PROJECT PIPELINE

W Main Street at Pioneer Drive and US 19 Bypass at Regional Park Road

Town Of Lebanon, VA
BR-25-04

PHASE 1 and PHASE 2 REPORT
June 2026

Prepared for

Office of INTERMODAL Planning and Investment

VDOT

DRPT
VIRGINIA DEPARTMENT OF RAIL AND PUBLIC TRANSPORTATION

Prepared by

vhb

Table of Contents

List of Figures

List of Tables

List of Appendices

Chapter 1: Needs Evaluation and Diagnosis

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. Visit the Project Pipeline webpage for additional information: https://vaprojectpipeline.virginia.gov/.

This study, entitled BR-25-04 W Main Street at Pioneer Drive and US 19 Bypass at Regional Park Road, focuses on concepts targeting identified needs including road safety and pedestrian safety. The four key steps within the Project Pipeline performance-based planning and programming process are shown in Figure 1.

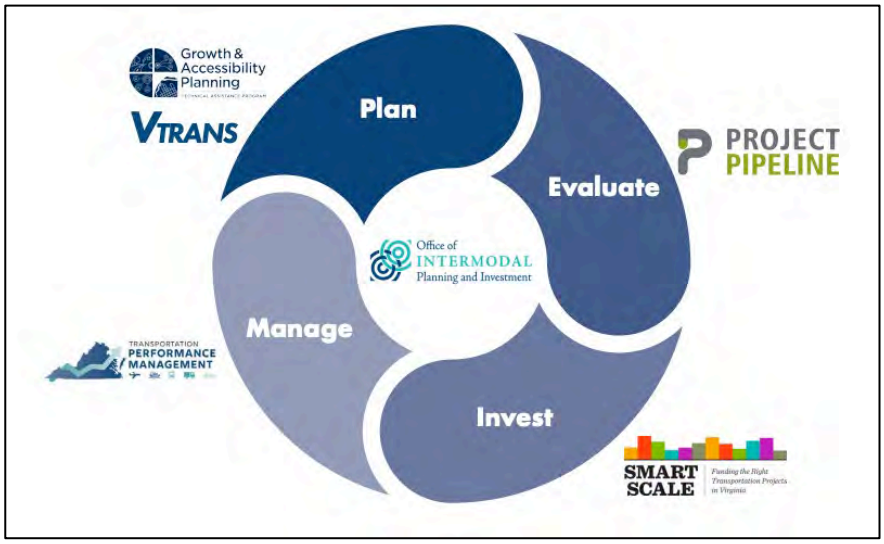


Figure 1: Project Pipeline Key Steps

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.

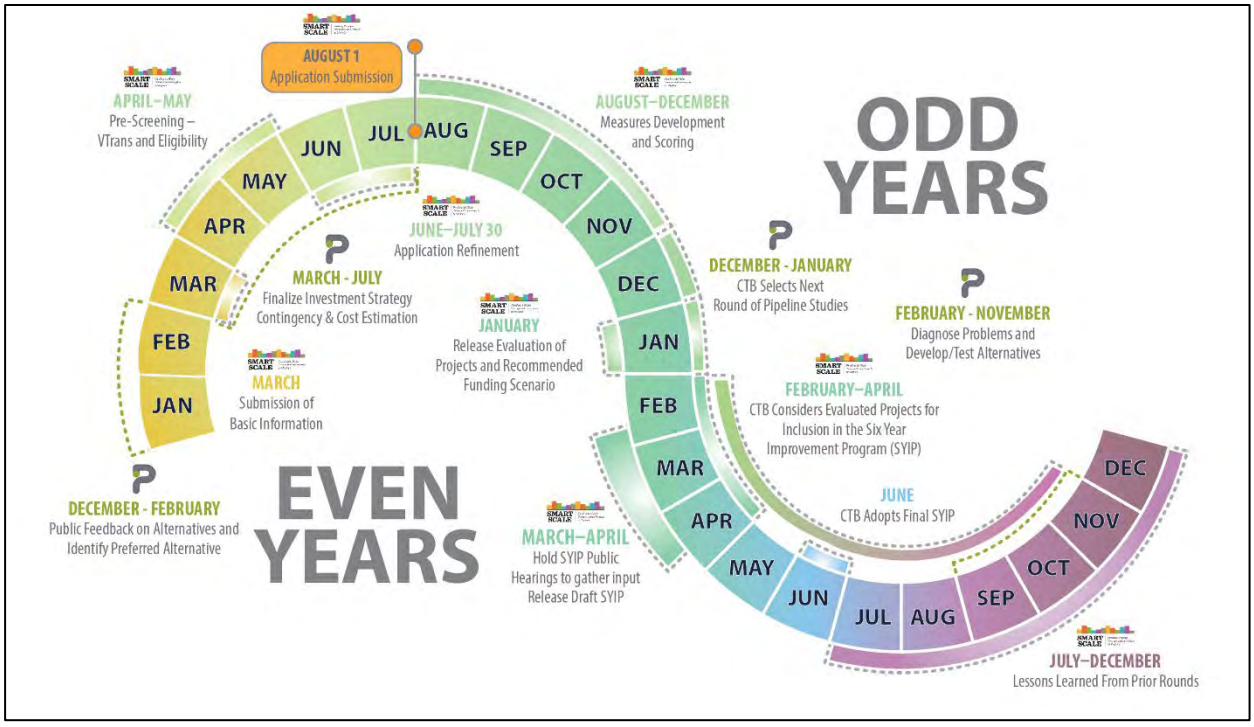


Figure 2: Study Phase Methods and Solutions

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(s), as needed
- 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.

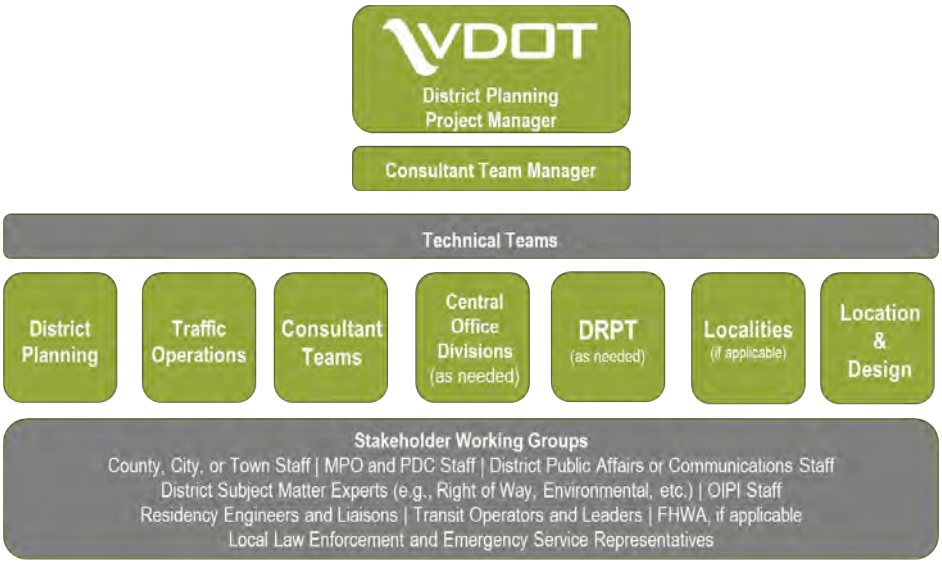


Figure 3: Structure of a Technical Team

1.3 Study Area 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:

- Town of Lebanon
- Cumberland Plateau Planning District Commission (CPPDC)
- Virginia Department of Transportation (VDOT)
- Office of Intermodal Planning and Investment (OIPI)
- Department of Rail and Public Transportation (DRPT)
- VHB

The W Main Street at Pioneer Drive study area comprises the intersections of W Main Street at Pioneer Drive and W Main Street at US 19 southbound on/off-ramps in Lebanon, Virginia. Within the US 19 interchange, Main Street is a four-lane median divided roadway with turn lanes; between the interchange and Pioneer Drive, Main Street transitions from a four lane to a two-lane median divided roadway with turn lanes; north of Pioneer Drive, Main Street is a two-lane undivided roadway. Main Street is classified as a Minor Arterial with a 35-mph posted speed limit. Pioneer Drive is a two-lane, undivided roadway classified as a Minor Collector with a 35-mph posted speed limit. The 2023 average annual daily traffic (AADT) from VDOT's traffic data is 7,000 vehicles per day (VPD).

The W Main Street at Pioneer Drive study area includes two unsignalized intersections and is bordered by commercial and residential properties. Pioneer Drive acts as an important connector for Lebanon High School and residential properties while W Main Street serves as an important connector between US 19 and downtown Lebanon. The study intersections within the this portion of the study area are shown in Table 1 and Figure 4.

Table 1 : Study Intersections in W Main Street at Pioneer Drive Study Area

#	Intersection Name	Control Type
1	W Main Street at Pioneer Drive	Unsignalized
2	W Main Street at US 19 On/Off Ramps	Unsignalized

The US 19 Bypass at Regional Park Road study area comprises the intersections of US 19 Bypass at Regional Park Road and Regional Park Road at Elliot Drive in Lebanon, Virginia. US 19 Bypass is a four-lane, limited access, median-divided roadway classified as a Freeway. The posted speed limit fluctuates within the study area, with a posted speed limit of 65-mph west of Exit 2, a posted speed limit of 55-mph within the vicinity of the Regional Park Road traffic signal, and a posted speed limit of 45-mph east of the study area around the Main Street traffic signal. The 2023 average annual daily traffic (AADT) from VDOT's traffic data is 10,000 vehicles per day (VPD) on US 19 Bypass. The study intersections within the second study area are shown in Table 2 and Figure 5.

Table 2: Study Intersections in US 19 Bypass at Regional Park Road Study Area

#	Intersection Name	Control Type
1	US 19 Bypass at Regional Park Road	Signalized
2	Regional Park Road at Elliot Drive	Unsignalized

The study team collected data including traffic counts, traffic signal timings, and crash records 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 kickoff meeting with the SWG was held on April 17, 2025, to provide an overview of the study and obtain feedback on the study's assumptions. The kickoff meeting materials are in Appendix A.

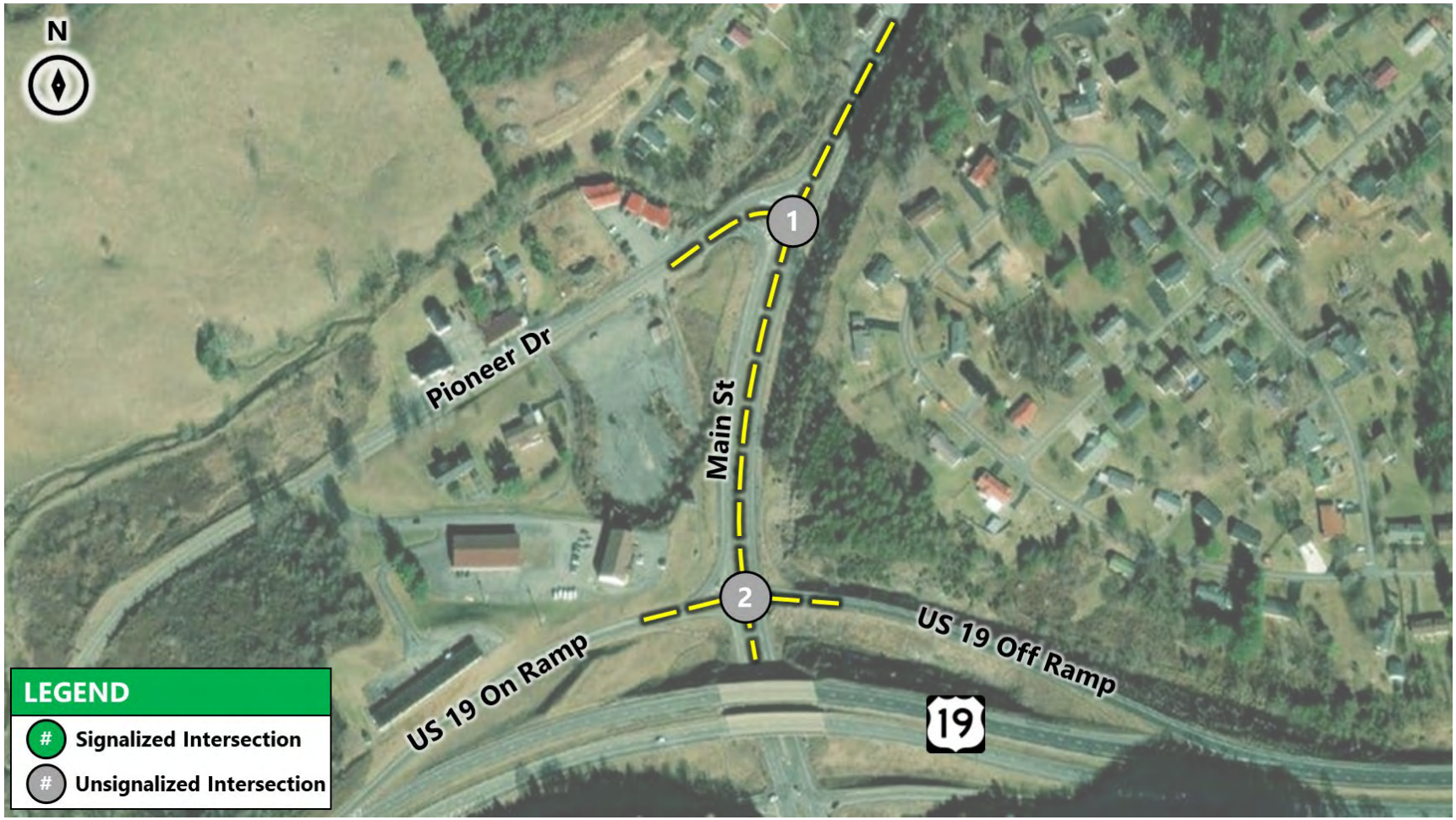


Figure 4: W Main Street at Pioneer Drive Study Area

Figure 5: US 19 Bypass at Regional Park Road 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 3 and Table 4 outline the VTrans needs in the first and second study areas, respectively. Priority level is a relative ranking within VTrans need locations (i.e., a "low" priority need is still a need).

Table 3: VTrans Needs Identified in the W Main Street at Pioneer Drive Study Area

VTrans 2023 Mid-Term Need	Priority
Road Safety	Medium
Pedestrian Safety	Low

Table 4: VTrans Needs Identified in the US 19 Bypass at Regional Park Road Study Area

VTrans 2023 Mid-Term Need	Priority
Road Safety	Medium

Both corridors were selected as Project Pipeline study locations due to the presence of multiple 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 dashboards 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
- Reviewed relevant studies and plans near the study area to inform the alternative development
- Conducted detailed existing conditions traffic operational analyses using Synchro and SimTraffic
- Performed a detailed assessment of five-year crash data to identify trends and hot spots
- Assessed existing transit service, multimodal infrastructure, and the suitability for additional transit service within the study area

1.5 High-Level Needs Diagnosis

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, 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

Neither study area in Lebanon has a Congestion Mitigation VTrans needs. This determination was based on the Travel Time Index (TTI) and the proportion of travel taking place during excessively congested conditions. The TTI is a metric comparing average travel time to free flow travel time, serving as a measure of congestion. A TTI of 1.0 means average travel time equals free flow travel time. According to VDOT, a TTI over 1.3 suggests minor congestion, over 1.5 suggests moderate congestion, and over 2.0 indicates severe congestion.

As seen in Figure 6, the greatest impact to TTI at the W Main Street at Pioneer Drive study area occurs in the AM Peak Hour likely due to Lebanon High School's arrival patterns. The peak TTI experienced in the study area was 1.09, which does not meet the minor congestion threshold of 1.3. Additionally, the average speeds of the study area are comparable to the posted speed limit.

