Fairfax County, Virginia

SHREVE ROAD CORRIDOR STUDY

December 2020

VDOT Virginia Department of Transportation

KITTELSON & ASSOCIATES

Shreve Road Corridor Study

Fairfax County, Virginia

Prepared For:
Virginia Department of Transportation
4975 Alliance Drive
Fairfax, VA 22030
(800) 367-7623

Prepared By:
Kittelson & Associates, Inc.
11480 Commerce Park Drive, Suite 450
Reston, VA 20191
(703) 885-8970

Lardner/Klein Landscape Architects, P.C.
815 North Royal Street, suite 200
Alexandria, VA 22314
(703) 739-0972

Project Managers: Amelia Martin, P.E.
Project Principals: Alek Pochowski, P.E. and Chris Tiesler, P.E.
Project Analyst: Mateo Van Thienen

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Shreve Road is a two-lane major collector roadway in Fairfax County, Virginia that runs from Lee Highway (Route 29) to Leesburg Pike (Route 7), where it becomes Haycock Road. Shreve Road is primarily surrounded by single-family residential uses and community destinations such as Shrevewood Elementary School, Jefferson District Park, businesses near Route 7, and the Poplar Heights Recreation Association. Separate pedestrian and bicycle facilities are present along Shreve Road, including the Washington & Old Dominion Trail (W&OD Trail) and pedestrian paths maintained by the Fairfax County Department of Transportation (FCDOT). The road is a truck-restricted route for through trucks, but some uses exist along the corridor that are served by heavy vehicles, such as the Dominion Power Substation and Vulcan Materials Company.

An impaired driver crash resulting in a pedestrian fatality occurred in the study area in Summer 2019. For many in the community, this highlighted the importance of evaluating safety conditions along the 2.3-mile corridor. Therefore, this study was conducted to understand the short- and long-term improvements being implemented by all stakeholders, define corridor challenges and opportunities, develop potential multimodal solutions to address safety and mobility needs, evaluate the effectiveness of these solutions, identify potential funding sources, and prioritize improvements where appropriate. The study was led by VDOT, as the agency responsible for managing the roadway, and Kittelson and Associates, Inc. with Lardner/Klein Landscape Architects (the Study Team) in consultation with the City of Falls Church, Fairfax County, NOVA Parks, and the Shreve Road Community Working Group. VDOT has not committed to implementing any of the recommendations. Funding for implementation of recommended improvements is competitive and may come from a variety of sources such as capital improvement projects, ongoing stormwater management infrastructure improvements, funding programs for pedestrian and bicycle safety, or through cooperative actions that are part of the ongoing redevelopment activity in the corridor, among others.

The study took place between April and December 2020 and included two virtual meetings with the study's Internal Management Team, one virtual meeting with the Community Working Group, and one virtual public information meeting. Recommendations were developed based on findings from the Study Team's existing conditions analysis and presented to the Internal Management Team, Community Working Group and the general public. The Study Team gathered feedback during these meetings to inform the development of the final recommendations.

Details about the goals and objectives, existing conditions analysis, alternatives development, and prioritization process are included in this Executive Summary.

INTRODUCTION

The Study Team developed goals and objectives for this study based on input from the Community Working Group. After reviewing information already provided by VDOT and the Community Working Group, the goal and five objectives for the study were identified:

Goal: Identify short- and/or long-term recommendations to address safety along the corridor.

- Objective 1: Provide more comfortable conditions for people walking and biking.
- Objective 2: Reduce conflicts between modes where activity points interface with Shreve Road, like Shrevewood Elementary School and the W&OD Trail.
- Objective 3: Identify design measures to reduce vehicle travel speeds along the corridor.
- Objective 4: Reduce impediments to sight lines, especially where pedestrians and bicycles are obstructed.
- Objective 5: Develop recommendations that are feasible, implementable, and/or appropriate for grant (funding) applications.

The vehicular, pedestrian and bicycle facilities were evaluated in the study area between Route 7 and Route 29. To better understand conditions along the W&OD Trail, the study scope also included the portion of the W&OD Trail between Shreve Road and Idylwood Park. The following intersections were selected for detailed analysis during the Weekday AM (6-9 AM) and Weekday PM (4-7 PM) time periods:

1. Shreve Road / Fairwood Lane
2. Shreve Road / Shrevewood Elementary School Driveway (1)
3. Shreve Road / Shrevewood Elementary School Driveway (2)
4. Shreve Road / Virginia Lane
5. Shreve Road / Pinecastle Road / Buckelew Drive

EXISTING AND BASELINE CONDITIONS ANALYSIS

Existing and 2030 baseline conditions were analyzed using an inventory of area facilities, review of previous studies and in-process improvements, review of community feedback, vehicle/pedestrian/bicycle/mode share data, crash data, speed data, and field visits. Traffic conditions were projected to a 2030 design year for longer-term operations. Notable findings of these analyses are as follows:

- Sidewalks are generally less than four feet wide in the study area, which reflect the Fairfax County development standards at the time many of these neighborhoods were constructed, and are substandard by current VDOT's standards.
- Several studies and improvements have been contemplated or completed along Shreve Road, including a previous VDOT speed study, striping improvements in front of Shrevewood Elementary School, a Safe Routes to School (SRTS) grant at Shrevewood Elementary School, a

W&OD Trail Crossing project on Shreve Road, and a City of Falls Church multi-use path project between Route 7 and Hickory Street.

- Initial community concerns noted pedestrian/bicycle and safety issues along the corridor.
- Daily W&OD Trail pedestrian/bicycle traffic is estimated to be approximately 20 percent of the daily vehicle traffic along Shreve Road.
- Crash details were available for crashes that occurred between January 2013 and May 2020. A review of historical crash data revealed that 31% of crashes were angle-related crashes, followed by fixed object crashes (25%). The majority of crashes were property damage only (PDO) crashes (55%).
    - Crash details show that 24% of crashes occurred in rainy conditions.
    - Driver behaviors were contributing factors, with distracted driving being a factor in 28% percent of crashes, speeding contributing to 18% of crashes, and alcohol/drug use contributing to 8% of crashes.
    - One fatal pedestrian crash took place near the Hickory Curve, where alcohol/drug use was also a contributing factor.
- Speeding has been observed along the corridor. The corridor's posted speed is generally 35 mph, and 85th percentile speeds range from 31-42 mph.
- All study intersections operate at uncongested conditions during the weekday morning and evening peak hours.
- The Shreve Road/Virginia Lane, Shreve Road/Buckelew Drive, and Shreve Road/Pinecastle Road intersections could operate with congested conditions during at least one peak hour under 2030 conditions.

ALTERNATIVES DEVELOPMENT

In collaboration with VDOT and Stakeholders, alternatives were developed considering corridor-wide recommendations, short-term recommendations, long-term recommendations, and leveraging in-process improvements. The Study Team first conducted an initial screening of potential recommendations to explore feasibility. Recommendations screened out based on cost, property impacts, or consistency with stakeholder agency guidance/policy included:

- Speed limit reduction,
- Bike lane feasibility and shared-used path opportunities,
- Speed humps,
- Stop signs,
- Radar signs,
- Grade-separated pedestrian/bicycle crossings,
- Guardrail, and
- Realignment of the Hickory and Oldewood Curves.

The remaining alternatives were developed to achieve the study's objectives: improve walking and biking, reduce conflicts at activity points, reduce vehicle travel speeds, reduce impediments to sight lines, and ensure feasibility for implementation and funding. The resulting recommendations include near-term solutions that focus on immediate, low-cost, easily implemented improvements for the corridor. Additionally, longer-term alternatives were developed for more permanent solutions through the identified design year 2030. Recommendations included:

- Neighborhood Gateway,
- Optical Speed Bars,
- Chicane,
- Pedestrian Median,
- Roundabouts or Median Removal,
- Mini Roundabouts,
- Vegetation Management, and
- Urban Cross Section.

NEXT STEPS & PRIORITIZATION

The feedback collected from the community provided critical direction when finalizing the recommendations for the Shreve Road corridor. The project objectives, community feedback, and suggestions from Stakeholders provided important information to finalize and prioritize the recommendations. The major takeaways from the community feedback process are:

- Approximately 70 community members attended the Virtual Public Information Meeting;
- The Study Team received feedback from over 60 community members throughout the project;
- Feedback was tallied to determine which recommendations were most popular, with recommendations in front of Shrevewood Elementary School and at Pinecastle Road/Buckelew Drive attracting the most comments; and
- Comments for and against roundabout concepts were generally evenly split.

Based on this feedback, the Study Team made the following final short-term recommendations in order from highest priority to lowest priority:

1. Add Pedestrian Beacons for W&OD Trail Crossings
2. Incorporate Pedestrian Median into SRTS Design at Fairwood Lane
3. Add and Upgrade Shreve Road Pedestrian Connections
4. Install Optical Speed Bars and Implement Vegetation Management

Similarly, the Study Team made the following final long-term recommendations in order from highest priority to lowest priority:

1. Advance the Roundabout Alternative Near Shrevewood Elementary School
2. Advance the Chicane Design at Pioneer Lane

3. Coordinate Potential Bicycle Speed Treatments for the W&OD Trail
4. Develop a Neighborhood Gateway Near Route 29
5. Consider an Urban Cross Section between Route 7 and Gordons Road
6. Potentially Revisit Mini Roundabouts at Pinecastle Road and Buckelew Drive

The following lists the general next steps anticipated in moving forward with the higher-priority recommendations:

- Coordination between VDOT, County staff, and elected officials to identify potential funding sources/mechanisms towards higher-priority recommendations.
- Refine the design of recommendations, including detailed cost estimates to support funding applications.
- Continue public outreach regarding advancing any recommendations and solicit feedback.

These next steps should provide a pathway toward implementing a feasible and publicly supported project on Shreve Road that achieves the project goals of the community, Stakeholders, and VDOT.

SECTION 2

INTRODUCTION

INTRODUCTION

PROJECT DESCRIPTION

Shreve Road is a two-lane major collector roadway in Fairfax County, Virginia that runs from Lee Highway (Route 29) to Leesburg Pike (Route 7), where it becomes Haycock Road. Shreve Road is primarily surrounded by single-family residential uses and community destinations such as Shrevewood Elementary School, Jefferson District Park, businesses near Route 7, and the Poplar Heights Recreation Association. Separate pedestrian and bicycle facilities are present along Shreve Road, including the Washington & Old Dominion Trail (W&OD Trail) and pedestrian paths maintained by the Fairfax County Department of Transportation (FCDOT). The road is a truck-restricted route for through trucks, but some uses exist along the corridor that are served by heavy vehicles, such as the Dominion Power Substation and Vulcan Materials Company.

An impaired driver crash resulting in a pedestrian fatality occurred in the study area in Summer 2019. For many in the community, this highlighted the importance of evaluating safety conditions along the 2.3-mile corridor. Through conversations with the community, VDOT conducted a speed study in October 2019 and made recommendations to lower the speed limit from 35 mph to 30 mph for a portion of the corridor. VDOT also conducted a review of signage on Shreve Road and has replaced/relocated signage and installed pavement markings.

The Shreve Road Community Working Group, composed of nearly 300 neighbors and 9 community associations surrounding Shreve Road, has also identified longer-term concerns for the corridor. The community working group provided a memorandum to VDOT in November 2019, outlining concerns related to speeding, pedestrian safety, sight distance, and drainage. Four priority areas were also identified by the community working group, including:

- Curve southwest of Oldewood Drive,
- Shrevewood Elementary School,
- W&OD Trail crossings, and
- Curve between Chestnut Street and Hickory Street.

Future growth is expected to continue in the area, including the West Falls Church Economic Development Project and the West Falls Church Transit Station Area Study. Therefore, VDOT and other stakeholders have identified the need to evaluate Shreve Road in the context of other development activities. The study area and major existing/proposed uses are shown on **Figure 2-1**.

Figure 2-1 Study Area Map

This study aims to understand the short- and long-term improvements being implemented by all stakeholders, define corridor challenges and opportunities, develop potential multimodal solutions to address safety and mobility needs, evaluate the effectiveness of these solutions, identify potential funding sources, and prioritize improvements where appropriate.

The study was led by VDOT and Kittelson and Associates, Inc. (Kittelson) in consultation with the City of Falls Church, Fairfax County, NOVA Parks, and the Shreve Road Community Working Group. Long-term potential treatments included a variety of mitigations, including widening/adding sidewalks and reconfiguring key intersections. Near-term alternatives focused on immediate, low-cost, easily implemented improvements for the corridor. This is a study phase and does not set construction dates for any of the alternatives. The purpose of this study is to develop proposed recommendations that localities can apply for to develop all or some of the recommendations.

PROJECT GOALS AND OBJECTIVES

The Study Team developed goals and objectives for this study based on input from the Community Working Group, in particular the November 2019 memorandum, which identified safety as the primary concern. While the Community Working Group also identified concerns related to flooding and drainage, these issues are not the primary focus of this study. However, stormwater management improvements may be developed as long-term recommendations are designed and constructed.

The goal of the Shreve Road Corridor Study is to identify short- and/or long-term recommendations to address safety along the corridor.

After reviewing information already provided by VDOT and the Community Working Group, five objectives have been identified:

Objective 1: Provide more comfortable conditions for people walking and biking.

This could include widening sections of sidewalk, providing more direct connections to destinations, reducing conflicts between modes, reducing vehicular speeds, adding or modifying street crossings, or providing street furnishings.

Objective 2: Reduce conflicts between modes where activity points interface with Shreve Road, like Shrevewood Elementary School and the W&OD Trail.

Intersections near activity clusters have been identified as areas of concern by the Working Group along Shreve Road at Virginia Lane, the W&OD crossing between Pinecastle Road and Buckelew Drive, and Shrevewood Elementary School.

Objective 3: Identify design measures to reduce vehicle travel speeds along the corridor

Speeding influences the perceived safety of all roadway users traveling along the corridor. As noted in the speed study conducted by VDOT, the current geometric features of the roadway help to govern

the travel speeds for the roadway. As such, design changes could help to reduce vehicle travel speeds.

Objective 4: Reduce impediments to sight lines, especially where pedestrians and bicycles are obstructed.

The Working Group identified several locations where roadway geometry and intersections may reduce sight lines. While it may be desirable to align the roadway from a vehicular perspective, these types of changes make it easier to drive at higher speeds, undermining Objective 3. As such, locations where sight lines of people walking and biking would be especially vulnerable should be prioritized for this objective. Beyond roadway realignment, improvements could include landscaping changes.

Objective 5: Develop recommendations that are feasible, implementable, and/or appropriate for grant (funding) applications

VDOT and other stakeholders have already expressed an interest that the study identifies future actions and next steps. Some recommendations may have a smaller impact but are more easily implemented in the short-term with minimal coordination. Other recommendations may be more comprehensive but require additional coordination and/or applying for grant funding. This objective will ensure recommendations strike an appropriate balance between implementation level-of-effort and safety benefits.

SCOPE OF THE REPORT

The scope of this effort is to conduct a corridor study of Shreve Road between Route 7 and Route 29. Primary tasks for this effort include:

- Conduct stakeholder and public outreach;
- Develop a matrix of project goals and objectives;
- Evaluate existing and future needs of the corridor based on previous studies, planned improvements, and existing vehicular travel demand characteristics;
- Develop short- and long-term improvements for the corridor as a whole and at spot locations; and
- Coordinate with VDOT and stakeholders to determine next steps following recommendations development and public outreach.

The roadway and trail facilities were evaluated in the study area between Route 7 and Route 29. To better understand conditions along the W&OD Trail, the study scope also includes the portion of the trail between Shreve Road and Idylwood Park. Data already collected for some local streets near Route 7 was also considered in evaluating Shreve Road. This allowed the Study Team to understand Shreve Road within the context of the surrounding local roads, as well as considering its classification as a collector roadway.

The four (4) priority areas described by the Community Working Group were considered for more thorough evaluation. To reiterate, these areas included:

1. Curve southwest of Oldewood Drive,
2. Shrevewood Elementary School,
3. W&OD Trail crossings, and
4. Curve between Chestnut Street and Hickory Street.

Based on these priority areas and the system of local streets served by Shreve Road, the following five (5) intersections were selected for detailed analysis:

6. Shreve Road / Fairwood Lane
7. Shreve Road / Shrevewood Elementary School Driveway (1)
8. Shreve Road / Shrevewood Elementary School Driveway (2)
9. Shreve Road / Virginia Lane
10. Shreve Road / Pinecastle Road / Buckelew Drive

For traffic operations analysis, the following time periods were evaluated:

- Weekday AM (6-9 AM) and
- Weekday PM (4-7 PM).

SECTION 3

EXISTING AND BASELINE CONDITIONS ANALYSIS

EXISTING AND BASELINE CONDITIONS ANALYSIS

To establish existing conditions and understand how future development may impact the Shreve Road study area, an existing and baseline conditions analysis was completed. This included the following tasks:

- Conducting an inventory of facilities in the study area,
- Reviewing previous studies, completed improvements, and in-process improvements in the area,
- Summarizing community feedback,
- Reviewing data related to vehicle volumes, pedestrian/bicycle volumes, and mode share in the study area,
- Completing a safety and speed analysis using previously collected crash and speed data.
- Evaluating peak hour intersection operations, and
- Conducting a field visit.

These tasks are discussed in more detail in the following sections.

INVENTORY OF FACILITIES

To understand the transportation characteristics of the study area, the Study Team reviewed the surrounding land uses and transit stops. As shown on **Figure 3-1**, residential land uses make up the majority of the study area while mixed-use and retail corridors along Route 7 and Route 29 border the study area. Bus stops are located along Route 29, while the West Falls Church Metro Station is north and west of Route 7.

The presence and width of sidewalks and the W&OD Trail varies along Shreve Road and the surrounding local streets. In general, sidewalks in the study area are less than four feet wide. The sidewalk and trail network within the study area is shown on **Figure 3-2.** The sidewalk ends on north side of the road from Gordons Road to Chestnut Street, and from Pioneer Lane to Route 29. The sidewalk also ends on the south side of the road from Buckelew Drive to Wieland Place, and partially between Wieland Place and Patricia Court. Lastly, there is a sidewalk gap requiring a detour around Holmes Run near Route 29.

An inventory of features that may impact construction feasibility and cost, including bridges and culverts, was prepared and is shown on **Figure 3-3**. Bridges and culverts not directly on Shreve Road are relevant to the corridor as these structures may require redesign for more impactful construction work. Finally, an inventory of travel lanes, sidewalks, bicycle lanes, and on-street parking was also conducted for Shreve Road. This information is summarized in **Table 3-1**.

Figure 3-1 Existing Land Uses and Transit Stops

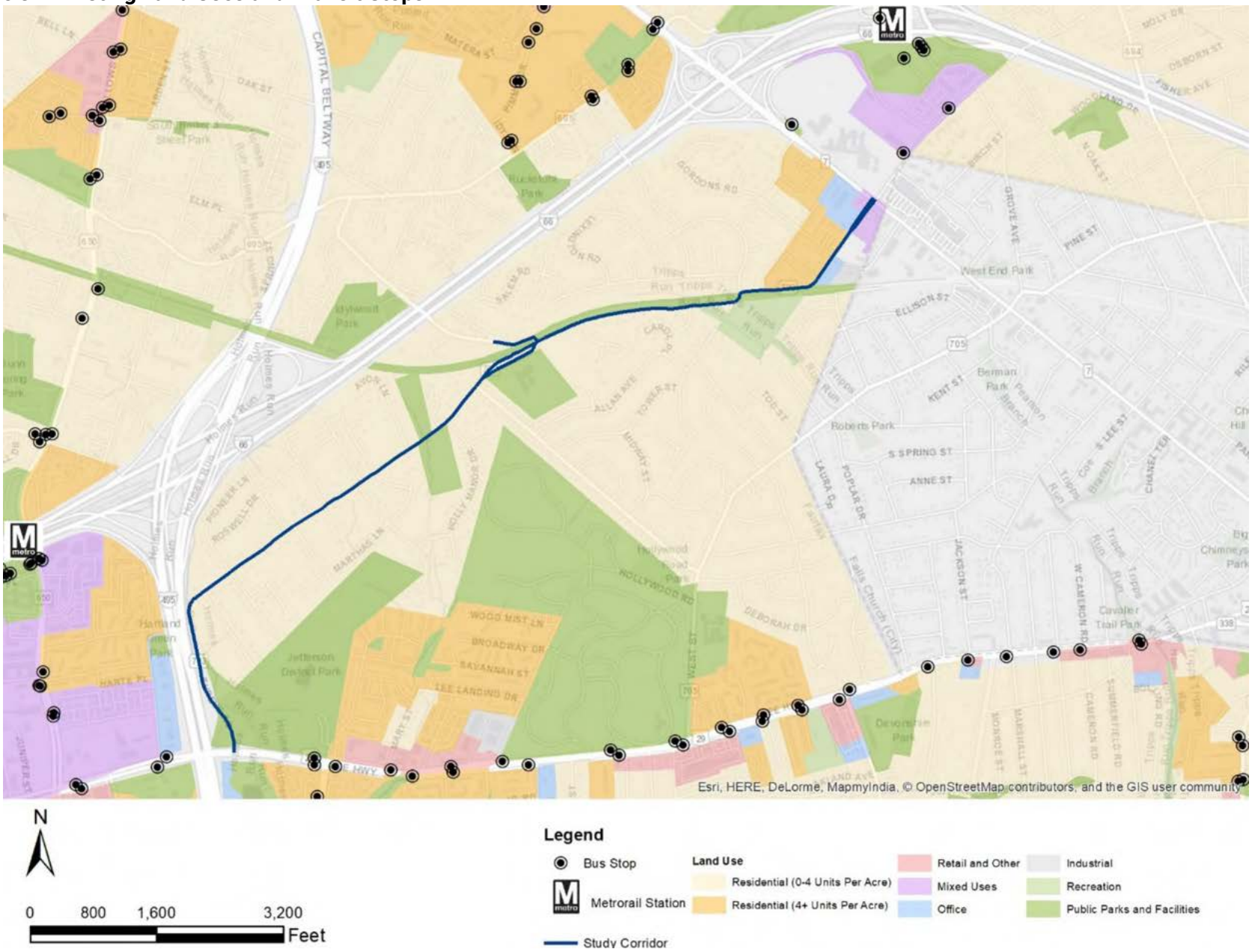


Figure 3-2 Existing Sidewalk and Trail Network

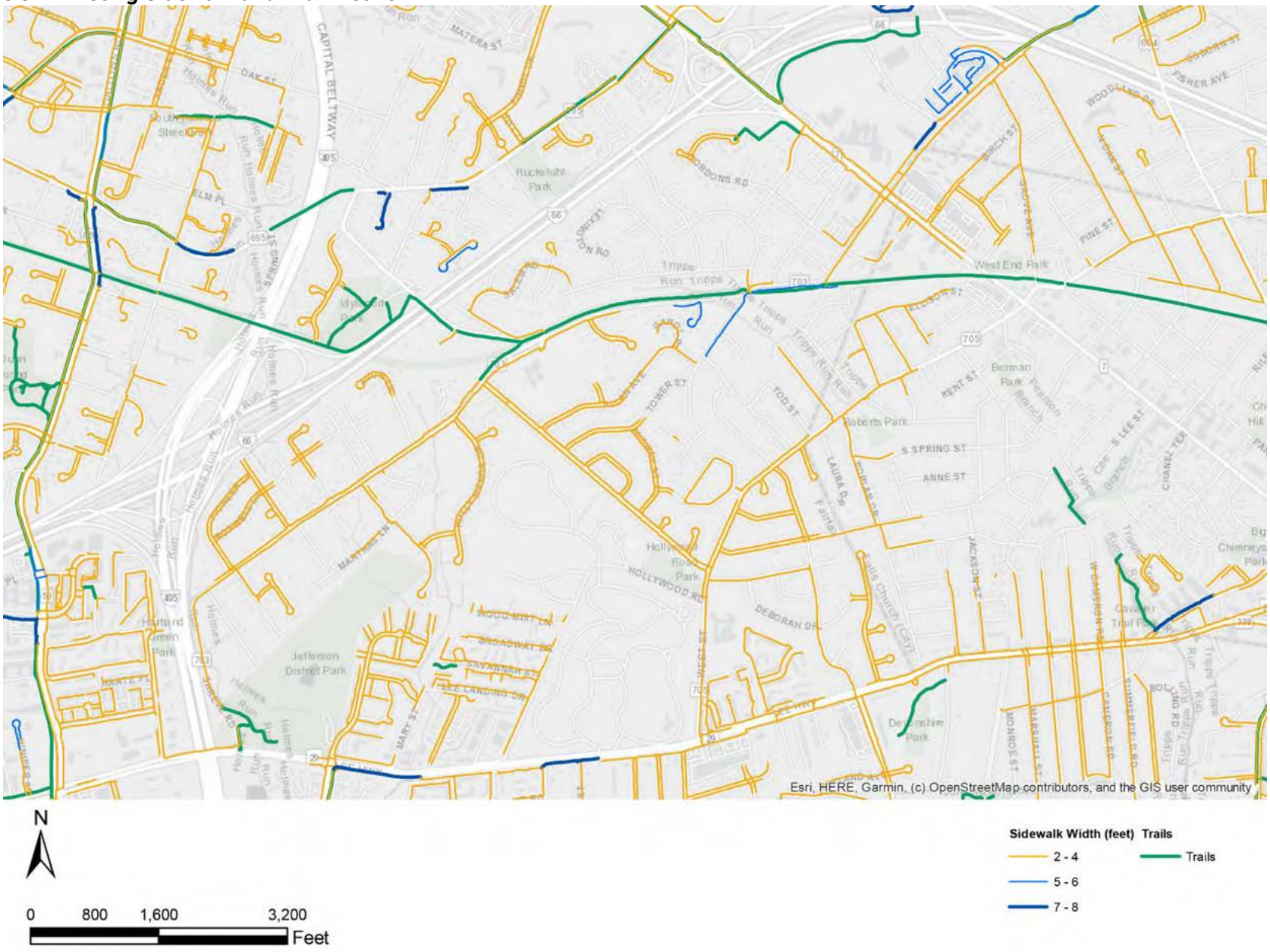


Figure 3-3 Existing Right-of-Way, Utilities, Culverts, and Flood Hazard Areas

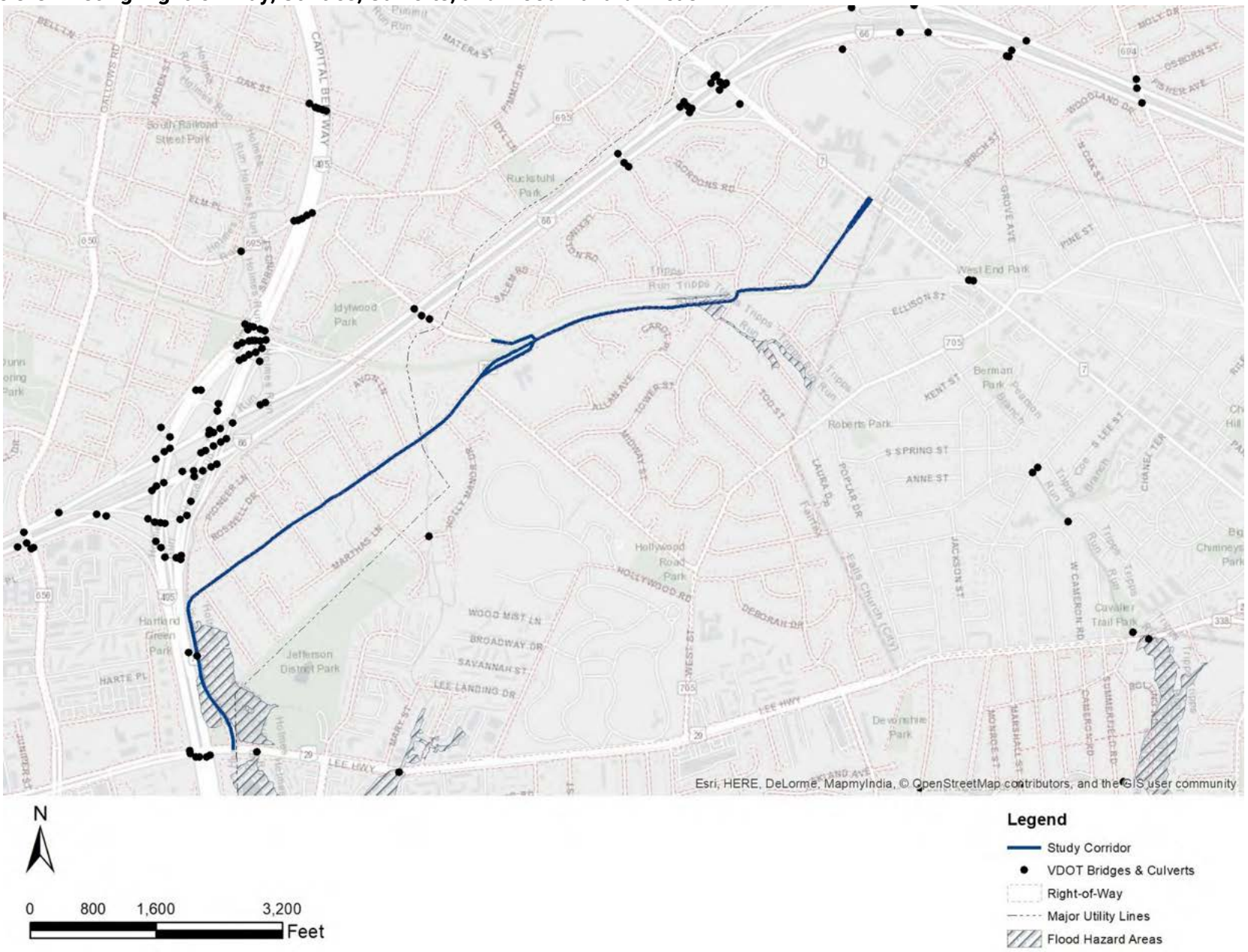


Table 3-1 Existing Transportation Facilities Along Shreve Road

Roadway Segment	Functional Classification	Number of Lanes	Posted Speed (MPH)	Sidewalks	Bicycle Lanes	On-Street Parking
Route 29 to Oldewood Drive	Major Collector	2 Lanes	35	One side	No	No
Oldewood Drive to Fairwood Lane	Major Collector	2 Lanes	35	Both sides	No	No
Fairwood Lane to Virginia Lane	Major Collector	2 Lanes - Divided	35	Both sides[1]	No	Yes
Virginia Lane to Patricia Court	Major Collector	2 Lanes	35	One side	No	No
Patricia Court to Weiland Place	Major Collector	2 Lanes	35	One side (partial)	No	No
Weiland Place to Pinecastle Road	Major Collector	2 lanes	30	None	No	No
Pinecastle Road to Chestnut Street	Major Collector	2 Lanes	30	One side	No	No
Chestnut Street to Hickory Street	Major Collector	2 Lanes	30	None	No	No
Hickory Street to Gordons Road	Major Collector	2 lanes	30	One side[2]	No	No
Gordons Road to Route 7	Major Collector	2 lanes	30	Both sides	No	Yes

[1]W&OD Trail serves as an extension of the west side sidewalk.
[2]A leg of the W&OD Trail serves as a sidewalk on the east side of Shreve Road.

PREVIOUS STUDIES, COMPLETED IMPROVEMENTS, AND IN-PROCESS IMPROVEMENTS

Several studies and improvements have been contemplated or completed along Shreve Road and in the surrounding area. A summary of these studies and improvements is provided below. Any data from these studies are discussed in more detail in the Data Collection and Safety/Speed Analysis evaluations later in this Section.

VDOT Speed Study and Completed Improvements

In October 2019, VDOT completed a speed limit study on Shreve Road as a response to a request from the Shreve Road Community Working Group. The study analyzed traffic volumes and speeds at six locations along the corridor. Based on the study's findings, VDOT lowered the posted speed limit from 35 mph to 30 mph on Shreve Road from Leesburg Pike to Wieland Place.

The study also analyzed road characteristics, roadside development, parking practices, pedestrian activity, and traffic control devices. The study recommended relocating and upgrading warning signs, adding regulatory signs, adding arrow and edge line pavement markings, adding object markers and chevrons, and trimming bushes. Recommendations were implemented shortly after completion of the speed study in Fall 2019.

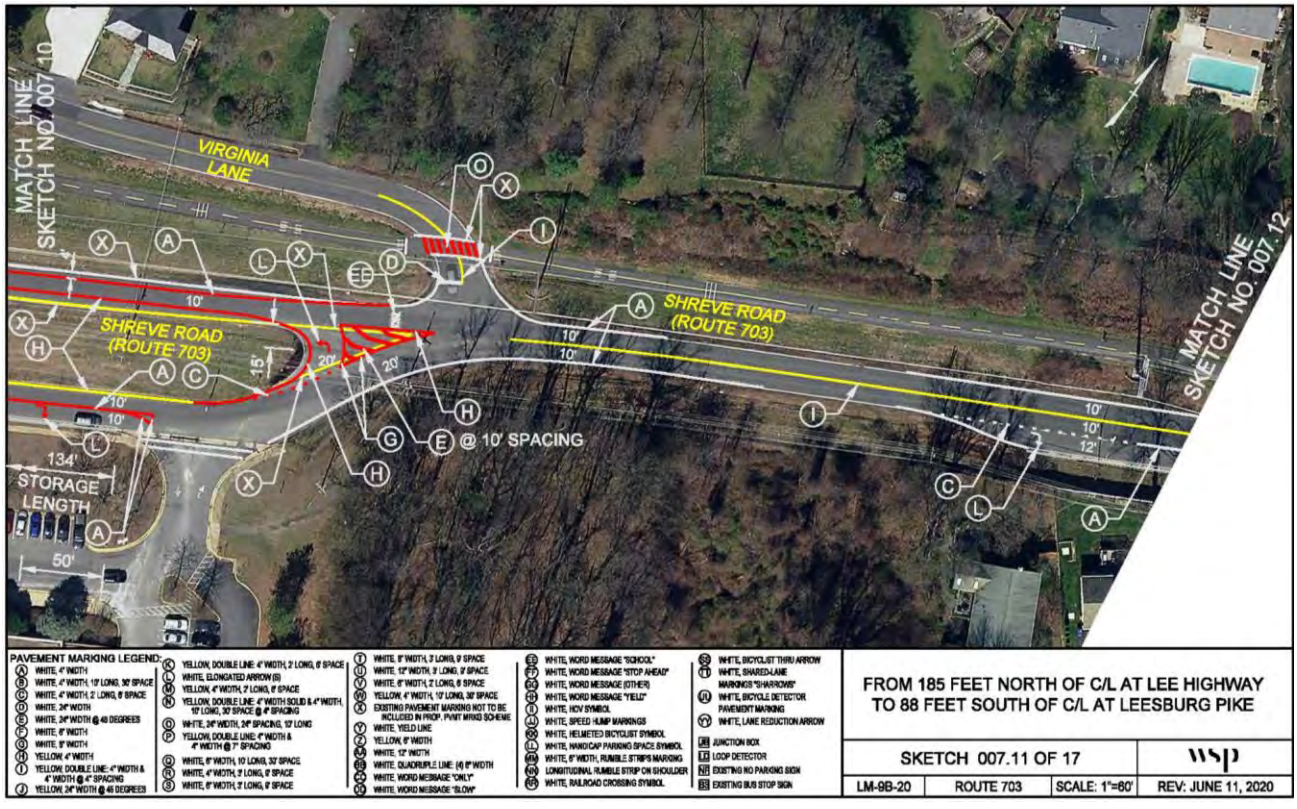
VDOT Striping Improvements

In Spring of 2020, VDOT began developing striping plans for Shreve Road between Route 29 and Route 7. These plans included removing on-street parking along eastbound Shreve Road in front of the Shrevewood Elementary School. These striping improvements have been coordinated with a project at the school the add parking spaces to the existing lot, ensuring the loss of on-street parking will not adversely impact the neighborhood.

Currently, conditions on eastbound Shreve Road in front of the school can become congested when traffic picking-up/dropping-off spills onto Shreve Road and blocks through traffic. The removal of on-street parking allows for the provision of a turn-lane into the school, which should improve traffic operations during school hours.

An excerpt from the striping plans are shown in **Figure 3-4**. The timing for the striping improvement coincides with this corridor study, as the improvements were completed in Fall 2020.

Figure 3-4 Shreve Road Striping Plans (West of Elementary School)



Source: VDOT June 11, 2020 Draft LM-9B-20

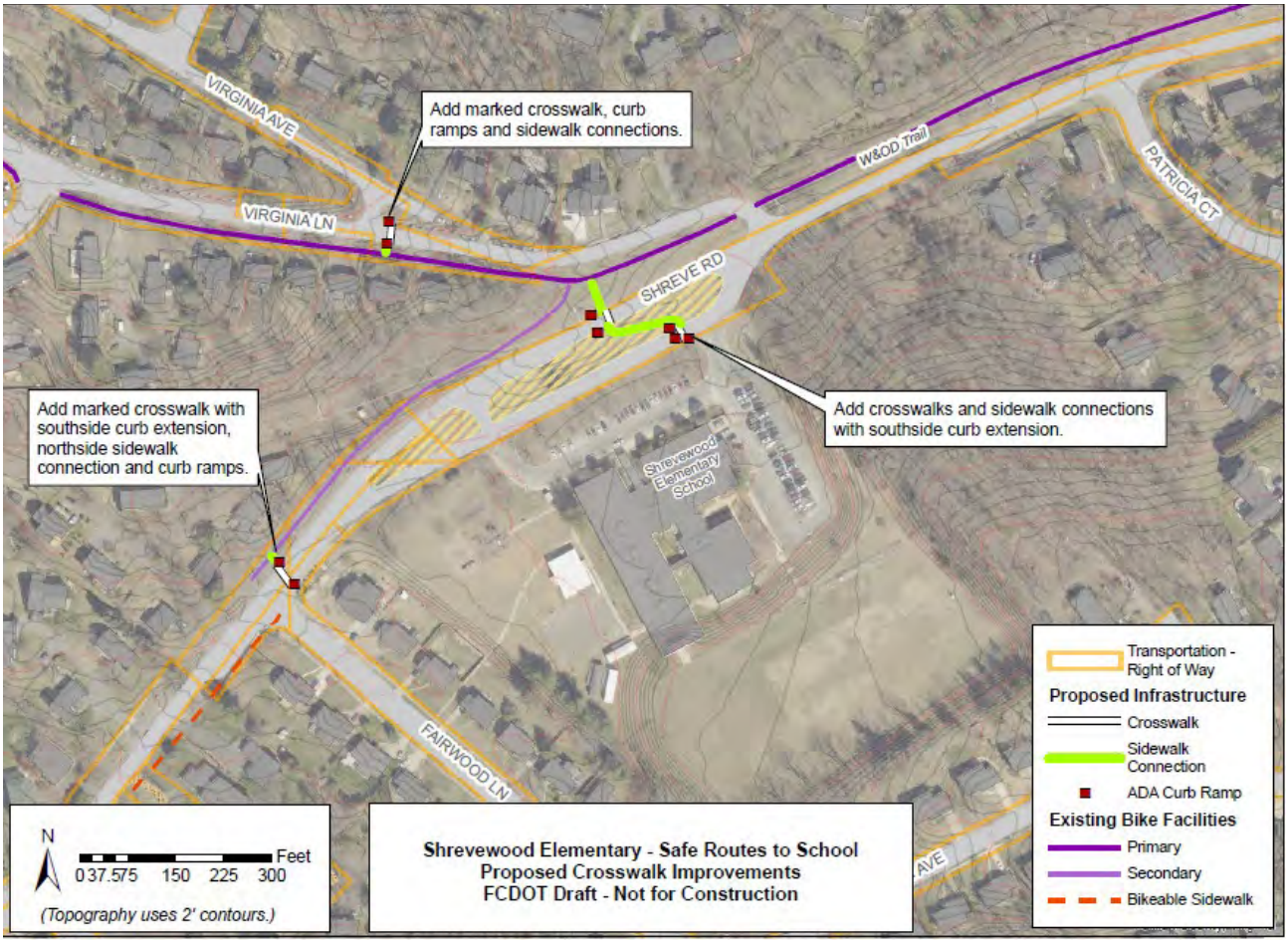
Shrevewood Elementary School Improvements

As noted above, Shrevewood Elementary School has been coordinating with VDOT to remove on-street parking on Shreve Road in front of the school. To offset the removal of these spaces, the

parking lot is being reconfigured to increase the school's parking supply. The timing for this improvement is similar to the VDOT Striping Improvements in Fall 2020.

In Fall 2020, Fairfax County's application for a Safe Routes to School (SRTS) grant to improve pedestrian crossings between the school and the W&OD Trail was approved for $560,000. A sketch of this improvement drafted by FCDOT is included as **Figure 3-5**.

Figure 3-5 Elementary School SRTS Sketch

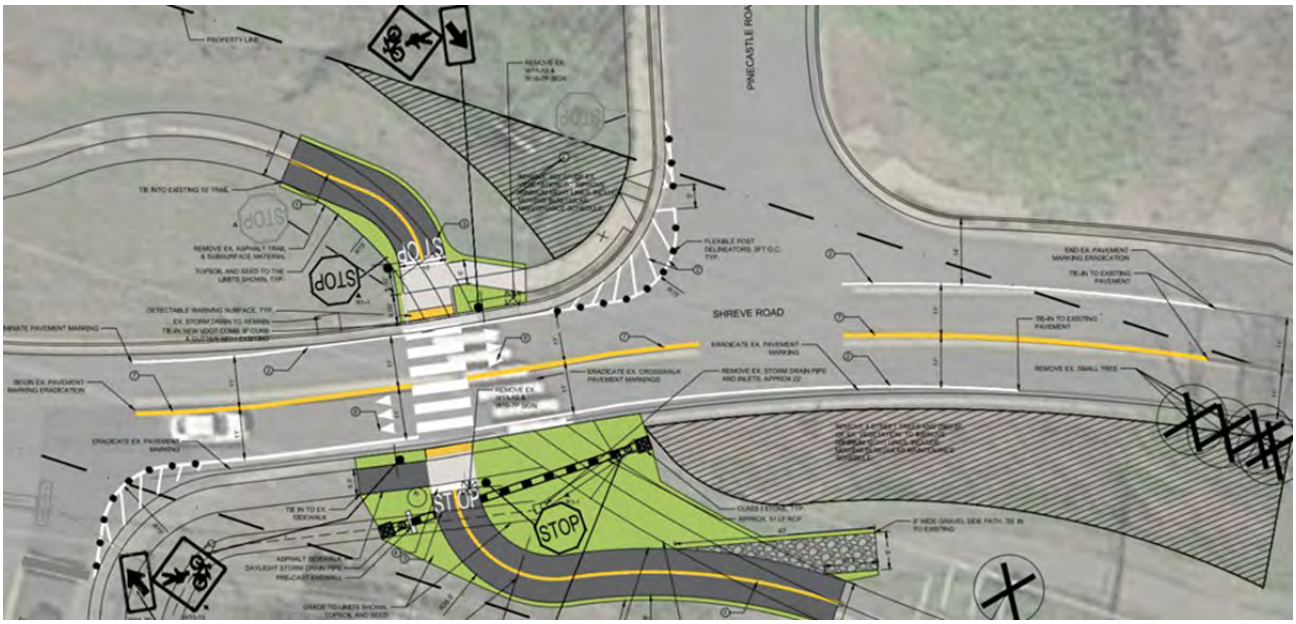


Source: Grant application sketch, provided by FCDOT

W&OD Trail In-Process Improvements

NOVA Parks is pursuing improvements to the W&OD Trail crossing on Shreve Road near Pinecastle Road. The improvements will realign the existing crosswalk to be perpendicular to the roadway, which will improve sight lines. A sketch prepared for NOVA Parks is included as **Figure 3-6**. While the timing for this improvement is unknown, the project is in design and permitting.

Figure 3-6 W&OD Trail Crossing Improvements at Shreve Road/Pinecastle Road



Source: Provided by NOVA Parks

A study was also completed in Winter 2017 to evaluate the need for the separate pedestrian and bicycle paths along the W&OD Trail from Little Falls Street to West Street. As a result of this study, NOVA Parks and AMT Engineering have submitted a Site Plan Application to implement the dedicated pedestrian and bicycle paths, with a 2-foot separation between the two. Other features include improved stormwater management system, replanting of disturbed areas with native/adaptive species, and groundwork for future lighting system improvements.

The Winter 2017 study has been provided to the Study Team to estimate pedestrian and bicycle volumes for the W&OD Trail Crossings on Shreve Road. Should the separate facility be constructed east of the study area, this could increase demand for walking and biking along Shreve Road.

FCDOT Falls Hill Traffic Calming Study

FCDOT completed speed and volume traffic counts within the study area in February 2020, prior to any impacts from COVID-19. At the request of the Falls Hill Civic Association, 24-hour weekday counts were conducted on local streets in the northeast portion of the Shreve Road Corridor Study area. Data was collected on Pinecastle Road, Barbour Road, Gordons Road, Chestnut Street, and Dale Drive. Count information was used to determine appropriate turning movement volumes for this corridor study.

