PROJECT PIPELINE

CU-23-06: CULPEPER COUNTY
US ROUTE 29 BUSINESS (MADISON ROAD) FROM SOUTHRIDGE PARKWAY TO GERMANNA HIGHWAY (ROUTE 3)

DRPT Office of INTERMODAL Planning and Investment VDOT

US Route 29 Business from Southridge Parkway to Germanna Highway (Route 3)

DRAFT Phase 2 Report

July 2024

Prepared for

VDOT Virginia Department of Transportation

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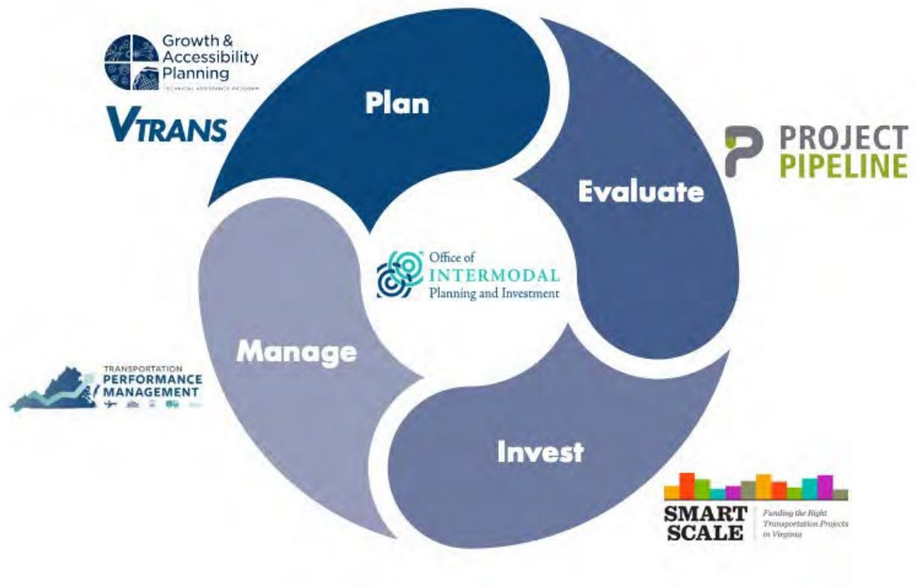
Chapter 1 Needs Evaluation and Diagnosis

1.1 Introduction

Project Pipeline is a performance-based planning program to identify cost-effective solutions to multimodal transportation needs in Virginia. Through this planning process, projects and solutions may be considered for funding through programs, including SMART SCALE, revenue sharing, interstate funding, and others. Visit the Project Pipeline webpage for additional information: vaprojectpipeline.org.

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

Figure 1-1. Project Pipeline Objectives



1.2 Background

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

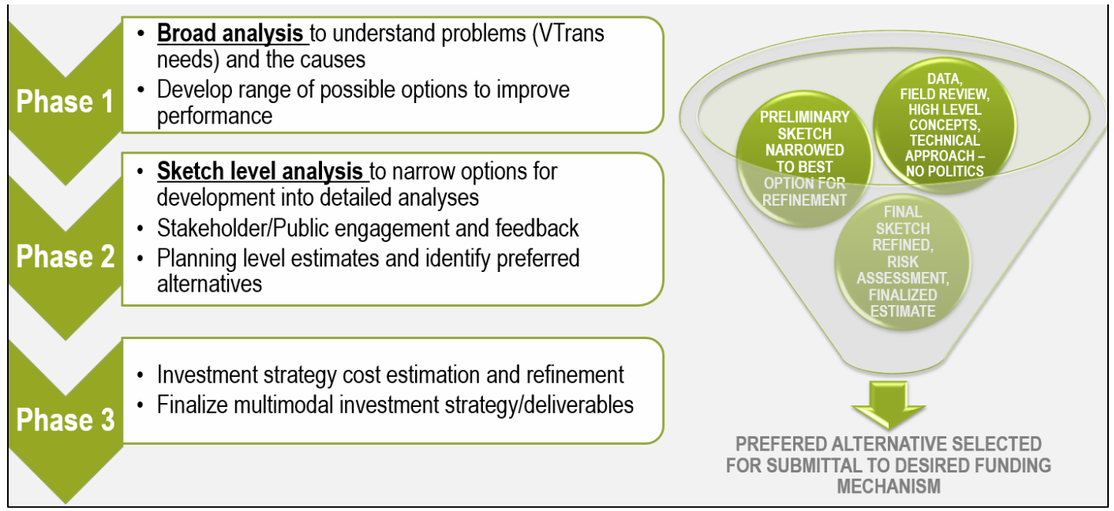
Table 1-1. VTrans Mid-Term Needs

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

1.3 Methodology

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

Figure 1-2. Study Phase Methods and Solutions



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

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

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

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

Figure 1-3. Structure of a Technical Team

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

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

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

1.4 Study Area

The US Route 29 Business study corridor from Southridge Parkway/Zeuswyn Drive to Germanna Highway (Route 3) is located in Culpeper County, Virginia. US Route 29 Business is classified as an *Other Principal Arterial* within the study area. The US Route 29 Business posted speed limit north and south of Golf Drive/Meadowbrook Drive is 35 and 45 MPH, respectively. There are five (5) unsignalized crossovers within the 1.14-mile stretch of the study corridor. A map presenting the overall study area and study corridor is shown below in **Figure 1-4.**

Figure 1-4. US Route 29 Business Study Area Map

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

The mid-term needs, as identified in VTrans for the US Route 29 Business study corridor, were identified as 'Very High' for IEDA (UDA) Access and Safety Improvement and 'High' for Rail On-time Performance and Transportation Demand Management, as presented in **Table 1-3**.

Table 1-3. VTrans Needs in Study Area

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

These mid-term needs, identified in VTrans, are prioritized on a tier from 1 to 4, with 1 being the most critical and 4 being the least critical. The segments ranked as "Priority 1" represent those with multiple categories identified as high in need. **Figure 1-5** presents a map of the study area with the 2019 VTrans Mid-term needs prioritized for construction in the district. **Figure 1-6** presents the pipeline project overview for US Route 29 Business.

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

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

Figure 1-6. Project Overview for US Route 29 Business from Southridge Parkway/Zeuswyn Drive to Germanna Highway

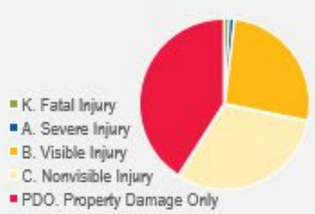
Project Purpose, Goals, & Objectives

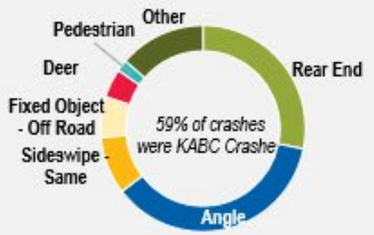
Analyze the operational and safety issues identified along US Route 29 Business, with a focus on providing enhanced safety improvements.

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

Issues in the Study Area

- A relatively high percentage of fatal or injury related crashes (59%) along Route 29 Business.
- Recurring traffic congestion, lack of pedestrian/bicycle facilities, speeding and aggressive driving noted as top issues in public survey
- Angle (36%) and rear-end (28%) collisions were most prevalent type of crashes along Route 29 Business.
- 56% of drivers of all crashes are less than 21 years old or greater than 65.





Project Fact Sheet	
VDOT District	Culpeper
Locality	Town of Culpeper
Corridor Length	1.14 miles
Number of Crossovers	5
Functional Classification	Other Principal Arterial
Speed Limit	35-45 mph

1.5 Previous Study Efforts

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

- Madison Road Connector Trail – The Town of Culpeper Park and Greenways Master Plan envisioned to connect the new Spring Street Trailhead at the north end to Rockwater Park with a street crossing at US Route 29 Business. The project was identified as a midterm project to be completed in 3-5 years.
- US Route 15 (Orange Road) Widening and Sunset Lane Extension – Both projects were listed in the Town's 2016 Comprehensive Plan.
- VDOT Projects
    - Highway Safety Improvement Program (HSIP) application for high visibility signal back plates (HVSB) and Flashing Yellow Arrow (FYA) for seventeen (17) intersections within the Town. The project aims to improve safety at four (4) of current study corridor intersections.
    - VDOT Smart Scale 2024 Application for Orange Road intersection – The project converts the Orange Road/Fredericksburg Road signalized intersection to a single-lane roundabout.
- US Route 29 Planned Bikeways – The Rappahannock-Rapidan Regional Commission's Active Transportation Plan envisions a planned bikeway for the study corridor.

1.6 FHWA STEAP Tool Analysis

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

- The majority of the population (64%) within the study area is between ages 18 and 64, as shown in **Figure 1-7**.
- There is a high personal vehicle ownership, with 64% of households owning two or more vehicles. Only 1% of households do not own a personal vehicle, as shown in **Figure 1-8**.
- Of the non-English speakers (age 5+) at home, 11% speak English very well, as shown in **Figure 1-9**.
- When compared to Culpeper County and the State of Virginia, the study area has a lower-than-average proportion of veterans, people with disabilities, households with no computers, and households without internet connection, as shown in **Figure 1-10**.
- Of all the households in the study area, 47% have household income greater than $75,000, as shown in **Figure 1-11**.

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

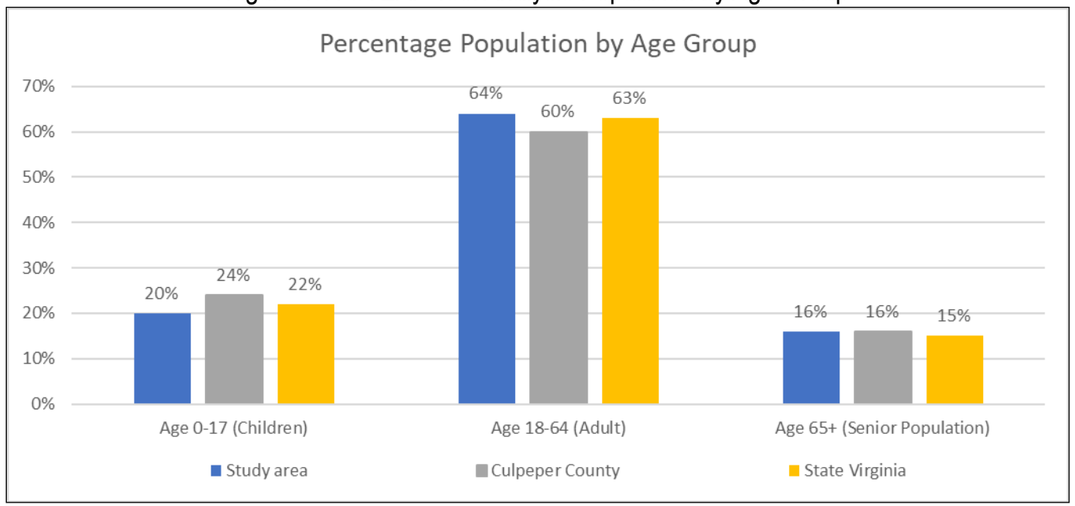


Figure 1-8. STEAP Tool Analysis Vehicle Ownership

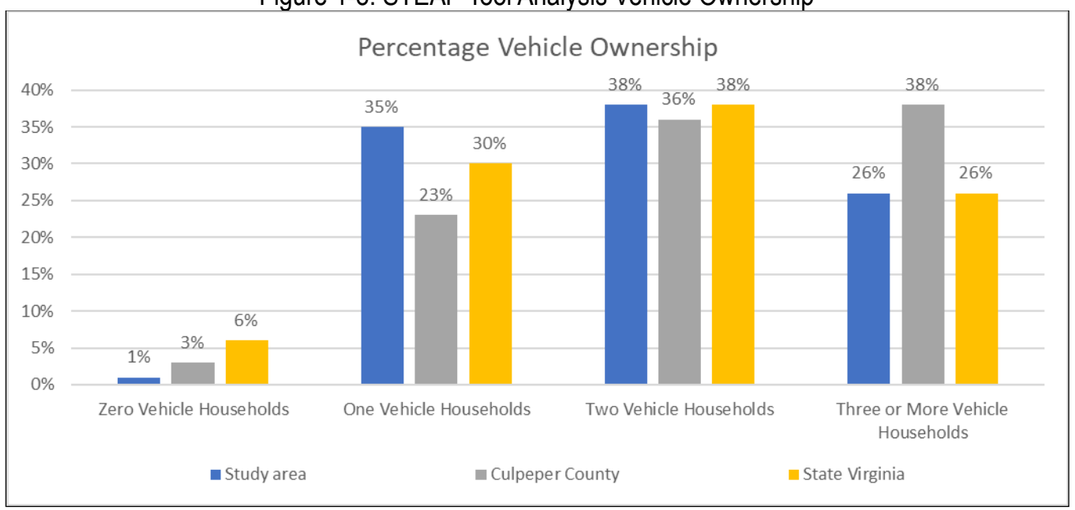


Figure 1-9. STEAP Tool Analysis Non-English at Home

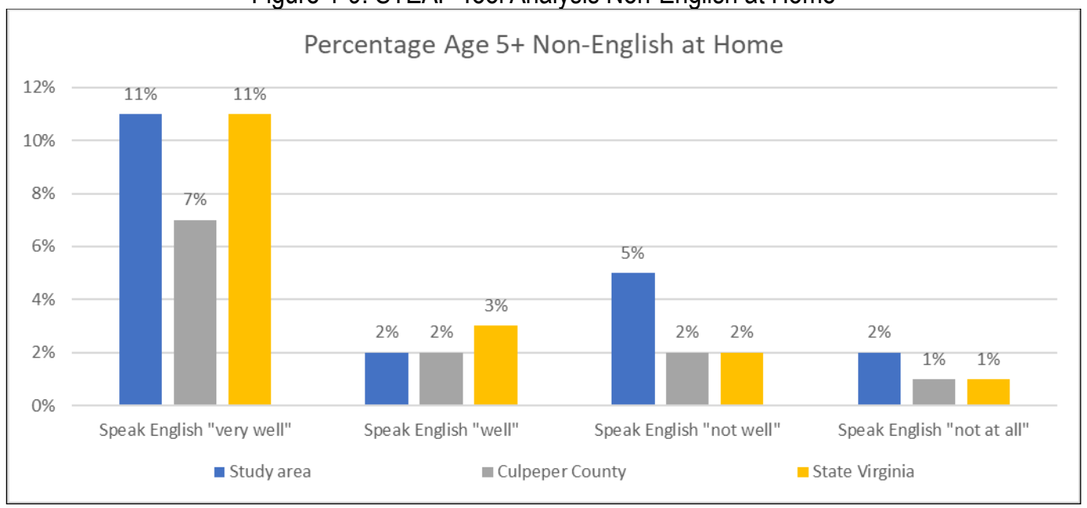


Figure 1-10. STEAP Tool Analysis Vulnerable Populations

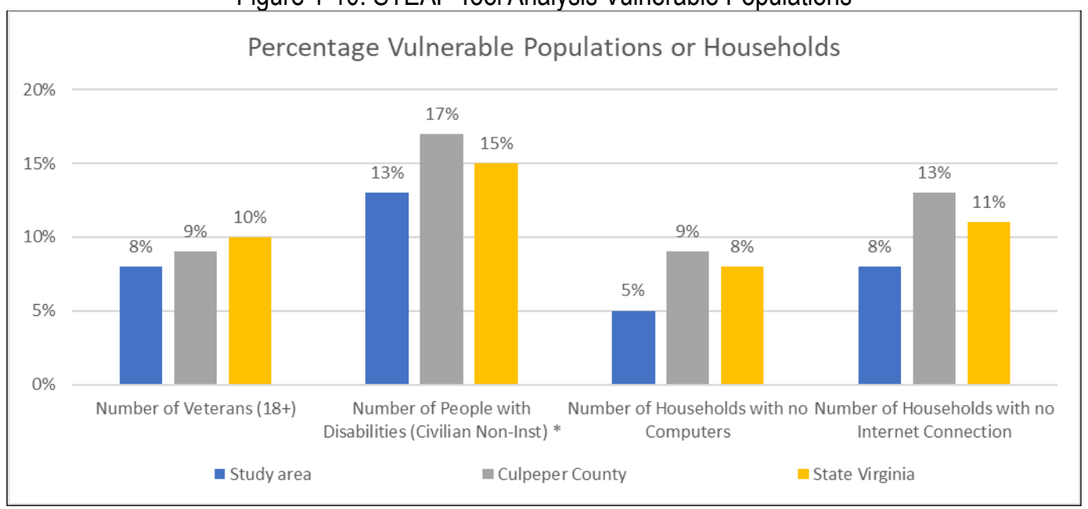
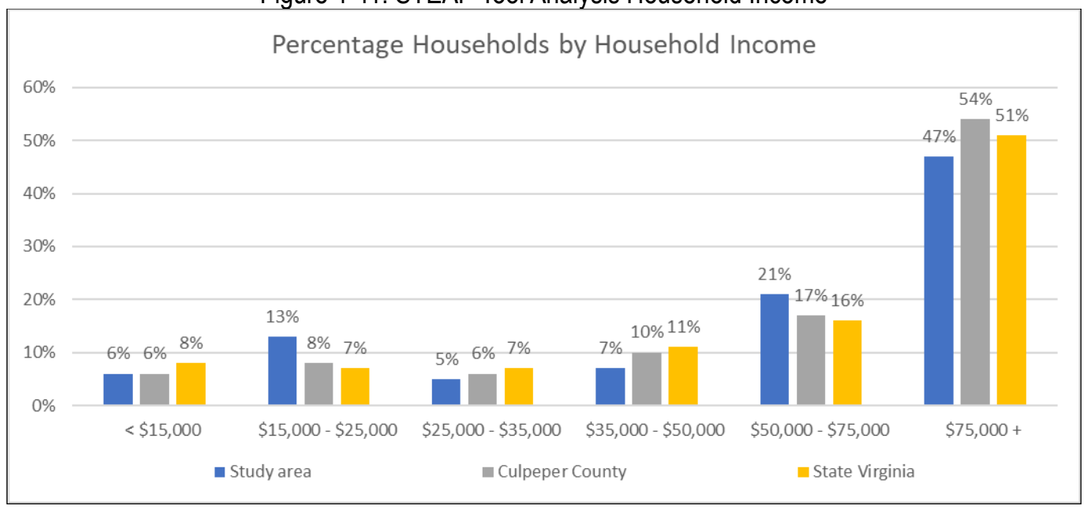


Figure 1-11. STEAP Tool Analysis Household Income



1.7 Traffic Operations and Accessibility

a.Traffic Data

The traffic data for the study area was obtained from turning movement counts collected on Tuesday, May 16, 2023. The counts were collected from 6:00 AM to 6:00 PM. The corridor AM peak hour was determined to be 7:30 AM to 8:30 AM, and the corridor PM peak hour was determined to be 3:45 PM to 4:45 PM. Raw traffic counts are provided in **Appendix B,** and the intersection volumes are shown in **Figure 1-12**. **Figure 1-13** presents the average US Route 29 Business corridor travel times (minutes), travel time indices (ratio of travel time during the individual hour to free-flow conditions), and speed (MPH) based on INRIX data from April 2023.

- The average eastbound US Route 29 Business travel time during AM and PM hours was identified to be under 3.0 minutes (180 seconds), with an average travel time index of approximately 1.25. The average speed varied between 28 MPH to 35 MPH.
- The average westbound US Route 29 Business travel time during AM and PM hours was identified to be under 2.75 minutes (165 seconds), with an average travel time index of approximately 1.15. The average speed varied between 30 MPH to 35 MPH.

b.Traffic Operations

The Existing Conditions (2023) analysis was performed for the US Route 29 Business corridor utilizing the volumes collected in May 2023. *Synchro* (Version 11) was utilized to build the network and input relevant parameters such as peak hour factor (PHF), truck percentages, posted speed limits, etc. *SimTraffic* was utilized to perform the analysis to obtain delay (seconds per vehicle), equivalent level of service (LOS), and to determine the maximum queue lengths (feet). The results were based on an average of ten (10) simulation runs. The analysis results for Existing Conditions (2023) are presented in **Table 1-4**. The results indicate that all study intersections are operating at overall LOS C or better during both the AM and PM peak hours. Detailed *SimTraffic* output reports are provided in **Appendix C.**

Table 1-4. US Route 29 Business – Existing Conditions Intersection Analysis Results

1: Southridge Pkwy/Zeuswyn Dr & Madison Road (Unsignalized)

Movement	Storage Length (Feet)	Volume Input AM	SimTraffic Delay1 AM	Max Q2 (Feet) AM	Volume Input PM	SimTraffic Delay1 PM	Max Q2 (Feet) PM
EBL	-	27	4.8	135	17	7.0	94
EBT	-	727	1.0	135	497	1.1	94
EBR	-	18	0.3	0	25	0.3	0
EB	-	*772*	*1.1*	*135*	*539*	*1.3*	*94*
WBL	145	34	8.5	56	69	5.3	58
WBT	-	386	0.5	0	679	0.8	2
WBR	-	1	0.1	0	2	0.3	0
WB	-	*421*	*1.1*	*56*	*750*	*1.2*	*58*
NBL	-	12	25.2	43	20	22.8	52
NBT	-	1	17.4	43	0	0.0	52
NBR	215	54	4.5	61	61	3.7	55
NB	-	*67*	*8.5*	*61*	*81*	*8.3*	*55*
SBL	-	2	20.0	20	1	0.0	18
SBT	-	1	35.1	20	0	0.0	18
SBR	-	1	2.5	20	1	3.3	18
SB	-	*4*	*15.0*	*20*	*2*	*3.3*	*18*
All	-	***1,264***	***1.6***	-	***1,372***	***1.6***	-

2: Laurel St & Madison Road (Unsignalized)

Movement	Storage Length (Feet)	Volume Input AM	SimTraffic Delay1 AM	Max Q2 (Feet) AM	Volume Input PM	SimTraffic Delay1 PM	Max Q2 (Feet) PM
EBL	-	2	5.0	39	2	7.9	43
EBT	-	720	0.8	39	527	0.7	43
EBR	160	63	0.4	12	33	0.3	3
EB	-	*785*	*0.8*	*39*	*562*	*0.7*	*43*
WBL	125	51	13.0	85	53	8.8	66
WBT	-	395	2.3	0	705	3.0	2
WBR	-	1	3.0	0	0	0.0	2
WB	-	*447*	*3.3*	*85*	*758*	*3.4*	*66*
NBL	-	25	27.6	99	45	28.8	168
NBT	-	0	0.0	99	0	0.0	168
NBR	-	55	8.8	99	81	13.4	168
NB	-	*80*	*13.9*	*99*	*126*	*18.9*	*168*
SBL	-	0	0.0	17	0	0.0	0
SBT	-	0	0.0	17	0	0.0	0
SBR	-	1	4.3	17	0	0.0	0
SB	-	*1*	*4.3*	*17*	*0*	*0.0*	*0*
All	-	***1,313***	***2.5***	-	***1,446***	***3.7***	-

1. SimTraffic Delay represents average control delay from SimTraffic. Delay values highlighted in green, yellow, orange and red indicate equivalent LOS A-C, D, E and F respectively.
2. Max Queue represents maximum queue in feet from SimTraffic.

Table 1-4. US Route 29 Business – Existing Conditions Intersection Analysis Results (Cont.)

3: Sunset Ln & Madison Road (Signalized)

Movement	Storage Length (Feet)	Volume Input AM	SimTraffic Delay1 AM	Max Q2 (Feet) AM	Volume Input PM	SimTraffic Delay1 PM	Max Q2 (Feet) PM
EBL	130	70	39.8	127	28	51.1	129
EBT	-	597	18.6	244	512	25.5	199
EBR	300	113	4.0	54	69	4.1	45
EB	-	*780*	*18.4*	*244*	*609*	*24.1*	*199*
WBL	200	165	36.1	183	101	44.3	160
WBT	-	345	14.2	177	522	22.0	217
WBR	-	53	3.0	57	52	3.1	44
WB	-	*563*	*19.1*	*0*	*675*	*22.8*	*217*
NBL	-	81	30.7	144	161	33.1	204
NBT	-	17	32.5	144	18	33.2	204
NBR	300	81	6.1	66	135	7.0	88
NB	-	*179*	*19.9*	*144*	*314*	*21.5*	*204*
SBL	-	29	39.1	83	73	39.4	125
SBT	-	4	35.5	83	10	32.6	125
SBR	-	20	4.7	46	75	6.1	56
SB	-	*53*	*25.1*	*83*	*158*	*24.0*	*125*
All	-	***1,575***	***19.2***	-	***1,756***	***23.5***	-

4: Meadowbrook Dr/Golf Dr & Madison Road (Signalized)

Movement	Storage Length (Feet)	Volume Input AM	SimTraffic Delay1 AM	Max Q2 (Feet) AM	Volume Input PM	SimTraffic Delay1 PM	Max Q2 (Feet) PM
EBL	160	43	34.0	113	41	41.0	132
EBT	-	663	13.4	220	690	15.9	259
EBR	375	9	5.3	6	20	5.5	13
EB	-	*715*	*14.3*	*220*	*751*	*16.7*	*259*
WBL	175	96	25.2	141	122	31.0	151
WBT	-	526	8.2	172	615	10.0	172
WBR	-	32	1.2	38	32	1.3	33
WB	-	*654*	*10.1*	*172*	*769*	*12.7*	*172*
NBL	-	19	26.5	91	21	30.6	127
NBT	-	2	34.3	91	2	37.9	127
NBR	-	38	8.2	91	78	10.6	127
NB	-	*59*	*14.6*	*91*	*101*	*15.9*	*127*
SBL	-	28	27.9	62	37	32.3	79
SBT	-	3	27.7	62	6	30.2	79
SBR	80	11	5.1	49	28	5.8	63
SB	-	*42*	*21.4*	*62*	*71*	*20.7*	*79*
All	-	***1,470***	***12.8***	-	***1,692***	***15.3***	-

Table 1-4. US Route 29 Business – Existing Conditions Intersection Analysis Results (Cont.)