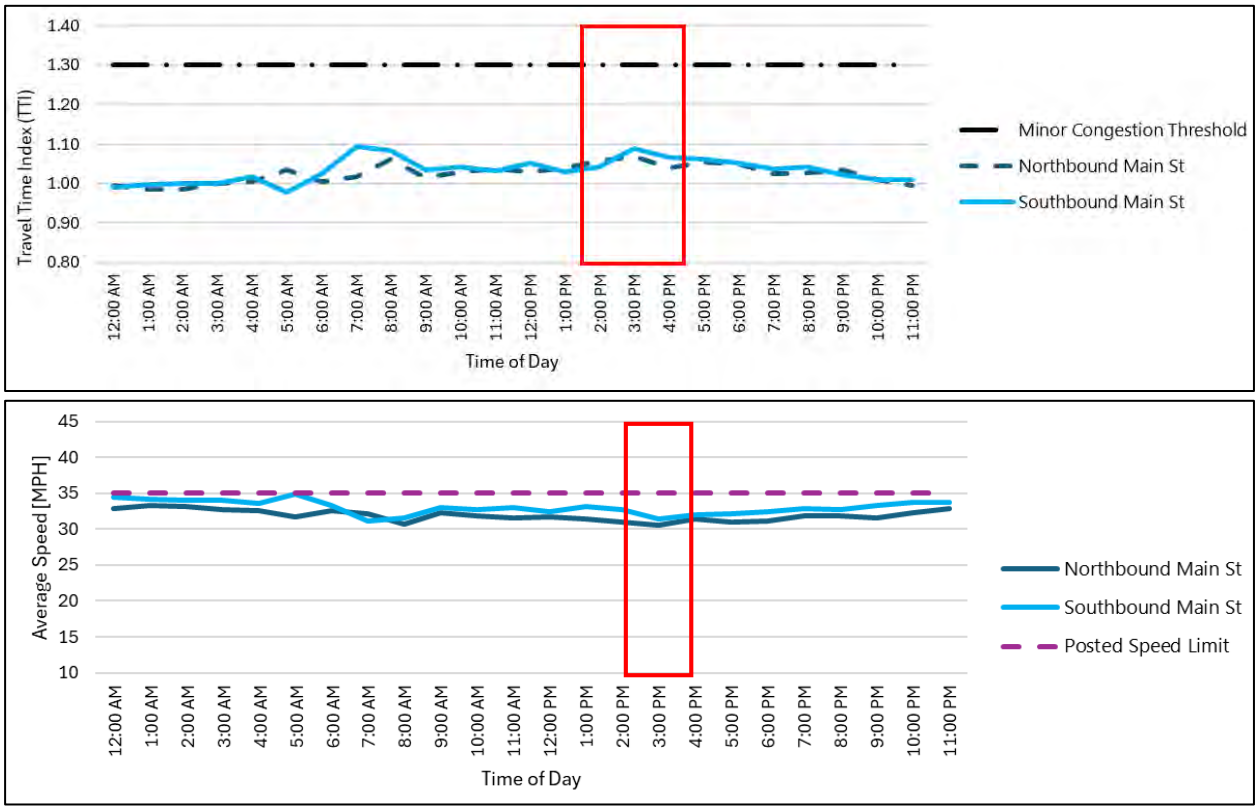


Figure 6: High-Level Operations Needs Summary W Main Street at Pioneer Drive

Figure 7 shows the greatest impact to TTI at the US Bypass 19 at Regional Park Road study area occurring during the PM peak hour. The peak TTI experienced in the study area was 1.08, which also does not meet the minor congestion threshold of 1.3. Additionally, the average speeds of the study area exceeded the posted speed limit in the morning hours, indicating free flow travel flow, while average speeds were slightly lower during the PM peak hour when TTI was highest.

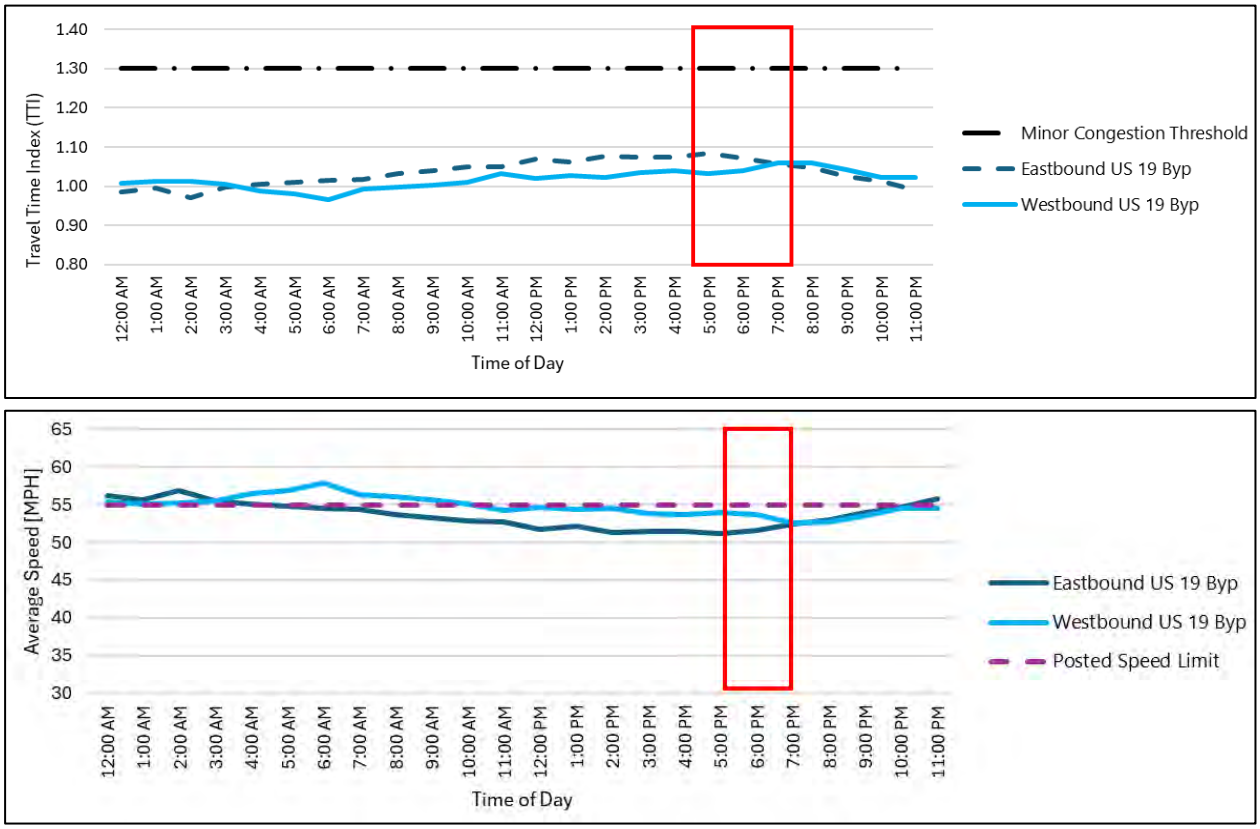


Figure 7: High-Level Operations Needs Summary US 19 Bypass at Regional Park Road

1.5.2. Safety and Reliability Needs

Both the W Main Street at Pioneer Drive and US 19 Bypass at Regional Park Road study areas have a medium Construction District Safety Improvement VTrans need, while the W Main Street at Pioneer Drive study area additionally has a low Pedestrian Safety VTrans need.

In the W Main Street at Pioneer Drive study area, a medium Construction District Safety Improvement VTrans need was identified across Main Street and a low Pedestrian Safety VTrans need was identified on the Main Street segment north of the Main Street at Pioneer Drive intersection. Figure 8 and Figure 9 show these needs. The Pedestrian Safety VTrans need is based on VDOT's Pedestrian Bicycle Safety Action Plan v4.0 (PBSAP) statewide top 5% priority corridors, meaning that there are systemic risk factors (e.g., number of lanes, speed limit, land use, demographics, crash data) indicating high pedestrian/bicycle crash risk.

A medium Construction District Safety Improvement VTrans need was identified for the northbound US 19 segment east of the signalized Regional Park Road intersection. A low Construction District Safety Improvement VTrans need was identified for the southbound US 19 segment east of the signalized Regional Park Road intersection. Figure 10 shows these needs.

Figure 8: High-Level District Road Safety Needs Summary W Main Street at Pioneer Drive

Figure 9: High-Level Pedestrian Safety Needs Summary W Main Street at Pioneer Drive

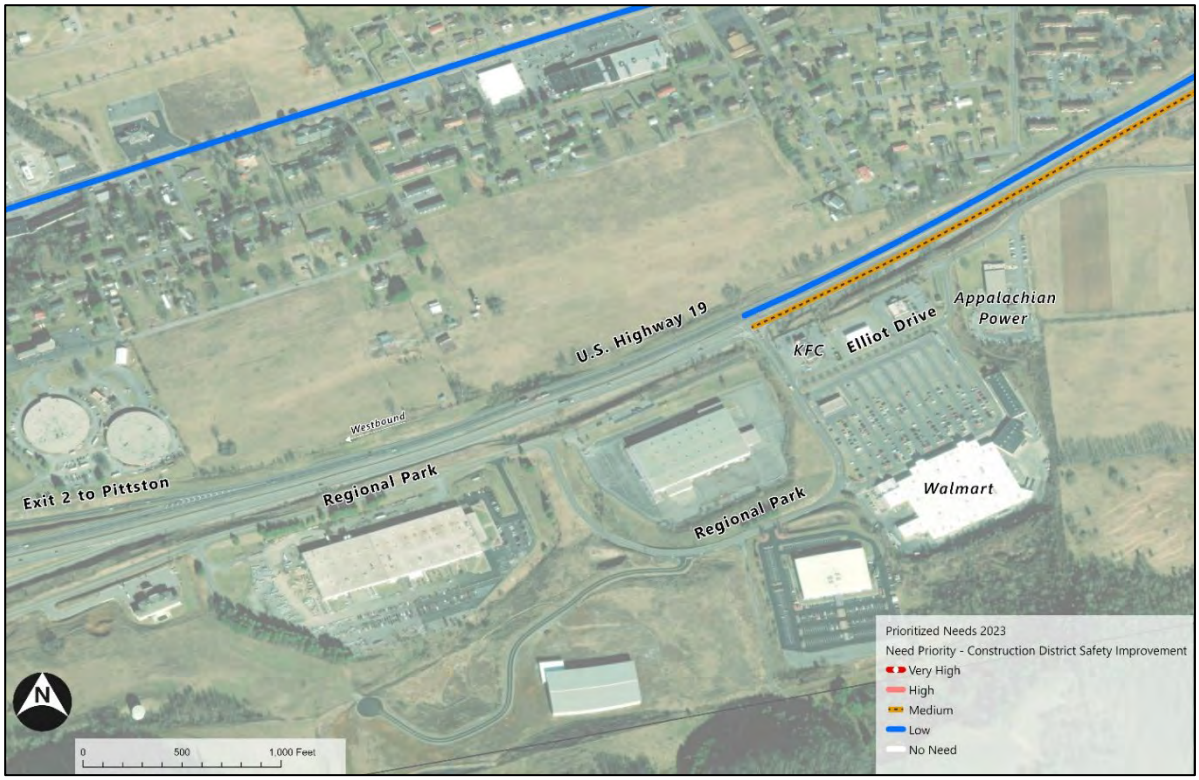


Figure 10: High-Level District Road Safety Needs Summary US 19 Bypass at Regional Park Road

The study team reviewed the VDOT crash data from 2020 to 2024 to identify high-level crash trends in the study corridor. In total, eight crashes occurred in the W Main Street at Pioneer Drive study area with half of these crashes (four) involving angle crashes. 41 crashes occurred in the study period at the US 19 Bypass at Regional Park Road study area with 32% of crashes (13 crashes) involving a distracted driver and 27% of crashes (11 crashes) resulting in a fatality or injury.

Figure 11 and Figure 12 display heat (density) maps of all crashes for each study area during the 2020 to 2024 study period. The Main Street at Pioneer Drive intersection was identified as a crash hot spot in the W Main Street at Pioneer Drive study area and the US 19 Bypass at Regional Park Road intersection was identified as a crash hot spot in the US 19 Bypass at Regional Park Road study area.

Figure 11: W Main Street at Pioneer Drive Crash Heat Map

Figure 12: US 19 Bypass at Regional Park Road Crash Heat Map

All intersection and roadway segments within the VDOT linear referencing system (LRS) are evaluated by VDOT annually for the potential for safety improvement (PSI) based on *Highway Safety Manual (HSM)* methodology. PSI is a statistical comparison between predicted crashes and crash experience, with an overrepresentation of crash experience indicating a potential for safety improvement. Crash frequency, severity of crashes, volume, and length of segment are contributing factors in the predictive analysis. The top 100 PSI intersections and 100 miles of PSI segments are published by VDOT for each district on an annual basis. VDOT also identifies Targeted Safety Need (TSN) locations, which are intersections or segments that have been identified as PSI locations for three or more of the last five years.

The intersection of Main Street at Pioneer Drive was identified as a PSI intersection with a ranking of 125 in the Bristol District and is shown in Figure 13. The intersection of US 19 Bypass at Regional Park Road was also identified as a PSI intersection with a ranking of 10 in the Bristol District and is shown in Figure 14.

Figure 13: W Main Street at Pioneer Drive PSI Intersection

Figure 14: US 19 Bypass at Regional Park Road PSI Intersection

1.5.3. Transit and Transportation Demand Management Needs

There are no transit or transportation demand management (TDM) needs in the Lebanon study areas.

1.5.4. Environmental Considerations

The Virginia Department of Environmental Quality (DEQ) EJScreen+ tool is an enhanced environmental justice screening and mapping tool. It is designed to support state-level decision-making by integrating various data sets to identify and address environmental justice issues. EJScreen+ offers detailed information on environmental and demographic indicators, helping to pinpoint areas with potential environmental risks and vulnerable communities. This tool helps to ensure that environmental actions and policies are equitable and effectively benefit all residents, particularly those disproportionately affected by environmental hazards.

An equity analysis report for the study area was generated by navigating to the study area and reviewing adjacent census block groups and tracts. VDOT Bristol District Environmental Division also offered input on the study area. The high-level desktop review of existing environmental conditions within the study area is summarized in Table 5.

Table 5: Existing Environmental Conditions Summary

Environmental Resource	Description	Source	Existing Resources in Study Area
Environmental Justice	Identifying minority and low-income populations adjacent to the project corridor, as defined by the VDOT Environmental Division Instructional and Informational Memorandum and determining if a disproportionately high and adverse effect is anticipated.	Environmental Justice (EJ) Screen: Low Income Communities - 30% or more of the Population Under HUD 80% AMI and Under Two Times Federal Poverty Level (2011-2018 ACS), Communities of Color – Over Statewide Average (37.8%) (2014-2018 ACS)	Within the study area, there is a low-income block group with 34.16% of the population under HUD, 80% AMI, and 36.40% of the population two times below the federal poverty level.
Architectural and Cultural Surveys	Surveys that may be required pertaining to architectural or cultural sites within a study area.	Aerial Imagery VDOT Bristol District Environmental Review	According to VDOT Bristol District's Environmental Division, an architectural survey may be required for 15 structures at the Route 19 & W Main Street interchange. If right of way and/or easements are needed, Russell County Career and Technical Center and Gilbert Farm north of Route 19 may also require a cultural resource survey.
Recreational Facilities	Places available for recreational or communal use, such as a YMCA or community parks.	Virginia Department of Conservation Recreation (VDCR) Natural Heritage Data Explorer (NHDE) VDCR Virginia Outdoor Plan Mapper Aerial Imagery	Lebanon Town Park, Old Mill Park, Russell County Veterans Memorial Park, and J.S. Easterly Park are located outside of both study areas.

Environmental Resource	Description	Source	Existing Resources in Study Area
Community Services	Places available to the public such as hospitals, schools, and churches.	Aerial Imagery Virginia Geographic Information Network (VGIN)	<u>W Main Street at Pioneer Drive</u> Lebanon High School and Gracewood Community Church are located west of the study area. Pioneer Drive serves as the primary way for people to get to these locations. <u>US 19 Bypass at Regional Park Road</u> There are no community services identified within or adjacent to the study area.
Bike/Pedestrian Facilities	Existing sidewalks, bike paths, and trails.	Aerial Imagery VDCR Virginia Outdoor Plan Mapper	There were no bike or pedestrian facilities identified within the study areas.
Section 6(f)	Sites funded through the Land and Water Conservation Fund (LWCF) and owned by state or local entities.	VDCR Virginia Outdoor Plan Mapper VDCR Conservation Lands	Lebanon Town Park was identified as Section 6(f) site, but it is located outside both study areas.
Section 106* Resources	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	Virginia Department of Historic Resources (VDHR) Virginia Cultural Resource Information System (V-CRIS) National Register of Historic Places (NRHP)	A NRHP site was identified outside the study area at the eastern terminus of the US 19 Bypass at Regional Park Road study area.

Environmental Resource	Description	Source	Existing Resources in Study Area
	status as noted on the VDHR V-CRIS website.		
Section 4(f)*	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 VDCR Virginia Outdoor Plan Mapper VDHR V-CRIS	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.
Protected Species	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) Virginia Department of Wildlife Resource (VDWR) Virginia Fish and Wildlife Information Services (VaFWIS) VDWR Bat Consultation Tool Northern Long-Eared Bat [NLEB], Tri-Colored Bat, and Little Brown Bat Center for Conservation Biology (CCB) Eagle Nest Locator	USFWS No critical habitats are located within the study area. Bald and/or golden eagles were not noted in the study area. VDWR Databases USFWS IPaC – The Gray Bat, Indiana Bat, Tri-Colored Bat, Finerayed Pigtoe Clam, and Shiny Pigtoe Clam all are endangered species within both study areas. VDWR NLEB- A Tri-colored Bat consultation range exists for both study areas, and a Little Brown Bat consultation range exists for the W Main Street at Pioneer Drive study area. CCB- No eagle nests were identified in the study area.

