INTERSTATE 395 EXPRESS LANES
NORTHERN EXTENSION

Alternatives Analysis Technical Report

City of Alexandria, and Arlington and Fairfax Counties
Project Number: 0395-969-205, P101; UPC: 108313
Federal Project Number: NHPP-395-4(189)
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<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AASHTO</td>
<td>American Association of State Highway Transportation Officials</td>
</tr>
<tr>
<td>CE</td>
<td>Categorical Exclusion</td>
</tr>
<tr>
<td>CLRP</td>
<td>Constrained Long-Range Plan</td>
</tr>
<tr>
<td>DDOT</td>
<td>District of Columbia Department of Transportation</td>
</tr>
<tr>
<td>DoD</td>
<td>Department of Defense</td>
</tr>
<tr>
<td>EA</td>
<td>Environmental Assessment</td>
</tr>
<tr>
<td>FWHA</td>
<td>Federal Highway Administration</td>
</tr>
<tr>
<td>FY</td>
<td>Fiscal Year</td>
</tr>
<tr>
<td>HOT</td>
<td>High Occupancy Toll</td>
</tr>
<tr>
<td>HOV</td>
<td>High Occupancy Vehicle</td>
</tr>
<tr>
<td>I-395</td>
<td>Interstate 395</td>
</tr>
<tr>
<td>MWCOG</td>
<td>Metropolitan Washington Council of Governments</td>
</tr>
<tr>
<td>NB</td>
<td>Northbound</td>
</tr>
<tr>
<td>NEPA</td>
<td>National Environmental Policy Act</td>
</tr>
<tr>
<td>NHS</td>
<td>National Highway System</td>
</tr>
<tr>
<td>PPTA</td>
<td>Public-Private Transportation Act</td>
</tr>
<tr>
<td>SB</td>
<td>Southbound</td>
</tr>
<tr>
<td>STRAHTNET</td>
<td>Strategic Highway Network</td>
</tr>
<tr>
<td>SYIP</td>
<td>Six-Year Improvement Program</td>
</tr>
<tr>
<td>TWG</td>
<td>Technical Working Group</td>
</tr>
<tr>
<td>VDOT</td>
<td>Virginia Department of Transportation</td>
</tr>
<tr>
<td>WHS</td>
<td>Washington Headquarters Service</td>
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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.

The purpose of this Technical Report is to describe the alternative development process, and assess the alternatives considered for this project. Information in this report, described below, will support discussions presented in the EA.

- **Section 1** provides project background information and an overview of the study area;
- **Section 2** describes the No Build Alternative and Build Alternative, the Eads Street Interchange options, Structure and Bridge Rehabilitations; and the factors that were considered in the evaluation and selection of the Eads Street Interchange option.

1.1 DESCRIPTION OF THE STUDY AREA

The study area 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. Additional signage, maintenance of traffic, and noise barrier activities are anticipated to occur beyond the study area. Crossroads and interchange areas also are included in the study area, as well as lands adjacent to the corridor\(^1\). The following interchanges along I-395 are located within the study area, moving south to north:

- Turkeycock Run;
- Duke Street/Little River Turnpike (Route 236);
- Seminary Road (Route 420);
- King Street (Route 7);
- Shirlington Road;
- Glebe Road (Route 120);
- Washington Boulevard (Route 27); and
- Eads Street near the Pentagon.

\(^1\) The study area is approximately 600 feet to either side of the existing corridor for a distance of eight miles. The study area was established to identify the full extent of environmental resources and their relevance to the project. Specific potential environmental consequences resulting from the expansion and conversion of the two existing reversible High Occupancy Vehicle (HOV) lanes on I-395 to three managed HOT lanes are documented in Chapter 3.0, Environmental Consequences of the EA.
1.2 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 demonstrate 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 High Occupancy Vehicle (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 an 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 six miles of HOT lanes on I-395 including modifications to the existing interchanges, instead, focusing traffic improvements on the I-95 corridor. VDOT then announced plans for a new I-95 HOT Lanes Project and prepared an EA and then a Revised EA to assess HOT lanes on I-95 from Garrisonville Road in Stafford County to I-395 at Edsall Road in Fairfax County and link those lanes directly to the new I-495 HOT lanes already under construction. In December 2011, upon review of the Revised EA and supporting documentation, FHWA issued a Finding of No Significant Impact.

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 allowed 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, the 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 and noted 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.

1.3 EXISTING CONDITIONS

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)\(^2\) and the Strategic Highway Network (STRAHNET)\(^3\). Additionally, I-395 is the primary north-south interstate highway into Washington, D.C. from Virginia serving both local, commuter, and regional traffic. The existing I-395 facility within the study limits generally includes four northbound and four southbound general purpose lanes and two reversible HOV lanes between the northbound and southbound general purpose lanes. 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. 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

\(^2\) 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/).

\(^3\) 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/).
Alternatives Analysis Technical Report

2. ALTERNATIVES CONSIDERED

2.1 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 2-1 illustrates the general process used to identify and screen alternatives.

![Figure 2-1: Alternatives Development and Screening Process](image)

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 1.2. While Express Lanes were only constructed on I-95 from Garrisonville Road in Stafford County to I-395 at 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 2-1, 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, as discussed in Chapter 4.0 Coordination and Comments of the EA.
Figure 2-2 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 system was the only alternative identified for evaluation.

**Figure 2-2: Express Lanes Network in Northern Virginia**
Since Express Lanes already exist within the median of I-95 from Garrisonville Road in Stafford County to I-395 at 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. The evaluation of one Build Alternative is consistent with FHWA’s Technical Advisory T 6640.8A Guidance For Preparing and Processing Environmental and Section 4(f) Documents. In order to provide a baseline for comparison, a No Build Alternative is also being evaluated as described in Section 2.3.1.

2.2 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.

2.3 ALTERNATIVES RETAINED FOR EVALUATION

2.3.1 No Build Alternative

In accordance with the regulations implementing NEPA (40 CFR § 1502.14(d)), 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 and associated interchanges in their current configuration, 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 would be implemented. The roadway and transit projects listed in the SYIP and MWCOG CLRP within the study area are shown in Table 2-1.

Table 2-1: No Build Projects within the I-395 Corridor

<table>
<thead>
<tr>
<th>Project/Study</th>
<th>Description</th>
<th>Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-395 HOV / Transit Ramp at Seminary Road ¹</td>
<td>Construction of a south-facing ramp from the HOV lanes to the top level of the Seminary Road Interchange that provides additional access for HOV and transit</td>
<td>Jan 2016</td>
</tr>
<tr>
<td>12th Street Extension ²</td>
<td>Construct 12th Street between S. Eads Street and S. Fern Street</td>
<td>2016</td>
</tr>
<tr>
<td>I-395 4th Lane South Widening – Duke Street to Edsall Road</td>
<td>Widening of SB I-395 to provide one additional through lane from north of Duke Street to south of Edsall Road</td>
<td>2019</td>
</tr>
<tr>
<td>Seminary Road and Beauregard Street Ellipse</td>
<td>Modification of the intersection to an ellipse design to eliminate weaving issues on westbound Seminary Road and increase capacity</td>
<td>2020</td>
</tr>
</tbody>
</table>
### Project/Study Description Completion Date

<table>
<thead>
<tr>
<th>Project/Study</th>
<th>Description</th>
<th>Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boundary Channel Drive Interchange</td>
<td>Interchange modifications to improve operations and reduce weaving along SB I-395 including constructing two roundabouts, providing connections to Long Bridge Park Drive and US Route 1, and multi-modal improvements</td>
<td>Summer 2021</td>
</tr>
<tr>
<td>Army Navy Drive Complete Streets</td>
<td>Multi-modal improvements along Army Navy Drive between South Joyce Street and 12th Street including constructing a dedicated bicycle facility and improving transit accommodations</td>
<td>2021</td>
</tr>
<tr>
<td>Arlington National Cemetery Southern Expansion Project and Associated Roadway Realignment</td>
<td>Interchange improvements to remove the NW and SW ramps and conversion to a diamond configuration to increase the contiguous area of Arlington National Cemetery</td>
<td>TBD 4</td>
</tr>
<tr>
<td>Pentagon South Parking Lot Improvements</td>
<td>Reconfiguration of the South Parking Lot as part of the Pentagon Master Plan</td>
<td>TBD 5</td>
</tr>
</tbody>
</table>

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### Ability of the No Build Alternative to Address the Purpose and Need

As discussed in *Traffic and Transportation Technical Report* (VDOT, 2016), traffic volumes are forecasted to increase in the future which will lead to more severe and a longer duration of congestion along the I-395 study corridor in both the general purpose and HOV lanes during both the AM and PM peak periods. Therefore, the No Build Alternative would not address the purpose and need for the project as identified in Section 2.1.

#### 2.3.2 Build Alternative

The Build Alternative, shown in Figures 2-3 through 2-7, 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 system of reversible HOV lanes 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. The proposed concrete barriers would be installed generally with a 2-foot offset along the western edge of the existing concrete island (to be removed), which provides an additional 2-foot shoulder on the southbound general purpose lanes. The wider shoulder would improve the functionality of the inside shoulder of the southbound general purpose lanes. The remaining portion of
the additional width gained from the removal of the concrete islands is allocated to the HOT facility to provide the space required for the three HOT lanes and shoulders.

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 with only minor impacts to the general purpose lane shoulders in the northern section on the southbound side. The available width for this HOT Lane facility is approximately 45 feet (variable), as shown below in Figure 2-8. The typical section consists 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. Disabled vehicles and emergency responders would use the east side of the corridor during emergency situations. The easternmost travel lane (11 feet wide) along with the eastern shoulder (generally 10 feet) would provide a 21-foot wide travel way which would be sufficient for the emergency vehicles to access incidents along the corridor. Additionally, enforcement/emergency pull-off areas have been proposed where space is available including in the vicinity of Seminary Road Interchange, Shirlington Interchange and King Street Interchange.

The Build Alternative was developed using current design guidelines including the American Association of State Highway and Transportation Officials (AASHTO) *A Policy on the Geometric Design of Highways and Streets, 2011* (Green Book) and the VDOT Road Design Manual (April, 2016). A Technical Working Group (TWG), comprised of VDOT, FHWA, 95 Express, and support staff, was formed to guide the development of the Build Alternative. The TWG met on a weekly basis to discuss design issues and constraints and to reach consensus on project design. Detailed tables showing the Design Criteria that were used for this study are included in Appendix A. Overall, the design criteria are based on the functional classification of the roadway as an urban freeway. The following is a discussion of specific design features of the Build Alternative and how these features are addressed.

**HOT Lane/Shoulder Widths:** As discussed above, the addition of a third lane in the existing two-lane HOV facility located in the median of I-395 is a key objective of the project, and implementation of proposed improvements requires the existing lane and shoulders widths to be reduced to minimize impacts to the I-395 northbound and southbound general purpose lanes. The two following safety concepts were considered:

- On high-speed facilities, providing adequate lane width is a critical roadway feature. With narrow lanes, there is an increased risk of cross-lane sideswipe crashes; and
- Functional shoulders provide numerous safety benefits (space for crash avoidance, disabled vehicle refuge, emergency response, snow removal, law enforcement, maintenance, etc.).

