PROJECT PIPELINE

CU-23-07: FAUQUIER COUNTY
US ROUTE 17 BUSINESS (SHIRLEY AVENUE) FROM FROST AVENUE (ROUTE 211) TO ALWINGTON BOULEVARD

DRPT Office of INTERMODAL Planning and Investment VDOT

US Route 17 Business (Shirley Avenue) from Frost Avenue (Route 211) to Alwington Boulevard

Phase 2 Report

June 2024

Prepared for

VDOT Virginia Department of Transportation

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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: vaprojectpipeline.org.

This study focuses on concepts targeting identified needs including congestion mitigation, safety improvement, pedestrian and bicycle infrastructure along the corridor, and transit access. The objectives of Project Pipeline are shown below in **Figure 1-1.**

Figure 1-1: Project Pipeline Objectives

1.2 Background

The Office of Intermodal Planning and Investment (OIPI) prepared the VTrans Virginia's statewide transportation plan for the Commonwealth Transportation Board (CTB) in which mid-term needs (0 - 10 years) were identified for different categories listed in **Table 1-1.** This study focuses on addressing needs identified in VTrans, and those previously identified by the localities.

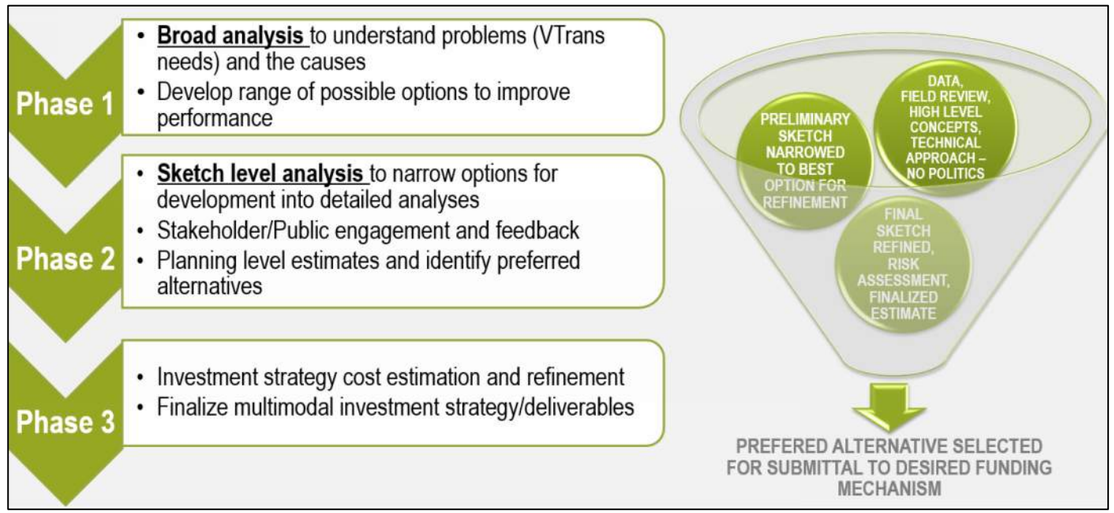
Table 1-1: List of VTrans Needs

VTrans Needs
Safety Improvement
Transportation Demand Management
Congestion Mitigation
Pedestrian Safety Improvement
Transit Access
Capacity Preservation
Bicycle Access

1.3 Methodology

The study is broken down into three phases. Phase I is the problem diagnosis and brainstorming alternatives, Phase II is the alternative evaluation and sketch level analysis, and Phase III is the investment strategy and cost estimates. Details on methods and solutions for each study phase are outlined below in **Figure 1-2**.

Figure 1-2: Study Phase Methods and Solutions



The study team is broken down into Technical Teams to improve the efficiency and effectiveness of the study process through extensive collaboration and synchronicity. To achieve the intended efficiency and consistency, it is generally expected that the same Technical Team will be responsible for all studies within a district for the duration of the cycle.

Each Technical Team will include certain leadership and technical roles that will be needed for each study, including the following:

- VDOT District Planning Project Manager – Provides leadership and direction; has overall responsibility for the study progress and outcomes.
- Consultant Team Manager – Provides direct support to the VDOT District Planning Project Manager; coordinates the work and technical efforts of consultant staff.
- District Planning Staff – Provides technical input regarding capacity, forecasting, land use, multimodal, and planning.
- District Traffic Engineering Staff – Provide technical input regarding safety and operations.
- Consultant Team Technical Staff – Provides multidisciplinary input, analysis, technical support, and expertise for the identified VTrans need categories.

A sample organizational chart, including the roles, responsibilities, and structure of a Technical Team is shown below in **Figure 1-3**.

Figure 1-3: Structure of a Technical Team

Additional team members and roles should be considered where appropriate. Certain roles may not be necessary for all studies. However, the following roles may contribute to study success during different stages and/or for different types of study areas, as shown in **Table 1-2**.

Table 1-2. Roles and Responsibilities for the Technical Team and SWGs

Phase	Responsibility	Role					
		OIPI/Program Support	District	Consultant	DRPT	Locality	VDOT Central Office
Study Selection & Initiation	Identify Study Needs and Priorities		X		X	X	
	Coordinate with CTB Members	X	X				
	Approve final study locations	X					
	Data Collection Planning		X				
	Data Dashboards	X					
	Assign Consultants & Issue Consultant Task Orders	X					X
Phase 1	Initiate Study & Hold Kickoff Meeting		X	X	X		
	Prepare Framework Document		X	X			
	Approve Framework Document		X		X	X	
	Provide Existing Data		X		X	X	
	Collect New Data			X			
	Coordinate with local leaders					X	
	Conduct & Support Initial Public Outreach (if desired)	X	X	X		X	X
	Diagnose Existing Needs			X			
	Brainstorm & Develop Preliminary Alternatives		X	X	X		X
	Present Diagnosis & Alternatives to SWG			X			
	Provide Feedback and Input on Analysis & Alternatives					X	
	Develop Phase 2 Scope of Work			X			
	Approve Scope & Issue Consultant Task Orders	X					X
Phase 2	Conduct Detailed Analysis of Alternatives			X			
	Develop Refinements to Alternatives		X	X	X		X
	Present Alternative Analysis Findings to SWG		X	X			
	Provide Feedback on Alternatives				X	X	X
	Prepare Planning Level Cost Estimates			X			
	Conduct & Support Public Outreach on Alternatives	X	X	X		X	
	Concurrence on Preferred Alternative(s)		X		X	X	X
	Develop Phase 3 Scope of Work			X			
	Approve Scope & Issue Consultant Task Orders	X					X
Phase 3	Conduct Alternative Risk Assessment		X	X			X
	Develop Practical Concept Design & Address Risk of Preferred Alternative		X	X			
	Prepare Cost Estimate with Workbook			X			
	Document Assumptions & Basis of Cost			X			
	Review & Concur with Concept & Estimate		X		X		X
Investment, Application, & Closeout	Prepare Final Study Deliverables, Design Packages, and Estimates			X			
	Apply for Funding of Preferred Alternative(s)				X	X	
	Application Support	X	X	X			
	Submit and Documentation and All Related Work			X			
	Review and approve final deliverables for public visibility		X		X		
	Program Closeout and Summary	X					

1.4 Study Area

The US Route 17 Business (Shirley Avenue) study corridor from Frost Avenue/Waterloo Street (Route 211) to Alwington Boulevard is located in Fauquier County, Virginia. US Route 17 Business is classified as an *Other Principal Arterial* road within the study area. The posted speed limit along US Route 17 Business is 40 MPH. The study corridor is an undivided roadway with intermittent two-way-left-turn lanes. A map presenting the overall study area and study corridor is shown below in **Figure 1-4.**

Figure 1-4: US Route 17 Business Study Area Map

VTrans is Virginia's statewide transportation plan. It identifies and prioritizes locations with transportation needs using data-informed transparent processes. The policy for identifying VTrans mid-term needs establishes multimodal need categories that correspond to the Commonwealth Transportation Board-adopted VTrans visions, goals, and objectives.[1] Each need category has one or more performance measures and thresholds to identify one or more needs. Visit the Vtrans policy guide for additional information: https://vtrans.org/resources/VTrans_Policy_Guide_v6.pdf.

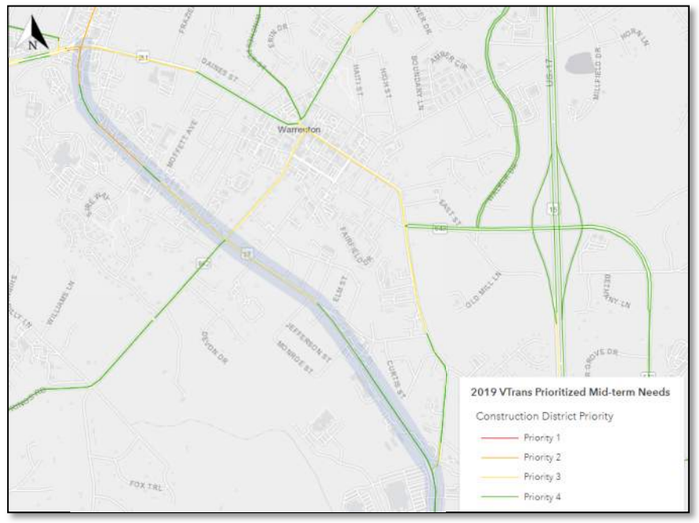
The mid-term needs, as identified in VTrans for the US Route 17 Business study corridor, were identified as 'Very High' for Congestion Mitigation and Transit Access for Equity Emphasis Areas; 'High' for Bicycle Access, Safety Improvement, and Transportation Demand Management; and 'Medium' for Pedestrian Access as presented in **Table 1-3.**

Table 1-3: VTrans Needs in Study Area

VTRANS IDENTIFIED NEEDS	PRIORITIES
Bicycle Access	High
Capacity Preservation	None
Congestion Mitigation	Very High
IEDA (UDA) Access	None
Pedestrian Access	Medium
Safety Improvement	High
Pedestrian Safety Improvement	None
Reliability	None
Rail On-time Performance	None
Transit Access	Select
Transit Access for Equity Emphasis Areas	Very High
Transportation Demand Management	High

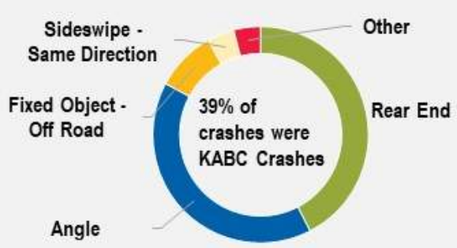
These mid-term needs, identified in VTrans, are prioritized on a tier from 1 to 4, with 1 being the most critical and 4 being the least critical. The segments ranked as "Priority 1" represent those with multiple categories identified as high in need. **Figure 1-5** presents the overview map of the study area with the 2019 VTrans mid-term needs prioritized for construction in the district with **Figure 1-6** presenting the detailed pipeline project overview for US Route 17 Business.

Figure 1-5: 2019 VTrans Prioritized Mid-term Needs in the Study Area



[1] Commonwealth Transportation Board, Actions to Approve the 2019 VTrans Vision, Goals, Objectives, Guiding Principles and the 2019 Mid-term Needs Identification Methodology and Accept the 2019 Mid-term Needs, January 15, 2020

Figure 1-6: Project Overview for US Route 17 Business from Frost Avenue to Alwington Boulevard



Issues in the Study Area

198 crashes were reported in the study area, of which one hundred and sixty-four (164) crashes (83%) occurred at or within 150 feet of an intersection.

The closest park & ride lot is at Colonial Road and US Route 15/29 intersection, outside the study area

No bike lanes or shared use path exist along Route 17 BUS. Warrenton Branch Greenway is located east of the study corridor.

Warrenton Transit operates with 45-min frequency along Route 17 BUS from 7:30 AM to 7:30 PM. There are existing bus stops in the vicinity of Green St and Cleveland St intersections.

Multimodal Safety and recurring peak hour congestion are the top ranked public concerns in the study area.

Sidewalk exists along both sides of Route 17 BUS from Frost Ave to Culpepper St, and on the north side between Warrenton Community Center entrance to Alwington Blvd. Crosswalks have adequate markings with curb ramps. Ped signals – with push buttons and countdown heads noticed at Culpeper St and Frost Ave intersections.

Project Purpose, Goals, & Objectives

Analyze the operational and safety issues identified along US Route 17 Business, with a focus on providing enhanced safety improvements.

Identify cost-effective preferred improvement alternatives that address the deficient conditions and prioritize safety.

Project Fact Sheet	
VDOT District	Culpeper
Locality	Town of Warrenton
Corridor Length	2 miles
Nearby Transit Connections	VA Regional Transit
Nearby Bikeways	Warrenton Branch Greenway
Functional Classification	Other Principal Arterial
Speed Limit	40 mph

1.5 Previous Study Efforts

A review of relevant study efforts in the study area vicinity and corresponding highlights are presented below.

- 1997/1998 widening plans of US Route 17 Business.
- Town of Warrenton 2040 Comprehensive Plan
- Town of Warrenton Complete Streets Guidelines
- 2017 Walkability Audit
- Arrington Property TIA
- Taylor Middle School TIA
- US 15/17/29 STARS (on-going)
- Current intersection improvement at W Shirley Ave. / Broadview Ave. & Frost Ave. / Waterloo St. (UPC 111648)

These reports helped inform the study team of prior improvement efforts and ongoing projects that may impact the study. Additionally, they provided additional insight into local priorities and planning focus areas. The TIA documents offered context and important growth data to upcoming development efforts that will impact the Shirley Avenue corridor study area.

1.6 FHWA STEAP Tool Analysis

The FHWA Screening for Equity Analysis of Projects (STEAP) Tool was reviewed for the corridor and surrounding areas. This tool is used to discover key population metrics and needs for the study area to raise awareness of equity needs in the selection of alternatives. The data source used for the analysis was the American Community Survey 2016 – 2020, and a 0.5-mile radius was used for the analysis buffer. The full STEAP Tool report is provided in **Appendix A,** and the results of the STEAP Tool analysis are presented below:

- The majority of the population (62%) within the study area is between the ages of 18 and 64, as shown in **Figure 1-7**.
- There is a high personal vehicle ownership, with 62% of households owning two or more vehicles. Only 4% of households do not own a personal vehicle as shown in **Figure 1-8**.
- Of the population within the study area, 7% are age 5+ Non-English at Home and speak English very well, as shown in **Figure 1-9.**
- When compared to Fauquier County and the State of Virginia, the study area has a lower-than-average proportion of veterans, people with disabilities, households with no computers, and households without internet connection, as shown in **Figure 1-10**.
- Of all the households in the study area, 53% have household income greater than $75,000, as shown in Figure 1-11.