5: Madison Road & Country Club Rd (Unsignalized)

Movement	Storage Length (Feet)	Volume Input AM	SimTraffic Delay1 AM	Max Q2 (Feet) AM	Volume Input PM	SimTraffic Delay1 PM	Max Q2 (Feet) PM
EBL	150	6	6.2	25	9	5.6	29
EBT	-	723	2.7	0	810	3.1	0
EBR	-	0	0.0	0	0	0.0	0
EB	-	*729*	*2.7*	*25*	*819*	*3.1*	*29*
WBL	-	0	0.0	0	0	0.0	0
WBT	-	651	0.9	0	759	1.3	0
WBR	-	8	0.6	0	16	0.9	0
WB	-	*659*	*0.9*	*0*	*775*	*1.3*	*0*
SBL	-	9	15.7	30	6	18.7	36
SBT	-	0	0.0	0	0	0.0	0
SBR	-	3	3.6	30	9	4.2	36
SB	-	*12*	*12.0*	*30*	*15*	*9.8*	*36*
All	-	***1,400***	***2.0***	-	***1,609***	***2.3***	-

6: Madison Road & Oaklawn Dr (Unsignalized)

Movement	Storage Length (Feet)	Volume Input AM	SimTraffic Delay1 AM	Max Q2 (Feet) AM	Volume Input PM	SimTraffic Delay1 PM	Max Q2 (Feet) PM
EBL	130	29	5.6	45	13	5.6	30
EBT	-	702	1.7	0	803	1.7	0
EBR	-	1	2.6	0	0	0.0	0
EB	-	*732*	*1.8*	*45*	*816*	*1.7*	*30*
WBL	115	7	9.6	19	1	0.0	2
WBT	-	636	2.1	4	751	2.3	0
WBR	-	12	2.1	4	9	2.1	0
WB	-	*655*	*2.1*	*19*	*761*	*2.3*	*2*
NBL	-	1	10.5	23	0	0.0	18
NBT	-	1	21.5	23	0	0.0	18
NBR	-	0	0.0	23	1	5.4	18
NB	-	*2*	*16.0*	*23*	*1*	*5.4*	*18*
SBL	-	7	16.4	45	18	21.7	57
SBT	-	0	0.0	45	0	0.0	57
SBR	-	20	4.4	45	21	6.5	57
SB	-	*27*	*7.6*	*45*	*39*	*13.7*	*57*
All	-	***1,416***	***2.1***	-	***1,617***	***2.3***	-

Table 1-4. US Route 29 Business – Existing Conditions Intersection Analysis Results (Cont.)

7: Blue Ridge Ave/S Blue Ridge Ave & Madison Road (Signalized)

Movement	Storage Length (Feet)	Volume Input AM	SimTraffic Delay1 AM	Max Q2 (Feet) AM	Volume Input PM	SimTraffic Delay1 PM	Max Q2 (Feet) PM
EBL	100	73	8.9	90	122	19.3	100
EBT	-	604	7.0	166	611	13.1	266
EBR	480	37	1.6	46	90	2.6	53
EB	-	*714*	*6.9*	*166*	*823*	*12.9*	*266*
WBL	75	22	9.4	54	70	19.0	75
WBT	-	423	7.4	135	512	13.2	195
WBR	-	0	0.0	127	0	0.0	182
WB	-	*445*	*7.5*	*135*	*582*	*13.8*	*195*
NBL	-	16	21.0	46	107	24.0	126
NBT	-	9	20.8	39	27	19.3	109
NBR	-	3	4.2	39	73	7.9	109
NB	-	*28*	*18.6*	*46*	*207*	*17.7*	*126*
SBL	-	21	20.7	148	26	35.0	216
SBT	-	14	19.5	148	46	31.6	216
SBR	-	216	8.1	148	142	16.8	216
SB	-	*251*	*9.7*	*148*	*214*	*22.3*	*216*
All	-	***1,438***	***7.8***	-	***1,826***	***14.9***	-

8: Madison Road & S West St (Unsignalized)

Movement	Storage Length (Feet)	Volume Input AM	SimTraffic Delay1 AM	Max Q2 (Feet) AM	Volume Input PM	SimTraffic Delay1 PM	Max Q2 (Feet) PM
EBL	90	154	6.3	85	143	9.1	87
EBT	-	464	2.1	53	544	2.6	110
EBR	-	13	0.7	8	23	0.8	3
EB	-	*631*	*3.1*	*85*	*710*	*3.8*	*110*
WBL	130	13	6.1	6	45	7.6	34
WBT	-	281	1.6	2	447	2.3	12
WBR	20	4	2.0	19	4	2.7	22
WB	-	*298*	*1.8*	*19*	*496*	*2.8*	*34*
NBL	-	3	10.0	26	5	27.5	47
NBT	-	2	18.6	26	15	28.7	47
NBR	-	14	5.2	22	26	5.5	39
NB	-	*19*	*6.9*	*26*	*46*	*14.6*	*47*
SBL	-	0	0.0	0	0	0.0	0
SBT	-	0	0.0	0	0	0.0	0
SBR	-	161	2.9	57	128	4.6	40
SB	-	*161*	*2.9*	*57*	*128*	*4.6*	*40*
All	-	***1,109***	***2.7***	-	***1,380***	***3.8***	-

Table 1-4. US Route 29 Business – Existing Conditions Intersection Analysis Results (Cont.)

9: Germanna Hwy & Madison Road/S Main St (Signalized)

Movement	Storage Length (Feet)	Volume Input AM	SimTraffic Delay1 AM	Max Q2 (Feet) AM	Volume Input PM	SimTraffic Delay1 PM	Max Q2 (Feet) PM
EBL	90	7	22.9	31	38	41.8	88
EBT	-	336	8.1	115	381	14.8	197
EBR	115	135	3.2	78	151	4.2	115
EB	-	*478*	*6.9*	*115*	*570*	*13.6*	*197*
WBL	90	53	21.0	83	55	37.9	89
WBT	-	228	4.6	103	364	13.3	211
WBR	265	16	1.8	32	34	2.4	41
WB	-	*297*	*7.3*	*103*	*453*	*15.5*	*211*
NBL	-	67	22.3	109	104	28.6	169
NBT	-	20	21.8	109	44	27.5	169
NBR	-	36	2.4	0	29	2.5	0
NB	-	*123*	*16.4*	*109*	*177*	*24.6*	*169*
SBL	-	4	26.3	31	25	36.7	64
SBT	-	2	17.9	31	20	38.5	64
SBR	-	3	4.2	24	28	4.1	45
SB	-	*9*	*18.0*	*31*	*73*	*25.2*	*64*
All	-	***907***	***8.4***	-	***1,273***	***16.5***	-

Figure 1-12. US Route 29 Business Corridor Intersection Existing Turning Movement Counts

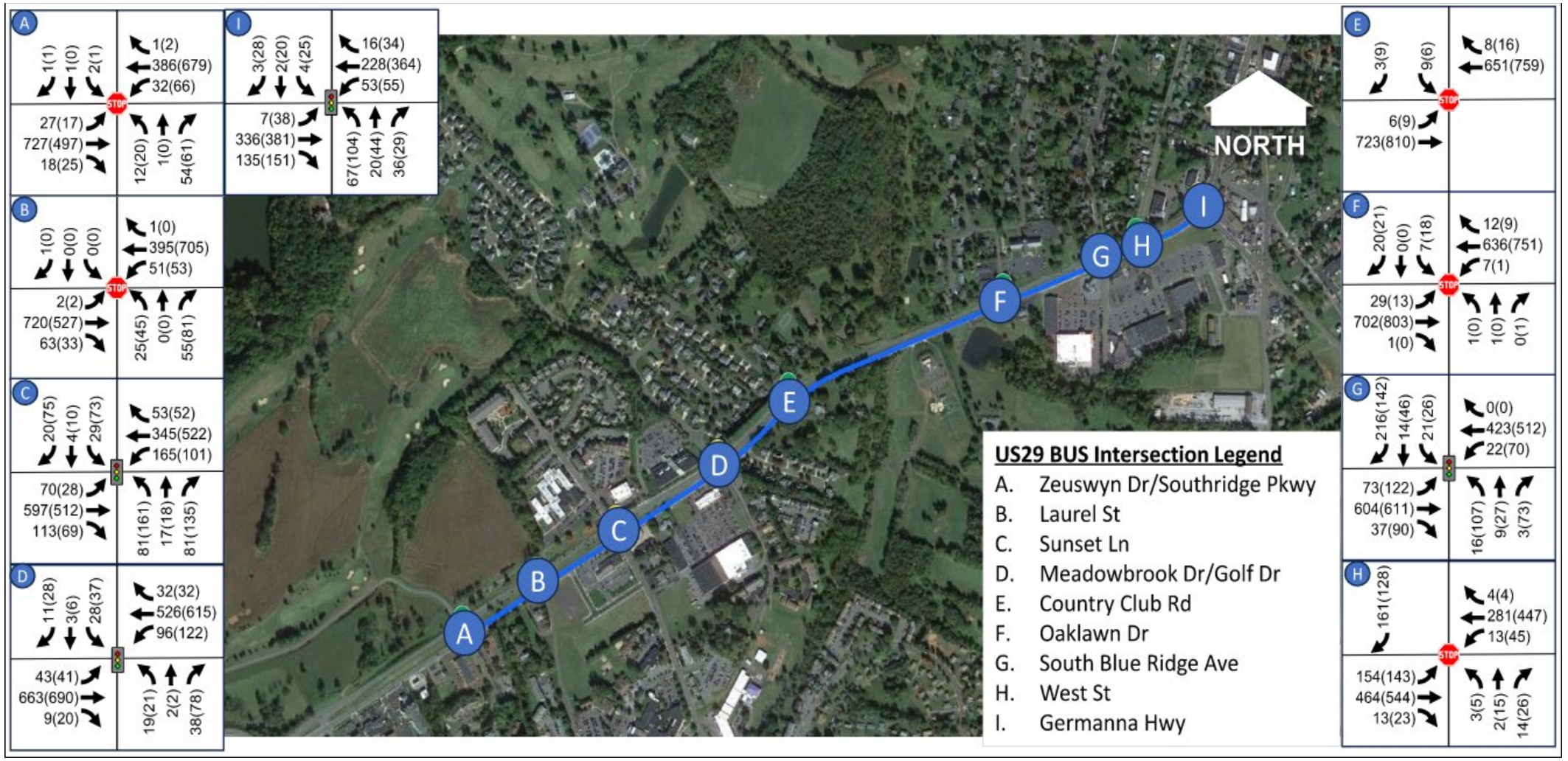
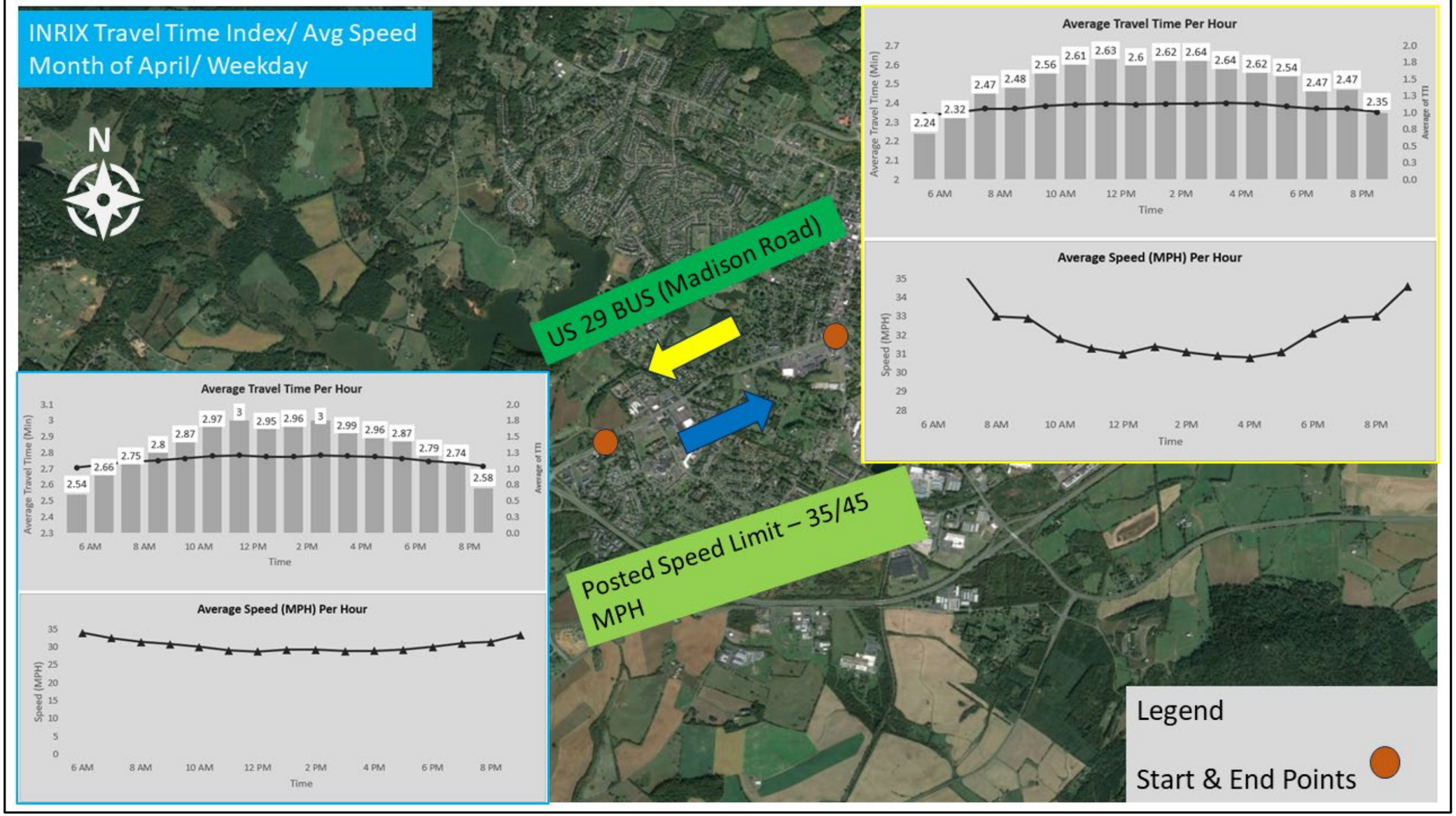


Figure 1-13. INRIX 2023 Travel Time Index and Average Speed



1.8 Safety and Reliability

The VDOT Crash Analysis PowerBI Tool was utilized to analyze safety history at the study intersections and along the US Route 29 Business corridor. Crash data was collected and analyzed for a five-year period spanning from January 2018 to December 2022. The study team reviewed the FR-300 reports provided by VDOT to determine specific trends and "hot spot" areas for consideration in developing alternative improvement concepts. For this analysis, "injury crashes" is defined as the sum of type A (severe injury), B (visible injury), and C (non-visible injury) crashes. Raw crash data is provided in **Appendix D**.

a. Safety Analysis Results

A total of one-hundred and ten (110) crashes were reported within the US Route 29 Business study corridor limits during the five-year study period. The US Route 29 Business crashes are summarized by severity in **Table 1-5** and by type in **Table 1-6**. A breakdown of reported crash history by lighting conditions, adverse weather conditions, and other related factors, including alcohol, speeding, and guardrail, are summarized in **Table 1-7**. Lastly, crash locations along US Route 29 Business are depicted in **Figure 1-14**.

Table 1-5. Study Area Crash Severity by Year

Crash Year and Severity	K. Fatal Injury	A. Severe Injury	B. Visible Injury	C. Nonvisible Injury	PDO. Property Damage Only	Total
2018	0	1	9	10	13	**33**
2019	0	0	6	9	6	**21**
2020	0	0	3	5	6	**14**
2021	0	0	5	6	9	**20**
2022	1	0	6	4	11	**22**
Total	**1**	**1**	**29**	**34**	**45**	**110**

Table 1-6. Study Area Crash Severity by Type

Crash Type and Severity	K. Fatal Injury	A. Severe Injury	B. Visible Injury	C. Nonvisible Injury	PDO. Property Damage Only	Total
Rear End	0	9	12	0	10	**31**
Angle	1	14	12	0	13	**40**
Head On	0	0	2	0	1	**3**
Sideswipe – Same Direction	0	0	5	0	5	**10**
Sideswipe – Opposite Direction	0	1	0	0	1	**2**
Fixed Object in Road	0	0	0	0	1	**1**
Non-Collision	0	0	0	0	1	**1**
Fixed Object – Off Road	0	3	2	0	2	**7**
Deer	0	0	1	0	4	**5**
Other Animal	0	0	0	0	2	**2**
Ped	0	1	0	1	0	**2**
Backed Into	0	0	0	0	1	**1**
Other	0	1	0	0	4	**5**
Total	**1**	**29**	**34**	**1**	**45**	**110**

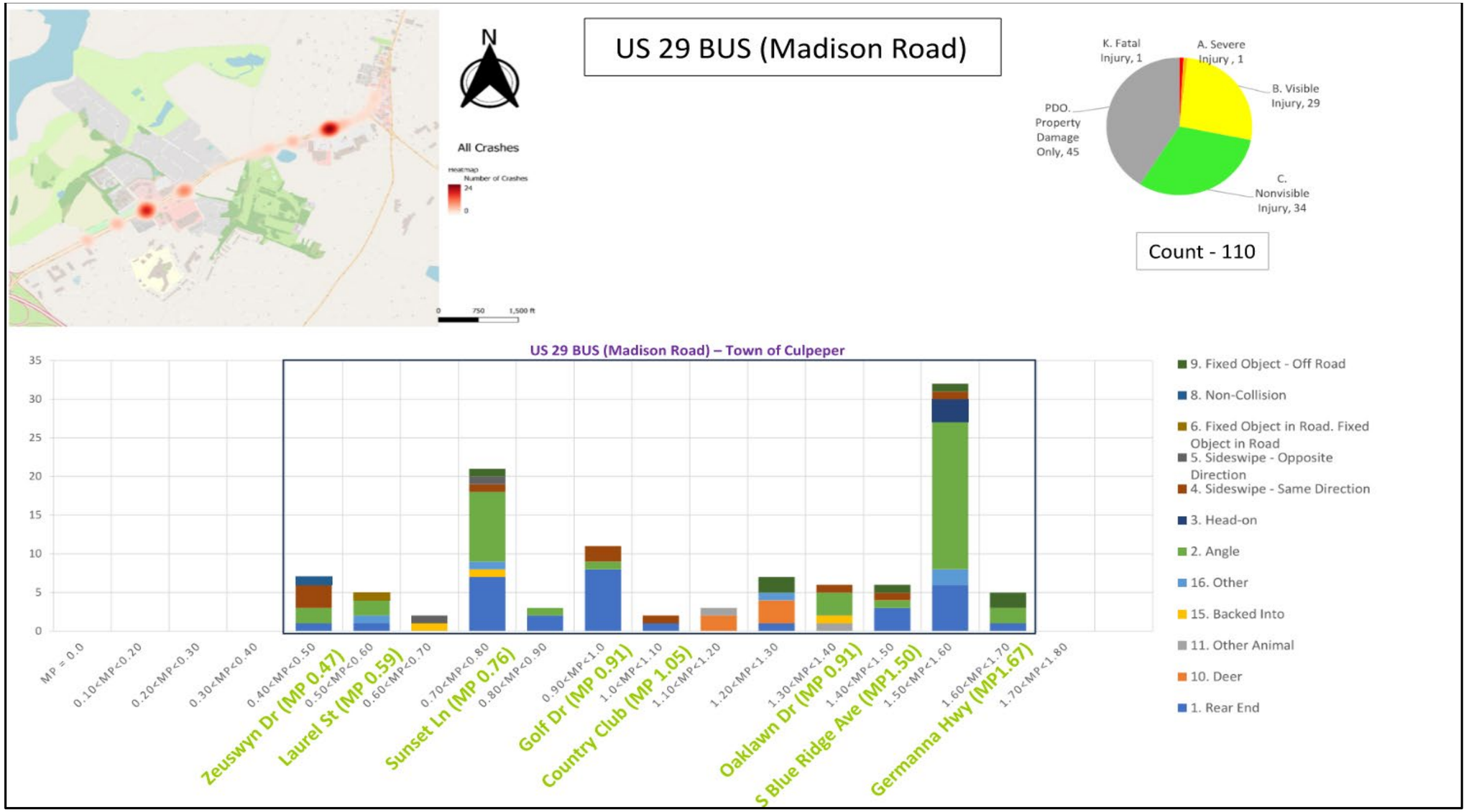
Key takeaways from the reported crash data are as follows:

1. Year-over-year crash occurrence varies, with the highest number of crashes (33) occurring in 2018, a downward trend followed through 2022 (22 crashes).
2. A relatively high percentage of injury (58%) related incidents were reported along the study corridor. Property damage-only crashes (PDO) accounted for approximately 41% of the total crashes.
3. There was one fatal crash reported in 2022, which occurred approximately 300 feet south of the Sunset Lane intersection. The subject crash involved a pedestrian crossing US Route 29 Business under dark lighting conditions.
4. There were 89 crashes (81%) which occurred at or within 150 feet of an intersection.
5. A majority of reported crashes within the corridor were angle (36%) collisions, followed by rear-end (28%) collisions.
6. There were 13 crashes (12%) that were related to speeding.
7. There were 14 crashes (13%) that occurred during rainy weather conditions.

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

Crash Type and Other Related Factors	Daylight	Darkness	No Adverse Conditions	Fog	Mist	Rain	Snow	Sleet/Hail	Yes	No	Yes	No	Yes	No
Rear End	25	6	26	0	1	4	0	0	2	29	2	29	0	31
Angle	31	9	32	1	0	6	1	0	0	40	5	35	0	40
Head On	2	1	3	0	0	0	0	0	0	3	1	2	0	3
Sideswipe – Same Direction	9	1	7	0	0	3	0	0	0	10	0	10	0	10
Sideswipe – Opposite Direction	2	0	2	0	0	0	0	0	0	2	0	2	0	2
Fixed Object in Road	1	0	1	0	0	0	0	0	0	1	0	1	0	1
Non-Collision	1	0	1	0	0	0	0	0	0	1	0	1	0	1
Fixed Object – Off Road	4	3	7	0	0	0	0	0	0	7	4	3	0	7
Deer	0	5	5	0	0	0	0	0	0	5	0	5	0	5
Other Animal	0	2	1	0	0	1	0	0	0	2	0	2	0	2
Ped	0	2	2	0	0	0	0	0	0	2	0	2	0	2
Backed Into	1	0	1	0	0	0	0	0	0	1	0	1	0	1
Other	3	2	5	0	0	0	0	0	0	5	1	4	0	5
Total	**79**	**31**	**93**	**1**	**1**	**14**	**1**	**0**	**2**	**108**	**13**	**97**	**38**	**110**

Figure 1-14. US Route 29 Business Crossover Locations and Crash Types



1.9 Rail, Transit, and TDM:

TEXT – To be added by Mead & Hunt

1.10 Traffic Forecast

The Design Year for this project was identified as 2050, and the Interim Year as 2035. No travel demand model exists for the Town of Culpeper and Culpeper County. Two (2) data sources were reviewed to estimate growth rates for the future year scenarios: the available VDOT historical AADT data and VDOT's Pathways for Planning (P4P) data (developed based on the new LRS-RNS). All traffic growth rate calculations use linear methodologies as the historical trend has demonstrated a near-consistent linear growth rate. Additional details about the forecasting effort can be found in the US *Route 29 Business Pipeline Study Traffic Forecasting Memorandum*, submitted and approved by VDOT in December 2023, provided in **Appendix E**.

a. Historic Growth Rate and P4P Data

Table 1-18 summarizes VDOT historical traffic count data (from P4P website). Using VDOT published data from 2011-2019, the annual growth rates were calculated using a linear method. The US Route 29 Business segments showed a historical growth rate of approximately 1.17% based on the 2010 and 2019 AADT data.

The historical 10-year (2010-2019) growth rate based on the linear regression method from the P4P module and, as identified in the VDOT Traffic Forecasting Guidebook using data points from each year, indicated a growth rate of 2.05%.

b. Growth Rate Recommendation

Based on the historical data, VDOT's P4P data, and the *Wawa- Laurel Street* TIA, all roads in the study are recommended for growth at an annual rate of 2.05%. The recommended growth rates were applied to the existing peak hour volumes to estimate Interim Year (2035) and Design Year (2050) peak hour volumes, presented in **Figures 1-15 and 1-16**, respectively.

