



# **PROJECT PIPELINE**

Route 684 (Mine Road)  
From Exeter Lane to Juggins Road Connector

Stafford County  
FR-25-05

PHASE 3 REPORT  
June 2026

Prepared for



Prepared by

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# Chapter 1: Needs Evaluation and Alternatives Development

## 1.1 Introduction

Project Pipeline is a performance-based planning program to identify cost-effective solutions to multimodal transportation needs in Virginia. Through this planning process, projects and solutions may be considered for funding through programs, including SMART SCALE, revenue sharing, interstate funding, and others. SMART SCALE is Virginia's data-driven prioritization process that scores and evaluates potential transportation projects based on key factors including congestion reduction, safety improvement, accessibility, land use, economic development, and environmental quality to determine which projects may receive state funding. Visit the Project Pipeline webpage for additional information:

<https://vapipeline.virginia.gov/>.

This study, entitled FR-25-05—Route 684 (Mine Road) from Exeter Lane to Juggins Road Connector, focuses on concepts targeting identified needs including pedestrian and vehicle safety, pedestrian and bicycle access along the corridor, in addition to Transportation Demand Management (TDM) and transit access. The four key steps within the Project Pipeline performance-based planning and programming process are shown in **Figure 1**.

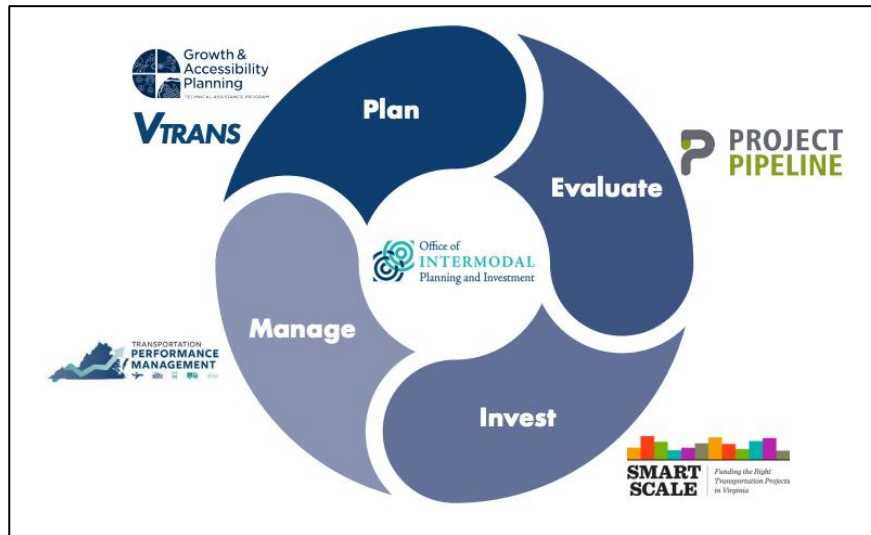


**Figure 1: Project Pipeline Key Steps**

## 1.2 Methodology

The Project Pipeline study process consists of three phases:

- **Phase 1:** Problem Diagnosis and Alternative Brainstorming
- **Phase 2:** Alternative Evaluation and Sketch-Level Analysis
- **Phase 3:** Investment Strategy and Cost Estimate

**Figure 2** shows the overall Project Pipeline process, key milestones, and schedule in relation to critical SMART SCALE dates.

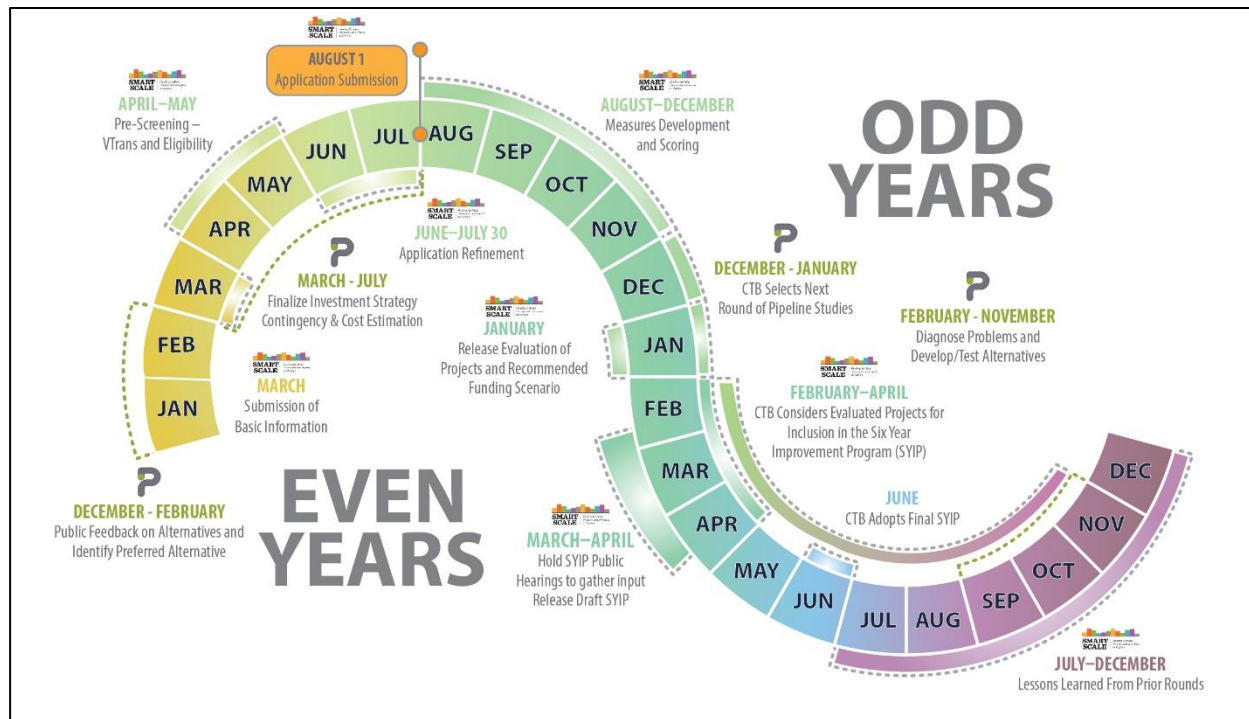


**Figure 2: Study Phase Methods and Solutions**

The study team is broken down into technical teams to review data, develop preliminary alternatives, refine solutions, and provide clear messages to stakeholders regarding the most viable and effective solutions related to the priorities and needs for each study. The priorities, needs, and scope of each study guides the level of Technical Team involvement. In general, the technical teams include the Office of Intermodal Planning and Investment (OIPI), the Virginia Department of Transportation (VDOT), and consultant staff from the following departments and/or disciplines:

- District Planning
- District Traffic Operations
- District Location and Design (L&D)
- District subject matter experts (e.g., Right of Way, Utilities, and Environmental, as needed)
- Consultant Teams, Central Office Divisions, as needed
- Department of Rail and Public Transportation (DRPT), as needed
- Localities, if applicable
- Metropolitan Planning Organizations (MPOs) or Planning District Commissions (PDCs), if applicable

A sample organizational chart of a technical team is shown in **Figure 3**.



**Figure 3: Structure of a Technical Team**

## 1.3 Study Background

A Study Work Group (SWG) was formed for this study to capture input from local stakeholders and shape the development of potential improvements. The SWG provided local and institutional knowledge of the corridor, reviewed study methodologies, provided input on key assumptions, and reviewed and approved proposed improvements developed through the study process. The SWG included members representing the following organizations:

- Office of Intermodal Planning and Investment (OIPI)
- Virginia Department of Transportation (VDOT)
- Virginia Department of Rail and Public Transportation (DRPT)
- Fredericksburg Area Metropolitan Planning Organization (FAMPO)
- George Washington Regional Commission
- Stafford County
- Fredericksburg Regional Transit (FXBGO!)
- Potomac and Rappahannock Transportation Commission (OmniRide)
- Kimley-Horn

The study area along Mine Road extends from Exeter Lane to Garrisonville Road and Staffordboro Boulevard from Garrisonville Road to Juggins Road Connector. Mine Road/Staffordboro Boulevard is a four-lane median divided roadway classified as a Major Collector. Within the study area, Staffordboro Boulevard has a posted speed limit of 25 mph, and Mine Road has a posted speed limit of 40 mph. Garrisonville Road is a four-lane median divided roadway classified as a Major Collector. In addition to major collectors, some intersections include minor collectors, such as Greenspring Drive and Northampton Boulevard, which are two-lane undivided roadways. The remaining intersections include local roads that are two-lane undivided roadways.

The study area is in northern Stafford County, immediately west of and parallel to I-95. Mine Road serves as an alternate route to I-95 and US 1, especially during incident events on either of these other corridors. The northern part of the study area is primarily commercial developments, and the southern part of the study area is primarily single-family residential neighborhoods. Fredericksburg Regional Transit (FXBGO!) Routes D3 and D4 operate in the northern part of the study area, and there are two commuter lots in the study area adjacent to Mine Road and Staffordboro Boulevard. The northern Park and Ride lot on

Staffordboro Boulevard serves OmniRide commuter routes 942 and 943. OmniRide is the operating name for the mobility services offered by the Potomac and Rappahannock Transportation Commission (PRTC). The Park and Ride lots also serve multiple “slug lines,” also known as “casual carpools” or “instant carpools,” in which drivers pick up enough passengers to meet the three-person high-occupancy vehicle minimum for their commute along the I-95 Express Lanes.

The study area includes seven signalized intersections and six unsignalized intersections. The 13 study intersections are shown in **Table 1** and **Figure 4**. Four additional upstream/downstream intersections along Garrisonville Road were included in the traffic volume data collection and operations analysis effort to more accurately model the congestion at the Garrisonville Road and Mine Road/Staffordboro Boulevard intersection.

**Table 1: Study Intersections**

| #   | Intersection Name                                                | Control Type |
|-----|------------------------------------------------------------------|--------------|
| 1   | Staffordboro Boulevard and Juggins Road Connector                | Unsignalized |
| 2   | Staffordboro Boulevard and Woodstream Boulevard                  | Unsignalized |
| 3   | Staffordboro Boulevard and Stafford Market Place/Elementary Lane | Signalized   |
| 4   | Staffordboro Boulevard and Prosperity Lane                       | Unsignalized |
| 5   | Mine Road/Staffordboro Boulevard and Garrisonville Road          | Signalized   |
| 6   | Mine Road and Greenspring Drive                                  | Signalized   |
| 7   | Mine Road and Midpoint Lane                                      | Signalized   |
| 8   | Mine Road and Highpointe Boulevard/N Vine Place                  | Signalized   |
| 9   | Mine Road and Settlers Way                                       | Unsignalized |
| 10  | Mine Road and Cathedral Lane                                     | Unsignalized |
| 11  | Mine Road and New Bedford Court                                  | Unsignalized |
| 12  | Mine Road and Northampton Boulevard                              | Signalized   |
| 13  | Mine Road and Exeter Lane                                        | Unsignalized |
| 14* | Garrisonville Road and Doc Stone Road                            | Signalized   |
| 15* | Garrisonville Road and North Stafford Office Park Driveway       | Unsignalized |
| 16* | Garrisonville Road and Walmart Driveway                          | Unsignalized |
| 17* | Garrisonville Road and Salisbury Drive/Stafford Market Place     | Signalized   |

\*Additional intersections included for traffic volume data collection and operations analysis efforts

The study team collected traffic counts, travel time runs, queueing observations, traffic signal timings, and pedestrian and bicycle counts to assist with the transportation analysis in the study area.

A framework document was developed prior to commencing the study which outlined the study methods and assumptions. The signed framework document is in **Appendix A**. A Round 3 Kickoff and Framework Meeting (SWG Meeting #1) was held on April 4th, 2025, to provide an overview of the study and obtain feedback on the study’s assumptions. The kickoff meeting materials are in Appendix A.

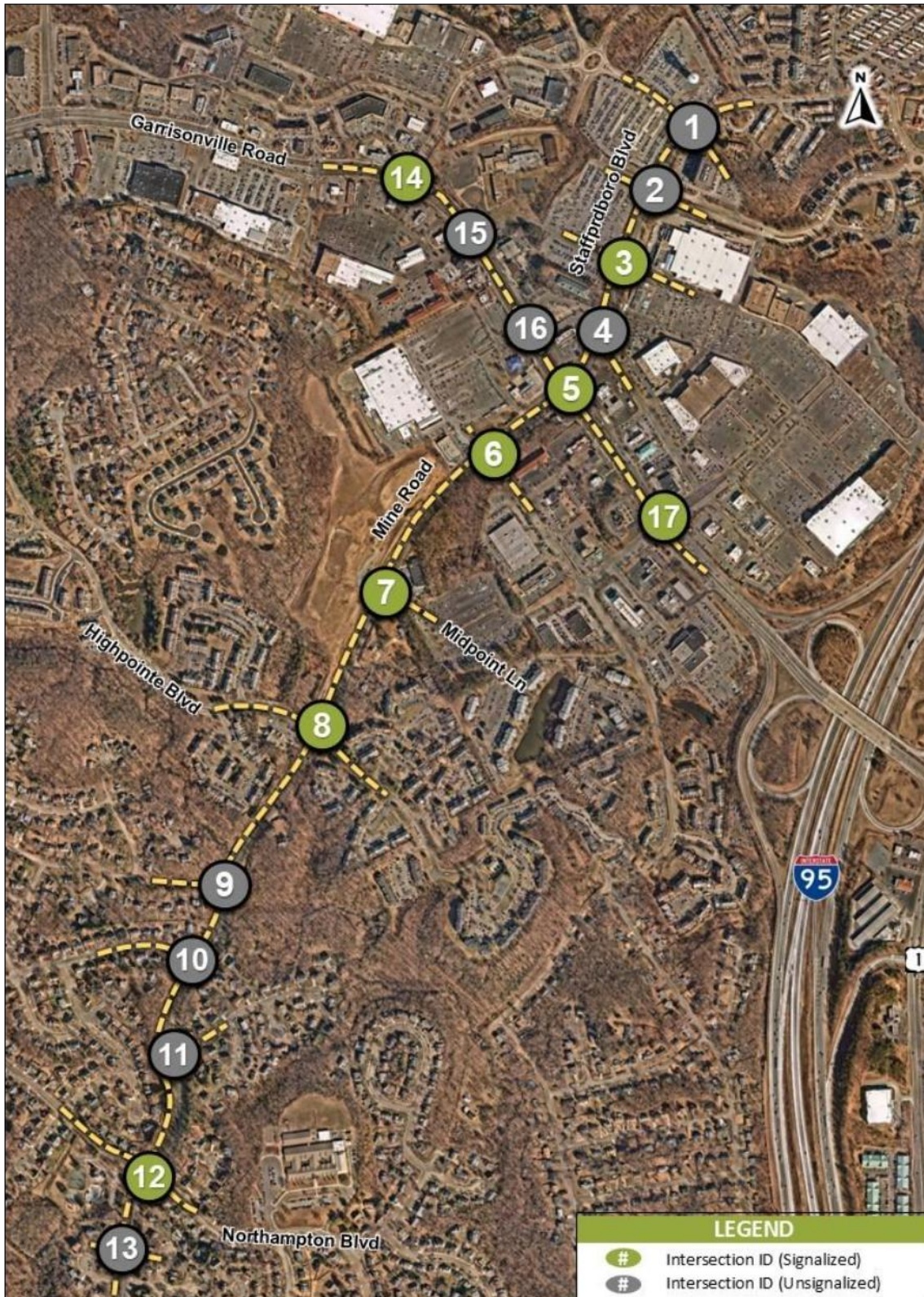


Figure 4: Project Study Area

## 1.4 VTrans Needs

Project Pipeline follows a performance-based planning approach to identify solutions that address VTrans mid-term needs. VTrans is Virginia's statewide transportation plan that is prepared by OIPI for the Commonwealth Transportation Board (CTB). VTrans mid-term needs (0-10 years) were identified from a data-informed process and were used as a primary source in the selection of Project Pipeline study corridors. **Table 2** outlines the VTrans needs in the study area.

**Table 2: VTrans Needs Identified in the Study Area**

| VTrans 2025 Mid-Term Need                                                                                                | Priority |
|--------------------------------------------------------------------------------------------------------------------------|----------|
|  Safety Improvement                     | Medium   |
|  Pedestrian Safety Improvement          | Medium   |
|  Transportation Demand Management (TDM) | Low      |
|  Pedestrian Access                      | High     |
|  Bicycle Access                         | High     |
|  Transit Access                         | Medium   |

The Mine Road corridor was selected as a Project Pipeline study location due to the presence of overlapping VTrans needs. The project team took the following steps to confirm and evaluate the VTrans needs identified in the study area:

- Reviewed the Project Pipeline data dashboard to identify issues and transportation trends in the study area
- Conducted a field review of the study area to observe issues and document existing conditions
- Collected traffic counts at the study area intersections and travel time runs along the study corridor.
- Reviewed relevant studies and plans near the study area to inform the alternative development
- Conducted detailed existing conditions and No-Build conditions traffic operational analyses using Synchro and SimTraffic
- Assessed existing transit service, multimodal infrastructure, and the suitability for additional transit service within the study area

## 1.5 High-Level Needs Evaluation

Data dashboards were developed by OIPI and VDOT to centralize data collection and leverage big data sources to streamline VTrans needs and problem diagnosis across all Project Pipeline studies as well as to expand on the core issues and patterns identified in the study's framework document.

The data dashboards contained performance measures including VDOT crash data, travel time index data, level of travel time reliability (LOTTR) data, and speed data for each study area. The results of this analysis are summarized in the Needs and Existing Conditions Summary, which can be found in **Appendix B**.

The study team reviewed the dashboard performance measures in addition to other sources to validate the presence of VTrans needs and identify the most effective improvements in the study area.

### 1.5.1. Operations and Access Needs

The study area currently does not have any Congestion Mitigation VTrans need. However, the study team assessed the current traffic operations at a high level to further understand the corridor needs. The greatest impact to Travel Time Index (TTI) happens during the PM peak period, between 3:00 PM –6:00 PM, where northbound traffic typically experiences longer average travel times and lower average speeds. Since Mine Road is classified as a major collector, corridor congestion is largely driven by demand for I-95 access. The congestion is primarily concentrated around the Garrisonville Road intersection, extending approximately one to two intersections to the north and south. **Figure 5** includes additional details from the operations needs diagnosis.



**Figure 5: High-Level Operations Needs Summary**

The study area has High Bicycle Access and High Pedestrian Access VTrans needs due to its proximity to activity areas including residential and businesses along Mine Road and Garrisonville Road. Currently, there is a discontinuity in pedestrian infrastructure on Mine Road between Greenspring Drive and Highpointe Boulevard. There are also no pedestrian facilities on the east side of Mine Road between Highpointe Boulevard and Cathedral Lane. Existing facilities, where present, exhibit deficiencies in Americans with Disabilities Act (ADA) and Public Right-of-Way Accessibility Guidelines (PROWAG) compliance, mainly with non-directional or outdated curb ramps. The gaps in the existing pedestrian and bicycle transportation infrastructure are shown in **Figure 6**.



**Figure 6: Existing Pedestrian Facilities**

The study team reviewed Replica data to assess the bicycle and pedestrian trips to verify the access needs for the corridor. The Replica data referenced is aggregated from data on a typical spring Thursday in 2024 and encompasses pedestrian patterns including trips, destinations, and points of interest. This analysis revealed a high volume of pedestrian activity between Settlers Way and Midpoint Lane, extending through the Midpoint Lane Park and Ride lot. These observed travel patterns provided insight into pedestrian demand and informed prioritization for further analysis. **Figure 7** and **Figure 8** show additional details regarding Pedestrian Needs and Bicycle Needs in the study area.

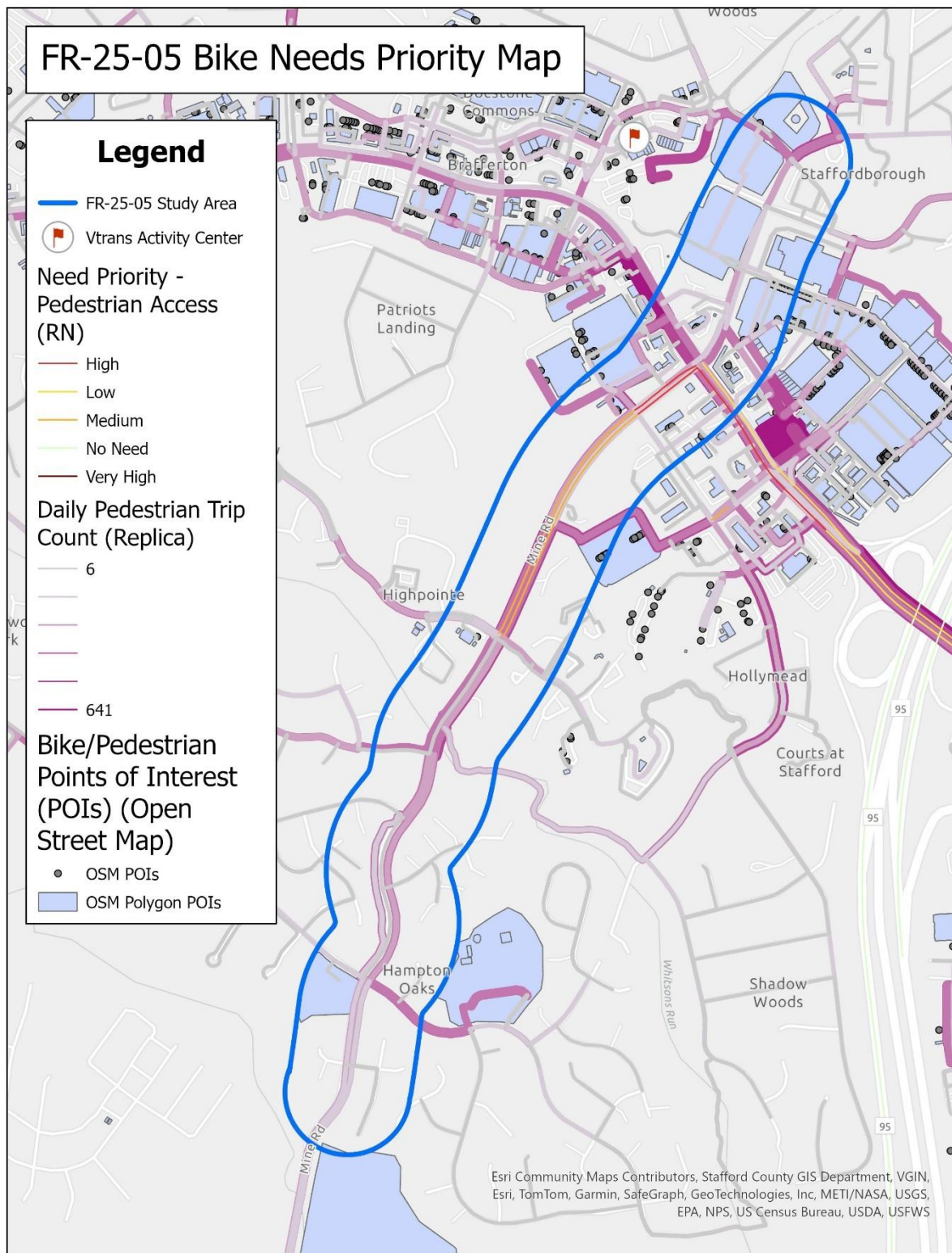


**Figure 7: High-Level Pedestrian Needs Summary**

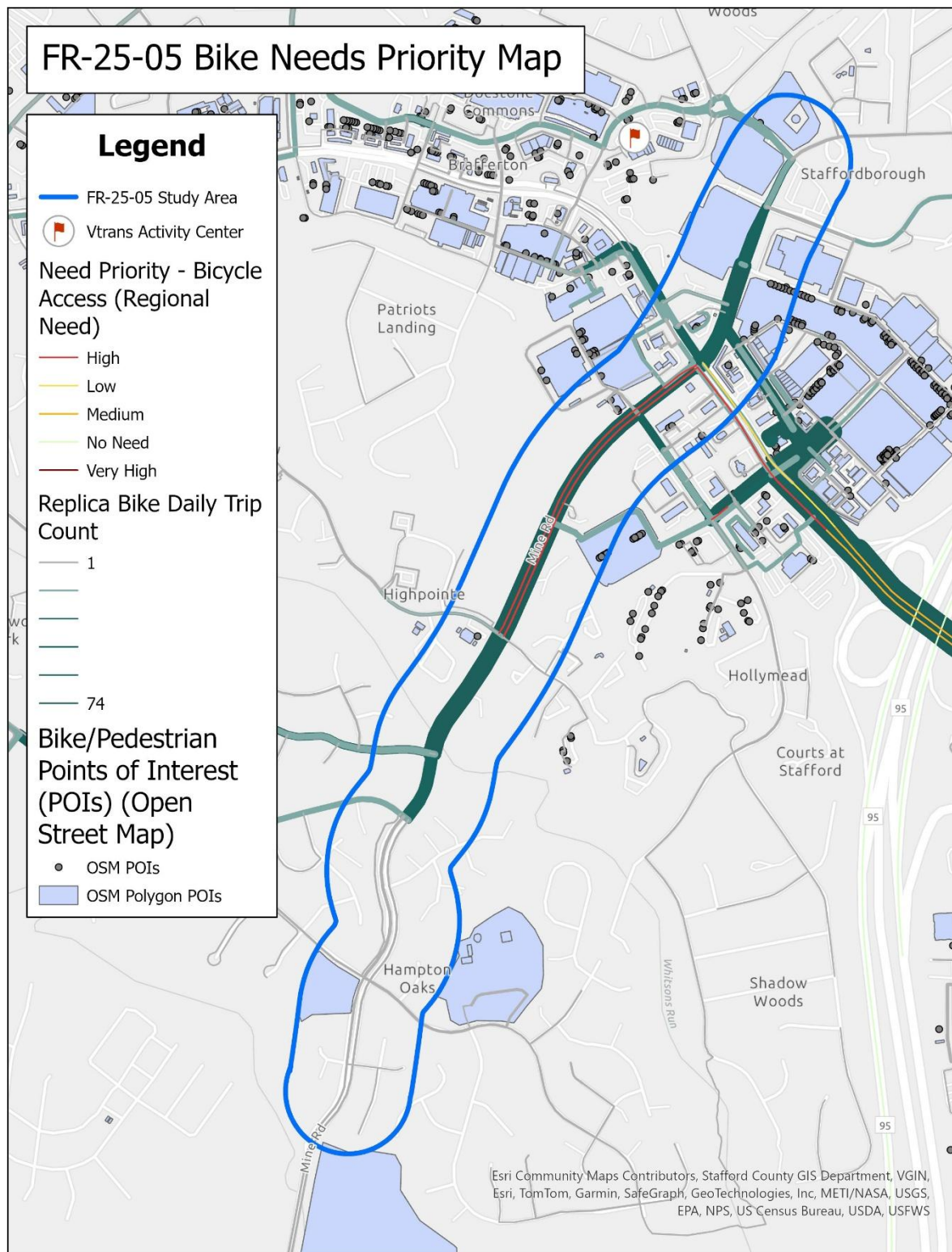


**Figure 8: High-Level Bicycle Needs Summary**

Mine Road has been identified for multimodal improvements in several planning documents. While capacity needs are limited to Garrisonville Road, multiple plans reflect the multimodal needs, both current and long-term, along Mine Road. Information from the following studies, plans, and projects was collected and reviewed to identify previous or ongoing recommendation in and adjacent to the study area:

- The Stafford County Transportation Master Plan
  - Includes recommendations for near-term sidewalk projects like crosswalk and sidewalk improvements:
    - Highpointe Boulevard/N Vine Place
    - Garrisonville Road
    - Juggins Road Connector
    - Greenspring Drive
- The FAMPO 2050 Active Transportation plan
  - Includes recommendations for a shared-use path:
    - Along Mine Road between Garrisonville Road and Austin Ridge Drive
    - Along Juggins Road Connector
    - Along Staffordboro Boulevard between Juggins Road Connector and Garrisonville Road
  - Includes recommendations for a sidewalk:
    - On Salisbury Drive Connecting the Midpoint Lane Park and Ride to Garrisonville Road
    - Along Woodstream Boulevard leading to the Commuter Lot on Staffordboro Boulevard.
- Garrisonville Road Service District Multimodal Study
  - Recommends pedestrian improvements from Garrisonville Road to Northampton Boulevard along Mine Road
  - Intersection enhancements at:
    - Highpointe Boulevard/N Vine Place
    - Garrisonville Road
    - Greenspring Drive

Anticipated developments such as The Garrison and The Hampton Run are expected to generate additional traffic demand across the network, which may exacerbate existing congestion along Garrisonville Road, despite the absence of current congestion along the remainder of the Mine Road.

There is a demonstrated need for improved pedestrian and bicycle connectivity across Mine Road, as current infrastructure does not adequately support non-motorized travel demand in the area.

## 1.5.2. Safety and Reliability Needs

The study area has Medium Statewide Safety Improvement and Medium Pedestrian Safety Improvement VTrans needs. The study team reviewed the VDOT crash data from 2020-2024 to identify high-level crash trends in the study corridor.

In total, 222 crashes were reported in the study area including one fatality, 40 injury crashes, and 181 crashes involving property damage only (PDO). Most crashes in the study area were either angle (49%) or

rear-end (29%) crashes. **Figure 9** shows the geographic distribution and frequency of crashes in the study area.

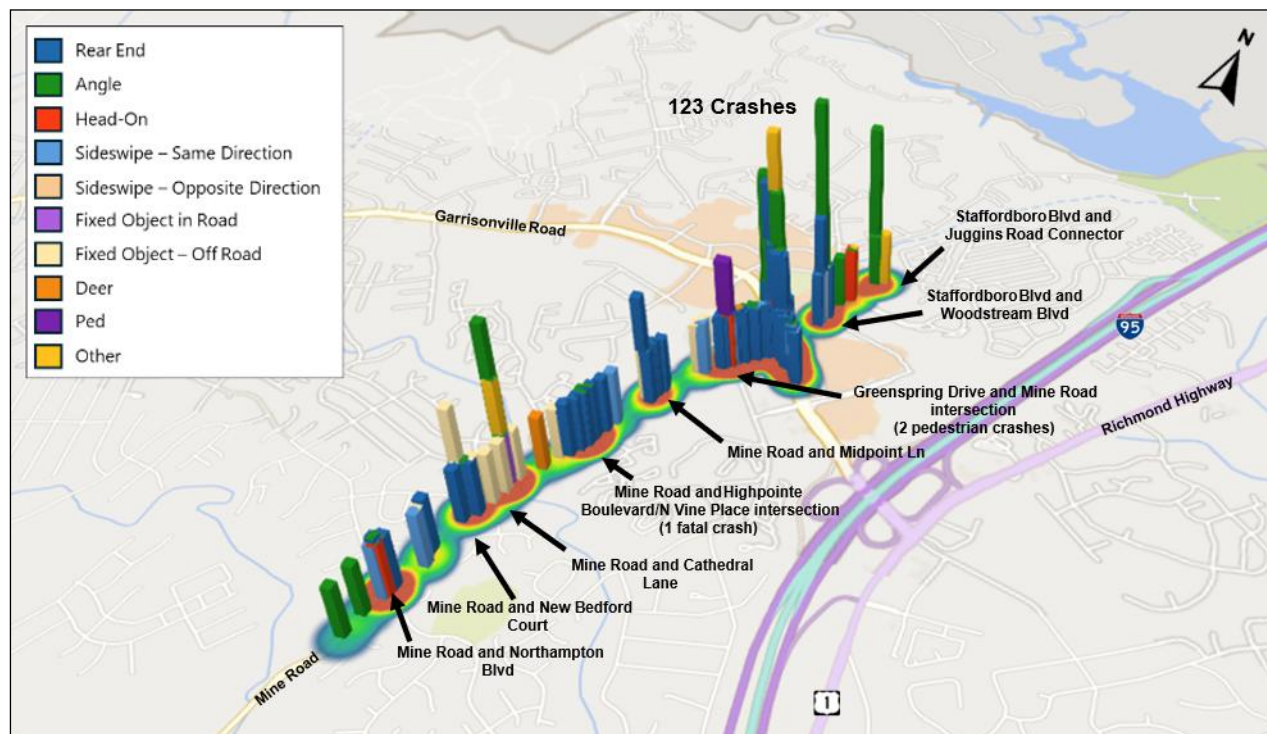


**Figure 9: High-Level Safety Needs Summary (2020-2024)**

Mine Road and Garrisonville Road within the study area are VDOT Pedestrian and Bicycle Safety Action Plan (PBSAP) priority segments and are in the statewide top 5% of segments. Woodstream Boulevard is in the statewide top 1% of segments. There are several segments within the study listed in the VDOT 2019-2023 Potential Safety Improvement (PSI) top 100 segments. These are listed in **Table 3** and shown in **Figure 10**.

**Table 3: Study Area VDOT 2019-2023 PSI Top 100 Segments**

| Corridor               | Location                                 | PSI Ranking<br>(District Rank) |
|------------------------|------------------------------------------|--------------------------------|
| Staffordboro Boulevard | North of Garrisonville Road              | #76                            |
| Mine Road              | South of Garrisonville Road              | #68                            |
| Garrisonville Road     | West of Mine Road/Staffordboro Boulevard | #33                            |
| Garrisonville Road     | East of Mine Road/Staffordboro Boulevard | #17                            |

These PSI rankings reflect crash rates (crashes per 100 million Vehicle Miles Traveled) of 162.35 (#76), 113.37 (#68), 102.23 (#33), and 130.85 (#17). These rates are significantly higher than the

Fredericksburg District crash rate from 2019 to 2023 of 101.67 for rural Minor Arterials. The statewide crash rate for rural Minor Arterials from 2019 to 2023 was 127.99.

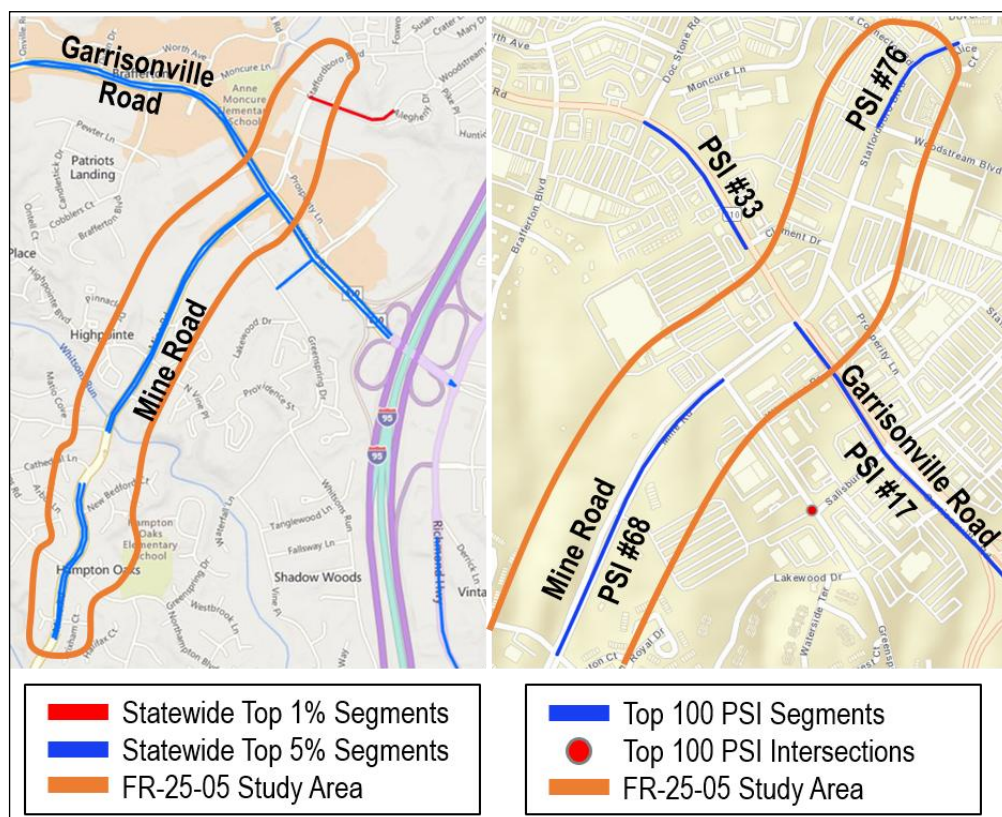


**Figure 10: VDOT PBSAP and PSI Segments**

The study area did not include a Reliability VTrans need, which is measured by variability in travel time along a corridor and impacted by factors such as incidents, weather, construction, and changes in demand.

### 1.5.3. Transit and Transportation Demand Management Needs

The study area is identified as having a Medium Transit Access VTrans need along the corridor. FXBGO! routes D3 and D4 currently service the general study area while OmniRide services the Staffordboro Boulevard Commuter Lot just south of Juggins Road Connector with commuter route services to the Pentagon and Washington D.C. (L'Enfant Plaza). These routes are listed in **Table 4** with average monthly ridership from March to April 2025. The Staffordboro Commuter Lot has 1,863 parking spaces and was approximately 69% full during this time. An additional Park and Ride lot is located on Midpoint Lane but does not have transit service and appears to be underutilized.

**Table 4: OmniRide Ridership Spring 2025**

| Route | Destination                | Average Ridership/Month |
|-------|----------------------------|-------------------------|
| 942   | Pentagon                   | 8,670                   |
| 943   | Washington D.C. (L'Enfant) | 6,686                   |

Based on the existing FXBGO! routes, gaps in the existing transit network, particularly south of Northampton Boulevard, were noted, as shown in the mapped quarter-mile walksheds in **Figure 12**.

According to the 2024 Transit Strategic Plan for the area, Route D4 is planned to be redeveloped to serve the southern portion of Mine Road starting in the fall 2025, as shown in **Figure 11**. Currently there are no transit stops along Mine Road south of Midpoint Lane. However, there is one near the intersection of Northampton Boulevard and Mine Road. All stops along the FXBGO! route on Mine Road lack amenities such as benches or shelters for riders. In addition to formalized transit to and from Stafford County, “slugging” is another popular method for commuters. Sluggers are commuters who take part in an informal carpool system that allows drivers to take HOV lanes to decrease travel time and save money for all commuters. Signs for sluggers traveling to the Pentagon and to Washington, D.C. are present in the Midpoint Lane and Staffordboro Commuter Lots.

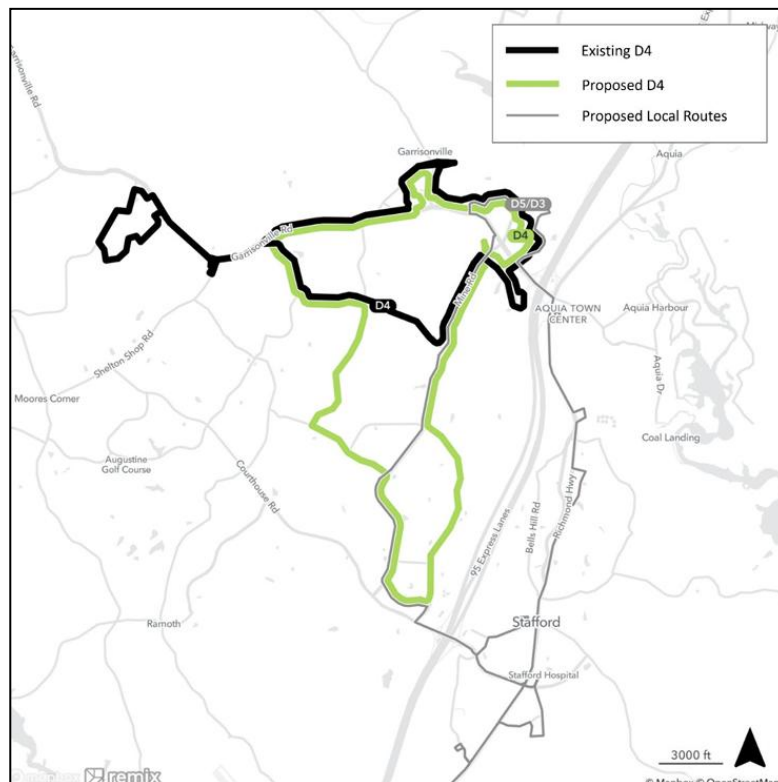


**Figure 11: Existing and Proposed FXBGO! Route D4**

The study area was noted to have a Low Transportation Demand Management (TDM) VTrans need which supports additional non-single occupancy modes of travel such as transit, vanpooling, or rail or reducing the need for peak hour trips by adjusting work schedules or encouraging remote work.

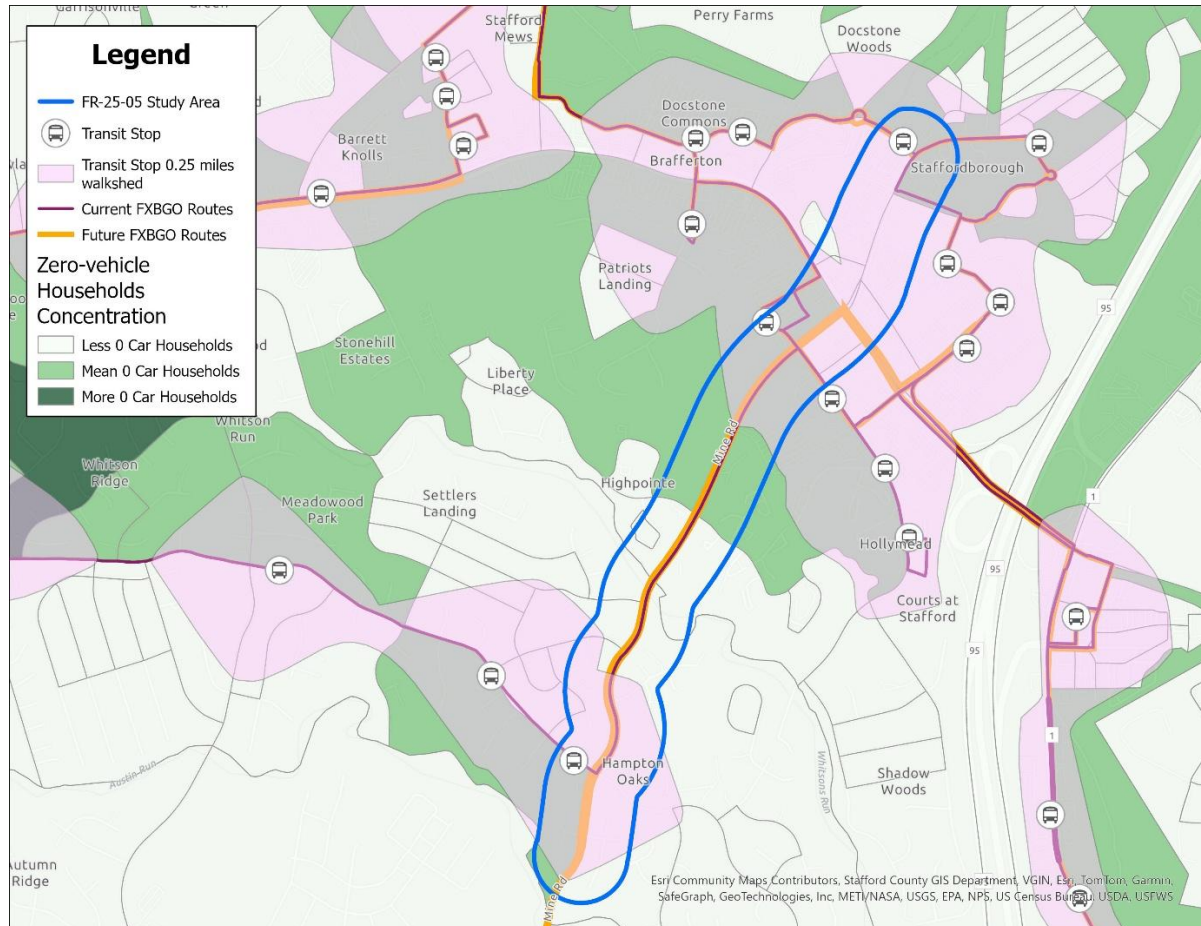


**Figure 12: High-Level Transit Access Needs Diagnosis Summary**

### 1.5.4. Environmental Considerations

A high-level review of existing environmental conditions was completed to better understand the existing environment, potential impacts of the project to resources within the study area, and future actions that may need to be taken to comply with state and federal environmental review regulations. The environmental resources discussed in this report are within the proposed project's study area.

A desktop review using readily available Geographic Information System (GIS) data, online environmental resource maps, census data, and other relevant information was referenced to identify existing socioeconomic and environmental conditions within the project study area. The methods utilized to complete this review were drawn from national, statewide, and local sources. Data was gathered to identify resources pertaining to the natural and human environment consistent with the resource categories included in the VDOT Categorical Exclusion checklist (EQ-104). The Virginia Department of Environmental Quality (DEQ) [EJScreen+ tool](#) is an enhanced environmental justice screening and mapping tool and was used to gather information on environmental and demographic indicators.

A summary of the environmental resources that were considered and the source for the data used to evaluate the existing conditions and potential impacts are summarized in **Table 5**. For this study, community services were defined as publicly accessible facilities used to provide services to the public or as gathering spaces for organizations. These may include public education, welfare, emergency services, postal office, libraries, social work, food banks, health care, police, fire services, public transportation, and public housing.

The limits of the environmental resources review were developed by implementing a buffer from the identified roadways and interchanges that were being evaluated for improvements, as well as initial improvement concepts being developed. The width of the buffer varied based on the anticipated improvements or level of impacts in that area from 100 to 500 feet. Therefore, the limits of the environmental resources review conservatively captured an inventory of known environmental resources. As part of this review, it was assumed that the entire study area may experience some level of disturbance. However, avoidance and minimization measures would be applied throughout project development, resulting in reduced impacts as the project progresses. The resources identified in the study areas are also shown in **Figure 13**.

