# South Boston Transporation Safety and Operation Study

November, 2022

VDOT
Virginia Department of Transportation

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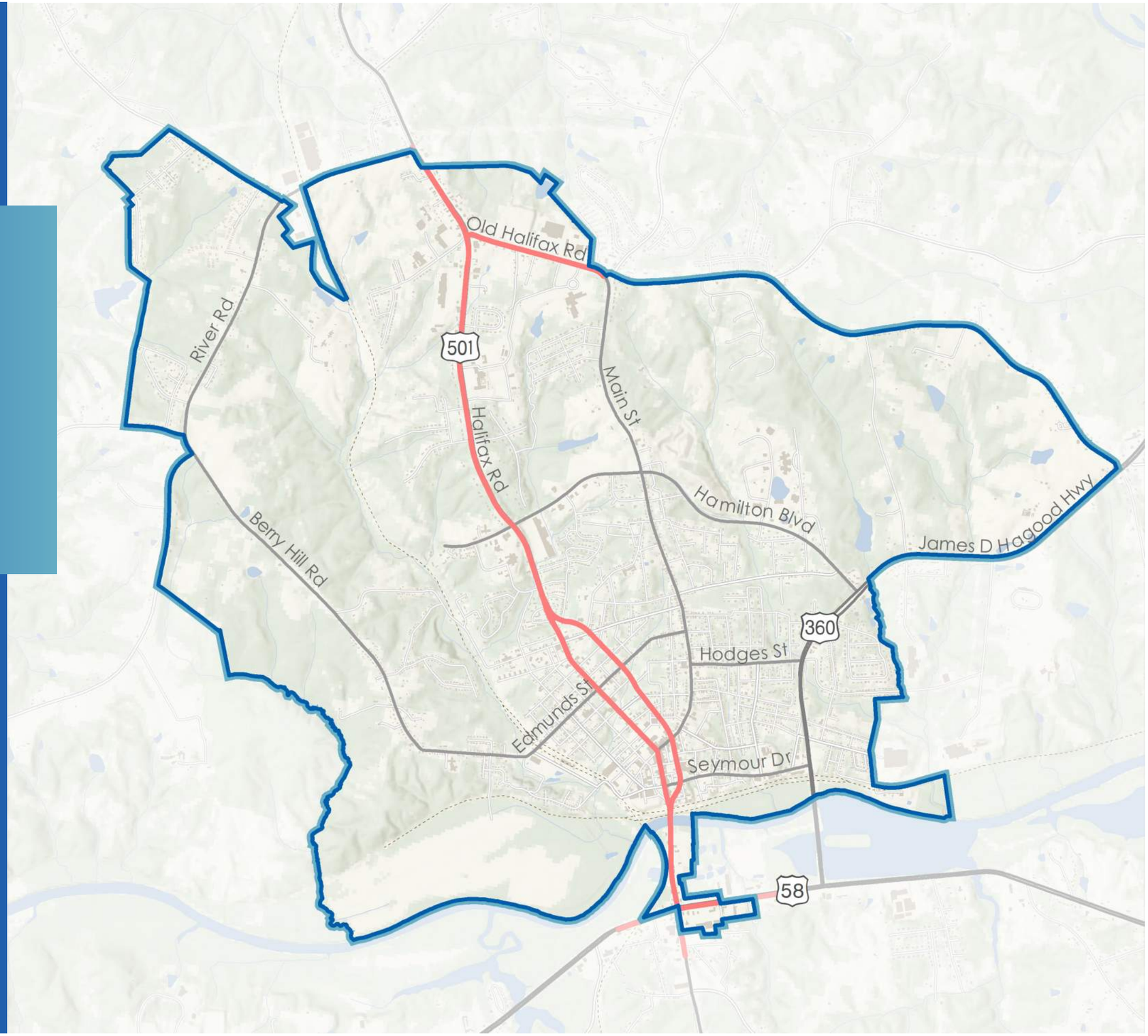
INTERNATIONAL



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## List of Acronyms

| | |
|---|---|
| AADT | Average Annual Daily Traffic |
| HCM | Highway Capacity Manual |
| LOS | Level of Service |
| MOE | Measures of Effectiveness |
| NEPA | National Environmental Policy Act |
| QR | Quadrant Roadway Intersection |
| TAZ | Traffic Analysis Zone |
| TOSAM | Traffic Operations and Safety Manual |
| TPO | Transportation Planning Organization |
| TTI | Travel Time Index |
| VDOT | Virginia Department of Transportation |

# 1. Introduction

## 1.1 Study Purpose

The Town of South Boston serves as a convergence of three major corridors: US 360, US 501 and US 58, creating a unique situation for the town. Additionally, there are intersections and segments in the South Boston area that have resided within the Top 100 PSI intersections or segments in the Lynchburg District for several years. Through this study, these locations were reviewed extensively, and practical solutions were developed to improve safety and support growth of the greater South Boston Area. The primary goal of this study is to produce project concepts that achieve the following:

- Improve safety for the traveling public
- preserve and improve the capacity of US 501 without wide scale road widenings,
- accommodate economic development,
- maintain the Commonwealth's vehicle mobility and economic competitiveness, and
- reduce long-term infrastructure capital and maintenance costs

## 1.2 Study Area

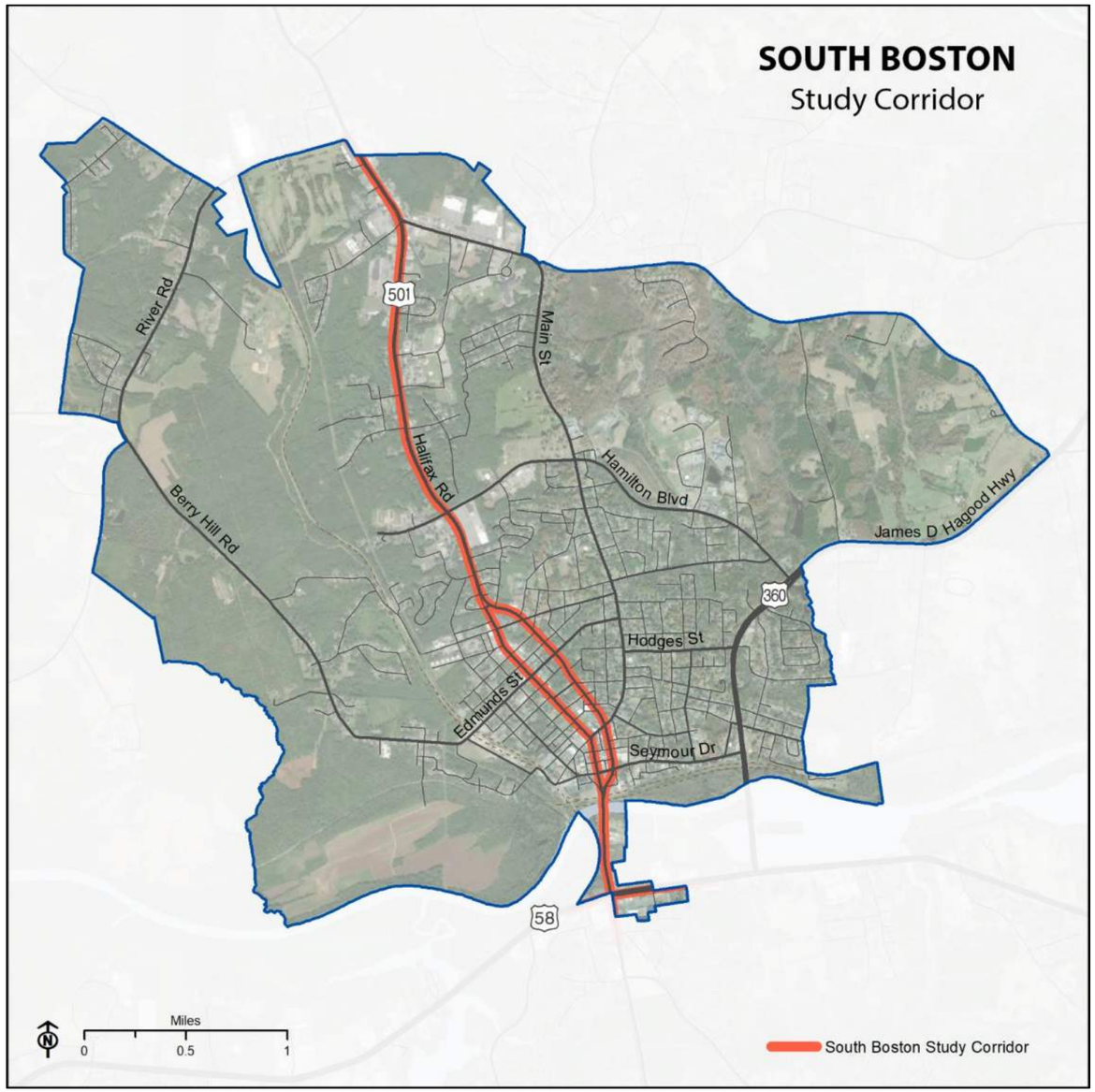
The study area includes a 4-mile US 501 corridor, with a segment break in between the intersection of US 501 (Halifax Road) and Old Halifax Road (VA 129) and US 501 (Broad Street / Wilborn Avenue) and Crescent Street. The study area also includes a 0.70-mile segment of Old Halifax Road from Halifax Road to Dan River Church Road. Figure 1 outlines the study corridor within the town limits of South Boston. The study team evaluated the entire corridor to identify locations in need of improvement based upon operational or safety needs. The locations for recommendations development were identified through the Existing Conditions process presented in Chapter 2.