Environmental Resource	Description	Source	Existing Resources in Study Area
Floodplains	Areas considered at risk for flooding during 100-year and 500-year storms.	Federal Emergency Management Agency (FEMA) Flood Hazard Areas	There is a 100-year floodplain (Zone AE) located within the W Main Street at Pioneer Drive study area.
Surface Water & Wetlands	Review of NHD and 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) USFWS National Wetland Inventory (NWI)	A wetland was identified on the eastern terminus of the US 19 Bypass at Regional Park Road study area. Little Cedar Creek runs through W Main Street at Pioneer Drive study area and Big Cedar Creek runs through the US 19 Bypass at Regional Park Road study area. Any work in Big Cedar Creek (Class VI Trout Stream) will require a water quality permit and an instream time of year restriction could be required for the Brook and Brown Trout (October 1– March 31), and Rainbow Trout (March 15 – May 15).
Hazardous Materials	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	<u>W Main Street at Pioneer Drive</u> Huffman's Service Station listed as a petroleum release site within the project corridor. There is an active gas station located at the intersection of Route 19 business and Fincastle Road. Historic hazmat sites may be located within the south end of the project corridor. Recommend avoiding these parcels. A Phase I Environmental Site Assessment will be required and can be

Environmental Resource	Description	Source	Existing Resources in Study Area
			conducted early in the design process to inform right of way acquisition if funding is available. <u>US 19 Bypass at Regional Park Road</u> RCRA and EPA Toxic Release Inventory sites along Route 19. Recommend avoiding these parcels. If right of way acquisition of these parcels is deemed necessary, a full ASTM Phase I will be required.
Open Space, Conservations Easements, Agricultural, and Forestal Districts	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 those defined as such in the zoning map.	VDCR NHDE VDCR Outdoors Plan Mapper The Virginia Outdoor Foundation The Nature Conservancy	<u>W Main Street at Pioneer Drive</u> Forested areas are located at the southern terminus of the study area. There are no conservation lands located within the study area. <u>US 19 Bypass at Regional Park Road</u> Forested areas are located at the western and eastern ends of the study area. There are no conservation lands located within the study area.
Farmland	Lands with soils that are considered prime farmland and outside a census-designated urban area.	United States Census Bureau Urban Area Maps Natural Resources Conservation Service Web Soil Survey	Both study areas have prime farmland and farmlands of statewide importance located within the study area. Neither study area is in a census-designated urban area.
Noise	Determining whether the subject project may be considered a Type	VDOT and FHWA Noise Guidance	A noise study will likely be required if capacity is added to the roadway, such as adding auxiliary

Environmental Resource	Description	Source	Existing Resources in Study Area
	I project based on VDOT and FHWA guidance.		lanes, the addition or extension of turn lanes, and the extension of acceleration and deceleration lanes, any minor intersection improvements or reconfigurations, and any interchange ramp extensions or modifications.
Land Use	Land Area that has been given a specific use based on local jurisdiction land use designations.	Russell County GIS Data	W Main Street at Pioneer Drive There is a mix of commercial, residential, and agricultural land uses within and adjacent to the study area. US 19 Bypass at Regional Park Road There is a mix of commercial and agricultural land uses within and adjacent to the study area.
Air Quality	Determine whether the subject project is in an air quality attainment area and whether a qualitative analysis may be required.	Environmental Protection Agency Green Book	No air quality impacts are anticipated; therefore, a qualitative analysis is not anticipated to be required.
Tree Clearing Time of Year Restriction	Identify if a restriction on tree clearing is restricted to certain times of the year.	VDOT Bristol District Environmental Review	A tree clearing time of year restriction will be required from April 1 – Nov 15 to protect bat habitat.

**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 evaluate*

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 will be 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. Synchro results of the existing conditions analysis were presented to the Study Work Group on July 2, 2025. The presentation is provided for reference below.[1]

Relevant Studies, Plans, and Projects

Small intersection safety studies were conducted for both study areas in 2023 and included the following recommendations:

W Main Street at Pioneer Drive:

- Move northbound Main Street lane drop outside of the intersection's functional area
- Consider long-term conversion to a roundabout

US 19 Bypass at Regional Park Road:

- Remove channelized right turns and evaluate all-red clearance interval
- Consider conversion to a continuous Green-T intersection

It should be noted that due to the constraints of the size of the studies, design elements associated with the roundabout concept and Green-T concept were not able to be evaluated.

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) and VDOT's most recent Potential for Safety Improvement (PSI) information. In total, 8 crashes were reported in the W Main Street at Pioneer Drive study area and 41 crashes were reported in the US 19 Bypass at Regional Park Road study area. Summaries of crashes in both study areas by intersection and severity are shown in Table 6 and Table 8, respectively. Table 7 and Table 9 identify the collision types for the crashes experienced for each respective study area.

[1] Existing Conditions Study Work Group Presentation

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

- K—Fatal Injury
- A—Severe Injury
- B—Visible Injury
- C—Nonvisible Injury
- PDO—Property Damage Only

The intersection of Main Street at Pioneer Drive had eight total crashes between 2020 and 2024. Half of the crashes (four crashes) were angle collisions involving left turns onto Main Street or Pioneer Drive. Two of these angle collisions resulted in a visible injury (B). 75% of these crashes (six crashes) involved young drivers (15-20 years old) likely due to the proximity of Lebanon High School (0.7 miles W of study area). Many young drivers use Pioneer Drive to access and exit Lebanon High School.

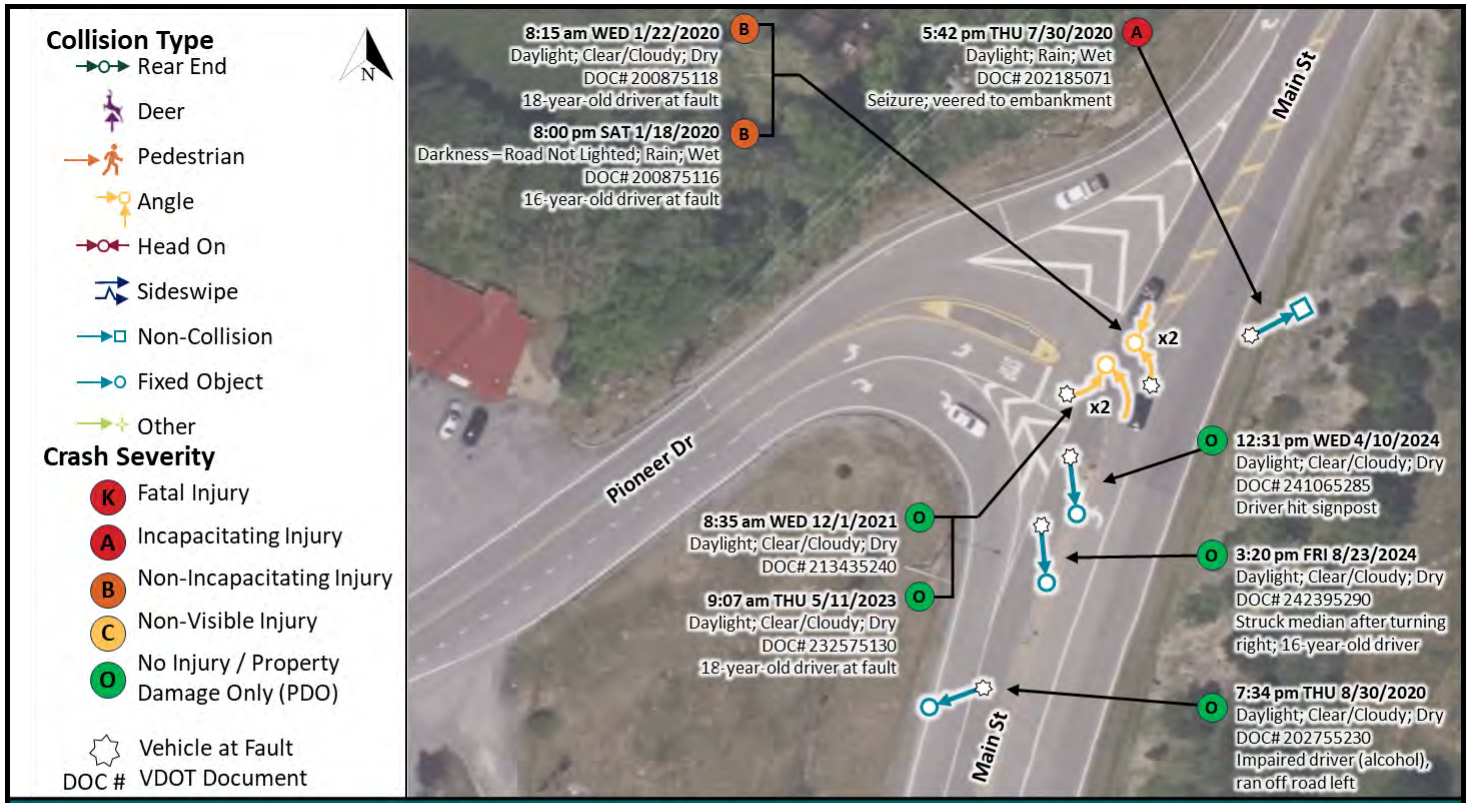
Table 6: W Main Street at Pioneer Drive Crashes by Crash Severity

Location	# of Crashes—K	# of Crashes—A	# of Crashes—B	# of Crashes—C	# of Crashes—PDO	Total
Main Street at Pioneer Drive	0	1	2	0	5	8
Total	0 (0%)	1 (13%)	2 (25%)	0 (0%)	5 (63%)	8

Table 7: W Main Street at Pioneer Drive Crashes by Collision Type

Intersection	# of Crashes – Angle	# of Crashes – Rear End	# of Crashes – Head-On	# of Crashes – Fixed Object	# of Crashes – Sideswipe	# of Crashes – Pedestrian	# of Crashes – Other	# of Crashes – Total
Main Street at Pioneer Drive	4	0	0	3	0	0	1	8
Total	4 (50%)	0 (0%)	0 (0%)	3 (38%)	0 (0%)	0 (0%)	1 (13%)	8

The study team reviewed FR300 crash reports to create a collision diagram for the crashes at the study intersection. The collision diagram is shown in Figure 15.



Collision Summary

Year	Type of Collision						Time of Day			Lighting			Weather		Pavement Condition			Severity					Total
	Angle	Rear-End	Head-On	Sideswipe	Fixed Object	Other	AM Peak (7-10AM)	PM Peak (4-7PM)	Off Peak	Daylight	Dawn/Dusk	Darkness	Clear	Rain/Mist/ Snow	Dry	Wet	Icy	K	A	B	C	PDO	
2020	2				1	1	1	1	2	3		1	2	2	2	2			1	2		1	4
2021	1						1			1				1		1						1	1
2022																							
2023	1						1			1			1		1							1	1
2024					2				2	2			2		2							2	2
Total	4				3	1	3	1	4	7		1	5	3	5	3			1	2		5	8

Figure 15: Main Street at Pioneer Drive Intersection Collision Diagram

Within the US 19 Bypass at Regional Park Road study area, there were 41 total crashes. Of these, 27% (11 crashes) resulted in a fatality or injury. At the US 19 Bypass at Regional Park Road intersection, 8% (3 crashes) involved a distracted driver. Moreover, 27% of intersection crashes (11 crashes) were an angle collision with one fatal injury (K) crash occurring due to an illegal left turn resulting in three fatalities. Six crashes attributed to red light running occurred.

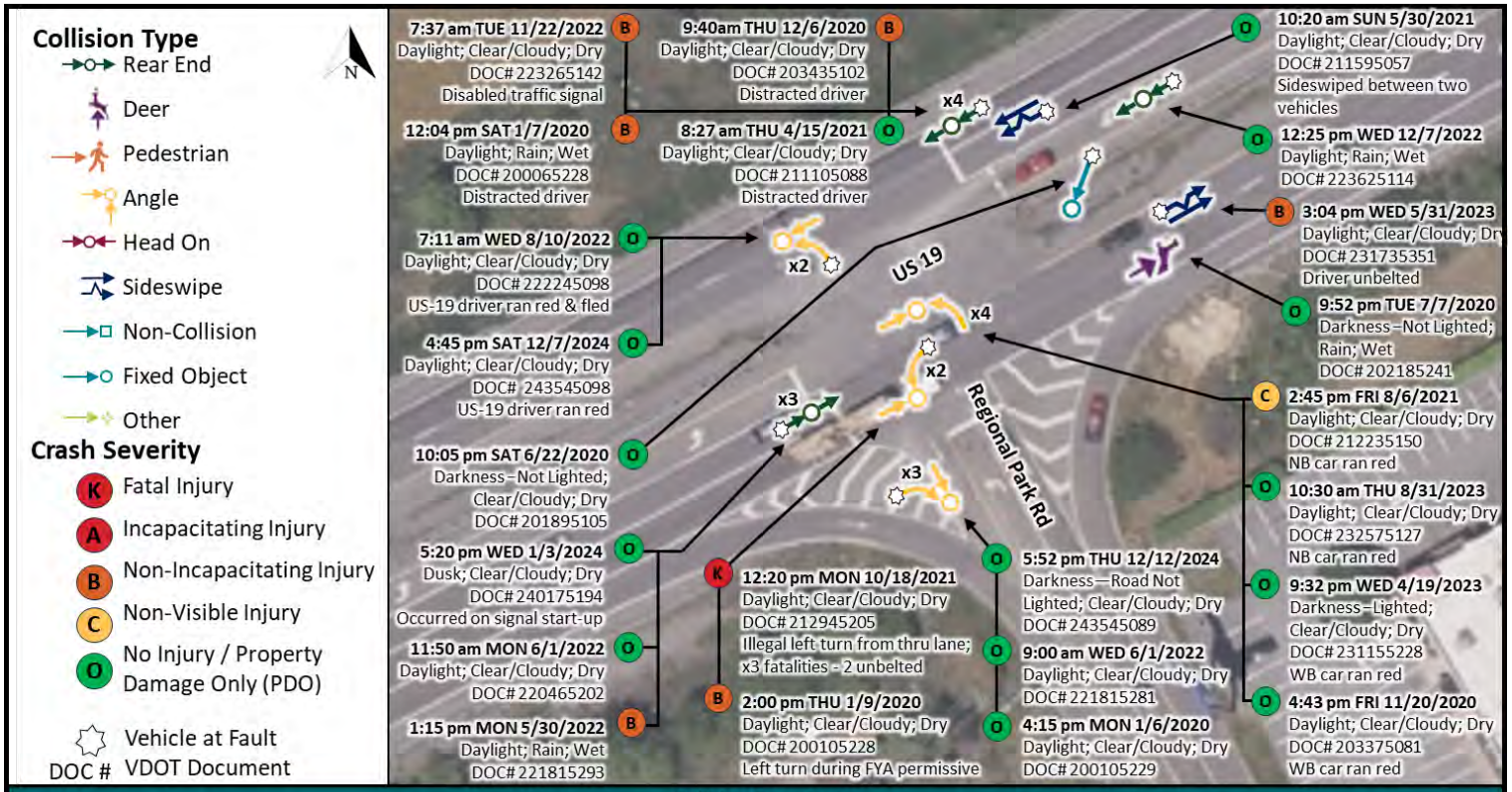
Table 8: US 19 Bypass at Regional Park Road Crashes by Crash Severity

Location	# of Crashes—K	# of Crashes—A	# of Crashes—B	# of Crashes—C	# of Crashes—PDO	Total
US 19 Bypass at Regional Park Road	1	0	6	1	15	23
Regional Park Road at Elliot Drive	0	0	1	0	5	6
Rest of US 19 Bypass Corridor	0	0	2	0	10	12
Total	1 (2%)	0 (0%)	9 (22%)	1 (2%)	30 (73%)	41

Table 9: US 19 Bypass at Regional Park Road Crashes by Collision Type

Location	# of Crashes – Angle	# of Crashes – Rear End	# of Crashes – Head-On	# of Crashes – Side-swipe	# of Crashes – Fixed Object	# of Crashes – Other	# of Crashes – Total
US 19 Bypass at Regional Park Road	11	8	0	2	1	1	23
Regional Park Road at Elliot Drive	5	1	0	0	0	0	6
Rest of US 19 Bypass Corridor	0	2	0	0	3	7	12
Total	16 (39%)	11 (27%)	0 (0%)	2 (5%)	4 (10%)	8 (20%)	41

The study team reviewed FR300 crash reports to create collision diagrams for all the crashes at the study intersections and adjacent roadway segments. These collision diagrams are shown in Figure 16, Figure 17, and Figure 18.