**Table 5: Existing Environmental Conditions Summary**

| Environmental Resource             | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Source                                                                                                                                                   | Existing Resources in Study Area                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Environmental Justice</b>       | Identifying communities of color and low-income communities adjacent to the project corridor, as defined by the Virginia Department of Environmental Quality. A low-income community has 30% or more of the population under the Department of Housing and Urban Development (HUD) 80% adjusted median income (AMI) and under two times the federal poverty level as defined by the American Community Survey. A community of color has a population with a higher percent of people of color as compared to the statewide average. | Virginia DEQ<br>EJScreen+                                                                                                                                | Within the study area, all three Census Tracts are noted as having communities of color (54% to 81% of the population). Two Block Groups with a low-income community (49% and 50% below HUD 80% AMI and 44% and 33% below two times the poverty level), generally located north of Settlers Way, were also identified within the study area. Transit routes through FXBGO! are present within the study area and within these Block Group areas to connect communities with commercial areas. As shown in <b>Figure 12</b> , a gap in transit access is present between Northampton Boulevard and Midpoint Lane, but there is good transit coverage throughout the rest of the study area. |
| <b>Limited English Proficiency</b> | Populations who speak English less than very well within the Census Tract where the study area is located                                                                                                                                                                                                                                                                                                                                                                                                                           | US Census Bureau<br>People That Speak English Less Than "Very Well" in the United States                                                                 | A total of 5% to 21% of the population within the Census Tract where the study area is located are considered LEP. Information regarding the specific languages spoken other than English was not available. Translation of engagement materials to other languages should be considered during future public engagement.                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Recreational Facilities</b>     | Places available for recreational or communal use, such as a YMCA or community parks.                                                                                                                                                                                                                                                                                                                                                                                                                                               | Virginia Department of Conservation<br>Recreation (VDCR)<br>Natural Heritage Data Explorer (NHDE)<br>VDCR Virginia Outdoor Plan Mapper<br>Aerial Imagery | A community center is located on the southwest corner of Mine Road and Northampton Boulevard near the southern terminus of the project within the study area. A playground is located just outside the study area at the corner of Highpointe Boulevard and Knollwood Court. The Austin Run Mine Ruins are located across from Settlers Way on the east side of Mine Road.                                                                                                                                                                                                                                                                                                                 |

| Environmental Resource            | Description                                                                                                                                                                                                                                                                                                                                      | Source                                                                                                                                                 | Existing Resources in Study Area                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                   |                                                                                                                                                                                                                                                                                                                                                  | Google Maps                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Community Services</b>         | Places available to the public such as hospitals, schools, and churches.                                                                                                                                                                                                                                                                         | Aerial Imagery<br>Virginia Geographic Information Network (VGIN)<br>Stafford County GIS Data<br>Google Maps                                            | The Hampton Oaks Elementary School is located to the southeast of the study area off of Northampton Boulevard. The Goddard School of Stafford is located on the southwest corner of Mine Road and Highpointe Boulevard. Several places of worship are in the surrounding vicinity of the study area. A managed trail is present along Mine Road toward the southern terminus of the study area. |
| <b>Bike/Pedestrian Facilities</b> | Existing sidewalks, bike paths, and trails.                                                                                                                                                                                                                                                                                                      | Stafford County GIS Data<br>Aerial Imagery<br>Google Maps<br>VDCR Virginia Outdoor Plan Mapper                                                         | Pedestrian facilities are present within a majority of the study area. Bike facilities are not present within the study area.                                                                                                                                                                                                                                                                   |
| <b>Section 6(f)</b>               | Sites funded through the Land and Water Conservation Fund (LWCF) and owned by state or local entities.                                                                                                                                                                                                                                           | VDCR Virginia Outdoor Plan Mapper<br>VDCR Conservation Lands                                                                                           | No Section 6(f) sites were identified within the study area or in the surrounding vicinity.                                                                                                                                                                                                                                                                                                     |
| <b>Section 106* Resources</b>     | Known historic architectural or archaeological sites within or immediately adjacent to the project corridor including sites that are listed or eligible for listing on the National Register of Historic Places (NRHP) and sites that have not been evaluated are potentially eligible, or any other status as noted on the VDHR V-CRIS website. | Virginia Department of Historic Resources (VDHR) Virginia Cultural Resource Information System (V-CRIS)<br>National Register of Historic Places (NRHP) | No known listed or eligible historic resources were identified within the study area.                                                                                                                                                                                                                                                                                                           |

| Environmental Resource   | Description                                                                                                                                                                                               | Source                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Existing Resources in Study Area                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Section 4(f)*</b>     | Publicly owned parks or recreation lands, wildlife and waterfowl refuges, and privately and publicly owned historic sites protected by Section 4(f) of the U.S. Department of Transportation Act of 1966. | VDCR NHDE<br>VDCR Virginia Outdoor Plan Mapper<br>VDHR V-CRIS<br>Stafford County GIS Data                                                                                                                                                                                                                                                                                                                                                                                 | No publicly owned parks or recreation lands, wildlife and waterfowl refuges, or privately and publicly owned historic sites are located within the study area or the surrounding vicinity.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Protected Species</b> | Threatened and endangered species, as defined by the state and federal government databases, existing within or near the project corridor.                                                                | United States Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPAC)<br>Virginia Department of Wildlife Resource (VDWR) Virginia Fish and Wildlife Information Services (VaFWIS)<br><a href="#">VDWR Bat Consultation Tool</a><br><a href="#">Northern Long-Eared Bat [NLEB], Tri-Colored Bat, and Little Brown Bat</a><br>VDWR Wildlife Environmental Review Map Service (WERMS)<br>Center for Conservation Biology (CCB) Eagle Nest Locator | <b><u>USFWS</u></b><br>No critical habitats are located within the study area. Bald and/or golden eagles were not noted in the study area.<br><b><u>VDWR Databases</u></b><br><u>VDWR VaFWIS</u> - Dwarf Wedgemussel are listed as federal endangered and state endangered. Site observations were identified within ¼ mile, 1-mile, and 2-mile search of the study area.<br><u>VDWR WERMS</u> - No threatened or endangered wildlife were identified within the study area.<br><u>VDWR Bat Consultation Tool</u> - The study area is within the consultation range of the NLEB and tri-colored bat but outside the year-round presence zone, capture area, and hibernacula regulatory buffer for all three bats<br><u>USFWS ICaP</u> - NLEB and PESU may occur within the study area and surrounding vicinity.<br><b><u>CCB</u></b> - No nests were identified within the study area. |

| Environmental Resource                                                            | Description                                                                                                                                                                                                            | Source                                                                                                              | Existing Resources in Study Area                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Floodplains</b>                                                                | Areas considered at risk for flooding during 100-year and 500-year storms.                                                                                                                                             | Federal Emergency Management Agency (FEMA) Flood Hazard Areas                                                       | Portions of the study area and surrounding areas are located in Floodway or 500-Year Floodplain areas                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Surface Water &amp; Wetlands</b>                                               | Review of National Hydrography Dataset (NHD) and National Wetland Inventory (NWI) to determine the likelihood of streams and wetlands present within and immediately adjacent to the project corridor.                 | United States Geological Survey (USGS) National Hydrography Dataset (NHD)<br>USFWS National Wetland Inventory (NWI) | Multiple wetlands are scattered within and around the study area.<br><br>One pond is located to the east of the study area near the Lakewood Apartments.<br><br>Whitson Run is located near the middle of the study area and runs through the study area.<br><br>VDOT noted that Culvert 089-0684-6080-25237 (Austin Run tributary) is a concrete pipe in fair condition with multiple joint openings which need multiple concrete repairs.<br><br>Portions of the study area and surrounding vicinity are located within the Chesapeake Bay Preservation Area. |
| <b>Hazardous Materials</b>                                                        | Any documented spills, releases, or history of contamination on surrounding sites that may be impacted by the proposed project.                                                                                        | Virginia Department of Environmental Quality (DEQ) Environmental Data Mapper                                        | Multiple registered petroleum tank facilities and closed petroleum release cases are located within and directly outside the study area.                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Open Space, Conservations Easements, Agricultural, and Forestral Districts</b> | Lands protected by a voluntary agreement with a non-profit land trust or government agency that allows a landowner to limit the type or amount of development on the property. Agricultural and forestal districts are | VDCR NHDE<br>VDCR Outdoors Plan Mapper<br>Stafford County GIS Data<br>The Virginia Outdoor Foundation               | Forested areas are scattered within and around the study area in all directions.<br><br>No conservation easements or agricultural districts were located within the study area or in the surrounding vicinity.                                                                                                                                                                                                                                                                                                                                                  |

| Environmental Resource | Description                                                                                     | Source                                                                                                | Existing Resources in Study Area                                                                                                                                                                                                                                          |
|------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                        | those defined as such in the zoning map.                                                        | The Nature Conservancy                                                                                |                                                                                                                                                                                                                                                                           |
| <b>Farmland</b>        | Lands with soils that are considered prime farmland and outside a census-designated urban area. | United States Census Bureau Urban Area Maps<br>Natural Resources Conservation Service Web Soil Survey | A small portion of prime farmland is located throughout the study area. The remainder of the study area is not prime farmland. The entire study area is located within a census designated urban area and is therefore not subject to the Farmland Protection Policy Act. |
| <b>Land Use</b>        | Land Area that has been given a specific use based on local jurisdiction land use designations. | Stafford County GIS Data                                                                              | The study area is primarily classified as residential with commercial areas at the northern terminus of the project.                                                                                                                                                      |

*\*Assessment based on the currently listed, determined eligible, or recommended eligible for the NRHP properties pending potential further investigations for recommendations not yet confirmed by VDHR or for individual sites not yet evaluated.*

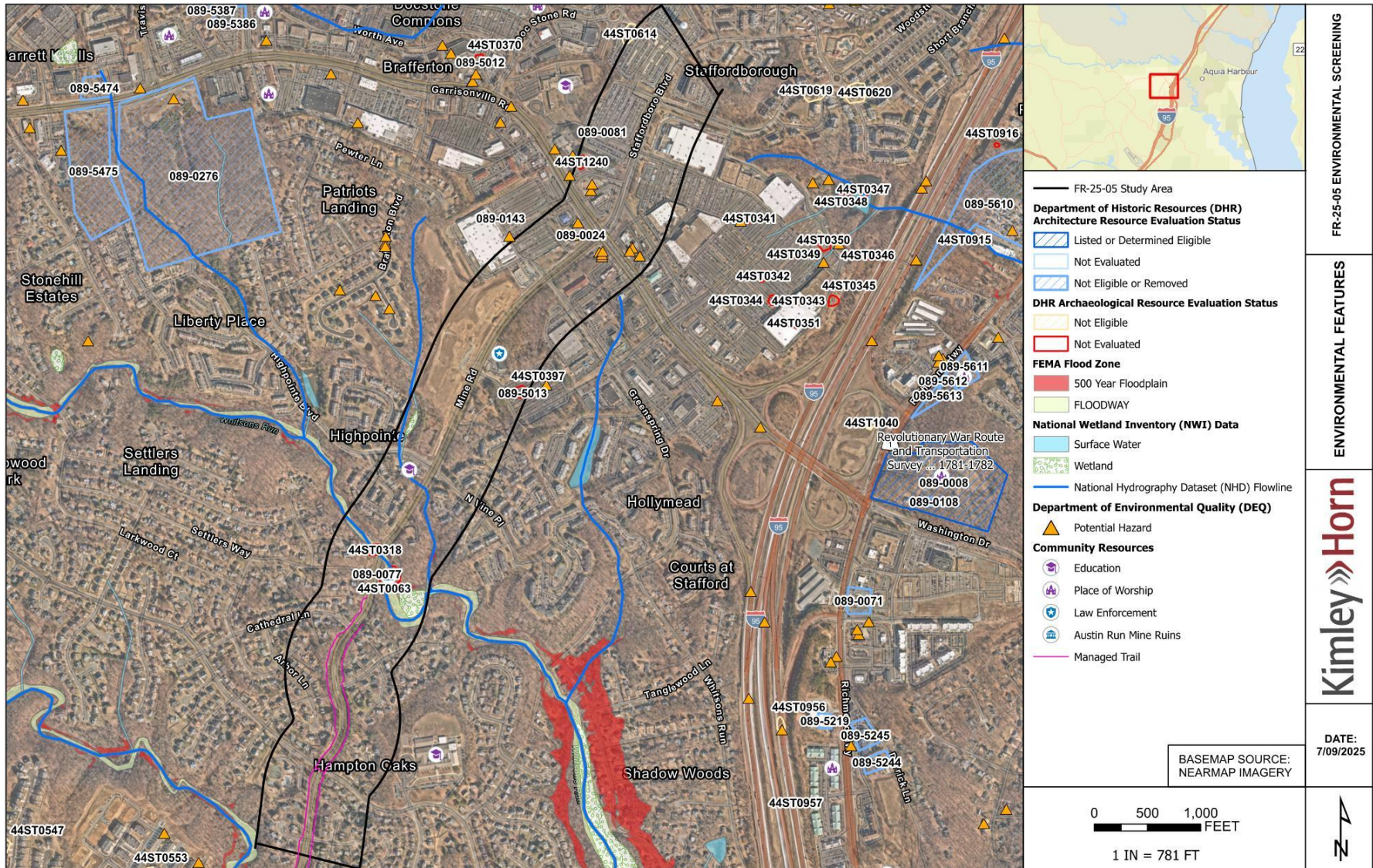


**Figure 13: Existing Environmental Conditions Map**

## 1.6 Detailed Needs Validation

The study team performed additional traffic operations and safety analysis to further quantify the existing and anticipated needs within the study area. Results from these analyses were used as a baseline when comparing the conditions of the proposed improvements to the existing and anticipated No-Build conditions.

### 1.6.1. Existing Conditions Traffic Operations and Safety Analysis

The study team conducted a multifaceted analysis of the existing conditions of the study corridor, which included reviewing previous studies, conducting a safety analysis, conducting a preliminary field review, analyzing traffic operations using Synchro and SimTraffic, and reviewing of pedestrian, bicycle, and transit activity. Preliminary Synchro results of the existing conditions analysis and preliminary brainstorming concepts were presented to the SWG on July 28, 2025. The presentation is provided for reference in **Appendix C**.

#### Relevant Studies, Plans, and Projects

Information for the following studies, plans, and projects was collected and reviewed to identify previous or ongoing recommendations in and adjacent to the study area:

- Stafford County Comprehensive Plan 2016-2036 (2021 5-Year Update)
  - Extension of Mine Road from Courthouse Road to Ramoth Church Road
  - Extension of Mine Road from Centreport Parkway to Enon Road
  - Upgrade Mine Road to a four-lane major collector standard
- Stafford County Transportation Master Plan (Approved November 2024)
  - Multiple sidewalk projects along Mine Road (near-term)
  - Previously mentioned Mine Road extension (long-term)
- FAMPO 2050 Active Transportation Plan – Fredericksburg, Spotsylvania, and Stafford (Adopted March 2022)
  - Shared-use paths on the existing Mine Road
  - Mine Road extension
- Garrisonville Road Service District Multimodal Study (July 2024)
  - Pedestrian improvements along Mine Road and at Mine Road's intersections with Highpointe Boulevard/N Vine Place, Garrisonville Road, and Greenspring Drive
- FXBGO! Transit Strategic Plan (June 2024)
  - Realigned Route D4 to extend service further south along the existing Mine Road Corridor

#### Safety Analysis

A safety analysis was conducted using crash data from the VDOT Crash Database over a five-year period (January 1, 2020 – December 31, 2024). In total, 222 crashes were reported in the study area, including one fatality. Summaries of crashes in the study area by severity and type are shown in **Table 6** and **Table 7**, respectively. **Appendix C** includes a detailed crash summary for the study area, by intersection.

Crash severity is coded using the KABCO scale, which is defined using the following classifications:

- K—Fatality
- A—Suspected Serious Injury
- B—Suspected Minor Injury
- C—Possible Injury
- PDO—Property Damage Only

The intersection with the highest number of crashes (123) was Mine Road/Staffordboro Boulevard and Garrisonville Road. Common issues included failure to yield during turning movements—particularly during right turns on red and U-turns—along with red-light running, rear-end collisions due to following too closely, and improper merges or lane changes.

The study team identified Mine Road and Greenspring Drive as a hot spot with 24 crashes between 2020 and 2024. About 38% of those crashes were angle crashes, many of which included left turns to merge onto Mine Road. Several incidents were linked to red-light running and signal confusion. Two pedestrian crashes were also reported at this intersection. One involved a pedestrian struck while attempting to cross mid-block. The other involved two pedestrians walking against traffic in the absence of sidewalks; both were hit by a speeding vehicle.

The intersection of Highpointe Boulevard/N Vine Place and Mine Road was another location with notable safety concerns. Although there were only 12 total crashes at this intersection, one of the crashes was fatal. This angle crash involved northbound traffic failing to yield to southbound traffic while attempting to make a left turn. The driver who was struck was riding a motorcycle. 75% of the crashes in this intersection resulted in property damage and 50% were rear end collisions.

**Table 6: Study Area Crashes by Crash Severity**

| Intersection                                                     | # of Crashes—K | # of Crashes—A | # of Crashes—B | # of Crashes—C | # of Crashes—PDO | Total |
|------------------------------------------------------------------|----------------|----------------|----------------|----------------|------------------|-------|
| Staffordboro Boulevard and Juggins Road Connector                | 0              | 1              | 2              | 0              | 7                | 10    |
| Staffordboro Boulevard and Woodstream Boulevard                  | 0              | 0              | 1              | 0              | 2                | 3     |
| Staffordboro Boulevard and Stafford Market Place/Elementary Lane | 0              | 1              | 1              | 0              | 8                | 10    |
| Staffordboro Boulevard and Prosperity Lane                       | 0              | 0              | 0              | 0              | 0                | 0     |
| Mine Road/Staffordboro Boulevard and Garrisonville Road          | 0              | 3              | 12             | 2              | 106              | 123   |
| Mine Road and Greenspring Drive                                  | 0              | 2              | 3              | 0              | 19               | 24    |
| Mine Road and Midpoint Lane                                      | 0              | 0              | 2              | 0              | 3                | 5     |

| Intersection                                        | # of Crashes—K  | # of Crashes—A | # of Crashes—B  | # of Crashes—C | # of Crashes—PDO   | Total      |
|-----------------------------------------------------|-----------------|----------------|-----------------|----------------|--------------------|------------|
| Mine Road and Highpointe Boulevard/<br>N Pine Place | 1               | 0              | 2               | 0              | 9                  | 12         |
| Mine Road and Settlers Way                          | 0               | 1              | 3               | 0              | 10                 | 14         |
| Mine Road and Cathedral Lane                        | 0               | 1              | 1               | 0              | 5                  | 7          |
| Mine Road and New Bedford Court                     | 0               | 0              | 1               | 0              | 0                  | 1          |
| Mine Road and Northampton Boulevard                 | 0               | 0              | 1               | 0              | 11                 | 12         |
| Mine Road and Exeter Lane                           | 0               | 0              | 0               | 0              | 1                  | 1          |
| <b>Total</b>                                        | <b>1 (0.5%)</b> | <b>9 (4%)</b>  | <b>29 (13%)</b> | <b>2 (1%)</b>  | <b>181 (81.5%)</b> | <b>222</b> |

**Table 7: Study Area Crashes by Crash Type**

| Intersection                                                     | # of Crashes – Angle | # of Crashes – Rear End | # of Crashes – Head-On | # of Crashes – Fixed Object | # of Crashes – Side-swipe | # of Crashes – Pedestrian | # of Crashes – Other | # of Crashes – Total |
|------------------------------------------------------------------|----------------------|-------------------------|------------------------|-----------------------------|---------------------------|---------------------------|----------------------|----------------------|
| Staffordboro Boulevard and Juggins Road Connector                | 9                    | 0                       | 0                      | 0                           | 0                         | 0                         | 1                    | 10                   |
| Staffordboro Boulevard and Woodstream Boulevard                  | 1                    | 0                       | 1                      | 0                           | 0                         | 0                         | 1                    | 3                    |
| Staffordboro Boulevard and Stafford Market Place/Elementary Lane | 6                    | 2                       | 0                      | 0                           | 1                         | 0                         | 1                    | 10                   |
| Staffordboro Boulevard and Prosperity Lane                       | 0                    | 0                       | 0                      | 0                           | 0                         | 0                         | 0                    | 0                    |
| Mine Road/Staffordboro Boulevard and Garrisonville Road          | 57                   | 43                      | 3                      | 0                           | 18                        | 0                         | 2                    | 123                  |
| Mine Road and Greenspring Drive                                  | 12                   | 5                       | 1                      | 0                           | 2                         | 2                         | 4                    | 24                   |
| Mine Road and Midpoint Lane                                      | 1                    | 4                       | 0                      | 0                           | 0                         | 0                         | 0                    | 5                    |
| Mine Road and Highpointe Boulevard/ N Pine Place                 | 5                    | 6                       | 0                      | 0                           | 0                         | 0                         | 1                    | 12                   |
| Mine Road and Settlers Way                                       | 10                   | 0                       | 0                      | 1                           | 0                         | 0                         | 3                    | 14                   |
| Mine Road and Cathedral Lane                                     | 1                    | 2                       | 0                      | 0                           | 0                         | 0                         | 4                    | 7                    |
| Mine Road and New Bedford Court                                  | 0                    | 1                       | 0                      | 0                           | 0                         | 0                         | 0                    | 1                    |
| Mine Road and Northampton Boulevard                              | 6                    | 2                       | 1                      | 0                           | 2                         | 0                         | 1                    | 12                   |
| Mine Road and Exeter Lane                                        | 1                    | 0                       | 0                      | 0                           | 0                         | 0                         | 0                    | 1                    |
| <b>Total</b>                                                     | <b>109 (49%)</b>     | <b>65 (29%)</b>         | <b>6 (3%)</b>          | <b>1 (0%)</b>               | <b>23 (10%)</b>           | <b>0 (0%)</b>             | <b>18 (8%)</b>       | <b>222</b>           |

All intersection and roadway segments within the VDOT linear referencing system (LRS) are evaluated annually for the potential for safety improvement (PSI) based on the Highway Safety Manual (HSM) methodology by VDOT. The crash frequency, severity of crashes, volume, and length of segment are contributing factors in the predicative analysis. Crash predictions, based on the safety performance function (SPF) crash data files, are made for intersection and segments. The top 100 intersections and 100 miles of segments are published by VDOT for each district on an annual basis. The PSI locations are displayed in **Figure 14**.

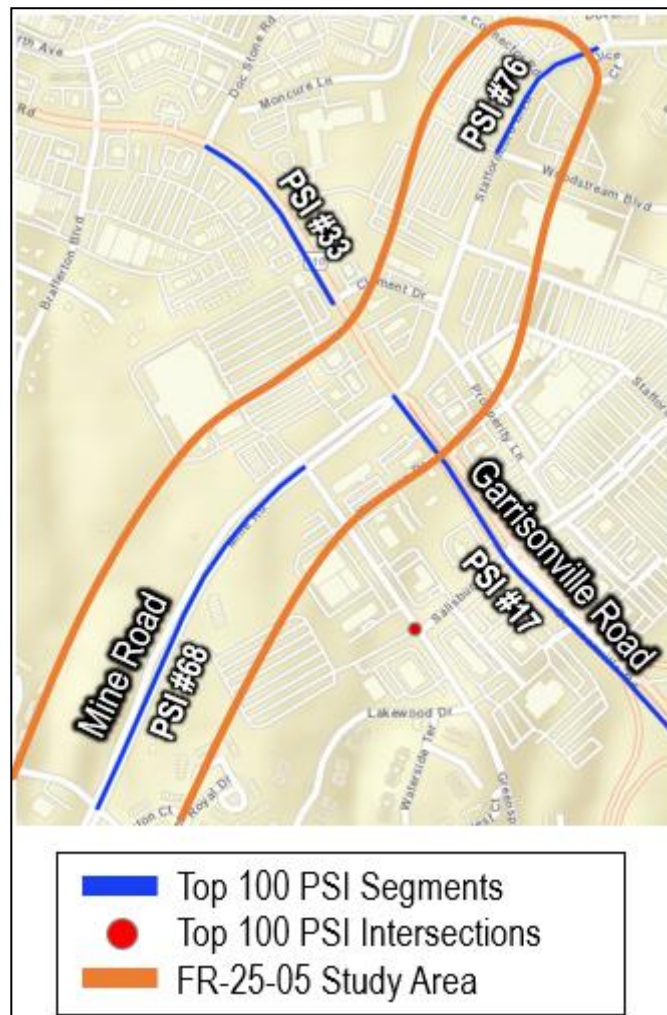


**Figure 14: VDOT PSI Segments and Intersections**

## Field Review Observations

A preliminary field review of the study area was conducted on Tuesday, April 8, 2025, to verify existing conditions, confirm traffic control devices and lane configurations, and observed peak hour traffic conditions and driver behavior. Travel time runs were conducted on Tuesday, April 8 and Wednesday April 9, 2025. The existing lane configurations and storage lengths in the study area are summarized in **Figure 15** and **Figure 16**.

The following observations were made along the Mine Road/Staffordboro Boulevard corridor during the field review:

#### **Staffordboro Boulevard and Juggins Connector Road**

- Poor sight distance turning left from westbound approach looking south
- Several school buses observed in northbound left and northbound through lanes (PM peak period)

#### **Staffordboro Boulevard and Woodstream Boulevard**

- Marked crosswalk on southbound approach
- NO U-TURN sign on westbound approach
- New pedestrian warning signs at crosswalk and in advance of both directions

#### **Staffordboro Boulevard and Stafford Market Place/Elementary Lane**

- Video detection at all approaches
- Intersection lighting present on all poles

#### **Staffordboro Boulevard and Prosperity Lane**

- No stop bar present on Prosperity Lane
- Right lane must turn right sign present

#### **Mine Road and Garrisonville Road**

- Eastbound queues extended back to Restaurant entrance past the Walmart Driveway (PM peak period)
- Eastbound queues mostly stack in center lanes (AM peak period)
- Eastbound U-turning drivers were observed yielding to southbound right turning drivers
- Pedestrian signal heads were observed as well as compliant detectable warning surfaces
- Westbound queues extended back to Chase Bank (AM and PM peak period)
- Higher through volume during PM peak period and higher left-turn volume during AM peak period on the westbound approach
- No pedestrian facilities across the westbound leg of the intersection
- Northbound queues extended back to Greenspring Road (PM peak period)
- Higher left-turn volume during the PM peak period and higher right-turn volume during the AM peak period on the northbound approach
- Southbound queues extended back to Stafford Market Place/Elementary Lane (PM peak period)
- Queues mostly stack in the left-most through lane (AM and PM peak period)
- The left turn queue often exceeds storage lengths (AM and PM peak period)

#### **Mine Road and Greenspring Road**

- Video detection present at all approaches
- No U-turn signs for northbound and southbound approaches
- East side of the intersection marked for construction

**Mine Road and Midpoint Lane**

- Pentagon and DC signs present for slug lanes
- Southeast corner flagged for future signal pole
- Video detection for northbound and southbound approaches and loop detector present for westbound left movement

**Mine Road and Highpointe Boulevard/N Vine Place**

- Video detection for northbound and southbound approaches
- Pedestrian facilities present on southeast and southwest corner of intersection

**Mine Road and Settlers Way**

- 35 mph advisory speed sign on the southbound leg
- Stop bar present on Settlers Way, no marked crosswalks
- Poor sight distance turning left from Settlers Way and looking south

**Mine Road and Cathedral Lane**

- No southbound right turns allowed from 3-6pm per existing sign to reduce cut through traffic
- 2-stage eastbound left turns observed from Cathedral Lane
- No stop bars or marked crosswalks

**Mine Road and New Bedford Court**

- Flashing 25 mph school zone sign present
- Poor sight distance turning left out of New Bedford Court
- Horizontal curves on northbound and southbound legs of the intersection
- School buses observed in the AM peak period

**Mine Road and Northampton Boulevard**

- Intersection lighting present on both mast arms
- Camera detection and ladder crosswalks present at all four approaches
- Steep grade on eastbound leg of intersection
- Horizontal curves on northbound and southbound legs of the intersection

**Mine Road and Exeter Lane**

- No stop bars or marked crosswalks present
- Flashing 25 mph school zone sign present
- Steep grade south of the intersection

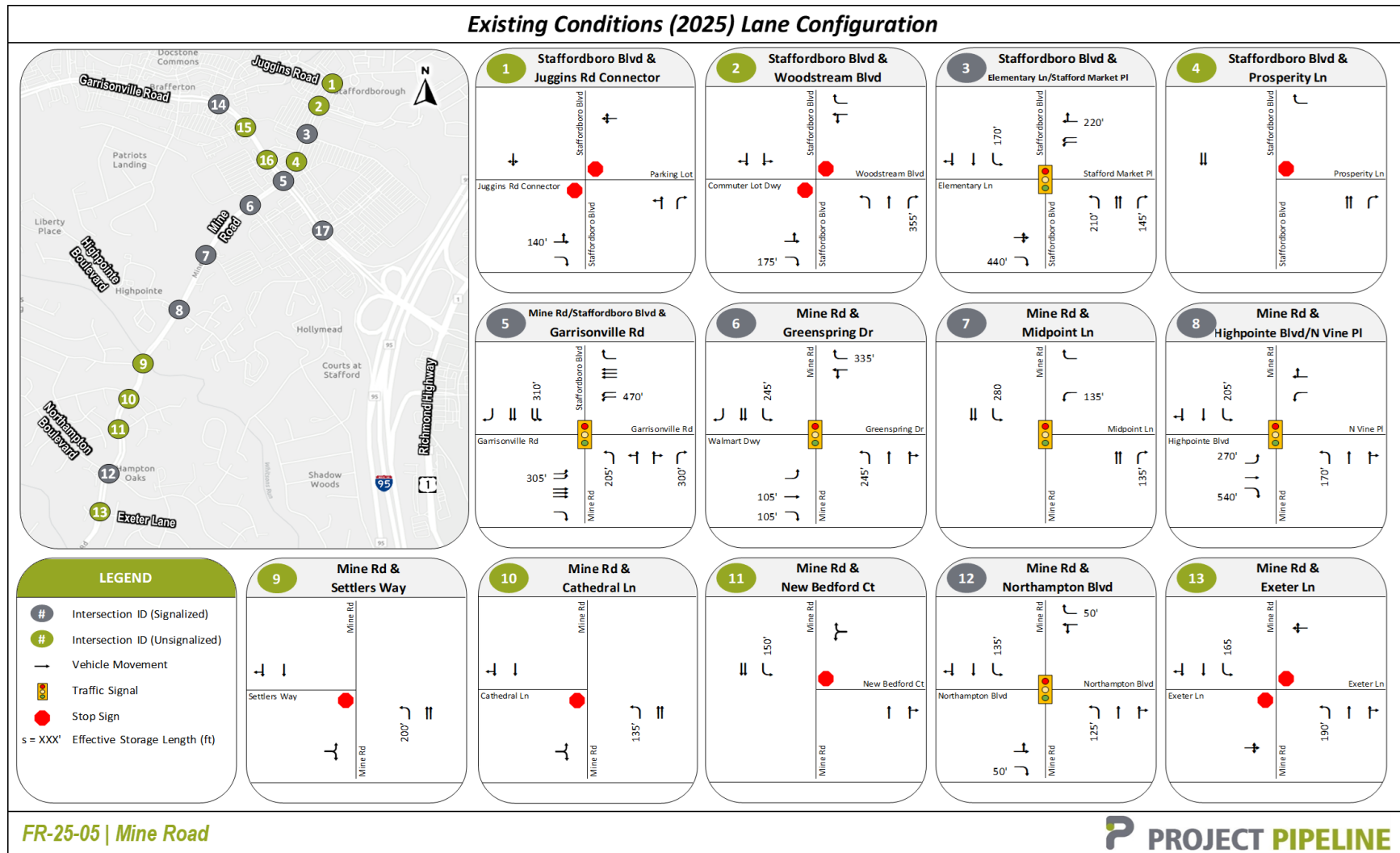
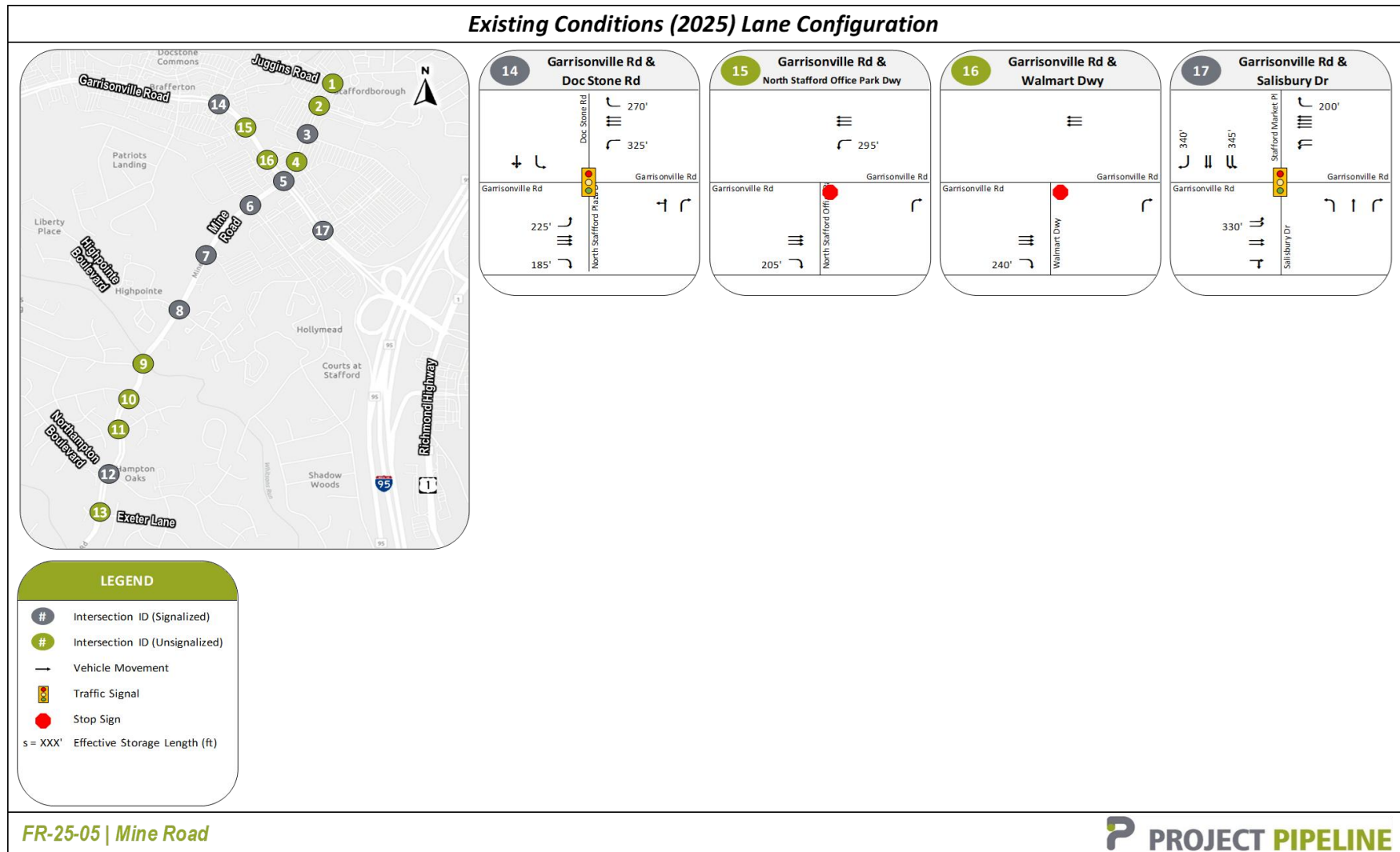


Figure 15: 2025 Existing Lane Configurations and Storage Lengths (1 of 2)



FR-25-05 | Mine Road

Figure 16: 2025 Existing Lane Configurations and Storage Lengths (2 of 2)

## Synchro and SimTraffic Analysis

The study team conducted a traffic operations analysis to evaluate the overall performance of the study corridor under existing (2025) AM and PM peak hour conditions. Existing conditions were modeled using Synchro 11 and SimTraffic 11.

The existing AM and PM Synchro models were developed based on the existing roadway geometry and collected traffic count data. Inputs and analysis methodologies were consistent with the VDOT Traffic Operations and Safety Analysis Manual (TOSAM), Version 2.0. **Appendix C** includes the SimTraffic Calibration Memo detailing the refinements made to the Synchro and SimTraffic models to reflect observed conditions.

## Traffic Data

Twelve-hour vehicular turning movement, pedestrian, and bicycle count data was collected at the 17 study intersections on Tuesday, April 8, 2025, from 6:30 AM to 6:30 PM. The AM and PM peak hours were determined to be 7:30 AM – 8:30 AM and 4:45 – 5:45 PM. Twenty four-hour average daily traffic count data was also collected along Staffordboro Road just north of Juggins Connector Road and on Mine Road just south of Exeter Road. Raw traffic data can be found in **Appendix C**.

The study team balanced traffic volumes up between intersections as a conservative approach, ensuring accurate modeling in SimTraffic and effective capacity under higher demand conditions. The resulting balanced volumes were used as existing volumes that formed the basis of this study. Turning movement counts, heavy vehicle percentages, and peak hour factors are included in **Figure 17** through **Figure 20**.

## Level of Service (LOS) Criteria

The intersection Level of Service (LOS) is a qualitative measure that describes a driver's perception of the operating conditions. LOS ratings range from A to F. LOS A indicates little or no congestion and LOS F indicates severe congestion, unstable traffic flow, and/or stop-and-go conditions.

**Table 8** summarizes the LOS corresponding to the delay at unsignalized and signalized intersections as specified in the HCM. The delay criteria for LOS differs slightly for unsignalized and signalized intersections due to driver expectations and behavior. For signalized intersections, LOS is calculated as the lost travel time caused by drivers waiting at a traffic signal. For unsignalized intersections, LOS is reported on an intersection approach basis and corresponding delay is calculated by determining the number of gaps that are available in the conflicting traffic stream, since the LOS analysis assumes that traffic on the mainline is not affected by the traffic on the side street.

**Table 8: Level of Service Criteria**

| Level of Service | Control Delay (sec/veh) — Signalized Intersection | Control Delay (sec/veh) — Unsignalized Intersection |
|------------------|---------------------------------------------------|-----------------------------------------------------|
| A                | ≤ 10.0                                            | ≤ 10.0                                              |
| B                | > 10.0 to 20.0                                    | > 10.0 to 15.0                                      |
| C                | > 20.0 to 35.0                                    | > 15.0 to 25.0                                      |
| D                | > 35.0 to 55.0                                    | > 25.0 to 35.0                                      |
| E                | > 55.0 to 80.0                                    | > 35.0 to 50.0                                      |
| F                | ≥ 80.0                                            | ≥ 50.0                                              |

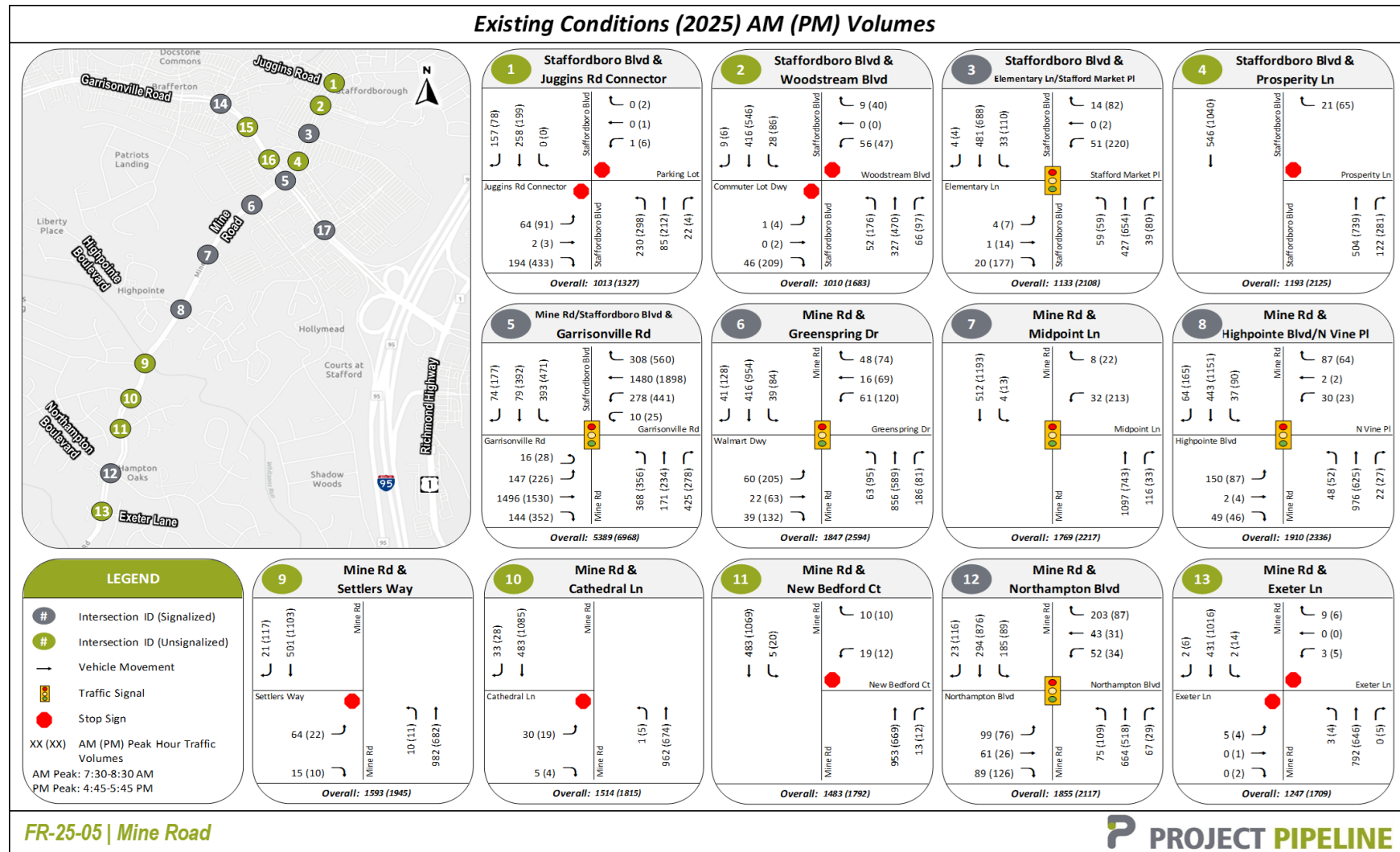


Figure 17: 2025 Existing Peak Hour Volumes (1 of 2)

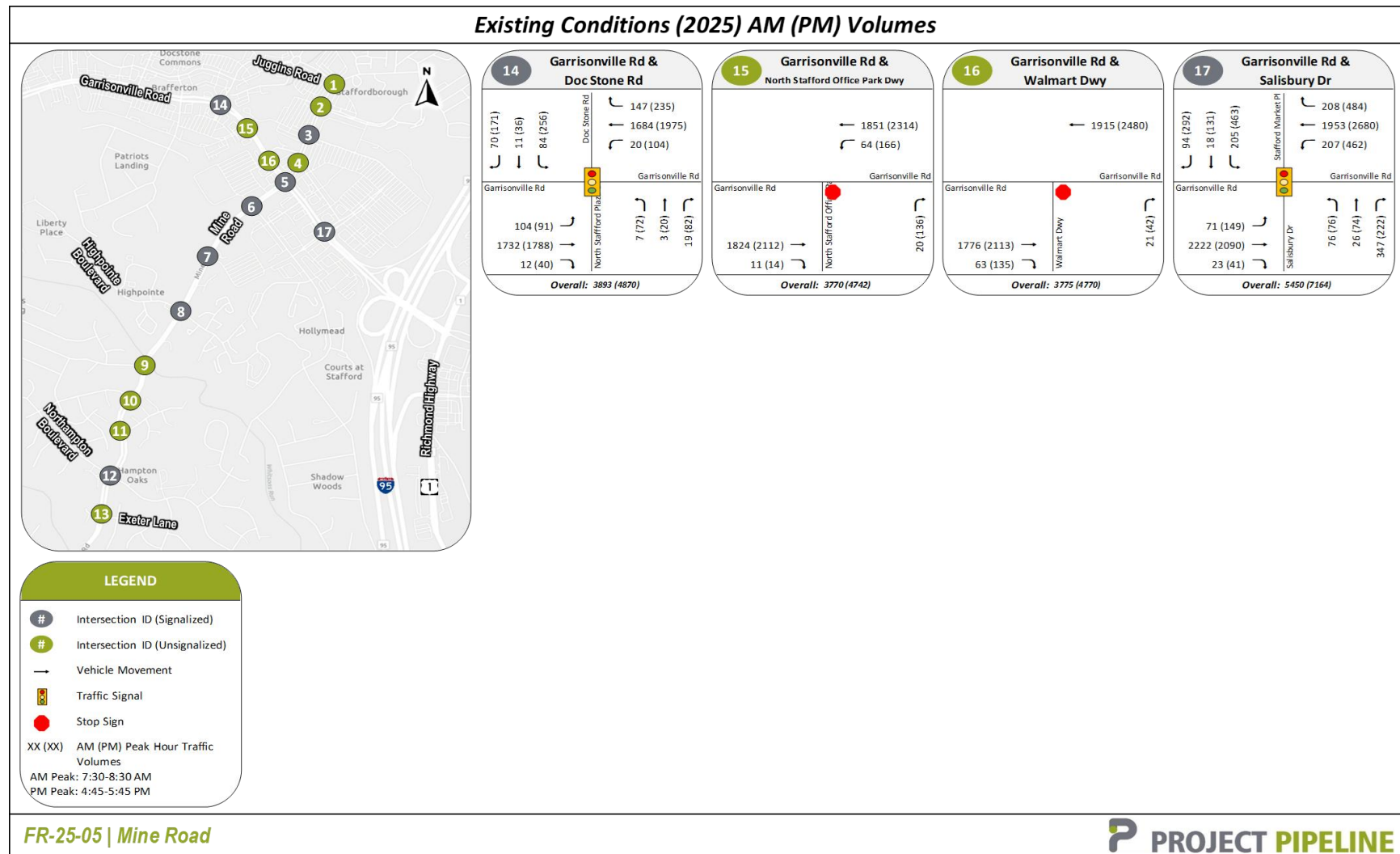


Figure 18: 2025 Existing Peak Hour Volumes (2 of 2)

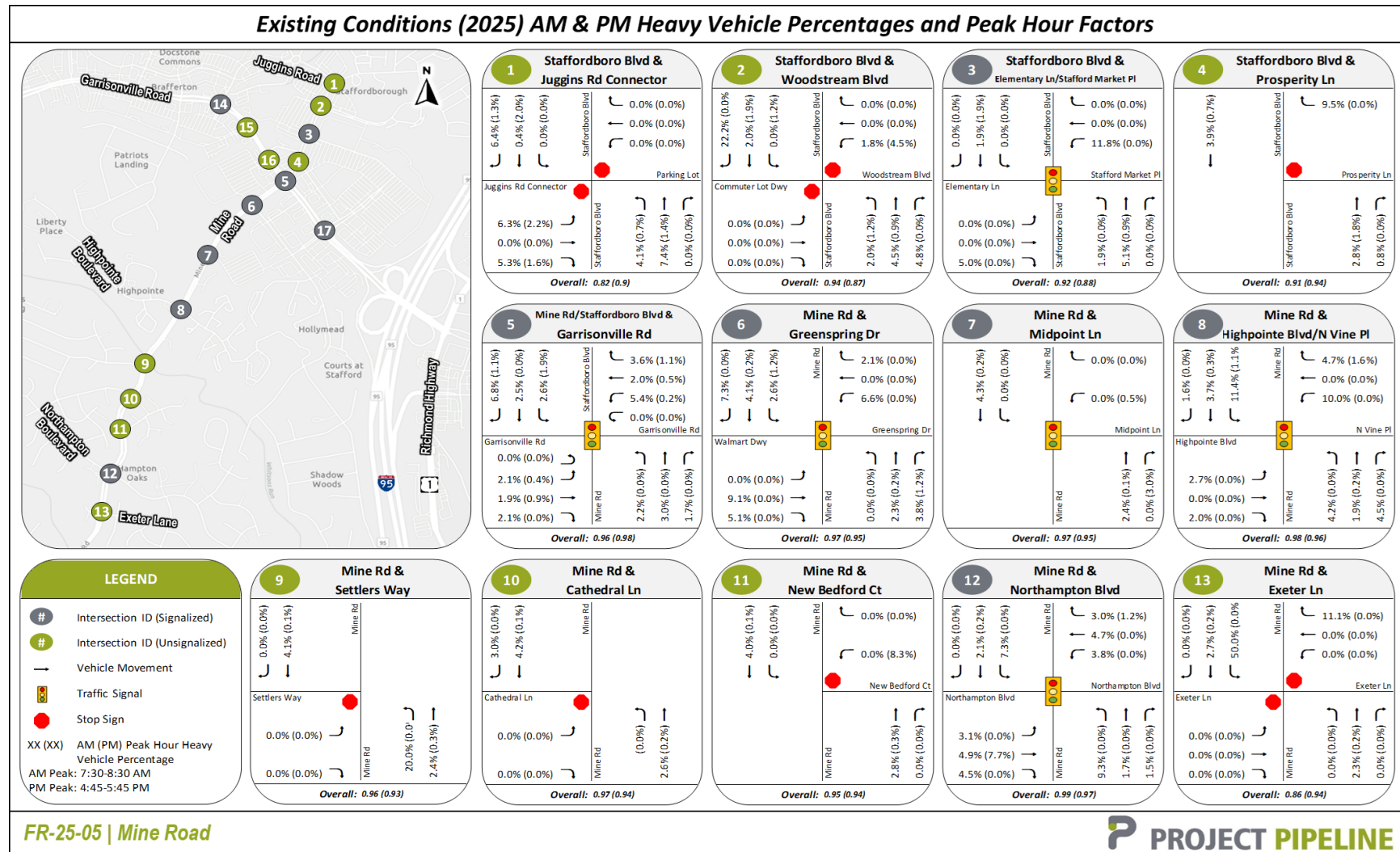


Figure 19: 2025 Existing Heavy Vehicle Percentages and Peak Hour Factors (1 of 2)

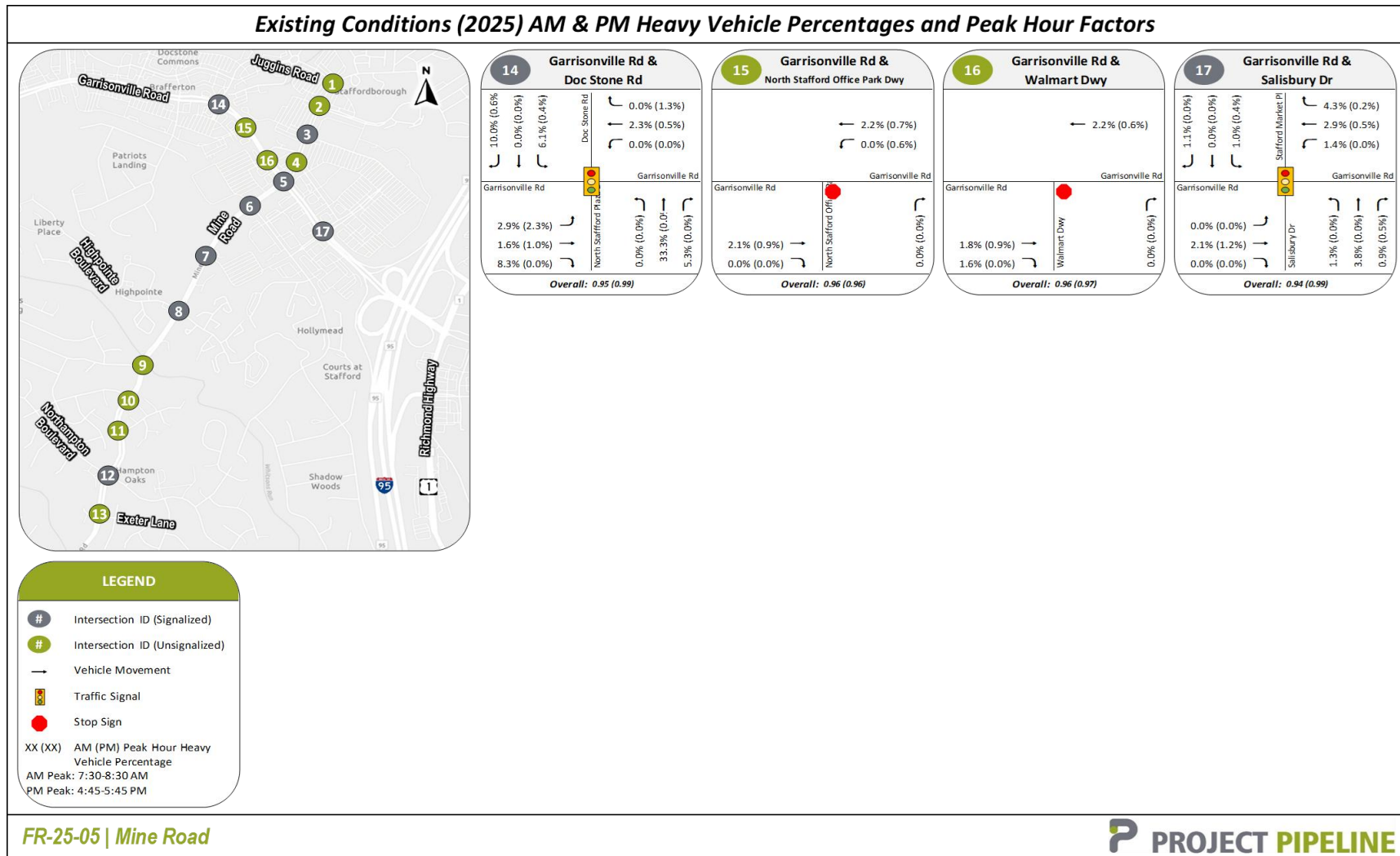


Figure 20: 2025 Existing Heavy Vehicle Percentages and Peak Hour Factors (2 of 2)

## Traffic Analysis Results

Using SimTraffic performance reports by movement and by approach, microsimulation delay (seconds per vehicle) and maximum queue length (feet) were selected as measures of effectiveness to quantitatively report the performance of each study intersection.