Table 1-8. VDOT Historical Growth Rates

Year	VDOT AADT
2010	16,169
2012	15,287
2013	15,387
2014	15,213
2015	15,811
2016	16,442
2017	17,748
2018	17,782
2019	18,058
Linear Growth Rate (2010 & 2019)	**1.17%**
Linear Growth Rate (2010 thru 2019 Regression Method & P4P)	**2.05%**

Figure 1-15. US Route 29 Business Corridor Interim Year (2035) Peak Hour Volumes

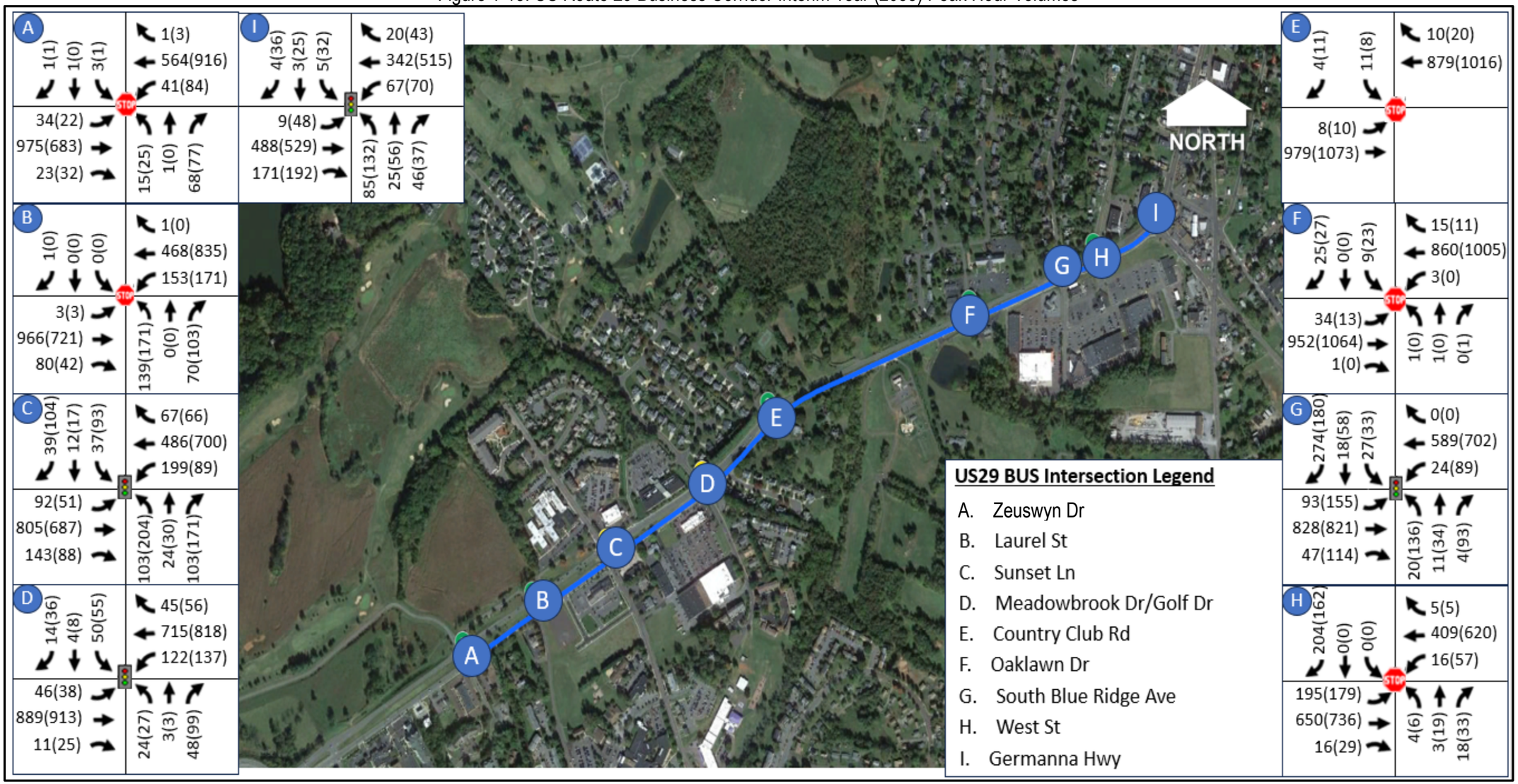
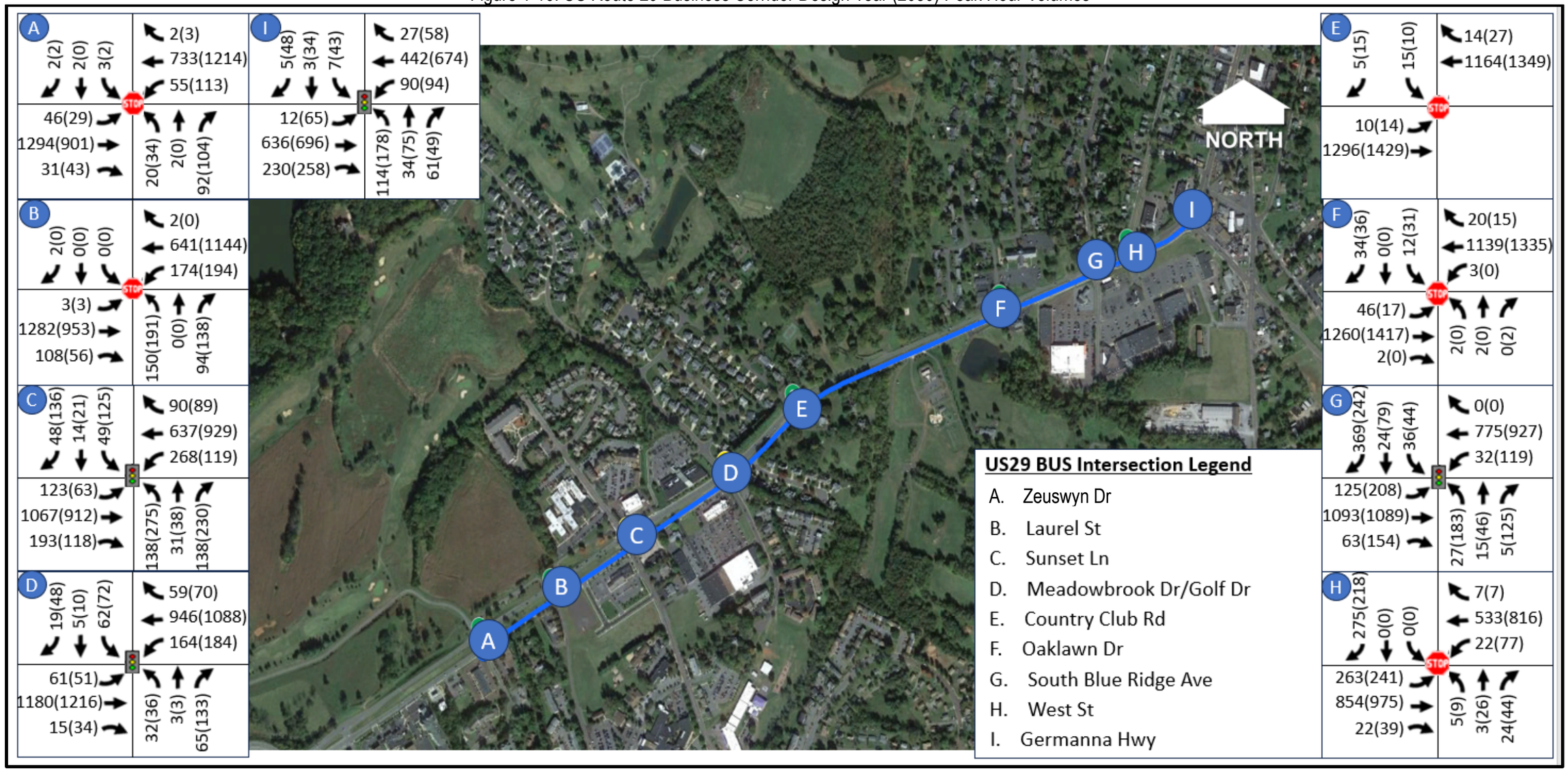


Figure 1-16. US Route 29 Business Corridor Design Year (2050) Peak Hour Volumes



1.11 Phase 1 Corridor/Existing Conditions Public Outreach & Involvement

Phase 1 initial Public Outreach was conducted from July 17th through 30th of 2023, to inform the public of the study efforts and goals and solicit feedback on what the public's priorities and perceptions of the corridor are to include in the evaluation of potential alternatives. The survey was conducted through Publicinput.com, and there were 272 participants.

The survey shows that the major needs of the corridor include safety, bicycle, and pedestrian accessibility/connectivity, and transit accessibility/connectivity, as shown in **Figure 1-17**.

Figure 1-17 Public Input Survey Results

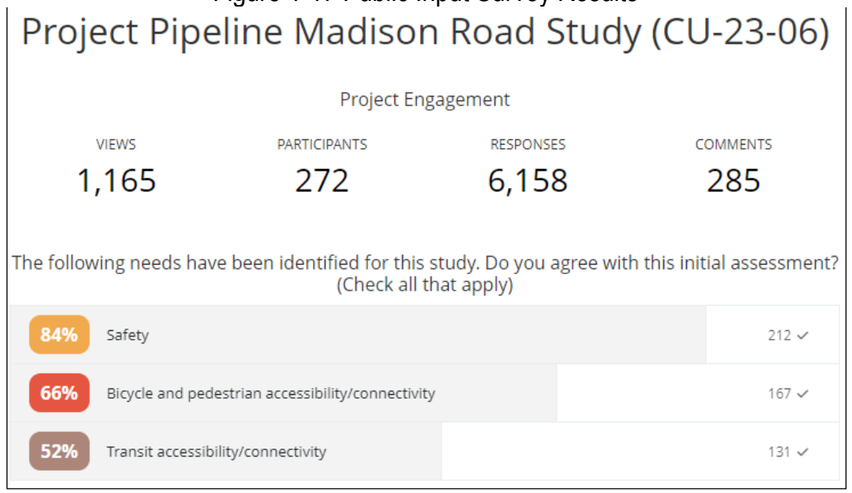
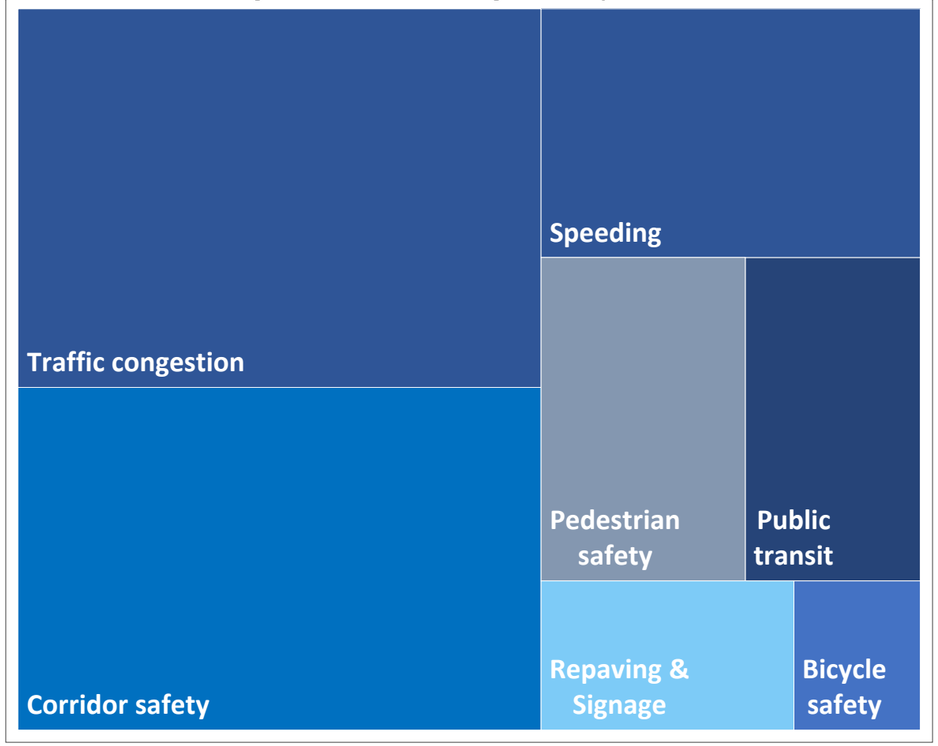


Figure 1-18 shows the issues along the corridor that respondents noted as a need to be addressed. **Figure 1-19** shows the major issues along the corridor, which include speeding, lack of sidewalks, insufficient crosswalks, lack of turn lanes, poor signal coordination, and overall corridor safety. Majority of the respondents use the corridor for shopping/errands, traveling to work, or passing through. Additionally, 99% of the respondents travel using personal vehicles, and over 65% of respondents agree that sidewalks, crosswalks or pedestrian signals are needed along this corridor.

Figure 1-18. Issues along the Study Corridor



The notable comments from the survey responses are summarized below:

- *Covered bus stop with a bench. I have two adult children that use our public transportation to get back and forth to work. Cross walks need to be properly marked with as much signage and flashing lights. I personally witness daily drivers NOT stopping for pedestrians at MULTIPLE places.*
- *Speeding in school zones is out of hand.*
- *Need more turn lanes; e.g., at Rock Water park.*
- *Aggressive drivers overly exceeding the posted limits.*
- *I think better signage is absolutely needed.*

Figure 1-19. Public Input Survey Responses

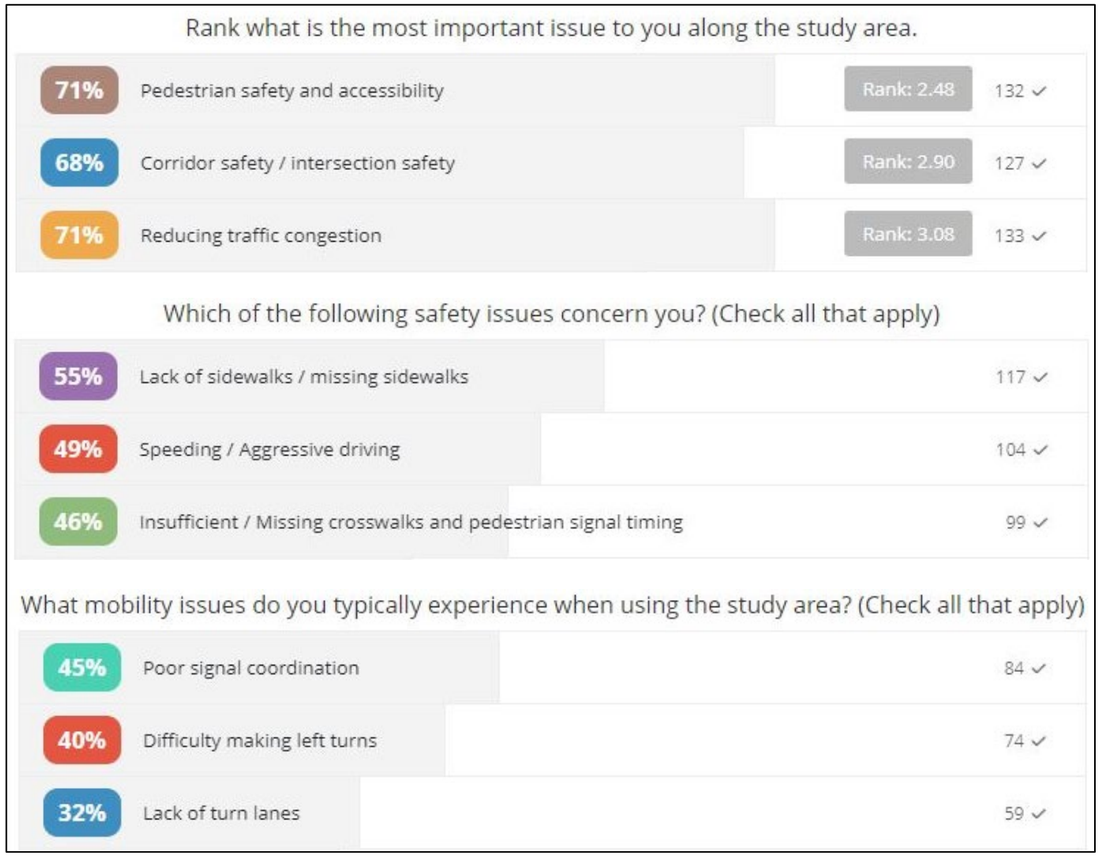
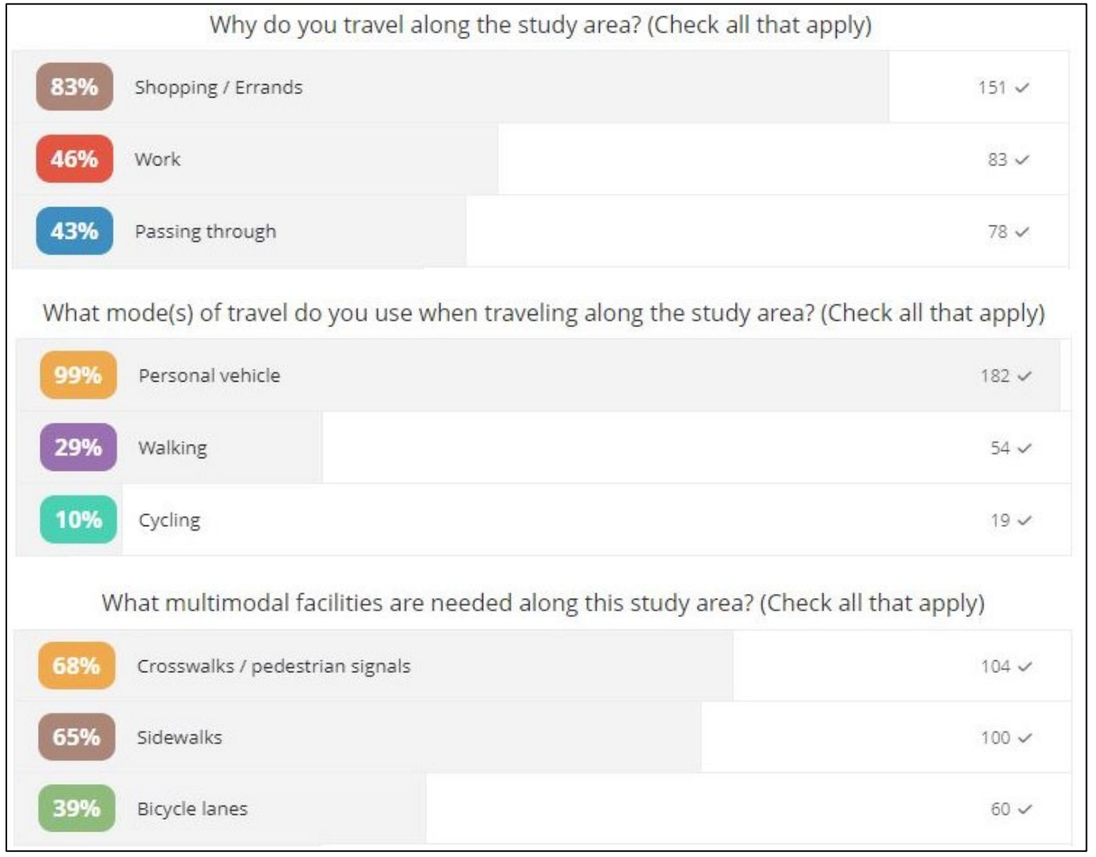


Figure 1-19. Public Input Survey Responses (Cont.)



Chapter 2 Alternative Development and Refinement

2.1 Introduction

The findings from the existing and no-build conditions analyses, as well as community feedback, were utilized to develop build alternatives for the study corridor. As the nature of the future build alternatives is to address spot operational and safety concerns, it is assumed that additional capacity is not being added to the facilities. Therefore, the future No-Build and Build conditions will have the same peak hour volumes, with the exception that the volume may be redistributed in a build concept if necessary.

2.2 Future No-Build Operational Analysis

Interim Year (2035) and Design Year (2050) No-Build analyses were performed for the US Route 29 Business corridor utilizing the peak hour volumes developed in Section 1.10. The future No-Build analysis followed the same methodology and utilized the same roadway geometry and intersection lane configurations as the Existing Conditions analysis. The analysis results for the Interim Year (2035) and Design Year (2050) No-Build conditions are presented in **Table 2-1** and **Table 2-2**, respectively. Detailed SimTraffic output reports are provided in **Appendix F**.

The 2035 No-Build results indicate that all intersections are expected to operate at overall LOS D or better during both the AM and PM peak hours, except for the intersection of US Route 29 Business at Laurel Street which is expected to operate at LOS F/E during the AM/PM peak hours. The northbound stop-controlled Laurel Street approach at the subject intersection is expected to have a queue length exceeding 800 feet during both AM and PM peak hours.

The 2050 No-Build results indicate that the majority of intersections are expected to operate at overall LOS D or better during both the AM and PM peak hours, except for the intersections of US Route 29 Business at Laurel Street during both peak hours (LOS F/E) and at Sunset Lane during the AM peak hour (LOS E). Also, under Design Year (2050) No-Build conditions, vehicular queue lengths exceeding 500 feet at least along one approach of the mainline Madison Road are expected at three of the four signalized intersections.

Table 2-1. US Route 29 Business – 2035 No-Build Intersection Analysis Results

1: Southridge Pkwy/Zeuswyn Dr & Madison Road (Unsignalized)

Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)	Max Q[2] (Feet)
EB	1,032	1.9	194	737	2.4	185
WB	619	1.5	62	1,019	1.5	82
NB	84	13.7	72	102	13.7	69
SB	5	37.2	20	2	4.8	18
Overall	***1,740***	***2.5***	-	***1,860***	***2.6***	-

2: Laurel St & Madison Road (Unsignalized)

Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)	Max Q[2] (Feet)
EB	1,051	1.5	48	772	1.3	74
WB	642	11.4	234	1,011	5.4	121
NB	209	300+	869	274	300+	878
SB	1	6.3	18	0	0.0	0
Overall	***1,903***	***80.3***	-	***2,057***	***71.6***	-

3: Sunset Lane & Madison Road (Signalized)

Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)	Max Q[2] (Feet)
EB	1,049	26.5	341	829	29.6	271
WB	768	25.3	348	909	22.9	292
NB	230	30.6	219	405	29.9	346
SB	88	31.0	134	214	30.0	176
Overall	***2,135***	***26.8***	-	***2,357***	***27.2***	-

4: Meadowbrook Dr/Golf Dr & Madison Road (Signalized)

Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)	Max Q[2] (Feet)
EB	960	12.7	170	1,020	15.6	224
WB	886	16.3	269	1,039	18.8	315
NB	75	33.9	139	129	28.2	201
SB	68	43.1	125	99	37.1	153
Overall	***1,989***	***16.4***	-	***2,287***	***18.8***	-

5: Madison Road & Country Club Rd (Unsignalized)

Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)	Max Q[2] (Feet)
EB	990	1.8	31	1,109	2.1	29
WB	892	1.3	0	1,036	1.9	5
SB	15	21.7	43	19	23.4	58
Overall	***1,897***	***1.7***	-	***2,164***	***2.2***	-

6: Madison Road & Oaklawn Dr (Unsignalized)

Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)	Max Q[2] (Feet)
EB	997	2.2	53	1,081	2.0	30
WB	891	2.2	32	1,027	2.6	5
NB	2	19.9	26	1	5.6	17
SB	34	10.9	52	50	20.8	87
Overall	***1,924***	***2.4***	-	***2,159***	***2.8***	-

Table 2-1. US Route 29 Business – 2035 No-Build Intersection Analysis Results (Continued)

7: Blue Ridge Ave/S Blue Ridge Ave & Madison Road (Signalized)

Movement	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	976	5.8	218	1,095	12.4	221
WB	626	8.4	181	803	19.6	210
NB	35	38.2	72	263	25.7	167
SB	319	26.6	329	271	37.6	331
Overall	***1,956***	***10.8***	-	***2,432***	***19.1***	-

8: Madison Road & S West St (Unsignalized)

Movement	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	877	3.4	152	954	5.0	183
WB	435	2.0	22	686	4.3	105
NB	25	13.2	29	58	26.8	73
SB	204	4.3	71	162	12.3	110
Overall	***1,541***	***3.3***	-	***1,860***	***6.0***	-

9: Germanna Hwy & Madison Road/S Main St (Signalized)

Movement	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	685	5.8	126	775	18.1	253
WB	429	13.4	240	628	22.3	336
NB	156	34.4	178	225	38.3	249
SB	12	42.6	42	93	30.1	64
Overall	***1,282***	***12.2***	-	***1,721***	***23.0***	-

Table 2-2. US Route 29 Business – 2050 No-Build Intersection Analysis Results

1: Southridge Pkwy/Zeuswyn Dr & Madison Road (Unsignalized)

Movement	Storage Length (Feet)	Volume Input AM	SimTraffic Delay1 AM	Max Q2 (Feet) AM	Volume Input PM	SimTraffic Delay1 PM	Max Q2 (Feet) PM
EB	1,371		340	973		270	EB
WB	793		93	1,335		105	WB
NB	114	50.9	125	138	70.7	222	NB
SB	7		39	4	53.8	21	SB
Overall	***2,285***		-	***2,450***		-	***Overall***

2: Laurel St & Madison Road (Unsignalized)

Movement	Storage Length (Feet)	Volume Input AM	SimTraffic Delay1 AM	Max Q2 (Feet) AM	Volume Input PM	SimTraffic Delay1 PM	Max Q2 (Feet) PM
EB	1,385	39.0	506	1,093	36.7	370	EB
WB	1,023	91.3	750	1,243	28.5	320	WB
NB	307	62.2	482	543	34.5	405	NB
SB	111	33.9	145	282	31.0	216	SB
Overall	***2,826***	***60.6***	-	***3,161***	***32.6***	-	***Overall***

3: Sunset Lane & Madison Road (Signalized)

Movement	Storage Length (Feet)	Volume Input AM	SimTraffic Delay1 AM	Max Q2 (Feet) AM	Volume Input PM	SimTraffic Delay1 PM	Max Q2 (Feet) PM
EB	1,385	39.0	506	1,093	36.7	370	EB
WB	1,023	91.3	750	1,243	28.5	320	WB
NB	307	62.2	482	543	34.5	405	NB
SB	111	33.9	145	282	31.0	216	SB
Overall	***2,826***	***60.6***	-	***3,161***	***32.6***	-	***Overall***

4: Meadowbrook Dr/Golf Dr & Madison Road (Signalized)

Movement	Storage Length (Feet)	Volume Input AM	SimTraffic Delay1 AM	Max Q2 (Feet) AM	Volume Input PM	SimTraffic Delay1 PM	Max Q2 (Feet) PM
EB	1,268	19.3	284	1,320	26.0	341	EB
WB	1,169	54.9	548	1,366	23.9	441	WB
NB	100	57.7	201	172	31.6	236	NB
SB	86	45.5	129	130	33.2	146	SB
Overall	***2,623***	***37.9***	-	***2,988***	***25.8***	-	***Overall***

5: Madison Road & Country Club Rd (Unsignalized)

Movement	Storage Length (Feet)	Volume Input AM	SimTraffic Delay1 AM	Max Q2 (Feet) AM	Volume Input PM	SimTraffic Delay1 PM	Max Q2 (Feet) PM
EB	1,306	2.6	39	1,445	3.4	46	EB
WB	1,178	47.9	842	1,376	2.8	8	WB
SB	20	79.1	73	25	105.6	105	SB
Overall	***2,504***	***25.3***	-	***2,846***	***4.1***	-	***Overall***

6: Madison Road & Oaklawn Dr (Unsignalized)

Movement	Storage Length (Feet)	Volume Input AM	SimTraffic Delay1 AM	Max Q2 (Feet) AM	Volume Input PM	SimTraffic Delay1 PM	Max Q2 (Feet) PM
EB	EB	1,311	3.1	85	1,439	6.8	102
WB	WB	1,171	5.7	157	1,352	3.4	18
NB	NB	4	53.7	31	2	44.3	26
SB	SB	46	29.1	103	67	89.3	138
Overall	***Overall***	***2,532***	***4.9***	-	***2,860***	***7.3***	-

7: Blue Ridge Ave/S Blue Ridge Ave & Madison Road (Signalized)

Movement	Storage Length (Feet)	Volume Input AM	SimTraffic Delay1 AM	Max Q2 (Feet) AM	Volume Input PM	SimTraffic Delay1 PM	Max Q2 (Feet) PM
EB	EB	1,311	3.1	85	1,439	6.8	102
WB	WB	1,171	5.7	157	1,352	3.4	18
NB	NB	4	53.7	31	2	44.3	26
SB	SB	46	29.1	103	67	89.3	138
Overall	***Overall***	***2,532***	***4.9***	-	***2,860***	***7.3***	-

8: Madison Road & S West St (Unsignalized)

Movement	Storage Length (Feet)	Volume Input AM	SimTraffic Delay1 AM	Max Q2 (Feet) AM	Volume Input PM	SimTraffic Delay1 PM	Max Q2 (Feet) PM
EB	1,139	5.6	205	1,258	10.4	213	EB
WB	562	3.0	68	900	11.3	220	WB
NB	32	20.8	42	79	96.1	110	NB
SB	275	9.0	150	218	280.2	798	SB
Overall	***2,008***	***5.6***	-	***2,455***	***38.0***	-	***Overall***

9: Germanna Hwy & Madison Road/S Main St(Signalized)

Movement	Storage Length (Feet)	Volume Input AM	SimTraffic Delay1 AM	Max Q2 (Feet) AM	Volume Input PM	SimTraffic Delay1 PM	Max Q2 (Feet) PM
EB	EB	878		240	1,019		316
WB	WB	559		282	826		449
NB	NB	209		230	302	38.6	306
SB	SB	15	42.3	37	125		64
Overall	***Overall***	***1,661***		-	***2,272***		-

Table 2-2. US Route 29 Business – 2050 No-Build Intersection Analysis Results (Cont.)