In general, the study found streets in this area close to Route 7 qualify for acceptance into FCDOT's traffic calming program. Traffic volumes are between 500 and 1,600 vehicles per day and recorded 85th percentile vehicles speeds are greater than or equal to 35 mph in at least one direction. The Study Team finds this important to consider for all local roads within the study area. Any changes made to

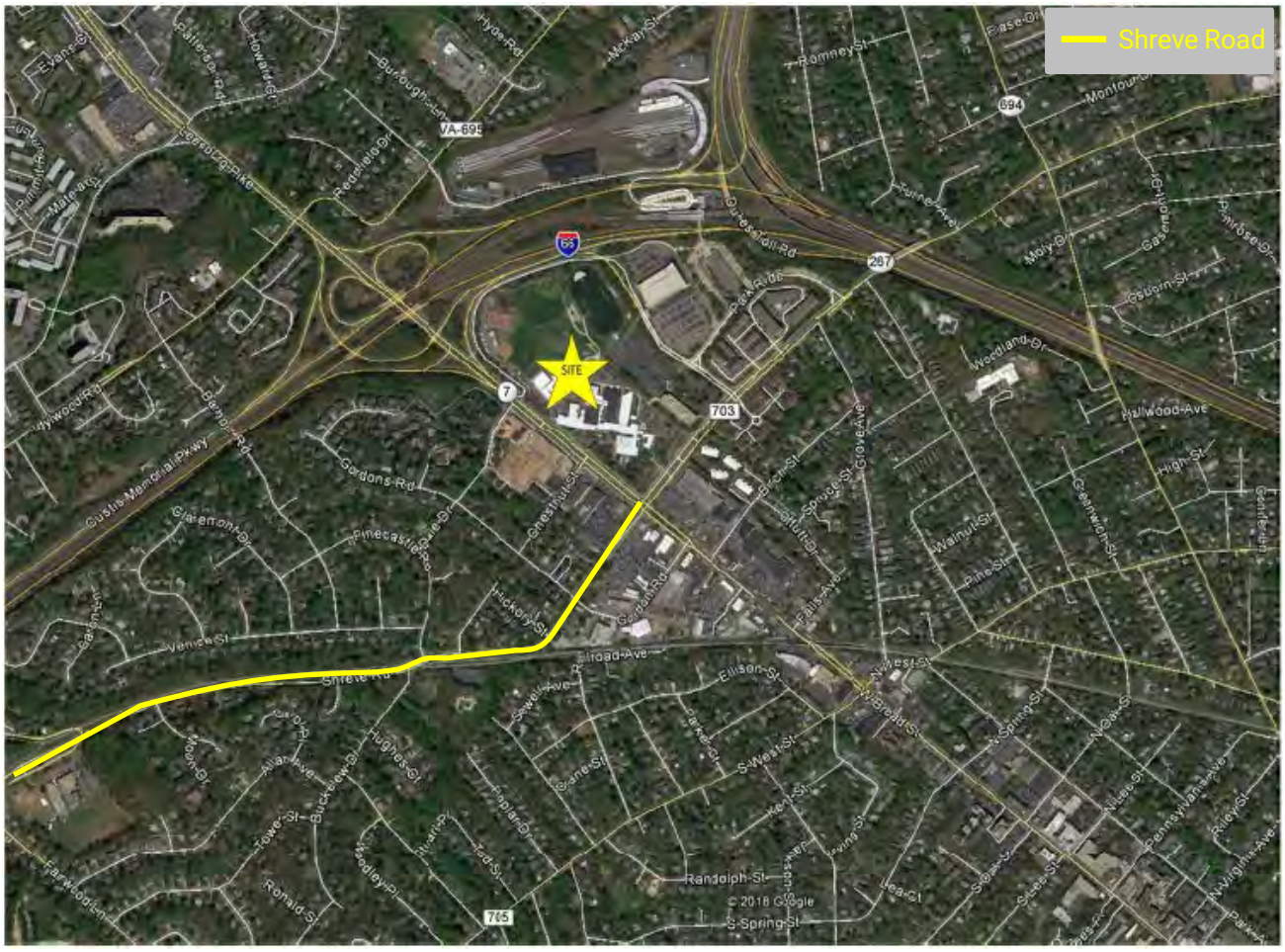
Shreve Road should be sensitive to impacts on other lower-classification roadways in the area. Recommendations analysis is presented later in this report to consider these types of impacts.

West Falls Church Economic Development Project

The site for the West Falls Church Economic Development Project is currently occupied by George Mason High School, serving 800 students, and Mary Ellen Henderson Middle School, serving 600 students. The proposed development program would expand the high school to include 1,500 students, retain the existing 600-student middle school, and add approximately 110,000 square feet of retail, 200,000 square feet of commercial space, 990 residential units, and a 160-room hotel. The project is part of a public-private partnership and will be constructed in combination with the re-development of the school sites.

A Transportation Impact Analysis (TIA) has been conducted for the project, including intersection traffic volume assignments for the proposed uses. The project location, as shown in the TIA, is included as **Figure 3-7**.

Figure 3-7 West Falls Church Economic Development Project Location



Adapted from Source: "High School & West Falls Church Economic Development: Transportation Impact Study", Gorove/Slade, 2018.

As analyzed in the study, the proposed development will include the installation of a high-intensity activated crosswalk (HAWK) signal mid-block on Haycock Road and installation of a signal at one of the site entrances on Route 7. The TIA also accounted for the West Falls Church Transit Station Area redevelopment planned by Virginia Tech and WMATA, which are adjacent to the Economic Development Project site.

The build-out year assumed in the TIA was 2030. This assumes completion of the Economic Development Project and the West Falls Church Transit Station Area.

West Falls Church Transit Station Area Study

The Fairfax County Board of Supervisors has authorized the consideration of a Comprehensive Plan Amendment in West Falls Church's Transit Station Area. The Transit Station Area includes the West Falls Church Metro Station, the Virginia Tech/University of Virginia Northern Virginia Center, 343 multi-family residential units along Haycock Road, and approximately 200 single-family residential units. The goal of the study is to concentrate new development within the area, while preserving the stable residential neighborhoods. The location and boundaries of the Transit Station Area, available on Fairfax County's website for the study, is shown in **Figure 3-8**.

Figure 3-8 West Falls Church Transit Station Area Location

Source: FCDOT website https://www.fairfaxcounty.gov/planning-development/sites/planning-development/files/Assets/documents/CompPlanAmend/westfallschurchtsa/west-falls-church-tsa-parcel.jpg

The study is currently underway and was scheduled for public hearings in Fall 2020, but the timeline for the study has likely been extended due to the effects of COVID-19. Traffic estimates were generated for this area as part of the West Falls Church Economic Development Project, assuming a build-out year of 2030.

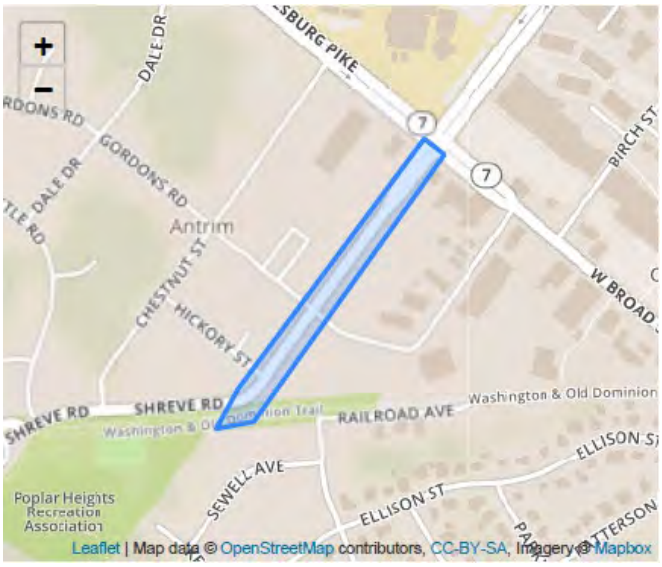
City of Falls Church Redevelopment Grant Applications

The City of Falls Church has also prepared several grant applications to support multimodal connectivity. These improvements would support the expected development activity near the metro station with the Economic Development Project and Transit Station Area Study.

In November 2019, the City of Falls Church applied for a $6.9 million Northern Virginia Transportation Authority (NVTA) grant for the West Falls Church Access to Transit and Multimodal Connectivity Project. The project includes professional and construction services for a new multi-use path to better connect the W&OD Trail with George Mason High School, the West Falls Church Economic Development Project, Virginia Tech, and the West Falls Church Metrorail Station.

The new 10' shared-use path would run along the east side of Shreve Road from Route 7 to where the current W&OD Trail extension intersects Shreve Road near Hickory Street. The path would be offset from Shreve Road by a 6' landscape and planting buffer and would include some stormwater drainage improvements. The project location, as included in the grant application, is shown on **Figure 3-9**.

Figure 3-9 West Falls Church Access to Transit and Multimodal Connectivity Project Location

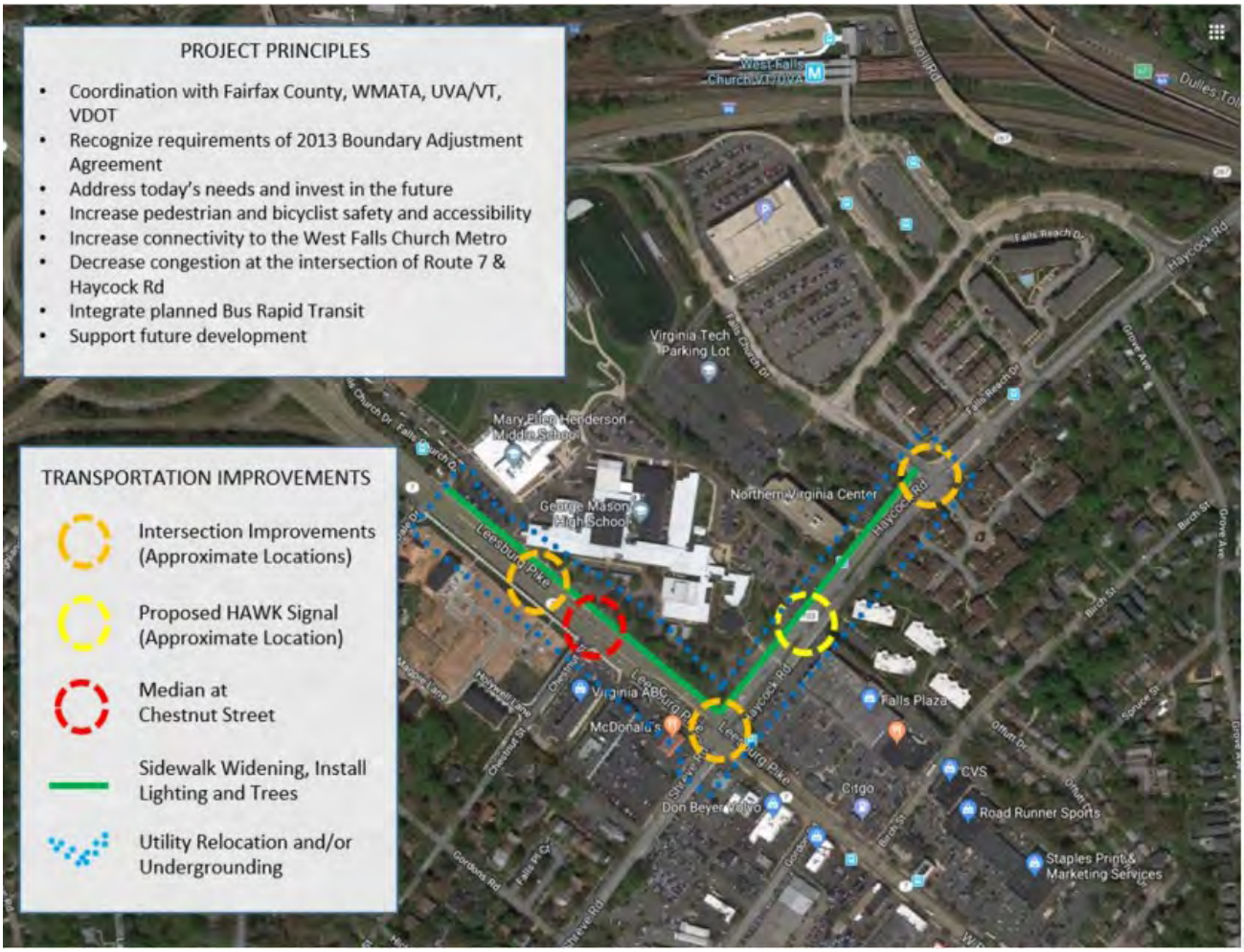


Source: City of Falls Church Grant Application

In addition to the construction of the shared-use path, the project includes the installation of a high-visibility crosswalk on Shreve Road and Gordons Road, near where the pedestrian fatality occurred in the Summer 2019. If approved, funding would begin in fiscal year 2024.

The City has also received a grant for the West Falls Church and Joint Campus Revitalization District Multimodal Improvements Project. As part of a $15.7 million NVTA grant, the project includes intersection and signal improvements, pedestrian access improvements, bicycle access improvements, bus stop enhancement, and utility relocation/undergrounding. The project location and scope, as available on the City of Falls Church website, is shown on **Figure 3-10**.

Figure 3-10 West Falls Church and Joint Campus Revitalization District Multimodal Improvements Project Location



Source: City of Falls Church website [*http://www.fallschurchva.gov/DocumentCenter/View/10422/West-Falls-Church-Transportation-ProjectScope?bidId*](http://www.fallschurchva.gov/DocumentCenter/View/10422/West-Falls-Church-Transportation-ProjectScope?bidId)

Signals will be installed or updated at the Chestnut Street/Route 7 intersection, Haycock Road/Shreve Route/Route 7 intersection, and Haycock Road/Schools Access Road intersection. The mid-block HAWK signal on Haycock Road will be funded to allow better connectivity and access to the school's area campus. Pedestrian access improvements will be made to the previously listed intersections, as well as along Route 7 between the Metro Station Exit and Haycock Road. Improvements will also be made along both sides of Haycock Road between Route 7 and the City line. Utility relocation/undergrounding and bicycle access improvements will take place along Haycock Road,

Shreve Road, and Route 7 within the project area. These improvements are expected to be constructed by the end of fiscal year 2023.

Other Development and Planning Projects

There are several land development projects in the study area that are anticipated in the near-term. This includes a rebuild of the Dominion Power Substation, located on Shreve Road near Holly Manor Drive. The Transform 66 Outside the Beltway project will reconstruct an I-66 ramp immediately adjacent to Shreve Road along the curve by Oldewood Dr. The Don Beyer Volvo site, located on the eastern end of corridor at Route 7, is also slated for redevelopment and provides an opportunity to accommodate wider sidewalks on both sides of the street, better street lighting, and potentially bicycle lanes or a shared use path if developed in coordination with the West Falls Church Access to Transit and Multimodal Connectivity Project. While no traffic studies have been conducted to estimate vehicle trip generation, the increases in traffic can largely be accounted for by assuming a background growth rate in the study area. This is discussed in more detail in the Data Collection evaluation.

Other sites in downtown Falls Church are also slated for redevelopment, such as the six-story, office and commercial building at 400 N Washington Street, the seven-story, mixed-use building at Broad & Washington, and "The Gateway" five-story, mixed-use development at 500 N Washington Street. These development projects are largely expected to be served by Route 7 and other roadways. While this may not directly impact Shreve Road and the surrounding local streets, the Study Team considers this context important. Any changes made to Shreve Road should be sensitive to impacts on other higher-classification VDOT roadways in the area, which are also expected to experience growth.

Fairfax County has also begun its ActiveFairfax Transportation Plan. This plan is intended to reconcile multiple pedestrian and bicycle facility plans, including the Countywide Trails Plan, Bicycle Master Plan, and Area Plans. The plan will also update design recommendations for facilities. The Countywide Trails Plan and Biycle Master Plan currently include differing facilities for Shreve Road, so it is expected the ActiveFairfax plan will help to clarify the desired pedestrian and bicycle facilities for the corridor.

COMMUNITY FEEDBACK SUMMARY

In November 2019, the Shreve Road Community Working Group addressed a memorandum to VDOT outlining their concerns as part of an ongoing effort to address the conditions on Shreve Road. The memorandum split the corridor into five different segments. **Table 3-2** summarizes community concerns for each segment of Shreve Road.

Table 3-2 Community Feedback Summary

Segment	Pedestrian/Bicycle Concerns	Safety Concerns	Other Concerns
Route 29 to Oldewood Drive	Unsafe walking trail due to low lighting and being isolated.	Sightline issues at the curve near Oldewood Drive.	Through trucks present regardless of "Through Trucks Prohibited" signs.
Oldewood Drive to Dominion Substation	Narrow sidewalks.	Sightline issues due to a steep hill. Speeding.	Trucks from the Dominion Power Substation block line of sight for motorists. Flooding.
Dominion Substation to Weiland Place	Absence of pedestrian infrastructure for kids getting to and from the elementary school.	Dangerous intersection with the W&OD Trail at Virginia Lane. Sightline issues at the intersection with Fairwood Lane. Speeding.	Double-parking near the elementary school.
Weiland Place to Chestnut Street	Absence of pedestrian infrastructure near the intersection with the W&OD Trail.	Sightline issues due to steep grade changes and sharp curves. Narrow road with no shoulders.	Congestion due to poor sight lines coming out of residential streets. Flooding.
Chestnut Street to Route 7.	Absence of pedestrian infrastructure.	Sharp curve near Hickory Street. Sightline issues at Gordons Road due to steep grade change. Speeding.	Flooding.

VOLUME DEVELOPMENT

VDOT studies typically include collecting turning-movement counts early in the project to determine the number of vehicles, including the percentage of large vehicles (trucks and buses), along with people walking and biking during morning and evening peak hours. In the case of this corridor study, school cancellations and stay-at-home orders due to COVID-19 coincided with commencing the study. Therefore, data collected would not reflect typical traffic patterns. Rather than delay the study and analyses, the Study Team worked to develop volume estimates. A four-step process was undertaken to develop the volume estimates:

1. **Establish Project Context and Data Needs**: Identified needs include peak-hour turning-movement volumes at intersections, daily bicycle and pedestrian volumes along the corridor and the adjacent W&OD Trail, speed data on the corridor, and Shrevewood Elementary School travel characteristics.

2. **Coordinate with Appropriate Agencies**: Worked with VDOT, FCDOT, Fairfax County Public Schools (FCPS), NOVA Parks, and the City of Falls Church to get feedback on the data needs and identify available data resources.

3. **Identify Available Data Resources**: From coordinating with the appropriate agencies, the Study Team was able to obtain ample information. This included directional speed and volume data from the 2019 VDOT Speed Study, directional speed and volume data from nearby local streets from the FCDOT Falls Hill Traffic Calming Study, VDOT AADT and k-factor (proportion of daily traffic occurring in an hour) data available to the public, Safe Routes to School (SRTS) travel-mode data for Shrevewood Elementary School, the Traffic Impact Analysis (TIA) for the West Falls Church Economic Development Project proposal including estimates for the Transit Station Area project, bicycle and pedestrian counts from the NOVA Parks permanent counters along with a W&OD Trail Study completed in late 2017, and AADT estimation using VDOT's StreetLight Data subscription.

4. **Develop Estimates Using Adjustments to Observed and/or User-Generated Data**: Adjustments were made to the AADT vehicular data available to develop weekday morning and evening peak hour turning-movement counts at the five intersections identified for detailed analysis. The adjustments are described in more detail in the following section.

By using this process, the Study Team was able to advance the study and development of corridor recommendations. Through these discussions it was determined data collection could also be conducted after the development of recommendations in late 2020, should stay-at-home orders and school restrictions be lifted.

Vehicle Volumes

As described above, a considerable amount of daily traffic volume data was available for the corridor to develop peak hour volumes. In general, adjustments were made by determining daily turning-movement volumes for the study intersections and applying k-factors to obtain the weekday morning and evening peak hour volumes.

ADTs from the 2019 VDOT Speed Study, FCDOT study, and VDOT ADT map were used to balance volumes between intersections along the corridor. VDOT ADT volumes from 2017 were grown to 2019 for local roads that do not dead end. This growth rate was calculated using data available for Shreve Road from 2017 to 2019.

VDOT ADT map volumes were verified using StreetLight data by comparing locations with both Streetlight data and 2019 VDOT speed study data. Streetlight is a big data transportation analytics company that uses data from smartphones and navigation devices to estimate multimodal volumes, including vehicle volumes. The vehicle StreetLight data was largely consistent with VDOT ADT volumes, but minor adjustments were made to VDOT ADT data for Fairwood Lane based on this

comparison. StreetLight data also provided daily ADT information for Shreve Road between Fairwood Lane and Virginia Lane.

Next, k-factors were calculated for the weekday morning and evening peak hours using VDOT data for Route 7 and Route 29, averaged with k-factors calculated from the FDCOT study. Hourly speed data was not available from the 2019 VDOT Speed Study. These k-factors were then applied to the intersections where ADT volumes had been balanced.

To balance volumes between Fairwood Lane and Virginia Lane, volume data to and from Shrevewood Elementary School was derived from SRTS travel mode data. Using percentages from the travel mode study, assumptions regarding number of students per school bus (35), and number of teachers per student (1:15 plus ten administrative/support staff), inbound and outbound volumes were calculated for the school driveways during the weekday morning and evening peak hours. Parents using the kiss-and-ride lot to drop-off/pick-up students were also included in the estimates. Given school dismissal times, it was assumed only teacher or administrator trips would occur during the weekday evening peak hour.

Once the school driveway volumes were determined, the remaining intersection volumes were balanced. The resulting 2019 baseline vehicular volumes for the five study intersections are shown in **Figure 3-11**.

In establishing the project context and data needs, it was also deemed appropriate to estimate traffic volumes for the year 2030. The year 2030 was deemed appropriate based on the TIA conducted for the West Falls Church Economic Development Plan, which used a final build-out year of 2030. This baseline year accounts for regional growth in the study area, as well as traffic assignments for development projects.

Based on the aforementioned TIA, a growth rate of ½ percent per year was compounded annually from 2019 to 2030. The TIA also provided peak hour vehicle trip assignments for two development projects that are expected to add vehicular traffic to Shreve Road. These trips were added on top of the regional growth. The resulting 2030 baseline vehicular volumes are shown in **Figure 3-12**.

Pedestrian/Bicycle Volumes

NOVA Parks provided the Study Team with pedestrian/bicycle volumes to develop estimates for the W&OD Trail in the study area. Counts were conducted in 2017 east of the study area, near West Street as shown in Figure 3-6. A continual count station providing May 2018 data is located further east, near Route 29 as shown in **Figure 3-13**

Figure 3-11 2019 Baseline Vehicular Volumes

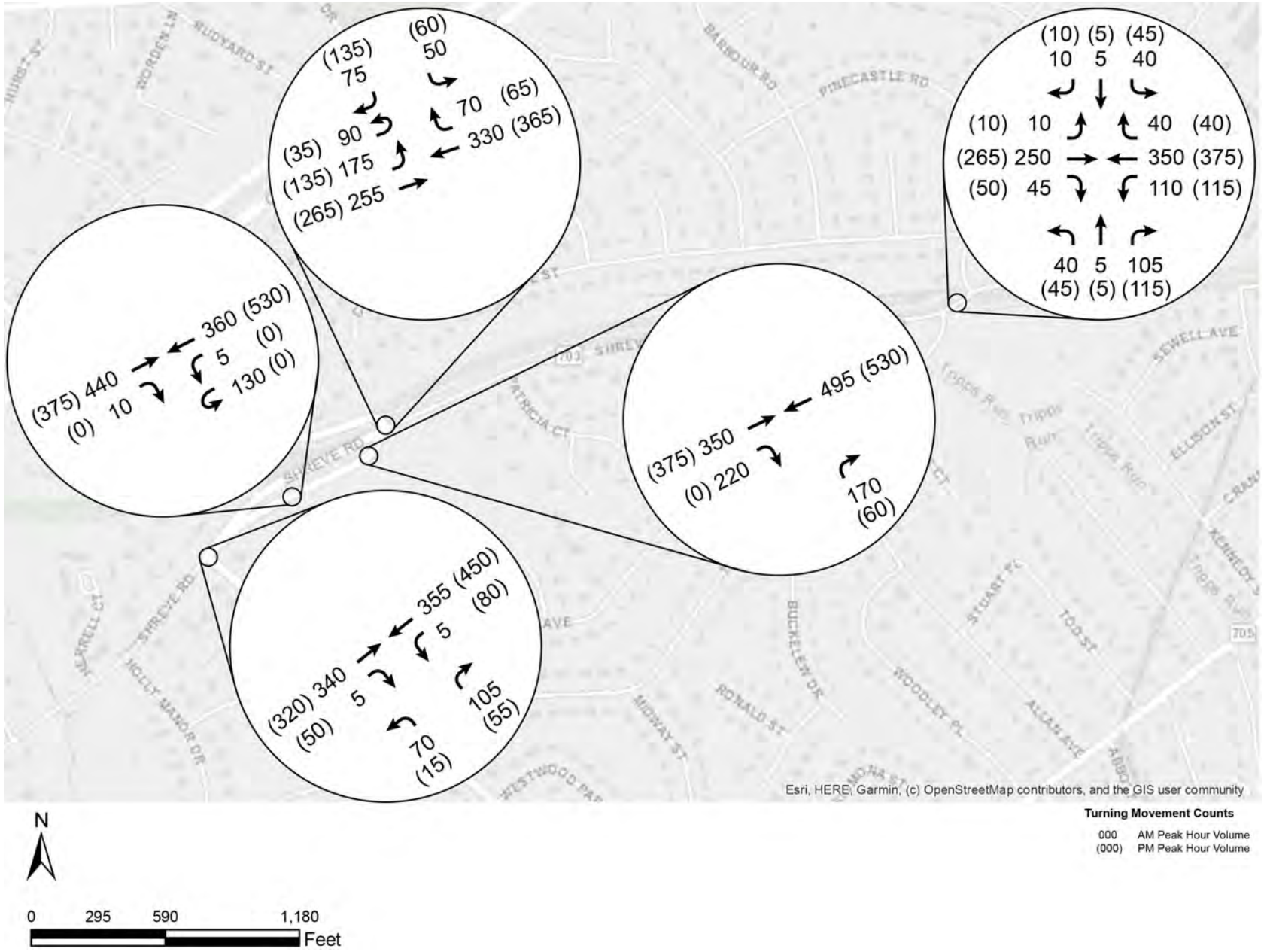


Figure 3-12 2030 Baseline Vehicular Volumes

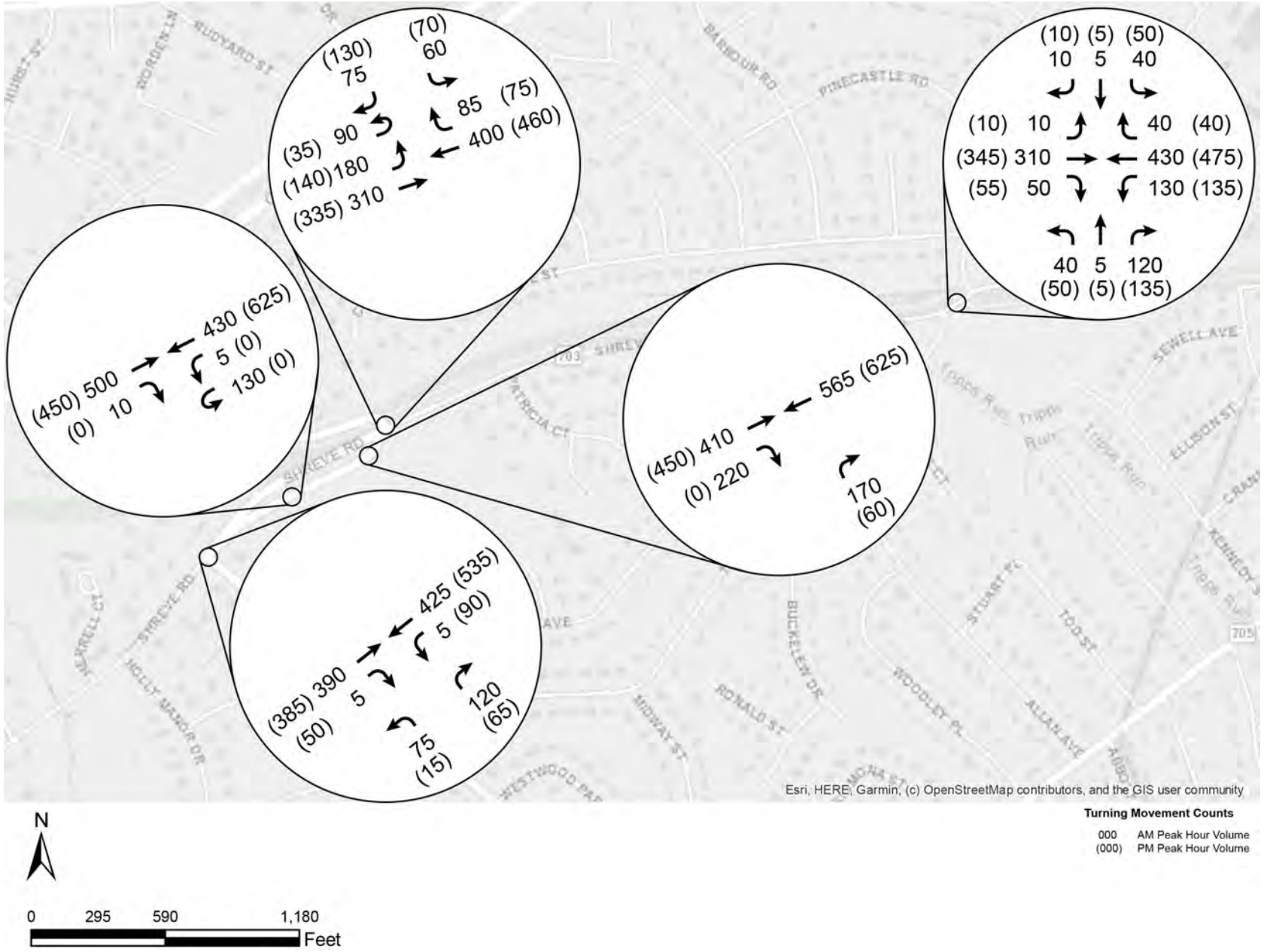
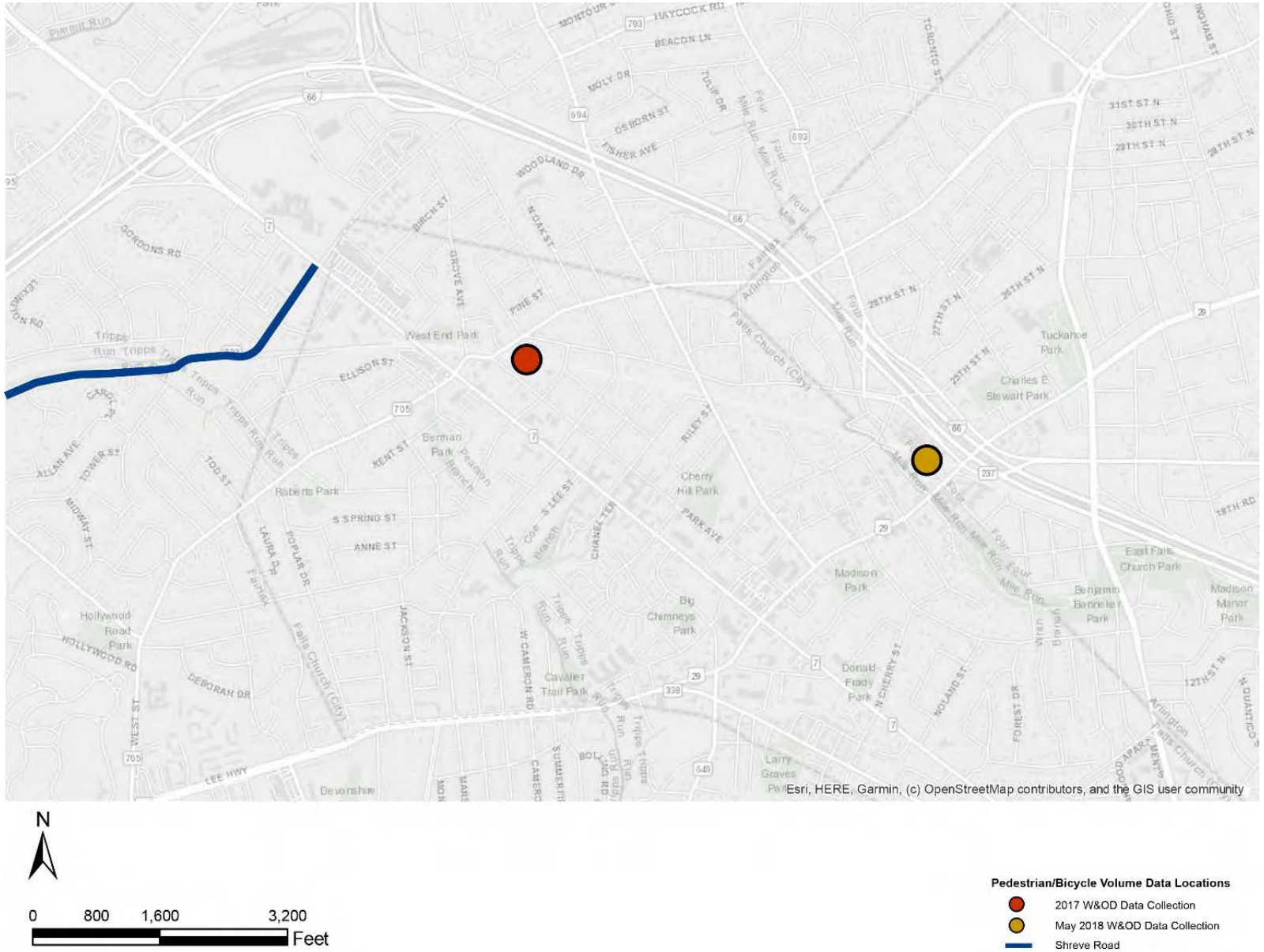
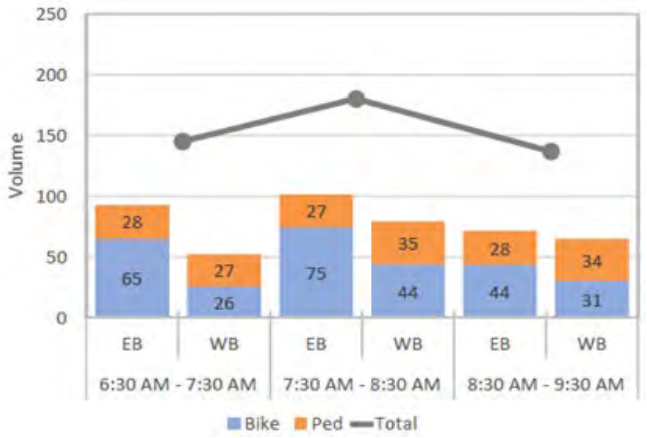


Figure 3-13 Pedestrian/Bicycle Volume Data Locations



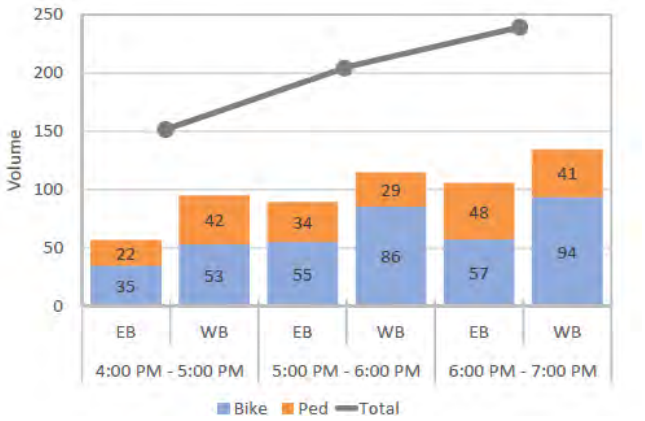
The counts conducted in 2017 were analyzed and summarized in a memorandum. Charts presented in the 2017 memorandum are shown in **Figure 3-14** through **Figure 3-16**. As shown, the majority of people using the trail were bikers.

Figure 3-14 2017 W&OD Trail Counts – Weekday AM



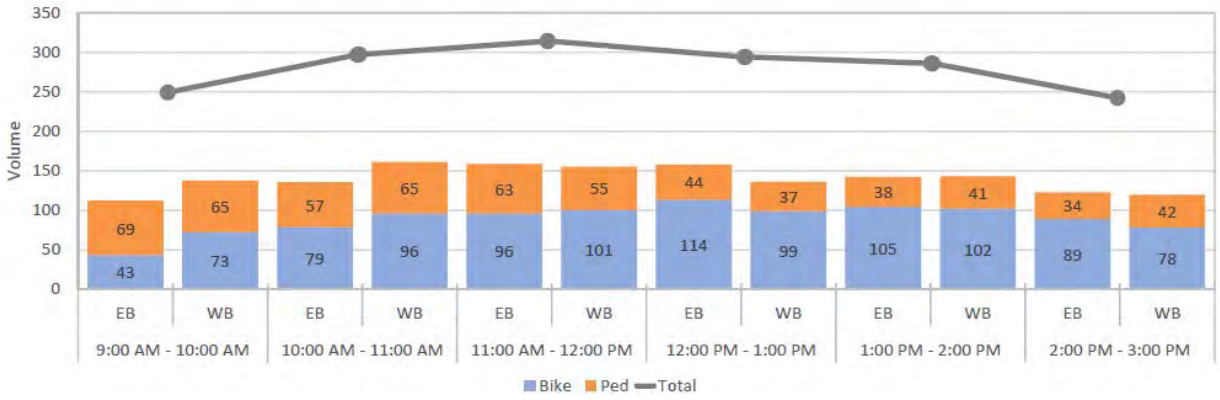
Source: "W&OD Parallel Trail Shared-use path LOS Update: Counts and Results Summary", Toole Design Group, 2017.

Figure 3-15 2017 W&OD Trail Counts – Weekday PM



Source: "W&OD Parallel Trail Shared-use path LOS Update: Counts and Results Summary", Toole Design Group, 2017.

Figure 3-16 2017 W&OD Trail Counts – Weekend

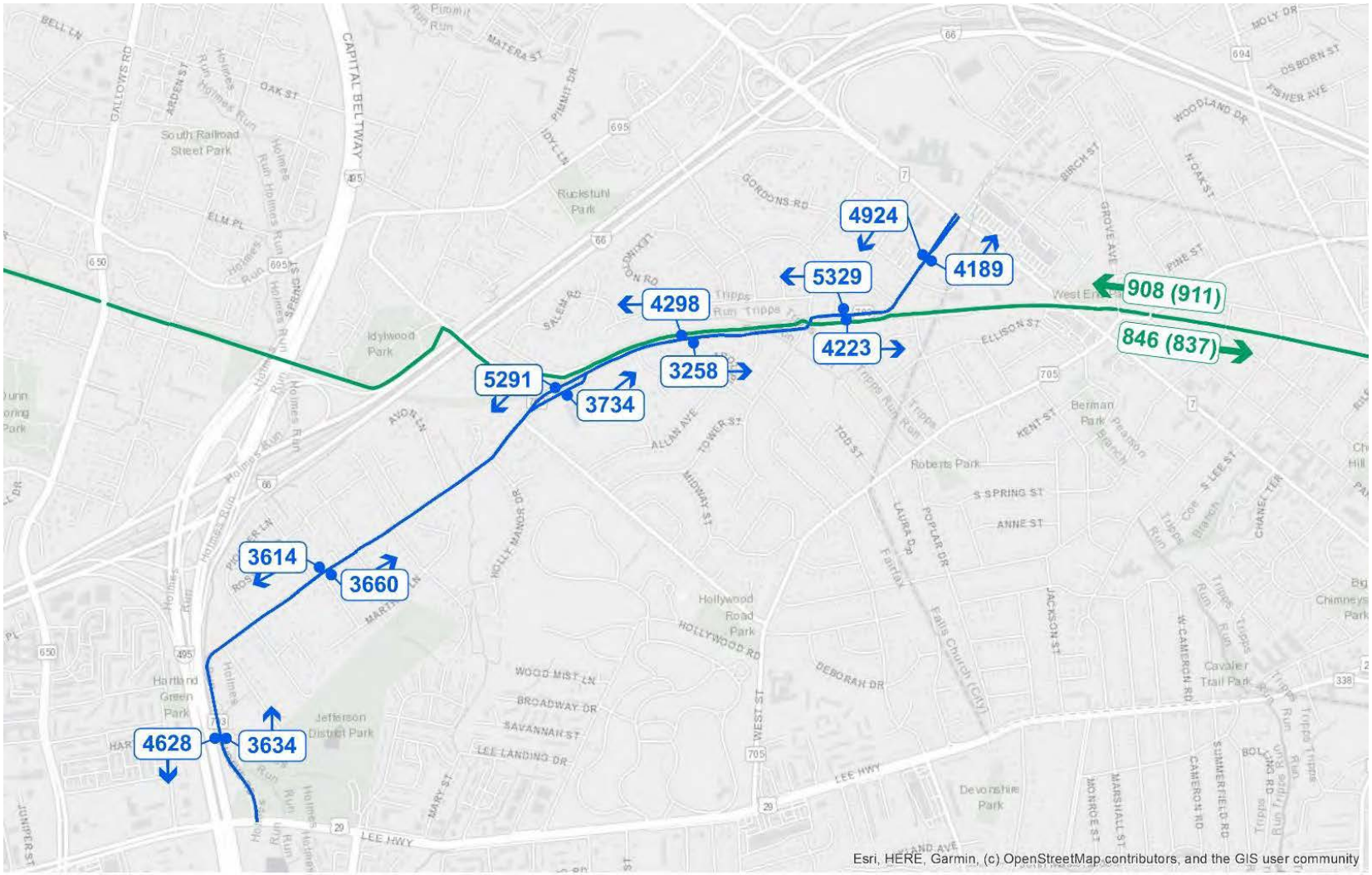


Source: "W&OD Parallel Trail Shared-use path LOS Update: Counts and Results Summary", Toole Design Group, 2017.

Data from the continual count station was also analyzed to estimate the daily volumes for people walking and biking. Averages were taken for weekdays and weekends in May 2018. While this data is for a location further east, the data does represent an approximation for the study area. There are no connecting bike routes between the counter location and study area, meaning that volumes are likely within the same order of magnitude. Therefore, **Figure 3-17** shows the estimated weekday and weekend daily volumes at the two crossings in the study area. Daily vehicular volumes are also shown for comparison.

Regional trails similar to the W&OD Trail have experienced 60% to 90% increase in 2020 usage month over month from 2019 due to the COVID-19 pandemic. The Rails-to-Trails Conservancy estimates nationwide trail usage has been 60% higher than 2019. Meanwhile, trail use counts for the Delaware and Lehigh Trail in Northampton County, Pennsylvania, have been 88% higher than 2019. The W&OD Trail has likely experienced similar growth in usage.

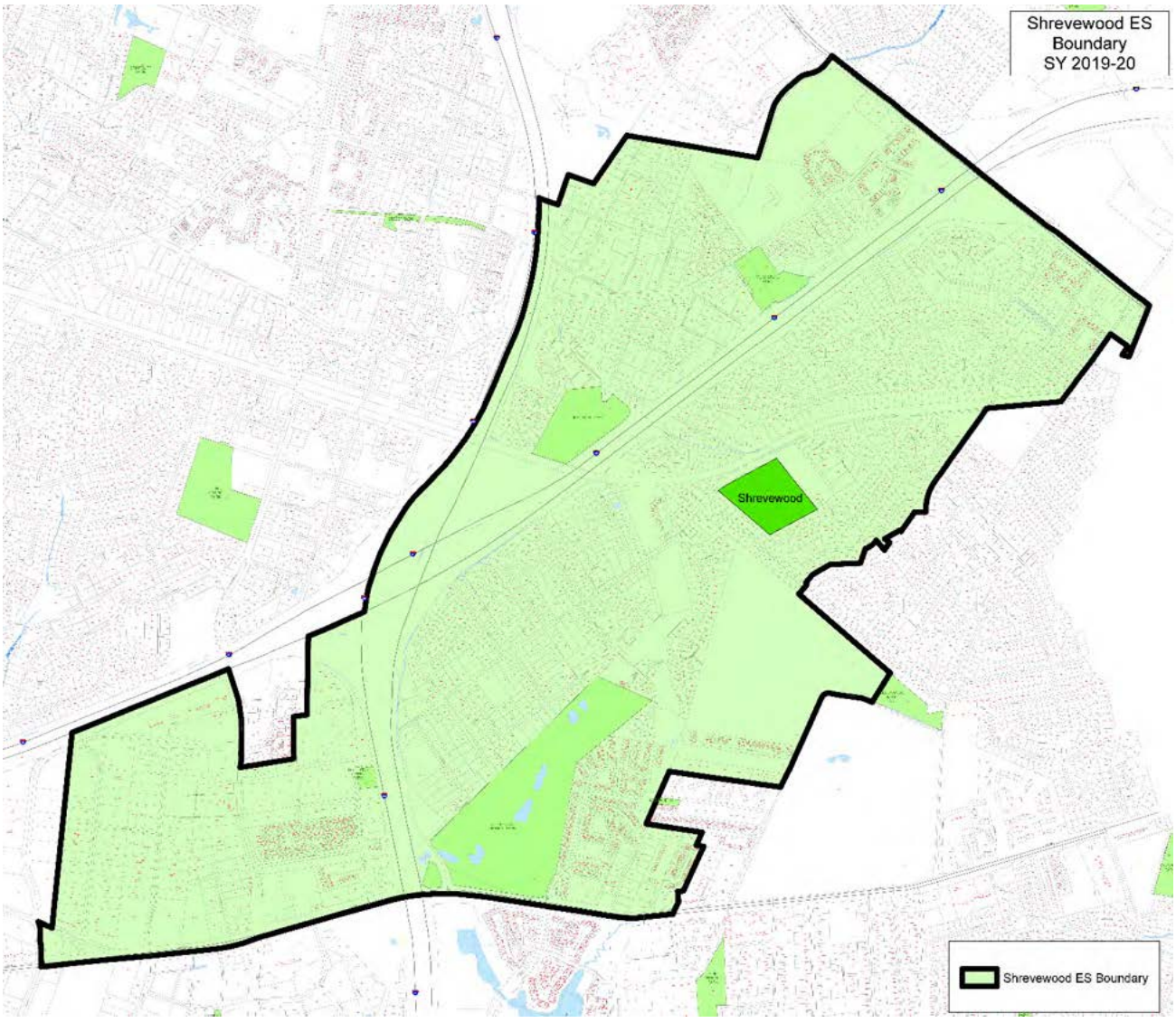
Figure 3-17 Existing Trail Crossing and Vehicular Volumes



School Travel Mode Share

In September 2019, a Student Travel Tally from the National Center for SRTS was administered to students of Shrevewood Elementary School to understand the students' travel modes to and from school. **Figure 3-18** displays the current Shrevewood Elementary School boundary. The responses are summarized in **Table 3-3**. The survey results show that most students (71%) ride the school bus in the morning and the afternoon. These responses were used to develop traffic volume estimates at the study intersections along Shreve Road.

Figure 3-18 Shrevewood Elementary School Boundary



While not the majority of trips, a notable number of students walk or bike to the school located on Shreve Road. Approximately 7.8% of students walk or bike to school in the morning. In the afternoon, approximately 9.6% of students walk or bike to school.