Figure 1-7: STEAP Tool Analysis Population by Age Group

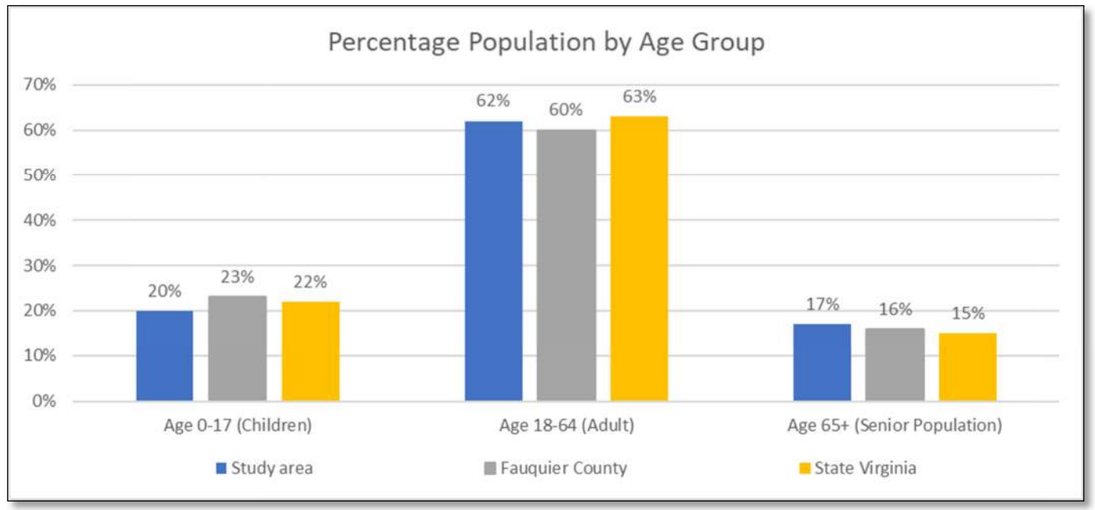


Figure 1-8: STEAP Tool Analysis Vehicle Ownership

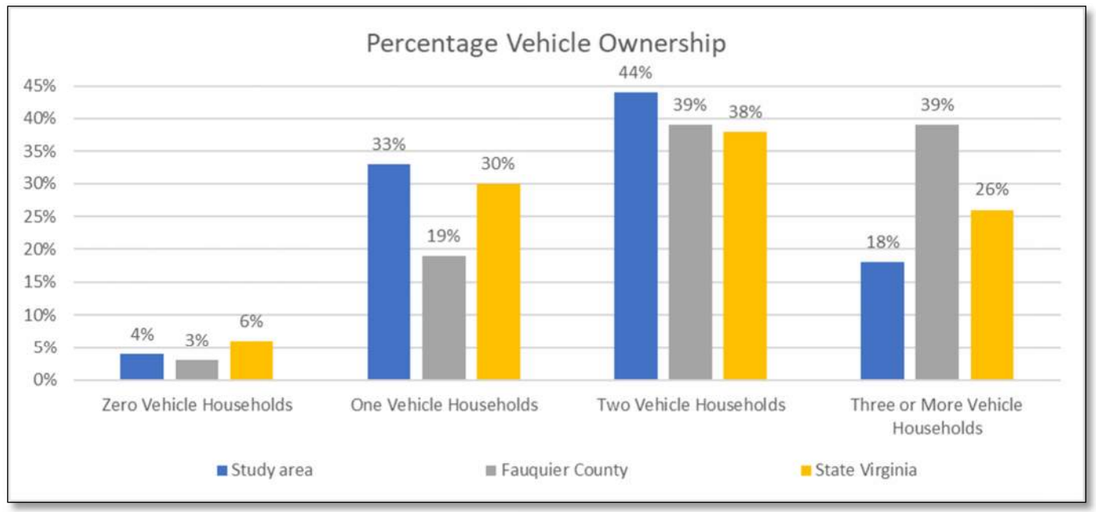


Figure 1-9: STEAP Tool Analysis Non-English at Home

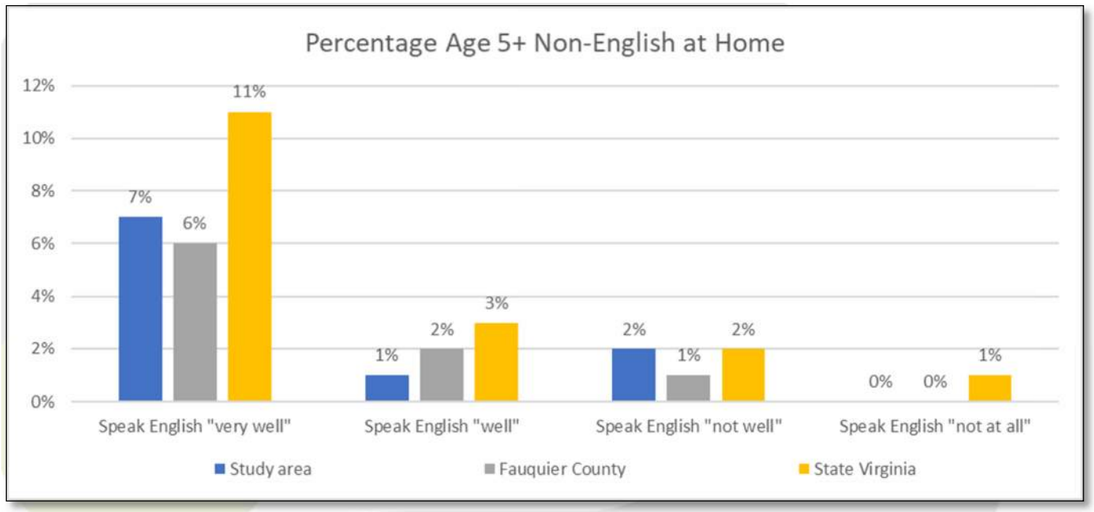


Figure 1-10: STEAP Tool Analysis Vulnerable Populations

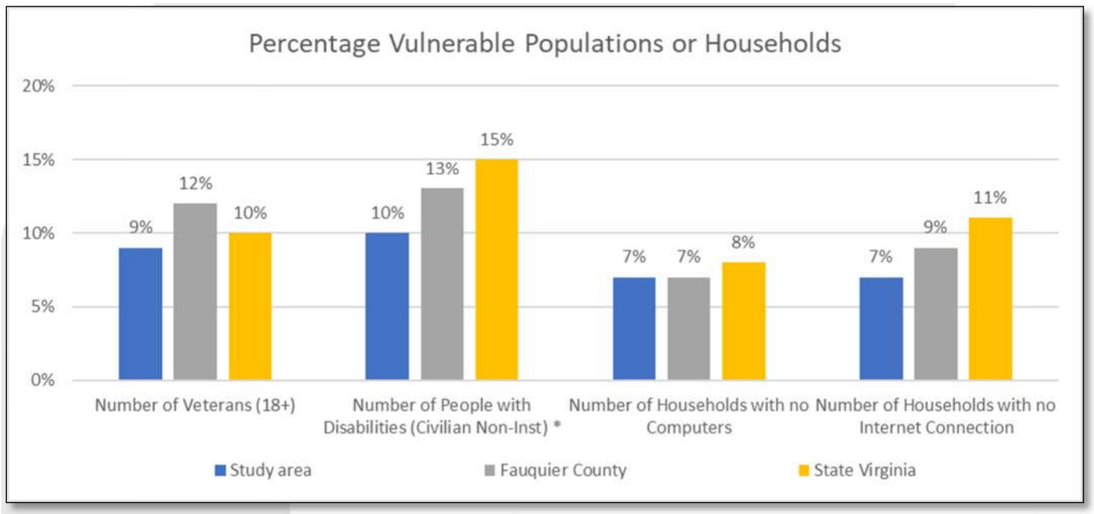
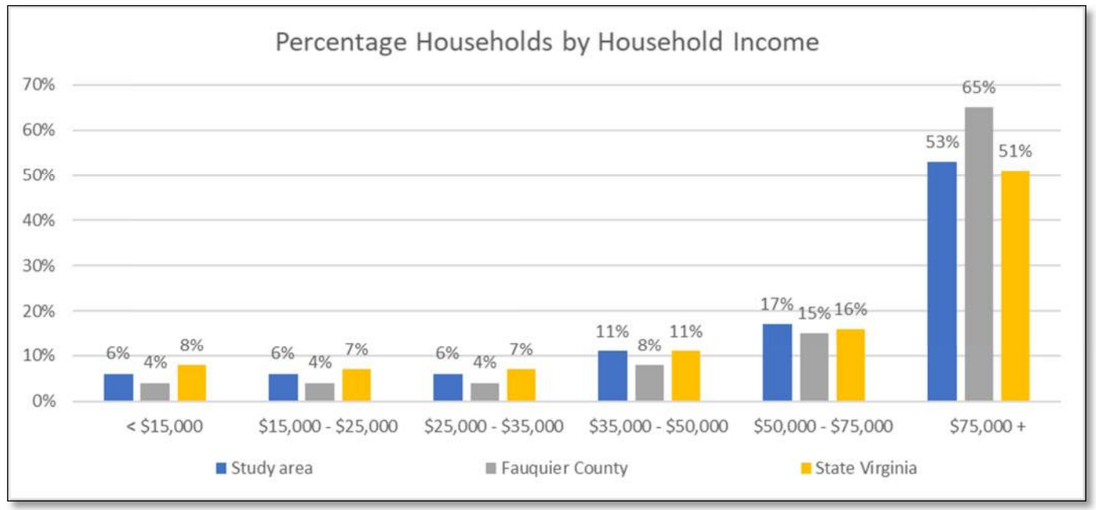


Figure 1-11: STEAP Tool Analysis Household Income



1.7 Traffic Operations and Accessibility

1.7.1 Traffic Data

The traffic data for the study area was obtained from 12-hour turning movement counts collected on Thursday, May 18, 2023. The counts were collected from 6:00 AM to 6:00 PM. The corridor AM peak hour was determined to be 8:00 AM to 9:00 AM, and the corridor PM peak hour was determined to be 3:00 PM to 4:00 PM. Raw traffic counts are provided in **Appendix A – ,** and the intersection volumes are shown in **Figure 1-12**. **Figure 1-13** presents the average US Route 17 Business corridor travel times (minutes), travel time indices (ratio of travel time during the individual hour to free-flow conditions), and speed (MPH) based on INRIX data.

- The average northbound US Route 17 Business travel time during AM and PM hours was identified to be under five minutes (300 seconds), with an average travel time index of approximately between 1.10 and 1.20. The average speed varied between 28 MPH to 32 MPH.
- The average southbound US Route 17 Business travel time during AM and PM hours was identified to be approximately nine minutes (540 seconds), with an average travel time index of approximately between 1.10 and 1.20. The average speed varied between 28 MPH to 32 MPH.

1.7.2 Traffic Operations

Overall, the US Route 17 Business corridor and corresponding intersections operate at an acceptable level of service (LOS D or better), with one exception presented below. Traffic analysis outputs are provided in **Appendix B,** and the results are presented in **Table 1-4**.

- The US Route 17 Business intersection with Frost Avenue/Waterloo Street operates at LOS F during the AM and PM peak hours. Notably, the significantly high conflicting volumes (See Figure 12) across all approaches during AM and PM peak hours result in failing level operations.

Table 1-4: Existing Condition Intersection Operation Analysis Results for Route 17 Business

Study Intersection	Intersection Control	Street Name	Approach	AM Peak Hour				PM Peak Hour			
				Approach Delay (s)	Approach LOS	Overall Delay (s)	Overall LOS	Approach Delay (s)	Approach LOS	Overall Delay (s)	Overall LOS
Frost Avenue/ Waterloo Street*	Signalized	Shirley Ave	Northbound	46.5	D	160.5	F	94.0	F	103.1	F
		Waterloo St	Westbound	48.4	D			68.9	E		
		Broadview Ave	Southbound	39.8	D			141.0	F		
		Frost Ave	Eastbound	316.1	F			56.4	E		
Hospital Drive	Unsignalized	Shirley Ave	Northbound	0.9	A	1.1	A	0.2	A	2.9	A
		Shirley Ave	Southbound	0.0	A			0.0	A		
		Hospital Dr	Eastbound	20.1	C			33.1	D		
Garrett Street	Unsignalized	Shirley Ave	Northbound	0.0	A	0.1	A	0.0	A	0.3	A
		Garrett St	Westbound	11.6	B			12.5	B		
		Shirley Ave	Southbound	0.1	A			0.3	A		
Carriage House Lane/Manor Ct*	Signalized	Shirley Ave	Northbound	14.7	B	16.2	B	14.2	B	16.4	B
		Manor Ct	Westbound	31.3	C			29.7	C		
		Shirley Ave	Southbound	15.2	B			15.8	B		
		Carriage House Ln	Eastbound	28.0	C			24.6	C		
Moffett Avenue	Unsignalized	Shirley Ave	Northbound	0.3	A	0.7	A	0.3	A	0.7	A
		Moffet Ave	Westbound	14.7	B			18.3	C		
		Shirley Ave	Southbound	0.1	A			0.1	A		
		Parking Lot	Eastbound	16.0	C			15.5	C		
Keith Street	Unsignalized	Shirley Ave	Northbound	0.4	A	2.3	A	0.1	A	2.6	A
		Keith St	Westbound	15.7	C			16.5	C		
		Shirley Ave	Southbound	1.0	A			1.0	A		
		Parking Lot	Eastbound	34.6	D			37.0	E		
Culpeper Street*	Signalized	Shirley Ave	Northbound	26.7	C	28.4	C	26.9	C	30.5	C
		Culpeper St	Westbound	43.2	D			41.0	D		
		Shirley Ave	Southbound	21.5	C			27.7	C		
		Culpeper St	Eastbound	42.0	D			42.3	D		
Green Street	Unsignalized	Shirley Ave	Northbound	0.1	A	0.7	A	0.1	A	1.3	A
		Green St	Westbound	13.7	B			15.6	C		
		Shirley Ave	Southbound	0.3	A			0.4	A		
		Parking Lot	Eastbound	21.2	C			22.9	C		
Madison Street	Unsignalized	Shirley Ave	Northbound	0.0	A	0.4	A	0.0	A	0.6	A
		Madison St	Westbound	12.6	B			12.8	B		
		Shirley Ave	Southbound	0.4	A			0.5	A		
Middle School Exit	Unsignalized	Shirley Ave	Northbound	0.0	A	0.3	A	0.0	A	0.2	A
		Middle School	Eastbound	14.7	B			15.9	C		
		Shirley Ave	Southbound	0.0	A			0.0	A		
Falmouth Street**	Roundabout	James Madison Hwy	Northbound	4.0	A	3.8	A	3.7	A	3.3	A
		Falmouth St	Westbound	8.7	A			7.3	A		
		Shirley Ave	Southbound	1.5	A			1.7	A		
Alwington Boulevard*	Signalized	Shirley Ave	Northbound	13.8	B	17.6	B	16.2	B	24.0	C
		Industrial Rd	Westbound	33.6	C			41.2	D		
		Shirley Ave	Southbound	16.0	B			21.8	C		
		Alwington Blvd	Eastbound	27.3	C			31.1	C		

*HCM 2000 results reported for the intersection

**SIDRA Standard results reported for the roundabout

Figure 1-12: US Route 17 Business Corridor Intersection Turning Movement Counts

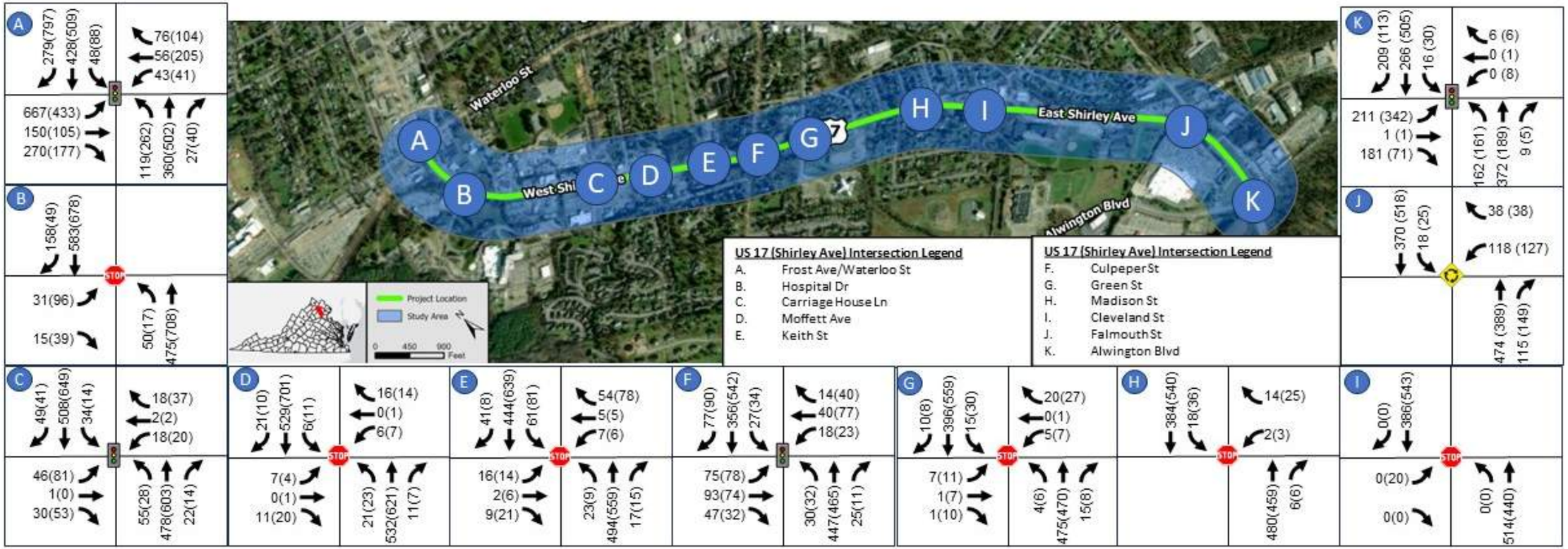
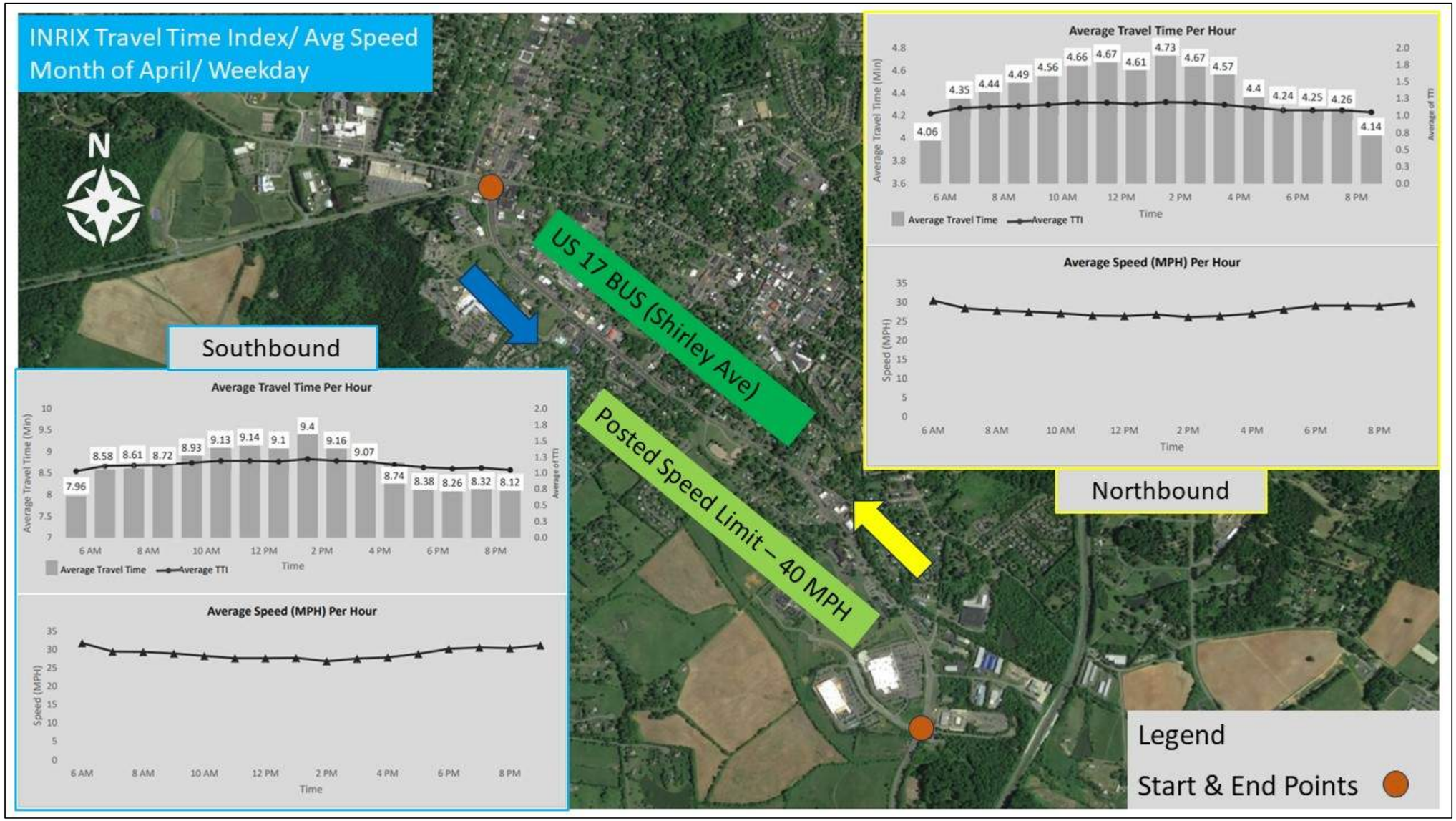


