Figure 3-9** (Washington Headquarters Service, 2015). The Pentagon Reservation, including the Pentagon Transit Center, accommodates more than 23,000 employees and commuters using the transit center traveling to and from the site every day. Modifications to the Eads Street Interchange have the potential to affect traffic circulation at the Pentagon Reservation.

As shown in **Figure 3-9**, the South Parking Lot improvements include the following major components:

- Direct access to the Pentagon Transit Center via a dedicated two-way bus loop that circulates on the eastern perimeter of the South Parking Lot. Transit vehicles would be separated from passenger vehicles and substantial pedestrian conflicts along North Rotary Road.
- Traffic signalization at the following four intersections within the South Parking Lot: Eads Street at South Rotary Road, Eads Street at North Rotary Road, Fern Street at South Rotary Road and Fern Street at North Rotary Road. These signals would be coordinated to provide smooth traffic flow within the parking lot and would include signalized pedestrian crossings.
- A dedicated ridesharing (slugging) area within the bus loop to accommodate the substantial ridesharing that occurs within the South Parking Lot.
- Other pedestrian amenities within the parking lot to accommodate the heavy pedestrian travel patterns between the parking lots, Pentagon Transit Center, and the ridesharing areas.

Figure 3-9: Pentagon Master Plan South Parking Lot Improvements



The exact timing of the implementation of the proposed South Parking Lot Improvements is not known at this time and is dependent on federal approvals and funding availability. As such, VDOT has worked closely with Pentagon staff to develop an interim improvement for the South Parking Lot that is consistent with the longer term Master Plan improvements and would allow the Eads Street Interchange to operate effectively until the ultimate improvements are implemented (see **Section 3.3.2.3**).

Options Analyzed During Prior Studies (2004 – 2009): An initial range of twelve options for the Eads Street interchange were considered as part of the original efforts to develop the I-395 Express Lanes project between 2004 and 2009. Original design efforts were suspended in February 2011. The initial range of twelve options for the Eads Street Interchange generally consisted of two families of options as described below and discussed in more detail in **Section 2.3** of the ***Alternatives Technical Report*** (VDOT, 2016):

- *Dedicated Entry and Exit Ramps To and From I-395 HOT Lanes:* Two options maintain the current ramp configurations between the I-395 HOT lanes and Eads Street including a NB I-395 HOT lanes off-ramp to Eads Street and a SB on-ramp from Eads Street to the SB I-395 HOT lanes.
- *Reversible Entry and Exit Ramps To and From I-395 HOT Lanes:* Ten options include a reversible operation of one or both of the ramps between Eads Street and the I-395 HOT lanes south of Eads

Street in addition to modifications to traffic flow and lane configurations along Eads Street and South Rotary Road.

3.3.2.2.2 Eads Street Refined Interchange Options Considered

The initial twelve options considered as part of the 2004 through 2009 studies were reviewed to develop two refined options and two new options to be considered as part of the current study efforts that would best meet the project purpose and need and current constraints of the project including the proposed improvements associated with the Pentagon Master Plan. The four refined options are discussed below:

Single Reversible Eads Street Ramp

The single reversible Eads Street ramp option would convert the existing I-395 NB HOV off-ramp to Eads Street into a widened three-lane, reversible ramp (see **Figure 3-10**). All existing traffic movements would be maintained at the Eads Street Interchange with additional capacity provided to and from Eads Street during the AM and PM peak hours. Traffic signals would be provided along Eads Street at both the NB and SB I-395 HOT ramps. Expansion of the existing NB I-395 HOV off-ramp to three lanes would require reconstruction of the I-395 HOV bridges over Fern Street and potentially Eads Street which would result in major access and maintenance of traffic challenges during construction and therefore, this option was not considered further.