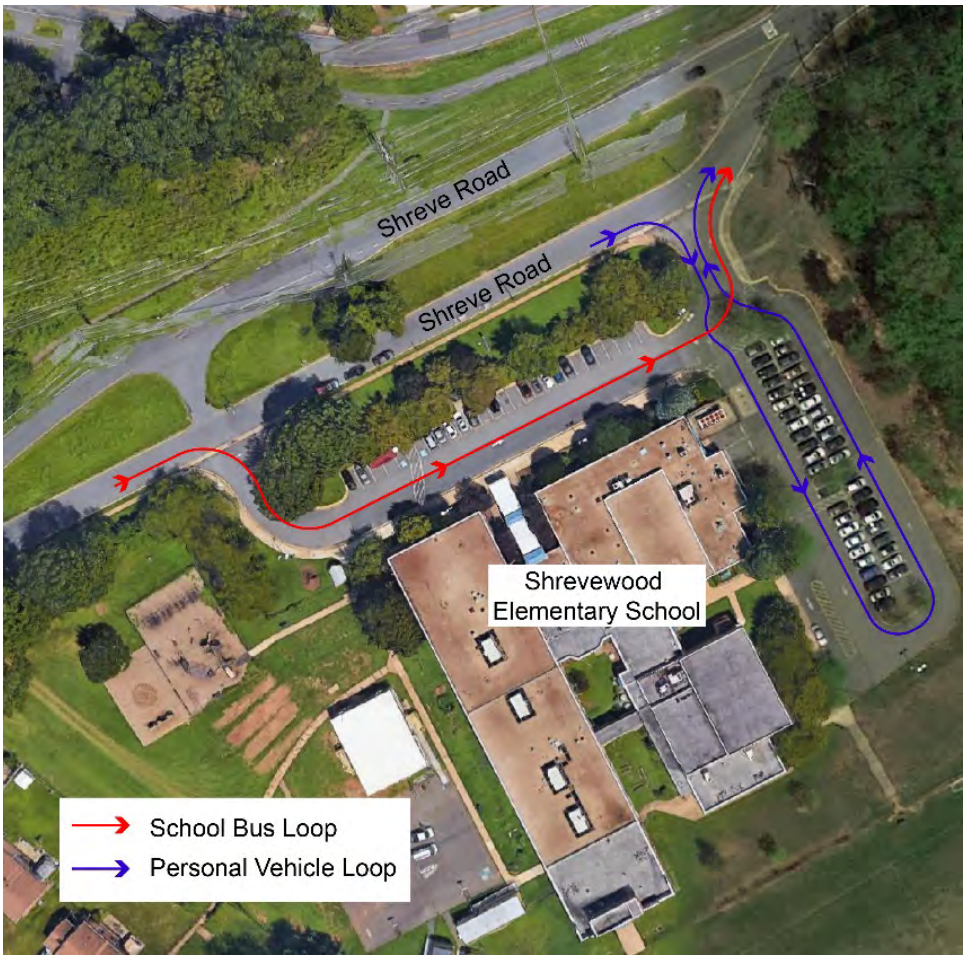
Table 3-3 Shrevewood Elementary School Travel Mode Comparison

	Walk	Bike	School Bus	Family Vehicle	Carpool	Transit	Other
Morning	7%	0.8%	71%	19%	1%	0%	1%
Afternoon	9%	0.6%	71%	17%	1%	0%	2%

Percentages may not total 100% due to rounding.

In coordination with FCPS, the Study Team also reviewed on-site vehicle and school bus circulation to understand pick-up/drop-off routes. These circulation patterns are shown on **Figure 3-19**.

Figure 3-19 Shrevewood Elementary School Bus and Vehicle Circulation



SAFETY/SPEED ANALYSIS

Safety and speed data for the Shreve Road corridor and surrounding area was compiled from several sources.

Crash Data

VDOT crash data, available publicly on VDOT's website, was reviewed for the Shreve Road corridor and surrounding area from 2013 to May 2020. Crashes were filtered to include those that occurred along Shreve Road, excluding crashes at the intersections with Route 29 and Route 7. Crashes that occurred on local roads that intersect with Shreve Road were also included in the analysis. Based on these criteria, 80 crashes have been reported in the study area since 2013.

Crash incidents were then reviewed further and are discussed in more detail below. Crash data was filtered and analyzed based on three considerations:

- Travel mode and severity
- Crash type
- Contributing crash factors (weather, speeding, etc.)

These three factors are important for several reasons. In terms of travel mode, data can provide valuable information to prioritize areas where the risk for injury is higher. Crash type analyses may help identify geometric features that factor into crashes. Lastly, contributing crash factors provide insight into driver behaviors and roadway conditions that increase the likelihood of a crash occurring.

VDOT crash data provides information by travel modes involved, including vehicle, bike, and pedestrian. Information is also provided by severity, including fatality, severe injury, visible injury, nonvisible injury, and property damage only. The crash locations shown by travel mode and severity are depicted on **Figure 3-20**. Percentages by travel mode and severity are calculated and summarized in **Table 3-4**.

As shown in the figure, clusters of crashes appear to occur near the W&OD crossings at Pinecastle Road and Virginia Lane. Available data also shows pedestrian- and bicycle-involved crashes at these two locations. One pedestrian fatality occurred in the study area near Hickory Street. It is also worth noting the cluster of vehicle crashes at this location, which members of the community highlighted as an area of focus due to the road's geometry. Similarly, the cluster of crashes on Shreve Road near Oldewood Drive is consistent with the area identified by community members as a priority location. Lastly, a crash involving a pedestrian was reported on Shreve Road near Route 29.

Figure 3-20 Crash Locations by Travel Mode and Severity (January 2013 – May 2020)

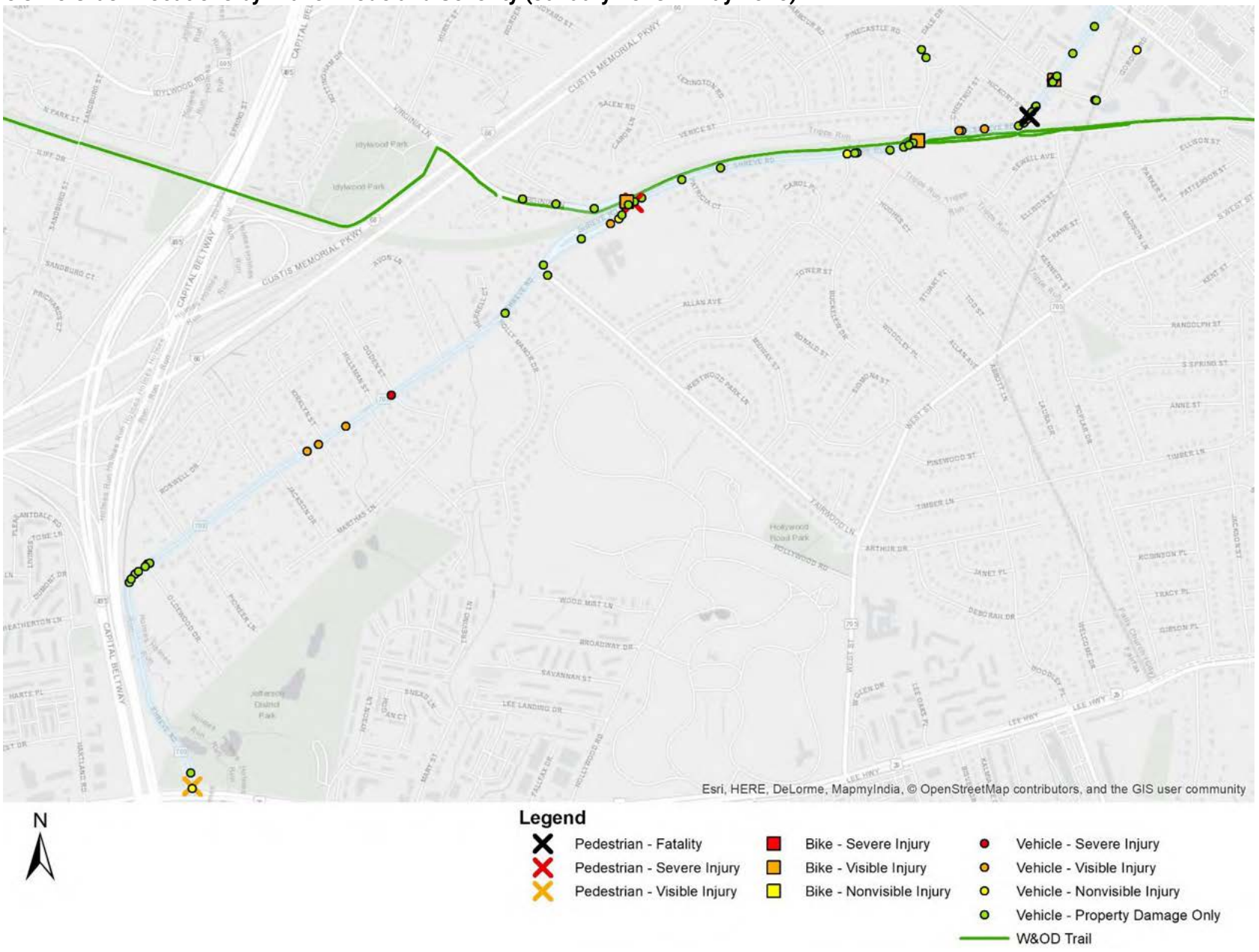


Table 3-4 Crash Percentages by Travel Mode and Severity (January 2013 – May 2020)

	Severity					
	Property Damage Only	Nonvisible Injury	Visible Injury	Severe Injury	Fatality	All Severity Types
No. of Vehicle Crashes	44	11	10	3	0	68
% of Total	55%	14%	13%	4%	0%	85%
No. of Bike Crashes	0	1	7	1	0	9
% of Total	0%	1%	9%	1%	0%	11%
No. of Pedestrian Crashes	0	0	1	1	1	3
% of Total	0%	0%	1%	1%	1%	4%
No. of Crashes (All Modes)	44	12	18	5	1	
Total			80			
% of Total Crashes	55%	15%	23%	6%	1%	

As shown in the table, the majority of crashes within the study area (55%) are vehicular crashes resulting in property damage only. While bike and pedestrian crashes make up a smaller percentage (15%), it is important to note these crashes result in an injury of some kind.

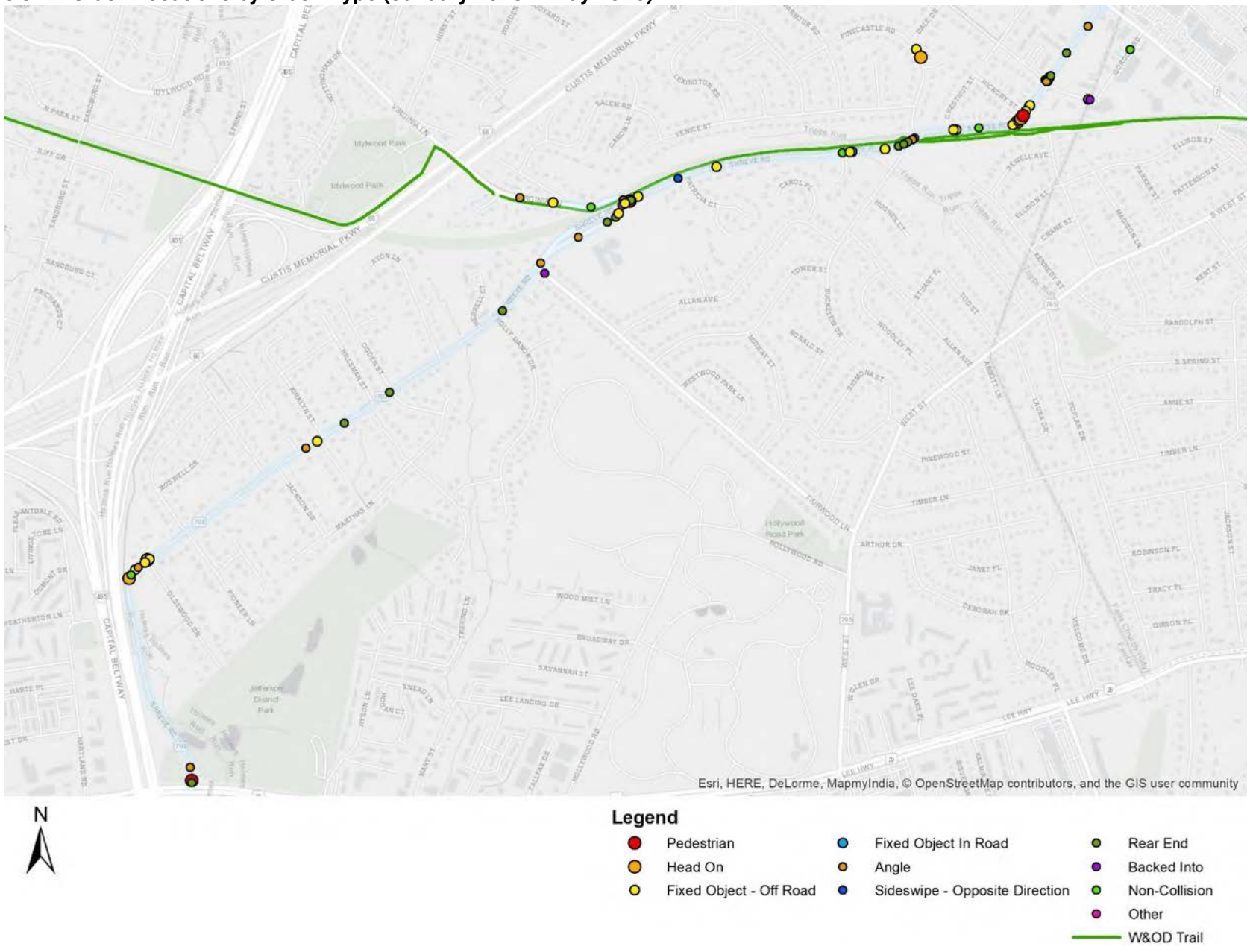
Crash information also includes crash type, such as sideswipe, rear end, angle, fixed object, etc. Percentages by crash type are calculated and summarized in **Table 3-5**. The crash locations shown by crash type are depicted on **Figure 3-21**.

Table 3-5 Crash Percentages by Crash Type (January 2013 – May 2020)

Crash Type	No. of Crashes	% of Total
Angle	25	31%
Fixed Object – Off Road	20	25%
Rear End	16	20%
Head On	5	6%
Non-Collision	5	6%
Pedestrian	3	4%
Sideswipe – Opposite Direction	2	3%
Backed Into	2	3%
Fixed Object In Road	1	1%
Other	1	1%
Total	80	100%

As shown in the table, the vast majority of crashes in the study area were angle, fixed object – off road, or rear end. Rear end crashes may be correlated with speeding behaviors, as more cautious drivers may be rear ended by those speeding.

Figure 3-21 Crash Locations by Crash Type (January 2013 – May 2020)



As shown in the figure, several "fixed object – off road" crashes occurred in the study area. This was particularly evident in areas previously identified by community members as having safety concerns. Angle collisions were also common in the study area, typically occurring where Shreve Road intersects with roadways and access points.

Lastly, crash information was reviewed by contributing factors. Contributing crash factors included driver behaviors and environmental conditions, including weather, presence of deer/wildlife, speeding, drug/alcohol use, distracted driving, etc. Percentages by contributing crash factors are calculated and summarized in **Table 3-6**.

As shown in the table, a notable percentage (18%) of crashes involved speeding. However, the more common driver behavior was distracted driving (22%). Distracted driving includes activities such as texting while driving, which significantly reduces driver reaction times. It is also important to note eight percent of crashes involved alcohol or drug use. In particular, the pedestrian fatality that occurred near Hickory Street involved drug use on the part of the vehicle operator.

Table 3-6 Crash Percentages by Contributing Factors

Contributing Factor	No. of Crashes	% of Total
Driver Behaviors		
Speeding	14	18%
Distracted	22	28%
Drowsy	2	3%
Alcohol/Drug Use	6	8%
Environmental Conditions		
Mist	4	5%
Rain	19	24%
Sleet/Hail	2	3%
Deer	1	1%

On the whole, driver behaviors appear to be a larger contributing factor than environmental conditions. As shown in the table, weather and wildlife conditions contributed to 33% of crashes while driver behaviors contributed to 57% of reported crashes.

To understand crash characteristics of Shreve Road in the context of similar VDOT roadways, the October 2019 VDOT Speed Study was reviewed. The study included a crash analysis for the corridor and provided a comparison to district-wide averages. The study found that the corridor had a crash rate of 131.1, an injury rate of 85.89, and a fatality rate of 4.52 per 100 million VMT. Compared to the district-wide averages, the crash rate for Shreve Road is significantly lower, the injury rate is slightly lower, and the fatality rate is significantly higher than other comparable roadways.

The discrepancy between the fatality rate compared to the injury and crash rates is likely related to the Summer 2019 pedestrian fatality. As was noted previously, drug use was associated with this crash, so driver behaviors were an important factor.

Speeds

The October 2019 Speed Study was reviewed to understand travel speeds along the corridor. VDOT reported 85th percentile, median and pace speeds for 6 different locations along Shreve Road. The 85th percentile speeds are summarized below.

As shown on **Figure 3-22**, speeds along the corridor are generally higher to the south west near Route 29. The 85th percentile speed for traffic heading northbound (42 mph) into the study area is slightly higher than traffic heading southbound (40 mph) out of the study area. The average 85th percentile speed for the entire corridor was 36 mph, the median speed 32 mph and the pace range 27 - 37 mph.

For context, measured 85th percentile speeds are typically used when establishing speed limits. This is because the 85th percentile represents the speed at which most drivers will travel. This ensures a greater uniformity of vehicle speeds, which reduces the risk for vehicle collisions.

This is why reducing the posted speed limit alone will not adequately address safety concerns along the corridor. Instead, the focus of this study is to develop recommendations that will encourage drivers to slow down based on the geometric and visual characteristics of the corridor. Ideally, this will result in lower 85th percentile speeds to eventually support lowering the speed limit further.

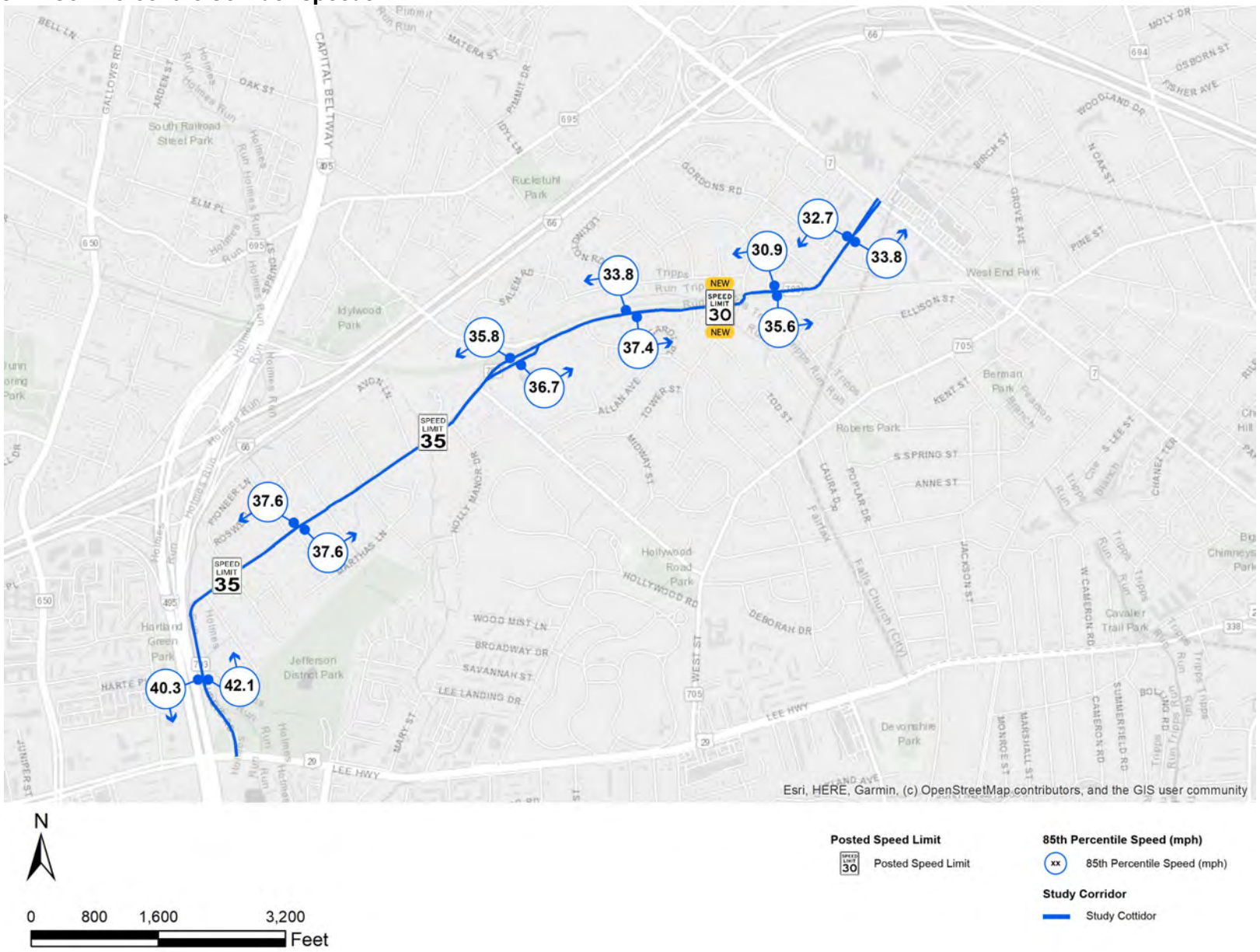
Lastly, FCDOT's Falls Hill Traffic Calming Study included speed and volume traffic counts in early February 2020 prior to any impacts from COVID-19. Data was collected on Pinecastle Road, Barbour Road, Gordons Road, Chestnut Street, and Dale Drive. The 85th percentile speeds were higher than 35 mph for the following roads and directions:

- Pinecastle Road (northbound direction)
- Barbour Road (southbound direction)
- Gordons Road (eastbound and westbound directions)
- Chestnut Street (northbound direction)

The maximum recorded 85th percentile speed in the Falls Hill Traffic Calming Study was 38 mph, recorded on Barbour Road in the southbound direction. The minimum recorded 85th percentile speed was 31 mph, recorded on Pinecastle Road in the southbound direction.

The Study Team finds this important to consider for all local roads within the study area. Any changes made to Shreve Road should be sensitive to impacts on other lower-classification roadways in the area. Recommendations analysis is presented later in this report to consider these types of impacts.

Figure 3-22 85th Percentile Corridor Speeds



Safety Considerations

While crash and speed data provides valuable insights for the corridor, there are limitations to relying solely on these sources on information. Crash data in particular does not provide information regarding near-misses or insight into comfort. To provide a more wholistic consideration of safety along the corridor, the Study Team has reviewed input. This input is discussed more in the Community Feedback Summary discussion in this Section.

The Study Team has also been provided with input from the Fairfax County Police Department (FCPD) to understand enforcement along the corridor. Based on traffic enforcement/citations issued on Shreve Road from 2015 to 2019, most were not speeding related. This appears to be consistent with crash data, which suggests distracted driving contributes to a higher percentage of crashes than speeding.

FCPD has also addressed questions related to speed enforcement options. Speed cameras would not be permitted as an enforcement measure for Shreve Road. FCPD has one radar board showing vehicle speeds that can be deployed around the McLean District, including Shreve Road. This radar board can be placed on Shreve Road intermittently, as it must be rotated around the District.

OPERATIONS SUMMARY

A traffic operations analysis was conducted using the baseline 2019 and 2030 volumes estimated in the Data Collection discussion in this Section. These analyses were conducted to help identify concerns and opportunities for potential improvements to Shreve Road.

Traffic operations were conducted using Synchro software and with guidance from VDOT's most recent (February 2020) version of the Traffic Operations and Safety Analysis Manual (TOSAM). In particular, TOSAM was used to determine appropriate default values for peak hour factors along the corridor.

Pedestrian and bicycle volumes were also factored into the analysis for the two intersections that also include W&OD Trail Crossings. The weekday daily volumes shown on **Figure 3-17** were adjusted using data from the aforementioned study conducted by Toole Design Group in 2017. Based on the information contained in the study, weekday morning trail volumes constitute approximately three percent of daily volumes and weekday evening trail volumes constitute approximately 3.5 percent of daily volumes. Results of the Synchro analyses are provided in **Appendix A**. A description of Level-of-Service methods and criteria are provided in **Appendix B**.

Notable findings of these analyses are as follows:

- The six study intersections likely operate with uncongested conditions during the weekday morning and evening peak hours under 2019 conditions.

- The Shreve Road intersection with Virginia Lane could operate with congested conditions during the weekday evening peak hours under 2030 conditions. In particular, southbound stop-controlled approach could operate at LOS E with a queue of five vehicles.
- The Shreve Road intersection with Buckelew Drive/Pinecastle Road could also operate with congested conditions during the weekday morning and evening peak hours under 2030 conditions. In particular, the northbound stop-controlled approach could operate at LOS F with a queue of up to eight vehicles.

These results are largely consistent with input received from the community and stakeholders. Both locations expected to operate worse under 2030 conditions were identified as key focus areas. It is also important to note these intersections coincide with W&OD Trail Crossings, which complicate intersection operations and impact user comfort.

FIELD VISIT

The Study Team also conducted a field visit along Shreve Road in April 2020 to document and verify existing conditions. Pictures were taken along the corridor and are included below with considerations. These photos provide important examples of key areas along the corridor. While not all are included here, the Study Team did collect several more photos within the study area for reference when developing recommendations.

Figure 3-23 shows conditions on Shreve Road heading northbound near the curve at Oldewood Drive. There have been several concerns brought up by members of the community regarding this curve, the lack of pedestrian infrastructure, and poor lighting along this route connecting to the Dunn-Loring/Merrifield Metro Station. In particular, the Study Team noted the small pedestrian path on the side to the right on the image.

Figure 3-23 Facing Northbound Near Oldewood Curve

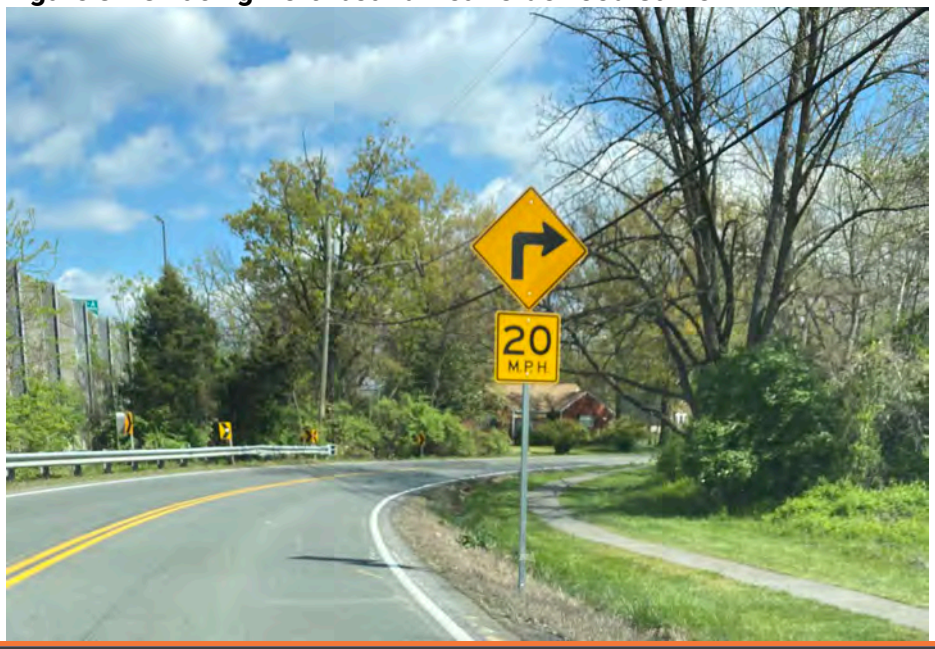


Figure 3-24 shows conditions heading eastbound on Shreve Road near Pioneer Lane. Of particular note, the sidewalk on the north side of the road ends near Pioneer Lane. However, no crossings or treatments are present at or near this location.

Figure 3-24 Facing Eastbound Near Pioneer Lane

Figure 3-25 continues eastbound on Shreve Road near Avon Lane. This portion of the corridor is a transition point into the Shrevewood Elementary School area and W&OD Trail Crossing at Virginia Lane.

Figure 3-25 Facing Eastbound Near Avon Lane

Figure 3-26 shows conditions facing westbound on Shreve Road near the elementary school. The Study Team has noted that where the road splits and has a median, there is a noticeable slope and a power line present.

Figure 3-26 Facing Westbound Near Shrevewood Elementary School

Figure 3-27 shows conditions facing northbound on Shreve Road at Virginia Lane. From field visits, it appears there is not adequate distance to store one vehicle between the stop bar on Virginia lane and the W&OD Trail crossing. While not included in this photo, the intersection configuration is also atypical with Shreve Road transitioning back to an undivided roadway at this point.

Figure 3-27 Facing Northbound at Virginia Lane

Figure 3-28 shows conditions facing westbound on Shreve Road near Pinecastle Road. Of particular note, the road makes an s-bend between Pinecastle Road and Buckelew Drive. There is also a W&OD Trail crossing between these two streets, which has been raised by members of the community and stakeholders as an area for improvement.

Figure 3-28 Facing Westbound Near Pinecastle

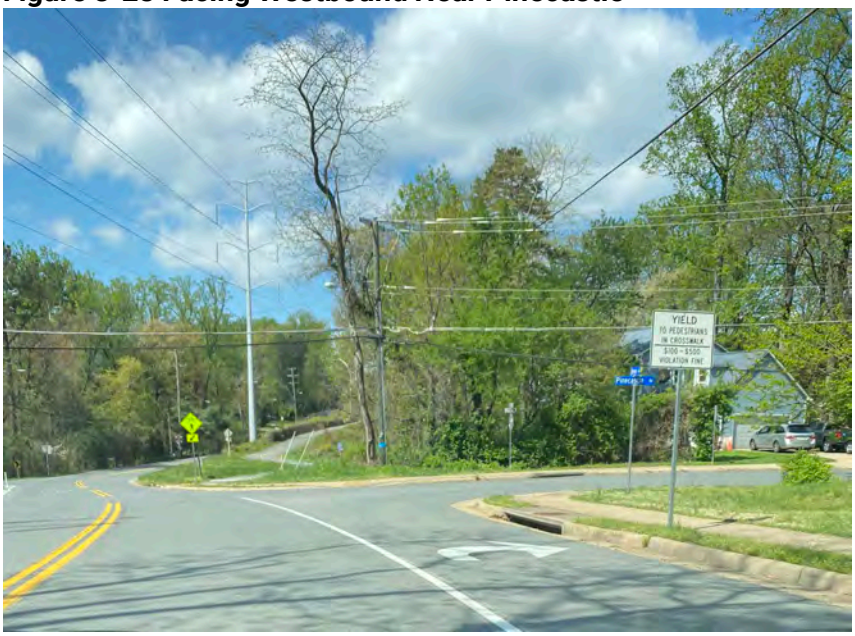
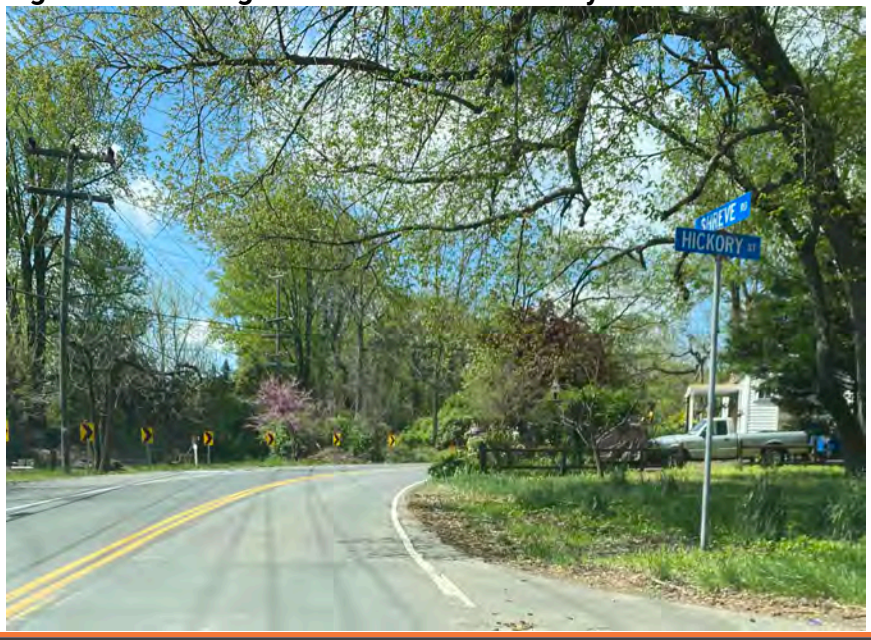


Figure 3-29 shows conditions facing southbound on Shreve Road near Hickory Street. This area was identified early on as needing improvement, given this was also the approximate location of a pedestrian fatality. While not clearly depicted in the photo, there is a small pedestrian path to the left side of the photo. A driveway for Vulcan Materials is also located to the left side of the photo and large trucks often turn in and out of the driveway.

Figure 3-29 Facing Southbound Near Hickory Street



SECTION 4

ALTERNATIVES DEVELOPMENT AND EVALUATION

ALTERNATIVES DEVELOPMENT AND EVALUATION

The Study Team took a comprehensive approach to develop alternatives, considering corridor-wide recommendations, short-term recommendations, long-term recommendations, and leveraging in-process improvements. This included a two-step process: 1) initial screening and 2) recommendation development. Initial screening and recommendation development activities are summarized in this section of the report.

Community/Stakeholder Engagement is documented in Section 5 of this report. Final Recommendations, and Next Steps are documented in Section 6 of this report (Next Steps & Prioritization).

INITIAL SCREENING

The Study Team first conducted an initial screening of potential recommendations to explore the feasibility of a wide range of recommendations. With input from VDOT staff and Stakeholders, the Study Team identified potential recommendations to be screened out. Factors considered in screening out potential recommendations included cost, property impacts, and consistency with stakeholder and agency guidance/policy.

This approach ensured that the Study Team considered a wide variety of options. Potential recommendations initially screened out at this time are organized by location and detailed below. Treatments may become more appropriate in the future if conditions or guidance changes.

Corridor-wide Potential Recommendations

- *Speed limit reduction*
  - **Description:** VDOT reduces the speed limit on the entirety of Shreve Road to 25 mph.
  - **Reason for screening out:** *Consistency with VDOT guidance/policy.* For Shreve Road, VDOT policy requires that speed limits are established based on a speed study. As previously mentioned, a speed study was conducted for the corridor. Based on the current travel speeds, physical features, and type/extent of development along the roadway, VDOT engineers could not justify a speed limit reduction to 25 mph for the entire corridor at this time. If roadway characteristics change, to potentially include some or all of the recommendations described in Section 6 (Next Steps & Prioritization), a new speed study that shows a change in vehicle speeds along the corridor could justify revising the speed limit.

- *Bike lane feasibility*
  - **Description:** Add bike lanes on Shreve Road, either using the existing pavement width or through a capital improvement project.
  - **Reason for screening out:** *Consistency with FCDOT policy and national guidance.* The Study Team reviewed the potential to repurpose existing pavement width on Shreve Road to provide on-street marked bikes lanes, as is currently included in the Bicycle Master Plan. Based on this review, no consistent facility connecting to destinations would be provided. This would not be recommended based on FCDOT, VDOT, and national guidance, which encourages continuous bike facilities without gaps.

    The Study Team also considered the potential for a capital improvement project to construct bicycle facilities comfortable for all ages and ability bicyclists on Shreve Road. National guidance strongly recommends bike lanes be protected, generally achieved by including a curb or buffer between vehicle and bicycle traffic. When considering the above-ground utilities along Shreve Road, a shared-use path or trail facility becomes more feasible than on-street bicycle facilities.

    FCDOT staff independently suggested a shared-use path or trail facility, citing the traffic volumes on Shreve Road and consistent with the Countywide Trails Plan. FCDOT will identify appropriate bicycle and pedestrian facilities for the corridor as part of the ActiveFairfax planning process reconciling the Countywid Trails Plan and Bicycle Master Plan .
- *Distracted driving/speeding campaign*
  - **Description:** Educate drivers about the dangers of distracted driving and speeding.
  - **Reason for screening out:** *Consistency with national guidance/policy.* Crash data for the corridor suggests distracted driving, such as texting while driving, is a notable contributing factor to crashes. The Study Team considered the potential for an educational campaign. The Study Team found that an educational/outreach campaign would be more effective as a community-led effort for corridor like Shreve Road. In particular, an educational or outreach campaign may have potential if integrated with events at Shrevewood Elementary School. While this potential recommendation is screened out as an action for agency stakeholders, community volunteers are not precluded from pursing these types of campaigns with support from agency stakeholders.
- *Speed humps*
  - **Description:** Add speed humps along Shreve Road.
  - **Reason for screening out:** *Consistency with VDOT guidance/policy.* Guidance in VDOT's Traffic Calming Process shows that Shreve Road does not qualify for traffic calming, including speed humps, given the daily traffic volumes and roadway classification.

- *Stop signs*
  - **Description:** Add stop signs on Shreve Road at intersections with side streets.
  - **Reason for screening out:** *Consistency with VDOT guidance/policy.* Before installing a multi-way stop, VDOT policy requires the completion of a warrant study. This is consistent with national guidance. Research has found that the overuse of stop signs can result in non-compliance by drivers. A multi-way stop may be warranted if specific crash history and/or volume and operational thresholds are met. VDOT does not consider stop signs as a speed control measure.

    The Study Team reviewed side street volumes, crash history, and operational results within the study area. No streets that would warrant or be appropriate for stop control were identified.
- *Rumble strips*
  - **Description:** Add rumble strips at locations along the corridor to slow drivers and/or alert them to activity areas.
  - **Reason for screening out:** *Consistency with VDOT guidance/policy.* VDOT guidance outlines rumble strips as an appropriate measure for interstates, freeways, expressways, rural arterials, rural collectors, and rural local roads. Given Shreve Road does not fall within these roadway categories, rumble strips would not be an appropriate measure for this corridor. The Study Team also noted that rumble strips could generate noise, which would not be desirable given the proximity of residential uses along the corridor.

Between Route 29 and Oldewood Curve

- *Radar Signs*
  - **Description:** Add radar signs on Shreve Road approaching the curve near Oldewood Drive.
  - **Reason for screening out:** *Consistency with VDOT/FCDOT guidance.* Given the roadway classification for Shreve Road, VDOT engineering staff noted that adding radar signs would require a waiver and a commitment from FCDOT to maintain the radar signs. FCDOT noted it would recommend screening out radar signs since the roadway classification is not consistent with VDOT guidance.
- *Redesign Oldewood Curve*
  - **Description:** Redesign the roadway alignment of Shreve Road near Oldewood Drive.
  - **Reason for screening out:** *Cost.* The curve on Shreve Road near Oldewood Drive would likely create impacts on structures near Interstate-495. Based on this, the Study Team determined that any redesign will likely have a high cost.

- *Interstate 495 Pedestrian Bridge*
  - **Description:** Construct a pedestrian bridge over Interstate 495 between Shreve Road and the Merrifield area.
  - **Reason for screening out:** *Cost.* The bridge structure components to construct a pedestrian bridge would be significant, especially over the interstate. For context, FCDOT is currently working on a pedestrian bridge crossing for the W&OD Trail over Wiehle Avenue and estimates the project to be about $13 million. Given the existing and expected land uses in the area, a pedestrian bridge project would likely not compete well against other projects for funding. However, further analysis of the long-term potential of another bridge across the interstate could be reassessed as part of the ActiveFairfax plan. Adding a project of this magnitude to Fairfax County's plans requires larger consideration of land use and development potential between Shreve Road and Merrifield, which is outside the scope of this study.

Between Oldewood Curve and Fairwood Lane

- *Chokers*
  - **Description:** Add chokers between Pioneer Lane and Fairwood Lane to narrow lane widths
  - **Reason for screening out:** *Consistency with VDOT/national guidance.* VDOT traffic calming guidance states that chokers have the disadvantage of also narrowing the travel lane for bicyclists. While there are ways to design chokers to accommodate bicyclists, it would require modifications to curb, gutter, and stormwater management that would be difficult to accommodate within the existing right-of-way. Also, the pavement width used to construct chokers could be used to improve sidewalk, trail, or bicycle facilities.
- *Crosswalks*
  - **Description:** Add crosswalks between Pioneer Lane and Fairwood Lane.
  - **Reason for screening out:** *Consistency with VDOT guidance.* The Study Team reviewed VDOT guidance for adding pedestrian crossings along Shreve Road between Pioneer Lane and Fairwood Lane. In this stretch of Shreve Road, adding crosswalks would not meet VDOT guidance for every intersection because the distance to schools, recreation areas, and transit stops is over ¼ of a mile at this time. Fairwood Lane and Holly Manor Drive *would* meet distance to schools, hence FCDOT's SRTS project adding a crosswalk at Fairwood Lane. The Study Team noted that crosswalks could be added across the local streets if a shared-use path was constructed instead of a sidewalk.
- *Roundabouts/mini-roundabouts*
  - **Description:** Construct roundabouts or mini-roundabouts at Pioneer Lane and/or Fairwood Lane.
  - **Reason for screening out:** *Cost and property impacts.* The Study Team reviewed the available right-of-way at Pioneer Lane and Fairwood Lane to construct either roundabouts or mini-roundabouts. Both options would require obtaining land from residential properties,

which would increase project costs. At Fairwood Lane, in particular, individual driveways would need to be accessed via the roundabout.

Designs using flexible barriers

- **Description:** Construct a chicane at Pioneer Lane and/or a pedestrian median at Fairwood Lane using flexible barriers.
- **Reason for screening out:** *Consistency with VDOT guidance.* The Study Team reviewed the potential to repurpose right-turn lanes at Pioneer Lane and Fairwood Lane using flexible barriers to implement in the short-term. Based on input from VDOT staff, flexible barriers are not a recommended treatment of VDOT roadways. VDOT has found that these materials can create maintenance and snow plowing issues and act as a potential vehicle obstruction.

Between Fairwood Lane and Pinecastle Road

- *Grade-separated W&OD crossing*
  - **Description:** Construct a bridge at the Virginia Lane W&OD crossing.
  - **Reason for screening out:** *Cost.* For context, FCDOT is currently working on a pedestrian bridge crossing for the W&OD Trail over Wiehle Avenue and estimates the project to be about $13 million. Given the existing and expected land uses in the area, a bridge project would not compete well against other projects for funding.
- *W&OD Trail bollards*
  - **Description:** Add centerline bollards on the W&OD Trail at Virginia Lane to deflect bicycles and reduce speeds.
  - **Reason for screening out:** *Consistency with NOVA Parks' guidance.* NOVA Parks has avoided using this treatment, given it narrows the trail and introduces the potential for people biking to collide with the bollards.

Between Pinecastle Road and Hickory Curve

- *Realignment of Pinecastle Road/Buckelew Drive*
  - **Description:** Realign the Pinecastle Road and Buckelew Drive approaches on Shreve Road to better accommodate the W&OD trail crossing.
  - **Reason for screening out:** *Property impacts.* The Study Team looked at potential reconfigurations of Buckelew Drive and Pinecastle Road to better align the crossings. There would be notable property impacts to at least one residential home and/or the Poplar Heights Recreation Association. These property impacts would likely include impacts to buildings/site designs.

- *Redesign Hickory Curve*
  - **Description:** Redesign the roadway alignment of Shreve Road near the curve at Hickory Street.
  - **Reason for screening out:** *Property impacts.* Based on the land uses near the Hickory Street curve, realigning Shreve Road would have notable property impacts to at least one residential home. These property impacts would likely include impacts to buildings/site designs.
- *Add guardrail*
  - **Description:** Add guardrail on Shreve Road along the Hickory curve.
  - **Reason for screening out:** *Consistency with VDOT guidance/policy.* The Study worked with VDOT engineering staff to understand VDOT guidance on the installation of guardrail. Guardrail is a device intended to shield a motorist who has left the roadway from striking fixed object hazards within the clear zone that cannot be mitigated through other means. These may include large trees, bridge piers, retaining walls, and utility poles, among other obstacles.

    Preference is always given to maintaining an area free of obstructions (a "clear zone") adjacent to the roadway instead of installing guardrail. If it is not feasible to remove those obstacles, guardrails are considered and installed as the consequences of striking a guardrail would be less severe than striking fixed object hazards. Based on this understanding outlined in VDOT guidelines, VDOT Traffic Engineering found that guardrail installation is not warranted for Shreve Road along the Hickory curve.
- *Close driveway*
  - **Description:** Close the current Vulcan Materials Company driveway.
  - **Reason for screening out:** *Consistency with VDOT guidance/policy.* Current VDOT driveway regulations do not give VDOT the absolute authority to close existing entrances. If there will be a significant change or redevelopment of the property, then VDOT may require site access changes. The Study Team would generally recommend any future land use action for this site include a reconfiguration of site access points to allow for the closure of the driveway on Shreve Road. However, some flexibility may be required for the potential site circulation and expected land use. Given the uncertainty and reliance on future land use development to make significant changes, the Study Team determined this potential recommendation has limited potential for immediate next steps.

- *Radar Signs*
  - **Description:** Add permanent radar signs on Shreve Road approaching the curve near Hickory Street.
  - **Reason for screening out:** *Consistency with VDOT/FCDOT guidance.* Given the roadway classification for Shreve Road, VDOT engineering staff noted that adding radar signs would require a waiver and a commitment from FCDOT to maintain the radar signs. FCDOT noted it would recommend screening out radar signs since the roadway classification is not consistent with VDOT guidance.

Between Hickory Curve and Route 7

- *Raised Intersection*
  - **Description:** Construct a raised intersection at Gordons Road.
  - **Reason for screening out:** *Consistency with VDOT guidance/policy.* Guidance in VDOT's Traffic Calming Process shows that Shreve Road does not qualify for traffic calming, including raised crossings or approaches, given the daily traffic volumes and roadway classification. While vertical deflection measures like raised intersections or speed humps are not appropriate, horizontal deflection measures are more applicable.

