



PROJECT PIPELINE

LY-23-08 | Lynchburg
Central Boulevard | Memorial Drive to
Industrial Avenue





Central Boulevard from Memorial Drive to Industrial Avenue

Final Report

August, 2024

Prepared for



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Chapter 1 – Needs Evaluation and Diagnosis

Introduction

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

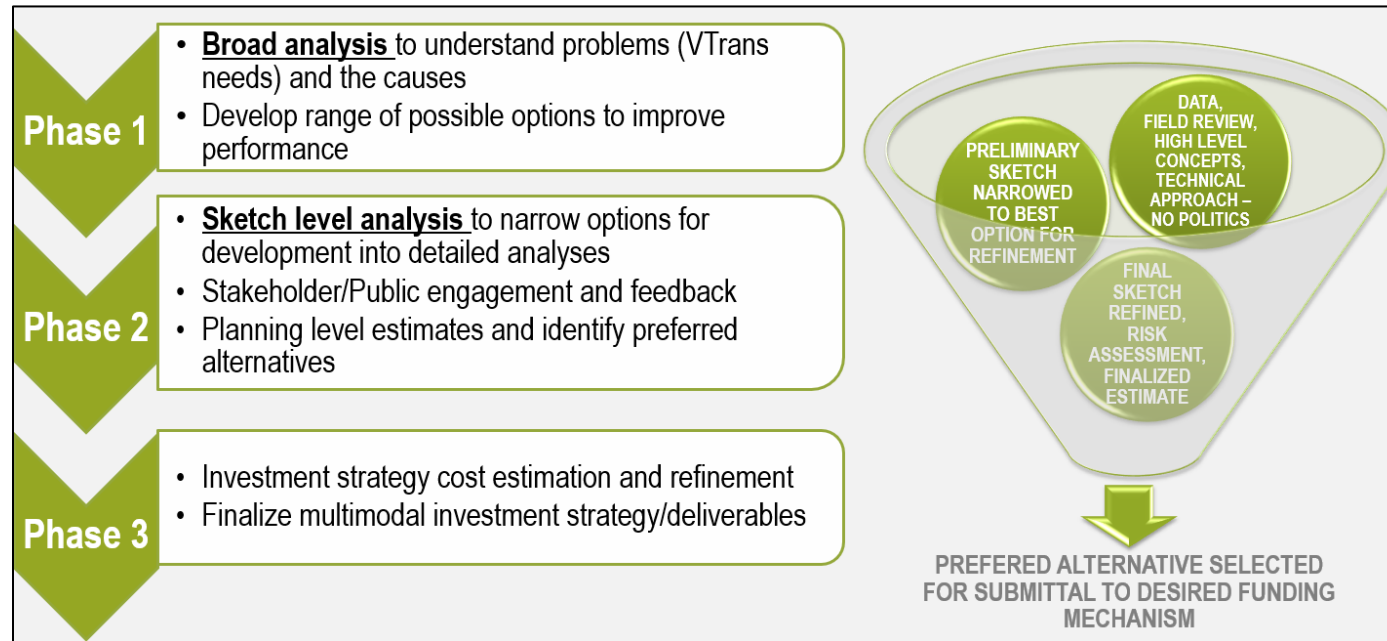
Table 1: List of VTrans Needs

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 Central Boulevard corridor, between Memorial Avenue and Industrial Avenue is located in Danville, Virginia. It is classified as a principal arterial with a posted speed limit of 40 miles per hour (mph) within the study area. There are 7 crossovers within this 1.33-mile corridor along Central Boulevard. The Central Boulevard corridor study limits are shown in Figure 4.

Figure 4: Central Boulevard 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 Langhorne Road corridor, were identified as “Very High” for Bicycle Access and Transportation Demand Management, “High” for Safety Improvement and “Medium” for Pedestrian Access, Pedestrian Safety Improvement and Transit Access, as shown in Table 3.

Table 3. VTrans Needs in Study Area

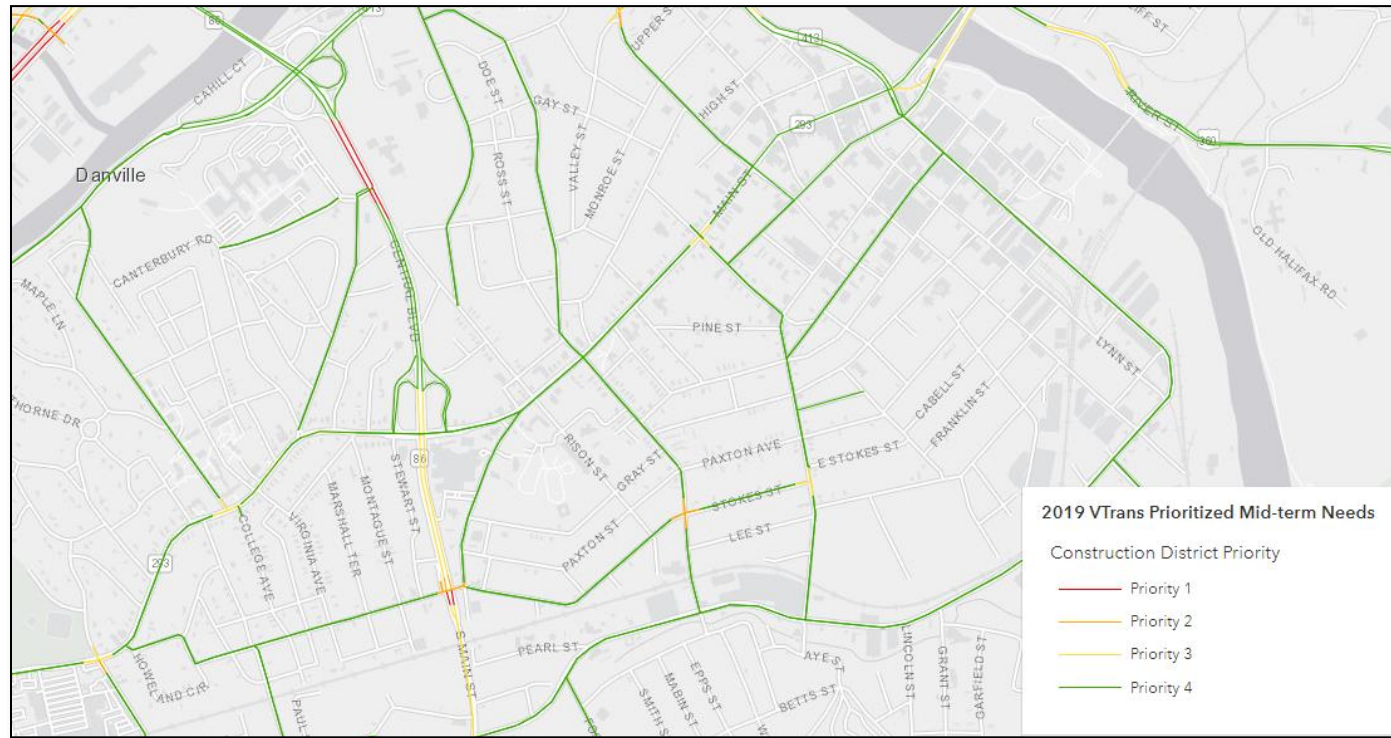
VTRANS IDENTIFIED NEEDS	PRIORITIES
Bicycle Access	Very High
Capacity Preservation	None
Congestion Mitigation	None
IEDA (UDA) Access	None
Pedestrian Access	Very High
Safety Improvement	Very High
Pedestrian Safety Improvement	High
Reliability	None
Rail On-time Performance	Low
Transit Access	High
Transit Access for Equity Emphasis Areas	None
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 Appendix A includes detailed notes for the corridor and each of the study intersections.

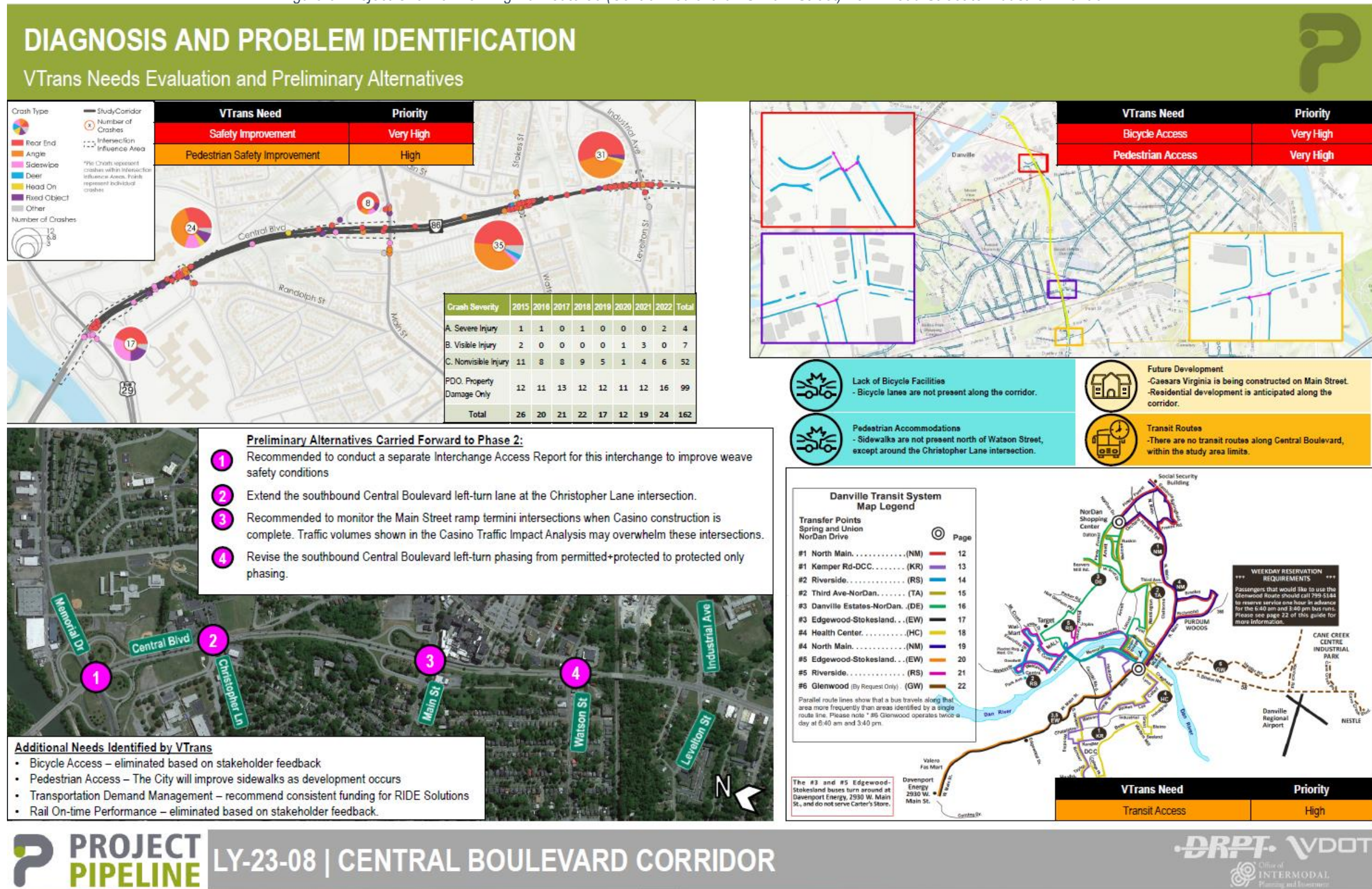
¹ Commonwealth Transportation Board, Actions to Approve the 2019 VTrans Vision, Goals, Objectives, Guiding Principles and the 2019 Mid-term Needs Identification Methodology and Accept the 2019 Mid-term Needs, January 15, 2020

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



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

Figure 6. Project Overview for Virginia Route 86 (Central Boulevard / S Main Street) from Broad Street to Industrial Avenue



LY-23-08 | CENTRAL BOULEVARD CORRIDOR

Previous Study Efforts

As detailed in the stakeholder meeting held on September 7, 2023, there were two nearby studies noted:

- Dan River Mills Redevelopment (EPR – September 2020): This traffic impact analysis (TIA) was prepared for the Dan River Mills Casino project (Caesars Virginia), located on a vacant site north of West Main Street, between Bishop Road and Wood Avenue. A build year of 2045 was used for the ultimate buildout analysis. No study area intersections in this TIA's study area overlap the study area intersections in the LY-23-08 corridor study.
- South Main at Stokes Street Intersection Study (EPR – April 2020): This study analyzed the existing traffic operations at South Main Street and Central Boulevard intersections along Stokes Street. Only the Central Boulevard and South Main Street intersection overlaps the LY-23-08 corridor study. Recommendations at this intersection were made related to constructing an exclusive northbound right-turn lane and other enhancements.

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. A 0.5-mile radius was used for the analysis buffer. The results of the STEAP Tool analysis are presented below:

- Most of the population (62%) within the study area is between the ages 18 and 64 as shown in Figure 7.
- There is a high personal vehicle ownership, with 38% of households owning one vehicle, 23% owning two vehicles and 19% owning three or more vehicles. Figure 8 shows that one out of every five households do not own a personal vehicle.
- Figure 10 shows that the population in the study area has a lower-than-average number of veterans, people with disabilities, households with no computers, and the number of households without internet connection when compared to the City of Danville as a whole. Compared to the Commonwealth of Virginia, the number of veterans in the study area is lower; however, there are a greater number of people with disabilities, households with no computers and number of households without internet connection.
- Of all the households in the study area, 20% have household income less than \$15,000, as shown in Figure 11.