## 1.3 Review of Existing Studies and Documents

A literature review gathered data and documented any proposed developments or projects for the US 501 corridor within the study area. These documents assisted in the development of land use assumptions and growth patterns and helped identify potential problem areas along the US 501 corridor. The literature review included the comprehensive plans for each locality in the study area, the Six-Year Improvement Plan, long range transportation plans and corridor studies as noted below:

- South Boston 2035 Transportation Plan (2008)
- South Boston Downtown Revitalization Master Plan (2015)
- VTrans Mid-term Report – Lynchburg District (2020)
- Halifax Safety & Operations Study (2021)

*Figure 1: Study Area*



## 1.4 Public Involvement Process

The public involvement process began with the December 3, 2019 project kick-off meeting and subsequent discussion with the core study team. Project stakeholders involved in the development of the study included:

- Town of South Boston
- Halifax County
- Southside Planning District Commission
- Virginia Department of Transportation

This stakeholder group consisted of staff-level representatives from each of the organizations. This group met at key milestones throughout the study to review progress and results. As the consultant member of the study team, Michael Baker International prepared content and facilitated the discussions. These meetings were typically held virtually. Table 1 lists the dates and topics of these meetings.

*Table 1: Core Study Team Meetings:*

| Meeting Date | Meeting Topic |
|---|---|
| December 3, 2019 | Study Kick-Off/Orientation |
| June 4, 2021 | Existing, Future No-Build Conditions Discussion |
| October 25, 2021 | Future No-Build Conditions and Preliminary Concepts |
| March 7, 2022 | Final Recommendations |

### 1.4.1 Public Outreach

Public feedback regarding the proposed recommendations from the study was conducted from May 20, 2022 to May 27, 2022. Due to the COVID-19 pandemic, this effort was conducted as an online MetroQuest survey to gain public insight along the study corridor to better understand conditions and identify issues to address along the study corridor. The online materials included preferred recommendations for the corridor with sketches, cost estimates, and anticipated benefits, accompanied by a MetroQuest survey for citizen comments.

# 2. Existing Conditions

## 2.1 Existing Infrastructure

A field review was conducted in September 2020 at the onset of the study to review roadway and intersection configurations; identify deficiencies and areas of concern, including sight distances or grade issues; identify unique roadway features; and observe traffic operations. This information was then utilized to conduct traffic operational analyses for the study intersections for typical weekday AM and PM peak hours. The key findings from the field visit are presented below:

- Access Management
  - Commercial entrances within the intersection influence area at several intersections
  - Substantial number of commercial entrances between Greens Folly Road and Old Halifax Road intersections
  - Right-turn lanes not consistently provided
- Signage and Markings
  - Visible and in good condition in both directions along US 501
  - Pavement markings along the Old Halifax Road corridor generally in poor condition along the side streets
  - No High-Visibility Backplates at 10 of the 11 signalized intersections (US 501 at US 58/US 360 being the exception)

US 501 is classified as a Minor Arterial according to VDOT's 2014 Functional Classification map with speed limits varying between 25 mph in the downtown area and 45 mph outside of the downtown area. The study corridor is predominantly a four-lane undivided roadway featuring a two-way left-turn lane. The Old Halifax Road corridor is also classified as a four-lane undivided Minor Arterial with a posted speed limit of 45 mph. According to the 2019 Published VDOT Counts, the US 501 study corridor carries an average annual daily traffic (AADT) volume of approximately 15,000 vehicles per day (VPD) within the Town of South Boston.

