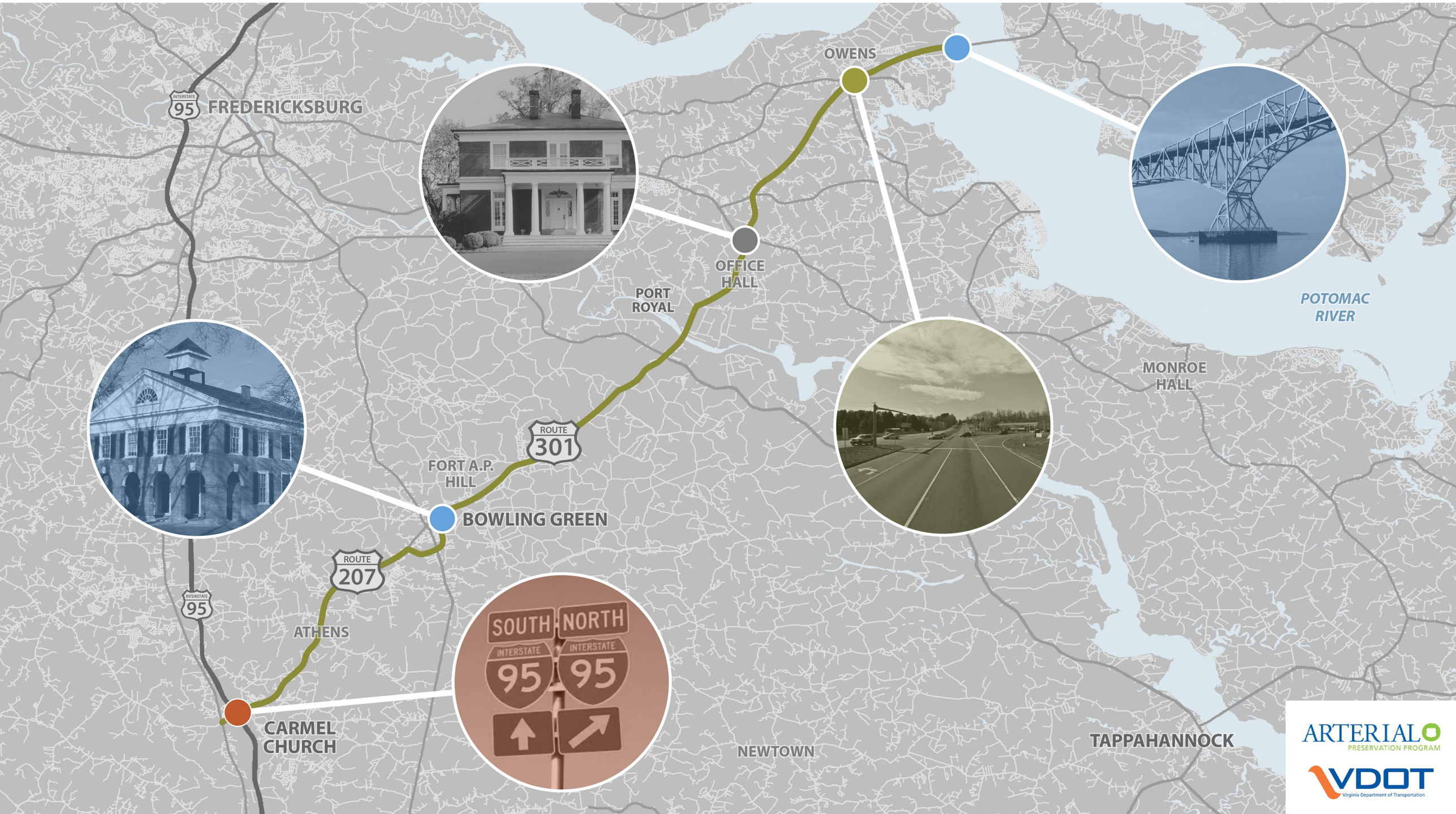
# US 301/Route 207 ARTERIAL PRESERVATION



# US 301 / Route 207 Arterial Preservation Plan

## King George & Caroline Counties

June 15, 2018

Prepared for:

**Virginia Department of Transportation**

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# CHAPTER 1: INTRODUCTION

## 1.1 BACKGROUND

The purpose of the US 301/Route 207 Arterial Preservation Plan is to develop a holistic approach that identifies ways to ensure the safety and preserve the capacity of the Commonwealth's arterial highway network without wide-scale roadway widenings or increased signal proliferation. This purpose of this plan is to identify investments recommendations that will help preserve and enhance this key transportation corridor due to the vital role it plays in the region as a potential alternative to Interstate 95 (I-95) and connection to Maryland.

This study is particularly important due to major improvements on I-95 and the Governor Harry Nice Memorial Bridge (Nice Bridge). The replacement of the Governor Harry Nice Memorial Bridge will add capacity and improve operations, safety and reliability crossing the Potomac River between Virginia and Maryland. In addition to this project, major construction activity planned for the I-95 corridor in Stafford & Spotsylvania Counties will divert traffic to alternative routes, including US 301/207, causing increases in traffic demand.

### 1.1.1. WHAT IS THE ARTERIAL PRESERVATION PROGRAM?

VDOT's Arterial Preservation Program is designed to preserve and enhance the capacity and safety of the critical transportation highways included in the Arterial Preservation Network. These major highways accommodate long-distance mobility of people and goods throughout the Commonwealth. Preserving mobility on these corridors is critical to the current and future economy. The Arterial Preservation Network includes segments of selected major highways that are part of the Corridors of Statewide Significance (CoSS) system or are functionally classified as principal or other principal arterials.

Within the framework of the Arterial Preservation Program, VDOT is developing methodologies to consistently and programmatically evaluate the corridors, creating a toolbox of preservation and enhancement strategies and identifying opportunities to implement these strategies. As an alternative to widening major highways to add capacity, preservation and enhancement strategies promote the use of innovative transportation solutions, minimizing delays for through traffic and improving safety, while incorporating local economic development goals. Developed in partnership with localities, the strategies will be used as tools to plan for infrastructure that supports future land use and development.

## 1.2 STUDY CORRIDOR

The 42-mile study area is divided into specific geographic areas with various levels of study detail. The greatest level of analysis occurred in three segments:

- King George County – This 12-mile segment of US 301 from Governor Nice Bridge to Route 3 in King George County has the greatest density of commercial and residential development in the corridor.
- Bowling Green – The Town of Bowling Green is a hub of retail, commercial and government services in the county.
- Carmel Church - This area of Caroline County receives high volumes of traffic due to the I-95 interchange.

The remainder of the study corridor, excluding those described above, includes 29-miles between Route 3 and US Route 1 just west of I-95. Figure 1 further details the study corridor and the level of analysis by segment.

It should be noted that a decision was made to exclude the Town of Port Royal from this study process due to the unique character of that transportation system. After discussion between the study team and Town officials, it was determined that a more detailed study, beyond the level provided in this Arterial Preservation Plan, would be needed to address the complex challenges within the Town limits.

## 1.3 PUBLIC INVOLVEMENT PROCESS

The public involvement process began with the January 17th, 2017 project kick-off/scoping meeting and subsequent discussion within the core study team, a set of nine project stakeholders were identified. The stakeholders include:

- King George County
- Caroline County
- Army/Fort A.P. Hill
- Navy/Naval Support Facility Dahlgren
- VDOT at the Residency, District and Central office level
- Fredericksburg Area Metropolitan Planning Association (FAMPO)/George Washington Regional Commission (GWRC)
- Maryland State Highway Administration/Maryland Transportation Authority (MDTA)
- Town of Bowling Green
- Town of Port Royal

This stakeholder group consisted of staff-level representatives from each of the organizations. This group met at key milestones throughout the study to review progress and results. These meetings were held at the L.E. Smoot Library in King George, Virginia. Table 1 lists the dates and topics of these meetings.

*Table 1. Core Study Team Meetings*

| Meeting Date | Meeting Topic |
|---|---|
| January 17, 2017 | Study Kick-Off/Orientation |
| June 30, 2017 | Existing Conditions |
| December 7, 2017 | Preliminary Recommendations |

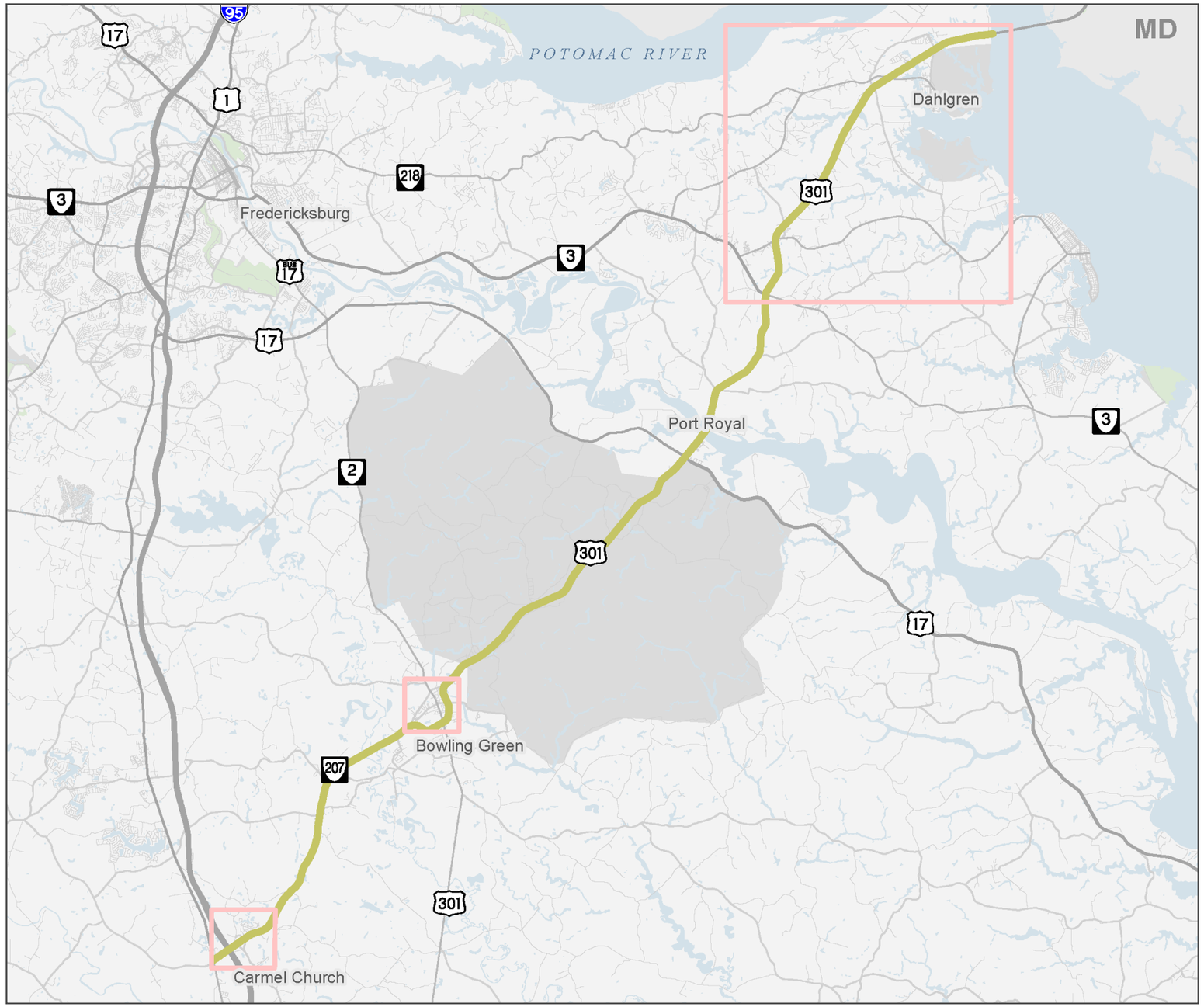
### 1.3.1 STAKEHOLDER INTERVIEWS

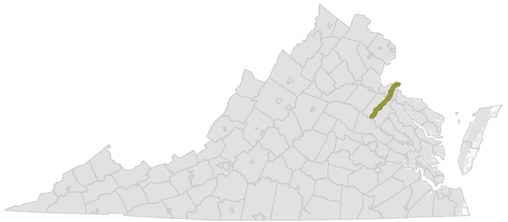
As part of the public outreach process, individual phone calls or in-person meetings were conducted in August 2017 to discuss and agree on growth assumptions along the corridor. Table 2 lists the stakeholders contacted during this process.

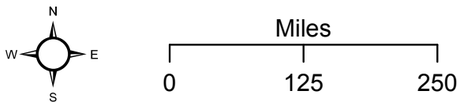
*Table 2. Stakeholder Interviews, Round I*

| Stakeholder | Stakeholder Representative | Title |
|---|---|---|
| Caroline County | Gary Wilson | Director of Economic Development |
| King George County | Neiman Young and other key staff | County Manager |
| Town of Port Royal | Jim Heimbach | Mayor |
| | Travis Quesenberry | Town Manager |
| US Army, Fort A.P. Hill | Billy Fortner | Staff |
| US Navy, Naval Support Facility Dahlgren | Lynne Keenan | Community Plans Liaison Officer |

*Figure 1. Study Corridor*



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Following a public meeting on December 14, 2017, individual meetings were held with stakeholders to discuss feedback received from the public meeting and review details of recommendations within their localities. These meetings are outlined in Table 3.

*Table 3. Stakeholder Interviews, Round II*

| Stakeholder | Stakeholder Representative |
|---|---|
| January 16, 2018 | Caroline County |
| | Town of Bowling Green |
| January 17, 2018 | Town of Port Royal |
| February 1, 2018 | King George County/ US Navy, Naval Support Facility Dahlgren |

### 1.3.2 PUBLIC OUTREACH

A corridor-wide citizen information meeting was held on December 14, 2017 at the Port Royal Volunteer Fire Department facility. The purpose of the meeting was to receive comments on the preliminary recommendations along the entire corridor. Approximately 34 people were in attendance beyond those of the study team. Members of the public were invited to provide comments on the preliminary recommendations of the corridor. Feedback received from the public was further reviewed with the stakeholders and revisions were made to the corridor recommendations where possible to address comments received.

A second and final citizen outreach effort took place in the Spring of 2018. Identical meetings were held in two locations to reveal the final corridor recommendations. The first open house was held on April 25, 2018 at the L.E. Smoot Library in King George where 36 guests were in attendance. The meeting included a formal presentation from the study team as well as various displays describing the study results. An identical meeting was held on May 1 at the Community Services Center in Caroline County with 16 citizens present.

