US Route 19 Corridor Study

Between Worthing Way and Stone Mountain Road

May 2019

Prepared by

Kimley»Horn

Prepared for

VDOT

US Route 19 Corridor Study
Between Worthing Way and Stone Mountain Road

May 2019 | Final

Prepared for

VDOT

Prepared by

Kimley»Horn

List of Acronyms

ADT – Average Daily Traffic

ASTM – American Society of Testing and Materials

CCB – Center for Conservation Biology

CMAQ – Congestion Mitigation and Air Quality

CMF – Crash Modification Factor

CoSS – Corridor of Statewide Significance

CTB – Commonwealth Transportation Board

DCR – Department of Conservation and Recreation

DGIF – Department of Game and Inland Fisheries

ESA – Endangered Species Act

FAST – Fixing America's Surface Transportation

FEMA – Federal Emergency Management Agency

FIRM – Flood Insurance Rate Maps

FOIA – Freedom of Information Act

GLNHR – General Locations of a National Resource

HCM – Highway Capacity Manual

HSIP – Highway Safety Improvement Program

HSM – Highway Safety Manual

IPaC – Information, Planning and Consultation System

JD – Jurisdictional Determination

MOE – Measures of Effectiveness

LOS – Levels of Service

LWFCA – Land and Water Conservation Fund Act

MPH – Miles per Hour

MUTCD – Manual on Uniform Traffic Control Devices

NEPA – National Environmental Policy Act

NHD – National Hydrography Dataset

NHDE – National Heritage Data Explorer

NLEB – Northern Long-Eared Bat

NPS – National Park Service

NRCS – National Resources Conservation

NRHP – National Register of Historic Places

NWI – National Wetland Inventory

PC – Pollution Complaint

PDO – Property Damage Only

PHF – Peak Hour Factor

POW – Palustrine Open Water

PSS – Palustrine Scrub-Shrub

RNS – Roadway Network System

SERP – State Environmental Review Process

SHSP – Strategic Highway Safety Plan

SPS – Statewide Planning System

SWG – Study Work Group

SYIP – Six-Year Improvement Program

TMC – Turning Movement Count

TMPD – Transportation and Mobility Planning Department

TRB – Transportation Research Board

TOSAM – Traffic Operations and Safety Analysis Manual

VaFWIS – Virginia Fish and Wildlife Information Service

V-CRIS – Virginia Cultural Resources Information System

VDEQ – Virginia Department of Environmental Quality

VDEGIS – Virginia Environmental Geographic Information System

VDHR – Virginia Department of Historic Resources

VDOT – Virginia Department of Transportation

VMRC – Virginia Marine Resources Commission

VPD – Vehicles per Day

VRP – Voluntary Remediation Program

UDA – Urban Development Area

USACE – United States Army Corps of Engineers

USDA – United States Department of Agriculture

USDOT – United States Department of Transportation

USFWS – United States Fish and Wildlife Service

WOUS – Waters of the United State

Table of Contents

List of Figures

List of Tables

Appendix

1 INTRODUCTION

1.1 Background

The Virginia Department of Transportation (VDOT) selected US Route 19 (Porterfield Highway) in Washington County, VA to be studied under the VDOT Transportation and Mobility Planning Division because of identified safety concerns along the corridor. This study is titled the US Route 19 Corridor Study and will be referred to as "the Study" in this report.

US Route 19, which is listed as a Corridor of Statewide Significance (CoSS) as a part of Virginia's "Southside Corridor", is a heavily traveled "north-south" connection and major commercial corridor that supports Russell, Wise, Dickenson, and Buchanan Counties by providing acces to Interstate 81. This portion of U.S. Route 19 serves as the primary means of maintaining freight mobility in and out of western Virginia.

VDOT retained Kimley-Horn and Associates, Inc. to perform transportation planning services to identify the deficiencies along the corridor and develop recommendations for improvements.

1.2 Purpose of Study

The purpose of this study was to identify the existing safety, operational, and access management deficiencies in the US Route 19 study corridor. The intent of this study was to serve as a planning and programming tool by Washington County and VDOT to document these deficiencies, develop operational and safety mitigation measures, identify preferred implemental solutions, define future planning activities, and establish levels of funding needed to support the proposed improvements. The goal of this study was to identify cost effective projects that can be programmed into the VDOT's Six-Year Improvement Program (SYIP), and/or allow the County to apply for alternative funding sources through such programs as SMART SCALE or the Highway Safety Improvement Program (HSIP) that will benefit the users of the corridor.

1.3 Study Work Group

A study work group (SWG) was formed to capture input from local stakeholders and to shape the development of improvement concepts. The SWG expressed local knowledge of the corridor, provided input on key assumptions, and participated in the development of alternatives. The SWG included representatives from the following organizations or neighborhoods:

a. VDOT Bristol District
b. Washington County Sheriff Department
c. Worthington Place Neighborhood
d. Paramont
e. Clifton Stewart
f. Virginia House of Delegates
g. Virginia State Senate

1.4 Study Area

The study area for the US Route 19 Corridor Study, as illustrated in **Figure 1**, was approximately 1.5 miles, located in Washington County just north of the Town of Abingdon. US Route 19 is generally oriented in a northwest/southeast direction within the study limits. However, for the purposes of this study, the corridor was referenced as "northbound" and "southbound". The limits of the study corridor extended along US Route 19 from Worthing Way to the median crossover approximately 850 feet west of Stone Mountain Drive.

In addition, the study area included the following ten at-grade intersections as displayed in **Figure 1**.

1. US Route 19 at Worthing Way (unsignalized)
2. US Route 19 at Briarwood Lane (unsignalized)
3. US Route 19 at Public Safety Lane (unsignalized)
4. US Route 19 at Lyons Den Pizza Driveway/Marathon Gas Driveway (unsignalized)
5. US Route 19 at Elementary Drive (signalized)
6. US Route 19 at Chantilly Way (signalized)
7. US Route 19 at Merman Street (unsignalized)
8. US Route 19 at Rustic Lane (unsignalized)
9. US Route 19 at Stone Mountain Drive (unsignalized)
10. US Route 19 at Median Crossover West of Stone Mountain Drive (unsignalized)

Figure 1: Study Area Map

2 Data Collection and Inventory

A preliminary field review was conducted on August 28, 2017 to verify existing conditions including: roadway geometry, safety issues, traffic control devices as well as observe traffic operations. In addition to the field review, existing traffic volume data was collected by VDOT from a combination of turning movement counts (TMC) and vehicle classification tube counts. VDOT also provided crash data, existing traffic signal timing plans, and the previously completed SMART SCALE application.

The following sections summarize collected data and field review observations.

2.1 Study Corridor

Field reconnaissance of existing conditions in the study area revealed that the corridor exists in a rural setting with rolling terrain. US Route 19 is the major north-south corridor in the study area. Within the study area, US Route 19 is a four-lane, divided roadway with a posted speed limit of 45 miles per hour (mph) from Worthing Way to the intersection of Rustic Lane. From Rustic Lane, the posted speed limit transitions to 55 mph. The northbound and southbound lanes are separated by a variable width grass median. The median consists of grass/vegetation and has variable widths that range between approximately 15' and 40'; except when adjacent to a left-turn lane, which results in reduced the median widths. The lane widths are approximately 11'. The shoulder consists of both paved and gravel sections along the study corridor. Shoulder widths also vary throughout; however, there are primarily no shoulders along the median/inside lane. US Route 19 is classified as a Principal Arterial and CoSS as well as a mobility enhancement segment of the arterial preservation network. **Figure 2** illustrates the existing roadway geometry along the study corridor.

2.2 Field Review

The following observations were noted during the field review conducted on August 28, 2017:

- The two signalized intersections (i.e., Elementary Drive and Chantilly Way) are not coordinated and vehicles traveling on northbound and southbound US Route 19 consistently experienced consecutive red traffic signal indications, impeding the mainline flow of traffic.
- Numerous commercial driveways are located adjacent to US Route 19 with dedicated ingress/egress driveways
- The combination of the median opening and approximate 170' driveway width at the intersection of Lee Roy's Wholesale and Public Safety Lane provides an opportunity for illegal vehicle maneuvers (i.e., northbound left-turn movement on US Route 19) creating unsafe conditions.
- Rustic Lane has poor sight distance for vehicles trying to turn onto US Route 19, due to vertical and horizontal curves.

2.3 Existing Land Use

Land use adjacent to this segment of US Route 19 consists primarily of residential and commercial. Commercial land uses located immediately adjacent to the corridor include gas stations, grocery stores, wholesale stores, and other small retail businesses. Single family residential land uses are located on US Route 19 near Chantilly Way and Briarwood Lane. US Route 19 is also a primary route to access Abingdon Elementary School via Elementary Drive. Additional land uses within the study area include churches, and the Washington County Sheriff's Office.

2.4 Traffic Volume Data

Collection of TMC data was conducted between 7:00 AM – 7:00 PM on Thursday, August 24, 2017 at the study area intersections. In addition, 72-hour Average Daily Traffic (ADT) vehicle and classification tube counts were collected at five locations throughout the corridor.

Table 1 summarized the date and source of the count data for the study areas intersections and five arterial tube count locations. Complete TMC and ADT data is provided in **Appendix A**.

Table 1: Study Area Intersection and Arterial Traffic Data Counts

	Location	Count Date (Source)
Intersections		
1	US Route 19 at Worthing Way	08/24/2017 (TMC)
2	US Route 19 at Briarwood Lane	08/24/2017 (TMC)
3	US Route 19 at Public Safety Lane	08/24/2017 (TMC)
4	US Route 19 at Lyons Den Pizza Driveway/Marathon Gas Driveway	08/24/2017 (TMC)
5	US Route 19 at Elementary Drive	08/24/2017 (TMC)
6	US Route 19 at Chantilly Way	08/24/2017 (TMC)
7	US Route 19 at Merman Street	08/24/2017 (TMC)
8	US Route 19 at Rustic Lane	08/24/2017 (TMC)
Arterials		
A	US Route 19 between Worthing Way and Russell Road	08/21/2017 – 08/23/2017 (ADT)
B	US Route 19 between Public Safety Lane and Chantilly Way	08/21/2017 – 08/23/2017 (ADT)
C	US Route 19 between Rustic Lane and Stone Mountain Road	08/21/2017 – 08/23/2017 (ADT)
D	Rattle Creek Road between Rustic Lane and Private Driveway	08/21/2017 – 08/23/2017 (ADT)
E	Rustic Lane between Public Safety Land and Sheriff's Office	08/21/2017 – 08/23/2017 (ADT)

2.4.1 Existing Traffic Volumes

Based on discussions with the SWG, AM and PM peak conditions were analyzed. The AM and PM peak hours of the study area were determined by first reviewing the individual intersections peak hour volumes were compared to hourly total study area volumes to determine a uniform peak hour that best represented existing traffic conditions in the study area.

The uniform peak hours of 7:30 AM to 8:30 AM and 4:45 PM to 5:45 PM were determined to represent the overall highest volumes of traffic observed during the AM and PM peak hours in the study corridor. These peak hours captured more than 99% of the total volume observed during the individual peak hours at intersections. **Figure 3** illustrates the existing traffic volumes for the AM and PM peak hours. A table comparing the individual intersections peak hours to the common peak hour is provided in **Appendix A**. An intersection peak hour factor (PHF) was calculated for each study area intersection during AM and PM peak hours using the TMC data. PHFs for each study area intersection are provided in **Appendix A**.

Figure 2: Existing (2017) Geometry

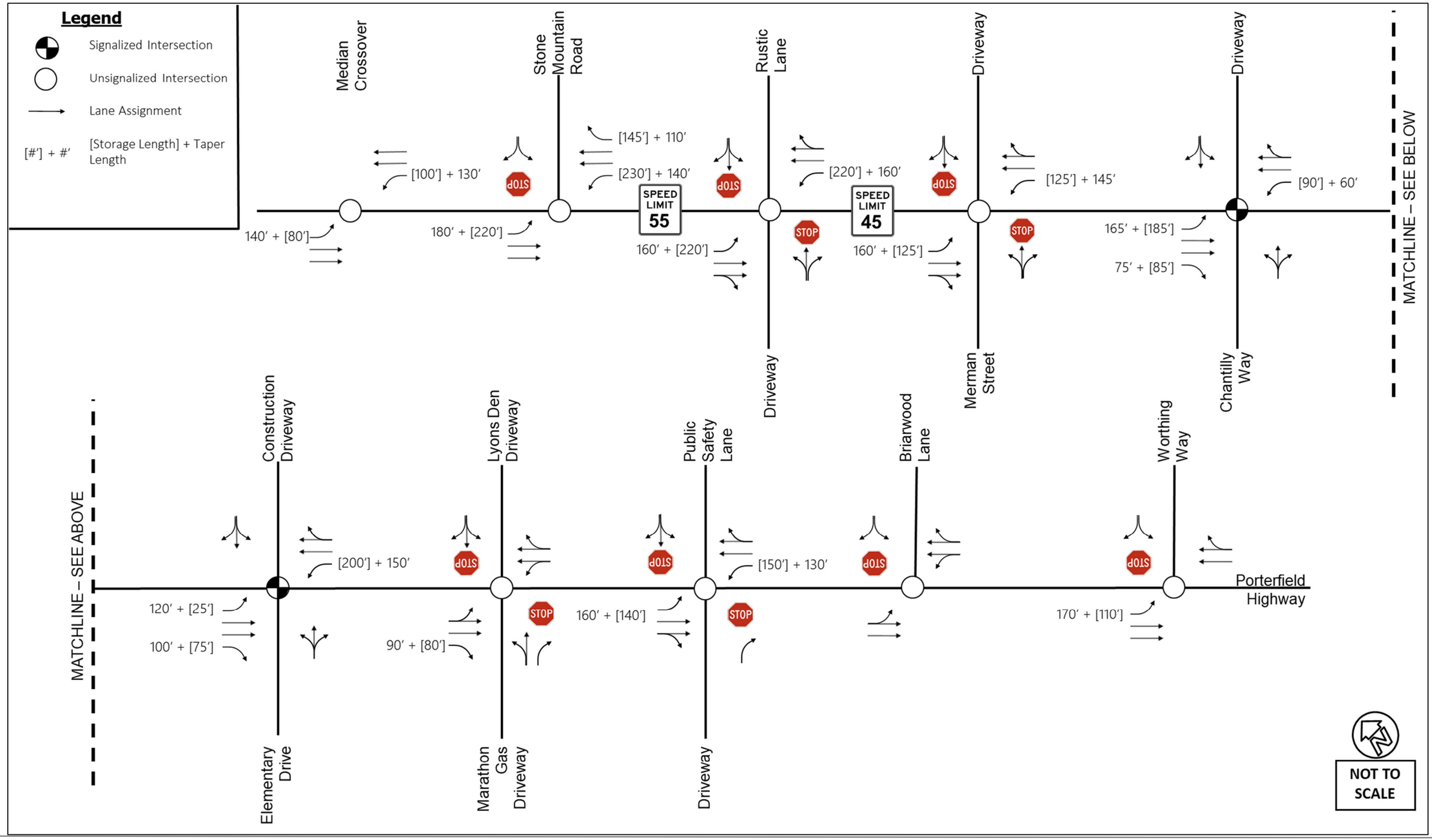
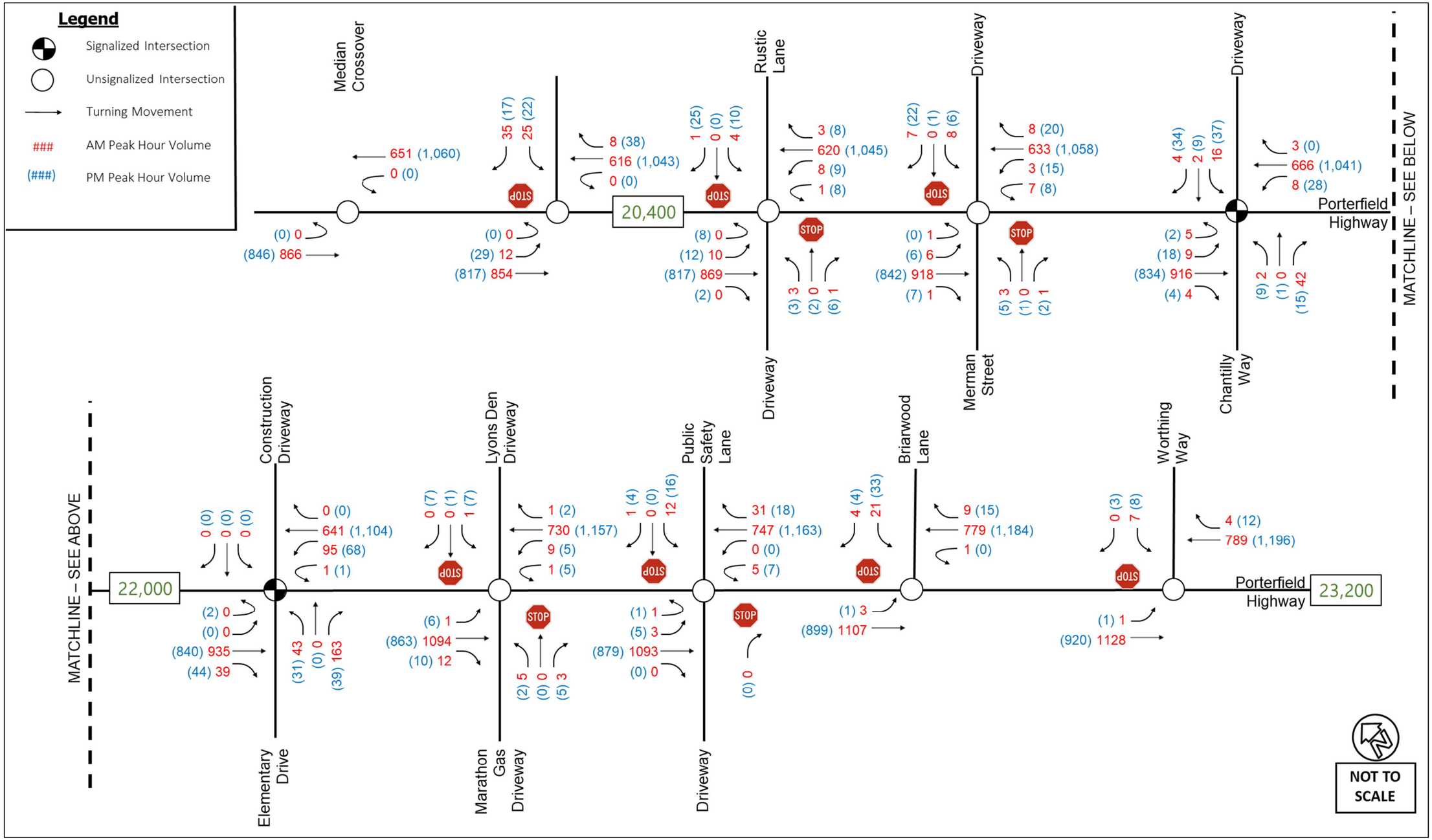


