PROJECT PIPELINE

FR-23-06: SPOTSYLVANIA COUNTY
ROUTE 208 (COURTHOUSE ROAD) FROM WOODLAND DRIVE TO BLOOMSBURY LANE

DRPT Office of INTERMODAL Planning and Investment VDOT

Route 208 Courthouse Road from Woodland Drive to Bloomsbury Lane (FR-23-06)

Final Report

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Prepared for

Virginia Department of Transportation

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Contents

List of Tables

List of Figures

Chapter 1:

Needs Evaluation and Diagnosis

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.***

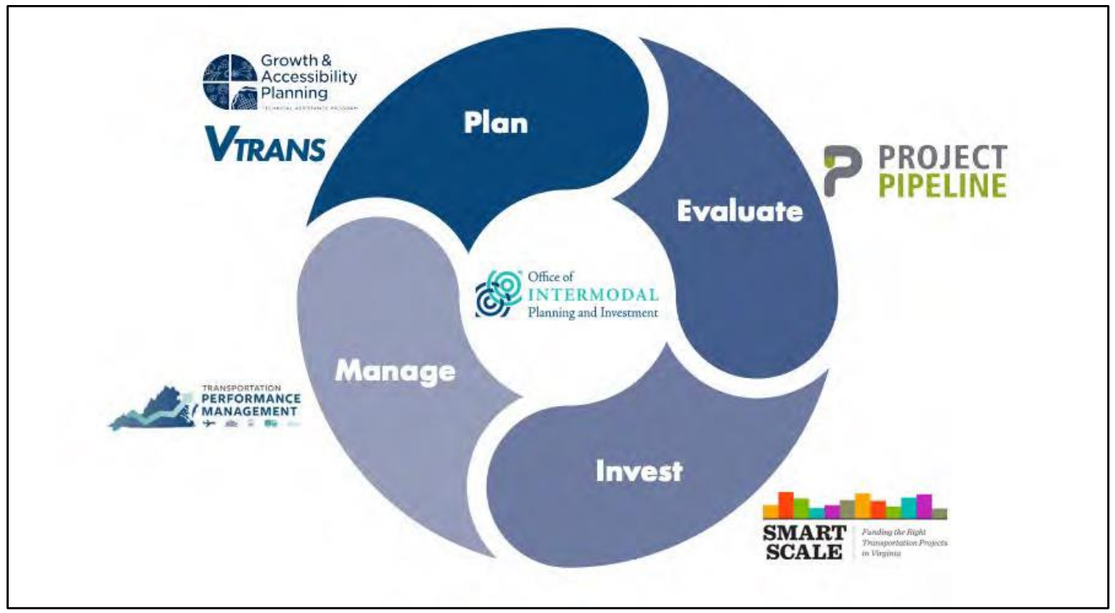


Figure 1: Project Pipeline Objectives

Background

The Office of Intermodal Planning and Investment (OIPI) prepared the trans 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***. This study focuses on addressing needs identified in VTrans, and those previously identified by the localities.

Table 1: List of VTrans Needs

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

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 2***

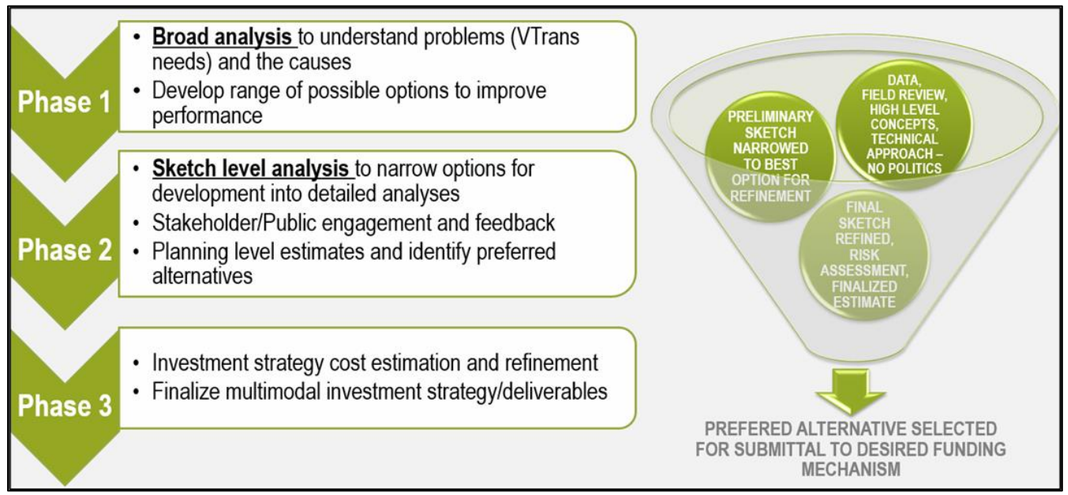


Figure 2: Study Phase Methods and Solutions

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 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 3***.

Figure 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 2.***

Table 2: Roles and Responsibilities for the Technical Team and Study Workgroups (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					

Study Area

Route 208 (Courthouse Road) study corridor from Woodland Drive to Bloomsbury Lane is 2.87 miles long and is located in Spotsylvania County, Virginia. A portion of Route 628 (Smith Station Road) from Cougars Way to Route 629 (Foster Road) as well as the entirety of Foster Road is included in the study area. Route 208 is classified as a minor arterial road, while Smith Station Road is classified as a major collector roadway. The posted speed limit ranges from 40 miles per hour (MPH) on the eastern portion of the corridor to 55 MPH on the western side, with the transition of speed limits occurring approximately 1900 ft west if the intersection of Route 208 at Leavells Road. A map detailing the locations of the study intersections is shown in ***Figure 4***.

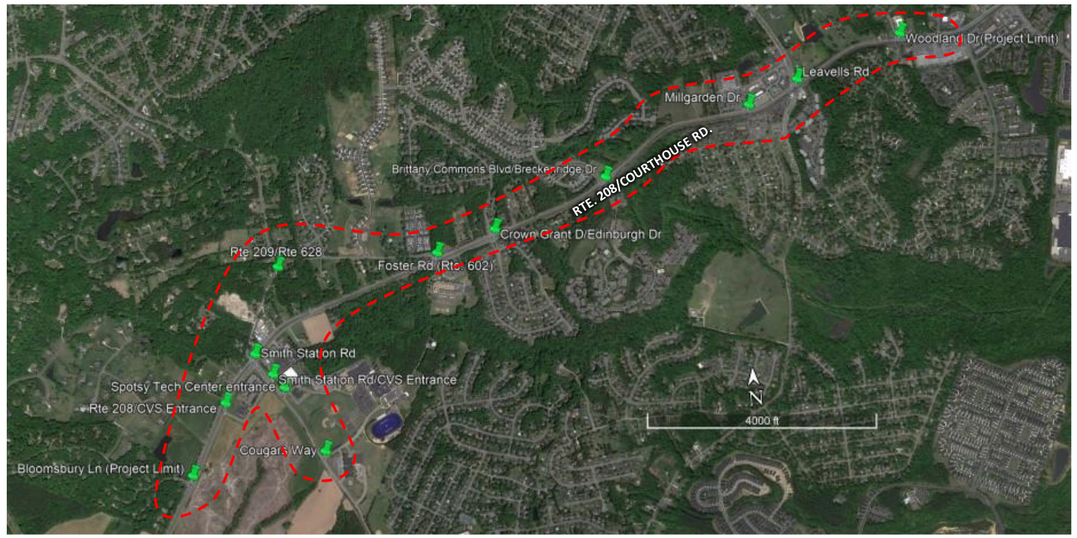


Figure 4: Route 208 Study Area Map

The following are the study intersections under this task:

1. Route 208 at Bloomsbury Lane (unsignalized)
2. Route 208 at CVS Entrance (unsignalized)
3. Route 208 at Smith Station Road (**signalized**)
4. Smith Station Road at CVS Entrance (unsignalized)
5. Smith Station Road at Spotsylvania County IT Center Entrance (unsignalized)
6. Smith Station Road at Cougars Way (unsignalized)
7. Smith Station Road at Foster Road (**signalized**)
8. Route 208 at Foster Road (unsignalized)
9. Route 208 at Crown Grant Drive/Edinburgh Drive (unsignalized)
10. Route 208 at Brittany Commons Boulevard/Breckenridge Drive **(signalized)**
11. Route 208 at Millgarden Drive (**signalized**)
12. Route 208 at Leavells Road (**signalized**)
13. Route 208 at Woodland Drive/Breezewood Drive (**signalized**)

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-tern 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.

These mid-term needs, identified in VTrans, are prioritized as Low, Medium, High, and Very High. The mid-term needs identified in VTrans for the US 208 study corridor, were 'Very High' for Bicycle Access, Safety Improvement, and Transportation Demand Management, 'High' for Pedestrian Access and Pedestrian Safety Improvement, and 'Low' for Transit Access and Transit Access for Equity Emphasis Areas, as presented in ***Table 3***.

Table 3: VTrans Needs in Study Area

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

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

Background Information

There are previous studies and proposed developments that would impact traffic in the study area. The Villas at Hilltop development, shown in ***Figure 5*****,** is planned for a parcel of land between Brittany Commons Boulevard, and Millgarden Drive. The development application included 80 single family townhomes and will generate additional traffic along Route 208. The development has not yet been approved and is still in the early stages.

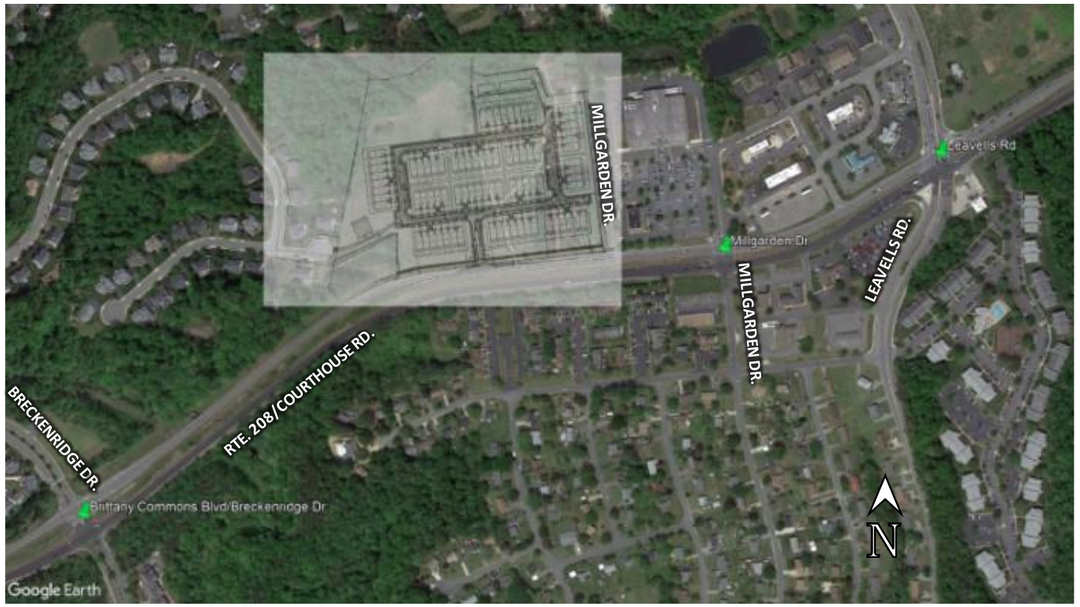


Figure 5: Villas at Hilltop Background Development (Source: The Villas at Hilltop Generalized Development Plan Rezoning Application)

Previous SMART SCALE Application for Improvements

Two applications were submitted to SMART SCALE for improvements along this corridor in 2018.Neither of the two applications received funding, but the proposed improvements are described and shown in ***Figure 6*** And ***Figure 7***:

1. Widening of Smith Station Road (Route 628) at Courthouse Road (Route 208), Smart Scale Application ID 1144, see ***Figure 6***:
   - New alignment for the southbound approach of Smith Station Road at Courthouse Road
   - New lane configuration, creating exclusive right, though, and left lanes.
   - New sidewalk and bike lanes
   - New pedestrian crossings

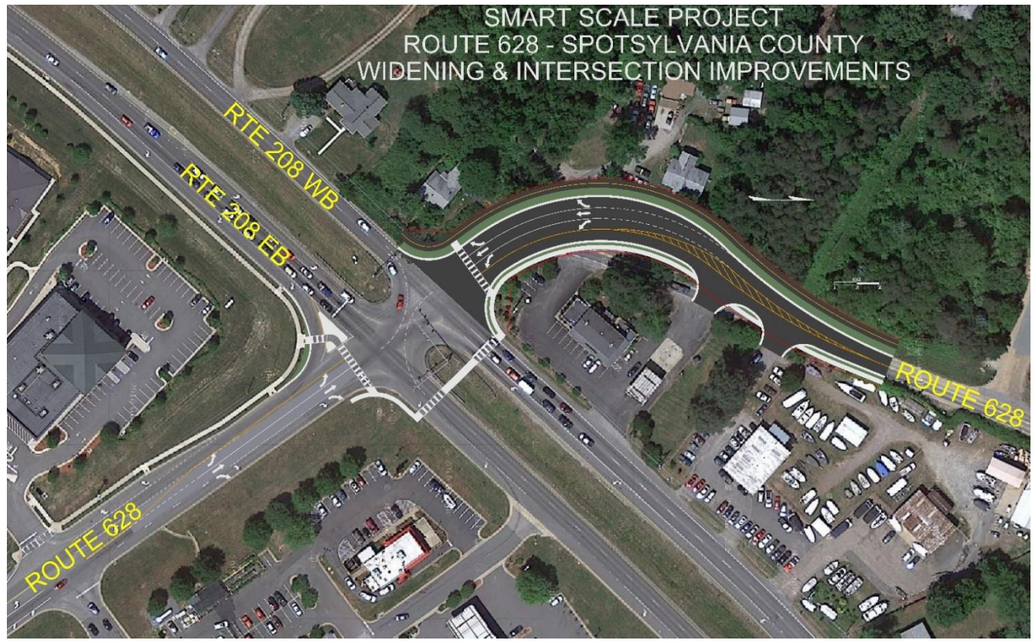


Figure 6: Round 4 SMART SCALE proposed improvements at Smith Station Rd. (Source: SMART SCALE application web portal)

2. Route 208 and Breckenridge Drive Intersection Improvements, Smart Scale Application ID 1138, which includes the extension of both westbound and eastbound left-turn storage lanes along Route 208, see ***Figure 7***.

Figure 7: Round 2 SMART SCALE proposed improvements at Breckenridge Dr. (Source: SMART SCALE application web portal)

Both proposed SMART SCALE applications focused on improvements in intersection performance during peak hours, especially through increased capacity. These intersections were both noted as having issues with congestion and long queues. During the field review this was also observed, particularly at Route 208 at Smith Station Road intersection.

Both of these applications also proposed sidewalk and pedestrian crossing facilities to improve pedestrian access. Based on the information available in the SMART SCALE application web portal, neither of these projects were funded.

Traffic Operations and Accessibility

Traffic operational analysis was performed using Synchro 11 and SimTraffic software for all study intersections along the Route 208 corridor as well as the intersections along Smith Station Road and Foster Road. Inputs and analysis methodologies followed the VDOT Traffic Operations and Safety Analysis Manual (TOSAM) 2.0 guidelines. Both the universal AM and PM peak hour analyses were utilized for the existing year 2023 analysis.

Traffic Data

Twelve-hour turning movement counts were collected on May 16, 2023, from 7:00 AM to 7:00 PM by National Data and Surveying Services (NDS). These counts were obtained while Spotsylvania County schools were still in session and include 15-minute intervals for cars, trucks, and pedestrians at each location. Based on further analysis, it was determined the universal peak hour for the corridor to be 7:15 AM - 8:15 AM (AM Peak) and 4:00 PM – 5:00 PM (PM Peak). The raw traffic data for all study intersections is included in ***Appendix-A***.

Measures of Effectiveness

For the purposes of this study, guidance for reporting measures of effectiveness (MOE) for signalized and unsignalized intersections was obtained from Chapter 4 of the VDOT TOSAM 2.0. A summary of the MOEs evaluated for the study intersections is as follows:

- Control Delay (measured in seconds per vehicle – sec/veh)
- Level of service (LOS)
- 95th Percentile Queue Length from SimTraffic (measured in feet – ft.)

LOS is a quantitative measure to characterize operational conditions within a traffic stream, in terms of such service measures as speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience. Letters designate each level, from A to F, with LOS A representing the best operating conditions and LOS F the worst. LOS is directly related to the control delay.

Traffic Operations Analysis Results

JMT utilized Synchro 11 and SimTraffic to model the existing conditions of the study area. The universal peak hour volumes for both the AM and PM peak hours were used for the analysis. Synchro files, which contained existing signal timings and phasing were provided by VDOT on June 20, 2023. The peak hour factor (PHF), peak hour volumes, and heavy vehicle percentage (HV%) were entered for each movement for both the AM and PM peak hour models. The models were calibrated based on the maximum queue length at each movement from field observations. The maximum queue from SimTraffic was compared to maximum field observed queues. VDOT's TOSAM Version 2.0 was used to determine if the models were calibrated. While TOSAM does not give specific thresholds to determine calibrated models it does state visually acceptable maximum queue lengths are represented for critical movements. Any LOS that was reported as "D", "E", or "F" have been shown in the table as yellow, orange, and red, respectively. Additionally, any queue that was reported as longer than the existing storage length observed in the field has been highlighted in yellow.

The result of the analysis shows that 11 of the 13 study intersections operate at an acceptable LOS D or better for the AM and PM Peak hours. The intersection of Route 208 and Smith Station Road is currently operating at a LOS E in the AM and F in the PM peak hour. Likewise, the intersection of Route 208 and Leavells Road is operating at a LOS E in the AM while operating at an acceptable LOS D in the PM peak hour. Several of the existing movements have queues that exceed the available storage lengths, based on the 95th queue from SimTraffic. The queues of the following movements currently exceed the available storage lengths:

1. Eastbound Left of Route 208 at Smith Station Road (AM & PM peak hours)
2. Northbound Left of Smith Station Road at CVS Driveway (AM & PM peak hours)
3. Westbound Left of Route 208 at Brittany Commons/Breckenridge (PM peak hour only)
4. Westbound Left of Route 208 at Leavells Road (PM peak hour only)
5. Southbound Left of Route 208 at Leavells Road (AM & PM peak hours)

Table 4 summarizes the AM and PM peak hour Synchro and SimTraffic analysis results for existing conditions. The 95th percentile queues highlighted in yellow represent those exceeding the available storage capacity. The Synchro and SimTraffic reports for existing conditions are included in ***Appendix-B***.

Table 4: Existing Condition Synchro Analysis Results Summary

INTERSECTION #	ROADWAY	DIRECTION	LANE	STORAGE LANE (FEET)	EXISTING CONDITION					
					AM PEAK			PM PEAK		
					Delay (S/Veh)	LOS	95th Percentile Queue (ft)	Delay (S/Veh)	LOS	95th Percentile Queue (ft)
1 (Unsignalized)	Courthouse Road (208)	Eastbound	L	215	9.7	A	12	12.9	B	15
			T		0	A	0	0	A	0
			Approach Delay		0	A	-	0.1	A	-
		Westbound	U	215	0	A	13	0	A	10
			T		0	A	0	0	A	0
			R	85	0	A	0	0	A	0
			Approach Delay		0	A	-	0	A	-
	Bloomsbury Lane	Southbound	TR		25	C	72	29.9	D	52
			Approach Delay		25	C	-	29.9	D	-
	Overall Delay				**0.7**	A	-	**0.6**	**A**	-
2 (Unsignalized)	Courthouse Road (208)	Eastbound	T		0	A	0	0	A	0
			R	180	0	A	0	0	A	0
			Approach Delay		0	A	-	0	A	-
		Westbound	T		0	A	0	0	A	0
			Approach Delay		0	A	-	0	A	-
	CVS Driveway	Northbound	R		25.5	D	26	13	B	43
			Approach Delay		25.5	D	-	13	B	-
	Overall Delay				**0**	A	-	**0.1**	**A**	-
3 (Signalized)	Courthouse Road (208)	Eastbound	LU	225	67.1	E	241	65	E	357
			T		58.2	E	428	43.6	D	428
			R		38.9	D	182	36.6	D	63
			Approach Delay		53.7	D	-	43.9	D	-
		Westbound	LU	580	176.9	F	303	324.4	F	340
			TR		27.4	C	248	42.8	D	327
			Approach Delay		67.7	E	-	90.2	F	-
	Smith Station Road	Northbound	L		100.1	F	408	306.4	F	500
			T		59	E	308	118	F	408
			R		49.3	D	156	42.8	D	151
			Approach Delay		72.6	E	-	199.4	F	-
		Southbound	LTR		91.8	F	421	69.6	E	395
			Approach Delay		91.8	F	-	69.6	E	-
	Overall Delay				**64.7**	**E**	-	**104.5**	F	-
4 (Unsignalized)	CVS Driveway	Eastbound	LR		24.5	C	46	22.5	C	78
			Approach Delay		24.5	C	-	22.5	C	-
		Westbound	R		9.9	A	0	10.8	B	5
			Approach Delay		9.9	A	-	10.8	B	-
	Smith Station Road	Northbound	L	85	1.7	A	89	1.5	A	117
			T		0	A	77	0	A	117
			R		0	A	0	0	A	0
			Approach Delay		0.4	A	-	0.4	**A**	-
		Southbound	T		0	A	22	0	A	35
			R	140	0	A	0	0	A	0
			Approach Delay		0	A	-	0	A	-
	Overall Delay				**0.7**	A	-	**1.5**	**A**	-
5 (Unsignalized)	Tech Center	Westbound	L		106.1	F	62	72.6	F	55
			R		15	B	54	19.4	C	50
			Approach Delay		56.1	F	-	37.7	E	-
	Smith Station Road	Northbound	T		0	A	31	0	A	67
			R	50	0	A	0	0	A	5
			Approach Delay		0	A	-	0	A	-
		Southbound	L	80	9.8	A	68	10.7	B	62
			T		0	A	21	0	A	0
			Approach Delay		1.1	**A**	-	1.3	**A**	-
	Overall Delay				**3.3**	A	-	**3.1**	A	-

Table 4: Existing Condition Synchro Analysis Results Summary (cont.)

