

# SS4A Vision Zero Action Plan

Town of Culpeper,  
Virginia  
Adopted July 9, 2024



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# 1

# Introduction

# About This Plan

The Town of Culpeper is committed to eliminating all roadway deaths by 2034. This document creates a plan to achieve this goal by recommending future projects and developing continual evaluation strategies. The development of this plan involved robust public outreach, the expansion of the Town's GIS database to accurately assess safety issues, an analysis of crash data from 2018 to 2022, and an analysis of the community's demographic profile to ensure equity in the planning process. Preliminary engineering was conducted to better define projects that would mitigate safety issues and determine costs for future budgetary purposes. This plan was created by the Town of Culpeper with assistance from Hurt & Proffitt and EPR, P.C. The funding mechanism for this plan was the U.S. Department of Transportation's Safe Streets and Roads for All (SS4A) Grant Program. This plan will serve as a guiding document and is not intended to be regulatory in nature.

# About Vision Zero

Vision Zero is an innovative approach to analyzing and preventing traffic related fatalities and severe injuries. According to the Vision Zero Network, "committing to Vision Zero takes the following strategies:

- Building and sustaining leadership, collaboration, and accountability – especially among a diverse group of stakeholders to include transportation professionals, policymakers, public health officials, police, and community members;
- Collecting, analyzing, and using data to understand trends and potential disproportionate impacts of traffic deaths on certain populations;
- Prioritizing equity and community engagement;
- Managing speed to safe levels; and
- Setting a timeline to achieve zero traffic deaths and serious injuries, which brings urgency and accountability, and ensuring transparency on progress and challenges."

*"Each year, more than 42,000 people, the population of a small city, are needlessly killed on American streets and thousands more are injured."*



# Safe Systems Approach

Vision Zero is deeply rooted in the Safe Systems Approach. This plan will utilize this strategy in its development and project selection and prioritization evaluation. The Safe Systems Approach follows these key principles according to the Department of Transportation:

- ***Death and serious injuries are unacceptable.*** A Safe System Approach prioritizes the elimination of crashes that result in death and serious injuries.
- ***Humans make mistakes.*** People will inevitably make mistakes and decisions that can lead or contribute to crashes, but the transportation system can be designed and operated to accommodate certain types and levels of human mistakes, and avoid death and serious injuries when a crash occurs.
- ***Humans are vulnerable.*** Human bodies have physical limits for tolerating crash forces before death or serious injury occurs; therefore, it is critical to design and operate a transportation system that is human-centric and accommodates physical human vulnerabilities.
- ***Responsibility is shared.*** All stakeholders—including government at all levels, industry, non-profit/advocacy, researchers, and the general public—are vital to preventing fatalities and serious injuries on our roadways.
- ***Safety is proactive.*** Proactive tools should be used to identify and address safety issues in the transportation system, rather than waiting for crashes to occur and reacting afterwards.
- ***Redundancy is crucial.*** Reducing risks requires that all parts of the transportation system be strengthened, so that if one part fails, the other parts still protect people.

## Vision

***Zero Roadway Deaths Within  
The Town of Culpeper By 2034***

# Task Force

To develop the Action Plan, the Town created a Vision Zero Task Force. This group is made up of the following Town departments:

- ***The Department of Planning and Community Development*** is charged with coordinating the development of the Action Plan and its implementation. This department will be the primary actor in seeking funds for proposed projects and the monitoring of project progress.
- ***The Department of Public Works*** contributes greatly in the creation of the Action Plan by providing feedback on potential projects. As the department that is charged with the ownership and maintenance of the roads, Public Works plays a major role in the implementation of the proposed projects.
- ***The Department of Economic Development & Tourism*** contributed to the creation of the plan by distributing the community survey and by providing feedback on potential projects and how they will impact the community.
- ***The Town of Culpeper Police Department*** is charged with the implementation of several of the proposed enforcement related projects and contributed to the plan by providing feedback on potential projects.



**RESOLUTION  
VISION ZERO**

**Resolution No. R-2024-016**

**WHEREAS**, traffic crashes are among the leading cause of deaths and injuries in the United States; and

**WHEREAS**, any death or serious injury on our streets is unacceptable and serious crashes are preventable; and

**WHEREAS**, the vision of the Comprehensive Plan is to promote development and investment to create long-term sustainability through a coordinated effort which ensures that there is a balance between aesthetics, economics, public health and safety, and transportation and public services that can be maintained over the long term resulting in a community that is equal to or better than the present day Town of Culpeper; and

**WHEREAS**, Vision Zero is a strategy to eliminate all traffic fatalities and severe injuries, while increasing safe, healthy, equitable mobility for all; and

**WHEREAS**, the Town of Culpeper has received a grant from the Federal Highway Administration under the Safe Streets and Roads for all (SS4A) grant program for the development of an action plan with the goal of eliminating all roadway fatalities by the year 2034; and

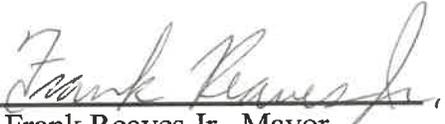
**WHEREAS**, qualifying action plans require a commitment from the governing body of a locality that includes setting a target date to reach zero road way fatalities and serious injuries; and

**WHEREAS**, having a qualified action plan will allow the Town of Culpeper to apply for implementation grants that will improve road safety for all users.

**NOW, THEREFORE, BE IT RESOLVED**, that the Council of the Town of Culpeper hereby commits to reaching zero road fatalities and serious injuries by the year 2034, endorses Vision Zero as an approach to achieving this goal, and adopts the Town of Culpeper SS4A Vision Zero Action Plan.

**ADOPTED** this 9th day of July 2024.

BY ORDER OF THE COUNCIL OF  
THE TOWN OF CULPEPER,  
VIRGINIA

  
\_\_\_\_\_  
Frank Reaves Jr., Mayor

ATTEST:

  
\_\_\_\_\_  
Ashley R. Clatterbuck Town Clerk

**MOTION:** Clancey

**SECOND:** Short

**Ayes:** Brown, Clancey, Olinger, Reaves, Rimeikis, Russell, Schmidt, Short, Yowell

**Nays:** None

**Absent from Vote:** None

**Absent from Meeting:** None



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# Community Profile

# Summary

The Town of Culpeper is a historic town that has rapidly grown over the past 20 years. The Town was established in 1759 and is located in the middle of the triangle formed by Washington, D.C., Fredericksburg, and Harrisonburg. Multiple major state highways and roads such as James Madison Parkway, Sperryville Pike, Germanna Highway, and Brandy Road, lead into the town from the North, South, East, and West. Most roads and right of ways within the Town, however, are owned and maintained by the Town itself. Culpeper is also served by Virginia Regional Transit and by Amtrak who operates a station downtown. Culpeper’s historic downtown is a popular destination for visitors from the metropolitan Washington D.C. area and regions throughout Virginia. In 2018, Culpeper was recognized as the “Prettiest Town in Virginia” by Architectural Digest and Davis Street is an American Planning Association “Great Street”.

The community itself is diverse along many different metrics. This plan was developed using inclusive and representative processes. An analysis of the Town’s demographics, housing, and economics is vital in ensuring equity in the planning process. Unless otherwise stated, the data utilized is from the U.S. Census 2022 5-year estimates. Below are some key findings resulting from this analysis:

- The Town’s population has more than doubled since the year 2000. Transportation networks and safety strategies will likely need to be updated to serve the increased population.
- More than a fifth of the Town’s population identifies as Hispanic or Latino. about 20% of the entire population speaks a language other than English at home. A higher percentage of Hispanic and Latino residents, when compared to the general public, do not have a high school diploma and are more likely to rent rather than own a home. Outreach for this and future plans/updates should include considerations so that all voices in the community are heard.
- Although 24.9% of residents report commuting less than 10 minutes, only about 3.5% report walking to work. Strategies on how to encourage residents with short commutes to walk should be explored.
- The median age of the Town is 34.4 and 32% of the Town’s population is under the age of 20.
- “Retail Trade” and “Arts, Entertainment, and Recreation, and Accommodation and Food Services” are both important industries in terms of employment. The Historic Downtown is an important tourism destination that features many of these businesses within a walkable distance.
- Portions of the Town are within Census Tracts that are deemed disadvantaged communities. Attention should be given to these areas during the project selection process.
- The Town has several projects that are approved and awaiting construction, and projects under review. These projects should be taken into consideration as part of this plan so that potential safety hazards can be mitigated.
- The planning of safety focused transportation projects should also consider the mitigation of environmental hazards.

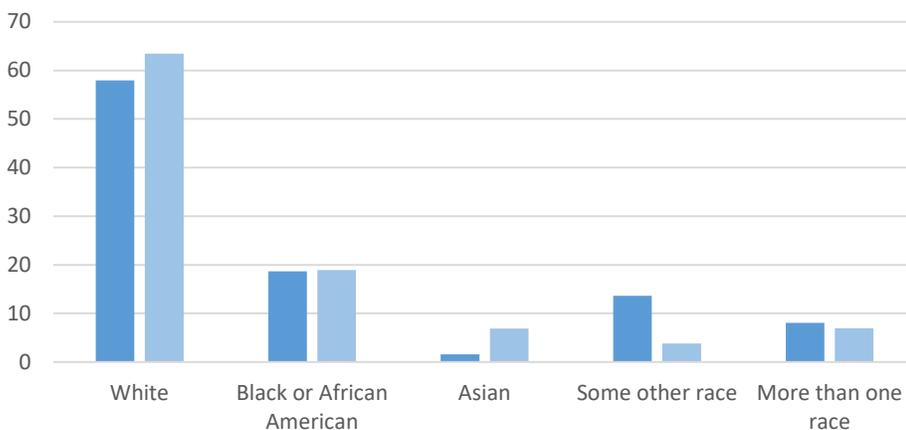
# Population

The population of the Town of Culpeper has been growing rapidly since the year 2000. The 2020 U.S. Decennial Census reported the Town’s population in 2020 was 20,062, which is a 22.5% increase from 2010, and more than double the Town’s population in 2000. According to population projections by the University of Virginia Weldon Cooper Center for Public Service, the population will climb to 21,981 by 2030, 25,096 by 2040, and 28,587 by 2050. About 13.3% of the Town’s population was born in a country other than the United States and almost 31% were born in a state other than Virginia.

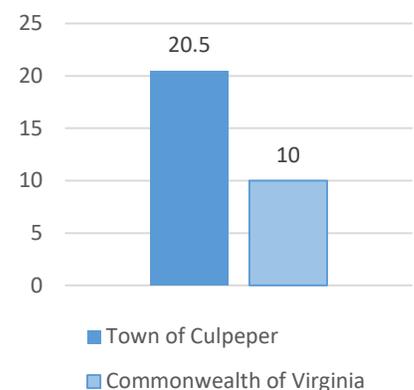
In terms of racial diversity, the Town’s make up is similar to that of Virginia’s but does have some differences. The percentage of citizens that identify as “some other race” in the Town is more than three and a half times that of Virginia. The percentage of the Town’s population that is of Hispanic or Latino origin is more than double when compared to Virginia. At least 20% of the Town’s population speaks a language other than English at home and only 51% of those report speaking English “very well.” Spanish is the most commonly spoken language at home other than English.

The median age of the Town is relatively low at 34.4. The median age for Virginia is 38.7. 32% of the Town’s population is under the age of 20.

Race by Percentage



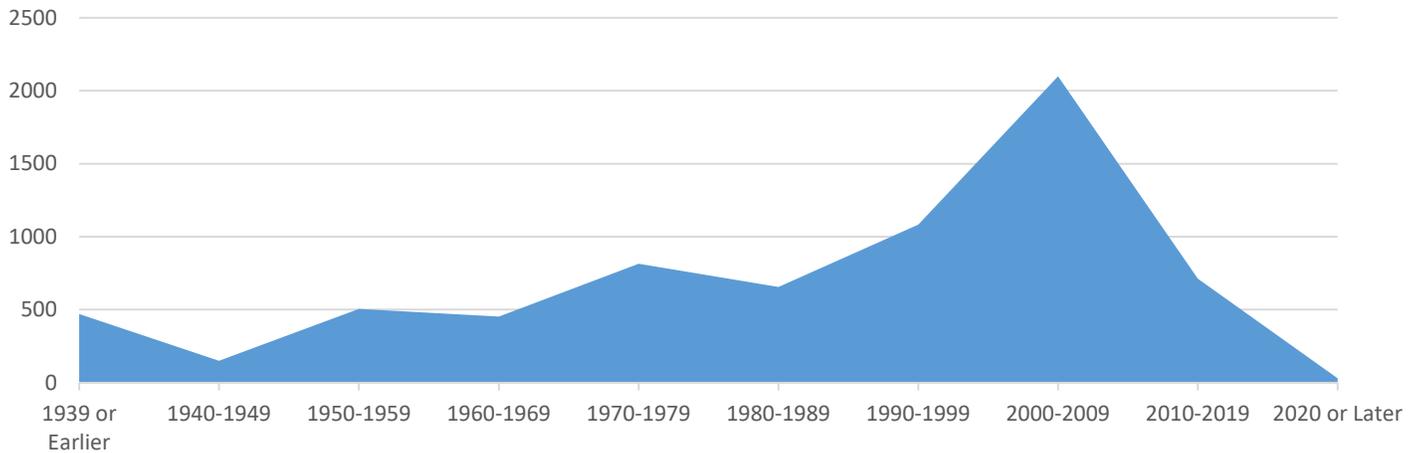
Hispanic or Latino Population by Percent



U.S. Census Bureau; American Community Survey, 2022 American Community Survey 5-Year Estimates

# Housing

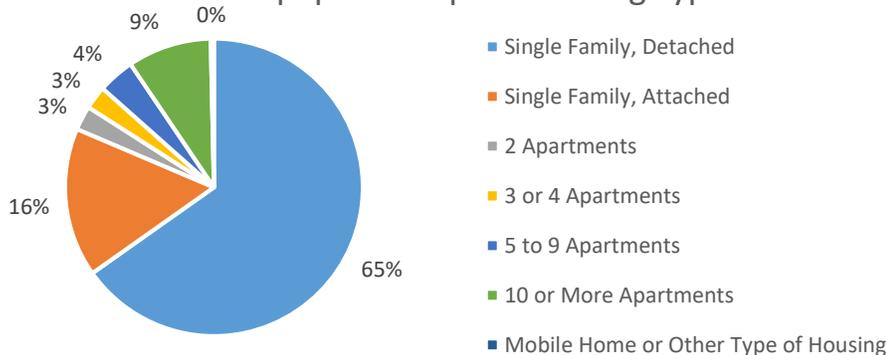
Number of Housing Units Built



U.S. Census Bureau; American Community Survey, 2022 American Community Survey 5-Year Estimates

Facilitating the rise in population, the Town saw a surge in the number of housing units built between 2000 and 2009. Most of the occupied housing stock in the Town of Culpeper is comprised of single family dwellings. 65% of the occupied units are detached single-family dwellings. Large, small lot single-family subdivisions such as Lakeview and Highpoint contribute to this trend. The Census Bureau estimates that 16% of the occupied housing are attached single family dwellings. Newer single-family attached developments, such as Madison Station, are located throughout the town as townhomes are permitted in most residential zoning districts. Units located in higher density apartment buildings (10 or more units) make up 9% of the occupied units.

Town of Culpeper Occupied Housing Types

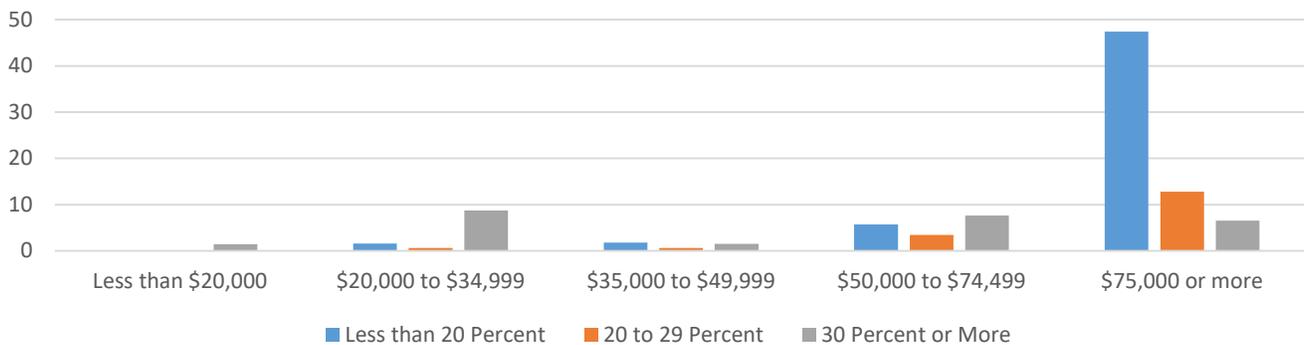


Housing Cost as a Percentage of Household Income		
	Owner Cost	Renter Cost
>20%	48.4%	39.1%
20-24.9%	11.6%	10.6%
25-29.9%	8.6%	9.4%
30-34.9%	7.9%	13.4%
35% or >	23.4%	27.4%

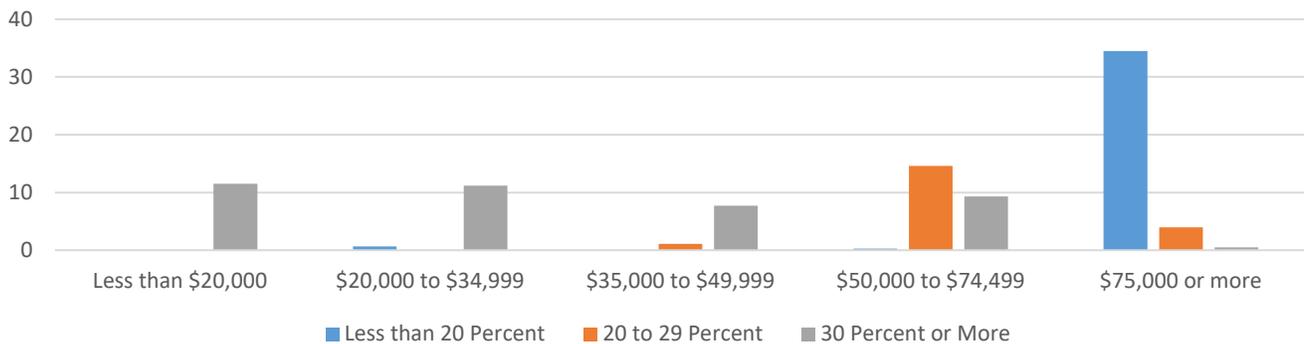
U.S. Census Bureau; American Community Survey, 2022 American Community Survey 5-Year Estimates

42% percent of occupied units in the Town are occupied by renters. The percentage for Virginia is only 33%. On average, the gross rent in the Town is \$1,372. 27.4% of renters spend 35% or more of their income on rent. Only 39.1% of renters spend less than 20% of their income on rent. Conversely, 48% of home owners with a mortgage spend less than 20% of their income on housing. Housing costs appear to impact renters with lower incomes more. As shown below, more renter households that earn less than \$50,000 spend more than 30% of their income on housing. Over 77% of owner-occupied units are owned by white residents. The occupancy of rental units is much more diverse with 47.3% being White, 28.9% being Black or African American and 18.2% being of some other Race. 58% of residents that are of Latino or Hispanic origin occupy rental units.

Owner Occupied: Percent of Income Spent on Housing Based on Income



Renter Occupied: Percent of Income Spent on Housing Based on Income



U.S. Census Bureau; American Community Survey, 2022 American Community Survey 5-Year Estimates

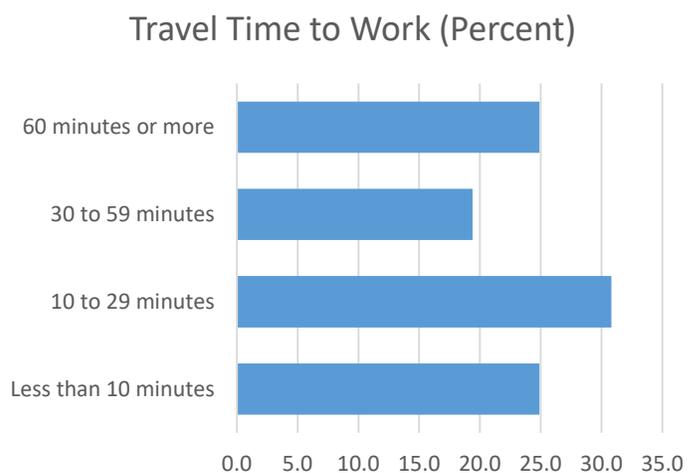
Residents in owner-occupied housing are also more likely to have access to more vehicles than those in renter-occupied housing. 71.6% of those in owner occupied housing have access to 2 or more vehicles. Only 46.2% of residents in renter-occupied housing have access to 2 or more vehicles even though the average household size of a renter-occupied unit is 2.81. Only 1.3% of residents in owner-occupied housing report having no vehicles available, but 6.7% of those in renter-occupied house have no vehicle available.

Most detached single-family dwelling units, 76.1%, and just over half of attached single-family units are owner occupied. All structures with 3 or more units are renter occupied. The Town of Culpeper does have 10% more units occupied by renters than that of Virginia.

# Economy, Jobs, & Education

The Town of Culpeper’s (and Virginia’s) largest industry when measured by labor force is “educational services, and healthcare and social assistance.” The UVA Medical Center located in the southern portion of Town is a large employment center for the Town and region. Where Culpeper differs from Virginia is “retail trade” and “arts, entertainment, and recreation, and accommodation and food services.” Retail trade is the second highest industry in terms of employment with arts, entertainment, and recreation, and accommodation and food services being the fourth. These industries take several different forms within the Town. The downtown district is where a large portion of locally owned shops and restaurants are located that cater to both tourists and local residents. The northern section of Town contains chains and big box stores such as Target, Walmart, and Lowe’s that serve a more regional customer base.

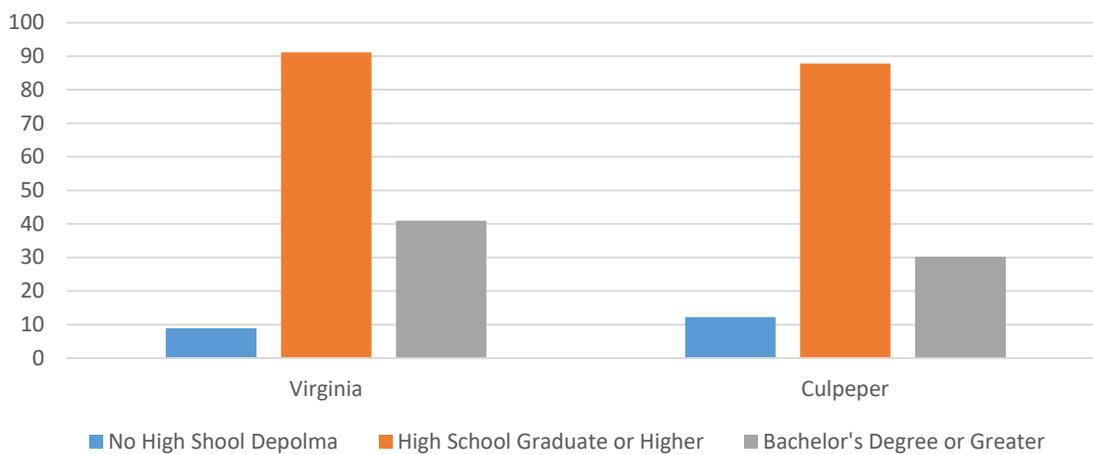
About 25% of Town residents report commuting less than 10 minutes to work. Nonetheless, only about 3.5% report walking to work. This percentage is higher, 6.8%, when looking at only workers living in renter-occupied housing. Driving alone is overwhelmingly the highest means of transportation for all workers. Of the 183 workers out of 9,888 that report having no vehicle available, 99 of them walked, 58 used public transportation and 26 worked from home.



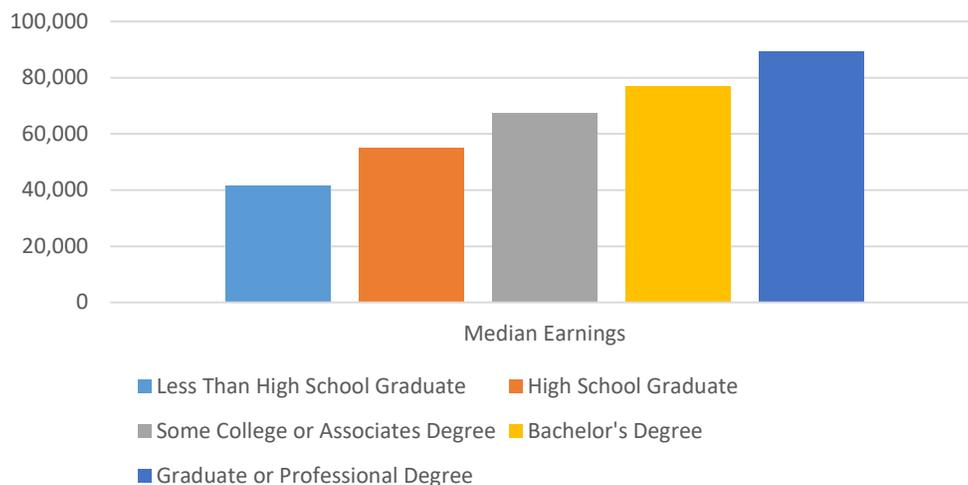
The median income for households in the Town is \$86,940. This is just below Virginia’s median household income of \$87,249. A higher percentage of town residents, 10.5%, live below the poverty line when compared to Virginia, 10.0%, and Culpeper County, 7.3%.

With respect to educational attainment, 30.3% of the Town’s residents 25 years of age and older have a bachelors degree or higher. This is 10 percentage points less than that of Virginia. Within the Town, 37% of Latino and 51.1% of those who identify as some other race and are 25 or older have less than a high school diploma. This disparity is stark compared to non-Hispanic whites at 6.8%, Black or African Americans at 9.2%, and Asians at 13.2%. Town residents without a high school diploma earn less than half as much as those with a graduate or professional degree.

Educational Attainment by Population 25 Years & Over (Percent)

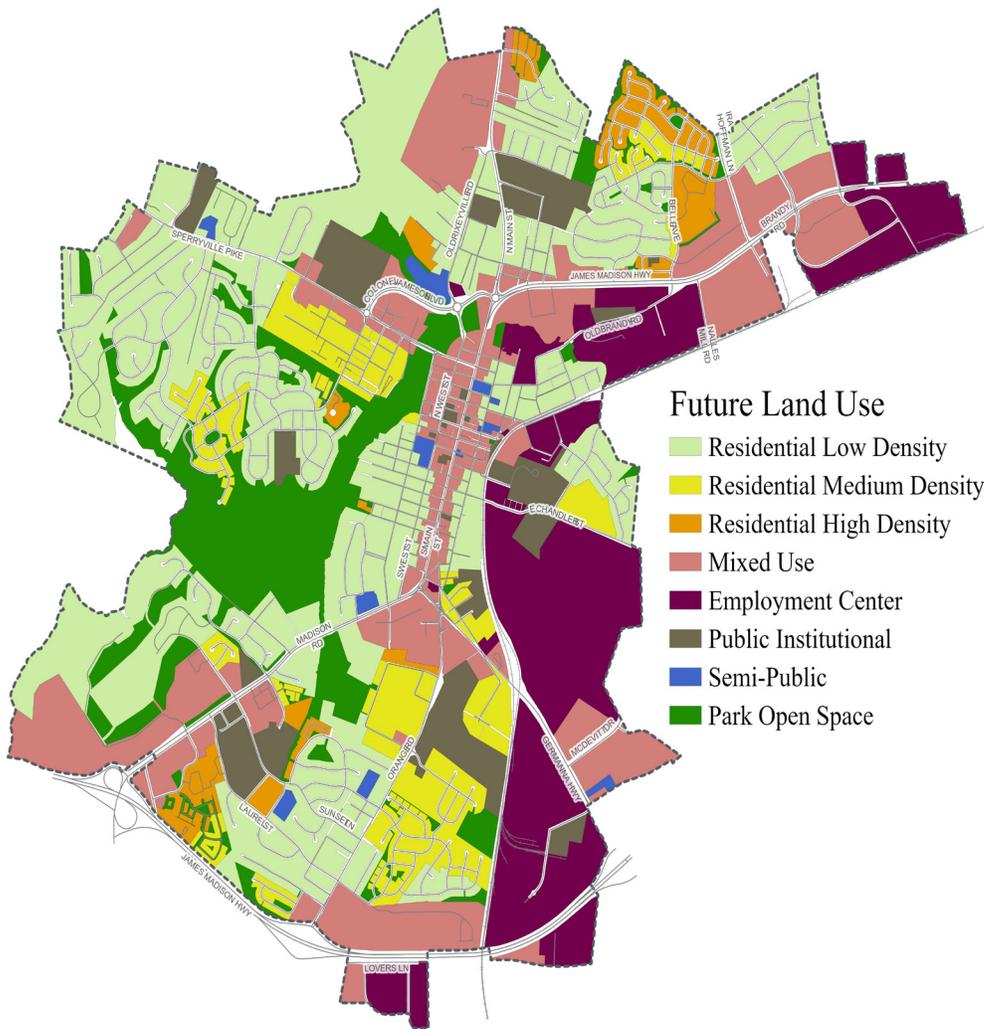


Median Earnings by Educational Attainment (25 and Older)



U.S. Census Bureau; American Community Survey, 2022 American Community Survey 5-Year Estimates

# Land Use

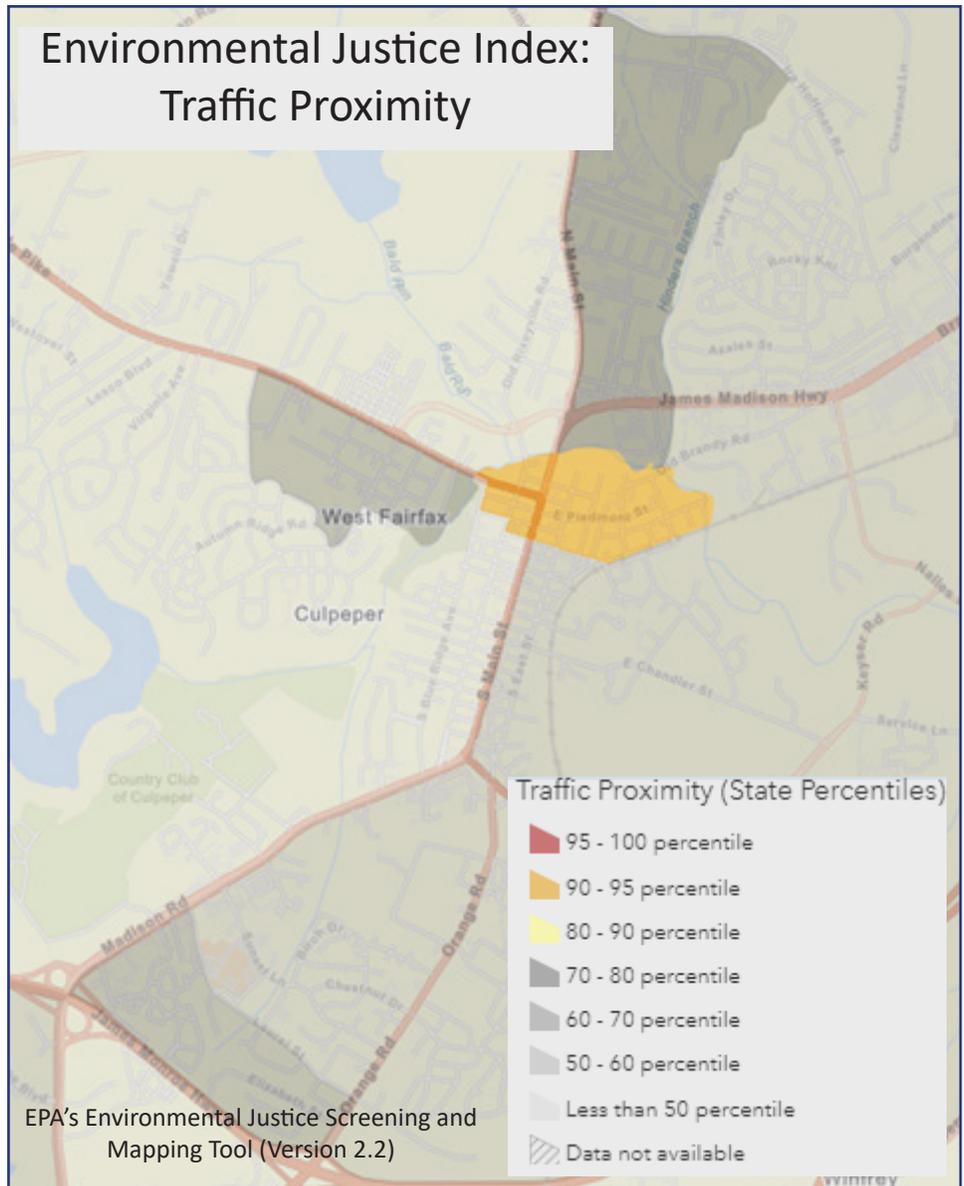


Commercial Development is primarily located along The Town's major thoroughfares: Madison Road, Main Street, and James Madison Highway. The southwest portion of the Town along Madison Road (Route 29) is where multiple Hotels and the UVA hospital campus is located. Strip mall and fast food establishments are also located along Madison Road as it merges with Germanna Highway (Route 522) and becomes Main Street north of the intersection. This is where locally owned shops and boutiques are located. Shops and other businesses are located along secondary streets off of Main Street such as Locust Street, Cameron Street, Culpeper Street,

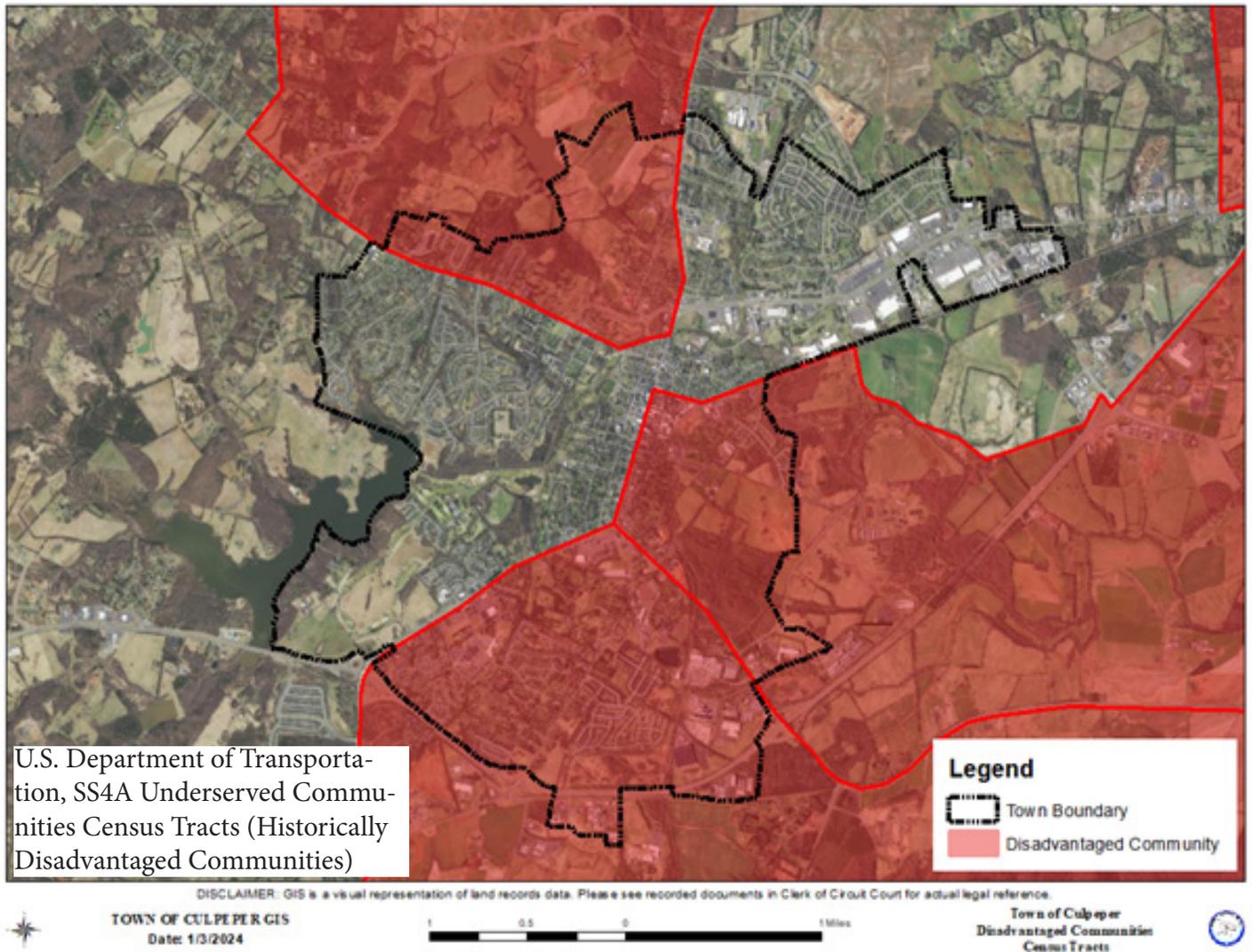
and Davis Street. This portion of the center of Town is part of the Historic District and is also where governmental offices of both the Town and Culpeper County are located. This area contains on-street parking on most streets and 8 parking lots that are open to the public. Therefore, the downtown sees a high volume of pedestrian and vehicle traffic. In the northern portion of the Town, big box stores and chain establishments are located along James Madison Highway. Industrial uses are primarily focused on the eastern border of the town, and along the railway. High-density residential uses can be found in close proximity to the commercial cores, while lower-density residential is primarily located on the west and north sides of the Town.

# Environment

The U.S. Environmental Protection Agency's EJScreen Tool was used to determine the vulnerability of areas in the Town to environmental hazards. This tool analyzes a census block group's vulnerability to environmental and health hazards by combining environmental and demographic socioeconomic indicators. In the indicators related to transportation, when compared to Virginia, portions of the Town fell into the 70th percentile or above in the particulate matter 2.5, air toxics cancer risk, and traffic proximity environmental justice indexes. The areas that scored the highest in these categories are mostly located in the northern portion of Town along North Main Street, Sperryville Pike and James Madison Highway. These are some of the most traveled thoroughfares in the Town. Three tracts have a demographic index, an average of the low-income and people of color indicator, above the 80th percentile when compared to Virginia. The block shown in orange has an environmental justice indicator in the 90th percentile for the traffic proximity categories. Traffic proximity takes into account the daily traffic count at major roads nearby. According to the EPA, living close to roads and heavy traffic can have negative health effects such as asthma, cardiovascular and heart disease.



# Disadvantaged Communities

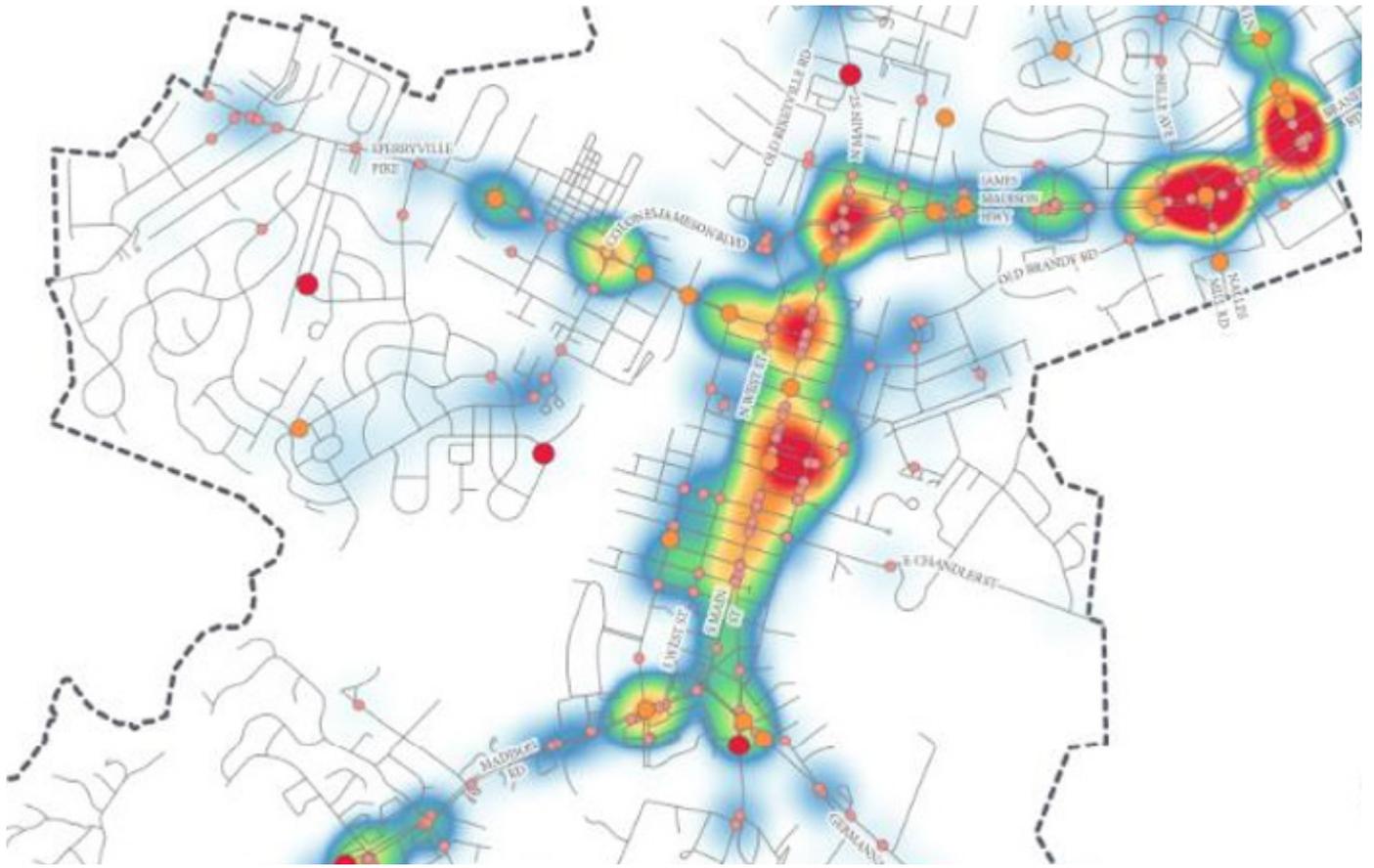


The Department of Transportation has developed a definition for and a way to identify highly disadvantaged communities by Census Tract. A disadvantaged Census Tract is one that exceeds the 50th percentile of 4 or more of the following transportation disadvantaged indicators:

- **Transportation Access Disadvantage** identifies communities and places that spend more, and longer, to get where they need to go. (CDC Social Vulnerability Index, Census America Community Survey, EPA Smart Location Map, HUD Location Affordability Index)

- **Health Disadvantage** identifies communities based on variables associated with adverse health outcomes, disability, as well as environmental exposures. (CDC Social Vulnerability Index)
- **Environmental Disadvantage** identifies communities with disproportionate pollution burden and inferior environmental quality. (EPA EJScreen)
- **Economic Disadvantage** identifies areas and populations with high poverty, low wealth, lack of local jobs, low homeownership, low educational attainment, and high inequality. (CDC Social Vulnerability Index, Census America Community Survey, FEMA Resilience Analysis & Planning Tool)
- **Resilience Disadvantage** identifies communities vulnerable to hazards caused by climate change. (FEMA National Risk Index)
- **Equity Disadvantage** identifies communities with a high percentile of persons (age 5+) who speak English “less than well.” (CDC Social Vulnerability Index)

The Town is part of 5 Census Tracts that include portions of Culpeper County. 3 of these tracts have been designated disadvantaged. All three have been identified as being transportation disadvantaged, health disadvantaged, economically disadvantaged, and equity disadvantaged.



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# Data Analysis

# Methodology

To help inform the Action Plan and achieve our Vision Zero goal, an extensive analysis of various data types was conducted. Staff used VDOT crash data to help identify trends that have led to serious crashes within the Town. This data helped staff create a High Injury Network (HIN) which shows the corridors where roadway users are at the most risk and to identify potential Priority Areas.

A thorough analysis of the existing conditions was conducted. Data was collected to accurately identify pedestrian infrastructure such as sidewalks and crosswalks. This data analysis also reviews the survey that was distributed in the community, and the current transportation policies of the Town.

## Crash Data

*Between 2018 and 2022, 1302 crashes were reported:  
**7 were Fatal.**  
22 resulted in severe injuries.*

*4 of the 7 fatal crashes involved  
**pedestrians.***

***More than half** of all crashes occurred at intersections.*

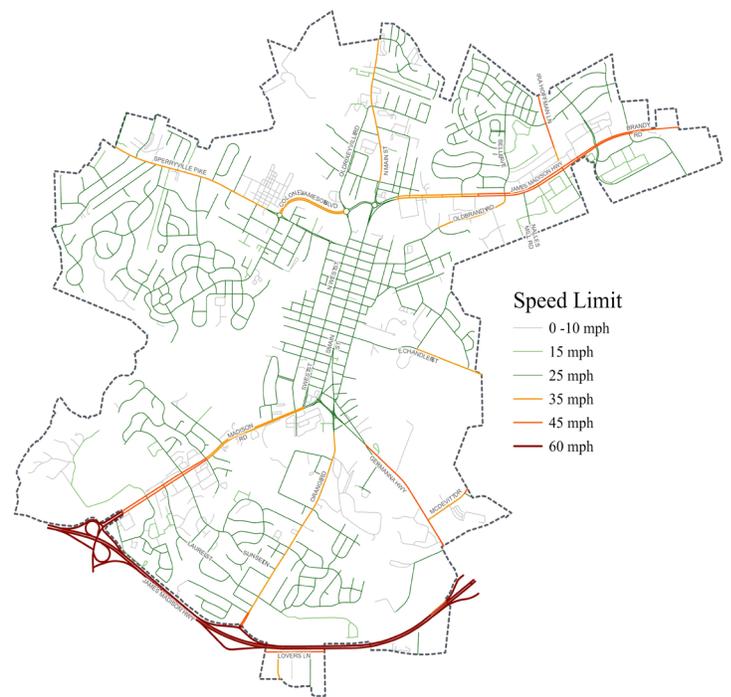
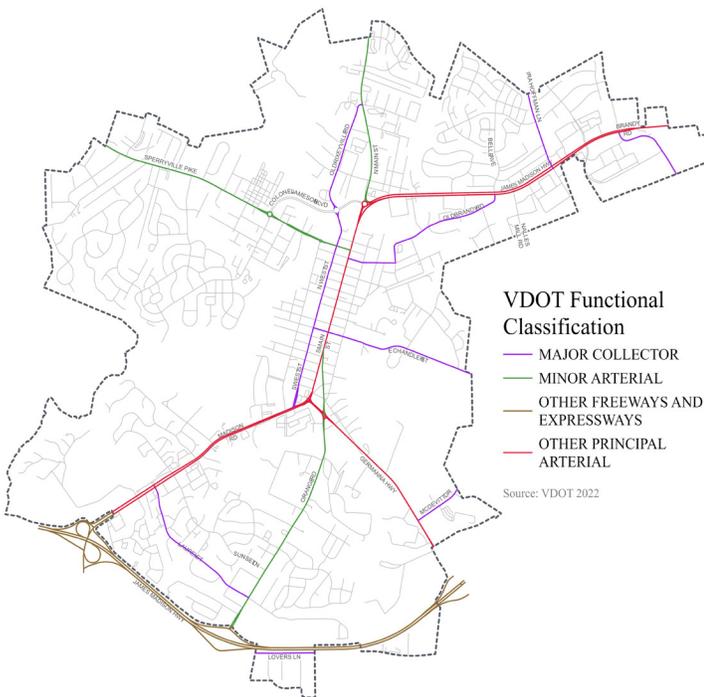
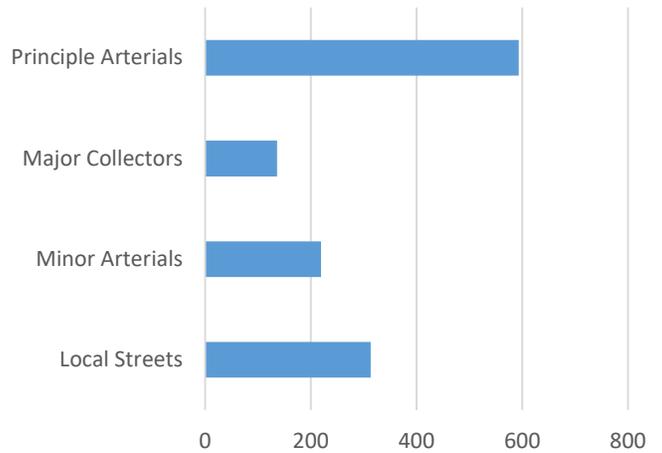
*Of the 29 fatal/severe crashes, **11 involved alcohol** and **12 occurred in dark road conditions.***

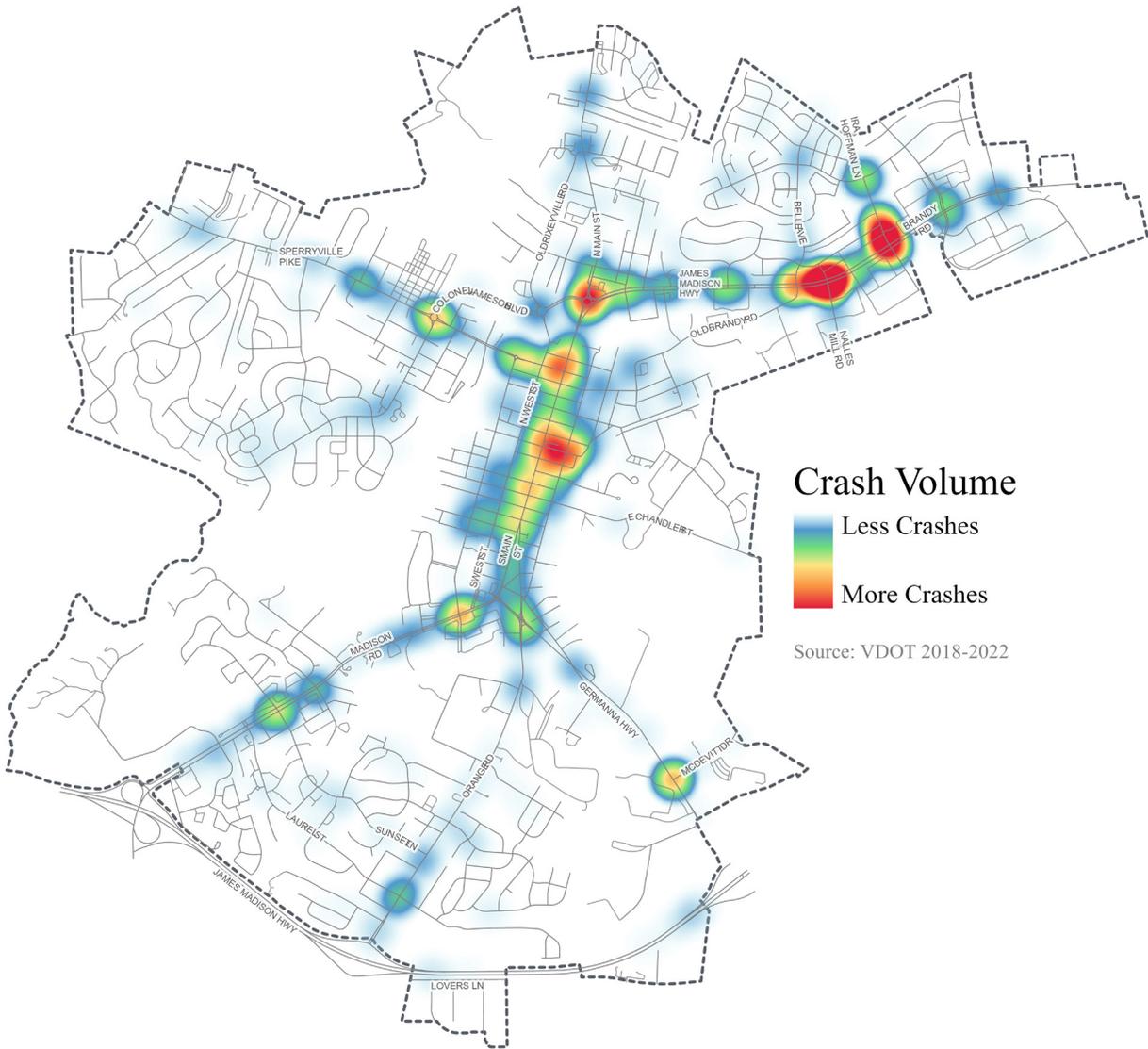
Between 2018 and 2022, 1,302 crashes within the town were reported. VDOT crash data provides us with detailed information on each of these crashes. With this data we can analyze the severity of the injuries of each crash, the type of collision, where the crash occurred, and possible causes for such incidents.

## Crashes by Location

The Town Geographic Information System (GIS) was used to map the location of every crash between 2018 and 2022. A heat map was generated to show where the majority of crashes took place. The majority of crashes took place on roadways VDOT classifies as Principle Arterials. These are typically the corridors with the highest volume of traffic and greater speed limits. They include Madison Road, Germanna Highway, South Main Street, James Madison Highway, and Brandy Road. About 47.5% of all crashes occurred along the main-line roadway and 51% occurred at an intersection.

Crashes by Road Classification





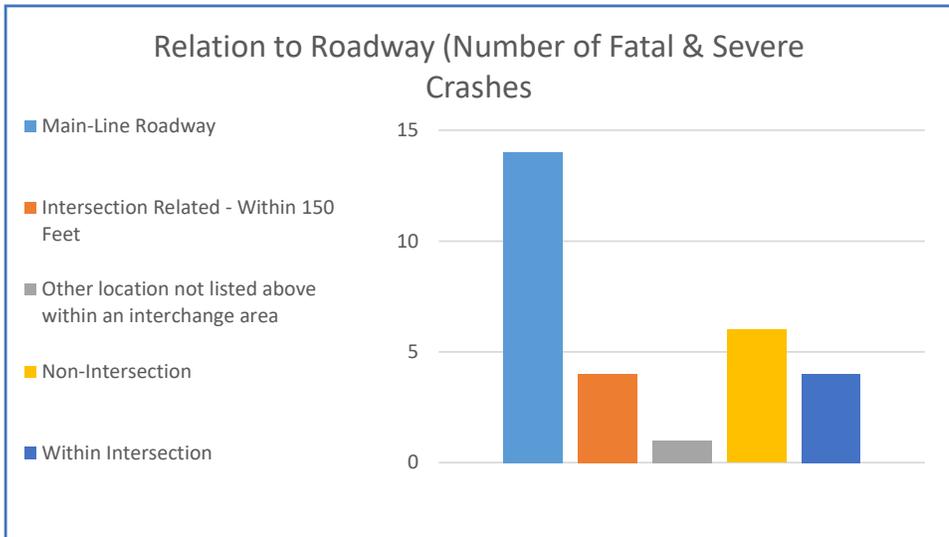
Crashes are also classified by the type of traffic control present at the site. This can include measures like stop signs, yield signs and traffic lights. About 42.5% of all crashes occurred where the most prominent traffic control measure were marked lanes. 24.1% occurred at stop signs, 18.1% at traffic signals, and 10.3% occurred where no traffic control measure was present. Only 6 crashes occurred at a pedestrian crosswalk. None of those crashes resulted in a fatality or severe injury.

# Crashes by Severity

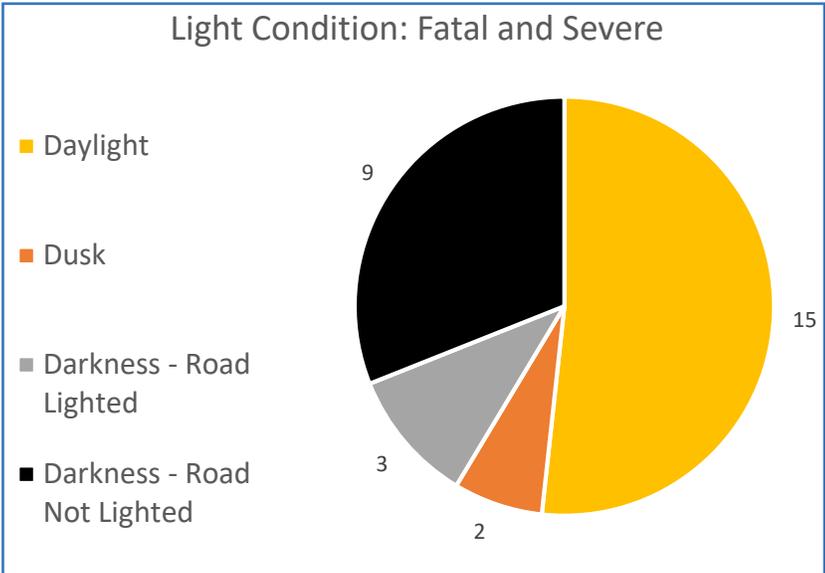
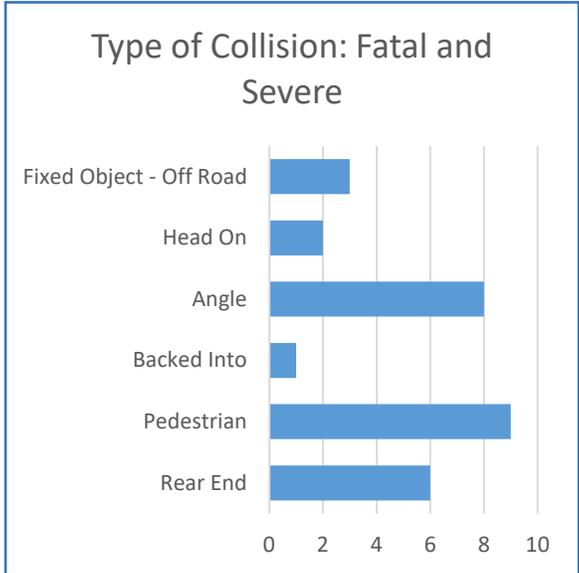
The severity of injuries resulting from crashes are broken down into 5 categories: K = fatal injury, A = incapacitating injury, B = non-incapacitating injury, C = possible injury, and O = property damage only. For this report, a crash classified as “K” will be referred to as fatal and a crash classified as “A” will be severe. 29 crashes between 2018 and 2022 were fatal or severe.