# CHAPTER 2: EXISTING CONDITIONS

## 2.1 EXISTING LAND USE

Existing land use in the study corridor varies by location but is generally characterized as rural or small town. Most land in the study area corridor is either agricultural or forest land use in both King George and Caroline counties with concentrations of commercial and residential development. These concentrations of development are areas identified for a higher level of analysis in this study.

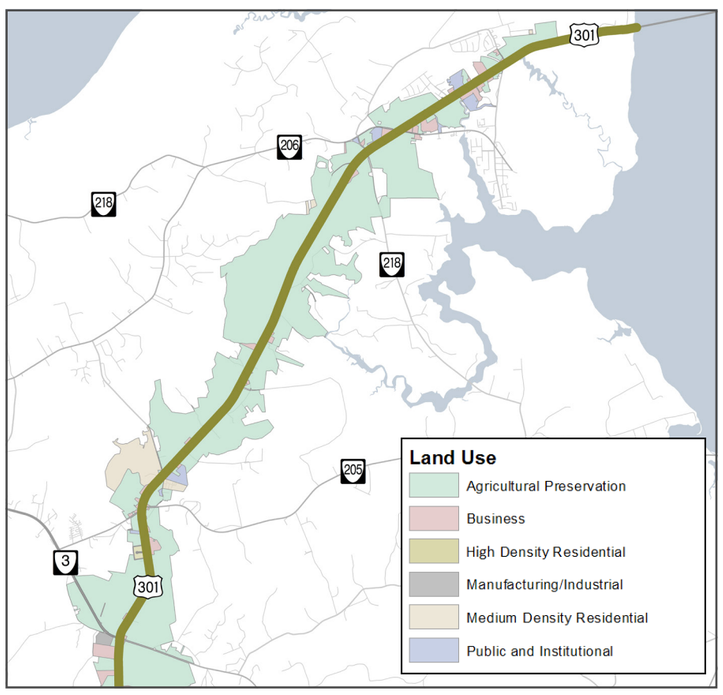
### 2.1.1 KING GEORGE COUNTY

The segment of the study corridor in King George County runs from the Governor Harry Nice Memorial Bridge to the Caroline County Line at the Rappahannock River. Much of the corridor is designated as agricultural or forest with a small amount of residential and commercial use scattered throughout the corridor between denser development. All sections of development are within the King George County Analysis Zone. The section of the corridor which is outside the analysis zone, between Route 3 and the Caroline County Line is predominantly agricultural and forest land.

#### *King George County Analysis Zone*

Development in this segment of the corridor is either public use, high density residential, medium density residential or commercial. Development in the King George County segment of the study corridor is most dense at the northern terminus of the corridor near Naval Support Facility Dahlgren, the community of Edgehill and at the intersection of Route 3 and US 301. Much of the development is low density residential, retail and county offices. Between these areas of development, the corridor land use is predominantly agricultural or forest. Figure 2 depicts the existing land use in the King George County analysis zone.

*Figure 2. King George County Analysis Zone*




### 2.1.2 CAROLINE COUNTY

The segment of the study corridor in Caroline County runs from the King George County Line/Rappahannock River and US 1. Much of the study corridor in Caroline County runs through Fort A.P. Hill, a US Army facility. Much of the Fort A.P. Hill land adjacent to US 301 is forest or vacant. Commercial and residential development is centered in Bowling Green and Carmel Church. Between the Carmel Church Analysis Zone and the Bowling Green Analysis Zone the land use is largely agricultural and forest except for the Caroline County High School.

#### *Carmel Church Analysis Zone*

Due to its proximity to the I-95/Route 207 interchange the land use in the Carmel Church area immediately adjacent to the interchange, is primarily commercial and oriented toward highway travelers. The land use includes hotels, truck stops, gas stations and restaurants. In addition to the commercial development there is residential development on Belmont Road. This residential development includes single-family detached homes and townhomes. Multiple industrial warehouse facilities are located south of Route 207 along Enterprise Parkway. Figure 3 depicts the existing land use in the Carmel Church analysis zone.

*Figure 3. Carmel Church Analysis Zone*

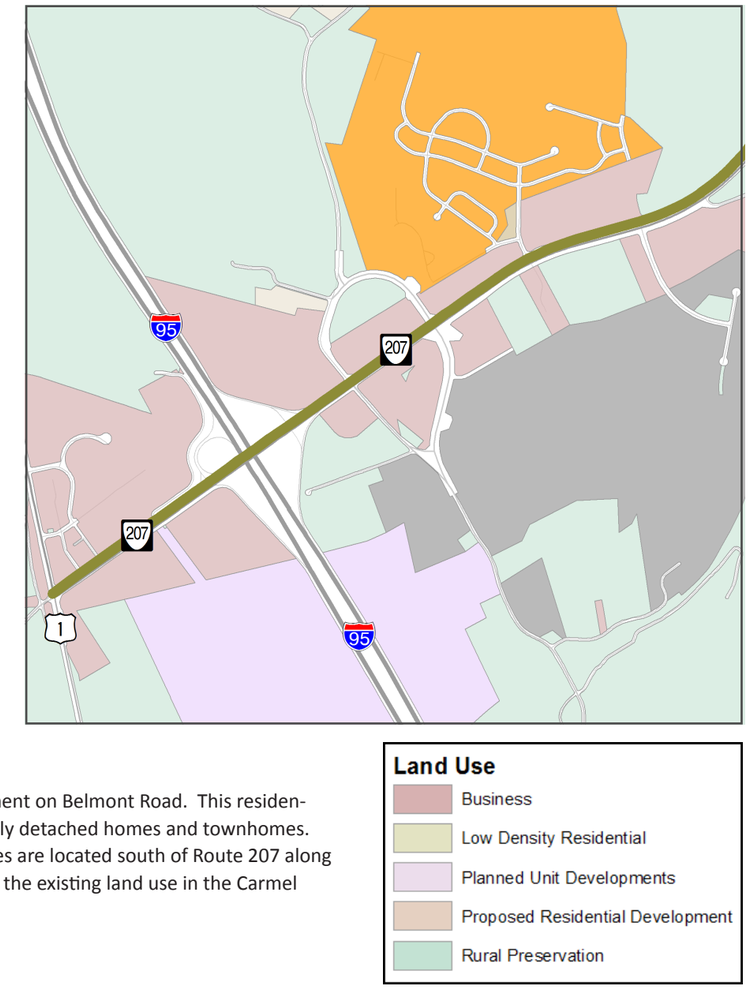
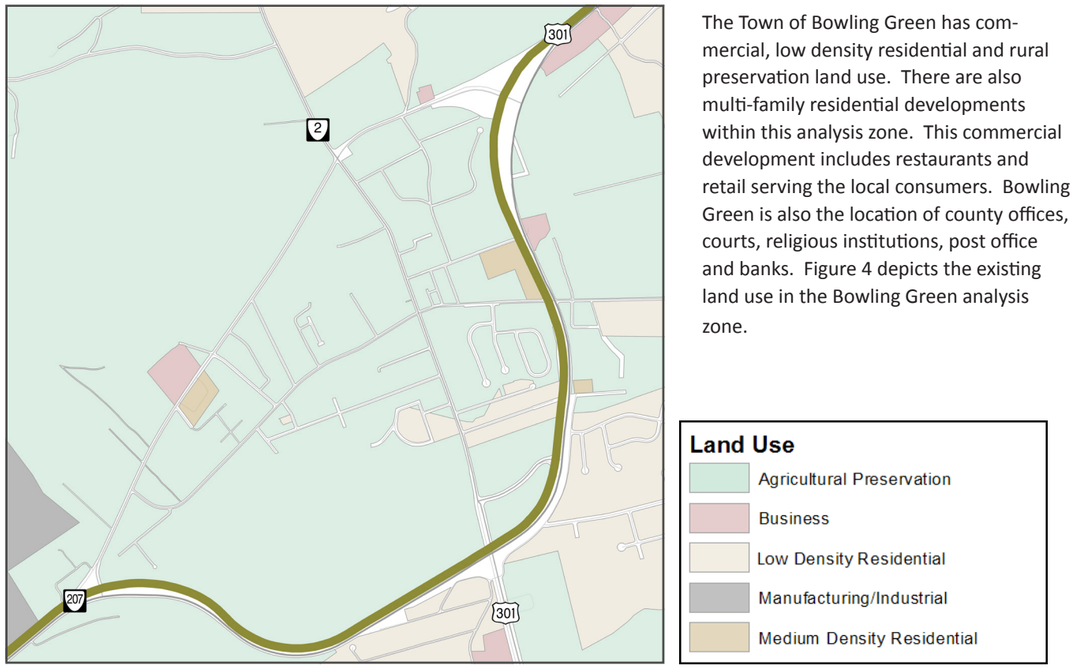


*Figure 4. Bowling Green Analysis Zone*




### *Bowling Green Analysis Zone*

The Town of Bowling Green has commercial, low density residential and rural preservation land use. There are also multi-family residential developments within this analysis zone. This commercial development includes restaurants and retail serving the local consumers. Bowling Green is also the location of county offices, courts, religious institutions, post office and banks. Figure 4 depicts the existing land use in the Bowling Green analysis zone.

### 2.1.3 EXISTING LAND USE KEY FINDINGS

- Agricultural and forest land for most of the corridor:
  - Much of the land within the US 301/Route 207 study corridor is agricultural or forest.
- There are two military installations on the corridor:
  - Naval Support Facility Dahlgren in King George County near the Governor Harry Nice Memorial Bridge at the northern terminus of the study corridor, and
  - Fort A.P. Hill in Caroline County north of the Town of Bowling Green.
- Commercial and residential density in the corridor:
  - At the northern terminus of US 301 around the Naval Support Facility Dahlgren in King George County;
  - The community of Edgehill in King George County;
  - The intersection of VA 3 and US 301 in King George County;
  - Town of Bowling Green, and
  - The I-95 interchange.

## 2.2 EXISTING INFRASTRUCTURE

Within the study corridor US 301/Route 207 is primarily a four-lane divided road running north-south. The corridor connects to Maryland via the Governor Harry Nice Memorial Bridge. The road is used regionally as an alternative to I-95. Access is partially controlled in most of the study area, except for the Town of Port Royal. US 301/Route 207 is classified as principal arterial.

A field review was conducted on June 7, 2017 at the outset of the study to review roadway and intersection configurations; identify unique roadway features; and observe traffic operations. The corridor has several roadway segments with designs that may reduce capacity, level of service or safety. One example of this throughout the corridor is crossover design. Throughout the corridor there are examples of crossovers with no turn lanes, vertical separation between northbound and southbound lanes and hidden crossovers. Some crossovers with turn lanes are sub-standard. Segments that present some of these crossover design issues include US 301 from Route 616 to Route 205, from Bowling Green Turnpike to the Town of Port Royal and from the Rappahannock River to Route 3. Other issues within the corridor include limited sight distance, short right-turn lanes at multiple intersections, and steep downgrades.

In addition to the design issues in the corridor that affect general traffic there are multiple design characteristics that specifically affect freight traffic. There are multiple steep downgrades and inclines that may affect freight traffic. An example of this is a section of the corridor, south of Route 205/Ridge Road, which features a steep downgrade into a sharp horizontal curve with a guard rail. A vertical curve southbound near a truck stop at Cool Water Drive makes left-turns into the truck stop difficult for heavy vehicles.

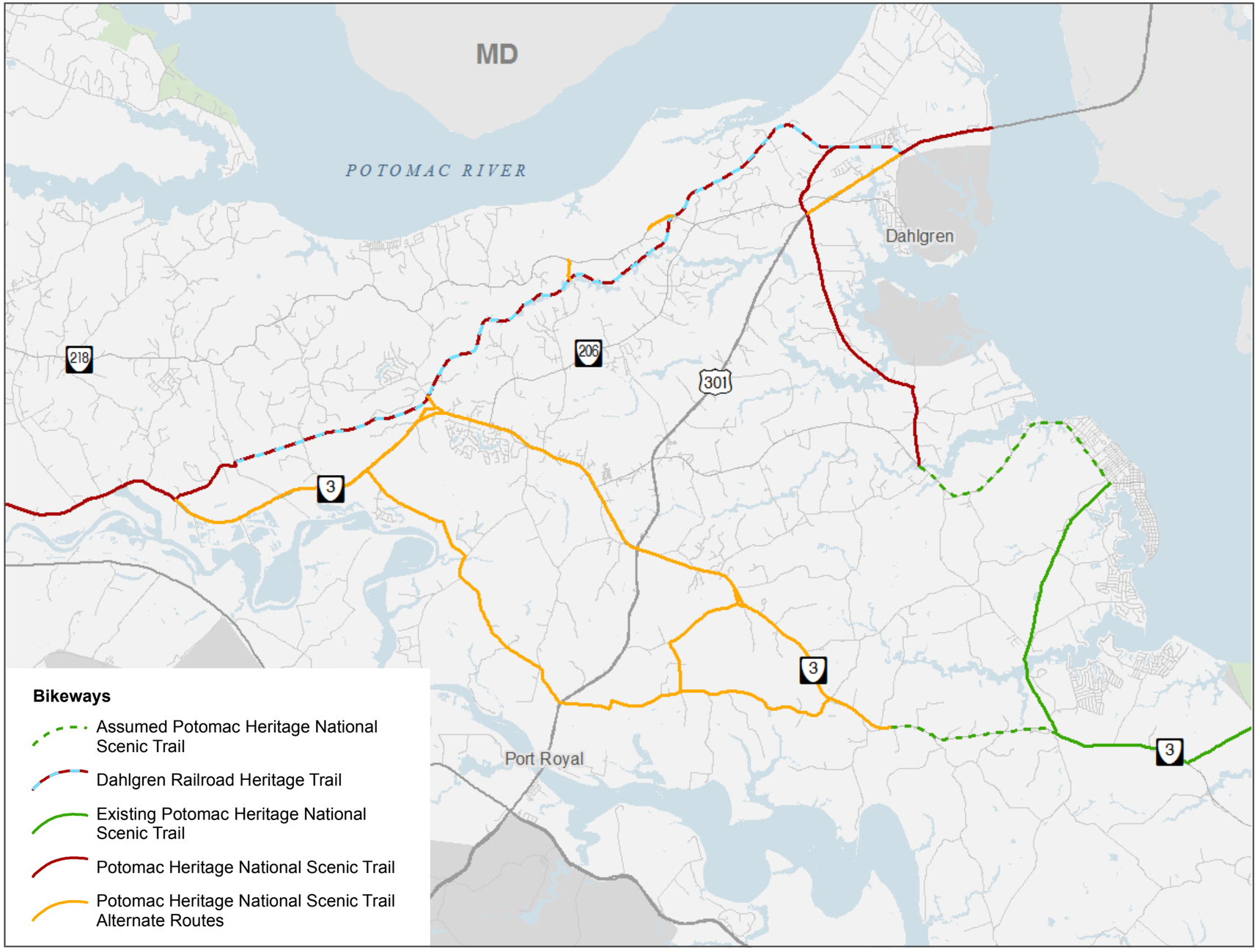
For more information regarding existing infrastructure please refer to the Field Review in Appendix A.