Collision Summary

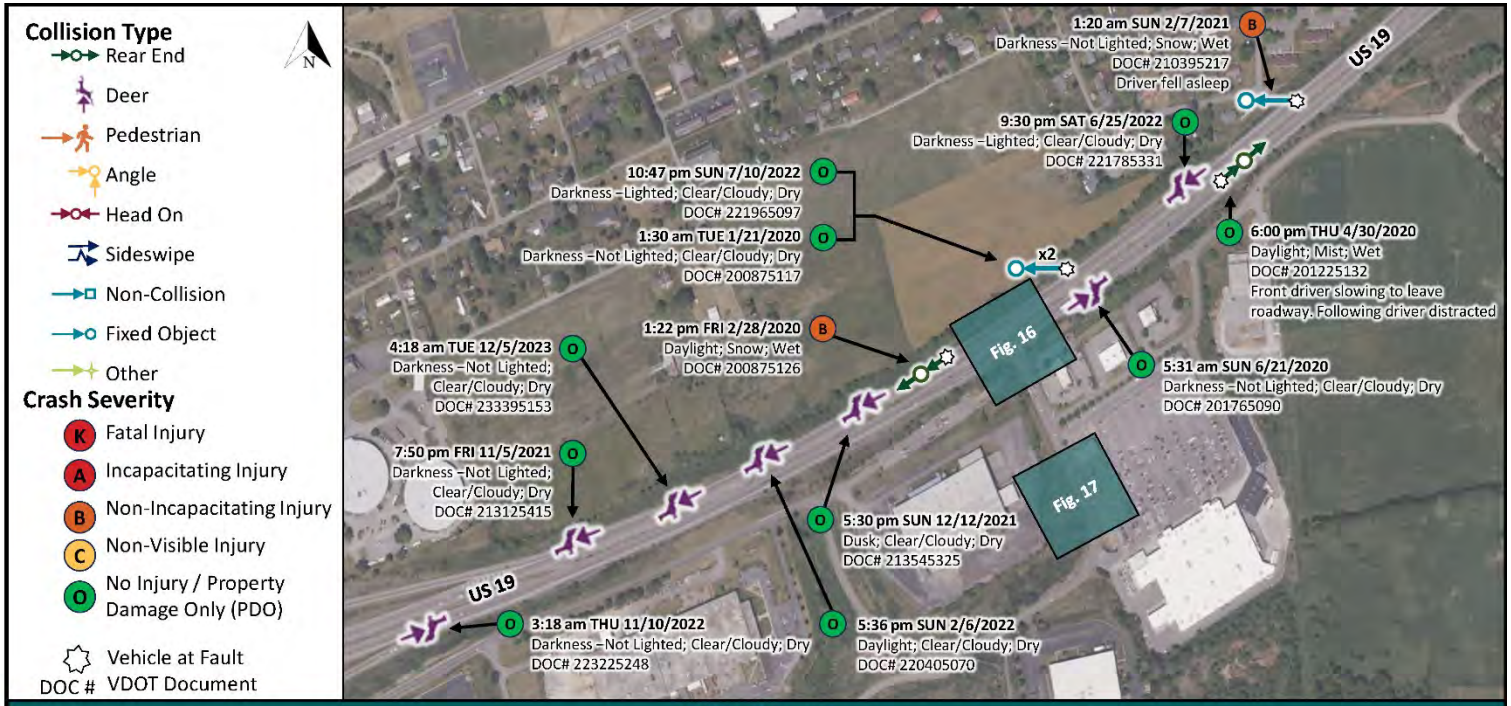
Year	Type of Collision						Time of Day			Lighting			Weather		Pavement Condition			Severity					Total
	Angle	Rear-End	Head-On	Sideswipe	Fixed Object	Other	AM Peak (7-10AM)	PM Peak (4-7PM)	Off Peak	Daylight	Dawn/Dusk	Darkness	Clear	Rain/Mist/Snow	Dry	Wet	Icy	K	A	B	C	PDO	
2020	3	2			1	1	1	2	4	5		2	5	2	5	2				3		4	7
2021	2	1		1			1		3	4			4		4			1			1	2	4
2022	3	3					3		3	6			4	2	4	2				2		4	6
2023	2			1					3	2		1	3		3					1		2	3
2024	1	2						3		1	1	1	3		3							3	3
Total	11	8		2	1	1	5	5	13	18	1	4	19	4	19	4		1		6	1	15	23

Figure 16: US 19 Bypass at Regional Park Road Intersection Collision Diagram

Collision Summary

Year	Type of Collision						Time of Day			Lighting			Weather		Pavement Condition			Severity					Total
	Angle	Rear-End	Head-On	Sideswipe	Fixed Object	Other	AM Peak (7-10AM)	PM Peak (4-7PM)	Off Peak	Daylight	Dawn/Dusk	Darkness	Clear	Rain/Mist/ Snow	Dry	Wet	Icy	K	A	B	C	PDO	
2020	1								1	1			1		1					1			1
2021																							
2022	1							1		1			1		1							1	1
2023	1	1							2	1		1	1	1	2							2	2
2024	2								2	2			2		2							2	2
Total	5	1						1	5	5		1	5	1	6					1		5	6

Figure 17: Regional Park Road at Elliot Drive Intersection Collision Diagram



Collision Summary

Year	Type of Collision						Time of Day			Lighting			Weather		Pavement Condition			Severity					Total
	Angle	Rear-End	Head-On	Sideswipe	Fixed Object	Other	AM Peak (7-10AM)	PM Peak (4-7PM)	Off Peak	Daylight	Dawn/Dusk	Darkness	Clear	Rain/Mist/ Snow	Dry	Wet	Icy	K	A	B	C	PDO	
2020		2			1	1		1	3	2		2	2	2	2	2				1		3	4
2021					1	2		1	2		1	2	2	1	2	1				1		2	3
2022					1	3		1	3	1		3	4		4							4	4
2023						1			1			1	1		1							1	1
2024																							
Total		2			3	7		3	9	3	1	8	9	3	9	3				2		10	12

Figure 18: US 19 Bypass at Regional Park Road Study Area Rest of Corridor Collision Diagram

Field Review Observations

A preliminary field review of the study area was conducted on April 22, 2025, to verify existing conditions, confirm traffic control devices and lane configurations, and observe peak hour traffic conditions and driver behavior. The existing lane configurations and speeds limits in each respective study area is summarized in Figure 19 and Figure 20.

The following observations were made at the intersection of Main Street and Pioneer Drive during the field review:

- Stormwater drainage system needs maintenance – overgrown vegetation, clogged channels and pipes, cracked/broken concrete channels
- Significant site constraints adjacent to the intersection, including a stream and steep topography
- No visible signs of pedestrian activity – note: Town of Lebanon staff indicated occasional pedestrian activity for the Lebanon High School cross country team and individuals walking between the Town & Country Motor Lodge and the Shell gas station at Fincastle Road

The following observations were made at the intersection of US 19 Bypass and Regional Park Road during the field review:

- Poor lane utilization on dual left turns from Regional Park Road onto southbound US 19 – 90% of turning traffic appears to use the outside lane, likely positioning to exit US 19 at Exit 2 Pittston Road
- Sun glare limits signal head visibility along US 19, particularly in the southbound direction in the afternoon period
- US 19 vehicular operating speeds appear greater than 55 MPH posted speed limit at Regional Park Road intersection
- Pedestrians entered the US 19 shoulder in the vicinity of Cedar Heights / Memorial Drive, walked along the southbound US 19 shoulder, and then crossed towards Walmart at the Regional Park Road traffic signal – note: VDOT Residency staff indicated that individuals have cut a hole in the limited access fence in this vicinity

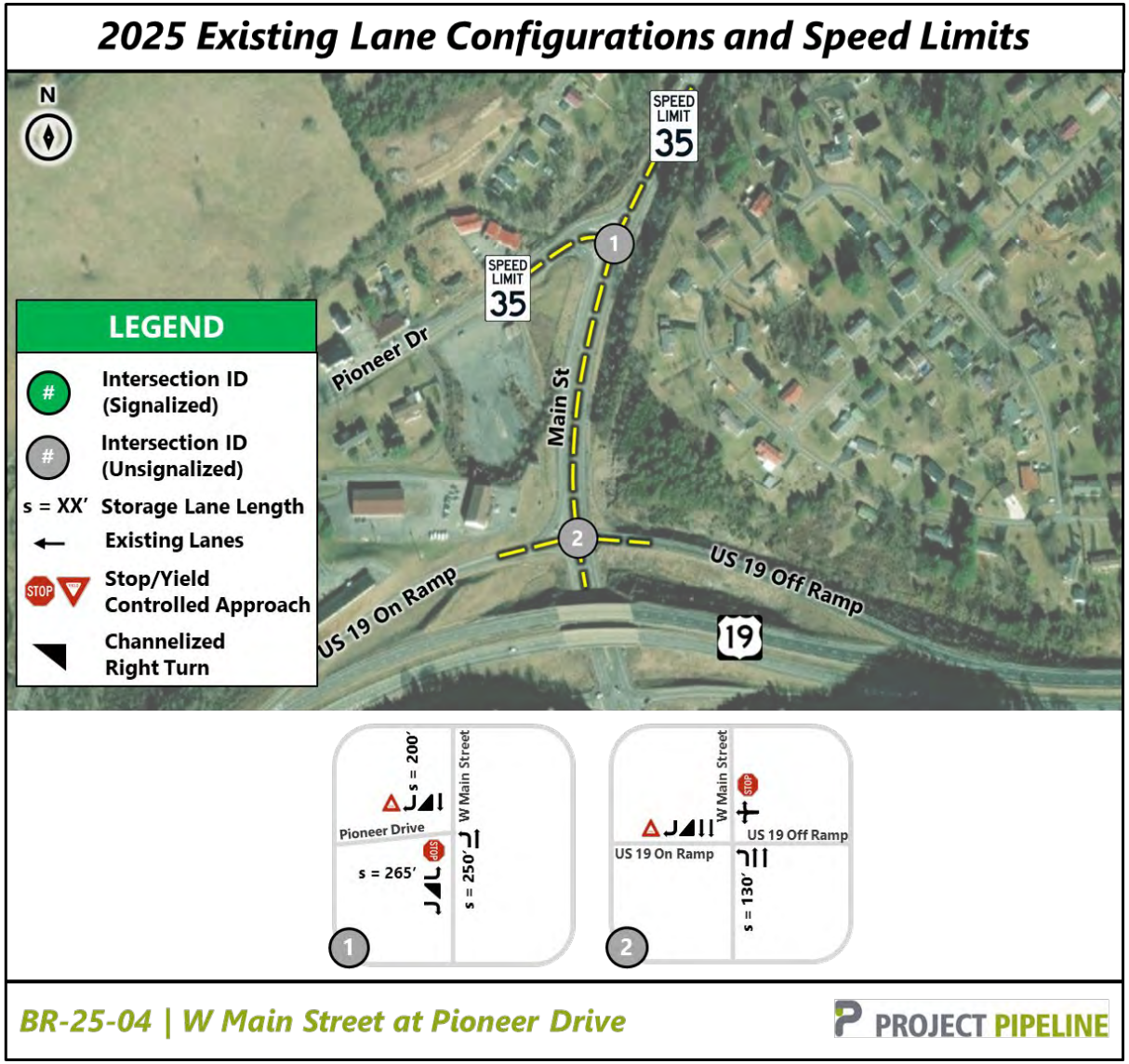


Figure 19: 2025 Existing Lane Configuration and Speed Limits W Main Street at Pioneer Drive

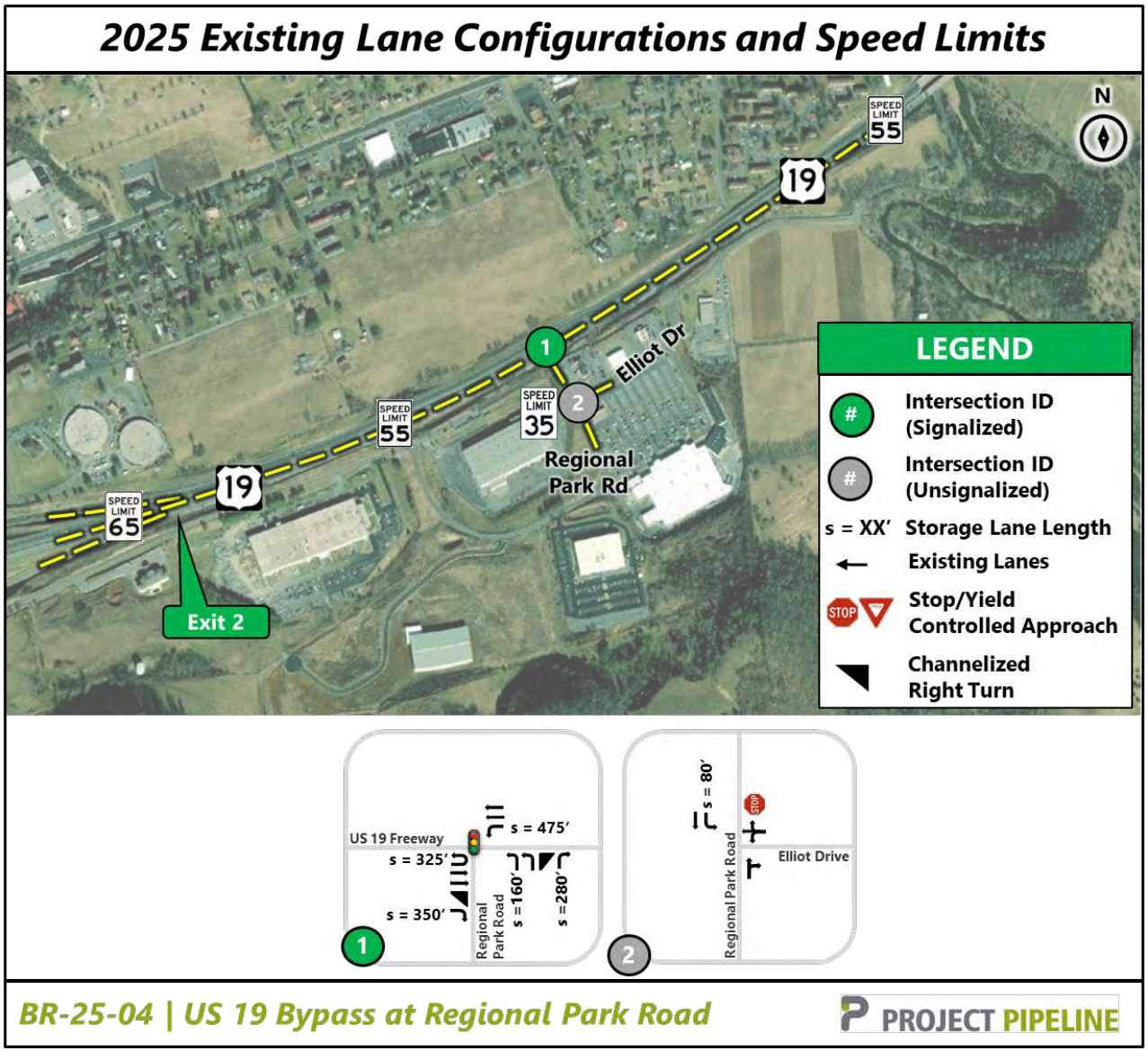


Figure 20: 2025 Existing Lane Configuration and Speed Limits US 19 Bypass at Regional Park Road

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, collected traffic count data, and provided signal phasing/timing plans. Input and analysis methodologies were consistent with the VDOT Traffic Operations and Safety Analysis Manual (TOSAM), Version 2.0.

Traffic Data

Eight-hour vehicular turning movement count data was collected at both study areas on Tuesday, April 8, 2025, from 6:00 AM to 10:00 AM and 2:00 PM to 6:00 PM. Additionally, 72 hours of roadway segment volume and speed data were collected at both study areas. Data was collected at the W Main Street at Pioneer Drive study area from Tuesday, April 29, 2025, to Thursday, May 1, 2025, and collected at the US 19 Bypass at Regional Park Road study area from Tuesday, April 8, 2025, to Thursday, April 10, 2025. The AM and PM peak hours for the W Main Street at Pioneer Drive study area were determined to be 7:45 AM to 8:45 AM and 3:00 PM to 4:00 PM. The AM and PM peak hours for the US 19 Bypass at Regional Park Road study area were determined to be 8:00 AM to 9:00 AM and 4:30 PM to 5:30 PM. Raw traffic data can be found in Appendix C.

As traffic data was collected over the course of three days, the ADT was determined based on averaging the counts. The resulting average ADT values can be seen in Figure 21 and Figure 22, which also depict 50th and 85th percentile speeds.

Figure 23 and Figure 24 display the temporal distributions of volume per hour on roadway segments in both study areas over the course of 24 hours. All segments in both study areas experience greater volumes during the established AM and PM peak hours.

Figure 25 and Figure 26 display the turning count movements for each respective study area experienced during AM and PM peak hours.