INTERSECTION #	ROADWAY	DIRECTION	LANE	STORAGE LANE (FEET)	EXISTING CONDITION					
					AM PEAK			PM PEAK		
					Delay (S/Veh)	LOS	95th Percentile Queue (ft)	Delay (S/Veh)	LOS	95th Percentile Queue (ft)
6 (Unsignalized)	Cougars Way	Westbound	L		59.5	F	75	24.5	C	43
			R	225	59.5	F	93	24.5	C	40
			Approach Delay		59.5	F	-	24.5	C	-
	Smith Station Road	Northbound	T		0	A	5	0	A	2
			R	200	0	A	5	0	A	0
			Approach Delay		0	A	-	0	A	-
		Southbound	L	310	11.4	B	81	10.1	B	40
			T		0	A	0	0	A	0
			Approach Delay		2.6	A	-	0.5	A	-
	Overall Delay				9.2	A	-	1.3	A	-
7 (Unsignalized)	Foster Road	Westbound	LR		14.3	B	101	17.4	C	133
			Approach Delay		14.3	B	-	17.4	C	-
	Smith Station Road	Northbound	TR		0	A	0	0	A	0
			Approach Delay		0	A	-	0	A	-
		Southbound	LT		5.4	A	115	4.1	A	95
			Approach Delay		5.4	A	-	4.1	A	-
	Overall Delay				5.2	A	-	5.5	A	-
8 (Signalized)	Courthouse Road (208)	Eastbound	LU	250	8.1	A	20	4.5	A	30
			T		19.6	B	204	8.1	A	110
			R	250	17.6	B	22	11.7	B	29
			Approach Delay		19.5	B	-	8	A	-
		Westbound	LU	260	9.3	A	50	4.6	A	43
			T		6	A	133	6.1	A	163
			R	220	3.7	A	58	0.9	A	61
			Approach Delay		5.8	A	-	5.1	A	-
	Foster Road	Northbound	LT		68.5	E	9	72.3	E	63
			R		67.4	E	0	67.9	E	0
			Approach Delay		67.6	E	-	70.9	E	-
		Southbound	LTR		93.1	F	384	84.7	F	221
			Approach Delay		93.1	F	-	84.7	F	-
	Overall Delay				25.2	C	-	13.5	B	-
9 (Unsignalized)	Courthouse Road (208)	Eastbound	LU	200	9.3	A	16	12	B	27
			T		0	A	0	0	A	0
			R	260	0	A	0	0	A	0
			Approach Delay		0	A	-	0.2	A	-
		Westbound	LU	220	11.5	B	21	10.1	B	61
			T		0	A	5	0	A	0
			R	80	0	A	0	0	A	0
			Approach Delay		0.1	A	-	0.3	A	-
	Crown Grant Drive	Northbound	LT		29.5	D	45	27.7	D	29
			R		9.8	A	34	9.6	A	27
			Approach Delay		19.9	C	-	17	C	-
	Edinburgh Drive	Southbound	LTR		16.4	C	62	28.8	D	46
			Approach Delay		16.4	C	-	28.8	D	-
	Overall Delay				0.7	A	-	0.8	A	-
10 (Signalized)	Courthouse Road (208)	Eastbound	L	120	32.4	C	85	46.6	D	62
			T		5.5	A	216	4	A	173
			R	165	7.3	A	13	8.5	A	34
			Approach Delay		5.8	A	-	5.1	A	-
		Westbound	LU	150	61.5	E	103	87.9	F	167
			T		31.5	C	317	5	A	264
			R	240	9.1	A	52	3.1	A	48
			Approach Delay		31.7	C	-	10.4	B	-
	Brittany Commons Blvd	Northbound	LT		65.2	E	64	70.2	E	54
			R	300	62.8	E	104	68	E	55
			Approach Delay		63.3	E	-	68.5	E	-
	Breckenridge Drive	Southbound	LT		65.9	E	121	72.5	E	82
			R		59	E	44	67.3	E	33
			Approach Delay		63.7	E	-	71.2	E	-
	Overall Delay				19.5	B	-	11.8	B	-

Table 4: Existing Condition Synchro Analysis Results Summary (cont.)

INTERSECTION #	ROADWAY	DIRECTION	LANE	STORAGE LANE (FEET)	EXISTING CONDITION					
					AM PEAK			PM PEAK		
					Delay (S/Veh)	LOS	95th Percentile Queue (ft)	Delay (S/Veh)	LOS	95th Percentile Queue (ft)
11 (Signalized)	Courthouse Road (208)	Eastbound	LU	350	64.3	E	107	90.1	F	118
			T		11.4	B	282	16.3	B	264
			R	180	3.2	A	18	8.2	A	42
			Approach Delay		13.2	B	-	20.9	C	-
		Westbound	LU	180	110.6	F	31	95.7	F	75
			T		6.7	A	108	9.4	A	134
			R		6.6	A	29	0.1	A	46
			Approach Delay		7.6	A	-	10.9	B	-
	Millgarden Drive	Northbound	LT		66.6	E	64	75.4	E	103
			R	50	64	E	51	67.9	E	51
			Approach Delay		65.4	E	-	73.1	E	-
	Hilltop Plaza Way	Southbound	LT		70	E	86	80.8	F	273
			R		63	E	42	56.1	E	50
			Approach Delay		67	E	-	72.6	E	-
	Overall Delay				14.1	B	-	22.2	C	-
12 (Signalized)	Courthouse Road (208)	Eastbound	LU	340	67.4	E	235	77	E	263
			T		27.9	C	375	21	C	365
			R	190	17.3	B	135	10.4	B	152
			Approach Delay		34.9	C	-	34	C	-
		Westbound	LU	300	75.6	E	150	90.5	F	460
			T		31.3	C	239	19.8	B	606
			R	385	131.6	F	229	7	A	370
			Approach Delay		66.5	E	-	25.5	C	-
	Leavells Road	Northbound	L	250	61.9	E	132	66.1	E	186
			LT		76.3	E	146	87.3	F	303
			R	250	68.3	E	158	62.2	E	175
			Approach Delay		71.1	E	-	75.9	E	-
		Southbound	L	185	109.3	F	284	91.5	F	290
			LT		84	F	542	80.5	F	377
			R	400	54.3	D	124	54.1	D	110
			Approach Delay		83.5	F	-	76.4	E	-
	Overall Delay				57	E	-	44.2	D	-
13 (Signalized)	Courthouse Road (208)	Eastbound	LU	320	9.3	A	20	75.2	E	83
			T		25.1	C	296	35.2	D	520
			R	150	10.3	B	57	11	B	102
			Approach Delay		24.7	C	-	35.1	D	-
		Westbound	LU	300	42.1	D	55	18.1	B	87
			T		13	B	170	25.4	C	363
			R	280	9.1	A	22	10.7	B	58
			Approach Delay		13.8	B	-	24.6	C	-
	Woodland Drive	Northbound	LT		68.2	E	52	93.8	F	134
			R	125	64.8	E	84	66.4	E	56
			Approach Delay		65.7	E	-	85.8	F	-
	Woodland Drive	Southbound	LTR		98.4	F	147	92.2	F	148
			Approach Delay		98.4	F	-	92.2	F	-
	Overall Delay				25.1	C	-	32.6	C	-

Access Management

In total, there are 91 access points located within the study area. For this corridor, access points are defined as median crossovers, driveways, or any entrance that allows vehicles to enter or exit the roadway. Along the 2.87-mile section of the Route 208 corridor, there are 63 access points. Along the eastbound direction, there are 19 access points with an average of 6.62 access points per mile. The westbound direction has significantly more access points, with a total of 44 entrances, averaging 15.33 access points per mile. Smith Station Road has 13 access points with an average of 18.24 access points per mile across the 0.71-mile road segment. Foster road has the highest average of 27.24 access points per mile with 15 entrances occurring in a 0.54-mile span.

In general, there is no correlation between access points and the location of crashes in the study area that occurred between 2017 and 2022. There were a few crashes near the intersection of Route 208 and Leavells Road that occurred right next to access points. The 7-Eleven on the eastern side of the intersection had a few crashes that might have been related to access management. Likewise, there were two crashes at the entrance of Atlantic Union Bank on the western side of the intersection. There were no crashes on the westbound direction of 208 that are related to access management as well as the entire segment of Foster Road. At the intersection of Route 208 and Smith Station Road, there were four crashes that occurred at the entrance of the Exxon gas station on the northern leg of the roadway. Most of the access points had no crashes that occurred directly in front of or in proximity to its entrance, where it could be attributed to an access management problem.

It was noted in the field that the Route 208 access point for the 7-Eleven at Leavells Rd and Route 208 is very close to the intersection. While no correlation was observed with crashes, this proximity could create challenging situations for vehicles attempting to enter or exit from the 7-Eleven to Route 208. ***Figure 8*** shows the location of the access points along the Route 208 corridor as well as Smith Station Road and Foster Road.

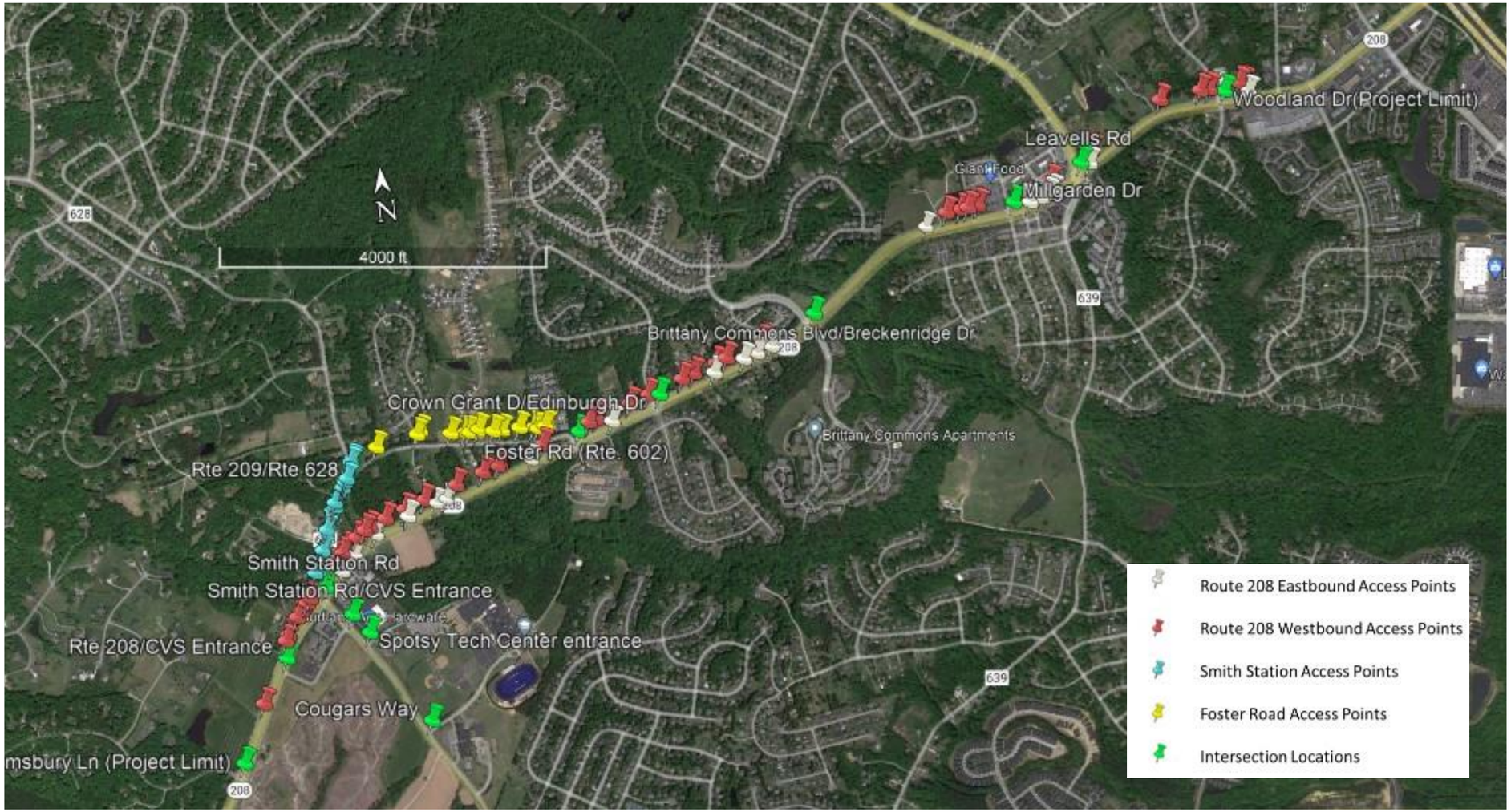


Figure 8: Corridor Access Points

Pedestrian and Bicycle Access

To identify the needs with respect to multimodal accessibility, the study team reviewed existing conditions of pedestrian and bicycle accommodations. Three of the six signalized intersections along the corridor have pedestrian facilities. These crossings were installed in 2021 as part of the Pedestrian Safety Action Plan (PSAP). During the field visit, pedestrian traffic was observed to be minimal, and pedestrians were observed crossing without actuating the pedestrian phase (push button). Most of the pedestrian facilities lack sidewalk connections. The sidewalks at the eastern-most portion of the project at Woodland Drive are part of an ongoing project with the plan to extend the sidewalk westward to Leavells Road. However, there are current challenges due to the historical preservation of the property on the northwest corner of Woodland Drive. ***Figure 9***, ***Figure 10***, and ***Figure 11*** show areas along the corridor where sidewalks and crosswalks are present. Locations where there are only crosswalks with no connecting sidewalk were installed as part of an intermediate and emergency improvement for pedestrians.

There was no noticeable bicycle volume along this corridor. There are also no bicycle facilities or accommodation to promote cycling.

Figure 9: Existing Pedestrian Accommodations at Rte. 208 at Leavells Rd. and Millgarden Dr.

Figure 10: Existing Pedestrian Accommodations at Rte. 208 at Woodland Dr.

Figure 11: Existing Pedestrian Accommodations along Rte. 208 and Simth Station Rd.

Existing Transit

The surrounding area has a total of eight Fredericksburg Regional Transit (FBXGO!) stops in close proximity to the corridor. One is in the shopping center at Smith Station Road and Courthouse Road, three are located along the southern leg of Brittany Commons Boulevard, one is by the Giant Food on Millgarden Drive, and three are in or around the shopping centers by Leavells Road and Courthouse Road. Demand for this bus route appears to be low, as the bus used is a small shuttle bus, and the routes seem to be completed infrequently. Only one bus was seen during the entire time of the field review, and it appeared to be carrying only two passengers. Few of the bus stops observed had no accommodation for waiting passengers. After a discussion with the county, ridership levels are back to pre-pandemic levels***. Figure 12, Figure 13, Figure 14, and Figure 15*** are examples of bus stops within close proximity to the corridor. ***Figure 16, Figure 17, and Figure 18*** show the two FBXGO! bus routes that have stops along the study corridor.

Figure 12: Bus Stop Number 256 (Pictured July 2023)

Figure 13: Bus Stop Number 255 (Pictured July 2023)

Figure 14: Bus Stop Number 29 (Pictured July 2023)

Figure 15: Bus Stop Number 307 (Pictured July 2023)

Figure 16: FXBGO! S1 Bus Route

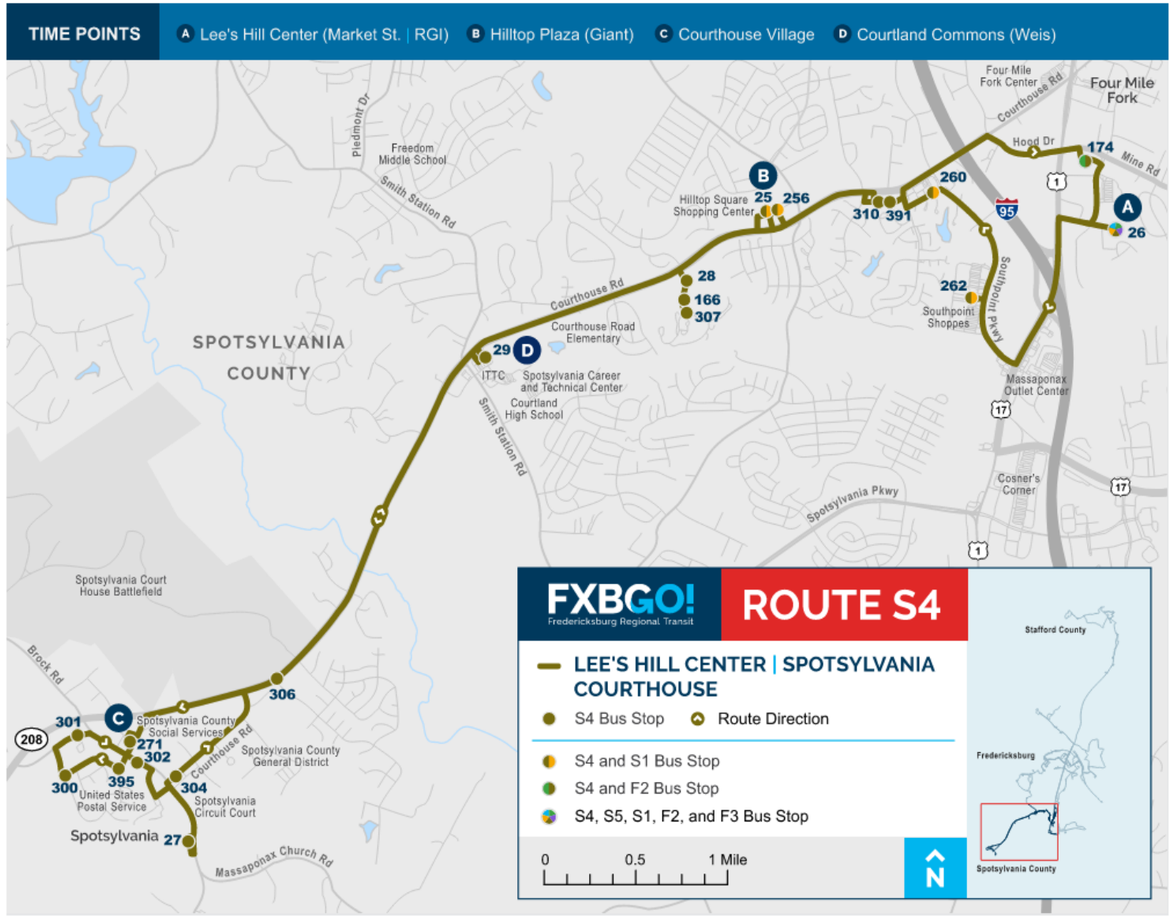


Figure 17: FXBGO! S4 Bus Route

FXBGO! Ridership (9/1/2022-9/1/2023)			
Stop #	Route		Total Riders
	S1	S4	
25	512	1028	**1540**
28	-	56	**56**
166	-	274	**274**
205	246	-	**246**
255	11	-	**11**
256	80	133	**213**
257	351	-	**351**
258	207	-	**207**
260	121	140	**261**
263	34	-	**34**
307	-	848	**848**
310	-	577	**577**
391	-	76	**76**

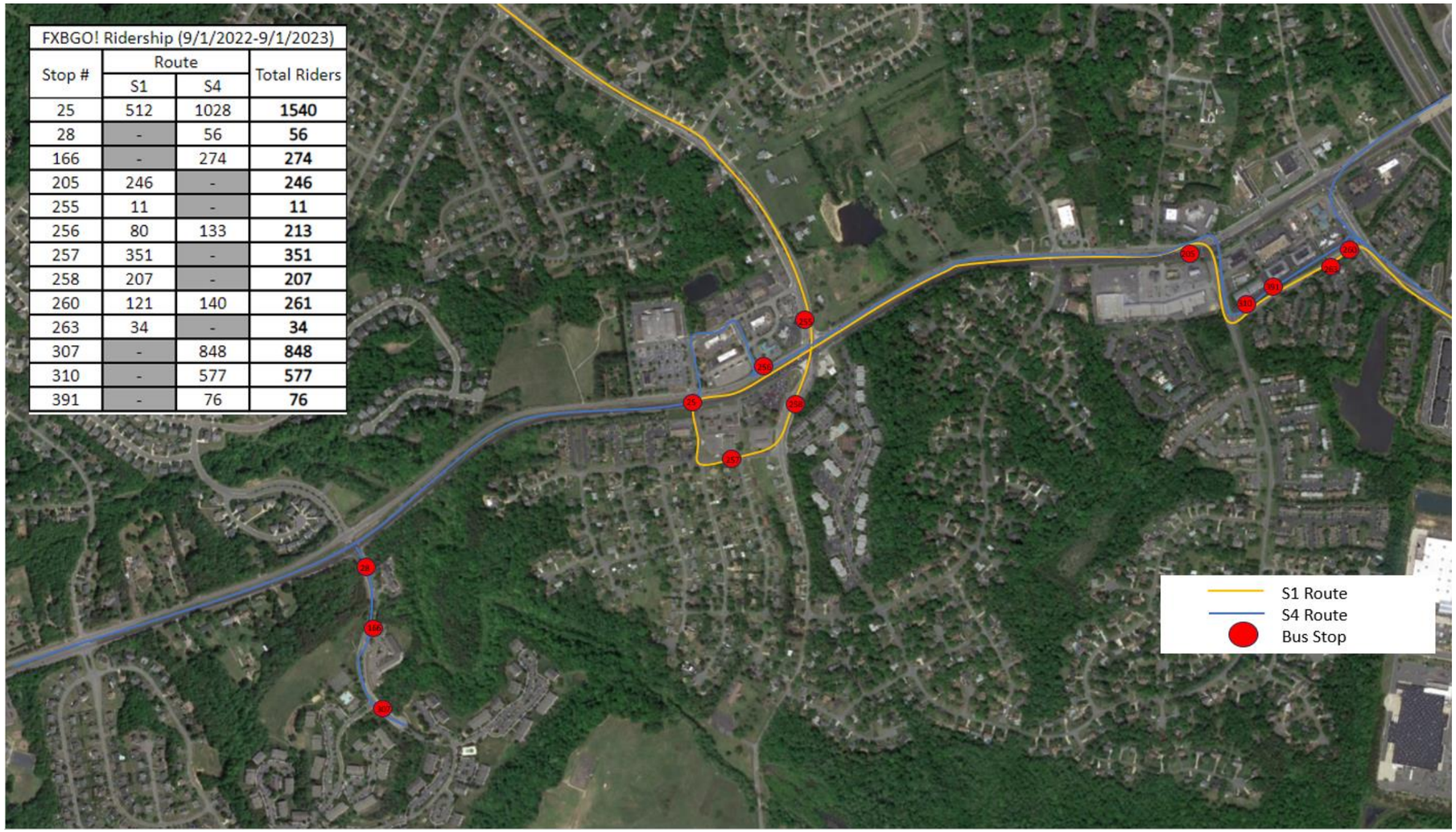


Figure 18: FXBGO! Bus Stops located within Project Limits

STEAP Report

A screening tool for equity analysis of projects (STEAP) report was developed for the study area. This tool provides estimates of the socioeconomic characteristics of the resident population surrounding a project location. The statistical categories reported relate to race, ethnicity, age, sex, household size and income, and household vehicle ownership. This analysis helps to identify disadvantaged population size and characteristics, to determine if any accommodation needs to be provided in any of the proposed 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 size. The general demographic of the project location with a 0.5-mile buffer size compared to Spotsylvania County and the state of Virginia is presented in ***Table 5***. A map depicting the buffer size coverage used in the analysis around the study area is presented in ***Figure 19***.