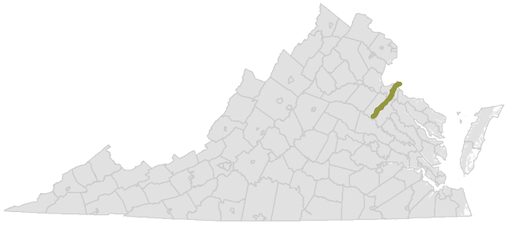
*Figure 5. Photos from Field Review*

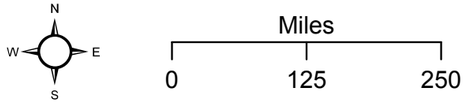
### 2.2.1 BICYCLE AND PEDESTRIAN FACILITIES

Bicycle and pedestrian facilities are limited or do not exist in most of the corridor, except for limited pedestrian facilities between the I-95 interchange and Belmont Boulevard. However, bicycle and pedestrian facilities exist on either parallel or intersecting facilities in King George County. The largest bicycle pedestrian facilities in the study area are the Potomac Heritage National Scenic Trail, Potomac Heritage Scenic Trail Alternate Routes and the Dahlgren Railroad Heritage Trail.

*Figure 6. Potomac Heritage National Scenic Trail, alternate routes and Dahlgren Railroad Heritage Trail*





The Potomac Heritage Scenic Trail and the Potomac Heritage Scenic Trail Alternate Route were added to the Potomac Heritage Scenic Trail in 2016. The Potomac Heritage Scenic Trail is a network of trails that goes from eastern Virginia to southwestern Pennsylvania. The Potomac Heritage Scenic Trail and Alternate Route intersect the study corridor at Salem Church Road, Mount Rose and Owens Road/Windsor Drive. The alternate route runs along US 301 between Owens Road/Windsor Drive and the Governor Harry Nice Memorial Bridge.

The Potomac Heritage Scenic Trail combines with Dahlgren Railroad Heritage Trail at Bloomsbury Road in King George County and terminates at the intersection of Owens Road and US 301. This is a former railroad facility converted to a trail for pedestrian and bicycle use. The trail is gravel and separated from the road but crosses Lambs Creek Church Road and Caledon Road. A map of the Potomac Heritage National Scenic Trail, the alternate routes and Dahlgren Railroad Heritage Trail is available in Figure 6.

## 2.3 EXISTING ACCESS POINTS

The commercial access points along the US 301/Route 207 study corridor were inventoried and the distance between each point measured and reviewed for compliance with VDOT's Access Management Spacing Standards. As VDOT access management standards do not apply to residential access points. Spacing between all access points within the study area are available in Appendix B. Table 4 outlines access segments within the study corridor.

*Table 4. US 301/Route 207 Study Corridor Access Segments*

| | Access Segments | | |
|---|---|---|---|
| | Compliant | Non-Compliant | Total |
| Northbound | 101 | 96 | 197 |
| Southbound | 103 | 72 | 175 |
| **Total** | **204** | **168** | **372** |

Ten percent (4.4 miles) of northbound segment miles and eight percent (3.6 miles) of southbound segment miles in the study corridor are non-compliant. The greatest number of non-compliant access segments in the study area for both the northbound and southbound direction of the US 301/Route 207 corridor are in King George County. Most of these non-compliant segments in both directions are between Route 3 and the Governor Harry Nice Memorial Bridge. These segments are concentrated in areas with a high density of commercial and residential development.

Though there are a fewer number of the non-compliant access segments are within Caroline County there is a concentration of non-compliant segments in both the northbound and southbound directions. These segments are:

- Route 207 from US 1 to I-95 interchange;
- Route 207 from I-95 interchange to Belmont Boulevard;
- US 301 from Route 207 to Fort A.P. Hill Drive, and
- US 301 from US 17 to the King George county line.

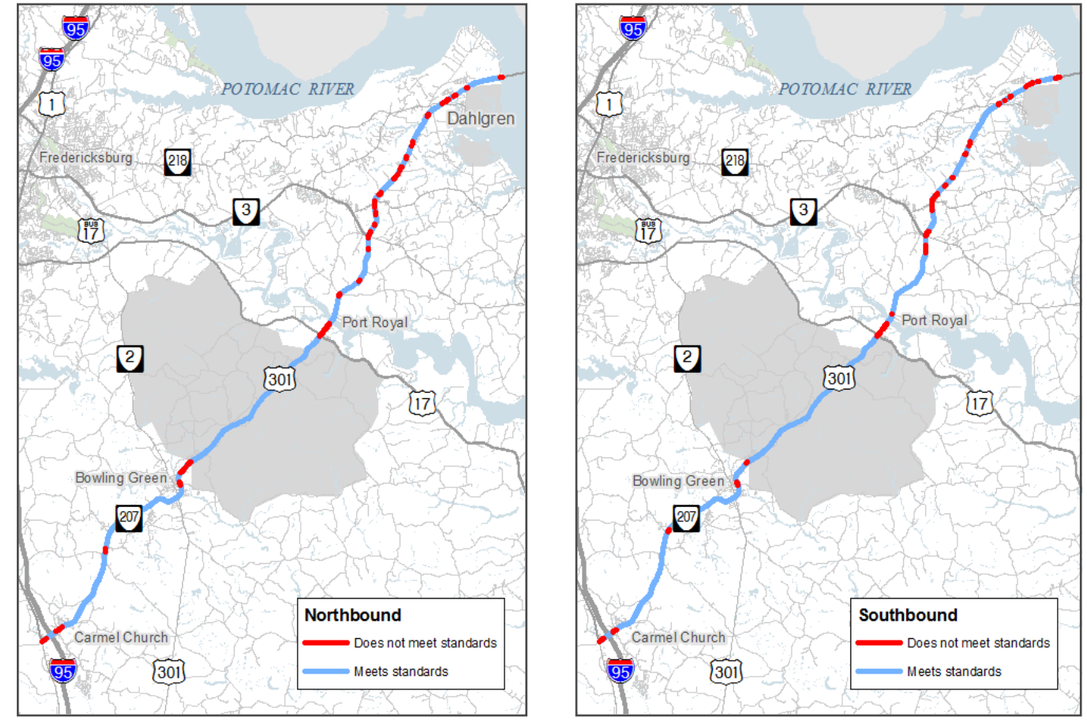
Due to the length and access control of the corridor, crossovers play a significant role in the design of the corridor and the preservation of corridor mobility. Many of these crossovers are non-compliant with VDOT design standards. Of the 12 signalized intersections 42 percent were non-compliant. Fifty-four percent of the 26 unsignalized intersections in the study corridor are non-compliant. Sixty-four percent of the median crossovers in the study corridor are non-compliant with VDOT design standards. Table 5 further outlines the crossovers in the study corridor. Figure 7 shows the existing access segment spacing in the study corridor.

*Table 5. US 301/Route 207 Study Corridor Crossovers**

| | Crossovers | | |
|---|---|---|---|
| | Compliant | Non-Compliant | Total |
| Signalized Intersection | 7 | 5 | 12 |
| Unsignalized Intersections | 12 | 14 | 26 |
| Median Crossovers | 30 | 53 | 83 |
| **Total** | **49** | **72** | **121** |

**Compliance was calculated based on VDOT design standards, Table 2-2 of the Virginia Road Design Manual Appendix F, for access management of entrances and intersections.*

*Figure 7. Access Segments*



For more information about existing access points are available in Appendix B.

## 2.4 CRASH ANALYSIS

An evaluation of corridor safety was conducted based on an analysis of crash summary information. A crash data analysis for the US 301/Route 207 study corridor over the latest seven years of available crash data (January 7, 2010 to March 5, 2017) was obtained from VDOT's Roadway Network System. Figure 10 illustrates the collision type that occurred in the study corridor during this timeframe. Figure 9 illustrates the crash severity in the study corridor during the same period and Table 6 shows the number of crashes by segment.

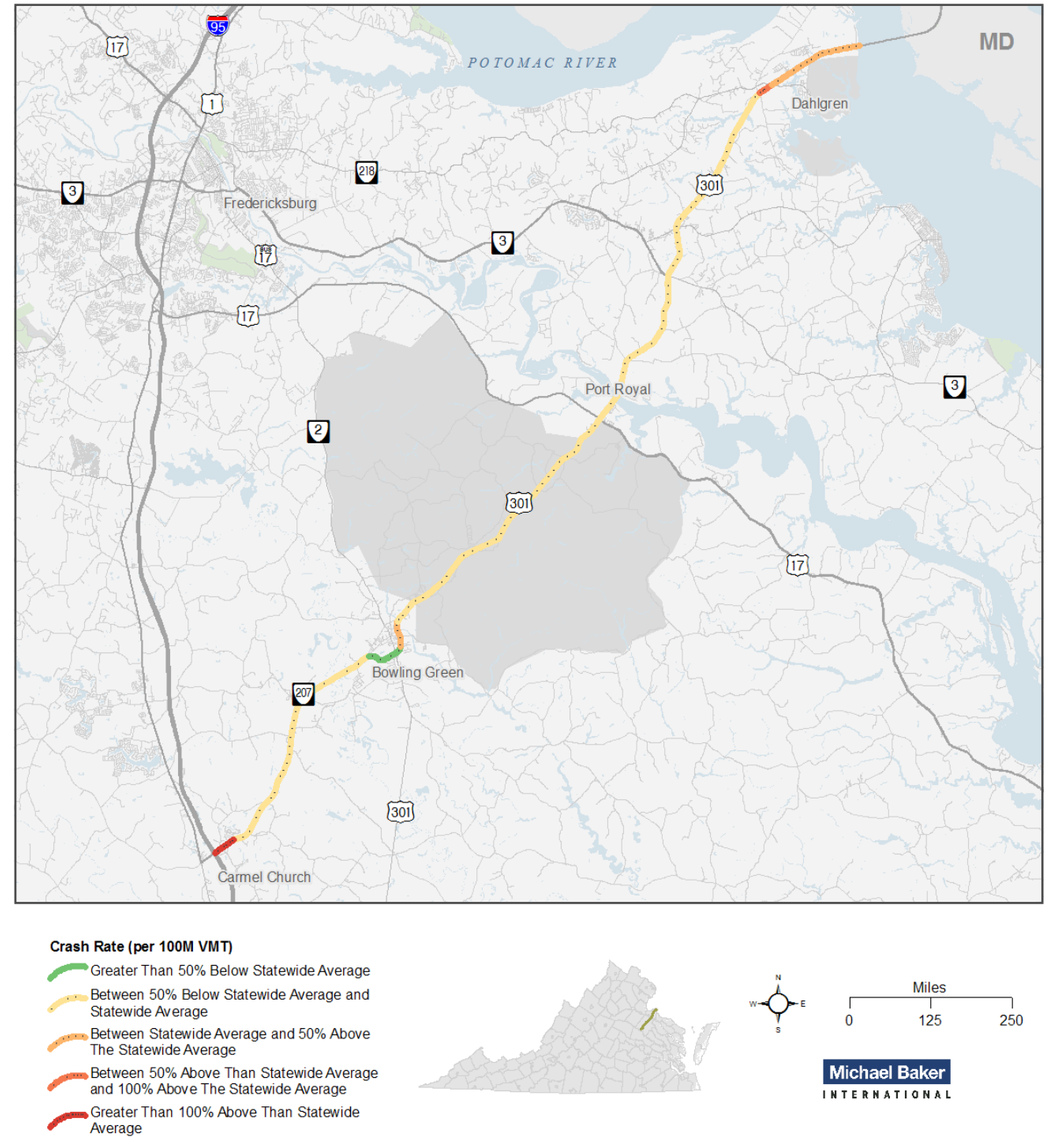
Analysis of existing conditions found that the crash rate is below the statewide average for principal arterials in most of the study corridor segments. Portions of the corridor with crash rates that are between the statewide average and 50% above the statewide average are near Naval Support Facility Dahlgren and near the Town of Bowling Green. One segment in Carmel Church at the I-95 interchange has a crash rate 100% above the statewide average. Figure 8 illustrates the crash density within the study area. For more information on the crash analysis please refer to Appendix C.

*Table 6. Number of Crashes by Segment in the US 301/Route 207 Study Corridor*

| From/To | Segment Length | Number of Crashes (2010-2017) | Crashes per 100-Million Vehicle Miles Traveled |
|---|---|---|---|
| Route 1 to Belmont Blvd | 0.93 | 120 | 565.62 |
| Belmont Blvd to Penola Rd | 4.14 | 50 | 52.94 |
| Penola Rd to Colonial Rd | 4.31 | 67 | 52.42 |
| Colonial Rd to W Broadus Ave | 0.57 | 9 | 57.68 |
| W Broadus Ave to Route 2 Bypass | 1.45 | 9 | 30.23 |
| Route 2 Bypass to Bowling Green Turnpike | 1.03 | 23 | 99.88 |
| Bowling Green Turnpike to Lakewood Rd | 0.98 | 15 | 60.99 |
| Lakewood Rd to Route 17 | 9.90 | 89 | 42.83 |
| Route 17 to Jersey Rd | 4.20 | 76 | 56.66 |
| Jersey Rd to Route 3 | 2.05 | 26 | 39.71 |
| Route 3 to Ridge Rd | 1.91 | 39 | 63.93 |
| Ridge Rd to Windsor Dr | 5.91 | 118 | 54.70 |
| Windsor Dr to Dahlgren Rd | 0.56 | 32 | 119.28 |
| Dahlgren Rd to Gov. Nice Memorial Bridge | 3.58 | 171 | 80.53 |

*Source: VDOT, 2013. Note: The statewide average for Other Principal Arterials is 79.43.*

*Figure 8. Corridor Crash Rates*



### 2.4.1 KEY FINDINGS

- In 74% of crashes only property damage occurred with no injuries or fatalities. Less than 1% of crashes resulted in fatal injury.
- The greatest number of crashes were rear end collisions, which accounted for 23% of crashes. This follows closely by angle and fixed object – off road collisions, which accounted for 22% and 21% of crashes respectively.
- The crash rate is highest between US 1 and Belmont Boulevard near the interchange with I-95 and Route 207.