A balanced approach was taken in allocating space to lanes and shoulders with the goal of providing adequate lane width for the traffic mix (percentage and type of large vehicles) expected and providing functional shoulders adjacent to the HOT lanes. In order to add a third lane to the existing two-lane HOV facility, VDOT proposes to reduce lane width from 12 feet to 11 feet and to reduce the width of the shoulder on one side of the facility. Eleven-foot wide lanes would maintain continuity with the existing I-95 Express Lanes from Prince William Parkway north to Turkeycock Run. The reduced lane and shoulder width would be extended from Turkeycock Run to the north, to just south of the Washington Boulevard Interchange where the lane width transitions back to 12-foot wide lanes. The corridor has a low percentage of large
trucks; in addition, large trucks (3+ axles) would be prohibited from using the I-395 Express Lanes facility. By providing narrower lane widths, other roadway features deemed critical to safety and operation, such as shoulders, barrier offsets, and horizontal stopping sight distance, would be optimized to a greater extent. A Design Exception would be requested for the reduced lane width (a Design Exception Request for lane and shoulder width reduction was approved for portions of the adjoining I-95 Express Lanes project).

Additionally, the width created from the removal of the existing guardrail and concrete island would be used to provide wider shoulders and space for emergency pull off, overhead sign structures, gantries, and drainage inlets. During the conceptual design efforts, the location and width of the proposed shoulders were considered. The continuity with the existing I-95 Express Lanes from Prince William Parkway north to Turkeycock Run was a critical factor in determining the project typical section. This continuity within this portion of the 36-mile HOT lanes facility would provide users, emergency responders, and maintenance personnel with a clear and consistent understanding of the operations of the HOT facility.
Figure 2-3: Build Alternative Section 1

<table>
<thead>
<tr>
<th>TIME PERIOD</th>
<th>PROPOSED OPERATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM PERIOD</td>
<td>CLOSED</td>
</tr>
<tr>
<td>PM PERIOD</td>
<td>OPEN SOUTHBOUND</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TIME PERIOD</th>
<th>PROPOSED OPERATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM PERIOD</td>
<td>OPEN NORTHBOUND</td>
</tr>
<tr>
<td>PM PERIOD</td>
<td>CLOSED</td>
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</table>
Figure 2-4: Build Alternative Section 2

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<tr>
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<th>PROPOSED OPERATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM PERIOD</td>
<td>OPEN NORTHBOUND HOV ONLY</td>
</tr>
<tr>
<td>PM PERIOD</td>
<td>OPEN SOUTHBOUND HOV ONLY</td>
</tr>
<tr>
<td></td>
<td>HOV ONLY AT ALL TIMES</td>
</tr>
</tbody>
</table>

**TIME PERIOD**
- AM PERIOD
- PM PERIOD

**PROPOSED OPERATION**
- OPEN NORTHBOUND HOV ONLY
- OPEN SOUTHBOUND HOV ONLY

**LEGEND**
- REVERSIBLE EXPRESS LANES
- PROPERTY LINES
- EXISTING NOISE WALL

Interstate 395 Express Lanes

Environmental Assessment
September 2016
Figure 2-5: Build Alternative Section 3
Figure 2-6: Build Alternative Section 4
Figure 2-7: Build Alternative Section 5

<table>
<thead>
<tr>
<th>TIME PERIOD</th>
<th>PROPOSED OPERATION</th>
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</thead>
<tbody>
<tr>
<td>AM PERIOD</td>
<td>OPEN NORTHBOUND</td>
</tr>
<tr>
<td>PM PERIOD</td>
<td>OPEN SOUTHBOUND</td>
</tr>
</tbody>
</table>

RAMP TO BE REMOVED

SEE EADS STREET INTERCHANGE CONCEPTS

LEGEND
- PROPOSED IMPROVEMENTS
- PROPERTY LINES
Stopping Sight Distance: The southern section of the study corridor beginning at Turkeycock Run to Memorial Drive (Army Navy Country Club overpass) has a posted speed limit of 65 mph and the northern section of the study corridor from Memorial Drive to Eads Street has a posted speed limit of 55 mph. The I-395 HOV study corridor has fifteen horizontal curves within the reversible section of the project; eleven of the curves are located in the southern portion of the reversible section with a 65 mph speed limit and four curves are located in the northern portion with a 55 mph speed limit. Existing roadway features (i.e., retaining walls, bridge piers, etc.) that are located within the inside of curves may cause sight obstructions and have been reviewed and compared to stopping sight distance criteria. The horizontal curve under the existing south rotary bridge at the Shirlington Circle Interchange requires a design exception for horizontal sight distance. The required sight distance for a design speed of 65 mph would be met with a wider shoulder on the west side. Since the restriction under the bridge is a short distance, the TWG determined that the better option would be to maintain the design speed through the above mentioned horizontal curve and provide 60 mph advisory speed signs on both approaches to the curve. The west shoulder would be wider than the east shoulder through this curve to provide sufficient horizontal stopping sight distance for a 60 mph speed. All other horizontal curves have sufficient stopping sight distance.

Emergency Responders Access: The design considered access for emergency responders. Transitioning the wide shoulder from one side of the HOT lanes to the other would impact the efficient access for emergency vehicles by eliminating a continuous shoulder for travel during emergency response. Providing a consistent wide shoulder on the east side of the I-395 HOT lanes would provide continuous access for emergency responders to travel.

Drainage: To improve drainage, the reduced shoulder widths would require additional drainage facilities along the project to control stormwater runoff to meet the design criteria for the project. Additionally, the proposed pavement would be sloped to the wider shoulder where possible throughout the project.

Snow Removal: Providing a consistent wide shoulder on the east side of the roadway enables more efficient snow removal by allowing the snow plow operators to plow in the same direction along the entire corridor and to provide a consistent space for placement of the snow piles prior to removal.

Continuity with the I-95 Express Lanes Typical Section: As discussed above, the I-395 Express Lanes would be an extension of the I-95 Express Lanes and would provide continuity of the typical section for the roadway to enhance drivers’ expectation and comfort on the roadway.

The conceptual design efforts for the Build Alternative included coordination with the TWG which was vital in deciding to maintain continuity with the I-95 Express Lanes typical section. The existing and proposed typical sections are shown below in Figure 2-8.
Figure 2-8: Existing and Proposed Typical Section
2.3.2.1 Proposed Access Points to the HOT Lanes

Table 2-2 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 2.3.2.2.

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 2-2: Access Point Modifications

<table>
<thead>
<tr>
<th>Access Point</th>
<th>Existing</th>
<th>Build Alternative</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Turkeycock Run</strong> (north of Edsall Road)</td>
<td>AM: Full access between NB HOV/HOT lanes and GP lanes PM: Full access between SB HOV/HOT lanes and GP lanes</td>
<td>AM: Full access between NB HOT lanes and GP lanes PM: Full access between SB HOT lanes and GP lanes</td>
</tr>
<tr>
<td><strong>Seminary Road – South Facing Ramp</strong></td>
<td>AM: NB access from HOV lanes PM: SB access to HOV lanes (HOV at all times)</td>
<td>No change (will remain HOV at all times)</td>
</tr>
<tr>
<td><strong>Seminary Road – North Facing Ramp</strong></td>
<td>AM: NB access to HOV lanes PM: SB access from HOV lanes</td>
<td>AM: NB access to HOT lanes PM: SB access from HOT lanes</td>
</tr>
<tr>
<td><strong>Shirlington Road – North Facing Ramp</strong></td>
<td>AM: NB access to HOV lanes PM: SB access from HOV lanes</td>
<td>AM: NB access to HOT lanes PM: SB access from HOT lanes</td>
</tr>
<tr>
<td><strong>Washington Boulevard – South Facing Ramp</strong></td>
<td>AM: NB access from HOV lanes PM: SB access to HOV lanes</td>
<td>AM: NB access from HOT lanes PM: SB access to HOT lanes</td>
</tr>
<tr>
<td><strong>Eads Street Interchange</strong></td>
<td>AM &amp; PM: SB access from HOV lanes</td>
<td>Capacity and operational improvements to be evaluated as part of the Interchange Modification Report.</td>
</tr>
<tr>
<td><strong>Ramp from SB HOV Lanes to SB GP Lanes</strong> (south of Eads Street)</td>
<td>AM &amp; PM: SB access from HOV lanes</td>
<td></td>
</tr>
<tr>
<td><strong>Eads Street – NB Off Ramp from HOV</strong></td>
<td>AM: NB access from HOV lanes PM: Closed</td>
<td></td>
</tr>
<tr>
<td><strong>Eads Street – SB On Ramp to HOV</strong></td>
<td>AM &amp; PM: SB access to HOV lanes</td>
<td></td>
</tr>
<tr>
<td><strong>Eads Street – NB On Ramp to HOV</strong></td>
<td>AM &amp; PM: NB access to HOV lanes</td>
<td></td>
</tr>
<tr>
<td><strong>Eads Street – SB Off Ramp from HOV</strong></td>
<td>AM &amp; PM: SB access from HOV lanes</td>
<td></td>
</tr>
<tr>
<td><strong>NB Ramp from GP Lanes to HOV Lanes north of Eads Street</strong></td>
<td>AM &amp; PM: NB access to HOV lanes</td>
<td>AM &amp; PM: NB access to HOT lanes</td>
</tr>
</tbody>
</table>
2.3.2.2 Eads Street Interchange

2.3.2.2.1 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 system 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 and non-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.

Pentagon Master Plan: 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, including a reconfiguration of the Pentagon South Parking Lot as shown in Figure 2-9 (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 2-9, 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 parking lot surrounded by 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.
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 2.3.2.3).

**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 Eads Street Interchange options are described below and generally consists of two families of options:

- **Dedicated Entry and Exit Ramps To and From I-395 HOT Lanes:** Options A and B maintain the current ramp configurations between the I-395 HOT lanes and Eads Street including a northbound I-395 HOT lanes off-ramp to Eads Street and a southbound on-ramp from Eads Street to the southbound I-395 HOT lanes.
- **Reversible Entry and Exit Ramps To and From I-395 HOT Lanes:** Options C through L all 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.

**Option A**
Option A would modify the existing I-395 northbound HOV off-ramp to Eads Street in order to increase capacity for traffic traveling northbound on Eads Street toward the Pentagon Reservation (see **Figure 2-10**). This option would keep the majority of the current interchange layout intact, including no impact to the existing I-395 general purpose and HOV bridges over Eads Street. Eads Street would be widened to provide two northbound lanes within the existing roadway footprint to facilitate an additional northbound left-turn lane (providing a dual left-turn lane) from the existing I-395 northbound HOV off-ramp (which would become the northbound HOT lanes).

**Figure 2-10: Option A Configuration**

In 2013, VDOT constructed a second lane along the Eads Street northbound off-ramp from the I-395 northbound HOV lanes to provide a dedicated left-turn lane and right-turn lane. These improvements implemented a portion of Option A, the widening of the Eads Street northbound off-ramp, but not the Eads Street widening and dual left-turn lane.
The dual left-turn movements from I-395 northbound HOV would require median reconstruction and lane reconfiguration along Eads Street. Approaching the Pentagon Reservation entrance, receiving lanes and medians would be realigned to make use of the proposed lane configuration and to avoid impacts to the existing I-395 bridge piers.