Ten simulations were conducted for both the AM and PM models. The VDOT Sample Size Determination Tool was used to confirm the number of SimTraffic model runs necessary. The full Synchro and SimTraffic reports are included in **Appendix C**. SimTraffic results for the existing condition models for the intersections along Mine Road are included in **Table 9** and **Table 10**. SimTraffic queuing results are shown in **Table 11** and **Table 12**.

Under existing conditions, the SimTraffic microsimulation delay results indicate the intersections along Mine Road operate acceptably, except for the intersection of Mine Road/Staffordboro Boulevard and Garrisonville Road, which operated with an overall intersection delay of 56.0 seconds per vehicle during the AM peak hour and 64.3 seconds per vehicle during the PM peak hour. Multiple individual movements also experienced high delays in the AM and PM peak hours with a maximum delay of 186.2 seconds per vehicle in the westbound direction.

The minor street approaches at the intersections of Staffordboro Boulevard and Woodstream Boulevard experienced long delays during the PM peak hour due to heavy northbound and southbound volumes along Staffordboro Boulevard. The minor street approaches at the unsignalized intersections along Mine Road operated with delays ranging between 7.9 seconds per vehicle to 30.2 seconds per vehicle in the AM peak hour and between 9.9 seconds per vehicle and 26.2 seconds per vehicle in the PM peak hour. Of the minor street approaches at the unsignalized intersections along Mine Road, the westbound approach at the intersection of Mine Road and Exeter Lane experienced the lowest delay of 7.9 seconds per vehicle during the AM peak hour.

The following trends were observed under Existing conditions.

### AM Peak Hour

- The signalized intersections south of Garrisonville Road operated with overall intersection delays ranging between 7.0 seconds per vehicle and 33.3 seconds per vehicle
- The westbound approach at the intersection of Garrisonville Road and Mine Road experienced the highest approach delay (63.0 seconds per vehicle)
- The longest queue was the westbound through movement at the intersection of Garrisonville Road and Mine Road at 776 feet
- The highest overall intersection delay for the signalized intersections occurred at the intersection of Garrisonville Road and Mine Road (56.0 seconds per vehicle)
- The highest approach delay for the unsignalized intersections occurred at the intersection of Mine Road and Exeter Lane in the eastbound direction (17.8 seconds per vehicle)
- The highest delay by movement for the unsignalized intersections occurred at the intersection of Staffordboro Boulevard and Juggins Road Connector (54.4 seconds per vehicle for the eastbound through movement)
- Queues for all of the left-turn and through movements and the northbound right-turn movement at Garrisonville Road and Mine Road/Staffordboro Boulevard extend to the upstream intersection

## PM Peak Hour

- The signalized intersections south of Garrisonville Road operated with overall intersection delays ranging between 11.6 seconds per vehicle and 38.5 seconds per vehicle
- The southbound approach at the intersection of Garrisonville Road and Mine Road experienced the highest approach delay (116.2 seconds per vehicle)
- The longest queue was the eastbound through movement at the intersection of Mine Road and Garrisonville Road at 1,398 feet, which extended to the intersection of Garrisonville Road and Doc Stone Road
- The highest overall intersection delay for the signalized intersections occurred at the intersection of Garrisonville Road and Mine Road (64.0 seconds per vehicle)
- The highest approach delay for the unsignalized intersections occurred at the intersection of Staffordboro Road and Woodstream Boulevard in the westbound direction (83.0 seconds per vehicle)
- Queues for the following movements extend back to the upstream intersection:

All left-turn and through movements and the northbound right-turn movement at Garrisonville Road and Mine Road/Staffordboro Boulevard

Eastbound Left/through movement on Woodstream Boulevard at Staffordboro Boulevard

Northbound and southbound through movement on Staffordboro Boulevard at Elementary Lane/Stafford Market Place

Southbound through movement Mine Road at Greenspring Drive

**Table 9: 2025 Existing Conditions Microsimulation Delay (seconds per vehicle) (1 of 2)**

| Intersection Number and Description |                                                      | Lane Group | Eastbound            |       | Westbound          |       | Northbound        |       | Southbound        |       | Overall      |      |
|-------------------------------------|------------------------------------------------------|------------|----------------------|-------|--------------------|-------|-------------------|-------|-------------------|-------|--------------|------|
|                                     |                                                      |            | AM                   | PM    | AM                 | PM    | AM                | PM    | AM                | PM    | AM           | PM   |
| 1                                   | Staffordboro Blvd & Juggins Rd Connector             |            | Juggins Rd Connector |       | Parking Lot        |       | Staffordboro Blvd |       | Staffordboro Blvd |       | Intersection |      |
|                                     |                                                      | Left       | 36.2                 | 33.9  | 0.0                | 16.9  | 8.3               | 6.4   | 2.0               | 1.3   | 6.7          | 7.6  |
|                                     |                                                      | Through    |                      |       |                    |       |                   |       |                   |       |              |      |
|                                     |                                                      | Right      | 4.6                  | 6.9   |                    |       | 0.6               | 2.1   |                   |       |              |      |
|                                     |                                                      | Approach   | 12.8                 | 11.9  | 0.0                | 16.9  | 7.7               | 6.3   | 2.0               | 1.3   |              |      |
| 2                                   | Staffordboro Blvd & Woodstream Blvd                  |            | Commuter Lot Dwy     |       | Woodstream Blvd    |       | Staffordboro Blvd |       | Staffordboro Blvd |       | Intersection |      |
|                                     |                                                      | Left       | 19.5                 | 200.1 | 17.8               | 71.8  | 4.2               | 10.5  | 1.4               | 7.5   | 2.4          | 9.0  |
|                                     |                                                      | Through    |                      |       |                    |       | 1.2               | 2.6   |                   |       |              |      |
|                                     |                                                      | Right      | 4.8                  | 18.9  |                    |       | 3.3               | 4.8   |                   |       |              |      |
|                                     |                                                      | Approach   | 5.2                  | 25.9  | 15.6               | 40.7  | 1.4               | 4.1   | 1.2               | 5.0   |              |      |
| 3                                   | Staffordboro Blvd & Elementary Ln/Stafford Market Pl |            | Elementary Ln        |       | Stafford Market Pl |       | Staffordboro Blvd |       | Staffordboro Blvd |       | Intersection |      |
|                                     |                                                      | Left       | 21.4                 | 36.8  | 56.7               | 82.6  | 6.7               | 15.7  | 6.8               | 21.5  | 6.7          | 30.0 |
|                                     |                                                      | Through    |                      |       |                    |       | 3.8               | 22.2  | 4.5               | 51.4  |              |      |
|                                     |                                                      | Right      | 5.1                  | 9.6   |                    |       | 5.3               | 9.2   | 0.7               | 2.3   |              |      |
|                                     |                                                      | Approach   | 19.0                 | 29.4  | 43.8               | 49.3  | 3.6               | 19.3  | 4.5               | 33.4  |              |      |
| 4                                   | Staffordboro Blvd & Prosperity Ln                    |            | Prosperity Ln        |       | Prosperity Ln      |       | Staffordboro Blvd |       | Staffordboro Blvd |       | Intersection |      |
|                                     |                                                      | Left       |                      |       |                    |       |                   |       |                   |       | 1.0          | 5.9  |
|                                     |                                                      | Through    |                      |       |                    |       | 1.5               | 1.2   | 0.8               | 14.5  |              |      |
|                                     |                                                      | Right      |                      |       |                    |       | 5.5               | 11.1  | 1.4               | 1.5   |              |      |
|                                     |                                                      | Approach   |                      |       | 5.5                | 11.1  | 1.3               | 1.3   | 0.6               | 10.3  |              |      |
| 5                                   | Mine Rd/Staffordboro Blvd & Garrisonville Rd         |            | Garrisonville Rd     |       | Garrisonville Rd   |       | Mine Rd           |       | Staffordboro Blvd |       | Intersection |      |
|                                     |                                                      | Left       | 125.7                | 222.9 | 184.5              | 104.3 | 71.1              | 66.8  | 68.3              | 140.9 | 56.0         | 64.0 |
|                                     |                                                      | Through    | 41.9                 | 52.8  | 65.4               | 51.1  | 87.6*             | 79.9* | 70.5              | 142.1 |              |      |
|                                     |                                                      | Right      | 2.3                  | 8.1   | 4.6                | 3.1   | 74.4*             | 18.3  | 17.5              | 35.4  |              |      |
|                                     |                                                      | Approach   | 44.3                 | 53.7  | 63.0               | 54.3  | 61.8              | 58.7  | 57.4              | 116.2 |              |      |
| 6                                   | Mine Rd & Greenspring Dr                             |            | Walmart Dwy          |       | Greenspring Dr     |       | Mine Rd           |       | Mine Rd           |       | Intersection |      |
|                                     |                                                      | Left       | 60.1                 | 110.2 | 69.2               | 59.6  | 91.4              | 49.2  | 67.1              | 48.0  | 33.3         | 38.5 |
|                                     |                                                      | Through    | 61.3                 | 49.8  |                    |       | 30.4              | 33.5  | 15.4              | 25.8  |              |      |
|                                     |                                                      | Right      | 47.5                 | 22.4  |                    |       | 71.3              | 36.8  | 30.4*             | 33.1* |              |      |
|                                     |                                                      | Approach   | 56.5                 | 72.0  | 69.5               | 53.1  | 33.8              | 35.3  | 17.1              | 25.2  |              |      |

\*Lane group is shared with through movement

Color coding is based on the delay reported for that movement and the analogous level of service as shown in **Table 8**.

**Table 10: 2025 Existing Conditions Microsimulation Delay (seconds per vehicle) (2 of 2)**

| Intersection Number and Description |                                     | Lane Group | Eastbound        |      | Westbound        |      | Northbound |       | Southbound |       | Overall      |      |
|-------------------------------------|-------------------------------------|------------|------------------|------|------------------|------|------------|-------|------------|-------|--------------|------|
|                                     |                                     |            | AM               | PM   | AM               | PM   | AM         | PM    | AM         | PM    | AM           | PM   |
| 7                                   | Mine Rd & Midpoint Ln               |            |                  |      | Midpoint Ln      |      | Mine Rd    |       | Mine Rd    |       | Intersection |      |
|                                     |                                     | Left       |                  |      | 37.0             | 35.9 |            |       | 24.9       | 10.8  | 7.0          | 11.6 |
|                                     |                                     | Through    |                  |      |                  |      | 8.3        | 6.7   | 5.2        | 10.4  |              |      |
|                                     |                                     | Right      |                  |      | 10.3             | 35.5 | 0.2        | 0.1   |            |       |              |      |
|                                     |                                     | Approach   |                  |      | 31.0             | 35.9 | 7.0        | 6.3   | 5.0        | 10.2  |              |      |
| 8                                   | Mine Rd & Highpointe Blvd/N Vine Pl |            | Highpointe Blvd  |      | N Vine Pl        |      | Mine Rd    |       | Mine Rd    |       | Intersection |      |
|                                     |                                     | Left       | 53.6             | 38.3 | 64.3             | 40.6 | 11.9       | 29.2  | 18.4       | 15.9  | 17.4         | 21.6 |
|                                     |                                     | Through    | 67.8             | 36.2 | 16.3             | 8.8  | 14.7       | 12.8  | 10.2       | 23.6  |              |      |
|                                     |                                     | Right      | 5.4              | 8.8  |                  |      | 15.5*      | 12.5* | 10.0*      | 27.7* |              |      |
|                                     |                                     | Approach   | 41.5             | 28.3 | 27.3             | 17.7 | 15.0       | 13.9  | 10.7       | 25.1  |              |      |
| 9                                   | Mine Rd & Settlers Way              |            | Settlers Way     |      |                  |      | Mine Rd    |       | Mine Rd    |       | Intersection |      |
|                                     |                                     | Left       | 17.1             | 19.5 |                  |      | 3.4        | 7.1   |            |       | 2.1          | 3.5  |
|                                     |                                     | Through    |                  |      |                  |      | 0.9        | 0.5   | 1.9        | 4.0   |              |      |
|                                     |                                     | Right      | 17.1             | 19.5 |                  |      |            |       | 2.2*       | 5.3*  |              |      |
|                                     |                                     | Approach   | 17.1             | 20.1 |                  |      | 0.9        | 0.6   | 2.0        | 4.7   |              |      |
| 10                                  | Mine Rd & Cathedral Ln              |            | Cathedral Ln     |      |                  |      | Mine Rd    |       | Mine Rd    |       | Intersection |      |
|                                     |                                     | Left       | 14.5             | 18.9 |                  |      | 1.1        | 6.3   |            |       | 1.0          | 1.2  |
|                                     |                                     | Through    |                  |      |                  |      | 0.7        | 0.5   | 0.6        | 0.8   |              |      |
|                                     |                                     | Right      | 14.5             | 18.9 |                  |      |            |       | 0.9*       | 1.5*  |              |      |
|                                     |                                     | Approach   | 14.5             | 18.9 |                  |      | 0.7        | 0.5   | 0.7        | 1.1   |              |      |
| 11                                  | Mine Rd & New Bedford Ct            |            | New Bedford Ct   |      |                  |      | Mine Rd    |       | Mine Rd    |       | Intersection |      |
|                                     |                                     | Left       |                  |      | 14.7             | 13.8 |            |       | 9.6        | 3.9   | 2.5          | 1.5  |
|                                     |                                     | Through    |                  |      |                  |      | 3.2        | 2.0   | 0.6        | 0.8   |              |      |
|                                     |                                     | Right      |                  |      | 14.0             | 13.8 | 2.9*       | 2.1*  |            |       |              |      |
|                                     |                                     | Approach   |                  |      | 15.3             | 13.8 | 3.0        | 2.0   | 0.6        | 0.9   |              |      |
| 12                                  | Mine Rd & Northampton Blvd          |            | Northampton Blvd |      | Northampton Blvd |      | Mine Rd    |       | Mine Rd    |       | Intersection |      |
|                                     |                                     | Left       | 43.5             | 49.6 | 46.9             | 45.9 | 14.2       | 22.2  | 29.5       | 11.7  | 26.6         | 20.1 |
|                                     |                                     | Through    |                  |      |                  |      | 30.8       | 15.7  | 30.1       | 20.2  |              |      |
|                                     |                                     | Right      | 4.6              | 5.8  | 9.1              | 3.7  | 27.6*      | 14.7* | 19.1*      | 22.7* |              |      |
|                                     |                                     | Approach   | 30.2             | 26.2 | 21.3             | 22.0 | 27.9       | 16.4  | 25.6       | 20.7  |              |      |
| 13                                  | Mine Rd & Exeter Ln                 |            | Exeter Ln        |      | Exeter Ln        |      | Mine Rd    |       | Mine Rd    |       | Intersection |      |
|                                     |                                     | Left       |                  |      |                  |      | 2.4        | 6.6   | 4.1        | 3.9   | 1.2          | 2.0  |
|                                     |                                     | Through    | 14.8             | 16.7 | 7.9              | 8.9  | 0.7        | 0.6   | 2.2        | 2.9   |              |      |
|                                     |                                     | Right      |                  |      |                  |      | 0.4*       | 0.3*  | 1.7*       | 2.5*  |              |      |
|                                     |                                     | Approach   | 17.8             | 16.7 | 7.9              | 9.9  | 0.6        | 0.5   | 1.9        | 2.0   |              |      |

\*Lane group is shared with through movement

Color coding is based on the delay reported for that movement and the analogous level of service as shown in **Table 8**.

**Table 11: 2025 Existing Conditions Peak Hour Maximum Queues (feet) (1 of 2)**

| Intersection Number and Description |                                                      | Type of Control | Lane Group | Maximum Queue        |          |                    |          |                   |          |                   |          |
|-------------------------------------|------------------------------------------------------|-----------------|------------|----------------------|----------|--------------------|----------|-------------------|----------|-------------------|----------|
|                                     |                                                      |                 |            | Eastbound            |          | Westbound          |          | Northbound        |          | Southbound        |          |
|                                     |                                                      |                 |            | AM                   | PM       | AM                 | PM       | AM                | PM       | AM                | PM       |
| 1                                   | Staffordboro Blvd & Juggins Rd Connector             | Unsignalized    |            | Juggins Rd Connector |          | Parking Lot        |          | Staffordboro Blvd |          | Staffordboro Blvd |          |
|                                     |                                                      |                 | Left       | 126                  | 138      | 10                 | 34       | 242               | 238      | 45                | 6        |
|                                     |                                                      |                 | Through    |                      |          |                    |          |                   |          |                   |          |
|                                     |                                                      |                 | Right      | 103                  | 200      |                    |          | 24                | †        |                   |          |
| 2                                   | Staffordboro Blvd & Woodstream Blvd                  | Unsignalized    |            | Commuter Lot Dwy     |          | Woodstream Blvd    |          | Staffordboro Blvd |          | Staffordboro Blvd |          |
|                                     |                                                      |                 | Left       | 9                    | ** (16%) | 86                 | 154      | 50                | 150      | 78                | 212      |
|                                     |                                                      |                 | Through    |                      | ^(12%)   |                    |          | 8                 | 21       | 78                | 212      |
|                                     |                                                      |                 | Right      | 52                   | * (19%)  | 31                 | 53       | 6                 | †        | 6                 | 102      |
| 3                                   | Staffordboro Blvd & Elementary Ln/Stafford Market Pl | Signal          |            | Elementary Ln        |          | Stafford Market Pl |          | Staffordboro Blvd |          | Staffordboro Blvd |          |
|                                     |                                                      |                 | Left       | 61                   | 194      | 103                | 243      | 57                | 134      | 50                | 169      |
|                                     |                                                      |                 | Through    |                      |          | 21                 | 199      | 162               | ** (13%) | 163               | ** (31%) |
|                                     |                                                      |                 | Right      | 25                   | 132      | 21                 | 65       | 91                | ^(5%)    | 100               | ^(11%)   |
| 4                                   | Staffordboro Blvd & Prosperity Ln                    | Unsignalized    |            | Prosperity Ln        |          | Prosperity Ln      |          | Staffordboro Blvd |          | Staffordboro Blvd |          |
|                                     |                                                      |                 | Left       |                      |          |                    |          |                   |          |                   |          |
|                                     |                                                      |                 | Through    |                      |          |                    |          | †                 | 51       | ** (1%)           | ** (41%) |
|                                     |                                                      |                 | Right      |                      |          | 43                 | 61       | †                 | 4        |                   |          |
| 5                                   | Mine Rd/Staffordboro Blvd & Garrisonville Rd         | Signal          |            | Garrisonville Rd     |          | Garrisonville Rd   |          | Mine Rd           |          | Staffordboro Blvd |          |
|                                     |                                                      |                 | Left       | *(1%)                | *(20%)   | *(7%)              | *(1%)    | *(2%)             | ** (14%) | *(1%)             | *(31%)   |
|                                     |                                                      |                 | Through    | ^(1%)                | ^(20%)   | ^(7%)              | ^(1%)    | ^(1%)             | ^(13%)   | ^(1%)             | ^(31%)   |
|                                     |                                                      |                 | Right      | ** (25%)             | ** (52%) | ** (21%)           | ** (19%) | ** (22%)          | ** (8%)  | ** (2%)           | ** (50%) |
| 6                                   | Mine Rd & Greenspring Dr                             | Signal          |            | Walmart Dwy          |          | Greenspring Dr     |          | Mine Rd           |          | Mine Rd           |          |
|                                     |                                                      |                 | Left       | ** (1%)              | ** (34%) | 170                | 260      | 222               | 220      | 110               | 233      |
|                                     |                                                      |                 | Through    | *(1%)                | *(3%)    | 170                | 260      | 588               | ** (1%)  | 216               | ** (6%)  |
|                                     |                                                      |                 | Right      | 85                   | *(2%)    | 132                | 135      | 588               | ^(8%)    | 56                | ^(8%)    |

† No queue reported. Movement does not have conflicting volumes

\*(X%) - Maximum queue extends full length of storage bay for X% of the analysis period

\*\* (Y%) - Queue in lane adjacent to storage bay extends beyond end of storage bay for Y% of the analysis period

^(Z%) - Maximum queue extends back to the upstream intersection for Z% of the analysis period

**Table 12: 2025 Existing Conditions Peak Hour Maximum Queues (feet) (2 of 2)**

| Intersection Number and Description |                                     | Type of Control | Lane Group | Maximum Queue    |          |                  |          |            |         |            |          |
|-------------------------------------|-------------------------------------|-----------------|------------|------------------|----------|------------------|----------|------------|---------|------------|----------|
|                                     |                                     |                 |            | Eastbound        |          | Westbound        |          | Northbound |         | Southbound |          |
|                                     |                                     |                 |            | AM               | PM       | AM               | PM       | AM         | PM      | AM         | PM       |
| 7                                   | Mine Rd & Midpoint Ln               | Signal          |            | Midpoint Ln      |          | Mine Rd          |          | Mine Rd    |         |            |          |
|                                     |                                     |                 | Left       |                  |          | 62               | *(9%)    |            |         | 31         | 35       |
|                                     |                                     |                 | Through    |                  |          |                  |          | 191        | 151     | 135        | 232      |
|                                     |                                     |                 | Right      |                  |          | 22               | 235      | 97         | 14      |            |          |
| 8                                   | Mine Rd & Highpointe Blvd/N Vine Pl | Signal          |            | Highpointe Blvd  |          | N Vine Pl        |          | Mine Rd    |         | Mine Rd    |          |
|                                     |                                     |                 | Left       | 223              | 135      | 86               | 62       | 148        | 122     | 86         | 204      |
|                                     |                                     |                 | Through    | 52               | 31       | 112              | 71       | *(5%)      | ** (1%) | 191        | ** (12%) |
|                                     |                                     |                 | Right      | 64               | 58       | 112              | 71       | 374        | 222     | 206        | 401      |
| 9                                   | Mine Rd & Settlers Way              | Unsignalized    |            | Settlers Way     |          |                  |          | Mine Rd    |         | Mine Rd    |          |
|                                     |                                     |                 | Left       | 95               | 63       |                  |          | 44         | 34      |            |          |
|                                     |                                     |                 | Through    |                  |          |                  |          | †          | †       | 4          | 4        |
|                                     |                                     |                 | Right      | 95               | 63       |                  |          |            |         | 4          | 22       |
| 10                                  | Mine Rd & Cathedral Ln              | Unsignalized    |            | Cathedral Ln     |          |                  |          | Mine Rd    |         | Mine Rd    |          |
|                                     |                                     |                 | Left       | 59               | 55       |                  |          | 2          | 20      |            |          |
|                                     |                                     |                 | Through    |                  |          |                  |          | †          | †       | 5          | †        |
|                                     |                                     |                 | Right      | 59               | 55       |                  |          |            |         | †          | †        |
| 11                                  | Mine Rd & New Bedford Ct            | Unsignalized    |            | New Bedford Ct   |          |                  |          | Mine Rd    |         | Mine Rd    |          |
|                                     |                                     |                 | Left       |                  |          | 52               | 67       |            |         | 26         | 40       |
|                                     |                                     |                 | Through    |                  |          |                  |          | 8          | †       | 8          | †        |
|                                     |                                     |                 | Right      |                  |          | 52               | 67       | 20         | 2       |            |          |
| 12                                  | Mine Rd & Northampton Blvd          | Signal          |            | Northampton Blvd |          | Northampton Blvd |          | Mine Rd    |         | Mine Rd    |          |
|                                     |                                     |                 | Left       | ** (1%)          | ** (28%) | 198              | ** (18%) | 125        | 120     | *(8%)      | 134      |
|                                     |                                     |                 | Through    |                  |          |                  |          | ** (19%)   | ** (2%) | ** (3%)    | ** (13%) |
|                                     |                                     |                 | Right      | 187              | *(7%)    | 148              | *(3%)    | 343        | 175     | 204        | 366      |
| 13                                  | Mine Rd & Exeter Ln                 | Unsignalized    |            | Exeter Ln        |          | Exeter Ln        |          | Mine Rd    |         | Mine Rd    |          |
|                                     |                                     |                 | Left       |                  |          |                  |          | 16         | 23      | 19         | 37       |
|                                     |                                     |                 | Through    | 31               | 29       | 46               | 30       | †          | †       | †          | 2        |
|                                     |                                     |                 | Right      |                  |          |                  |          | †          | 2       | †          | 2        |

† No queue reported. Movement does not have conflicting volumes

\*(X%) - Maximum queue extends full length of storage bay for X% of the analysis period

\*\* (Y%) - Queue in lane adjacent to storage bay extends beyond end of storage bay for Y% of the analysis period

^(Z%) - Maximum queue extends back to the upstream intersection for Z% of the analysis period

### 1.6.2. Phase 1 Public Outreach

The Phase 1 Public Input survey was held from May 7, 2025, to May 22, 2025, to collect feedback on existing traffic, safety, transit, and bicycle and pedestrian issues within the study area. The online survey had a total of 635 participants and received 875 comments. Participants ranked pedestrian safety and accessibility and reducing traffic congestion as the two most important issues in the study area. A lack of sidewalks/missing sidewalks and speeding/aggressive driving were identified as the greatest safety issues. The prevalence of feedback citing concerns for pedestrian safety directly informed development of bicycle and pedestrian concepts. Detailed results from the Phase 1 public outreach efforts can be found in **Appendix C**.

Common themes among written comments included the following:

- Settlers Way sight distance causes safety concerns from drivers speeding
- Intersection lighting was heavily mentioned after sidewalks and speeding
- I-95 backups reroute traffic to Mine Road causing congestion
- Difficulty making left turns onto Mine Road due to poor sight distance
- Transit shelters are strongly desired
- Poor signal timing compounds frustration with backups

Participants were asked to drop pins where they have concerns regarding congestion, multimodal access, and safety. The results of this survey are shown in **Figure 21** and **Figure 22**.

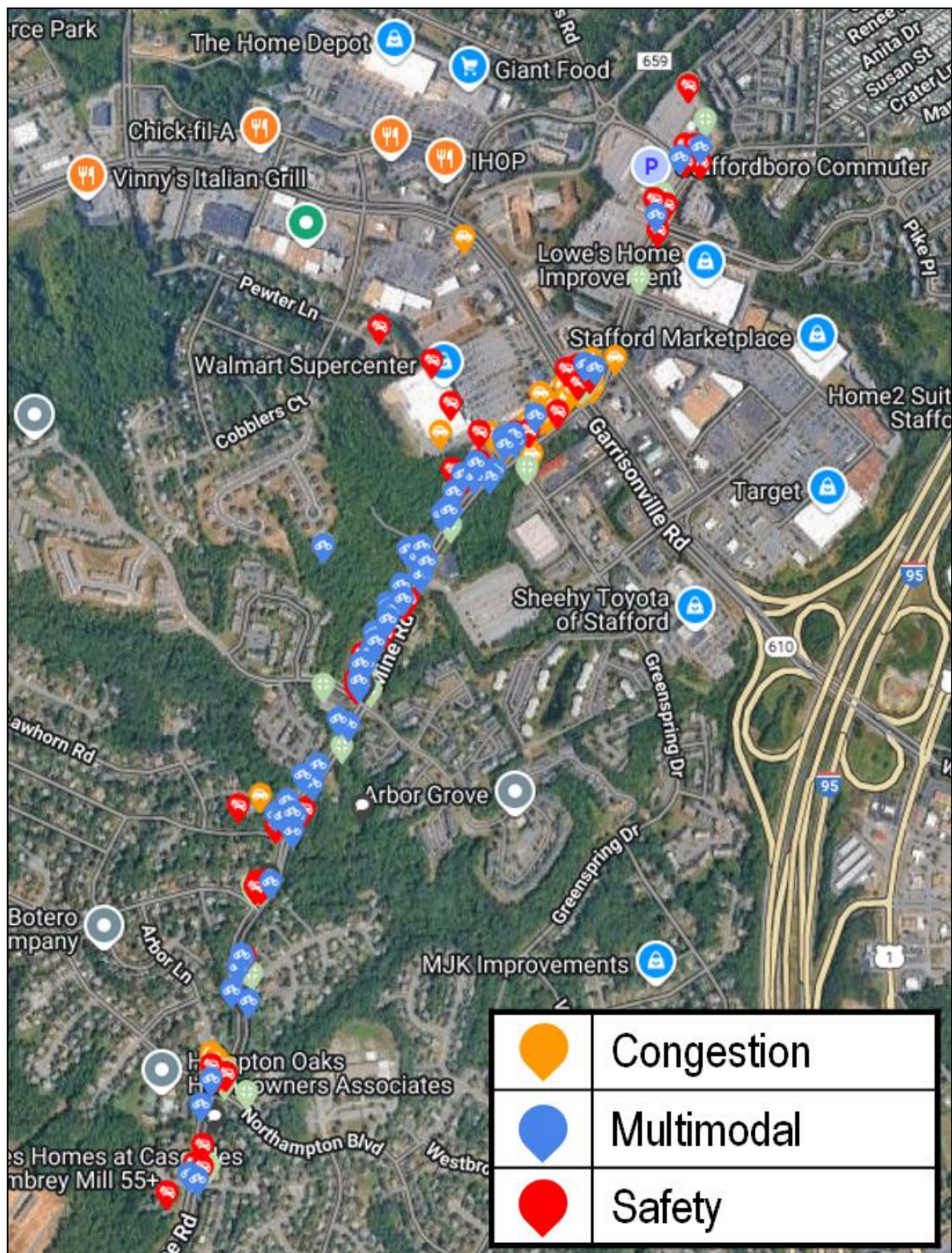


Figure 21: Comment Pins and Themes

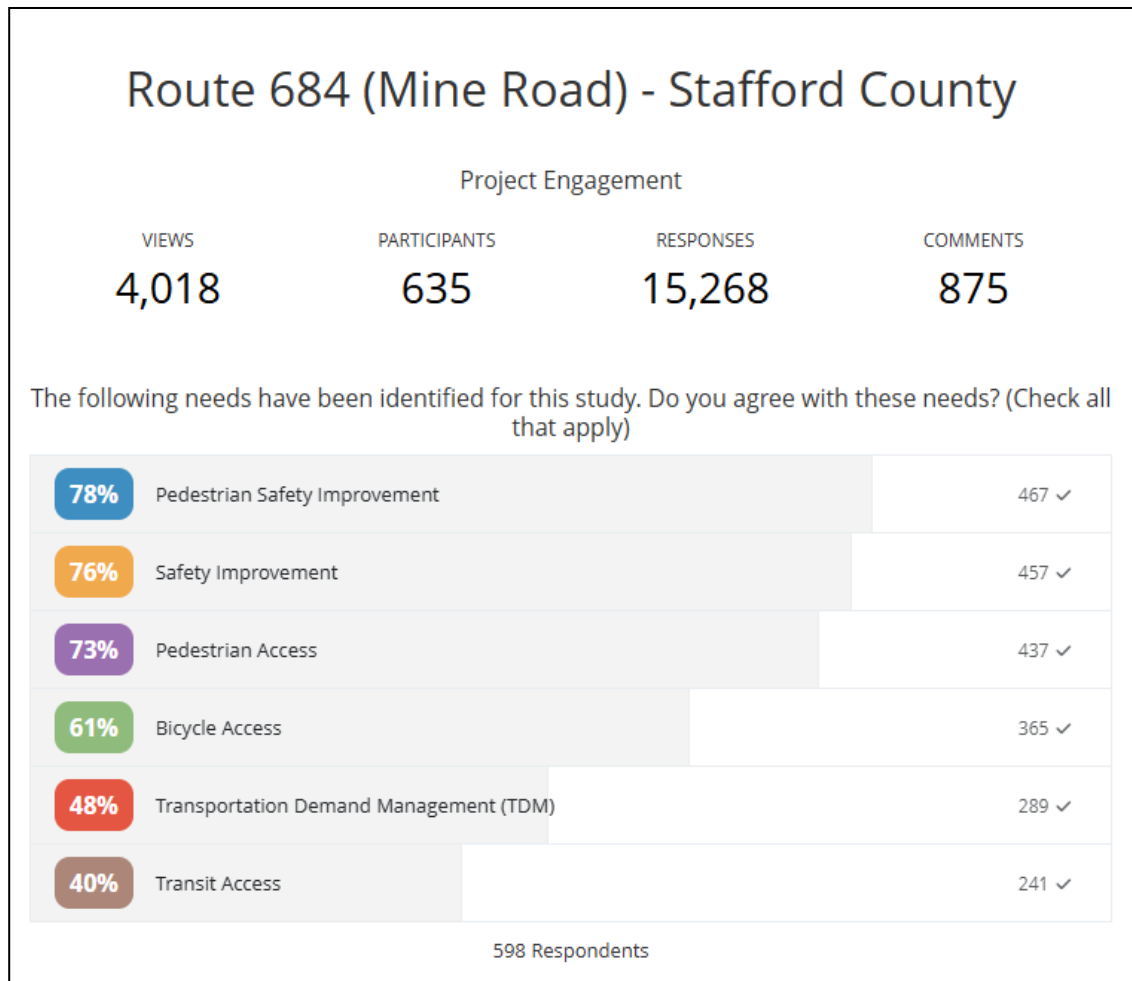


**Figure 22: Primary Public Comment Themes**

### 1.6.3. No-Build Conditions Traffic Operations Analysis

Traffic operational analyses were conducted to evaluate the overall performance of the study corridor under No-Build (2050) AM and PM peak hour conditions. The intent of the No-Build conditions analysis is to provide a general understanding of the baseline future traffic conditions as a starting point for developing improvement concepts.

#### No-Build 2050 Volume Development

The following sources were reviewed to determine the growth rates to apply to existing traffic volumes to forecast future (2050) traffic volumes.

- **FAMPO Travel Demand Model**

At the time the forecasting effort for this study was underway, the FAMPO TDM had not yet been approved by VDOT since the TDM's 2050 estimates exceeded the allowable 10% difference from the Weldon Cooper projections. Therefore, the TDM was not referenced for this study.

- **Historical traffic count data**

Historical traffic count data was sourced primarily from official VDOT historical annual average daily traffic (AADT) counts referencing Pathways for Planning (P4P) data. Significant development and regression trends between years were identified, outliers were removed, and a linear regression analysis was performed to produce linear growth rates for segments throughout the study area.

- **Previous study**

Growth rates from The Garrison Traffic Impact Analysis (TIA) (2014) and the Hampton Run Commercial TIA (2018) were reviewed and compared to the other sources. The study team used the distribution of additional trips generated by the development as shown in both TIAs, in addition to the base background growth, which were then balanced through the rest of the network.

**Table 13** and **Figure 23** present the recommended linear growth rates based on growth rates determined from historical AADT from P4P. The study team and stakeholders agreed to use an effective growth rate of 0.50% along Staffordboro Boulevard north of Garrisonville Road. Along Garrisonville Road and Mine Road a growth rate of 0.50% plus the additional trips generated by the two proposed developments, excluding drive by trips, were applied. Traffic forecasting growth rate development was presented in a stakeholder meeting on June 27, 2025 (revised June 2, 2025). The full presentation is included in **Appendix D**. The No-Build (2050) AM and PM peak hour volumes are shown in **Figure 24** and **Figure 25**.

**Table 13: Linear Growth Rate Development**

| ID | Segment                                            | Historical Linear Growth Rate | Previous Study Growth Rate | Recommended Linear Growth Rate |
|----|----------------------------------------------------|-------------------------------|----------------------------|--------------------------------|
| 1  | Staffordboro Boulevard north of Garrisonville Road | 0.50%                         | -                          | 0.50%                          |
| 2  | Garrisonville Road                                 | 0.50%                         | 2.00%                      | 0.76%                          |
| 3  | Mine Road south of Garrisonville Road              | 4.23%                         | 2.00%                      | 2.27%                          |

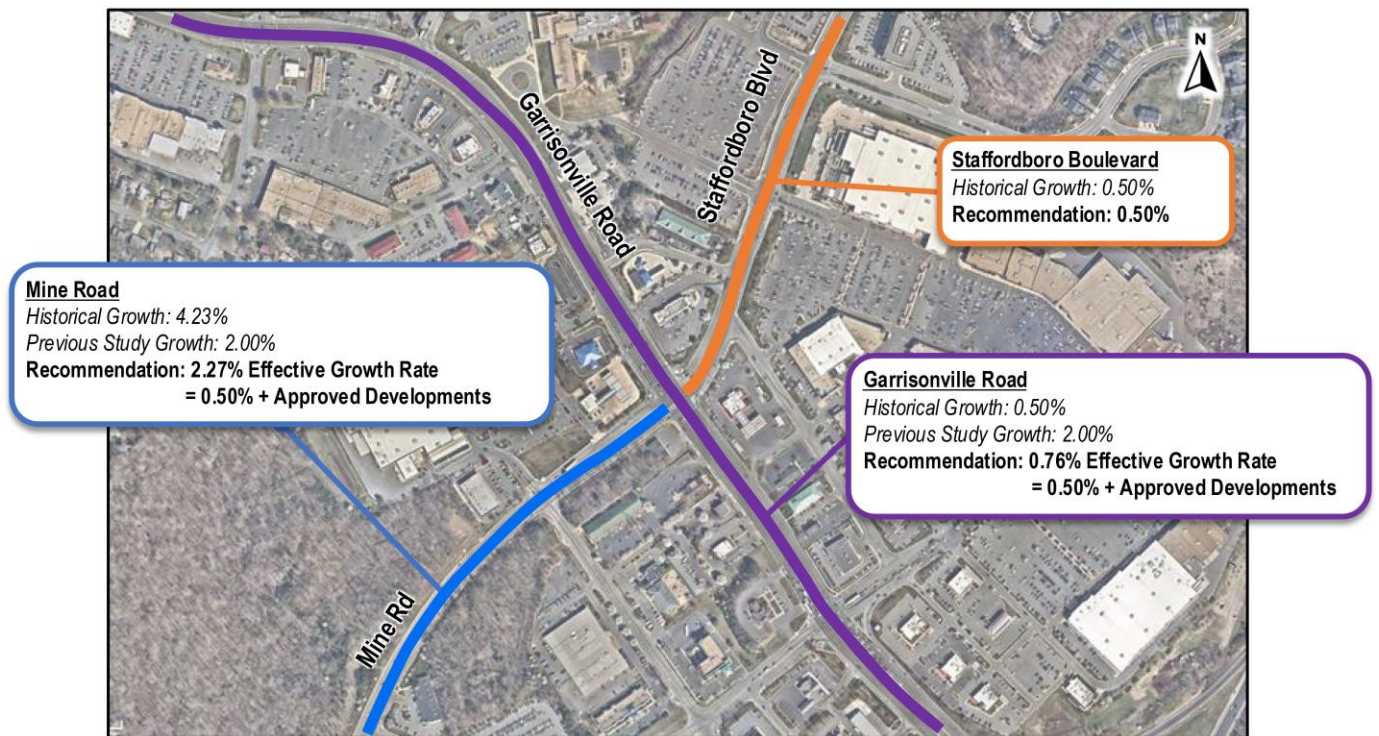


**Figure 23: Study Area Linear Growth Rates**

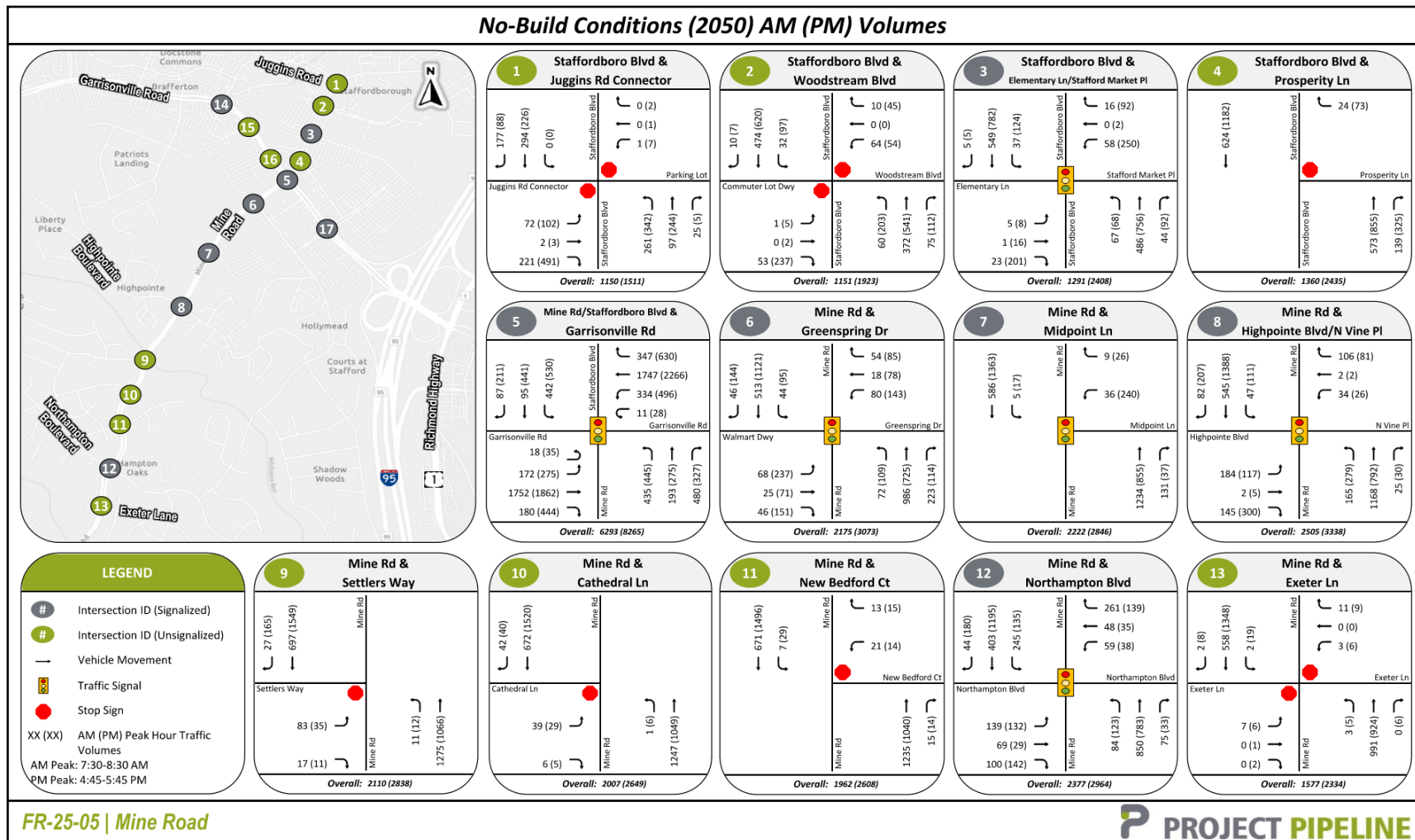


Figure 24: 2050 No-Build Peak Hour Volumes (1 of 2)

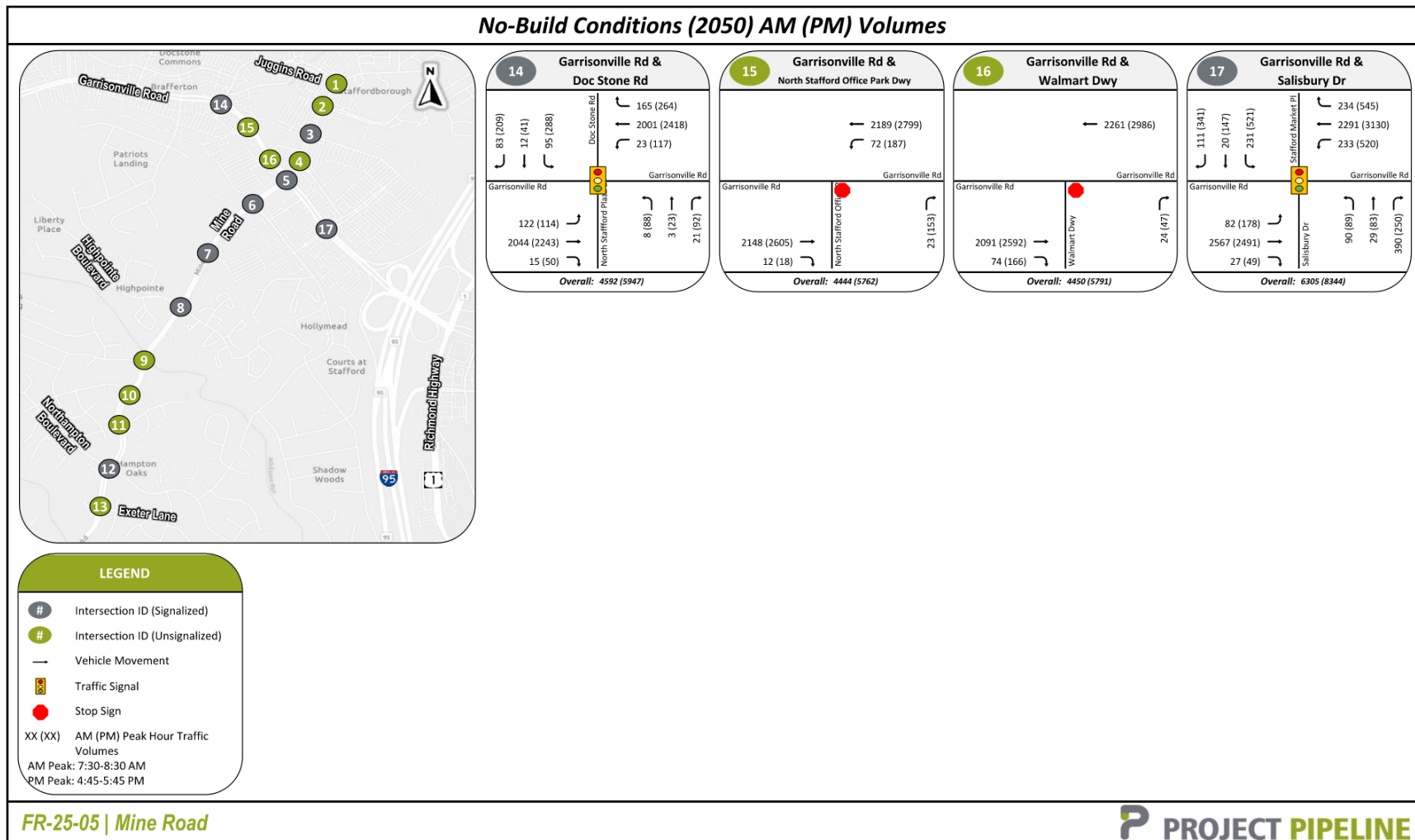


Figure 25: 2050 No-Build Peak Hour Volumes (2 of 2)

## Synchro and SimTraffic Analysis

Traffic operational analyses were conducted to evaluate the overall performance of the study intersections under No-Build (2050) AM and PM peak hour conditions. No-Build conditions were modeled using Synchro 11 and SimTraffic 11 for the entire study area.

The existing conditions Synchro models were used as a basis to develop the No-Build models for the AM and PM peak hour conditions. The models were updated with the projected 2050 No-Build traffic volumes and the anticipated development to the west of Midpoint Lane, which adds a fourth leg to the intersection, in the eastbound direction. Traffic signal cycle lengths, splits, and offsets were adjusted and optimized for future conditions due to the network being oversaturated in existing conditions. No-Build inputs and analysis methodologies were applied consistently with *TOSAM*, Version 2.0.

Ten simulations were conducted for both the AM and PM No-Build SimTraffic models. Microsimulation delay (seconds per vehicle) and maximum queue length (feet) were selected as measures of effectiveness to quantitatively report the performance of each study intersection. The full Synchro and SimTraffic reports are included in **Appendix D** and shown in **Table 14** through **Table 17**.

Under No-Build conditions, SimTraffic microsimulation delay results indicate all signalized intersections are projected to operate acceptably in both AM and PM peak hours. At the intersection of Mine Road/Staffordboro Boulevard and Garrisonville Road the overall intersection delay was 53.6 seconds per vehicle during the AM peak hour and 75.7 seconds. The movement with the largest delay was the eastbound left, with a delay in the PM peak hour of 230.9 seconds per vehicle.

The minor street approaches at the intersections of Staffordboro Boulevard and Woodstream Boulevard are consistent with existing conditions, experiencing long delays during the PM peak hour. The unsignalized intersections along Mine Road operated with delays ranging between 23.7 seconds per vehicle to 30.7 seconds per vehicle in the AM peak hour and between 22.5 seconds per vehicle and 73.0 seconds per vehicle in the PM. Among the signalized intersections along Mine Road, the Greenspring Drive intersection experienced the highest overall delay in the PM peak hour (75.8 seconds per).

The following trends were observed under No-Build conditions:

### AM Peak Hour

- The signalized intersections south of Garrisonville Road operated with overall intersection delays ranging between 11.1 seconds per vehicle and 34.1 seconds per vehicle
- The southbound approach at the intersection of Mine Road/Staffordboro Boulevard and Garrisonville Road experienced the highest approach delay (113 seconds per vehicle)
- The longest queue at the intersection of Mine Road and Garrisonville Road was the eastbound through movement which extended back 1,428 feet
- The highest overall intersection delay for the signalized intersections occurred at the intersection of Mine Road/Staffordboro Boulevard and Garrisonville Road (53.6 seconds per vehicle)
- The highest approach delay for the unsignalized intersections occurred at the intersection of Mine Road and Settlers Way in the eastbound direction (30.7 seconds per vehicle)

## PM Peak Hour

Staffordboro Boulevard and Elementary Lane/Stafford Market Place and Staffordboro Boulevard and Woodstream experienced the highest overall intersection delay.