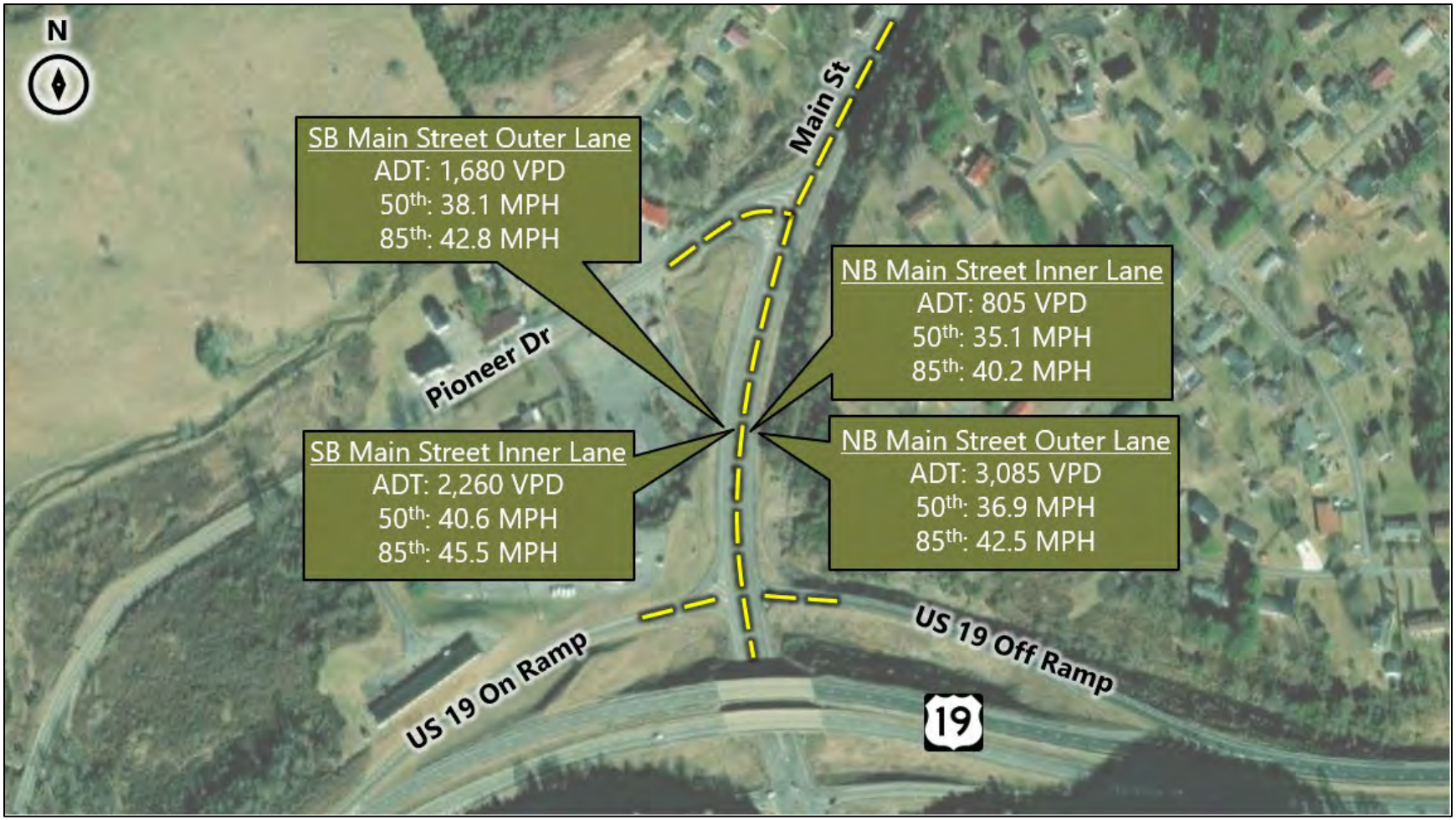


Figure 21: W Main Street at Pioneer Drive ADT and Speed Data

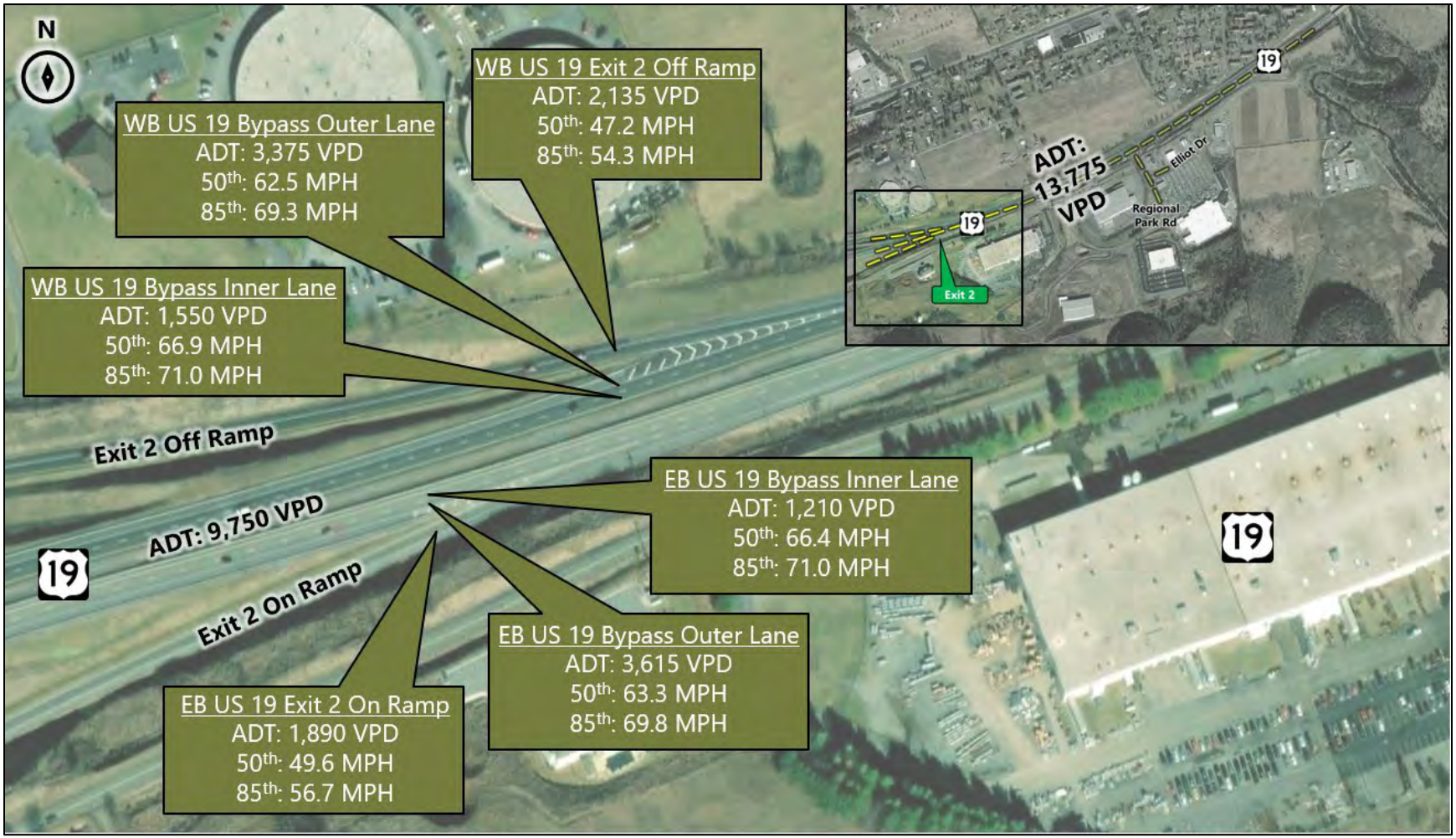


Figure 22: US 19 Bypass ADT and Speed Data

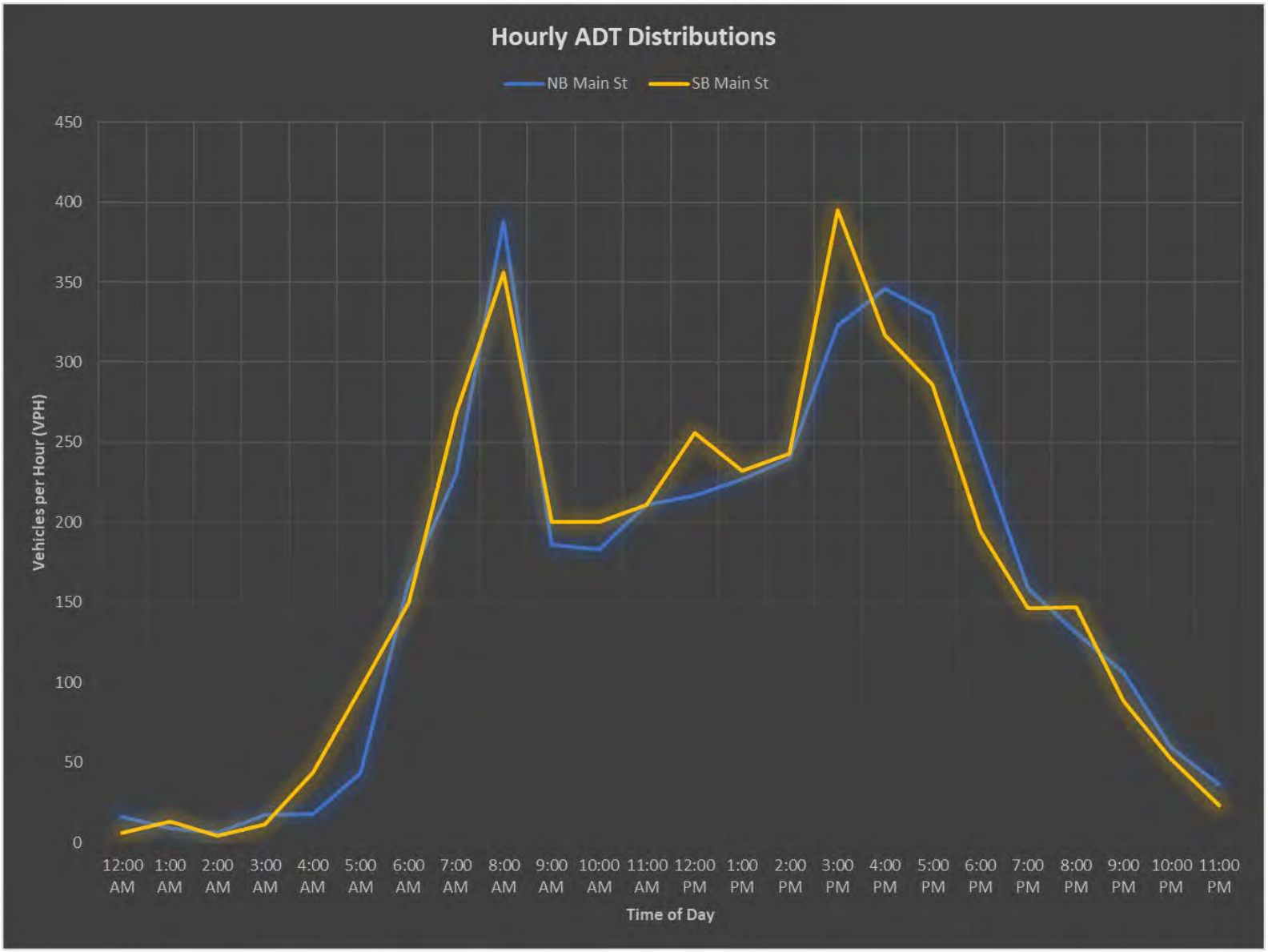


Figure 23: W Main Street at Pioneer Drive Hourly ADT Distributions

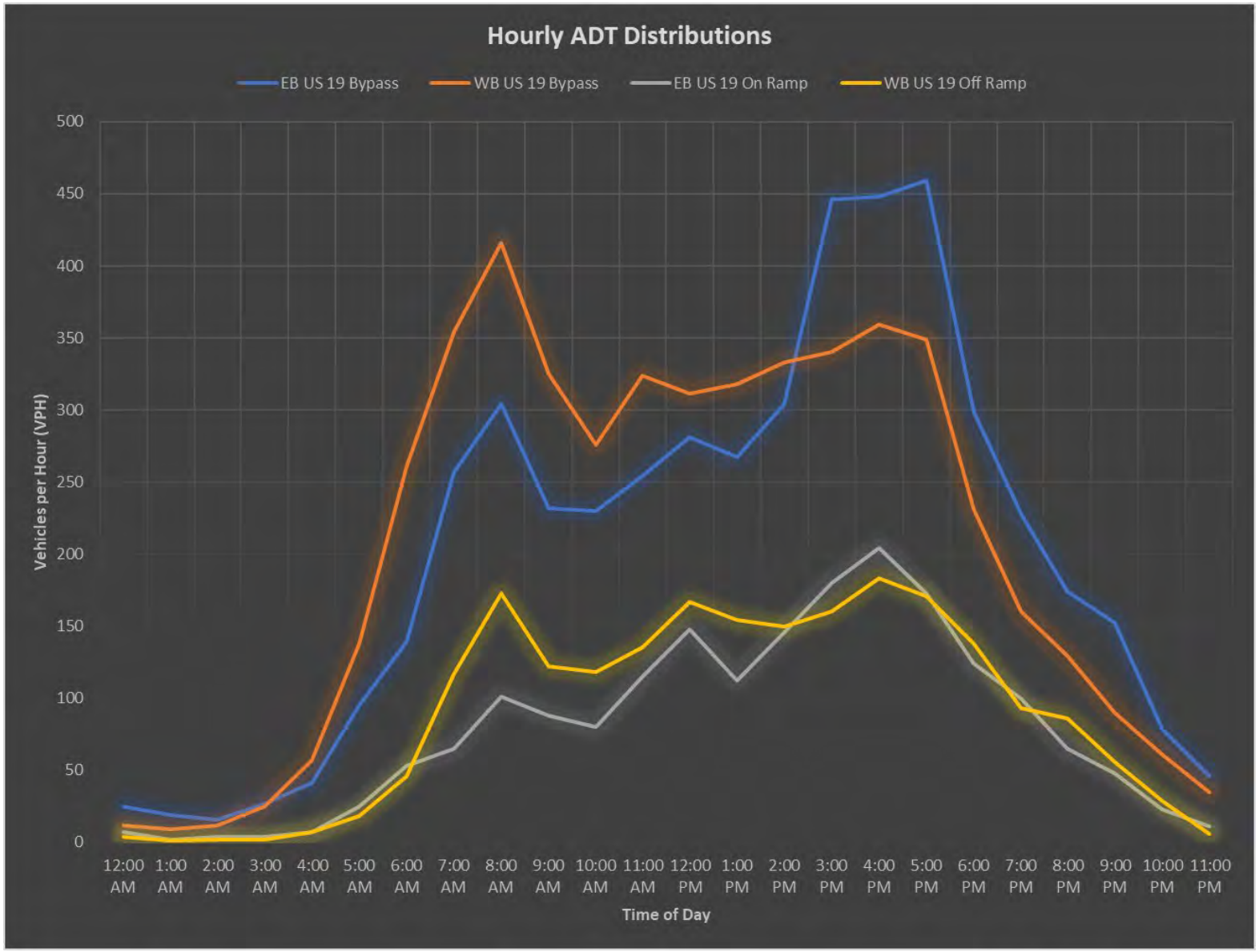


Figure 24: US 19 Bypass at Regional Park Road Hourly ADT Distributions

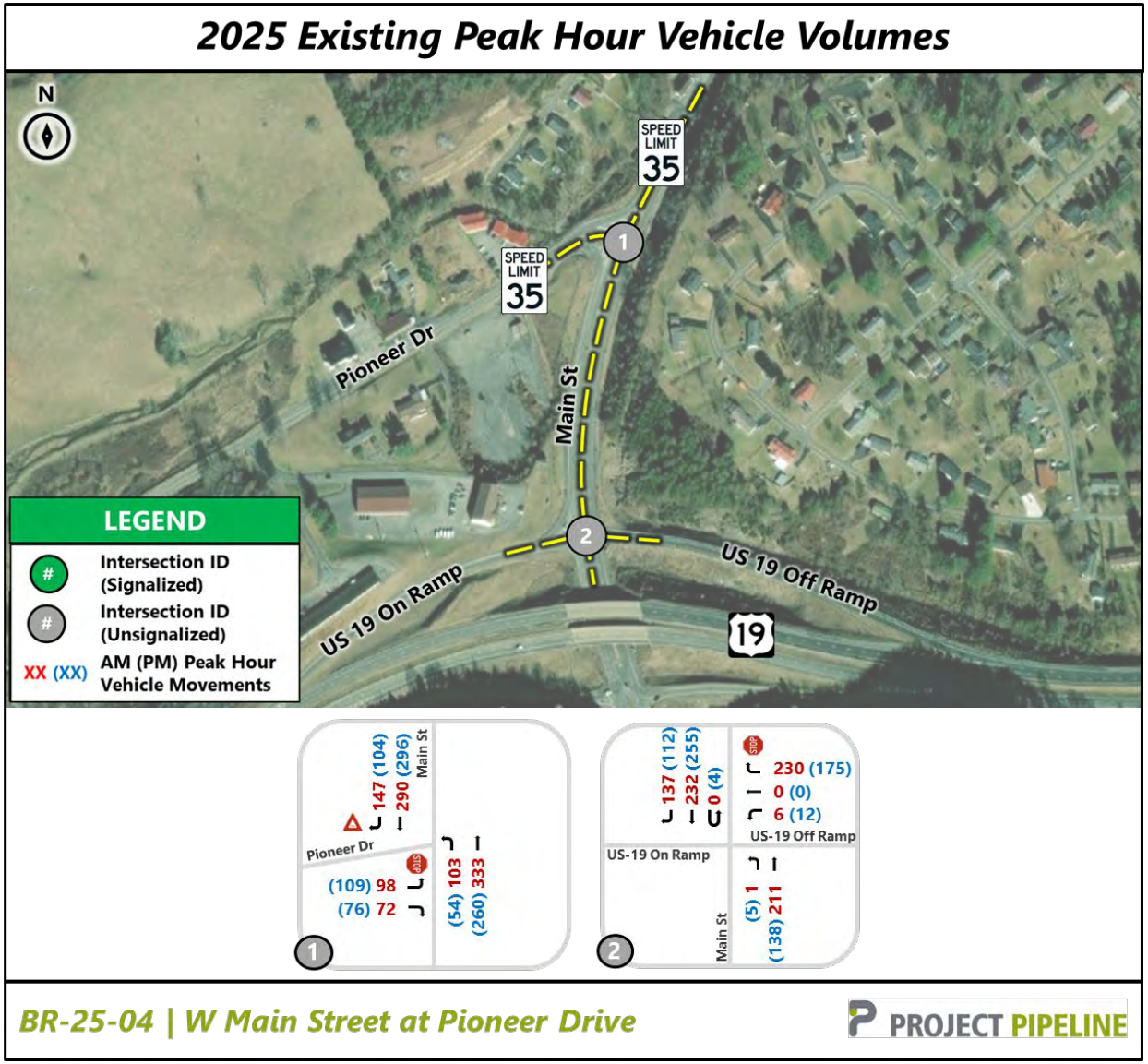


Figure 25: Existing Peak Hour Volumes W Main Street at Pioneer Drive

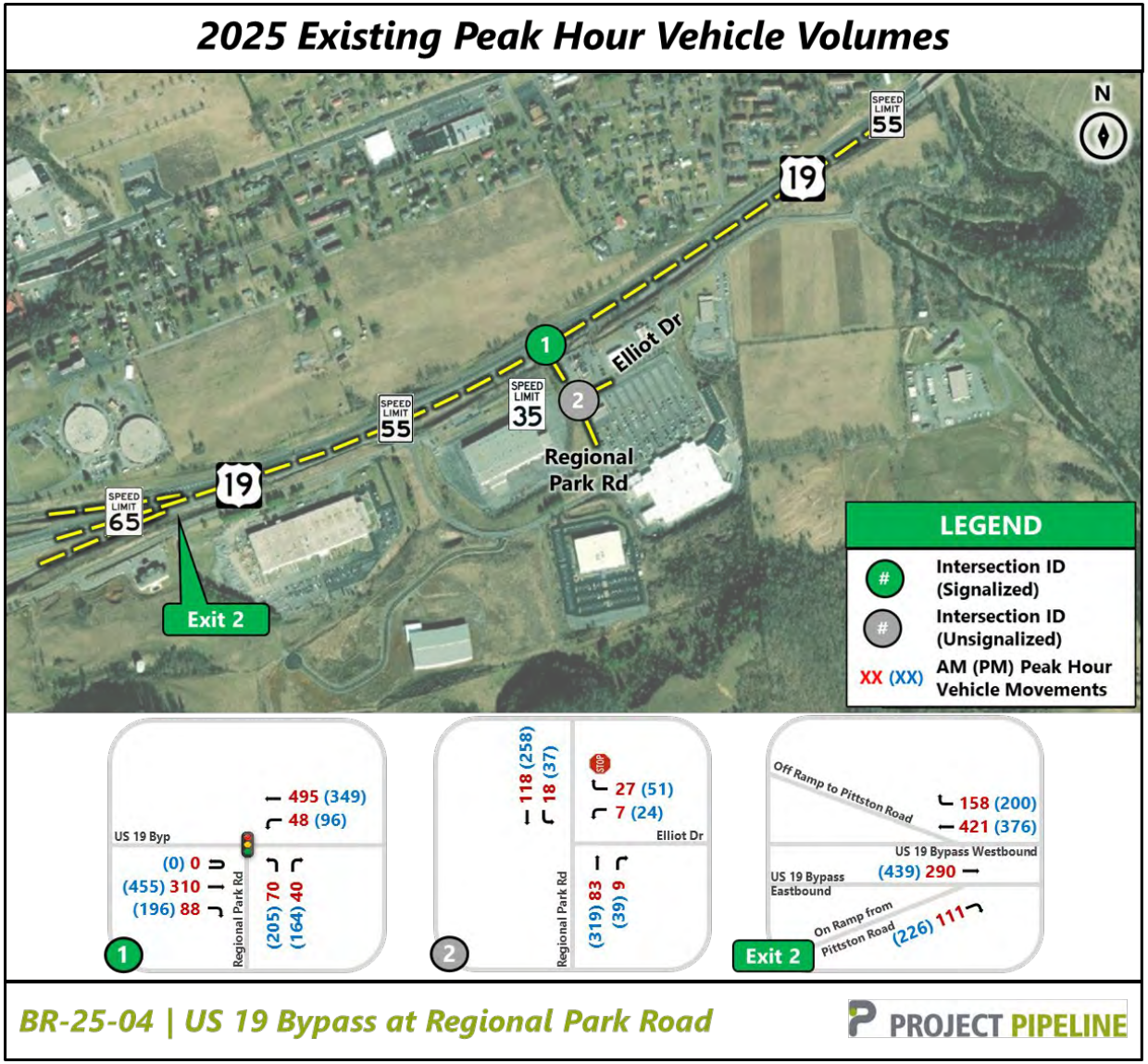


Figure 26: Existing Peak Hour Volumes US 19 Bypass at Regional Park Road

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 10 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 vehicles waiting at a traffic signal. For unsignalized intersections, LOS 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 10: Level of Service Criteria

Level of Service	Control Delay (seconds/vehicle) - Signalized Intersection	Control Delay (seconds/vehicle) - 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

Traffic Analysis Results

Control delay (seconds per vehicle), LOS, and maximum queue length (feet) were selected as measures of effectiveness to quantitatively report the performance of each study intersection. Table 11 and Table 12 summarize the Synchro analysis used to determine control delay for each intersection. Ten SimTraffic simulations were conducted for both the AM and PM models. Full Synchro and SimTraffic reports are included in Appendix D. Synchro results for the existing condition models are included in Table 13. SimTraffic queuing results are shown in Table 14.

Table 11: Synchro Report for Control Delay at W Main Street at Pioneer Drive Study Area

Intersection Name	Synchro Report for Control Delay
Main Street at Pioneer Drive	HCM 6th TWSC
Main Street at US 19 On/Off Ramp	HCM 6th TWSC

Table 12: Synchro Report for Control Delay at US 19 Bypass at Regional Park Road Study Area

Intersection Name	Synchro Report for Control Delay
US 19 Bypass at Regional Park Road	HCM 2010 Signalized
Regional Park Road at Elliot Drive	HCM 6th TWSC

Table 13: 2025 Existing Conditions Peak Hour Control Delay and LOS

Intersection Number and Description		Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall LOS (delay)	
				AM		PM		AM		PM		AM		PM		AM		PM			
				Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	AM	PM
1	W Main Street at US 19 On/Off Ramp							US 19 On/Off Ramp				W Main Street				W Main Street				Intersection	
		Unsignalized	Left					10.7	B	9.9	A	7.8	A	7.8	A					A (3.1)	A (2.8)
			Through									-	-	-	-	-	-	-	-		
			Right					-	-	-	-	-	-	-	-	-	-	-	-		
			Approach					10.7	B	9.9	A	0	A	0.3	A	0	A	0.1	A		
2	W Main Street at Pioneer Drive			Pioneer Drive								W Main Street				W Main Street				Intersection	
		Unsignalized	Left	59.1	F	25.5	D					8.4	A	8.2	A					A (6.9)	A (3.9)
			Through									-	-	-	-	-	-	-	-		
			Right	0	A	0	A									-	-	-	-		
			Approach	59.1	F	25.5	D					2	A	1.4	A	0	A	0	A		
3	US 19 Bypass at Regional Park Road			US 19 Bypass				US 19 Bypass				Regional Park Road								Intersection	
		Signalized	Left					25	C	24.5	C	22.5	C	21.3	C					A (8.9)	B (12)
			Through	12.9	B	18.9	B	5.1	A	6.5	A										
			Right	0.1	A	0.2	A					0	A	0.1	A						
			Approach	10.1	B	13.3	B	6.8	A	10.4	B	14.3	B	11.9	B						
4	Regional Park Road at Elliot Drive			Elliot Drive				Elliot Drive				Regional Park Road				Regional Park Road				Intersection	
		Unsignalized	Left					9.2	A	13.5	B	-	-	-	-	7.6	A	8.3	A	A (1.7)	A (1.8)
			Through									-	-	-	-	-	-	-	-		
			Right					-	-	-	-	-	-	-	-						
			Approach					-	-	-	-	0	A	0	A	1	A	1	A		

- No delay or level of service provided by Synchro. Movement exists.
Approach or movement does not exist.

Table 14: 2025 Existing Conditions Peak Hour Maximum Queues

Intersection Number and Description		Type of Control	Lane Group	Eastbound		Westbound		Northbound		Southbound	
				AM	PM	AM	PM	AM	PM	AM	PM