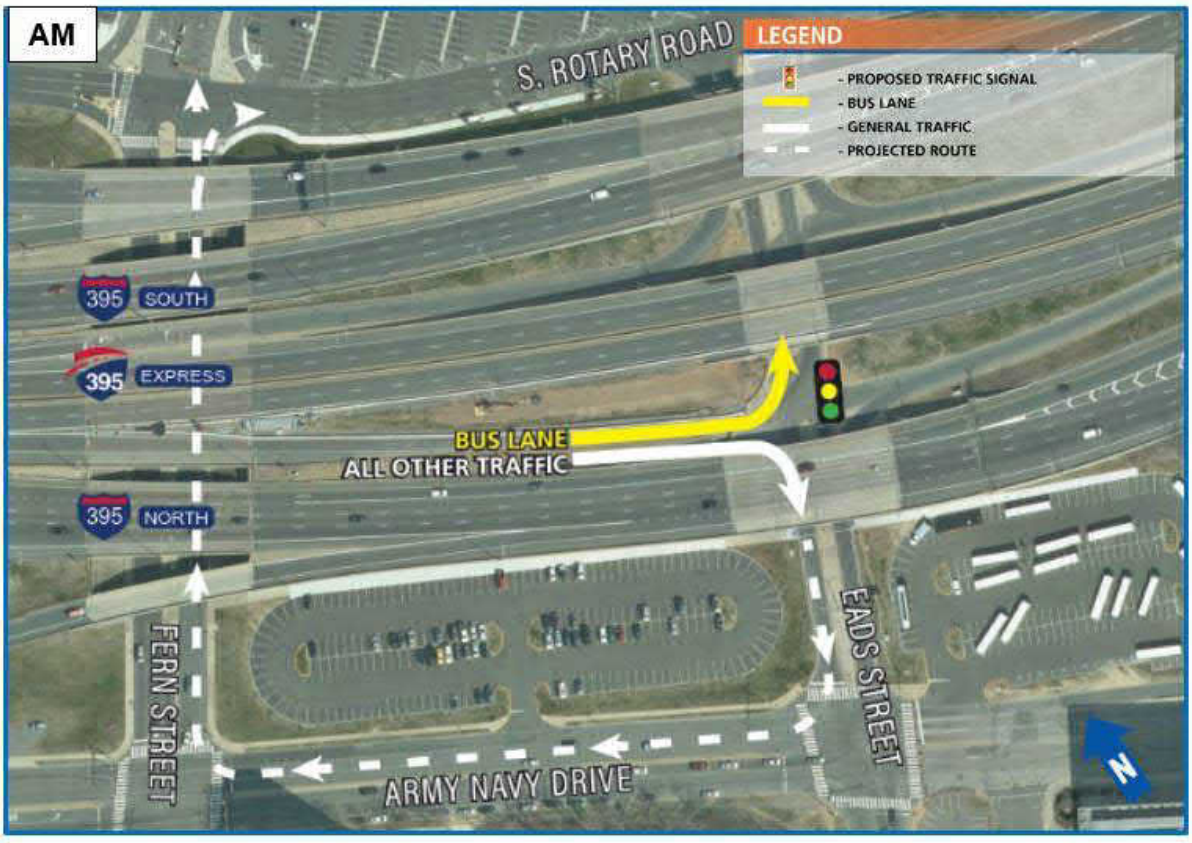
Figure 3-10: Single Reversible Eads Street Ramp

Dedicated Bus Lane and Right-Turn Lane

This option would widen the NB I-395 HOV off-ramp to Eads Street and establish a bus-only left-turn lane and right-turn lane along the ramp. All traffic (excluding buses) would be directed to make a right-turn onto Eads Street toward the Army Navy Drive intersection (see **Figure 3-11**). Traffic would then continue to Fern Street to access the Pentagon Reservation. In this option, Eads Street through traffic would be limited to transit based vehicles by creating dedicated bus lanes from the HOT lanes to the Pentagon Reservation. Although the dedicated bus lanes create a more roundabout method of entering the Pentagon for non-transit traffic, this option simplifies the Eads Street intersection operations and prevents reconstruction of the existing I-395 bridges.

Directing all traffic entering the Pentagon Reservation from the I-395 NB HOT lanes (excluding transit vehicles) to use Army Navy Drive and Fern Street would increase traffic volumes along these streets and would require roadway improvement to mitigate the impacts. Additionally, the diverted traffic volumes would increase pedestrian and vehicle conflicts since Fern Street is the designated pedestrian route to the Pentagon (pedestrians are currently prohibited along Eads Street). Lastly, this option would provide a minimal increase to capacity on the Eads Street ramp compared to existing conditions. For these reasons, this option was not considered further.

