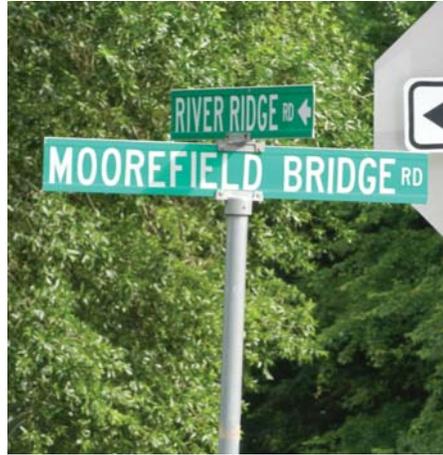




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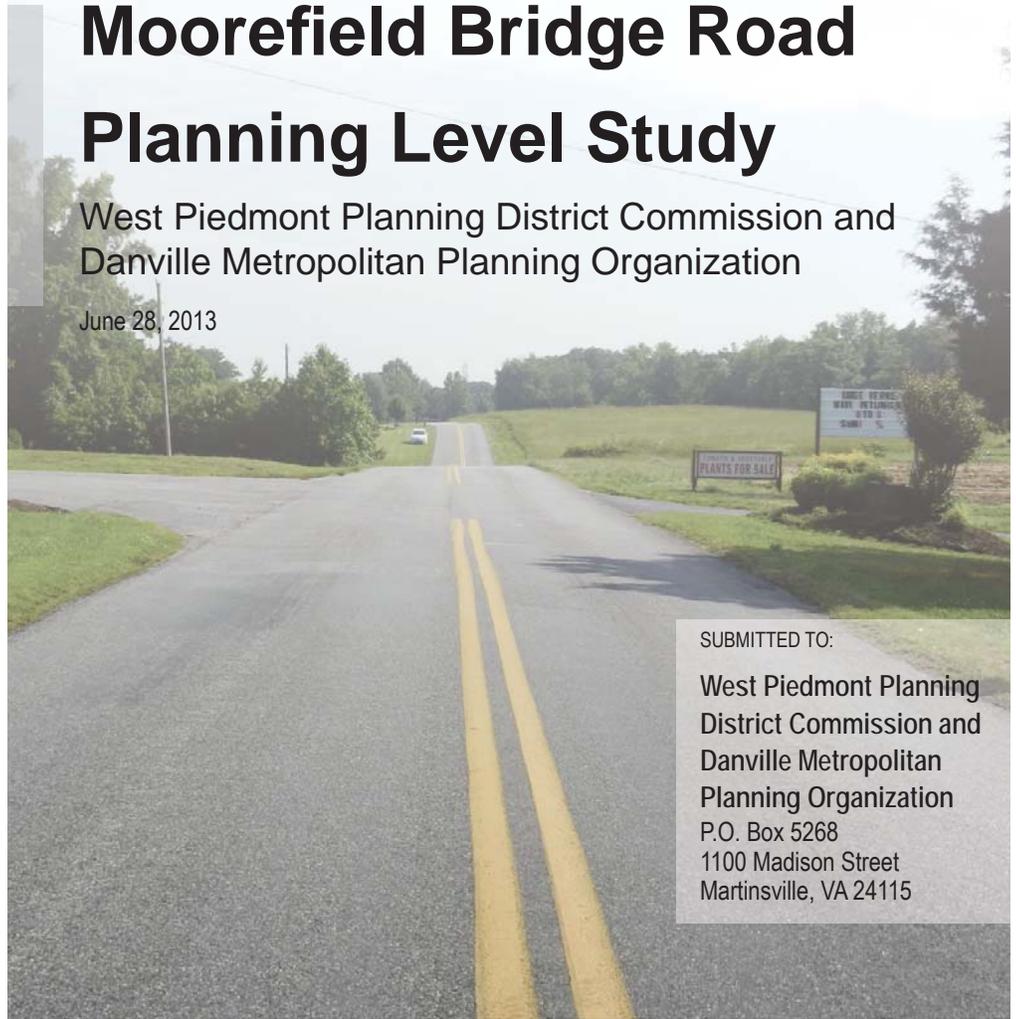
## Increasing Safety and Capacity



# Moorefield Bridge Road Planning Level Study

West Piedmont Planning District Commission and  
Danville Metropolitan Planning Organization

June 28, 2013



SUBMITTED TO:

West Piedmont Planning  
District Commission and  
Danville Metropolitan  
Planning Organization  
P.O. Box 5268  
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Martinsville, VA 24115



# Planning Level Study – Moorefield Bridge Road

FINAL REPORT

Pittsylvania County and Danville, Virginia

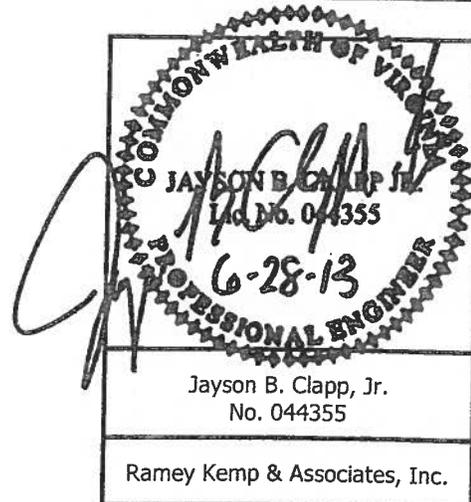
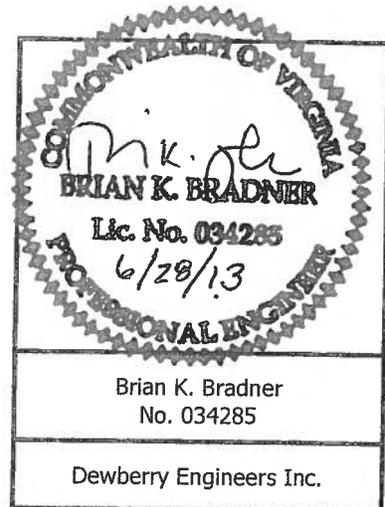
June 28, 2013