				Delay	Delay	Delay	Delay	Delay	Delay	Delay	Delay
1	W Main Street at US 19 On/Off Ramp					US 19 On/Off Ramp		W Main Street		W Main Street	
		Unsignalized	Left			67	60	-	9		
			Through					-	3	-	-
			Right							5	-
2	W Main Street at Pioneer Drive			Pioneer Drive				W Main Street		W Main Street	
		Unsignalized	Left	90	79			53	45		
			Through					-	-	2	-
			Right	-	-					-	-
3	US 19 Bypass at Regional Park Road			US 19 Bypass		US 19 Bypass		Regional Park Road			
		Signalized	Left	-	-	65	94	70	131		
			Through	115	162	90	85				
			Right	-	-			-	-		
4	Regional Park Road at Elliot Drive			Elliot Drive		Elliot Drive		Regional Park Road		Regional Park Road	
		Unsignalized	Left			50	61			16	26
			Through					-	-	-	-
			Right			50	61	-	-		

- No queue length provided by SimTraffic report. Movement exists
Approach or movement does not exist

Under existing conditions, all intersections operate at intersection LOS A in AM and PM peak hours except for US 19 Bypass at Regional Park Road which operates at LOS B in the PM peak hour. At the intersection approach level, Pioneer Drive at Main Street operates at LOS F in the AM and LOS D in the PM. Figure 27 and Figure 28 display the maximum queue lengths at the study intersections within both study areas. Relatively short queue lengths are experienced during both AM and PM peak hours.

The following trends were observed under existing conditions:

AM Peak Hour

- The eastbound approach for W Main Street at Pioneer Drive operates at LOS F and experiences the highest approach delay (59.1 seconds)
- All other approaches in both study areas operate from LOS A to LOS C
- The greatest signalized approach delay is 25 seconds at the westbound left turn movement for US 19 Bypass at Regional Park Road
- The longest queue experienced is 115 feet at the westbound approach of the US 19 Bypass at Regional Park Road
- No queues extend past storage bay lengths

PM Peak Hour

- The eastbound approach for W Main Street at Pioneer Drive operates at LOS D and experiences the highest approach delay (25.5 seconds)
- All other approaches in both study areas operate from LOS A to LOS C
- The greatest signalized approach delay is 24.5 seconds at the westbound left turn movement for US 19 Bypass at Regional Park Road
- The longest queue experienced is 162 feet at the eastbound approach of the US 19 Bypass at Regional Park Road
- No queues extend past storage bay lengths

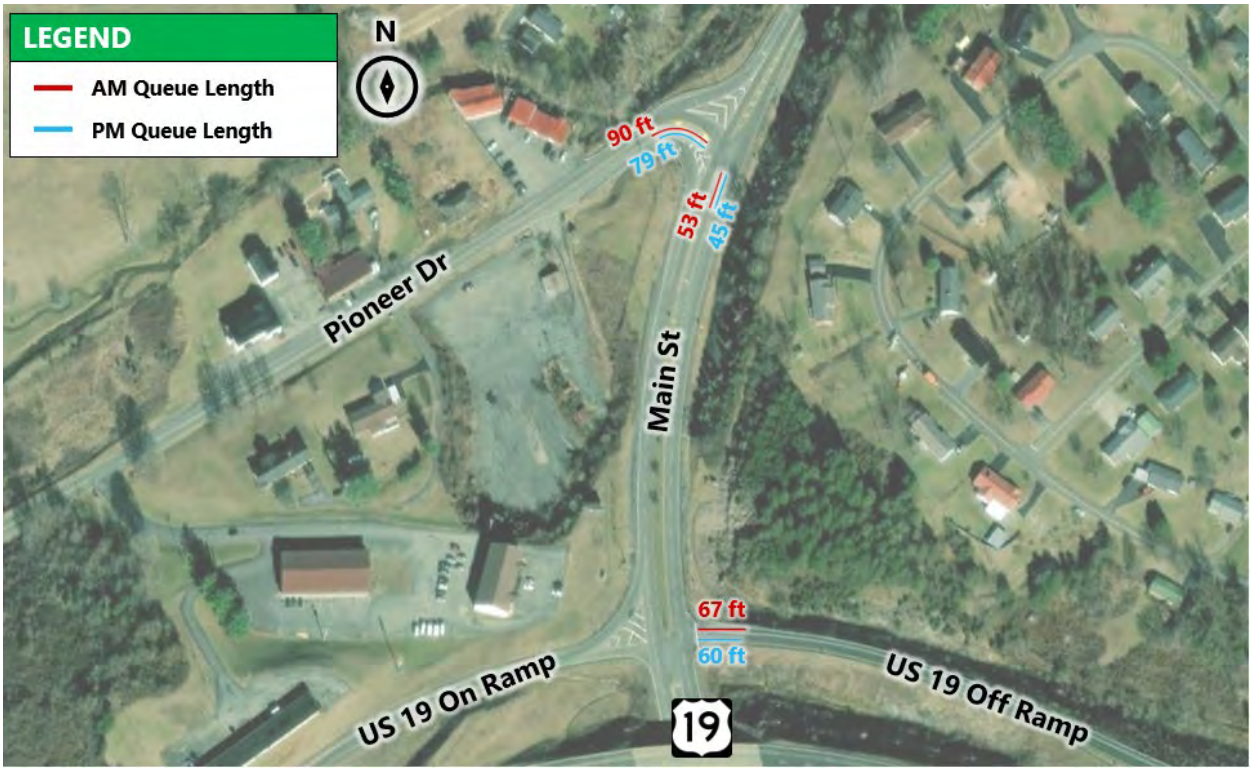


Figure 27: SimTraffic Queues at W Main Street at Pioneer Drive Study Area

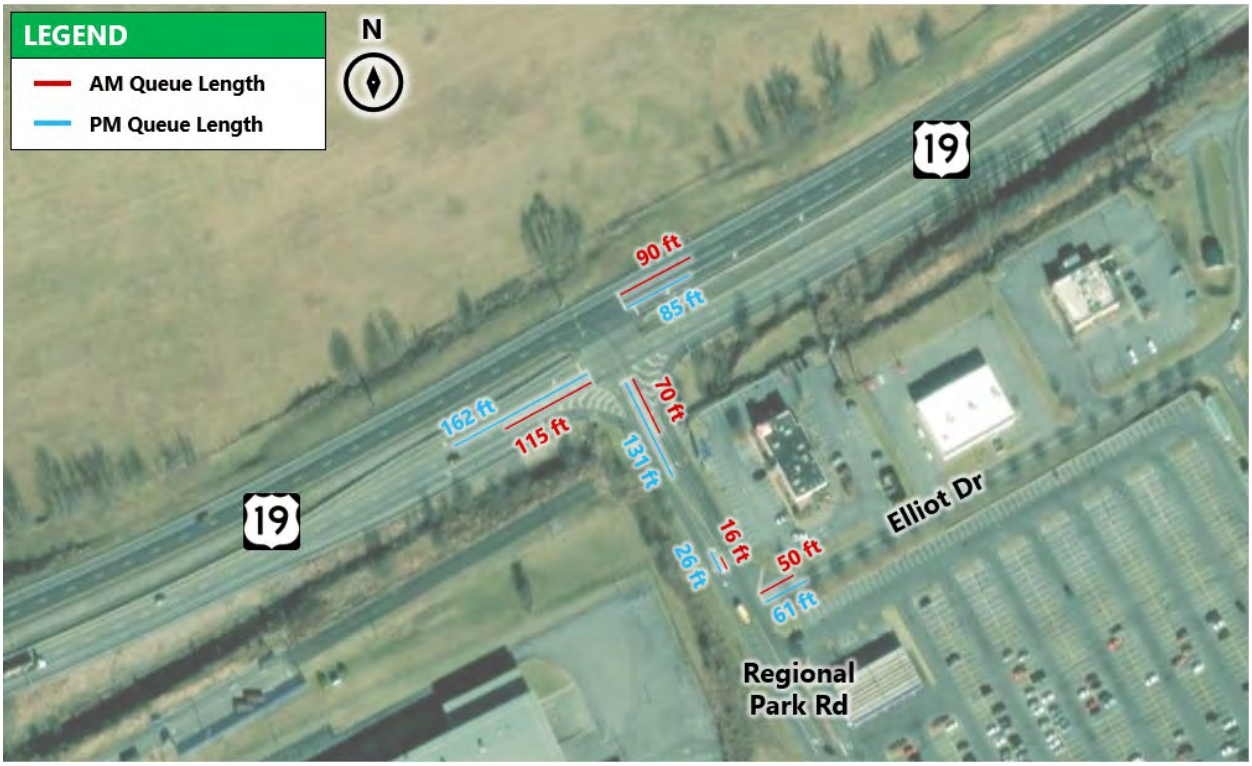


Figure 28: SimTraffic Queues at US 19 Bypass at Regional Park Road Study Area

1.6.2. Phase 1 Public Outreach

The Phase 1 Public Input online survey was held from May 27, 2025, to June 10, 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 211 participants and received 341 comments. Detailed results from the Phase 1 public outreach efforts can be found in Appendix E.

In the W Main Street at Pioneer Drive study area, participants noted the lack of sidewalks, sudden stopping/rear-end crashes, and insufficient crosswalks as safety issues that concern them. These concerns can be referenced in Figure 29 and Figure 30.

Common themes among written comments included the following:

- Aggressive driving behavior on the corridor
- Perceived need for increased signage
- Traffic operations, especially during school hours, are an issue
- Lack of yielding behavior for Main Street southbound right turn movement onto Pioneer Drive
- Perceived need for roadway maintenance
- Left turns across the intersection are perceived to be dangerous during congestion
- Sight distance issues due to the topography of the area

In the US 19 Bypass at Regional Park Road study area, participants noted speeding/aggressive driving, sudden stopping/rear-end crashes, and side-impact crashes as safety issues that concern them. These concerns can be referenced in Figure 31 and Figure 32.

