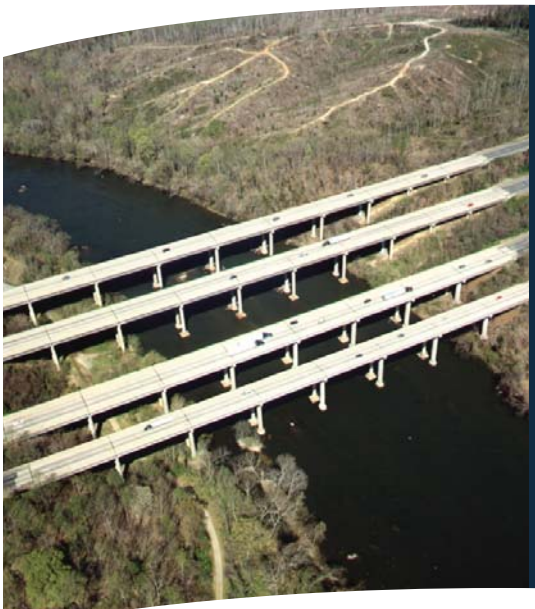
I-95 Interchange Modification Report

Improvements to I-95 between Exit 133 and Exit 130

Volume I Report



February 13, 2015

Prepared by:

Michael Baker Jr., Inc.

I-95 INTERCHANGE MODIFICATION REPORT

Improvements to I-95 between Exit 133 and Exit 130

Prepared for:

Virginia Department of Transportation

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EXECUTIVE SUMMARY

PROJECT BACKGROUND AND NEED

Since 1980, the George Washington Region has been the fastest growing area in Virginia, on a percent population basis. An existing population of 328,000 is projected to almost double to 617,000 by 2040. With this explosive growth the region has emerged to be a significant urban area of economic and social activity. It is also an area which has high commuting exchange with the greater Washington, D.C. business and military community. This growth has led to increased traffic volumes and congestion on the existing roadway network.

Traffic volumes on I-95 are projected to increase from 150,000 in 2013 to 244,000 vehicles per day by 2040, while Route 3 volumes are expected to increase from 71,000 to over 99,000 vehicles per day and Route 17 from 65,000 to over 108,000 vehicles per day. The ability of these facilities to carry volumes at these levels is a serious concern, even with the proposed construction of the two reversible express lanes in the median of I-95. Therefore, congestion and operating levels of service will continue to deteriorate on I-95, Route 3, Route 17 and at their interchanges. This congestion will spread out from the peak periods into greater portions of the day.

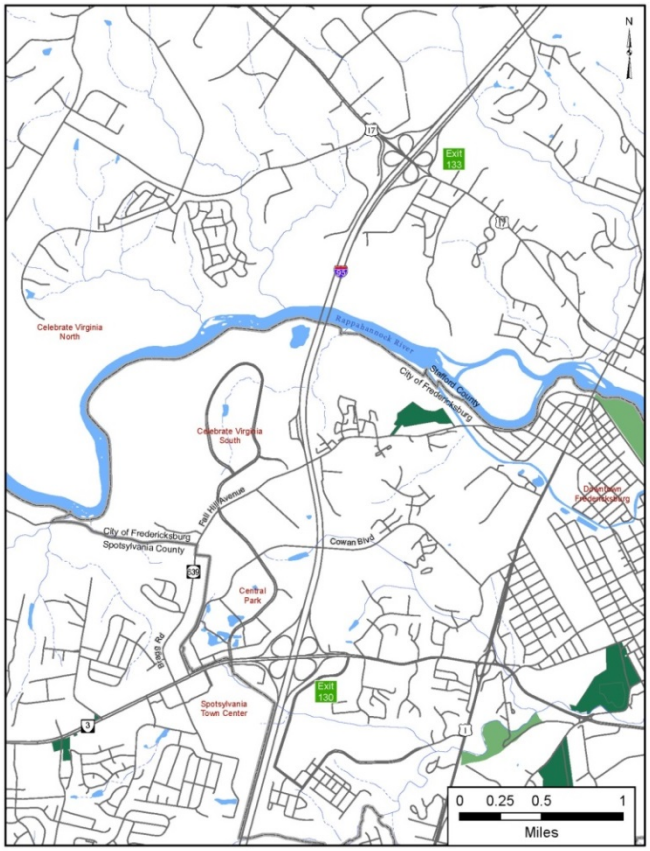


Figure ES-1: Study Area

With the specific intent of addressing documented safety and operational deficiencies on I-95 between Route 17 (Exit 133) and Route 3 (Exit 130) this I-95 Interchange Modification Report (IMR) was initiated by VDOT. As a result of previous documented deficient conditions in previous studies (Section 1.4) in the study area, and a detailed investigation of the traffic operations in the existing conditions (Chapter 2) as well as 2040 No-Build condition (Chapter 3), a Purpose and Need Statement (Chapter 4) was prepared for this effort. In summary, the purpose of the project is to:

- Advance the recommendations, objectives and policy identified in the FAMPO 2040 Long Range Transportation Plan, adopted April 2013.

- Address recurring safety and congestion challenges associated with study area peak period travel along the I-95 mainline.
- Address recurring safety and congestion challenges associated with peak period activity at the interchanges of Route 3 and US 17.
- Eliminate I-95 weaving movements wherever possible.
- Remove from the I-95 mainline, as much of the local traffic as possible that uses I-95 to travel between Route 3 and Route 17.
- Provide additional parallel I-95 bridges over the Rappahannock River to allow for needed redundancy and flexibility during incidents, required maintenance, and bridge rehabilitation activities.
- Arrive at a solution that is compatible with the development of park and ride, TDM, and transit opportunities within the I-95 Corridor to reduce single occupant vehicle travel.

This I-95 IMR was initiated to identify alternatives that address this Purpose and Need.

ALTERNATIVES ANALYSIS

In 2010/2011 GWRC/FAMPO in coordination with VDOT completed an I-95 Access Study that recommended a new interchange on I-95 between Exit 130 and Exit 133. The new interchange provided access to a 4-mile toll road that provided an alternate route to highly congested Route 3. The I-95 Access Study was submitted to FHWA as an Interchange Justification Report and approved in April 2011. The approved project included the construction of parallel collector-distributor (C-D lanes) in each direction between the new interchange and Route 17 interchange with a pair of braided ramps to separate heavy new interchange volumes and Route 17 ramp volumes. The project also included new I-95 bridges in each direction across the Rappahannock River, and reconstruction of the Route 17 interchange (Exit 133). The NEPA process was then initiated by VDOT. With a change in the Spotsylvania County Board of Supervisors, the County removed their support for the project and the project and NEPA work was put on hold. The Spotsylvania concerns were associated with the toll road connector portion of the larger project.

VDOT decided to pursue approval of some of the I-95 improvements recommended in the I-95 Access Study. These improvements served as the base alternative considered for evaluation in this IMR. The proposed NB and SB C-D roads were extended to the Route 3 interchange. Due to the removal of the connector road and the expansion of the project limits further south to include the Route 3 interchange, additional analysis was needed.

Nine alternatives were developed (Alts 1B, 2A, 2B, 3A, 3B, 4A, 4B, 5 & 7) and evaluated for their ability to improve the operations at Route 3. Several long-term Alternatives (Alts 6, and 8A & 8B) that require reconstruction of the interchange or long bridge structures were also evaluated to determine what future designs may be feasible and if the short/intermediate term improvements can be salvaged with the future designs. Each of the alternatives is shown graphically in Figures 5-1 through 5-8B in Volume II.

Based on the alternatives evaluation discussed above and input from the VDOT steering committee members, Alternative 3A with modifications was selected as the best and most cost effective solution for meeting the project's purpose and need. Overall, it provides the most benefits with fewest impacts and lowest cost.

The preferred alternative includes the following components shown in Figures ES-2:

- Parallel two-lane collector-distributor (C-D) roads in each direction between the Route 3 and Route 17 interchanges. The C-D roads cross the Rappahannock River on separate bridge structures (Figure 6-2). Typical sections of the C-D Roads are shown in Figure 6-3 in Volume II.

- Major Reconstruction of the Route 17 interchange (Figure 6-6)

- Improvements to the I-95/Route 3 interchange (Figure 6-7)

- Mitigation improvements are also required at the Virginia Welcome Center (Figure 6-5)

Larger graphics of the Preferred Alternative are shown in Figure 6-1 (Sheets 1 through 5) in Volume II.

Due to funding constraints, the recommended I-95 improvements may need to be phased. The first phase would include constructing the southbound CD Roads with all southbound ramp improvements at the Route 3 and Route 17 interchanges. The second phase would include constructing the northbound CD Roads with all northbound ramp improvements at the Route 3 and Route 17 interchanges.

Constructing only the southbound improvements first, does not have any negative impacts on the corridor in the 2020 design year. Remaining congestion in the unimproved northbound direction does not impact operations in the southbound direction.

I-95 Interchange Modification Report

Figure ES-2 : Preferred Alternative

Legend

- Edge of Pavement
- Edge of Shoulder
- Previous Construction Replaced by Flyover
- Existing Parcels
- Proposed Barriers
- Proposed Bridges

PREFERRED ALTERNATIVE

3000 1500 0 3000 FEET

Baker

RESPONSES TO FHWA 8-POINT POLICY ON INTERSTATE HIGHWAY ACCESS MODIFICATIONS

FHWA's Policy on Access to the Interstate System provides the requirements necessary to justify or substantiate any proposed changes in access to the Interstate System. FHWA's policy statement is printed below. Following the policy statement are the eight specific policy requirements along with a response for each concerning the proposed improvements to I-95 between Exit 133 and Exit 130 associated with the preferred alternative:

> *It is in the national interest to preserve and enhance the Interstate System to meet the needs of the 21st Century by assuring that it provides the highest level of service in terms of safety and mobility. Full control of access along the Interstate mainline and ramps, along with control of access on the crossroad at interchanges, is critical to providing such service. Therefore, FHWA's decision to approve new or revised access points to the Interstate System must be supported by substantiated information justifying and documenting that decision. The FHWA's decision to approve a request is dependent on the proposal satisfying and documenting the following requirements.*[1]

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

The study team considered the feasibility and effectiveness of local street improvements. Potential local street improvements could include additional crossings of I-95 and access management improvements and capacity improvements to Route 3 and Route 17. Additional crossings of I-95 other than Fall Hill Avenue and Cowan Boulevard could improve east-west travel but would not improve access to and from I-95 for shoppers and commuters and thus not meet the study's Purpose and Need. Likewise, access management and capacity improvements at Route 3 and Route 17 alone would not eliminate the existing congestion and expected worsening traffic operations at the interchanges and along I-95 mainline. Therefore, VDOT is pursuing improvements to the existing interchanges at Exit 133 (Route 17) and Exit 130 (Route 3). No new interchanges are being proposed as part of this project.

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

The study team considered possible TSM improvements consisting of additional HOV facilities, expanded transit services, improved signal timing and synchronization and intelligent transportation system improvements over those included as part of the No-Build Alternative. Additional details of the TSM Alternative are contained in Section 5.2.

1. Federal Register: August 27, 2009 (Volume 74, Number 165) page 43743.

Potential TSM measures included additional HOV/Express lanes, park and ride lo ts, carpools and vanpools. The *FAMPO 2040 (Constrained) Long-Range Transportation Plan* (CLRP), and thus the No-build alternative, includes two reversible express lanes that are available to HOV+3. It is un likely that additi onal HOV facilit ies beyond those planned would improve operations based on th e results fro m the *I-95 HOV Feasibility Study* that concluded that additional time savings (projected at 7 minutes of savings) is not pivotal when the commuter can already sav e 40 minutes by using the existing HOV lanes. Thi s additional 7 minutes of savings would not be enough to induce a significant shift of traffic to HOV mode.

Another TSM measure considered was Intelligent Transportation System (ITS) improvement s such as ch angeable message sig ns and cameras. Th e biggest benefit of these types of improvements is to warn traffic of congestion a nd offer alternative routes and help authorities manage and respond to incidents. There are very fe w alternatives to I-95 across the Rappahannock River, so although ITS can have an effect help ing relieve no n-recurring congestion, it is more limited in solving reoccurring congestion along facilities well over capacity. Under the n o-build conditions, the expected >225,000 ve hicles per d ay demand for I-95 well exceeds the approximate 150,000 vehicles per day capacity of the exis ting six general purpose lanes.

Signal timing coordination and improvements also would have limited ability t o improve operations. Currently the signals on Route 3 and Route 17 are coordinated by VDOT to ge t the most capacity possible of both facilities. VDOT periodically retimes the signals to respond to changes in travel demand. As demands in these corridor s grow, signal timing changes would provide diminishing return in terms of traffic oper ations. Any improvement on the arterials would have little impact on the I-95 mainline.

Additional transit improvements we re also con sidered. However, Th e transit improvement s shown in th e 2040 CL RP result in the same conclusion noted in the 2035 F AMPO CLRP: Public transit performan ce cannot be impro ved by simply increasing transit service frequencies and areas of coverage, because the land use densitie s are too low to support this type o f increase economically. Also the type of trans it proposed for the FAMPO area would run in mixed traffic and thus would be a victim of background congestion.

Ramp metering was co nsidered however not investigated as both the I-95 mainline and ramp junctions are all project ed to be over capacity in the 2 020 No-Build scenario, ren dering ramp metering ineffective.

Bicycle and pedestrian improvements (including those listed in Section 3.2) were not considered in the build alternative. Pedestrian and/or bicycle facilities through a major interchange between the I-95 corridor and Route 3 or Route 17 wo uld be unsafe and provi de little or no positive impacts to vehicular traffic congestion.

The TSM measures discussed above are limited in the ability to improve traffic operations in the region and would not eliminate the need for the capacity improvements identified in the Purpose and Need.

3. An operational and safety analysis has concluded that the proposed change in access does not have a significant adverse impact on the safety and operation of the Interstate facility (which includes mainline lanes, existing, new, or modified ramps, ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis shall, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access (23 CFR 625.2(a), 655.603(d) and 771.111(f)). The crossroads and the local street network, to at least the first major intersection on either side of the proposed change in access, shall be included in this analysis to the extent necessary to fully evaluate the safety and operational impacts that the proposed change in access and other transportation improvements may have on the local street network (23 CFR 625.2(a) and 655.603(d)). Requests for a proposed change in access must include a description and assessment of the impacts and ability of the proposed changes to safely and efficiently collect, distribute and accommodate traffic on the Interstate facility, ramps, intersection of ramps with crossroad, and local street network (23 CFR 625.2(a) and 655.603(d)). Each request must also include a conceptual plan of the type and location of the signs proposed to support each design alternative (23 U.S.C. 109(d) and 23 CFR 655.603(d)).

A safety and operational analysis was conducted for the preferred alternative and is summarized below and presented in detail in Sections 6.6 and 6.7 and in Appendix C – Preferred Alternative. This analysis included the two full service interchanges that provide access to and from I-95. The Interstate 95 interchange at Exit 130 provides northbound and southbound access to and from Route 3. The Interstate 95 interchange at Exit 133 provides full access to Route 17. Between these two interchanges lie the Rappahannock River and two overpasses south of the river (Fall Hill Avenue and Cowan Boulevard). The next closest interchanges to the study area are at Exit 126 (US 1 / Massaponax) to the south and Exit 136 (US 1 / Stafford Airport), 4 miles and 3 miles respectively from the study area. These adjacent interchanges are far enough away from the Route 3 and Route 17 interchanges that they do not affect the operations or safety at the Route 3 and Route 17 interchanges and thus are not analyzed in this report. On both Route 3 and Route 17 at least one major intersection on each side of the interchange was included in the operational and safety analysis. 2040 Build condition results for the mainline and ramp analyses are discussed below and shown **in Figure 6-11 in Volume II**.

Northbound I-95

There is significant improvement in level of service for northbound I-95 mainline segments and ramp junctions when compared to the 2040 No-Build Conditions. Most of the segments were operating at LOS F in the AM peak hour and LOS F in the PM peak hour under 2040 No-Build conditions. These segments have improved to LOS B or C in the AM peak and LOS D in the PM peak.

North of Route 17 where no improvements are proposed, the LOS is expected to drop to LOS F due to the projected higher traffic volumes during the PM peak hour when compared to the 2040 No-Build condition. (Although the travel demand model shows a significant shift in traffic from Route 1 to I-95 due to the preferred alternative, it is unlikely that a significant shift would occur. Expected congestion north of Route 17 as shown in the 2040 No-Build Condition would discourage this shift until capacity improvements are made north of the interchange.) Additional

improvements to I-95 north of the study area will be required in the future when funding becomes available.

The new C-D road across the Rappahannock River is expected to operate at LOS F (depending on the segment) in the AM peak hour and LOS C in the PM peak hour. Although the densities expected in 2040 will push the C-D Road into LOS F for some segments, the vehicle speeds are still expected to be within 5 mph of the posted speed limit of 55 mph. Obtaining a LOS better than LOS F would require widening the proposed NB C-D Road to three lanes. This would add significant cost to the project. See discussion at the end of the next section (Southbound I-95) for more information on this subject.

Southbound I-95
In the southbound direction, similar improvements in LOS are expected. During the AM peak hour, movements that are predominately LOS D in the 2040 No-Build Condition become LOS C in the 2040 Build Condition for mainline segments and ramp junctions. During the PM peak hour, movements that are predominately LOS F in the 2040 No-Build Condition become LOS D for mainline segments and ramp junctions in the 2040 Build Condition. North of Route 17 where no improvements are proposed, the LOS remains F. Additional improvements to I-95 north of the study area will be required in the future when funding becomes available.

The analysis shows that south of Route 3 the mainline is expected to worsen to LOS E under the 2040 build condition from LOS D in the 2040 no-build condition. This is because this section of I-95 (south of Route 3) is expected to have a higher volume in the general purpose lanes under the build condition than in the no-build condition because less drivers will use the express lanes between Route 17 and Route 3 under the build condition because there is essentially additional capacity in the general purpose lanes because of the huge volume of traffic destined for Route 3 is on the SB C-D Road (see the Build Volume methodology in Appendix C (page C1).

The new C-D road across the Rappahannock River is expected to operate predominately at LOS A or B during the AM peak hour and LOS D during the PM peak hour. Although the densities expected in 2040 will push the C-D Road into LOS D, the vehicle speeds are still expected to be at or above the posted speed limit of 55 mph. Obtaining a LOS better than LOS D would require widening the proposed SB C-D Road to three lanes. This would add significant cost to the project.

Although all the expected operational problems for SB and NB I-95 are not solved, significant improvements in operating conditions are expected with the construction of the Preferred Alternative. Additional mainline lanes on I-95 north of the project area will be required to bring deficient segments up to an acceptable LOS. Any additional lanes will need to be continuous and extend many miles north of the existing project area. The proposed preferred alternative will not prevent these further improvements from being implemented in the future. Additional improvements to the C-D Roads such as widening to three lanes would also not be precluded in the future with additional funding. It should be noted that recently the Commonwealth Transportation Board has authorized VDOT to study other regional improvements such as the Rappahannock Parkway, Outer Connector, Stafford Parkway and other proposals to improve connectivity from I-95 to destinations to the west. Any of these improvements could change the demand volumes for the I-95 Corridor, particularly if the Outer Connector is advanced. The

outcome of these studies should be known before investing additional funds in the I-95 Corridor between Exits 133 and 130 above those committed for the Preferred Alternative.

Route 3 and Route 17
Generally, the traffic operations and intersection LOS on Route 3 and Route 17 under the 2040 Build Condition is expected to remain the same as under the 2040 No-Build condition because the traffic volumes on Route 3 and Route 17 remain similar and few improvements are proposed to the intersection geometry (See Table 6-8 and Table 6-9). However, intersections #5 (Route 17 and Sanford Drive) and #6 (Route 17 and Short Street) are expected to have significant reductions in delay (although the same LOS) due to the flyover proposed at intersection #5 (Route 17 and Sanford Drive) and the diversion of traffic to I-95 from Route 17 (east of I-95) and intersection #6 (Route 17 and Short Street). The new proposed intersections that are part of the Preferred Alternative are not expected to have operational problems with the exception of intersection #8 (Route 3 and SB I-95 Ramp) which is expected to operate at LOS F due to traffic queuing back from the downstream intersection. Only intersection #3 (Route 3 and Gateway Blvd)is expected to see increases in delay and worsen LOS in the AM peak hour (from LOS C to LOS D) due to increases in traffic using I-95 and Route 3 instead of Route 1.

The CORSIM analysis generally confirms the results from the HCS analysis. The CORSIM model shows that the new northbound CD road will operate under capacity for both 2020 and 2040 and that the southbound CD road is under capacity in 2020 only. There are significant improvements to the operations at Route 3, Route 17, and I-95 when compared to the No-Build Condition. In 2020 and 2040, during the AM peak hour, the new triple left turns from eastbound Route 3 to the northbound CD road reduce much of the congestion on Route 3 at the former weave area.

During the PM peak hour for both build conditions (2020 and 2040), the congestion resulting from the high southbound traffic volumes is mostly contained to the new southbound CD road. The diverge locations from southbound I-95 prior to the exit to the new CD road are still expected to operate with high vehicle densities (more so in 2040) however much of the southbound traffic diverges to the southbound CD road resulting in greatly improved operations on the remaining components on southbound I-95. The extremely high westbound volumes on Route 3 and the close proximity at the intersection of Route 3 and Carl D Silver Parkway cause the new southbound CD road to back up approximately 2.5 miles almost to the new braided ramps at the Route 17 interchange is 2040. This is also the case at the intersection of Route 17 and Stanstead Road; the distance between this intersection and the ramp from southbound I-95 is approximately 900 feet in the Build condition (approximately 450 feet in the No-Build condition). Queue lengths for the northbound approach at this intersection cause some spill back onto the relocated ramp from southbound I-95 in the CORSIM model, however the end of queue does not impact the I-95 mainline. Access points to developments along Route 3 and Route 17 would have to be eliminated to improve the southbound operations.

Due to funding constraints, the recommended I-95 improvements may need to be phased. The first phase would include constructing the southbound CD Roads with all southbound ramp improvements at the Route 3 and Route 17 interchanges. The second phase would include constructing the northbound CD Roads with all northbound ramp improvements at the Route 3 and Route 17 interchanges.

Constructing only the southbound improvements first, does not have any negative impacts on the corridor in the 2020 design year. Remaining congestion in the unimproved northbound direction does not impact operations in the southbound direction.

Safety Analysis

Section 6.7 documents the qualitative analysis of the safety impact the Preferred Alternative would have on the interstate and primary roadways in the area of influence as compared to the No-Build scenario. The Preferred Alternative will add capacity to I-95 between Route 3 and Route 17 in the form of additional C-D roads. The proposed braided ramps and C-D roads reduce conflict points and significantly reduce the large weaving volumes between the Route 17 Interchange and Route 3 Interchange. The increase in capacity on I-95 and reduction in weaving volume is determined to contribute to safer operating conditions when compared to the No-Build Conditions in 2040. Safer operating conditions include less stop-and-go conditions, lower vehicle density, and lower speed differential between free-flow travel and congested travel (Compare Tables 3-11 and 6-10 and Figures 3-5 and 6-11). Due to the additional capacity of I-95 some traffic is expected to divert from Route 1 to I-95. Because limited access facilities have lower crash rates than primary arterials, the vehicles being diverted to I-95 are expected to experience lower crash rates as opposed to using Route 1. These factors are expected to improve traffic flow and reduce crashes and crash rates as compared to the 2020 and 2040 No-Build scenarios.

The Preferred Alternative will not only see a benefit of added capacity, but also from the geometric improvements proposed at the Route 3 and Route 17 interchanges. At the Route 17 Interchange in the northbound direction, the existing Route 17 northbound loop off-ramp at the C-D road weave area would be replaced by a flyover ramp, eliminating the northbound I-95 C-D weave as well as the weave on WB/NB Route 17. In the southbound direction, the weave at the Route 17 Interchange is eliminated by removing the loop on-ramp from WB/NB Route 17 to southbound I-95, providing only one on-ramp in the southbound direction.

Geometric improvements are also planned at the Route 3 Interchange. In the northbound direction, the low speed EB to NB on-loop ramp will be removed and replaced with a left turn on Route 3 onto the NB C-D road. Removing this ramp eliminates the NB I-95 weave at Route 3 and the EB weave on the Route 3 bridge over I-95.

By replacing existing ramps with modern design standards, traffic flow is expected to increase and crash rates and overall crashes are expected to decrease with the Preferred Alternative as compared to the 2020 and 2040 No-Build scenarios.

Conceptual Sign Layout

A conceptual sign layout of the necessary guide signs was prepared for the preferred alternative, in order to demonstrate that the proposed interchange improvements could be signed in accordance with the standards in the Manual on Uniform Traffic Control Devices (MUTCD). The conceptual guide sign layout is shown in Figure 6-12 in Volume II. There are no apparent problems with signing the preferred alternative in accordance with the MUTCD.

4. The proposed access connects to a public road only and will provide for all traffic movements. Less than ``full interchanges'' may be considered on a case-by-case basis for applications requiring special access for managed lanes (e.g., transit, HOVs, HOT lanes) or park and ride lots. The proposed access will be designed to meet or exceed current standards (23 CFR 625.2(a), 625.4(a)(2), and 655.603(d)).

The preferred alternative includes improvements to existing public roads maintained by VDOT. These include I-95, Route 17 and Route 3. Full interchanges providing for all traffic movements exist at both the Route 3 and Route 17 interchanges and will remain so after the proposed improvements are completed.

With exception to the items identified below, the proposed modifications are designed conceptually to meet or exceed current standards for Federal-aid projects on the Interstate System. The current VDOT Road Design Manual and AASHTO A Policy on Geometric Design of Highways and Streets (Green Book) guidelines served as the design standards for all design criteria. Survey data was not available to assist with the conceptual design of the proposed improvements, so as the project moves forward some refinements in the design may be required. All new lanes and shoulders on the I-95 mainline, C-D roads, and ramps will be full width. All new ramps connecting to the I-95 mainline will have design speeds of 50 mph or higher with vertical and horizontal alignments that meet or exceed the design speed. All ramp terminal spacings exceed AASHTO minimum standards. There are no limitations in providing adequate acceleration and deceleration lanes for the new I-95 ramps and C-D roads merges and diverges with I-95. Both acceleration and deceleration lanes can exceed 1000 feet in length for all ramps.

The parallel C-D roads have horizontal alignments that exceed 60 m.p.h. design speeds, except at where they braided with I-95 on and off ramps. At these locations vertical grades will likely exceed 4% but meet a 50 mph design speed.

The recommendations for the Route 17 interchange will improve the geometry at the interchange by removing two tight loop ramps (the I-95 NB to Route 17 WB/NB off-ramp and the Route 17 WB/NB to I-95 SB on-ramp). The first is replaced with a directional ramp and the second with a left turn to the existing Route 17 EB/SB to I-95 SB on-ramp. However, two tight loop ramps with curve radii of approximately 250' (~30 m.p.h. design speed) will remain. Both of these ramps (the I-95 SB to Route 17 EB/SB off-ramp and the Route 17 EB/SB to I-95 NB on-ramp) will connect to Route 17 interchange C-D roads and not the I-95 mainline. The recommendations for Route 3 remove the tight WB Route 3 to NB I-95 SB loop on-ramp. However, three existing loop ramps will remain as part of the interchange.

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

The proposed interchange is consistent with local and regional land use transportation plans. The Fredericksburg Area Metropolitan Planning Organization (FAMPO) and its member communities have developed a long-range comprehensive plan and strategy to address the growing demands on the region's transportation network. Central to this planning has been the need for improving mobility between I-95 and Route 3 and Route 17 respectively. FAMPO adopted the 2040 Constrained Long-Range Plan (CLRP) in April 2013 and designates $10 million for designing improvements to the Route 3 and Route 17 interchanges and four new C-D lanes across the river, connecting the interchanges.

In the current Fiscal Year 2015 Six-Year Improvement Program (FY15 SYIP), the proposed improvements for southbound I-95 are included under the project identified as UPC 101595. Project was funded to $69.2M of the in the Final FY15 SYIP. This is covered preliminary engineering (PE), right of way (RW) and partial construction (CN). Based on funding, RW could not have begun prior to FY19 and CN was unscheduled. The project scope includes capacity expansion, NEPA is not complete, and the project is not fully funded so it did not qualify for an exemption from House Bill 2. PE is fully funded to the $ 9.5M estimate in the Revised FY15 SYIP. This covers the NEPA document for both the NB (UPC 105510) and SB (UPC 101595) side. A total of $59.7M was removed from the project.

The proposed improvements for northbound I-95 are included under the project identified as UPC 105510. The NB CD roads were funded to $7.5M in the Final FY 15 SYIP. This covered partial preliminary engineering (PE). Based on funding, construction (CN) for this project was unscheduled. The project scope includes capacity expansion, NEPA is not complete, and the project is not fully funded so it did not qualify for an exemption from HB2. The project currently has $1 programmed to it in the Revised FY15 SYIP. The NEPA document is being prepared for both the NB (UPC 105510) and SB (UPC 101595) side under the SB UPC. A total of $7.5M was removed from the project.

The proposed improvements will be scored under the new prioritization process as outlined in House Bill 2. Once the projects are prioritized, the Commonwealth transportation Board will select the projects statewide that will be funded in VDOT's Six-Year Improvement Program. Section 8.1 contains more detail on the funding planned for the proposed improvements to I-95 between Exit 133 and Exit 130.

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

This I-95 IMR Study is being coordinated closely with other relevant I-95 studies such as the Jackson Gateway I-95 Interchange Modification Report (IMR) and the I-95/Route 630 IMR. These studies incorporate a 17-mile section of I-95 from milepost 126 to milepost 143. Six interchanges exist along this section of I-95 at mileposts 126, 130, 133, 136, 140 and 143. The Jackson Gateway I-95 IMR is addressing interim ramp improvements and longer term improvements at Exit 126. This I-95 IMR (near the rest area) is addressing deficiencies and changes in access between mileposts 130 and 133. The I-95/Route 630 IMR is addressing

deficiencies and changes in access between milepost 136 and 143. Traffic data and forecasts have been coordinated and are consistent between the three studies. Between these studies, any and all requests for new or revised access are being addressed in detail for this 25 mile section of I-95. No additional changes in access are planned or have been identified at this time.

A fourth initiative in the study area is the I-95 Express Lanes Initiative. Two new Express Lanes from Massaponax (milepost 126) in Spotsylvania County through the study area tying into the Express Lanes being constructed to Garrisonville Road are included in the FAMPO Constrained Long-Range Plan. Although a definitive schedule and funding plan have not been developed by VDOT and regional leaders, this project was taken into account during the development and evaluation of alternatives. More information on the I-95 Express Lanes is provided in Section 1.4.

7. When a new or revised access point is due to a new, expanded, or substantial change in current or planned future development or land use, requests must demonstrate appropriate coordination has occurred between the development and any proposed transportation system improvements (23 CFR 625.2(a) and 655.603(d)). The request must describe the commitments agreed upon to assure adequate collection and dispersion of the traffic resulting from the development with the adjoining local street network and Interstate access point (23 CFR 625.2(a) and 655.603(d)).

The Fredericksburg Area Metropolitan Planning Organization (FAMPO) and its member communities in coordination with VDOT have developed a long-range comprehensive plan and strategy to address the growing demands on the region's transportation network. Central to this planning has been the need for improving mobility between I-95 and Route 3 and Route 17 respectively. FAMPO adopted the 2040 Constrained Long-Range Plan (CLRP) in April 2013 for improvements to the Route 3 and Route 17 interchanges and four new C-D lanes across the river, connecting the interchanges. Section 3.2 of this study, describes the planned transportation commitments to improve the local street network and traffic operations within the study area.

In addition, VDOT and the City of Fredericksburg, Spotsylvania County and Stafford County have a formal traffic analysis process via VDOT's "Traffic Impact Analysis Regulation", 24-VAC 30-155, to assure adequate collection and dispersion of the traffic resulting from the development with the adjoining local street network and Interstate access point.

However, this need for the improvements to I-95 between Exit 133 and Exit 130 is not the result of any one development but the need to address existing and forecasted congestion on existing interchanges and the I-95 Rappahannock River crossing due to regional land use development and increase in interstate travel on the East Coast of the United States.

There is a commitment from VDOT and the local governments to protect and improve access to I-95 through comprehensive planning of land use and the local transportation network.

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

771.111).

The proposed project involves major upgrades to a federal interstate facility. Therefore, it will be necessary to comply with the requirements of NEPA and prepare the appropriate level of environmental analysis, documentation, and coordination. Concurrently, VDOT is completing an Environmental Assessment (EA) for the project to determine if there are any project-related impacts to resources covered under NEPA.

While FHWA may conditionally approve an IMR for this project, the draft EA must be completed and approved by FHWA before FHWA will formally approve the IMR. FHWA may grant conditional approval of a new or modified interchange location without the NEPA process being completed as long the IMR indicates how the NEPA requirements are anticipated to be satisfied. Issues to be addressed in the NEPA process are discussed in Chapter 7.

The alternatives evaluated in this IMR were developed to avoid and minimize impacts to known sensitive resources/constraints as identified in Section 2.10 and shown on Figure 2-12. During future phases of more detailed design, additional effort will be made to minimize environmental impacts. These could include the use of retaining walls to minimize construction limits, slight shifts in alignment, design exceptions, innovative stormwater systems, etc. Construction of the project will likely require Federal and state permits. Federally issued permits also require compliance with NEPA. VDOT will require compliance with all Federal and State rules and regulations as the project is implemented.

The development of final plans, right-of-way acquisition and physical construction will be performed only after FHWA's acceptance of the environmental document.

CHAPTER 1 INTRODUCTION

1.1 Background

The Virginia Department of Transportation (VDOT) is evaluating proposed improvements to I-95 between Exit 133 (Route 17) and Exit 130 (Route 3) including new bridges across the Rappahannock River to address existing and future congestion problems along I-95.

Located midway between Washington, D.C. and Richmond, the George Washington Region of Virginia is the scene of intensive growth extending back several decades, as it has become a bedroom community to Washington, D.C. and, to a lesser extent Richmond. Since 1960, the regional population has more than quintupled, from 60, 000 residents to nearly 328,000 residents. This hyper growth has manifested itself in rapid suburbanization and has unduly strained the surface transportation system of the Region, taxing the capacity of roadway arterials and collectors alike. None of these roadways has been impacted as much as I-95, a national lifeline and a vital Regional arterial.

Interstate 95 traverses the George Washington Region for about 47 miles, through the Counties of Stafford, Spotsylvania and Caroline, as well as the City of Fredericksburg. At various places along its course through the Region, I-95 fails from too much traffic and too little capacity. This failure adversely affects the nation as a whole, but it directly threatens the economic well-being and quality of life of residents in the Region.

In the past, traditional highway engineering approaches and funding to this problem have led to the definition of a discrete set of improvements to I-95 to address localized bottle necks in the George Washington Region. For two decades these discrete solutions have witnessed little funding and less progress towards implementation. In the same time, the population and growth has intensified, and the transportation gridlock has increased.

For the past several years, the Fredericksburg Area Metropolitan Planning Organization (FAMPO) and its member communities have worked with VDOT to develop a long-range comprehensive plan and strategy to address the growing demands on the region's transportation network. Central to this planning has been the need for modernizing existing access to I-95 and eliminating the weaving of large volumes within and between the Route 17 and Route 3 interchanges.

In 2010/2011 GWRC/FAMPO in coordination with VDOT completed an I-95 Access Study that recommended a new interchange on I-95 between Exit 130 and Exit 133. The new interchange provided access to a 4-mile toll road that provided an alternate route to highly congested Route 3. The I-95 Access Study was submitted to FHWA as an Interchange Justification Report and approved in April 2011. The NEPA process was then initiated by VDOT. With a change in the Spotsylvania County Board of Supervisors, the County removed their support for the project and

the project and NEPA work was put on hold. The Spotsylvania concerns were associated with the toll road connector portion of the larger project.

Due to the need to offset the negative effects of the additional access, the Study had included a number of improvements along this portion of the I-95 corridor. However, even without the additional volumes and movements resulting from the additional access, there were already operational deficiencies on I-95 and at the Exit 130 and Exit 133 interchanges. VDOT is interested in reconsidering and updating some elements of the I-95 Access Study to determine new improvements on I-95 that do not include the new interchange and toll road. The update would be developed as an Interchange Modification Request (IMR) and submitted to FHWA for approval.

This report is broken in to two volumes. Volume I (this document) provides the written text, tables and exhibits. Volume II contains the report figures under a separate cover and is a collection of 11 X 17 sized figures illustrating the data discussed in Volume I. The appendices are also under separate cover providing additional backup data, methodologies, assumptions, and analysis software inputs and output reports.

1.2 Proposed Project

The proposed project includes the construction of parallel collector-distributor (C-D lanes) in each direction between the Route 3 and Route 17 interchanges on I-95 with a pair of braided ramps to separate heavy Route 3 and Route 17 ramp volumes. The project also includes new I-95 bridges in each direction across the Rappahannock River, reconstruction of the Route 17 interchange (Exit 133) and modest improvements to the Route 3 interchange (Exit 130). Mitigation improvements are also required at the Virginia Welcome Center.

Due to funding constraints, the recommended I-95 improvements may need to be phased. The first phase would include constructing the southbound CD Roads with all southbound ramp improvements at the Route 3 and Route 17 interchanges. The second phase would include constructing the northbound CD Roads with all northbound ramp improvements at the Route 3 and Route 17 interchanges.

Constructing only the southbound improvements first, does not have any negative impacts on the corridor in the 2020 design year. Remaining congestion in the unimproved northbound direction does not impact operations in the southbound direction.

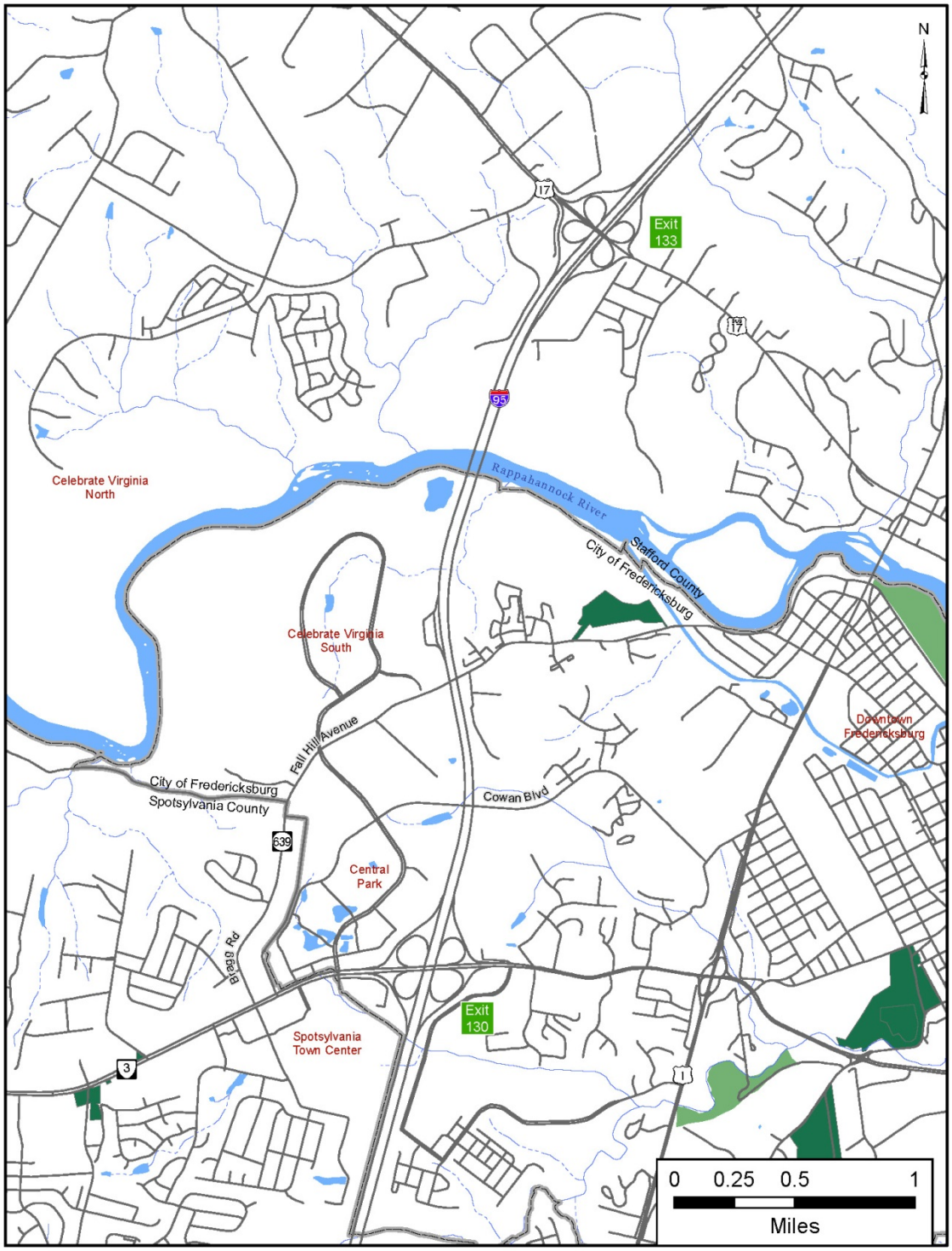
Chapter 4 documents the purpose and need of this proposed project while Chapter 6 provides a detailed description of the proposed project and documents its operational benefits.

1.3 Study Location

The Study Area for this effort is located in the George Washington Region of Virginia and includes portions of Spotsylvania County, Stafford County and the City of Fredericksburg. The study area is shown in Figure 1-1 and surrounds I-95 from the VA 3 (Route 3) Interchange (Exit 130) to just north of US 17 (Route 17) Interchange (Exit 133). Route 1 borders the study area to the east and Bragg Road to the west. The Rappahannock River bisects the study area creating a barrier for north-south travel with few crossings. Both Route 3 and Route 17 are the primary

routes providing east-west travel in the study area. Fall Hill Avenue and Cowan Boulevard are the only other crossings of I-95 in the study area. This proposed study area lies completely within the study area of the I-95 Access Study.

Figure 1-1: Study Area



1.4 Previous Studies

The above concerns have been evidenced by a series of previous attempts to find affordable solutions to documented problems. Examples of previous efforts include the *I-95 Access Study, October 2010*, *VDOT March 2000 Draft I-95 Interchange Justification Report*, the I-95 Express Lanes Initiative, and previous versions of the *FAMPO Constrained Long Range Transportation Plan*. Previous I-95 studies in the region include VDOT's *I-95 Collector-Distributor Access Feasibility Study*[2] and VDOT's *I-95 HOV Feasibility Study*[3]. In addition, VDOT initiated two separate studies of a western bypass around Fredericksburg with eastern termini at I-95: the Outer Connector – Northwestern Quadrant[4] and the southwestern quadrant of the Outer Connector, referred to as the Spotsylvania Parkway[5]. Both of these bypass studies involved the preparation of Environmental Impact Statements (EISs); however, due to a lack of available funding and a lack of local support, VDOT stopped both EIS efforts[6,7].