7: Blue Ridge Ave/S Blue Ridge Ave & Madison Road (Signalized)

Movement	Storage Length (Feet)	Volume Input AM	SimTraffic Delay1 AM	Max Q2 (Feet) AM	Volume Input PM	SimTraffic Delay1 PM
EB	1,281	14.2	333	1,451	37.7	497
WB	812	14.5	218	1,046	35.6	234
NB	47	31.0	78	354	27.5	215
SB	429	36.8	513	365	63.3	526
Overall	***2,569***	***18.6***	-	***3,216***	***39.0***	-

8: Madison Road & S West St (Unsignalized)

Movement	Storage Length (Feet)	Volume Input AM	SimTraffic Delay1 AM	Max Q2 (Feet) AM	Volume Input PM	SimTraffic Delay1 PM
EB	1,139	5.6	205	1,258	10.4	213
WB	562	3.0	68	900	11.3	220
NB	32	20.8	42	79	96.1	110
SB	275	9.0	150	218	280.2	798
Overall	***2,008***	***5.6***	-	***2,455***	***38.0***	-

9: Germanna Hwy & Madison Road/S Main St (Signalized)

Movement	Storage Length (Feet)	Volume Input AM	SimTraffic Delay1 AM	Max Q2 (Feet) AM	Volume Input PM	SimTraffic Delay1 PM
EB	878	8.8	240	1,019	29.4	316
WB	559	14.9	282	826	31.0	449
NB	209	34.4	230	302	38.6	306
SB	15	42.3	37	125	28.8	64
Overall	***1,661***	***14.6***	-	***2,272***	***31.3***	-

2.3 VJuST Screening

Given the operational and safety needs of the study corridor, multiple innovative designs were screened using the VJuST screening tool. The results presented in **Tables 2-3 through 2-11** indicate that:

- At the intersection of US Route 29 Business at Zeuswyn Drive, all evaluated configurations show volume to capacity ratio (V/C) of less than 0.50 during both the AM and PM peak hours.
- At the intersection of US Route 29 Business at Laurel Street, all evaluated configurations show V/C of less than 0.50 during both the AM and PM peak hours.
- At the intersection of US Route 29 Business at Sunset lane, all evaluated configurations except a two-way-stop-control (TWSC) show V/C of less than 0.50 during both the AM and PM peak hours. A TWSC configuration would have a V/C ratio of 1.01 and 1.40 during AM and PM peak hours, respectively.
- At the intersection of US Route 29 Business at Golf Drive, all evaluated configurations show V/C of less than 0.50 during both the AM and PM peak hours.
- At the intersection of US Route 29 Business at Country Club Road, all evaluated configurations show V/C of less than 0.50 during both the AM and PM peak hours.
- At the intersection of US Route 29 Business at Oaklawn Drive, all evaluated configurations show V/C of less than 0.50 during both tphe AM and PM peak hours.
- At the intersection of US Route 29 Business at Blue Ridge Avenue, all evaluated configurations except a two-way-stop-control (TWSC) show V/C of less than 0.50 during both the AM and PM peak hours. A TWSC configuration would have a V/C ratio of 0.48 and 1.90 during AM and PM peak hours, respectively.
- At the intersection of US Route 29 Business at West Street, all evaluated configurations show V/C of less than 0.50 during both the AM and PM peak hours.
- At the intersection of US Route 29 Business at Germanna Highway, all evaluated configurations except a two-way-stop-control (TWSC) show V/C of less than 0.50 during both the AM and PM peak hours. A TWSC configuration would have a V/C ratio of 0.25 and 0.60 during AM and PM peak hours, respectively.

Table 2-3. US Route 29 Business at Zeuswyn Drive VJuST Analysis Results

AM

Type	Dir	Maximum V/C	Accommodation	Weighted Total Conflict Points
Conventional	-	0.29		48
Restricted Crossing U-Turn	-	0.29		20
Thru-Cut	-	0.31		28
Roundabout	-	0.29		8
Two-Way Stop Control	-	0.20		48

PM

Type	Dir	Maximum V/C	Accommodation	Weighted Total Conflict Points
Conventional	-	0.26		48
Restricted Crossing U-Turn	-	0.25		20
Thru-Cut	-	0.26		28
Roundabout	-	0.34		8
Two-Way Stop Control	-	0.19		48

Table 2-4. US Route 29 Business at Laurel Street VJuST Analysis Results

AM

Type	Dir	Maximum V/C	Accommodation	Weighted Total Conflict Points
Conventional	-	0.32		48
Restricted Crossing U-Turn	-	0.29		20
Thru-Cut	-	0.29		28
Roundabout	-	0.32		8
Two-Way Stop Control	-	0.20		48

PM

Type	Dir	Maximum V/C	Accommodation	Weighted Total Conflict Points
Conventional	-	0.31		48
Restricted Crossing U-Turn	-	0.27		20
Thru-Cut	-	0.25		28
Roundabout	-	0.30		8
Two-Way Stop Control	-	0.23		48

Table 2-5. US Route 29 Business at Sunset Lane VJuST Analysis Results

AM

Type	Dir	Maximum V/C	Accommodation	Weighted Total Conflict Points
Conventional	-	0.41		48
Restricted Crossing U-Turn	-	0.32		20
Thru-Cut	-	0.37		28
Roundabout	-	0.36		8
Two-Way Stop Control	-	1.01		48

PM

Type	Dir	Maximum V/C	Accommodation	Weighted Total Conflict Points
Conventional	-	0.49		48
Restricted Crossing U-Turn	-	0.31		20
Thru-Cut	-	0.39		28
Roundabout	-	0.42		8
Two-Way Stop Control	-	1.40		48

Table 2-6. US Route 29 Business at Golf Drive VJuST Analysis Results

AM

Type	Dir	Maximum V/C	Accommodation	Weighted Total Conflict Points
Conventional	-	0.31		48
Restricted Crossing U-Turn	-	0.28		20
Thru-Cut	-	0.29		28
Roundabout	-	0.29		8
Two-Way Stop Control	-	0.23		48

PM

Type	Dir	Maximum V/C	Accommodation	Weighted Total Conflict Points
Conventional	-	0.37		48
Restricted Crossing U-Turn	-	0.31		20
Thru-Cut	-	0.32		28
Roundabout	-	0.32		8
Two-Way Stop Control	-	0.46		48

Table 2-7. US Route 29 Business at Country Club Drive VJuST Analysis Results

AM

Type	Dir	Maximum V/C	Accommodation	Weighted Total Conflict Points
Conventional	-	0.24		48
Roundabout	-	0.26		8
Two-Way Stop Control	-	0.19		48

PM

Type	Dir	Maximum V/C	Accommodation	Weighted Total Conflict Points
Conventional	-	0.26		48
Roundabout	-	0.30		8
Two-Way Stop Control	-	0.44		48

Table 2-8. US Route 29 Business at Oaklawn Drive VJuST Analysis Results

AM

Type	Dir	Maximum V/C	Accommodation	Weighted Total Conflict Points
Conventional	-	0.25		48
Restricted Crossing U-Turn	-	0.23		20
Thru-Cut	-	0.24		28
Roundabout	-	0.27		8
Two-Way Stop Control	-	0.19		48

PM

Type	Dir	Maximum V/C	Accommodation	Weighted Total Conflict Points
Conventional	-	0.28		48
Restricted Crossing U-Turn	-	0.27		20
Thru-Cut	-	0.27		28
Roundabout	-	0.30		8
Two-Way Stop Control	-	0.22		48

Table 2-9. US Route 29 Business at Blue Ridge Avenue VJuST Analysis Results

AM

Type	Dir	Maximum V/C	Accommodation	Weighted Total Conflict Points
Conventional	-	0.24		48
Restricted Crossing U-Turn	-	0.32		20
Roundabout	-	0.35		8
Two-Way Stop Control	-	0.48		48

PM

Type	Dir	Maximum V/C	Accommodation	Weighted Total Conflict Points
Conventional	-	0.36		48
Restricted Crossing U-Turn	-	0.31		20
Roundabout	-	0.54		8
Two-Way Stop Control	-	1.90		48

Table 2-10. US Route 29 Business at West Street VJuST Analysis Results

AM

Type	Dir	Maximum V/C	Accommodation	Weighted Total Conflict Points
Conventional	-	0.21		48
Median U-Turn	-	0.32	+	20
Restricted Crossing U-Turn	-	0.20		20
Two-Way Stop Control	-	0.19		48

PM

Type	Dir	Maximum V/C	Accommodation	Weighted Total Conflict Points
Conventional	-	0.25		48
Median U-Turn	-	0.33	+	20
Restricted Crossing U-Turn	-	0.22		20
Two-Way Stop Control	-	0.16		48

Table 2-11. US Route 29 Business at Germanna Highway VJuST Analysis Results

AM

Type	Dir	Maximum V/C	Accommodation	Weighted Total Conflict Points
Conventional	-	0.20		48
Thru-Cut	-	0.20		28
Roundabout	-	0.23		8
Two-Way Stop Control	-	0.25		48

PM

Type	Dir	Maximum V/C	Accommodation	Weighted Total Conflict Points
Conventional	-	0.26		48
Thru-Cut	-	0.26		28
Roundabout	-	0.28		8
Two-Way Stop Control	-	0.60		48

2.4 Build Concepts & Cost Estimate

The findings from the Existing and No-Build conditions analyses, as well as community feedback (See Section 1.11), were utilized to develop build concepts for the study corridor. The proposed concepts are aimed at improving the multimodal operations, safety, and access within the study area. A concept improvement matrix for the US Route 29 Business corridor is presented in **Table 2-12**.

Table 2-12. US Route 29 Business – Concept Matrix

Intersections	Concept A	Concept B	Concept C
US 29 Business at Laurel St	Hybrid Roundabout	Hybrid Roundabout	Conventional Signal
US 29 Business at Sunset Lane	Increase EBL/WBL storage, Re-stripe NB approach	Dual left-Turn	Hybrid Roundabout
US 29 Business at Golf Drive	Thru cut	Hybrid Roundabout	-
US 29 Business at Blue Ridge Ave	Thru cut	Hybrid Roundabout	Hybrid Roundabout
US 29 Business at West St	Partial RCUT NB/SB, Restrict EBL only	Restrict EBL/WBL by closing median access	Restrict EBL/WBL by closing median access
US 29 Business at Germanna Hwy	Hybrid Roundabout	Thru cut	Thru cut

Multimodal Improvements include Sidewalk Infill, Pedestrian Crossing with Hybrid Beacons, Directional Bike lanes/SUP

Concept A – Figure 2-1:

- US Route 29 Business at Laurel Street: Construct a hybrid roundabout (2x1) with two circulating lanes along US Route 29 Business and one circulating lane for minor street movements.
- US Route 29 Business at Sunset Lane: Increase the existing eastbound and westbound left-turn storage by 120 feet and 200 feet, respectively. Re-stripe the northbound approach to provide a dedicated left-turn lane and a shared through/right lane.
- US Route 29 Business at Golf Drive: Restrict through movements from the side street.
- US Route 29 Business at Blue Ridge Avenue: Restrict through movements from the side street.
- US Route 29 Business at West Street: Restrict the eastbound left-turn movement. Additionally, restrict the northbound through and left-turn movements.
- US Route 29 Business at Germanna Highway: Construct a hybrid roundabout (2x1) with two circulating lanes along US Route 29 Business and one circulating lane along Germanna Highway.

Concept B – Figure 2-2:

- US Route 29 Business at Laurel Street: Construct a hybrid roundabout (2x1) with two circulating lanes along US Route 29 Business and one circulating lane for minor street movements.
- US Route 29 Business at Sunset Lane: Increase existing eastbound left-turn storage lengths by 120 feet, provide dual left-turn lanes on the westbound approach, and re-stripe the northbound approach to provide a dedicated left-turn lane and a shared through/right lane.
- US Route 29 Business at Golf Drive: Construct a hybrid roundabout (2x1) with two circulating lanes along US Route 29 Business and one circulating lane for minor street movements.
- US Route 29 Business at Blue Ridge Avenue: Construct a hybrid roundabout (2x1) with two circulating lanes along US Route 29 Business and one circulating lane for minor street movements.
- US Route 29 Business at West Street: Close the existing full median opening and only allow right-in/out access for the side street.
- US Route 29 Business at Germanna Highway: Restrict through movements from the side streets.

Concept C – Figure 2-3:

- US Route 29 Business at Laurel Street: Install a conventional traffic signal.
- US Route 29 Business at Sunset Lane: Construct a hybrid roundabout (2x1) with two circulating lanes along US Route 29 Business and one circulating lane for minor street movements.
- US Route 29 Business at Blue Ridge Avenue: Construct a hybrid roundabout (2x1) with two circulating lanes along US Route 29 Business and one circulating lane along Blue Ridge Avenue.
- US Route 29 Business at West Street: Close the existing full median opening and only allow right-in/out access for the side street.
- US Route 29 Business at Germanna Highway: Restrict through movements from the side Streets.

Multimodal Improvements (All Concepts):

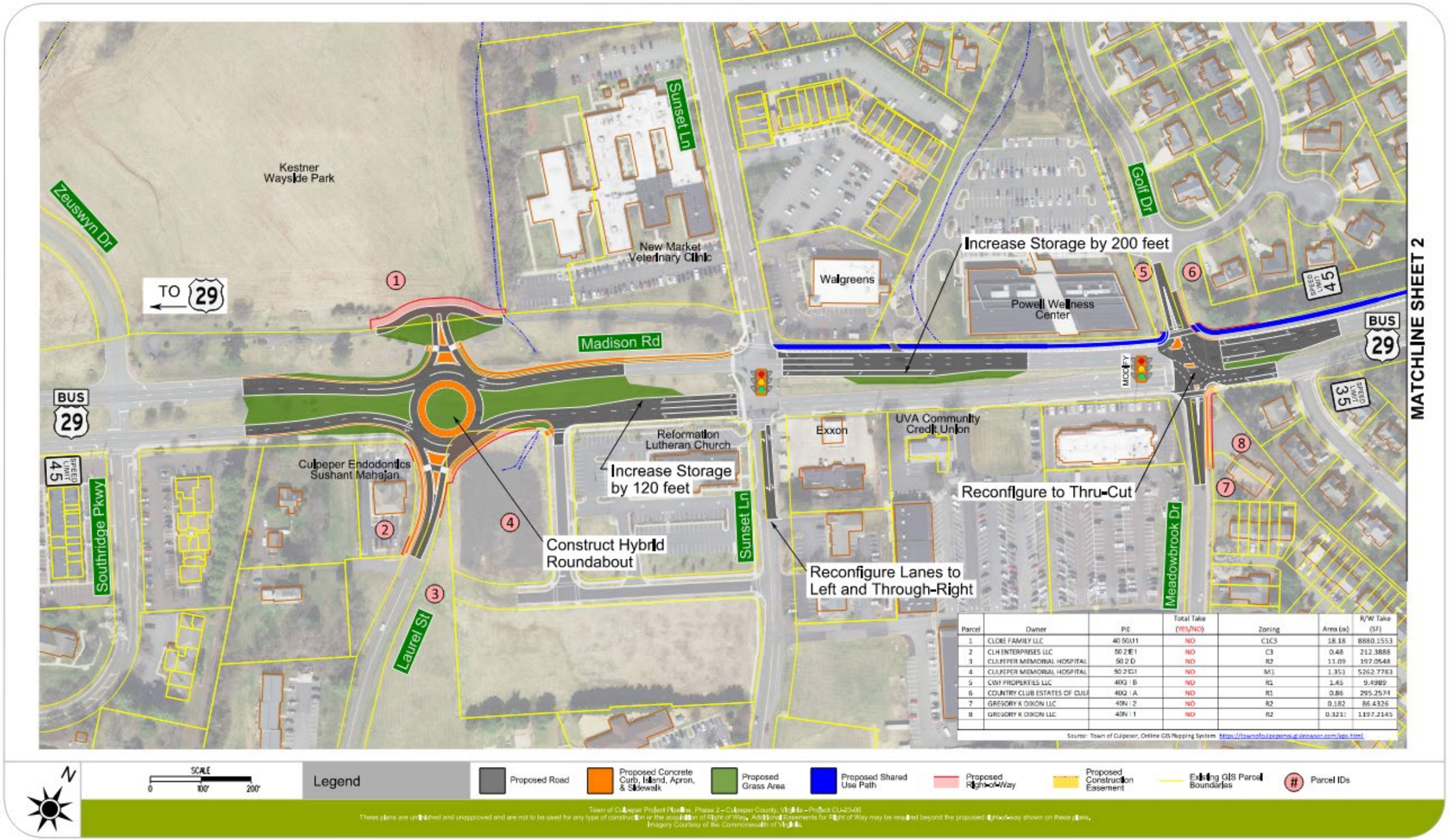
- Construct a curb and shared-use path on the north side of US Route 29 Business from Sunset Lane to Madison Road Connector Trail (located between Country Club Road and Oaklawn Drive).
- Install a midblock crosswalk with High Intensity Activated Crosswalk (HAWK) beacon signals where Madison Road Connector Trail intersects US Route 29 Business.
- Construct curb and sidewalk on the north side of US Route 29 Business from Madison Road Connector Trail to Germanna Highway.

Cost estimates for the four Build concepts were developed utilizing the methodologies from the 2021 *VDOT Cost Estimating Manual* and are presented in **Table 2-13**. Details of cost estimate sheets are provided in **Appendix G.**

Table 2-13. US Route 29 Business – Cost Estimate for Build Concepts

Cost Description	Concept A	Concept B	Concept C
Preliminary Engineering	$3,108,000	$2,795,310	$2,321,310
Right of Way and Utility	$1,980,510	$2,521,450	$905,370
Construction	$10,335,970	$12,896,260	$8,818,980
Total Cost	**$15,424,480**	**$18,213,020**	**$12,045,660**

Figure 2-1: US Route 29 Business Layout for Concept A (Sheet 1)



Parcel	Owner	PIE	Total Take (YES/NO)	Zoning	Area (ac)	R/W Take (SF)
1	CLORE FAMILY LLC	40 50 A1	NO	C1C3	18.18	8880.1553
2	CLH ENTERPRISES LLC	50 2 E1	NO	C3	0.48	212.3888
3	CULPEPER MEMORIAL HOSPITAL	50 2 D	NO	R2	11.09	197.0548
4	CULPEPER MEMORIAL HOSPITAL	50 2 E1	NO	M1	1.351	5262.7783
5	CWF PROPERTIES LLC	40Q 1 B	NO	R1	1.45	9.4989
6	COUNTRY CLUB ESTATES OF CULP	40Q 1 A	NO	R1	0.86	295.2574
7	GREGORY K DIXON LLC	40N 1 2	NO	R2	0.182	86.4326
8	GREGORY K DIXON LLC	40N 1 1	NO	R2	0.321	1197.2145

Source: Town of Culpeper, Online GIS Mapping System https://townofculpeperva.giswebservice.com/app.html

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Figure 2-1: US Route 29 Business Layout for Concept A (Sheet 2)

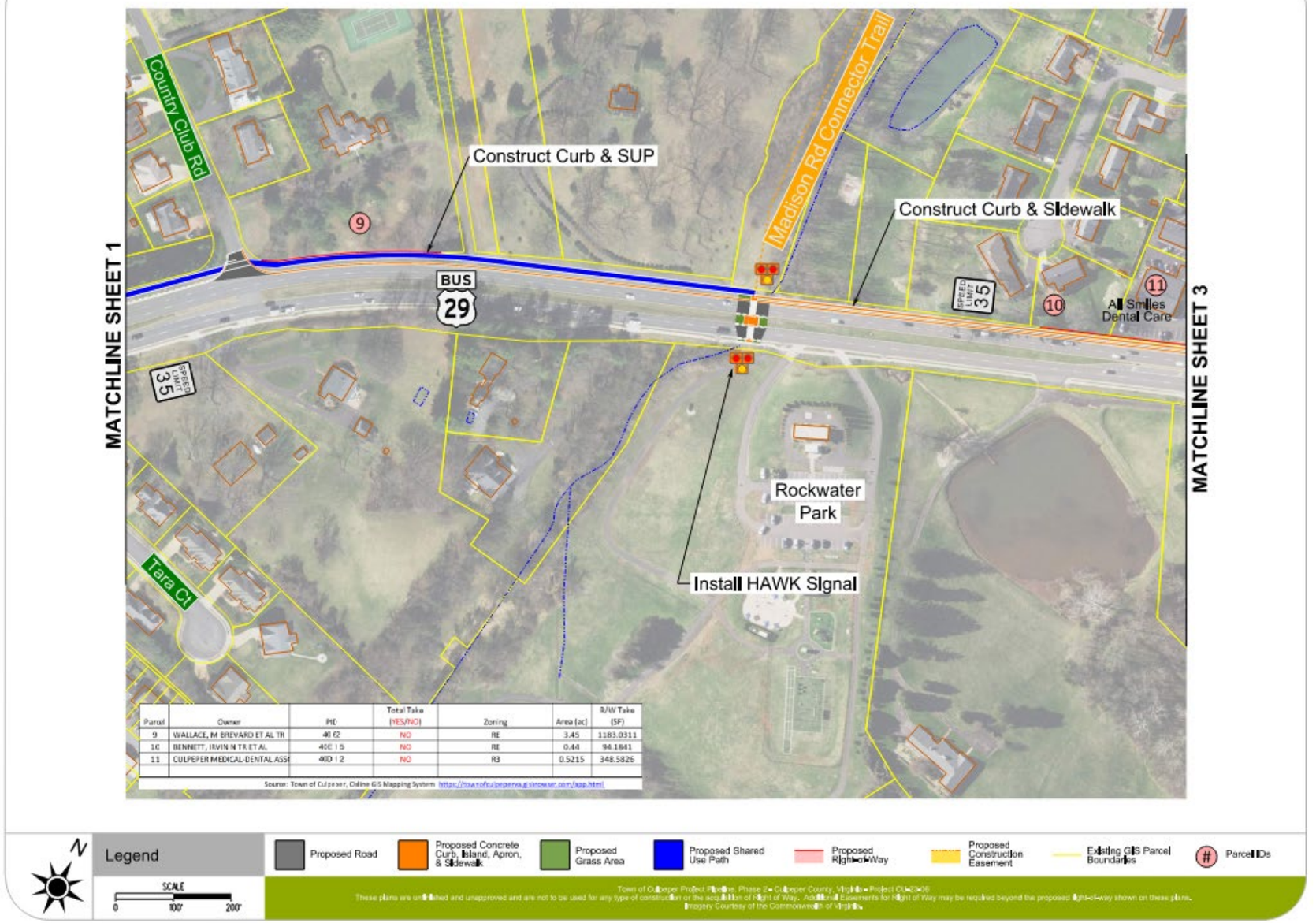
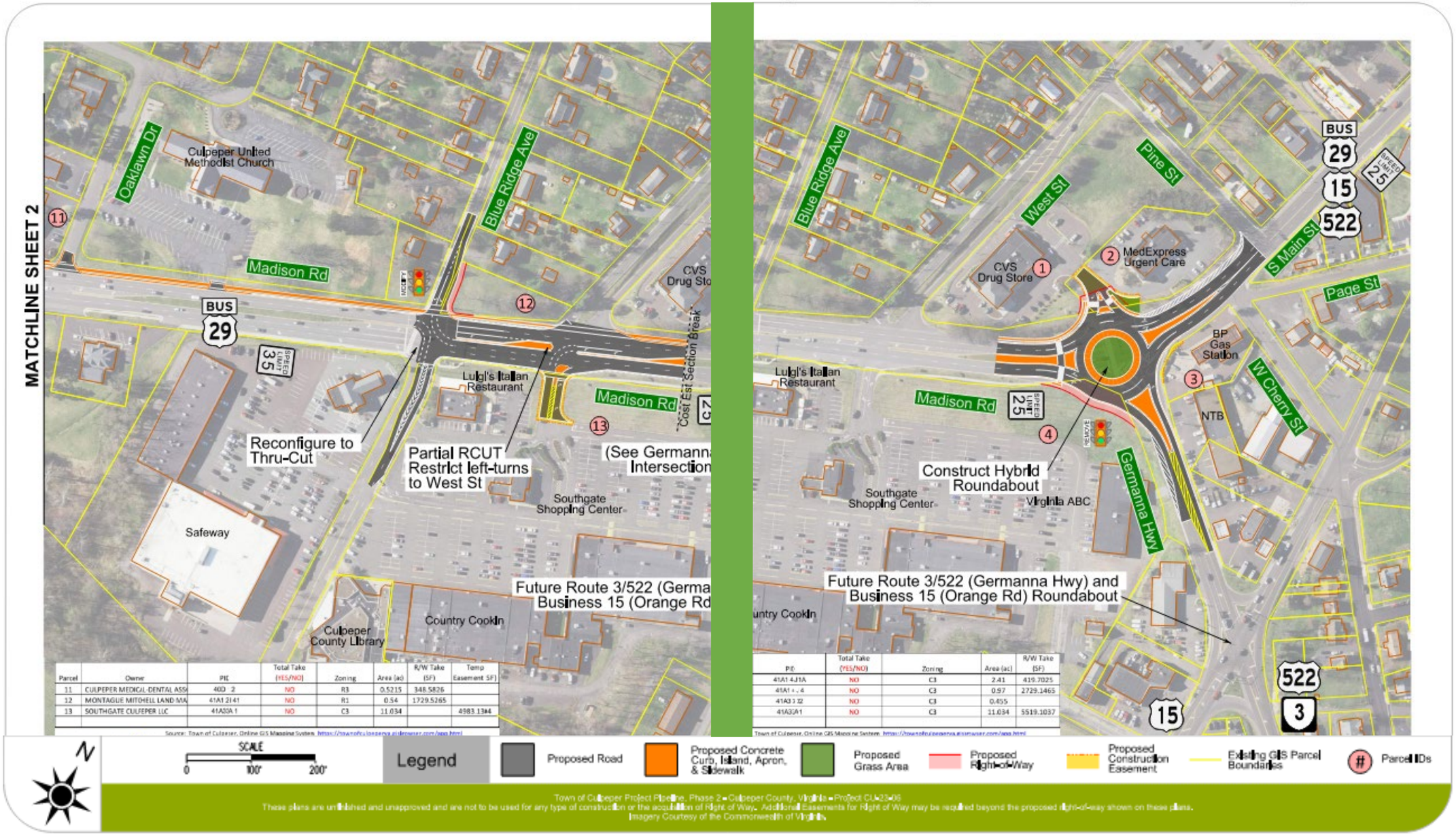


Figure 2-1: US Route 29 Business Layout for Concept A (Sheet 3)



Parcel	Owner	PIE	Total Take (YES/NO)	Zoning	Area (ac)	R/W Take (SF)	Temp Easement SF)
11	CULPEPER MEDICAL-DENTAL ASS	40D 2	NO	R3	0.5215	348.5826	
12	MONTAGUE MITCHELL LAND MA	41A1 2141	NO	R1	0.54	1729.5265	
13	SOUTHGATE CULPEPER LLC	41A30A 1	NO	C3	11.034		4983.1384

PIE	Total Take (YES/NO)	Zoning	Area (ac)	R/W Take (SF)
41A1 4J1A	NO	C3	2.41	419.7025
41A1 4 4	NO	C3	0.97	2729.1465
41A3 3 2	NO	C3	0.455	
41A30A1	NO	C3	11.034	5519.1037