RECOMMENDATIONS DEVELOPMENT AND EVALUATION

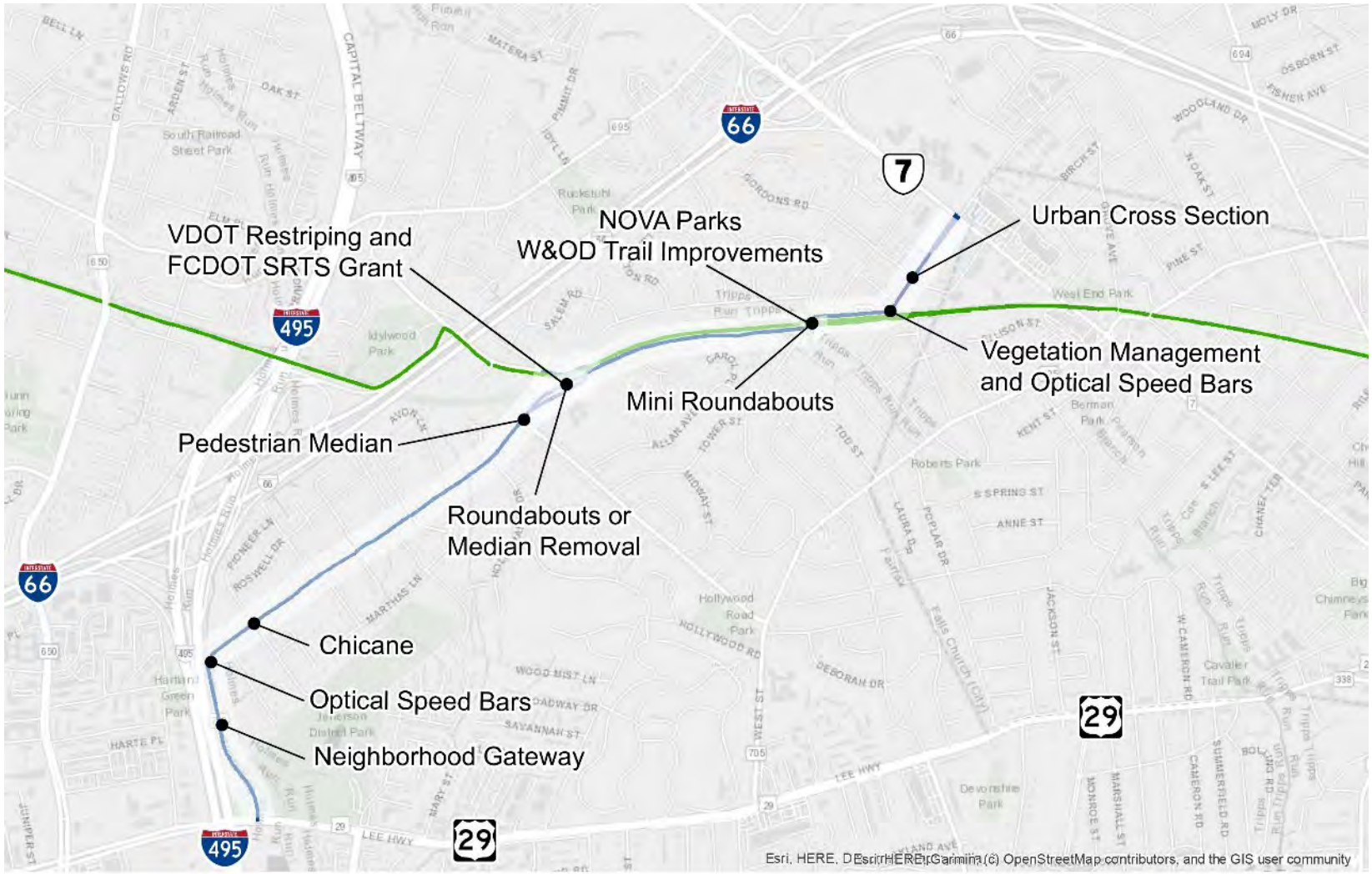
Following the initial screening, the Study Team identified issue and opportunity areas shown in **Figure 4-1**. The areas were defined as Route 29 Transition, Oldewood Curve, Pioneer Lane, Fairwood Lane, Shrevewood Elementary School, Pinecastle Road & Buckelew Drive Intersections, Hickory Curve, and Gordons Road.

The Study Team further developed potential recommendations that survived the screening process. These are shown for the entire corridor in **Figure 4-2**. These recommendations were shared with the community at a Virtual Public Information Meeting on October 7, 2020. The recommendations are described in this section and are evaluated based on the objectives outlined for the study.

Given FCDOT plans to identify appropriate bicycle and pedestrian facilities for the corridor as part of a more extensive planning process, the Study Team used input from the engagement process to identify priority sidewalk/trail improvements to include in the final recommendations. These activities and recommendations are included in Section 5 of this report (Next Steps & Prioritization).

Figure 4-1 Issue and Opportunity Areas

Figure 4-2 Developed Recommendations



Neighborhood Gateway

At the entrance to the neighborhood near Route 29, the Study Team recommends adding a neighborhood gateway. An example is shown in **Figure 4-3**. A neighborhood gateway is typically a monument sign and may incorporate a median or landscaping for additional traffic calming benefits. This recommendation would be a long-term alternative, although it could be implemented in less than ten years.

Figure 4-3 Neighborhood Gateway

Objectives met by the recommendation include:

- Walking and biking: **Maybe.** This recommendation may allow for some landscaping to improve people's walking and biking experience, along with potentially reducing vehicle speeds.
- Reduce conflicts at activity points: **Maybe.** A pedestrian median could be incorporated with the gateway, which would reduce potential conflicts between pedestrians and vehicles.
- Reduce vehicle travel speeds: **Yes.** Based on VDOT's Traffic Calming Guide, this type of treatment can reduce vehicle speeds by 2 mph or up to 6 mph if incorporated with a pedestrian median.
- Reduce impediments to sight lines: **No.** This recommendation would not cut back vegetation, change geometry, or move parking.
- Feasible for implementation and funding: **Yes.** Depending on size, design, and drainage needs, the cost for this recommendation varies. This recommendation would not leverage nearby grants/applications and would have unique maintenance needs.

Optical Speed Bars (near Oldewood Drive)

At the curve in Shreve Road near Oldewood Drive, the Study Team recommends adding optical speed bars. An example is shown in **Figure 4-4**. Optical speed bars are a kind of retroreflective pavement marking which can be installed to visually narrow the roadway and encourage drivers to slow down as they approach the curve. This recommendation would be a short-term alternative and could be implemented relatively quickly.

Figure 4-4 Optical Speed Bars

Objectives met by the recommendation include:

- Walking and biking: **No.** This recommendation may potentially reduce vehicle speeds, but benefits to walkers and bikers would be minimal.
- Reduce conflicts at activity points: **No.** This recommendation would not change the geometry of the roadway or conflict points between modes.
- Reduce vehicle travel speeds: **Yes.** VDOT has conducted before and after evaluations of optical speed bars and found average vehicle speeds could be reduced by 1 mph or up to 10 mph.
- Reduce impediments to sight lines: **No.** This recommendation would not cut back vegetation, change geometry, or move parking.
- Feasible for implementation and funding: **Yes.** The cost of this recommendation would be minimal and include the cost of retroreflective pavement markings. Future roadway maintenance activities could incorporate this recommendation.

Chicane

At Pioneer Lane, the Study Team identified an opportunity to repurpose a right-turn lane provided on Shreve Road. Based on data provided in the Vehicle Volumes discussion in Section 3, this location does not likely meet turn lane warrants outlined in VDOT's Road Design Manual Appendix F. The turn lane warrant evaluation is included in **Appendix C**. A sketch of this recommendation is included in **Figure 4-5**.

Chicanes add a back-and-forth movement to vehicle traffic, which helps slow vehicle speeds. This recommendation also includes curb extensions and tightening the curb radii to reduce vehicle turning speeds. This recommendation would be a long-term alternative, although it could be implemented in less than ten years. Objectives met by the recommendation include:

- Walking and biking: **Yes.** This recommendation widens the sidewalk and increases the buffer with vehicle traffic. Curb ramp improvements are also included.
- Reduce conflicts at activity points: **Yes.** Curb extensions reduce the crossing distance for pedestrians and bicyclists. This reduces the vehicle-pedestrian conflict area.
- Reduce vehicle travel speeds: **Yes.** Based on VDOT's Traffic Calming Guide, chicanes can reduce vehicle speeds by 3 to 9 mph. Curb extensions can reduce turning vehicle speeds by 6 to 8 mph.
- Reduce impediments to sight lines: **Yes.** Geometry changes to add curb extensions improve sight lines to see people walking and biking.
- Feasible for implementation and funding: **Yes.** This recommendation would not leverage nearby grants/applications and would have minimal maintenance needs.

Figure 4-5 Chicane

KITTELSON & ASSOCIATES

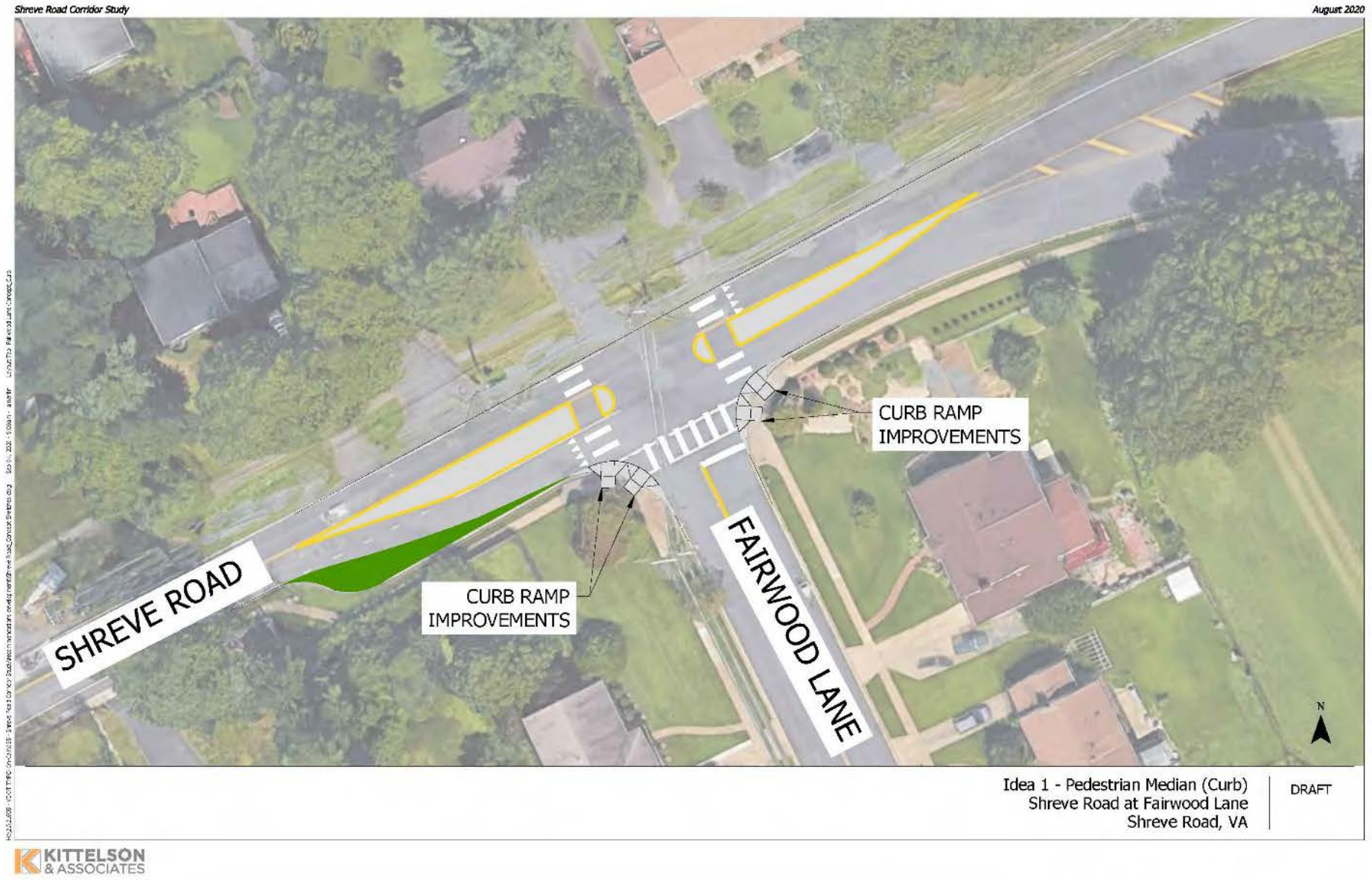
Pedestrian Median

Similarly, at Fairwood Lane, the Study Team identified an opportunity to repurpose an existing right-turn lane. The turn lane warrant evaluation is included in **Appendix C**. A sketch of this recommendation is included in **Figure 4-6**. This recommendation would repurpose the right-turn lane to accommodate pedestrian medians, add crosswalks, and add yield markings. It is recommended that curb ramp improvements also be constructed. With the pedestrian median, people crossing the road would have a refuge space to cross one lane of traffic and be able to wait to find a gap in traffic in the other direction. This recommendation would be a long-term alternative, although it could be implemented in less than ten years.

Objectives met by the recommendation include:

- Walking and biking: **Yes.** This recommendation increases the buffer with vehicle traffic and includes curb ramp improvements.
- Reduce conflicts at activity points: **Yes.** Potential conflicts between pedestrians and vehicles are effectively cut in half with the addition of the median.
- Reduce vehicle travel speeds: **Yes.** Based on VDOT's Traffic Calming Guide, this type of treatment can reduce vehicle speeds by about 4 mph.
- Reduce impediments to sight lines: **Yes.** Geometry changes improve sight lines to see people walking and biking.
- Feasible for implementation and funding: **Yes.** Based on VDOT's Traffic Calming Guide, pedestrian median projects can cost between $10,000 and $30,000. This recommendation would leverage the nearby SRTS grant and would have minimal maintenance needs.

Figure 4-6 Pedestrian Median



VDOT Restriping and FCDOT SRTS Grant

To build upon ongoing efforts by VDOT and FCDOT, the Study Team recommends moving forward with the proposed short-term improvements in front of Shrevewood Elementary School, as shown in **Figure 3-5** and **Figure 3-6** in the previous section.

Roundabouts

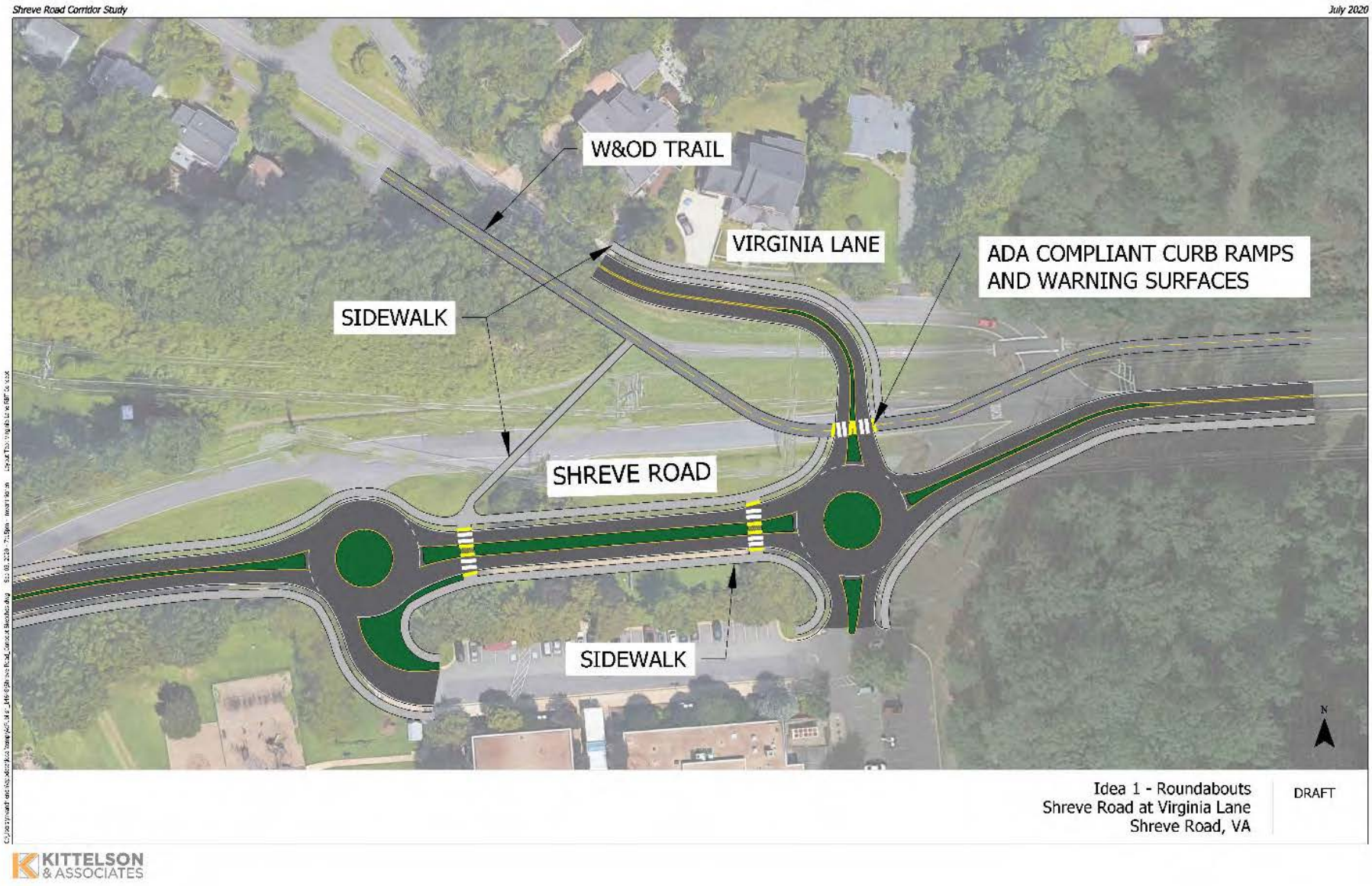
In front of Shrevewood Elementary School, the Study Team looked at two potential long-term alternatives. The first is shown in **Figure 4-7** and adds roundabouts at the school driveways and realign Virginia Lane to intersect as a more conventional intersection. One of the benefits of this alternative is roundabout designs allow for greater speed control entering and exiting an intersection, which extends upstream and downstream of the roundabout.

The Study Team completed a capacity analysis for this intersection configuration, included in **Appendix D,** and found the roundabouts to operate below capacity and with minimal delay for current and future traffic volumes. The Study Team also reviewed VDOT's Road Design Manual Appendix F to ensure the roundabouts' spacing meets VDOT's required 250 feet for this configuration. This recommendation would be a long-term alternative, likely taking more than ten years to implement.

Objectives met by the recommendation include:

- Walking and biking: **Yes.** This recommendation would add and widen sidewalks, add crosswalks, and increase the buffer from vehicle traffic.
- Reduce conflicts at activity points: **Yes.** While a conventional intersection has 32 conflict points, a roundabout has only eight conflict points. Also, pedestrian medians are incorporated on each approach to allow pedestrians a refuge space when crossing streams of traffic.
- Reduce vehicle travel speeds: **Yes.** Roundabout design typically assumes 15 to 25 mph entering speeds.
- Reduce impediments to sight lines: **Yes.** This recommendation would add pedestrian medians to improve visibility when crossing streams of traffic. The realignment of the Virginia Lane approach also improves sight lines.
- Feasible for implementation and funding: **Maybe.** Roundabout projects typically cost in the range of several million dollars. However, the upfront capital costs are often offset when considering the lifecycle maintenance, safety, and capacity costs compared to stop-controlled and signalized intersections. This recommendation could leverage the nearby SRTS grant. There would be several steps required to secure funding before a concept like this could be implemented.

Figure 4-7 Roundabouts



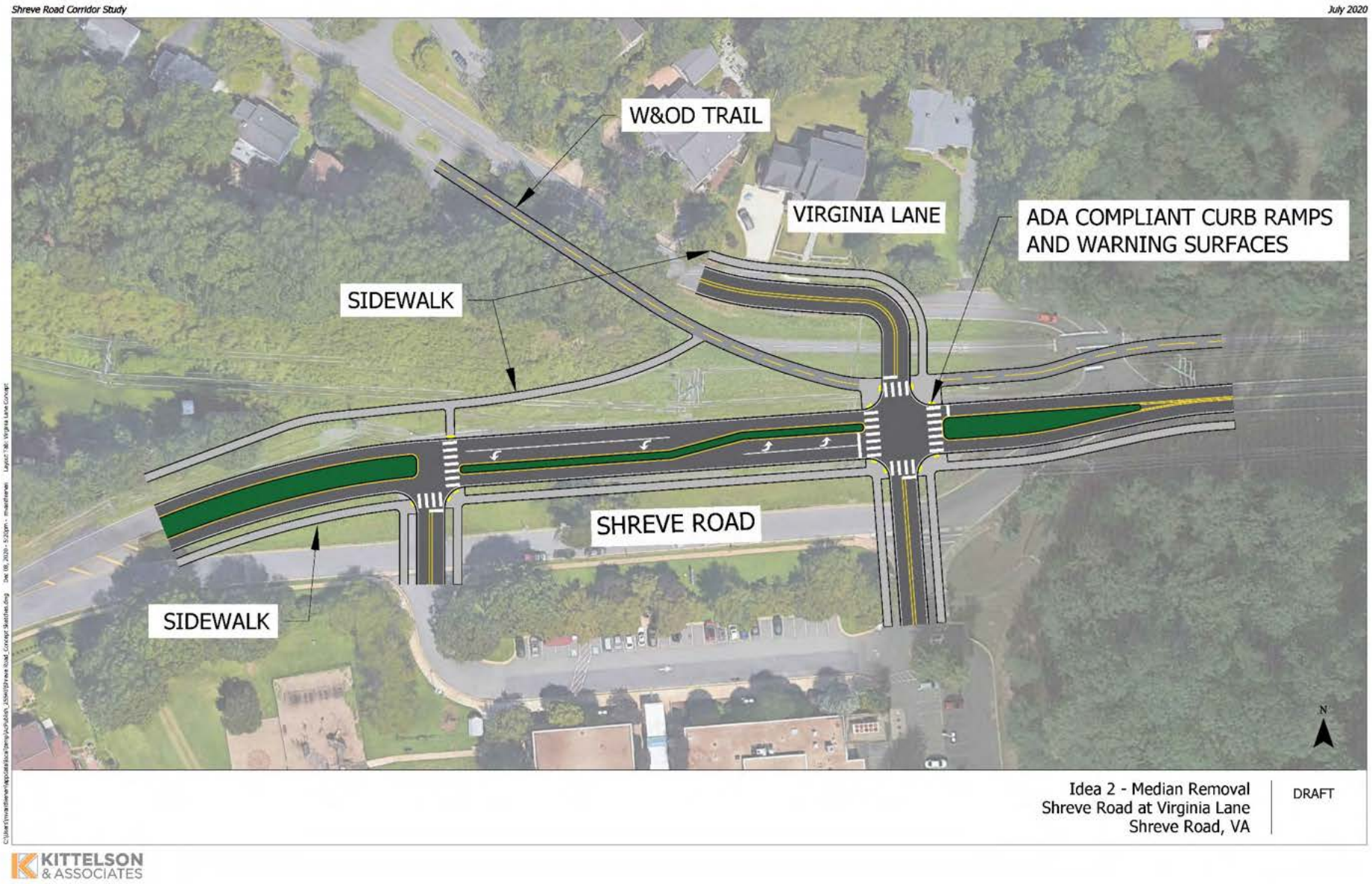
Median Removal

The second potential long-term alternative the Study Team recommended in front of Shrevewood Elementary School is shown in **Figure 4-8**. This recommendation would reduce the existing median width, add sidewalks and crosswalks, and construct a signalized intersection at the realigned Virginia Lane, pending the completion of a Signal Justification Report. An initial review of traffic data and signal warrants was completed and is included in **Appendix D**. Based on this initial review, it is likely the intersection would meet MUTCD eight-hour vehicle volume and four-hour vehicle volume signal warrants for existing conditions. The intersection might also meet MUTCD school crossing warrants under existing conditions. A capacity analysis for this intersection configuration is also included in **Appendix D.** The Study Team also reviewed VDOT's Road Design Manual Appendix F to ensure spacing between the signal and median crossover meets VDOT's required 335 feet for this configuration. This recommendation would be a long-term alternative, likely taking more than ten years to implement.

Objectives met by the recommendation include:

- Walking and biking: **Yes.** This recommendation would add and widen sidewalks, add crosswalks, and increase the buffer from vehicle traffic.
- Reduce conflicts at activity points: **Yes.** Signalized pedestrian crossings in front of the school would be an improvement over existing conditions, as no marked crossings are provided to cross Shreve Road. The roundabouts alternative provides a greater reduction of conflicts.
- Reduce vehicle travel speeds: **Maybe.** While a signal may introduce some delay to slow through traffic on Shreve Road, this alternative would not provide the same continuous speed control as the roundabouts alternative.
- Reduce impediments to sight lines: **Yes.** Like the roundabouts alternative, this alternative would realign the Virginia Lane approach to improve sight lines.
- Feasible for implementation and funding: **Maybe.** Signal installations are first contingent on the completion of a Signal Justification Report. Following the report's completion, signal projects typically cost in the range of several hundreds of thousands of dollars. Should a signal not be warranted, there would still be some benefits to realigning Virginia Lane and reducing the median width in front of the school. This recommendation could leverage the nearby SRTS grants. There would be several steps required to secure funding before a concept like this could be implemented.

Figure 4-8 Median Removal



NOVA Parks W&OD Trail Improvements

To build upon ongoing efforts by VDOT and NOVA Parks, the Study Team recommends moving forward with the proposed short-term improvements to the W&OD Trail near the intersections of Pinecastle Road and Buckelew Drive, as shown in **Figure 3-7** in the previous section. VDOT staff recommend reconstructing the Pinecastle Road curb instead of using flexible barriers as currently shown due to maintenance considerations, snow removal, and potential for flying objects should vehicles hit the flexible barriers

- Walking and biking: **Yes.** This recommendation would increase the buffer from vehicle traffic and include curb ramp improvements.
- Reduce conflicts at activity points: **Yes.** Curb extensions reduce the crossing distance for pedestrians and bicyclists. This reduces the vehicle-pedestrian conflict area.
- Reduce vehicle travel speeds: **Yes.** Curb extensions can reduce turning vehicle speeds by 6 to 8 mph.
- Reduce impediments to sight lines: **Yes.** Geometry changes to add curb extensions improve sight lines to see people walking and biking.
- Feasible for implementation and funding: **Yes.** VDOT and NOVA Parks have identified funding for this project and are moving forward with design and permitting.

Mini Roundabouts

The Study Team also looked at a long-term alternative for the W&OD Trail crossing between Pinecastle Road and Buckelew Drive. As shown in **Figure 4-9**, this recommendation would add mini-roundabouts at Buckelew Drive and Pinecastle Road. The trail crossing is located between the two roundabouts, where vehicle speeds are slower. One of the benefits of this alternative is roundabout designs allow for greater speed control entering and exiting an intersection, which extends upstream and downstream of the roundabout.

The Study Team completed a capacity analysis for this intersection configuration, which is included in **Appendix D**, and found the roundabouts to operate below capacity and with minimal delay for current and future traffic volumes. Community feedback was mixed about this recommendation, therefore the Study Team considers it a low priority until more feedback is collected. This recommendation would be a long-term alternative, likely taking more than ten years to implement.

Figure 4-9 Mini Roundabouts

Objectives met by the recommendation include:

- Walking and biking: **Yes.** This recommendation would add and widen sidewalks and include curb ramp improvements.
- Reduce conflicts at activity points: **Yes.** As previously noted, roundabouts have fewer conflict points than conventional intersections. However, the Study Team did note that left-turning traffic from the side streets would introduce two potential conflicts with the W&OD Trail crossing.
- Reduce vehicle travel speeds: **Yes.** Roundabout design typically assumes 15 to 25 mph entering speeds.
- Reduce impediments to sight lines: **Yes.** This recommendation would add a pedestrian median in the middle of the W&OD Trail crossing to improve the visibility of pedestrians/bicyclists when crossing streams of traffic.
- Feasible for implementation and funding: **Maybe.** Roundabout projects typically cost in the range of several million dollars. However, the upfront capital costs are often offset when considering the lifecycle maintenance, safety, and capacity costs compared to stop-controlled and signalized intersections. This recommendation could leverage the nearby City of Falls Church shared-use path project along Shreve Road between Route 7 and Hickory Street. There would be several steps required to secure funding before a concept like this could be implemented.

Vegetation Management

At the curve in Shreve Road near Hickory Street, the Study Team identified the potential to clear vegetation. There are several small trees and other vegetation in the area that may obstruct sight lines. An example of this recommendation is shown in **Figure 4-10**. This recommendation would be a short-term alternative and could be implemented relatively quickly.

Figure 4-10 Vegetation Management

Objectives met by the recommendation include:

- Walking and biking: **No.** This recommendation does not add or widen sidewalks or crosswalks.
- Reduce conflicts at activity points: **No.** No geometric changes are included with this recommendation that would reduce conflict points between modes.
- Reduce vehicle travel speeds: **No.** VDOT and national guidance do not identify research linking vegetation management to a reduction in travel speeds.
- Reduce impediments to sight lines: **Yes.** This recommendation would cut back vegetation to increase sight lines through the curve.
- Feasible for implementation and funding: **Yes.** The cost of this recommendation would be minimal. Future roadway maintenance activities could incorporate this recommendation.

Optical Speed Bars (near Hickory Street)

At the curve in Shreve Road near Hickory Street, the Study Team recommends adding optical speed bars. An example of this recommendation was shown in **Figure 4-4**. Optical speed bars are a kind of retroreflective pavement marking which can be installed to visually narrow the roadway and encourage drivers to slow down as they approach the curve. This recommendation would be a short-term alternative and could be implemented relatively quickly.

Objectives met by the recommendation include:

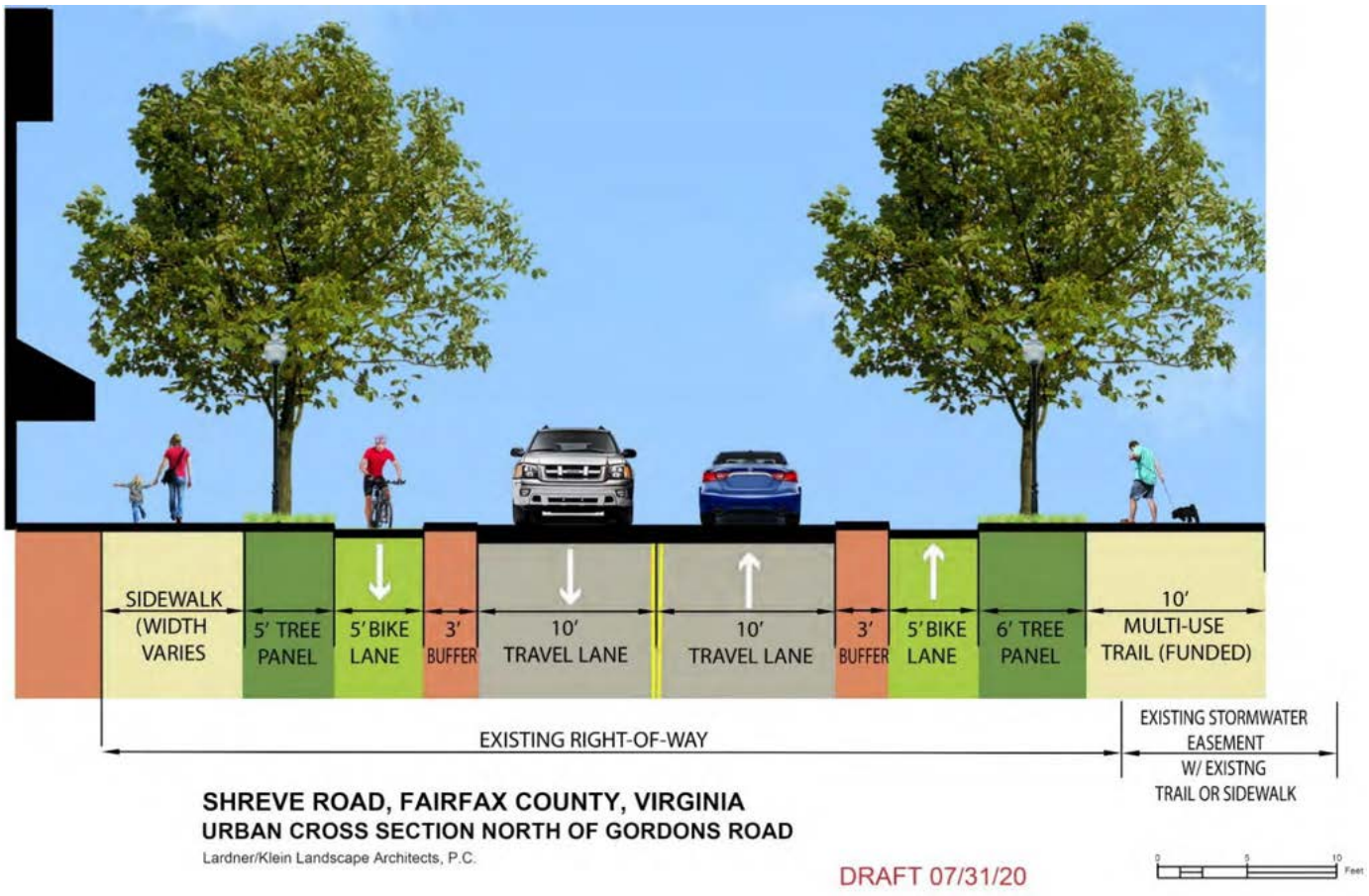
- Walking and biking: **No.** This recommendation may potentially reduce vehicle speeds, but benefits to walkers and bikers would be minimal.
- Reduce conflicts at activity points: **No.** This recommendation does not change the geometry of the roadway or conflict points between modes.
- Reduce vehicle travel speeds: **Yes.** VDOT has conducted before and after evaluations of optical speed bars and found average vehicle speeds could be reduced by 1 mph or up to 10 mph.
- Reduce impediments to sight lines: **No.** This recommendation does not cut back vegetation, change geometry, or move parking.
- Feasible for implementation and funding: **Yes.** The cost of this recommendation is minimal and includes the cost of retroreflective pavement markings. Future roadway maintenance activities could incorporate this recommendation.

Urban Cross Section

The final recommendation from the Study Team is an Urban Cross Section between Route 7 and Gordons Road. This would build on the City of Falls Church shared-use path project depicted on the right side of **Figure 4-11**.

The primary benefit of this cross-section are the buffered bike lanes for this portion of the corridor. Depending on FCDOT recommendations for bicycle facilities along the corridor, a future project could connect the buffered bike lanes with a shared-use path or trail along the rest of Shreve Road. The Study Team identified value in adding buffered bike lanes along this section of Shreve Road as the roadway transitions toward the more multimodal Route 7 corridor. This recommendation provides separate pedestrian and bicycle facilities and could be accommodated mainly within the available right-of-way.

Figure 4-11 Urban Cross Section between Route 7 and Gordons Road



Objectives met by the recommendation include:

- Walking and biking: **Yes.** This recommendation widens sidewalks and provides separated pedestrian and bicycle facilities.
- Reduce conflicts at activity points: **Yes.** The addition of a buffered bike lane reduces bicycle-vehicle conflicts.
- Reduce vehicle travel speeds: **Maybe.** Based on VDOT's Traffic Calming Guide, the addition of parallel parking to narrow travel lanes can reduce vehicle speeds by 1 to 5 mph. Similar reductions may be possible with the addition of a bike lane.
- Reduce impediments to sight lines: **Yes.** This recommendation moves parking to reduce impediments to sight lines, especially at intersections.
- Feasible for implementation and funding: **Maybe.** This recommendation could leverage the nearby City of Falls Church shared-use path project along Shreve Road between Route 7 and Hickory Street. The Don Beyer Volvo site also provides an opportunity to implement this cross section.

SECTION 5

COMMUNITY OUTREACH

COMMUNITY OUTREACH

COMMUNITY/STAKEHOLDER ENGAGEMENT

Numerous outreach activities were conducted throughout the study to incorporate community input. As noted in the Community Feedback Summary included in Section 3 (Existing and Baseline Conditions Analysis), initial community feedback was considered in developing recommendations. A project website was also developed to provide contact information for the study, so comments could be sent while the study was conducted. The Study Team held several meetings with community members and stakeholders throughout the project, including the following meetings:

- Kick-off with VDOT and FCDOT staff in April 2020;
- Introductory meeting with elected officials and a representative from the Community Working Group in April 2020;
- Stakeholder meeting in June 2020;
- Elected official briefing in September 2020;
- Community Working Group meeting in September 2020;
- Virtual Public Information meeting on October 7th, 2020; and,
- Stakeholder next steps meeting in November 2020.

VDOT conducted a Virtual Public Information Meeting on October 7th, 2020, via GoToWebinar. Staff from VDOT, FCDOT, City of Falls Church, Fairfax County Public Schools, NOVA Parks, FCPD, the consultant team, and local elected officials were in attendance. The meeting included a presentation summarizing information about issues within the existing corridor, ongoing and current improvements, and potential design concepts to mitigate the issues. A recording of the Virtual Public Information Meeting was also posted to the project website, so those unable to attend could watch the Study Team's presentation.

Public feedback was collected using several methods, including written and oral questions during the virtual public meeting, a post-meeting online survey for attendees, and a two-week email comment period after the virtual public meeting.

Summary of Community Feedback

Approximately 70 community members attended the Virtual Public Information Meeting, with approximately 20 people providing comments or asking questions during the webinar. VDOT also received emailed comments throughout the project, which captured comments from 30 community members. Finally, 11 survey responses were provided for the post-meeting online survey. Feedback from the webinar, emailed correspondence, and survey responses are included in **Appendix E**.

To identify common themes among comments from more than 60 community members, the Study Team reviewed comments and tallied how many people expressed support or concerns for any of the recommendations. The results are summarized in **Table 5-1**.

Table 5-1 Community Feedback on Recommendations

Recommendation	Location	Like	Dislike/Had Concerns
Median Removal	Shrevewood Elementary School	9	1
Roundabouts	Shrevewood Elementary School	4	3
Mini Roundabouts	Pinecastle Road and Buckelew Drive	6	8
Chicane	Pioneer Lane	3	0
Neighborhood Gateway	Near Route 29	3	0
Pedestrian Median	Fairwood Lane	3	3
Vegetation Management	Hickory Curve	2	0
Optical Speed Bars	Oldewood Curve and Hickory Curve	2	0
Urban Cross Section	Between Route 7 and Gordons Road	1	2

One goal for the Study Team going into the community engagement process was to better understand the public perception of roundabouts in the locations under consideration. While there were generally people who had concerns for either of the two roundabout recommendations, there were also a roughly equal number of people who expressed support. Of the two locations, the roundabout in front of Shrevewood Elementary School had the fewest feedback concerns.

The Study Team also noted comments related to the Urban Cross Section. While there were people who expressed concerns, those comments were related to this recommendation's relative benefit and cost compared to others along the corridor.

In addition to reviewing comments on the recommendations, the Study Team also summarized comments relating to other issues or specific suggestions. These comment themes are summarized in **Table 5-2**.

Table 5-2 Community Feedback on Issues/Suggestions

Issue/Suggestion	Number of Comments
Other issue: Develop more measures/data between Pioneer Lane and Fairwood Lane	5
Other issue: Develop more measures to address bicycle speeds	5
Suggestion: Add pedestrian beacons for trail crossings	5
Other issue: Develop more measures to address truck traffic	2

The Study Team noted that comments relating to more measures or data between Pioneer Lane and Fairwood Lane are partially due to the limited amount of time to cover all analyses during the Virtual Public Information Meeting. As described in the Between Oldewood Curve and Fairwood Lane discussion in Section 4, the Study Team did consider measures within this area.

While addressing bicycle speeds was not an initial objective for this study, the Study Team considered some options with NOVA Parks. Additional options were developed following the Virtual Public Information Meeting in coordination with NOVA Parks. This is discussed in more detail in the Final Short-Term Recommendations.

The Study Team noted the suggestion from community members that pedestrian beacons be added at the trail crossings. This type of measure would be appropriate for the area and relatively easy to implement. The Study Team incorporated this suggestion into the Final Short-Term Recommendations.

SECTION 6

NEXT STEPS & PRIORITIZATION

NEXT STEPS & PRIORITIZATION

To ensure recommendations incorporate community feedback and maximize the potential for implementation, the Study Team added next steps and prioritization of recommendations to the corridor study. Activities generally included Community/Stakeholder Engagement, Final Short-Term Recommendations, and Final Long-Term Recommendations.

FINAL SHORT-TERM RECOMMENDATIONS

As identified by community members early in the process, one key outcome for the study was to identify recommendations that could be implemented relatively quickly. The Study Team identified which recommendations could be implemented in the short-term during the development of recommendations. To finalize these, the Study Team generally considered three factors:

- How recommendations meet the Project Goals and Objectives,
- Common themes from community feedback, and
- Suggestions from Stakeholders to improve and prioritize the recommendations.

The final short-term recommendations are discussed below and prioritized, with the highest priority recommendations discussed first. VDOT has already taken steps to implement some of these short-term recommendations. Any refinements to the recommendation are discussed along with factors making the recommendation faster or slower to implement. The Study Team makes the following final short-term recommendations in order from fastest to slowest in terms of implementation:

1. Add Pedestrian Beacons for W&OD Trail Crossings
2. Incorporate Pedestrian Median into SRTS Design at Fairwood Lane
3. Add and Upgrade Shreve Road Pedestrian Connections
4. Install Optical Speed Bars and Implement Vegetation Management

1. Add Pedestrian Beacons for W&OD Trail Crossings

- Objectives met: Walking and biking, reduce conflicts at activity points, reduce impediments to sight lines, and feasible for implementation and funding.
- Community feedback: Multiple community members suggested this recommendation. Comments received during the engagement process suggested there are no major concerns.
- Stakeholder suggestions: VDOT staff developed a similar, temporary treatment to implement immediately.

The Study Team recommends adding pedestrian beacons at the W&OD Trail crossings at Shreve Road and Virginia Lane, particularly at the Shreve Road crossing. Community members initially suggested this, and the Study Team found it to be in line with the project goals and objectives. Stakeholders also expressed support for this recommendation. VDOT has already taken steps to

implement a temporary flashing beacon at the W&OD Trail Crossing near Pinecastle Road and Buckelew Drive. An image of this treatment is shown in **Figure 5-1**.

Figure 6-1 Temporary Flashing Beacon at Shreve Road W&OD Trail Crossing

The Study Team recommends a more permanent Rectangular Rapid Flash Beacon (RRFB) be installed on Shreve Road in the near-term to formalize this treatment. The Study Team notes that there may be an opportunity to install an RRFB with Nova Parks' in-process project at this location. The Study Team also recommends an RRFB at the Virginia Lane W&OD Trail crossing.

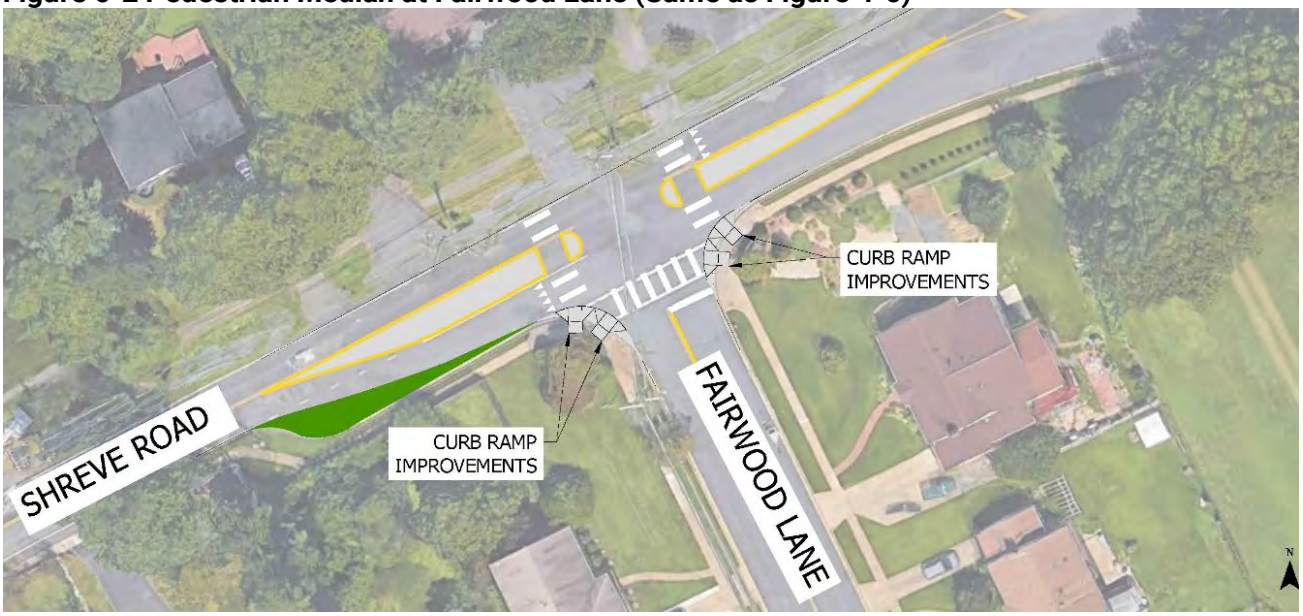
This recommendation meets several of the study objectives, has received positive feedback from community members, and can continue to be implemented relatively quickly.

2. Incorporate Pedestrian Median into SRTS Design at Fairwood Lane

- Objectives met: Walking and biking, reduce conflicts at activity points, reduce vehicle travel speeds, reduce impediments to sight lines, and feasible for implementation and funding.
- Community feedback: Feedback on this recommendation was mixed. Half of the comments for this recommendation were supportive, and half noted some concerns.
- Stakeholder suggestions: FCDOT staff suggested this recommendation could be incorporated in the County's SRTS project, which has been funded and will be moving into design. FCDOT noted that adding the median is not guaranteed for approval. Likely, only one crossing on the east or west side of the intersection would be approved.

The Study Team recommends incorporating a pedestrian median into Fairfax County's proposed Fairwood Lane crossing (shown in **Figure 6-2**). This location is included in Fairfax County's SRTS grant to improve pedestrian crossings between Shrevewood Elementary School and the W&OD Trail. While the Study Team initially identified this as a long-term recommendation, FCDOT staff noted the opportunity to potentially incorporate this suggestion into the SRTS project.

Figure 6-2 Pedestrian Median at Fairwood Lane (Same as Figure 4-6)



While there were some community concerns noted, this recommendation meets all study objectives and has clear next steps for implementation. The Study Team will provide FCDOT with the necessary volume and crash data to support the right turn lane's recommended repurposing.

3. Add and Upgrade Shreve Road Pedestrian Connections

- Objectives met: Walking and biking, and feasible for implementation and funding.
- Community feedback: Multiple community members expressed interest in several specific sidewalk, path, and trail locations. Key locations are identified herein. Completing this connection could also add barrier curb along the Hickory Curve. Comments received during the engagement process suggested there are no major concerns.
- Stakeholder suggestions: FCDOT and City of Falls Church staff suggested scaling back the Urban Cross Section between Route 7 and Gordons Road to remove the bike lanes. This would allow the opportunity to provide more pedestrian facilities, close gaps, and implement the project sooner. Completing the sidewalk connection would provide these similar benefits.

The Study Team noted the following locations specifically throughout the planning process:

- The sidewalk gap on Shreve Road's north side between Chestnut Street and Gordons Road, as shown in **Figure 6-3**.
- Sidewalk gaps on the south side of Shreve Road near Wieland Place, as shown in **Figure 6-4**.
- Widening the existing pedestrian path to be at least 5 feet wide, per VDOT's standard, on the south side of Shreve Road between Route 29 and Pioneer Lane, as shown in **Figure 6-5**.
- Increasing the sidewalk buffer with the roadway on the south side of Shreve Road near Holly Manor Drive, as shown in **Figure 6-6**.
- Adding detectable warning surfaces at the W&OD Trail crossings.