- The signalized intersections south of Garrisonville Road operated with overall intersection delays ranging between 24.9 seconds per vehicle and 75.8 seconds per vehicle
- The southbound approach at the intersection of Garrisonville Road and Mine Road/Staffordboro Boulevard experienced the highest approach delay (144.3 seconds per vehicle)
- The longest queue at the intersection of Mine Road/Staffordboro Boulevard and Garrisonville Road was the eastbound through movement which extended back 2,924 feet
- The highest overall intersection delay for the signalized intersections occurred at the intersection of Staffordboro Boulevard and Elementary Lane/Stafford Market Place (90.0 seconds per vehicle)
- The highest approach delay for the unsignalized intersections occurred at the intersection of Staffordboro Boulevard and Woodstream Boulevard in the westbound direction (717.6 seconds per vehicle)

**Table 14: 2050 No-Build Conditions Microsimulation Delay (seconds per vehicle) (1 of 2)**

| Intersection Number and Description |                                                      | Lane Group | Eastbound            |       | Westbound          |        | Northbound        |       | Southbound        |       | Overall      |       |
|-------------------------------------|------------------------------------------------------|------------|----------------------|-------|--------------------|--------|-------------------|-------|-------------------|-------|--------------|-------|
|                                     |                                                      |            | AM                   | PM    | AM                 | PM     | AM                | PM    | AM                | PM    |              |       |
| 1                                   | Staffordboro Blvd & Juggins Rd Connector             |            | Juggins Rd Connector |       | Parking Lot        |        | Staffordboro Blvd |       | Staffordboro Blvd |       | Intersection |       |
|                                     |                                                      | Left       | 48.1                 | 101.3 | 9.4                | 65.6   | 11.3              | 34.1  |                   |       | 8.3          | 48.0  |
|                                     |                                                      | Through    | 41.9                 | 103.6 | 0.0                | 34.1   | 8.3               | 10.7  | 2.6               | 9.4   |              |       |
|                                     |                                                      | Right      | 4.9                  | 97.9  | 0.0                | 10.7   | 0.2               | 11.3  | 1.3               | 1.7   |              |       |
|                                     |                                                      | Approach   | 15.9                 | 98.5  | 9.4                | 51.5   | 9.9               | 10.4  | 2.1               | 20.6  |              |       |
| 2                                   | Staffordboro Blvd & Woodstream Blvd                  |            | Commuter Lot Dwy     |       | Woodstream Blvd    |        | Staffordboro Blvd |       | Staffordboro Blvd |       | Intersection |       |
|                                     |                                                      | Left       | †                    | 260.7 | 24.4               | 1278.1 | 5.0               | 78.9  | 5.4               | 2.1   | 3.1          | 106.1 |
|                                     |                                                      | Through    | †                    | 442.3 | †                  | †      | 1.3               | 27.1  | 1.1               | 80.4  |              |       |
|                                     |                                                      | Right      | 6.9                  | 525.1 | 3.8                | 1278.1 | 1.0               | 4.3   | 0.6               | 54.9  |              |       |
|                                     |                                                      | Approach   | 7.1                  | 522.1 | 21.4               | 717.6  | 1.7               | 9.5   | 1.4               | 57.9  |              |       |
| 3                                   | Staffordboro Blvd & Elementary Ln/Stafford Market Pl |            | Elementary Ln        |       | Stafford Market Pl |        | Staffordboro Blvd |       | Staffordboro Blvd |       | Intersection |       |
|                                     |                                                      | Left       | 56.4                 | 335.5 | 56.7               | 139.1  | 9.5               | 27.1  | 13.7              | 80.4  | 10.2         | 90.9  |
|                                     |                                                      | Through    | 57.4                 | 304.4 | †                  | 39.9   | 4.5               | 4.3   | 10.8              | 54.9  |              |       |
|                                     |                                                      | Right      | 13.3                 | 176.0 | 6.7                | 11.0   | 1.6               | 2.1   | 2.2               | 20.9  |              |       |
|                                     |                                                      | Approach   | 20.8                 | 191.9 | 45.1               | 105.8  | 4.8               | 24.6  | 10.9              | 126.3 |              |       |
| 4                                   | Staffordboro Blvd & Prosperity Ln                    |            |                      |       | Prosperity Ln      |        | Staffordboro Blvd |       | Staffordboro Blvd |       | Intersection |       |
|                                     |                                                      | Left       |                      |       |                    |        |                   |       |                   |       | 5.5          | 12.1  |
|                                     |                                                      | Through    |                      |       |                    |        | 1.2               | 1.2   | 10.4              | 23.1  |              |       |
|                                     |                                                      | Right      |                      |       | 8.0                | 11.0   | 1.1               | 1.3   |                   |       |              |       |
|                                     |                                                      | Approach   |                      |       | 8.0                | 11.0   | 1.2               | 1.2   | 10.4              | 23.1  |              |       |
| 5                                   | Mine Rd/Staffordboro Blvd & Garrisonville Rd         |            | Garrisonville Rd     |       | Garrisonville Rd   |        | Mine Rd           |       | Staffordboro Blvd |       | Intersection |       |
|                                     |                                                      | Left       | 140.6                | 230.9 | 67.4               | 116.8  | 94.7              | 110.1 | 141.8             | 181.9 | 53.6         | 75.7  |
|                                     |                                                      | Through    | 53.3                 | 45.2  | 23.3               | 50.3   | 85.9              | 105.7 | 67.1              | 129.4 |              |       |
|                                     |                                                      | Right      | 6.3                  | 12.5  | 4.7                | 15.2   | 48.0              | 40.9  | 20.6              | 84.8  |              |       |
|                                     |                                                      | Approach   | 57.1                 | 66.1  | 26.9               | 54.4   | 73.1              | 87.5  | 113.3             | 144.3 |              |       |
| 6                                   | Mine Rd & Greenspring Dr                             |            | Walmart Dwy          |       | Greenspring Dr     |        | Mine Rd           |       | Mine Rd           |       | Intersection |       |
|                                     |                                                      | Left       | 49.6                 | 251.6 | 53.4               | 72.9   | 67.2              | 62.6  | 20.3              | 30.0  | 34.1         | 75.8  |
|                                     |                                                      | Through    | 51.4                 | 227.4 | 54.1               | 78.6   | 35.5              | 55.4  | 5.7               | 22.3  |              |       |
|                                     |                                                      | Right      | 36.7                 | 208.2 | 55.6               | 82.8   | 33.1              | 43.8  | 3.5               | 19.7  |              |       |
|                                     |                                                      | Approach   | 45.0                 | 233.3 | 53.9               | 77.1   | 36.9              | 54.9  | 20.7              | 36.6  |              |       |

† No Simtraffic delay is reported

Color coding is based on the delay reported for that movement and the analogous level of service as shown in **Table 8**.

**Table 15: 2050 No-Build Conditions Microsimulation Delay (seconds per vehicle) (2 of 2)**

| Intersection Number and Description |                                     | Lane Group | Eastbound        |      | Westbound        |      | Northbound |      | Southbound |      | Overall      |      |
|-------------------------------------|-------------------------------------|------------|------------------|------|------------------|------|------------|------|------------|------|--------------|------|
|                                     |                                     |            | AM               | PM   | AM               | PM   | AM         | PM   | AM         | PM   |              |      |
| 7                                   | Mine Rd & Midpoint Ln               |            | Midpoint Ln      |      | Midpoint Ln      |      | Mine Rd    |      | Mine Rd    |      | Intersection |      |
|                                     |                                     | Left       | 50.0             | 50.9 | 51.8             | 51.1 | 17.3       | 36.2 | 20.3       | 30.0 | 11.1         | 24.9 |
|                                     |                                     | Through    | 46.3             | 41.8 | 37.2             | 36.9 | 11.5       | 19.3 | 5.7        | 22.3 |              |      |
|                                     |                                     | Right      | 6.9              | 19.0 | 11.8             | 17.4 | 7.2        | 7.8  | 3.5        | 19.7 |              |      |
|                                     |                                     | Approach   | 26.1             | 31.6 | 44.7             | 47.6 | 11.4       | 20.5 | 5.7        | 22.3 |              |      |
| 8                                   | Mine Rd & Highpointe Blvd/N Vine Pl |            | Highpointe Blvd  |      | N Vine Pl        |      | Mine Rd    |      | Mine Rd    |      | Intersection |      |
|                                     |                                     | Left       | 51.6             | 64.9 | 53.1             | 63.6 | 26.5       | 82.1 | 41.0       | 29.3 | 24.3         | 34.1 |
|                                     |                                     | Through    | 39.0             | 61.9 | 61.9             | 69.1 | 22.6       | 20.0 | 21.6       | 33.1 |              |      |
|                                     |                                     | Right      | 8.1              | 26.2 | 19.3             | 12.3 | 19.1       | 10.2 | 17.3       | 30.5 |              |      |
|                                     |                                     | Approach   | 32.3             | 37.5 | 27.5             | 24.5 | 23.0       | 35.8 | 22.5       | 32.6 |              |      |
| 9                                   | Mine Rd & Settlers Way              |            | Settlers Way     |      |                  |      | Mine Rd    |      | Mine Rd    |      | Intersection |      |
|                                     |                                     | Left       | 32.8             | 82.1 |                  |      | 5.1        | 19.0 |            |      | 3.1          | 5.1  |
|                                     |                                     | Through    |                  |      |                  |      | 1.0        | 0.9  | 2.8        | 5.8  |              |      |
|                                     |                                     | Right      | 21.1             | 50.0 |                  |      |            |      | 2.4        | 5.6  |              |      |
|                                     |                                     | Approach   | 30.7             | 73.0 |                  |      | 1.1        | 1.1  | 2.8        | 5.8  |              |      |
| 10                                  | Mine Rd & Cathedral Ln              |            | Cathedral Ln     |      |                  |      | Mine Rd    |      | Mine Rd    |      | Intersection |      |
|                                     |                                     | Left       | 25.8             | 50.1 |                  |      | 1.5        | 11.0 |            |      | 1.4          | 2.0  |
|                                     |                                     | Through    |                  |      |                  |      | 0.8        | 0.8  | 0.9        | 1.8  |              |      |
|                                     |                                     | Right      | 10.9             | 24.4 |                  |      |            |      | 0.8        | 1.9  |              |      |
|                                     |                                     | Approach   | 23.7             | 46.2 |                  |      | 0.8        | 0.8  | 0.9        | 1.8  |              |      |
| 11                                  | Mine Rd & New Bedford Ct            |            |                  |      | New Bedford Ct   |      | Mine Rd    |      | Mine Rd    |      | Intersection |      |
|                                     |                                     | Left       |                  |      | 31.6             | 98.6 |            |      | 8.9        | 10.8 | 2.7          | 4.5  |
|                                     |                                     | Through    |                  |      |                  |      | 2.9        | 2.6  | 1.0        | 4.7  |              |      |
|                                     |                                     | Right      |                  |      | 16.8             | 36.9 | 2.4        | 2.3  |            |      |              |      |
|                                     |                                     | Approach   |                  |      | 27.2             | 63.3 | 2.9        | 2.6  | 1.1        | 4.8  |              |      |
| 12                                  | Mine Rd & Northampton Blvd          |            | Northampton Blvd |      | Northampton Blvd |      | Mine Rd    |      | Mine Rd    |      | Intersection |      |
|                                     |                                     | Left       | 54.8             | 50.4 | 53.9             | 49.2 | 41.5       | 55.7 | 138.9      | 63.8 | 45.3         | 48.7 |
|                                     |                                     | Through    | 55.6             | 48.6 | 52.8             | 50.1 | 40.9       | 26.1 | 26.9       | 66.7 |              |      |
|                                     |                                     | Right      | 9.2              | 32.7 | 14.3             | 18.3 | 32.5       | 18.1 | 19.9       | 69.6 |              |      |
|                                     |                                     | Approach   | 40.0             | 41.8 | 25.6             | 28.9 | 40.4       | 29.7 | 65.8       | 66.8 |              |      |
| 13                                  | Mine Rd & Exeter Ln                 |            | Exeter Ln        |      | Exeter Ln        |      | Mine Rd    |      | Mine Rd    |      | Intersection |      |
|                                     |                                     | Left       | 29.4             | 27.2 | 20.2             | 32.8 | 4.2        | 33.1 | 15.1       | 8.6  | 1.5          | 2.2  |
|                                     |                                     | Through    | †                | 32.8 | †                | †    | 0.8        | 4.4  | 2.0        | 2.8  |              |      |
|                                     |                                     | Right      | †                | 11.2 | 6.6              | 11.2 | 40.4       | 11.8 | 1.5        | 3.2  |              |      |
|                                     |                                     | Approach   | 29.4             | 22.5 | 8.6              | 14.8 | 0.8        | 0.9  | 2.0        | 2.9  |              |      |

† No Simtraffic delay is reported

Color coding is based on the delay reported for that movement and the analogous level of service as shown in **Table 8**.

**Table 16: 2050 No-Build Conditions Peak Hour Maximum Queues (feet) (1 of 2)**

| Intersection Number and Description |                                                      | Type of Control | Lane Group | Maximum Queue        |                   |                    |                   |                   |                   |                   |                   |
|-------------------------------------|------------------------------------------------------|-----------------|------------|----------------------|-------------------|--------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
|                                     |                                                      |                 |            | Eastbound            |                   | Westbound          |                   | Northbound        |                   | Southbound        |                   |
|                                     |                                                      |                 |            | AM                   | PM                | AM                 | PM                | AM                | PM                | AM                | PM                |
| 1                                   | Staffordboro Blvd & Juggins Rd Connector             | Unsignalized    |            | Juggins Rd Connector |                   | Parking Lot        |                   | Staffordboro Blvd |                   | Staffordboro Blvd |                   |
|                                     |                                                      |                 | Left       | 149                  | **(1%)            | 18                 | 44                | 284               | 336               | 29                | 383               |
|                                     |                                                      |                 | Through    |                      |                   |                    |                   |                   |                   |                   |                   |
|                                     |                                                      |                 | Right      | 115                  | **(53%)<br>^(36%) | 22                 | 74                |                   |                   |                   |                   |
| 2                                   | Staffordboro Blvd & Woodstream Blvd                  | Unsignalized    |            | Commuter Lot Dwy     |                   | Woodstream Blvd    |                   | Staffordboro Blvd |                   | Staffordboro Blvd |                   |
|                                     |                                                      |                 | Left       | 9                    | **(69%)<br>^(80%) | 94                 | ^(15%)            | 63                | 296               | 97                | ^(26%)            |
|                                     |                                                      |                 | Through    |                      |                   |                    |                   | 25                | 292               |                   |                   |
|                                     |                                                      |                 | Right      | 60                   | *(85%)            | 31                 | 534               | 0                 | 78                | 24                | ^(12%)            |
| 3                                   | Staffordboro Blvd & Elementary Ln/Stafford Market Pl | Signal          |            | Elementary Ln        |                   | Stafford Market Pl |                   | Staffordboro Blvd |                   | Staffordboro Blvd |                   |
|                                     |                                                      |                 | Left       | 63                   | ^(5%)             | 113                | **(2%)            | 68                | 203               | 96                | **(1%)            |
|                                     |                                                      |                 | Through    |                      |                   | 32                 | 194               | **(1%)            | **(19%)<br>^(7%)  | **(6%)<br>^(1%)   | **(76%)<br>^(51%) |
|                                     |                                                      |                 | Right      | **(7%)               | 99                |                    |                   | 145               | 146               | ^(13%)            |                   |
| 4                                   | Staffordboro Blvd & Prosperity Ln                    | Unsignalized    |            | Prosperity Ln        |                   | Staffordboro Blvd  |                   | Staffordboro Blvd |                   | Staffordboro Blvd |                   |
|                                     |                                                      |                 | Left       |                      |                   |                    |                   |                   |                   |                   |                   |
|                                     |                                                      |                 | Through    |                      |                   |                    |                   | 9                 | 43                | ^(24%)            | ^(65%)            |
|                                     |                                                      |                 | Right      |                      |                   | 42                 | 65                | †                 | 7                 |                   |                   |
| 5                                   | Mine Rd/Staffordboro Blvd & Garrisonville Rd         | Signal          |            | Garrisonville Rd     |                   | Garrisonville Rd   |                   | Mine Rd           |                   | Staffordboro Blvd |                   |
|                                     |                                                      |                 | Left       | *(3%)<br>^(3%)       | *(32%)<br>^(32%)  | 333                | *(1%)<br>^(1%)    | *(6%)<br>^(2%)    | *(8%)<br>^(3%)    | *(17%)<br>^(17%)  | *(23%)<br>^(23%)  |
|                                     |                                                      |                 | Through    | **(53%)<br>^(58%)    | **(78%)<br>^(78%) | **(4%)<br>^(6%)    | **(21%)<br>^(34%) | *(42%)<br>^(42%)  | **(53%)<br>^(54%) | **(35%)<br>^(35%) | **(67%)<br>^(67%) |
|                                     |                                                      |                 | Right      | 122                  | 175               | 168                | 314               | *(4%)<br>^(4%)    | *(2%)<br>^(2%)    | 138               | *(18%)            |
| 6                                   | Mine Rd & Greenspring Dr                             | Signal          |            | Walmart Dwy          |                   | Greenspring Dr     |                   | Mine Rd           |                   | Mine Rd           |                   |
|                                     |                                                      |                 | Left       | ^(1%)                | **(68%)<br>^(77%) | 165                | **(2%)            | 245               | 245               | 119               | 244               |
|                                     |                                                      |                 | Through    | 104                  | *(4%)             |                    |                   | **(16%)<br>^(5%)  | **(21%)<br>^(3%)  | ^(1%)             | **(15%)<br>^(17%) |
|                                     |                                                      |                 | Right      | 84                   | *(4%)             | 117                | 268               |                   |                   | 72                | 155               |

† No queue reported. Movement does not have conflicting volumes

\*(X%) - Maximum queue extends full length of storage bay for X% of the analysis period

\*\*\*(Y%) - Queue in lane adjacent to storage bay extends beyond end of storage bay for Y% of the analysis period

^(Z%) - Maximum queue extends back to the upstream intersection for Z% of the analysis period

**Table 17: 2050 No-Build Conditions Peak Hour Maximum Queues (feet) (2 of 2)**

| Intersection Number and Description |                                     | Type of Control | Lane Group | Maximum Queue    |          |                  |          |            |          |            |          |
|-------------------------------------|-------------------------------------|-----------------|------------|------------------|----------|------------------|----------|------------|----------|------------|----------|
|                                     |                                     |                 |            | Eastbound        |          | Westbound        |          | Northbound |          | Southbound |          |
|                                     |                                     |                 |            | AM               | PM       | AM               | PM       | AM         | PM       | AM         | PM       |
| 7                                   | Mine Rd & Midpoint Ln               | Signal          |            | Midpoint Ln      |          | Midpoint Ln      |          | Mine Rd    |          | Mine Rd    |          |
|                                     |                                     |                 | Left       |                  |          | 76               | *(14%)   |            |          | 31         | 161      |
|                                     |                                     |                 | Through    |                  |          |                  |          | ** (5%)    | ** (11%) | 154        | ** (6%)  |
|                                     |                                     |                 | Right      |                  |          | 25               | ** (1%)  | 134        | 126      | 152        | 506      |
| 8                                   | Mine Rd & Highpointe Blvd/N Vine Pl | Signal          |            | Highpointe Blvd  |          | N Vine Pl        |          | Mine Rd    |          | Mine Rd    |          |
|                                     |                                     |                 | Left       | *(1%)            | 213      | 90               | 71       | 170        | *(21%)   | 150        | 205      |
|                                     |                                     |                 | Through    | 60               | 41       | 121              | 93       | ** (11%)   | ** (7%)  | ** (2%)    | ** (15%) |
|                                     |                                     |                 | Right      | 103              | 259      |                  |          | 479        | 563      | 269        | 702      |
| 9                                   | Mine Rd & Settlers Way              | Unsignalized    |            | Settlers Way     |          |                  |          | Mine Rd    |          | Mine Rd    |          |
|                                     |                                     |                 | Left       | 129              | 135      |                  |          | 53         | 46       |            |          |
|                                     |                                     |                 | Through    |                  |          |                  |          | 0          | 0        | 8          | 82       |
|                                     |                                     |                 | Right      | 129              | 135      |                  |          | 0          |          | 13         | 57       |
| 10                                  | Mine Rd & Cathedral Ln              | Unsignalized    |            | Cathedral Ln     |          |                  |          | Mine Rd    |          | Mine Rd    |          |
|                                     |                                     |                 | Left       | 82               | 74       |                  |          | 3          | 32       |            |          |
|                                     |                                     |                 | Through    |                  |          |                  |          |            |          | 25         | 33       |
|                                     |                                     |                 | Right      | 82               | 74       |                  |          |            |          |            |          |
| 11                                  | Mine Rd & New Bedford Ct            | Unsignalized    |            | New Bedford Ct   |          |                  |          | Mine Rd    |          | Mine Rd    |          |
|                                     |                                     |                 | Left       |                  |          | 74               | 94       |            |          | 34         | 69       |
|                                     |                                     |                 | Through    |                  |          |                  |          | 98         | 6        | 29         | ** (2%)  |
|                                     |                                     |                 | Right      |                  |          | 74               | 94       | 98         | 2        |            |          |
| 12                                  | Mine Rd & Northampton Blvd          | Signal          |            | Northampton Blvd |          | Northampton Blvd |          | Mine Rd    |          | Mine Rd    |          |
|                                     |                                     |                 | Left       |                  |          |                  |          | *(1%)      | *(3%)    | *(51%)     | *(1%)    |
|                                     |                                     |                 | Through    | ** (7%)          | ** (47%) | 251              | ** (25%) | ** (39%)   | ** (20%) | ** (43%)   | ** (39%) |
|                                     |                                     |                 | Right      | 200              | *(9%)    | 199              | *(7%)    | 484        | 338      | 499        | ^(6%)    |
| 13                                  | Mine Rd & Exeter Ln                 | Unsignalized    |            | Exeter Ln        |          | Exeter Ln        |          | Mine Rd    |          | Mine Rd    |          |
|                                     |                                     |                 | Left       |                  |          |                  |          | 17         | 29       | 40         | 44       |
|                                     |                                     |                 | Through    | 33               | 40       | 57               | 36       | 2          | †        | 7          | 28       |
|                                     |                                     |                 | Right      |                  |          |                  |          |            |          |            |          |

† No queue reported. Movement does not have conflicting volumes

\*(X%) - Maximum queue extends full length of storage bay for X% of the analysis period

\*\*\*(Y%) - Queue in lane adjacent to storage bay extends beyond end of storage bay for Y% of the analysis period

^(Z%) - Maximum queue extends back to the upstream intersection for Z% of the analysis period

## 1.7 Phase 1 Alternatives Development

The study team developed preliminary alternatives in parallel with the high-level needs diagnosis efforts documented in **Chapter 1.5**. The proposed Phase 1 alternatives were developed to meet the following criteria:

- Improve transit access throughout the study area
- Mitigate safety issues for drivers and pedestrians in the study area
- Enhance bike and pedestrian access throughout the study area
- Improve operations at intersections in the study area

### 1.7.1. Initial Alternatives

The Needs Evaluation, Diagnosis, and Preliminary Concepts Meeting (SWG Meeting #2) was held on June 13, 2025. Several alternatives for the Mine Road corridor were presented during the meeting, which are summarized in **Table 18**. Due to the size of the study area, the meeting focused on improvements at the ten intersections along the Mine Road corridor that are north and south of Garrisonville Road as well as the corridor-wide multimodal and safety improvements.

The alternatives considered for the main intersection of Mine Road and Garrisonville Road were presented and discussed at the Preliminary Concepts Refinement and Phase 2 Scoping Meeting (SWG Meeting #3), held on July 1, 2025. All alternatives discussed across the two meetings are summarized in **Table 18**. The study team used the Virginia Intersection and Interchange Control Assessment Program (iCAP) and the Assessment Tool and Virginia Junction Screening Tool (VJuST) to screen intersections where reconfigurations were considered based on impacts to traffic operations, pedestrian accommodations, safety, and cost following processes outlined in VDOT IIM-TOD-397—Virginia iCAP Policy and Guidance. The VJuST and iCAP results for the following five intersections along Mine Road were presented in SWG Meetings #2 and #3:

- Midpoint Lane
- Highpointe Boulevard/N Vine Place
- Settlers Way
- Cathedral Lane
- New Bedford Court
- Garrisonville Road

Details of the Stage 1 iCAP results are summarized in **Section 1.7.2** and the meeting materials can be found in **Appendix E**.

**Table 18: Phase 1 Alternatives**

| Intersection                                            | Alternative                                | Description                                                                                                                                                                                                                                                          |
|---------------------------------------------------------|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mine Road/Staffordboro Boulevard and Garrisonville Road | Modified Conventional                      | Install a fourth through lane on the eastbound and westbound Garrisonville Road approaches. Install intersection lighting, increase clearance intervals, install high visibility crosswalk on the westbound approach, add curb extensions.                           |
|                                                         | Full Displaced Left Turn                   | Separate left turns from main intersection to reduce angle crashes. Left turns are directed to the other side of opposing traffic and are controlled with a signalized crossover.                                                                                    |
|                                                         | <u>Echelon</u>                             | Grade separate eastbound and northbound approaches with a two-phase cycle and 500-foot-long ramps.                                                                                                                                                                   |
|                                                         | <u>Center Turn Overpass</u>                | Grade separate left turns with a two-phase cycle and 500-foot-long ramps.                                                                                                                                                                                            |
|                                                         | Tight Urban Diamond Interchange            | Separate major roadway through traffic from intersection and operates with one traditional signal. Local access is maintained.                                                                                                                                       |
|                                                         | <u>Michigan Urban Diamond</u>              | Separate major roadway through traffic from intersection and redirect all left turns to U-turns.                                                                                                                                                                     |
|                                                         | Pedestrian Access and Safety Improvements  | Add curb extension to reduce crossing distance, extend median into crosswalk, install intersection lighting, add high visibility crosswalk on westbound approach, increase clearance intervals, add advance intersection warning signage or queue detection warning. |
| Midpoint Lane and Mine Road                             | <u>Partial Displaced Left Turn (NB-SB)</u> | Cross motorists making a left-turn at the intersection to the other side of oncoming traffic at an upstream signal prior to the main intersection. These drivers then make the left-turn at the main intersection.                                                   |
|                                                         | <u>Restricted Crossing U-Turn (NB-SB)</u>  | Reroute through and left-turn movements on side streets to make a right-turn at the intersection and a U-turn downstream on the main road approximately 500 feet away.                                                                                               |
|                                                         | <u>Thru-cut</u>                            | Reroute through movements on side streets to make a right-turn and a downstream U-turn or use the surrounding network to reach the desired destination.                                                                                                              |
|                                                         | Pedestrian Access and Safety Improvements  | Add pedestrian signals and push buttons, restripe westbound approach stop bar and add crosswalk.                                                                                                                                                                     |

| Intersection                                    | Alternative                                | Description                                                                                                                                                                                                                                                   |
|-------------------------------------------------|--------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Highpointe/N Vine Place Boulevard and Mine Road | <u>Partial Displaced Left Turn (NB-SB)</u> | Cross motorists making a left-turn at the intersection to the other side of oncoming traffic at an upstream signal prior to the main intersection. These drivers then make the left-turn at the main intersection.                                            |
|                                                 | <u>Restricted Crossing U-Turn (NB-SB)</u>  | Reroute through and left-turn movements on side streets to make a right-turn at the intersection and a U-turn downstream on the main road approximately 500 feet away.                                                                                        |
|                                                 | <u>Thru-cut</u>                            | Reroute through movements on side streets to make a right-turn and a downstream U-turn or use the surrounding network to reach the desired destination.                                                                                                       |
|                                                 | Pedestrian Access and Safety Improvements  | Install intersection lighting, add crosswalks and curb ramps, add northbound and southbound protected left-turns, increase clearance intervals, update median curblines to accommodate crossings.                                                             |
| Mine Road and Settlers Way                      | <u>Restricted Crossing U-Turn (NB-SB)</u>  | Reroute through and left-turn movements on side streets to make a right-turn at the intersection and a U-turn downstream on the main road approximately 500 feet away.                                                                                        |
|                                                 | <u>Continuous Green-T</u>                  | Permit one direction of motorists on Mine Road to pass through the intersection without stopping, control the opposite direction with a traffic signal, and route left-turning side street drivers into a channelized receiving lane to merge onto Mine Road. |
|                                                 | Pedestrian Access and Safety Improvements  | Update curb ramps, install traffic calming measures, install advance intersection warning sign, install crosswalks, install pedestrian hybrid beacon or rectangular rapid flashing beacon.                                                                    |
| Mine Road and Cathedral Lane                    | <u>Restricted Crossing U-Turn (NB-SB)</u>  | Reroute through and left-turn movements on side streets to make a right-turn at the intersection and a U-turn downstream on the main road approximately 500 feet away.                                                                                        |
|                                                 | <u>Continuous Green-T</u>                  | Permit one direction of motorists on Mine Road to pass through the intersection without stopping, control the opposite direction with a traffic signal, and route left-turning side street drivers into a channelized receiving lane to merge onto Mine Road. |
|                                                 | Pedestrian Access and Safety Improvements  | Update curb ramps, install traffic calming measures, install lighting, install advance intersection warning sign, install crosswalk.                                                                                                                          |

| Intersection                                      | Alternative                               | Description                                                                                                                                                                                                                                                   |
|---------------------------------------------------|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mine Road and New Bedford Court                   | <u>Restricted Crossing U-Turn (NB-SB)</u> | Reroute through and left-turn movements on side streets to make a right-turn at the intersection and a U-turn downstream on the main road approximately 500 feet away.                                                                                        |
|                                                   | <u>Continuous Green-T</u>                 | Permit one direction of motorists on Mine Road to pass through the intersection without stopping, control the opposite direction with a traffic signal, and route left-turning side street drivers into a channelized receiving lane to merge onto Mine Road. |
|                                                   | Pedestrian Access and Safety Improvements | Install intersection lighting, update curb ramps, Install advanced intersection warning sign, install crosswalks, install pedestrian hybrid beacon or rectangular rapid flashing beacon.                                                                      |
| Staffordboro Boulevard and Juggins Road Connector | Pedestrian Access and Safety Improvements | Install concrete channelizing islands to discourage improper use of lanes, install new curb ramps and crosswalks.                                                                                                                                             |
| Staffordboro Boulevard and Elementary Lane        | Pedestrian Access and Safety Improvements | Update curb ramps, adjust curb-line to accommodate northbound U-turn, add crosswalks, curb ramps, and pedestrian signals, optimize signal timing and increase clearance intervals.                                                                            |
| Staffordboro Boulevard and Woodstream Boulevard   | Pedestrian Access and Safety Improvements | Update curb ramps, add curb bump-outs, install crosswalks, install W11-2, install pedestrian hybrid beacon or rectangular rapid flashing beacon.                                                                                                              |
| Mine Road and Northampton Boulevard               | Pedestrian Access and Safety Improvements | Optimize signal timing, increase clearance intervals, convert flashing yellow arrow phasing to protected lefts only, update curb ramps.                                                                                                                       |
| Mine Road and Exeter Lane                         | Pedestrian Access and Safety Improvements | Install intersection lighting, update curb ramps, install advanced intersection warning sign, install crosswalks.                                                                                                                                             |

### **Corridor-wide Safety Improvements**

The study team reviewed various safety improvements to implement along the Staffordboro Boulevard/Mine Road corridor. The improvements included traffic calming measures, such as reducing lane widths to 11 feet, installing pole mounted speed display signs (PMSD), installing additional advisory warning signs, and increased fines and enforcement. Other safety improvements were considered on an intersection basis.

### **Bicycle and Pedestrian Concepts**

In addition to concepts addressing vehicular operations and safety, the study team reviewed alternatives addressing bicycle and pedestrian access. This consisted of the following concepts:

- 10-foot wide shared-use path along the west side of Mine Road (widening existing or installing a new facility)
- 5-foot-wide sidewalk on the east side of Mine Road
- 5-foot-wide sidewalk along the west side of Staffordboro Boulevard from Garrisonville Road to Clement Drive
- 5-foot-wide sidewalk connection along the north side of Midpoint Lane and west side of Salisbury Drive establishing a direct pedestrian route between Mine Road, the park and ride lot, and Garrisonville Road.

These improvements were determined to be included as part of the alternatives to be analyzed further in Phase 2. The innovative intersection configurations would benefit bicycles and pedestrians due to the removal and restriction of certain movements. Within the innovative intersection concepts and the pedestrian access and safety improvement concepts applied at intersections, additional concrete islands, refuge islands, and curb bump-outs are proposed which reduce the crossing distance for bicyclists and pedestrians as well as reduce the number of conflict points at the crosswalks. Several intersections also are proposed to receive upgraded curb ramps oriented in the direction of pedestrian travel and meet ADA/PROWA requirements.

### **Transit Access and Transportation Demand Management (TDM) Improvements**

The study team identified transit access and TDM improvements including transit service enhancements, improved connectivity and access points, and bus stop infrastructure. Upgrades to bus stop infrastructure included adding new shelters, signs, and benches. The study team also identified improvements to the existing FXBGO! Route D4 to improve access from neighborhoods south of Garrisonville Road along Mine Road to the Staffordboro Boulevard Park and Ride. This improvement included adding reverse circulation, increasing frequency and extending daily schedule, and adding stops along Mine Road.

### 1.7.2. Phase 1 Alternatives Summary

The Stage 1 iCAP results are summarized in **Figure 26** through **Figure 31**. During these meetings, the SWG decided which concepts would move forward to Phase 2.

The SWG agreed to carry four of the six alternatives presented for the intersection of Mine Road/Staffordboro Boulevard and Garrisonville Road to Phase 2 for further refinement:

1. Modified Conventional
2. Full Displaced Left Turn
3. Michigan Urban Diamond
4. Tight Urban Diamond

The Echelon and the Center Turn Overpass were eliminated because although they would increase capacity, improve safety, and scored well in the Stage 1 iCAP evaluation, neither alternative was determined to be compatible in the context of the study network and were not anticipated to be geometrically feasible given the close proximity of adjacent intersections.

At the intersections of Mine Road and Midpoint Lane and Mine Road and Highpointe Boulevard/N Vine Place, the SWG selected two alternatives to carry forward to Phase 2:

1. Restricted Crossing U-Turn (NB-SB)
2. Thru-cut

The Partial Displaced Left Turn (NB-SB) alternatives at both of these intersections were eliminated because although they worked operationally, they did not notably improve safety and pedestrian access. Though the RCUT alternative at Highpointe Boulevard/N Vine Place was originally eliminated during the SWG meeting, the traffic operations were revisited and determined to be acceptable, so the alternative was carried forward.

The Continuous Green-T alternative was eliminated at the intersections of Mine Road and Settlers Way, Mine Road and Cathedral Lane, and Mine Road and New Bedford Court because the intersections were not anticipated to warrant a signal, the concepts would prevent potential future pedestrian crossings of Mine Road at the intersections, and the concept footprints and costs were anticipated to be larger than the RCUT. Therefore, only the RCUT alternative was carried forward for these three intersections.

**Table 19** summarizes the alternatives considered in Phase 1 and gives the justification for whether a concept was moved forward to Phase 2. **Figure 32** shows the preliminary alternatives graphically categorized by the needs addressed by the alternative. The SWG agreed to carry forward all pedestrian access and safety, transit, and TDM alternatives considered along the corridor, with the exception of route geometry modifications to FXBGO! Route D4.

| Metric Weighting<br>(Based on Purpose and Need) |                          | Traffic Operations         |                                        | Pedestrian                                         |                                | Safety                                  |                            | Stage 1 Cost                          |                                  | Total Possible Score |  |
|-------------------------------------------------|--------------------------|----------------------------|----------------------------------------|----------------------------------------------------|--------------------------------|-----------------------------------------|----------------------------|---------------------------------------|----------------------------------|----------------------|--|
|                                                 |                          | Traffic Operations Weight  |                                        | Pedestrian Weight                                  |                                | Safety Weight                           |                            | Stage 1 Cost Weight                   |                                  |                      |  |
|                                                 |                          | 3                          |                                        | 1                                                  |                                | 3                                       |                            | 2                                     |                                  | 9                    |  |
| Alternatives                                    |                          | VJuST Maximum<br>V/C Ratio | Traffic Operations<br>Metric MOE Score | VJuST Accommodation<br>Compared to<br>Conventional | Pedestrian<br>Metric MOE Score | VJuST Weighted Total<br>Conflict Points | Safety<br>Metric MOE Score | VJuST Planning Level<br>Cost Category | Stage 1 Cost<br>Metric MOE Score | Total Stage 1 Score  |  |
|                                                 |                          |                            |                                        |                                                    |                                |                                         |                            |                                       |                                  |                      |  |
| Existing                                        | Conventional             | 0.70                       | --                                     | 0                                                  | --                             | 48                                      | --                         |                                       | --                               |                      |  |
| Alternative 1                                   | Center Turn Overpass     | 0.64                       | 0.9                                    | +                                                  | 1.0                            | 32                                      | 0.7                        | \$\$\$\$                              | 0.5                              | 7 out of 9           |  |
| Alternative 2                                   | Echelon                  | 0.66                       | 0.8                                    | +                                                  | 1.0                            | 28                                      | 0.8                        | \$\$\$\$                              | 0.5                              | 7.2 out of 9         |  |
| Alternative 3*                                  | Full Displaced Left Turn | 0.68                       | 0.8                                    | -                                                  | 0.0                            | 40                                      | 0.3                        | \$\$\$                                | 0.7                              | 3.1 out of 9         |  |
| Alternative 4*                                  | Michigan Urban Diamond   | 0.80                       | 0.5                                    | +                                                  | 1.0                            | 24                                      | 1.0                        | \$\$\$\$\$                            | 0.4                              | 7.3 out of 9         |  |
| Alternative 5*                                  | Conventional             | 0.82                       | 0.4                                    | 0                                                  | 0.5                            | 48                                      | 0.0                        | \$                                    | 1.0                              | 3.9 out of 9         |  |
| Alternative 6*                                  | Traditional Diamond      | 0.59                       | 1.0                                    | 0                                                  | 0.5                            | 28                                      | 0.8                        | \$\$\$\$\$                            | 0.4                              | 5.7 out of 9         |  |

\*Alternative carried forward to Stage 2

Figure 26: Virginia iCAP Stage 1 Results—Garrisonville Road PM Peak Hour

| Metric Weighting<br>(Based on Purpose and Need) |                                   | Traffic Operations         |                                        | Pedestrian                                         |                                | Safety                                  |                            | Stage 1 Cost                          |                                  | Total Possible Score |  |
|-------------------------------------------------|-----------------------------------|----------------------------|----------------------------------------|----------------------------------------------------|--------------------------------|-----------------------------------------|----------------------------|---------------------------------------|----------------------------------|----------------------|--|
|                                                 |                                   | Traffic Operations Weight  |                                        | Pedestrian Weight                                  |                                | Safety Weight                           |                            | Stage 1 Cost Weight                   |                                  |                      |  |
|                                                 |                                   | 3                          |                                        | 1                                                  |                                | 3                                       |                            | 2                                     |                                  | 9                    |  |
| Alternatives                                    |                                   | VJuST Maximum<br>V/C Ratio | Traffic Operations<br>Metric MOE Score | VJuST Accommodation<br>Compared to<br>Conventional | Pedestrian<br>Metric MOE Score | VJuST Weighted Total<br>Conflict Points | Safety<br>Metric MOE Score | VJuST Planning Level<br>Cost Category | Stage 1 Cost<br>Metric MOE Score | Total Stage 1 Score  |  |
| Existing                                        | Conventional                      | 0.70                       | --                                     | 0                                                  | --                             | 48                                      | --                         |                                       | --                               |                      |  |
| Alternative 1                                   | Partial Displaced Left Turn EB-WB | 0.84                       | 0.0                                    | -                                                  | 0.0                            | 44                                      | 0.1                        | \$\$\$                                | 0.7                              | 1.7 out of 9         |  |
| Alternative 2*                                  | Restricted Crossing U-Turn NB-SB  | 1.20                       | 0.0                                    | 0                                                  | 0.5                            | 20                                      | 1.0                        | \$\$                                  | 1.0                              | 6.5 out of 9         |  |
| Alternative 3*                                  | Thru-Cut                          | 0.77                       | 0.0                                    | 0                                                  | 0.5                            | 28                                      | 0.7                        | \$                                    | 1.0                              | 5.6 out of 9         |  |

\*Alternative carried forward to Stage 2

Figure 27: Virginia iCAP Stage 1 Results—Highpointe Boulevard/N Vine Place PM Peak Hour

| Metric Weighting<br>(Based on Purpose and Need) |                                   | Traffic Operations         |                                        | Pedestrian                                         |                                | Safety                                  |                            | Stage 1 Cost                          |                                  | Total Possible Score |  |
|-------------------------------------------------|-----------------------------------|----------------------------|----------------------------------------|----------------------------------------------------|--------------------------------|-----------------------------------------|----------------------------|---------------------------------------|----------------------------------|----------------------|--|
|                                                 |                                   | Traffic Operations Weight  |                                        | Pedestrian Weight                                  |                                | Safety Weight                           |                            | Stage 1 Cost Weight                   |                                  |                      |  |
|                                                 |                                   | 3                          |                                        | 1                                                  |                                | 3                                       |                            | 2                                     |                                  |                      |  |
| Alternatives                                    |                                   | VJuST Maximum<br>V/C Ratio | Traffic Operations<br>Metric MOE Score | VJuST Accommodation<br>Compared to<br>Conventional | Pedestrian<br>Metric MOE Score | VJuST Weighted Total<br>Conflict Points | Safety<br>Metric MOE Score | VJuST Planning Level<br>Cost Category | Stage 1 Cost<br>Metric MOE Score | Total Stage 1 Score  |  |
|                                                 |                                   |                            |                                        |                                                    |                                |                                         |                            |                                       |                                  |                      |  |
| Existing                                        | Conventional                      | 0.56                       | --                                     | 0                                                  | --                             | 48                                      | --                         |                                       | --                               |                      |  |
| Alternative 1                                   | Partial Displaced Left Turn EB-WB | 0.44                       | 1.0                                    | -                                                  | 0.0                            | 44                                      | 0.1                        | \$\$\$                                | 0.7                              | 2.7 out of 9         |  |
| Alternative 2*                                  | Restricted Crossing U-Turn NB-SB  | 0.63                       | 0.0                                    | 0                                                  | 0.5                            | 20                                      | 1.0                        | \$\$                                  | 1.0                              | 6.5 out of 9         |  |
| Alternative 3*                                  | Thru-Cut                          | 0.67                       | 0.0                                    | 0                                                  | 0.5                            | 28                                      | 0.7                        | \$\$                                  | 1.0                              | 5.6 out of 9         |  |

\*Alternative carried forward to Stage 2

**Figure 28: Virginia iCAP Stage 1 Results—Midpoint Lane PM Peak Hour**

| Metric Weighting<br>(Based on Purpose and Need) |                                   | Traffic Operations         |                                        | Pedestrian                                         |                                | Safety                                  |                            | Stage 1 Cost                          |                                  | Total Possible Score |  |
|-------------------------------------------------|-----------------------------------|----------------------------|----------------------------------------|----------------------------------------------------|--------------------------------|-----------------------------------------|----------------------------|---------------------------------------|----------------------------------|----------------------|--|
|                                                 |                                   | Traffic Operations Weight  |                                        | Pedestrian Weight                                  |                                | Safety Weight                           |                            | Stage 1 Cost Weight                   |                                  |                      |  |
|                                                 |                                   | 3                          |                                        | 1                                                  |                                | 3                                       |                            | 2                                     |                                  |                      |  |
| Alternatives                                    |                                   | VJuST Maximum<br>V/C Ratio | Traffic Operations<br>Metric MOE Score | VJuST Accommodation<br>Compared to<br>Conventional | Pedestrian<br>Metric MOE Score | VJuST Weighted Total<br>Conflict Points | Safety<br>Metric MOE Score | VJuST Planning Level<br>Cost Category | Stage 1 Cost<br>Metric MOE Score | Total Stage 1 Score  |  |
|                                                 |                                   |                            |                                        |                                                    |                                |                                         |                            |                                       |                                  |                      |  |
| Existing                                        | Two-Way Stop Control              | 0.99                       | --                                     | 0                                                  | --                             | 48                                      | --                         |                                       | --                               |                      |  |
| Alternative 1                                   | Partial Displaced Left Turn NB-SB | 0.51                       | 1.0                                    | -                                                  | 0.0                            | 44                                      | 0.1                        | \$\$\$                                | 0.7                              | 2.7 out of 9         |  |
| Alternative 2                                   | Partial Median U-Turn NB-SB       | 1.00                       | 0.0                                    | +                                                  | 1.0                            | 28                                      | 0.5                        | \$\$                                  | 1.0                              | 6.5 out fo 9         |  |
| Alternative 3*                                  | Restricted Crossing U-Turn NB-SB  | 0.52                       | 1.0                                    | 0                                                  | 0.5                            | 20                                      | 0.7                        | \$\$                                  | 1.0                              | 6.6 out of 9         |  |
| Alternative 4                                   | Roundabout                        | 0.81                       | 0.4                                    | 0                                                  | 0.5                            | 8                                       | 1.0                        | \$\$                                  | 1.0                              | 6.9 out of 9         |  |
| Alternative 5                                   | Continuous Green-T                | 0.58                       | 0.9                                    | -                                                  | 0.0                            | 12                                      | 0.9                        | \$\$                                  | 1.0                              | 5.6 out of 9         |  |

\*Alternative carried forward to Stage 2

**Figure 29: Virginia iCAP Stage 1 Results—Settlers Way PM Peak Hour**

| Metric Weighting<br>(Based on Purpose and Need) |                                  | Traffic Operations         |                                        | Pedestrian                                         |                                | Safety                                  |                            | Stage 1 Cost                          |                                  | Total Possible Score |              |  |
|-------------------------------------------------|----------------------------------|----------------------------|----------------------------------------|----------------------------------------------------|--------------------------------|-----------------------------------------|----------------------------|---------------------------------------|----------------------------------|----------------------|--------------|--|
|                                                 |                                  | Traffic Operations Weight  |                                        | Pedestrian Weight                                  |                                | Safety Weight                           |                            | Stage 1 Cost Weight                   |                                  |                      |              |  |
|                                                 |                                  | 3                          |                                        | 1                                                  |                                | 3                                       |                            | 2                                     |                                  |                      |              |  |
| Alternatives                                    |                                  | VJuST Maximum<br>V/C Ratio | Traffic Operations<br>Metric MOE Score | VJuST Accommodation<br>Compared to<br>Conventional | Pedestrian<br>Metric MOE Score | VJuST Weighted Total<br>Conflict Points | Safety<br>Metric MOE Score | VJuST Planning Level<br>Cost Category | Stage 1 Cost<br>Metric MOE Score | Total Stage 1 Score  |              |  |
|                                                 |                                  |                            |                                        |                                                    |                                |                                         |                            |                                       |                                  |                      |              |  |
| Existing                                        | Two-Way Stop Control             | 0.64                       | --                                     | 0                                                  | --                             | 48                                      | --                         |                                       | --                               |                      |              |  |
| Alternative 1*                                  | Restricted Crossing U-Turn NB-SB | 0.43                       | 1.0                                    | 0                                                  | 0.5                            | 20                                      | 0.8                        |                                       | \$\$                             | 1.0                  | 6.9 out of 9 |  |
| Alternative 2                                   | Continuous Green-T               | 0.51                       | 0.6                                    | -                                                  | 0.0                            | 12                                      | 1.0                        |                                       | \$\$                             | 1.0                  | 5.6 out fo 9 |  |

\*Alternative carried forward to Stage 2

Figure 30: Virginia iCAP Stage 1 Results—Cathedral Lane PM Peak Hour

| Metric Weighting<br>(Based on Purpose and Need) |                                  | Traffic Operations         |                                        | Pedestrian                                         |                                | Safety                                  |                            | Stage 1 Cost                          |                                  | Total Possible Score |              |  |  |
|-------------------------------------------------|----------------------------------|----------------------------|----------------------------------------|----------------------------------------------------|--------------------------------|-----------------------------------------|----------------------------|---------------------------------------|----------------------------------|----------------------|--------------|--|--|
|                                                 |                                  | Traffic Operations Weight  |                                        | Pedestrian Weight                                  |                                | Safety Weight                           |                            | Stage 1 Cost Weight                   |                                  |                      |              |  |  |
|                                                 |                                  | 3                          |                                        | 1                                                  |                                | 3                                       |                            | 2                                     |                                  |                      |              |  |  |
| Alternatives                                    |                                  | VJuST Maximum<br>V/C Ratio | Traffic Operations<br>Metric MOE Score | VJuST Accommodation<br>Compared to<br>Conventional | Pedestrian<br>Metric MOE Score | VJuST Weighted Total<br>Conflict Points | Safety<br>Metric MOE Score | VJuST Planning Level<br>Cost Category | Stage 1 Cost<br>Metric MOE Score | Total Stage 1 Score  |              |  |  |
|                                                 |                                  |                            |                                        |                                                    |                                |                                         |                            |                                       |                                  |                      |              |  |  |
| Existing                                        | Two-Way Stop Control             | 0.42                       | --                                     | 0                                                  | --                             | 48                                      | --                         |                                       | --                               |                      |              |  |  |
| Alternative 1*                                  | Restricted Crossing U-Turn NB-SB | 0.47                       | 0.0                                    | 0                                                  | 0.5                            | 20                                      | 0.8                        |                                       | \$\$                             | 1.0                  | 5.9 out of 9 |  |  |
| Alternative 2                                   | Continuous Green-T               | 0.47                       | 0.0                                    | -                                                  | 0.0                            | 12                                      | 1.0                        |                                       | \$\$                             | 1.0                  | 5 out of 9   |  |  |