This effort was built on the work completed in these studies and does not redo analysis that is likely to come to the same conclusion. During the development of alternatives as much relevant information as possible was taken from these studies to help screen alternatives and identify viable solutions. Brief descriptions of the studies on I-95 are provided below paraphrasing the conclusions contained in each report. Additional information and results from these reports are contained in Chapter 5 as they relate to the development and evaluation of alternatives.

I-95 Access Study

In 2010/2011 GWRC/FAMPO in coordination with VDOT completed an I-95 Access Study that recommended a new interchange on I-95 between Exit 130 and Exit 133. The new interchange provided access to a 4-mile toll road that provided an alternate route to highly congested Route 3. The project also included the construction of parallel collector-distributor (C-D lanes) in each direction on I-95 between the Route 17 interchange and new interchanges with a pair of braided ramps to separate heavy new interchange and Route 17 ramp volumes. The project also included new I-95 bridges in each direction across the Rappahannock River and reconstruction of the Route 17 interchange (Exit 133). The I-95 Access Study was submitted to FHWA as an Interchange Justification Report and approved in April 2011. The NEPA process was then initiated by VDOT. With a change in the Spotsylvania County Board of Supervisors, the County removed their support for the project and the project and NEPA work was put on hold. The Spotsylvania concerns were associated with the toll road connector portion of the larger project.

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[2] Virginia Department of Transportation. *I-95 Collector-Distributor Access Feasibility Study, Final Report.* March 2002.
[3] Virginia Department of Transportation. *I-95 HOV Feasibility Study, Final Report*. March 2002.
[4] Virginia Department of Transportation. *Outer Connector – Northwest Quadrant Supplemental Environmental Impact Statement*. April 2001.
[5] Virginia Department of Transportation.
[6] Federal Highway Administration. "Notice to Rescind Five Notices of Intent to Prepare Environmental Impact Statements in Virginia". Federal Register: May 22, 2008 (Volume 73, Number 100) [Page 29837 – 29838. Notice to Rescind Five Notices of Intent to Prepare Environmental Impact Statements in Virginia.
[7] Spotsylvania County. *Spotsylvania County, Virginia: Draft Comprehensive Plan – Chapter 6: Transportation Element*. March 2008. Pages 5–7.

I-95 Collector/Distributor Access Feasibility Study

This study was initiated by VDOT and completed in 2002. The objective of this study was to examine the feasibility of providing collector-distributor lanes and additional access to I-95 in the greater Fredericksburg area. Collector-distributor roads, which are frequently referred to as C-D roads, parallel the interstate and provide access to cross roads while eliminating weaving on the mainline. This study employed a two-prong approach. The first was to identify improvements that would be necessary to existing interchanges to accommodate the projected year 2025 traffic at acceptable levels of service in the PM peak hour. The second was to identify the location and conceptual configurations of new interchanges that would serve the regional demand.

The FAMPO Technical Committee selected eleven specific scenarios for further analysis. Following preliminary analysis, the Committee decided to carry forward five candidate interchange locations (a new Fredericksburg access between Route 3 and the Rappahannock River, Route 620, Route 208, the Spotsylvania Parkway south of US 17 Bypass overpass on I-95, and Route 608). This study did not involve further analysis of the new Fredericksburg access interchange, since a draft interchange justification study had been previously completed for that location (*VDOT March 2000 Draft I-95 Interchange Justification Report).*

A range of options was considered as improvements to the baseline for the existing four interchanges on I-95. Key findings of the traffic and engineering analysis indicate that C-D roads are needed on I-95 between Route 3 and US Route 17. Analysis of individual interchanges revealed that the greatest benefits in terms of satisfying projected traffic demand resulted from two new interchanges: (1) at the Spotsylvania Parkway south of the existing overpass for US Route 17 Bypass; and (2) a new interchange on I-95 between Route 3 and the Rappahannock River. The study also looked at improvements to the Route 1 Interchange and conceptual configurations of C-D roads between a new Spotsylvania Parkway Interchange and the Route 1 Interchange.

I-95 HOV Feasibility Study

This study was initiated by VDOT and completed in 2002. The objective of this study was to determine if an extension of the existing I-95 High Occupancy Vehicle (HOV+3) lanes would be an effective strategy to accommodate future peak commuter demand in the I-95 Corridor in the FAMPO Region. Two build alternatives were evaluated; the first assumed addition of an HOV facility and the second assumed addition of a fourth general use lane in each direction. The additional lanes whether HOV or general use, would extend from the Stafford County/Prince William County line as far as VA Route 3 to the south.

The analysis results demonstrate a need to add capacity to this section of I-95; however, it is undetermined whether added capacity should be in the form of HOV or general use lanes. With respect to the goal of improving multimodal trip mobility within the corridor, both build alternatives have the same effects on person hours of travel and level of service on I-95, although both are shown to provide improvement over baseline conditions. In addition, the "analysis has shown that the HOV facility would be projected to carry appropriate levels of person trips as compared to national guidelines; however, there is not projected to be a significant shift in mode share as a result of extending the HOV facility southward into the

FAMPO region."[8] The analysis shows that HOV lanes if extended should be extended to VA Route 3. The type of HOV lanes was not recommended but was noted that separated reversible HOV facilities are generally superior in terms of safety and ease of enforcement, but are also five to six times more costly than concurrent flow HOV lanes.

The study notes that further preliminary engineering studies will be required to address design and cost elements. In addition, the potential role for a HOV facility will need to be examined in the context of regional roadway and transit system improvements, such as new interchanges and/or collector-distributor facilities along I-95 and/or improvements and extensions to rail and bus transit services.

I-95 Interchange Justification Study, Fredericksburg Virginia (March 2000)

This study was initiated by VDOT and completed in 2000. The study evaluated several alternatives to develop C-D Roads and a new interchange along I-95 in the vicinity of the rest area. These alternatives included:

1. A new interchange with localized C-D Roads at the new interchange and at Route 3 and Route 17 Interchanges.
2. A new interchange with continuous C-D Roads from Route 3 to Route 17.
3. A new interchange with continuous C-D Roads from Route 3 to Route 17 and some braided ramps.

The study found that the C-D Road would carry more traffic than the mainline so braided ramps were needed to better balance the traffic between the mainline and the C-D Roads. Also, improvements to the existing interchanges beyond just C-D Roads were required to obtaining acceptable traffic operations. To solve Route 3 operational problems required the use of grade separations between I-95 and Brag Road. The recommended alternative, New Interchange with C-D Roads and Braided Ramps, included the following improvements:

- New diamond interchange in the vicinity of Rest Area
- Carl D. Silver Parkway extended across I-95 and tied into Mary Washington Boulevard
- Fall Hill Avenue removed across I-95 and cul-de-saced on both sides of I-95
- Route 3 Interchange improvements include removing the southeast loop ramp (EB to NB on ramp) and replacing it with a two-lane directional ramp.
- US 17 Interchange improvements include removing the northeast loop ramp (NB to WB off-ramp) and replacing it with a two-lane directional flyover and widening the EB to SB on ramp to two lanes.
- Mainline I-95 widened to four through lanes plus up to two auxiliary lanes in each direction
- Collector-distributor roads on both sides of I-95 with braided ramps
- Various grade-separation improvements to Route 3

Although this alternative is a feasible alternative from a traffic operations standpoint there were several problems that prevented VDOT from forwarding the IJR to FHWA for approval. The main reason the alternative was not carried forward was cost. It was estimated that

8 Prepared for VDOT by BMI. *I-95 HOV Feasibility Study*. March 2002, P 27.

construction would cost $400 million plus an additional $100 million for right-of-way in 1999 dollars.

Outer Connector Northwest Quadrant Environmental Impact Statement

VDOT proposed to construct a four-lane, median divided, limited access roadway on new location referred to as the Outer Connector – Northwest Quadrant to relieve congestion in the I-95 Corridor. VDOT undertook a Major Investment Study and Environmental Impact Study to evaluate the environmental impacts of the proposed roadway. As a part of the MIS, a full range of conceptual, multi-modal transportation alternatives were considered and fully evaluated. Nine possible corridors for the proposed Outer Connector – Northwest Quadrant were developed for the regional build alternative. Eight of the nine corridors would have a northern terminus at the planned Mine Road Extension in Stafford County and a southern terminus at Route 3 in Spotsylvania County, west of I-95. All include a new crossing of the Rappahannock River. Any one of the eight corridors could ultimately become the northwest quadrant of a proposed circumferential roadway around the City of Fredericksburg.

The remaining corridor included a connector road between the planned Nine Mile Road Extension and Route 17 in Stafford County. It also involved a Route 3 bypass with new interchanges on I-95 in the City of Fredericksburg connected to the Route 3 and Route 17 interchanges via collector-distributor roadways. Additional bridges at the exiting I-95 Rappahannock River crossing would be required.

The recommended preferred alternative consisted of the westernmost crossing of the Rappahannock River. Because of a change in locality support and opposition from resource agencies, this project was terminated by VDOT when the Final EIS was being prepared.

I-95 Express Lanes Initiative

The following description of the project is taken from the project website www.95expresslanes.com:

The 95 Express Lanes project will create approximately 29 miles of HOV/HOT lanes on I-95 from Garrisonville Road in Stafford County to the Edsall Road area on I-395 in Fairfax County. The project will:

- Extend nine miles of existing HOV lanes from Dumfries to Garrisonville Road in Stafford County, which will alleviate one of the region's worst traffic back ups
- Expand existing HOV lanes from two to three lanes for 14 miles between Prince William Parkway to vicinity of Edsall Road on I-395
- Make operational improvements to the existing two HOV lanes for six miles from Route 234 to Prince William Parkway
- Add eight new or improved access points to and from HOV/HOT network at key interchanges
- Alongside the project, VDOT will also construct new Park & Ride spaces across Fairfax, Prince William, Stafford and Spotsylvania Counties.

Virginia Department of Transportation (VDOT) is delivering this project in partnership with 95 Express Lanes LLC, a joint venture between Transurban DRIVe and Fluor Virginia, Inc.

Tolls for the Express Lanes will be dynamic meaning they will change periodically based on real-time traffic conditions to keep the lanes free-flowing. Most toll-paying customers are expected to pay to use the 95 Express Lanes only a couple of times a week when they need a faster trip. HOV-3+, vanpools, motorcycles and buses travel free at all times. Unlike the existing HOV lanes, the new 95 Express Lanes will be in effect at all times including weekends. High occupancy vehicles (HOV-3+), motorcycles and transit will have free access at all times; drivers with fewer than three occupants may choose to pay a toll to use the lanes on occasions when they need to get somewhere on time.

The project has an anticipated opening date of December 2014.

Two new Express Lanes from Massaponax (milepost 126) in Spotsylvania County through the study area tying into the Express Lanes being constructed to Garrisonville Road are included in the FAMPO Constrained Long-Range Plan, although a definitive schedule and funding plan have not been developed by VDOT and regional leaders.

1.5 Conformance with Transportation Plans

As detailed below, the proposed Improvements to I-95 between Route 17 and Route 3 are in conformance with regional transportation plans.

FAMPO 2040 Constrained Long Range Plan

The Fredericksburg Area Metropolitan Planning Organization (FAMPO) and its member communities have developed a long-range comprehensive plan and strategy to address the growing demands on the region's transportation network. Central to this planning has been the need for improving mobility between I-95 and Route 3 and Route 17 respectively. FAMPO adopted the 2040 Constrained Long-Range Plan (CLRP) in April 2013 and designates $10 million for designing improvements to the Route 3 and Route 17 interchanges and four new C-D lanes across the river, connecting the interchanges.

Virginia Department of Transportation

VDOT's Six-Year Improvement Program includes $9.5 million in funding of the estimated $210 million needed for the I-95 Rappahannock River Crossing (UPC # 101595 and # 105510).

CHAPTER 2 EXISTING CONDITIONS

This section identifies the conditions that existed in the project's base year, including: existing land use; existing transportation system demand, and performance; and existing environmental conditions.

2.1 Demographics

The demographic data cited here and input into the regional travel demand model was gathered from the Fredericksburg Area Metropolitan Planning Organization's long range plan entitled *2040 Long Range Transportation Plan*. The 2040 LRTP was adopted through resolution 09-01 on April 15, 2013.

The City of Fredericksburg, and the Counties of Caroline, King George, Spotsylvania and Stafford are part of the George Washington Region. As outlined in the 2040 LRTP, the George Washington Region has been one of the fastest growing regions in Virginia. Over the last half century, the George Washington Region has experienced an average growth rate of 8.2%, with an increase in population from 64,302 in 1960 to 327,773 in 2010. In recent years, the region has experienced significant growth rates, surpassing Northern Virginia as the fastest growing region in the state on a percent population basis. Accordingly, the number of households has grown quickly in recent years as well. Between 2000 and 2010 over 28,000 additional households were added. This is a 34% increase since 2000.

Figure 2-1: George Washington Regional Population Trends

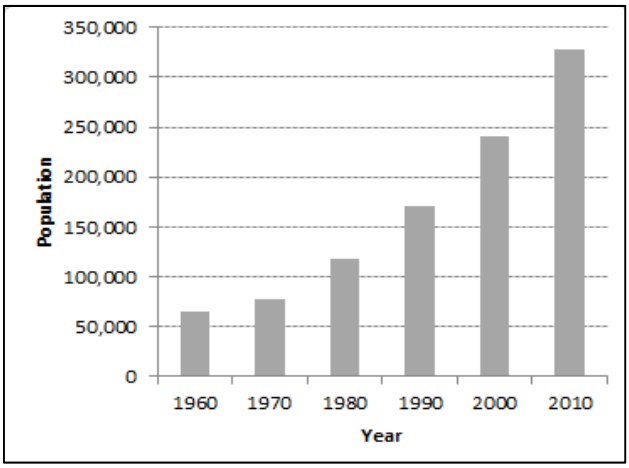
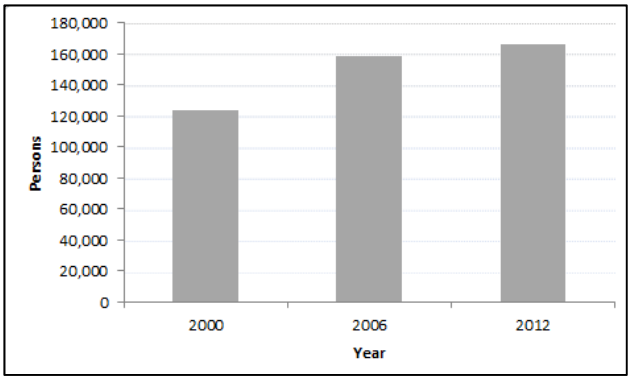


Figure 2-2: George Washington Region Labor Force Trends



The increase in population can be attributed in large part to the George Washington Region's location midway between the national and state capitols. Much of the incoming population seeks the affordable housing and the suburban and rural lifestyles available in the region, while still being able to find employment in Richmond, VA and the continually growing metropolitan area of Northern Virginia/Washington D.C.

The labor force has grown, along with the population increase. Figure 2-2, shows the yearly labor force trends between 2000 and 2012.

Over this period the number of employed persons has grown from approximately 120,000 to 165,000, an increase of about 38% or just slightly over 3% per year.

While the region serves as a bedroom community for the greater Washington, D.C. area, the number of jobs in the George Washington Region has increase in the last decade. In 2000, there were 97,424 jobs in the region and, despite the economic downturn in 2008/2009; the region's employment grew to 149,656 jobs in 2010. This is an overall increase of 54%; averaging 5% growth a year. The government sector is one of the most prominent employers in the George Washington Region. The 2040 LRTP illustrates this point, by indicating that the U.S. Department of Defense and Stafford County Schools are the first and second largest employers in the region. The number of government jobs should continue to increase as the federal government continues to decentralize and open satellite offices in the George Washington Region. In addition, Washington D.C. and Richmond are expected to continue expanding outward as companies find cheaper land on the fringes of the metropolitan areas to locate their offices. This will bring employment opportunities closer to the residents of the George Washington Region.

2.2 Existing Land Use

2.2.1 City of Fredericksburg

The proposed access project is partially located within two Land Use Planning Areas as designated by the Fredericksburg Comprehensive Plan: Celebrate Virginia and Central Park (Figure 2-3). The Celebrate Virginia Planning Area is located in the northwestern portion of Fredericksburg and is bounded by the Rappahannock River to the north and west, I-95 to the east, Fall Hill Avenue to the southeast and the Spotsylvania County border to the south. The Central Park Land Use Planning Area boundaries consist of Fall Hill Avenue to the north; I-95 to the east; Route 3 to the south, and the City-County line to the west.

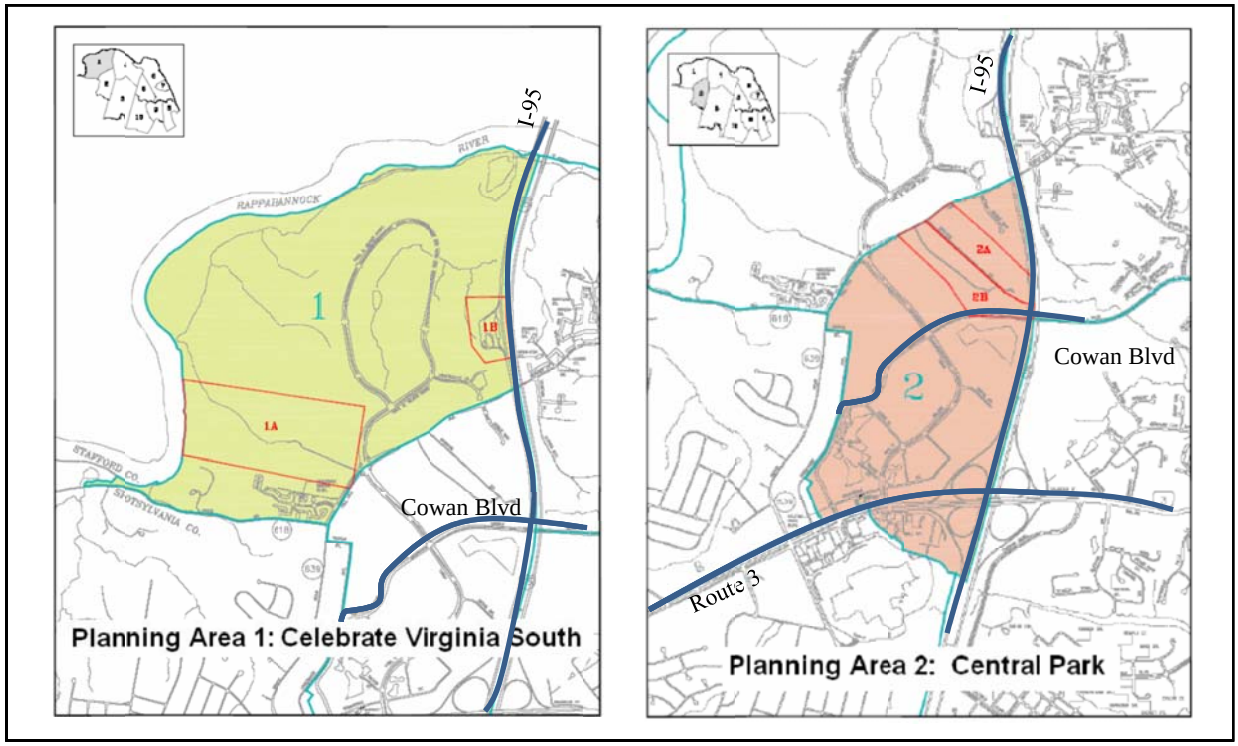
The existing land use for the Celebrate Virginia Land Use Planning Area is composed of predominately commercial-zoned parcels, containing the Celebrate Virginia tourism development. This portion of the campus includes hotels, a conference center, and numerous retail and service oriented businesses. In addition to the Celebrate Virginia development, a 129-acre conservation easement also exists to preserve Civil War resources and to screen development viewable from the Rappahannock River. A new, minor league baseball stadium and related fields, facilities, and parking areas are being considered by the City of Fredericksburg within this Planning Area.

Recommendations in the Fredericksburg Comprehensive Plan state that the Celebrate Virginia Planning Area should function as a visitor destination, attracting outside visitors to the City of Fredericksburg. To attract visitors to the area, the Comprehensive Plan promotes improving access to the area from I-95 and facilitating private development within existing infrastructure capacity while simultaneously preserving the historical and natural resources of the area.

The Central Park Land Use Planning Area is a 310-acre retail and office space complex. The Central Park complex is the major retail destination within Fredericksburg and accounts for approximately 40% of the City's tax income. Outside of the Central Park retail development,

scattered single-family housing exists along Briscoe Lane. The Comprehensive Plan states that the Central Park Planning Area should continue to support this major commercial center to boost local employment opportunities and the local tax base.

Figure 2-3: Fredericksburg Planning Areas



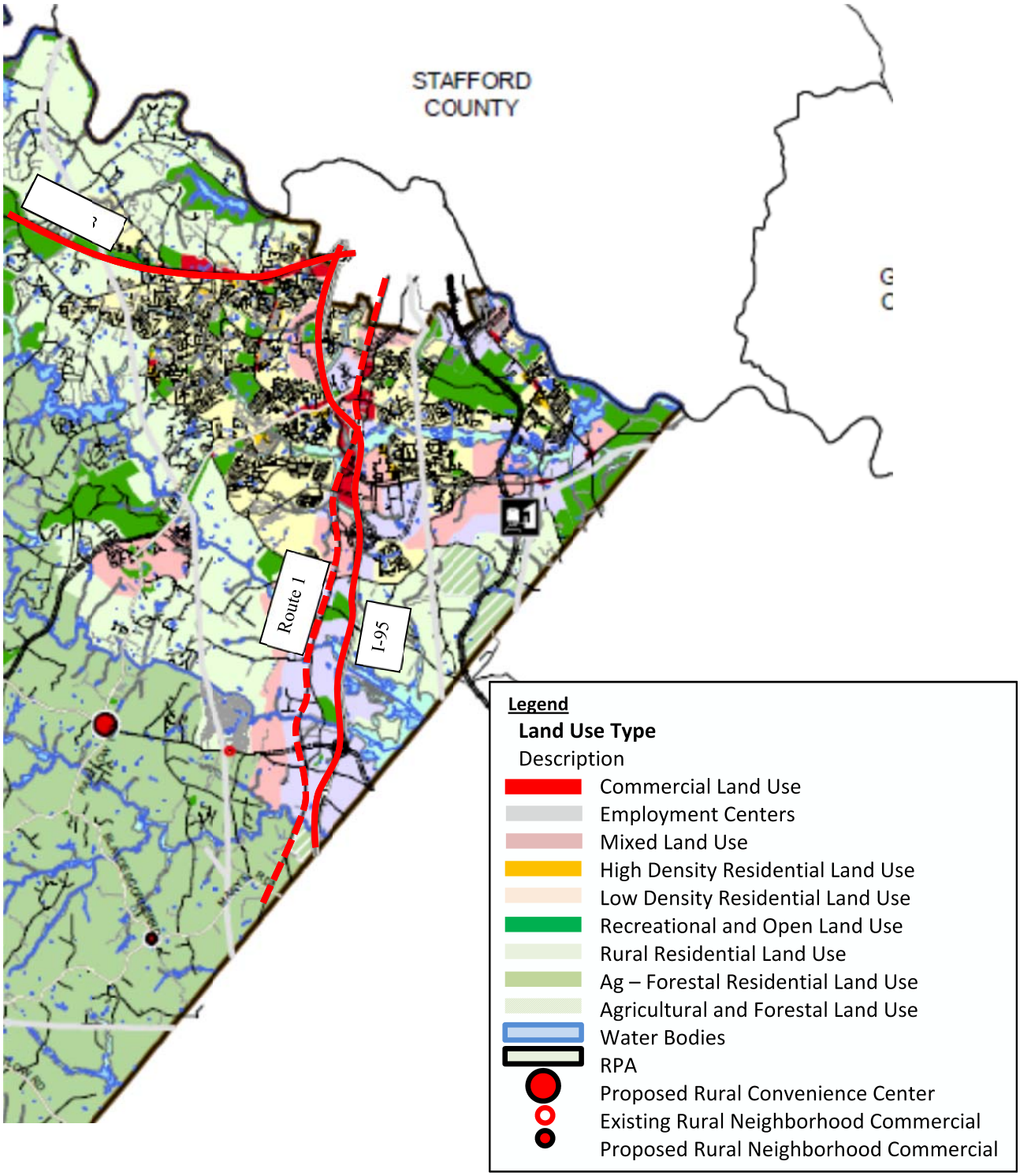
2.2.2 Spotsylvania County

The study area abuts the north/east edge of Spotsylvania County (Figure 2-4) with the south leg of the Route 3/Mall Drive intersection being located in the County. A significant portion of the traffic within the study area originates or has destinations within Spotsylvania County. The Primary Settlement District is where most of the development in the County has occurred in recent decades and is projected to accommodate the majority of future growth. The Primary Settlement District is located along two major transportation corridors, Interstate 95 and Route 3. The Primary Settlement District contains nearly all of the commercial, office, and industrial uses located in Spotsylvania in addition to residential subdivisions. The 2008 Spotsylvania Comprehensive Plan only continues to center growth and development in the Primary Settlement District along these corridors.

The Comprehensive Plan promotes the preservation of rural areas in the County by encouraging growth to occur along the major transportation corridors within the Primary Settlement District where water and sewer infrastructure already exist. The areas depicted in green represent the open space, agricultural, and rural residential land. The majority of mixed use, employment, and higher density development are focused just south of the City of

Fredericksburg and along major corridors such as Interstate 95, Route 1, Route 3, Route 17, and Route 208.

Figure 2-4: Spotsylvania Land Use Map



According to the 2008 Spotsylvania Comprehensive Plan, future growth is designated to be higher density development in the area. The plan promotes traditional neighborhood development, mixed-use development, residential infill development, and pedestrian paths. The plan also raises the possibility of transit-oriented development near the VRE station.

2.2.3 Stafford County

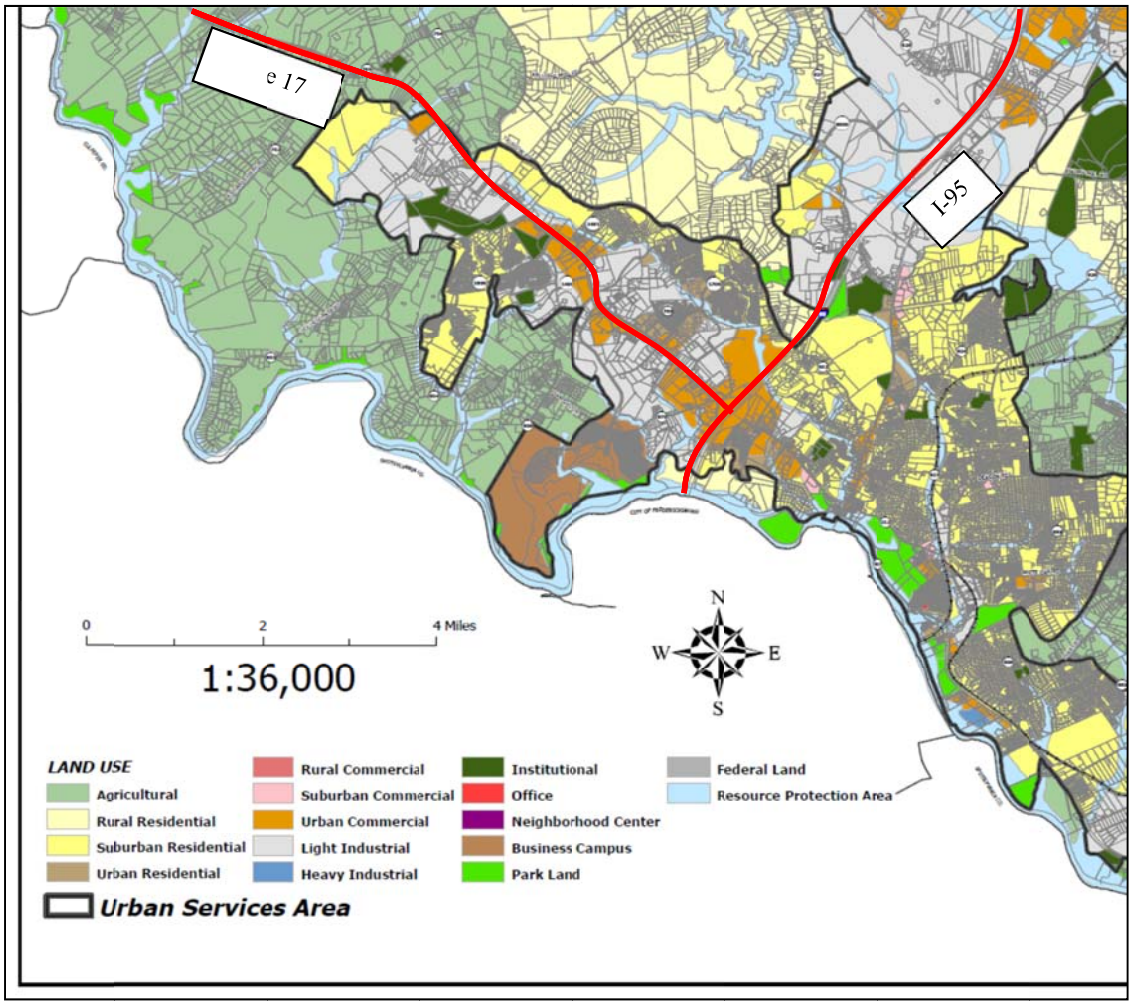
Crossing the Rappahannock River, which serves as the county line, Stafford County is the third and final jurisdiction in which the project is located. According to the Stafford County Land Use Plan, one goal, like Spotsylvania County, is to direct growth along major transportation and utility corridors. As a result, Stafford County employs the growth management technique of defining Urban Service Areas, which dictate what land areas may be served by public water and sewer lines. Due to its proximity with Route 17 and Interstate 95, much of the project area falls within Stafford County's Urban Service Area.

The project area is within a redevelopment area identified in the comprehensive plan, the Southern Gateway Redevelopment Area. The development area is along the Route 17 corridor, west of I-95. This area is adjacent to the Celebrate Virginia Planning Area in the City of Fredericksburg. The area is currently a mix of low-density retail and residential.

Similarly, to Spotsylvania County, the Stafford County Comprehensive Plan identifies Route 17 as a major transportation hub and identified it as an area for future growth. The Comprehensive Plan sees the area as a place for economic development by taking advantage of the accessibility to I-95. Overall, the County anticipates greater growth and density in Route 17 Corridor. Future land use recommendations for this area include hotels and residential developments.

Figure 2-5 shows the southwestern portion of Stafford County's Land Use Map and marks the Urban Service Area discussed above with a thick black outline. This map shows that there is a mix of land uses, including commercial, industrial and residential within the project area.

Figure 2-5: Stafford County Land Use Map



2.3 Multimodal Transportation Service

Multiple alternative travel modes exist within proximity to the project area. These travel modes include public transit, rail, park and ride facilities, an airport, and bicycle and pedestrian accommodations. The following subsections outline each mode of travel as they specifically relate to the project area.

2.3.1 Public Transportation System

Fredericksburg Regional Transit (FRED) operates three types of public transit service in the greater Fredericksburg area. These services include basic weekday service along 21 routes in four counties and the City of Fredericksburg, weekday morning and evening VRE feeder services for commuters, and late night services that operate Thursday through Sunday centering on the University of Mary Washington's (UMW) campus.

Of these services, there are nine routes that specifically function within the project area. These routes and the route service descriptions are described in Table 2-1.

Table 2-1: FRED Transit Service in Project Area

Route Number	Route Name	Service Description
F1	Fredericksburg	Operates Monday-Friday, servicing Route 1 and Route 3, ending service at the Greenbriar and Westwood Shopping Centers.
S1	Spotsylvania County	Operates Monday-Friday, servicing Spotsylvania Town Center, traveling along Route 3, then heading south on County Route 639 (Salem Church/Leavells Rd), ending service near the Route 1 interchange with I-95.
F4	Fredericksburg	Operates Monday-Friday, travels north on Route 17 and Route 1, then heading west along Fall Hill Ave and ending at Eagle Village Shopping Center.
D1	Stafford County South	Operates Monday-Friday, beginning at train station on Caroling Street, then heads north along King's Highway to Route 17, then circling on residential streets, ending back at the train station on Caroline Street.
D2	Stafford County South	Operates Monday-Friday, servicing Route 17 and the neighborhoods along Plantation Drive, ending service at FRED Central.
E1	Eagle Express Downtown	Operates Saturday -Sunday during the University of Mary Washington academic year. The route starts at the university campus, heads north along the Rappahannock River, then circles on Fall Hill Ave, and then returns to campus on Route 1.
E2	Eagle Express Central Park	Operates Thursday-Sunday during the University of Mary Washington academic year, and starts at the university campus then south along Route 1, then heads west under Interstate 95, circling back to campus.
E2LN	Eagle Express Late Night	Operates Friday-Saturday during the University of Mary Washington academic year, and starts at the university campus then south along Route 1, then heads west under Interstate 95, circling back to campus.
VS1	VRE Spotsylvania	Operates Monday-Friday, connecting the Martins and Gordon Road commuter lots to the Amtrak/VRE station via Route 3.

Source: FRED Transit 2013

Commuter bus services are also provided by two private companies: Martz Virginia and Quick's Bus Company. Martz and Quick's offer several commuter express routes from the Fredericksburg Area to the Washington DC area during the AM and PM peak commute times. Patrons are able to access commuter transit services at the various park and ride lots around the George Washington Region, including the Falmouth commuter lot on Route 17.

2.3.2 Rail

Two agencies provide rail service within close proximity to the project site. A train station located at 200 Lafayette Blvd. in downtown Fredericksburg provides access to Virginia Railway Express (VRE) and Amtrak services. VRE is a commuter rail service that operates Monday through Friday, generally traveling northbound to Washington, D.C. during morning commute times, and southbound in the evening. Rail alignment generally follows the I-95 corridor and is shared by Amtrak passenger service.

Amtrak, a national passenger rail service, operates the Carolina/Piedmont Route and the Northeast Regional Route via Fredericksburg. These routes operate along the eastern seaboard, connecting to cities such as Washington D.C., Baltimore, Philadelphia, New York,

Boston, and Charlotte. These routes also make connections to routes servicing the South, Midwest and Western United States.

The Amtrak/VRE station is less than five miles from the project site and can be accessed via FRED transit services.

2.3.3 Park and Ride Service

Three park and ride facilities are located outside the study area but remove cars that would travel through the study area. These facilities include the Salem Church Commuter Lot, the Gordon Road Commuter Lot, and the Route 17 Commuter Lot. Lot characteristics are described in the table below. As shown in Table 2-2, all of the lots are served by FRED transit. The Gordon Road Commuter Lot will be expanded to 1,061 spaces in 2015.

Table 2-2: Commuter Lots in Project Area

Lot Name	*Location*	*Number of Spaces*	*Served by Transit*
Route 17	Warrenton Rd & Falls Run Dr	1052	X
Salem Church Lot	Plank Rd & Salem Church Rd	675	X
Gordon Road	Plank Rd & Gordon Road	600 to 1061 (future)	X

2.3.4 Bicycle and Pedestrian

The George Washington Regional Bicycle and Pedestrian Plan states that the increasing traffic volumes and lack of proper facilities and amenities has created a transportation environment not conducive to bicycling or walking. In fact, the bicycle and pedestrian plan points out that according to the 2006-2010 American Community Survey, 2% of George Washington Region residents bike or walk to work. This is lower than the 3.3% national average. As a result, the plan establishes goals to complete an accessible regional network of bicycle and pedestrian facilities and increase the public's awareness and knowledge of non-motorized transportation.

2.3.5 Air

The Stafford Regional Airport is located about four miles north of the study area adjacent to I-95. The airport covers an area of 566 acres and contains one asphalt runway measuring 5,000 by 100 feet. According to its website, the facility can accommodate 75,000 annual operations and serves mainly business and recreational aircraft owners. The Stafford Regional Airport is a reliever airport and not a significant traffic generator.

2.4 Existing Roadway Network

I-95 runs north to south through the study area. The Rappahannock River bisects the study area creating a barrier for north-south travel with few crossings. Route 1 just east of I-95, is the only other north/south route in the study area. Both VA 3 (Route 3) and US 17 (Route 17) are the

primary routes providing east-west travel in the study area. Fall Hill Avenue and Cowan Boulevard are the only other crossings of I-95 in the study area.

2.5 Existing Interchanges

The project study area currently has two full service interchanges that provide access to and from I-95. The Interstate 95 interchange at Exit 130 provides northbound and southbound access to and from Route 3. The Interstate 95 interchange at Exit 133 provides full access to Route 17. Between these two interchanges lie the Rappahannock River and two overpasses south of the river (Fall Hill Avenue and Cowan Boulevard). The next closest interchanges to the study area are at Exit 126 (US 1 / Massaponax) to the south and Exit 136 (US 1 / Stafford Airport), 4 miles and 3 miles respectively from the study area. These adjacent interchanges are far enough away from the Route 3 and Route 17 interchanges that they do not affect the operations or safety at the Route 3 and Route 17 interchanges and thus are not analyzed in this report.

2.5.1 I-95 Interchange at Route 3 (Exit 130)

This interchange is currently designed as a full cloverleaf interchange with loop ramps with radii as small as 250 feet (maximum 30 m.p.h. design speed). This interchange offers access to the City of Fredericksburg to the east as well as Spotsylvania and Culpeper, further to the west. The area immediately adjacent (east and west) of this interchange consists of dense commercial retail development. The increasing number of vehicles due to development in this area makes this interchange heavily used.

2.5.2 I-95 Interchange at Route 17 (Exit 133)

This interchange is also currently designed as a full cloverleaf interchange with loop ramps with radii as small as 250 feet (maximum 30 m.p.h. design speed). Unlike the Route 3 interchange to the south, this interchange features a Collector-Distributer Roadway (C-D Roadway) in the northbound direction. Instead of merging and diverging directly onto northbound I-95, vehicles merge on the parallel C-D roadway first and then onto the interstate. This interchange offers access to northern Fredericksburg to the east and Stafford County, Warrenton and other locations in northwestern Virginia to the west, eventually connecting with Interstate 81 near Winchester Virginia. This connection with I-81 makes this a heavily utilized interchange. The area immediately adjacent (east and west) of this interchange consists of commercial retail development with many hotels and shopping centers.

2.6 Existing Traffic Volumes

Existing and historic traffic volumes were collected at key intersections and roadway segments within the study area for the original I-95 Access Study (approved by FHWA in April 2011). In coordination with VDOT and FHWA, it was decided that the 2008 traffic volumes used in the I-95 Access Study are representative of the existing traffic conditions in 2013 and will be used as the existing traffic volumes and as a base to project future traffic volumes in this IMR. This section will present these representative 2013 volumes. The count data and methodology used to turn these counts into representative volumes and the more information on the decision to use 2008 counts as existing volumes is provided in Appendix A – Existing Conditions.

2.6.1 I-95 Mainline and Ramp Traffic Volumes

VDOT maintains continuous count stations on select roadways throughout the Commonwealth of Virginia. The closest vehicle classification count station along I-95 is located at mile marker 120, south of the project study area. Conducting tube counts along the I-95 mainline is both difficult and cost prohibitive; therefore, the VDOT count station was utilized in developing I-95 Mainline traffic volumes within the study area. Traffic count data was obtained from the continuous count station during the same time period that 96-hour tube counts were conducted at all I-95 interchange ramps at Exit 126, 130 and 133 for the original I-95 Access Study (only 72-hours of good data was obtained for the I-95 NB to US 17 EB/SB on-ramp and the US 17 EB/SB to I-95 SB on-ramp). To determine the northbound and southbound mainline I-95 traffic volumes in the study area (adjacent to the Route 3 and Route 17 interchanges), the tube-counted ramp volumes were either added or subtracted from the continuous count station volumes, based on ramp type and direction. Representative weekday I-95 (mainline and ramp) volumes were determined by averaging the developed Tuesday-Friday weekday counts. Based on historic data, the month of May appears to represent above average traffic volumes. Additional detail on the methodology used is shown in Appendix A - Existing Conditions (Page A-1). Resulting I-95 mainline ADT volumes are shown below in Table 2-3.

Table 2-3: I-95 Mainline 2013 Existing Average Daily Volume

Roadway / Location	Northbound	Southbound	Total
I-95 - South of Exit 130 (VA 3)	58,000	57,100	115,100
I-95 - At River	76,800	75,800	152,600
I-95 - North of Exit 133 (US 17)	68,300	66,400	134,700

As shown in Table 2-3, the traffic volumes along I-95 increase north of Route 3 and then drop off north of Route 17. The reasons include a significant volume of traffic makes a horseshoe movement east along Route 3 to I-95 and then north to Route 17 and back west towards Warrenton and returns the reverse movement. During the peak hours up to 20-24% of the traffic using some the heaviest volume Route 3 and Route 17 ramps are making this horseshoe movement. Other heavy traffic movements include from Route 3 to Northern Virginia via I-95 and from Richmond to Route 17. This results in extremely heavy traffic volumes on I-95 for vehicles making difficult lane changes between the Route 3 and Route 17 Interchanges. Historically this has been the traffic pattern in the Fredericksburg area.

Truck percentages were obtained from VDOT continuous count stations. I-95 northbound and southbound truck percentages were pulled for the week of May 12, 2013 for comparison with the truck percentages from the original I-95 Access Study (approved by FHWA in April 2011). The highest truck percentages from either 2008 or 2013 counts were used in the analysis and shown in Table 2-4. A lack of vehicle classification data on the interchange ramps prevents the development of different truck percentages on Mainline I-95 at the Rappahannock River

crossing and also on the ramps themselves. The same peak hour mainline truck percentages where assumed for the interchange ramps for their respective direction of travel on I-95.

Table 2-4: I-95 Mainline 2013 Average Truck Percentages

Peak Hour and Direction of Travel	Average Truck Percentage
AM Peak Hour (Northbound I-95)	13.7 %
AM Peak Hour (Southbound I-95)	17.6 %
PM Peak Hour (Northbound I-95)	12.3 %
PM Peak Hour (Southbound I-95)	12.5 %

2.6.2 Intersection Traffic Volumes

Single day intersection turning movement counts at key intersections along Route 3 east and west of I-95 and along Route 17 northwest and southeast of I-95 were conducted as part of the original I-95 Access Study (approved by FHWA in April 2011). Due to recent development at the Route 17/Sanford intersection, counts from 2012 were used for that intersection. In coordination with VDOT and FHWA, it was decided that the 2008 turning movement volumes used in the I-95 Access Study are representative of the 2013 traffic conditions and will be used as the existing turning movement volumes in this IMR for the following intersections:

1. VA 3 (Plank Road) / Central Park Boulevard / Mall Drive;
2. VA 3 (Plank Road) / Carl D. Silver Parkway / Mall Court;
3. VA 3 (Plank Road) / Gateway Boulevard (Route 693) / Ramseur Street;
4. US 17 (Warrenton Road) / McLane Drive / Hardee's Access;
5. US 17 (Warrenton Road) / Sanford Drive (Route 670);
6. US 17 (Warrenton Road) / Short Street (Route 1034) / Driveway;

The AM and PM peak hour volumes for each intersection were determined from these counts and are shown in **Figure 2-6A and Figure 2-6B in Volume II**, which also include I-95 ramp volumes. These AM and PM peak hour turn movement volumes were used in the capacity analysis discussed in the following chapter. Peak hour factors and truck percentages for each movement for each intersection are shown in Appendix A – Existing Conditions with the intersection turn movement counts (starting on Page A-20) and in the Highway Capacity Output Files (starting on Page A-68). The truck percentages are much lower on Route 3 and Route 17 than on I-95.