Figure 7. STEAP Tool Analysis Population by Age Group

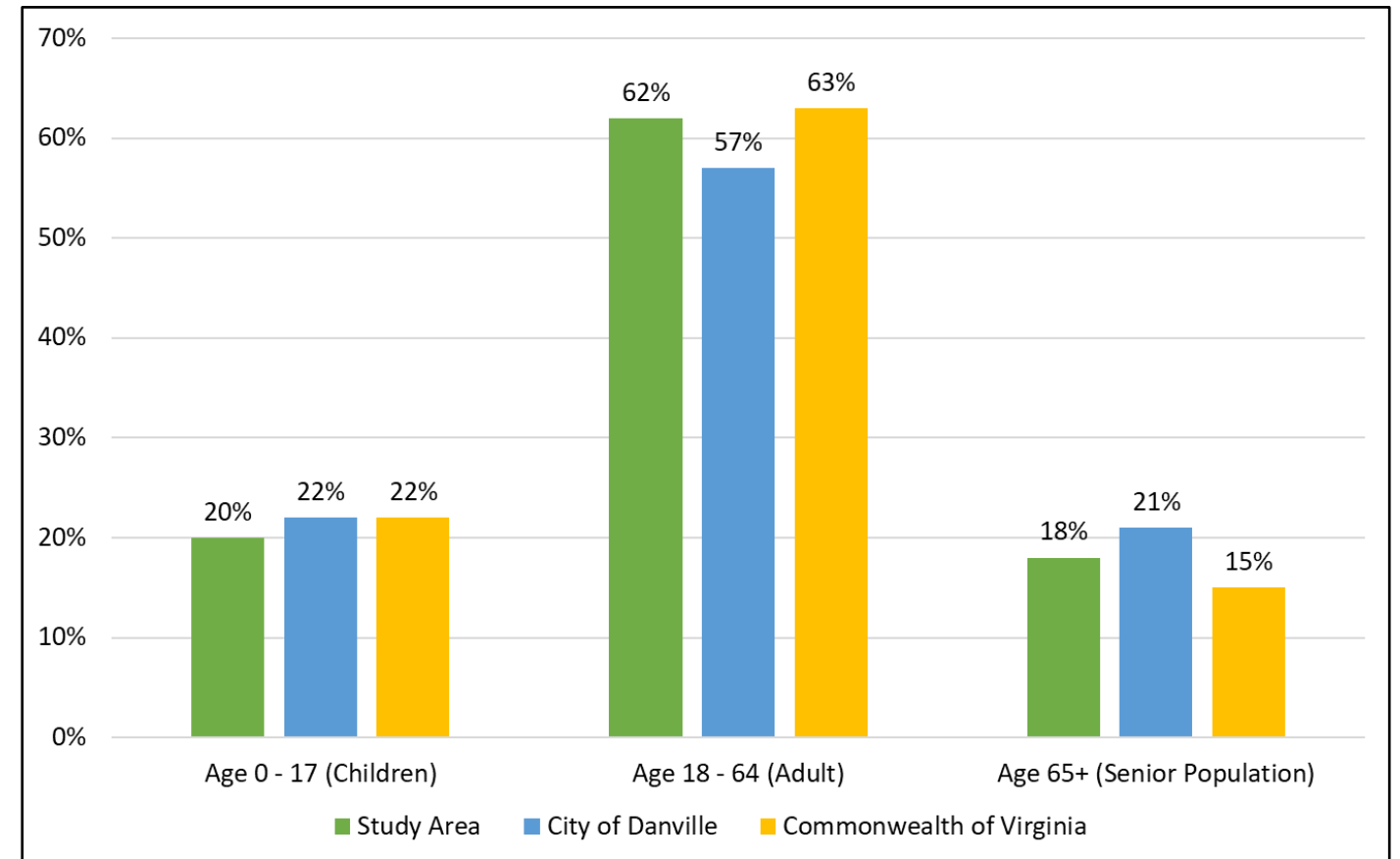


Figure 8. STEAP Tool Analysis Vehicle Ownership

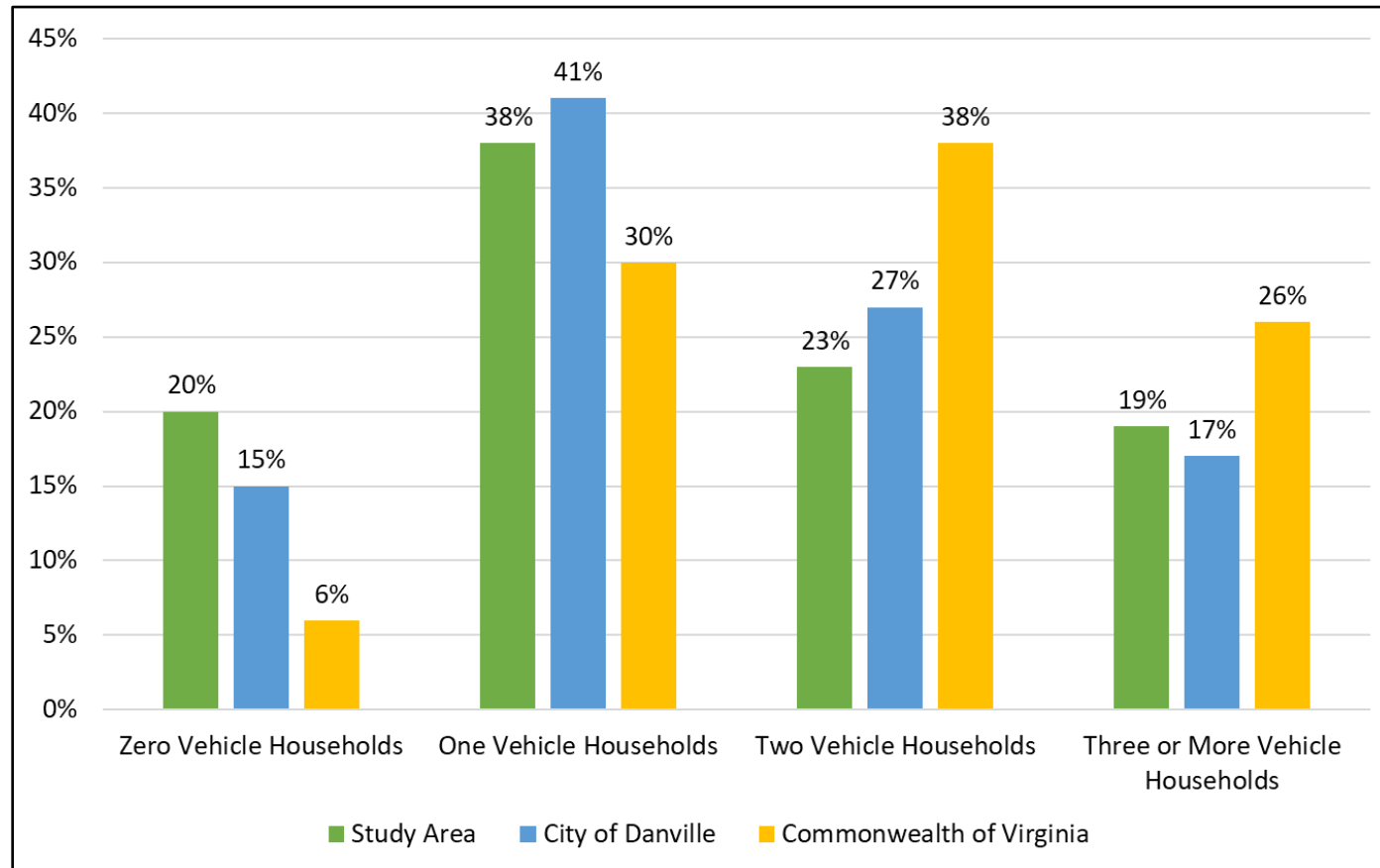


Figure 9. STEAP Tool Analysis English Proficiency in Non-English Speaking and Multilingual Households

