# PROJECT PIPELINE

## SA-23-10: Roanoke County
## ROUTE 11/460 AT DOW HOLLOW ROAD

# Route 11/460 (West Main Street) – From Route 940 (Fallbrooke Dr) to Route 796 (Pleasant Run Dr)

Final Report

July, 2024

Prepared for

VDOT Virginia Department of Transportation

Prepared by

WRA

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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: 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.**

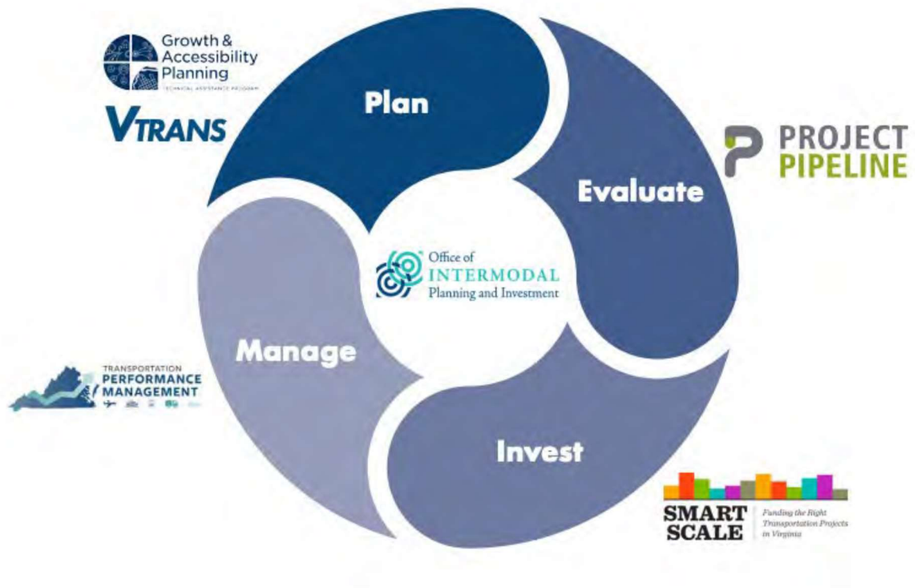



*Figure 1: Project Pipeline Objectives*

# 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**.

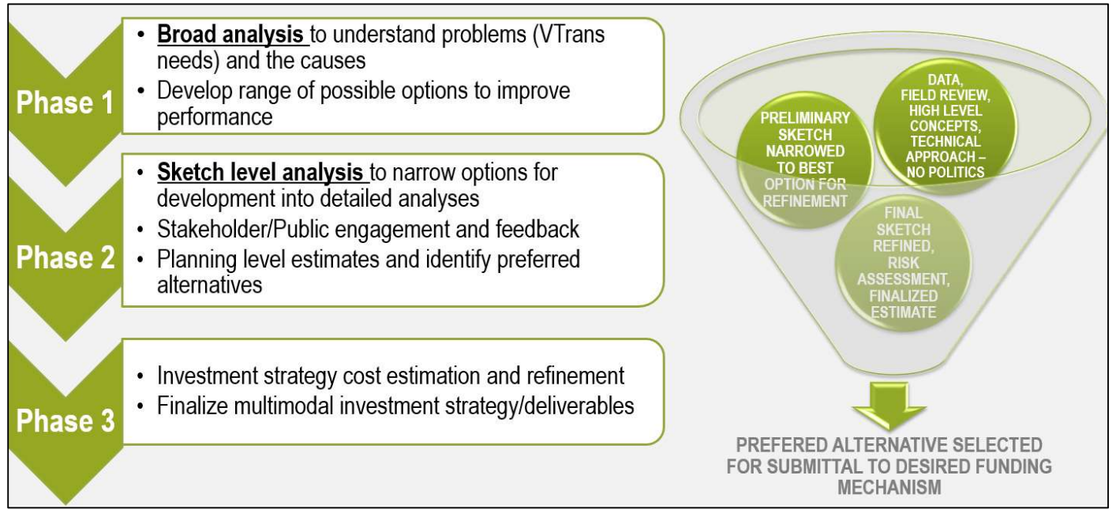



*Figure 2: Study Phase Methods and Solutions*

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 West Main Street (Route 11/460) study corridor from Fallbrooke Drive (Route 940) to Pleasant Run Drive (Route 796) is located in Roanoke County, Virginia. West Main Street is classified as a minor arterial road within the study area and is a Corridor of Statewide Significance (COSS) and is located on the Arterial Preservation Network (APN). The posted speed limit is 55 MPH. A map detailing the locations of the study intersections and count locations is shown below in **Figure 4**. Intersection geometry and features are shown in **Figure 5.**


*Figure 4: Study Area Map*

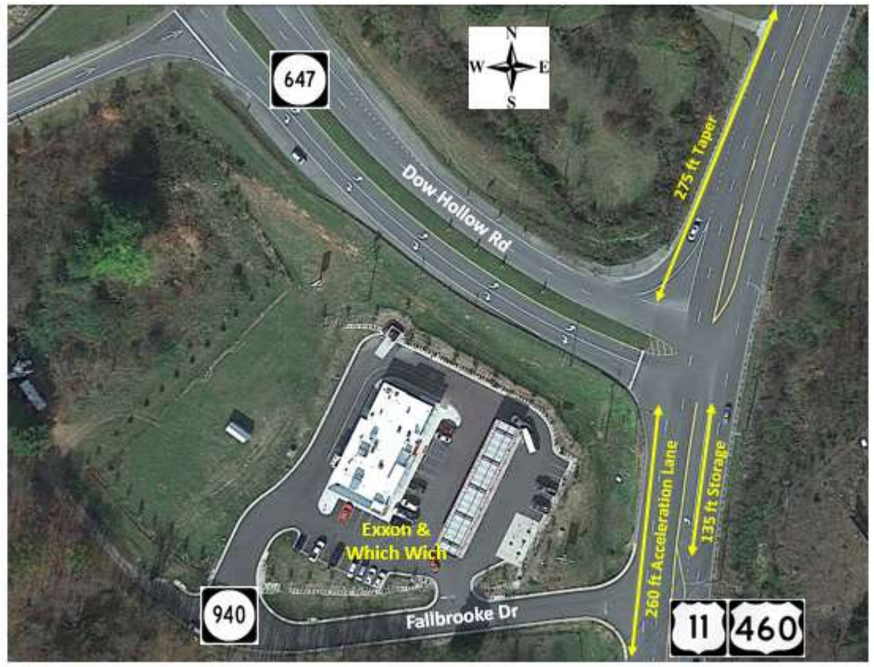



*Figure 5: Study Intersection Geometry*

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 Route 11/460 study corridor, were 'Very High' for Safety Improvement, 'High' for Capacity Preservation and 'Low' for Bicycle Access, IEDA (UDA) Access, Transit Access, and Transportation Demand Management as presented in **Table 3**.

[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

*Table 3: VTrans Needs in Study Area*

| VTRANS IDENTIFIED NEEDS | PRIORITIES |
|---|---|
| Bicycle Access | Low |
| Capacity Preservation | High |
| Congestion Mitigation | None |
| IEDA (UDA) Access | Low |
| Pedestrian Access | None |
| Safety Improvement | Very High |
| Pedestrian Safety Improvement | None |
| Reliability | None |
| Rail on-time Performance | None |
| Transit Access | Low |
| 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 6** presents a map of the study area with the 2019 VTrans mid-term needs prioritized for district construction. The US 11/460 at Dow Hollow Road intersection has also been identified as a PSI intersection. **Figure 7** presents an overview of the study needs.


*Figure 6: 2019 VTrans Prioritized Mid-term Needs in the Study Area*

## Purpose, Goals & Objectives

**The purpose of this study is to identify recommendations to improve safety and preserve capacity along Route 11/460 in the vicinity of the Dow Hollow Road intersection.**

**Identify cost-effective improvement alternatives that address the identified safety and capacity preservation needs.**

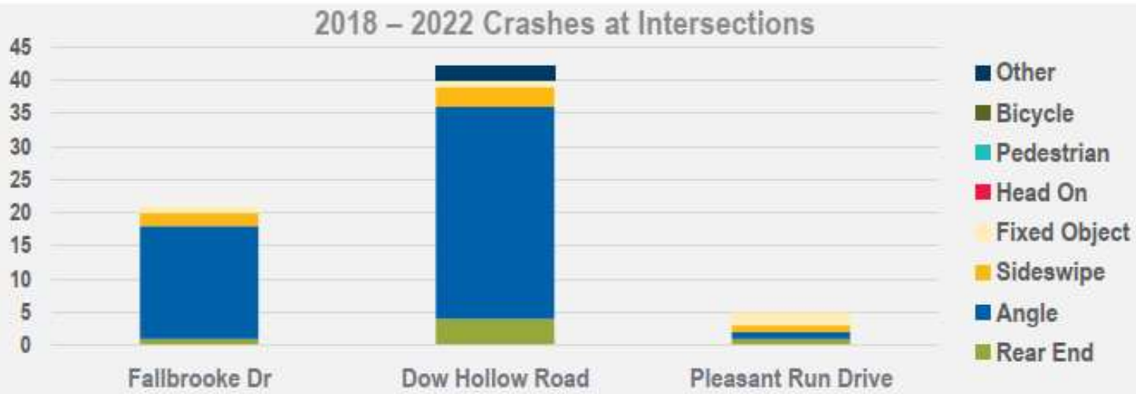
| Study Summary | |
|---|---|
| **VDOT District** | Salem |
| **Locality** | Roanoke County |
| **Length** | 0.18 miles |
| **Study Limits** | South of Fallbrooke Drive to north of Pleasant Run Drive |
| **Functional Classification** | Minor arterial / Corridor of Statewide Significance |
| **Speed Limit** | 55 MPH |

| VTrans Needs | |
|---|---|
| NEED | PRIORITY |
| Safety Improvement | Very High |
| Capacity Preservation | Very High |

