PROJECT PIPELINE

LY-23-06 | Lynchburg
Old Forest Road | Kings Drive to Link Road

DRPT Virginia Department of Rail and Public Transportation

Office of INTERMODAL Planning and Investment

VDOT Virginia Department of Transportation

Old Forest Road from Kings Drive to Link Road

Final Report

August, 2024

Prepared for

VDOT Virginia Department of Transportation

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Chapter 1 – Needs Evaluation and Diagnosis

Introduction

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

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

Figure 1: Project Pipeline Objectives

Background

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

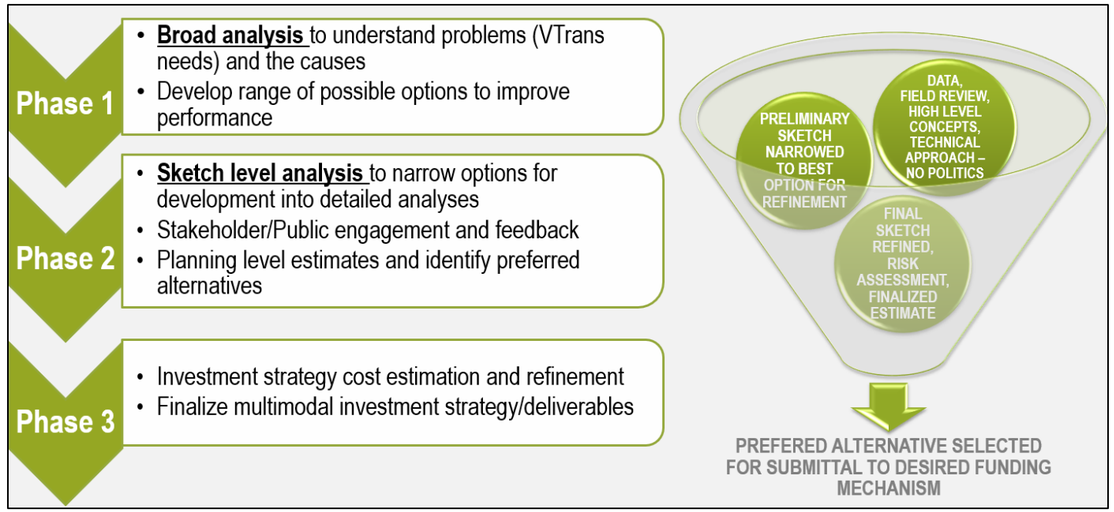
Table 1: List of VTrans Needs

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

Methodology

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

Figure 2: Study Phase Methods and Solutions



The study team is broken down into Technical Teams to improve the efficiency and effectiveness of the study process through extensive collaboration and synchronicity. To achieve the intended efficiency and consistency, it is 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 3.

Figure 3. Structure of a Technical Team

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

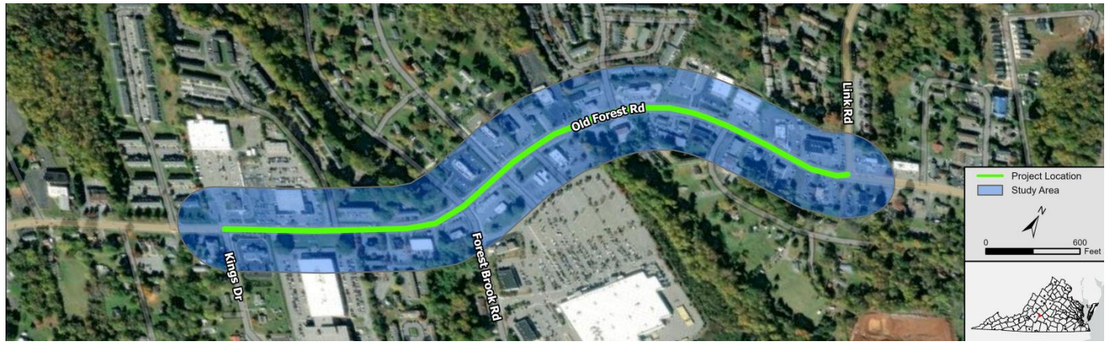
Table 2. Roles and Responsibilities for the Technical Team and SWGs

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

Study Area

The Old Forest Road corridor, between Kings Drive and Link Road, is located in Lynchburg, Virginia. It is primarily a four-lane undivided roadway, classified as a minor arterial with a posted speed limit of 35 miles per hour (mph) within the study area. There are 41 crossovers within this 0.71-mile corridor along Old Forest Road. The Old Forest Road corridor study limits are shown in Figure 4.

Figure 4: Old Forest Road 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 Old Forest Road corridor, were identified as "Very High" for Bicycle Access and Safety Improvement, "Medium" for Pedestrian Access, Transit Access and Transit Access for Equity Emphasis Areas, and "Low" for Transportation Demand Management, as shown in Table 3.

Table 3. VTrans Needs in Study Area

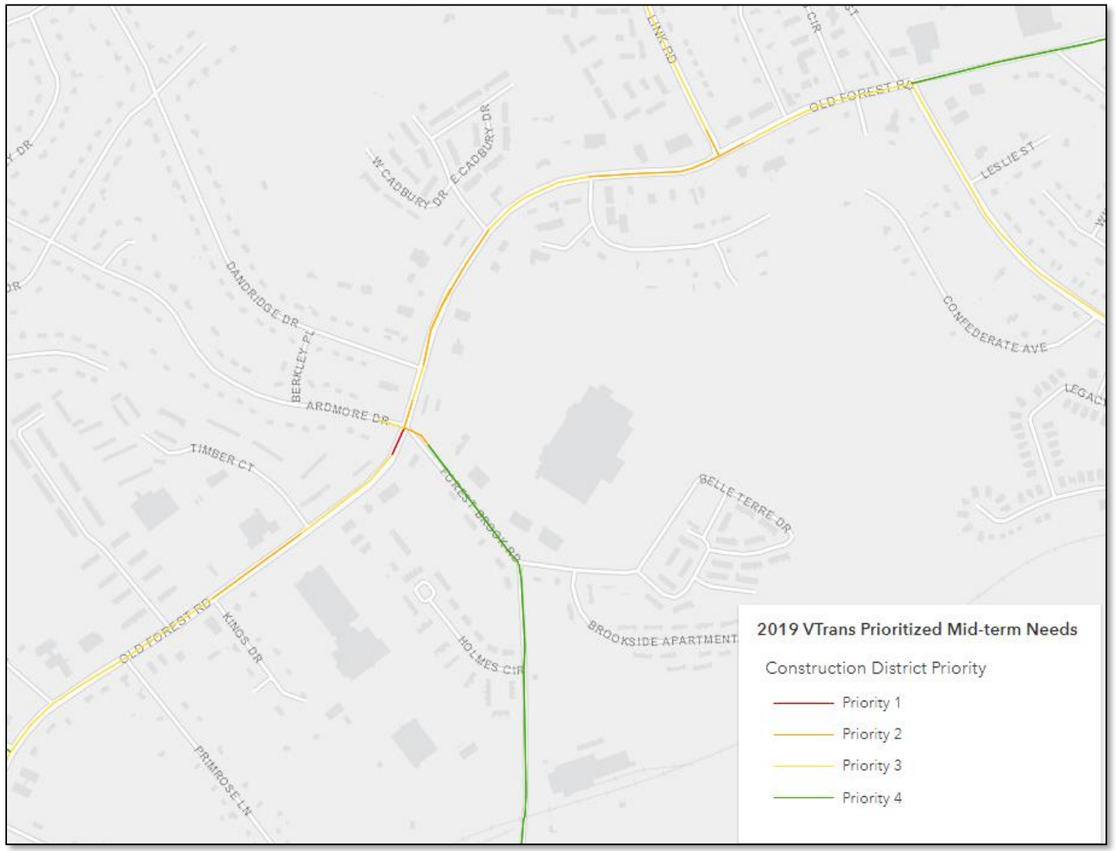
VTRANS IDENTIFIED NEEDS	PRIORITIES
Bicycle Access	Very High
Capacity Preservation	None
Congestion Mitigation	None
IEDA (UDA) Access	None
Pedestrian Access	Medium
Safety Improvement	Very High
Pedestrian Safety Improvement	None
Reliability	None
Rail On-time Performance	None
Transit Access	Medium
Transit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

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 5 presents a map of the study area with the 2019 VTrans mid-term needs prioritized for district construction. Figure 6 presents an overview of the diagnosis and problem identification for the Old Forest Road corridor.

A field visit was conducted July 14, 2023 and the notes from the visit are available in Appendix A.

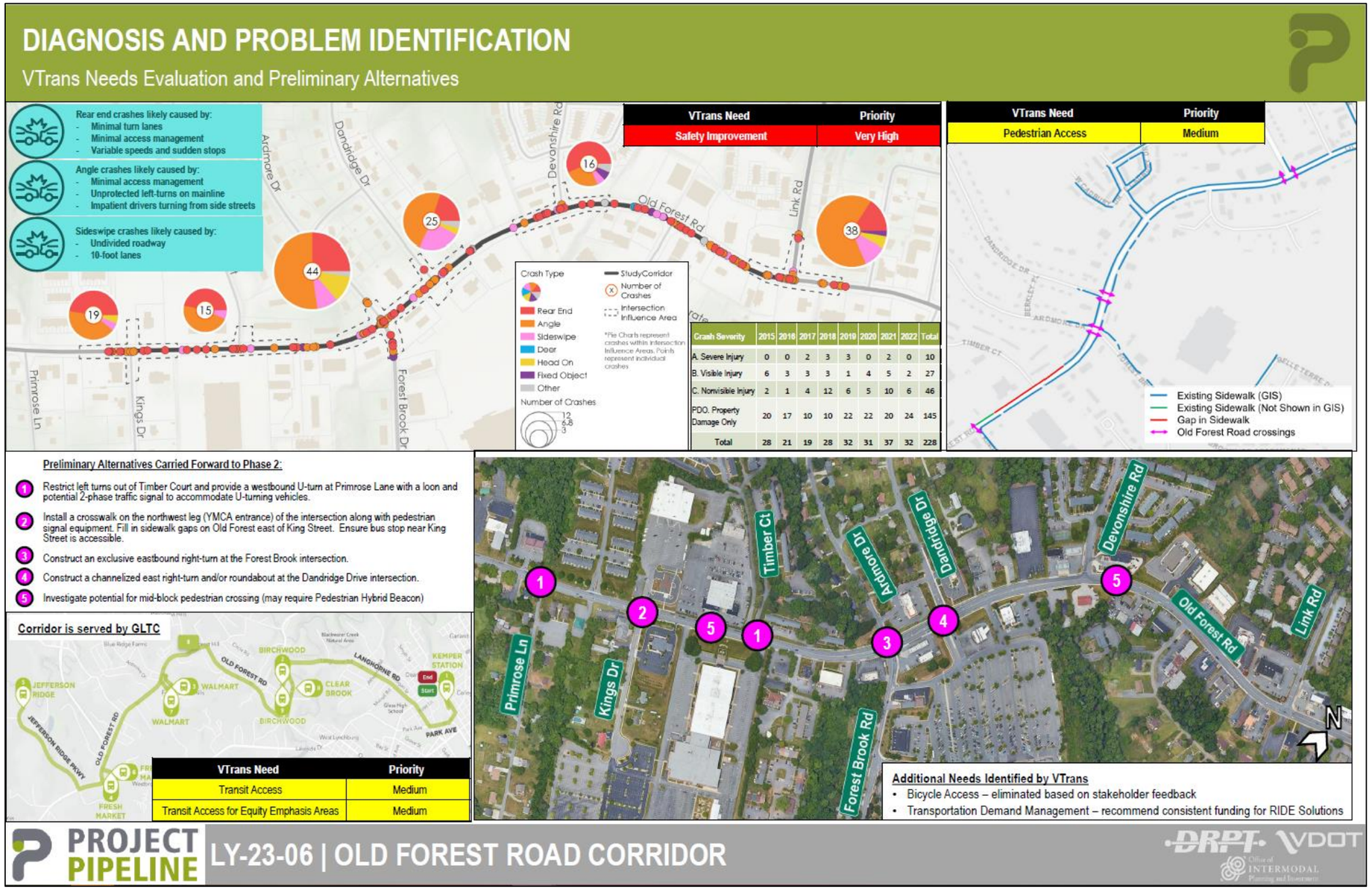
[1] Commonwealth Transportation Board, Actions to Approve the 2019 VTrans Vision, Goals, Objectives, Guiding Principles and the 2019 Mid-term Needs Identification Methodology and Accept the 2019 Mid-term Needs, January 15, 2020

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



https://vtrans.org/interactvtrans/map-explorer

Figure 6. Diagnosis and Problem Identification Overview for Old Forest Road, from Kings Drive to Link Road



Previous Study Efforts

There were no recent studies noted within the study area.