Prepared for:  
West Piedmont Planning District Commission and  
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## Executive Summary

Dewberry Engineers Inc. (Dewberry) and Ramey Kemp & Associates Inc. (RKA) have completed the Moorefield Bridge Road (Route 863) improvements study for the West Piedmont Planning District Commission (WPPDC) and the Danville Pittsylvania Metropolitan Planning Organization (MPO) in cooperation with the Virginia Department of Transportation (VDOT), the City of Danville, and Pittsylvania County. The intent of this study is to define the most advantageous locations for spot improvements along Moorefield Bridge Road between the intersections with Mount Cross Road (CO RD 750) and Westover Drive (US 51), as well as to determine the need for signalized traffic control. Below is a summary of the conclusions and recommendations from this study.

1. Based on the analysis within this report, it is expected that due to the expected growth of this area and the existing crash rates, improvements to the existing roadway and associated intersections should be identified.
2. To deal with these deficiencies, three (3) locations for spot improvements have been identified. For each location different improvement alternatives were identified. The locations and associated improvements are listed below:
  - a. Along the curved sections of Moorefield Bridge Road, between River Ridge Road/Pinecrest Drive and Red Bud Lane.
    - i. Installation of Chevron Warning Signs utilizing Warning Signs W1-1 and W1-8 placed in strategic locations.
    - ii. Installation of the Warning Signs, as well as pavement widening to add four (4) foot paved shoulders on either side.
  - b. The intersection of Moorefield Bridge Road and Mount Cross Road.
    - i. Addition of 200 foot left turn lanes on the eastbound and westbound approaches and a 150 foot left turn lane on the northbound approach.
    - ii. Construction of a single lane roundabout with widened approaches of each leg.
    - iii. Addition of 100 foot left turn lanes on the eastbound, westbound and northbound approaches, as well as the installation of a traffic signal.
  - c. The intersection of Moorefield Bridge Road and Westover Drive.
    - i. Addition of 100 foot left turn lane on the southbound approach.
3. The alternatives for each location were evaluated using eight (8) criteria to determine the preferred alternative for the two spot improvements. The recommended spot improvements are listed below for each location.
  - a. Location 1: Installation of the Warning Signs, as well as pavement widening to add four (4) foot paved shoulders on either side.
  - b. Location 2: Addition of 100 foot left turn lanes on the eastbound, westbound and northbound approaches, as well as the installation of a traffic signal.
  - c. Location 3: Addition of 100 foot left turn lane on the southbound approach.
4. Through the implementation of these improvements, this segment of Moorefield Bridge Road will operate under capacity and with increased safety.

## MOOREFIELD BRIDGE ROAD – PLANNING LEVEL STUDY

### I. INTRODUCTION

Dewberry Engineers Inc. (Dewberry) and Ramey Kemp & Associates Inc. (RKA) have completed the Moorefield Bridge Road (Route 863) improvements study for the West Piedmont Planning District Commission (WPPDC) and the Danville Pittsylvania Metropolitan Planning Organization (MPO) in cooperation with the Virginia Department of Transportation (VDOT), the City of Danville, and Pittsylvania County. The intent of this study is to define the most advantageous locations for spot improvements along Moorefield Bridge Road between its intersections with Mount Cross Road (County Road 750) and with Westover Drive (US 51), as well as to determine the need for signalized traffic control.

This section of Moorefield Road is in both Pittsylvania County and the City of Danville. This road crosses into Pittsylvania County approximately 300 feet north of the intersection with Westover Drive. (See Figure 1 for location of roadway section to be analyzed within this report.) This section of roadway was identified for improvement within the *Year 2035 Long Range Transportation Plan* prepared by URS on August 16, 2010. The improvements, listed within the Roadway Vision Plan include constructing a roadway on a new alignment to allow for better access from Route 863 to US 58 and the Danville Bypass. This need was identified in conjunction with the proposed Mega Park located along Berry Hill Road. For the purposes of this study, it is anticipated that Moorefield Bridge Road will remain on its current alignment.