## Existing Issues in the Study Area

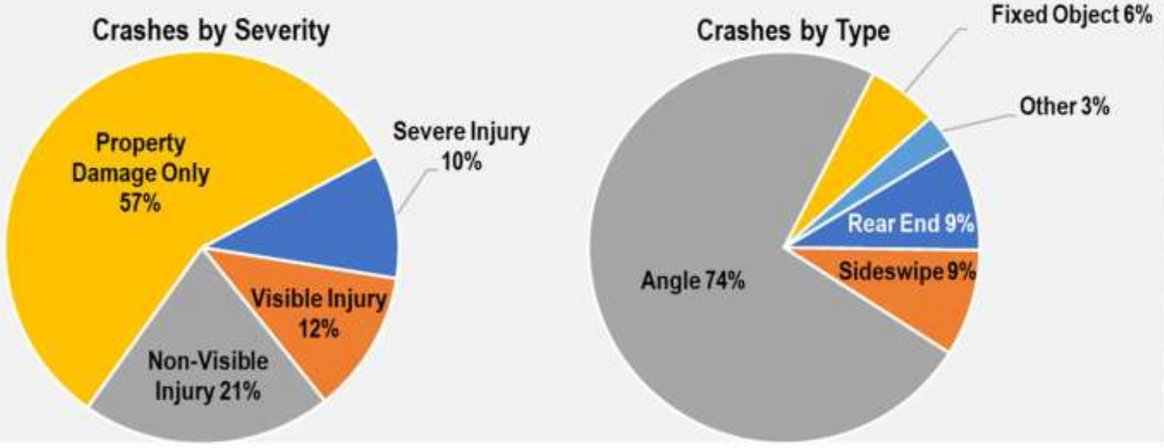
- Route 11/460 at Dow Hollow Road serves as a detour route during incidents on I-81; long delays and queues on the Dow Hollow Road approach during incidents
- Steep downgrade (5-6%) on the southbound US 11/460 approach to Dow Hollow Road impacts travel speeds


*Figure 7a: Study Overview and Needs*




## Safety Issues in the Study Area

- **Angle crashes at the Dow Hollow Road and the Fallbrooke Drive intersections**
- **24 crashes involved left turns from Dow Hollow Road and southbound Route 11/460 vehicles including 7 involving trucks**
- **43% of crashes resulted in injuries including 7 serious injuries**
- **41% of crashes occurred between 3 PM and 6 PM**



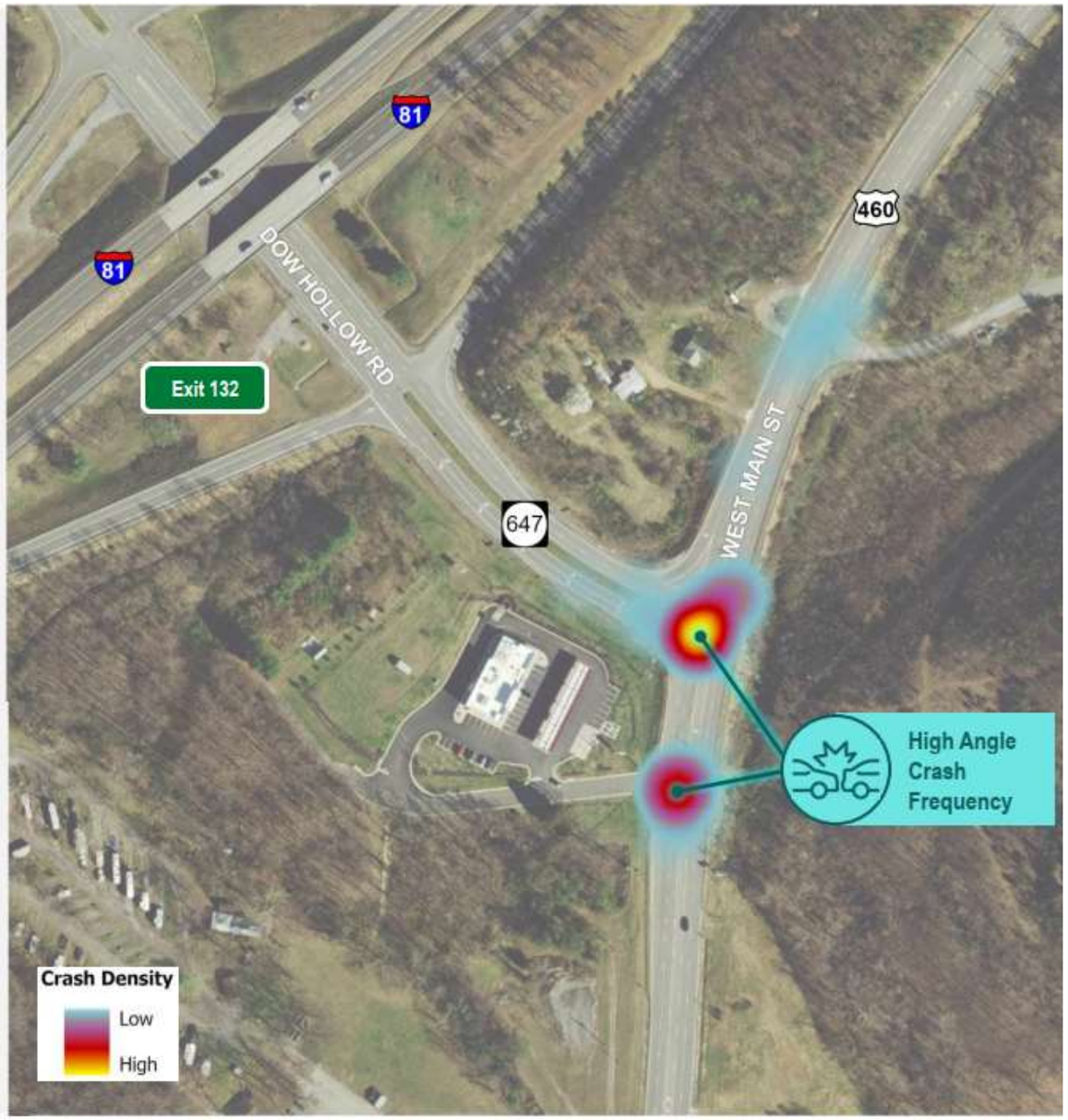




*Figure 7b: Study Overview and Needs*

## Previous Study Efforts

In July 2022, the US 460 at Dow Hollow Road Traffic Study was completed that evaluated several intersection improvements including a Green-T, signalization, and RCUT, and a roundabout. The study recommendations were not recommended in SMART SCALE Round 5 due to concerns regarding the negative impacts of traffic signalization along the US 460 corridor.

## Phase 1 Existing Conditions Public Outreach

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 in the evaluation of potential alternatives. The survey was conducted through Publicinput.com and there were 241 participants. The detailed summary of the public survey is included in **Appendix A**.

The survey shows that the major needs of the corridor include safety and capacity preservation as shown in **Figure 8**.

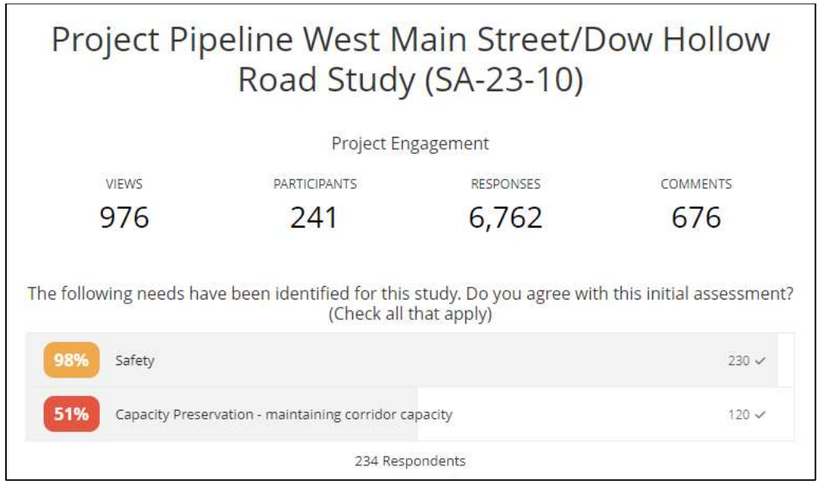



*Figure 8: Public Input Survey Results*

**Figure 9** shows the most important issues along the study corridor including corridor/intersection safety, I-81 detour impacts, reducing traffic congestion and speeding/aggressive driving.