Table 5: STEAP Analysis Area Statistics

General Buffer Area Statistics	Estimates		
	0.5-mile	Spotsylvania County	Virginia
Land Area (in square miles)	4	401	39,482
Population	7,182	134,683	8,509,358
Housing Units	2,710	48,522	3,537,788
Households	2,557	45,463	3,184,121
Families	1,888	34,302	2,103,100

The results of the STEAP tool analysis are presented below:

- Most of the population (65%) within the study area is between ages 18 and 64, as shown in ***Figure 20***, which is similar to Spotsylvania County and the Commonwealth of Virginia.
- In the 0.5-mile buffer size of the project location, most of the households (44%) own two-vehicles, like in Spotsylvania County and the state of Virginia. Only two percent of households in the 0.5-mile buffer size of the project location do not own a personal vehicle, as shown in ***Figure 21***.
- Of the non-English speakers (age 5+) at home, only one percent of the population within the 0.5-mile buffer size do not speak English well, similar to Spotsylvania County and the state of Virginia, as shown in ***Figure 22***. Everyone speaks at least a little English within the 0.5-mile buffer size of the project location.
- The household income result shows 61% have income greater than $75,000, which is similar to the County, as shown in ***Figure 23***.
- When compared to Spotsylvania County, the study area has a lower average number of veterans, people with disabilities, households with no computers, and households without internet connection, as shown in ***Figure 24.***

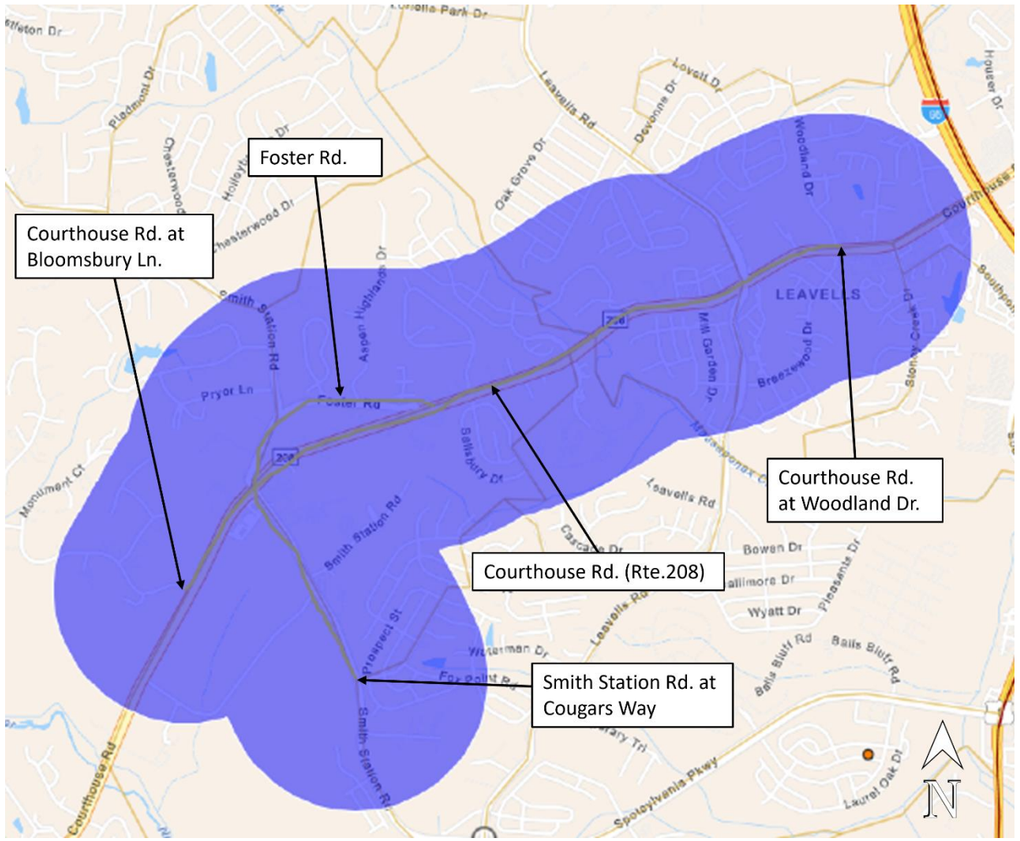


Figure 19: STEAP Analysis 0.5-Mile Buffer Size

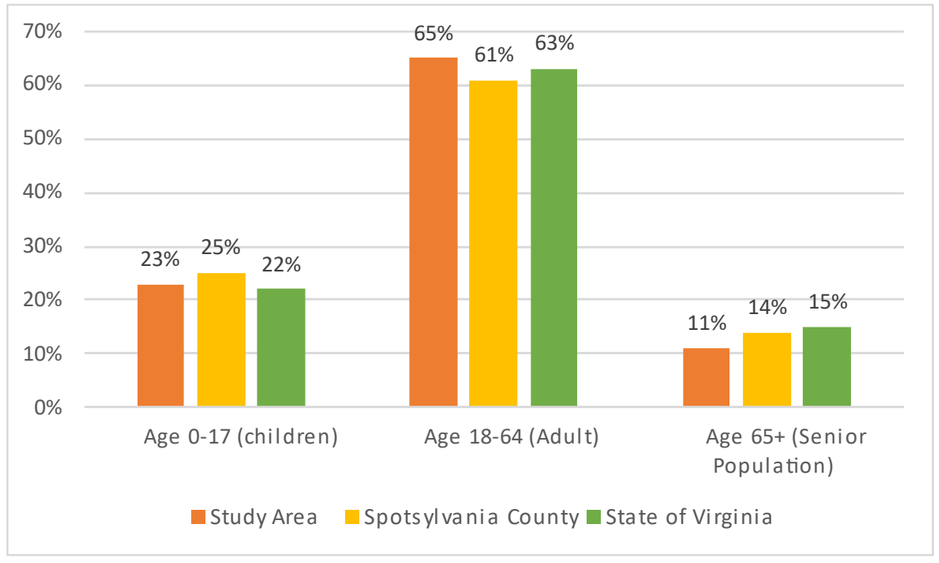


Figure 20: STEAP Analysis Result of Population by Age

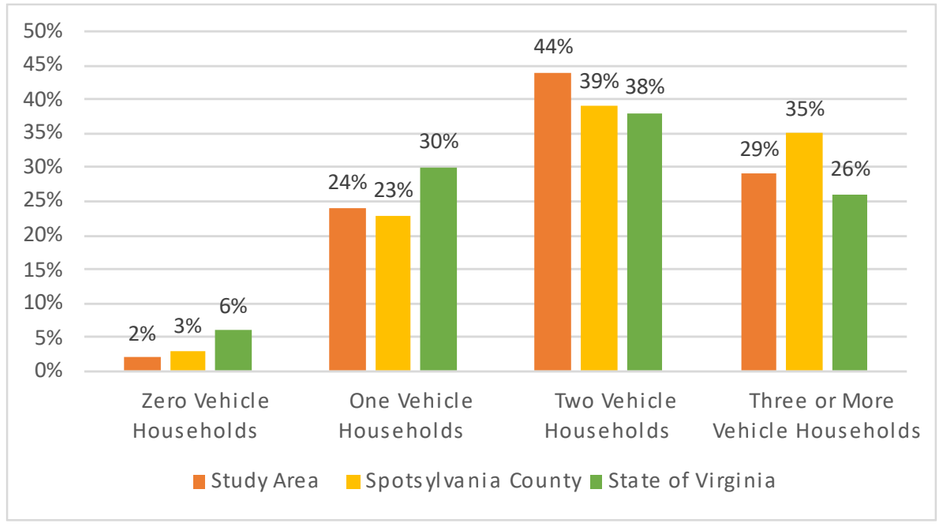


Figure 21: STEAP Analysis Result of Vehicle Ownership

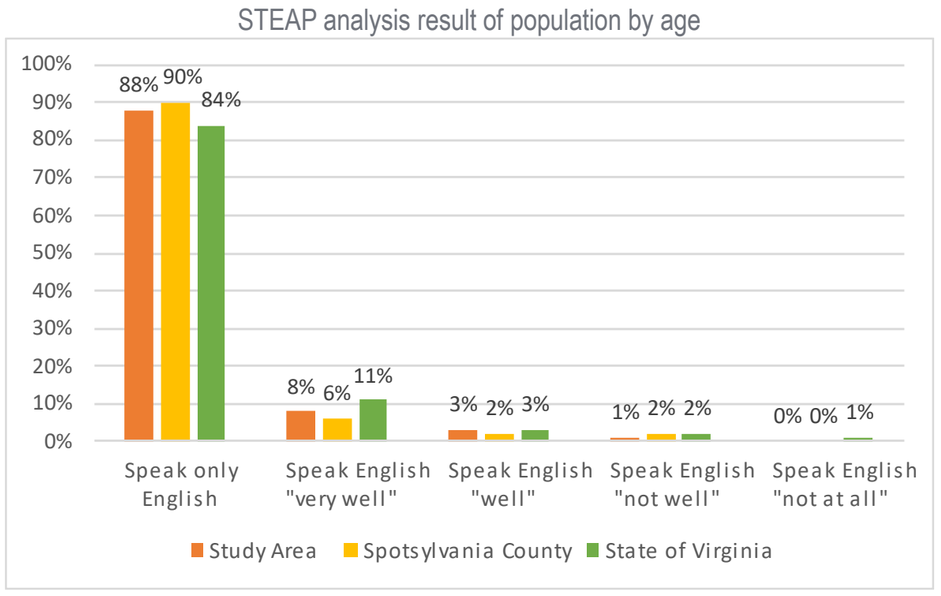


Figure 22: STEAP Analysis Result of Population Age 5+ Years by Ability to Speak English

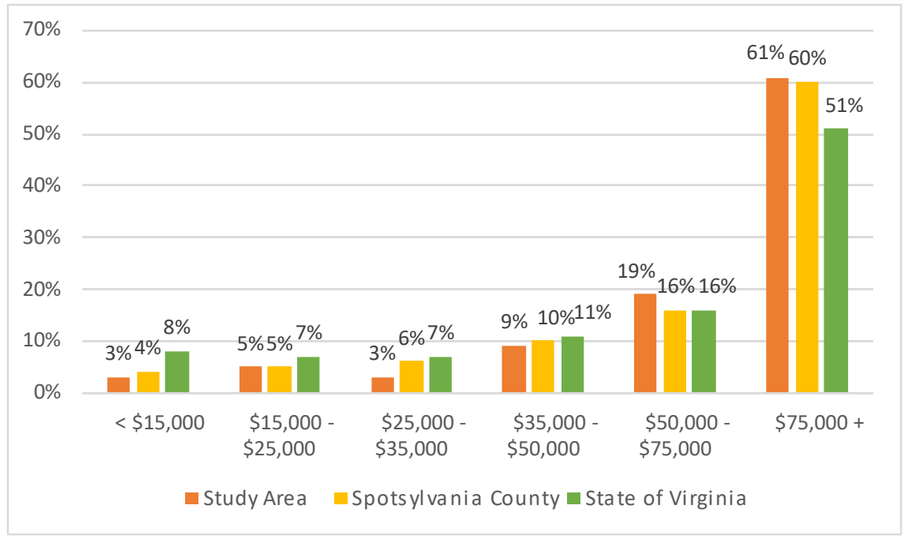


Figure 23: STEAP Analysis Result of Household Income

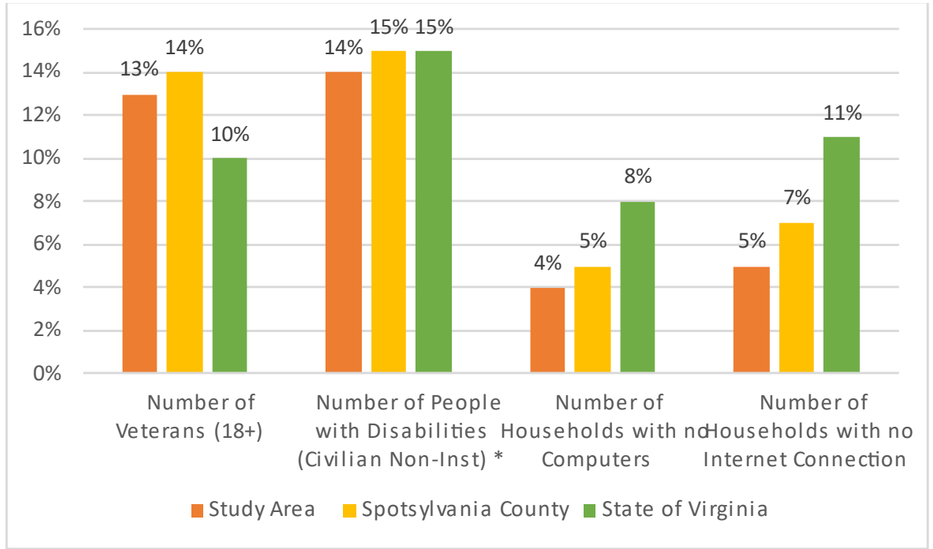


Figure 24: STEAP Analysis Result of Other Vulnerable Populations

Field Review

JMT conducted a field visit on Tuesday, July 11, 2023, to observe existing conditions during the universal AM (7:15 AM – 8:15 AM) and PM (4:00 PM – 5:00 PM) peak hours. Road geometry, lane configurations, signing and pavement conditions, travel pattern, and sight distances were collected throughout the day. Signal operations, queue lengths, and travel patterns at all approaches of the signalized study intersections within the study area were observed during the universal AM and PM peak hours.

While in the field, JMT observed the drivers in the area to be impatient and aggressive. Several vehicles were seen running red lights after missing the allotted green time. southbound vehicles at Smith Station Road and Courthouse Road were observed crossing the double yellow line while maneuvering the curve before the intersection, and there was frequent honking at several intersections. The following sections discuss specific site observations:

SMITH STATION ROAD

The southbound approach has a very tight left curve just before the intersection, shown in ***Figure 25***. The posted speed limit is 35 mph with a 15-mph advisory speed, but there are no chevron signs. Several vehicles were observed running the yellow/red light to make the movement. Northbound traffic consistently queues beyond the CVS entrance.

Figure 25: Southbound Approach of Smith Station Rd. at Courthouse Rd. (Pictured July 2023)

FOSTER ROAD

The southbound approach is a minor road with mostly housing development; all southbound traffic observed turned left at the intersection with Route 208. The southbound approach has a tight curve just ahead of the signal. Drivers have limited visibility of the traffic signal until driving past the curve, at which point the stop bar is less than 100 feet ahead. The northbound right-turn has a receiving lane, but it quickly becomes a right-turn only towards Courthouse Road Elementary School. This configuration has a potential for weaving issues during school drop-off/pick-up.

MILLGARDEN DRIVE

Pedestrian ramps and high visibility crosswalks were installed between 2020 and 2021; they end abruptly with significant grade differences. Pedestrians were observed crossing without actuating pedestrian push buttons. ***Figure 26*** shows the new crosswalk at the southwest corner of the intersection.

Figure 26: Example of Grade Difference at the Southwest Corner of Millgarden Dr. and Courthouse Rd. (Pictured July 2023)

LEAVELLS ROAD

Pedestrians were observed crossing without actuating push buttons. During peak hours, drivers displayed impatient and aggressive driving behaviors. The 7-Eleven at the southeast corner has two access points very close to the intersection, creating difficult situations for traffic exiting the entrance and attempting to find gaps to merge onto Route 208.

WOODLAND DRIVE

Pedestrian crossings were observed to be different from the available aerial image from Google Maps (dated May 1, 2021). Pavement markings have been updated to be high visibility markings. Only the northeast corner of the intersection has sidewalk connections for pedestrian facilities. ***Figure 27*** and ***Figure 28*** show the new pavement markings.

Figure 27: Connected Sidewalk and new Ped Markings across North Leg of Courthouse Rd. at Woodland Dr. (Pictured July 2023)

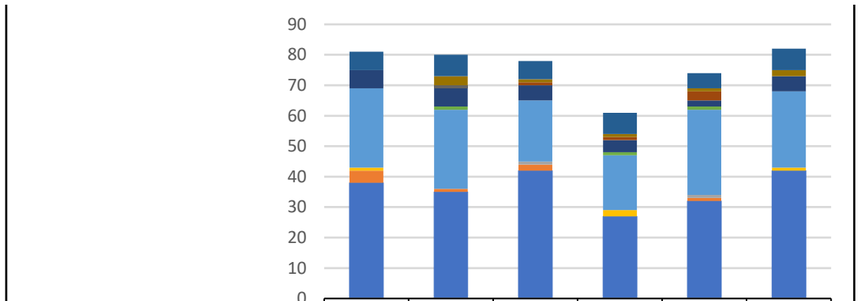
Figure 28: View of new crosswalks from the southwest corner of Courthouse Rd. at Woodland Dr. (Pictured July 2023)

Safety and Reliability

A crash analysis was conducted for the study corridor along Route 208 (Courthouse Road) between Bloomsbury Ln. and Woodland Dr. Crash data was collected from VDOT ArcGIS Crash Map, as well as the Project Pipeline Dashboard for a six-year period, between January 1, 2017, and December 31, 2022. A six-year period was used in place of the standard five-year period to more accurately encompass the years affected by the COVID pandemic (2020, and 2021), and to increase the sample size of years unaffected by the pandemic.