The entire corridor would benefit from improved and more complete pedestrian facilities, however these locations were identified as having the potential and need to be addressed in the short term. Some locations, such as the W&OD Trail crossing on Shreve Road, can be implemented relatively quickly as part of on-going efforts.

Filling the sidewalk gap on Shreve Road's north side between Chestnut Street and Gordons Road (**Figure 6-3**). It presents the opportunity to construct barrier curb through the Hickory Curve of Shreve Road. Based on community feedback, providing improvements to the Hickory Curve is a concern for residents.

Filling the sidewalk gaps on the south side of Shreve Road near Wieland Place (**Figure 6-4**) would fill a gap in pedestrian facilities, particularly for residents on Wieland Place. Filling this gap would also provide a second option for pedestrians to the W&OD Trail. The Study Teams notes this recommendation presents an opportunity to address some of the additional concerns related to bicycle speeds and potential bicyclist-pedestrian conflicts on the W&OD Trail.

Figure 6-3 Sidewalk Connection between Chestnut Street and Gordons Road

Figure 6-4 Sidewalk Connections near Wieland Place

Widening the existing pedestrian path on the south side of Shreve Road between Route 29 and Pioneer Lane (**Figure 6-5**) should be completed to increase the width to 5 feet in line with VDOT standards. The Study Team would also recommend adding pedestrian-scale lighting, if feasible.

Figure 6-5 Pedestrian Path Improvements between Route 29 and Pioneer Lane

Increasing the sidewalk buffer with the roadway on the south side of Shreve Road near Holly Manor Drive (**Figure 6-6**) should be completed to provide a buffer of 4 feet. The current buffer is approximately 1 foot, while current VDOT standards are that a 4 foot buffer be provided for streets with curb and gutter and posted speeds greater than 25 mph. Curb and gutter is currently provided for a portion of this section along Shreve Road.

Figure 6-6 Sidewalk improvements near Holly Manor Drive

Finally, the study team reviewed typical trail treatments to determine if additional timely improvements could be made to the W&OD Trail crossing to better control bicycle speeds. Both locations lack detectable warning surfaces (see **Figure 6-7**). While this measure is most effective for alerting visually impaired pedestrians, it could serve as a visual cue to cyclists to be more aware when traveling through the crossing.

These detectable warning surfaces are already included in the trail realignment design near Pinecastle Road and Buckelew Drive.

Figure 6-7 Example Image of Detectable Warning Surfaces

4. Install Optical Speed Bars and Implement Vegetation Management

- Objectives met: Reduce vehicle travel speeds, reduce impediments to sight lines, and feasible for implementation and funding.
- Community feedback: Multiple community members expressed support for this recommendation. Comments received during the engagement process suggested there are no major concerns.
- Stakeholder suggestions: VDOT noted these activities could be incorporated into routine maintenance for the roadway.

The Study Team recommends installing Optical Speed Bars (see **Figure 4-4**) near the Oldewood and Hickory Curves and implementing vegetation management (see **Figure 4-10**) near the Hickory Curve. This recommendation met only three study objectives and was not as enthusiastically received by the community as adding barrier curb along the Hickory Curve. However, the Study Team believes these modest improvements could be implemented relatively easily with routine maintenance for the roadway.

FINAL LONG-TERM RECOMMENDATIONS

The Study Team also identified which recommendations could be implemented in the long-term during the development of recommendations. The Study Team generally considered the same three factors as were considered with the short-term recommendations:

- How recommendations meet the Project Goals and Objectives,
- Common themes from community feedback, and
- Suggestions from Stakeholders to improve and prioritize the recommendations.

Future planning efforts will also be used to identify appropriate pedestrian and bicycle facilities for the corridor. Based on discussions with FCDOT staff, there is potential for the currently planned bicycle lanes along Shreve Road to be revised to include a shared-use path or trail. Discussions with NOVA Parks have also highlighted the desire to provide separate biking and walking facilities along the W&OD Trail. The Study Team supports both these long-term goals and has coordinated with agency staff throughout the process to provide FCDOT and NOVA Parks with technical analysis and community insight as they pursue these long-term goals.
In addition to supporting long-term efforts to add and improve continuous pedestrian/bicycle facilities, the Study Team's final long-term recommendations are discussed below and prioritized. The highest priority recommendations are discussed first. Any refinements to the recommendation are discussed along with factors making the recommendation higher or lower priority. The Study Team makes the following final long-term recommendations in order from highest priority to lowest priority:

1. Advance the Roundabout Alternative Near Shrevewood Elementary School
2. Advance the Chicane Design at Pioneer Lane
3. Coordinate Potential Bicycle Speed Treatments for the W&OD Trail
4. Develop a Neighborhood Gateway Near Route 29
5. Consider an Urban Cross Section between Route 7 and Gordons Road
6. Potentially Revisit Mini Roundabouts at Pinecastle Road and Buckelew Drive

1. Advance the Roundabout Alternative Near Shrevewood Elementary School

- Objectives met: Walking and biking, reduce conflicts at activity points, reduce vehicle travel speeds, and reduce impediments to sight lines.
- Community feedback: Feedback on this recommendation was mixed. Approximately half of the comments for this recommendation were supportive, and half noted some concerns. Several community members commented on the need to consider peak-hour school operations.
- Stakeholder suggestions: FCDOT and FCPS also noted the need to consider peak hour school operations, and FCDOT suggested adding more pedestrian/bicycle facilities. The type of facility (trail, shared-use path, or sidewalk) is unspecified at this time, as the County expects planning-level facility recommendations for the corridor may change.

The Study Team developed two recommendation options near Shrevewood Elementary School for the long-term. Of those options, the Study Team recommends advancing a roundabout option. While there are similarities between the two options, a roundabout has additional benefits in introducing speed control, reducing the number of crossing conflicts for vehicles, and adding pedestrian medians for every approach to the intersection. While community support for the second option was more uniform, more study objectives are met with the roundabout, and the Study Team identified decent support for the roundabout option.

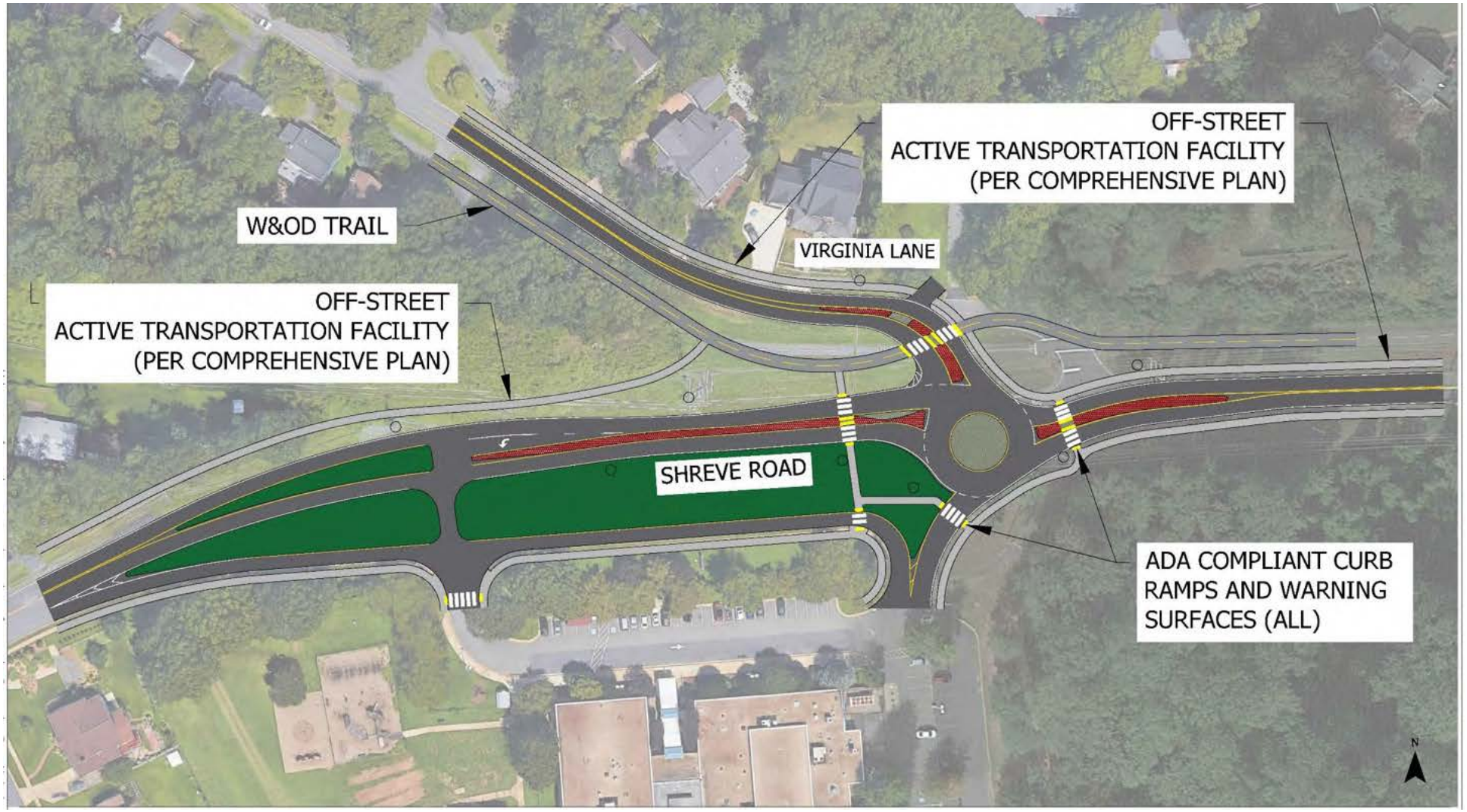
FCDOT and FCPS provided comments for the initial roundabouts recommendation. They noted there could likely be difficulties in accommodating Shrevewood Elementary School's pick-up/drop-off activities. The Study Team held a call with FCDOT and FCPS staff to discuss changes that could be made to the recommendation. Revisions were made to the concept, and the final recommendation is shown in **Figure 6-6**.

The revisions separate through traffic on Shreve Road from school traffic turning in to the driveway. The second western roundabout would also be eliminated to consolidate crossings for the elementary school. FCPS prefers to reduce the number of crossing guards needed for the school. Eliminating the western roundabout also reduces costs, making the recommendation more feasible for implementation.

Design-vehicle checks were conducted to ensure a school bus could traverse the roundabout on a regular basis. Other constructability elements to consider as this recommendation is furthered are grades, utilities, and right-of-way impacts, particularly potential impacts to the large power-line poles in the area. Should any of those elements become too costly, the Study Team would note that the Median Removal option (**Figure 4-8**) would be an appropriate alternative. With the Median Removal option, a Signal Justification Report (SJR) would need to be completed, and the Study Team would recommend adding a right turn lane in to the school at the realigned intersection with Virginia Lane.

This recommendation is a high priority because it meets four study objectives, was relatively well-received by the community, and has incorporated Stakeholder suggestions. Potential funding sources to pursue this project would include VDOT Smart Scale or Northern Virginia Transportation Authority (NVTA) grants.

Figure 6-8 Roundabout Near Shrevewood Elementary School (Revised from Figure 4-7)



○ POWER POLE

2. Advance the Chicane Design at Pioneer Lane

- Objectives met: Walking and biking, reduce conflicts at activity points, reduce vehicle travel speeds, reduce impediments to sight lines, and feasible for implementation and funding.
- Community feedback: Feedback on this recommendation was limited but positive. Comments received during the engagement process suggested there are no major concerns. Some suggested combining the neighborhood gateway recommendation with the chicane.
- Stakeholder suggestions: FCDOT inquired if a pedestrian median could be incorporated at the intersection. The Study Team found that it would increase the cost and scope of the design.

The Study Team recommends advancing the design of a chicane at Pioneer Lane. This recommendation adds horizontal deflection before vehicle traffic approaches the Oldewood Curve. Some community members did suggest combining the neighborhood gateway with the chicane. The Study Team does suggest keeping these recommendations separate to provide spacing between treatments along the corridor. The chicane recommendation is shown again in **Figure 6-7**.

Figure 6-9 Chicane at Pioneer Lane (Same as Figure 4-5)

This recommendation is a higher priority because it meets the study objectives to at least a small degree, did not raise concerns for community members, and could likely be implemented in less than ten years.

3. Coordinate Potential Bicycle Speed Treatments for the W&OD Trail

- Objectives met: Walking and biking, reduce conflicts at activity points, and feasible for implementation and funding.
- Community feedback: Several community members mentioned this issue throughout the planning process.
- Stakeholder suggestions: NOVA Parks and VDOT reviewed current agency guidance and trail treatments, however most treatments do not specifically address bicycle speeds.

The Study Team recommends further coordinating between NOVA Parks and VDOT to identify potential bicycle speed treatments for the W&OD Trail. The safety of pedestrians and bicyclists crossing Virginia Avenue and Shreve Road is a shared responsibility between the NOVA Parks (with responsibilities for the management of the W&OD trail), VDOT (with responsibilities for the management of the road and associated rights-of-way) and the trail users (who must follow the rules and regulations that apply to both the trail and the road crossings).

The next step in addressing bicycle speed concerns is to jointly review new trail treatment options in more detail. The Study Team recommends VDOT and NOVA Parks review peer studies related to speed management on shared paths to determine what treatments are appropriate for the W&OD Trail. An example of a peer study on this topic is included in Appendix F.

This recommendation is a mid-level priority because it meets three of the study objectives and was raised by several community members throughout the planning process.

4. Develop a Neighborhood Gateway Near Route 29

- Objectives met: Reduce vehicle travel speeds, and feasible for implementation and funding.
- Community feedback: Feedback on this recommendation was limited but positive. Comments received during the engagement process suggested there are no major concerns. Some suggested combining the neighborhood gateway recommendation with the chicane.
- Stakeholder suggestions: No suggestions were noted.

The Study Team recommends further developing a neighborhood gateway design near Route 29. This recommendation was generally well-received by community members but provided only modest benefits compared to other long-term recommendations. The Study Team does suggest keeping this recommendation separate from the chicane to provide spacing between treatments along the corridor. An example of a neighborhood gateway was provided in **Figure 4-3**.

This recommendation is a mid-level priority because it only meets two of the study objectives, it did not raise concerns for community members, and could likely be implemented in less than ten years.

5. Consider an Urban Cross Section between Route 7 and Gordons Road

- Objectives met: Walking and biking, reduce conflicts at activity points, and reduce impediments to sight lines.
- Community feedback: Feedback on this recommendation was limited, with some concerns expressed. Most concerns were related to cost and benefits compared to other recommendations.
- Stakeholder suggestions: FCDOT and City of Falls Church staff suggested scaling back the Urban Cross Section between Route 7 and Gordons Road to remove the bike lanes. This would allow the opportunity to provide more pedestrian facilities, close gaps, and implement the project sooner. The Study Team has incorporated this suggestion in its short-term recommendation 3. Complete Sidewalk Connection between Chestnut Street and Gordons Road.

The Study Team recommends considering the Urban Cross Section between Route 7 and Gordons Road. Feedback on this recommendation was limited, with some people expressing concerns about cost and benefits compared to other recommendations. The Urban Cross Section was depicted in **Figure 4-11**.

This recommendation is a lower priority because it only meets three of the study objectives, raised some concerns with community members, and the Study Team's short-term recommendation to fill sidewalk gaps in this area may address issues more efficiently. However, the Study Team identified value in keeping this recommendation for the long-term as development potential along Route 7 increases. As noted previously, development of the Don Beyer Volvo site introduces the potential to incorporate all or some components of this cross section into streetscape.

6. Potentially Revisit Mini Roundabouts at Pinecastle Road and Buckelew Drive

- Objectives met: Walking and biking, reduce conflicts at activity points, reduce vehicle travel speeds, and reduce impediments to sight lines.
- Community feedback: Feedback on this recommendation was mixed. Less than half of the comments for this recommendation were supportive, and slightly more than half noted some concerns.
- Stakeholder suggestions: FCDOT suggested adding more pedestrian/bicycle facilities to this recommendation. FCDOT also suggested separating the two mini-roundabouts so the splitter island could be separated into two. The Study Team noted that this would likely have more property impacts and increase project costs.

The Study Team recommends potentially revisiting the mini roundabout design at Pinecastle Road and Buckelew Drive. Feedback on this recommendation was mixed, with slightly more comments noting concerns. FCDOT also had suggestions for the recommendation that would likely make a future project more costly. The Mini Roundabouts were depicted in **Figure 4-9**.

This recommendation is a low priority. While it meets four of the study objectives, it raised notable concerns with some community members, would likely become more expensive after incorporating FCDOT suggestions, and would not be positioned well for funding when compared to the roundabout recommendation in front of Shrevewood Elementary School. However, the Study Team would still keep this recommendation for potentially refining in the long-term. The Study Team noted the potential for congestion to occur at this intersection under 2030 conditions, which could be mitigated with the mini-roundabouts. Should changes in front of Shrevewood Elementary School become infeasible, this recommendation may become more appropriate to apply for VDOT Smart Scale and NVTA funding.

SECTION 7

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS AND RECOMMENDATIONS

As identified by community members early in the process, this study intended to identify recommendations that could be implemented in the short-term and long-term. These recommendations for Shreve Road consider enabling safe and comfortable pedestrian and bicycle facilities in a neighborhood setting. The information presented in this report is intended to provide background information and analysis to guide future discussions and plans to improve Shreve Road.

EXISTING AND BASELINE CONDITIONS FINDINGS

Existing and 2030 baseline conditions were analyzed using an inventory of area facilities, review of previous studies and in-process improvements, review of community feedback, vehicle/pedestrian/bicycle/mode share data, crash data, speed data, and field visits. Traffic conditions were projected to a 2030 design year for longer-term operations. Notable findings of these analyses are as follows:

- Sidewalks are generally less than four feet wide in the study area, which is substandard by VDOT's standards.
- Several studies and improvements have been contemplated or completed along Shreve Road, including a previous VDOT speed study, striping improvements in front of Shrevewood Elementary School, a Safe Routes to School (SRTS) grant at Shrevewood Elementary School, a W&OD Trail Crossing project on Shreve Road, and a City of Falls Church multi-use path project between Route 7 and Hickory Street.
- Initial community concerns noted pedestrian/bicycle and safety issues along the corridor.
- Daily W&OD Trail pedestrian/bicycle traffic is estimated to be approximately 20 percent of the daily vehicle traffic along Shreve Road.
- Crash details were available for crashes that occurred between January 2013 and May 2020. A review of historical crash data revealed that 31% of crashes were angle-related crashes, followed by fixed object crashes (25%). The majority of crashes were property damage only (PDO) crashes (55%).
    - Crash details show that 24% of crashes occurred in rainy conditions.
    - Driver behaviors were contributing factors, with distracted driving being a factor in 28% percent of crashes, speeding contributing to 18% of crashes, and alcohol/drug use contributing to 8% of crashes.
    - One fatal pedestrian crash took place near the Hickory Curve, where alcohol/drug use was also a contributing factor.
- Speeding has been observed along the corridor. The corridor's posted speed is generally 35 mph, and 85th percentile speeds range from 31-42 mph.
- All study intersections operate at uncongested conditions during the weekday morning and evening peak hours.

- The Shreve Road/Virginia Lane, Shreve Road/Buckelew Drive, and Shreve Road/Pinecastle Road intersections could operate with congested conditions during at least one peak hour under 2030 conditions.

ALTERNATIVES DEVELOPMENT AND EVALUATION

In collaboration with VDOT and Stakeholders, alternatives were developed considering corridor-wide recommendations, short-term recommendations, long-term recommendations, and leveraging in-process improvements. The Study Team first conducted an initial screening of potential recommendations to explore feasibility. Recommendations screened out based on cost, property impacts, or consistency with stakeholder agency guidance/policy included:

- Speed limit reduction,
- Bike lane feasibility,
- Speed humps,
- Stop signs,
- Radar signs,
- Grade-separated pedestrian/bicycle crossings,
- Guardrail, and
- Realignment of the Hickory and Oldewood Curves.

The remaining alternatives were developed to achieve the study's objectives: improve walking and biking, reduce conflicts at activity points, reduce vehicle travel speeds, reduce impediments to sight lines, and ensure feasibility for implementation and funding. The resulting recommendations include near-term solutions that focus on immediate, low-cost, easily implemented improvements for the corridor. Additionally, longer-term alternatives were developed for more permanent solutions through the identified design year 2030. Recommendations included:

- Neighborhood Gateway,
- Optical Speed Bars,
- Chicane,
- Pedestrian Median,
- Roundabouts or Median Removal,
- Mini Roundabouts,
- Vegetation Management, and
- Urban Cross Section.

NEXT STEPS & PRIORITIZATION

The feedback collected from the community provided critical direction when finalizing the recommendations for the Shreve Road corridor. The project objectives, community feedback, and suggestions from Stakeholders provided important information to finalize and prioritize the recommendations. The major takeaways from the community feedback process are:

- Approximately 70 community members attended the Virtual Public Information Meeting;
- The Study Team received feedback from over 60 community members throughout the project;
- Feedback was tallied to determine which recommendations were most popular, with recommendations in front of Shrevewood Elementary School and at Pinecastle Road/Buckelew Drive attracting the most comments; and
- Comments for and against roundabout concepts were generally evenly split.

Based on this feedback, the Study Team made the following final short-term recommendations in order from highest priority to lowest priority:

1. Add Pedestrian Beacons for W&OD Trail Crossings
2. Incorporate Pedestrian Median into SRTS Design at Fairwood Lane
3. Add and Upgrade Shreve Road Pedestrian Connections
4. Install Optical Speed Bars and Implement Vegetation Management

Similarly, the Study Team made the following final long-term recommendations in order from highest priority to lowest priority:

1. Advance the Roundabout Alternative Near Shrevewood Elementary School
2. Advance the Chicane Design at Pioneer Lane
3. Coordinate Potential Bicycle Speed Treatments for the W&OD Trail
4. Develop a Neighborhood Gateway Near Route 29
5. Consider an Urban Cross Section between Route 7 and Gordons Road
6. Potentially Revisit Mini Roundabouts at Pinecastle Road and Buckelew Drive

The following lists the general next steps anticipated in moving forward with the higher-priority recommendations:

- Coordination between VDOT, County staff, and elected officials to identify potential funding sources/mechanisms towards higher-priority recommendations.
- Refine the design of recommendations, including detailed cost estimates to support funding applications.
- Continue public outreach regarding advancing any recommendations and solicit feedback.

These next steps should provide a pathway toward implementing a feasible and publicly supported project on Shreve Road that achieves the project goals of the community, Stakeholders, and VDOT.

SECTION 8

REFERENCES

REFERENCES

1. November 2019 Shreve Road Community Working Group memorandum
2. Fairfax County Comprehensive Plan
3. Fairfax County Bike Plan
4. Fairfax County Trails Plan
5. ActiveFairfax Transportation Plan. https://www.fairfaxcounty.gov/transportation/bike-walk/activefairfax
6. October 2019 VDOT Speed Study
7. FCDOT SRTS Application
8. Winter 2017 W&OD Trail from Little Falls Street to West Street Study (Toole)
9. FCDOT Falls Hill Traffic Calming Study
10. High School & West Falls Church Economic Development: Transportation Impact Study, Gorove/Slade, 2018.
11. West Falls Church Transit Station Area Study. https://www.fairfaxcounty.gov/planning-development/sites/planning-development/files/Assets/documents/CompPlanAmend/westfallschurchtsa/west-falls-church-tsa-parcel.jpg)
12. City of Falls Church. *West Falls Church Access to Transit and Multimodal Connectivity Project.*
13. City of Falls Church. *West Falls Church and Joint Campus Revitalization District Multimodal Improvements Project*. http://www.fallschurchva.gov/DocumentCenter/View/10422/West-Falls-Church-Transportation-ProjectScope?bidId
14. September 2019 Student Travel Tally from the National Center for SRTS.
15. Virginia Department of Transportation. *Road Design Manual*. 2020
16. Virginia Department of Transportation. *Road Design Manual (Appendix F: Access Management Design Standards for Entrances and Intersections)*. 2020.
17. National Cooperative Highway Research Program. Second Edition, *Report 672: Roundabouts, An Informational Guide*. 2010.
18. National Cooperative Highway Research Program. *Report 772: Evaluating the Performance of Corridors with Roundabouts*. 2013. http://www.trb.org/Publications/Blurbs/171016.aspx

APPENDIX A

DETAILED EXISTING/BASELINE SYNCHRO RESULTS

Intersection	
Int Delay, s/veh	3.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	340	5	5	355	70	105
Future Vol, veh/h	340	5	5	355	70	105
Conflicting Peds, #/hr	0	5	5	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	75	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	4	-	-	0	2	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	370	5	5	386	76	114

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	380	0	771	375
Stage 1	-	-	-	-	375	-
Stage 2	-	-	-	-	396	-
Critical Hdwy	-	-	4.12	-	6.82	6.42
Critical Hdwy Stg 1	-	-	-	-	5.82	-
Critical Hdwy Stg 2	-	-	-	-	5.82	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1178	-	338	657
Stage 1	-	-	-	-	667	-
Stage 2	-	-	-	-	651	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1171	-	334	653
Mov Cap-2 Maneuver	-	-	-	-	334	-
Stage 1	-	-	-	-	663	-
Stage 2	-	-	-	-	648	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	17.7
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	472	-	-	1171	-
HCM Lane V/C Ratio	0.403	-	-	0.005	-
HCM Control Delay (s)	17.7	-	-	8.1	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	1.9	-	-	0	-

Intersection	
Int Delay, s/veh	1.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	350	220	0	495	0	170
Future Vol, veh/h	350	220	0	495	0	170
Conflicting Peds, #/hr	0	5	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	-2	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	380	239	0	538	0	185

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	-	-	-	385
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	6.02
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	3.318
Pot Cap-1 Maneuver	-	-	0	-	0	677
Stage 1	-	-	0	-	0	-
Stage 2	-	-	0	-	0	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	-	-	-	673
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	12.4
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBT
Capacity (veh/h)	673	-	-	-
HCM Lane V/C Ratio	0.275	-	-	-
HCM Control Delay (s)	12.4	-	-	-
HCM Lane LOS	B	-	-	-
HCM 95th %tile Q(veh)	1.1	-	-	-

Intersection	
Int Delay, s/veh	2.5

Movement	EBU	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations							
Traffic Vol, veh/h	90	175	255	330	70	50	75
Future Vol, veh/h	90	175	255	330	70	50	75
Conflicting Peds, #/hr	0	53	0	0	53	53	53
Sign Control	Free	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	-	None	-	None	-	None
Storage Length	-	25	-	-	-	0	-
Veh in Median Storage, #	-	-	0	0	-	0	-
Grade, %	-	-	0	1	-	-3	-
Peak Hour Factor	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2
Mvmt Flow	98	190	277	359	76	54	82

Major/Minor	Major1		Major2		Minor2		
Conflicting Flow All	-	488	0	-	0	1160	503
Stage 1	-	-	-	-	-	450	-
Stage 2	-	-	-	-	-	710	-
Critical Hdwy	-	4.12	-	-	-	5.82	5.92
Critical Hdwy Stg 1	-	-	-	-	-	4.82	-
Critical Hdwy Stg 2	-	-	-	-	-	4.82	-
Follow-up Hdwy	-	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	-	1075	-	-	-	262	593
Stage 1	-	-	-	-	-	692	-
Stage 2	-	-	-	-	-	548	-
Platoon blocked, %			-	-	-		
Mov Cap-1 Maneuver	-	1030	-	-	-	241	542
Mov Cap-2 Maneuver	-	-	-	-	-	241	-
Stage 1	-	-	-	-	-	663	-
Stage 2	-	-	-	-	-	525	-

Approach	EB	WB	SE
HCM Control Delay, s		0	20.9
HCM LOS			C

Minor Lane/Major Mvmt	EBU	EBL	EBT	WBT	WBR	SELn1
Capacity (veh/h)	-	1030	-	-	-	361
HCM Lane V/C Ratio	-	0.185	-	-	-	0.376
HCM Control Delay (s)	-	9.3	-	-	-	20.9
HCM Lane LOS	-	A	-	-	-	C
HCM 95th %tile Q(veh)	-	0.7	-	-	-	1.7

Intersection	
Int Delay, s/veh	5.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	260	45	115	360	40	110
Future Vol, veh/h	260	45	115	360	40	110
Conflicting Peds, #/hr	0	5	53	0	0	53
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	2	-	-	-3	6	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	283	49	125	391	43	120

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	385	0	1002	414
Stage 1	-	-	-	-	361	-
Stage 2	-	-	-	-	641	-
Critical Hdwy	-	-	4.12	-	7.62	6.82
Critical Hdwy Stg 1	-	-	-	-	6.62	-
Critical Hdwy Stg 2	-	-	-	-	6.62	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1173	-	192	596
Stage 1	-	-	-	-	625	-
Stage 2	-	-	-	-	424	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1119	-	157	545
Mov Cap-2 Maneuver	-	-	-	-	157	-
Stage 1	-	-	-	-	596	-
Stage 2	-	-	-	-	363	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.1	26.2
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	329	-	-	1119	-
HCM Lane V/C Ratio	0.496	-	-	0.112	-
HCM Control Delay (s)	26.2	-	-	8.6	0
HCM Lane LOS	D	-	-	A	A
HCM 95th %tile Q(veh)	2.6	-	-	0.4	-

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	15	355	460	40	40	15
Future Vol, veh/h	15	355	460	40	40	15
Conflicting Peds, #/hr	53	0	0	5	0	53
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	80	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	2	-3	-	-5	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	16	386	500	43	43	16

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	596	0	-	0	971	606
Stage 1	-	-	-	-	553	-
Stage 2	-	-	-	-	418	-
Critical Hdwy	4.12	-	-	-	5.42	5.72
Critical Hdwy Stg 1	-	-	-	-	4.42	-
Critical Hdwy Stg 2	-	-	-	-	4.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	980	-	-	-	367	541
Stage 1	-	-	-	-	672	-
Stage 2	-	-	-	-	746	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	931	-	-	-	324	492
Mov Cap-2 Maneuver	-	-	-	-	324	-
Stage 1	-	-	-	-	624	-
Stage 2	-	-	-	-	709	-

Approach	EB	WB	SB
HCM Control Delay, s	0.4	0	17.1
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	931	-	-	-	357
HCM Lane V/C Ratio	0.018	-	-	-	0.167
HCM Control Delay (s)	8.9	0	-	-	17.1
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0.1	-	-	-	0.6

Intersection	
Int Delay, s/veh	1.7

Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Vol, veh/h	15	55	320	50	80	450
Future Vol, veh/h	15	55	320	50	80	450
Conflicting Peds, #/hr	0	0	0	5	5	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	75	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	2	-	4	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	16	60	348	54	87	489

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1016	353	0	0	407	0
Stage 1	353	-	-	-	-	-
Stage 2	663	-	-	-	-	-
Critical Hdwy	6.82	6.42	-	-	4.12	-
Critical Hdwy Stg 1	5.82	-	-	-	-	-
Critical Hdwy Stg 2	5.82	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	236	677	-	-	1152	-
Stage 1	684	-	-	-	-	-
Stage 2	476	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	210	673	-	-	1145	-
Mov Cap-2 Maneuver	210	-	-	-	-	-
Stage 1	680	-	-	-	-	-
Stage 2	426	-	-	-	-	-

Approach	NW	NE	SW
HCM Control Delay, s	14.4	0	1.3
HCM LOS	B		

Minor Lane/Major Mvmt	NET	NER	NWLn1	SWL	SWT
Capacity (veh/h)	-	-	457	1145	-
HCM Lane V/C Ratio	-	-	0.166	0.076	-
HCM Control Delay (s)	-	-	14.4	8.4	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.6	0.2	-

Intersection	
Int Delay, s/veh	0.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱		↑		↱
Traffic Vol, veh/h	375	0	0	530	0	60
Future Vol, veh/h	375	0	0	530	0	60
Conflicting Peds, #/hr	0	5	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	-2	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	408	0	0	576	0	65

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	-	-	-	413
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	6.02
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	3.318
Pot Cap-1 Maneuver	-	-	0	-	0	654
Stage 1	-	-	0	-	0	-
Stage 2	-	-	0	-	0	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	-	-	-	650
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	11.2
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBT
Capacity (veh/h)	650	-	-	-
HCM Lane V/C Ratio	0.1	-	-	-
HCM Control Delay (s)	11.2	-	-	-
HCM Lane LOS	B	-	-	-
HCM 95th %tile Q(veh)	0.3	-	-	-

Intersection	
Int Delay, s/veh	4.8

Movement	EBU	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations							
Traffic Vol, veh/h	35	135	265	365	65	60	135
Future Vol, veh/h	35	135	265	365	65	60	135
Conflicting Peds, #/hr	0	61	0	0	61	61	61
Sign Control	Free	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	-	None	-	None	-	None
Storage Length	-	25	-	-	-	0	-
Veh in Median Storage, #	-	-	0	0	-	0	-
Grade, %	-	-	0	1	-	-3	-
Peak Hour Factor	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2
Mvmt Flow	38	147	288	397	71	65	147

Major/Minor	Major1			Major2		Minor2	
Conflicting Flow All	-	529	0	-	0	1137	555
Stage 1	-	-	-	-	-	494	-
Stage 2	-	-	-	-	-	643	-
Critical Hdwy	-	4.12	-	-	-	5.82	5.92
Critical Hdwy Stg 1	-	-	-	-	-	4.82	-
Critical Hdwy Stg 2	-	-	-	-	-	4.82	-
Follow-up Hdwy	-	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	-	1038	-	-	-	270	556
Stage 1	-	-	-	-	-	666	-
Stage 2	-	-	-	-	-	583	-
Platoon blocked, %			-	-	-		
Mov Cap-1 Maneuver	-	988	-	-	-	245	501
Mov Cap-2 Maneuver	-	-	-	-	-	245	-
Stage 1	-	-	-	-	-	634	-
Stage 2	-	-	-	-	-	555	-

Approach	EB	WB	SE
HCM Control Delay, s		0	25.9
HCM LOS			D

Minor Lane/Major Mvmt	EBU	EBL	EBT	WBT	WBR	SELn1
Capacity (veh/h)	-	988	-	-	-	379
HCM Lane V/C Ratio	-	0.149	-	-	-	0.559
HCM Control Delay (s)	-	9.3	-	-	-	25.9
HCM Lane LOS	-	A	-	-	-	D
HCM 95th %tile Q(veh)	-	0.5	-	-	-	3.3

Intersection	
Int Delay, s/veh	6.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	275	50	120	385	45	120
Future Vol, veh/h	275	50	120	385	45	120
Conflicting Peds, #/hr	0	5	61	0	0	61
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	2	-	-	-3	6	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	299	54	130	418	49	130

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	414	0	1065	448
Stage 1	-	-	-	-	387	-
Stage 2	-	-	-	-	678	-
Critical Hdwy	-	-	4.12	-	7.62	6.82
Critical Hdwy Stg 1	-	-	-	-	6.62	-
Critical Hdwy Stg 2	-	-	-	-	6.62	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1145	-	173	567
Stage 1	-	-	-	-	603	-
Stage 2	-	-	-	-	402	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1084	-	138	511
Mov Cap-2 Maneuver	-	-	-	-	138	-
Stage 1	-	-	-	-	571	-
Stage 2	-	-	-	-	339	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.1	34.7
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	294	-	-	1084	-
HCM Lane V/C Ratio	0.61	-	-	0.12	-
HCM Control Delay (s)	34.7	-	-	8.8	0
HCM Lane LOS	D	-	-	A	A
HCM 95th %tile Q(veh)	3.7	-	-	0.4	-

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	15	355	490	40	45	15
Future Vol, veh/h	15	355	490	40	45	15
Conflicting Peds, #/hr	61	0	0	5	0	61
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	80	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	2	-3	-	-5	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	16	386	533	43	49	16

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	637	0	-	0	1012	655
Stage 1	-	-	-	-	594	-
Stage 2	-	-	-	-	418	-
Critical Hdwy	4.12	-	-	-	5.42	5.72
Critical Hdwy Stg 1	-	-	-	-	4.42	-
Critical Hdwy Stg 2	-	-	-	-	4.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	947	-	-	-	351	510
Stage 1	-	-	-	-	650	-
Stage 2	-	-	-	-	746	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	892	-	-	-	304	457
Mov Cap-2 Maneuver	-	-	-	-	304	-
Stage 1	-	-	-	-	598	-
Stage 2	-	-	-	-	703	-

Approach	EB	WB	SB
HCM Control Delay, s	0.4	0	18.5
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	892	-	-	-	332
HCM Lane V/C Ratio	0.018	-	-	-	0.196
HCM Control Delay (s)	9.1	0	-	-	18.5
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0.1	-	-	-	0.7

Intersection	
Int Delay, s/veh	4.3

Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Vol, veh/h	75	120	390	5	5	425
Future Vol, veh/h	75	120	390	5	5	425
Conflicting Peds, #/hr	0	0	0	5	5	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	75	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	2	-	4	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	82	130	424	5	5	462

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	901	429	0	0	434	0
Stage 1	429	-	-	-	-	-
Stage 2	472	-	-	-	-	-
Critical Hdwy	6.82	6.42	-	-	4.12	-
Critical Hdwy Stg 1	5.82	-	-	-	-	-
Critical Hdwy Stg 2	5.82	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	279	611	-	-	1126	-
Stage 1	626	-	-	-	-	-
Stage 2	596	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	276	607	-	-	1119	-
Mov Cap-2 Maneuver	276	-	-	-	-	-
Stage 1	622	-	-	-	-	-
Stage 2	592	-	-	-	-	-

Approach	NW	NE	SW
HCM Control Delay, s	22.4	0	0.1
HCM LOS	C		

Minor Lane/Major Mvmt	NET	NER	NWLn1	SWL	SWT
Capacity (veh/h)	-	-	415	1119	-
HCM Lane V/C Ratio	-	-	0.511	0.005	-
HCM Control Delay (s)	-	-	22.4	8.2	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	2.8	0	-

Intersection	
Int Delay, s/veh	1.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	410	220	0	565	0	170
Future Vol, veh/h	410	220	0	565	0	170
Conflicting Peds, #/hr	0	5	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	-2	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	446	239	0	614	0	185

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	-	-	-	451
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	6.02
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	3.318
Pot Cap-1 Maneuver	-	-	0	-	0	624
Stage 1	-	-	0	-	0	-
Stage 2	-	-	0	-	0	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	-	-	-	620
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	13.3
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBT
Capacity (veh/h)	620	-	-	-
HCM Lane V/C Ratio	0.298	-	-	-
HCM Control Delay (s)	13.3	-	-	-
HCM Lane LOS	B	-	-	-
HCM 95th %tile Q(veh)	1.2	-	-	-

Intersection	
Int Delay, s/veh	3.2

Movement	EBU	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations							
Traffic Vol, veh/h	90	180	310	400	85	60	75
Future Vol, veh/h	90	180	310	400	85	60	75
Conflicting Peds, #/hr	0	53	0	0	53	53	53
Sign Control	Free	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	-	None	-	None	-	None
Storage Length	-	25	-	-	-	0	-
Veh in Median Storage, #	-	-	0	0	-	0	-
Grade, %	-	-	0	1	-	-3	-
Peak Hour Factor	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2
Mvmt Flow	98	196	337	435	92	65	82

Major/Minor	Major1			Major2		Minor2	
Conflicting Flow All	-	580	0	-	0	1316	587
Stage 1	-	-	-	-	-	534	-
Stage 2	-	-	-	-	-	782	-
Critical Hdwy	-	4.12	-	-	-	5.82	5.92
Critical Hdwy Stg 1	-	-	-	-	-	4.82	-
Critical Hdwy Stg 2	-	-	-	-	-	4.82	-
Follow-up Hdwy	-	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	-	994	-	-	-	217	535
Stage 1	-	-	-	-	-	643	-
Stage 2	-	-	-	-	-	514	-
Platoon blocked, %			-	-	-		
Mov Cap-1 Maneuver	-	952	-	-	-	199	489
Mov Cap-2 Maneuver	-	-	-	-	-	199	-
Stage 1	-	-	-	-	-	616	-
Stage 2	-	-	-	-	-	492	-

Approach	EB	WB	SE
HCM Control Delay, s		0	28.4
HCM LOS			D

Minor Lane/Major Mvmt	EBU	EBL	EBT	WBT	WBR	SELn1
Capacity (veh/h)	-	952	-	-	-	297
HCM Lane V/C Ratio	-	0.206	-	-	-	0.494
HCM Control Delay (s)	-	9.8	-	-	-	28.4
HCM Lane LOS	-	A	-	-	-	D
HCM 95th %tile Q(veh)	-	0.8	-	-	-	2.6

Intersection	
Int Delay, s/veh	7.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	320	50	135	440	40	125
Future Vol, veh/h	320	50	135	440	40	125
Conflicting Peds, #/hr	0	5	53	0	0	53
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	2	-	-	-3	6	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	348	54	147	478	43	136

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	455	0	1200	481
Stage 1	-	-	-	-	428	-
Stage 2	-	-	-	-	772	-
Critical Hdwy	-	-	4.12	-	7.62	6.82
Critical Hdwy Stg 1	-	-	-	-	6.62	-
Critical Hdwy Stg 2	-	-	-	-	6.62	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1106	-	137	540
Stage 1	-	-	-	-	570	-
Stage 2	-	-	-	-	352	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1055	-	106	493
Mov Cap-2 Maneuver	-	-	-	-	106	-
Stage 1	-	-	-	-	544	-
Stage 2	-	-	-	-	285	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.1	44
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	262	-	-	1055	-
HCM Lane V/C Ratio	0.685	-	-	0.139	-
HCM Control Delay (s)	44	-	-	9	0
HCM Lane LOS	E	-	-	A	A
HCM 95th %tile Q(veh)	4.5	-	-	0.5	-

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	15	430	560	40	40	15
Future Vol, veh/h	15	430	560	40	40	15
Conflicting Peds, #/hr	53	0	0	5	0	53
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	80	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	2	-3	-	-5	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	16	467	609	43	43	16

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	705	0	-	0	1161	715
Stage 1	-	-	-	-	662	-
Stage 2	-	-	-	-	499	-
Critical Hdwy	4.12	-	-	-	5.42	5.72
Critical Hdwy Stg 1	-	-	-	-	4.42	-
Critical Hdwy Stg 2	-	-	-	-	4.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	893	-	-	-	298	476
Stage 1	-	-	-	-	617	-
Stage 2	-	-	-	-	701	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	848	-	-	-	262	433
Mov Cap-2 Maneuver	-	-	-	-	262	-
Stage 1	-	-	-	-	571	-
Stage 2	-	-	-	-	666	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	20.3
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	848	-	-	-	294
HCM Lane V/C Ratio	0.019	-	-	-	0.203
HCM Control Delay (s)	9.3	0	-	-	20.3
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0.1	-	-	-	0.7

Intersection	
Int Delay, s/veh	1.8

Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Vol, veh/h	15	65	385	50	90	535
Future Vol, veh/h	15	65	385	50	90	535
Conflicting Peds, #/hr	0	0	0	5	5	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	75	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	2	-	4	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	16	71	418	54	98	582

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1201	423	0	0	477	0
Stage 1	423	-	-	-	-	-
Stage 2	778	-	-	-	-	-
Critical Hdwy	6.82	6.42	-	-	4.12	-
Critical Hdwy Stg 1	5.82	-	-	-	-	-
Critical Hdwy Stg 2	5.82	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	179	616	-	-	1085	-
Stage 1	631	-	-	-	-	-
Stage 2	415	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	154	612	-	-	1079	-
Mov Cap-2 Maneuver	154	-	-	-	-	-
Stage 1	627	-	-	-	-	-
Stage 2	359	-	-	-	-	-

Approach	NW	NE	SW
HCM Control Delay, s	16.7	0	1.2
HCM LOS	C		

Minor Lane/Major Mvmt	NET	NER	NWLn1	SWL	SWT
Capacity (veh/h)	-	-	393	1079	-
HCM Lane V/C Ratio	-	-	0.221	0.091	-
HCM Control Delay (s)	-	-	16.7	8.7	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.8	0.3	-

Intersection	
Int Delay, s/veh	0.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	450	0	0	625	0	60
Future Vol, veh/h	450	0	0	625	0	60
Conflicting Peds, #/hr	0	5	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	-2	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	489	0	0	679	0	65

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	-	-	-	494
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	6.02
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	3.318
Pot Cap-1 Maneuver	-	-	0	-	0	591
Stage 1	-	-	0	-	0	-
Stage 2	-	-	0	-	0	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	-	-	-	587
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	11.9
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBT
Capacity (veh/h)	587	-	-	-
HCM Lane V/C Ratio	0.111	-	-	-
HCM Control Delay (s)	11.9	-	-	-
HCM Lane LOS	B	-	-	-
HCM 95th %tile Q(veh)	0.4	-	-	-

Intersection	
Int Delay, s/veh	6.7

Movement	EBU	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations							
Traffic Vol, veh/h	35	140	335	460	75	70	130
Future Vol, veh/h	35	140	335	460	75	70	130
Conflicting Peds, #/hr	0	61	0	0	61	61	61
Sign Control	Free	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	-	None	-	None	-	None
Storage Length	-	25	-	-	-	0	-
Veh in Median Storage, #	-	-	0	0	-	0	-
Grade, %	-	-	0	1	-	-3	-
Peak Hour Factor	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2
Mvmt Flow	38	152	364	500	82	76	141

Major/Minor	Major1		Major2		Minor2		
Conflicting Flow All	-	643	0	-	0	1331	663
Stage 1	-	-	-	-	-	602	-
Stage 2	-	-	-	-	-	729	-
Critical Hdwy	-	4.12	-	-	-	5.82	5.92
Critical Hdwy Stg 1	-	-	-	-	-	4.82	-
Critical Hdwy Stg 2	-	-	-	-	-	4.82	-
Follow-up Hdwy	-	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	-	942	-	-	-	213	487
Stage 1	-	-	-	-	-	605	-
Stage 2	-	-	-	-	-	539	-
Platoon blocked, %			-	-	-		
Mov Cap-1 Maneuver	-	896	-	-	-	193	439
Mov Cap-2 Maneuver	-	-	-	-	-	193	-
Stage 1	-	-	-	-	-	576	-
Stage 2	-	-	-	-	-	513	-

Approach	EB	WB	SE
HCM Control Delay, s		0	41.7
HCM LOS			E

Minor Lane/Major Mvmt	EBU	EBL	EBT	WBT	WBR	SELn1
Capacity (veh/h)	-	896	-	-	-	304
HCM Lane V/C Ratio	-	0.17	-	-	-	0.715
HCM Control Delay (s)	-	9.8	-	-	-	41.7
HCM Lane LOS	-	A	-	-	-	E
HCM 95th %tile Q(veh)	-	0.6	-	-	-	5.1

Intersection	
Int Delay, s/veh	17.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	355	55	140	485	50	140
Future Vol, veh/h	355	55	140	485	50	140
Conflicting Peds, #/hr	0	5	61	0	0	61
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	2	-	-	-3	6	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	386	60	152	527	54	152

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	507	0	1308	538
Stage 1	-	-	-	-	477	-
Stage 2	-	-	-	-	831	-
Critical Hdwy	-	-	4.12	-	7.62	6.82
Critical Hdwy Stg 1	-	-	-	-	6.62	-
Critical Hdwy Stg 2	-	-	-	-	6.62	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1058	-	114	497
Stage 1	-	-	-	-	533	-
Stage 2	-	-	-	-	324	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1002	-	85	448
Mov Cap-2 Maneuver	-	-	-	-	85	-
Stage 1	-	-	-	-	505	-
Stage 2	-	-	-	-	254	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.1	104.1
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	211	-	-	1002	-
HCM Lane V/C Ratio	0.979	-	-	0.152	-
HCM Control Delay (s)	104.1	-	-	9.2	0
HCM Lane LOS	F	-	-	A	A
HCM 95th %tile Q(veh)	8.5	-	-	0.5	-

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	15	480	610	40	50	15
Future Vol, veh/h	15	480	610	40	50	15
Conflicting Peds, #/hr	61	0	0	5	0	61
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	80	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	2	-3	-	-5	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	16	522	663	43	54	16

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	767	0	-	0	1278	785
Stage 1	-	-	-	-	724	-
Stage 2	-	-	-	-	554	-
Critical Hdwy	4.12	-	-	-	5.42	5.72
Critical Hdwy Stg 1	-	-	-	-	4.42	-
Critical Hdwy Stg 2	-	-	-	-	4.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	847	-	-	-	262	438
Stage 1	-	-	-	-	587	-
Stage 2	-	-	-	-	671	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	798	-	-	-	226	393
Mov Cap-2 Maneuver	-	-	-	-	226	-
Stage 1	-	-	-	-	538	-
Stage 2	-	-	-	-	632	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	24.9
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	798	-	-	-	251
HCM Lane V/C Ratio	0.02	-	-	-	0.281
HCM Control Delay (s)	9.6	0	-	-	24.9
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0.1	-	-	-	1.1

APPENDIX B

DESCRIPTION OF LEVEL-OF-SERVICE METHODS AND CRITERIA

LEVEL-OF-SERVICE CONCEPT

Level of service (LOS) is a concept developed to quantify the degree of comfort (including such elements as travel time, number of stops, total amount of stopped delay, and impediments caused by other vehicles) afforded to drivers as they travel through an intersection or roadway segment. Six grades are used to denote the various level of service from "A" to "F".1

SIGNALIZED INTERSECTIONS

The six level-of-service grades are described qualitatively for signalized intersections in **Table B-1**. Additionally, **Table B-2** identifies the relationship between the level of service and average control delay per vehicle. Control delay is defined to include initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. Using this definition, the Level of Service "D" is generally considered to represent the minimum acceptable design standard.