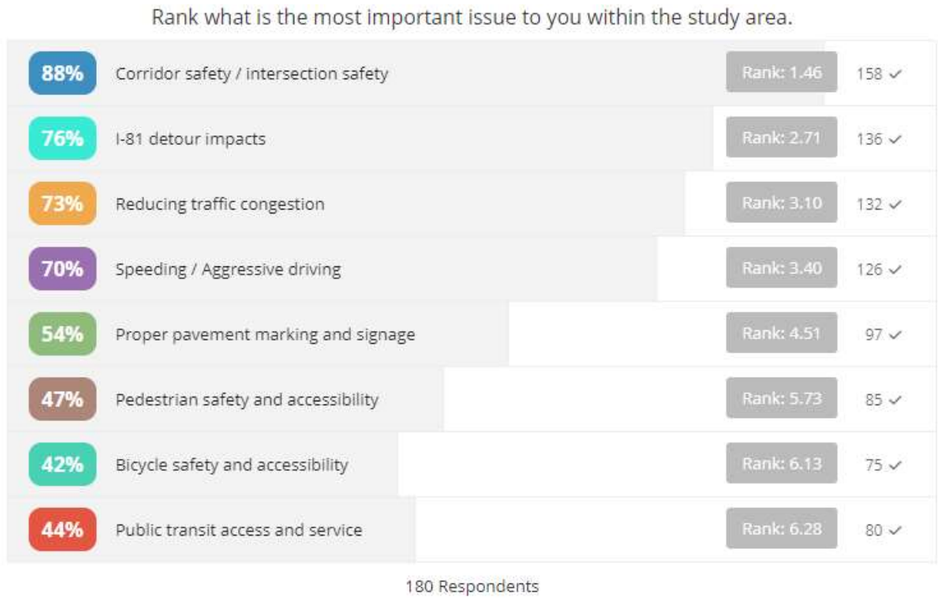



*Figure 9: Public Input Survey Results*

The notable comments from the survey responses are summarized below:

**General**

- Roadway congestion caused by diversion of traffic from I-81
- Lack of visibility when entering onto US 460 (especially from Pleasant Run Dr)
- Speeding concerns on US 460

**US 460 at Dow Hollow Rd**

- Extreme safety concerns
- Cars going downhill over a crest causes safety issues (10+ comments)
    - Makes it harder to stop
    - Causes poor sight distance
- Numerous requests for traffic signal installation (10+ comments)
- Concerns regarding crashes that result in serious injuries/fatalities (5 comments)

**US 460 at Fallbrooke Drive**

- Safety concerns when turning left from Fallbrooke Dr (8 comments)
- Vehicles fail to obey stop sign (4 comments)

## FHWA Screening Tool for Equity Analysis of Projects (STEAP)

The Federal Highway (FHWA) Screening for Equity Analysis of Projects (STEAP) Tool was reviewed for the study area and surrounding locations. The tool allows you to compare the population to evaluate the metrics and needs of the study area to a city, town, county, or the State of Virginia. The tool is used to elevate consciousness of equity desires 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 shown in **Figures 10-14** and presented below:

- The majority of households contain two members and only 1% has more than six members of the household as show in **Figure 10.**
- There is a moderate personal vehicle ownership, with 36% of households owning three or more vehicles, while 7% of the study area does not have a personal vehicle as shown in **Figure 11.**
- Of all the households in the study area, 37% of households make over $75,000 in annual income. However, 23% make less that $15,000 as shown in **Figure 12.**
- When compared to the State of Virginia and Roanoke County, the study area has a higher average of households without computer access at 13.2% as shown in **Figure 13.**
- The study area has a lower percentage of veterans (5%) and higher percentage of people with disabilities (46%) compared to Roanoke County, as shown in **Figure 14.**

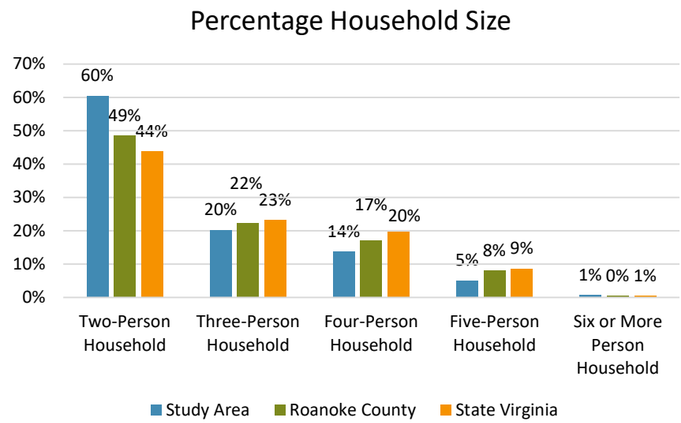



*Figure 10: STEAP Tool Analysis Household Size*

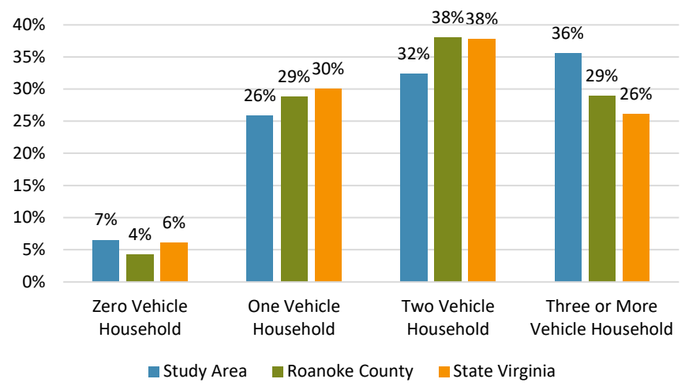



*Figure 11: STEAP Tool Analysis Vehicle Ownership*

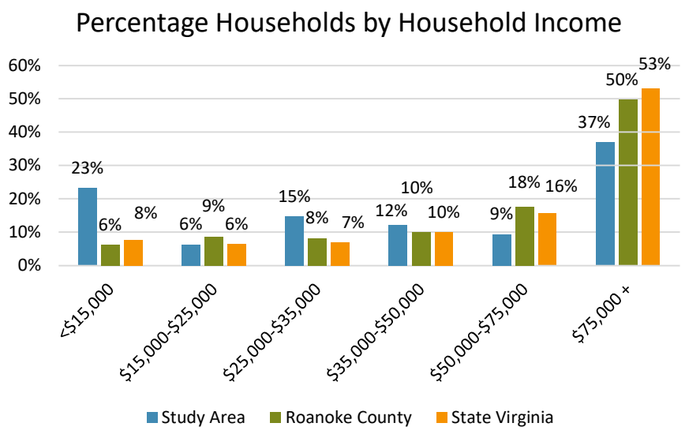



*Figure 12: STEAP Tool Analysis Household Income*

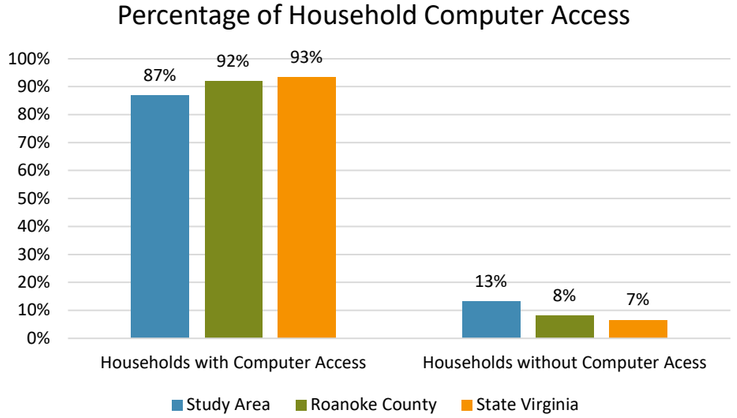



*Figure 13: STEAP Tool Analysis Household Computer Access*

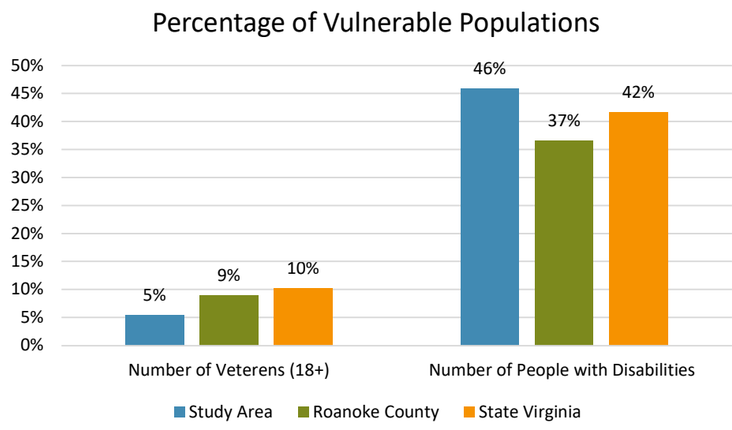



*Figure 14: STEAP Tool Analysis Vulnerable Populations*

# Traffic Operations and Accessibility:

The initial traffic operational analysis was performed using Synchro 11 software for the study intersections along the Route 11/460 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 for the 2050 design year under no build and build conditions.