Figure 1-13: INRIX Travel Time Index and Average Speed



1.8 Safety and Reliability

The VDOT Crash Analysis PowerBI Tool was utilized to analyze safety history at the study intersections and along the US Route 17 Business corridor. Crash data was collected and analyzed for a five-year period spanning from January 2018 to December 2022. The study team reviewed the FR-300 reports provided by VDOT to determine specific trends and "hot spot" areas for consideration in developing alternative improvement concepts. For this analysis, "injury crashes" is defined as the sum of type K (fatal injury), A (severe injury), B (visible injury), and C (non-visible injury) crashes. Raw crash data is provided in **Appendix D**. The detailed collision diagrams (FR 300s) are shown in **Appendix E**.

1.8.1 Safety Analysis Results

A total of one-hundred and ninety-eight (198) crashes were reported within the US Route 17 Business study corridor limits during the five-year study period. The US Route 17 Business crashes are summarized by severity in **Table 1-5** and by type in **Table 1-6.** A breakdown of reported crash history by lighting conditions, adverse weather conditions, and other related factors including alcohol, speeding, and guardrail, are summarized in **Table 1-7**.

Table 1-5: Study Area Crash Severity by Year

Crash Year and Severity	K. Fatal Injury	A. Severe Injury	B. Visible Injury	C. Nonvisible Injury	PDO. Property Damage Only	Total
2018	0	2	4	16	28	**50**
2019	0	1	5	5	27	**38**
2020	0	1	2	7	24	**34**
2021	1	0	0	9	26	**36**
2022	0	3	3	18	16	**40**
Total	**1**	**7**	**14**	**55**	**121**	**198**

A total of 198 crashes were reported within the US Route 17 Business study corridor during the five-year study period.

Key takeaways from the crash data are as follows:

1. Year-to-year crash occurrence varies, with the highest number of crashes (50) occurring in 2018, followed by a downward trend through 2022 (40 crashes).
2. A relatively notable percentage of injury (38%) related incidents were reported along the study corridor. Property damage only crashes (PDO) accounted for approximately 61% of the total crashes.
3. The one reported fatal crash during the study time period, occurred in November of 2021 at the start of the AM peak period. The crash report stated that "Driver 1 was experiencing a medical emergency and ran off the road on East Shirley Avenue. Vehicle 1 struck a traffic sign and continued to travel off the road, which then struck Vehicle 2.
4. There were 164 crashes (83%) which occurred at or within 150 feet of an intersection.
5. A majority of reported crashes within the corridor were rear-end (42%) collisions, followed by angle (40%) collisions.
6. The US Route 17 Business intersections with Frost Avenue/Waterloo Street and with Culpeper Street accounted for approximately 37% and 11% of total study area crashes, respectively.
7. Distracted driving was listed as a contributing factor for a significant number of crashes along the US 17 corridor. Forty-five (45) crashes had reported cases of distracted driving, making up 23% of the total crashes.
8. There were 11 crashes (6%) that were related to speeding. There were 19 crashes (10%) that occurred during adverse weather conditions.
9. Senior drivers were involved in 35% of the crashes, and young drivers were involved in 25% of the crashes.

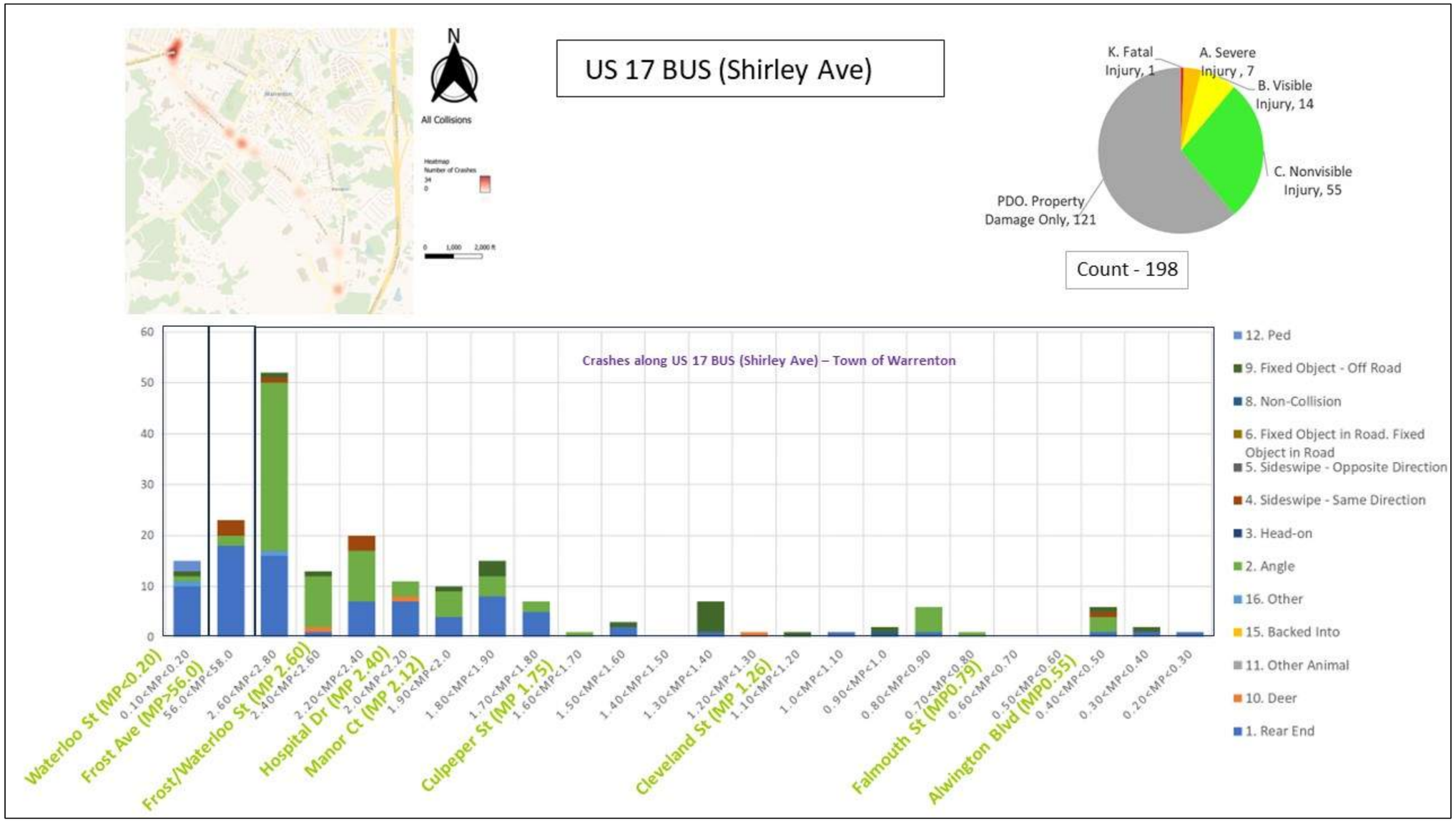
Table 1-6: Study Area Crash Severity by Type

Crash Type and Severity	K. Fatal Injury	A. Severe Injury	B. Visible Injury	C. Nonvisible Injury	PDO. Property Damage Only	Total
Rear End	0	2	6	28	48	**84**
Angle	0	3	7	18	52	**80**
Head On	0	0	0	0	0	**0**
Sideswipe – Same Direction	0	0	0	0	8	**8**
Fixed Object in Road	0	0	0	0	0	**0**
Non-Collision	0	0	0	1	0	**1**
Fixed Object – Off Road	1	2	1	5	9	**18**
Deer	0	0	0	0	3	**3**
Other Animal	0	0	0	0	0	**0**
Ped	0	0	0	2	0	**2**
Other	0	0	0	1	1	**2**
Total	**1**	**7**	**14**	**55**	**121**	**198**

Table 1-7: Study Area Crash Type and Lighting, Adverse Weather, Alcohol, Speeding, and Guardrail Conditions

Crash Type and Other Related Factors	Lighting Conditions		Weather Conditions						Alcohol Related		Speeding Related		Guardrail Related	
	Daylight	Darkness	No Adverse Conditions	Fog	Mist	Rain	Snow	Sleet/Hail	Yes	No	Yes	No	Yes	No
Rear End	77	7	76	0	0	8	0	0	0	84	3	3	84	0
Angle	65	15	71	1	3	5	0	0	1	79	3	3	80	0
Head On	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sideswipe – Same Direction	6	2	8	0	0	0	0	0	1	7	1	1	8	0
Fixed Object in Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-Collision	1	0	1	0	0	0	0	0	0	1	0	0	1	0
Fixed Object – Off Road	7	11	17	1	0	0	0	0	3	15	3	3	12	6
Deer	1	2	3	0	0	0	0	0	0	3	0	0	3	0
Other Animal	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ped	0	2	1	0	0	1	0	0	0	2	0	0	2	0
Other	1	0	2	0	0	0	0	0	0	2	1	1	2	0
Total	**159**	**39**	**179**	**2**	**3**	**14**	0	0	**5**	**193**	**187**	**11**	**192**	**6**

Figure 1-14: US 17 Business Crossover Locations and Crash Types



1.11 Phase 1 Corridor/Existing Conditions Public Outreach & Involvement

Initial Public Outreach was conducted to inform the public of the study efforts and goals and solicit feedback on what the public's priorities and perceptions of the corridor are to include in the evaluation of potential alternatives. The survey was conducted through Publicinput.com, and there were 402 participants. The raw results of the public survey are provided in **Appendix F**.

The survey shows that the major needs of the corridor, as identified via the public feedback, include congestion mitigation, safety, bicycle and pedestrian accessibility/connectivity, and transit accessibility/connectivity as shown in **Figure 1-15**.

Figure 1-15: Phase 1 Public Input Survey Results

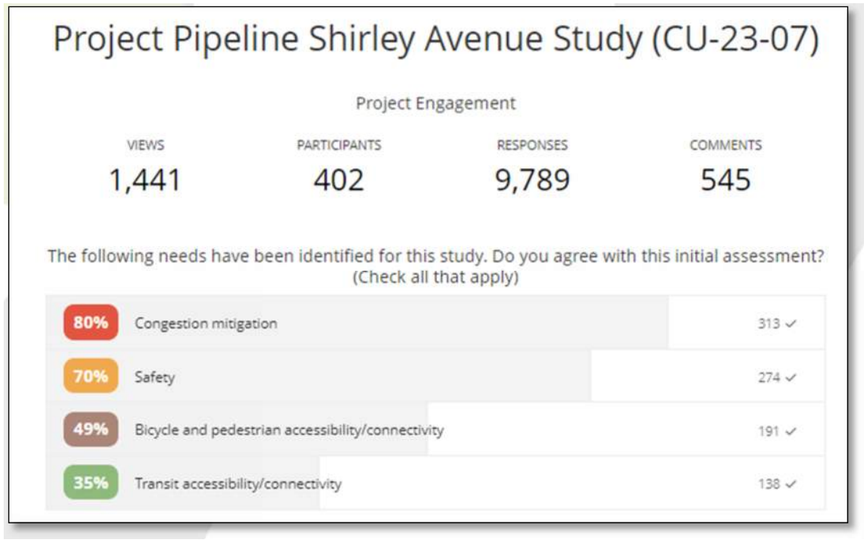
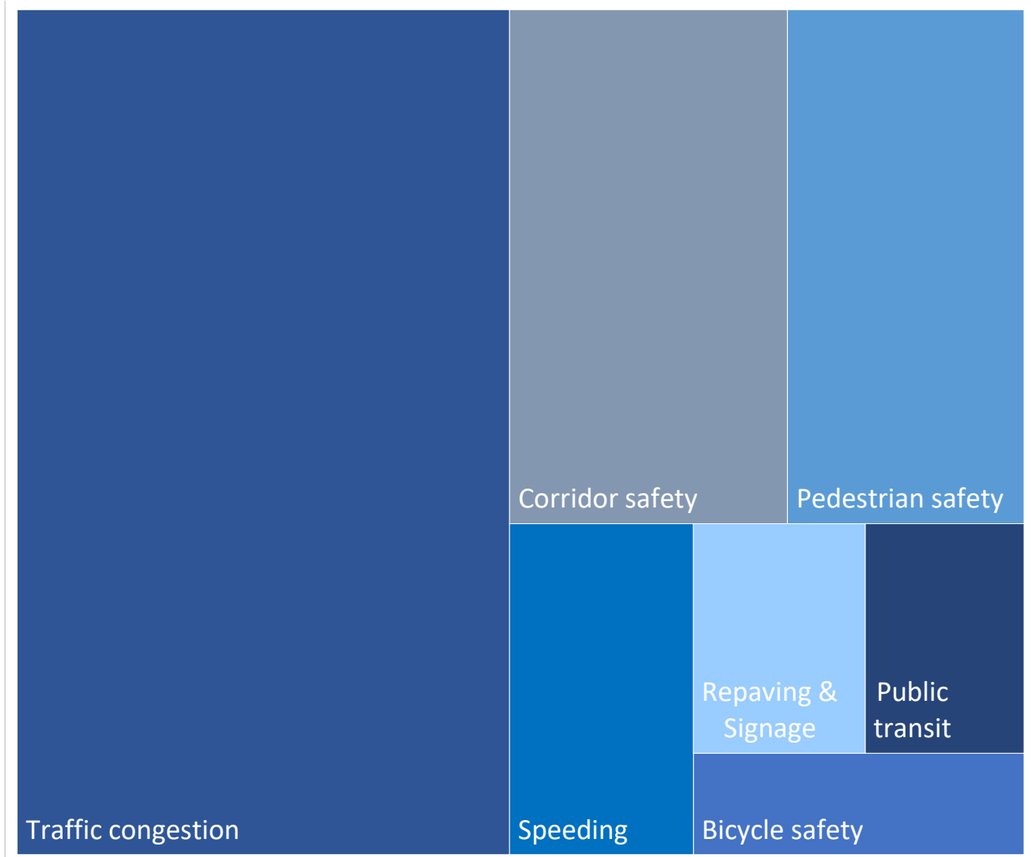


Figure 1-16 shows the issues along the corridor that the respondents noted as need to be addressed. **Figure 1-17** shows the major issues along the corridor which includes traffic congestion, lack of sidewalks, speeding, pedestrian safety and accessibility, sudden stopping, lack of turn lanes, poor signal coordination, and overall corridor safety. The majority of the respondents use the corridor for shopping/errands, passing through or commuting to and from home. Additionally, 99% of the respondents travel using personal vehicles and 64% of respondents agree that sidewalks are needed along this corridor.