**Option B**
This option converts the existing I-395 southbound on-ramp from Eads Street (for those leaving the Pentagon Reservation) to a bus-only ramp (see Figures 2-11 and 2-12). A new braided ramp would be built to allow access to the I-395 southbound general purpose lanes from the HOV lanes. This option would also widen northbound Eads Street to two lanes within the existing footprint; however, this option would provide for a triple left turn from Eads Street HOT exit ramp by converting the southbound Eads Street lane to a northbound lane during the AM peak period. This would subsequently require modifications to the Pentagon Reservation entrance along South Rotary Road to accommodate the three left-turn lanes from the northbound HOT ramp to Eads Street.

Option B has impacts on the current lane configuration along Eads Street and entering the Pentagon Reservation at South Rotary Road and would heavily modify the current ridesharing, bus, and commuter patterns. South Rotary Road would be converted from one-way to two-way west of Eads Street. Approaching the Pentagon Reservation entrance, receiving lanes and medians would be realigned to make use of the proposed lane configuration and to avoid impact to the existing I-395 bridge piers.

**Figure 2-11: Option B AM Configuration along I-395**

![Option B AM Configuration along I-395](image)
Figure 2-12: Option B Configuration along Eads Street
Option C
Option C would convert the I-395 northbound HOT Lanes exit ramp at Eads Street to a reversible ramp which would accommodate access from and to the I-395 HOT lanes during the AM (northbound) and PM (southbound) peak periods (see Figure 2-13). This option converts the existing ramp from Eads Street to the southbound I-395 HOT lanes to a reversible bus-only ramp that would operate in the northbound direction during the AM peak period and the southbound direction during the PM peak period. Eads Street would operate as northbound only in the AM peak period which is not consistent with the Pentagon Master Plan.

Although lane use changes are proposed with this option, Option C would keep the majority of the existing interchange footprint, including no impacts to the existing I-395 general purpose and HOV bridges over Eads Street.

Figure 2-13: Option C Configuration
**Option D**

Option D would convert the existing I-395 northbound HOV off-ramp to Eads Street to a reversible ramp which would allow access to the I-395 HOT lanes during both the AM (northbound) and PM (southbound) peak periods (see Figure 2-14).

**Figure 2-14: Option D Configuration**

Similar to Option C, this option converts the existing ramp from Eads Street to the southbound HOT lanes to a reversible bus-only ramp that would operate in the northbound direction during the AM peak period and the southbound direction during the PM peak period. Eads Street would be widened to two lanes in both directions. North of South Rotary Road, Eads Street would serve transit vehicles only which is not consistent with the Pentagon Master Plan.

Although lane use changes are proposed with this option, Option D would keep the majority of the existing interchange footprint, including no impacts to the existing I-395 general purpose and HOV bridges over Eads Street.
Option E
Option E would convert the existing I-395 northbound HOV off-ramp to Eads Street to a reversible ramp which would allow access to the HOT lanes during both the AM (northbound) and PM (southbound) peak periods (see Figure 2-15). Similar to Option C, this option converts the existing ramp from Eads Street to the southbound HOT lanes to a reversible bus-only ramp that would operate in the northbound direction during the AM peak period and the southbound direction during the PM peak period. Eads Street through movements would be prohibited under the I-395 HOT lanes. During the PM peak period, Eads Street would operate one-way eastbound. Option E would retain the majority of the existing interchange footprint, including no impacts to the existing I-395 general purpose and HOV bridges over Eads Street.

This option also includes prohibiting through movements along eastbound South Rotary Road at Eads Street which would impact operations within the Pentagon Reservation including commuter travel patterns, transit operations, and ridesharing activities, and is not consistent with the Pentagon Master Plan.

Figure 2-15: Option E Configuration
Option F
Option F would convert the existing I-395 northbound HOV off-ramp to Eads Street to a reversible ramp which would allow access to the HOT lanes during both the AM (northbound) and PM (southbound) peak periods (see Figure 2-16). Similar to Option C, this option converts the existing ramp from Eads Street to the southbound HOT lanes to a reversible bus-only ramp that would operate in the northbound direction during the AM peak period and the southbound direction during the PM peak period. Eads Street would accommodate two lanes in both directions. Option F differs operationally from Option D in that left turns from eastbound South Rotary Road are permitted onto Eads Street (on the left-hand side of the roadway) and a dual right-turn lane is provided from southbound Eads Street to the southbound I-395 HOT lanes during the PM peak period.

Although lane use changes are proposed with this option, Option F would keep the majority of the existing interchange footprint, including no impacts to the existing I-395 general purpose and HOV bridges over Eads Street.

Figure 2-16: Option F Configuration
Option G

Option G would convert the existing I-395 northbound HOV off-ramp to Eads Street to a reversible ramp which would allow access to the HOT lanes during both the AM (northbound) and PM (southbound) peak periods (see Figure 2-17). The ramp would be widened to three lanes including two left-turn lanes and one right-turn lane to Eads Street during the AM peak period. The two leftmost lanes would serve traffic destined for and traveling from the Pentagon Reservation and the right lane would serve traffic to and from Pentagon City. This option converts the existing ramp from Eads Street to the southbound HOT lanes to a bus-only ramp during the PM peak period. Eads Street northbound through movements would be prohibited under the I-395 HOT lanes during both the AM and PM peak periods and Eads Street would operate one-way southbound during the peak period.

Similar to Option E, this option includes prohibiting through movements along northbound South Rotary Road at Eads Street which would impact operations within the Pentagon Reservation including commuter travel patterns, transit operations, and ridesharing activities, and is not consistent with the Pentagon Master Plan.

Although lane use changes are proposed with this option, Option G would retain the majority of the existing interchange footprint, including no impacts to the existing I-395 general purpose and HOV bridges over Eads Street.

**Figure 2-17: Option G Configuration**
Option H
Option H would convert the existing I-395 northbound HOV off-ramp to Eads Street to a reversible ramp which would allow access to the HOT lanes during both the AM (northbound) and PM (southbound) peak periods (see Figure 2-18). The ramp would be widened to three lanes including two left-turn lanes and one right-turn lane to Eads Street during the AM peak period. The two leftmost lanes would serve traffic destined for and traveling from the Pentagon Reservation and the right lane would serve traffic to and from Pentagon City. Similar to Option C, this option converts the existing ramp from Eads Street to the southbound HOT lanes to a reversible bus-only ramp that would operate in the northbound direction during the AM peak period and the southbound direction during the PM peak period.

Similar to Option E, this option includes prohibiting through movements along eastbound South Rotary Road at Eads Street which would impact operations within the Pentagon Reservation including commuter travel patterns, transit operations, and ridesharing activities, and is not consistent with the Pentagon Master Plan.

Although lane use changes are proposed with this option, Option H would keep the majority of the existing interchange footprint, including no impacts to the existing I-395 general purpose and HOV bridges over Eads Street.

Figure 2-18: Option H Configuration
Option I
Option I would convert the existing I-395 northbound HOV off-ramp to Eads Street to a reversible ramp which would allow access to the HOT lanes during both the AM (northbound) and PM (southbound) peak periods (see Figure 2-19). Bus-only traffic would be permitted to make the left turn from this ramp toward the Pentagon Reservation during the AM peak period. All other traffic (excluding buses) would be directed to make a right-turn onto Eads Street toward the Army Navy Drive intersection. Traffic would then continue to Fern Street to access the Pentagon Reservation. Directing all traffic entering the Pentagon Reservation (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).

This option converts the existing ramp from Eads Street to the southbound HOT lanes to a reversible ramp that would operate in the northbound direction during the AM peak period and the southbound direction during the PM peak period.

Although lane use changes are proposed with this option, Option I would keep the majority of the existing interchange footprint, including no impacts to the existing I-395 general purpose and HOV bridges over Eads Street.

Figure 2-19: Option I Configuration
**Option J**

Option J would convert the existing I-395 northbound HOV off-ramp to Eads Street to a reversible ramp which would allow access to the HOT lanes during both the AM (northbound) and PM (southbound) peak periods (see Figure 2-20). Eads Street northbound through movements would be prohibited at the existing northbound I-395 HOV ramp. During the PM peak period, the leftmost lane along southbound Eads Street would be designated for bus use only and northbound Eads Street traffic would be prohibited at the two ramp intersections.

This option converts the existing ramp from Eads Street to the southbound HOT lanes to a reversible ramp that would operate as a bus-only ramp in the northbound direction during the AM peak period and for all vehicles in the southbound direction during the PM peak period.

The configuration of the Eads Street at South Rotary Road intersection would be impacted during the AM peak period with eastbound South Rotary Road right-turn movements and southbound Eads Street movements prohibited. During the PM peak, Eads Street would operate one-way southbound for buses only which is not consistent with the Pentagon Master Plan.

Although lane use changes are proposed with this option, Option J would keep the majority of the existing interchange footprint, including no impacts to the existing I-395 general purpose and HOV bridges over Eads Street.

**Figure 2-20: Option J Configuration**
Option K

Option K would convert the existing I-395 northbound HOV off-ramp to Eads Street to a reversible ramp which would allow access to the HOT lanes during both the AM (northbound) and PM (southbound) peak periods (see Figure 2-21). Similar to Option C, this option converts the existing ramp from Eads Street to the southbound HOT lanes to a reversible bus-only ramp that would operate in the northbound direction during the AM peak period and the southbound direction during the PM peak period.

Eads Street through movements would be eliminated under the I-395 HOT lanes and Eads Street would operate one-way southbound during the PM peak period.

The configuration of the Eads Street at South Rotary Road intersection would be impacted during the AM peak period with eastbound South Rotary Road left-turn and right-turn movements and southbound Eads Street movements prohibited. Additionally, Eads Street between North Rotary Road and South Rotary Road would operate one-way northbound for buses only which is not consistent with the Pentagon Master Plan.

Although lane use changes are proposed with this option, Option J would keep the majority of the existing interchange footprint, including no impacts to the existing I-395 general purpose and HOV bridges over Eads Street.

Figure 2-21: Option K Configuration
Option L
Option L would convert the existing I-395 northbound HOV off-ramp to Eads Street to a reversible ramp which would allow access to the HOT lanes during both the AM (northbound) and PM (southbound) peak periods (see Figure 2-22). The ramp would be widened to three lanes which would require reconstruction of the I-395 HOV bridges over Fern Street and potentially Eads Street and result in major access and maintenance of traffic challenges during construction. Eads Street would be widened to two lanes in each direction under the I-395 HOT lanes. Circulation within the Pentagon Reservation and along Eads Street, South Rotary Road and North Rotary Road would remain unchanged.

Figure 2-22: Option L Configuration

As part of the earlier studies, Option L was the preferred option because this option increased capacity on the northbound I-395 HOV off-ramp to Eads Street without impacting operations within the Pentagon Reservation; however, the widening of the I-395 HOV bridges over Fern Street and potentially Eads Street would result in major disruption to traffic during construction.
Screening of Prior Options Studied: Table 2-3 summarizes the twelve options previously studied and the reasons why the options were eliminated from further consideration or retained as part of the current study efforts.