Figure 3: Existing (2017) Traffic Volumes



2.5 Crash Analysis

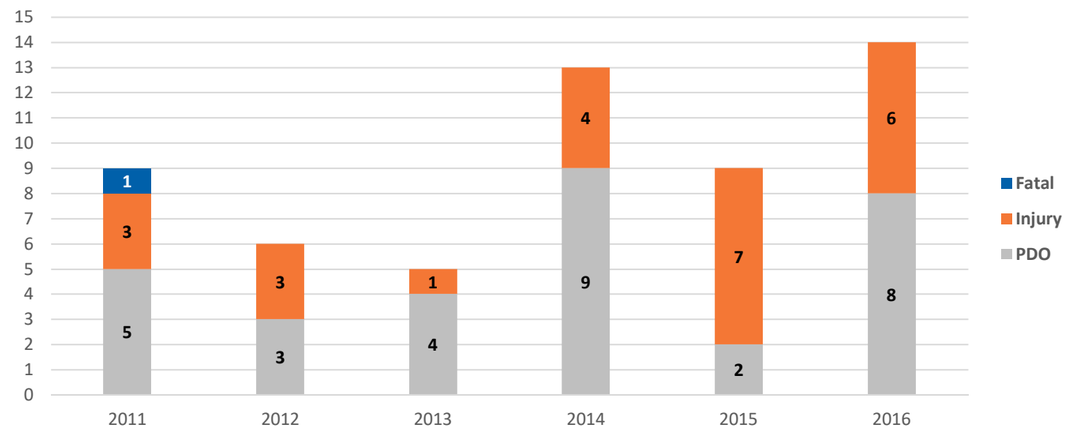
Crash data for the study area was used to evaluate corridor safety and identify crash patterns. VDOT Roadway Network System (RNS) crash data was obtained for the latest available six years of crash data (January 1, 2011 to December 31, 2016). Typically, a five-year crash period is acceptable for crash analysis along a corridor; however, the crash analysis for this study included 2011 data due to a fatal crash located within the study area at that time. This data was used to identify potential crash patterns and locations with high frequencies along the study corridor.

The following sections of this report summarize the crashes that occurred within the study corridor during the six-year crash analysis period.

2.5.1 Summary of Study Area Crashes

Over the six-year crash analysis period, 56 total crashes were reported within the study area. Of the reported crashes, there was one fatal crash, 24 injury crashes, and 31 property damage only (PDO) crashes. A summary of the study areas crashes is shown in **Figure 4** and additional details are provided in the following sections. Based on review of this data, there were two observable trends: total crash frequencies and crash severities have increased since 2013.

Figure 4: Study Area Crashes



In addition, fatal, injury, and PDO crash rates were calculated for the study areas for 2011 to 2016. Crash rates were based on the total number of crashes, length of the study corridor, and the AADT. Crash rates for the US Route 19 study area are summarized in **Table 2** are reported in crashes per 100 million vehicle miles traveled. The table shows the total crash rate and injury crash rate declined from 2011 to 2013; however, the total crash rate and injury crash rates have significantly increased after 2013.

The fatal crash occurred on the morning of July 2011 at the unsignalized intersection of US Route 19 at Public Safety Lane. The crash occurred when the driver traveling northbound encountered slowing traffic at the intersection and swerved to avoid the traffic. The driver lost control of the vehicle and traveled into the oncoming southbound traffic where contact was made with another vehicle.

Table 2: Study Area Crash Rates

Year	Crash Rate (crashes per 100 million vehicle miles traveled)			
	Fatal	Injury	PDO	Total
2011	11	32	53	96
2012	0	32	32	64
2013	0	11	45	56
2014	0	45	101	147
2015	0	79	23	101
2016	0	61	81	141

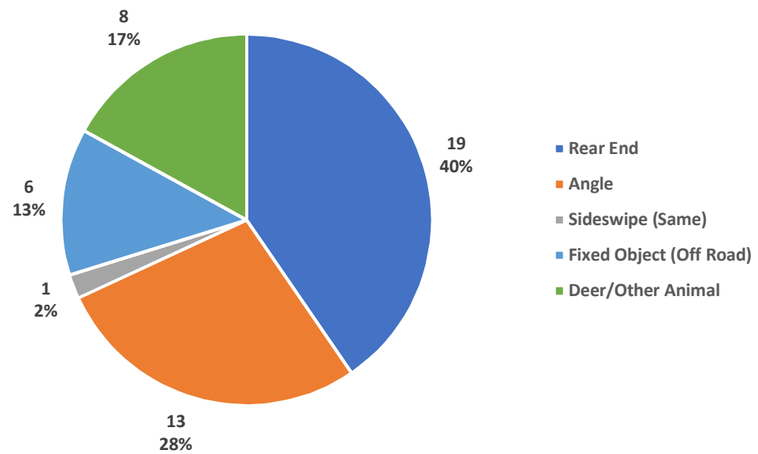
2.5.1.1 Northbound US Route 19 Crash Summary

During the six-year crash analysis period, the following crashes were reported on northbound US Route 19 between Worthing Way and the median cross over immediately west of Stone Mountain Road.

a. Total number of report crashes = 47
b. Total number of reported fatal crashes = 1
c. Total number of reported injury crashes = 21

A summary of the northbound US Route 19 crashes by crash type is provided in **Figure 5**. The predominant crash type was rear end, which accounted for 40% of all reported crashes in the northbound direction. The next most frequent crash type was angle, which accounted for 28% of all reported northbound crashes.

Figure 5: Northbound US Route 19 Crash Type Summary



Other crash trends on northbound US Route 19 included:

a. 74% of the reported northbound crashes occurred on a weekday (Monday through Friday)
b. 89% of the reported northbound crashes occurred during clear weather conditions
c. 66% of the reported northbound crashes occurred during day light conditions
d. 36% of the reported northbound crashes occurred during the PM peak period (3:00 PM – 7:00 PM), while only 6% occurred during the AM peak period (6:00 AM – 10:00 AM)
e. 26% of the reported northbound rear-end crashes occurred at the Chantilly Way and Elementary Drive intersections

Appendix A contains additional details on the northbound US Route 19 crashes.

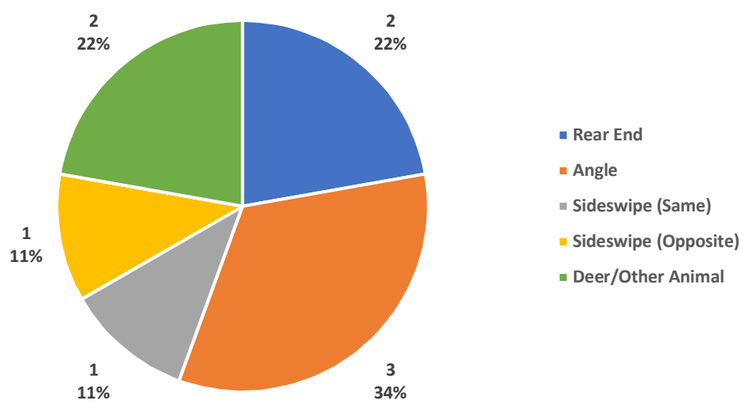
2.5.1.2 Southbound US Route 19 Crash Summary

During the six-year crash analysis period, the following crashes were reported on southbound US Route 19 between the median cross over immediately west of Stone Mountain Road and Worthing Way.

a. Total number of report crashes = 9
b. Total number of reported injury crashes = 3

A summary of the southbound US Route 19 crashes by crash type is provided in **Figure 6.** The predominant crash type was angle, which accounted for 34% of all reported crashes in the southbound direction. The next most frequent crash type was rear end, which accounted for 22% of all reported southbound crashes.

Figure 6: Southbound US Route 19 Crash Type Summary



Other crash trends on southbound US Route 19 included:

a. 67% of the reported southbound crashes occurred on a weekday (Monday through Friday)
b. 78% of the reported southbound crashes occurred during clear weather conditions
c. 44% of the reported southbound crashes occurred during day light conditions, while 22% occurred during dark light conditions without road lights
d. 44% of the reported southbound crashes occurred during the PM peak period (3:00 PM – 7:00 PM), while only 11% occurred during the AM peak period (6:00 AM – 10:00 AM)

Appendix A contains additional details on the southbound US Route 19 crashes.

2.5.2 Crash Histograms

Crash activity by quarter-mile segments of roadway, or crash density, on northbound and southbound US Route 19 is shown on the histograms in **Figure 7**. The histograms illustrate the frequencies and types of crashes that occurred in each quarter-mile segment. Because US Route 19 is a divided roadway, crashed that occurred in the northbound and southbound directions were broken into separate histograms.

In the study area, the segment with the highest crash density was located on northbound US Route 19 immediately adjacent to milepost 15.75. There are two signalized intersections (Chantilly Way and Elementary Drive) within the vicinity of this milepost. Twelve crashes were reported at this location during the six-year crash analysis period and 8 crashes of the reported northbound crashes were rear end crashes.

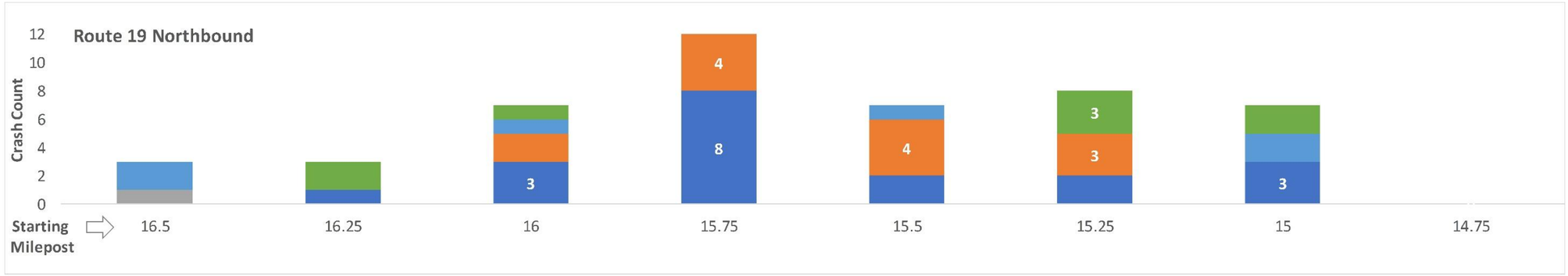
The highest crash density of angle crashes on northbound US Route 19 were located on the segment between mileposts 15.25 and 15.75. There are two signalized intersections within this segment. Twelve angle crashes in the northbound direction were reported on this segment during the six-year crash analysis period.

Overall, the US Route 19 corridor had a total of 10 reported animal crashes with 9 of those crashes involving deer. Eight of the animal crashes occurred in the northbound direction with the highest crash density occurring at milepost 15.25 which is adjacent to a wooded area along US Route 19.

2.6 Access Spacing

The existing access spacing on US Route 19 in the study area was evaluated according to the VDOT access management regulations in Appendix F of the VDOT Road Design Manual. The minimum spacing standards for intersections, median crossovers, and commercial entrances are dependent on the functional classification and posted speed limit of the roadway, and, as a result, the spacing standards varied within the study area. According to VDOT's 2014 Functional Classification Map, US Route 19 is classified as a Principal Arterial. In addition, the posted speed limit on US Route 19 is 45 MPH from Worthing Way to Rustic Lane then transitions to 55 MPH north of Rustic Lane. VDOT access management regulations application to the functional classification and speed limits on US Route 19 are listed in **Table 3**. Existing centerline to centerline access point spacing on US Route 19 was measured using aerial photography. The existing spacing in the study area is shown in **Figure 9** and **Figure 10** and is summarized in the following sections.

Figure 7: Crash Type Histograms



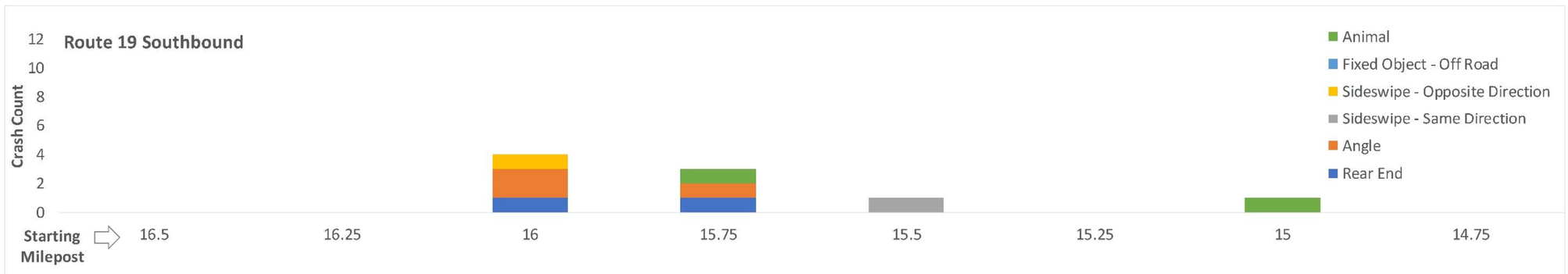


Table 3: Principal Arterial Access Management Spacing Requirements

Minimum Spacing Standards (feet)			
From	To	45 MPH	55 MPH
Signalized Intersections	Signalized Intersections	1,320	2,640
Unsignalized Intersections/Full Median Crossovers	Signalized Intersections Unsignalized Intersections/Full Median Crossovers	1,050	1,320
Full Access Entrances/Directional Median Crossovers	Full Access Entrances/Directional Median Crossovers Any Intersection or Median Crossover	565	750
Partial Access Entrances	Any Entrance, Intersection, or Median Crossover	305	495

2.6.1 Signalized Intersection Spacing

There were two signalized intersections in the study area. All signalized intersections were located on US Route 19 where the posted speed limit was 45 MPH. The required spacing between signalized intersections on a Principal Arterial with a posted speed limit of 45 MPH is 1,320 feet. Signalized intersection spacing in the study area is summarized in **Table 4**. Within the study area, none of the signalized intersection spacing met the minimum spacing standards.

Table 4: Signalized Intersection Spacing

Arterial	From	To	Existing Spacing (Feet)	Required Spacing (Feet)	Meets Standard?
US Route 19	Chantilly Way	Elementary Drive	375	1,320	No

2.6.2 Unsignalized Intersection Spacing

This segment of US Route 19 has two signalized intersections and 42 unsignalized nonresidential access points. In addition, there are nine full median crossovers. The required spacing between full median crossovers with a posted speed limit of 55 MPH and 45 MPH is 1,320 feet and 1,050 feet, respectively. Within the study area, only two of the full median crossovers meet the minimum spacing requirements. The spacing between Stone Mountain Road and Rustic Lane is 1,360 feet; this spacing is adequate for the 55 MPH segment of US Route 19. The spacing between Public Safety Lane and Briarwood Lane is greater than the minimum required spacing. The remaining full median crossovers do not meet the minimum required spacing and are summarized in

Table 5.

Of the 42 unsignalized access points, 33 are partial access entrance. The required spacing between partial access entrance with a posted speed limit of 55 MPH and 45 MPH is 495 feet and 305 feet, respectively. The majority of the partial access entrances (i.e., 31) do not meet the minimum spacing requirements. The only two partial entrance access points that meet the minimum spacing requirements are from the Stone Mountain Road full median crossover to Glory Lane and the entrance to the Loyal Order of Moose.

Table 5: Full Median Crossover Spacing

Arterial	From	To	Existing Spacing (Feet)	Required Spacing (Feet)	Meets Standard?
US Route 19	North of Study Limits	Stone Mountain Road	800	1,320	No
US Route 19	Stone Mountain Road	Rustic Lane	1,360	1,320	Yes
US Route 19	Rustic Lane	Merman Street	610	1,050	No
US Route 19	Merman Street	Chantilly Way	600	1,050	No
US Route 19	Elementary Drive	Lyons Den Pizza Driveway/Marathon Gas Driveway	820	1,050	No
US Route 19	Lyons Den Pizza Driveway/Marathon Gas Driveway	Public Safety Lane	800	1,050	No
US Route 19	Public Safety Lane	Briarwood Lane	1,540	1,050	Yes
US Route 19	Briarwood Lane	Worthing Way	950	1,050	No
US Route 19	Worthing Way	Adjacent Full Median Crossover	240	1,050	No

2.6.3 Conflict Points

Access along a corridor introduces conflict points where a driver crossing, merging, or diverging a road or driveway conflicts with another driver. Conflict points can be associated with increased levels of roadway crashes due to the driver's ability to safety negotiate only so many conflict points within an intersection. Each intersection type (e.g., full median crossover, directional median crossover, and right-in/right-out driveway) has a distinct number of conflicts points based on the crossing, merging, and diverging movements, as shown in **Figure 8**. The study area has approximately 300 conflict points among the study area intersection.