## Traffic Data

Turning movement counts were performed on May 16, 2023, by Peggy Malone and Associates. The AM and PM weekday peak hours were identified as 7:15 - 8:15 AM and 3:30 – 4:30 PM, respectively. The existing intersection peak hour volumes are shown in **Figure 15**. The raw turning movement counts are provided in **Appendix B**.

## 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 Synchro/SimTraffic (for signalized and unsignalized intersections) and SIDRA (for roundabouts). For this study, guidance for reporting MOEs for signalized and unsignalized intersections was obtained from Chapter 4 of the VDOT TOSAM Version 2.0. 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)
- Maximum queue length from SimTraffic (measured in feet – ft)
- 95$^{th}$ percentile queue length from SIDRA (measure in feet – ft)

## Future Traffic Forecasting

In order to develop volume forecasts for the future 2050 design year volumes, background linear traffic growth rates were developed in conjunction with VDOT Salem District Planning using Statewide Planning System data. **Table 4** presents the annual linear growth rates along the study area roadways. The growth rates were applied to the existing traffic volumes to develop the 2050 design year traffic volumes. Future traffic volumes were re-balanced as necessary through the study area. 2050 design year traffic volumes are included in **Figure 16**.

***Table 4: Growth Rate Summary***

| Facility | From | To | Pathways for Planning Data | | | | Recommended Growth Rate |
|---|---|---|---|---|---|---|---|
| | | | Existing ADT | | 2050 ADT | Linear Annual Growth Rate | |
| | | | Year | ADT | | | |
| Route 460 W Main Street | Dow Hollow Road | Daugherty Road | 2022 | 8901 | 10147 | 0.5% | 0.5% |
| Route 460 W Main Street | Fallbrooke Drive | Dow Hollow Road | 2019 | 9570 | 11053 | 0.5% | 0.5% |
| Route 460 W Main Street | Harwick Drive | Dow Hollow Road | 2022 | 8530 | 9724 | 0.5% | 0.5% |
| Dow Hollow Road | I-81 SB Ramps | Route 460 W Main Street | 2022 | 6387 | 19514 | 7.3% | 0.5% |
| Pleasant Run Drive | Route 460 W Main Street | Edgewood Street | 2018 | 160 | 186 | 0.5% | 0.5% |
| Fallbrooke Drive | End of Road | Route 460 | 2019 | 1300 | 1502 | 0.5% | 0.5% |