Table B-1 Level-of-Service Definitions (Signalized Intersections)

Level of Service	Average Delay per Vehicle
A	Very low average control delay, less than 10 seconds per vehicle. This occurs when progression is extremely favorable, and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.
B	Average control delay is greater than 10 seconds per vehicle and less than or equal to 20 seconds per vehicle. This generally occurs with good progression and/or short cycle lengths. More vehicles stop than for a level of service A, causing higher levels of average delay.
C	Average control delay is greater than 20 seconds per vehicle and less than or equal to 35 seconds per vehicle. These higher delays may result from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping.
D	Average control delay is greater than 35 seconds per vehicle and less than or equal to 55 seconds per vehicle. The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle length, or high volume/capacity ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.
E	Average control delay is greater than 55 seconds per vehicle and less than or equal to 80 seconds per vehicle. This is usually considered to be the limit of acceptable delay. These high delay values generally (but not always) indicate poor progression, long cycle lengths, and high volume/capacity ratios. Individual cycle failures are frequent occurrences.
F	Average control delay is in excess of 80 seconds per vehicle. This is considered to be unacceptable to most drivers. This condition often occurs with oversaturation. It may also occur at high volume/capacity ratios below 1.0 with many individual cycle failures. Poor progression and long cycle lengths may also contribute to such high delay values.

1 Most of the material in this appendix is adapted from the Transportation Research Board, Highway Capacity Manual, (2000).

Table B-2 Level-of-Service Criteria for Signalized Intersections

Level of Service	Average Control Delay per Vehicle (Seconds)
A	<10.0
B	>10 and ≤20
C	>20 and ≤35
D	>35 and ≤55
E	>55 and ≤80
F	>80

UNSIGNALIZED INTERSECTIONS

Unsignalized intersections include two-way stop-controlled (TWSC) and all-way stop-controlled (AWSC) intersections. The 2000 Highway Capacity Manual (HCM) provides models for estimating control delay at both TWSC and AWSC intersections. A qualitative description of the various service levels associated with an unsignalized intersection is presented in **Table B-3**. A quantitative definition of level of service for unsignalized intersections is presented in **Table B-4**. Using this definition, Level of Service "E" is generally considered to represent the minimum acceptable design standard.

Table B-3 Level-of-Service Criteria for Unsignalized Intersections

Level of Service	Average Delay per Vehicle to Minor Street
A	• Nearly all drivers find freedom of operation. • Very seldom is there more than one vehicle in queue.
B	• Some drivers begin to consider the delay an inconvenience. • Occasionally there is more than one vehicle in queue.
C	• Many times there is more than one vehicle in queue. • Most drivers feel restricted, but not objectionably so.
D	• Often there is more than one vehicle in queue. • Drivers feel quite restricted.
E	• Represents a condition in which the demand is near or equal to the probable maximum number of vehicles that can be accommodated by the movement. • There is almost always more than one vehicle in queue. • Drivers find the delays approaching intolerable levels.
F	• Forced flow. • Represents an intersection failure condition that is caused by geometric and/or operational constraints external to the intersection.

Table B-4 Level-of-Service Criteria for Unsignalized Intersections

Level of Service	Average Control Delay per Vehicle (Seconds)
A	<10.0
B	>10.0 and ≤ 15.0
C	>15.0 and ≤ 25.0
D	>25.0 and ≤ 35.0
E	>35.0 and ≤ 50.0
F	>50.0

It should be noted that the level-of-service criteria for unsignalized intersections are somewhat different than the criteria used for signalized intersections. The primary reason for this difference is that drivers expect different levels of performance from different kinds of transportation facilities. The expectation is that a signalized intersection is designed to carry higher traffic volumes than an unsignalized intersection. Additionally, there are a number of driver behavior considerations that combine to make delays at signalized intersections less galling than at unsignalized intersections. For example, drivers at signalized intersections are able to relax during the red interval, while drivers on the minor street approaches to TWSC intersections must remain attentive to the task of identifying acceptable gaps and vehicle conflicts. Also, there is often much more variability in the amount of delay experienced by individual drivers at unsignalized intersections than signalized intersections. For these reasons, it is considered that the control delay threshold for any given level of service is less for an unsignalized intersection than for a signalized intersection. While overall intersection level of service is calculated for AWSC intersections, level of service is only calculated for the minor approaches and the major street left turn movements at TWSC intersections. No delay is assumed to the major street through movements. For TWSC intersections, the overall intersection level of service remains undefined: level of service is only calculated for each minor street lane.

In the performance evaluation of TWSC intersections, it is important to consider other measures of effectiveness (MOEs) in addition to delay, such as v/c ratios for individual movements, average queue lengths, and 95th-percentile queue lengths. By focusing on a single MOE for the worst movement only, such as delay for the minor-street left turn, users may make inappropriate traffic control decisions. The potential for making such inappropriate decisions is likely to be particularly pronounced when the HCM level-of-service thresholds are adopted as legal standards, as is the case in many public agencies.

APPENDIX C

TURN LANE WARRANT ANALYSIS

Key

- EPL — Eastbound at Pioneer Lane
- EHS — Eastbound at Hillsman Street
- WHS — Westbound at Hillsman Street
- EHD — Eastbound at Holly Manor Drive
- WHC — Westbound at Herrell Court
- EFL (1) — Eastbound at Fairwood Lane
- EFL (2) — Eastbound at Fairwood Lane (with Streetlight data adjustments)
- EPC — Eastbound at Patricia Court
- WPR — Westbound at Pinecastle Road

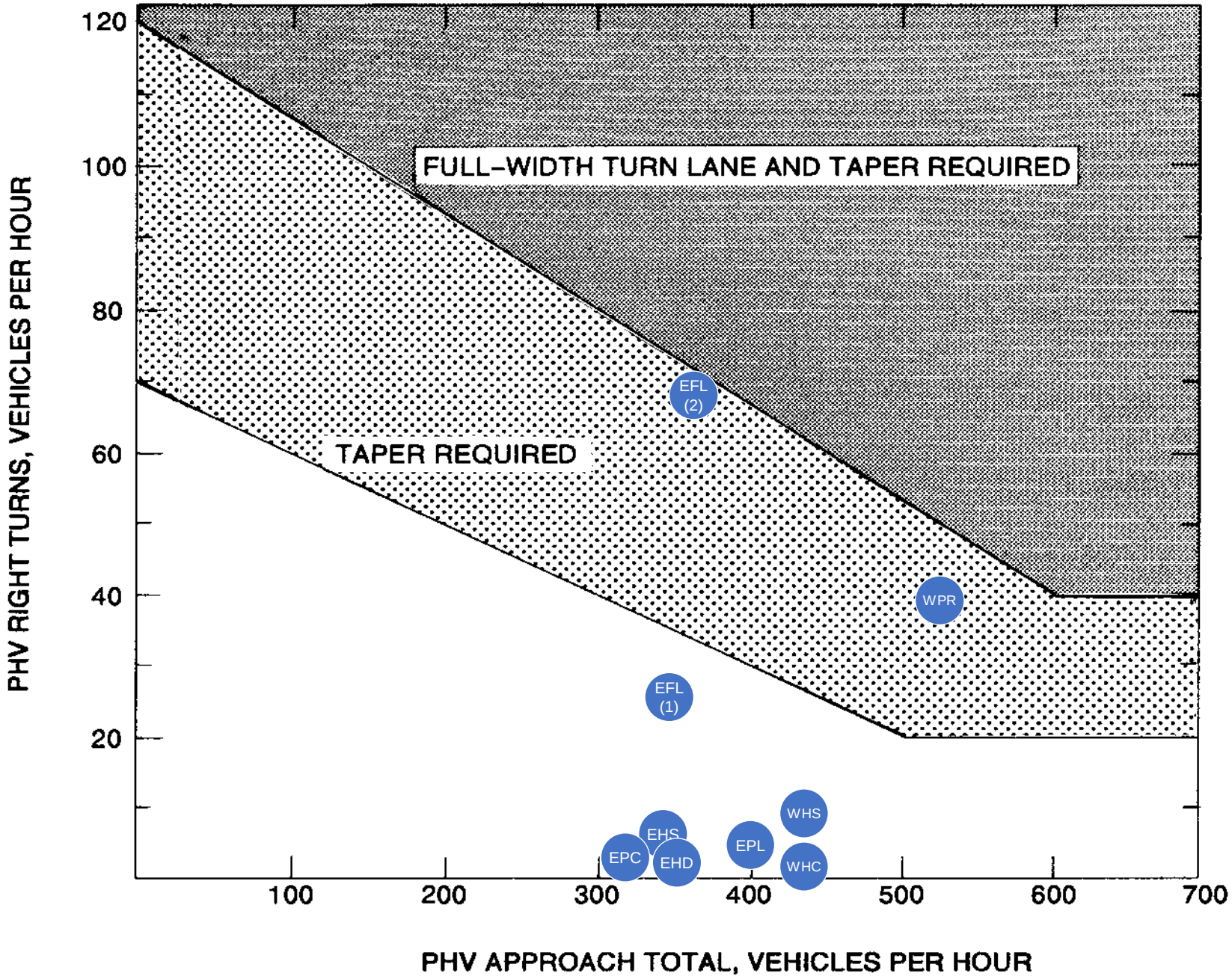


Figure 3-26 Warrants for Right Turn Treatment (2-Lane Highway) from VDOT Road Design Manual Appendix F

Note: Volumes for the eastbound approach at Fairwood Lane were evaluated in two different ways. First, using only vehicle count data as EFL (1). The second incorporated Streetlight data as EFL (2) for a more conservative estimate.

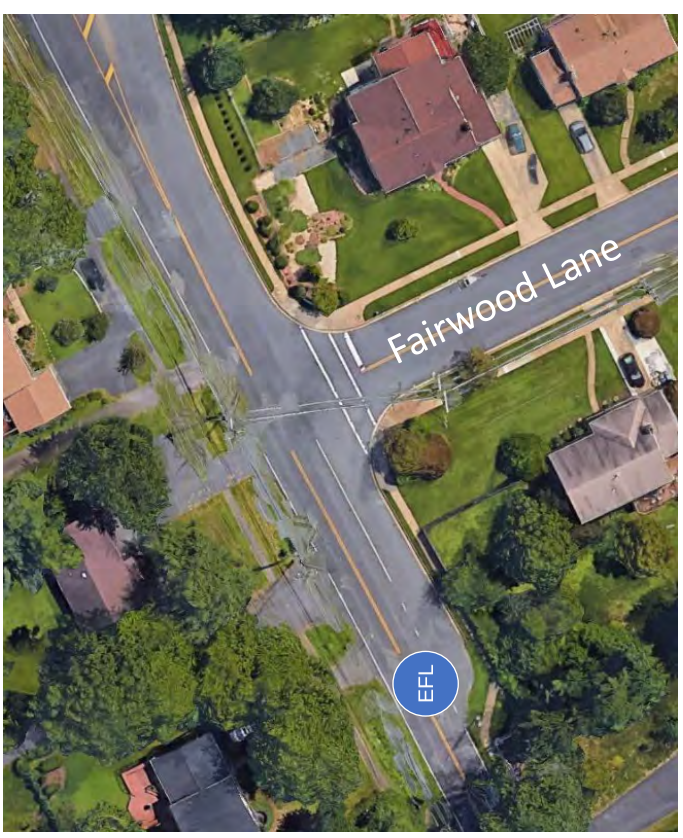

Holly Manor Drive
WHC
Herrell Court
EHD


WPR
Pinecastle Road


WHS
Hillsman Street
EHS


Patricia Court
EPC


Pioneer Lane
EPL


Fairwood Lane
EFL

Calculations

When PHV right turns>40 and PHV total<300, then subtract 20 from PHV right turns.

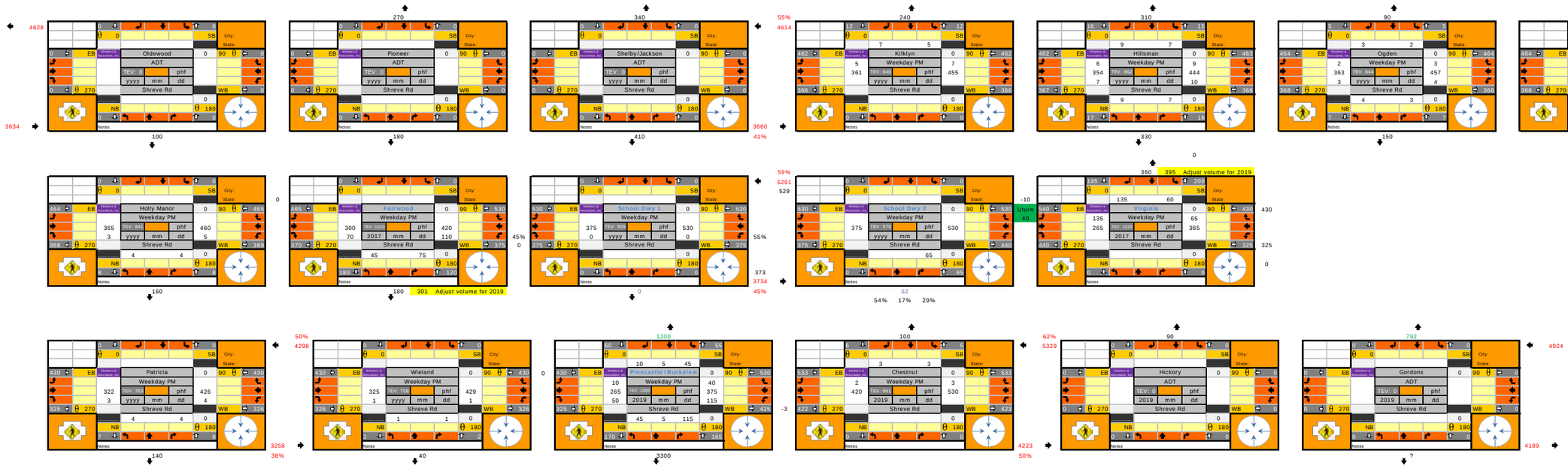
See volume development spreadsheet (2019 Baseline PM Volumes)

Note: For the eastbound approach at Fairwood Lane, extrapolating vehicle count data only (EFL 1) suggests the turn lane would not be warranted. While volumes could be higher based on supplemental Streetlight data (EFL 2), even under this more conservative scenario only a taper would be warranted.

For the sake of the turn lane warrant analysis, it is recommended the (EFL 1) volumes take precedence. Streetlight data is not directly analogous to number of vehicles and turn lane warrant analyses are more sensitive to overestimating vehicle turning volumes than a typical capacity analysis.

xxx VDOT ADT map | **Intersection Name** Study intersection
xxx 2019 speed study counters | 1.048 2017 to 2019 growth
xxx RTAP speed study counters | 0.100 PM Shreve K factor
xxx Weekday AM School counts from SRS study
61 W&OD Volumes (PM peak represents 3.5% of daily)

schol bus 0 school buses
private vehicle
776 students 62 teacher trips
0.067 teacher ratio



APPENDIX D

DETAILED RECOMMENDATIONS SYNCHRO RESULTS

MOVEMENT SUMMARY

Site: 101 [W School Dwy and Shreve - 2019 AM]

W School Dwy/Shreve Rd
Weekday AM Peak Hour, Year 2019
Sidra Standard Model, EF = 1.1
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: W School Dwy												
3	L2	1	2.0	0.003	4.4	LOS A	0.0	0.3	0.53	0.29	0.53	23.9
18	R2	1	2.0	0.003	4.4	LOS A	0.0	0.3	0.53	0.29	0.53	23.2
Approach		2	2.0	0.003	4.4	LOS A	0.0	0.3	0.53	0.29	0.53	23.5
East: Shreve Rd												
1	L2	5	2.0	0.320	5.9	LOS A	2.3	58.9	0.03	0.00	0.03	24.1
6	T1	391	2.0	0.320	5.9	LOS A	2.3	58.9	0.03	0.00	0.03	23.9
Approach		397	2.0	0.320	5.9	LOS A	2.3	58.9	0.03	0.00	0.03	23.9
West: Shreve Rd												
2	T1	478	2.0	0.396	6.8	LOS A	2.7	69.7	0.07	0.01	0.07	23.7
12	R2	11	2.0	0.396	6.8	LOS A	2.7	69.7	0.07	0.01	0.07	23.2
Approach		489	2.0	0.396	6.8	LOS A	2.7	69.7	0.07	0.01	0.07	23.6
All Vehicles		888	2.0	0.396	6.4	LOS A	2.7	69.7	0.05	0.01	0.05	23.7

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [E School Dwy/Virginia Ln and Shreve - 2019 AM]

E School Dwy/Shreve Rd
Weekday AM Peak Hour, Year 2019
Sidra Standard Model, EF = 1.1
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: E School Dwy												
3	L2	98	2.0	0.231	7.1	LOS A	1.4	35.4	0.64	0.53	0.64	23.2
8	T1	33	2.0	0.231	7.1	LOS A	1.4	35.4	0.64	0.53	0.64	23.0
18	R2	54	2.0	0.231	7.1	LOS A	1.4	35.4	0.64	0.53	0.64	22.5
Approach		185	2.0	0.231	7.1	LOS A	1.4	35.4	0.64	0.53	0.64	23.0
East: Shreve Rd												
1	L2	114	2.0	0.467	9.6	LOS A	3.3	83.7	0.64	0.50	0.64	22.9
6	T1	245	2.0	0.467	9.6	LOS A	3.3	83.7	0.64	0.50	0.64	22.7
16	R2	76	2.0	0.467	9.6	LOS A	3.3	83.7	0.64	0.50	0.64	22.3
Approach		435	2.0	0.467	9.6	LOS A	3.3	83.7	0.64	0.50	0.64	22.7
North: Virginia Ln												
7	L2	54	2.0	0.174	6.5	LOS A	1.0	25.1	0.63	0.51	0.63	23.5
4	T1	27	2.0	0.174	6.5	LOS A	1.0	25.1	0.63	0.51	0.63	23.2
14	R2	54	2.0	0.174	6.5	LOS A	1.0	25.1	0.63	0.51	0.63	22.8
Approach		136	2.0	0.174	6.5	LOS A	1.0	25.1	0.63	0.51	0.63	23.2
West: Shreve Rd												
5	L2	158	2.0	0.614	12.2	LOS B	5.4	136.7	0.66	0.48	0.66	22.3
2	T1	223	2.0	0.614	12.2	LOS B	5.4	136.7	0.66	0.48	0.66	22.1
12	R2	239	2.0	0.614	12.2	LOS B	5.4	136.7	0.66	0.48	0.66	21.7
Approach		620	2.0	0.614	12.2	LOS B	5.4	136.7	0.66	0.48	0.66	22.0
All Vehicles		1375	2.0	0.614	10.1	LOS B	5.4	136.7	0.65	0.50	0.65	22.4

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

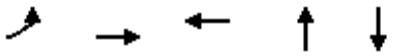
Site: 101 [Pinecastle/Buckelew and Shreve - 2019 AM]

Pinecastle Rd/Buckelew Dr/Shreve Rd
Weekday AM Peak Hour, Year 2019
Sidra Standard Model, EF = 1.1
Site Category: (None)
Roundabout

Movement Performance - Vehicles

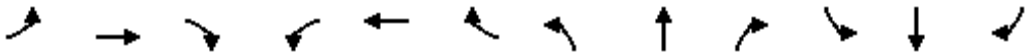
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: Buckelew Dr												
3b	L3	43	2.0	0.182	5.8	LOS A	1.0	25.7	0.53	0.40	0.53	24.1
8	T1	5	2.0	0.182	5.8	LOS A	1.0	25.7	0.53	0.40	0.53	23.6
18a	R1	114	2.0	0.182	5.8	LOS A	1.0	25.7	0.53	0.40	0.53	23.4
Approach		163	2.0	0.182	5.8	LOS A	1.0	25.7	0.53	0.40	0.53	23.6
NorthEast: Shreve Rd												
1ax	L1	120	2.0	0.469	8.2	LOS A	3.9	98.0	0.33	0.15	0.33	23.1
6x	T1	380	2.0	0.469	8.2	LOS A	3.9	98.0	0.33	0.15	0.33	23.1
16bx	R3	43	2.0	0.469	8.2	LOS A	3.9	98.0	0.33	0.15	0.33	22.5
Approach		543	2.0	0.469	8.2	LOS A	3.9	98.0	0.33	0.15	0.33	23.1
North: Pinecastle Rd												
7b	L3	43	2.0	0.080	5.7	LOS A	0.4	10.9	0.62	0.49	0.62	23.5
4	T1	5	2.0	0.080	5.7	LOS A	0.4	10.9	0.62	0.49	0.62	23.1
14a	R1	11	2.0	0.080	5.7	LOS A	0.4	10.9	0.62	0.49	0.62	22.9
Approach		60	2.0	0.080	5.7	LOS A	0.4	10.9	0.62	0.49	0.62	23.3
SouthWest: Shreve Rd												
5ax	L1	11	2.0	0.317	6.6	LOS A	2.0	49.7	0.43	0.28	0.43	23.6
2x	T1	272	2.0	0.317	6.6	LOS A	2.0	49.7	0.43	0.28	0.43	23.6
12bx	R3	49	2.0	0.317	6.6	LOS A	2.0	49.7	0.43	0.28	0.43	23.0
Approach		332	2.0	0.317	6.6	LOS A	2.0	49.7	0.43	0.28	0.43	23.5
All Vehicles		1098	2.0	0.469	7.2	LOS A	3.9	98.0	0.41	0.25	0.41	23.3

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.



Lane Group	EBL	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	158	462	435	185	135
v/c Ratio	0.26	0.47	0.55	0.47	0.32
Control Delay	9.3	8.1	11.9	16.3	11.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	9.3	8.1	11.9	16.3	11.6
Queue Length 50th (ft)	20	45	62	28	15
Queue Length 95th (ft)	69	152	198	85	55
Internal Link Dist (ft)		321	715	220	411
Turn Bay Length (ft)					
Base Capacity (vph)	739	1179	973	726	771
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.21	0.39	0.45	0.25	0.18

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	145	205	220	105	225	70	90	30	50	50	25	50
Future Volume (veh/h)	145	205	220	105	225	70	90	30	50	50	25	50
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	2027	1949	2027	1870	1870	1870
Adj Flow Rate, veh/h	158	223	239	114	245	76	98	33	54	54	27	54
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	650	372	399	235	392	103	320	90	98	251	107	134
Arrive On Green	0.45	0.45	0.45	0.45	0.45	0.45	0.21	0.21	0.21	0.21	0.21	0.21
Sat Flow, veh/h	1059	823	882	208	868	228	721	440	479	457	519	651
Grp Volume(v), veh/h	158	0	462	435	0	0	185	0	0	135	0	0
Grp Sat Flow(s),veh/h/ln	1059	0	1706	1303	0	0	1640	0	0	1628	0	0
Q Serve(g_s), s	0.0	0.0	6.5	3.1	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	3.8	0.0	6.5	9.6	0.0	0.0	3.0	0.0	0.0	2.1	0.0	0.0
Prop In Lane	1.00		0.52	0.26		0.17	0.53		0.29	0.40		0.40
Lane Grp Cap(c), veh/h	650	0	771	730	0	0	509	0	0	491	0	0
V/C Ratio(X)	0.24	0.00	0.60	0.60	0.00	0.00	0.36	0.00	0.00	0.27	0.00	0.00
Avail Cap(c_a), veh/h	1124	0	1535	1376	0	0	1151	0	0	1124	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	5.9	0.0	6.6	7.0	0.0	0.0	11.3	0.0	0.0	11.0	0.0	0.0
Incr Delay (d2), s/veh	0.2	0.0	0.8	0.8	0.0	0.0	0.4	0.0	0.0	0.3	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	1.3	1.2	0.0	0.0	1.0	0.0	0.0	0.7	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	6.1	0.0	7.4	7.8	0.0	0.0	11.7	0.0	0.0	11.3	0.0	0.0
LnGrp LOS	A	A	A	A	A	A	B	A	A	B	A	A
Approach Vol, veh/h		620			435			185			135	
Approach Delay, s/veh		7.0			7.8			11.7			11.3	
Approach LOS		A			A			B			B	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		20.0		12.1		20.0		12.1				
Change Period (Y+Rc), s		5.5		5.5		5.5		5.5				
Max Green Setting (Gmax), s		28.9		20.1		28.9		20.1				
Max Q Clear Time (g_c+I1), s		8.5		5.0		11.6		4.1				
Green Ext Time (p_c), s		3.7		0.9		2.8		0.6				

Intersection Summary												
HCM 6th Ctrl Delay			8.3									
HCM 6th LOS			A									

MOVEMENT SUMMARY

Site: 101 [W School Dwy and Shreve - 2019 PM]

W School Dwy/Shreve Rd
Weekday PM Peak Hour, Year 2019
Sidra Standard Model, EF = 1.1
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: W School Dwy												
3	L2	1	2.0	0.003	4.2	LOS A	0.0	0.3	0.49	0.25	0.49	23.9
18	R2	1	2.0	0.003	4.2	LOS A	0.0	0.3	0.49	0.25	0.49	23.2
Approach		2	2.0	0.003	4.2	LOS A	0.0	0.3	0.49	0.25	0.49	23.6
East: Shreve Rd												
1	L2	1	2.0	0.465	7.7	LOS A	4.1	105.2	0.03	0.00	0.03	23.7
6	T1	576	2.0	0.465	7.7	LOS A	4.1	105.2	0.03	0.00	0.03	23.4
Approach		577	2.0	0.465	7.7	LOS A	4.1	105.2	0.03	0.00	0.03	23.4
West: Shreve Rd												
2	T1	408	2.0	0.329	6.0	LOS A	2.1	53.0	0.02	0.00	0.02	23.9
12	R2	1	2.0	0.329	6.0	LOS A	2.1	53.0	0.02	0.00	0.02	23.4
Approach		409	2.0	0.329	6.0	LOS A	2.1	53.0	0.02	0.00	0.02	23.9
All Vehicles		988	2.0	0.465	7.0	LOS A	4.1	105.2	0.03	0.00	0.03	23.6

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [E School Dwy/Virginia Ln and Shreve - 2019 PM]

E School Dwy/Shreve Rd
Weekday PM Peak Hour, Year 2019
Sidra Standard Model, EF = 1.1
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: E School Dwy												
3	L2	33	2.0	0.081	5.3	LOS A	0.4	10.8	0.58	0.44	0.58	23.7
8	T1	11	2.0	0.081	5.3	LOS A	0.4	10.8	0.58	0.44	0.58	23.4
18	R2	22	2.0	0.081	5.3	LOS A	0.4	10.8	0.58	0.44	0.58	23.0
Approach		65	2.0	0.081	5.3	LOS A	0.4	10.8	0.58	0.44	0.58	23.4
East: Shreve Rd												
1	L2	1	2.0	0.453	8.6	LOS A	3.2	81.8	0.51	0.35	0.51	23.4
6	T1	397	2.0	0.453	8.6	LOS A	3.2	81.8	0.51	0.35	0.51	23.2
16	R2	71	2.0	0.453	8.6	LOS A	3.2	81.8	0.51	0.35	0.51	22.7
Approach		468	2.0	0.453	8.6	LOS A	3.2	81.8	0.51	0.35	0.51	23.1
North: Virginia Ln												
7	L2	65	2.0	0.265	7.4	LOS A	1.6	40.3	0.64	0.54	0.64	23.3
4	T1	1	2.0	0.265	7.4	LOS A	1.6	40.3	0.64	0.54	0.64	23.1
14	R2	147	2.0	0.265	7.4	LOS A	1.6	40.3	0.64	0.54	0.64	22.6
Approach		213	2.0	0.265	7.4	LOS A	1.6	40.3	0.64	0.54	0.64	22.8
West: Shreve Rd												
5	L2	136	2.0	0.353	6.6	LOS A	2.6	65.5	0.32	0.15	0.32	23.6
2	T1	266	2.0	0.353	6.6	LOS A	2.6	65.5	0.32	0.15	0.32	23.3
12	R2	1	2.0	0.353	6.6	LOS A	2.6	65.5	0.32	0.15	0.32	22.9
Approach		403	2.0	0.353	6.6	LOS A	2.6	65.5	0.32	0.15	0.32	23.4
All Vehicles		1150	2.0	0.453	7.5	LOS A	3.2	81.8	0.47	0.32	0.47	23.2

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Pinecastle/Buckelew and Shreve - 2019 PM]

Pinecastle Rd/Buckelew Dr/Shreve Rd
Weekday PM Peak Hour, Year 2019
Sidra Standard Model, EF = 1.1
Site Category: (None)
Roundabout

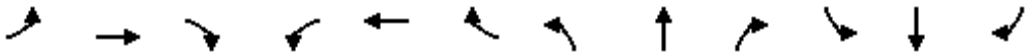
Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: Buckelew Dr												
3b	L3	49	2.0	0.204	6.2	LOS A	1.2	29.4	0.56	0.43	0.56	24.0
8	T1	5	2.0	0.204	6.2	LOS A	1.2	29.4	0.56	0.43	0.56	23.5
18a	R1	125	2.0	0.204	6.2	LOS A	1.2	29.4	0.56	0.43	0.56	23.3
Approach		179	2.0	0.204	6.2	LOS A	1.2	29.4	0.56	0.43	0.56	23.5
NorthEast: Shreve Rd												
1ax	L1	125	2.0	0.500	8.7	LOS A	4.3	109.7	0.37	0.18	0.37	23.0
6x	T1	408	2.0	0.500	8.7	LOS A	4.3	109.7	0.37	0.18	0.37	23.0
16bx	R3	43	2.0	0.500	8.7	LOS A	4.3	109.7	0.37	0.18	0.37	22.4
Approach		576	2.0	0.500	8.7	LOS A	4.3	109.7	0.37	0.18	0.37	22.9
North: Pinecastle Rd												
7b	L3	49	2.0	0.091	6.0	LOS A	0.5	12.6	0.65	0.52	0.65	23.4
4	T1	5	2.0	0.091	6.0	LOS A	0.5	12.6	0.65	0.52	0.65	23.0
14a	R1	11	2.0	0.091	6.0	LOS A	0.5	12.6	0.65	0.52	0.65	22.8
Approach		65	2.0	0.091	6.0	LOS A	0.5	12.6	0.65	0.52	0.65	23.3
SouthWest: Shreve Rd												
5ax	L1	11	2.0	0.342	7.0	LOS A	2.2	54.9	0.46	0.30	0.46	23.5
2x	T1	288	2.0	0.342	7.0	LOS A	2.2	54.9	0.46	0.30	0.46	23.5
12bx	R3	54	2.0	0.342	7.0	LOS A	2.2	54.9	0.46	0.30	0.46	22.9
Approach		353	2.0	0.342	7.0	LOS A	2.2	54.9	0.46	0.30	0.46	23.4
All Vehicles		1174	2.0	0.500	7.7	LOS A	4.3	109.7	0.44	0.27	0.44	23.2

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Lane Group	EBL	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	136	266	468	66	212
v/c Ratio	0.29	0.28	0.50	0.17	0.43
Control Delay	10.2	8.5	10.4	9.7	7.8
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	10.2	8.5	10.4	9.7	7.8
Queue Length 50th (ft)	14	26	51	6	9
Queue Length 95th (ft)	65	101	189	30	51
Internal Link Dist (ft)		321	715	220	372
Turn Bay Length (ft)					
Base Capacity (vph)	607	1216	1198	866	927
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.22	0.22	0.39	0.08	0.23

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	125	245	0	0	365	65	30	10	20	60	0	135
Future Volume (veh/h)	125	245	0	0	365	65	30	10	20	60	0	135
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	2027	1949	2027	1870	1870	1870
Adj Flow Rate, veh/h	136	266	0	0	397	71	33	11	22	65	0	147
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	464	831	0	0	687	123	296	111	117	223	24	219
Arrive On Green	0.44	0.44	0.00	0.00	0.44	0.44	0.20	0.20	0.20	0.20	0.00	0.20
Sat Flow, veh/h	925	1870	0	0	1544	276	603	543	573	355	120	1074
Grp Volume(v), veh/h	136	266	0	0	0	468	66	0	0	212	0	0
Grp Sat Flow(s),veh/h/ln	925	1870	0	0	0	1821	1720	0	0	1549	0	0
Q Serve(g_s), s	4.0	2.9	0.0	0.0	0.0	6.0	0.0	0.0	0.0	2.4	0.0	0.0
Cycle Q Clear(g_c), s	10.0	2.9	0.0	0.0	0.0	6.0	0.9	0.0	0.0	3.9	0.0	0.0
Prop In Lane	1.00		0.00	0.00		0.15	0.50		0.33	0.31		0.69
Lane Grp Cap(c), veh/h	464	831	0	0	0	809	523	0	0	466	0	0
V/C Ratio(X)	0.29	0.32	0.00	0.00	0.00	0.58	0.13	0.00	0.00	0.45	0.00	0.00
Avail Cap(c_a), veh/h	759	1429	0	0	0	1391	1174	0	0	1131	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	10.2	5.6	0.0	0.0	0.0	6.5	10.3	0.0	0.0	11.4	0.0	0.0
Incr Delay (d2), s/veh	0.3	0.2	0.0	0.0	0.0	0.7	0.1	0.0	0.0	0.7	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.6	0.0	0.0	0.0	1.2	0.3	0.0	0.0	1.1	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	10.6	5.8	0.0	0.0	0.0	7.2	10.4	0.0	0.0	12.1	0.0	0.0
LnGrp LOS	B	A	A	A	A	A	B	A	A	B	A	A
Approach Vol, veh/h		402			468			66			212	
Approach Delay, s/veh		7.5			7.2			10.4			12.1	
Approach LOS		A			A			B			B	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		19.4		11.9		19.4		11.9				
Change Period (Y+Rc), s		5.5		5.5		5.5		5.5				
Max Green Setting (Gmax), s		23.9		20.1		23.9		20.1				
Max Q Clear Time (g_c+I1), s		12.0		2.9		8.0		5.9				
Green Ext Time (p_c), s		1.7		0.3		2.6		1.0				

Intersection Summary												
HCM 6th Ctrl Delay			8.4									
HCM 6th LOS			A									

MOVEMENT SUMMARY

Site: 101 [W School Dwy and Shreve - 2030 AM]

W School Dwy/Shreve Rd
Weekday AM Peak Hour, Year 2030
Sidra Standard Model, EF = 1.05
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: W School Dwy												
3	L2	1	2.0	0.003	4.3	LOS A	0.0	0.3	0.56	0.31	0.56	23.9
18	R2	1	2.0	0.003	4.3	LOS A	0.0	0.3	0.56	0.31	0.56	23.2
Approach		2	2.0	0.003	4.3	LOS A	0.0	0.3	0.56	0.31	0.56	23.5
East: Shreve Rd												
1	L2	5	2.0	0.364	6.2	LOS A	2.8	71.9	0.03	0.00	0.03	24.0
6	T1	467	2.0	0.364	6.2	LOS A	2.8	71.9	0.03	0.00	0.03	23.8
Approach		473	2.0	0.364	6.2	LOS A	2.8	71.9	0.03	0.00	0.03	23.8
West: Shreve Rd												
2	T1	543	2.0	0.428	7.0	LOS A	3.1	79.0	0.07	0.01	0.07	23.6
12	R2	11	2.0	0.428	7.0	LOS A	3.1	79.0	0.07	0.01	0.07	23.1
Approach		554	2.0	0.428	7.0	LOS A	3.1	79.0	0.07	0.01	0.07	23.6
All Vehicles		1029	2.0	0.428	6.6	LOS A	3.1	79.0	0.05	0.01	0.05	23.7

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [E School Dwy/Virginia Ln and Shreve - 2030 AM]

E School Dwy/Shreve Rd
Weekday AM Peak Hour, Year 2030
Sidra Standard Model, EF = 1.05
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: E School Dwy												
3	L2	98	2.0	0.235	7.2	LOS A	1.5	37.1	0.69	0.58	0.69	23.2
8	T1	33	2.0	0.235	7.2	LOS A	1.5	37.1	0.69	0.58	0.69	23.0
18	R2	54	2.0	0.235	7.2	LOS A	1.5	37.1	0.69	0.58	0.69	22.5
Approach		185	2.0	0.235	7.2	LOS A	1.5	37.1	0.69	0.58	0.69	23.0
East: Shreve Rd												
1	L2	114	2.0	0.537	10.5	LOS B	4.3	110.2	0.68	0.56	0.70	22.7
6	T1	321	2.0	0.537	10.5	LOS B	4.3	110.2	0.68	0.56	0.70	22.5
16	R2	92	2.0	0.537	10.5	LOS B	4.3	110.2	0.68	0.56	0.70	22.1
Approach		527	2.0	0.537	10.5	LOS B	4.3	110.2	0.68	0.56	0.70	22.5
North: Virginia Ln												
7	L2	65	2.0	0.191	6.8	LOS A	1.1	29.0	0.68	0.57	0.68	23.4
4	T1	27	2.0	0.191	6.8	LOS A	1.1	29.0	0.68	0.57	0.68	23.1
14	R2	54	2.0	0.191	6.8	LOS A	1.1	29.0	0.68	0.57	0.68	22.7
Approach		147	2.0	0.191	6.8	LOS A	1.1	29.0	0.68	0.57	0.68	23.1
West: Shreve Rd												
5	L2	163	2.0	0.649	12.7	LOS B	7.1	180.3	0.69	0.56	0.76	22.2
2	T1	283	2.0	0.649	12.7	LOS B	7.1	180.3	0.69	0.56	0.76	22.0
12	R2	239	2.0	0.649	12.7	LOS B	7.1	180.3	0.69	0.56	0.76	21.6
Approach		685	2.0	0.649	12.7	LOS B	7.1	180.3	0.69	0.56	0.76	21.9
All Vehicles		1543	2.0	0.649	10.7	LOS B	7.1	180.3	0.69	0.56	0.73	22.3

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

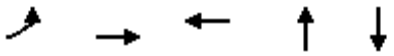
Site: 101 [Pinecastle/Buckelew and Shreve - 2030 AM]

Pinecastle Rd/Buckelew Dr/Shreve Rd
Weekday AM Peak Hour, Year 2030
Sidra Standard Model, EF = 1.05
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: Buckelew Dr												
3b	L3	43	2.0	0.200	6.0	LOS A	1.2	29.3	0.58	0.45	0.58	24.0
8	T1	5	2.0	0.200	6.0	LOS A	1.2	29.3	0.58	0.45	0.58	23.6
18a	R1	130	2.0	0.200	6.0	LOS A	1.2	29.3	0.58	0.45	0.58	23.4
Approach		179	2.0	0.200	6.0	LOS A	1.2	29.3	0.58	0.45	0.58	23.5
NorthEast: Shreve Rd												
1ax	L1	141	2.0	0.535	9.0	LOS A	5.0	126.0	0.36	0.17	0.36	22.9
6x	T1	467	2.0	0.535	9.0	LOS A	5.0	126.0	0.36	0.17	0.36	22.9
16bx	R3	43	2.0	0.535	9.0	LOS A	5.0	126.0	0.36	0.17	0.36	22.4
Approach		652	2.0	0.535	9.0	LOS A	5.0	126.0	0.36	0.17	0.36	22.9
North: Pinecastle Rd												
7b	L3	43	2.0	0.083	5.9	LOS A	0.5	11.9	0.68	0.54	0.68	23.4
4	T1	5	2.0	0.083	5.9	LOS A	0.5	11.9	0.68	0.54	0.68	23.0
14a	R1	11	2.0	0.083	5.9	LOS A	0.5	11.9	0.68	0.54	0.68	22.8
Approach		60	2.0	0.083	5.9	LOS A	0.5	11.9	0.68	0.54	0.68	23.3
SouthWest: Shreve Rd												
5ax	L1	11	2.0	0.372	7.2	LOS A	2.4	62.1	0.48	0.32	0.48	23.5
2x	T1	337	2.0	0.372	7.2	LOS A	2.4	62.1	0.48	0.32	0.48	23.5
12bx	R3	54	2.0	0.372	7.2	LOS A	2.4	62.1	0.48	0.32	0.48	22.9
Approach		402	2.0	0.372	7.2	LOS A	2.4	62.1	0.48	0.32	0.48	23.4
All Vehicles		1293	2.0	0.535	7.9	LOS A	5.0	126.0	0.44	0.27	0.44	23.2

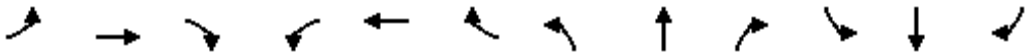
Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.