Figure 8: Comparison of Conflict Points for Difference Median Types

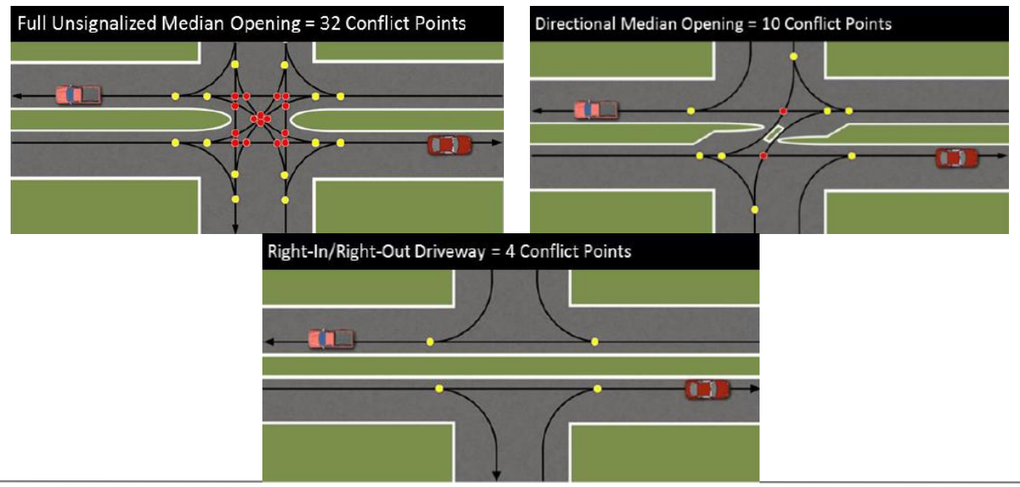


Figure 9: Access Management on US Route 19 (1 of 2)

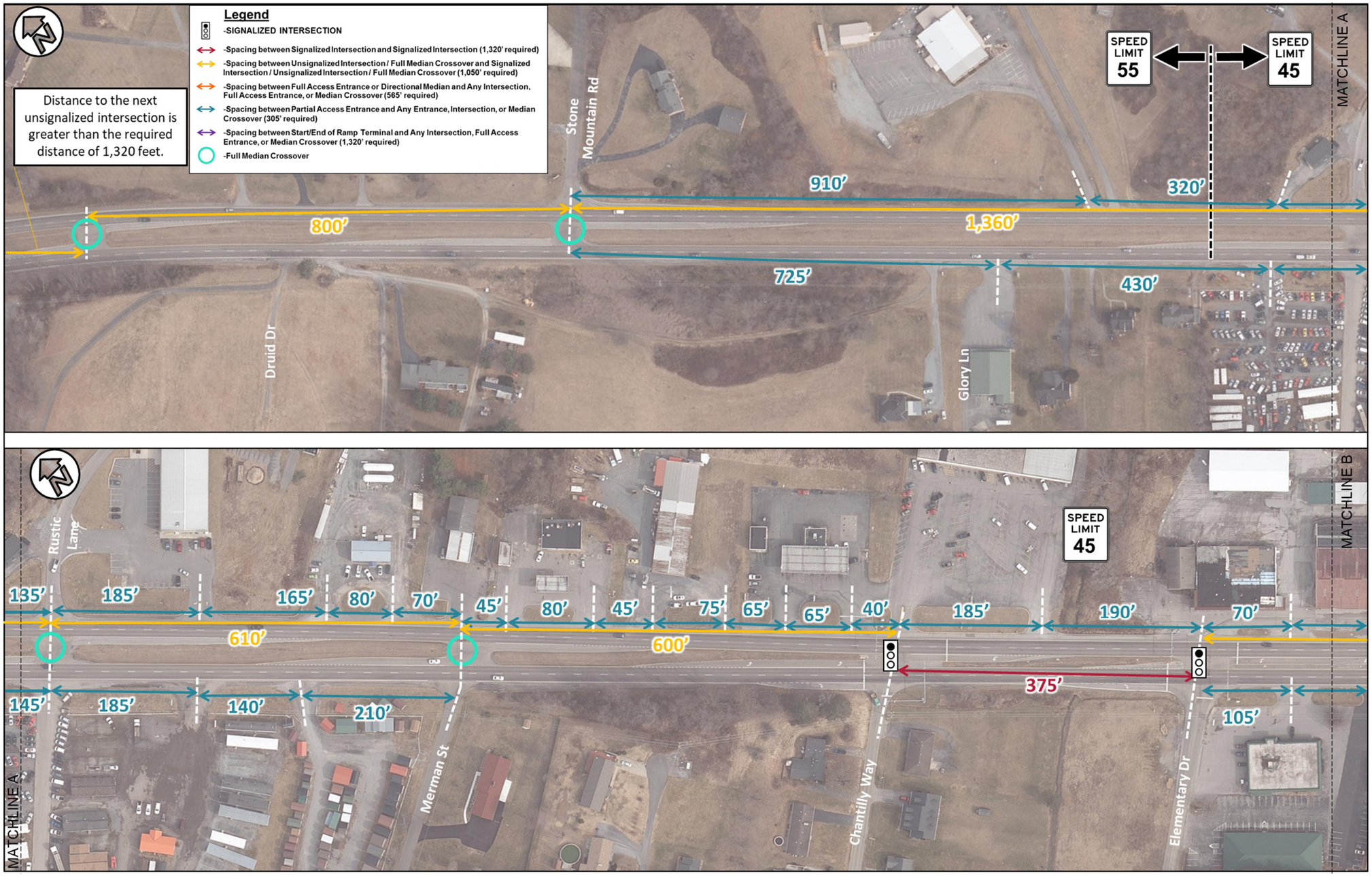
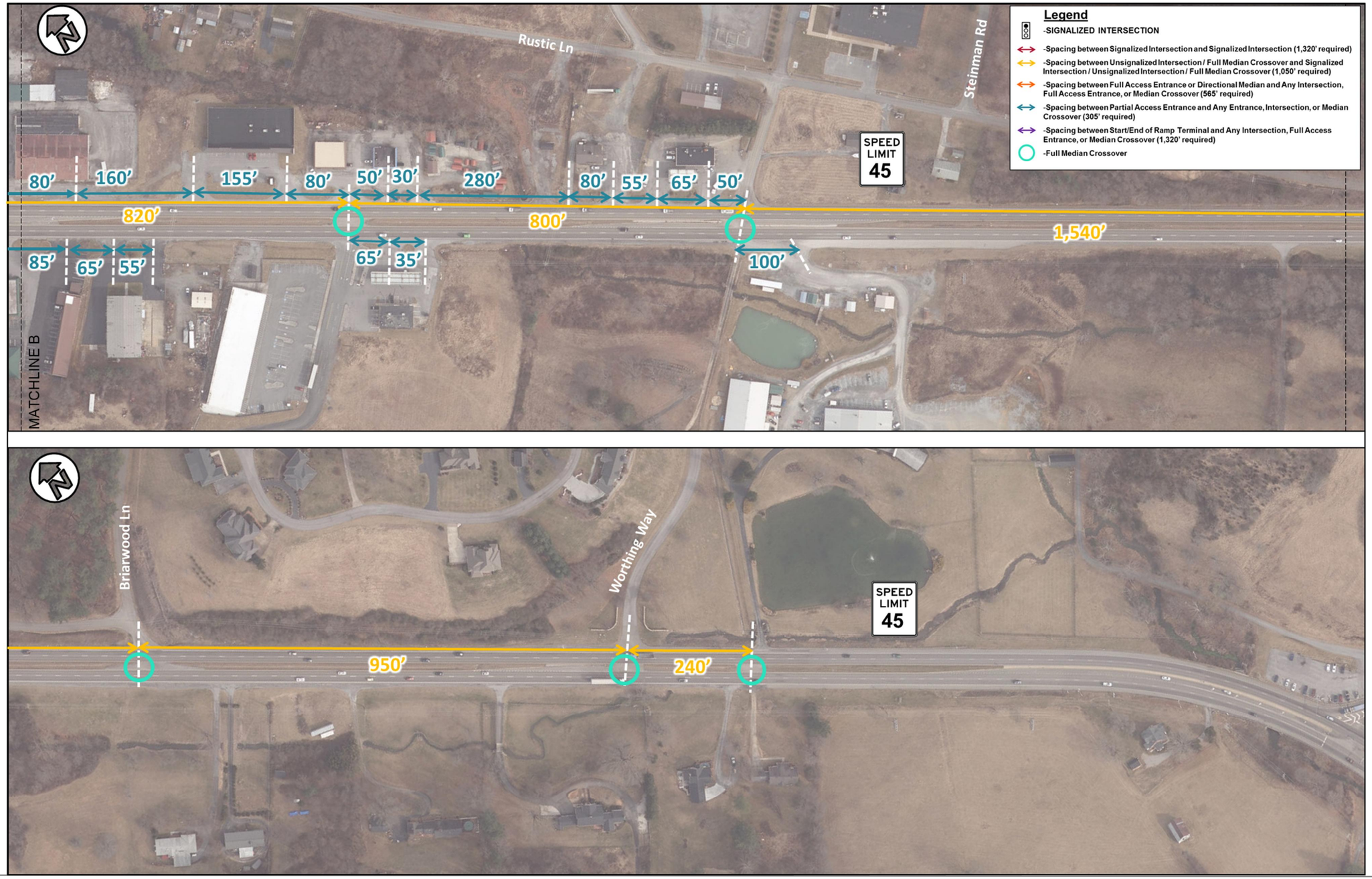


Figure 10: US Route 19 Access Management Spacing (2 of 2)



3 TRAFFIC FORECASTING

To understand future traffic conditions in the study area and assess the long-term benefits of proposed improvements, traffic volumes were forecasted for 2030 traffic conditions. The 2030 horizon year was selected for analysis based on discussions and approval from the SWG. The following sections describe the methodology for developing traffic growth rates and projecting future traffic volumes for the study area.

3.1 Traffic Growth Rate Development

Both historic traffic growth trends and VDOT's Statewide Planning System (SPS) projected traffic growth rates were reviewed to determine traffic growth rates for the study area.

Historic traffic growth trends were calculated from the VDOT published historic annual average daily traffic (AADT) traffic volume estimates. VDOT AADT were reviewed from 2011 to 2017 along US Route 19 from the Town of Abingdon Line (to the east) to Rich Valley Road (to the west).

VDOT published AADT traffic volume estimates are based on collected traffic count data. The amount and detail of collected traffic count data varies from roadway to roadway and from year to year. In general, greater amounts of data are collected on a more frequent basis for higher volume roads. Between 2011 to 2017, the VDOT AADT estimates for the US Route 19 corridor segment in the study area were based on either factored short-term traffic count data or factored short-term traffic count data with a growth element. Historic traffic growth rates for the US 19 was calculated using the VDOT AADT estimates based on factored short-term traffic count data, not the estimates that included a growth factor, as shown in **Table 6**. The calculated historic traffic growth rates showed approximately 1% of growth in the study area.

Table 6: Historic Traffic Growth Rates

Roadway	From	To	Average Rate (2011 -2017)
US Route 19	Town of Abington Line	Rich Valley Road	0.95%

SPS projected future traffic growth rates were also reviewed as part of the traffic growth rate development process. SPS forecast AADT's were reviewed for 2040 and 2045 and compared to the 2017 AADT based on traffic count data for US Route 19. Projected future traffic growth rates for the study area roadway segments were calculated using the SPS forecast AADTs, as shown in **Table 7**. The calculated projected future traffic growth rates showed minimal growth in the study area.

Table 7: SPS Projected Future Traffic Growth Rates

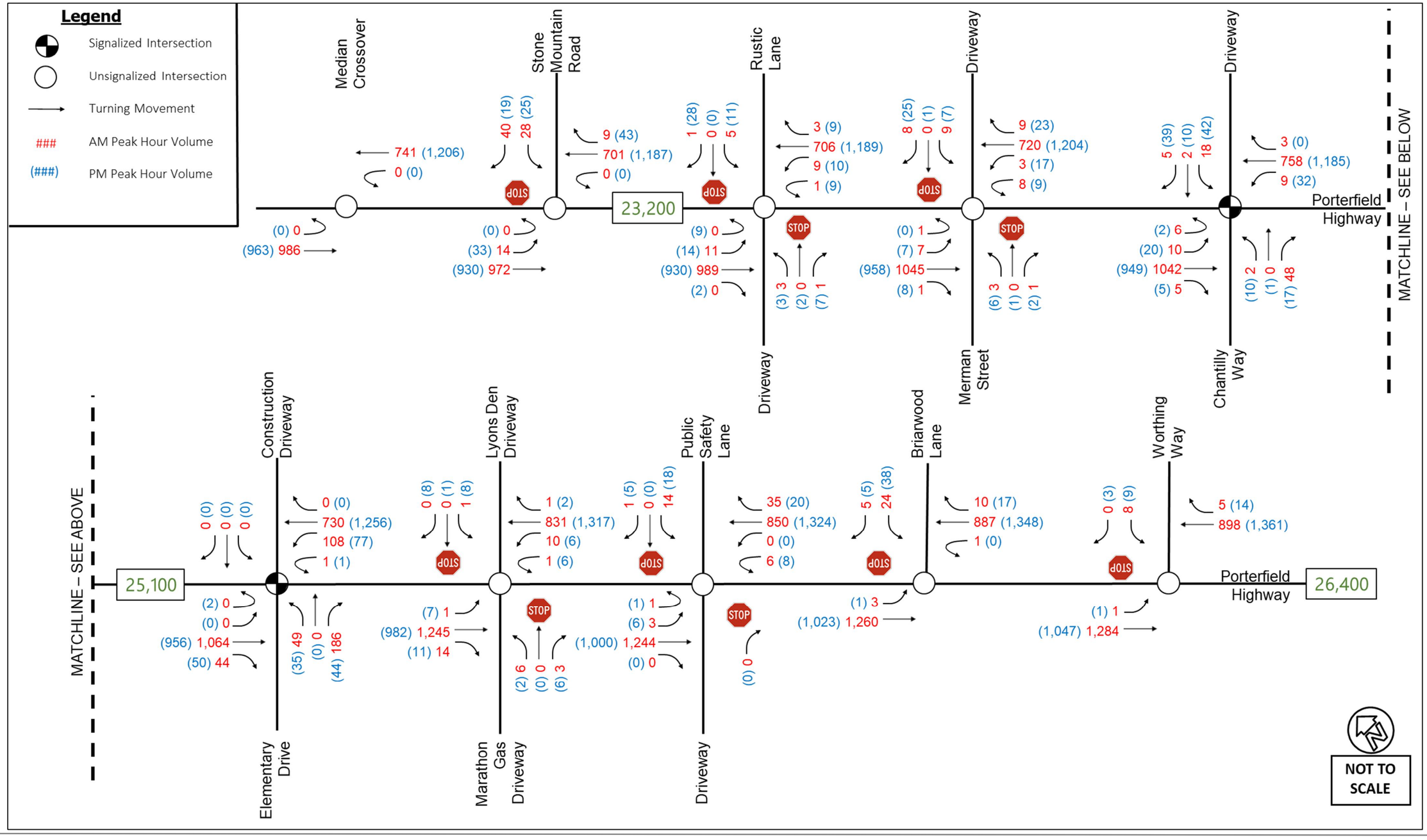
Roadway	From	To	2040	2045	Average
US Route 19	Town of Abington Line	Rich Valley Road	0.47%	0.44%	0.46%

Based on the results of the historic traffic growth trends and review of the SPS project traffic growth rates, the SWG identified a 1% annual growth rate for use in the US Route 19 study area. This annual growth rate represents any unknown or unaccounted regional growth that may occur in and around the study area.

3.2 Projected Traffic Volumes

The traffic growth rate was applied to the 2017 existing traffic volumes to generate projected 2030 traffic volumes. The projected 2030 AM and PM peak hour traffic volumes for the study area are summarized in **Figure 11**.

Figure 11: No Build (2030) Peak Hour Traffic Volumes



4 Build (2030) Improvements

Improvement projects were developed to address safety, geometric, and operational deficiencies along the study corridor identified in the existing and no-build analyses, as described in **Chapter 5**. Alternative concepts were developed based on conversations with the SWG, as well as concepts developed as part of previous funding applications. Based on the spacing of intersections along US Route 19, the following roadway improvements were discussed with the SWG and were incorporated in the 2030 build conditions analysis:

- US Route 19 at Worthing Way
  - Construct a northbound left-turn lane with 100' storage and 200' taper lengths.
  - Construct shoulder area on the south side of US Route 19 to allow for U-turns.
  - Close the adjacent median opening to the south of Worthing Way
- US Route 19 at Briarwood Lane
  - Close the median opening
  - Realign Briarwood Lane to Rustic Lane
- US Route 19 at Steinman Road
  - Install relocated signal from Chantilly Way
  - Realign Steinman Road as the westbound leg
  - Realign eastbound driveway with Steinman Road
- US Route 19 at Public Safety Lane
  - Close the median opening so this intersection is a right-in/right-out in both directions
- US Route 19 at Elementary Drive
  - Realign the westbound approach to access Goodwill
- US Route 19 at Chantilly Way
  - Close westbound driveway
  - Close median opening
  - Relocate signal to Steinman Road

Figure 12 displays the proposed intersection geometry for the study area intersections with the build improvements.

It should be noted that the removal and relocation of the traffic signal at Chantilly Way to the proposed intersection of Steinman Road will satisfy the access management requirements for signalized intersections between Steinman Road and Elementary Drive. Increased traffic signal spacing will improve the progression of traffic along US Route 19. In addition, the proposed traffic signal at Steinman Road will serve as a direct and controlled connection to US Route 19 for the emergency vehicles associated with the Washington County Sherriff Department. Lastly, the closure of median openings will reduce the number of conflict points and improve safety operations along US Route 19.

4.1 Access Management Impacts

Access management is a set of proven techniques that can help reduce traffic congestion, preserve the flow of traffic, improve traffic safety, minimize crash frequencies, preserve existing roadway capacity and preserve investment in roads by managing the location, design and type of access to property. The following sections describe the potential impacts to the operational and safety conditions with the application of access management strategies.

4.1.1 Impacts to Operations

A large number of access points and traffic signals per mile can have a negative impact on operations of a corridor. Through traffic is slowed due to vehicles entering and exiting access points, reduction of traffic speeds; thus, decreasing the capacity of the roadway. **Table 8** lists suggested access density adjustment factors for LOS determinations as provided by the HCM 2010 and the estimated impacts of signal density on travel time along a corridor.