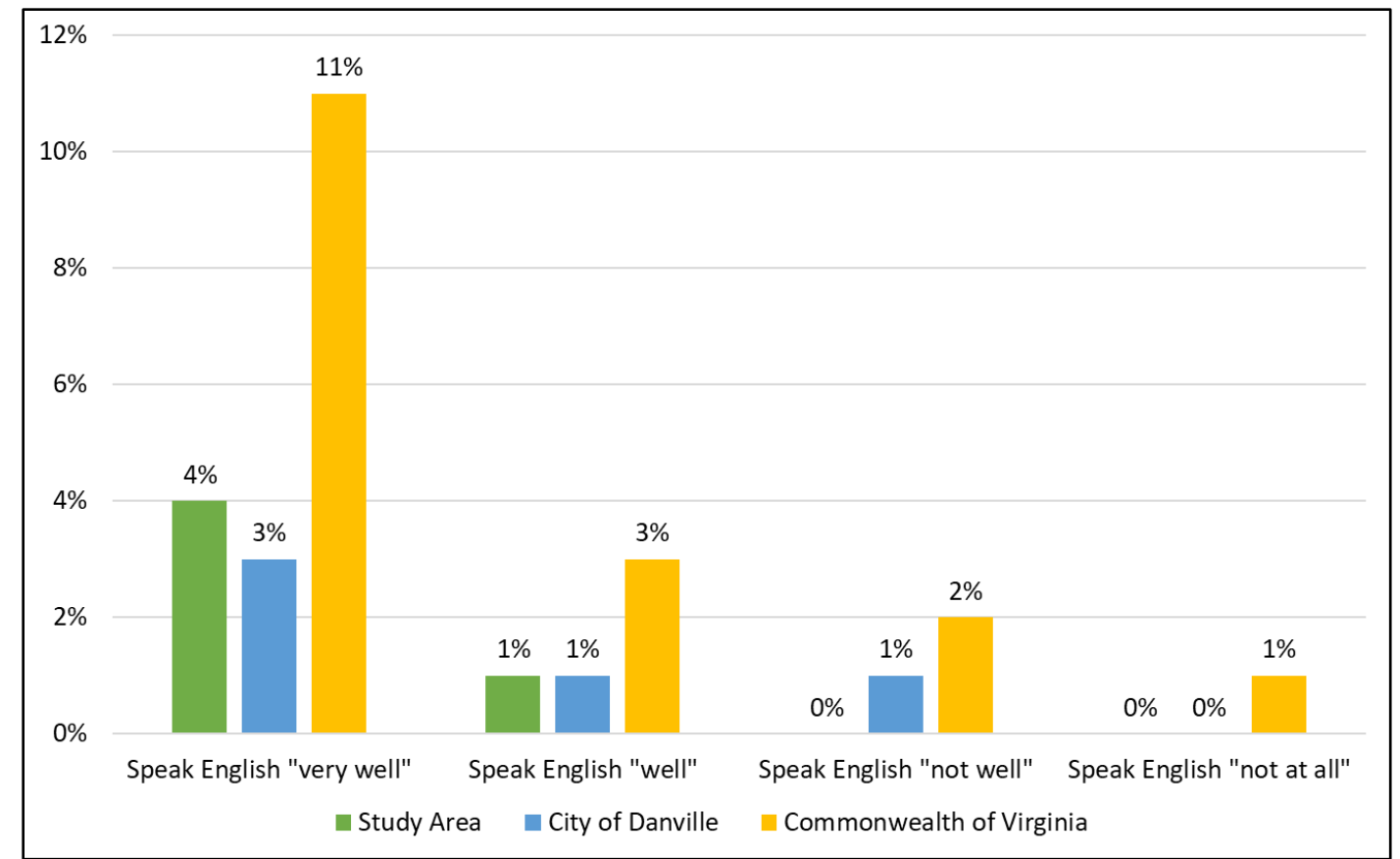


Figure 10. STEAP Tool Analysis Vulnerable Populations

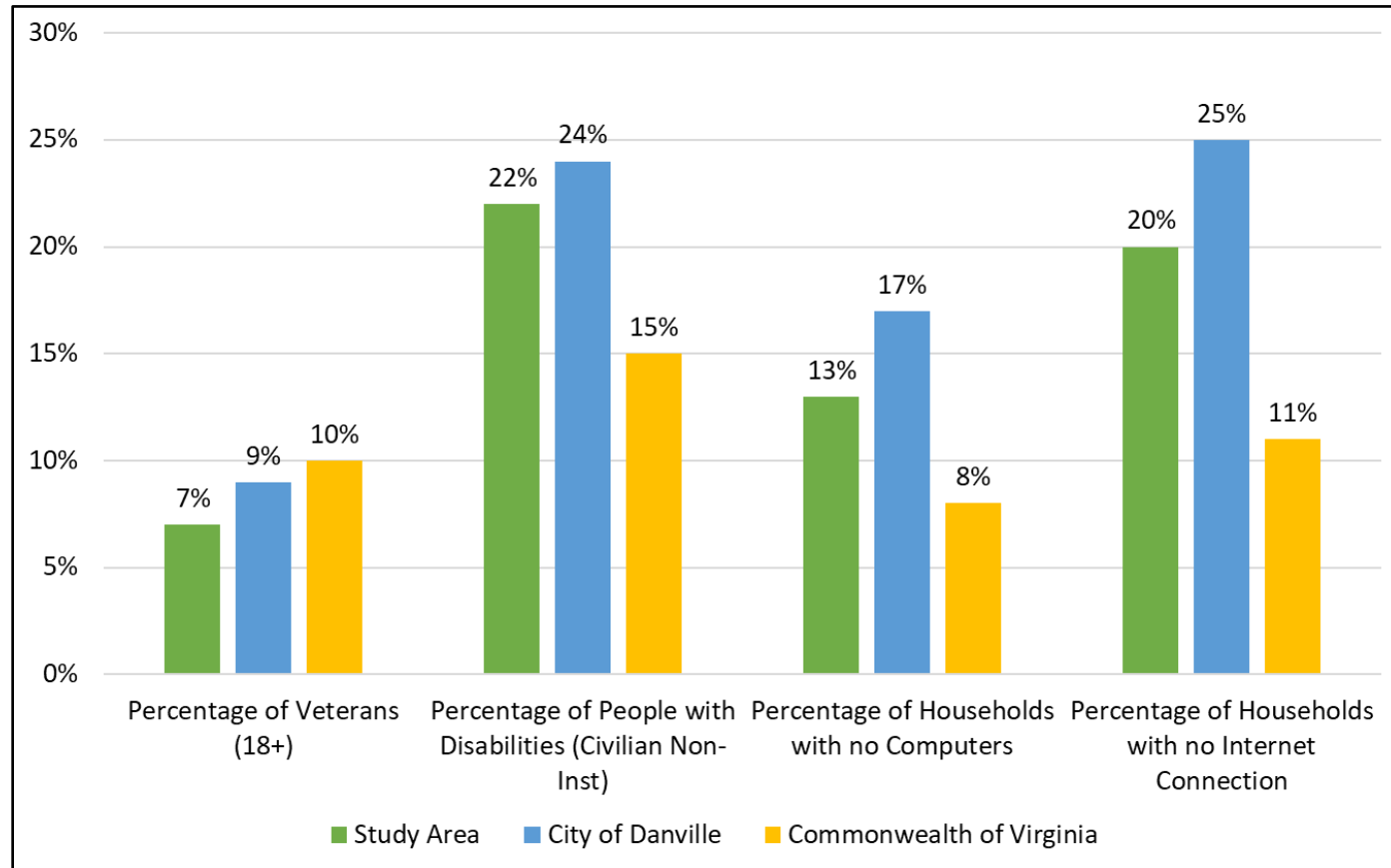
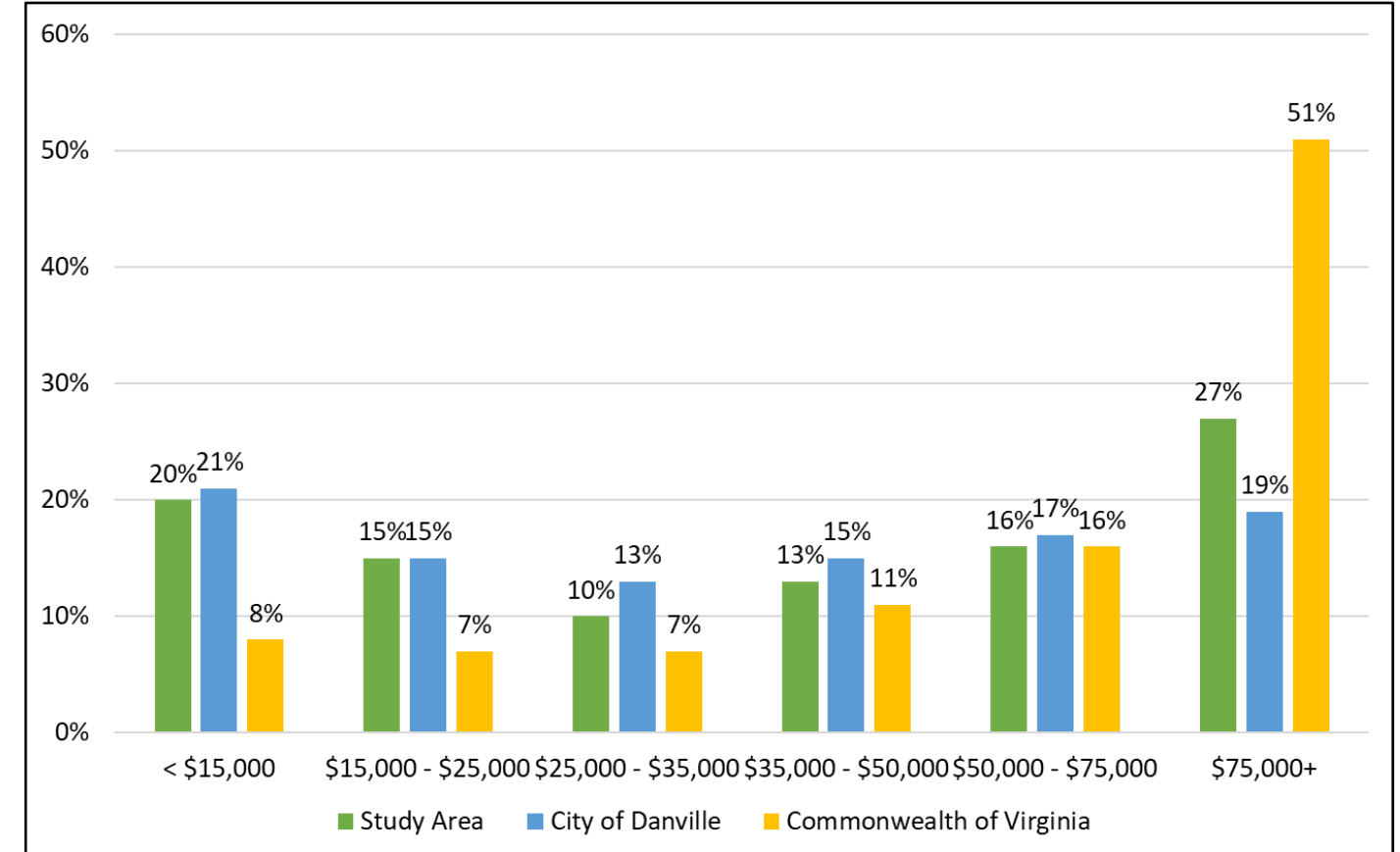


Figure 11. STEAP Tool Analysis Household Income



Traffic Operations and Accessibility

A traffic operational analysis was performed using Synchro 11 and/or Sidra Intersection 8 software for all study intersections along the Central Boulevard 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.

Due to the presence of two interchanges along the study area corridor, VISSIM was used during the Phase 1 analysis; however, no recommendations were identified at either interchange. Therefore, as part of the Phase 2 scoping, the interchange locations were not further analyzed and Synchro was deemed to be an appropriate software package for the Phase 2 and Phase 3 analysis/

Traffic Data

The traffic data for the study area was obtained from turning movement counts collected on Thursday, May 11, 2023 between 7:00 AM and 7:00 PM, as well as tube count data collected between midnight on Wednesday, May 11, 2023 and midnight on May 12, 2023 (48 hours). 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 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 was obtained from Chapter 4 of the VDOT TOSAM. A summary of the MOEs evaluated for the study intersections is presented below:

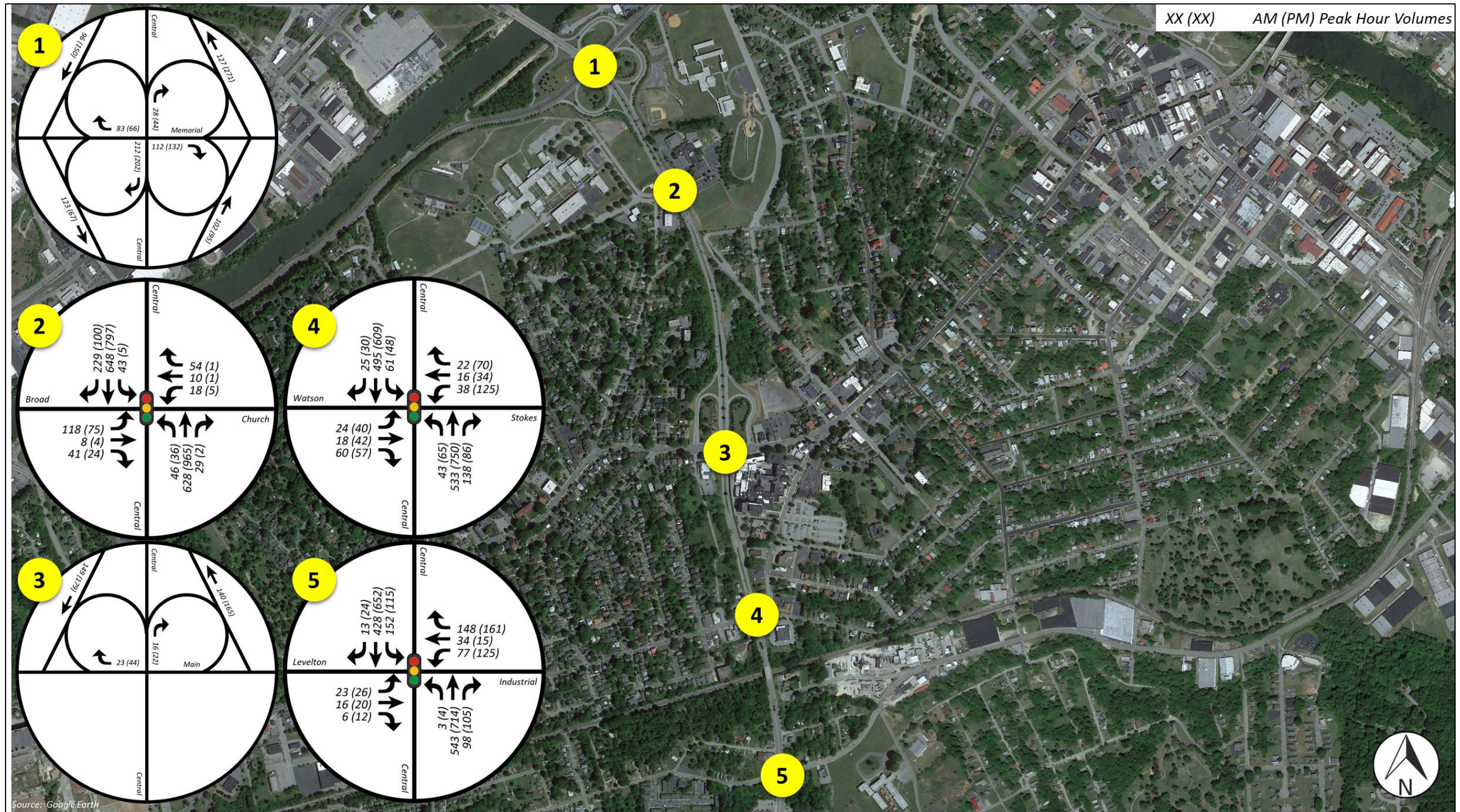
- Control Delay (measured in seconds per vehicle – sec/veh)
- Level of service (LOS)
- 95th Percentile Queue Length for Synchro and SIDRA (measured in feet – ft)
- Volume-to-Capacity (v/c) Ratio

Traffic Operations Analysis Results

Overall, the study area intersections along Central Boulevard / S Main Street are currently operating under capacity, with the intersection Level of Service (LOS) at B or better for each of the three intersections during both AM and PM peak hours. As well, the interchanges with Route 413 (Memorial Drive) and Route 293 (W Main Street) operate at LOS A during both peak periods. Operations along the corridor are summarized below. Detailed analysis results are provided in Appendix C.

- The side street approaches at Christopher Lane / Broad Street achieve LOS between C and D during the peak periods, with the westbound left and through movements at LOS E during the PM peak hour.
- At the Industrial Avenue intersection, the eastbound left and through movement operate at LOS E during both peak hours. The northbound left-turn also operates at LOS E through both AM and PM peaks. The overall intersection LOS is B for both peak hours.
- The weaving segments at the Memorial Drive interchange operate at LOS B or better during both peak hours, with densities ranging from 6.6 vehicles per mile per lane to 10.7 vehicles per mile per lane.
- Each of the ramp movements at the W Main Street interchange operate at LOS A during both peak hours, with densities ranging from 4.7 vehicles per mile per lane to 8.4 vehicles per mile per lane.

Figure 12. Turning Movement Counts



Pedestrian and Bicycle Access

Sidewalks are present along both sides of Central Boulevard from Watson Street to the southern extents of the corridor study. North of Watson Street, Central Boulevard primarily functions as a controlled-access facility, with no sidewalks present, except for a small section south of Broad Street.

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 Central Boulevard. 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 13. Figure 14 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	1	2	11	12	26
2016	0	1	0	8	11	20
2017	0	0	0	8	13	21
2018	0	1	0	9	12	22
2019	0	0	0	5	12	17
2020	0	0	1	1	11	12
2021	0	0	3	4	12	19
2022	0	2	0	6	16	24
Total	0	4	7	52	99	162

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	2	3	22	35	62
Angle	0	1	3	16	26	46
Head On	0	0	0	1	2	3
Sideswipe – Same Direction	0	0	0	2	15	17
Fixed Object in Road	0	0	0	1	1	2
Non-Collision	0	0	0	0	2	2
Fixed Object – Off Road	0	1	1	3	9	14
Deer	0	0	0	1	1	2
Other Animal	0	0	0	0	0	0
Ped	0	0	0	0	0	0
Other	0	0	0	6	8	14
Total	0	4	7	52	99	162

A total of 162 crashes were reported within the Central Boulevard corridor study area during the eight-year study period.