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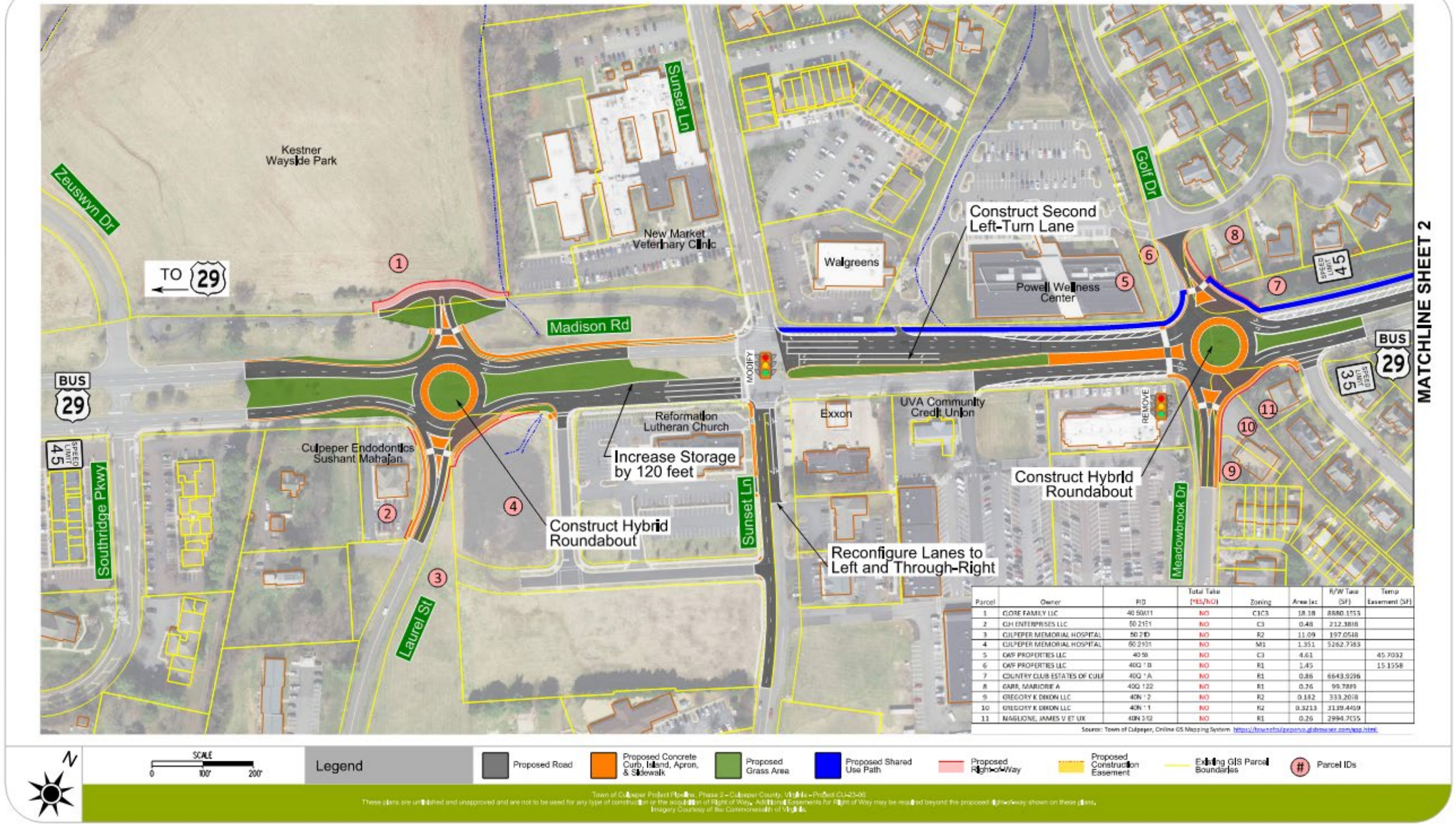
Figure 2-2: US Route 29 Business Layout for Concept B (Sheet 1)



Parcel	Owner	PID	Total Take (YES/NO)	Zoning	Area (ac	R/W Take (SF)	Temp Easement (SF)
1	CLORE FAMILY LLC	40 50M11	NO	C1C3	18.38	8880.1553	
2	CH ENTERPRISES LLC	50 21S1	NO	C3	0.48	212.3818	
3	CULPEPER MEMORIAL HOSPITAL	50 21D	NO	R2	11.09	197.0518	
4	CULPEPER MEMORIAL HOSPITAL	50 21S1	NO	M1	1.351	5262.7783	
5	CAF PROPERTIES LLC	40 5B	NO	C3	4.61		45.7032
6	CAF PROPERTIES LLC	40Q 1 B	NO	R1	1.45		15.1558
7	COUNTRY CLUB ESTATES OF CULF	40Q 1 A	NO	R1	0.86	6643.9296	
8	GARR, MARJORIE A	40Q 122	NO	R1	0.76	99.7889	
9	GREGORY K DIXON LLC	40N 1 2	NO	R2	0.182	333.2018	
10	GREGORY K DIXON LLC	40N 1 1	NO	R2	0.3213	3139.4459	
11	NAGLIONE, JAMES V ET UX	40N 3 1C	NO	R1	0.26	2994.7055	

Source: Town of Culpeper, Online GIS Mapping System https://townofculpeperva.gisbrowser.com/app.html

Figure 2-2: US Route 29 Business Layout for Concept B (Sheet 2)

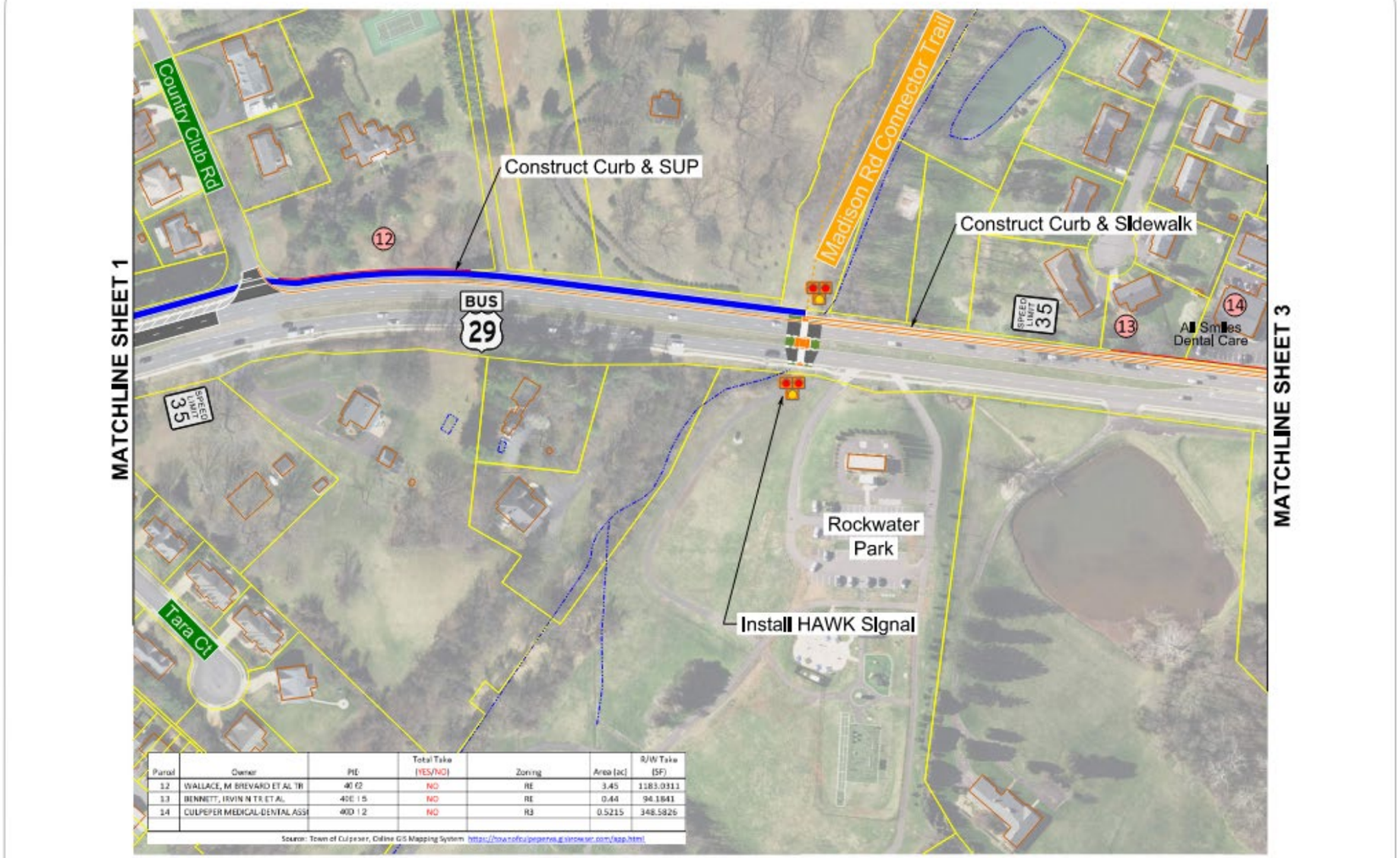
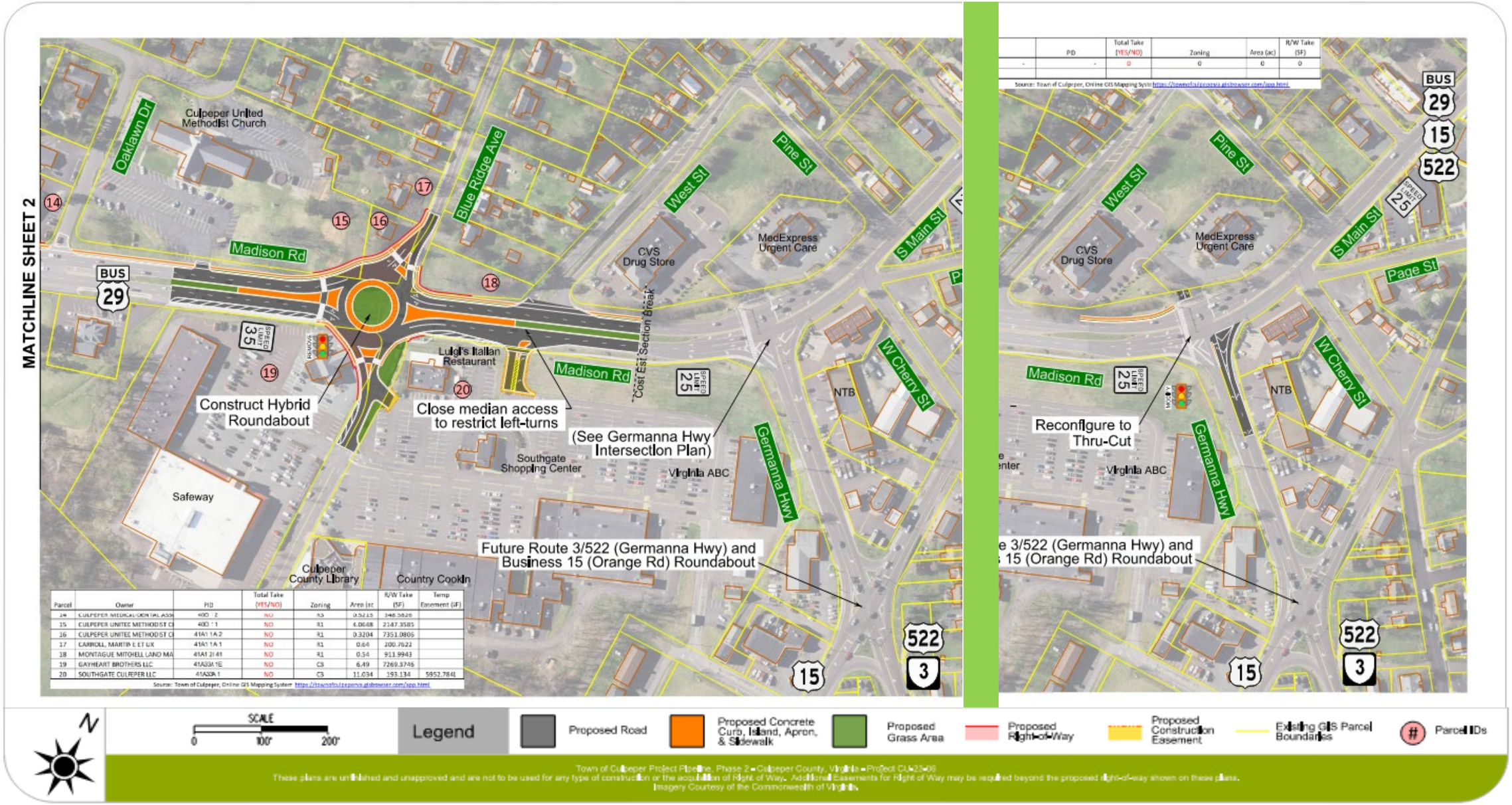


Figure 2-2: US Route 29 Business Layout for Concept B (Sheet 3)



Parcel	Owner	PID	Total Take (YES/NO)	Zoning	Area (ac)	R/W Take (SF)	Temp Easement (sF)
14	CULPEPER MEDICAL-DENTAL ASSN	400 - 2	NO	R5	0.5215	346.5826	
15	CULPEPER UNITEC METHODIST CH	400 - 1	NO	R1	4.0648	2147.3585	
16	CULPEPER UNITEC METHODIST CH	41A1 1A 2	NO	R1	0.3204	7351.0806	
17	CARROLL, MARTIN E ET UX	41A1 1A 1	NO	R1	0.64	200.7622	
18	MONTAGUE MITCHELL LAND MA	41A1 2I 41	NO	R1	0.54	911.9943	
19	GAYHEART BROTHERS LLC	41A39A 1E	NO	CS	6.49	7269.3746	
20	SOUTHGATE CULPEPER LLC	41A39A 1	NO	CS	11.034	193.134	5952.7841

Source: Town of Culpeper, Online GIS Mapping System https://townofculpeperva.gisbrowser.com/app.html

	PID	Total Take (YES/NO)	Zoning	Area (ac)	R/W Take (SF)
-	-	0	0	0	0

Source: Town of Culpeper, Online GIS Mapping System https://townofculpeperva.gisbrowser.com/app.html

Figure 2-3: US Route 29 Business Layout for Concept C (Sheet 1)

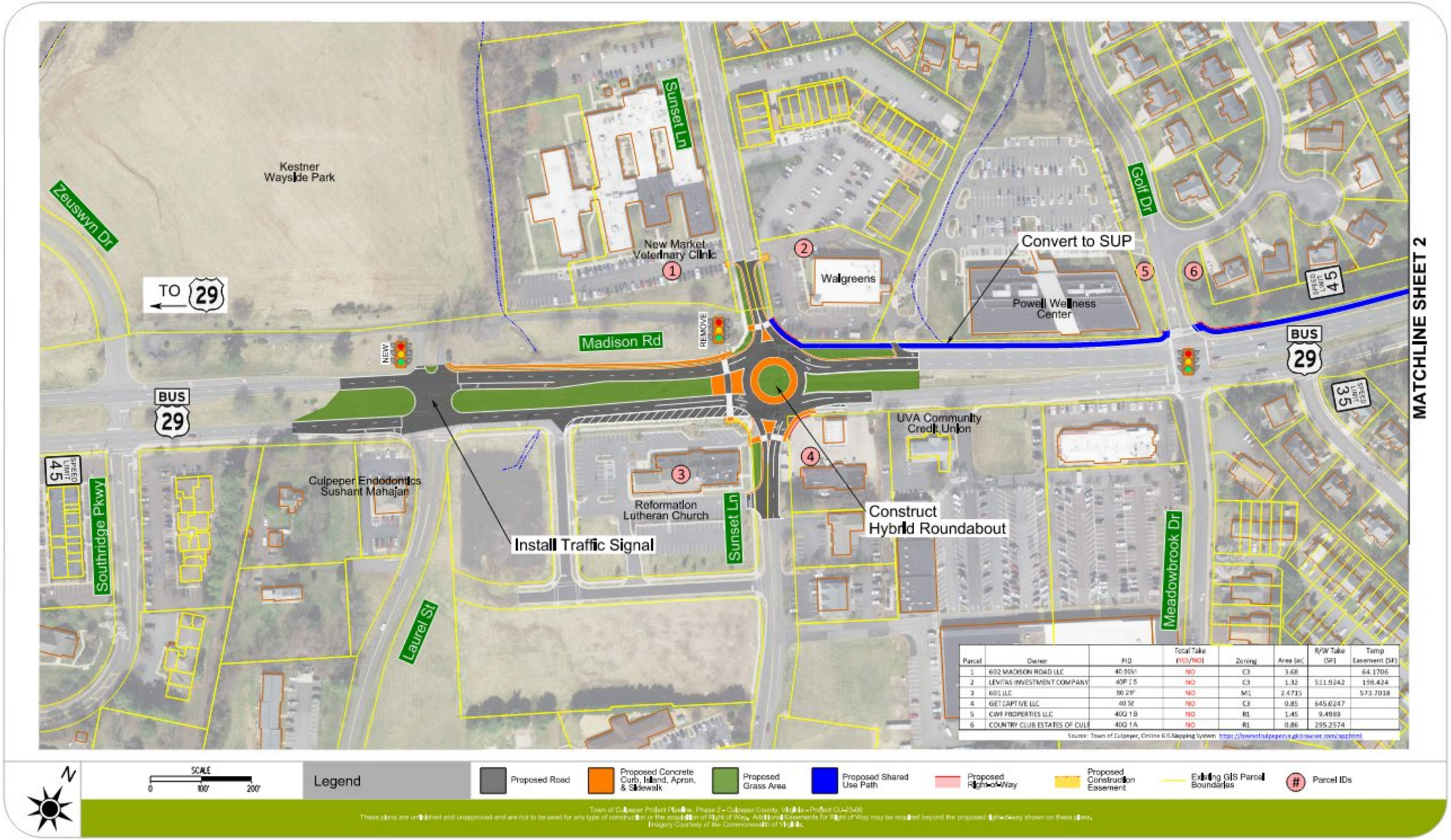
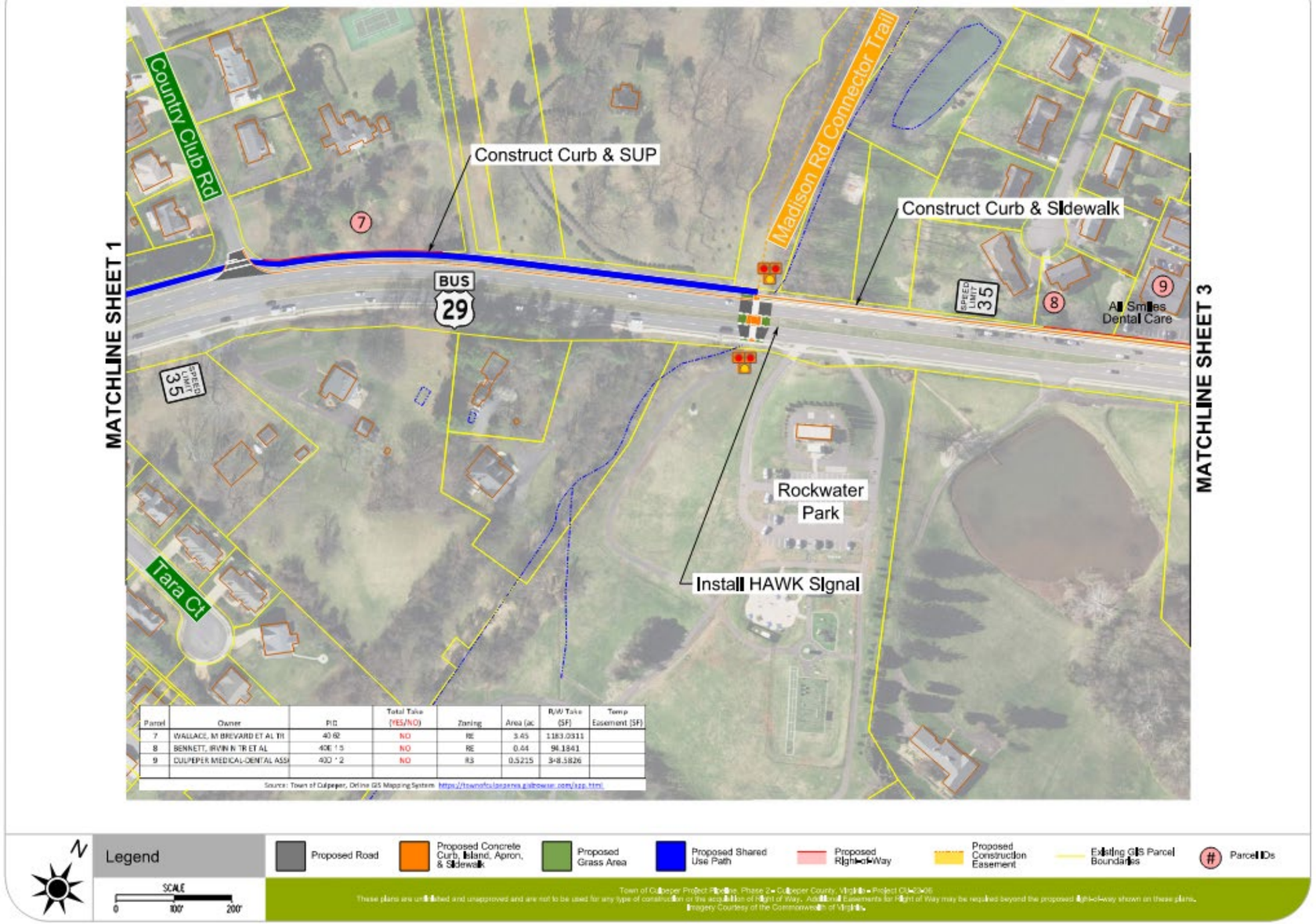


Figure 2-3: US Route 29 Business Layout for Concept C (Sheet 2)



Parcel	Owner	PID	Total Take (YES/NO)	Zoning	Area (ac	R/W Take (SF)	Temp Easement (SF)
7	WALLACE, M BREVARD ET AL TR	40 62	NO	RE	3.45	1183.0311	
8	BENNETT, IRVIN N TR ET AL	40E 1 5	NO	RE	0.44	96.1841	
9	CULPEPER MEDICAL-DENTAL ASS	40D ' 2	NO	RS	0.5215	348.5826	

Source: Town of Culpeper, Online GIS Mapping System https://townofculpeperva.gisbrowser.com/app.html

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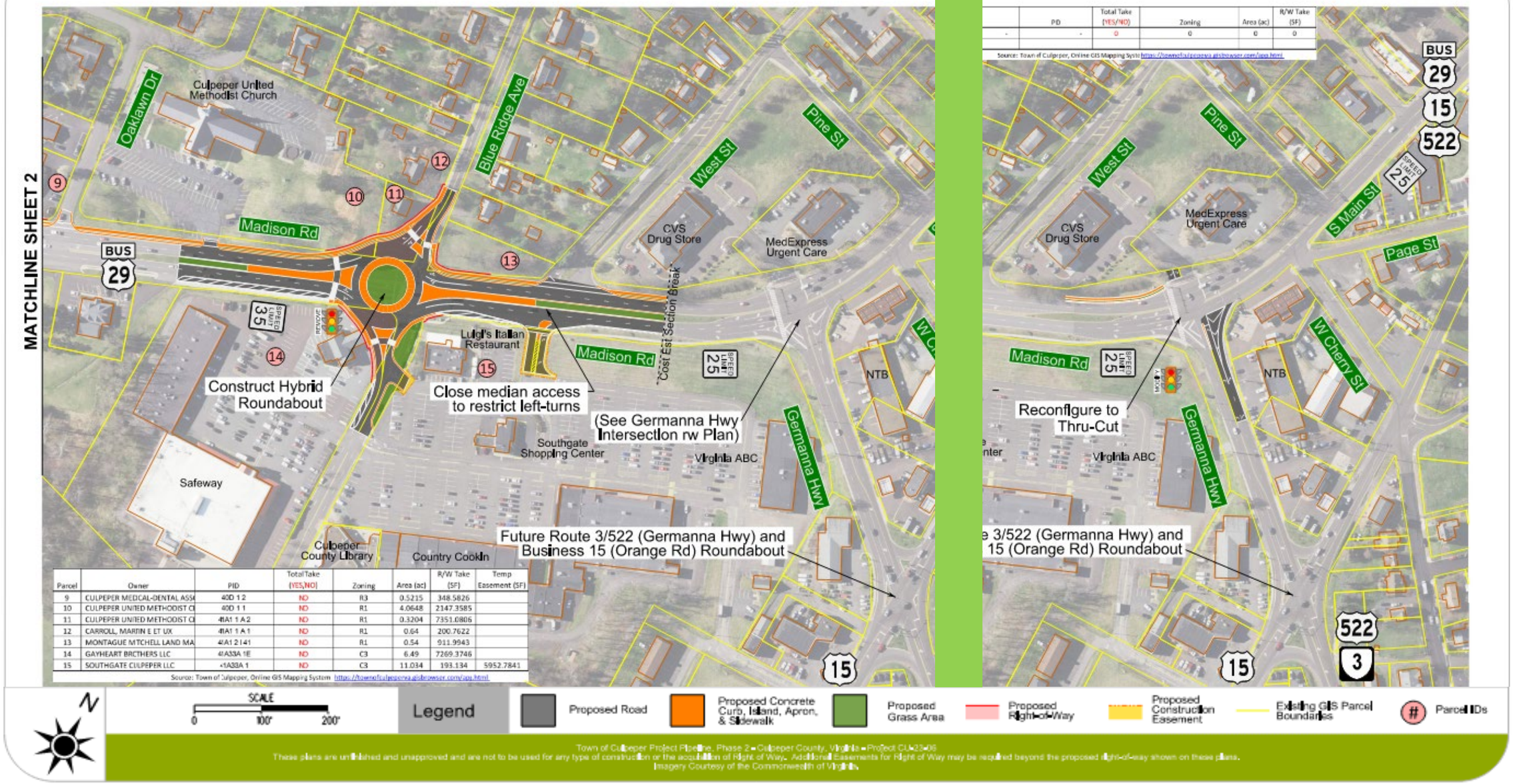
Figure 2-3: US Route 29 Business Layout for Concept C (Sheet 3)



Parcel	Owner	PID	Total Take (YES,NO)	Zoning	Area (ac)	R/W Take (SF)	Temp Easement (SF)
9	CULPEPER MEDCAL-DENTAL ASS(	40D 1 2	NO	R3	0.5215	348.5826	
10	CULPEPER UNITED METHODIST CI	40D 1 1	NO	R1	4.0648	2147.3585	
11	CULPEPER UNITED METHODIST CI	41A1 1 A 2	NO	R1	0.3204	7351.0806	
12	CARROLL, MARTIN E ET UX	41A1 1 A 1	NO	R1	0.64	200.7622	
13	MONTAGUE MTCHELL LAND MA	41A1 2 141	NO	R1	0.54	911.9943	
14	GAYHEART BRCTHERS LLC	41A33A 1E	NO	C3	6.49	7269.3746	
15	SOUTHGATE CULPEPER LLC	41A33A 1	NO	C3	11.034	193.134	5952.7841

Source: Town of Culpeper, Online GIS Mapping System https://townofculpeperva.gisbrowser.com/app.html

PID	Total Take (YES/NO)	Zoning	Area (ac)	R/W Take (SF)
-	0	0	0	0

Source: Town of Culpeper, Online GIS Mapping System https://townofculpeperva.gisbrowser.com/app.html

Town of Culpeper Project Pipeline, Phase 2 – Culpeper County, Virginia – Project CUL-23-06
These plans are unfinished and unapproved and are not to be used for any type of construction or the acquisition of Right of Way. Additional Easements for Right of Way may be required beyond the proposed right-of-way shown on these plans.
Imagery Courtesy of the Commonwealth of Virginia.

