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## Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>AADT</td>
<td>Average Annual Daily Traffic.</td>
</tr>
<tr>
<td>Crash rate</td>
<td>A rate to express number of crashes per one hundred million vehicle miles travelled, it is used to compare roadways as daily traffic differs on roadways.</td>
</tr>
<tr>
<td>CMFs</td>
<td>Crash Modification Factors quantify an expected reduction in crashes if various measures were implemented.</td>
</tr>
<tr>
<td>Delay</td>
<td>Measurement of travel time lost due to impedance to traffic flow, measured in average seconds per vehicle.</td>
</tr>
<tr>
<td>GS-2</td>
<td>Functional classification for a rural minor arterial highway. All highways are classified based to the character of service they are intended to provide.</td>
</tr>
<tr>
<td>GS-3</td>
<td>Functional classification for a rural major collector highway.</td>
</tr>
<tr>
<td>HCM</td>
<td>Highway Capacity Manual; a transportation engineering manual that presents concepts, guidelines and computational procedure on how to analyze roadway operations and develop LOS ratings.</td>
</tr>
<tr>
<td>HCS</td>
<td>Highway Capacity Software, a computer software program used to analyze roadway operations.</td>
</tr>
<tr>
<td>HSM</td>
<td>Highway Safety Manual; details the process used to analyze crash patterns, to develop crash rates and to identify potential measures to reduce crashes</td>
</tr>
<tr>
<td>JUANT</td>
<td>Jefferson Area UNited Transportation, a regional public transit service.</td>
</tr>
<tr>
<td>LOS</td>
<td>Level of Service, a rating of roadway operations from a letter grade of “A” for the least amount of congestion and “F” for the most amount of congestion.</td>
</tr>
<tr>
<td>MOEs</td>
<td>Measure of Effectiveness; includes delay, LOS and queue length.</td>
</tr>
<tr>
<td>Peak Hour</td>
<td>The highest volume hour in the morning and evening rush hours.</td>
</tr>
<tr>
<td>Queue Report</td>
<td>A report that summarizes the average queue lengths and 95th percentile queue lengths expected based on roadway operations.</td>
</tr>
<tr>
<td>Synchro</td>
<td>A computer software program used to analyze intersection operations.</td>
</tr>
<tr>
<td>TJPDC</td>
<td>Thomas Jefferson Planning District Commission.</td>
</tr>
<tr>
<td>VDOT</td>
<td>Virginia Department of Transportation.</td>
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</table>
1. Introduction and Overview

1.1 Introduction and Background

The Route 151 (Rockfish Valley Highway/Critzers Shop Road) Corridor Study will evaluate the operations and safety of approximately 14 miles of Route 151 in the North District and Central District of Nelson County, Virginia. The study area runs from the intersection of Route 151/Route 664 (Beech Grove Road) in the south to the intersection of Route 151/U.S. Route 250 in the north. The study corridor is shown in Figure 1. For most of its length Virginia State Route 151 (Route 151) is a rural two-lane north-south Minor Arterial highway that provides residents with access to jobs, schools, recreation and shopping. Route 151 serves as an important tourist route, with an increasingly high volume of vehicular traffic. This increase is due to the proximity of the George Washington National Forest and Wintergreen Resort, the growing popularity of Nelson County’s craft breweries, vineyards and wineries, and the road’s designation as a Virginia Scenic Byway. Route 151 is also a designated bicycle route. In addition, JUANT (Jefferson Area UNited Transportation) provides limited “demand-response” bus service, linking the urbanized areas of the corridor to points beyond the corridor.

Figure 1: Route 151 Corridor Study Location Map
Although Nelson County is a sparsely populated rural community, it has experienced steady population growth and an increase in vehicles traveling the Route 151 corridor in the past 10 years. In addition, the corridor has been established as a viable shortcut for many commercial trucks traveling between I-64 and U.S. Route 29. While commercial truck operators save considerable time by using Route 151 as a bypass between U.S. Route 250 in the north and U.S. Route 29 in the south, this shortcut has resulted in increased traffic congestion and has caused safety concerns for the corridor.

A previous corridor study was conducted in 2001, which identified safety and operational deficiencies of the corridor and potential improvement measures. Since that time, VDOT has performed spot improvements to the corridor, which have mainly been low-cost improvements including the addition of turn lanes where warranted or other safety related improvements. VDOT has also reconstructed the intersection at Route 709 (Chapel Hollow Road) and at Route 635 (Greenfield Road). The need for other improvements, in addition to those previously implemented, has also been identified in this study.

1.2 Project Vision and Goals

This project included coordination with stakeholders including VDOT, County Supervisors and Staff, and members of the public. At the kick-off meeting on January 10, 2013, project goals and a vision statement were developed by the project team, as outlined below:

Vision Statement:

“We envision a Route 151 corridor that serves the needs of all users and stakeholders while maximizing safety; preserving the corridor’s rural character, local sense of place, and high quality of life; and promoting place-based economic vitality.”

Goals:

1. Obtain public input through public meetings.

2. Identify corridor improvements, with an emphasis on context-sensitive solutions, that:
   - Improve safety for all users,
   - Enhance operations and access management,
   - Provide safe multimodal opportunities,
   - Retain two-lane cross-section,
   - Promote appropriate economic opportunities, and
   - Preserve and incorporate the corridor’s cultural heritage and historical resources.

1.3 Study Process

The study process is illustrated in Figure 2. Although this is a VDOT project, it has been closely coordinated and shared with Nelson County. Public input through the stakeholder meetings is an important part of the overall process. Reaching a consensus with the Nelson County Board of
Supervisors and staff is key to this project. This cooperation was implemented at coordination meetings which involved VDOT, County Supervisors and Staff.

1.4 Report Outline

This report is organized into four (4) chapters:
- Chapter 1: Introduction and overview of the study.
- Chapter 2: Data collection process, operational analysis, information gathered during the site visit and safety analysis for the existing conditions.
- Chapter 3: Operational analysis for both no-build and build conditions for the study horizon year of 2018; and the safety assessment for potential improvements.
- Chapter 4: Conclusions with recommendations.
Figure 2: Study Process

Kick-off Meeting / Coordination Meeting 1

Data Collection
- Intersection turn movement counts
- Obtain crash data

Existing Analysis
- Operational analysis
- Field Review with VDOT and County Staff

Coordination Meeting 2 Stakeholder Meeting 1

Develop Alternatives/Draft Recommendations
- 2020 and 2040 operational analysis
- Safety Analysis

Coordination Meeting 3 Stakeholder Meeting 2

Finalize Recommendations/Prepare Draft Report

VDOT/County review of Draft Report

Final Report

Study Deliverables

Existing Conditions chapter for Draft Report

2020 and 2040 Conditions Chapter Report

Draft Report

Final Report

July 2013
2. Overview of Existing Conditions

This chapter presents an overview of the Existing Conditions operational and safety assessments, as well as recommendations and findings from three speed studies that were conducted in 2007, 2008 and 2012.

2.1 Study Corridor

The Route 151 Study Corridor is approximately 14 miles in length, running from the intersection at Route 664 (Beech Grove Road) in the south to the intersection at U.S. Route 250 in the north.

2.1.1 Key Roadways

For most of its length Route 151 is a rural two-lane north-south Rural Minor Arterial highway (GS-2) with a posted speed limit of either 45 mph or 55 mph. The corridor serves as an important tourism route, as it provides access to the George Washington National Forest, Wintergreen Resort, and numerous craft breweries and wineries. It is also a designated bicycle route, and bus service operated by JAUNT provides transit connections with urbanized areas.

U.S. Route 250 (Rockfish Gap Turnpike) is classified as a Rural Minor Arterial highway (GS-2) west of Route 151, but as a Rural Major Collector highway (GS-3) east of Route 151. This roadway provides a parallel link to I-64 between Waynesboro and Charlottesville, and points beyond. It is a two lane roadway in the vicinity of Route 151, with turn bays for traffic to turn onto Route 151.

Route 6 (River Road) is classified as a Rural Minor Arterial highway (GS-2), and serves as a link between Route 151 and U.S. Route 29. Afton Mountain Road, also Route 6, is also classified as a Rural Minor Arterial highway (GS-2). Both roadways have two lanes.

The combination of Route 6 (River Road), Route 151 and U.S. Route 250 is an alternate truck route between U.S. Route 29 to the south and I-64 to the northwest. Truckers use this route to achieve significant time savings and to avoid the I-64/U.S. 29 interchange at the edge of Charlottesville which can be highly congested during peak periods.