This study will provide the WPPDC, MPO, and local governments with a planning level document that details multiple alternatives for improving the safety and capacity of Moorefield Bridge Road for the Year 2035. In order to determine these alternatives, the following are addressed within this study:

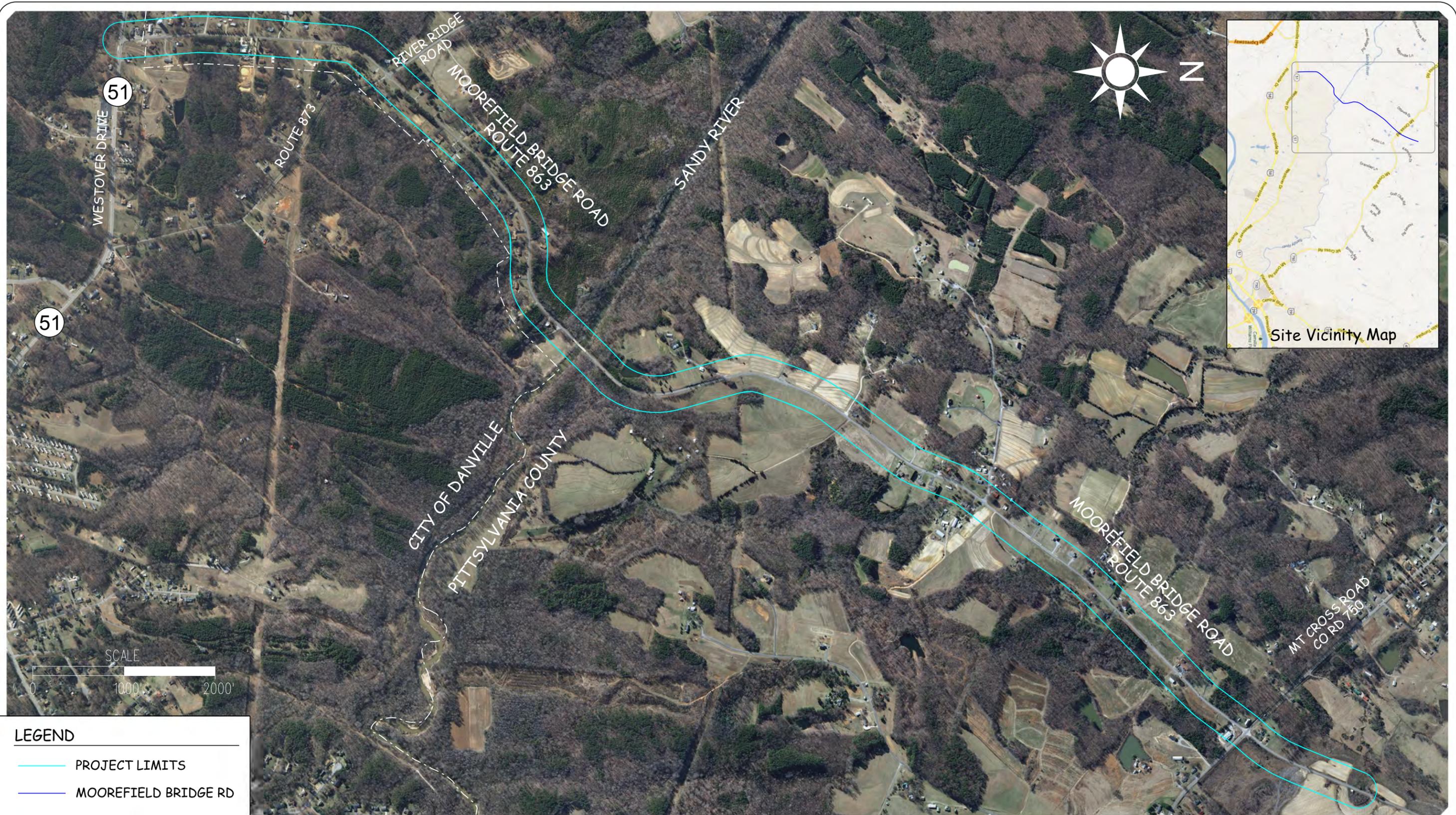
1. Identification of Existing Conditions;
2. Discussion of Possible Environmental Constraints;
3. Review of Existing Traffic Safety;
4. Analysis of the No-Build Alternative;
5. Statement of Purpose and Need; and
6. Improvement Alternatives.

From the improvement alternatives developed within this report, one preferred alternative will be recommended for future design and construction.

### II. EXISTING TRAFFIC CONDITIONS

A description of each existing road within the study area is provided below.

**Moorefield Bridge Road (Route 863)** is classified as an Urban Minor Arterial from Westover Drive to Route 873, and is a Rural Major Collector from Route 873 to Mount Cross Road. The posted speed limit along this road is 45 miles per hour (MPH). The typical road section includes two 10-foot lanes with no shoulders. The horizontal and vertical alignments follow the natural terrain with limited passing zones or no passing zones.



**Westover Drive (US 51)** is classified as an Urban Minor Arterial with a posted speed limit of 40 MPH. The typical road section includes a four-lane undivided roadway (two lanes in each direction) with lane widths of 10 feet. The horizontal alignment is primarily straight, with very subtle horizontal curves. The vertical alignment generally approximates the adjacent rolling terrain.

**Pinecrest Drive/River Ridge Road (Route 873)** is a two-lane rural road with a posted speed limit of 45 MPH. The typical road section includes two lanes with a lane width of 10 feet. The shoulders along this road are limited. The horizontal alignment follows a windy path with multiple horizontal curves.

**Mount Cross Road (Route 750)** is a Rural Major Collector with a posted speed limit of 45 MPH. The typical road section includes 11-foot lanes with limited or no shoulder. This road serves as an east-west route for local traffic to Danville.

**Bicycle and pedestrian facilities** are not present within the project limits. Review of the *West Piedmont Regional Bicycle Plan*, prepared by Kimley-Horn & Associates and revised September 2007, revealed that Moorefield Bridge Road is not seen as a possible bicycle route. This study, however, will consider how to accommodate bicyclists and pedestrians so as to conform to the Commonwealth Transportation Board's (CTB) policy.