2.6.3 Arterial Roadway Traffic Volumes – Route 3 and Route 17

Existing and historic traffic volumes were collected at key intersections and roadway segments within the study area for the original I-95 Access Study (approved by FHWA in April 2011). In coordination with VDOT and FHWA, it was decided that the 2008 traffic volumes used in the I-95 Access Study are representative of the existing traffic conditions in 2013 and will be used as the existing traffic volumes and as a base to project future traffic volumes in this IMR. This section will present these representative 2013 volumes. The count data and methodology used to turn these counts into representative volumes and the more information on the decision to use 2008 counts as existing volumes is provided in Appendix A – Existing Conditions.

96-hour (4 days) tube counts were conducted on Route 3 and Route 17 as part of the original I-95 Access Study. These counts were conducted to help develop Average Daily Traffic (ADT) volumes to the east and west of each interchange. Adjacent intersection turn movements were also used to develop ADT volumes on Route 3 and Route 17. Detailed methodology on developing arterial ADT volumes can be found in Appendix A - Existing Conditions (Page A-12). Resulting arterial ADT volumes are shown below in Table 2-5. Both Route 3 and Route 17 carry extremely high daily volumes (over 70,000 vehicles per day) for non-limited access facilities.

Table 2-5: Arterial 2013 Existing Average Daily Volume

Roadway / Location	2013 Existing Conditions Daily Volume		
	Eastbound	Westbound	Total
VA 3 - East of I-95 Interchange	25,000	24,800	49,800
VA 3 - West of I-95 Interchange	39,900	30,800	70,700

Roadway / Location	2013 Existing Conditions Daily Volume		
	Westbound/ Northbound	Eastbound/ Southbound	Total
US 17 - Southeast of I-95 Interchange	16,700	22,400	39,100
US 17 - Northwest of I-95 Interchange	32,200	32,500	64,700

2.7 2013 Existing Traffic Operations

This section documents the existing conditions of key intersections and ramp junctions at the existing interchanges: Exit 133 (Route 17) and Exit 130 (Route 3). Capacity analyses and queue analyses were conducted for the baseline conditions at each of the key intersections in the area of influence using Highway Capacity Software (HCS2010) which adheres to the Highway Capacity Manual (HCM) methodology. Capacity analyses of the interstate mainline segments, existing ramp junctions and weave movements were also performed using HCS2010. Default and adjusted parameters in the analysis software are listed and addressed

in Appendix A - Existing Condition s (Page A-136). CORSIM models were also d eveloped for each peak hour to confirm the results of the HCS analysis (Section 2.8).

The key output from th e capacity analyses is level of service. Leve l of service (LOS) is a qualitative measure of the operatin g conditions of a traffic stream on a transportation facility. There are six LOS categories (LOS A through LOS F) used to rate facilit ies. LOS A represents the best operating conditions with no congestion and LOS F the worst with heavy congestion. AASHTO recommends LOS C as desirable and should be sought; however in most urban areas it is not alw ays obtainable in peak travel periods. The LOS analysis for existing conditions is summarized below. P erformance measures and threshold values th at determine LOS are different for different transportation facility typ es. A list of performa nce measures and LOS threshold values are contained in Appendix A – Existing Conditions (Page A-144).

2.7.1 Intersection Analysis – 2013 Existing Traffic Operations

The AM an d PM peak hours at the six key i ntersections were analyzed to identify existing deficiencies. Brief descriptions of the analysis results for each intersection are presented below. A summary of the 2013 Existing Co nditions intersection capacity analysis, including LOS and overall intersection delay (seconds/vehicle), is shown in Table 2-6. Th e queue analysis results are shown in Table 2-6B. Detailed HCS analysis reports are presented in Appendix A - Existing Conditions (Page A-68).

Intersection #1 (VA 3 & Mall Dr / Central Park Blvd): This intersection currently operates at overall LOS B during t he AM Pea k Hour and overall LOS F during the PM Peak Hour. Substantial volumes on the northbound and southbound approaches result in LOS E and LOS F on these approaches during both peak hours. LOS E also currently exists on the eastbound and westbound left turn mo vements during both peak hours, and on the eastbound through movement during the PM Peak Hour.

Intersection #2 (VA 3 & Mall Ct / Carl D Silver Pkwy): During the AM Pea k Hour, this intersection currently operates at LOS C, ho wever, during the PM Peak Hour, the overall intersection LOS is F. Many movements operate at LOS E and F in cluding the westbound Route 3 through movement during the PM Peak Hour.

Intersection #3 (VA 3 & Gateway Blvd / Ramseur St): This intersection currently operates at overall LOS C during both peak hours. Th e northbound left turn movement is the only movement operating at LOS E or F during an y of the peak hours and does so du ring the PM Peak Hour.

Intersection #4 (US 17 & Hardee's Access / McLane Dr): Overall interse ction LOS is currently LOS C or better. LOS E or LOS F do not currently exist on any individual movements during the AM Peak Hour. During the PM Peak Hour, the Route 17 left tur n movements currently operate at LOS E.

Intersection #5 (US 17 & Sanford Dr): Current operations at this intersection include overall LOS D during the AM Peak Hour and overall LOS F during the PM Peak Hour. During the AM Peak Hour, the majority of movements operate at unacceptable LOS. During th e PM Peak Hour, substantial delays currently exist on many of the movements.

Table 2-6A: 2013 Existing Conditions Intersection LOS Summary

Intersection		Approach	Movement	AM Peak Hour Exisiting Condition						PM Peak Hour Exisiting Condition					
				Movement		Approach		Intersection		Movement		Approach		Intersection	
				Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS
1	Route 3 / Mall Dr. / Central Park Blvd.	NB	Left	65.0	E	115.0	F	15.1	B	73.9	E	520.3	F	103.8	F
			Through	65.9	E					76.7	E				
			Right	125.1	F					744.6	F				
		SB	Left	68.8	E	76.7	E			70.8	E	276.6	F		
			Through	68.8	E					69.8	E				
			Right	79.0	E					452.0	F				
		EB	Left	62.7	E	8.9	A			67.4	E	64.3	E		
			Through	3.6	A					64.9	E				
			Right	0.1	A					43.1	D				
		WB	Left	66.6	E	11.4	B			58.2	E	18.1	B		
			Through	6.6	A					9.1	A				
			Right	8.7	A					12.7	B				
2	Route 3 / Carl D. Silver Pkwy	NB	Left	70.9	E	70.2	E	29.7	C	76.8	E	76.0	E	97.8	F
			Through	70.9	E					76.8	E				
			Right	69.5	E					74.9	E				
		SB	Left	57.9	E	57.2	E			120.3	F	107.7	F		
			Through	51.8	D					51.2	D				
			Right	53.4	D					71.3	E				
		EB	Left	62.6	E	23.1	C			63.0	E	14.5	B		
			Through	21.1	C					7.3	A				
			Right	24.5	C					5.7	A				
		WB	Left	69.5	E	34.6	C			75.7	E	143.0	F		
			Through	31.0	C					74.1	F				
			Right	41.7	D					345.6	F				
3	Route 3 / Gateway Blvd.	NB	Left	52.6	D	48.9	D	20.6	C	87.9	F	74.3	E	27.5	C
			Through	38.2	D					38.0	D				
			Right	40.9	D					54.4	D				
		SB	Left	48.7	D	49.8	D			48.7	D	48.8	D		
			Through	50.2	D					49.0	D				
			Right	50.2	D					49.0	D				
		EB	Left	47.2	D	25.4	C			47.1	D	27.8	C		
			Through	25.4	C					27.4	C				
			Right	23.2	C					27.9	C				
		WB	Left	46.0	D	8.2	A			52.5	D	11.9	B		
			Through	5.3	A					5.3	A				
			Right	3.0	A					0.0	A				
4	Route 17 / McLane Dr.	NB	Left	54.1	D	21.4	C	25.8	C	68.9	E	2.7	A	19.1	B
			Through	21.5	C					2.4	A				
			Right	1.1	A					0.0	A				
		SB	Left	53.6	D	30.9	C			68.0	E	31.2	C		
			Through	30.7	C					31.2	C				
			Right	17.6	B					14.2	B				
		EB	Left	32.6	C	32.6	C			46.6	D	46.6	D		
			Through	32.6	C					46.6	D				
			Right	32.6	C					46.6	D				
		WB	Left	33.1	C	33.1	C			48.0	D	48.0	D		
			Through	33.1	C					48.0	D				
			Right	33.1	C					48.0	D				
5	Route 17 /Sanford Dr.	NB	Left	63.2	E	80.5	F	36.4	D	101.4	F	2489.3	F	291.7	F
			Through	54.0	D					74.3	E				
			Right	89.3	F					2662.5	F				
		SB	Left	61.3	E	61.0	E			72.5	E	71.6	E		
			Through	60.9	E					59.6	E				
			Right	57.8	E					60.8	E				
		EB	Left	57.6	E	38.5	D			59.5	E	60.2	E		
			Through	38.5	D					60.9	F				
			Right	21.1	C					23.1	C				
		WB	Left	54.6	D	29.8	C			72.4	E	36.1	D		
			Through	29.0	C					33.0	C				
			Right	15.3	B					21.3	C				
6	Route 17 /Short St.	NB	Left	34.7	C	34.3	C	34.9	C	42.1	D	41.4	D	105.6	F
			Through	34.7	C					42.1	D				
			Right	31.4	C					39.1	D				
		SB	Left	40.9	D	40.9	D			44.8	D	44.8	D		
			Through	40.9	D					44.8	D				
			Right	40.9	D					44.8	D				
		EB	Left	52.1	D	50.0	D			166.9	F	157.6	F		
			Through	50.3	D					158.5	F				
			Right	22.1	C					19.9	B				
		WB	Left	19.2	B	20.1	C			21.7	C	15.2	B		
			Through	20.2	C					15.3	B				
			Right	20.0	B					14.9	B				

Notes: All results from HCS 2010. Intersections 1,2,3,5,6 major movement is E-W; Intersections 4 major movement is N-S.

Intersection #6 (US 17 & Short St / Driveway): All movements at this intersection are currently operating at LOS D or better in the AM peak hour. During the PM Peak Hour, the overall intersection and the eastbound/southbound Route 17 left turn and through movements operate at LOS F.

As can be seen from this LOS analysis, to accommodate the substantial though volumes along Route 3 and Route 17 requires allocating most of the green time to the through movements causing the cross street approaches and mainline left turns to fail and experience a poor LOS. Many of these intersections that are failing will require capacity improvements more significant than signal timing optimization if the mainline through volumes are not reduced.

Queuing

The queue analysis was also conducted using the HCS 2010 software and the results are shown in Table 2-6B. The results show that multiple movements at intersections within the study area have queue lengths that exceed the available storage. Most of the locations are on minor approaches which is due to the green time at the signals needing to be devoted to the major through movements because of the high volumes. However, during the PM peak hour, the queue length for the westbound right turn at the intersection of Route 3 and Carl D. Silver Parkway greatly exceeds the available storage. The queue then causes the ramp from southbound I-95 to back up usually causing significant delays on southbound I-95. During the AM peak hour on Route 17, the queue length for the eastbound approach at the intersection with Sanford Drive (#5) exceeds the distance between this intersection and the upstream intersection with McLane Drive (#4).

The CORSIM model confirms the HCS2010 results however, the queue spill backs from the above mentioned intersections greatly impacts the main direction of travel on both the Route 3 and Route 17 corridors.

Table 2-7B: 2013 Existing Conditions Intersection Queue Summary

Intersection		Approach	Movement	Storage (ft)	Queue Length (ft) Existing Condition AM Peak Hour	Queue Length (ft) Existing Condition PM Peak Hour
1	Route 3 / Mall Dr. / Central Park Blvd.	NB	Left	425	5	88
			Through	425	25	113
			Right	150	208	870
		SB	Left	250	8	105
			Through	2750	8	95
			Right	250	78	705
		EB	Left	475	130	168
			Through	900	25	623
			Right	900	0	98
		WB	Left	675	45	240
			Through	825	48	118
			Right	675	63	168
2	Route 3 / Carl D. Silver Pkwy	NB	Left	-	-	-
			Through	50	20	35
			Right	50	18	25
		SB	Left	475	168	600
			Through	1250	5	13
			Right	495	43	315
		EB	Left	250	73	145
			Through	800	425	78
			Right	250	8	3
		WB	Left	400	23	40
			Through	3675	188	843
			Right	650	400	1845
3	Route 3 / Gateway Blvd.	NB	Left	400	185	320
			Through	4500	5	0
			Right	400	63	163
		SB	Left	650	8	8
			Through	650	18	3
			Right	650	-	-
		EB	Left	350	23	20
			Through	3675	230	283
			Right	450	150	243
		WB	Left	275	35	85
			Through	375	40	40
			Right	375	0	0
4	Route 17 / McLane Dr.	NB	Left	35	13	10
			Through	35	223	28
			Right	35	3	0
		SB	Left	875	20	10
			Through	875	398	635
			Right	875	10	8
		EB	Left	-	-	-
			Through	1000	18	15
			Right	-	-	-
		WB	Left	-	-	-
			Through	845	28	50
			Right	-	-	-
5	Route 17 /Sanford Dr.	NB	Left	425	50	45
			Through	875	5	5
			Right	400	133	1470
		SB	Left	850	65	173
			Through	475	55	18
			Right	360	13	5
		EB	Left	580	10	5
			Through	845	468	865
			Right	845	8	23
		WB	Left	275	165	250
			Through	2750	508	490
			Right	400	83	98
6	Route 17 /Short St.	NB	Left	-	-	-
			Through	1000	48	48
			Right	100	5	15
		SB	Left	-	-	-
			Through	35	8	8
			Right	-	-	-
		EB	Left	2750	413	1215
			Through	2750	373	1075
			Right	275	20	30
		WB	Left	150	5	3
			Through	3000	238	185
			Right	3000	240	188

2.7.2 I-95 Mainline and Ramp Junction Analysis – 2013 Existing Traffic Operations

The I-95 Mainline segments and ramp junctions at interchanges were analyzed for 2013 Existing Conditions, again using HCS2010. AM and PM Peak Hour volumes were analyzed to identify existing deficiencies. A summary of the 2013 Existing Conditions Mainline and Ramp Junction analysis, including LOS and density (passenger cars/mile/lane), is shown in **Figure 2-7 in Volume II**. Detailed HCS2010 mainline and ramp junction analysis reports are presented in the Appendix A - Existing Conditions (starting on Page A-82).

As shown in **Figure 2-7 in Volume II**, north of Route 3 the I-95 Mainline northbound segments are currently operating at LOS E in the AM peak hour. In the PM peak hour, the I-95 Mainline southbound segments, north of Route 3, are operating at poor levels of service; mostly LOS F. LOS C or better exists on the southbound segments during the AM Peak Hour and the northbound segments during the PM Peak Hour.

The ramp junctions at the interchanges of I-95 have a similar trend as the mainline. Unacceptable LOS currently exists at some of the northbound ramp junctions during the AM Peak Hour and some of the southbound ramp junctions during the PM Peak Hour. The weave movement along I-95 Northbound at Route 3 and Route 17 interchanges are currently operating at LOS F during the AM Peak Hour.

As can be seen from the analysis, I-95 has undesirable congestion and delay between the Route 3 and the Route 17 Interchanges. The worst congestion is in the northbound direction during the AM peak hour and the southbound direction during the PM Peak hour corresponding to the heavy commuting patterns between Route 3 and Route 17 and between Fredericksburg area and Northern Virginia. The heaviest volume ramps all exceed their capacity, including the Route 17 EB/SB to SB I-95 on-ramp and NB I-95 C-D Road to Route 17 WB/NB off-ramp, and the Route 3 SB to WB off-ramp and Route 3 EB to NB on-ramp. Other ramp congestion is more attributed to the heavy mainline volumes.

2.8 2013 Existing Conditions CORSIM Analysis

CORSIM micro-simulation analysis was performed on the I-95 Mainline and on the Route 3 and Route 17 interchanges. The CORSIM software provides a visual and analytical representation of traffic operations. HCS2010 software is limited in fact that the software analyzes mainline freeway segments, ramp junctions, and intersections as stand-alone or independent facilities. HCS2010 does not take into account upstream and downstream operations. CORSIM also has the added benefit of providing validation of traffic operations. The CORSIM network created for this study area was validated by travel times runs on the I-95 corridor as well as identifying queuing locations and lengths along I-95, Route 3 and Route 17. CORSIM analysis results for I-95 Mainline and Ramp Junctions were generated for the same locations as those completed with HCS (**shown in Figure 2-7 in Volume II**). Note that the discrepancies in the densities and speeds are a result of the differences of the functionality of the software. The results of the CORSIM network consist of the average of 10 simulation runs. Table 2-7 presents the results of the CORSIM model runs. The results confirm those shown for the HCS analysis with problem areas being the merge and diverge areas of ramps with heavy volumes in the northbound direction during the AM peak hour and the southbound direction during the PM peak hour. Additional detail on CORSIM micro-simulation methodologies and calibration are provided in

Appendix A – Existing Conditions (Page A-136). Densities and speed by lane an d roadway segment from the CORSIM microsimulation is shown on g raphics in Appendix A – Existing Conditions (Page A-125).

Table 2-8: CORSIM Results for 2013 Existing Conditions

Northbound I-95 Mainline & Ramp Analysis			2013 Existing			
			AM Peak Hour		PM Peak Hour	
Roadway	Location	Analysis ID	Vehicle Density (pc/mi/ln)	Vehicle Speed (mph)	Vehicle Density (pc/mi/ln)	Vehicle Speed (mph)
I-95 NB Mainline	South of Route 3 Interchange	Mainline Segment 1	18.0	67.6	17.0	67.9
Route 3 Interchange Ramps	I-95 NB **Diverge** to Route 3 EB	D-1	16.6	67.3	15.6	67.6
	Route 3 EB Merge to I-95 NB diverge - **Weave**	W-1	25.4	50.9	17.7	56.0
	Route 3 WB **Merge** to I-95 NB	M-1	27.1	56.4	16.8	62.8
I-95 Mainline	Route 3 to Route 17	Mainline Segment 2	28.5	64.3	19.1	66.2
I-95 Mainline	Route 3 to Route 17	Mainline Segment 3	28.9	63.4	19.2	65.8
Route 17 Interchange Ramps	I-95 NB **diverge** to I-95 C/D Roadway	D-2	26.7	57.2	16.7	62.9
	I-95 C/D Roadway **diverge** to Route 17 Bus SB	D-3	19.4	46.3	13.7	47.1
	Route 17 SB Merge to I-95 NB diverge - **Weave**	W-2	36.8	30.6	19.0	47.1
	Route 17 Bus NB **merge** to I-95 C/D Roadway	M-2	19.8	43.6	8.8	47.1
	I-95 C/D Roadway **merge** to I-95 NB	M-3	22.7	60.2	13.2	65.0
I-95 Mainline	North of Route 17 Interchange	Mainline Segment 4	25.6	60.2	15.4	66.7

Southbound I-95 Mainline & Ramp Analysis			2013 Existing			
			AM Peak Hour		PM Peak Hour	
Roadway	Location	Analysis Type	Vehicle Density (pc/mi/ln)	Vehicle Speed (mph)	Vehicle Density (pc/mi/ln)	Vehicle Speed (mph)
I-95 SB Mainline	North of Route 17 Interchange	Mainline Segment 4	12.9	69.0	27.2	66.9
Route 17 Interchange Ramps	I-95 SB diverge to Route 17 NB	D-4	12.0	67.8	25.6	65.5
	Route 17 NB Merge to I-95 SB diverge - **Weave**	W-3	9.4	60.7	22.8	54.8
	Route 17 SB **merge** to I-95 SB	M-4	14.4	54.9	37.2	45.0
I-95 SB Mainline	Route 17 to Rest Area	Mainline Segment 3	14.1	66.9	37.2	55.8
Rest Area	Rest Area - Diverge	D-5	14.1	66.5	34.4	50.8
	Rest Area - Merge	M-5	13.4	66.1	48.2	43.3
I-95 SB Mainline	Rest Area to Route 3	Mainline Segment 2	14.2	66.2	52.4	38.5
Route 3 Interchange Ramps	I-95 SB **Diverge** to Route 3 WB	D-6	11.8	64.2	40.7	40.3
	Route 3 WB Merge to I-95 SB diverge - **Weave**	W-4	9.3	62.5	16.7	60.1
	Route 3 EB **Merge** to I-95 SB	M-6	9.3	66.2	18.0	63.6
I-95 SB Mainline	South of Route 3 Interchange	Mainline Segment 1	10.7	67.6	20.5	65.7

2.9 Existing Safety Concerns

A crash analysis covering the years 2005-2008 was included as part of the I-95 Access Study. This study updates t he same analysis using the most recent 3 -year data (2010-2012) Comparisons between t he original and updated analysis are also discussed. VDOT pro vided crash data developed from the Highway Traffic R oadway Information System (HTRIS) for both studies to enable the analysis of historical data for the same study area.

The most r ecent three years of V DOT's recent crash data (2010-2012) was ob tained and included a total of 1,180 crashes along the following five roadway segments to be analyzed:

- Route 3 – Gateway Boulevard to Carl D Silver Parkway
- I-95 – within the Route 3 Interchange area
- I-95 – Route 3 to Route 17
- I-95 – within the Route 17 Interchange area
- Route 17 – Stanstead Road / Sanford Drive to Short Street

The most three recent years have significantly more accidents that was observed during the 2005-2008 time period as a total of 704 crashes occurred along the five roadway segments listed above. However, the 2005-2008 data only included one year of data for Route 3 versus three years for the 2020-2012 data. Removing Route 3 from the totals results in 809 crashes between 2010 and 2012 versus 640 crashes between 2005 and 2008; still a large increase.

The crash rates of these roadway segments were analyzed and compared to statewide averages of the same roadway type. Based on the most recently published VDOT Average Crash Rates (2012), the statewide average crash rate for interstates was 72 crashes per 100-Million Vehicle Miles Traveled (VMT) and for primary roadways the statewide average was 108 crashes per 100-Million VMT. The analysis results are shown in Table 2-8.

All of the five analyzed segments are currently operating with a crash rate above the statewide average with the same roadway type. The Route 17 and Route 3 segments across I-95 are currently operating with a crash rate of almost three to four times the statewide average for primary roadways respectively. The segments of I-95 within the Route 3 Interchange and Route 17 interchanges are operating significantly over the state wide average for interstate facilities while the section between Route 3 and Route 17 is slightly over the statewide average.

Table 2-9: 2010-2012 Existing Conditions – Roadway Segment Crash Rates

Roadway Segment	From/To	Segment Length (mi)	Average Annual Crash Total	2011 ADT	Crashes per 100-Million Vehicle Miles Traveled[1]
VA 3 - Interchange Area	Gateway Blvd to Central Park Blvd.	1.09	124	60,300 [2]	**517**
Interstate 95	through the VA 3 Interchange	0.7	37	114,000 [3]	**127**
	VA 3 to US 17	2.3	93	141,500	**78**
	through US 17 Interchange	1.2	47	102100 [3]	**105**
US 17 - Interchange Area	Short St to McLane Drive	0.91	63	51,800 [2]	**366**

1. **Highlighted Crash Rates are higher than the Statewide Average (72 crashes per 100 million VMT for interstates and 108 crashes per 100 million VMT for primary arterials)**
2. **Average ADT from the following locations (East of Interchange and West of Interchange on crossroad)**
3. **ADT located at I-95 Mainline Weave Segment of Interchange**

Above average crash rates along these segments can be attributed to capacity or geometric deficiencies along the segment. Crashes due to lengthy traffic queues resulting in stop and go traffic are often rear end collisions, which account for 603 of the 1,180 total crashes (51 percent) over the three-year period (2010-2012). Loop ramps and weaves at cloverleaf interchanges create a greater speed differential between lanes, which can lead to sideswipe collisions in the same direction, which account for 151 crashes (13 per cent) of the 1,180 total crashes. Statistics of the crashes by crash types are shown below in Table 2-9 and Figure 2-8. Rear-end crashes are slightly higher on northbound I-95 than on southbound I-95. The highest number of rear ends for southbound I-95 occurs between the Route 17 and Route 3 interchanges. *The types of accidents observed between 2005-2008 are very similar to those between 2010-2012*

with the exception of more angle crashes and less sideswipes. The lack of three years of data on Route 3 would likely reduce the number of angle accident associated with signalized intersections for 2005-2008.

Crash severity was also analyzed to determine the number of crashes with injuries or fatalities and the crashes involving pedestrians. It was determined from the data that on I-95, the majority (74 percent) of the crashes did not result in any injury or fatality. 154 of the total I-95 crashes (25 percent) resulted in a vehicle occupant injury. There were no crashes on I-95 involving a pedestrian injury, and therefore no reports of pedestrian fatalities. However, four crashes led to vehicle occupant fatalities. Of the total crashes on the arterial streets 63 percent were property damage only crashes, 35 percent resulted in an injury to a vehicle passenger, 1 percent resulted in pedestrian injuries, and less than 1 percent (2 crashes) resulted in a vehicle occupant fatality. There were no crashes resulting in a pedestrian fatality on the arterial streets. Figure 2-8: Crash Type by Roadway (2010-2012)

Table 2-10 and Figure 2-9 show the results from the severity analysis. *The number and rate of fatalities increased slightly as did the number and rate of injury accidents when compared to 2005-2008 time period.*

The reported crashes were also analyzed by the time of day of each occurrence. As expected, the majority of the crashes occurred during the AM and PM peak periods, when the traffic volumes are at their highest and operating conditions are at their poorest. Ten percent of all crashes occurred between 5:00 pm and 6:00 pm. 4:00 pm to 5:00 pm was the second most frequent hour for crashes (eight percent). Complete hourly data is shown in Table 2-11 and Figure 2-10. Generally, the northbound direction of I-95 has more crashes between 1:00 am and 4:00 pm, while the southbound lanes have more crashes from 4:00 pm to 1:00 am. *The time of day crash pattern observed between 2010 and 2012 is similar to the pattern from 2005 to 2008; however, there is an increase in the number and percentage of crashes occurring between 7:00 am and 10:00 am.*

Figure 2-11 visualizes the number of crashes during the study period at each 0.1 mile milepost on I-95. The highest volume of crashes occurred northbound on I-95 at the Route 3 interchange (between mileposts 130.3 and 130.5). These were the only segments in the study area that had at least 20 crashes over the three-year study period. There are heavy weaving and merging volumes along this segment of I-95 leading to rear-end and sideswipe accidents. Conversely, the I-95 North interchanges with Route 17 had some of the mileposts with the fewest incidences of crashes within the study area likely due to the separation of mainline and ramp traffic because of the NB C-D roads. The crashes drop significantly on southbound I-95 after the off-ramp to westbound Route 3. A large amount of rear-end and sideswipe accidents occur along southbound I-95 due to the large number of weaving, merging and diverging movements.

Table 2-10: Crash Types by Roadway (2010-2012)

Type	I-95 NB	I-95 SB	US 17	VA 3	Total % (2010-2012)	Total % (2005-2008)
Rear End	155	144	102	202	51%	51%
Angle	43	24	32	77	15%	3%
Head On	1	0	0	0	<1%	0%
Sideswipe - Same Direction	42	43	30	36	13%	20%
Sideswipe – Opposite Direction	0	1	1	1	<1%	0%
Fixed Object - In Road	4	2	1	2	1%	2%
Train	0	0	0	0	0%	0%
Non-Collision	6	12	1	7	2%	3%
Fixed Object - Off Road	65	53	15	40	15%	17%
Deer	10	10	1	1	2%	3%
Other Animal	0	0	0	0	0%	0%
Pedestrian	0	0	4	2	1%	1%
Bicyclist	0	0	0	0	0%	0%
Motorcyclist	1	0	1	0	<1%	0%
Backed Into	0	0	0	0	0%	0%
Miscellaneous or Other	2	1	2	3	1%	0%
Not Stated	0	0	0	0	0%	0%
TOTAL	329	290	190	371	1,180	704*

* Total includes only 2008 data for Route 3, approximately 200 less accidents if three years of data is estimated and included.

Figure 2-8: Crash Type by Roadway (2010-2012)

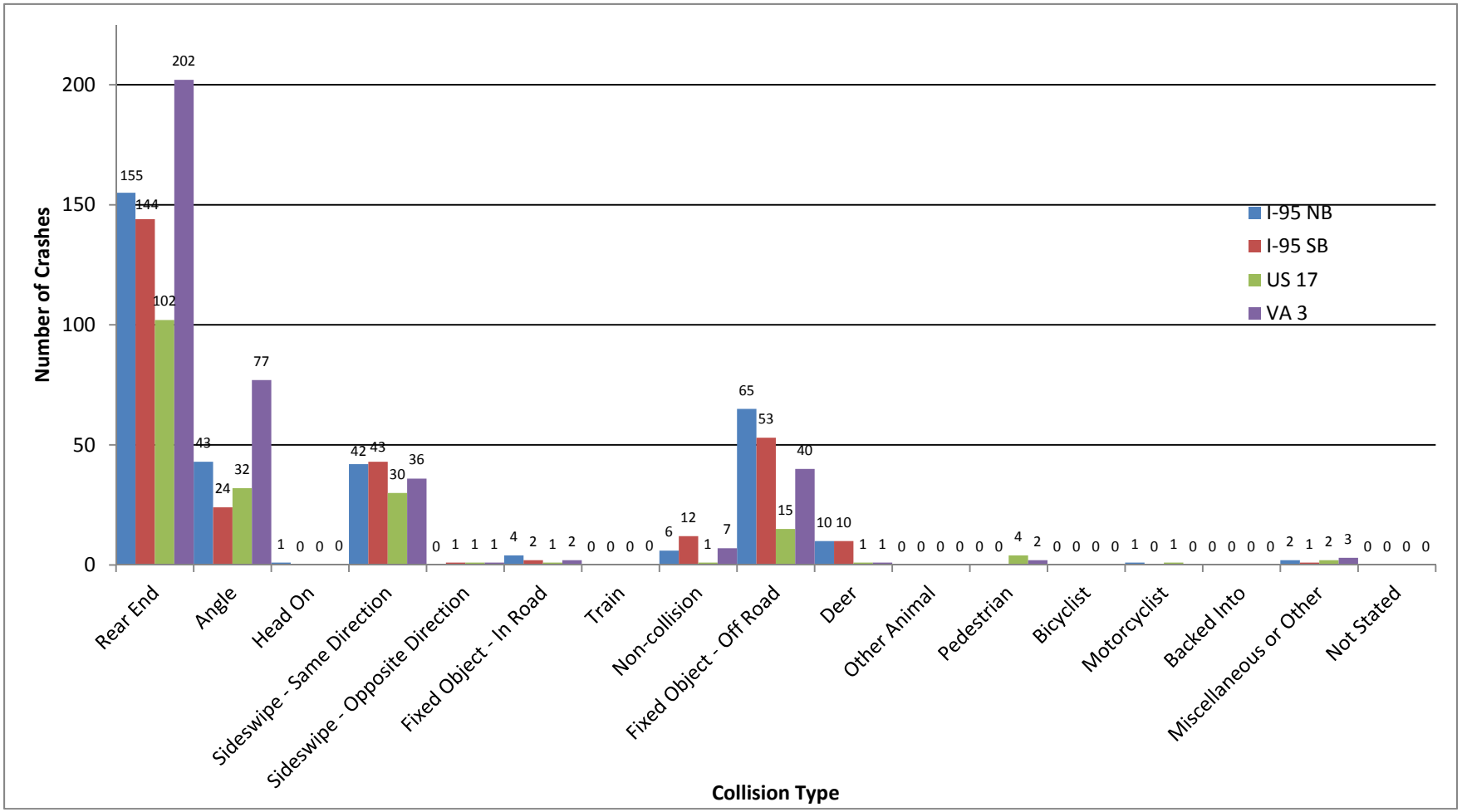


Table 2-11: Crash Severity by Roadway (2010-2012)*

Type	I-95 NB	I-95 SB	US 17	VA 3	Total % (2010-2012)	Total % (2005-2008)
Pedestrian Fatality	0	0	0	0	0%	0%
Vehicle Occupant Fatality	3	1	2	0	<1%	<1%
Pedestrian Injury	0	0	4	3	<1%	1%
Vehicle Occupant Injury	90	64	50	147	30%	23%
No Injury/Fatality	236	225	134	221	69%	76%
TOTAL	329	290	190	371	1,180	

*Totals in chart are number of crashes, not number of injuries or fatalities.

Figure 2-9: Crash Severity (2010-2012)

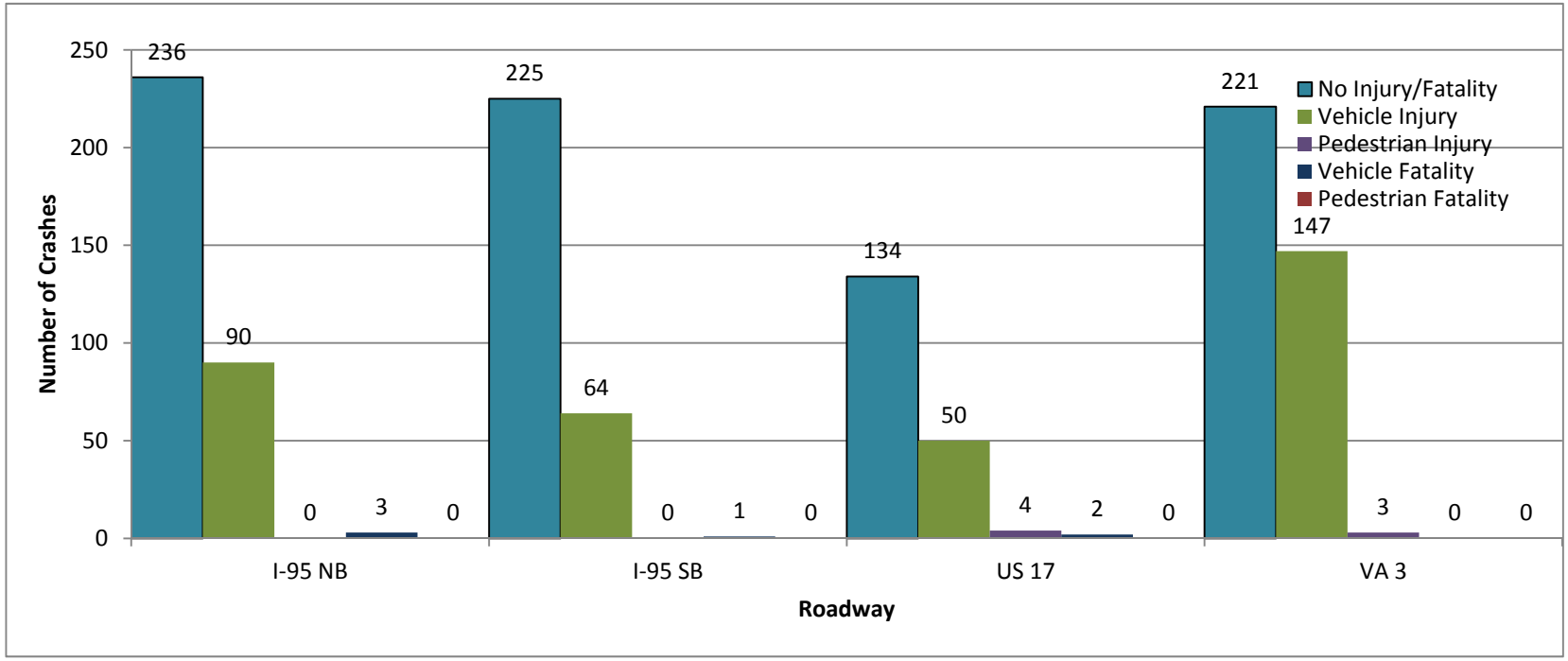


Table 2-12: Crashes by Hour of Day

Hour of Day (AM)	I-95 NB	I-95 SB	US 17	VA 3	Total % (2010-2012)	Total % (2005-2008)		Hour of Day (PM)	I-95 NB	I-95 SB	US 17	VA 3	Total % (2010-2012)	Total % (2005-2008)
0:00	4	12	0	3	2%	2%		12:00	19	13	15	19	6%	5%
1:00	5	1	2	7	1%	2%		13:00	8	5	10	23	4%	6%
2:00	3	3	0	2	1%	2%		14:00	21	13	10	26	6%	6%
3:00	8	9	2	2	2%	1%		15:00	28	22	15	25	8%	7%
4:00	11	3	1	5	2%	1%		16:00	24	31	16	29	8%	8%
5:00	10	3	3	6	2%	4%		17:00	28	31	17	44	10%	10%
6:00	9	5	5	10	2%	4%		18:00	17	30	12	24	7%	8%
7:00	34	12	10	21	7%	4%		19:00	11	14	15	20	5%	5%
8:00	25	8	11	22	6%	4%		20:00	10	11	4	16	3%	3%
9:00	4	4	10	14	3%	2%		21:00	7	11	5	11	3%	3%
10:00	12	8	12	13	4%	4%		22:00	10	12	4	7	3%	2%
11:00	14	20	7	15	5%	4%		23:00	7	9	4	7	2%	3%

Figure 2-10: Crashes by Hour of Day (2010-2012)

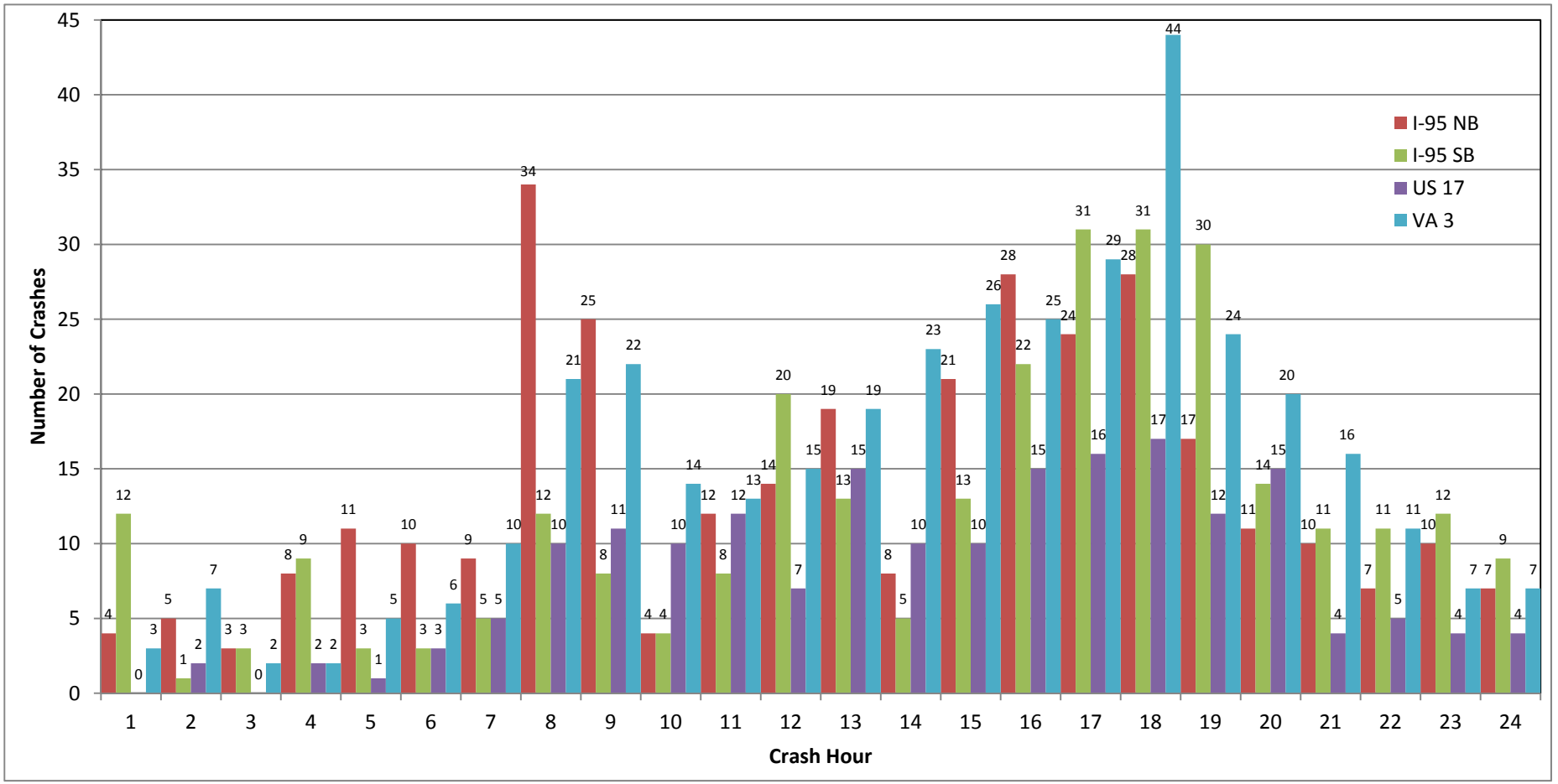
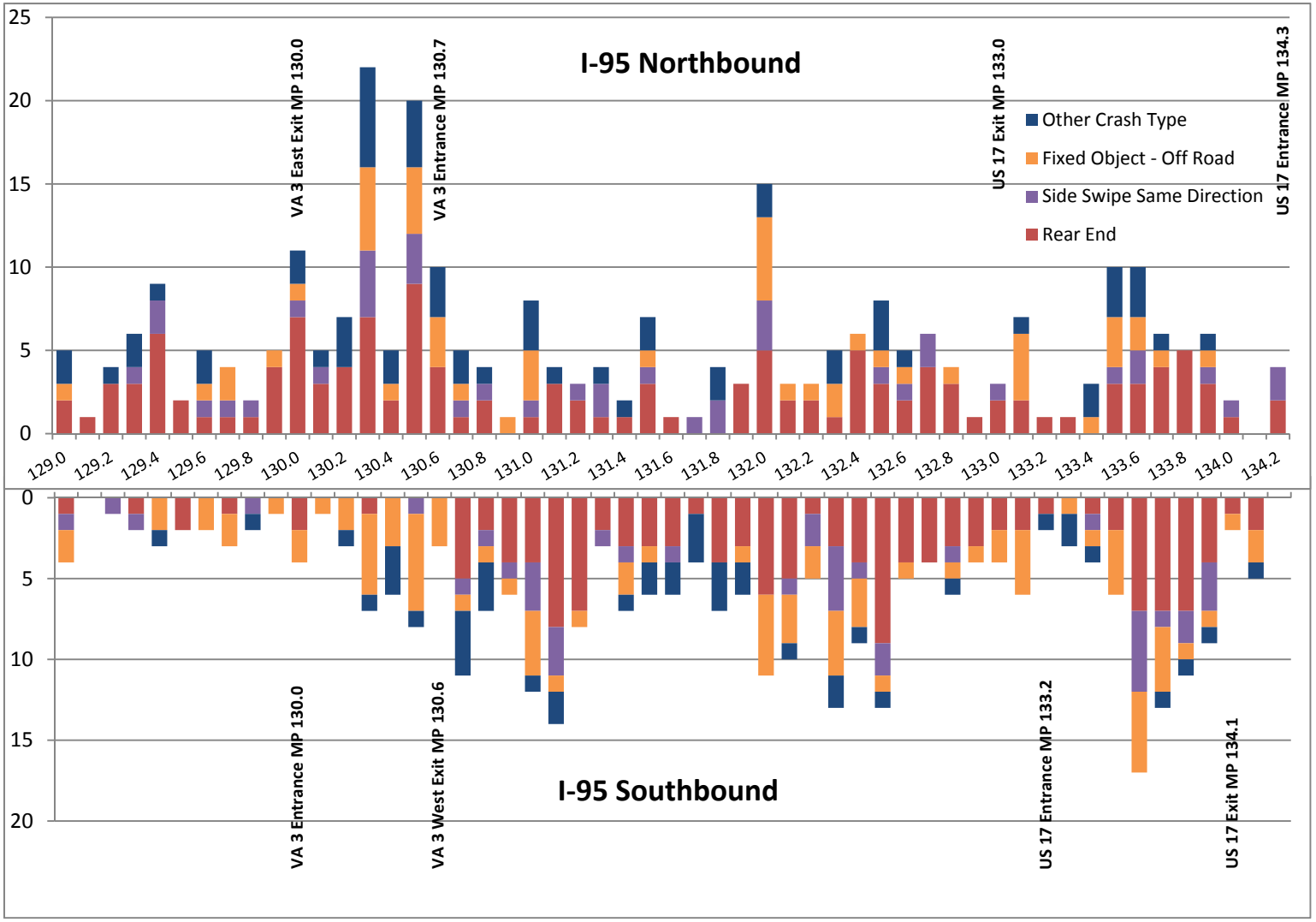


Figure 2-11: Crash Frequency on I-95 by Milepost (2010-2012)



2.10 Environmental Constraints

A fatal flaw evaluation of environmental constraints examined the major areas of impact assessed under the National Environmental Policy Act (NEPA) that could have a substantive effect on the proposed project. A desktop review of the NEPA-related environmental constraints or "fatal flaws" within the proposed study area was completed and the results were incorporated into the project mapping for use in the development of potential alternatives. Data sources included: VDOT databases, Virginia Department of Environmental Quality geographic information system databases, Comprehensive Plans for the City of Fredericksburg and the Counties of Spotsylvania and Stafford, Virginia; locality input, ADC mapping; findings from the 2001 Outer Connector SDEIS; and other online databases.