The study area and key intersections, described in the following section, are shown in Figure 3.
Figure 3: Study Area and Study Intersections

Route 151 Study Intersections
1. Route 664 (Beech Grove Road and Glenthorne Loop)
2. Route 627 (Spruce Creek Lane and Glenthorne Loop)
3. Route 634 (Adial Road)
4. Route 613 (Rodes Farm Drive and Lodebar Estate)
5. Route 6 (River Road)
6. Route 635 (Rockfish School Lane)
7. Route 635 (Greenfield Road)
8. Route 729 (Creek Road)
9. Route 784 (Bland Wade Lane)
10. Route 760 (Sunrise Drive)
11. Route 609 (Mill Lane)
12. Route 638 South (Avon Road)
13. Route 840 (Tanbark Drive)
14. Route 6 (Afton Mountain Road) and Route 638 North (Avon Road)
15. U.S. Route 250 (Rockfish Gap Turnpike)
2.1.2 Study Intersections

There are a total of 15 study intersections undergoing safety analysis, four (4) of which are being examined for operational improvements. The 15 intersections are shown in Figure 3 and listed below along with the characteristics of the intersection:

1. **Route 664 (Beech Grove Road and Glenthorne Loop) and Route 151**

<table>
<thead>
<tr>
<th>Roadway</th>
<th>Approach Direction</th>
<th>Stop Controlled</th>
<th>Lane Width (feet)</th>
<th>Speed (mph)</th>
<th>Centerline present?</th>
<th>Turn Bay Present?</th>
<th>Driveways within 200 feet?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route 151 NB/SB</td>
<td>No</td>
<td>11</td>
<td>55</td>
<td>Yes</td>
<td>No</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Route 664 EB</td>
<td>Yes</td>
<td>11</td>
<td>45</td>
<td>Yes</td>
<td>No</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Route 627 WB</td>
<td>Yes</td>
<td>10</td>
<td>Not posted</td>
<td>No</td>
<td>No</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

2. **Route 627 (Spruce Creek Lane and Glenthorne Loop) and Route 151**

<table>
<thead>
<tr>
<th>Roadway</th>
<th>Approach Direction</th>
<th>Stop Controlled</th>
<th>Lane Width (feet)</th>
<th>Speed (mph)</th>
<th>Centerline present?</th>
<th>Turn Bay Present?</th>
<th>Driveways within 200 feet?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route 151 NB/SB</td>
<td>No</td>
<td>11</td>
<td>55</td>
<td>Yes</td>
<td>No</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Route 627 EB/WB</td>
<td>Yes</td>
<td>10</td>
<td>35 (east of Route 151 not posted)</td>
<td>No</td>
<td>No</td>
<td>1</td>
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3. **Route 634 (Adial Road) and Route 151**

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<th>Speed (mph)</th>
<th>Centerline present?</th>
<th>Turn Bay Present?</th>
<th>Driveways within 200 feet?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route 151 NB/SB</td>
<td>No</td>
<td>11</td>
<td>45</td>
<td>Yes</td>
<td>No</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Route 634 WB</td>
<td>Yes</td>
<td>10</td>
<td>Not posted</td>
<td>No</td>
<td>No</td>
<td>2</td>
<td></td>
</tr>
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4. **Route 613 (Rodes Farm Drive and Lodebar Estate) and Route 151**

<table>
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<th>Roadway</th>
<th>Approach Direction</th>
<th>Stop Controlled</th>
<th>Lane Width (feet)</th>
<th>Speed (mph)</th>
<th>Centerline present?</th>
<th>Turn Bay Present?</th>
<th>Driveways within 200 feet?</th>
</tr>
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<tbody>
<tr>
<td>Route 151 NB/SB</td>
<td>No</td>
<td>11</td>
<td>45</td>
<td>Yes</td>
<td>No</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Route 613 EB (Rodes Farm)</td>
<td>Yes</td>
<td>9-10</td>
<td>Not posted</td>
<td>No</td>
<td>No</td>
<td>0</td>
<td></td>
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<table>
<thead>
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<th>Roadway</th>
<th>Approach Direction</th>
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<th>Lane Width (feet)</th>
<th>Speed (mph)</th>
<th>Centerline present?</th>
<th>Turn Bay Present?</th>
<th>Driveways within 200 feet?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route 151 NB/SB</td>
<td>No</td>
<td>11</td>
<td>45</td>
<td>Yes</td>
<td>No</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Route 613 WB (Lodebar Est.)</td>
<td>Yes</td>
<td>9-10</td>
<td>Not posted</td>
<td>No</td>
<td>No</td>
<td>0</td>
<td></td>
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</table>
5. **Route 6 (River Road) and Route 151**

<table>
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<th>Roadway</th>
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<th>Speed (mph)</th>
<th>Centerline present?</th>
<th>Turn Bay Present?</th>
<th>Driveways within 200 feet?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route 151</td>
<td>NB/SB</td>
<td>No</td>
<td>11</td>
<td>45</td>
<td>Yes</td>
<td>No</td>
<td>1</td>
</tr>
<tr>
<td>Route 6</td>
<td>WB</td>
<td>Yes</td>
<td>11</td>
<td>55</td>
<td>Yes</td>
<td>No</td>
<td>1</td>
</tr>
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6. **Route 635 (Rockfish School Lane) and Route 151**

<table>
<thead>
<tr>
<th>Roadway</th>
<th>Approach Direction</th>
<th>Stop Controlled</th>
<th>Lane Width (feet)</th>
<th>Speed (mph)</th>
<th>Centerline present?</th>
<th>Turn Bay Present?</th>
<th>Driveways within 200 feet?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route 151</td>
<td>NB/SB</td>
<td>No</td>
<td>11</td>
<td>45</td>
<td>Yes</td>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td>Route 635</td>
<td>EB</td>
<td>Yes</td>
<td>10</td>
<td>35</td>
<td>No</td>
<td>No</td>
<td>0</td>
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7. **Route 635 (Greenfield Road) and Route 151**

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<th>Speed (mph)</th>
<th>Centerline present?</th>
<th>Turn Bay Present?</th>
<th>Driveways within 200 feet?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route 151</td>
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<td>No</td>
<td>11</td>
<td>45</td>
<td>Yes</td>
<td>NB right SB left</td>
<td>3</td>
</tr>
<tr>
<td>Route 635</td>
<td>WB</td>
<td>No</td>
<td>11</td>
<td>Not posted</td>
<td>Yes</td>
<td>No</td>
<td>0</td>
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8. **Route 729 (Creek Road) and Route 151**

<table>
<thead>
<tr>
<th>Roadway</th>
<th>Approach Direction</th>
<th>Stop Controlled</th>
<th>Lane Width (feet)</th>
<th>Speed (mph)</th>
<th>Centerline present?</th>
<th>Turn Bay Present?</th>
<th>Driveways within 200 feet?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route 151</td>
<td>NB/SB</td>
<td>No</td>
<td>11</td>
<td>45</td>
<td>Yes</td>
<td>No</td>
<td>1</td>
</tr>
<tr>
<td>Route 729</td>
<td>EB</td>
<td>Yes</td>
<td>8+</td>
<td>Not posted</td>
<td>No</td>
<td>No</td>
<td>1</td>
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9. **Route 784 (Bland Wade Lane) and Route 151**

<table>
<thead>
<tr>
<th>Roadway</th>
<th>Approach Direction</th>
<th>Stop Controlled</th>
<th>Lane Width (feet)</th>
<th>Speed (mph)</th>
<th>Centerline present?</th>
<th>Turn Bay Present?</th>
<th>Driveways within 200 feet?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route 151</td>
<td>NB/SB</td>
<td>No</td>
<td>11</td>
<td>45 (35 advisory)</td>
<td>Yes</td>
<td>No</td>
<td>3</td>
</tr>
<tr>
<td>Route 784</td>
<td>WB</td>
<td>Yes</td>
<td>7</td>
<td>Not posted</td>
<td>No</td>
<td>No</td>
<td>0</td>
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</table>

10. **Route 760 (Sunrise Drive) and Route 151**

<table>
<thead>
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<th>Roadway</th>
<th>Approach Direction</th>
<th>Stop Controlled</th>
<th>Lane Width (feet)</th>
<th>Speed (mph)</th>
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<th>Turn Bay Present?</th>
<th>Driveways within 200 feet?</th>
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<tbody>
<tr>
<td>Route 151</td>
<td>NB/SB</td>
<td>No</td>
<td>11</td>
<td>55</td>
<td>Yes</td>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td>Route 760</td>
<td>EB</td>
<td>Yes</td>
<td>8</td>
<td>Not posted</td>
<td>No</td>
<td>No</td>
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</table>
### 11. Route 609 (Mill Lane) and Route 151

<table>
<thead>
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<th>Roadway</th>
<th>Approach Direction</th>
<th>Stop Controlled</th>
<th>Lane Width (feet)</th>
<th>Speed (mph)</th>
<th>Centerline present?</th>
<th>Turn Bay Present?</th>
<th>Driveways within 200 feet?</th>
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<tr>
<td>Route 151</td>
<td>NB/SB</td>
<td>No</td>
<td>11</td>
<td>55</td>
<td>Yes</td>
<td>No</td>
<td>1</td>
</tr>
<tr>
<td>Route 609</td>
<td>EB</td>
<td>Yes</td>
<td>11</td>
<td>Not posted</td>
<td>Yes</td>
<td>No</td>
<td>1</td>
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### 12. Route 638 S (Avon Road) and Route 151