Table 8: Operational Impacts Associated with Access[1]

Impact of Access Point Density on Travel Speed	
Access Points per Mile	**Reduction in Free-Flow Speed (mph)**
0	0.0
10	2.5
20	5.0
30	7.5
≥ 40	10.0
Impact of Signal Density on Travel Time	
Signals per Mile	**Percent Increase in Travel Time***
2.0	0
3.0	9
4.0	16
5.0	23
6.0	29
7.0	34
8.0	39
*Note: * Compared with 2 signals per mile*	

[1] Source: Transportation Research Board, Access Management Manual, 2nd Edition. National Academy of Sciences, Washington DC, 2014

4.1.2 Impacts to Safety

Research has documented the varied safety benefits associated with access management. These safety benefits are attributable to improved access design, fewer traffic conflict locations, and higher driver response time to potential conflicts. The following safety benefits could be realized with implementation of access management strategies.

Reducing the number of conflict points reduces the number of crashes – Crash modification factors (CMF) represent the quantitative results from research studies, indicating the percent reduction in crashes that can be expected after implementation of a treatment. Per the Highway Safety Manual (HSM), the CMF for reducing the number of access points is 0.70 or a reduction of 30% in the total number of crashes.

Reducing number of conflict points reduces the number and severity of crashes – Crossing conflict points are more severe with the merge/diverge conflict points resulting in less severe conflict points.

With the proposed median closures and consolidated access points, the number of conflict points for the study area intersections is anticipated to decrease by approximately 100 points (35% reduction).

4.2 Build Traffic Volume Redistribution

Under 2030 build conditions, turning movements and access to US Route 19 are restricted at some of the study intersections due to the aforementioned build improvements. The volumes were removed from these intersections and redistributed onto upstream and downstream intersections. **Figure 13** displays the projected 2030 build traffic volumes for the AM and PM peak hours. Detailed worksheets used in the traffic redistribution are attached in **Appendix B** of this report

Figure 12: Build (2030) Geometry

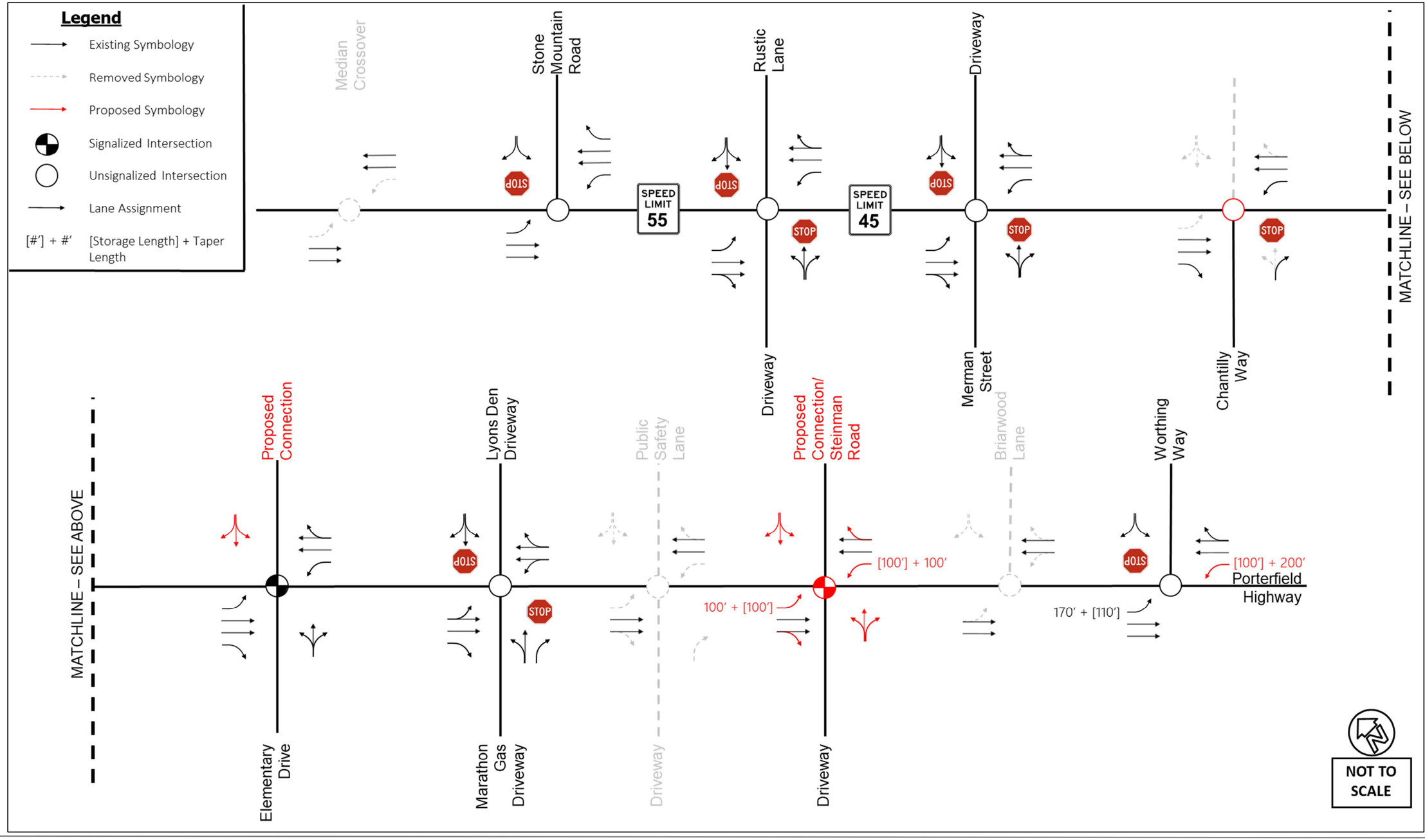
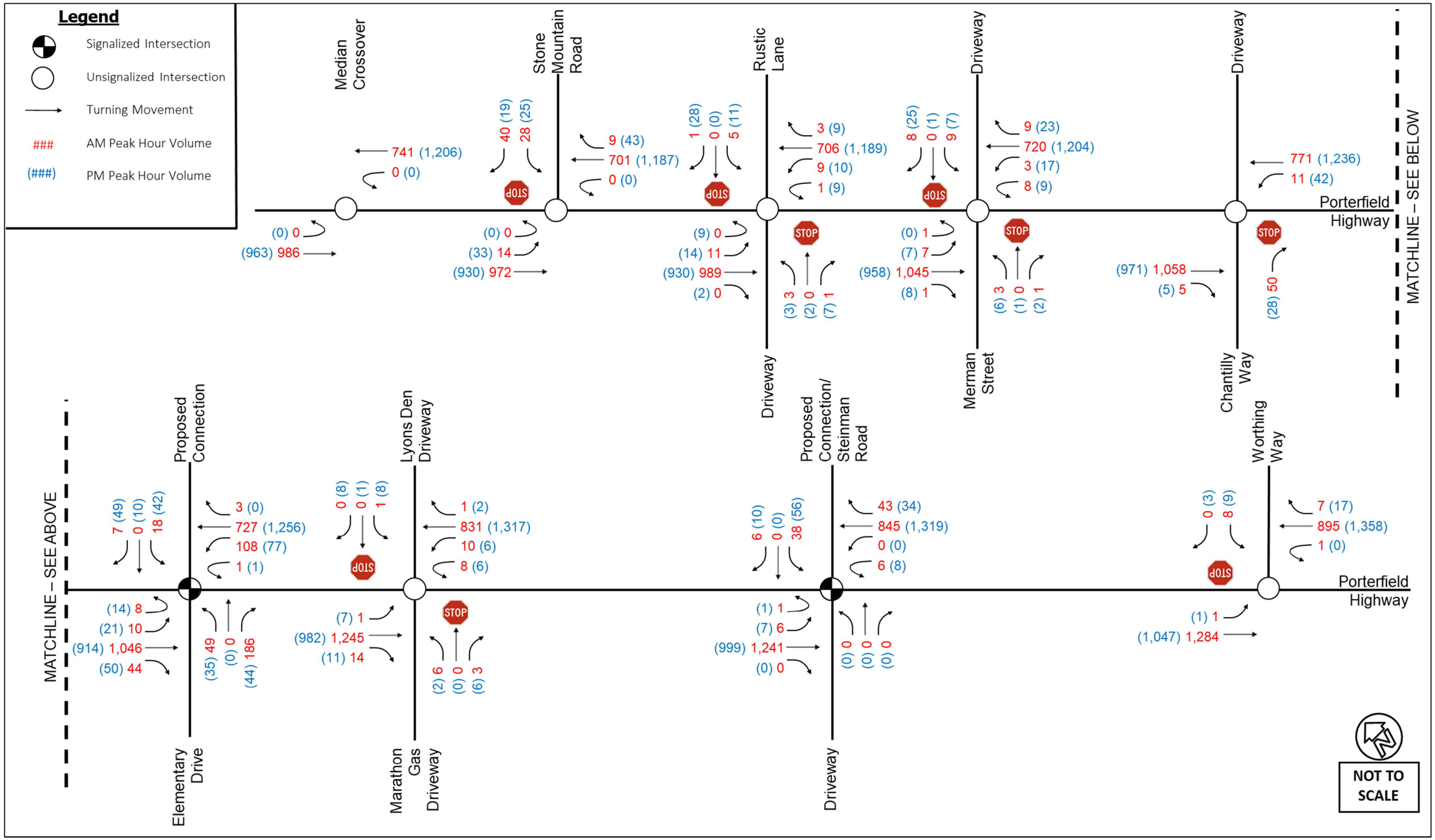


Figure 13: Build (2030) Peak Hour Traffic Volumes



5 Traffic Operations

The traffic operations included the analysis of the AM and PM peak hours under the existing (2017), no build (2040), and build (2040) conditions. The following section describes the analysis methodology, assumptions, and results for each scenario.

5.1 Analysis Methodology

The following measures of effectiveness (MOEs) were selected to measure the quantitative performance of the study intersections within the network for the existing, no build, and build conditions:

- Average control delay by movement, approach, and intersection – measured in seconds per vehicle
- Maximum queue length by movement – measured in feet

5.1.1 Delay and Level of Service

The Transportation Research Board's (TRB) *Highway Capacity Manual* (HCM) methodologies govern the methodology for evaluating capacity and the quality of service provided to road users traveling through a roadway network. There are six letter grades for Levels of Service (LOS) ranging from A to F, with LOS A representing the best operating conditions and LOS F representing the worst operating conditions. The Synchro analysis follows this methodology and is thus presented in a LOS format. Intersection level of service is defined in terms of delay (seconds per vehicle). **Table 9** summarizes the delay associated with each LOS category per the HCM.

Table 9: Level of Service Criteria

	Delay (seconds/vehicle)	
	Unsignalized	Signalized
A	0-10	0-10
B	>10-15	>10-20
C	>15-25	>20-35
D	>25-35	>35-55
E	>35-50	>55-80
F	>50	>80

Synchro, Version 9.1, was used to evaluate the study in order to calculate the delay and associated LOS under the existing, no build, and build conditions. Synchro modeling results are described in more detail in the following sections.

5.1.2 Maximum Queue Length

Queue length is an indicator of congestion at both signalized and unsignalized intersections. A maximum queue length analysis was completed for the study area intersections under the existing, no build, and build conditions. A maximum queue length refers to the longest queue length that is observed or simulated during a given period.

SimTraffic, Version 9.1, was used to calculate the maximum queue lengths for each intersection lane group by averaging results from 10 individual runs under each scenario. Queue lengths were compared to the effective storage length which is the sum of the storage length and half of the taper length. Queue length results are described in more detail in the following sections.

5.2 Existing Conditions Operational Analysis

Traffic operational analyses were conducted to evaluate the overall performance of the study corridor under existing (2017) AM and PM peak hour conditions. The intent of the existing conditions analyses was to provide an understanding of the baseline traffic conditions and to provide basis for developing future improvement strategies. Synchro modeling assumptions and analysis results for existing conditions are described in the following sections.

5.2.1 Assumptions

Existing (2017) Synchro models were developed for AM and PM peak hour conditions based on the existing roadway geometry and collected traffic count data, as described in **Chapter 2**. Synchro inputs and analysis methodologies were consistent with the VDOT Traffic Operations and Safety Analysis Manual (TOSAM), Version 1.0. A detailed summary of the Synchro analysis inputs and assumptions is provided in **Appendix C**.

5.2.2 Results

Table 10 and **Table 11** summarizes the existing conditions delay/HCM LOS and queuing results for the study area intersections, respectively.

Based on the LOS results of the existing conditions analysis, this corridor operates with minimal delays along US Route 19 with moderate delays on the minor streets. The movements and approaches that currently operate at LOS E or worse occur at the following locations:

- Westbound approach of US Route 19 at Worthing Way
  - LOS E during the AM and PM peak hours.
  - This is a low volume (i.e., less than 10 vehicles during the AM peak hour and less than 15 vehicles during the PM peak hour) approach and does not significantly impact overall operations at this intersection.
- Westbound approach of US Route 19 at Briarwood Lane
  - LOS E during the AM peak hour and LOS F during the PM peak hour.
  - Relatively low volumes (i.e., less than 40 vehicles) at an unsignalized intersection with insufficient gaps along US Route 19 for the turning vehicles to exit.
- Westbound approach of US Route 19 at Public Safety Lane
  - LOS F during the AM and PM peak hours.
  - This is a relatively low volume (i.e., 20 vehicles) approach and does not impact overall operations at this intersection.
  - Northbound and southbound approach have high volumes and operate with minimal delays.
- Eastbound shared left-turn/through movement of US Route 19 at Lyons Den Plaza Driveway/Marathon Gas Driveway
  - LOS E during the AM and PM peak hours.
  - This is a low volume (i.e., less than 10 vehicles) movement and does not significantly impact overall operations at this intersection.
- Westbound approach of US Route 19 at Lyons Den Plaza Driveway/Marathon Gas Driveway
  - LOS E during the PM peak hour.
  - This is a low volume (i.e., 15 vehicles) approach and does not significantly affect overall operations at this intersection.

Table 10: Existing (2017) Intersection Level of Service Results

Intersection Number and Description	Type of Control	Lane Group	EASTBOUND AM Delay	EASTBOUND AM LOS	EASTBOUND PM Delay	EASTBOUND PM LOS	WESTBOUND AM Delay	WESTBOUND AM LOS	WESTBOUND PM Delay	WESTBOUND PM LOS	NORTHBOUND AM Delay	NORTHBOUND AM LOS	NORTHBOUND PM Delay	NORTHBOUND PM LOS	SOUTHBOUND AM Delay	SOUTHBOUND AM LOS	SOUTHBOUND PM Delay	SOUTHBOUND PM LOS	Overall AM	Overall PM
1 US Route 19 at Worthing Way			-		-		Worthing Way				US Route 19				US Route 19					
	One-way Stop	Left	-	-	-	-	**41.1**	**E**	**42.8**	**E**	-	-	-	-	9.7	A	11.4	B	**Delay**	**Delay**
		Through	-	-	-	-					†	†	†	†	†	†	†	†	0.2	0.2
		Right	-	-	-	-									-	-	-	-	**LOS**	**LOS**
		Approach	-	-	-	-	**41.1**	**E**	**42.8**	**E**	-	-	-	-	-	-	-	-	A	A
2 US Route 19 at Briarwood Lane			-		-		Briarwood Lane				US Route 19				US Route 19					
	One-way Stop	Left	-	-	-	-	**40.9**	**E**	**68.2**	**F**	-	-	-	-	0.1	A	0.1	A	**Delay**	**Delay**
		Through	-	-	-	-					†	†	†	†					0.6	1.2
		Right	-	-	-	-									-	-	-	-	**LOS**	**LOS**
		Approach	-	-	-	-	**40.9**	**E**	**68.2**	**F**	-	-	-	-	-	-	-	-	A	A
3 US Route 19 at Public Safety Lane			Residential Driveway				Public Safety Lane				US Route 19				US Route 19					
	One-way Stop	Left	-	-	-	-	**53.8**	**F**	**65.4**	**F**	0.0	A	0.0	A	9.5	A	11.2	B	**Delay**	**Delay**
		Through	-	-	-	-					†	†	†	†	†	†	†	†	0.4	0.6
		Right	0.0	A	0.0	A													**LOS**	**LOS**
		Approach	-	-	-	-	**53.8**	**F**	**65.4**	**F**	-	-	-	-	-	-	-	-	A	S
4 US Route 19 at Lyons Den Plaza Driveway/Marathon Gas Driveway			Marathon Gas Driveway				Lyons Den Plaza Driveway				US Route 19				US Route 19					
	One-way Stop	Left	**47.6**	**E**	**40.5**	**E**	31.4	D	**38.3**	**E**	0.5	A	0.2	A	0.0	A	0.4	A	**Delay**	**Delay**
		Through																	0.3	0.4
		Right	9.3	A	9.2	A									†	†	†	†	**LOS**	**LOS**
		Approach	34.8	D	18.2	C	31.4	D	**38.3**	**E**	-	-	-	-	-	-	-	-	A	A
5 US Route 19 at Elementary Drive			Elementary Drive				Construction Area				US Route 19				US Route 19					
	Traffic Signal	Left	33.6	C	34.8	C	0.0	A	0.0	A	41.3	D	36.0	D	0.0	A	41.3	D	**Delay**	**Delay**
		Through									4.0	A	6.9	A	11.8	B	5.4	A	12.9	8.2
		Right													8.2	A	6.4	A	**LOS**	**LOS**
		Approach	33.6	C	34.8	C	-	-	-	-	8.8	A	8.7	A	11.6	B	5.6	A	B	A
6 US Route 19 at Chantilly Way			Chantilly Way				Commercial Entrance				US Route 19				US Route 19					
	Traffic Signal	Left	36.1	D	38.6	D	39.5	D	36.6	D	53.0	D	51.7	D	19.9	B	22.4	C	**Delay**	**Delay**
		Through									26.3	C	**62.5**	**E**	10.8	B	12.6	B	18.3	40.0
		Right													6.9	A	8.8	A	**LOS**	**LOS**
		Approach	36.1	D	38.6	D	39.5	D	36.6	D	26.6	C	**62.2**	**E**	11.0	B	12.8	B	B	D
7 US Route 19 at Merman Street			Merman Street				Retail Driveway				US Route 19				US Route 19					
	One-way Stop	Left	18.7	C	17.9	C	12.7	B	12.1	B	10.1	B	9.7	A	8.1	A	9.2	A	**Delay**	**Delay**
		Through									†	†	†	†	†	†	†	†	0.2	0.3
		Right																	**LOS**	**LOS**
		Approach	18.7	C	17.9	C	12.7	B	12.1	B	-	-	-	-	-	-	-	-	A	A
8 US Route 19 at Rustic Lane			Rustic Lane				Rustic Lane				US Route 19				US Route 19					
	One-way Stop	Left	21.5	C	15.5	C	15.4	C	12.3	B	10.0	B	10.0	A	8.4	A	9.2	A	**Delay**	**Delay**
		Through									†	†	†	†	†	†	†	†	0.2	0.4
		Right																	**LOS**	**LOS**
		Approach	21.5	C	15.5	C	15.4	C	12.3	B	-	-	-	-	-	-	-	-	A	A
9 US Route 19 at Stone Mountain Drive			-		-		Stone Mountain Drive				US Route 19				US Route 19					
	One-way Stop	Left	-	-	-	-	14.2	B	21.3	C	0.0	A	0.0	A	9.0	A	11.4	B	**Delay**	**Delay**
		Through	-	-	-	-					†	†	†	†	†	†	†	†	0.6	0.6
		Right	-	-	-	-					†	†	†	†	-	-	-	-	**LOS**	**LOS**
		Approach	-	-	-	-	14.2	B	21.3	C	-	-	-	-	-	-	-	-	A	A
10 US Route 19 at Median Crossover West of Stone Mountain Drive			-		-		-				US Route 19				US Route 19					
	Median Crossover	U-Turn	-	-	-	-	-	-	-	-	0.0	A	0.0	A	0.0	A	0.0	A	**Delay**	**Delay**
		Through	-	-	-	-	-	-	-	-	†	†	†	†	†	†	†	†	0.0	0.0
		Right	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**LOS**	**LOS**
		Approach	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	A

† Delay for movements with no conflicting movements have not been included.