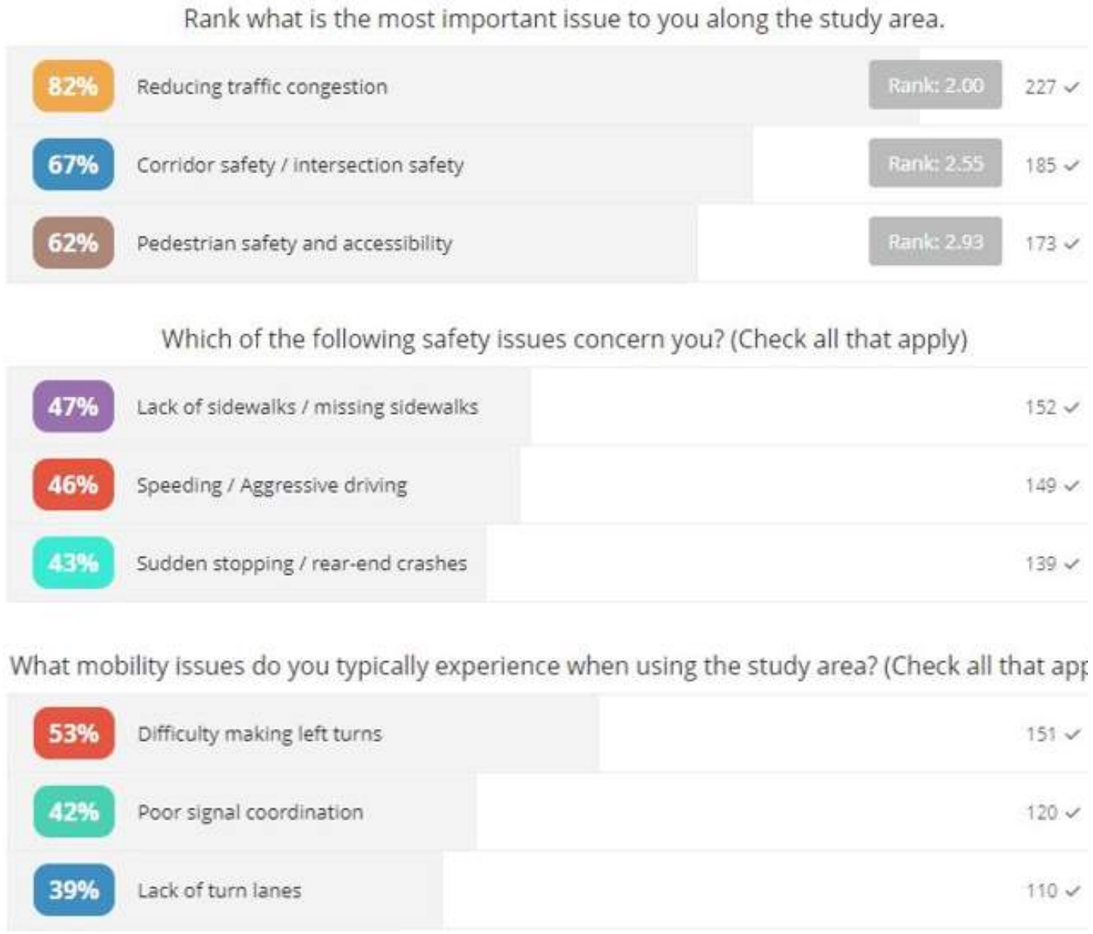
Figure 1-16: Issues Identified along the Study Corridor



The notable comments from the survey responses are summarized below:

- *Traffic is severely heavy am and pm and to get from 211 to north 29 and 29 to 211 west. A lot of unnecessary town traffic could be redirected with a bypass.*
- *School buses cannot drive around circle without going up on center with wheels. Circles need to be larger so bus can make it around correctly.*
- *Traffic circle is too small. Road narrows to a single lane.*
- *Sidewalks: pedestrian access; very dangerous crossing Shirley Ave at several points.*
- *Reckless driving, speeding, are common along this corridor.*

Figure 1-17: Public Input Survey Responses



Chapter 2 Alternative Development and Refinement

2.1 Introduction

To develop build alternatives for the study corridor, the future no-build conditions were analyzed. The existing volumes were grown to the design year 2050 and volumes were added or redistributed through the network from the planned Arrington development and Taylor Middle School expansion projects. The findings from the existing and no-build conditions analyses as well as community feedback were utilized to develop build alternatives for the study corridor. As the nature of the future build alternatives is to address spot operational and safety concerns, it is assumed that capacity is not being added to the facilities. Therefore, the future No-Build and Build conditions will have the same peak hour volumes, with the exception that the volume may be redistributed in a build concept if necessary. The following sections detail the future volume network development process and the results of a 2050 No-Build analysis.

The following recommendations identified by the Town of Warrenton were considered during the development phase for this study:

1. US 17 BUS at Garrett Street / Hospital Drive – Access Management Improvements
2. US 17 BUS at Carriage House Lane – Traffic Signal Improvements
3. US 17 BUS at Moffett Avenue – Possible Median / Right-in/Right-Out
4. US 17 BUS at Keith Street – Possible Median / Right-in/Right-Out
5. US 17 BUS at Culpeper Street – Roundabout or Improved Signal
6. US 17 BUS at Madison Street – Mini-Roundabout or Intersection Closure
7. US 17 BUS at Alwington Boulevard – Signal Improvements/Phasing Changes
8. Multimodal Improvements
    a. Corridor Improvements
        i. 3-Lane Typical with On-Road Bike Lanes
        ii. 5-Lane Typical with On-Road Bike Lanes
        iii. Sidewalk Infill between Culpeper Street and Taylor Middle School
    b. Targeted Pedestrian Treatments
        i. ADA and Crosswalk Upgrades – Existing Signals
        ii. New SUP Crossing at Green Street for connection to future Master Plan facilities to the south
        iii. Enhanced Pedestrian Crossing at Cleveland Street
        iv. Enhance Taylor Middle School / Greenway Crossing to PHB

The following sections summarize the progression of these concepts including concept level sketches and planning level cost estimates.

2.2 Traffic Forecast

The Design Year for this project was identified as 2050, with an Interim Year of 2035. No travel demand model exists for the Town of Warrenton and Culpeper County. Three data sources were evaluated to estimate growth rates for future scenarios: the available VDOT historical AADT data, VDOT's Pathways for Planning (P4P), and recent traffic impact analyses (TIAs) for the Arrington Development and Taylor Middle School Expansion. All traffic growth rate calculations use linear methodologies because the historical trend has demonstrated consistent small linear growth rates. The total forecasted volumes include the existing peak hour volumes grown with the determined 1% growth rate, the Arrington development volumes, and the Taylor Middle School expansion additional and redistributed volumes.

2.2.1 Historic Growth Rate

Table 2-1 summarizes the VDOT historical traffic count data used in the trend analysis. Using VDOT published data from 2010-2021, the annual growth rates were calculated using the linear regression method specified in the VDOT Traffic Forecasting Guidebook. Road segments of the Shirley Ave study area displayed annual growth rates between 0.5-0.91%. The roads that intersect Shirley Ave displayed historical growth rates of 0.5%.

Table 2-1: VDOT Historical AADT

VDOT Historical AADT									
Road	**Segment Location**	**2011**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**VDOT Historical Linear Regression Annual Growth Rate (2011-2021)**
Route 15 BUS (Shirley Ave)									
Shirley Avenue	Frost Avenue to Culpeper Street	18,713	18,183	18,380	18,544	16,971	14,144	20,856	0.91%
	Culpeper Street to Falmouth Street	13,707	11,679	11,805	11,996	12,236	10,198	15,037	0.50%
	Falmouth Street to James Madison Highway	10,430	10,871	11,067	11,013	10,775	9,261	9,679	0.73%
Major Intersecting Roads									
Frost Ave	West of Shirley Avenue	22,171	21,772	22,008	22,201	23,488	19,576	28,865	0.50%
Waterloo Street	East of Shirley Avenue	6,782	6,423	6,493	6,550	6,616	5,514	8,131	0.50%
Culpeper Street	West of Shirley Avenue	3,908	4,447	4,527	4,505	4,809	4,133	4,320	2.26%
	East of Shirley Avenue	2,847	2,618	2,646	2,670	2,687	2,239		0.50%
Falmouth Street	East of Shirley Avenue	3,908	4,447	4,527	4,505	4,809	4,133	4,320	2.26%
Alwington Boulevard	West of Shirley Avenue		7,000					8,600	

2.2.2 Pathways for Planning Projected Growth

Table 2-2 displays the P4P forecasts. The P4P data provides 2022 and forecasted 2030, 2035, and 2050 daily traffic volumes. Annual growth rates were calculated between these points using a linear regression method. The annual growth rates showed a small spread among all the study area roads, ranging from 0.5% to 1.2% annually. Most annual growth rates for the side streets were 0.50%, potentially because they were set to the minimum recommended growth rate (per VDOT's Forecasting Guidebook).

Table 2-2: VDOT Pathways for Planning Growth Rate

VDOT P4P Data (AADT)						
Road	**Segment Location**	**2022**	**2030**	**2035**	**2050**	**VDOT P4P Linear Regression Annual Growth Rate (2022-2050)**
Route 17 BUS (Shirley Ave)	Frost Avenue to Culpeper Street	15,179	16,588	17,468	20,109	1.20%
	Culpeper St to Falmouth Street	10,934	11,371	11,645	12,465	0.50%
	Falmouth Street to James Madison Hwy	9,640	10,319	10,743	12,015	0.90%
Culpeper Street	South of Barracks Road	1,108	1,152	1,208		0.50%
Frost Ave	N/A	21,934	22,811	23,360		0.50%
Warterloo Street	N/A	5,427	5,644	5,780		0.50%
Falmouth Street	N/A	4,053	4,215	4,316		0.50%
Alwington Boulevard	N/A					

2.2.3 TIA Growth Rate

A traffic impact analysis (TIA) for the Arrington Development was conducted in April 2023. According to the Arrington TIA, an inherent growth rate of 1.0% was applied to all movements on E Shirley Ave. Additionally, a traffic impact analysis for the Taylor Middle School Expansion was conducted in September 2023 which utilized an annual vehicle trip growth rate of 1%.

2.2.4 Growth Rate Recommendation

Based on the historical data, VDOT's P4P data, and recent TIAs, all roads in the study were recommended for a 1% linear growth rate to be utilized. The recommended growth rate was applied to the existing peak hour volumes and TIA trip-generated volumes were distributed throughout the network to estimate Interim Year (2035) and Design Year (2050) peak hour volumes.

2.3 Future Year 2050 No-Build Operational Analysis

A future year 2050 No-Build analysis was performed for the US Route 17 Business corridor utilizing the 2050 volumes developed in **Section 1.10**. *Synchro* (Version 11) was utilized to build the network and input relevant parameters such as peak hour factor (PHF), truck percentages, posted speed limits, etc. *Synchro* (Version 11) was utilized to obtain average intersection delay per vehicle and level of service (LOS). *SimTraffic* was utilized to perform queueing analysis to determine the maximum queue lengthns. The results were based on an average of ten (10) simulation runs. The analysis results for the Design Year (2050) No-Build conditions are presented in **Table 2-1**. Detailed Synchro/*SimTraffic* output reports are provided in **Appendix E.**

The results indicate that all unsignalized intersections are expected to operate at overall LOS B or better during both the AM and PM peak hours. The intersection at Carriage House Lane is expected to degrade from a LOS B to LOS C in the PM peak hour only. The intersection at Culpeper Street is expected to degrade from an LOS C to LOS E. At the intersection at Frost Avenue/Waterloo Street is expected to remain at LOS F with the delay remaining approximately the same in the PM peak hour, however the LOS F condition in the AM will see an increase in delay from 161 seconds to 243 seconds. The intersection of Alwington Boulevard is expected to degrade from LOS B to LOS C in the AM peak hour and remain at LOS C in the PM peak hour.

Table 2-3: Future Year 2050 No-Build Operational Analysis Results

Study Intersection	Intersection Control	Street Name	Approach	AM Peak Hour				PM Peak Hour			
				Approach Delay (s)	Approach LOS	Overall Delay (s)	Overall LOS	Approach Delay (s)	Approach LOS	Overall Delay (s)	Overall LOS
Frost Avenue/ Waterloo Street*	Signalized	Shirley Ave	Northbound	60.9	E	243.2	F	94.0	F	103.1	F
		Waterloo St	Westbound	50.1	D			68.9	E		
		Broadview Ave	Southbound	49.6	D			141.0	F		
		Frost Ave	Eastbound	531.2	F			56.4	E		
Hospital Drive	Unsignalized	Shirley Ave	Northbound	1.7	A	3.2	A	0.2	A	2.9	A
		Shirley Ave	Southbound	0.0	A			0.0	A		
		Hospital Dr	Eastbound	60.6	F			33.1	D		
Garrett Street	Unsignalized	Shirley Ave	Northbound	0.0	A	0.2	A	0.0	A	0.3	A
		Garrett St	Westbound	15.4	C			12.5	B		
		Shirley Ave	Southbound	0.2	A			0.3	A		
Carriage House Lane/Manor Ct*	Signalized	Shirley Ave	Northbound	17	B	19.9	B	20.6	C	23.1	C
		Manor Ct	Westbound	32.2	C			35.3	D		
		Shirley Ave	Southbound	19.7	B			22	C		
		Carriage House Ln	Eastbound	32.5	C			32	C		
Moffett Avenue	Unsignalized	Shirley Ave	Northbound	0.4	A	1.9	A	0.3	A	0.7	A
		Moffet Ave	Westbound	21.3	C			18.3	C		
		Shirley Ave	Southbound	0.2	A			0.1	A		
		Parking Lot	Eastbound	35.7	E			15.5	C		
Keith Street	Unsignalized	Shirley Ave	Northbound	0.5	A	13.5	B	0.1	A	2.6	A
		Keith St	Westbound	32.8	D			16.5	C		
		Shirley Ave	Southbound	1.3	A			1.0	A		
		Parking Lot	Eastbound	363.2	F			37.0	E		
Culpeper Street*	Signalized	Shirley Ave	Northbound	66.4	E	65.5	E	45	D	59.2	E
		Culpeper St	Westbound	64	E			55.1	E		
		Shirley Ave	Southbound	116.5	F			54.4	D		
		Culpeper St	Eastbound	34.6	C			114.5	F		
Green Street	Unsignalized	Shirley Ave	Northbound	0.1	A	1.8	A	0.1	A	1.3	A
		Green St	Westbound	24.3	C			15.6	C		
		Shirley Ave	Southbound	0.4	A			0.4	A		
		Parking Lot	Eastbound	52.2	F			22.9	C		
Madison Street	Unsignalized	Shirley Ave	Northbound	0.0	A	0.8	A	0.0	A	0.6	A
		Madison St	Westbound	18.5	C			12.8	B		
		Shirley Ave	Southbound	0.5	A			0.5	A		
Middle School Exit	Unsignalized	Shirley Ave	Northbound	0.0	A	21.4	C	0.0	A	3.2	A
		Middle School	Eastbound	255.6	F			73.2	F		
		Shirley Ave	Southbound	3.0	A			0.3	A		
Falmouth Street**	Roundabout	ames Madison Hw	Northbound	4.0	A	3.8	A	3.7	A	3.3	A
		Falmouth St	Westbound	8.7	A			7.3	A		
		Shirley Ave	Southbound	1.5	A			1.7	A		
Alwington Boulevard*	Signalized	Shirley Ave	Northbound	14.4	B	20.5	C	16.2	B	24.0	C
		Industrial Rd	Westbound	38.2	D			41.2	D		
		Shirley Ave	Southbound	19.9	B			21.8	C		
		Alwington Blvd	Eastbound	31.1	C			31.1	C		