*Figure 9. Crash Severity*

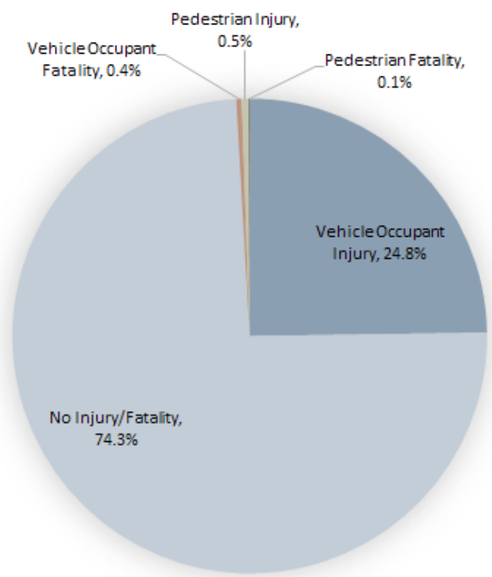
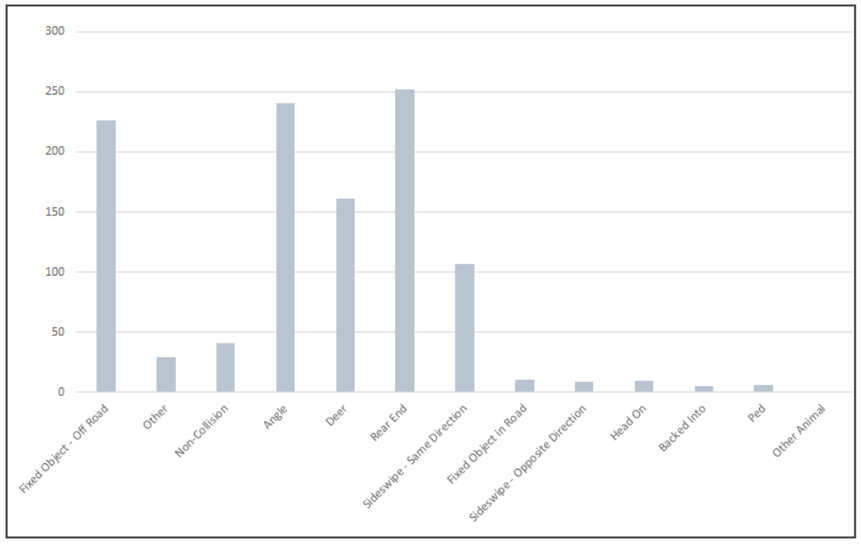



*Figure 10. Collision Type*




## 2.5 EXISTING TRAFFIC VOLUMES

Existing peak hour traffic volumes were developed using turning movement counts collected on April 20th, 2017. These traffic counts were collected for the highest volume segments of the 42-mile study corridor, which included King George County intersections from State Route 3 to the Governor Harry Nice Memorial Bridge. The AM and PM peak hours are the times of the highest traffic volumes in the study area. The AM peak hour for analysis is 7:00 to 8:00 and the PM peak hour is 4:30 to 5:30.

For more information on 2017 intersection volumes and operations, see Appendix D and Appendix E.

## 2.6 EXISTING TRAFFIC OPERATIONS

Existing traffic volumes were analyzed in Synchro using the Highway Capacity Manual (HCM) module for both the AM and PM peak hours. Figures 11 and 12 depicts the delay and level of service (LOS). Delay is a travel time ratio (TTR) that compares the free flow condition of a roadway and the condition of a certain time such as either AM or PM peak hour. The ratio shows how much longer it takes for a vehicle to travel a roadway during a peak hour. For example, if a roadway segment has a TTR of 1.20 during the AM peak hour it will take 20 percent longer to travel on the same roadway segment compared to free flow.

LOS is a qualitative measure used to relate the quality of traffic operations using letters A through F, A being the best and F being the worst. During an analysis of existing operations during the AM peak period indicates that three of the intersections analyzed are operating at an LOS D and three are operating at an LOS C or better. During the PM peak period, three of the intersections are operating at an LOS D or worse. Three intersections are operating at an LOS C. Table 7 further outlines the LOS of intersections analyzed and Appendix E outlines the intersection levels of service in greater detail.

*Table 7. Intersection LOS*

| Intersection | LOS AM | LOS PM |
|---|---|---|
| VA 3 and US 301 | D | E |
| Route 205 and US 301 | D | D |
| Route 218 and US 301 | C | C |
| Route 206 and US 301 | D | C |
| SR 1101 and US 301 | N/A | N/A |
| University Drive and US 301 | B | C |
| Market Center and US 301 | N/A | N/A |
| Route 614 and US 301 | B | D |

*Figure 11. Travel Time Ratio: AM*

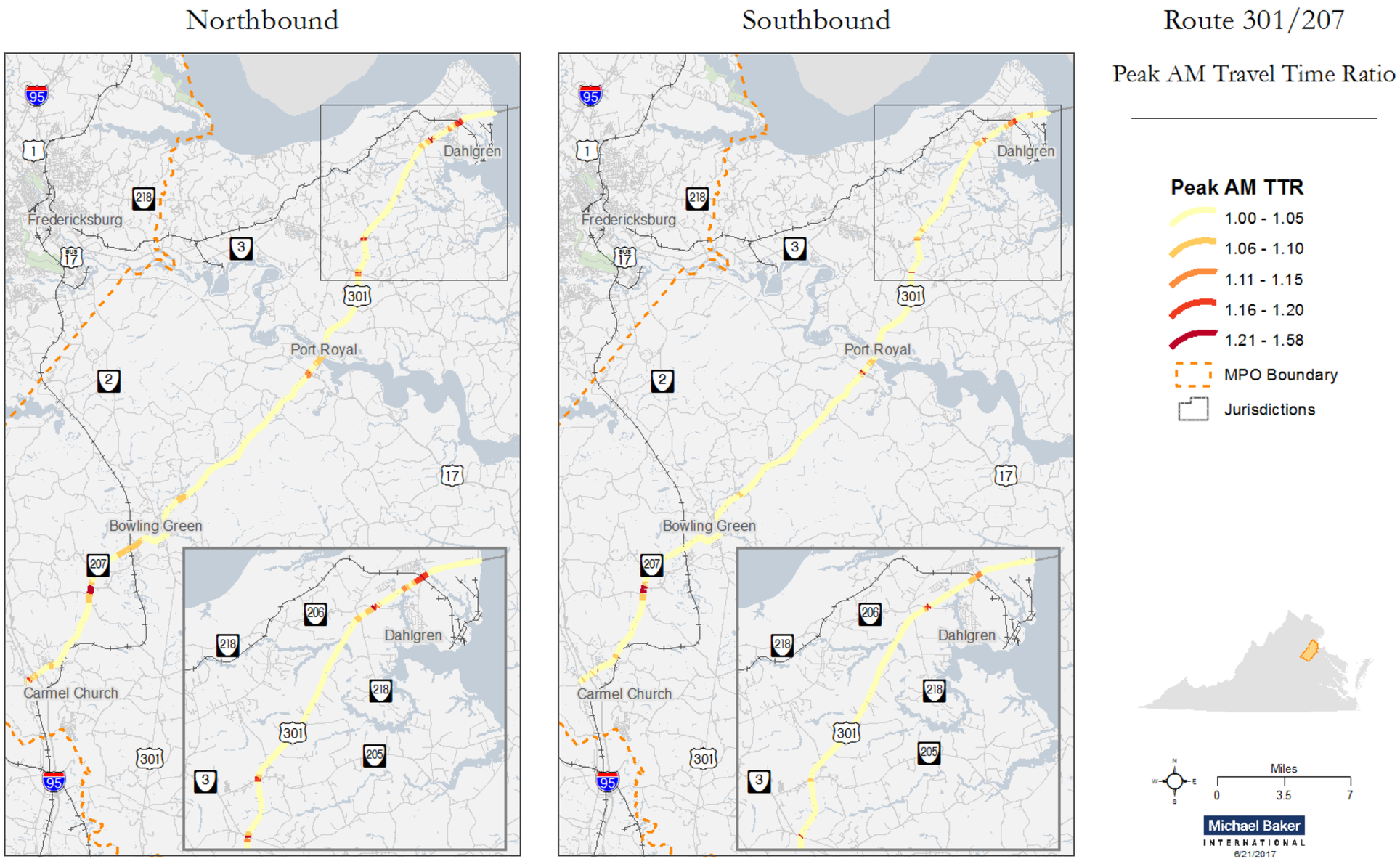
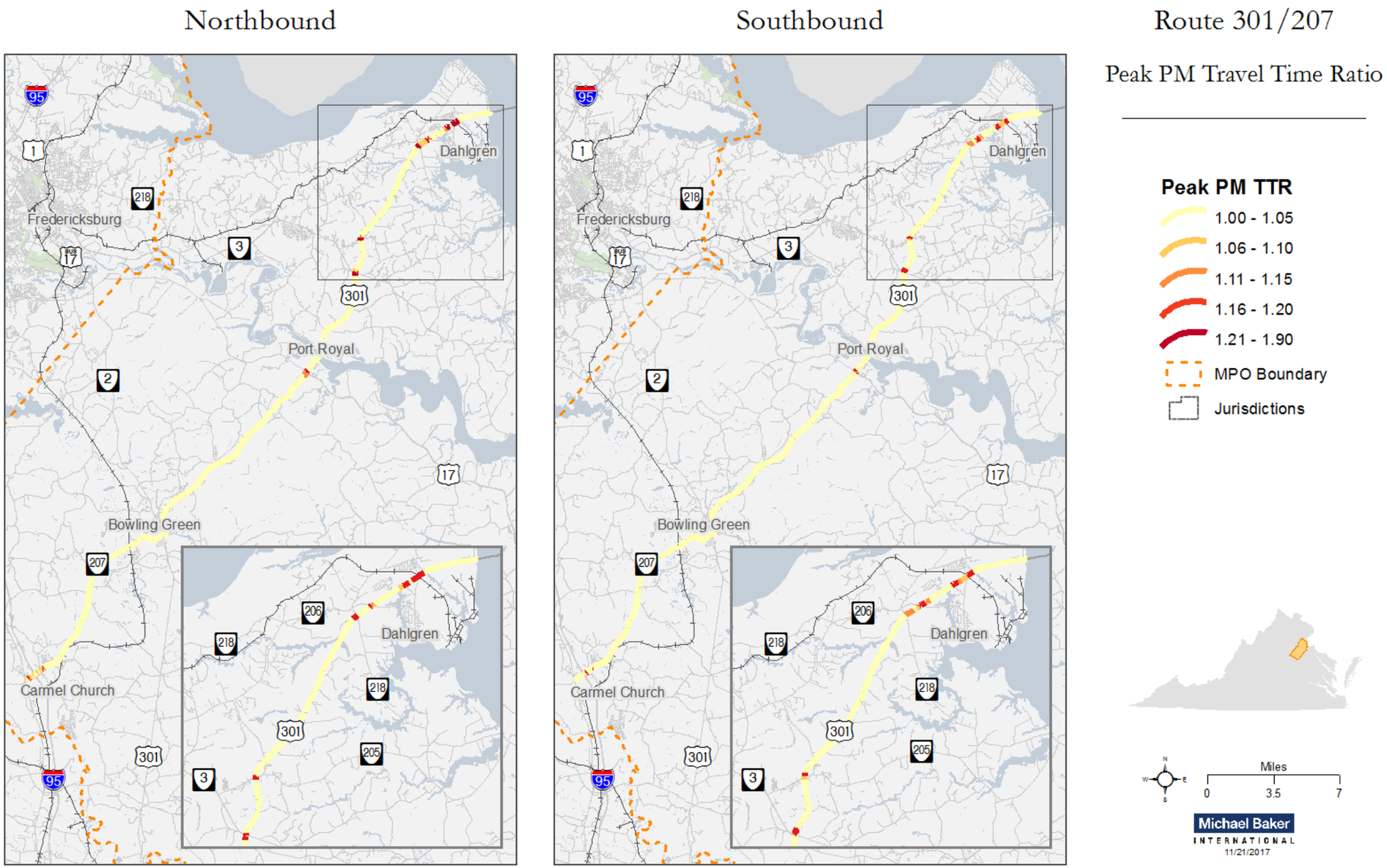


*Figure 12. Travel Time Ratio: PM*



# CHAPTER 3: FUTURE CONDITIONS

## 3.1 DEVELOPMENT OF GROWTH RATES

The US 301/Route 207 study corridor is likely to experience increased traffic volumes as the result of two large regional infrastructure changes. Widening of the Nice Bridge, a current bottleneck on US 301, will increase capacity on US 301/Route 207 and may make it a more attractive route for those traveling down the east coast. There are several major programmed construction projects along I-95 in the Fredericksburg area, including the extension of express lanes south to US 17, as well as the construction of the southbound Rappahannock River crossing (CD lanes) between Exits 133 and 130. Traffic impacts due to years of construction are expected to also cause diversion to the US 301/Route 207 corridor for travelers in this corridor. A review of historic traffic trends may not capture this future growth. Updated traffic growth rates for the US 301/Route 207 were collaboratively developed using previous studies, historic traffic counts, the regional travel demand model and stakeholder input.

### 3.1.1 HISTORICAL ANNUAL AVERAGE TRAFFIC VOLUME ESTIMATES AND TRAVEL PATTERNS

Historical average annual traffic volumes help establish a trend along the corridor and highlight places where traffic volume may increase. The study team used two sources to establish historic traffic volumes in the corridor, the VDOT historic traffic counts and the Governor Harry W. Nice Memorial Bridge Improvement Project Environmental Assessment / Draft Section 4(f) Evaluation. VDOT conducts traffic counts from sensors in or along streets and highways and other sources and compiles a blended two-way annual average daily traffic count. From this data, estimates of the number of vehicles that traveled each segment of road can be calculated. Daily vehicle miles traveled for specific groups of facilities and vehicle types are also calculated. Table 8 outlines these historic traffic volumes from 2007 to 2017.

Historic traffic counts show slightly increased overall traffic volumes on numerous segments in the study corridor between 2007 and 2017. The average annual growth rate along the corridor varies from 0.2% to 3%. Several segments experienced an overall decrease in traffic volumes and most segments experienced decreases in traffic volumes for most segments of the corridor between 2008 and 2013. This is due to the economic recession and a nationwide decrease in average annual daily traffic (AADT). Volumes began to regain their previous momentum as the economy recovered in 2013. As the 2008 economic was an unprecedented worldwide financial crisis it can be assumed that volume growth will grow at a higher rate than previously anticipated.