Common themes among written comments included the following:

- Perceived need for speed management
- Sun glare causes traffic signal visibility issues
- Red light running driver behavior at traffic signal is common occurrence
- Perceived need for roadway maintenance
- Perceived need for pedestrian facilities

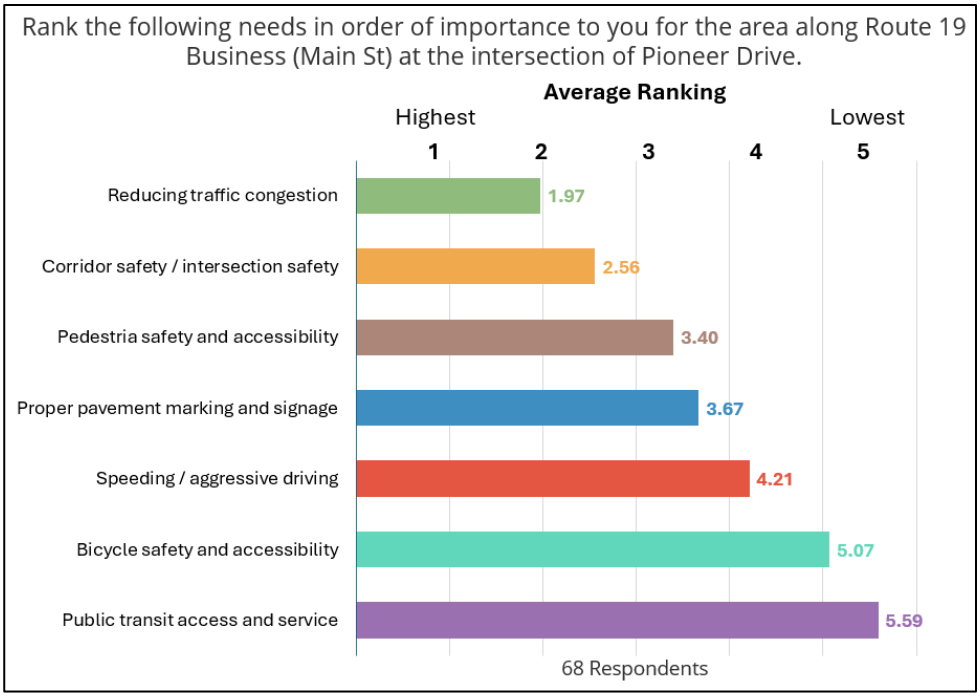


Figure 29: Ranked Corridor Needs Public Feedback W Main Street at Pioneer Drive

Figure 30: Public Outreach Identified Safety Concerns W Main Street at Pioneer Drive

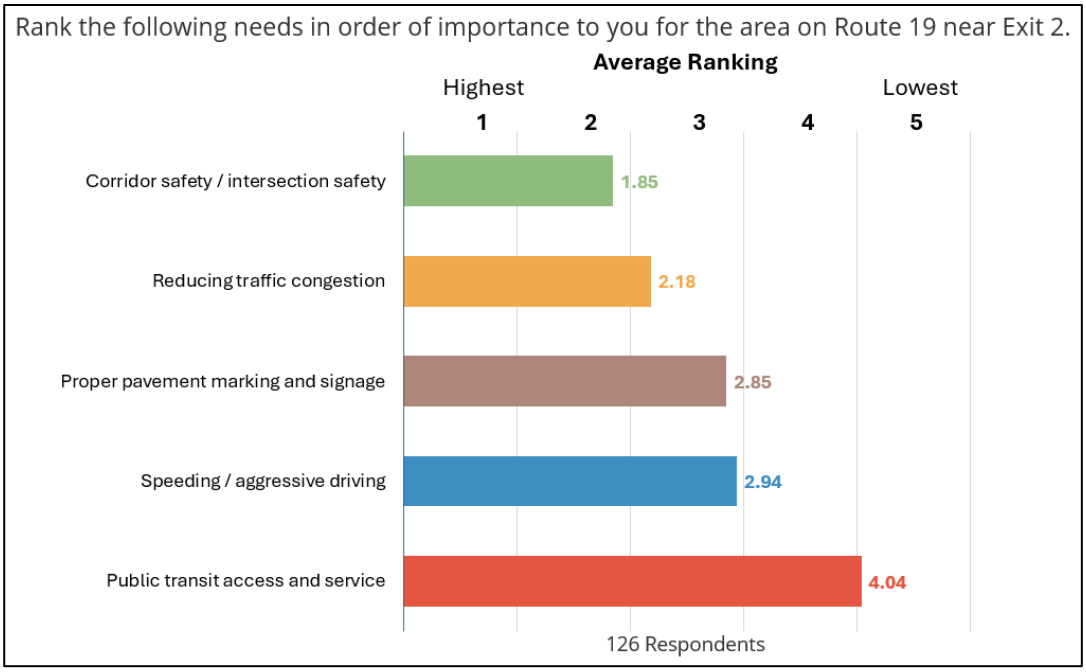


Figure 31: Ranked Corridor Needs Public Feedback US 19 Bypass at Regional Park Road

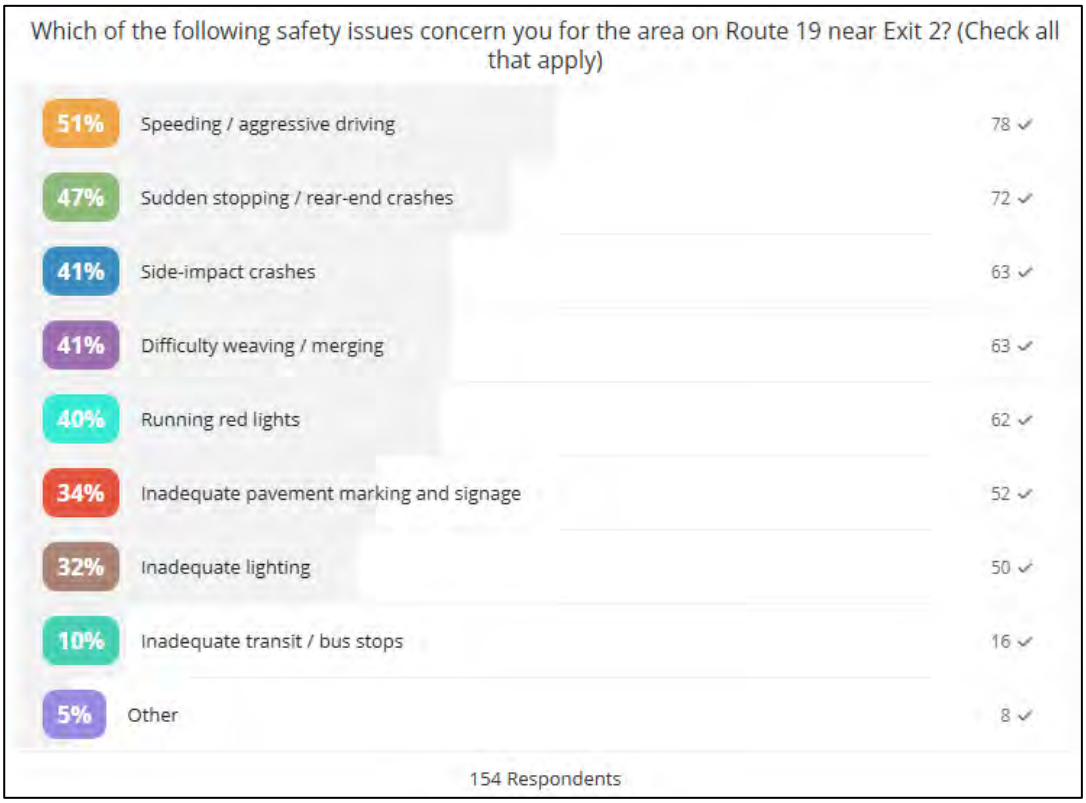


Figure 32: Public Outreach Identified Safety Concerns US 19 Bypass at Regional Park Road

1.7 Phase 1 Alternatives Development

VHB, in partnership with the SWG, developed preliminary alternatives in parallel with the high-level needs diagnosis efforts documented earlier in Chapter 1. The proposed Phase 1 alternatives were developed to meet the following criteria:

W Main Street at Pioneer Drive

- Reduce angle collisions
- Improve operations

US 19 Bypass at Regional Park Road

- Reduce crashes related to red light running
- Reduce vehicle speeds throughout the study area

1.7.1. Initial Alternatives

The needs evaluation, diagnosis, and initial alternatives were presented in SWG Meeting #3, held on August 6, 2025, via the online Mural platform[2], which is a collaborative meeting space. Multiple initial alternatives for both the W Main Street at Pioneer Drive intersection and the US 19 Bypass at Regional Park Road intersection were presented during the meeting, which are summarized in Table 15 and Table 16.

For SWG Meeting #3, the study team used the Virginia Junction Screening Tool (VJuST) to screen intersection and interchange alternatives based on impacts to traffic operations, pedestrian accommodations, safety, and cost. The VJuST results are summarized in Section 1.7.2.

[2] https://app.mural.co/t/vhbipd8103/m/vhbipd8103/1753125052851/60cbe850f82a83f90f308e33ce8faf27eb6bc53d

Table 15: W Main Street at Pioneer Drive Phase 1 Alternatives

Alternative	Intersection	Description
Pavement Marking/Restriping	W Main Street at Pioneer Drive	Restripe northbound W Main Street to shift the lane drop from two lanes to one lane further upstream outside of the functional area of the W Main Street at Pioneer Drive intersection.
Single Lane Roundabout	W Main Street at Pioneer Drive	Install a single lane roundabout as the intersection control type.
RCUT with Single-Lane Roundabout	W Main Street at Pioneer Drive	Revise the lane configuration to provide right-in/left-in/right-out access only for Pioneer Drive (prohibit left-out movements). Reroute left-out traffic to W Main Street at southbound US 19 ramps intersection, located approximately 800 ft south, where traffic can U-turn.
	W Main Street at Southbound US 19 On/Off Ramps	Install a single-lane roundabout to facilitate U-turn movements for rerouted left-out traffic from Pioneer Drive.
RCUT with U-Turn Loon	W Main Street at Pioneer Drive	Revise the lane configuration to provide right-in/left-in/right-out access only for Pioneer Drive (prohibit left-out movements). Reroute left-out traffic to W Main Street at southbound US 19 On/Off Ramps intersection, located approximately 800 ft south, where traffic can U-turn.
	W Main Street at Southbound US 19 On/Off Ramps	Install a U-Turn loon to facilitate U-turn movements for rerouted left-out traffic from Pioneer Drive.

Table 16: US 19 Bypass at Regional Park Road Phase 1 Alternatives

Alternative	Intersection	Description
RCUT with Signalized Rights	US 19 Bypass at Regional Park Road	Revise the lane configuration to provide right-in/left-in/right-out access only (prohibit left-out movements from Regional Park Road). Install signalized dual right-turn lanes and remove signal control for the southbound US 19 through movement. Reroute left-out traffic from Regional Park Road to a median opening 725 feet east where traffic can U-turn.
RCUT with Free Flow Rights	US 19 Bypass at Regional Park Road	Revise the lane configuration to provide right-in/left-in/right-out access only (prohibit left-out movements from Regional Park Road). Install a free-flow slip lane for Regional Park Road right-out movements and remove signal control for the southbound US 19 through movement. Reroute left-out traffic from Regional Park Road to a median opening 1,525 ft east where traffic can U-turn.
Remove Signalization with Right-In/Right-Out Access Management	US 19 Bypass at Regional Park Road	Remove signal control for all movements. Close the median opening and revise the lane configuration to provide right-in/right-out access only for the Regional Park Road approach. Reroute Regional Park Road left-in and left-out traffic to Regional Park Road at Pittson Road and Elliott Drive at Big Cedar Creek Road intersections.
Signal Modification	US 19 Bypass at Regional Park Road	Install a supplemental signal head for the westbound US 19 Bypass approach. Install Dynamic All Red Extension (DARE) for both US 19 Bypass approaches to extend the all-red clearance interval when the system detects a vehicle is unlikely to stop safely before entering the intersection on a red signal.

1.7.2. Phase 1 Alternatives Summary

The VJuST results for the initial alternatives are summarized in Table 17, Table 18, and Table 19. These were presented at SWG Meeting #3, where it was decided which alternatives would move forward to Phase 2. The SWG agreed to carry the following three alternatives forward to Phase 2 for further refinement:

W Main Street at Pioneer Drive

- Pavement Marking/Restriping
- Single Lane Roundabout – this alternative was included only as a viability/constructability test for a long-term vision; existing conditions data does not appear to support current funding viability.

US 19 Bypass at Regional Park Road

- Signal Modification

For the W Main Street at Pioneer Drive study area, the Pavement Marking/Restriping alternative was carried forward as a low-cost improvement that enhances safety by minimizing conflict points attributed to merging within the functional area of the intersection. The Single Lane Roundabout alternative was carried forward only as a viability/constructability test for a long-term vision. While the roundabout projected safety and operational benefits from reducing conflict points and reducing delay for the Pioneer Drive approach, existing conditions data does not appear to support current funding viability. The Signal Modification alternative was carried forward as a low-cost improvement that enhances safety by addressing sun glare and speeding patterns observed in the study area. Sun glare and speeding are the primary crash concerns at the intersection.

RCUT alternatives across both study areas (RCUT with Single-Lane Roundabout, RCUT with U-Turn Loon, RCUT with Signalized Rights, RCUT with Free Flow Rights) and the Remove Signalization with Right-In/Right-Out Access Management alternative for the US 19 Bypass at Regional Park Road alternative were eliminated due to potential public opposition to the removal, restriction, and rerouting of movements. An RCUT on US 19 Bypass at Regional Park Road would also require signalized U-turn control, which would negate some of the concept benefit of removing signal control from a direction of US 19 Bypass. It would also not inherently mitigate the sun glare and speeding crash concerns at the intersection. The RCUT options on W Main Street were also removed due to concerns about the high school driver population navigating intersection designs that require U-turn movements.

Table 20 and Table 21 summarize the alternatives considered in Phase 1 and gives the justification of if a concept were to move forward to Phase 2. Figure 33 and Figure 34 show the preliminary alternatives graphically categorized by the needs addressed by the alternative. The SWG Meeting #3 presentation was hosted on Mural, an online platform[3].

[3] https://app.mural.co/t/vhbipd8103/m/vhbipd8103/1753125052851/60cbe850f82a83f90f308e33ce8faf27eb6bc53d

Table 17: VJuST Results - W Main Street at Pioneer Drive

Intersection Results						
						Congestion / Pedestrian / Safety / Planning Level Costs / Scenario
Type	Dir	Maximum V/C	Accommodation Compared to Conventional	Weighted Total Conflict Points	Planning Level Cost Category	
Two-Way Stop Control	-	0.31		48	$	Existing - AM
Two-Way Stop Control	-	0.27		48	$	Existing - PM
Restricted Crossing U-Turn	-	0.19		20	$$	RCUT - AM
Restricted Crossing U-Turn	-	0.16		20	$$	RCUT - PM
Roundabout	-	0.35		8	$$	Roundabout - AM
Roundabout	-	0.31		8	$$	Roundabout - PM

Table 18: VJuST Results - W Main Street at Southbound US 19 On/Off Ramps

Intersection Results						
		Congestion	Pedestrian	Safety	Planning Level Costs	Scenario
Type	Dir	Maximum V/C	Accommodation Compared to Conventional	Weighted Total Conflict Points	Planning Level Cost Category	
Two-Way Stop Control	-	0.26		48	$	Existing - AM
Two-Way Stop Control	-	0.19		48	$	Existing - PM
Roundabout	-	0.27		8	$$	Roundabout - AM
Roundabout	-	0.27		8	$$	Roundabout - PM

Table 19: VJuST Results - US 19 Bypass at Regional Park Road

Intersection Results						
			Congestion / Pedestrian / Safety / Planning Level Costs			Scenario
Type	Dir	Maximum V/C	Accommodation Compared to Conventional	Weighted Total Conflict Points	Planning Level Cost Category	
Conventional	-	0.16		48	$	Existing - AM
Conventional	-	0.21		48	$	Existing - PM
Restricted Crossing U-Turn	-	0.18		20	$$	RCUT with Signalized Rights - AM
Restricted Crossing U-Turn	-	0.27		20	$$	RCUT with Signalized Rights - PM
Restricted Crossing U-Turn	-	0.16		20	$$	RCUT with Free-Flow Rights - AM
Restricted Crossing U-Turn	-	0.21		20	$$	RCUT with Free-Flow Rights - AM

Table 20: Phase 1 Alternatives to Move Forward to Phase 2 - W Main Street at Pioneer Drive Study Area

Alternative	Intersection	Move Forward to Phase 2?	Justification
Single Lane Roundabout	W Main Street at Pioneer Drive	Yes	Projected safety and operational benefits, particularly for eastbound Pioneer Drive approach. Reduces conflict points and encourages lower speeds.
Pavement Marking/Restriping	W Main Street at Pioneer Drive	Yes	Low-cost improvement with projected safety benefit by minimizing conflict points attributed to merging within the functional area of the intersection.
RCUT with Single-Lane Roundabout	W Main Street at Pioneer Drive	No	Potential public opposition to the removal, restriction, and rerouting of movements. Concerns with high school student drivers navigating intersection design that requires U-turn movement. No safety or operational issues at southbound ramps intersection.
	W Main Street at Southbound US 19 On/Off Ramps		
RCUT with U-Turn Loon	W Main Street at Pioneer Drive	No	Potential public opposition to the removal, restriction, and rerouting of movements. Concerns with high school student drivers navigating intersection design that requires U-turn movement.
	W Main Street at Southbound US 19 On/Off Ramps		

Table 21: Phase 1 Alternatives to Move Forward to Phase 2 - US 19 Bypass at Regional Park Road Study Area

Alternative	Intersection	Move Forward to Phase 2?	Justification
RCUT with Signalized Rights	US 19 Bypass at Regional Park Road	No	Potential public opposition to the removal, restriction, and rerouting of movements. U-turn movement would require signalization. Does not address primary crash concern.
RCUT with Free Flow Rights	US 19 Bypass at Regional Park Road	No	Potential public opposition to the removal, restriction, and rerouting of movements. U-turn movement would require signalization. Does not address primary crash concern.
Remove Signalization with Right-In/Right-Out Access Management	US 19 Bypass at Regional Park Road	No	Potential public opposition to the removal, restriction, and rerouting of movements.
Signal Modification	US 19 Bypass at Regional Park Road	Yes	Low-cost improvement with projected safety benefit by addressing sun glare and speeding patterns observed in the study area.