Safety Analysis Results

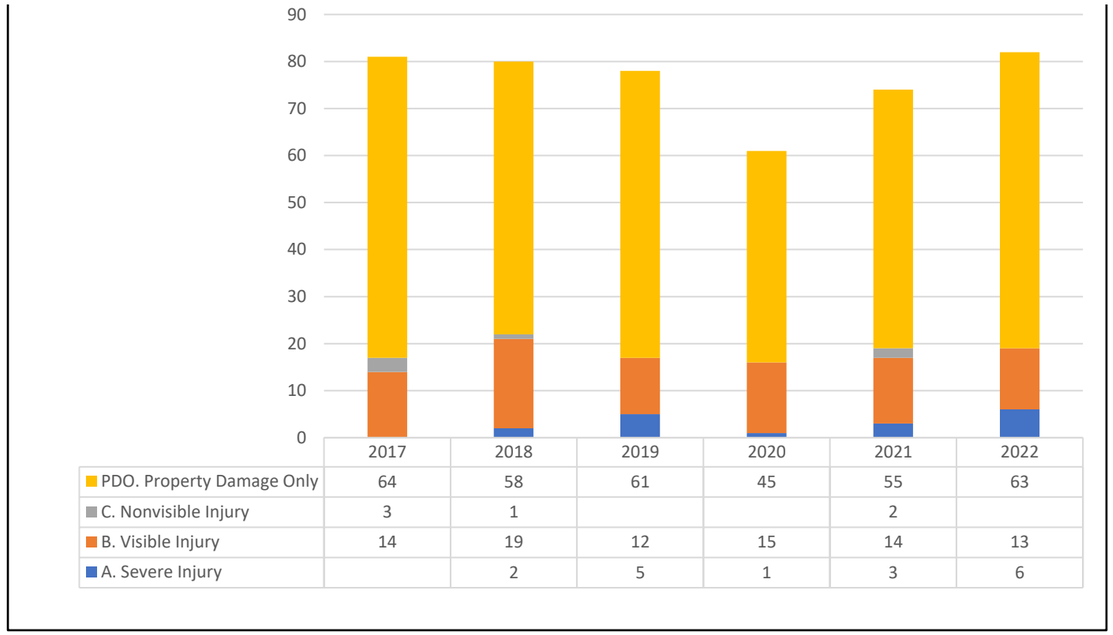
Review of the data showed a total of 456 crashes along the segment over the six-year period. ***Figure 29*** shows a breakdown of crashes by type, which were predominantly rear end (216, 47%), and angle (143, 31%). All other crash types account for 97 crashes, or about 22% of the crashes along the Corridor.



	2017	2018	2019	2020	2021	2022
9. Fixed Object - Off Road	6	7	6	7	5	7
8. Non-Collision		3	1	1	1	2
6. Fixed Object in Road		1				
5. Sideswipe - Opposite Direction			1	1	3	
4. Sideswipe - Same Direction	6	6	5	4	2	5
3. Head On		1		1	1	
2. Angle	26	26	20	18	28	25
16. Other	1			2		1
15. Backed Into			1		1	
10. Deer	4	1	2		1	
1. Rear End	38	35	42	27	32	42

Figure 29: Crash Type by Year

Figure 30 shows crashes by severity for each analysis year. Crash data is categorized as K: Fatal injury, A: Serious Injury, B: Visible Injury, C: Nonvisible Injury, and PDO: Property Damage Only. The majority of crashes along the corridor were property damage only (346, 76%), followed by visible injury (87, 19%), and severe injury (17, 4%). No fatal crashes were reported in the six-year study period.



	2017	2018	2019	2020	2021	2022
PDO. Property Damage Only	64	58	61	45	55	63
C. Nonvisible Injury	3	1			2	
B. Visible Injury	14	19	12	15	14	13
A. Severe Injury		2	5	1	3	6

Figure 30: Crash Severity by Year

The crash history was also analyzed by environmental factors, including lighting conditions, weather, and roadway surface conditions. As ***Table 6*** shows, 66% of crashes occurred under normal conditions, which is during clear weather, dry pavement, and during daylight hours. 75% of crashes occurred under daylight conditions, 88% under clear weather, and 86% on dry pavement.

Table 6: Crash History by Environment

Crash Type	Lighting						Weather					Surface						Total		
	2. Daylight	1. Dawn	3. Dusk	4. Darkness - Road Lighted	5. Darkness - Road Not Lighted	6. Darkness - Unknown Road Lighting	1. No Adverse Condition (Clear/Cloudy)	3. Fog	4. Mist	5. Rain	6. Snow	1. Dry	2. Wet	3. Snowy	4. Icy	6. Oil/Other Fluids	7. Other	Number	%	
1. Rear End	185	3	2	11	14	1	187	1	4	22	2	184	29	2	0	0	1	216	47%	79%
2. Angle	102	1	4	16	19	1	130	1	1	10	1	128	13	1	0	1	0	143	31%	
3. Head On	1	0	0	1	1	0	2	0	0	0	1	2	0	0	1	0	0	3	1%	
4. Sideswipe - Same Direction	21	1	0	1	5	0	28	0	0	0	0	28	0	0	0	0	0	28	6%	
5. Sideswipe - Opposite Direction	2	0	0	1	2	0	5	0	0	0	0	4	1	0	0	0	0	5	1%	
6. Fixed Object in Road	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0%	
8. Non-Collision	1	0	1	1	5	0	6	0	0	2	0	5	2	0	0	0	1	8	2%	21%
9. Fixed Object - Off Road	21	0	0	4	13	0	30	0	1	7	0	30	8	0	0	0	0	38	8%	
10. Deer	4	0	0	1	3	0	8	0	0	0	0	8	0	0	0	0	0	8	2%	
15. Backed Into	2	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	2	0%	
16. Other	1	0	0	0	3	0	4	0	0	0	0	3	1	0	0	0	0	4	1%	
Total Frequency	341	5	7	36	65	2	402	2	7	41	4	394	55	3	1	1	2	456		
Total(%)	75%	1%	2%	8%	14%	0%	88%	0%	2%	9%	1%	86%	12%	1%	0%	0%	0%			
				25%						12%					14%					
% of Crashes occurred during a combination of daylight, clear weather, and dry surface conditions							300													
							66%													

Crash Rates were calculated for each intersection based on available crash data, and AADT obtained from VDOT published records. The average crash rate for Fredericksburg/Spotsylvania was determined to be 0.44 for comparison using VDOT's Tableau Intersection Crash data. Six of the thirteen intersections analyzed have a higher crash rate than average for the area (Route 208 at Woodland Drive, Route 208 at Leavells Road, Route 208 at Breckenridge Drive, Route 208 at Smith Station Road, Smith Station Road at CVS Entrance, and Smith Station Road at Foster Road). These intersections have crash rates between 0.5 and 0.88, as shown in ***Figure 31.***

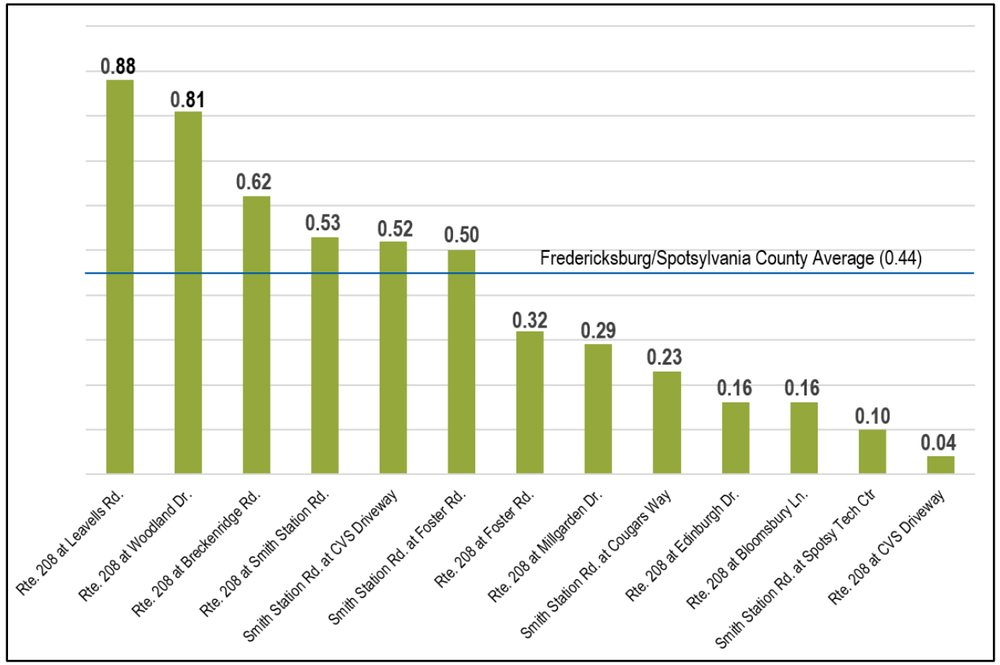


Figure 31: Crash Rate by Intersection

Field observations showed significant queuing at the major intersections of Smith Station Road and Leavells Road. These queues likely play a significant role in the prevalence of rear end collisions at these intersections.

Drivers were also observed to have limited patience; there was considerable amounts of honking and vehicles running red lights to avoid waiting for another full cycle at the red light. These vehicles running red-lights contribute to the number of angle crashes at the major intersections along the corridor.

To assist with visualization about the volume of crashes occurred at intersections along the corridor, a heat map has been provided in ***Figure 32.***

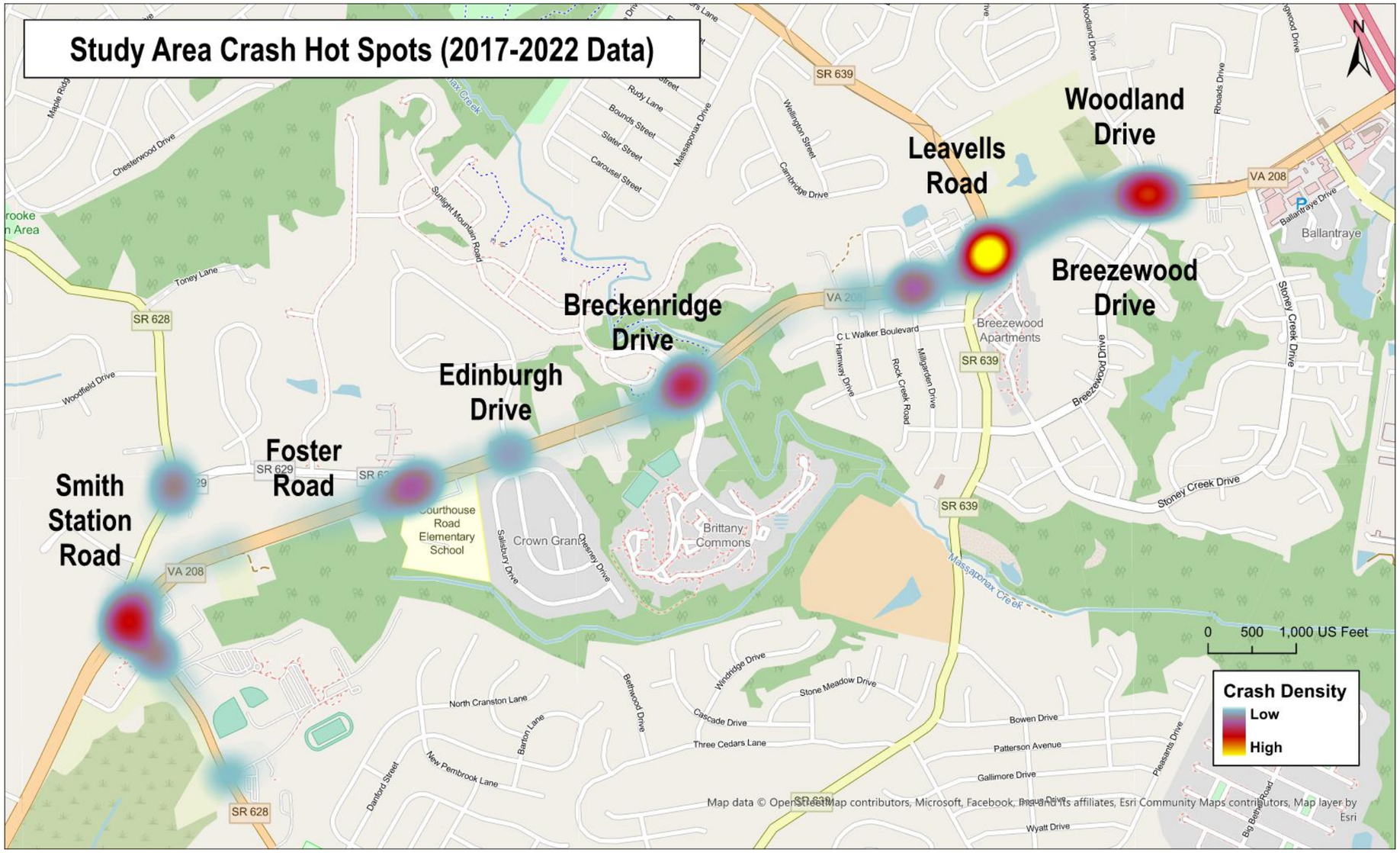


Figure 32: Route 208 Corridor Crash Frequency Heatmap

Anticipated Corridor Issues

The major crash hotspots along the Route 208 corridor are all centered around intersections. Observed driver behaviors in the study area included a noticeably high number of vehicles running red lights at the end of signal phases as well as speeding, swerving, and honking horns. This was particularly true during the high congestion periods of the AM and PM peak hours.

One of the problematic locations is the southbound approach on Smith Station Road at Courthouse Road. There is a tight horizontal curve just before the signal. The advisory speed is 15 mph lower than the speed limit, and there are no chevron signs along the curve. The curve is sharp enough that many vehicles were observed crossing the double yellow line while approaching the intersection. There are trees and commercial developments along the inside of the curve which further restrict visibility while approaching the signal and intersection. The heavy vehicle traffic is high along the route as well, due to dump trucks using the road to access a mulch/aggregate site.

Six of the thirteen intersections have a higher crash rate than the Spotsylvania/Fredericksburg average. Of the six, four are signalized, while the two unsignalized intersections are along Smith Station Road adjacent to Courthouse Road.

Pedestrian facilities are largely lacking along the corridor. While the intersections along Route 208 at Woodland Drive, Leavells Road, and Millgarden Road have pedestrian crossings and pedestrian signals, the sidewalks along the corridor are largely not connected. Three of the four pedestrian curb ramps at Route 208 at Millgarden Drive are leading to significant grade differences on the surrounding terrain. The bus stops along the corridor also lack proper facilities. Most of the bus stops are marked by only one sign, with no supporting facilities or shelters for the riders. Bicycle accommodations are non-existent along the corridor; sidewalks and shoulder widths are also limited, making it difficult for potential bicyclists to use this corridor.

Potential Corridor Improvements

After a thorough analysis of the historical crash data, existing condition operational analysis, pedestrian, and bicycle facilities as well as location of access points, several corridor improvements are recommended.

Access Point Improvements

The access points in the eastbound direction along Route 208 between Millgarden Drive and Leavells Road are connected parcels with multiple entrances. It is recommended to close these access points on Route 208 as these present potential safety and operational concerns. Vehicles will still be able to access these parcels through Millgarden Drive or Leavells Road.

Pedestrian Improvements

VTrans lists pedestrian access and pedestrian safety improvements as a high priority for this corridor. It is recommended to construct a shared use path on the northern side of Route 208 starting at Leavells Road and continuing to the signalized intersection of Smith Station Road. With the majority of access points and residential areas located on the western side of the corridor, a shared use path would provide pedestrians safer and easier access to traverse the roadway. In addition to this shared use path, crosswalks are recommended to be added to any signalized intersection currently without facilities. The intersections along Route 208 include:

1. Breckenridge Drive / Brittany Commons Boulevard
2. Foster Road
3. Smith Station Road

Along with the proposed shared use path, the existing sidewalk on the southern leg of Route 208 at Leavells Road intersection should be extended further south due to the current housing development and lack of pedestrian facilities in this area.

The existing sidewalk on the southern leg of Smith Station Road should be continued into the Spotsylvania County IT center entrance to the Parking Lot of Courtland Highschool. This proposed sidewalk will provide students who walk home a safer route instead of using the parking lot area. This proposed sidewalk will tie into the existing sidewalk on Smith Station Road and will also provide the students with a safer pathway to visit one of the various convenience stores, restaurants, or grocery stores located just north of the school.

Another alternative for pedestrians is a walking trail connecting Courtland Highschool to Courthouse Road Elementary school. This would keep pedestrians away from Smith Station Road and provide a safter trail for walking. ***Figure 33*** and ***Figure 34*** show the areas where the proposed paths, crosswalks, and access points are recommended.

Figure 33: Proposed Pedestrian Improvements

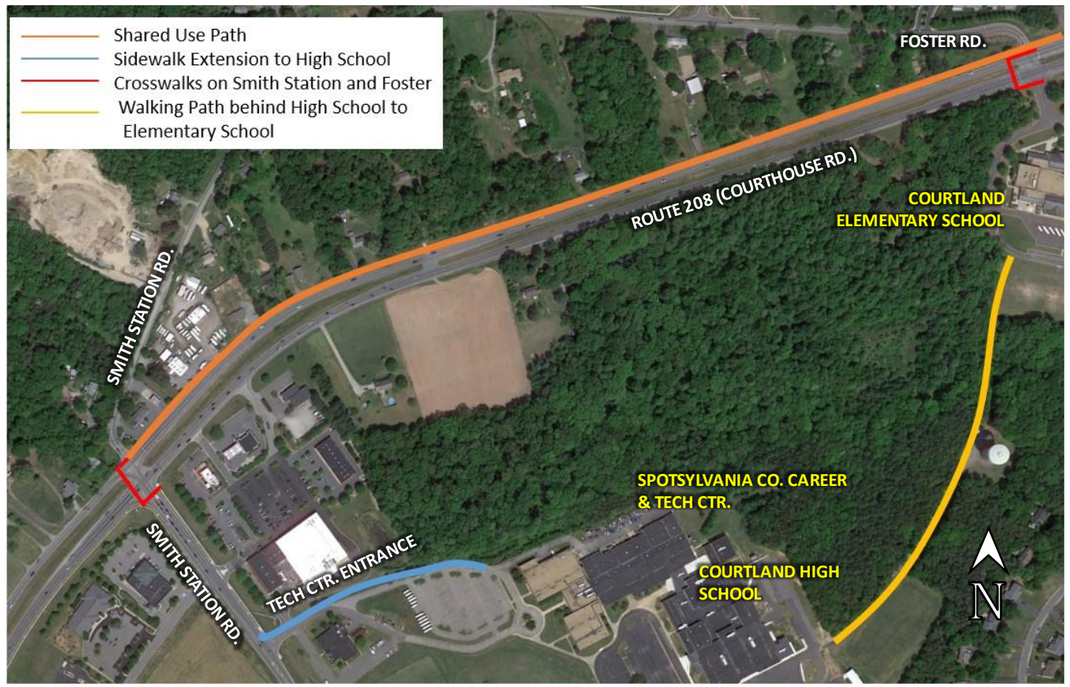


Figure 34: Proposed Pedestrian Improvements

Bicycle Improvements

Bicycle access is listed as a very high priority for VTrans' needs along the Route 208 corridor. There are currently no bike paths. As discussed in the Pedestrian Improvements section, a shared use path will allow cyclists a much safer way to travel compared to riding on the limited shoulders on the corridor and it will potentially attract more bicyclists as there is currently very few who bicyclists use the roadway.

General Corridor Improvements

These alternatives are low-cost improvements that are expected to have a beneficial impact on the entire corridor, especially left-turn movements at signalized intersections:

- Flashing Yellow Arrows for signalized left turns: Currently the intersections of Smith Station Road, Breckenridge Drive, and Millgarden Drive are protected only phasing. Allowing protected/permissive phasing with a flashing yellow arrow will allow left-turning vehicles to move with the through movements if there are adequate gaps to safely maneuver.

- Signal Optimization: along with the alternatives presented in this section, each signalized intersection along the corridor should be reoptimized due to lane reconfiguration or changes in phasing.

Intersection Improvements

Due to the high crash rates, long queue lengths, and unacceptable levels of service, the intersections of Route 208 at Smith Station Road and Route 208 at Leavells Road are recommended for improvements. After conducting high-level analysis using VJuST, the universal AM and PM peak hour volumes and heavy vehicle percentage, five alternatives are being proposed for each location. The five alternative descriptions and anticipated Volume to Capacity (V/C) ratios are presented in ***Table 7***.

Table 7: VJuST Alternative Results

Intersection	Alternative #	AM V/C	PM V/C	Alternative Description
Rte. 208 at Leavells Rd.	Initial V/C	0.87	1.00	V/C based on existing conditions
	1	0.74	0.78	Dual Left on NB & SB Approaches
	2	0.85	1.00	Dual Left on WB Approach
	3	0.73	0.78	Dual Left on NB, SB, & WB Approaches
	4	0.73	0.67	Dual Left on NB, SB, & WB Approaches with 3rd WB Thru Lane
	5	0.72	0.59	Partial Displaced Left Turn (EB-WB Direction)
Route 208 at Smith Station Rd.	Initial V/C	0.88	0.91	V/C based on existing conditions
	1	0.79	0.76	Dual Left on NB Approach
	2	0.82	0.82	Exclusive Left/Thru/Right Lanes on SB Approach
	3	0.72	0.66	Exclusive Left/Thru/Right Lanes on SB & Shared Left/Thru on NB Approach
	4	0.72	0.63	Addition of 3rd WB Thru along with Dual NB Left Exlusive Left/Thru/Right Lanes on SB Approach
	5	0.65	0.65	SW Quadrant using CVS Driveway access

ROUTE 208 AT SMITH STATION ROAD

The intersection of Route 208 and Smith Station Road has the worst overall LOS in both the AM and PM peak hours. The only approach that currently meets acceptable LOS is the eastbound direction. Likewise, Route 208 and Smith Station Road intersection has the second most crashes of the 13 intersections along the corridor. The following are the proposed improvements:

Alternative 1 - Dual Northbound Left-Turns

The first alternative shown in ***Figure 35*** for Smith Station Road involves adding a left-turn lane on the northbound approach. The northbound left-turn movement has 267 vehicles per hour (vph) in the AM and 465 vph in the PM peak hour. This has caused the movement to have a LOS F during both peak hours and the queue for the northbound approach backs up past the CVS entrance along Smith Station Road south of Route 208. The remaining three approaches are recommended to stay unchanged for this alternative.