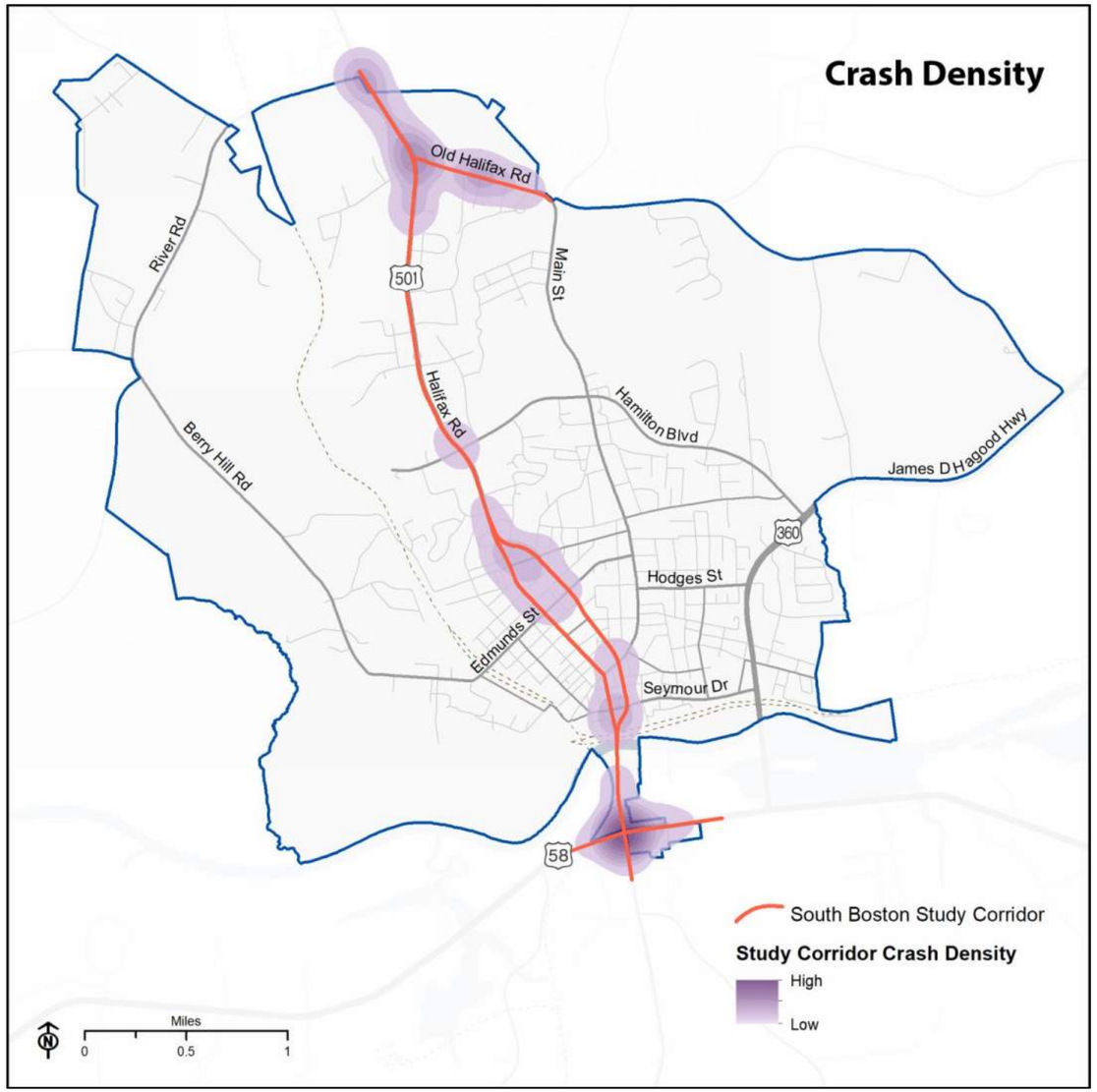
## 2.2 Crash Analysis

An evaluation of corridor safety was conducted based on an analysis of crash summary information. The latest five years of available crash data (2015-2019) was obtained from VDOT's Roadway Network System to determine predominant crash types and crash severity.

Analysis of the existing conditions found that the two most prevalent crash types within the study area were angle crashes and rear-ends. The more prevalent collision type varies from intersection to intersection; for example, the Greens Folly Road intersection features a high concentration of angle collisions, particularly involving the northbound left-turn movement, whereas at the US 501 / Old Halifax Road intersection the main collision type are rear-ends, which suggests congestion-related issues. Other intersections with significant crash history include several unsignalized intersections such as Old Halifax Road and Centerville Park Road, and Broad Street at Edmunds Street downtown, both of which feature a large concentration of angle collisions. Each of these intersections have been identified by the Lynchburg District as a PSI (Potential for Safety Improvement) intersection.

The US 58/US 360/US 501 intersection and the segments approaching the intersection have experienced a high volume of angle and rear-end crashes over the last five years of available data, with each of the segments and intersection itself within the district's top 100 PSI rankings. Several commercial entrances that have a history of angle collisions, including several severe incidents, are within the influence area of the intersection. **Figure 2** presents the crash density map for the US 501 study corridor. The crash maps for the entire study area are found in **Appendix B**. It is important to note that safety is one of the evaluation factors for consideration of funding in the VDOT SMART SCALE project prioritization process.

*Figure 2: South Boston Crash Density Map*



The SMART SCALE Safety Evaluation for roadway projects on existing alignments requires applicants to project the potential for expected crash reduction percentages developed using the Federal Highway Administration's (FHWA) Crash Modification Factors (CMF) Clearinghouse website, related safety research, and Virginia crash rate summaries and models. A CMF is an indicator of how crash occurrence will change as a result of a project. A CMF less than 1.0 indicates a treatment that has a potential to reduce crashes. For example, a treatment with a CMF of 0.86 indicates that there is an expected 14% reduction in total estimated crash frequency. **Table 2** displays fatal and injury crash CMFs for SMART SCALE for typical innovative intersections and access management treatments.

*Table 2: Fatal and Injury CMFs*

| Improvement Type / Features | F + I CMF |
|---|---|
| **Intersections** | |
| Roundabout: Convert signal to roundabout | 0.40 |
| Roundabout: Convert stop/yield control to roundabout | 0.20 |
| Access Management: Close median opening (allow right-in right-out only) | 0.40 |
| Two-way Stop Control to Restricted Crossing U-turn | 0.65 |
| Signal Control to Signalized Restricted Crossing U-turn | 0.80 |
| Signal Control to Continuous Green T Signal | 0.85 |
| Displaced Left Turn | 0.80 |
| Median U-turn | 0.70 |
| **Segments** | |
| Access Management: Reduce Driveway Density (eliminate/close) | 0.70 |
| Access Management: Provide Median (allow right-in right-out only) | 0.40 |

## 2.3 Existing Traffic Volumes

Existing Peak Hour traffic volumes were collected by Peggy Malone & Associates at the 17 intersections listed below:

- US 501 (Halifax Road) / Greens Folly Road
- VA 129 (Old Halifax Road) & Powell Road / US 501
- Old Halifax Road / Tabernacle Trail
- Old Halifax Road / Centerville Park Road
- Old Halifax Road / Halifax High School
- Old Halifax Road / Dan River Church Road
- US 501 (Broad Street / Wilborn Avenue) / Crescent Drive
- US 501 Southbound (Wilborn Avenue) / Webster Street
- US 501 Northbound (Broad Street) / Webster Street
- US 501 Northbound (Broad Street) / Edmunds Street
- US 501 Southbound (Wilborn Avenue) / VA 129 (North Main Street) & Ferry Street
- US 501 Northbound (Broad Street) / VA 129 (North Main Street)
- US 501 Southbound (Main Street) / VA 304 (Seymour Drive)
- US 501 Northbound (Broad Street) / VA 304 (Seymour Drive)
- US 501 Southbound (Main Street) / Factory Street & Wall Street
- US 501 Northbound (Broad Street) / Factory Street & Wall Street
- US 501 (Main Street) / US 58 & US 360 (Philpott Road / Bill Tuck Highway)

The detailed 2019 intersection volumes by AM and PM peak hour can be found in **Appendix C**. The AM and PM peak hours are the times with the highest traffic volumes in the study area. The AM Peak Hour for analysis was found to be 7:30 AM – 8:30 AM. The PM peak hour is 4:45 PM – 5:45 PM.

It is important to note that the study began during the height of the COVID-19 lockdowns and traffic volumes were less than typical traffic volumes in the area when the site visit was performed. The traffic volume development also occurred prior to VDOT's Transportation Planning and Mobility Division published guidance on the best practices for obtaining base year traffic data due to the impacts of the COVID-19 pandemic. Therefore, all traffic analyses and simulations were validated with INRIX speed data, volumes and stakeholder feedback.

## 2.4 Existing Traffic Operations

The Peak Hour intersection turning movement counts developed in the previous section were analyzed using the Highway Capacity Manual (HCM) module of the Synchro software. All intersections operate at an acceptable LOS (C or better) during the AM peak period. Apart from the US 58 / US 360 / US 501 intersection, the LOS during the PM peak period were LOS C or better. The US 58 / US 360 / US 501 intersection operates at LOS D, with each of the four approaches experiencing over 35 seconds of delay. This is most likely due to the volumes along each of the approaches being similar, necessitating longer phase times to serve each approach. **Table 3** displays a summary of the results of the Synchro operational analysis for the 2020 Existing conditions. Detailed reports of the Existing conditions intersection operations throughout the study area are presented in **Appendix D.**

*Table 3: Existing Conditions Operational Analysis Results Summary*

| 2020 Existing Conditions | | |
|---|---|---|
| **Intersection** | **AM LOS** | **PM LOS** |
| US 501 (Halifax Road) / Greens Folly Road | B | B |
| US 501 (Halifax Road) / VA 129 (Old Halifax Road) | C | C |
| VA 129 (Old Halifax Road) / Tabernacle Trail | B | B |
| VA 129 (Old Halifax Road) / Centerville Park Road | A | A |
| VA 129 (Old Halifax Road) / Halifax High School | B | B |
| VA 129 (Old Halifax Road) / Dan River Church Road | B | B |
| US 501 (Wilborn Avenue) / Crescent Drive | A | A |
| US 501 (Wilborn Street) / Webster Street | B | B |
| US 501 (Broad Street) / Webster Street | A | A |
| US 501 (Broad Street) / Edmunds Street | A | A |
| US 501 (Wilborn Avenue) / VA 129 (North Main Street) | A | A |
| US 501 (Broad Street) / VA 129 (North Main Street) | A | A |
| US 501 (Main Street) / VA 304 (Seymour Drive) | A | A |
| US 501 (Broad Street) / VA 304 (Seymour Drive) | B | B |
| US 501 (Main Street) / Factory Street & Wall Street | A | A |
| US 501 (Broad Street) / Factory Street & Wall Street | A | A |
| US 501 / US 58 / US 360 | C | D |

# 3. Future Conditions

## 3.1 Development of Growth Rates

Traffic volumes within the study area are anticipated to continue growing. A review of the local Comprehensive Plans indicates areas appropriate for commercial, residential, and industrial growth along the study corridor. The following sections outline the steps taken to develop the future 2045 traffic volumes.