<table>
<thead>
<tr>
<th>Roadway</th>
<th>Approach Direction</th>
<th>Stop Controlled</th>
<th>Lane Width (feet)</th>
<th>Speed (mph)</th>
<th>Centerline present?</th>
<th>Turn Bay Present?</th>
<th>Driveways within 200 feet?</th>
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</thead>
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<tr>
<td>Route 151</td>
<td>NB/SB</td>
<td>No</td>
<td>11</td>
<td>55</td>
<td>Yes</td>
<td>NB Right</td>
<td>1</td>
</tr>
<tr>
<td>Route 638</td>
<td>WB</td>
<td>Yes</td>
<td>9</td>
<td>Not posted</td>
<td>Yes</td>
<td>No</td>
<td>0</td>
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### 13. Route 840 (Tanbark Drive) and Route 151

<table>
<thead>
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<th>Roadway</th>
<th>Approach Direction</th>
<th>Stop Controlled</th>
<th>Lane Width (feet)</th>
<th>Speed (mph)</th>
<th>Centerline present?</th>
<th>Turn Bay Present?</th>
<th>Driveways within 200 feet?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route 151</td>
<td>NB/SB</td>
<td>No</td>
<td>11</td>
<td>55</td>
<td>Yes</td>
<td>SB Right</td>
<td>2</td>
</tr>
<tr>
<td>Route 840</td>
<td>EB/WB</td>
<td>Yes</td>
<td>10</td>
<td>Not posted</td>
<td>No</td>
<td>No</td>
<td>1</td>
</tr>
</tbody>
</table>

### 14. Route 6 (Afton Mountain Road) and Route 638 North (Avon Road) and Route 151

<table>
<thead>
<tr>
<th>Roadway</th>
<th>Approach Direction</th>
<th>Stop Controlled</th>
<th>Lane Width (feet)</th>
<th>Speed (mph)</th>
<th>Centerline present?</th>
<th>Turn Bay Present?</th>
<th>Driveways within 200 feet?</th>
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<tbody>
<tr>
<td>Route 151</td>
<td>NB/SB</td>
<td>No</td>
<td>11</td>
<td>55 (45 advisory)</td>
<td>Yes</td>
<td>SB Right, Channelized</td>
<td>1</td>
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<td>Route 6</td>
<td>EB</td>
<td>Yes</td>
<td>11</td>
<td>55</td>
<td>Yes</td>
<td>EB Right, Channelized</td>
<td>1</td>
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<td>Route 638</td>
<td>WB</td>
<td>Yes</td>
<td>9</td>
<td>Not posted</td>
<td>No</td>
<td>No</td>
<td>2</td>
</tr>
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</table>

### 15. U.S. Route 250 (Rockfish Gap Turnpike) and Route 151

<table>
<thead>
<tr>
<th>Roadway</th>
<th>Approach Direction</th>
<th>Stop Controlled</th>
<th>Lane Width (feet)</th>
<th>Speed (mph)</th>
<th>Centerline present?</th>
<th>Turn Bay Present?</th>
<th>Driveways within 200 feet?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route 151</td>
<td>NB/SB</td>
<td>Yes</td>
<td>10</td>
<td>55</td>
<td>Yes</td>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td>Route 250</td>
<td>EB/WB</td>
<td>No</td>
<td>10</td>
<td>55</td>
<td>Yes</td>
<td>WB Left, EB Right</td>
<td>0</td>
</tr>
</tbody>
</table>
2.2 Data Collection and Data Sources

2.2.1 Traffic Counts

Intersection turning movement counts were performed in late January 2013 at four (4) key intersections in the study area where operations are being analyzed. Three (3) hours of data was collected for both the AM and PM peak period. The data is captured in 15 minute increments, which allows for calculation of the intersection peak hour factor. The four (4) key intersections are:

- Intersection 1: Route 151 and Route 664/627
- Intersection 5: Route 151 and Route 6
- Intersection 6: Route 151 and Route 635
- Intersection 15: Route 151 and U.S. Route 250

Typical volumes at the four (4) intersections for the AM and PM peak hours are shown in Figure 4. The detailed intersection turn movement raw counts are provided in Appendix A.

Heavy vehicle percentages were applied in the analysis (using Synchro) based on the data from the VDOT database, and are shown in Figure 5. Route 151 and Route 6 are part of a truck short-cut route to avoid the I-64/U.S. Route 29 interchange and to shorten overall travel time. South of Route 6, truck percentages on Route 151 drop.

In addition to data collection efforts performed by the study team, VDOT provided other data for the roadways in Nelson County. The data includes existing average annual daily traffic (AADT) and future daily volume forecasts for roadway segments.
Figure 4: Existing Conditions AM and PM Peak Hour Volumes at Key Study Area Intersections

Figure 5: Truck Percentages on Key Study Area Intersections

xx(yy) AM(PM) peak hour volumes

5% 9%

3% 3% 3%

5%

5%

5%

5% 5% 5%

5%

5%

5%

5% 5% 5%

9%

3%

3%

9%
2.2.2 Crash Data

VDOT Central office provided four (4) years of crash data for the Route 151 corridor. The data provided includes the following information:

- Crash severity, including fatalities
- Date and time of day of the crashes
- Collision type
- Whether a truck was involved in the crash
- Latitude and Longitude information/milepost
- Work zone presence

2.3 Operational Analysis

Synchro 8 (Synchro Version 8, Build 803), a traffic analysis software package, was used to conduct an operational analysis on the four (4) study intersections. The Highway Capacity Manual 2010 (HCM) methodologies were followed to determine the intersection measures of effectiveness (MOEs). These intersections are separated by large distances with multiple intersections and driveways in-between. Therefore, Synchro models of the intersections were developed in isolation. The volumes and peak hour factors obtained from the data collection efforts were used in the models. The HCM reports Level of Service (LOS) and Queue reports were used to determine queues, delay and LOS for the intersections. The HCM methodology measures the degree of delay at intersections using the letter rating “A” for the least amount of congestion and letter rating “F” for the most amount of congestion. An LOS of “C” or better is typically considered to be acceptable for a rural setting such as Nelson County during peak hours. **Table 1** presents the LOS by approach and overall intersection LOS. The detailed MOEs (queuing conditions, delays and LOS) obtained from the Synchro models in the AM and PM peak hours and the Synchro output sheets are provided in **Appendix B**.
The operational analysis conducted did not indicate any major issues. Findings include:

- All four (4) intersections perform at LOS “B” or better in both time periods, with all approaches performing at LOS “C” or better.
- Field observations of traffic conditions at the U.S. Route 250/Route 151 intersection indicate that the westbound U.S. Route 250 left-turning traffic arrive at the intersection in platoons and periodically exceed the available turn bay storage. When this occurred, the queue would spill into the through lane and cause delays for the through movement. Several times, through movement vehicles were observed driving on the shoulder to bypass the queue.

### Safety Analysis

The safety analysis of the 15 intersections was completed in two steps. The first step was to evaluate the crash database for the recent 4-year crash history for the corridor and at each of the intersections. The crash data was reviewed and crash rates were developed for each key segment.

The second step was to conduct site visits. Intersection crash type summary figures were prepared to assess the patterns and frequency of crashes at each intersection. Site visits were conducted on February 21 and 22, 2013.

#### 2.4.1 Crash Data

From January 2008 to December 2011, a total of 111 reported crashes occurred in the corridor, resulting in 53 injuries and two (2) fatalities. Note that at the time of the study, detailed 2012 crash data for the
entire year was not available, but information on some 2012 crashes was also reviewed in this study. Crash rates were calculated for the three (3) key segments along the corridor, as well as the overall corridor. The rates computed for this corridor include total crash rate, injury rate and fatality rate. The segmentation in the following table is based on the VDOT database, which indicated a shift in traffic patterns at the termini of these segments. The following table presents the rates, and compares them to the Statewide Average for rural minor arterial roadways.

**Table 2: Crash Rates by Segment, Study Corridor and Statewide Averages**

<table>
<thead>
<tr>
<th>Segment</th>
<th>Length (miles)</th>
<th>Number of Crashes</th>
<th>Injury</th>
<th>Fatality</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beech Grove Road to River Road</td>
<td>5.5</td>
<td>22</td>
<td>7</td>
<td>1</td>
<td>58.71</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>18.68</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.67</td>
</tr>
<tr>
<td>River Road to Afton Mountain Road</td>
<td>6.2</td>
<td>67</td>
<td>22</td>
<td>1</td>
<td>99.37</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>32.63</td>
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<td></td>
<td></td>
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<td></td>
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<td>1.48</td>
</tr>
<tr>
<td>Afton Mountain Road to U.S. 250</td>
<td>2.5</td>
<td>22</td>
<td>24</td>
<td>0</td>
<td>70.13</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>76.51</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Study Corridor</td>
<td>14.2</td>
<td>111</td>
<td>53</td>
<td>2</td>
<td>81.45</td>
</tr>
<tr>
<td></td>
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<td>38.89</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>1.47</td>
</tr>
<tr>
<td>Statewide Average (2008)</td>
<td>3,353.6</td>
<td>5,868</td>
<td>3,580</td>
<td>101</td>
<td>109</td>
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<td>67</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.8</td>
</tr>
</tbody>
</table>

Note: Red shading indicates that segment is higher than Statewide Average. Crash rate expressed as crashes per hundred million vehicle miles travelled.