Figure 35: Smith Station Road Alternative 1 – Dual Northbound Left-Turn Lanes

Alternative 2 - Exclusive Turn Lanes on Southbound Approach

The southbound approach currently has a LOS F in the AM and LOS E in the PM peak hour. Based on the field observations, this approach has sight distance concerns with the tight horizontal curve. It was also observed that several vehicles ran red lights due to the short green time. Adding an exclusive left and right turn lane will allow the change of the southbound phasing to be concurrent with northbound, allowing protected left-turn phase, which is expected to increase both safety and efficiency at the intersection. Right-turning vehicles will also have a dedicated lane to turn when red instead of potentially stopping behind left or through moving vehicles. The remaining approaches are recommended to stay unchanged for this alternative as shown in ***Figure 36***.

Figure 36: Smith Station Road Alternative 2 - Exclusive Southbound Lanes

Alternative 3 - Dual Northbound Left-Turn Lanes with Exclusive Southbound Lanes

This alternative is a combination of the previous two alternatives. The VJuST results have a V/C ratio of 0.72 in the AM and 0.66 in the PM peak hour. No other changes besides optimization will be made to the intersection. Alternative 3 is presented in ***Figure 37.***

Figure 37: Smith Station Road Alternative 3 - Dual Northbound Left-Turn Lanes with Exclusive Southbound Lanes

Alternative 4 - Dual Northbound Left-Turn with Exclusive Southbound Turn Lanes along with an Additional Westbound Through Lane

This alternative builds upon the previous alternatives and adds an additional westbound through lane that would carry through the whole corridor. In the project kickoff meeting, it was recommended to look into adding a third westbound through lane past the intersection for Route 208 and Leavells Road. With the through volume in PM peak hour exceeding 1,000 vph at most of the intersections in the study area, it is recommended to continue the additional through lane all the way to the end of the project limits at Bloomsbury Lane. ***Figure 38*** represents this alternative.

Figure 38: Smith Station Road Alternative 4 - Dual Northbound Left-Turn Lanes with Exclusive Southbound Lanes & Additional Westbound Through

Alternative 5a: Full Quadrant Roadway

While the previous four alternatives were more conventional improvements, Alternative 5 is an innovative intersection recommendation. Quadrant Roadways utilize the existing infrastructure to reroute all left-turning vehicles. In the instance of Smith Station Road, the CVS entrance on both Route 208 and on Smith Station Road will be used. In total, three intersections are required for this alternative to work. Due to the high volumes, the CVS intersections will no longer be stop controlled, instead it will need to be signalized. All left turns previously conducted at the main intersection of Route 208 and Smith Station Road, will be done at one of the two CVS entrances. Only through and right turns will be

permitted at this intersection. To accommodate the increase in volume, an additional lane will be provided for both directions along the CVS roadway. Likewise, the previous right-in, right-out entrance to the parking lot across from CVS will be converted into a shared left, through, and right lane. The lane configuration for each intersection is seen in ***Figure 39***.

Figure 39: Smith Station Road Alternative 5a - Full Quadrant Roadway

Alternative 5b - Hybrid Quadrant Roadway

Another quadrant roadway alternative is a hybrid version which involves displacing the left turns on the northbound and southbound approaches only. These left turns would still take place at the CVS entrance. There would be no changes to the eastbound or westbound lane configurations along Route 208. Another option for the hybrid quadrant roadway could be performed if the CVS entrance was extended further south to align with the entrance of Courtland Highschool/Spotsylvania Tech Center. This would create a larger distance between the quadrant roadway and the signalized intersection of Smith Station Road. Due to the expected volumes, all three intersections involved would be signalized. An example of this intersection configuration is presented in ***Figure 40***.

Figure 40: Smith Station Road Alternative 5b - Hybrid Quadrant Roadway

ROUTE 208 AT LEAVELLS ROAD

The intersection of Route 208 and Leavells Road has the second worst overall LOS and the most intersection crashes along the corridor. In each alternative, the signal timing will be optimized to add additional efficiency.

Alternative 1 - Dual Northbound and Southbound Left-Turn Lane

Currently the northbound and southbound approaches are split phase due to the shared left and through lane. This alternative would add an exclusive left-turn lane to make both the northbound and southbound approaches dual left and change the shared through left/through into a through lane. This in turn would allow concurrent phasing for signal operations. There would be two through lanes and one right-turn lane for both the northbound and southbound approaches. No changes would be made to the eastbound or westbound direction as shown in ***Figure 41***.

Figure 41: Leavells Road Alternative 1 - Dual Northbound & Southbound Left-Turn Lanes

Alternative 2 - Dual Westbound Left-Turn Lane

The westbound left-turn lane is currently operating at LOS E in the AM and LOS F in the PM peak hours with the PM queue length exceeding the available storage lane. An additional left-turn lane would be added to this approach while the remaining approaches would remain the same as the existing condition. Alternative 2 is represented in ***Figure 42***.

Figure 42: Leavells Road Alternative 2 - Dual Westbound Left-Turn Lanes

Alternative 3 - Northbound, Southbound, and Westbound Dual Left-Turn Lane

Alternative 3, shown in ***Figure 43***, is a combination of the first two alternatives with no other changes to the intersection. The left-turn movement for these approaches is currently the biggest issue in terms of queue length and level of service. Adding the additional turn lane for these three approaches along with signal timing optimization is expected to improve overall intersection efficiency compared to existing conditions.

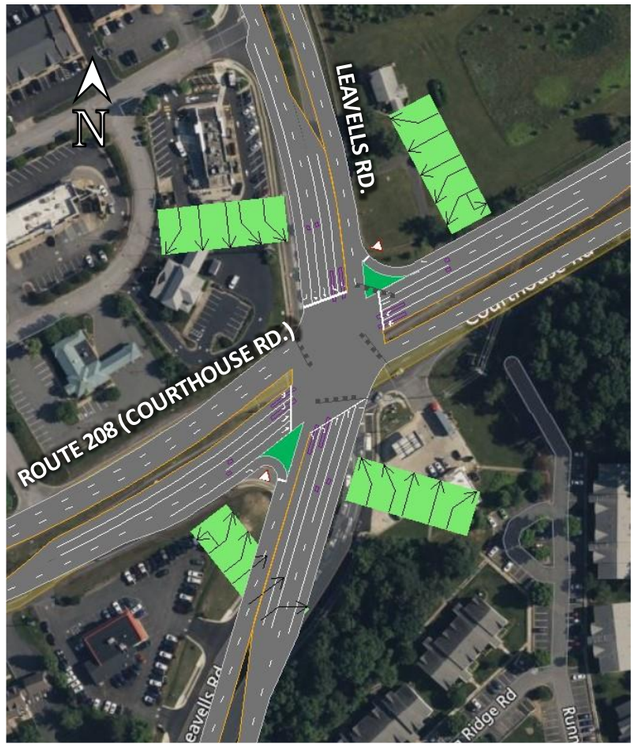


Figure 43: Leavells Road Alternative 3 – Dual Northbound, Southbound, and Westbound Left-Turn Lanes

Alternative 4 - Dual Northbound, Southbound, and Westbound Left-Turn Lanes with an Additional Westbound Through Lane

Alternative 4, shown in ***Figure 44,*** builds off the previous three alternatives however a third through lane in the westbound direction is added. There are currently over 1,000 vph heading westbound through the intersection with only two available lanes. The third lane would be a continuation of the proposed additional through lane that was slated to start at Route 208 and Woodland Drive intersection.

Figure 44: Leavells Road Alternative 4 - Dual Northbound, Southbound, Westbound Left-Turn Lanes & Additional Westbound Through

Alternative 5 - Partial Displaced Left Turn (East-West Direction)

Alternative 5 involves displacing the left-turning movements in the eastbound and westbound directions. The eastbound and westbound left-turns along Route 208 cross the other side of the roadway in advance of the main intersection at signalized crossover locations. The left-turns and opposing through movements can travel through the main intersection at the same time. The number of conflict points where a crash may occur is spread out through the intersection, which may result in a reduction of crashes. Only through and right-turns will be permitted at the main intersection for Route 208 while the existing conditions of Leavells Road will be unchanged. While this intersection offers the lowest V/C ratio for both the AM and PM peak hours, it does present the greatest right-of-way needs with the

proximity of the Route 208 and Millgarden Drive intersection, making it difficult to add a crossover between these two intersections. ***Figure 45*** shows how a partial displaced left turn operates.

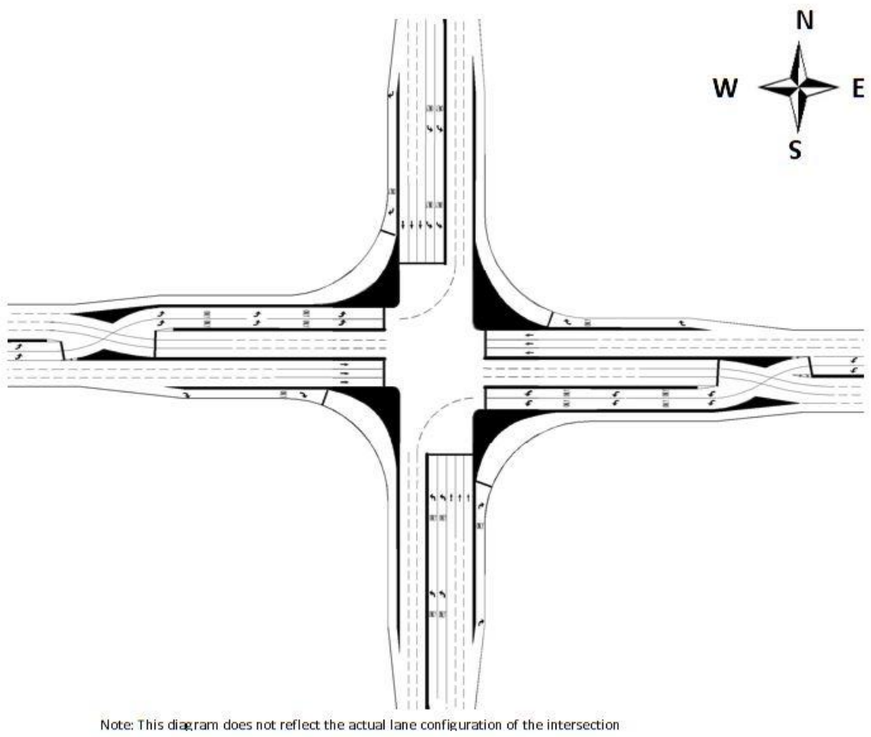


Figure 45. Example of Partial Displaced Left Turn

ROUTE 208 AT BLOOMSBURY LANE

During the technical team discussion meeting on August 31, 2023, SWG identified the intersection of Route 208 at Bloomsbury Lane as having safety concerns. Due to the high speeds in the westbound direction and the short right-turn lane, vehicles attempting to turn right onto Bloomsbury Lane can face difficulty making the maneuver. To help with this, the westbound right-turn storage lane should be lengthened to allow drivers more time to decelerate from the mainline and properly turn into Bloomsbury Lane. VDOT criteria for storage lanes in urban areas are 100' minimum storage length as well as 200' minimum for design speeds 50 MPH or greater. The existing right-turn lane is approximately 70 feet long.

ROUTE 208 AT BRECKENRIDGE DRIVE/BRITTANY COMMONS BOULEVARD

The intersection of Route 208 and Breckenridge Drive/Brittany Commons Boulevard currently has queuing issues in the PM peak hour for westbound left-turning vehicles. The 95th queue for the westbound left in the PM currently exceeds available storage capacity. Extending the storage and taper lengths for the westbound left-turn movement would allow more vehicles into the turn lane and avoid spillback into the through lanes.

END OF CHAPTER 1

Chapter 2:

Alternative Development & Refinement

Future Demand Development

The vehicular volumes were projected to increase linearly until the project opening year 2030 and design year 2052. VDOT provided the following annual growth rates for the study roadways.

- 1.5% for all segments, except
  - 2% for Route 208, west of Route 628 (Smith Station Road)
  - 2.5% for Smith Station Road, south of Route 208

The projected vehicular volumes for both years 2030 and 2052 are presented in ***Figure 46*** and ***Figure 47***, respectively. The build conditions do not involve volume rerouting; therefore, the build volumes remain the same as the no-build volumes.

Background Improvement at Route 208 / Woodland Drive Intersection

An application with ID 6867[2] was previously submitted and approved for funding in Smart Scale. The project aims to increase the capacity of Route 208 by adding a third lane in the westbound direction between Hood Drive and Woodland Drive. This addition will convert westbound Route 208 at Woodland Drive into a continuous shared through-right lane and two through lanes. However, the shared through-right lane will drop past the Woodland Drive intersection before Leavells Road. The project is listed in the VDOT SYIP Approved Projects online GIS map and is expected to be completed by December 2025.

The opening year (2030) and design year (2052) no-build conditions were modeled in Synchro 11 based on the existing conditions configuration, the background improvement at Woodland Drive and the years 2030 and 2052 traffic volumes. The intersections signal splits and offsets were optimized to account for the increased volumes in the network. Same as the 2023 existing condition analysis, HCM 2000 methodology reports from Synchro were used to extract delay and level of services (LOS) results for all the study intersections, and ten randomly seeded SimTraffic simulation runs were averaged and statistically validated to extract maximum queue results.

[2] https://smartportal.virginiahb2.org/api/pdf/F30-0000007648-R01

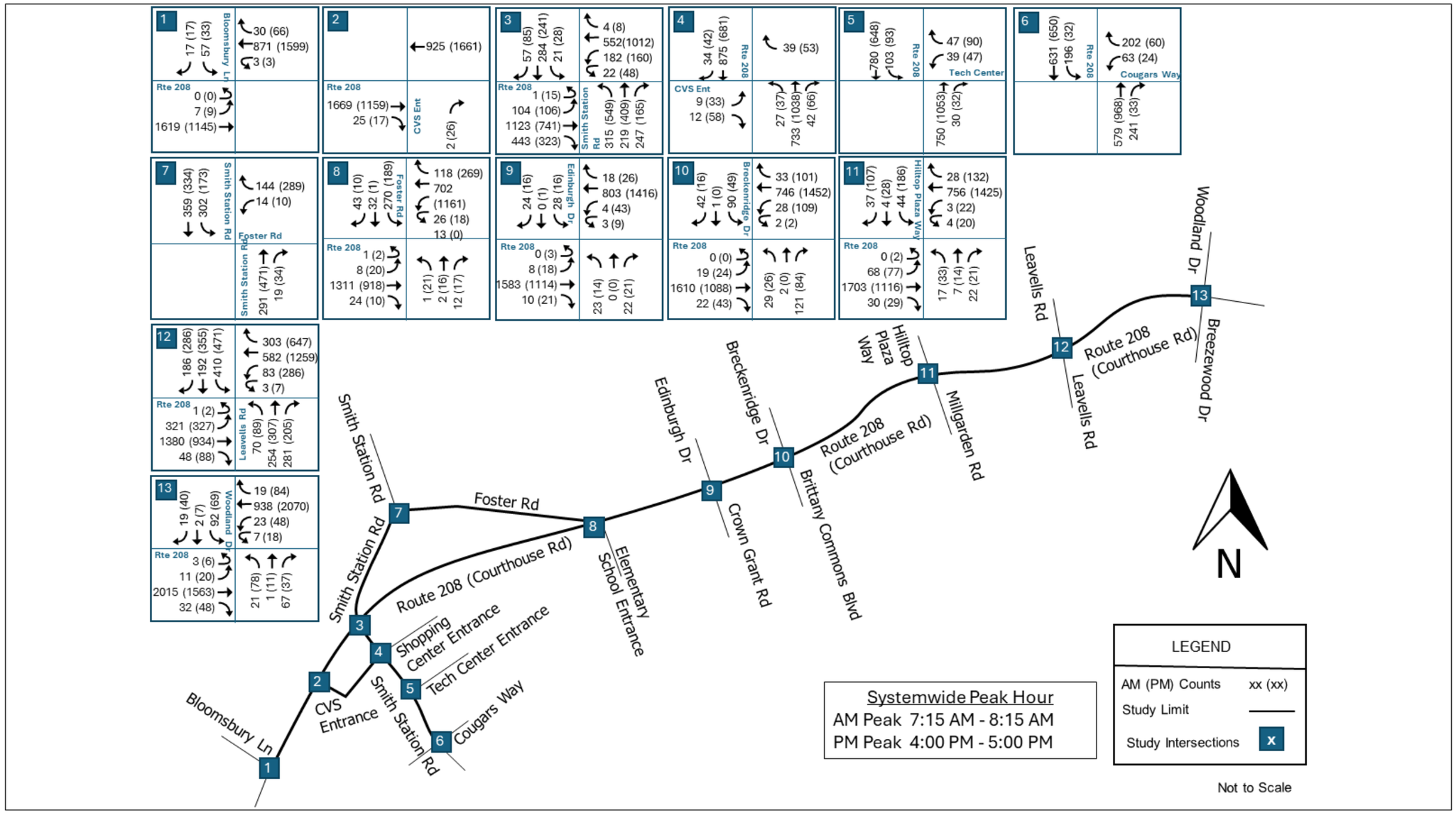


Figure 46. Year 2030 Peak Hour Volumes

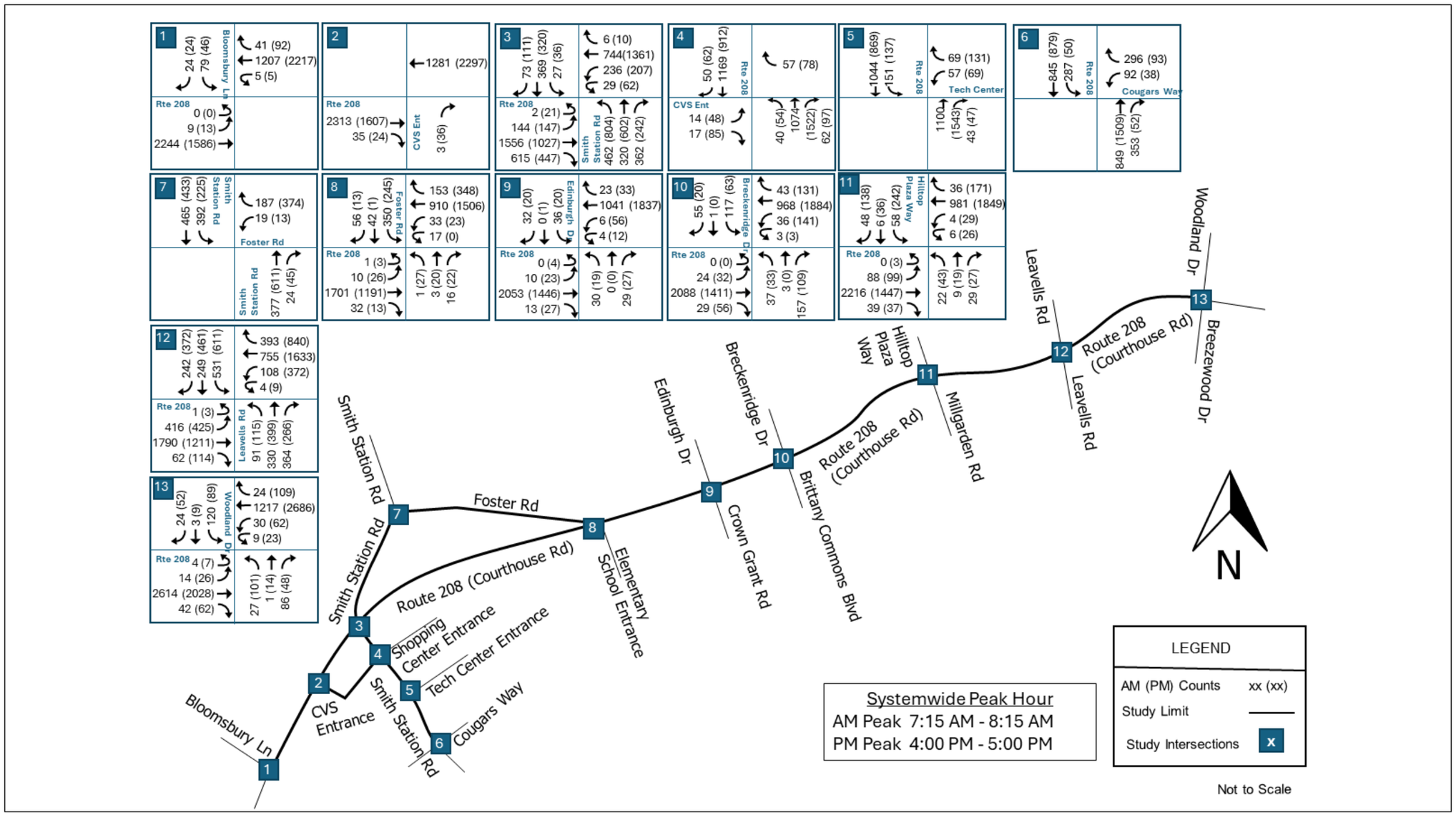


Figure 47. Year 2052 Peak Hour Volumes

2030 No-Build Condition

The analysis indicates that, compared to 2023, the intersections of Route 208 / Smith Station Road and Route 208 / Leavells Road would maintain LOS E or F during at least one peak hour. Average delay at Route 208 / Smith Station Road would increase by over 10 sec/veh during the AM peak hour, while at Route 208 / Leavells, delay increases slightly (less than 10 sec/veh) during both peak hours. Route 208 / Woodland Drive's operation would slightly improve, due to added westbound capacity and split/offset optimization. Other signalized intersections are expected to maintain LOS C or better. However, stop-controlled approaches of Southbound Bloomsbury Lane at Route 208 and Southbound Edinburgh Drive at Route 208 would degrade to LOS E compared to existing LOS D during the PM peak hour, and delay on the westbound Tech Center approach at Smith Station Road would increase by over 100 sec/veh during both peak hours.