Safety Improvements

1. Restripe Main Street to remove lane drop from functional area of intersection

Note: this safety improvement will be developed with a goal of implementing during the next repaving schedule as a part of Virginia's State of Good Repair (SGR) program. The existing conditions data does not appear to support the funding viability of a larger capital improvement project at this location.

Figure 33: Phase 1 Scoping Level Improvement Alternatives – W Main Street at Pioneer Drive Study Area

Safety Improvements

1. Dynamic All Red Extension (DARE) for traffic signal
2. Supplemental traffic signal heads not located in the horizon line

Note: these safety improvements will be developed with a goal of submitting for Virginia's Highway Safety Improvement Program (VHSIP) funding. The predominant needs identified at this location – red light running and rear end crashes partially caused by driver behavior and sun glare issues – are best addressed by these types of safety improvement projects.

Figure 34: Phase 1 Scoping Level Improvement Alternatives – US 19 Bypass at Regional Park Road Study Area

Chapter 2: Alternatives Refinement

2.1 Alternatives Refinement Overview

VHB further developed the alternatives chosen to be carried forward in Phase 2 including concept drawings and concept screening traffic operations and safety analysis.

SWG Meeting #4 was held on December 16, 2025. VHB presented revised concept sketches and concept screening results to receive feedback from the SWG. The SWG analyzed the alternatives based on impacts to safety, traffic operations, right-of-way, and estimated implementation timeline. The meeting concluded with the SWG determining next steps for the alternatives. The SWG Meeting #4 presentation was hosted on Mural, an online platform[4].

2.2 Phase 2 Alternatives

The SWG advanced into Phase 2 three alternatives, including two alternatives for the W Main Street at Pioneer Drive study area and one alternative for the US 19 Bypass at Regional Park Road study area. The two alternatives advanced for the W Main Street at Pioneer Drive study area were a single lane roundabout and a pavement marking / restriping project. The US 19 Bypass at Regional Park Road alternative was a signal modification. Section 2.2.1, Section 2.2.2, and Section 2.2.3 include a description, conceptual sketch, safety analysis, and screening level traffic operations analysis, where applicable, for each alternative.

The Single Lane Roundabout alternative was the only alternative where VHB conducted a screening-level traffic operations analysis. The additional alternatives, Pavement Marking/Restriping and Signal Modification, do not impact intersection operations and therefore do not require traffic operations analysis. The screening level traffic operations analysis for the Single Lane Roundabout alternative, as well as other analyses conducted by VHB for this alternative, can be found in Section 2.2.1.

VHB conducted a safety analysis for all alternatives. VHB determined the potential safety benefits for each alternative by analyzing Crash Modification Factors (CMFs). CMFs 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 Round 7 Planning Level CMF List. The CMF resulting in the highest projected crash reduction was applied to fatal and injury (F+I) crashes within the influence area of each intersection.

2.2.1. Single Lane Roundabout at Pioneer Drive

Alternative Description

The Single Lane Roundabout alternative proposes to install a 120-foot diameter roundabout at the W Main Street at Pioneer Drive intersection. This builds upon a small intersection safety study conducted in 2023 in

[4] https://app.mural.co/t/vhbipd8103/m/vhbipd8103/1762520616345/4c03f53d8d4bd92c70bc00d88dd73ea387b7fc3e

which a roundabout was recommended for the intersection. The alternative maintains all existing movements, accommodates school bus traffic, and includes a truck apron for larger heavy vehicles. Figure 35 presents a conceptual sketch of the alternative.

Four angle collisions at the W Main Street at Pioneer Drive intersection occurred from 2020 to 2024. By installing a Single Lane Roundabout, the alternative reduces the number of intersection conflict points and crash severity of turning movements.

Projected Traffic Operations Results for Alternative

VHB used *SIDRA* to conduct a traffic sensitivity analysis for the W Main Street at Pioneer Drive intersection to evaluate intersection operations under roundabout control (Existing Volumes) as well as a potential future scenario where Russell County high schools are consolidated to the existing Lebanon High School site. Input and analysis methodologies were consistent with the *VDOT Traffic Operations and Safety Analysis Manual (TOSAM), Version 2.0*. To ensure the roundabout alternative would be able to accommodate a potential consolidated Lebanon High School, existing turning movement volumes to and from Pioneer Drive were conservatively doubled. These volumes were used for evaluating the Consolidated Scenario.

Control delay (seconds per vehicle), LOS, and 95th percentile queue length (feet) were selected as measures of effectiveness to quantitatively report the performance of the intersection. Results are summarized below and documented in detail in Table 22 and Appendix F.

Compared to existing stop-control (Tables 13 and 14), the Single Lane Roundabout alternative performs very well, even under Consolidated Scenario traffic volumes. Under roundabout control, the eastbound left turn movement at Pioneer Drive showed significant improvement compared to existing stop-control conditions, with delay reductions of 46.3 seconds and 13.1 seconds in the AM and PM peak hours respectively.

The following trends were observed under the Consolidated Scenario:

AM Peak Hour

- Approaches at the intersection have minimal approach delays
- The eastbound left movement experienced the largest reduction in movement delay (-46.3 seconds per vehicle)
- The longest queue is at the southbound approach at 324.6 feet. This queue length does not spill back into any other intersections.
- The highest movement delay occurs at the eastbound left movement (12.8 seconds per vehicle)

PM Peak Hour

- Approaches at the intersection have minimal approach delays
- The eastbound left movement experienced the largest reduction in movement delay (-13.1 seconds per vehicle)
- The longest queue is at the southbound approach at 136.4 feet. This queue length does not spill back into any other intersections.
- The highest movement delay occurs at the eastbound left movement (12.4 seconds per vehicle)

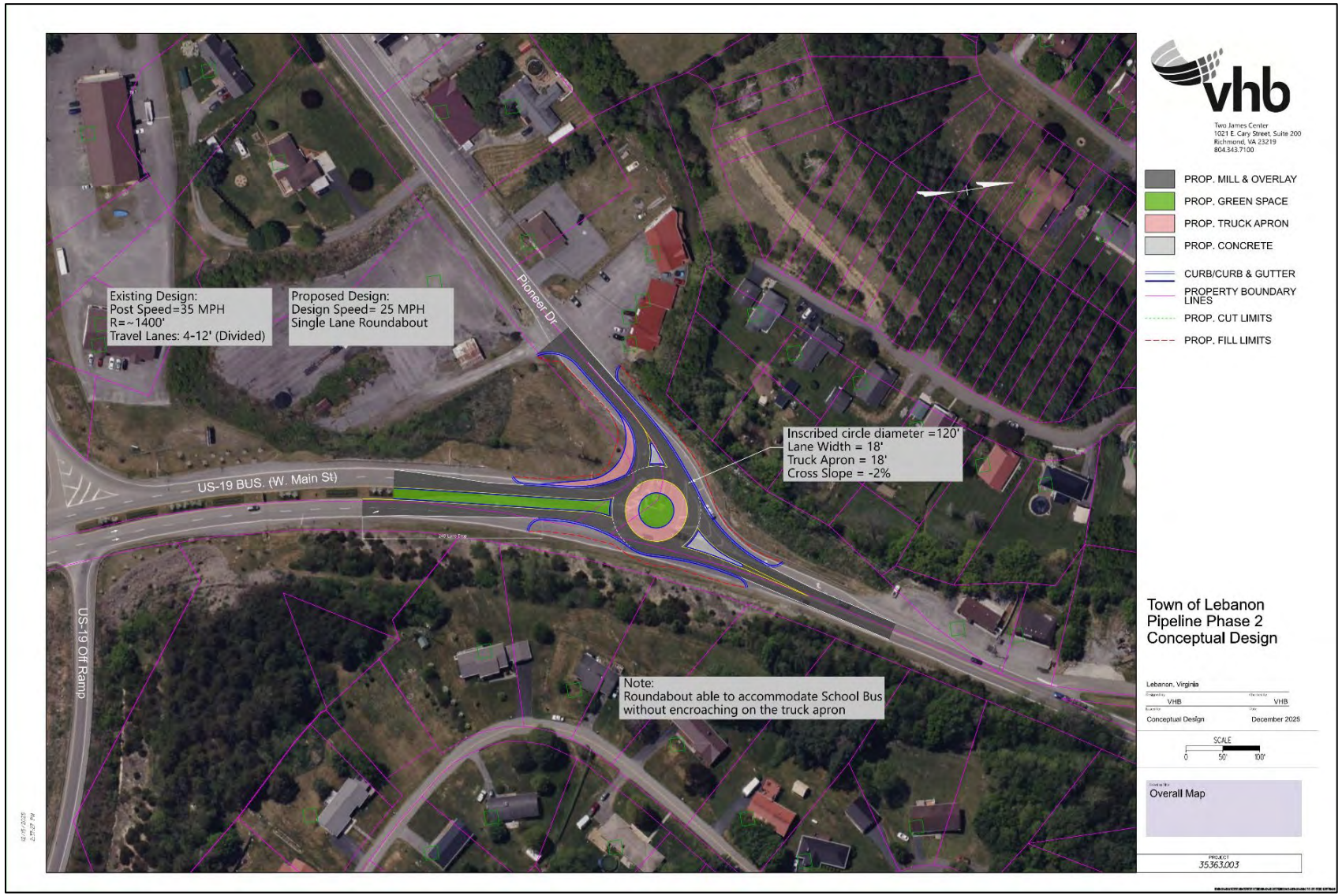


Figure 35: Phase 2 Alternative – Single Lane Roundabout

Table 22: Traffic Operations Analysis for W Main Street at Pioneer Drive – Single Lane Roundabout

Approach/ Movement	Existing Volumes AM		Consolidated Volumes AM		Existing Volumes PM		Consolidated Volumes PM	
	Delay, sec (LOS)	Queue Length, ft	Delay, sec (LOS)	Queue Length, ft	Delay, sec (LOS)	Queue Length, ft	Delay, sec (LOS)	Queue Length, ft
W Main St								
NBL	10.0 (A)	115.9	12.7 (B)	192.1	9.8 (A)	62.5	11.3 (B)	93.8
NBT	4.5 (A)		7.2 (A)		4.2 (A)		5.6 (A)	
Approach	5.8 (A)		9.3 (A)		5.2 (A)		7.2 (A)	
W Main St								
SBT	4.9 (A)	135.2	10.9 (B)	324.6	3.8 (A)	82.7	4.7 (A)	136.4
SBR	5.1 (A)		11.1 (B)		4.0 (A)		4.9 (A)	
Approach	5.0 (A)		11.0 (B)		3.8 (A)		4.8 (A)	
Pioneer Dr								
EBL	11.9 (B)	46.4	12.8 (B)	114.7	11.3 (B)	39.2	12.4 (B)	107.4
EBR	6.4 (A)		7.4 (A)		5.9 (A)		7.0 (A)	
Approach	9.6 (A)		10.5 (B)		9.1 (A)		10.2 (B)	
Intersection	**6.1 (A)**	**-**	**10.3 (B)**	**-**	**5.4 (A)**	**-**	**7.1 (A)**	**-**

Projected Crash Reduction for Alternative

Converting a stop/yield control intersection to a roundabout is listed in the SMART SCALE Round 7 Planning Level CMF List at 0.18, indicating an expected 82% reduction in crashes with this alternative. Applying the CMF to the eight crashes that occurred within the W Main Street and Pioneer Drive intersection over the five-year study period yields an Annual Crash Reduction of 1.31 crashes per year. Table 23 displays the CMF and the crash reduction for the alternative.

It should be noted though that the most severe crash at this intersection was the result of a medical emergency and was thus randomly geographically located. Two of the four angle crashes occurred in 2020 and will thus be soon outside the five-year crash evaluation window for project funding consideration. Given these considerations, the SWG felt that the actual crash reduction benefit of the roundabout is lower than indicated by the data in Table 23.

Table 23: CMF and Crash Reduction Summary – Single Lane Roundabout

Improvement Type/Feature	CMF	Annual Crash Reduction
Convert Stop/Yield Control Intersection to Roundabout	0.18	1.31

2.2.2. Pavement Marking/Restriping on W Main Street

Alternative Description

This concept would install new pavement markings on the northbound W Main Street approach to relocate the northbound two-to-one lane drop further upstream, outside of the functional area of the W Main Street at Pioneer Drive intersection. This restriping would safely transition northbound traffic from two lanes to one lane before vehicles enter the intersection influence area. Figure 36 presents a conceptual sketch of the alternative.

Projected Crash Reduction for Alternative

Although installing new pavement markings does not have an associated CMF in the SMART SCALE Round 7 Planning Level CMF List, VHB believes these measures improve the safety of the intersection by encouraging safer merging movements attributed to the lane drop further upstream.

Figure 36: Phase 2 Alternative — Pavement Marking/Restriping

2.2.3. Signal Modification at Regional Park Road

Alternative Description

The Signal Modification alternative proposes to install a standalone supplemental signal head outside of the horizon line to address visibility issues caused by sun glare impairing the existing signal heads for southbound traffic on US 19 Bypass. Additionally, this alternative includes the implementation of Dynamic All-Red Extension (DARE) for both US 19 Bypass approaches, an Intelligent Transportation Systems (ITS) technology that allocates additional all red time when detectors identify that an approaching vehicle is likely to run a red light based on the vehicle's trajectory. Figure 37 presents a conceptual sketch of the alternative.

Six crashes at the US 19 Bypass at Regional Park Road intersection were attributed to red light running. Red light running can occur for multiple reasons, including driver inattention, aggressiveness, or inability to see the signal head display. By installing the supplemental signal head, visibility concerns related to sun glare are mitigated, reducing the likelihood of one red light violation source. Moreover, the implementation of DARE mitigates collision risk between red light running vehicles and vehicles legally within the intersection by extending the all-red clearance time for red light running vehicles to clear the intersection prior to the next vehicle phase receiving the green signal display.

Projected Crash Reduction for Alternative

Although addressing visibility concerns attributed to sun glare and the implementation of DARE do not have an associated CMF in the SMART SCALE Round 7 Planning Level CMF List, VHB believes these measures mitigate the red-light running crash pattern. The calculated Annual Crash Reduction is up to 1.2 crashes per year, based on six crashes involving the red-light running pattern over the five-year analysis period.

2.3 Phase 2 Public Involvement

Public involvement was not conducted for this study. As Section 2.4 details, the SWG did not advance any alternatives to Phase 3 or SMART SCALE funding and therefore determined that public engagement was not necessary.

Figure 37: Phase 2 Alternative — Signal Modifications

2.4 Preferred Alternative Selection

The Project Pipeline Program requires that all recommended improvements be categorized 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 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.

Following evaluation of the three alternatives, the SWG determined that none of the alternatives warranted categorization as a Mid-Term Investment Strategy – otherwise known as the "Preferred Alternative" – and thus, none will advance to Phase 3 of Project Pipeline or pursue SMART SCALE funding. Table 24 summarizes the alternatives considered in Phase 2 and gives the justification for not advancing to Phase 3.

The Single Lane Roundabout alternative at Pioneer Drive was categorized as a Long-Term Investment Vision. The SWG concluded that the existing conditions data does not appear to currently support the funding viability of a larger capital improvement project. If Russell County schools pursue consolidation in the future, or if there is an uptick in crash activity, then the roundabout could be pursued.

The Pavement Marking/Restriping and Signal Modifications alternatives were both categorized as Short Term Recommendations. These low-cost improvements can be implemented through state or local forces without requiring SMART SCALE funding or Phase 3 development. The Pavement Marking/Restriping alternative can be implemented during the next repaving schedule as part of Virginia's State of Good Repair (SGR) program. The Signal Modifications alternative requires further evaluation and coordination with VDOT Central Office regarding statewide DARE implementation and will be developed with a goal of submitting for Innovation and Technology Transportation Fund (ITTF) funding. The predominant safety needs identified at the US 19 Bypass at Regional Park Road intersection (red light running and rear-end crashes partially caused by driver behavior and sun glare issues) are best addressed by safety improvement projects, making this alternative well-aligned with VHSIP or ITTF funding priorities. Appendix G includes the Phase 2 Preferred Alternative Summary.

Table 24: Phase 2 Alternatives to Move Forward to Phase 3

Alternative	Intersection	Move Forward to Phase 3?	Justification
Single-Lane Roundabout	W Main Street at Pioneer Drive	No	Categorized as Long-Term Investment Vision that would not involve a need for SMART SCALE funding or Phase 3 of Project Pipeline.
Pavement Marking/Restriping	W Main Street at Pioneer Drive	No	Low-cost improvement categorized as a Short Term Recommendation that would not involve a need for SMART SCALE funding or Phase 3 of Project Pipeline.
Signal Modifications	US 19 Bypass at Regional Park Road	No	Low-cost improvement categorized as a Short Term Recommendation that would not involve a need for SMART SCALE funding or Phase 3 of Project Pipeline. Further evaluation and coordination with VDOT Central Office regarding DARE implementation is needed.