Table 2-3: Reason Option Eliminated from Further Consideration

<table>
<thead>
<tr>
<th>Option</th>
<th>Reason Option Eliminated or Retained for Further Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Provides minimal capacity increase on the Eads Street off-ramp from the NB I-395 HOV lanes. <em>A modification to this option that provides additional capacity on the ramp was retained for further consideration as part of the current study efforts.</em></td>
</tr>
<tr>
<td>B</td>
<td>Not consistent with the Pentagon Master Plan along S. Rotary Road due to proposed conversion from one-way to two-way operation west of Eads Street.</td>
</tr>
<tr>
<td>C</td>
<td>Not consistent with the Pentagon Master Plan due to proposed one-way inbound pattern on Eads Street during the AM peak period.</td>
</tr>
<tr>
<td>D</td>
<td>Not consistent with the Pentagon Master Plan due to bus-only movements on Eads Street west of South Rotary Road.</td>
</tr>
<tr>
<td>E</td>
<td>Not consistent with the Pentagon Master Plan due to proposed one-way inbound pattern on Eads Street during the AM peak period and prohibition of EB through traffic on South Rotary Road during the AM and PM peak periods.</td>
</tr>
<tr>
<td>F</td>
<td>Not consistent with the Pentagon Master Plan due to prohibition of SB Eads Street through traffic at South Rotary Road.</td>
</tr>
<tr>
<td>G</td>
<td>Provides minimal capacity increase on the Eads Street off-ramp from the NB I-395 HOV lanes to movement restrictions along Eads Street and prohibition of EB South Rotary Road through movements at Eads Street.</td>
</tr>
<tr>
<td>H</td>
<td>Not consistent with the Pentagon Master Plan due to proposed one-way inbound pattern on Eads Street during the AM peak period (for non-transit vehicles) and prohibition of EB through traffic on South Rotary Road at Eads Street during the AM and PM peak periods.</td>
</tr>
<tr>
<td>I</td>
<td>Directing all traffic entering the Pentagon Reservation (excluding transit vehicles) to use Army Navy Drive and Fern Street would substantially increase traffic volumes to these surface streets and would increase pedestrian and vehicle conflicts. Fern Street is the designated pedestrian route to the Pentagon. <em>This option was retained for further consideration as part of the current study efforts due to the minimal impact on the I-395 bridges and potential simplification of the Eads Street intersection operations.</em></td>
</tr>
<tr>
<td>J</td>
<td>Not consistent with the Pentagon Master Plan due to the prohibition of EB South Rotary Road right-turn movements at Eads Street and SB Eads Street movements at South Rotary during the AM peak period. During the PM peak, Eads Street would operate one-way SB for buses only which is also not consistent with the Pentagon Master Plan.</td>
</tr>
<tr>
<td>K</td>
<td>Not consistent with the Pentagon Master Plan due to the prohibition of the EB South Rotary Road left-turn and right-turn movements and SB Eads Street movements at the Eads Street at South Rotary Road intersection during the AM peak period. Additionally, Eads Street between North Rotary Road and South Rotary Road would operate one-way NB for buses only which is not consistent with the Pentagon Master Plan.</td>
</tr>
<tr>
<td>L</td>
<td>Widening of the I-395 HOV bridges over Fern Street and potentially Eads Street would result in major disruption to traffic during construction.</td>
</tr>
</tbody>
</table>
2.3.2.2 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 northbound HOV off-ramp to Eads Street into a widened three-lane, reversible ramp (see Figures 2-23 and 2-24). 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 northbound and southbound I-395 HOT ramps. Expansion of the existing northbound 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 2-23: Single Reversible Eads Street Ramp**
Figure 2-24: Single Reversible Eads Street Ramp
**Dedicated Bus Lane and Right-Turn Lane**

This option would widen the northbound 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 2-25). 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 (denoted in red in Figure 2-26). 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 northbound 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 2-25: Dedicated Bus Lane and Right Turn at Eads Ramp**
Figure 2-26: Bus Lane and Right Turns 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 2-27). 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 system.

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 2-27: 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 2-28), providing a total of four ramp lanes traveling to and from Eads Street. The northbound I-395 HOV off-ramp to Eads Street would operate northbound in the AM peak period and southbound 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 southbound I-395 HOV lanes would be expanded to two lanes approaching the intersections at Eads Street and operate northbound in the AM peak period and southbound 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 2-28: Dual Reversible Eads Ramps](image)

As part of this option, the access to the southbound I-395 general purpose lanes from the existing southbound I-395 HOV lanes would be removed. Access to the southbound 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 southbound I-395 HOV lanes and eliminate a merge condition along the southbound 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 substantially 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.

2.3.2.3 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 was consistent with the long-term plans proposed as part of the Pentagon Master Plan and also met the operational needs of the I-395 Express Lanes project. Figure 2-29 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 eastbound South Rotary Road approaching Eads Street that would be used to access the future HOT lanes.
Figure 2-29: Eads Street Interchange Concept and Pentagon Improvements
2.3.2.4 Structure and Bridge Rehabilitation

No new structures and bridges, or structure and bridge replacements are included as part of the I-395 Express Lanes Project. The Build Alternative includes design and construction of repairs and modifications to various existing bridges along, over, and adjacent to the proposed I-395 Express Lanes, including but not limited to (detailed information on structure and bridge rehabilitation for this study are included in Appendix B):

- **Mainline Bridges** – replacement of bridge barriers/railing systems (includes reconstruction of selected general purpose lane bridge barriers), joint reconstruction at abutments, elimination of joints at piers, deck repairs, milling/hydro-demolition and overlay of selected decks, widening and repairs to approach slabs, widening of one bridge (I-395 HOV bridge over Country Club Road), backwall reconstruction, beam seat repairs and reconstruction, replace bearing pads, clean and paint beam ends and bearings, modifications related to addition of conduit duct bank, installing new deck drain systems, surface repairs and waterproofing of existing barriers, and substructure repairs to the following bridges:
  - I-395 over Sanger Avenue;
  - I-395 over West Braddock Road;
  - I-395 HOV & Bus Ramp over Four Mile Run;
  - I-395 over Glebe Road;
  - I-395 over Ramp G (Glebe Road);
  - I-395 HOV over Country Club Road;
  - I-395 HOV over EB Route 27 (Washington Boulevard);
  - I-395 HOV & NBL over Route 27 NBL & Joyce Street;
  - I-395 HOV NB and SB over Ramps CC and CE;
  - I-395 HOV over Fern Street;
  - I-395 HOV over Eads Street;
  - I-395 HOV NB and SB over Route 110; and,
  - I-395 HOV over Pentagon Access Road.

- **Ramp Bridges** – repairs, including joint reconstruction at abutments, elimination of joints at piers, deck and approach slab repairs, milling/hydro-demolition and overlay of selected decks, beam seat reconstruction, clean and paint beam ends and bearings, surface repairs and waterproofing of curbs and parapets, railing post anchor bolt adjustments, replacing guardrail transitions, and substructure repairs to the following bridges:
  - Ramp B over I-395 SBL;
  - Seminary Road HOV Bus Ramp;
  - Shirlington HOV Bus Ramp;
  - Route 27 Reversible Ramp over Joyce Street; and,
  - Ramp G of I-395 NBL over Route 110.

- **Pier Protection** - addition of structurally independent, crashworthy ground-mounted 54 inch high pier protection barriers at bridges over the 395 Express Lanes.

- **Bridge-Mounted Signs** - removal of existing sign attachments or supports at three existing bridges.
Ability of the Build Alternative to Address the Purpose and Need

As discussed in the *Traffic and Transportation Technical Report* (VDOT, 2016j), under the Build Alternative, a higher proportion of traffic is carried within the HOT lanes compared to the No Build Alternative resulting in congestion relief within both the general purpose and HOT lanes during peak periods. Additionally, during the AM and PM peak periods the Build Alternative has a higher capacity to move people with the availability of the I-395 Express Lanes.

**AM Peak Period** – Northbound General Purpose Lanes: Under 2040 Build conditions, travel times along the northbound I-395 general purpose lanes decrease by 10 to 11 minutes from 8 AM to 10 AM when compared to 2040 No Build conditions. From Route 1 to the north end of the study area, travel times increase by up to 2 minutes due to higher traffic volumes in the general purpose lanes in this section of the study area compared to No Build conditions.

**AM Peak Period** – Northbound HOV/HOT Lanes: From 7 AM to 10 AM, travel times decrease by 1 to 6 minutes. From 7 AM to 9 AM, travel times decrease by 1 to 1.5 minutes south of Turkeycock Run as there are fewer northbound motorists in the HOT lanes attempting to exit to the general purpose lanes and encountering lower congestion levels in the general purpose lanes compared to No Build conditions. Travel times decrease by approximately 4 minutes from 8 to 9 AM between Eads Street and 14th Street in Washington D.C., as a result in lower traffic volumes and congestion levels in this section compared to No Build conditions.

**PM Peak Period** – Southbound General Purpose Lanes: Under 2040 Build conditions, travel times along the southbound I-395 general purpose lanes decrease by 6 to 16 minutes between 3 PM and 6 PM. Travel times decrease incrementally from the northern study limits to approximately Glebe Road from 3 PM to 6 PM with an average of 11 minutes of travel time savings over the three hours.

**PM Peak Period** – Southbound HOV/HOT Lanes: Travel times from 3 PM to 5 PM and 6 PM to 7 PM remain approximately the same in the southbound HOV/HOT lanes when comparing 2040 No Build to Build conditions.

In addition to reducing congestion and overall travel times in both the I-395 general purpose and HOV lanes during peak periods, the extension of the I-395 Express Lanes would increase roadway safety, provide additional travel choices, and improve travel reliability. The congestion reduction benefits would reduce the potential for congestion-related rear end crashes in both the general purpose and HOV lanes, which account for more than half of all reported crashes. The I-395 Express Lanes would offer consistent and predictable travel times for all roadway users including HOV motorists and transit buses and provide an additional travel choice for vehicles with less than three occupants that want to continue north along the I-95 / I-395 Express Lanes facility north of the Turkeycock Run Interchange or access the southbound Express Lanes facility exiting Washington, D.C. Although congestion would still exist during peak hours in the general purpose lanes as well as the I-395 Express Lanes approaching Washington, D.C., overall travel speeds would increase and travel times would decrease compared to the No Build Alternative. Additional details are included in the *Traffic and Transportation Technical Report* (VDOT, 2016j). Therefore, the Build Alternative would address the purpose and need for the project as identified in Section 2.1.
3. REFERENCES


Appendix A: Design Criteria
Project Design Criteria

395 Express Lanes

The proposed project will be developed in accordance with AASHTO, FHWA and Virginia Department of Transportation (VDOT) design guidelines. Tables below show specific design criteria for 395 Express lanes, Eads Street and the ramps. Design Vehicle is assumed to be Intercity Bus (Motor Coaches) BUS-45. The column “Criteria to be used” shows what design criteria was applied in this project.