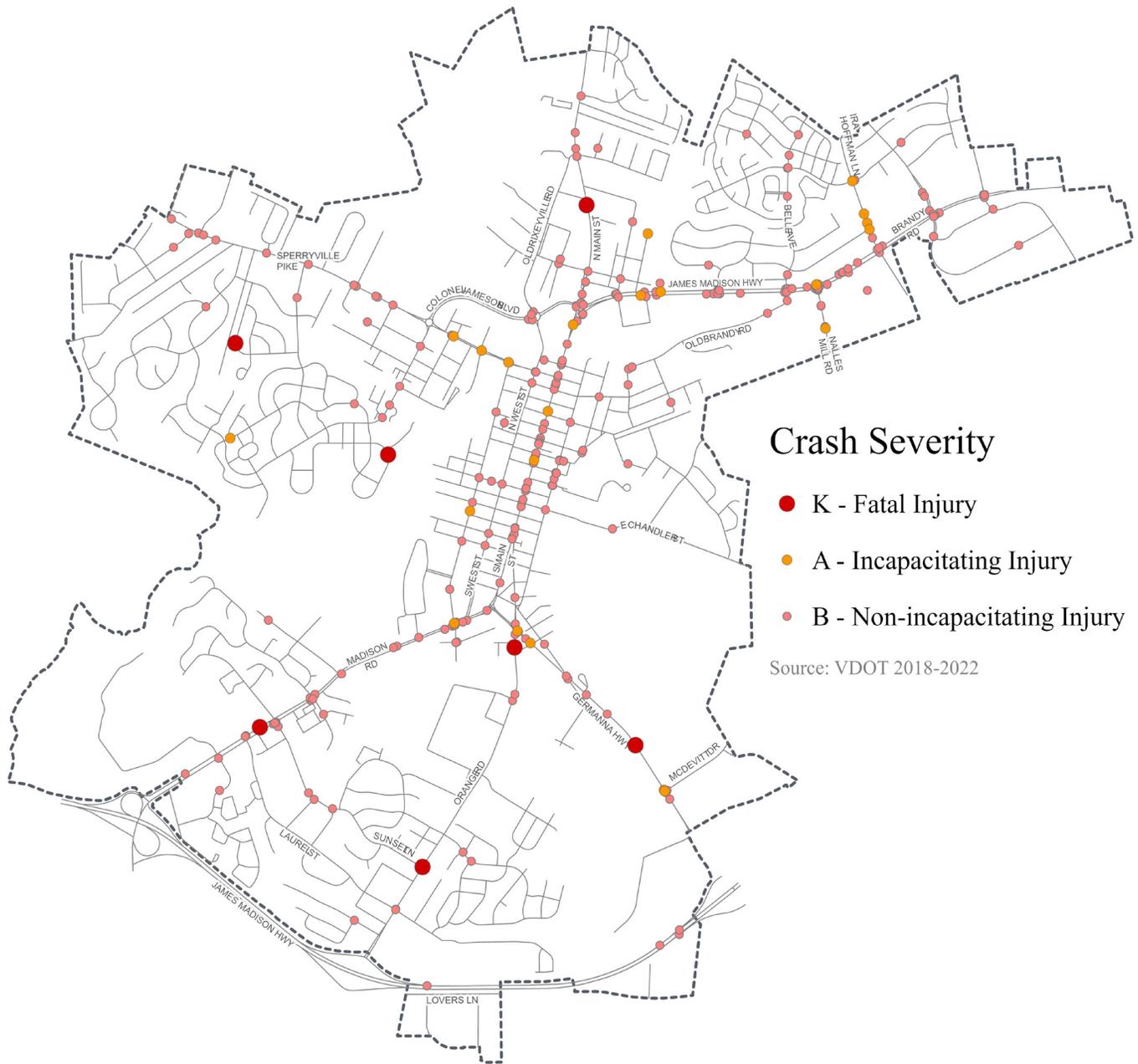
Crash Severity (2018-2022)		
Injury Type	Count	Percent
K	7	.5%
A	22	1.7%
B	321	24.7%
C	476	36.6%
O	476	36.6%

## Quick Charts: Severe and Fatal Crashes



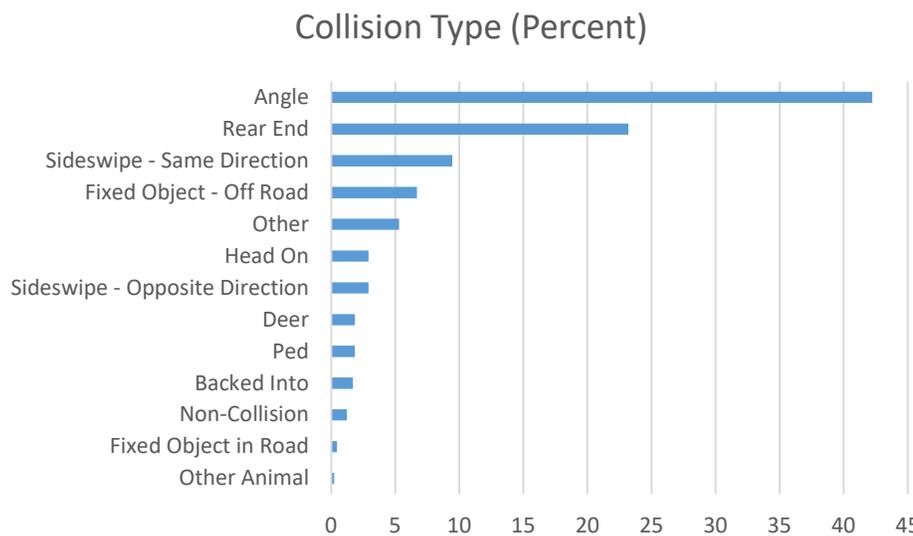
Behavioral Factors (Fatal & Severe)	
	YES
Alcohol	11
Speeding	7
Unbelted	2
Distracted	3
Drugs	1





Of the 29 fatal or severe crashes, 9 involved pedestrians and 1 involved a bike. While the 1 bike crash resulted in a serious injury, 4 of the pedestrian crashes resulted in a fatal injury. This is more than half of all fatal crashes (7).

# Crashes by Type



Crashes can be categorized by the type of collision. The most common collision between 2018 and 2022 was an angled collision which accounted for about 42.2% of all crashes. According to VDOT, an angle collision is when a motor vehicle in transport strikes another vehicle at an angle. For example, the front of one motor vehicle strikes the side of another motor vehicle. Of the 550

angle crashes that occurred in the Town, almost 60% occurred within an intersection or related to an intersection (within 150 feet).

Driver behavior is another aspect of a crash that can have a significant impact on the number and severity of crashes. These behaviors can include speeding, drinking and driving, age of the driver, and even type of vehicle.

Driver Behaviors - All Crashes (2018-2022)		
	Count	Percent
Age - Old	318	24.42%
Age - Young	314	24.12%
Distracted	187	14.36%
Speeding	137	10.52%
Alcohol	88	6.76%
Large Truck	61	4.96%
Unbelted	55	4.22%
Drowsy	18	1.38%
Drugged	18	1.38%
Motorcycle	13	1%
Bicycle	7	.54%

# High Injury Network

The High Injury Network (HIN) identifies the corridors within the Town with a higher concentration of not only crashes, but also those that result in fatal or serious injuries. The HIN represents only 13.53% of the public roadway. Of all crashes, 64.34% occurred in the HIN. It also includes 82.76% of severe and fatal crashes.



**82.76% of Fatal and Severe Crashes  
Occurred on 13.53% of the Roadway**

# HIN Methodology

The HIN was determined by rating every road segment within the town. Each segment was rated based on the total number of crashes. Fatal and severe crashes were heavily weighted. Pedestrian crashes were weighted even further as those tend to be the most severe on average. The highest scoring segments were then connected to create a comprehensive corridor showing the most dangerous roadways in Town. The HIN is comprised of mostly principle arterials like Germanna Highway, Madison Road, South Main Street, and James Madison Highway. It also includes minor arterials like Sperryville Pike, North Main Street, and Orange Road. Blue Ridge Avenue is the only road whose function is classified as a local street in the HIN.

While the HIN will be used to help prioritize recommended projects, it will not be the only factor. This plan will also consider projects already proposed within the HIN under other programs, the findings of the Community Profile analysis to ensure disadvantaged communities are not neglected, the community survey results, and the Priority Areas identified in this data analysis.

## Projects Within the HIN

There are multiple proposed and/or approved/funded projects/studies that are planned to take place in the HIN:

- *Blue Ridge Avenue Sidewalk Extension*
- *Madison Road and Main Street Roundabout*
- *Orange Road and Germanna Highway Roundabout & Pedestrian Accommodations*
- *Germanna Highway and McDevitt Drive Roundabout*
- *James Madison Highway Pedestrian Accommodations*
- *Old Brandy Road Pedestrian Accommodations*
- *James Madison Highway and Nalles Mill Road R-Cut*
- *James Madison Highway and Dominion Square Roundabout*
- *James Madison Highway and Ira Hoffman Lane Roundabout*
- *VDOT Pipeline Study of US 29 Business (Madison Road)*
- *VDOT STARS Study of the US 15 Business Corridor*

# Community Outreach

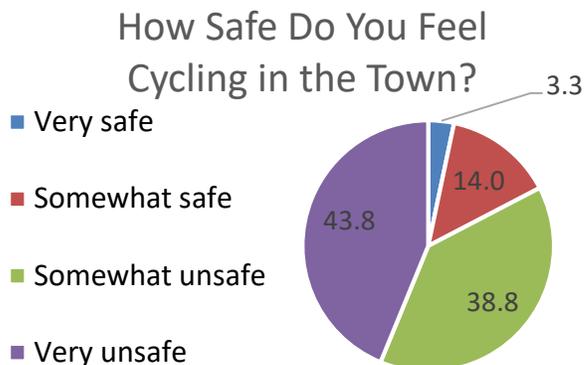
This plan was created after extensive community outreach. Staff attended two public events, both of which were located in Disadvantaged Communities per the Community Profile. At these events, staff discussed transportation related issues with citizens, distributed the survey, and allowed for citizens to identify areas on a map where they have experienced safety concerns. An online survey was posted along with an interactive map. A Spanish language version of the survey was also distributed.

The results of the survey showed that the primary mode of transportation within the town of the participants is driving (85.71 %). The second most popular mode is walking (10.5%) and then cycling (2.10%). The feeling of safety while cycling was by far the lowest with 82% of those who cycle saying they feel “somewhat unsafe” or “very unsafe” while cycling. 29.41% of survey participants cited the lack of bicycle lanes as an issue and 21.43% noted that narrow streets and street parking contribute to difficulties while cycling. When it came to walking, most respondents had issues crossing streets and intersections, and with sidewalk connectivity. The three most cited driving related issues were congestion on the roads, long/short traffic signals, and difficulty making left turns.

What issues do you typically experience when driving in the Town?	
Difficulty making left turns	32.91%
Lack of turn lanes	14.35%
Visibility/lack of adequate sight distance	28.27%
Difficulty merging into traffic	17.30%
Long or short turn signals	35.02%
Lighting	18.14%
Inadequate signage/road markings	9.28%
Congestion on roads	48.95%
Narrow roads	4.22%

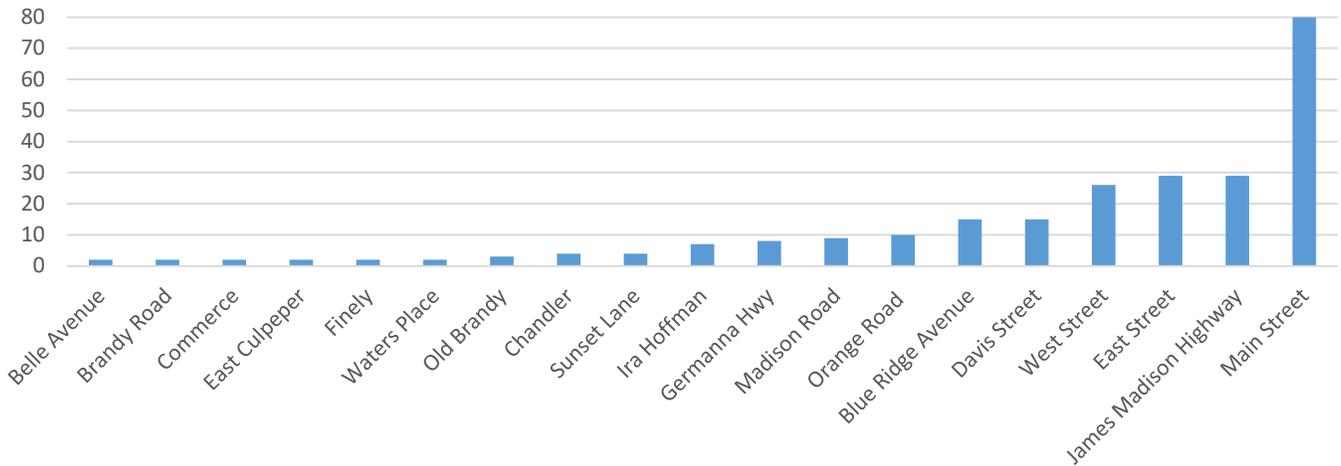
What issues do you typically experience when walking in the Town?	
Narrow sidewalks	31.22%
Lack of sidewalks/sidewalk connectivity	51.48%
Difficulty crossing streets/intersections	56.12%
Visibility	26.16%
Obstacles in walking path	23.63%
Congestion on sidewalks	11.81%
Non-ADA compliant sidewalks	11.39%

Survey participants were also asked to rate certain safety focuses. Improving pedestrian safety and accessibility, and reducing traffic congestion were by far the highest scoring. To improve walking within the Town, participants rated adding more sidewalks and trails, adding more signalized crosswalks, and increasing the connectivity of the sidewalk/trail network as the most important strategies. As for driving, participants prioritized increasing/improving signs and pavement markings, reducing speeds and replacing intersections with roundabouts.

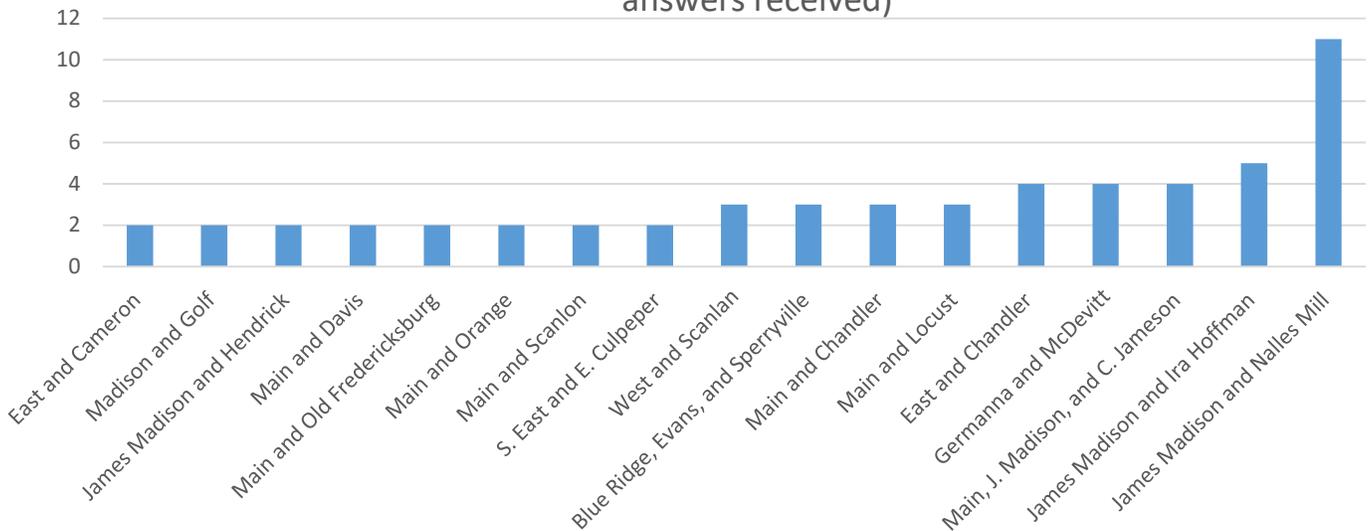


The Survey also asked respondents to identify areas and roadways within the town where they have experienced issues. The overwhelming majority indicated Main Street in response to that question. Other often identified streets included James Madison Highway, East Street, and West Street. As for intersections, James Madison and Nalles Mill Road cause the most issues for survey respondents.

In what specific areas, streets, or intersections have you experienced issues related to driving, walking, or cycling? (Non-Intersections)  
(Multiple answers received)



In what specific areas, streets, or intersections have you experienced issues related to driving, walking, or cycling? (Intersections)(Multiple answers received)



# Priority Areas

The data analysis identified several trends or Priority Areas. Focusing on these areas will help direct safety measures to areas of need. This portion of the data analysis will summarize each of the following Priority Areas:

**Crashes Involving Pedestrians**

**Crashes in Dark Conditions**

**Crashes at Intersections**

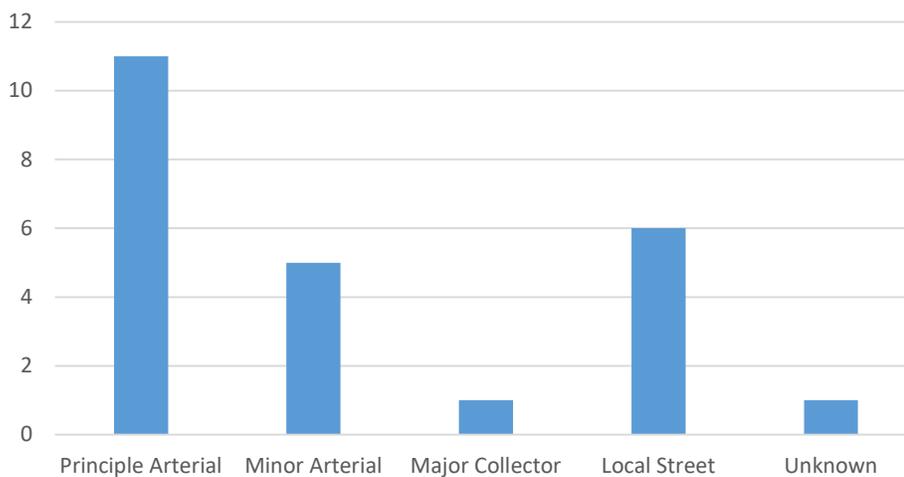
**Crashes Within the HIN**

**Crashes Caused by Behavioral Factors**

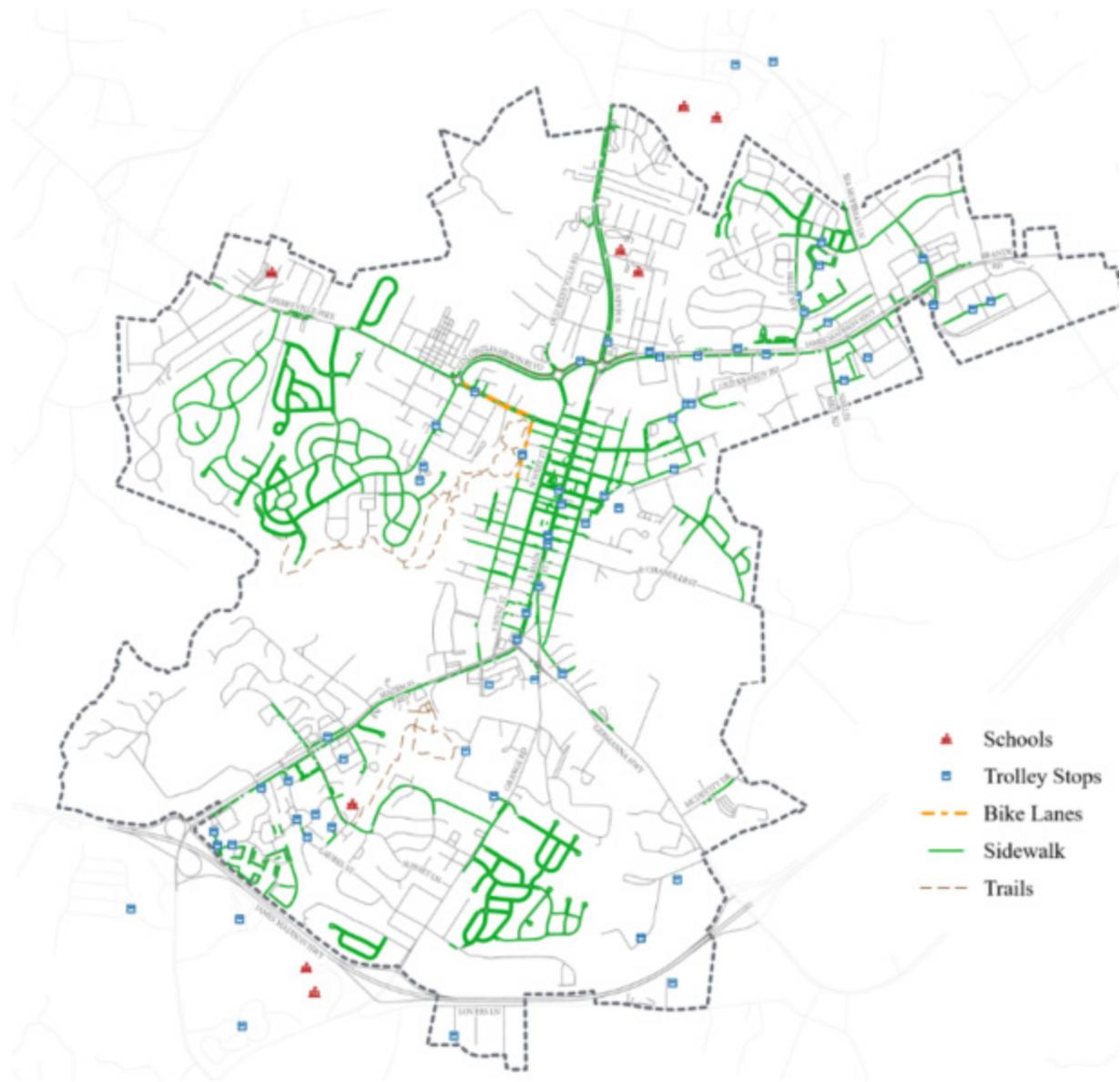
## Crashes Involving Pedestrians

Although only 24 of the 1,302 crashes involved pedestrians, these were by far the most severe on average. 5 resulted in severe injuries and 4 resulted in fatal injuries.

Pedestrian Crashes by Road Classification



Pedestrian crashes along major arterials were the most prevalent. Only 2 crashes occurred at pedestrian crosswalks and 16 occurred where there was no traffic control measure or where the control measure were marked lanes.



As part of the creation of this plan, Staff collected data on all sidewalks and crosswalks so the walkability of the Town can be fully understood and analyzed. By using this data we can see where gaps in the pedestrian network exist when prioritizing future projects and policies. This database can continuously be updated in the future as additions and modifications are made.

While the downtown appears to have the highest concentration of sidewalks and paths, there are several gaps including on Blue Ridge Avenue. The Northern and Southern sections of town are lacking in a connected pedestrian network. This is particularly alarming considering the location of schools in the town. For elementary schools, the walk zone can be one mile from the school property. For high schools and middle schools, the walk zone can be 1.5 miles. With the small size of Culpeper and the number of schools, almost the entire Town could potentially be in a school walk zone. Attention should be paid to underserved areas specifically near schools.

# Crashes in Dark Conditions

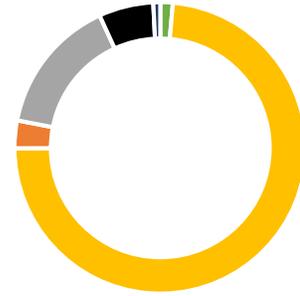
Only about 22% of all crashes occurred after dark. However, about 31% of fatal or severe crashes occurred in darkness with the road not lighted and over 10% occurred in darkness with the road lighted. As for fatal crashes, 1 occurred at dusk, 2 in darkness with the road lighted, and 4 in darkness with the road not lighted. 7 of the 9 pedestrian crashes that resulted in fatal or severe injuries occurred in the darkness with the road not lighted. The other 2 occurred at dusk or in darkness with the road lighted.

With these crashes being more severe on average than those that occur in daylight, it is important to analyze where lighting and other visibility improvements can be made. Madison Road, Germanna Highway, Sperryville Pike, Virginia Avenue, and James Madison Highway all had multiple crashes that occurred in darkness with the road not lighted. GIS data was used to map the density of streetlights within the Town’s right of way. Large sections of these corridors are lacking lights along the road. These areas should not be neglected in future project selection and strategies should be developed to increase visibility in these areas.



Example of Street lighting on Main Street

Light Conditions - All Crashes



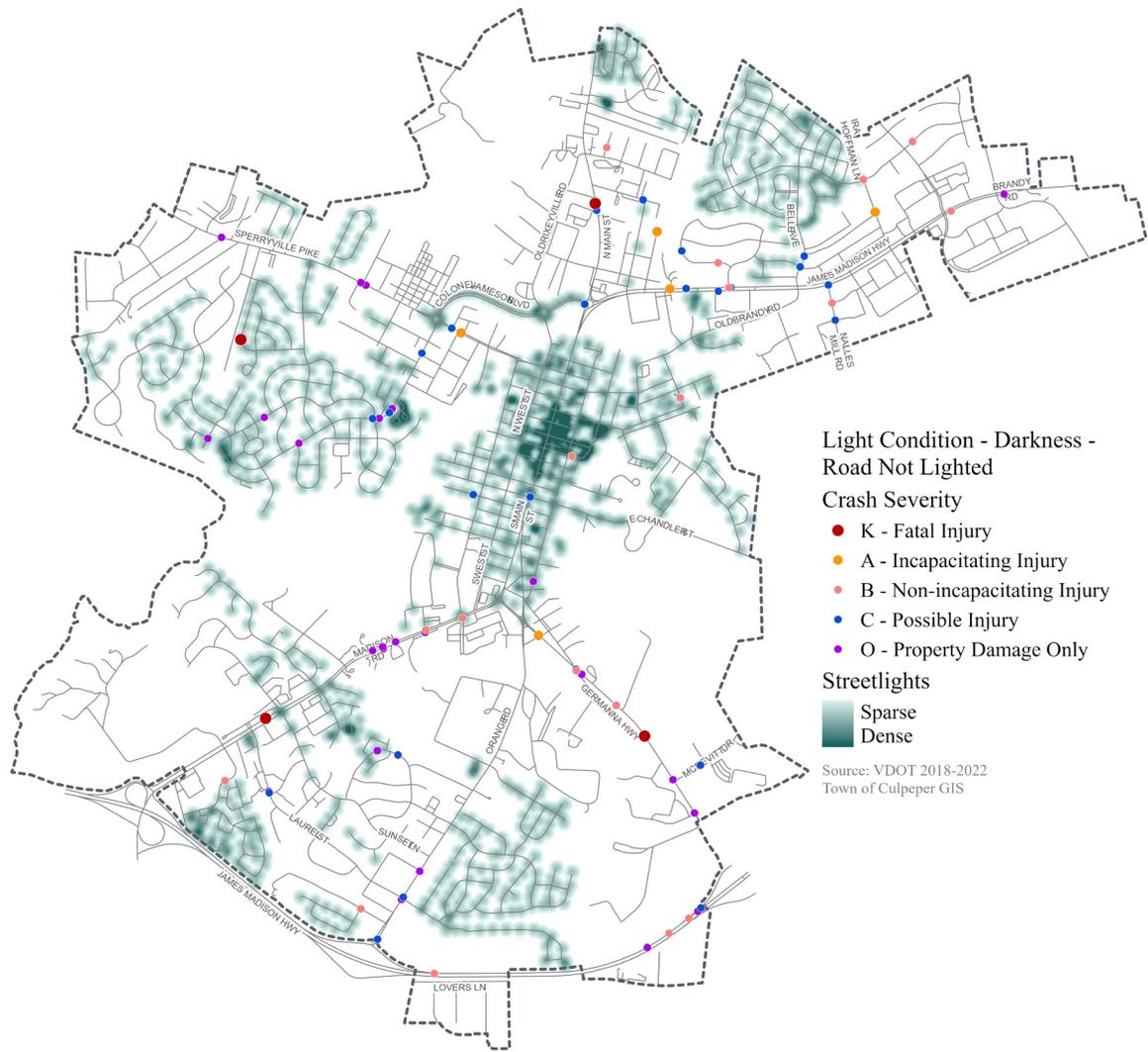
Light Conditions - Fatal & Severe



Light Conditions - Fatal Only



- Dawn
- Daylight
- Dusk
- Darkness - Road Lighted
- Darkness - Road Not Lighted
- Darkness - Unknown Road Lighting



## Crashes at Intersections

More than half of all crashes occurred at intersections. The most common type of crash at intersections were angle crashes (53%) and rear end crashes (23.24%). South Main Street and James Madison Highway had a large number of these crashes and were a common complaint in the community survey. On Main Street, over 30% of intersection crashes occurred where a traffic signal was present and 18% occurred where the traffic control measure was a stop sign. The most intersection crashes, however, occurred at the intersection of James Madison Highway and Nalles Mill Road, and the intersection of James Madison Highway and Ira Hoffman Lane. An R-Cut design for the Nalles Mill intersection is currently planned and a roundabout at the Ira Hoffman intersection was included in the Town's future SmartScale projects. Still, these intersections should be monitored once these improvements are made and other intersections within the HIN, such as Main Street, should be prioritized.



## Crashes Within the HIN

About 55% of all crashes within the HIN were at intersections. This is a slightly higher percentage when compared to the town as a whole. 44.15% were angle crashes and 28.16 were rear-end crashes. Safety efforts within the HIN should be focused on these types of crashes.

## Crashes Caused by Behavioral Factors

VDOT documents many variables when it comes to driver characteristics and behavior. Below is an analysis of these variables:

- **Age:** VDOT classifies drivers or pedestrians as seniors if they are 65 years of age or older and as young if they are under the age of 21. About 48% of all crashes involved a driver or pedestrian that is classified as either a senior or as young (24.42% and 24.12% respectively).
- **Alcohol:** Of total crashes, only 6.76% involved alcohol. However, of fatal and severe crashes, nearly 38% involved alcohol, as did 7 of 9 the pedestrian crashes.
- **Speeding:** Almost 22% of crashes that involved speeding occurred on Route 15 BUS (S. Main Street & James Madison Highway). Route 522 (Germanna Highway) and Route 29 BUS (Madison Road) were the other 2 roads with the highest number of crashes that involved speeding. 2 fatal crashes involved speeding: one on Route 15 BUS and the other on Woodcrest Loop.
- **Distracted:** Distracted drivers were a factor in 14.36% of all crashes and 10.34% of crashes that resulted in serious or fatal injuries. Nearly 28% of distracted drivers involved in a crash were under the age of 21.
- **Unbelted:** 54 crashes involved an unbelted occupant. 2 of these were fatal or severe. Both of those crashes involved speeding,
- **Large Truck:** 61 crashes involved a large truck. A large truck is defined as a vehicle that is a commercial vehicle or has the configuration type/body type of a heavy vehicle. 44.26% of these crashes occurred on principle arterials, which is where most truck traffic can be expected. However, 34.43% were on local streets. One crash involving a large truck resulted in fatal injuries and it occurred in the darkness on Germanna Highway and involved alcohol.

# Downtown Area Study

As part of this plan, the Town commissioned a study focused on the downtown and surrounding areas to reveal any pedestrian upgrades that can be implemented. Those recommendations were incorporated into the Action Plan and can be found in Appendix B and C. Some of the recommendations can also be applied in other areas of the Town as well. Hurt & Profitt and EPR, PC were contracted to perform this study.



# 4 Policies & Processes

# Current Policies

This section will outline and evaluate the Town’s current transportation policies. This will help to identify opportunities to change and improve our policies to prioritize safety. Transportation policy creation and enforcement is the responsibility of multiple departments and governmental bodies. Below is an outline of the role that each organization plays in the transportation process.

Town Council, Planning Commission, & Public Transportation Board	The Town Council is the elected body empowered to create and adopt policies, ordinances and plans related to transportation. The Planning Commission, a body composed of appointed citizens, serves as an advisory board to Town Council. The Public Transportation Board is also an advisory body, but is composed of citizens of the Town and Culpeper County.
Planning Department	The Planning Department enforces all policies and ordinances approved by Town Council and implements related plans. It reviews all plans of development including the construction of roads and other right-of-ways for compliance with the Town’s codes. It helps craft plans and policies at the will of Town Council.
Public Works Department	The Public Works Department maintains all Town owned roads. It influences the design and contributes to the plan review process as requested by the Planning Department.
Virginia Department of Transportation	Although most roads are maintained and owned by the Town, VDOT plays a pivotal role by providing maintenance funding and grant funding through programs such as Smart Scale and HBAP. VDOT provides technical advisory comments to the Planning Department on development plans.

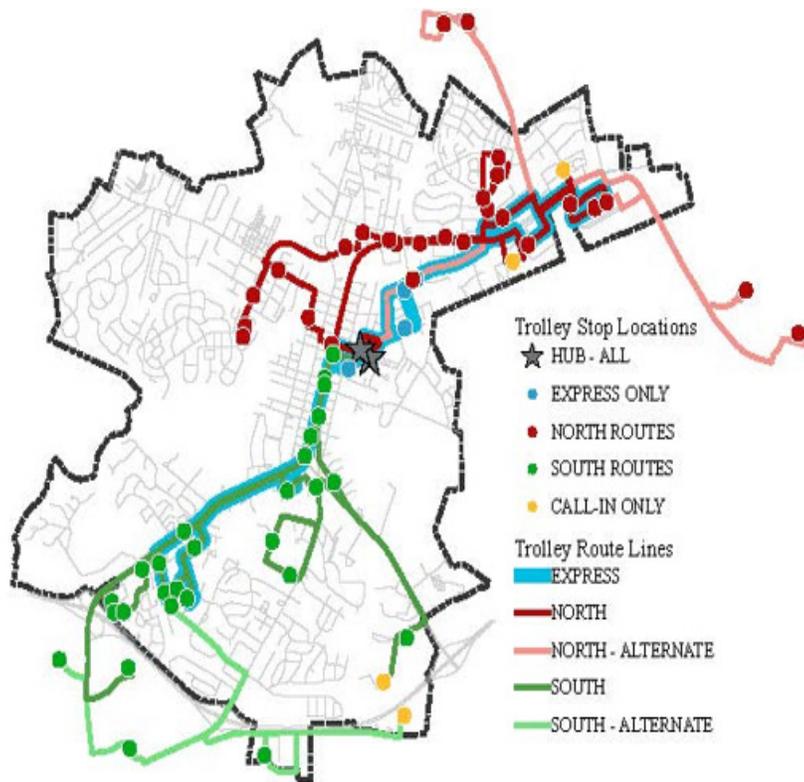
## Plans & Ordinances

Transportation related policy is set forth in the Town Code and the Facilities Standards Manual as guided by the Comprehensive Plan. Goals of the Comprehensive Plan related to transportation include: creating pedestrian-friendly neighborhoods and business districts, creating complete streets, encouraging connectivity, and implementing congestion management techniques in key areas including Main Street. In pursuit of the goals, the plan recommends designing the future road system to “minimize lives lost and the number and severity of personal injuries.” It does contain guidance for the creation and implementation for complete streets.

The Town Code contains the Zoning Ordinance and Subdivision Ordinance which hold the rules for development within the town. The Standards and Facilities Manual (FSM) contains the detailed requirement for constructing, designing and maintaining public facilities including roads, sidewalks, and trails. Together, these three documents are the primary tools for enforcing regulations for future development. The Zoning and Subdivision Ordinance are currently being completely overhauled. Once complete, the FSM will need to be revised. It is recommended that the revision is safety focused concerning the design of streets. The Safe Systems approach should be considered during the revision.

**What Are Complete Streets?**  
 Complete streets are streets that work for all users, not just those using a car. Efforts have been underway to adopt legislation at the national level that will require states to adopt complete street principles. The latest bill introduced to the House of Representatives is the Safe Streets Act of 2015 which would encourage inclusive design of America's streets. Many states, including Virginia, have adopted local policies supporting this type of roadway design. (Town of Culpeper Comprehensive Plan, 2018, Page 17)

## Public Transportation



Public transportation is provided by Virginia Regional Transit (VRT), a not-for-profit organization. The Town has three transit lines shown in the map to the left. The Express route was recently launched. Its goal is to provide access to the entire Town with a maximum waiting for pick up time of 10 minutes. The Public Transportation Board is made up of 6 members appointed by the Town Council and 1 that is appointed by the County Board of Supervisors. Public Transit can be important to safety by reducing the amount of vehicles on the roads. However, it is important that streets are designed with public transportation in mind. This can include complete streets principles.



# 5 Action Plan

# Action Plan Creation

To realize our vision of zero roadway deaths within the Town of Culpeper by 2034, 3 primary goals were developed. Each goal includes several strategies for reaching the goal. The project list then incorporates these strategies into specific actions. Each project includes a description with an initial equity assessment and a time frame in which the project will take place (Long, Mid., Short). The projects were also ranked based on priority. The prioritization takes into account the following:

***Safety Benefit:*** Information and recommendations from the data analysis was taken into account to determine the need and overall benefit of the project to the community.

***Projected Cost:*** The estimated cost of each project was weighed. Projects with lower costs were graded higher.

***Equity Considerations:*** Each project was scored on how it would benefit disadvantaged communities as identified in the Community Profile or disabled residents.

These factors were then averaged to rank the priority of each project as “High”, “Med” (medium), and “Low.” The projects with a high priority will be the first ones undertaken and will take precedence when seeking funds in the short term.



# Goals, Strategies, & Projects

## Goal 1: Institutionalize a Focus on Safety

**Strategy 1:** Create/revise policies and plans with a focus on safety to include traffic calming, complete streets, and other Safe System Approach principles.

**Strategy 2:** Prioritize Projects within the HIN.

**Strategy 3:** Conduct studies to inform and improve the data analysis.

## Goal 2: Design Streets to be Safe for All Users

**Strategy 1:** Increase visibility on streets by effectively illuminating the roadway and improving signage and street markings.

**Strategy 2:** Improve pedestrian and cyclist safety by implementing complete streets principles, connecting the sidewalk/pedestrian network, and by improving accessibility.

**Strategy 3:** Improve driver safety and traffic flow throughout Town by implementing complete streets principles, using the Safe System Approach when analyzing and developing projects, and by installing traffic calming measures.

**Strategy 4:** Ensure representation and public involvement in the planning process.

## Goal 3: Create a Culture of Safety

**Strategy 1:** Reduce dangerous driver behavior through education and enforcement.

**Strategy 2:** Regularly monitor and reevaluate the Action Plan.

Operational				
Project	Description	Timeframe	Strategy	Priority
Revise Facility Standards Manual	In conjunction with the Zoning and Sub-division Ordinance, the FSM is to be revised. Requirements regarding road design should be safety focused.	Short	1.1	High
	Initial Equity Assessment: This project is townwide and will impact all street users.			
Develop a process to incorporate safety improvements with future maintenance projects.	Create a process in which the Planning Department and the Public Works Department can coordinate regular maintenance with safety projects to reduce costs.	Short	1.1	High
	Initial Equity Assessment: This project is townwide and will impact all street users.			
Implement Complete Streets Guidance	Continue to implement the complete street guidance as supported in the Comprehensive Plan and continue its inclusion in the future plan revisions.	Mid	1.1	High
	Initial Equity Assessment: This project is townwide. It will improve street safety for those who walk, bike and use public transit.			
Seek grant funding for safety improvements	Staff will seek funding for safety projects from the State and Federal Governments. Projects within the HIN will be prioritized.	Continuous	1.1, 1.2	High
	Initial Equity Assessment: This project is townwide and will impact all street users. Portions of the HIN are within or adjacent to areas identified as disadvantaged communities in the Community Profile.			
Conduct a street lighting study	While decorative lighting exists in some areas, preliminary light meter readings suggest that they do not consistently provide sufficient light to the intersections. A downtown lighting study should be conducted to identify specific areas where lighting can be improved to reduce nighttime crashes.	Short	3.2	High
	Initial Equity Assessment: Portions of the Downtown are located in areas identified as disadvantaged communities in the Community Profile.			

Operational (Cont.)				
Project	Description	Timeframe	Strategy	Priority
Collect traffic counts & speeds traveled	Collect data on the number of trips and actual speeds traveled on local streets. This will help inform future projects and recommendations during the reevaluation process.	Mid	1.3	Med
	Initial Equity Assessment: This project is townwide and will impact all street users.			
Develop a process for citizens to request studies and improvements	A process will be created in which Town residents can apply for a traffic study for the implementation of specific safety measures.	Mid	1.1, 2.4	Med
	Initial Equity Assessment: This will allow residents in all areas of town and in all communities to give input on future projects.			
Monitor Action Plan success	Track and report project progress and implementation. The Task Force will review and update the Action Plan and Data Analysis every 5 years.	Continuous	1.1, 3.2	Med
	Initial Equity Assessment: This project is townwide and will impact all street users.			
Strengthen relationship with schools	Staff will coordinate with Culpeper County Schools to develop guidelines for increasing walkability to and from schools.	Short	2.2	Low
	Initial Equity Assessment: This project is townwide and will impact all street users.			

Infrastructure				
Project	Description	Timeframe	Strategy	Priority
High visibility crosswalks	Existing crosswalks can be redesigned to increase visibility. Suggested locations and design information can be found in Appendix B & C.	Short	2.1, 2.2, 2.3	High
	Initial Equity Assessment: Recommended locations are in areas identified as disadvantaged communities in the Community Profile.			
ADA curb ramp upgrades	Install and upgrade existing curb ramps to be ADA compliant. Suggested locations and design information can be found in Appendix B & C.	Short	2.2	High
	Initial Equity Assessment: This project will provide improved accessibility for disabled pedestrians.			
Curb extensions	Curb extensions make pedestrians more visible to drivers, help the pedestrians see around parked vehicles, and reduce pedestrian exposure. Curb extensions should be considered at locations with needed curb ramp upgrades in the short-term and at existing compliant intersections as needs arise. Consideration of heavy vehicle turning movements should be considered to balance the needs of people walking and deliveries to local businesses. Suggested locations and design information can be found in Appendix B & C.	Mid	2.2, 2.3	High
	Initial Equity Assessment: This should improve street safety and access for those who walk. Recommended locations are in areas identified as disadvantaged communities in the Community Profile.			
Sidewalk installation	Sidewalks should be installed where feasible and where gaps exist. Suggested locations can be found in Appendix B.	Long	2.2	High
	Initial Equity Assessment: This should improve street safety and access for those who walk. Recommended locations are in areas identified as disadvantaged communities in the Community Profile.			

Infrastructure (Cont.)				
Project	Description	Timeframe	Strategy	Priority
Stop sign improvements	Some existing stop signs are not visible to drivers and there are no corresponding stop bar pavement markings. Increasing the size of stop signs can improve visibility of these signs. Adding stop bars would also help drivers prepare to stop in advance of the crosswalk. Suggested locations and design information can be found in Appendix B.	Mid	2.1, 2.2, 2.3	High
	Initial Equity Assessment: Recommended locations are in areas identified as disadvantaged communities in the Community Profile.			
Pedestrian signal upgrades	Pedestrian Signals should include vibrotactile arrows, countdown signals and audible features. Suggested locations and design information can be found in Appendix B & C.	Short	2.2	Med
	Initial Equity Assessment: This should improve street safety and access for those who walk. Recommended locations are in areas identified as disadvantaged communities in the Community Profile.			
Median refuges	Median refuges can enhance pedestrian safety by allowing them to cross one direction of traffic at a time. Suggested locations and design information can be found in Appendix B & C.	Long	2.2, 2.3	Med
	Initial Equity Assessment: This should improve street safety and access to those who walk while also serving as a traffic calming device.			
Bus stop improvements	Improve existing bus shelters and install them at unsheltered stops. This will protect those waiting at stops and make using public transportation more appealing.	Short	2.3	Med
	Initial Equity Assessment: This project is townwide but will benefit those who use public transit and those who do not have access to a vehicle.			

Infrastructure (Cont.)				
Project	Description	Timeframe	Strategy	Priority
Conversion of two-way streets into one-way streets	Converting East Davis Street and Culpeper Street into one-way streets limits the number of potential crashes attributable to turning movements at the intersection and create more space safe for pedestrian movement. Suggested design information can be found in Appendix B.	Long	2.2, 2.3	Med
	Initial Equity Assessment: Recommended locations are in areas identified as disadvantaged communities in the Community Profile.			
Improved signal timing	Coordinated signal timing synchronizes traffic movements and manages the progression speed where uninterrupted flow is desired along a corridor. Suggested locations and design information can be found in Appendix B & C.	Short	2.3	Low
	Initial Equity Assessment: Recommended locations are in areas identified as disadvantaged communities in the Community Profile.			
Raised crosswalks	Raised crosswalks improve pedestrian visibility and safety by elevating them to the same level as the sidewalk. Suggested locations and design information can be found in Appendix B & C.	Long	2.2, 2.3	Low
	Initial Equity Assessment: This should improve street safety and access to those who walk while also serving as a traffic calming device.			
Utility pole relocation	Moving utility poles that obstruct pedestrian access behind the sidewalk or undergrounding utilities would remove these barriers and provide safe, accessible travel. Suggested locations can be found in Appendix B.	Long	2.2	Low
	Initial Equity Assessment: This should improve street safety to those who walk and improve the accessibility of the sidewalks for disabled users.			

Infrastructure (Cont.)				
Project	Description	Timeframe	Strategy	Priority
Intersection reconfiguration	Intersection reconfiguration could involve street realignment, round-a-bout installation, and one-way traffic patterns. Suggested design information can be found in Appendix B.	Long	1.2, 2.3	Low
	Initial Equity Assessment: Recommended locations are in areas identified as disadvantaged communities in the Community Profile.			

Behavioral				
Project	Description	Timeframe	Strategy	Priority
Multi-language publications	Publish all future planning and street safety related documents in Spanish.	Short	2.4	High
	Initial Equity Assessment: This project will help distribute information to the Town's Spanish speaking population.			
Seat belt enforcement signage	Increase signage encouraging the use of seat belts.	Mid	3.1	Med
	Initial Equity Assessment: This project is town wide and will most impact those who drive.			
DUI Checkpoints	Expand the use of DUI checkpoints conducted by the Culpeper Police Department to discourage impaired driving.	Short	3.1	Med
	Initial Equity Assessment: This project is town wide and will most impact those who drive.			
Driver education programs	Integrate Vision Zero principles into driver's education programs.	Mid	2.3, 3.1	Low
	Initial Equity Assessment: This project is town wide and will impact all street users.			
Way-finding Signage	Add way-finding signage throughout the Town to help drivers to effectively reach their destinations.	Long	3.1	Low
	Initial Equity Assessment: This project is town wide and will impact all street users.			

Behavioral (Cont.)				
Project	Description	Timeframe	Strategy	Priority
School zone speed enforcement	School zone speed photo enforcement can be used to increase driver compliance in the reduced speed zones while improving the safety of students near schools.	Mid	3.1	Low
	Initial Equity Assessment: This project is townwide and will impact all street users.			

# Progress & Transparency

To ensure the vision of this plan in being realized, the success of the strategies and projects will need to be analysed. The following measures will be implemented to measure progress and ensure transparency:

**Plan Availability:** Once adopted this plan and all future updates and amendments will be available online through the Town’s website.

**Project Tracking:** Projects will be tracked for adherence to this plan. Each year the Task Force will produce a report detailing the progress of each project. This report will include the funding source, status update, and estimated completion time. This may be combined with the Culpeper 2030 Plan.

**Review and Updates:** In addition to the project tracking, every 5 years the Task Force will review and update the plan with current data and revise the Action Plan as needed. New crash data will help reveal the successes and weakness of the proposed strategies and projects.

# Appendix A



# TOWN OF CULPEPER

## DEPARTMENT OF PLANNING & COMMUNITY DEVELOPMENT

400 S. Main St., Suite 301 • Culpeper, VA 22701  
(540) 829-8260 • FAX (540) 829-8279

[www.culpeperva.gov](http://www.culpeperva.gov)

## Transportation Safety Action Plan Survey

### Part 1: Issues and Concerns

1. What is your primary mode of transportation within the Town?
  - A. Driving
  - B. Walking
  - C. Cycling
  - D. Public Transit
  - E. Other
2. How safe do you feel **walking** in the Town?
  - A. Very safe
  - B. Somewhat safe
  - C. Somewhat unsafe
  - D. Very unsafe
  - E. N/A
3. How safe do you feel **driving** in the Town?
  - A. Very safe
  - B. Somewhat safe
  - C. Somewhat unsafe
  - D. Very unsafe
  - E. N/A
4. How safe do you feel **biking** in the Town?
  - A. Very safe
  - B. Somewhat safe
  - C. Somewhat unsafe
  - D. Very unsafe
  - E. N/A
5. What issues do you typically experience when **walking** in the Town? (Select all that apply)
  - A. Narrow sidewalks
  - B. Lack of sidewalks/sidewalk connectivity
  - C. Difficulty crossing streets/intersections
  - D. Visibility
  - E. Obstacles in walking path
  - F. Congestion on sidewalks
  - G. Non-ADA complainant sidewalks (lack of ramped entrance, narrowness, steep slopes, etc.)
  - H. Other \_\_\_\_\_
  - I. N/A
6. What issues do you typically experience when **driving** in the Town? (Select all that apply)
  - A. Difficulty making left turns
  - B. Lack of turn lanes

- C. Visibility/lack of adequate sight distance when making turns
  - D. Difficulty Merging into traffic
  - E. Long or short traffic signals
  - F. Lighting
  - G. Inadequate signage/road markings
  - H. Congestion on roads
  - I. Narrow roads
  - J. Other \_\_\_\_\_
  - K. N/A
7. What issues do you typically experience when **cycling** in the Town? (Select all that apply)
- A. Difficulty making Left Turns
  - B. Crossing intersections
  - C. Visibility/lack of adequate sight distance when making turns
  - D. Maintenance of roads and paths
  - E. Lack of bicycle lanes
  - F. Inadequate signage/road markings
  - G. Congestion on roads
  - H. Narrow roads/cars parked on streets
  - I. Other \_\_\_\_\_
  - J. N/A
8. In what specific areas, streets, or intersections have you experienced issues related to driving, walking, or cycling?

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**Part 2: Safety Strategies**

9. Rank the following safety focuses in order of importance (“1” being of greatest importance):
- \_\_\_ Reducing traffic congestion
  - \_\_\_ Reducing speeds/speeding
  - \_\_\_ Improving public transit access and service
  - \_\_\_ Improving pedestrian safety and accessibility
  - \_\_\_ Improving cyclist safety and accessibility
  - \_\_\_ Other
10. Rank the following safety strategies that would improve **walking** in the Town in order of importance (“1” being of greatest importance):
- \_\_\_ More Signalized crosswalks
  - \_\_\_ More sidewalks and trails
  - \_\_\_ Increased connectivity of sidewalks and trails
  - \_\_\_ increase width of sidewalks
  - \_\_\_ Elevated/dome crosswalks

- Street lights
  - Creating pedestrian-only streets
  - Other: \_\_\_\_\_
- 

11. Rank the following safety strategies that would improve **driving** in the Town in order of importance (“1” being of greatest importance):

- Reduced speeds
  - Better/increased signs and pavement markings
  - Replacing intersections with roundabouts
  - Stronger law enforcement presence
  - automated speed enforcement
  - Conversion of 2-way streets into 1-way streets
  - Improved visibility/sight distances
  - Bypass for through traffic
  - Other: \_\_\_\_\_
- 

12. Rank the following safety strategies that would improve **cycling** in the Town in order of importance (“1” being of greatest importance):

- More Bike Lanes
  - Wider streets
  - Better maintained streets
  - Physical barrier along bike lines
  - Reduced speeds of vehicles
  - More signs to increase awareness
  - Other: \_\_\_\_\_
- 

13. Please share any other strategies you feel would help improve the safety of all drivers, pedestrians and cyclists:

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**Part 3: Demographics**

14. What gender do you identify as? (optional)

- a. Male
- b. Female
- c. Other \_\_\_\_\_
- d. Prefer not to say

15. Please select your age. (optional)

- a. 18 - 24
- b. 25 - 34
- c. 35 - 44
- d. 45 - 54
- e. 55 - 64
- f. 65 and over
- g. Prefer not to say

16. Please select your race. (optional)

- a. American Indian or Alaska Native
- b. Asian
- c. Black or African American
- d. Native Hawaiian or Other Pacific Islander
- e. White
- f. More than one race
- g. Other \_\_\_\_\_
- h. Prefer not to say

17. Please select your ethnicity. (optional)

- a. Hispanic or Latino or Spanish Origin
- b. Not Hispanic or Latino or Spanish Origin
- c. Prefer not to say

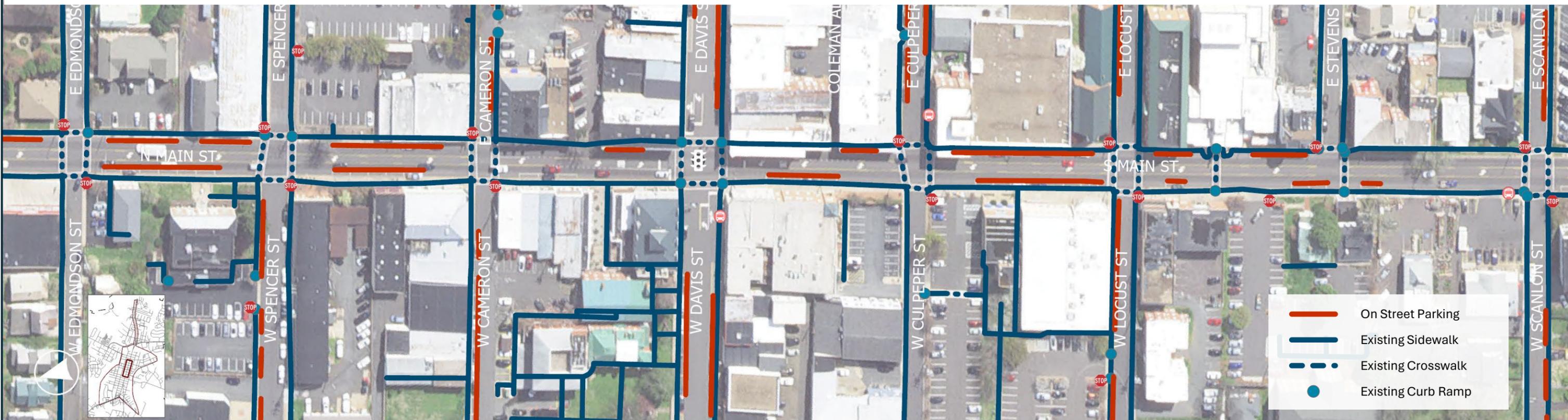
18. Please select your annual household income. (optional)

- a. Less than \$25,000
- b. \$25,000 - \$50,000
- c. \$50,000 - \$75,000
- d. \$75,000 - \$100,000
- e. \$100,000 - \$200,000
- f. More than \$200,000
- g. Prefer not to say

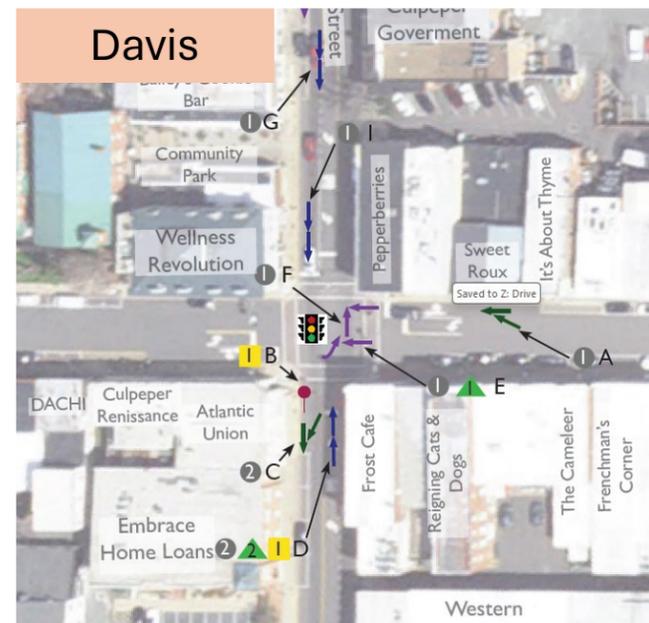
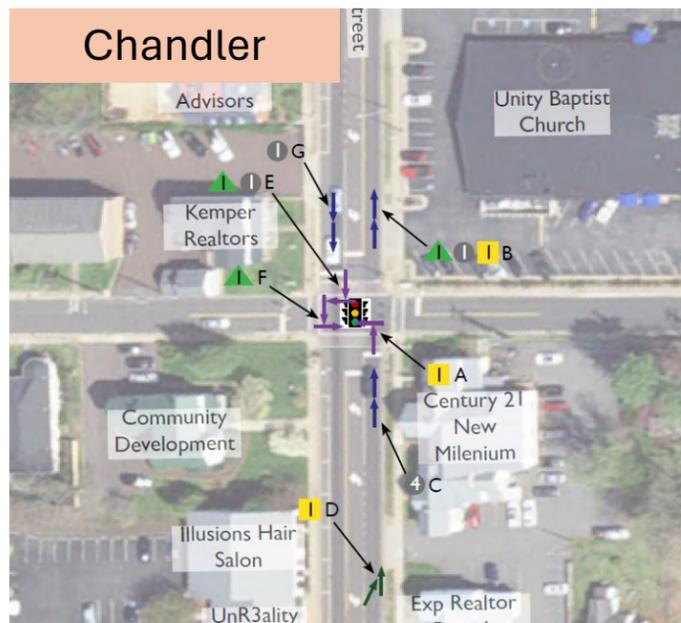
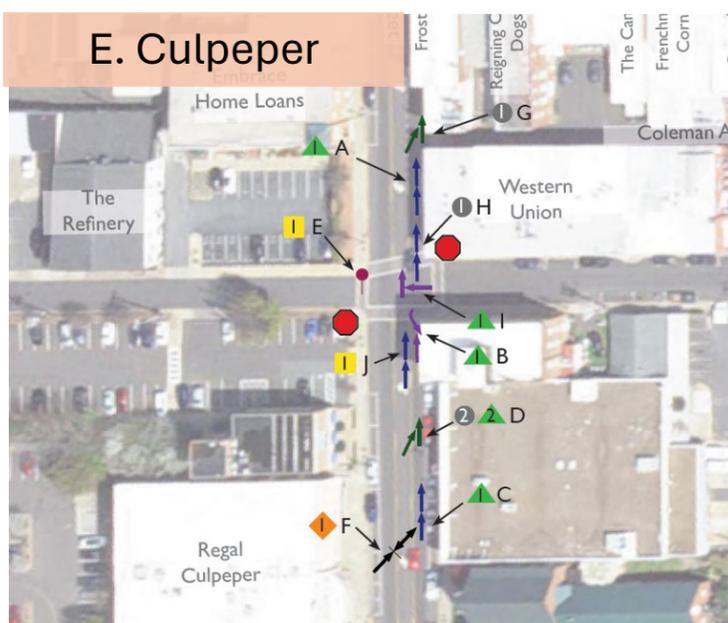
# Appendix B

### Corridor Description

Main Street is a principal arterial serving local and regional traffic, commercial vehicles, pedestrians, and transit. The typical section is consistent throughout the corridor with two lanes of traffic, a continuous center turn lane to serve the numerous side streets and driveway access points, as well as on-street parking. There are continuous sidewalks with paver-style marked crosswalks at all of the intersections in the downtown area and decorative streetlighting to emphasize the character of the downtown district. Outside of the downtown core, the crosswalks change to high-visibility markings and more distributed street lighting.



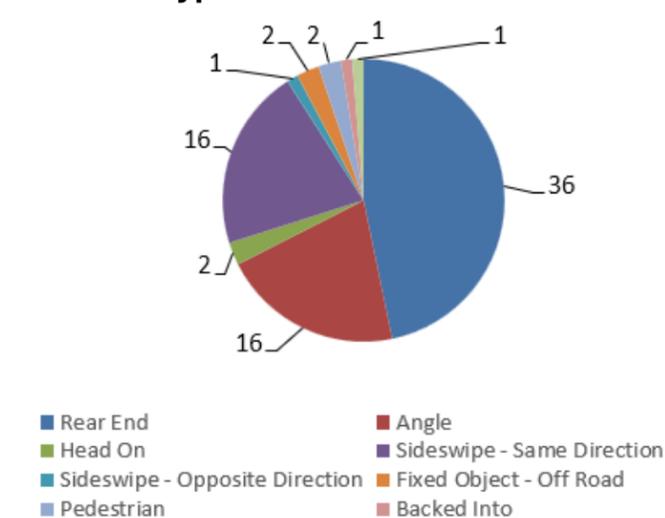
### High Crash Intersections



### Corridor Crash Summary (2019-2023)

**Total Crashes: 77**  
 Severe Injury: 2  
 Visible Injury: 14  
 Non-Visible Injury: 29  
 Property Damage Only: 32

### Collision Types



# MAIN ST – from Edmondson Street to Scanlon Street



## Recommended Improvements & Safety Benefits

### Pedestrian Improvements

- 1 High Visibility Crosswalks** - In the short term, wider parallel markings could improve the visibility of the existing paver crosswalks. As existing markings reach the end of their useful life, high-visibility crosswalks should be considered. These provide a CMF value of .60.
- 2 ADA Curb Ramp Upgrades**—Several intersections need ADA-compliant curb ramp upgrades. These include Edmondson, Spencer, Cameron, Culpeper, Locust, Scanlon, Mason, Park, Chandler, Asher, Spring, and Oakview.
- 3 Pedestrian Signal Upgrades** – The current pedestrian signals at Davis and Evans Streets lack vibrotactile arrows and audible features. At Evans, there is no pedestrian countdown timer. Installing a pedestrian countdown timer provides a CMF of .30. In addition, a leading pedestrian interval can improve pedestrian visibility at these intersections providing a CMF value of .41-.81.
- 4 Curb Extensions** – On-street parking restricts the view of both drivers and pedestrians waiting to cross Main Street. Curb extensions make pedestrians more visible to drivers and help the pedestrians see around parked vehicles. Curb extensions should be considered at locations with needed curb ramp upgrades in the short term and at existing compliant intersections as needs arise. Consideration of heavy vehicle turning movements should be given to balance the needs of people walking and deliveries to local businesses.
- 5 Median Refuge**—Significant pedestrian traffic crosses mid-block at the Post Office. A median refuge in this location would allow someone to cross one traffic lane while providing a safe waiting area to cross the other lane. A median refuge provides a CMF of .69 - .75.