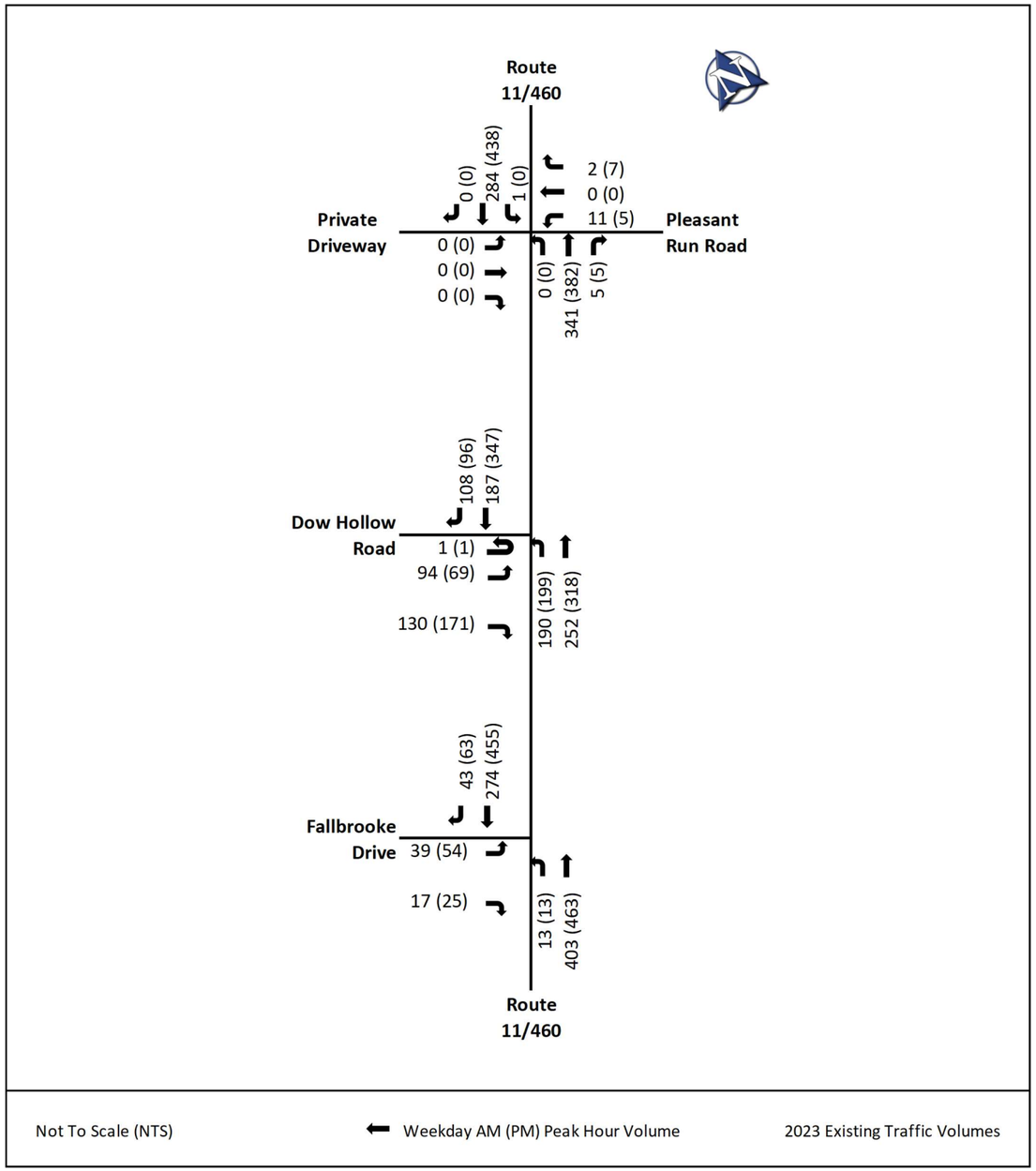



*Figure 15: Existing Peak Hour Turning Movement Counts*

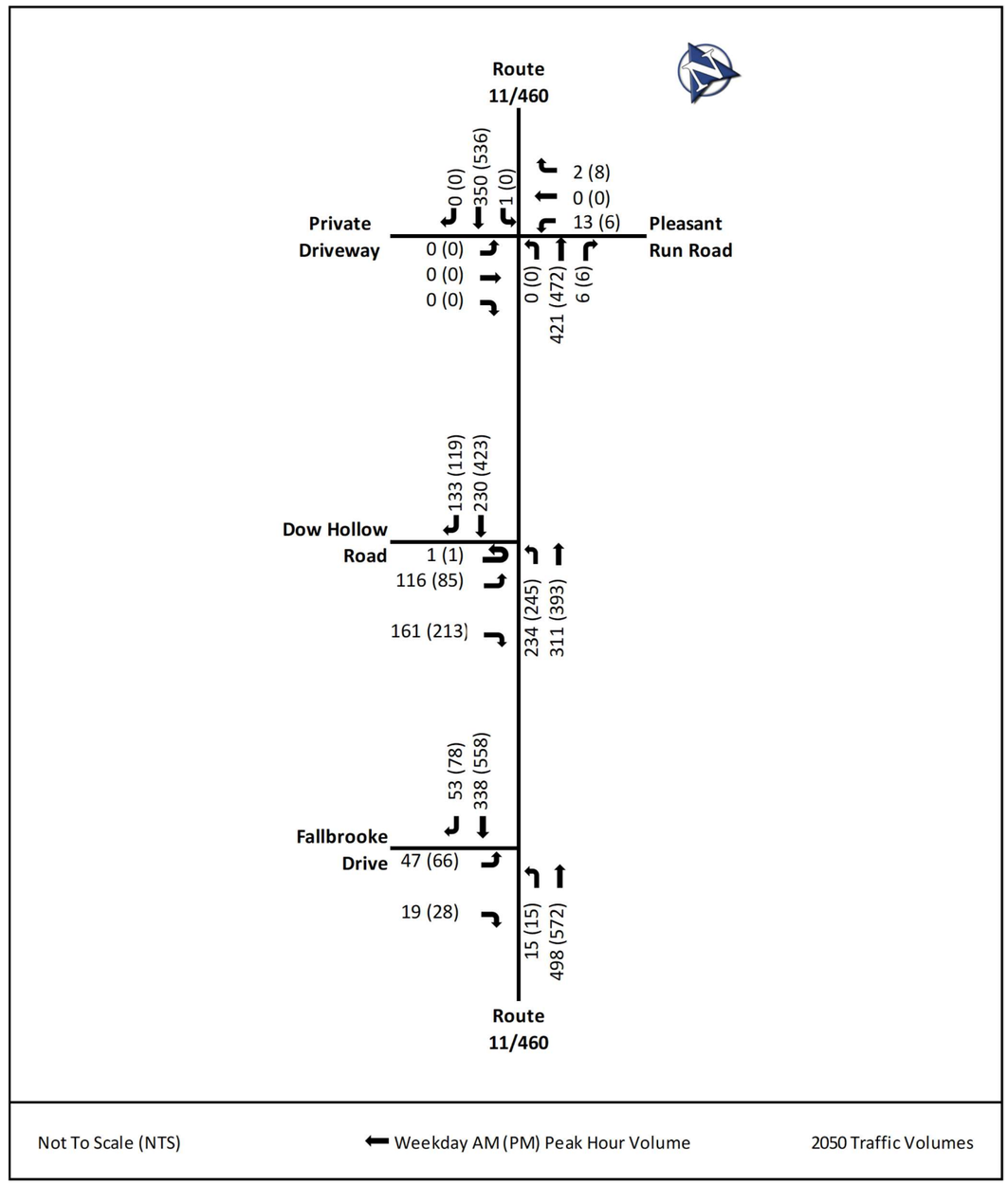



*Figure 16: 2050 Peak Hour Forecasted Traffic Volumes*

## Existing and No Build Traffic Operations Analysis Results

**Table 5** depicts intersection delays, queue lengths, and LOS for intersections along Route 11/460 within the study area, for the AM and PM peak hours under 2023 existing conditions. During the peak hours, all movements at each of the study intersections along Route 11/460 operate at LOS C or better and delays of less than 25 seconds. The only movement that experiences traffic queues exceeding 100 feet is the eastbound left turn from Down Hollow Road to northbound Route 11/460, which occurs during both the AM and PM peak hours.

The 2050 No Build analysis has been included for evaluation as a benchmark for the comparison of future conditions and impacts. The No Build analysis retains the same geometry as existing conditions since there are no funded improvements in the study area that would impact traffic operations. Traffic volumes were updated using projected 2050 design year volumes.

**Table 6** depicts intersection delays, queue lengths, and LOS for intersections along Route 11/460 within the study area, for the AM and PM peak hours under 2050 No Build conditions. By 2050, intersection delays and queues are projected to increase throughout the study area, with worsening levels of service. During the AM and PM peak hours, all movements at each of the study intersections along Route 11/460 operate at LOS C or better with delays of less than 25 seconds, except for the eastbound left turn from Dow Hollow Road which is projected to degrade to LOS D. During the AM peak hour, the only movement that experiences traffic queues exceeding 100 feet is the eastbound left turn from Down Hollow Road to northbound Route 11/460. During the PM peak hour, queues exceeding 100 feet are projected for eastbound Fallbrooke Drive, both the left-turn and right-turn lanes for eastbound Dow Hollow Road, and the northbound Route 11/460 left-turn to Dow Hollow Road. The queue for the eastbound Dow Hollow Road left turn is projected to exceed 360 feet, extending to within approximately 100 feet of the northbound I-81 off-ramp junction with Dow Hollow Road.

Detailed analysis results for the intersections are contained in **Appendix C**.

*Table 5: 2023 Existing Conditions Analysis Results Summary*

| Intersection | Approach | Movement | Existing AM | | | | | | | Existing PM | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Queue Length (ft) | Movement LOS | Approach LOS | Overall LOS | Delays (sec) | Approach Delay (sec) | Overall Delay (sec) | Queue Length (ft) | Movement LOS | Approach LOS | Overall LOS | Delays (sec) | Approach Delay (sec) | Overall Delay (sec) |
| **Route 11/460 & Fallbrooke Drive** Unsignalized | EB | L-R | 64 | B | B | - | 11.0 | 11.0 | - | 80 | B | B | - | 13.2 | 13.2 | - |
| | NB | L | 36 | A | - | | 8.2 | - | | 40 | A | - | | 9.0 | - | |
| | | T | - | - | | | - | | | - | - | | | - | | |
| | SB | T | - | - | - | | - | - | | - | - | - | | - | - | |
| | | R | - | - | | | - | | | - | - | | | - | | |
| **Route 11/460 & Dow Hollow Road** Unsignalized | EB | L | 142 | C | B | - | 18.3 | 13.3 | - | 204 | C | B | - | 22.5 | 14.6 | - |
| | | R | 73 | A | | | 9.7 | | | 95 | B | | | 11.4 | | |
| | NB | L | 80 | A | - | | 8.3 | - | | 87 | A | - | | 9.2 | - | |
| | | T | - | - | | | - | | | - | - | | | - | | |
| | SB | T | - | - | - | | - | - | | - | - | - | | - | - | |
| | | R | - | - | | | - | | | - | - | | | - | | |
| **Route 11/460 & Pleasant Run Road/Private Driveway** Unsignalized | EB | L-T-R | 0 | A | A | - | 0.0 | 0.0 | - | 0 | A | A | - | 0.0 | 0.0 | - |
| | WB | L-T-R | 25 | B | B | | 11.5 | 11.5 | | 62 | B | B | | 12.2 | 12.2 | |
| | NB | L | 0 | A | - | | 0.0 | - | | 0 | A | - | | 0.0 | - | |
| | | T-R | - | - | | | - | | | - | - | | | - | | |
| | SB | L | 12 | B | - | | 10.5 | - | | 0 | A | - | | 0.0 | - | |
| | | T-R | - | - | | | - | | | - | - | | | - | | |

*Table 6: 2050 No Build Analysis Results Summary*

| Intersection | Approach | Movement | 2050 No Build AM | | | | | | | 2050 No Build PM | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Queue Length (ft) | Movement LOS | Approach LOS | Overall LOS | Delays (sec) | Approach Delay (sec) | Overall Delay (sec) | Queue Length (ft) | Movement LOS | Approach LOS | Overall LOS | Delays (sec) | Approach Delay (sec) | Overall Delay (sec) |
| **Route 11/460 & Fallbrooke Drive** Unsignalized | EB | L-R | 76 | B | B | - | 11.6 | 11.6 | - | 122 | B | B | - | 14.6 | 14.6 | - |
| | NB | L | 34 | A | - | | 8.4 | - | | 42 | A | - | | 9.4 | - | |
| | | T | - | - | | | - | | | - | - | | | - | | |
| | SB | T | - | - | - | | - | - | | - | - | - | | - | - | |
| | | R | - | - | | | - | | | - | - | | | - | | |
| **Route 11/460 & Dow Hollow Road** Unsignalized | EB | L | 247 | C | C | - | 24.0 | 15.9 | - | 369 | D | C | - | 29.7 | 17.2 | - |
| | | R | 86 | B | | | 10.1 | | | 228 | B | | | 12.2 | | |
| | NB | L | 86 | A | - | | 8.6 | - | | 117 | A | - | | 9.7 | - | |
| | | T | - | - | | | - | | | - | - | | | - | | |
| | SB | T | - | - | - | | - | - | | - | - | - | | - | - | |
| | | R | - | - | | | - | | | - | - | | | - | | |
| **Route 11/460 & Pleasant Run Road/Private Driveway** Unsignalized | EB | L-T-R | 0 | A | A | - | 0.0 | 0.0 | - | 0 | A | A | - | 0.0 | 0.0 | - |
| | WB | L-T-R | 27 | B | B | | 12.1 | 12.1 | | 61 | B | B | | 13.0 | 13.0 | |
| | NB | L | 0 | A | - | | 0.0 | - | | 0 | A | - | | 0.0 | - | |
| | | T-R | - | - | | | - | | | - | - | | | - | | |
| | SB | L | 14 | B | - | | 10.9 | - | | 0 | A | - | | 0.0 | - | |
| | | T-R | - | - | | | - | | | - | - | | | - | | |

# 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 the study corridor. Crash data was collected and analyzed for five years spanning from January 2018 to December 2022. 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.