### I-395 Express Lanes

#### Segment 1: Turkeycock Run to Station 1828+00

#### Segment 2: Station 1828+00 to Potomac River

<table>
<thead>
<tr>
<th></th>
<th>AASHTO</th>
<th>FHWA 1</th>
<th>VDOT</th>
<th>Criteria to be Used</th>
<th>Design Exception (DE)/Design Waiver (DW)</th>
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<tr>
<td><strong>Functional Classification</strong></td>
<td>Urban Freeway</td>
<td>Managed Lanes</td>
<td>Urban Freeway GS-5</td>
<td>Urban Freeway</td>
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<td><strong>ADT</strong></td>
<td>55,000</td>
<td>55,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Truck Percentage</strong></td>
<td>0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Design Speed</strong></td>
<td>50-70 mph</td>
<td>50-70 mph</td>
<td>50-70 mph</td>
<td>Segment 1: 65 mph Segment 2: 55 mph</td>
<td>DE10/DW20</td>
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<td><strong>Access Control</strong></td>
<td>Full</td>
<td>Full</td>
<td>Full</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Gore Spacing</strong></td>
<td>1,000ᵃ</td>
<td>500ᵇ</td>
<td>N/A</td>
<td>1,000ᵃ 500ᵇ 1,600ᶜ 600ᵈ</td>
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<td>3</td>
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<td><strong>Lane Width</strong></td>
<td>12’</td>
<td>12’</td>
<td>12’</td>
<td>Segment 1 and Spot Locations Segment 2: 11’⁵ Segment 2: 12’</td>
<td>DE11</td>
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<tr>
<td><strong>Paved Shoulder Width</strong></td>
<td>10⁶</td>
<td>2’ – 10’</td>
<td>10’</td>
<td>2’ – 10’ Spot Locations: 2’ – &lt; 10’</td>
<td>DE11/DE13/DE14</td>
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<td><strong>Terrain</strong></td>
<td>Rolling</td>
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<td></td>
<td></td>
<td></td>
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<td><strong>Minimum Radius</strong></td>
<td>758’-1810⁷</td>
<td>N/A</td>
<td>760’-1821’</td>
<td>Segment 1: 1.821’ Segment 2: 964’</td>
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<td><strong>Minimum Stopping Sight Distance</strong></td>
<td>425’-730⁸</td>
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<td>425’-730’</td>
<td>Segment 1: 730’ Segment 2: 495’ Spot Locations: 425’</td>
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<td><strong>Superelevation Standard</strong></td>
<td>8% Max</td>
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<td>TC-5.11R 8% Max</td>
<td>TC-5.11R 8% Max</td>
<td>DE12</td>
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<td>2%</td>
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<td><strong>Vertical Clearance</strong></td>
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<td>16’-6”</td>
<td>16’-6”</td>
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<td><strong>Minimum Vertical Grade</strong></td>
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<td>N/A</td>
<td>0.5%</td>
<td>0.5%</td>
<td></td>
</tr>
</tbody>
</table>

1. Federal Highway Administration, Price Managed Lane Guide, 2012
2. ADT value is taken from the Intersection Justification Report I-95/I-395 HOV/Bus/ HOT Lanes Volume 2
3. There will be <1% buses on HOV/HOT lanes. The roadway is designed for BUS-45 (Intercity Bus) design vehicle from AASHTO Green Book, Table 2-1b Design Vehicle Dimensions.
4. AASHTO Green Book 2011, Figure 10-68 Gore Spacing: a (Entry-Entry/Exit-Exit), b (Exit-Entry), c (Entry-Exit Weaving), d (Turning Roadway).
5. The HOT lanes will be designed for 11' lane width because of various factors like limited space, minimizing impacts to the existing GP lanes, and cost associated with ROW impacts. Design Exception will be requested.


7. AASHTO Green Book 2011, Table 3-7 Minimum Radius Using Limiting Values of e and f (based on 8% max superelevation).

8. AASHTO Green Book 2011, Table 3-1, Stopping Sight Distance on Level Roadway (To be adjusted for grade using Equation 3-3 or use Table 3-2).

9. AASHTO Green Book 2011, Section 4.2.2-Cross Slope, Page 4-5.

10. VDOT Road Design Manual, Page 2E-72


12. Not altering existing clearance

13. VDOT Drainage Manual, Chapter 9, Section 9.3.3 Pavement Drainage.

---

**Eads Street**

<table>
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<tr>
<th>Functional Classification</th>
<th>AASHTO</th>
<th>FHWA¹</th>
<th>VDOT</th>
<th>Criteria to Be Used</th>
<th>Design Exception (DE)/ Design Waiver (DW)</th>
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<tr>
<td>ADT²</td>
<td>Urban Collector</td>
<td>Urban Collector GS-7</td>
<td>Urban Collector GS-7</td>
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<td>Truck Percentage</td>
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<td>Partial</td>
<td>35 mph</td>
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</tr>
<tr>
<td>Access Control</td>
<td>Partial</td>
<td>N/A</td>
<td>1.5%³ - 3%³</td>
<td>Partial</td>
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<tr>
<td>Intersection Spacing</td>
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<td>N/A</td>
<td>660 ft/ 440 ft⁷</td>
<td>660'440'</td>
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<td>Distance from Ramp Terminal to First Major Intersection ⁵</td>
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<td>N/A</td>
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<td>Curb and Gutter</td>
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<td>Yes</td>
<td>-</td>
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<td>Level</td>
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<td>Level</td>
<td>-</td>
<td>-</td>
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<td>Minimum Radius</td>
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<td>Cross-Slope</td>
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<td>TC-5.11U, 4% Max</td>
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<tr>
<td>Minimum Stopping Sight Distance</td>
<td>250¹⁰</td>
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<td>Lateral Offset</td>
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<tr>
<td>Vertical Clearance</td>
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<td>16'-6¹³</td>
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<tr>
<td>Maximum Vertical Grade</td>
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<td>N/A</td>
<td>0.5%¹⁵</td>
<td>0.5%¹⁵</td>
<td>-</td>
</tr>
</tbody>
</table>

---

1. Federal Highway Administration, Price Managed Lane Guide, 2012

2. ADT value is taken from the Intersection Justification Report I-95/I-395 HOV/ Bus/ HOT Lanes Volume 2

3. There will be <1% buses on HOV/HOT lanes. The minimum radius from roadway is designed for BUS-45 (Intercity Bus) design vehicle from AASHTO Green Book, Table 2-1b Design Vehicle Dimensions.

4. VDOT Road Design Manual, Appendix F, Table 2-2, based on Legal Speed Limit of 30 mph. First number is for signalized intersections; second number is for un-signalized intersections and full-access entrances.

5. VDOT Road Design Manual, Appendix F, Table 2-3 and Figure 2-9.

6. AASHTO Green Book 2011, Table 3-7 Minimum Radius Using Limiting Values of e and f (based on 4% max superelevation standard)

7. VDOT Road Design Manual – Appendix A, A-17, Geometric Design Standards for Urban Collector Street System (GS-7)
8. AASHTO Green Book 2011, Section 4.2.2 – Cross Slope, Page 4-5
9. VDOT Road Design Manual- Cross Slope, Page 2E-72
10. AASHTO Green Book 2011, Table 3-1. Minimum Stopping Sight Distance on Level Roadway (To be adjusted for grade using Equation 3-3 or use Table 3-2).
11. AASHTO Green Book 2011, Section 6.3.4. Roadside Design (1.5' from the face of curb)
14. AASHTO Green Book 2011, Section 6.3.1 Urban Collector General Design Considerations, Grades, Page 6-12.
14. VDOT Drainage Manual, Chapter 9, Section 9.3.3 Pavement Drainage.

<table>
<thead>
<tr>
<th>ONE LANE RAMP</th>
<th>AASHTO</th>
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<th>VDOT</th>
<th>Criteria to Be Used</th>
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<th>Design Waiver (DW)</th>
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<td>Functional Classification</td>
<td>Interchange Ramp</td>
<td>Ramp GS-R</td>
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<td>ADT</td>
<td>5,000 – 21,000</td>
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<td>-</td>
<td></td>
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</tr>
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<td>30 mph – 50 mph</td>
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<td>Pavement Width</td>
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<tr>
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<td>Approach Shoulder Width (4’ Min.)</td>
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<tr>
<td>Vertical Clearance</td>
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<td>-</td>
<td></td>
</tr>
<tr>
<td>Maximum Vertical Grade</td>
<td>7% at 30 mph 5% at 50 mph</td>
<td>7% at 30MPH 6% at 35-40 mph 5% at 45-50 mph</td>
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<td>-</td>
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<tr>
<td>Minimum Vertical Grade</td>
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<td>0.5%</td>
<td>0.5%</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Cross- Slope</td>
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<td>-</td>
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<td></td>
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<tr>
<td>Acceleration / Deceleration Length</td>
<td>580’ – 1,420’</td>
<td>580’ – 1,420’</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: 1 Federal Highway Administration, Price Managed Lane Guide, 2012
3 There will be <1% buses on HOV/HOT lanes. The facility is designed for BUS-45 (Intercity Bus) design vehicle from AASHTO Green Book, Table 2-1b Design Vehicle Dimensions.
4 Higher range of ramp design speeds will be used for directional type ramps. Lower range will be used for semi-direct ramps, loop ramps and terminals.
5 AASHTO Green Book 2011, Figure 10-68- Gore Spacing: a (Turning Roadway-Service), b (Turning Roadway-System).
6 AASHTO Green Book 2011, Table 3-29, Design Widths of Pavements for Turning Roadways with provision for passing a stalled vehicle.
7 AASHTO Green Book 2011, Table 3-1, Stopping Sight Distance on Level Roadways (To be adjusted for grade using Equation 3-3 or use Table 3-2
10 VDOT Drainage Manual, Chapter 9, Section 9.3.3 Pavement Drainage.
11 AASHTO Green Book 2011, Superelevation and Cross Slopes, Page 10-93
12 AASHTO Green Book 2011, Page 10-102, Section 10.9.6 Ramps – Shoulders and Lateral Offsets
13 2011 AASHTO Green Book 2011, Table 10-3 Minimum Acceleration Lengths for Entrance Terminal with flat grades. The range is based on design speed range on ramps from 25 mph – 50 mph. The value is to be adjusted for grades/acceleration/deceleration speeds as per Table 10-4
Appendix B: Structure and Bridge Rehabilitation Requirement
395 Project Information and Technical Requirements

Attachment 3.15c

Structure and Bridge Repair Quantities and Notes
1. 395 Express Lanes Structures and Bridges

A. 395 Express Lanes Structure and Bridge Repair Quantities

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Specifications</th>
<th>Units</th>
<th>395 over George Rd.</th>
<th>395 over Martin Luther King Jr. Ave.</th>
<th>395 over Hoxie Rd.</th>
<th>395 over Hornet Rd.</th>
<th>395 over Park Rd.</th>
<th>395 over Capo Rd.</th>
<th>395 over North Suburban Express Rd.</th>
<th>395 over celestine St.</th>
<th>395 over Roundhouse Rd.</th>
<th>395 over George St.</th>
<th>395 over 27th Ave.</th>
<th>395 over 27th Ave. &amp; Airport Rd.</th>
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<td>Replace Existing Bridge Barrier</td>
<td>404, 410, 421, 422, 423, 425</td>
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<td>1 2 2 2 2 2 2</td>
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<td>2</td>
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B. 395 Express Lanes Bridge Repair Notes

1. General Notes – The notes provided herein are intended to clarify the requirements for the items listed in the Structure and Bridge Repair Quantities Table. Sections of the VDOT 2016 Road and Bridge Specifications (“the Specifications”) are referenced where applicable. Except for the items listed below, the Design-Builder shall be responsible for estimating the quantities required to complete the repairs and modifications as shown on the RFP Conceptual Plans – Structure and Bridge Repair Plans and as described herein.