### Corridor Improvements

- 6 Corridor Lighting** – The South Main Street corridor has existing decorative streetscape lighting. While preliminary light meter readings suggest that these lights are sufficient, the overhead lights do not sufficiently light the intersections. A downtown lighting study should be conducted to identify specific areas where lighting can be improved to reduce night-time crashes. Improved lighting at intersections provides a CMF value of .881.
- 7 Improved Signal Timing** – Main Street is both a heavy vehicle thoroughfare and many of the crashes can be attributed to traffic congestion. Coordinated signal timing synchronizes traffic movements and manages the progression speed where uninterrupted flow is desired along a corridor. Signal timing is one of the most cost-effective ways to improve traffic flow and safety by coordinating signals to reward slower driving speeds of 15–20 mph through the downtown area. Re-timing or optimizing traffic signals provides a CMF value of .958. Installing an adaptive signal provides a CMF value of .642.

## Planning Level Cost Estimates

- Crosswalks** = \$1200 each
- Curb Ramps** = \$2500 each
- Pedestrian Signal Upgrades** = \$20K per intersection
- Curb Extensions** = \$10K-\$60k
- Median Refuge** = \$10-\$60K each
- Sidewalk** = \$250/LF
- Lighting** = \$100,000/intersection
- Raised Crosswalk** = \$50,000/crossing
- Raised intersection** = \$300,000/intersection
- Relocating Overhead Utility Pole** = \$60-150K/pole

# EAST ST – from Edmondson Street to Scanlon Street

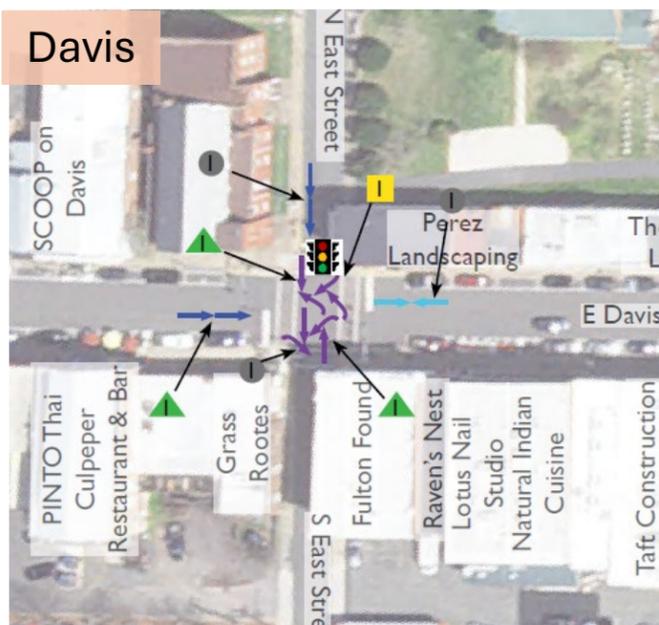
## Corridor Description

East Street is a mix of commercial and residential uses and is used as an alternative to Main Street for people traveling north/south. It is a relatively narrow street with roadway widths of approximately 24 feet. Visibility and sight distances are limited travelling WB on Davis, Culpeper and Locust. There is a continuous sidewalk along the west side of East Street and long portions of sidewalk on the east, though they are not continuous. There are few marked crossings at Edmondson, Davis and Culpeper. Davis Street has a signalized intersection and there is a new 4-way stop at the intersection of Locust.

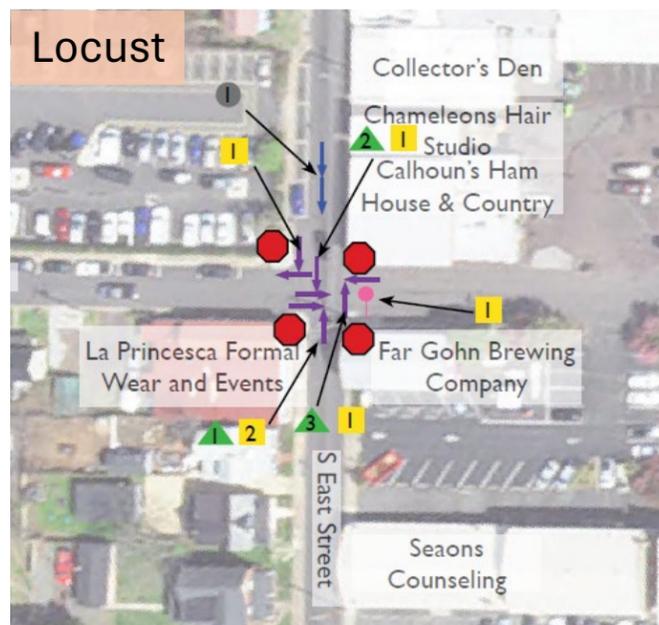


## High Crash Intersections

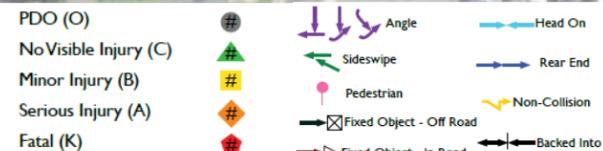
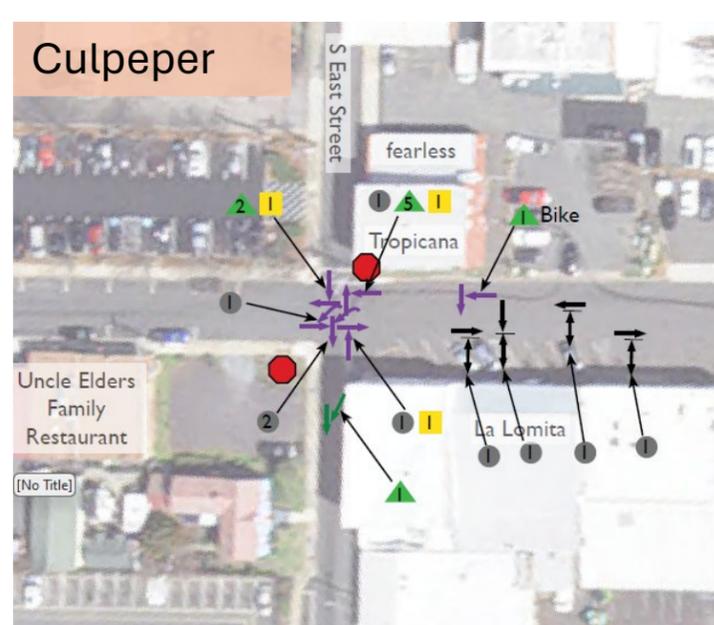
### Davis



### Locust



### Culpeper



## Corridor Crash Summary (2019-2023)

**Total Crashes:** 57

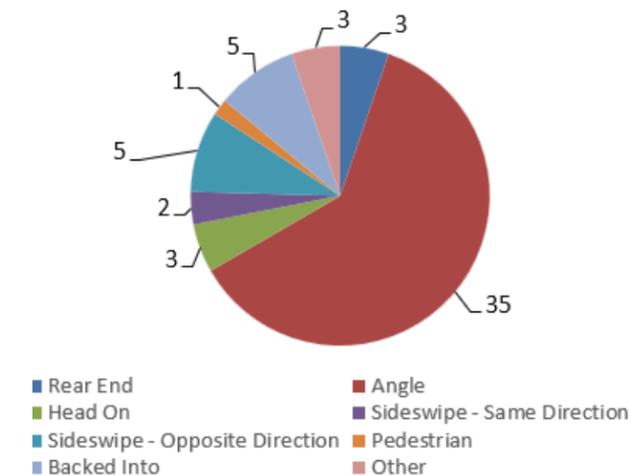
### Severity

Visible Injury: 15

Non-Visible Injury: 23

Property Damage Only: 19

### Collision Types



# EAST ST – from Edmondson Street to Scanlon Street



## Recommended Improvements & Safety Benefits

### Pedestrian Improvements

- 1 **High Visibility Crosswalks** - There is an immediate need to provide marked crosswalks across East Street at East Culpeper, E. Locust, and E. Stevens Street to facilitate pedestrian travel. Where new crossings are provided, curb ramps should be provided to ensure pedestrian access in the desired direction of travel. As existing markings on East Davis reach the end of their useful life, high-visibility crosswalks should be considered. These provide a CMF value of .60.
- 2 **Curb Extensions** - While there is limited on-street parking on East Street, there is one small section north of Locust that restricts the view of both drivers and pedestrians waiting to cross East Street and increases pedestrian exposure in the intersection. Curb extensions make pedestrians more visible to drivers, help pedestrians see around parked vehicles, and shorten the crossing distance.
- 3 **Sidewalks** - There is a 400' sidewalk gap between East Spencer and Piedmont that could be completed to provide safe and continuous pedestrian access to the marked crosswalk at Edmondson. In addition, there are gaps in the sidewalk network on Culpeper, Locust, and Stevens approaching the intersection of East Street. Completing these sidewalk gaps, along with crosswalk and curb ramp upgrades, would provide additional pedestrian access within the downtown area. New sidewalks provide a CMF of .12 -.598. In the short-term, a pedestrian lane could provide dedicated space for pedestrians walking in this area.
- 4 **Pedestrian Signal Upgrades** - The current pedestrian signal at Davis/East Street lacks vibrotactile arrows and audible features. There are also no pedestrian countdown features, the pushbuttons are located high on the signal pole, and on the SE corner the button is located 16' from the crosswalk. Updating these features can provide additional information to users wanting to cross Davis Street. In addition, a leading pedestrian interval can improve pedestrian visibility at the signalized intersections. Installing a pedestrian countdown timer provides a CMF of .30 and a leading pedestrian interval provides a CMF value of .81. The town could also conduct a traffic signal warrant analysis to determine if the signalized intersection is needed.

### Corridor Improvements

- 5 **Corridor Lighting** - While lighting is present in certain segments of the corridor, preliminary light meter readings suggest that they do not consistently provide sufficient light to the intersections. A downtown lighting study should be conducted to identify specific areas where lighting can be improved to reduce night-time crashes. Improved lighting at intersections provides a CMF value of .881.

## Planning Level Cost Estimates

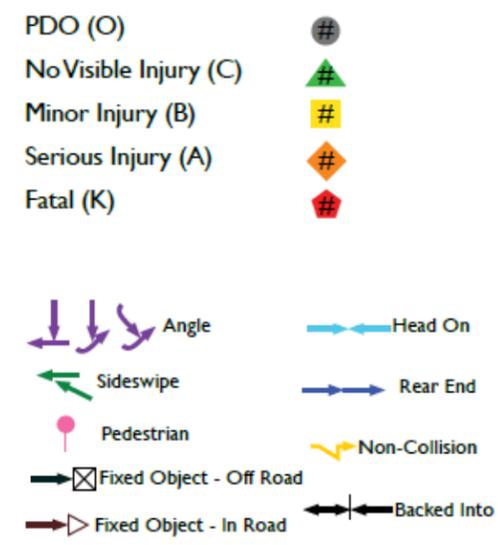
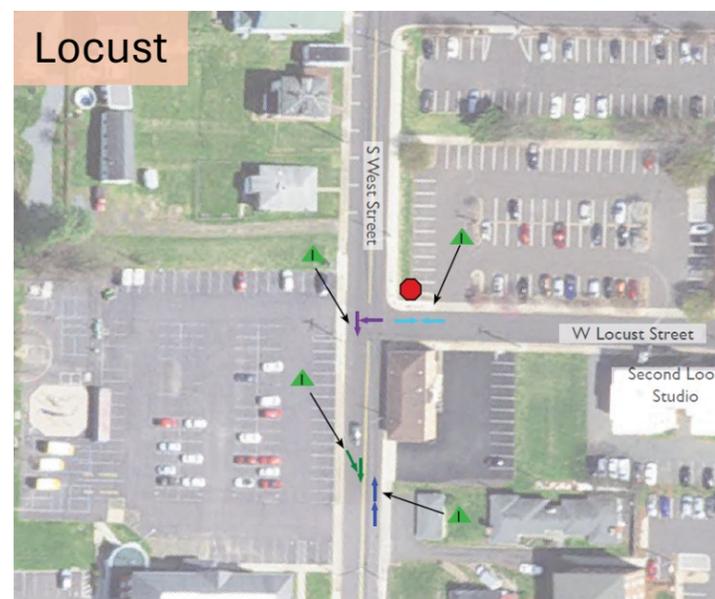
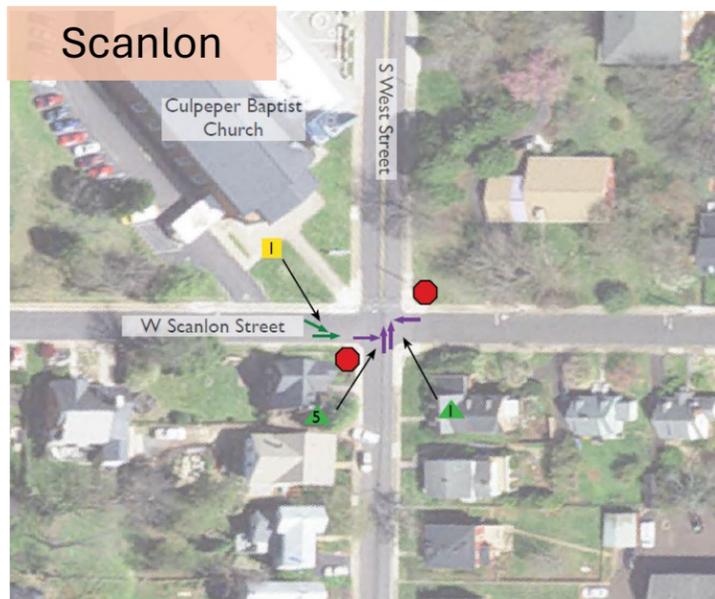
- Crosswalks** = \$1200 each
- Curb Ramps** = \$2500 each
- Pedestrian Signal Upgrades** = \$20K per intersection
- Curb Extensions** = \$10K-\$60k
- Median Refuge** = \$10-\$60K each
- Sidewalk** = \$250/LF
- Lighting** = \$100,000/intersection
- Raised Crosswalk** = \$50,000/crossing
- Raised intersection** = \$300,000/intersection
- Relocating Overhead Utility Pole** = \$60-150K/pole

### Corridor Description

West Street is a major collector with a mix of commercial/residential uses and is often used as an alternative to Main Street for people traveling north/south. A church at the intersection of Scanlon Street houses an adult daycare and preschool, which contributes to the need for safe pedestrian accommodations and slow speeds along this corridor. The typical section varies from block to block, with pavement widths ranging from 23-40 feet. There is a continuous sidewalk along the west side of West Street between 522 and Park Street, with portions of sidewalk on the east side and limited sections of on-street parking between Spencer and Locust Ave. There are marked pedestrian crossings at Cameron and Culpeper and a your speed is feedback sign at the mid-block crossing between Locust and Scanlon. Outside of these areas, some hills block visibility at the intersections.



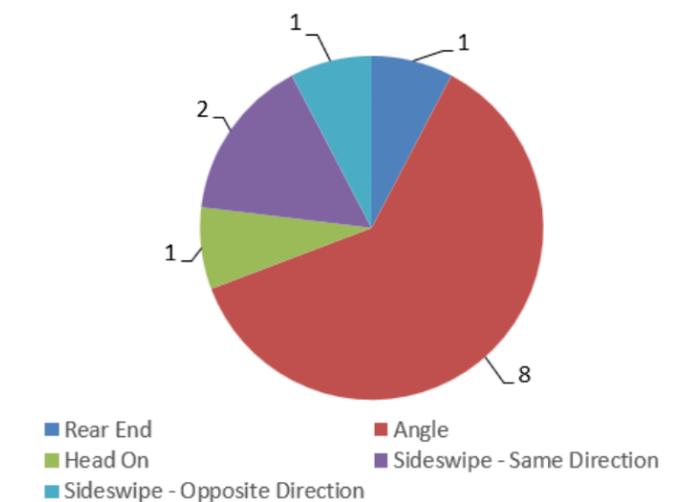
### High Crash Intersections



### Corridor Crash Summary (2019-2023)

**Total Crashes: 13**  
**Severity**  
 Visible Injury: 1  
 Non-Visible Injury: 12

#### Collision Types



# WEST ST – from Edmondson Street to Scanlon Street



## Recommended Improvements & Safety Benefits

### Pedestrian Improvements

- 1 High Visibility Crosswalks**—Three high-visibility crosswalks currently exist on West Street at W. Culpeper, W. Cameron, and mid-block between Scanlon and Locust. However, both Davis Street and Scanlon could benefit from marked crosswalks. Davis is a heavy pedestrian corridor and on a direct route to many public buildings and Scanlon connects significant residential areas to the Main Street. New high visibility crosswalks provide a CMF value of .60.
- 2 Curb Extensions** – Curb extensions on the west side of West Street at Cameron, Davis, Culpeper would improve visibility for pedestrians trying to cross amidst the on-street parking. Curb extensions make pedestrians more visible to drivers, help pedestrians see around parked vehicles, and reduce pedestrian exposure. Curb extensions can also calm traffic. A curb extension with a high-visibility crosswalk at Davis Street can facilitate east-west travel along the community’s primary pedestrian corridor, providing access to several governmental and commercial destinations.
- 3 ADA Curb Ramp Upgrades** - While most of the curb ramps are up to date on this corridor, there are a couple of locations where the curb ramp orientation does not provide for safe crossing in the desired direction of travel. A curb ramp is needed on the NE corner of West Cameron to facilitate north/south travel on West Street and curb ramps are needed at the marked crossing at Culpeper to facilitate the crossing of West Street.
- 4 Median Refuge**—A median refuge at the existing midblock crossing can calm traffic and reduce speeds by narrowing the roadway and providing deflection. It can also be used as a refuge island for people walking or biking to facilitate a safer and more comfortable crossing. A median refuge in this location would allow older road users and young children to cross one traffic lane while providing a safe waiting area to cross the other lane. A median refuge provides a CMF of .69.

### Corridor Improvements

- 5 Corridor Lighting** – While lighting is present in certain segments of the corridor, preliminary light meter readings suggest that they do not consistently provide sufficient light to the intersections. A downtown lighting study should be conducted to identify specific areas where lighting can be improved to reduce night-time crashes. Improved lighting at intersections provides a CMF value of .881.
- 6 Traffic Calming** – Curb extensions and median refuges can provide traffic calming for this corridor. Alternating parking/mid-block curb extensions between Edmonson and Locust can create a chicane that narrows the roadway and requires vehicles to follow a curving, S-shaped path, discouraging speeding.

## Planning Level Cost Estimates

- Crosswalks** = \$1200 each
- Curb Ramps** = \$2500 each
- Pedestrian Signal Upgrades** = \$20K per intersection
- Curb Extensions** = \$10K-\$60k
- Median Refuge** = \$10-\$60K each
- Sidewalk** = \$250/LF
- Lighting** = \$100,000/intersection
- Raised Crosswalk** = \$50,000/crossing
- Raised intersection** = \$300,000/intersection
- Relocating Overhead Utility Pole** = \$60-150K/pole

# BLUE RIDGE AVE – from Edmondson Street to Scanlon Street

## Corridor Description

The character of Blue Ridge Avenue varies widely. The road is wide on the northern limits of the corridor with good visibility. There are bike lanes and a high-visibility crosswalk to access Yowell Meadow Park. A sidewalk and on-street parking improvements are planned on the west side of the road. Heading south at Culpeper the road rises with some rolling hills restricting visibility at many intersections. On-street parking is present in some locations, further reducing the available pavement width and visibility at the intersections. Two-way stops are present on most of the side streets.

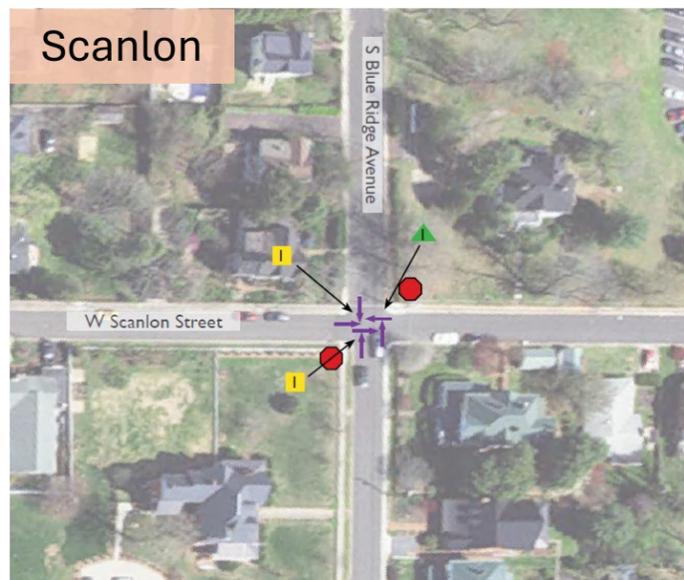


## High Crash Intersections

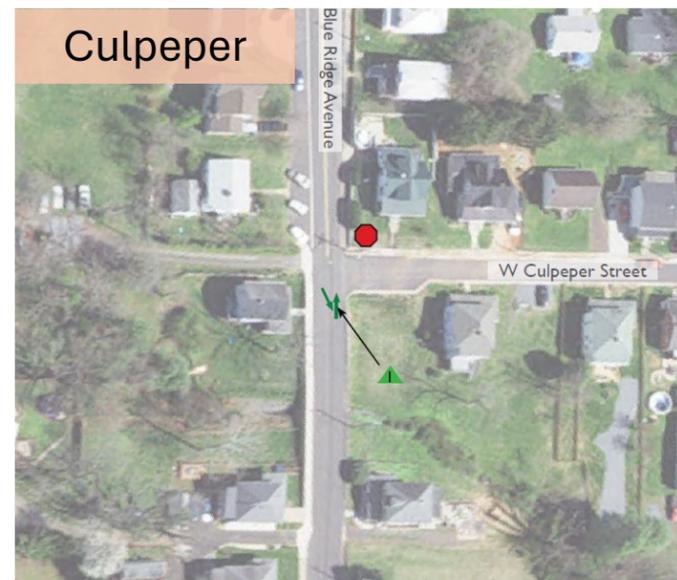
### Locust



### Scanlon



### Culpeper



- |                       |                         |               |
|-----------------------|-------------------------|---------------|
| PDO (O)               | Angle                   | Head On       |
| No Visible Injury (C) | Sideswipe               | Rear End      |
| Minor Injury (B)      | Pedestrian              | Non-Collision |
| Serious Injury (A)    | Fixed Object - Off Road | Backed Into   |
| Fatal (K)             | Fixed Object - In Road  |               |

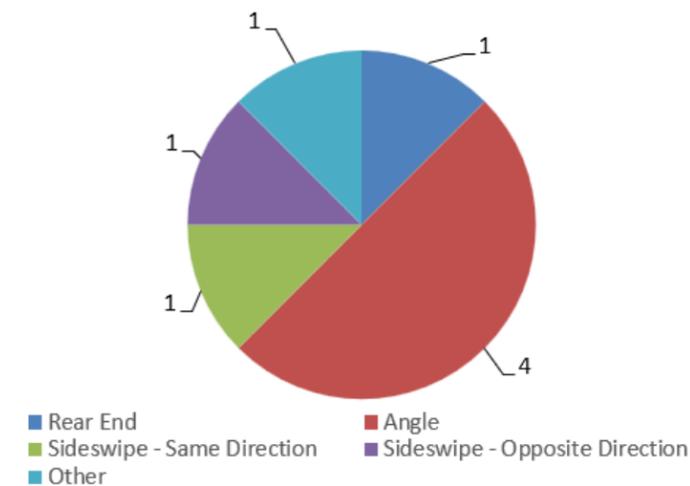
## Corridor Crash Summary (2019-2023)

**Total Crashes: 8**

### Severity

- Visible Injury: 3
- Non-Visible Injury: 4
- Property Damage Only: 1

### Collision Types



# BLUE RIDGE AVE – from Edmondson Street to Scanlon Street



## Recommended Improvements & Safety Benefits

### Pedestrian Improvements

- 1 **Sidewalks** – The public parking lot on Blue Ridge Avenue generates pedestrian activity to the park, as well as to downtown. Note the parking lot on W. Cameron directs people to park on Blue Ridge for all day parking. A sidewalk connection on the east side of Blue Ridge between the crosswalk/parking lot on Blue Ridge and along W. Cameron Street would provide safe, accessible accommodations for a range of users. A funded sidewalk project is currently under design on the south side. New sidewalks provide a CMF of .12-.598. In the short-term, a pedestrian lane could provide dedicated space for pedestrians walking in this area.
- 2 **Raised crosswalk** – Converting the existing high visibility crosswalk to a raised crosswalk can slow traffic and improve pedestrian safety and accessibility with a CMF of .7.
- 3 **ADA Curb Ramp Upgrades** – the existing marked crosswalk does not have a tactile warning surface to alert people with visual impairments of the crossing.

### Corridor Improvements

- 4 **Traffic Calming** – Combining the raised crosswalk with periodic narrowing/curb extensions in the segment between James Madison and Culpeper can provide traffic calming for this corridor.
- 5 **Corridor Lighting** – While overhead street lighting is present in certain segments of the corridor, a lighting study should be conducted to identify specific areas where lighting can be improved to reduce night-time crashes and improve pedestrian safety. Improved lighting at intersections provides a CMF value of .881.

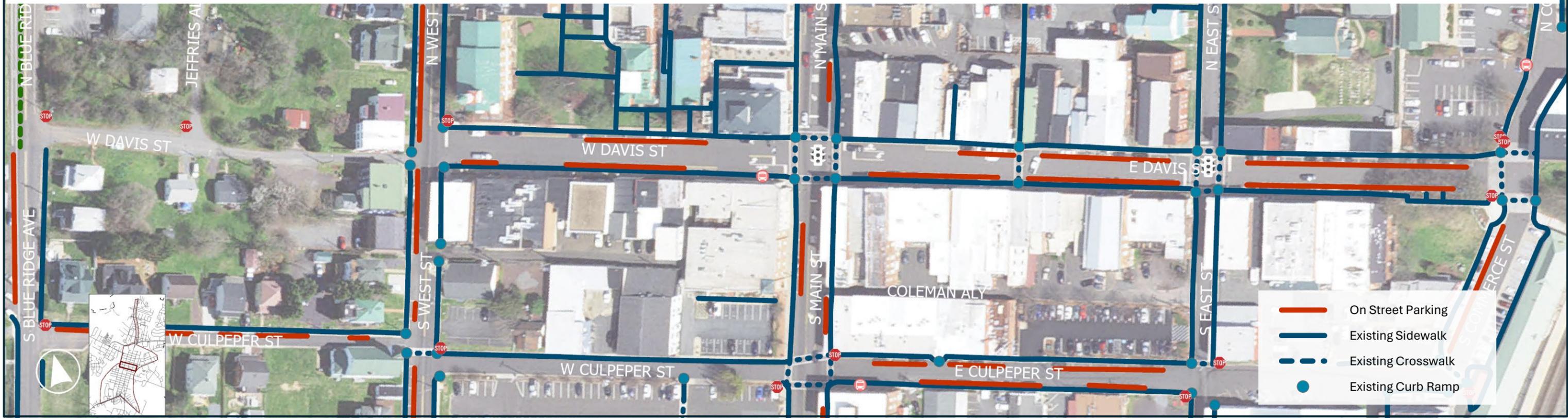
## Planning Level Cost Estimates

- Crosswalks** = \$1200 each
- Curb Ramps** = \$2500 each
- Pedestrian Signal Upgrades** = \$20K per intersection
- Curb Extensions** = \$10K-\$60k
- Median Refuge** = \$10-\$60K each
- Sidewalk** = \$250/LF
- Lighting** = \$100,000/intersection
- Raised Crosswalk** = \$50,000/crossing
- Raised intersection** = \$300,000/intersection
- Relocating Overhead Utility Pole** = \$60-150K/pole

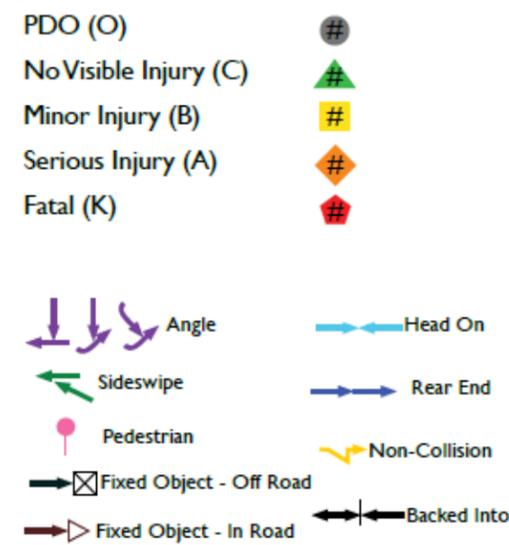
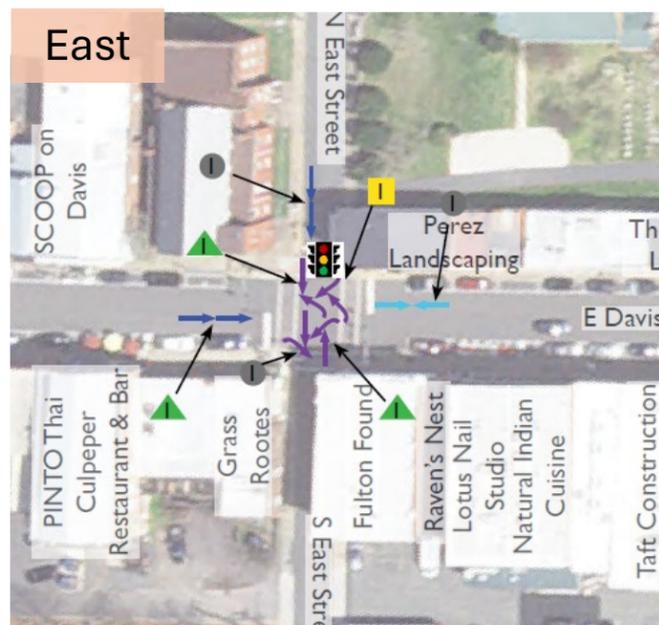
# DAVIS ST – from Blue Ridge Avenue to Commerce Street

## Corridor Description

Davis Street is the primary commercial corridor in the town of Culpeper. There are numerous restaurants and shops with on-street parking and parklets to provide additional outdoor dining opportunities. Sidewalks are generally 7 feet wide with decorative street lights. There are signals and marked crosswalks at Main Street and East Street, but there are limited pedestrian features at the signals.



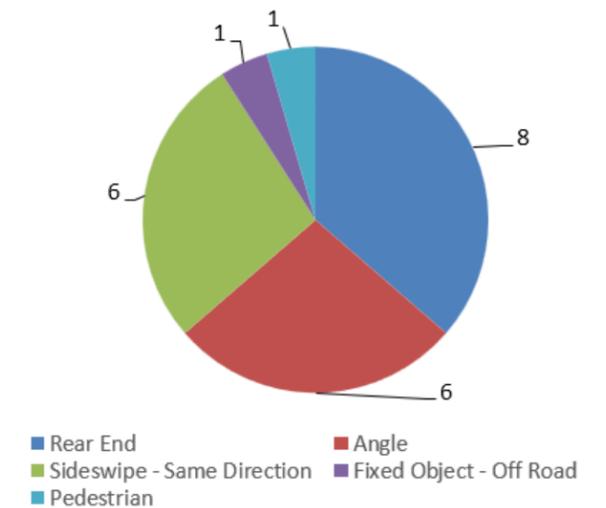
## High Crash Intersections



## Corridor Crash Summary (2019-2023)

**Total Crashes: 22**  
**Severity**  
 Visible Injury: 3  
 Non-Visible Injury: 9  
 Property Damage Only: 10

### Collision Types



# DAVIS ST – from Blue Ridge Avenue to Commerce Street



## Recommended Improvements & Safety Benefits

### Pedestrian Improvements

- 1 **High Visibility Crosswalks** – Davis Street is the primary commercial area. In the short term, wider parallel lines could improve the visibility of the existing paver crosswalks. As existing markings reach the end of their useful life, high-visibility crosswalks should be considered. These provide a CMF value of .60.
- 2 **Curb Extensions** – On-street parking restricts the view of both drivers and pedestrians waiting to cross Main Street, West Street, and East Street. A curb extension on the eastbound curb of its intersection with Commerce Street would allow for signage to be put further in the driver's line of sight. Curb extensions make pedestrians more visible to drivers, help the pedestrians see around parked vehicles, and reduce pedestrian exposure. Curb extensions should be considered at locations with needed curb ramp upgrades in the short-term and at existing compliant intersections as needs arise. Consideration of heavy vehicle turning movements should be considered to balance the needs of people walking and deliveries to local businesses. Curb extensions provide a CMF of 1.
- 3 **Pedestrian Signal Upgrades** – The current pedestrian signals at Main and East Street lack vibrotactile arrows and audible features. At East Street there are no pedestrian countdown features, the pushbuttons are located high on the signal pole and on the SE corner the button is located 16' from the crosswalk. Adding these features can provide additional information to a range of users wanting to cross Davis Street. Specifically, installing a pedestrian countdown timer provides a CMF of .30. In addition, a leading pedestrian interval can improve pedestrian visibility at the signalized intersections, which provides a CMF value of .81. The town could also conduct a traffic signal warrant analysis to determine if the signalized intersection is needed.
- 4 **Raised Intersection/crosswalks** – A raised intersection at Commerce Street and E. Davis could reinforce the need to travel slowly through this area, along with a raised midblock crossing.
- 5 **Stop Sign Improvements** – Crossing East Davis Street to the train depot can be hazardous for pedestrians. Existing stop signs are not visible to drivers and there are no corresponding stop bar pavement markings. Increasing the size of stop signs on the northbound and eastbound approach of the East Davis and Commerce Street will improve visibility of these signs. Adding a stop bar would also help drivers prepare to stop in advance of the crosswalk.

### Corridor Improvements

- 6 **Corridor Lighting** – While decorative streetscape lighting exists downtown, preliminary light meter readings suggest that they do not consistently provide sufficient light to the intersections. A lighting study should be conducted to identify specific areas where lighting can be improved to reduce night-time crashes. Intersection lighting provides a CMF of .881.

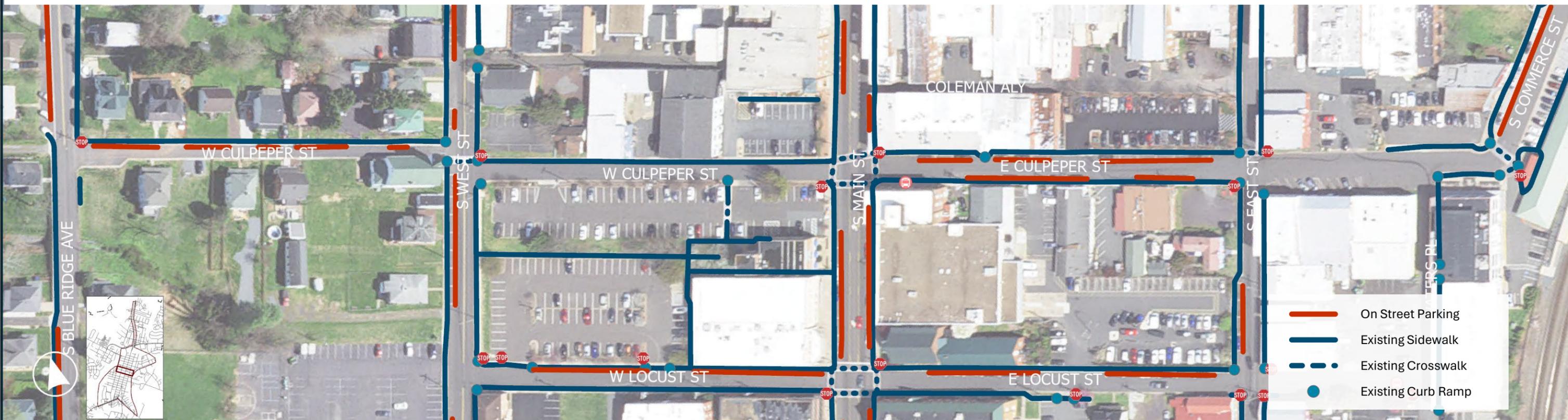
## Planning Level Cost Estimates

- Crosswalks** = \$1200 each
- Curb Ramps** = \$2500 each
- Pedestrian Signal Upgrades** = \$20K per intersection
- Curb Extensions** = \$10K-\$60k
- Median Refuge** = \$10-\$60K each
- Sidewalk** = \$250/LF
- Lighting** = \$100,000/intersection
- Raised Crosswalk** = \$50,000/crossing
- Raised intersection** = \$300,000/intersection
- Relocating Overhead Utility Pole** = \$60-150K/pole

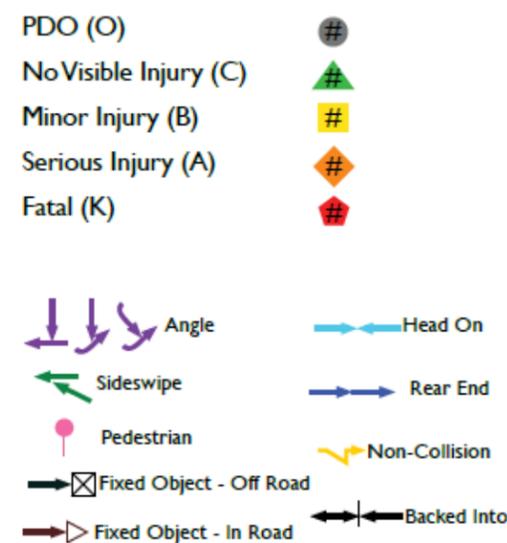
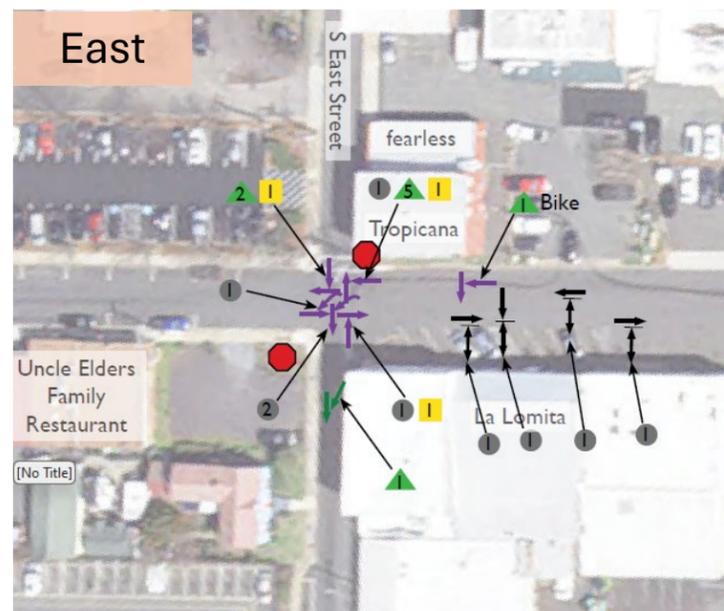
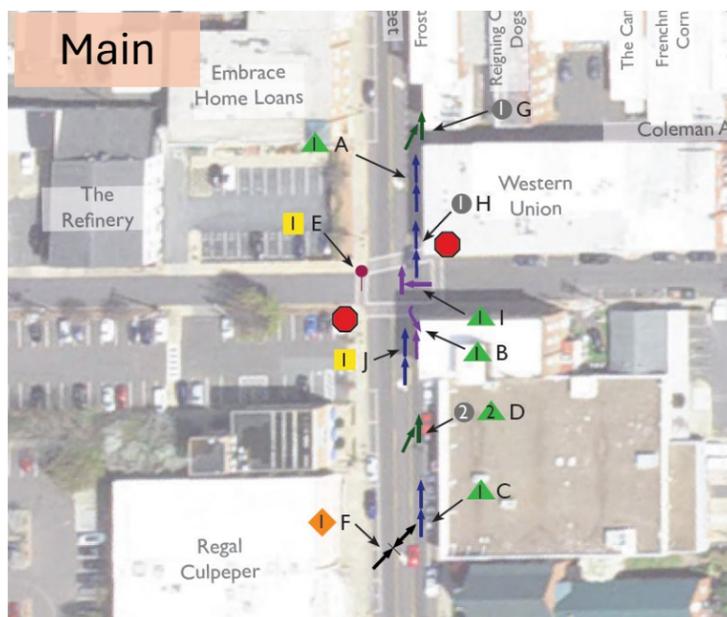
# CULPEPER ST – from Blue Ridge Avenue to Commerce Street

## Corridor Description

Culpeper Street is an important parallel route to Davis Street providing a direct connection to the depot. There are some limited commercial uses on Culpeper Street, but it is largely fronted with parking lots and driveway access points. There is a sidewalk on the north side between East and Blue Ridge, but it is not continuous. There is a section of sidewalk on the south side between S. Main and East Street in the block with the transit stop. However, no continuous pedestrian route exists between the Amtrak station, Main Street and Blue Ridge Avenue. Culpeper Street is stop controlled at all intersections. Poor visibility traveling WB at the East Street intersection and angle parking contribute to a number of crashes on this corridor.



## High Crash Intersections



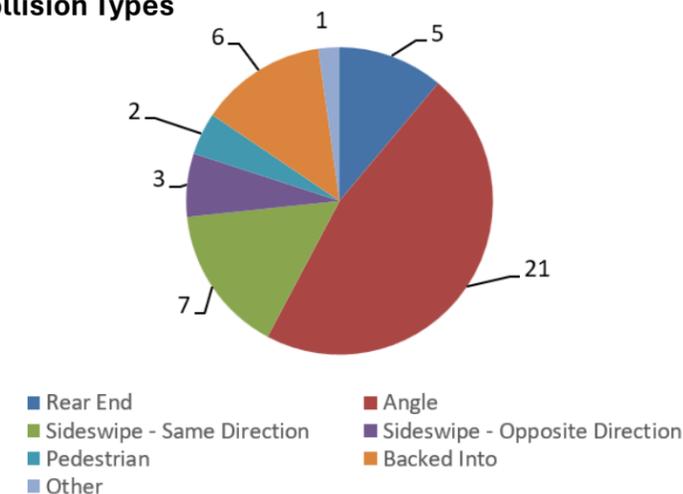
## Corridor Crash Summary (2019-2023)

**Total Crashes: 45**

### Severity

- Severe Injury: 1
- Visible Injury: 7
- Non-Visible Injury: 17
- Property Damage Only: 20

### Collision Types



# CULPEPER ST – from Blue Ridge Avenue to Commerce Street



## Recommended Improvements & Safety Benefits

### Pedestrian Improvements

- 1 **High Visibility Crosswalks** – Main Street and Commerce Street have decorative crosswalks. In the short term, wider parallel markings could improve the visibility of the existing paver and cobblestone crosswalks. As existing markings reach the end of their useful life, high-visibility crosswalks should be considered. A new high-visibility crosswalk is needed at the intersection of East Street. Where new crossings are provided, curb ramps should be evaluated to ensure pedestrian access in the desired direction of travel. These provide a CMF value of .60.
- 2 **Curb Extensions** – On-street parking restricts the view of both drivers and pedestrians waiting to cross Main Street and S. West Street. Curb extensions make pedestrians more visible to drivers, help the pedestrians see around parked vehicles, and reduce pedestrian exposure. Curb extensions should be considered at locations with needed curb ramp upgrades in the short-term and at existing compliant intersections as needs arise. Consideration of heavy vehicle turning movements should be considered to balance the needs of people walking and deliveries to local businesses. Curb extensions provide a CMF of 1.
- 3 **ADA Curb Ramp Upgrades**- A couple intersections need ADA compliant curb ramp upgrades. These include: the existing marked crosswalk at S. West Street and South Main Streets.
- 4 **Sidewalks** – There is a small sidewalk gap (~150 ft) on the north side of Culpeper Street near the intersection of East Street that needs to be filled to provide for continuous pedestrian travel in this area. A sidewalk on the south side is also recommended given the pedestrian activity from the redevelopment on Waters Place and the depot. New sidewalks provide a CMF of .598. In the short-term, a pedestrian lane could provide dedicated space for pedestrians walking in this area.

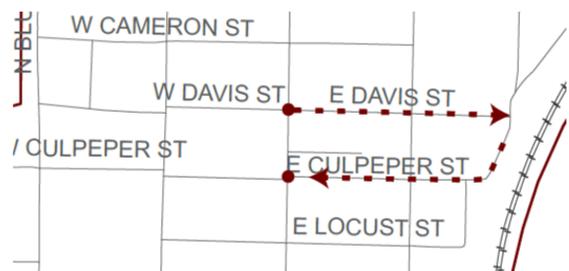
### Corridor Improvements

- 5 **Corridor Lighting** – While decorative streetscape lighting exists in some areas, preliminary light meter readings suggest that they do not consistently provide sufficient light to the intersections. A downtown lighting study should be conducted to identify specific areas where lighting can be improved to reduce night-time crashes.
- 6 **Change Parking Orientation** – The existing head-in parking configuration on Culpeper Street has contributed to 4 crashes in the block east of East Street from people backing into traffic. Changing the orientation of the parking so that people back into a parking spot instead of pulling in head first is a safer option for all roadway users.

## Planning Level Cost Estimates

- Crosswalks** = \$1200 each
- Curb Ramps** = \$2500 each
- Pedestrian Signal Upgrades** = \$20K per intersection
- Curb Extensions** = \$10K-\$60k
- Median Refuge** = \$10-\$60K each
- Sidewalk** = \$250/LF
- Lighting** = \$100,000/intersection
- Raised Crosswalk** = \$50,000/crossing
- Raised intersection** = \$300,000/intersection
- Relocating Overhead Utility Pole** = \$60-150K/pole

# ONE-WAY PAIR ALTERNATIVE: DAVIS ST. EASTBOUND (EB)



## Description

### Typical Section Changes

This alternative creates a one-way pair with Davis Street and Culpeper Street. Davis Street would be one-way eastbound (EB), and Culpeper would be one-way westbound. The proposed changes to the typical sections are shown in the images to the right.

On Culpeper Street (top images), two wide, undefined travel lanes and angle parking are replaced with one travel lane, parallel on-street parking, and additional pedestrian space.

On Davis Street (bottom images), two travel lanes and on-street parking are replaced by one eleven-foot travel lane and two parking lanes. A permanent space for a parklet/outdoor dining is provided on one side of the street, and there are opportunities for additional parklets in the flex parking lane on the opposite side.

### Safety Benefits

This change limits the number of potential crashes attributable to turning movements at the East Street intersections and removes the opportunity for crashes associated with angled parking on Culpeper.

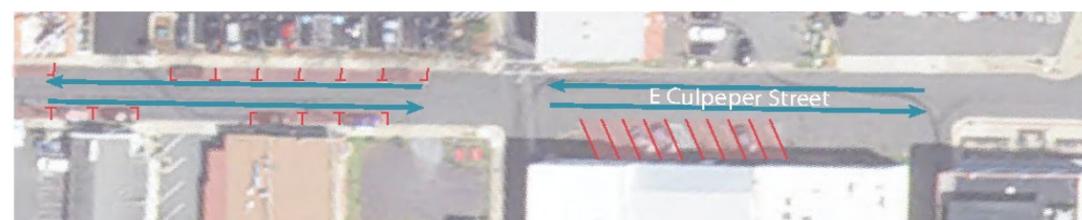
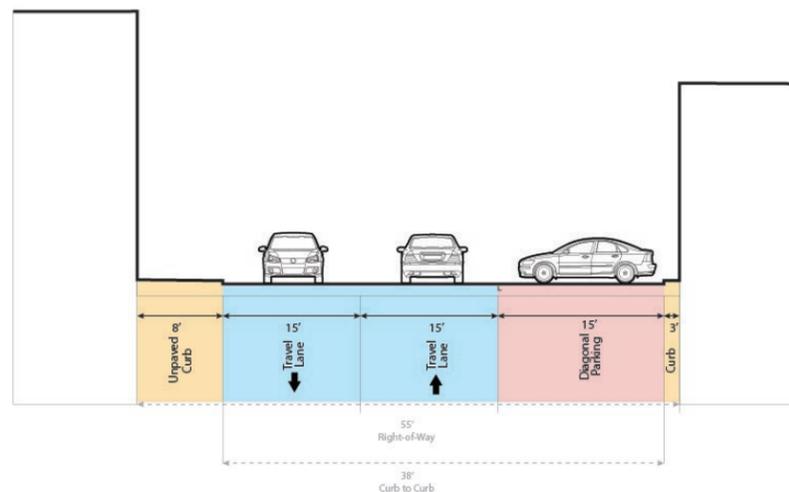
### Parking Analysis

This change affects existing parking for both East Culpeper and East Davis Street. An analysis of the number of available spots for existing conditions and each alternative is shown in the table below:

Conditions	East Culpeper Street	East Davis Street
Existing	21	47
Alternative	17	25-54*

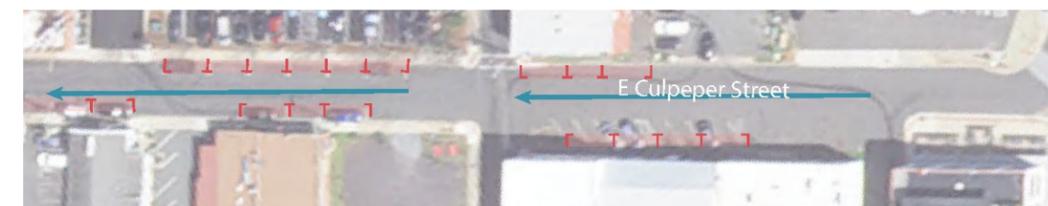
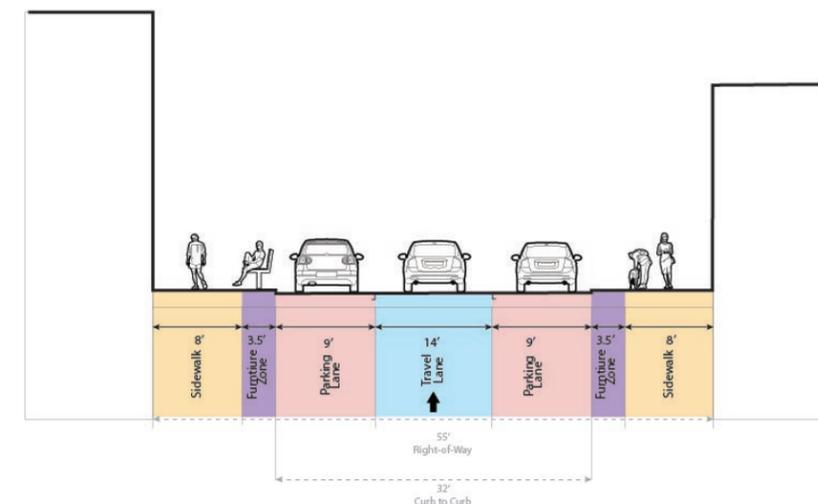
\* Range based on number of parklets used.

E Culpeper Street from S East Street to Waters Place  
Existing Configuration



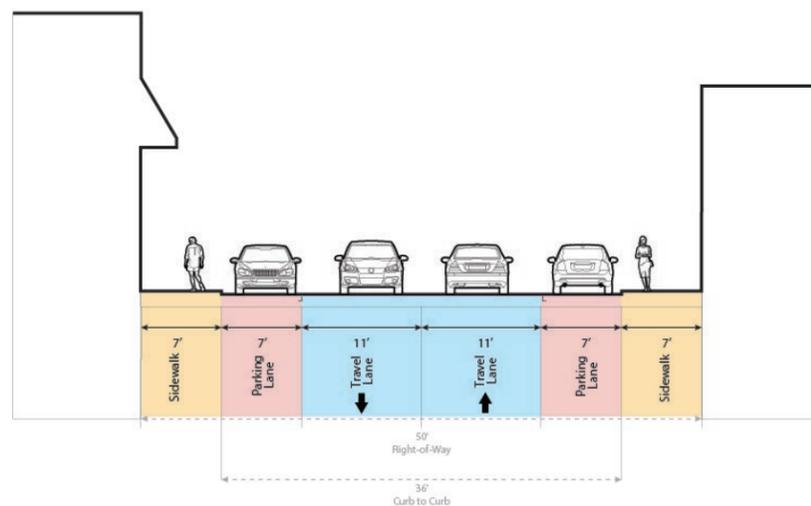
Available Street Parking: 21 Spots

E Culpeper Street from S East Street to Waters Place  
Pedestrian Alternative



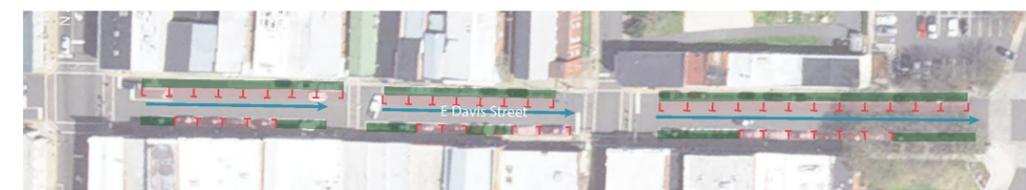
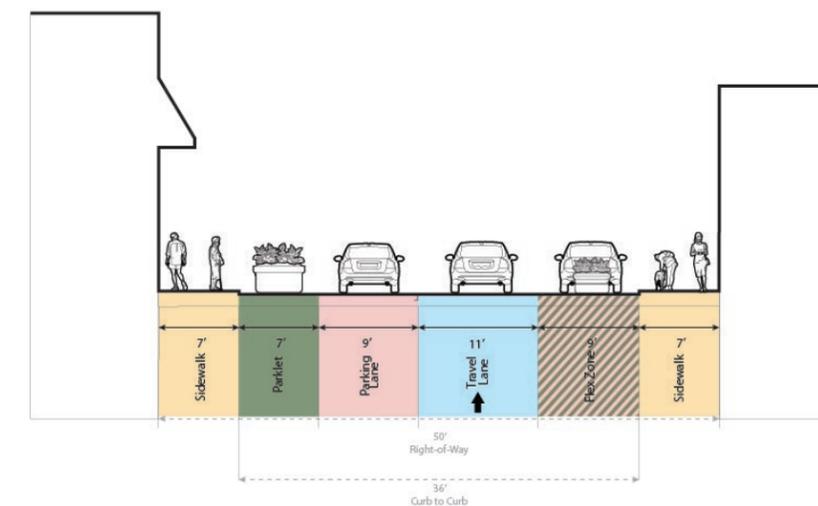
Available Street Parking: 17 Spots

E Davis Street  
Existing Configuration



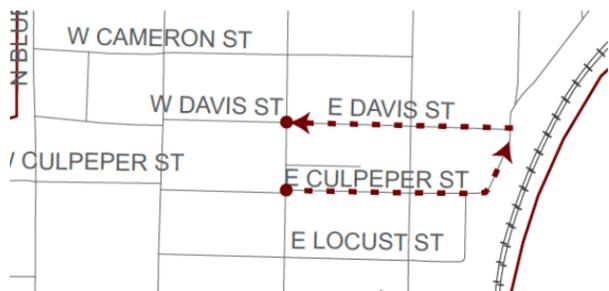
Available Street Parking: 47 Spots

E Davis Street  
Parklet Alternative



Available Street Parking: 25-54 Spots

# ONE-WAY PAIR ALTERNATIVE: DAVIS ST. WESTBOUND (WB)



## Description

### Typical Section Changes

This alternative creates a one-way pair with Davis Street and Culpeper Street. Davis Street would be one-way westbound (WB), and Culpeper would be one-way eastbound (EB). The proposed changes to the typical sections are shown on the images to the right.

On Culpeper Street (top images), two wide, undefined travel lanes and angle parking are replaced with one travel lane, parallel on-street parking and additional space for pedestrians.

On Davis Street (bottom images), two travel lanes and on-street parking are replaced by one eleven-foot travel lane, and two parking lanes. A permanent space for a parklet/outdoor dining is provided on one side of the street with opportunities for additional parklets in the flex parking lane on the opposite side.

## Safety Benefits

This change limits the number of potential crashes attributable to turning movements at the intersection, removes the opportunity for crashes associated with angled parking, and removes the visibility concerns for people traveling WB on Culpeper.

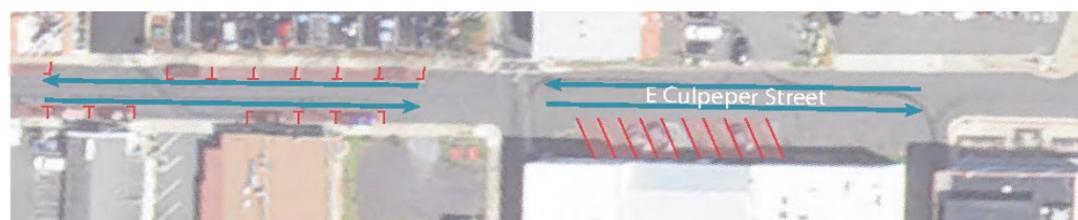
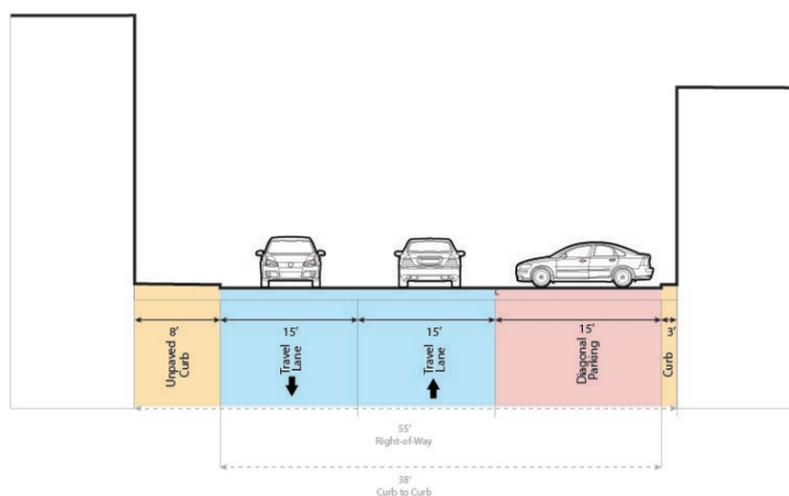
## Parking Analysis

This change affects existing parking for both East Culpeper and East Davis Street. An analysis of the number of available spots for existing conditions and each alternative is shown in the table below:

Conditions	East Culpeper Street	East Davis Street
Existing	21	47
Alternative	21	25-54*

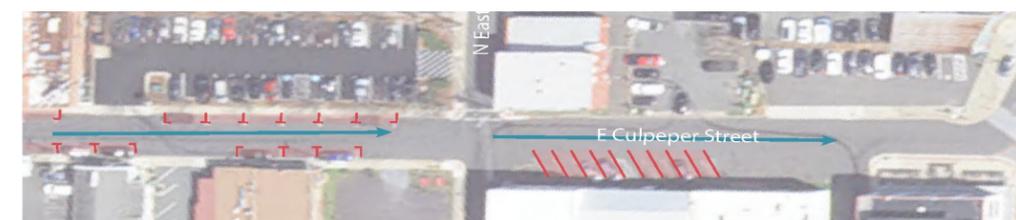
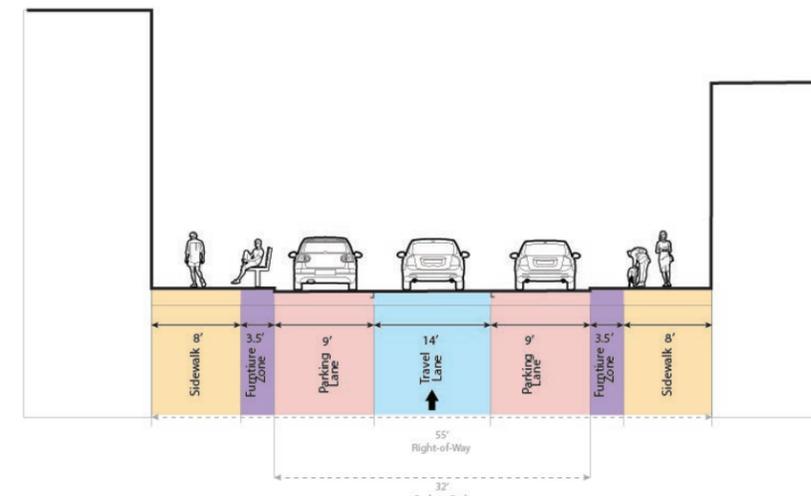
\* Range based on number of parklets used.