### 3.1.1 Historical Average Annual Traffic Volumes and Travel Patterns

Historical average annual traffic volumes help establish a trend along the corridor and highlight segments where traffic volumes may increase. The study team used the VDOT historic traffic counts for 10 segments in the corridor. VDOT collects traffic counts from sensors in or along streets and highways and compiles a blended two-way annual average daily traffic count. From this data, estimates of the number of vehicles that traveled each segment of road can be calculated. These historical traffic volumes from 2010 to 2019 are shown in **Appendix A**. Growth rates from previous studies were also investigated to assist in the determination of a background growth rate for the US 501 corridor.

### 3.1.2 Projected Future Growth (2045) and Traffic Volumes

The stakeholder group agreed on a 2045 forecast year to evaluate future operations of the study intersections. The growth rates were based on VDOT's Statewide Travel Demand Model, historical volumes, and funded developments. The development of the future volumes also considered the growth rate used for the adjacent Halifax Safety and Operations Study. The growth rates were approved by VDOT TMPD and the stakeholder group and were based on the following data:

- 1% background linear growth rate applied to all Existing (2020) volumes
- Site Traffic ITE Calculation for the anticipated warehouse along Greens Folly Road

The 2045 projected turning movement volumes for the study corridor are shown in **Appendix C**.

# 4. Future (2045) Traffic Conditions

## 4.1 Future Traffic Operations

The 2045 future year capacity analyses were completed in accordance with VDOT's Traffic Operations and Safety Manual (TOSAM). The operational analysis for the 2045 scenarios considered all funded improvements within the study area. These include:

- US 501 (Broad Street / Main Street) & Factory Street / Wall Street VDOT SMART SCALE roundabout

Two scenarios were analyzed; the No-Build scenario assumes that US 501 will remain as is, including the funded improvement listed above, which were included in the No-Build models. A Build model which assumes the recommended improvements will be constructed along US 501 along with the funded improvements. The Build alternatives are discussed further in Chapter 5.

A second round of analysis was conducted to examine the viability of converting the US 501 two-way pair of Wilborn Avenue/Main Street and Broad Street to allow bi-directional traffic along both facilities. As it exists, Broad Street carries northbound US 501 traffic through the downtown area, and Wilborn Avenue/Main Street facilitates the southbound traffic. These analyses are described further in Chapter 5.

## 4.2 Future No-Build Traffic Operations and Deficiencies

An operational analysis was conducted for the 2045 No-Build condition using the same methodology as the Existing Conditions analysis. The 2045 No-Build condition represents a scenario where traffic volumes include the background growth and trip generation discussed in previous sections. The roadway network remains the same as the Existing Conditions except for improvements that are funded for construction prior to 2045. A summary of the No-Build conditions operational results compared to the Existing results showing overall intersection LOS is presented in **Table 4**. Detailed results of the No-Build conditions intersection operations along the corridor are presented in **Appendix D**.

As shown below in **Table 4**, traffic operations are expected to either maintain the existing LOS or deteriorate slightly at many of the study intersections in the 2045 No-Build scenario when compared to the Existing Conditions. However, at the US 501 / Old Halifax Road intersection, the LOS degrades from LOS C in the Existing Condition to LOS E in the 2045 No-Build Condition PM peak hour. Due to the heavy southbound left-turn volumes and the conflicting movements, this intersection is expected to experience 57.2 seconds of delay. The southbound left turn movement is expected to have more than 250 seconds of delay, indicating excessive delays and queues which are larger than the existing length of storage. The eastbound through and left turn movements along with the northbound left turn are expected to operate at LOS D in 2045. At the US 58 / US 360 / US 501 intersection the LOS degrades from LOS D to LOS E in the 2045 No-Build Condition peak hour. Each of the approaches are expected to operate at LOS D or worse in the PM peak hour, with the northbound and southbound approaches of US 501 operating at LOS E and F respectively. The following sections will discuss the recommended improvements at locations along the US 501 corridor and how these improvements mitigate the degradation in operations at each location.

*Table 4: 2045 No-Build Operations compared to Existing Conditions Operations*

| Intersection Operations Comparison | | | | |
|---|---|---|---|---|
| Intersection | AM LOS | | PM LOS | |
| | 2019 Existing | 2045 No-Build | 2019 Existing | 2045 No-Build |
| US 501 (Halifax Road) / Greens Folly Road | B | C | B | C |
| US 501 (Halifax Road) / VA 129 (Old Halifax Road) | C | C | C | E |
| VA 129 (Old Halifax Road) / Tabernacle Trail | B | B | B | B |
| VA 129 (Old Halifax Road) / Centerville Park Road | A | A | A | A |
| VA 129 (Old Halifax Road) / Halifax High School | B | B | B | C |
| VA 129 (Old Halifax Road) / Dan River Church Road | B | B | B | C |
| US 501 (Wilborn Avenue) / Crescent Drive | A | A | A | A |
| US 501 (Wilborn Street) / Webster Street | B | B | B | C |
| US 501 (Broad Street) / Webster Street | A | A | A | A |
| US 501 (Broad Street) / Edmunds Street | A | A | A | A |
| US 501 (Wilborn Avenue) / VA 129 (North Main Street) | A | A | A | A |
| US 501 (Broad Street) / VA 129 (North Main Street) | A | B | A | B |
| US 501 (Main Street) / VA 304 (Seymour Drive) | A | A | A | A |
| US 501 (Broad Street) / VA 304 (Seymour Drive) | B | B | B | B |
| US 501 (Main Street) / Factory Street & Wall Street | A | A | A | A |
| US 501 (Broad Street) / Factory Street & Wall Street | A | | A | |
| US 501 / US 58 / US 360 | C | D | D | E |

## 4.3 Results of Operational Analyses for Recommended Improvements

Chapter 5 details the recommended improvements, operations, and safety benefits of the recommendations. Although many of the study intersections are expected to operate with acceptable delay in the future, recommendations were provided at these locations to improve safety based on the crash history discussed previously. The analysis was conducted to ensure that both safety and capacity would be satisfactory.

Recommendations frequently included the development of innovative intersections. Some of the innovative intersections include two or three intersections that function together as one system. Synchro does not currently have a method to analyze innovative intersections; however, Chapter 23 of the Highway Capacity Manual and Appendix G of VDOT's Traffic Operations and Safety Analysis Manual (TOSAM) outline the methodologies for calculating delays and LOS by using travel time and the appropriate delay(s) through the innovative intersections. The HCM method provides a better way of comparing innovative intersections with the traditional intersection configurations that occupy the corridor today. The operational analyses for each location are compared in the following Chapter 5.