The SimTraffic Maximum queues indicate that:

1. The following lane groups will have queues reaching / exceeding available storage lengths, similar to existing conditions:
    - Northbound Left of Smith Station Road at CVS Driveway (AM / PM)
    - Southbound Left of Smith Station Road at Tech Center (AM / PM)
    - Eastbound Left of Route 208 at Brittany Commons Boulevard (PM)
    - Westbound Left of Route 208 at Brittany Commons Boulevard (PM)
    - Northbound Left of Leavells Road at Route 208 (PM)
    - Eastbound Left of Route 208 at Woodland Drive (PM)
2. Entrance to the following storage lanes will be blocked by queues on Route 208:
    - Eastbound Left of Route 208 at Smith Station Road (AM / PM)
    - Westbound Right of Route 208 at Foster Road (PM)
    - Eastbound Left of Route 208 at Millgarden Drive (PM)
    - Eastbound Right of Route 208 at Millgarden Drive (PM)
    - Eastbound Right of Route 208 at Leavells Road (AM / PM)
    - Westbound Left of Route 208 at Leavells Road (PM)
    - Westbound Right of Route 208 at Leavells Road (PM)
    - Southbound Left of Leavells Road at Route 208 (PM)
    - Eastbound Right of Route 208 at Woodland Drive (PM)
    - Westbound Left of Route 208 at Woodland Drive (PM)

Appendix-C summarizes the AM and PM peak hours Synchro and SimTraffic analysis results for 2030 no-build condition.

2052 No-Build Condition

Compared to the 2030 no-build scenario, traffic operation at the intersections of Route 208 with Smith Station Road and Leavells Road is expected to decline to LOS F during both peak hours. The average delay at Route 208 / Smith Station Road intersection is projected to exceed 90 sec/veh during both peaks, while at Route 208 / Leavells Road, it would increase by 40 sec/veh during both peak hours.

Additionally, during the AM peak hour, traffic operation at Route 208 / Woodland Drive intersection would decline to LOS F compared LOS C in 2030. Moreover, the stop-controlled approaches of Southbound Bloomsbury Lane at Route 208, Southbound Edinburgh Drive at Route 208, and eastbound CVS Driveway at Smith Station Road would also deteriorate to LOS F during at least one peak hour. Furthermore, the delay on the westbound Tech Center approach at Smith Station Road is anticipated to be over 100 sec/veh during both peak hours.

The SimTraffic Maximum queues indicate that:

1. Several lane groups would experience queues that reach or exceed available storage lengths, similar to 2030 no-build:
    - Northbound Left of Smith Station Road at CVS Driveway (AM / PM)
    - Southbound Left of Smith Station Road at Tech Center (AM / PM)
    - Eastbound Left of Route 208 at Brittany Commons Boulevard (PM)
    - Westbound Left of Route 208 at Brittany Commons Boulevard (PM)
    - Northbound Left of Leavells Road at Route 208 (PM)
    - Eastbound Left of Route 208 at Woodland Drive (PM)
2. Turning movements to the following storage lanes may be blocked by queues on Route 208:
    - Westbound Right of Route 208 at Foster Road (PM)
    - Eastbound Left of Route 208 at Smith Station Road (AM / PM)
    - Eastbound Left of Route 208 at Millgarden Drive (PM)
    - Eastbound Right of Route 208 at Millgarden Drive (PM)
    - Eastbound Right of Route 208 at Leavells Road (AM / PM)
    - Westbound Left of Route 208 at Leavells Road (PM)
    - Westbound Right of Route 208 at Leavells Road (PM)
    - Southbound Left of Leavells Road at Roue 208 (PM)
    - Eastbound Right of Route 208 at Woodland Drive (PM)
    - Westbound Left of Route 208 at Woodland Drive (PM)

Appendix-D summarizes the AM and PM peak hours Synchro and SimTraffic analysis results for 2052 no-build condition.

Phase 1 Alternative Development

The team identified the needs of the study area and proposed several alternatives to improve the corridor. These alternatives can be separated into the following three categories:

1. Improvements at the intersections of Route 208 / Smith Station Road and Route 208 / Leavells Road.
2. Additional bike and pedestrian facility improvements.
3. Additional road configuration improvements.

The alternatives were screened and refined in two phases of development. Phase 1 focused on existing issues, and the potential alternatives were analyzed using VJuST and Synchro. The traffic operations improvement concepts were centered on the intersections of Route 208/Smith Station Road and Route 208/Leavells Road, and the analysis was based on the 2023 existing year volumes. Refer to **Chapter 1** for more information.

Phase 2 Concept Refinement and Preferred Alternative

Intersections of Route 208/Smith Station Road & Route 208/Leavells Road

Phase 2 of the study did not modify the scope or study area. Five alternatives were analyzed using Synchro for design year 2052, assuming that the build volumes were the same as the no-build volumes. The sketches and detailed VJuST results for the five preliminary alternatives are attached as ***Appendix-E***.

For the intersections of Route 208 / Smith Station Road and Route 208 / Leavells Road, delay and v/c results from Synchro were used, along with VTRANS needs, crash data and crash modification factors (CMFs), and preliminary cost estimates, as inputs into VDOT Intersection and Interchange Control Assessment Program (iCAP) spreadsheet-based tool Stage 2 input worksheet. iCAP, developed by VDOT, is a data-driven, performance-based tool designed to objectively screen alternatives for intersections and interchanges. It is intended for use in VDOT studies located on the State's defined Arterial Preservation Network (APN). The tool operates in two stages:

- **Stage 1: Alternatives Screening** – This stage involves preliminary assessments and relies mostly on VDOT Junction Screening Tool (VJuST).
- **Stage 2: Alternative Assessment** – Building on Stage 1, this stage incorporates operational analysis results, crash modification factors (CMFs), and construction cost estimates for each alternative. iCAP processes this data to produce a "performance matrix."

The iCAP performance matrices are presented in ***Figure 48*** and ***Figure 49*** for the intersections of Route 208 / Smith Station Road and Route 208 / Leavells Road, respectively. It is worth noting that the construction costs for these alternatives were preliminary and only used for the purposes of comparing alternatives. Detailed iCAP reports are available in ***Appendix-E***. Synchro/SimTraffic files can be found in ***Appendix-F-1***.

The iCAP matrices and Synchro results for the two intersections were presented to the study workgroup (SWG) on January 11th, 2024. During the meeting, the SWG was particularly concerned with traffic operational performances, and the operational results played a crucial role in selecting the preferred alternatives. The iCAP operational performance metrics are available in ***Appendix-E***.

Considering the above, the SWG recommended Alternative 3 (hereafter referred to as Concept 1) and Alternative 4 (hereafter referred to as Concept 2) as preferred alternatives for both intersections, with the following recommendations:

1. Route 208 / Smith Station Road: The proposed pedestrian crosswalk would shift from the west side of Route 208 to the east side, and the proposed north side crosswalk was dismissed. As a result, the two proposed crosswalks at this intersection are shown on the south and east legs.
2. The three access points along eastbound Route 208 between Millgarden Drive and Leavells Road should remain open.

In the remaining report, the preferred Alternative 3 and Alternative 4 will be referred to as Concept 1 and Concept 2. The sketches for the concepts resulting from Phase 2 are displayed in ***Figure 50*** through ***Figure 53***.

These two concepts were carried forward for detailed analysis. Maximum SimTraffic queues were used to determine the length of the storage lanes for Route- 208/Smith Station and at Route 208/Leavells Road intersections. Same as the 2023 existing and future years no-build analyses, HCM 2000 reports were used at all these locations, and ten randomly seeded SimTraffic simulation runs were averaged and statistically validated.

Dual NB Left Turn Lanes
Widen SB Approach
Dual/ NB Left Turn Lane + Widen SB Approach
Alternative 3 + 3rd Thru Lane on WB Approach
Full Quadrant
Hybrid Quadrant

AM Peak Hour

Alternative	Traffic Operations Metric			Pedestrian Metric Score	Safety Metric		Stage 2 Cost Metric		Total Stage 2 Score
	MOE 1 Score	MOE 2 Score	Total Score		Annual F+I Crash Reduction	Score	VJuST-C Cost Estimate	Score	
Alternative 1	0.7	0.8	0.8	1.0	0.15	0.8	$ 447,346	0.8	7.8 out of 9
Alternative 2	0.7	0.7	0.7	1.0	0.19	1.0	$ 365,372	1.0	8.7 out of 9
Alternative 3	0.8	1.0	0.9	1.0	0.19	1.0	$ 754,745	0.5	7.9 out of 9
Alternative 4	0.8	1.0	0.9	1.0	0.15	0.8	$ 9,566,870	0.0	6.3 out of 9
Alternative 5a	1.0	0.7	0.9	1.0	0.09	0.5	$ 3,439,369	0.1	5.6 out of 9
Alternative 5b	1.0	0.9	1.0	1.0	0.09	0.5	$ 2,988,517	0.1	5.7 out of 9

Dual NB Left Turn Lanes
Widen SB Approach
Dual/ NB Left Turn Lane + Widen SB Approach
Alternative 3 + 3rd Thru Lane on WB Approach
Full Quadrant
Hybrid Quadrant

PM Peak Hour

Alternative	Traffic Operations Metric			Pedestrian Metric Score	Safety Metric		Stage 2 Cost Metric		Total Stage 2 Score
	MOE 1 Score	MOE 2 Score	Total Score		Annual F+I Crash Reduction	Score	VJuST-C Cost Estimate	Score	
Alternative 1	0.8	0.7	0.8	1.0	0.15	0.8	$ 447,346	0.8	7.8 out of 9
Alternative 2	0.7	0.6	0.7	1.0	0.19	1.0	$ 365,372	1.0	8.7 out of 9
Alternative 3	0.9	0.9	0.9	1.0	0.19	1.0	$ 754,745	0.5	7.9 out of 9
Alternative 4	1.0	1.0	1.0	1.0	0.15	0.8	$ 9,566,870	0.0	6.4 out of 9
Alternative 5a	0.9	0.6	0.8	1.0	0.09	0.5	$ 3,439,369	0.1	5.5 out of 9
Alternative 5b	1.0	0.7	0.9	1.0	0.09	0.5	$ 2,988,517	0.1	5.6 out of 9
Metric Weighting		1		3	3		2		

Figure 48. iCAP Results _ Route 208 / Smith Station Road

Note: Alternative 3 corresponds to Preferred Concept 1 (Concept 1), and Alternative 4 corresponds to Preferred Concept 2 (Concept 2).

Dual NB/SB Left Turn Lanes
Dual WB Left Turn Lanes
Dual/ NB/SB/WB Left Turn Lanes
Alternative 3 + 3rd Thru Lane on WB Approach
Partial DLT

AM Peak Hour

Alternative	Traffic Operations Metric			Pedestrian Metric Score	Safety Metric		Stage 2 Cost Metric		Total Stage 2 Score
	MOE 1 Score	MOE 2 Score	Total Score		Annual F+I Crash Reduction	Score	VJuST-C Cost Estimate	Score	
Alternative 1	0.9	0.7	0.8	0.5	0.30	1.0	$ 2,144,192	0.2	5.7 out of 9
Alternative 2	0.9	0.7	0.8	0.5	0.30	1.0	$ 406,359	1.0	7.3 out of 9
Alternative 3	0.9	0.8	0.9	0.5	0.30	1.0	$ 3,131,970	0.1	5.6 out of 9
Alternative 4	0.9	0.8	0.9	0.5	0.30	1.0	$ 6,554,353	0.1	5.6 out of 9
Alternative 5	1.0	1.0	1.0	0.0	0.30	1.0	$ 7,783,952	0.1	4.2 out of 9

Dual NB/SB Left Turn Lanes
Dual WB Left Turn Lanes
Dual/ NB/SB/WB Left Turn Lanes
Alternative 3 + 3rd Thru Lane on WB Approach
Partial DLT

PM Peak Hour

Alternative	Traffic Operations Metric			Pedestrian Metric Score	Safety Metric		Stage 2 Cost Metric		Total Stage 2 Score
	MOE 1 Score	MOE 2 Score	Total Score		Annual F+I Crash Reduction	Score	VJuST-C Cost Estimate	Score	
Alternative 1	0.9	0.5	0.7	0.5	0.30	1.0	$ 2,144,192	0.2	5.6 out of 9
Alternative 2	0.8	0.5	0.7	0.5	0.30	1.0	$ 406,359	1.0	7.2 out of 9
Alternative 3	0.9	0.7	0.8	0.5	0.30	1.0	$ 3,131,970	0.1	5.5 out of 9
Alternative 4	1.0	0.8	0.9	0.5	0.30	1.0	$ 6,554,353	0.1	5.6 out of 9
Alternative 5	1.0	1.0	1.0	0.0	0.30	1.0	$ 7,783,952	0.1	4.2 out of 9
Metric Weighting	1			3	3		2		

Figure 49. iCAP Results _ Route 208 / Leavells Road

Note: Alternative 3 corresponds to Preferred Concept 1 (Concept 1), and Alternative 4 corresponds to Preferred Concept 2 (Concept 2).