2.5 Build Operational Analysis

Interim Year (2035) and Design Year (2050) Build analyses were performed for Concepts A, B, and C, utilizing the peak hour volumes developed in **Section 1.10**. The future Build analysis followed the same methodology as the Existing and No-Build Conditions analysis; however, *SIDRA* software (Version 9.1) was utilized to perform roundabout analysis where needed. In addition, the Build analysis utilized the geometry and lane configurations described in **Section 2.3**. The analysis results for the Interim Year (2035) and Design Year (2050) Build conditions are presented in **Tables 2-14 through 2-17**. Detailed SimTraffic and SIDRA output reports are provided in **Appendix H**.

The results indicate that under Concepts A, B, and C conditions, all study operations are expected to operate at overall LOS C or better and to experience shorter vehicular queues during both the AM and PM peak hours. In general, corridor-wide operations are expected to improve under all Build Concepts when compared to the No-Build scenario.

Table 2-14. Interim Year (2035) - Intersection Analysis Results AM Peak

1: Southridge Pkwy/Zeuswyn Dr & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	1,032	1.9	194	1,032	2.5	227	1,032	2.4	201	1,032	2.6	252
WB	619	1.5	62	619	2.0	72	619	1.9	67	618	1.4	68
NB	84	13.7	72	84	20.6	81	84	21.5	80	84	20.8	82
SB	5	37.2	20	5	114.3	35	5	67.2	20	5	68.4	33
Overall	***1,740***	***2.5***	-	***1,740***	***3.5***	-	***1,740***	***3.3***	-	***1,739***	***3.4***	-

2: Laurel St & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	1,051	1.5	48	1,049	8.4	99	1,049	8.4	99	1,051	8.4	183
WB	642	11.4	234	628	6.0	54	628	6.0	54	777	3.6	129
NB	209	300+	869	209	18.6	72	209	18.6	72	209	9.5	150
SB	1	6.3	18	1	6.5	1	1	6.5	1	1	4.5	12
Overall	***1,903***	***80.3***	-	***1,887***	***8.7***	-	***1,887***	***8.7***	-	***2,038***	***6.7***	-

3: Sunset Lane & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	1,049	26.5	341	1,055	25.3	323	1,055	16.7	230	1,180	10.6	134
WB	768	25.3	348	772	25.2	296	772	16.9	163	762	8.9	78
NB	230	30.6	219	230	35.4	184	230	22.2	124	230	11.4	30
SB	88	31.0	134	88	31.1	127	88	18.0	87	88	6.9	9
Overall	***2,135***	***26.8***	-	***2,145***	***26.5***	-	***2,145***	***17.3***	-	***2,260***	***9.9***	-

4: Meadowbrook Dr/Golf Dr & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	960	12.7	170	968	10.6	157	955	7.8	82	968	16.5	273
WB	886	16.3	269	890	13.3	205	882	6.4	70	886	14.2	213
NB	75	33.9	139	92	21.7	83	75	10.2	17	75	22.6	116
SB	68	43.1	125	64	41.7	109	68	8.4	13	68	30.6	93
Overall	***1,989***	***16.4***	-	***2,014***	***13.3***	-	***1,980***	***7.3***	-	***1,997***	***16.2***	-

5: Madison Road & Country Club Rd

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	990	1.8	31	992	2.1	33	990	1.2	30	990	3.9	32
WB	892	1.3	0	892	1.5	0	892	1.2	0	892	1.2	0
SB	15	21.7	43	19	15.9	47	16	20.4	44	15	19.8	51
Overall	***1,897***	***1.7***	-	***1,903***	***1.9***	-	***1,898***	***1.4***	-	***1,897***	***2.8***	-

6: Madison Road & Oaklawn Dr

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	997	2.2	53	997	2.7	70	997	1.7	64	997	2.6	64
WB	891	2.2	32	903	1.7	29	891	1.0	28	891	1.0	27
NB	2	19.9	26	2	40.8	23	2	27.0	20	2	34.7	28
SB	34	10.9	52	34	13.3	60	34	23.8	76	34	18.4	66
Overall	***1,924***	***2.4***	-	***1,936***	***2.4***	-	***1,924***	***1.8***	-	***1,924***	***2.2***	-

Table 2-14. Interim Year (2035) - Intersection Analysis Results AM Peak (Cont.)

7: Blue Ridge Ave/S Blue Ridge Ave & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	976	5.8	218	975	3.7	165	967	6.8	77	967	6.8	77
WB	626	8.4	181	626	7.5	195	633	6.5	52	633	6.5	52
NB	35	38.2	72	36	50.3	96	35	8.6	7	35	8.6	7
SB	319	26.6	329	318	18.4	220	319	10.0	50	319	10.0	50
Overall	***1,956***	***10.8***	-	***1,955***	***8.3***	-	***1,954***	***7.2***	-	***1,954***	***7.2***	-

8: Madison Road & S West St

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	877	3.4	152	800	0.7	7	799	0.3	6	799	0.4	8
WB	435	2.0	22	541	1.4	34	541	1.8	29	541	1.8	29
NB	25	13.2	29	24	6.3	39	24	5.3	36	24	6.0	41
SB	204	4.3	71	204	3.9	78	204	4.7	81	204	4.7	87
Overall	***1,541***	***3.3***	-	***1,569***	***1.4***	-	***1,568***	***1.5***	-	***1,568***	***1.5***	-

9: Germanna Hwy & Madison Road/S Main St

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	685	5.8	126	772	5.6	55	794	6.9	130	794	6.9	121
WB	429	13.4	240	429	5.4	32	432	8.7	195	432	8.6	170
NB	156	34.4	178	156	9.9	31	156	13.1	127	156	13.9	102
SB	12	42.6	42	12	5.8	2	9	12.3	29	9	15.3	27
Overall	***1,282***	***12.2***	-	***1,369***	***6.0***	-	***1,391***	***8.2***	-	***1,391***	***8.2***	-

Table 2-15. Interim Year (2035) - Intersection Analysis Results PM Peak

1: Southridge Pkwy/Zeuswyn Dr & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	737	2.4	185	738	2.7	215	737	2.7	188	737	4.0	246
WB	1,019	1.5	82	1,020	1.7	78	1,019	1.8	84	1,022	1.2	81
NB	102	13.7	69	102	18.1	79	102	16.7	78	102	16.9	78
SB	2	4.8	18	2	12.0	16	2	4.4	16	0	20.9	22
Overall	***1,860***	***2.6***	-	***1,862***	***3.1***	-	***1,860***	***3.0***	-	***1,861***	***3.2***	-

2: Laurel St & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	772	1.3	74	766	6.4	62	766	6.4	62	772	9.3	178
WB	1,011	5.4	121	1,007	8.0	95	1,007	8.0	95	1,184	2.7	110
NB	274	300+	878	274	15.7	82	274	15.7	82	274	7.4	143
SB	0	0.0	0	0	8.5	1	0	8.5	1	0	0.0	0
Overall	***2,057***	***71.6***	-	***2,047***	***8.5***	-	***2,047***	***8.5***	-	***2,230***	***5.6***	-

3: Sunset Lane & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	829	29.6	271	830	28.6	286	829	27.5	302	991	8.3	89
WB	909	22.9	292	909	23.3	260	909	28.6	270	894	10.7	114
NB	405	29.9	346	405	32.1	263	405	30.7	256	405	12.4	57
SB	214	30.0	176	214	29.4	170	214	27.3	179	214	10.2	26
Overall	***2,357***	***27.2***	-	***2,358***	***27.3***	-	***2,357***	***28.1***	-	***2,504***	***10.0***	-

4: Meadowbrook Dr/Golf Dr & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	1,020	15.6	224	1,021	11.6	153	990	8.3	86	1,020	19.8	303
WB	1,039	18.8	315	1,048	13.7	224	1,029	6.5	75	1,039	16.8	281
NB	129	28.2	201	128	18.6	90	129	13.1	32	129	22.0	167
SB	99	37.1	153	91	32.3	113	99	9.5	19	99	30.0	132
Overall	***2,287***	***18.8***	-	***2,288***	***13.8***	-	***2,247***	***7.8***	-	***2,287***	***19.1***	-

5: Madison Road & Country Club Rd

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	1,109	2.1	29	1,113	2.3	34	1,109	1.5	31	1,109	4.3	35
WB	1,036	1.9	5	1,037	2.0	4	1,036	1.4	6	1,036	1.4	4
SB	19	23.4	58	27	14.5	56	23	15.9	44	19	13.3	40
Overall	***2,164***	***2.2***	-	***2,177***	***2.3***	-	***2,168***	***1.5***	-	***2,164***	***3.0***	-

6: Madison Road & Oaklawn Dr

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	1,081	2.0	30	1,082	2.2	34	1,081	1.6	37	1,081	2.5	42
WB	1,027	2.6	5	1,060	2.2	9	1,027	1.2	13	1,027	1.3	9
NB	1	5.6	17	1	5.7	26	1	4.8	14	1	11.8	23
SB	50	20.8	87	50	21.2	77	50	33.9	88	50	43.9	93
Overall	***2,159***	***2.8***	-	***2,193***	***2.6***	-	***2,159***	***2.2***	-	***2,159***	***2.9***	-

Table 2-15. Interim Year (2035) - Intersection Analysis Results PM Peak (Cont.)

7: Blue Ridge Ave/S Blue Ridge Ave & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	1,095	12.4	221	1,096	7.6	212	1,089	8.6	96	1,089	8.6	96
WB	803	19.6	210	804	14.5	264	848	8.6	77	848	8.6	77
NB	263	25.7	167	263	34.3	231	263	19.8	88	263	19.8	88
SB	271	37.6	331	271	31.8	324	271	9.9	33	271	9.9	33
Overall	***2,432***	***19.1***	-	***2,434***	***15.5***	-	***2,471***	***9.9***	-	***2,471***	***9.9***	-

8: Madison Road & S West St

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	954	5.0	183	924	1.1	19	920	0.8	29	920	0.9	12
WB	686	4.3	105	805	2.4	62	805	2.3	29	805	2.4	29
NB	58	26.8	73	58	6.7	63	58	6.6	67	58	7.4	70
SB	162	12.3	110	162	5.4	79	162	8.3	88	162	9.4	82
Overall	***1,860***	***6.0***	-	***1,949***	***2.2***	-	***1,945***	***2.2***	-	***1,945***	***2.5***	-

9: Germanna Hwy & Madison Road/S Main St

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	775	18.1	253	886	6.6	69	892	10.1	165	892	10.3	182
WB	628	22.3	336	628	7.1	55	653	12.7	229	653	12.8	247
NB	225	38.3	249	225	12.6	55	225	16.6	150	225	16.4	143
SB	93	30.1	64	93	9.1	19	68	15.5	59	68	14.4	63
Overall	***1,721***	***23.0***	-	***1,832***	***7.7***	-	***1,838***	***12.1***	-	***1,838***	***12.2***	-

1. SimTraffic Delay represents average control delay from SimTraffic. Delay values highlighted in green, yellow, orange and red indicate equivalent LOS A-C, D, E and F respectively.
2. Max Queue represents maximum queue in feet from SimTraffic.

Table 2-16. Design Year (2050) - Intersection Analysis Results AM Peak

1: Southridge Pkwy/Zeuswyn Dr & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	1,371	3.6	340	1,371	4.9	348	1,371	5.4	362	1,371	7.6	404
WB	793	2.3	93	793	3.3	98	793	3.3	96	793	3.1	98
NB	114	50.9	125	114	156.4	280	114	263.9	350	114	240.1	314
SB	7	144.9	39	7	300+	59	7	300+	74	7	300+	67
Overall	***2,285***	***6.3***	-	***2,285***	***15.2***	-	***2,285***	***21.1***	-	***2,285***	***19.7***	-

2: Laurel St & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	1,393	2.6	124	1,393	12.5	210	1,393	12.5	210	1,393	21.6	380
WB	835	77.1	588	817	7.4	83	817	7.4	83	975	5.2	152
NB	244	300+	849	244	50.6	161	244	50.6	161	244	18.0	194
SB	2	9.0	23	2	7.7	1	2	7.7	1	2	6.4	18
Overall	***2,474***	***90.6***	-	***2,456***	***14.5***	-	***2,456***	***14.5***	-	***2,614***	***15.0***	-

3: Sunset Lane & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	1,385	39.0	506	1,385	35.7	506	1,385	22.4	352	1,535	22.4	504
WB	1,023	91.3	750	1,009	30.2	363	1,009	21.5	200	1,009	14.6	200
NB	307	62.2	482	307	35.1	215	307	29.9	184	307	26.4	79
SB	111	33.9	145	111	32.2	135	111	18.6	112	111	15.9	37
Overall	***2,826***	***60.6***	-	***2,812***	***33.6***	-	***2,812***	***22.7***	-	***2,962***	***19.9***	-

4: Meadowbrook Dr/Golf Dr & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	1,268	19.3	284	1,268	12.6	152	1,256	11.7	177	1,268	23.8	380
WB	1,169	54.9	548	1,174	14.2	256	1,169	8.6	117	1,169	19.1	331
NB	100	57.7	201	100	23.8	84	100	16.9	34	100	27.5	159
SB	86	45.5	129	81	37.2	130	86	11.6	21	86	35.0	122
Overall	***2,623***	***37.9***	-	***2,623***	***14.6***	-	***2,611***	***10.5***	-	***2,623***	***22.3***	-

5: Madison Road & Country Club Rd

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	1,306	2.6	39	1,310	2.4	38	1,306	1.6	34	1,306	5.6	55
WB	1,178	47.9	842	1,178	2.3	53	1,178	1.6	6	1,178	1.6	0
SB	20	79.1	73	25	34.2	69	20	33.2	56	20	45.3	60
Overall	***2,504***	***25.3***	-	***2,513***	***2.6***	-	***2,504***	***1.9***	-	***2,504***	***4.0***	-

6: Madison Road & Oaklawn Dr

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	1,311	3.1	85	1,311	3.4	91	1,311	2.2	88	1,311	4.1	95
WB	1,171	5.7	157	1,187	2.7	36	1,171	1.4	29	1,171	1.4	32
NB	4	53.7	31	4	56.1	35	4	176.4	37	4	71.5	31
SB	46	29.1	103	46	26.3	98	46	144.2	209	46	75.8	152
Overall	***2,532***	***4.9***	-	***2,548***	***3.6***	-	***2,532***	***4.7***	-	***2,532***	***4.4***	-

Table 2-16. Design Year (2050) - Intersection Analysis Results AM Peak (Cont.)

7: Blue Ridge Ave/S Blue Ridge Ave & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	1,281	14.2	333	1,281	4.9	267	1,281	9.3	129	1,281	9.3	129
WB	812	14.5	218	812	16.3	255	834	8.9	85	807	8.9	85
NB	47	31.0	78	48	53.1	102	47	12.1	13	47	12.1	13
SB	429	36.8	513	429	35.9	482	429	17.1	115	429	17.1	115
Overall	***2,569***	***18.6***	-	***2,570***	***14.7***	-	***2,591***	***10.5***	-	***2,564***	***10.5***	-

8: Madison Road & S West St

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	1,139	5.6	205	1,031	0.9	13	1,029	0.5	6	1,029	0.6	6
WB	562	3.0	68	702	2.1	73	702	2.4	48	702	2.3	48
NB	32	20.8	42	32	9.5	50	32	7.9	48	32	9.8	55
SB	275	9.0	150	275	8.0	146	275	7.8	131	275	8.2	133
Overall	***2,008***	***5.6***	-	***2,040***	***2.4***	-	***2,038***	***2.3***	-	***2,038***	***2.3***	-

9: Germanna Hwy & Madison Road/S Main St

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	878	8.8	240	1,018	7.1	86	1,018	10.1	163	1,018	9.0	200
WB	559	14.9	282	559	6.7	49	563	12.0	243	563	11.6	219
NB	209	34.4	230	209	15.0	62	210	15.4	144	210	15.2	130
SB	15	42.3	37	15	6.8	3	12	15.2	34	12	14.5	34
Overall	***1,661***	***14.6***	-	***1,801***	***7.9***	-	***1,803***	***10.6***	-	***1,803***	***10.6***	-

1. SimTraffic Delay represents average control delay from SimTraffic. Delay values highlighted in green, yellow, orange and red indicate equivalent LOS A-C, D, E and F respectively.

2. Max Queue represents maximum queue in feet from SimTraffic.

Table 2-17. Design Year (2050) - Intersection Analysis Results PM Peak

1: Southridge Pkwy/Zeuswyn Dr & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	973	4.1	270	973	7.2	367	973	6.9	338	973	8.4	384
WB	1,335	2.3	105	1,335	2.8	122	1,443	2.8	119	1,335	2.1	108
NB	138	70.7	222	138	243.5	385	138	171.5	340	138	225.2	334
SB	4	53.8	21	4	112.9	25	4	68.8	29	4	269.2	29
Overall	***2,450***	***7.5***	-	***2,450***	***18.7***	-	***2,558***	***14.1***	-	***2,450***	***17.3***	-

2: Laurel St & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	1,012	1.9	93	1,012	8.4	99	1,012	8.4	99	1,012	11.0	264
WB	1,342	9.0	350	1,338	11.6	168	1,338	11.6	168	1,530	3.9	131
NB	329	300+	867	329	32.0	161	329	32.0	161	328	12.0	212
SB	0	0.0	0	0	11.6	1	0	11.6	1	0	0.0	0
Overall	***2,683***	***61.9***	-	***2,679***	***12.9***	-	***2,679***	***12.9***	-	***2,870***	***7.4***	-

3: Sunset Lane & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	1,093	36.7	370	1,093	38.3	426	1,093	35.1	413	1,283	13.0	218
WB	1,243	28.5	320	1,190	32.6	299	1,190	35.1	396	1,190	22.6	342
NB	543	34.5	405	543	39.5	392	543	34.8	366	543	29.4	146
SB	282	31.0	216	282	30.6	193	282	30.7	188	282	116.8	421
Overall	***3,161***	***32.6***	-	***3,108***	***35.6***	-	***3,108***	***34.1***	-	***3,298***	***28.0***	-

4: Meadowbrook Dr/Golf Dr & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	1,320	26.0	341	1,320	15.9	228	1,301	13.2	231	1,320	30.9	441
WB	1,366	23.9	441	1,377	14.1	261	1,342	8.8	128	1,366	24.3	414
NB	172	31.6	236	173	23.2	135	172	28.4	77	172	28.1	199
SB	130	33.2	146	120	28.6	131	130	14.6	36	130	34.8	163
Overall	***2,988***	***25.8***	-	***2,990***	***16.1***	-	***2,945***	***12.2***	-	***2,988***	***27.9***	-

5: Madison Road & Country Club Rd

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	1,445	3.4	46	1,448	3.0	45	1,445	2.0	41	1,445	6.2	41
WB	1,376	2.8	8	1,376	2.8	7	1,376	1.8	9	1,376	1.9	0
SB	25	105.6	105	36	31.5	82	25	109.7	108	25	50.3	86
Overall	***2,846***	***4.1***	-	***2,860***	***3.3***	-	***2,846***	***2.9***	-	***2,846***	***4.6***	-

6: Madison Road & Oaklawn Dr

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	1,439	6.8	102	1,439	2.8	49	1,439	2.3	51	1,439	3.8	45
WB	1,352	3.4	18	1,398	3.4	21	1,352	1.8	16	1,352	1.9	16
NB	2	44.3	26	2	13.4	23	2	18.0	26	2	13.3	26
SB	67	89.3	138	67	47.1	141	67	791.6	391	67	274.9	303
Overall	***2,860***	***7.3***	-	***2,906***	***4.2***	-	***2,860***	***18.3***	-	***2,860***	***10.0***	-

1. SimTraffic Delay represents average control delay from SimTraffic. Delay values highlighted in green, yellow, orange and red indicate equivalent LOS A-C, D, E and F respectively.
2. Max Queue represents maximum queue in feet from SimTraffic.

Table 2-17. Design Year (2050) - Intersection Analysis Results PM Peak (Cont.)

7: Blue Ridge Ave/S Blue Ridge Ave & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	1,451	37.7	497	1,452	13.2	337	1,452	15.0	294	1,452	15.0	294
WB	1,046	35.6	234	1,046	25.2	296	1,123	15.3	216	1,046	15.3	216
NB	354	27.5	215	354	38.0	292	354	111.0	493	354	111.0	493
SB	365	63.3	526	365	70.2	628	365	18.1	79	365	18.1	79
Overall	***3,216***	***39.0***	-	***3,217***	***26.6***	-	***3,294***	***25.7***	-	***3,217***	***25.7***	-

8: Madison Road & S West St

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	1,258	10.4	213	1,216	1.7	27	1,214	1.6	39	1,214	1.6	24
WB	900	11.3	220	1,058	4.1	188	1,058	3.6	92	1,058	3.5	91
NB	79	96.1	110	79	12.7	91	79	13.9	106	79	13.2	93
SB	218	280.2	798	218	16.3	173	218	17.3	151	218	19.0	158
Overall	***2,455***	***38.0***	-	***2,571***	***4.3***	-	***2,569***	***4.1***	-	***2,569***	***4.2***	-

9: Germanna Hwy & Madison Road/S Main St

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C
EB	1,019	29.4	316	1,177	9.4	120	1,177	15.1	212	1,177	12.8	213
WB	826	31.0	449	826	10.7	109	860	17.9	336	860	17.3	328
NB	302	38.6	306	302	26.4	134	303	18.5	189	303	19.2	197
SB	125	28.8	64	125	13.9	37	91	16.0	64	91	14.2	63
Overall	***2,272***	***31.3***	-	***2,430***	***12.2***	-	***2,431***	***15.6***	-	***2,431***	***15.3***	-

2.6 Development of Preferred Alternative

Concepts A, B and C were presented to the public and stakeholders for feedback through an online survey. The survey process and results are presented in **Chapter 3** of this report. Based on the results of the public survey, an additional Build Concept was developed, henceforth referred as the Preferred Concept.

The Preferred Concept included the following improvements:

- US Route 29 Business at Laurel Street: Install a conventional traffic signal.
- US Route 29 Business at Sunset Lane: Increase the existing eastbound and westbound left-turn storage by 120 feet and 200 feet, respectively. Re-stripe the northbound approach to provide a dedicated left-turn lane and a shared through/right lane.
- Install a midblock crosswalk with High Intensity Activated Crosswalk (HAWK) beacon signals where Madison Road Connector Trail intersects US Route 29 Business.
- US Route 29 Business at West Street: Close the existing full median opening and only allow right-in/out access for the side street.
- US Route 29 Business at Germanna Highway: Construct a hybrid roundabout (2x1) with two circulating lanes along US Route 29 Business and one circulating lane along Germanna Highway.
- Construct curb and shared use path on the north side of US Route 29 Business from Sunset Lane to Madison Road Connector Trail (located between Country Club Road and Oaklawn Drive).
- Construct curb and sidewalk on the north side of US Route 29 Business from Madison Road Connector Trail to Germanna Highway.

The layout for the Preferred Concept is presented in **Figure 2-4**.

The Preferred Concept Analysis followed the same methodology as the other Build Concepts analyses. An analysis results comparison for the Interim Year (2035) and Design Year (2050) for all study scenarios (No-Build, A, B, C and Preferred Concepts) are presented in **Tables 2-19 through 2-22**. Detailed SimTraffic and SIDRA output reports are provided in **Appendix H.**

The Interim Year (2035) analysis results indicate that similar to the other Build Concepts, all intersections are expected to operate at LOS C or better under both AM and PM peak hours under Preferred Concept conditions. The Design Year (2050) results show the same pattern; however, the intersection of US Route 29 Business at Sunset Lane is expected to operate at LOS D during the AM peak hours, which is an improvement compared to No-Build conditions.