E Culpeper Street from S East Street to Waters Place  
Existing Configuration



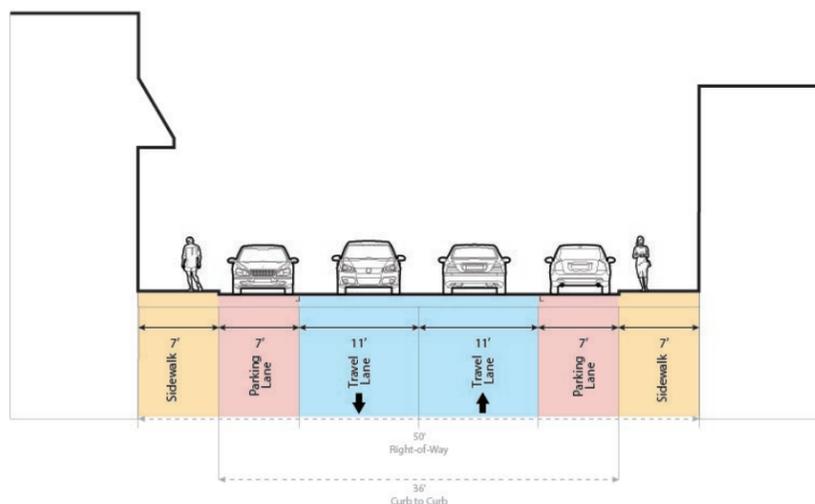
Available Street Parking: 21 Spots

E Culpeper Street from S East Street to Waters Place  
Pedestrian Alternative



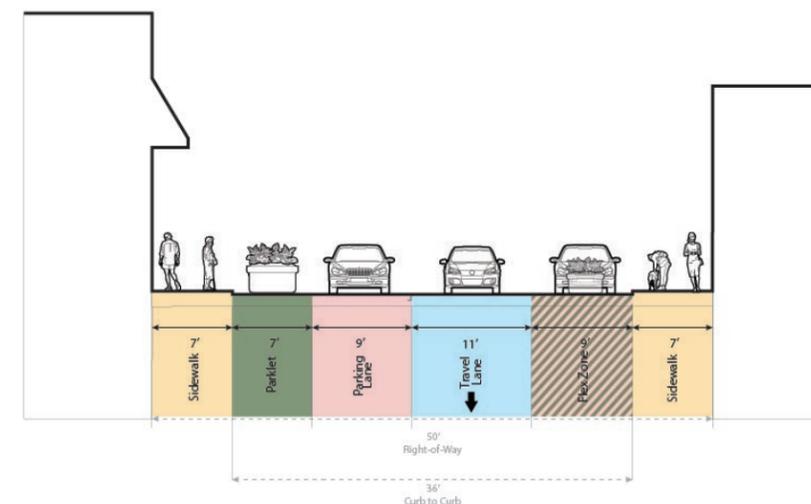
Available Street Parking: 21 Spots

E Davis Street  
Existing Configuration



Available Street Parking: 47 Spots

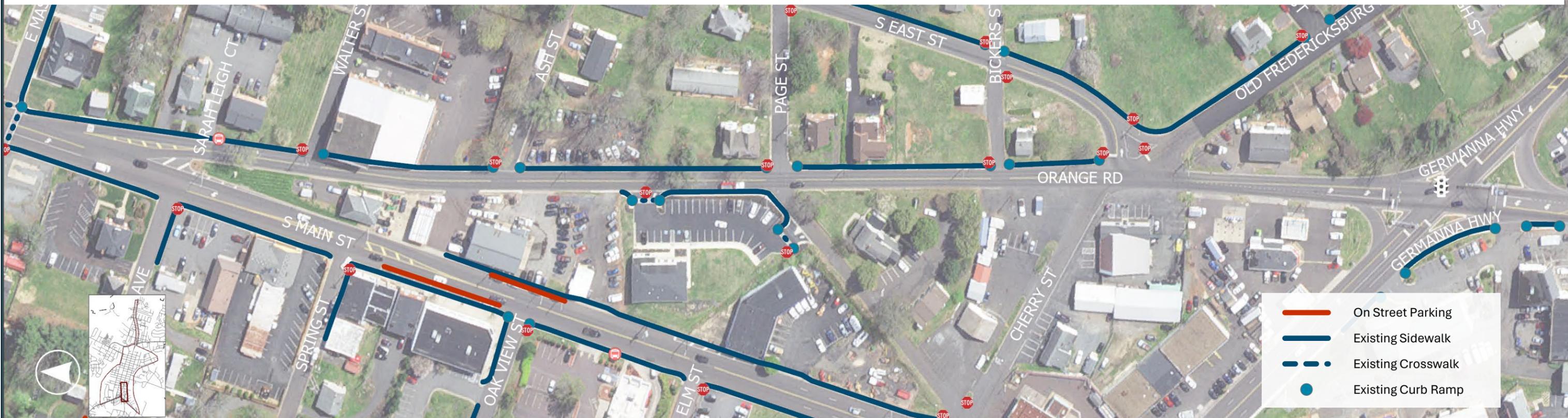
E Davis Street  
Parklet Alternative



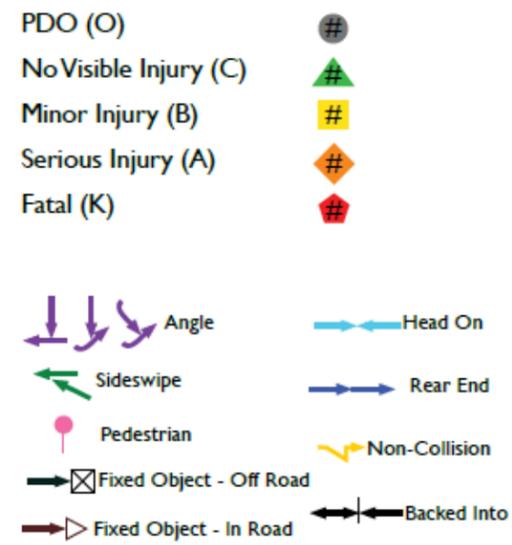
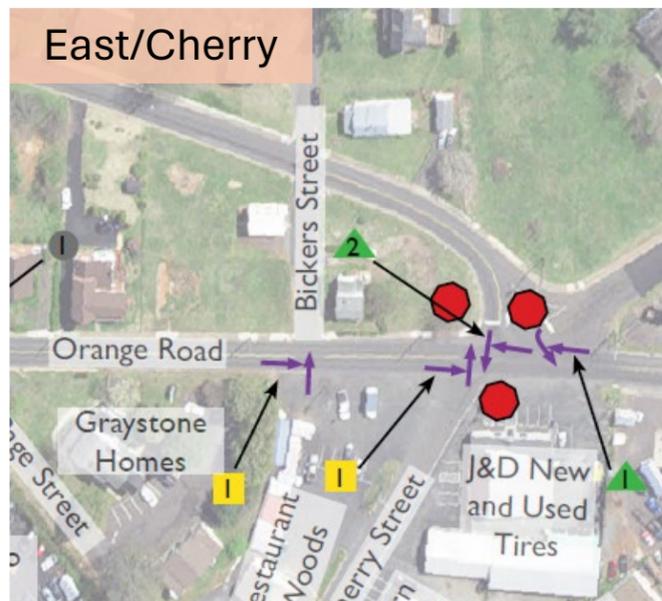
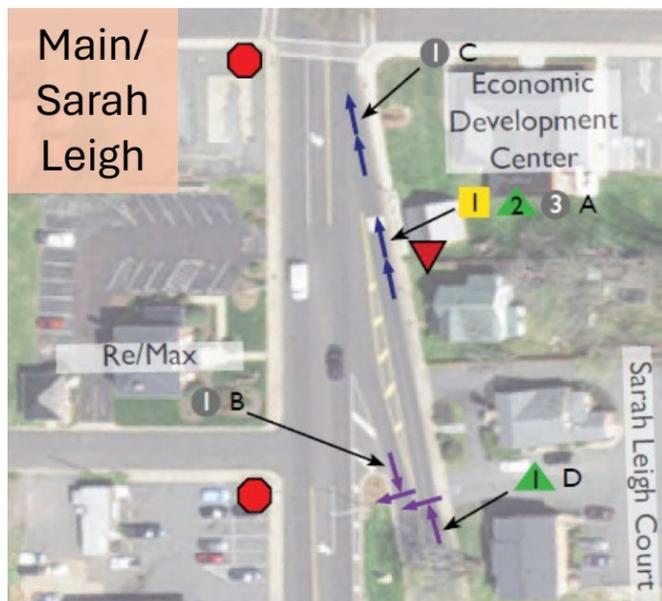
Available Street Parking: 25-54 Spots

### Corridor Description

Orange Road a minor arterial, with a mix of industrial, commercial and residential uses, and is often used as an alternative to Main Street for people traveling east. There is a continuous sidewalk from E. Mason to E. Street, but it is obstructed by utility poles in many locations and there are no pedestrian crossings. In addition, the skewed intersection geometry at Old Fredericksburg Road and Germanna Highway makes pedestrian accommodations challenging. A proposed roundabout at Germanna will improve the pedestrian accommodations in this area with sidewalks and crosswalks at the intersection, but access management will also be needed to better define the parking, travel way and pedestrian areas and improve safety.



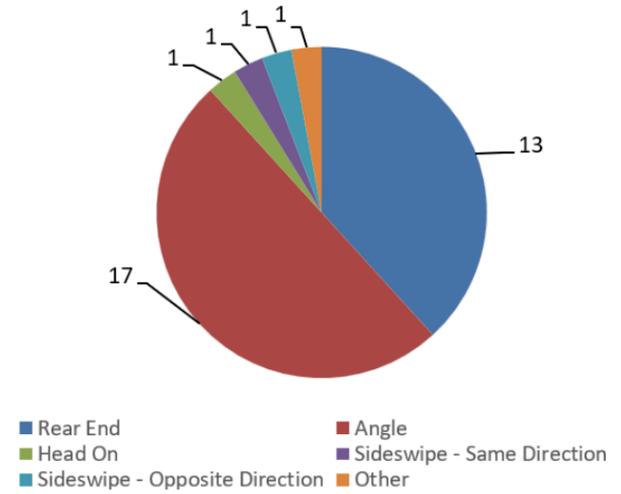
### High Crash Intersections



### Corridor Crash Summary (2019-2023)

**Total Crashes: 34**  
**Severity**  
 Visible Injury: 5  
 Non-Visible Injury: 15  
 Property Damage Only: 14

#### Collision Types



# ORANGE RD – from Main Street to Germanna Highway



## Recommended Improvements & Safety Benefits

### Pedestrian Improvements

- 1 Remove/relocate utility poles** – South of Ash Street there are several utility poles that obstruct pedestrian access along the corridor. Moving the poles behind the sidewalk or undergrounding utilities would remove these barriers and provide safe, accessible travel.
- 2 Intersection Reconfiguration** – The NB yield condition from Orange Road to Main Street contributes to rear-end crashes approaching East Mason. Teeing up the intersection with Park could allow for continued two-way traffic while reducing rear end crashes. A one-way pattern could also be evaluated pending completion of the roundabout projects.
- 3 Sidewalks** – While sidewalks exist on the east side of the corridor, there are critical gaps between East and Germanna Highway, that would facilitate better access to Southgate Plaza. While new sidewalks are proposed as part of the Germanna roundabout project, it is important to continue to fill gaps in the sidewalk network as properties redevelop on the west side of the corridor. New sidewalks provide a CMF of .598.
- 4 High Visibility Crosswalks** – There is an immediate need to provide a marked crosswalk across East Street to facilitate pedestrian travel from East Street/Old Fredericksburg Road to Orange Road. Where new crossings are provided, curb ramps should be provided to ensure pedestrian access in the desired direction of travel. These provide a CMF value of .60. The existing marked island could be retrofitted with temporary curbing to provide a median refuge while funding is located for permanent construction.

### Corridor Improvements

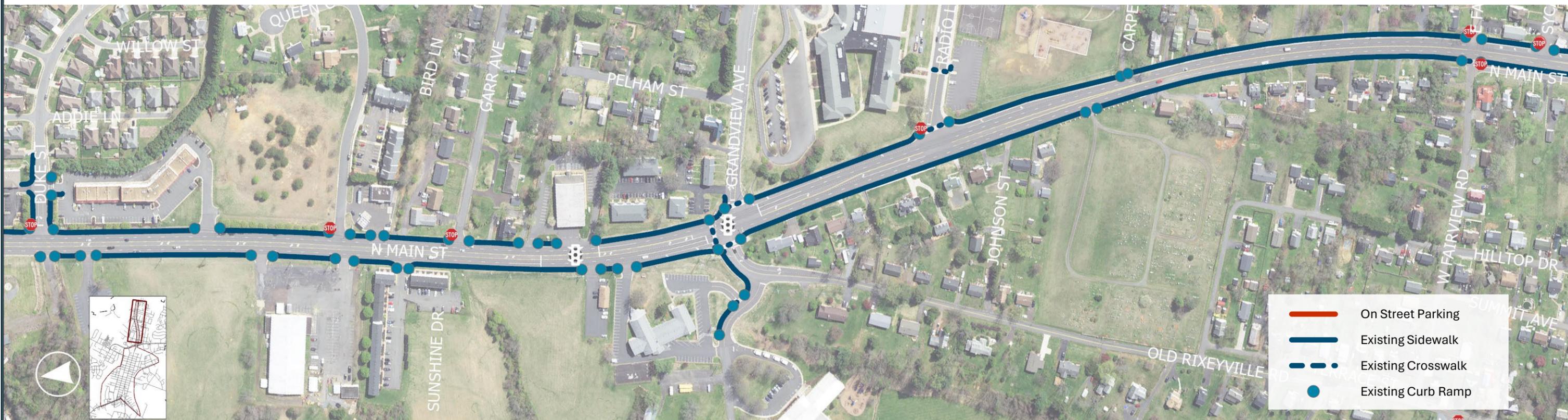
- 5 Access Management** – The area around Cherry Street/East Street is not well-defined. The travel lanes blend with the skewed intersection and wide expanses of parking with no specific access points. Thoughtful access management along a corridor can simultaneously enhance safety for all modes, facilitate walking and biking, and reduce trip delay and congestion.
- 6 Corridor Lighting** – While decorative streetscape lighting exists in some areas, preliminary light meter readings suggest that they do not consistently provide sufficient light to the intersections. A downtown lighting study should be conducted to identify specific areas where lighting can be improved to reduce night-time crashes.

## Planning Level Cost Estimates

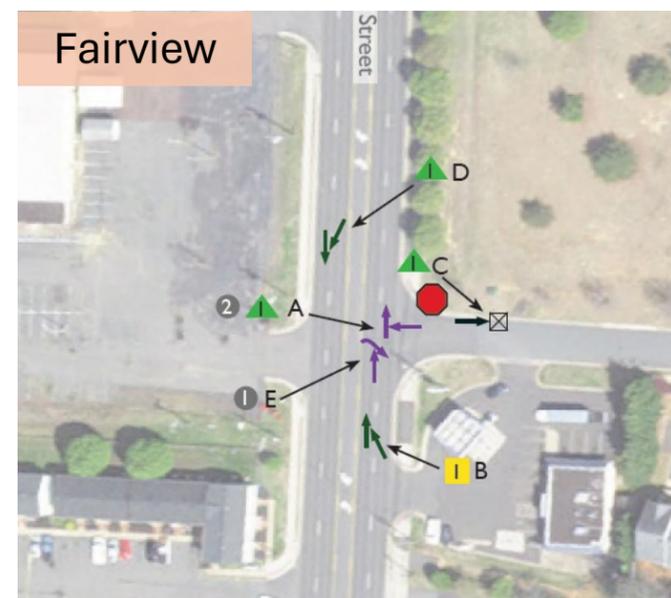
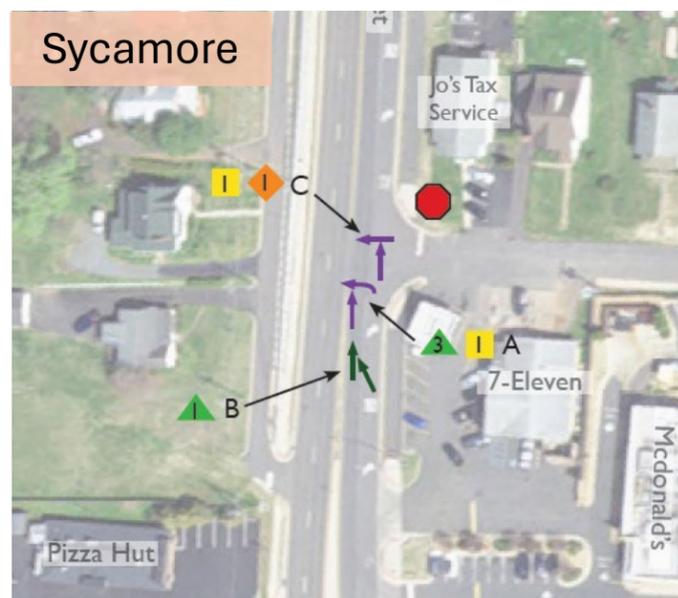
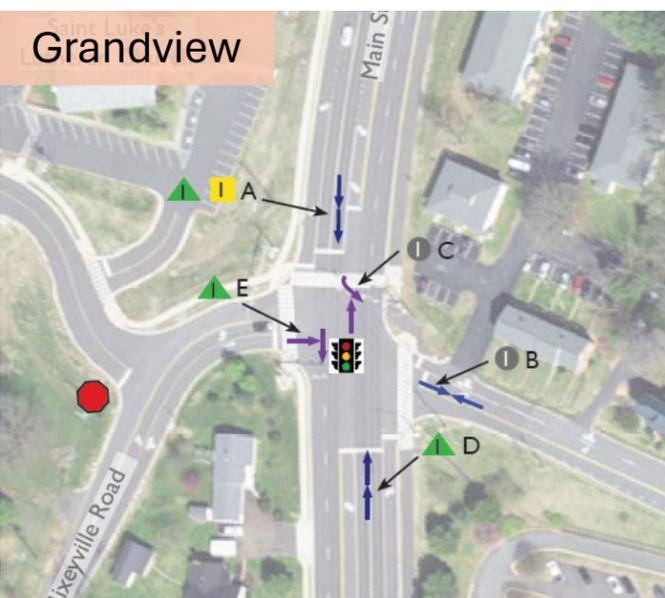
- Crosswalks** = \$1200 each
- Curb Ramps** = \$2500 each
- Pedestrian Signal Upgrades** = \$20K per intersection
- Curb Extensions** = \$10K-\$60k
- Median Refuge** = \$10-\$60K each
- Sidewalk** = \$250/LF
- Lighting** = \$100,000/intersection
- Raised Crosswalk** = \$50,000/crossing
- Raised intersection** = \$300,000/intersection
- Relocating Overhead Utility Pole** = \$60-150K/pole

### Corridor Description

North Main Street is a wide, suburban-style minor arterial corridor with residential (single-family and high-density residential), commercial, and school/church uses adjacent to it. It was widened from a 2-lane road to its current 4-5 lane configuration in 2013. It has a shared-use path on the east side, a sidewalk on the west side, and a posted speed of 35-45mph. Marked crosswalks exist at the roundabout at James Madison Highway and the signalized intersections at Grandview/Old Rixeyville and Achievement Drive, approximately .5 miles apart. There was a pedestrian fatality south of Johnson Street and a serious pedestrian injury at Fairview Rd.–both involving pedestrians attempting to cross the road. One occurred at night.



### High Crash Intersections



- |                       |                         |               |
|-----------------------|-------------------------|---------------|
| PDO (O)               | Angle                   | Head On       |
| No Visible Injury (C) | Sideswipe               | Rear End      |
| Minor Injury (B)      | Pedestrian              | Non-Collision |
| Serious Injury (A)    | Fixed Object - Off Road | Backed Into   |
| Fatal (K)             | Fixed Object - In Road  |               |

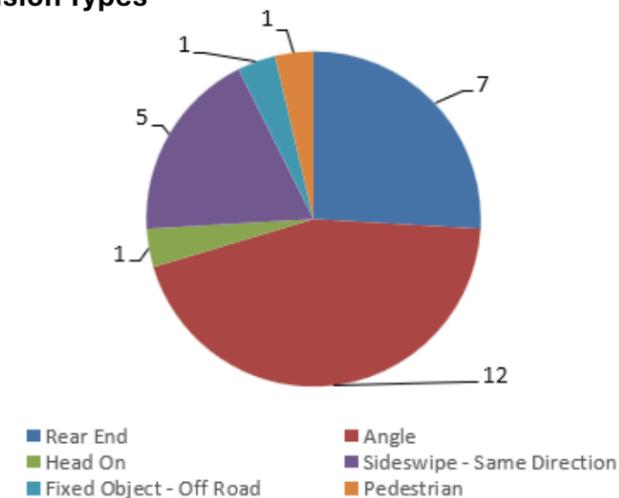
### Corridor Crash Summary (2019-2023)

**Total Crashes: 27**

#### Severity

- Severe Injury: 1
- Visible Injury: 6
- Non-Visible Injury: 11
- Property Damage Only: 9

#### Collision Types



# N MAIN ST – from Duke Street to Sycamore Street



## Recommended Improvements & Safety Benefits

### Pedestrian Improvements

- 1 High Visibility Crosswalks** – Additional marked crosswalks across North Main Street are needed to facilitate access from the residential uses on the west side of the road to the commercial and school activities on the east side. Given the higher speed of traffic additional measures, such as Pedestrian Hybrid Beacons, Rapid Flashing Beacons or a Road Diet, would need to be installed to ensure the safety of pedestrians. (refer to VDOT IIM-384.1).
- 2 Median Refuge**—A median refuge at the intersection of Fairview can provide a refuge island for people walking or biking to facilitate a safer and more comfortable crossing. A median refuge in this location would allow users to cross one traffic lane while providing a safe waiting area to cross the other lane – reducing the crossing from nearly 50 feet to 12 feet at a time. A median refuge provides a CMF of .69.
- 3 Pedestrian Signal Upgrades** – The current pedestrian signals at Grandview Avenue and Achievement Drive lack vibrotactile arrows, countdown signals and audible features. Adding these features can provide additional information to a range of users wanting to cross and improve safety with a CMF of .30.
- 4 School zone speed enforcement** - School zone speed photo enforcement can be used to increase driver compliance in the reduced speed zones on North Main Street while improving the safety of students in adjacent schools.

### Corridor Improvements

- 5 Traffic Calming** – Curb extensions and/or median refuges can provide traffic calming and improved pedestrian safety along Radio Lane, which provides direct school access to Floyd T. Binns Middle School and Sycamore Park Elementary School.

## Planning Level Cost Estimates

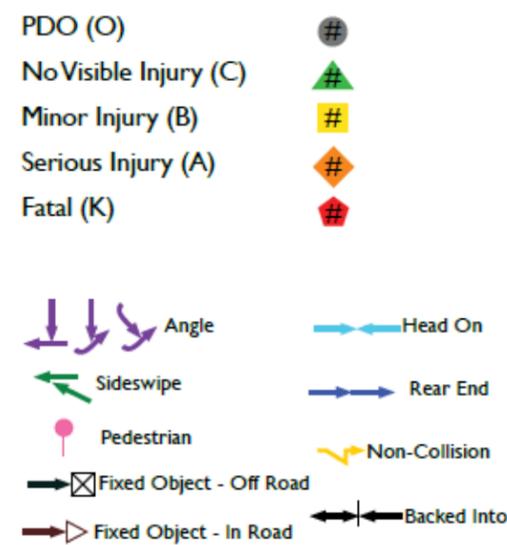
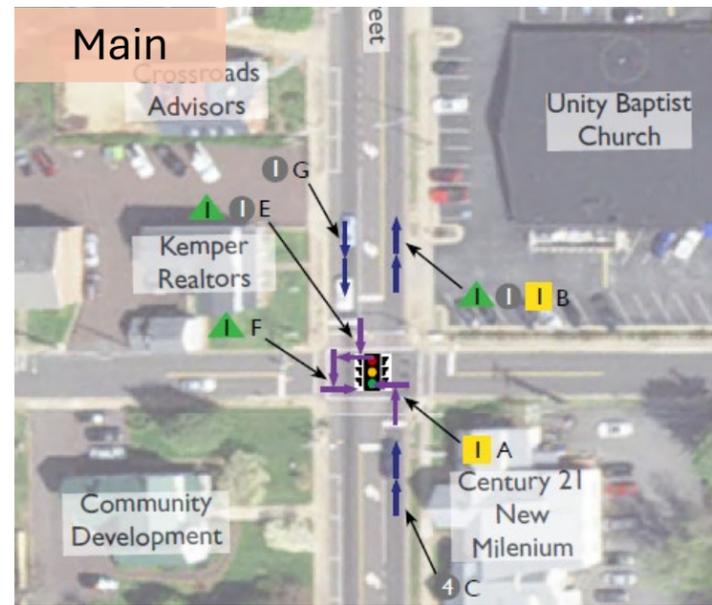
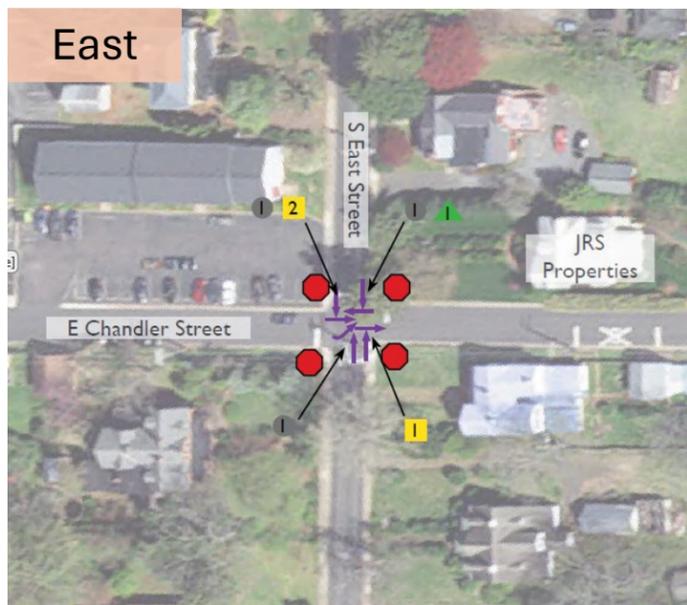
- Crosswalks** = \$1200 each
- Curb Ramps** = \$2500 each
- Pedestrian Signal Upgrades** = \$20K per intersection
- Curb Extensions** = \$10K-\$60k
- Median Refuge** = \$10-\$60K each
- Sidewalk** = \$250/LF
- Lighting** = \$100,000/intersection
- Raised Crosswalk** = \$50,000/crossing
- Raised intersection** = \$300,000/intersection
- Relocating Overhead Utility Pole** = \$60-150K/pole

### Corridor Description

Chandler Street is a major collector and provides one of the few direct east/west connections over the railroad tracks. It is primarily residential with a mix of single-family and apartment buildings. Some commercial uses are present at the intersection at South Main Street. There are four-way stops at East, West and Blue Ridge, along with a signalized intersection at Main Street. There is a continuous, but narrow, sidewalk between South Main and Blue Ridge Avenue on the south side and small portions of sidewalk on the north side. The only marked crossing is at Main Street.



### High Crash Intersections



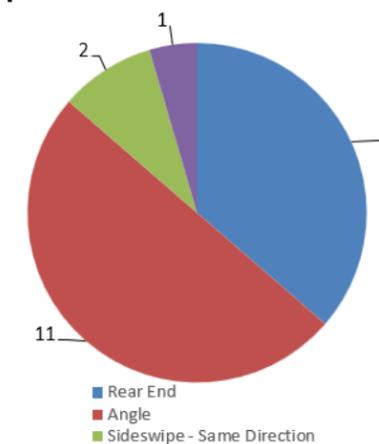
### Corridor Crash Summary (2019-2023)

**Total Crashes: 22**

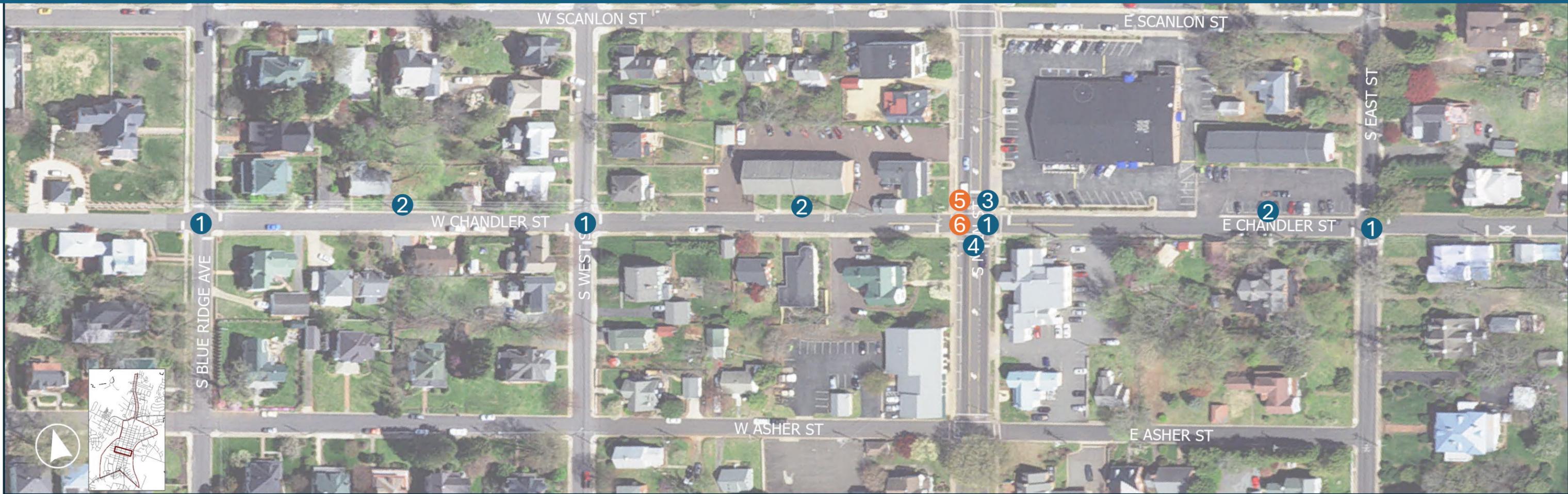
#### Severity

- Fatal: 0
- Severe Injury: 0
- Visible Injury: 6
- Non-Visible Injury: 6
- Property Damage Only: 10

#### Collision Types



# CHANDLER ST – from Blue Ridge Avenue to East Street



## Recommended Improvements & Safety Benefits

### Pedestrian Improvements

- 1 **High Visibility Crosswalks**—High-visibility crosswalks are needed to facilitate access from the residential areas to the commercial uses on Main Street. These provide a CMF value of .60. Curb ramps should be evaluated to ensure pedestrian access in the desired direction of travel.
- 2 **Sidewalks** – Completing the sidewalk network on the north side of Chandler would provide improved pedestrian access from the apartment buildings to the commercial uses and transit stops on Main Street. New sidewalks provide a CMF of .598.
- 3 **ADA Curb Ramp Upgrades** - While most of the curb ramps are up to date on this corridor, there is a need to upgrade the ramps at Main Street to meet standards.
- 4 **Pedestrian Signal Upgrades** - The current pedestrian signal S. Main Street lacks vibrotactile arrows, audible features, and a pedestrian countdown timer. Installing a pedestrian countdown timer provides a CMF of .30. A leading pedestrian interval could also be considered.

### Corridor Improvements

- 5 **Corridor Lighting** – While the Main Street corridor has decorative streetscape lighting, preliminary light meter readings suggest that they do not consistently provide sufficient light to the intersections. A downtown lighting study should be conducted to identify specific areas where lighting can be improved to reduce night-time crashes. Improved lighting at intersections provides a CMF value of .881.
- 6 **Improved Signal Timing** –Signal timing is a cost-effective ways to improve traffic flow and safety by coordinating signals to reward slower driving speeds of 15–20 mph through the downtown area. Re-timing or optimizing traffic signals provides a CMF value of .958. Installing an adaptive signal provides a CMF value of .642.

## Planning Level Cost Estimates

- Crosswalks** = \$1200 each
- Curb Ramps** - \$2500 each
- Pedestrian Signal Upgrades** - \$20K per intersection
- Curb Extensions** = \$10K-\$60k
- Median Refuge** - \$10-\$60K each
- Sidewalk** = \$250/LF
- Lighting** - \$100,000/intersection
- Raised Crosswalk** = \$50,000/crossing
- Raised intersection** = \$300,000/intersection
- Relocating Overhead Utility Pole** = \$60-150K/pole

# Appendix C

# CULPEPER TRAFFIC IMPROVEMENTS TOOLKIT

## Pedestrian Improvements

### ADA Curb Ramp Upgrades

Several intersections in the downtown area need ADA-compliant curb ramp upgrades.

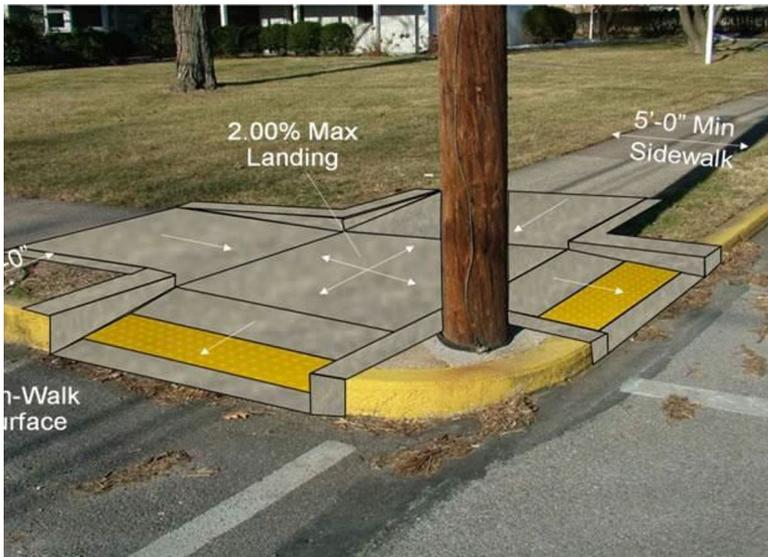


Figure 1: ADA Curb Ramp (Idaho Press)

*Description:* ADA curb ramps are inclined surfaces that provide a smooth transition between the sidewalk and the roadway for those with limited mobility. They also incorporate tactile warning surfaces to alert visually impaired pedestrians of the transition between the sidewalk and the street.

*Benefits:*

- **Accessibility:** accessible routes for individuals with disabilities, including wheelchair users, those with mobility aids, and people with limited mobility.

- All pedestrians benefit from easier access to sidewalks (parents with strollers, travelers with luggage, etc.)
- **Safety:** eliminates barriers between sidewalks and roadways, reducing the risk of accidents, trips, and falls for all pedestrians.

*Design Considerations:*

- **Width:** at least 48 inches wide
- **Running Slope:** 1:12 maximum slope (8.3% maximum)
- **Cross Slope:** maximum ratio of 1:48 (2.1% maximum)

*Additional Resources:*

Public Right of Way Accessibility Guidelines: <https://www.access-board.gov/prowag/technical.html>

US Access Board: <https://www.access-board.gov/ada/guides/chapter-4-ramps-and-curb-ramps/>

ADA Toolkit: <https://archive.ada.gov/pcatoolkit/chap6toolkit.htm>

## Curb Extensions

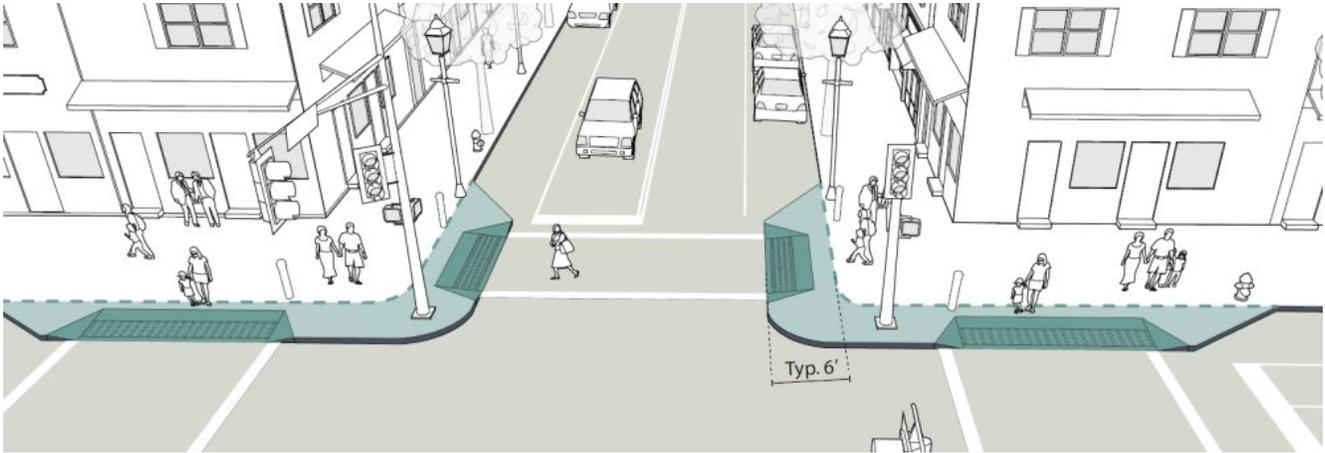


Figure 2: Curb Extensions (City of Alexandria)

There are many locations in the town where on-street parking restricts the view of both drivers and pedestrians waiting to cross the street. Curb extensions make pedestrians more visible to drivers and help the pedestrians see around parked vehicles. Consideration of heavy vehicle turning movements should be given to balance the needs of people walking and deliveries to local businesses.



Figure 3: Curb Extensions (City of Alexandria)

*Description:* “Curb extensions - also known as bulb-outs or neckdowns extend the sidewalk or curb line out into the parking lane, which reduces the effective street width” (DOT & FHWA).

### *Benefits:*

- Improves safety for pedestrians and motorists at intersections.
- Increases pedestrian and vehicle visibility.
- Reduces pedestrian crossing distance.
- Reduces speed of turning vehicles.
- Encourages pedestrians to cross at designated locations.

*Design Considerations:* Site specific.

### *Additional Resources:*

City of Alexandria Complete Street Guides:

<https://www.alexandriava.gov/transportation-planning/complete-streets-design-guidelines>

FHWA Traffic Calming Guide:

<https://safety.fhwa.dot.gov/saferjourney1/Library/countermeasures/23.htm#:~:text=Curb%20extensions%20%2D%20also%20known%20as,reduces%20the%20effective%20street%20width.>

## High Visibility Crosswalks

Existing decorative crosswalks in the downtown area could be improved with high visibility crosswalks. Additional marked crossing locations would also improve pedestrian safety. VDOT's *IIM-TE-384.1: Pedestrian Crossing Accommodations at Unsignalized Locations* provides additional guidance for pedestrian crossing accommodations at unsignalized locations, including the appropriate conditions for including in-street signage.



Figure 4: High Visibility Enhancements (FHWA)

**Description:** High visibility crosswalks use high contrast markings, signage, and lighting to make crossings more visible to both the driver and pedestrian from farther away. (FHWA)

**Benefits:**

- Improved visibility: Increases driver recognition distance by 2x standard markings.
- Improved safety: reduce crashes by 23-48%. (VDOT)



Figure 5: Harrisonburg, VA Paver Crosswalk with Wide Parallel Markings (EPR)

**Design Considerations: VDOT**

- Proximity to nearest crosswalk
- Pedestrian-oriented land uses
- Roadway configuration
- Speed
- Traffic Volumes
- Stopping sight distance

**Additional Resources:**

FHWA Crosswalk Visibility Enhancements Tech Sheet:

[https://safety.fhwa.dot.gov/ped\\_bike/step/docs/techSheet\\_VizEnhancement2018.pdf](https://safety.fhwa.dot.gov/ped_bike/step/docs/techSheet_VizEnhancement2018.pdf)

FHWA High-Visibility Crosswalk Marking Styles:

[https://www.pedbikeinfo.org/cms/downloads/PBIC\\_WhitePaper\\_Crosswalks.pdf](https://www.pedbikeinfo.org/cms/downloads/PBIC_WhitePaper_Crosswalks.pdf)

Traffic Engineering Division Memorandum IIM-TE-384.1 Pedestrian Crossing Accommodations at Unsignalized Approaches.” [https://www.vdot.virginia.gov/media/vdotvirginiagov/doing-business/technical-guidance-and-support/technical-guidance-documents/traffic-operations/TE-384.1\\_Pedestrian\\_Crossing\\_Accommodations\\_at\\_Unsignalized\\_Approaches\\_acc081622.pdf](https://www.vdot.virginia.gov/media/vdotvirginiagov/doing-business/technical-guidance-and-support/technical-guidance-documents/traffic-operations/TE-384.1_Pedestrian_Crossing_Accommodations_at_Unsignalized_Approaches_acc081622.pdf)

## Median Refuge

Main St and West St could benefit from a median refuge to improve pedestrian safety and calm traffic.

*Description:* A median refuge is an area located between opposite lanes of traffic where pedestrians cross traffic. This enhances pedestrian safety by allowing them to cross one direction of traffic at a time.

### *Benefits:*

- Reduces time pedestrians are exposed to traffic.
- Allows pedestrians to cross the street one direction of travel or fewer lanes at a time at uncontrolled intersections or at the midblock.
- Provides a midway point for slower pedestrians (e.g., youth, older adults, and people with disabilities).
- May provide space for additional lighting at the crossing.
- May slow vehicle speeds going through or turning at the crosswalk. (Arlington)



Figure 6: Pedestrian Refuge (VTA)



Figure 7: Pedestrian Refuge (Henrico)

### *Design Considerations:*

- Width: recommended between 6 -10 FT to accommodate bicyclists and larger volumes of pedestrians.
- Must accommodate pedestrians with disabilities and should be part of an Americans with Disabilities Act (ADA) compliant pathway. (Arlington)

### *Additional Resources:*

FHWA:

[https://safety.fhwa.dot.gov/ped\\_bike/tools\\_solve/medians\\_brochure/](https://safety.fhwa.dot.gov/ped_bike/tools_solve/medians_brochure/)

Arlington Vision Zero Tools and Guidelines:

[https://www.arlingtonva.us/Government/Programs/Transportation/Vision-Zero/Tools-and-Guidelines/Multimodal-Safety-Engineering-Toolbox-Web-Format/Raised-Refuge-Islands#:~:text=Reduces%20time%20pedestrians%20are%20exposed,%2C%20and%20people%20with%20disabilities\).](https://www.arlingtonva.us/Government/Programs/Transportation/Vision-Zero/Tools-and-Guidelines/Multimodal-Safety-Engineering-Toolbox-Web-Format/Raised-Refuge-Islands#:~:text=Reduces%20time%20pedestrians%20are%20exposed,%2C%20and%20people%20with%20disabilities).)

## Pedestrian Signal Upgrades

While the existing traffic signals accommodate pedestrians, nearly all of them lack vibrotactile arrows and audible features. In some locations, there is no pedestrian countdown timer provided.



Figure 8: Updated Pedestrian Crossing (MN-DOT)

*Description:* Pedestrian signal upgrades involve enhancing pedestrian crossings with countdown timers, audible cues, and pedestrian push buttons that are compliant with ADA standards. These upgrades aim to increase pedestrian safety by providing clear indications of when it is safe to cross.

### *Benefits:*

- Improved visibility for drivers and pedestrians
- Improved crossing efficiency for pedestrians
- Better accessibility for all pedestrians, but especially those with visual and/or auditory impairments
- Improved safety when crossing by reducing risk of accidents or injury (FHWA)

### *Design Considerations:*

- Must follow Federal Highway Administration Pedestrian Control Guidelines
- Must meet Americans with Disabilities Act (ADA) requirements for accessibility (i.e. button height)

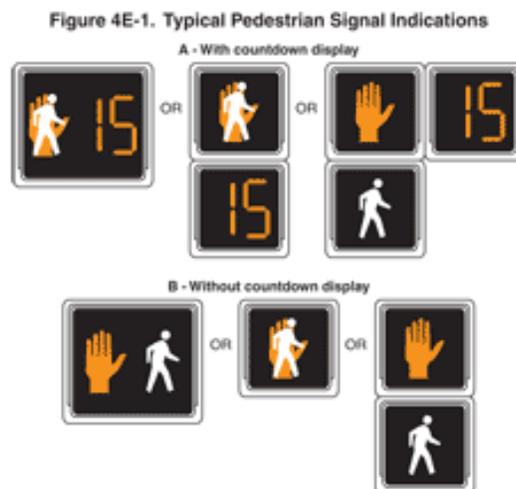


Figure 9: FHWA Pedestrian Signals

### *Additional Resources:*

FHWA Pedestrian Control Features: <https://mutcd.fhwa.dot.gov/htm/2009/part4/part4e.htm>

## Raised Intersection/Crosswalks

A raised intersection along Davis St and Blue Ridge Ave could reinforce the need to travel slowly through this area.



Figure 10: Raised Crosswalks (Arlington)

### Benefits:

- Increased visibility: Raised crosswalks improve visibility of pedestrians within a crosswalk.
- Improved safety: Raised crosswalks can reduce crashes by 45%.
- Reduced speed: Raised crosswalks can reduce 85 percentile speeds to 20 to 30 miles per hour (mph). (VDOT)

### Design Considerations:

- Width: 10 FT and allow a vehicle's front and rear wheels to be on the top of the raised crosswalk at the same time
- Usually 3-6 inches above road grade
- Raised crosswalks may be constructed flush with adjacent curb or with pedestrian ramps on both the curb and raised crosswalk to be fully accessible for those with visual or physical disabilities.
- Consider drainage and snowplow impacts (VDOT)
- Qualifying Road:
  - 2-3 lane roads
  - 30 mph speed limit (or less)
  - Annual average daily traffic (AADT) below 9,000

### Additional Resources:

FHWA Raised Crosswalks Tech Sheet:

[https://safety.fhwa.dot.gov/ped\\_bike/step/docs/techSheet\\_VizEnhancemt2018.pdf](https://safety.fhwa.dot.gov/ped_bike/step/docs/techSheet_VizEnhancemt2018.pdf)

*Description:* Raised crosswalks improve pedestrian visibility and safety by elevating them to the same level as the sidewalk. They're marked as pedestrian crossings and reduce vehicle speeds by acting as traffic calming.



Figure 11: Raised Crosswalk (Orlando)

## School Zone Speed Enforcement

School zone speed photo enforcement can be used to increase driver compliance in the reduced speed zones on North Main Street while improving the safety of students in adjacent schools.



*Description:* School zone speed enforcement uses photo speed capture technology to monitor and fine speeding vehicles in school zones. Indicated by signs, flashing lights, and current speed displays, this enforcement method warns drivers to comply with slower speed limits near schools (Blacksburg).

Figure 12: School Zone Photo Enforcement (Blacksburg)

### Benefits:

- Traffic calming and slower speeds in school zones.
- Safety: reduce the risk of accidents or injury.
- Resource Efficiency: While in-person monitoring by law enforcement is a temporary solution, automated speed enforcement offers a cost-effective solution for continuous monitoring.
- Accountability: drivers speeding in school zones can face tickets and fines for violating the speed limit (Blacksburg)

### Design Considerations:

- Public Trust: With proper controls in place, photo enforcement can offer fair and equitable enforcement of speeding, regardless of driver age, race, gender, or socio-economic status. Photo enforcement should be planned with community input and equity impacts in mind.
- Photo enforcement should be regularly evaluated to determine that they are aiding safety goals. (FHWA)

### Additional Resources:

Fauquier County Example: <https://www.fauquiercounty.gov/government/departments-h-z/sheriff-s-office/school-speed-zone-photo-enforcement>

FHWA Speed Safety Cameras:

<https://safety.fhwa.dot.gov/provencountermeasures/speed-safety-cameras.cfm>



Figure 13: School Zone Photo Enforcement (City of Kirkland)

# Corridor Improvements

## Improved Signal Timing



Figure 14: Culpeper Main St

Main St and Chandler St traffic flow could benefit from improved signal timing. Main Street is a heavy vehicle thoroughfare and congestion is attributed to many of the accidents. Similarly, Chandler St accidents and speeding could be reduced by signal timing. Coordinated signal timing synchronizes traffic movements and manages the progression speed where uninterrupted flow is desired along a corridor. Signal timing is one of the most cost-effective ways to improve traffic flow and safety by coordinating signals to reward slower driving speeds of 15–20 mph through the downtown area. Re-timing or optimizing traffic signals provides a CMF value of

.958 or installing an adaptive signal provides a CMF value of .642.

### *Additional Resources:*

Richmond Vision Zero: <https://www.rva.gov/public-works/vision-zero/#:~:text=Vision%20Zero%20espouses%20the%20belief,Vision%20Zero%20in%20the%20U.S.>

NACTO Coordinated Signal Timing: <https://nacto.org/publication/urban-street-design-guide/intersection-design-elements/traffic-signals/coordinated-signal-timing/#:~:text=Coordinated%20signal%20timing%20is%20typically,user%20or%20set%20progression%20speed.>

FHWA Traffic Signal Timing Manual:

<https://ops.fhwa.dot.gov/publications/fhwahop08024/chapter6.htm>

## Corridor Lighting

Insufficient or inconsistent lighting is present at each of the corridors, especially at intersections. The Main Street corridor has existing decorative streetscape lighting. While preliminary light meter readings suggest that these lights are sufficient, the overhead lights do not sufficiently light the intersections. A downtown lighting study should be conducted to identify specific areas where lighting can be improved to reduce night-time crashes. Improved lighting at intersections provides a CMF value of .881.



Figure 15: Culpeper Main St Street Lighting (Culpeper Times)

According to the Federal Highway Administration, lighting can reduce crashes up to 42% for nighttime pedestrian crashes at intersections and 33-38% for rural and urban intersection crashes.

#### *Design Considerations:*

- Lighting choices should be based on history of crashes, traffic volume, non-motorized users, visibility of crosswalks, and transit stops.
- Modern lighting options can control light pollution, excessive lighting, and can prevent light spilling into close-by properties.



Figure 16: NJ Conservation Light Pollution Infographic

#### *Additional Resources:*

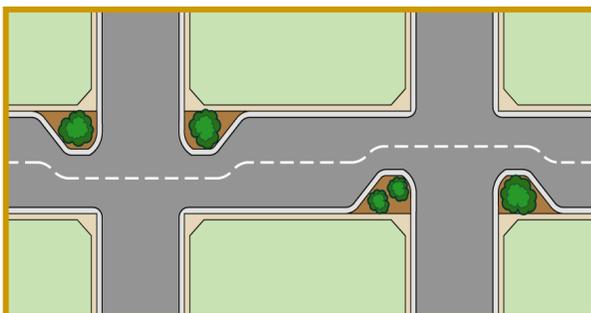
FHWA Safety Lighting: <https://safety.fhwa.dot.gov/provencountermeasures/lighting.cfm>

FHWA Roadway Lighting Resources: <https://highways.dot.gov/safety/other/visibility/roadway-lighting-resources>

DarkSky Smart City Street Light Emissions: <https://darksky.org/news/tucson-street-light-experiment/>

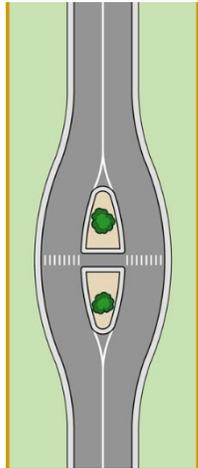
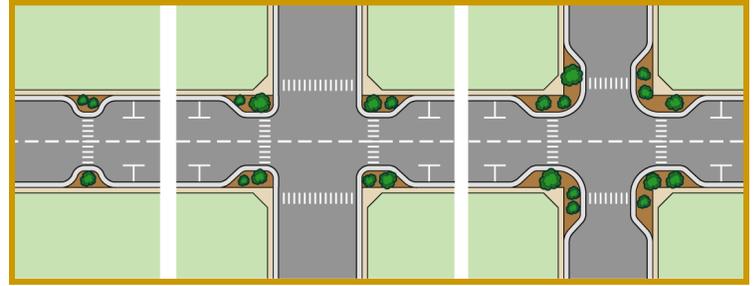
## Traffic Calming

Traffic calming encompasses a variety of tools, including vertical deflections like raised crosswalks and intersections, as well as horizontal shifts and roadway narrowing. These tools aim to slow traffic speeds and create a safer environment for pedestrians and cyclists. Traffic calming decreases the frequency and severity of crashes, making travel safer for everyone.

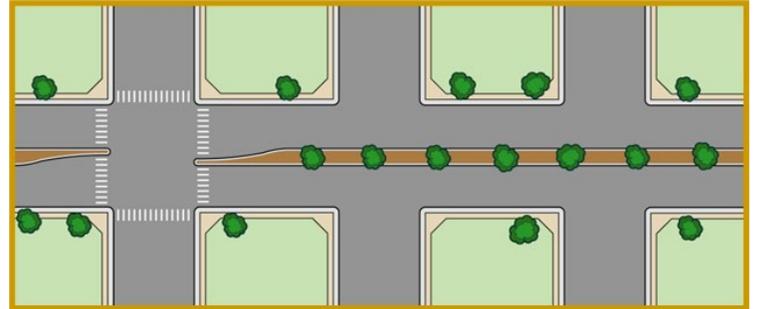


*Chicane:* A chicane consists of a series of narrow curves or bends along a road. By forcing vehicles to navigate through the winding path, chicanes reduce traffic speed, making streets more pedestrian-friendly and promoting a smoother flow of traffic.

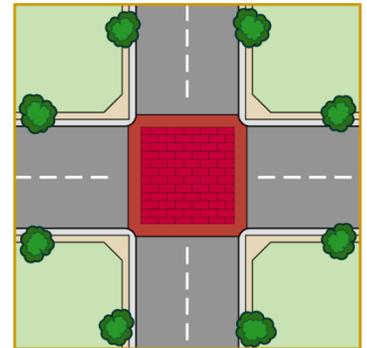
**Neckdown:** A neckdown, also known as a curb extension or a bulb-out, involves extending the sidewalk into the street at intersections or mid-block locations, narrowing the roadway and shortening crossing distances for pedestrians. This tool enhances visibility for both pedestrians and drivers, slows driving speeds, and increases opportunities for street parking.



**Median Treatment:** Median treatments for traffic calming can include installing physical barriers such as raised islands, landscaped medians, or bollards to prevent illegal U-turns or lane changes and slow down drivers. Medians can be designed with artistic elements, landscaping, median refuges, and lighting to improve aesthetics, placemaking, and pedestrian safety.



**Raised Intersection:** A raised intersection, also known as a raised crosswalk or speed table, is a traffic calming measure designed to slow down vehicles and enhance pedestrian safety at intersections. By elevating the entire intersection, vehicles must slow down as they approach and cross the raised portion, creating a natural traffic calming effect. Additionally, raised intersections provide a visual and physical indication pedestrian crossings, reinforcing the importance of yielding to foot traffic and promoting a safer and more walkable environment.



## Access Management

The area around Cherry Street/East Street is not well-defined. The travel lanes blend with the skewed intersection and wide expanses of parking with no specific access points. Thoughtful access management along a corridor can simultaneously enhance safety for all modes, facilitate walking and biking, and reduce trip delay and congestion.

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# Appendix D

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<https://data.census.gov/table>

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<https://ejscreen.epa.gov/mapper/>

**DOT SS4A Underserved Communities Census Tracts (Historically Disadvantaged Communities):**

<https://www.arcgis.com/apps/dashboards/99f9268777ff4218867ceedfabe58a3a>

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<https://www.virginiaroads.org/maps/1a96a2f31b4f4d77991471b6cabb38ba/about>

**Town of Culpeper Zoning and Subdivision Ordinance:**

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**Town of Culpeper Facilities Standards Manual:**

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**VRT Website:**

<https://vatransit.org/>

# Appendix E

**VDOT Pipeline Study of US 29 Business (Madison Road)  
is hereby incorporated by reference.**

# Appendix F



# CULPEPER US 15 BUS CORRIDOR STUDY

From N Main Street to Inlet Road/Normans Lane | Town of Culpeper and Culpeper County, Virginia

Draft Report

May 2024





# Culpeper US 15 BUS Corridor Study

From N Main Street to Inlet Road/Normans Lane | Town of Culpeper and Culpeper County, Virginia

May 2024 | Draft Report

Prepared for:



1401 East Broad Street, Richmond, VA 23219

Prepared by:



2035 Maywill Street, Suite 200, Richmond, VA 23230

## LIST OF ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials	PDO	Property Damage Only
APN	Arterial Preservation Network	PE	Preliminary Engineering
CDBG	Community Development Block Grants	PHB	Pedestrian Hybrid Beacon
CEI	Construction Engineering and Inspection	PSAP	Pedestrian Safety Action Plan
CMAQ	Congestion Mitigation and Air Quality	PSI	Potential for Safety Improvement
CMF	Crash Modification Factor	RCUT	Restricted Crossing U-turn
CN	Construction	RI/RO	Right-in/Right-out
CoSS	Corridors of Statewide Significance	SPF	Safety Performance Function
DRPT	Department of Rail and Public Transportation	STARS	Strategically Targeted and Affordable Roadway Solutions
EPDO	Equivalent Property Damage Only	SWG	Study Work Group
ETT	Experienced Travel Time	SYIP	Six-Year Improvement Program
F+I	Fatal and Injury	TA	Transportation Alternatives
HCM	Highway Capacity Manual	TMC	Turning Movement Count
HSM	Highway Safety Manual	TOD	Traffic Operations Division
HSIP	Highway Safety Improvement Program	TOSAM	Traffic Operations and Safety Analysis Manual
iCAP	Intersection and Interchange Control Assessment Program	VDOT	Virginia Department of Transportation
LOS	Level of Service	VTrans	Virginia's Transportation Plan
MUTCD	Manual on Uniform Traffic Control Devices	VJuST	VDOT Junction Screening Tool

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# 1 INTRODUCTION

## 1.1 Background and Study Initiation

The Virginia Department of Transportation (VDOT) identified the US 15 Business (BUS) corridor in the Town of Culpeper and Culpeper County for study under the Strategically Targeted and Affordable Roadway Solutions (STARS) program. The STARS program uses a data-driven process to identify candidate projects with critical traffic and safety challenges. The US 15 BUS corridor is identified as a Corridor of Statewide Significance (CoSS) and meets the following needs from Virginia's Transportation Plan (VTrans):

- Congestion mitigation
- Capacity preservation
- Rail on-time performance
- Transportation demand management
- Safety improvements
- Improved access to industrial and economic development area
- Various urban development area needs

The STARS program seeks to develop comprehensive, innovative transportation solutions to relieve congestion bottlenecks and resolve safety issues. The goals of STARS studies include:

- Develop innovative, cost-effective solutions
- Evaluate potential solutions more thoroughly
- Identify potential project risks and costs
- Build stakeholder consensus
- Improve readiness for project implementation

## 1.2 Purpose of Study

The purpose of this study was to evaluate existing deficiencies in the US 15 BUS corridor and to develop potential projects to improve pedestrian connectivity, improve safety at hot spots, mitigate congestion, and improve transit access. The primary goal of the STARS program was to identify targeted improvements that met project needs and could be programmed into the VDOT Six-Year Improvement Program (SYIP). The study team considered the likelihood that recommended improvements would perform favorably in the SMART SCALE project prioritization process or other transportation funding programs. The primary needs for this study are:

- Improve safety at intersections with potential for safety improvement or where documented safety issues exist
- Improve access for pedestrians and bicyclists throughout the corridor
- Improve progression and operations on US 15 BUS where congestion occurs
- Reduce control delay and queuing on side streets where congestion occurs while maintaining progression and operations on US 15 BUS

## 1.3 Study Work Group

A study work group (SWG) was formed to capture input from local stakeholders and shape the development of improvement concepts. The SWG provided local and institutional knowledge of the corridor; reviewed study methodologies; provided input on key assumptions; and reviewed and approved proposed improvements created through the study process. The SWG included members representing the following organizations:

- VDOT
- Town of Culpeper
- Culpeper County
- Department of Rail and Public Transportation (DRPT)
- Kimley-Horn

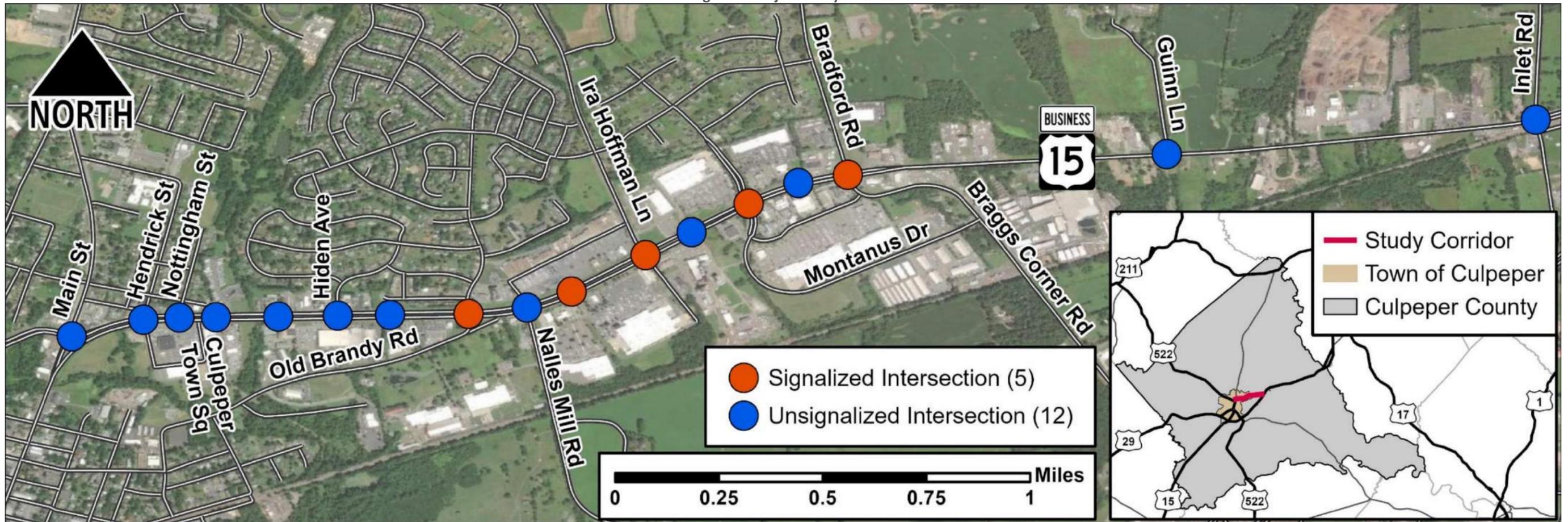
## 1.4 Study Area

The study area extended approximately 2.8 miles along US 15 BUS between N Main Street and Inlet Road/Normans Lane. US 15 BUS within the study area is a four-lane divided roadway for 1.6 miles between N Main Street and Bradford Road/Braggs Corner Road and a two-lane roadway for 1.2 miles between Bradford Road/Braggs Corner Road and Inlet Road/Normans Lane. US 15 BUS is functionally classified as an other principal arterial with a speed limit ranging from 25 to 55 miles per hour (mph). US 15 BUS is signed as James Madison Highway from N Main Street to Nalles Mill Road and as Brandy Road from Ira Hoffman Lane and to the east.