Table 11: Existing (2017) Intersection Queue Length Results

Intersection Number and Description	Type of Control	Lane Group	EASTBOUND			WESTBOUND			NORTHBOUND			SOUTHBOUND		
			Effective Storage Length (ft)	AM Max Queue (ft)	PM Max Queue (ft)	Effective Storage Length (ft)	AM Max Queue (ft)	PM Max Queue (ft)	Effective Storage Length (ft)	AM Max Queue (ft)	PM Max Queue (ft)	Effective Storage Length (ft)	AM Max Queue (ft)	PM Max Queue (ft)
1 US Route 19 at Worthing Way			-			Worthing Way			US Route 19			US Route 19		
	One-Way Stop	Left	-	-	-	-	37	39	-	-	-	195	8	8
		Through	-	-	-				-	0	0	-	0	0
		Right	-	-	-							-	-	-
2 US Route 19 at Briarwood Lane			-			Briarwood Lane			US Route 19			US Route 19		
	One-Way Stop	Left	-	-	-	50*	65	100	-	12	0	-	38	8
		Through	-	-	-				-	0	3			
		Right	-	-	-							-	-	-
3 US Route 19 at Public Safety Lane			Residential Driveway			Public Safety Lane			US Route 19			US Route 19		
	One-Way Stop	Left	-	-	-	-	61	46	215	18	18	220	25	25
		Through	-	-	-				-	0	0	-	0	0
		Right	-	0	0				-			-		
4 US Route 19 at Lyons Den Plaza Driveway/Marathon Gas Driveway			Marathon Gas Driveway			Lyons Den Plaza Driveway			US Route 19			US Route 19		
	One-Way Stop	Left	-	28	18	-	16	40	-	88	58	-	2	47
		Through												
		Right	300	23	24				-	3	5	125	0	0
5 US Route 19 at Elementary Drive			Elementary Drive			Construction Area			US Route 19			US Route 19		
	Traffic Signal	Left	-	186	104	-	0	0	275	134	95	85	0	25
		Through							-	116	157	-	236	139
		Right										125	118	52
6 US Route 19 at Chantilly Way			Chantilly Way			Commercial Entrance			US Route 19			US Route 19		
	Traffic Signal	Left	-	59	53	-	73	129	120	43	**120**	270	48	45
		Through							-	237	351	-	134	169
		Right										125	20	16
7 US Route 19 at Merman Street			Merman Street			Retail Driveway			US Route 19			US Route 19		
	One-Way Stop	Left	-	23	29	-	55	58	200	35	38	205	15	18
		Through							-	8	2	-	0	0
		Right												
8 US Route 19 at Rustic Lane			Rustic Lane			Rustic Lane			US Route 19			US Route 19		
	One-Way Stop	Left	-	44	34	-	44	58	300	26	53	300	22	34
		Through							-	0	0	-	0	0
		Right												
9 US Route 19 at Stone Mountain Drive			-			Stone Mountain Drive			US Route 19			US Route 19		
	One-Way Stop	Left	-	-	-	-	82	75	300	0	0	310	28	50
		Through	-	-	-				-	0	0	-	0	0
		Right	-	-	-				200	0	2	-	-	-
10 US Route 19 at Median Crossover West of Stone Mountain Drive			-			-			US Route 19			US Route 19		
	Median Crossover	Left	-	-	-	-	-	-	165	0	0	150	0	0
		Through	-	-	-	-	-	-	-	0	0	-	0	0
		Right	-	-	-	-	-	-	-	-	-	-	-	-

- Northbound shared through/right-turn movement of US Route 19 at Chantilly Way
  - LOS E during the PM peak hour.
  - This approach has heavy through volumes (i.e., over 1,000 vehicles) with limited green time.

Based on the queuing results of the existing conditions analysis, this corridor operates with all maximum queue lengths contained in the available storage with the exception of the following:

- Westbound approach of US Route 19 at Briarwood Lane
  - This approach experiences a maximum queue length past Rustic Lane during the AM and PM peak hours.
- Northbound left-turn movement of US Route 19 at Chantilly Way
  - This movement queues experiences a maximum queue length equivalent to the available storage length during the PM peak hour.

5.3 No Build Operational Analysis

No build traffic conditions were analyzed to evaluate the results of future (2030) traffic demand on the existing roadway network. The intent of no build conditions analysis was to provide a general understanding of baseline future traffic conditions to be used to evaluate the effectiveness of potential improvements. Synchro modeling assumptions and analysis results for no build conditions are described in the following sections.

5.3.1 Assumptions

The existing conditions Synchro models were used as a basis to develop the no build models. No geometric changes were made to the existing Synchro models, but the models were updated with projected 2030 no build traffic volumes. In the no build analysis, existing traffic signal timings were optimized to account for the proposed changes in future volumes. This included reviewing each intersection's cycle length, splits, and offsets. In all future analysis models, it was assumed that the signalized intersections at Chantilly Way and Elementary Drive would be coordinated together within the study area. A detailed summary of Synchro modeling inputs and assumptions for the no build models is provided in **Appendix C**.

5.3.2 Results

Table 12 and **Table 13** summarizes the no build conditions' delay/HCM LOS and queuing results for the study area intersections, respectively.

Based on the LOS results of the no build conditions analysis, this corridor operates with minimal delays along US Route 19, with moderate delays on the minor streets. The movements and approaches that currently operate at LOS E or worse occur at the following locations:

- Westbound approach of US Route 19 at Worthing Way
  - LOS F during the AM and PM peak hours.
  - Degradation of operations is due to the increase in traffic volumes.
  - Similar to existing conditions, this is a low volume (i.e., less than 10 vehicles during the AM peak hour and less than 15 vehicles during the PM peak hour) approach and does not significantly impact overall operations at this intersection.
- Westbound approach of US Route 19 at Briarwood Lane
  - LOS F during the AM and PM peak hours.
  - Degradation of operations is due to the increase in traffic volumes.
  - Relatively low volumes (i.e., less than 45 vehicles) at an unsignalized intersection with insufficient gaps along US Route 19 for the turning vehicles to exit.
- Westbound approach of US Route 19 at Public Safety Lane
  - LOS F during the AM and PM peak hours.
  - Degradation of operations is due to the increase in traffic volumes.
  - This is a relatively low volume (i.e., 25 vehicles) approach and does not impact overall operations at this intersection.
  - Northbound and southbound approach have high volumes and operate with minimal delays.
- Eastbound shared left-turn/through movement of US Route 19 at Lyons Den Plaza Driveway/Marathon Gas Driveway
  - LOS F during the AM and PM peak hours.
  - Degradation of operations is due to the increase in traffic volumes.
  - This is a low volume (i.e., less than 10 vehicles) movement and does not significantly impact overall operations at this intersection.
- Westbound approach of US Route 19 at Lyons Den Plaza Driveway/Marathon Gas Driveway
  - LOS E during the AM peak hour and LOS F during the PM peak hour.
  - Degradation of operations is due to the increase in traffic volumes.
  - This is a low volume (i.e., less than 20 vehicles) approach and does not significantly affect overall operations at this intersection.
- Southbound left-turn movement of US Route 19 at Chantilly Way
  - LOS F during the AM peak hour.
  - Degradation of operations is due to the increase in traffic volumes.
  - This is a low volume (i.e., less than 25 vehicles) approach with heavy opposing through traffic volumes. However, this approach does not significantly affect overall operations at this intersection.

Based on the queuing results of the no build conditions analysis, this corridor operates with all maximum queue lengths contained in the available storage with the exception of the following:

- Westbound approach of US Route 19 at Briarwood Lane
  - This approach experiences a maximum queue length past Rustic Lane during the AM and PM peak hours.

It should be noted that the movements with improved operations under no build conditions can be attributed to optimized traffic signal operations.

Table 12: No Build (2030) Intersection Level of Service Results

Intersection Number and Description	Type of Control	Lane Group	EASTBOUND AM Delay	EASTBOUND AM LOS	EASTBOUND PM Delay	EASTBOUND PM LOS	WESTBOUND AM Delay	WESTBOUND AM LOS	WESTBOUND PM Delay	WESTBOUND PM LOS	NORTHBOUND AM Delay	NORTHBOUND AM LOS	NORTHBOUND PM Delay	NORTHBOUND PM LOS	SOUTHBOUND AM Delay	SOUTHBOUND AM LOS	SOUTHBOUND PM Delay	SOUTHBOUND PM LOS	Overall AM	Overall PM
1 US Route 19 at Worthing Way			-				Worthing Way				US Route 19				US Route 19					
	One-way Stop	Left	-	-	-	-	**50.8**	**F**	**63.9**	**F**	-	-	-	-	10.1	B	12.4	B	**Delay**	**Delay**
		Through	-	-	-	-					†	†	†	†	†	†	†	†	0.2	0.3
		Right	-	-	-	-									-	-	-	-	**LOS**	**LOS**
		Approach	-	-	-	-	**50.8**	**F**	**63.9**	**F**	-	-	-	-	-	-	-	-	A	A
2 US Route 19 at Briarwood Lane			-				Briarwood Lane				US Route 19				US Route 19					
	One-way Stop	Left	-	-	-	-	**54.0**	**F**	**134.3**	**F**	-	-	-	-	0.1	A	0.1	A	**Delay**	**Delay**
		Through	-	-	-	-					†	†	†	†					0.7	2.4
		Right	-	-	-	-									-	-	-	-	**LOS**	**LOS**
		Approach	-	-	-	-	**54.0**	**F**	**134.3**	**F**	-	-	-	-	-	-	-	-	A	A
3 US Route 19 at Public Safety Lane			Residential Driveway				Public Safety Lane				US Route 19				US Route 19					
	One-way Stop	Left	-	-	-	-	**83.3**	**F**	**112.7**	**F**	0.0	A	0.0	A	10.0	A	12.2	B	**Delay**	**Delay**
		Through	-	-	-	-					†	†	†	†	†	†	†	†	0.6	1.1
		Right	0.0	A	0.0	A													**LOS**	**LOS**
		Approach	-	-	-	-	**83.3**	**F**	**112.7**	**F**	-	-	-	-	-	-	-	-	A	A
4 US Route 19 at Lyons Den Plaza Driveway/Marathon Gas Driveway			Marathon Gas Driveway				Lyons Den Plaza Driveway				US Route 19				US Route 19					
	One-way Stop	Left	**62.2**	**F**	**55.6**	**F**	**36.7**	**E**	**57.3**	**F**	0.6	A	0.2	A	0.0	A	0.4	A	**Delay**	**Delay**
		Through																	0.4	0.6
		Right	9.4	A	9.0	A									†	†	†	†	**LOS**	**LOS**
		Approach	**46.3**	**E**	20.7	C	**36.7**	**E**	**57.3**	**F**	-	-	-	-	-	-	-	-	A	A
5 US Route 19 at Elementary Drive			Elementary Drive				Construction Area				US Route 19				US Route 19					
	Traffic Signal	Left	31.1	C	32.4	C	0.0	A	0.0	A	39.1	D	33.8	C	0.0	A	33.5	C	**Delay**	**Delay**
		Through									4.4	A	8.2	A	17.2	B	8.7	A	15.3	10.0
		Right													8.8	A	6.9	A	**LOS**	**LOS**
		Approach	31.1	C	32.4	C	-	-	-	-	8.9	A	9.7	A	16.9	B	8.6	A	B	B
6 US Route 19 at Chantilly Way			Chantilly Way				Commercial Entrance				US Route 19				US Route 19					
	Traffic Signal	Left	33.6	C	36.3	D	37.3	D	35.7	D	39.0	D	52.3	D	**130.6**	**F**	41.7	D	**Delay**	**Delay**
		Through									13.1	B	10.2	B	12.2	B	13.4	B	14.6	13.7
		Right													7.3	A	8.7	A	**LOS**	**LOS**
		Approach	33.6	C	36.3	D	37.3	D	35.7	D	13.4	B	11.3	B	14.0	B	14.0	B	B	B
7 US Route 19 at Merman Street			Merman Street				Retail Driveway				US Route 19				US Route 19					
	One-way Stop	Left	22.0	C	21.3	C	14.5	B	13.3	B	10.8	B	10.3	B	8.7	A	10.1	B	**Delay**	**Delay**
		Through									†	†	†	†	†	†	†	†	0.2	0.4
		Right																	**LOS**	**LOS**
		Approach	22.0	C	21.3	C	14.5	B	13.3	B	-	-	-	-	-	-	-	-	A	A
8 US Route 19 at Rustic Lane			Rustic Lane				Rustic Lane				US Route 19				US Route 19					
	One-way Stop	Left	25.5	D	17.2	C	19.1	C	13.7	B	10.6	B	10.5	B	9.1	A	10.1	B	**Delay**	**Delay**
		Through									†	†	†	†	†	†	†	†	0.2	0.4
		Right																	**LOS**	**LOS**
		Approach	25.5	D	17.2	C	19.1	C	13.7	B	-	-	-	-	-	-	-	-	A	A
9 US Route 19 at Stone Mountain Drive			-				Stone Mountain Drive				US Route 19				US Route 19					
	One-way Stop	Left	-	-	-	-	15.5	C	25.4	D	0.0	A	0.0	A	9.3	A	12.4	B	**Delay**	**Delay**
		Through	-	-	-	-					†	†	†	†	†	†	†	†	0.7	0.7
		Right	-	-	-	-					†	†	†	†	-	-	-	-	**LOS**	**LOS**
		Approach	-	-	-	-	15.5	C	25.4	D	-	-	-	-	-	-	-	-	A	A
10 US Route 19 at Median Crossover West of Stone Mountain Drive			-				-				US Route 19				US Route 19					
	Median Crossover	U-Turn	-	-	-	-	-	-	-	-	0.0	A	0.0	A	0.0	A	0.0	A	**Delay**	**Delay**
		Through	-	-	-	-	-	-	-	-	†	†	†	†	†	†	†	†	0.0	0.0
		Right	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**LOS**	**LOS**
		Approach	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	A

† Delay for movements with no conflicting movements have not been included.

Table 13: No Build (2030) Intersection Queue Length Results

Intersection Number and Description	Type of Control	Lane Group	EASTBOUND			WESTBOUND			NORTHBOUND			SOUTHBOUND		
			Effective Storage Length (ft)	AM Max Queue (ft)	PM Max Queue (ft)	Effective Storage Length (ft)	AM Max Queue (ft)	PM Max Queue (ft)	Effective Storage Length (ft)	AM Max Queue (ft)	PM Max Queue (ft)	Effective Storage Length (ft)	AM Max Queue (ft)	PM Max Queue (ft)
1 US Route 19 at Worthing Way			-			Worthing Way			US Route 19			US Route 19		
	One-Way Stop	Left	-	-	-	-	35	46	-	-	-	195	8	14
		Through	-	-	-				-	0	0	-	0	0
		Right	-	-	-							-	-	-
2 US Route 19 at Briarwood Lane			-			Briarwood Lane			US Route 19			US Route 19		
	One-Way Stop	Left	-	-	-	50*	**69**	**112**	-	10	0	-	29	13
		Through	-	-	-				-	0	5			
		Right	-	-	-							-	-	-
3 US Route 19 at Public Safety Lane			Residential Driveway			Public Safety Lane			US Route 19			US Route 19		
	One-Way Stop	Left	-	-	-	-	61	50	215	18	18	220	23	28
		Through	-	-	-				-	0	0	-	0	0
		Right	-	0	0				-			-		
4 US Route 19 at Lyons Den Plaza Driveway/Marathon Gas Driveway			Marathon Gas Driveway			Lyons Den Plaza Driveway			US Route 19			US Route 19		
	One-Way Stop	Left	-	26	25	-	22	51	-	111	108	-	6	52
		Through												
		Right	300	19	24				-	12	48	125	2	2
5 US Route 19 at Elementary Drive			Elementary Drive			Construction Area			US Route 19			US Route 19		
	Traffic Signal	Left	-	202	114	-	0	0	275	148	121	85	0	20
		Through							-	132	134	-	247	179
		Right										125	124	72
6 US Route 19 at Chantilly Way			Chantilly Way			Commercial Entrance			US Route 19			US Route 19		
	Traffic Signal	Left	-	76	63	-	83	111	120	63	99	270	66	54
		Through							-	151	259	-	175	188
		Right										125	28	20
7 US Route 19 at Merman Street			Merman Street			Retail Driveway			US Route 19			US Route 19		
	One-Way Stop	Left	-	24	40	-	60	59	200	34	45	205	21	21
		Through							-	0	10	-	0	0
		Right												
8 US Route 19 at Rustic Lane			Rustic Lane			Rustic Lane			US Route 19			US Route 19		
	One-Way Stop	Left	-	44	41	-	44	60	300	32	54	300	27	41
		Through							-	0	2	-	0	0
		Right												
9 US Route 19 at Stone Mountain Drive			-			Stone Mountain Drive			US Route 19			US Route 19		
	One-Way Stop	Left	-	-	-	-	92	121	300	0	0	310	36	52
		Through	-	-	-				-	0	0	-	0	0
		Right	-	-	-				200	0	12	-	-	-
10 US Route 19 at Median Crossover West of Stone Mountain Drive			-			-			US Route 19			US Route 19		
	Median Crossover	Left	-	-	-	-	-	-	165	0	0	150	0	0
		Through	-	-	-	-	-	-	-	0	0	-	0	0
		Right	-	-	-	-	-	-	-	-	-	-	-	-

* Distance to upstream intersection

5.4 Build Operational Analysis

Build traffic conditions were analyzed to evaluate the results of the future (2030) traffic demand on the build roadway network. The intent of the build condition analyses was to evaluate the effectiveness of the improvements and understand how they may work in conjunction with one another. Synchro modeling assumptions and analysis results for the build traffic conditions are described in the following sections.