A cost estimate for the Preferred Concept was developed following the same methodology as Build Concepts A, B and C and is presented in **Table 2-18**. Details cost estimate sheets are provided in **Appendix G.**

Table 2-18. US Route 29 Business – Cost Estimate for Preferred Concept

Cost Description	Preferred Concept
Preliminary Engineering	$2,130,000
Right of Way and Utility	$1,129,040
Construction	$9,024,480
Total Cost	**$12,283,520**

Figure 2-4. US Route 29 Business Layout for Preferred Concept (Sheet 1)

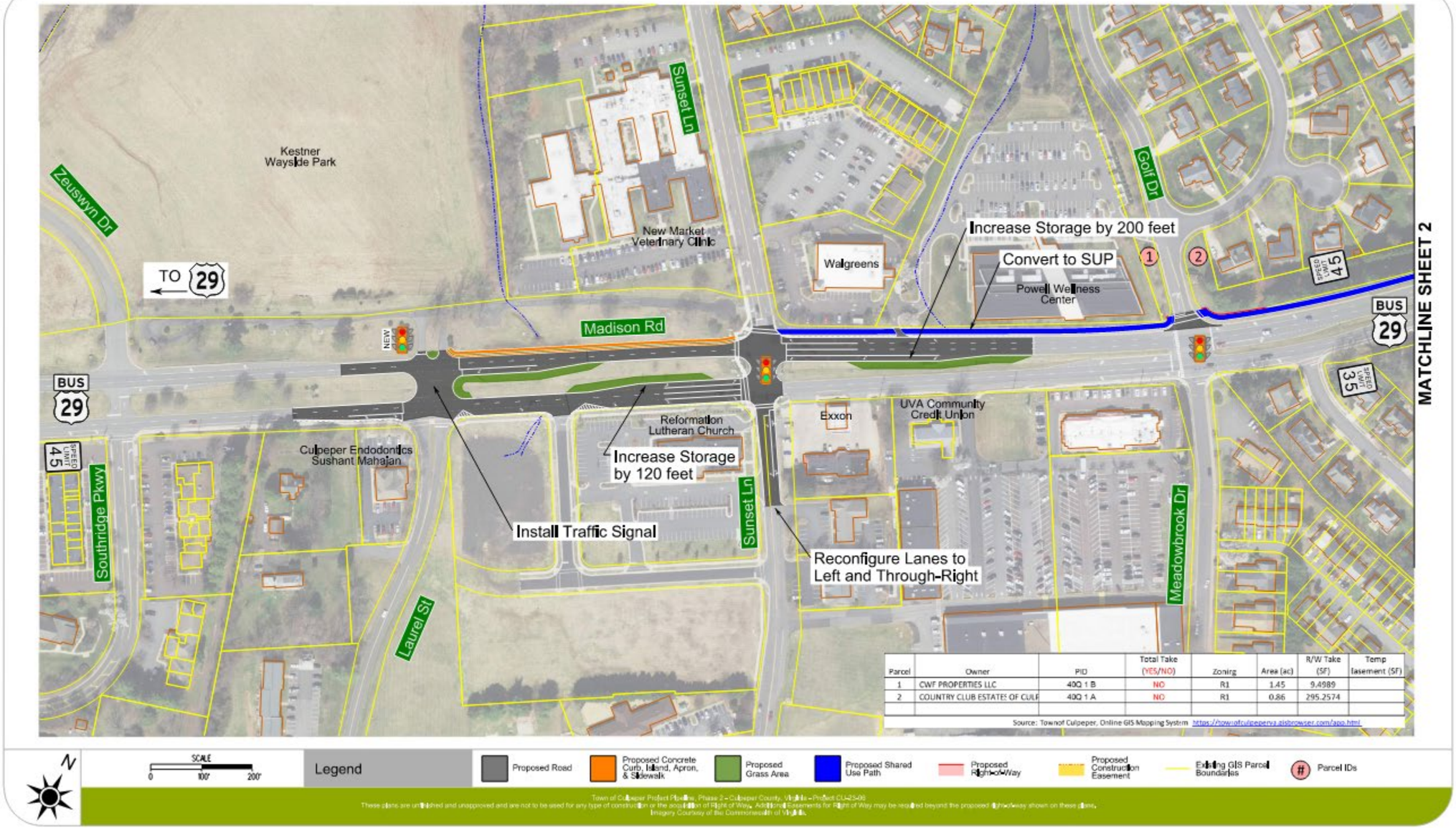


Figure 2-4. US Route 29 Business Layout for Preferred Concept (Sheet 2)

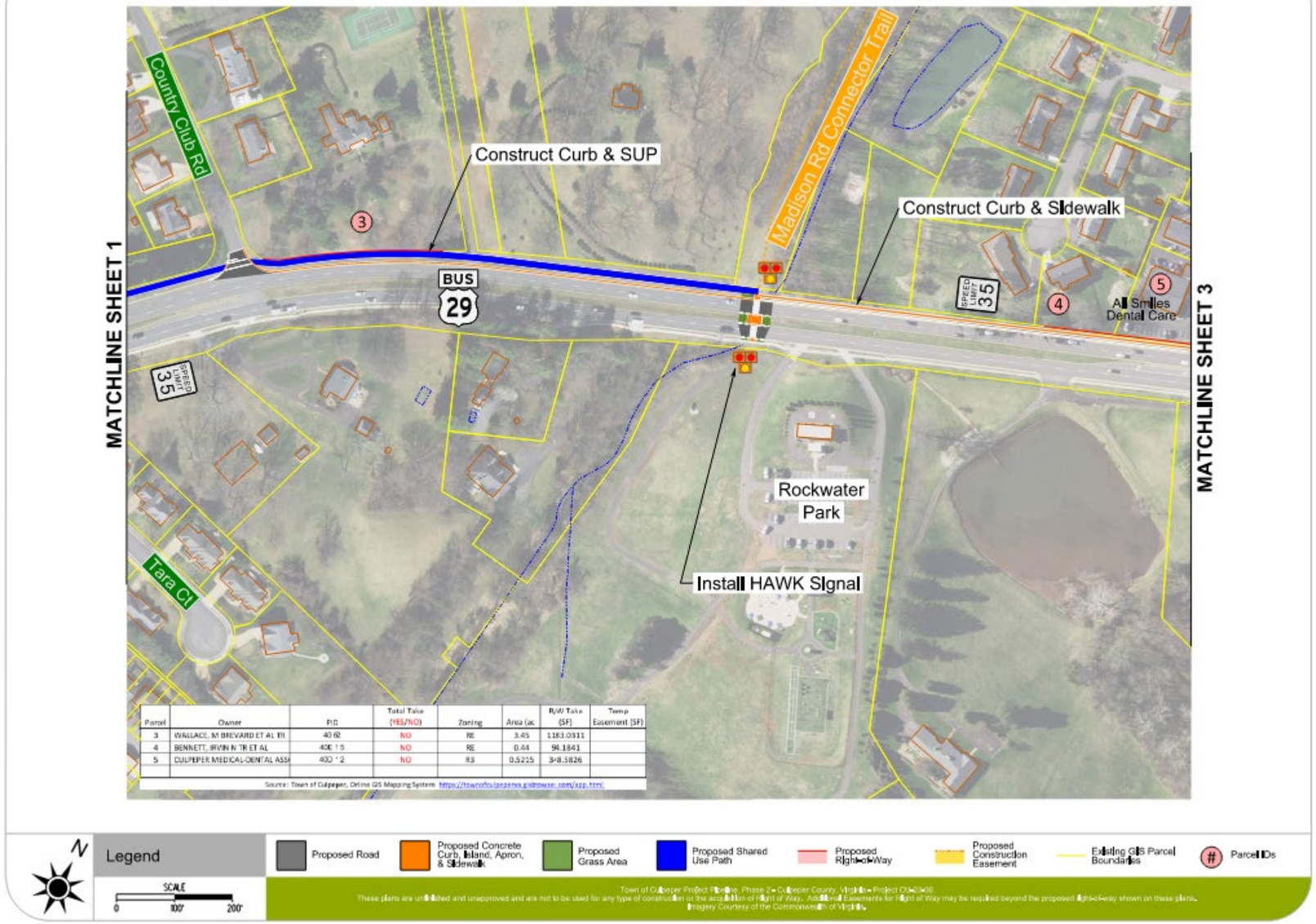
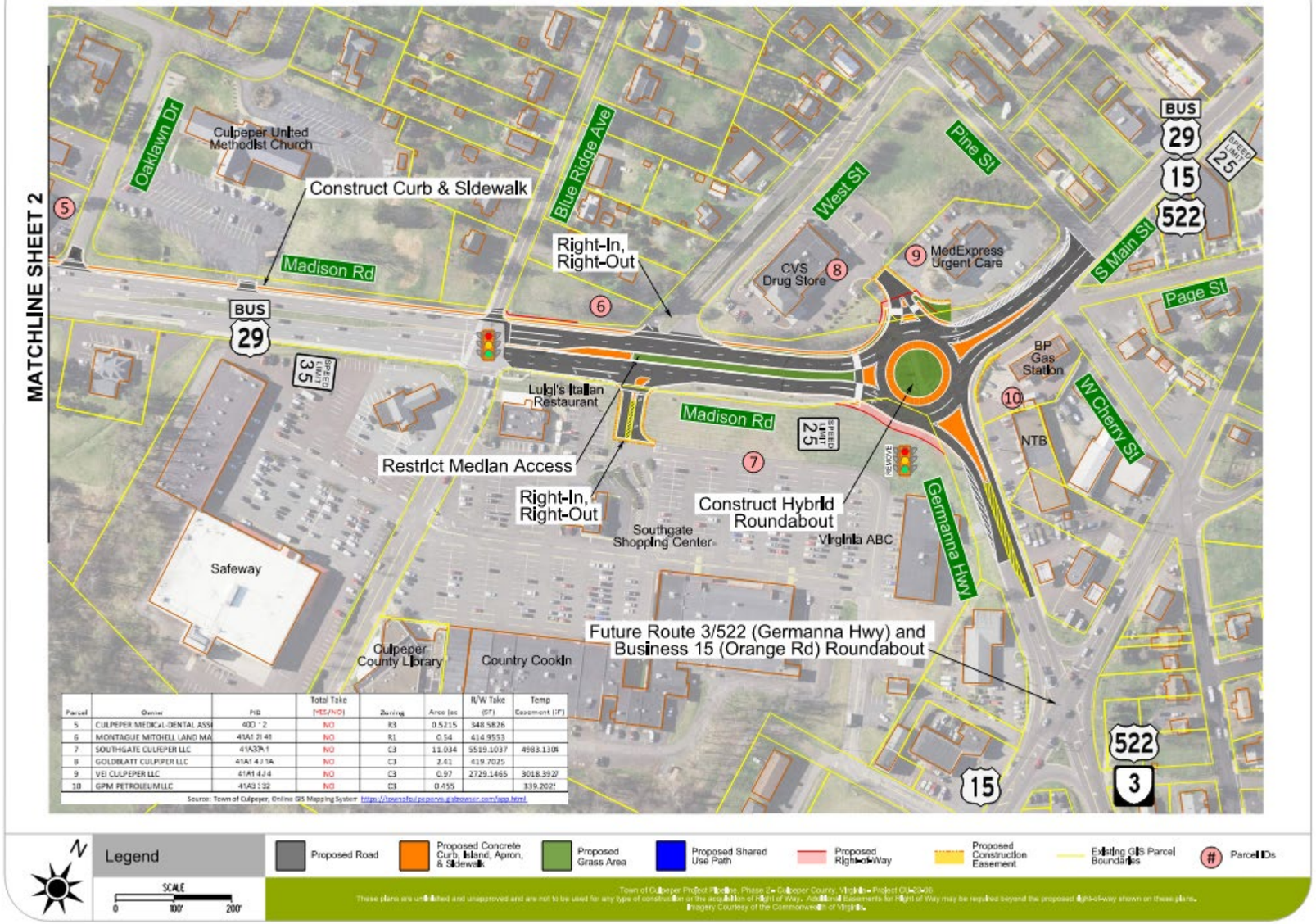


Figure 2-4. US Route 29 Business Layout for Preferred Concept (Sheet 3)



Parcel	Owner	PID	Total Take (YES/NO)	Zoning	Area (ac	R/W Take (SF)	Temp Easement (SF)
5	CULPEPER MEDICAL-DENTAL ASSI	40D 2	NO	R3	0.5215	348.5826	
6	MONTAGUE MITCHELL LAND MA	41A1 21 41	NO	R1	0.54	414.9553	
7	SOUTHGATE CULPEPER LLC	41A3A 1	NO	C3	11.034	5519.1037	4983.1306
8	GOLDBLATT CULPEPER LLC	41A1 4 1A	NO	C3	2.41	419.7025	
9	VEI CULPEPER LLC	41A1 4 4	NO	C3	0.97	2729.1465	3018.3927
10	GPM PETROLEUM LLC	41A3 1 32	NO	C3	0.455		339.2027

Source: Town of Culpeper, Online GIS Mapping System https://townofculpeperva.gisbrowser.com/app.html

Legend

SCALE 0 100' 200'

Proposed Road; Proposed Concrete Curb, Island, Apron, & Sidewalk; Proposed Grass Area; Proposed Shared Use Path; Proposed Right-of-Way; Proposed Construction Easement; Existing GIS Parcel Boundaries; Parcel IDs

Town of Culpeper Project #18-18 - Phase 2 - Culpeper County, Virginia - Project CUL2008
These plans are unpublished and unapproved and are not to be used for any type of construction or the acquisition of Right of Way. Additional Easements for Right of Way may be required beyond the proposed right-of-way shown on these plans.
Imagery Courtesy of the Commonwealth of Virginia.

Table 2-19. Interim Year (2035) Preferred Concept – Intersection Analysis Results AM Peak

1: Southridge Pkwy/Zeuswyn Dr & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	1,032	1.9	194	1,032	2.5	227	1,032	2.4	201	1,032	2.6	252	1,032	2.0	197
WB	619	1.5	62	619	2.0	72	619	1.9	67	618	1.4	68	619	3.0	65
NB	84	13.7	72	84	20.6	81	84	21.5	80	84	20.8	82	84	26.8	88
SB	5	37.2	20	5	114.3	35	5	67.2	20	5	68.4	33	5	64.3	29
Overall	***1,740***	***2.5***	-	***1,740***	***3.5***	-	***1,740***	***3.3***	-	***1,739***	***3.4***	-	***1,740***	***3.8***	-

2: Laurel St & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	1,051	1.5	48	1,049	8.4	99	1,049	8.4	99	1,051	8.4	183	1,051	16.0	341
WB	642	11.4	234	628	6.0	54	628	6.0	54	777	3.6	129	642	19.2	265
NB	209	300+	869	209	18.6	72	209	18.6	72	209	9.5	150	209	41.8	277
SB	1	6.3	18	1	6.5	1	1	6.5	1	1	4.5	12	1	4.3	13
Overall	***1,903***	***80.3***	-	***1,887***	***8.7***	-	***1,887***	***8.7***	-	***2,038***	***6.7***	-	***1,903***	***20.0***	***0***

3: Sunset Lane & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	1,049	26.5	341	1,055	25.3	323	1,055	16.7	230	1,180	10.6	134	1,050	26.1	417
WB	768	25.3	348	772	25.2	296	772	16.9	163	762	8.9	78	768	24.8	297
NB	230	30.6	219	230	35.4	184	230	22.2	124	230	11.4	30	230	30.6	203
SB	88	31.0	134	88	31.1	127	88	18.0	87	88	6.9	9	88	33.3	113
Overall	***2,135***	***26.8***	-	***2,145***	***26.5***	-	***2,145***	***17.3***	-	***2,260***	***9.9***	-	***2,136***	***26.5***	-

4: Meadowbrook Dr/Golf Dr & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	960	12.7	170	968	10.6	157	955	7.8	82	968	16.5	273	960	12.2	184
WB	886	16.3	269	890	13.3	205	882	6.4	70	886	14.2	213	890	16.3	287
NB	75	33.9	139	92	21.7	83	75	10.2	17	75	22.6	116	75	30.6	120
SB	68	43.1	125	64	41.7	109	68	8.4	13	68	30.6	93	64	42.5	120
Overall	***1,989***	***16.4***	-	***2,014***	***13.3***	-	***1,980***	***7.3***	-	***1,997***	***16.2***	-	***1,989***	***15.7***	-

5: Madison Road & Country Club Rd

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	990	1.8	31	992	2.1	33	990	1.2	30	990	3.9	32	992	1.9	34
WB	892	1.3	0	892	1.5	0	892	1.2	0	892	1.2	0	892	1.6	0
SB	15	21.7	43	19	15.9	47	16	20.4	44	15	19.8	51	19	21.3	47
Overall	***1,897***	***1.7***	-	***1,903***	***1.9***	-	***1,898***	***1.4***	-	***1,897***	***2.8***	-	***1,903***	***2.0***	-

6: Madison Road & Oaklawn Dr

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	997	2.2	53	997	2.7	70	997	1.7	64	997	2.6	64	997	2.6	65
WB	891	2.2	32	903	1.7	29	891	1.0	28	891	1.0	27	891	3.1	24
NB	2	19.9	26	2	40.8	23	2	27.0	20	2	34.7	28	2	59.2	20
SB	34	10.9	52	34	13.3	60	34	23.8	76	34	18.4	66	34	12.1	62
Overall	***1,924***	***2.4***	-	***1,936***	***2.4***	-	***1,924***	***1.8***	-	***1,924***	***2.2***	-	***1,924***	***3.1***	-

Table 2-19. Interim Year (2035) Preferred Concept – Intersection Analysis Results AM Peak (Cont.)

7: Blue Ridge Ave/S Blue Ridge Ave & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	976	5.8	218	975	3.7	165	967	6.8	77	967	6.8	77	975	18.1	262
WB	626	8.4	181	626	7.5	195	633	6.5	52	633	6.5	52	643	20.5	220
NB	35	38.2	72	36	50.3	96	35	8.6	7	35	8.6	7	35	37.1	62
SB	319	26.6	329	318	18.4	220	319	10.0	50	319	10.0	50	319	27.7	324
Overall	***1,956***	***10.8***	-	***1,955***	***8.3***	-	***1,954***	***7.2***	-	***1,954***	***7.2***	-	***1,972***	***20.8***	-

8: Madison Road & S West St

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	877	3.4	152	800	0.7	7	799	0.3	6	799	0.4	8	799	1.7	0
WB	435	2.0	22	541	1.4	34	541	1.8	29	541	1.8	29	540	1.3	31
NB	25	13.2	29	24	6.3	39	24	5.3	36	24	6.0	41	24	8.7	47
SB	204	4.3	71	204	3.9	78	204	4.7	81	204	4.7	87	204	4.8	78
Overall	***1,541***	***3.3***	-	***1,569***	***1.4***	-	***1,568***	***1.5***	-	***1,568***	***1.5***	-	***1,567***	***2.1***	-

9: Germanna Hwy & Madison Road/S Main St

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	685	5.8	126	772	5.6	55	794	6.9	130	794	6.9	121	870	6.1	67
WB	429	13.4	240	429	5.4	32	432	8.7	195	432	8.6	170	432	6.0	35
NB	156	34.4	178	156	9.9	31	156	13.1	127	156	13.9	102	156	11.0	33
SB	12	42.6	42	12	5.8	2	9	12.3	29	9	15.3	27	12	6.3	2
Overall	***1,282***	***12.2***	-	***1,369***	***6.0***	-	***1,391***	***8.2***	-	***1,391***	***8.2***	-	***1,470***	***6.3***	-

Table 2-20. Interim Year (2035) Preferred Concept – Intersection Analysis Results PM Peak

1: Southridge Pkwy/Zeuswyn Dr & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	737	2.4	185	738	2.7	215	737	2.7	188	737	4.0	246	737	2.2	177
WB	1,019	1.5	82	1,020	1.7	78	1,019	1.8	84	1,022	1.2	81	1,019	2.9	93
NB	102	13.7	69	102	18.1	79	102	16.7	78	102	16.9	78	102	15.5	73
SB	2	4.8	18	2	12.0	16	2	4.4	16	0	20.9	22	2	4.8	22
Overall	***1,860***	***2.6***	-	***1,862***	***3.1***	-	***1,860***	***3.0***	-	***1,861***	***3.2***	-	***1,860***	***3.4***	-

2: Laurel St & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	772	1.3	74	766	6.4	62	766	6.4	62	772	9.3	178	772	17.5	260
WB	1,011	5.4	121	1,007	8.0	95	1,007	8.0	95	1,184	2.7	110	1,011	20.7	346
NB	274	300+	878	274	15.7	82	274	15.7	82	274	7.4	143	274	41.3	338
SB	0	0.0	0	0	8.5	1	0	8.5	1	0	0.0	0	0	0.0	0
Overall	***2,057***	***71.6***	-	***2,047***	***8.5***	-	***2,047***	***8.5***	-	***2,230***	***5.6***	-	***2,057***	***22.2***	***0***

3: Sunset Lane & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	829	29.6	271	830	28.6	286	829	27.5	302	991	8.3	89	829	27.1	304
WB	909	22.9	292	909	23.3	260	909	28.6	270	894	10.7	114	909	21.0	228
NB	405	29.9	346	405	32.1	263	405	30.7	256	405	12.4	57	405	30.3	291
SB	214	30.0	176	214	29.4	170	214	27.3	179	214	10.2	26	214	29.7	177
Overall	***2,357***	***27.2***	-	***2,358***	***27.3***	-	***2,357***	***28.1***	-	***2,504***	***10.0***	-	***2,357***	***25.6***	-

4: Meadowbrook Dr/Golf Dr & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	1,020	15.6	224	1,021	11.6	153	990	8.3	86	1,020	19.8	303	1,020	16.2	276
WB	1,039	18.8	315	1,048	13.7	224	1,029	6.5	75	1,039	16.8	281	1,047	19.2	336
NB	129	28.2	201	128	18.6	90	129	13.1	32	129	22.0	167	128	28.8	190
SB	99	37.1	153	91	32.3	113	99	9.5	19	99	30.0	132	91	35.1	131
Overall	***2,287***	***18.8***	-	***2,288***	***13.8***	-	***2,247***	***7.8***	-	***2,287***	***19.1***	-	***2,286***	***19.2***	-

5: Madison Road & Country Club Rd

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	1,109	2.1	29	1,113	2.3	34	1,109	1.5	31	1,109	4.3	35	1,112	2.5	32
WB	1,036	1.9	5	1,037	2.0	4	1,036	1.4	6	1,036	1.4	4	1,036	2.4	6
SB	19	23.4	58	27	14.5	56	23	15.9	44	19	13.3	40	27	17.8	63
Overall	***2,164***	***2.2***	-	***2,177***	***2.3***	-	***2,168***	***1.5***	-	***2,164***	***3.0***	-	***2,175***	***2.7***	-

6: Madison Road & Oaklawn Dr

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	1,081	2.0	30	1,082	2.2	34	1,081	1.6	37	1,081	2.5	42	1,081	2.3	41
WB	1,027	2.6	5	1,060	2.2	9	1,027	1.2	13	1,027	1.3	9	1,027	3.8	7
NB	1	5.6	17	1	5.7	26	1	4.8	14	1	11.8	23	1	4.1	14
SB	50	20.8	87	50	21.2	77	50	33.9	88	50	43.9	93	50	21.0	75
Overall	***2,159***	***2.8***	-	***2,193***	***2.6***	-	***2,159***	***2.2***	-	***2,159***	***2.9***	-	***2,159***	***3.4***	-

1. SimTraffic Delay represents average control delay from SimTraffic. Delay values highlighted in green, yellow, orange and red indicate equivalent LOS A-C, D, E and F respectively.

2. Max Queue represents maximum queue in feet from SimTraffic.

Table 2-20. Interim Year (2035) Preferred Concept – Intersection Analysis Results PM Peak (Cont.)

7: Blue Ridge Ave/S Blue Ridge Ave & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	1,095	12.4	221	1,096	7.6	212	1,089	8.6	96	1,089	8.6	96	1,096	20.4	286
WB	803	19.6	210	804	14.5	264	848	8.6	77	848	8.6	77	862	31.8	225
NB	263	25.7	167	263	34.3	231	263	19.8	88	263	19.8	88	263	25.8	160
SB	271	37.6	331	271	31.8	324	271	9.9	33	271	9.9	33	271	39.2	306
Overall	***2,432***	***19.1***	-	***2,434***	***15.5***	-	***2,471***	***9.9***	-	***2,471***	***9.9***	-	***2,492***	***26.9***	-

8: Madison Road & S West St

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	954	5.0	183	924	1.1	19	920	0.8	29	920	0.9	12	922	2.3	3
WB	686	4.3	105	805	2.4	62	805	2.3	29	805	2.4	29	805	2.5	100
NB	58	26.8	73	58	6.7	63	58	6.6	67	58	7.4	70	58	9.2	75
SB	162	12.3	110	162	5.4	79	162	8.3	88	162	9.4	82	162	15.0	156
Overall	***1,860***	***6.0***	-	***1,949***	***2.2***	-	***1,945***	***2.2***	-	***1,945***	***2.5***	-	***1,947***	***3.6***	-

9: Germanna Hwy & Madison Road/S Main St

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	775	18.1	253	886	6.6	69	892	10.1	165	892	10.3	182	976	7.2	81
WB	628	22.3	336	628	7.1	55	653	12.7	229	653	12.8	247	628	8.0	61
NB	225	38.3	249	225	12.6	55	225	16.6	150	225	16.4	143	225	14.0	61
SB	93	30.1	64	93	9.1	19	68	15.5	59	68	14.4	63	93	10.0	21
Overall	***1,721***	***23.0***	-	***1,832***	***7.7***	-	***1,838***	***12.1***	-	***1,838***	***12.2***	-	***1,922***	***8.4***	-

Table 2-21. Design Year (2050) Preferred Concept – Intersection Analysis Results AM Peak

1: Southridge Pkwy/Zeuswyn Dr & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	1,371	3.6	340	1,371	4.9	348	1,371	5.4	362	1,371	7.6	404	1,371	4.7	361
WB	793	2.3	93	793	3.3	98	793	3.3	96	793	3.1	98	793	4.8	113
NB	114	50.9	125	114	156.4	280	114	263.9	350	114	240.1	314	114	169.4	264
SB	7	144.9	39	7	300+	59	7	300+	74	7	300+	67	7	300+	77
Overall	***2,285***	***6.3***	-	***2,285***	***15.2***	-	***2,285***	***21.1***	-	***2,285***	***19.7***	-	***2,285***	***15.7***	-

2: Laurel St & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	1,393	2.6	124	1,393	12.5	210	1,393	12.5	210	1,393	21.6	380	1,393	26.0	480
WB	835	77.1	588	817	7.4	83	817	7.4	83	975	5.2	152	826	21.0	378
NB	244	300+	849	244	50.6	161	244	50.6	161	244	18.0	194	244	45.8	336
SB	2	9.0	23	2	7.7	1	2	7.7	1	2	6.4	18	2	6.4	25
Overall	***2,474***	***90.6***	-	***2,456***	***14.5***	-	***2,456***	***14.5***	-	***2,614***	***15.0***	-	***2,465***	***26.3***	***0***

3: Sunset Lane & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	1,385	39.0	506	1,385	35.7	506	1,385	22.4	352	1,535	22.4	504	1,385	43.4	560
WB	1,023	91.3	750	1,009	30.2	363	1,009	21.5	200	1,009	14.6	200	1,009	31.7	402
NB	307	62.2	482	307	35.1	215	307	29.9	184	307	26.4	79	307	33.4	263
SB	111	33.9	145	111	32.2	135	111	18.6	112	111	15.9	37	111	30.6	143
Overall	***2,826***	***60.6***	-	***2,812***	***33.6***	-	***2,812***	***22.7***	-	***2,962***	***19.9***	-	***2,812***	***37.7***	-

4: Meadowbrook Dr/Golf Dr & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	1,268	19.3	284	1,268	12.6	152	1,256	11.7	177	1,268	23.8	380	1,268	20.6	262
WB	1,169	54.9	548	1,174	14.2	256	1,169	8.6	117	1,169	19.1	331	1,169	19.9	428
NB	100	57.7	201	100	23.8	84	100	16.9	34	100	27.5	159	100	37.5	173
SB	86	45.5	129	81	37.2	130	86	11.6	21	86	35.0	122	86	43.8	153
Overall	***2,623***	***37.9***	-	***2,623***	***14.6***	-	***2,611***	***10.5***	-	***2,623***	***22.3***	-	***2,623***	***21.6***	-

5: Madison Road & Country Club Rd

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	1,306	2.6	39	1,310	2.4	38	1,306	1.6	34	1,306	5.6	55	1,306	3.0	32
WB	1,178	47.9	842	1,178	2.3	53	1,178	1.6	6	1,178	1.6	0	1,178	2.3	3
SB	20	79.1	73	25	34.2	69	20	33.2	56	20	45.3	60	20	72.1	77
Overall	***2,504***	***25.3***	-	***2,513***	***2.6***	-	***2,504***	***1.9***	-	***2,504***	***4.0***	-	***2,504***	***3.2***	-

6: Madison Road & Oaklawn Dr

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	1,311	3.1	85	1,311	3.4	91	1,311	2.2	88	1,311	4.1	95	1,311	3.8	81
WB	1,171	5.7	157	1,187	2.7	36	1,171	1.4	29	1,171	1.4	32	1,187	3.7	34
NB	4	53.7	31	4	56.1	35	4	176.4	37	4	71.5	31	4	65.9	28
SB	46	29.1	103	46	26.3	98	46	144.2	209	46	75.8	152	46	22.3	78
Overall	***2,532***	***4.9***	-	***2,548***	***3.6***	-	***2,532***	***4.7***	-	***2,532***	***4.4***	-	***2,548***	***4.2***	-

Table 2-21. Design Year (2050) Preferred Concept – Intersection Analysis Results AM Peak (Cont.)