Overall, the study corridor crash rates are below the 2008 Statewide Average for Rural Minor Arterial. However, two segments have rates higher than the Statewide Average:

- The segment from Afton Mountain Road to U.S. 250 has an injury rate higher than the average.
- The segment from Beech Grove Road to River Road has a fatality rate higher than the average. However, this segment had only one fatality during the analysis period caused by an intoxicated pedestrian stepping in front of a moving vehicle at night.

The data indicate that:

- There were 111 crashes between 2008 and 2011:
  - 79 property-damage-only crashes,
  - 30 crashes that resulted in 53 injuries, and
  - Two (2) crashes that resulted in two (2) fatalities.
- Approximately 25 percent of all crashes occurred on Saturdays.
- The top four (4) crash types comprised nearly 85 percent of all crashes and consist of rear end, deer and other wildlife, angle and fixed object/off-road.
- Only two (2) reported crashes involved a truck.

Diagrams illustrating crash types along the corridor are provided in Appendix C. These diagrams present the crash type and the reported location of the crash based on the police crash reports. A crash type diagram for each intersection is presented in Appendix D, which includes the full detailed safety assessment of each intersection, including recommendations developed in Chapter 3.
2.4.2 Site Visit

The next step in the process was to perform a site visit to the study intersections. In preparation for the site visit, intersection crash summary diagrams were prepared, in which all crashes occurring within the intersection influence area (200 feet) were identified by crash type. This allowed for patterns and potential causes to be identified. These diagrams were used by the site visit team, consisting of VDOT, Nelson County and HNTB representatives, to understand what factors should be examined in the field. A Nelson County Sherriff Deputy also participated in the site visit to provide insight on issues along the corridor.

The site visit was conducted on February 21 and 22, 2013 for the 13 study intersections identified at the kick-off meeting. While in the field, a 14th location was visited per request of a County Supervisor, as a fatal crash resulting in two (2) fatalities occurred in 2012. A follow-up meeting after the site visits was held with two (2) County Supervisors to review the findings of the site visit, at which a 15th location, in proximity to another intersection, was identified. This location was examined on February 28, 2013.

The key field observations are presented below. Full details by intersection are presented in Appendix D, and include a crash type diagram, crash summary, including time of day, field observations, as well as detailed recommendations as developed in Chapter 3. Appendix E presents the catalogue of site visit photos.

1. Route 664 (Beech Grove Road / Glenthorne Loop) at Route 151
   - Some confusion exists for Route 664 driver in determining whether Route 151 southbound right turning traffic is turning onto Beech Grove Road, or into the “Ski Barn” parking lot located just south of the intersection.
   - Some vegetation in the northwest quadrant impedes sight distance for vehicles on the eastbound approach.
   - Signage on northbound Route 151 at entrance to Devils Backbone creates driver confusion.

Photo 1: Roadway guide sign at entrance to Devils Backbone creates driver confusion.
2. **Route 627 (Spruce Creek Lane and Glenthorne Loop) at Route 151**
   - Spruce Creek Lane eastbound left turning onto Route 151 northbound has very poor line of sight due to the embankment in the southwest quadrant limits sight distance for vehicles on the eastbound approach. Often left turning traffic will turn and drive in the southbound lane (i.e. wrong way traffic) until they can move over into the northbound lane.

3. **Route 634 (Adial Road)/Nellysford area at Route 151**
   - Lack of stop bar and end-of-road treatment.
   - Vegetation along the side of the roadway can block the line of sight for the stop sign.
   - Lack of pedestrian facilities.
   - Access Management/Poor inter-parcel connectivity.

4. **Route 613 (Rodes Farm Drive and Lodebar Estate) at Route 151**
   - Crest in hill and embankments between two offset intersections limits sight distance for turning vehicles from minor roadways and driveways.

5. **Route 6 (River Road) at Route 151**
   - Route 151 southbound left turning traffic crosses over double-yellow of both Route 151 and River Road, due to a tight turning radius caused by a narrow receiving area.
6. **Route 635 (Rockfish School Lane) at Route 151**
   - Increased number of crashes in the last two years with an increase of land-use activities.
   - Lack of turn lanes.

7. **Route 635 (Greenfield Road) at Route 151**
   - The northbound right turn bay is short.

8. **Route 729 (Creek Road) at Route 151**
   - Line of sight issues for traffic egressing from Creek Road.
   - Lack of turn lanes for Route 151 traffic.

9. **Route 784 (Bland Wade Lane) at Route 151**
   - Limited sight distance to the north, less than 200 feet.
   - Route 151 dips to the south, limiting sight distance.

10. **Route 760 (Sunrise Drive) at Route 151**
    - Due to the crest of hill to the south, left turning traffic has limited sight distance, specifically of northbound vehicles.

11. **Route 609 (Mill Lane) at Route 151**
    - Poor sight distance due to parapet wall of the Goodwins Creek Bridge and overgrown vegetation.
    - Poor access management: driveways of gas station are close to the intersection.
12. Route 638 S (Avon Road) at Route 151
   - Overgrown vegetation on the eastside of the roadway can restrict sight distance for Avon Road traffic looking south.
   - Stop bar is too far back from roadway.

13. Route 840 (Tanbark Drive) at Route 151
   - The eastbound approach (Tanbark Drive) dips as the roadway approaches Route 151, which hides the view of Route 151 until the vehicle reaches the intersection.
   - Embankments in southwest and southeast quadrants limit sight distance for traffic on Tanbark Drive.

14. Route 6 (Afton Mountain Road) and Route 638 North (Avon Road) at Route 151
   - Route marker sign and vegetation block view of the stop sign on Route 6 eastbound approach.
   - Eastbound right turning angle is poor, forcing drivers to really look over their shoulder.
   - Limited sight distance exists on minor roadways due to approach to Route 151.
15. U.S. Route 250 (Rockfish Gap Turnpike) at Route 151

- U.S. Route 250 eastbound right turning traffic blocks line of sight of eastbound through traffic for Route 151 turning traffic. The curve on U.S. Route 250 makes it difficult to differentiate eastbound rights from eastbound through movement vehicles.
- The westbound left turn queue often spills into the westbound through lane, as the turn bay’s length is insufficient. U.S. Route 250 westbound through traffic drives around the queued vehicles, by driving on the shoulder and grass.

General observations for the corridor that were identified during the site visit:

- Route 151 is signed as a bike corridor. However, this corridor is relatively unsafe for bicyclists. There are no on-street bicycle lanes, and most of the corridor does not have paved shoulders. As such, cyclists are forced into the vehicular travel lane; and with no shoulders, cyclists are not able to move to the side to allow sufficient space for vehicles to pass. Thus, vehicles have to pass the cyclists by travelling into the opposing lane.
- While some segments do have shoulders, most of the corridor does not. Lack of shoulders creates safety issues for cyclists as described above, as well as for pedestrians, and can contribute to vehicle crashes.
- Route 151 does not have turn lanes at most of its intersections, even those with larger land-use generators. This requires turning vehicles to slow down or stop in the through lane. These unexpected stops in traffic flows can contribute to rear-end collisions.
- Poor sight distance exists at a number of intersections along the corridor, both on Route 151 and the approaches of the intersecting roadways. This can contribute to crashes when vehicles are turning onto Route 151 from the minor roadways or driveways. Drivers must accelerate aggressively when they turn onto Route 151. Contributors to site distance issues are horizontal and vertical alignment, embankments, and vegetation.
• Some locations along the study corridor have been noted to have sign clutter. This can overwhelm, confuse and/or distract drivers traversing the corridor. In particular, some VDOT guide signs and business advertising signage are noted as being improperly placed, or too frequent.

• For most of its length the corridor predates the VDOT’s Access Management Guidelines, which were developed in the mid-2000’s. There are a number of instances where businesses have access points less than 200 feet from the intersections with no inter-parcel connections to adjacent businesses.

2.5 Previous Speed Studies

VDOT has performed speed studies along the corridor in the past 10 years and has reduced the speed limit where it was deemed appropriate. The Route 151 Coalition had previously requested that the speed limit be reduced on the segment between Route 664 (Beech Grove Road) and U.S. Route 250. The following segments listed below are the available speed studies that were completed followed by the general outcome of such studies.