Key takeaways from the crash data are as follows:

1. The three lowest reported crash years have occurred during the past four years with the lowest (12) in 2020, second lowest (17) in 2019 and third lowest (19) in 2021; however, 2022 had the second highest number of reported crashes (24).
2. The approximate average number of reported crashes per year is 20.
3. Rear End crashes (38%) were the highest reported crashes along the corridor.
4. A total of 63 reported crashes were associated with injuries, accounting for approximately 39% of the reported crashes along the corridor. There were no fatalities reported.
5. A total of 40 crashes (25%) occurred during the night.
6. There were 15 crashes (9%) due to speeding.
7. There were 6 crashes (4%) that involved guardrail.
8. There were 25 crashes (15%) 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 ¹		Weather Conditions						Alcohol Related		Speeding Related		Guardrail Related	
	Daylight	Darkness	No Adverse Conditions	Fog	Mist	Rain	Snow	Sleet/Hail	Yes	No	Yes	No	Yes	No
Rear End	46	15	51	0	1	10	0	0	2	60	5	57	0	62
Angle	34	12	39	0	1	5	1	0	1	45	3	43	0	46
Head On	2	1	2	0	1	0	0	0	1	2	1	2	0	3
Sideswipe – Same Direction	13	4	14	0	1	2	0	0	0	17	1	16	0	17
Fixed Object in Road	2	0	2	0	0	0	0	0	0	2	0	2	0	2
Non-Collision	1	1	2	0	0	0	0	0	0	2	1	1	0	2
Fixed Object – Off Road	11	3	12	0	0	2	0	0	0	14	3	11	6	8
Deer	1	1	2	0	0	0	0	0	0	2	0	2	0	2
Other Animal	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ped	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	11	3	13	0	0	1	0	0	0	14	1	13	0	14
Total	121	40	137	0	4	20	1	0	4	158	15	147	6	156

¹The weather conditions for Crash 190155139 was classified as “other” and is not accounted for in the table.

Figure 13: Central Boulevard Locations and Types of Crashes

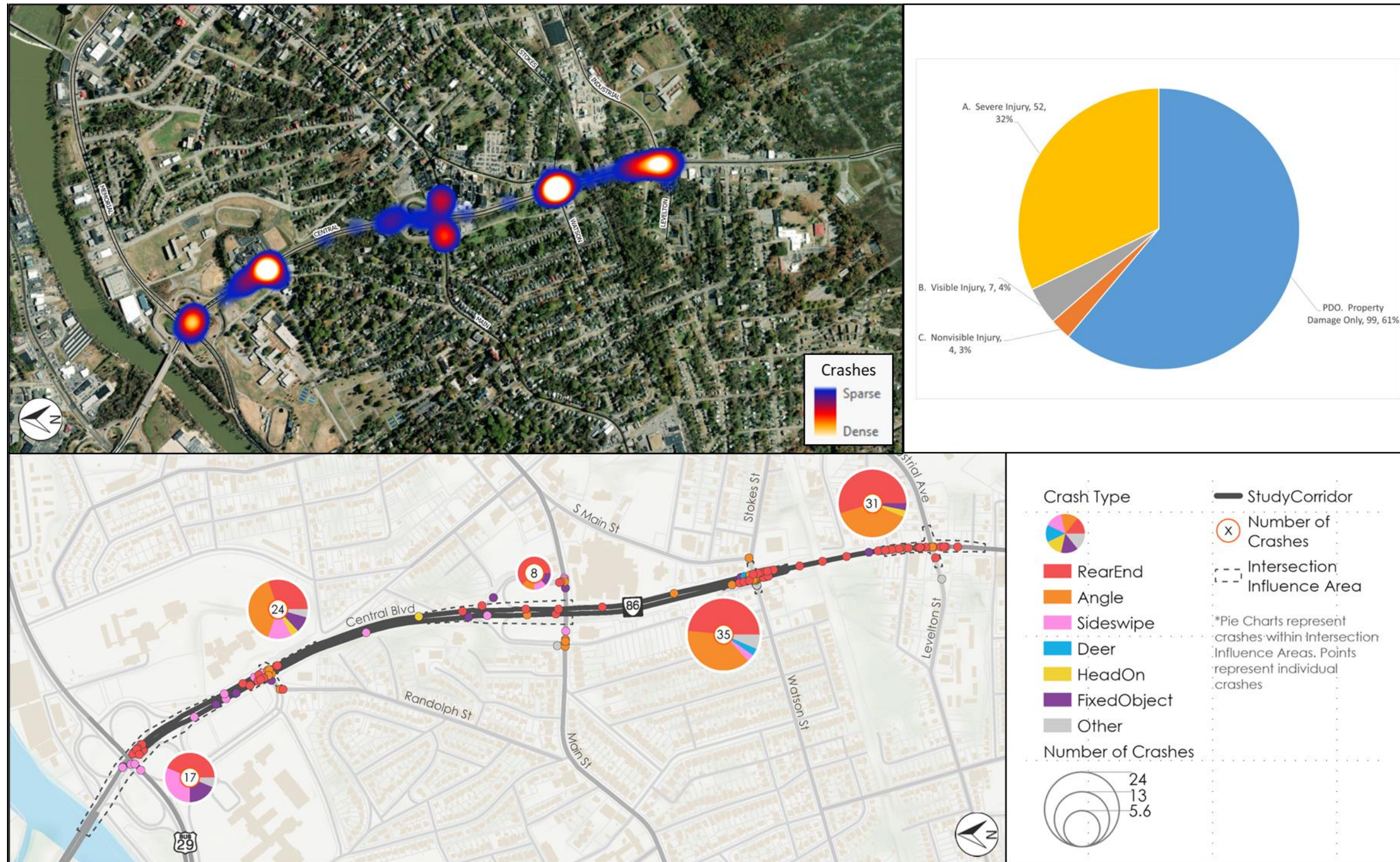


Figure 14: INRIX Travel Time Index and Average Speed

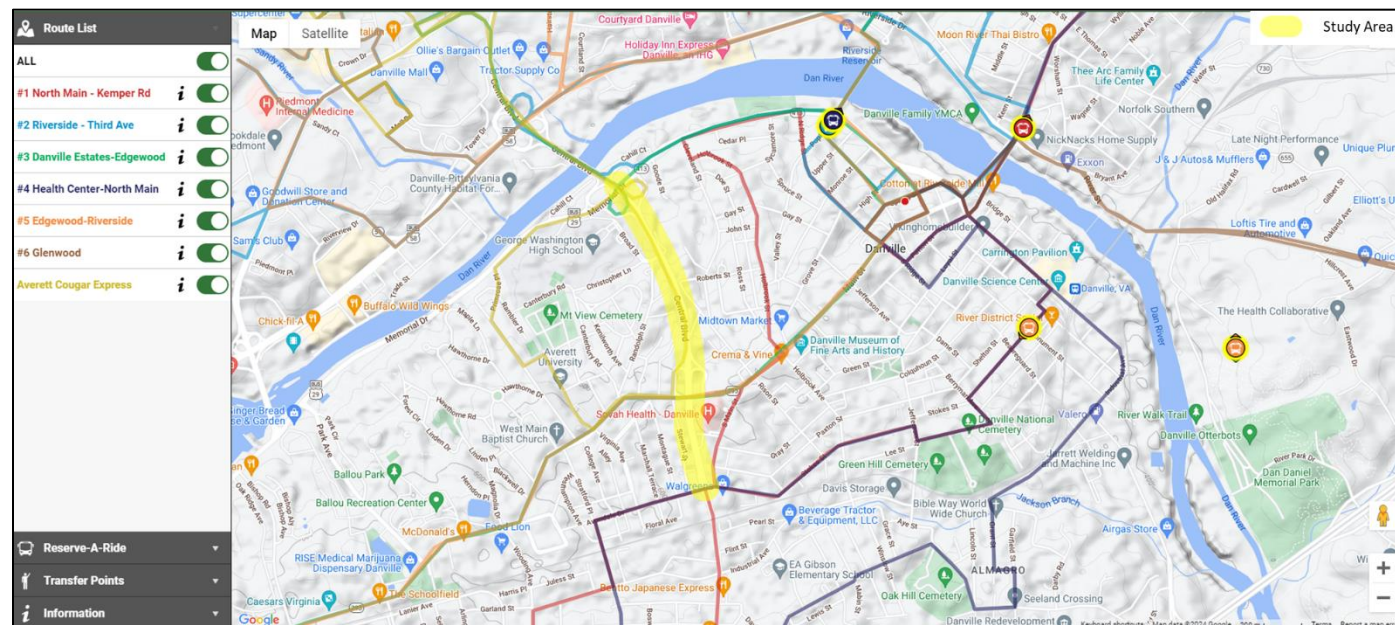


Rail, Transit, and TDM

VTrans identified Transit Access as a medium need and Transportation Demand Management as a low need along the study corridor as previously mentioned. Rail On-Time Performance was identified as a low need by VTrans.

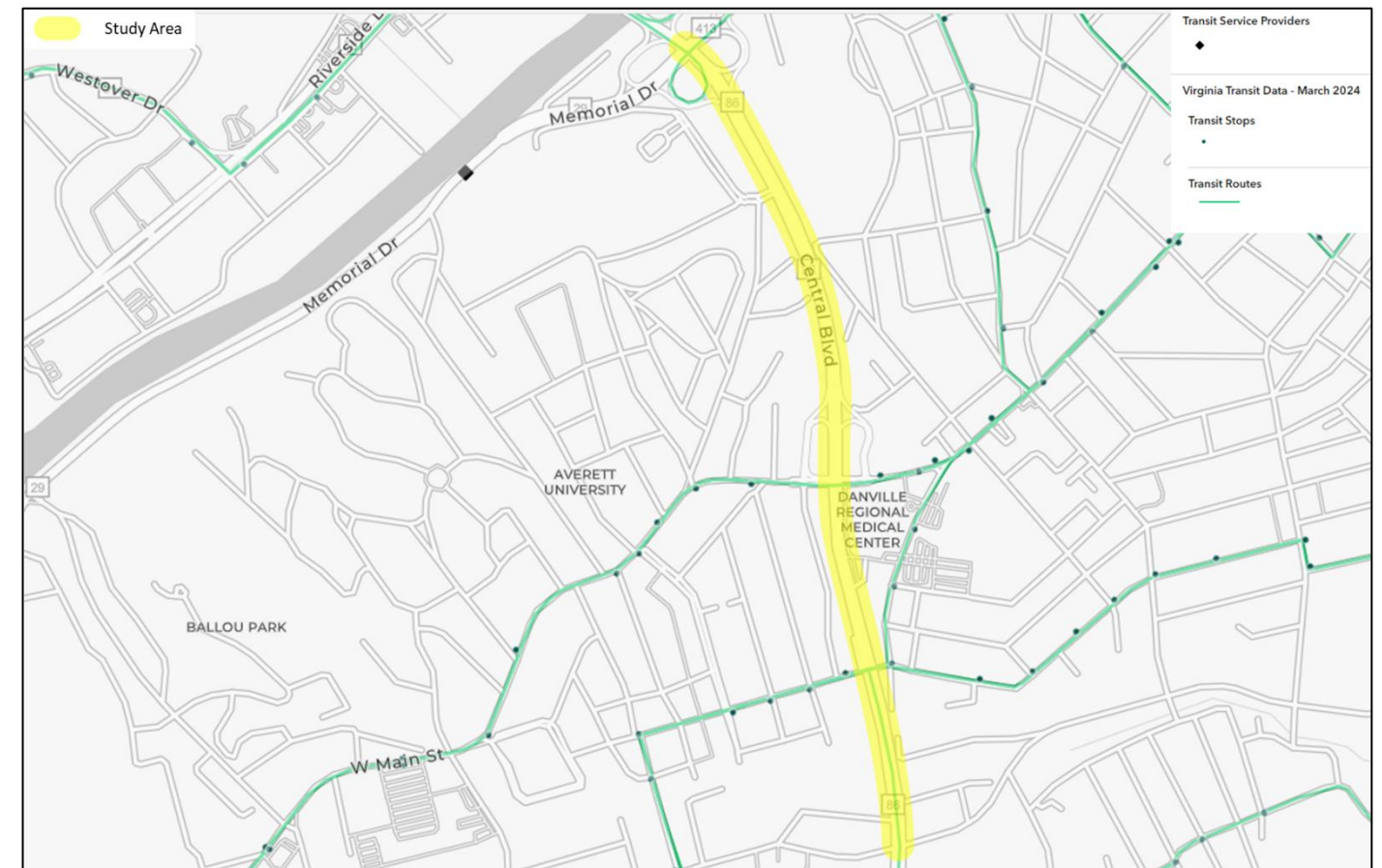
The corridor is currently served by the Danville Transit System (DTS), with multiple routes traveling along or crossing over Central Boulevard. There are no bus stops along the Central Boulevard corridor. Figure 15 shows the DTS routes along Central Boulevard from the DTS bus locator website. Figure 16 shows the same information from Virginia's Statewide Transit Data. Figure 17 shows the rail infrastructure in the vicinity of the Central Boulevard corridor, from the DRPT Rail Database (Virginia Rail Infrastructure Database).