7: Blue Ridge Ave/S Blue Ridge Ave & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	1,281	14.2	333	1,281	4.9	267	1,281	9.3	129	1,281	9.3	129	1,281	17.1	288
WB	812	14.5	218	812	16.3	255	834	8.9	85	807	8.9	85	834	20.9	225
NB	47	31.0	78	48	53.1	102	47	12.1	13	47	12.1	13	47	33.1	74
SB	429	36.8	513	429	35.9	482	429	17.1	115	429	17.1	115	429	36.9	457
Overall	***2,569***	***18.6***	-	***2,570***	***14.7***	-	***2,591***	***10.5***	-	***2,564***	***10.5***	-	***2,591***	***22.0***	-

8: Madison Road & S West St

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	1,139	5.6	205	1,031	0.9	13	1,029	0.5	6	1,029	0.6	6	1,161	2.4	5
WB	562	3.0	68	702	2.1	73	702	2.4	48	702	2.3	48	832	2.4	96
NB	32	20.8	42	32	9.5	50	32	7.9	48	32	9.8	55	32	15.4	59
SB	275	9.0	150	275	8.0	146	275	7.8	131	275	8.2	133	275	9.6	188
Overall	***2,008***	***5.6***	-	***2,040***	***2.4***	-	***2,038***	***2.3***	-	***2,038***	***2.3***	-	***2,300***	***3.5***	-

9: Germanna Hwy & Madison Road/S Main St

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	878	8.8	240	1,018	7.1	86	1,018	10.1	163	1,018	9.0	200	1,149	7.9	108
WB	559	14.9	282	559	6.7	49	563	12.0	243	563	11.6	219	559	8.1	56
NB	209	34.4	230	209	15.0	62	210	15.4	144	210	15.2	130	209	18.3	72
SB	15	42.3	37	15	6.8	3	12	15.2	34	12	14.5	34	15	7.7	3
Overall	***1,661***	***14.6***	-	***1,801***	***7.9***	-	***1,803***	***10.6***	-	***1,803***	***10.6***	-	***1,932***	***9.1***	-

Table 2-22. Design Year (2050) Preferred Concept – Intersection Analysis Results PM Peak

1: Southridge Pkwy/Zeuswyn Dr & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	973	4.1	270	973	7.2	367	973	6.9	338	973	8.4	384	973	4.6	305
WB	1,335	2.3	105	1,335	2.8	122	1,443	2.8	119	1,335	2.1	108	1,335	4.6	128
NB	138	70.7	222	138	243.5	385	138	171.5	340	138	225.2	334	138	90.3	267
SB	4	53.8	21	4	112.9	25	4	68.8	29	4	269.2	29	4	103.2	28
Overall	***2,450***	***7.5***	-	***2,450***	***18.7***	-	***2,558***	***14.1***	-	***2,450***	***17.3***	-	***2,450***	***10.1***	-

2: Laurel St & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	1,012	1.9	93	1,012	8.4	99	1,012	8.4	99	1,012	11.0	264	1,012	25.0	394
WB	1,342	9.0	350	1,338	11.6	168	1,338	11.6	168	1,530	3.9	131	1,340	25.5	448
NB	329	300+	867	329	32.0	161	329	32.0	161	328	12.0	212	329	39.4	394
SB	0	0.0	0	0	11.6	1	0	11.6	1	0	0.0	0	0	0.0	0
Overall	***2,683***	***61.9***	-	***2,679***	***12.9***	-	***2,679***	***12.9***	-	***2,870***	***7.4***	-	***2,681***	***27.2***	***0***

3: Sunset Lane & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	1,093	36.7	370	1,093	38.3	426	1,093	35.1	413	1,283	13.0	218	1,093	43.0	474
WB	1,243	28.5	320	1,190	32.6	299	1,190	35.1	396	1,190	22.6	342	1,190	26.9	303
NB	543	34.5	405	543	39.5	392	543	34.8	366	543	29.4	146	543	34.5	410
SB	282	31.0	216	282	30.6	193	282	30.7	188	282	116.8	421	282	30.7	202
Overall	***3,161***	***32.6***	-	***3,108***	***35.6***	-	***3,108***	***34.1***	-	***3,298***	***28.0***	-	***3,108***	***34.4***	-

4: Meadowbrook Dr/Golf Dr & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	1,320	26.0	341	1,320	15.9	228	1,301	13.2	231	1,320	30.9	441	1,320	36.5	428
WB	1,366	23.9	441	1,377	14.1	261	1,342	8.8	128	1,366	24.3	414	1,366	25.5	472
NB	172	31.6	236	173	23.2	135	172	28.4	77	172	28.1	199	172	33.0	213
SB	130	33.2	146	120	28.6	131	130	14.6	36	130	34.8	163	130	35.1	156
Overall	***2,988***	***25.8***	-	***2,990***	***16.1***	-	***2,945***	***12.2***	-	***2,988***	***27.9***	-	***2,988***	***31.5***	-

5: Madison Road & Country Club Rd

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	1,445	3.4	46	1,448	3.0	45	1,445	2.0	41	1,445	6.2	41	1,445	5.0	37
WB	1,376	2.8	8	1,376	2.8	7	1,376	1.8	9	1,376	1.9	0	1,376	3.4	9
SB	25	105.6	105	36	31.5	82	25	109.7	108	25	50.3	86	25	92.4	95
Overall	***2,846***	***4.1***	-	***2,860***	***3.3***	-	***2,846***	***2.9***	-	***2,846***	***4.6***	-	***2,846***	***5.0***	-

6: Madison Road & Oaklawn Dr

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	1,439	6.8	102	1,439	2.8	49	1,439	2.3	51	1,439	3.8	45	1,439	3.8	48
WB	1,352	3.4	18	1,398	3.4	21	1,352	1.8	16	1,352	1.9	16	1,352	4.5	23
NB	2	44.3	26	2	13.4	23	2	18.0	26	2	13.3	26	2	8.0	26
SB	67	89.3	138	67	47.1	141	67	300+	391	67	274.9	303	67	31.9	106
Overall	***2,860***	***7.3***	-	***2,906***	***4.2***	-	***2,860***	***18.3***	-	***2,860***	***10.0***	-	***2,860***	***4.8***	-

Table 2-22. Design Year (2050) Preferred Concept – Intersection Analysis Results PM Peak (Cont.)

7: Blue Ridge Ave/S Blue Ridge Ave & Madison Road

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	1,451	37.7	497	1,452	13.2	337	1,452	15.0	294	1,452	15.0	294	1,451	27.0	387
WB	1,046	35.6	234	1,046	25.2	296	1,123	15.3	216	1,046	15.3	216	1,123	36.1	236
NB	354	27.5	215	354	38.0	292	354	111.0	493	354	111.0	493	354	27.6	206
SB	365	63.3	526	365	70.2	628	365	18.1	79	365	18.1	79	365	77.4	587
Overall	***3,216***	***39.0***	-	***3,217***	***26.6***	-	***3,294***	***25.7***	-	***3,217***	***25.7***	-	***3,293***	***35.8***	-

8: Madison Road & S West St

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	1,258	10.4	213	1,216	1.7	27	1,214	1.6	39	1,214	1.6	24	1,335	3.2	2
WB	900	11.3	220	1,058	4.1	188	1,058	3.6	92	1,058	3.5	91	1,179	6.0	184
NB	79	96.1	110	79	12.7	91	79	13.9	106	79	13.2	93	79	16.2	107
SB	218	280.2	798	218	16.3	173	218	17.3	151	218	19.0	158	218	127.4	513
Overall	***2,455***	***38.0***	-	***2,571***	***4.3***	-	***2,569***	***4.1***	-	***2,569***	***4.2***	-	***2,811***	***14.6***	-

9: Germanna Hwy & Madison Road/S Main St

Movement	Volume Input No Build	SimTraffic Delay[1] No Build	Max Q[2] (Feet) No Build	Volume Input Concept A	SimTraffic Delay[1] Concept A	Max Q[2] (Feet) Concept A	Volume Input Concept B	SimTraffic Delay[1] Concept B	Max Q[2] (Feet) Concept B	Volume Input Concept C	SimTraffic Delay[1] Concept C	Max Q[2] (Feet) Concept C	Volume Input	SimTraffic Delay[1]	Max Q[2] (Feet)
EB	1,019	29.4	316	1,177	9.4	120	1,177	15.1	212	1,177	12.8	213	1,238	10.7	146
WB	826	31.0	449	826	10.7	109	860	17.9	336	860	17.3	328	826	13.4	144
NB	302	38.6	306	302	26.4	134	303	18.5	189	303	19.2	197	302	36.3	164
SB	125	28.8	64	125	13.9	37	91	16.0	64	91	14.2	63	125	16.4	44
Overall	***2,272***	***31.3***	-	***2,430***	***12.2***	-	***2,431***	***15.6***	-	***2,431***	***15.3***	-	***2,491***	***14.8***	-

2.7 Anticipated Safety Performance

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

1. Countermeasure 1: Convert two-way-stop-controlled intersection to signalized control.
2. Countermeasure 2: Convert an open median to a directional median.
3. Countermeasure 3: Convert signalized intersection into a hybrid roundabout.

Table 2-23 presents the expected CMFs for each countermeasure and the intersections to which these countermeasures apply under the preferred concept. The table indicates the following:

- Crashes at the intersection of US Route 29 Business at Laurel Street are expected to decrease by approximately 39%.
- Crashes at the intersection of US Route 29 Business at West Street are expected to decrease by approximately 7%.
- Crashes at the intersection of US Route 29 Business at Germanna Highway are expected to decrease by approximately 19%.

Table 2-23. US Route 29 Business – Preferred Concept CMF Matrix

Countermeasure #	1	2	3
CMF	*0.61*	*0.93*	*0.81*
Laurel Street	✓	-	-
West Street	-	✓	-
Germanna Highway	-	-	✓

2.8 Conclusion

The intersection analysis results indicate that all the original Build Concepts (A, B & C) are expected to perform better than the No-Build conditions. Based on these results, a public survey was conducted to present the public with the Build Concepts and receive feedback on their needs and improvement preferences (more details are presented in **Section 3**).

Based on the public's responses, the Preferred Concept was developed incorporating feedback, while at the same time provide individual intersection and corridor-wide improvements, with the purpose of enhancing operations and increase safety along US Route 29 Business. Please see **Section 2.5** for a detail list of improvements included in the Preferred Concept.

The Preferred Concept intersection analysis results indicate that under Interim Year (2035) conditions, all intersections are expected to operate at LOS C or better during both AM and PM peak hours. The Design Year (2050) results show the same pattern; however, the intersection of US Route 29 Business at Sunset Lane is expected to operate at overall LOS D during the AM peak hours, which is still an improvement when compared to No-Build conditions.

The anticipated safety performance results for the Preferred Concept show significant (5% or larger) expected crash reduction at three intersections within the study corridor when compared to No-Build conditions.

Chapter 3 Public and Stakeholder Outreach and Feedback

The Phase 2 online public survey was conducted from February 28th through March 8th of 2024, and presented proposed concepts A, B, and C, as described under **Section 2.3** of this report. Respondents were asked to rank these concepts by assigning values one (1) through five (5); with one (1) representing strong opposition and five (5) strong support. The survey included improvements in Concepts A through C, and multimodal/pedestrian improvements at the following locations as shown in **Figures 2-1 through 2-3**.

1. US Route 29 Business from Laurel Street to Golf Drive
2. US Route 29 Business from Oaklawn Drive to Germanna Highway
3. Pedestrian improvements along US Route 29 Business from Golf Drive to Oaklawn Drive

Figure 3-1 shows the survey results for the proposed intersection improvements from Laurel Street to Golf Drive under Concept A. As shown in the bar graph, intersection improvements under Concept A received an approximate average rating of 3.0, 3.7, and 3.1, respectively.

Figure 3-1. Survey Results - Concept A: Laurel Street to Golf Drive

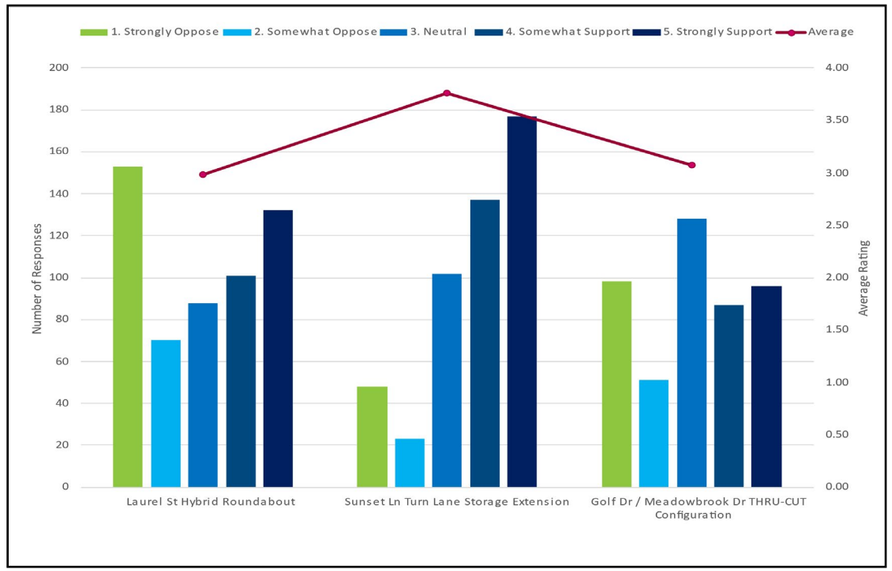


Figure 3-2 shows the survey results for the proposed improvements at each intersection from Oaklawn Drive to Germanna Highway under Concept A. As shown in the bar graph, intersection improvements under Concept A received an approximate average rating of 2.9, 2.9, and 3.4, respectively.

Figure 3-2. Survey Results – Concept A: Oaklawn Drive to Germanna Highway

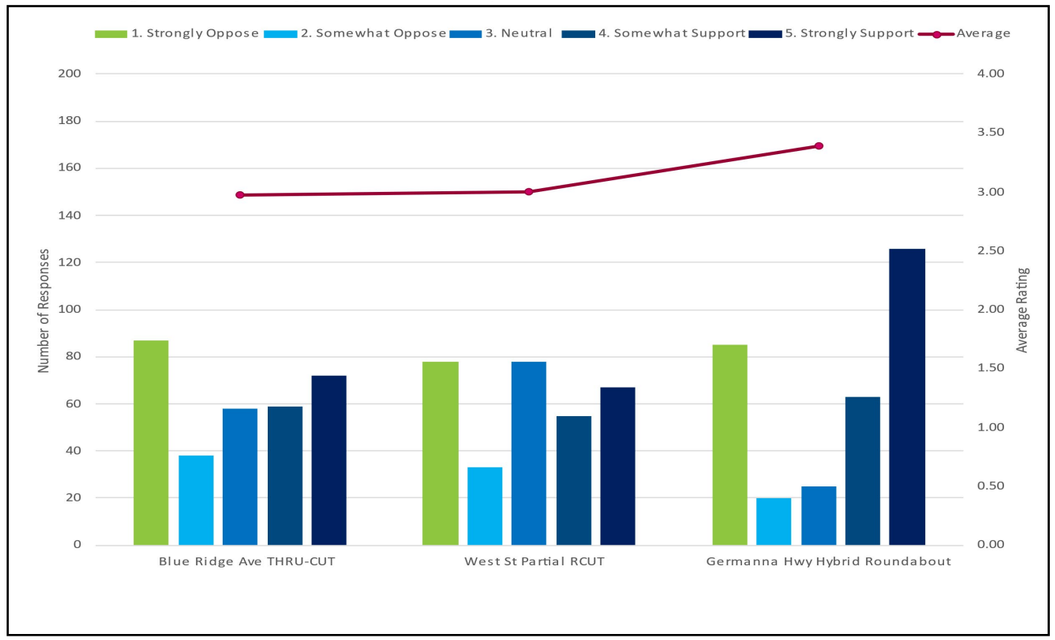


Figure 3-3 shows the survey results for the proposed improvements at each intersection from Laurel Street to Golf Drive under Concept B. As shown in the bar graph, intersection improvements under Concept B received an approximate average rating of 3.0, 3.2, and 3.0, respectively.

Figure 3-3. Survey Results - Concept B: Laurel Street to Golf Drive

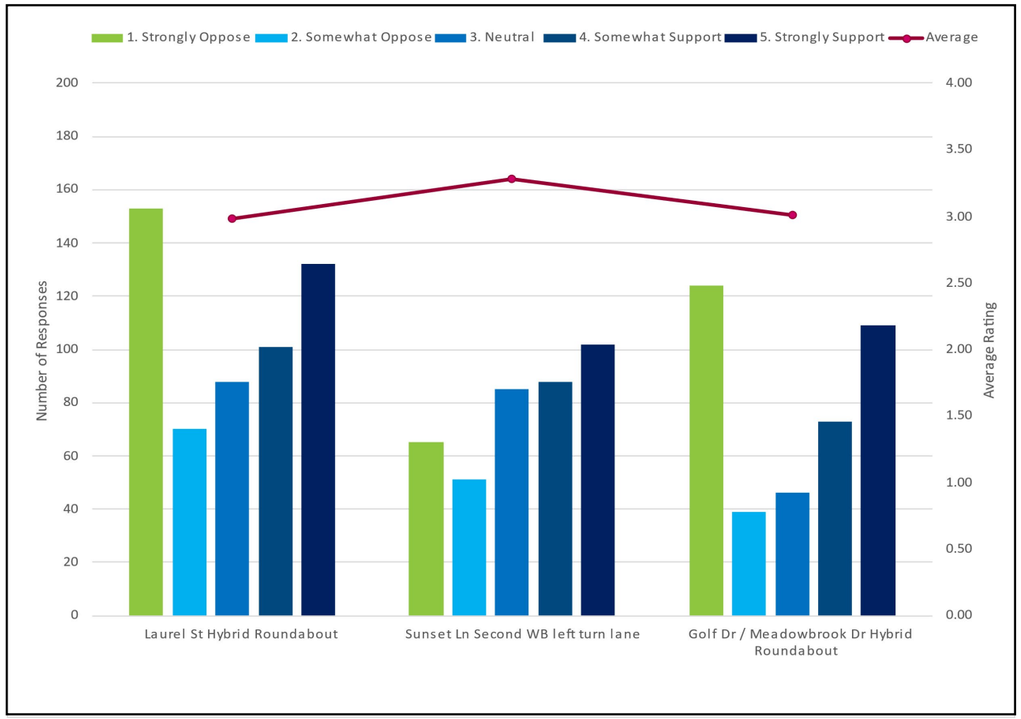


Figure 3-4 shows the survey results for the proposed improvements at each intersection from Laurel Street to Golf Drive under Concept C. As shown in the bar graph, both intersection improvements under Concept C received an approximate average rating of 3.0.

Figure 3-4. Survey Results - Concept C: Laurel Street to Golf Drive

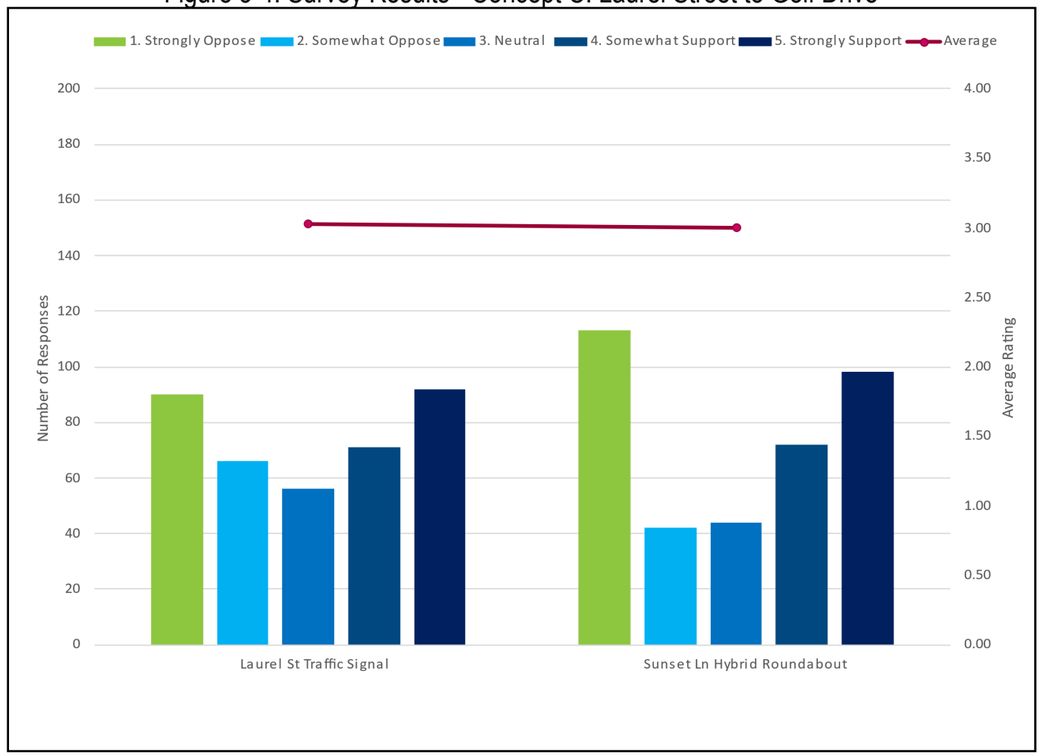


Figure 3-5 shows the survey results for the proposed improvements at each intersection from Oaklawn Drive to Germanna Highway under Concepts B and C. As shown in the bar graph, intersection improvements under Concepts B and C received an approximate average rating of 2.8, 2.7, and 2.8, respectively.

Figure 3-5. Survey Results – Concept B and C: Oaklawn Drive to Germanna Highway

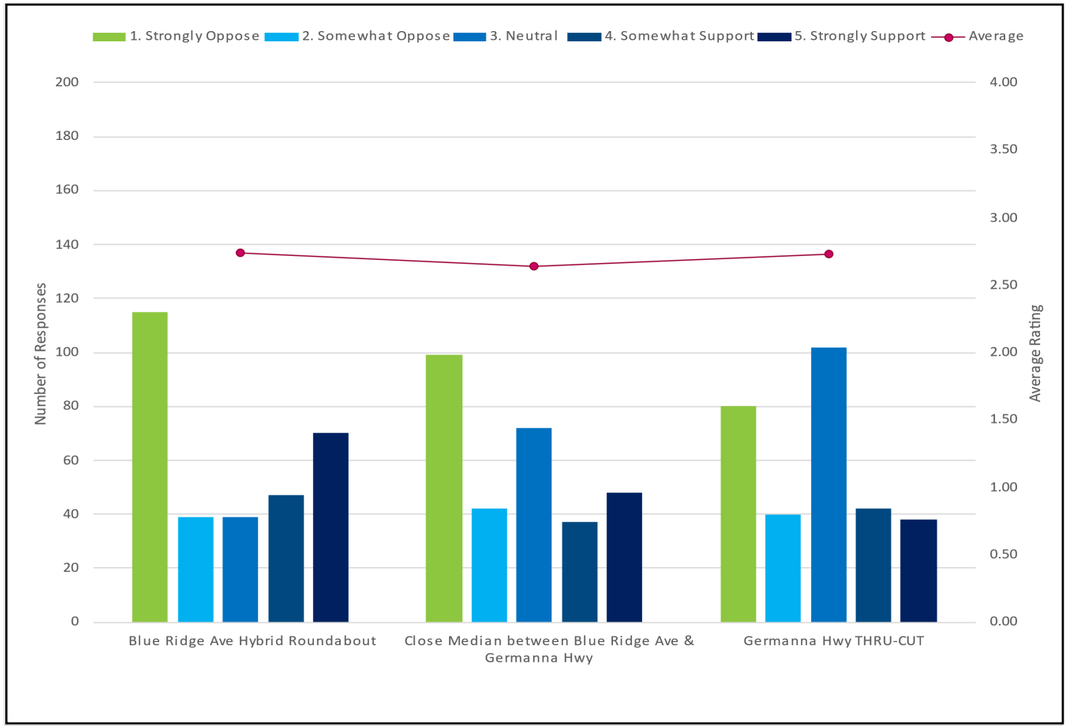
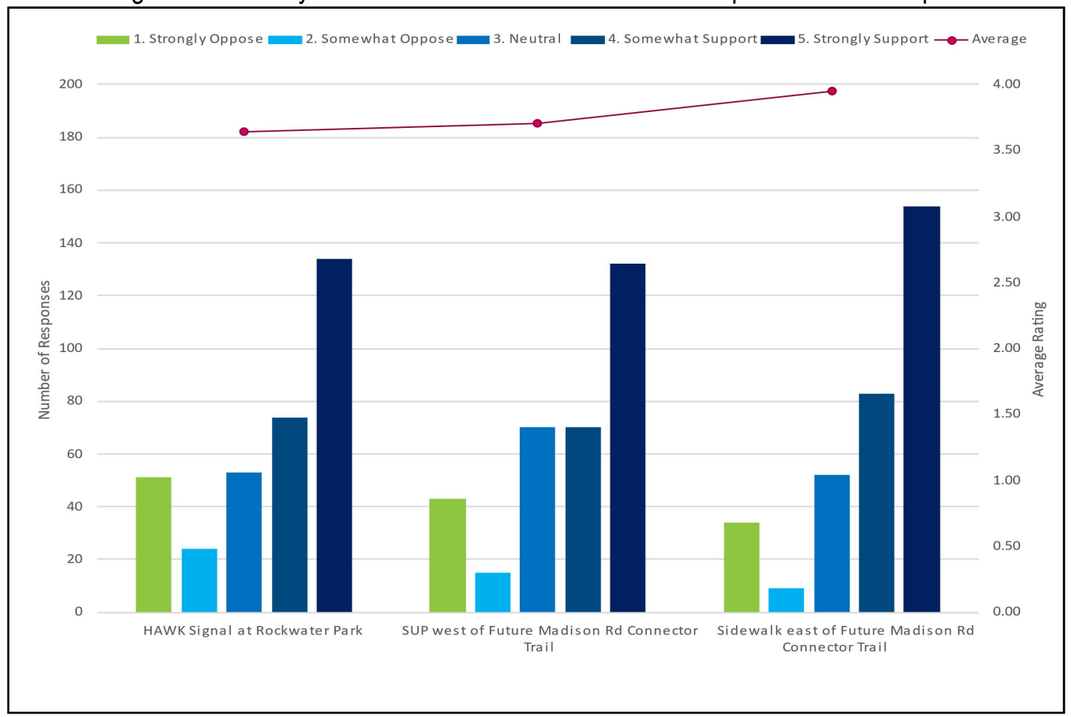


Figure 3-6 shows the survey results for the proposed multimodal and pedestrian improvements along US Route 29 Business under Concepts A through C. As shown in the bar graph, the multimodal improvements received an approximate average rating of 3.6, 3.7 and 3.9, respectively.

Figure 3-6. Survey Result – Multimodal and Pedestrian Improvement Concepts



Chapter 4 Investment Strategy

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

a.SMART SCALE

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

b.Transportation Alternatives (TAP)

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

c.Revenue Sharing (RS)

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

d.Central Virginia Transportation Authority (CVTA)

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

e.Other Funding Sources

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

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

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

Appendices

Appendix A: STEAP Tool Report

Appendix B: Raw Traffic Counts

Appendix C: Existing Condition Outputs

Appendix D: Raw Crash Data

Appendix E: US Route 29 Business Pipeline Study Traffic Forecasting Memorandum

Appendix F: Interim (2035) and Design (2050) Year No-Build Analysis Results

Appendix G: Cost Estimates

Appendix H: Interim (2035) and Design (2050) Year Build Analysis Results