Based on this desktop review, the project area contains multiple environmental constraints that are shown in **Figure 2-12 in Volume II**. The ramifications of impacting these resources are discussed in Chapter 7 (Section 7.2). A summary of the environmental constraints within the project area is listed below.

- **Section 106 Cultural Resources**
  (Historic and Archaeological Resources)
  - Fredericksburg Battlefield Historic District (Civil War)
  - Salem Church Battlefield Historic District (Civil War)
  - Rappahannock Navigational System Historic District

- **Section 4(f) Resources**

  These are publicly-owned parks and recreation areas, wildlife and waterfowl refuges, and publicly or privately-owned sites listed or eligible for listing in the National Register of Historic Places (NRHP):
  - The City of Fredericksburg's Riparian Lands, also held in a conservation easement by The Nature Conservancy (TNC) and the Virginia Outdoors Foundation (VOF) (Public Recreation Area and Public Conservation Area)
  - Virginia Department of Conservation and Recreation (DCR) conservation and recreation lands
  - Motts Run Reservoir & Park (Public Recreation Area)
  - Fredericksburg Battlefield Historic District (NRHP - Eligible)
  - Salem Church Battlefield Historic District (NRHP - Eligible)
  - Rappahannock Navigational System Historic District (NRHP - Eligible)
  - Snowden Park Playground and Baseball Field on Fall Hill Avenue

  Note that some of the battlefields themselves (not the Historic Districts) are on the National Register of Historic Places.

- **Properties with Conservation Easements**

  Lands adjacent to the Rappahannock River, west of I-95, are under multiple conservation easements held by the Virginia Outdoors Foundation (VOF), the Virginia Department of Conservation and Recreation (DCR), The Nature Conservancy (TNC) and the City of Fredericksburg. See **Figure 2-12 in Volume II** for properties with conservation easements.

- **Protected Species and Habitat**

  - There are several documented locations of Bald Eagle nests adjacent to the existing I-95 bridge over the Rappahannock River.
  - The green floater mussel (Lasmigona subviridis) is a state protected species known to inhabit the Rappahannock River in the area of the I-95 crossing.
  - Within the I-95 crossing area, the Rappahannock River is a confirmed migration pathway, spawning ground, or nursery area for anadromous fish.

- **Designated State Scenic River**

  Within the I-95 area, the Rappahannock River is a designated State Scenic River

- **Residential and Commercial Development**

  - Residential – Several residential sections exist within the study area. Concentrations of residences in neighborhoods include east of I-95 between Cowan Boulevard and Fall Hill Avenue and between the River and Route 17. Concentrated neighborhoods also exist south of Route 3 and off Bragg Road. North of Route 3 residential homes are more scattered.
  - Commercial - The bulk of the City's commercial development is located along major roadways. Central Park, for instance, has been able to take advantage of a sizable area where I-95 and Route 3 intersect. A new, minor league baseball stadium and related fields, facilities, and parking areas are being considered by the City of Fredericksburg. This resource would be located in the vicinity of the existing I-95 rest area, to the west of I-95, in Fredericksburg. Other significant, commercially designated property occurs in the Route 3 corridor and in the US 17 corridor. Hotels, gas stations and other commercial establishments line both the north and south sides of Route 17.

- **Water Quality, Wetlands, and Waters of the U.S. and Related Permits**

  The Rappahannock River is classified as a freshwater, riverine wetland. The pond at the quarry adjacent to the western side of the I-95 crossing is classified as a freshwater pond.

- **Chesapeake Bay Preservation Act RPAs and RMAs**

  As shown on **Figure 2-12 in Volume II**, the majority of the Resource Protection Areas

(RPA) and Resource Management Areas (RMA) are located to the north of the Rappahannock River. However, there are several RPAs adjacent to the river's tributaries and wetlands on the south side of the river.

- **Superfund Sites**

No superfund sites were identified within the study area according to the Environmental Protection Agency's superfund website.

- **Petroleum Facilities and Petroleum Release Sites**

There are multiple petroleum facilities, as well as petroleum release sites, in the vicinity of the existing I-95/US 17 interchange area.

Because several of the environmental constraints are linear, complete avoidance of all sensitive resources in the I-95 Access Study project area is difficult to achieve. During the development and evaluation of alternatives in Chapter 5, the aforementioned environmental constraints were considered. Chapter 7 contains an identification of potential environment impacts associated with the preferred alternative and the next steps in the process for obtaining environmental clearance for the proposed project.

CHAPTER 3 FUTURE YEAR TRAFFIC & NO-BUILD ALTERNATIVE ANALYSIS

This section documents the project future conditions for 2020 and 2040 including future traffic volumes and the resulting No-Build Alternative traffic operations in the study area. The highway capacity analyses presented in this chapter are based on a future roadway condition where no new roadway improvements are in place other than those already planned and programmed in VDOT's Six-Year Plan or the FAMPO Long-Range Transportation Plan.

3.1 Projected Growth

As stated in the 2040 FAMPO Long-Range Transportation Plan, population forecasts show that the George Washington Region will continue to experience high growth rates and development through 2040. Between 2010 and 2020, the population will grow by 29%, from 328,000 to 423,500. The regional population will nearly double by 2040, when is projected to reach 617,000 (See Figure 3-1).

Employment will also experience growth during this time. It is anticipated that employment will grow from 149,900 in 2010, to 182,300 in 2020, which is a 22% employment increase in the next decade. By 2040, the employment is projected to grow to 253,240, which is a 69% increase.

As explained in Table 3-1, sectors of employment expected to experience the most growth are Educational Services, Professional, Scientific, and Technical Services Administrative Support, as well as the Healthcare and Other Services. Conversely, Utility employment is projected to decrease.

Figure 3-1: Population Projection for George Washington Region

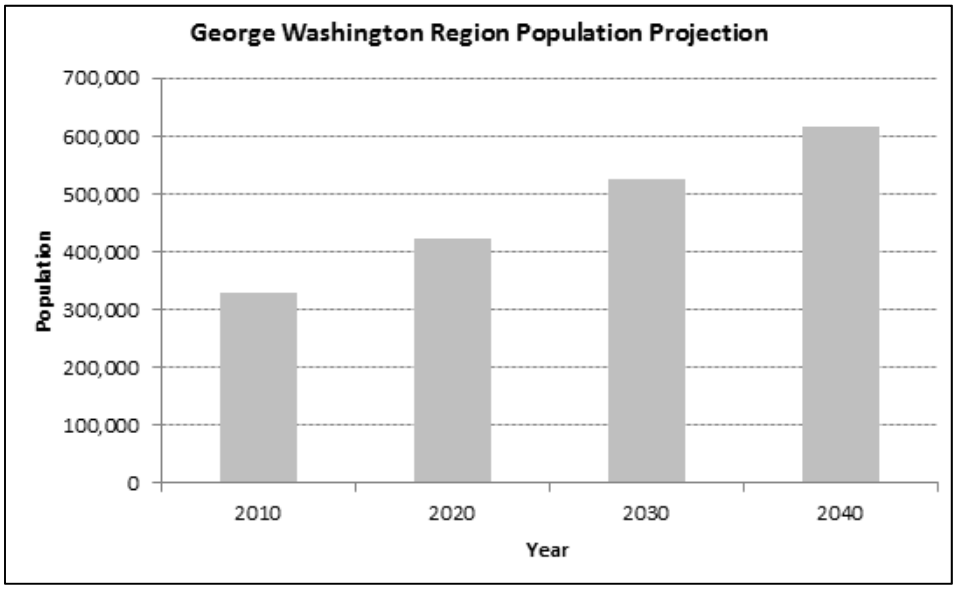


Table 3-1: Regional Employment Projections

GW Region Employment by Sector	2010	2020	2030	2040	Percent Growth 2010-2040
Agriculture, Forestry, Fishing and Hunting	1,294	1,280	1,300	1,310	1%
Mining, Quarrying, and Oil and Gas Extraction	272	260	250	230	-15%
Utilities	612	570	530	490	-20%
Construction	9,205	11,040	12,920	14,860	61%
Manufacturing	3,538	3,420	3,320	3,180	-10%
Wholesale Trade	4,151	4,420	4,720	4,910	18%
Retail Trade	21,190	25,360	29,600	34,030	61%
Transportation and Warehousing	3,113	3,130	3,130	3,070	-1%
Information	2,414	2,890	3,370	3,880	61%
Finance and Insurance	8,271	9,030	9,990	10,730	30%
Real Estate and Rental and Leasing	6,713	8,260	9,840	11,720	75%
Professional, Scientific, and Technical Services	11,759	16,170	20,930	27,350	133%
Management of Companies and Enterprises	1,153	1,330	1,500	1,670	45%
Administrative and Support and Waste Management and Remediation Services	6,090	7,990	10,080	12,700	109%
Educational Services	11,032	18,520	23,540	30,030	172%
Health Care and Social Assistance	15,731	20,550	25,410	30,820	96%
Arts, Entertainment, and Recreation	2,841	3,010	3,240	3,410	20%
Accommodation and Food Services	13,804	16,290	18,830	21,320	54%
Other Services (except Public Administration)	9,282	11,910	14,740	18,200	96%
Government	17,395	16,900	18,280	19,330	11%
Total Employment	**149,860**	**182,330**	**215,520**	**253,240**	**69%**

3.2 Planned Transportation Infrastructure

Several planned roadway improvements located within the study area have been identified in local area plans and the 2040 FAMPO Constrained Long-Range Plan.

FAMPO Constrained Long Range Plan

2040 LRTP includes a Constrained Long Range Plan (CLRP), which highlights numerous improvements to the transportation infrastructure within the study area. The Table 3-2 includes the proposed projects for roadways in proximity to the project area in all three jurisdictions.

Table 3-2: FAMPO Constrained Project List in Study Area

Highway/ Street Name	Route Number	From	To	Length in Miles	Improvement Description	Estimated YOE^	Total Cost (Inflated to YOE)	Allocation
I-95 HOV/Hot Lanes	95	Prince William Co. Line	I-95 Int. #126	25	Construct 2 Hot Lanes	2015	$1,048,110,000	$1,048,110,000
I-95 ICM Program Improvements	95	I-95 MM #145	I-95 MM #126	19.0	Improved ITS on I-95 & Arterials	2016-2020	$20,000,000	$20,000,000
(st) **Falmouth Bridge Replacement**	US-1	US-17/PR-218	Princess Anne Street	0.4	Replace Falmouth Bridge to a 6 lane facility with bike/ped	2021-2025	$51,049,000	$2,011,000
(fr) **William Street Widening**	PR-3	Gateway Blvd	William St/Blue Grey Parkway	0.8	Widen PR-3 to 6 lanes divided with bike/ped accommodations	2036-2040	$28,122,000	$28,122,000
US-17 Widening (st)	US-17	Stafford Lakes Parkway	Hartwood Rd. (SC-612)	3.5	Widen from 4 to 6 lanes divided with paved highway shoulders	2036-2040	$51,347,000	$51,347,000
US-17 Widening (st)	US-17	McLane Dr.	Stafford Lakes Pkwy.	2.9	Widen from 4 to 6 lanes divided with sidewalks	2015	$50,056,000	$50,056,000
(fr) Fall Hill Ave.	UR-3965	Mary Washington Blvd. Extended	Gordon Shelton Blvd.	1.6	Widen from 2 to 4 lanes with sidewalk and shared use path and extend Mary Washington Blvd	2016-2020	$47,726,000	$11,094,000
(fr) Princess Anne St Improvements Phase II	US-1/17	US-1	Herndon St.	0.7	Road resurfacing, drainage improvements	2016-2020	$1,480,000	$734,000
(st) Truslow Rd. Improvements	SC-652	Poplar Rd. (SC-616)	US-1	0.4	Operational improvements, turn lanes, bike/ped accommodations and access management	2036-2040	$23,538,000	$23,538,000

^YOE = Year of Expenditure
(fr) = Fredericksburg (sp) = Spotsylvania (st) = Stafford

Intersection Improvements

Three of the projects listed in Table 3-2 result in capacity improvements up to several of the study intersections. The widening of Route 3 from Gateway Boulevard to William Street/Blue Grey Parkway improves the departure leg of intersection #3. The widening of Route 17 from McLane Drive to Stafford Lakes Parkway improves the departure leg of intersection #4. Neither of the improvements changes the lane capacities of either intersection but do increase capacities of adjacent intersections and are included in the CORSIM networks used for this IMR.

Multimodal Improvements

In addition to roadway improvements, several multimodal improvements are planned in the 2040 CLRP. These improvements are applicable to the public transit, park and ride, rail, and the bike and pedestrian systems.

Bicycle/Pedestrian: The Bicycle and Pedestrian Plan also outlines several planned facilities that will support biking and walking in the George Washington Region. The planned facilities specifically within the project area are listed, by jurisdiction, in Table 3-3. Bicycle and pedestrian improvements (including those listed in the table) were not considered in the build alternative. Pedestrian and/or bicycle facilities through a major interchange between the I-95 corridor and Route 3 or Route 17 would be unsafe and provide little or no positive impacts to vehicular traffic congestion.

Public Transit: FRED local service is expected to expand to 109,000 hours of service in 2017 and 122,000 in 2035. In total, this accounts for an approximate 50% increase by 2035. Despite the planned increase in service hours, a specific service plan has not been identified.

Park and Ride: A new park and ride lot is planned for the Celebrate Virginia site, including 800 spaces. The new lot is planned for 2017. However, there is currently no funding provide for the project and the FAMPO CLRP does not list any planned new park and ride lots in the study area.

Rail: VRE is planning an extension of service to Spotsylvania County. This will include a new station along Route 17, five miles south of the Fredericksburg City line. The new station is scheduled to open in 2015.

Table 3-3: FAMPO Constrained Bicycle and Pedestrian Project List in Study Area

Bicycle and Pedestrian Planned Infrastructure		
	Location	**Type**
City of Fredericksburg	Fall Hill Avenue Trail	Shared - Use Trail
	Cowan Blvd/William Street Connector	Shared – Use Trail
	Route 1 and the Rappahannock Canal Trail	Safety and Lighting Improvements
	I-95 @ Fall Hill Ave	Bike/Ped Improvement on Bridge
	Route 1 and Fall Hill Ave	Improve bike/ped safety
Spotsylvania County	Route 3 (Fred. CL to Old Plank Rd)	Sidewalks
	Route 3 and Salem Church Rd	Pedestrian Intersection Improvements
	Route 3 and Bragg Rd	Pedestrian Intersection Improvements
	Route 3 and Taskforce Dr	Pedestrian Intersection Improvements
Stafford County	Truslow Rd (Route 1 to Poplar Rd) Route 17 (Poplar Rd to Route 1)	Shoulder Improvements Sidewalks
	Route 1 and Route 17	Pedestrian Intersection Improvements

3.3 2020 No-Build Traffic Volumes

This section documents the development of the future year design traffic for the 2020 No-Build scenario. There was a significant amount of coordination between VDOT and FHWA in developing forecast volumes for the study area. Traffic growth rates were developed using a combination of historic growth rates, FAMPO travel demand model output, and professional judgment. 2020 forecast volumes were developed for the arterials (Route 3 and Route 17), for I-95 (mainline and interchange ramps), and for the analyzed intersections by applying the developed growth rates to the 2013 traffic volumes. The resulting forecast volumes are discussed below. Detailed methodology and detailed forecast volume information can be found in Appendix B - No-Build Conditions (Page B-1). The No-Build scenario includes those projects within the study area that are listed and fully funded in the FAMPO 2040 Constrained Long Range Plan (see Table 3-2) or VDOT's Six-Year Plan and expected to be open by 2020. The No-Build Scenario does not include the proposed Jackson Gateway Interchange (south of Route 1) since it is not funded for construction in the FAMPO 2040 Constrained Long Range Plan.

3.3.1 2020 No-Build Arterial Roadway Traffic Volumes – Route 3 & Route 17

The 2013 Existing Conditions volumes on Route 3 and Route 17 were grown to 2020 No-Build forecast volumes using the developed growth rates. Growth rates along the arterials varied to the east and west of the interchanges at both Route 3 and Route 17 and are discussed in Appendix B No-Build Conditions. The growth rates and projected future volumes are shown below in Table 3-4.

Table 3-4: 2020 No-Build Arterial Forecast Daily Volumes

Roadway / Location	2013 Existing Conditions Daily Volume			2020 No-Build Forecast Daily Volumes		
	EB	WB	Total	EB	WB	Total
VA 3 - East of I-95 Interchange	25,000	24,800	49,800	27,100	26,700	53,800
VA 3 - West of I-95 Interchange	39,900	30,800	70,700	44,000	34,100	78,100

Roadway / Location	2013 Existing Conditions Daily Volume			2020 No-Build Forecast Daily Volumes		
	WB/NB	EB/SB	Total	WB/NB	EB/SB	Total
US 17 - Southeast of I-95 Interchange	16,700	22,400	39,100	18,700	25,200	43,900
US 17 - Northwest of I-95 Interchange	32,200	32,500	64,700	37,700	38,200	75,900

3.3.2 2020 No-Build I-95 Mainline and Ramp Traffic Volumes

2020 No-Build forecast volumes were developed for the I-95 Mainline by growing the 2013 Existing Conditions volumes to 2020 using the developed growth rates. The resulting I-95 volumes are shown below in Table 3-5.

Table 3-5: I-95 Mainline Growth Rate and Resulting 2020 No-Build Volumes

Roadway / Location	2013 Existing Conditions Daily Volumes			Average Annual Growth Rate		2020 No-Build Conditions Daily Volumes		
	NB	SB	Total*	NB	SB	NB SB		Total*
I-95 - South of Exit 130 (VA 3)	58,000	57,100	115,100	2.5%	2.5%	68,200	67,100	135,300
I-95 - At River	76,800	75,800	152,600	2.3%*	2.1%*	88,800	87,600	176,400
I-95 - North of Exit 133 (US 17)	68,300	66,400	134,700	2.1%*	2.1%8	78,600	76,300	154,900

* Calculated from resulting volumes of adding and subtracting Ramp ADT. Rounded to the nearest 0.1%

The I-95 interchange ramps at Route 3 and Route 17 were grown with the same growth rate as the arterial to which they belong. The Route 3 interchange ramps, to and from the west of I-95, were grown at 1.5%, annually. The Route 3 ramps, to and from the east of I-95, were grown at 1.0%. The ramps at US 17, to and from the west of I-95, were grown at 2.5%, while the ramp to and from the east were grown at 1.5%. The resulting ramp volumes are shown in **Figure 3-2A and 3-2B in Volume II.**

3.3.3 2020 No-Build Intersection Traffic Volumes

The intersections analyzed in the existing conditions were grown to 2020 forecast volumes by the same growth rates as their respective arterials. All movements, major and minor, were grown at the same growth rate at each intersection. The intersections along Route 3, west of I-95, were grown at 1.5%, annually, while the Route 3 intersection to the east of I-95 was grown at 1.0%, annually. The intersections along Route 17 were grown at 2.5% for those intersections west of I-95 and at 1.5% for those east of the interstate. Resulting 2020 No-Build intersection turn movement volumes are shown in **Figure 3-2A and 3-2B in Volume II**.

3.4 2020 No-Build Traffic Operations

This section presents the 2020 No-Build conditions analysis of the key intersections, I-95 Mainline, and I-95 Ramp Junctions that were analyzed for the 2013 Existing Conditions (See Chapter 2).

3.4.1 Intersection Analysis – 2020 No-Build Traffic Operations

The AM and PM peak hours at each intersection were analyzed to identify expected deficiencies without any additional improvements other than those currently planned and programmed (discussed in Section 3.2). Signal timings and phases were not changed from existing conditions. As done in the existing conditions chapter, a brief discussion of each intersection is provided to identify the main causes of any deficiency. A summary of the 2020 No-Build level of service (LOS), compared to 2013 Existing Conditions, is shown below in Table 3-6A. The results of the queue analysis are shown in Table 3-6B. Detailed HCS2010 analysis reports are presented in Appendix B – No-Build Conditions (Page B-26). CORSIM models were also developed for each peak hour to confirm the results of the HCS analysis (Section 3.5).

Intersection #1 (Route 3 & Mall Dr / Central Park Blvd): Overall the intersection is expected to operate at LOS B during the AM peak hour and LOS F during the PM peak hour. The eastbound left turn, westbound left turn, northbound approach, and southbound approach are expected to operate at LOS E or LOS F in the AM peak hour. In the PM peak hour, the entire northbound and southbound approaches are projected to operate at LOS E or LOS F. In addition, the eastbound and westbound left turn movements as well as the eastbound through movement are projected to experience high delays during the PM peak hour.

Intersection #2 (Route 3 & Mall Ct / Carl D Silver Pkwy): Overall the intersection is expected to operate at LOS C during the AM peak hour and LOS F during the PM peak hour. In the AM peak hour, movements from the northbound and southbound minor approaches and the mainline left turns are projected to operate at LOS E or LOS F. During the PM peak hour, the eastbound through and right movements are the only movements that are projected to operate better than LOS E.

Intersection #3 (Route 3 & Gateway Blvd / Ramseur St): Overall the intersection is expected to operate at LOS D during the AM peak hour and LOS C during the PM peak hour. The northbound left turn lane is the only movement projected to operate at an unacceptable LOS during the AM peak hour and the northbound left and right movements are projected to operate at LOS E or F during the PM peak hour.

Intersection #4 (Route 17 & Hardee's Access / McLane Dr): Overall the intersection is expected to operate at LOS D during the AM peak hour and LOS C during the PM peak hour. The Route 17 northbound through movement is expected to operate at an unacceptable LOS during the AM peak hour. The Route 17 northbound and southbound left turn movements are expected to operate at an unacceptable LOS the PM peak hour.

Table 3-6A: 2020 No-Build Intersection LOS Summary (All results from HCS)

				AM Peak Hour								PM Peak Hour							
				2013		2020 No Build						2013		2020 No Build					
				Intersection		Movement		Approach		Intersection		Intersection		Movement		Approach		Intersection	
	Intersection	Approach	Movement	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS
1	Route 3 / Mall Dr. / Central Park Blvd.	NB	Left	15.1	B	65.2	E	133.5	F	19.4	B	103.8	F	75.8	E	616.9	F	120.0	F
			Through			66.1	E							80.1	F				
			Right			151.0	F							885.6	F				
		SB	Left			69.0	E	87.1	F					72.3	E	326.4	F		
			Through			68.7	E							70.3	E				
			Right			91.5	F							544.0	F				
		EB	Left			63.3	E	13.7	B					69.3	E	67.6	E		
			Through			9.1	A							68.7	E				
			Right			0.1	A							43.4	D				
		WB	Left			66.8	E	11.5	B					60.5	E	19.3	B		
			Through			6.7	A							9.8	A				
			Right			8.8	A							14.1	B				
2	Route 3 / Carl D. Silver Pkwy	NB	Left	29.7	C	70.8	E	70.2	E	32.8	C	97.8	F	76.7	E	76.0	E	127.8	F
			Through			70.8	E							76.7	E				
			Right			69.6	E							75.2	E				
		SB	Left			59.1	E	58.3	E					160.0	F	139.9	F		
			Through			51.9	D							51.1	D				
			Right			53.6	D							80.3	F				
		EB	Left			63.0	E	27.2	C					63.6	E	14.9	B		
			Through			25.4	C							7.6	A				
			Right			24.4	C							5.7	A				
		WB	Left			69.5	E	36.0	D					75.9	E	189.4	F		
			Through			31.6	C							111.7	F				
			Right			45.3	D							419.3	F				
3	Route 3 / Gateway Blvd.	NB	Left	20.6	C	58.9	E	53.3	D	21.8	C	27.5	C	107.3	F	87.7	F	30.2	C
			Through			38.2	D							38.0	D				
			Right			41.3	D							59.3	E				
		SB	Left			48.7	D	49.7	D					48.7	D	48.9	D		
			Through			50.1	D							49.1	D				
			Right			50.1	D							49.1	D				
		EB	Left			47.4	D	26.5	C					47.1	D	29.5	C		
			Through			26.6	C							28.9	C				
			Right			23.8	C							30.3	C				
		WB	Left			46.1	D	8.6	A					54.4	D	12.6	B		
			Through			5.9	A							5.9	A				
			Right			3.1	A							0.0	A				
4	Route 17 / McLane Dr.	NB	Left	25.8	C	54.3	D	67.6	E	53.7	D	19.1	B	69.0	E	3.7	A	27.9	C
			Through			68.7	F							3.5	A				
			Right			1.2	A							0.0	A				
		SB	Left			53.8	D	37.5	D					68.0	E	46.6	D		
			Through			37.5	D							46.7	D				
			Right			17.7	B							14.2	B				
		EB	Left			32.5	C	32.5	C					46.7	D	46.7	D		
			Through			32.5	C							46.7	D				
			Right			32.5	C							46.7	D				
		WB	Left			33.3	C	33.3	C					48.1	D	48.1	D		
			Through			33.3	C							48.1	D				
			Right			33.3	C							48.1	D				
5	Route 17 /Sanford Dr.	NB	Left	36.4	D	65.2	E	105.9	F	53.2	D	291.7	F	115.2	F	3023.1	F	382.6	F
			Through			54.4	D							76.1	E				
			Right			126.2	F							3267.3	F				
		SB	Left			62.8	E	62.4	E					78.8	E	77.4	E		
			Through			62.6	E							59.7	E				
			Right			58.9	E							61.2	E				
		EB	Left			57.4	E	59.9	E					59.8	E	118.5	F		
			Through			60.2	F							120.4	F				
			Right			21.1	C							23.2	C				
		WB	Left			60.2	E	44.0	D					81.6	F	41.8	D		
			Through			45.0	D							38.8	D				
			Right			15.8	B							22.2	C				
6	Route 17 /Short St.	NB	Left	34.9	C	35.0	C	34.7	C	46.8	D	105.6	F	42.4	D	41.6	D	150.7	F
			Through			35.0	C							42.4	D				
			Right			31.4	C							39.2	D				
		SB	Left			40.9	D	40.9	D					44.9	D	44.9	D		
			Through			40.9	D							44.9	D				
			Right			40.9	D							44.9	D				
		EB	Left			77.5	F	73.1	E					243.5	F	228.5	F		
			Through			73.1	F							229.6	F				
			Right			22.3	C							20.1	C				
		WB	Left			20.5	C	22.3	C					21.7	C	16.3	B		
			Through			22.3	C							16.4	B				
			Right			22.4	C							16.1	B				

Notes: All results from HCS 2010. Intersections 1,2,3,5,6 major movement is E-W; Intersections 4 major movement is N-S.

Intersection #5 (Route 17 & Sanford Dr): Overall the intersection is expected to operate at LOS D during the AM peak hour and LOS F during the PM peak hour. Most of the minor approach movements are projected to operate at LOS E or LOS F during both peak hours. In addition, the northwest left and through movements on Route 17 are expected to operate at an unacceptable LOS during the AM peak hour. The northbound/westbound left turn along with the southbound/eastbound left and through movements on Route 17 are expected to operate at an unacceptable LOS during the PM peak hour.

Intersection #6 (Route 17 & Short St / Driveway): Overall the intersection is expected to operate at LOS D and LOS F during the AM and PM peak hours respectively. During the AM peak hour, the northeast minor approach is expected to operate at an unacceptable LOS while during the PM peak hour, the southbound/eastbound Route 17 approach is expected to operate at an unacceptable LOS.

Overall, the 2020 No-Build intersection level of service and delay are expected to worsen when compared to the 2013 conditions because of the increase of traffic along the arterials and the cross streets.

Queuing
The queue analysis was also conducted using the HCS 2010 software and the results are shown in Table 3-6B. The results show longer queue lengths at all locations when compared to the existing conditions. The minor approaches at multiple intersections within the study area will queue lengths that exceed the available storage. Similar to the existing conditions, during the PM peak hour, the queue length for the westbound right turn at the intersection of Route 3 and Carl D. Silver Parkway greatly exceeds the available storage. The queue then causes the ramp from southbound I-95 to back up usually causing significant delays on southbound I-95. During the AM peak hour on Route 17, the queue length for the eastbound approach at the intersection with Sanford Drive (#5) exceeds the distance between this intersection and the upstream intersection with McLane Drive (#4).

The CORSIM model for the 2020 No-Build condition confirms the HCS2010 results however, the queue spill backs from the above mentioned intersections greatly impacts the main direction of travel on both the Route 3 and Route 17 corridors.

Table 3-6B: 2020 No-Build Conditions Intersection Queue Summary

Intersection		Approach	Movement	Storage (ft)	Queue Length (ft)			
					AM Peak Hour		PM Peak Hour	
					Existing	2020 No Build	Existing	2020 No Build
1	Route 3 / Mall Dr. / Central Park Blvd.	NB	Left	425	5	10	88	100
			Through	425	25	30	113	130
			Right	150	208	248	870	1018
		SB	Left	250	8	10	105	120
			Through	2750	8	5	95	108
			Right	250	78	103	705	825
		EB	Left	475	130	145	168	193
			Through	900	25	65	623	700
			Right	900	0	0	98	105
		WB	Left	675	45	50	240	278
			Through	825	48	53	118	133
			Right	675	63	70	168	210
2	Route 3 / Carl D. Silver Pkwy	NB	Left	-	-	-	-	-
			Through	50	20	20	35	33
			Right	50	18	18	25	30
		SB	Left	475	168	190	600	713
			Through	1250	5	8	13	10
			Right	495	43	48	315	370
		EB	Left	250	73	80	145	160
			Through	800	425	550	78	85
			Right	250	8	5	3	3
		WB	Left	400	23	20	40	45
			Through	3675	188	210	843	1025
			Right	650	400	465	1845	2153
3	Route 3 / Gateway Blvd.	NB	Left	400	185	215	320	370
			Through	4500	5	5	0	3
			Right	400	63	70	163	183
		SB	Left	650	8	8	8	8
			Through	650	18	18	3	8
			Right	650	-	-	-	-
		EB	Left	350	23	28	20	20
			Through	3675	230	260	283	318
			Right	450	150	163	243	283
		WB	Left	275	35	38	85	90
			Through	375	40	45	40	45
			Right	375	0	0	0	0
4	Route 17 / McLane Dr.	NB	Left	35	13	15	10	10
			Through	35	223	535	28	38
			Right	35	3	3	0	0
		SB	Left	875	20	25	10	10
			Through	875	398	535	635	958
			Right	875	10	13	8	8
		EB	Left	-	-	-	-	-
			Through	1000	18	18	15	20
			Right	-	-	-	-	-
		WB	Left	-	-	-	-	-
			Through	845	28	33	50	55
			Right	-	-	-	-	-
5	Route 17 /Sanford Dr.	NB	Left	425	50	58	45	60
			Through	875	5	8	5	13
			Right	400	133	198	1470	1795
		SB	Left	850	65	73	173	213
			Through	475	55	65	18	20
			Right	360	13	18	5	10
		EB	Left	580	10	10	5	10
			Through	845	468	678	865	1188
			Right	845	8	8	23	28
		WB	Left	275	165	208	250	310
			Through	2750	508	755	490	645
			Right	400	83	95	98	123
6	Route 17 /Short St.	NB	Left	-	-	-	-	-
			Through	1000	48	55	48	55
			Right	100	5	5	15	18
		SB	Left	-	-	-	-	-
			Through	35	8	8	8	13
			Right	-	-	-	-	-
		EB	Left	2750	413	563	1215	1613
			Through	2750	373	508	1075	1428
			Right	275	20	25	30	35
		WB	Left	150	5	5	3	3
			Through	3000	238	288	185	220
			Right	3000	240	293	188	220

3.4.2 I-95 Mainline and Ramp Junction Analysis – 2020 No-Build Traffic Operations

2020 No-Build level of service analyses were also performed for the Weekday AM / PM peak hours for northbound and southbound I-95 Mainline segments and at ramp junctions (merge, diverge, and weave) in the study area using HCS2010 Ramp Junction software, HCS2010 Weaving Analysis software, CORSIM micro-simulation software. The 2020 No-Build traffic forecasts developed in Section 3.3 were used in the analyses. Findings for the mainline and ramp analyses are discussed below and shown in **Figure 3-3 in Volume II**. Detailed HCS2010 mainline and ramp junction analysis reports are presented in the Appendix B - No-Build Conditions (starting on Page B-53).

Northbound I-95

Poor operating conditions are projected to continue along I-95 Northbound, similar to the 2013 Existing Condition. The I-95 Northbound mainline segments north of Route 3 are projected to operate at LOS F during the AM Peak Hour. The I-95 Northbound mainline segments are projected to operate at LOS D or better during the PM Peak Hour. Similar trends are projected at the merges, diverges, and weaving segments.

Southbound I-95

The I-95 Southbound mainline segments are projected to operate at acceptable conditions during the AM peak hour in the 2020 No-Build Condition. During the PM peak hour the I-95 Southbound mainline segments are projected to operate at LOS F north of Route 3 with many of the ramp junctions also operating at LOS F.

3.5 2020 No-Build Conditions – CORSIM Analysis

CORSIM micro-simulation analysis was again performed on the I-95 Mainline and on the Route 3 and Route 17 interchanges. CORSIM analysis results for I-95 Mainline and Ramp Junctions were generated for the same locations as those completed with HCS (Figure 3-3). Note that the discrepancies in the densities and speeds are a result of the differences of the functionality of the software. The results of the CORSIM network are shown in Table 3-7.

The CORSIM base networks used for the 2013 existing conditions analysis were modified to include the roadway improvements planned for Route 17 (see Section 3.2). Volumes were updated to reflect the No-Build volumes discussed in Section 3.3. No global parameters or additional default values were changed from those changed during the calibration of the base year model.

Table 3-7: CORSIM 2020 No-Build I-95 Mainline and Ramp Junction Analysis Summary

Northbound I-95 Mainline & Ramp Analysis			2020 No-Build			
			AM Peak Hour		PM Peak Hour	
Roadway	Location	Analysis ID	Vehicle Density (pc/mi/ln)	Vehicle Speed (mph)	Vehicle Density (pc/mi/ln)	Vehicle Speed (mph)
I-95 NB Mainline	South of Route 3 Interchange	Mainline Segment 1	21.3	67.2	20.2	67.2
Route 3 Interchange Ramps	I-95 NB **Diverge** to Route 3 EB	D-1	20.3	65.0	18.6	67.1
	Route 3 EB Merge to I-95 NB diverge - **Weave**	W-1	44.7	33.6	19.9	56.6
	Route 3 WB **Merge** to I-95 NB	M-1	56.6	33.2	19.9	62.2
I-95 Mainline	Route 3 to Route 17	Mainline Segment 2	69.0	31.8	22.6	65.6
I-95 Mainline	Route 3 to Route 17	Mainline Segment 3	84.2	23.2	23.2	64.0
Route 17 Interchange Ramps	I-95 NB **diverge** to I-95 C/D Roadway	D-2	55.9	28.6	23.0	57.9
	I-95 C/D Roadway **diverge** to Route 17 Bus SB	D-3	57.1	15.1	22.8	42.7
	Route 17 SB Merge to I-95 NB diverge - **Weave**	W-2	96.1	11.8	33.7	42.7
	Route 17 Bus NB **merge** to I-95 C/D Roadway	M-2	19.2	43.1	8.3	42.7
	I-95 C/D Roadway **merge** to I-95 NB	M-3	24.1	59.7	14.7	64.9
I-95 Mainline	North of Route 17 Interchange	Mainline Segment 4	27.0	64.0	17.2	66.5

Southbound I-95 Mainline & Ramp Analysis			2020 No-Build			
			AM Peak Hour		PM Peak Hour	
Roadway	Location	Analysis Type	Vehicle Density (pc/mi/ln)	Vehicle Speed (mph)	Vehicle Density (pc/mi/ln)	Vehicle Speed (mph)
I-95 SB Mainline	North of Route 17 Interchange	Mainline Segment 4	14.8	68.7	96.1	16.0
Route 17 Interchange Ramps	I-95 SB diverge to Route 17 NB	D-4	13.9	67.4	85.8	15.9
	Route 17 NB Merge to I-95 SB diverge - **Weave**	W-3	10.8	60.6	72.8	13.5
	Route 17 SB **merge** to I-95 SB	M-4	16.5	54.4	110.2	9.9
I-95 SB Mainline	Route 17 to Rest Area	Mainline Segment 3	16.0	66.5	123.3	10.5
Rest Area	Rest Area - Diverge	D-5	16.1	66.0	96.5	10.8
	Rest Area - Merge	M-5	15.2	65.4	116.5	10.6
I-95 SB Mainline	Rest Area to Route 3	Mainline Segment 2	12.3	67.4	75.6	17.5
Route 3 Interchange Ramps	I-95 SB **Diverge** to Route 3 WB	D-6	12.3	67.4	59.0	18.0
	Route 3 WB Merge to I-95 SB diverge - **Weave**	W-4	12.3	67.4	11.1	60.9
	Route 3 EB **Merge** to I-95 SB	M-6	10.7	66.0	13.3	64.2
I-95 SB Mainline	South of Route 3 Interchange	Mainline Segment 1	12.3	67.4	15.0	66.8

The CORSIM analysis confirms the results from the HCS analysis. The HCS analysis showed long delays at intersections along Route 3 and Route 17. The CORSIM analysis showed significant queues backing through intersections on Route 3 and Route 17 particularly in the PM peak hour. The HCS analysis also showed I-95 being over capacity with most ramp junctions failing for northbound I-95 during the AM peak hour and on southbound I-95 during the PM peak hour. The CORSIM analysis also showed congestion and significantly reduced speeds on the I-95 mainline for northbound I-95 during the AM peak hour. The CORSIM analysis showed the southbound I-95 mainline breaking down during the PM peak hour.

Densities and speed by lane and roadway segment from the CORSIM microsimulation is shown on graphics in Appendix B - No-Build Conditions (starting on Page B-139).

3.6 2020 No-Build Conditions - Safety Evaluation

As traffic volumes increase in the study area and congestion worsens, total annual crashes in 2020 are expected to increase over 2013 existing conditions. As can be seen when comparing Figures 2-7 and 3-3 and Tables 2-7 and 3-7, densities are expected to increase and travel speeds decrease under the 2020 No-Build condition when compared to the 2013 existing conditions. It is likely that the crash rate may also increase as higher densities and greater speed differentials between free flow and congested speeds occur.

3.7 2040 No-Build Traffic Volumes

This section documents the development of the future year design traffic for the 2040 No-Build scenario. There was a significant amount of coordination between VDOT and FHWA in developing forecast volumes for the study area. Using a combination of historic growth rates, FAMPO travel demand model output, and professional judgment, 2040 forecast volumes were developed for the arterials (Route 3 and Route 17), for I-95 (mainline, proposed express lanes, and interchange ramps), and for the analyzed intersections. The resulting forecast volumes are discussed below. Detailed methodology and detailed forecast volume information can be found in Appendix B - No-Build Conditions (Page B-1). The No-Build scenario includes those projects within the study area that are listed and fully funded in the FAMPO 2040 Constrained Long Range Plan (see Table 3-2) or VDOT's Six-Year Plan.

3.7.1 2040 No-Build Arterial Roadway Traffic Volumes – Route 3 & Route 17

The 2013 Existing Conditions volumes on Route 3 and Route 17 were grown to 2040 No-Build forecast volumes using the developed growth rates. Growth rates along the arterials varied to the east and west of the interchanges at both Route 3 and Route 17. The growth rates and projected future volumes are shown below in Table 3-8.

Table 3-8: 2040 No-Build Arterial Growth Rates and Resulting Volumes

Roadway / Location	2013 Existing Conditions Daily Volume			2040 No-Build Forecast Daily Volumes		
	EB	WB	Total	EB	WB	Total
VA 3 - East of I-95 Interchange	25,000	24,800	49,800	32,600	32,300	64,900
VA 3 - West of I-95 Interchange	39,900	30,800	70,700	55,800	43,300	99,100

Roadway / Location	2013 Existing Conditions Daily Volume			2040 No-Build Forecast Daily Volumes		
	WB/NB	EB/SB	Total	WB/NB	EB/SB	Total
US 17 - Southeast of I-95 Interchange	16,700	22,400	39,100	24,800	33,500	58,300
US 17 - Northwest of I-95 Interchange	32,200	32,500	64,700	54,000	54,300	108,300

3.7.2 2040 No-Build I-95 Mainline and Ramp Traffic Volumes

2040 No-Build forecast volumes were developed for the I- 95 Mainline, including the existing general purpose lanes and the proposed I-95 express lanes. The total 2013 existing conditions I-95 Mainline volumes were grown to 2040 and then express lane volumes were determined

using FAMPO travel demand model output. The express lane volumes shown are consistent through the study area between the Route 3 interchange and the Route 17 Interchange. The status of the southern section of the express lanes project is undetermined at this time; however for this study it is assumed access to and from the express lanes would occur north of Route 17 or south of Route 3. The resulting 2040 No-Build I-95 volumes are shown below in Table 3-9.