The study area for the US 250 corridor is shown in [Figure 1](#). The following US 15 BUS intersections were included in the study area. The intersections with Guinn Lane and Inlet Road/Normans Lane were not included in the traffic operations analysis.

- |  |   |
|--|---|
| 1. N Main Street (roundabout)                | 10. Walmart (signalized)                          |
| 2. Hendrick Street (unsignalized)            | 11. Ira Hoffman Lane (signalized)                 |
| 3. Nottingham Street (unsignalized)          | 12. Lidl/Lowe's (unsignalized)                    |
| 4. Culpeper Town Square (unsignalized)       | 13. Montanus Drive (signalized)                   |
| 5. Advance Auto Parts (unsignalized)         | 14. Starbucks (unsignalized)                      |
| 6. Hiden Avenue (unsignalized)               | 15. Bradford Road/Braggs Corner Road (signalized) |
| 7. Taco Bell (unsignalized)                  | 16. Guinn Lane (unsignalized)*                    |
| 8. Belle Avenue/Old Brandy Road (signalized) | 17. Inlet Road/Normans Lane (unsignalized)*       |
| 9. Nalles Mill Road (unsignalized)           | *Not included in traffic operations analysis      |

Figure 1: Project Study Area



## 2 DATA COLLECTION AND INVENTORY

This chapter summarizes data collection and field review observations for this study. Data collection and processing assumptions are based on guidance in the VDOT *Traffic Operations and Safety Analysis Manual (TOSAM)*.

### 2.1 Field Review

The study team conducted a preliminary field review of the study area on Thursday, November 17, 2022, and Saturday, December 3, 2022, to verify existing lane configurations and sidewalks, confirm traffic control devices, verify bus stop locations, and observe peak hour traffic conditions and driver behavior.

#### 2.1.1 Field Review Observations

The study team made the following observations during the field review:

- Median openings along US 15 BUS from Main Street to the Dominion Square Shopping Center lack sufficient storage and sight distance for vehicles to make safe two-stage movements. See Photo A and Photo B.
- Long southbound, eastbound, and westbound queues formed along Ira Hoffman Lane (see Photo C and Photo D). Occasionally, the green phase was not long enough to process all vehicles in the queue.
- Vehicles prepositioned in the left eastbound through lane at intersection with Bradford Road/Braggs Corner Road in advance of the lane drop to the east of intersection (see Photo E)
- Several bus stops along the study corridor (Culpeper Trolley Service, Culpeper County Demand Shuttle, and Rappahannock Rapidan Community Services Shuttle) lack accessible boarding pads or direct connections to sidewalks (see Photo F)
- Pedestrian and bicyclist accommodations along the corridor lack connectivity (e.g., missing sidewalk or crosswalks) and should be reviewed for compliance with accessibility standards. Photo G through Photo L document observations of pedestrian and bicyclist activity or facilities.

#### 2.1.2 Additional Observations

The study team noted that the eastbound left-turn lane at Inlet Road does not have a uniform width. Furthermore, the lane reduction from two lanes to one lane on westbound US 15 BUS east of Inlet Road/Normans Lane lacks lane reduction arrow pavement markings or advance warning signs.

The study team observed the following movements were not fully served during their green phase at the intersection of US 15 BUS and Ira Hoffman Lane:

- Eastbound left-turn lane (weekday PM peak period)
- Northbound through/right-turn lane (weekday PM and Saturday peak periods)
- Westbound left-turn lane (weekday PM peak period)
- Southbound through/left-turn lane (weekday PM and Saturday peak periods)

#### 2.1.3 Potential Recommendations from Field Review Observations

Several issues in the field could be mitigated by low-cost strategies and will be considered during the concept development phase of the study:

- **Westbound US 15 BUS east of Inlet Road/Normans Lane:** Install lane-reduction transition markings and lane reduction signs in advance of the westbound lane reduction to one through lane.
- **US 15 BUS east of Bradford Road/Braggs Corner Road:** Install rumble strips along the shoulder and centerline to mitigate roadway departure crashes.
- **Eastbound US 15 BUS between Main Street and Walmart/Dominion Square Shopping Center:** Install high visibility crosswalks along US 15 BUS at unmarked crossing locations between curb ramps.

### 2.2 Existing Roadway Geometry

The study team reviewed and documented existing roadway geometry during the field review. For the purpose of this study, US 15 BUS is oriented in an east-west direction and other intersecting roads are oriented in a north-south direction. US 15 BUS is a four-lane divided roadway in the western portion of the study area and a two-lane undivided roadway in the eastern portion of the study area. *Figure 2* summarizes the existing lane configurations and effective storage lengths for turn lanes. Effective storage length is measured as the length of the full-width storage lane plus one half of the taper length. The speed limit along US 15 BUS in the study area varies from 25 mph to 55 mph. The study team assumed a 25-mph speed limit on side streets where no posted speed limit signs were present.

Photo A



Four vehicles stage in median at US 15 BUS and Culpeper Town Square (Saturday)

Photo B



Two left-turn vehicles stage in median at US 15 BUS and Nalles Mill Road. The mainline left-turn queue blocks the visibility of the driver of the red minivan (weekday AM).

Photo C



Southbound queues on Ira Hoffman Lane (weekday AM)

Photo D



Eastbound queues on US 15 BUS at Ira Hoffman Lane (weekday PM)

Photo E



High utilization of inside eastbound lane on US 15 BUS upstream of lane drop (weekday AM)

Photo F



A Culpeper Trolley stop on US 15 BUS near Popeye's with no sidewalks and pedestrian ramps

Photo G



Pedestrian takes refuge in the median as they cross US 15 BUS east of Ira Hoffman Lane (weekday PM). There are no crosswalks at Ira Hoffman Lane.

Photo H



Crosswalk at intersection with Dominion Square Shopping Center does not connect to sidewalk on north side of US 15 BUS

Photo I



Sidewalk along the north side of US 15 BUS ends near Oak View National Bank

Photo J



Walking "desire" path along westbound US 15 BUS from Jiffy Lube to Belle Avenue

Photo K



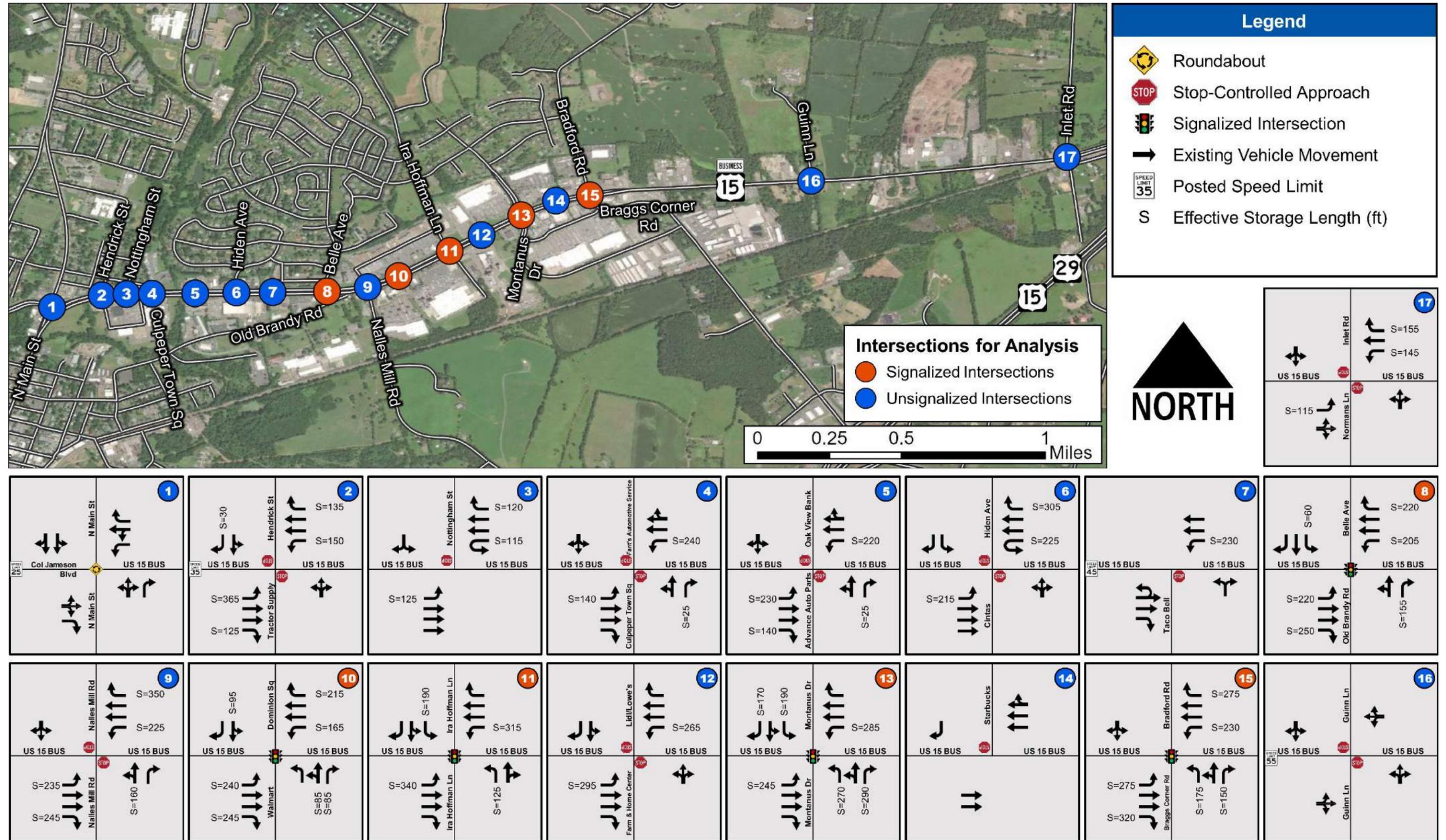
Cyclist crosses Montanus Drive with no crosswalk or pedestrian signal (weekday AM)

Photo L



Cyclist crosses Old Brandy Road with traffic signal (Saturday)

Figure 2: 2022 Existing Lane Configurations and Speed Limits



## 2.3 Land Use

The Code of Virginia requires localities to adopt a comprehensive plan that considers existing and projected conditions for the physical development of jurisdictions. Existing and future land use maps for Culpeper County and the Town of Culpeper can be found in [Appendix B](#).

The parcels along US 15 BUS within the study area primarily serve commercial and industrial uses, though there are a few small sections of residential and agricultural uses. Culpeper Town Square, Dominion Square Shopping Center, and businesses such as Lowe's and Walmart are notable traffic generators along the corridor. Residential neighborhoods to the north of US 15 BUS can be accessed via Hendrick Street, Hiden Avenue, Belle Avenue, Ira Hoffman Lane, and Montanus Drive.

*Culpeper 2030*, the Town of Culpeper's strategic vision plan and the *2023 Culpeper County Comprehensive Plan* identify the following planned land use changes:

- Convert low-density residential areas into high- and medium-density residential areas along Belle Avenue (Town of Culpeper)
- Convert commercial and industrial areas into employment centers or mixed-use areas (Town of Culpeper)
- Convert agricultural areas into mixed-use or commercial areas (Culpeper County)
- Convert commercial and/or industrial areas to industrial-only areas (Culpeper County)

## 2.4 Traffic Volume Data

The study team collected weekday traffic volume data at four study area intersections (N Main Street through Culpeper Town Square) on Tuesday, November 15, 2022, and at 12 study area intersections (Advance Auto Parts through Guinn Lane) on Thursday, November 17, 2022. The study team also collected weekend traffic volume data at all study area intersections on Saturday, December 4, 2022. Turning movement counts (TMCs) were not collected at the intersection of US 15 BUS and Inlet Road/Normans Lane since weekday AM and PM TMCs were collected for another study on Wednesday, November 30, 2022. Saturday TMCs were not collected at this intersection. All traffic data is provided in [Appendix C](#).

### 2.4.1 Peak Hour Determination

The study team determined a network-wide peak hour for the AM, PM, and Saturday peak periods by comparing traffic volumes during a given hour to the traffic volumes during the peak hour of each intersection. The hours that captured the highest percentage of overall traffic volumes in the network when compared to the individual peak hours were selected as the network peak hours. The peak hour determination summary tables are provided in [Appendix C](#). Based on the results of this analysis, the study team selected the following network peak hours:

- AM weekday: 7:15 AM to 8:15 AM
- PM weekday: 4:15 PM to 5:15 PM
- Saturday: 11:45 AM to 12:45 PM

### 2.4.2 Traffic Volume Balancing

[Figure 3](#) and [Figure 4](#) show the 2022 existing traffic volumes at each study area intersection. The study team balanced traffic volumes between N Main Street and Bradford Road. The study team did not balance volumes at the US 15 BUS intersections with Guinn Lane and Inlet Road/Normans Lane since these study area intersections are outside of the traffic operations modeling area. The study team used the following assumptions to balance traffic volumes.

- Raw traffic volumes should not be adjusted by more than 10 percent, if possible
- U-turn volumes were removed from undivided side streets
- U-turn volumes were not adjusted on US 15 BUS except at the US 15 BUS intersections with Hendrick Street and Nottingham Street since U-turns were not included in the raw Saturday traffic volumes

Traffic volumes collected on Thursday, November 17, 2022, were higher on US 15 BUS than those collected on Tuesday, November 15, 2022. The study team addressed the imbalance caused by the TMCs occurring on different days by increasing the through volumes on US 15 BUS at the four intersections west of Advance Auto Parts to balance with the higher volumes to the east. The US 58 BUS through traffic volume adjustments ranged from 6 to 12 percent.

### 2.4.3 Heavy Vehicle Percentages and Peak Hour Factors

The study team calculated heavy vehicle percentages for each movement and peak hour factors for each intersection during the AM, PM, and Saturday peak hours. [Figure 5](#) and [Figure 6](#) summarize the calculated AM, PM, and Saturday peak hour heavy vehicle percentages and peak hour factors for each study area intersection.

Since the AM and PM network peak hours differed from the peak hours used in the separate study at the US 15 BUS Inlet Road/Normans Lane intersection and that study did not include the raw data for heavy vehicles, the study team assumed that the heavy vehicle percentages for the individual peak hours were consistent with the heavy vehicle percentages for the network peak hour.

## 2.5 Pedestrian, Bicycle, and Transit Data

The study area west of Lidl/Lowe's is served by the Culpeper Transit system which connects riders to the Culpeper Hospital, Culpeper Department of Social Services, and various apartments and businesses throughout Culpeper. None of the bus stops along US 15 BUS have bus shelters or connections to sidewalks.

Sidewalks along US 15 BUS lack connectivity and often end abruptly in the middle of a block. Worn paths along the side of the road where no sidewalks are available provide evidence of pedestrian activity and demand. Two crosswalks are available to cross US 15 BUS within the study area, one at the western leg of the N Main Street roundabout and one at the eastern leg of the intersection with Walmart. The study team observed pedestrians crossing US 15 BUS without a crosswalk during the field review, which was verified by the pedestrian volumes collected during the TMCs. The summary of pedestrian and bicycle activity for the 14-hour weekday and 4-hour Saturday counts are summarized in [Figure 7](#) and [Figure 8](#).

Figure 3: 2022 Existing Weekday Peak Hour Traffic Volumes

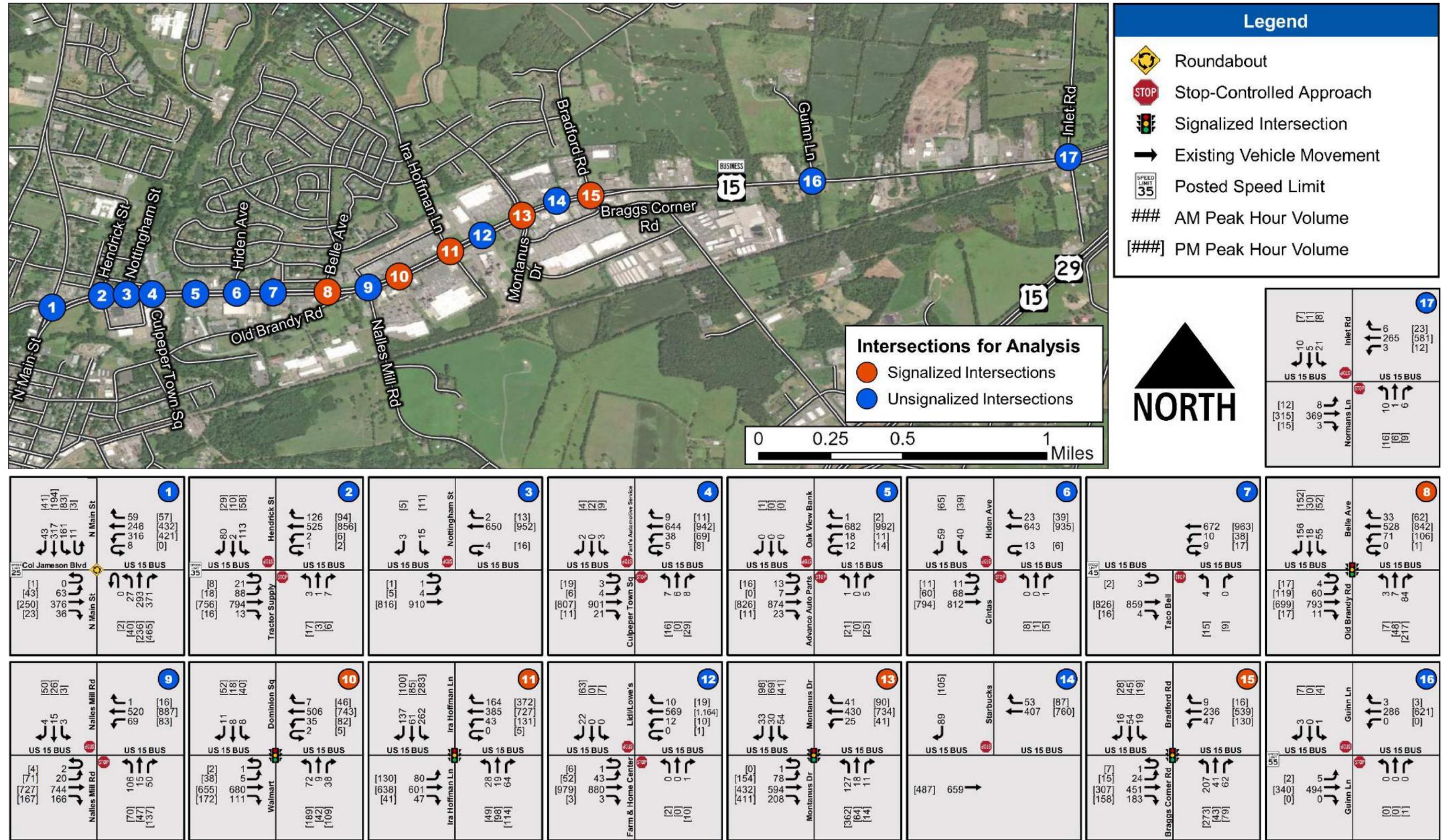


Figure 4: 2022 Existing Saturday Peak Hour Traffic Volumes

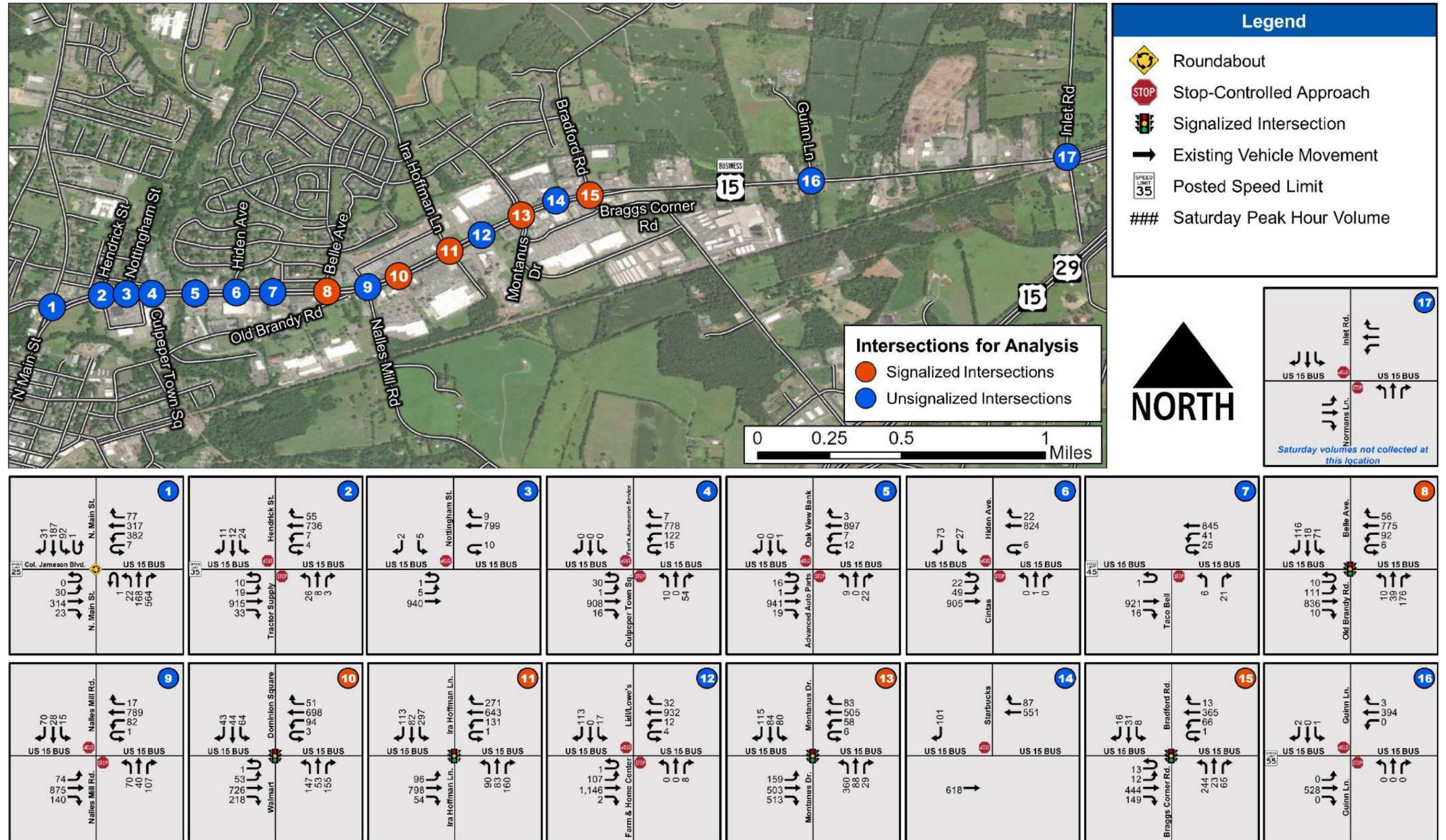


Figure 5: 2022 Existing Weekday Peak Hour Heavy Vehicle Percentages and Peak Hour Factors

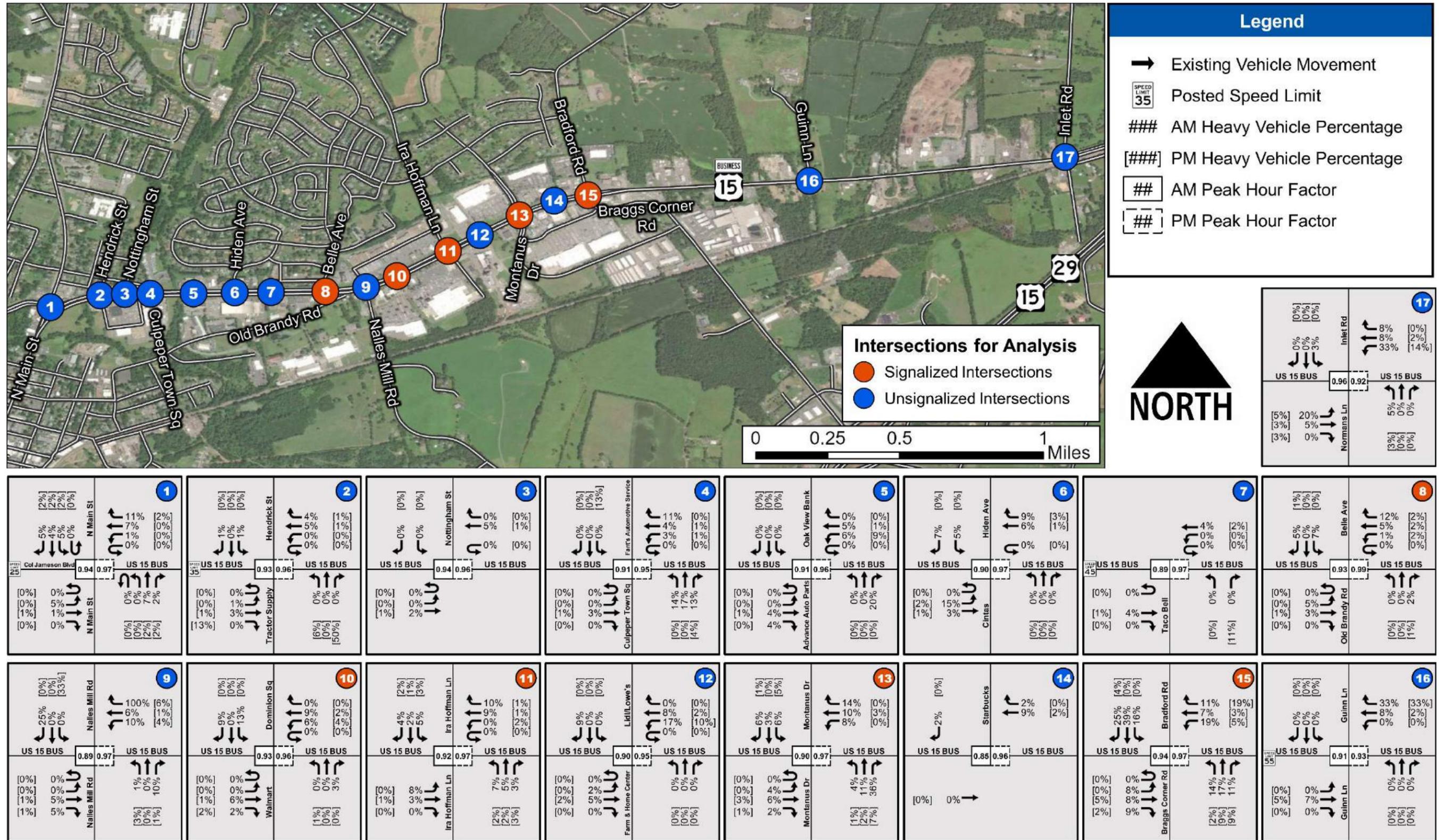


Figure 6: 2022 Existing Saturday Peak Hour Heavy Vehicle Percentages and Peak Hour Factors

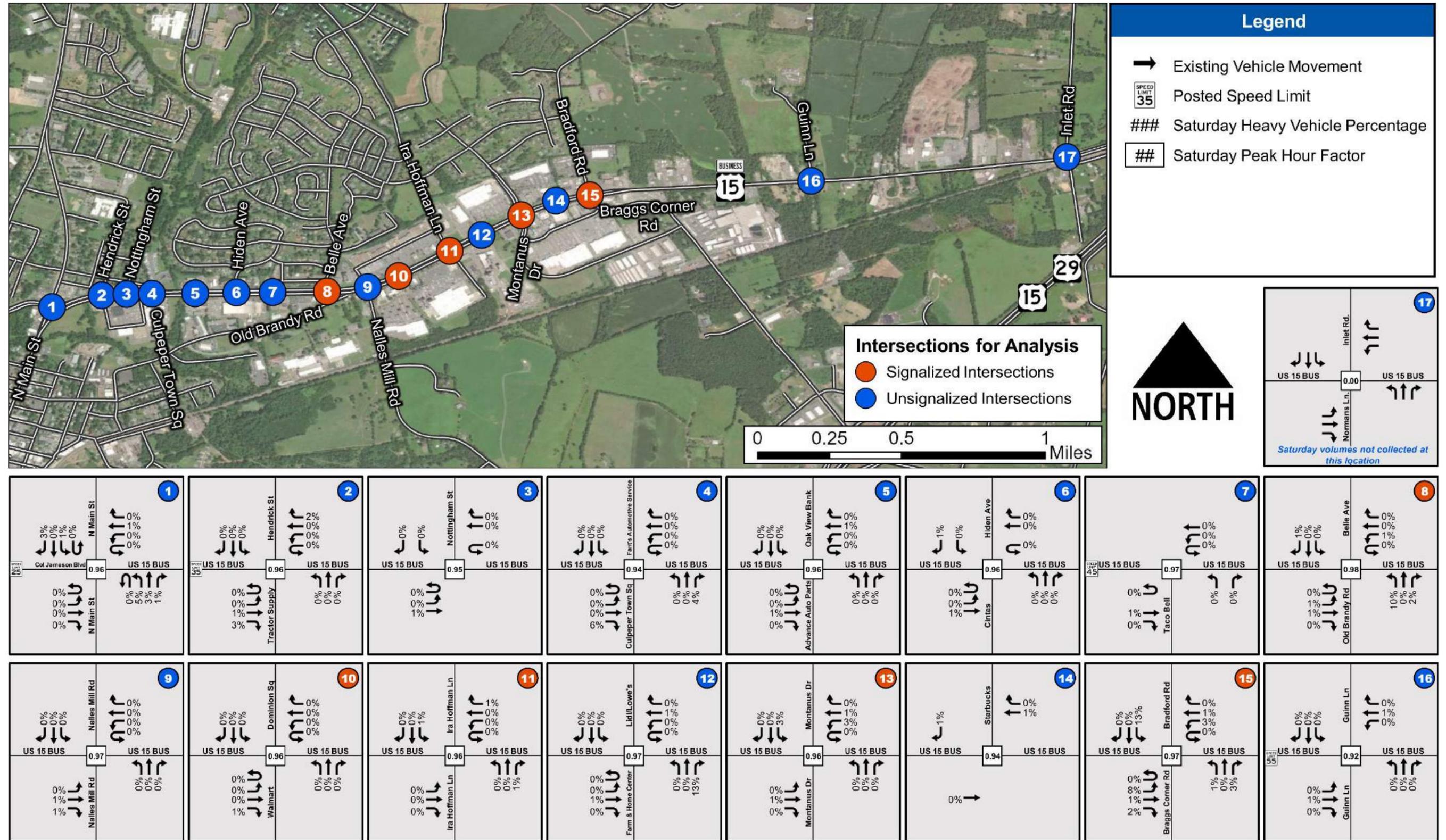


Figure 7: 2022 Existing Weekday 14-Hour Pedestrian and Bicycle Volumes

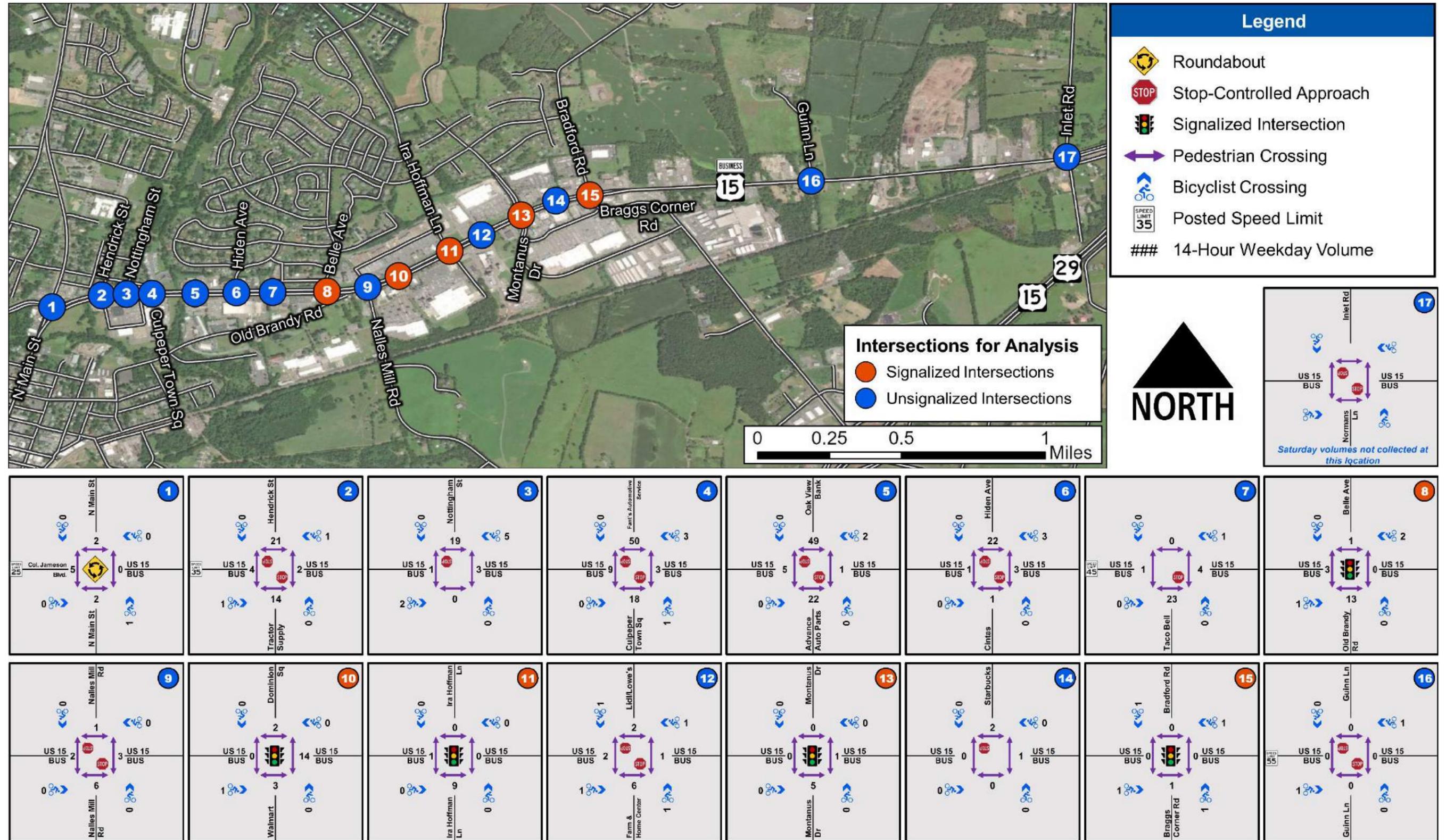
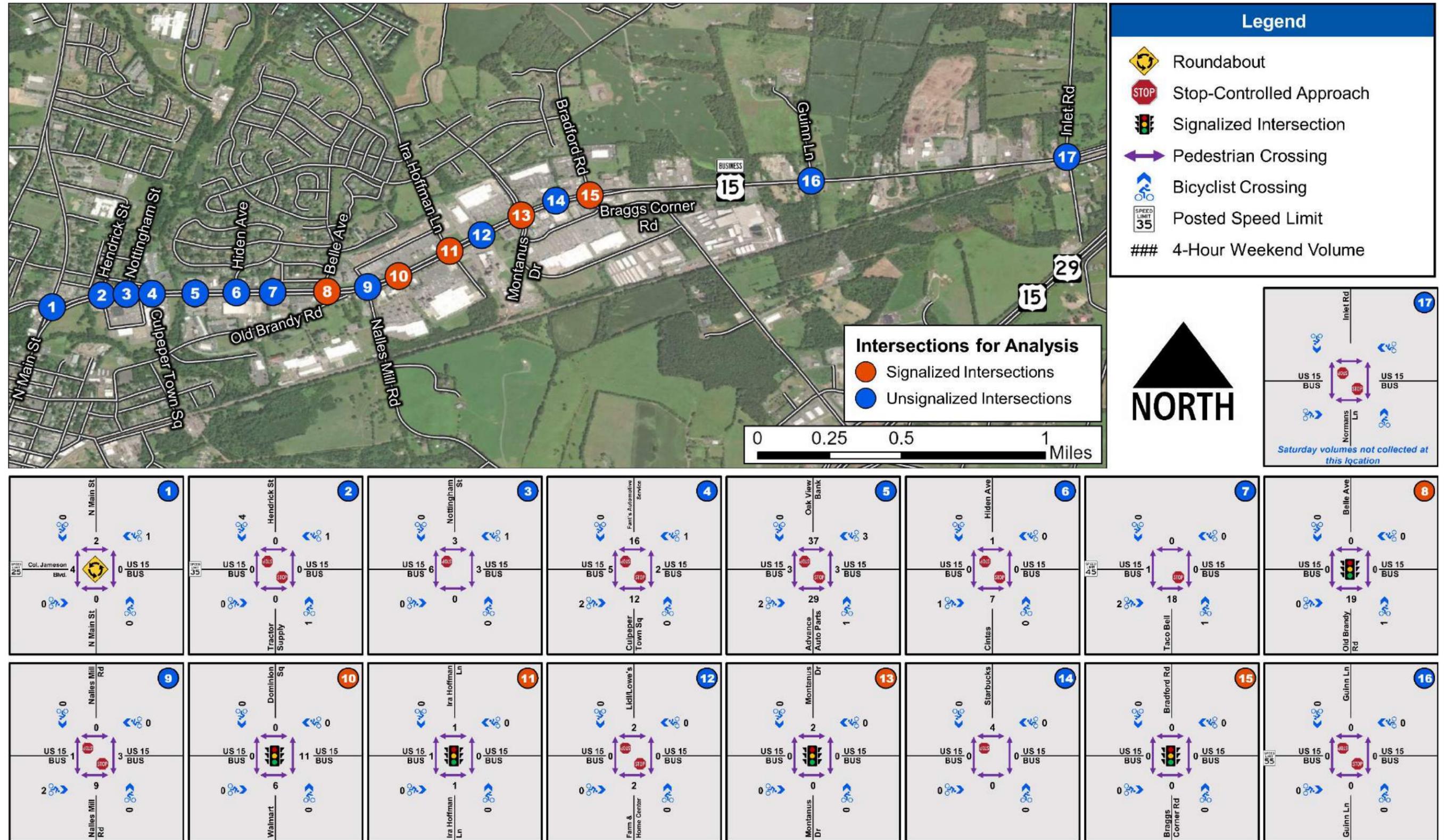


Figure 8: 2022 Existing Saturday 4-Hour Pedestrian and Bicycle Volumes



## 2.6 Access Management Spacing

The VDOT Road Design Manual provides access management design standards for entrances and intersections along roadways, which aim to provide access to land uses while preserving the flow of traffic and enhancing safety by reducing unnecessary conflict points. The standards are based on the functional classification and posted speed limit of the roadway. The US 15 BUS corridor is classified as an other principal arterial with a speed limit of 25 mph to 55 mph. The VDOT access management guidance applicable to US 15 BUS in the study area are listed in [Table 1](#) and [Table 2](#).

Table 1: VDOT Access Management Design Standards – Intersections and Median Crossovers

Functional Classification	Design Speed <sup>1</sup>	Minimum Spacing (Distance) in Feet			
		Type 1 (Signalized)	Type 2 (Unsignalized/ Full Crossover)	Type 3 (Full Access/ Directional Crossover)	Type 4 (Partial Access)
Other Principal Arterial	≤ 30 mph	1,050	880	440	250
	35 to 45 mph	1,320	1,050	565	305
	≥ 50 mph	2,640	1,320	750	495

<sup>1</sup>Design speed is equal to the posted speed for roadways with a posted speed of 45 mph or less. Design speed is at least 5 mph higher than posted speed for roadways with a posted speed of 50 mph or higher.

Source: VDOT Road Design Manual (Appendix F, Section 2)

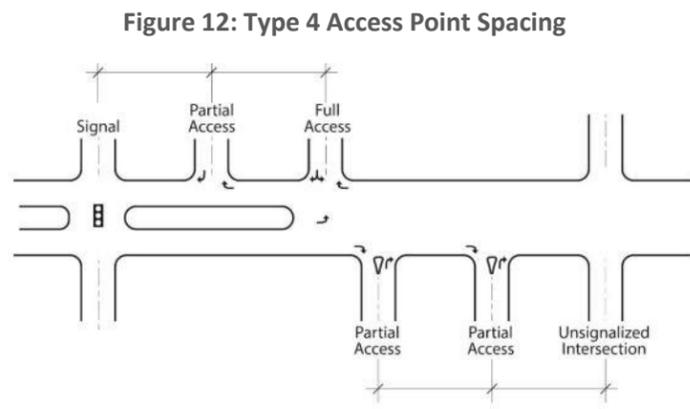
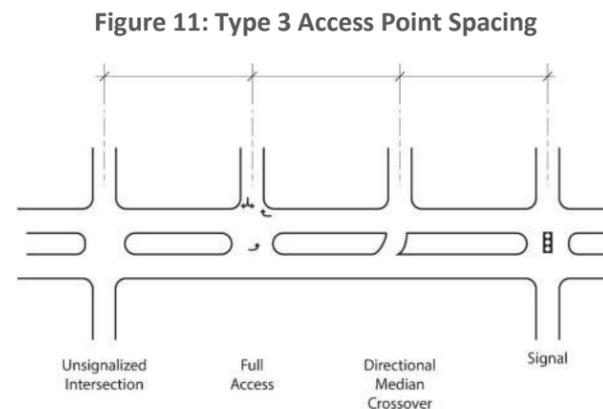
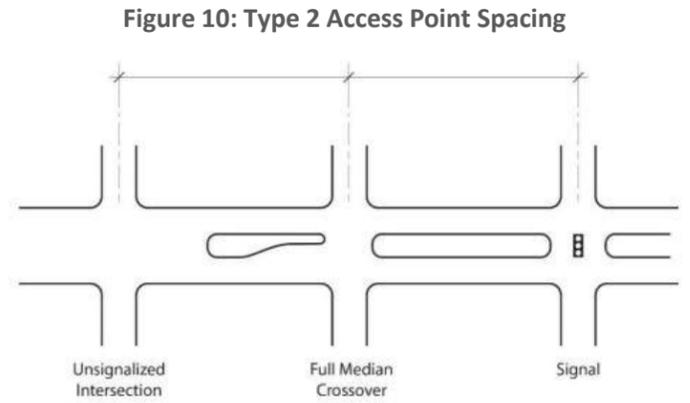
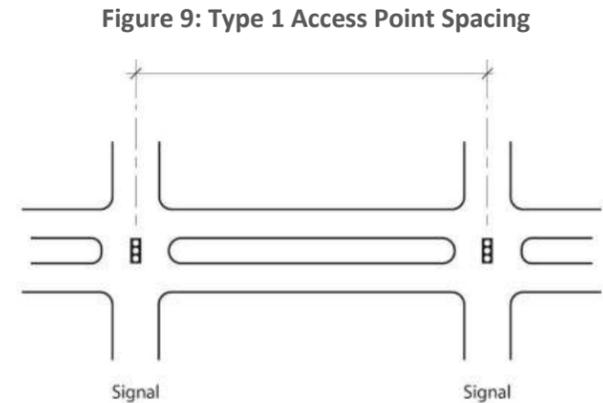
Table 2: VDOT Access Management Design Standards – Accesses Near Interchange Areas

Lane Type	Minimum Spacing (Distance) in Feet
	M (Directional Median Crossover)
Multilane	990

Source: VDOT Road Design Manual (Appendix F, Section 2)

Appendix F of the VDOT Road Design Manual defines the following types of access point spacing:

- **Type 1 (Signalized Intersection Spacing)** – applies to spacing from one signalized intersection to another, regardless of the number of intersection legs ([Figure 9](#))
- **Type 2 (Unsignalized Intersection/Full Crossover Spacing)** – applies to spacing from unsignalized intersections to other signalized and unsignalized intersections. Full median crossovers qualify as unsignalized intersections, but three-leg intersections do not. ([Figure 10](#))
- **Type 3 (Full Access/Directional Crossover Spacing)** – applies to spacing from full access/directional crossovers to other signalized intersections, unsignalized intersections, full accesses, and directional median crossovers. Three-leg unsignalized accesses qualify if no turning movements are restricted. If restricted, the three-leg unsignalized access do not qualify. ([Figure 11](#))
- **Type 4 (Partial Access Spacing)** – applies to spacing from partial access to other signalized intersections, unsignalized intersections, full accesses, directional crossovers, and partial accesses. Partial accesses include right-in/right-out driveways and can include one-way or two-way access, including three-leg accesses with restricted movements. ([Figure 12](#))
- **M (Directional Median Crossover)** – distance to first directional median crossover from off-ramp terminal



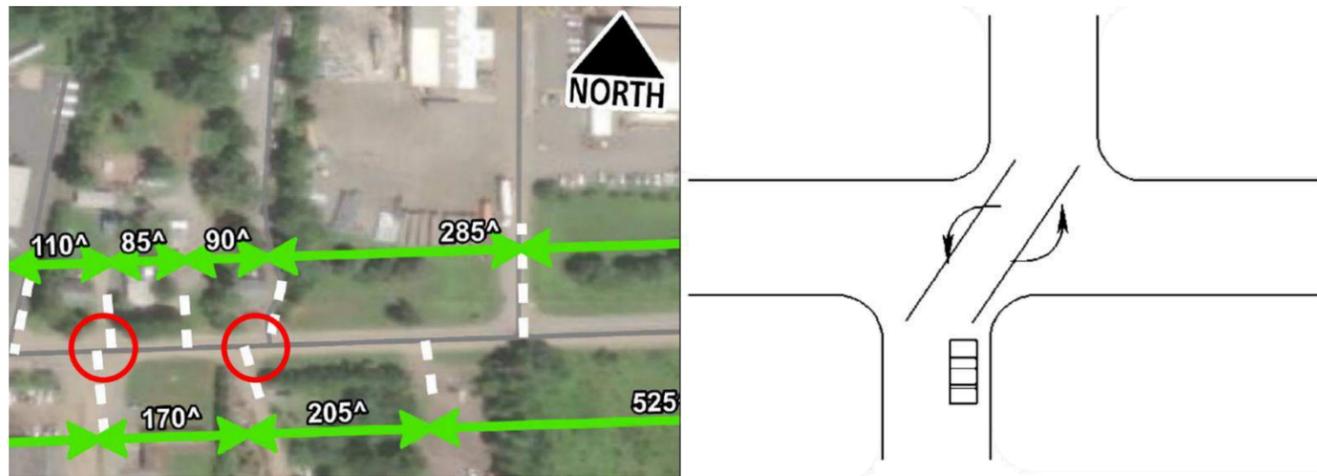
The study team also reviewed Town of Culpeper and Culpeper County access management standards since the US 15 BUS study corridor is within these jurisdictions. The Town of Culpeper requires 225 feet of spacing between intersections and 50 feet between partial access driveways. Culpeper County uses access management standards consistent with VDOT requirements. VDOT access management spacing requirements are the most stringent among the three agencies. [Table 3](#) summarizes whether VDOT access management spacing standards are met between access point along the study corridor. None of the signalized intersections and almost 90 percent of the unsignalized/full crossover, full access/directional crossover, and partial access points to get to and from commercial and residential properties do not meet VDOT access management standards. The high proportion of non-conforming access management spacing suggests the driveway density in the corridor is too high given the functional classification and speed of the roadway—99 of the 106 (93 percent) spacings between full access/directional crossovers or partial access points are commercial or residential driveways. [Appendix D](#) includes access management spacing exhibits that identify deficient spacing between access points along US 15 BUS by access type.

Table 3: VDOT Access Management Standards Summary

Access Point Type	Access Management Spacing Met?		Total
	Yes	No	
Type 1 (Signalized)	0	5	5
Type 2 (Unsignalized/Full Crossover)	3	8	11
Type 3 (Full Access/Directional Crossover)	2	46	48
Type 4 (Partial Access)	10	48	58
<b>Total</b>	<b>15</b>	<b>107</b>	<b>122</b>

The study team identified three locations on US 15 BUS between Guinn Lane and Inlet Road, shown in [Appendix D](#), where access points on opposite sides of US 15 BUS create left-turn safety and operational challenges on US 15 BUS. Safety and operational challenges are created in the undivided portion of the corridor when access points on opposite sides of the roadway are offset so that vehicles intending to turn left into access points may block the other's movement. [Figure 13](#) depicts two instances of this issue within this study area along with a sample graphic.

Figure 13: Offset Access Points



### 3 EXISTING CONDITIONS ANALYSIS

#### 3.1 Safety Analysis

The following data sources were used to assess safety within the study corridor and identify crash patterns:

- Latest five years of crash data obtained from VDOT crash database (January 1, 2018–December 31, 2022)
- Potential for safety improvement (PSI) locations

The following sections provide a summary of the crashes that occurred within the study area during the five-year crash reporting period.

##### 3.1.1 Summary of Study Area Crashes

Over the five-year period, 457 crashes were reported in the study area. Of the reported crashes, there are no fatal crashes, 282 injury crashes, and 175 crashes involving property damage only (PDO). A yearly summary of crashes by crash severity is shown in [Table 4](#). Crash severity is coded using the KABCO scale.

- K: fatal injury
- A: suspected serious injury
- B: suspected minor injury
- C: possible injury
- PDO: property damage only

Table 4: Study Area Crashes by Crash Severity

Year	Crash Severity				Total
	A	B	C	PDO	
2018	5	20	33	36	94
2019	0	27	31	37	95
2020	0	32	34	32	98
2021	4	24	22	41	91
2022	1	21	28	29	79
<b>Total</b>	<b>10</b>	<b>124</b>	<b>148</b>	<b>175</b>	<b>457</b>

A yearly summary of crashes by collision type is shown in [Table 5](#). Angle (47 percent) and rear-end (31 percent) crashes were the most prevalent collision types in the study area. The “other” category includes the following collision types: deer, backed into, head on, non-collision, and other. The number of crashes was consistent on a yearly basis between 2018 and 2022, though there was a 13 percent drop in crashes between 2021 and 2022.

Table 5: Study Area Crashes by Crash Type

Year	Crash Frequency						Total
	Angle	Rear End	Sideswipe	Fixed Object – Off Road	Pedestrian	Other	
2018	35	33	13	5	1	7	94
2019	44	32	10	1	1	7	95
2020	48	31	14	2	0	3	98
2021	51	27	2	6	2	3	91
2022	39	20	8	1	0	11	79
<b>Total</b>	<b>217</b>	<b>143</b>	<b>47</b>	<b>15</b>	<b>4</b>	<b>31</b>	<b>457</b>

##### 3.1.2 Safety Analysis by Intersection

The study team associated crashes with a study area intersection if the crash occurred between the intersection and the back of taper for the longest turn lane on each approach or within 250 feet of the stop bar if no turn lanes were present. A map summarizing the number and types of crashes that occurred at each intersection over the five-year period is shown in [Figure 19](#).

The study team also ranked all intersections based on the number of equivalent property damage only (EPDO) crashes. EPDO crashes is a metric that weights crashes by severity relative to the cost of a property damage only crash. The study team calculated EPDO scores for each intersection using the following weights. The weights for fatal and injury crashes are consistent with the *SMART SCALE Technical Guide* from Round 5 of SMART SCALE.

- K (fatality) = 160
- A (suspected serious injury) = 160
- B (suspected minor injury) = 20
- C (possible injury) = 10
- O (property damage only) = 1

The five intersections with the highest EPDO scores are listed in [Table 6](#). Three of the five intersections were unsignalized intersections, which is largely attributed to the presence of one or more A severity crashes. Only one A severity crash occurred at a signalized intersection within the five-year study period at the intersection with Bradford Road/Braggs Corner Road. The intersection with Nalles Mill Road has the highest EPDO score in the corridor. Despite having the seventh-lowest crash frequency, the intersection with Culpeper Town Square has the fourth-highest EPDO score since two of the 11 crashes at this intersection were A severity crashes. The following sections summarize findings from a review of crashes at the five intersections listed in [Table 6](#) plus additional findings throughout the study area.

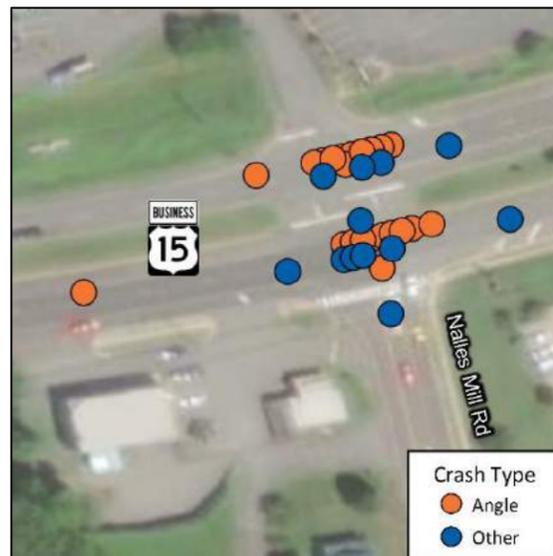
Table 6: Intersection Rankings by EPDO Score

Intersection	2018-2022 Total Crashes*	EPDO (Fatal + Injury Only)	EPDO (All Crashes)
Nalles Mill Rd	74	1,050	1,063
N Main St	51	550	571
Ira Hoffman Ln	59	430	454
Culpeper Town Square	11	420	422
Bradford Rd/Braggs Corner Rd	34	400	418

**NALLES MILL ROAD**

The most prominent crash hotspot occurred at the intersection with Nalles Mill Road, which accounted for 16 percent of all crashes along the corridor and 58 percent of crashes at unsignalized median openings. More than 80 percent of all crashes at this intersection were angle crashes, which often result in more severe injuries, as shown in [Figure 14](#). Over the five-year period, all angle crashes at this intersection resulted in an injury. From a review of the crash descriptions, the study team determined that 84 percent of crashes at this intersection were attributed to vehicles failing to yield right-of-way when turning from the side street: 13 percent during the first stage of a two-stage movement and 71 percent during the second stage. A few crashes involved motorists unable to see conflicting vehicles due to queued vehicles on US 15 BUS.

Figure 14: Crashes by Collision Type at Nalles Mill Road Intersection



\*Crash locations are approximate. Crashes were offset from roadway centerline for visual purposes.

**N MAIN STREET**

The crash patterns at this intersection reflected typical crash patterns in roundabouts: vehicles failing to yield right-of-way when entering the roundabout and improper merging within the roundabout. The crashes were largely angle, rear end, or sideswipe – same direction crashes and typically occurred at the merge areas from the eastbound, westbound, and southbound approaches as shown in [Figure 15](#). Additionally, nine crashes occurred on the northbound slip lane; however, all nine crashes occurred by April 2021. The sidewalk and crosswalks that provide access across the northbound lanes were constructed in 2021. The reduction in crashes on the slip lane may be attributed due to increased visibility within the roundabout due to the new crosswalks and pedestrian signage.

One A severity crash occurred within the influence area of this intersection, but it occurred on the southbound lane of N Main Street downstream of the roundabout and was not a result of maneuvering through the roundabout.

Figure 15: Crashes by Collision Type at N Main Street Intersection

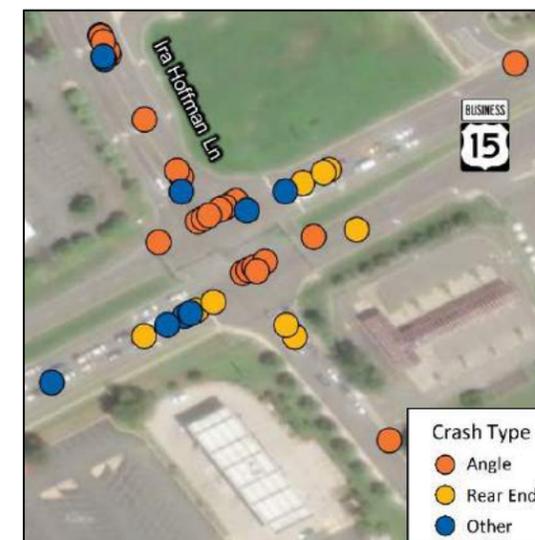


\*Crash locations are approximate. Crashes were offset from roadway centerline for visual purposes.

**IRA HOFFMAN LANE**

The intersection with Ira Hoffman Lane had the second most crashes (59) of all study area intersections over the five-year period, 56 percent of which were angle crashes. Eleven of the crashes occurred on the southbound leg of the intersection at the entrance to the Dominion Square Shopping Center as shown in [Figure 16](#). All 11 crashes involved vehicles turning into or out of the shopping center; several crashes involved blocked line of sight due to vehicles queuing on the southbound approach to the signal. Of the 21 angle crashes that occurred within the signalized intersection, 16 crashes involved one vehicle either running a red light or turning right on red.

Figure 16: Crashes by Collision Type at Ira Hoffman Lane Intersection



\*Crash locations are approximate. Crashes were offset from roadway centerline for visual purposes.

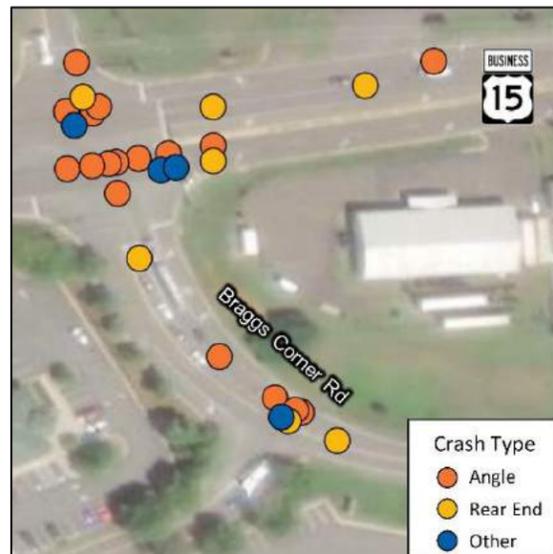
**CULPEPER TOWN SQUARE**

The intersection with Culpeper Town Square was ranked in the top five study area intersections for EPDO score due to the presence of two A severity crashes. One A severity crash involved a distracted driver who ran off the road and the other A severity crash involved a pedestrian and is described in the *Pedestrian and Bicycle Crashes* section.

**BRADFORD ROAD/BRAGGS CORNER ROAD**

Of the 34 crashes that occurred within the five-year study period, seven crashes occurred at the stop-controlled intersection of Braggs Corner Road and Creativity Drive as shown in *Figure 17*. These crashes were included because this intersection is within the influence area of the signalized intersection and the northbound queue on Braggs Corner Road was observed to extend beyond this intersection. The crashes at the stop-controlled intersection were largely attributed to vehicles not yielding right-of-way when turning left out of Creativity Drive. Of the crashes attributed to the signal, 15 of 25 crashes were angle crashes.

**Figure 17: Crashes by Collision Type at Bradford Road/Braggs Corner Road Intersection**



\*Crash locations are approximate. Crashes were offset from roadway centerline for visual purposes.