Lane Group	EBL	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	163	522	527	185	146
v/c Ratio	0.33	0.56	0.69	0.52	0.41
Control Delay	9.7	9.4	15.3	20.5	16.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	9.7	9.4	15.3	20.5	16.2
Queue Length 50th (ft)	21	60	92	39	25
Queue Length 95th (ft)	m74	188	#276	97	70
Internal Link Dist (ft)		321	715	220	289
Turn Bay Length (ft)					
Base Capacity (vph)	598	1105	912	599	596
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.27	0.47	0.58	0.31	0.24

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	150	260	220	105	295	85	90	30	50	60	25	50
Future Volume (veh/h)	150	260	220	105	295	85	90	30	50	60	25	50
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	2027	1949	2027	1870	1870	1870
Adj Flow Rate, veh/h	163	283	239	114	321	92	98	33	54	65	27	54
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	605	470	397	214	469	119	296	81	92	251	90	114
Arrive On Green	0.50	0.50	0.50	0.50	0.50	0.50	0.19	0.19	0.19	0.19	0.19	0.19
Sat Flow, veh/h	973	934	789	181	934	236	751	427	486	555	478	606
Grp Volume(v), veh/h	163	0	522	527	0	0	185	0	0	146	0	0
Grp Sat Flow(s),veh/h/ln	973	0	1724	1350	0	0	1664	0	0	1639	0	0
Q Serve(g_s), s	0.0	0.0	7.7	4.5	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	5.2	0.0	7.7	12.2	0.0	0.0	3.3	0.0	0.0	2.6	0.0	0.0
Prop In Lane	1.00		0.46	0.22		0.17	0.53		0.29	0.45		0.37
Lane Grp Cap(c), veh/h	605	0	866	802	0	0	469	0	0	455	0	0
V/C Ratio(X)	0.27	0.00	0.60	0.66	0.00	0.00	0.39	0.00	0.00	0.32	0.00	0.00
Avail Cap(c_a), veh/h	1041	0	1638	1458	0	0	1041	0	0	1013	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	5.7	0.0	6.3	7.0	0.0	0.0	13.0	0.0	0.0	12.8	0.0	0.0
Incr Delay (d2), s/veh	0.2	0.0	0.7	0.9	0.0	0.0	0.5	0.0	0.0	0.4	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	1.5	1.6	0.0	0.0	1.2	0.0	0.0	0.9	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	5.9	0.0	7.0	8.0	0.0	0.0	13.6	0.0	0.0	13.2	0.0	0.0
LnGrp LOS	A	A	A	A	A	A	B	A	A	B	A	A
Approach Vol, veh/h		685			527			185			146	
Approach Delay, s/veh		6.7			8.0			13.6			13.2	
Approach LOS		A			A			B			B	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		23.4		12.2		23.4		12.2				
Change Period (Y+Rc), s		5.5		5.5		5.5		5.5				
Max Green Setting (Gmax), s		33.9		20.1		33.9		20.1				
Max Q Clear Time (g_c+I1), s		9.7		5.3		14.2		4.6				
Green Ext Time (p_c), s		4.5		0.9		3.7		0.7				

Intersection Summary												
HCM 6th Ctrl Delay			8.6									
HCM 6th LOS			A									

MOVEMENT SUMMARY

Site: 101 [W School Dwy and Shreve - 2030 PM]

W School Dwy/Shreve Rd
Weekday PM Peak Hour, Year 2030
Sidra Standard Model, EF = 1.05
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: W School Dwy												
3	L2	1	2.0	0.003	4.2	LOS A	0.0	0.3	0.53	0.28	0.53	23.9
18	R2	1	2.0	0.003	4.2	LOS A	0.0	0.3	0.53	0.28	0.53	23.2
Approach		2	2.0	0.003	4.2	LOS A	0.0	0.3	0.53	0.28	0.53	23.6
East: Shreve Rd												
1	L2	1	2.0	0.524	8.4	LOS A	5.2	132.9	0.04	0.00	0.04	23.5
6	T1	679	2.0	0.524	8.4	LOS A	5.2	132.9	0.04	0.00	0.04	23.3
Approach		680	2.0	0.524	8.4	LOS A	5.2	132.9	0.04	0.00	0.04	23.3
West: Shreve Rd												
2	T1	489	2.0	0.377	6.3	LOS A	2.5	64.8	0.03	0.00	0.03	23.8
12	R2	1	2.0	0.377	6.3	LOS A	2.5	64.8	0.03	0.00	0.03	23.3
Approach		490	2.0	0.377	6.3	LOS A	2.5	64.8	0.03	0.00	0.03	23.8
All Vehicles		1173	2.0	0.524	7.5	LOS A	5.2	132.9	0.03	0.00	0.03	23.5

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [E School Dwy/Virginia Ln and Shreve - 2030 PM]

E School Dwy/Shreve Rd
Weekday PM Peak Hour, Year 2030
Sidra Standard Model, EF = 1.05
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: E School Dwy												
3	L2	33	2.0	0.083	5.4	LOS A	0.5	11.5	0.63	0.49	0.63	23.6
8	T1	11	2.0	0.083	5.4	LOS A	0.5	11.5	0.63	0.49	0.63	23.4
18	R2	22	2.0	0.083	5.4	LOS A	0.5	11.5	0.63	0.49	0.63	22.9
Approach		65	2.0	0.083	5.4	LOS A	0.5	11.5	0.63	0.49	0.63	23.4
East: Shreve Rd												
1	L2	1	2.0	0.537	9.8	LOS A	4.3	108.5	0.57	0.39	0.57	23.1
6	T1	500	2.0	0.537	9.8	LOS A	4.3	108.5	0.57	0.39	0.57	22.9
16	R2	82	2.0	0.537	9.8	LOS A	4.3	108.5	0.57	0.39	0.57	22.5
Approach		583	2.0	0.537	9.8	LOS A	4.3	108.5	0.57	0.39	0.57	22.8
North: Virginia Ln												
7	L2	76	2.0	0.283	7.9	LOS A	1.8	45.2	0.71	0.62	0.71	23.1
4	T1	1	2.0	0.283	7.9	LOS A	1.8	45.2	0.71	0.62	0.71	22.9
14	R2	141	2.0	0.283	7.9	LOS A	1.8	45.2	0.71	0.62	0.71	22.5
Approach		218	2.0	0.283	7.9	LOS A	1.8	45.2	0.71	0.62	0.71	22.7
West: Shreve Rd												
5	L2	141	2.0	0.410	7.2	LOS A	3.2	82.5	0.36	0.18	0.36	23.5
2	T1	342	2.0	0.410	7.2	LOS A	3.2	82.5	0.36	0.18	0.36	23.2
12	R2	1	2.0	0.410	7.2	LOS A	3.2	82.5	0.36	0.18	0.36	22.8
Approach		485	2.0	0.410	7.2	LOS A	3.2	82.5	0.36	0.18	0.36	23.3
All Vehicles		1351	2.0	0.537	8.3	LOS A	4.3	108.5	0.52	0.36	0.52	23.0

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

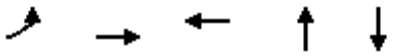
Site: 101 [Pinecastle/Buckelew and Shreve - 2030 PM]

Pinecastle Rd/Buckelew Dr/Shreve Rd
Weekday PM Peak Hour, Year 2030
Sidra Standard Model, EF = 1.05
Site Category: (None)
Roundabout

Movement Performance - Vehicles

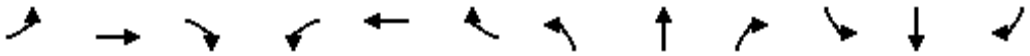
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: Buckelew Dr												
3b	L3	54	2.0	0.241	6.8	LOS A	1.4	36.8	0.63	0.52	0.63	23.8
8	T1	5	2.0	0.241	6.8	LOS A	1.4	36.8	0.63	0.52	0.63	23.4
18a	R1	147	2.0	0.241	6.8	LOS A	1.4	36.8	0.63	0.52	0.63	23.2
Approach		207	2.0	0.241	6.8	LOS A	1.4	36.8	0.63	0.52	0.63	23.4
NorthEast: Shreve Rd												
1ax	L1	147	2.0	0.588	10.1	LOS B	5.9	151.0	0.43	0.22	0.43	22.7
6x	T1	516	2.0	0.588	10.1	LOS B	5.9	151.0	0.43	0.22	0.43	22.7
16bx	R3	43	2.0	0.588	10.1	LOS B	5.9	151.0	0.43	0.22	0.43	22.1
Approach		707	2.0	0.588	10.1	LOS B	5.9	151.0	0.43	0.22	0.43	22.6
North: Pinecastle Rd												
7b	L3	54	2.0	0.106	6.6	LOS A	0.6	15.9	0.73	0.61	0.73	23.2
4	T1	5	2.0	0.106	6.6	LOS A	0.6	15.9	0.73	0.61	0.73	22.8
14a	R1	11	2.0	0.106	6.6	LOS A	0.6	15.9	0.73	0.61	0.73	22.6
Approach		71	2.0	0.106	6.6	LOS A	0.6	15.9	0.73	0.61	0.73	23.1
SouthWest: Shreve Rd												
5ax	L1	11	2.0	0.419	7.9	LOS A	2.9	73.6	0.52	0.36	0.52	23.3
2x	T1	375	2.0	0.419	7.9	LOS A	2.9	73.6	0.52	0.36	0.52	23.3
12bx	R3	60	2.0	0.419	7.9	LOS A	2.9	73.6	0.52	0.36	0.52	22.7
Approach		446	2.0	0.419	7.9	LOS A	2.9	73.6	0.52	0.36	0.52	23.2
All Vehicles		1429	2.0	0.588	8.8	LOS A	5.9	151.0	0.50	0.32	0.50	22.9

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.



Lane Group	EBL	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	141	342	582	66	217
v/c Ratio	0.44	0.40	0.68	0.18	0.48
Control Delay	13.5	9.2	13.7	11.2	9.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	13.5	9.2	13.7	11.2	9.9
Queue Length 50th (ft)	16	38	74	7	12
Queue Length 95th (ft)	77	129	254	34	62
Internal Link Dist (ft)		321	715	220	338
Turn Bay Length (ft)					
Base Capacity (vph)	461	1235	1217	731	790
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.31	0.28	0.48	0.09	0.27

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	130	315	0	0	460	75	30	10	20	70	0	130
Future Volume (veh/h)	130	315	0	0	460	75	30	10	20	70	0	130
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	2027	1949	2027	1870	1870	1870
Adj Flow Rate, veh/h	141	342	0	0	500	82	33	11	22	76	0	141
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	419	938	0	0	786	129	274	104	116	215	24	200
Arrive On Green	0.50	0.50	0.00	0.00	0.50	0.50	0.20	0.20	0.20	0.20	0.00	0.20
Sat Flow, veh/h	833	1870	0	0	1567	257	640	520	580	417	122	1001
Grp Volume(v), veh/h	141	342	0	0	0	582	66	0	0	217	0	0
Grp Sat Flow(s),veh/h/ln	833	1870	0	0	0	1824	1740	0	0	1540	0	0
Q Serve(g_s), s	5.5	4.1	0.0	0.0	0.0	8.6	0.0	0.0	0.0	3.2	0.0	0.0
Cycle Q Clear(g_c), s	14.1	4.1	0.0	0.0	0.0	8.6	1.1	0.0	0.0	4.8	0.0	0.0
Prop In Lane	1.00		0.00	0.00		0.14	0.50		0.33	0.35		0.65
Lane Grp Cap(c), veh/h	419	938	0	0	0	915	494	0	0	440	0	0
V/C Ratio(X)	0.34	0.36	0.00	0.00	0.00	0.64	0.13	0.00	0.00	0.49	0.00	0.00
Avail Cap(c_a), veh/h	654	1468	0	0	0	1431	1009	0	0	960	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	11.9	5.6	0.0	0.0	0.0	6.7	12.2	0.0	0.0	13.6	0.0	0.0
Incr Delay (d2), s/veh	0.5	0.2	0.0	0.0	0.0	0.7	0.1	0.0	0.0	0.9	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	0.9	0.0	0.0	0.0	1.9	0.4	0.0	0.0	1.4	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	12.3	5.8	0.0	0.0	0.0	7.5	12.4	0.0	0.0	14.5	0.0	0.0
LnGrp LOS	B	A	A	A	A	A	B	A	A	B	A	A
Approach Vol, veh/h		483			582			66			217	
Approach Delay, s/veh		7.7			7.5			12.4			14.5	
Approach LOS		A			A			B			B	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		24.0		12.9		24.0		12.9				
Change Period (Y+Rc), s		5.5		5.5		5.5		5.5				
Max Green Setting (Gmax), s		28.9		20.1		28.9		20.1				
Max Q Clear Time (g_c+I1), s		16.1		3.1		10.6		6.8				
Green Ext Time (p_c), s		2.3		0.3		3.6		1.0				

Intersection Summary												
HCM 6th Ctrl Delay			8.9									
HCM 6th LOS			A									

APPENDIX E

COMMUNITY FEEDBACK

Member(s)	Comments/Suggestions
Raymond Lawrence	Install speed bumps or rumble strips, or marbles on the trail to slow down cyclists. He mentioned based on his observation cyclists do not want to stop or slow down and that is a major safety issue not only for cyclists but also for pedestrians Install flash lights at the trail crossing to inform drivers before pedestrians or cyclists enter the crossing. He referenced similar lights are used for the trail crossing on Prosperity avenue south of Rt 50 Vehicles might end up rear-ending each other as the following vehicles do not expect the car in front of them to make a suden full stop at the crossing. Tall enough flash lights should be installed that can be seen from a distance He did not have any specific objection to the alternative recommended by NOVA Park Authority. However, he wanted additional flash lights He advocated for having one larger roundabout by making necessary realignmnets. We might want to have a draft design concept for this alternative that shows the ROW impact of such an alternative and keep it in the appendix. Use same bike trail crossing treatment in place on Prosperity Avenue between Route 50 and Route 236 (Warning lights).
Frank Bernheisel	I thought the presentation was professionally done and provided many good ideas. Speeding, the values for 85% were mostly above the 35 MPH speed limit and I have observed cars doing 50 MPH No modifications were suggested for the straight stretch from Shelby Lane to Holly Manor Drive, which is where I have observed speeding. I suggest traffic calming, speed bumps at a minimum. The most extreme changes in front of Shrevewood Elementary School looked great. Consolidating the lanes provides more space for parking and drop off, which are problems. The crosswalk design looked good and the move of Virginia Lane to the crosswalk was very good. I would have the added benefit of slowing the bikers coming down Virginia Lane. I also liked the roundabout idea. Fairwood Lane intersection needs either a roundabout or an all-way stop. Both Pinecastle Road alternatives provided major improvement and traffic separation. The Route 7 transition with separate lanes for pedestrians, bicycles, and cars/trucks looked like the best alternative. Also, the proposal to trim plant growth was good; it would keep the “No Through Trucks” sign from being obscured; a larger more noticeable sign is needed; similar to those on Route 29. As a resident of the Shreve Road neighborhood, I appreciate having the safety issues associated with Shreve Road studied. The discussion during the presentation highlighted the limitations of options because VDOT has classified Shreve Road as a Minor Arterials (Type B); a classification I would like to see changed. The study did not address the violations of the through truck prohibition on Shreve Road. I believe there is inadequate signage on Route 7 and Haycock Road. Also, the sign on Shreve Road is old and small, and it does not specifically reference Shreve Road, nor does it have the modern yellow bar. Also, the sign on Gordon Road was removed during construction and has not been replaced. Slide 8 shows the measurements that resulted from the speed study done by VDOT in October 2019. The statistic shown is the 85th percentile speed, which is defined by the Federal Highway Administration as: “the speed at or below which 85 percent of vehicles travel”. Note that of the 12 measured locations, only one has a measurement below the posted limit. Also, this measurement indicates that 15 percent of the traffic is exceeding the posted limit. The highest speeds were measured at roughly Shelby Lane and Shrevewood Elementary School; Shreve Road between these two points is relatively straight and level. My observation is that speeds increase in this area. The study has no recommended modification to this area, which would reduce speeds, except for the recommended changes at Fairwood Lane. Slide 10 shows insufficient width for bike lanes. Moreover, some of the current walkways in this area are inadequate and less than 5 feet, which is recommended for bicycles, and the 3-foot buffer has no curb. This is a hazard for pedestrians and bicyclists, especially children. Slide 19 shows the recommended chicane and cross walks at the Pioneer Lane intersection. This looks like a good solution to the problem pedestrians have at this crossing. Slide 20 shows an alternative for the pedestrian problems at the Fairwood Lane intersection. This is an improvement, however the drawing does not show any walkway connections from the crosswalk to the walkway on the north side of Shreve Road. This alternative does not address the access and turn difficulties entering Shreve Road from Fairwood. A round about would be my choice for solution Slide 22 and Slide 23 show alternatives for the problems at the Shrevewood Elementary School. Both alternatives are a big improvement over the current situation. Both alternatives address the problem of Virginia Lane traffic, both vehicle and bicycle. Bicycles use Virginia Lane because they find the W&OD Trail along Virginia Lane inadequate. Neither alternative adequately addresses the drop-off/pick-up problem at the school. The Slide 23 alternative has the space to add a separate lane for this function. Slides 24 and 25 show alternatives for the problems at the Pinecastle Road, Buckelew Drive, and W&OD Trail Intersections. The slide 25 alternative is a great solution to multiple problems at this intersection. Slide 28 showing the Urban Cross Section (UCS) as an expansion of the City of Falls Church – West Falls Church Project along Shreve Road shown in Slide 14. While Slide 14 does not show detail, I assume there will be a high-quality connection of the 10-foot Shared Use Path on the east side of Shreve, including the 6-foot landscaping buffer, with the W&OD Trail. I appreciate the City of Falls Church undertaking this project, and I would point out that the improvements discussed are within the jurisdiction of Fairfax County. I assume the two jurisdictions are coordinating, and also with the Northern Virginia Regional Park Authority on matters impacting the W&OD trail. While the UCS expansion would be an improvement, the additional cost and property issues make it a low priority for me.
	I would like to recognize the great work that has gone into this already, and the willingness to propose some more innovative or unusual ideas like roundabouts (especially around Shrevewood ES).

Member(s)	Comments/Suggestions
John Kosco	One of the primary goals of the study is to "reduce vehicle travel speeds along the corridor" however the study does not appear to address a reduction in the current speed limit. I strongly recommend that the study address the feasibility of a reduction in the speed limit, and if this is not feasible then why. West Street is roughly parallel to Shreve Road and is a similar street (e.g., both connect Rt 29 and Rt 7, both through largely residential areas) but West Street has a 25 mph limit while Shreve Road has a 35 mph limit along most of its length. If a 25 mph limit is OK for West Street, why can't Shreve Road be reduced to 25 mph? Another fairly inexpensive way to reduce traffic speeds is by installing stop signs. Has this been considered at one or more key points along Shreve Road? For example, at Fairwood, near the school or the bike path? I know there are drawbacks to stop signs, but I would like the study to at least consider these as an inexpensive option, and if not feasible, then explain why. I represent about 180 homes between Shreve Road and West Street near Fairwood Lane, and we are very concerned about traffic and safety along Shreve Road, especially in light of the tragic accident last summer that resulted in the death of someone I knew personally. The presentation on Oct. 7, 2020 did not include any of the short-term alternatives that were presented to a community working group on Sept. 9. Specifically, several radar signs were included as short-term alternatives, and were not included in the Oct. 7 presentation. Given the difficulty in obtaining funding for the long-term alternatives, these short-term alternatives should also be included in the study. The proposed alternatives are all innovative and I believe will help improve safety, but I am concerned that there will not be funding for them and that it will take many years for them to be designed and installed, if funding is ever found. I still encourage VDOT to reduce the speed limit on Shreve Road as the best and most cost-effective way to improve safety.
Jeremy Hancock	Between Route 29 and Curve: For the long-term alternative, I have heard some interest in moving the neighborhood gateway beyond the curve and closer to Pioneer. Perhaps there could be mentioned as an option, depending on community input. Pioneer Lane: The short-term design shows a painted crosswalk across Shreve and Pioneer that does not exist right now and is not specifically mentioned. Would this be included in the short-term design? The use of a chicane appears to move the road close to a driveway and directs traffic toward the sidewalk, with no curb to slow a car down if they veer off. Any thoughts on making sure the sidewalk is protected? Fairwod Lane: Same question as above related to the painted crossing on Shreve and Fairwood. Shrevewood Elementary: Is there a short-term option to help with the traffic flow at Virginia Lane and W&OD intersection? The long-term alternative includes warning surfaces for the trail. Could this element be a short-term alternative? W&OD Crossing at Pinecastle/Buckelew: In the short-term, please consider a pedestrian indicator, such as a HAWK signal or rapid flash beacons now being used in Fairfax County. Despite improvements around the trail, there are still concerns about pedestrian/bike awareness as cars move quickly and come from multiple directions. It would be great to have some indication on the timing for the NOVA Parks plans. This design was first circulated to the community over two years ago and I understood all of the easement issues were resolved some time ago. Hickory Curve: There remains concerns about the short and long term alternatives to address safety at the Hickory curve. Even after the recent improvements at the curve, I've seen two cars end up on the sidewalk this year. It's a major pedestrian pathway for the metro that is not getting full use because the community is nervous about the curve. Often neighbors will drive to the metro as an alternative. Would transverse markings, similar to the other end of Shreve alternative, be an option? Thank you to VDOT and Kittleson for their responsiveness to our community's concerns. I am supportive of the proposed plans to improve the safety and operational issues along Shreve Road and believe the draft addresses the priority areas raised by our community in the document submitted to VDOT last year. An important priority of the Shreve Road Community Working Group was that improvements needed to be addressed holistically, solving not only the challenges today, but where the area is headed. Need to balance short- and long-term alternatives: The goal of the study was "to identify short- and long-term recommendations to address community safety concerns along the corridor." While I appreciate the inclusion of some short-term options, such as vertical bars at the curves, I'm concerned the study leans heavily on long-term, large, comprehensive projects and has avoided alternatives that could be implemented in a shorter time frame. As you know, funding for these types of projects take considerable time, possible a decade or more given funding schedules. I would encourage the study to incorporate additional short-term steps to help with greater awareness of speed and pedestrians, and an examination of missing pedestrian infrastructure along Shreve. There should be reconsideration of flexible posts, particularly around sensitive pedestrian areas. VDOT suggests that snow removal is a concern, but it is unclear how a cement curb is any more intrusive for snow removal. Flexible posts are inexpensive and can easily be replaced if they are knocked down . A pedestrian can not be replaced if they are knocked down. Ensuring recommendations are feasible and implementable for funding: While I am supportive of the designs offered, it is unclear how easy they would be to implement or the range or costs. It is my hope that the final study will include some narrative about the design and challenges to help the community prioritize projects
Frank Spielberg	I have at times found north/eastbound Shreve Road completely blocked by persons in cars waiting to turn into the school to pick up children. There is insufficient waiting area on the school grounds and if cars are parked on the school side of Shreve Road those waiting to enter the school seem not to care that by waiting in the travel lane they are blocking the entire road so that through vehicle cannot pass. There is no police enforcement. As this is a one-way narrow section those attempting to pass though must wait until school dismissal begins and waiting traffic can move onto the school area. I have been forced to wait more than 10 minutes on occasion. Whatever solution is adopted must provide a way for vehicle not destined to the school to have a way to bypass waiting vehicles.

Member(s)	Comments/Suggestions
Lynnette Yount	Thank you so much for an excellent and well-managed presentation! It is evident that you have considered many options, as well as the ramifications and regulations/requirements that pertain. I live in the Highland View neighborhood (at the top of the Gordons Rd hill) and use Shreve Road regularly to get to Route 29. Not only was a woman killed recently on Shreve, but a friend of mine was also killed near the same spot, many years ago, while driving a car in rainy/slick conditions. The road is narrow and winding! I believe the long-term plan is to have a sidewalk and/or walking path available for pedestrians along the whole course of Shreve Road – bravo! Currently there are often narrow lanes with no shoulders; I sincerely hope that this project will also address this situation through widening and/or adding curbs and sidewalks. I also have concerns about the safety of bicyclers and pedestrians at the W&OD crossing. I understand from the presentation that a stop sign would probably not be permitted. I sincerely hope that flashing lights and the proposed pavement/roadway changes will address this concern. Here are my Likes: (1) The mini-roundabouts ("peanut") near the bike trail crossing, (2) Alternative #2 at the school (although I do see how #1 would also work, the straight shot sections notwithstanding), (3) Keeping the vegetation trimmed. Right now, traveling south, it's difficult to turn left onto Buckelew due to the tall grasses on the right/bike trail side of the road, which block visibility for that curve. (4) The idea of adding curb/gutter on at least one side of the whole street, (5) Adding middle median strips that reduce the straight shot sections, (6) The Gordons Road "cross-section" proposal. Thank you again for all the work you've done, and for including us citizens in this process! I would like to add one more thing to my comments. That is, the difficulty of turning left onto Shreve Road from Gordons Road in the morning during rush hour to access the light at route seven. I loved the design for Shreve road from the pike to the W&OD crossing. But I am not sure it will help the bottleneck that occurs at the intersection of Gordon's and Shreve in the morning.
Rachel Jones	I missed the meeting yesterday despite my intentions to join in. It doesn't look like there are any planned crossings between pioneer and Fairwood. Would cost please add a crosswalk somewhere in the middle of that stretch to increase the walk ability for neighbors. It's not a problem area for sight lines, but it is hard for neighbors to safely cross. For example, I have an old dog and three children and even if we start to cross when no cars are coming, they come at such speeds if one comes after we start they usually have to slow down by the time we get to the other side (we are slow moving with the old dog and stroller). Cars have always slowed down to let us cross, but I would be more comfortable if there was a crosswalk for us to be in.
Richard Ott	Traffic from Virginia Lane tends to back up at the intersection with Shrevewood road a few times each day. Once vehicles get onto Shrevewood they may tend to speed up to 'make up for the lost time waiting. That intersection only allows one vehicle at a time to get onto Shrevewood turning either left or right. The vehicles that want to make a left turn must wait for traffic on both sides of Shrevewood Road to pass. However vehicles that wish to make a right turn only need to have it oncoming traffic from the left open up for them. However, the left turning vehicles cause the long wait periods. If the side of Virginia Lane that places vehicles onto Shrevewood was to be widened to two lanes (one left turn, one right turn) then the backup would be greatly reduced. There is available room to do this, but it involves moving some storm water drainage facilities.
Gillian Cohen-Boyer	Thank you for your good work study proposed improvements to the Shreve Road corridor. The presentation was really well laid out and I appreciate the opportunity to comment. The concern and recommendation that I would like to raise in addition to what was included is considering sidewalk access on the East Side of the road between Shrevewood Elementary and Buckelew. Right now, pedestrians are limited to walking on the W&O along with bikers speeding by. I like the fact that there's a bike path, but one has to be really wary when walking, at all times but especially when with children or in small groups. Tension between walkers and bikers would be reduced, as well as potential accidents, if there was room on the other side of the road to walk. Alternatively, it seems like there is plenty of room to widen the path to allow a pedestrian only lane.
Betsy Goodman	Thanks for providing this update and some recommendations for much needed improvements along Shreve Rd.
EJ Palanzo	Here are my concerns: 1. Trucks are not allowed on Shreve Road. I see and hear them all day. No enforcement from Fairfax Police (what a surprise). Maybe the County can make some money by enforcing the law instead of raising my taxes every year. If you would like me to take pictures I would be happy to do so even if the County should.l be investigating the problem. By the way, I've followed some trucks at times and they are driving on Shreve from Rt. 7 all the way to Lee Highway (why shouldn't they — THERE IS NO ENFORCEMENT. 2. Speeding cars day and night with loud mufflers on Shreve and Va Lane. AGAIN NO ENFORCEMENT. If the police say they're out there, they're lying. They should be in a spot where they cannot be seen by a driver then pull them over. Take a cue from the Arlington Police dept. Maybe Fairfax police can learn something. Fairfax says they don't have enough cops to go around. Spare me! I find that hard to believe. This isn't Mayberry. USA. 3. Bike riders need some abide by the rules. They never stop at stop signs so if a car hits them it's the driver of the car's fault. Seems a lot of attention is given to bike riders instead of the residents along Shreve who pay very high taxes so these people can have a bike lane or whatever you want to call it. God forbid if someone wants to walk their child or dog —they'll run you over. 4. Exiting PINECASTLE to SHREVE is very dangerous especially with bike riders who always seem to criss at the wrong time. They need to YIELD. It's a dangerous section just like SHREVE and VA LANE 5. Thought should be given to planting trees (evergreens) to block the sound of cars and trucks since nothing will be done by the police. I believe there is a law on the books about noise in the County but AGAIN NO MONITORING OR ENFORCEMENT. In conclusion: The Shreve Road Situation will only get worse when everyone goes back to work. So let's try to keep that in mind. I don't expect much from VDOT or anyone else in Fairfax County govt. to do the right thing. I hope so but I doubt it.

Member(s)	Comments/Suggestions
Mike Paulson	I listened to most of the meeting, I posed the following question, but I did not hear any discussion of 'how a bicyclist from Falls Hill on Pinecastle could safely get to the south side of the WO&D trial going east'. I live on Salem Rd and see bicyclist taking a shortcut through Falls Hill rather than the dangerous intersection of Virginia La and Shreve all day long. I also use the Pinecastle/Shreve intersection. Coming down Pinecastle Rd towards Shreve it seems that by either of the plans it is quite difficult and possibly dangerous to cross Shreve and enter the bike trail on the other side. The plan shown on P 13 of 34 in the PDF shows possibly using the sidewalk and making a difficult crossover of the trail. If the bicyclist were on Pinecastle itself they would have to enter moving traffic and cross the road. The double roundabout method is even more difficult. Personally, I like the current way better. While it is not good, when cars see bikes on the path, they usually stop, then everyone on each of the 6 entries to the intersection seem to get through generally easily. Both of your choices are difficult for a bicyclist going either direction. Coming from the east on the bike trail and entering Falls Hill on Pinecastle it is also difficult and/or dangerous, requiring the bicyclist either to make a hard right on a narrow sidewalk path or enter traffic and go around a circle. The Virginia Lane/Shreve intersection is really dangerous. Bikes are usually coming down hill quite quickly and it is impossible for a motorist going south on Virginia Lane to turn their head far enough to the right to see up the trail. This is one place where clear lines of sight are really important, with no obstructing bushes and other growth so a driver or bicyclist can see across to each other's path and slow or stop accordingly. I don't see where the new plan improves this. One of the written questions was interpreted by the responder as about speed humps in front of Shrevewood school, but I believe the question was speaking of rumble strips like they put across the roadway to indicate upcoming tolls so you should slow down. Why not consider rumble strips along with the 'School Slow' signs. Rumble strips are used safely on highways. You could also use the rumble system along Oldwood curve or particularly near Hickory Street to alert motorists that they are going off the roadway. This is done along many highways, why not local roads that have dangerous curves? By the way the 'Optical Speed Bars' shown for Hickory and other curves on Shreve were not illustrated in a way that shows the designer/artist really knows what they really look like. The lines must be farther apart a the beginning of the curve, getting closer together as you go around to give the optical illusion that you are going faster, encouraging you to slow down. A pet peeve of mine is that pedestrians and bicyclists are not taught properly what a crosswalk is. You do not have the right to walk into a crosswalk without looking, you always have to yield to oncoming traffic, and cars cannot just stop on a dime because someone is "in the crosswalk". We have to stop talking as if the crosswalk gives anyone the right to just step into it without looking. I was taught <when crossing a road> to stop and wait for the traffic to abate, which it usually does even along Shreve. Finally, as a bicyclist, I almost never stop at stop signs. I approach them slowly and look both ways. I am always prepared to stop, but if there is no traffic, I do not stop. If I do stop because a car is coming, even at a great distance away, they generally stop for me, even if they are the only vehicle on the road and I am fully stopped with my feet on the ground. Then I have to slowly start up again and cross while they wait, even though I had followed the stop sign. Even if I approach an intersection slowly and try to wave the car through, they stop, so I do not, I just continue through cautiously. Personally, I think most stop signs should be Yield signs, and treated as such. It is really frustrating to see the time and expense VDOT has put into this and it appears that no one on the committee has thought of these issues as a driver or bike rider from all directions. One question concerned how some of the suggested improvements might cause backups on Pinecastle and Virginia lane once businesses and traffic get back to normal. The VDOT answer was that backups would not be an issue. Another example that I doubt anyone from VDOT lives in this area or at least observed it during a normal rush hour (which of course we have not had since February). I have frequently seen multi car backups so long that they blocked access to Virginia or Pinecastle at the nearest cross street. There is a lot of cut through traffic from Rt7 to Shreve via Buckelew. (Driving during Covid is actually fun and easy...)
(Follow-up)	I guess I was not clear, on the plans I saw, crossing Shreve Rd from the east side of the bike path to Pinecastle in Falls Hill shows no easy (smooth) way to enter Pinecastle st. The plans showed such a sharp narrow right turn the bicyclist would almost have to stop. I was simply stating that the right turn onto the sidewalk to get to Pinecastle St needed to be wider and easier. The plans show a narrow sharp turn. It would be simple to make it wider and rounder.
Michele Grant	First, I am so happy to know that there is a plan and some proposals to make Shreve road safer for community members. Thank you! This is a follow-up email to one I sent earlier today, I was able to find the meeting video that explains the proposals and I wanted to add some comments/suggestions. I had originally stumbled across the study by googling "Shreve road construction" because we have been trapped in the paving traffic every day these past couple weeks and I was interested in what was going on. It led me to an article that referenced this study and email and said to email comments by the 19th. Tonight i was able to find the video! I was thrilled to know there is a plan to implement a crosswalk near fairwood lane to get to the other side of Shreve road where the paved path connect to the WO&D. I live the next street down from Fairwood Lane in the Holly Crest development on Bent Oak Ct, so we drive past that area where the crosswalk is proposed multiple times a day and we also use the trail multiple times a week. Some things I wanted to note about that specific area: coming down Shreve road past the elementary school on your left hand side going toward Fairwood Lane (westbound on Shreve road): This is a blind hill and people FLY down this hill. My concern with a crosswalk at Fairwood Lane is pedestrian safety in regards to cars flying down the hill. If possible, I would add a flashing crosswalk sign (the bright LED flashes after pressing a button) AND a flashing sign at the crest of the hill to say "pedestrian crosswalk" or something similar to the flashing yellow sign for the W&OD crosswalk near Poplar heights. Or a preferable option would be to push it further back from Fairwood lane in front of either Holly Manor Dr, or in front of the Dominion electric station where sightlines are better and more straight than the hill. We always sprint across Shreve road right outside our development Holly Crest to get to the trail, and sightlines are good there east and west both for drivers and for people crossing the streets. We can easily see cars coming from both directions to get across safely near our development at Holly Crest, but not so much from Fairwood Lane because of the hill on Shreve going westbound. We never opt to cross there

Member(s)	Comments/Suggestions
	Or if you possibly implement the roundabouts at Shrevewood elementary that might help slow things down for a safe crossing at Fairwood Ln. I'm just really concerned seeing a crosswalk at Fairwood Lane as I know how fast people fly down that hill. I would love a crosswalk closer to me, and Fairwood lane is right next to us, but i'm not sure it would be safe there without some of the things I mentioned. Instead of a roundabout at pinecastle, could we do a bridge instead? That crossing is incredibly dangerous for trail users. Sometimes pedestrians and cyclists are wearing all black as well and are near impossible to see. It would be safer for everyone to have that trail crossing be an overpass. I do understand the cost prohibition you mentioned, but I really think a bridge would be so much better. Thought i'd throw that out there I would also like to see a widened portion of the side road as Julie mentioned during the Q&A of the presentation. It's our safe connection to the W&OD trail and it's pretty narrow and often overgrown by weeds (though they did just cut them back!) It goes up to Virginia ave, parallel to Shreve rd and then gives access to the trail. It's not a sidewalk, but it's not really trail width either ave you considered passive speed cameras with warning signage? That may at least stop people from going 50, 60 mph on Shreve road, or the people who like to race down it at night. Yes to right turn lanes in front of Shrevewood elementary to direct school traffic that way and allow through traffic
Jim Branson	I use this road often. There are places where there are no sidewalks and I think the addition of them would help the situation
Justin Cowan	I am a resident of the Shreve Road corridor and live directly on Shreve Rd. There is a SIGNIFICANT gap in the VDOT Speed Study preformed in October of 2019. The section of Shreve Road between Holly Manor Drive and Jackson Drive provides the longest, straightest stretch, with the farthest line of sight for drivers. Because of this, this section of road is where driver speeds peak. There are no curves or hills to deter speeding, it is the ONLY SECTION that is four lanes across, and drivers regularly travel WELL OVER THE SPEED LIMIT through this section. The data map shows speed averages immediately before and after hills and curves where drivers are actively slowing, giving lower perceived speed values, but misses the middle of this long, wide, flat straight at Ogden Street where speeds peak. Averages through this section will be closer to, if not exceeding, the data retrieved at the entrance to Shreve Road from Route 29. VDOT must re-evaluate average speeds at the critical zone between Ogden and Hillsman Street where numerous school bus stops exist for children of all ages.
Giulliano Camargos	I am a resident of the Shreve Road corridor and live directly on Shreve Rd. Given the focus of this study on pedestrian safety, I was surprised not to see plans for a sidewalk on Shreve between Chestnut and Hickory Streets. That is a very dangerous section for pedestrians walking towards Rt 7. I'd highly encourage you to look for a pedestrian friendly solution in that stretch of road. I also want to reiterate something brought up to my attention by a fellow Shreve Rd resident; there's a SIGNIFICANT gap in the VDOT Speed Study performed in October of 2019. The section of Shreve Road between Holly Manor Drive and Jackson Drive provides the longest, straightest stretch, with the farthest line of sight for drivers. Because of this, this section of road is where driver speeds peak. There are no curves or hills to deter speeding, it is the ONLY SECTION that is four lanes across, and drivers regularly travel WELL OVER THE SPEED LIMIT through this section. The data map shows speed averages immediately before and after hills and curves where drivers are actively slowing, giving lower perceived speed values, but misses the middle of this long, wide, flat straight at Ogden Street where speeds peak. Averages through this section will be closer to, if not exceeding, the data retrieved at the entrance to Shreve Road from Route 29. VDOT should either disclose or capture average speeds at the critical zone between Ogden and Hillsman Street where numerous school bus stops exist for children of all ages and propose appropriate mitigating solutions/ideas.
Hilary and Alfred Thesmar	Our family is in favor of the Shrevewood Elementary School (Alternative 2) Improvement. We like the idea of eliminating the Median in front of Shrevewood and the installation of two normal square type intersections, with one having an operational traffic signal for the main parking lot entrance of the school. This should be a smart traffic signal that would have green for Shreve Road until cars were approaching from Virginia Lane, or needing a left turn exit out of the school. There should be some coordination with the school for their traffic flow. Also, an additional northbound lane should be added which to allow cars proceeding straight to pass the school without being hampered by drop off and pickup traffic As for the W&OD crossing at Buckelew and Pinecastle. It should definitely be squared up, so it is 90 degrees to Shreve. We are not sure of the "peanut" concept utilizing two mini roundabouts. Strongly suggest High visibility crossing lights, that when activated by pedestrians force cars to yield to pedestrians. Or perhaps you just straighten out Buckelew and Pinecastle to form a conventional intersection with a regular traffic light.
Gail Wright	I live along Shreve Road and have a request/comment to make regarding the PDF that was distributed: Please remove Slide #28 entitled "Shreve Road near Gordons." This slide depicts an "Urban Cross Section" that includes a 3-foot Buffer + 5-foot Bike Lane + 5-foot Tree Panel + a Sidewalk on both sides of the street north of Gordons Road and continuing to Rt 7. It is marked "Draft 7/31/20" and "Study Only - Not for Construction". My assumption is that this is no longer a consideration due to its labeling and because it was not discussed on the call when requesting input from the community. Therefore, it no longer has any relevance. Additionally, I suspect it would cause the people who live in the Falls Place townhouses along Shreve Road a major rise in blood pressure if they were to see this slide - as I can't imagine how this plan could be implemented without a "land grab" of the back yards of the people who live there. It is best just to remove this slide. If; however, it is still under consideration, then you definitely need to be explicit and upfront about how this will impact residents' properties. In general, if any of the Shreve Road proposals have a direct impact on a resident's property, I think this needs to be spelled out explicitly, along with listing the addresses of these residents and the nature of the impact. Each impacted resident needs to be notified multiple times in writing and given a chance to discuss this directly with VDOT, etc. One more thing... along Gordons Rd on the south side, we have a serious drainage problem from the water going down the front ditches and from the backyards and then going across Shreve Road. There is a drain on the opposite side of Gordons Rd next to Shreve Rd that often gets backed up or cannot handle the water load. When putting in any walkways between the bike path and Rt 7 (along Shreve Rd), please ensure that the water coming from the houses on the south side of Gordons has a place to go.

Member(s)	Comments/Suggestions
Julio and Joann Garcia	As 20-year residents of the Falls Hill neighborhood, we present the following remarks: The character of the general neighborhood is changing dramatically. Trees and green areas are being destroyed in the name of "density". Much larger houses are built on small lots, or multiple houses are built where only one house stood before. With these developments come more people, and hence more traffic. So, part of VDOT's calculation should be on how to control the traffic and prevent neighborhood streets from becoming extensions of congested highways and major streets, and also avoid concomitant speeding from occurring in quiet residential neighborhoods. We think some of VDOT's proposals may result in unintended consequences because the architects of these plans probably do not live in this neighborhood and, therefore, do not see its traffic patterns everyday. 1. The proposed traffic light at Chestnut and Route 7 would be just a short distance from the light at Shreve Road and Route 7. This situation would not allow a fluid movement of traffic. It will create additional backups in this segment of the road. Backups already exist due to traffic exiting at Exit 66 from Route 66, as well as because of the increasing traffic from Tysons (as it evolves into a city). And much like a fluid, traffic will seek to flow into the path of least resistance . . . 2. Hence, the above situation is an invitation for traffic to bail out of Route 7 and head straight into the Falls Hill neighborhood to avoid slow traffic. We have already seen, specifically the block on Dale Drive between Gordons Road and Route 7, an increase in traffic and speeds that make it even dangerous to exit one's driveway. Drivers looking for shortcuts away from slow traffic, don't really care about their effect on the neighborhood. Additionally, the serpentine course of Dale Drive from Route 7 adds additional dangers due to limited visibility. Cars parked on the street narrow the lane and add to the congestion. Simply, Dale Drive, Gordons Road, and Chestnut Street would carry the resulting traffic burden. But these streets already face dangerous conditions as the roads were not designed to carry the demand of increased development. VDOT should work proactively to implement traffic calming measures and encourage commercial traffic to take alternative routes and reconsider the placing of traffic lights. 3. People in our neighborhood have mentioned this before … the myriad of safety issues related to vehicles merging onto Route 7 from I-66, which impacts the number of accidents in the area. Despite signs requiring I-66 vehicles to yield, the open merging lane does not encourage a safe reduction in speed. The poor sightline from Route 7, combined with high speeds, results in a dangerous situation for Route 7 east-bound vehicles to navigate across the right lane to turn onto Dale Drive or Chestnut Street. The straightforward solution is to eliminate that merging lane, and direct all traffic to the traffic light that currently is used only for cars going onto Route 7 west-bound from that exit (Exit 66). That lane should be widened so that it becomes the only way for traffic to exit Route 66, and then use that lane to make the turn either way onto Route 7. Hence, the traffic light would control east-bound and west-bound traffic from Exit 66 onto Route 7. 4. In regard to Shreve Road in front of Shrevewood Elementary School, the VDOT proposals seem sophisticated, but expensive. Consideration should be given to paving over the median patch of land in front of the school to create a service road to the school. Regular traffic could bypass the school entirely. Consider traffic calming devices such as speed bumps or rumble strips as you get close to the school in either direction. We think these techniques could be incorporated faster into the traffic pattern and be less expensive.
Lisa Wilson	I live on Wieland Place and am troubled by the fact that there is not a safe way for my children (or me) to safely leave our neighborhood cul-de-sac by bike or on foot. If we leave our neighborhood to the right, we must quickly scurry along the edge of Shreve where there is almost no shoulder until we reach Buckelew. If we leave the neighborhood to the left, we have a sidewalk that runs out before it connects to any cross street. If we want to access the trail from the sidewalk, we must run across Shreve and then through vegetation to reach the W&OD Trail. We anticipate getting a dog after Christmas and I don't know how we will safely walk the dog. Possible Solutions: 1) The lowest-cost solution might be to stripe Shreve Road with a crosswalk at the point where the sidewalk runs out and also mow the vegetation and/or put sidewalk down between Shreve and the trail. 2) Add sidewalk all the way to the elementary school. 3) Add a sidewalk and small bridge to Buckelew
Enid Palazzolo	The speed on Shreve Rd. in general is an issue. It's too bad no one at VDOT can answer the question on how we can change the classification of Shreve Rd., so that Shreve Rd. can be 25mph. My primary concern is the Hickory St. curve. I have seen many accidents on this curve and one fatality too many. There has to be a way to keep kids, families and bikers safe. There's no way to stop a car from sliding or driving onto the pedestrian/biker trail along Shreve Rd. at the Hickory St. curve. Why there is such an objection to some kind of barrier to protect our kids is very troubling because it makes NO sense from a protection of human life perspective The bike lanes is a safety hazard because we cannot keep bikers safe because we are not able to change the classification of Shreve Rd., so that we can have 25 mph. A Biker's lane will only cause accidents and fatalities of bikers. Shrevewood Elementary School Alternative 1 with roundabouts will help keep pedestrians safer. No right turn lane should be added from Shreve Rd. into the school because vehicles will only use them to avoid the roundabouts. If anything, you should use the unused old median to recreate parking for the school that can be used for drop-off and pickup for the school which is essential if you don't want Shreve Road blocked at those times. Shrevewood Elementary School Alternative 2 will not slow traffic or keep pedestrians safer. If anything, you will endanger pedestrians at the crosswalks. Crosswalks don't work on Shreve at 30 to 42mph speeds (based on study). In addition, pedestrians will get run over especially at night with limited lighting on Shreve Rd. Pinecastle Road reconstructed alternative is a non-starter because it does not slow traffic or keep pedestrians safter. If anything, it will increase the danger to pedestrians and bikers. You have removed the curve which will allow vehicles to increase their speed at the intersection AND at the crosswalk. This is a ludicrous option because of the increase danger of fatalities to bikers and pedestrians. Crosswalks don't work on Shreve at 30 to 42mph speeds (based on study). In addition, pedestrians will get run over especially at night with limited lighting on Shreve Rd. Pinecastle Rd. and Buckelew Dr. Intersections roundabouts is the most feasible option to slow traffic and make the crosswalk on Shreve Rd. safer for bikers and pedestrians because we cannot change the classification of Shreve Rd. and have a speed limit of 25 mph. at all times.

Member(s)	Comments/Suggestions
	Hickory curve discussion is a cop-out. Optical speed bars will not stop a car from hitting a pedestrian or biker. A curb and gutter will definitely enhance safety. More lighting is definitely needed. The guardrail discussion explaining guardrails are only to protect vehicles is ridiculous. You should be protecting pedestrians and bikers. You have a guardrail at the Oldewood curve. The Hickory curve has trees, telephone poles, fences, parked concrete trucks right on the other side of the fence that cars can hit not to mention pedestrians and bikers. If you research how many times that the telephone pole at hickory on the concrete plant side of Shreve has been hit. In addition, many times the accidents go unreported. I would like to propose additional lighting for Shreve Rd's Oldewood curve and Hickory curve. In addition, I would like to propose a barrier on hickory street curve to protect the pedestrians and bikers. Just because most drivers drive 30-42mph speeds, it doesn't mean that a drunk driver won't miss the turn and hit a pedestrian AGAIN. It only takes one, unfortunately. If there's no barrier, then you need to have a sign on the bike trail and the sidewalk stating "Danger Ahead-you walk on this sidewalk at your own RISK" because many people may not know the danger that curve poses to pedestrians and bikers on that sidewalk.
Marybeth Nassif	Thank you for giving me the opportunity to comment. The curve at Hickory Rd on Shrevewood is horrendous. I don't understand how guardrails have been deemed unnnecessary along this section. Merely adding lines to the street and removing vegetation will not prevent another death along that section. If a car goes off the road, pedestrians and cyclists will be injured and this can possibly result in more deaths. It is a very dangerous stretch from the bike path to Rt 7. Suggestions: Move walkway/path far back from the road. Extend the plan to widen the bike/ walk path from route 7 to the turn at Hickory. Add high curb and gutter between road and bike/ walkway. Add permanent black four foot high ballasts every four feet along bike/walkway from Hickory to Rt7.(protection for cyclists and pedestrians). Close off the Entrance to the Cement factory On Shrevewood rd. Close off the entrance to Hickory Street, essentially making this a deadend .(plant vegetation at the end of the street.) This will mitigate entering and exiting traffic. More needs to be done on the turn by Hickory. The proposed is not enough and does not address the recent death and multiple accidents that occur on that section of Shrevewood annually.
Joseph Ferraro	My family lives on Shreve Road between Roswell and Pioneer. While I applaud the fact the VDOT is exploring opportunities to address the safety issues on Shreve, based on my review of the recommendations, they are not nearly enough. I've lived and worked out of my home office on Shreve Road for the last six years and I witness massive trucks along this route (which is supposedly prohibited) and drivers exceeding 50mph along this corridor on a daily basis. My wife and I have to watch our two children like hawks when they're outside in our front yard and taking bike rides with our children along this route is incredibly dangerous. Shreve Road, while an important thoroughfare that connects drivers between 7 and 29, runs through the definition of a residential district. Why are we prioritizing drivers over the families that live along Shreve Road? Why are we prioritizing drivers over the children that attend Shrevewood Elementary? Shreve Road should be converted immediately into a residential roadway with a speed limit of 25 mph and there should be crosswalks and speed bumps installed (much like West Avenue, the next street over!) to prioritize the health and safety of our residents. The fact that this is even a debate is ridiculous.
Chesidio Barberis	I applaud most of the proposed improvements to encourage lower speeds and improve visibility for all users of the Shreve Road corridor. As a bicyclist, walker, and driver in this neighborhood, I have some specific difficulties with the existing intersections, and hope that your "final plan improvements" will address these difficulties. In other words, does the solution still solve these problems? Difficulty #1: Traffic that is a "factor" for me [might hit me] approaching an intersection from an angle well behind my left or right shoulder. In a car, that's a challenge; on a bicycle, even more so, particularly when I need both hands on both brakes to slow due to a downhill approach to an intersection. This happens when I am riding downhill on W&OD along Virginia approaching Shreve [threat is faster cars coming downhill from behind me on Virginia]. Similar problem from the other [westbound W&OD] direction—I have to look behind and to left on Shreve, cannot really see the Shreve traffic coming from in front of the school because of the terrain/median, and have to look uphill as well. My impression is that changing the Shreve/Virginia interchange to a 90 degree setup will help a lot, but one critical sightline will be for the bicyclists on the W&OD—can they see the approaching cars early enough to estimate their speed and intentions, or will cars and bikes still surprise each other there? Possible mitigation to #1: Make sure there is a significant "low slope" part of the W&OD on BOTH sides of the Virginia crossing, so bikes can slow/stop comfortably after seeing cars approach… and cars can do the same. That might be as simple as making the W&OD parallel Shreve a bit more than it does in the Alternative 1 depiction on pg 22. As the road currently exists, many cyclists prefer to ride the trail uphill and use Virginia downhill at higher speed so that any cars downhill on Virginia are safely BEHIND them and already see them/slow for them. Difficulty #2: There is a pretty nice bike trail along the low area of Shreve between route 29 and the Oldewood Curve, but it falls apart between there and Pioneer. If there could be at least a decently paved sidewalk on ONE side of the road along there, that would really help drivers not be surprised by walkers and cyclists as they turn right to follow Shreve. Difficulty #3: Pinecastle at Shreve onto W&OD eastbound: Issue here is that quite a few cyclists use the Barbour bridge over Rte 66 to approach the W&OD trail, so there is some bike "traffic" from Pinecastle onto the Eastbound W&OD. I personally enter the W&OD there to travel in either direction. It is possible to use the sidewalk or Shreve Road itself to approach the striped crossing now, but it is confusing to both trail users and car drivers when a bicycle tries to turn left from the "Pinecastle sidewalk" to cross Shreve on the marked crossing for the W&OD eastbound. It is also a sight line problem because the weeds grow tall enough there to hamper vision for everyone.