Table 3-9: I-95 Mainline Growth Rate and Resulting 2040 No-Build Volumes

Roadway / Location	2013 Existing Conditions Daily Volume			Average Annual Growth Rate		2040 No-Build Conditions Daily Volume				
						NB		SB		Total*
	NB	SB	Total*	NB	SB	General Purpose	HOT Lanes	General Purpose	HOT Lanes	
I-95 - South of Exit 130 (VA 3)	58,000	57,100	115,100	2.5%	2.5%	90,500	6,700	84,000	11,600	192,800
I-95 - At River	75,800	76,800	152,600	2.3%*	2.1%*	116,200	6,700	109,800	11,600	244,300
I-95 - North of Exit 133 (US 17)	68,300	66,400	134,700	2.1%*	2.1%*	101,100	6,700	92,900	11,600	212,300

* Calculated from resulting volumes of adding and subtracting Ramp ADT. Rounded to the nearest 0.1%

The I-95 interchange ramps at Route 3 and Route 17 were grown with the same growth rate as the arterial to which they belong. The Route 3 interchange ramps, to and from the west of I-95, were grown at 1.5%, annually. The Route 3 ramps, to and from the east of I-95, were grown at 1.0%. The ramps at US 17, to and from the west of I-95, were grown at 2.5%, while the ramp to and from the east were grown at 1.5%. The resulting ramp volumes are shown in **Figure 3-4A and 3-4B in Volume II**.

3.7.3 2040 No-Build Intersection Traffic Volumes

The intersections analyzed in the existing conditions were grown to 2040 forecast volumes by the same growth rates as their respective arterials. All movements, major and minor, were grown at the same growth rate at each intersection. The intersections along Route 3, west of I-95, were grown at 1.5%, annually, while the Route 3 intersection to the east of I-95 was grown at 1.0%, annually. The intersections along Route 17 were grown at 2.5% for those intersections west of I-95 and at 1.5% for those east of the interstate. Resulting 2040 No-Build intersection turn movement volumes are shown in **Figure 3-4A and Figure 3-4B in Volume II**.

3.8 2040 No-Build Conditions Traffic Operations

This section presents the 2040 No-Build conditions analysis of the key intersections, I-95 Mainline, and I-95 Ramp Junctions that were analyzed for the 2013 Existing Conditions (see Chapter 2) and the 2020 No-Build Conditions (see Section 3.4).

3.8.1 Intersection Analysis – 2040 No-Build Traffic Operations

The AM and PM peak hours at each intersection were analyzed to identify expected deficiencies without any additional improvements other than those currently planned and programmed (discussed in Section 3.2). Signal timings and phases were not changed from existing conditions. As done in the existing conditions chapter, a brief discussion of each intersection is provided to identify deficiencies. A summary of the 2040 No-Build level of service (LOS), compared to 2013 Existing Conditions and 2020 No-Build Conditions, is shown in Table 3-10A. The results of the queue analysis are shown in Table 3-10B Detailed HCS2010 analysis reports are presented in Appendix B – No-Build Conditions (Page B-40). CORSIM models were also developed for each peak hour to confirm the results of the HCS analysis (Section 3.9).

Intersection #1 (Route 3 & Mall Dr / Central Park Blvd): Overall the intersection is expected to operate at LOS E during the AM Peak Hour and LOS F during the PM Peak Hour. The eastbound right turn is the only movement projected to operate at LOS D or better during both peak hours. Several movements are projected to experience extensive delays beyond 99 seconds per vehicle.

Intersection #2 (Route 3 & Mall Ct / Carl D Silver Pkwy): Overall the intersection is expected to operate at LOS E during the AM Peak Hour and LOS F during the PM Peak Hour. The northbound and southbound minor approaches are both projected to operate at LOS E or LOS F during both peak hours. The majority of Route 3 turning movements are also projected to operate at an unacceptable LOS during both peak hours.

Intersection #3 (Route 3 & Gateway Blvd / Ramseur St): Overall the intersection is expected to operate at LOS C during the AM Peak Hour and LOS D during the PM Peak Hour. The northbound left is expected to operate with an unacceptable LOS during the AM peak hour. During the PM peak hour, the northbound left, northbound right, and westbound left are all projected to operate with an unacceptable LOS during the PM peak hour.

Intersection #4 (Route 17 & Hardee's Access / McLane Dr): Overall the intersection is projected to operate at LOS F during both the AM and PM peak hours. The Route 17 through movements are projected to operate at an unacceptable LOS during the AM peak hour. The Route 17 left turns and through movements are projected to operate at LOS E or LOS F during the PM peak hour.

Intersection #5 (Route 17 & Sanford Dr): Overall the intersection is expected to operate at LOS F during both peak hours. During the AM Peak Hour, all movements are projected to operate at unacceptable conditions with the exception of the eastbound and westbound right turn movements. During the PM Peak Hour, most movements are projected to operate at poor levels of services and both of the Route 17 through movements are projected to experience high levels of delay.

Table 3-10A: 2040 No-Build Intersection LOS Summary (All results from HCS)

				AM Peak Hour										PM Peak Hour									
				2013		2020 No Build		2040 No Build						2013		2020 No Build		2040 No Build					
				Intersection		Intersection		Movement		Approach		Intersection		Intersection		Intersection		Movement		Approach		Intersection	
	Intersection	Approach	Movement	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS
1	Route 3 / Mall Dr. / Central Park Blvd.	NB	Left	15.1	B	19.4	B	65.2	E	229.4	F	78.1	E	103.8	F	120.0	F	82.7	F	852.0	F	169.1	F
			Through					66.5	E									98.6	F				
			Right					269.4	F									1224.0	F				
		SB	Left					69.0	E	116.3	F							79.9	E	479.9	F		
			Through					68.9	E									72.3	E				
			Right					130.2	F									813.0	F				
		EB	Left					65.8	E	96.9	F							78.1	E	90.0	F		
			Through					101.7	F									95.0	F				
			Right					0.1	A									44.9	D				
		WB	Left					67.6	E	12.1	B							79.8	E	29.5	C		
			Through					7.1	A									15.8	B				
			Right					9.8	A									30.1	C				
2	Route 3 / Carl D. Silver Pkwy	NB	Left	29.7	C	32.8	C	71.5	E	70.9	E	72.9	B	97.8	F	127.8	F	77.5	E	76.7	E	224.9	F
			Through					71.5	E									77.5	E				
			Right					70.3	E									75.9	E				
		SB	Left					63.1	E	61.7	E							291.4	F	254.7	F		
			Through					51.9	D									51.4	D				
			Right					54.3	D									157.6	F				
		EB	Left					63.8	E	89.5	F							65.6	E	16.5	B		
			Through					91.1	F									9.2	A				
			Right					24.7	C									5.7	A				
		WB	Left					70.0	E	43.9	D							76.6	E	337.0	F		
			Through					33.6	C									239.4	F				
			Right					67.3	E									630.1	F				
3	Route 3 / Gateway Blvd.	NB	Left	20.6	C	21.8	C	86.7	F	74.9	E	26.9	C	27.5	C	30.2	C	186.7	F	150.0	F	43.8	D
			Through					38.2	D									38.0	D				
			Right					42.0	D									97.6	F				
		SB	Left					48.7	D	50.3	D							48.7	D	48.9	D		
			Through					50.7	D									49.1	D				
			Right					50.7	D									49.1	D				
		EB	Left					47.4	D	29.8	C							47.4	D	36.9	D		
			Through					30.1	C									36.0	D				
			Right					26.7	C									39.3	D				
		WB	Left					46.6	D	12.1	B							69.7	E	18.1	B		
			Through					9.4	A									9.1	A				
			Right					3.1	A									0.0	A				
4	Route 17 / McLane Dr.	NB	Left	25.8	C	53.7	D	54.8	D	271.8	F	218.0	F	19.1	B	27.9	C	69.5	E	61.3	E	144.1	F
			Through					277.8	F									61.8	F				
			Right					1.2	A									0.1	A				
		SB	Left					54.2	D	158.9	F							68.5	E	213.8	F		
			Through					162.2	F									216.0	F				
			Right					17.9	B									14.4	B				
		EB	Left					33.1	C	33.1	C							47.1	D	47.1	D		
			Through					33.1	C									47.1	D				
			Right					33.1	C									47.1	D				
		WB	Left					33.7	C	33.7	C							49.3	D	49.3	D		
			Through					33.7	C									49.3	D				
			Right					33.7	C									49.3	D				
5	Route 17 /Sanford Dr.	NB	Left	36.4	D	53.2	D	76.8	E	204.1	F	241.8	F	291.7	F	382.6	F	82.6	F	2690.1	F	486.7	F
			Through					54.4	D									69.7	E				
			Right					267.0	F									2870.7	F				
		SB	Left					74.1	E	72.1	E							121.2	F	116.8	F		
			Through					70.4	E									59.4	E				
			Right					61.3	E									60.3	E				
		EB	Left					44.6	D	96.1	F							64.4	E	318.8	F		
			Through					97.2	F									324.8	F				
			Right					14.0	B									23.6	C				
		WB	Left					574.8	F	361.5	F							288.6	F	152.1	F		
			Through					373.2	F									147.6	F				
			Right					27.6	C									24.7	C				
6	Route 17 /Short St.	NB	Left	34.9	C	46.8	D	35.7	D	35.2	D	128.4	F	105.6	F	150.7	F	43.3	D	42.4	D	276.0	F
			Through					35.7	D									43.3	D				
			Right					31.6	C									39.5	D				
		SB	Left					41.3	D	41.3	D							44.9	D	44.9	D		
			Through					41.3	D									44.9	D				
			Right					41.3	D									44.9	D				
		EB	Left					246.2	F	231.6	F							451.7	F	425.2	F		
			Through					234.3	F									431.6	F				
			Right					22.5	C									20.7	C				
		WB	Left					20.5	C	36.7	D							21.8	C	20.7	C		
			Through					34.6	C									20.7	C				
			Right					39.1	D									20.7	C				

Notes: All results from HCS 2010. Intersections 1,2,3,5,6 major movement is E-W; Intersections 4 major movement is N-S.

Intersection #6 (Route 17 & Short St / Driveway): Overall the intersection is expected to operate at LOS F during both peak hours with the eastbound/southbound left turn and through movements on Route 17 projected to operate at LOS E or LOS F.

In general, Year 2040 No-Build operations are projected to worsen significantly when compared to the Year 2020 No-Build conditions. Delays are expected to be very long at most of the study area intersections due to expected high traffic volumes that greatly exceed the capacity of the intersections.

Queuing

The queue analysis was also conducted using the HCS 2010 software and the results are shown in Table 3-10B. The results show longer queue lengths at all locations when compared to both the 2020 no-build and existing conditions. The minor approaches at multiple intersections within the study area will queue lengths that exceed the available storage. Similar to the existing conditions but to a much greater degree, during the PM peak hour, the queue length for the westbound right turn at the intersection of Route 3 and Carl D. Silver Parkway greatly exceeds the available storage. The queue then causes the ramp from southbound I-95 to back up usually causing significant delays on southbound I-95. The results show that this is likely to occur during the AM peak hour as well which is not the case in the 2020 no-build condition. During the AM peak hour on Route 17, the queue length for the eastbound approach at the intersection with Sanford Drive (#5) exceeds the distance between this intersection and the upstream intersection with McLane Drive (#4). The results show that this is likely to occur during the AM peak hour as well which is not the case in the 2020 no-build condition. During the PM peak hour, the HCS results show that the queue length for the westbound left turn will exceed the available storage.

The CORSIM model for the 2040 No-Build condition confirms the HCS2010 results however, the study roadways in the CORSIM simulation are completely gridlocked as a result of the high 2040 traffic volumes.

Table 3-10B: 2040 No-Build Conditions Intersection Queue Summary

Intersection		Approach	Movement	Storage (ft)	Queue Length (ft)					
					AM Peak Hour			PM Peak Hour		
					Existing	2020 No Build	2040 No Build	Existing	2020 No Build	2040 No Build
1	Route 3 / Mall Dr. / Central Park Blvd.	NB	Left	425	5	10	10	88	100	133
			Through	425	25	30	40	113	130	185
			Right	150	208	248	375	870	1018	1375
		SB	Left	250	8	10	10	105	120	165
			Through	2750	8	5	10	95	108	138
			Right	250	78	103	155	705	825	1180
		EB	Left	475	130	145	190	168	193	260
			Through	900	25	65	725	623	700	1008
			Right	900	0	0	0	98	105	140
		WB	Left	675	45	50	65	240	278	415
			Through	825	48	53	70	118	133	293
			Right	675	63	70	93	168	210	515
2	Route 3 / Carl D. Silver Pkwy	NB	Left	-	-	-	-	-	-	-
			Through	50	20	20	30	35	33	45
			Right	50	18	18	30	25	30	40
		SB	Left	475	168	190	245	600	713	1088
			Through	1250	5	8	8	13	10	18
			Right	495	43	48	68	315	370	630
		EB	Left	250	73	80	103	145	160	208
			Through	800	425	550	1135	78	85	115
			Right	250	8	5	13	3	3	3
		WB	Left	400	23	20	30	40	45	55
			Through	3675	188	210	280	843	1025	1643
			Right	650	400	465	735	1845	2153	3025
3	Route 3 / Gateway Blvd.	NB	Left	400	185	215	325	320	370	553
			Through	4500	5	5	5	0	3	3
			Right	400	63	70	85	163	183	298
		SB	Left	650	8	8	8	8	8	8
			Through	650	18	18	25	3	8	8
			Right	650	-	-	-	-	-	-
		EB	Left	350	23	28	28	20	20	28
			Through	3675	230	260	343	283	318	445
			Right	450	150	163	220	243	283	403
		WB	Left	275	35	38	48	85	90	128
			Through	375	40	45	68	40	45	70
			Right	375	0	0	0	0	0	0
4	Route 17 / McLane Dr.	NB	Left	35	13	15	25	10	10	20
			Through	35	223	535	1703	28	38	428
			Right	35	3	3	3	0	0	0
		SB	Left	875	20	25	33	10	10	20
			Through	875	398	535	1330	635	958	2128
			Right	875	10	13	18	8	8	13
		EB	Left	-	-	-	-	-	-	-
			Through	1000	18	18	30	15	20	30
			Right	-	-	-	-	-	-	-
		WB	Left	-	-	-	-	-	-	-
			Through	845	28	33	45	50	55	85
			Right	-	-	-	-	-	-	-
5	Route 17 /Sanford Dr.	NB	Left	425	50	58	95	45	60	60
			Through	875	5	8	8	5	13	10
			Right	400	133	198	353	1470	1795	2573
		SB	Left	850	65	73	115	173	213	353
			Through	475	55	65	100	18	20	30
			Right	360	13	18	28	5	10	10
		EB	Left	580	10	10	15	5	10	10
			Through	845	468	678	1090	865	1188	2298
			Right	845	8	8	10	23	28	38
		WB	Left	275	165	208	678	250	310	688
			Through	2750	508	755	2243	490	645	1430
			Right	400	83	95	195	98	123	185
6	Route 17 /Short St.	NB	Left	-	-	-	-	-	-	-
			Through	1000	48	55	73	48	55	75
			Right	100	5	5	10	15	18	23
		SB	Left	-	-	-	-	-	-	-
			Through	35	8	8	15	8	13	13
			Right	-	-	-	-	-	-	-
		EB	Left	2750	413	563	1158	1215	1613	2713
			Through	2750	373	508	1165	1075	1428	2420
			Right	275	20	25	28	30	35	50
		WB	Left	150	5	5	5	3	3	5
			Through	3000	238	288	500	185	220	345
			Right	3000	240	293	533	188	220	348

3.8.2 I-95 Mainline and Ramp Junction Analysis – 2040 No-Build Traffic Operations

2040 No-Build level of service analyses were also performed for the Weekday AM / PM peak hours for northbound and southbound I-95 Mainline segments and at ramp junctions (merge, diverge, and weave) in the study area using HCS2010 Ramp Junction software, HCS2010 Weaving Analysis software, CORSIM micro-simulation software, and manual calculations from Highway Capacity Manual methodologies. The 2040 No-Build traffic forecasts developed in Section 3.7 were used in the analyses. Findings for the mainline and ramp analyses are discussed below and shown in **Figure 3-5 in Volume II**. Detailed HCS2010 mainline and ramp junction analysis reports are presented in the Appendix B - No-Build Conditions (starting on Page B-96).

Northbound I-95

Operations are projected to degrade significantly in 2040 when compared to the Year 2020 No-Build Condition. The I-95 Northbound mainline segments are projected to operate at LOS E or worse during at least one peak hour at almost all locations within the study area. Many locations are projected to operate at LOS F with substantial reductions in operating speed. Poor LOS is projected for many of the ramp merges, ramp diverges, and weaving segments during both peak hours.

Southbound I-95

All of the mainline segments and ramp junctions in the southbound direction are expected to operate at LOS C or D in the AM peak hour. The PM peak hour is expected to experience poor levels of service (LOS E or F) for the majority of the study area. The southbound I-95 weave segment at the Route 3 interchange and the eastbound Route 3 to SB I-95 merge are both expected to operate at LOS C in the PM peak hour. The southbound I-95 mainline segment south of Route 3 is expected to operate at LOS D in the PM peak hour.

As can be seen from the analysis, I-95 delay and congestion in 2040 is expected to worsen when compared to the 2020 no-build conditions. The 2040 demand exceeds the capacity of the mainline between the Route 3 and Route 17 Interchanges in the peak direction during the peak hours. Severe congestion is expected to occur in the northbound direction during the AM peak hour and the southbound direction during the PM Peak hour corresponding to the heavy commuting patterns between Route 3 and Route 17 and between Fredericksburg area and Northern Virginia. The heaviest volume ramps all exceed their capacity. These include the EB to SB on-ramp and NB to WB off-ramp at Route 17 and the SB to WB off-ramp and EB to NB on-ramp at Route 3. Due to the heavy mainline volumes and short weave distances the majority of the ramps experience poor levels of service. Due to the lack of express lanes access and corresponding capacity in the northbound direction during the PM peak hour, the I-95 northbound direction also is expected to have breakdown conditions.

3.9 2040 No-Build Conditions – CORSIM Analysis

CORSIM micro-simulation analysis was again performed on the I-95 Mainline and on the Route 3 and Route 17 interchanges. CORSIM analysis results for I-95 Mainline and Ramp Junctions were generated for the same locations as those completed with HCS (Figure 3-5 in Volume II).

Note that the discrepancies in the densities and speeds are a result of the differences of the functionality of the software. The results of the CORSIM network are shown in Table 3-11.

Table 3-11: CORSIM 2040 No-Build I-95 Mainline and Ramp Junction Analysis Summary

Northbound I-95 Mainline & Ramp Analysis			2040 No-Build			
			AM Peak Hour		PM Peak Hour	
Roadway	Location	Analysis ID	Vehicle Density (pc/mi/ln)	Vehicle Speed (mph)	Vehicle Density (pc/mi/ln)	Vehicle Speed (mph)
I-95 NB Mainline	South of Route 3 Interchange	Mainline Segment 1	23.6	39.5	36.5	46.0
Route 3 Interchange Ramps	I-95 NB **Diverge** to Route 3 EB	D-1	22.1	33.5	43.5	32.4
	Route 3 EB Merge to I-95 NB diverge - **Weave**	W-1	29.3	26.5	44.6	22.8
	Route 3 WB **Merge** to I-95 NB	M-1	42.8	13.8	62.9	18.6
I-95 Mainline	Route 3 to Route 17	Mainline Segment 2	61.0	11.2	78.8	16.2
I-95 Mainline	Route 3 to Route 17	Mainline Segment 3	45.2	14.7	66.3	18.4
Route 17 Interchange Ramps	I-95 NB **diverge** to I-95 C/D Roadway	D-2	46.2	11.6	50.6	17.5
	I-95 C/D Roadway **diverge** to Route 17 Bus SB	D-3	90.1	6.2	81.5	6.6
	Route 17 SB Merge to I-95 NB diverge - **Weave**	W-2	122.6	7.7	101.8	6.6
	Route 17 Bus NB **merge** to I-95 C/D Roadway	M-2	24.0	41.5	9.3	6.6
	I-95 C/D Roadway **merge** to I-95 NB	M-3	10.0	63.0	11.4	65.7
I-95 Mainline	North of Route 17 Interchange	Mainline Segment 4	11.1	67.9	13.5	67.5

Southbound I-95 Mainline & Ramp Analysis			2040 No-Build			
			AM Peak Hour		PM Peak Hour	
Roadway	Location	Analysis Type	Vehicle Density (pc/mi/ln)	Vehicle Speed (mph)	Vehicle Density (pc/mi/ln)	Vehicle Speed (mph)
I-95 SB Mainline	North of Route 17 Interchange	Mainline Segment 4	62.8	23.0	74.2	20.7
Route 17 Interchange Ramps	I-95 SB diverge to Route 17 NB	D-4	68.7	17.1	64.5	19.4
	Route 17 NB Merge to I-95 SB diverge - **Weave**	W-3	14.1	54.7	50.1	17.8
	Route 17 SB **merge** to I-95 SB	M-4	19.2	53.1	84.9	10.6
I-95 SB Mainline	Route 17 to Rest Area	Mainline Segment 3	18.4	63.1	98.1	11.2
Rest Area	Rest Area - Diverge	D-5	19.7	56.8	72.8	12.4
	Rest Area - Merge	M-5	19.5	54.6	116.7	8.9
I-95 SB Mainline	Rest Area to Route 3	Mainline Segment 2	19.5	53.7	78.4	14.2
Route 3 Interchange Ramps	I-95 SB **Diverge** to Route 3 WB	D-6	18.4	46.4	56.8	15.7
	Route 3 WB Merge to I-95 SB diverge - **Weave**	W-4	21.0	32.5	7.7	60.3
	Route 3 EB **Merge** to I-95 SB	M-6	10.5	65.4	10.0	63.8
I-95 SB Mainline	South of Route 3 Interchange	Mainline Segment 1	12.1	66.9	11.2	67.7

The CORSIM base networks used for the 2013 existing conditions analysis were modified to include the roadway improvements planned for Route 3 and Route 17 (see Section 3.2). Volumes were updated to reflect the No-Build volumes discussed in Section 3.7. No global parameters or additional default values were changed from those changed during the calibration of the base year model.

The CORSIM analysis confirms the results from the HCS analysis. The HCS analysis showed long delays at intersections along Route 3 and Route 17. The CORSIM analysis showed significant queues backing through intersections on Route 3 and Route 17 particularly in the PM

peak hour. The HCS analysis also showed I-95 being over capacity with most ramp junctions failing in both peak periods for northbound I-95 and failing in the PM peak for southbound I-95. The CORSIM analysis also showed breakdown conditions on the I-95 mainline in both directions during both peak periods. In addition, CORSIM showed the Route 17 cloverleaf interchange starting to become paralyzed with traffic barely moving due to the high traffic volumes. Densities and speed by lane and roadway segment from the CORSIM microsimulation is shown on graphics in Appendix B - No-Build Conditions (starting on Page B-151).

3.10 2040 No-Build Conditions - Safety Evaluation

As traffic volumes increase in the study area and congestion worsens, total annual crashes are expected to increase in 2040 when compared to 2013 existing conditions. As can be seen when comparing Figures 2-7 and 3-5 and Tables 2-7 and 3-11, densities are expected to increase and travel speeds decrease under the 2040 No-Build condition when compared to the 2013 existing conditions. It is likely that the crash rate will also increase as higher densities and greater speed differentials between free flow and congested speeds occur.

CHAPTER 4 PURPOSE AND NEED

4.1 Background / Need

Since 1980, the George Washington Region has been the fastest growing area in Virginia, on a percent population basis. An existing population of 328,000 is projected to almost double to 617,000 by 2040. With this explosive growth the region has emerged to be a significant urban area of economic and social activity. It is also an area which has high commuting exchange with the greater Washington, D.C. business and military community. This growth has led to increased traffic volumes and congestion on the existing roadway network.

Major existing economic and commercial centers for the region are located along Route 3 and Route 17 near I-95 as well as within the areas adjacent to I-95 between Route 3 and Route 17. One such area is the Central Park/Celebrate Virginia! South complex which is expected to grow as a mixed use development with potential residential land uses, an expanded conference center resort, a minor league baseball stadium and expanded retail and entertainment choices. The Central Park/Celebrate Virginia! South complex is bounded by I-95, Route 3, the Rappahannock River, and a western edge approximately one mile west of I-95. Additional development is occurring at the Route 17 interchange. The I-95/Route 3 Interchange and I-95/Route 17 interchanges are the main access point to these high generating traffic commercial areas.

Currently I-95 carries over 150,000 vehicles per day and experiences congestion during peak periods, with portions of the interstate operating at LOS F. Route 3 carries up to 71,000 vehicles per day, exceeding the capacity of a six-lane arterial street and resulting in LOS F during the peak periods at its signalized intersections. Route 17 carries up to 65,000 vehicles per day, also exceeding the capacity of a six-lane arterial street and resulting in LOS F during the peak periods at its signalized intersections. Both Route 3 and Route 17 interchanges are cloverleaf interchanges with weaves between ramps that exceed capacity. In addition, there is a significant amount of local traffic that only uses the three miles of I-95 between Route 3 and Route 17 in order to cross the Rappahannock River adding congestion to the merges and diverges at the Route 3 and Route 17 interchanges.

Traffic volumes on I-95 are projected to increase to 244,000 vehicles per day by 2040, while Route 3 volumes are expected to increase to over 99,000 vehicles per day and Route 17 to over 108,000 vehicles per day. The ability of these facilities to carry volumes at these levels is a serious concern, even with the proposed construction of the two reversible express lanes in the median of I-95. Therefore, congestion and operating levels of service will continue to deteriorate on I-95, Route 3, Route 17 and at their interchanges. This congestion will spread out from the peak periods into greater portions of the day.

The above concerns have been evidenced by a series of previous attempts to find affordable solutions to these documented problems. Examples of previous efforts include the Outer Connector Environmental Impact Statement, the March 2000 Draft I-95 Interchange Justification

Report by Volkert & Associates, the I-95 Express Lanes initiative, the I-95 Access Study and previous versions of the FAMPO Constrained Long Range Transportation Plan.

More recently, building on these past efforts, the Fredericksburg Area Metropolitan Planning Organization (FAMPO) and its member communities have developed a long-range comprehensive plan and strategy to address the growing demands on the region's transportation network. Central to this planning has been the need for improving mobility between I-95 and Routes 3 and 17. The 2040 Constrained Long-Range Plan (CLRP) was adopted in April 2013 and designates $10 million for designing improvements to the Route 3 and Route 17 interchanges and four new collector-distributor lanes across the river connecting the interchanges.

The CLRP also includes the construction of two new I-95 Express Lanes between north Stafford County and Massaponax in Spotsylvania County, a distance of about twenty-eight miles. A similar project is under construction from the Capital Beltway to I-95 Exit 143 in Stafford County. These improvements consist of converting 14 miles of the existing HOV lanes to Express Lanes and extending them 9 miles south to Garrisonville Road. The northern section of the project consists of converting 14 miles of HOV lanes to Express Lanes and extending them 9 miles south to Garrisonville Road. This section has an anticipated construction completion date in late 2014 and is expected to start collecting tolls in early 2015. No time frame has been established for extending the Express Lanes to Massaponax in Spotsylvania.

The CLRP includes Expanded Fredericksburg Regional Transit service, express bus, significant Transportation Demand Management (TDM) measures (carpools, vanpools, etc.), and provision of expanded park and ride lots at Massaponax, the Central Park/Celebrate Virginia! South complex, and Route 610 in proximity to I-95.

4.2 Project-Specific Purpose

With the specific intent of addressing documented safety and operational deficiencies on I-95 between Route 17 (Exit 133) and Route 3 (Exit 130) this I-95 Interchange Modification Study has been initiated. The following Purpose is established to:

- Advance the recommendations, objectives and policy identified in the FAMPO 2040 Long Range Transportation Plan, adopted April 2013.
- Address recurring safety and congestion challenges associated with study area peak period travel along the I-95 mainline.
- Address recurring safety and congestion challenges associated with peak period activity at the interchanges of Route 3 and US 17.
- Eliminate I-95 weaving movements wherever possible.
- Remove from the I-95 mainline, as much of the local traffic as possible that uses I-95 to travel between Route 3 and Route 17.
- Provide additional parallel I-95 bridges over the Rappahannock River to allow for needed redundancy and flexibility during incidents, required maintenance, and bridge rehabilitation activities.
- Arrive at a solution that is compatible with the development of park and ride, TDM, and transit opportunities within the I-95 Corridor to reduce single occupant vehicle travel.

CHAPTER 5 ALTERNATIVES

This section discusses the alternatives that were considered to address the purposes and need for the project. Alternatives considered at the study area location include:

- No-Build Alternative
- Transportation System Management (TSM) Alternative
- Local Street Network Improvements Only Alternative
- Build Alternatives

During the development and evaluation of alternatives several key items were taken into consideration including but not limited to:

1. Meeting the Purpose and Need of the study (see Chapter 4)
2. Environmental Constraints (see Chapter 2)
3. Existing and Planned Development (see Chapters 2 and 3)
4. 2040 Traffic Volumes and Operations (see Chapters 3 and 6)
5. Safety Considerations (see Chapters 2, 3, and 6)
6. Funding Constraints (only $200 million might be fundable - see Chapter 8)
7. Professional judgment of the Steering Committee

Below are a summary of the alternatives considered and the results of the screening process. Ultimately one of these alternatives was considered the preferred alternative that best met the purpose and need. Detailed traffic operations were then conducted for the preferred alternative and are presented in Chapter 6.

5.1 No-Build Alternative

The No-Build Alternative represents no modifications to the interstate or arterial roadway system other than the planned and programmed improvements identified in the FAMPO 2040 Constrained Long-Range Plan. However, it would allow for short-term restoration types of activities (safety and maintenance improvements, etc.) that maintain continuing operation of the existing interstate facility. The list of roadway and transit projects contained in the 2040 Constrained Long-Range Plan was provided in Chapter 3. Key projects include:

Roadway Projects

- Widen US 17 to 6 lanes from McLane Dr. to the west and provide sidewalks
- Build 2-lane reversible Express Lanes in the median of I-95 through the study area

TSM Improvements in 2040 Constrained Long Range Plan

- Expand VRE service including a new station south of the project area
- 50 percent expansion of FRED service in the region
- New park and ride lots including one at Celebrate Virginia
- Expanded TDM programs such as capital assistance for vanpools, enhanced guaranteed ride home program, carpool incentives, marketing incentives, and vanpool drive incentives.

As the data in Chapter 3 demonstrates, under the No-Build Alternative, the existing interchange

and/or local roads and streets in the corridor cannot provide a satisfactory level of service (LOS) to accommodate the weekday AM/PM Peak Hour Design Year traffic demands for 2040, while at the same time providing safe and adequate access. There is oversaturation on Route 3, I-95 and Route 17 creating bottlenecks that effectively paralyze travel in the region. Therefore, as stated in the Purpose and Need, there is a need to explore alternatives that add capacity to the I-95 corridor and reduce congestion on Route 3 and I-95. Analysis of the No-Build Alternative will be used as the baseline to which build alternatives are evaluated.

5.2 Transportation System Management Alternative

Transportation System Management (TSM) improvements reduce roadway congestion and improve traffic safety through the use of technology, reducing demand, increasing vehicle occupancy and alternative modes of travel. The No-Build Alternative includes many TSM improvements (see Section 3.2), however even with these improvements, Route 3, I-95 and Route 17 are expected to remain over capacity creating bottlenecks that effectively paralyze travel in the region.

The study team considered possible TSM improvements consisting of additional HOV facilities, expanded transit services, improved signal timing and synchronization and intelligent transportation system improvements.

TSM measures considered included additional HOV lanes, park and ride lots, or carpools and vanpools. The FAMPO CLRP, and thus the No-build alternative, includes two reversible express lanes that are available to HOV+3. It is unlikely that additional HOV facilities beyond those planned would improve operations based on the results from the *I-95 HOV Feasibility Study* that concluded:

> *"In general, the feasibility of providing HOV lane is assessed in terms of: 1) projected HOV utilization and 2) increased usage of high occupant modes, such as carpools, vanpools, and buses. This analysis has shown that the HOV facility would be projected to carry appropriate levels of person trips as compared to national guidelines; however, there is not projected to be a significant shift in mode share as a result of extending the HOV facility southward into the FAMPO region. There are two primary factors behind this finding: 1) a large proportion of commuters in this corridor are already using high occupant modes due to the significant travel time benefits gained in the I-95/I-395 corridor to the north of the FAMPO region and 2) although the I-95 general use lanes are projected to be congested in the FAMPO region in 2025, the actual travel time savings between VA 3 and the Stafford County/Prince William County Line is estimated to be approximately seven minutes over this eighteen-mile portion of I-95. The pivot point model is predicting that this seven-minute travel time saving, combined with the approximately forty-minute travel time saving already formed north of the FAMPO region, is still not enough to induce a significant shift to HOV modes." (The additional seven minutes is not pivotal when the commuter can already save 40 minutes).*[9]

Another TSM measure considered was Intelligent Transportation System (ITS) improvements such as changeable message signs and cameras. The biggest benefit of these types of

[9] Prepared for VDOT by BMI. *I-95 HOV Feasibility Study*. March 2002, P 27.

improvements is to warn traffic of congestion and offer alternative routes and help authorities manage and respond to incidents. There are very few alternatives to I-95 across the Rappahannock River, so although ITS can have a tremendous effect helping relieve non-recurring congestion, it is more limited in solving reoccurring congestion along facilities well over capacity. Under the no-build conditions, the expected >225,000 vehicles per day demand well exceeds the approximate 150,000 vehicles per day capacity of the existing six general purpose lanes.

Signal timing coordination and improvements also would have limited ability to improve operations. Currently the signals on Route 3 and Route 17 are coordinated by VDOT resulting in getting out the most capacity possible of both facilities. VDOT periodically retimes the signals to respond to changes in travel demand. As demand in these corridors grows, signal timing changes would provide diminishing return in terms of traffic operations.

Ramp metering was considered however not investigated as both the I-95 mainline and ramp junctions are all projected to be over capacity in the 2020 No-Build scenario, rendering ramp metering ineffective.

Additional transit improvements were also considered. However as noted below in the *FAMPO 2035 (Constrained) Long-Range Transportation Plan*, public transit performance cannot be improved by simply increasing transit service frequencies and areas of coverage, because the land use densities are too low to support this type of increase economically.

> *"one of the key findings of this work is that the George Washington Region is a particularly challenging area in which to provide public transit. This is because the effectiveness of transit is closely related to land use patterns and commute patterns. Transit is most effective in densely developed areas with concentrated development. In the George Washington Region, development is of a very low-density nature. Most recent residential development has been in large complexes located away from transit, and most new commercial construction has been in strip developments along existing and new arterials and collectors. Various research efforts have shown that productive, traditional; fixed-route transit requires at least 3 households per acre or at least 4 jobs per acre. In terms of how "transit supportive" areas are, those with 3 to 10 households per acre or 4 to 20 jobs per acre generally have a medium level of transit supportiveness, and those with higher levels generally have a higher level of transit supportiveness. In the George Washington Region, relatively few areas currently have these densities. As the Region's grows, some existing areas are projected to develop more densely, but most new development patterns are expected to be similar as at present, and to sprawl into new areas.*
>
> *In addition, nearly all transit riders walk to and from transit, and thus are also pedestrians. As a result, an area's walking environment is critical to the success of transit. If the walking environment is unpleasant (no sidewalks, wide roads to cross, large parking lots between bus stops and stores, etc.), people who have cars will drive instead of using transit. As a result, in automobile-oriented environments such as the George Washington Region, transit typically struggles to attract "choice" riders. These land use characteristics in the George Washington Region limit the potential of transit*

within the Region."[10]

"FRED service currently provides a basic level of one hour headway service, and its primary market consists of residents in the Region who do not have access to a private automobile. As described earlier, the Region's development patterns preclude the economic implementation of region-wide transit service that would attract large numbers of "choice" riders."[11]

The TSM measures discussed above (those beyond those contained in the CLRP) are limited in the ability to improve traffic operations in the region and would not be expected to eliminate the need for the capacity improvements identified in the Purpose and Need. Therefore, TSM measures are included in the no-build but not as a standalone alternative.

5.3 Improvements to Local Streets Only Alternative

This alternative would include improvements to the local street network with no modifications to I-95 beyond those in the No-Build alternative. Potential improvements could include additional crossings of I-95 and improvements to Route 3. Additional crossings of I-95 other than Fall Hill Avenue and Cowan Boulevard could improve east-west travel but would not improve access to and from I-95 for shoppers and commuters. Also, no capacity improvements to I-95 resulting in I-95 remaining oversaturated with the >225,000 vehicles per day demand well exceeding the approximate 150,000 vehicles per day capacity of the existing six general purpose lanes. Improvements to the local streets only does not meet the project's purpose and need.

5.4 Build Alternatives

As previously discussed in Chapter 1, in 2010/2011 GWRC/FAMPO in coordination with VDOT completed an I-95 Access Study that recommended a new interchange on I-95 between Exit 130 and Exit 133. The new interchange provided access to a 4-mile toll road that provided an alternate route to highly congested Route 3. The I-95 Access Study was submitted to FHWA as an Interchange Justification Report and approved in April 2011. The approved project included the construction of parallel collector-distributor (C-D lanes) in each direction between the new interchange and Route 17 interchange with a pair of braided ramps to separate heavy new interchange volumes and Route 17 ramp volumes. The project also includes new I-95 bridges in each direction across the Rappahannock River, and reconstruction of the Route 17 interchange (Exit 133). The NEPA process was then initiated by VDOT. With a change in the Spotsylvania County Board of Supervisors, the County removed their support for the project and the project and NEPA work was put on hold. The Spotsylvania concerns were associated with the toll road connector portion of the larger project.

VDOT decided to pursue approval of the I-95 improvements recommended in the I-95 Access Study. These improvements served as the base alternative considered for evaluation in this IMR. The proposed NB and SB C-D roads were extended to the Route 3 interchange. The proposed base alternative (Alternative 1) is shown in **Figure 5-1 in Volume II** and includes the construction of parallel collector-distributor (C-D lanes) in each direction between the Route 3

[10] Prepared for VDOT by BMI. *I-95 HOV Feasibility Study*. March 2002, P 60.
[11] Prepared for VDOT by BMI. *I-95 HOV Feasibility Study*. March 2002, P 63.

and Route 17 interchanges on I-95 with a pair of braided ramps to separate heavy Route 3 and Route 17 ramp volumes. The project also includes new I-95 bridges in each direction across the Rappahannock River, reconstruction of the Route 17 interchange (Exit 133) and modest improvements to the Route 3 interchange (Exit 130). Mitigation improvements are also required at the Virginia Welcome Center.

5.4.1 Development and Evaluation of Additional Build Alternatives

Initial evaluation of the safety and operational conditions of the Base Alternative: Alternative 1 showed that the NB C-D roads would only carry about 15,500 vehicles per day. This small diversion of traffic would still leave NB I-95 operating at a LOS of E or F during the peak periods. In addition, the proposed improvements associated with Alternative 1 would neither eliminate the existing NB weave on I-95 between the NB on-ramp and NB off-ramp, nor the EB weave movement on the Route 3 overpass. Both weaves currently have severe congestion and are safety problems in the existing conditions. It was decided by the project steering committee that additional alternatives should be developed and evaluated that include looking at short-term to intermediate improvements to the Route 3 interchanges that :

A. Increase the traffic volumes on the northbound CD road, but not to the point that the facility has an unacceptable LOS.
B. Eliminate or reduce the number of weaves at the Route 3 interchange with I-95, particularly the NB I-95 weave.

Nine alternatives were developed (Alts 1B, 2A, 2B, 3A, 3B, 4A, 4B, 5 & 7) and evaluated to improve the operations at Route 3. Several long-term Alternatives (Alts 6, and 8A & 8B) that require reconstruction of the interchange or long bridge structures were also evaluated to determine what future designs may be feasible and if the short/intermediate term improvements can be salvaged with the future designs.

Each of the alternatives is shown graphically in **Figures 5-1 through 5-8B in Volume II**. All the alternatives are similar to each other north of Cowan Boulevard except for Alternative 7. Therefore Alternative 1 and Alternative 7 are shown graphically in 5 sheets each to cover the full area of proposed improvements. While only the improvements at Route 3 are shown for the other alternatives.

Table 5-1 in Volume II was used as a screening tool to evaluate various components of each alternative. This allowed the study team to carry forward only the most feasible alternatives to analyze in CORSIM and then select a preferred alternative. Table 5-1 includes a brief description of each alternative that was developed along with the impacts to the weaves and traffic operations. Below is a description of the data shown and used for evaluating the alternatives in Table 5-1:

- Column A: The Name and Description of each alternative
- Column B: Impact on the weaves at the Route 3 interchange (removed or not)
- Column C: The ADTs, Densities, and LOS for the AM and PM peak hours for each direction of the proposed CD roads.
- Column D: Whether or not the design requires additional signals on Route 3 and resulting LOS if required

- Column E: Any additional comments on the design
- Column F: Recommendation on whether to advance the alternative for additional detailed CORSIM analysis
- Column G: The Figure number associated with each Alternative to view it graphically. All figures depicting the alternatives are in Volume II.

Table 5-2 in Volume II documents the resulting densities and LOS that is expected on the mainline I-95 for both peak periods for each of the alternatives in 2040 as wells as on the proposed NB and SB C-D roads. Analysis was completed for the volumes expected in 2040 at the Rappahannock bridges for both the existing three lanes in each direction and for a fourth general purpose lane in each direction. It is important to note that all of the volumes used in the table for each alternative assume that the Express Lanes are in place. During the PM peak hour, the express lanes will not be running in the northbound direction, that is why the LOS for northbound is generally worse in the PM peak hour than in the AM peak hour.

These alternatives were compared to each other and the base alternative (Alternative 1). A brief description of each is provided below along with how the alternative performs and a recommendation of whether to advance the alternative for further analysis.

Alternative 1: The proposed base alternative (Alternative 1) is shown in **Figure 5-1 (Sheets 1 through 5) in Volume II** and includes the construction of parallel collector-distributor (C-D lanes) in each direction between the Route 3 and Route 17 interchanges on I-95 with a pair of braided ramps to separate heavy Route 3 and Route 17 ramp volumes. The NB C-D Road would start at the EB Route 3 to NB I-95 on-ramp and end at the new I-95 NB to Route 17 WB/NB underpass. The SB C-D Road would start just south Route 17 and end at the I-95 SB off-ramp to WB Route 3. The project also includes new I-95 bridges in each direction across the Rappahannock River, reconstruction of the Route 17 interchange (Exit 133) and modest improvements to the Route 3 interchange (Exit 130). Mitigation improvements are also required at the Virginia Welcome Center.