**ADDITIONAL FINDINGS**

- At the remaining unsignalized median openings, 70 percent of total crashes were angle crashes. From a review of the crash descriptions, the study team determined that 55 percent of crashes were attributed to vehicles failing to yield right-of-way when making a movement from the side street: 29 percent during the first stage of a two-stage movement and 26 percent during the second stage.
- Red light running was cited as a contributing factor for 30 percent of all crashes at signalized intersections
- Nineteen crashes (4 percent) involved a person driving without a valid license

**3.1.3 US 15 BUS East of Bradford Road/Braggs Corner Road**

The study team identified 77 crashes that occurred along US 15 BUS east of Bradford Road/Braggs Corner Road during the five-year. This segment included the study area intersections of Guinn Lane and Inlet Road/Normans Lane. The predominant collision types included 46 rear end and 19 angle crashes. Most rear ends were related to vehicles slowing down to turn off US 15 BUS. Ten of the 77 crashes along the segment were related to vehicles failing to yield right-of-way when turning onto US 15 BUS from a side street or driveway.

The intersection with Inlet Road/Normans Lane had a relatively high proportion of A severity crashes compared to other intersections. Two of ten A severity crashes in the study area occurred at this intersection due to vehicles failing to yield right-of-way when entering US 15 BUS from the side street. All four crashes at this intersection were angle crashes.

A pattern of rear-end crashes occurred on eastbound US 15 BUS where the roadway merges from two lanes to one as shown in *Figure 18*. Crash descriptions for six of the 12 rear end crashes that occurred in this location specifically mention a vehicle stopping to turn left into a driveway. The one sideswipe – same direction crash was the only crash where the lane merge was mentioned in the description.

**Figure 18: Crashes by Collision Type at Lane Merge**



\*Crash locations are approximate. Crashes were offset from roadway centerline for visual purposes.

**3.1.4 Pedestrian and Bicycle Crashes**

The study team analyzed crashes involving pedestrians or bicyclists to evaluate corridor safety specific to these modes of travel. *Table 7* summarizes the crash severity of these crashes.

**Table 7: Study Area Pedestrian and Bicycle Crashes**

Severity	Number of Crashes	
	Pedestrian	Bicycle
K	0	0
A	1	0
B	3	1
C	0	1
PDO	0	0
<b>Total</b>	<b>4</b>	<b>2</b>

Two of the four pedestrian crashes involved pedestrians attempting to cross US 15 BUS at the unsignalized median opening of Culpeper Town Square. There are no crosswalks on US 15 BUS at this location. One crash resulted in a suspected severe injury and occurred at night on an unlit section of road. The pedestrian was under the influence of

alcohol and was not wearing reflective clothing. The other crash occurred when a pedestrian stepped in front of a vehicle turning left onto US 15 BUS from the median, which resulted in a suspected minor injury and occurred during daylight.

The two remaining pedestrian crashes occurred within crosswalks at the signalized intersections of Belle Avenue/Old Brandy Road and Walmart. The crash at Walmart involved a pedestrian rushing across a crosswalk as the traffic signal turned green. A vehicle proceeded through the intersection and hit the pedestrian. The crash occurred during misty weather and resulted in a minor injury.

The pedestrian crash at Belle Avenue/Old Brandy Road involved a wheelchair user crossing Old Brandy Road within the crosswalk. A vehicle attempting to make a northbound right turn on red did not check for pedestrians and knocked the wheelchair user out of her chair. A second motorist attempting to make this same movement caused a bicycle crash within the same crosswalk. Both crashes resulted in injuries.

The remaining bicycle crash occurred at the unsignalized median opening at Culpeper Town Square. A vehicle attempting to make a northbound left turn from the side street did not yield to the bicyclist in the crosswalk. This crash resulted in a suspected minor injury. [Figure 20](#) includes a map of pedestrian and bicycle crashes.

### 3.1.5 Potential for Safety Improvement Locations

VDOT Traffic Operations Division (TOD) performed a network screening analysis based on *Highway Safety Manual (HSM)* methodologies to rank intersection and roadway segments throughout the state based on each site's potential for safety improvement (PSI). PSI is an indication of how much the long-term crash frequency could be reduced at a particular site and is based on Virginia-specific safety performance functions (SPFs). TOD releases intersections ranked higher than the 100<sup>th</sup>-ranked VDOT-maintained intersection and for all segments ranked higher than the 100<sup>th</sup>-ranked segment on a VDOT-maintained roadway within each district, for top 100 VDOT-maintained intersections, and the top 100 miles of VDOT-maintained roadway segments within each district.

[Table 8](#) and [Table 9](#) summarizes the segments and intersections within the study area that were included in the PSI list for Culpeper District based on 2016-2020 crash data. Segments are ranked based on the cumulative mileage of segments (e.g., two segments can be ranked in the top mile if the highest-ranking segment is shorter than one mile).

Table 8: PSI Segment Ranks

Segment	Length (mi)	2016-2020 PSI Rank*	
		All Roadways	VDOT-Maintained Roadways
US 15 BUS from Mountain Run bridge to Nottingham St	0.280	7	N/A
US 15 BUS from Nottingham St to Hiden Ave	0.321	17	N/A
US 15 BUS from Hiden Ave to Belle Ave	0.269	51	N/A
US 15 BUS from Belle Ave to Walmart	0.190	1	N/A
US 15 BUS from Walmart to Ira Hoffman Ln	0.130	8	N/A
US 15 BUS from Ira Hoffman Ln to Montanus Dr	0.200	12	N/A
US 15 BUS from Bradford Rd/Braggs Corner Rd to end of lane merge	0.110	84	N/A
US 15 from 0.290 miles west of Guinn Ln to Guinn Ln	0.290	48	38
US 15 BUS from Guinn Ln to Inlet Rd	0.700	16	11
N Main St from US 15 BUS to Sycamore St	0.168	13	N/A
Montanus Dr from US 15 BUS to Braggs Corner Rd	0.650	93	N/A

\*Mile rank for segments within Culpeper District

Table 9: PSI Intersection Ranks

Intersection	2016-2020 PSI Rank	
	All Roadways	VDOT-Maintained Roadways
US 15 BUS at Belle Ave/Old Brandy Rd	49	N/A
US 15 BUS at Montanus Dr	37	N/A
US 15 BUS at Bradford Rd/Braggs Corner Rd	41	37

### 3.1.6 Pedestrian Safety Action Plan Locations

VDOT TOD performed a network screening analysis for the Pedestrian Safety Action Plan (PSAP) that identified priority corridors throughout the state that should be prioritized when considering pedestrian safety improvements. The network screening analysis considers pedestrian crash history as well as other pedestrian safety factors such as annual average daily traffic, posted speed limit, number of lanes, and various census tracts. US 15 BUS between N Main Street and Guinn Lane plus both N Main Street approaches at the roundabout were included in the top 1 percent of priority corridors statewide in the PSAP 3.0 analysis, which was based on 2016 to 2020 data.

Figure 19: 2018-2022 Intersection Crash Type Pie Charts

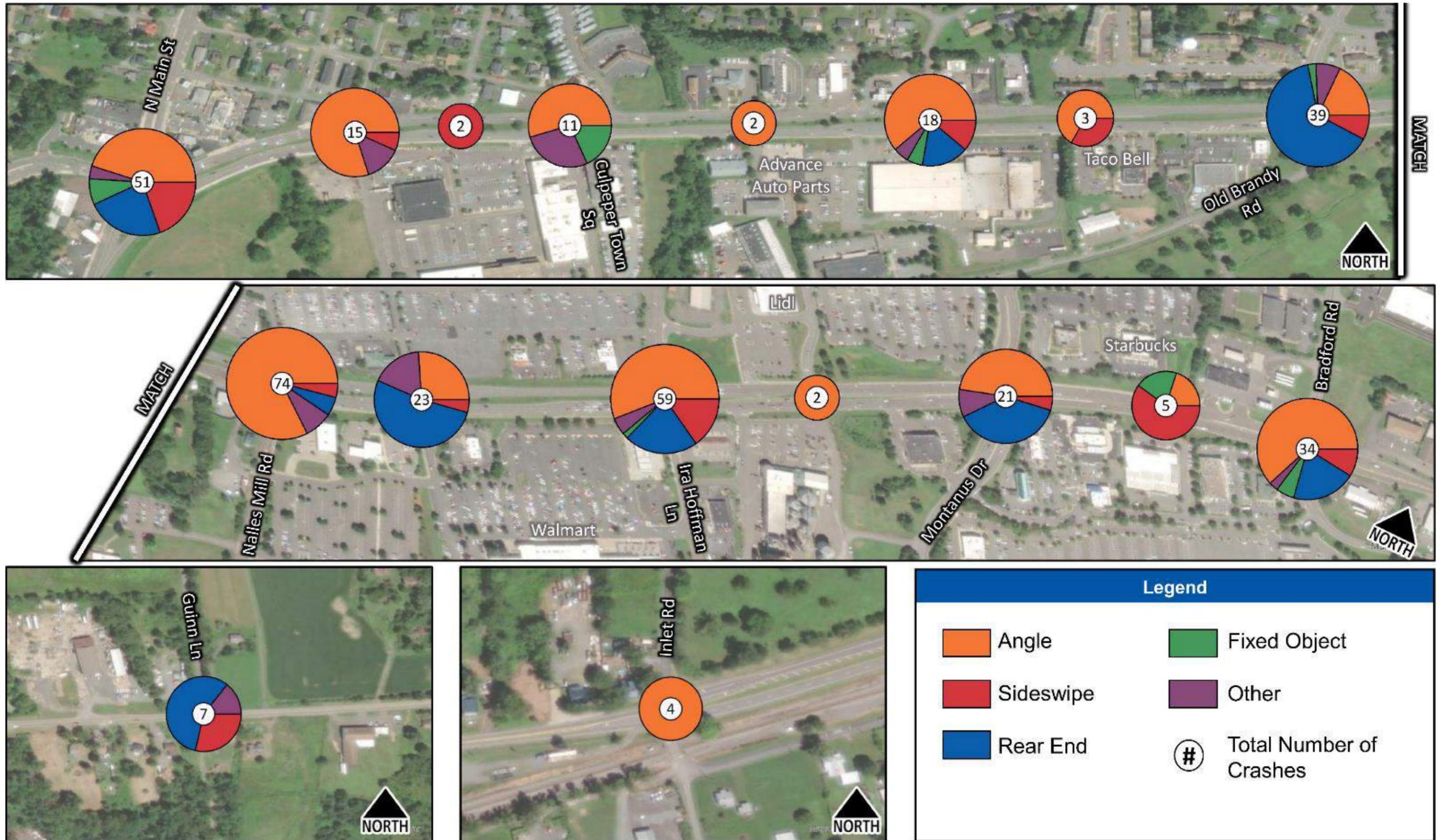


Figure 20: 2018-2022 Pedestrian and Bicycle Crashes



### 3.2 Traffic Operations Analysis

The study team conducted a traffic operations analysis to evaluate the overall performance of US 15 BUS between N Main Street and Bradford Road/Braggs Corner Road under existing (2022) AM, PM, and Saturday peak hour conditions. Existing conditions were modeled using Synchro 11 and SIDRA Intersection 8. The study team developed the existing Synchro and SIDRA Intersection models based on the existing roadway geometry, signal timing, and traffic volume data. Inputs and analysis methodologies were consistent with the *TOSAM*, Version 2.0.

#### 3.2.1 Level of Service Criteria

The intersection level of service (LOS) is a qualitative measure that describes a driver’s perception of the operating conditions. LOS ratings range from A to F. LOS A indicates little or no congestion and LOS F indicates severe congestion, unstable traffic flow, and/or stop-and-go conditions. **Table 10** summarizes the LOS corresponding to the control delay at unsignalized and signalized intersections as specified in the *Highway Capacity Manual (HCM)*. The LOS criteria is consistent between *HCM 2000* and the *HCM, 6<sup>th</sup> Edition (HCM 6)*. The control delay criteria for LOS differs for unsignalized and signalized intersections due to driver expectations and behavior. For signalized intersections, LOS is calculated as the lost travel time caused by vehicles waiting at a traffic signal. For unsignalized intersections, LOS is calculated by determining the number of gaps that are available in the conflicting traffic stream, since the analysis assumes that the traffic on the mainline is not affected by traffic on the side street. To remain consistent with guidance in the *TOSAM*, the study team used the unsignalized intersection LOS criteria for the analysis of the existing roundabout at the intersection of US 15 BUS and N Main Street.

Table 10: LOS Criteria

LOS	Control Delay (seconds/vehicle)	
	Signalized Intersection	Unsignalized Intersection
A	≤ 10	≤ 10
B	> 10 to 20	> 10 to 15
C	> 20 to 35	> 15 to 25
D	> 35 to 55	> 25 to 35
E	> 55 to 80	> 35 to 50
F	≥ 80	≥ 50

#### 3.2.2 Traffic Operations Analysis Results

The study team selected the following measures of effectiveness to quantitatively report the performance of each study area intersection:

- Control delay (seconds per vehicle)
- Maximum queue length (feet)

The study team used the *HCM 6* methodology to analyze the unsignalized intersections in Synchro. The *HCM 6* methodology does not allow U-turn movements at signalized intersections and is not flexible when signals deviate from NEMA phasing, so the study team used the *HCM 2000* methodology to analyze control delay and level of service at signalized intersections. Since the *HCM 2000* methodology does not report 95<sup>th</sup> percentile queue length, the study team used the Synchro queue report at signalized intersections.

**Figure 21** through **Figure 24** show depictive representations of the control delay and queue length for each study area intersection during the AM, PM, and Saturday peak hours. The full Synchro and SIDRA Intersection reports are included in **Appendix D**.

Queue length measures how efficiently each intersection processes traffic and indicates whether turn lanes have adequate storage to accommodate turning vehicles. No queue length was reported for movements without conflicting traffic volumes. Where intersections or lane blockages occur, queue lengths are reported in **Figure 23** and **Figure 24** as follows:

- † – No queue reported. Movement does not have conflicting volumes
- m – Movement is metered by upstream signal
- # – Volume exceed capacity, queue may be longer

#### 3.2.2.1 AM Peak Hour

##### CONTROL DELAY AND LEVEL OF SERVICE

All signalized intersections under existing conditions operate at an overall LOS C or better; however, all side street approaches operate at LOS D or E. Additionally, the following major street left-turn movements operate at LOS E:

- Belle Avenue/Old Brandy Road: eastbound left-turn movement
- Ira Hoffman Lane: westbound left-turn movement
- Montanus Drive: westbound left-turn movement

At the unsignalized intersections, all major street left-turn or U-turn movements operate at LOS C or better. The northbound approach at the intersection with Nalles Mill Road is the only side street approach that operates at LOS D, which is due to the northbound left-through lane group operating at LOS E.

##### QUEUE LENGTH

The following through movements experience 95<sup>th</sup> percentile queue lengths longer than the effective storage length of an adjacent turn lane:

- Hendrick Street: southbound left-through movement queue blocks the right-turn lane
- Belle Avenue/Old Brandy Road: eastbound through movement queue blocks the left- and right-turn lanes
- Ira Hoffman Lane: southbound through movement queue blocks the exclusive left-turn lane
  - Southbound left and left-through queues block the southern entrance to the Dominion Square Shopping Center. This queue may contribute to the existing crash issue documented in the **Safety Analysis by Intersection** section.
- Bradford Road/Braggs Corner Road: northbound left-through movement queue blocks the exclusive left-turn lane
  - Northbound left and left-through queues extend through the intersection of Braggs Corner Road and Creativity Drive. This queue may contribute to the existing crash issue documented in the **Safety Analysis by Intersection** section.

Additionally, the following movements experience 95<sup>th</sup> percentile queue lengths longer than the available storage length:

- Belle Avenue/Old Brandy Road: southbound left-turn movement
- Ira Hoffman Lane: southbound exclusive left-turn movement
- Bradford Road/Braggs Corner Road: northbound exclusive left-turn movement

Figure 21: 2022 Existing Weekday Peak Hour Control Delay and LOS

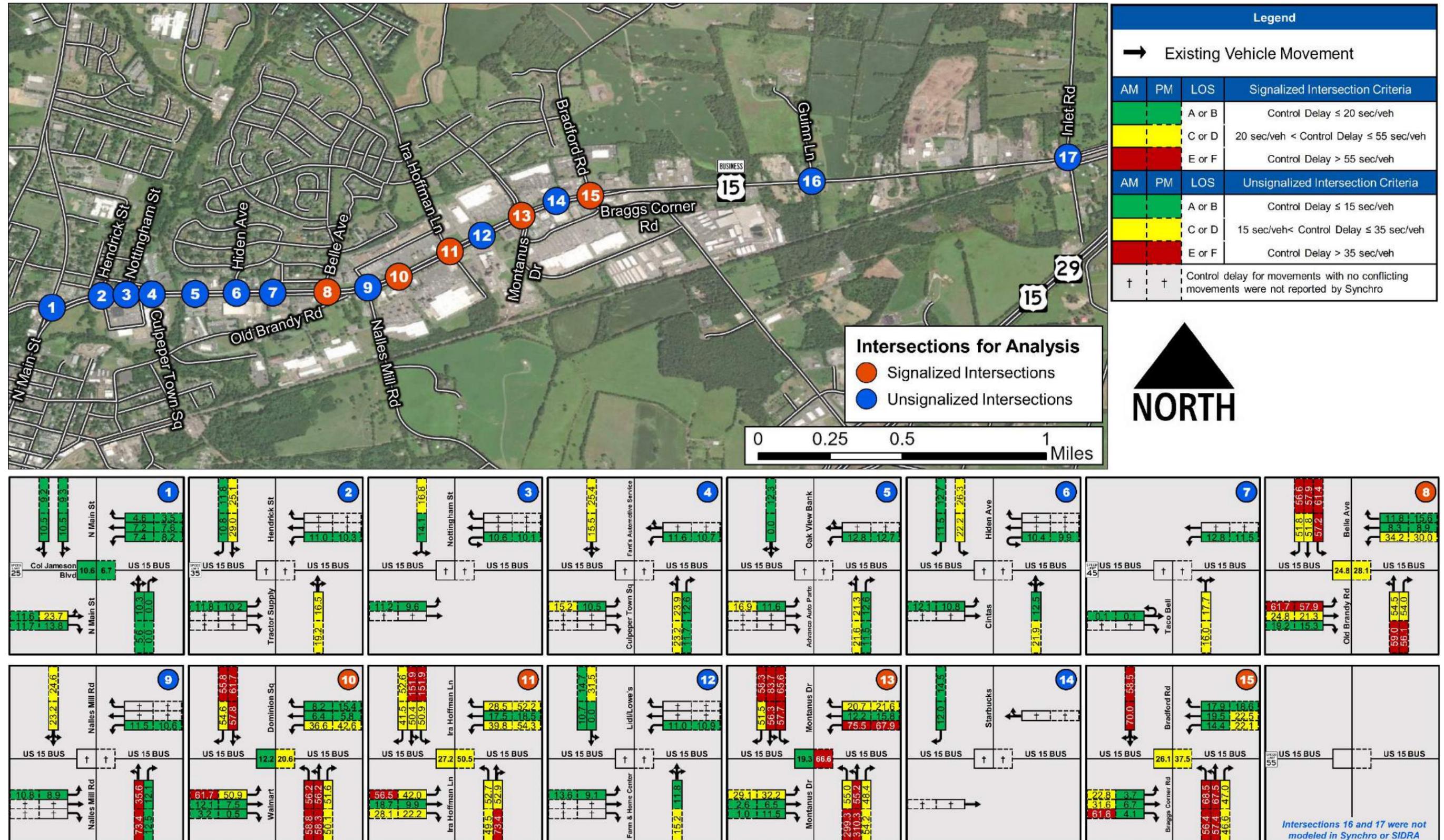


Figure 22: 2022 Existing Saturday Peak Hour Control Delay and LOS

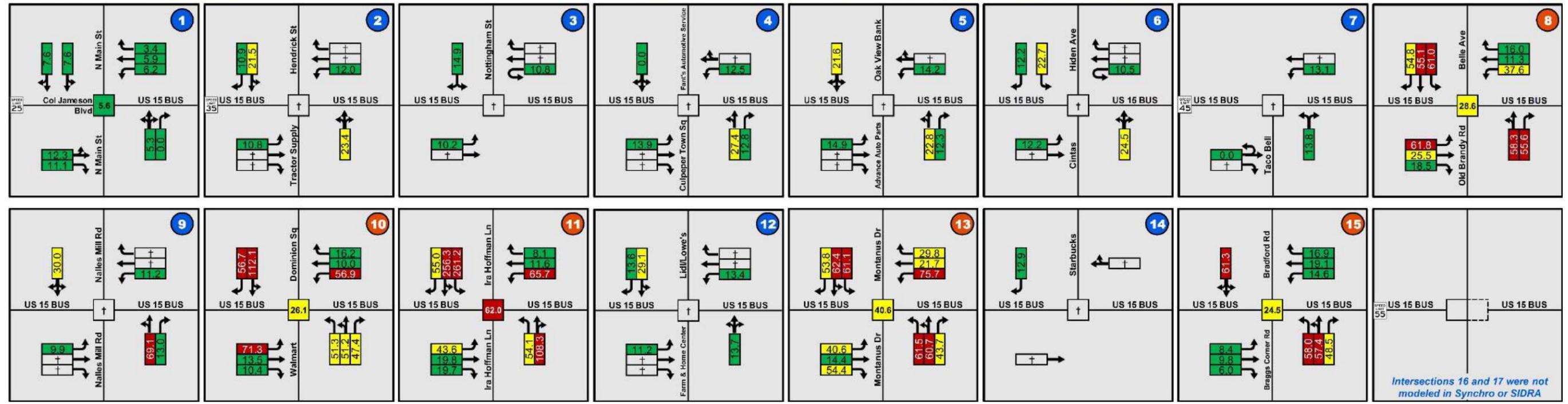
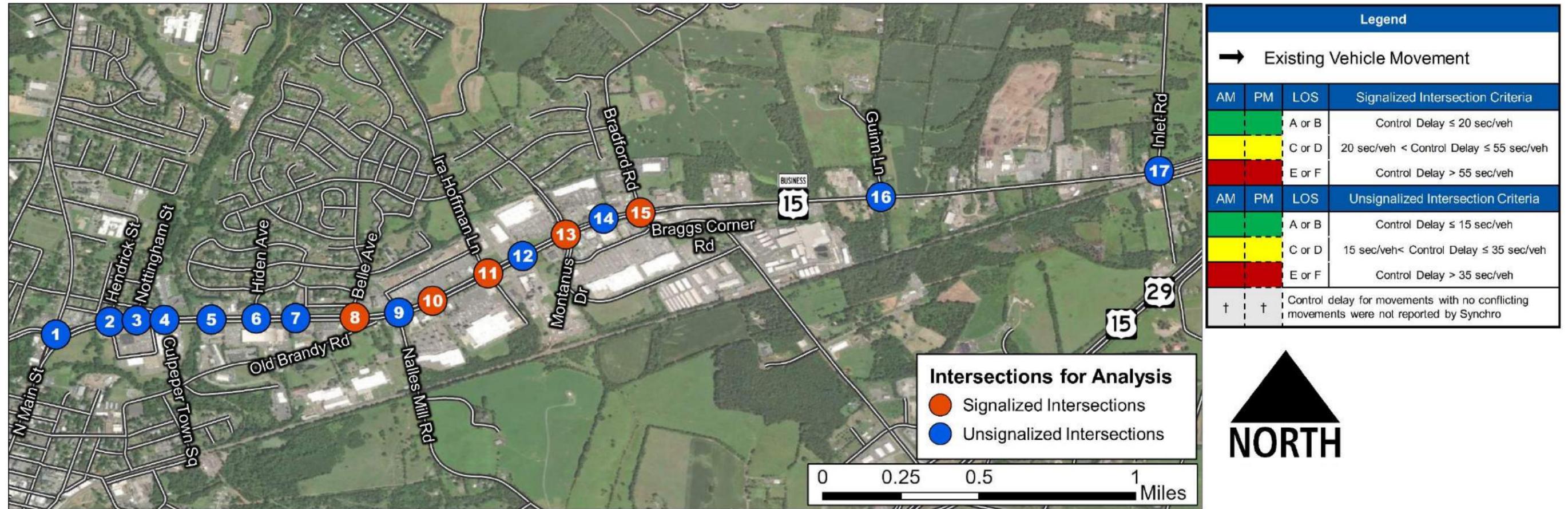


Figure 23: 2022 Existing Weekday Peak Hour 95<sup>th</sup> Percentile Queues

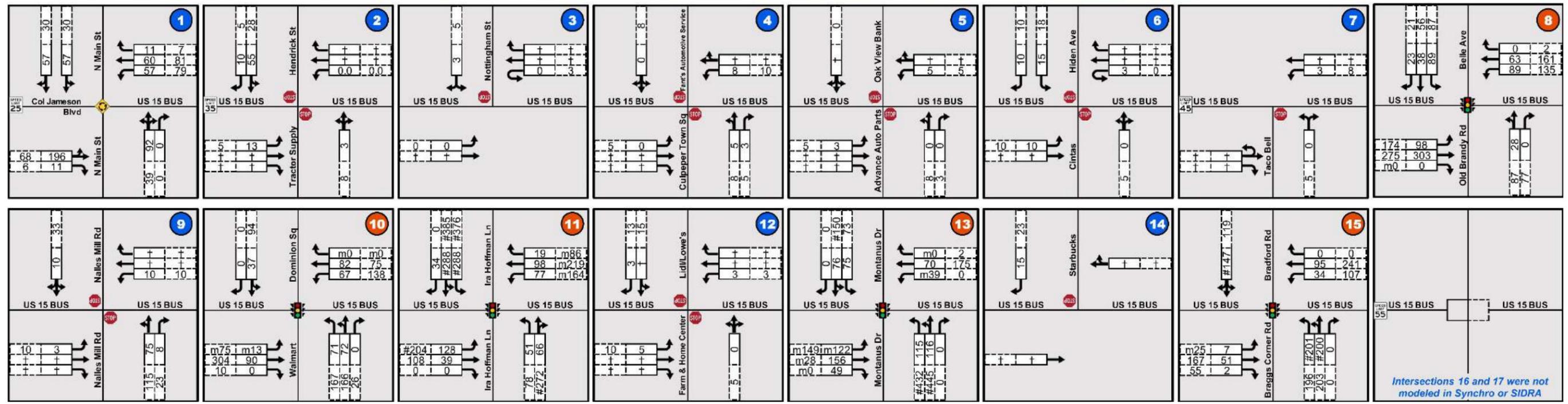
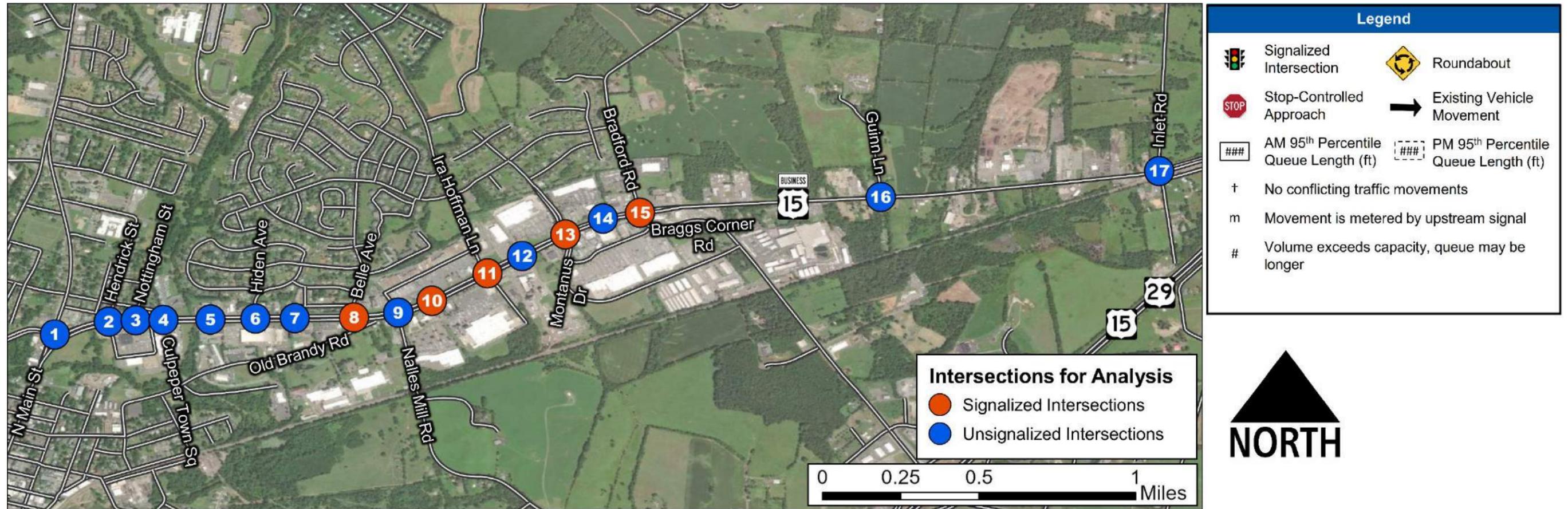
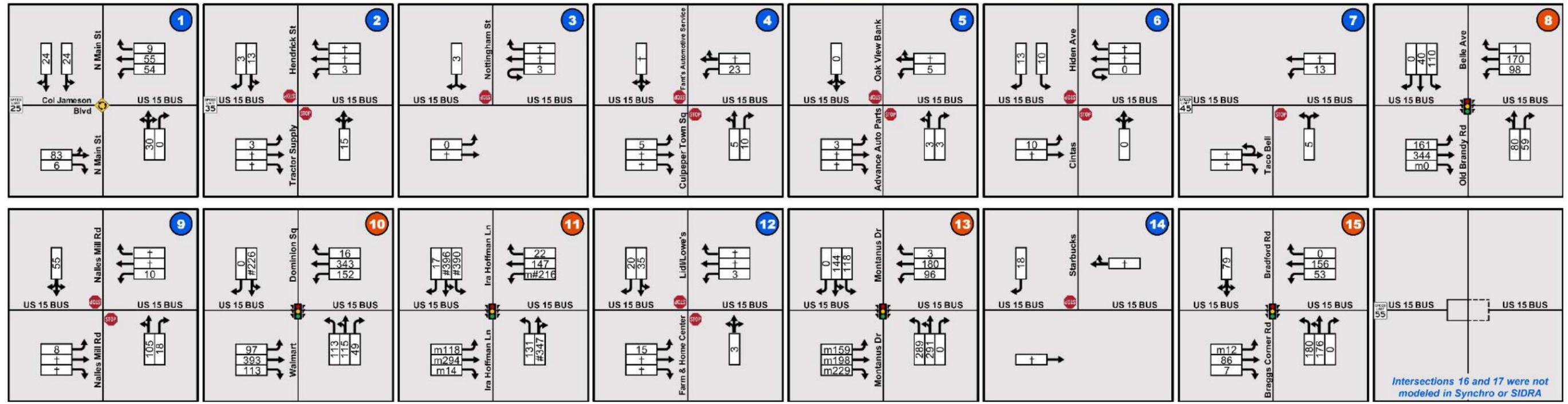
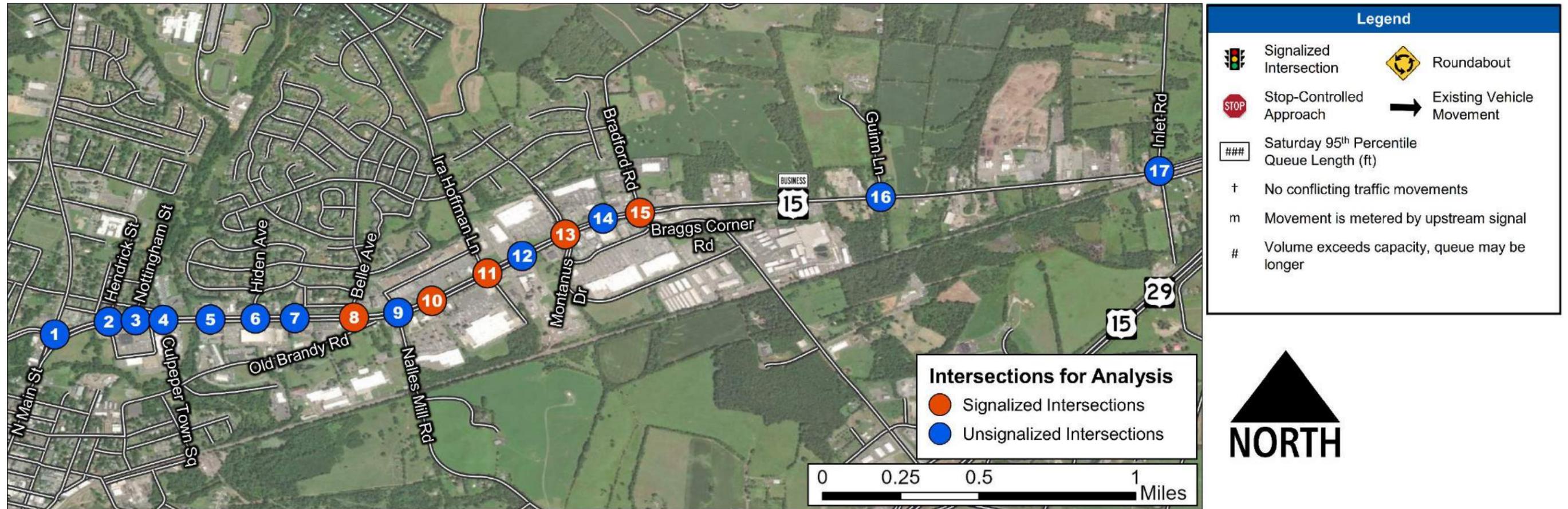


Figure 24: 2022 Existing Saturday Peak Hour 95<sup>th</sup> Percentile Queues



### 3.2.2.2 PM Peak Hour

#### CONTROL DELAY AND LEVEL OF SERVICE

The following signalized intersections operate at an overall LOS D or worse under existing conditions:

- Ira Hoffman Lane (LOS D)
- Montanus Drive (LOS E)
- Bradford Road/Braggs Corner Road (LOS D)

All side street approaches at signalized intersections operate at LOS E or worse, except for the northbound approach at the intersection with Bradford Road/Braggs Corner Road. The northbound approach at the intersection with Montanus Drive experiences the most control delay at 297.1 seconds per vehicle. The southbound approach at the intersection with Ira Hoffman Lane also operates at LOS F with 130.7 seconds per vehicle of control delay.

Additionally, the following major street left-turn movements operate at LOS E or worse:

- Belle Avenue/Old Brandy Road: eastbound left-turn movement (LOS E)
- Walmart: eastbound left-turn movement (LOS E)
- Ira Hoffman Lane: eastbound and westbound left-turn movement (LOS E)

At the unsignalized intersections, all major street left-turn or U-turn movements operate at LOS C or better. The side street approach with the most control delay is the northbound approach at the intersection with Nalles Mill Road, which operates at LOS E. The northbound left-through lane group at the intersection with Nalles Mill Road operates at LOS F with 73.4 seconds per vehicle of control delay.

#### QUEUE LENGTH

The following through movements experience 95<sup>th</sup> percentile queue lengths longer than the effective storage length of an adjacent turn lane:

- Belle Avenue/Old Brandy Road: eastbound through movement queue blocks the left- and right-turn lanes
- Walmart:
  - Eastbound through movement queue blocks the left- and right-turn lanes
  - Northbound exclusive left-turn movement queue blocks the shared left-through and right-turn lanes
- Ira Hoffman Lane: northbound and southbound through movement queues block the left-turn lanes
  - Southbound left and left-through queues block both entrances to the Dominion Square Shopping Center. This queue may contribute to the existing crash issue documented in the [Safety Analysis by Intersection](#) section.
  - Northbound through-right movement queues extend to the entrance of the Farm & Home Center parking lot
- Montanus Drive: northbound left-through movement queue blocks the exclusive left- and right-turn lanes
  - Northbound left and left-through queues extend through the intersection of Montanus Drive and Creativity Drive
- Bradford Road/Braggs Corner Road:
  - Westbound through movement queue blocks the left-turn lane
  - Northbound left-through movement queue blocks the exclusive left- and right-turn lanes
    - Northbound left and left-through movement queues extend through the intersection of Braggs Corner Road and Creativity Drive. This queue may contribute to the existing crash issue documented in the [Safety Analysis by Intersection](#) section.

Additionally, the following movements experience 95<sup>th</sup> percentile queue lengths longer than the available storage length:

- Belle Avenue/Old Brandy Road: southbound left-turn movement
- Walmart: northbound left-through movement

- Ira Hoffman Lane: southbound exclusive left-turn movement
- Montanus Drive: northbound exclusive left-turn movement
- Bradford Road/Braggs Corner Road: northbound exclusive left-turn movement

### 3.2.2.3 Saturday Peak Hour

#### CONTROL DELAY AND LEVEL OF SERVICE

The following signalized intersections operate at an overall LOS D or worse under existing conditions:

- Ira Hoffman Lane: LOS E
- Montanus Drive: LOS D

All side street approaches at signalized intersections operate at LOS E or worse, except for the northbound approach at the intersection with Walmart. The following three side street approaches operate at LOS F, with the southbound approach at Ira Hoffman Lane experiencing the most control delay at 211.8 seconds per vehicle.

- Ira Hoffman Lane: northbound and southbound approaches
- Montanus Drive: westbound approach

The westbound left-turn movement at Montanus Drive experiences the most control delay among the major street left-turn movements at 100 seconds per vehicle. Overall, the following major street left-turn movements operate at LOS E or worse:

- Belle Avenue/Old Brandy Road: eastbound left-turn movement (LOS E)
- Walmart: westbound left-turn movement (LOS E)
- Ira Hoffman Lane: westbound left-turn movement (LOS E)
- Montanus Drive: westbound left-turn movement (LOS F)

At the unsignalized intersections, all major street left-turn or U-turn movements operate at LOS C or better. The side street approach with the most control delay is the northbound approach at the intersection with Nalles Mill Road, which operates at LOS E. The northbound left-through lane group at the intersection with Nalles Mill Road operates at LOS F with 69.1 seconds per vehicle of control delay. The southbound approach at the intersection with Nalles Mill Road and the southbound approach at the intersection with Lidl/Lowe's also operate at LOS D.

**QUEUE LENGTH**

The following through movements experience 95<sup>th</sup> percentile queues longer than the effective storage length of an adjacent turn lane:

- Belle Avenue/Old Brandy Road: eastbound through movement queue blocks the left- and right-turn lanes
- Walmart:
  - Eastbound and westbound through movement queues block the left and right-turn lanes
  - Northbound exclusive left-turn movement queue blocks the shared left-through and right-turn lanes
- Ira Hoffman Lane: northbound and southbound through movement queues block the left-turn lanes
  - Southbound left and left-through queues block both entrances to the Dominion Square Shopping Center. These queues may contribute to the existing crash issue documented in the [Safety Analysis by Intersection](#) section.
- Montanus Drive: northbound left-through movement queue blocks the exclusive left- and right-turn lanes
- Bradford Road/Braggs Corner Road:
  - Eastbound through movement queue blocks the left- and right-turn lanes
  - Northbound left-through lane blocks the exclusive left- and right-turn lanes
    - Northbound left and left-through movement queues extend through the downstream intersection of Braggs Corner Road and Creativity Drive. These queues may contribute to the existing crash issue documented in the [Safety Analysis by Intersection](#) section.

In addition, 95<sup>th</sup> percentile queue lengths are projected to exceed the available storage length at the following locations:

- Belle Avenue/Old Brandy Road: southbound left-turn movement
- Walmart: northbound and southbound left-through movements
- Ira Hoffman Lane: northbound and southbound exclusive left-turn movements
- Montanus Drive: northbound exclusive left-turn movement
- Bradford Road/Braggs Corner Road: northbound exclusive left-turn movement

**3.3 Public Involvement Survey Results**

VDOT hosted a public survey from May 26 to June 9, 2023, to collect feedback on existing traffic, safety, mobility, and multimodal issues within the study corridor. Participants were asked to rank issues most important to them within the study area, select the issues experienced, and select new or modified facilities that they think are needed. Participants were also asked to drop pins on a map to indicate location-specific issues or comments related to congestion, safety, intersection improvements, or other issues. [Figure 25](#) through [Figure 28](#) provide a visual overview of where participants reported issues or comments based on the issue or comment type. [Table 11](#) summarizes the different issues participants experience within the study corridor. The two intersections with the highest number of comments were located at US 15 BUS at Nalles Mill Road and Montanus Drive. Participants commented about congestion issues most often; those comments were largely centered at the five signalized intersections and at the intersection with Nalles Mill Road. Outside those six intersections, the comments were largely focused on safety issues in the corridor.

Figure 25: Public Survey Map Pins – Congestion Issues

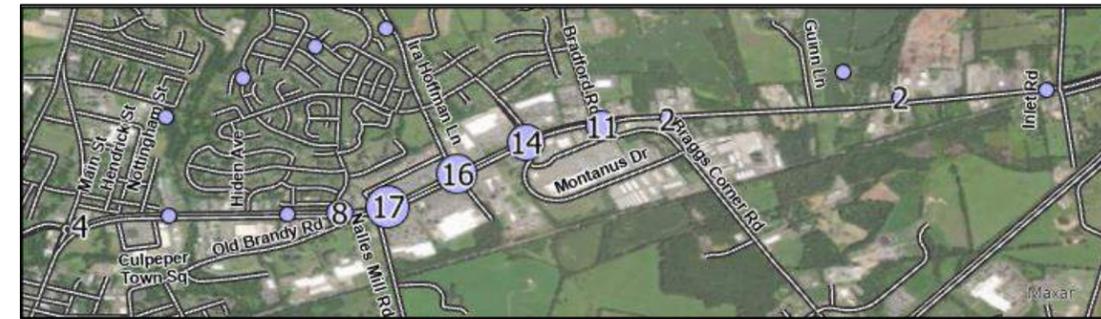


Figure 26: Public Survey Map Pins – Safety Issues



Figure 27: Public Survey Map Pins – Intersection Improvement Issues



Figure 28: Public Survey Map Pins – Other Issues



Table 11: Summary Table of Map Pins

Pin Category	Count	Percentage
Congestion	82	44%
Intersection Improvements	36	19%
Safety	66	35%
Other	4	2%

Figure 29 summarizes the participants' ranking of the most important issues within the study corridor. Out of 184 participants who responded to this question, 96 (52 percent) participants indicated that traffic congestion was the most important issue within the study corridor and another 37 (20 percent) participants indicated that it was the second-most important issue. Corridor safety / intersection safety was selected by 22 (12 percent) participants as the most important issue and by another 39 (21 percent) participants as the second-most important issue. Speeding / aggressive driving and pedestrian safety and accessibility rounded out the top four issues with 21 (11 percent) and 17 (9 percent) first and second place votes, respectively. Table 12 indicates the average rank of each issue.

Figure 29: Study Area Issues by Rank

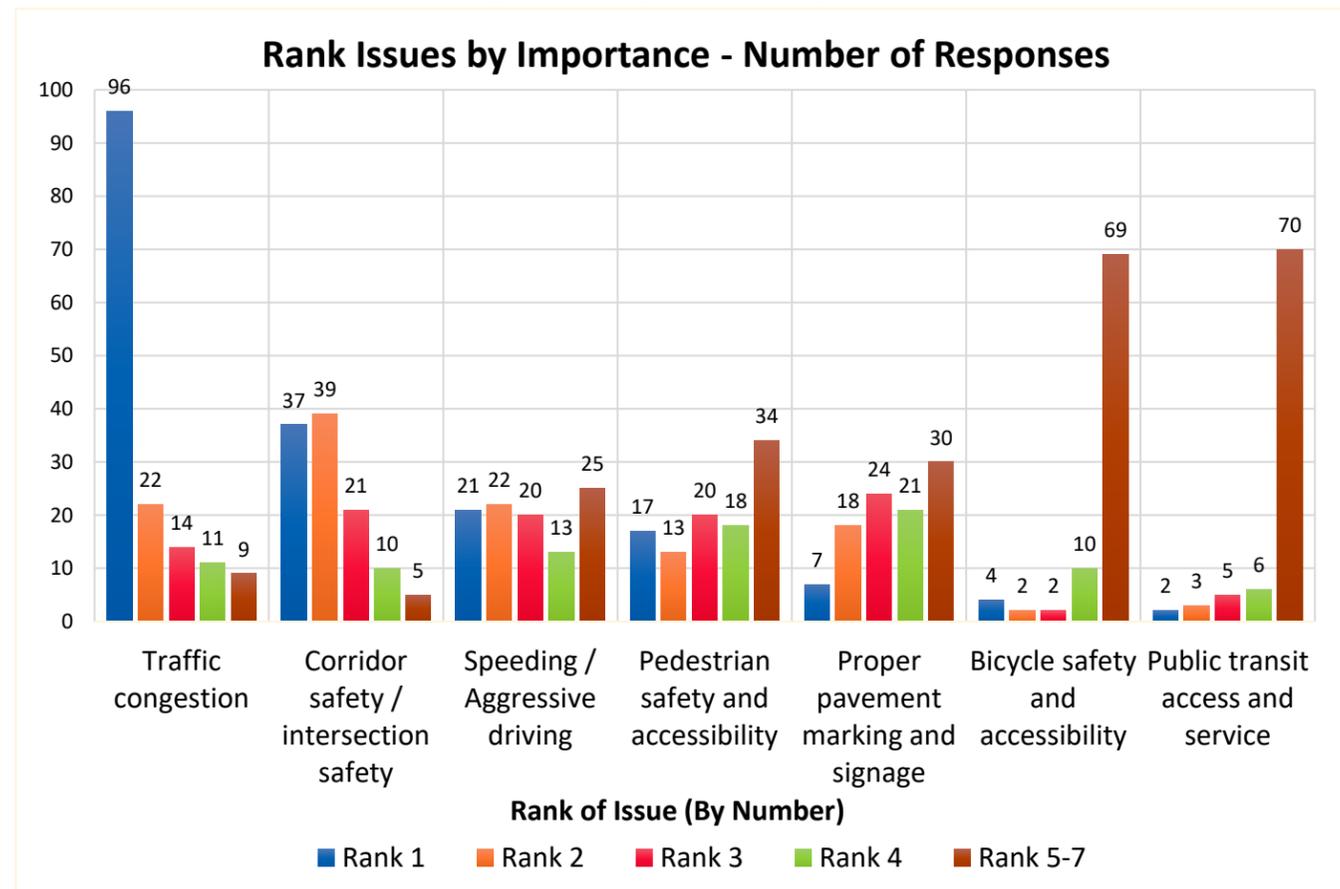


Table 12: Average Rank of Study Area Issues

Issue	Average Rank
Traffic congestion	1.84
Corridor safety / intersection safety	2.22
Speeding / aggressive driving	3.29
Pedestrian safety and accessibility	3.55
Proper pavement marking and signage	3.69
Public transit access and service	5.49
Bicycle safety and accessibility	5.55

Figure 30 summarizes the safety issues that participants experience within the study corridor. Participants were allowed to select more than one option if they experience multiple safety issues. Out of 206 participants who responded to this question, 100 participants selected speeding and aggressive driving as a safety issue, with difficulty making turning movements (90 participants) and lack of sidewalks (89 participants) receiving the second- and third-most votes, respectively.

Figure 30: Frequency of Safety Issues

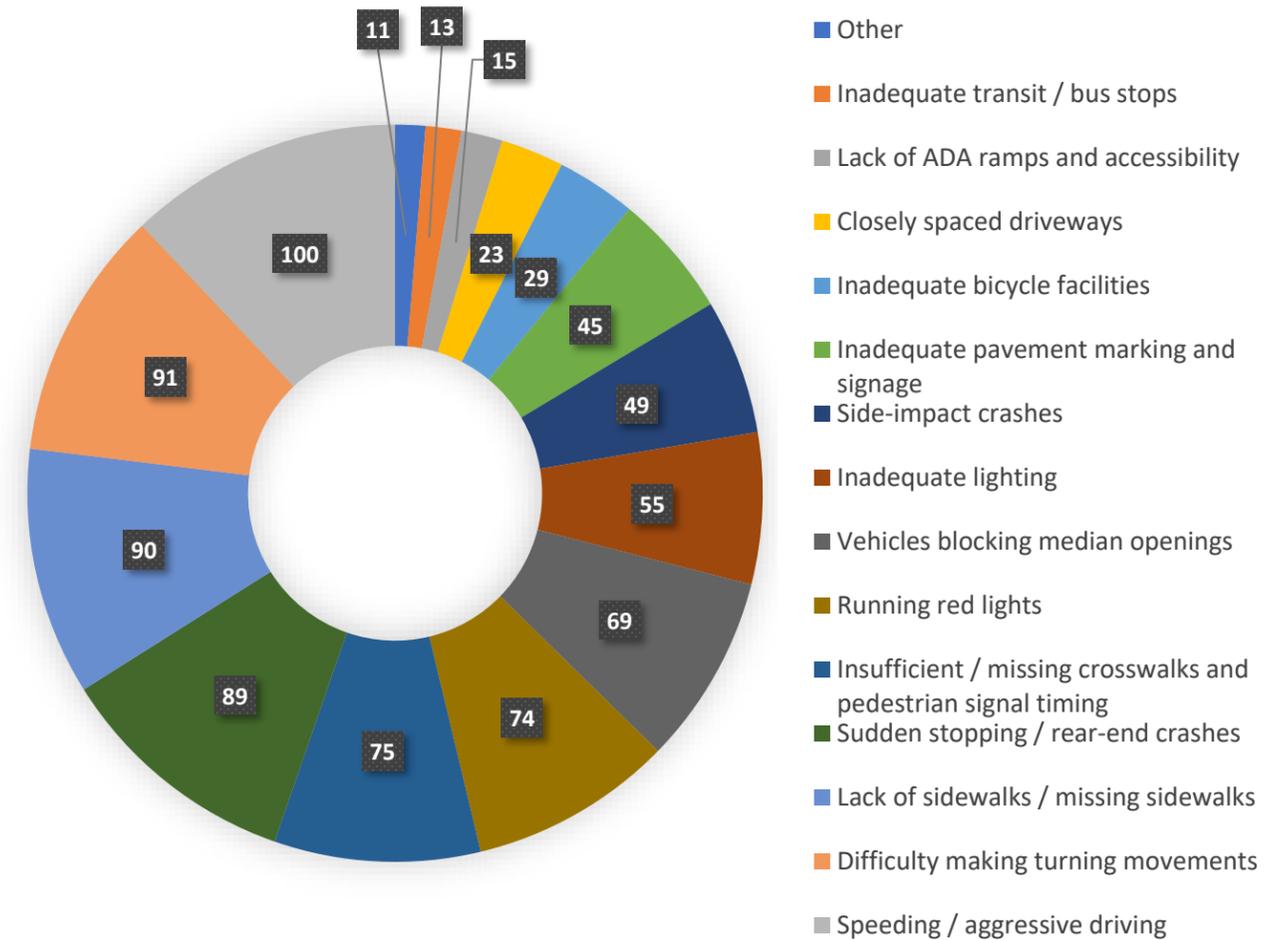


Figure 31 summarizes the mobility issues that participants experience within the study area. Participants were allowed to select more than one option if they experience multiple mobility issues. Out of 191 participants who responded to this question, 99 (52 percent) participants selected poor signal coordination as a mobility issue. Difficulty making left turns and excessive queuing at intersections received the second-most votes with 93 (49 percent) participants each.

Figure 31: Frequency of Mobility Issues

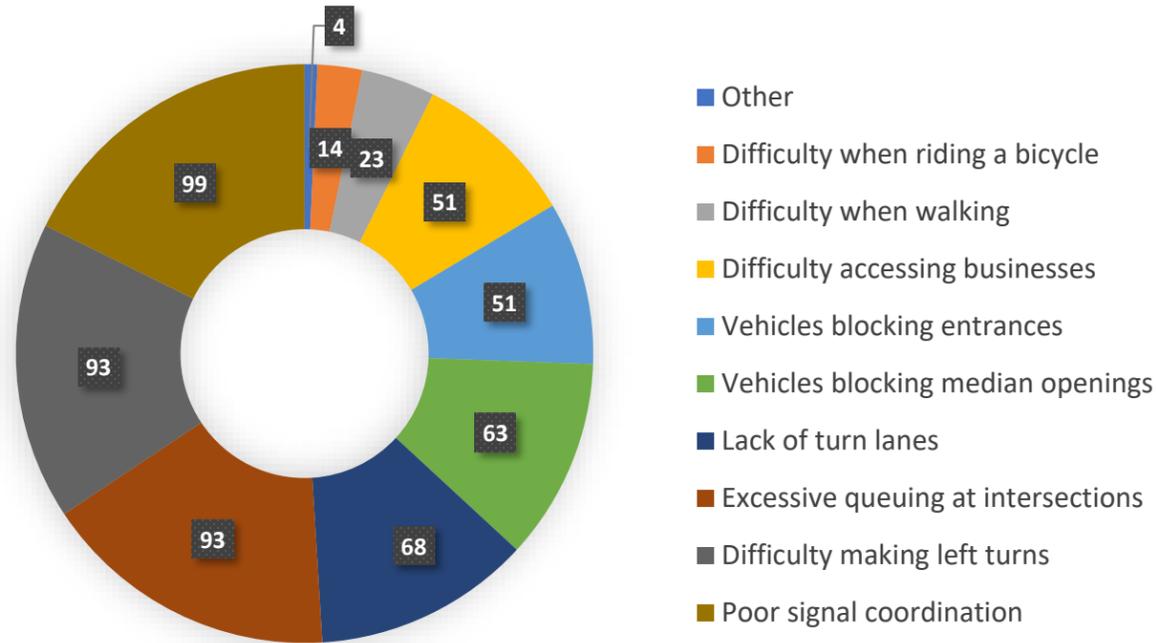
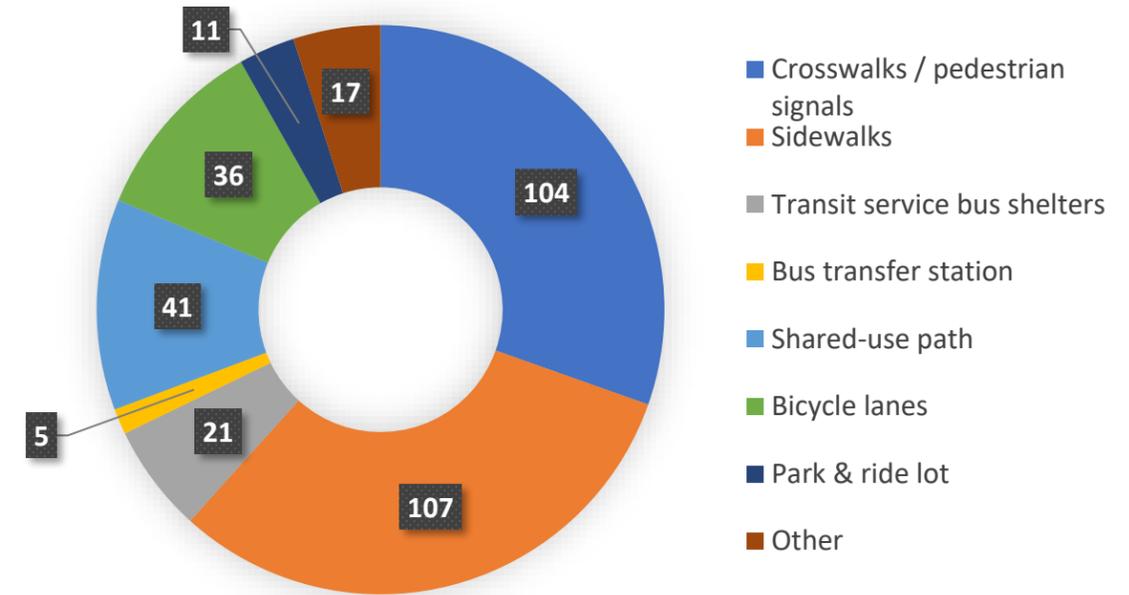


Figure 32 summarizes the multimodal facilities and services participants found to be the most needed within the study corridor. Participants were allowed to select more than one option. Of the 169 participants who responded to this question, 107 (63 percent) participants indicated that sidewalks were needed, and 104 (62 percent) participants indicated that crosswalks and pedestrian signals were needed.

Figure 32: Needed Multimodal Facilities



## 4 TRAFFIC FORECASTING

The study team forecasted traffic volumes to 2045 to understand future traffic conditions in the study area and assess the long-term benefits of proposed improvements. The following sections of the report describe the methodology for developing traffic growth rates and projecting future traffic volumes for the study area.

### 4.1 Traffic Growth Rate Development

The study team reviewed the following sources to develop growth rates within the study area:

- **Historical traffic count data** – The study team compiled historical traffic count data and performed a linear regression analysis on 10- and 20-year periods to calculate linear traffic growth rates throughout the study area.
- **Culpeper Small Area Plan** – The study team reviewed the approved traffic growth rates from the Culpeper Small Area Plan study, which was completed in 2022 including 2045 traffic volumes.
- **Traffic impact analyses** – The study team reviewed the approved traffic growth rates from various traffic impact analyses for developments in the study area.

The SWG reviewed the traffic forecasts and recommended growth rates (see [Appendix E](#)) on June 6, 2023, and reached consensus on the following traffic growth rates for this study, which are summarized in [Figure 33](#).

- 2 percent linear traffic growth rate on Braggs Corner Road
- 1.5 percent linear traffic growth rate on Ira Hoffman Lane north of US 15 BUS
- 1 percent linear traffic growth rate on Old Brandy Road, Nalles Mill Road south of US 15 BUS, and US 15 BUS east of Ira Hoffman Lane
- 0.5 percent linear traffic growth rate on US 15 BUS west of Ira Hoffman Lane and all other side street approaches

Figure 33: Study Area Traffic Growth Rates



### 4.2 Trip Generation from Known Developments

The study team assigned new traffic to the roadway network to account for trips generated by the following three developments within the study area that were likely to be approved.

- Wawa at the northeast corner of the intersection of US 15 BUS and Ira Hoffman Lane
- Sheetz at the southwest corner of the intersection of US 15 BUS and Nalles Mill Road
- Williams Mill Village (senior-only housing development) on Nalles Mill Road

The trip generation assumptions associated with each development were taken from the respective traffic impact analyses and were not grown to a future year. If the traffic impact analyses did not include trip generation assumptions for the Saturday peak hour, the study team projected the new trips and distribution for entering and exiting vehicles based on the *ITE Trip Generation Manual, 11<sup>th</sup> Edition* and assigned them to the study area network using the trip distribution assumptions for the weekday peak hours from the traffic impact analyses. [Table 13](#) summarizes the total new trips generated during each peak hour for each of the three developments included in the No-Build volumes. The trip generation numbers do not include pass-by trips destined for each development. The trip distribution for each development is summarized in [Appendix E](#) along with the traffic impact analysis for each development.

Table 13: Trip Generation from Known Developments

Development	New Trips During Peak Hour		
	Weekday AM	Weekday PM	Saturday
Wawa	136	102	104
Sheetz	121	101	93
Williams Mill Village	88	105	76

The SWG also discussed the Armstrong property, a mixed-use property serving single-family housing, industrial uses, and office space located south of US 15 BUS between Braggs Corner Road and Nalles Mill Road. Since plans for the Armstrong property are in the preliminary stage of development, the SWG decided to account for potential development in this area by applying a higher traffic growth rate on Nalles Mill Road and Braggs Corner Road as discussed in [Section 4.1](#).

### 4.3 Projected 2045 Traffic Volumes

The study team applied the recommended traffic growth rates and generated trips to the 2022 existing traffic volumes to develop the projected 2045 traffic volumes. The study team then balanced the projected 2045 traffic volumes. The projected 2045 AM, PM, and Saturday peak hour traffic volumes are summarized in [Figure 34](#) and [Figure 35](#).