# 5. Alternatives and Recommendations

## 5.1 US 501 Corridor Recommendations

Future traffic volumes show that the US 501 corridor will benefit from improvements to maintain capacity and improve operations and safety. Most of these improvements are driven to maintain regional growth and improve roadway safety. The stakeholder group reviewed the following areas for alternatives and recommendations:

- US 501 (Halifax Road) / Greens Folly Road
- US 501 (Halifax Road) / Old Halifax Road & Powell Road
- US 501 (Broad Street / Wilborn Avenue) / Crescent Drive
- US 501 Southbound (Wilborn Avenue) / Webster Street
- US 501 (Main Street) / US 58 & US 360 (Philpott Road / Bill Tuck Highway)

Alternative analyses were performed for the controlling peak hour, 4:45 PM – 5:45 PM, and analyzed with VDOT's VJuST tool, which is used to screen preliminary improvement concepts. The volume-to-capacity (V/C) ratio and conflict points were used to evaluate operations and safety, respectively. Lower numbers are better for either metric. The "no improvement" scenario in each table evaluates the future volumes with the existing lane and control configuration. After the VJuST screening and discussions with the stakeholder group, detailed analyses were performed further for the intersections of US 501 at Greens Folly Road, Old Halifax Road/Powell Road, Dan River Church Road, Webster Street, and US 58 / US 360.

Innovative intersections and access management techniques were evaluated for the development of recommendations. Below is a list of alternative intersection designs that are included in the VDOT toolbox that were evaluated as potential alternatives. Some of the alternative designs were not suitable for recommendation due to the geometric constraints, concept's principles, associated costs and/or Right-of-Way limitations. The concepts listed below were evaluated to screen individual concepts at each of the locations listed above to determine the most effective options for analysis and recommendation.

- Roundabout
- Thru-Cut
- Median U-turn Intersection (MUT)
- Restricted Crossing U-turn Intersection (RCUT)
- Continuous Green-T (CGT)
- Quadrant Roadway (QR)
- Center Turn Overpass

Detailed information on each of these concepts is available at VDOT's Innovative Intersections website located at http://www.virginiadot.org/innovativeintersections/.

Recommendations were developed by using the crash evaluation and analyzing the future volumes from both planned and potential developments along the study corridor. Project stakeholders and the public were engaged through the project process to identify the most preferred recommendations. Detailed Synchro reports for the Build conditions are presented in **Appendix E**. The concept sketches for these recommendations are presented in **Appendix H**.

The recommendations developed for this study are described in the following sections, from north to south along the US 501 corridor.

### 5.1.1 US 501 & Greens Folly Road

The alternatives shown in **Table 5** were considered at the Greens Folly Road intersection. After discussions with the stakeholder group, only the northbound dual left-turn lane improvement was carried forward for Synchro analysis.

*Table 5: US 501 & Greens Folly Road VJuST Results*

| Scenario | PM V/C |
|---|---|
| No Improvement | 0.62 |
| Dual Northbound Left Turn Lanes | 0.50 |
| Partial Median U-Turn | 0.67 |
| Roundabout | 0.73 |

**Table 6** shows the analysis results of the proposed Build concept compared to the existing and No-Build conditions. The operational analysis shows that with an additional lane, the northbound left-turn movement delay is decreased by approximately 37 percent. While the delay experienced by the eastbound and southbound approaches are increased compared to the No-Build, the overall intersection delay is 18 percent less than the No-Build condition.

*Table 6: US 501 & Greens Folly Road - Detailed Operational Results*

| Intersection | Scenario | Overall Delay (LOS) | Delay per Lane Group by Approach (sec/veh) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
| | | | LT | TH | RT | LT | TH | RT | LT | TH | RT | LT | TH | RT |
| US Route 501 (Halifax Road) at Greens Folly Road | **AM Peak Hour** | | | | | | | | | | | | | |
| | Existing | 19.6 | 13.1 | N/A | 32.3 | N/A | | | 14 | 14.2 | N/A | 9.3 | 16.1 | 12.7 |
| | | | B | | C | | | | B | B | | A | B | B |
| | | B | 29.8 - C | | | | | | 14.1 - B | | | 15.9 - B | | |
| | Future No Build | 23.3 | 21.3 | N/A | 24.5 | N/A | | | 22.5 | 15.3 | N/A | 21.3 | 27.9 | 22.8 |
| | | | C | | C | | | | C | B | | C | C | C |
| | | C | 24.0 - C | | | | | | 18.5 - B | | | 27.3 - C | | |
| | Future Build | 16.1 | 29.2 | N/A | 29.4 | N/A | | | 23 | 2.1 | N/A | N/A | 9.3 | 7.6 |
| | | | C | | C | | | | C | A | | | A | A |
| | | B | 29.2 - C | | | | | | 11.5 - B | | | 9.1 - A | | |
| | **PM Peak Hour** | | | | | | | | | | | | | |
| | Existing | 12.1 | 32.7 | N/A | 21.6 | N/A | | | 6.4 | 7.8 | N/A | 13.7 | 17.1 | 14.8 |
| | | | C | | C | | | | A | A | | B | B | B |
| | | B | 19.7 - B | | | | | | 7.2 - A | | | 16.8 - B | | |
| | Future No Build | 22.6 | 33.4 | N/A | 24.4 | N/A | | | 40.4 | 9.4 | N/A | 15.1 | 19.9 | 16.3 |
| | | | C | | C | | | | D | A | | B | B | B |
| | | C | 25.8 - C | | | | | | 23.0 - C | | | 19.4 - B | | |
| | Future Build | 18.4 | 33.5 | N/A | 22.2 | N/A | | | 25.5 | 4.9 | N/A | 18.8 | 23.9 | 19 |
| | | | C | | C | | | | C | A | | B | C | B |
| | | B | 23.9 - C | | | | | | 13.9 - B | | | 23.3 - C | | |

### 5.1.2 US 501 & Old Halifax Road

Several innovative intersection designs were considered at this location. Initial alternatives considered included full and partial displaced left-turn intersection, thru-cut, and hybrid roundabout. Grade-separated alternatives such an echelon or center-turn overpass were considered as well. **Table 7** presents the VJuST results.

*Table 7: US 501 & Old Halifax Road VJuST Results*

| Scenario | PM V/C |
|---|---|
| At-grade intersections | |
| No Improvement | 0.79 |
| Conventional Improvements | 0.78 |
| Partial Displaced Left Turn | 0.47 |
| Full Displaced Left Turn | 0.60 |
| Restrict Crossing U-Turn | 0.58 |
| Thru-Cut | 0.55 |
| Roundabout | 0.86 |
| Grade separated | |
| Echelon | 0.50 |
| Center Turn Overpass | 0.34 |

Both grade-separated options were eliminated due to the anticipated costs and right-of-way impacts. The alternatives that advanced for further analysis were conventional improvements (removal of the split-phase for the side-streets) and a partial displaced left-turn for the southbound approach.

**Table 8** displays the operational analysis results for these alternatives compared with the existing and No-Build conditions. Following discussions with the stakeholder group, it was agreed that both concepts were advanced for conceptual design and preliminary cost estimates. It was determined that the conventional improvements could be implemented first, and once traffic demand exceeds capacity and operations deteriorate, the partial displaced left-turn may be considered for implementation and could be pursued for future funding.