- Concrete Superstructure Surface Repair
- Crack Repairs – Existing Bridge Barrier
- Type A Patching (HES)
- Type B Patching (HES)
- Type C Patching (HES)
- Crack Repairs – Existing Bridge Deck
- Replace Bearing
- Reconstruct Beam Seat
- Crack Repairs (Substructure)
- Concrete Substructure Surface Repair
- Waterproofing – Epoxy Resin (Type EP-5)
- Waterproofing Coating
- Repair Existing Roadway Barrier
- Repair Undermining of Approach Pavement

2. Superstructure

a. Replace Existing Bridge Barrier – This work shall include removing the existing concrete bridge barrier and deck overhang and replacing with a cast-in-place concrete barrier or parapet (F-shape) in accordance with Sections 410 and 412 of the Specifications. The barrier and deck shall be designed and detailed in accordance with the requirements of the Manuals of the S&B Division and AASHTO LRFD. To comply with the requirements of Chapter 10 of the Manuals of the S&B Division, for the design of deck overhang, partial depth removal of existing deck (including Type A milling and Type B Hydro-demolition) will be required for installation of additional deck reinforcement and shall be performed in accordance with Section 425 of the Specifications. Deck repairs shall utilize Latex-modified Concrete, Very-Early Strength (LMC-VE) for overlay and deck overhang reconstruction. Bridge deck grooving shall be performed in accordance with Section 404 of the Specifications.

Any existing conduit(s) in barrier shall be maintained during construction and replaced with new conduit system in accordance with the Technical Requirements and Section 419 of the Specifications.
Existing deck expansion joints disturbed due to milling/hydro-demolition and overlay shall be repaired and/or reconstructed to match existing joint type and spliced with existing joint material in accordance with Section 412 of the Specifications.

b. **Waterproof Existing Bridge Barrier** – This work shall include applying waterproofing (Epoxy Resin Type EP-5) to existing bridge curbs, barriers, and parapets in accordance with Section 416 of the Specifications.

c. **Concrete Superstructure Surface Repair** – This work shall include repairing spalls and delaminated areas of existing curbs, barriers, and parapets in accordance with the requirements of Section 412 of the Specifications.

d. **Crack Repairs – Existing Bridge Barrier** – This work includes repairing cracks in existing curbs, barriers, and parapets using Type A or Type B crack repair methods in accordance with Section 412 of the Specifications.

e. **Deck Overlay – Shallow** – This work shall be completed in accordance with Section 425 of the Specifications and shall include the following: Type A milling to a maximum depth of ¾" above the top mat of reinforcement, Type A Hydro-demolition to a minimum depth not less than ¾", Type B deck patching repairs (as needed), furnishing and placing Latex-modified Concrete, Very-Early Strength (LMC-VE) and bridge deck grooving. Bridge deck grooving shall be performed in accordance with Section 404 of the Specifications.

Existing top of deck elevations shall be maintained. The work shall be applicable to the limits of bridge deck and exposed concrete area of existing approach slabs as shown in the RFP Conceptual Plans. Unless otherwise approved by the Concessionaire, Type A milling shall not be closer than ¾” to top mat of reinforcing steel and the minimum depth of hydro-demolition shall not be less than ¾”.

Once an area of a deck is milled, the Design-Builder shall be responsible for maintaining the surface of the milled deck to be free from any loose aggregate, pot holes, drop-offs between lanes and shall perform cleaning of the milled deck and/or pothole repairs (Type A and B deck patching) as necessary to provide a safe riding surface for all vehicular traffic (including motorcycles) for the entire duration and until the concrete overlay is placed over the entire deck. Deck overlay operations shall not commence until all patching repairs for the entire bridge deck have been completed.

Design-Builder shall be responsible for temporary support of deck during milling, hydro-demolition, and overlay operations.
f. **Deck Overlay – Deep** – This work shall be completed in accordance with Section 425 of the Specifications and shall include the following: Type A milling to a maximum depth of ¾" above the top mat of reinforcement, Type B Hydro-demolition, Type C deck patching repairs (as needed), furnishing and placing Latex-modified Concrete, Very-Early Strength (LMC-VE) and bridge deck grooving. Bridge deck grooving shall be performed in accordance with Section 404 of the Specifications.

Existing top of deck elevations shall be maintained. The work shall be applicable to the limits of bridge deck and exposed concrete area of existing approach slabs as shown in the RFP Conceptual Plans. Unless otherwise approved by the Concessionaire, Type A milling shall not be closer than ¾” to top mat of reinforcing steel.

Once an area of a deck is milled, the Design-Builder shall be responsible for maintaining the surface of the milled deck to be free from any loose aggregate, pot holes, drop-offs between lanes and shall perform cleaning of the milled deck and/or pothole repairs (Type A and B deck patching) as necessary to provide a safe riding surface for all vehicular traffic (including motorcycles) for the entire duration and until the entire depth of concrete overlay is placed over the entire deck. Deck overlay operations shall not commence until all patching repairs for the entire bridge deck have been completed.

Design-Builder shall be responsible for temporary support of deck during milling, hydro-demolition, and overlay operations.

g. **Type A Patching (HES) / Type B Patching (HES) / Type C Patching (HES)** – This work shall include patching repairs of delaminated, spalled, and asphalt-patched areas of the existing bridge deck and exposed concrete areas of existing approach slabs using High Early Strength (HES) concrete in accordance with Section 412 of the Specifications.

h. **Crack Repairs – Existing Bridge Deck** – This work includes repairing cracks in existing bridge deck using Type A, Type B, or Type D crack repair methods in accordance with Section 412 of the Specifications.

i. **Remove and Replace Raised Median** – This work shall include demolition and removal of existing concrete raised median and placement of concrete and reinforcing steel for new concrete raised median to match existing median geometry. Work shall be performed in accordance with Section 412 and 413 of the Specifications.

j. **Expansion Joint Reconstruction – Expansion Dam at Abutments** – This work shall include removal and disposal of concrete and any existing joint armor and joint material, reconstruction of joint and replacement with new
elastomeric expansion dam using either partial or full-depth reconstruction as shown in the RFP Conceptual Plans. The work shall be performed in accordance with Section 412 and 421 of the Specifications.

**K. Expansion Joint Reconstruction – Continuous Link Slab at Piers (Deck Slab Closure)** – This work shall include removal and disposal of concrete and any existing joint armor and joint material and elimination of deck joint at pier locations by placement of continuous link slab using Latex-modified Concrete, Very-Early Strength (LMC-VE). The work shall conform to the requirements of Section 412 of the Specifications. Design-Builder shall analyze existing bearings and substructure elements and submit to Engineer for review and acceptance regarding the feasibility of link slab joint closure. If link slab is determined to not be feasible without bearing and/or substructure modification, the existing joint shall be reconstructed using full-depth joint reconstruction in accordance with “Expansion Joint Reconstruction – Expansion Dam at Abutments”.

**L. Clean and Paint Beam Ends** – This work shall include zone coating of the entire 5 feet of existing beam ends at supports including bearings and end diaphragms, and replacement of existing bearing stiffener plates with new stiffener plates on each side of the web at selected locations specified in the RFP Conceptual Plans. This work shall be completed in accordance with the requirements of Section 411 of the Specifications and shall include environmental protection, health and safety protection, and disposal of material.

**M. Replace Bearing** – This work shall include jacking and blocking of existing beams, removal and disposal of existing bearings, and installation of new bearings for existing or proposed beams as detailed in the RFP Conceptual Plans. Feasibility of the jacking scheme shall be verified and designed by the Design-Builder. The work shall be completed in accordance with Section 426 of the Specifications.

**N. Structural Steel Beam** – This work shall include furnishing, fabricating, and erecting new structural steel rolled beam or welded plate girder, lateral bracing and cross-frame members (i.e. diaphragms), connection elements, and bearing assemblies for proposed widening of bridge deck at the I-395 HOV Bridge over Country Club Road (Structure No. 000-2020). The work shall be performed in accordance with Section 407 of the Specifications. Modification of existing abutments for new beam seats shall be performed in accordance with “Reconstruct Beam Seat” and new bearings shall be provided in accordance with “Replace Bearing.”

**O. Widen Bridge Deck** – This work shall include demolition of existing bridge deck to the limits detailed in the RFP Conceptual Plans and reconstruction of widened deck and overhang for proposed widening of bridge deck at the I-395
p. Deck Drainage System – This work shall include design and installation of bridge deck drainage system which meets project hydraulic design criteria in accordance with the Technical Requirements and VDOT Manuals of the S&B Division, and any applicable bridge repairs and/or modifications required to accommodate the proposed drainage system.

q. Widen/Overlay Existing Approach Slab – This work shall include removal of existing asphalt pavement, excavation, temporary shoring, preparation of subgrade, reconstruction of abutment backwall, and furnishing and placement of Class A4 concrete for widening of existing approach slab to the full width of the roadway. Existing reinforcing steel shall be cleaned and prepared in accordance with Section 412 of the Specifications and incorporated into new concrete. Areas of existing approach slabs with asphalt overlay shall be milled and overlaid with new asphalt concrete in accordance with Section 425 of the Specifications.

3. Substructure

   a. Reconstruct Beam Seat – This work shall include jacking and blocking of existing beams, reconstruction of existing beam seats with large spalls and/or loss of bearing, and modification and reconstruction of existing abutments for new beam seats at proposed beams. Feasibility of the jacking scheme shall be verified and designed by the Design-Builder. The work shall be completed in accordance with Section 412 of the Specifications.

   b. Crack Repairs (Substructure) – This work includes repairing cracks in existing piers and abutments using Type A or Type B crack repair methods in accordance with Section 412 of the Specifications.

   c. Concrete Substructure Surface Repair – This work shall include repairing concrete surfaces of substructures (piers and abutments) and retaining walls in accordance with Section 412 of the Specifications. The work shall include installing embedded galvanic anodes during repair. Galvanic anodes shall conform to Section 251 of the Specifications. Waterproofing shall be applied to substructure after completion of concrete substructure surface repair in accordance with “Waterproofing Coating”.

For substructure surface repair of existing piers at bridges crossing over the 395 Express Lanes, only the bottom 5 ft of pier wall or column shall be applicable for
repair. Repairs shall be completed in these areas prior to construction of pier protection barriers.

d. **Waterproofing – Epoxy Resin (Type EP-5)** – This work shall include applying waterproofing (Epoxy Resin Type EP-5) to top of beam seats, pier caps, and abutment caps/stems after completion of substructure repairs and reconstruction of beam seats in accordance with Section 416 of the Specifications.

e. **Waterproofing Coating** – This work shall consist of cleaning and preparing pier and abutment surfaces; and applying waterproofing coating to all areas of the substructure after completion of concrete substructure repairs. Top of beam seats, pier caps, and abutment caps/stems shall be waterproofed in accordance with “Waterproofing – Epoxy Resin (Type EP-5)”.