*Table 8. Historic Daily Two-Way VDOT Traffic Counts*

| Caroline County | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Segment** | **From** | **To** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **Average Annual Growth Rate** |
| VA 207 | US 1 Jefferson Davis Hwy | I-95 | 6,300 | 7,000 | 7,000 | 6,100 | 5,800 | 9,000 | 13,000 | 13,000 | 7,300 | 8,000 | 8,100 | 3% |
| | I-95 | Route 601 S, Penola Rd | 9,800 | 9,300 | 9,300 | 9,300 | 8,900 | 11,000 | 9,600 | 9,600 | 9,800 | 10,000 | 10,000 | 0.2% |
| | Route 601 S, Penola Rd | Route 722 Milford | 11,000 | 11,000 | 11,000 | 11,000 | 10,000 | 11,000 | 11,000 | 11,000 | 11,000 | 13,000 | 13,000 | 2% |
| | Route 722 Milford | Bus SR 207 | 12,000 | 11,000 | 11,000 | 12,000 | 11,000 | 8,200 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 0.0% |
| | Bus SR 207 | US 301 Richmond Tpke | 8,400 | 8,000 | 8,000 | 8,400 | 3,400 | 3,400 | 8,900 | 8,900 | 9,100 | 9,000 | 9,200 | 1% |
| US 301 | SR 207 | Bus US 301, Bus SR 207 Broaddus Ave | 11,000 | 10,000 | 10,000 | 9,800 | 11,000 | 9,600 | 11,000 | 11,000 | 11,000 | 9,800 | 10,000 | -1% |
| | Bus US 301, Bus SR 207 Broaddus Ave | NCL Bowling Green; 16-608 Lakewood Rd | 12,000 | 11,000 | 11,000 | 11,000 | 8,500 | 11,000 | 11,000 | 11,000 | 12,000 | 11,000 | 11,000 | -1% |
| | 16-608 Lakewood Rd | US 17 Tidewater Trail | 9,000 | 8,500 | 8,700 | 8,400 | 12,000 | 8,300 | 8,200 | 8,200 | 8,500 | 9,200 | 9,300 | 0.3% |
| | US 17 Tidewater Trail | SCL Port Royal | 15,000 | 14,000 | 14,000 | 12,000 | 12,000 | 12,000 | 13,000 | 13,000 | 13,000 | 14,000 | 15,000 | 0.0% |

| King George County | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Segment** | **From** | **To** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **Average Annual Growth Rate** |
| US 301 | Caroline County Line | Route 623 Jersey Rd | 13,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 13,000 | 13,000 | 13,000 | 14,000 | 14,000 | 1% |
| | Route 623 Jersey Rd | SR 3 Kings Hwy | 12,000 | 12,000 | 12,000 | 11,000 | 11,000 | 11,000 | 13,000 | 13,000 | 13,000 | 14,000 | 14,000 | 2% |
| | SR 3 Kings Hwy | SR 205 Ridge Rd | 14,000 | 13,000 | 13,000 | 12,000 | 12,000 | 12,000 | 14,000 | 14,000 | 14,000 | 14,000 | 14,000 | 0% |
| | SR 205 Ridge Rd | SR 218 Windsor Dr | 15,000 | 14,000 | 15,000 | 15,000 | 15,000 | 14,000 | 15,000 | 15,000 | 16,000 | 16,000 | 16,000 | 1% |
| | SR 218 Windsor Dr | SR 206 Dahlgren Rd | 21,000 | 19,000 | 20,000 | 19,000 | 19,000 | 19,000 | 22,000 | 22,000 | 23,000 | 21,000 | 21,000 | 0% |
| | SR 206 Dahlgren Rd | Maryland State Line | 20,000 | 19,000 | 19,000 | 23,000 | 24,000 | 23,000 | 25,000 | 25,000 | 26,000 | 26,000 | 26,000 | 3% |

The *Governor Harry W. Nice Memorial Bridge Improvement Project Environmental Assessment / Draft Section 4(f) Evaluation* is the environmental study conducted for the widening of Nice Bridge. As part of the existing conditions analysis the study examined historic and existing and expected future traffic volumes to measure impacts in association with the widening project. Since the corridor serves as an alternative route to I-95, the travel demand volume analysis focuses not only on weekday volumes but also weekend and seasonal volumes. This study also estimated 2030 average daily traffic conditions for a no-build scenario. Table 9 shows that travel volume across the bridge is expected to more than double from 2006 levels.

*Table 9. Average Daily Traffic Volumes*

| Average Summer Weekend Day Daily Traffic Volumes at the Nice Bridge | | | | | | |
|---|---|---|---|---|---|---|
| | 2006 (June through August) | | | 2030 | | |
| Day | Northbound | Southbound | Total | Northbound | Southbound | Total |
| Saturday | 10,024 | 10,776 | 20,800 | 20,528 | 22,072 | 42,600 |
| Sunday | 11,674 | 8,426 | 20,100 | 23,870 | 17,230 | 41,100 |

| Average Weekday at the Nice Bridge | | | | | |
|---|---|---|---|---|---|
| 2004 (October) | | | 2030 | | |
| 8,670 | 8,430 | 17,100 | 17,745 | 17,255 | 35,000 |

*Source: Governor Harry W. Nice Memorial Bridge Improvement Project Environmental Assessment / Draft Section 4(f) Evaluation*

The environmental assessment for the widening of the Nice Bridge shows a higher annual percentage growth than the regional travel demand volumes . Weekday and weekend travel volumes both are expected to grow by four percent annually between October 2004 and 2030. This is higher than growth rates observed in previous VDOT historic two-way traffic counts but reflects the assumption that more travelers will choose the US 301/Route 207 corridor to bypass the construction associated with the extension of the I-95 HOT lanes and connect to I-95 further south. Due to the nature of the corridor as a connecting route to points south and connection to I-95 interchange it is assumed that much of the traffic will travel through the study corridor.

### 3.1.2 FREDERICKSBURG AREA TRAVEL DEMAND MODEL

The Fredericksburg Area Travel Demand Model forecasts traffic volumes and patterns for the Fredericksburg area , including both Caroline and King George counties. All roadway segments within the study area are forecasted to experience traffic volume increases between 2015 and 2045. Table 10 lists the Fredericksburg Area Travel Demand Model traffic volumes and growth rate by roadway segment. The average annual growth rate for the entire corridor is 1.72 during the AM peak and 1.93 percent during PM peak hour . The highest percentage of annual volume growth is projected to occur between Potomac River and Route 3 and the lowest average annual percentage growth between I-95 and Route 2 .

*Table 10. Travel Demand Model Traffic Volumes and Growth Rates*

| Direction | Location | | AM Peak Volume | | PM Peak Volume | | Growth Rates | |
|---|---|---|---|---|---|---|---|---|
| | From | To | 2015 | 2045 | 2015 | 2045 | AM | PM |
| Northbound | I-95 | Route 2 | 558 | 740 | 956 | 1,189 | 1.09% | 0.81% |
| | Route 2 | US 17 | 747 | 1,150 | 974 | 1,487 | 1.80% | 1.76% |
| | US 17 | Route 3 | 1,040 | 1,595 | 1,177 | 1,942 | 1.78% | 2.17% |
| | Route 3 | Potomac River | 693 | 1,144 | 764 | 1,174 | 2.17% | 1.79% |
| Southbound | Potomac River | Route 3 | 617 | 974 | 840 | 1,784 | 1.93% | 3.75% |
| | Route 3 | US 17 | 818 | 1,350 | 1,382 | 2,200 | 2.17% | 1.97% |
| | US 17 | Route 2 | 687 | 1,066 | 1,008 | 1,623 | 1.84% | 2.03% |
| | Route 2 | I-95 | 791 | 997 | 733 | 990 | 0.87% | 1.17% |

*Source: Fredericksburg Area Travel Demand Model, VDOT*

### 3.1.3 SOCIO-ECONOMIC DATA

This corridor plan derived estimated changes in population, households, employment and retail for the study area from the Fredericksburg Area Travel Demand Model. Employment and population estimates are for the traffic analysis zones (TAZs) along the study corridor as shown in Figure 13 and Figure 14. Table 11 summarizes the 2015 and 2040 population, household, employment and retail data and 2040 estimates from the Fredericksburg area travel demand model.

*Table 11. Socio-Economic Data for Study Corridor TAZs*

| Jurisdiction | 2015 | | | | 2040 | | | | % Change (2015-2040) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Population | Households | Employment | Retail | Population | Households | Employment | Retail | Population | Households | Employment | Retail |
| Caroline County TAZs | 6,386 | 2,406 | 6,035 | 2,413 | 11,218 | 4,014 | 6,663 | 2,725 | 76% | 67% | 10% | 13% |
| King George County TAZs | 5,275 | 1,985 | 9,861 | 2,350 | 14,040 | 4,517 | 13,602 | 3,554 | 166% | 128% | 38% | 51% |
| **Total** | 11,661 | 4,391 | 15,896 | 4,763 | 25,258 | 8,531 | 20,265 | 6,279 | 117% | 94% | 27% | 32% |

*Source: Fredericksburg Area Travel Demand Model, VDOT*

The socio-economic data from the Fredericksburg area travel demand model shows an anticipated overall percent change for population, households, employment and retail in the study corridor TAZs. The study area TAZs in Caroline County are expected to see more modest growth in the socio-economic categories ranging from a 10 percent increase in employment to a 76 percent increase in population. Study area TAZs in King George County are expected to see greater growth, ranging from a 38 percent increase in retail to a 166 percent increase in population. In King George County the greatest population growth is expected to occur in TAZs between Naval Support Station Dahlgren and Route 3. The greatest percentage of employment growth in King George County is forecasted to occur in TAZs near the Route 3/US 301 intersection. In Caroline County the area with the greatest expected population growth is the Carmel Church Analysis Area. The area with the highest expected employment growth is along US 17 at the northern county line. This anticipated increase in population, households, employment and retail support the expectation of increased in traffic volumes.

### 3.1.4 ANNUALIZED BACKGROUND GROWTH RATE

Both the regional travel demand model and VDOT historic growth rates establish a projected increase in traffic volumes across the study corridor. As previously mentioned, these historic traffic volume trends may underestimate the future volume growth due to the increased capacity of the Gov. Nice Bridge and diverted traffic from I-95. After analyzing these detailed traffic counts from the environmental assessment, an annualized background growth rate of four percent was established for use in this study. This is consistent with , which was the annualized growth rate observed in the Nice Bridge environmental assessment. Stakeholders and VDOT historic traffic volumes concurred with this annualized background growth rate.

## 3.2 PROJECTED FUTURE GROWTH (2040) BUILD TRAFFIC VOLUMES

### 3.2.1 FUTURE LAND USE AND APPROVED DEVELOPMENT

Future land use was based on the socio-economic data in the travel demand model and stakeholder input. The study team looked at the projected population, household, retail and employment growth in the regional travel demand model between 2015 and 2045 in TAZs within the study corridor. The study team used percentage growth in each of the socio-economic categories to identify areas of population and employment growth. Stakeholders reviewed these findings to assess the accuracy and provided feedback to the study team to adjust assumed growth in certain TAZs. These adjusted socio-economic datasets were used to estimate future traffic volumes in the study corridor.

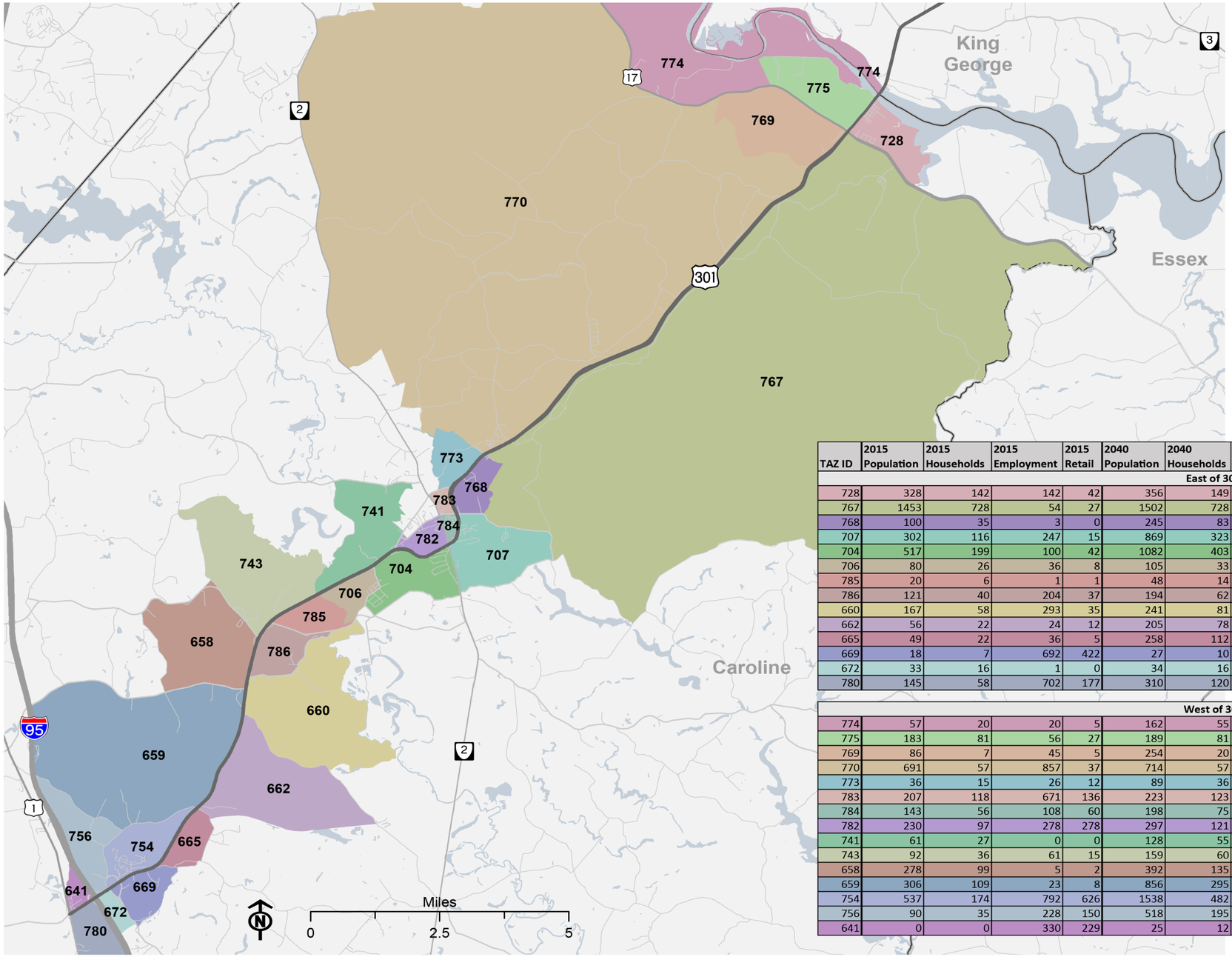
### 3.2.2 TRIP GENERATION AND DISTRIBUTION

The study team evaluated the TAZs in the areas of King George County that have a direct effect on the turning movement counts used for the existing and future analyses. The land use forecasts for the TAZs was translated into land uses using the Institute of Transportation Engineers Trip Generation Manual. Using the equations for the various land uses, specific AM and PM peak trips were calculated for each TAZ. These trips were added to the calculated background growth for the corridor and then used in the year 2040 analyses.