*Table 8: US 501 & Old Halifax Road - Detailed Operational Results*

| Intersection | Scenario | Overall Delay (LOS) | Delay per Lane Group by Approach (sec/veh) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
| | | | LT | TH | RT | LT | TH | RT | LT | TH | RT | LT | TH | RT |
| US Route 501 (Halifax Road) at Route 129 (Old Halifax Road) / Powell Road | PM Peak Hour | | | | | | | | | | | | | |
| | Existing | 27.2 | 34.0 | 36.0 | 0.1 | 28.7 | 28.6 | 0.6 | 39.9 | 25.9 | 12.6 | 76.3 | 20.6 | 12.5 |
| | | C | C | D | A | C | C | A | D | C | B | E | C | B |
| | | C | 21.8 - C | | | 10.3 - B | | | 22.7 - C | | | 48.8 - D | | |
| | Future No Build | 57.2 | 38.5 | 46.1 | 0.1 | 32.6 | 32.5 | 0.9 | 43.3 | 28.6 | 13.5 | 252.7 | 24.7 | 14.1 |
| | | D | D | D | A | C | C | A | D | C | B | F | C | B |
| | | E | 26.8 - C | | | 11.7 - B | | | 24.8 - C | | | 140.8 - F | | |
| | Future Build (Conventional Improvements) | 27.2 | 17.2 | 16.8 | 16.0 | 36.7 | 18.8 | 37.9 | 63.5 | 26.3 | 19.6 | 32.5 | 13.0 | 10.8 |
| | | B | B | B | B | D | B | D | E | C | B | C | B | B |
| | | C | 16.6 - B | | | 35.6 - D | | | 27.5 - C | | | 22.9 - C | | |
| | Future Build (Partial DLT) | 9.7 | 28.6 | 21.4 | 20.7 | 25.4 | 16.7 | 23.4 | 8.2 | 22.4 | 7.5 | 23.2 | 7.6 | 10.6 |
| | | C | C | C | C | C | B | C | A | C | A | C | A | B |
| | | A | 16.7 - B | | | 30.7 - D | | | 14.7 - B | | | 4.8 - A | | |

### 5.1.3 US 501 (Broad Street/Wilborn Avenue) & Crescent Avenue

A previous study identified a hybrid roundabout concept that was advanced for SMART SCALE funding during the 2020 round. Although this concept did not receive funding, it is recommended that funding opportunities should continue to be pursued at this location, given the operational and safety benefits. In terms of safety, roundabouts have been proven to reduce the risk of crashes at previously unsignalized intersections by as much as 80 percent. Operationally, the delay for the eastbound and westbound approaches is reduced by approximately 38 percent and 93 percent, respectively, with the construction of the roundabout. **Table 9** compares the delay experienced by the stop-controlled approaches in the No-Build versus the build conditions that include the roundabout.

*Table 9: US 501 & Crescent Avenue - Detailed Operational Results*

| Intersection | Approach | Approach Delay (sec) | | Approach LOS | |
|---|---|---|---|---|---|
| | | No-Build PM | Build PM | No-Build PM | Build PM |
| US 501 (Broad St/Wilborn Ave) & Crescent Street | Crescent Avenue Eastbound | 15.6 | 9.7 | C | A |
| | Broad Street Westbound | 18.1 | 1.3 | C | A |

### 5.1.4 US 501 (Wilborn Avenue) & Webster Street

Two concepts were screened for this location using VJuST:

- Conventional improvements – Within the footprint of the existing pavement, convert the single-lane side street approaches to include dedicated left-turn lanes and shared thru-right lanes
- Mini-roundabout

The VJuST results are shown below in **Table 10**. The stakeholder group determined that the conventional improvements were the most viable option at this location. **Table 11** below shows the Synchro results compared with the existing and No-Build conditions. As shown in **Table 11**, operations are expected to improve from an overall LOS C to an overall LOS A with the conventional improvements.

*Table 10: Wilborn Ave & Webster Street VJuST Results*

| Scenario | PM V/C |
|---|---|
| No Improvement | 0.60 |
| Conventional Improvements | 0.56 |
| Mini-Roundabout | 0.87 |

*Table 11: Wilborn Ave & Webster Street - Detailed Operational Results*

| Intersection | Scenario | Overall Delay (LOS) | Delay per Lane Group by Approach (sec/veh) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
| | | | LT | TH | RT | LT | TH | RT | LT | TH | RT | LT | TH | RT |
| US Route 501 SB (Wilborn Avenue) at Webster Street | PM Peak Hour | | | | | | | | | | | | | |
| | Existing | 14.1 | 34.7 | 34.9 | 34.9 | 34.4 | 35.0 | 35.0 | 8.1 | 7.2 | 7.2 | 4.7 | 11.9 | 11.9 |
| | | | C | C | C | C | D | D | A | A | A | A | B | B |
| | | B | 34.8 - C | | | 34.8 - C | | | 7.2 - A | | | 11.5 - B | | |
| | Future No-Build | 20.8 | 24.9 | 24.9 | 24.9 | 26.7 | 26.7 | 26.7 | 10.3 | 8.7 | 8.7 | 6.6 | 23.5 | 23.5 |
| | | | C | C | C | C | C | C | B | A | A | A | C | C |
| | | C | 24.9 - C | | | 26.7 - C | | | 8.8 - A | | | 22.6 - C | | |
| | Future Build: Conventional | 9.6 | 20.9 | 20.7 | 20.7 | 20.4 | 20.5 | 20.5 | 5.1 | 4.8 | 4.8 | 3.2 | 8.8 | 8.8 |
| | | | C | C | C | C | C | C | A | A | A | A | A | A |
| | | A | 20.8 - C | | | 20.5 - C | | | 4.8 - A | | | 8.5 - A | | |

### 5.1.5 US 501 (Main Street) & US 58/US 360 (Philpott Road / Bill Tuck Highway)

As previously noted, this convergence of three US Routes has several operational issues in the 2045 No-Build condition. With the high volume of left turns along the eastbound and southbound approaches, the stakeholder group sought improvements that would eliminate or relocate these movements. The alternatives that were initially screened in VJuST were conventional improvements (removal of split-phase for side-streets, utilize flashing yellow-arrow operation for the US 501 approaches), partial displaced left-turn; partial median U-turn; quadrant roadway; hybrid roundabout; and RCUT. **Table 12** displays the results from the VJuST analysis using the PM peak hour volumes.

*Table 12: US 58 / US 360 / US 501 VJuST Results*

| Scenario | PM V/C |
|---|---|
| No Improvement | 0.82 |
| Conventional Improvements | 0.67 |
| Partial Displaced Left Turn | 0.55 |
| Partial Median U-Turn | 0.56 |
| Restrict Crossing U-Turn | 0.89 |
| Quadrant Roadway | 0.68 |
| Roundabout | 1.31 |

The VJuST results indicate that the conventional improvements, partial MUT and quadrant roadway options were viable to be advance for further analysis. Despite the favorable V/C ratio, the partial DLT option was screened out due to concerns of right-of-way acquisition costs. Although the RCUT shows a high V/C ratio, the stakeholder group decided to advance it to analysis to verify the operations**. Table 13** summarizes the results of the operational analyses. The overall intersection delay of the partial median U-turn and quadrant roadway alternatives is very similar. With the quadrant roadway, however, the left-turn movements have a LOS of D or worse at three of the four approaches. This coupled with the anticipated right-of-way and construction costs due to the need to establish a new connecting roadway, the study group elected to eliminate the quadrant roadway concept and advance the Partial MUT option. The partial MUT was initially submitted as a pre-application for the round of SMART SCALE funding for fiscal year 2024, and a detailed cost estimate was developed. Ultimately, this project was not advanced as a full application. The cost estimate for this alternative is included in **Appendix I.**

*Table 13: US 58 / US 360 / US 501 - Detailed Operational Results*

| Location | Approach | Movement | 2045 PM Peak Hour Delay per Vehicle (sec) | | | |
|---|---|---|---|---|---|---|
| | | | No-Build | Conventional Improvements | Partial MUT | Quadrant Roadway |
| US 501 (Main Street/ Huell Matthews Highway) at US 58/US 360 (Philpott Road/ Bill Tuck Highway) | EB US 58/360 | EBL | D (51.6) | D (50.0) | C (31.3) | D (46.2) |
| | | EBT | C (34.3) | D (39.3) | C (21.6) | B (12.9) |
| | | EBR | C (30.2) | C (22.4) | B (18.8) | A (8.8) |
| | WB US 58/360 | WBL | D (46.6) | D (46.6) | C (27.4) | E (58.3) |
| | | WBT | D (37.4) | D (44.8) | C (22.3) | A (4.6) |
| | | WBR | C (33.4) | C (27.3) | C (21.0) | B (15.0) |
| | NB US 501 | NBL | D (40.2) | C (33.5) | E (78.9) | F (113.2) |
| | | NBT | E (70.1) | D (37.1) | C (26.1) | B (18.9) |
| | | NBR | E (70.1) | D (37.1) | A (9.2) | B (15.5) |
| | SB US 501 | SBL | F (109.6) | D (40.4) | E (66.8) | C (29.3) |
| | | SBT | F (109.6) | D (51.7) | C (25.4) | B (17.0) |
| | | SBR | C (23.1) | B (19.2) | A (7.5) | D (38.1) |
| | **Intersection Delay** | | **E (57.7)** | **D (39.3)** | **C (23.8)** | **C (24.1)** |

NOTE: The delays reported in Table 13 account for the Extra Distance Travel Time (EDTT), as per Appendix G in the TOSAM. The values highlighted in orange are the re-routed movements for that concept.