The proposed improvements to the I-95/Route 17 interchange require major reconstruction to the interchange (Figure 6-6). Southbound, the base alternative would include combined I-95 SB to Route 17 EB/SB and I-95 SB to Route 17 WB/NB off-ramps that would diverge from I-95 onto a C-D road that would drop at the SB to EB/SB loop ramp. The improvements also would replace the Route 17 WB/NB to I-95 SB loop ramp with a signalized left turn movement from Route 17 to the Route 17 EB/SB to I-95 SB on-ramp. The Route 17 EB/SB to I-95 SB on-ramp would be widened to two lanes (a portion would be three lanes). By removing the Route 17 WB/NB to I-95 SB loop ramp, the I-95 SB to Route 17 WB/NB ramp can intersect Route 17 further from the Sanford Drive intersection and thus improve lane change opportunities prior to the intersection. The I-95 NB to Route 17 WB/NB tight loop ramp will be replaced with a semi-directional flyover or as an underpass under I-95 (as shown in Figure 5-1 in Volume II).

The NB C-D Road is expected to carry 15,500 daily vehicles and operate at LOS B and LOS A for the AM and PM peak hours respectively. While, the SB C-D Road is expected to carry 38,000 daily vehicles and operate at LOS A and LOS D for the AM and PM peak hours respectively. These are the base operational conditions that will be compared to the operational conditions of the other alternatives.

Recommendation: Although Alternative 1 appears to operate well overall, it is NOT recommended to be advanced for further study due to the low volume served on the NB C-D Road and it does not eliminate any of the weaves at the Route 3 interchange.

Alternative 1B: Alternative 1B is a modification to Alternative 1. The proposed improvements are the same except for the addition of improvements at Route 3. The additional improvements include splitting traffic on Ramp M (I-95 SB off-ramp to WB Route 3) between those destined for Central Park and those traveling further west on Route 3. The ramp would split and widen out to provide three lanes to WB Route 3 and a single lane bypass to Carl D Silver Parkway. Both splits would be signalized at their termini. Alternative 1B is shown in **Figure 5-1B in Volume II**.

This alternative resulted in improved operation of westbound Route 3 and improved operation at Intersection 2 (Route 3/ Carl D. Silver Parkway). The proposed new signal (Intersection #8) at the end of Ramp M is still significantly congested and operates at LOS F causing traffic to back up on the SB C-D Road. However, that is the case for Alternative 1. The proposed signal eliminates the high volume merge of WB Route 3 traffic and SB ramp traffic allowing drivers to travel safely through protected movements.

Recommendation: The improvements associated with Alternative 1B were deemed beneficial and decided by VDOT to be included as part of any alternatives advanced for further study.

Alternative 2A: Alternative 2A is a modification to Alternative 1. The proposed improvements are the same except for the addition of improvements at Route 3. The additional improvements include providing a slip ramp from NB I-95 to enter the NB C-D Road approximately 400 feet north of the NB I-95 to EB Route 3 off-ramp. This slip ramp would allow traffic destined for Route 17 to enter the NB C-D Road and increase the volume served on the C-D Road. Alternative 2A is shown in **Figure 5-2A in Volume II**.

The NB C-D Road is expected to carry over 27, 000 daily vehicles and operate at LOS C and LOS B for the AM and PM peak hours respectively. Currently the I-95 NB weave between the EB Route 3 on-ramp and WB Route 3 off-ramp is over congested. Adding potential large amounts of traffic destined for Route 17 in the outer lanes of I-95 will make this weave worse and likely create additional safety problems.

Recommendation: Alternative 2A is NOT recommended for further study due to a congested weave that would be created between Route 3 traffic entering the interstate and Route 17 traffic exiting the interstate.

Alternative 2B: Alternative 2B is a modification to Alternative 2A. The proposed improvements are the same as Alternative 2A except for the exit for Route 17 is moved 2000 feet north of Route 3 and would be signed as an exit for Eastbound Route 17. No graphic is shown for Alternative 2B.

The NB C-D Road is expected to carry over 18,800 daily vehicles and operate at LOS B and LOS A for the AM and PM peak hours respectively. Adding traffic destined for Route 17 in the outer lanes of I-95 nearer to the Route 3 on-ramp will create a congested weave between Route 3 traffic entering the interstate and Route 17 traffic exiting the interstate.

Recommendation: Alternative 2B is NOT recommended for further study due to the potential congested weave that would be created between Route 3 traffic entering the interstate and Route 17 traffic exiting the interstate and the low volume of traffic on the NB C-D Road.

Alternative 3A: Alternative 3A is a modification to Alternative 1. The proposed improvements are the same except for the addition of improvements at Route 3. The additional improvements include replacing the EB Route 3 to NB I-95 on-ramp with a triple left turn from EB Route 3. The triple left turn will be signalized stopping WB Route 3 traffic but not EB Route 3 through traffic. The I-95 NB to EB Route 3 ramp can be realigned closer to I-95 allowing more distance between its merge with Route 3 and the Route 3/Gateway Boulevard intersection. Alternative 3A is shown in **Figure 5-3A in Volume II**.

This alternative removes the NB I-95 weave and the EB Route 3 weave. The NB C-D Road is expected to carry over 46,800 daily vehicles and operate at LOS F and LOS C for the AM and PM peak hours respectively. The AM peak hour volume exceeds the capacity of the two-lane C-D Road. The proposed signal on the east side of Route 3 is expected to operate at LOS B during both peak hours.

Recommendation: Although the alternative diverts too much traffic to the NB C-D Road that may require it's widening by 2040, Alternative 3A is recommended for further study as it removes two weave movements from the Route 3 interchange, results in the best performance for the NB I-95 mainline, and the proposed signalized intersection results in minimal increased delay for WB Route 3 traffic.

Alternative 3B: The proposed improvements for Alternative 3B are the same as Alternative 3A except for the addition improvement of removing the WB Route 3 to SB I-95 loop ramp and replacing it will a dual left turn onto the EB Route 3 to SB I-95 on-ramp. The dual left turn will be signalized stopping EB Route 3 traffic but not WB Route 3 through traffic. Alternative 3B is shown in **Figure 5-3B in Volume II**.

This alternative removes the NB and SB I-95 weaves and the WB and EB Route 3 weaves. The NB C-D Road is expected to carry over 46,800 daily vehicles and operate at LOS F and LOS C for the AM and PM peak hours respectively. The AM peak hour volume exceeds the capacity of the two-lane C-D Road. The proposed signal on the east side of Route 3 is expected to operate at LOS C and LOS B during the AM and PM peak hours respectively. The proposed signal on the west side of Route 3 is expected to operate at LOS D and LOS A during the AM and PM peak hours respectively.

Recommendation: The alternative is NOT recommended for further study due to the additional delay (42 seconds) added to the EB Route 3 movement during the AM peak hour.

Alternative 4A: Alternative 4A is a modification to Alternative 1. The proposed improvements are the same except for the addition of improvements at Route 3. The additional improvements include replacing the NB I-95 off-ramp to WB Route 3 with a dual left turn at the terminus of the NB I-95 off-ramp to EB Route 3. The dual left turn from the ramp will be signalized stopping EB and WB Route 3 traffic. The EB Route 3 to I-95 on-ramp is reconstructed and separated from the mainline until it is past the Route 3 bridges and then will merge with NB I-95. A slip ramp

from the EB Route 3 to I-95 on-ramp to the NB C-D Road allows traffic from Route 3 destined for Route 17 to use the NB C-D Road. Alternative 4A is shown in **Figure 5-4A in Volume II**.

This alternative removes the NB I-95 weave and the WB Route 3 weave. The NB C-D Road is expected to carry over 27,400 daily vehicles and operate at LOS C and LOS B for the AM and PM peak hours respectively. The proposed signal on the east side of Route 3 is expected to operate at LOS B and LOS D during the AM and PM peak hours respectively.

Recommendation: Alternative 4A is recommended for further study due to a balance of traffic between the I-95 mainline and C-D Roads in each direction and the elimination of two weaves.

Alternative 4B: The proposed improvements for Alternative 4B are the same as Alternative 4A except for the additional improvement of replacing the SB I-95 off-ramp to EB Route 3 with a dual left turn at the terminus of the SB I-95 C-D Road. The dual left turn from the ramp will be signalized stopping EB and WB Route 3 traffic. Alternative 4B is shown in **Figure 5-4B in Volume II**.

This alternative removes the NB and SB I-95 weaves and the WB and EB Route 3 weaves. The NB C-D Road is expected to carry over 27,400 daily vehicles and operate at LOS C and LOS B for the AM and PM peak hours respectively. SB C-D Road is expected to carry over 51,700 daily vehicles and operate at LOS B and LOS F for the AM and PM peak hours respectively. The PM peak hour volume exceeds the capacity of the two-lane C-D Road. The proposed signal on the east side of Route 3 is expected to operate at LOS B during the AM and PM peak hours. The proposed signal on the west side of Route 3 is expected to operate at LOS B during the AM and PM peak hours.

Recommendation: The alternative is NOT recommended for further study due to the right-of-way constraints associated with widening the SB C-D Road to three lanes.

Alternative 5: Alternative 5 is a modification to Alternative 1. The proposed improvements are the same except for the addition of improvements at Route 3. The additional improvements include replacing the cloverleaf interchange with a diverging diamond interchange. The SB I-95 to EB Route 3 movement would be from the SB C-D Road. The EB Route 3 to NB I-95 movement would access the NB C-D Road. The existing Route 3 bridges could remain in place and would not need to be rebuilt. Cross-over signals east and west of I-95 would be added to Route 3. Alternative 5 is shown in **Figure 5-5 in Volume II**.

This alternative removes the NB and SB I-95 weaves. The WB and EB Route 3 weaves would remain. The NB C-D Road is expected to carry over 46,800 daily vehicles and operate at LOS F and LOS C for the AM and PM peak hours respectively. The AM peak hour volume exceeds the capacity of the two-lane C-D Road. SB C-D Road is expected to carry over 51,700 daily vehicles and operate at LOS B and LOS F for the AM and PM peak hours respectively. The PM peak hour volume exceeds the capacity of the two-lane C-D Road. The proposed signal on the east side of Route 3 is expected to operate at LOS C and LOS D during the AM and PM peak hours respectively. The proposed signal on the west side of Route 3 is expected to operate at LOS F during the AM and PM peak hours.

Recommendation: The alternative is NOT recommended for further study due to the right-of-way constraints associated with widening the SB C-D Road to three lanes; and the EB Route 3 traffic volumes exceed the capacity of the proposed west side cross-over signal.

Alternative 6: Alternative 6 is a modification to Alternative 1. The proposed improvements are the same except for the addition of improvements at Route 3. The additional improvements include extending the NB and SB C-D Roads through the Route 3 interchange. All ramps would need to be reconstructed and would connect to the C-D Roads instead of I-95. The existing Route 3 bridges would need to be reconstructed. Alternative 6 is shown in **Figure 5-6 in Volume II** and is considered a longer-term solution due to the significant added cost over the base alternative.

This alternative relocates the NB and SB I-95 weaves to the C-D Roads. The WB and EB Route 3 weaves would remain. The NB C-D Road is expected to carry over 46,800 daily vehicles and operate at LOS F and LOS C for the AM and PM peak hours respectively. The AM peak hour volume exceeds the capacity of the two-lane C-D Road. SB C-D Road is expected to carry over 51,700 daily vehicles and operate at LOS B and LOS F for the AM and PM peak hours respectively. The PM peak hour volume exceeds the capacity of the two-lane C-D Road.

Recommendation: The alternative is NOT recommended for further study due to the right-of-way constraints associated with widening the SB C-D Road to three lanes, and no weaves are removed from the interchange. This alternative is also significantly more expensive than the base alternative.

Alternative 7: Alternative 7 has the same improvements as Alternative 1 for the SB direction of I-95 and the same improvements for Route 17. However, the braided ramps in the northbound direction on the CD road are at the Route 3 interchange instead of Route 17 swapping the traffic carried by the I-95 mainline and NB C-D Road when compared to Alternative 1. The NB C-D Road carries all traffic destined for Route 17 in Alternative 7 while carrying WB to NB Route 3 traffic in Alternative 1. Alternative 7 has a two lane off-ramp from I-95 just north of Route 3 that begins the NB C-D Road. The EB Route 3 to NB I-95 on-ramp is removed and replaced with a triple left turn. The WB and EB Route 3 to NB I-95 movements merge into a single ramp and are braided with the NB C-D Road prior to merging with NB I-95. The NB I-95 off ramp to WB Route 3 is reconstructed and separated from the mainline requiring the reconstruction of the Route 3 bridges. Alternative 7 is shown in **Figure 5-7 (Sheets 1 through 5) in Volume II**.

The proposed improvements to the I-95/Route 17 interchange require major reconstruction to the interchange. Southbound, the base alternative would include combined I-95 SB to Route 17 EB/SB and I-95 SB to Route 17 WB/NB off-ramps that would diverge from I-95 onto a C-D road that would drop at the SB to EB/SB loop ramp. The improvements also would replace the Route 17 WB/NB to I-95 SB loop ramp with a signalized left turn movement from Route 17 to the Route 17 EB/SB to I-95 SB on-ramp. The Route 17 EB/SB to I-95 SB on-ramp would be widened to two lanes (a portion would be three lanes). By removing the Route 17 WB/NB to I-95 SB loop ramp, the I-95 SB to Route 17 WB/NB ramp can intersect Route 17 further from the Sanford Drive intersection and thus improve lane change opportunities prior to the intersection. The I-95 NB to Route 17 WB/NB tight loop ramp will be replaced with a semi-directional flyover or as an underpass under I-95 (as shown in Figure 5-7 in Volume II).

This alternative removes the NB I-95 weave and the EB Route 3 weave. The NB C-D Road is expected to carry over 37,800 daily vehicles and operate at LOS C for the AM and PM peak hours. The proposed signal on the east side of Route 3 is expected to operate at LOS B during both peak hours.

Recommendation: Although the alternative appears to operate well, it is NOT recommended to be advanced for further study due to the significant additional cost associated with the need to reconstruct the Route 3 bridges.

Alternative 8A: Alternative 8A is a longer-term solution that adds additional improvements to Alternative 7. The additional improvements include replacing the EB Route 3 triple left to NB I-95 with a two-lane flyover ramp. The flyover ramp would split off from the EB Route 3 to SB I-95 ramp, cross over I-95, and cross over Route 3. The ramp would then split tying into both I-95 and the NB C-D Road. Additional improvements to the west side of the interchange include replacing the SB I-95 off-ramp to EB Route 3 with a dual left turn at the terminus of the SB I-95 C-D Road and removing the WB Route 3 to SB I-95 loop ramp and replacing it will a dual left turn onto the EB Route 3 to SB I-95 on-ramp. Both dual left turns will be signalized stopping EB and WB Route 3 through traffic. Alternative 8A is shown in **Figure 5-8A in Volume II**.

This alternative removes the NB and SB I-95 weaves and the WB and EB Route 3 weaves The NB C-D Road is expected to carry over 37,800 daily vehicles and operate at LOS C for the AM and PM peak hours. The proposed signal on the west side of Route 3 is expected to operate at LOS A for both the AM and PM peak hours.

Recommendation: The alternative is NOT recommended for further study since it is based on Alternative 7 which was also not advanced.

Alternative 8B: Alternative 8B is a longer-term solution that adds additional improvements to Alternative 3A. The additional improvements include replacing the EB Route 3 triple left to NB I-95 with a two-lane flyover ramp. The flyover ramp would split off from the EB Route 3 to SB I-95 ramp, cross over I-95, cross over Route 3 and tying into the NB C-D Road. Additional improvements to the west side of the interchange include those proposed in Alternative 1B. Alternative 8B is shown in **Figure 5-8B in Volume II**.

This alternative removes the NB I-95 weave and the EB Route 3 weave. The NB C-D Road is expected to carry over 46,800 daily vehicles and operate at LOS F and LOS C for the AM and PM peak hours respectively. The AM peak hour volume exceeds the capacity of the two-lane C-D Road. The proposed signal on the east side of Route 3 is expected to operate at LOS B during both peak hours.

Recommendation: The alternative is recommended for further study as it provides the most improvements to Route 3 operations and has the same benefits that Alternative 3A has which was also advanced for further study.

5.4.2 Selection of Preferred Alternative

Four of the alternatives evaluated above were advanced for further study by the project steering committee. These are Alternatives 1B, 3A, 4A and 8B. The improvements associated with Alternative 1B provided benefit to WB Route 3 and the SB I-95 C-D Road to WB Route 3 movement. The project steering committee decided to add the improvements in Alternative 1B to Alternatives 3A, 4A, and 8B.

Alternatives 3A and 4A were analyzed using CORSIM with the 2020 Build Volumes. Based on the CORSIM analysis, Alternative 4A was eliminated from further consideration due to the failure of the weave movement on EB Route 3 bridge. The weave is expected to be overcapacity bringing the EB Route 3 traffic flow to a standstill. Traffic queues back to the Route 3/Carl D. Silver Parkway intersection in the microsimulation.

CORSIM analysis of Alternative 3A in 2020 and 2040 showed that there were no operational problems associated with the EB Route 3 triple left turns that could not be mitigated. Therefore, Alternative 8B was eliminated at this time from further consideration due to that it would be significantly more expensive to build a flyover ramp at Route 3 when there were no operational problems with the triple left turns that it would replace. Alternative 3A does not preclude the construction of Alternative 8B in the future if additional funding becomes available. Based on the CORSIM analysis several modifications were made to Alternative 3A. These include:

- Adding the improvements shown in Alternative 1B plus extending the fourth through lane on the WB approach at Carl D. Silver Parkway back through the new signal providing triple right turns on WB Route 3.
- Combining the traffic from the EB to NB triple left turn with the WB to NB on-ramp on a four-lane C-D road (previously was three lanes). The four lanes would transition to three lanes before the Cowan Boulevard Underpass and then down to two lanes prior to the Falls Hill Avenue Underpass.
- Extend the I-95 NB to Route 17 WB/NB semi-directional flyover over the Route 17/ Sanford Drive intersection and then tie down on the right side of Route 17.

Based on the alternatives evaluation discussed above and input from the VDOT steering committee members, Alternative 3A with the modifications discussed above was selected as the best and most cost effective solution for meeting the project's purpose and need. Overall, it provides the most benefits with fewest impacts and lowest cost. The preferred alternative includes the following components:

- Two-lane C-D Roads between Route 3 and Route 17 in both directions.
- New two-lane parallel structures over the Rappahannock River in each direction. Bridges could be separate structures or widening of existing bridges.
- Interchange improvements at Route 17
- Interchange improvements at Route 3
- Improvements to the Virginia Welcome Center

Chapter 6 will describe the preferred alternative in more detail and provide a detailed operational analysis and a conceptual guide signing plan for the alternative.

CHAPTER 6 ANALYSIS OF PREFERRED ALTERNATIVE

6.1 Description of Preferred Alternative

The preferred alternative is composed of Alternative 1B and 3A. The preferred alternative consists of several components described below. Graphics of the preferred alternative are shown in **Figure 6-1 (Sheets 1 through 5) in Volume II.** Due to funding constraints, the recommended I-95 improvements may need to be phased. The first phase would include constructing the southbound CD Roads with all southbound ramp improvements at the Route 3 and Route 17 interchanges. The second phase would include constructing the northbound CD Roads with all northbound ramp improvements at the Route 3 and Route 17 interchanges.

Constructing only the southbound improvements first, does not have any negative impacts on the corridor in the 2020 design year. Remaining congestion in the unimproved northbound direction does not impact operations in the southbound direction.

New Collector-Distributor (C-D) Roads

The preferred alternative includes parallel two-lane collector-distributor (C-D) roads in each direction between the Route 3 and Route 17 interchanges. The C-D roads cross the Rappahannock River on separate bridge structures (Figure 6-2). Typical sections of the C-D Roads are shown in **Figure 6-3 in Volume II**. The southbound C-D road would start at the Route 17 Interchange, diverge from I-95 and braid with the Route 17 EB/SB to I-95 SB on-ramp (Figure 6-4) and cross the Rappahannock River. The southbound CD road would proceed down to Route 3 and become the SB to WB two-lane off-ramp at Route 3. The Virginia Welcome Center (rest area) would have on and off-ramps from the new C-D road. Realigning the rest area ramps also require realignment of the parking for the rest area. Figure 6-5 illustrates one option of how the parking impacts can be mitigated. A single lane slip ramp just south of Cowan Boulevard would provide access back to I-95 for drivers stopping at the Virginia Welcome Center.

Figure 6-2: Parallel C-D Roads

Figure 6-4: Southbound & Northbound Braided Ramps

Figure 6-5: Virginia Welcome Center Modifications

The northbound C-D roads would start at the Route 3 interchange combining the traffic from the EB to NB triple left turn with the WB to NB on-ramp on a four-lane C-D road. The four lanes would transition to three lanes before the Cowan Boulevard Underpass and then down to two lanes prior to the Falls Hill Avenue Underpass. The NB C-D road would cross the Rappahannock River then split providing access to I-95 and Route 17, braid with the I-95 NB to Route 17 EB and WB off-ramp (Figure 6-4) and then merge with NB I-95. The NB I-95 bridge over Route 17 will be replaced and widened to accommodate the on-ramp acceleration lane and provide additional vertical clearance for Route 17.

Improvements to I-95 / Route 17 Interchange

The proposed improvements to the I-95/Route 17 interchange require major reconstruction to the interchange (Figure 6-6). Southbound, the preferred alternative would include combined I-95 SB to Route 17 EB/SB and I-95 SB to Route 17 WB/NB off-ramps that would diverge from I-95 onto a C-D road that would drop at the SB to EB/SB loop ramp. The improvements also would replace the Route 17 WB/NB to I-95 SB loop ramp with a signalized left turn movement from Route 17 to the Route 17 EB/SB to I-95 SB on-ramp. The Route 17 EB/SB to I-95 SB on-ramp would be widened to two lanes (a portion would be three lanes). By removing the Route 17 WB/NB to I-95 SB loop ramp, the I-95 SB to Route 17 WB/NB ramp can intersect Route 17 farther from the Sanford Drive intersection and thus improve lane change opportunities prior to the intersection. The I-95 NB to Route 17 WB/NB tight loop ramp will be replaced with a semi-directional flyover. The flyover would cross over Route 17, I-95, and Sanford Drive and then tie down on the right side of Route 17.

Improvements to I-95 / Route 3 Interchange

The proposed improvements to the I-95/Route 3 interchange include adding two new signals along Route 3 (Figure 6-7). The SB C-D road terminates into the SB to WB off ramp. This ramp would divide with the major movement intersecting WB Route 3 at a new signal providing triple right turns on WB Route 3. The westbound through movement would be controlled by the signal while the EB Route 3 movement would remain free-flow. The minor movement would turn onto a free-flowing ramp to Carl D. Silver Boulevard. This ramp would be barrier or median separated from WB Route 3. The fourth through lane on the WB approach at Carl D. Silver Boulevard would be extended back through the new signal providing triple right turns on WB Route 3.

The other signal would be added to Route 3 east of I-95. The EB to NB loop on-ramp would be replaced with a triple left turn onto the NB C-D road. This triple left would merge with the WB to NB on-ramp to form a four lane NB C-D road that would taper down to three lanes prior to the Cowan Boulevard Bridge. WB Route 3 traffic would be stopped at the new signal but EB through traffic would remain free-flowing. By removing the Route 3 WB to NB loop ramp, the I-95 NB to Route 3 EB off-ramp can be realigned to intersect Route 3 farther from the Gateway Boulevard intersection and thus improve lane change opportunities prior to the intersection.

Figure 6-6: Route 17 Interchange Improvements

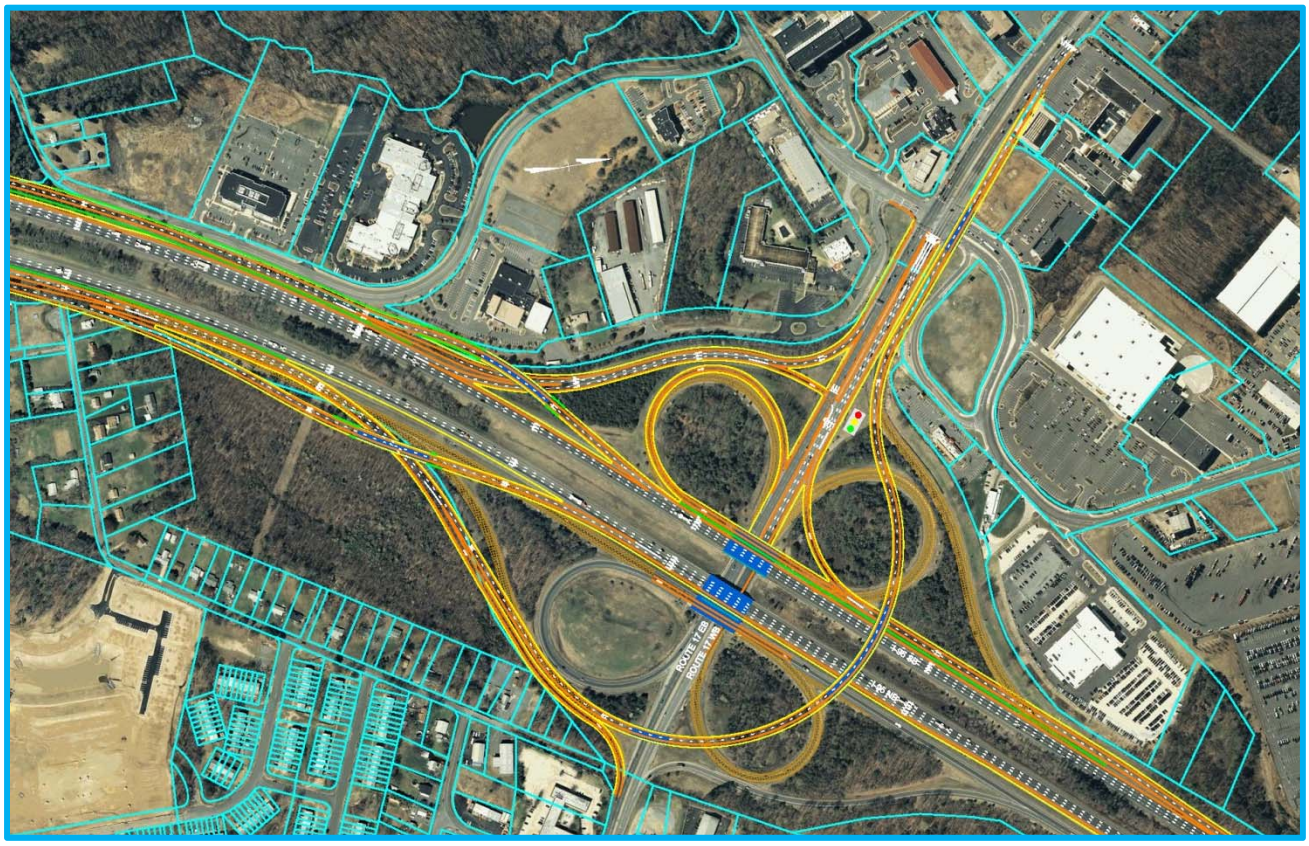


Figure 6-7: Route 3 Interchange Improvements

Additional I-95 Improvements

VDOT has a design-build project underway that will replace the existing Falls Hill Avenue bridge over I-95. The bridge will be widened to four lanes and provide room for the proposed northbound and southbound CD-Roads.

In the future additional improvements to the I-95 Corridor will be required. These improvements are not included as part of the preferred alternative 3A. However, constructing the preferred alternative will not preclude them from being able to be constructed in the future. Other potential improvements include:

- Further widening of I-95 to four general purpose lanes in each direction.

- Construction of the I-95 Express Lanes in the median of I-95. The express lanes are in the FAMPO long-range transportation plan and considered part of this project's no-build condition. The status of the southern section of the express lanes project is undetermined at this time; however for this study it is assumed access to and from the express lanes would occur north of Route 17 or south of Route 3.

- Construction of a new interchange and connector road or access ramps adjacent to the rest area. This new access would provide access west of I-95 to Central Park and the proposed minor league baseball stadium, and allow the possibility for a connector road to bypass Route 3.

- Additional improvements to the Route 3 Interchange such as replacing the proposed EB to NB triple left turn on Route 3 to a two-lane EB to NB flyover ramp. This improvement is shown as Alternative 8B in **Figure 5-8B in the Volume II**.

6.2 Compliance with Policies and Engineering Standards

With exception to the items identified below, the proposed modifications are designed conceptually to meet or exceed current standards for Federal-aid projects on the Interstate System. The current VDOT Road Design Manual and AASHTO A Policy on Geometric Design of Highways and Streets (Green Book) guidelines served as the design standards for all design criteria. Survey data was not available to assist with the conceptual design of the proposed improvements, so as the project moves forward some refinements in the design may be required. All new lanes and shoulders on the I-95 mainline, C-D roads, and ramps will be full width. All new ramps connecting to the I-95 mainline will have design speeds of 50 mph or higher with vertical and horizontal alignments that meet or exceed the design speed. All ramp terminal spacings exceed AASHTO minimum standards. There are no limitations in providing adequate acceleration and deceleration lanes for the new I-95 ramps and C-D roads merges and diverges with I-95. Both acceleration and deceleration lanes can exceed 1000 feet in length for all ramps.

The parallel C-D roads have alignments that exceed 60 m.p.h. design speeds, except the new braided ramp over the existing ramp from southbound Route 17 to southbound I-95. At this location, vertical grades will likely exceed 4%, but the design meets a 50 mph design speed both horizontally and vertically.

The recommendations for the Route 17 interchange will improve the geometry at the interchange by removing two tight loop ramps (the I-95 NB to Route 17 WB/NB off-ramp and the Route 17 WB/NB to I-95 SB on-ramp). The first is replaced with a directional ramp and the second with a left turn to the existing Route 17 EB/SB to I-95 SB on-ramp. However, two tight loop ramps with curve radii of approximately 250' (~30 m.p.h. design speed) will remain. Both of

these ramps (the I-95 SB to Route 17 EB/SB off-ramp and the Route 17 EB/SB to I-95 NB on-ramp) will connect to Route 17 interchange C-D roads and not the I-95 mainline. The recommendations for Route 3 remove the tight WB Route 3 to NB I-95 SB loop on-ramp. However, three existing loop ramps will remain as part of the interchange.

6.3 2020 Build Traffic Volumes for Preferred Alternative

This section documents the development of the future year design traffic for the 2020 Build scenario. There was a significant amount of coordination between VDOT, FHWA, and FAMPO in developing forecast volumes for the study area. The latest FAMPO regional travel demand model (Version 3.0 used for air quality conformity) was used to determine the amount of traffic that would divert from Route 1 to I-95 due to the capacity improvements and congestion reduction on I-95. The resulting forecast volumes are discussed below. Detailed methodology and detailed forecast volume information can be found in the Appendix C – Build Condition s Preferred Alternative (page C-1).

6.3.1 I-95 Mainline and Ramp Traffic Volumes

2020 Build forecast volumes were developed for the I-95 Mainline, proposed C-D Roads and Route 3 and Route 17 interchange ramps using the methodology discussed in Appendix C – Build Conditions Preferred Alternative (page C-1). The model was used to determine the amount of diversion to/from each of the arterial roads to I-95 due to the capacity improvements between Route 3 and Route 17.

Overall there are several major changes in traffic patterns:

- A portion of the traffic to and from north of the study area that previously utilized Route 1 will now use the I-95 mainline and CD roads.
- A portion of traffic to and from north of the study area that previously utilized the Route 17/I-95 Interchange and travelled east to Route 1 and then used either Fall Hill Avenue or Cowan Boulevard to access the retail areas will now use the I-95 mainline and CD roads and the Route 3 interchange.
- A portion of the traffic to and from west of the study area that previously travelled on Route 17 to and from Route 1 and then used either Fall Hill Avenue or Cowan Boulevard will now use the I-95 mainline and CD roads and the Route 3 interchange.

As the result of the travel pattern changes discussed above, traffic volumes on I-95 are expected to increase north of Route 3 and north of Route 17 when compared to the No-Build Condition. Table 6-1 shows the resulting I-95 Volumes for the 2020 Build condition. Route 3 ramps providing access east and west of I-95 will increase slightly from traffic using a less congested I-95 instead of Route 1. Volumes will also increase on some of the west side Route 17 ramps due to traffic using the interchange ramps instead of passing through the interchange to and from Route 1. Volumes on ramps serving Route 17 east of I-95 slightly decrease. Ramp volumes are shown in **Figures 6-8A and 6-8B in Volume II.**

Table 6-1: I-95 2020 Build Volumes

I-95	Daily Volumes							
	2020 No-Build			2020 Build				Difference
	GP Lanes	Express Lanes	Total	GP Lanes	Express Lanes	CD Lanes	Total	Total
South of Route 3	135,300	0	135,300	135,300	0	0	135,300	0
At River Crossing	176,400	0	176,400	121,000	0	65,200	186,200	9,800
North of US 17	154,900	0	154,900	158,900	0	0	158,900	4,000

6.3.2 Arterial Roadway 2020 Traffic Volumes – Route 3 & Route 17

Build turn movement volumes for the intersections along Route 3 and Route 17 were calculated by determining how much of the traffic diverted to/from the Route 3 and Route 17 passes through the intersections. Peak hour turn movement volumes for the study intersections are shown in **Figures 6-8A & 6-8Bi n Volume II** . Intersection volumes are also shown for Intersections #7, #8, and #9; all new intersections that are part of the preferred alternative.

Table 6-2 shows the projected 2020 Build traffic volumes on both Route 3 and Route 17. Build traffic volumes on Route 17 do not change west of the I-95 Interchange when compared to the No-Build condition. Build volumes east of the I-95/Route 17 interchange decrease due to a small projected reduction in ramp volumes for ramps providing access to and from the east of I-95. Build traffic volumes on Route 3 increase due to the diversion of traffic to the Route 3 interchange from Route 1, Fall Hill Avenue, and Cowan Boulevard. Additional information on the 2020 build volumes is provided in the Appendix C – Build Conditions Preferred Alternative (page C-1).

Table 6-2: Arterial 2020 Build Volumes

Roadway / Location	2040 No-Build Forecast Daily Volumes			2040 Build Forecast Daily Volumes		
	Eastbound	Westbound	Total*	Eastbound	Westbound	Total*
VA 3 - East of I-95 Interchange	27,100	26,700	53,800	29,900	30,100	60,000
VA 3 - West of I-95 Interchange	44,000	34,100	78,100	54,200	34,100	79,300

Roadway / Location	2040 No-Build Forecast Daily Volumes			2040 Build Forecast Daily Volumes		
	Northbound	Southbound	Total*	Northbound	Southbound	Total*
US 17 - East of I-95 Interchange	18,700	25,200	43,900	15,800	22,700	38,500
US 17 - West of I-95 Interchange	37,700	38,200	75,900	37,700	38,200	75,900

6.4 Preferred Alternative 2020 Traffic Operations

This section presents the traffic operations for the Preferred Alternative 3A. The 2020 Build conditions were completed for the key intersections, I-95 Mainline, and I-95 Ramp Junctions that were analyzed for the 2013 Existing Conditions (See Chapter 2) and 2020 No-Build Conditions (See Chapter 3), as well as the new CD-roads and interchange improvements. Detailed HCS output files are contained in Appendix C – Build Conditions Preferred Alternative (starting on Page C-16).

6.4.1 I-95 Mainline, CD Road and Ramp Operations

2020 Build level of service analyses were also performed for the Weekday AM / PM peak hours for northbound and southbound I-95 Mainline segments and at ramp junctions (merge, diverge, and weave) in the study area using HCS2010 Ramp Junction software, HCS2010 Weaving Analysis software, CORSIM micro-simulation software. The 2020 Build traffic forecasts developed in Section 6.3 were used in the analyses. Findings for the mainline and ramp analyses are discussed below and shown in **Figure 6-9 in Volume II**. Detailed HCS2010 mainline and ramp junction analysis reports are presented in the Appendix C – Build Conditions Preferred Alternative (starting on Page C-57).

Northbound I-95
There is significant improvement in level of service for northbound I-95 mainline segments and ramp junctions when compared to the No-Build Conditions. Most of the segments were operating at LOS F in the AM peak hour and LOS D in the PM peak hour under 2020 No-Build conditions. These segments have improved to LOS B or C in the AM peak and LOS C or better in the PM peak. North of Route 17 where no improvements are proposed, the LOS remains F. Additional improvements to I-95 north of the study area will be required in the future when funding becomes available. The new C-D road across the Rappahannock River is expected to operate at LOS C or D (depending on the segment) in the AM peak hour and LOS B in the PM peak hour. Although the densities expected in 2020 will push the C-D Road into LOS D, the vehicle speeds are still expected to exceed the posted speed limit of 55 mph. Obtaining a LOS better than LOS D would require widening the proposed NB C-D Road to three lanes. This would add significant cost to the project with minimal additional benefit to the corridor.

Southbound I-95
In the southbound direction, similar improvements in LOS are expected. During the AM peak hour, movements that are predominately LOS C in the No-Build Condition become LOS A or B in the Build Condition. During the PM peak hour, movements that are predominately LOS F in the No-Build Condition become LOS C or D for mainline segments and ramp junctions in the Build Condition. North of Route 17 where no improvements are proposed, the LOS remains F. Additional improvements to I-95 north of the study area will be required in the future when funding becomes available. The new C-D road across the Rappahannock River is expected to operate predominately at LOS A and C for the AM and PM peak hours respectively.

6.4.2 Route 3 and Route 17 Intersection Operations

The AM and PM peak hours at each of the study intersections along Route 3 and Route 17 were analyzed to identify expected deficiencies under the Build Conditions. It is assumed that the traffic signal timings and phases would be optimized in the future to best accommodate the expected 2020 Build Traffic volumes (discussed in Section 6.3). Similar to the existing conditions chapter, a brief discussion of each intersection is provided to identify the main causes of any deficiency. A summary of the 2020 Build level of service (LOS), compared to 2020 No-Build Conditions for the Route 3 intersections, is shown in Table 6-3A. The same comparison is shown for the Route 17 intersections in Table 6-3B. A summary of the 2020 Build queue analysis results for the Route 3 intersections, is shown in Table 6-4A. The same comparison is shown for the Route 17 intersections in Table 6-4B. Similar to the existing conditions chapter, a brief discussion of each intersection is provided to discuss the comparison between Build and No-build conditions. HCS output files are provided in Appendix C – Build Conditions Preferred Alternative (starting on page C-17). CORSIM models were also developed for each peak hour to confirm the results of the HCS analysis (Section 6.4.3).

Intersection #1 (Route 3 & Mall Dr / Central Park Blvd): As there are no improvements planned for the intersection as part of the build alternative and traffic volumes are just slightly increased when compared to the No-build condition, the intersection is expected to operate very similar to the No-Build Condition. The intersection is expected to operate at LOS B and LOS F for the AM and PM peak hours respectively; the same as in the No-Build condition. Minimal change in delay is expected when compared to the No-Build condition.

Intersection #2 (Route 3 & Mall Ct / Carl D Silver Pkwy): Overall the intersection is expected to operate similar to the No-Build Condition. Traffic volumes increase when compared to the No-Build condition as some traffic that uses Fall Hill Avenue and Cowan Boulevard along with Route 1 will now use I-95 and Route 3. However, this increase in traffic is offset by the bypass ramp to Carl D. Silver Parkway from Ramp M (I-95 SB off-ramp to WB Route 3). The intersection is expected to operate at LOS C and LOS F for the AM and PM peak hours respectively; the same as in the No-Build condition. Minimal change in delay is expected when compared to the No-Build condition.

Proposed Intersection #8 (Route 3 & SB C-D Road): The proposed intersection provides access to WB Route 3 from the SB C-D Road. Only westbound Route 3 and the C-D road/ramp triple right turn traffic is stopped. Eastbound through traffic is not stopped at this intersection. The intersection is expected to operate at LOS C and LOS E during the AM and PM peak hours respectively. During the PM peak hour the LOS E is a result of WB Route 3 traffic queuing back from Intersection #2. The proposed signal eliminates the uncontrolled high volume merge of WB Route 3 traffic and SB ramp traffic allowing drivers to travel safely via protected movements. Traffic is expected to queue back on the SB C-D Road. However, this traffic would queue on the I-95 mainline in the No-Build condition.

Proposed Intersection #9 (Route 3 & NB C-D Road): The proposed intersection provides access from Route 3 onto the NB C-D Road. Only westbound Route 3 and the eastbound triple left turn traffic are stopped. Eastbound through traffic is not stopped at this intersection. The

intersection is expected to operate at LOS C and LOS B during the AM and PM peak hours respectively.

Intersection #3 (Route 3 & Gateway Blvd / Ramseur St): Delay is expected to increase slightly when compared to the No-Build Condition due to increased traffic volumes associated with traffic diverting from Route 1 to use Route 3. However, the intersection is expected to operate at LOS C during both peak periods, similar to the No-Build condition.

Intersection #4 (Route 17 & Hardee's Access / McLane Dr): Traffic volumes and operations only change slightly between the Build and No-Build Conditions. Some WB/NB traffic that turned left or right at Intersection 5 is now on the flyover. These vehicles would most likely make a right turn or make a U-turn at the downstream intersection with Falls Run Drive. It is projected that approximately 130 and 140 vehicles would be moved to the downstream left turn lane for a U-turn at Falls Run Drive during the AM and PM peak hours, respectively. Approximately 140 and 110 vehicles would be moved to the downstream Falls Run Drive right turn lane during the AM and PM peak hours, respectively. These vehicles can then use S. Gateway Drive to loop back to their destination. Overall in the 2020 Build condition, intersection #4 is expected to operate at LOS D and LOS C during the AM and PM peak hours respectively; the same as in the No-Build condition.

Intersection #5 (Route 17 & Sanford Dr): Traffic from Ramp C (I-95 NB to WB/NB Route 17) will pass over intersection 5 and be removed from the WB/NB approach. The expected reduction in volumes through the intersection is expected to reduce the delay by 28% and 55% for the AM and PM peak hours respectively when compared to the No-Build condition. However, the intersection is expected to still operate at LOS D and LOS F during the AM and PM peak hour respectively; the same as in the No-Build condition.

Proposed Intersection #7 (Route 17 & EB to SB I-95 On-Ramp): This proposed intersection is a split intersection that should be controlled by a single controller. The WB/NB Route 17 movement is uninterrupted, while the EB/SB Route 17 movement is stopped. This intersection replaces the WB/NB Route 17 to I-95 SB on-loop ramp with a left turn onto the EB/SB Route 17 to SB I-95 on-ramp. The intersection is expected to operate at LOS A during both peak hours.

Intersection #6 (Route 17 & Short St / Driveway): Delay is expected to decrease significantly when compared to the No-Build condition due to decreased traffic volumes associated with traffic diverting from Route 1 to I-95. The expected reduction in volumes through the intersection is expected to reduce the delay by 24% and 26 % for the AM and PM peak hours respectively when compared to the No-Build condition. However, the intersection is expected to still operate at LOS D and LOS F during the AM and PM peak hour respectively; the same as in the No-Build condition.

Generally, the intersection level of service under the Build Condition is expected to remain the same as under the build condition because the traffic volumes on Route 3 and Route 17 remain similar and few improvements are proposed to the intersection geometry. However, intersections #5 and #6 are expected to have significant reductions in delay due to the flyover proposed at intersection #5 and the diversion of traffic to I-95 from Route 17 (east of I-95) and intersection #6. The new proposed intersections are expected to not have operational problems

with the exception of intersection #8 which is expected to operate at LOS E due to traffic queuing back from the downstream intersection.