The trips generated from the future land use and approved development were distributed using multiple methods and sources of information. This operation was only completed for the portions of the study area with turning movement counts and where the study team analyzed the TAZ data. For areas with multiple uses and potential internal interaction , the National Cooperative Highway Research Program, Report 684 methodology and spreadsheet was used to estimate the internal capture percentages. This methodology approximates the interaction of trips between different land use types in the same area that may result in a single person making multiple stops within an area rather than each trip being generated by a separate person.

A review of the regional travel demand model provided the initial distribution of traffic from the TAZs onto US 301 / Route 207 corridor. Traffic was then distributed at the study intersections based on the existing turning movement counts. With consideration for location, potential growth areas and infrastructure off the US 301 / Route 207, engineering judgement was used to make reasonable adjustments to the trip distribution.

*Figure 13. Caroline County TAZ Future Growth*



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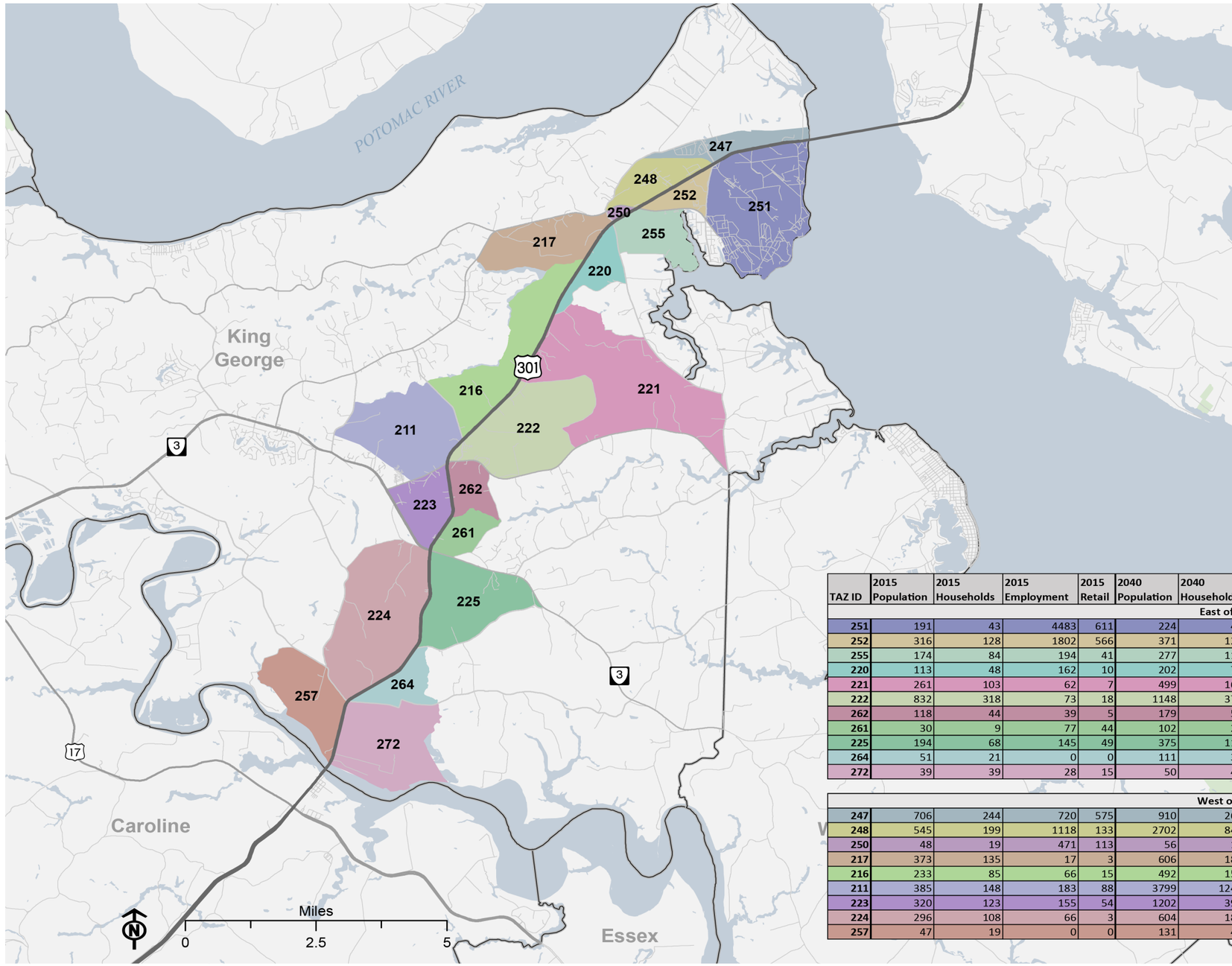
| TAZ ID | 2015 Population | 2015 Households | 2015 Employment | 2015 Retail | 2040 Population | 2040 Households | 2040 Employment | 2040 Retail | 2040-2015 Population | 2040-2015 Households | 2040-2015 Employment | 2040-2015 Retail |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **East of 301** | | | | | | | | | | | | |
| 728 | 328 | 142 | 142 | 42 | 356 | 149 | 148 | 44 | 28 | 7 | 6 | 2 |
| 767 | 1453 | 728 | 54 | 27 | 1502 | 728 | 54 | 27 | 49 | 0 | 0 | 0 |
| 768 | 100 | 35 | 3 | 0 | 245 | 83 | 50 | 10 | 145 | 48 | 47 | 10 |
| 707 | 302 | 116 | 247 | 15 | 869 | 323 | 247 | 15 | 567 | 207 | 0 | 0 |
| 704 | 517 | 199 | 100 | 42 | 1082 | 403 | 118 | 56 | 565 | 204 | 18 | 14 |
| 706 | 80 | 26 | 36 | 8 | 105 | 33 | 38 | 8 | 25 | 7 | 2 | 0 |
| 785 | 20 | 6 | 1 | 1 | 48 | 14 | 1 | 1 | 28 | 8 | 0 | 0 |
| 786 | 121 | 40 | 204 | 37 | 194 | 62 | 204 | 37 | 73 | 22 | 0 | 0 |
| 660 | 167 | 58 | 293 | 35 | 241 | 81 | 293 | 35 | 74 | 23 | 0 | 0 |
| 662 | 56 | 22 | 24 | 12 | 205 | 78 | 26 | 12 | 149 | 56 | 2 | 0 |
| 665 | 49 | 22 | 36 | 5 | 258 | 112 | 44 | 5 | 209 | 90 | 8 | 0 |
| 669 | 18 | 7 | 692 | 422 | 27 | 10 | 853 | 516 | 9 | 3 | 161 | 94 |
| 672 | 33 | 16 | 1 | 0 | 34 | 16 | 46 | 23 | 1 | 0 | 45 | 23 |
| 780 | 145 | 58 | 702 | 177 | 310 | 120 | 777 | 192 | 165 | 62 | 75 | 15 |
| **West of 301** | | | | | | | | | | | | |
| 774 | 57 | 20 | 20 | 5 | 162 | 55 | 139 | 43 | 105 | 35 | 119 | 38 |
| 775 | 183 | 81 | 56 | 27 | 189 | 81 | 56 | 27 | 6 | 0 | 0 | 0 |
| 769 | 86 | 7 | 45 | 5 | 254 | 20 | 58 | 6 | 168 | 13 | 13 | 1 |
| 770 | 691 | 57 | 857 | 37 | 714 | 57 | 857 | 37 | 23 | 0 | 0 | 0 |
| 773 | 36 | 15 | 26 | 12 | 89 | 36 | 56 | 40 | 53 | 21 | 30 | 28 |
| 783 | 207 | 118 | 671 | 136 | 223 | 123 | 673 | 139 | 16 | 5 | 2 | 3 |
| 784 | 143 | 56 | 108 | 60 | 198 | 75 | 111 | 62 | 55 | 19 | 3 | 2 |
| 782 | 230 | 97 | 278 | 278 | 297 | 121 | 278 | 278 | 67 | 24 | 0 | 0 |
| 741 | 61 | 27 | 0 | 0 | 128 | 55 | 0 | 0 | 67 | 28 | 0 | 0 |
| 743 | 92 | 36 | 61 | 15 | 159 | 60 | 61 | 15 | 67 | 24 | 0 | 0 |
| 658 | 278 | 99 | 5 | 2 | 392 | 135 | 5 | 2 | 114 | 36 | 0 | 0 |
| 659 | 306 | 109 | 23 | 8 | 856 | 295 | 23 | 8 | 550 | 186 | 0 | 0 |
| 754 | 537 | 174 | 792 | 626 | 1538 | 482 | 861 | 683 | 1001 | 308 | 69 | 57 |
| 756 | 90 | 35 | 228 | 150 | 518 | 195 | 256 | 175 | 428 | 160 | 28 | 25 |
| 641 | 0 | 0 | 330 | 229 | 25 | 12 | 330 | 229 | 25 | 12 | 0 | 0 |

*Figure 14. King George County TAZ Future Growth*



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| TAZ ID | 2015 Population | 2015 Households | 2015 Employment | 2015 Retail | 2040 Population | 2040 Households | 2040 Employment | 2040 Retail | 2040-2015 Population | 2040-2015 Households | 2040-2015 Employment | 2040-2015 Retail |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **East of 301** | | | | | | | | | | | | |
| **251** | 191 | 43 | 4483 | 611 | 224 | 43 | 4486 | 613 | 33 | 0 | 3 | 2 |
| **252** | 316 | 128 | 1802 | 566 | 371 | 128 | 2772 | 799 | 55 | 0 | 970 | 233 |
| **255** | 174 | 84 | 194 | 41 | 277 | 114 | 261 | 83 | 103 | 30 | 67 | 42 |
| **220** | 113 | 48 | 162 | 10 | 202 | 73 | 162 | 10 | 89 | 25 | 0 | 0 |
| **221** | 261 | 103 | 62 | 7 | 499 | 168 | 63 | 8 | 238 | 65 | 1 | 1 |
| **222** | 832 | 318 | 73 | 18 | 1148 | 374 | 79 | 22 | 316 | 56 | 6 | 4 |
| **262** | 118 | 44 | 39 | 5 | 179 | 57 | 52 | 13 | 61 | 13 | 13 | 8 |
| **261** | 30 | 9 | 77 | 44 | 102 | 26 | 90 | 52 | 72 | 17 | 13 | 8 |
| **225** | 194 | 68 | 145 | 49 | 375 | 112 | 203 | 60 | 181 | 44 | 58 | 11 |
| **264** | 51 | 21 | 0 | 0 | 111 | 39 | 0 | 0 | 60 | 18 | 0 | 0 |
| **272** | 39 | 39 | 28 | 15 | 50 | 43 | 28 | 15 | 11 | 4 | 0 | 0 |
| **West of 301** | | | | | | | | | | | | |
| **247** | 706 | 244 | 720 | 575 | 910 | 268 | 879 | 679 | 204 | 24 | 159 | 104 |
| **248** | 545 | 199 | 1118 | 133 | 2702 | 841 | 1615 | 454 | 2157 | 642 | 497 | 321 |
| **250** | 48 | 19 | 471 | 113 | 56 | 19 | 483 | 121 | 8 | 0 | 12 | 8 |
| **217** | 373 | 135 | 17 | 3 | 606 | 187 | 27 | 9 | 233 | 52 | 10 | 6 |
| **216** | 233 | 85 | 66 | 15 | 492 | 153 | 88 | 26 | 259 | 68 | 22 | 11 |
| **211** | 385 | 148 | 183 | 88 | 3799 | 1245 | 248 | 115 | 3414 | 1097 | 65 | 27 |
| **223** | 320 | 123 | 155 | 54 | 1202 | 394 | 1994 | 468 | 882 | 271 | 1839 | 414 |
| **224** | 296 | 108 | 66 | 3 | 604 | 188 | 72 | 7 | 308 | 80 | 6 | 4 |
| **257** | 47 | 19 | 0 | 0 | 131 | 45 | 0 | 0 | 84 | 26 | 0 | 0 |

### 3.2.3 FUTURE (2040) BUILD TRAFFIC VOLUMES

Traffic volumes for the year 2040 were developed based on the trip generation discussed in the previous section and the background growth of four percent for the thru traffic along the US 301 / Route 207 corridor. The background growth is attributed to the expansion of the Nice Bridge and travelers re-routing from I-95. This makes the US 301 / Route 207 not just a source of local growth but regional growth as well. The projected AADT for 2040 at various point within the study area is listed in Table 12. These estimations are based on a 4% annual growth of ADTs published in 2017 VDOT's traffic counts.