\*Alternative carried forward to Stage 2

Figure 31: Virginia iCAP Stage 1 Results—New Bedford Court PM Peak Hour

**Table 19: Phase 1 Alternatives to Move Forward to Phase 2**

| Intersection                                             | Alternative                                                                                     | Move Forward to Phase 2? | Justification                                                                       |
|----------------------------------------------------------|-------------------------------------------------------------------------------------------------|--------------------------|-------------------------------------------------------------------------------------|
| Mine Road/Staffordboro Boulevard and Garrisonville Road  | Modified Conventional                                                                           | Yes                      | Capacity and safety improvement                                                     |
|                                                          | Full Displaced Left Turn                                                                        | Yes                      | Capacity and safety improvement                                                     |
|                                                          | Center Turn Overpass                                                                            | No                       | Capacity and safety improvement, but not compatible with network                    |
|                                                          | Echelon                                                                                         | No                       | Capacity and safety improvement, but not compatible with network                    |
|                                                          | Tight Urban Diamond                                                                             | Yes                      | Capacity and safety improvement                                                     |
|                                                          | Michigan Urban Diamond                                                                          | Yes                      | Capacity and safety improvement                                                     |
| Mine Road and Midpoint Lane                              | Partial Displaced Left Turn                                                                     | No                       | Works operationally, but less safety and pedestrian access improvements             |
|                                                          | Restricted Crossing U-Turn (RCUT)                                                               | Yes                      | Traffic operations and safety improvement                                           |
|                                                          | Thru-cut                                                                                        | Yes                      | Traffic operations and safety improvement                                           |
| Mine Road and Highpointe Boulevard/N Vine Place          | Partial Displaced Left Turn                                                                     | No                       | Works operationally, but less safety and pedestrian access improvements             |
|                                                          | Restricted Crossing U-Turn (RCUT)                                                               | Yes                      | Traffic operations and safety improvement                                           |
|                                                          | Thru-cut                                                                                        | Yes                      | Traffic operations and safety improvement                                           |
| Mine Road and Settlers Way                               | Restricted Crossing U-Turn (RCUT)                                                               | Yes                      | Traffic operations and safety improvement                                           |
|                                                          | Continuous Green-T (CGT)                                                                        | No                       | Encroaches on 100-foot buffer zone and reduces pedestrian access                    |
| Mine Road and Cathedral Lane                             | Restricted Crossing U-Turn (RCUT)                                                               | Yes                      | Safety improvement while maintaining capacity                                       |
|                                                          | Continuous Green-T (CGT)                                                                        | No                       | Compatible with roadway geometry, but not anticipated to warrant a signal           |
| Mine Road and New Bedford Court                          | Restricted Crossing U-Turn (RCUT)                                                               | Yes                      | Safety improvement while maintaining capacity                                       |
|                                                          | Continuous Green-T (CGT)                                                                        | No                       | Compatible with roadway geometry, but not anticipated to warrant a signal           |
| Transit Access and Travel Demand Management Improvements | Add reverse/clockwise circulation to FXBGO! Route D4                                            | Yes                      | Improved transit access and travel demand management                                |
|                                                          | Increase FXBGO! Route D4 frequency and extend daily schedule                                    | Yes                      | Improved transit access and travel demand management                                |
|                                                          | Add bus stops along Mine Road                                                                   | Yes                      | Improved transit access and travel demand management                                |
|                                                          | Revise FXBGO! Route D4 geometry to better serve existing park and ride lots                     | No                       | FXBGO! Staff indicated low commuter ridership                                       |
|                                                          | Bus Stop Infrastructure Improvements                                                            | Yes                      | Improved transit access and travel demand management                                |
|                                                          | Construct sidewalk along Midpoint Lane and Salisbury Drive to connect to Park and Ride facility | Yes                      | Improved pedestrian safety and access, transit access, and travel demand management |

## PROJECT PIPELINE

| Intersection                        | Alternative                                                                                   | Move Forward to Phase 2? | Justification                            |
|-------------------------------------|-----------------------------------------------------------------------------------------------|--------------------------|------------------------------------------|
| Bicycle and Pedestrian Improvements | Construct new shared-use path from Exeter Lane to Midpoint Lane on the west side of Mine Road | Yes                      | Pedestrian safety and access improvement |
|                                     | Construct new sidewalk from Cathedral Lane to Greenspring Drive on east side of Mine Road     | Yes                      | Pedestrian safety and access improvement |
|                                     | Corridor-wide intersection improvements                                                       | Yes                      | Pedestrian safety and access improvement |

|                                                                                                                              |                                                                    |
|------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|
| <b>Safety Improvements</b>                  |                                                                    |
| <b>1</b>                                                                                                                     | Traffic calming                                                    |
| <b>2</b>                                                                                                                     | Innovative intersections                                           |
| <b>3</b>                                                                                                                     | Low-cost intersection improvements                                 |
| <b>Transit Access/TDM Improvements</b>      |                                                                    |
| <b>1</b>                                                                                                                     | Transit Service Enhancements                                       |
| <b>2</b>                                                                                                                     | Improved Connectivity                                              |
| <b>3</b>                                                                                                                     | Access Points                                                      |
| <b>4</b>                                                                                                                     | Bus Stop Infrastructure                                            |
| <b>Pedestrian and Bicycle Improvements</b>  |                                                                    |
| <b>1</b>                                                                                                                     | Install pedestrian signals, crosswalks, and curb ramp improvements |
| <b>2</b>                                                                                                                     | Install crosswalks and curb ramp improvements                      |

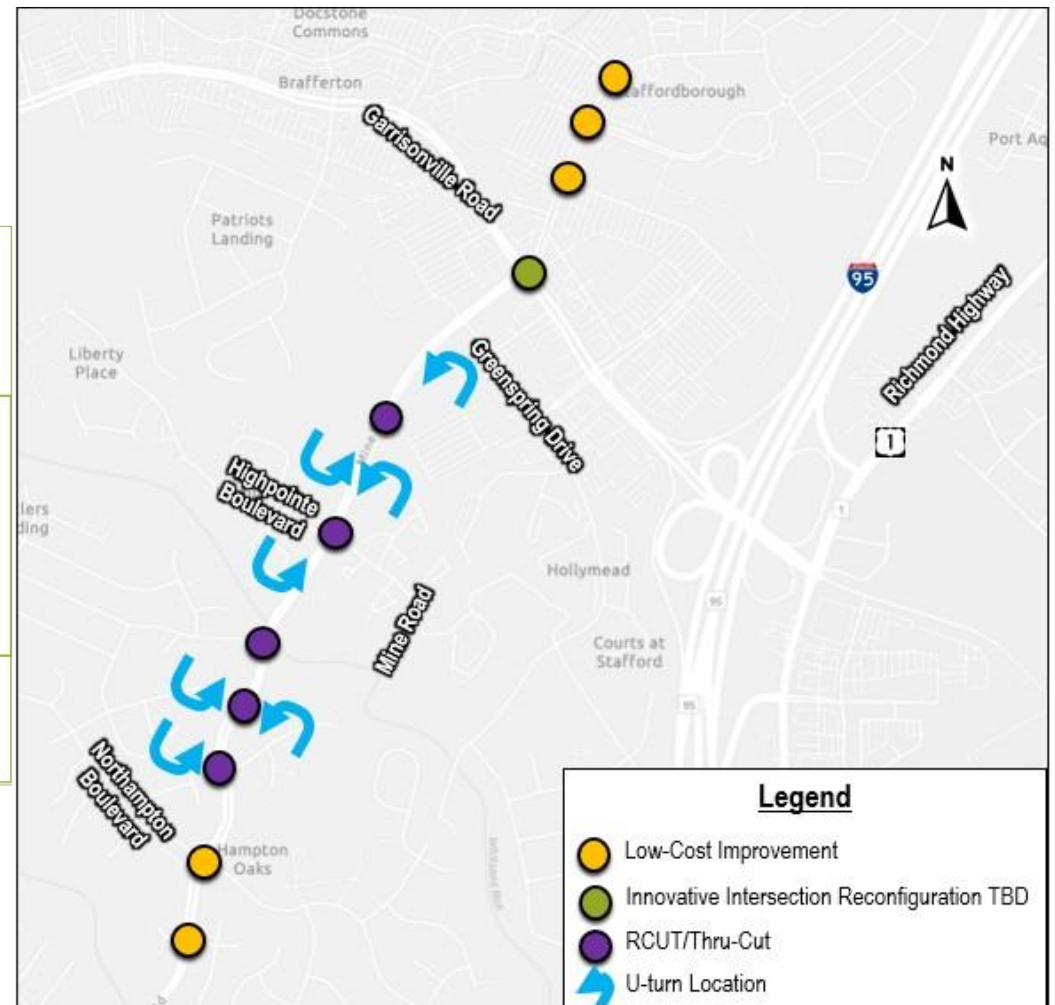


**Figure 32: Phase 1 Scoping Level Improvement Alternatives**

## Chapter 2: Alternatives Refinement

## 2.1 Alternatives Refinement Overview

The study team refined the alternatives carried forward in Phase 2 including concept drawings, cost estimates, and concept screening traffic operations and safety analysis. The primary goal of the Phase 2 alternatives refinement effort was to prepare a refined set of alternatives to present to the public and solicit feedback. The study team compared each alternative across several metrics using the Virginia iCAP Assessment Tool including traffic operations, safety, pedestrian and bicycle access, and cost to determine the refined list of alternatives to present to the public.

The Concept Screening Refinements and Results Meeting (SWG Meeting #4) was held on October 20, 2025, to gather feedback on the draft concept sketches, cost estimates, and to share the concept screening results in advance of public outreach. During SWG Meeting #4, the study team discussed each alternative based on impacts to safety, traffic operations, cost, and right-of-way impacts and chose which concepts to be shared during public outreach. The meeting materials along with the detailed concept benefits are included in **Appendix E**.

## 2.2 Phase 2 Alternatives Description

### 2.2.1. Midpoint Lane

#### Reduced Crossing U-Turn (RCUT)

This concept proposes a Reduced Crossing U-Turn (RCUT) at the intersection of Mine Road and Midpoint Lane. The proposed improvement would redirect the side street (Midpoint Lane) traffic at the intersection such that all drivers on Midpoint Lane begin their movement with a right turn. Drivers wanting to make a left-turn or through movement from Midpoint Lane would be rerouted downstream on Mine Road approximately 500 feet where they would then make a U-turn at an opening in the median. Once back at the original intersection on Mine Road, drivers could then continue straight or make a right-turn to reach their intended destination. Crosswalks would be added on each side of the intersection to connect the proposed sidewalk and shared-use path along Mine Road. The installation of an RCUT reduces the number of points where drivers cross paths, eliminates the potential for severe angle crashes, and improves overall intersection operations by reducing the number of signal phases, thereby increasing the green time per phase within a single signal cycle. Other pedestrian access and safety improvements proposed were to upgrade curb ramps to be in line with the direction of pedestrian travel and compliant with Americans with Disabilities Act (ADA), install additional curb ramps, add pedestrian signals and push buttons, restripe the westbound approach stop bar and crosswalk, increase the signal clearance intervals, and add a protected southbound left-turn phase. **Figure 33** presents a conceptual sketch of the alternative.

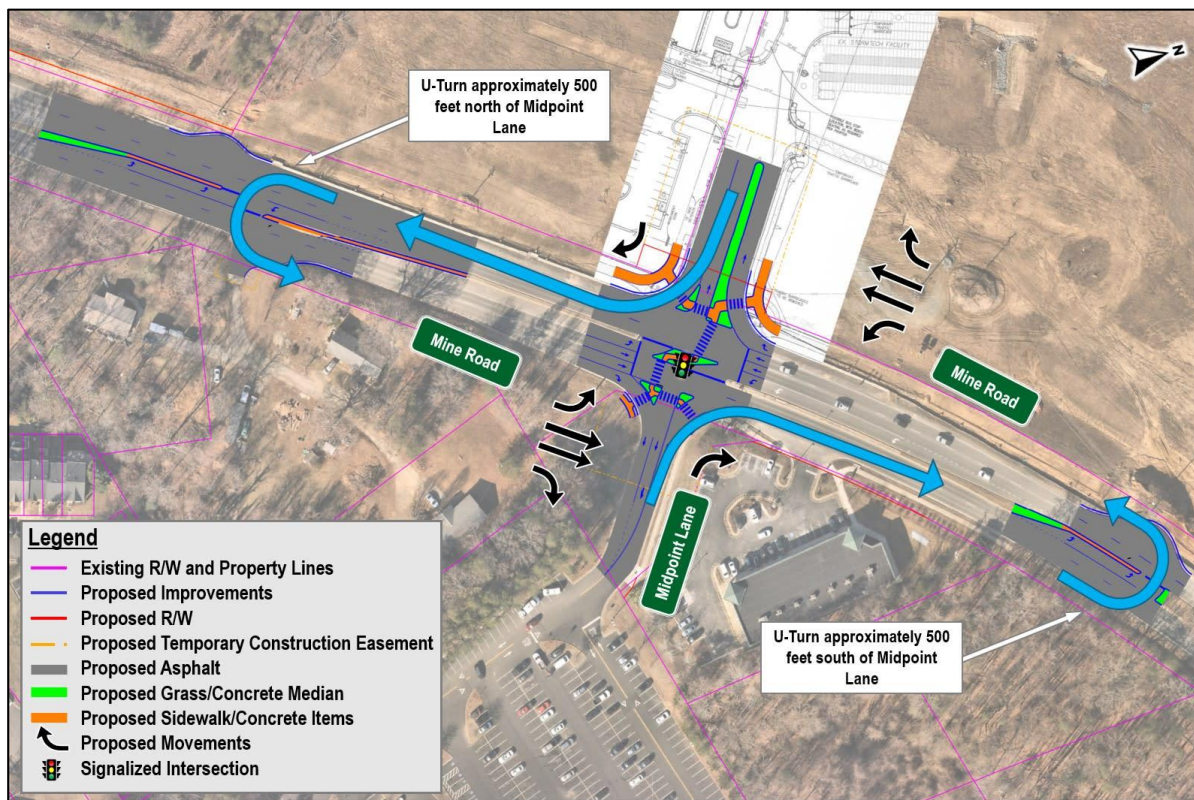


**Figure 33: Mine Road and Midpoint Lane RCUT**

## Thru-cut

The second concept proposed at the intersection of Mine Road and Midpoint Lane was a thru-cut. The proposed improvement would install concrete islands on the side street of the intersection (Midpoint Lane) to create left-turn and right-turn only lanes, prohibiting through movements. Drivers wanting to proceed straight on Midpoint Lane would be redirected to make a right-turn onto Mine Road, followed by a U-turn at an opening in the median approximately 500 feet downstream. Unlike the RCUT, the thru-cut allows left-turns from Midpoint Lane. Crosswalks would be constructed on each leg of the intersection to connect the proposed sidewalk and shared-use path along Mine Road. The installation of a thru-cut reduces the number of points where drivers cross paths, eliminates the potential for severe angle crashes, and improves overall intersection operations by reducing the number of signal phases, thereby increasing the green time per phase within a single signal cycle. Other pedestrian access and safety improvements proposed were to upgrade curb ramps to be in line with the direction of pedestrian travel and compliant with ADA, install additional curb ramps, add pedestrian signals and push buttons, restripe the westbound approach stop bar and crosswalk, increase the signal clearance intervals, and add a protected southbound left-turn phase. **Figure 34** presents a conceptual sketch of the alternative.

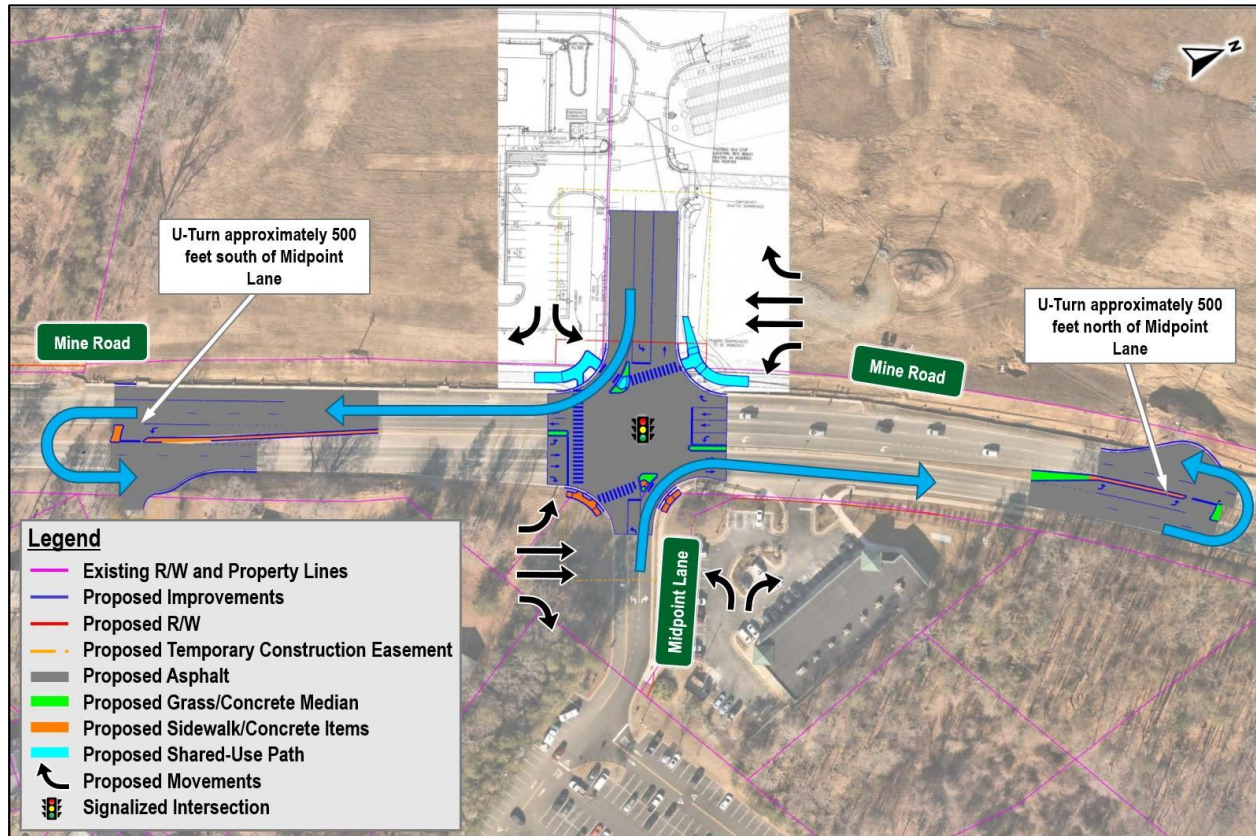


**Figure 34: Mine Road and Midpoint Lane Thru-cut**

## 2.2.2. Highpointe Boulevard/N Vine Place

### Reduced Crossing U-Turn (RCUT)

This concept proposes a Reduced Crossing U-Turn (RCUT) at the intersection of Mine Road and Highpointe Boulevard/N Vine Place. The proposed improvement would redirect the side street (Highpointe Boulevard/N Vine Place) traffic at the intersection such that all drivers on Highpointe Boulevard and N Vine Place begin their movement with a right turn. Drivers wanting to make a left-turn or through movement from Highpointe Boulevard or N Vine Place would be rerouted downstream on Mine Road approximately 500 feet where they would then make a U-turn at an opening in the median. Once back at the original intersection on Mine Road, drivers could then continue straight or make a right-turn to reach their intended destination. Crosswalks would be added on each side of the intersection to connect the proposed sidewalk and shared-use path along Mine Road. The installation of an RCUT reduces the number of points where drivers cross paths, eliminates the potential for severe angle crashes, and improves overall intersection operations by reducing the number of signal phases, thereby increasing the green time per phase within a single signal cycle. Other pedestrian access and safety improvements proposed were to install intersection lighting, upgrade or install new curb ramps to be in line with direction of pedestrian travel and ADA compliance, add northbound and southbound protected left-turns, and increase clearance intervals. **Figure 35** presents a conceptual sketch of the alternative.

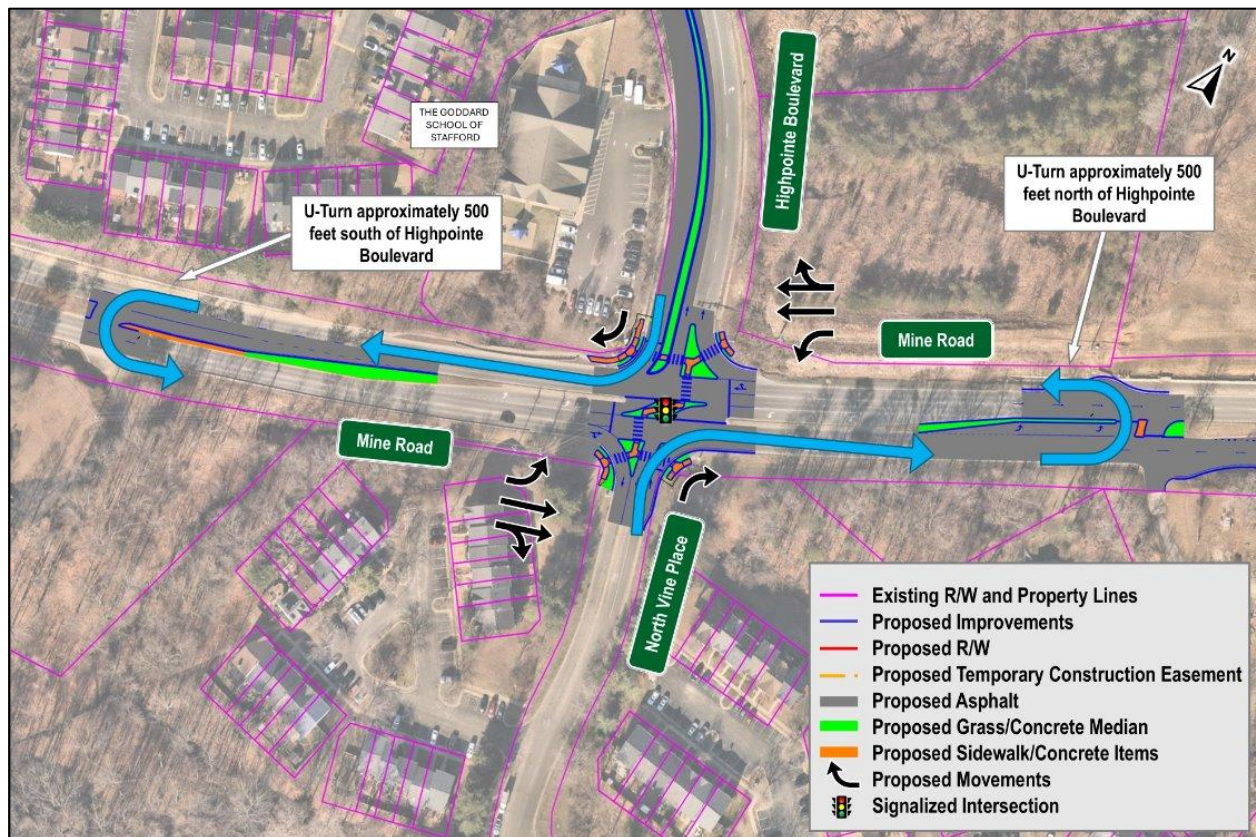


**Figure 35: Mine Road and Highpointe Boulevard/N Vine Place RCUT**

## Thru-cut

The second concept proposed at the intersection of Mine Road and Highpointe Boulevard/N Vine Place was a thru-cut. The proposed improvement would install concrete islands on the side streets of the intersection (Highpointe Boulevard/N Vine Place) to create left-turn and right-turn only lanes, prohibiting through movements. Drivers wanting to proceed straight on Highpointe Boulevard/N Vine Place would be redirected to make a right-turn onto Mine Road, followed by a U-turn at an opening in the median approximately 500 feet downstream. Unlike the RCUT, the thru-cut allows left-turns from Highpointe Boulevard and N Vine Place. Crosswalks would be constructed on each leg of the intersection to connect the proposed sidewalk and shared-use path along Mine Road. The installation of a thru-cut reduces the number of points where drivers cross paths, eliminates the potential for severe angle crashes, and improves overall intersection operations by reducing the number of signal phases, thereby increasing the green time per phase within a single signal cycle. Other pedestrian access and safety improvements proposed were to install intersection lighting, curb ramps, update the existing curb ramp to be in line with direction of pedestrian travel and ADA compliance, add northbound and southbound protected left-turns, and increase clearance intervals. **Figure 36** presents a conceptual sketch of the alternative.

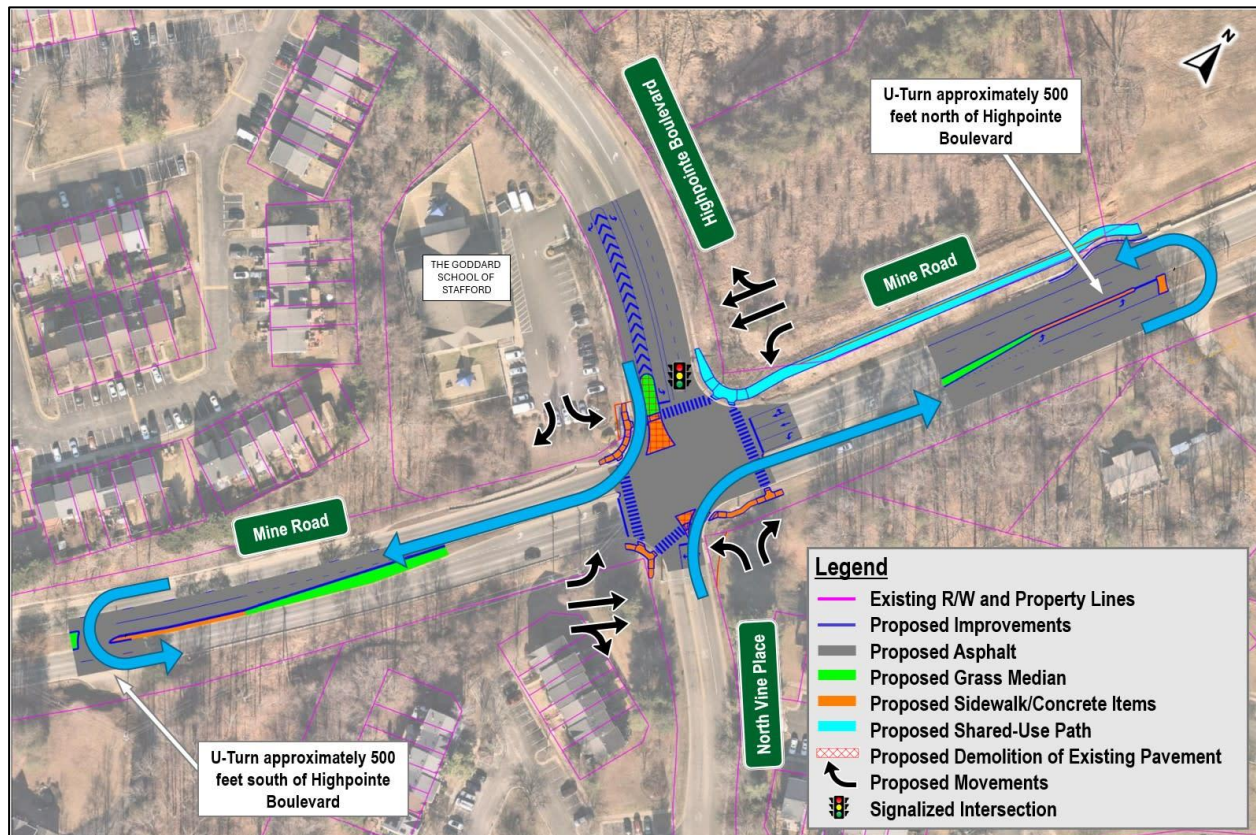


**Figure 36: Mine Road and Highpointe Boulevard/N Vine Place Thru-cut**

### 2.2.3. Mine Road and Settlers Way RCUT

This concept proposes a Reduced Crossing U-Turn (RCUT) at the intersection of Mine Road and Settlers Way. The proposed improvement would redirect the side street (Settlers Way) traffic at the intersection such that all drivers on Settlers Way begin their movement with a right turn. Drivers wanting to make a left-turn or through movement from Settlers Way would be rerouted downstream on Mine Road to New Bedford Court where they would then make a U-turn at an opening in the median. Once back at the original intersection on Mine Road, drivers could then continue straight or make a right-turn to reach their intended destination. Crosswalks would be added on each side of the intersection to connect the proposed sidewalk and shared-use path along Mine Road. The installation of an RCUT reduces the number of points where drivers cross paths, eliminating the potential for severe angle crashes. The concept also includes extending the medians into the crosswalks for a pedestrian refuge, installing traffic calming measures, and installing W2-2 advance intersection warning signs. **Figure 37** presents a conceptual sketch of the alternative.

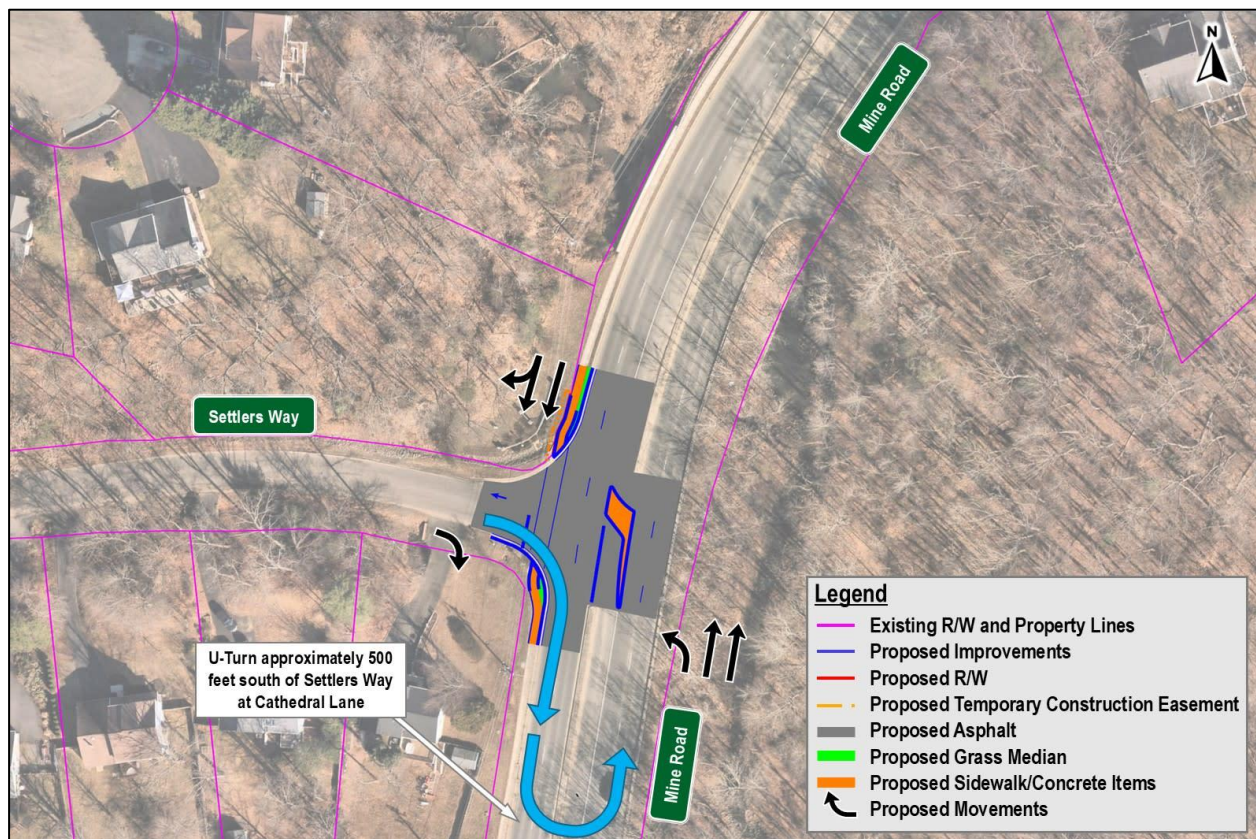


**Figure 37: Mine Road and Settlers Way RCUT**

## 2.2.4. Mine Road and Cathedral Lane RCUT

This concept proposes a Reduced Crossing U-Turn (RCUT) at the intersection of Mine Road and Cathedral Lane. The proposed improvement would redirect the side street (Cathedral Lane) traffic at the intersection such that all drivers on Cathedral Lane begin their movement with a right turn. Drivers wanting to make a left-turn or through movement from Cathedral Lane would be rerouted downstream on Mine Road to New Bedford Court where they would then make a U-turn at an opening in the median. Once back at the original intersection on Mine Road, drivers could then continue straight or make a right-turn to reach their intended destination. The installation of an RCUT reduces the number of points where drivers cross paths eliminating the potential for severe angle crashes. The concept also includes adding intersection lighting, extending the medians into the crosswalks for a pedestrian refuge, installing traffic calming measures, and installing W2-2 advance intersection warning signs. Crosswalk improvements across Cathedral Lane would be included and a crosswalk over Mine Road may be evaluated based on the sight distance and other requirements in IIM-TE-384.1. **Figure 38** presents a conceptual sketch of the alternative.

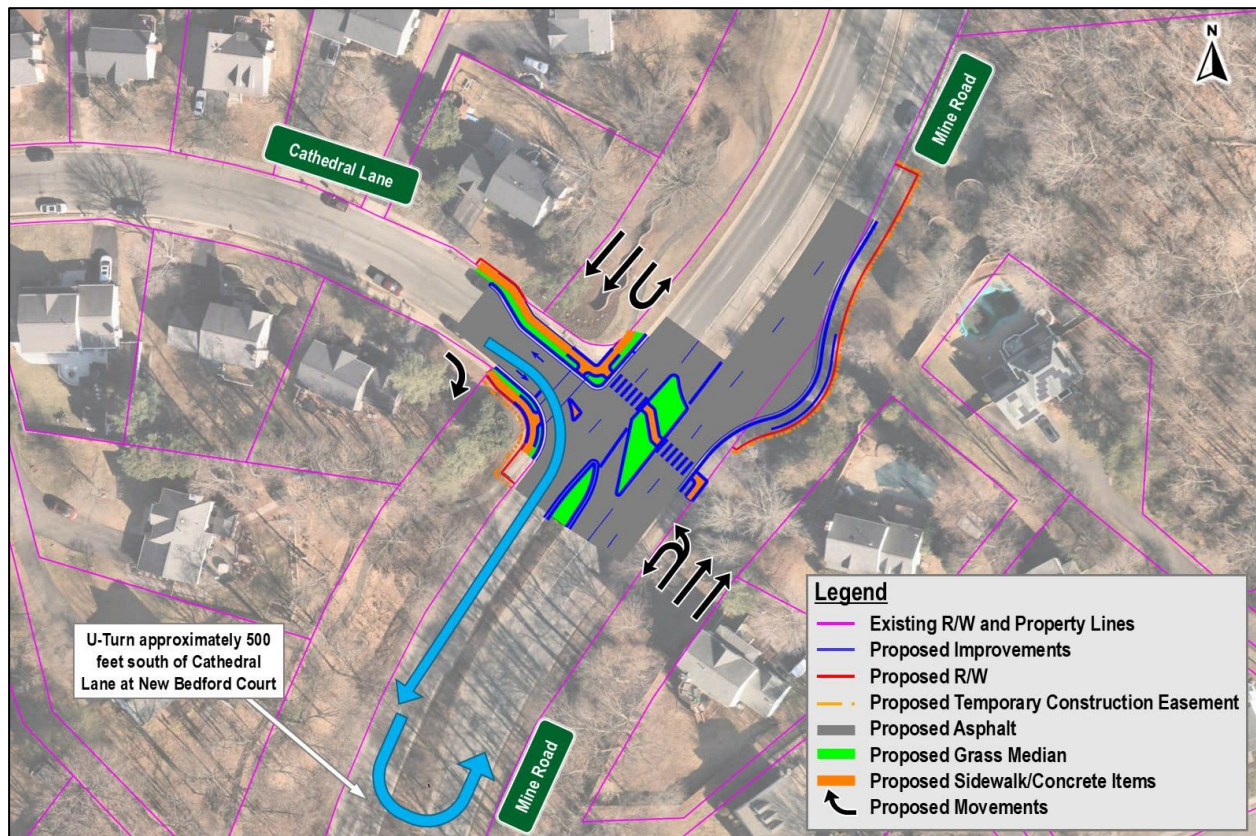


**Figure 38: Mine Road and Cathedral Lane RCUT**

## 2.2.5. Mine Road and New Bedford Court RCUT

This concept proposes a Reduced Crossing U-Turn (RCUT) at the intersection of Mine Road and New Bedford Court. The proposed improvement would redirect the side street (New Bedford Court) traffic at the intersection such that all drivers on New Bedford Court begin their movement with a right turn. Drivers wanting to make a left-turn or through movement from Settlers Way would be rerouted downstream on Mine Road to Cathedral Lane where they would then make a U-turn at an opening in the median. Once back at the original intersection on Mine Road, drivers could then continue straight or make a right-turn to reach their intended destination. The installation of an RCUT reduces the number of points where drivers cross paths eliminating the potential for severe angle crashes. The concept also includes adding intersection lighting, extending the medians into the crosswalks for a pedestrian refuge, and installing W2-2 advance intersection warning signs. Crosswalk improvements across New Bedford Court would be included and a crosswalk over Mine Road may be evaluated based on the sight distance and other requirements in IIM-TE-384.1 to connect to the existing trail on the west side of Mine Road. **Figure 39** presents a conceptual sketch of the alternative.

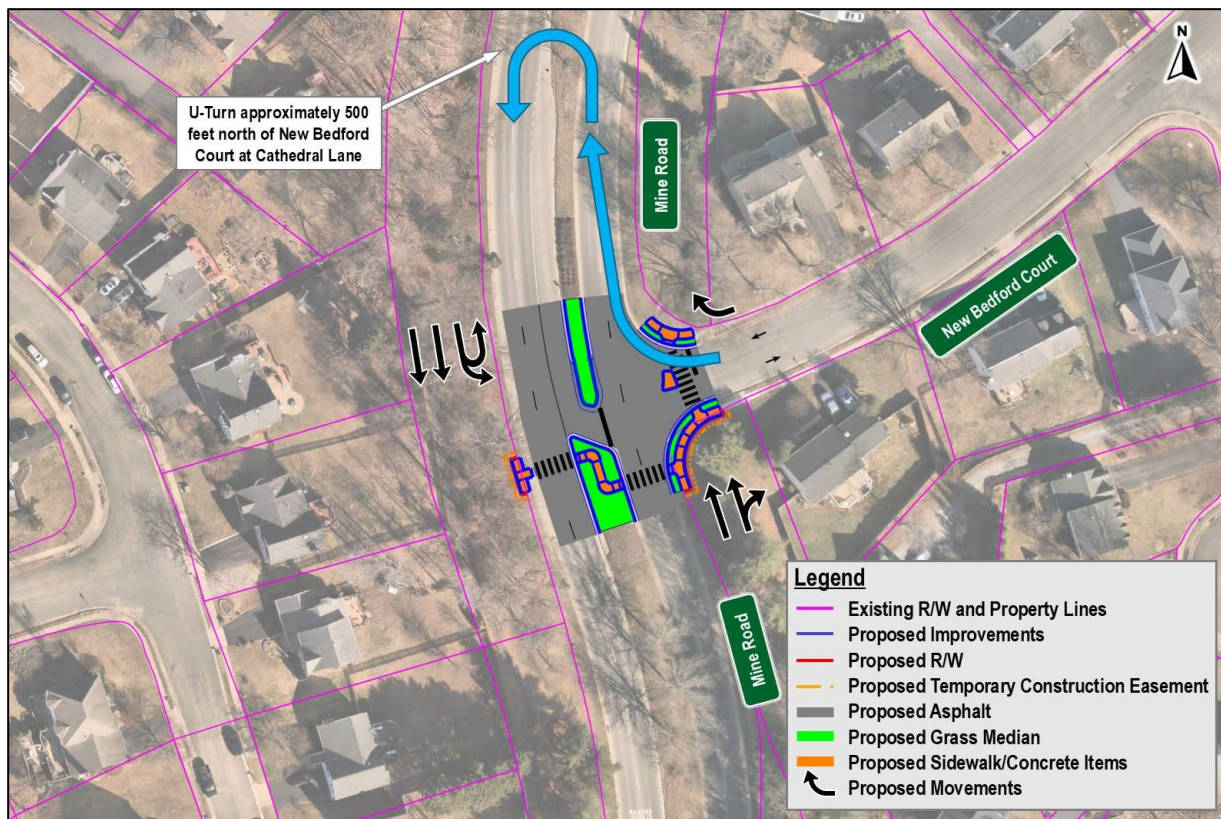


**Figure 39: Mine Road and New Bedford Court RCUT**

## 2.2.6. Mine Road/Staffordboro Boulevard and Garrisonville Road

### Additional Eastbound and Westbound Through Lanes

The modified conventional intersection configuration concept would include widening Garrisonville Road to add a fourth through lane in the eastbound and westbound directions to increase capacity along Garrisonville Road. In the eastbound direction, the additional lane would begin at the Walmart driveway by converting the existing right-turn lane into a shared through-right lane approaching the driveway and adding a new dedicated eastbound right-turn lane at Mine Road. The new fourth lane would extend to the intersection of Garrisonville Road and Stafford Market Place/Salisbury Drive. Similarly, in the westbound direction the existing dedicated right-turn lane between Stafford Market Place and Staffordboro Boulevard would be converted to a through lane and a new dedicated right-turn lane constructed. The additional westbound lane would terminate as a right-turn only lane at Doc Stone Road. The concept also includes adding a high visibility crosswalk on the westbound leg of the intersection, increasing the signal clearance, and adding intersection lighting. **Figure 40** presents a conceptual sketch of the alternative

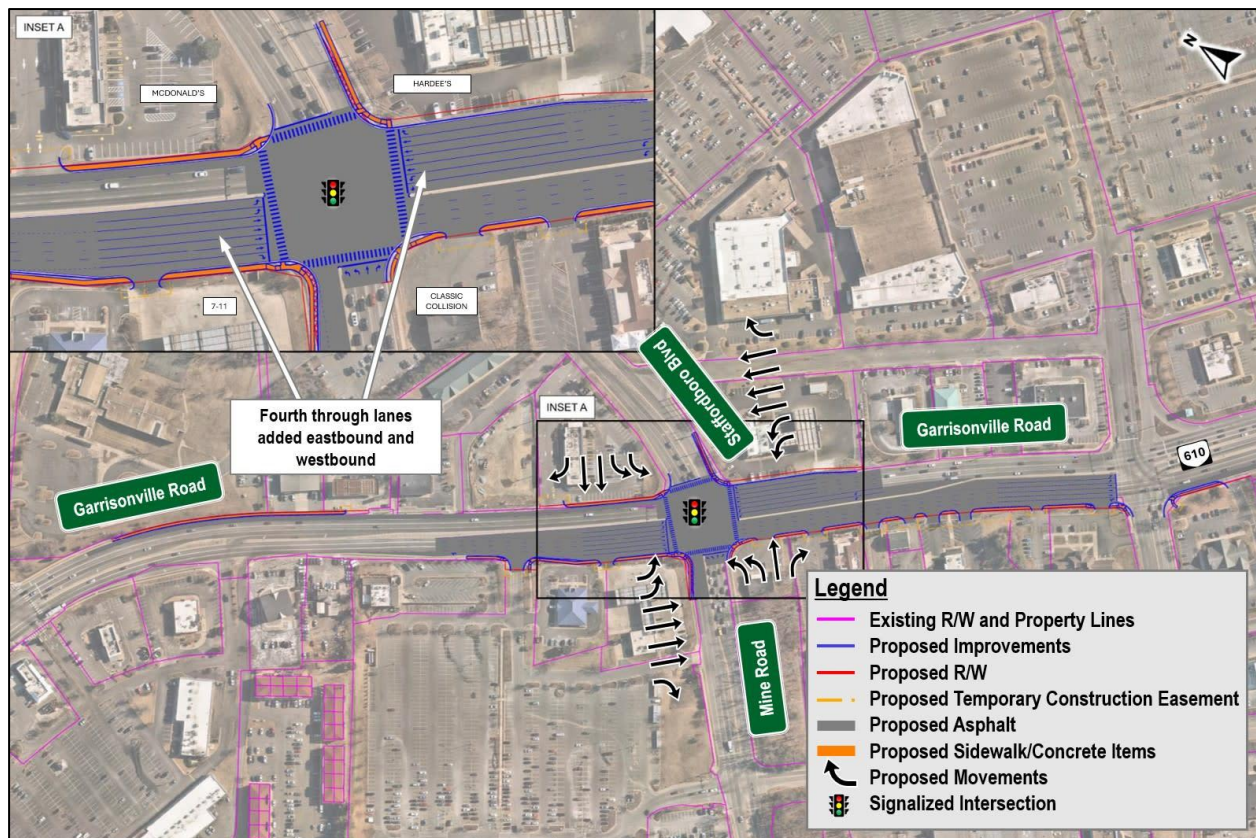


**Figure 40: Phase 2 Alternative—Mine Road/Staffordboro Boulevard and Garrisonville Road Modified Conventional**

## Displaced Left-Turn

The displaced left-turn would reduce the amount of conflict points at the intersection of Mine Road/Staffordboro Boulevard and Garrisonville Road by eliminating crossing conflicts due to left turns at the main intersection. The left-turning drivers would cross to the other side of the opposing through traffic before the main intersection at a new upstream signal. Drivers would then proceed to make the intended left-turn at the main intersection without needing to cross over oncoming traffic. The installation of a displaced left-turn intersection reduces the potential for angle crashes by separating the left-turn drivers from the side streets. By separating the through travel on the major street, the number of signal phases can be reduced to increase green time. **Figure 41** presents a conceptual sketch of the alternative.

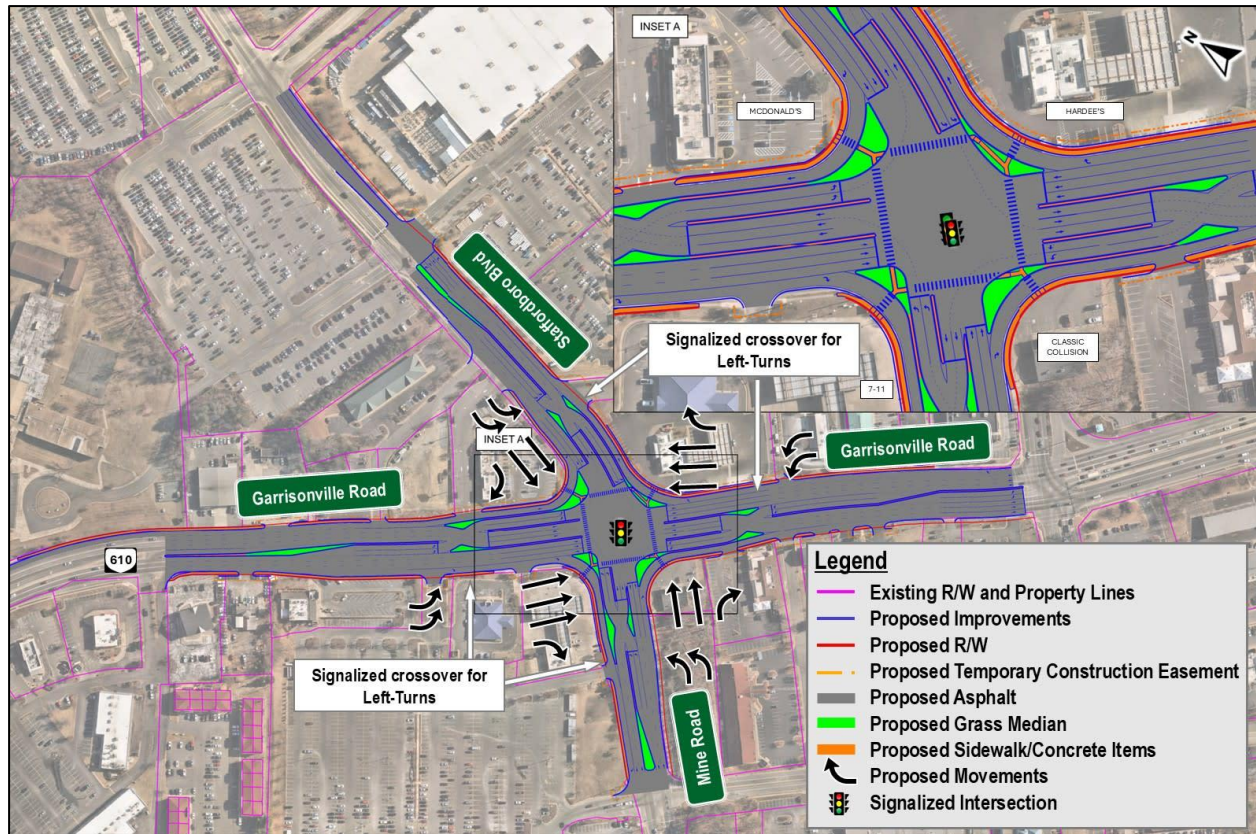


**Figure 41: Phase 2 Alternative–Mine Road/Staffordboro Boulevard and Garrisonville Road Displaced Left Turn**

## Tight Urban Diamond

The tight urban diamond configuration would elevate the eastbound and westbound through traffic above the intersection of Mine Road/Staffordboro Boulevard and Garrisonville Road and the adjacent Salisbury Drive/Stafford Market Place intersection to allow free-flow eastbound and westbound through movements between Doc Stone Road and I-95. Access to Mine Road/Staffordboro Boulevard, Salisbury Drive/Stafford Market Place, and driveways between Doc Stone Road and I-95 would be maintained via a frontage road. The two existing signalized intersections would remain. **Figure 42** presents a conceptual sketch of the alternative.