Table 6-3A: 2020 Build Level of Service for Study Route 3 Intersections (All results are from HCS)

				AM Peak Hour														PM Peak Hour											
				2013		2020 No Build						2020 Build						2013		2020 No Build						2020 Build			
				Intersection		Movement		Approach		Intersection		Movement		Approach		Intersection		Intersection		Movement		Approach		Intersection		Movement		Approach		Intersection	
	Intersection	Approach	Movement	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS
1	Route 3 / Mall Dr. / Central Park Blvd.	NB	Left	15.1	B	65.2	E	133.5	F	19.4	B	65.2	E	133.5	F	19.5	B	103.8	F	75.8	E	616.9	F	120.0	F	75.8	E	616.9	F	120.0	F
			Through			66.1	E					66.1	E							80.1	F					80.1	F				
			Right			151.0	F					151.0	F							885.6	F					885.6	F				
		SB	Left			69.0	E	87.1	F			69.9	E	98.5	F					72.3	E	326.4	F			72.3	E	326.4	F		
			Through			68.7	E					69.6	E							70.3	E					70.3	E				
			Right			91.5	F					105.6	F							544.0	F					544.0	F				
		EB	Left			63.3	E	13.7	B			63.3	E	18.4	B					69.3	E	67.6	E			69.3	E	68.7	E		
			Through			9.1	A					9.4	A							68.7	E					69.9	E				
			Right			0.1	A					0.1	A							43.4	D					43.4	D				
		WB	Left			66.8	E	11.5	B			69.1	E	11.1	B					60.5	E	19.3	B			60.5	E	19.3	B		
			Through			6.7	A					6.1	A							9.8	A					9.8	A				
			Right			8.8	A					8.2	A							14.1	B					14.1	B				
2	Route 3 / Carl D. Silver Pkwy	NB	Left	29.7	C	70.8	E	70.2	E	32.8	C	70.8	E	70.2	E	34.5	C	97.8	F	76.7	E	76.0	E	127.8	F	76.7	E	76.0	E	126.7	F
			Through			70.8	E					70.8	E							76.7	E					76.7	E				
			Right			69.6	E					69.6	E							75.2	E					75.2	E				
		SB	Left			59.1	E	58.3	E			63.7	E	63.0	E					160.0	F	139.9	F			181.1	F	160.1	F		
			Through			51.9	D					51.9	D							51.1	D					51.1	D				
			Right			53.6	D					52.5	D							80.3	F					58.9	E				
		EB	Left			63.0	E	27.2	C			63.0	E	29.6	C					63.6	E	14.9	B			63.6	E	14.8	B		
			Through			25.4	C					27.9	C							7.6	A					7.7	A				
			Right			24.4	C					24.4	C							5.7	A					5.7	A				
		WB	Left			69.5	E	36.0	D			69.5	E	34.8	C					75.9	E	189.4	F			52.1	D	185.4	F		
			Through			31.6	C					32.6	C							111.7	F					180.6	F				
			Right			45.3	D					39.4	D							419.3	F					211.9	F				
8	New Signal Route 3 / Ramp from SB I-95	NB	Left													28.1	C													67.0	E
			Through																												
			Right																												
		SB	Left											65.3	E													72.2	E		
			Through																												
			Right									65.3	E													72.2	F				
		EB	Left																												
			Through																												
			Right																												
		WB	Left																												
			Through									6.2	A	6.2	A											63.5	F	63.5	E		
			Right																												
9	New Signal Route 3 / Ramp to NB I-95 (triple lefts)	NB	Left													25.6	C													19.5	B
			Through																												
			Right																												
		SB	Left																												
			Through																												
			Right																												
		EB	Left									37.6	D													62.0	E				
			Through									0.5	A	22.0	C											0.7	A	21.5	C		
			Right																												
		WB	Left																												
			Through									41.6	D	41.6	D											14.9	B	14.9	B		
			Right																												
3	Route 3 / Gateway Blvd.	NB	Left	20.6	C	58.9	E	53.3	D	21.8	C	58.9	E	53.3	D	22.8	C	27.5	C	107.3	F	87.7	F	30.2	C	107.3	F	87.7	F	31.1	C
			Through			38.2	D					38.2	D							38.0	D					38.0	D				
			Right			41.3	D					41.3	D							59.3	E					59.3	E				
		SB	Left			48.7	D	49.7	D			48.7	D	49.7	D					48.7	D	48.9	D			48.7	D	48.9	D		
			Through			50.1	D					50.1	D							49.1	D					49.1	D				
			Right			50.1	D					50.1	D							49.1	D					49.1	D				
		EB	Left			47.4	D	26.5	C			47.4	D	27.9	C					47.1	D	29.5	C			47.1	D	32.1	C		
			Through			26.6	C					28.3	C							28.9	C					32.3	C				
			Right			23.8	C					23.8	C							30.3	C					30.3	C				
		WB	Left			46.1	D	8.6	A			46.1	D	10.8	B					54.4	D	12.6	B			54.4	D	13.1	B		
			Through			5.9	A					8.6	A							5.9	A					7.1	A				
			Right			3.1	A					3.1	A							0.0	A					0.0	A				

Notes: All results from HCS 2010. Intersections 1,2,3,5,6,8,7&9 major movement is E-W; Intersection 4 major movement is N-S.

Table 6-3B: 2020 Build Level of Service for Study Route 17 Intersections (All results are from HCS)

				AM Peak Hour														PM Peak Hour											
				2013		2020 No Build						2020 Build						2013		2020 No Build						2020 Build			
				Intersection		Movement		Approach		Intersection		Movement		Approach		Intersection		Intersection		Movement		Approach		Intersection		Movement		Approach		Intersection	
	Intersection	Approach	Movement	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS
4	Route 17 / McLane Dr.	NB	Left	25.8	C	54.3	D	67.6	E	53.7	D	55.2	E	67.0	E	53.6	D	19.1	B	69.0	E	3.7	A	27.9	C	70.1	E	4.3	A	28.0	C
			Through			68.7	F					68.7	F							3.5	A					3.5	A				
			Right			1.2	A					1.2	A							0.0	A					0.1	A				
		SB	Left			53.8	D	37.5	D			53.8	D	37.8	D					68.0	E	46.6	D			68.0	E	46.6	D		
			Through			37.5	D					37.9	D							46.7	D					46.7	D				
			Right			17.7	B					17.7	B							14.2	B					14.2	B				
		EB	Left			32.5	C	32.5	C			32.8	C	32.8	C					46.7	D	46.7	D			46.7	D	46.7	D		
			Through			32.5	C					32.8	C							46.7	D					46.7	D				
			Right			32.5	C					32.8	C							46.7	D					46.7	D				
		WB	Left			33.3	C	33.3	C			33.2	C	33.2	C					48.1	D	48.1	D			48.1	D	48.1	D		
			Through			33.3	C					33.2	C							48.1	D					48.1	D				
			Right			33.3	C					33.2	C							48.1	D					48.1	D				
5	Route 17 /Sanford Dr.	NB	Left	36.4	D	65.2	E	105.9	F	53.2	D	65.2	E	105.9	F	38.0	D	291.7	F	115.2	F	3023.1	F	382.6	F	50.6	D	377.2	F	170.9	F
			Through			54.4	D					54.4	D							76.1	E					48.4	D				
			Right			126.2	F					126.2	F							3267.3	F					404.6	F				
		SB	Left			62.8	E	62.4	E			76.1	E	74.6	E					78.8	E	77.4	E			327.6	F	309.0	F		
			Through			62.6	E					73.5	E							59.7	E					71.1	E				
			Right			58.9	E					65.1	E							61.2	E					72.7	E				
		EB	Left			57.4	E	59.9	E			65.4	E	30.1	C					59.8	E	118.5	F			78.4	E	105.0	F		
			Through			60.2	F					30.0	C							120.4	F					106.6	F				
			Right			21.1	C					15.0	B							23.2	C					22.1	C				
		WB	Left			60.2	E	44.0	D			106.6	F	31.4	C					81.6	F	41.8	D			637.6	F	159.8	F		
			Through			45.0	D					13.4	B							38.8	D					25.9	C				
			Right			15.8	B					11.6	B							22.2	C					22.9	C				
7	New Signal Route 17 / Ramp F to SB I-95	NB	Left													3.8	A													5.4	A
			Through																												
			Right																												
		SB	Left																												
			Through																												
			Right																												
		EB	Left																												
			Through									4.0	A	4.0	A											5.0	A	5.0	A		
			Right																												
		WB	Left									62.7	E													75.7	E				
			Through									1.0	A	3.7	A											0.6	A	5.7	A		
			Right																												
6	Route 17 /Short St.	NB	Left	34.9	C	35.0	C	34.7	C	46.8	D	35.0	C	34.7	C	35.7	D	105.6	F	42.4	D	41.6	D	150.7	F	42.4	D	41.6	D	112.0	F
			Through			35.0	C					35.0	C							42.4	D					42.4	D				
			Right			31.4	C					31.4	C							39.2	D					39.2	D				
		SB	Left			40.9	D	40.9	D			40.9	D	40.9	D					44.9	D	44.9	D			44.9	D	44.9	D		
			Through			40.9	D					40.9	D							44.9	D					44.9	D				
			Right			40.9	D					40.9	D							44.9	D					44.9	D				
		EB	Left			77.5	F	73.1	E			53.7	D	51.2	D					243.5	F	228.5	F			177.6	F	165.6	F		
			Through			73.1	F					51.6	D							229.6	F					166.1	F				
			Right			22.3	C					22.3	C							20.1	C					20.1	C				
		WB	Left			20.5	C	22.3	C			19.4	B	19.0	B					21.7	C	16.3	B			21.7	C	14.9	B		
			Through			22.3	C					19.1	B							16.4	B					15.0	B				
			Right			22.4	C					18.8	B							16.1	B					14.6	B				

Notes: All results from HCS 2010. Intersections 1,2,3,5,6,8,7&9 major movement is E-W; Intersection 4 major movement is N-S.

Table 6-4A: 2020 Build Conditions Intersection Queue Summary for Route 3

Intersection		Approach	Movement	Storage (ft)	Queue Length (ft)					
					AM Peak Hour			PM Peak Hour		
					Existing	2020 No-Build	2020-Build	Existing	2020 No-Build	2020-Build
1	Route 3 / Mall Dr. / Central Park Blvd.	NB	Left	425	5	10	10	88	100	100
			Through	425	25	30	30	113	130	130
			Right	150	208	248	248	870	1018	1018
		SB	Left	250	8	10	10	105	120	120
			Through	2750	8	5	5	95	108	108
			Right	250	78	103	110	705	825	825
		EB	Left	475	130	145	145	168	193	193
			Through	900	25	65	68	623	700	725
			Right	900	0	0	0	98	105	105
		WB	Left	675	45	50	50	240	278	278
			Through	825	48	53	50	118	133	133
			Right	675	63	70	65	168	210	210
2	Route 3 / Carl D. Silver Pkwy	NB	Left	-	-	-	-	-	-	-
			Through	50	20	20	20	35	33	33
			Right	50	18	18	18	25	30	30
		SB	Left	475	168	190	253	600	713	773
			Through	1250	5	8	8	13	10	10
			Right	495	43	48	20	315	370	193
		EB	Left	250	73	80	80	145	160	160
			Through	800	425	550	610	78	85	88
			Right	250	8	5	5	3	3	3
		WB	Left	400	23	20	20	40	45	40
			Through	3675	188	210	223	843	1025	1233
			Right	650	400	465	355	1845	2153	1293
8	New Signal Route 3 / Ramp from SB I-95	NB	Left	-			-			-
			Through	-			-			-
			Right	-			-			-
		SB	Left	-			-			-
			Through	500			0			0
			Right	500			225			683
		EB	Left	-			-			-
			Through	-			-			-
			Right	-			-			-
		WB	Left	-			-			-
			Through	1725			95			978
			Right	-			-			-
9	New Signal Route 3 / Ramp to NB I-95 (triple lefts)	NB	Left	-			-			-
			Through	-			-			-
			Right	-			-			-
		SB	Left	-			-			-
			Through	-			-			-
			Right	-			-			-
		EB	Left	575			753			410
			Through	1725			3			5
			Right	-			-			-
		WB	Left	-			-			-
			Through	825			258			225
			Right	-			-			-
3	Route 3 / Gateway Blvd.	NB	Left	400	185	215	215	320	370	370
			Through	4500	5	5	5	0	3	3
			Right	400	63	70	70	163	183	183
		SB	Left	650	8	8	8	8	8	8
			Through	650	18	18	18	3	8	8
			Right	650	-	-	-	-	-	-
		EB	Left	350	23	28	28	20	20	20
			Through	3675	230	260	303	283	318	388
			Right	450	150	163	163	243	283	283
		WB	Left	275	35	38	38	85	90	90
			Through	375	40	45	63	40	45	55
			Right	375	0	0	0	0	0	0

Table 6-4B: 2020 Build Conditions Intersection Queue Summary for Route 17

Intersection		Approach	Movement	Storage (ft)	Queue Length (ft)					
					AM Peak Hour			PM Peak Hour		
					Existing	2020 No-Build	2020-Build	Existing	2020 No-Build	2020-Build
4	Route 17 / McLane Dr.	NB	Left	35	13	15	33	10	10	30
			Through	35	223	535	535	28	38	38
			Right	35	3	3	3	0	0	0
		SB	Left	875	20	25	25	10	10	10
			Through	875	398	535	540	635	958	958
			Right	875	10	13	13	8	8	8
		EB	Left	-	-	-	-	-	-	-
			Through	1000	18	18	25	15	20	20
			Right	-	-	-	-	-	-	-
		WB	Left	-	-	-	-	-	-	-
			Through	845	28	33	33	50	55	55
			Right	-	-	-	-	-	-	-
5	Route 17 /Sanford Dr.	NB	Left	425	50	58	58	45	60	35
			Through	875	5	8	8	5	13	8
			Right	400	133	198	198	1470	1795	1218
		SB	Left	850	65	73	80	173	213	355
			Through	475	55	65	73	18	20	23
			Right	360	13	18	18	5	10	10
		EB	Left	580	10	10	10	5	10	13
			Through	845	468	678	493	865	1188	1145
			Right	845	8	8	8	23	28	25
		WB	Left	275	165	208	258	250	310	565
			Through	2750	508	755	128	490	645	213
			Right	400	83	95	68	98	123	113
7	New Signal Route 17 / Ramp F to SB I-95	NB	Left	-			-			-
			Through	-			-			-
			Right	-			-			-
		SB	Left	-			-			-
			Through	-			-			-
			Right	-			-			-
		EB	Left	-			-			-
			Through	725			75			125
			Right	-			-			-
		WB	Left	1100			110			170
			Through	2000			5			3
			Right	-			-			-
6	Route 17 /Short St.	NB	Left	-	-	-	-	-	-	-
			Through	1000	48	55	55	48	55	55
			Right	100	5	5	5	15	18	18
		SB	Left	-	-	-	-	-	-	-
			Through	35	8	8	8	8	13	13
			Right	-	-	-	-	-	-	-
		EB	Left	2750	413	563	423	1215	1613	1265
			Through	2750	373	508	383	1075	1428	1113
			Right	275	20	25	25	30	35	35
		WB	Left	150	5	5	5	3	3	3
			Through	3000	238	288	210	185	220	175
			Right	3000	240	293	213	188	220	178

The queue analysis was also conducted using the HCS 2010 software and the r esults are shown in Table 6-4A and 6-4B. The results show that queue lengths at intersect ions along Route 3 will remain the same or increase very slightly as a result of the project. The absence of improvement along Rou te 3 is due to the CD roads providing extra capacity with in the I-95 corridor, resulting in mo re vehicles attempting to access th e highway via Route 3. The queue lengths at t he two proposed inter sections on Route 3 a ll remain le ss than the proposed available storage with t wo exceptions. The southbound right turn qu eue length at the new intersection with the I-95 southbound CD road ramp is expected to extend beyond the ramp into the southbound CD road. This ho wever is not expected t o impact th e I-95 mainline as t he congestion will be confined to the CD road. During the A M peak hour, the eastb ound triple left turn queue from Route 3 onto the northbound CD road is expected to extend beyond the available storage, however the queue will most likely be confined to the outside left tu rning lane. This outside left turn lane is propo sed as a drop lane from the three through lanes from the

upstream signal. Backup in this outside left turn lane should not impact eastbound through traffic. On Route 17, queue lengths are expected to be reduced as a result of the build project, especially those queues for the Route 17 through movements.

The CORSIM model for the 2020 Build condition confirms the queue analysis results from HCS2010.

6.4.3 2020 Build Conditions – CORSIM Analysis

CORSIM micro-simulation analysis was performed on the I-95 Mainline and on the Route 3 and Route 17 interchanges as well as the C-D Roads and braided ramps. The base networks used for the 2020 No-Build analysis were modified to include the new build alternative improvements. Volumes were updated to reflect the build volumes discussed in Section 6.3. No global parameters or additional default values were changed from those changed during the calibration of the base year model. The CORSIM software provides a visual and analytical representation of traffic operations. CORSIM analysis results for I-95 Mainline and Ramp Junctions were generated for the same locations as those completed with HCS and shown in Figure 6-9. Note that the discrepancies in the densities and speeds are a result of the differences of the functionality of the software. The results of the CORSIM network are shown in Table 6-5.

The CORSIM analysis confirms the results from the HCS analysis. There are significant improvements to the operations at Route 3, Route 17, and I-95 when compared to the No-Build Condition. During the AM peak hour, the new triple left turns from eastbound Route 3 to the northbound CD road reduce much of the congestion on Route 3 at the former weave area. The CORSIM model shows that even with the high northbound traffic volumes, the new northbound CD road will operate under capacity for the AM peak hour. The high volumes on northbound I-95 and the new CD road increase the vehicle densities at the merge and diverge locations; however the model shows they are still expected to remain under capacity. Queue lengths for the 2020 AM peak hour are expected to be greatly reduced along all roadways. The CORSIM model shows that queue length for the new eastbound triple lefts on Route 3 to the northbound CD road is expected to clear during one signal cycle most of the time with any overflow only blocking the inner most lane of Route 3. The flyover ramp to northbound Route 17 greatly reduces queue lengths along northbound 17 at the effected signals.

During the 2020 PM peak hour, the high traffic volumes and congestion on southbound Route 17 result in bottlenecks that restrict the amount of traffic that is able to enter the study area and thus lower volumes than the design volumes are processed through the CORSIM model in the southbound direction. In the northbound direction all of the freeway components of the network are shown to operate with vehicle densities of 20 pc/mi/ln or better resulting in minimal congestion. In the southbound direction, all of the ramp and mainline components of I-95 operate with much lower (better) densities than in the No build condition, however the traffic signal at the intersection of Route 3 with Carl D Silver Parkway causes the new southbound CD road to back up to approximately 3300 feet. This queue does not affect the southbound I-95 mainline.

Due to funding restraints, the southbound portion of the project may be constructed independently of the northbound component. The operations were investigated for a scenario in which only the southbound portion of the project is constructed in the year 2020.

Table 6-5: CORSIM Analysis for 2020 Build Condition

Northbound I-95 Mainline & Ramp Analysis			2020 Build Conditions			
			AM Peak Hour		PM Peak Hour	
Roadway	Location	Analysis Type	Vehicle Density (pc/mi/ln)	Vehicle Speed (mph)	Vehicle Density (pc/mi/ln)	Vehicle Speed (mph)
I-95 NB Mainline	South of Route 3 Interchange	Segment 1	21.3	67.2	20.1	67.4
Route 3 Interchange Ramps	I-95 NB **Diverge** to Route 3 EB	D-1	19.7	66.7	18.6	67.1
	I-95 NB **Diverge** to Route 3 WB	D-17	15.0	66.0	13.9	65.2
I-95 Mainline	Route 3 to Route 17	Segment 2 & 3	17.6	66.2	15.5	66.8
Route 17 Interchange Ramps	I-95 NB **diverge** to I-95 C/D Roadway	D-7	15.6	62.1	13.3	64.4
	NEW CD Road **merge** to I-95 NB	M-7	18.8	61.2	11.4	65.4
	Route 17 NB **merge** to Exist NB CD Road	M-2	17.8	44.8	10.5	45.5
	Existing CD Road **merge** to I-95 NB	M-3	33.7	50.1	17.1	63.2
I-95 Mainline	North of Route 17 Interchange	Segment 4	33.2	61.0	19.8	65.7
Northbound CD Road and Ramps	NEW NB CD Road across River	CD-1	31.8	55.6	15.5	56.3
	NEW NB CD Road **diverge** to Route 17 ramp	D-11	33.4	53.1	15.6	55.2
	NEW NB CD Braided Ramp **merge** to Rt 17 ramp	M-11	12.5	55.4	9.0	58.8
	Route 17 ramp East/West **diverge**	D-12	12.8	54.2	9.7	54.8

Southbound I-95 Mainline & Ramp Analysis			2020 Build Conditions			
			AM Peak Hour		PM Peak Hour	
Roadway	Location	Analysis Type	Vehicle Density (pc/mi/ln)	Vehicle Speed (mph)	Vehicle Density (pc/mi/ln)	Vehicle Speed (mph)
I-95 SB Mainline	North of Route 17 Interchange	Segment 4	17.7	59.3	34.7	63.1
Route 17 Interchange Ramps	I-95 SB **diverge** to Route 17 CD Road	D-4	11.6	66.3	34.8	59.0
	Route 17 SB CD road **diverge** to Route 17 NB	D-13	10.7	38.9	17.4	36.6
	I-95 SB **diverge** to NEW CD Road	D-9	7.9	67.0	16.6	64.5
	Route 17 **merge** to I-95 SB	M-4	9.3	61.3	19.0	57.9
I-95 SB Mainline	Route 17 to Route 3	Segment 2 & 3	12.9	67.3	24.1	65.1
Route 3 Interchange Ramps	NEW CD Road slip ramp **merge** to I-95 SB	M-10	11.4	60.2	19.5	62.5
	Route 3 WB Merge to I-95 SB - **Weave**	W-4	11.5	67.1	21.7	59.3
	I-95 SB diverge to Route 3 EB - **Weave**					
	Route 3 EB **merge** to I-95 SB	M-6	11.4	65.8	22.0	62.7
I-95 SB Mainline	South of Route 3 Interchange	Segment 1	13.2	67.3	25.0	64.9
Southbound CD Road and Ramps	Route 17 ramp **merge** to NEW CD Road	M-14	5.7	47.4	18.9	53.2
	NEW SB CD Road across River	CD-2	6.8	59.1	21.4	57.0
	NEW SB CD Road **diverge** to rest area	D-15	5.0	58.7	15.6	56.8
	Rest Area **merge** to NEW SB CD Road	M-15	4.9	59.4	15.6	56.9
	NEW SB CD Road **diverge** to SB I-95 (slip ramp)	D-16	5.9	59.3	21.7	56.8

6.5 2040 Build Traffic Volumes for Preferred Alternative

This section documents the development of the future year design traffic for the 2040 Build scenario. There was a significant amount of coordination between VDOT, FHWA, and FAMPO in developing forecast volumes for the study area. The latest FAMPO regional travel demand model (Version 3.0 used for air quality conformity) was used to determine the amount of traffic that would divert from Route 1 to I-95 due to the capacity improvements and congestion reduction on I-95. The resulting forecast volumes are discussed below. Detailed methodology and detailed forecast volume information can be found in the Appendix C – Build Conditions Preferred Alternative (page C-1).

6.5.1 I-95 Mainline and Ramp Traffic Volumes

2040 Build forecast volumes were developed for the I-95 Mainline, proposed C-D Roads and Route 3 and Route 17 interchange ramps using the methodology discussed in Appendix C – Build Conditions Preferred Alternative (page C-1). The model was used to determine the

amount of diversion to/from each of the arterial roads to I-95 due to the capacity improvements between Route 3 and Route 17.

Overall there are several major changes in traffic patterns:

- A portion of the traffic to and from north of the study area that previously utilized Route 1 will now use the I-95 mainline and CD roads.
- A portion of traffic to and from north of the study area that previously utilized the Route 17/I-95 Interchange and travelled east to Route 1 and then used either Fall Hill Avenue or Cowan Boulevard to access the retail areas will now use the I-95 mainline and CD roads and the Route 3 interchange.
- A portion of the traffic to and from west of the study area that previously travelled on Route 17 to and from Route 1 and then used either Fall Hill Avenue or Cowan Boulevard will now use the I-95 mainline and CD roads and the Route 3 interchange.

As the result of the travel pattern changes discussed above, traffic volumes on I-95 are expected to increase north of Route 3 and north of Route 17 when compared to the No-Build condition. Table 6-6 shows the resulting I-95 Volumes for the 2040 Build condition. Route 3 ramps providing access east and west of I-95 will increase slightly from traffic using a less congested I-95 instead of Route 1. Volumes will also increase on some of the west side Route 17 ramps due to traffic using the interchange ramps instead of passing through the interchange to and from Route 1. Volumes on ramps serving Route 17 east of I-95 slightly decrease. Ramp volumes are shown in **Figures 6-10A & 6-10B in Volume II**.

Table 6-6: I-95 2040 Build Volumes

I-95	Daily Volumes							
	2040 No-Build			2040 Build				Difference
	GP Lanes	Express Lanes	Total	GP Lanes	Express Lanes	CD Lanes	Total	Total
South of Route 3	174,500	18,300	192,800	178,300	14,500	0	192,800	0
At River Crossing	226,000	18,300	244,300	159,000	14,500	84,800	258,300	14,000
North of US 17	194,000	18,300	212,300	203,800	14,500	0	218,300	6,000

6.5.2 Arterial Roadway 2040 Traffic Volumes – Route 3 & Route 17

2040 Build turn movement volumes for the intersections along Route 3 and Route 17 were calculated by determining how much of the traffic diverted to/from the Route 3 and Route 17 passes through the intersections. Peak hour turn movement volumes for the study intersections are shown in **Figures 6-10A & 6-10B in Volume II** . Intersection volumes are also shown for Intersections #7, #8, and #9; all new intersections that are part of the preferred alternative.

Table 6-7 shows the projected 2040 Build traffic volumes on both Route 3 and Route 17. Build traffic volumes on Route 17 do not change west of the I-95 Interchange when compared to the No-Build condition. Build volumes east of the I-95/Route 17 interchange decrease due to a small projected reduction in ramp volumes for ramps providing access to and from the east of I-95. Build traffic volumes on Route 3 increase due to the diversion of traffic to the Route 3

interchange from Route 1, Fall Hill Avenue, and Cowan Boulevard. Additional information on the 2040 build volumes is provided in the Appendix C – Build Conditions Preferred Alternative (page C-1).

Table 6-7: Arterial 2040 Build Volumes

Roadway / Location	2040 No-Build Forecast Daily Volumes			2040 Build Forecast Daily Volumes		
	Eastbound	Westbound	Total*	Eastbound	Westbound	Total*
VA 3 - East of I-95 Interchange	32,600	32,300	64,900	36,700	37,000	73,700
VA 3 - West of I-95 Interchange	55,800	43,300	99,100	57,500	43,300	100,800

Roadway / Location	2040 No-Build Forecast Daily Volumes			2040 Build Forecast Daily Volumes		
	Northbound	Southbound	Total*	Northbound	Southbound	Total*
US 17 - East of I-95 Interchange	24,800	33,500	58,300	20,500	29,800	50,300
US 17 - West of I-95 Interchange	54,000	54,300	108,300	54,000	54,300	108,300

6.6 Preferred Alternative 2040 Traffic Operations

This section presents the traffic operations for the Preferred Alternative 3A. The 2040 Build conditions were completed for the key intersections, I-95 Mainline, and I-95 Ramp Junctions that were analyzed for the 2040 Build conditions (see Section 6.5) as well as the new C-D roads and interchange improvements. Detailed HCS output files are contained in Appendix C – Build Conditions Preferred Alternative (starting on Page C-16).

6.6.1 I-95 Mainline, CD Road and Ramp Operations

2040 Build level of service analyses were also performed for the Weekday AM / PM peak hours for northbound and southbound I-95 Mainline segments and at ramp junctions (merge, diverge, and weave) in the study area using HCS2010 Ramp Junction software, HCS2010 Weaving Analysis software, CORSIM micro-simulation software. The 2040 Build traffic forecasts developed in Section 6.5 were used in the analyses. Findings for the mainline and ramp analyses are discussed below and shown in **Figure 6-11 in Volume II**. Detailed HCS2010 mainline and ramp junction analysis reports are presented in the Appendix C – Build Conditions Preferred Alternative (starting on Page C-57). It should be noted that when comparing the 2020 Build to 2040 Build operating conditions, the 2040 Build conditions include the reversible I-95 Express Lanes. It should also be noted that although the AM peak hour volumes are significantly higher for northbound travel in the I-95 Corridor than for the PM peak hour, the volume in the I-95 general purpose lanes is almost equal or higher in the PM peak hour due to the Express Lanes diverting traffic from the northbound general purpose lanes during the AM peak hour.

Northbound I-95
There is significant improvement in level of service for northbound I-95 mainline segments and ramp junctions when compared to the No-Build Conditions. Most of the segments were operating at LOS F in the AM peak hour and LOS F in the PM peak hour under 2040 No-Build conditions. These segments have improved to LOS B or C in the AM peak and LOS D in the PM peak.

North of Route 17 where no improvements are proposed, the LOS is expected to drop to LOS F due to the projected higher traffic volumes during the PM peak hour when compared to the No-Build condition. (Although the travel demand model shows a significant shift in traffic from Route 1 to I-95 due to the preferred alternative, it is unlikely that a significant shift would occur. Expected congestion north of Route 17 as shown in the No-Build Condition would discourage this shift until capacity improvements are made north of the interchange.) Additional improvements to I-95 north of the study area will be required in the future when funding becomes available.

The new C-D road across the Rappahannock River is expected to operate at LOS F (depending on the segment) in the AM peak hour and LOS C in the PM peak hour. Although the densities expected in 2040 will push the C-D Road into LOS F for some segments, the vehicle speeds are still expected to be within 5 mph of the posted speed limit of 55 mph. Obtaining a LOS better than LOS F would require widening the proposed NB C-D Road to three lanes. This would add significant cost to the project. See discussion at the end of the next section (Southbound I-95) for more information on this subject.

Southbound I-95
In the southbound direction, similar improvements in LOS are expected. During the AM peak hour, movements that are predominately LOS D in the No-Build Condition become LOS C in the Build Condition for mainline segments and ramp junctions. During the PM peak hour, movements that are predominately LOS F in the No-Build Condition become LOS D for mainline segments and ramp junctions in the Build Condition. North of Route 17 where no improvements are proposed, the LOS remains F. Additional improvements to I-95 north of the study area will be required in the future when funding becomes available.

The analysis shows that south of Route 3 the mainline is expected to worsen to LOS E under the build condition from LOS D in the no-build condition. This is because this section of I-95 (south of Route 3) is expected to have a higher volume in the general purpose lanes under the build condition than in the No-Build condition because less drivers will use the express lanes between Route 17 and Route 3 under the build condition because there is essentially additional capacity in the general purpose lanes because of the huge volume of traffic destined for Route 3 is on the SB C-D Road (see the Build Volume methodology in Appendix C (page D1).

The new C-D road across the Rappahannock River is expected to operate predominately at LOS A or B during the AM peak hour and LOS D during the PM peak hour. Although the densities expected in 2040 will push the C-D Road into LOS D, the vehicle speeds are still expected to be at or above the posted speed limit of 55 mph. Obtaining a LOS better than LOS D would require widening the proposed SB C-D Road to three lanes. This would add significant cost to the project.

Although all the expected operational problems for SB and NB I-95 are not solved, significant improvements in operating conditions are expected with the construction of the Preferred Alternative. Additional mainline lanes on I-95 north of the project area will be required to bring deficient segments up to an acceptable LOS. Any additional lanes will need to be continuous and extend many miles north of the existing project area. The proposed preferred alternative will not prevent these further improvements from being implemented in the future. Additional improvements to the C-D Roads such as widening to three lanes would also not be precluded in the future with additional funding. It should be noted that recently the Commonwealth Transportation Board has authorized VDOT to study other regional improvements such as the Rappahannock Parkway, Outer Connector, Stafford Parkway and other proposals to improve connectivity from I-95 to destinations to the west. Any of these improvements could change the demand volumes for the I-95 Corridor, particularly if the Outer Connector is advanced. It would be wise to know the outcome of these studies before investing additional funds in the I-95 Corridor between Exits 133 and 130 above those committed for the Preferred Alternative.

6.6.2 Route 3 and Route 17 Intersection Operations

The AM and PM peak hours at each of the study intersections along Route 3 and Route 17 were analyzed to identify expected deficiencies under the Build Conditions. It is assumed that the traffic signal timings and phases would be optimized in the future to best accommodate the expected 2040 Build Traffic volumes (discussed in Section 6.3). Similar to the existing conditions chapter, a brief discussion of each intersection is provided to identify the main causes of any deficiency. A summary of the 2040 Build level of service (LOS), compared to 2040 No-Build Conditions for the Route 3 and Route 17 intersections, is shown in Table 6-8A and B. A comparison of the queue lengths for each condition is shown in Table 6-9A and B. Similar to the existing conditions chapter, a brief discussion of each intersection is provided to discuss the comparison between Build and No-build conditions. HCS output files are provided in Appendix C Build Conditions Preferred Alternative (starting on page C-37). CORSIM models were also developed for each peak hour to confirm the results of the HCS analysis (Section 6.6.3).

Intersection #1 (Route 3 & Mall Dr / Central Park Blvd): As there are no improvements planned for the intersection as part of the build alternative and traffic volumes are just slightly increased when compared to the No-build condition, the intersection is expected to operate very similar to the No-Build Condition. The intersection is expected to operate at LOS E and LOS F for the AM and PM peak hours respectively; the same as in the No-Build condition. Minimal change in delay is expected when compared to the No-Build condition.

Intersection #2 (Route 3 & Mall Ct / Carl D Silver Pkwy): Overall the intersection is expected to operate similar to the No-Build Condition. Traffic volumes increase when compared to the No-Build condition as some traffic that uses Fall Hill Avenue and Cowan Boulevard along with Route 1 will now use I-95 and Route 3. However, this increase in traffic is offset by the bypass ramp to Carl D. Silver Parkway from Ramp M (I-95 SB off-ramp to WB Route 3). The intersection is expected to operate at LOS E and LOS F for the AM and PM peak hours respectively; the same as in the No-Build condition. Minimal change in delay is expected when compared to the No-Build condition.

Proposed Intersection #8 (Route 3 & SB C-D Road): The proposed intersection provides access to WB Route 3 from the SB C-D Road. Only westbound Route 3 and the C-D road/ramp triple right turn traffic is stopped. Eastbound through traffic is not stopped at this intersection. The intersection is expected to operate at LOS C and LOS F during the AM and PM peak hours respectively. During the PM peak hour the LOS F is a result of WB Route 3 traffic queuing back from Intersection #2. The proposed signal eliminates the uncontrolled high volume merge of WB Route 3 traffic and SB ramp traffic allowing drivers to travel safely via protected movements. Traffic is expected to queue back on the SB C-D Road but not back to the I-95 mainline. However, this traffic is expected to queue on the I-95 mainline in the No-Build condition.

Proposed Intersection #9 (Route 3 & NB C-D Road): The proposed intersection provides access from Route 3 onto the NB C-D Road. Only westbound Route 3 and the eastbound triple left turn traffic are stopped. Eastbound through traffic is not stopped at this intersection. The intersection is expected to operate at LOS C and LOS C during the AM and PM peak hours respectively.

Intersection #3 (Route 3 & Gateway Blvd / Ramseur St): Delay is expected to increase 46% during the AM peak hour and 24% during the PM peak hour when compared to the No-Build condition due to increased traffic volumes associated with traffic diverting from Route 1 to use Route 3. The intersection is expected to operate at LOS D during both peak periods. This is the same one LOS worse during the AM peak and the same LOS during the PM peak hour when compared to the No-Build condition.

Intersection #4 (Route 17 & Hardee's Access / McLane Dr): Traffic volumes and operations only change slightly between the Build and No-Build Conditions. Some WB/NB traffic that turned left or right at Intersection #5 is now on the flyover. These vehicles would most likely make a right turn or make a U-turn at the downstream intersection with Falls Run Drive. It is projected that approximately 200 and 220 vehicles would be moved to the downstream left turn lane for a U-turn at Falls Run Drive during the AM and PM peak hours, respectively. Approximately 220 and 180 vehicles would be moved to the downstream Falls Run Drive right turn lane during the AM and PM peak hours, respectively. These vehicles can then use S. Gateway Drive to loop back to their destination. Overall in the 2040 Build condition, intersection #4 is expected to operate at LOS F during the AM and PM peak hours.

Intersection #5 (Route 17 & Sanford Dr): Traffic from Ramp C (I-95 NB to WB/NB Route 17) will pass over intersection 5 and be removed from the WB/NB approach. The expected reduction in volumes through the intersection is expected to reduce the delay by 62% and 44% for the AM and PM peak hours respectively when compared to the No-Build condition. However, the intersection is expected to still operate at LOS F during both peak periods; the same as in the No-Build condition.

Proposed Intersection #7 (Route 17 & EB to SB I-95 On-Ramp): This proposed intersection is a split intersection that should be controlled by a single controller. The WB/NB Route 17 movement is uninterrupted, while the EB/SB Route 17 movement is stopped. This intersection replaces the WB/NB Route 17 to I-95 SB on-loop ramp with a left turn onto the EB/SB Route 17 to SB I-95 on-ramp. The intersection is expected to operate at LOS A during both peak hours.

Intersection #6 (Route 17 & Short St / Driveway): Delay is expected to decrease significantly when compared to the No-Build condition due to decreased traffic volumes associated with traffic diverting from Route 1 to I-95. The expected reduction in volumes through the intersection is expected to reduce the delay by 38% and 20 % for the AM and PM peak hours respectively when compared to the No-Build condition. However, the intersection is expected to still operate at LOS F during both peak hours; the same as in the No-Build condition.

Generally, the intersection level of service under the Build Condition is expected to remain the same as under the build condition because the traffic volumes on Route 3 and Route 17 remain similar and few improvements are proposed to the intersection geometry. However, intersections #5 and #6 are expected to have significant reductions in delay due to the flyover proposed at intersection #5 and the diversion of traffic to I-95 from Route 17 (east of I-95) and intersection #6. The new proposed intersections are expected to not have operational problems with the exception of intersection #8 which is expected to operate at LOS F due to traffic queuing back from the downstream intersection. Only intersection #3 is expected to see increases in delay and worsen LOS due to increases in traffic using I-95 and Route 3 instead of Route 1.

Table 6-8A: 2040 Build Level of Service for Study Route 3 Intersections (All results are from HCS)

				AM Peak Hour												PM Peak Hour											
				2013		2020 No Build		2040 No Build						2040 Build				2013		2020 No Build		2040 No Build						2040 Build			
				Intersection		Intersection		Movement		Approach		Intersection		Movement		Approach		Intersection		Intersection		Movement		Approach		Intersection		Movement		Approach		Intersection	
	Intersection	Approach	Movement	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS
1	Route 3 / Mall Dr. / Central Park Blvd.	NB	Left	15.1	B	19.4	B	65.2	E	229.4	F	78.1	E	65.2	E	229.4	F	78.7	E	103.8	F	120.0	F	82.7	F	852.0	F	169.1	F	82.7	F	852.0	F	170.8	F
			Through					66.5	E					66.5	E									98.6	F					98.6	F		
			Right					269.4	F					269.4	F									1224.0	F					1224.0	F		
		SB	Left					69.0	E	116.3	F			70.9	E	167.1	F							79.9	E	479.9	F			79.9	E	479.9	F		
			Through					68.9	E					70.8	E									72.3	E					72.3	E		
			Right					130.2	F					195.4	F									813.0	F					813.0	F		
		EB	Left					65.8	E	96.9	F			65.8	E	95.8	F							78.1	E	90.0	F			78.1	E	96.9	F		
			Through					101.7	F					100.4	F									95.0	F					103.4	F		
			Right					0.1	A					0.1	A									44.9	D					44.9	D		
		WB	Left					67.6	E	12.1	B			70.7	E	11.2	B							79.8	E	29.5	C			79.8	E	29.5	C		
			Through					7.1	A					5.9	A									15.8	B					15.8	B		
			Right					9.8	A					8.6	A									30.1	C					30.1	C		
2	Route 3 / Carl D. Silver Pkwy	NB	Left	29.7	C	32.8	C	71.5	E	70.9	E	72.9	E	77.0	E	76.7	E	73.0	E	97.8	F	127.8	F	77.5	E	76.7	E	224.9	F	77.5	E	76.7	E	225.5	F
			Through					71.5	E					77.0	E									77.5	E					77.5	E		
			Right					70.3	E					76.3	E									75.9	E					75.9	E		
		SB	Left					63.1	E	61.7	E			70.7	F	69.4	E							291.4	F	254.7	F			330.8	F	283.3	F		
			Through					51.9	D					50.4	D									51.4	D					51.4	D		
			Right					54.3	D					51.0	D									157.6	F					66.3	E		
		EB	Left					63.8	E	89.5	F			61.8	E	98.7	F							65.6	E	16.5	B			65.6	E	16.6	B		
			Through					91.1	F					91.4	F									9.2	A					9.5	A		
			Right					24.7	C					23.5	C									5.7	A					5.7	A		
		WB	Left					70.0	E	43.9	D			68.6	E	40.0	D							76.6	E	337.0	F			63.6	E	336.5	F		
			Through					33.6	C					35.0	D									239.4	F					331.1	F		
			Right					67.3	E					52.2	D									630.1	F					372.7	F		
8	New Signal Route 3 / Ramp from SB I-95	NB	Left															29.8	C													206.9	F
			Through																														
			Right																														
		SB	Left													60.3	E															214.6	F
			Through																														
			Right											60.3	E															214.6	F		
		EB	Left																														
			Through																														
			Right																														
		WB	Left																														
			Through											10.2	B	10.2	B													194.7	F	194.7	F		
			Right																														
9	New Signal Route 3 / Ramp to NB I-95 (triple lefts)	NB	Left															33.5	C													21.1	C
			Through																														
			Right																														
		SB	Left																														
			Through																														
			Right																														
		EB	Left											41.1	D	24.6	C													55.5	E	19.9	B		
			Through											0.7	A															1.0	A		
			Right																														
		WB	Left																														
			Through											74.6	E	74.6	E													24.0	C	24.0	C		
			Right																														
3	Route 3 / Gateway Blvd.	NB	Left	20.6	C	21.8	C	86.7	F	74.9	E	26.9	C	89.7	F	74.9	E	38.6	D	27.5	C	30.2	C	186.7	F	150.0	F	43.8	D	186.7	F	150.0	F	54.3	D
			Through					38.2	D					38.2	D									38.0	D					38.0	D		
			Right					42.0	D					42.0	D									97.6	F					97.6	F		
		SB	Left					48.7	D	50.3	D			48.7	D	50.3	D							48.7	D	48.9	D			48.7	D	48.9	D		
			Through					50.7	D					50.7	D									49.1	D					49.1	D		
			Right					50.7	D					50.7	D									49.1	D					49.1	D		
		EB	Left					47.4	D	29.8	C			47.4	D	33.6	C							47.4	D	36.9	D			47.4	D	54.6	D		
			Through					30.1	C					34.8	C									36.0	D					58.5	F		
			Right					26.7	C					26.7	C									39.3	D					39.3	D		
		WB	Left					46.6	D	12.1	B			46.6	D	36.5	D							69.7	E	18.1	B			69.7	E	26.3	C		
			Through					9.4	A					36.0	F									9.1	A					20.1	C		
			Right					3.1	A					3.1	A									0.0	A					0.0	A		

Notes: All results from HCS 2010. Intersections 1,2,3,5,6,8,7&9 major movement is E-W; Intersection 4 major movement is N-S.