The crash severity within the study area is summarized by year and type in **Table 7** and **Table 8**, respectively. A summary of the crash severity and crash type by intersection is shown in **Table 9** and **Table 10**, respectively. A summary of the safety needs and diagnosis is illustrated in **Figure 7.**

*Table 7: Study Area Crash Severity by Year*

| Crash Year and Severity | K. Fatal Injury | A. Severe Injury | B. Visible Injury | C. Nonvisible Injury | PDO. Property Damage Only | Total |
|---|---|---|---|---|---|---|
| **2018** | 0 | 1 | 2 | 1 | 7 | **11** |
| **2019** | 0 | 2 | 0 | 4 | 7 | **13** |
| **2020** | 0 | 0 | 2 | 3 | 4 | **9** |
| **2021** | 0 | 4 | 1 | 3 | 10 | **18** |
| **2022** | 0 | 0 | 3 | 3 | 11 | **17** |
| **Total** | 0 | 7 | 8 | 14 | 39 | **68** |

*Table 8: Study Area Crash Severity by Type*

| Collision Type and Crash Severity | K. Fatal Injury | A. Severe Injury | B. Visible Injury | C. Nonvisible Injury | PDO. Property Damage Only | Total |
|---|---|---|---|---|---|---|
| **Angle** | 0 | 5 | 7 | 13 | 25 | **50** |
| **Rear End** | 0 | 1 | 1 | 1 | 3 | **6** |
| **Sideswipe – Same Direction** | 0 | 1 | 0 | 0 | 5 | **6** |
| **Fixed Object – Off Road** | 0 | 0 | 0 | 0 | 4 | **4** |
| **Non-Collision** | 0 | 0 | 0 | 0 | 1 | **1** |
| **Pedestrian** | 0 | 0 | 0 | 0 | 0 | **0** |
| **Head On** | 0 | 0 | 0 | 0 | 0 | **0** |
| **Sideswipe – Opposite Direction** | 0 | 0 | 0 | 0 | 0 | **0** |
| **Other** | 0 | 0 | 0 | 0 | 1 | **1** |
| **Total** | **0** | **7** | **8** | **14** | **39** | **68** |

*Table 9: Study Area Crash Severity by Intersection*

| Intersections | K. Fatal Injury | A. Severe Injury | B. Visible Injury | C. Nonvisible Injury | PDO. Property Damage Only | Total |
|---|---|---|---|---|---|---|
| **Fallbrooke Drive** | 0 | 1 | 5 | 5 | 10 | **21** |
| **Dow Hollow Road** | 0 | 5 | 3 | 8 | 26 | **42** |
| **Pleasant Run Drive** | 0 | 1 | 0 | 1 | 3 | **5** |
| **Total** | **0** | **7** | **8** | **14** | **39** | **68** |

*Table 10: Study Area Crash Type by Intersection*

| Intersections | Rear End | Angle | Sideswipe | Fixed Object | Other | Total |
|---|---|---|---|---|---|---|
| **Fallbrooke Drive** | 1 | 17 | 2 | 1 | 0 | **21** |
| **Dow Hollow Road** | 4 | 32 | 3 | 1 | 2 | **42** |
| **Pleasant Run Drive** | 1 | 1 | 1 | 2 | 0 | **5** |
| **Total** | **6** | **50** | **6** | **4** | **2** | **68** |

A total of 68 crashes were reported within the study area during the five-year study period. Key takeaways from the crash data are as follows:

1. Crash occurrence varies by year with the highest number of crashes (18) occurring in 2021, followed by 17 crashes in 2022 as shown in **Table 7.**
2. The approximate average number of reported crash incidents per year is 13.6.
3. The majority of reported crash incidents within the corridor are angle crashes. These crashes account for 74% of all crashes in the study area.
4. A total of 29 crash incidents were associated with injuries, which account for approximately 43% of the total reported crashes within the corridor.
5. 41% of crashes occurred between 3 PM and 6 PM.

The following is a detailed  summary of the crashes at intersection during the five-year study period:

US 11/460 at Dow Hollow Road - 42 crashes

- 32 angle crashes (76%)
  - 24 EBL/SBT (7 involving trucks)
  - 4 NBL/SBT
  - 2 EBL/SBT
  - 1 NBL/SBR
- 16 injury crashes (38%)
- A fatal angle crash occurred after study period on 8/17/23 involving a motorcycle and a truck

US 11/460 at Fallbrooke Drive - 21 crashes

- 17 angle crashes (81%)
  - 10 EBL/SBT
  - 4 EB/SBT
  - 1 NBL/SBT
  - 1 SBT/SBT
  - 1 NBL/NBL
- 11 injury crashes (52%)

The collision diagram is presented in **Figure 17.**


*Figure 17: Collision Diagram*

# Chapter 2:

# Alternative Development and Refinement

# Alternative Development and Screening

In order to develop alternative concepts to address the needs and incorporate diagnosis identified in Chapter 1, a thorough review of the existing conditions data was conducted. A screening-level analysis was performed to identify potential improvements along Route 11/460 (West Main Street). Alternatives evaluated include:

- Continuous Green-T with One NB Lane for Route 11/460
- Peanut Roundabout
- Three-Phase Traffic Signal

The conceptual designs for each of the alternatives under consideration are shown in **Figures 18 through 20** including a summary of advantages and disadvantages. As noted, the Continuous Green-T would create a weave along northbound Route 11/460 between Dow Hollow Road and Pleasant Run Road and would not accommodate access to future development on the east side of Route 11/460 should it develop in the future. The Continuous Green-T also creates a stop condition on a steep grade on southbound Route 11/460.

The Three-Phase Traffic Signal alternative would create a new stop condition on both northbound and southbound Route 11/460, will increase the potential for rear end crashes and does not address the angle crash problem at Fallbrooke Drive. It also has higher delays than the Continuous Green-T alternative.

Given that Route 11/460 is on the Arterial Preservation Network (APN), an iCAP analysis including VJuST was performed for the 2050 design year for both the AM and PM peak hours to document the three alternatives under consideration in addition to the existing stop-controlled intersection configuration. The results are summarized in **Appendix D**. Both VJuST and iCAP have limitations regarding the evaluation of the peanut roundabout; however, both VJuST and iCAP indicated that the roundabout alternative scored the highest given the significant safety benefits and conflict reduction with the roundabout.

Based on the safety benefits of the Peanut Roundabout and the disadvantages of the Continuous Green T and Three-Phase Traffic Signal and the results of the VJuST and iCAP analysis, the Peanut Roundabout was selected as the preferred alternative.


### Advantages

- No widening required
- Overall LOS B during I-81 NB incident

### Disadvantages

- New stop condition on SB US 460 on steep downgrade
- Reduces NB US 460 to a single lane
- Weave along NB US 460 between Dow Hollow Rd and Pleasant Run Rd (issue if property on east side of US 460 is developed)
- Does not address angle crashes at Fallbrooke Dr

*Figure 18: Route 11/460 at Dow Hollow Road Continuous Green-T*


*Figure 19: Route 11/460 at Dow Hollow Road Roundabout*

**Advantages**

- No stop conditions
- Reduces potential for angle crashes at both Dow Hollow Rd and Fallbrook Dr
- Overall LOS C during I-81 NB incident
  - NB US 460 operates at LOS D (~800 ft northbound queue)

**Disadvantages**

- Significant fill required due to steep grades adjacent to the intersection
- Right of way impacts anticipated on west side of US 460
- Roundabout on 6-7% grade


*Figure 20: Route 11/460 at Dow Hollow Road Traffic Signal*

**Advantages**

- No significant physical improvements required
- Potential short-term improvement to reduce the potential for angle crashes
- Overall LOS B/C during I-81 NB incident

**Disadvantages**

- New stop condition on SB US 460 on steep downgrade
- New stop condition on NB US 460
- Potential increase in read end crashes
- Higher delays than Green-T alternative
- Does not address angle crashes at Fallbrooke Dr

# Preferred Alternative

The Preferred Alternative option was developed for the study area based on the results of a screening-level traffic analysis as discussed in the previous *Alternative Development and Screening* section as well as through stakeholder meetings. The proposed improvement and analyses performed for the Preferred Alternative are discussed in greater detail in the following section.

A summary of the proposed improvement included in the Preferred Alternative is shown in **Table 11** and a detailed concept is included in **Figure 21**. A peanut roundabout is proposed to control traffic movements at both the Route 11//460 at Dow Hollow Road and Route 11/460 at Fallbrooke Drive intersection.

***Table 11: List of Preferred Alternative Improvement***

| Intersection/Segment | Description | Improvement Categories |
|---|---|---|
| Route 11/460 at Dow Hollow Road and Fallbrooke Drive | Convert the intersection to a Peanut Roundabout | Safety Improvement<br>Capacity Preservation |

# Traffic Operations Analysis

Following the alternatives development process and the selection of preferred improvements, the 2050 No Build Synchro traffic analysis network files were updated to reflect the recommended improvements proposed for intersections within the study area. SIDRA was utilized to analyze the proposed roundabout. The results of the Synchro traffic analysis, SimTraffic microsimulation, and SIDRA roundabout analysis are documented for the measures of effectiveness (MOEs) in accordance with the TOSAM.

**Table 12** depicts intersection delays, queue lengths, and LOS for intersections along Route 11/460 within the study area, for the AM and PM peak hours under 2050 Build conditions. The proposed improvements are projected to reduce intersection delays and queues and improve levels of service for all movements at the Fallbrooke Drive and Dow Hollow Road intersections, which will be combined into a single peanut roundabout configuration. During both the AM and PM peak hours, all movements at the roundabout operate at LOS A with delays of less than 10 seconds. Additionally, queues are not projected to exceed 100 feet for any movement at the proposed roundabout, including the eastbound Dow Hollow Road left turn which has queues approaching the northbound I-81 off-ramp under No Build conditions.

Detailed analysis results for the intersections are contained in **Appendix C**.