FHWA STEAP Tool Analysis

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

- The majority of the population (63%) within the study area is between ages 18 and 64 as shown in Figure 7.
- There is a high personal vehicle ownership, with 41% of households owning one vehicle, 35% owning two vehicles and 17% owning three or more vehicles. Only 6% of households do not own a personal vehicle as shown in Figure 8.
- When compared to the City of Lynchburg and the Commonwealth of Virginia, the study area has a higher than average number of veterans, people with disabilities, and households with no computers; however it is a greater number of households without internet connection, as shown in Figure 10.
- Of all the households in the study area, 41% have household income greater than $75,000, as shown in Figure 11.

Figure 7: STEAP Tool Population by Age Group (%)

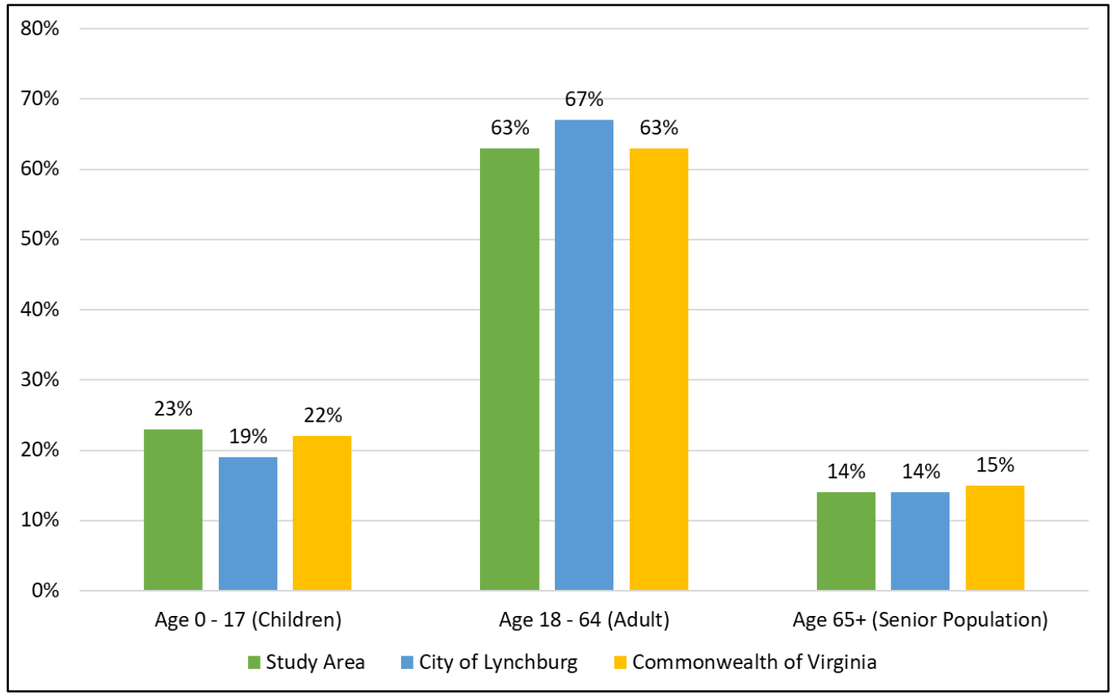


Figure 8. STEAP Tool Analysis Vehicle Ownership (%)

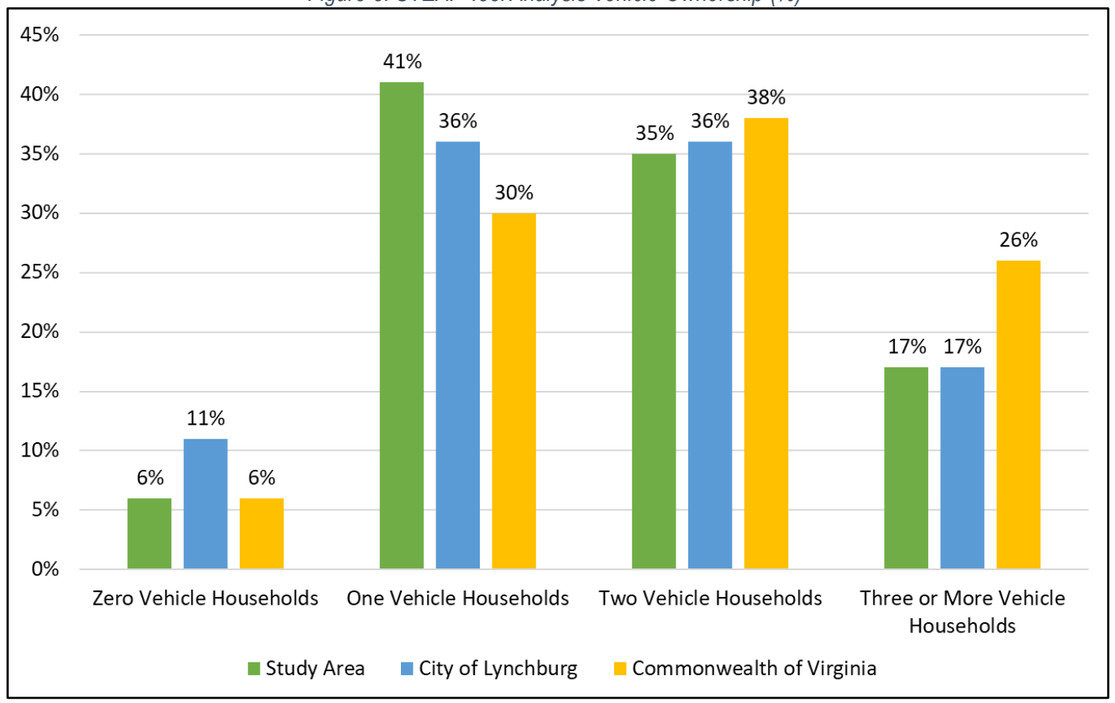


Figure 9. STEAP Tool Analysis English Proficiency in Non-English Speaking and Multilingual Households

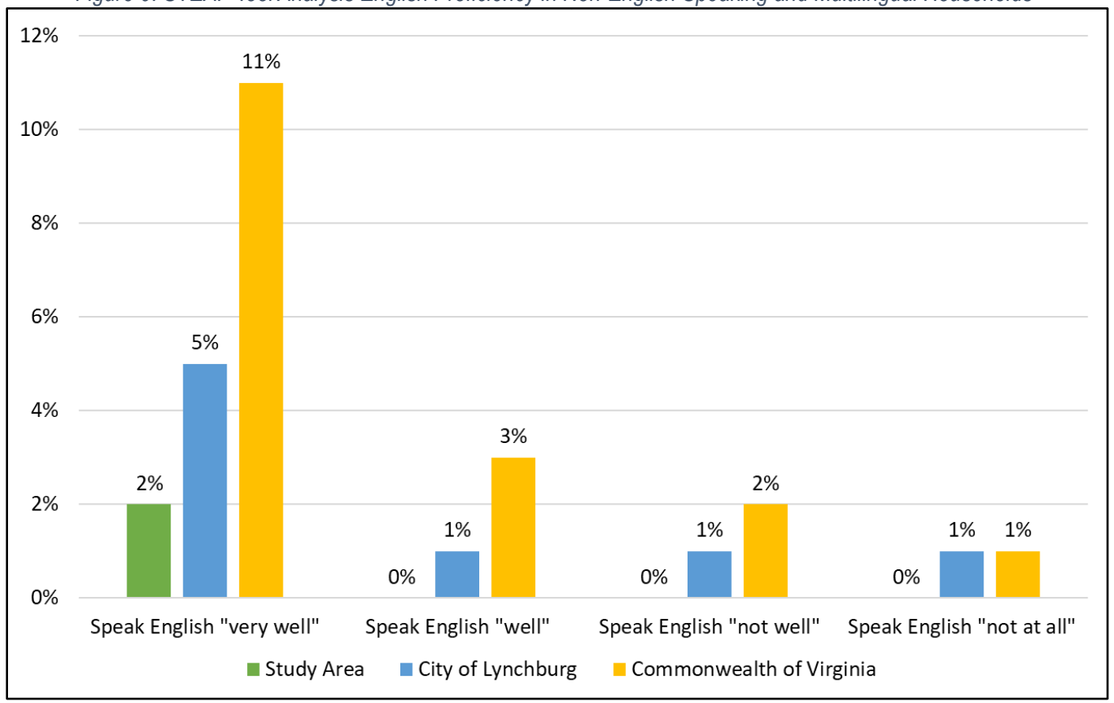


Figure 10. STEAP Tool Analysis Vulnerable Populations (%)

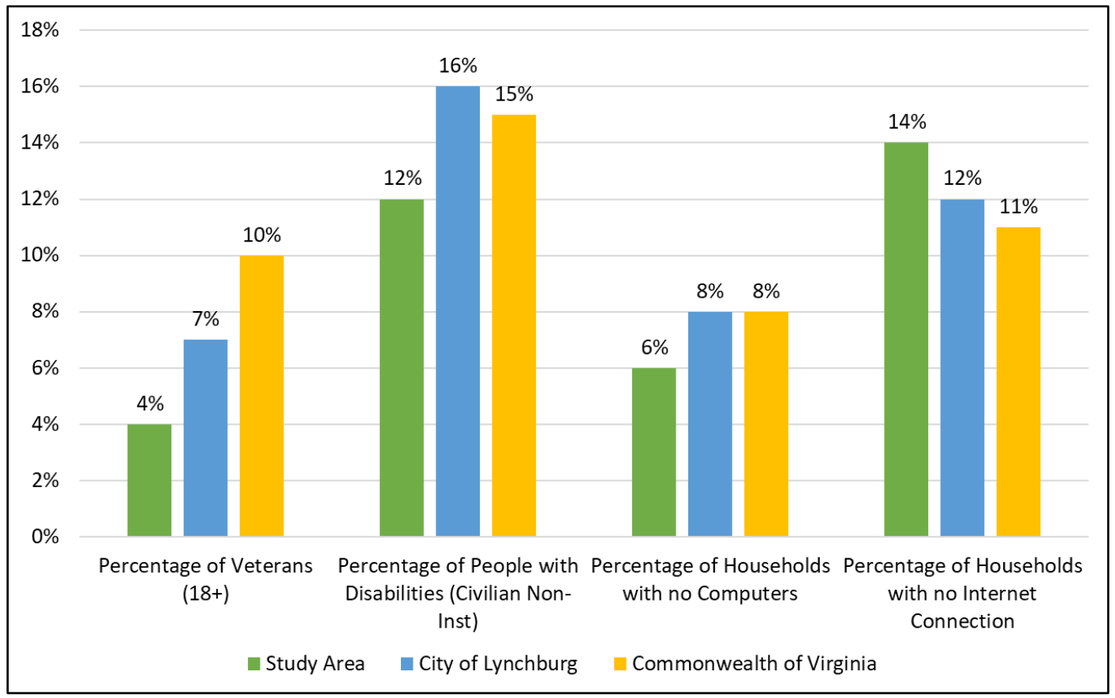
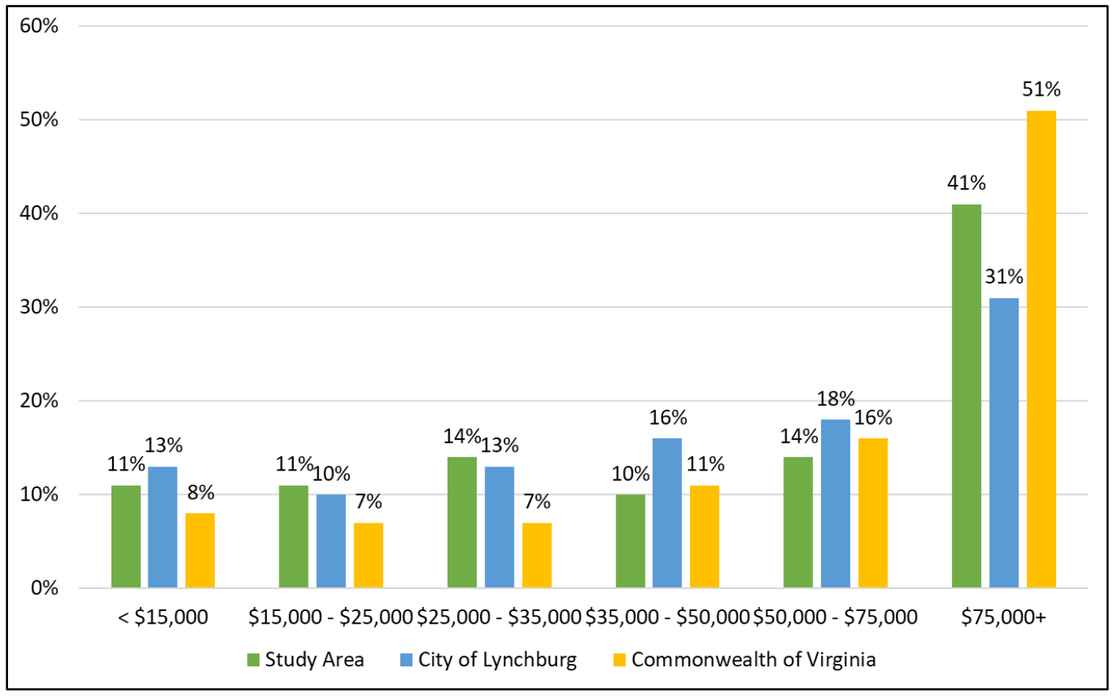


Figure 11. STEAP Tool Analysis Household Income (%)



Traffic Operations and Accessibility

Traffic operational analysis was performed using Synchro 11 and/or Sidra Intersection 8 software for all study intersections along the Old Forest Road corridor. Inputs and analysis methodologies are consistent with the VDOT Traffic Operations and Safety Analysis Manual (TOSAM) guidelines. Both AM and PM peak hour analyses were performed for the existing year 2023 and future diagnosis year 2045.