Figure 15: Danville Transit System



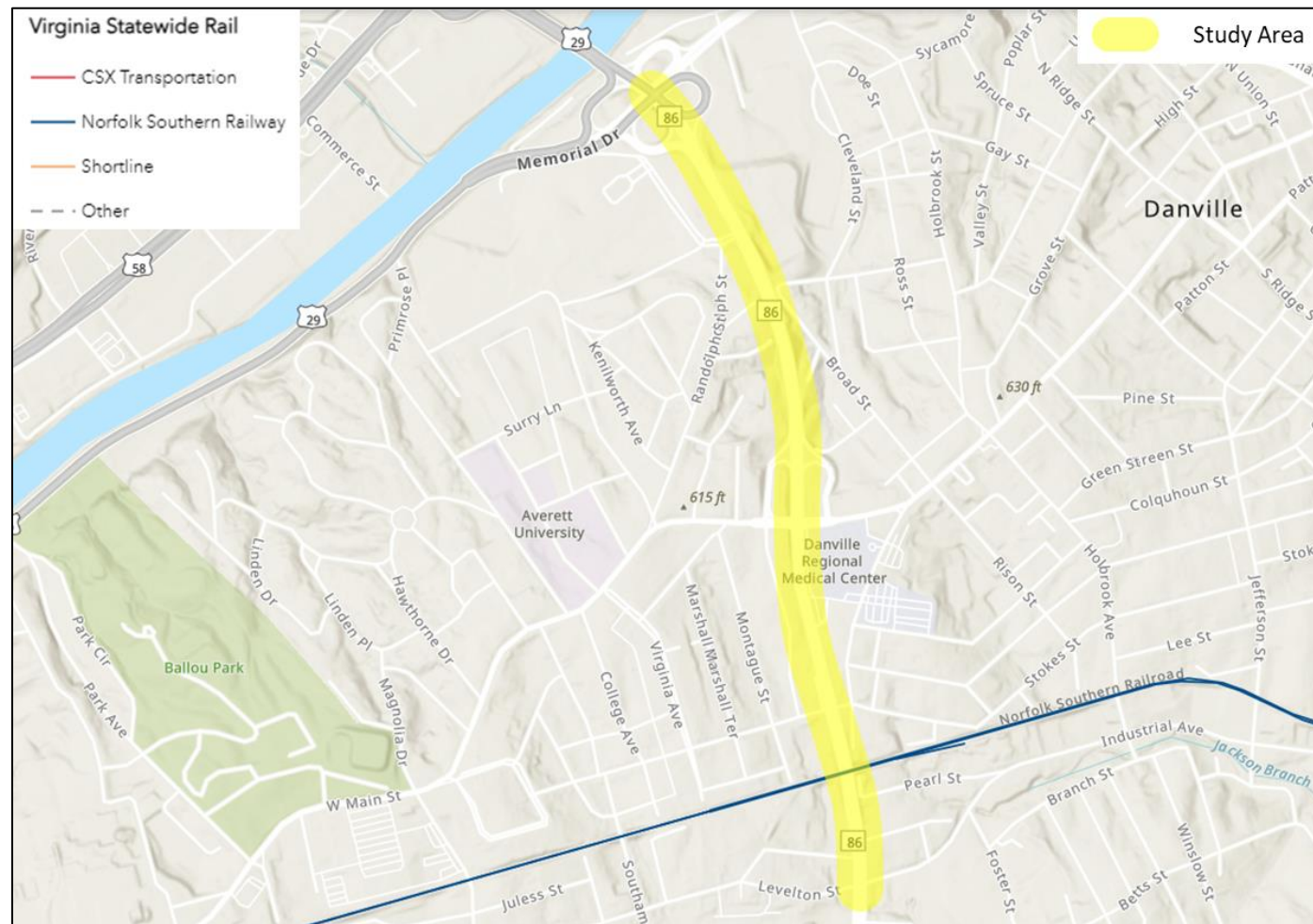
<https://dtbuslocator.com/>

Figure 16: Statewide Transit Data



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

Figure 17: 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 18, 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 18. VTrans Needs Along Study Corridor

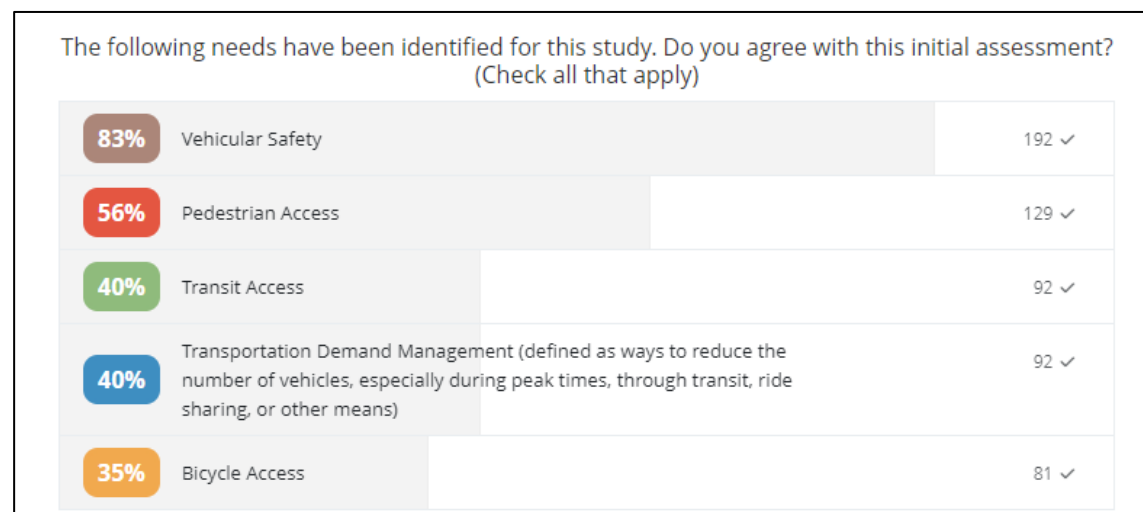
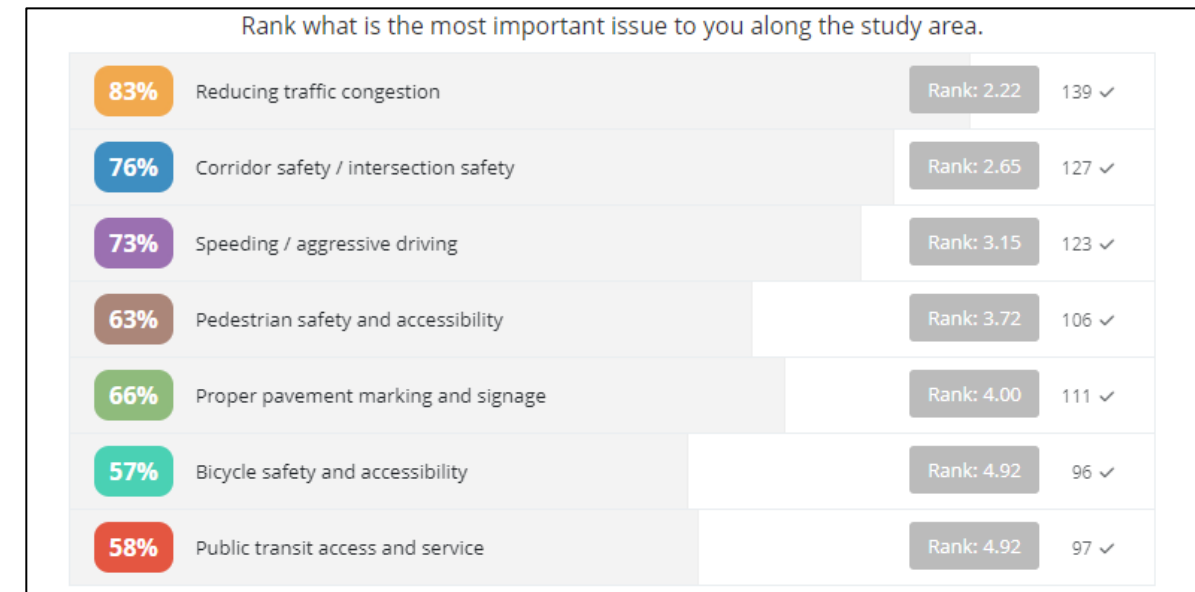


Figure 19 shows the issues along the corridor that the respondents noted need to be addressed. Figure 20 shows the respondent results from the survey regarding major issues along the corridor which include vehicles speeding, suddenly stopping and running red lights along the corridor. The majority of 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.

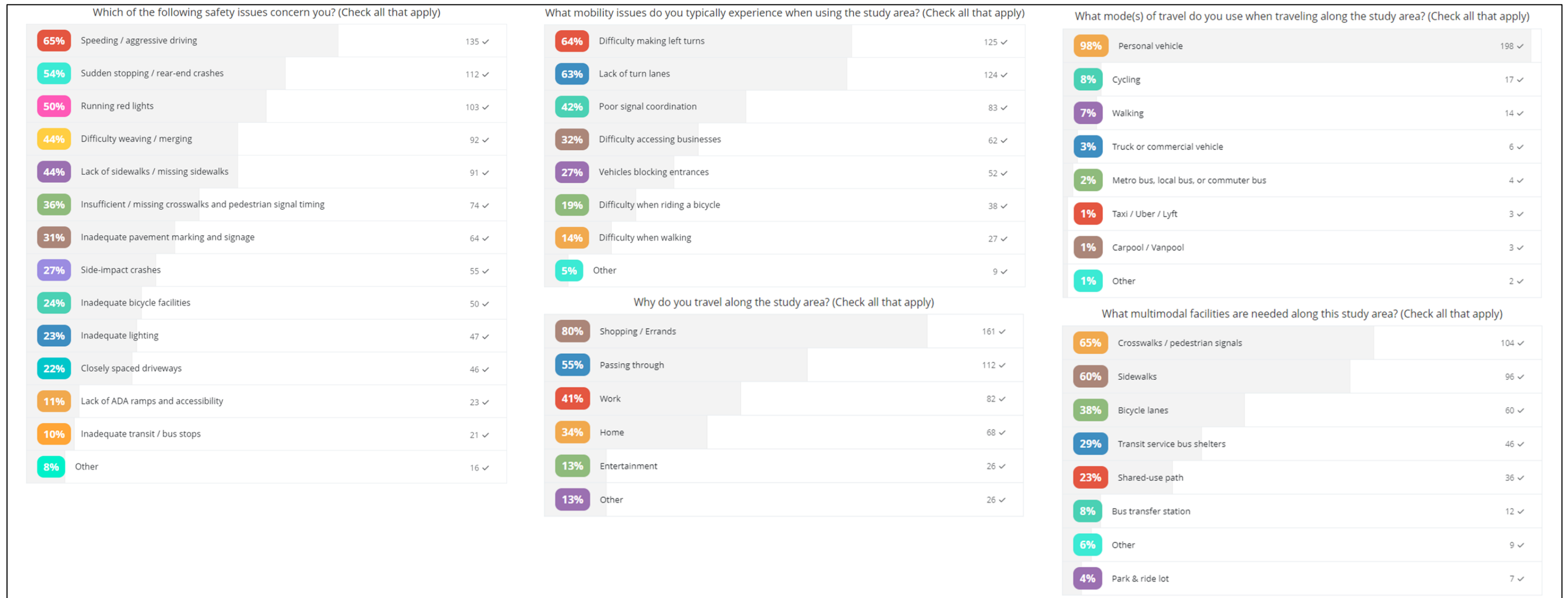
Figure 19. Issues along the Study Corridor



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 20. Public Input Survey Responses



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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 Langhorne Road corridor. These concepts were further screened 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.

While bicycle, pedestrian and transit access were identified as very high needs along the corridor, much of the Central Boulevard corridor, within the study area, already has sidewalks present or operates as an access-controlled facility. Additionally, stakeholders indicated that they did not consider bicycle and pedestrian access to be very high needs along this corridor, within the study area. Therefore, many of the concepts developed as part of the alternative development and screening primarily focused on vehicular operations and safety, while also maintaining pedestrian safety.

Future Traffic Forecasting

As mentioned in Chapter 1, the future year analysis along the corridor would be done for the year 2045. To estimate these volumes, growth rates were developed along the Central Boulevard corridor and other study area roadways, using the latest Danville-Pittsylvania MPO Travel Demand Model, 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 Danville-Pittsylvania MPO Travel Demand Model, Table 8 shows the historic traffic volumes and Figure 21 shows the growth rates from Pathways for Planning.

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

- Central Boulevard – 0.5%
- Other Y-lines – 0.5%

The resulting 2045 turning movement volumes for the study area intersections are presented in Figure 22.