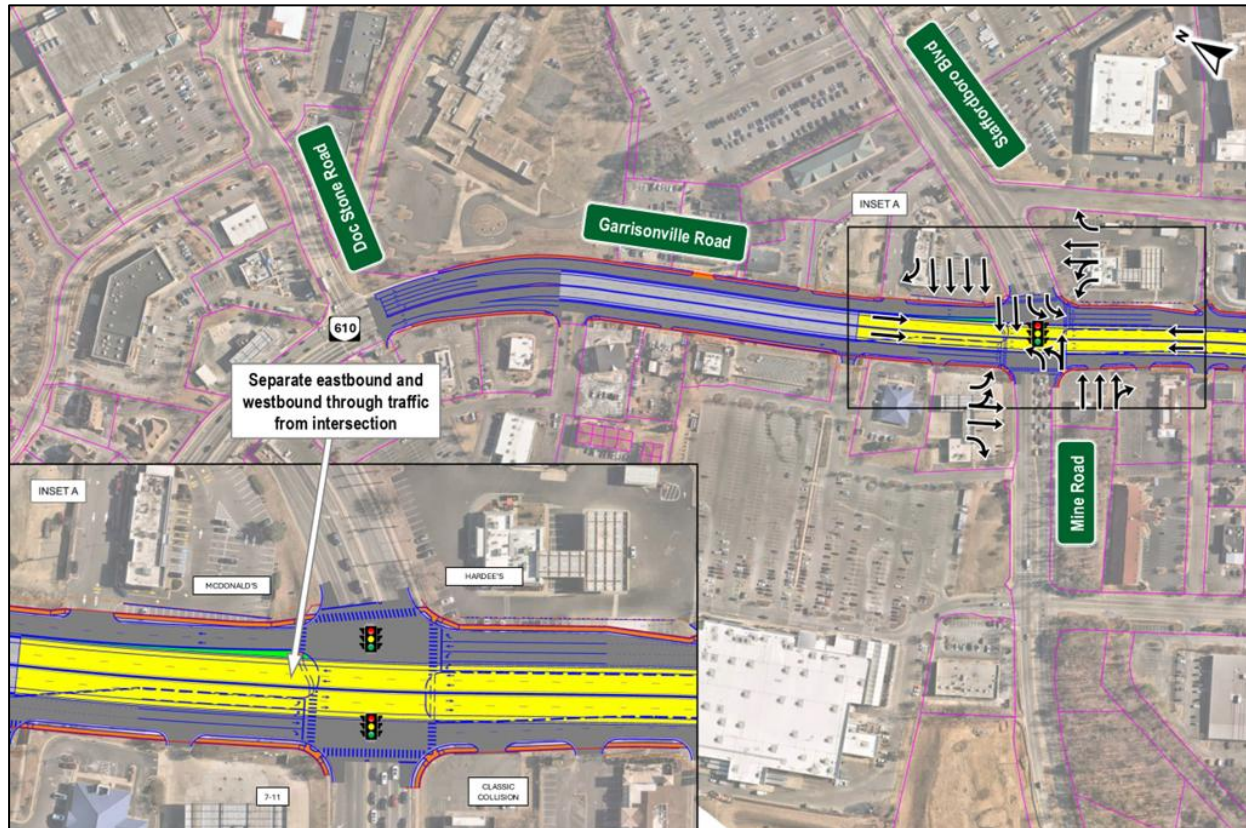


**Figure 42: Phase 2 Alternative—Mine Road/Staffordboro Boulevard and Garrisonville Road Tight Urban Diamond**

## Michigan Urban Diamond

The Michigan urban diamond configuration would elevate the eastbound and westbound through traffic above the intersection of Mine Road/Staffordboro Boulevard and Garrisonville Road and the adjacent Salisbury Drive/Stafford Market Place intersection to allow free flow movement eastbound and westbound movements between Doc Stone Road and I-95. Access to Mine Road/Staffordboro Boulevard, Salisbury Drive/Stafford Market Place, and driveways between Doc Stone Road and I-95 would be maintained via a frontage road. Left-turn movements at the Mine Road/Staffordboro Boulevard and Garrisonville Road intersection would be restricted. Drivers wanting to turn left would be redirected to make a U-turn at a median opening downstream along Garrisonville Road. These proposed U-turn locations would be signalized on the proposed frontage road. The installation of a Michigan urban-diamond reduces the number of points where drivers cross paths by separating the eastbound and westbound through traffic decreasing the potential for angle crashes. This alternative also eliminates left turn movements from the main intersection with fewer signal phases drivers spend less time stopped at the main intersection.

Figure 43 presents a conceptual sketch of the alternative.

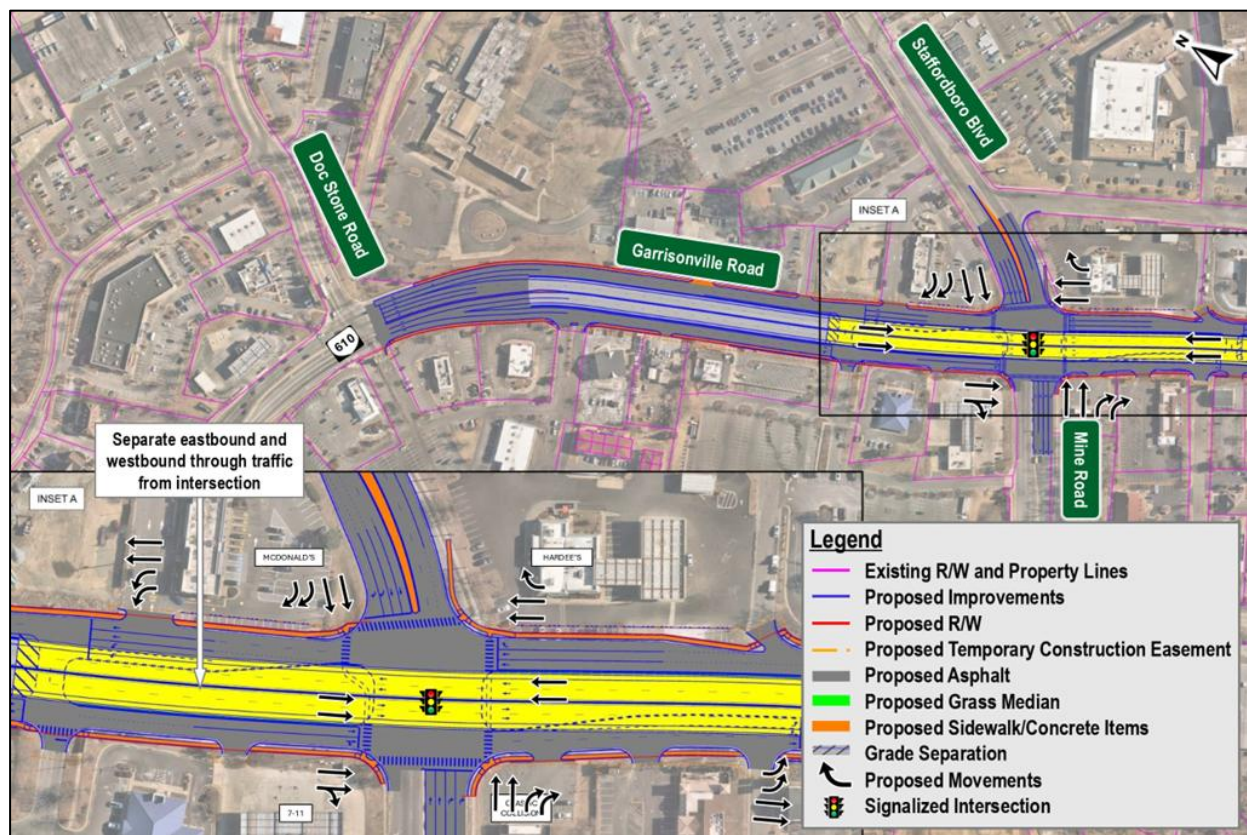


Figure 43: Phase 2 Alternative—Mine Road/Staffordboro Boulevard and Garrisonville Road Michigan Urban Diamond

## 2.2.7. Bicycle and Pedestrian Alternatives

### Shared-Use Path and Sidewalk along Mine Road - Option 1

The first alternative for pedestrian access along Mine Road would construct a ten-foot wide shared-use path from Exeter Lane to the proposed Hampton Run Commercial site/Midpoint Lane on the west side of Mine Road, and a five-foot wide sidewalk on the east side of Mine Road from Cathedral Lane to Greenspring Drive. Due to space constraints between Settlers Way and Highpointe Boulevard/N Vine Place caused by the existing stream crossing and retaining wall that are present, the shared-use path would be narrowed to five feet wide in this section. These improvements would fill the existing gaps in the pedestrian network on both sides of Mine Road between Exeter Lane and Garrisonville Road and upgrade the existing trail facility on the west side to accommodate bicyclists. **Figure 44** presents a conceptual sketch of the alternative

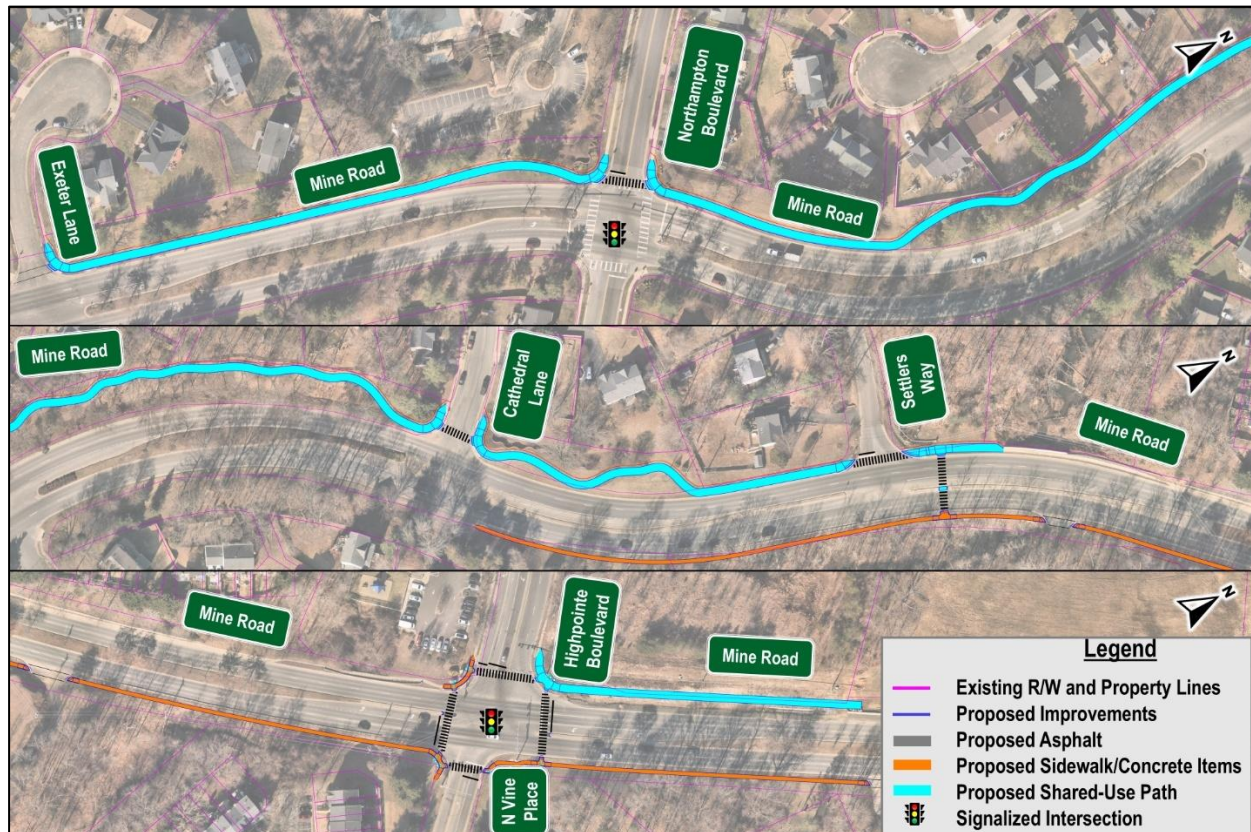


**Figure 44: Phase 2 Alternative – Shared-Use Path and Sidewalk along Mine Road Option 1**

## Shared-Use Path and Sidewalk along Mine Road - Option 2

The second alternative for pedestrian access along Mine Road would construct a ten-foot-wide shared-use path along the west side of Mine Road from Exeter Lane to the proposed Hampton Run Commercial site/Midpoint Lane. Where the width of the proposed shared-use path are constrained due to the existing stream crossing and retaining wall between Settlers Way and Highpointe Boulevard/N Vine Place, the southbound lanes of Mine Road are proposed to be shifted into the median to make room behind the curb to accommodate the wider ten-foot wide shared-use path. A five-foot wide sidewalk on the east side of Mine Road from Cathedral Lane to Greenspring Drive is also proposed. These improvements would fill the existing gaps in the pedestrian network on both sides of Mine Road between Exeter Lane and Garrisonville Road and upgrade the existing trail facility on the west side to accommodate bicyclists. **Figure 45** presents a conceptual sketch of the alternative.



**Figure 45: Phase 2 Alternative – Shared-Use Path and Sidewalk along Mine Road Option 2**

## Staffordboro Boulevard Sidewalk

The proposed improvement alternative would extend pedestrian accommodations along Staffordboro Boulevard by constructing a five-foot wide sidewalk on the west side of the corridor from Garrisonville Road to Clement Drive. This new sidewalk segment would fill an existing gap in the pedestrian network.

**Figure 46** presents a conceptual sketch of the alternative.



**Figure 46: Phase 2 Alternative – Sidewalk along Staffordboro Boulevard**

## Midpoint Lane/Salisbury Drive Sidewalk

The proposed improvement alternative would extend pedestrian accommodations along Salisbury Drive and Midpoint Lane by constructing a five-foot wide sidewalk on the west side of the corridor from Midpoint Lane to Garrisonville Road. This new sidewalk segment would fill an existing gap in the pedestrian network and provide pedestrian access to the existing park and ride lot. **Figure 47** presents a conceptual sketch of the alternative.



Figure 47: Phase 2 Alternative –Sidewalk along Midpoint Lane/Salisbury Drive

## 2.2.8. Intersection Safety and Pedestrian Access Improvements

### Staffordboro Boulevard and Juggins Road Connector Pedestrian Safety Improvements

The proposed improvement for this alternative focused on enhancing pedestrian accessibility and intersection safety. Concrete channelizing islands would be installed to discourage improper use of lanes, especially the northbound right-turn only lane, and reduce pedestrian crossing distances. All existing curb ramps would be reconstructed to match the direction of pedestrian travel and meet current ADA standards. Crosswalks would be installed on the east, west, and south legs of the intersection and tie into the existing sidewalk network, including a currently in development sidewalk on the west side of Staffordboro Boulevard north of Juggins Road Connector. **Figure 48** presents a conceptual sketch of the alternative.

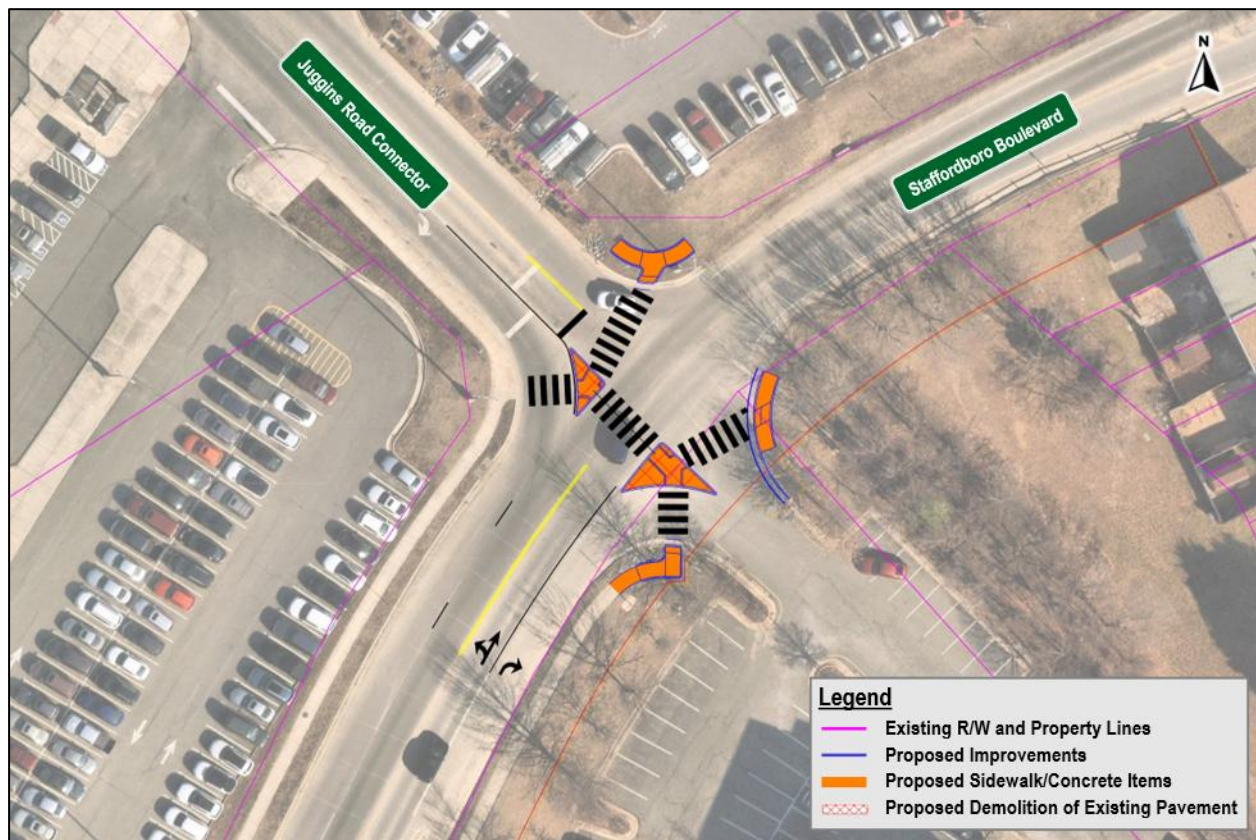


**Figure 48: Phase 2 Alternative – Staffordboro Boulevard and Juggins Road Connector Pedestrian Improvements**

## Staffordboro Boulevard and Woodstream Boulevard Pedestrian Safety Improvements

The proposed improvement for this alternative focused on enhancing pedestrian accessibility and intersection safety. The curb in the northeast quadrant of the intersection is proposed to be extended into the intersection to reduce the pedestrian crossing distance and restrict traffic from using the northbound right turn lane as a through lane. **Figure 49** presents a conceptual sketch of the alternative.

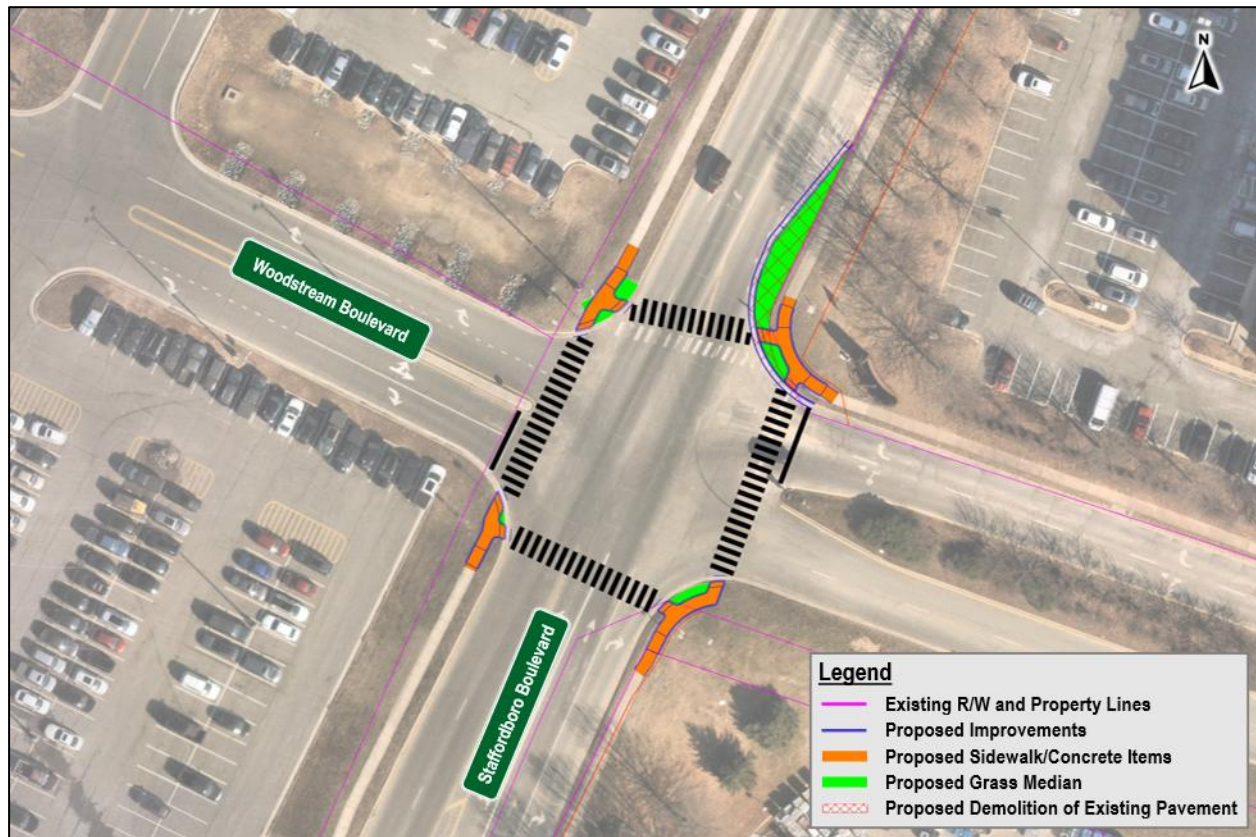


**Figure 49: Phase 2 Alternative – Staffordboro Boulevard and Woodstream Boulevard Pedestrian Improvements**

## Staffordboro Boulevard and Stafford Market Place/Elementary Lane Pedestrian Safety Improvements

The proposed improvement for this alternative focused on enhancing pedestrian accessibility and intersection safety. The curb in the northeast quadrant of the intersection is proposed to be extended into the intersection to reduce the pedestrian crossing distance and restrict traffic from using the northbound right turn lane as a through lane. Crosswalks would be installed on all four legs of the intersection and tie into the existing sidewalk. New pedestrian signal heads and buttons would be required. The curbs in the southwest and southeast quadrants were pulled back to allow U-turns to be made without requiring drivers to make a three-point turn. **Figure 50** presents a conceptual sketch of the alternative.

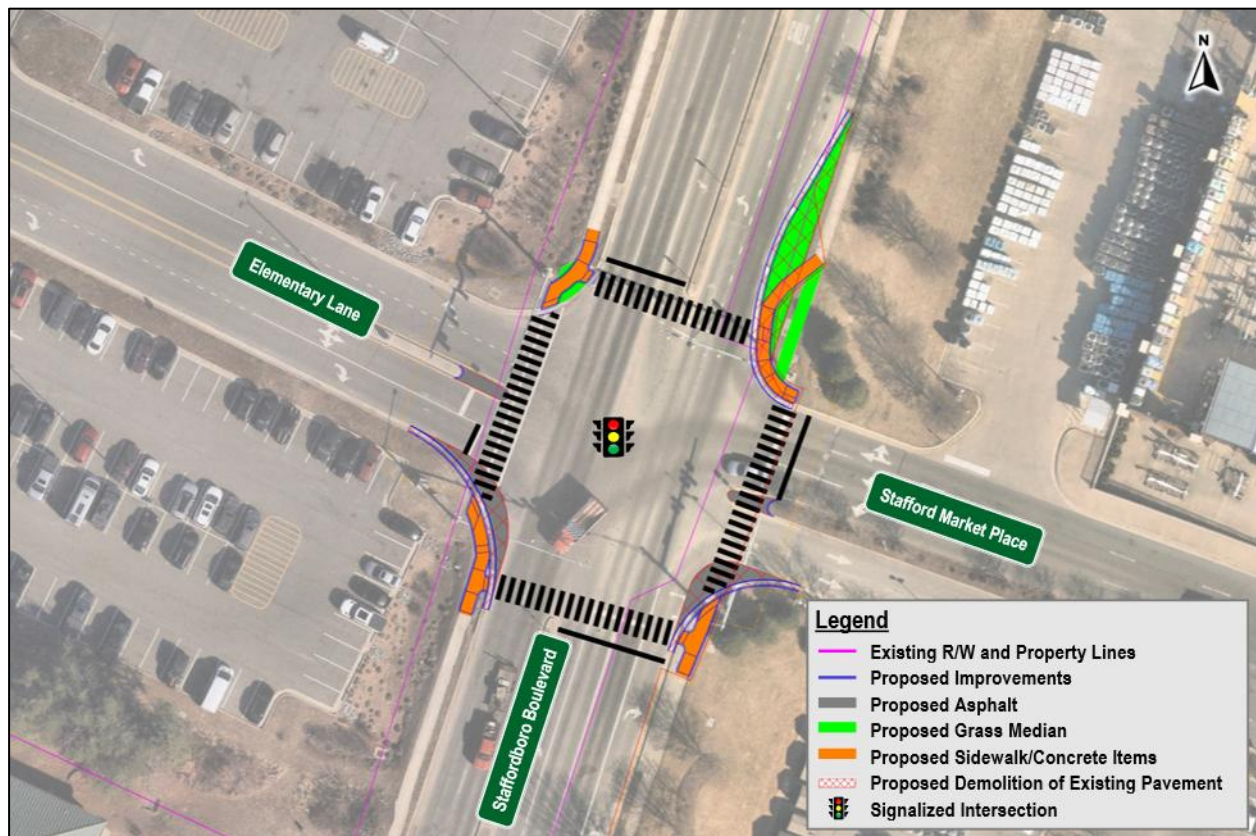


**Figure 50: Phase 2 Alternative – Staffordboro Boulevard and Elementary Lane/Stafford Market Place Pedestrian Improvements**

## Mine Road and Northampton Boulevard Pedestrian Safety Improvements

The proposed improvement for this alternative focused on enhancing pedestrian accessibility and intersection safety. All existing curb ramps would be reconstructed to match the direction of pedestrian travel and meet current ADA standards. Signal timing at the intersection would be optimized, including lengthened clearance intervals to improve pedestrian crossing comfort and overall safety at the intersection. In addition, the existing flashing yellow arrow phasing for the northbound and southbound approaches would be converted to protected-only left-turn operations to reduce the risk of angle crashes and improve safety. **Figure 51** presents a conceptual sketch of the alternative.

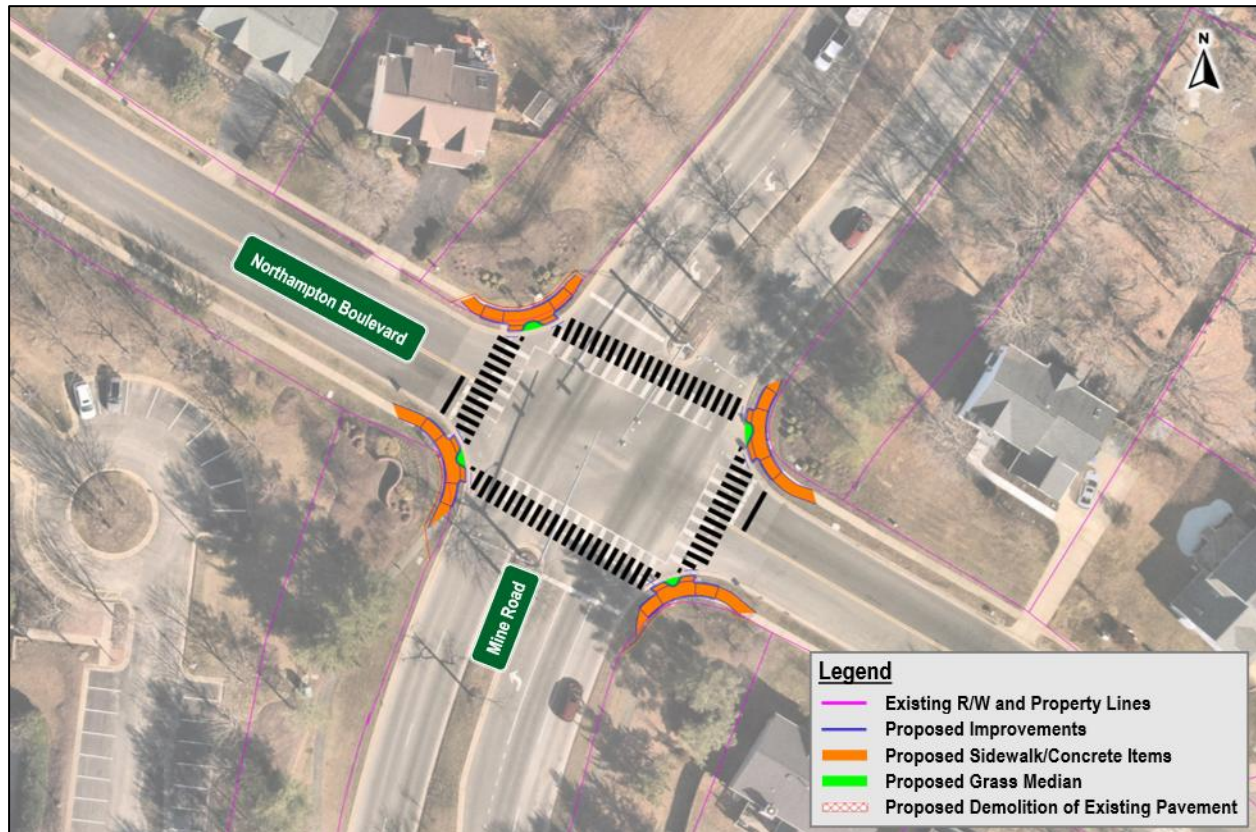


**Figure 51: Phase 2 Alternative – Mine Road and Northampton Boulevard Pedestrian Improvements**

## Mine Road and Exeter Lane Pedestrian Safety Improvements

The proposed improvement for this alternative focused on enhancing pedestrian accessibility and intersection safety. All existing curb ramps would be reconstructed to match the direction of pedestrian travel and to meet current ADA standards. A crosswalks would be installed on the north leg of the intersection with an extension of the median to provide a refuge island. Pedestrian warning signing would be included. **Figure 52** presents a conceptual sketch of the alternative.

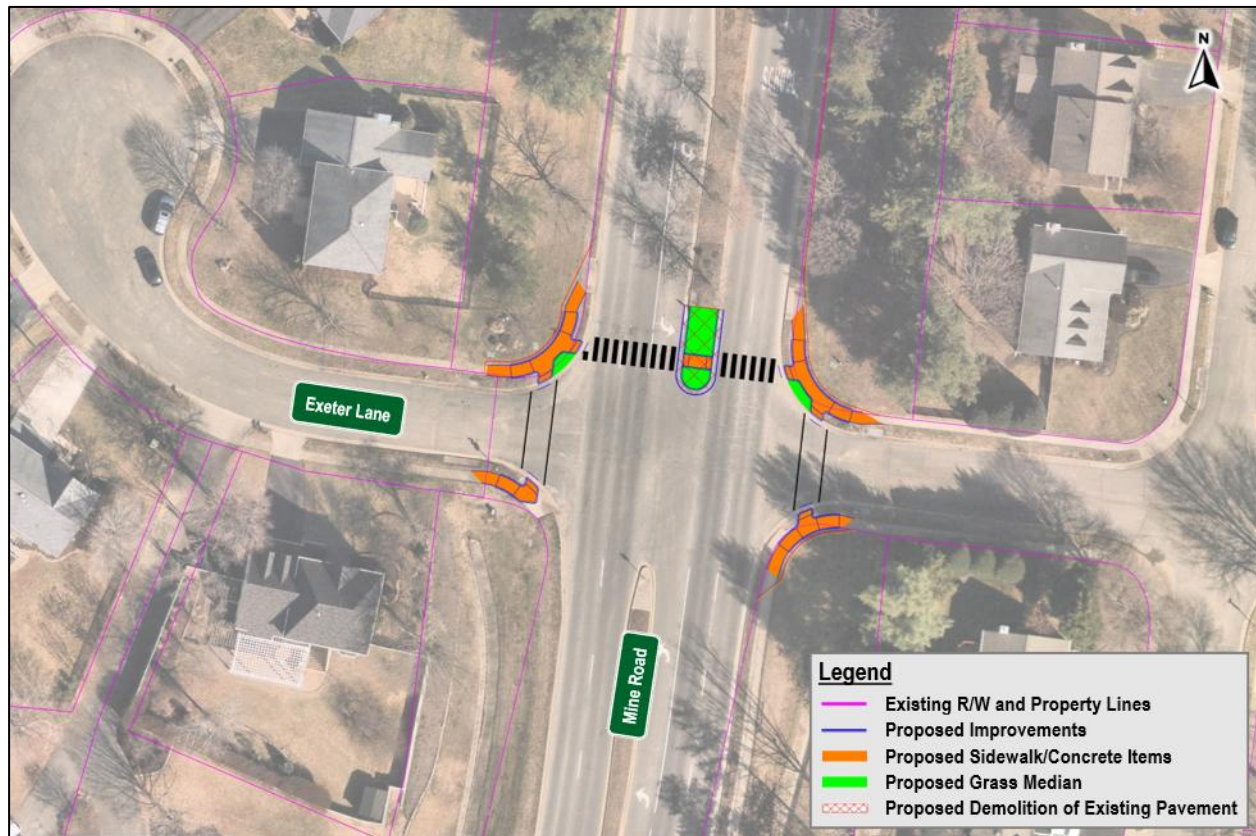


**Figure 52: Phase 2 Alternative – Mine Road and Exeter Lane Pedestrian Improvements**

## 2.2.9. Transit Improvements

### Bus Stop Infrastructure Improvements

This alternative would enhance transit accessibility and rider comfort through the installation of upgraded bus stop infrastructure along the corridor. Each improved stop would include an 8-foot by 14-foot concrete waiting pad with optional amenities (bench, shelter, trash can, etc. can be added). To support safe and efficient bus operations, the improvement also includes a 25-foot by 4-foot concrete loading pad positioned along the curb for consistent level boarding. A 50-foot pull off area with 60-foot tapers would be constructed at each stop to allow buses to exit the travel lane smoothly, reduce traffic disruptions, and provide a safer environment for loading and unloading passengers. Collectively, these upgrades create a more accessible and comfortable transit experience while improving the operational performance and overall visibility of transit stops throughout the corridor.

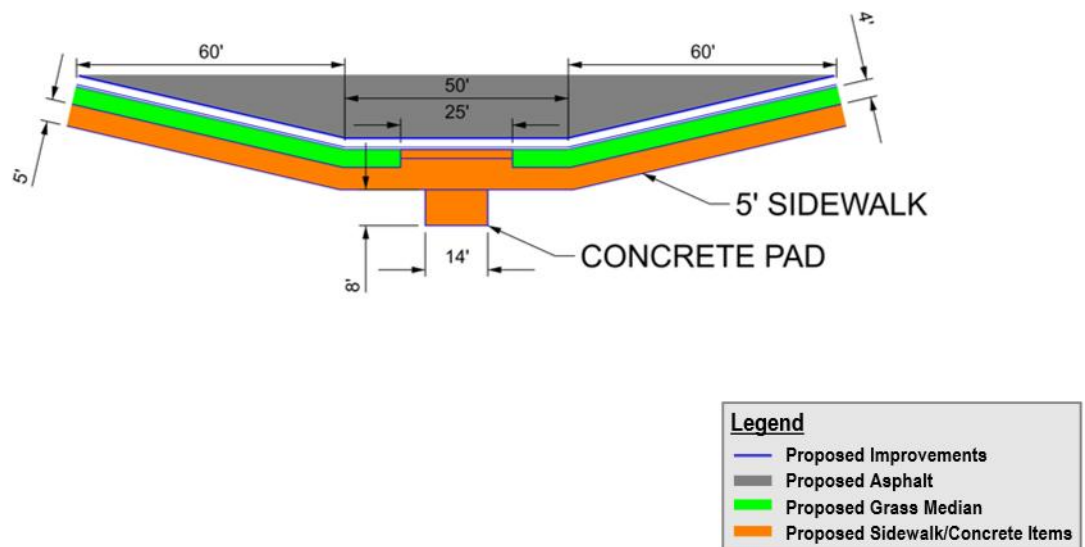


**Figure 53: Bus Stop Infrastructure Improvements Concept Sketch**

## 2.3 Traffic Operations and Safety Results

The study team conducted a screening-level traffic operations and safety analysis to help narrow down the alternatives considered. At intersections where multiple configurations were carried forward to Phase 2, improvement alternatives were further screened to aid in selecting a preferred alternative using the Virginia iCAP Assessment Tool to rank each alternative based on traffic operations, safety, pedestrian accommodations, and cost.

### Projected Traffic Operations Results for Alternatives

Intersection operations were evaluated to compare projected operations between the different alternatives using Synchro 11 and SimTraffic 11. The study team analyzed AM and PM future year (2050) traffic volumes to evaluate the operational benefits of five alternatives. Peak hour microsimulation delay in seconds per vehicle (s/veh) and maximum queues were used as measures of effectiveness for the intersection operations analysis. The study team calculated experienced travel time (ETT) following methodologies provided in the HCM 6th Edition for innovative intersection designs that involve diverting traffic movements to other intersections. **Table 20** summarizes the traffic operations results.

**Table 20: Traffic Operations Results**

| Intersection                                            | Alternative             | AM Peak Hour<br>Change in Delay<br>(s/veh) | PM Peak Hour<br>Change in Delay<br>(s/veh) |
|---------------------------------------------------------|-------------------------|--------------------------------------------|--------------------------------------------|
| Garrisonville Road and Mine Road/Staffordboro Boulevard | Modified Conventional   | -3.5                                       | -6.6                                       |
| Garrisonville Road and Mine Road/Staffordboro Boulevard | Displace Left Turn*     | -7.3                                       | -10.7                                      |
| Garrisonville Road and Mine Road/Staffordboro Boulevard | Tight Urban Diamond*    | -18.3                                      | -16.5                                      |
| Garrisonville Road and Mine Road/Staffordboro Boulevard | Michigan Urban Diamond* | -0.4                                       | +155.8                                     |
| Mine Road and Highpointe Boulevard                      | RCUT*                   | -9.6                                       | -5.9                                       |
| Mine Road and Highpointe Boulevard                      | Thru-Cut*               | -3.3                                       | +7.5                                       |
| Mine Road and Midpoint Lane                             | RCUT*                   | -2.3                                       | -3.3                                       |
| Mine Road and Midpoint Lane                             | Thru-Cut*               | 3.2                                        | +1.1                                       |

\*Concept results include experienced travel time (ETT)

### Projected Crash Reduction for Alternatives

The study team reviewed crash modification factors (CMFs) to determine the potential safety benefits for each alternative. CMFs are used to estimate the expected change in the number of crashes after a specific countermeasure is implemented. They are calculated as the ratio of crashes with the countermeasure to the number of crashes without the countermeasure. A CMF of 1.00 means that there is no expected change, a CMF less than 1.00 means there is an expected reduction in crashes, and a CMF greater than 1.00 means there is an expected increase in crashes (e.g., a CMF of 0.6 means the countermeasure is projected to reduce crashes by 40%). CMFs were selected from the SMART SCALE Planning Level CMF List from Round 6 when an applicable CMF did not exist in SMART SCALE CMFs were taken from the Virginia State preferred CMF list or the CMF Clearinghouse. The individual CMF, or combined CMFs,

representing the most applicable treatments for each location based on SMART SCALE and VDOT guidance was applied to fatal and injury crashes within the influence area of each intersection, as shown in **Table 21**. This study applied CMFs for intersection improvements for reconfiguration of the intersection to an innovative intersection type and the addition of intersection lighting. Since the addition of intersection lighting can only be applied to nighttime crashes, separate CMFs were applied to crashes reported at each intersection depending on the time of day they occurred.

**Table 21: CMF and Crash Reduction Summary**

| Alternative                                                                            | Combined F+ I CMF<br>Daylight | Combined F+I CMF<br>Nighttime | Annual Crash Reduction<br>(F+I) |
|----------------------------------------------------------------------------------------|-------------------------------|-------------------------------|---------------------------------|
| Garrisonville Road and Mine Road/Staffordboro Blvd:<br>Full Displaced Left Turns       | 0.81                          | 0.71                          | 0.8                             |
| Garrisonville Road and Mine Road/Staffordboro Blvd:<br>Michigan Urban Diamond          | 0.70                          | 0.62                          | 1.3                             |
| Garrisonville Road and Mine Road/Staffordboro Blvd:<br>Modified Conventional           | 0.86                          | 0.76                          | 0.6                             |
| Garrisonville Road and Mine Road/Staffordboro Blvd:<br>Tight Urban Diamond Interchange | 1.02                          | 0.90                          | 0.1                             |
| Midpoint Lane and Mine Road: RCUT                                                      | 0.78                          | -                             | 0.1                             |
| Midpoint Lane and Mine Road: Thru-Cut                                                  | 0.96                          | -                             | 0                               |
| Highpointe Blvd/N Vine Place and Mine Road: RCUT                                       | 0.78                          | 0.69                          | 0.2                             |
| Highpointe Blvd/N Vine Place and Mine Road: Thru-Cut                                   | 0.96                          | 0.84                          | 0                               |
| Settlers Way & Mine Road: RCUT (Unsignalized)                                          | -                             | 0.37                          | 0.5                             |
| Cathedral Lane & Mine Road: RCUT (Unsignalized)                                        | -                             | 0.37                          | 0.1                             |
| New Bedford Court & Mine Road: RCUT (Unsignalized)                                     | -                             | 0.37                          | 0.1                             |
| Stafford Market Place/Elementary Lane Retiming                                         | -                             | 0.83                          | 0.1                             |
| Northampton Blvd Retiming                                                              | -                             | 0.83                          | 0.00                            |

\*No CMF exists

## 2.4 Phase 2 Public Involvement

The Phase 2 PublicInput survey was held from November 10, 2025, to November 24, 2025, to collect feedback on the potential improvements within the study corridor. The online survey had a total of 180 participants and received 53 comments. The survey provided the study team with an understanding of how the public viewed each alternative before selecting the preferred alternative. Considering the size of the study and the amount of proposed improvements along the study area, the intersection pedestrian access and safety improvement concepts, transit and travel demand management concepts, and bicycle and pedestrian improvement concepts (with the exception of the Mine Road sidewalk and shared-use path) were not shown to the public in the survey to reduce the likelihood of survey fatigue. These concepts were selected for exclusion from the survey given their relatively low controversial nature, cost, and impact.

In total, 180 respondents participated in the survey and submitted a total of 53 written comments.

**Figure 54** summarizes the average ranking of the public's favored alternative for each intersection or corridor-wide bicycle and pedestrian improvement presented in the survey. A rating of 5.0 represents a strongly supported concept and a rating of 1.0 represents a strongly opposed concept.

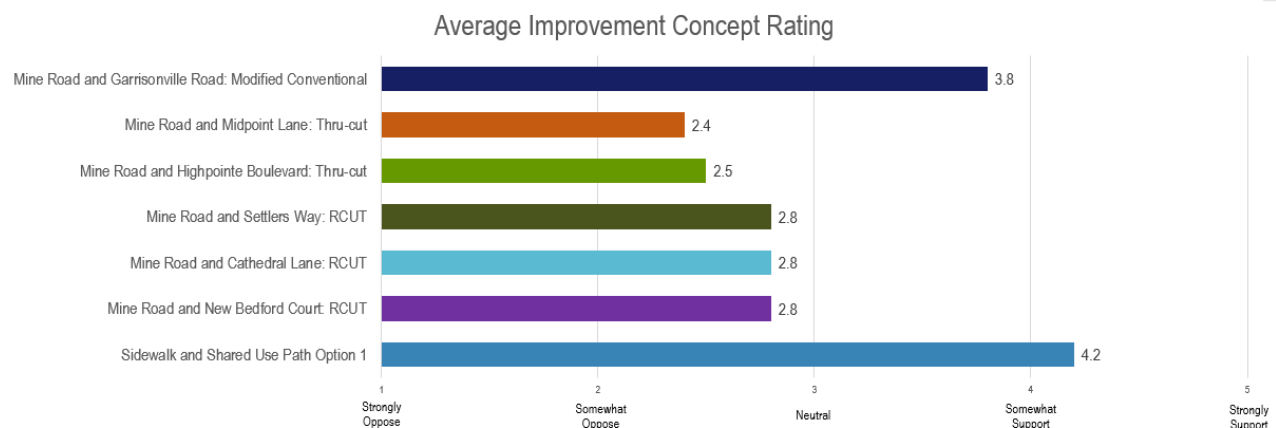


**Figure 54: Public Engagement—Average Rating of Public's Preferred Alternatives**

Public involvement feedback themes associated with the proposed alternatives are shown in **Table 22**. **Figure 55** and **Figure 56** presents the survey feedback for each intersection concept. Detailed Survey results are shown in **Appendix E**.

**Table 22: Public Involvement Feedback Themes for Proposed Alternatives**

| Alternative                                             | Public Involvement Feedback Themes                                                                       |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| Proposed RCUTs                                          | Concerns with rerouting traffic to make U-turns and insufficient gaps to complete movements              |
| Staffordboro Boulevard/Mine Road and Garrisonville Road | Concerns with congestion and safety                                                                      |
| Pedestrian Safety and Access along Mine Road            | Support for the shared-use path and sidewalk along Mine Road, intersection lighting, and traffic calming |



**Figure 55: Intersection Survey Responses (1 of 2)**

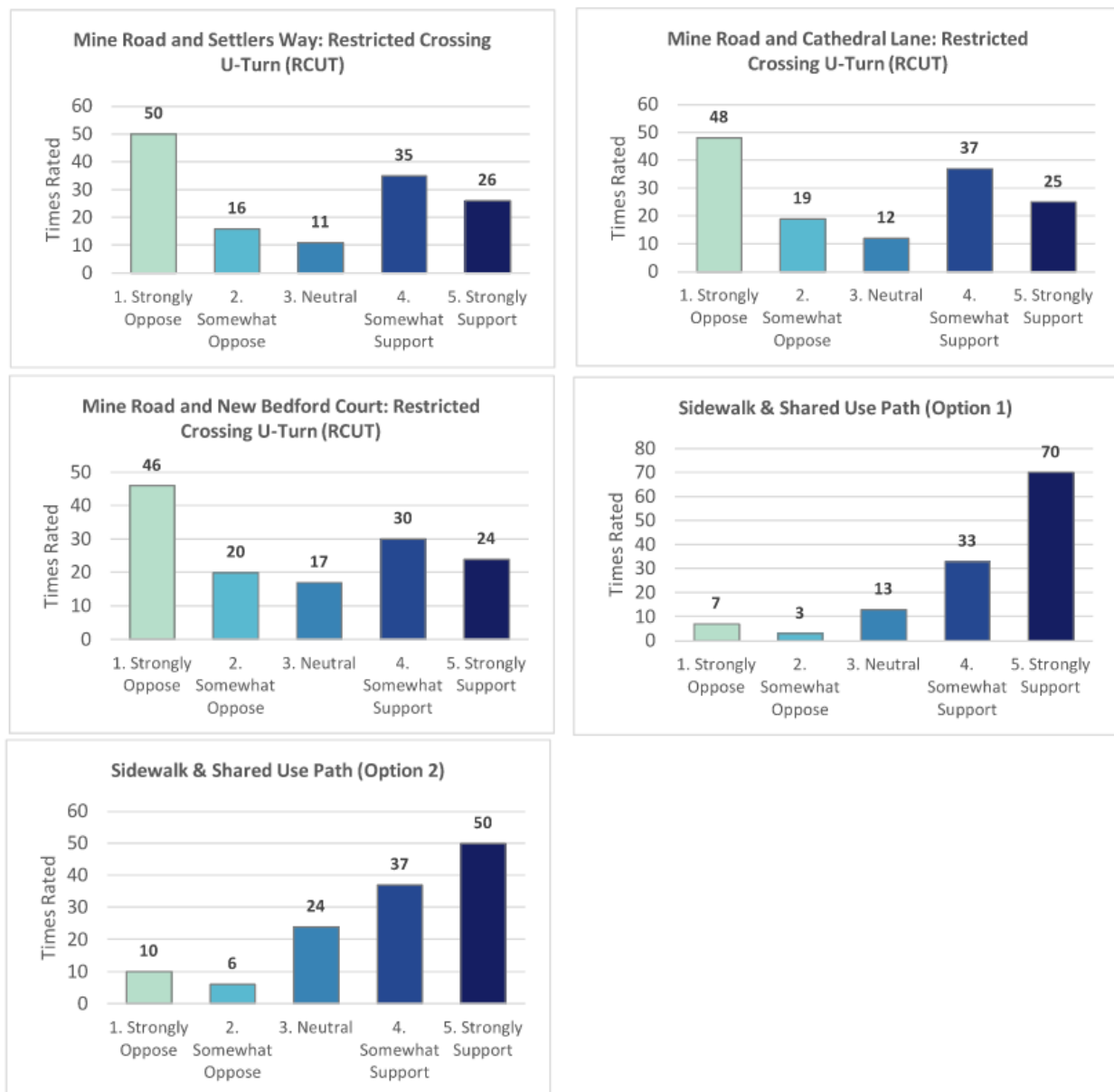


**Figure 56: Intersection Survey Responses (2 of 2)**

## 2.5 Preferred Alternative Selection

The study team presented the PublicInput survey results at The Phase 2 Public Engagement Results, Preferred Alternative Selection, and Phase 3 Scoping Meeting (SWG Meeting #5), held on December 18, 2025. During this meeting, Kimley-Horn suggested a set of alternatives to advance towards the development of a preferred alternative as outlined in **Table 19** from **Chapter 1.7**. The Project Pipeline Program categorizes the recommended improvements into three distinct groups:

- **Short Term Recommendations (State/Local Forces):** This category consists of immediate maintenance and operational improvements that could be implemented through state/local forces. Examples include vegetation management, HSIP systemic-level safety improvements, adjusting

signal timings. Some improvements in this category may also be included in the final-mid-term investment strategy.

- **Mid-Term Investment Strategy (Preferred Alternative):** This category consists of improvements that are targeted for a funding request/application within the next 12 months. Items in this group will advance to Phase 3 of the Project Pipeline study process for further design and cost refinement. All recommendations in the mid-term investment strategy category will be considered the preferred alternative per SMART SCALE High Priority Program (HPP) policy.
- **Long-Term Investment Vision:** This category includes recommendations that represent a long-term investment vision (beyond 20 years). These improvements are not targeted for funding in near or mid-term but are intended to guide localities in their comprehensive planning efforts, inform land development decisions, and reserve and protect future right-of-way. Recommendations in this category will not advance to Phase 3 of Project Pipeline.