1. **Route 634 North (Monocan Drive) to Route 6 South (River Road):** This study was completed in 2008; based on safety considerations of frequent pedestrian traffic and on-roadway parking, and that crash rates were higher than statewide averages, VDOT reduced the speed limit from 55 mph to 45 mph.

2. **Route 6 South (River Road) to Route 784 (Bland Wade Lane):** This study was completed in 2007; based on safety considerations of frequent pedestrian traffic and on-roadway parking, and that crash rates were higher than statewide averages, VDOT reduced the speed limit from 55 mph to 45 mph.

3. **Route 6 North (Afton Mountain Road) to U.S. Route 250 (Rockfish Gap Turnpike):** This study was completed in 2012. Although the crash and injury rates are higher than the statewide averages, VDOT did not reduce the speed limit as prevailing speeds warranted retaining the 55 mph speed limit, and VDOT did not observe on-roadway parking or pedestrian activity. VDOT recommended placing “watch for turning traffic” signs at a key location along the corridor.
2.6 Access Management and Multimodal Issues

Most businesses along the Route 151 corridor pre-date VDOT’s current access management guidelines. Businesses often have multiple driveways in proximity to each other with no inter-parcel connections. There are some businesses with access points at intersections or within 100 feet. This creates confusion for other drivers as they may be unsure where vehicles are turning, i.e. into the business or onto the adjacent minor road.

In the area of Nellysford, this is still prevalent, but progress towards access management was observed. There are a few shared driveways and inter-parcel connectivity with some of the newer business establishments. There is a large residential neighborhood to the north that has only one egress point, Monocan Drive, onto Route 151. There are no direct vehicular access points between this neighborhood and the retail businesses in Nellysford, but a pedestrian trail exists from Apple Blossom Court to the retail area.

Throughout the corridor, there are issues affecting multimodal transportation. Route 151 is a bike route, but the roadway lacks a dedicated bike lane and does not have paved shoulders of adequate width, if any paved shoulders are present. This means that cyclists are traveling in the roadway with vehicles. No reported crashes exist for the 2008-2011 timeframe involving a cyclist. Incidents such as a cyclist having to swerve off the road may have occurred, but no data exist. There are not any pedestrian facilities, such as a sidewalk or off-road trail, on Route 151.

JAUNT, a regional bus service in the Thomas Jefferson Planning District, provides limited services to/from destinations along the Route 151 corridor:

- Commuter services, linking Wintergreen Resort to Charlottesville. Monday-Tuesday and Friday-Saturday services.
- Linking Wintergreen Resort to Nelson/Amherst, Wednesday through Monday services.
- Mid-day service from Nelson County to Charlottesville, Monday, Wednesday, and Friday-Saturday services.
- Thursday service to/from in the Nellysford/Afton area.

No other transit services are provided within the study area.

2.7 Existing Environmental Issues

The Route 151 Corridor has environmental issues that may affect the ability to implement improvements to the corridor. The following environmental issues should be considered as improvements are developed and implemented. A map of these environmental issues is presented in Appendix F.

- Virginia Outdoors Federation (VOF) protected easements: only one easement exist that could impact any potential improvement to the Route 151 Corridor. VOF easement 1636 straddles
Route 151 on both sides, and is located just south of the South Rockfish River and north of Route 664.

- The Virginia Department of Environmental Quality (DEQ) petroleum release sites: DEQ has identified a number of locations along the Route 151 corridor and surrounding area at which leaks or spills of petroleum and/or regulated substance have occurred and are monitored by DEQ. These sites can be at gas stations or other businesses, as well as farms and homes. A number of these sites are located on parcels immediately adjacent to Route 151.
- Petroleum facilities: a total of 13 petroleum facilities have been identified on parcels immediate adjacent to Route 151. Other facilities exist on parcels located on intersecting roadways.
- FEMA DFIRM flood plains categories: the Federal Emergency Management Agency (FEMA) has developed flood zone rating categories based on the risk of flooding by frequency or severity. These areas are illustrated on the Digital Flood Insurance Rate Map (DFIRM) developed by FEMA. A number of locations along the Route 151 Corridor are within the zone categories of A, AE, AH, and AO. Some of these zones have at least a one percent annual chance of flooding and a 26 percent chance of flooding over the life of a 30-year mortgage.
- Architectural/Historic features: the Virginia Department of Historic Resources (State Historic Preservation Office) is responsible for identifying historic sites within the state. Within the Route 151 corridor two (2) rural historic districts, South Rockfish and Greenwood-Afton, run along Route 151. These two (2) districts are of historical importance to Nelson and Albemarle Counties in the study area. There are eight (8) other historic sites, which include Rockfish Valley School, homes and a cemetery.

2.8 Overview of Existing Conditions Findings

The operational analysis indicated that intersection operations perform at an acceptable level of service. Driver perception of intersection performance can differ if considering such factors as speeds of opposing traffic, poor access management or sight distance limitations. These factors influence the acceptable gap they desire prior to turning, so actual delays may be higher if drivers require larger gaps in opposing traffic.

The safety analysis indicated that overall, the corridor is below the statewide average crash rate of comparable facilities, but crashes are clustered at key intersections. A field visit was performed along the corridor and identified safety deficiencies that contribute to crashes. Recent geometric improvements by VDOT have included turn lanes, improved sight distance and shoulders at two intersections, which have reduced the crash rate for those locations.

Access Management is a concern for the corridor, as most locations do not conform to current access management guidelines. Inter-parcel connectivity of adjacent parcels is limited to only newly developed parcels. The study corridor, which is lightly populated, only has limited transit service. Although Route 151 is signed as a bike route, it does not have adequate paved shoulders for bicycle activity.
3. **Future Traffic Conditions**

This chapter presents the Future Conditions Assessment for the Route 151 Corridor, including an overview of previous planning studies. Forecasts for study years 2020 and 2040, No-Build and Build Conditions Operational Analysis, and the Safety Analysis are presented in this chapter.

3.1 **Previous Planning Studies**

This section provides a brief overview of previous planning studies conducted for the corridor.

3.1.1 **Route 151 Corridor Study**

VDOT completed a study in 2001 of the Route 151 corridor, from Route 664 (Beech Grove Road) to U.S. Route 250 (Rockfish Gap Turnpike), and of Route 6 (River Road) from Route 151 to U.S. Route 29. This study examined the safety and operational issues at eight (8) key intersections. The operational analysis examined existing conditions (1999 data) and future conditions (year 2025) to identify operational deficiencies and develop recommendations for operational improvements. Crash data (period of 1996 to 1998) was examined to identify crash hot spots and to develop recommendations to address safety concerns.

The following are recommendations from the study that address operational, geometric and safety deficiencies:

**Short Term:**
- At Route 613 (report does not specify whether this is Rodes Farm Drive or Lodebar Estates) – lower grade at the intersection.
- At Route 6 south (River Road) – add a left turn lane on the southbound and westbound approaches.
- At Route 635 south (Rockfish School Lane) – add a left turn lane on the northbound and eastbound approaches.
- At Route 784 (Bland Wade Lane) – reconstruct the roadway to improve horizontal and vertical alignment.
- At Route 849 (Tanbark Drive) – Slope the embankments in the southeast and southwest quadrants to improve sight distance for the northbound approach.
- Improvements were recommended at Route 635 north (Greenfield) and Route 709 (Chapel Hollow Road); **improvements have since been constructed.**

**Long Term:**
- From Route 634 south (Adial Road) to Route 6 south (River Road) – reconstruct the existing roadway to accommodate two 12-foot travel lanes with paved 6-foot shoulders marked as bike lanes. Right-of-way should be reserved for an ultimate four-lane cross-section when volumes warrant.
• From Route 6 south (River Road) to Route 638 south (Avon Road) – reconstruct the existing roadway to accommodate two 12-foot travel lanes with paved 6-foot shoulders marked as bike lanes. Right-of-way should be reserved for an ultimate four-lane cross-section when volumes warrant.
• From Route 638 south (Avon Road) to U.S. Route 250 (Rockfish Gap Turnpike) – widen the existing roadway to accommodate four 12-foot travel lanes with paved 6-foot shoulders marked as bike lanes.
• At the intersection with Route 6 north – provide left turn lanes on the minor approaches, and signalize the intersection when warranted.
• At the intersection with U.S. Route 250 – add a northbound left turn lane and signalize the intersection when warranted.

3.1.2 Nelson County Comprehensive Plan

Nelson County’s most recent Comprehensive Plan was officially adopted in 2002. Nelson County is currently updating its Comprehensive Plan. This update includes the transportation chapter which addresses roadways, pedestrians and bicyclists, but information is not yet available. The 2002 Plan established the county’s land-use plan and recommendations for bicycle and pedestrian facilities throughout Nelson County. The Comprehensive Plan does not provide specific recommendations for roadway improvements as the Plan indicates that such improvements are the responsibility of the VDOT Lynchburg District. Specific recommendations related to pedestrian and bicyclist traffic for the Route 151 Corridor include the following:

• When roadways are reconstructed, paved shoulders should be provided to accommodate pedestrian and bicyclist traffic. Shoulders should be constructed on Route 151 and Route 6, which are identified as primary bicycle routes in Nelson County.
• Secondary bicycle routes in Nelson County should be treated as transportation corridors and have climbing lanes and pull-out areas. These routes include Route 634, Route 635, Route 638 and Route 664.
• Share the Road signs should be installed on Route 151 and Route 6.
• Sidewalks should be constructed along Route 151 in the Nellysford area, and one well-marked crosswalk should be installed.
• Greenway trails should be developed along Route 151, these trails would follow the rivers and streams. The trails would provide opportunities for open-space and stream preservation, and provide connections to communities and community facilities along the corridor.