Table 6-8B: 2040 Build Level of Service for Study Route 17 Intersections (All results are from HCS)

				AM Peak Hour																PM Peak Hour													
				2013		2020 No Build		2040 No Build						2040 Build						2013		2020 No Build		2040 No Build						2040 Build					
				Intersection		Intersection		Movement		Approach		Intersection		Movement		Approach		Intersection		Intersection		Intersection		Movement		Approach		Intersection		Movement		Approach		Intersection	
	Intersection	Approach	Movement	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS
			Left					54.8	D					56.1	E									69.5	E					71.3	E				
		NB	Through					277.8	F	271.8	F			277.8	F	268.0	F							61.8	F	61.3	E			61.8	F	60.8	E		
			Right					1.2	A					1.4	A									0.1	A					0.1	A				
			Left					54.2	D					54.2	D									68.5	E					68.5	E				
		SB	Through					162.2	F	158.9	F			162.2	F	158.9	F							216.0	F	213.8	F			216.0	F	213.8	F		
			Right					17.9	B					17.9	B									14.4	B					14.4	B				
4	Route 17 / McLane Dr.		Left	25.8	C	53.7	D	33.1	C			218.0	F	33.1	C			216.3	F	19.1	B	27.9	C	47.1	D			144.1	F	47.1	D			143.3	F
		EB	Through					33.1	C	33.1	C			33.1	C	33.1	C							47.1	D	47.1	D			47.1	D	47.1	D		
			Right					33.1	C					33.1	C									47.1	D					47.1	D				
			Left					33.7	C					33.7	C									49.3	D					49.3	D				
		WB	Through					33.7	C	33.7	C			33.7	C	33.7	C							49.3	D	49.3	D			49.3	D	49.3	D		
			Right					33.7	C					33.7	C									49.3	D					49.3	D				
			Left					76.8	E					97.5	F									82.6	F					92.6	F				
		NB	Through					54.4	D	204.1	F			56.5	E	285.2	F							69.7	E	2690.1	F			72.0	E	741.8	F		
			Right					267.0	F					378.4	F									2870.7	F					787.0	F				
			Left					74.1	E					237.4	F									121.2	F					444.8	F				
		SB	Through					70.4	E	72.1	E			145.8	F	200.1	F							59.4	E	116.8	F			70.0	E	418.2	F		
			Right					61.3	E					87.3	F									60.3	E					70.2	E				
5	Route 17 /Sanford Dr.		Left	36.4	D	53.2	D	44.6	D			241.8	F	72.5	E			91.3	F	291.7	F	382.6	F	64.4	E			486.7	F	83.2	F			272.5	F
		EB	Through					97.2	F	96.1	F			50.5	F	50.3	D							324.8	F	318.8	F			222.8	F	218.8	F		
			Right					14.0	B					10.7	B									23.6	C					17.6	B				
			Left					574.8	F					524.4	F									288.6	F					227.9	F				
		WB	Through					373.2	F	361.5	F			11.2	B	107.9	F							147.6	F	152.1	F			13.4	B	61.9	E		
			Right					27.6	C					10.9	B									24.7	C					11.3	B				
			Left																														
		NB	Through																														
			Right																														
			Left																														
		SB	Through																														
			Right																														
7	New Signal Route 17 / Ramp F to SB I-95		Left															8.8	A													6.8	A
		EB	Through											5.7	A	5.7	A													8.4	A	8.4	A		
			Right																														
			Left											61.5	E															73.3	E				
		WB	Through											8.3	A	10.1	B													2.2	A	5.9	A		
			Right																														
			Left					35.7	D					35.7	D									43.3	D					43.3	D				
		NB	Through					35.7	D	35.2	D			35.7	D	35.2	D							43.3	D	42.4	D			43.3	D	42.4	D		
			Right					31.6	C					31.6	C									39.5	D					39.5	D				
			Left					41.3	D					41.3	D									44.9	D					44.9	D				
		SB	Through					41.3	D	41.3	D			41.3	D	41.3	D							44.9	D	44.9	D			44.9	D	44.9	D		
			Right					41.3	D					41.3	D									44.9	D					44.9	D				
6	Route 17 /Short St.		Left	34.9	C	46.8	D	246.2	F			128.4	F	147.8	F			80.2	F	105.6	F	150.7	F	451.7	F			276.0	F	354.4	F			219.5	F
		EB	Through					234.3	F	231.6	F			137.5	F	137.5	F							431.6	F	425.2	F			337.9	F	331.9	F		
			Right					22.5	C					22.5	C									20.7	C					20.7	C				
			Left					20.5	C					20.5	C									21.8	C					21.8	C				
		WB	Through					34.6	C	36.7	D			24.2	C	24.3	C							20.7	C	20.7	C			17.5	B	17.4	B		
			Right					39.1	D					24.6	C									20.7	C					17.2	B				

Notes: All results from HCS 2010. Intersections 1,2,3,5,6,8,7&9 major movement is E-W; Intersection 4 major movement is N-S.

Table 6-9A: 2040 Build Conditions Intersection Queue Summary for Route 3

Intersection		Approach	Movement	Storage (ft)	Queue Length (ft)									
					Existing	2020 No-Build	2020 Build	2040 No-Build	2040 Build	Existing	2020 No-Build	2020 Build	2040 No-Build	2040 Build
					AM Peak Hour					PM Peak Hour				
1	Route 3 / Mall Dr. / Central Park Blvd.	NB	Left	425	5	10	10	10	10	88	100	100	133	133
			Through	425	25	30	30	40	40	113	130	130	185	185
			Right	150	208	248	248	375	375	870	1018	1018	1375	1375
		SB	Left	250	8	10	10	10	10	105	120	120	165	165
			Through	2750	8	5	5	10	10	95	108	108	138	138
			Right	250	78	103	110	155	180	705	825	825	1180	1180
		EB	Left	475	130	145	145	190	190	168	193	193	260	260
			Through	900	25	65	68	725	745	623	700	725	1008	1053
			Right	900	0	0	0	0	0	98	105	105	140	140
		WB	Left	675	45	50	50	65	68	240	278	278	415	415
			Through	825	48	53	50	70	60	118	133	133	293	293
			Right	675	63	70	65	93	83	168	210	210	515	515
2	Route 3 / Carl D. Silver Pkwy	NB	Left	-	-	-	-	-	-	-	-	-	-	-
			Through	50	20	20	20	30	33	35	33	33	45	45
			Right	50	18	18	18	30	30	25	30	30	40	40
		SB	Left	475	168	190	253	245	350	600	713	773	1088	1200
			Through	1250	5	8	8	8	8	13	10	10	18	18
			Right	495	43	48	20	68	30	315	370	193	630	275
		EB	Left	250	73	80	80	103	100	145	160	160	208	208
			Through	800	425	550	610	1135	1158	78	85	88	115	118
			Right	250	8	5	5	13	13	3	3	3	3	3
		WB	Left	400	23	20	20	30	30	40	45	40	55	55
			Through	3675	188	210	223	280	298	843	1025	1233	1643	1895
			Right	650	400	465	355	735	570	1845	2153	1293	3025	1958
8	New Signal Route 3 / Ramp from SB I-95	NB	Left	-			-		-			-		-
			Through	-			-		-			-		-
			Right	-			-		-			-		-
		SB	Left	-			-		-			-		-
			Through	500			0		0			0		0
			Right	500			225		298			683		1788
		EB	Left	-			-		-			-		-
			Through	-			-		-			-		-
			Right	-			-		-			-		-
		WB	Left	-			-		-			-		-
			Through	1725			95		168			978		1105
			Right	-			-		-			-		-
9	New Signal Route 3 / Ramp to NB I-95 (triple lefts)	NB	Left	-			-		-			-		-
			Through	-			-		-			-		-
			Right	-			-		-			-		-
		SB	Left	-			-		-			-		-
			Through	-			-		-			-		-
			Right	-			-		-			-		-
		EB	Left	575			753		1053			410		518
			Through	1725			3		5			5		8
			Right	-			-		-			-		-
		WB	Left	-			-		-			-		-
			Through	825			258		438			225		380
			Right	-			-		-			-		-
3	Route 3 / Gateway Blvd.	NB	Left	400	185	215	215	325	325	320	370	370	553	553
			Through	4500	5	5	5	5	5	0	3	3	3	3
			Right	400	63	70	70	85	85	163	183	183	298	298
		SB	Left	650	8	8	8	8	8	8	8	8	8	8
			Through	650	18	18	18	25	25	3	8	8	8	8
			Right	650	-	-	-	-	-	-	-	-	-	-
		EB	Left	350	23	28	28	28	28	20	20	20	28	28
			Through	3675	230	260	303	343	428	283	318	388	445	650
			Right	450	150	163	163	220	220	243	283	283	403	403
		WB	Left	275	35	38	38	48	48	85	90	90	128	128
			Through	375	40	45	63	68	203	40	45	55	70	123
			Right	375	0	0	0	0	0	0	0	0	0	0

Table 6-9B: 2040 Build Conditions Intersection Queue Summary for Route 17

Intersection		Approach	Movement	Storage (ft)	Queue Length (ft)									
					Existing	2020 No-Build	2020 Build	2040 No-Build	2040 Build	Existing	2020 No-Build	2020 Build	2040 No-Build	2040 Build
					AM Peak Hour					PM Peak Hour				
4	Route 17 / McLane Dr.	NB	Left	35	13	15	33	25	50	10	10	30	20	53
			Through	35	223	535	535	1703	1703	28	38	38	428	428
			Right	35	3	3	3	3	5	0	0	0	0	0
		SB	Left	875	20	25	25	33	33	10	10	10	20	20
			Through	875	398	535	540	1330	1330	635	958	958	2128	2128
			Right	875	10	13	13	18	18	8	8	8	13	13
		EB	Left	-	-	-	-	-	-	-	-	-	-	-
			Through	1000	18	18	25	30	30	15	20	20	30	30
			Right	-	-	-	-	-	-	-	-	-	-	-
		WB	Left	-	-	-	-	-	-	-	-	-	-	-
			Through	845	28	33	33	45	45	50	55	55	85	85
			Right	-	-	-	-	-	-	-	-	-	-	-
5	Route 17 /Sanford Dr.	NB	Left	425	50	58	58	95	108	45	60	35	60	65
			Through	875	5	8	8	8	1	5	13	8	10	10
			Right	400	133	198	198	353	398	1470	1795	1218	2573	2108
		SB	Left	850	65	73	80	115	188	173	213	355	353	535
			Through	475	55	65	73	100	148	18	20	23	30	33
			Right	360	13	18	18	28	35	5	10	10	10	10
		EB	Left	580	10	10	10	15	23	5	10	13	10	13
			Through	845	468	678	493	1090	888	865	1188	1145	2298	2025
			Right	845	8	8	8	10	10	23	28	25	38	33
		WB	Left	275	165	208	258	678	598	250	310	565	688	583
			Through	2750	508	755	128	2243	175	490	645	213	1430	200
			Right	400	83	95	68	195	100	98	123	113	185	103
7	New Signal Route 17 / Ramp F to SB I-95	NB	Left	-			-		-			-		-
			Through	-			-		-			-		-
			Right	-			-		-			-		-
		SB	Left	-			-		-			-		-
			Through	-			-		-			-		-
			Right	-			-		-			-		-
		EB	Left	-			-		-			-		-
			Through	725			75		143			125		270
			Right	-			-		-			-		-
		WB	Left	1100			110		138			170		228
			Through	2000			5		70			3		18
			Right	-			-		-			-		-
6	Route 17 /Short St.	NB	Left	-	-	-	-	-	-	-	-	-	-	-
			Through	1000	48	55	55	73	73	48	55	55	75	75
			Right	100	5	5	5	10	10	15	18	18	23	23
		SB	Left	-	-	-	-	-	-	-	-	-	-	-
			Through	35	8	8	8	15	15	8	13	13	13	13
			Right	-	-	-	-	-	-	-	-	-	-	-
		EB	Left	2750	413	563	423	1158	868	1215	1613	1265	2713	2200
			Through	2750	373	508	383	1165	770	1075	1428	1113	2420	1960
			Right	275	20	25	25	28	28	30	35	35	50	50
		WB	Left	150	5	5	5	5	5	3	3	3	5	5
			Through	3000	238	288	210	500	330	185	220	175	345	255
			Right	3000	240	293	213	533	335	188	220	178	348	255

The queue analysis for the 2040 Build scenario was also conducte d using the HCS 2010 software and the resu lts are show n in Table 6-9. Compared to the 2040 No-Build cond ition, during both peak hour s, the southbound left and westb ound through movements at t he intersection of Route 3 and Carl D. Silver Parkway are expected to see slight increases in queue lengths. The s outhbound right turn and westbound right turn are expe cted to see significant decreases in queue lengths. The queue length for the new signal on Rou te 3 at the southbound ramp from the I-95 CD road is expected to extend approximately 1790 feet during the PM pea k hour. Thi s queue will be confine d to the CD road and will not impact the I-95 mainline. During the AM peak hour, the qu eue length at this lo cation is exp ected to be approximately 300 feet. During the AM peak hour at the ne w signalized intersection of Route 3 and the northbound CD road ramp, t he eastbound triple left turn queue from Route 3 onto the

northbound CD road is expected to be approximately 1050 feet, extending beyond the available storage, however the queue will most likely be confined to the outside left turning lane. This outside left turn lane is proposed as a drop lane from the three through lanes from the upstream signal. Backup in this outside left turn lane should not impact eastbound through traffic. On Route 17, queue lengths are expected to be reduced as a result of the build project. The major through movements see the most improvements, especially the northbound direction as a result of the new flyover ramp from I-95.

The CORSIM model for the 2040 Build condition confirms the queue analysis results from HCS2010.

6.6.3 2040 Build Conditions – CORSIM Analysis

CORSIM micro-simulation analysis was performed on the I-95 Mainline and on the Route 3 and Route 17 interchanges as well as the C-D Roads and braided ramps. The base networks used for the 2040 No-Build analysis were modified to include the new build alternative improvements. Volumes were updated to reflect the build volumes discussed in Section 6.5. No global parameters or additional default values were changed from those changed during the calibration of the base year model. The CORSIM software provides a visual and analytical representation of traffic operations. CORSIM analysis results for I-95 Mainline and Ramp Junctions were generated for the same locations as those completed with HCS and shown in Figure 6-11 in Volume II. Note that the discrepancies in the densities and speeds are a result of the differences of the functionality of the software. The results of the CORSIM network are shown in Table 6-10.

The CORSIM analysis for the 2040 build condition confirms the results from the HCS analysis. There are significant improvements to the operations at Route 3, Route 17, and I-95 when compared to the No-Build Condition. However, during both peak hours, there is still congestion on eastbound Route 3 and southbound Route 17 that restricts the amount of traffic that is able to enter I-95 mainline and CD-roads. This results in lower volumes than the design volumes being processed through the CORSIM model resulting in slightly lower densities than those calculated using the HCS software.

During the AM peak hour, the new triple left turns from eastbound Route 3 to the northbound CD road reduce much of the congestion on Route 3 at the former weave area which operates at a virtual stand-still in the no-build condition. The CORSIM model shows that queue length for the new eastbound triple lefts on Route 3 to the northbound CD road is expected to clear during one signal cycle most of the time with any overflow only blocking the inner most lane of Route 3. The CORSIM model does contradict the HCS results for the new northbound CD road during the AM peak hour; showing that even with the high northbound traffic volumes, the CD road will operate under capacity for the AM peak hour. The high northbound volumes on I-95 and the new CD road increase the vehicle densities at the merge and diverge locations; however the model shows they are still expected to remain under capacity. Queue lengths for the 2040 AM peak hour are expected to be greatly reduced along all roadways. The flyover ramp to northbound Route 17 greatly reduces queue lengths along northbound 17 at the effected signals. The CORSIM model shows that during the 2040 AM peak hour, queues from traffic signals northbound Route 17 are expected to cause some queuing on the flyover ramp

(approximately 2000 feet from the tie-in point with Route 17, however this is not expected to impact the northbound CD road or the CD road merges and diverges.

During the 2040 PM peak hour, the congestion resulting from the high southbound traffic volumes is mostly contained to the new southbound CD road. The diverge locations from southbound I-95 prior to the exit to the new CD road are still expected to operate with high vehicle densities (poor LOS), however much of the southbound traffic diverges to the southbound CD road resulting in greatly improved operations on the remaining components on southbound I-95. The extremely high westbound volumes on Route 3 and the close proximity at the intersection of Route 3 and Carl D Silver Parkway cause the new southbound CD road to back up approximately 2.5 miles almost to the new braided ramps at the Route 17 interchange. This is also the case at the intersection of Route 17 and Stanstead Road; the distance between this intersection and the ramp from southbound I-95 is approximately 900 feet in the Build condition (approximately 450 feet in the No-Build condition). Queue lengths for the northbound approach at this intersection cause some spill back onto the relocated ramp from southbound I-95 in the CORSIM model, however the end of queue does not impact the I-95 mainline. Access points to developments along Route 3 and Route 17 would have to be eliminated to improve the southbound operations.

Although all the expected operational problems for SB and NB I-95 are not solved, significant improvements in operating conditions are expected with the construction of the Preferred Alternative when compared to the No-Build condition. Additional mainline lanes on I-95 north of the project area will be required to bring deficient segments up to an acceptable LOS. Any additional lanes will need to be continuous and extend many miles north of the existing project area. The proposed preferred alternative will not prevent these further improvements from being implemented in the future. It should be noted that recently the Commonwealth Transportation Board has authorized VDOT to study other regional improvements such as the Rappahannock Parkway, Outer Connector, Stafford Parkway and other proposals to improve connectivity from I-95 to destinations to the west. Any of these improvements could change the demand volumes for the I-95 Corridor, particularly if the Outer Connector is advanced.

Table 6-10: CORSIM Analysis for 2040 Build Condition

Northbound I-95 Mainline & Ramp Analysis			2040 Build Conditions			
			AM Peak Hour		PM Peak Hour	
Roadway	Location	Analysis Type	Vehicle Density (pc/mi/ln)	Vehicle Speed (mph)	Vehicle Density (pc/mi/ln)	Vehicle Speed (mph)
I-95 NB Mainline	South of Route 3 Interchange	Segment 1	17.4	67.7	29.3	66.0
Route 3 Interchange Ramps	I-95 NB **Diverge** to Route 3 EB	D-1	16.1	67.3	27.0	65.7
	I-95 NB **Diverge** to Route 3 WB	D-17	11.8	66.8	20.4	64.2
I-95 Mainline	Route 3 to Route 17	Segment 2 & 3	13.1	67.1	23.1	65.5
Route 17 Interchange Ramps	I-95 NB **diverge** to I-95 C/D Roadway	D-7	12.2	59.8	20.7	60.8
	NEW CD Road **merge** to I-95 NB	M-7	13.0	64.4	15.3	64.1
	Route 17 NB **merge** to Exist NB CD Road	M-2	30.4	39.9	12.0	45.3
	Existing CD Road **merge** to I-95 NB	M-3	30.7	48.3	22.7	61.3
I-95 Mainline	North of Route 17 Interchange	Segment 4	27.8	63.9	26.0	64.2
Northbound CD Road and Ramps	NEW NB CD Road across River	CD-1	34.1	55.4	16.5	56.3
	NEW NB CD Road **diverge** to Route 17 ramp	D-11	35.9	52.7	17.3	55.1
	NEW NB CD Braided Ramp **merge** to Rt 17 ramp	M-11	19.8	49.0	12.4	58.6
	Route 17 ramp East/West **diverge**	D-12	34.8	33.8	13.4	54.2

Southbound I-95 Mainline & Ramp Analysis			2040 Build Conditions			
			AM Peak Hour		PM Peak Hour	
Roadway	Location	Analysis Type	Vehicle Density (pc/mi/ln)	Vehicle Speed (mph)	Vehicle Density (pc/mi/ln)	Vehicle Speed (mph)
I-95 SB Mainline	North of Route 17 Interchange	Segment 4	24.6	58.7	51.3	49.1
Route 17 Interchange Ramps	I-95 SB **diverge** to Route 17 CD Road	D-4	16.2	65.3	60.2	34.8
	Route 17 SB CD road **diverge** to Route 17 NB	D-13	13.4	38.6	53.4	13.7
	I-95 SB **diverge** to NEW CD Road	D-9	11.7	65.7	14.1	62.0
	Route 17 **merge** to I-95 SB	M-4	13.1	60.6	16.2	58.3
I-95 SB Mainline	Route 17 to Route 3	Segment 2 & 3	18.5	65.9	20.6	65.3
Route 3 Interchange Ramps	NEW CD Road slip ramp **merge** to I-95 SB	M-10	16.3	59.1	118.0	14.6
	Route 3 WB Merge to I-95 SB - **Weave**	W-4	16.7	65.7	18.4	65.2
	I-95 SB diverge to Route 3 EB - **Weave**					
	Route 3 EB **merge** to I-95 SB	M-6	15.8	64.9	19.6	62.5
I-95 SB Mainline	South of Route 3 Interchange	Segment 1	18.2	66.1	22.2	65.1
Southbound CD Road and Ramps	Route 17 ramp **merge** to NEW CD Road	M-14	7.7	47.1	25.8	46.6
	NEW SB CD Road across River	CD-2	9.2	58.9	45.5	40.0
	NEW SB CD Road **diverge** to rest area	D-15	6.8	58.4	43.8	32.1
	Rest Area **merge** to NEW SB CD Road	M-15	6.7	59.1	59.9	25.4
	NEW SB CD Road **diverge** to SB I-95 (slip ramp)	D-16	7.9	59.1	107.5	16.8

6.7 Preferred Alternative Safety Evaluation

This section documents the anticipated safety impacts of the preferred alternative to the study area roadway network.

The Preferred Alternative, as discussed in this chapter, includes the addition of the new northbound and southbound C-D roads and bridges across the Rappahannock River, major modifications to the existing Route 17 Interchange, as well as modifications to the Route 3 Interchange.

The Preferred Alternative will add capacity to I-95 between Route 3 and Route 17 in the form of additional C-D roads. The proposed braided ramps and C-D roads reduce conflict points and significantly reduce the large weaving volumes between the Route 17 Interchange and Route 3 Interchange. The increase in capacity on I-95 and reduction in weaving volume is determined to contribute to safer operating conditions when compared to the No-Build Conditions in 2020 and

2040. Safer operating conditions include less stop-and-go conditions, lower vehicle density, and lower speed differential between free-flow travel and congested travel (Compare Tables 3-11 and 6-10 and Figures 3-5 and 6-11). Due to the additional capacity of I-95 some traffic is expected to divert from Route 1 to I-95. Because limited access facilities have lower crash rates than primary arterials, the vehicles being diverted to I-95 are expected to experience lower crash rates as opposed to using Route 1. These factors are expected to improve traffic flow and reduce crashes and crash rates as compared to the 2020 and 2040 No-Build scenarios.

The Preferred Alternative will not only see a benefit of added capacity, but also from the geometric improvements proposed at the Route 3 and Route 17 interchanges. At the Route 17 Interchange in the northbound direction, the existing Route 17 northbound loop off-ramp at the C-D road weave area would be replaced by a flyover ramp, eliminating the northbound I-95 C-D weave as well as the weave on WB/NB Route 17. In the southbound direction, the weave at the Route 17 Interchange is eliminated by removing the loop on-ramp from WB/NB Route 17 to southbound I-95, providing only one on-ramp in the southbound direction.

Geometric improvements are also planned at the Route 3 Interchange. In the northbound direction, the low speed EB to NB on-loop ramp will be removed and replaced with a left turn on Route 3 onto the NB C-D road. Removing this ramp eliminates the NB I-95 weave at Route 3 and the EB weave on the Route 3 bridge over I-95. at the weave area, but instead would merge onto I-95 using the new connector road flyover ramp designed to modern standards and a higher design speed.

By replacing existing ramps with modern design standards, traffic flow is expected to increase and crash rates and overall crashes are expected to decrease with the Preferred Alternative as compared to the 2020 and 2040 No-Build scenarios.

6.8 Conceptual Sign Plan

A conceptual sign layout of the necessary guide signs was prepared for the preferred alternative to demonstrate that the proposed interchange improvements could be signed in accordance with the standards in the Manual on Uniform Traffic Control Devices (MUTCD). The conceptual guide sign layout is shown in **Figure 6-12 in Volume II.** These figures are not a complete signing plan for the proposed project but are intended to show the guide signs that will be required along the I-95 mainline and at the interchanges to direct motorists. More detailed signing plans will be prepared as part of the final design of the interchange improvements. Those plans will show additional ground mounted warning and regulatory signs. Final wording and precise spacing of guide signs will occur during the design phase and will require additional FHWA approval. Signs directing traffic to the rest area are shown as ground-mounted signs. During final design consideration should be given to putting the rest area signs overhead. There are no apparent problems with signing the preferred alternative in accordance with the MUTCD.

CHAPTER 7 ENVIRONMENTAL COMPLIANCE

The proposed project involves major upgrades to a federal interstate facility. Therefore, it will be necessary to comply with the requirements of NEPA and prepare the appropriate level of environmental analysis, documentation, and coordination. Concurrently, VDOT is completing an Environmental Assessment (EA) for the project to determine if there are any project-related impacts to resources covered under NEPA.

While FHWA may conditionally approve an IMR for this project, the draft EA must be completed and approved by FHWA before FHWA will formally approve the IMR. FHWA may grant conditional approval of a new or modified interchange location without the NEPA process being completed as long the IMR indicates how the NEPA requirements are anticipated to be satisfied.

7.1 Issues to be addressed in the NEPA Process

During completion of the EA, following resources will be evaluated to determine if there are any impacts associated with the proposed I-95 improvements[12]:

- Section 106 Cultural Resources (Historic and Archaeological Resources)
- Section 4(f) Resources Impacts
- Displacements and Relocations
- Water Quality, Wetlands, and Waters of the U.S. Impacts and Related Permits
- Chesapeake Bay Preservation Act RPAs and RMAs
- Properties with Virginia Outdoors Foundation Easements
- Scenic River – the Rappahannock River is designated a Scenic River.
- Air Quality Impacts
- Noise Impacts
- Threatened & Endangered Species
- Floodplains
- Farmlands
- Land Use
- Economic Impacts
- Community Impacts
- Environmental Justice
- Visual Impacts

12 This reference is not all-inclusive.

- Hazardous Materials
- Indirect & Cumulative Impacts

Development of compensatory mitigation to any impacts will also be completed as part of the EA.

The alternatives evaluated in this IMR were developed to avoid and minimize impacts to known sensitive resources/constraints as identified in Section 2.10 and shown on Figure 2-12. During future phases of more detailed design, additional effort will be made to minimize environmental impacts. These could include the use of retaining walls to minimize construction limits, slight shifts in alignment, design exceptions, innovative stormwater systems, etc. Construction of the project will likely require Federal and state permits. Federally issued permits also require compliance with NEPA. Permits that may be required include the following:

- A Section 10, Rivers and Harbors Act permit from the U.S. Army Corps of Engineers for all activities in navigable waters (Rappahannock River);
- A Section 9, Rivers and Harbors Act permit from the U.S. Coast Guard for any I-95 bridge construction activity over the Rappahannock River;
- Permits pursuant to the Clean Water Act, a Section 404 permit from the ACOE, as well as a Section 401 permit from the VDEQ if wetlands and/or waters of the U.S. are impacted;
- A subaqueous lands permit from the VMRC; and
- A Virginia Stormwater Management Program Permit for stormwater associated with the disturbance of one acre or greater.

VDOT will require compliance with all Federal and State rules and regulations as the project is implemented.

CHAPTER 8 FUNDING PLAN

Planning level cost estimates were developed for the proposed improvements to I-95 between Exit 133 and Exit 130. Separate estimates were completed for the southbound CD roads and the northbound CD roads. The southbound CD roads' estimate is $121.3 million and covers all proposed improvements for SB I-95 including the CD roads, new SB bridge over the River, the southbound ramp improvements at the Route 3 and Route 17 interchanges and the Welcome Center modifications. The northbound CD roads' estimate is $152 million and covers all proposed improvements for NB I-95 including the CD roads, new NB bridge over the River, and the northbound ramp improvements at the Route 3 and Route 17 interchanges. Both estimates include, preliminary engineering, right-of-way and construction.

In the current Fiscal Year 2016 (FY16) SYIP, the proposed improvements for southbound I-95 are included under the project identified as UPC 101595. PE is fully funded to the $9.5M estimate in the Revised FY16 SYIP. This covers the NEPA document for both the NB (UPC 105510) and SB (UPC 101595) side. The proposed improvements for northbound I-95 are included under the project identified as UPC 105510. The northbound project currently has $0 programmed to it in the Revised FY16 SYIP.

The project scopes include capacity expansion, NEPA is not complete, and the projects are not fully funded so they did not qualify for an exemption from House Bill 2. The proposed projects will be scored under the new prioritization process as outlined in House Bill 2. Once the projects are prioritized, the Commonwealth transportation Board will select the projects statewide that will be funded in VDOT's Six-Year Improvement Program (SYIP). The schedules for implementing projects UPC 101595 and UPC 105510 are dependent on the results of the HB2 prioritization process.

CHAPTER 9 CONCLUSION & RECOMMENDATIONS

This Interchange Modification Report evaluated the need for modernizing existing access to I-95 between Exit 133 (Route 17) and Exit 130 (Route 3). Currently I-95 carries over 150,000 vehicles per day and experiences congestion during peak periods, with portions of the interstate operating at LOS F. Route 3 carries up to 71,000 vehicles per day, exceeding the capacity of a six-lane arterial street and resulting in LOS F during the peak periods at its signalized intersections. Route 17 carries up to 65,000 vehicles per day, also exceeding the capacity of a six-lane arterial street and resulting in LOS F during the peak periods at its signalized intersections. Both Route 3 and Route 17 interchanges are cloverleaf interchanges with weaves between ramps that exceed capacity. In addition, there is a significant amount of local traffic that only uses the three miles of I-95 between Route 3 and Route 17 in order to cross the Rappahannock River adding congestion to the merges and diverges at the Route 3 and Route 17 interchanges.

Traffic volumes on I-95 are projected to increase to 244,000 vehicles per day by 2040, while Route 3 volumes are expected to increase to over 99,000 vehicles per day and Route 17 to over 108,000 vehicles per day. The ability of these facilities to carry volumes at these levels is a serious concern, even with the proposed construction of the two reversible express lanes in the median of I-95. Therefore, congestion and operating levels of service will continue to deteriorate on I-95, Route 3, Route 17 and at their interchanges. This congestion will spread out from the peak periods into greater portions of the day.

The No-Build Alternative represents no modifications to the interstate or arterial roadway system other than the planned and programmed improvements identified in the FAMPO 2040 Constrained Long-Range Plan (see Section 3.2). As the data in Chapter 3 demonstrates, under the No-Build Alternative, the existing interchanges and/or local roads and streets in the corridor cannot provide a satisfactory level of service (LOS) to accommodate the weekday AM/PM Peak Hour Design Year traffic demands for 2040, while at the same time providing safe and adequate access. There is oversaturation on Route 3, I-95 and Route 17 creating bottlenecks that effectively paralyze travel in the region.

Therefore, as stated in the Purpose and Need, there is a need to explore alternatives that add capacity to the I-95 corridor and reduce congestion on I-95 and at the Route 3 and Route 17 interchanges.

The analysis in Chapter 5 explored many Build Alternatives and came to the following conclusions.

- Transportation System Management Alternative:
  TMS measures are limited in their ability to improve traffic operations in the region and would not be expected to eliminate the need for the capacity improvements identified in the Purpose and Need. Therefore, TSM measures are included in the no-build (see Section 3.2) but not as a standalone alternative.

- Local Street Network Improvements Only Alternative:

The study team considered the feasibility and effectiveness of local street improvements. Additional crossings of I-95 other than Fall Hill Avenue and Cowan Boulevard could improve east-west travel but would not improve access to and from I-95 for shoppers and commuters and thus not meet the study's Purpose and Need. Likewise, access management and capacity improvements at Route 3 and Route 17 alone would not eliminate the existing congestion and expected worsen traffic operations at the interchanges and along I-95 mainline. Therefore, VDOT is pursuing improvements to the existing interchanges at Exit 133 (Route 17) and Exit 130 (Route 3).

- Build Alternatives:
  Nine alternatives were developed (Alts 1B, 2A, 2B, 3A, 3B, 4A, 4B, 5 & 7) and evaluated for their ability to improve the operations at Route 3. Several long-term Alternatives (Alts 6, and 8A & 8B) that require reconstruction of the interchange or long bridge structures were also evaluated to determine what future designs may be feasible and if the short/intermediate term improvements can be salvaged with the future designs. Each of the alternatives is shown graphically in Figures 5-1 through 5-8B in Volume II. Based on the alternatives evaluation discussed above and input from the VDOT steering committee members, Alternative 3A with modifications was selected as the best and most cost effective solution for meeting the project's purpose and need. Overall, it provides the most benefits with fewest impacts and lowest cost.

The preferred alternative includes the following components shown in in **Figure 6-1 (Sheets 1 through 5) in Volume II.**

- Parallel two-lane collector-distributor (C-D) roads in each direction between the Route 3 and Route 17 interchanges. The C-D roads cross the Rappahannock River on separate bridge structures (Figure 6-2). Typical sections of the C-D Roads are shown in Figure 6-3 in Volume II.

- Major Reconstruction of the Route 17 interchange (Figure 6-6)

- Improvements to the I-95/Route 3 interchange (Figure 6-7)

- Mitigation improvements are also required at the Virginia Welcome Center.

Due to funding constraints, the recommended I-95 improvements may need to be phased. The first phase would include constructing the southbound CD Roads with all southbound ramp improvements at the Route 3 and Route 17 interchanges. The second phase would include constructing the northbound CD Roads with all northbound ramp improvements at the Route 3 and Route 17 interchanges.

Constructing only the southbound improvements first, does not have any negative impacts on the corridor in the 2020 design year. Remaining congestion in the unimproved northbound direction does not impact operations in the southbound direction.

Northbound I-95 Expected Traffic Operations

There is significant improvement in level of service for northbound I-95 mainline segments and ramp junctions when compared to the 2040 No-Build Conditions. Most of the segments were operating at LOS F in the AM peak hour and LOS F in the PM peak hour under 2040 No-Build conditions. These segments have improved to LOS B or C in the AM peak and LOS D in the PM peak. The new C-D road across the Rappahannock River is expected to operate at LOS F (depending on the segment) in the AM peak hour and LOS C in the PM peak hour. Although the densities expected in 2040 will push the C-D Road into LOS F for some segments, the vehicle speeds are still expected to be within 5 mph of the posted speed limit of 55 mph. Obtaining a LOS better than LOS F would require widening the proposed NB C-D Road to three lanes. This would add significant cost to the project. See discussion at the end of the next section (Southbound I-95) for more information on this subject.

Southbound I-95 Expected Traffic Operations

In the southbound direction, similar improvements in LOS are expected. During the AM peak hour, movements that are predominately LOS D in the 2040 No-Build Condition become LOS C in the 2040 Build Condition for mainline segments and ramp junctions. During the PM peak hour, movements that are predominately LOS F in the 2040 No-Build Condition become LOS D for mainline segments and ramp junctions in the 2040 Build Condition. North of Route 17 where no improvements are proposed, the LOS remains F. Additional improvements to I-95 north of the study area will be required in the future when funding becomes available. The new C-D road across the Rappahannock River is expected to operate predominately at LOS A or B during the AM peak hour and LOS D during the PM peak hour. Although the densities expected in 2040 will push the C-D Road into LOS D, the vehicle speeds are still expected to be at or above the posted speed limit of 55 mph. Obtaining a LOS better than LOS D would require widening the proposed SB C-D Road to three lanes. This would add significant cost to the project and create additional right of way needs and adversely affect the Virginia Welcome Center.

Although all the expected operational problems for SB and NB I-95 are not solved, significant improvements in operating conditions are expected with the construction of the Preferred Alternative. Additional improvements that are outside of the scope of work for this report will be required to bring deficient segments up to an acceptable LOS. Any additional lanes on the I-95 mainline will need to be continuous and extend many miles north of the existing project area. The proposed preferred alternative will not prevent these further improvements from being implemented in the future. Additional improvements to the C-D Roads such as widening to three lanes would also not be precluded in the future with additional funding. It should be noted that recently the Commonwealth Transportation Board has authorized VDOT to study other regional improvements such as the Rappahannock Parkway, Outer Connector, Stafford Parkway and other proposals to improve connectivity from I-95 to destinations to the west. Any of these improvements could change the demand volumes for the I-95 Corridor, particularly if the Outer Connector is advanced. The outcome of these studies should be known before investing additional funds in the I-95 Corridor between Exits 133 and 130 above those committed for the Preferred Alternative.

Route 3 and Route 17 Expected Traffic Operations

Generally, the traffic operations and intersection LOS on Route 3 and Route 17 under the 2040 Build Condition is expected to remain the same as under the 2040 No-Build condition because the traffic volumes on Route 3 and Route 17 remain similar and few improvements are proposed to the intersection geometry (See Table 6-8 and Table 6-9). However, intersections #5 and #6 are expected to have significant reductions in delay (although the same LOS) due to the flyover proposed at intersection #5 and the diversion of traffic to I-95 from Route 17 (east of I-95) and intersection #6. The new proposed intersections that are part of the Preferred Alternative are not expected to have operational problems with the exception of intersection #8 which is expected to operate at LOS F due to traffic queuing back from the downstream intersection. Only intersection #3 is expected to see increases in delay and worsen LOS in the AM peak hour (from LOS C to LOS D) due to increases in traffic using I-95 and Route 3 instead of Route 1.

The CORSIM analysis confirms the results from the HCS analysis. The CORSIM model shows that the new northbound CD road will operate under capacity for both 2020 and 2040 and that the southbound CD road is under capacity in 2020 only. There are significant improvements to the operations at Route 3, Route 17, and I-95 when compared to the No-Build Condition. In 2020 and 2040, during the AM peak hour, the new triple left turns from eastbound Route 3 to the northbound CD road reduce much of the congestion on Route 3 at the former weave area.

During the PM peak hour for both build conditions (2020 and 2040), the congestion resulting from the high southbound traffic volumes is mostly contained to the new southbound CD road. The diverge locations from southbound I-95 prior to the exit to the new CD road are still expected to operate with high vehicle densities (more so in 2040) however much of the southbound traffic diverges to the southbound CD road resulting in greatly improved operations on the remaining components on southbound I-95. The extremely high westbound volumes on Route 3 and the close proximity at the intersection of Route 3 and Carl D Silver Parkway cause the new southbound CD road to back up approximately 2.5 miles almost to the new braided ramps at the Route 17 interchange is 2040. This is also the case at the intersection of Route 17 and Stanstead Road; the distance between this intersection and the ramp from southbound I-95 is approximately 900 feet in the Build condition (approximately 450 feet in the No-Build condition). Queue lengths for the northbound approach at this intersection cause some spill back onto the relocated ramp from southbound I-95 in the CORSIM model, however the end of queue does not impact the I-95 mainline. Access points to developments along Route 3 and Route 17 would have to be eliminated to improve the southbound operations

Due to funding constraints, the recommended I-95 improvements may need to be phased. The first phase would include constructing the southbound CD Roads with all southbound ramp improvements at the Route 3 and Route 17 interchanges. The second phase would include constructing the northbound CD Roads with all northbound ramp improvements at the Route 3 and Route 17 interchanges.

Constructing only the southbound improvements first, does not have any negative impacts on the corridor in the 2020 design year. Remaining congestion in the unimproved northbound direction does not impact operations in the southbound direction.

Safety Analysis

The increase in capacity on I-95 and reduction in weaving volume as a result of the Build Condition is determined to contribute to safer operating conditions when compared to the No-Build Conditions in 2040. Safer operating conditions include less stop-and-go conditions, lower vehicle density, and lower speed differential between free-flow travel and congested travel.

The Preferred Alternative will not only see a benefit of added capacity, but also from the geometric improvements proposed at the Route 3 and Route 17 interchanges. By replacing existing ramps with modern design standards, traffic flow is expected to increase and crash rates and overall crashes are expected to decrease with the Preferred Alternative as compared to the 2020 and 2040 No-Build scenarios.

Conceptual Sign Layout

A conceptual sign layout of the necessary guide signs was prepared for the preferred alternative, in order to demonstrate that the proposed interchange improvements could be signed in accordance with the standards in the Manual on Uniform Traffic Control Devices (MUTCD). The conceptual guide sign layout is shown in Figure 6-12 in Volume II. There are no apparent problems with signing the preferred alternative in accordance with the MUTCD.

Additional I-95 Improvements

VDOT has a design-build project underway that will replace the existing Falls Hill Avenue bridge over I-95. The bridge will be widened to four lanes and provide room for the proposed northbound and southbound CD-Roads.

In the future additional improvements to the I-95 Corridor will be required. These improvements are not included as part of the preferred alternative 3A. However, constructing the preferred alternative will not preclude them from being able to be constructed in the future. Other potential improvements include:

- Further widening of I-95 to four general purpose lanes in each direction.

- Construction of the I-95 Express Lanes in the median of I-95. The express lanes are in the FAMPO long-range transportation plan and considered part of this project's no-build condition. The status of the southern section of the express lanes project is undetermined at this time; however for this study it is assumed access to and from the express lanes would occur north of Route 17 or south of Route 3.

- Construction of a new interchange and connector road or access ramps adjacent to the rest area. This new access would provide access west of I-95 to Central Park and the proposed minor league baseball stadium, and allow the possibility for a connector road to bypass Route 3.

- Additional improvements to the Route 3 Interchange such as replacing the proposed EB

to NB triple left turn on Route 3 to a two-lane EB to NB flyover ramp. This improvement is shown as Alternative 8B in **Figure 5-8B in the Volume II**.

Next Steps

Completing this Interchange Modification Report (IMR) is one of the first steps in implementing a project such as this. There are many additional steps required before construction can begin. The next steps to implement the project include:

- VDOT submittal of the IMR to FHWA for conditional approval
- Complete the NEPA process and obtain environmental clearance and formal approval for the IMR.
- Conduct preliminary engineering of the preferred alternative on survey grade mapping either under a design-bid-build or design-build contract.
- Seek additional funding. The proposed improvements will need to go through the prioritization process outlined in House Bill 2 prior to construction funding being approved by the Commonwealth Transportation Board.