Table 7: TDM Total Volumes and Growth Rates within the LY-23-08 Study Area

Route	Location	2016	2045	Annual Growth Rate (%)
Central Boulevard - NB	N of Memorial Drive	14,989.85	13,743.22	-0.29%
Central Boulevard - SB	N of Memorial Drive	13,598.85	13,222.88	-0.10%
Memorial Drive - WB	E of Central Boulevard	6,951.43	8,618.33	0.83%
Memorial Drive - EB	E of Central Boulevard	6,480.85	8,067.22	0.84%
Memorial Drive - WB	W of Central Boulevard	5,123.15	6,375.64	0.84%
Memorial Drive - EB	W of Central Boulevard	4,336.45	6,173.45	1.46%
Central Boulevard - NB	S of Memorial Drive	11,766.59	9,274.39	-0.73%
Central Boulevard - SB	S of Memorial Drive	11,632.87	9,102.92	-0.75%
Broad Street	W of Central Boulevard	3,828.61	3,072.41	-0.68%
Sacred Heart Catholic Church	E of Central Boulevard	984.24	726.50	-0.90%
Central Boulevard - NB	S of Broad Street	9,766.60	7,652.16	-0.75%
Central Boulevard - SB	S of Broad Street	9,756.75	7,593.07	-0.76%
Main Street	W of Central Boulevard	7,241.71	6,030.50	-0.58%
Main Street	E of Central Boulevard	7,865.36	7,293.06	-0.25%
Central Boulevard - NB	S of Main Street	6,224.26	4,740.61	-0.82%
Central Boulevard - SB	S of Main Street	8,873.87	6,673.81	-0.85%
Watson Street	W of Central Boulevard	3,452.04	3,765.29	0.31%
Stokes Street	E of Central Boulevard	9,864.35	8,899.37	-0.34%
Central Boulevard	N of Industrial Drive	19,363.21	16,406.00	-0.53%
Central Boulevard	S of Industrial Drive	18,574.25	15,489.80	-0.57%
Industrial Drive	E of Central Boulevard	4,635.79	4,330.51	-0.23%

Table 8: Historic AADT within the LY-23-08 Study Area

Route	Location	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Central Boulevard	N of Memorial Drive	39,548	39,955	40,102	35,147	35,346	34,918	36,244	36,856	37,047	36,486	36,615	39,749	58,053
Memorial Drive	W of Central Boulevard	13,522	13,661	13,711	13,332	13,402	13,240	12,061	12,265	12,328	11,700	11,741	12,746	10,214
Memorial Drive	E of Central Boulevard	16,560	16,731	16,792	14,866	14,941	14,760	11,549	11,744	11,805	12,767	12,812	13,909	11,548
Central Boulevard	Memorial Drive to W Main Street	24,525	24,778	24,869	22,616	22,748	22,473	25,003	25,425	25,557	24,660	24,747	26,866	21,910
Central Boulevard	W Main Street to Watson Street	17,692	17,874	17,940	16,723	16,818	16,614	18,838	19,156	19,255	18,595	18,661	20,258	16,787
Central Boulevard	Watson Street to S of Industrial Avenue	18,694	18,887	18,956	17,889	17,985	17,768	19,570	19,901	20,003	19,431	19,500	21,169	17,873
Christopher Lane	W of Central Boulevard	2,031	2,052	2,059	2,069	2,077	2,052	1,870	1,906	1,915	1,466	1,471	1,597	2,146
W Main Street	E/W of Central Boulevard	10,866	10,978	11,018	10,576	10,629	10,500	9,992	10,161	10,213	10,040	10,075	10,938	8,502
Watson Street	W of Central Boulevard	4,468	4,514	4,531	4,215	4,232	4,181	3,418	3,485	3,503	3,696	3,709	4,027	3,150
Stokes Street	E of Central Boulevard	4,468	4,514	4,531	4,215	4,232	4,181	3,418	3,485	3,503	3,696	3,709	4,027	3,150
Levelton Street	W of Central Boulevard	1,738	1,756	1,762	1,868	1,876	1,853	1,861	1,894	1,904	1,667	1,673	1,816	1,540
Industrial Avenue	E of Central Boulevard	6,422	6,488	6,512	6,662	6,689	6,608	5,920	6,024	6,055	5,196	5,214	5,661	4,731

Covid & Recovery

Route	Location	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Central Boulevard	N of Memorial Drive	31,200	29,478	29,593	29,636	30,056	31,275	32,208	32,398	32,157	32,066	29,458	28,548	28,548
Memorial Drive	W of Central Boulevard	10,456	9,878	8,655	8,669	8,791	9,512	9,833	9,891	9,817	9,789	8,993	9,458	9,481
Memorial Drive	E of Central Boulevard	11,548	11,169	8,481	8,495	8,615	11,600	11,992	12,063	11,972	14,514	13,334	14,023	14,056
Central Boulevard	Memorial Drive to W Main Street	22,428	21,190	21,303	21,339	21,639	22,531	23,258	23,392	23,201	20,540	18,870	19,214	19,259
Central Boulevard	W Main Street to Watson Street	17,184	16,236	16,480	16,508	16,740	14,043	14,518	14,603	15,949	15,904	14,611	14,480	14,514
Central Boulevard	Watson Street to S of Industrial Avenue	18,296	17,286	17,855	17,885	18,137	16,486	17,043	17,144	17,686	17,636	16,202	15,348	15,384
Christopher Lane	W of Central Boulevard	2,197	2,076	1,970	1,973	2,001	1,769	1,829	1,840	1,507	1,503	1,381	1,237	1,240
W Main Street	E/W of Central Boulevard	8,703	8,223	8,279	8,293	8,410	7,398	7,648	7,693	7,635	7,217	6,630	6,973	6,080
Watson Street	W of Central Boulevard	3,224	3,047	2,715	2,720	2,758	2,372	2,452	2,467	2,340	2,333	2,144	2,194	2,199
Stokes Street	E of Central Boulevard	3,224	3,047	2,715	2,720	2,758	2,372	2,452	2,467	2,340	2,333	2,144	2,194	2,199
Levelton Street	W of Central Boulevard	1,576	1,489	1,294	1,296	1,314	1,302	1,346	1,354	1,071	1,068	981	1,039	1,041
Industrial Avenue	E of Central Boulevard	4,843	4,576	4,624	4,632	4,697	4,142	4,282	4,307	4,275	4,254	3,908	4,110	-

Figure 21: Pathways for Planning Growth Rates within the LY-23-08 Study Area

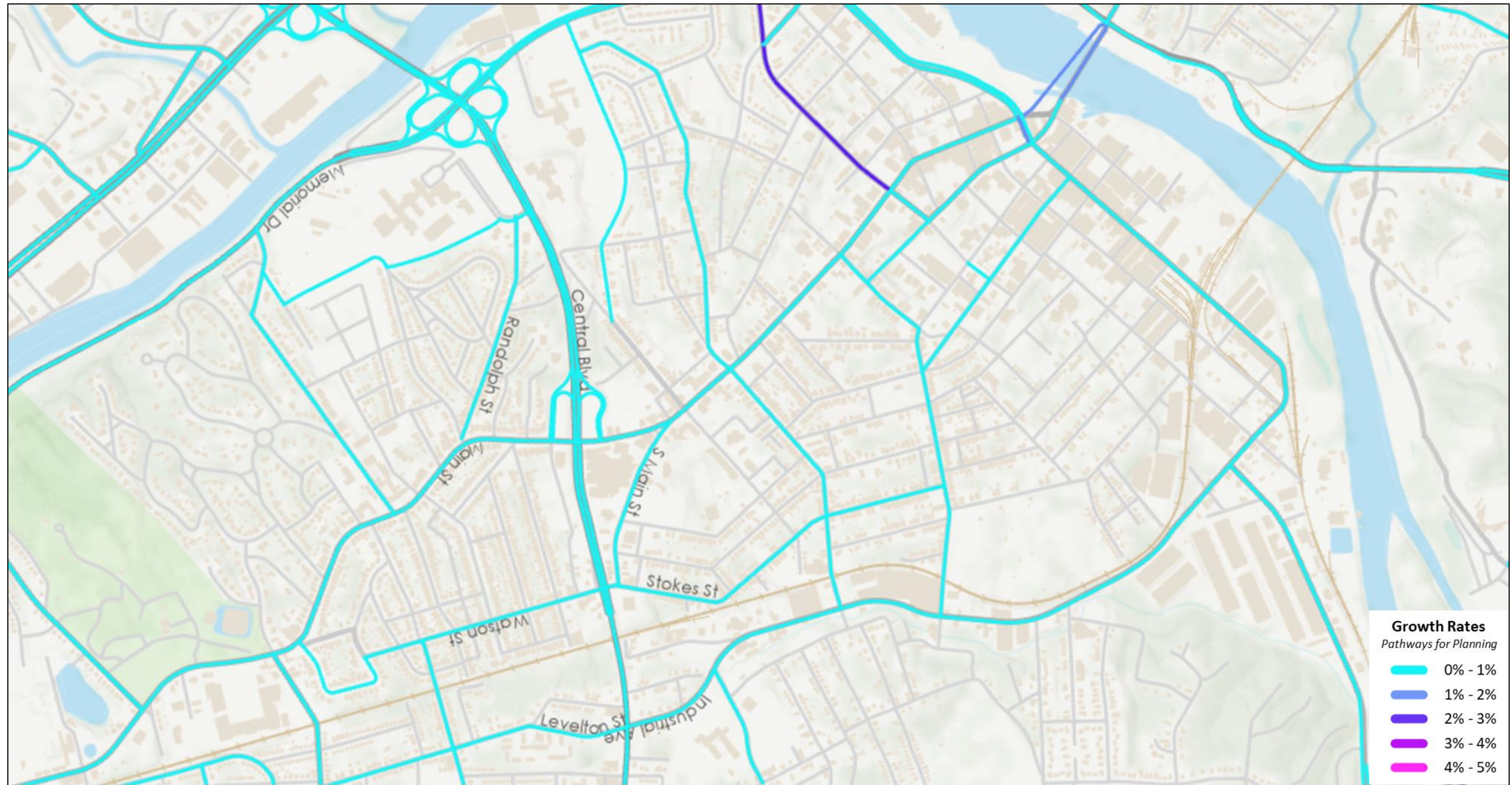
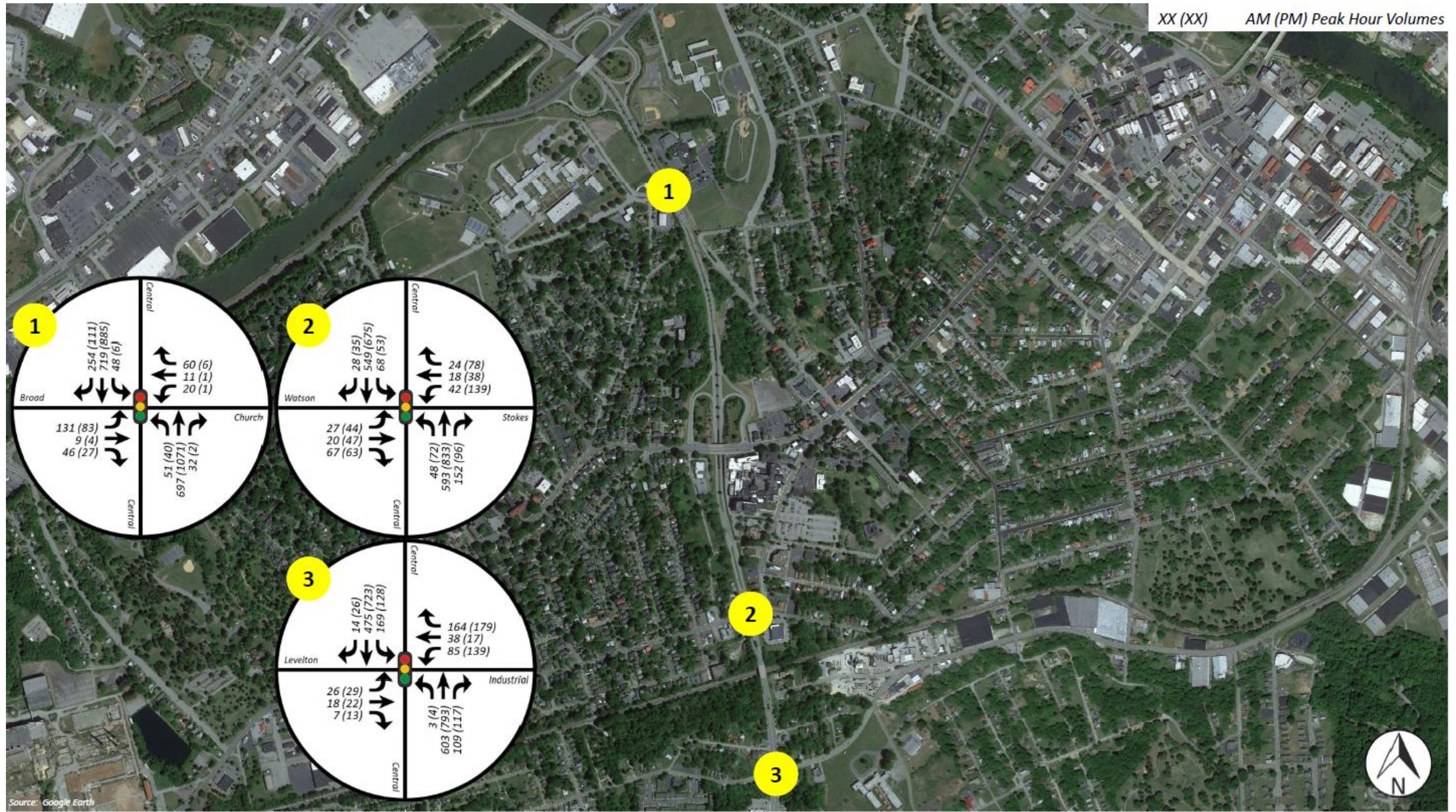


Figure 22: Study Intersections 2045 Turning Movement Volumes



VJuST Analysis

VJuST was used as a high-level screening tool to identify potential alternative concepts at all study area intersections along the Central Boulevard corridor. 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. Table 9, Table 10, and Table 11 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.

As shown in Table 3 in Chapter 1, the VTrans needs did not show a congestion issue along the corridor. This was supported by the 2023 Existing and 2045 No-Build PM peak hour VJuST analysis and the 2023 and 2045 No-Build AM and PM peak hour Synchro analysis. In general, a conventional intersection provided some of the best operations at each location; however, it has the highest number of conflict points, which may lead to more crashes.

A preliminary iCAP analysis was developed for each preliminary concept however the Central Boulevard/S Main Street Corridor is not on the Arterial Preservation Network (APN) and 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.