#### Existing Roadway Volumes and Levels of Service

To determine the peak hour volumes within the study area, turning movement counts for the AM and PM peak periods were conducted by RKA on February 5<sup>th</sup> and 6<sup>th</sup>, 2013, and are included in Appendix A for reference. A review of the traffic counts indicates the AM and PM peak hours occurred at different times at each intersection. It should be noted that for the purpose of this study, the peak hour volumes at each intersection were assumed to occur simultaneously. The turning movement counts were taken at the following intersections:

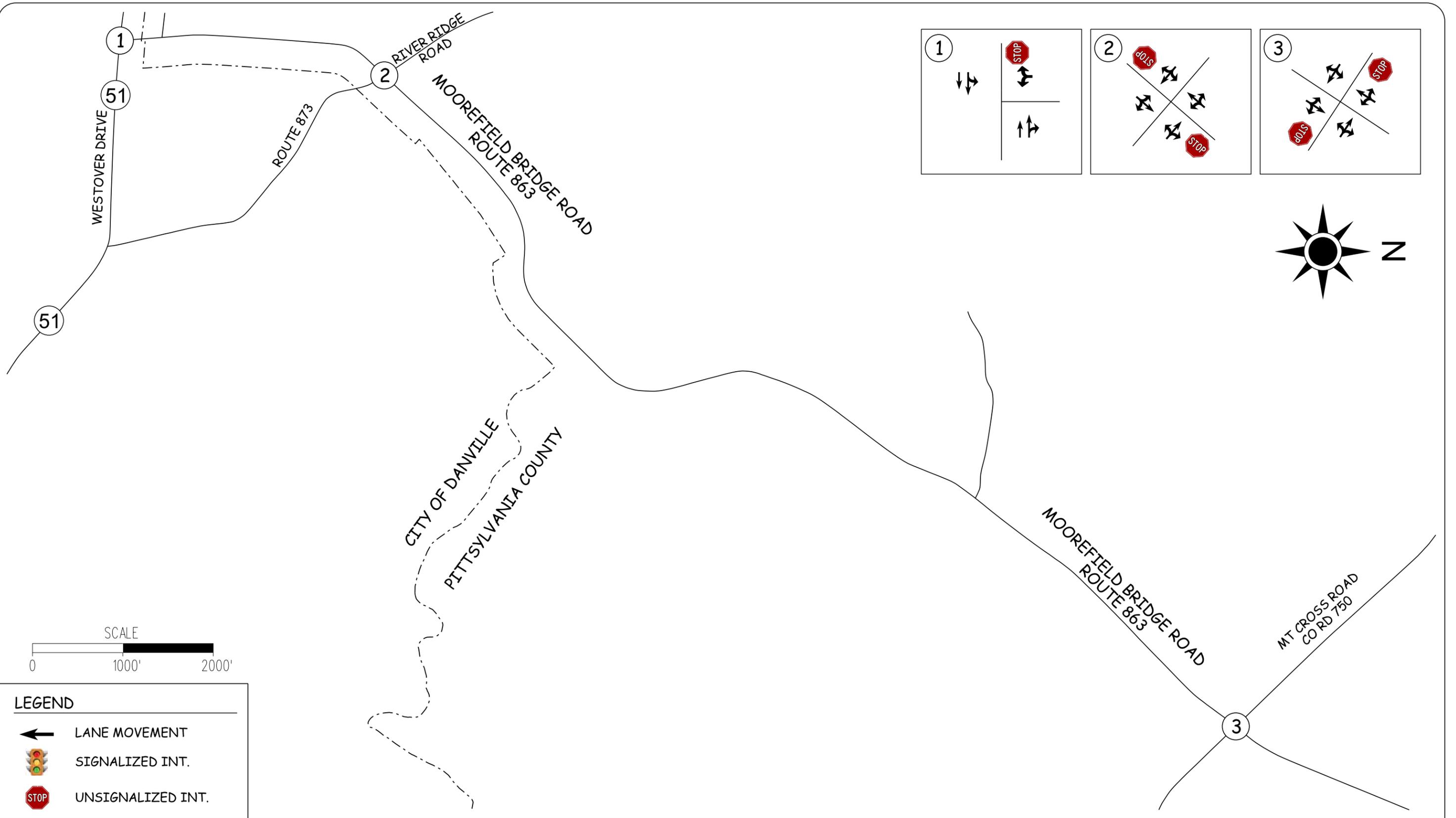
1. Moorefield Bridge Road and Westover Drive
2. Moorefield Bridge Road and River Ridge Road/Pinecrest Drive
3. Moorefield Bridge Road/Laniers Mill Road and Mount Cross Road