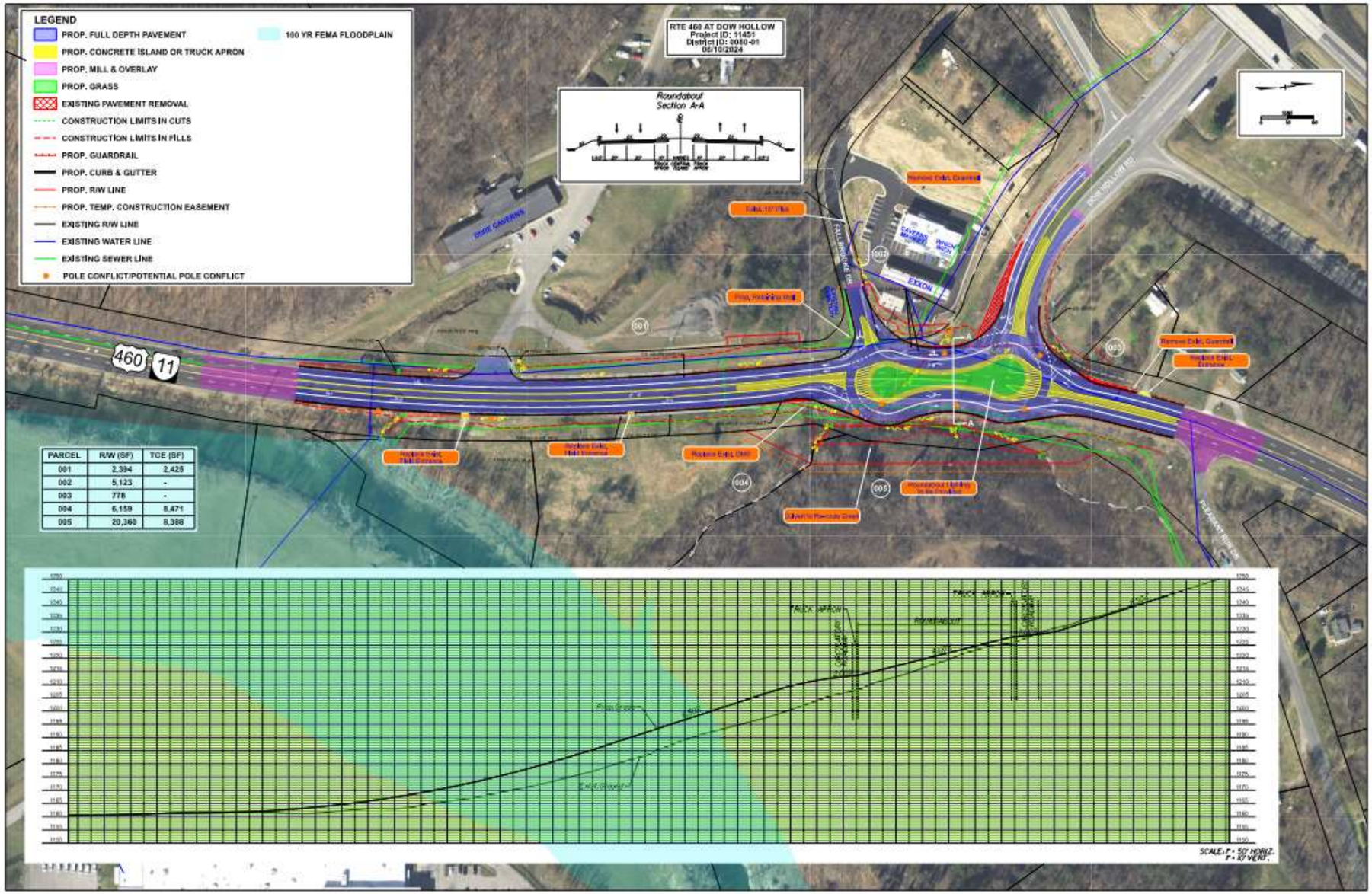



*Figure 21: Route 11/460 at Dow Hollow Road Peanut Roundabout Preferred Alternative*

*Table 12: 2050 Build Analysis Results Summary*

| Intersection | Approach | Movement | 2050 Build AM | | | | | | | 2050 Build PM | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Queue Length (ft) | Movement LOS | Approach LOS | Overall LOS | Delays (sec) | Approach Delay (sec) | Overall Delay (sec) | Queue Length (ft) | Movement LOS | Approach LOS | Overall LOS | Delays (sec) | Approach Delay (sec) | Overall Delay (sec) |
| **Route 11/460 & Dow Hollow Road / Fallbrooke Drive** Roundabout[1] | EB Dow Hollow | L | 18 | A | A | A | 5.5 | 5.1 | 5.3 | 22 | A | A | A | 8.6 | 7.1 | 6.2 |
| | | R | 20 | A | | | 4.8 | | | 31 | A | | | 6.5 | | |
| | EB Fallbrooke | L-R | 9 | A | A | | 5.4 | 5.4 | | 15 | A | A | | 7.0 | 7.0 | |
| | NB | L-T | 38 | A | A | | 5.5 | 5.3 | | 45 | A | A | | 5.8 | 5.6 | |
| | | T | 39 | A | | | 5.1 | | | 45 | A | | | 5.4 | | |
| | SB | T | 31 | A | A | | 5.5 | 5.5 | | 45 | A | A | | 6.1 | 6.1 | |
| | | T-R | 32 | A | | | 5.4 | | | 47 | A | | | 6.1 | | |
| **Route 11/460 & Pleasant Run Road/Private Driveway** Unsignalized | EB | L-T-R | 0 | A | A | - | 0.0 | 0.0 | - | 0 | A | A | - | 0.0 | 0.0 | - |
| | WB | L-T-R | 27 | B | B | | 12.1 | 12.1 | | 61 | B | B | | 13.0 | 13.0 | |
| | NB | L | 0 | A | - | | 0.0 | - | | 0 | A | - | | 0.0 | - | |
| | | T-R | - | - | | | - | | | - | - | | | - | | |
| | SB | L | 14 | B | - | | 10.9 | - | | 0 | A | - | | 0.0 | - | |
| | | T-R | - | - | | | - | | | - | - | | | - | | |

[1] Level of Service (LOS), delays, and 95th percentile queues obtained from SIDRA

# Expected Crash Reduction

A Crash Modification Factor (CMF) is used to determine the expected number of crashes after implementing a countermeasure on a road or intersection. CMFs for the various improvements under consideration were applied to the relevant crash history to evaluate the expected crash reduction. CMFs were obtained from Virginia State Preferred CMF List, the SMART SCALE Planning Level CMFs – Round 6 list, or the Crash Modification Factors Clearinghouse. **Table 13** presents the CMF value used for each crash severity type to calculate the crash reduction expected from the installation of the safety improvements.

***Table 13: Recommended Improvement CMFs by Crash Severity***

| Location | Proposed Improvement | Applicable Crash Type | K | A | B C | O |
|---|---|---|---|---|---|---|
| Route 11/460 at Dow Hollow Road and Fallbrooke Drive | Install roundabout | All | 0.18 | 0.18 | 0.18 | 0.18 |

CMFs for total crashes were applied to the total number of crashes during the 5-year study period to determine the expected crash reductions within the study area. CMFs for fatal and injury crashes were applied to the type K (fatal), A (severe injury), B (visible injury), and C (non-visible injury) crashes. **Table 14** summarizes the expected crash reductions for each crash severity and the overall crashes.

***Table 14: Total Expected Number of Crashes and % Crash Reduction (2018 – 2022)***

| Location | | K | A | B C | O | Total |
|---|---|---|---|---|---|---|
| Route 11/460 at Dow Hollow Road and Fallbrooke Drive | Total Crashes | 0 | 6 | 21 | 36 | 63 |
| | Total Expected Crashes | 0.0 | 1.1 | 3.8 | 6.5 | 11.3 |
| | *Change in Crashes* | 0.0 | -4.9 | -17.2 | -29.5 | -51.7 |
| | **Percent Crash Reduction After Improvements** | | | | | **82%** |

*Total expected number of crashes is rounded to the nearest tenth

Key findings from the expected crash analysis are as follows:

- An annual crash reduction of 10 crashes is expected along Route 11/460 from Fallbrooke Drive to Pleasant Run Drive, which is equivalent to an approximately 82% reduction in crashes.
- An annual crash reduction of 4.4 injury crashes is expected along Route 11/460 from Fallbrooke Drive to Pleasant Run Drive, which is equivalent to an approximately 82% reduction in crashes.

# Chapter 3:

# Public and Stakeholder Outreach and Feedback

# Public Involvement

Following the development and analysis of the build alternatives, a public involvement survey was developed using the PublicInput survey tool to determine the public's response to the improvements and what they perceived as the relevant issues within the study area. This survey was available online for 14 days from February 28 – March 13, 2024. In addition, a public meeting was held on February 28, 2024 from 5:00 to 7:00 PM at Glenvar Library.

Overall, the survey was divided into three sections, which include the following:

1. Introduction with overview of the project and study area
2. Recommended improvement
3. Wrap up with demographic questions

For the recommended improvement, participants were asked to provide a rating based on their opinion from one to five, with one being strongly opposed to the concept and 5 being strongly support the concept. Respondents were also provided with an option to provide comments or concerns. At the end of the survey, participants were asked demographic questions. There were a total of 487 participants and 448 comments were provided. **Figure 22** presents the concept rating screen from the survey.