Table 10: 2045 No-Build PM Peak Hour VJuST Results for S Main Street

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	-	0.44		48	\$						
Median U-Turn	-	0.46	+	20	\$\$						
Partial Median U-Turn	-	0.28	+	28	\$\$						
Restricted Crossing U-Turn	-	0.42		20	\$\$						
Thru-Cut	-	0.45		28	\$\$						
Roundabout	-	0.42		8	\$\$						

Table 11: 2045 No-Build PM Peak Hour VJuST Results for Industrial Avenue

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	-	0.44		48	\$						
Median U-Turn	-	0.56	+	20	\$\$						
Partial Median U-Turn	-	0.25	+	28	\$\$						
Quadrant Roadway	N-W	0.41		40	\$\$\$						
	N-E	0.43		40	\$\$\$						
Restricted Crossing U-Turn	-	0.39		20	\$\$						
Thru-Cut	-	0.45		28	\$\$						
Roundabout	-	0.49		8	\$\$						

Table 9: 2045 No-Build PM Peak Hour VJuST Results for Broad Street

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	-	0.46	+	20	\$\$						
Partial Median U-Turn	-	0.31	+	28	\$\$						
Restricted Crossing U-Turn	-	0.37		20	\$\$						
Thru-Cut	-	0.40		28	\$\$						
Roundabout	-	0.45		8	\$\$						

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 Sidra Intersection 8:

- Broad Street
 - Extension of the southbound left-turn lane
- Watson Street/S. Main Street
 - Constructing a northbound right-turn lane at the Central Boulevard and S Main Street intersection, in addition to pedestrian improvements at this intersection and the S Main Street and Stokes Street intersection, and striping modification at the S Main Street and Stokes Street intersection. This is in concurrence with the Intersection Study that was completed in 2020 encompassing the Central Boulevard and S Main Street intersection and the S Main Street and Stokes Street intersection.
- Industrial Avenue
 - Improve the sight distance and restrict the right-turn on red for the eastbound Levelton Street approach.

The 2023 Existing analysis was initially analyzed in Synchro for screening purposes; however, only the 2045 No-Build analysis is included below 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. All of the study area intersections are identified by VTrans as having safety needs (District Safety Improvement). Although the analysis does not show a need to address operations, the following improvements carried forward are to address the identified VTrans needs and crash history along the corridor.

As noted previously, pedestrian, bicycle and transit access were identified as very high needs by VTrans; however, the stakeholders indicated they were not critical along the corridor.

Broad Street

Broad Street is anticipated to operate at LOS B or better in the 2045 No-Build scenario, as shown in Table 12. Based on the identified VTrans needs and crash history at this location, it was determined that signal phasing and geometric improvements would not materially improve the operations at this intersection. However, extending the southbound left-turn lane along Central Boulevard would enhance safety by allowing vehicles making the southbound right-turn to exit the mainline flow of traffic quicker. The extension would also result in the southbound left-turn storage meeting VDOT standards. This improvement was included in the Synchro model; however, it does not result in significant improvements to operations or safety.

Other improvements were considered during Phase 1, including alternative intersection concepts and constructing an exclusive northbound right-turn lane; 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 12: Broad Street LOS & Delay Summary

Alternative Option	LOS - Delay (sec/veh)	
	2045 AM	2045 PM
No-Build	B - 19.9	A - 8.8
Build (SBL Extended)	B - 19.9	A - 8.8

Watson Street / S. Main Street

The intersection of Watson Street with Central Boulevard/S Main Street is anticipated to operate at LOS B or better in the 2045 No-Build scenario, as shown in Table 13. An Intersection Study prepared by EPR in 2020 recommended constructing a northbound right-turn lane at the Central Boulevard and Watson Street/S Main Street intersection, in addition to pedestrian improvements and striping modification at the S Main Street and Stokes Street intersection. These improvements were assumed to be in place by 2045 and were included in both the 2045 No-Build and 2045 Build models.

Other improvements were considered during Phase 1, including alternative intersection concepts and constructing an exclusive southbound right-turn lane; 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 13: S Main Street LOS & Delay Summary

Alternative Option	LOS - Delay (sec/veh)	
	2045 AM	2045 PM
No-Build¹	B - 18.9	B - 18.3
Build¹	B - 18.9	B - 18.3

¹ Includes improvements from Intersection Study prepared by EPR.

Industrial Avenue

Industrial Avenue is anticipated to operate at LOS C or better in the 2045 No-Build scenario, as shown in Table 14. Based on the identified VTrans needs and crash history at this location, it was determined that enhancing safety would be appropriate at this location. As a result, providing better sight distance on the eastbound approach by moving the stop bar on the west leg closer to the intersection and restricting the right-turn on red for the eastbound right-turning movement was recommended.

Other improvements were considered during Phase 1, including a roundabout, alternative intersection concepts, and constructing an exclusive southbound right-turn lane; 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 14: Industrial Avenue LOS & Delay Summary

Alternative Option	LOS - Delay (sec/veh)	
	2045 AM	2045 PM
No-Build	B - 18.6	C - 27.4
Build (Right-Turn on Red Restricted for EBR)	B - 18.6	C - 27.4

Figure 23: Central Boulevard and Broad Street Intersection Phase 2 Concept

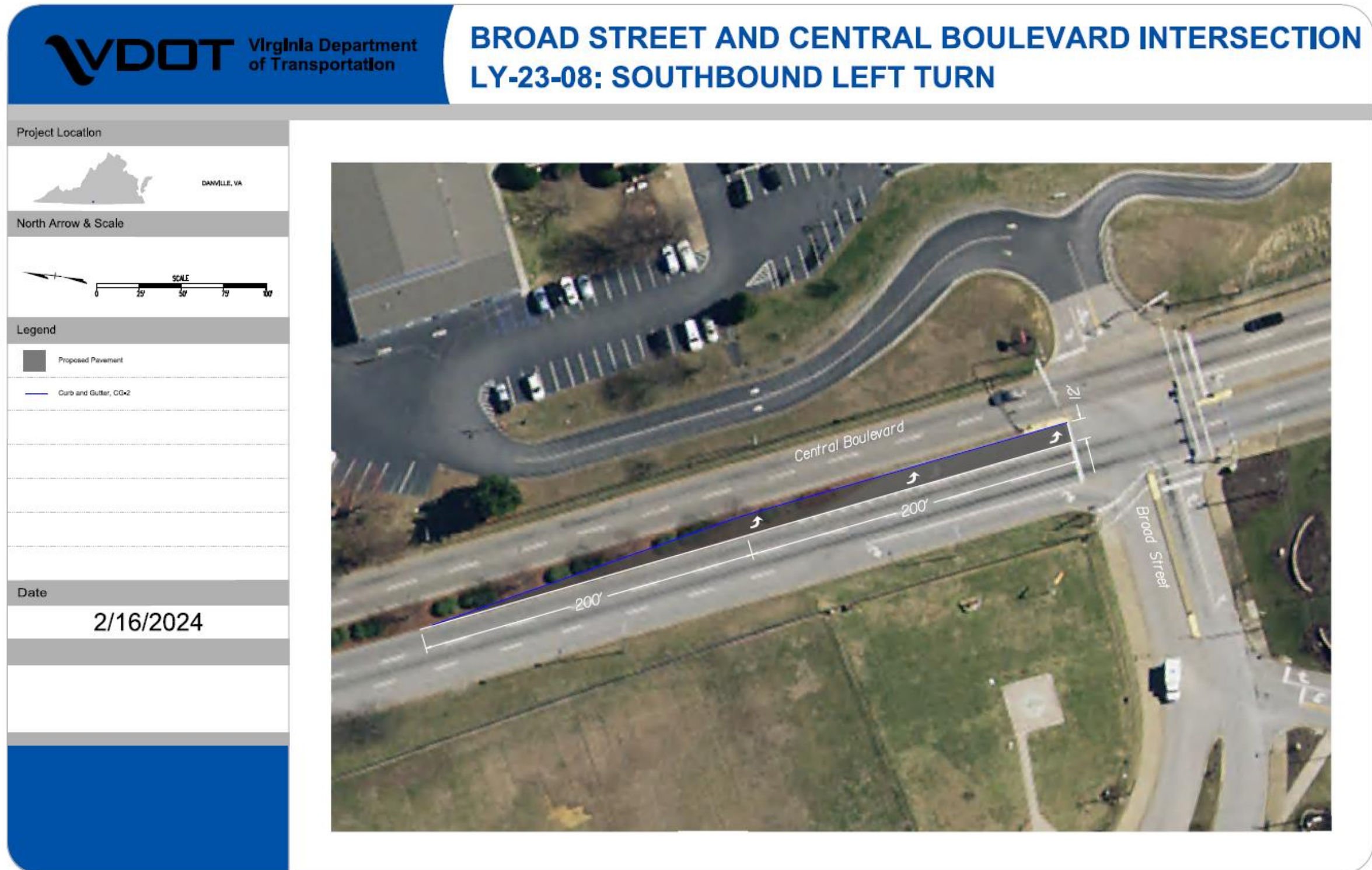
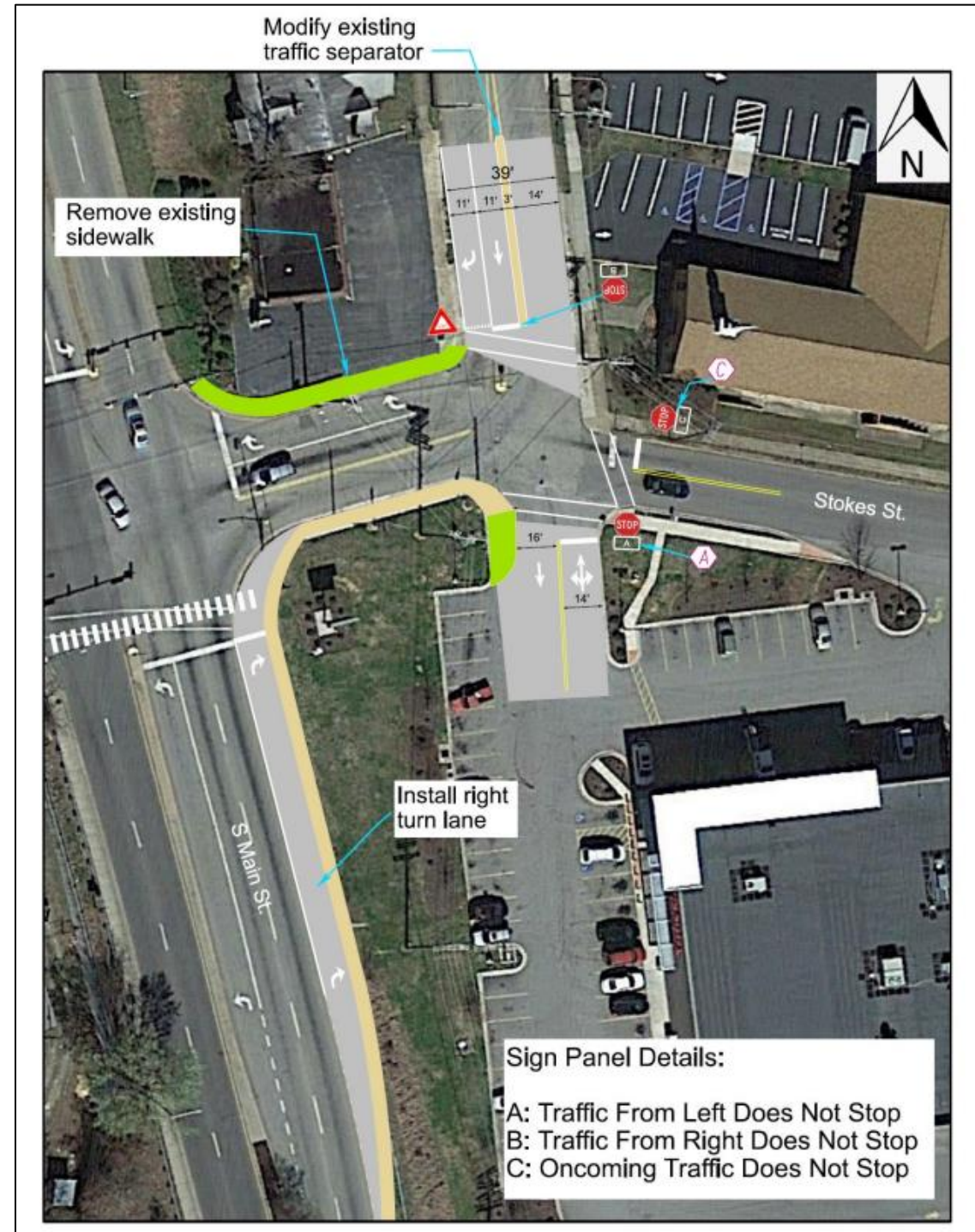


Figure 24: Central Boulevard/S. Main Street and Watson Street Intersection Phase 2 Concept



Preferred Alternatives

Preferred alternatives were developed for the Central Boulevard corridor and at each intersection based on the VJuST screening, the Synchro and/or Sidra Intersection analysis and input from the stakeholders during a stakeholders working group meeting held on February 16, 2024.

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

- Extend the southbound left-turn lane at the Central Boulevard and Broad Street intersection
- Construct a northbound right-turn lane at the Central Boulevard and S Main Street intersection, in addition to pedestrian improvements at this intersection and the S Main Street and Stokes Street intersection, and striping modification at the S Main Street and Stokes Street intersection. Install and upgrade pedestrian accommodations at Halsey Road, Hill Street and Tate Springs Road
- Improve the sight distance and restrict the right-turn on red for the eastbound Levelton Street approach at the Central Boulevard and Industrial Avenue intersection

Expected Crash Reduction


The SMART SCALE Planning Level Crash Modification Factors (CMFs) were reviewed for each of the improvements included at the study area segments and intersections along the Central Boulevard corridor to compare safety benefits. Note that some locations list the CMF value as “Function.” At these locations, the expected crash reduction was used based on the functions included in the *Virginia State Preferred CMF List* documentation.

Table 15 summarizes the CMFs used along the Central Boulevard corridor study area.

Table 15: CMF Summary

Intersection	CMF
Broad Street Southbound Left-Turn	0.85
S Main Street Intersection Improvements¹	0.96
Levelton Street Right-Turn on Red Restriction¹	0.98

¹ Calculated using function.