*HCM 2000 results reported for the intersection
**SIDRA Standard results reported for the roundabout

2.4 Proposed Potential Improvements

The findings from the existing and no-build conditions analyses as well as community feedback were utilized to develop build alternatives for the study corridor. The following concepts are proposed to improve multi-modal operations, safety, and access within the study area:

- **Concept 1 (long-term improvement)** – converts the Hospital Drive intersection from a conventional ntersection to a hybrid roundabout. A roundabout is expected to reduce the number and severity of crashes and reduce delays compared to the no-build condition for the Hospital Drive approach. The construction of a roundabout would also provide a transition point along the corridor to begin a roadway reconfiguration between Hospital Drive and Keith Street to allow for on-road bike lanes. The layout for Concept 1 is presented in **Figure 2-1**.
- **Concept 2** – installs a concrete median to close the southbound left-turn lane at Garrett Street and a channelizing island at Garrett Street to restrict movements to and from Garrett Street as right turns only. Benefits include a reduction in crash frequency and severity and a decrease in delays for vehicles entering Shirley Avenue from Garrett Street. The layout for Concept 2 is presented in **Figure 2-2**.
- **Concept 3 (long-term improvement)** – constructs a single-lane roundabout at the intersection with Carriage House Lane. The roundabout would include a right-turn slip lane for southbound traffic onto Carriage House Lane. The roundabout is expected to reduce the number and severity of crashes at the intersection. It would also reduce delays compared to the future no-build condition. The layout for Concept 3 is presented in **Figure 2-3**.
- **Concept 4 (short-term improvement)** – installs enhanced pavement markings to indicate no stopping in front of the entrance to the fire station access along Shirley Avenue. These pavement markings are expected to alleviate some confusion among drivers navigating the Carriage House Lane intersection with the existing offset signal pole along the northbound approach. The layout for Concept 4 is presented in **Figure 2-4**
- **Concept 5 –** installs a channelizing island at Keith St. to restrict movements from Garrett St. as right turns only. The layout for Concept 5 is presented in **Figure 2-5**.
- **Concept 6** - constructs a single-lane roundabout at the intersection with Culpeper St. The roundabout is expected to reduce traffic delays and the number and severity of crashes at the intersection. The layout for Concept 6 is presented in **Figure 2-6.**
- **Concept 7** - constructs a mini-roundabout to form an intersection along Shirley Avenue with Elm St. and Madison St. The layout for Concept 7 is presented in **Figure 2-7.**

- **Concept 8** - re-configures the intersection of Madison St. at Shirley Ave. to relocate the southbound left-turn and northbound right-turn movements onto Madison St. south of the existing intersection. Adjust the alignment of Madison St. at Shirley Ave. to provide better sight distance for vehicles entering Shirley Ave. The layout for Concept 8 is presented in **Figure 2-8.**
- **Concept 9** - constructs pedestrian accommodations along the west side of Shirley Ave. The improvements would include a new 5' sidewalk from Culpeper St. to Taylor Middle School. A 10' shared-use path would be constructed from the Warrenton Branch Greenway crossing at Taylor Middle School to approximately 870' south. A marked crosswalk would be installed at Green St. An upgraded crosswalk and Rectangular Rapid Flashing Beacons would be installed near Cleveland St. The layout for Concept 9 is presented in **Figure 2-9.**