Member(s)	Comments/Suggestions
	Possible mitigation to #3: A bit of extra sidewalk pavement there [a Y in the sidewalk?] would allow bikes to at least be pointed in the right direction and able to see [and be seen by] approaching traffic before entering Shreve or the W&OD. In addition, make the "crossing cut out" in the roundabout large enough/angled widely enough that a bicyclist can ride from Pinecastle on the car lane onto Shreve and then turn left onto the eastbound W&OD without riding all the way around the roundabout as a car would. Bottom line is: bicyclists need to see how they are supposed to execute that maneuver and be able to do it safely—if we are supposed to ride around the roundabout, mark it that way for us, or make the curb cut accept a tandem turning left [that's not as easy as you might think!!!] Difficulty #4: Striping and stop line at Gordon's Road eastbound and Shreve intersection: This is a confusing intersection at present because the stop sign and stop line for eastbound Gordons Road are aligned with the curb to the NORTH along Shreve, but those are actually a parking lane and a right turn lane. After stopping legally, I routinely have to pull 20 feet or so PAST the stop sign so that I can see traffic on northbound Shreve approaching from my right. Whatever solution is chosen for the section of Shreve from Hickory through Route 7, please ensure that the visibility for drivers on Gordons road in BOTH directions is sufficient to see oncoming traffic at the speed limit in both directions—placing the stop signs and stop lines appropriately would be helpful.
Dan Huddleston	1. Pinecastle Rd: Agree with VDOT exceptions. a. Consider flashing ped. lights like those added at Prosperity Ave. and Cross County Trail near Aiken Park. or b. run the trail under the road and eliminate all conflicts. 2. Shrevewood Elem. School alternatives: Alt. #2. is much better than Alt 1. Alt. 1 is just too busy and difficult especially in snow. 3. Pinecastle and Buckalew: If you are going to all this effort, just Run trail under or over the road and eliminate the conflict. Mini round bouts are terrible. Turn onto Buckalew is too difficult in snow and rain, good opportunity for rear end accidents, and cars ending up in the ditch during severe weather conditions. 4. Fairwood Intersection: turn lanes and eliminating parking is an improvement. However, line of sight northward will still require cars on Fairwood to go out into and past the cross walk to see on coming traffic on Shreve Road going south. Suggest relocating or removing the neighborhood sign and plantings on north side of Fairwood, to allow line of sight.
Elaine Suriano	Thank you for making the proceedings of the meeting available on your website. I am opposed to round-abouts on this road, period. I lived in PA and NJ as well as New England and these come with their own dangers. They also often contribute to traffic congestion. These are typically used when there are multiple roads coming into a common junction. There are other, less costly and effective ways to address our issues. There is also the issue of holding drivers accountable to following the rules. Separate bikers hikers from traffic, add sidewalks and maintain a speed typical for this type of road. As population and traffic increase we must learn to accommodate everyone's needs. I want my tax dollars used effectively and round-abouts are not the answer. BTW - While bikers an others have the right of way (And I biked or years) those on the WD&O trail seldom stop an then proceed. as the stop sign requires. Everyone is responsible to contributing to safe use of Shreve Rd.
Marion Jacks	As someone who lives on Fairwood, crossing Shreve at Fairwood and simply crossing Fairwood to get from one side to the other at the crosswalk are my primary concerns. That crosswalk has been deadly where people have put their lives at risk to cross from one side to the other. During the presentation, I heard the engineer beckon to USE THE CROSSWALK, USE THE CROSSWALK. I refuse to because of the near accidents that occur at the crosswalk. I would rather size up the car situation from another point on Fairwood and cross when no one is coming. The crosswalk as it now stands is the last place I would use. That's not how I choose to die. 1. If the chart on pg 20 means that the county plan is to install concrete medians on both sides of Fairwood on Shreve then that should help to slow cars down and make them think before swinging into Fairwood. That would be an improvement. I realize that a stop light would require additional evaluation but that too would help. 2. The bike path that's dedicated to bikers appears to run along side of the current walking path. That should help but unless the walking path is dedicated not to all purpose but to walkers only, it remains UNFIXED and dangerous. Bikers expect pedestrians to defer to them, not the other way around. I no longer use the walking/bike path and neither do virtually all the over 60 yr olds I know. Again, much too dangerous. If the all purpose walking path remains a free for all, you lost an opportunity. The bikers need their own dedicated space as do pedestrians. I know that the County is trying relatively inexpensive ways to fix the problems on Shreve, but it cost a woman's life already and almost her son's. I stil think that a bridge would help enormously around that Buckilew area to avoid similarly tragic outcomes. Thanks for your consideration of these points.
Chris Huling	What about relocating the above ground old wooden telephone/electrical poles along Shreve Rd.? A few of these wooden poles are very close to edge of road, not sure if it is the telephone or electric companies responsibility and if there is a minimum safety distance requirement? This really is a an accident waiting to happen!
David Austin	Thank you for sharing the improvements recommendation with the community. You have my full support as a local homeowner just off of Shreve. I believe you are missing one key safety issue / area and I am surprised it did not come up. There is a 100 yard section of side walk along Shreve Rd between the power plant/Holly Manor that goes to just before the turn off to Fairwood. This section of side walk is literally 6 inches from the Road way with no curb barrier, and zero protection for walkers or bikers. It takes one slightly distracted driver to move just a couple of inches to the right to take out someone on the sidewalk. It is such a dangerous stretch that several years ago I wrote the Providence supervisor who was kind enough to engage VDOT which reviewed the location and placed approximately a dozen delineator posts along the stretch. As though to prove my point, they were all destroyed by vehicle impacts within about a month time frame and never replaced. Can you please look at this stretch and identify a more permanent solution as part of the SRTS work?
	First I'd like to express my appreciation for the thoroughness of the study in addressing the concerns of the nearby neighborhoods and presenting possible creative solutions.

Member(s)	Comments/Suggestions
Peter G. Hart	I lived in the the house on Virginia Lane directly opposite Shrevewood Elementary for 5 years and still visit regularly. (I also lived in the much smaller house that it replaced for 2 years back in the mid-2000s.) During my most recent residence (2014-2019) I walked my grandsons to school, then supervised their walk across Virginia Lane and the divided lanes of Shreve Road when they were older. I was also a member of the trail patrol on the W&OD Trail. So, I am probably as familiar with the problems with crossing Shreve Road in the vicinity of the school, the backup on eastbound Shreve Road due to the Kiss-and-Ride and the hazards associated with the Virginia Lane/Shreve Road intersection and the W&OD Trail crossing there. Happily, the FCDOT SRTS grant provides at least a workable, if not ideal, solution for crossing Shreve by the school. The Kiss-and-Ride backup in the mornings and afternoons when school kids would use the crossing still makes the last part of crossing to the school across the eastbound lane of Shreve hazardous. In normal times, anyone in earshot of the school couldn't fail to miss the blaring horns and sometimes shouted imprecations indicative of highly frustrated drivers. Thus I was even happier to see that the study came up with 2 alternatives for the Shreve Road/Virginia Lane intersection and the entrances to Shrevewood Elementary. Initially I was really impressed with the Shrevewood Elementary Alternative 1 as I'm a big fan of roundabouts. New York State replaced 3 or 4 signal-controlled intersections in my hometown, a small village south of Buffalo, with roundabouts that have proved to be very successful. I like the fact that here they could act as traffic calming features for the Shreve Road corridor in addition to handling the traffic flow. Either alternative would be plagued by the Kiss-and-Ride backup unless a long right turn lane into the eastern entrance of the school were incorporated. It's not clear whether or not on-street parking is currently part of the designs, but perhaps parking could be created on the no longer needed divided lane of Shreve Road. The crosswalks and sidewalk re-alignments in both Alternatives 1 and 2 are steps in the right direction, but I prefer how the sidewalk aligns on the south side of Shreve Road in Alternative 2. I used to see a number of folks jogging or taking evening strolls along that side of the road and Alternative 1 unfortunately fails to provide an uninterrupted sidewalk along the south side of Shreve. I realize that topography limits the placement of the Alternative 1 roundabouts, but if they can't be shifted to the north, Alternative 1 should not be considered. I would like to add here that as a driver, bicyclist and pedestrian, I have been very impressed with the exceptional courtesy shown by most drivers to W&OD Trail users at both the crossings at Virginia Lane and Pinecastle. Many drivers slow and stop when they see trail users approaching these crossings, not just when they are stopped at the crossing and waiting to see if drivers will stop. I'm sure that the yellow mid-road sign at the Pinecastle trail crossing has helped, but I think that the majority of drivers on Shreve Road are either nearby residents or regular users of the corridor and have developed a highly-tuned awareness of trail users. This is particularly evident at the Virginia Lane intersection where drivers turning right onto Virginia Lane frequently stop in anticipation of trail users approaching the crosswalk. I mention this behavior because it suggests to me that most drivers using the corridor would respond well to roundabouts once they got used to them. (I realize that I'm arguing both for and against roundabouts in my response, but in my opinion they should not be seriously considered where they don't offer the best solution.) As to the Pinecastle Road W&OD Trail crossing, both the NOVA Parks plan for trail improvements or the roundabout appear to be workable solutions. I'd be in favor of the roundabout as it addresses the awkward mis-alignment of Pinecastle Road and Buckleview Drive and would naturally slow motorists as they approached the re-positioned W&OD Trail crossing. However, it would be best if input could be directly solicited from neighborhood residents who are more frequent users of Pinecastle and Buckleview. Thanks again for the thoroughness of the study and providing a means for neighborhood feedback!

Q&A Report: Shreve Road Virtual Public Information Meeting

Actual Start Date/Time	Duration	# Registered
10/07/2020 06:28 PM EDT	2 hours 10 minutes	125

Last Name	First Name	Time Asked	Question Asked
Gupta	Ajay	07:46:11 PM EDT	Can you add bumper near school
Gupta	Ajay	07:50:16 PM EDT	Can you create a turning lane for school cars and buses. They clogg the main road
Gupta	Ajay	08:01:33 PM EDT	Can you move the round about circle to fairwood lane so it is easy to cross for kids
Sibre	Brendan	07:43:15 PM EDT	How would the recommended improvements at Buckelew/Pinecastle address the "slam brakes" issues where drivers are looking for bike trail traffic and don't have sufficient time to see that someone has stopped to turn left onto Buckelew or Pinecastle? I'm not sure that the double roundabout or bike trail re-alignment will resolve the issue.
Sibre	Brendan	07:56:20 PM EDT	Thank you. I appreciate the response - I do think the bike trail realignment will help - mostly by slowing down the bikes and giving drivers more time to see them coming.
Helm	Cathy	07:43:40 PM EDT	Can you provide the email address again?
Helm	Cathy	07:46:16 PM EDT	The alternative 2 for Shrevewood Elementary has a stoplight. If this option is done, would you eliminate the proposed crosswalk at Fairwood? I think that is a better alternative. I do not think it is safe to cross Shreve Road at Fairwood — traffic zooms by there.
Helm	Cathy	07:47:43 PM EDT	I think the stoplight for Shreve/Virginia Road would help reduce speed as well.
Helm	Cathy	07:51:02 PM EDT	I do not think the mini roundabout at Bucklew is a good option. Traffic gets very backed up there. I also think cut through traffic will increase with the construction at Rt. 7 and West Street.
Helm	Cathy	07:55:30 PM EDT	Does the Pinecastle Road mini roundabout include 4-way stop signs?
Helm	Cathy	08:03:50 PM EDT	If Shrevewood is a major facility, then I believe that a stoplight between Rt.7 and Lee Highway would be warranted.
Helm	Cathy	08:11:41 PM EDT	I think the question was how to get off of Buckeyes and Pinecastle onto Shreve — which is a real challenge in morning and evening rush hours.
Helm	Cathy	08:14:02 PM EDT	Would people understand the rules for entry into mini-roundabouts?
Helm	Cathy	08:14:43 PM EDT	Can we get a copy of the slides so we can provide more thoughtful comments?
Lenert	Dawn	07:49:05 PM EDT	For the mini roundabout ideas by pine castle and bike path: if shreve is streaming traffic consistently during morning and evening rush how will cars leaving the neighborhoods from pine castle and buckleview be able to even enter the roundabout? I assume shreve rd would have the right of way. Would traffic back up significantly in the neighborhood like it did at rush pre pandemic?
Lenert	Dawn	08:34:16 PM EDT	Thanks this was well done!
Tiller	de Teel Patterson	07:42:28 PM EDT	How was the extensive development now begun at Geo. Mason HS and West Falls Church Metro factored in given likely increase in cut trough traffic between Lee Highway and Rt. ?
Palanzo	E J	07:52:26 PM EDT	Va Lane and Shreve and the Bike/Walking Lane is a major problem. Cars are speeding from Shreve going forward and making a right on Va Lane. I think more planning needs to be done. Speed bumps or a red light. Also there is a lot of truck traffic that should not be happening. Why no enforcement.
Palanzo	E J	07:54:39 PM EDT	Whoever did the resurfacing of Shreve Road did a lousy job. Does anyone ever look over the results.
Palanzo	E J	07:58:05 PM EDT	I suggest more planning should go into the VA Lane/Shreve Road section. It doesn't look from the slide that much is being done there.

Last Name	First Name	Time Asked	Question Asked
Palanzo	E J	08:04:33 PM EDT	Who decided that Shreve Road is a majorly artery? Robert G.
Palanzo	E J	08:11:01 PM EDT	Is there going to be any plans to plant trees and other noise reducing vegetation? The noise from Shreve and Va Lane is very very loud. I pay a lot of money in taxes and would like some peace and quiet.
Palanzo	E J	08:13:26 PM EDT	West Street is not designated a collector?
Colglazier	Elizabeth	07:41:09 PM EDT	Of the suggestions made, which are the cheapest (and therefore easiest and quickest) to get instituted? Would any of these changes preclude the more complicated, expensive changes?
Colglazier	Elizabeth	07:50:03 PM EDT	Thank you!
Palazzolo	Enid	07:49:23 PM EDT	How can we get Shreve Rd. reclassified as a residential street, so we can get a speed limit of 25 mph.?
Palazzolo	Enid	08:24:19 PM EDT	It ends at chestnut.
Palazzolo	Enid	08:32:51 PM EDT	Yes. I agree with that. There is no enforcement on Shreve Rd. for through trucks.
Banachoski	James	08:09:01 PM EDT	Not question, only comment_ too many pedestrain crossing within a short distance make it difficult to control the students crossing with crossing guards. There is a criteria that FCPD considers when providing a CG. One of the variables is the number of students crossing at a specific location.
Galdo	Julia	07:58:00 PM EDT	Can you give us a clearer understanding of how pedestrians will move from Rte. 7 to the WO&D crossing
Sibbing	Julie	07:43:51 PM EDT	Was there any study of improving the pathway on the west side of shreve from VA lane to Dominion's facility?
Sibbing	Julie	07:45:07 PM EDT	This could provide a safe space for bicycles to get around the dangerous, narrow, hill with short sight lines in this area.
Sibbing	Julie	07:57:00 PM EDT	exactly!
Moya	Karen	07:48:40 PM EDT	Has this study considered reducing the traffic that cuts through from Shreve Rd to West St via Allan Ave? Or improving the safety for children and pedestrians along Allan Ave that currently does not have a side walk down Allan. Several previous studies have shown that Allan adds a large amount of traffic down Shreve to Buckeyes intersection. Would closing off this known cut-through or restricting traffic somehow improve this corridor?
Moya	Karen	08:08:11 PM EDT	Allan ave is not accessed via Fairwood
Moya	Karen	08:16:02 PM EDT	At least two separate studies have been done about the traffic volume coming from and to Buckelew/Shreve intersection. At least 1/3 of the traffic volume on Shreve road between Buckelew and RT. 7 is traveling through this cut-through. Will this study recommend how to reduce volume on Shreve and include Buckelew/Allan Ave type cut-through streets?
Oliveira	Leticia	07:45:41 PM EDT	Thank you very much for the presentation and the work done by all involved to get us to this point. Given the focus on pedestrian safety, I would like you guys to explore opportunities on shreve road between chestnut and hickory; sidewalk seems to be an option of paramount importance as pedestrian safety is concerned. Especially given the "blind" Gordon curve. Thanks.

Last Name	First Name	Time Asked	Question Asked
Kauffman	Louis	07:46:42 PM EDT	Hickory guardrail presentation appears to benefit safety of cars. What can be done to protect pedestrians walking on sidewalk leading into the trail?
Paulson	Michael	07:52:51 PM EDT	coming from the east on the W0&D trail, crossing shreve RD, there is no easy way to continue up Pinecastle into Falls Hill, the right turn should be opened up...
Anderson	Nicholas	07:45:04 PM EDT	I like the Shrevewood option #2. What would happen to the existing eastbound lane closer to the school?
Rhodes	Patrick	07:44:46 PM EDT	Why are we only considering surface crossings at W&OD and Shreve? All of these conflicts seem to be more safely remidiated by a bridge crossing in lieu of surface crossing
Tomas	Richard	07:05:07 PM EDT	how about a sound check
Ochsendorf	Robert	08:00:55 PM EDT	There is also just to the east crossing 29 in Arlington. Brand new bridge.
Kulesz	Sharon	07:55:30 PM EDT	How would one make a left out of Falls Hill onto Shreve Road if there is a roundabout?
Breehey	Sonya	07:49:47 PM EDT	Did you look at the possiblity of a shared use path from Rt. 29 to teh W&OD? There's alrady a narrow trail/sidewalk that could be expanded.
Breehey	Sonya	07:57:36 PM EDT	That side trail goes all the way to Rt. 29.
Breehey	Sonya	08:05:14 PM EDT	I support the Fairwood pedestrian crossing improvments. The pedestrian media is great. It helps connect to the sidepath that connects to WODD.
Breehey	Sonya	08:06:54 PM EDT	Agree with the guardail question about what will protect a pedestrian from a car that leaves the roadway. That's why protected bike trails with a barrier are safer for bike/ped.
Welch	Steven	06:50:10 PM EDT	This is Steve Welch... Mic check? I'm muted.

ObjectID	Name (optional)	Do you have concerns related to speeding, pedestrian safety and/or sight distance along the corridor?	Please list in which segment of the corridor and elaborate on your concerns.	What recommendations do you agree with and why? What recommendations do you disagree with and why?	Are there other recommendations that you would like to propose?	How did you hear about this meeting?	Other - How did you hear about this meeting?
1		yes	From Route 7 to beyond Shreve			website	
2	Brandon	yes	The W&OD trail.	Pedestrians need to stop flying through, especially bikers.	Figuring out how to get Pedestrians need to stop flying through, especially	website	
3		yes	Oldewood Drive Corner; Shrevewood Elementary School, the W & OD Trail crossing: Speeding and pedestrian safety are my biggest concerns. I have been		Students need to be allowed to have a crossing guard in front of Shrevewood Elementary during arrival and dismissal. Many families cross that street unsafely as they do	other	Friend
4	Roger Severino	yes	The trail crossing has a sharp curve and very poor sight distance.		The curve at the trail crossing should be straightened and the trail should have a bridge over the road like over	choice_1	
5	Joe Knecht	yes	I have lived in the vicinity of Oldewood and Shreve for 40 years. The speeding and pedestrian safety issues remained unchanged since my childhood; the differences between the 1980s and today are:	I concur with the recommendations for traffic calming measures around Shreve/Oldewood; recommend increased enforcement in the straightaway between Lee Hwy and the Oldewood. Concur with traffic concepts around Shrevewood School.	Highly recommend that guardrail/other barrier be extended along the Oldewood curve of the pedestrian path to protect walkers. And I like the bike lane ideas, but dropping the speed limit to 30 mph	other	Shreve Road Group
6	George Hogeman	yes	I am most concerned about the volume of cut through traffic between routes 7 & 29 and the speed of the traffic.	I really like the suggested mini roundabouts at Pinecastle and either of the plans to make a traffic light or roundabout at the intersection of Virginia lane. I think they will make it easier for local drivers and	I am concerned about the effect of the commercial development in Falls Church. In particular if that development results in more cut through traffic coming from Rt7 to	other	email from various people.
7		yes	W&OD crossing near Virginia Lane, speeding around curve (going			choice_1	
8	Allen Muchnick	yes	speeding, motorist intolerant of bicyclists on the roadway		install speed cameras (photo speed monitoring devices)	website	
9		yes	Near Shrevewood Elementary and the W&OD crossing at Buckelew/Pinecastle	The speed by the 495 barrier is not an issue, so maybe the "neighborhood gateway" could be at Pioneer instead. A median at Fairwood is a good idea. The Option 2 at Shrevewood makes a lot of sense. The "peanut" at the W&OD crossing has	If Option 2 for Shrevewood is selected, it would be great to turn the current eastbound lane area over to FCPS so that the bus drop off could be more orderly. Also, any improvement to the sidewalks along	website	
10	Matt Ries	yes	W&OD crossings	Roundabout designs at both W&OD crossings may distract drivers from bikers/walkers on trail crossing, rather, their focus would be on getting safely through the roundabouts (something we're not used to here in the US)	flashing lights at W&OD crossings. Speed bump or similar in roadway coming down Virginia Ln toward W&OD crossing to slow traffic. Rt turn from Shreve to VA leaves no room for a car to turn and then wait	social_media	
11	Wendy Hoskins	yes	Hickory) driver has limited line of sight, sidewalks on Shreve not safe for pedestrians, kids walking to/from school especially between Fairwood and Holly Manor. Speeding is an issue at 2 sharp	down/keeps traffic moving/safer for ped/bikes.Alt2-traffic light stops cars but if green they race ahead/traffic will back up/need more to slow cars down here. LOVE Pine/Buck roundabout for same reasons as Alt1	Move Alt #1 roundabouts little north so more room for school - kiss and ride lane, parking, sidewalks or if can't move both, just move the west roundabout more north to give school extra space	other	Neighborhood listserve

APPENDIX F

BICYCLE SPEED TREATMENTS PEER STUDY

Technical Note 130

Speed management on shared paths

November 2014

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1 Purpose and scope

The purpose of this technical note is to provide operational and best practice guidance on speed management techniques for shared paths in order to minimise potential conflict between users. Design guidance is provided in the Transport and Main Roads *Road Planning and Design Manual* Volume 3, Part 6A.

Currently there is no technical guidance available on the management of excessive speeds on shared paths in Queensland. This lack of guidance has resulted in speed limits being introduced and applied to facilities with no consideration to more appropriate design treatments or the high likelihood of non-compliance.

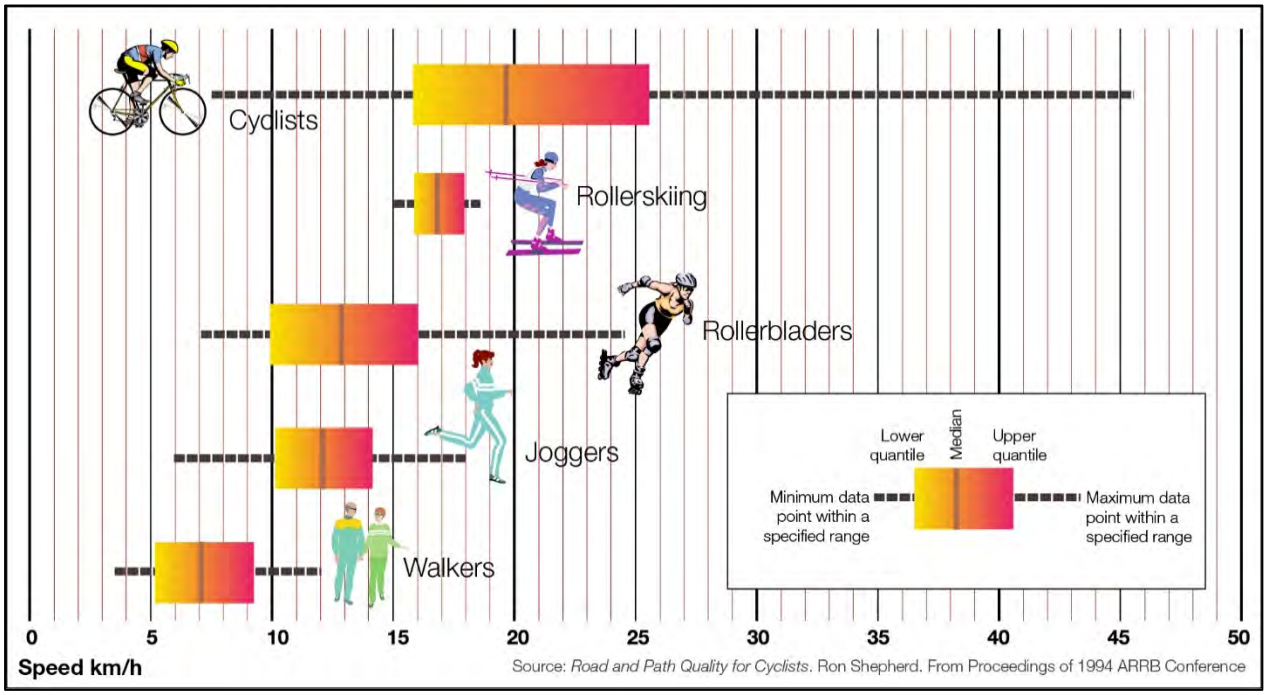
1.1 Introduction and background

Austroads Guide to Road Design Part 6A: Pedestrian and Cycle Paths (2009) describes shared paths as a type of off-road cycling facility which is accessible by pedestrians and cyclists. Shared paths are the most common type of facility due to the cost of constructing separated paths, limitations in the physical area available for a path and the versatility of a shared path, being accessible by all users.

Austroads also recommends that shared paths should be used in situations where there is demand for both a cycling and a pedestrian facility, but where the demand is not expected to be sufficiently great to provide separated facilities. However, as cycling increases greater pressure is being placed on shared paths which in turn have led to increased conflict between cyclists and pedestrians. Where separated facilities cannot be provided and an increasing number of cyclists and pedestrians are expected to use the same space there is growing need for management to mitigate potential conflict.

Of particular concern to both path users and path managers (asset managers) is the speed of cyclists. The wide difference in operating speeds between the modes is shown in Figure 1.

Figure 1: Operating speeds of the different types of shared path users (indicative)



Since bicycles are not required to have a speed-measuring device (and most do not have one), mandatory speed limits are not a viable option, even if they could be enforced. However, advisory speed signing and warning signage on paths where there are large numbers of slower users can be effective when used selectively at appropriate locations, and in accordance with the prevailing conditions.[1]

A review of national and international literature has demonstrated that speed limits for cyclists are not used or recommended as a safety device, with the exception of the rule which states that the speed limit of the adjacent roadway shall apply to any road related area.

1.2 Related documents

This technical note should be read in conjunction with the following guidelines:

- Austroads project NS1018 report and resources toolkit: *Pedestrian-Cyclist Conflict Minimisation on Shared Paths and Footpaths* (Austroads 2006)
- *Austroads Guide to Road Design Part 6A: Pedestrian and Cyclist Paths*. (Austroads 2009)
- Transport and Main Roads *Road Planning and Design Manual* Volume 3, Part 6A
- *Austroads Cycling Aspects of the Austroads Guides*, Section 7.5.8 Sight Distance.(Austroads 2011)
- *Manual of Uniform Traffic Control Devices* – Part 9: Bicycle Facilities (based on AS/NZS 1742.9) Department of Transport and Main Roads (MUTCD 2013)
- *NSW Bicycle Guidelines* Roads and Maritime Services NSW. (RMS 2005).

Figure 2: Inappropriate speed limit signage application

Though the path on the right in this photo has been linemarked as a bicycle path, the modified R8-2 regulatory sign declares it as a shared path with an 8 km/h speed limit. The adjacent path on the left is designed and signed for pedestrian-only use. Cairns, QLD.

[1] Austroads 2006

Figure 3: Effective use of pavement markings to manage speeds

The speeds cyclists can comfortably operate at are much higher than that of pedestrians. Poorly designed facilities can produce conflicts between the users due to insufficient operating space, poor surface or a lack of path definition and linemarking. This well-designed path is smooth and well defined with centrelining. The path markings warn users to slow for a sharp bend in the path. Bicentennial Bikeway, Brisbane, QLD.

2 Bicycle operating requirements

A rider balances their bicycle in an upright position mainly due to the forward-motion forces they exert on their machine. Without this forward-motion the bicycle loses stability and falls over. The speed of this forward motion at which cyclists chose to travel is influenced by a combination of human and other factors.

At slow speeds a rider stays upright by continually adjusting the steering and shifting their body weight in response to the motion of the bicycle. At higher speeds, the forces set up by the rotating wheels make front wheel steering difficult, so a rider steers by leaning in the intended travel direction.

On well-designed paths and in good conditions cyclists can comfortably travel at speeds of between 15 and 25 km/h with minimum risk or decrease in amenity to pedestrians.

An analysis by Transport and Main Roads of its permanent bicycle counters in the SEQ region found that cyclists travel, on average, at a speed of 20 km/h[2]. As is the case in on-road situations, the small percentage of riders travelling at excessive speeds (not appropriate to the prevailing conditions) presents the largest concern to the safe operation of shared paths.

Studies of bicycle operational stability during the last century have shown that a bicycle can become unstable at speeds below 11 km/h. The degree of stability depends on a number of factors: the skill of the rider; the design of the bicycle; and, environmental factors such as path surface and slope[3].

[2] Rees 2011. Speed Setting on Shared Paths. Griffith University study commissioned by Transport and Main Roads.
[3] Wilson, Papadopoulos (2004). *Bicycling Science* (Third ed.). The MIT Press. pp. 263–390.
Whipple (1899). *Quarterly Journal of Pure and Applied Mathematics* 30, pp 312-385.

Requiring cyclists to travel at speeds which may detrimentally affect their stability (and hence safety), on inadequately designed paths, shared with other users insensitive to their operational needs, is not an equitable or safe path management strategy.

Any regulatory device which instructs a cyclist to undertake a behaviour that will compromise their safety cannot be expected to be complied with and damages the credibility of the device.

2.1 Speed setting on shared paths

In situations where a speed limit has been pursued, it has proven high cost for little benefit as it is problematic to enforce for the following reasons:

- technological limitations in measuring the speed of a cyclist from a standing position
- the required expectation of the cyclist themselves to monitor their specific speed
- few bicycles are equipped with a speedometer (or similarly accurate speed measuring instrument).

Research into speed limit setting issues on shared paths was undertaken for Transport and Main Roads in 2011 (see footnote 2). The study surveyed user behaviour on a number of popular paths in Brisbane and reviewed current research including accident data and current practice. The key findings of this study were:

- From an analysis of a range of available data, it was observed that the frequency of crashes between pedestrians and cyclists on footpaths and bikeways is extremely low, with an average of 4.7 crashes per year on off-road facilities across the state of Queensland. In the 17 year period analysed, only two fatalities were recorded, and in both circumstances the crash occurred on the nearby road.
- Data sourced from traffic counters installed on shared paths in Brisbane suggested that at periods of higher volume there is more consistent speed on the paths, whereas when the path is unoccupied cyclists will travel freely at a broad range of speeds. Counter data shows that the average speed of each facility at peak times approximates a reasonable design speed for each location. It is therefore posed that the cycling community is able to self-moderate speeds that are appropriate to the location.
- There is no defensible justification for imposing regulatory speed limits on shared paths. A more constructive approach would be to provide clear instructions to cyclists of appropriate cycling speed and behaviour in relation to other path users through effective path design and traffic control devices.
- The feedback received from cyclists surveyed suggested decisively that the cycling community was opposed to the introduction of regulatory speed limits on shared paths. There was agreement however that there is a safety issue in some locations that needs to be addressed. A number of alternative treatment measures were discussed to address safety issues in place of a speed limit.
- A review of literature has demonstrated that speed limits are not used or recommended as a safety measure for paths.

- Alternative treatment methods to speed limiting may be as, or more, effective as safety devices for path management thus avoiding the negative connotations associated with regulation. If a speed limit is to be imposed it is recommended that advisory speed signs be used in place of regulatory speed limits. It is further recommended that only sections of path that are below current design standards or have a localised safety hazard be assessed for speed limits.

Speed management guidelines for paths cannot be viewed in isolation. Implementing a path speed limit may increase the number of cyclists choosing to use an on-road alternative. If the road does not positively provide for cyclists this could be potentially counter-productive for cyclist safety. The likely consequences and risk of non-compliance must be considered.

Figure 4: Speed signs in current use

The two signs on the left are regulatory (enforceable) speed signs which apply to both the road and the road-related area (adjacent paths). The centre right sign is an (unenforceable) advisory speed sign. This type of sign is preferred for indicating advisory speeds (photo right). Where a regulatory speed limit is not signed the default speed limits apply – 50 km/h in built-up areas and 100 km/h outside built-up areas.

It should always be recognised that there are always spatial issues when different transport modes mix. In the case of mixed street traffic, cyclists feel that it is essential that they be given at least one metre separation space to motor vehicles. This has been recognised in recent changes to the Queensland Road Rules, specifying a 'minimum overtaking distance' when passing a cyclist. Likewise pedestrians regularly voice the need for similar separation between themselves and cyclists on shared paths and footpaths. These issues should be addressed through carefully considered facility design and targeted behavioural interventions. The following sections provide advice and guidelines on the implementation of such measures.

3 Designing paths to account for speed

There are a range of treatment measures available for use on shared paths to address the safety concerns of users. However, when operational safety issues arise on existing paths, it is seldom a single design category which needs to be addressed. Practitioners are advised to take a holistic approach to path design by taking into account all the following categories and carefully studying path user behaviour (where possible consulting with actual path users) before implementing remedial measures.

The impact of the treatment in terms of the likely compliance by cyclists must also be carefully considered. If there is a high likelihood of non-compliance then an alternative treatment should be used. It is also essential to determine if the treatment is 'solving' the problem or just 'relocating' it.

Common design and management issues affecting the operation of a path are:

- path design speed
- path widths and user volumes
- path gradient, surface, alignment and sightlines
- physical devices
- advisory devices.

3.1 Path design speed[4]

Austroads 2011 recommends that shared *paths be built to a design speed of at least 30 km/h wherever possible and desirable given the purpose of the path, and in other cases for the anticipated operating speeds. However, it should be recognised that it may be necessary to adopt higher or lower design speeds in specific circumstances*.

Design speed should not be confused with operating speed or preferred operating speed which are related more to the driver rather than the path's design.

All path and road users have a legal obligation to travel at safe speeds according to the prevailing conditions. It is also a legal obligation of all road and path users to travel with all due-care and attention to avoid a collision with other road/path users. A travel speed appropriate to the prevailing conditions may well be below a posted speed limit.

In instances where shared paths or short sections of these paths have not been adequately designed for the desired operating speed specific site measures may need to be implemented as an interim measure prior to a path upgrade.

[4] Design speed is the selected speed used to determine the various geometric factors of a shared path e.g: curve radii, cross slope, grade, sight distance, path width. Once the design speed has been selected all pertinent path features should be related to it to achieve a balanced design. See Figure 5 for example of the various design elements.

Figure 5: Design parameters for off-road paths (updated from Table 6.2 NSW Bicycle Guidelines)

Design element	Coverage in Austroads *Guide to Road Design - Part 6A Pedestrian and Cyclist Paths*	Example values for 30 km/h design speed
Operating speed	7.2 Bicycle operating speed	30km/h
Horizontal curvature	7.3 Horizontal curvature Tables 7.1 and 7.2	25m minimum path radius without superelevation
Bicycle path width	7.5 Width of bicycle paths 7.5.2 Table 7.3	2.5m local access, 3.0m major path
Shared path width	7.5 Width of shared paths 7.5.3 Table 7.4	2.5m local access, 3.0m major path
Separated path width	7.5 Width of separated paths 7.5.4 Table 7.5 and 7.6	Two-way 2.5m bikepath, 2.0m footpath One-way 1.5m bikepath, 1.5m footpath
Clearances	7.7 Clearances Figure 7.4, 7.5, 7.6 and 7.8	0.5 - 1.0m to walls and fences
Gradient	7.4 Gradient Figure 7.1	5% maximum
Sight and stopping distance	7.8 Sight distance Figures 7.7, 7.8 and 7.9 for vertical	35-40m 8m sight clearance on min 25m radius curves
Crossfall and drainage	7.6 Crossfalls and drainage Figure 7.3	2% for minimum radius of 25m

Also refer to the Transport and Main Roads *Road Planning and Design Manual* Volume 3, Part 6A.

Figure 6: Use of segregation and pavement markings to minimise conflict

During morning and evening peak periods this path is heavily used by cyclists and pedestrians. To minimise conflicts and improve user amenity the path has been widened into separate bicycle and pedestrian paths. Bicentennial Bikeway, Brisbane QLD.

3.2 Path widths and path user volumes

In urban situations where paths carry high volumes of both types of users; cyclists and pedestrians, the width of the facility is a critical factor in its safe operation and user amenity. The departmental *Road Planning and Design Manual* Volume 3, Part 6A provides design guidance, and the departmental technical note Guidance on the Widths of Shared Paths and Separated Bicycle Paths provides operational guidance, to practitioners on suitable path widths relative to path use. In

instances where path volumes are excessive, the physical separation of cyclists and pedestrians onto separate but parallel paths may be the most desirable option.

3.3 Path gradient, surface, alignment and sightlines

Bicycles are very manoeuvrable but this manoeuvrability has limits when the forward movement of the bicycle becomes insufficient to comfortably maintain an upright position. While people can travel slowly on a bicycle at times, they can also travel relatively fast. As bicycles are vehicles of momentum, riders will commonly coast quickly down hills using the momentum built up from prior physical effort to travel further with minimal effort.

Figure 7: Path safety issues due to broader design issues exacerbated by speed

Left: This path is built on a downhill slope with a significant pedestrian crossing movement across the path to the ferry wharf. The crossing point is marked with warning signage and highlighted pavement colour. The sign assembly is top to bottom – TC9785, W8-23 and TC1952-2. Right: This merge point for separated pedestrian, and cyclist merges into a shared path section which is signed (in the opposite direction) with warning signage and different pavement material. Kangaroo Point, QLD.

These factors relating to the operating characteristics of the vehicle are not widely recognised by path designers. This can result in excessively steep grades, insufficient warning of path curves or sudden path narrowing obscured by poor sightlines. Adequate warning signage of upcoming potential hazards and the maintenance of good sightlines are factors that can in themselves moderate excessive path speeds. For further design criteria please refer to the department's *Road Planning and Design Manual* Volume 3, Part 6A.

3.4 Physical devices

Refer to the department's *Road Planning and Design Manual* Volume 3, Part 6A for path design criteria for physical devices and path speed limiting devices.

Crash data analysis suggested that the frequency of crashes between pedestrians and cyclists on footpaths and bikeways is extremely low (compared with road crashes). Data analysis showed that the average speed of each (shared use path) facility at peak times approximates a reasonable design speed for each location. It is therefore posed that the cycling community is able to self-moderate speeds that are appropriate to the location. (see footnote 2).

The following section demonstrates some examples of 'best practice' speed management, utilising the path speed limiting devices listed in the department's *Road Planning and Design Manual* Volume 3, Part 6A.

3.5 Pavement markings and segregation

The use of line marking and signage (Section 3.6 Advisory devices) on pathways has an impact on user behaviour. The over-use of centre line pavement markings and advisory signage, can result in shared paths looking like 'roads'. In these instances it is highly likely that cyclist will treat the facility as if it were in fact a 'road' – a dedicated right-of-way, travelling at higher speeds. The alternative is to use an uncluttered 'shared space' look with minimal or zero demarcation of user space, allowing for slower speed 'mixing' of users.

Practitioner experience has found that placing pedestrians on the 'view' side of the path (for example, the riverside) and the cyclists on the 'non-view' side will minimise conflicts and encourage the 'through' movement of cyclists, whilst allowing pedestrians to enjoy the amenity/scenery.

It should be noted that, particularly in Queensland, pedestrians will naturally tend to use facilities with shade. For example: a 'bicycle only' path with shade from overhanging tree branches may have significant pedestrian usage if the adjoining footpath has none.

The following section demonstrates some examples of 'best practice' speed management, utilising the path speed limiting devices listed in the department's *Road Planning and Design Manual* Volume 3, Part 6A.

Figure 8: A shared path adjacent to Perth central railway station

This particular section of path is crossed by pedestrians and traversed by cyclists and service vehicles. The flush brick paving makes the area look like a pedestrian plaza (i.e. not like a road) thus encouraging drivers and cyclists to be alert and respectful when traversing this area. To assist cyclists (this is a major cycling network route) and to provide clear definition of the facility, edgelining and centrelining has been installed. The bollards have been installed to physically prevent parking at the curve.

Figure 9: Pavement markings use on a sight restricted corner to manage approach speed

Distinctive pavement markings have been added to the pavement of this curving shared path as it enters an underpass on a downhill slope. Normanby Pedestrian Cyclist Link, Brisbane, QLD.

Figure 10: Shared path slow point treatment at railway station access point

City West Station, Perth, WA.

3.6 Advisory devices

Advising cyclists and pedestrians that they are on a designated shared path and additional care needs to be taken is best done through the provision of clear sightlines and the use of traditional warning devices, such as signs and pavement markings. In most instances the use of a R8-2 shared path in

conjunction with pavement markings (centrelining – solid in the case of tight curves and constrained widths, edgelining particularly in low light locations and, bicycle/pedestrian pavement symbols) will communicate a strong regulatory/safety message to cyclists and pedestrians.

Additional departmental warning signage is also available for shared path use: TC1952-2 “Slow down watch for pedestrians, TC6605 Steep downhill, W4-3 Path (road) narrows.

Figure 11: Warning advisory signage recommended for use on paths in Queensland

Left to right: W4-3 Path narrows (also W4-3 Narrow bridge); TC9605 Steep descent – W4 signs and TC9605 to be 450mm square; TC1608 (300mm wide) Slow down – used in conjunction with other diamond shape warning signs); TC1592-2 Slow down watch for pedestrians.

3.6.1 Path behavioural signage

A properly designed path may still experience major safety issues if the type of usage changes from that for which it was designed. Similarly, a narrow path (less than 2.5 m width) may not operate safely if, over time, the volume of pedestrians or cyclists exceeds its design capacity[5].

In place of a costly full upgrade, path management measures will need to be implemented to reduce risk to users. These in themselves may be unpopular with the path users as they may reduce the level of service of the path and require changes in behaviour. Balancing safety with path amenity and level of service for the users should always be given careful consideration and any introduced physical measures communicated to the path users.

Repeated instances of poor path user behaviour can be address by the installation of the path behaviour signage which is designed to remind path users of four key behaviour messages.

[5] Technical Note 133 Guidance on the widths of shared paths and separated bicycle paths.

Figure 12 (right): Path behavioural sign (similar to ACT sign DS13-15-1)

Details on additional path advisory signs can be found in the departmental publication *A Guide to Signing Cycle Networks* – Page 17, Figure 5 available for download from the department's website.

4 Behavioural interventions to mitigate excessive path speeds

4.1 Path behaviour interventions – a case history

On paths with high volumes of users where, due to site limitations, path authorities have resorted to targeted interventions to educate users and to develop site-specific micro improvements to reduce path user conflicts.

One such intervention was carried out in 2009 by the City of Sydney Council on a section of harbourside shared path at Glebe Point in Sydney's Inner West. This path was heavily used by walkers, cyclists, dog owners and their pets. During the campaign Council staff and contractors were stationed along a problematic section of path to interact with the users.

Improved behaviour and respect between the user groups was achieved by the campaign. Physical design issues were also addressed on a critical narrow section of shared path. Cyclists were diverted from this short section of path and provided with an alternative bypass route (of similar length and path type).

Figure 13: Example of a constrained mixed speed environment, prior to treatment

Left – a section of the path at Glebe Point prior to the Council intervention. This path is heavily used and has seating designed into the retaining wall to the right. To the left the bank falls away steeply to the waters of harbour. The bypass path for cyclists now takes them to the right of the fig tree. Right – Campaign poster showing the blue advisory pavement pictograms and key messages for shared path behaviour.

For further information on this technical note, please contact:

Michael Langdon
Transport and Main Roads – Engineering & Technology Branch
Phone: (07) 3066 8965 Email: michael.j.langdon@tmr.gov.qld.au

5 References

The document listed below have been referenced in this technical note but are not listed in Section 1.2 Related Documents.

Rees 2011 *Speed Limit Setting on Shared Paths*. Unpublished Griffith University study commissioned by the Department of Transport and Main Roads Brisbane, Queensland.