*Table 12. Future (2040) Build Traffic Volumes*

| Segment | From | To | 2017 | 2040 |
|---|---|---|---|---|
| VA 207 | US 1 Jefferson Davis Hwy | I-95 | 8,100 | 15,900 |
| | I-95 | Route 601 S, Penola Rd | 10,000 | 19,600 |
| | Route 601 S, Penola Rd | Route 722 Milford | 13,000 | 25,500 |
| | Route 722 Milford | Bus SR 207 | 12,000 | 23,500 |
| | Bus SR 207 | US 301 Richmond Tpke | 9,200 | 18,000 |
| US 301 | SR 207 | Bus US 301, Bus SR 207 Broaddus Ave | 10,000 | 19,600 |
| | Bus US 301, Bus SR 207 Broaddus Ave | NCL Bowling Green; Route 608 Lakewood Rd | 11,000 | 21,600 |
| | Route 608 Lakewood Rd | US 17 Tidewater Trail | 9,300 | 18,200 |
| | US 17 Tidewater Trail | SCL Port Royal | 15,000 | 29,400 |
| Bus US 301, VA 2 | SCL Port Royal | NCL Port Royal | 15,000 | 29,400 |
| | NCL Port Royal | King George County Line | 15,000 | 29,400 |
| US 301 | Caroline County Line | Route 623 Jersey Rd | 14,000 | 27,400 |
| | Route 623 Jersey Rd | SR 3 Kings Hwy | 14,000 | 27,400 |
| | SR 3 Kings Hwy | SR 205 Ridge Rd | 14,000 | 27,400 |
| | SR 205 Ridge Rd | SR 218 Windsor Dr | 16,000 | 31,400 |
| | SR 218 Windsor Dr | SR 206 Dahlgren Rd | 21,000 | 41,200 |
| | SR 206 Dahlgren Rd | Maryland State Line | 26,000 | 51,000 |

The future turning movement volumes are outlined in Appendix F. Because of the development, it was assumed that not all the new traffic would enter or exit US 301 / Route 207 at the study intersections. This is a concern particularly in areas of heavy growth or with considerable distance between signalized intersections. Therefore, as a part of the no-build condition, it was assumed some traffic would enter or exit US 301 / Route 207 at either un-signalized intersections that were not originally included as study intersections.

For more information on 2040 Intersection Operations, see Appendix G.

# CHAPTER 4: FUTURE OPERATIONS

## 4.1 FUTURE NO-BUILD TRAFFIC OPERATIONS AND DEFICIENCIES

The following section details the deficiencies of the US 301 / Route 207 corridor under the 2040 No-Build conditions. The locations discussed will be those in King George County which reflected the highest volumes in the overall study corridor, and thus where traffic counts were conducted. Traffic counts were not taken at the intersections within Caroline County and therefore will not be discussed in detail in this section. The recommendations for Caroline County outlined in Part 4 of this document are based on the existing deficiencies, anticipated regional growth and making necessary improvements as development occurs based on general concepts and principals presented in the recommendations. Table 13 outlines 2040 no-build intersection LOS.

**Route 3 with US 301**

The intersection of Route 3 (Kings Hwy) with US 301 (James Madison Pkwy) is an intersection of two regionally-significant routes. As such, it is anticipated that traffic pressure on the intersection will increase considerably, particularly due to left-turning traffic from all four approaches. With the increase in turning traffic will come degradation of service for the through movements along both US 301 and Route 3. Because of this, the intersection is expected to operate at a LOS F during both the AM and PM peak hours.

**Route 205 with US 301**

It is anticipated that the intersection of Route 205 (Ridge Road) with US 301 (James Madison Parkway) will experience significant growth in volume due to development in the surrounding areas. As a result, this will degrade the operations of the intersection, particularly to and from Route 205. The anticipated 2040 intersection LOS for the AM peak hour is D and the PM peak hour is F. The poorest performing movements are generally the left turns and eastbound and westbound through movements.

**Route 218 with US 301**

The intersection of Rte. 218 (Windsor Drive) and US 301 (James Madison Parkway) is not expected to see the same impacts from growth in surrounding areas as other intersections in the area. However, the intersection will still be impacted by the regional growth that will exacerbate current deficiencies at the intersection. The intersection is expected to operate at LOS B during the 2040 AM peak hour and LOS D during the PM peak hour. During the PM peak hour, the Rte. 218 movements and northbound left turn all operate at LOS D.

**Route 206 with US 301**

Route 206 (Dahlgren Rd.) and US 301 (James Madison Parkway) is expected to see modest traffic increases associated with development in the area and the nearby naval facility. It is expected that the primary point of access for the naval facility will remain the intersection of Route 614 with US 301. With the modest increase in development traffic and the increase in regional traffic, the intersection will still see a degradation of LOS. The intersection is anticipated to operate at LOS E during the AM peak hour and LOS F during the PM peak hour. The southbound through movement and all westbound movements are forecasted to see significant delays during the PM peak hour, ranging from 86 seconds to 360 seconds.

**SR 1101 with US 301**

The un-signalized intersection of SR 1101 (Danube Drive) with US 301 (James Madison Parkway) was assumed as the access point for development east of US 301. Although there will be an increase in side street traffic due to development, the through volume on US 301 will be the limiting factor for operations at this intersection. The 2040 AM peak hour LOS is A while the PM peak hour LOS is B. These results are slightly skewed by the amount of through traffic passing through the intersection. The eastbound approach experiences 900 seconds of delay during the future PM peak due to the lack of gaps for left-turning traffic.

**University Drive with US 301**

The existing levels of service at the intersection of University Drive at US 301 (James Madison Pkwy) are currently at an acceptable level. However, it is expected that this intersection will become a focal point of growth in the future. The LOS for the future AM peak period is projected to be acceptable at C. The PM peak will see a significant reduction in operational performance at a LOS F. The southbound through, northbound left, westbound left and eastbound right are all expected to experience delays of at least 220 seconds and up to 300 seconds.

**Market Center with US 301**

Market Center at US 301 (James Madison Parkway) is currently an un-signalized intersection. Based on the anticipated volume in the year 2040, it was assumed this intersection would be a signalized intersection under the No-Build condition. The operations are anticipated to be like those of the intersection at University Drive, with the LOS B and F for the AM and PM peaks, respectively. Although the volumes are anticipated to be lower on the side streets, the southbound through movement results in a delay of over 230 seconds.

**Route 614 with US 301**

Route 614 (Owens Drive) at US 301 is the final signalized intersection before the Nice Bridge and is also the primary access to US 301 for Naval Support Facility Dahlgren. It is anticipated that growth will occur on the western portion US 301 along Owens Dr. as well as at the Navy facility. Currently, the intersection's PM peak hour performance is degrading and will only continue to do so with growth. The projected 2040 No-Build LOS are D and F for the AM and PM peaks, respectively. While the delays are generally comparable for most approaches in the AM peak, the PM peak has a few movements that stick out. Particularly, the westbound through and left, northbound left and southbound through movements all see delays more than 200 seconds.

*Table 13. 2040 No-Build Intersection LOS*

| Intersection | LOS AM | LOS PM |
|---|---|---|
| Route 3 and US 301 | F | F |
| Route 205 and US 301 | D | F |
| Route 218 and US 301 | B | D |
| Route 206 and US 301 | E | F |
| SR 1101 and US 301 | A | B |
| University Drive and US 301 | C | F |
| Market Center and US 301 | B | F |
| Route 614 and US 301 | D | F |

## 4.2 RECOMMENDED IMPROVEMENTS ANALYSES

Analyses of the recommended improvements were conducted to evaluate the projected future traffic demand discussed in Chapter 3 of this document. Chapter 5 details the recommended improvements and operational and safety benefits of the recommendations. Recommendations were initially reviewed using VDOT's Junction Screening Tool (VJuST) to determine which innovative intersections may be useful in facilitating the through traffic along US 301 while also providing efficient access along the corridor.

## 4.3 RESULTS OF OPERATIONAL ANALYSES FOR RECOMMENDED IMPROVEMENTS

Capacity analyses for the recommended improvements at signalized and un-signalized intersection were performed using Synchro in accordance with VDOT Traffic Operations and Safety Manual (TOSAM). As mentioned in section 4.1 detailed operations analysis was only conducted at intersections where traffic counts were collected. Recommendations consisted mainly of alternative intersections developed using VJuST. Some of the alternative intersections are multiple intersections that function together as one system. Synchro does not currently have a method to analyze alternative intersections; however, Chapter 23 of the Highway Capacity Manual (HCM) outlines methodology for calculating delays and LOS by using travel time and the appropriate delay(s) through the alternative intersections. The HCM method provides a better way of comparing alternative intersections with the traditional intersection configurations that occupy the corridor today.

Table 14 shows the LOS and delay values of typical signalized and un-signalized intersection and values used as part of the HCM method. Many of the 2040 no-build intersections performed between an LOS D and F in the AM and PM. With the recommended improvements, all intersections saw an increase in LOS. In the AM, LOS ranged between B and D with more than 20 percent improvement in delay, and in the PM, LOS ranged between C and E with more than 60% improvement in delay. Table 15 summarizes LOS for the intersections based on the recommended improvements that are detailed in Chapter 5 of this document.

*Table 14. LOS Delay Values for Signalized and Unsignalized Intersections, Based on HCM Method*

| LOS | Standard Signalized Intersection LOS Criteria per HCM | Standard Unsignalized Intersection LOS Criteria per HCM | LOS Criteria based on HCM Chapter 23 for Alternative Intersections |
|---|---|---|---|
| | Delay (s) | Delay (s) | Delay or Estimated Travel Time (s) |
| A | ≤10 | ≤10 | ≤10 |
| B | 10-20 | 10-15 | 10-20 |
| C | 20-35 | 15-25 | 20-35 |
| D | 35-55 | 25-35 | 35-55 |
| E | 55-80 | 35-50 | 55-80 |
| F | >80 | >50 | >80 |

**If v/c is greater than 1, movement or intersection is LOS F*

*Table 15. Recommended Improvement Analysis Intersection LOS*

| Intersection | LOS AM | LOS PM |
|---|---|---|
| Route 3 and US 301 (Median U-Turn) | B | C |
| Route 3 and US 301 (Quadrant) | B | B |
| Route 205 and US 301 (Median U-Turn) | D | D |
| Route 218 and US 301 (R-Cut) | A | B |
| Route 206 and US 301 (Median U-Turn) | E | D |
| Route 206 and US 301 (Quadrant) | D | E |
| SR 1101 and US 301 (R-Cut) | A | A |
| University Drive and US 301 (R-Cut) | C | E |
| Market Center and US 301 (R-Cut) | A | D |
| Route 614 and US 301 (Quad) | B | E |

# CHAPTER 5: RECOMMENDATIONS

## US 301/ROUTE 207 CORRIDOR RECOMMENDATIONS

Future traffic volumes and operating conditions show that US 301 / Route 207 corridor needs improvements to ensure capacity and safety within the corridor. While some of these improvements may be driven by development, many improvements will be driven by regional growth and the need to maintain capacity of the corridor. Additional improvements such as crossover closings may be implemented immediately to increase safety through access management. Based on capacity analyses of current and future conditions and a review of current corridor infrastructure, a "toolbox" of improvements were developed for the US 301 / Route 207 study area. These include:

- Remove existing crossover (based on inadequate spacing/grade/etc.)
- Upgrade existing crossover to meet VDOT standards.
- Convert existing crossover to directional median to allow only certain movements.
- Install alternative intersection concepts.
- Consolidate existing access points based on VDOT access management standards.

A primary focus for this study was the existing traditional signalized intersections. As many of these tradition intersections are reaching their operational limits, there is a need for new options. It is not intended for a conventional signalized intersection to be a traffic control device for this corridor. Instead alternative intersections and access management techniques will be evaluated for any future project and development. Below is a list of alternative intersection designs that are included in the VDOT Arterial Preservation Plan toolbox that were evaluated as potential recommendations. Some of the alternative designs were not suitable for recommendation due to the location traffic volumes, concept's principles, associated costs and/or Right-of-Way limitations. The concepts listed below were evaluated using VDOT's Junction Screening Tool (VJuST) to screen individual concepts at every location to determine the most effective options for analysis and recommendation.

- Median U-turn intersection (MUT)
- Restricted crossing U-turn intersection (RCUT)
- Continuous green T (CGT)
- Quadrant road (QR)
- Roundabout
- Displaced left turn (DLT)
- Grade separation
- Single point urban interchange (SPUI)
- Diverging diamond interchange (DDI)

Recommendations were formulated by analyzing the future volumes from both planned and potential developments along the study corridor. However, corridor AADT, thru growth, crash history, and future development were used to develop recommendations. Project stakeholders and the public were engaged through the project process to identify the most preferred recommendations. The following reflects a written description of the corridor recommendations for intersections only.

**Graphical displays of all recommendations are available in Appendix H.**

***Intersection #1: US 1 with Route 207***

*No recommendation for this intersection*

***Intersection #2: Welcome Way Drive with Route 207***

*No recommendation for this intersection.*

***Intersection #3: I-95 Southbound Ramp with Route 207***

*I-95 interchange with Route 207 requires further study.*

***Intersection #4: I-95 Northbound Ramp with Route 207***

***Short-term:*** *Short term solutions include modifying the northbound I-95 off ramp to include dedicated left-turn lanes with a shared right-turn lane. Extending the southbound Route 207 right right-turn lane through the NB ramp intersection. Long-term: I-95 interchange with Route 207 requires further study.*

***Intersection #5:*** *Carmel Church Loop with Route 207*

*No recommendation for this intersection.*

***Intersection #6:*** *Belmont Boulevard with Route 207*

*Reconfigure the intersection to a Continuous Green-T (CGT) intersection to accommodate left-turning vehicles from eastbound Belmont Blvd*

- The westbound lanes of Route 207 between Belmont Boulevard and Enterprise Parkway are experiencing rapid residential and commercial growth that will require efficient traffic movements onto Route 207.
- The distance between Belmont Boulevard and Enterprise Parkway does not permit a traffic signal at Belmont Boulevard due to VDOT Design Stands. A CGT can provide safe movements onto Route 207 without the use of a traffic signal.

***Intersection #7: Enterprise Parkway with Route 207***

Reconfigure the intersection to a Continuous Green-T (CGT) intersection to accommodate left-turning vehicles from westbound Enterprise Pkwy

- The grade difference between northbound and southbound Route 207 lanes do not meet VDOT Design Standards and heavy commercial traffic make for longer traffic signal clearance times and less safe movements onto southbound Route 207
- The CGT provides an acceleration lane for commercial traffic on level terrain for easier movements and merging onto Rte. 207. Removal of the southbound traffic signal phase eliminates delay for southbound Route 207 traffic and decreases delay time of the intersection.

***Intersection #8: Dry Bridge Road with Route 207***

*Re-align Dry Bridge Road and relocate intersection north of the existing intersection. Eliminate the existing intersection with Route 207.*

- The existing intersection does not meet VDOT Road Design Manual spacing standards with its proximity to Enterprise Parkway. Additionally, the alignment and horizontal curves of Dry Bridge Road does not provide safe access onto Route 207.
- Straightening and relocating the intersection north of existing intersection provides safer access onto Route 207.

***Intersection #9: Moncure Drive with Route 207***

*Lengthen all existing turn lanes on Route 207*

- The existing turn lanes do not meet the VDOT Road Design Manual's minimum standard for turn lane storage and taper lengths.