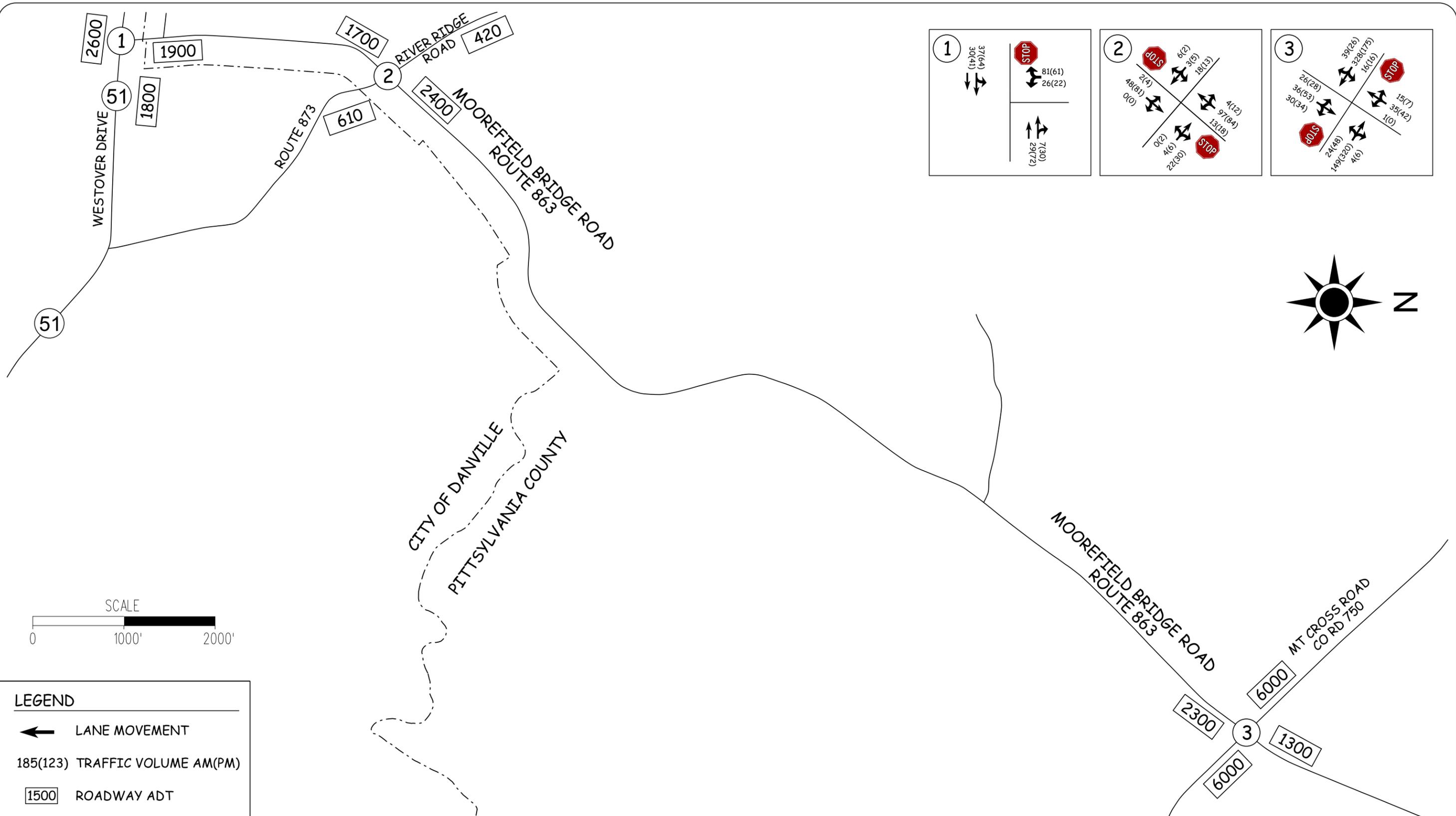
The existing intersection geometry and traffic control devices are presented in Figure 2; and the existing (2013) traffic volumes are presented in Figure 3.