5.4.1 Assumptions

The no build conditions models were used as the basis to develop the build conditions models. Roadway geometry and traffic signal timings adjustments were made to reflect these improvements and changes in volumes. The models were updated with rerouted future (2030) traffic volumes to account for changing traffic patterns primarily due to geometric changes associated with the proposed improvements. A detailed summary of Synchro modeling inputs and assumptions for the no build models is provided in **Appendix C**.

The proposed realignment of Steinman Road and US Route 19 involves removing access to US Route 19 from Public Safety Lane and Briarwood Lane. For the purposes of this study, it was assumed that all of the traffic from Public Safety Lane and Briarwood Lane will be diverted onto Steinman Road as a "worse case' scenario.

5.4.2 Traffic Signal Warrant Analysis

A signal warrant analysis was conducted at the proposed realigned Steinman Road at US Route 19. This warrant analysis was included as part of a Signal Justification Report (SJR) developed for its SMART SCALE funding application.

As it was previously noted, the intersections of Public Safety Lane and Briarwood Lane would be closed, and access removed from US Route 19. As a result, traffic from these intersections would be diverted onto the realigned Steinman Road. These diverted turning movement volumes were used to determine if the hourly volume thresholds provided in the Manual on Uniform Traffic Control Devices (MUTCD) were met, with the warrant analysis results reflected in **Table 14.** Detailed worksheets used in the warrant analysis are provided in **Appendix D** of this report.

Table 14: Summary of Warrant Analysis

Intersection	Warrant Analysis			
	Warrant 1 (8-Hour)			Warrant 2 (4 Hour)
	Condition A	Condition B	Combination (A & B)	
US Route 19 at Steinman Road	× (0 out of 8)	× (4 out of 8)	× (0 out of 8)	× (2 out of 4)

Notes: × *- Warrant not met*
✓ ***- Warrant met***
(# out of 8) – Number of hours that were able to meet the 8-hour warrant requirements

Based on the results of the traffic signal warrant analysis for the proposed realigned Steinman Road at US Route 19, the anticipated 2030 traffic volumes did not meet the necessary volume threshold criteria needed for either Warrant 1 or Warrant 2 as shown in **Table 14**. It should be noted that the volumes on the major street exceed the volume threshold for Warrant 1 and Warrant 2. However, the volumes on the minor street do not meet the threshold for either Warrant 1 or Warrant 2. The minor street has volumes greater than the threshold criteria for Warrant 1, Condition B for four hours. Four of the remaining hours are only slightly below the threshold (i.e., 15 vehicles per hour or less) to meet warrants for Warrant 1, Condition B. Similarly, for Warrant 2, two of the hours meet the required volume threshold (i.e., 60 vehicles per hour) while three of the remaining hours are only slightly below the threshold (i.e., 8 vehicles per hour or less). Due to the heavy volume on US Route 19 and the minor street slightly missing the volume thresholds under Warrant 1 B and Warrant 2, installing a signal at the proposed intersection of Steinman Road and US Route 19 is recommended under 2030 conditions.

5.4.3 Results

Table 15 and **Table 16** summarize the build conditions' delay, HCM LOS, and queuing results for the study area intersections, respectively.

Based on the LOS results of the build conditions analysis, this corridor operates with minimal delays along US Route 19 with minimal delays on the minor streets. The movements and approaches that currently operate at LOS E or worse occur at the following locations:

- Westbound approach of US Route 19 at Worthing Way
  - LOS F during the AM and PM peak hours.
  - Degradation of operations is due to the increase in traffic volumes.
  - Similar to no build conditions, this is a low volume (i.e., less than 10 vehicles during the AM peak hour and less than 15 vehicles during the PM peak hour) approach and does not significantly impact overall operations at this intersection.

Based on the queuing results of the build conditions analysis, this corridor operates with all maximum queue lengths contained in the available storage.

5.5 Summary of Analysis

In conclusion, the proposed improvements are anticipated to improve the overall operations and safety conditions throughout the study area. The increased traffic signal spacing will improve the progression of traffic along US Route 19. In addition, the proposed traffic signal at Steinman Road will serve as a direct and controlled connection to US Route 19 for the emergency vehicles associated with the Washington County Sherriff Department. Lastly, the closure of median openings will reduce the number of conflict points and improve safety operations along US Route 19.

Table 15: Build (2030) Intersection Level of Service Results

Intersection Number and Description	Type of Control	Lane Group	EASTBOUND AM Delay	EASTBOUND AM LOS	EASTBOUND PM Delay	EASTBOUND PM LOS	WESTBOUND AM Delay	WESTBOUND AM LOS	WESTBOUND PM Delay	WESTBOUND PM LOS	NORTHBOUND AM Delay	NORTHBOUND AM LOS	NORTHBOUND PM Delay	NORTHBOUND PM LOS	SOUTHBOUND AM Delay	SOUTHBOUND AM LOS	SOUTHBOUND PM Delay	SOUTHBOUND PM LOS	Overall AM	Overall PM
1 US Route 19 at Worthing Way	-		-		-		Worthing Way				US Route 19				US Route 19					
	One-way Stop	Left	-	-	-	-	**50.7**	**F**	**63.8**	**F**	-	-	-	-	10.1	B	12.4	B	**Delay**	**Delay**
		Through	-	-	-	-					†	†	†	†	†	†	†	†	0.2	0.3
		Right	-	-	-	-									-	-	-	-	**LOS**	**LOS**
		Approach	-	-	-	-	**50.7**	**F**	**63.8**	**F**	-	-	-	-	-	-	-	-	A	A
2 US Route 19 at Briarwood Lane	-		-		-		Briarwood Lane				US Route 19				US Route 19					
	Median Crossover Closed	Left	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**Delay**	**Delay**
		Through	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Right	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**LOS**	**LOS**
		Approach	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11 US Route 19 at Proposed Connection/Steinmen Road	Realigned Driveway						Proposed Connection				US Route 19				US Route 19					
	Proposed Traffic Signal	Left	-	-	-	-					39.5	D	40.7	D	**58.0**	**E**	47.0	D	**Delay**	**Delay**
		Through	-	-	-	-	33.6	C	32.4	C	†	†	†	†	†	†	†	†	5.1	7.9
		Right	0.0	A	0.0	A													**LOS**	**LOS**
		Approach	-	-	-	-	33.6	C	32.4	C	-	-	-	-	-	-	-	-	A	A
3 US Route 19 at Public Safety Lane	Residential Driveway						Public Safety Lane				US Route 19				US Route 19					
	Median Crossover Closed	Left	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**Delay**	**Delay**
		Through	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Right	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**LOS**	**LOS**
		Approach	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4 US Route 19 at Lyons Den Plaza Driveway/Marathon Gas Driveway	Marathon Gas Driveway						Lyons Den Plaza Driveway				US Route 19				US Route 19					
	One-way Stop	Left	32.4	D	17.8	C									0.0	A	0.4	A	**Delay**	**Delay**
		Through					21.5	C	18.0	C	0.6	A	0.2	A					0.3	0.3
		Right	9.4	A	9.2	A									†	†	†	†	**LOS**	**LOS**
		Approach	25.5	D	11.4	B	21.5	C	18.0	C	-	-	-	-	-	-	-	-	A	A
5 US Route 19 at Elementary Drive	Elementary Drive						Proposed Connection				US Route 19				US Route 19					
	Traffic Signal	Left									44.8	D	43.4	D	48.9	D	36.4	D	**Delay**	**Delay**
		Through	31.3	C	32.5	C	27.7	C	31.5	C	4.5	A	5.1	A	14.7	B	10.0	B	14.9	10.4
		Right													8.9	A	6.9	A	**LOS**	**LOS**
		Approach	31.3	C	32.5	C	27.7	C	31.5	C	9.7	A	7.3	A	15.1	B	10.8	B	B	B
6 US Route 19 at Chantilly Way	Chantilly Way						-				US Route 19				US Route 19					
	Traffic Signal	Left	-	-	-	-	-	-	-	-	11.8	B	10.6	B	-	-	-	-	**Delay**	**Delay**
		Through	-	-	-	-	-	-	-	-	†	†	†	†	†	†	†	†	0.4	0.3
		Right	14.0	B	12.4	B	-	-	-	-	-	-	-	-	0.0	A	0.0	A	**LOS**	**LOS**
		Approach	14.0	B	12.4	B	-	-	-	-	-	-	-	-	-	-	-	-	A	A
7 US Route 19 at Merman Street	Merman Street						Retail Driveway				US Route 19				US Route 19					
	One-way Stop	Left									10.8	B	10.3	B	9.0	A	10.5	B	**Delay**	**Delay**
		Through	22.4	C	21.7	C	15.6	C	13.6	B	†	†	†	†	†	†	†	†	0.3	0.4
		Right																	**LOS**	**LOS**
		Approach	22.4	C	21.7	C	15.6	C	13.6	B	-	-	-	-	-	-	-	-	A	A
8 US Route 19 at Rustic Lane	Rustic Lane						Rustic Lane				US Route 19				US Route 19					
	One-way Stop	Left									10.6	B	10.5	B	9.7	A	11.5	B	**Delay**	**Delay**
		Through	27.2	D	19.2	C	22.0	C	20.3	C	†	†	†	†	†	†	†	†	0.2	0.6
		Right																	**LOS**	**LOS**
		Approach	27.2	D	19.2	C	22.0	C	20.3	C	-	-	-	-	-	-	-	-	A	A
9 US Route 19 at Stone Mountain Drive	-		-		-		Stone Mountain Drive				US Route 19				US Route 19					
	One-way Stop	Left	-	-	-	-					0.0	A	0.0	A	9.4	A	12.6	B	**Delay**	**Delay**
		Through	-	-	-	-	15.6	C	25.8	D	†	†	†	†	†	†	†	†	0.7	0.7
		Right	-	-	-	-					†	†	†	†	-	-	-	-	**LOS**	**LOS**
		Approach	-	-	-	-	15.6	C	25.8	D	-	-	-	-	-	-	-	-	A	A
10 US Route 19 at Median Crossover West of Stone Mountain Drive	-		-		-		-				US Route 19				US Route 19					
	Median Crossover Closed	U-Turn	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**Delay**	**Delay**
		Through	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Right	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**LOS**	**LOS**
		Approach	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

† Delay for movements with no conflicting movements have not been included.

Table 16: Build (2030) Intersection Queue Length Results

Intersection Number and Description	Type of Control	Lane Group	EASTBOUND			WESTBOUND			NORTHBOUND			SOUTHBOUND		
			Effective Storage Length (ft)	AM Max Queue (ft)	PM Max Queue (ft)	Effective Storage Length (ft)	AM Max Queue (ft)	PM Max Queue (ft)	Effective Storage Length (ft)	AM Max Queue (ft)	PM Max Queue (ft)	Effective Storage Length (ft)	AM Max Queue (ft)	PM Max Queue (ft)
1 US Route 19 at Worthing Way			-			Worthing Way			US Route 19			US Route 19		
	One-Way Stop	Left	-	-	-	-	43	45	200	8	0	195	19	5
		Through	-	-	-				-	0	0	-	0	0
		Right	-	-	-							-	-	-
2 US Route 19 at Briarwood Lane			-			Briarwood Lane			US Route 19			US Route 19		
	Median Crossover Closed	Left	-	-	-	-	-	-	-	-	-	-	-	-
		Through	-	-	-	-	-	-	-	-	-	-	-	-
		Right	-	-	-	-	-	-	-	-	-	-	-	-
11 US Route 19 at Proposed Connection/Steinman Road			Realigned Driveway			Proposed Connection			US Route 19			US Route 19		
	Proposed Traffic Signal	Left	-	0	0	-	78	104	215	21	29	220	32	37
		Through							-	105	164	-	132	128
		Right							-			-		
3 US Route 19 at Public Safety Lane			Residential Driveway			Public Safety Lane			US Route 19			US Route 19		
	Median Crossover Closed	Left	-	-	-	-	-	-	-	-	-	-	-	-
		Through	-	-	-	-	-	-	-	-	-	-	-	-
		Right	-	-	-	-	-	-	-	-	-	-	-	-
4 US Route 19 at Lyons Den Plaza Driveway/Marathon Gas Driveway			Marathon Gas Driveway			Lyons Den Plaza Driveway			US Route 19			US Route 19		
	One-Way Stop	Left	-	37	17	-	22	45	-	111	102	-	6	43
		Through							-	12	18			
		Right	300	21	24							125	2	0
5 US Route 19 at Elementary Drive			Elementary Drive			Proposed Connection			US Route 19			US Route 19		
	Traffic Signal	Left	-	185	93	-	53	104	275	145	126	85	74	83
		Through							-	170	214	-	235	193
		Right										125	124	122
6 US Route 19 at Chantilly Way			Chantilly Way			-			US Route 19			US Route 19		
	Traffic Signal	Left	-	80	47	-	-	-	120	48	50	-	-	-
		Through				-	-	-	-	0	0	-	2	0
		Right				-	-	-				125	0	0
7 US Route 19 at Merman Street			Merman Street			Retail Driveway			US Route 19			US Route 19		
	One-Way Stop	Left	-	23	34	-	52	63	200	34	42	205	19	29
		Through							-	0	5	-	0	2
		Right												
8 US Route 19 at Rustic Lane			Rustic Lane			Rustic Lane			US Route 19			US Route 19		
	One-Way Stop	Left	-	45	39	-	52	77	300	25	55	300	29	38
		Through							-	0	2	-	2	0
		Right												
9 US Route 19 at Stone Mountain Drive			-			Stone Mountain Drive			US Route 19			US Route 19		
	One-Way Stop	Left	-	-	-	-	99	114	300	0	0	310	26	61
		Through	-	-	-				-	0	0	-	0	0
		Right	-	-	-				200	0	11	-	-	-
10 US Route 19 at Median Crossover West of Stone Mountain Drive			-			-			US Route 19			US Route 19		
	Median Crossover Closed	Left	-	-	-	-	-	-	-	-	-	-	-	-
		Through	-	-	-	-	-	-	-	-	-	-	-	-
		Right	-	-	-	-	-	-	-	-	-	-	-	-

6 Environmental Compliance

6.1 Environmental Overview

A preliminary review was conducted for this project to determine if any sensitive sites may be present or potentially impacted by the proposed roadway improvements. This preliminary environmental review identified and assesses potential impacts from the proposed project on natural and cultural resources. The review was limited to readily available database information and a site visit conducted from public thoroughfares. The environmental study area for the proposed project consists of ±277 acres surrounding and including US Route 19 and Rustic Lane between Worthing Way and Stone Mountain Road. The project corridor overlain on an aerial photograph is shown in **Figure 14**. Based on this preliminary environmental review, no environmental constraints or items were identified that would prohibit the construction of the proposed roadway improvements.

The following areas were reviewed to identify potential significant impacts:

- Cultural and Historic Resources Impacts
- Section 4(f) and Section 6(f)
- Natural Resources Impacts
  - Floodplain
  - Wetlands and Surface Waters
  - Wildlife and Habitat
- Hazardous Materials Impact

At this time, no National Environmental Policy Act (NEPA) or Virginia State Environmental Review Process (SERP) documents are being prepared for this project. Therefore, the following additional areas will need to be reviewed for the required NEPA and/or SERP document, as necessary:

- Socio-economic impacts
- Farmland impacts
- Air quality impacts
- Noise
- Right-of-way and relocations
- Cumulative and indirect impacts
- Public involvement

Coordination with state environmental and natural resource agencies to provide comments on any significant environmental impacts of the project and identification of strategies to avoid and minimize those impacts

6.2 Cultural and Historic Resources

A review of the Virginia Department of Historic Resources' (VDHR) Cultural Resources Information System (V-CRIS) database on December 11, 2017 was conducted to identify known architectural or archaeological sites within the project corridor and the immediate vicinity of the project corridor that are eligible or potentially eligible for listing on the National Register of Historic Places (NRHP). Under Federal law, a historic property is any district, site, building, structure, or object that is listed in or eligible for listing in the National Register of Historic Places (NRHP). To be eligible for listing, sites must meet at least one of the National Register Criteria for Evaluation, which involves examining the age, integrity, and significance of the site. Historic sites that are eligible for listing on the NRHP and/or are recommended for preservation in place by VDHR are also protected under Section 4(f). Section 4(f) is further discussed in **Section 6.2.1.**

Five architectural resources were identified within the project corridor and one architectural resource was identified within the immediate vicinity of the project corridor. Additionally, two archaeological resources were identified within the immediate vicinity of the project corridor. **Table 17** below presents a summary of the architectural and archaeological resources identified in the database.