Figure 34: 2045 No-Build Weekday Peak Hour Traffic Volumes

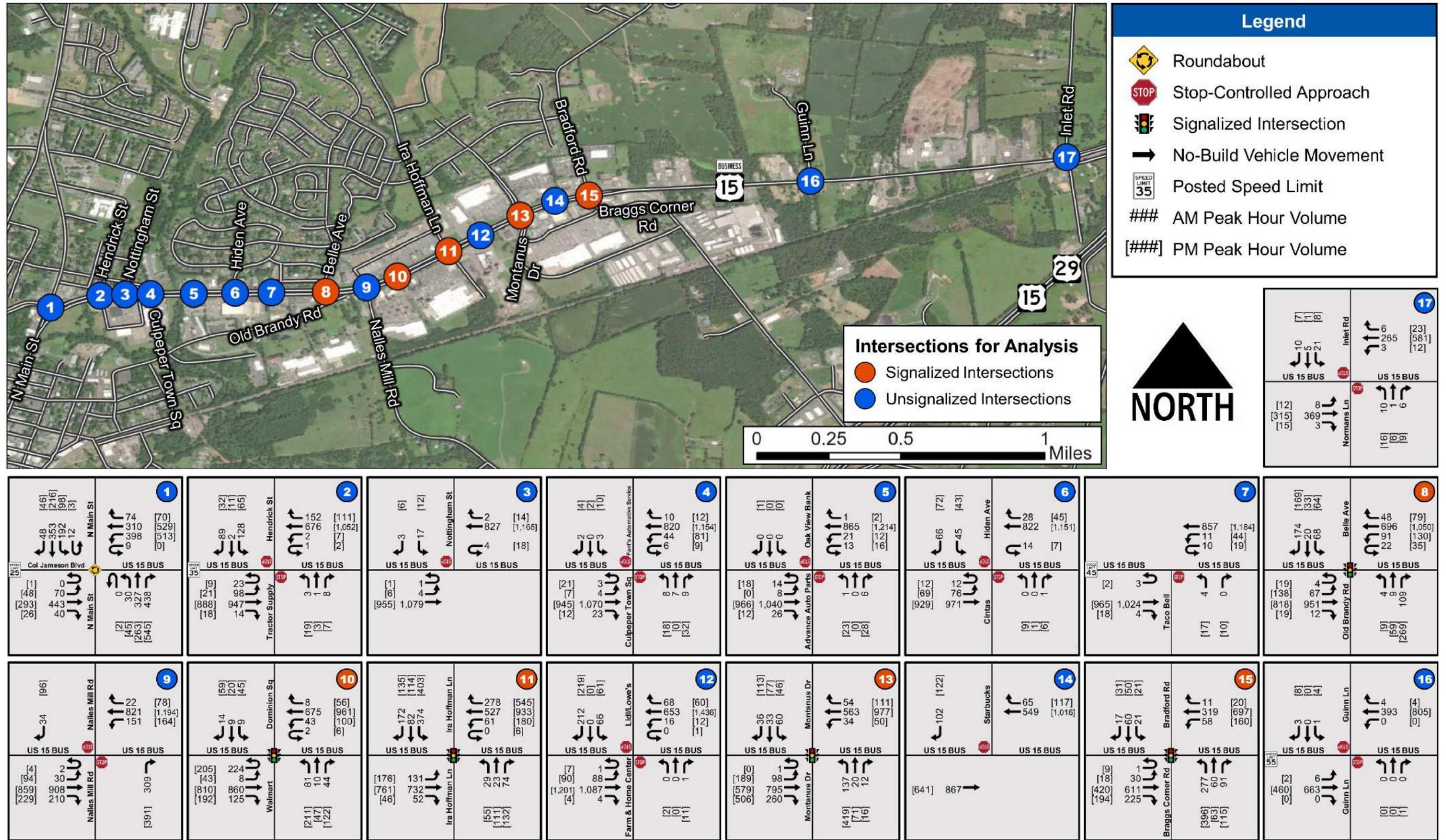
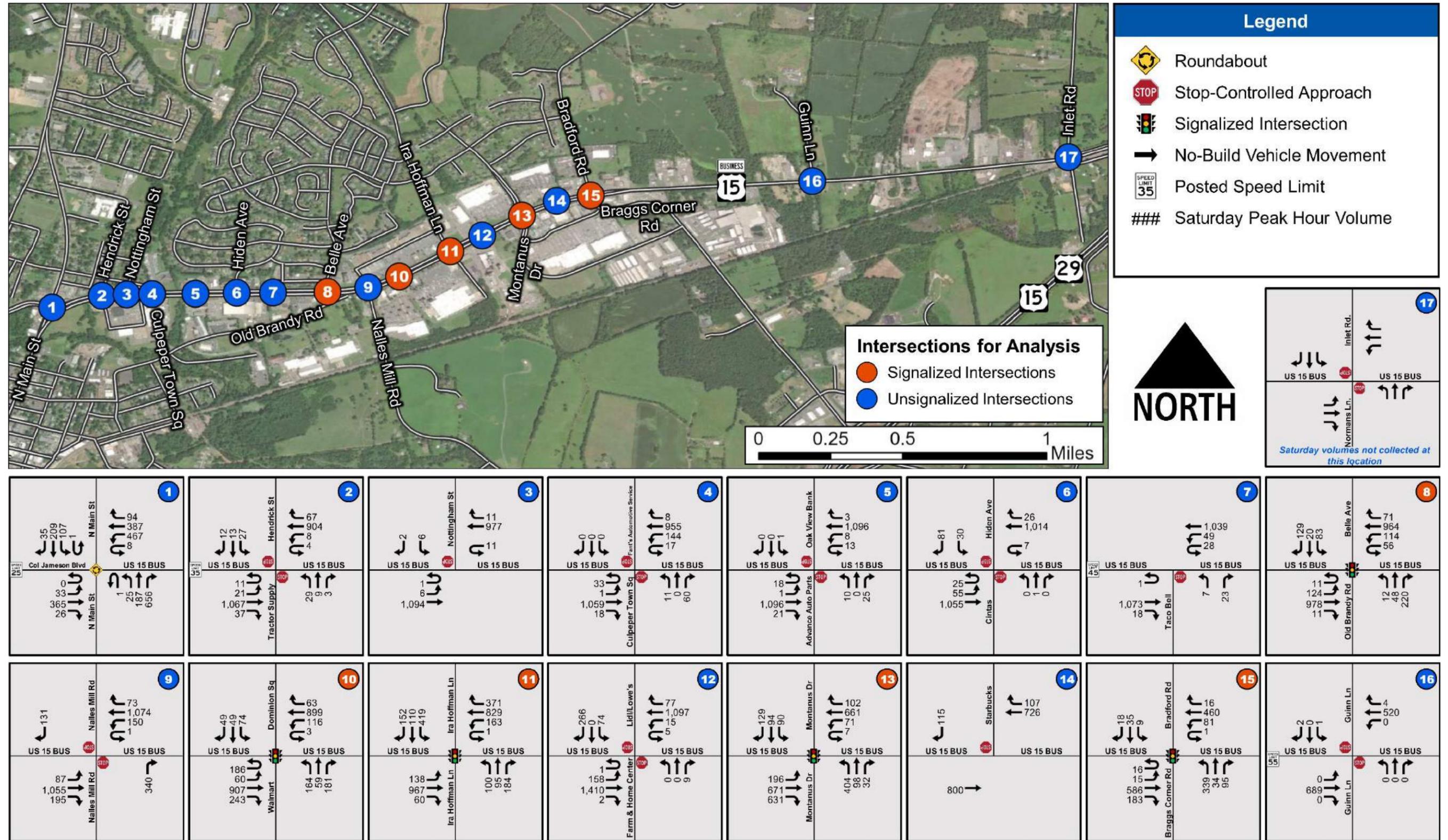


Figure 35: 2045 No-Build Saturday Peak Hour Traffic Volumes



## 5 NO-BUILD CONDITIONS ANALYSIS

The study team evaluated the overall performance of the study corridor under No-Build (2045) AM, PM, and Saturday peak hour conditions. The intent of the No-Build conditions analyses is to understand the baseline future traffic conditions before developing future improvement strategies. No-Build traffic conditions were modeled using Synchro 11 and SIDRA Intersection 8.

### 5.1 Background Improvements

The study team incorporated one planned transportation improvement in the No-Build models – an unsignalized restricted crossing U-turn (RCUT) improvement at the intersection of US 15 BUS and Nalles Mill Road. This improvement is planned to be constructed in conjunction with the Williams Mill Village development. The study team rerouted the side street left-turn and through movements at this intersection to turn right and U-turn at the downstream signalized intersection.

Additionally, a sidewalk improvement project along Old Brandy Road were funded in SMART SCALE Round 5. However, this improvement does not affect the No-Build operations analyses.

### 5.2 Traffic Operations Analysis Assumptions

The study team used the existing conditions Synchro and SIDRA Intersection models as a basis to develop the No-Build models for peak hour conditions. The study team updated the models with the projected 2045 No-Build traffic volumes and optimized cycle lengths and splits at signalized intersections. The study team updated other input parameters to be consistent with guidance in the *TOSAM*.

### 5.3 Traffic Operations Analysis Results

The study team used the same MOEs and reporting methodologies as the existing conditions traffic operations analysis as documented in [Section 3.2.2](#).

[Figure 36](#) through [Figure 39](#) show depictive representations of the control delay and queue length for each study intersection during the AM, PM, and Saturday peak hours. Minor street control delay for Nalles Mill Road is reported as experienced travel time (ETT) to reflect additional time motorists must travel plus any delay experienced at adjacent intersections to complete their desired movement. The study team summarized ETT for movements to match the existing laneage to facilitate easier comparisons between Existing and No-Build results. Tables summarizing the delay and queue by lane group, approach, and intersection as well as the full Synchro and SIDRA Intersection reports are provided in [Appendix F](#).

#### 5.3.1 AM Peak Hour

##### Control Delay and Level of Service

All signalized intersections under No-Build conditions were projected to operate at an overall LOS C or better, except for the intersection with Belle Avenue/Old Brandy Road. All side street approaches to the signalized intersections were projected to operate at LOS D or E. The side street movement projected to have the most control delay is the northbound left-through movement at Bradford Road/Braggs Corner Road, which was projected to operate with 61.6 seconds per vehicle of control delay. Additionally, the following major street left-turn movements were projected to operate at LOS E:

- Belle Avenue/Old Brandy Road: eastbound left-turn movement
- Montanus Drive: westbound left-turn movement

The overall intersection control delay was projected to improve from existing conditions at the intersections with Montanus Drive and Bradford Road/Braggs Corner Road despite the increase in traffic volumes. The decrease in control delay was attributed to the signal retiming that resulted in lower control delays for side street movements. While the control delays for the major street through movements were projected to increase from the existing conditions, the movements were still projected to operate at LOS C or better.

At the unsignalized intersections, all major street left-turn or U-turn movements were projected to operate at LOS C or better, except for the eastbound left-through movement at N Main Street, which was projected to operate at LOS F. The side street movement projected to have the most control delay is the southbound left-through movement at Hendrick Street, which was projected to operate at LOS F with 52.9 seconds per vehicle.

##### Queue Length

The following through movements were projected to experience 95<sup>th</sup> percentile queue lengths longer than the effective storage length of an adjacent turn lane. Movements are highlighted in orange italics if the 95<sup>th</sup> percentile queue length did not exceed the effective storage length of an adjacent turn lane in existing conditions.

- Hendrick Street: southbound left-through movement queue was projected to block the right-turn lane
- Belle Avenue/Old Brandy Road: eastbound through movement queue was projected to block the left- and right-turn lanes
- Ira Hoffman Lane: southbound left-through movement queue was projected to block the exclusive left-turn lane
  - Southbound left and left-through queues were projected to block the southern entrance to the Dominion Square Shopping Center, which may exacerbate the existing crash issue documented in the [Safety Analysis by Intersection](#) section.
- Bradford Road/Braggs Corner Road:
  - *Eastbound through movement queue was projected to block the left- and right-turn lanes*
  - Northbound left-through movement queue was projected to block the exclusive left-turn lane
    - Northbound left and left-through queues were projected to extend through the intersection of Braggs Corner Road and Creativity Drive, which may exacerbate the existing crash issue documented in the [Safety Analysis by Intersection](#) section.

Additionally, the following movements were projected to experience 95<sup>th</sup> percentile queue lengths longer than the available storage length. Movements are highlighted in orange italics if the 95<sup>th</sup> percentile queue length did not exceed the effective storage length in existing conditions.

- Belle Avenue/Old Brandy Road: southbound left-turn movement
- *Walmart: eastbound left-turn movement*
- Ira Hoffman Lane: southbound exclusive left-turn movement
- Bradford Road/Braggs Corner Road: northbound exclusive left-turn movement

Figure 36: 2045 No-Build Weekday Peak Hour Control Delay and LOS

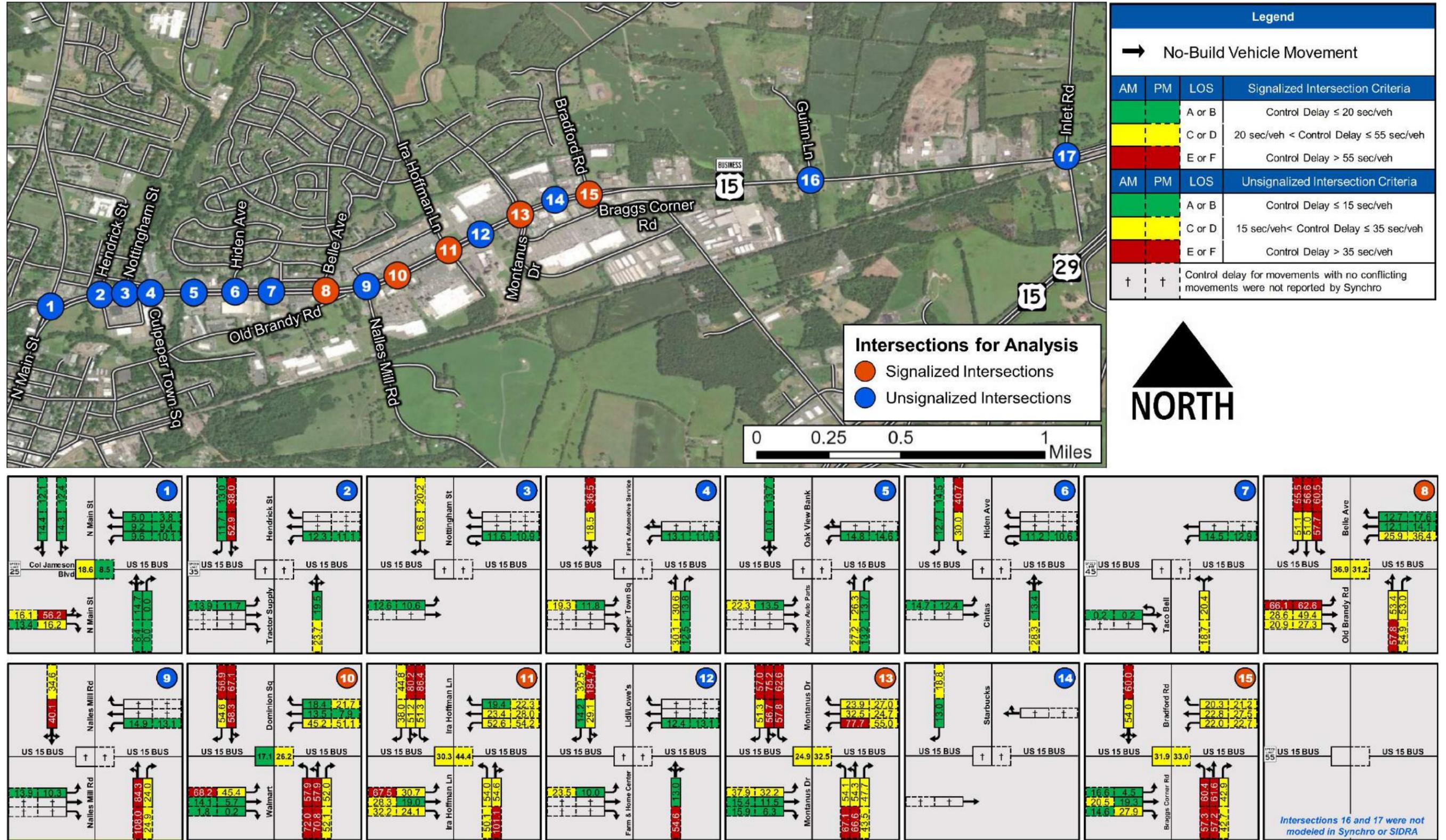


Figure 37: 2045 No-Build Saturday Peak Hour Control Delay and LOS

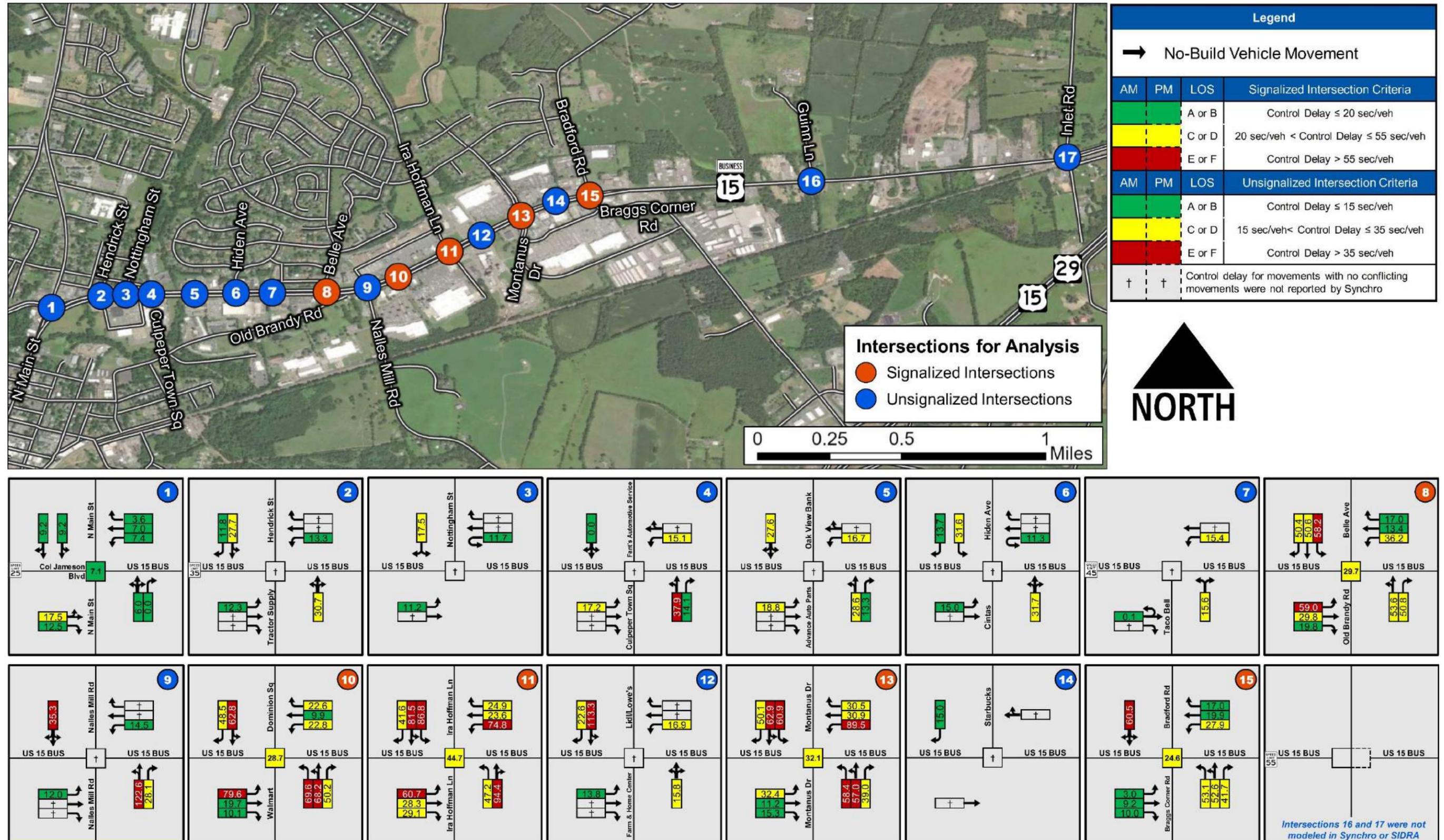


Figure 38: 2045 No-Build Weekday Peak Hour 95<sup>th</sup> Percentile Queues

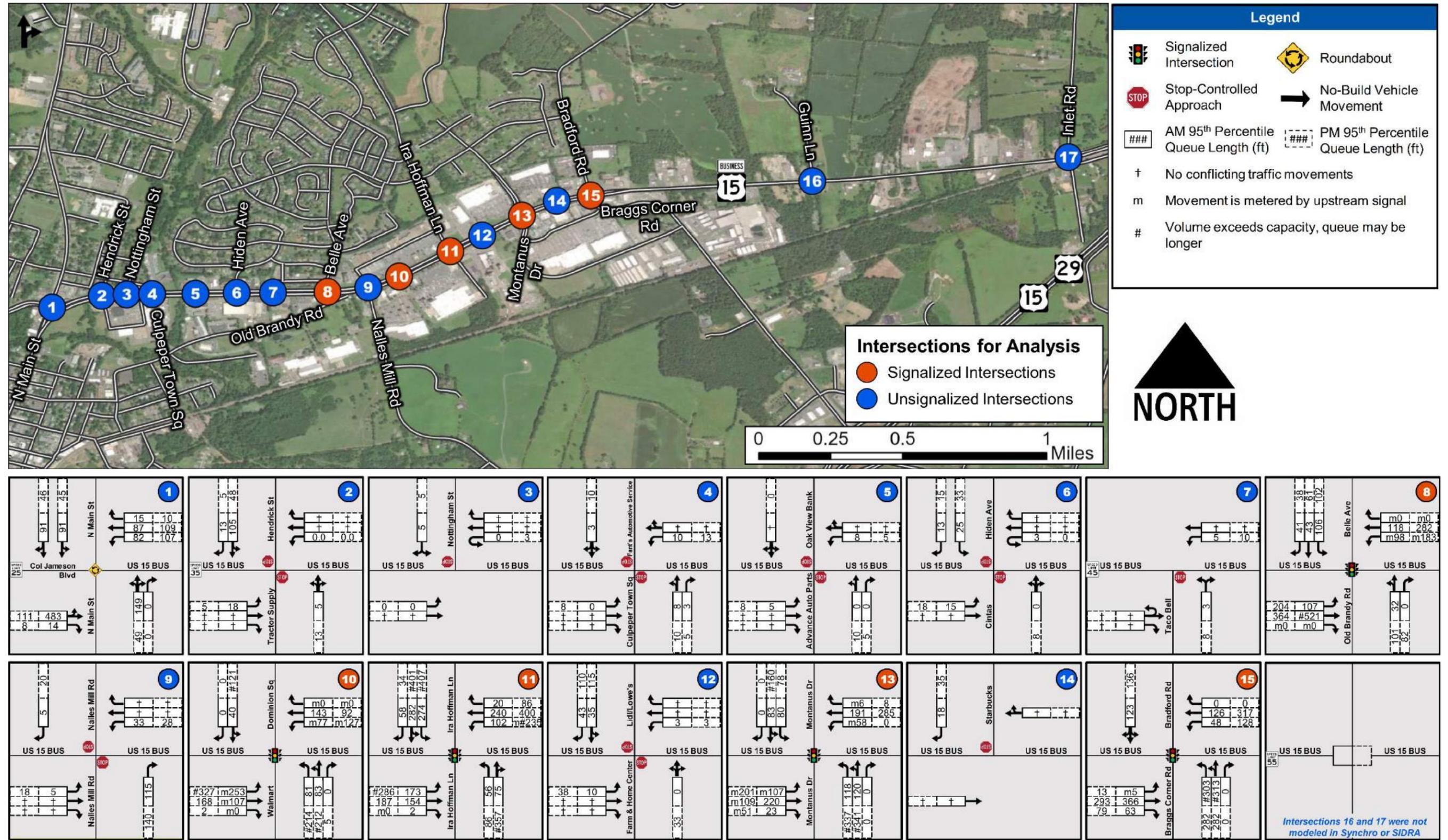
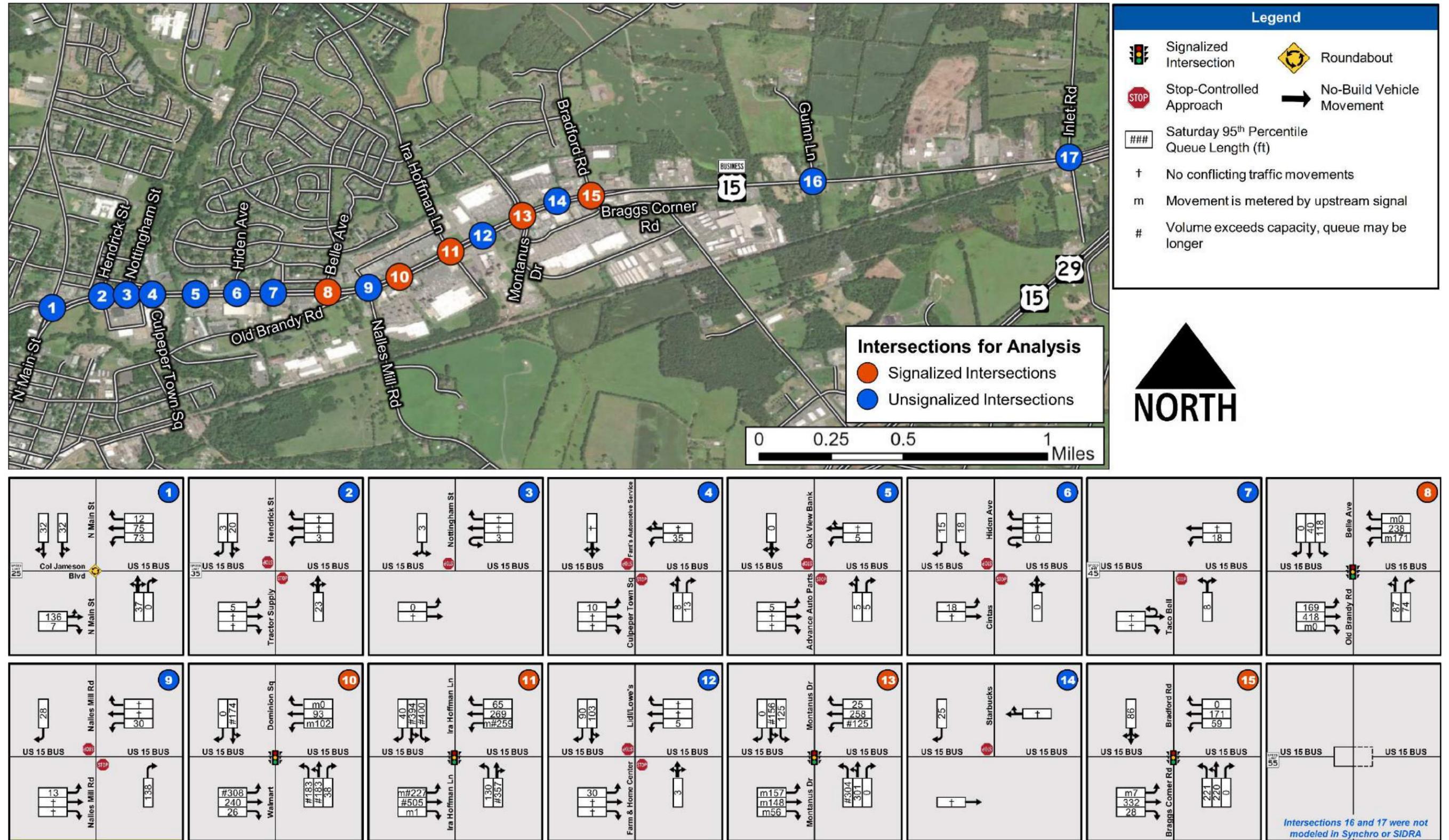


Figure 39: 2045 No-Build Saturday Peak Hour 95<sup>th</sup> Percentile Queues



### 5.3.2 PM Peak Hour

#### Control Delay and Level of Service

All signalized intersections under No-Build conditions were projected to operate at an overall LOS C or better except for the intersection with Ira Hoffman Lane, which was projected to operate at LOS D. All side street approaches at signalized intersections were projected to operate at LOS E or worse, except for the northbound approach at the intersection with Bradford Road/Braggs Corner Road, which was projected to operate at LOS D. The side street movement projected to have the most control delay is the northbound through-right movement, which was projected to operate with 101.1 seconds per vehicle of control delay.

Additionally, the following major street left-turn movements were projected to operate at LOS E:

- Belle Avenue/Old Brandy Road: eastbound left-turn movement
- Walmart: eastbound left-turn movement
- Ira Hoffman Lane: eastbound left-turn movement

The overall intersection control delay was projected to improve from existing conditions at the intersections with Ira Hoffman Lane and Montanus Drive despite the increase in traffic volumes. The decrease in control delay was attributed to the signal retiming that resulted in lower control delays for side street movements. While the control delays for the major street through movements were projected to increase from the existing conditions, the movements were still projected to operate at LOS C or better.

At the unsignalized intersections, all major street left-turn or U-turn movements were projected to operate at LOS C or better. The side street movement projected to have the most control delay is the southbound left-through movement at the intersection with Lidl/Lowe's, which was projected to operate at LOS F with 184.7 seconds per vehicle of control delay. The volume for the southbound left-through lane group was projected to increase from 7 vehicles in existing conditions to 61 vehicles in No-Build conditions due to vehicles leaving the Wawa planned on Ira Hoffman Lane.

#### Queue Length

The following through movements were projected to experience 95<sup>th</sup> percentile queue lengths longer than the effective storage length of an adjacent turn lane. Movements are highlighted in orange italics if the 95<sup>th</sup> percentile queue length did not exceed the effective storage length of an adjacent turn lane in existing conditions.

- *Hendrick Street: southbound left-through movement queue was projected to block the right-turn lane*
- Belle Avenue/Old Brandy Road
  - Eastbound through movement queue was projected to block the left- and right-turn lanes
  - *Westbound through movement queue was projected to block the right-turn lane*
  - *Southbound through movement queue was projected to block the left-turn lane*
- Walmart: northbound exclusive left-turn movement queue was projected to block the shared left-through and right-turn lanes
- Ira Hoffman Lane
  - *Westbound through movement queue was projected to block the left-turn lane*
  - Northbound and southbound through movement queues were projected to block the left-turn lanes
    - Southbound left and left-through movement queues were projected to block both entrances to the Dominion Square Shopping Center, which may exacerbate the existing crash issue documented in the [Safety Analysis by Intersection](#) section.
    - Northbound through-right movement queues were projected to extend to the entrance of the Farm & Home Center parking lot

- Montanus Drive:
  - *Westbound through movement queue was projected to block the left-turn lane*
  - Northbound left-through movement queue was projected to block the exclusive left- and right-turn lanes
    - *Northbound left and left-through queues were projected to extend through the intersection of Montanus Drive and Creativity Drive*
- Bradford Road/Braggs Corner Road
  - *Eastbound through movement queue was projected to block the left-turn lane*
  - *Westbound through movement queue was projected to block the left- and right-turn lanes*
  - Northbound left-through movement queue was projected to block the exclusive left- and right-turn lanes
    - Northbound left and left-through queues were projected to extend through the intersection of Braggs Corner Road and Creativity Drive, which may exacerbate the existing crash issue documented in the [Safety Analysis by Intersection](#) section.

The eastbound through movement queue at the intersection with Walmart blocks the left- and right-turn lanes in existing conditions but was not projected to block the turn lanes in the No-Build scenario.

Additionally, the following movements were projected to experience 95<sup>th</sup> percentile queue lengths longer than the available storage length. Movements are highlighted in orange italics if the 95<sup>th</sup> percentile queue length did not exceed the effective storage length in existing conditions.

- Belle Avenue/Old Brandy Road: southbound left-turn movement
- Walmart: *eastbound left-turn movement*, northbound and *southbound left-through movements*
- Ira Hoffman Lane: southbound exclusive left-turn movement
- Montanus Drive: northbound exclusive left-turn movement
- Bradford Road/Braggs Corner Road: northbound exclusive left-turn movement

### 5.3.3 Saturday Peak Hour

#### Control Delay and Level of Service

All signalized intersections under No-Build conditions were projected to operate at an overall LOS C or better except for Ira Hoffman Lane, which was projected to operate at LOS D. All side street approaches at signalized intersections were projected to operate at LOS D or worse. The northbound approach of Ira Hoffman Lane is the only side street that was projected to operate at LOS F with 82.0 seconds of control delay per vehicle.

The westbound left-turn movement at Montanus Drive was projected to experience the most control delay among the major street left-turn movements at 89.5 seconds per vehicle. Overall, the following major street left-turn movements were projected to operate at LOS E or F:

- Belle Avenue/Old Brandy Road: eastbound left-turn movement (LOS E)
- Walmart: eastbound left-turn movement (LOS E)
- Ira Hoffman Lane: eastbound and westbound left-turn movement (LOS E)
- Montanus Drive: westbound left-turn movement (LOS F)

The side street control delays were projected to improve from existing conditions at the intersection with Ira Hoffman Lane despite the increase in traffic volumes. The decrease in control delay was attributed to the signal retiming that reallocated green time from the major street to the side street movements. While the control delays for the major street through movements were projected to increase from the existing conditions, the movements were still projected to operate at LOS C or better.

At the unsignalized intersections, all major street left-turn or U-turn movements were projected to operate at LOS C or better. The side street movement projected to have the most control delay is the southbound left-through movement at the intersection with Lidl/Lowes, which was projected to operate at LOS F with 113.3 seconds of control delay per vehicle. The volume for the southbound left-through lane group was projected to increase from 17 vehicles in existing conditions to 74 vehicles in No-Build conditions due to vehicles leaving the Wawa planned on Ira Hoffman Lane.

**Queue Length**

The following through movements were projected to experience 95<sup>th</sup> percentile queues longer than the effective storage length of an adjacent turn lane. Movements are highlighted in orange italics if the 95<sup>th</sup> percentile queue length did not exceed the effective storage length of an adjacent turn lane in existing conditions.

- Belle Avenue/Old Brandy Road
  - Eastbound through movement queue was projected to block the left- and right-turn lanes
  - *Westbound through movement queue was projected to block the right-turn lane*
- Walmart:
  - Eastbound through movement queue was projected to block the left-turn lane
  - Northbound exclusive left-turn movement queue was projected to block the shared left-through and right-turn lanes
- Ira Hoffman Lane
  - *Eastbound through movement queue was projected to block the left-turn lane*
  - Northbound and southbound through movement queues were projected to block the left-turn lanes
    - Southbound left and left-through queues were projected to block both entrances to the Dominion Square Shopping Center, which may exacerbate the existing crash issue documented in the *Safety Analysis by Intersection* section.
- Montanus Drive: northbound left-through movement queue was projected to block the exclusive left- and right-turn lanes
  - *Northbound left and left-through queues were projected to extend through the intersection of Montanus Drive and Creativity Drive.*
- Bradford Road/Braggs Corner Road
  - Eastbound through movement queue was projected to block the left- and right-turn lanes
  - Northbound left-through movement queue was projected to block the exclusive left- and right-turn lanes
    - Northbound left and left-through movement queues were projected to extend through the downstream intersection of Braggs Corner Road and Creativity Drive, which may exacerbate the existing crash issue documented in the *Safety Analysis by Intersection* section.

In addition, 95<sup>th</sup> percentile queue lengths were projected to exceed the available storage length at the following locations. Movements are highlighted in orange italics if the 95<sup>th</sup> percentile queue length did not exceed the effective storage length in existing conditions.

- Belle Avenue/Old Brandy Road: southbound left-turn movement
- Walmart: *eastbound left-turn movement*, northbound and southbound left-through movements
- Ira Hoffman Lane: northbound and southbound exclusive left-turn movements
- Montanus Drive: northbound exclusive left-turn movement
- Bradford Road/Braggs Corner Road: northbound exclusive left-turn movement

## 6 IMPROVEMENT SCREENING AND ANALYSIS

The study team developed improvement concepts to address safety, access, geometric, and/or operational deficiencies identified in the field review, Existing and No-Build analyses, and public survey. The study team vetted concepts with the SWG at two concept development meetings and the public via a second public survey before finalizing the concepts to be included in the study recommendations during a third SWG meeting.

The study team used the Virginia Intersection and Interchange Control Assessment Program (iCAP) assessment tool to evaluate alternatives for three intersections on the VDOT Arterial Preservation Network (APN): US 15 BUS at Ira Hoffman Lane, Montanus Drive, and Braggs Corner Road/Bradford Road. The goal of iCAP is to holistically screen intersection alternatives to determine configurations that provide the best value accounting for various metrics. The SWG agreed to use consistent metric weightings across all intersections evaluated with the iCAP assessment tool. **Table 14** includes the metric weightings used for the iCAP assessments and the justification for the selection of each weighting (priority). **Appendix G** includes iCAP assessment tool output sheets.

Table 14: iCAP Metric Weightings

Metric	Priority	Justification
Traffic Operations	Moderate (2)	Network can generally accommodate no-build traffic, although expected growth in volume due to future development will likely exacerbate existing peak period queuing.
Pedestrian	Moderate (2)	US 15 BUS is a PSAP corridor. Pedestrian facilities lack connectivity.
Safety	High (3)	Intersections are all Culpeper District PSI locations.
Cost	Low (1)	Cost effectiveness is a factor, but no specific funding limitations.

### 6.1 Initial Concept Screening

The study team initially considered the list of concepts summarized in **Table 15** to address multimodal safety, access, geometric, and operational deficiencies throughout the corridor.

The study team reviewed crash modification factors (CMFs) from the VDOT State Preferred CMF List and the VDOT SMART SCALE Round 5 CMF List to determine the potential safety benefits of each alternative. The study team also analyzed the concepts using Synchro 11 (stop-controlled or signalized intersections) or Sidra Intersection 8 (roundabouts) to evaluate the operational benefits of the improvements compared to the No-Build scenario. For any innovative intersection concepts that involved diverting vehicles to adjacent intersections, the study team calculated ETT using the methodology provided in the HCM 6<sup>th</sup> Edition for a more direct comparison to the control delay reported in the No-Build scenario. ETT accounts for the additional distance motorists must travel plus any delay experienced at adjacent intersections to complete their desired movement.

Table 15: Initial Concepts

Location	Concept	Included in Public Survey
Hendrick Street to Montanus Dr	Sidewalk <i>North side of US 15 BUS from Hendrick Street to Lidl/Lowes</i> <i>South side of US 15 BUS from Ira Hoffman Ln to Montanus Dr</i>	
Hendrick St to Braggs Corner Rd/Bradford Rd	Shared use path <i>North side of US 15 BUS</i>	<input checked="" type="checkbox"/>
Various signalized and unsignalized intersections	Pedestrian crossings	<input checked="" type="checkbox"/>
Existing transit stops	Transit stop improvements	
Various commercial entrances	Access management	
Hendrick St to Taco Bell	RCUTs at unsignalized intersections	<input checked="" type="checkbox"/> (Hendrick St)
Belle Ave/ Old Brandy Rd	Pedestrian safety improvements	
	RCUT	<input checked="" type="checkbox"/>
	Concurrent left-turn phasing	
	Roundabout	
Nalles Mill Rd	RCUT <i>Planned improvement with the addition of pedestrian accommodation improvements</i>	<input checked="" type="checkbox"/>
	Full median closure	
	Roundabout	<input checked="" type="checkbox"/>
Walmart	Concurrent left-turn phasing	
	RCUT	<input checked="" type="checkbox"/>
	Roundabout	<input checked="" type="checkbox"/>
Ira Hoffman Ln	Right-in/right-out (RI/RO) at the southernmost entrance to the Dominion Square Shopping Center	
	Concurrent left-turn phasing	
	Concurrent left-turn phasing with 2 <sup>nd</sup> eastbound left-turn lane	
	Thru-cut	
	Hybrid thru-cut with southbound-through movements prohibited	
	Roundabout	<input checked="" type="checkbox"/>
Montanus Dr	Concurrent left-turn phasing	
Braggs Corner Rd/Bradford Rd	RI/RO at the intersection with Creativity Drive	
	Concurrent left-turn phasing	
	Protected mainline left-turns	
East of Braggs Corner Rd/Bradford Road	Merge extension	<input checked="" type="checkbox"/>
Bradford Rd/Braggs Corner Rd to Inlet Rd	Two-way left-turn lane	
Inlet Rd	Pavement markings to improve safety	

## 6.2 Concept Development Meetings

The SWG conducted concept development meetings on September 18, 2023, and October 31, 2023, to review the projected traffic analysis results, safety benefits, and geometric considerations for each concept. The meeting presentation is provided in [Appendix G](#). The agreed-upon alternatives that were screened forward to the public involvement survey are summarized in [Table 15](#).

During these meetings, the SWG discussed the infeasibility of constructing a shared use path on the north side of US 15 BUS between Hiden Avenue and Belle Avenue since a retaining wall would be needed to accommodate the path next to the embankment. The SWG recommended constructing a sidewalk along this section and offering two options for bicycle accommodation to the public: a shared use path that connects to Highview Court or sharrows on Hiden Avenue, Overlook Street, and Belle Avenue.

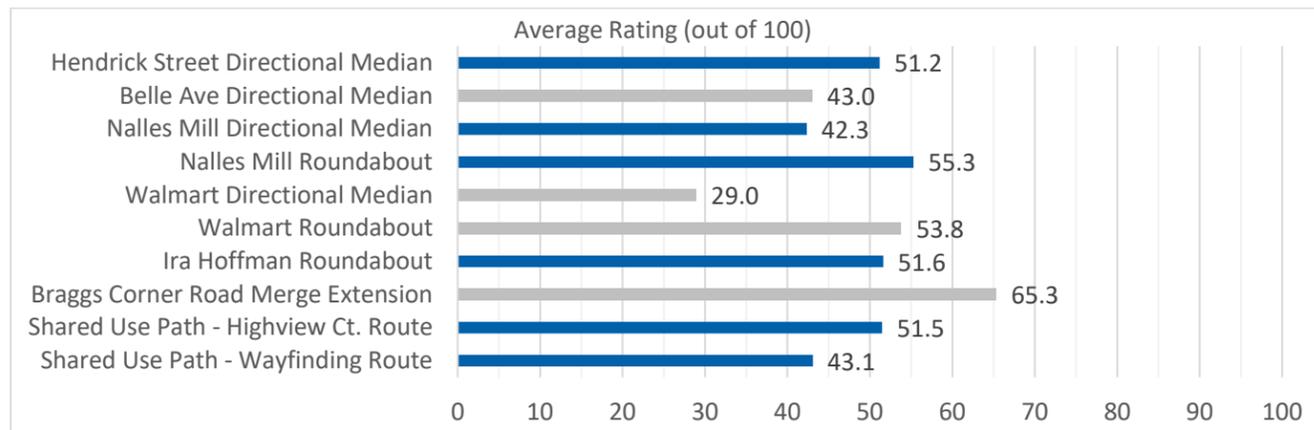
Additionally, the SWG discussed the compatibility of the potential intersection concepts between Belle Avenue/Old Brandy Road and Ira Hoffman Lane. The study team determined that a roundabout at Nalles Mill Road was not compatible with a traffic signal at the Belle Avenue/Old Brandy Road or Walmart intersections since the queues from the signals were projected to affect roundabout operations. The study team also determined that the potential roundabouts at Walmart and Ira Hoffman Lane could be built independently and operations would not be affected by queuing from upstream or downstream signalized intersections.

## 6.3 Public Survey Results

VDOT hosted an in-person public meeting on December 7, 2023, and a second public survey from December 7, 2023, to January 2, 2024, to collect feedback on potential concepts along the study corridor. In total, 286 participants completed the survey and provided 492 typed comments. Two members of the public attended the in-person meeting. Although the study team evaluated proposed concepts in series to test compatibility, the survey asked for participant feedback for individual concepts.

[Figure 40](#) summarizes the average score for each concept presented. The survey asked participants to rank each concept between highly unfavorable (0) and highly favorable (100). The survey provided the SWG with an understanding of how the public viewed each concept before selecting the preferred concepts. Aside from the Walmart directional median concept, all concepts received average rankings between 40 and 60. The rankings of each alternative highlighted a polarized opinion amongst participants, with a high frequency of ratings on the highly unfavorable and highly favorable poles of the scale. The SWG used the survey results as an additional metric to determine the preferred concepts. For example, the unfavorable opinion of the Walmart directional median when compared to the roundabout provided the SWG with additional justification to advance the roundabout as a preferred concept. Furthermore, the results from the survey provided additional justification to advance the Shared Use Path routing through Highview Court as the preferred Shared Use Path alternative. Survey results for each concept are summarized in the Concept Refinement Meeting presentation in [Appendix G](#).

Figure 40: Public Input Survey Average Rating by Improvement\*



\*The proposed RCUT concepts were presented to the public as directional medians

### 6.4 Preferred Concepts

After the public survey, the SWG regrouped on February 12, 2024, to discuss the projected safety and operational benefits, review planning-level cost estimates, and finalize the list of preferred concepts to be recommended in this study. The meeting presentation, provided in [Appendix G](#), includes additional details, such as safety benefits and cost estimates, for each concept. [Appendix G](#) also includes the iCAP tool outputs for the US 15 BUS intersections with Ira Hoffman Lane, Montanus Drive, and Braggs Corner Road/Bradford Road. The recommended improvements are summarized in [Table 16](#) and final preferred alternative sketches are shown in [Figure 41](#) through [Figure 49](#). [Figure 50](#) shows the full shared use path extents, and [Figure 51](#) shows the cyclist rerouting along Highview Court. The final preferred alternative sketches are also included in [Appendix H](#).

Table 16: Recommended Improvements

Location	Recommendation
N Main St	Crosswalk and pedestrian flashing beacons
Hendrick St	RCUT
Hendrick St to Bradford Rd	Shared use path, sidewalk, and access management <i>Shared use path along north side of US 15 BUS from Hendrick St to Bradford Rd</i> <i>Sidewalk along south side of US 15 BUS between Ira Hoffman Ln and Montanus Dr</i> <i>Commercial driveway modifications along US 15 BUS</i>
Culpeper Town Square	Pedestrian hybrid beacon (PHB)
Culpeper Town Square to Lidl/Lowe's	Bus stop amenities and modifications <i>Culpeper Trolley stop realignment with pedestrian crossing at Culpeper Town Square</i> <i>Culpeper Trolley stop connection to existing sidewalk at Taco Bell</i> <i>Bus stop sign installation at Lowe's Culpeper Trolley stop</i>
Belle Ave/Old Brandy Rd	Crosswalks and pedestrian islands
Nalles Mill Rd	Crosswalks and pedestrian hybrid beacons along the planned RCUT
Walmart	Roundabout
Ira Hoffman Ln	Roundabout RI/RO at Dominion Square Shopping Center entrance
Montanus Dr	Concurrent left-turn phasing Northbound and southbound lane reconfiguration
Braggs Corner Rd/Bradford Rd	Protected mainline left turns
East of Braggs Corner Rd/Bradford Rd	Merge extension
Inlet Road	Signing and marking improvements