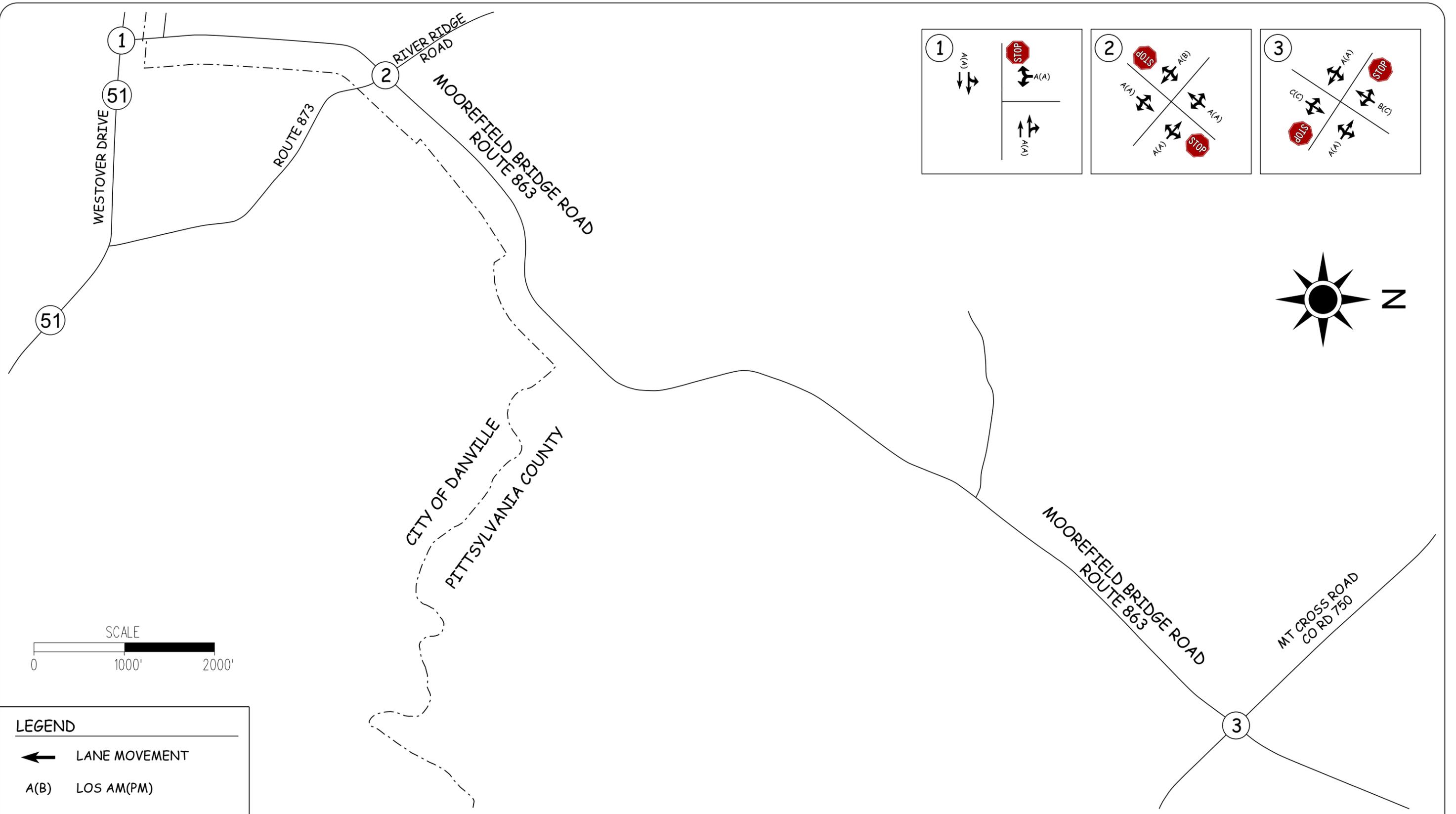
Using the existing traffic volumes shown in Figure 3, the existing levels of service were determined for each intersection.

The levels of service for each intersection are shown in Figure 4. As can be seen, all approaches currently operate at acceptable levels of service and only the northbound (AM and PM peak hour) and southbound (PM peak hour) approaches at the intersection with Mount Cross Road operate at Level of Service (LOS) C.

Table 1 also shows the existing LOSs for each intersection.







**LEGEND**

← LANE MOVEMENT

A(B) LOS AM(PM)

**Dewberry**  **RAMEY KEMP & ASSOCIATES**  
TRANSPORTATION ENGINEERS

MOOREFIELD BRIDGE ROAD (RTE. 863) EXISTING LOS AM & PM PEAK HOUR  
PITTSYLVANIA COUNTY AND DANVILLE, VIRGINIA

FIGURE  
**4**

Table 1  
Year 2013 – Existing Intersection Level of Service

INTERSECTION	TYPE OF CONTROL	MOVEMENT APPROACH	AM PEAK HOUR		PM PEAK HOUR	
			LEVEL OF SERVICE*	DELAY (SEC/VEH)	LEVEL OF SERVICE*	DELAY (SEC/VEH)
Moorefield Bridge Road and Westover Drive	Unsignalized	EB	A	4.1	A	4.6
		WB	A	0.0	A	0.0
		SB	A	9.1	A	9.5
Moorefield Bridge Road and River Ridge Road	Unsignalized	EB	A	9.9	B	10.5
		WB	A	8.9	A	9.3
		NB	A	0.3	A	0.3
		SB	A	0.8	A	1.2
Moorefield Bridge Road and Mount Cross Road	Unsignalized	EB	A	0.3	A	0.6
		WB	A	1.1	A	1.0
		NB	C	16.4	C	18.8
		SB	B	14.3	C	16.9

\* Please note that the LOSs are reported in accordance with the Highway Capacity Manual 2010 designations.

The complete LOS analysis for the existing conditions is included in Appendix C for reference.

All analysis was performed utilizing the methodologies as defined in the Highway Capacity Manual (HCM). The measurement used to define the performance of an intersection is determined by LOS A through F. A LOS C or better will be considered an acceptable LOS for this area. See Appendix B for a more detailed explanation of the methodology and criteria used for the LOS analysis.

### Bicycle and Pedestrian

Currently Moorefield Bridge Road (Route 863) does not support bicycle or pedestrian traffic along the section analyzed within this report. This study will consider the accommodation of bicyclists and pedestrians along this section of road to adhere to CTB policy. Review of the *West Piedmont Regional Bicycle Plan*, revised September 2007, revealed that Moorefield Bridge Road is not a planned bike route.