Table 17: Summary of Resources Identified within the Project Corridor or Immediate Vicinity

VDHR #	Resource Name	Address or Site Characteristic	Eligibility or Status
Architectural Resources			
095-0007	A.C. Cummings House (historic), Parson Cummings House (historic), Cummings House (historic/current)	US Route 19	
095-0008	Parson Cummings Manse	US Route 19, West 58	No longer extant.
095-5430	House, 20288 Rustic Lane	20288 Rustic Lane	
095-5431	House, 20298 Rustic Lane	20298 Rustic Lane	
095-5432	House, 20105 Rustic Lane, Farmstead (historic)	20105 Rustic Lane	
140-0119	House, Lynch House	Russell Road	
Archaeological Resources			
44WG0169	Terrestrial, open air	Early Woodland, Late Woodland, Middle Woodland (1200 B.C.E – 1606 C.E.)	
44WG0170	Terrestrial, open air	Early Archaic Period (8500 - 6501 B.C.E), Middle Archaic Period (6500 - 3001 B.C.E), Late Archaic Period (3000 - 1201 B.C.E)	

The architectural and archaeological resources identified within and adjacent to the project corridor have not been evaluated for listing on the NRHP. However, the associated roadway improvements would not likely intersect theses resources; therefore, it is not anticipated this project will have an adverse impact on these resources. A Phase I Cultural Resource Survey may be required to identify, evaluate, and determine the eligibility of these resources, if federal funding is involved in this project. Additional coordination with VDHR to determine the project's potential effect to historic properties may be required for concurrence on an effect determination. If adverse effects are identified by VDHR, then additional consultation including an evaluation of the avoidance, minimization and mitigation of impacts will be required.

Figure 14: Study Area Aerial

6.2.1 Section 4(f)

Section 4(f) of the Department of Transportation Act of 1966 stipulates that federal agencies cannot approve the use of land from publicly owned parks, recreation areas, wildlife and waterfowl refuges, or historic sites unless there is no prudent and feasible alternative to using that land, and the program or project includes all possible planning to minimize harm to the Section 4(f) resource. A "use" of a Section 4(f) property includes any acquisition of right-of-way or a permanent easement, temporary occupancy, or constructive use.

No local, state, or national parks, recreational areas or wildlife and waterfowl refuges that are protected under Section 4(f) were identified within the project corridor.

Historic resources identified within the project corridor are described in Section 1.1. Depending upon the impacts to historic resources and the potential for an effect determination by VDHR, additional coordination regarding Section 4(f), as it pertains to historic resources, may be required.

6.2.2 Section 6(f)

The National Park Service (NPS) Land and Water Conservation Fund Act (LWCFA) of 1965 (16 USC 4601-4 et seq.) established a funding source to assist state and federal agencies in the acquisition and development of public outdoor recreational areas and facilities. Section 6(f) of the LWFCA requires that all properties "acquired or developed, either partially or wholly, with LWCF funds" must be maintained as such in perpetuity.

According to a Detailed Listing of Grants, grouped by County and prepared by the NPS LWCF program, multiple sites in Washington County are identified by the NPS as being acquired by LWCF funds. Based on GIS mapping, these sites are not located within the study area. Therefore, no conversions of Section 6(f) properties are anticipated.

6.3 Natural Resources

Impacts to natural resources were reviewed in the following areas:

- Floodplain impacts
- Wetlands and Surface Water impacts
- Wildlife and habitat impacts

6.3.1 Floodplain

The Federal Emergency Management Agency (FEMA) defines the 100-year floodplain as the area that will be inundated by the flood event having a one percent chance of being equaled or exceeded in any given year. According to the FEMA Flood Insurance Rate Maps (FIRM) for Washington County, Virginia, Community Panel Number 51191C0260C, dated September 29, 2010, a portion of the project corridor is located within Zone AE and Zone A. Zone AE and Zone A are designed as special flood hazard areas subject to inundation by the 1% annual chance flood (100-year flood). Portions of the project corridor are also located within shaded Zone X or areas of 0.2% annual chance flood, areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile, and areas protected by levees from 1% annual chance flood. These floodplain areas appear to be associated with Wolf Creek and its associated tributaries.

6.3.2 Wetlands and Surface Waters

Tidal and non-tidal wetlands and Waters of the US (WOUS) are subject to the jurisdiction of the US Army Corps of Engineers (USACE) and the Virginia Department of Environmental Quality (VDEQ). Subaqueous lands, tidal wetlands, and non-tidal waters with a drainage area greater than five square miles are subject to the jurisdiction of the Virginia Marine Resources Commission (VMRC). Permit types and the level of coordination will be determined based on the amount of impact to these jurisdictional areas. Permit issuance is subject to the level of effort during the design to first avoid, and then minimize impacts to jurisdictional areas.

A desktop review of GIS data, including topographic and National Wetland Inventory (NWI) mapping, National Hydrography Dataset (NHD), aerial photography, and U.S. Department of Agriculture (USDA) Natural Resources Conservation (NRCS) soil survey data was conducted to determine the presence of wetlands, water bodies, and streams within the study area.

The following streams and wetland systems were identified by the NWI and NHD databases and are depicted in **Figure 15**:

- A PUBHx wetland system was identified within the southeastern portion of the project corridor approximately 75-feet north of the existing Route 19 roadway footprint.
- Multiple PSS1C wetland systems were identified within the southern portion of the project corridor approximately 50-feet south of the existing Route 19 roadway footprint.
- A PUBHh wetland system was identified within the southern portion of the project corridor approximately 150-feet south of the existing US Route 19 roadway footprint.
- A PSS1C wetland system was identified within the central portion of the project corridor approximately 300-feet north of the existing US Route 19 roadway footprint and approximately 150-feet south of the existing Rustic Lane roadway footprint.
- PUBHh and PEM1Eh wetland systems were identified within the northern portion of the project corridor approximately 450-feet north of the existing Rustic Lane roadway footprint.
- Wolf Creek and its associated tributaries were identified within portions of the project corridor. Wolf Creek enters the project corridor in the south along the northern side of US Route 19 and crosses beneath Route 19 at the intersection of US Route 19 and Worthing Way. Wolf Creek runs parallel to US Route 19 until it crosses beneath US Route 19 between Keywood Animal Clinic and Lyons Den Pizza. The stream continues northwest crossing beneath Rustic Lane and flowing into a PEM1Eh wetland system within the northern portion of the project corridor. A tributary of Wolf Creek flows south from the PEM1Eh wetland, crossing US Route 19 and continuing south out of the project corridor. Another tributary of Wolf Creek continues northwest and eventually meanders south, crossing US Route 19 and continues southwest outside of the project corridor.

Figure 15: National Wetland Inventory and Nation Hydrology Dataset Map

A site visit was conducted December 21, 2017. The following wetland systems were observed within the project corridor and are consistent with the systems identified in the NWI and NHD database review:

- Wolf Creek and its associated unnamed tributaries are located within the central and southeastern half of the project corridor. The primary channel of the system appears to have perennial flow and drains in a southeastern direction.
- Two palustrine open water (POW) systems were observed within the project corridor within the southeastern and southcentral portion of the project corridor.
- Palustrine Scrub-Shrub (PSS) wetlands were observed within the central area of the project corridor, bordering Wolf Creek, and within the southeastern portion of the project corridor adjacent to Rustic Lane.

A field delineation of wetlands and WOUS in accordance with the USACE *Wetland Delineation Manual* (1987) and applicable Regional Supplement has not been conducted. Upon completion and submittal of the wetland delineation, USACE will conduct a site visit to confirm the boundaries of wetlands and WOUS and subsequently issues a Jurisdictional Determination (JD). Additionally, a site specific perenniality determination has not been conducted nor confirmed with the County and may be required.

If jurisdictional features located within the limits of proposed improvements are identified during the field delineation, efforts to avoid and minimize impacts to these features to the maximum extent practicable should be incorporated during design.

6.3.3 Wildlife and Habitat

Section 7 of the Endangered Species Act (ESA) requires that any undertaking is not likely to jeopardize the continued existence of species that are listed as endangered or threatened.

The U.S. Fish and Wildlife Service (USFWS) Information, Planning, and Consultation (IPaC) System, the Department of Game and Inland Fisheries (DGIF) Virginia Fish and Wildlife Information Service (VaFWIS) database, DGIF's Northern Long-Eared Bat (NLEB) Winter Habitat and Roost Trees Application, DGIF's Little Brown Bat (MYLU) and Tri-colored Bat (PESU) Winter Habitat and Roosts Application, the Center for Conservation Biology's (CCB) Eagle Nest Locator, and the Department of Conservation and Recreation (DCR) Natural Heritage Data Explorer interactive map were reviewed to identify known federal or state listed threatened and endangered (T&E) species and critical habitats within the project corridor. **Table 18** provides an overview of database findings.

The USFWS Official Species List, dated December 12, 2017, documented the following species that may occur within the vicinity of the project corridor:

Table 18: Summary of Species Identified on USFWS Official Species List

Name/ Listing	Habitat Requirements	Comments
Carolina Northern Flying Squirrel (*Glaucomys sabrinus colaratus)* FE	The Carolina Northern Flying Squirrel is found in areas that contain northern hardwood tree species and adjacent to higher-elevation Red spruce-Fraser fir forests.	Additional coordination with VDGIF and USFWS will be conducted to determine potential impacts to this species as a result of this project.
Gray Bat (*Myotis grisescens)* FE	According to USFWS, the Gray Bat is found in caves year-round. Specifically, in the winter the Gray Bat prefers to hibernate in deep, vertical caves, and in the summer the Gray Bat prefers to roost in caves scattered along rivers.	Because there are no known caves within the Route 19 corridor, it is not anticipated that the proposed project will have an adverse impact on this species. However, coordination will be conducted with VDGIF and USFWS.
Indiana Bat *(Myotis sodalis)/* FE	There is final critical habitat for this species. The project corridor is located outside the critical habitat. VDGIF recommends a time of year restriction (TOYR) of April 15 - September 15 outside of the 5.5-mile radius buffer for hibernacula, and April 01 – November 15 within a hibernaculum buffer.	Additional coordination with VDGIF and USFWS will be conducted to determine the projects proximity to winter hibernaculum and appropriate TOYRs, if any.
Northern Long-eared Bat (*Myotis septentrionalis*)/ FT	Based on VDGIF's NLEB Winter Habitat and Roost Trees Application, no known NLEB winter hibernaculum or maternity roost trees were identified within the project corridor, referenced ranges, or a 2-mile radius of the project site.	It is not anticipated that the proposed project would have an adverse impact on this species. However, coordination will be conducted with VDGIF and USFWS.
Virginia Big-eared Bat (*Corynorhimus tomnsendii virginianus)* FE	There is final critical habitat for this species. The project corridor is located outside the critical habitat.	Additional coordination with VDGIF and USFWS will be conducted to determine the projects proximity to winter hibernaculum and appropriate TOYRs, if any.
Spotfin Chub (*Erimonax monachus)* FT	There is final critical habitat for this species. The project corridor is located outside the critical habitat. VDGIF recommends a TOYR of May 1 – August 31 for this species.	Additional coordination with VDGIF and USFWS will be conducted to determine the potential occurrence of this species within the project corridor and appropriate TOYRs, if any.
Yellowfin Madtom (*Noturus flavipinnis)* Experimental Population, Non-Essential	This species is listed as threatened in specified portions of the Holston River and its watershed. This species is found in medium to large sized creeks and small rivers. More specifically, this species prefers slow pools and riffles under cover.	Additional coordination with VDGIF and USFWS will be conducted to determine the potential occurrence of this species within the project corridor and appropriate TOYRs, if any.
Yellowfin Madtom (*Noturus flavipinnis)* FT	There is final critical habitat for this species. The project corridor is located outside the critical habitat designated for this species.	Additional coordination with VDGIF and USFWS will be conducted to determine the potential occurrence of this species within the project corridor and appropriate TOYRs, if any.

Name/ Listing	Habitat Requirements	Comments
Birdwing Pearlymussel (*Lemiox rimosus)* FE	The Birdwing Pearlymussel is typically found in riffle pool areas with stable sand and gravel substrates in small to medium sized rivers. VDGIF recommends a TOYR of April 15 – June 15 for the glochidia release, and August 15 – September 30 for the spawning season.	Additional coordination with VDGIF and USFWS will be conducted to determine the potential occurrence of this species within the project corridor and appropriate TOYRs, if any.
Cumberland Monkeyface (pearlymussel) (*Quadrula intermedia)* FE	The Cumberland Monkeyface inhabits shallow riffle pool areas and shoal areas within headwater streams and large rivers. It does not occur in ponded sections of rivers, and rarely found within small streams. VDGIF recommends a TOYR of May 15 – July 31 for this species	Based on the habitat preferences of the Cumberland Monkeyface and because the only waterbody intersecting the project corridor is a small stream, it is not anticipated that the proposed project will have an adverse impact on this species. However, additional coordination with the VDGIF and USFWS will be conducted.
Cumberland Combshell (*Epioblasma brevidens)* FE	There is final critical habitat for this species. The project corridor is located outside of the critical habitat designated for this species. VDGIF recommends a TOYR of April 15 – June 15 for the glochidia release, and August 15 – September 30 for the spawning season.	Additional coordination with VDGIF and USFWS will be conducted to determine the potential occurrence of this species within the project corridor and appropriate TOYRs, if any.
Finerayed Pigtoe (*Fusconaia cuneolus)* FE	The Finerayed Pigtoe inhabits shoals of creeks and rivers. It prefers smaller streams with stable gravel substrates and a moderate current. VDGIF recommends a TOYR of May 15 – July 31 for this species.	Additional coordination with VDGIF and USFWS will be conducted to determine the potential occurrence of this species within the project corridor and appropriate TOYRs, if any.
Fluted Kidneyshell (*Ptychobranchus subtentum)* FE	There is final critical habitat for this species. The project corridor is located outside of the critical habitat designated for this species. VDGIF recommends a TOYR of April 15 – June 15 for the glochidia release, and August 15 – September 30 for the spawning season.	Additional coordination with VDGIF and USFWS will be conducted to determine the potential occurrence of this species within the project corridor and appropriate TOYRs, if any.
Littlewing Pearlymussel (*Pegias fabula)* FE	The Littlewing Pearlymussel inhabits small creeks and small to medium sized rivers. It prefers riffle pools with sand or gravel substrates. VDGIF recommends a TOYR of April 15 – June 15 for the glochidia release, and August 15 – September 30 for the spawning season.	Additional coordination with VDGIF and USFWS will be conducted to determine the potential occurrence of this species within the project corridor and appropriate TOYRs, if any.
Oyster Mussel (*Epioblasma capsaeformis)* FE	There is final critical habitat for this species. The project corridor is located outside of the critical habitat designated for this species. VDGIF recommends a TOYR of April 15 – June 15 for the glochidia release, and August 15 – September 30 for the spawning season.	Additional coordination with VDGIF and USFWS will be conducted to determine the potential occurrence of this species within the project corridor and appropriate TOYRs, if any.
Purple Bean (*Villosa perpurpurea)* FE	There is final critical habitat for this species. The project corridor is located outside of the critical habitat designated for this species. VDGIF recommends a TOYR of February 15 – June 15 and August 15 – September 15 for this species.	Additional coordination with VDGIF and USFWS will be conducted to determine the potential occurrence of this species within the project corridor and appropriate TOYRs, if any.
Rough Rabbitsfoot (*Quadrula cylindrica strigillata)* FE	There is final critical habitat for this species. The project corridor is located outside of the critical habitat designated for this species. VDGIF recommends a TOYR of May 15 – July 31 for this species.	Additional coordination with VDGIF and USFWS will be conducted to determine the potential occurrence of this species within the project corridor and appropriate TOYRs, if any.
Shiny Pigtoe (*Fusconaia cor)* FE	The Shiny Pigtoe is commonly found in shoals and riffle pools within small to medium sized rivers with clear water and a moderate to fast current. VDGIF recommends a TOYR of May 15 – July 31 for this species.	Additional coordination with VDGIF and USFWS will be conducted to determine the potential occurrence of this species within the project corridor and appropriate TOYRs, if any.

Name/ Listing	Habitat Requirements	Comments
Slabside Pearlymussel (*Pleuronaia dolabelloides)* FE	There is final critical habitat for this species. The project corridor is located outside of the critical habitat designated for this species. VDGIF recommends a TOYR of May 15 – July 31 for this species.	Additional coordination with VDGIF and USFWS will be conducted to determine the potential occurrence of this species within the project corridor and appropriate TOYRs, if any.
Snuffbox Mussel *(Epioblasma triquetra)* FE	According to USFWS, the Snuffbox Mussel is typically found in small to medium sized creeks and more specifically in areas with swift current with sand and gravel substrates. VDGIF recommends a TOYR of April 15 – June 15 for the glochidia release, and August 15 – September 30 for the spawning season.	Additional coordination with VDGIF and USFWS will be conducted to determine the potential occurrence of this species within the project corridor and appropriate TOYRs, if any.
Tan Riffleshell (*Epioblasma florentina walkeri)* FE	USFWS has not designated critical habitat or typical habitat requirements for this species. VDGIF recommends a TOYR of April 15 – June 15 for the glochidia release, and August 15 – September 30 for the spawning season.	Additional coordination with VDGIF and USFWS will be conducted to determine the potential occurrence of this species within the project corridor and appropriate TOYRs, if any.
Spruce-fir Moss Spider (*Microhexura montivaga)* FE	There is final critical habitat for this species. The project corridor is located outside of the critical habitat designated for this species.	Additional coordination with VDGIF and USFWS will be conducted to determine the potential occurrence of this species within the project corridor and appropriate TOYRs, if any.