Traffic Data

The traffic data for the study area was obtained from turning movement counts collected on Tuesday, May 23, 2023 between 7:00 AM and 7:00 PM. The corridor AM peak hour was determined to be 7:45 AM to 8:45 AM and the corridor PM peak hour was determined to be 4:30 PM to 5:30 PM. The intersection turning movement volumes are shown in Figure 12.

Measures of Effectiveness

There are many measures of effectiveness (MOE) in traffic operations analysis to quantify operational and safety objectives and provide a basis for evaluating the performance of a transportation network. Several MOEs for intersection analyses can be reported from the Synchro software, VDOT Junction Screening Tool (VJuST), and SIDRA. For the purposes of this study, guidance for reporting MOEs for signalized and unsignalized intersections were obtained from Chapter 4 of the VDOT TOSAM. A summary of the MOEs evaluated for the study intersections is presented below:

- Control Delay (measured in seconds per vehicle – sec/veh)
- Level of service (LOS)
- 95th Percentile Queue Length for Synchro and SIDRA (measured in feet – ft)
- Volume-to-Capacity (v/c) Ratio

Traffic Operations Analysis Results

Overall, the study area intersections along the Old Forest Road corridor are currently operating under capacity. Operations along the corridor are summarized below. Detailed analysis results for the existing conditions are provided in Appendix C.

- The existing analysis indicates that all of the signalized study area intersections are currently operating at an overall level of service (LOS) of LOS B or better in both peak hours; while the worst approach at the unsignalized intersections are currently operating at LOS C or better in both peak hours.
- In the PM peak hour, there are over 100 northbound vehicles turning right onto Forest Brook Road and the Walmart Driveway. Southbound, there are 100 vehicles turning right onto Link Road. None of these movement have an exclusive right-turn lane.
- At the Link Road intersection, the northbound left-turning vehicles onto Link Road are 280 vehicles in the AM peak hour and 331 vehicles in the PM peak hour. These vehicles are contained to a single shared thru/left-turn lane and operate under permitted+protected phasing.
- While the level of service along the stop-controlled Timber Court approach is currently operating at LOS D or better in both peak hours, the amount of left-turning vehicles exiting from Timber Court is moderately high in both peak hours.

Pedestrian and Bicycle Access

Sidewalks are present along both sides of the Old Forest Road corridor, with the exception of a section on the west side of Old Forest Road, between Kings Drive and north of Timber Court. The missing sidewalk section is shown in Figure 13. Pedestrian accommodations are present at all signalized intersections within the study area.

There is a Six-Year Improvement Program (SYIP) project, funded using Highway Safety Improvement Program (HSIP) funds, that includes pedestrian improvements along Old Forest Road, from Kings Drive to the bridge over the Norfolk Southern Railway. This project will construct sidewalk and ramps on the east side of Old Forest Road, from the Norfolk Southern Railway to Wigginton Road, where it will cross to the west side of Old Forest Road and continue from Wigginton Road to Kings Drive. At Kings Drive, the project will again cross Old Forest Road and continue on the east side. Construction is planned for FY2025. Figure 14 shows the SYIP details for the project.

Figure 12: Existing AM & PM Peak Hour Volumes

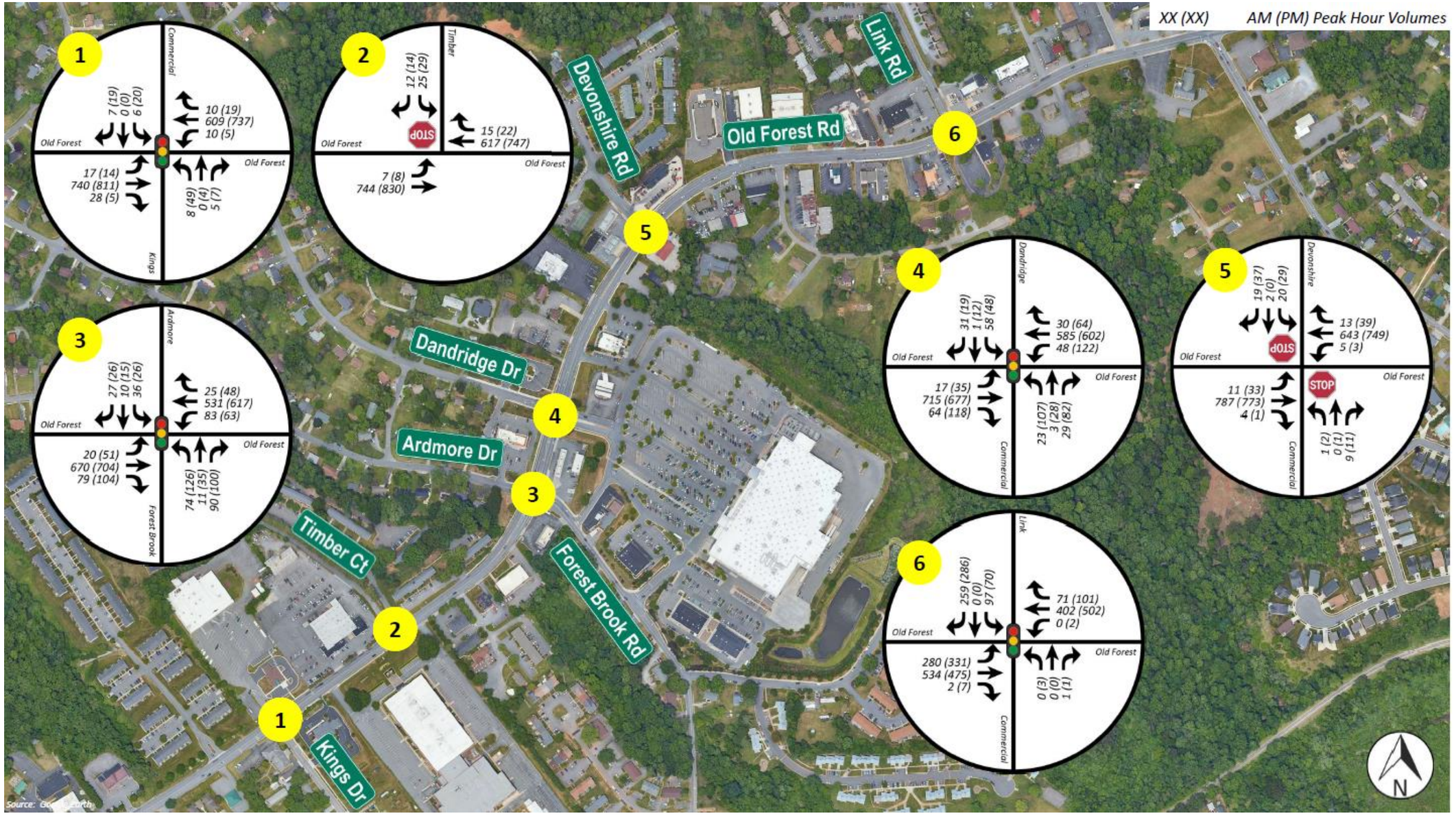


Figure 13: Missing Sidewalk along Old Forest Road

Image Source – Google Earth

Figure 14: Six Year Improvement Plan Project Details

Project Summary

UPC	114065
Project	HSIP21 - UR 6044 - PEDESTRIAN IMPROVEMENTS (OLD FOREST RD)
Scope of Work	Safety
Description	FROM: KINGS DRIVE TO: BRIDGE OVER NORFOLK SOUTHERN RAILWAY
Report Note	
Fund Source	HSIP

Project Location

District	Lynchburg	Jurisdiction	Lynchburg
Road System	Urban	Length	0.5700 MI
Route	6044	Street	OLD FOREST ROAD
MPO Area	Lynchburg		

Estimates & Schedule

	Estimated Cost (Thousands)	Schedule
Prelim. Eng. (PE)	$498	Complete
Right of Way (RW)	$204	Underway
Construction (CN)	$1,929	FY2025
Total Estimate	**$2,632**	

Required Allocations

Fund Sources	Previous Allocations	FY2024	FY2025	FY2026	FY2027	FY2028	FY2029	Required After FY2029
	Values in Thousands of Dollars							
Specialized State and Federal: Federal	$50	$0	$0	$0	$0	$0	$0	
VA Safety Funds: Federal	$1,945	$0	$637	$0	$0	$0	$0	
Total Funding	**$1,995**	**$0**	**$637**	**$0**	**$0**	**$0**	**$0**	**$0**

Safety and Reliability

For the analysis of existing safety conditions, the VDOT Crash Analysis PowerBI Tool was utilized to determine the crash history at the study intersections and along Old Forest Road. Crash data was collected and analyzed for an eight-year period spanning from January 2015 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 the purposes of this analysis, "injury crashes" is defined as the sum of type A (severe injury), B (visible injury), and C (non-visible injury) crashes.

Safety Analysis Results

The crash severity within the study area is summarized by year and type in Table 4 and Table 5, respectively. The lighting conditions, adverse weather conditions, and the other related factors, including alcohol, speeding, and guardrail are summarized in Table 6. Crash locations and crash types for each of the study intersections are shown in Figure 15. Figure 16 shows the travel time data along each direction of the corridor.

Table 4. 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
2015	0	0	6	2	20	**28**
2016	0	0	3	1	17	**21**
2017	0	2	3	4	10	**19**
2018	0	3	3	12	10	**28**
2019	0	3	1	6	22	**32**
2020	0	0	4	5	22	**31**
2021	0	2	5	10	20	**37**
2022	0	0	2	6	24	**32**
Total	**0**	**10**	**27**	**46**	**145**	**228**

Table 5. 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	0	6	20	42	**68**
Angle	0	5	13	20	68	**106**
Head On	0	1	4	0	6	**11**
Sideswipe – Same Direction	0	0	1	0	21	**22**
Fixed Object in Road	0	0	0	0	2	**2**
Non-Collision	0	0	0	0	0	**0**
Fixed Object – Off Road	0	0	1	1	4	**6**
Deer	0	0	0	0	1	**1**
Other Animal	0	0	0	0	0	**0**
Ped	0	3	0	1	0	**4**
Other	0	1	2	4	1	**8**
Total	**0**	**10**	**27**	**46**	**145**	**228**

A total of 228 crashes were reported within the Old Forest Road corridor study area during the eight-year study period.

Key takeaways from the crash data are as follows:

1. The highest number of reported crashes along the corridor have all occurred in the past four years, with the highest (37) being in 2021 and the next highest (32) occurring in 2022 and 2019.
2. The approximate average number of reported crashes per year is 29.
3. Angle crashes (46%) and rear end crashes (30%) were the highest reported crashes along the corridor.
4. A total of 83 reported crashes were associated with injuries, accounting for approximately 36% of the reported crashes along the corridor. There were no fatalities reported.
5. A total of 48 crashes (21%) occurred during the night.
6. There were 4 crashes (2%) due to speeding.
7. Guardrail was not involved in any crashes.
8. There were 32 crashes (14%) that occurred during adverse weather conditions.

The detailed collision diagrams are shown in Appendix C.