Waterproofing Coating shall be Tex. Cote 300 by Textured Coatings of America Inc., Thorocoat by BASF Construction Chemicals LLC, Mark - 173.5 by Poly-Carb Cleveland, Ohio or Ultracrete Solvent Borne Textured Coating by Sherwin Williams.

For substructure surface repair of existing piers at bridges crossing over the 395 Express Lanes, only the bottom 5 ft of pier wall or column shall receive the waterproofing coating. Waterproofing coating shall be completed in these areas prior to construction of pier protection barriers.

4. **Miscellaneous**

a. **Replace Approach Guardrail Transition** – This work shall include reconstruction and/or replacement of existing approach guardrail transition fixed object attachment to existing bridge barrier at the Ramp G of I-395 NBL Bridge over Route 110 (Structure No. 000-2054) in accordance with Section 505 of the Specifications.

b. **Repair Existing Roadway Barrier** – This work shall include partial or complete removal and reconstruction of damaged and deteriorated sections of existing roadway barriers. The work shall include repair of cracks, spalls, and other damaged areas at the approximate locations shown in the RFP Conceptual Plans. The work shall be performed in accordance with Section 412 of the Specifications.

c. **Replace Existing Barrier on Retaining Wall** – This work shall include removal and reconstruction of existing barrier on retaining wall, modification and reconstruction of existing retaining wall, and constructing new cast-in-place concrete F-shape barrier on top of the modified retaining wall. The barrier and retaining wall shall be designed and detailed in accordance with the requirements of the Manuals of the S&B Division and AASHTO LRFD. The work shall include all necessary structure excavation, temporary shoring, preparation of
subgrade, and reconstruction of asphalt pavement sections, and shall be performed in accordance with Sections 410 and 412 of the Specifications.

d. Repair Undermining of Approach Pavement – This work shall include repairing undermined areas of existing asphalt pavement with flowable fill material at bridge approaches in accordance with Section 509 of the Specifications. The work shall include any necessary removal of existing pavement, structure excavation, temporary shoring, preparation of subgrade, and reconstruction of asphalt pavement section after placement of the flowable fill material.

e. ITS/TTMS Duct Bank Installation – This work shall include modification of existing abutment backwalls and installation of ITS/TTMS conduits on bridges at the locations shown in the RFP Conceptual Plans. The work shall include any necessary demolition, structure excavation, temporary shoring, structure removal, reconstruction, and design and construction of substructure and superstructure modifications to accommodate the proposed conduits. The feasibility and design of abutment backwalls and superstructure elements for proposed conduits shall be verified and designed by Design-Builder.

f. Remove Existing Sign Structure from Bridge – This work shall include removal and disposal of existing overhead sign structures attached to bridge. This work shall be performed in accordance with Section 413 of the Specifications.
2. Additional Department Improvements

A. **395 General Purpose Lanes Bridge Repair Quantities**

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Specifications</th>
<th>Units</th>
<th>100-2805 Route 395 (Henry G. Shirley Memorial Hwy) over Sanger Ave.</th>
<th>Quantity</th>
<th>100-2806 Route 395 (Henry G. Shirley Memorial Hwy) over West Breddock Road</th>
<th>Quantity</th>
<th>000-2640 Route 395 (NBL &amp; HOV) over Route 27 (NBL)</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>Patching (Type B)</td>
<td>See Notes, 412</td>
<td>SY</td>
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<td>212</td>
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<td>694</td>
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<td>Replace Existing Bridge Barrier (Deck)</td>
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<td>LF</td>
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<tr>
<td>Modify Approach Barrier / Guardrail</td>
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<tr>
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<td>See Notes, 425</td>
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<td>772</td>
<td></td>
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<tr>
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<tr>
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<td></td>
<td>772</td>
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<tr>
<td>Furnish (Very-early-strength latex-modified concrete (1 1/2 - 2&quot;)</td>
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<td>CY</td>
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<td>43</td>
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<td>Place (Very-early-strength latex-modified) concrete overlay</td>
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<td>Expansion Joint Reconstruction (Very-early strength latex modified concrete)</td>
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<td>Bridge-Deck Grooving</td>
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<td>Ultrasonic Impact Treatment</td>
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<td>Replace Bearing</td>
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<td>Zone Coating of Existing Structure (Str. No. 2040-HOV)</td>
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<td>Prepare and Overcoat Existing Structure (Str. No. 2040-NB GP)</td>
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<td>Concrete Substructure Surface Repair</td>
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<td>110</td>
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</tbody>
</table>
B. 395 General Purpose Lanes Bridge Rehabilitation Notes

1. General Notes - Repair quantities listed in the 395 General Purpose Lanes Bridge Repair Quantities table shall be in addition to repairs included in the Section 1 of this Attachment 3.15c.

- At its discretion, the Concessionaire may elect to decrease or increase a repair quantity for any the items listed for a specific bridge provided that the total quantity for the item (i.e. sum of quantities listed for all bridges) is not exceeded.

- The cost of deck, superstructure, substructure evaluations and preparing plans for the repairs listed in 395 General Purpose Lanes Bridge Repair Quantities Table, including any necessary engineering calculations required for the preparation of repair details shall not be measured for separate payment and shall be included in the cost of the repair items.

- The cost of all maintenance of traffic, including any installation and removal of any work area protection appurtenances (barriers etc.) shall not be measured for separate payment. The cost thereof shall be included in the cost of other repair items.

- The cost of all new required pavement markings shall not be measured for separate payment. The cost thereof shall be included in the cost of other repair items.

- The cost of Environmental protection and health and safety, worker protection, Disposal of material shall not be measured for separate payment. The cost thereof shall be included in the cost of other repair items.

2. Patching (Type B) – Very-early-strength latex-modified concrete shall be used for all deck patching. Type B patching shall be performed at the following locations:

- Spalled areas of deck
- Delaminated areas of deck
- Previously repaired areas of deck (as deemed necessary by the Department)
- Areas of deck where the concentration of chloride ions at the depth of top layer of deck reinforcement is equal to or greater than 2.0 pounds per cubic yard.
- Others areas as directed by the Concessionaire.
3. **Replace Existing Bridge Barrier (Deck)**– This work shall include removing the existing concrete bridge barrier and replacing with a Cast-in-Place Concrete Parapet (F-shape) designed and detailed in accordance with the requirements of the Manuals of the S&B Division and AASHTO LRFD. At a minimum, this work will require the removal and reconstruction of the existing deck overhang. To comply with the requirements of Chapter 10 of the Manuals of the S&B Division, Part 2, for the design of deck overhang, additional partial depth removal of existing deck will be required. Partial deck removal shall be performed in accordance with Section 425 of the Road and Bridge Specifications and shall utilize Very-early-strength latex-modified concrete for overlay material.

   Face-of-curb shall of new barrier shall be located such that width of existing outside shoulder shall be maintained.

4. **Modify Approach Barrier / Guardrail**– This work shall include removing the existing approach barrier / guardrail as necessary to interface with the reconstructed bridge barrier. This work may require partial reconstruction of bridge wing walls and / or approach retaining walls as necessary to permit the construction of new approach barriers.

5. **Type A milling (1” or 3/4”), (Type A) Hydro-demolition (3/4” ), Furnish (Very-early-strength latex-modified) concrete (1 1/2”- 2” ) and Place (Very-early-strength latex-modified) concrete overlay** shall be completed in accordance with the requirements of Section 425 of the Road and Bridge Specifications and the following:

   a. The depths of milling and hydro-demolition noted above were established on the basis of concrete deck cover shown on the as built plans. The Department will review the results of the deck evaluation surveys to confirm established depths of milling and hydro-demolition prior to commencement of milling operations. Unless otherwise approved by the Department, Type A milling shall not be closer than ¾” to top mat of reinforcing steel and the minimum depth of hydro-demolition shall not be less than ¾”

   b. At Bridge over Sanger Ave., entire existing rigid overlay shall be removed.

   c. Existing top of deck elevations shall be maintained.

   d. Once an area of a deck is milled, the Design-Builder shall be responsible for maintaining the surface of the milled deck free from any loose aggregate, pot holes, drop offs between lanes and shall perform cleaning of the milled deck and / or pot hole repairs (deck patching) as necessary to provide a safe riding surface for all vehicular traffic (including motorcycles) for the entire duration and until the concrete overlay is placed over the entire deck.
e. Concrete Overlay operations shall not commence until all Patching (Type B) for the entire bridge deck has been completed.

6. **Expansion Joint Reconstruction (Very-early-strength latex-modified concrete)** shall be performed in accordance with Section 412 of the Road and Bridge Specifications and the following:

a. Expansion Joint Reconstruction shall consist of removing and disposing of existing concrete and any existing joint armor, repairing and replacing reinforcing steel, as may be required by the Concessionaire, preparing the contact surfaces, and furnishing and placing new concrete and reinforcing steel, in accordance with the details shown in Figure 1. Concrete used in Expansion Joint Reconstruction shall be Very-early-strength latex-modified concrete in accordance with Section 425 of the specifications.

b. Expansion joint reconstruction shall be performed after all concrete overlay operations have been completed.

c. The cost of elastomeric expansion dam shall not be measured for separate payment and shall be included in the cost of Expansion Joint Reconstruction.

7. **Deck Slab Closure** shall be in accordance with Section 412 of the Road and Bridge Specifications and the following:

a. Deck Slab Closure shall consist of repairing bridge decks for link slabs at piers in accordance with the details shown in the Manual of the Structure and Bridge Division Part 2 File No. 10.02-2 and including parapet concrete as required by the Concessionaire. Details shown in Figure 2 may be used as a reference for an alternative system that may be further evaluated by the Design-Builder for use at Deck Slab Closures.

b. Unless otherwise approved by the Concessionaire, concrete for the deck slab closure shall be Very-early-strength latex-modified concrete in accordance with Section 425 of the Road and Bridge Specifications.

c. Deck slab closure shall be completed prior to the placement of the concrete overlay.

d. The cost of modifying existing expansion or fixed bearings required for the deck slab closure shall not be measured for separate payment. The cost thereof shall be included in the cost of Deck Slab Closure.

8. **Ultrasonic Impact Treatment – Retrofit all members with a fatigue stress category D, E, and E’**. All treated areas shall be spot-painted in accordance with the requirements of Section 411 of the Road and Bridge Specifications.
9. **Replace Bearing** shall consist of removing existing bridge bearings and replace with new bearings. This work shall be performed in accordance with Sections 408 and 413, and the following:

   a. This work shall consist of removing existing welds, removing and disposing of existing bearing components and anchor bolts, furnishing, painting and installing new bearing assemblies (including sole plate, anchor bolts, washers and nuts), placing and inspecting new welds, cleaning and applying paint to new bearings and any disturbed areas, and providing environmental, worker and safety protection, and disposal of material.

   b. The existing structures are designated as Type B structures in accordance with Section 411 of the Specifications.

   c. A plan for installing new anchor bolts shall be submitted to the Concessionaire for review and approval.

   d. Beams shall be jacked a minimum distance as specified on the repair plans prepared by the Design-Builder in order to relieve the load on the bearings. The cost of jacking and supporting beams shall be paid for under the pay item Jacking and Blocking.

   e. Remove fillet weld between beam flange and sole plate, and remove the existing bearing assembly.

   f. Grind bottom of bottom flange to remove burrs. Clean bottom of flange in accordance with Specifications Section 411.04(a) Method 5.

   g. Place the new bearing assembly.

   h. Install new anchor bolts, nuts and washers.

   i. Fillet weld sole plate to beam flange. New welds shall be inspected by magnetic particle testing to be performed by the Contractor.

   j. The bearing assemblies shall be painted in the shop with the system specified on the repair plans prepared by the Design-Builder. The new welds and all disturbed areas shall be cleaned and coated using the coating system specified in the repair plans.

   k. Materials and Fabrication shall be in accordance with the applicable requirements of Section 408 of the Specifications. Steel in sole plates and other steel components of the bearings, except as noted on the details, shall be ASTM A709 Grade 36. Grout and adhesive material for anchor bolts shall be from the VDOT approved list.
l. Contractor shall verify heights of existing bearing assemblies prior to preparing shop drawings.

m. Immediately before casting the new anchor bolts in VDOT approved high-strength grout and mortar, the holes shall be thoroughly cleaned to the satisfaction of the Concessionaire.