From these alternatives, the study team and Stafford County determined a set of alternatives to advance towards the development of a preferred alternative. The following sections present the alternatives considered and the rationale for the selection of the preferred alternative(s) throughout the study corridor.

**Appendix F** includes the Phase 2 Preferred Alternative Summary.

### Mine Road and Midpoint Lane

**Figure 57** includes the iCAP Stage 2 summary at the Mine Road and Midpoint Lane intersection. The minimal increase in intersection performance, low support from the public, and high cost associated with the RCUT alternative led the SWG to choose not to move forward with either the RCUT or Thru-cut alternatives. Instead, the SWG selected the pedestrian safety and access improvements as the preferred alternative at the Mine Road and Midpoint Lane intersection.

| Alternative                      | Traffic     |             | Pedestrian Metric Score | Safety Metric              |       | Stage 2 Cost | Total Stage 2 Score |
|----------------------------------|-------------|-------------|-------------------------|----------------------------|-------|--------------|---------------------|
|                                  | MOE 1 Score | Total Score |                         | Annual F+I Crash Reduction | Score | Score        |                     |
| Restricted Crossing U-Turn NB-SB | 1.0         | 1.0         | 0.5                     | 0.90                       | 1.0   | 0.9          | 7.3 out of 9        |
| Thru-cut                         | 0.6         | 0.6         | 0.5                     | 0.04                       | 0.4   | 1.0          | 5.3 out of 9        |
| <b>Metric Weighting</b>          | <b>3</b>    |             | <b>1</b>                | <b>3</b>                   |       | <b>2</b>     |                     |

**Figure 57: Virginia iCAP Stage 2 Results–Mine Road and Midpoint Lane PM Peak Hour**

### Mine Road and Highpointe Boulevard/N Vine Place

**Figure 58** includes the iCAP Stage 2 summary at the Mine Road and Highpointe Boulevard/N Vine Place intersection. The minimal increase in intersection performance, low score from the PublicInput survey, and high cost associated with the RCUT alternative led the SWG to choose not to move forward with either of the RCUT or Thru-cut alternatives. Instead, the SWG selected the pedestrian safety and access improvements as the preferred alternative at the Mine Road and Highpointe Boulevard/N Vine Place intersection.

| Alternative                      | Traffic     |             | Pedestrian Metric Score | Safety Metric              |       | Stage 2 Cost | Total Stage 2 Score |
|----------------------------------|-------------|-------------|-------------------------|----------------------------|-------|--------------|---------------------|
|                                  | MOE 1 Score | Total Score |                         | Annual F+I Crash Reduction | Score | Score        |                     |
| Restricted Crossing U-Turn NB-SB | 1.0         | 1.0         | 0.5                     | 0.13                       | 1.0   | 0.9          | 7.5 out of 9        |
| Thru-cut                         | 0.6         | 0.6         | 0.5                     | 0.05                       | 0.4   | 1.0          | 5.3 out of 9        |
| Metric Weighting                 | 3           |             | 1                       | 3                          |       | 2            |                     |

**Figure 58: Virginia iCAP Stage 2 Results–Mine Road and Highpointe Boulevard/N Vine Place PM Peak Hour**

### Mine Road/Staffordboro Boulevard and Garrisonville Road

**Figure 59** includes the iCAP Stage 2 summary at the Mine Road/Staffordboro Boulevard and Garrisonville Road intersection. The proposed Modified Conventional alternative is projected to decrease the overall intersection delay by 3.5 s/veh during the AM peak hour and 6.6 s/veh during the PM peak hour as compared to the No-Build conditions. While the Full Displaced Left-Turn and Tight-Urban Diamond alternatives had greater decreases in delay, they also had substantially higher costs and impacts to the surrounding properties. The Michigan Urban Diamond scored the highest in the iCAP Stage 2 analysis but was found to gridlock the frontage road network during some of the microsimulation model runs. The SWG discussed options for pursuing improvements at the intersection and ultimately determined the Modified Conventional configuration would be the preferred alternative but would be pursued further as part of a separate study. The SWG decided to carry the Tight Urban Diamond forward for consideration as a long-term improvement.

| Alternative              | Traffic     |             | Pedestrian Metric Score | Safety Metric              |       | Stage 2 Cost | Total Stage 2 Score |
|--------------------------|-------------|-------------|-------------------------|----------------------------|-------|--------------|---------------------|
|                          | MOE 1 Score | Total Score |                         | Annual F+I Crash Reduction | Score | Score        |                     |
| Full Displaced Left Turn | 0.9         | 0.9         | 0.0                     | 0.99                       | 0.9   | 0.1          | 3.8 out of 9        |
| Michigan Urban Diamond   | 0.3         | 0.3         | 1.0                     | 1.09                       | 1.0   | 0.1          | 6.5 out of 9        |
| Modified Conventional    | 0.8         | 0.8         | 0.5                     | 0.41                       | 0.4   | 1.0          | 5.5 out of 9        |
| Tight Urban Diamond      | 1.0         | 1.0         | 0.5                     | 0.34                       | 0.3   | 0.1          | 3.6 out of 9        |
| Metric Weighting         | 3           |             | 1                       | 3                          |       | 2            |                     |

**Figure 59: Virginia iCAP Stage 2 Results–Mine Road/Staffordboro Boulevard and Garrisonville Road PM Peak Hour**

### Corridor Summary

After reviewing the survey results, Virginia iCAP Stage 2 results, and further discussing the concepts, the SWG decided to move forward with the following improvements as the preferred alternative:

The safety and pedestrian access intersection improvements, shared-use path, sidewalk, and bus stop infrastructure were selected as part of the preferred alternative due to the high VTrans pedestrian and bicycle connectivity needs of the study area, high support from the public, and relatively low cost. The addition of new bus stops along Mine Road, increased frequency and service windows, and counterclockwise service that were considered earlier in the study were not carried forward as part of the

preferred alternative since FXBGO! recently implemented changes to the route and bus stop locations as part of their recently completed Transit Strategic Plan. The preferred alternative also aligns with key SMART SCALE factor areas by improving safety and operations, enhancing multimodal accessibility, and supporting planned development within the study area, consistent with current SMART SCALE evaluation criteria. The Staffordboro Boulevard and Salisbury Road sidewalk were not carried forward given their relatively low benefit compared to the anticipated cost to construct. The meeting materials can be found in **Appendix F**.

**Table 23** and **Figure 60** show the intersection alternatives and their recommended investment strategy. The SWG decided that improvements at the intersection of Mine Road/Staffordboro Boulevard and Garrisonville Road would be considered part of the long-term investment vision and would be pursued in another study which is focused on the Garrisonville Road corridor within Stafford County.

**Table 23: Preferred Alternative Selection for FR-25-05**

| <b>Preferred Alternative Selection Recommendation</b>                                                                                                                                                                                                                                         |                                                                 |                                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|------------------------------------|
| <b>Improvement Concept</b>                                                                                                                                                                                                                                                                    | <b>Mid-Term Investment Strategy<br/>(Preferred Alternative)</b> | <b>Long-Term Investment Vision</b> |
| <b>Restricted Crossing U-Turn Intersection</b>                                                                                                                                                                                                                                                |                                                                 |                                    |
| Settlers Way                                                                                                                                                                                                                                                                                  | ✓                                                               |                                    |
| Cathedral Lane                                                                                                                                                                                                                                                                                | ✓                                                               |                                    |
| New Bedford Court                                                                                                                                                                                                                                                                             | ✓                                                               |                                    |
| <b>Intersection Safety and Pedestrian Access Improvements</b>                                                                                                                                                                                                                                 |                                                                 |                                    |
| Midpoint Lane                                                                                                                                                                                                                                                                                 | ✓                                                               |                                    |
| Highpointe Boulevard/N Vine Place                                                                                                                                                                                                                                                             | ✓                                                               |                                    |
| Juggins Road Connector                                                                                                                                                                                                                                                                        | ✓                                                               |                                    |
| Woodstream Boulevard                                                                                                                                                                                                                                                                          | ✓                                                               |                                    |
| Stafford Market Place/Elementary Lane                                                                                                                                                                                                                                                         | ✓                                                               |                                    |
| Northampton Boulevard                                                                                                                                                                                                                                                                         | ✓                                                               |                                    |
| Exeter Lane                                                                                                                                                                                                                                                                                   | ✓                                                               |                                    |
| <b>Multimodal Improvements</b>                                                                                                                                                                                                                                                                |                                                                 |                                    |
| 10-foot-wide shared-use path on west side of Mine Road*<br>(from Exeter Lane to north of Settlers Way and from Highpointe Boulevard to south of Midpoint Lane)                                                                                                                                | ✓                                                               |                                    |
| Sidewalk on east side of Mine Road*<br>(from New Bedford Court to Greenspring Drive)                                                                                                                                                                                                          | ✓                                                               |                                    |
| Bus Stop Infrastructure <ul style="list-style-type: none"> <li>Stop #404: Greenspring Drive (KinderCare)</li> <li>Stop #440: Staffordboro Boulevard (VDOT Commuter Lot)</li> <li>Stop #526: Mine Road (Walmart)</li> <li>Stops #555 &amp; #556: Mine Road at Northampton Boulevard</li> </ul> | ✓                                                               |                                    |
| <b>Mine Road/Staffordboro Boulevard and Garrisonville Road Improvements</b>                                                                                                                                                                                                                   |                                                                 |                                    |
| Modified Conventional*                                                                                                                                                                                                                                                                        |                                                                 |                                    |
| Tight Urban Diamond                                                                                                                                                                                                                                                                           |                                                                 | ✓                                  |

\*Preferred alternative at Mine Road/Staffordboro Boulevard and Garrisonville Road will be pursued in a separate County led initiative for a Garrisonville Road corridor study.

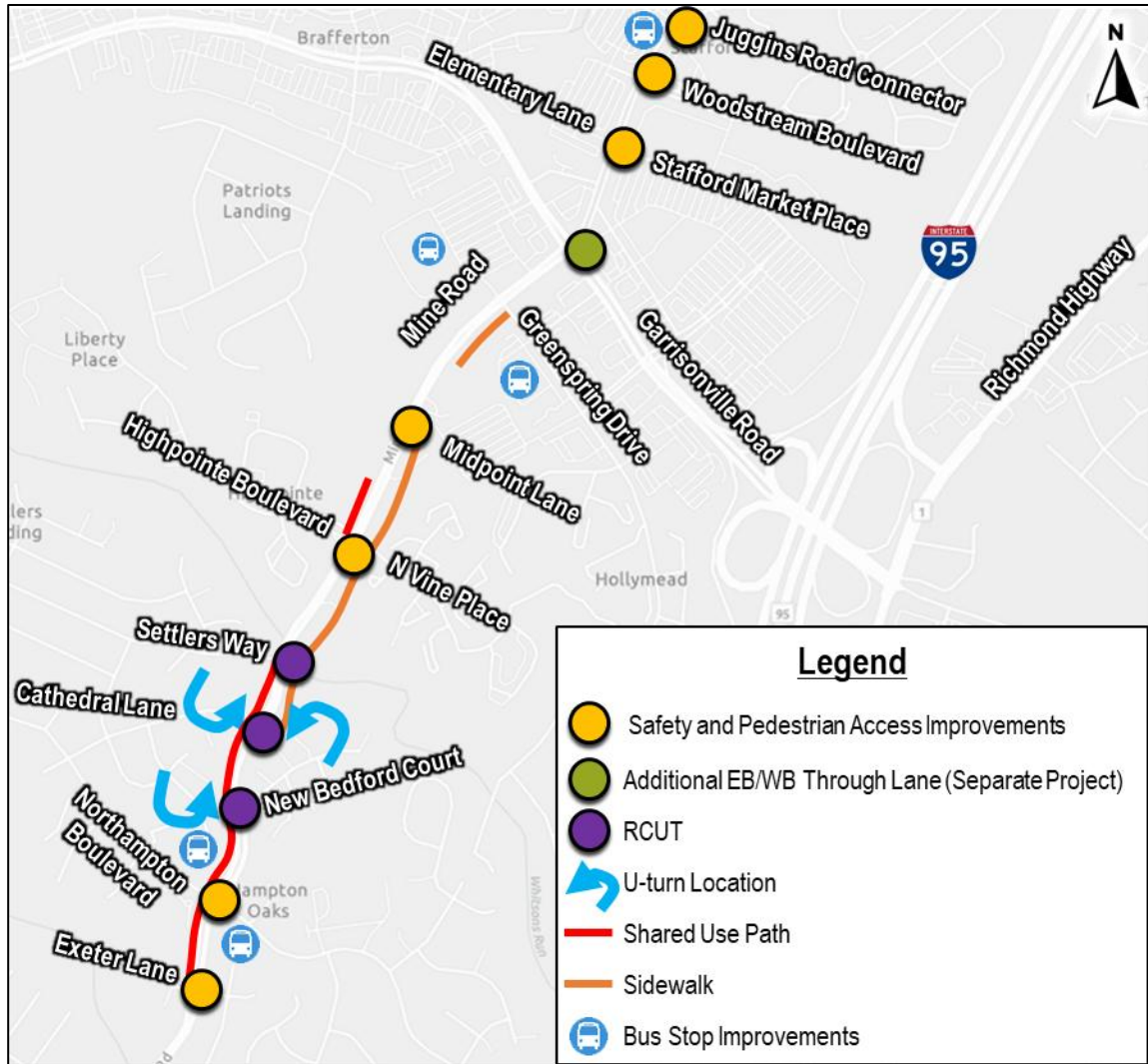


**Figure 60: Phase 2 Selected Preferred Alternative**

## Chapter 3: Preferred Alternative Analysis and Investment Strategy

### 3.1 Phase 3 Preferred Alternative Summary

Phase 3 of the study included a detailed design, cost estimate, risk assessment, and further operations assessment of the selected preferred alternative. As discussed in **Section 2.5**, the SWG chose the following components to be carried forward as the preferred alternative:

- Restricted Crossing U-Turn (RCUT) configurations at three unsignalized intersections (Settlers Way, Cathedral Lane, and New Bedford Court)
- Intersection safety and pedestrian access improvements at Juggins Road Connector, Woodstream Boulevard, Stafford Market Place/Elementary Lane, Midpoint Lane, Highpointe Boulevard/N Vine Place, Northampton Boulevard, and Exeter Lane
- Shared-use path along the west side of Mine Road from Exeter Lane to Settlers Way and from Highpointe Boulevard to the proposed Hampton Run commercial development
- Sidewalk along the east side of Mine Road from Cathedral Lane to Midpoint Lane
- Bus stop improvements at stops #404, #440, #526, #555, and #556

A field review meeting was conducted with the VDOT and SWG members on February 26, 2026, to evaluate and discuss the draft concept designs within the existing context of the corridor. Based on this meeting, multiple revisions were made to the components to be included in the preferred alternative, as listed below and summarized in **Figure 61**.

- Exclude FXBGO! stop #440 from proposed bus stop improvements (Staffordboro Boulevard/VDOT Commuter Lot)
- Relocate FXBGO! stop #526 (Walmart) to southbound Mine Road (preference for far-side of intersection with a pull-out) and include in Stafford County's on-going Greenspring Drive Transportation Alternatives Program (TAP) project
- Relocate FXBGO! stop #404 (Greenspring Drive/KinderCare) to just east of Mine Road and include in Stafford County's on-going Greenspring Drive TAP project
- Extend proposed 10-foot shared-use path on west side of Mine Road from Highpointe Boulevard to existing sidewalk north of Midpoint Lane
- Exclude 10-foot shared-use path on west side of Mine Road from Exeter Lane to Settlers Way
- Exclude 5-foot sidewalk on east side of Mine Road from New Bedford Court to Midpoint Lane
- Relocate FXBGO! stop #555 (southbound Mine Road at Northampton Boulevard) to far side of intersection
- Restrict U-turns at Cathedral Lane to passenger vehicles only to no longer require U-turn bulb and retaining wall

The final Phase 3 Preferred Alternative consists of the following components:

- Restricted Crossing U-Turn (RCUT) configurations at three unsignalized intersections (Settlers Way, Cathedral Lane, and New Bedford Court) with U-turn restrictions at Cathedral Lane
- Intersection safety and pedestrian access improvements at Juggins Road Connector, Woodstream Boulevard, Stafford Market Place/Elementary Lane, Midpoint Lane, Highpointe Boulevard/N Vine Place, Northampton Boulevard, and Exeter Lane

## PROJECT PIPELINE

- Bus stop improvements at stops #404, #526, #555, and #556 (bus stops #404, #526, and #555 will be relocated)
- 10-foot shared-use path on west side of Mine Road from Highpointe Boulevard to existing sidewalk north of Midpoint Lane

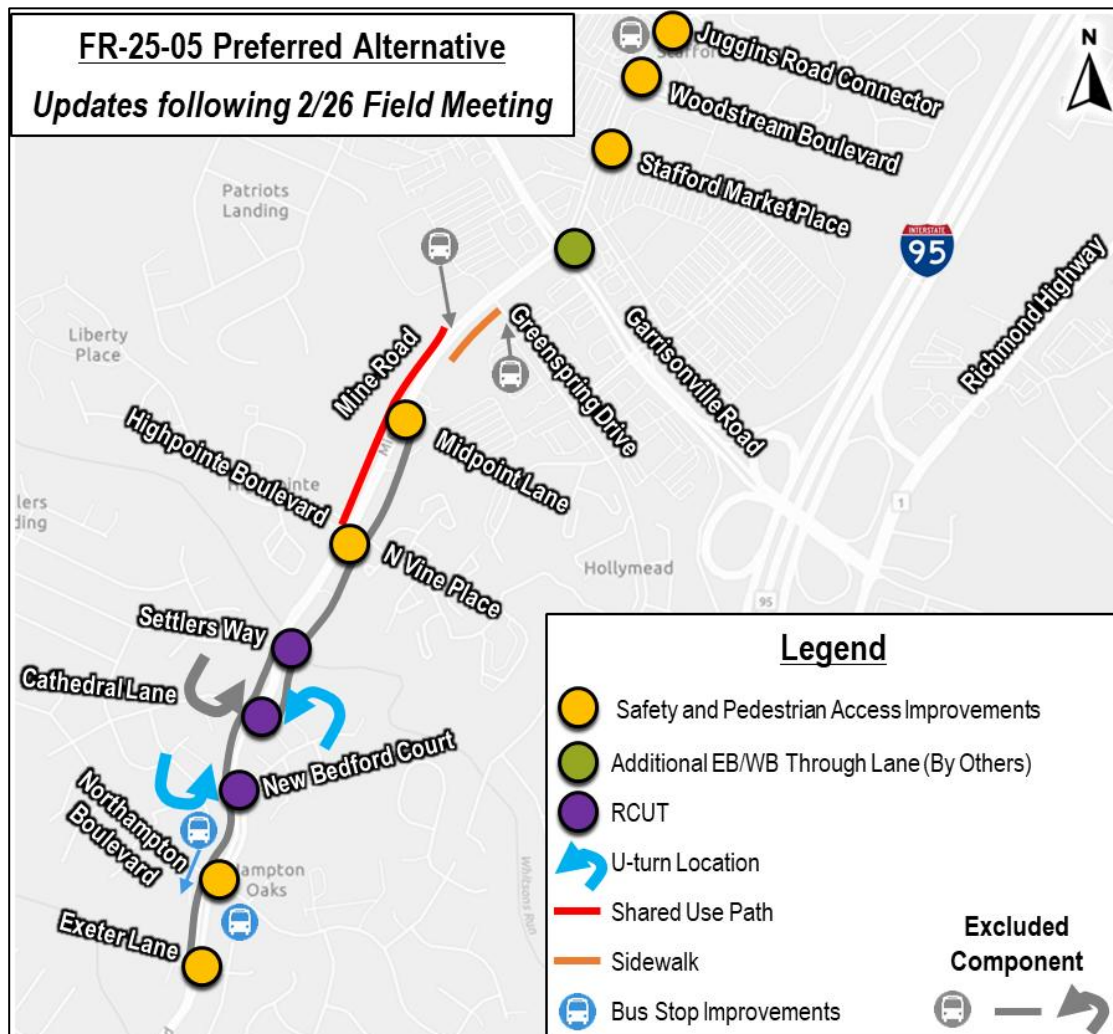


**Figure 61: Changes to Preferred Alternative Following February 2026 Field Visit**

A detailed description of the preferred alternative is described below.

### Staffordboro Boulevard and Juggins Road Connector

The southern leg of the intersection would be reconfigured to have one southbound receiving lane and three northbound lanes (one dedicated left-turn lane, one through lane, and one dedicated right-turn lane). A concrete channelizing island would be installed between the northbound right-turn lane and through lane. Existing curb ramps on the south leg of the intersection would be reconstructed to match the direction of pedestrian travel and meet current the ADA standards. The curb in the southwest corner would need to be adjusted to accommodate the eastbound right-turn movement of the SU-40 design vehicle. Crosswalks would be installed on the south leg and west leg of the intersection and tie into the existing sidewalk network, including a recently constructed sidewalk on the west side of Staffordboro Boulevard north of Juggins Road Connector. A short sidewalk connection is also proposed to connect the existing sidewalk to the Park and Ride lot. Rectangular rapid flashing beacons (RRFB) are proposed to be installed on either side of the crosswalk on the southern leg of the intersection. **Figure 62** presents a conceptual sketch of the alternative

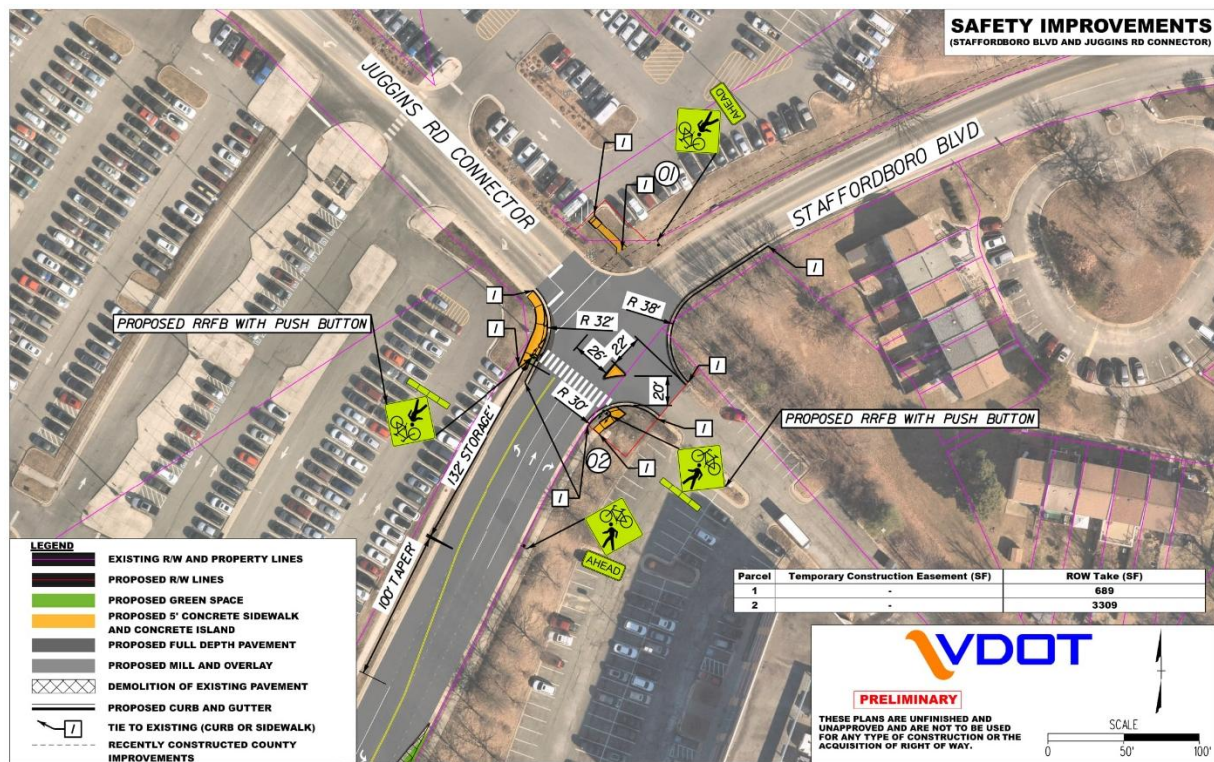


**Figure 62: Staffordboro Boulevard and Juggins Road Connector Conceptual Sketch**

## Staffordboro Boulevard and Woodstream Boulevard

The curbline in the northeast quadrant of the intersection is proposed to be bumped out into the intersection to reduce the number of northbound receiving lanes to one and reduce the crossing distance for pedestrians across the northern leg of the intersection. Curb ramp improvements would be included in each corner of the intersection to match the direction of pedestrian travel and meet current ADA standards. Crosswalks are proposed across all legs of the intersection, except the southern leg. An RRFB is proposed to be installed on the northern leg of the intersection. **Figure 63** presents a conceptual sketch of the alternative.

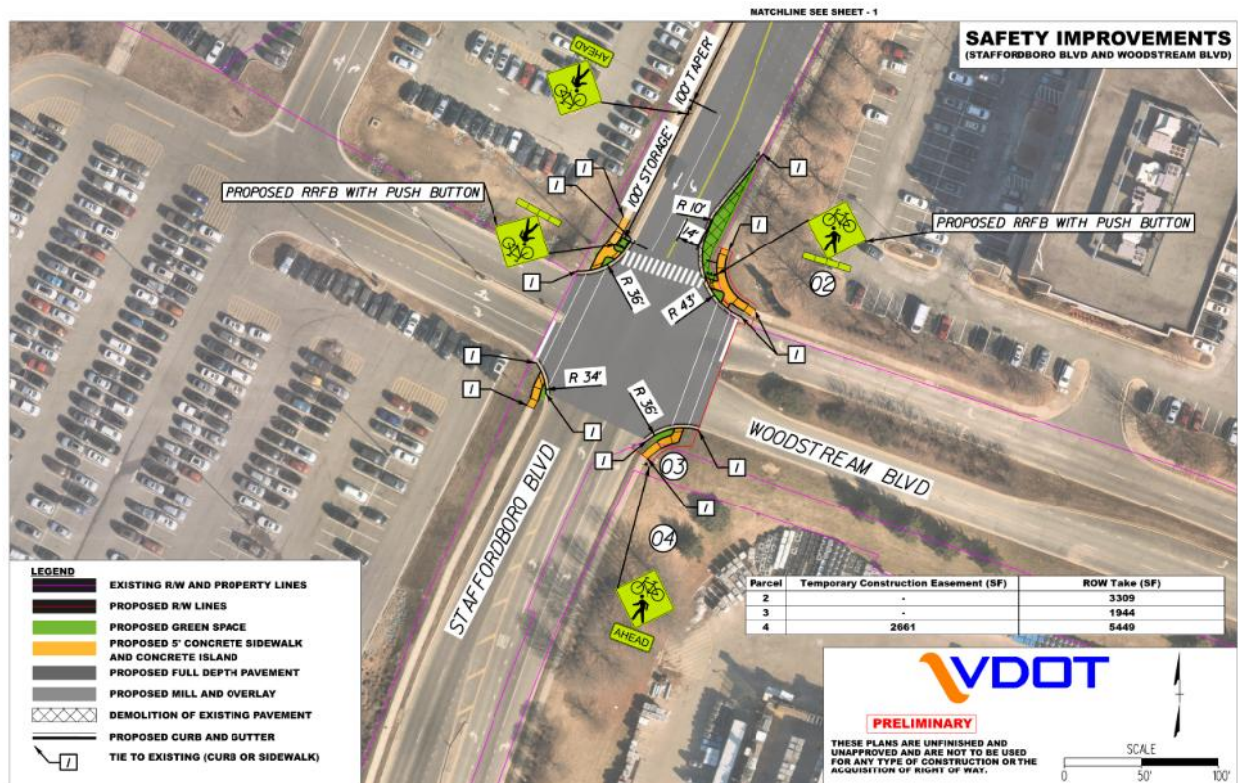


Figure 63: Staffordboro Boulevard and Woodstream Boulevard Conceptual Sketch

## Staffordboro Boulevard and Stafford Market Place/Elementary Lane

The curbline in the northeast quadrant of the intersection is proposed to be bumped out into the intersection to reduce the number of northbound receiving lanes to two and reduce the crossing distance for pedestrians across the northern leg of the intersection. Curb ramp improvements would be included in each corner of the intersection to match the direction of pedestrian travel and meet current ADA standards. High-visibility crosswalks would be installed on all four legs of the intersection. Pedestrian pushbuttons would be added to the three quadrants of the intersection that don't currently have them. Right turns would be restricted for trucks in the northbound direction to reduce impacts to existing utilities in that corner of the intersection. **Figure 64** presents a conceptual sketch of the alternative.

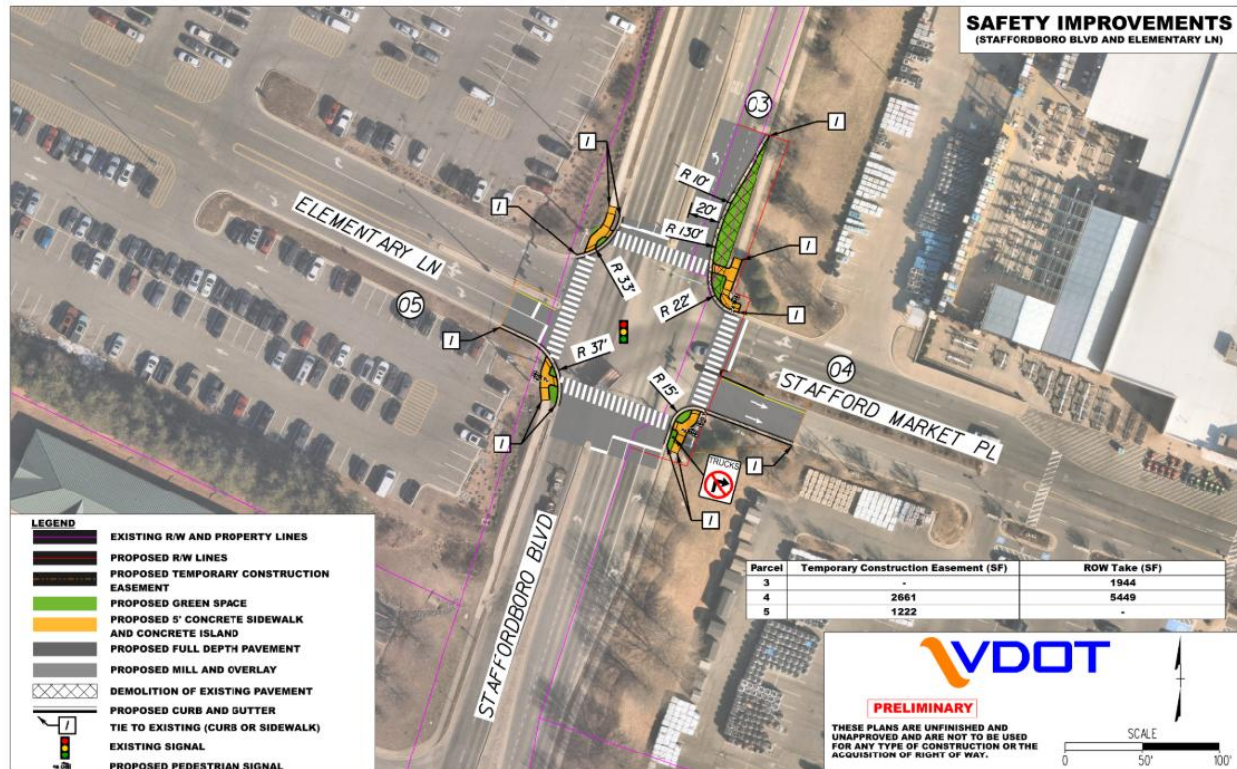


Figure 64: Staffordboro Boulevard and Stafford Market Place/Elementary Lane Conceptual Sketch

### Mine Road Shared-Use Path and Sidewalk

A five-foot concrete sidewalk is proposed on the east side of Mine Road from Greenspring Drive to the existing sidewalk just north of Midpoint Lane. Where the minimum buffer space is not feasible, the sidewalk would be placed at the back of curb and widened to six feet. On the west side of Mine Road, a 10-foot wide asphalt paved shared-use path is proposed from the existing sidewalk just south of Greenspring Drive to Highpointe Boulevard. A short sidewalk transition is proposed to connect the shared-use path with the existing sidewalk. Near Highpointe Boulevard the path is proposed to be narrowed to eight feet in width with a five-foot buffer from the curb to avoid utility impacts. **Figure 65** presents a conceptual sketch of the alternative.

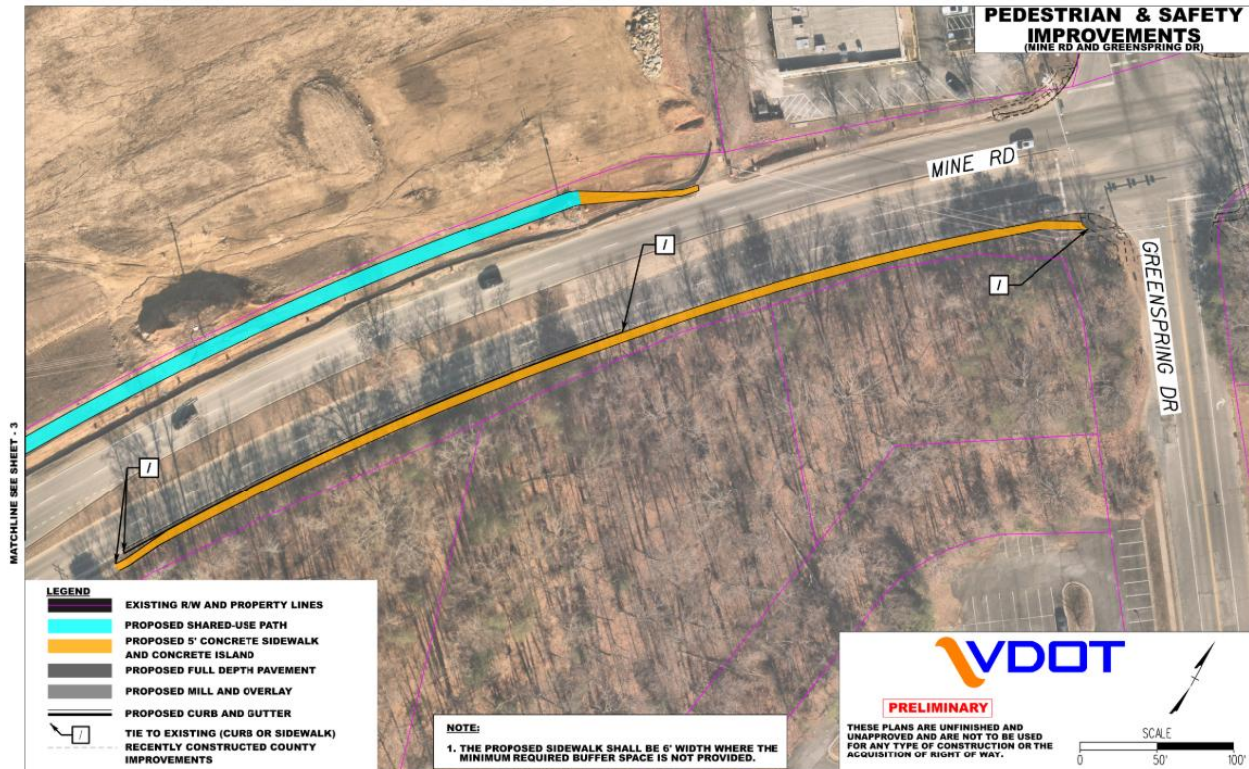


**Figure 65: Pedestrian and Bicycle Improvements along Mine Road Conceptual Sketch**

### Mine Road and Midpoint Lane

Curb ramps are proposed across the northern and western leg of the intersection to be in line with the direction of pedestrian travel, compliant with ADA, and high visibility crosswalk markings. An engineering-based spot exception is required for the two omitted pedestrian crossings. No pedestrian improvements are being constructed along northbound traffic from Midpoint Lane to N Vine Place based on existing site constraints including steeper topography and forested areas. The proposed improvements will also include the pavement striping and markings for the new pavement that was constructed for the proposed site development's thru-right lane and acceleration lane. Applicable pedestrian signals and push buttons would also be installed. The existing signal timing and phasing is proposed to be modified to optimize the signal, convert the flashing yellow arrow phasing for the northbound and southbound lefts to protected only phasing during the AM and PM peak hours, and increase the all-red clearance interval. **Figure 66** presents a conceptual sketch of the alternative.

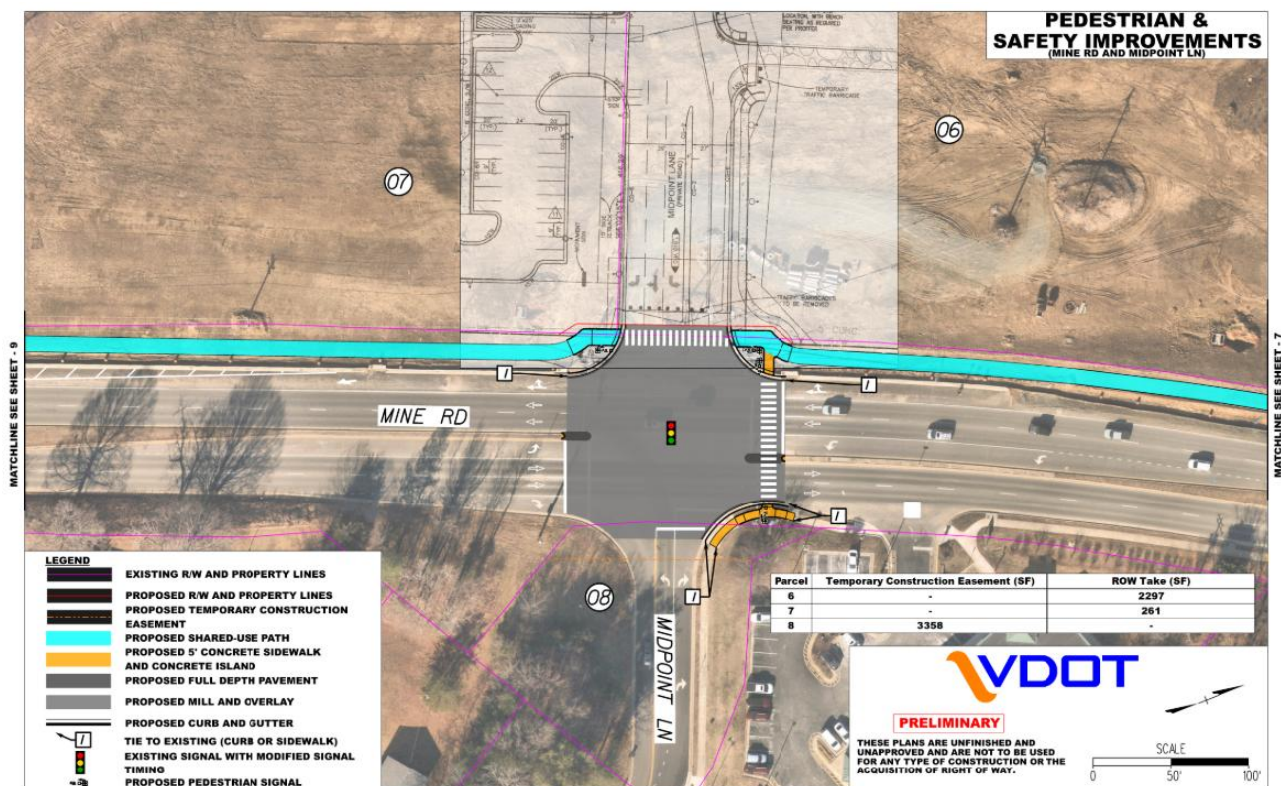


**Figure 66: Mine Road and Midpoint Lane Conceptual Sketch**

### Mine Road and Highpointe Boulevard/N Vine Place

This concept would install a curb bump-out on the northwest corner of the intersection to reduce the crossing distance for pedestrians across the western leg of the intersection and reduce the number of westbound receiving lanes to one. Curb ramps are proposed to be updated to be in line with the direction of pedestrian travel and compliant with ADA across the southern and western leg of the intersection with high visibility crosswalk markings. Applicable pedestrian signals and push buttons would also be installed. An engineering-based spot exception is required for the two omitted pedestrian crossings. No pedestrian improvements are being constructed along northbound traffic from Midpoint Lane to N Vine Place based on existing site constraints including steeper topography and forested areas. Intersection lighting is also proposed. The existing signal timing and phasing is proposed to be modified to optimize the signal, convert the flashing yellow arrow phasing for the northbound and southbound lefts to protected only phasing during the AM and PM peak hours, and increase the all-red clearance interval. **Figure 67** presents a conceptual sketch of the alternative.

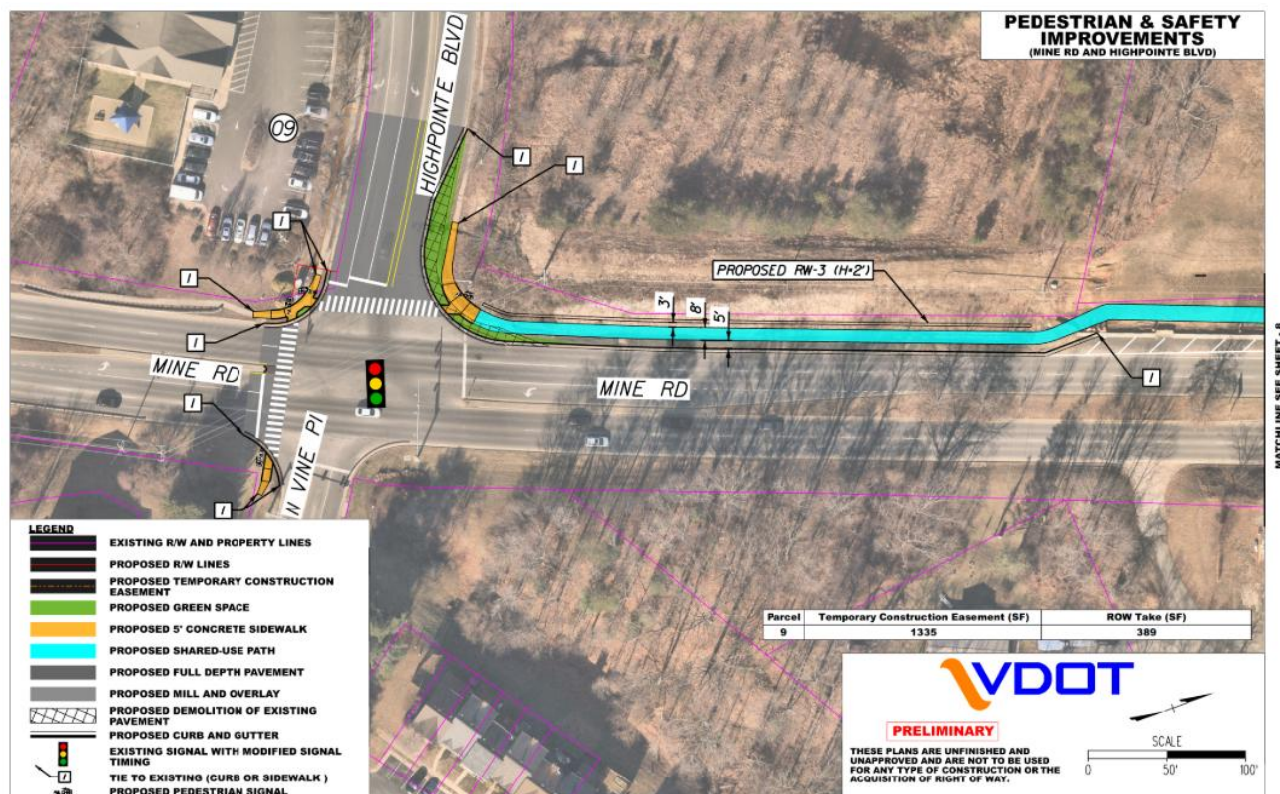


**Figure 67: Mine Road and Highpointe Boulevard/N Vine Place Conceptual Sketch**

### Mine Road and Settlers Way

This concept would upgrade the sidewalk and curb ramps to be in line with the direction of pedestrian travel with a marked crosswalk over the western leg of the intersection. The eastbound approach would be reconfigured to allow right-turns only and redirect left-turns to make a U-turn at Cathedral Lane. Truck U-turns at the intersection would be restricted. **Figure 68** presents a conceptual sketch of the alternative.

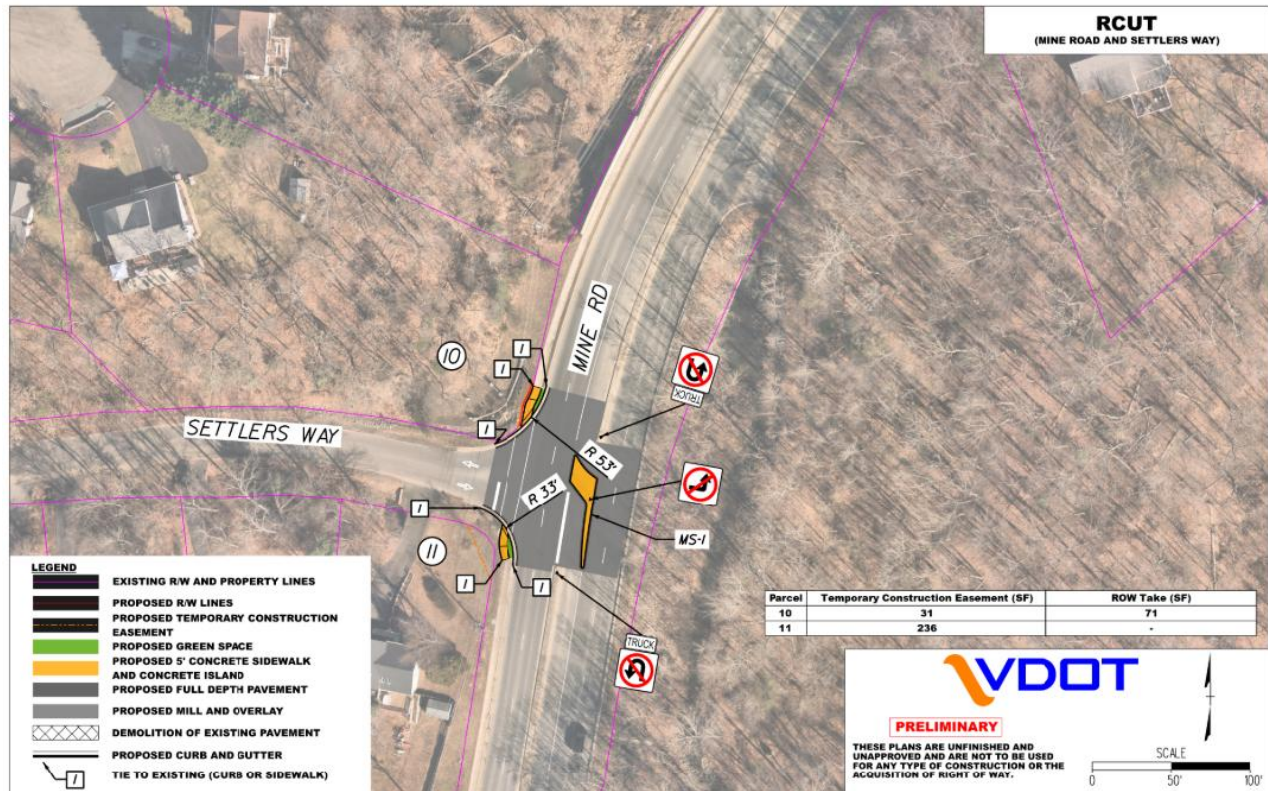


**Figure 68: Mine Road and Settlers Way Conceptual Sketch**

### Mine Road and Cathedral Lane

This concept would upgrade the sidewalk and curb ramps to be in line with the direction of pedestrian travel with a marked crosswalk over the western leg of the intersection. The eastbound approach would be reconfigured to allow right-turns only and redirect left-turns to make a U-turn at New Bedford Court. Truck U-turns at the intersection would be restricted. The southbound right-turns would also be restricted with a revised curb in the northwest corner and signage that directs these right turns to Northampton Boulevard. Intersection lighting is also proposed. **Figure 69** presents a conceptual sketch of the alternative.