Figure 2-1: Hospital Drive Roundabout Layout

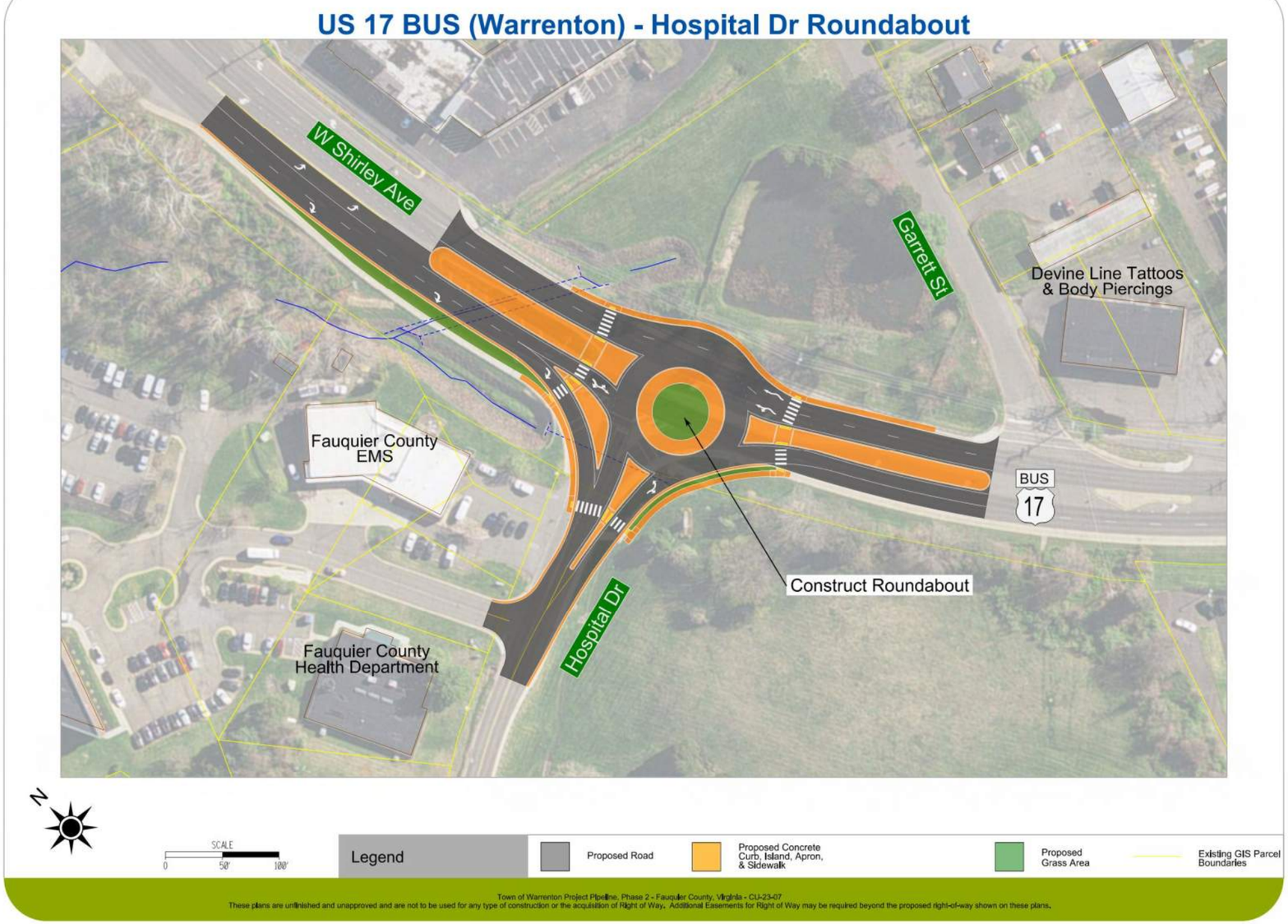


Figure 2-2: Garrett Street Right-In Right-Out Layout

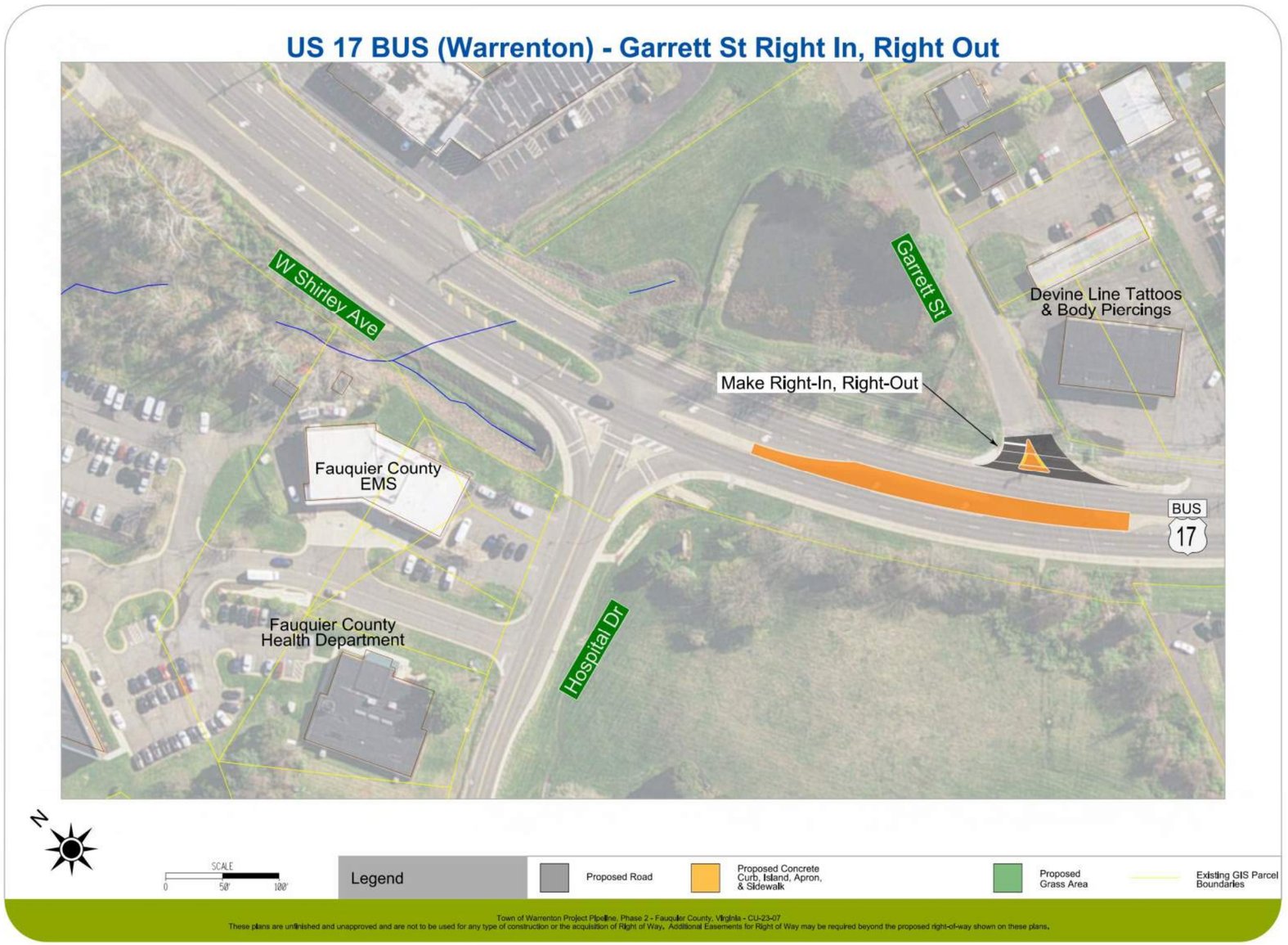


Figure 2-3: Carriage House Lane Roundabout

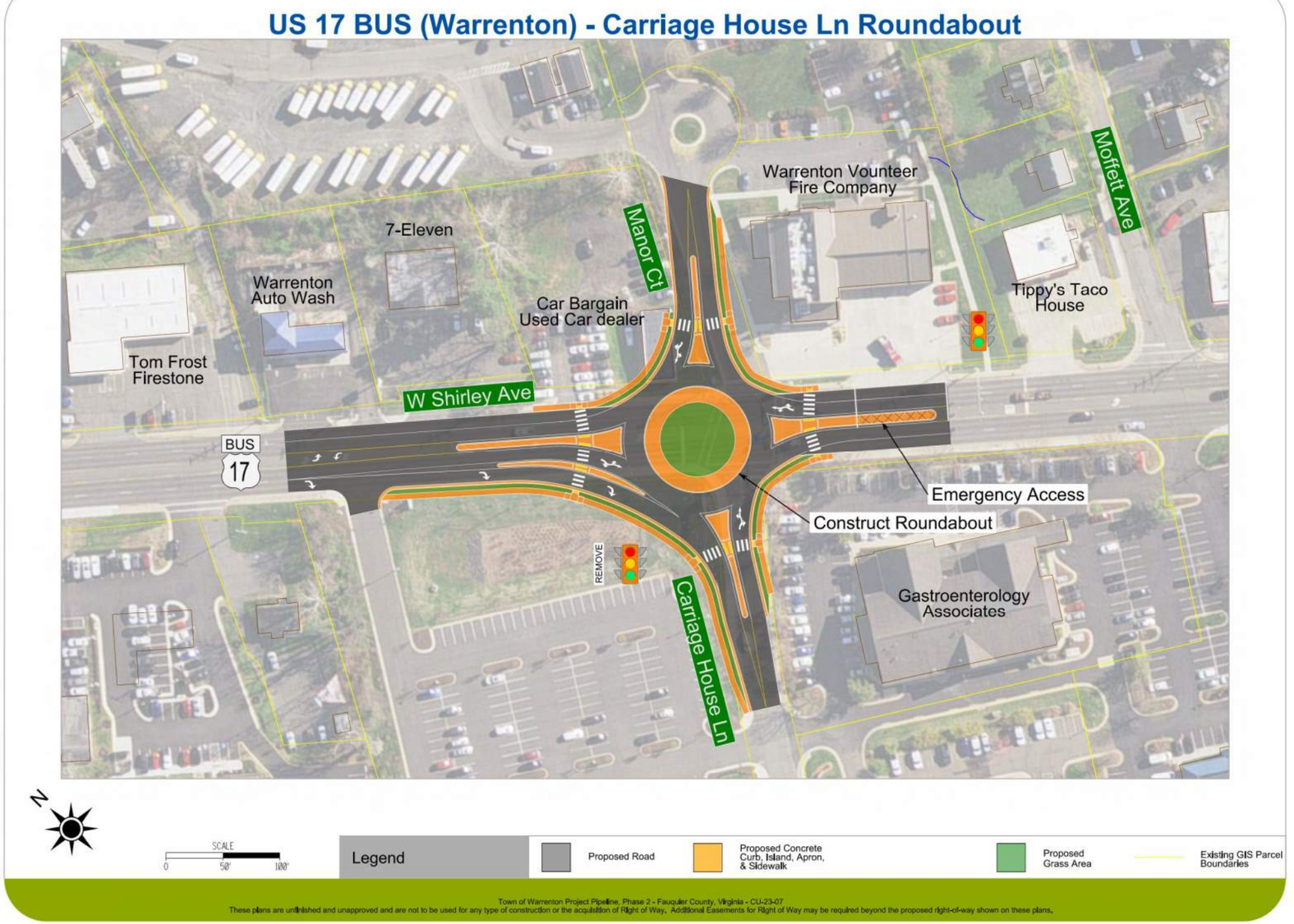


Figure 2-4: Carriage House Lane Restriping

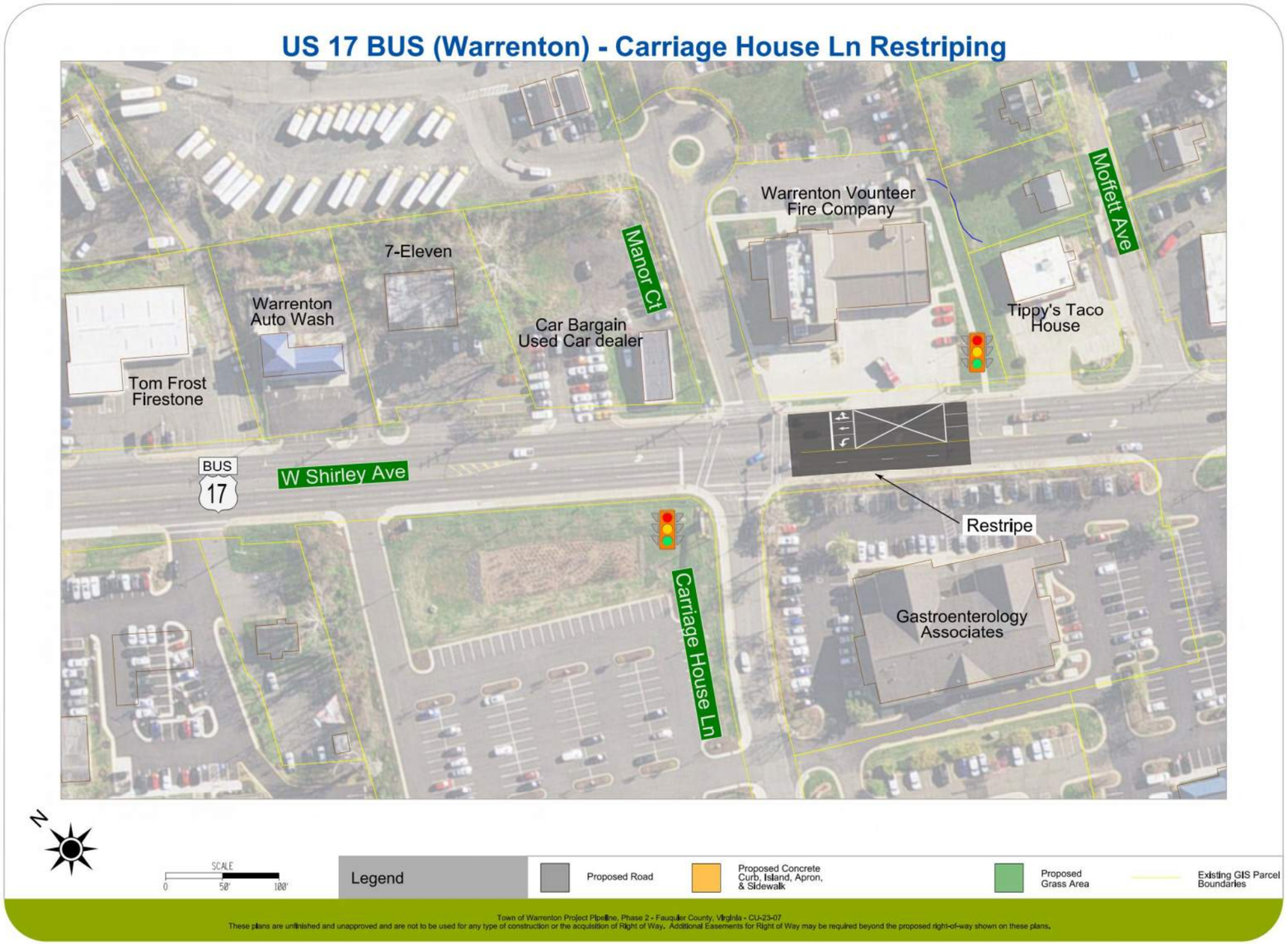


Figure 2-5: Keith Street Right-In, Right-Out Layout

Figure 2-6: Culpeper Street Roundabout Layout

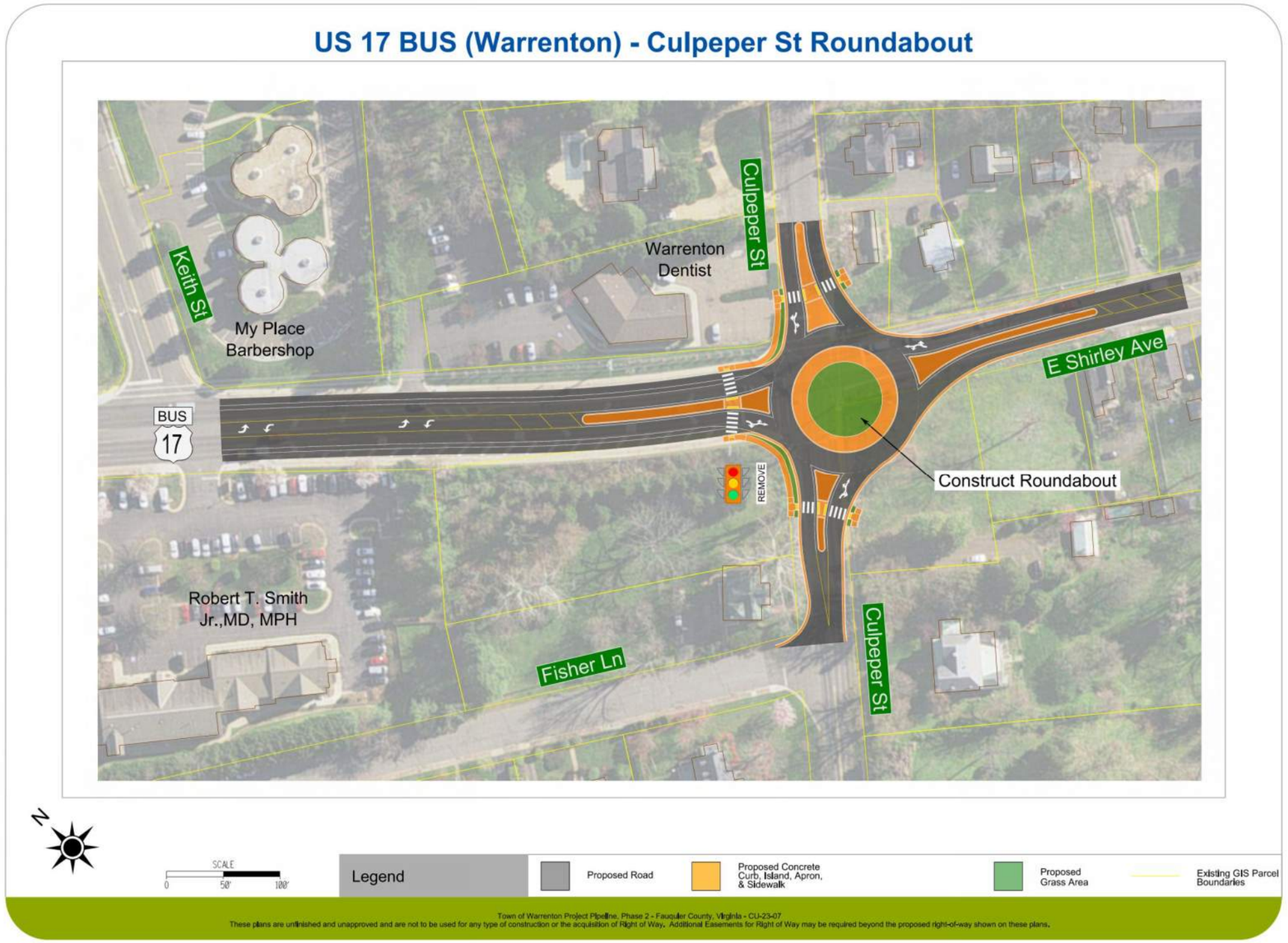


Figure 2-7: Madison Street and Elm Street Mini-Roundabout Layout

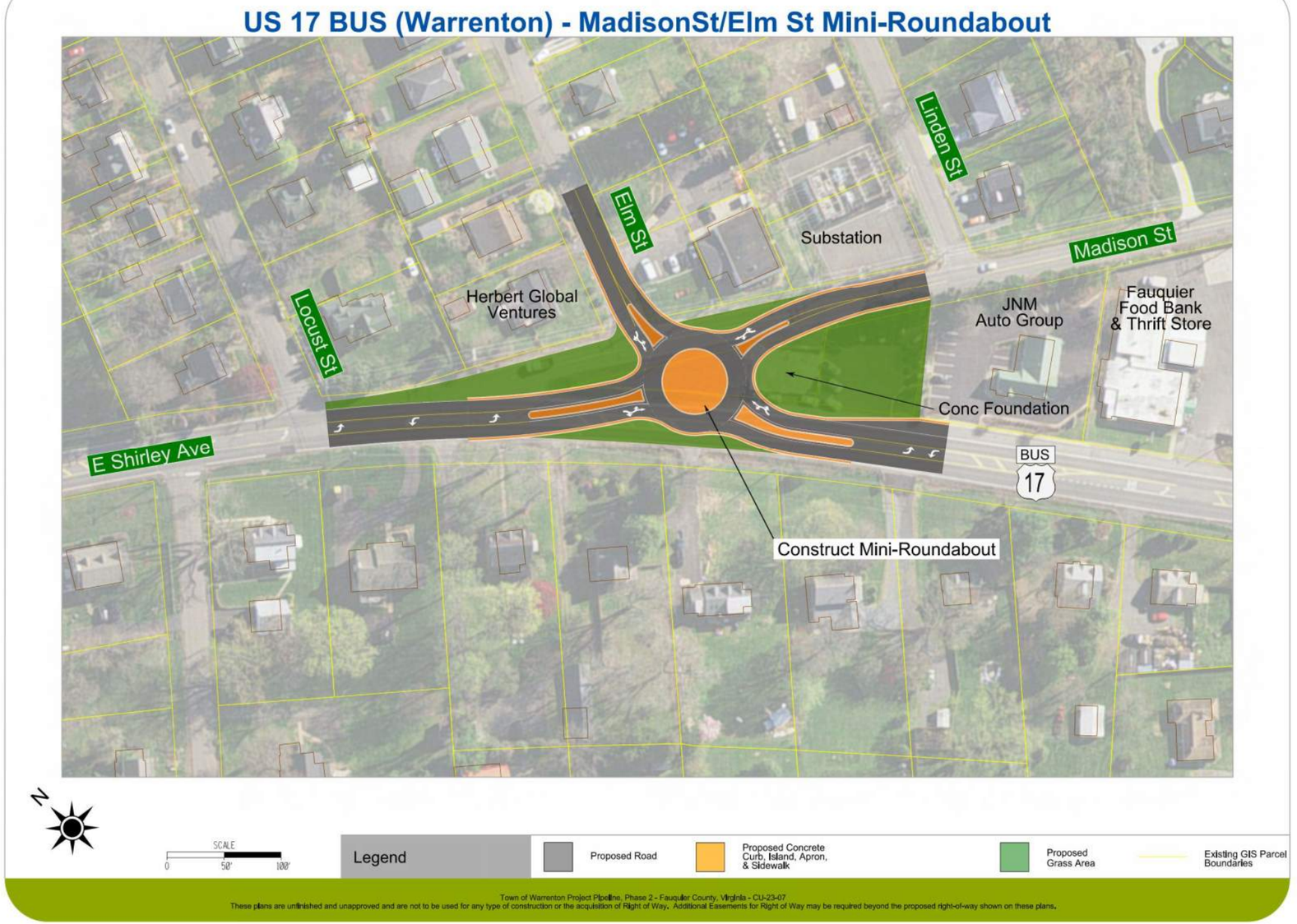


Figure 2-8: Madison Street and Elm Street Intersection Reconfiguration Layout

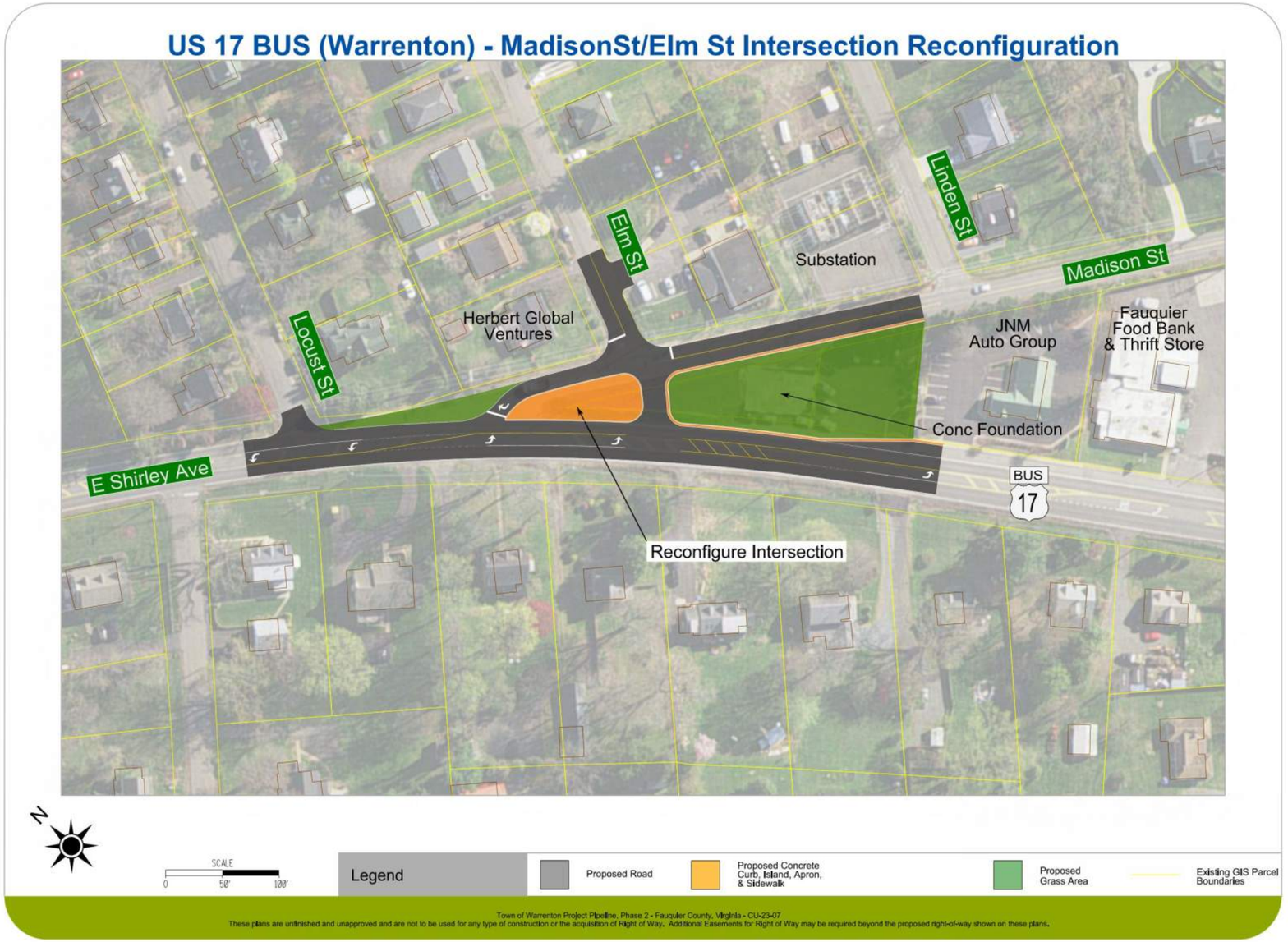
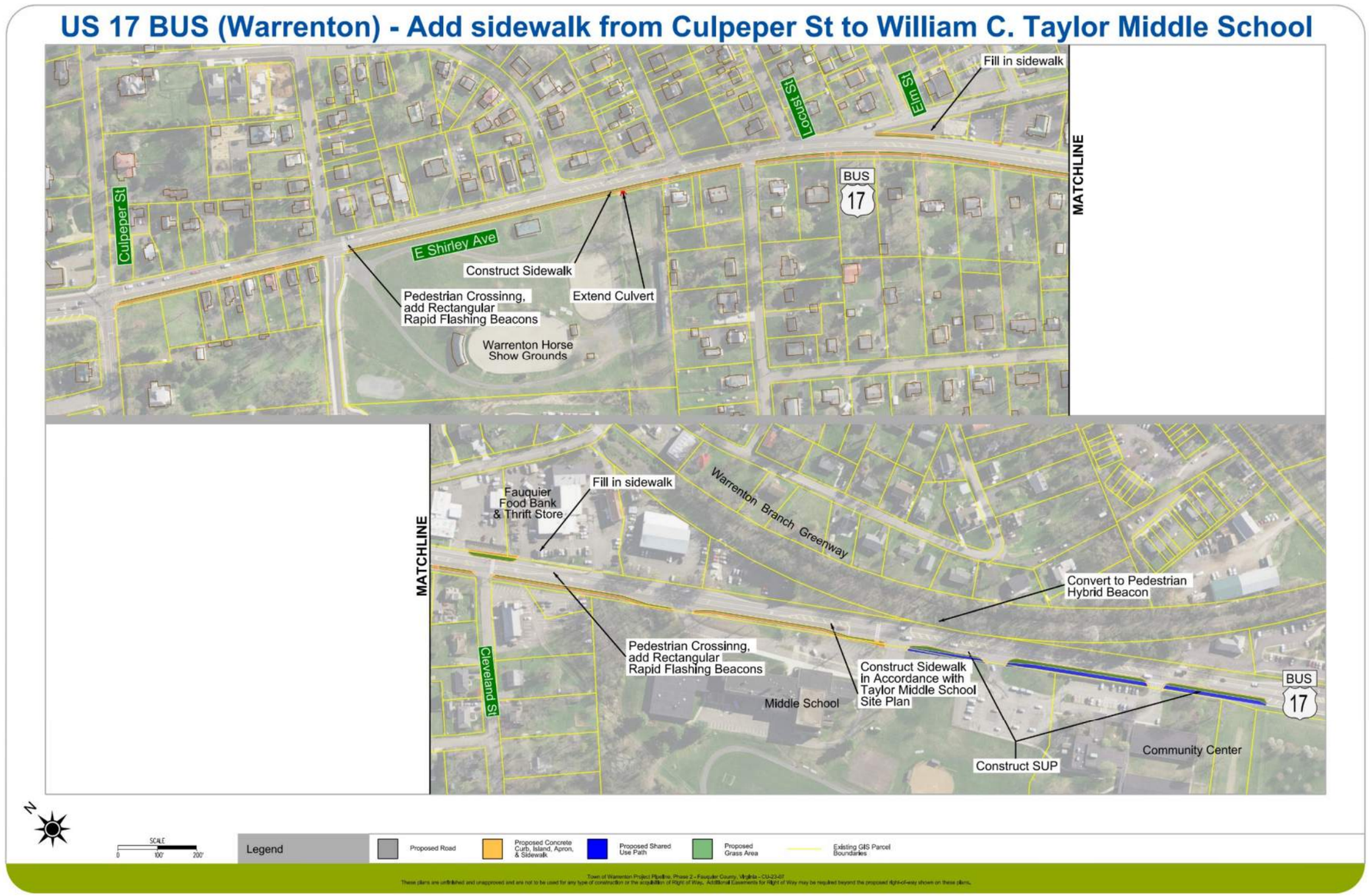


Figure 2-9: Pedestrian Improvements Layout



2.5 Cost Estimates

Cost estimates for the nine proposed concepts were developed utilizing the methodologies from the 2021 VDOT Cost Estimating Manual and are presented in **Table 2-4**. Detailed cost estimate sheets are provided in **Appendix G**.