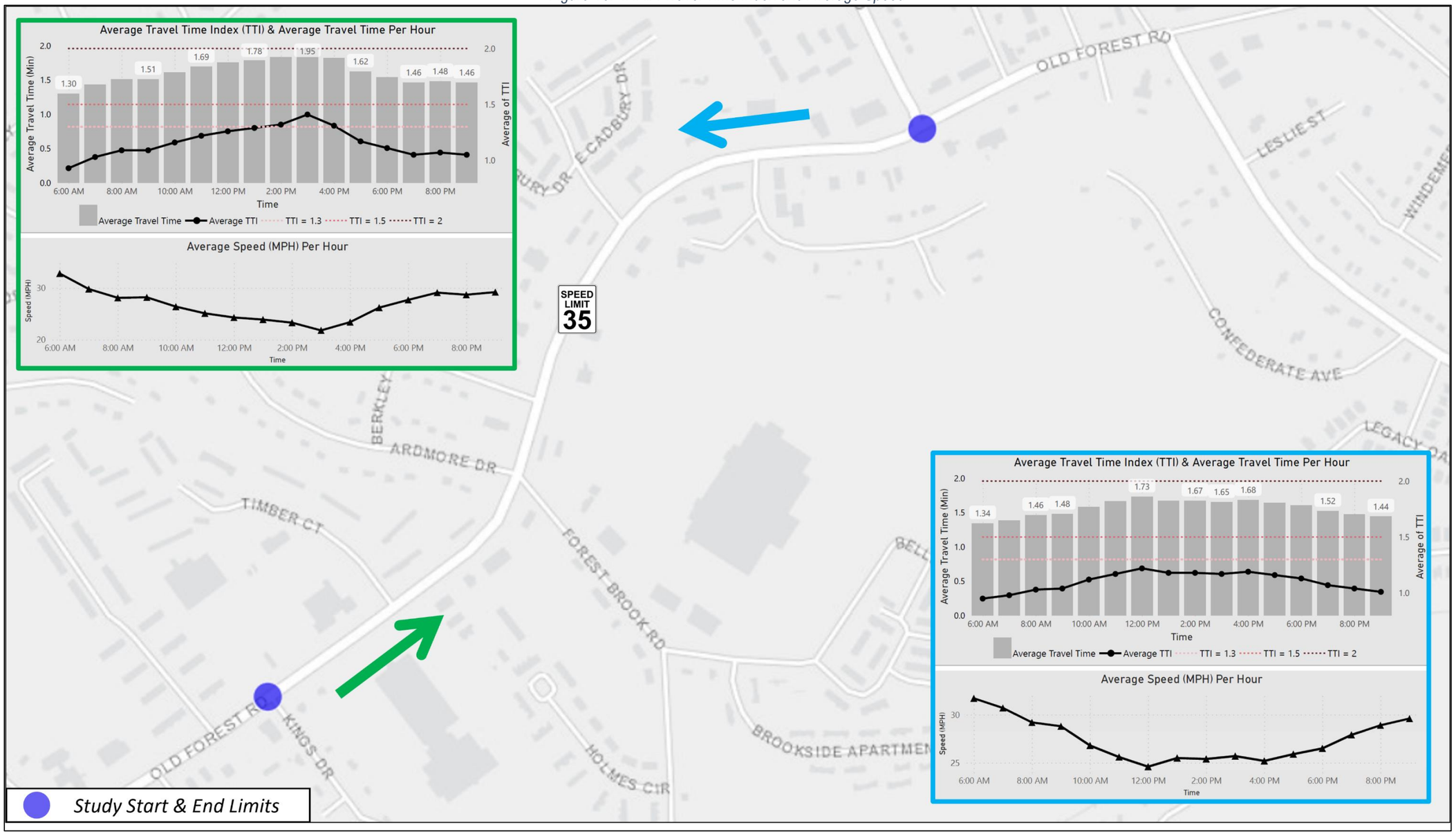
Table 6. Study Area Crash Type and Lighting, Adverse Weather, Alcohol, Speeding, and Guardrail Conditions

Crash Type and Other Related Factors	Lighting Conditions		Weather Conditions[1]						Alcohol Related		Speeding Related		Guardrail Related	
	Daylight	Darkness	No Adverse Conditions	Fog	Mist	Rain	Snow	Sleet/Hail	Yes	No	Yes	No	Yes	No
Rear End	57	11	49	0	3	14	1	0	1	67	2	66	0	68
Angle	87	19	94	0	3	8	0	1	2	104	2	104	0	106
Head On	6	5	9	0	0	2	0	0	1	10	0	11	0	11
Sideswipe – Same Direction	17	3	20	0	0	0	0	0	0	20	0	20	0	20
Fixed Object in Road	1	1	2	0	0	0	0	0	0	2	0	2	0	2
Non-Collision	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fixed Object – Off Road	2	4	6	0	0	0	0	0	4	2	0	6	0	6
Deer	1	0	1	0	0	0	0	0	0	1	0	1	0	1
Other Animal	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ped	2	2	4	0	0	0	0	0	1	3	0	4	0	4
Other	7	3	10	0	0	0	0	0	1	9	0	10	0	10
Total	**180**	**48**	**195**	**0**	**6**	**24**	**1**	**1**	**10**	**218**	**4**	**224**	**0**	**228**

[1]The weather conditions for Crash 160355117 was classified as “other” and is not accounted for in the table.

Figure 15: Old Forest Road Crash Locations and Types

Figure 16: INRIX Travel Time Index and Average Speed



Rail, Transit, and TDM

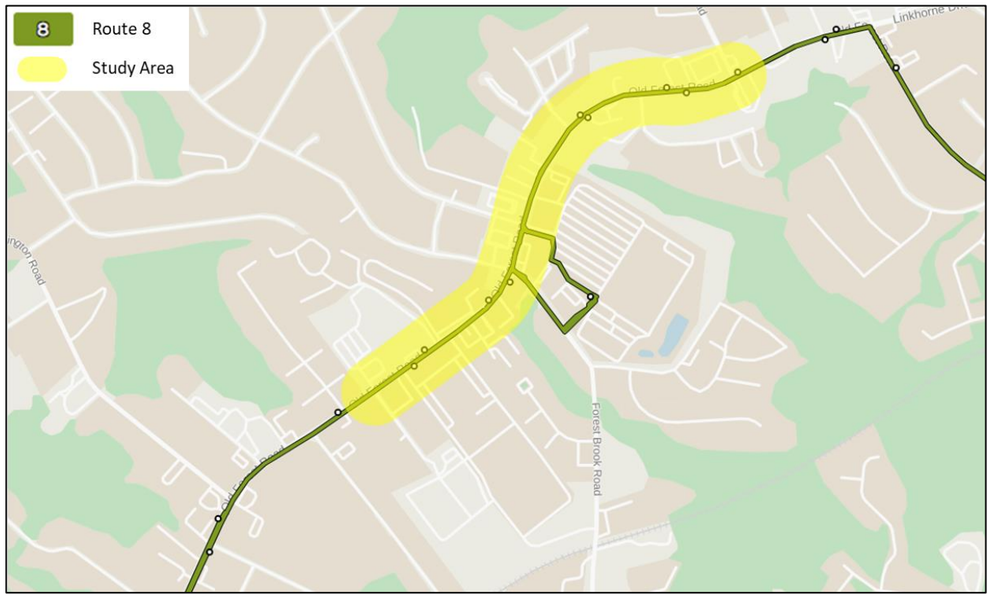
As previously mentioned, VTrans identified Transit Access and Transit Access for Equity Emphasis Areas as a medium need and Transportation Demand Management as a low need. Rail On-Time Performance was not identified as a need by VTrans.

The corridor is currently served by the Greater Lynchburg Transit Company (GLTC) – Route 8. There are several stops along the corridor; however, the field visit noted that there were some concerns with access to the existing bus stop locations and accommodations at the bus stop locations.

- There are nine (9) bus stop locations within the study corridor.
- Only one (1) location included a bench; none included a shelter.
- One (1) location, near the Kings Drive intersection, was not connected to a sidewalk.

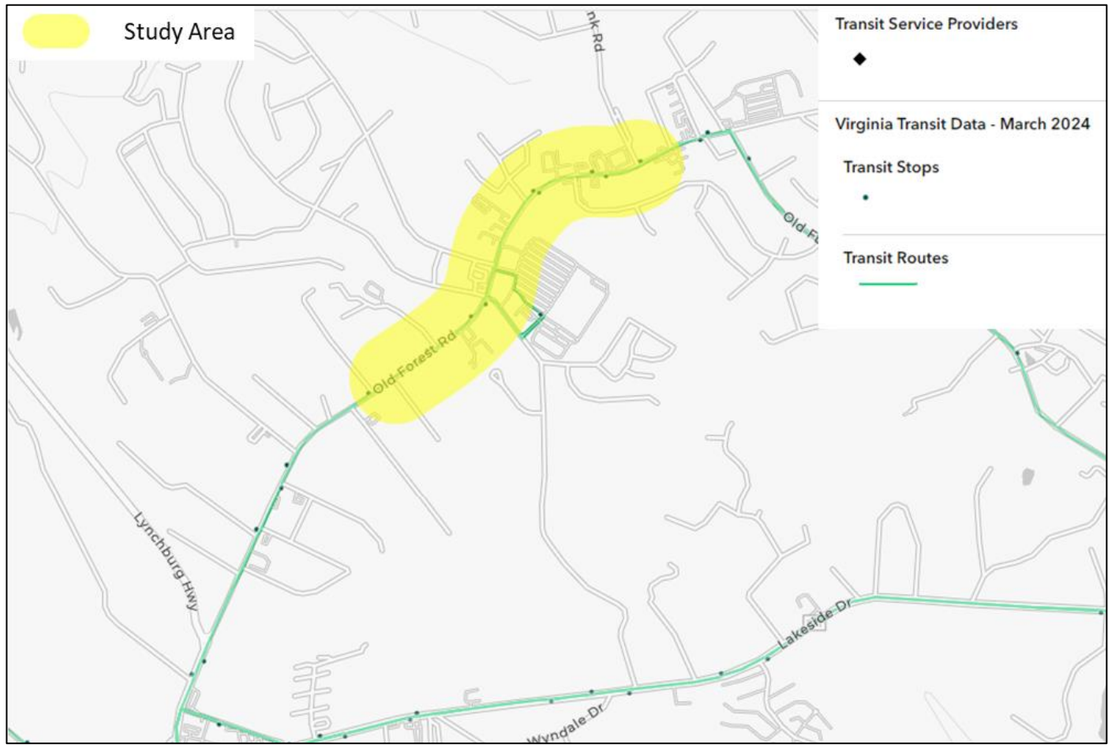
Figure 17 shows the GLTC transit route (Route 8) and stops along the Old Forest Road corridor from GLTC's Realtime Tracking website, while Figure 18 shows the same information from Virginia's Statewide Transit Data. Figure 19 shows the rail infrastructure in the vicinity of the Old Forest Road corridor, from the DRPT Rail Database (Virginia Rail Infrastructure Database).

Figure 17: Greater Lynchburg Transit Company Route 8



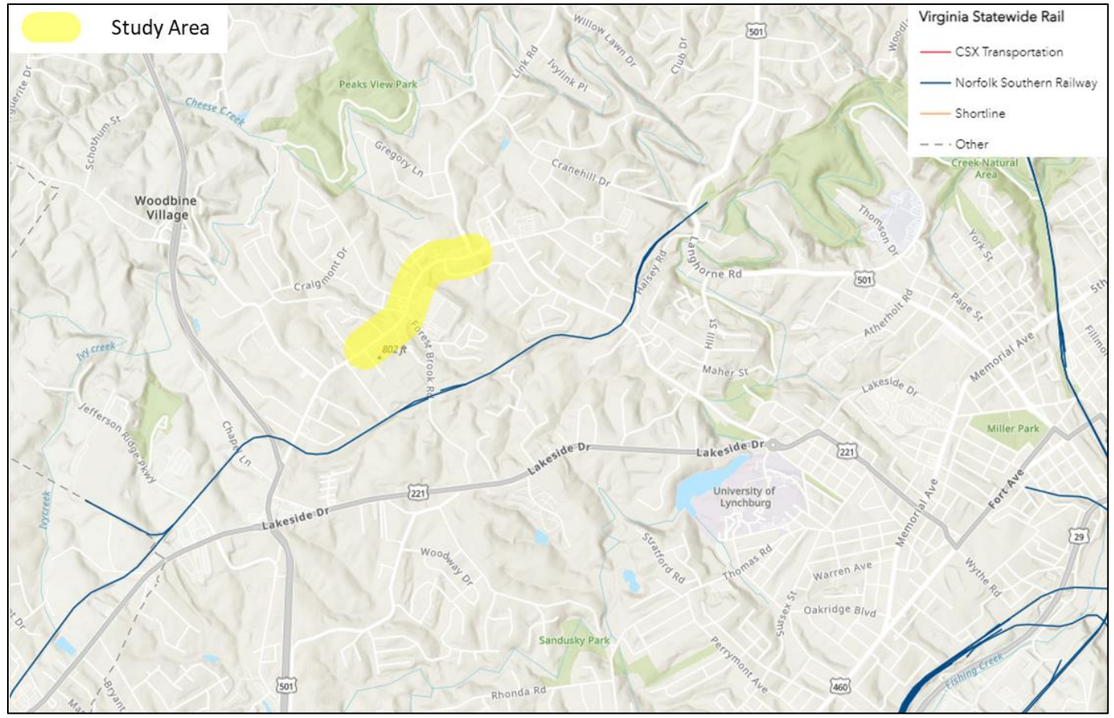
https://gltc.cadavl.com/SWIV/GLTC

Figure 18: Statewide Transit Data



https://gis-drpt.opendata.arcgis.com/apps/d9702b3076f1494a8eb8db5ae2ee66bb/explore

Figure 19: DRPT Rail Database (Virginia Rail Infrastructure Database)



https://gis-drpt.opendata.arcgis.com/apps/DRPT::virginia-rail-infrastructure-application/explore

Phase 1 Corridor/Existing Conditions Public Outreach & Involvement

Initial Public Outreach was conducted to inform the public of the study efforts and goals and solicit feedback on what the public's priorities and perceptions of the corridor are to include in the evaluation of potential alternatives. The survey was conducted through Publicinput.com and there were 245 participants.