## 5.2 Old Halifax Road (VA 129) Corridor Recommendations

Future traffic volumes show that the Old Halifax Road corridor will benefit from improvements to maintain capacity and improve operations and safety. Most of these improvements are driven to maintain regional growth and improve roadway safety. The stakeholder group reviewed the following areas for alternatives and recommendations:

- Old Halifax Road / Tabernacle Trail
- Old Halifax Road / Centerville Park Road
- Old Halifax Road / Halifax High School
- Old Halifax Road / Dan River Church Road

The recommendations developed for this study are described below, from west to east along the Old Halifax Road corridor. Detailed Synchro and SIDRA reports are presented in **Appendix E**. The concept sketches for these recommendations are presented in **Appendix H**.

### 5.2.1 Old Halifax Road and Tabernacle Trail

The stakeholder group identified several alternatives at this location that were viable for VJuST analysis. The VJuST results for the PM peak hour are shown in **Table 14**.

*Table 14: Old Halifax Road & Tabernacle Trail VJuST Results*

| Scenario | PM V/C |
|---|---|
| No Improvement | 0.11 |
| Median U-Turn | 0.37 |
| Partial Median U-Turn | 0.24 |
| RCUT | 0.34 |
| Thru-Cut | 0.32 |

The stakeholder group chose to advance the Thru-Cut alternative, citing the anticipated lower cost of construction compared to the other alternatives. The median U-turn and RCUT alternatives would require establishing a U-turn location west of the intersection which could occur associated right-of-way costs. Because the collected turning movement counts show no through movement volumes along Tabernacle Trail, the intersection effectively operates as a Thru-Cut. **Table 15** summarizes the comparison of operations between the existing, No-Build, and proposed build scenarios. The northbound approach delay is reduced by 56 percent and the southbound approach delay is reduced by 30 percent when the proposed improvement is implemented.

*Table 15: Old Halifax Road & Tabernacle Trail - Detailed Operational Results*

| Intersection | Scenario | Overall Delay (LOS) | Delay per Lane Group by Approach (sec/veh) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Eastbound | | | Westbound | | | Northbound | | Southbound | |
| | | | LT | TH | RT | LT | TH | RT | LT | RT | LT | RT |
| Route 129 (Old Halifax Road) at Tabernacle Trail | PM Peak Hour | | | | | | | | | | | |
| | Existing | 14.5 | 7.3 | 11.3 | 11.3 | 12.3 | 16.7 | 13.5 | 35.8 | 35.8 | 29.9 | 20.4 |
| | | | A | B | B | B | B | B | D | D | C | C |
| | | B | 10.9 - B | | | 16.3 - B | | | 35.8 - D | | 24.4 - C | |
| | Future No-Build | 16.4 | 9.3 | 13.2 | 13.2 | 12.3 | 18.0 | 13.8 | 43.7 | 43.7 | 35.1 | 25.2 |
| | | | A | B | B | B | B | B | D | D | D | C |
| | | B | 12.7 - B | | | 17.5 - B | | | 43.7 - D | | 29.4 - C | |
| | Future Build | 12.1 | 9.2 | 16.1 | 16.1 | 4.3 | 7.8 | 1.3 | 19.3 | 19.2 | 21.4 | 19.8 |
| | | | A | B | B | A | A | A | B | B | C | B |
| | | B | 15.3 - B | | | 6.9 - A | | | 19.3 - B | | 20.5 - C | |

### 5.2.2 Old Halifax Road and Centerville Park Road

Due to the previously noted safety concerns along the segment between US 501 and Centerville Park Road, the focus at this intersection was addressing the number of angle collisions that occurred within the past five years of available data. The stakeholder group recommended converting the side-street approaches to right-in/right-out only and eliminating the eastbound left-turn lane. The westbound left-turn lane would be maintained to provide access to the commercial businesses along Centerville Park Road, as currently there is no alternative route to access these businesses east of the intersection. Although operations were not critical at this location, VJuST analysis was performed to verify if operations were adversely affected by the proposed alternative. **Table 16** displays the volume-to-capacity ratios at the Centerville Park intersection.

*Table 16: Old Halifax Road & Centerville Park Road VJuST Results*

| Scenario | PM V/C |
|---|---|
| No Improvement | 0.36 |
| right-in/right-out | 0.27 |

### 5.2.3 Old Halifax Road and Halifax High School

Looking at systemic improvements along the Old Halifax Road corridor, this intersection was identified as another viable candidate for a Thru-Cut configuration. The stakeholder group decided to forgo the VJuST analysis and analyze the thru-cut using Synchro. **Table 17** displays the Synchro results for this intersection. The Thru-Cut is projected to decrease the overall intersection delay by 44 percent, factoring in the additional U-turn volumes added because of the modifications to the adjacent Centerville Park Road intersection.

*Table 17: Old Halifax Road & Halifax High School - Detailed Operational Results*

| Intersection | Scenario | Overall Delay (LOS) | Delay per Lane Group by Approach (sec/veh) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
| | | | LT | TH | RT | LT | TH | RT | LT | TH | RT | LT | TH | RT |
| Route 129 (Old Halifax Road) at Halifax High School | PM Peak Hour | | | | | | | | | | | | | |
| | Existing | 16.8 | 9.0 | 14.1 | 11.6 | 14.4 | 18.3 | 16.7 | 29.5 | 29.5 | 28.1 | 23.3 | 23.3 | 14.9 |
| | | | A | B | B | B | B | B | C | | C | C | | B |
| | | B | 13.4 - B | | | 17.7 - B | | | 29.1 - C | | | 20.3 - C | | |
| | Future No-Build | 20.5 | 11.4 | 17.8 | 13.7 | 15.7 | 22.0 | 19.5 | 33.7 | 33.7 | 32.0 | 28.9 | 28.9 | 17.2 |
| | | | B | B | B | B | C | B | C | | C | C | | B |
| | | C | 16.9 - B | | | 21.2- C | | | 33.1 - C | | | 24.6 - C | | |
| | Future Build | 11.5 | 10.9 | 3.3 | 6.4 | 11.7 | 14.1 | 11.8 | 19.2 | N/A | 18.5 | 25.2 | N/A | 18.9 |
| | | | B | A | A | B | B | B | B | | B | C | | B |
| | | B | 15.3 - B | | | 13.4 - B | | | 19.0 - B | | | 22.9 - C | | |

### 5.2.4 Old Halifax Road and Dan River Church Road

The Intersection with Dan River Church Road was prioritized by the stakeholder group to develop a viable alternative that could be pursued via SMART SCALE funding. While the No-Build analysis indicated acceptable operations with an LOS C in the PM peak hour, it was observed in the field review excessive queues including spillbacks along the southbound left-turn lane. The innovative intersections that were analyzed through VJuST were a continuous green-T (CGT) and hybrid roundabout. Two conventional improvements were considered: both options modify the southbound approach to feature two left turn lanes and a single through lane; option 1 maintains the existing lane configuration for the northbound approach, while option 2 drops the existing outside through lane into a right turn lane to enable the westbound right turn lane to be under free-flow operation. The results are shown in **Table 18**.