Table 2-4: Proposed Conceptual Level Cost Estimates

Cost Description	Preliminary Engineering	Right of Way and Utility	Construction	Total Cost
Hospital Dr Roundabout	$1,455,000	$989,000	$4,397,000	$6,841,000
Garrett Street Right in Right Out	$458,000	$0	$593,000	$1,051,000
Carriage House Roundabout	$1,395,000	$1,181,000	$4,060,000	$6,636,000
Carriage House Restriping	$182,000	$0	$125,000	$307,000
Keith Street Right in Right Out	$254,000	$0	$212,000	$466,000
Culpeper Roundabout	$1,307,000	$1,165,000	$3,588,000	$6,060,000
Madison Mini-Roundabout	$1,128,000	$643,000	$2,716,000	$4,487,000
Madison Street Reconfiguration	$718,000	$431,000	$1,356,000	$2,505,000
Pedestrian Improvements	$1,207,000	$935,000	$3,619,000	$5,761,000

2.6 Build Operational Analysis

A future year 2050 Build Analysis was performed for the US Route 17 Business corridor utilizing the 2050 volumes developed in Section 1.10. Just as in the No-Build analysis, Synchro (Version 11) was utilized to build the network and input relevant parameters such as peak hour factor (PHF), heavy vehicle percentages, posted speed limits, etc. SIDRA (Version 9.1) was the software utilized to perform roundabout analyses where needed. Detailed Synchro and SIDRA output reports are provided in **Appendix C**.

The intersection analysis results for Design Year (2050) and Build conditions is presented in **Table 2-5**. The results indicate that all intersections are expected to operate at overall LOS B or better in the AM peak hour and overall LOS C or better in the PM peak hour. The roundabout at Culpeper Street is expected to have the greatest improvement from an anticipated LOS E in the AM and PM peak hour to LOS B & C in the AM and PM peak hour, respectively. The roundabout concepts at Hospital Drive and Madison Street are expected to result in marginal increased overall intersection delay but decreased delay for side street approaches, most significantly seen at Hospital Drive in the eastbound movement which decreased from 60 seconds to 8 seconds.In general, network-wide performance and intersection analysis results indicate that traffic operations are expected to improve under all alternative Build Concepts when compared to No-Build. Furthermore, implementation of roundabout along US Route 17 Business would provide the opportunity to re-pupurose underutilized capacity between intersections for additional multi-modal improvements.

Table 2-5: 2050 Build Conditions Analysis Results

Study Intersection	Intersection Control	Street Name	Approach	AM Peak Hour				PM Peak Hour			
				Approach Delay (s)	Approach LOS	Overall Delay (s)	Overall LOS	Approach Delay (s)	Approach LOS	Overall Delay (s)	Overall LOS
Hospital Drive	Roundabout	Shirley Ave	Northbound	5.4	A	8.1	A	7.8	A	10.4	B
		Shirley Ave	Southbound	9.9	A			12.2	B		
		Hospital Dr	Eastbound	8.1	A			14.3	B		
Garrett Street	Unsignalized	Shirley Ave	Northbound	0.0	A	0	A	0.0	A	0.2	A
		Garrett St	Westbound	11	B			13.3	B		
		Shirley Ave	Southbound	0	A			0	A		
Carriage House Lane/Manor Ct*	Roundabout	Shirley Ave	Northbound	10.1	B	12.9	B	18.2	B	19	B
		Manor Ct	Westbound	16.6	B			26.8	C		
		Shirley Ave	Southbound	9.4	A			16.3	B		
		Carriage House Ln	Eastbound	9.9	A			12.1	B		
Keith Street	Unsignalized	Shirley Ave	Northbound	0.5	A	1.6	A	0.2	A	2.3	A
		Keith St	Westbound	16.2	C			20.2	C		
		Shirley Ave	Southbound	0.0	A			0.0	A		
		Parking Lot	Eastbound	14.3	B			18.2	C		
Culpeper Street*	Roundabout	Shirley Ave	Northbound	21.5	C	15.7	B	19.6	B	27.5	C
		Culpeper St	Westbound	10.7	B			14.8	B		
		Shirley Ave	Southbound	12	B			36.5	D		
		Culpeper St	Eastbound	11.9	B			25.3	C		
Madison Street	Mini Roundabout	Shirley Ave	Northbound	10.0	B	8.3	A	10.5	B	9.1	A
		Madison St	Westbound	7.2	A			7.2	A		
		Shirley Ave	Southbound	6.3	A			8	A		
Madison Street	Unsignalized	Shirley Ave	Northbound	0.0	A	0.8	A	0.0	A	0.6	A
		Madison St	Westbound	18.5	C			12.8	B		
		Shirley Ave	Southbound	0.5	A			0.5	A		

2.7 Anticipated Safety Performance

A combination of crash modification factors (CMF's) from FHWA's Clearinghouse were utilized to estimate the safety benefits of the proposed alternatives. These factors are based on the results from multiple research studies, which looked at the safety benefits of the following countermeasures:

1. Countermeasure 1: Convert two-way-stop-controlled intersection to roundabout
2. Countermeasure 2: Convert signalized intersection to roundabout
3. Countermeasure 3: Install right-in-right-out (RIRO) operations at stop-controlled intersections
4. Countermeasure 3: Reduce intersection skew from X to Y – 3-Leg intersection
5. Countermeasure 4: Add or upgrade Sidewalk

Table 2-6 presents the expected CMFs for each countermeasure and the intersections to which these countermeasures apply under each concept. The table indicates that:

- Crashes at Hospital Drive and Madison Street are expected to reduce at least by approximately 44% under new roundabout conditions.
- Crashes at the intersections of Carriage House Lane and Culpeper Street are expected to reduce by approximately 48% under new roundabout conditions.
- Under RIRO concepts, the intersections at Garrett Street and Keith Street are expected to reduce by approximately 45%.
- The proposed roadway reconfiguration at Madison Street is expected to reduce crashes by at least 24%.
- Pedestrian crashes along the corridor are expected to reduce by at least 88% in segments where new sidewalk is being constructed.

Table 2-6. Route 17 Business - CMF Matrix for Build Concepts

Build Concept	Countermeasure #:	1	2	3	4	5
	CMF Range:	*0.56*	*0.52*	*0.55*	*0.76*	*0.12*
Concept 1	Hospital Drive Roundabout	✓	-	-	-	-
Concept 2	Garrett Street Right-In Right-Out	-	-	✓	-	-
Concept 3	Carriage House Lane Roundabout	-	✓	-	-	✓
Concept 4	Carriage House Lane Restriping	-	-	-	-	-
Concept 5	Keith Street Right-In Right-Out	-	-	✓	-	-
Concept 6	Culpeper Street Roundabout	-	✓	-	-	-
Concept 7	Madison Street Mini Roundabout	✓	-	-	-	-
Concept 8	Madison Street Reconfiguration	-	-	-	✓	-
Concept 9	Pedestrian Improvements	-	-	-	-	✓

Chapter 3 Public and Stakeholder Outreach and Feedback

A second public survey was conducted for during the concept development phase and ran from February 24, 2024 to March 8, 2024. The online survey presented the community with the improvement concepts described in **Section 2.3** of this report. The public was asked to rank these concepts by assigning values one (1) through five (5); with one (1) representing strong opposition and five (5) strong support. The survey included improvements in safety, operations, and multimodal/pedestrian access at the following locations as shown in **Figure 3-1 to Figure 3-9:**

1. US Route 17 Business at Hospital Drive and Garrett Street
2. US Route 17 Business at Carriage House Lane
3. US Route 17 Business at Keith Street
4. US Route 17 Business at Culpeper Street
5. US Route 17 Business at Madison Street
6. Pedestrian improvements along US Route 17 Business between Madison Street and Falmouth Street

1,498 participants were recorded with 17,162 total responsed to questions and 2,922 comments. Average ratings for the improvements varied between 2.52 - 4.07, as shown in the **Table 3-1** and where each rating is provided in detail in the following section.

Table 3-1: Average Rating of Presented Alternative

Improvement	Average Rating
1	3.04
2	3.09
3	2.86
4	3.95
5	3.04
6	3.18
7	2.52
8	3.43
9	4.07

Figure 3-1 shows the survey results for the proposed roundabout at Hospital Drive. The proposed roundabout received an approximate average rating of 3.04, indicating neutral support for this improvement.

Figure 3-1: Survey Results - Hospital Drive Roundabout

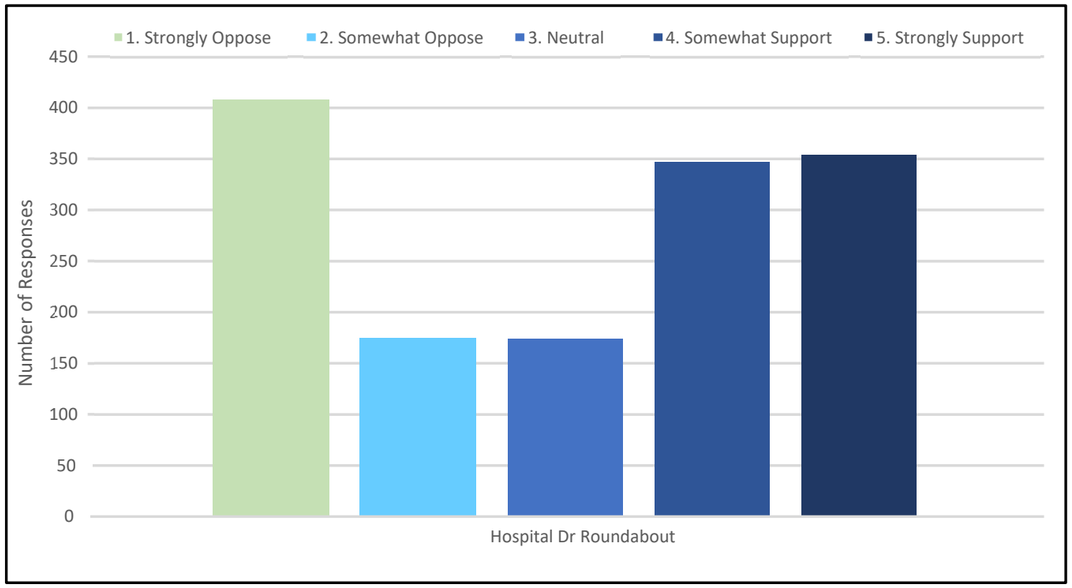


Figure 3-2 shows the survey results for a right-in right-out at the intersection of US Route 17 Business (Shirley Ave) and Garrett Street. The proposed concept received an approximate average rating of 3.09, indicating neutral support for this improvement.

Figure 3-2: Survey Results - Garrett Street Right-In Right-Out

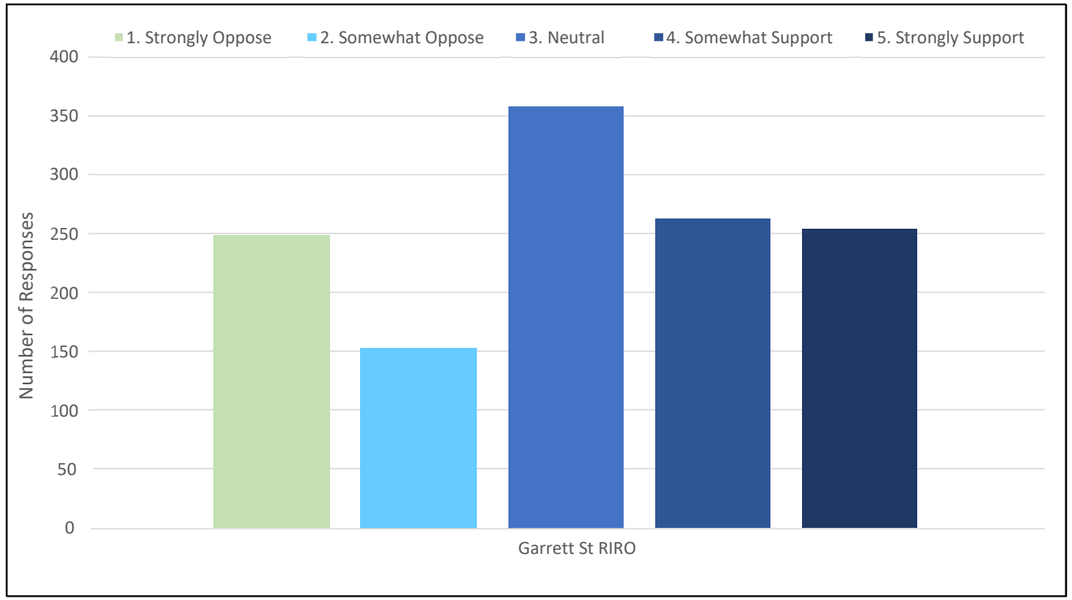


Figure 3-3 shows the survey results for the proposed roundabout at Carriage House Lane.The proposed roundabout received an approximate average rating of 2.86, indicating mild opposition to this alternative.

Figure 3-3: Survey Results – Carriage House Lane Roundabout

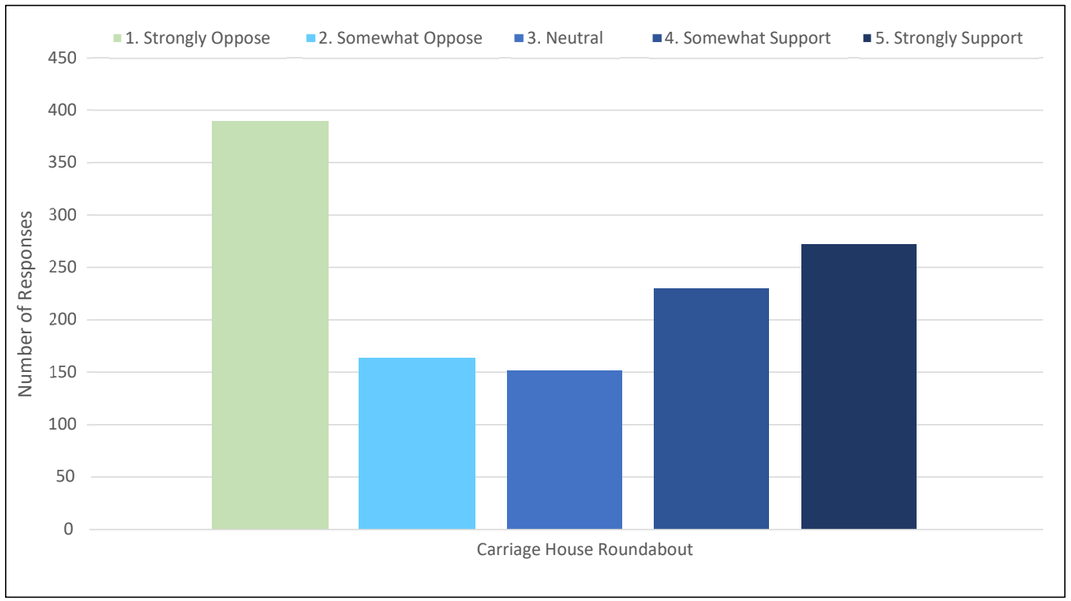


Figure 3-4 shows the survey results for the proposed restriping at Carriage House Lane. The proposed restriping concept received an approximate average rating of 3.95, indicating support for this alternative.