Chapter 3 – Public and Stakeholder Outreach and Feedback

Public Involvement

Two surveys were developed as part of this Pipeline corridor study using the PublicInput.com platform. The initial survey 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 September 7, 2023 – September 21, 2023.

As part of Phase 2, a stakeholder meeting was held on February 16, 2024 to discuss the alternative concepts at the study area intersections and segments along the Langhorne Road corridor that were developed during Phase 1 and Phase 2. Based on input from the stakeholders, six preferred alternative concepts were carried forward to Phase 3. A second survey was prepared soliciting public feedback on these preferred alternatives. This survey was open from March 18, 2024 to April 1, 2024. These improvements include:

- Extend the southbound left-turn lane at the Central Boulevard and Broad Street intersection
- Construct a northbound right-turn lane at the Central Boulevard and S Main Street intersection, in addition to pedestrian improvements at this intersection and the S Main Street and Stokes Street intersection, and striping modification at the S Main Street and Stokes Street intersection.
- Improve the sight distance and restrict the right-turn on red for the eastbound Levelton Street approach at the Central Boulevard and Industrial Avenue intersection

Survey Questions and Results

Phase 1

There were 82 participants and 2,113 responses to the Phase 1 survey. Of the VTrans needs identified along the corridor, public responses indicated that vehicular safety was the greatest need and the vast majority of people using the corridor use their personal vehicle. Additionally, they indicated that reducing traffic congestion, corridor and intersection safety and ensuring proper pavement markings and signage are the most important issues within the study area.

Phase 2

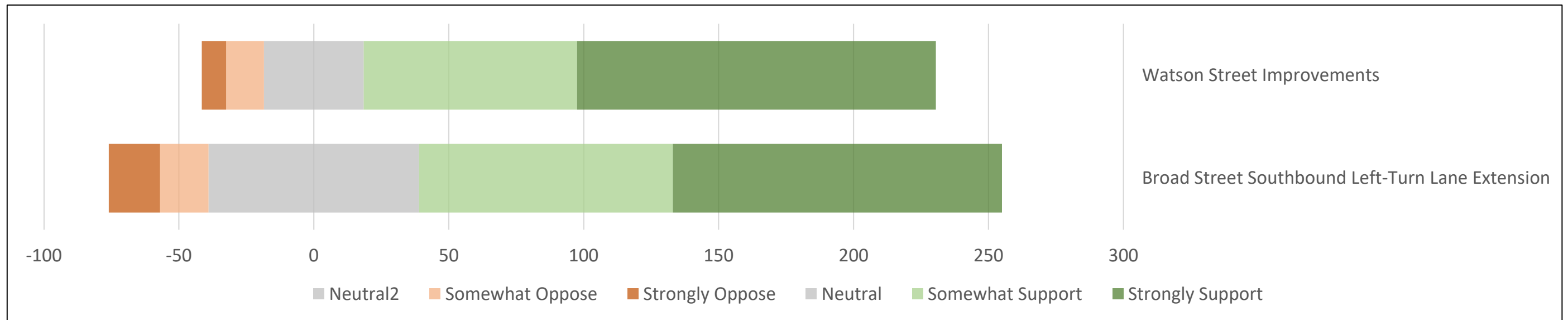
There were 337 participants and 2,226 responses to the Phase 2 survey. Each preferred concept was presented visually with feedback solicited via a 5-point Likert scale, as follows:

- Strongly Oppose
- Somewhat Oppose
- Neutral
- Somewhat Support
- Strongly Support

The concepts presented in the survey were well received by the public with the majority of respondents indicating that they strongly supported each concept, with at least 35% of respondents (with ranges up to 49%) indicating strong support for each concept. Overall, support for each concept (“somewhat support” and “strongly support”) ranged from 65% to 78% for each concept and opposition (“somewhat oppose” and “strongly oppose”) ranged from 8% to 11% for each concept.

The results of the survey are shown in Figure 25.

Figure 25: Phase 2 Survey Results





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 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 16, 2024:

- Extend the southbound left-turn lane at the Central Boulevard and Broad Street intersection
- Construct a northbound right-turn lane at the Central Boulevard and S Main Street intersection, in addition to pedestrian improvements at this intersection and the S Main Street and Stokes Street intersection, and striping modification at the S Main Street and Stokes Street intersection.
- Improve the sight distance and restrict the right-turn on red for the eastbound Levelton Street approach at the Central Boulevard and Industrial Avenue intersection

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, the City indicated that the improvements at the Industrial Avenue intersection would not be submitted for VDOT funding, but would be funded by City funds if they decided to implement those improvements in the future.

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)*.

Broad Street Southbound Left-Turn Extension

The southbound left-turn extension at Broad Street was designed to include 200 feet of full width storage and a 200-foot taper. Extending this left-turn lane is expected to occur within the right-of-way and is not anticipated to impact any of the existing utilities however coordination with utility companies should still be conducted to ensure there are no conflicts.

Intersection Improvements at Central Boulevard/S Main Street and S Main Street/Stokes Street

The current concept proposes to construct a northbound right-turn lane at Central Blvd and S. Main Street. In addition, the intersection of South Main Street and Stokes Street will be restriped along with a new 4-foot concrete median. Pedestrian improvements are also proposed to upgrade the ADA ramps to current standards and provide a clear 5-foot-wide pedestrian path. The proposed sidewalk will be curb-abutted and require a design waiver since the buffer width (utility strip) is less than 4 feet. New 10-foot-wide crosswalks are featured along with a high-visibility crosswalk across Central Boulevard. It is anticipated there will be significant utility relocation required as part of this project. Some existing utility poles may need to be relocated and existing guy wires will need to be repositioned out of the proposed pedestrian pathways. Several existing curb inlets will need to be relocated to the proposed curb lines.

The proposed northbound right-turn was designed to include 150 feet of full width storage and a 113-foot taper. Constructing this turn lane is expected to require some right-of-way and is anticipated to impact several of the existing utilities. The existing utility poles, overhead utility lines and several curb inlets will need to be relocated.

The final concept design for the improvements at Central Boulevard/S Main Street and S Main Street/Stokes Street is shown in Figure 26. The Phase 2 concept sketch for the southbound left-turn lane extension at the intersection of Central Boulevard and Broad Street is shown in Figure 23.

Risk Assessment

Several risks were identified for each of the preferred alternatives, including the following:

Broad Street Southbound Left-Turn Extension

- Multiple underground utilities are located within the proposed project site including but not limited to water, electric, natural gas, fiber optic cable, and drainage. Coordination with utility owners will be required to ensure there are no underground utilities in the median.
- Existing median may be in poor condition and/or substandard requiring improvement(s).

Intersection Improvements at Central Boulevard/S Main Street and S Main Street/Stokes Street

- Existing overhead utility lines and poles may be impacted and need to be relocated.
- Existing guy wires within sidewalk will need to be relocated away from pedestrian route.
- Several existing curb inlets will need to be relocated.

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 16 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 16. SMART SCALE-Level Cost Estimates for the Preferred Alternatives

Preferred Alternative	Preliminary Engineering	Right-of-Way and Utilities	Construction	Contingency	Total Cost
Broad Street Southbound Left-Turn Extension¹	-	-	-	-	\$1M - \$1.4M
Intersection Improvements at Central Boulevard/S Main Street and S Main Street/Stokes Street	\$208,500	\$400,000	\$1,197,960	\$803,400	\$2,609,860

¹ Estimate is from Phase 2

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 17 shows which funding sources the preferred alternatives may be applicable for.

Table 17. Project Funding Sources

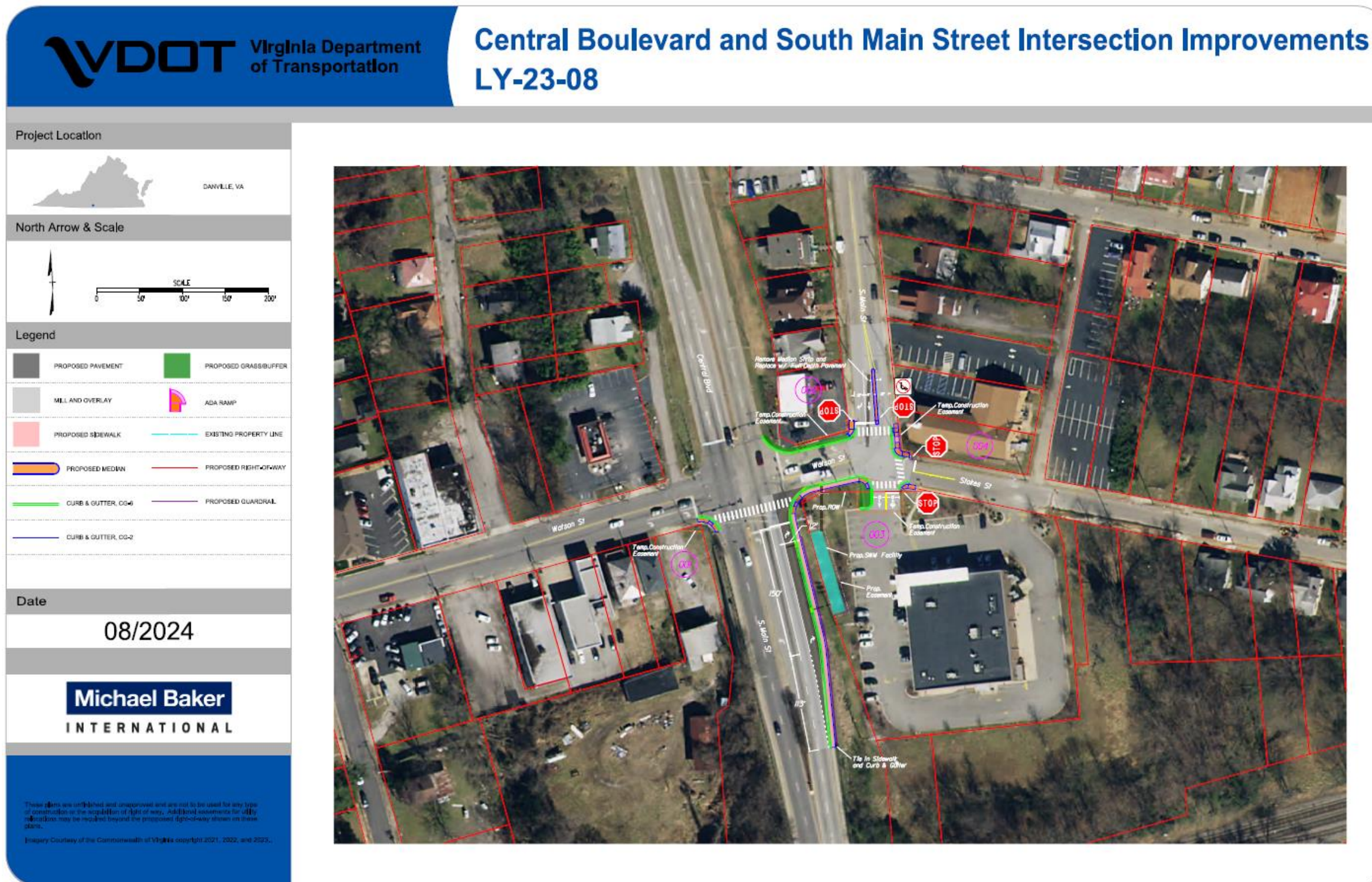
Funding Source	Project Types Funded	Preferred Alternative Applicable
VDOT Revenue Sharing¹	Appropriate for local construction projects, reconstruction projects, improvement projects and maintenance projects on VDOT- or locally-maintained roadways.	<p>Broad Street Southbound Left-Turn Extension</p> <p>Intersection Improvements at Central Boulevard/S Main Street and S Main Street/Stokes Street</p>
USDOT CMAQ²	<p>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:</p> <ul style="list-style-type: none"> • Electric vehicles and charging stations • Diesel engine replacements and retrofits • Transit improvements • Bicycle and pedestrian facilities • Shared micromobility projects including shared scooter systems 	<p>Intersection Improvements at Central Boulevard/S Main Street and S Main Street/Stokes Street</p>
Virginia HSIP³	<p>Appropriate for projects that have the greatest potential to reduce fatalities and injuries along roadways. To be eligible, projects must generally conform to the following:</p> <ul style="list-style-type: none"> • Be consistent w/ a State's SHSIP • Correct or improve a hazardous road location or feature, or address a highway safety problem • Be identified on the basis of crash experience, crash potential, crash rate, or other data-support means • Be listed under 23.U.S.C 148(a)(4)(B) or (a)(11); and • Comply with other title 23 requirements 	<p>Broad Street Southbound Left-Turn Extension</p> <p>Intersection Improvements at Central Boulevard/S Main Street and S Main Street/Stokes Street</p>

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

³<https://www.vdot.virginia.gov/doing-business/technical-guidance-and-support/traffic-operations/vhsip/> & https://safety.fhwa.dot.gov/hsip/rulemaking/docs/BIL_HSIP_Eligibility_Guidance.pdf

Figure 26: Final Design for Central Boulevard/S Main Street/Stokes Street Intersection Improvements



Appendices

Appendix A:

Framework Document
Pre-Scoping Meeting Presentation
Kickoff Meeting Presentation
Previous Studies
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
Phase 2 Public Outreach
iCAP Workbooks

Appendix F:

Preliminary Alternative Future Build Condition Operational Analysis Results
Basis of Design Memos
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Appendix E:

Phase 2 Stakeholder Working Group Meeting Presentation

Phase 2 Public Outreach

iCAP Workbooks

Appendix F:

Preliminary Alternative Future Build Condition Operational Analysis Results

Basis of Design Memos

Preferred Alternative Cost Estimate