As shown in Figure 20, the survey responses indicate that vehicular safety was the greatest need along the corridor, followed by pedestrian access, transit access, transportation demand management and bicycle access.

Figure 20. VTrans Needs Along Study Corridor

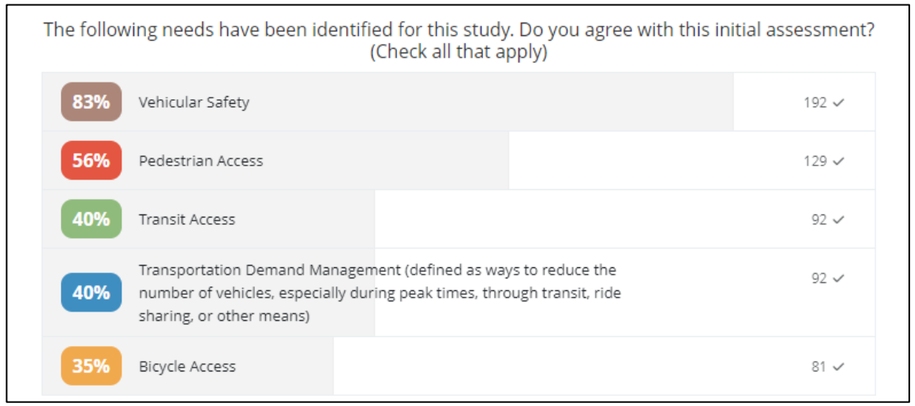
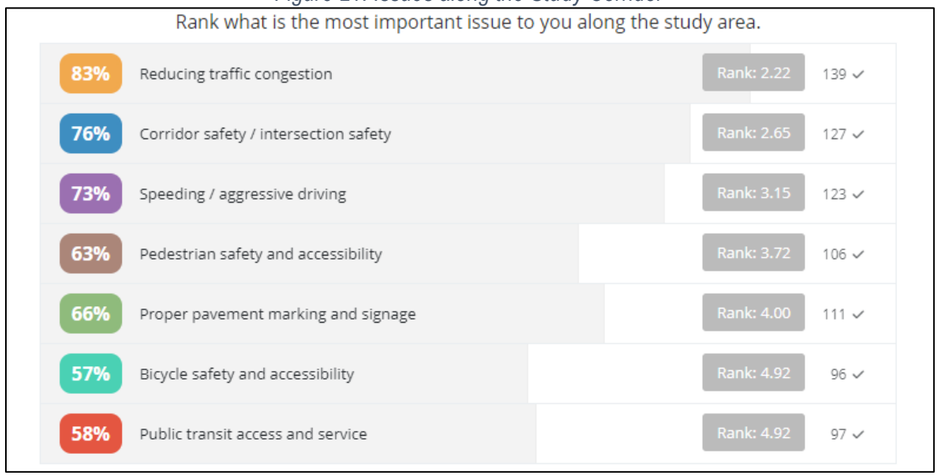


Figure 21 shows the issues along the corridor that the respondents noted need to be addressed. Figure 22 shows the major issues along the corridor which include vehicles speeding, suddenly stopping and running red lights along the corridor. The majority of the respondents noted that they use the corridor for shopping/errands, passing through, traveling home, or traveling to work. Additionally, 98% of the respondents shared that they travel using personal vehicles. Adding crosswalks/pedestrian signals (65%) and sidewalks (60%) were the two highest multimodal needs identified in the survey.

Figure 21. Issues along the Study Corridor



Some notable comments from the survey responses are summarized below:

- *"There is nothing wrong with this road other than (sic) properly timing the traffic lights… Leave this road alone and spend money on other roads that actually need to change."*
- *"Frequently congested because of all the closely spaced traffic lights. There are 2 lanes but so many people are turning into businesses that it often holds up traffic."*
- *"There should be a turn lane here. It holds up traffic when people are turning into McDonald's, with people weaving around and sudden stops."*
- *"Visibility as a part of intersection safety is important, turning right from Ardmore Dr onto Old Forest is a guessing game because of boxes obscuring the already naturally difficult view."*
- *"Please consider making this a 1 lane going each way for cars and building bigger sidewalks and protected cycling infrastructure."*
- *"Consolidate driveways!"*
- *"Turn lanes would be the biggest improvement by far."*

Figure 22. Public Input Survey Responses

Which of the following safety issues concern you? (Check all that apply)

65%	Speeding / aggressive driving	135 ✓
54%	Sudden stopping / rear-end crashes	112 ✓
50%	Running red lights	103 ✓
44%	Difficulty weaving / merging	92 ✓
44%	Lack of sidewalks / missing sidewalks	91 ✓
36%	Insufficient / missing crosswalks and pedestrian signal timing	74 ✓
31%	Inadequate pavement marking and signage	64 ✓
27%	Side-impact crashes	55 ✓
24%	Inadequate bicycle facilities	50 ✓
23%	Inadequate lighting	47 ✓
22%	Closely spaced driveways	46 ✓
11%	Lack of ADA ramps and accessibility	23 ✓
10%	Inadequate transit / bus stops	21 ✓
8%	Other	16 ✓

What mobility issues do you typically experience when using the study area? (Check all that apply)

64%	Difficulty making left turns	125 ✓
63%	Lack of turn lanes	124 ✓
42%	Poor signal coordination	83 ✓
32%	Difficulty accessing businesses	62 ✓
27%	Vehicles blocking entrances	52 ✓
19%	Difficulty when riding a bicycle	38 ✓
14%	Difficulty when walking	27 ✓
5%	Other	9 ✓

Why do you travel along the study area? (Check all that apply)

80%	Shopping / Errands	161 ✓
55%	Passing through	112 ✓
41%	Work	82 ✓
34%	Home	68 ✓
13%	Entertainment	26 ✓
13%	Other	26 ✓

What mode(s) of travel do you use when traveling along the study area? (Check all that apply)

98%	Personal vehicle	198 ✓
8%	Cycling	17 ✓
7%	Walking	14 ✓
3%	Truck or commercial vehicle	6 ✓
2%	Metro bus, local bus, or commuter bus	4 ✓
1%	Taxi / Uber / Lyft	3 ✓
1%	Carpool / Vanpool	3 ✓
1%	Other	2 ✓

What multimodal facilities are needed along this study area? (Check all that apply)

65%	Crosswalks / pedestrian signals	104 ✓
60%	Sidewalks	96 ✓
38%	Bicycle lanes	60 ✓
29%	Transit service bus shelters	46 ✓
23%	Shared-use path	36 ✓
8%	Bus transfer station	12 ✓
6%	Other	9 ✓
4%	Park & ride lot	7 ✓

Chapter 2 – Alternative Development and Refinement

Alternative Development and Screening

In order to develop alternative concepts to address the needs identified in Chapter 1, a thorough review of the existing conditions data was conducted. VJuST was used as a high-level screening tool to identify potential alternative concepts at all study area intersections along the Old Forest Road corridor, with the exception of Link Drive, which was recently improved. These concepts were further screened manually based on a number of factors including operational and safety benefits, costs and right-of-way impacts. The remaining concepts were modeled in Synchro and/or Sidra Intersection.

Future Traffic Forecasting

As mentioned in Chapter 1, the future year analysis along the corridor was conducted for the year 2045. To estimate these volumes, growth rates were developed along the Old Forest Road corridor and other study area roadways, using the latest Central-Virginia MPO Travel Demand Model (TDM), Pathways for Planning and 10-year historic growth. These growth rates were approved by VDOT on December 20, 2023. Table 7 shows the traffic volumes from the Central-Virginia MPO Travel Demand Model, Table 8 shows the historic traffic volumes and Figure 23 shows the growth rates from Pathways for Planning.

The approved growth rates (non-compounded) are as follows:

- Old Forest Road – 1.0%
- Forest Brook Road – 2.0%
- Other Y-lines – 0.5%

The resulting 2045 turning movement volumes for the study area intersections are presented in Figure 24.

Table 7: TDM Total Volumes and Growth Rates within the LY-23-06 Study Area

Route	Location	2016	2045	Annual Growth Rate (%)
Old Forest Road	Primrose Lane to Timber Court	19,308.88	31,162.94	2.12%
Timber Court	N of Old Forest Road	3,960.39	5,960.34	1.74%
Old Forest Road	Timber Court to Forest Brook Road	18,963.79	30,463.90	2.09%
Forest Brook Road	S of Old Forest Road	3,328.30	5,905.03	2.67%
Old Forest Road	Forest Brook Road to Link Drive	16,906.31	27,718.40	2.21%
Link Drive	N of Old Forest Road	10,146.48	13,174.22	1.03%
Old Forest Road	E of Link Drive	12,257.02	21,366.63	2.56%

Table 8: Historic AADT within the LY-23-06 Study Area

Route	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Old Forest Road	21,940	22,022	21,752	20,049	20,081	20,167	18,778	22,315	22,601	19,858	20,746	19,563	18,931
Old Forest Road	19,159	19,231	18,995	19,916	19,948	20,034	18,158	18,247	18,646	18,898	19,743	18,617	18,342
Forest Brook Road	3,255	3,267	3,227	3,351	3,356	3,371	2,662	3,512	3,557	3,596	3,757	3,543	4,034
Link Drive	8,243	8,274	8,172	8,179	8,192	8,227	8,821	8,864	9,058	7,851	8,202	7,734	7,613

Covid & Recovery

Route	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Old Forest Road	18,576	18,491	19,240	19,512	20,313	21,058	21,184	20,538	20,481	22,382	23,539	20,283
Old Forest Road	17,998	17,916	21,149	21,448	22,328	19,856	19,974	19,367	20,091	18,457	19,412	18,441
Forest Brook Road	3,958	3,940	4,676	4,742	4,937	4,906	4,935	4,858	4,844	4,450	4,681	4,661
Link Drive	7,470	7,436	8,890	9,016	9,386	9,049	8,103	8,799	8,114	7,454	7,840	7,821