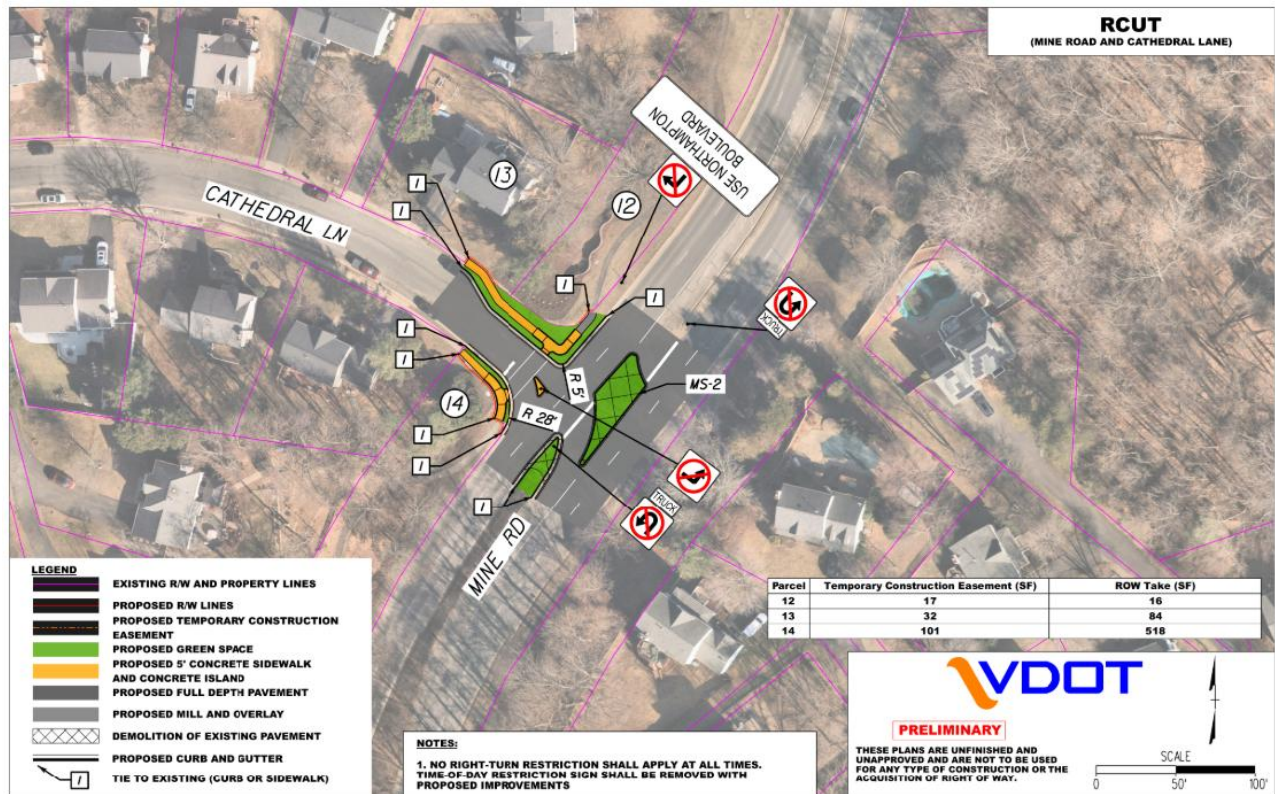


**Figure 69: Mine Road and Cathedral Lane Conceptual Sketch**

### Mine Road and New Bedford Court

This concept would upgrade the sidewalk and curb ramps to be in line with the direction of pedestrian travel with a marked crosswalk over the eastern leg of the intersection and across Mine Road with a median refuge. This crosswalk would connect to the existing sidewalk and trail that are parallel to Mine Road. The westbound approach would be reconfigured to allow right-turns only and redirect left-turns to make a U-turn at Cathedral Lane. Intersection lighting and an RRFB would be installed at the proposed crosswalk across Mine Road. Further evaluation during final design will be necessary to confirm sight distance requirements are met for the proposed crosswalk and that trees are cleared or trimmed where needed to meet the requirements. **Figure 70** presents a conceptual sketch of the alternative.

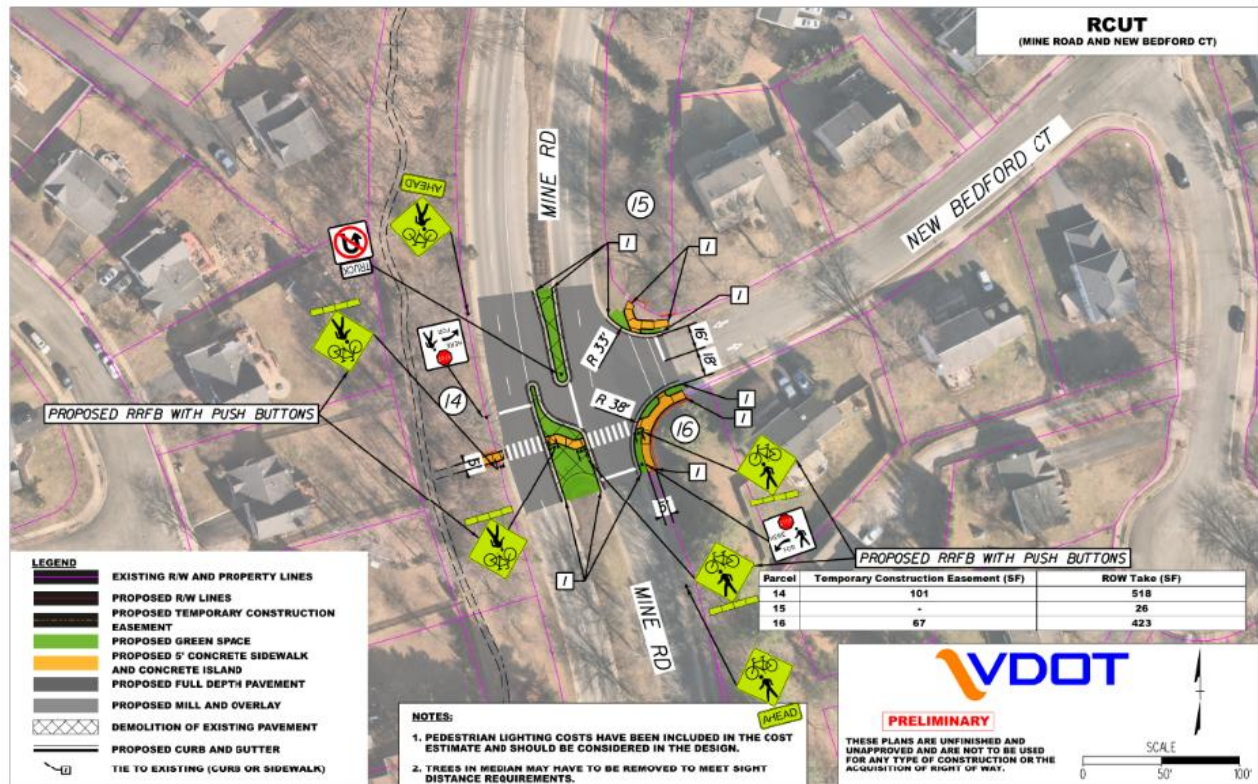


**Figure 70: Mine Road and New Bedford Court Conceptual Sketch**

### Mine Road and Northampton Boulevard

The proposed improvements will include two bus pullouts designed in accordance with Virginia Department of Rail and Public Transportation (VDRPT) standards. The southbound bus stop is proposed downstream of the intersection, and the northbound bus stop is proposed upstream of the intersection. The existing four-foot asphalt path along Mine Road will be replaced with a five-foot sidewalk from the bus pads to the intersection to bring the pedestrian facilities up to ADA standards. Curb ramps are proposed to be updated to be in line with the direction of pedestrian travel and compliant with ADA at all legs of the intersection with high visibility crosswalk markings. The existing signal timing and phasing is proposed to be modified to optimize the signal, convert the flashing yellow arrow phasing for the northbound and southbound lefts to protected only phasing during the AM and PM peak hours, and increase the all-red clearance interval. On the south side of the intersection, bus pull outs are proposed for FXBGO! stops #555 and #556, with bus boarding pads and new sidewalk connections to the intersection. **Figure 71** presents a conceptual sketch of the alternative.

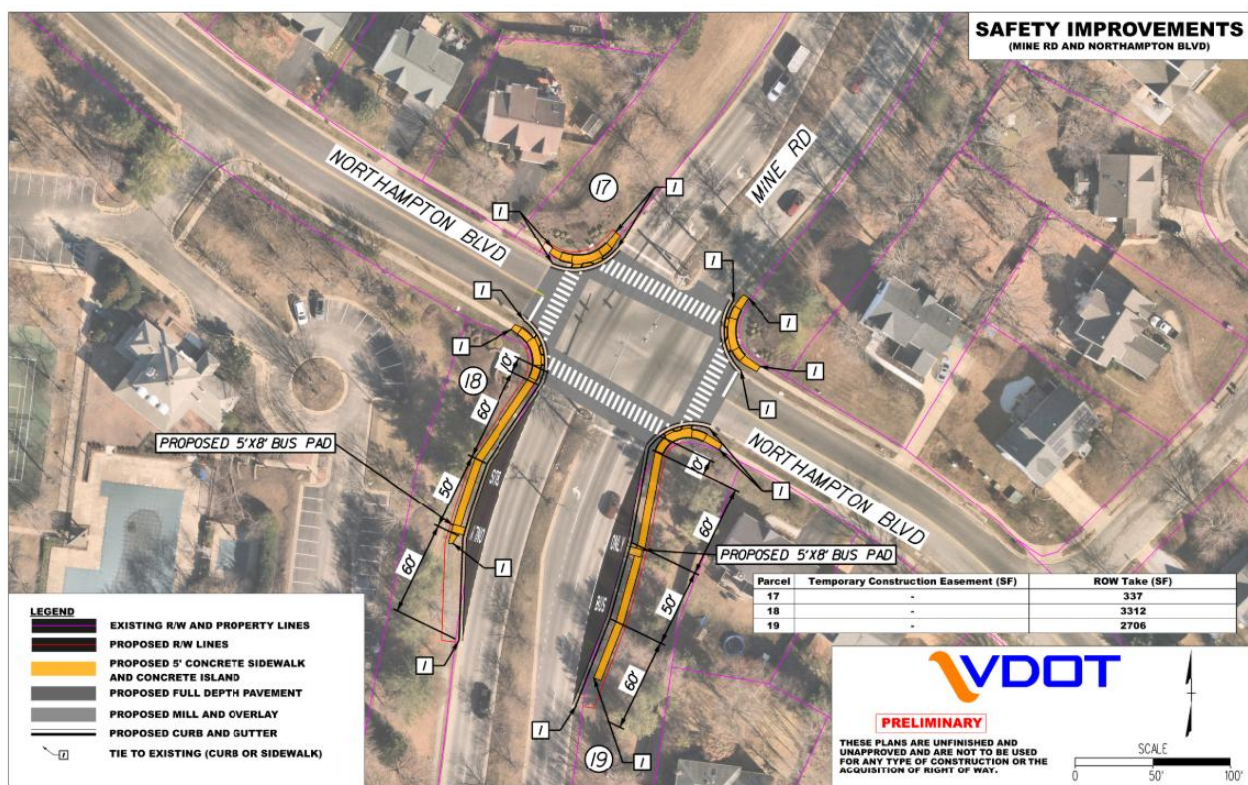


**Figure 71: Mine Road and Northampton Boulevard Conceptual Sketch**

## Mine Road and Exeter Lane

This concept would upgrade the sidewalk and curb ramps to be in line with the direction of pedestrian travel with a marked crosswalk over each leg of the intersection, except the southern leg, and include a median refuge on Mine Road. Intersection lighting and an RRFB would be installed at the proposed crosswalk across Mine Road. Further evaluation during final design will be necessary to confirm sight distance requirements are met for the proposed crosswalk and that trees are cleared or trimmed where needed to meet the requirements. **Figure 72** presents a conceptual sketch of the alternative.

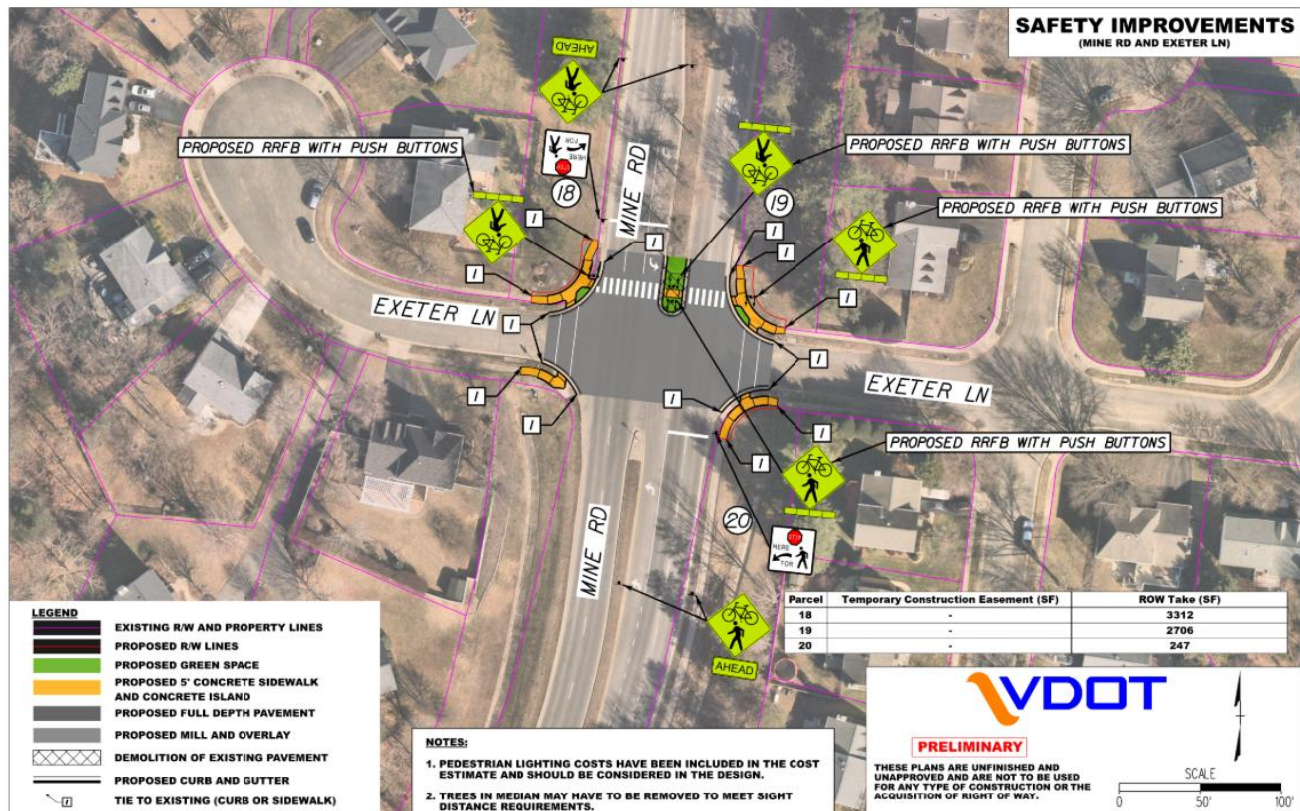


Figure 72: Mine Road and Exeter Lane Conceptual Sketch

## 3.2 Preferred Alternative Safety and Operational Analysis

The crash modification factors (CMFs) described in **Section 2.3** were updated based on the revised preferred alternative concepts. CMFs were selected from the SMART SCALE Planning Level CMF List for Round 6. When an applicable CMF did not exist in the SMART SCALE list, CMFs were taken from the Virginia State Preferred CMF list or the CMF Clearinghouse. The individual CMF, or combined CMFs, resulting in the highest anticipated crash reduction was applied to fatal and injury crashes within the influence area of each intersection. The following CMFs applied to the preferred alternative:

- Reconfiguration of an unsignalized intersection to an RCUT (0.37 – SMART SCALE)
- Addition of intersection lighting (0.881 – SMART SCALE)
  - Since the addition of intersection lighting can only be applied to nighttime crashes, separate CMFs were applied to crashes at each intersection depending on the time of day they occurred.
- Multiple CMFs for upgrades to pedestrian and bicyclist facilities apply (e.g. addition of crosswalks, RRFBs, median refuge, etc.); however, there were no observed fatal and injury crashes during the five-year study period at the intersections where improvements are proposed, so these were excluded from the analysis.
- Change from Permitted/Protected Left-Turn to Protected on Major Approach (0.01 – Virginia State Preferred CMF List)
- Retiming and optimization of signal (0.958 – SMART SCALE)
- Increase all-red clearance interval (0.863 – Virginia State Preferred CMF List)

**Table 24** summarizes the combined SMART SCALE CMFs and anticipated annual crash reduction for each intersection where a quantitative safety benefit is anticipated.

**Table 24: CMF and Crash Reduction Summary**

| Alternative                                        | Combined F+I CMF<br>Daytime | Combined F+I CMF<br>Nighttime | Annual Crash<br>Reduction |
|----------------------------------------------------|-----------------------------|-------------------------------|---------------------------|
| Settlers Way & Mine Road: RCUT (Unsignalized)      | 0.37                        | -                             | 0.50                      |
| Cathedral Lane & Mine Road: RCUT (Unsignalized)    | 0.37                        | 0.33                          | 0.27                      |
| New Bedford Court & Mine Road: RCUT (Unsignalized) | 0.37                        | 0.33                          | 0.13                      |
| Highpointe Boulevard Retiming                      | 0.96                        | 0.81                          | 0.05                      |
| Northampton Blvd Retiming                          | 0.96                        | -                             | 0.01                      |
| Midpoint Lane Retiming                             | 0.96                        | -                             | 0.02                      |
| <b>Total</b>                                       |                             |                               | <b>0.91</b>               |

The study team conducted Synchro analyses to quantify the anticipated future traffic operations of the preferred alternative. The Build Synchro models incorporated the proposed turn restrictions at the three RCUT intersections, the revised turn lane geometry at Juggins Road Connector and Woodstream Boulevard, and a 1.1 second increase in all-red time clearance interval and protected northbound and southbound left-turn phasing at the Midpoint Lane, Highpointe Boulevard, and Northampton Boulevard. Given that no operational changes were proposed at other intersections, including Garrisonville Road,

SimTraffic was not used for the analysis and Synchro results were only reported for the affected intersections.

Build conditions analyses were conducted for the AM and PM peak hours. **Table 25** through **Table 28** summarize the control delay and 95<sup>th</sup> percentile queue lengths for the Build conditions compared to the No-Build conditions.

**Table 25: 2050 Preferred Alternative AM Peak Hour Control Delay and LOS (seconds per vehicle)**

| Intersection Number and Description |                                     | Lane Group | Eastbound        |     |       |     | Westbound        |     |       |     | Northbound |     |       |     | Southbound |     |       |     | Overall      |       |
|-------------------------------------|-------------------------------------|------------|------------------|-----|-------|-----|------------------|-----|-------|-----|------------|-----|-------|-----|------------|-----|-------|-----|--------------|-------|
|                                     |                                     |            | No-Build         |     | Build |     | No-Build         |     | Build |     | No-Build   |     | Build |     | No-Build   |     | Build |     |              |       |
|                                     |                                     |            | Delay            | LOS | Delay | LOS | Delay            | LOS | Delay | LOS | Delay      | LOS | Delay | LOS | Delay      | LOS | Delay | LOS | No-Build     | Build |
| 7                                   | Mine Rd & Midpoint Ln               |            | Midpoint Ln      |     |       |     | Midpoint Ln      |     |       |     | Mine Rd    |     |       |     | Mine Rd    |     |       |     | No-Build     | Build |
|                                     |                                     | Left       | s                | s   | s     | s   | 64.3             | E   | 69.9  | E   | 3.9        | A   | 64.8  | E   | -          | F   | 45.1  | D   | Delay        | Delay |
|                                     |                                     | Through    | 48.3             | D   | 48.3  | D   | 51.6             | D   | 51.9  | D   | 7.8        | A   | 10.1  | B   | 8.3        | A   | 9.8   | A   | 10.3         | 17.4  |
|                                     |                                     | Right      | 47.4             | D   | 47.4  | D   | s                | s   | s     | s   | 5.0        | A   | 50.5  | D   | 7.0        | A   | 6.3   | A   | LOS          | LOS   |
|                                     |                                     | Approach   | 48.0             | D   | 48.0  | D   | 61.4             | E   | 65.8  | E   | 7.3        | A   | 17.1  | B   | 8.3        | A   | 10.2  | B   | B            | B     |
| 8                                   | Mine Rd & Highpointe Blvd/N Vine Pl |            | Highpointe Blvd  |     |       |     | N Vine Pl        |     |       |     | Mine Rd    |     |       |     | Mine Rd    |     |       |     | Intersection |       |
|                                     |                                     | Left       | 56.5             | E   | 59.8  | E   | 50.6             | D   | 51.5  | D   | 16.6       | B   | 49.9  | D   | 19.0       | B   | 61.4  | E   | Delay        | Delay |
|                                     |                                     | Through    | 40.6             | D   | 41.1  | D   | 48.6             | D   | 49.2  | D   | 27.6       | C   | 32.2  | C   | 14.1       | B   | 18.5  | B   | 27.5         | 34.1  |
|                                     |                                     | Right      | 41.2             | D   | 41.7  | D   | s                | s   | s     | s   | s          | F   | s     | F   | s          | F   | s     | F   | LOS          | LOS   |
|                                     |                                     | Approach   | 49.7             | D   | 51.7  | D   | 49.1             | D   | 49.7  | D   | 26.3       | C   | 34.4  | C   | 14.4       | B   | 21.5  | C   | C            | C     |
| 9                                   | Mine Rd & Settlers Way              |            | Settlers Way     |     |       |     | N/A              |     |       |     | Mine Rd    |     |       |     | Mine Rd    |     |       |     | Intersection |       |
|                                     |                                     | Left       | 32.9             | D   | 64.9  | F   |                  |     |       |     | 9.9        | A   | 9.9   | A   |            |     |       |     | Delay        | Delay |
|                                     |                                     | Through    |                  |     |       |     |                  |     |       |     | -          | -   | -     | -   | -          | -   | -     | -   | -            | -     |
|                                     |                                     | Right      | s                | s   | 11.4  | B   |                  |     |       |     |            |     |       |     | s          | s   | s     | s   | LOS          | LOS   |
|                                     |                                     | Approach   | -                | -   | 55.8  | F   |                  |     |       |     | 0.9        | A   | 0.1   | A   | 2.0        | A   | 0.0   | A   | -            | -     |
| 10                                  | Mine Rd & Cathedral Ln              |            | Cathedral Ln     |     |       |     | N/A              |     |       |     | Mine Rd    |     |       |     | Mine Rd    |     |       |     | Intersection |       |
|                                     |                                     | Left       | 28.8             | D   | 32.4  | D   |                  |     |       |     | 9.1        | A   | 20.9  | C   |            |     |       |     | Delay        | Delay |
|                                     |                                     | Through    |                  |     |       |     |                  |     |       |     | -          | -   | -     | -   | -          | -   | -     | -   | -            | -     |
|                                     |                                     | Right      | s                | s   | 10.9  | B   |                  |     |       |     |            |     |       |     | s          | s   | s     | s   | LOS          | LOS   |
|                                     |                                     | Approach   | -                | -   | 29.6  | D   |                  |     |       |     | 0.7        | A   | 0.0   | A   | 0.7        | A   | 0.0   | A   | -            | -     |
| 11                                  | Mine Rd & New Bedford Ct            |            | N/A              |     |       |     | New Bedford Ct   |     |       |     | Mine Rd    |     |       |     | Mine Rd    |     |       |     | Intersection |       |
|                                     |                                     | Left       |                  |     |       |     | 31.1             | D   | 35.4  | E   |            |     |       |     | 11.9       | B   | 26.5  | C   | Delay        | Delay |
|                                     |                                     | Through    |                  |     |       |     |                  |     |       |     | -          | -   | -     | -   | -          | -   | -     | -   | -            |       |
|                                     |                                     | Right      |                  |     |       |     | s                | s   | 13.9  | B   | s          | s   | s     | s   |            |     |       |     | LOS          | LOS   |
|                                     |                                     | Approach   |                  |     |       |     | -                | -   | 27.2  | D   | 3.0        | A   | 0.0   | A   | 0.6        | A   | 0.3   | A   | -            | -     |
| 12                                  | Mine Rd & Northampton Blvd          |            | Northampton Blvd |     |       |     | Northampton Blvd |     |       |     | Mine Rd    |     |       |     | Mine Rd    |     |       |     | Intersection |       |
|                                     |                                     | Left       | s                | s   | s     | s   | s                | s   | s     | s   | 18.0       | B   | 65.9  | E   | 40.4       | D   | 65.9  | E   | Delay        | Delay |
|                                     |                                     | Through    | 53.4             | D   | 67.9  | E   | 54.0             | D   | 73.8  | E   | 35.6       | D   | 47.0  | D   | 24.8       | C   | 28.0  | C   | 37.4         | 50.0  |
|                                     |                                     | Right      | 40.4             | D   | 48.7  | D   | 48.1             | D   | 58.4  | E   | s          | s   | s     | s   | s          | s   | s     | s   | LOS          | LOS   |
|                                     |                                     | Approach   | 49.2             | D   | 61.6  | E   | 49.8             | D   | 62.9  | E   | 34.2       | C   | 48.6  | D   | 30.3       | C   | 40.7  | D   | D            | D     |

s Denotes shared movement

- Denotes no Level of Service is reported for this movement

**Table 26: 2050 Preferred Alternative PM Peak Hour Control Delay and LOS (seconds per vehicle)**

| Intersection Number and Description                         |                                     | Lane Group | Eastbound        |     |       |     | Westbound        |     |       |     | Northbound |     |       |     | Southbound |     |       |     | Overall      |       |     |   |     |     |
|-------------------------------------------------------------|-------------------------------------|------------|------------------|-----|-------|-----|------------------|-----|-------|-----|------------|-----|-------|-----|------------|-----|-------|-----|--------------|-------|-----|---|-----|-----|
|                                                             |                                     |            | No-Build         |     | Build |     | No-Build         |     | Build |     | No-Build   |     | Build |     | No-Build   |     | Build |     |              |       |     |   |     |     |
|                                                             |                                     |            | Delay            | LOS | Delay | LOS | Delay            | LOS | Delay | LOS | Delay      | LOS | Delay | LOS | Delay      | LOS | Delay | LOS | Delay        | LOS   |     |   |     |     |
| 7                                                           | Mine Rd & Midpoint Ln               |            | Midpoint Ln      |     |       |     | Midpoint Ln      |     |       |     | Mine Rd    |     |       |     | Mine Rd    |     |       |     | Intersection |       |     |   |     |     |
|                                                             |                                     | Left       | s                | s   | s     | s   | 71.8             | E   | 65.9  | E   | 34.9       | C   | 43.8  | D   | 9.1        | A   | 68.5  | E   | Delay        | Delay |     |   |     |     |
|                                                             |                                     | Through    | 57.1             | E   | 57.1  | E   | 45.9             | D   | 45.1  | D   | 32.9       | C   | 21.7  | C   | 11.4       | B   | 28.3  | C   | 26.8         | 31.9  |     |   |     |     |
|                                                             |                                     | Right      | 55.4             | E   | 55.4  | E   | s                | s   | s     | s   | 17.2       | B   | 18.9  | B   | 7.0        | A   | 6.3   | A   | LOS          | LOS   |     |   |     |     |
|                                                             |                                     | Approach   | 56.6             | E   | 56.6  | E   | 69.2             | E   | 63.7  | E   | 32.5       | C   | 23.7  | C   | 11.3       | B   | 28.7  | C   | C            | C     |     |   |     |     |
| 8                                                           | Mine Rd & Highpointe Blvd/N Vine Pl |            | Highpointe Blvd  |     |       |     | N Vine Pl        |     |       |     | Mine Rd    |     |       |     | Mine Rd    |     |       |     | Intersection |       |     |   |     |     |
|                                                             |                                     | Left       | 68.2             | E   | 69.5  | E   | 63.5             | E   | 63.8  | E   | 86.0       | F   | 115.2 | F   | 6.9        | A   | 40.0  | D   | Delay        | Delay |     |   |     |     |
|                                                             |                                     | Through    | 53.4             | D   | 53.6  | D   | 60.5             | E   | 60.6  | E   | 16.8       | B   | 24.2  | C   | 33.1       | C   | 80.4  | F   | 36.8         | 64.8  |     |   |     |     |
|                                                             |                                     | Right      | 55.0             | D   | 54.8  | D   | s                | s   | s     | s   | s          | F   | s     | F   | s          | F   | s     | F   | LOS          | LOS   |     |   |     |     |
|                                                             |                                     | Approach   | 58.6             | E   | 58.8  | E   | 61.2             | E   | 61.4  | E   | 34.4       | C   | 47.3  | D   | 31.4       | C   | 77.8  | E   | D            | E     |     |   |     |     |
| 9                                                           | Mine Rd & Settlers Way              |            | Settlers Way     |     |       |     | N/A              |     |       |     | Mine Rd    |     |       |     | Mine Rd    |     |       |     | Intersection |       |     |   |     |     |
|                                                             |                                     | Left       | 105.1            | F   | 58.2  | F   |                  |     |       |     | 16.2       | C   | 16.2  | C   |            |     |       |     | Delay        | Delay |     |   |     |     |
|                                                             |                                     | Through    |                  |     |       |     |                  |     |       |     | -          | -   | -     | -   |            |     |       |     | -            | -     | -   | - | -   |     |
|                                                             |                                     | Right      | s                | s   | 18.2  | C   |                  |     |       |     |            |     |       |     |            |     |       |     | s            | s     | s   | s | LOS | LOS |
|                                                             |                                     | Approach   | -                | -   | 48.6  | E   |                  |     |       |     |            |     |       |     |            |     |       |     | 0.9          | A     | 0.2 | A | 2.0 | A   |
| 10                                                          | Mine Rd & Cathedral Ln              |            | Cathedral Ln     |     |       |     | N/A              |     |       |     | Mine Rd    |     |       |     | Mine Rd    |     |       |     | Intersection |       |     |   |     |     |
|                                                             |                                     | Left       | 122.7            | F   | 38.3  | E   |                  |     |       |     | 14.3       | B   | 34.2  | D   |            |     |       |     | Delay        | Delay |     |   |     |     |
|                                                             |                                     | Through    |                  |     |       |     |                  |     |       |     | -          | -   | -     | -   |            |     |       |     | -            | -     | -   | - | -   |     |
|                                                             |                                     | Right      | s                | s   | 16.8  | C   |                  |     |       |     |            |     |       |     |            |     |       |     | s            | s     | s   | s | LOS | LOS |
|                                                             |                                     | Approach   | -                | -   | 35.2  | E   |                  |     |       |     |            |     |       |     |            |     |       |     | 0.7          | A     | 0.2 | A | 0.7 | A   |
| 11                                                          | Mine Rd & New Bedford Ct            |            | N/A              |     |       |     | New Bedford Ct   |     |       |     | Mine Rd    |     |       |     | Mine Rd    |     |       |     | Intersection |       |     |   |     |     |
|                                                             |                                     | Left       |                  |     |       |     | 39.8             | E   | 34.1  | D   |            |     |       |     | 11.0       | B   | 16.5  | C   | Delay        | Delay |     |   |     |     |
|                                                             |                                     | Through    |                  |     |       |     |                  |     |       |     |            |     |       |     | -          | -   | -     | -   | -            | -     | -   | - | -   |     |
|                                                             |                                     | Right      |                  |     |       |     | s                | s   | 12.6  | B   |            |     |       |     | s          | s   | s     | s   |              |       |     |   | LOS | LOS |
|                                                             |                                     | Approach   |                  |     |       |     | -                | -   | 23.0  | C   |            |     |       |     | 3.0        | A   | 0.0   | A   |              |       |     |   | 0.6 | A   |
| 12                                                          | Mine Rd & Northampton Blvd          |            | Northampton Blvd |     |       |     | Northampton Blvd |     |       |     | Mine Rd    |     |       |     | Mine Rd    |     |       |     | Intersection |       |     |   |     |     |
|                                                             |                                     | Left       | s                | s   | s     | s   | s                | s   | s     | s   | 24.6       | C   | 79.6  | E   | 16.2       | B   | 69.8  | E   | Delay        | Delay |     |   |     |     |
|                                                             |                                     | Through    | 52.9             | D   | 75.7  | E   | 50.6             | D   | 81.7  | F   | 24.6       | C   | 26.3  | C   | 38.4       | D   | 34.8  | C   | 34.7         | 41.5  |     |   |     |     |
|                                                             |                                     | Right      | 42.1             | D   | 54.7  | D   | 47.4             | D   | 63.2  | E   | s          | s   | s     | s   | s          | s   | s     | s   | LOS          | LOS   |     |   |     |     |
|                                                             |                                     | Approach   | 47.8             | D   | 65.9  | E   | 48.5             | D   | 69.6  | E   | 24.6       | C   | 33.3  | C   | 36.4       | D   | 37.9  | D   | C            | D     |     |   |     |     |
| s Denotes shared movement                                   |                                     |            |                  |     |       |     |                  |     |       |     |            |     |       |     |            |     |       |     |              |       |     |   |     |     |
| - Denotes no Level of Service is reported for this movement |                                     |            |                  |     |       |     |                  |     |       |     |            |     |       |     |            |     |       |     |              |       |     |   |     |     |

s Denotes shared movement

- Denotes no Level of Service is reported for this movement

**Table 27: 2050 Preferred Alternative AM Peak Hour 95<sup>th</sup> Percentile Queues (feet)**

| Intersection Number and Description                                |                                     | Type of Control | Lane Group | 95th Percentile Queue |       |                  |       |            |       |            |       |
|--------------------------------------------------------------------|-------------------------------------|-----------------|------------|-----------------------|-------|------------------|-------|------------|-------|------------|-------|
|                                                                    |                                     |                 |            | Eastbound             |       | Westbound        |       | Northbound |       | Southbound |       |
|                                                                    |                                     |                 |            | No Build              | Build | No Build         | Build | No Build   | Build | No Build   | Build |
| 7                                                                  | Mine Rd & Midpoint Ln               | Signal          |            | Midpoint Ln           |       | Midpoint Ln      |       | Mine Rd    |       | Mine Rd    |       |
|                                                                    |                                     |                 | Left       | s                     | s     | 60               | 61    | m6         | m91   | m2         | m13   |
|                                                                    |                                     |                 | Through    | 37                    | 37    | 20               | 20    | 202        | 217   | 42         | 44    |
|                                                                    |                                     |                 | Right      | 0                     | 0     | s                | s     | m4         | m5    | s          | s     |
| 8                                                                  | Mine Rd & Highpointe Blvd/N Vine Pl | Signal          |            | Highpointe Blvd       |       | N Vine Pl        |       | Mine Rd    |       | Mine Rd    |       |
|                                                                    |                                     |                 | Left       | #211                  | #230  | 62               | 63    | 94         | 187   | 22         | #95   |
|                                                                    |                                     |                 | Through    | 9                     | 9     | 56               | 57    | 486        | 514   | 96         | 96    |
|                                                                    |                                     |                 | Right      | 0                     | 0     | s                | s     | s          | s     | s          | s     |
| 9                                                                  | Mine Rd & Settlers Way              | Unsignalized    |            | Settlers Way          |       | N/A              |       | Mine Rd    |       | Mine Rd    |       |
|                                                                    |                                     |                 | Left       | 55                    | †     |                  | 0     | 3          |       |            |       |
|                                                                    |                                     |                 | Through    |                       | †     |                  | †     | †          | †     |            |       |
|                                                                    |                                     |                 | Right      | s                     | 15    |                  |       | s          | s     |            |       |
| 10                                                                 | Mine Rd & Cathedral Ln              | Unsignalized    |            | Cathedral Ln          |       | N/A              |       | Mine Rd    |       | Mine Rd    |       |
|                                                                    |                                     |                 | Left       | 23                    | †     |                  | 0     | 8          |       |            |       |
|                                                                    |                                     |                 | Through    |                       | †     |                  | †     | †          | †     |            |       |
|                                                                    |                                     |                 | Right      | s                     | 5     |                  |       |            |       |            |       |
| 11                                                                 | Mine Rd & New Bedford Ct            | Unsignalized    |            | N/A                   |       | New Bedford Ct   |       | Mine Rd    |       | Mine Rd    |       |
|                                                                    |                                     |                 | Left       |                       | 18    | †                |       |            | 0     | 20         |       |
|                                                                    |                                     |                 | Through    |                       |       | †                | †     | †          | †     |            |       |
|                                                                    |                                     |                 | Right      |                       | s     | 8                | s     | s          |       |            |       |
| 12                                                                 | Mine Rd & Northampton Blvd          | Signal          |            | Northampton Blvd      |       | Northampton Blvd |       | Mine Rd    |       | Mine Rd    |       |
|                                                                    |                                     |                 | Left       | s                     | s     | s                | s     | 76         | 145   | #311       | m#368 |
|                                                                    |                                     |                 | Through    | 273                   | #321  | 158              | #197  | 471        | 512   | 201        | 217   |
|                                                                    |                                     |                 | Right      | 24                    | 0     | 87               | 95    | s          | s     | s          | s     |
| † No queue reported. Movement does not have conflicting volumes    |                                     |                 |            |                       |       |                  |       |            |       |            |       |
| m - Volume for 95th percentile queue is metered by upstream signal |                                     |                 |            |                       |       |                  |       |            |       |            |       |
| # - 95th percentile queue exceeds capacity, queue may be longer    |                                     |                 |            |                       |       |                  |       |            |       |            |       |
| s - Denotes shared movement                                        |                                     |                 |            |                       |       |                  |       |            |       |            |       |

**Table 28: 2050 Preferred Alternative PM Peak Hour 95<sup>th</sup> Percentile Queues (feet)**

| Intersection Number and Description                                |                                     | Type of Control | Lane Group | 95th Percentile Queue |       |                  |       |            |       |            |       |
|--------------------------------------------------------------------|-------------------------------------|-----------------|------------|-----------------------|-------|------------------|-------|------------|-------|------------|-------|
|                                                                    |                                     |                 |            | Eastbound             |       | Westbound        |       | Northbound |       | Southbound |       |
|                                                                    |                                     |                 |            | No Build              | Build | No Build         | Build | No Build   | Build | No Build   | Build |
| 7                                                                  | Mine Rd & Midpoint Ln               | Signal          |            | Midpoint Ln           |       | Midpoint Ln      |       | Mine Rd    |       | Mine Rd    |       |
|                                                                    |                                     |                 | Left       | s                     | s     | #331             | 295   | m#103      | m129  | m4         | m21   |
|                                                                    |                                     |                 | Through    | 64                    | 64    | 30               | 29    | 436        | 448   | 164        | 293   |
|                                                                    |                                     |                 | Right      | 0                     | 0     | s                | s     | m8         | m2    | s          | s     |
| 8                                                                  | Mine Rd & Highpointe Blvd/N Vine Pl | Signal          |            | Highpointe Blvd       |       | N Vine Pl        |       | Mine Rd    |       | Mine Rd    |       |
|                                                                    |                                     |                 | Left       | #185                  | #190  | 56               | 56    | #370       | m#433 | m24        | m127  |
|                                                                    |                                     |                 | Through    | 17                    | 17    | #57              | #60   | 256        | m317  | #888       | #991  |
|                                                                    |                                     |                 | Right      | 98                    | 91    | s                | s     | s          | s     | s          | s     |
| 9                                                                  | Mine Rd & Settlers Way              | Unsignalized    |            | Settlers Way          |       | N/A              |       | Mine Rd    |       | Mine Rd    |       |
|                                                                    |                                     |                 | Left       | 70                    | †     |                  | 3     | 3          |       |            |       |
|                                                                    |                                     |                 | Through    |                       | †     |                  | †     | †          | †     |            |       |
|                                                                    |                                     |                 | Right      | s                     | 13    |                  |       | s          | s     |            |       |
| 10                                                                 | Mine Rd & Cathedral Ln              | Unsignalized    |            | Cathedral Ln          |       | N/A              |       | Mine Rd    |       | Mine Rd    |       |
|                                                                    |                                     |                 | Left       | 60                    | †     |                  | 0     | 13         |       |            |       |
|                                                                    |                                     |                 | Through    |                       | †     |                  | †     | †          | †     |            |       |
|                                                                    |                                     |                 | Right      | s                     | 10    |                  |       |            |       |            |       |
| 11                                                                 | Mine Rd & New Bedford Ct            | Unsignalized    |            | N/A                   |       | New Bedford Ct   |       | Mine Rd    |       | Mine Rd    |       |
|                                                                    |                                     |                 | Left       |                       | 20    | †                |       |            | 5     | 15         |       |
|                                                                    |                                     |                 | Through    |                       |       | †                | †     | †          | †     |            |       |
|                                                                    |                                     |                 | Right      |                       | s     | 5                | s     | s          |       |            |       |
| 12                                                                 | Mine Rd & Northampton Blvd          | Signal          |            | Northampton Blvd      |       | Northampton Blvd |       | Mine Rd    |       | Mine Rd    |       |
|                                                                    |                                     |                 | Left       | s                     | s     | s                | s     | 109        | #219  | 91         | 197   |
|                                                                    |                                     |                 | Through    | 214                   | #283  | 110              | #151  | 361        | 363   | #799       | 704   |
|                                                                    |                                     |                 | Right      | 67                    | 12    | 65               | 11    | s          | s     | s          | s     |
| † No queue reported. Movement does not have conflicting volumes    |                                     |                 |            |                       |       |                  |       |            |       |            |       |
| m - Volume for 95th percentile queue is metered by upstream signal |                                     |                 |            |                       |       |                  |       |            |       |            |       |
| # - 95th percentile queue exceeds capacity, queue may be longer    |                                     |                 |            |                       |       |                  |       |            |       |            |       |
| s - Denotes shared movement                                        |                                     |                 |            |                       |       |                  |       |            |       |            |       |

In the AM and PM peak hours, the overall delay at the signalized intersections of the study intersections carried forward to the preferred alternative were comparable to No-Build conditions, with slight increases in delay due to the proposed signal modifications adding protected left turns and increasing clearance intervals. At the unsignalized intersections where RCUTs were proposed, the improvement projected a reduction in delay for the side street approaches. The following is a summary of the operational results at each of the preferred alternative intersections compared to No-Build:

- Mine Road and Midpoint Lane
  - In the AM peak hour, the overall intersection delay increased by approximately 7.1 seconds but remained an acceptable LOS B.
  - In the PM peak hour, the overall intersection increased by approximately 5.1 seconds but remained an acceptable LOS C.
  - There was not a notable change in the 95<sup>th</sup> percentile queue during the AM peak hour, but the southbound through queue in the PM peak increased by 130 feet.
- Mine Road and Highpointe Boulevard/N Vine Place
  - In the AM peak hour, the overall intersection increased by about 6.6 seconds, but remained an acceptable LOS C.
  - In the PM peak hour Build scenario, the overall intersection increased by about 28 seconds which degraded the overall LOS from LOS D to LOS E.
  - Notable changes in the 95<sup>th</sup> percentile queue were limited to a 90-foot increase in the northbound left-turn queue during the AM peak hour, and a 110-foot increase to the southbound through queue in the PM peak hour.
- Mine Road and Settlers Way
  - In the AM peak hour Build scenario, the eastbound approach degraded from LOS D to LOS F with almost 23 seconds of delay
  - In the PM peak hour build scenario, the eastbound approach improved by almost 57 seconds of delay resulting in an improvement from LOS F to LOS D
  - The preferred alternative had minor improvements to the eastbound queueing at the intersection in both peak periods.
- Mine Road and Cathedral Lane
  - In the AM peak hour Build scenario, the eastbound approach remained LOS D with negligible increase in delay
  - In the PM peak hour Build scenario, the eastbound approach improved by almost 88 seconds of delay resulting in an improvement from LOS F to LOS E.
  - The preferred alternative had minor improvements to the eastbound queueing at the intersection in both peak hours.
- Mine Road and New Bedford Court
  - In the AM peak hour Build scenario, the westbound approach remained LOS D with negligible decrease in delay of approximately 4 seconds
  - In the PM peak hour Build scenario, the westbound approach improved by almost 17 seconds of delay resulting in an improvement from LOS E to LOS C.
  - The preferred alternative had minor improvements to the westbound queueing at the intersection during both peak hours.

- Mine Road and Northampton Boulevard
  - In the AM peak hour Build scenario, the overall intersection increased by almost 13 seconds, but remained at an acceptable LOS D
  - In the PM peak hour Build scenario, the overall intersection increased by almost 7 seconds and resulted in a change of LOS from LOS C to LOS D, which is still acceptable.
  - Notable changes in the 95<sup>th</sup> percentile queue during the AM peak hour were limited to a 70-foot increase in the northbound left-turn queue. In the PM peak hour, notable changes in queuing included a 70-foot increase to the eastbound through queue, a 110-foot increase to the northbound left-turn queue, a 100-foot increase to the southbound left-turn queue, and a 100-foot reduction in the southbound through queue.

**Appendix F** includes the full Synchro results from the analysis and meeting materials.

### 3.3 Conceptual Sketch and Cost Estimates

**Appendix F** includes the Basis of Design Memo detailing the established project design criteria, field review notes, risk assessment, and assumptions made during the design effort. **Appendix F-2** presents the preferred alternative conceptual sketches for each of the study intersections.

An engineer's preliminary opinion of probable cost was developed for construction costs, right-of-way acquisition costs, and utility relocation costs for the preferred alternatives. These cost opinions established the total project cost estimate, in FY2026 dollars, as shown in **Table 29**. Supporting documentation for the cost estimates are included in **Appendix F**.

**Table 29: FY2026 Preferred Alternative Cost Estimate**

| Phase Description                   | Cost Estimate (FY2026) |
|-------------------------------------|------------------------|
| Preliminary Engineering             | \$2,444,000            |
| Right of Way and Utility Relocation | \$1,552,200            |
| Construction                        | \$10,402,049           |
| <b>Total Project Cost Estimate</b>  | <b>\$14,398,249</b>    |

### 3.4 Schedule Estimates

A schedule estimate was developed for the preferred alternative. **Table 30** summarizes the projected timeframes for the preliminary engineering (PE), right of way (RW), and construction (CN) phases. Durations are planning-level estimates and may overlap depending on project delivery strategy.

**Table 30: Schedule Estimate**

| Preferred Concept (all inclusive)   | Estimated Schedule by Phase (months) |
|-------------------------------------|--------------------------------------|
| Preliminary Engineering             | 26                                   |
| Right of Way and Utility Relocation | 40                                   |
| Construction                        | 30                                   |
| <b>Total</b>                        | <b>96</b>                            |

### 3.5 Project Risks

All projects have risks; however, some projects may have more significant risks than others due to technical complexity, funding, financing, and stakeholder acceptance. Risk management generally involves the process of anticipating what risks a project may face, mitigating them to the extent reasonably possible, and having a plan to react to them if and when they occur. This is recognized in VDOT guidance regarding the analysis of and mitigation of risks.

A project risk meeting, SWG Meeting #7 (SWG meetings #6 and #7 were combined), was held on March 18, 2026. The following is a list of the most notable potential issues that may affect project development, risks faced by the project, and risk mitigation strategies to be applied to manage and minimize risks throughout project development. The preferred alternative safety and traffic operational results were presented at SWG Meeting #9 (SWG meetings #8 and #9 were combined), held on June 5, 2026, to finalize the full package of materials prior to submittal to SMART SCALE. **Appendix F** includes the materials from both meetings, risk analysis matrix with details on the risk assessment, and mitigation strategy.

#### **Risk/Issue: Roadway Design**

Potential design waivers and design exceptions may be warranted and will be developed as part of the project PE phase, particularly for the sections of shared-use path and sidewalk along Mine Road between Greenspring Drive and Highpointe Boulevard that have reduced buffer space and path width. Some intersections have been designed to accommodate large trucks. The proposed design speeds correspond to the posted speed limits along the corridor of 40 mph (Mine Road only) and 25 mph. The minimum buffer space is provided except for the SW corner at Juggins Road Connector and NE corner of Stafford Market Place where the sidewalk ties to an existing condition, the Northampton Boulevard intersection to avoid signal impacts, and along Mine Road between Midpoint Lane and Greenspring Drive to avoid impacts to right-of-way and an existing drainage outfall.

#### **Risk/Issue: Right of Way**

Twenty parcels, including three parcels owned by the Commonwealth of Virginia and eight owned by Homeowner Association (HOA), will be impacted along the study corridor. Approximately 0.51 acres of

proposed right-of-way is anticipated from 17 parcels and 0.21 acres of temporary construction easements from 10 parcels is anticipated. No residential relocations and no impacts to principal structures are anticipated by the proposed improvements. Engagement with property owners and HOA will be performed early during the project PE phase.

**Risk/Issue: Environmental**

Based on the presence of several threatened and endangered (T&E) species within the project vicinity and on the proposed activity and anticipated tree clearing/habitat disturbance associated with the project, time of year restrictions for tree clearing activities may be required. An environmental mitigation analysis will be performed as part of the project PE phase. Coordination with the appropriate resource agencies will occur during project development if impacts to listed species or habitats are anticipated. Multiple registered petroleum tank facilities are located adjacent to the study area that may require Phase I and Phase II material testing.

**Risk/Issue: Utilities**

Underground fiber optic line markers and unknown depth/location gas markers were observed in the field within the anticipated grading limits for the project. These observations include a 6" gas line and communication lines at Woodstream Boulevard and Stafford Market Place, a gas line and communication lines along northbound Mine Road, south of Greenspring Drive, and a sanitary sewer line along Mine Road, north of Highpointe Boulevard. Utility relocation responsibilities and associated costs will be determined during the Preliminary Engineering phase in coordination with the utility owners. Sidewalk and shared-use path alignments will be shifted to the back of curb to avoid major utility conflicts.

**Risk/Issue: Geotechnical**

There is potential for uncovering unsuitable soils, rocks, and other materials during construction. Existing pavement conditions such as subgrade material and depth of cut are undefined without a geotechnical report. Geotechnical analysis will be performed as part of the project PE phase.

**Risk/Issue: Drainage**

There are several curb inlets along Staffordboro Boulevard and Mine Road that will require relocation based on the proposed improvements. A detailed drainage and stormwater management analysis will be conducted during the project PE phase. Inlet relocations and system tie-ins will be coordinated as well.

**Risk/Issue: Construction**

Based on the presence of several T&E species within the project vicinity, time-of-year restrictions for tree clearing activities will likely be required. Additional coordination on allowable work hours may be required for construction adjacent to Hampton Oaks Elementary School. Maintenance of traffic design shall be performed as part of the project PE phase.

**Risk/Issue: Coordination with other Ongoing Projects**

There is a site plan for an assisted living facility at Midpoint Lane. Construction had begun on the project before it was halted. The shared-use path and acceleration lane proposed at the frontage of the site have been incorporated into the proposed improvements.

### 3.6 Possible Funding Sources

Stafford County elected to submit the preferred alternative for SMART SCALE funding, which includes the safety and pedestrian access intersection improvements listed above, shared-use path and sidewalk along Mine Road, and bus stop infrastructure. Funding for the improvements at the intersection of Mine Road/Staffordboro Boulevard and Garrisonville Road to be completed by others will be pursued by Stafford County separately and were excluded in the preferred alternative cost estimate or SMART SCALE application associated with FR-25-05. These improvements may take advantage of SMART SCALE, Revenue Sharing, County funding, or other state and federal funding sources.