10. **Jacking and Blocking Beam** – This work shall include the replacement of end diaphragms, as necessary, to permit jacking and blocking beam ends.

11. **Zone Coating of Existing Structures (Str. No. 2040-HOV)** shall include zone coating of the entire 3 feet of beam ends including bearings and diaphragms and entire length of the transverse girders at pier 1 under both the HOV and General Purpose lanes.

12. **Prepare and Overcoat Existing Structure (Str. No. 2805-HOV)** shall be limited to the steel superstructure under the HOV lanes.

13. **Prepare and Overcoat Existing Structure (Str. No. 2040-NB GP)** shall be limited to the steel superstructure under the NB General Purpose lanes.

14. **Crack Repair (Type B)** for pier or abutment shall be completed in accordance with the requirements of Section 412 of the Specifications.

15. **Concrete Substructure Surface Repair** shall be performed in accordance with the requirements of Section 412 of the Road and Bridge Specifications. The use of shotcrete will not be permitted. Removal of existing concrete shall extend a minimum of 12” beyond the limits of delaminated or otherwise defective surfaces. Minimum concrete cover to reinforcement at repaired areas shall be 1 ½”. Jacking and blocking of beams necessary to perform beam seat repairs shall not be measured for separate payment. The cost thereof shall be included in the cost of Concrete substructure surface repair.

16. **Waterproofing Coating** - This work shall consist of cleaning and preparing pier and abutment surfaces; and applying waterproofing coating to all areas of the substructure after completion of concrete substructure repairs.

Waterproofing Coating shall be Tex. Cote 300 by Textured Coatings of America Inc., Thorocote by BASF Construction Chemicals LLC, Mark - 173.5 by Poly-Carb Cleveland, Ohio or Ultracrete Solvent Borne Textured Coating by Sherwin Williams. Top of pier caps and abutment caps / stems shall be waterproofed with EP-5.

17. **Waterproofing – Epoxy Resin (Type EP-5)** - shall be completed in accordance with the requirements of Section 416 of the Specifications.
395 GENERAL PURPOSE LANES BRIDGE REHABILITATION SCOPE OF WORK

A. Location of General Purpose Lanes Bridge Rehabilitation
   1. I-395 over Sanger Ave. – Str. No. 2805
   2. I-395 over West Braddock Rd. – Str. No. 2806
   3. I-395 (NB GP Lanes and HOV) over Rte. 27 NBL and Joyce St. – Str. No. 2040

B. Description of Work
See Attachment 3.15c for details and bridge location of specific repairs. Deck level repair work outlined in this scope of work (including joint reconstruction, elimination, barrier replacement) is limited to the 395 General Purpose (GP) lanes portions of the bridges listed above. All other work, shall apply to the entire structure (i.e. both the GP lanes and HOV lanes portions of the structures).

- Perform deck evaluation
- Perform substructure and superstructure evaluation to accurately delineate locations of defects outlined in Bridge Repair Quantities Table.
- Prepare detailed repair plans for each of the listed structures. The scope of repair work to be included in the repair plans shall be based in the repair items listed in the Bridge Repair Quantities Table and information collected during the deck, substructure and superstructure evaluations.
- Perform Type A milling and Type A Hydro-demolition of entire bridge deck (and approach slab surface without asphalt overlay) and overlay with Very-early-strength latex-modified concrete
- Remove existing barrier and replace with a cast-in-place concrete parapet (F-Shape)
- Reconstruct expansion joints with elastomeric dams.
- Perform Deck slab closure (joint elimination).
- Painting of steel superstructure.
- Replace Bearings.
- Perform substructure repairs listed in Bridge Repair Quantities Table.
- Clean and Wash Abutments and Piers.
- Ultrasonic Impact Treatment
- Crack repair (Type B)
- Concrete substructure surface repairs
- Waterproofing Coating
- Waterproofing – Epoxy Resin (Type EP-5)
C. Deck Evaluation

Perform visual, sounding and concrete cover depth measurements to accurately delineate areas of the deck that are previously repaired, spalled, and / or delaminated. Determine delamination in accordance with ASTM D4580-03 (2007). Cover depth measurements shall be made using equipment capable of providing continuous cover depth measurements and shall be made along grid lines spaced at not more than 10 feet.

Perform chloride content survey. Chloride content tests, in accordance with AASHTO T 260-97 (2005), Procedure A, shall be performed on concrete samples taken from the deck at locations determined by the Concessionaire and at the following approximate depths:

- 1” below top of deck.
- At top layer of the reinforcing steel.
- ½” below top of layer of the reinforcing steel.

All core locations shall be repaired in accordance Section 412 of the Specifications.

The minimum number of samples shall be as follows:

- I-395 NB GP Lanes over Sanger Ave. – 15 samples
- I-395 NB GP Lanes over West Braddock Rd. – 30 samples
- I-395 NB GP Lanes over Rte. 27 NBL and Joyce St. - 20 samples
- I-395 SB GP Lanes over Sanger Ave. – 15 samples
- I-395 SB GP Lanes over West Braddock Rd. – 30 samples

Deck evaluation for all bridges shall be completed prior to the commencement of any bridge deck repair work (i.e. no deck milling, patching etc. work shall be permitted on any bridge deck until after deck evaluations for all the bridges have been completed).

D. Superstructure Evaluation

- Accurately identify areas of steel superstructure to receive zone coating.
- Identify bearings that will need to be replaced.
- Identify weld locations for Ultrasonic Impact Treatment (UIT)
- Prepare and Submit Report

Results of deck, superstructure and substructure evaluations shall be included in a report for review and approval by the Concessionaire. The report shall include test results, location of chlorides cores, location and size of all delaminated or otherwise defective concrete, list of weld locations with a fatigue stress category D, E, and E’, and all other defective items encountered during the evaluations. Sample photos of all defective concrete, bearings, paint, etc. shall also be included in the report.

E. Substructure Evaluation

Perform visual and sounding surveys to accurately delineate areas of the substructure that are previously repaired, spalled, and delaminated. Crack survey shall also be performed.
• A fully redundant fiber optic communication network to ensure reliability and no single points of failure,
• ITS and TMS roadside equipment cabinets and integrated roadside units,
• A power distribution system with back-up generators and Uninterruptible Power Supplies to support Tolling and Traffic Management Systems, and
• Testing and commissioning of the ITS and TMS roadside equipment with the existing 95 Express Lanes TTMS.

The Design-Builder shall relocate existing Concessionaire and Department TTMS Roadside Equipment located within the 395 Project Right of Way that is affected by construction, including power and communication service to the equipment, and shall ensure that loss of functionality is minimized.

**TTMS Work on the Pentagon Reservation and Mark Center Property:**

The Design-Builder shall be responsible for designing, coordinating and constructing the TTMS related Work on the Pentagon Reservation and Mark Center, including but not limited to the following:

- Reconstruction of the roadway at the South Rotary Road and Eads Street intersection,
- TTMS roadside equipment along South Rotary Road, Army Navy Drive and the Mark Center, and
- Providing Maintenance of Traffic support to ensure work is completed by minimizing impacts to the existing Pentagon and Mark Center traffic flow and movements.

The Design-Builder shall be responsible for following all rules and regulations, including coordinating necessary permit requirements, on the Pentagon Reservation and Mark Center property.

**Systems Integration and Design-Builder Interface**

Systems integration will be performed by Transurban (USA), Inc. The TTMS Interface Plan shall identify the responsibilities of the Design-Builder and Transurban (USA), Inc. as they pertain to the 395 Express Lanes TTMS and system integration. Generally, under the TTMS Interface Plan, the Design-Builder is responsible for the management, design, procurement, and construction of the toll gantries and the procurement, installation and commissioning of all TTMS roadside equipment, and necessary supporting infrastructure. Transurban (USA), Inc. will be responsible for Systems Integration, Back Office Systems, Traffic Management System, and the procurement, installation and commissioning of the ETC equipment. The Design-Builder shall provide continuous and effective coordination with Transurban (USA), Inc. throughout the duration of the project.

**395 Express Lanes Bridges**

No new bridges or bridge replacements are included as part of the 395 Express Lanes Project. The Design-Builder shall be responsible for the design, repairs and construction of various existing bridges carrying future 395 Express Lanes traffic as shown in the RFP Conceptual Plans, including but not limited to:
A. Mainline Bridges - replacement of bridge barriers/railing systems (includes reconstruction of selected general purpose lane bridge barriers), joint reconstruction at abutments, elimination of joints at piers, deck repairs, milling/hydro-demolition and overlay of selected decks, widening and repairs to approach slabs, widening of one bridge, backwall reconstruction, beam seat repairs and reconstruction, replace bearing pads, clean and paint beam ends and bearings, modifications related to addition of conduit duct bank, installing new deck drain systems, surface repairs and waterproofing of existing barriers, and substructure repairs to the following bridges:

- I-395 over Sanger Avenue,
- I-395 over West Braddock Road,
- I-395 HOV & Bus Ramp over Four Mile Run,
- I-395 over Glebe Road,
- I-395 over Ramp G (Glebe Road),
- I-395 HOV over Country Club Road,
- I-395 HOV over EB Route 27 (Washington Boulevard),
- I-395 HOV & NBL over Route 27 NBL & Joyce Street,
- I-395 HOV NB and SB over Ramps CC and CE,
- I-395 HOV over Fern Street,
- I-395 HOV over Eads Street,
- I-395 HOV NB and SB over Route 110, and
- I-395 HOV over Pentagon Access Road.

B. Ramp Bridges - repairs, including joint reconstruction at abutments, elimination of joints at piers, deck and approach slab repairs, milling/hydro-demolition and overlay of selected decks, beam seat reconstruction, clean and paint beam ends and bearings, surface repairs and waterproofing of curbs and parapets, railing post anchor bolt adjustments, replacing guardrail transitions, and substructure repairs to the following bridges:

- Ramp B over I-395 SBL
- Seminary Road HOV Bus Ramp
- Shirlington HOV Bus Ramp
- Route 27 Reversible Ramp over Joyce Street
- Ramp G of I-395 NBL over Route 110

C. Addition of structurally independent, crashworthy ground-mounted 54 inch high pier protection barriers at bridges over the 395 Express Lanes.

D. Removal of existing sign attachments or supports at three existing bridges.