**FE=Federally Endangered, FT = Federally Threatened*

A review of the CCB VaEagles Nest Locator (accessed December 11, 2017) was conducted to identify known active bald eagle nests within the vicinity of the project corridor. No known active bald eagle nests were identified within the vicinity of the project corridor. Therefore, it is not anticipated that this project will have an adverse impact on this species.

The VDGIF VaFWIS Search Report, dated December 11, 2017, did not document any federal or state listed threatened or endangered species within the project corridor or within a 2-mile radius of the project corridor.

VDGIF's NLEB Winter Habitat and Roost Trees Application (accessed December 11, 2017) was reviewed to identify winter habitat within 0.25 mile of the project corridor or known maternity roost trees within 150 feet of the project corridor. No known NLEB winter hibernaculum or maternity roost trees were identified within the project site, referenced ranges, or a 2-mile radius of the project corridor. It is not anticipated that the proposed project will have an adverse impact on these species.

VDGIF's MYLU and PESU Winter Habitat and Roosts Application (accessed December 11, 2017) was reviewed to identify MYLU and PESU hibernaculum within 0.25-mile of the project corridor and known roost trees within 150 feet of the project corridor. No known MYLU or PESU winter hibernaculum or maternity roost trees were identified within the project corridor or referenced ranges. It is not anticipated that the proposed project will have an adverse impact on these species. The project site was submitted to DCR through the Virginia Natural Heritage Data Explorer (NHDE) to identify natural heritage resources within the vicinity of the project site. Natural heritage resources are defined by DCR as "the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations." DCR also typically provides comments regarding anticipated negative impacts and recommendations to avoid, minimize or mitigate impacts.

According to the initial project report, received on December 12, 2017, DCR identified the following:

- Barns Chapel Swamp (Conservation Site 1491) – this site is located approximately 1.5-miles north of the project corridor. According to the NHDE database, this site protects a unique calcareous wetland that provides habitat for many state-rare plants. Threats include alteration of the saturated hydrology, introduction of non-native species, and shrub encroachment.
- Frayleys (Conservation Site 2652) – this site is located approximately 2-miles southwest of the project corridor. According to the NHDE database, this site encompasses land containing one or more biologically significant karst resources.
- General Locations of a Natural Resource (GLNHR) – this site is located approximately 1.5-miles north of the project corridor and is recorded as an occurrence of a vascular plant. The occurrence of the GLNHR is associated with the Barns Chapel Swamp (Conservation Site 1491).

The project has been submitted to DCR for additional information on the identified natural heritage resources and will be forwarded upon receipt.

6.4 Hazardous Materials

The Virginia Department of Environmental Quality's (VDEQ) GIS datasets and Virginia Environmental Geographic Information Systems (VEGIS) were reviewed for known petroleum releases, tank facilities, and Voluntary Remediation Program (VRP) sites within the study area.

The project corridor is predominantly developed with commercial land uses consisting of retail, restaurants, gas stations and hotels. Residential uses and agricultural land are also located adjacent to the project corridor. Based on a review of available GIS data, petroleum release sites and registered tank facilities were identified within the project corridor. Specifically, seven (7) petroleum releases and six (6) registered tank facilities were identified within the study area or immediately adjacent to the study area. No VRP sites were identified within the study area. **Table 19** and **Table 20** provide a summary of the identified facilities, Pollution Complaint (PC) Numbers, location and case status for petroleum releases and registered tanks, respectively.

Table 19: Summary of Petroleum Releases

Facility Name	Facility Address	PC Number	Case Status	Release Status	Release Reported Date	Date Case Closed
Roadrunner Market 195	15785 Porterfield Hwy	20111025	Closed	Confirmed	2/24/2011	7/27/2011
Residential (David Beam)	15492 Chantilly Way	20141031	Closed	Confirmed	5/30/2014	11/14/2014
Abingdon Service Center	20281 Rustic Ln	19921250	Closed	Confirmed	11/21/1991	10/03/1994
		19920986	Closed	Confirmed	11/21/1991	4/10/1996
		20081064	Closed	Confirmed	5/22/2008	6/09/2008
Double Kwik #17 (currently FasMart)	16085 Porterfield Hwy	20061033	Closed	Confirmed	11/17/2005	12/19/2007
Residential (Eugenia Phillips)	16098 Porterfield Hwy	20151010	Closed	Confirmed	8/28/2014	12/23/2014

Table 20: Summary of Registered Tank Facilities

Facility Name	Facility Address	Facility ID	Facility Type	Facility Active	Active UST	Inactive UST
David Buck Residence	15121 Porterfield Hwy	1038076	Residential	No	0	1
Widener's Market	15749 Porterfield Hwy	1019311	Gas Station	Yes	5	0
Roadrunner Market 195	15785 Porterfield Hwy	1026248	Gas Station	Yes	5	0
Fas Mart 461	16030 Porterfield Hwy	1038907	Gas Station	Yes	4	0
Fas Mart 417	16085 Porterfield Hwy	1015334	Gas Station	Yes	4	5
Washington County Utilities	20281 Rustic Lane	1014902	Utility	Yes	3	6

In addition to a review of GIS data, a site visit was conducted on December 21, 2017 to review the project corridor and adjacent properties from public thoroughfares. Multiple segments of overhead powerlines with pole-mounted transformers were observed within the project corridor along US Route 19 and Rustic Lane. While a detailed inspection of each pole-mounted transformer for the presence of a non-PCB (poly-chlorinated biphenyls) sticker was not ascertainable, no stressed vegetation or staining around the poles was observed. Additionally, many of the residential structures within and adjacent to the project corridor contained 500-750-gallon heating oil aboveground storage tanks (AST). Stained vegetation was not observed around the ASTs that were visible from public thoroughfare. According to a county official at the Washington County Sheriff's Office, a Phase I ESA was conducted on the Washington County Utilities property at 20281 Rustic Lane when the property was purchased from Appalachian Power. Documents pertaining to this property can be obtained through a Freedom of Information Act (FOIA) request from DEQ. **Figure 16** depicts pertinent site features within and adjacent to the study corridor.

A detailed review to assess and identify the potential for the selected contractor to encounter contamination during construction should be conducted. In addition, if right-of-way acquisition will be required for the proposed project, a Phase I Environmental Site Assessments (ESA), conducted in accordance with American Society of Testing and Materials (ASTM) Standard 1527-13, may be required.

Figure 16: Pertinent Environmental Site Features

7 PROJECT ADVANCEMENT

7.1 Geometric Characteristics

Several geometric improvements are proposed along the US Route 19 Corridor. The improvements are identified below and were developed as a result of field observations of existing conditions, operational and safety analyses, and most importantly collaboration with SWG. The improvements as described below are from the Worthing Way to Stone Mountain Drive. **Figure 17** through **Figure 20** provide graphical representations of the proposed improvements. It is proposed to implement the improvements in two phases, as determined by the SWG based on prioritization of the improvements and cost estimations. The two phases are described below.

7.2 Phase 1

7.2.1 US Route 19 & Worthing Way

- Close the median opening along US Route 19 at the driveway immediately south of Worthing Way, creating the driveway as a right-in/right-out only.
- Construct a northbound left-turn lane with 100' storage/200' taper at the intersection.
- Construct a shoulder area along the southbound shoulder to allow northbound U-turns. This will require right-of-way acquisition.
- Construct a driveway connection off Worthing Way to the private residence.

7.2.2 US Route 19 & Briarwood Lane

- Remove the connection between Briarwood Lane and US Route 19, thereby closing the median opening.
- Create a continuous connection between Briarwood Lane and Rustic Lane with the construction of a curve, appropriate to handle heavy vehicles. This will require right-of-way acquisition.

7.2.3 US Route 19 & Steinman Road

- Realign Steinman Road slightly to the north, intersecting with Rustic Lane (creating a four-legged intersection) and continuing with a new two-lane connection between US Route 19 and Rustic Lane. This will require right-of-way acquisition.
- Realign Leeroy's driveway to the south to create a four-legged intersection with US Route 19 and the realigned Steinman Road. This will require right-of-way acquisition. Close the current driveway opening to Leeroy's.
- Relocate the traffic signal from Chantilly Way to the new four-legged intersection of US Route 19, Steinman Road and Leeroy's Driveway.
- Close the section of Public Safety Lane between Rustic Lane and US Route 19.
- Close the median opening and associated left-turn lane along US Route 19 at Public Safety Lane.

7.2.4 US Route 19 & Elementary Drive

- Create an east-west 2-lane connection between US Route 19 and Rustic Lane.
- Create a north-south connection to the Food County parking lot for this new connection between US Route 19 and Rustic Lane. This will require the installation of a box culvert.

7.2.5 US Route 19 & Chantilly Way

- Relocate the traffic signal to Steinman Road and modify the median opening, with channelization and closure of the southbound left-turn lane, to allow northbound lefts from US Route 19.
- Create Chantilly Way as a right-in/right-out at its intersection with US Route 19.
- Close the driveway to Food County, that is opposite Chantilly Way.

7.2.6 US Route 19 Median Opening North End

- Close the median opening and associated left-turn lanes at the median opening along US Route 19 immediately north of Stone Mountain Drive.

7.3 Phase 2

7.3.1 Parallel Road to US Route 19

- Construct a two-lane roadway connection between Chantilly Way and the intersection of US Route 19/Leeroy's and Steinman Road. This will also cross Elementary Drive and create a new four-way, stop controlled intersection with stop control on the proposed connection.

Figure 17: Phase 1 Improvements – Worthing Way to Briarwood Lane

Figure 18: Phase 1 Improvements – Briarwood Lane to Chantilly Way

Figure 19: Phase 1 Improvements – Chantilly Way to Stone Mountain Drive

Figure 20: Phase 2 Improvements

7.4 Planning-Level Cost Estimates

Planning-level cost estimates were developed for each improvement phase. The probable cost estimates have been estimated using VDOT's Transportation and Mobility Planning Department (TMPD) Planning Level Cost Estimating process and are reported in 2017 dollars. The proposed improvements and associated probable construction costs are shown as follows for both Phase 1 and Phase 2. **Table 21** through **Table 23** list the opinions of probable cost for the roadway improvements, miscellaneous items, and total cost of Phase 1. **Table 24** through **Table 26** list the opinions of probable cost for the roadway improvements, miscellaneous items, and total cost of Phase 2. Detailed planning level cost estimates are included in **Appendix E**.

Table 21: Phase 1 Roadway Improvement Opinion of Probable Costs

Improvement	Estimated Cost
Worthing Way and Driveway Connection	$29,039
US Route 19 U-Turn Shoulder and Turn Lane	$879,490
Briarwood Lane Re-Alignment and Median/Road Closures	$1,576,708
US Route 19 Turn Lane and Intersection Improvements (Near Leeroy's)	$1,035,014
Leeroy's Driveway	$161,896
Steinman Road	$1,120,221
Us Route 19 and Food Country Connection	$1,201,731
General	$322,450
Total	**$6,326,549**

Table 22: Phase 1 Miscellaneous Item Costs

Item	Estimated Cost
Mobilization	$632,655
Construction Field Office	$18,000
Erosion and Sediment Control	$316,327
Maintenance of Traffic	$500,000
VDOT Application Review	$0
Relocate Utility Pole	$150,000
Stormwater Management	$1,000,000
Building and Right-of-Way Acquisition (Commercial Properties)	$0
Total	**$2,616,982**

Table 23: Phase 1 Total Cost

Item	Estimated Cost
Engineering/Design	$948,982
Roadway Improvements	$6,326,549
Miscellaneous	$2,616,982
CEI (20% per VDOT)	$1,265,310
ROW (25% of Construction Cost)	$0
Contingency (25%)	$1,587,637
Total	**$12,739,000**

Table 24: Phase 2 Roadway Improvement Opinion of Probable Costs

Improvement	Estimated Cost
New Two-Lane Connection Between Chantilly Way and Leeroy's Driveway	$3,807,412
Total	**$3,807,412**

Table 25: Phase 2 Miscellaneous Item Costs

Item	Estimated Cost
Mobilization	$380,741
Construction Field Office	$22,500
Erosion and Sediment Control	$190,371
Maintenance of Traffic	$150,000
VDOT Application Review	$0
Relocate Utility Pole	$50,000
Stormwater Management	$1,000,000
Building and Right-of-Way Acquisition (Commercial Properties)	$0
Total	**$1,793,612**

Table 26: Phase 2 Total Cost

Item	Estimated Cost
Engineering/Design	$571,112
Roadway Improvements	$3,807,412
Miscellaneous	$1,793,612
CEI (20% per VDOT)	$761,482
ROW (25% of Construction Cost)	$0
Contingency (25%)	$951,853
Total	**$7,885,000**

7.5 Funding Programs

The following federal and state funding sources should be considered for improvement projects identified in this study.

7.5.1 Federal Funding Source Alternatives

7.5.1.1 Highway Safety Improvement Program (HSIP)

Safety throughout all transportation programs remains VDOT's number one priority. Federal legislation, "Fixing America's Surface Transportation Act" (FAST Act), authorizes the federal surface transportation programs for highways, highway safety, and transit. The HSIP is a core program administered at the federal level by the U.S. Department of Transportation's (USDOT) FHWA Office of Safety. HSIP's purpose is to make significant progress in reducing highway fatalities and serious injuries on all public roadways. The Federal FAST Act continues the successful HSIP, with an estimated 2018 annual funding amount of $2.318 billion, including $235 million per year for the Rail-Highway Crossings program. Annually, Virginia expects to receive approximately $66M for roadway safety improvements.

The HSIP emphasizes a data-driven, strategic approach to improving highway safety on all public roads that focuses on performance. The foundation for this approach is a safety data system, which each state is required to have to identify key safety problems, establish their relative severity, and then adopt strategic and performance-based goals to maximize safety. Every state is required to develop a Strategic Highway Safety Plan (SHSP) that lays out strategies to address these key safety problems. Every state now has an SHSP in place, and the FAST Act ensures ongoing progress toward achieving safety targets by requiring regular plan updates and defining a clear linkage between behavioral (NHTSA funded) state safety programs and the SHSP.

Virginia's 2017-2021 SHSP identified eight (8) emphasis areas for the updated plan including impaired driving, intersections, speeding, young drivers, occupant protection, bicycles, roadway departure, and pedestrians. The updated SHSP also initiates a comprehensive evaluation plan to track progress and effectiveness towards the plan's goal of reducing deaths and severe injuries by half by 2030.

The federal share for HSIP projects is 90%, with the remaining 10% typically being covered by VDOT. Where VDOT funding is limited, however, the locality could be required to cover this 10%.

HSIP provides funding for improvements that correct or improve safety on a section of roadway or intersection with a high incidence of crashes. All US Route 19 improvement projects are candidate projects for HSIP funding.

7.5.2 State Funding Source Alternatives

7.5.2.1 SMART SCALE

Virginia uses the SMART SCALE funding program to review and score which transportation projects should be funded into the SYIP. The program is intended to improve the transparency and accountability of project selection, as well as provide improved stability in the SYIP by ensuring that all projects are fully funded through all phases. The process scores projects based on an objective and fair analysis process that is applied statewide. This process is intended to help the Commonwealth Transportation Board (CTB) members select projects that provide the maximum benefit for per the tax dollars invested.

The prioritization process will evaluate projects in the following factor areas: congestion mitigation, economic development, accessibility, safety, environmental quality and land use coordination. Factor areas are weighted in each highway construction district, and may be weighted differently within each highway construction district

Within the SMART SCALE process, there are several types of projects that are eligible for funding. Highway, transit, rail, road, operational improvements and transportation demand management projects and strategies will be considered. However, projects must meet a need identified in VTrans 2040 for a Corridor of Statewide Significance (CoSS), Regional Network or Urban Development Area (UDA). Projects seeking funding from most state and Federal discretionary fund categories are required to go through the SMART SCALE program. However, the following funding categories are exempt from the SMART SCALE program: Congestion Mitigation and Air Quality, Highway Safety Improvement Program, Transportation Alternatives, Revenue Sharing program, and secondary/urban formula funds.

The SMART SCALE will consist of a two-year cycle where projects applications are submitted, reviewed, and selected. Candidate projects will be solicited from eligible entities (i.e., Washington County). From there VDOT will screen, review, and evaluate the projects to determine the preliminary list of projects and scores for the CTB to consider. A draft SYIP will be released by the CTB, followed by public hearings to gather input. A final SYIP will be released and considered for adoption by the CTB. All proposed US Route 19 improvement projects are candidate projects for SMART SCALE funding.

7.5.3 Revenue Sharing

The "Revenue Sharing Program" provides additional funding for use by a county, city, or town to construct, reconstruct, or improve the highway systems within such county, city, or town. Locality funds are matched on a dollar-for-dollar basis with state funds, with statutory limitations on the amount of state funds authorized per locality. A locality may apply for up to a maximum of $10 million in matching allocations per fiscal year, with up to $5 million of these requested funds being utilized for maintenance projects. There is no limit to the amount of additional funds the locality may contribute. Priority will be given first to allocations that accelerate construction projects in the Commonwealth SYIP or the locality's capital plan. Locality requests up to a total of $1 million will be evaluated first and funded first.

The Revenue Sharing Program is administered by VDOT, in cooperation with the participating localities, under the authority of Section 33.1-23.05 of the Code of Virginia and the CTB's Revenue Sharing Program Policy. Application for program funding must be made by resolution of the governing body of the jurisdiction requesting the funds. Applications for program funding are typically due by November for funding under the next fiscal year. Localities are typically notified by June prior to the effective fiscal year of application approvals.

The Revenue Sharing Program may be used to finance eligible work on highway systems within a locality. The Revenue Sharing Program is intended to provide funding for immediately needed improvements or to supplement funding for existing projects. Larger new projects may also be considered, provided the locality identifies any additional funding needed to implement the project. Revenue Sharing Program funds are generally expected to be used to finance project costs in the same fiscal year and projects should be in active development that is leading to their completion within the near term.

The total funds available each fiscal year will be determined by the Commonwealth Transportation Board. The maximum allocation the CTB may make to the Revenue Sharing Program is $200 million annually. The minimum allocation the CTB may make to the Revenue Sharing Program is $15 million annually. All US Route 19 improvement projects are candidate projects for Revenue Sharing.