Figure 3-11: Dedicated Bus Lane and Right Turn at Eads Ramp



Diverging Diamond Interchange

A diverging diamond at the Eads Street Interchange would shift mainline traffic on Eads Street to the opposite side of the roadway in order to receive the I-395 HOT ramps beyond the two proposed signals (see **Figure 3-12**). All existing traffic movements would be retained with this option. The ramps would maintain their current operational functionality as exit/entrance ramps from the I-395 HOV (future HOT) lanes. The proposed diverging diamond configuration would simplify I-395 HOT egress and ingress movements, as well as reduce the number of signal phases at the ramp signals. Although this option would reduce the number of turning conflicts at the interchange, introducing a diverging diamond at this location is an unconventional intersection configuration considering the traffic volumes, emergency evacuation procedures at the Pentagon Reservation, and the dual General Purpose and proposed HOT facility.

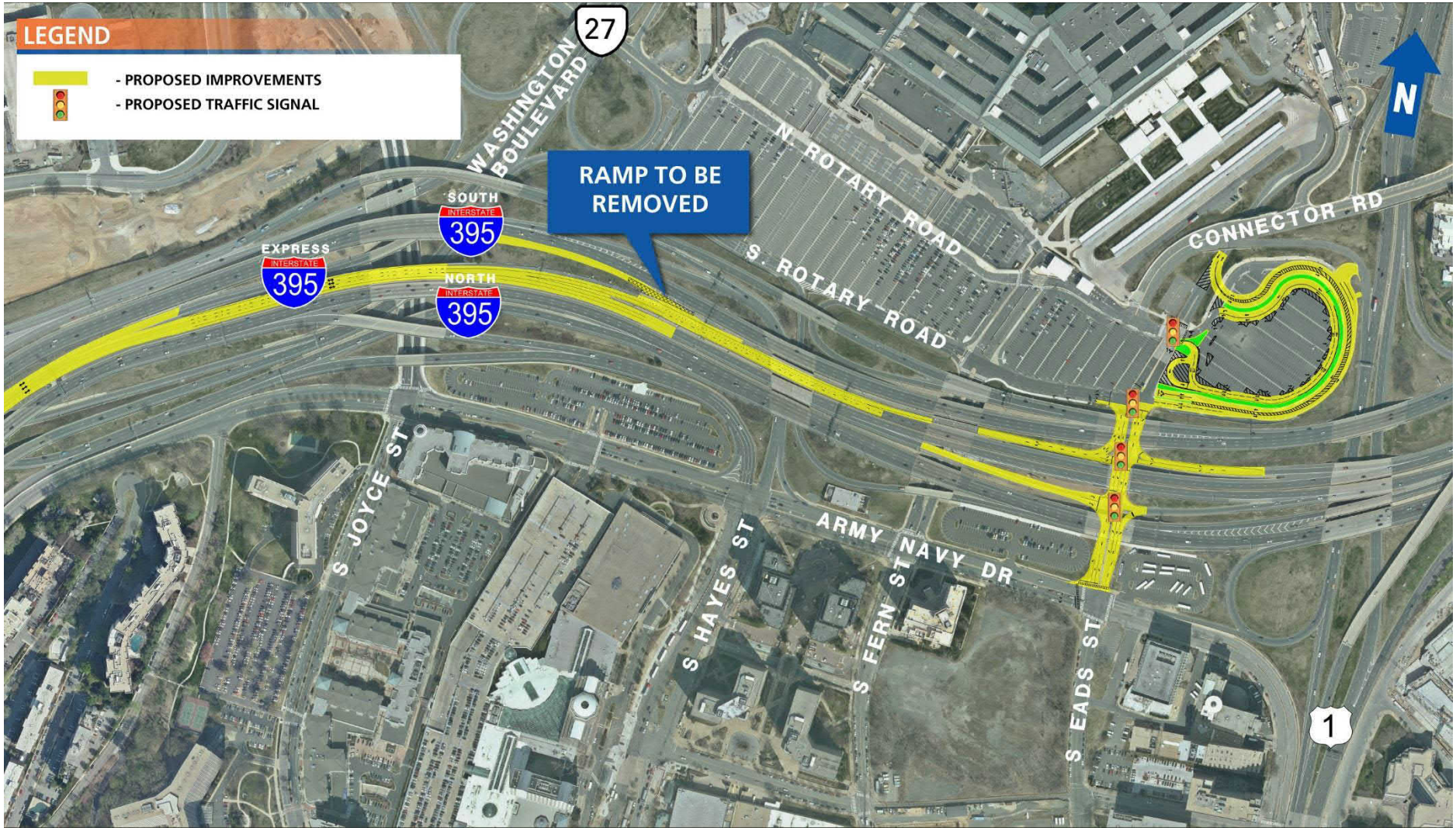
Based on the existing configuration of the Eads Street Interchange at the I-395 HOV ramps, the restricted width under the existing I-395 HOV bridge (future I-395 Express Lanes Bridge) does not accommodate an optimal diverging diamond interchange configuration. Diverging diamond interchanges rely on proper crossover intersection angles in order to minimize the potential for wrong way movements. In order to achieve the desired crossover intersection angles (i.e., as close as possible to 90 degrees), this option would likely require reconstruction of the I-395 HOV bridge over Eads Street. This would result in access and maintenance of traffic challenges during construction and therefore this option was not considered further.