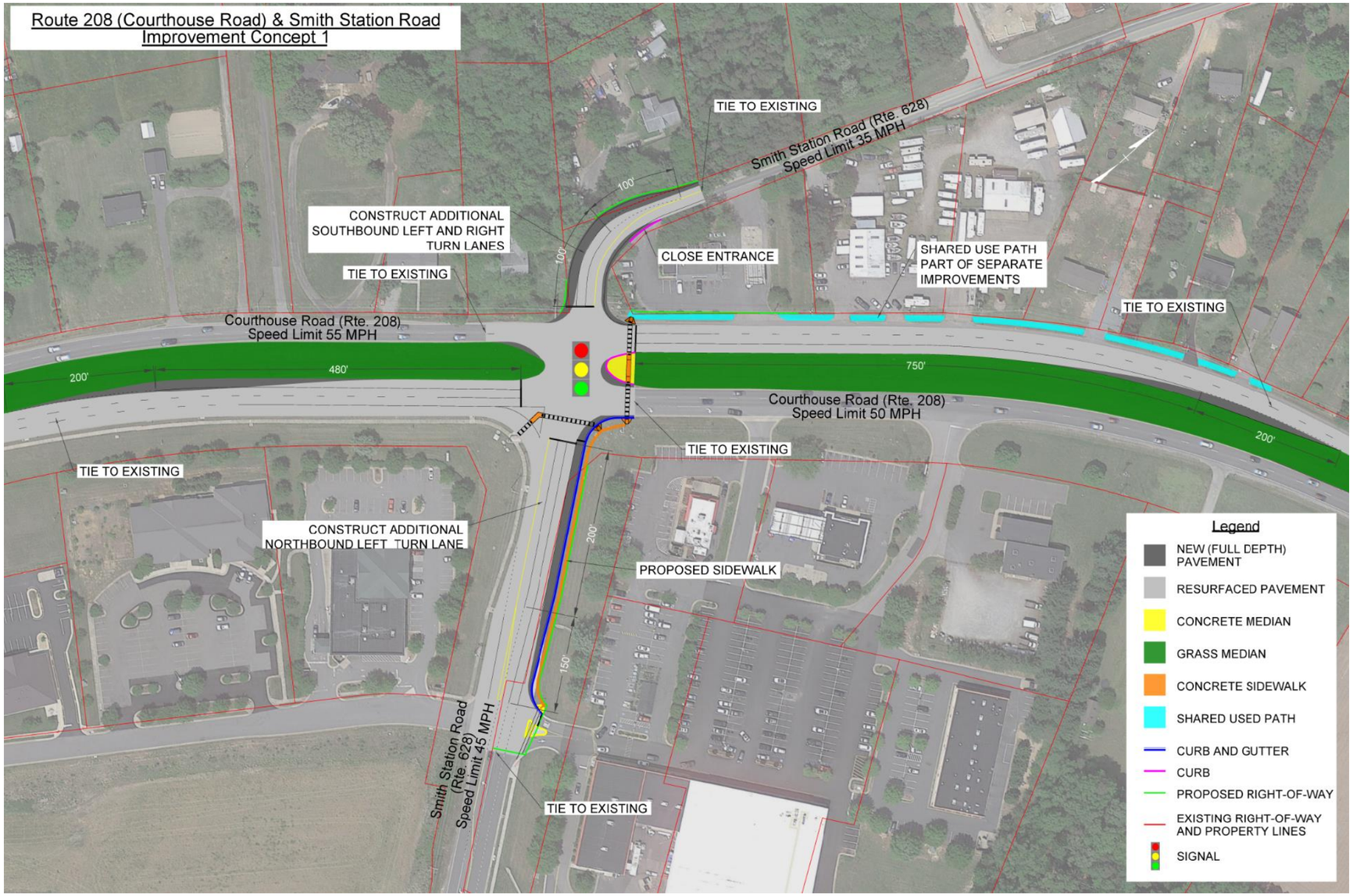


Figure 50. Layout for Concept 1 Smith Station Road

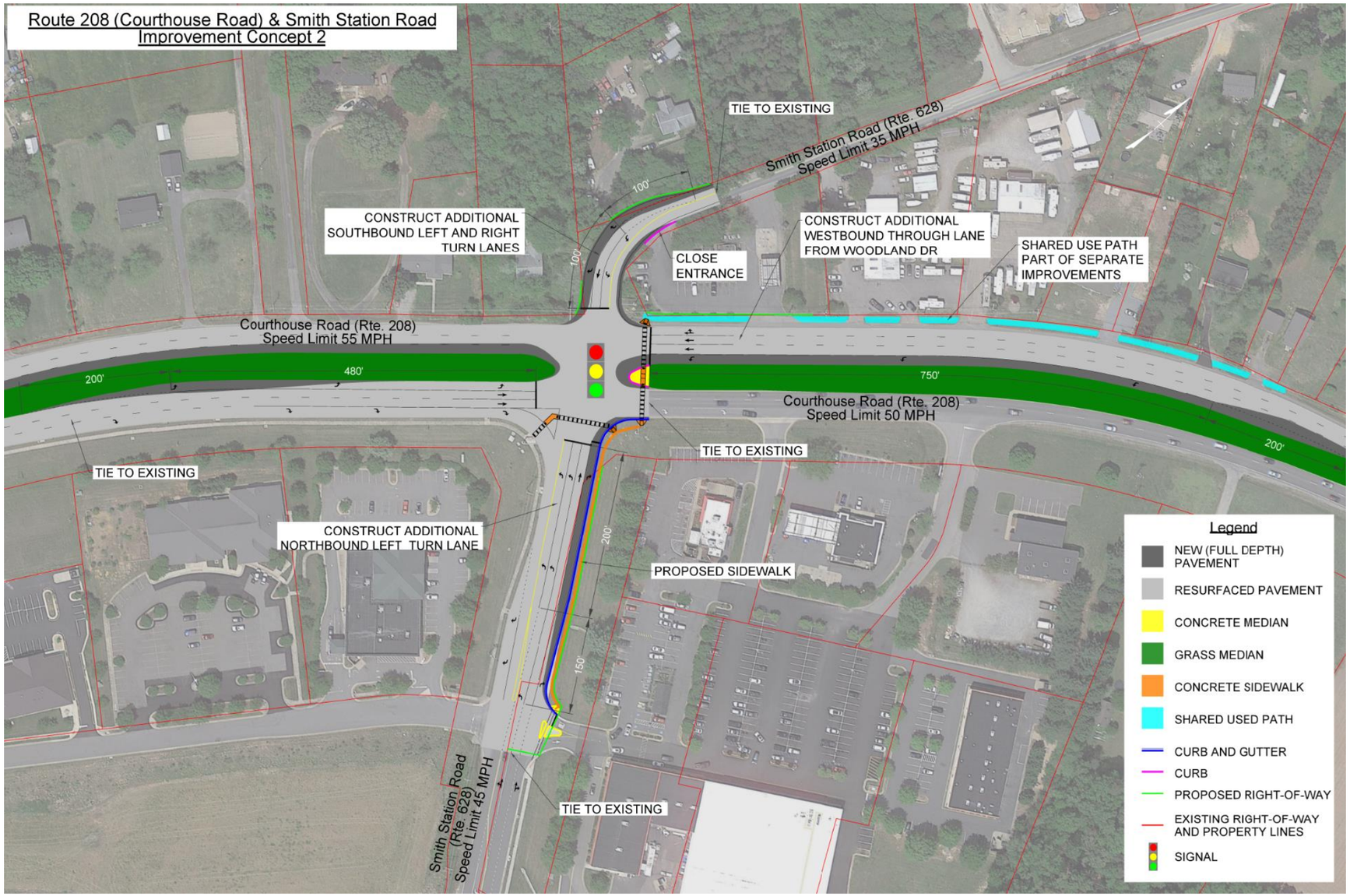


Figure 51 Layout for Concept 2 Smith Station Road

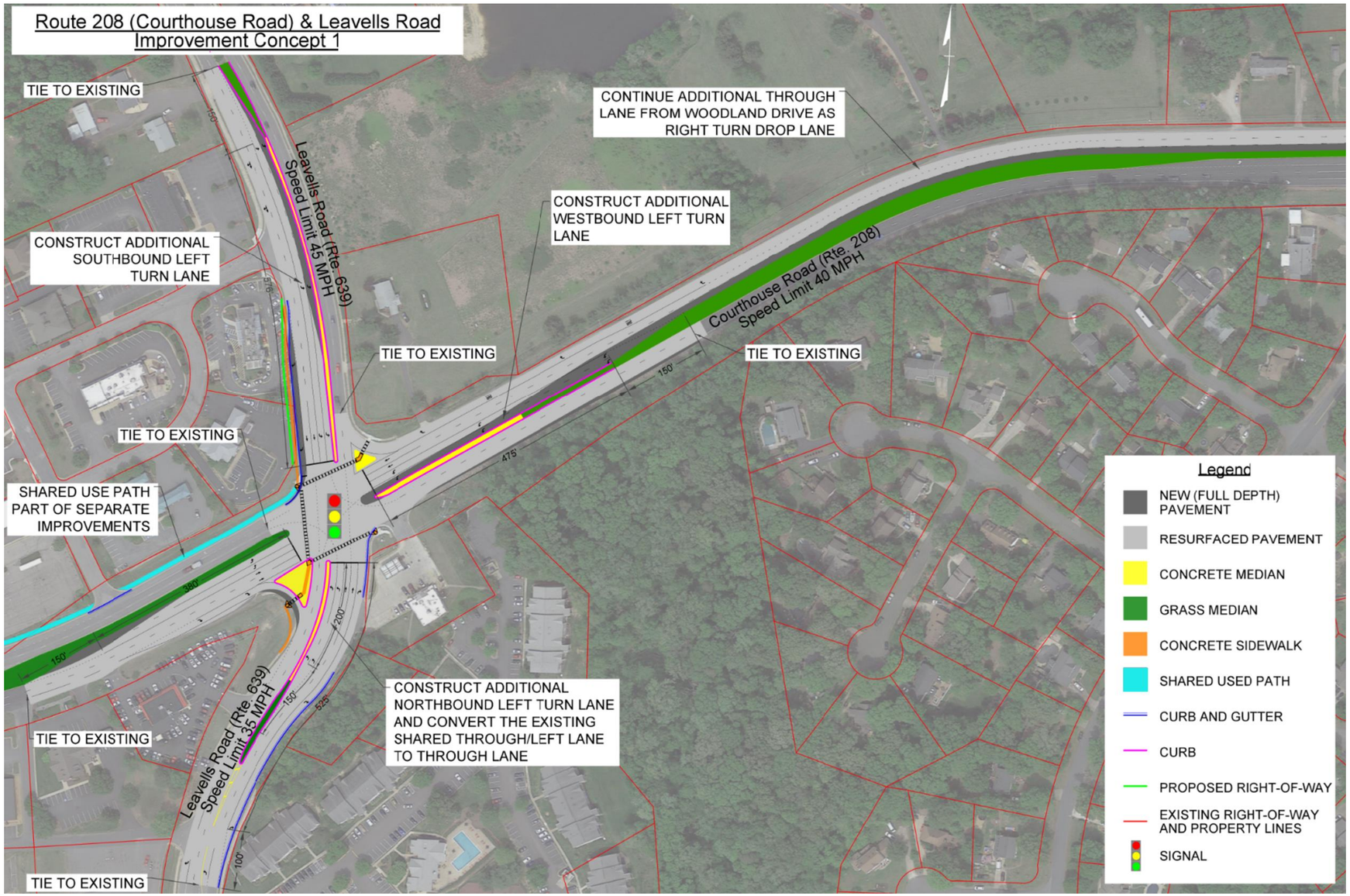


Figure 52. Layout for Concept 1 Leavells Road

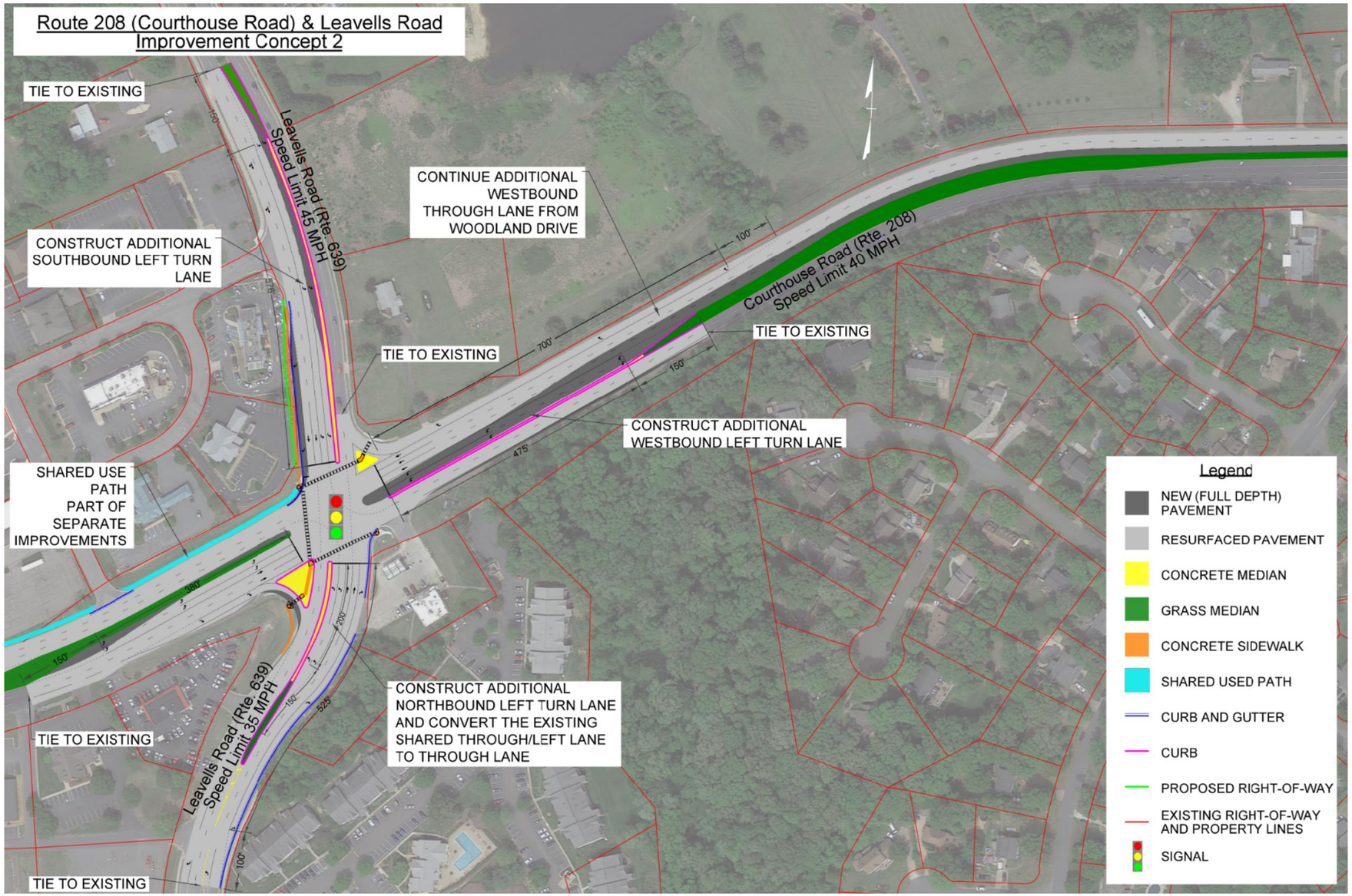


Figure 53 Layout for Concept 2 Leavells Road

Safety Analysis Results

The effectiveness of the proposed improvements in mitigating crash risks at the Route 208 intersections with Smith Station Road and Leavells Road was evaluated. Crash modification factors (CMFs) were utilized to determine the potential safety benefits of these improvements. CMFs were selected from the CMF Calculator and the approved list, both prepared as part of the VDOT's SMART SCALE safety scoring process (2024 SMART SCALE Round 6 CMF). The applicable CMFs and potential safety benefits of the proposed improvements are documented in **Table 8**.

Table 8. Intersection Alternatives and Proposed Safety Improvements

Route 208 intersection with:	Alternative	Construct Shared-Use Path (0.60)[1]	Construct sidewalk (0.60)[2]	Improve at-grade crossing (0.60)[2]	Extend turn lanes (0.85)	Optimize signals (0.96)	Add a westbound through lane (follows a function)[3]
Smith Station Road	Concept 1	-	✓	✓	✓	✓	-
	Concept 2	-	✓	✓	✓	✓	✓
Leavells Road	Concept 1	✓	✓	-	✓	✓	-
	Concept 2	✓	✓	-	✓	✓	✓

1. Targeted Crash Type is Pedestrians and Bicyclists.
2. Targeted Crash Type is Pedestrians.
3. CMF for Smith Station Road = 0.89; CMF for Leavells Road = 0.91

The best applicable CMF was applied to crashes in the influence area of each intersection. This method is consistent with the methodology used during the SMART SCALE scoring process. For both intersections, all crash types are expected to decrease by 15% while pedestrian and bicyclist crashes are expected to decrease by 40%.

2030 Build Analysis Results

The results for the build conditions are compared with the 2030 no-build conditions.

Concept 1 – Route 208 / Smith Station Road

Due to the proposed widening of the southbound approach, the delay is expected to be reduced by 80 sec/veh and LOS expected to improve from F to E. With the addition of a second left turn lane on the northbound approach, the delay is anticipated to be reduced by 32 sec/veh and LOS expected to improve from F to E. The overall intersection delay is anticipated to be reduced by 30 sec/veh and LOS is expected to improve from F to E. Maximum queues within the left turn lanes are expected to be contained within the storage lengths.

Concept 2-Route 208 / Smith Station Road

The proposed changes on Southbound Smith Station Road are expected to significantly reduce delays by more than 70 sec/veh during both peak hours and the LOS improves from F to E. The addition of a westbound through lane is also anticipated to improve LOS from F to C during the PM peak hour. Overall, the intersection is expected to operate with significantly lower average delays (+30 sec/veh difference) during both peak hours due to the proposed improvements. The maximum queues on the eastbound left-turn and westbound left-turn lanes are expected to be contained within the proposed extended storage lanes.

Appendix-F-2 presents the Synchro and SimTraffic analysis results for the AM and PM peak hours for 2030 Concept 1, while ***Appendix-G*** presents the same results for the AM and PM peak hours for 2030 Concept 2.

Concept 1 – Route 208 / Leavells Road

Because of the addition of a left turn lane on the northbound, southbound, and westbound approaches, the LOS for the westbound left turn improves from F to E during the AM peak hour and the Southbound left turn is expected to improve from F to E during both peak hours. The overall intersection LOS is anticipated to improve from E to D during the AM peak hour. Maximum queues on left-turn lanes are expected to be contained within the proposed storages. Maximum queues on all through movement lanes would reduce significantly during the PM peak hour (+200 feet difference for eastbound and +800 feet difference for all other approaches).

Concept 2-Route 208 / Leavells Road

Because of the proposed dual left-turn lanes on the westbound, northbound and southbound approaches along with an additional westbound through lane, the overall intersection delay is expected to decrease by about 7 and 11 sec/veh during the AM and PM peak hours, respectively and the LOS during the AM peak hour is expected to improve from E to D. Maximum queues on left-turn lanes are

expected to be contained within the proposed storages. For all other approaches, maximum queues on all through movement lanes would significantly reduce during the PM peak hour (+300 feet difference for eastbound and +800 feet difference for all other approaches).

The average delay at other signalized intersections along the corridor is not expected to change significantly. The stop-controlled approaches throughout the study area are expected to operate at the same level of service as the no-build conditions.

Appendix-F-2 presents the Synchro and SimTraffic analysis results for the AM and PM peak hours for 2030 Concept 1, while ***Appendix-G*** presents the same results for the AM and PM peak hours for 2030 Concept 2.

2052 Build Analysis Results

The results for the build conditions are compared with the 2052 no-build conditions.

Concept 1 – Route 208 / Smith Station Road

Due to the widening of the Southbound Smith Station Road, the delay is expected to reduce significantly on this approach by over 150 sec/veh during both peak hours. Intersection delay will decrease by more than 60 sec/veh, but it will still operate at LOS F. Maximum queue lengths on the Westbound left-turn lanes are expected to be contained within the proposed extended storage lanes.

Concept 2 – Route 208/Smith Station Road

Due to the southbound Smith Station Road widening, the delay on this approach is expected to reduce by more than 200 sec/veh during both peak hours. The overall intersection is expected to operate with a significantly lower average delay (+60 sec/veh) during both peak hours, although it would still operate at LOS F. Maximum queues on the southbound and westbound left-turn lanes are expected to be contained within the proposed extended storage lanes. However, the southbound right-turn lane and left-turn lanes at other approaches are likely to be blocked because of the queue spillback from adjacent through lanes.

Appendix-H presents the Synchro and SimTraffic analysis results for the AM and PM peak hours for 2052 Concept 1, while ***Appendix-I*** presents the same results for the AM and PM peak hours for 2052 Concept 2.

[3] https://gis.spotsylvania.va.us/CompPlan/Approved/20_Chapter3A_TrailwaysMasterPlanMap.pdf

Concept 1 – Route 208 / Leavells Road

Due to the dual left turn lanes, the overall intersection delay is anticipated to be reduced by 30 sec/veh during both peak hours. Maximum queue lengths for southbound left-turn lanes are expected to be contained within the proposed storage lanes. Maximum queues lengths for the northbound/southbound traffic would reduce significantly with a 600-feet difference in the AM peak hour and 250-feet difference in the PM peak hour.

Concept 2 – Route 208 / Leavells Road

With the additional through lane on the westbound approach, the LOS for the westbound through movement is expected to improve from F to C during the PM peak hour. The overall intersection delay is expected to be reduced by 30 sec/veh during the AM peak hour and 40 sec/veh during the PM peak hour. SimTraffic analysis shows that the maximum queues are expected to be contained within the proposed storages lanes for the southbound left turn lane. Maximum queues for the through movements on the northbound and southbound approaches are expected to be reduced significantly (+700 feet) during both peak hours.

Appendix-H presents the Synchro and SimTraffic analysis results for the AM and PM peak hours for 2052 Concept 1, while ***Appendix-I*** presents the same results for the AM and PM peak hours for 2052 Concept 2.

The Synchro and SimTraffic reports for 2030 and 2052 no build conditions and 2030 and 2052 build conditions are included in ***Appendix-J*** and ***Appendix-K***, respectively.

Additional Bike and Pedestrian Concepts

In addition to the sidewalk and crosswalks proposed at Route 208 intersections with Smith Station Road and Leavells Road, the following concepts were also proposed which have been updated based on the SWG feedback from the January 11, 2024, meeting.

- Construct a Shared-Use Path (SUP) on the north side of Route 208 from Leavells Road to Smith Station Road. The County's Trailway Master Plan[3] shows a future SUP, which will help move the proposed SUP application through this study.
- Install crosswalks and pedestrian signal heads on the west, north and south legs of the Route 208 / Breckenridge Drive intersection. VDOT recommended extending the sidewalk on the northeast side of the intersection to the proposed curb ramp.

[4] AppendF.pdf (virginia.gov)

- Install crosswalks and pedestrian signal heads on the east and south legs of the Route 208 / Foster Road intersection. VDOT recommended connecting the crosswalks to the school in the south.
- Extend the sidewalk in the southwest quadrant of the intersection at Route 208 and Leavells Road further south to connect it with the residential developments to the south of Creek Lane
- Extend the existing southeast sidewalk at the intersection of Route 208 and Smith Station Road, to the entrance of the Tech Center.
- Extend the existing walkway at Courtland High School to connect it with the entrance to Courthouse Elementary School.

The conceptual sketch for the Shared-Use Path is presented in ***Figure 54***. The other pedestrian and bicyclist improvements are presented in ***Figure 55.***

Road Configuration Improvements at Other Locations

Westbound Right-Turn Lane at Route 208 and Bloomsbury Lane Intersection

In Chapter 1, safety concerns were highlighted with regards to right-turning vehicles from Route 208 into Bloomsbury Lane. The existing storage length is 85 feet, however, for a right turn lane on a roadway with a design speed of over 50 mph, VDOT's Road Design Manual[4] recommends a minimum full length of 100 feet with a taper of 200 feet. Capacity analysis reveals no significant queuing in the right-turn lane; however, the right-turn lane should be extended to meet the recommended 100-foot storage length and 200-foot taper.

Westbound Left-Turn Lane at Route 208 and Brittany Commons Boulevard Intersection

Chapter 1 also emphasized the necessity of extending the Westbound left-turn storage lane at the intersection of Route 208 and Brittany Commons Boulevard. This recommendation is further supported by the maximum SimTraffic queue lengths from the 2052 no build analysis results.

Table 9 outlines the recommended storage lengths for the Route 208 right turn lane to Bloomsburg Lane and the Route 208 left turn lane to Brittany Commons Boulevard.

Table 9. Recommended Storage Lengths

Intersection	Lane	Existing Storage Length[1] (ft)	Maximum SimTraffic Queues (ft) AM (PM)	Proposed Storage Length[1] (ft)	Additional Notes
Route 208 / Bloomsbury Lane	WBR	85	0 (0)	200	Proposed storage length is based on VDOT Road Design Manual. Recommends 100' full lane and 200' taper. This recommendation will only be implemented if Preferred Concept 2 does not proceed to construction.
	WBT	-	0 (0)	-	-
Route 208 / Breckenridge Drive / Brittany Commons Boulevard	WBL	150	136 (149)	250	Proposed storage length is based on the 2052 No Build analysis and includes 150' full length and 200' taper. The proposed storage length is expected to improve operations in the westbound left (WBL) turn lane by reducing queue blockages and spillbacks.
	WBT	-	392 (553)	-	-

Note 1. The storage length refers to the effective length for storage, which includes the full storage length plus half the length of the tapered section.

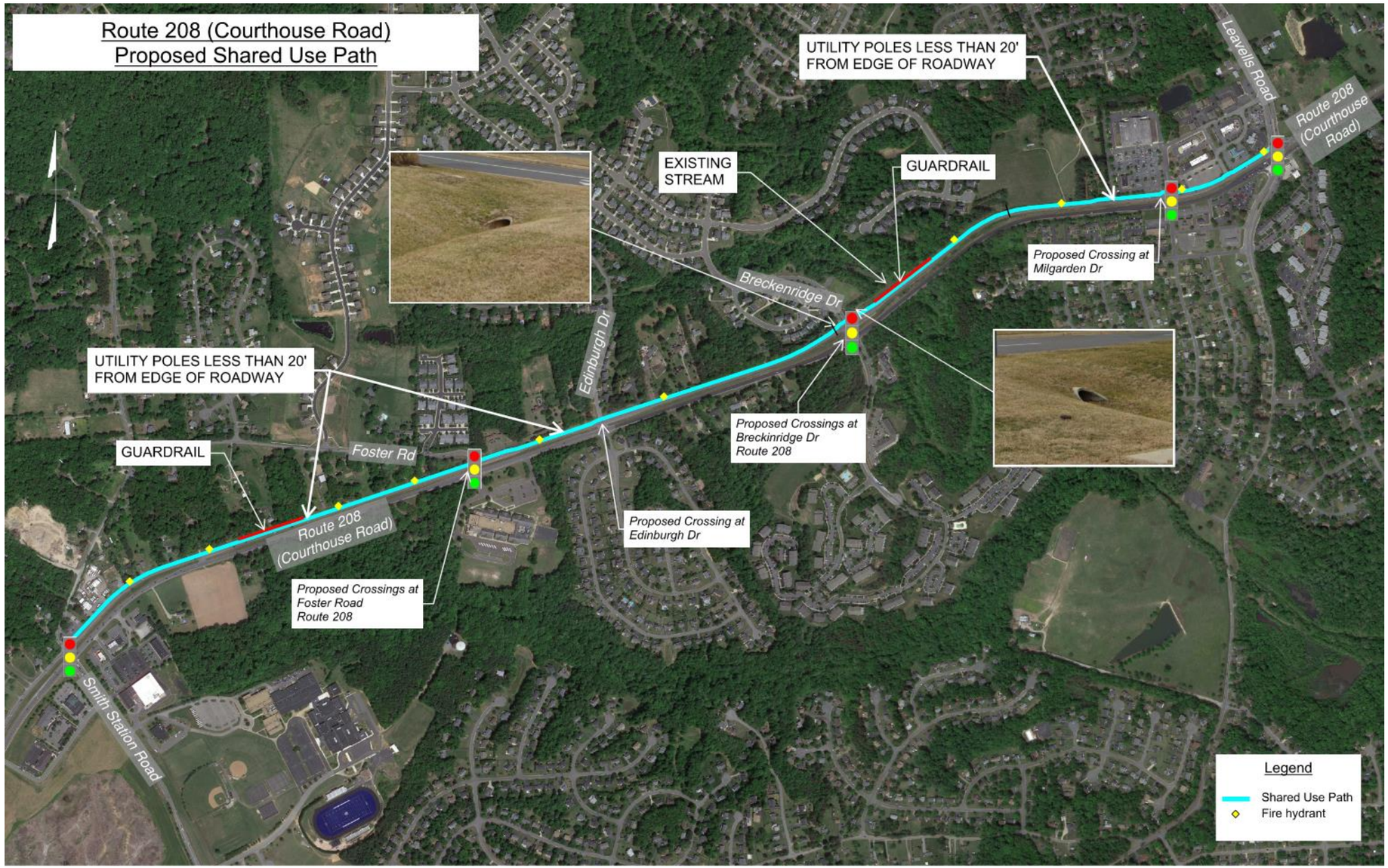


Figure 54. Proposed Shared Use-Path (SUP)