***Intersection #10: Penola Road with Route 207***

*Lengthen all existing turn lanes on Route 207*

- The existing turn lanes do not meet the VDOT Road Design Manual's minimum standard for turn lane storage and taper lengths.

***Intersection #11: Golansville Road with Route 207***

*No recommendation for this intersection.*

***Intersection #12: Devils 3 Jump Road with Route 207***

*No recommendation for this intersection.*

***Intersection #13: Ladysmith Road with Route 207***

*Lengthen all existing turn lanes on Route 207.*

- The existing turn lanes do not meet the VDOT Road Design Manual's minimum standard for turn lane storage and taper lengths.

***Intersection #14: Nelson Hill Road with Route207***

*Lengthen all existing turn lanes on Route 207*

- The existing turn lanes do not meet the VDOT Road Design Manual's minimum standard for turn lane storage and taper lengths.

***Intersection #15: Colonial Road with Route 207***

*Lengthen all existing turn lanes on Route 207*

- The existing turn lanes do not meet the VDOT Road Design Manual's minimum standard for turn lane storage and taper lengths

***Intersection #16: W Broaddus Avenue with Route 207***

*The intersection should be evaluated further as development occurs within the Town of Bowling Green.*

***Intersection #17: Route 2 Ramp with US 301***

*Reconfigure the intersection to a Continuous Green-T (CGT) intersection to accommodate left-turning vehicles from east-bound Route 2 Ramp*

- The Town of Bowling Green has two intersections directly on US 301, Chase Street and Courthouse Lane, that do not meet spacing standards and has a significant history of crashes
- The CGT provides safe and efficient movements, thus encouraging traffic to utilize Route 2 ramp due to reconfigure intersections at Chase Street and Courthouse Lane

***Intersection #18: Chase Street with US 301***

Chase Street and Courthouse Lane do not meet VDOT Road Design Manual spacing standards and have a significant history of crashes. Westbound Chase Street does not have immediate access (<20 min) to southbound US 301; therefore, keeping as much access for westbound Chase Street is preferred

***Option 1:*** *Reconfigure the intersection to a Continuous Green-T (CGT) to accommodate left-turning vehicles from westbound Chase Street. Reconfigure the eastbound approach to right-in/right-out only.*

***Option 2:*** *Reconfigure the intersection to a Partial Restrict Crossing U-Turn (RCUT) to accommodate left-turning and through vehicles from westbound Chase Street. Reconfigure the eastbound approach to right-in/right-out only. Reconfigure the intersection of Courthouse Lane to permit lefts-in and U-turns.*

***Intersection #19: Courthouse Lane with US 301***

Chase Street and Courthouse Lane do not meet VDOT Road Design Manual spacing standards and have a significant history of crashes. The existing turn lanes does not meet the VDOT Road Design Manual's minimum standard for turn lane storage and taper lengths

***Option 1:*** *Eliminate the existing crossover and convert to traversable median for emergency vehicles only. Reconfigure the intersection to right-in/right-only. Lengthen the existing southbound US 301 right-turn lane.*

***Option 2:*** *Reconfigure the intersection of Courthouse Ln to permit lefts-in andU-turns from northbound US 301 and right-in/right-outs onto and from southbound US 301. Lengthen the existing southbound US 301 right-turn lane.*

***Intersection #20: W Broaddus Avenue with US 301***

*Eliminate the southbound US 301 left-turn lane and extend the median stop bar towards US 301 mainline to improve sight distance*

- Inadequate sight-distance from the westbound approach, looking northbound, creates difficult movement through the intersection.

***Area between W Broaddus Avenue and Lakewood Road***

*Consolidate and eliminate crossovers and convert area to a Restricted Crossing U-Turn (RCUT) superstreet as development occurs*

- Multiple crossovers do not meet the VDOT Road Design Manual spacing standards.
- The area has been designated as a development area by the Town of Bowling Green. Consolidating accesses and utilizing the superstreet concept will comply with VDOT standards and promote safe and efficient traffic operations.

***Intersection #21: Lakewood Road with US 301***

*Extend the existing US 301 turn lanes. Evaluate the US 301 northbound right-turn lane based on future expansion of Fort A.P. Hill. Lengthen all existing turn lanes on Route 207. Evaluate the intersection as development occurs and reconfigure to Restricted Crossing U-Turn (RCUT).*

- Existing turn lanes do not meet the VDOT Road Design Manual's minimum standard for turn lane storage and taper lengths.

The Town of Bowling Green designated this area as a development area. Consolidating accesses and utilizing the superstreet concept will comply with VDOT standards and promote safe and efficient traffic operations.

***Intersection #22: AP Hill Drive with US 301***

*No recommendation for this intersection.*

***Intersection #22: US 17 with US 301***

*Construct a dedicated left-turn lane for the eastbound and westbound directions and consolidate the existing commercial access points.*

- The intersection was observed to have operational concerns during peak-hours due to significant left-turn movements. In addition, commercial driveways are within the intersection influence area and do not meet VDOT Road Design Manual Standards spacing standards.
- Providing dedicated left-turn lanes will increase capacity of the intersection and reduce delay for through movements.

***Intersection #24: Port Conway Road with US 301***

*Lengthen existing left-turn lanes on US 301. A future VDOT project will reconfigure intersection to Restricted Crossing U-Turn.*

- The existing turn lanes do not meet the VDOT Road Design Manual's minimum standard for turn lane storage and taper lengths.

***Intersection #25: Jersey Road with US 301***

*Lengthen the existing left-turn lanes on US 301 and widen the median opening.*

- The existing turn lanes do not meet the VDOT Road Design Manual's minimum standard for turn lane storage and taper lengths. The existing grass median shows signs of heavy degradation due to vehicles cutting into median.

***Intersection #26: Route 3 with US 301***

Significant future development will be occurring along both Route 3 and Route 205 as well at the intersection of Rte. 3 and US 301,. The intersection will not be able to accommodate future traffic in the Minimally Managed conditions, operating at LOS F during both the AM and PM peak hours. Additionally, commercial driveways are within the intersection influence area and do not meet VDOT Road Design Manual Standards spacing standards.

***Option 1:*** *Reconfigure the intersection to a Median U-Turn (MUT) intersection and consolidate commercial access points*

- The Median U-turn concept can provide operational and safety improvements. Operations will improve from LOS F to LOS B during the AM peak hour and from LOS F to LOS C during the PM peak hour.

***Option 2:*** Reconfigure the intersection to a Quadrant Roadway (QR) and consolidate commercial access points

- The Quadrant Roadway concept can provide operational and safety improvements. Operations will improve from LOS F to LOS B in both the AM and PM peak hours. It should be noted that significant land acquisition would be required, however development may occur within quadrant roadway area should VDOT Road Design Manual standards are followed.
- This intersection has three corners for potential quadrant roadway, if desired. While this would change the traffic operations, LOS and delay would still improve.

***Intersection #27: Ridge Road (Route 205) with US 301***

*Reconfigure the intersection to a Median U-Turn (MUT) intersection and consolidate commercial access points*

- Significant future development will be in the land area between Route 3, Route 205, and intersection of Route 3 and Route 205. Minimally Managed conditions will not be able to accommodate this increase, with the intersection operating at LOS D during the AM peak hour and LOS F during the PM peak hour. In addition, commercial driveways are within the intersection influence area and do not meet VDOT Road Design Manual Standards spacing standards.
- The Median U-turn concept can provide operational and safety improvements. Delay will improve minimally in the AM,but significantly during the PM peak hour from LOS F to LOS D.

***Intersection #28: Eden Road with US 301***

*Lengthen the existing northbound left-turn lane on US 301.*

- The existing turn lane does not meet the VDOT Road Design Manual's minimum standard for turn lane storage and taper lengths

***Intersection #29: State Road with US 301***

*Lengthen the existing southbound left-turn lane and construct a northbound left-turn lane on US 301.*

- The existing turn lane does not meet the VDOT Road Design Manual's minimum standard for turn lane storage and taper lengths. Construction of a turn lane will provide safer movements for U-turns.

***Intersection #30 Poplar Neck Road with US 301***

*Lengthen all existing turn lanes on US 301.*

- The existing turn lanes do not meet the VDOT Road Design Manual's minimum standard for turn lane storage and taper lengths.

***Intersection #31 Washington Mill Road with US 301***

*Lengthen the existing southbound left-turn lane and construct a northbound left-turn lane on US 301.*

- The existing turn lane does not meet the VDOT Road Design Manual's minimum standard for turn lane storage and taper lengths. Construct of turn lane will provide safer movements for U-turns.

***Intersection #32 Windsor Drive (Route 218) with US 301:***

*Reconfigure the intersection to a Restricted Crossing U-Turn (RCUT) intersection and provide an acceleration lane for right-turn movements the westbound approach.*

- Significant future development will be occurring in King George County with the through-volume expected to increase significantly due to the Nice Bridge widening. Volume from Windsor Drive through the intersection is not high compared to the volume on US 301. Minimally managed conditions will experience excessive delay for the US 301 through movements. The intersection would experience LOS B in the AM and LOS D in the PM.
- The RCUT can provide operational and safety improvements. Delay will improve minimally in the AM to LOS A; however, it will improve significantly in the PM to LOS B.

***Intersection #33 Dahlgren Road with US 301***

Significant future development will be occurring in King George County with the through-volume expected to increase significantly due to the Nice Bridge widening. Left-turn volume from US 301 is minimal and creates delay for all other movements at the intersection. Existing operations have been observed to be poor with LOS D in AM and LOS E in PM. Minimally managed conditions will not be able to accommodate growth with a LOS E in AM and LOS F in PM. In addition, commercial driveways are within the intersection influence area and do not meet VDOT Road Design Manual Standards spacing standards.

***Option 1:*** *Reconfigure the intersection to a Median U-Turn (MUT) intersection and consolidate commercial access points*

- The Median U-turn concept can provide operational and safety improvements. The intersection will remain at LOS E in the AM peak hour due to high number of left-turn movements from eastbound Dahlgren Rd onto US 301; however, the PM peak hour will improve from LOS F to LOS E in PM.

***Option 2:*** *Reconfigure the intersection to a Quadrant Roadway (QR) and consolidate commercial access points*

- The Quadrant Roadway concept can provide operational and safety improvements. LOS will improve to LOS D in the AM and from LOS F to LOS E in PM.
- This intersection has two corners for potential quadrant roadway, if desired. This would change the traffic operations; however, LOS and delay would still be improved.

***Intersection #34 Danube Drive with US 301***

*Reconfigure the intersection to a directional median to allow only left turns from northbound US 301. Utilize existing crossover south of the intersection for movements heading northbound on US 301 from Danube Drive*

- Significant future development will be occurring in King George County with the through-volume expected to increase significantly due to the Nice Bridge widening. In the Minimally Managed conditions, vehicles turning left from Danube Drive would experience significant delay in the PM with a LOS F and a delay greater than 900 seconds.
- Reconfiguring the intersection with a directional median keeps same LOS in the AM; however, it significantly decreases the delay for the Danube Drive approach in the PM from greater than 900 seconds to 110.9 seconds.

***Intersection #35 University Drive with US 301***

*Reconfigure the intersection to Restrict Crossing U-Turn (RCUT) intersection*

- Significant future development will be occurring in King George County with the through-volume expected to increase significantly due to the Nice Bridge widening. The intersection will not accommodate the expected growth in the Minimally Managedcondition with a LOS C in AM and LOS F in PM.
- The RCUT improvement can provide operational and safety improvements. LOS will improve minimally in the AM, however it will improve from LOS F to LOS E in PM.

***Intersection #36 Market Center with US 301***

*Reconfigure the intersection to a directional median permitting only U-turns/left-turns from US 301 as part of the RCUT improvement at University Drive*

- Significant future development will be occurring in King George County with the through-volume expected to increase significantly due to the Nice Bridge widening. The intersection will be unable to accommodate the growth in the Minimally Managed condition with a LOS B in AM and LOS F in PM.
- The RCUT improvement can provide operational and safety improvements. LOS will improve to LOS A in the AM and LOS D in PM.

***Intersection #37 Owens Drive with US 301***

*Reconfigure the intersection to a Quadrant Roadway (QR)*

- Significant future development will be occurring in King George County with the through-volume expected to increase significantly due to the Nice Bridge widening. Significant queueing from the northbound right-turn and southbound left-turn movements is observed in the AM due to the proximity of the military gate to US 301. This queuing creates safety concerns as it backs up into through lanes. The intersection will be unable to accommodate the growth in the Minimally Managed condition operating at LOS D during the AM peak hour and LOS F during the PM peak hour.
- The Quadrant Roadway improvement can provide operational and safety improvements. Additionally, it reduced left-turn phases and should reduce the queuing safety concern as storage is moved to other components of the system (i.e. southbound left-turns become additional through movements on the eastbound approach). This configuration will improve operations at the intersection to LOS B during the AM peak hour and LOS E during the PM peak hour.

**Shoulders**

Construct additional shoulder width in areas that do not meet minimum eight feet widths. All shoulders should be paved to eight feet to better accommodate broken down vehicles, turning, and bicyclists. In areas where grade does not support shoulders, guardrail should be installed. A detailed inventory of existing shoulders can be found in Appendix I.

**Bicycle and Pedestrian Accommodations**

As development occurs construct  pedestrian accommodation such as crosswalks, curb ramps, and sidewalks along Route 207 between Enterprise Parkway and Carmel Church Loop. In addition, install bike lanes between Enterprise Parkway and Route 1. Further, pedestrian studies should be performed as development occurs on west side of I-95, such as the proposed transit center in the southeast area at Route 1 and Route 207.

- Carmel Church is expected to experience significant residential and commercial growth between I-95 and Enterprise Parkway
- A proposed transit center has been proposed in the southeast area at Route 1 and Route 207. This is expected to be a major hub for residents commuting between Northern Virginia and Richmond

Construct and improve pedestrian accommodation such as crosswalks, curb ramps, and sidewalks along US 301 between University Drive and Market Center. Further, pedestrian studies should be performed to determine possibility of connections to Naval Surface Warfare Center Dahlgren Division and nearby neighborhoods as development occurs.

- Area between University Drive and Market Center has grown considerably and is expected to grow more with expected Nissan dealership and future planned phased as part of the King George Gateway plan

Remaining intersections that are to be reconfigured as part of the recommendations in this study should require further bicycle and pedestrian analysis to determine accommodations, especially at locations where the Potomac Heritage Scenic Trail and Dahlgren Railway Heritage Trail connects to or crosses the study corridor.