*Table 18: Old Halifax Road & Dan River Church Road VJuST Results*

| Scenario | PM V/C |
|---|---|
| No Improvement | 0.60 |
| Conv. Option 1 | 0.48 |
| Conv. Option 2 | 0.56 |
| CGT | 0.48 |
| Roundabout | 0.55 |

The stakeholder group elected to advance all alternatives for further analysis. The conventional improvements and CGT concepts were analyzed in Synchro; SIDRA was used to analyze the roundabout**. Table 19** compares the four concepts with the 2045 No-Build condition. Although the roundabout shows the greatest operational improvement, the stakeholder group screened the concept out due to concerns of right-of-way and utility relocation costs. The two alternatives that were advanced for conceptual design and public feedback were the CGT and the second conventional alternative.

*Table 19: Old Halifax Road & Dan River Church Road Operational Analysis*

| Location | Approach | Movement | 2045 PM Peak Hour Delay per Vehicle (sec) | | | | |
|---|---|---|---|---|---|---|---|
| | | | No-Build | Conventional Improvements Alt 1 | Conventional Improvements Alt 2 | CGT | Roundabout |
| Route 129 (Old Halifax Road) at Dan River Church Road | WB | WBL | C (31.1) | C (26.8) | B (18.5) | C (22.0) | A (8.0) |
| | DR Church Rd | WBR | C (29.7) | A (0.4) | A (8.2) | A (0.4) | A (7.8) |
| | NB | NBT | C (28.1) | C (22.6) | B (17.1) | C (21.3) | A (7.3) |
| | VA 129 | NBR | C (28.1) | A (9.4) | B (17.1) | A (5.9) | A (6.7) |
| | SB | SBL | C (20.0) | C (20.7) | B (18.9) | C (24.7) | A (6.1) |
| | VA 129 | SBT | A (2.9) | A (3.1) | A (4.9) | A (0.1) | A (5.6) |
| | **Intersection Delay** | | **C (20.5)** | **B (13.1)** | **B (13.2)** | **B (12.2)** | **A (6.7)** |

## 5.3 Downtown Two-Way Analysis

The study team was tasked with investigating the operational impacts of converting the one-way pair of US 501 downtown to allow two-way traffic along both facilities. Currently US 501 is split downtown: Wilborn Avenue / Main Street carries the southbound traffic through the downtown area, and Broad Street carries northbound traffic. While Broad Street is one-way for the entirety of the 1.25-mile segment, Wilborn Avenue allows for two-way traffic from the Crescent Street intersection until the North Main Street (VA 129) intersection where it becomes Main Street. The study team used the 2045 volumes and developed the re-routed volumes to be used for the analysis. Using the directional factor in the 2019 VDOT Published Counts as well as the movement splits at each intersection, the two-way volumes assumed that Broad Street would be the intended route for through-traffic, and the Wilborn Avenue / Main Street corridor would be designated as the business route of US 501.

To establish a baseline to determine what types of geometric/operational improvements were necessary at each of the downtown intersections, a "No-Build" analysis was conducted using the afternoon peak period volumes. The existing lane configuration at each intersection would be maintained with the exception of the approach that now allows two-way traffic (i.e. the northbound approach along Main Street and the southbound approach along Broad Street). The baseline analysis concluded that the unsignalized intersections along the Broad Street corridor would not be adversely impacted by the two-way conversion and would have satisfactory operations with single-lane approaches. Only two of the signalized intersections (Broad Steet at Main Street, Broad Street at Seymour Drive) had less than acceptable LOS with one-lane approaches for the new allowable movements. Recommendations for these two intersections were developed for a scenario in which the two-way conversion is implemented and are described in the following sections.

### 5.3.1 Broad Street at North Main Street

Due to the high volume of projected southbound left turns, a dedicated left-turn lane with 100' storage and 100' taper is recommended. To establish this, the existing on-street parking between First Street and Main Street would be eliminated. The northbound approach is recommended to include dedicated left-turn and right-turn lanes in addition to a dedicated through lane. The lengths of the left-turn and right-turn lanes are 50 feet and 75 feet, respectively. Similar to the southbound approach, the parking along the northbound approach would be eliminated. Th westbound approach would include a left-turn lane and a shared through-right lane, while the eastbound lane would be a single-lane approach. The southbound left-turn is assumed to operate under protected-permissive phasing, and the Main Street approaches would operate under concurrent phasing.

### 5.3.2 Broad Street at Seymour Drive

The configurations of the side-street approaches of Seymour Drive would be kept the same as existing, with the ability to make left- and right-turns onto southbound Broad Street. The northbound approach would be converted to a shared left-through and right-turn lane configuration. The southbound approach would feature a dedicated left-turn lane and a shared through-right lane. It is anticipated that this intersection would achieve satisfactory LOS A using two-phase operations.

**Table 20** compares the operational analysis results of the No-build scenario (with one-way pairs) to a scenario that includes the two-way conversion and intersection improvements discussed previously. The analysis concludes that eliminating the one-way pair of US 501 would not be detrimental to operations and would facilitate through-traffic along Broad Street while Wilborn Avenue / Main Street would serve as the business route through the downtown area. Detailed Synchro reports are presented in **Appendix F**. Conceptual sketches of the downtown improvements are included in **Appendix H.**

*Table 20: Downtown Two-Way Analysis Comparison Table*

| Intersection Operations Comparison | | | | |
|---|---|---|---|---|
| Intersection | AM LOS | | PM LOS | |
| | 2045 No-Build | 2045 Two-Way | 2045 No-Build | 2045 Two-Way |
| US 501 (Wilborn Avenue) / Crescent Drive | A | A | A | A |
| US 501 (Wilborn Street) / Webster Street | B | A | C | A |
| US 501 (Broad Street) / Webster Street | A | A | A | A |
| US 501 (Broad Street) / Edmunds Street | A | A | A | A |
| US 501 (Wilborn Avenue) / VA 129 (North Main Street) | A | A | A | A |
| US 501 (Broad Street) / VA 129 (North Main Street) | A | B | B | B |
| US 501 (Main Street) / VA 304 (Seymour Drive) | A | A | A | A |
| US 501 (Broad Street) / VA 304 (Seymour Drive) | B | A | B | A |
| US 501 (Main Street) / Factory Street & Wall Street | A | A | A | A |
| US 501 (Broad Street) / Factory Street & Wall Street | | | | |

## 5.4 Costs & Funding Sources

### 5.4.1 Opinion of Costs

The study group was tasked with the development of detailed cost estimates for the selected alternatives that were advanced for SMART SCALE submittal by the stakeholder group. The Partial MUT at the US 58 / US 360 / US 501 intersection was submitted as a pre-application. Using VDOT's Project Cost Estimate System (PCES) and Cost Estimation Workbook (CEWB) to assess preliminary engineering, right-of-way acquisition and construction costs, the partial MUT alternative was estimated to have a total project cost of $10,591,522.20. This includes an estimated $761,218 for preliminary engineering, $3,740,577 for right-of-way and utilities, and $6,089,747 for construction. **Appendix I** features the cost estimate for the partial median U-turn alternative.

### 5.4.2 Possible Funding Sources

Implementation of the recommended improvements will require funding sources. The VDOT SMART SCALE Program is a process which invests in projects that meet the most critical transportation needs in the state. Projects are evaluated based on improvements in certain categories such as congestion and safety. At the corridor level, more specific strategies and operational improvements can be assessed in studies and implemented using a variety of funding sources, including Federal funding streams such as the Surface Transportation Program (STP), National Highway System (NHS) funds, and the Congestion Mitigation and Air Quality Improvement (CMAQ) Program, Revenue Sharing, Highway Safety Improvement Program (HSIP), as well as through state or local funding or other discretionary funding sources. For larger projects, particularly capacity-adding projects, demand management and operational strategies should also be analyzed for incorporation into the project as part of the project development process.