3.1.3 Jefferson Area Bicycle, Pedestrian, and Greenways Plan

The Jefferson Area Bicycle, Pedestrian and Greenways Plan, developed by the Thomas Jefferson Planning District Commission (TJPDC), was adopted in 2004. The Plan details pedestrian, bike and greenway improvements in the Jefferson Area, which includes the City of Charlottesville and Nelson, Albemarle, Fluvanna, Greene and Louisa Counties. The Plan’s recommendations for the Route 151 area
are identical to the recommendations in the Nelson County Comprehensive, including paved shoulders on Route 151 and U.S. Route 250 to accommodate pedestrian and bicyclist traffic.

3.1.4 2035 Rural Long Range Transportation Plan

In 2010 VDOT completed the Rural Long Range Plan (RLRP) for the TJPDC. This transportation plan identified short, mid and long-term improvements to address operational, geometric and safety challenges in TJPDC, which includes Nelson County. The study team included members of TJPDC as well as Nelson County and Albemarle County planning staff. Recommendations for improvements to the study corridor include the following:

Short-Term:

- At the intersection with Route 635 (Greenfield Road) – perform a study to identify safety improvements; **improvements have since been constructed.**

Mid-Term:

- From Route 613 (Rodes Farm Road) to 0.05 miles north of Route 613 – reconstruct the roadway to address geometric deficiencies, including improvements at the intersection with Route 613 (Rodes Farm Road) to correct sight distance deficiency (note, although not specified, it is assumed that the northern terminus is north of Route 613 – Lodebar Estates).
- At the intersection with U.S. Route 250 – install traffic control improvements, including a signal with a northbound turn lane, or a roundabout.

Long-Term:

- At the Route 151 intersection with Route 627 (Spruce Creek Lane) – reconstruct the intersection to improve horizontal and vertical curves.
- From Route 6 south (River Road) to Route 6 north (Afton Mountain Road) / Route 638 south (Avon Road) – widen the road to increase capacity and address geometric deficiencies, including full-width lanes and shoulders.
- Route 6 north (Afton Mountain Road) / Route 638 south (Avon Road) to the Albemarle County Line – widen road to increase capacity and address geometric deficiencies, including full-width lanes and shoulders.
- From the Nelson County Line to U.S. 250 (Rockfish Gap Turnpike) – long-term spot safety and alignment improvements are needed to address geometric deficiencies and pave the shoulders for bikes.

Continue to monitor for potential improvements:

- At the Route 151 intersection with Route 6 south.
- At the Route 151 intersection with Route 6 north / Route 638 north.
3.2 Traffic Projections

The VDOT Statewide Planning System (SPS) database was used to quantify expected growth rates for the area. Historical growth rates were developed based on historical data in the VDOT Daily Traffic Volumes Including Vehicle Classification Estimates “countbooks”. Data suggests varying growth rate by facility, and even segment of roadway. Table 3 presents the estimated growth rates based on historical and SPS data.

<table>
<thead>
<tr>
<th>Roadway</th>
<th>Segment</th>
<th>Annual Growth Rate to 2020-2020</th>
<th>Annual Growth Rate to 2040-2060</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rte. 151</td>
<td>south of Beech Grove Road (664)</td>
<td>1.54%</td>
<td>1.63%</td>
</tr>
<tr>
<td></td>
<td>Beech Grove Road (664)</td>
<td>0.74%</td>
<td>0.81%</td>
</tr>
<tr>
<td></td>
<td>River Road (6)</td>
<td>1.64%</td>
<td>1.40%</td>
</tr>
<tr>
<td></td>
<td>Afton Mtn. Road (6)</td>
<td>1.91%</td>
<td>1.66%</td>
</tr>
<tr>
<td>U.S. 250</td>
<td>Afton Mtn. Road (6)</td>
<td>3.14%</td>
<td>2.45%</td>
</tr>
<tr>
<td>Rte. 6 south</td>
<td>Rte. 151</td>
<td>1.28%</td>
<td>1.04%</td>
</tr>
<tr>
<td>Rte. 664</td>
<td>west of Rte. 151</td>
<td>1.75%</td>
<td>1.63%</td>
</tr>
<tr>
<td>Rte. 627</td>
<td>east of Rte. 151</td>
<td>&lt;no data&gt;</td>
<td></td>
</tr>
<tr>
<td>Rte. 635 (Rockfish School Lane)</td>
<td>west of Rte. 151</td>
<td>&lt;no data&gt;</td>
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</tbody>
</table>

The growth rates were reviewed for reasonableness, considering land-use changes and information in Nelson County’s Comprehensive Plan. The growth rate for the Route 151 segment from Beech Grove Road to River Road is low, considering future expansion potential of the residential development in Nellysford area. The growth rate along U.S. Route 250 is too large to apply to Route 151. Therefore a study area-wide growth rate of 1.5 percent per year (compounded) was used with the approval of VDOT Transportation Planning – Lynchburg District. Figure 6 and Figure 7 present the 2020 and 2040 AM and PM peak hour volumes. As potential improvements identified in this project consist of spot improvements to address operational, geometric and safety issues, and is not a regional transportation solution (i.e. a regional bypass), it is expected that traffic patterns will remain identical between No-Build and Build Conditions. Note that all volumes have been rounded up to the nearest five (5) vehicles.
Figure 6: 2020 AM and PM Peak Hour Volumes at Key Study Area Intersections

Figure 7: 2040 AM and PM Peak Hour Volumes at Key Study Area Intersections
3.3 No Build Conditions

For the No-Build Condition, it was assumed that no roadway improvements would be made at the study area intersections, as no planned improvements are currently funded. The operational analysis followed the same procedures as the Existing Conditionals analysis, including use of Synchro 8. Table 4 presents the LOS by approach and overall intersection LOS for 2020 AM and PM peak hours, while Table 5 presents the LOS by approach and overall intersection LOS for 2040 AM and PM peak hours. The detailed MOEs (queuing conditions, delays and LOS) obtained from the Synchro models in the AM and PM peak hours, as well as the Synchro output sheets, are provided in Appendix B.

### Table 4: 2020 No-Build Conditions Measures of Effectiveness – AM and PM Peak Hours

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Movement</th>
<th>AM LOS</th>
<th>PM LOS</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Approach</td>
<td>Overall</td>
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<tr>
<td>Route 250 (Rockfish Gap Turnpike) at Route 151</td>
<td>EB</td>
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<tr>
<td>Route 635 (Rockfish School Lane) at Route 151</td>
<td>EB</td>
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<tr>
<td>Route 6 (River Road) at Route 151</td>
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<td>Route 664 (Beech Grove Road / Glenthorne Loop) at Route 151</td>
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Note: Yellow shading indicates LOS “D”, orange shading indicates LOS “E”, and red shading indicates LOS “F”
Table 5: 2040 No-Build Conditions Measures of Effectiveness – AM and PM Peak Hours

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<thead>
<tr>
<th>Intersection</th>
<th>Movement</th>
<th>AM LOS</th>
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<td>Approach</td>
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<td>Route 250 (Rockfish Gap Turnpike) at Route 151</td>
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<td>Route 635 (Rockfish School Lane) at Route 151</td>
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Note: Yellow shading indicates LOS “D”, orange shading indicates LOS “E”, and red shading indicates LOS “F”

The operational analysis indicates that over time, some operational challenges will emerge. Findings include:

- For 2020 conditions, the four (4) study intersections would operate at LOS “B” or better during peak hours.
- In 2040, the intersection of U.S. Route 250/Route 151 would operate at LOS “C” in the AM peak hour and at LOS “D” in the PM peak hours. All other intersections would remain at LOS “A” in 2040.
- The northbound Route 151 approach to U.S. Route 250 is the only movement of concern for operations. In 2040 the LOS for this approach is expected to be LOS “E” in the AM peak hour and LOS “F” in the PM peak hour.
- The analysis did not indicate queuing spillback for the westbound U.S. Route 250 left turn movement (to southbound Route 151), as observed in the field in existing conditions. As traffic volumes increase, it can be expected that the queue length would also increase.
3.4 Build Conditions

The No-Build Conditions, as discussed in Section 3.3, and the Safety Assessment, as discussed in Section 3.5, identified operational and/or safety deficiencies at the four intersections where detailed operational analyses were performed. The following improvements are proposed at the four (4) study intersections to improve either traffic operations or enhance safety conditions.