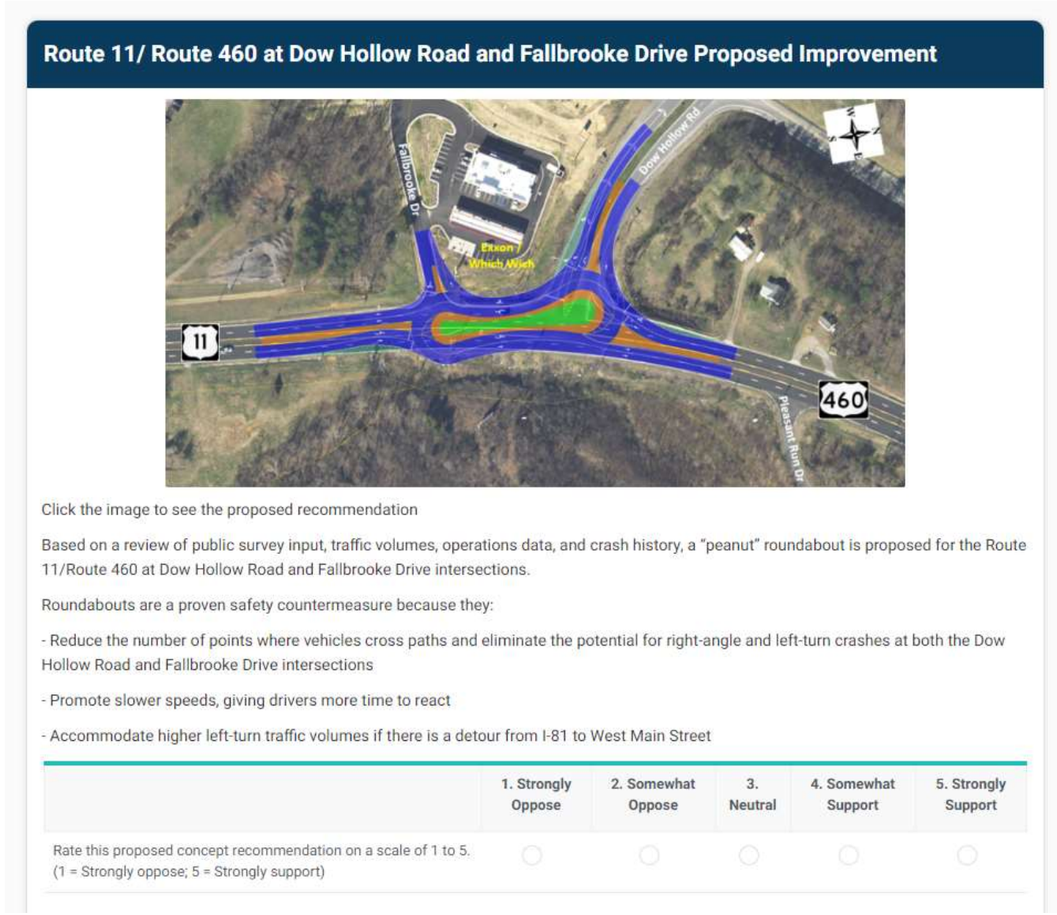



*Figure 22: Public Survey Layout*

## Survey Question and Results

The roundabout improvement at Dow Hollow Road received an average rating of 3.052 (see **Figure 23**) on a scale of 1 to 5.

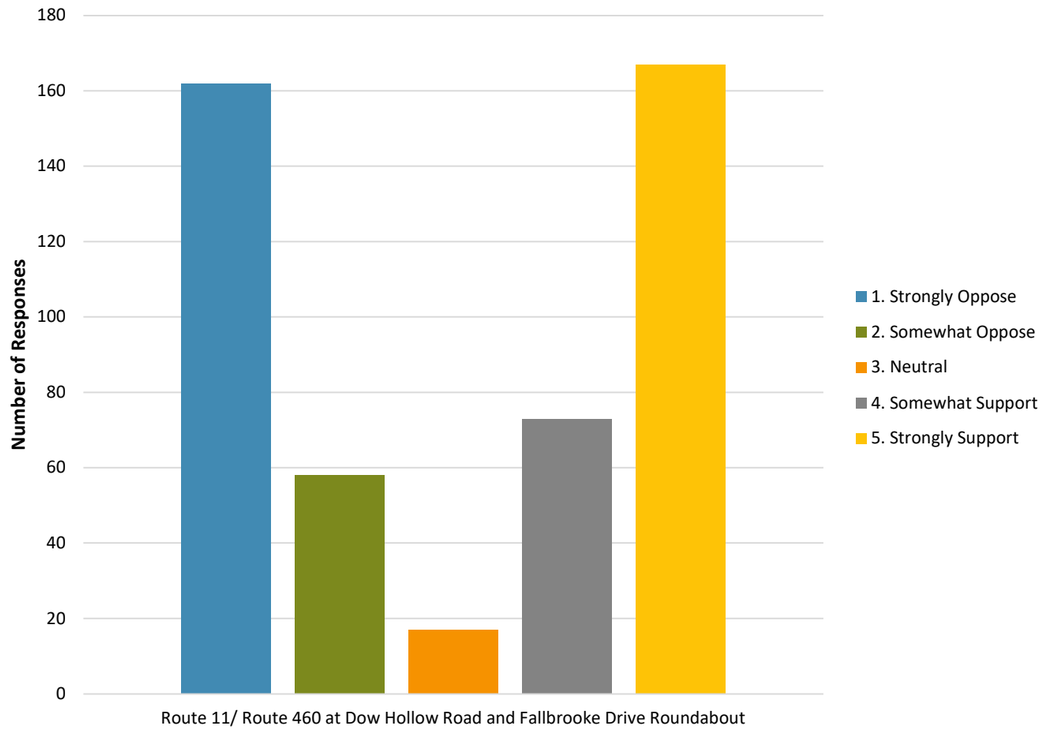



*Figure 23: Route 11/460 at Dow Hollow Road Survey Results*

# Chapter 4:

# Preferred Alternative Design Refinement & Investment Strategy

# Investment Strategy:

This study should be used as a planning tool to achieve the next steps of planning, programming, designing, and constructing the identified improvements along study corridor. To build upon the efforts of this study, VDOT Salem District should continue to coordinate with Roanoke County and other stakeholders.

Improvement projects should be prioritized on a local and regional level. Prior to submitting funding applications, the applicant must have inclusion or proven consistency with the Constrained Long-Range Transportation Plan (CLRP) or resolution of support from a governing body.

## Preferred Alternative

Throughout the study process, proposed improvements were presented for stakeholder and public engagement, refined based on feedback, and analyzed in detail to verify that they met both safety and operational needs. As of the completion of this report, the concept plan displayed in in **Figure 16** is the final recommended preferred alternative. This conceptual design was developed in accordance with the following applicable guidelines:

- A Policy on Geometric Design of Highways and Streets (AASHTO 2018)
- VDOT Road Design Manual (Issued January 2005, Revised June 2022)
- VDOT Road and Bridge Standards (VDOT 2016, latest revisions)
- Manual on Uniform Traffic Control Devices (MUTCD 2009)
- 2011 Virginia Supplement to the MUTCD

Design criteria and guidance from these documents were applied to roadways within the project limits based on functional classification and roadway design speeds.

## Planning-Level Cost Estimates

An engineer's preliminary opinion of probable cost was created for construction costs, right of way acquisition costs, and utility relocation costs for the preferred alternative using Version 3.1 of the Cost Estimate Workbook (CEWB) as shown in **Table 15. Appendix E** includes detailed cost estimates.

***Table 15: Planning Level Cost Estimates for the Preferred Alternative***

| Phase Description | Budget* |
|---|---|
| Preliminary Engineering | $4,375,467 |
| Right of Way and Utility Relocation | $2,152,300 |
| Construction | $31,108,883 |
| Total Project Budget | $37,636,649 |

*Estimate as of July 29, 2024

## Project Risks

The project team worked with VDOT staff to identify potential project risks, discuss mitigation strategies and determine risk items which needed additional contingencies carried with the project estimate. The Salem District Scope of Work document identifies project risks (see **Appendix F**).

## Possible Funding Sources

The development of this study and the preferred alternative were conducted in accordance with eligibility criteria for SMART SCALE, a competitive funding program that allocates funding from the construction District Grants Program (DGP) and High-Priority Projects Program (HPPP) to transportation projects. SMART SCALE uses a scoring process that evaluates, scores, and ranks project applications based on six measures: congestion mitigation, economic development, accessibility, safety, environmental quality, and land use. Roanoke Valley Transportation Planning Organization (RVTPO) submitted the proposed roadway improvements for SMART SCALE Round 6 funding consideration.

Other funding sources that may be considered for the proposed roadway improvements identified in this study include:

- **Revenue Sharing:** a competitive funding program providing a dollar-for-dollar state match to local funds for transportation projects. Projects eligible for Revenue Sharing funds include construction, reconstruction, improvement, and maintenance projects.
- **Congestion Mitigation and Air Quality (CMAQ):** a competitive funding program allocating funds to surface transportation projects that improve air quality by reducing congestion.
- **Highway Safety Improvement Program (HSIP):** a competitive funding program providing funds for improvements that correct or improve safety on a section of roadway or intersection with a high incidence of crashes.