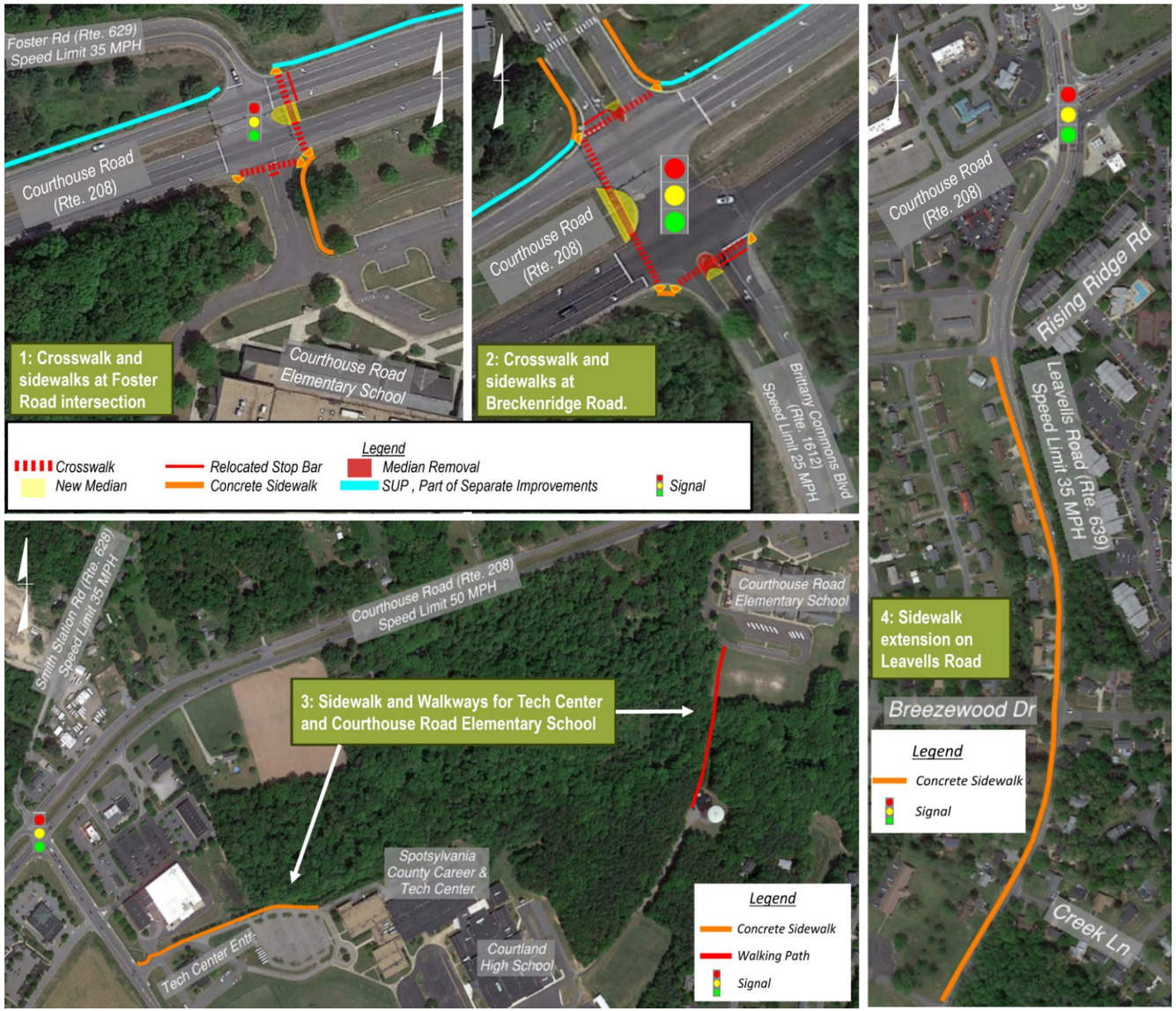


Figure 55. Proposed Crosswalk and Sidewalk Improvements (Other than Shared-Use Path)

Chapter 3:

Public & Stakeholder Outreach & Feedback

In the first stage of the alternatives development process, feedback from the Study Work Group (SWG) was collected and evaluated for the preliminary alternatives. Based on this feedback, the preliminary alternatives were refined, resulting in the finalization of two preferred alternatives, referred to in this report as Concept 1 and Concept 2. In the second stage, public feedback was collected, evaluated, and used to further improve Concept 1 and Concept 2.

Stakeholder Coordination

A Phase 1 overview of the study area and its needs was presented to the SWG in August 2023. Following Phase 1, Phase 2 was initiated that focused on future analysis of the proposed improvements, planning level concepts development and cost estimation. The results from the Phase 2 preliminary analysis findings regarding roadway reconfiguration and initial pedestrian and bicycle improvements were shared with the group on January 11, 2024.

Public Involvement

A PublicInput survey was conducted over the 14-day period from March 18 to April 1, 2024, collecting responses from 205 participants.

The survey sought public feedback on Concepts 1 and 2 for the intersections of Route 208 at Smith Station Road and Route 208 at Leavells Road. The results, presented in ***Figure 56*** revealed that over 60% of respondents favored Concept 2 for both intersections.

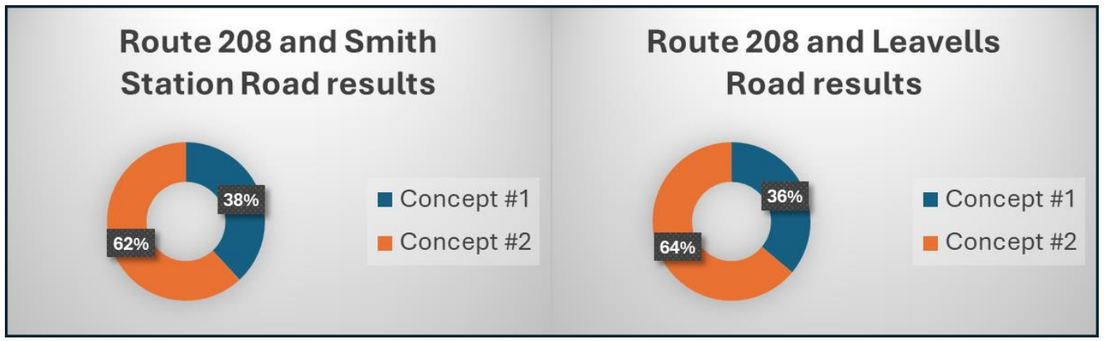


Figure 56. Public Feedback on Route 208 Intersection Improvements: Concepts 1 and 2

The survey then asked participants about their opinion regarding the proposed shared-use path (SUP) along the northside of Route 208. Of the 924 respondents, 43% strongly supported SUP. The breakdown of public responses regarding the SUP are shown in ***Figure 57***.

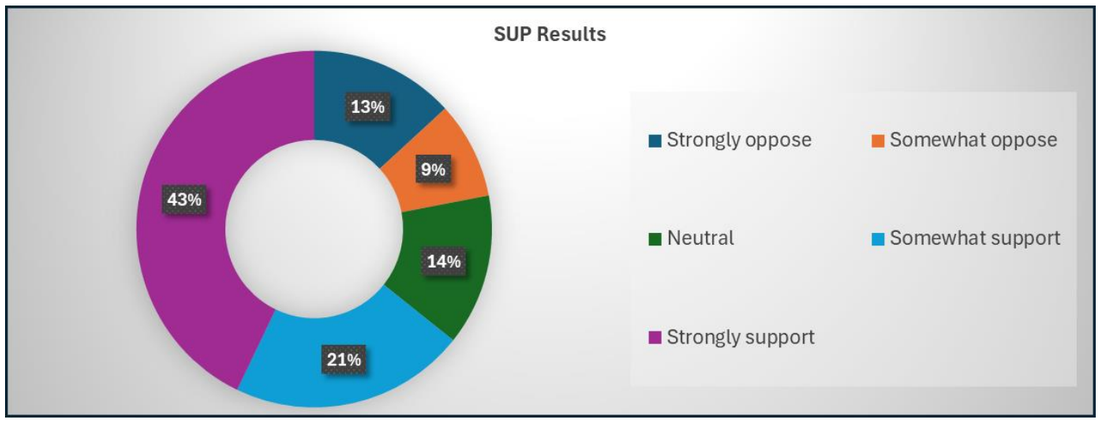


Figure 57. Public Feedback on Shared-Use Path

Next, participants were asked to rate the proposed pedestrian/bicycle improvements from Strongly Support to Strongly Oppose. The results, presented in ***Figure 58***, indicate that more than 45% of respondents strongly supported the proposed improvements. However, approximately 20% of respondents strongly opposed the proposed crosswalks at Route 208 intersections with Breckenridge Road and Foster Road.

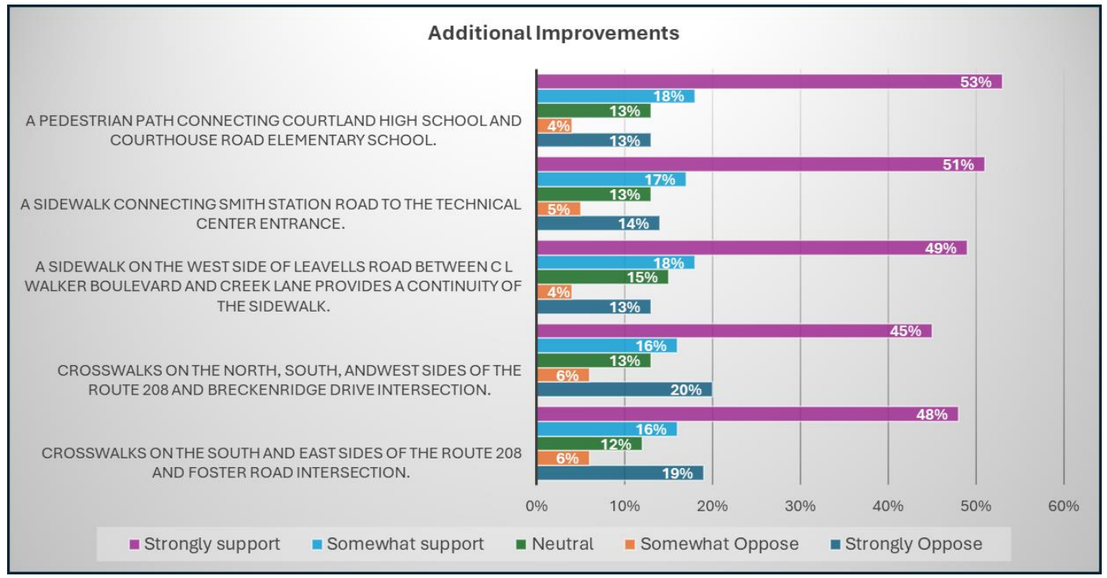


Figure 58. Public Feedback on Proposed Crosswalks and Sidewalks (Except SUP)

Although most of the public input was supportive of all the proposed improvements, some respondents raised concerns regarding the feasibility, cost, utilization, security, and safety of the proposed improvements. Other comments suggested solutions to the roadway operation and safety for road users (drivers, pedestrians, bicyclists). Here is a summary of the received comments:

Safety Concerns

- **Pedestrian Safety**: A significant portion of the comments expressed concerns about pedestrian safety. While some supported the addition of sidewalks and crosswalks for safer walking, others worried about the risks posed by heavy traffic, speeding cars, and unsafe crossings. Comments mentioned specific spots where accidents are frequent and suggested that adding crosswalks might increase the danger.
- **Crime and Security**: Several comments raised the issue of increased crime and safety risks, particularly with secluded paths through wooded areas. The proposed pedestrian path between Courthouse Road Elementary and Courtland High School was identified as potentially unsafe due to its narrow and tree-lined route.

Traffic and Congestion

- **Traffic Congestion**: Many comments expressed concern about increased traffic congestion due to the proposed improvements. Adding crosswalks, especially on busy roads like Route 208, could slow down traffic and create longer wait times at intersections.
- **Infrastructure Improvements**: Suggestions for reducing traffic congestion include adding turn lanes, widening roads, and improving traffic signals. Some respondents believed that current traffic lights are not synchronized, causing additional delays.

Cost and Usage Concerns

- **Cost Effectiveness**: Several respondents questioned the cost of the proposed improvements, suggesting that the money could be better spent on other infrastructure projects. They stated that these pathways might not be used enough to justify the expense.
- **Usage Rates**: Respondents also questioned whether people actually walk in these areas and whether the proposed sidewalks and crosswalks would be utilized. Some suggested that the current traffic patterns do not indicate a need for these pedestrian improvements.

Suggestions and Recommendations

- **Alternate Solutions**: There were suggestions for pedestrian bridges instead of crosswalks to avoid worsening traffic congestion. Other recommendations included adding security cameras and lighting to ensure pedestrian safety.
- **Infrastructure Expansion**: There were also recommendations for extending sidewalks to more areas, especially around schools and neighborhoods. The need for better pedestrian pathways to encourage walking and improve safety was emphasized.

Detailed results of the PublicInput survey, including individual comments, are provided in ***Appendix-L***.

Selected Alternatives

Based on traffic operations analysis results and SWG' and public feedback, Concept 2 has emerged as the preferred alternative for the Route 208 intersections at Smith Station Road and at Leavells Road. Furthermore, the proposed shared-use path and enhancements for pedestrians and bicyclists have garnered support from both the SWG and the public, warranting advancement for funding applications.

Chapter 4:

Preferred Alternative Design Refinement & Investment Strategy

Intent of Phase 3

Phase 3 of the Pipeline Effort is intended to develop detailed concepts of the Phase 2 Preferred Alternative that will carry through to funding applications and project validation. The goal is to ensure that projects are defined to the maximum extent possible and to identify and mitigate potential risks. Utilizing technical resources of both VDOT and consultant teams, a multidisciplinary design approach is part of the overall effort that provides the needed input and problem-solving to ensure funding applications are thoroughly vetted and taken past a planning level sketch and estimate.

The goal is to develop more detailed, quantity based, deterministic estimates and designs paired with thoughtful risk assessment and mitigation. The team will use practical design and common-sense engineering methods to document the assumptions and approaches that lead to the most efficient and effective project scopes. The effort maintains focus on the purpose and needs identified through Phase 1 and 2 that address the VTRANS priorities.

Technical resources use Phase 3 for thorough communication and collaboration with VDOT District, VDOT Central Office, FHWA, or other key partners and stakeholders that may have decision making authority or input on final designs if projects are selected for funding. An intended outcome is that projects, if funded, will have the documentation and support for innovation and flexibility that may be necessary to achieve success.

The Phase 3 Technical Team developed the analysis, design, deliverables, and documentation that will serve as the basis for future Preliminary Engineering work on the projects. At the conclusion of Phase 3, projects should achieve a solid foundation of understanding from a planning and preliminary engineering focus that will ensure applications are well validated, reasonably scoped, meet the needs originally established in studies, and have a high probability of success.

Assumptions

The following are key design assumptions that informed the concept development and cost estimate preparation:

- Intersection of Route 208/Smith Station Road
    - Roadway Geometry: The design assumes widening the existing roadway to provide an additional westbound through lane from Foster Road to Bloomsbury Lane and provide an additional northbound left turn lane on Smith Station Road.
    - Pedestrian Accommodations: A 10-ft shared use path is proposed along the south side of Route 208 connecting Smtih Station Road to Foster Road. At Smith Station Road the existing 5-ft sidewalk is connected to the proposed shared use path with crosswalks across the south leg of the intersection.
    - Hydraulics: A new storm drain system would be required to accommodate the new curb lines. The new system would be able to connect to the existing system. Existing median drainage would need to be replaced.
    - Stormwater Management: Stormwater management is expected to be achieved with swales in the median.
    - Traffic: Traffic signal modifications will be required at the Route 208/Smith Station intersection to accommodate the new lane configuration and pedestrian accommodations. Traffic signal replacement will be required at the Route 208/Foster Road intersection to accommodate the new lane configuration.
    - Right-of-Way: The proposed improvements will involve acquiring right-of-way and easements on two parcels, one south of Route 208 and one north of Route 208. Additionally, the project is proposing to remove the existing entrance to the gas station on Smith Station Road.
- Intersection of Route 208/Leavells Road
    - Roadway Geometry: The design assumes widening the existing roadway to continue the additional westbound through lane from Woodland Drive that terminates in the westbound right turn lane at Leavells Road. This design also provides additional northbound, southbound, and westbound left turn lanes.
    - Pedestrian Accommodations: A 10-ft shared use path is proposed along the north side of Route 208 to connect the existing sidewalk at Leavells Road to the shared use path being proposed by the new development at Millgarden Drive.
    - Hydraulics: A new storm drain system would be required to accommodate the new curb lines. The new system would be able to connect to the existing system. Existing median drainage would need to be replaced.
    - Stormwater Management: New stormwater management would be required to accommodate the new median work.

- Traffic: Traffic signal redesign will be required at the Route 208/Leavells Road intersection to accommodate the new lane configuration and pedestrian accommodations.
- Utility Impacts: The widening from the additional turn lane will impact utility poles and overhead utilities along southbound Leavells Road.
- Right-of-Way: The proposed improvements will involve acquiring right-of-way and easements on the north side of Route 208.

Risk Assessment/Contingency

As part of the risk assessment process, a risk register was developed to identify major/high impact project risk elements. The guidance provided in VDOT's Cost Estimating Manual (Chapter 5) and IIM PMO-15.0 was followed and identified after assessing collected data, field visits, stakeholder input, and concept development. Risks were organized into broad categories including Maintenance of Traffic, Roadway Design, Right-of-Way, Utilities, Mobilization/Construction Survey, Hydraulics, Traffic, Structures/Bridge Design, Geotechnical, and Environmental. The major risks identified in this project include:

- Utilities;
- Drainage;
- The VOF property;
- Access management to include entrances within the functional area and closing an access to the Exxon gas station at Smith Station Road

The project is considered Moderately Complex. However, the level of concept design development is relatively detailed (between Pre-Scoping and PFI level of design), therefore the Most Likely Estimate (MLE) contingency would be more accurately in the 40% to 45% range. Each individual risk was "scored" based on probability, cost impacts, and time impacts. Scoring was used to assign contingencies per risk line item. These line-item risk contingencies were then aggregated to determine a contingency amount per category to include preliminary engineering, right-of-way and utilities, mobilization/construction survey, maintenance of traffic (MOT), roadway design, hydraulics, traffic, and earthwork/geotechnical.

Cost Estimate

The project cost estimate was developed using the following methodology:

- Understanding the goals of the project and scope of the improvements to be implemented.
- Gathering and reviewing as much information about the project as possible including site visits and stakeholder input.
- Establishing design criteria and developing a detailed design concept.
- Performing quantity take offs and using the Pre-Quantity Tool (PQT)
- Performing a risk assessment as outlined above and identifying appropriate contingency percentages by category.
- Developing Preliminary Engineering costs by category based on a percentage of the Construction cost.

Concept Revisions & Final Estimate

Based on VDOT and Stakeholder input from Phase 2 and the site visit performed at the commencement of Phase 3, the concept was advanced, refining key elements of the preferred alternative. As the design progressed, several elements were altered from the concept that resulted from Phase 2 to include:

- Reconfiguring the southbound design on Leavells Road to avoid the McDonalds parking lot;
- Removing the additional westbound thru lane from Leavells Road to Foster Road;
- Removing the Shared Use Path from Millgarden Road to Foster Road;
- Removing all the northern leg modifications from Smith Station Road;
- Reconfiguring the northbound Smith Station Road widening to the western side to avoid the grade difference;
- Relocating the shared use path from the northern side of Route 208 to the southern side of Route 208 from Smith Station Road to Foster Road.

See **Appendix M** for the refined concepts.

The total project cost is estimated to be $57,338,771 and is broken down by Route 208/Leavells Road and Route 208/Smith Station Road as shown in **Table 10**. The cost includes contingencies and represents uninflated 2024 dollars. See **Appendix N** for the Cost Estimate Workbook and the Pre-Quantity Tool (PQT) for each intersection.

Table 10. Cost Estimate Breakdown

Phase	Route 208 and Leavells Road	Route 208 and Smith Station Road	Total
Preliminary Engineering Phase	$3,620,880	$3,148,800	$6,769,680
Right-of-Way and Utilities Phase	$627,600	$307,000	$934,600
Construction Phase (without CEI)	$20,544,218	$17,966,925	$38,511,143
Construction Phase (with CEI)	$26,277,488	$23,357,003	$49,634,491
Total (with CEI)	$30,525,968	$26,812,803	**$57,338,771**

Phase 3 Refined SimTraffic Operations Analysis

Traffic operations analysis indicates that the reduction of the southbound right turn lane from proposed 250 feet to 100 feet may cause some blockage of right turning vehicles in the SB through lane. However, the microsimulation runs also show that all SB right turning traffic is expected to clear during the same cycle and no cycle failures were observed. This shows no significant impacts of the SB right turning storage length reduction on traffic operations. SimTraffic analysis results are provided in **Appendix O**.