Figure 23: Pathways for Planning Growth Rates within the LY-23-06 Study Area

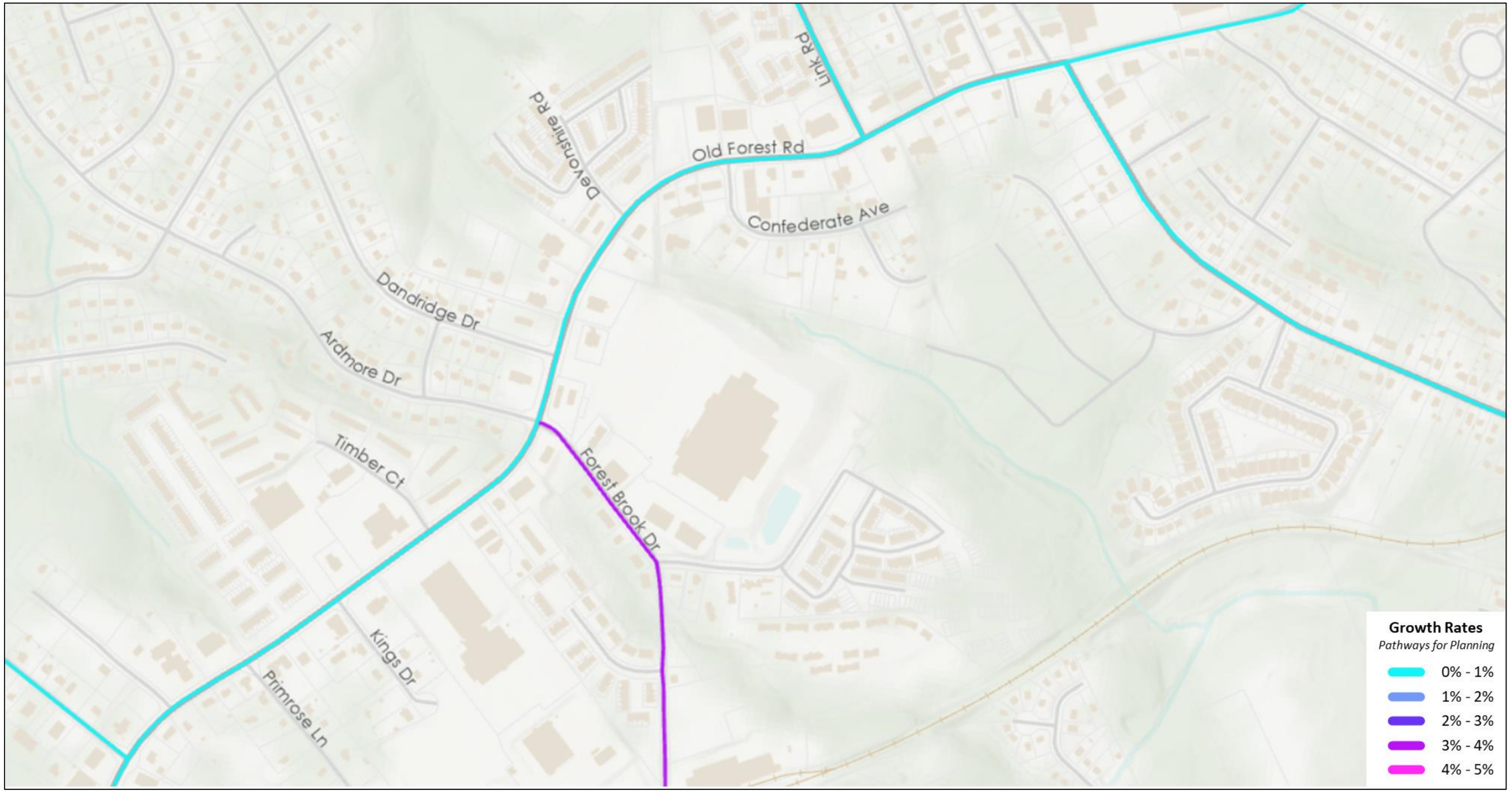
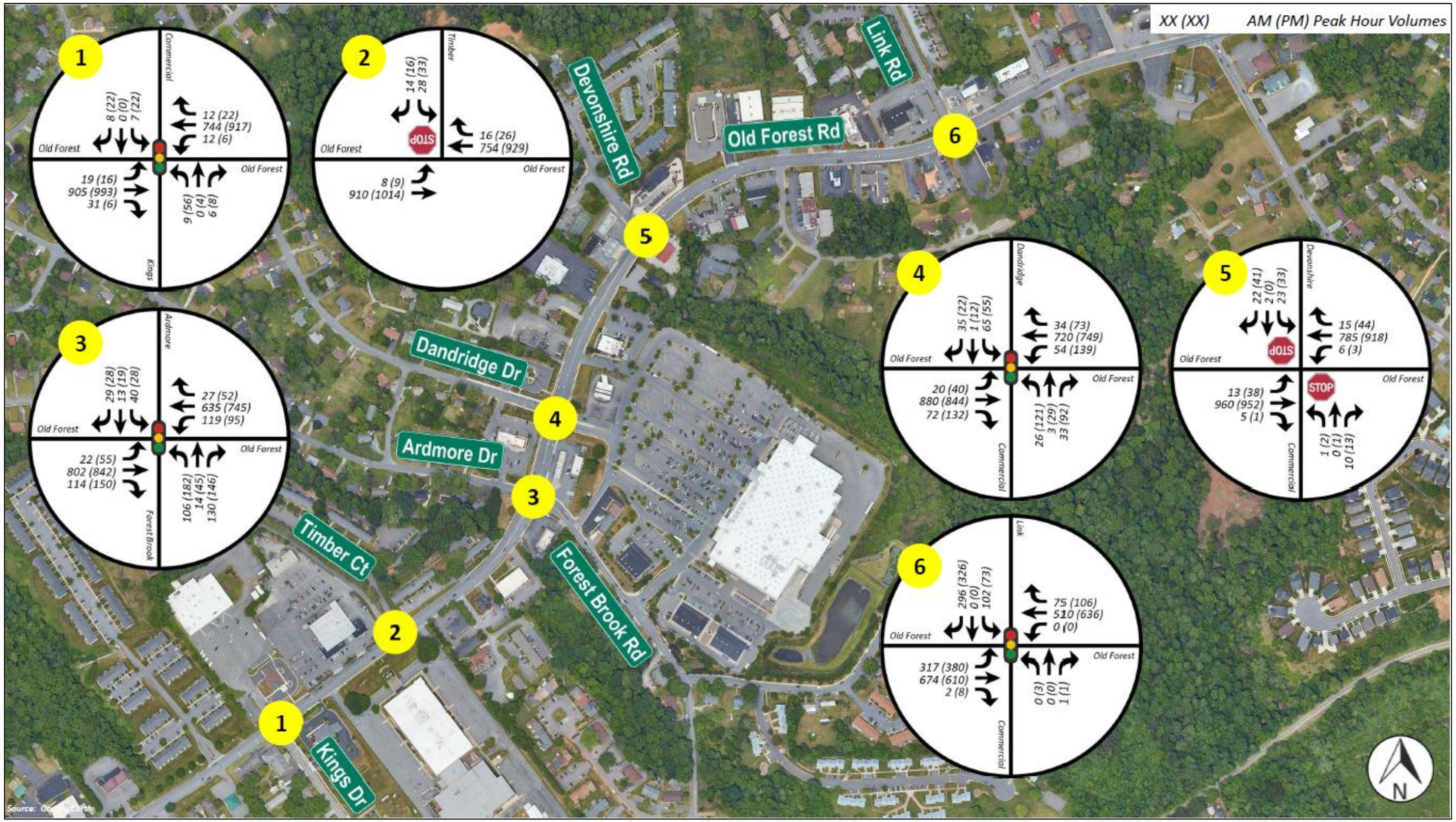


Figure 24: Future AM & PM Peak Hour Turning Movement Volumes



VJuST Analysis

VJuST was used as a high-level screening tool to identify potential alternative concepts at all study area intersections along the Old Forest Road corridor, with the exception of Link Drive, which was recently improved. These concepts were further screened manually based on a number of factors including operational and safety benefits, costs, and right-of-way impacts. The remaining concepts were modeled in Synchro and/or Sidra Intersection.

Figure 25 through Figure 30 show the results of the VJuST analysis for each intersection.

For the initial VJuST screening, the 2023 Existing PM peak hour volumes were used; however, a subsequent screening was developed using the forecasted 2045 No-Build PM peak hour volumes, which are presented in the following tables.

As shown in Table 3 in Chapter 1, the VTrans needs did not identify a congestion issue along the corridor. This was supported by the 2023 Existing and 2045 No-Build PM peak hour VJuST analyses and the 2023 and 2045 No-Build AM and PM peak hour Synchro analysis, as shown previously. In general, a conventional intersection provided some of the best operations at each location; however, it has the highest number of conflict points, which has a higher risk for crash compared to other alternatives.

A preliminary iCAP analysis was developed for each preliminary concept although the Old Forest Road corridor is not on the Arterial Preservation Network (APN). As discussed later in this report, none of the preferred alternatives were carried forward for SMART SCALE applications. The results of the preliminary iCAP analysis are included in Appendix E.

Figure 25: 2045 No-Build PM Peak Hour VJuST Results for Kings Drive

Intersection Results						
		Congestion	Pedestrian	Safety	Planning Level Costs	Notes
Type	Dir	Maximum V/C	Accommodation Compared to Conventional	Weighted Total Conflict Points	Planning Level Cost Category	
Conventional	-	0.05		12	$	
Bowtie	-	0.93	+	24	$$$	
Median U-Turn	-	0.38	+	20	$$	
Partial Median U-Turn	-	0.28	+	28	$$	
Restricted Crossing U-Turn	-	0.37		20	$$	
Thru-Cut	-	0.05		28	$$	
Roundabout	-	0.76		6	$$	

Figure 26: 2045 No-Build PM Peak Hour VJuST Results for Timber Court

Intersection Results						
		Congestion	Pedestrian	Safety	Planning Level Costs	Notes
Type	Dir	Maximum V/C	Accommodation Compared to Conventional	Weighted Total Conflict Points	Planning Level Cost Category	
Conventional	-	0.36		12	$	
Roundabout	-	0.38		6	$$	
Two-Way Stop Control	-	0.32		12	$	

Figure 27: 2045 No-Build PM Peak Hour VJuST Results for Forest Brook Road/Ardmore Drive

Intersection Results						
		Congestion	Pedestrian	Safety	Planning Level Costs	Notes
Type	Dir	Maximum V/C	Accommodation Compared to Conventional	Weighted Total Conflict Points	Planning Level Cost Category	
Conventional	-	0.48		48	$	
Median U-Turn	-	0.63	+	20	$$	
Partial Median U-Turn	-	0.48	+	28	$$	
Quadrant Roadway	N-E	1.94		40	$$$	
Restricted Crossing U-Turn	-	0.48		20	$$	
Thru-Cut	-	0.52		28	$$	
Roundabout	-	0.59		8	$$	

Figure 28: 2045 No-Build PM Peak Hour VJuST Results for Dandridge Drive

Intersection Results						
		Congestion	Pedestrian	Safety	Planning Level Costs	Notes
Type	Dir	Maximum V/C	Accommodation Compared to Conventional	Weighted Total Conflict Points	Planning Level Cost Category	
Conventional	-	0.53		48	$	
Median U-Turn	-	0.55	+	20	$$	
Partial Median U-Turn	-	0.45	+	28	$$	
Quadrant Roadway	S-E	0.50		40	$$$	
Restricted Crossing U-Turn	-	0.43		20	$$	
Thru-Cut	-	0.50		28	$$	
Roundabout	-	0.48		8	$$	

Figure 29: 2045 No-Build PM Peak Hour VJuST Results for Devonshire Drive

Intersection Results						
		Congestion	Pedestrian	Safety	Planning Level Costs	Notes
Type	Dir	Maximum V/C	Accommodation Compared to Conventional	Weighted Total Conflict Points	Planning Level Cost Category	
Conventional	-	0.40		48	$	
Median U-Turn	-	0.38	+	20	$$	
Partial Median U-Turn	-	0.28	+	28	$$	
Restricted Crossing U-Turn	-	0.28		20	$$	
Roundabout	-	0.75		8	$$	
Two-Way Stop Control	-	0.52		48	$	

Figure 30: 2045 No-Build PM Peak Hour VJuST Results for Link Road

Intersection Results						
		Congestion	Pedestrian	Safety	Planning Level Costs	Notes
Type	Dir	Maximum V/C	Accommodation Compared to Conventional	Weighted Total Conflict Points	Planning Level Cost Category	
Conventional	-	0.24		12	$	
Median U-Turn	-	0.54	+	20	$$	
Partial Median U-Turn	-	0.62	+	28	$$	
Restricted Crossing U-Turn	-	0.50		20	$$	
Thru-Cut	-	0.24		28	$$	
Roundabout	-	0.81		6	$$	

Synchro/Sidra Intersection Analysis

The following alternative concepts were analyzed for the 2023 Existing and 2045 No-Build AM and PM peak hours using Synchro 11 and/or Sidra Intersection 8:

- Kings Drive
  - None
- Timber Court
  - Restrict to right-in/right-out with leftover; restricted movements accommodated at Primrose Lane via a signalized u-turn and loon.
- Ardmore Drive/Forest Brook Road
  - Restricted movements.
  - Construction of an exclusive eastbound right-turn lane.
- Dandridge Drive
  - Hybrid roundabout.
  - Restricted movements.
- Devonshire Drive
  - Right-in/right-out
- Link Road
  - None

Note that the restricted movements at the Ardmore Drive/Forest Brook Road and Devonshire Drive intersections were analyzed both with and without the roundabout at Dandridge Drive.

The 2023 Existing analysis was initially analyzed in Synchro for screening purposes; however, only the 2045 No-Build analysis is included in the subsequent tables as it was used as a basis to compare the alternative concepts listed previously.

The 2045 No-Build AM and PM peak hour Synchro analysis shows that all signalized intersections and stop-controlled movements are currently operating at LOS D or better in both peak hours, with the exception of the southbound Devonshire Drive approach, which is anticipated to operate at LOS E in the 2045 No-Build PM peak hour. All of the study area intersections are identified by VTrans as having safety needs (District Safety Improvement). Therefore, while operations do not show the need for improvements at the study area intersections, to address the identified VTrans needs and crash history along the corridor, the following improvements were carried forward and presented to the stakeholders.