Figure 3-4: Survey Results - Carriage House Lane Restriping

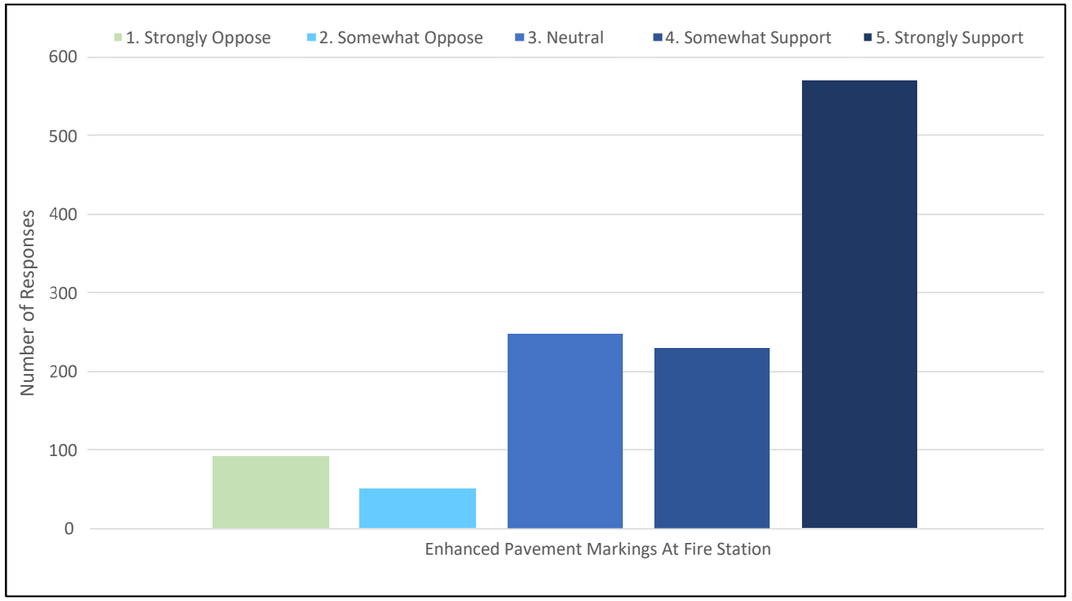


Figure 3-5 shows the survey results for the proposed right-in, right-out at Keith Street. The proposed concept received an approximate average rating of 3.04, indicating neutral support for this improvement.

Figure 3-5: Survey Results – Keith Street Channelizing Island

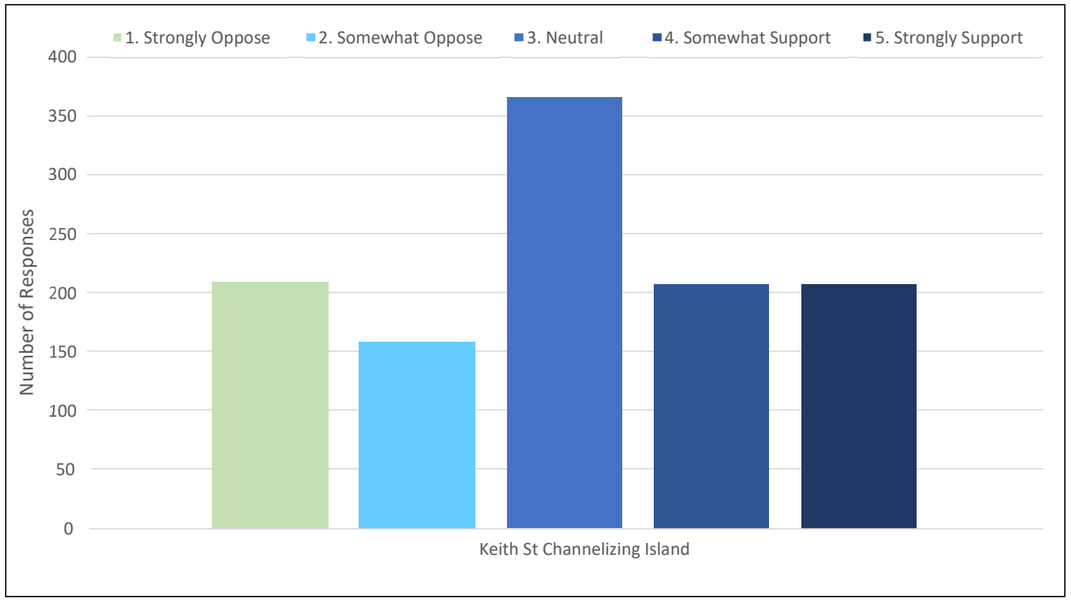


Figure 3-6 shows the survey results for the proposed roundabout at Culpeper Street. The proposed roundabout received an approximate average rating of 3.18, indicating slight support for this improvement.

Figure 3-6: Survey Results – Culpeper Street Roundabout

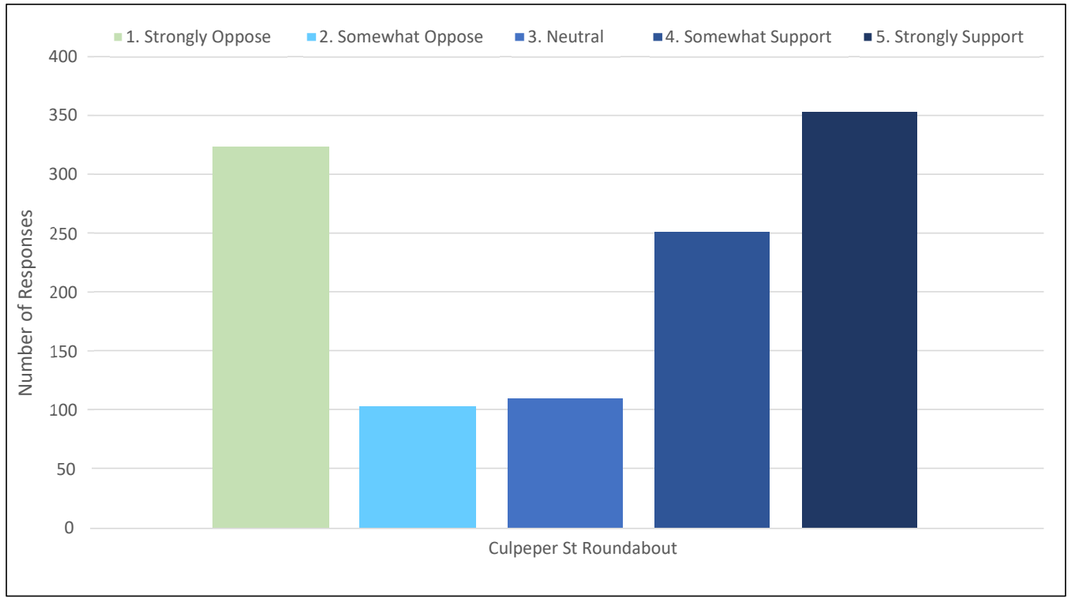


Figure 3-7 shows the survey results for the proposed mini-roundabout at Madison Street. The proposed roundabout received an approximate average rating of 2.52, indicating that there is opposition to this improvement.

Figure 3-7: Survey Results – Madison Street Mini Roundabout

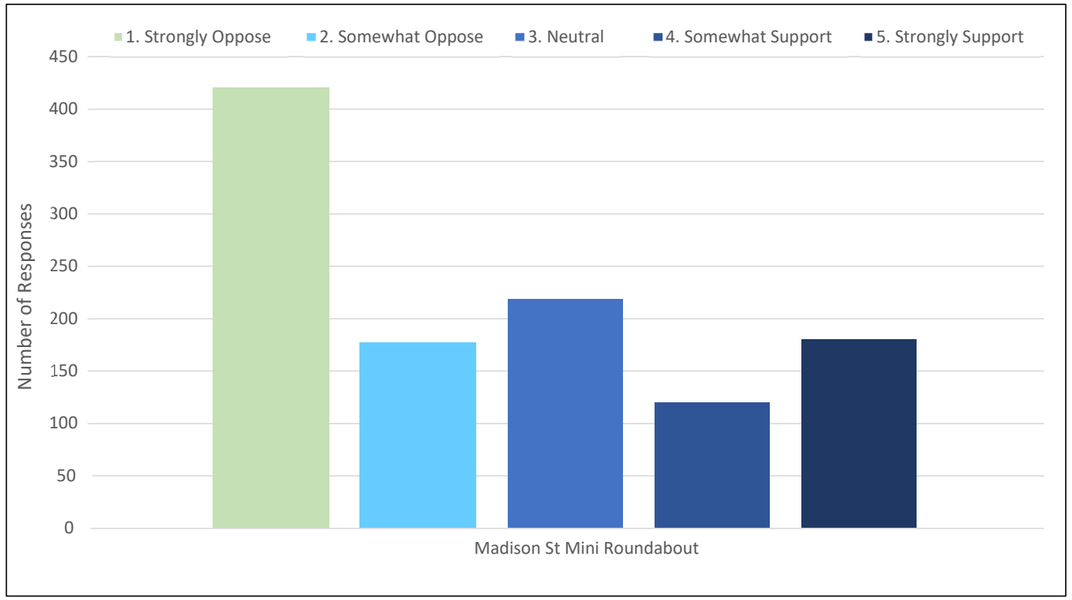


Figure 3-8 shows the survey results for the proposed roadway reconfiguration at Madison Street. The proposed roundabout received an approximate average rating of 3.43, indicating that there is more interest in the roadway reconfiguration than the mini-roundabout at this intersection.

Figure 3-8: Survey Results – Madison Street Roadway Reconfiguration

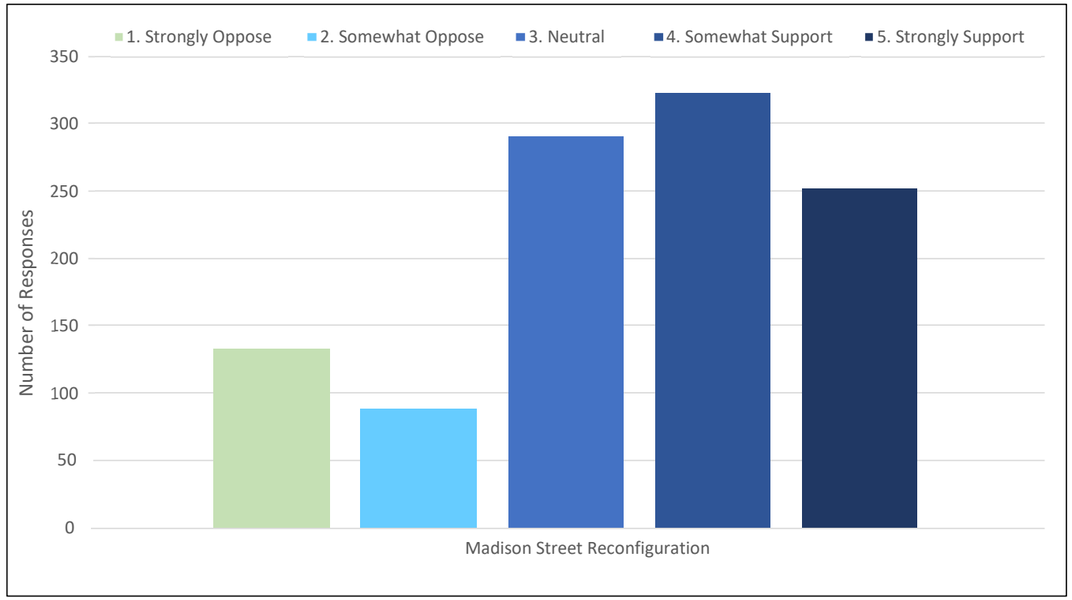
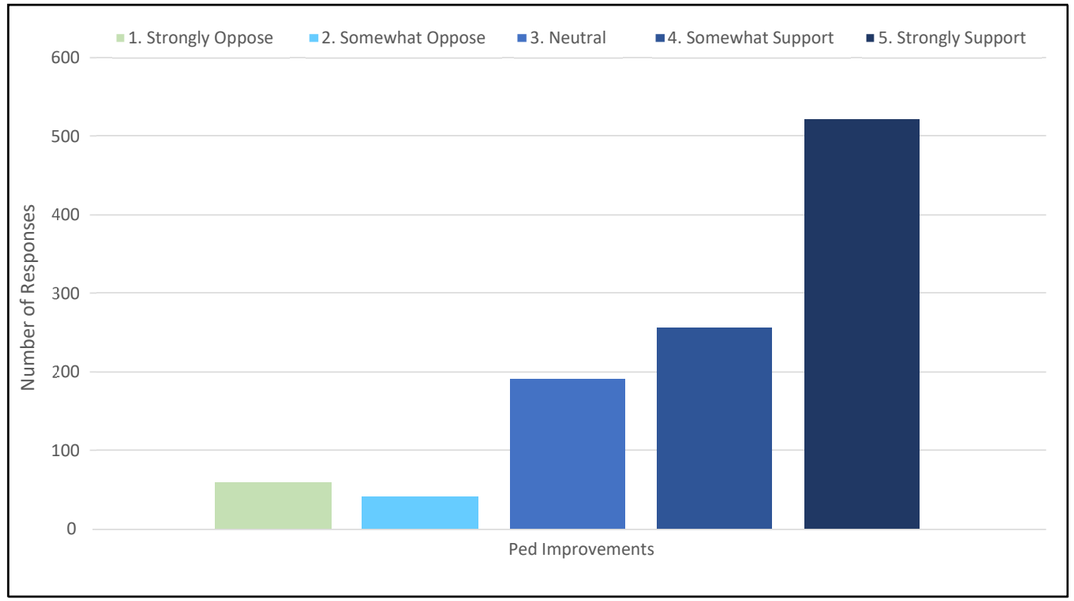


Figure 3-9 shows the survey results for the proposed pedestrian improvements along the corridor. The proposed pedestrian improvements received an approximate average rating of 4.07, indicating that it is the most desirable concept of the alternatives shown.

Figure 3-9: Survey Results – Pedestrian Improvements



Chapter 4 Investment Strategy

VDOT facilitates access to multiple funding sources for transportation improvement projects, below is a description of the most relevant to the Pipeline Initiative. Additionally, **Table 4-1** shows potential funding sources for the study recommendations.

a. SMART SCALE

- A statewide program that distributes funding based on a transparent and objective evaluation of projects that will determine how effectively they help the state achieve its transportation goals.
- Two main pathways to funding within the SMART SCALE process, the Construction District Grant Program (DGP) and the High Priority Projects Program (HPPP).
- Applications may be submitted through the SMART Portal by regional entities including Metropolitan Planning Organizations (MPOs) and Planning District Commissions (PDCs), along with public transit agencies, and counties, cities, and towns that maintain their own infrastructure.
- Approximately $500-600 million in each program is expected to be available per funding cycle. Funding includes both state and federal sources.

b. Transportation Alternatives (TAP)

- This program is intended to help sponsors fund projects that expand non-motorized travel choices and enhance the transportation experience It focuses on providing pedestrian and bicycle facilities and other community improvements.
- TAP funds are only available on a reimbursement basis. The program will reimburse up to a maximum of 80% of the eligible project costs and requires a minimum 20% local match. It requires strict adherence to federal and state regulations including Americans with Disability Act (ADA) design standards.
- Approximately $20 million is available per year with a maximum request of $1 million per year ($2 million per application). All funding is federal.

c. Revenue Sharing (RS)

- This program provides additional funding for use by a county, city, or town to construct, reconstruct, improve, or maintain the highway systems within such county, city, or town, and for eligible rural additions in certain counties of the Commonwealth.
- The RS program will match, dollar for dollar, eligible project costs up to limitations specified in C TB Policy.
- Approximately $100 million in state funding is available per year. All funding is non-federal.

d. Central Virginia Transportation Authority (CVTA)

- The CVTA provides transportation funding to member localities from revenues collected by special taxes within the CVTA localities.
- Funding for projects is directed by CVTA through the Technical Advisory Committee which consists of 15 members from the localities and other regional and state organizations.
- 50% of funding is distributed to member localities, 35% for regional projects and 15% for Greater Richmond Transit Company (GRTC) projects.
- Over $130 million in revenues were created in the first year of the implementation of CVTA.

e. Other Funding Sources

- **Local Funds:** Localities may also direct funds themselves in order to procure transportation projects. This ability may vary depending on the locality, the amount of transportation-related funding allocated to the locality by the state, and other funding availability for transportation projects.
- **Federal Grant Programs:** Additional discretionary grant funding opportunities are available through the recent Infrastructure Investment and Jobs Act (Public Law 117-58).

Table 4-1. Culpeper Pipeline Projects – Potential Funding Sources

Project	Funding Sources				
	SMART SCALE	*TAP*	*RS*	*CVTA*	*Locality Funding*
US Route 29 Business	✓		✓	✓	✓

Appendix A – Screening Tool for Equity Analysis of Projects (STEAP) Report

Appendix B – Turning Movement Counts

Appendix C – Traffic Analysis Results

Appendix D – Raw Crash Data

Appendix E – FR300 Crash Diagrams

Appendix F – Public Input Results

Appendix G – Cost Estimates