### Environmental Resources

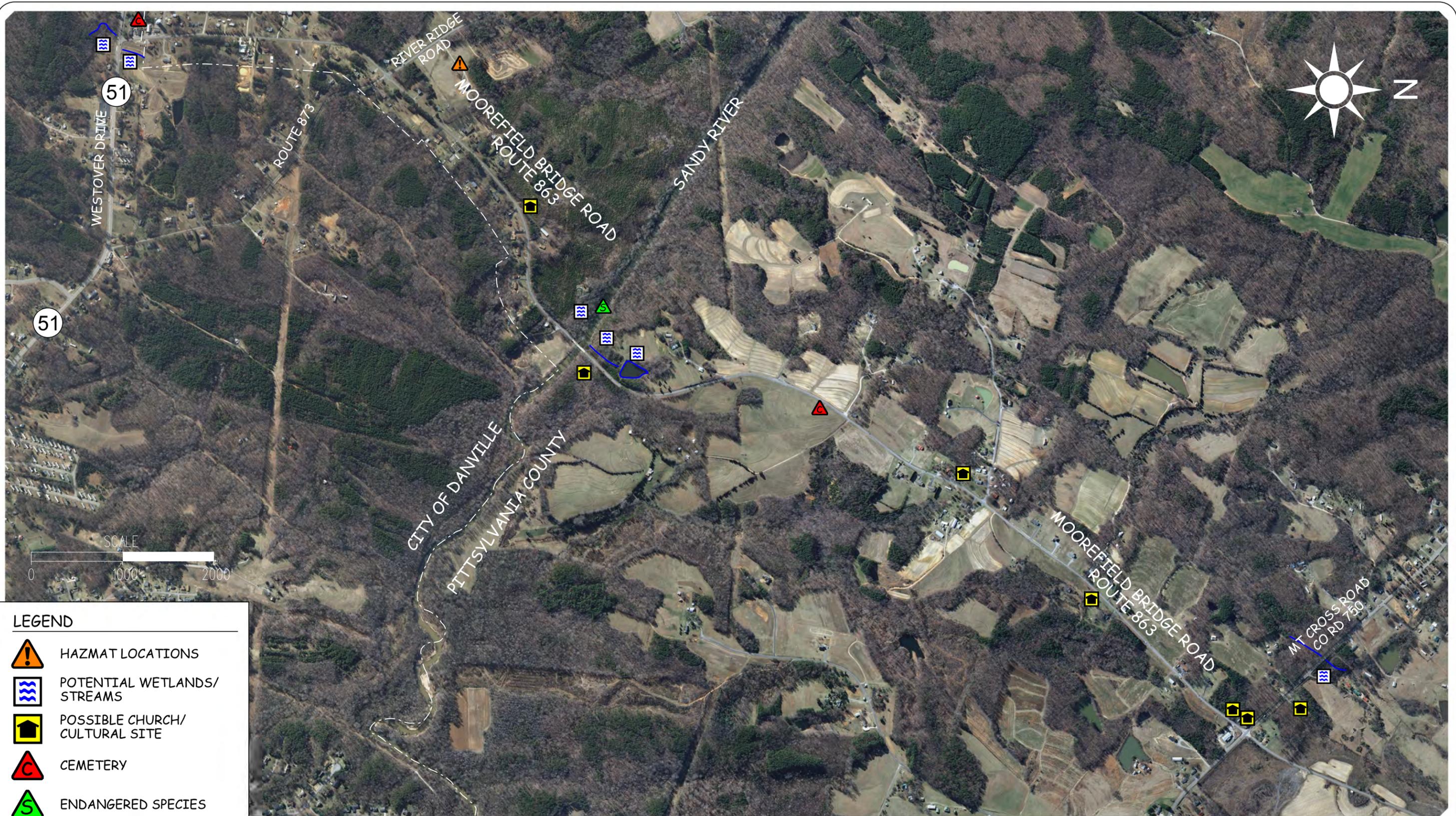
This section describes the potential environmental resources within the proposed project area. Table 2 summarizes potential environmental issues and recommendations on addressing potential impacts to those resources. Additional environmental resources that are not included in the table may exist within the proposed project area.