Figure 3-12: Diverging Diamond at Eads Street

Dual Reversible Eads Street Ramps

The Dual Reversible Eads Street Ramps option would increase capacity to and from Eads Street by dividing traffic between two reversible ramps (see **Figure 3-13),** providing a total of four ramp lanes traveling to and from Eads Street. The NB I-395 HOV off-ramp to Eads Street would operate NB in the AM peak period and SB in the PM peak period for traffic traveling to and from Army Navy Drive and the Pentagon City area. The existing ramp from Eads Street to the SB I-395 HOV lanes would be expanded to two lanes approaching the intersections at Eads Street and operate NB in the AM peak period and SB in the PM peak period for traffic traveling to and from the Pentagon Reservation. The use of existing ramp and bridge infrastructure would not require reconstruction of the interchange and comparatively reduced maintenance of traffic impacts.

Figure 3-13: Dual Reversible Eads Ramps



As part of this option, the access to the SB I-395 general purpose lanes from the existing SB I-395 HOV lanes would be removed. Access to the SB I-395 general purpose lanes would be provided via Hayes Street/Army Navy Drive, Washington Boulevard/Columbia Pike, and Boundary Channel Drive instead of the current ramp. This would eliminate a weave condition along the SB I-395 HOV lanes and eliminate a merge condition along the SB I-395 general purpose lanes in an area with a high density of access points.

This option would retain the current circulation patterns within the Pentagon Reservation and is consistent with the Pentagon Master Plan improvements in the Pentagon South Parking Lot. Four traffic signals would be constructed along Eads Street at the two I-395 HOT ramp intersections, at South Rotary Road, and at North Rotary Road.

The Dual Reversible Eads Street Ramps option was selected as the preferred option for detailed study because this option significantly increases capacity on the two ramps serving Eads Street from the south (providing four ramp lanes) and minimizes turning conflicts at the signalized intersections proposed along Eads Street. This option also minimizes disruption to the Pentagon South Parking Lot compared to other previously considered options.

3.3.2.3 Pentagon Interim Improvements

As noted above, the timing of the improvements to the Pentagon South Parking Lot is unknown at this time; however, some improvements to the South Parking Lot are required in order to create a smooth transition between the improvements planned at the Eads Street Interchange and within the Pentagon Reservation.

During the development of the interchange alternatives at Eads Street, VDOT worked very closely with Pentagon staff to develop an interim solution for the Pentagon South Parking Lot that is consistent with the long-term plans proposed as part of the Pentagon Master Plan and also meets the operational needs of the I-395 Express Lanes project. **Figure 3-14** depicts the planned improvements within the South Parking Lot that would be constructed as part of the Eads Street Interchange improvements associated with the I-395 Express Lanes project. The interim improvements incorporate the following components:

- Direct access to the Pentagon Transit Center via a dedicated two-way bus loop that circulates on the eastern perimeter of the South Parking Lot. Transit vehicles would be separated from passenger vehicles and substantial pedestrian conflicts along North Rotary Road.
- Traffic signalization at the Eads Street at South Rotary Road and Eads Street at North Rotary Road intersections. These signals would be coordinated to provide smooth traffic flow and would be coordinated with the signals along Eads Street at the I-395 HOT ramps and Army Navy Drive.
- A dedicated ridesharing (slugging) area within the bus loop to accommodate the substantial ridesharing that occurs within this portion of the South Parking Lot.
- A fourth lane along EB South Rotary Road approaching Eads Street that would be used to access the future HOT lanes. The lane would be open to traffic during the PM period when the I-395 HOT lanes are operating in a southbound direction.

Figure 3-14: Pentagon South Parking Lot Interim Improvements