Timber Court

As shown in Table 9, the Timber Court approach is not anticipated to experience any significant congestion in the 2045 No-Build AM or PM peak hour. It is currently a stop-controlled intersection along a 4-lane undivided roadway with no access restriction. Converting this intersection to a restricted right-in/right-out with leftover configuration would reduce the number of conflict points and enhance safety for vehicular traffic.

Table 9 also shows that with the restriction implemented at Timber Court, operations on the southbound Timber Court approach are anticipated to operate better than the existing full access configuration because the southbound left-turn delays are no longer present.

Other improvements were considered during Phase 1, including an interparcel connector through the YMCA/KIA parking lot; however, at the direction of the stakeholders during a meeting held on September 7, 2023, these concepts were not carried forward to Phase 2.

Table 9: Timber Court LOS & Delay Summary

Alternative Option	LOS - Delay (sec/veh)	
	2045 AM	2045 PM
No-Build[1]	C - 16.6	C - 20.0
Build (Right-in/Right-out with Leftover)	B - 11.6	B - 12.9

[1] *LOS and Delay reported for the southbound Timber Court approach*

Primrose Lane

Primrose Lane was not initially identified as a study area intersection. It is currently a stop-controlled intersection south of Kings Drive. With Timber Court being converted to a right-in/right-out with leftover intersection, Primrose Lane was identified as an appropriate location to provide u-turn access for those restricted movements at Timber Court (southbound left-turn). As a result, a traffic signal was analyzed at the Primrose Lane to accommodate the anticipated westbound u-turns. The construction of a U-turn loon is also included in this concept. As shown in Table 10, with the improvements at Primrose Lane the intersection is anticipated to operate at LOS A in both the AM and PM peak hours, with minimal overall delay.

Table 10: Primrose Lane LOS & Delay Summary

Alternative Option	LOS - Delay (sec/veh)	
	2045 AM	2045 PM
No-Build[1]	-	-
Build (Signalized U-turn Loon[2]**)**	A - 0.1	A - 0.2

[1] *Not part of original study area*

[2] *Included in analysis to accommodate restricted movements Timber Court*

Forest Brook Road

Forest Brook Road is not anticipated to experience any significant congestion in the 2045 No-Build AM or PM peak hour, as shown in Figure 11. However, based on the identified VTrans needs, constructing an exclusive northbound right-turn lane at this location was identified as a viable option that would enhance safety by removing northbound right-turning vehicles from the mainline flow of traffic quicker and safer than in the existing conditions.

Table 11 also shows that with the exclusive northbound right-turn lane constructed, the intersection is anticipated to continue operating at LOS B in both peak hours.

A second alternative at this intersection was considered that included restricting movements. These restrictions were considered as part of the installation of a hybrid roundabout at the Dandridge Drive intersection that would provide accommodations for restricted movements at Forest Brook Road and Devonshire Drive.

Table 11 shows that with the restrictions in place, the overall intersection is anticipated to continue operating at LOS B in both peak hours.

Table 11: Forest Brook Road LOS & Delay Summary

Alternative Option	LOS - Delay (sec/veh)	
	2045 AM	2045 PM
No-Build	B - 12.7	B - 14.6
Build (Restricted Movements)	B - 11.5	B - 11.4
Build (Eastbound Right-Turn)	B - 12.3	B - 14.4

Dandridge Drive

Dandridge Drive is not anticipated to experience any significant congestion in the 2045 No-Build AM or PM peak hour, as shown in Table 12. However, based on the identified VTrans needs, two options were identified at this location – constructing a hybrid roundabout or constructing a channelized northbound right-turn lane.

In conjunction with the construction of a hybrid roundabout at this location, several movements at Forest Brook Road and Devonshire Drive were also restricted. These restricted movements can be accommodated at the Dandridge Drive roundabout.

Table 12 shows that both options are anticipated to operate acceptably, with the overall levels of service for both options operating at LOS B or better in both peak hours. It is important to note that the roundabout is not dependent on the adjacent intersections having restricted turning movements and is feasible without them.

Table 12: Dandridge Drive LOS & Delay Summary

Alternative Option	LOS - Delay (sec/veh)	
	2045 AM	2045 PM
No-Build	A - 7.7	B - 11.5
Build (Hybrid Roundabout[1]**)**	A - 5.0 (0.452)	A - 7.1 (0.554)
Build (Channelized Eastbound Right-Turn)	A - 7.5	B - 10.8

[1]Overall LOS and delay is from Sidra for the hybrid roundabout; includes rerouted traffic; volume-to-capacity (V/C) reported for the worst approach.

Devonshire Drive

The southbound Devonshire Drive approach is anticipated to operate at LOS D and LOS E in the 2045 No-Build AM and PM peak hours, respectively, as shown in Table 13. Based on the identified VTrans needs, restricting movements at the intersection was considered a viable option (in conjunction with constructing a hybrid roundabout at the Dandridge Drive intersection). Table 13 also shows that restricting the southbound Devonshire Drive approach to a right-in/right-out would increase the delay and worsen the level of service in the PM peak hour; however, it would enhance safety by eliminating some of the conflict points at this intersection.

Table 13: Devonshire Drive LOS & Delay Summary

Alternative Option	LOS - Delay (sec/veh)	
	2045 AM	2045 PM
No-Build[1]	D - 32.1	E - 42.5
Build (Right-in/Right-out[1]**)**	C - 17.2	D - 25.0

[1] *LOS and Delay reported for the worst side street approach*

Old Forest Road

As previously mentioned, VTrans identified bicycle access as a very high priority. Two road diet concepts were presented to the stakeholders during a meeting held on September 5, 2023. These concepts included a 3-lane cross-section that includes bike lanes and a 2-lane cross-section with a concrete median that would provide off-street bicycle accommodations. Ultimately, at the direction of the stakeholders, these concepts were not carried forward to Phase 2.

Figure 31: Timber Court Right-in/Right-out and Primrose Lane U-turn Phase 2 Concept