- Route 151 at U.S. Route 250:
  - Option 1: Construct a 400-foot northbound right turn bay.
  - Option 2: Install a signal as well as the northbound right turn lane.
  - Option 3: Convert the T-intersection into a single-lane roundabout.
- Route 151 at Route 635 (Rockfish School Lane):
  - Construct a 250-foot northbound left turn bay.
- Route 151 at Route 6 (River Road):
  - Option 1: Construct a 250-foot southbound left turn bay.
  - Option 2: Convert the intersection into a single-lane roundabout.
- Route 151 at Route 664:
  - Construct a 250-foot southbound right turn bay.

As previously mentioned these improvements are minor in scale and will not result in an increase of traffic volumes. As such, the Build Conditions forecasts are the same as the No-Build Conditions forecasts. Synchro 8 was used to analyze the operational performance of unsignalized and signalized intersections. For the roundabout options, Highway Capacity Manual 2010 (HCM 2010) procedures were used to analyze the roundabouts by using the HCS module for roundabouts. Table 6 presents the LOS by approach and overall intersection LOS for 2020 AM and PM peak hours, while Table 7 presents the LOS by approach and overall intersection LOS for 2040 AM and PM peak hours. The detailed MOEs (queueing conditions, delays and LOS) obtained from the Synchro models in the AM and PM peak hours, as well as the Synchro output sheets, are provided in Appendix B.
Table 6: 2020 Build Conditions Measures of Effectiveness – AM and PM Peak Hours

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Movement</th>
<th>AM LOS</th>
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<td>Approach</td>
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<td>Route 250 (Rockfish Gap Turnpike) at Route 151 - Option 2</td>
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<td>Route 250 (Rockfish Gap Turnpike) at Route 151 - Option 3</td>
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Note: Yellow shading indicates LOS “D”, orange shading indicates LOS “E”, and red shading indicates LOS “F”
The operational analysis indicated that the proposed improvements will provide sufficient capacity. Findings include:

- The improvements tested for the Route 151 intersection at U.S. Route 250 will improve operations for the northbound approach.
  - In the 2040 PM peak hour with the recommended northbound right turn lane, the approach would operate at LOS “E”.
  - Signalizing the intersection or converting into a roundabout will provide comparable delays and LOS.
- For the other three (3) intersections, the proposed improvements focus mainly on safety and do not show any operational deficiencies.

### Table 7: 2040 Build Conditions Measures of Effectiveness – AM and PM Peak Hours

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Movement</th>
<th>AM LOS</th>
<th>PM LOS</th>
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<tbody>
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<td></td>
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<td>Approach</td>
<td>Overall</td>
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<tr>
<td>Route 250 (Rockfish Gap Turnpike) at Route 151 - Option 1</td>
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<td>Route 635 (Rockfish School Lane) at Route 151</td>
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<tr>
<td>Route 6 (River Road) at Route 151 - Option 1</td>
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<td>Route 6 (River Road) at Route 151 - Option 2</td>
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<tr>
<td>Route 664 (Beech Grove Road / Loop) at Route 151</td>
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Note: Yellow shading indicates LOS “D”, orange shading indicates LOS “E”, and red shading indicates LOS “F”
3.5 Safety Assessments

The Existing Conditions safety assessment, presented in Section 2.4, focused on identifying crash patterns at the 15 study intersections along the study corridor, general patterns for the corridor, and identifying potential mitigation measures. Information gathered from public comments received at the first public meeting was also considered in the process. The safety assessment considered Crash Modification Factors (CMFs) to quantify an expected reduction in crashes if various measures were implemented. The primary source for CMF was the AASHTO Highway Safety Manual (HSM)\(^1\), while the VDOT Highway Safety Improvement Program (HSIP) CRFs were used as a supplement reference where the HSM did not have listed factors. The HSM was also used to develop additional countermeasures or recommendations to improve safety. The operations of any improvements that recommended new turn lanes or a roundabout was tested and presented in Section 3.4.

Intersection Recommendations

Full details by intersection are presented in Appendix D, and include a crash type diagram, crash summary, including time of day, field observations, as well as detailed recommendations. Corridor-wide recommendations to address general deficiencies are also provided. Key recommendations, listed by intersections and the corridor, are as follows:

1. **Route 664 (Beech Grove Road / Glenthorne Loop) at Route 151**
   - Adjust the signage along northbound Route 151.
   - Add a southbound right turn bay; offset the turn bay by 6 feet to aid drivers on the eastbound approach to differentiating of southbound through movement versus right turning vehicles.

2. **Route 627 (Spruce Creek Lane and Glenthorne Loop) at Route 151**
   - Realign Route 627 to reduce skew (by 25 degrees) and improve sight distance.
   - Add intersection-ahead signage with flashers on the northbound approach.
   - Regrade the embankment in the southwest quadrant.

3. **Route 634 (Adial Road)/Nellysford area at Route 151**
   - Add sidewalks for pedestrians.
   - As new development or re-development occurs, improve access management and inter-parcel connectivity.

4. **Route 613 (Rodes Farm Drive and Lodebar Estate) at Route 151**
   - Reduce the crest of hill and regrade the embankments to improve sight distance.
   - Review commercial signage to ensure signage is not within the VDOT right-of-way.

5. **Route 6 (River Road) at Route 151**
   - Widen the east leg of the intersection creating a wider receiving lane for turning vehicles.
   - Consider a roundabout or southbound left turn bay.

6. **Route 635 (Rockfish School Lane) at Route 151**
   - Construct a northbound left turn lane. Note that an HSIP grant for the turn bay was recently approved. Designs will be prepared and the preliminary start date of construction is October 2015.

7. **Route 635 (Greenfield Road) at Route 151**
   - Extend the northbound right turn bay by utilizing (restriping) the existing northbound shoulder prior to the start of the turn bay.

8. **Route 729 (Creek Road) at Route 151**
   - Restripe the roadway to provide a northbound left turn into the Ashley’s Market southern access.
   - Add a southbound right turn bay on Route 151 for turning traffic onto Creek Road, move the stop bar on Creek Road closer to the southbound through lane.

9. **Route 784 (Bland Wade Lane) at Route 151**
   - Consider changing flashers to be demand responsive, so that they flash only when a vehicle is present or approaching (35 mph advisory speed sign with flashers already present).
   - Regrade the roadway to improve sight distance and eliminate the dip in the road, or
   - Consider relocating Bland Wade Lane south of the Fitness Center.

10. **Route 760 (Sunrise Drive) at Route 151**
    - Regrade the roadway to reduce crest and reduce embankment.
    - Add deer crossing signs in vicinity of intersection.

11. **Route 609 (Mill Lane) at Route 151**
    - Improve access management.
    - Widen the bridge structure.

12. **Route 638 S (Avon Road) at Route 151**
    - Move the stop bar on Route 638 closer to the roadway to improve sight distance.
    - Add deer crossing signs south of the intersection and gas station.

13. **Route 840 (Tanbark Drive) at Route 151**
    - Refresh the yellow lines and stop bars and move the stop sign.
    - Consider rumble strips on Route 840 approaches.
    - Regrade Tanbark Road to improve visibility to Route 151.
    - Regrade the embankment in the southwest and southeast quadrants.
14. Route 6 (Afton Mountain Road) and Route 638 North (Avon Road) at Route 151

- Construct left turn lanes for the northbound and southbound approaches. Note that an HSIP grant for the turn bays was recently approved, designs will be prepared and the preliminary start date of construction is March 2016.
- Reconfigure the eastbound right turn lane to reduce skew by 20 percent.
- Improve signage.
- Consider rumble strips on the approaches of Routes 6 and 638 to the intersection.
- Regrade the approaches of Routes 6 and 638 to the intersection.

15. U.S. Route 250 (Rockfish Gap Turnpike) at Route 151

- Extend the westbound left turn lane.
- Offset the eastbound right turn bay by 12 feet to improve the visibility of eastbound through vehicles.
- Consider street lighting at the intersection.
- Consider a roundabout or signalization with a northbound right turn lane. If this improvement would not be constructed, consider a northbound right turn lane with an acceleration lane on U.S. 250.