Figure 41: N Main Street Pedestrian Improvements

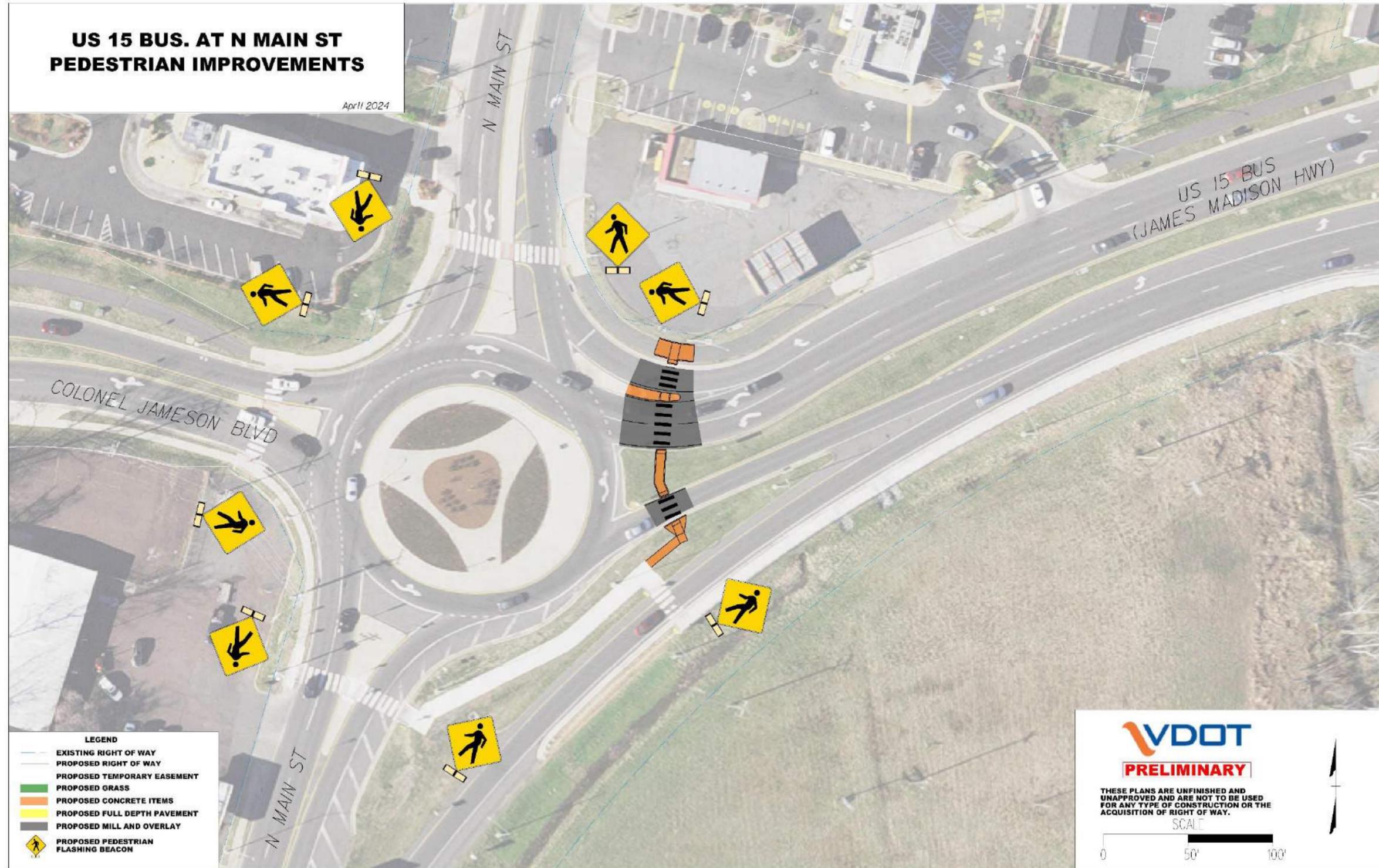


Figure 42: Hendrick Street RCUT



Figure 43: Culpeper Town Square Pedestrian Crossing

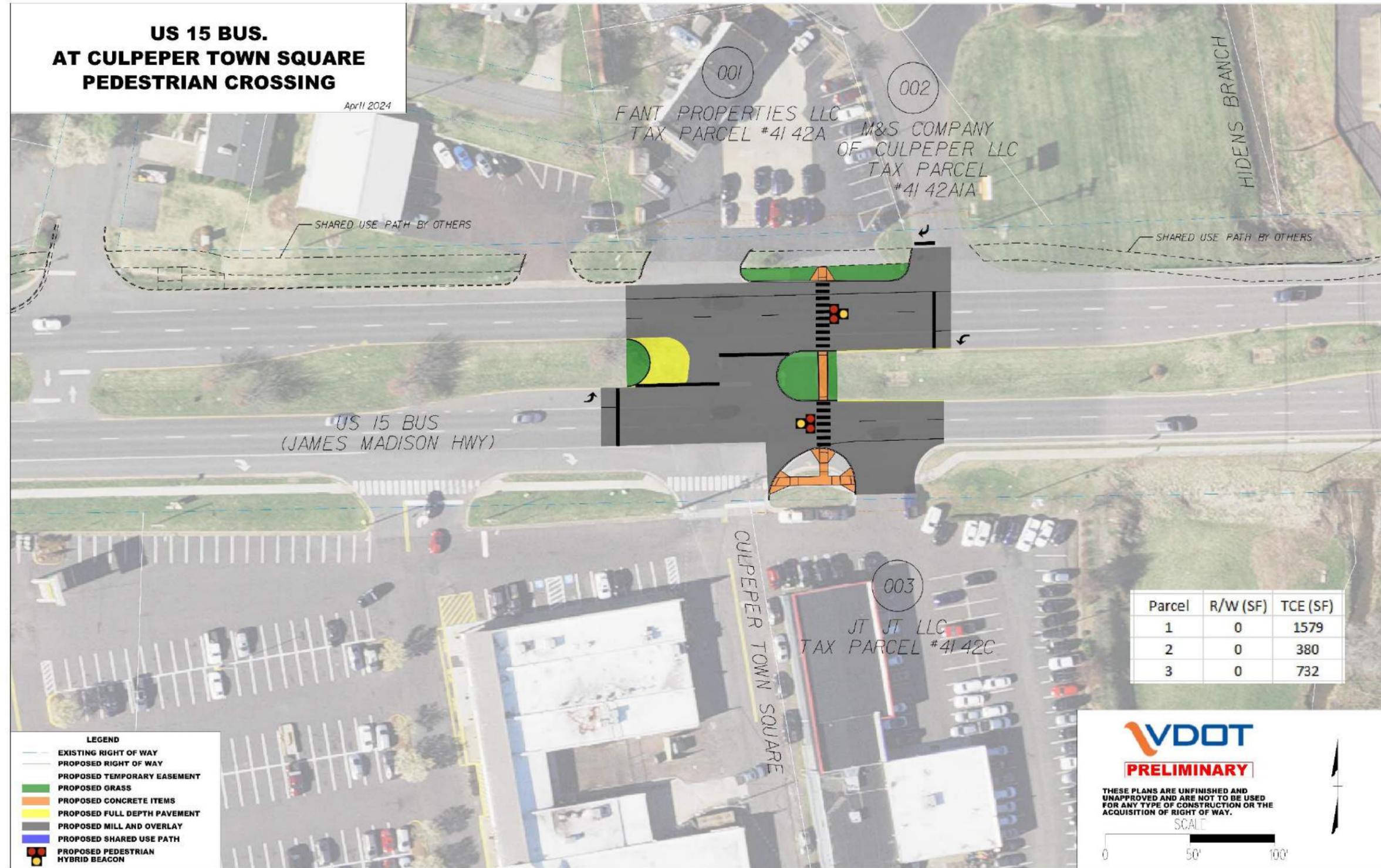


Figure 44: Belle Avenue/Old Brandy Road Pedestrian Improvements

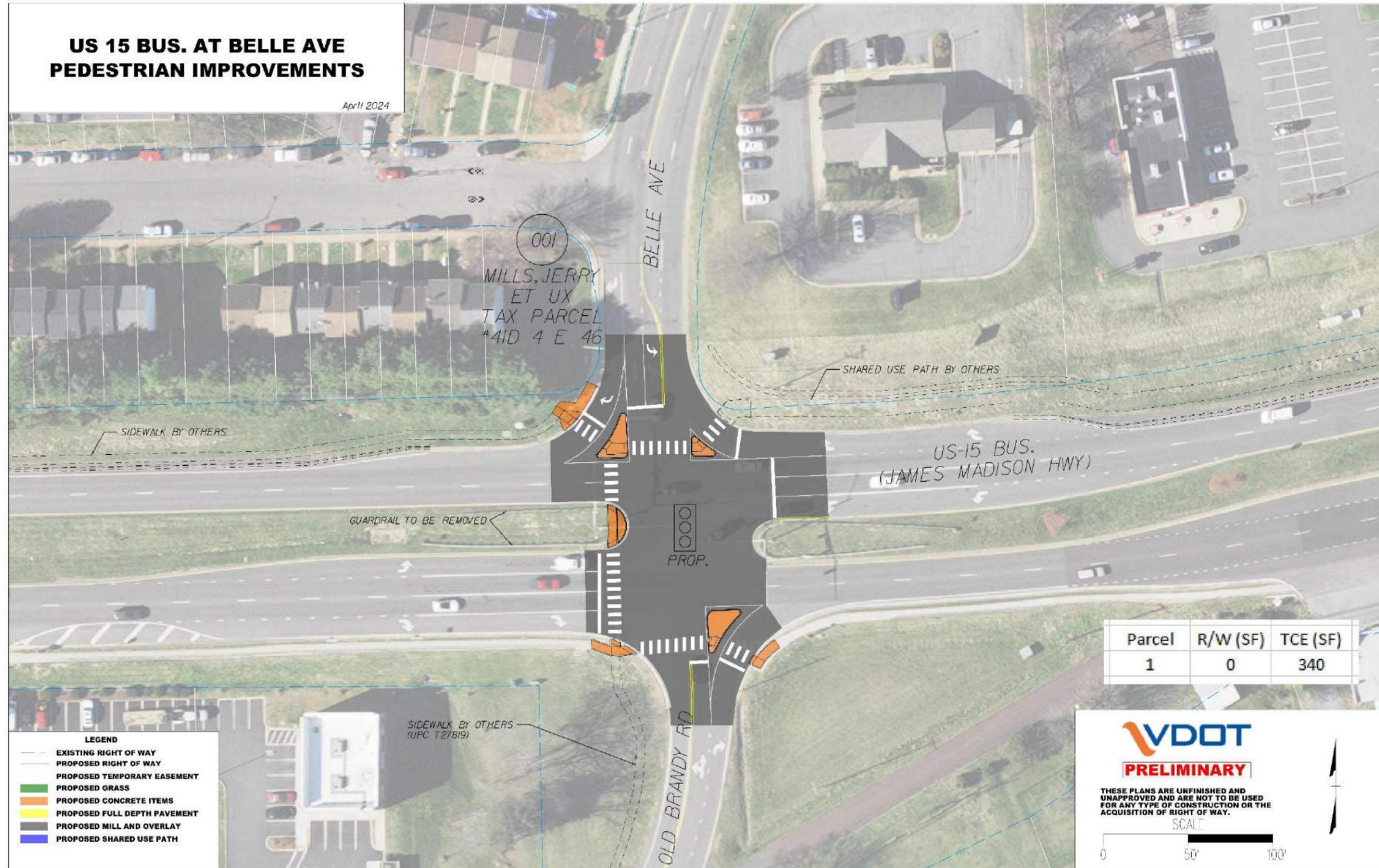


Figure 45: Nalles Mill Road RCUT

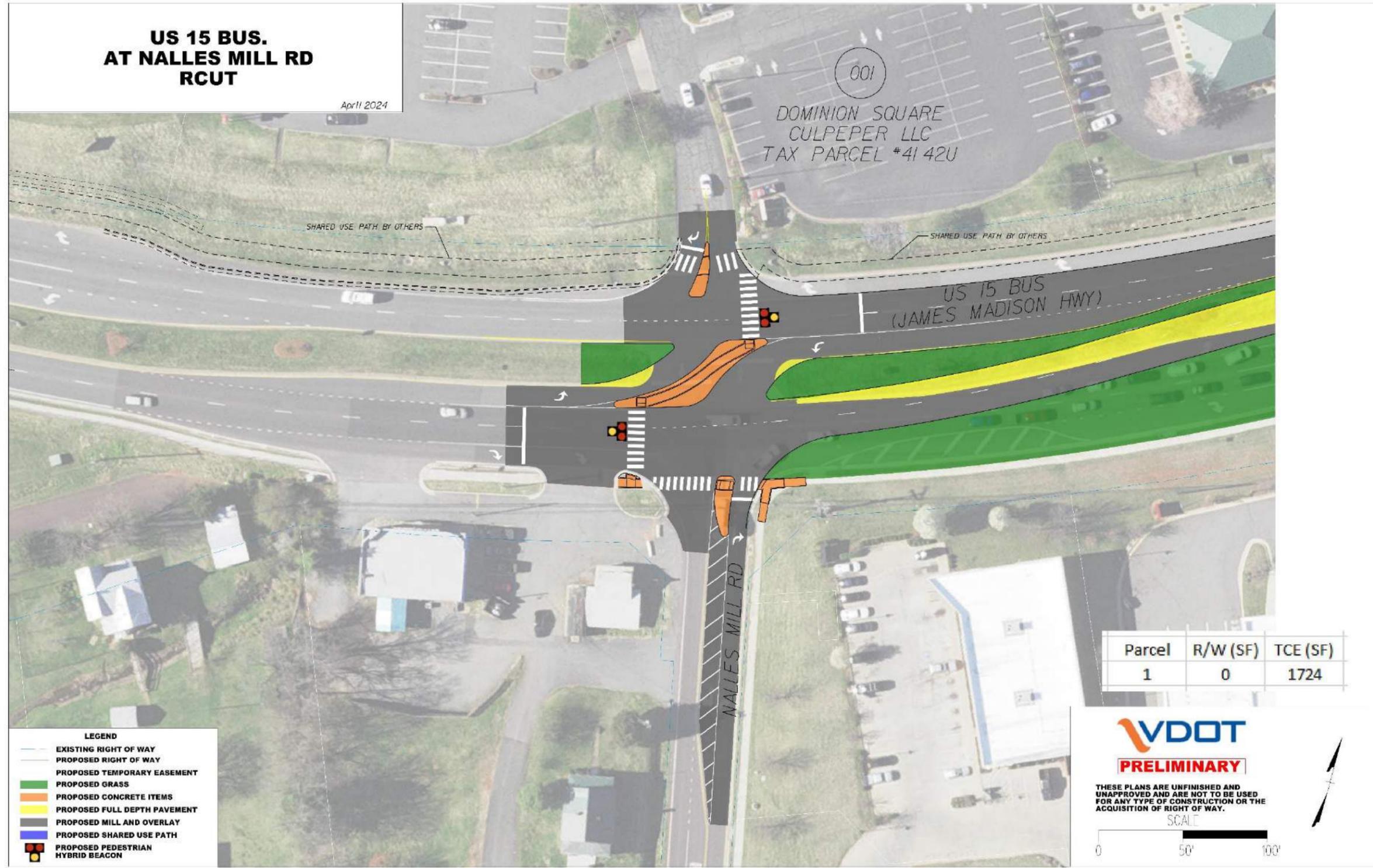


Figure 46: Walmart Roundabout



Figure 47: Ira Hoffman Lane Roundabout

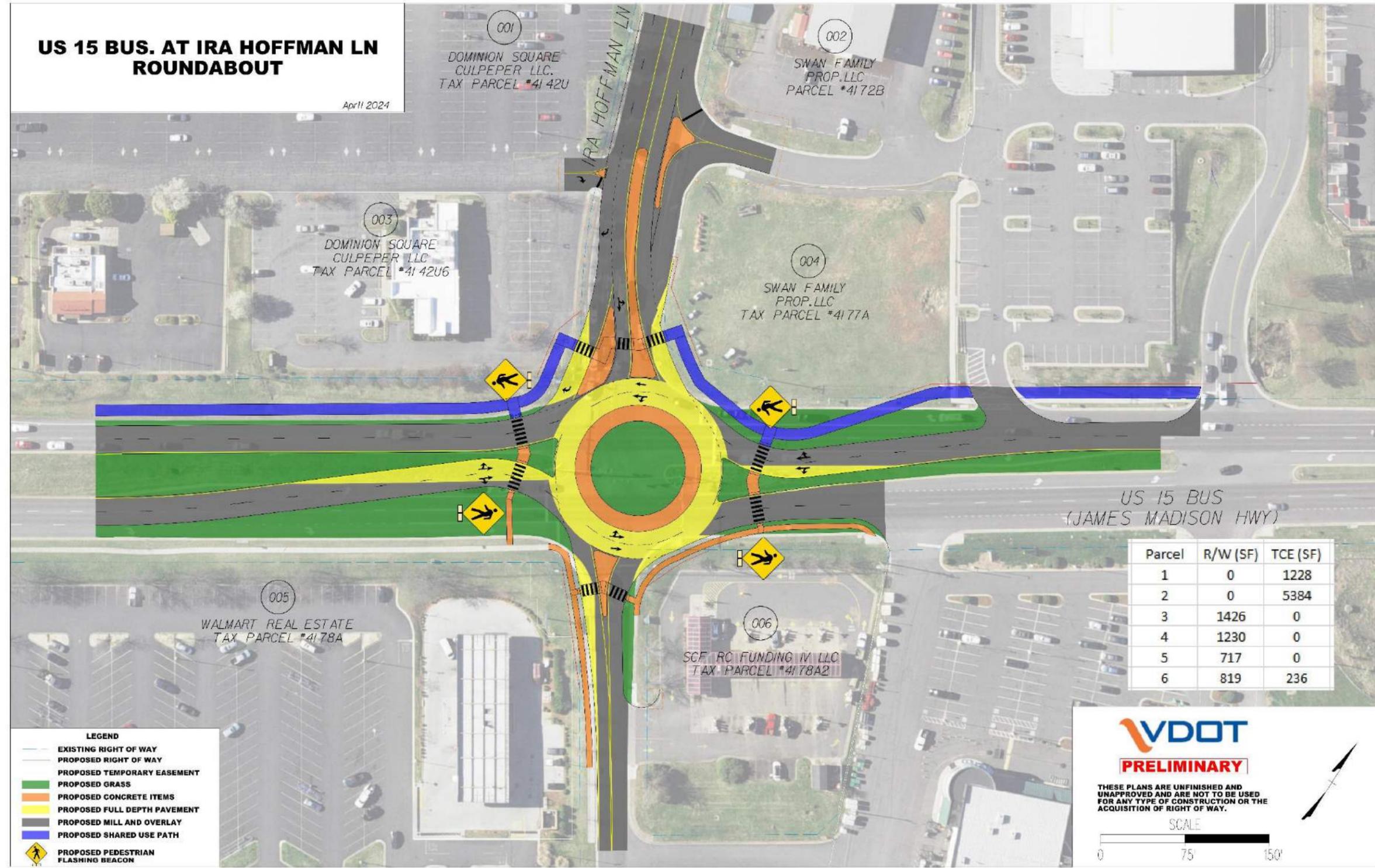


Figure 48: Merge Extension East of Braggs Corner Road/Bradford Road

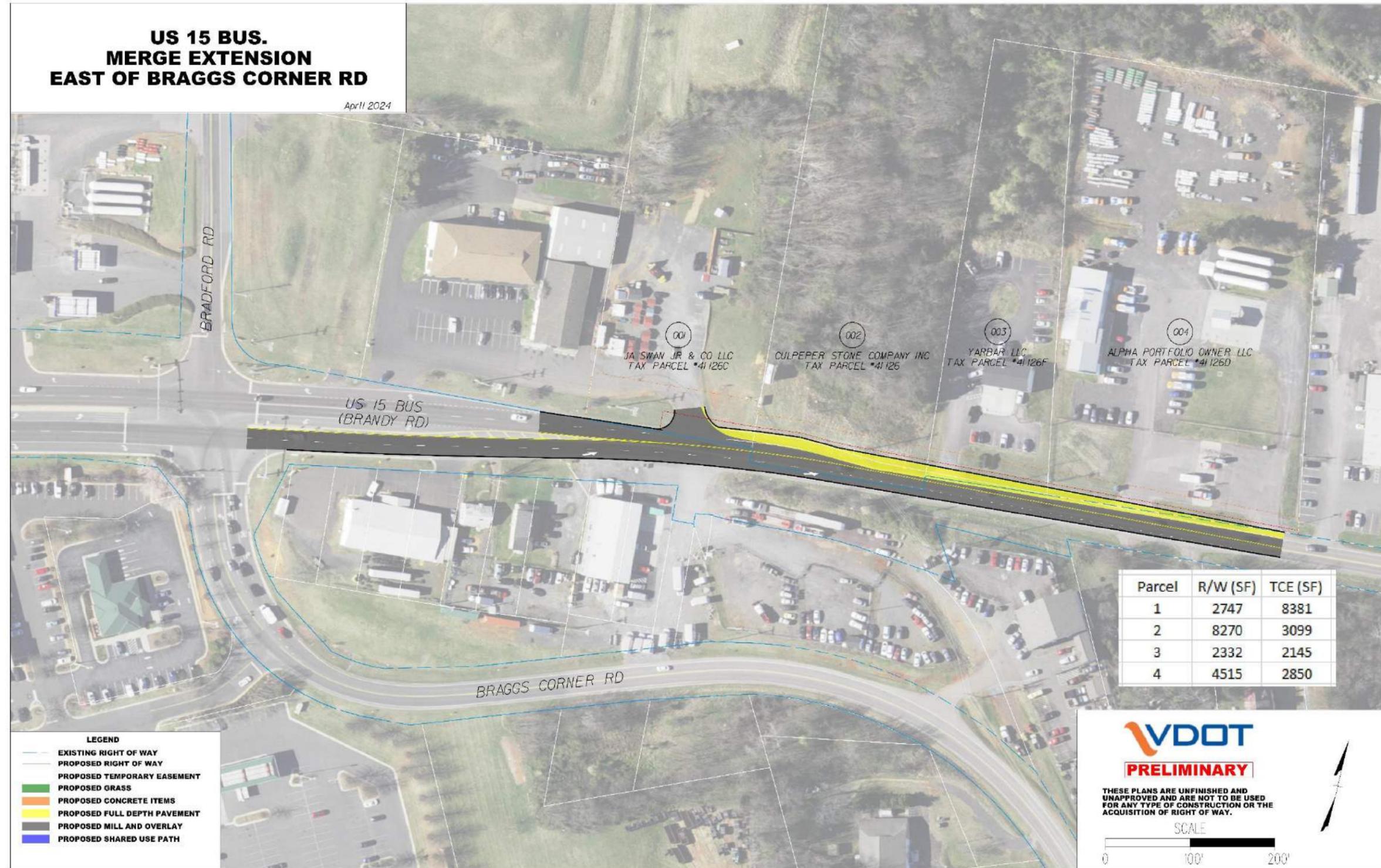


Figure 49: Inlet Road Safety Improvements

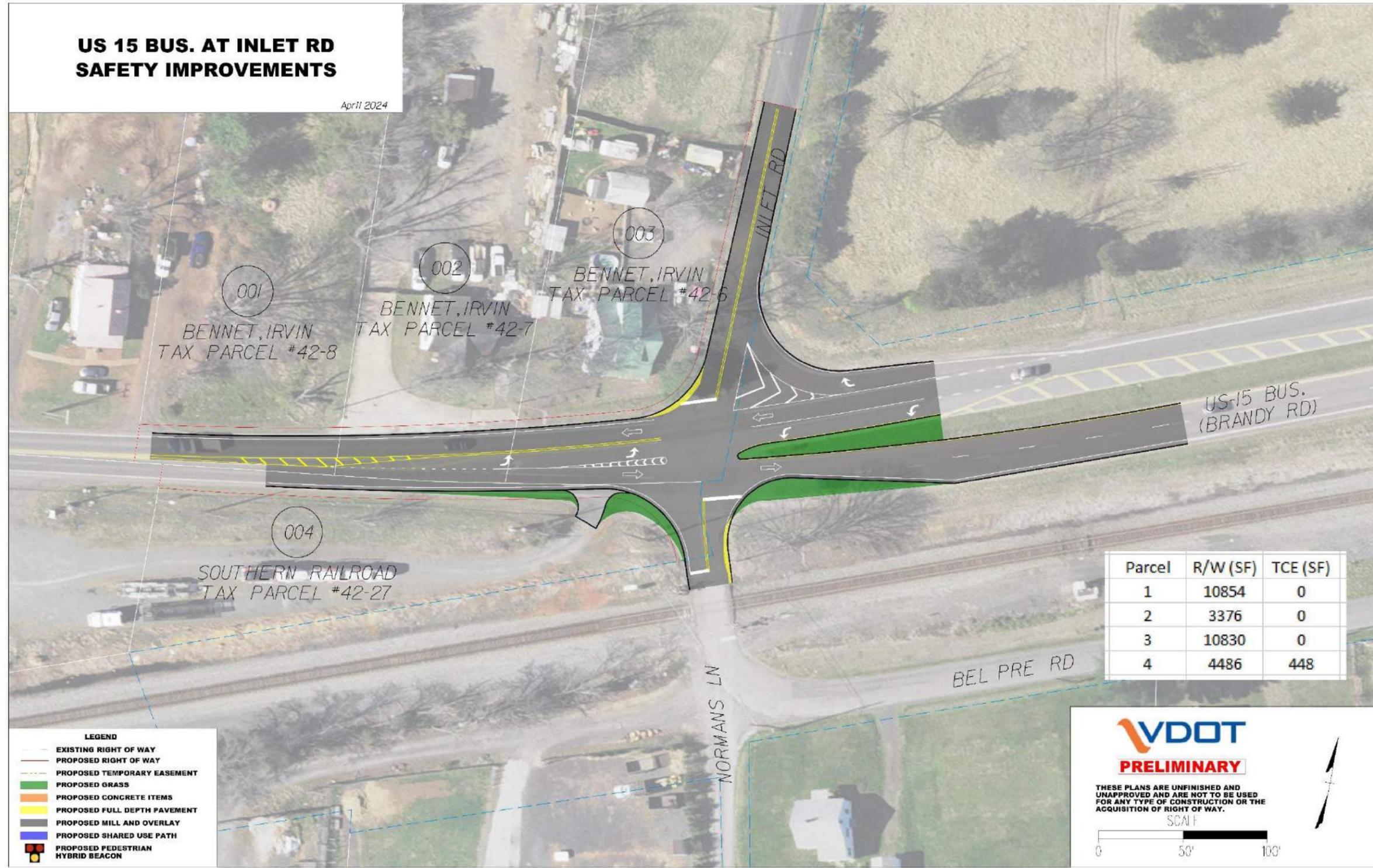


Figure 50: Shared Use Path and Sidewalk

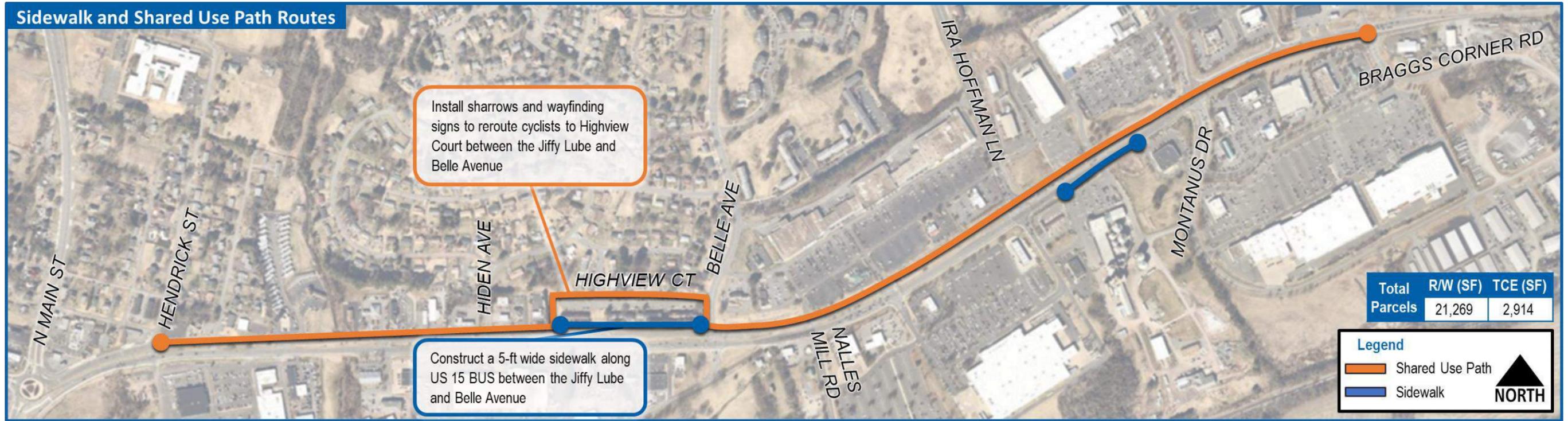


Figure 51: Shared Use Path Cyclist Routing Along Highview Court



## 7 BUILD CONDITIONS ANALYSIS

The study team evaluated the overall performance of the study corridor under Build (2045) AM, PM, and Saturday peak hour conditions. The intent of the Build conditions analyses was to evaluate the effectiveness of the preferred concepts to understand how the improvement projects work in conjunction with one another. Build traffic conditions were modeled using Synchro 11 and SIDRA Intersection 8.

### 7.1 Traffic Operations Analysis Assumptions

The study team used the No-Build conditions Synchro and SIDRA Intersection models as a basis to develop the Build models for peak hour conditions. The study team updated the models with the projected 2045 Build traffic volumes to account for traffic movement restrictions. The projected 2045 AM, PM, and Saturday peak hour traffic volumes for the Build conditions are summarized in [Figure 52](#) and [Figure 53](#). The study team optimized cycle lengths and splits at signalized intersections.

### 7.2 Traffic Operations Analysis Results

The study team used the same MOEs and reporting methodologies as the existing and No-Build conditions traffic operations analysis as documented in [Section 3.2.2](#). Since the proposed roundabouts at the US 15 BUS intersections with Walmart and Ira Hoffman Lane were both signalized intersections, the LOS criteria for signalized criteria was used to allow for a direct comparison between the No-Build and Build conditions.

[Figure 54](#) through [Figure 57](#) show depictive representations of the control delay and queue length for each study intersection during the AM, PM, and Saturday peak hours. Minor street control delay for Nalles Mill Road and Hendrick Street was reported as ETT to reflect additional time motorists must travel plus any delay experienced at adjacent intersections to complete their desired movement. The study team summarized ETT for movements to match the existing lane configuration to facilitate easier comparisons between Existing, No-Build, and Build results.

The study team modeled the PHBs at the US 15 BUS intersections with Culpeper Town Square and Nalles Mill Road to project the delay and 95<sup>th</sup> percentile queue length for mainline through and right-turning vehicles. The study team assumed that the PHB would be activated once per pedestrian and used the existing pedestrian count volumes for each peak hour. The signalized intersection HCM reports showed that the delay for mainline left-turn movements and all side street movements was lower than the unsignalized HCM reports from the No-Build conditions. The study team determined that the PHB should have minimal effect on these movements and reported the unsignalized delay and 95<sup>th</sup> percentile queue lengths from the No-Build analysis as the Build analysis results.

Tables summarizing the delay and queue by lane group, approach, and intersection as well as the full Synchro and SIDRA Intersection reports are included in [Appendix I](#).

#### 7.2.1 AM Peak Hour

##### Control Delay and Level of Service

The proposed improvements were projected to operate similarly to No-Build traffic operations except at the following intersections.

- N Main Street: The eastbound left-turn control delay was projected to increase by 19.2 seconds due to rerouted vehicles from the Hendrick Street RCUT making a westbound U-turn at N Main Street that reduced the number and length of gaps that eastbound motorists could use to enter the roundabout. Despite this increase, the roundabout was projected to remain at LOS C for the overall intersection delay.

- Belle Avenue/Old Brandy Road: Signal optimization and altered vehicle progression through the corridor was projected to reduce control delay on mainline approaches. The largest decrease was projected on the eastbound approach at 22.2 seconds, improving the approach from LOS D to LOS C.
- Nalles Mill Road: ETT for the rerouted northbound movements was projected to be reduced by 34.9 seconds due to a projected reduction in delay for the eastbound U-turn movement at the proposed roundabout at the Walmart intersection.
- Walmart: Control delay on all approaches was projected to be reduced, with the overall intersection delay projected to decrease from 17.1 seconds (LOS B) to 7.7 seconds (LOS A).
- Ira Hoffman Lane: Control delay on all approaches was projected to be reduced, with the overall intersection delay decreasing from 30.3 seconds (LOS C) to 11.4 seconds (LOS B).
- Montanus Drive: The westbound approach delay was projected to be reduced by 19.4 seconds.

##### Queue Length

The proposed improvements were projected to maintain No-Build 95<sup>th</sup> percentile queue lengths except at the following intersections.

- N Main Street: The eastbound left-turn queue was projected to increase by 139 feet. The southbound right-turn queue was projected to decrease by 62 feet. Both queue increases were due to rerouting traffic from the Hendrick Street RCUT.
- Hendrick Street: Allowing only right-turn movements from side streets was projected to reduce side street queues, with the largest decrease of 62 feet occurring for the southbound approach.
- Culpeper Town Square: Mainline movements are no longer free flow due to the PHB. The 95<sup>th</sup> percentile queue length was projected to reach 267 feet for the eastbound through movement when the PHB is called.
- Belle Avenue/Old Brandy Road: Signal optimization and altered vehicle progression through the corridor was projected to decrease the eastbound and westbound through queues by 114 and 91 feet, respectively. The westbound left-turn queues were projected to increase by 60 feet.
- Nalles Mill Road: Mainline movements are no longer free flow due to the PHB. The 95<sup>th</sup> percentile queue length was projected to reach 307 feet for the westbound through movement when the PHB is called.
- Walmart: All queues were projected to decrease, with the largest decrease projected on the eastbound left-turn movement at 154 feet.
- Ira Hoffman Lane: All queues except the eastbound through queue were projected to decrease, with the largest decrease projected on the westbound-through movement at 169 feet. The projected change in the eastbound through queue was negligible.
- Montanus Drive: The westbound and northbound through queues were projected to decrease by 88 and 70 feet, respectively. Eastbound through queues were projected to increase by 86 feet.
- Bradford Road/Braggs Corner Road: Eastbound-through, northbound left-turn, and northbound through queues were projected to decrease by 265, 85, and 88 feet respectively.

#### 7.2.2 PM Peak Hour

##### Control Delay and Level of Service

The proposed improvements were projected to operate similarly to No-Build traffic operations except at the following intersections.

- Hendrick: Experienced travel time for side street movements was projected to increase due to rerouting, with the largest increase projected on the northbound approach at 14.2 seconds, which altered the LOS from C to E.
- Nalles Mill Road: ETT for the rerouted northbound movements was projected to reduce by 59 seconds due to a projected reduction in delay for the eastbound U-turn movement at the proposed roundabout at the Walmart intersection.
- Walmart: Control delay on all but the westbound approach was projected to decrease, with overall intersection delay projected to decrease from 26.2 seconds (LOS C) to 12.2 seconds (LOS B).

- Ira Hoffman Lane: Control delay on all approaches was projected to decrease, with overall intersection delay projected to decrease from 44.4 seconds (LOS D) to 25.8 seconds (LOS C). The southbound approach delay was projected to decrease by 20.9 seconds, with LOS changing from LOS E to LOS D.

#### Queue Length

The proposed improvements were projected to maintain No-Build 95<sup>th</sup> percentile queue lengths except at the following intersections.

- Culpeper Town Square: Mainline movements are no longer free flow due to the PHB. The 95<sup>th</sup> percentile queue length was projected to reach 205 feet for the eastbound through movement when the PHB is called.
- Belle Avenue/Old Brandy Road: Signal optimization and altered vehicle progression through the corridor was projected to increase westbound-through queues by 206 feet.
- Walmart: Eastbound, northbound, and southbound queues were projected to decrease, with the largest decrease of 228 feet occurring for the eastbound left-turn lane.
- Ira Hoffman Lane: Westbound left turn queues were projected to increase by 86 feet. Southbound left-turn and through queues were projected to increase by 193 feet. All other queues were projected to be maintained or reduced, with the largest decrease of 178 feet occurring for the northbound left-through lane.
- Montanus Drive: Eastbound through lane queues were projected to increase by 101 feet, northbound left-turn queues were projected to decrease by 100 feet, and northbound right-turn queues were projected to increase by 118 feet. The increase in northbound right-turn lane queues is due to the reconfiguration of the northbound approach from an exclusive right-turn lane to a shared through-right lane in the Build condition.
- Bradford Road/Braggs Corner Road: Eastbound right-turn queues were projected to decrease by 71 feet. Westbound left-turn queues were projected to increase by 79 feet, due to changing the signal controlled from protected-permissive to protected in the Build condition.

### 7.2.3 Saturday Peak Hour

#### Control Delay and Level of Service

The proposed improvements were projected to operate similarly to No-Build traffic operations except at the following intersections.

- Hendrick: ETT for side street movements was projected to increase due to rerouting, with the largest increase projected of 17.9 seconds for the southbound through and left-turn movements, which altered the LOS from D to E.
- Nalles Mill: ETT for rerouted northbound movements was projected to reduce by 59.9 seconds due to a projected reduction in delay for the eastbound U-turn movement at the proposed roundabout at the Walmart intersection.
- Walmart: Control delay on all approaches was projected to reduce, with overall intersection delay projected to decrease from 28.7 seconds (LOS C) to 14.1 seconds (LOS B).
- Ira Hoffman Lane: Control delay was projected to decrease on the westbound approach by 19.3 seconds and on the southbound approach by 43 seconds. Control delay was projected to increase on the northbound approach by 45.2 seconds. The study team assumed no change in peak hour volumes between the No-Build and Build conditions analysis. However, motorists leaving the shopping center with Walmart may elect to avoid the delay on the northbound approach at Ira Hoffman Lane and use the northbound approach at the Walmart intersection, which is projected to operate at LOS C.

#### Queue Length

The proposed improvements were projected to maintain No-Build 95<sup>th</sup> percentile queue lengths except at the following intersections.

- Culpeper Town Square: Mainline movements are no longer free flow due to the PHB. The 95<sup>th</sup> percentile queue length was projected to reach 251 feet for the eastbound through movement when the PHB is called.

- Belle Avenue/Old Brandy Road: Signal optimization and altered vehicle progression through the corridor was projected to increase westbound-through queues by 114 feet.
- Nalles Mill Road: Mainline movements are no longer free flow due to the PHB. The 95<sup>th</sup> percentile queue length was projected to reach 392 feet for the westbound through movement when the PHB is called.
- Walmart: Eastbound, westbound, and southbound queues were projected to be maintained or reduced, with the largest projected reduction in queues of 176 feet occurring for the eastbound left-turn movement.
- Ira Hoffman Lane: All queues were projected to decrease except for the eastbound left-turn, northbound left-turn, and northbound through-right turn, which were projected to increase by 144, 578, and 351 feet, respectively.
- Montanus Drive: Eastbound left-turn and through queues were projected to increase by 75 and 132 feet, respectively. Northbound left-turn and through queues were projected to reduce by 100 and 151 feet, respectively. Northbound right-turn queues were projected to increase by 150 feet due to there no longer being an exclusive right-turn lane in the Build configuration.
- Bradford Road/Braggs Corner Road: Eastbound left-turn and through queues were projected to increase by 47 and 71 feet, respectively.

Figure 52: 2045 Build Weekday Peak Hour Traffic Volumes

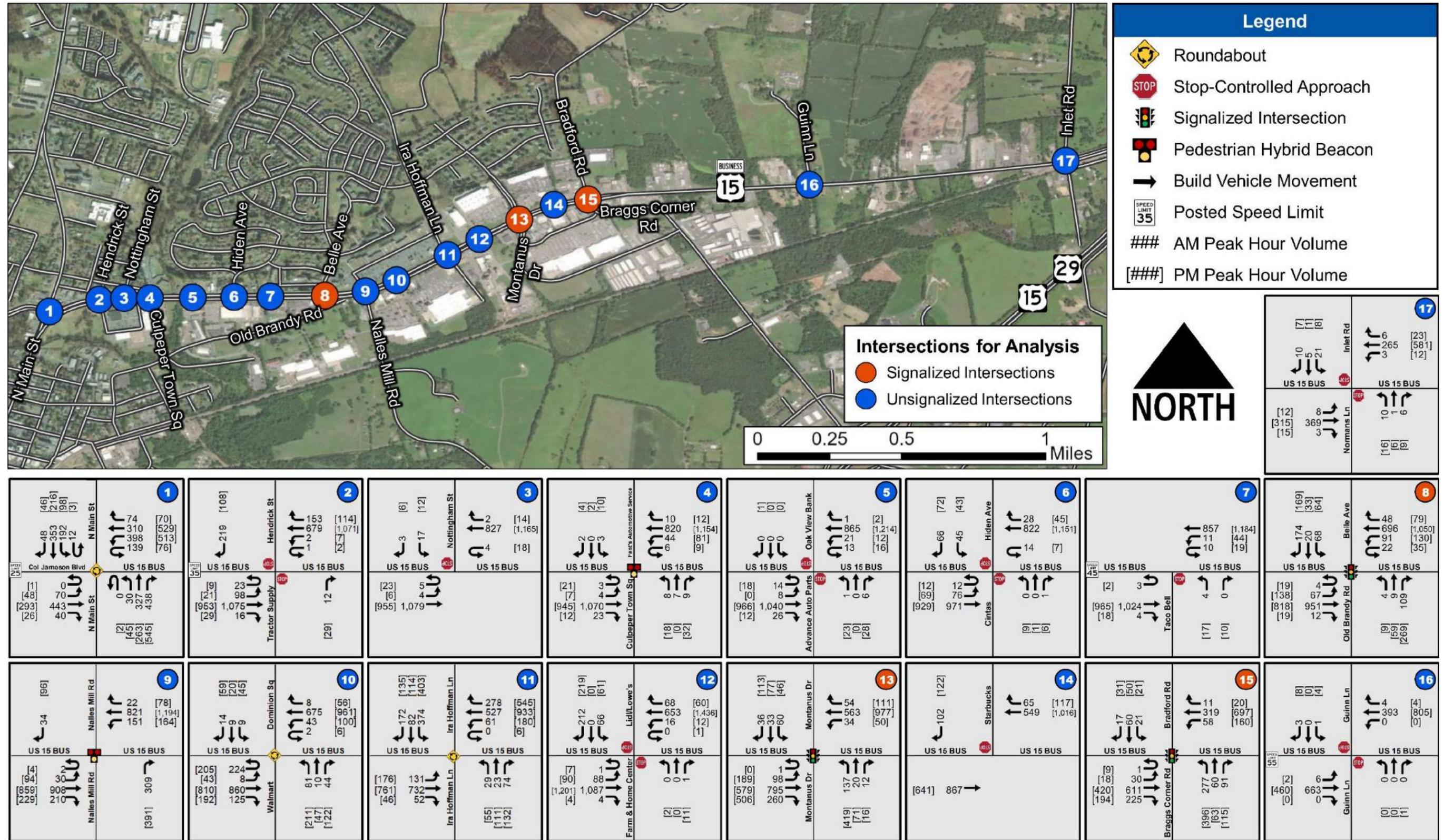


Figure 53: 2045 Build Saturday Peak Hour Traffic Volumes

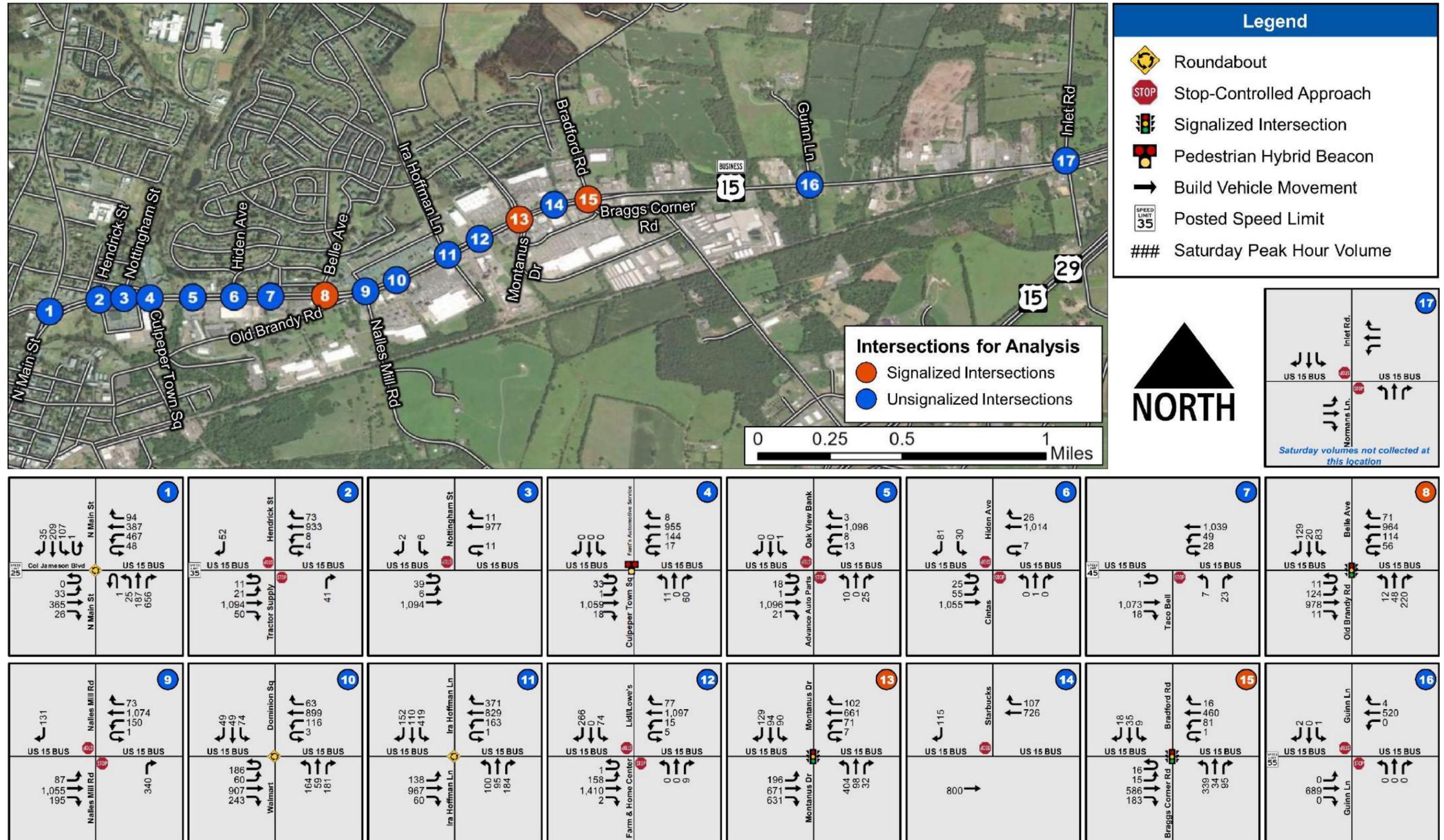


Figure 54: 2045 Build Weekday Peak Hour Control Delay and LOS

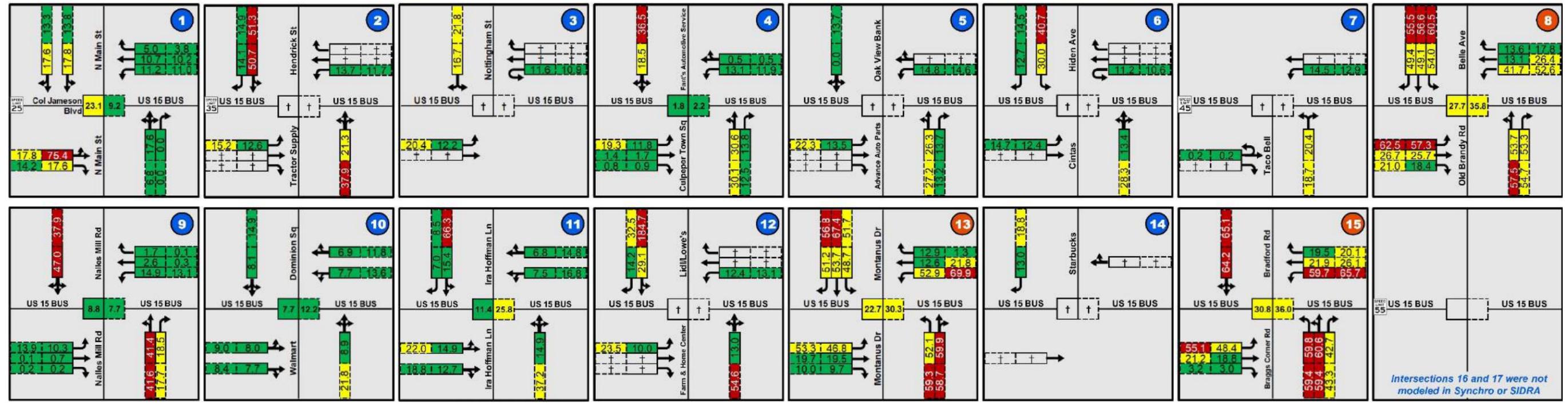
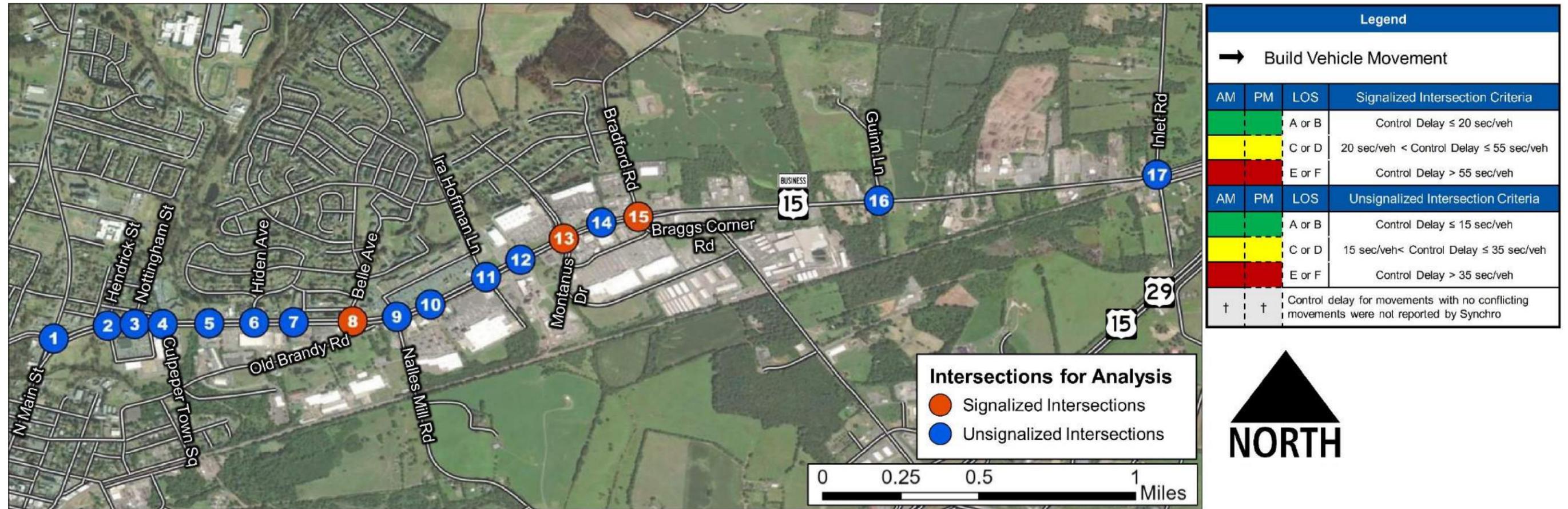


Figure 55: 2045 Build Saturday Peak Hour Control Delay and LOS

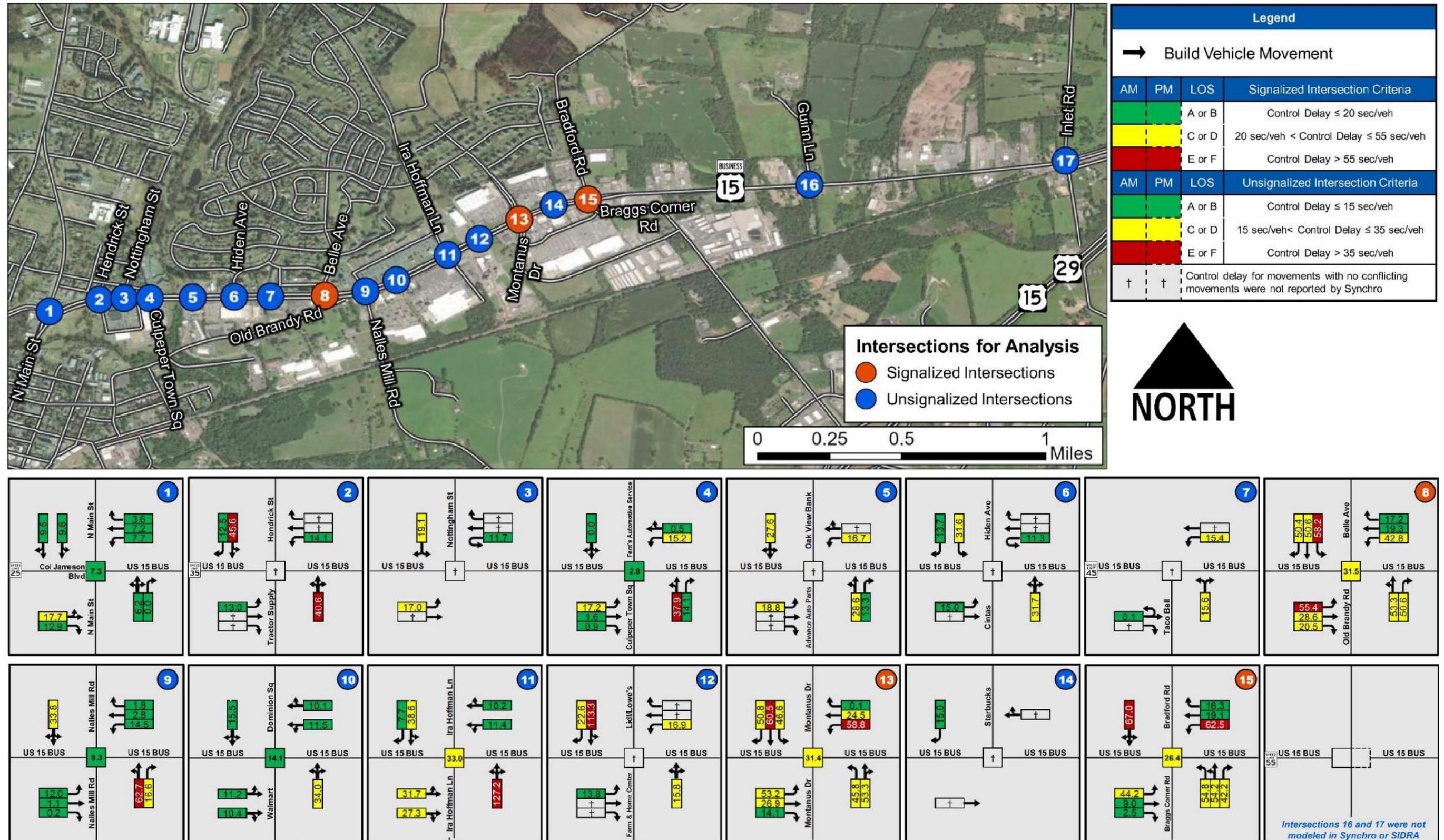


Figure 56: 2045 Build Weekday Peak Hour 95th Percentile Queues

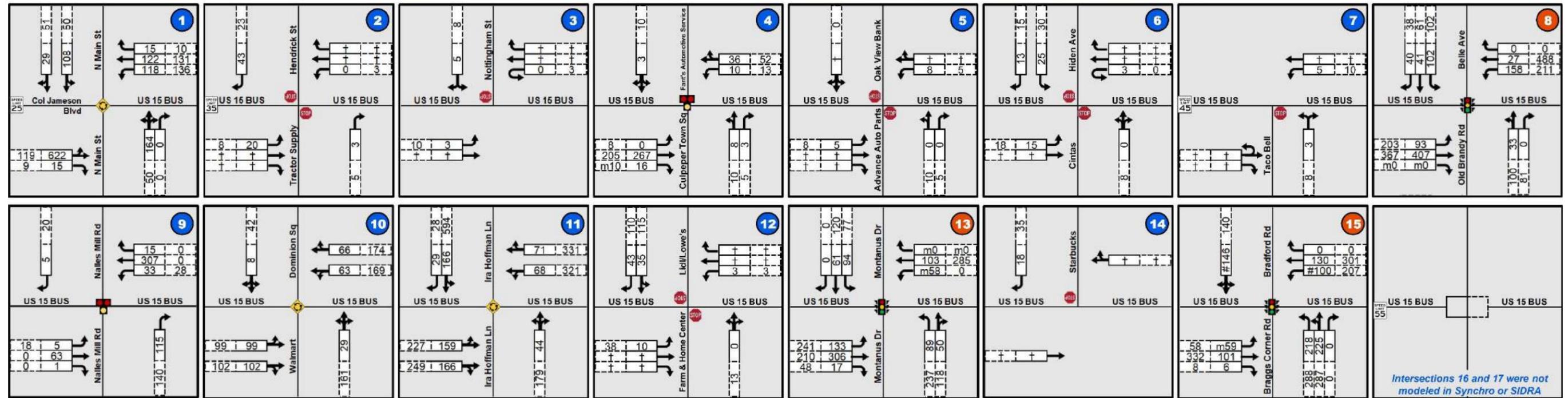
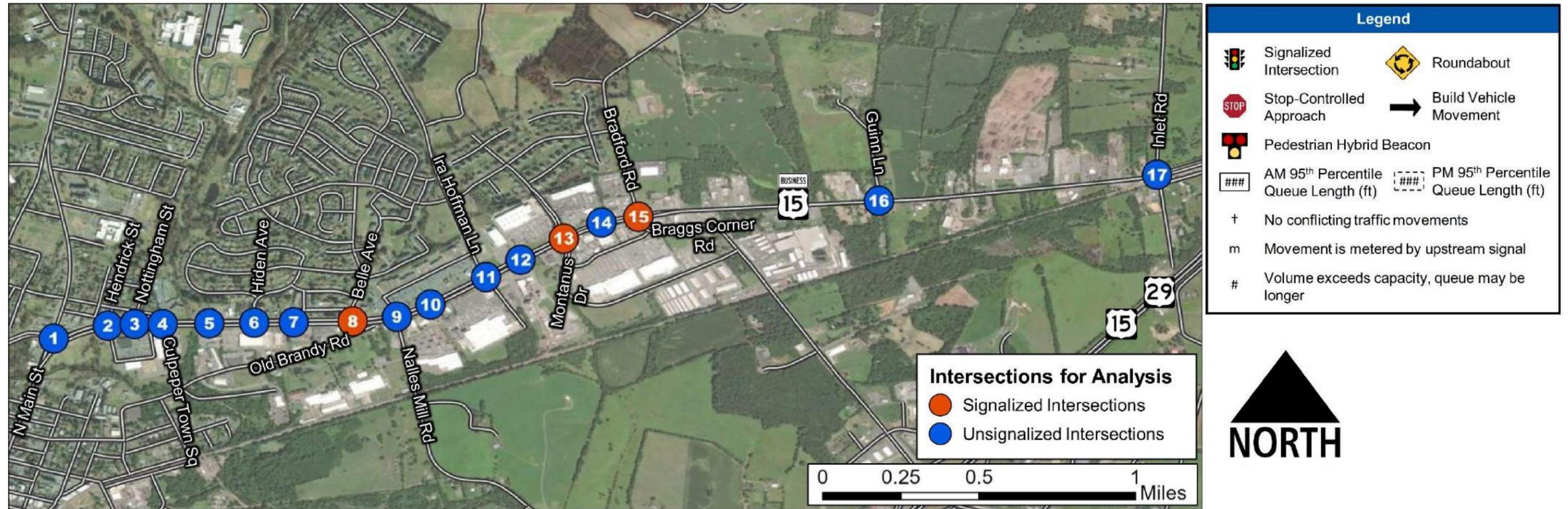
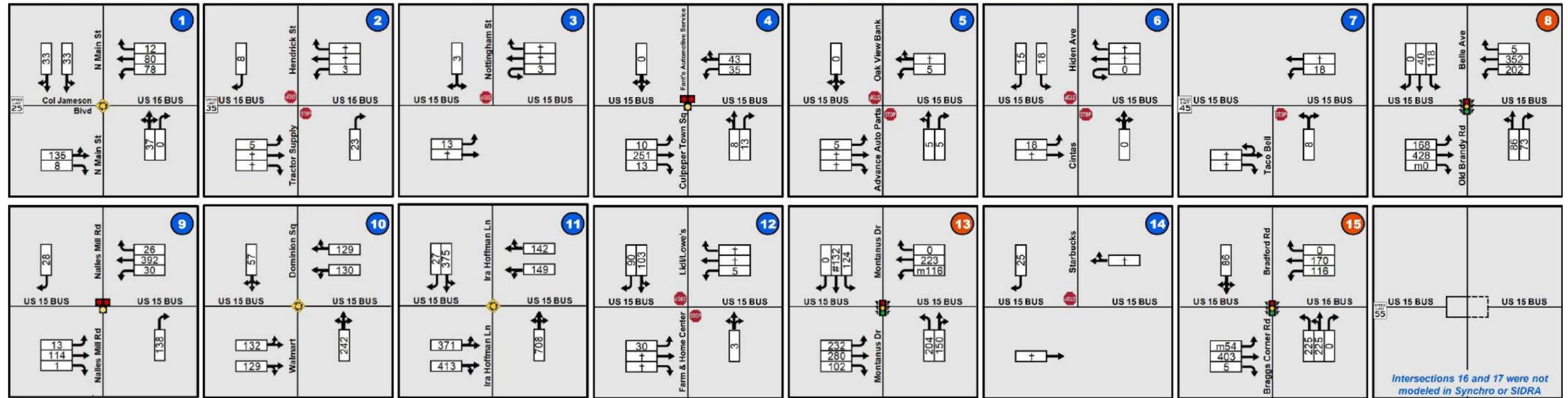
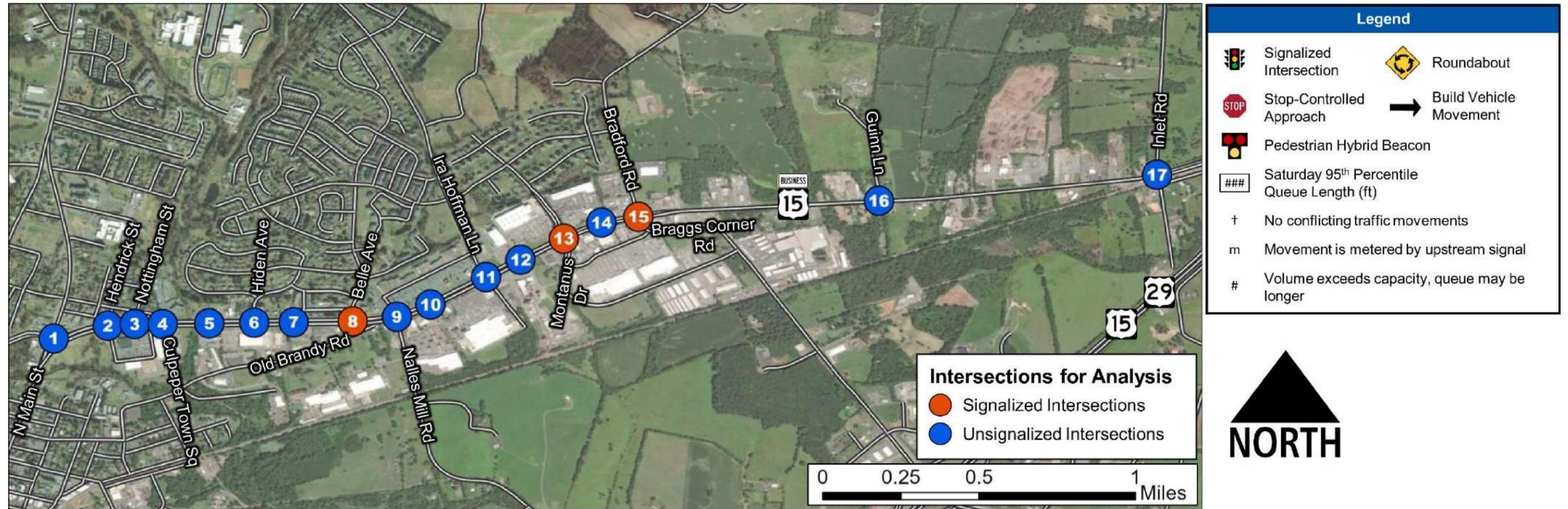


Figure 57: 2045 Build Saturday Peak Hour 95th Percentile Queues



### 7.3 Safety Analysis

The study team reviewed and applied CMFs from the VDOT State Preferred CMF List and the VDOT SMART SCALE Round 5 CMF List to determine the projected safety benefit of each recommended improvement. The resulting projected reduction in fatal and injury (F+I) crashes is documented in [Table 17](#).

**Table 17: Projected Reductions in Fatal and Injury Crashes**

Location	Concept	Applicable F+I Crashes	CMF	5-Year F+I Crash Reduction
Hendrick St to Bradford Rd	Shared Use Path	2*	0.75*	0.5*
		4^	0.12^	3.5^
Hendrick St	RCUT	10	0.37	6.3
Culpeper Town Sq	Pedestrian Hybrid Beacon	2^	0.453^	1.1^
Belle Ave	Pedestrian Improvements	1^	0.75^	0.3^
Nalles Mill Road	RCUT	61	0.37	38.4
Walmart	Roundabout	13	0.22	10.1
	Pedestrian Flashing Beacon	1^	0.526^	0.5^
Ira Hoffman Ln	Roundabout	35	0.22	27.3
	RI/RO at Dominion Square Shopping Center	7	0.20	5.6
Braggs Corner Rd/Bradford Rd	Protected Mainline Left Turns	8	0.01	7.9

\*Cyclist crashes only

^ Pedestrian crashes only

The following safety benefits are projected at locations where no CMF is available or in locations where a CMF was available but there were no applicable crashes:

- The crosswalk and pedestrian flashing beacons at N Main Street are projected to increase pedestrian safety on all legs of the roundabout.
- The pedestrian hybrid beacons at Culpeper Town Square and Nalles Mill Road are projected to increased pedestrian safety for pedestrians crossing US 15 BUS.
- The sidewalk between Ira Hoffman Lane and Montanus Drive is projected to increase pedestrian safety along US 15 BUS.
- The merge extension east of Braggs Corner Road/Bradford Road is projected to allow motorists more time to merge after passing through the intersection. The extension will also allow motorists to navigate around left-turning vehicles at the driveways near the existing merge point where rear-end crashes have occurred.
- The enhanced lane markings and signage at Inlet Road are projected to increase driver awareness and recognition of the potential conflicts at the intersection

## 8 CONCEPTUAL DESIGN, COSTS, AND SCHEDULES

### 8.1 Conceptual Design

Conceptual designs were developed in MicroStation for the proposed improvements in accordance with the following applicable guidelines:

- A Policy on Geometric Design of Highways and Streets (AASHTO 2018)
- Guide for the Development of Bicycle Facilities (AASHTO 2012)
- VDOT Road Design Manual (Issued January 2005, Revised July 2022)
- VDOT Road and Bridge Standards (VDOT 2016, Revised September 2022)
- Manual on Uniform Traffic Control Devices (MUTCD 2023)
- 2011 Virginia Supplement to the MUTCD

Design criteria and guidance from these documents were applied to roadways within the project limits based on functional classification and roadway design speeds.

### 8.2 Planning-Level Cost Estimates and Schedules

The study team developed a refined planning-level cost estimate, in 2024 dollars for each improvement. The cost estimate included a preliminary engineering (PE) cost that ranges from 15 to 35 percent of the construction estimate based on project size and project complexity. For projects with anticipated right-of-way and/or utility impacts, right-of-way and utility relocation costs will be developed by VDOT; however, the study team estimated square footage of right-of-way to be purchased and square footage of temporary construction easements needed for each project. These estimates are included in [Figure 41](#) through [Figure 50](#), where applicable. The breakdown of estimates on a per parcel basis for the shared use path are shown in [Appendix H](#). The study team estimated the construction costs for major items based on recent bid costs from VDOT projects. In addition to construction costs, the study team conducted a deterministic risk-based analysis for each concept to develop contingencies. The risk analysis added a 20 percent contingency to the base construction cost for unidentified items, a 15 percent contingency for supply chain issues and extra ordinary market pressures, a 5 to 7.5 percent contingency for management reserve/construction contract (per IIM-LD-249), and a 15 percent contingency for construction engineering and inspection (CEI). [Table 18](#) summarizes the preliminary engineering (PE), construction (CN), and total planning-level cost estimates for each improvement.

The cost for sections of the shared use path that connect with the Walmart and Ira Hoffman Lane roundabouts are included in the roundabout cost estimates as well as in the overall shared use path estimate.

The study team also developed planning-level schedule estimates for each proposed improvement, which are summarized in [Table 19](#).

Table 18: Planning-Level Cost Estimates

Improvement	Cost Estimate (2024 Dollars)		
	Preliminary Engineering	Construction	Total
Shared Use Path and Sidewalk	\$1,774,000	\$9,230,000	\$11,004,000
N Main St Pedestrian Improvements	\$575,000	\$649,000	\$1,224,000
Hendrick St RCUT	\$575,000	\$567,000	\$1,142,000
Culpeper Town Square Pedestrian Crossing	\$575,000	\$1,477,000	\$2,052,000
Belle Ave/Old Brandy Rd Pedestrian Improvements	\$743,000	\$2,108,000	\$2,851,000
Nalles Mill Rd RCUT	\$627,000	\$1,779,000	\$2,406,000
Walmart Roundabout	\$1,847,000	\$8,946,000	\$10,793,000
Ira Hoffman Ln Roundabout and RI/RO at Dominion Square Shopping Center	\$1,761,000	\$8,207,000	\$9,968,000
Montanus Dr Concurrent Left-Turn Phasing	\$327,000	\$919,000	\$1,246,000
Braggs Corner Rd/Bradford Rd Protected Mainline Left-Turns	\$38,000	\$106,000	\$144,000
Merge Extension East of Braggs Corner Road	\$839,000	\$2,372,000	\$3,211,000
Inlet Rd Safety Improvements	\$272,000	\$766,000	\$1,038,000

Table 19: Planning-Level Schedule Estimates

Improvement	Schedule Estimate (Months)			
	Preliminary Engineering	Right-of-Way and Utilities	Construction	Total
Shared Use Path and Sidewalk	24	24	24	72
N Main St Pedestrian Improvements	12	0	6	18
Hendrick St RCUT	12	6	8	26
Culpeper Town Square Pedestrian Crossing	18	6	10	34
Belle Ave/Old Brandy Rd Pedestrian Improvements	12	6	12	30
Nalles Mill Rd RCUT	12	4	12	28
Walmart Roundabout	18	12	24	54
Ira Hoffman Ln Roundabout and RI/RO at Dominion Square Shopping Center	18	12	24	54
Montanus Dr Concurrent Left-Turn Phasing	6	0	9	15
Braggs Corner Rd/Bradford Rd Protected Mainline Left-Turns	6	0	6	12
Merge Extension East of Braggs Corner Road	18	18	18	54
Inlet Rd Safety Improvements	24	12	12	48

## 9 PROJECT ADVANCEMENT

This study should be used as a planning tool to achieve the next steps of programming, designing, and constructing the identified safety, multimodal, and operational improvements within the study area. To continue the progress from this study, the Town of Culpeper, Culpeper County, and VDOT should coordinate with regional stakeholders to pursue the advancement and funding of the recommendations outlined in this study.

### 9.1 Preparing Projects for Advancement

Following the selection of the preferred alternatives, the study team developed project summary sheets that include a brief project description, planning-level cost estimate, and planning-level schedule estimate for the full set of recommended improvements. The project summary sheets are provided in [Appendix J](#). The study team also considered several options for the Town of Culpeper, Culpeper County, and VDOT to package or phase improvements to allow for more flexibility in pursuing and attaining funding. Overall, the study team identified that each improvement could work effectively if constructed independently or in any sequence with respect to other improvements. Therefore, the Town of Culpeper, Culpeper County, and VDOT may pursue funding of improvements in any order and may package improvements if desired.

While the study team determined that the two recommended roundabouts at Walmart and Ira Hoffman Lane could be built in any sequence without operational challenges, the Town of Culpeper should consider building the roundabout at Walmart first. Assuming the planned directional median is built at Nalles Mill Road prior to either roundabout being funded, the roundabout at Walmart is projected to accommodate the increased eastbound U-turns at Walmart caused by rerouted turns at Nalles Mill Road better than a signalized intersection.

The study team also considered logical termini for a phased construction of the shared use path and sidewalk project should the Town of Culpeper decide to break the project into phases. The study team proposed the following sections for the phased construction of the shared use path and sidewalk project:

1. Hendrick Street to Belle Avenue/Old Brandy Road
2. Belle Avenue/Old Brandy Road to Nalles Mill Road
3. Nalles Mill Road to Ira Hoffman Lane\*
4. Ira Hoffman Lane to Bradford Road/Braggs Corner Road

\*The section of shared use path between Nalles Mill Road and Ira Hoffman Lane could be constructed as an isolated project or be included as part of the scope for the proposed roundabouts at Walmart and Ira Hoffman Lane. The cost of the shared use path is included in the cost estimates for the two roundabouts since it is assumed that if the shared use path was constructed prior to the construction of the roundabouts, the shared use path would need to be reconstructed as part of the roundabout project.

### 9.2 Applying for Funding

The following funding sources may be considered to advance the recommendations identified in this plan:

- **Congestion Mitigation and Air Quality (CMAQ):** A federal program that allocates funding to surface transportation projects that improve air quality by reducing congestion.
- **Highway Safety Improvement Program (HSIP):** A federal program that provides funding for systemic improvements, such as upgrading pedestrian crossings or installing high visibility signal backplates, that correct or improve safety on a section of roadway or at an intersection that experience high crash incidents.
- **Revenue Sharing:** A state program that provides a dollar-for-dollar state match to local funds for construction, reconstruction, improvement, and/or maintenance transportation projects.
- **SMART SCALE:** A state program that allocates funding to transportation projects based on congestion mitigation, economic development, accessibility, safety, environmental quality, and land use.
- **Community Development Block Grants (CDBG):** A federal program that provides funding opportunities for transportation projects that aim to develop viable urban communities by providing a suitable living environment and expanding economic activities, principally for persons of low- and moderate-income.
- **Transportation Alternatives (TA):** A federal program that provides funding opportunities for pedestrian and bicycle facilities and requires a 20% match of local funds.