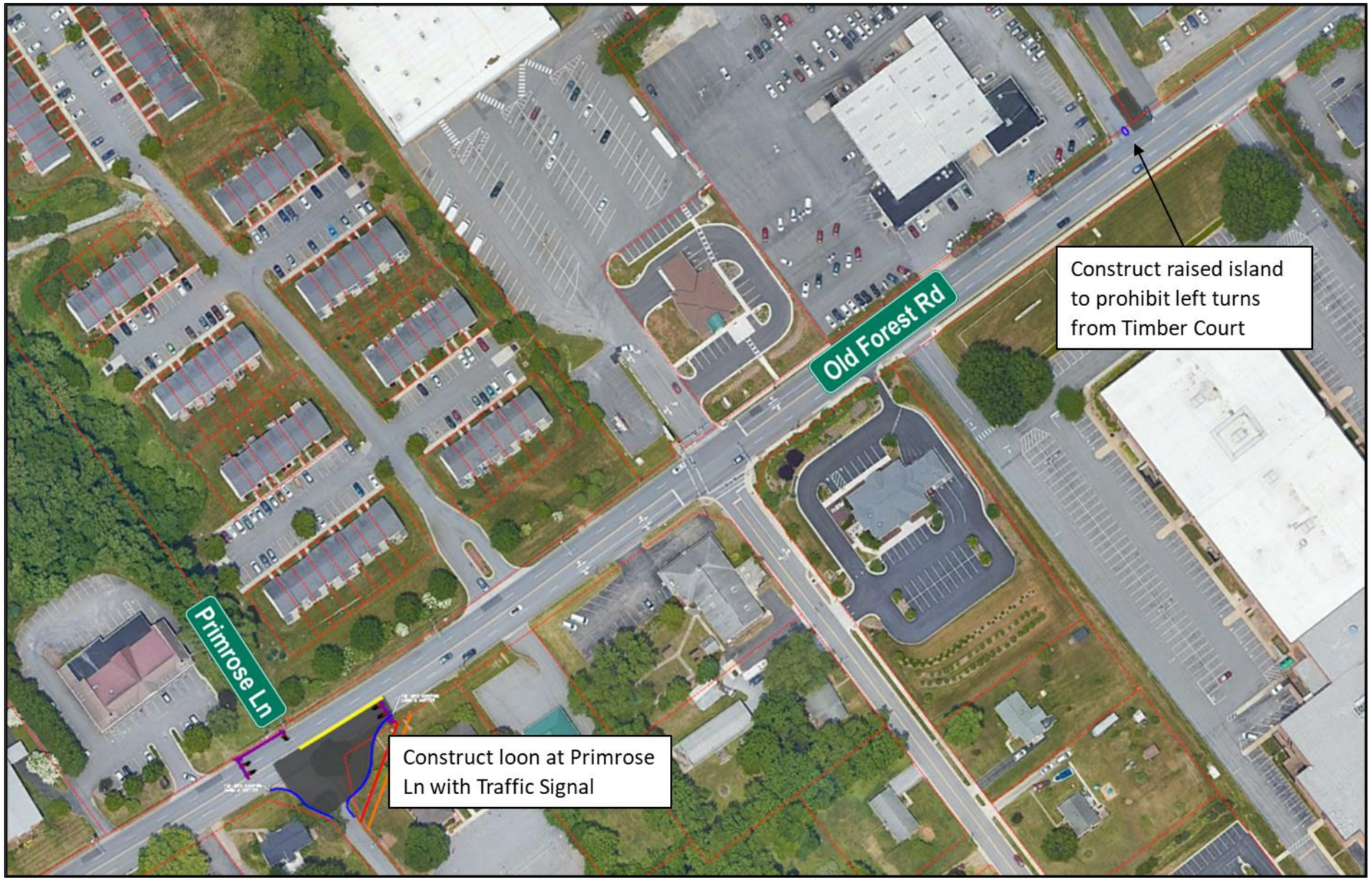


Figure 32: Forest Brook Road Northbound Right-Turn Lane Phase 2 Concept

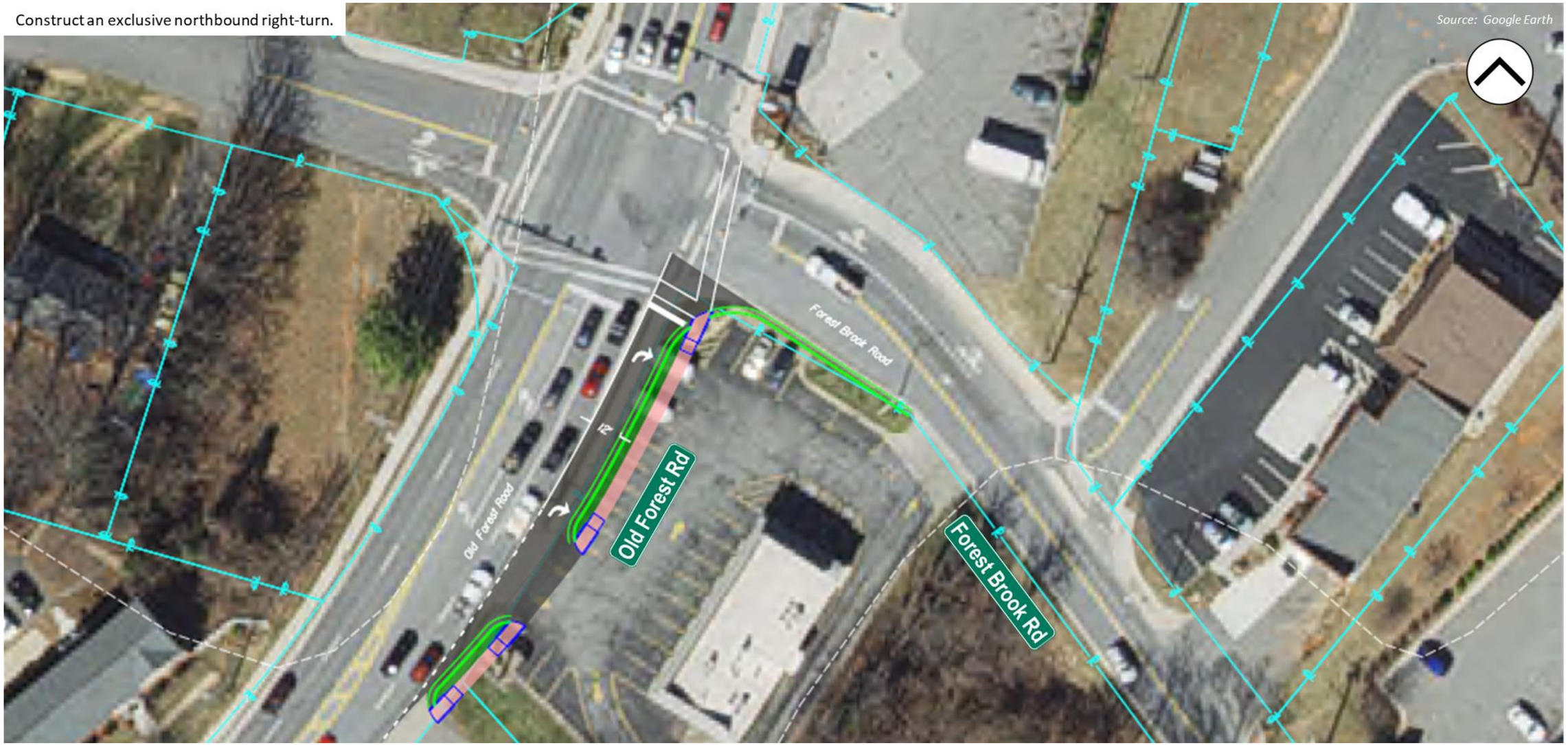
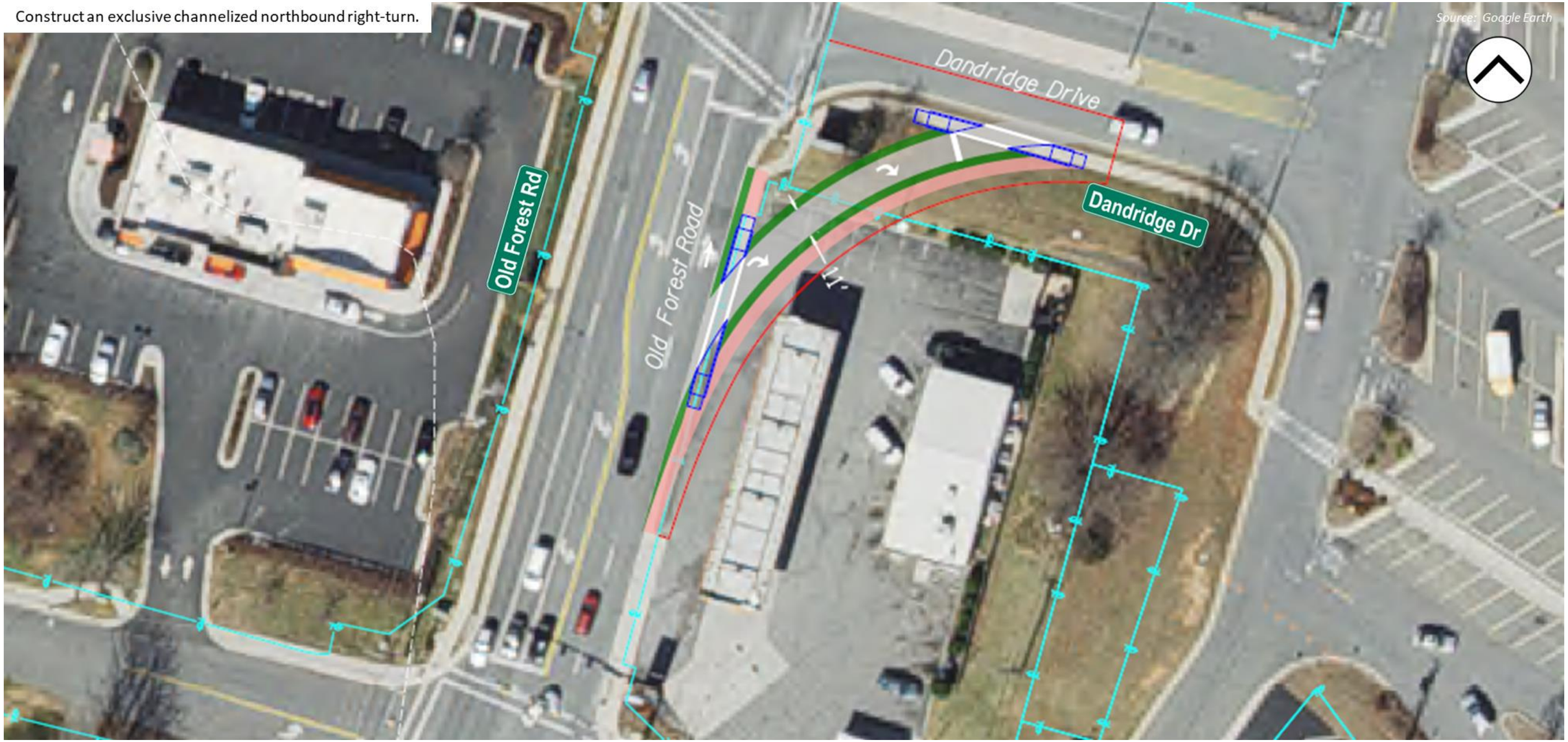


Figure 33: Dandridge Drive Hybrid Roundabout Phase 2 Concept

Figure 34: Dandridge Drive Northbound Channelized Right-Turn Phase 2 Concept



Preferred Alternatives

Preferred alternatives were developed at each intersection based on the VJuST screening, the Synchro and/or Sidra Intersection analysis and input from the stakeholders during a working group meeting held on February 12, 2024.

The City indicated that the following concepts should be carried forward to Phase 3 as preferred alternatives:

- Providing sidewalk connectivity along the west/north side of Old Forest Road, between Kings Drive and east of Timber Court.
- Improving the bus stop on the west/north side of Old Forest Road, in front of KIA, just south of Timber Court.

Expected Crash Reduction

The SMART SCALE Planning Level Crash Modification Factors (CMFs) for Round 5 were reviewed for each of the improvements included at the study area segments and intersections along the Old Forest Road corridor to determine what changes may be expected in crash frequency. Ultimately, the preferred concepts being carried forward to Phase 3 are not anticipated to reduce vehicle crashes along the corridor. It is important to note that the CMF for pedestrian crashes for adding sidewalk is 12% reduction and applies to new sidewalks (not upgrades or widening).

Chapter 3 – Public and Stakeholder Outreach and Feedback

Public Involvement

Typically, public involvement for Pipeline projects includes at least two surveys; however, for this corridor, only the Phase 1 survey was needed (discussed in Chapter 1 of this report). The survey was developed using the PublicInput.com platform and focused on soliciting public feedback regarding their use of the corridor and identifying issues and needs along the corridor. It was available for public feedback from August 30, 2023 – September 13, 2023.

As part of Phase 2, a stakeholder meeting was held on February 12, 2024 to discuss the alternative concepts at the study area intersections and segments along the Old Forest Road corridor that were developed during Phase 1 and Phase 2. Based on input from the stakeholders, it was determined that a survey would not be needed as part of Phase 2 as the improvements approved to be carried forward to Phase 3 were needed to meet ADA standards. These improvements include:

- Providing sidewalk connectivity along the west/north side of Old Forest Road, between Kings Drive and east of Timber Court.
- Improving the bus stop on the west/north side of Old Forest Road, in front of KIA, just south of Timber Court.

Chapter 4 – Preferred Alternative Design Refinement and Investment Strategy

Intent of Phase 3

As part of Phase 3, the preferred alternatives carried over from Phase 2 were further refined and detailed cost estimates were developed in order to aid with project funding and validation. The design refinement process included in Phase 3 intends to provide highly-detailed designs and cost estimates, while also identifying and mitigating risks associated with the designs.

As noted previously, the following projects were identified as preferred alternatives by the stakeholders during a meeting held February 12, 2024:

- Providing sidewalk connectivity along the west/north side of Old Forest Road, between Kings Drive and east of Timber Court.
- Improving the bus stop on the west/north side of Old Forest Road, in front of KIA, just south of Timber Court.

While these projects were identified as preferred alternatives during the meeting, City staff later indicated that these projects would not be submitted for SMART SCALE funding during this cycle; however, based on discussions with VDOT this document is being prepared as though the preferred alternatives are being carried through to the funding stage and will be a shelf-ready document in the future. Additionally, for the purposes of this study, these improvements were combined into a single improvement project.

Preferred Alternative Refinement

No modifications were made to the *Synchro* or *Sidra* models developed during Phase 1 and Phase 2.

Designs for each of the preferred alternatives were refined, and the final concepts were developed with the following design details and assumptions. These designs conform to VDOT's most-recent *Road Design Guide (published January 1, 2005; revised July 11, 2024)* and the *2009 Manual on Uniform Traffic Control Devices (MUTCD).*

Sidewalk Connectivity & Bus Stop Upgrade

Sidewalk connectivity is being provided along the west/north side of Old Forest Road, between Kings Drive and east of Timber. The sidewalk was designed to be 5 feet wide with a minimum setback of 3 feet. The bus stop on the west/north side of Old Forest Road, in front of KIA, just south of Timber Court was identified as being deficient during the site visit on July 14, 2023. To meet ADA standards, this bus stop was enhanced to include an 8.5-foot by 8-foot concrete pad with a cross slope of 2% towards the roadway.

The final concept design is shown in Figure 35.

Risk Assessment

No significant risks were identified for either of the preferred alternatives in Phase 3. Some minor risks to note are, one fire hydrant and two existing apartment complex signs will need to be relocated, as well as coordination with the existing bus stop to ensure service is maintained throughout construction. Consideration was given to the potential to impact a nearby utility pole. This was accounted for as an allowance in the contingency estimate.

Cost Estimate

Cost estimates for each of the preferred alternatives were developed using VDOT's *Cost Estimate Workbook (CEWB, published February 1, 2023)* and other resources as needed. Table 14 summarizes the cost estimates developed for each of the preferred alternatives in Phase 3, with a detailed breakdown of each preferred alternative's cost estimate included in Appendix F.

Table 14. SMART SCALE-Level Cost Estimates for the Preferred Alternatives

Preferred Alternative	Preliminary Engineering	Right-of-Way and Utilities	Construction	Contingency	Total Cost
Sidewalk Connectivity and Bus Stop Enhancements	$33,900	$90,000	$150,480	$100,755	$375,135

Investment Strategy

While this study was developed following the guidance included in the *Project Pipeline Program Guide 2023 – 2024 (dated January 2023) and the SMART SCALE Technical Guide (dated February 2024)*, as noted previously, the preferred alternatives included in Phase 3 are not being submitted as part of the SMART SCALE applications during this round; however, there are potential funding sources that can aid with the final development and construction of each of the preferred alternatives including VDOT's Revenue Sharing Program, the United States Department of Transportation's (USDOT) Congestion Mitigation and Air Quality (CMAQ) Improvement Program and the Virginia Highway Safety Improvement Program (VHSIP). Table 15 shows which funding sources the preferred alternatives may be applicable for.

Table 15. Project Funding Sources

Funding Source	Project Types Funded	Preferred Alternative Applicable
VDOT Revenue Sharing[1]	Appropriate for local construction projects, reconstruction projects, improvement projects and maintenance projects on VDOT- or locally-maintained roadways.	Sidewalk connectivity
USDOT CMAQ[2]	Appropriate for projects that reduce congestion and/or improve air quality by reducing emissions. Many types of projects are eligible under the CMAQ program including: • Electric vehicles and charging stations • Diesel engine replacements and retrofits • Transit improvements • Bicycle and pedestrian facilities • Shared micromobility projects including shared scooter systems	Sidewalk connectivity Bus Stop Enhancements

[1] https://www.vdot.virginia.gov/doing-business/for-localities/local-assistance/revenue-sharing/ & https://law.lis.virginia.gov/vacode/title33.2/chapter3/section33.2-357/

[2] https://www.transportation.gov/sustainability/climate/federal-programs-directory-congestion-mitigation-and-air-quality-cmaq & https://www.fhwa.dot.gov/environment/air_quality/cmaq/index.cfm

Figure 35: Final Sidewalk Connectivity & Bus Stop Upgrade Design

Appendices

Appendix A:

Framework Document

Pre-Scoping Meeting Presentation

Kickoff Meeting Presentation

Field Visit Notes

Appendix B:

Phase 1 Executive Summary

Appendix C:

Phase 1 Stakeholder Working Group Presentation

Crash Diagrams and HSM Spreadsheets

Traffic Count Data

Existing Conditions Analysis Results

Phase 1 Public Outreach

Appendix D:

Volume Balancing Sheet

Traffic Forecasting

Future No-Build Condition Analysis Results

Traffic Signal Timing Plans

Appendix E:

Phase 2 Shareholder Working Group Meeting Presentation

iCAP Workbooks

Appendix F:

Preliminary Alternative Future Build Condition Operational Analysis Results

Basis of Design Memos

Preferred Alternative Cost Estimate

Appendix A:

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Appendix D:

Volume Balancing Spreadsheet

Traffic Forecasting

Future No-Build Condition Analysis Results

Traffic Signal Timing Plans

Appendix E:

Phase 2 Stakeholder Working Group Meeting Presentation

iCAP Workbooks

Appendix F:

Preliminary Alternative Future Build Condition Operational Analysis Results

Basis of Design Memos

Preferred Alternative Cost Estimate