General Recommendations

In additional to the location-specific recommendations, general recommendations were developed for the corridor, which include:

- Perform speed studies to set speed limits appropriate for traffic patterns and land uses along the corridor.
- Improve access management for existing parcels by looking for opportunities to consolidate existing driveways and inter-parcel connectivity. Ensure new developments comply with VDOT access management guidelines.
- Develop a comprehensive plan for the Village of Nellysford. For the transportation components, key elements to be considered include parallel road(s) to Route 151, inter-parcel connectivity and pedestrian/bicyclist accommodations.
- Reconstruct Route 151 to correct geometric deficiencies (horizontal, vertical and/or sight distance) and to provide paved shoulders to accommodate pedestrians and cyclists. This project can be phased by segment.
- Reduce sign clutter. VDOT should improve wayfinding and other roadway signage as projects are implemented along the corridor. Nelson County will review and update its zoning ordinance relative to commercial signage within and adjacent to the VDOT right-of-way.
- As state funding becomes available, replace deficient guardrail or install new guardrail at the identified locations.
- Nelson County police should continue its active program in enforcing the speed limit and truck size regulations for the corridor. Nelson County should continue to work with VDOT on geometric safety issues.
3.6 Environmental Considerations

The recommendations identified above include the reconstruction of the roadway to 11-foot lanes and 5-foot paved shoulders. These improvements may have an impact on environmental resources along the Route 151 corridor. A VOF easement straddles on both sides of Route 151, just south of the South Rockfish River. Widening may impact the easement, depending on the available right-of-way at this location. As two rural historic districts exist along the corridor, as well as a number of historically-significant homes and the former Rockfish Valley School, any widening should be sensitive to these important resources.

Route 151 crosses over a number of rivers and streams; as such mitigation may be needed to reduce the potential impacts of widening the bridges over the waterways. Larger-scale intersection-specific improvements, at the intersections of Route 151 and River Road, Mill Lane and U.S. Route 250, include reconstruction of the intersection or conversion to roundabout. During the design process, mitigations may be needed to reduce any potential impacts to these waterways near these intersections.

A number of petroleum facilities exist along the Route 151 Corridor. As improvements are implemented, their proximity to Route 151 should be considered as the improvement might impact these facilities.

3.7 Multimodal Assessment

There are several challenges facing multimodal transportation on the corridor, as identified in the Existing Conditions. These challenges are both stand-alone and related to a residual effect of other issues affecting the corridor. The issues and recommendations include the following:

1. Lack of bike lanes: Route 151 is designated as an on-roadway bike facility, where bicyclist and vehicles share the travel lane. As most of the corridor lacks paved shoulders, there is no safe place for a cyclist to go to if they have to perform an evasive maneuver. This is critical in areas where limited sight distance exists. There is also no safe location for cyclists to go when faster vehicles pass. As indicated in Section 3.5, if Route 151 is reconstructed to address horizontal, vertical and/or sight distance limitations, paved shoulders should also be included to improve pedestrian and cyclist mobility and safety. This is particularly important in Virginia, as it is (by law) required that motorist must pass at a reasonable speed at least two feet to the left of cyclists (with the potential for three feet being required).

2. Lack of pedestrian accommodations: Similar to the challenges facing cyclists, there are no pedestrian accommodations for the corridor, as most of the corridor lacks paved shoulders and there are not any sidewalks or multi-use trails. As indicated in Section 3.5, if Route 151 is reconstructed to address horizontal, vertical and/or sight distance limitations, paved shoulders should also be included to improve pedestrian and cyclist mobility and safety. Alternatively, potential maintenance activities, such as resurfacing, should look for the opportunity to make improvements to better accommodate pedestrians and cyclist.
3. Limited transit services exist for the corridor, as identified in Section 2.6. JAUNT is the transit provider for the jurisdictions in the Thomas Jefferson Planning District Commission (TJPDC). JAUNT provides limited services to the adjacent counties, such as services between Wintergreen Resort and Nelson/Amherst. JAUNT’s strategic plan calls to apply for funding to add one commuter route per year. The Transit Development Plan for JAUNT\(^2\) provides the following two (2) recommendations with the year of implementation in parenthesis:

a. **Nelson County Rural Demand Response Service (R4):** Rural demand response service within Nelson County would be expanded to operate on Wednesdays, so that this service would operate Monday through Thursday of each week (FY 2013).

b. **Nelson County Food Pantry Service (L17):** Beginning in FY 2013, this grant-funded monthly service would become one of JAUNT’s core services. No additional vehicles would be required (FY 2013).

4. Conclusions and Recommendations

The following section offers a conclusion and recommendations as a result of the process undertaken. The following are covered:

- Safety
- Multimodal accommodations
- Speed limits
- The effects of tourism
- Comprehensive plan
- Access management
- Signage
- Transit services

This study’s recommendations considered previously developed recommendations in the Nelson County Comprehensive Plan and other planning studies. These past studies identified a need for capacity improvements at select locations, improvements to address safety or geometric deficiencies and improvements for better pedestrian and bicycle accommodations. The recommendations described below are consistent with the past plans and studies. The exception is the widening of Route 151 from two (2) to four (4) lanes, identified in the previous Route 151 Corridor Study, is not recommended in this study.

The operational and safety analyses have indicated that improvements are needed for the study intersections, as well as the corridor as a whole. Four (4) intersections were examined from a capacity standpoint to determine operational deficiencies. Only one of the four, Route 151 at U.S. 250, would need capacity improvements to provide a sufficient level of service. The recommended improvements for this location are to either construct a roundabout or install a traffic signal in the mid-term timeframe. The other three locations examined did not need improvements to address operational needs; rather improvements are needed to address safety and geometric deficiencies. For these three locations, where turn lanes or roundabouts are recommended, operational analysis was completed to ensure such improvements would not have a negative impact to operations. Section 3.4 presents the results of the operational analysis.

A comprehensive safety assessment was conducted for the corridor. A total of 15 intersections were examined from a safety standpoint to identify deficiencies that contribute to crashes and to identify mitigation measures to address these deficiencies. The improvements were categorized as short-, mid-, long-term improvements or on-going actions. On-going actions predominately include maintenance to remove overgrown vegetation that should occur on a regular schedule, monitoring the effectiveness of intersection improvements or enforcement of state code or county regulations. Short-term improvements include maintenance items, roadway restriping, or projects that can easily be added to the six-year improvement program or funded through the highway safety improvement program. Mid-term projects are projects with higher costs that require time for implementation. Long-term projects
require additional studies and/or design efforts. Depending on the funding mechanism, some projects can be accelerated and implemented ahead of the normal process. Section 3.5 presents the summary of the recommendations for the corridor while the full detailed safety assessment and improvement recommendations are presented in Appendix D.

At many of the intersections, the dominate safety issue is the lack of sight distance. This is caused by horizontal and/or vertical alignment, embankments near the roadway, placement of the stop bar or overgrown vegetation. Regular maintenance to remove vegetation would address the issue with overgrown vegetation and stop bars can be shifted closer to intersections as identified. To address the first two issues listed, roadway reconstruction in vicinity of the intersection is needed to improve the sight distance. However, sight distance is not limited to just the study intersections, other intersections and segments of Route 151 also have sight distance issues. This calls to attention the need for corridor-wide reconstruction to address sight distance issues caused by the horizontal and/or vertical alignment of the roadway.

When segments of the roadway are reconstructed, be it an intersection or a segment, a minimum of five-foot paved shoulders should be included to provide accommodations for cyclists and pedestrians. This construction will help provide the corridor with wide bike lanes. The incremental cost of including paved shoulders during smaller construction projects is less than adding paved shoulders after the roadway reconstruction has occurred.

A number of segments on Route 151 have had the speed limits reduced based on prevailing speeds and/or safety considerations. Several sections still retain the 55mph speed limit. Route 151 is transitioning from a pass-through roadway to being a destination roadway. New businesses have opened in recent years, attracting new people to the corridor. The natural beauty of the area has also generated additional tourism.

This increase in tourism has caused an increase in turning traffic along the corridor. This increase in turning traffic increases the potential for crashes if speed limits are not set appropriately for the prevailing speeds and the adjacent land uses. New speed studies should be conducted for the sections with increased land-use generators. When these speed studies are conducted they should consider the time period which the land-use generators experience their peak activity times. The Nellysford area has seen a recent increase in both residential and commercial development, and the increase in development is likely to continue. With this growth Nellysford will transition from a rural area to a village setting. The speed limit should be examined to determine whether the speed limit should be lowered.

Nellysford is becoming an activity center in Nelson County; however it lacks a village or comprehensive plan. A plan should be developed to guide the long-term growth. For the transportation components of the plan, key elements to be considered include parallel road(s) to Route 151, inter-parcel connectivity and pedestrian/bicyclist accommodations.

Most locations along the corridor do not have good access management practices. Older, established businesses that are adjacent to each other do not share driveways, nor do they have inter-parcel
connections. The lack of inter-parcel connections requires short trips on Route 151 as drivers travel between these businesses. Access management for existing parcels can be improved by looking for opportunities to consolidate existing driveways and create inter-parcel connectivity. New developments should comply with VDOT access management guidelines.

Signage is a challenge along the corridor and opportunities exist for improvements. VDOT should improve way-finding and other roadway signage as projects are implemented along the corridor. Nelson County is beginning to review and update its zoning ordinance relative to commercial signage. This action will improve how commercial signage is installed within and adjacent to the VDOT right-of-way. Such actions will enhance the corridor.

Expansion of the rural demand response service, as identified in JAUNT Transit Development Plan, to include another day of operations will improve mobility for Nelson County residents that do not have a personal automobile.