Table 2  
Environmental Issues

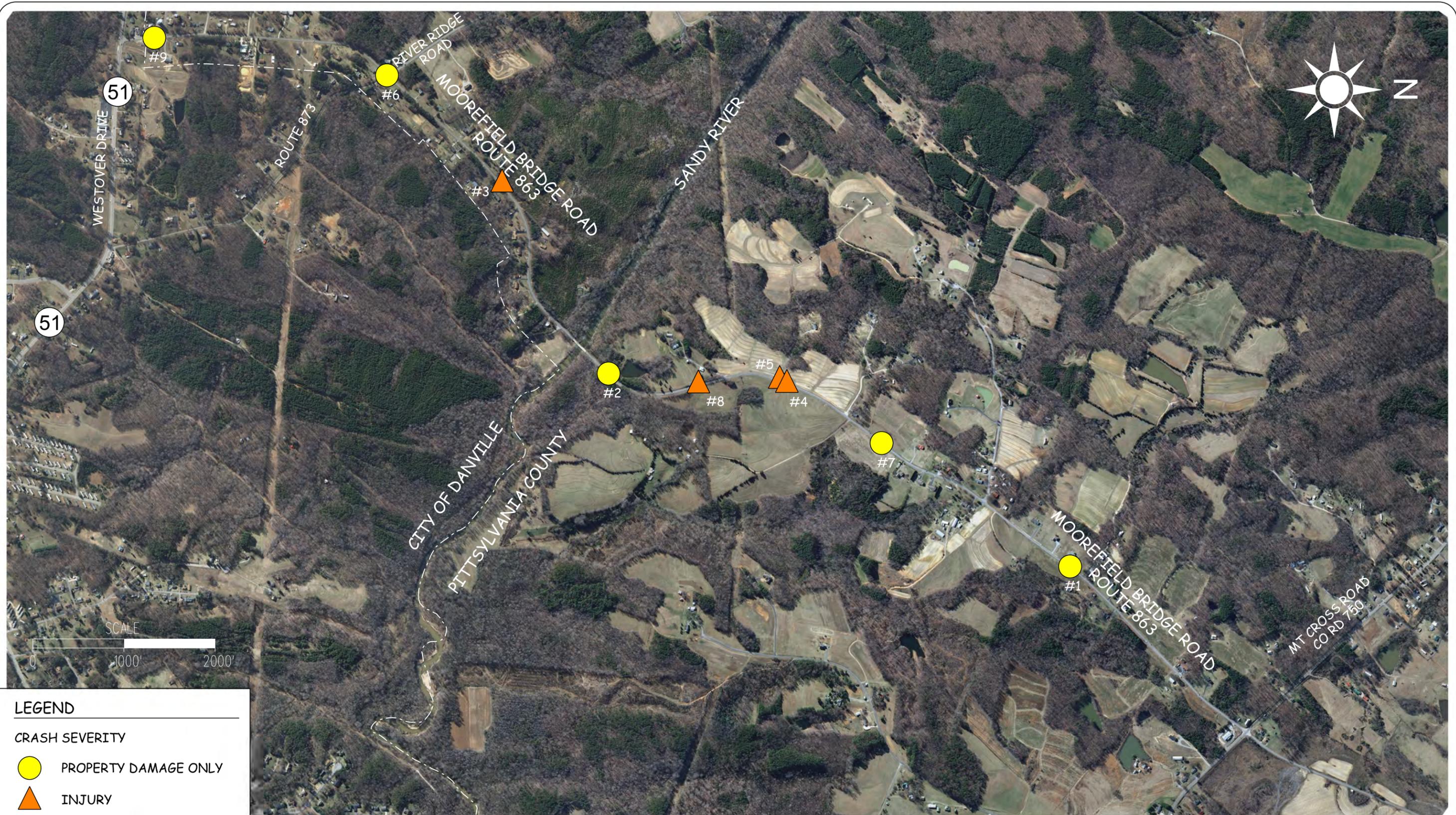
Resources/Issue	Comments
Cultural Resources	A review of U.S. Geological Survey (USGS) topographic maps and aerials identified three cemeteries within the study area. The first is located between Page Road and Westover Drive approximately 150 feet west of Moorefield Bridge Road, the second is located approximately 300 feet south of Red Bud Lane abutting the northbound lane of Moorefield Bridge Road, and the third is located abutting the eastbound lane of Mount Cross Road approximately 1,900 feet east of Moorefield Bridge Road. Further review of these resources should be conducted. We reviewed the Virginia Department of Historic Resources Data Sharing Service (DSS) database online and it noted no known or mapped resources within the project corridor. The absence of mapped resources does not mean resources are not present in the project corridor; the absence could be due to a lack of survey information. A Phase I survey should be conducted once the proposed improvements are identified.
Waters of the United States, including wetlands	We reviewed the National Wetland Inventory Geographic Information System (GIS) online mapper. It noted 7-10 adjacent Palustrine Open Water ponds located within the project corridor; note the absence of other wetland types mapped does not mean those resources are not present in the corridor. A Waters of the United States/Wetland delineation should be conducted once an alternative is identified. Review of U.S. Geological Survey (USGS) topographic maps and aerials indicated 3 or 4 locations, including the Sandy River, that likely contain unmapped jurisdictional waters/wetlands.
Water Quality Permits	This roadway appears to follow a topographic ridge and only minor drainage crossing and headwater wetland areas exist. Permitting scenarios will vary depending on verification of wetland and stream locations and the location of construction activities. In comparison to similar projects, impacts generally will fit general permits from both Virginia Department of Environmental Quality (DEQ) and the U.S. Army Corps of Engineers.
Agricultural and Forest Districts, Prime Farmland and Soil	Most of the project corridor is classified as prime farmland or farmland of statewide importance by the Natural Resources Conservation Services (NRCS). Coordination with NRCS may be necessary when an alternative is identified.

Table 2 (Cont.)  
Environmental Issues

<p>Threatened and Endangered Species/Wildlife and Waterfowl Refuges</p>	<p>The U.S. Fish and Wildlife Service data base (IPaC) documents the potential of the Federal Endangered/State Endangered (FESE) Roanoke Logperch to be located within the project corridor. Furthermore, there is a potential for critical habitat within the project corridor, and certain actions within the project corridor may also affect downstream species. A search of Virginia's Department of Conservation and Recreation (DCR), and the Virginia Department of Game and Inland Fisheries databases did not note any mapped observations of SE or State Threatened (ST) species within the project corridor. The absence of mapped species observation does not mean SE or ST species are not present. The absence may be related to the lack of a survey. No wildlife or waterfowl refuges are located within the project corridor. A search of DCR's Biotics Data System was submitted and resulted in no documented State-listed plants or insects in the project area.</p>
<p>Hazardous Materials</p>	<p>A review of the Environmental Protection Agency "Enviro-mapper" and the DEQ website "What's in my Backyard" indicates that there are known hazardous material sites (see Figure 5) within the project limits. Acquisitions of land that contain hazardous material will require, at minimum, a Phase I Environmental Site Assessment (ESA) report. Multiple Phase I ESA reports should be anticipated due to the past and current use of existing properties and observation that many areas are used as trash dump sites. Additionally, acquisition of residential or commercial buildings with lead based paint and/or asbestos-containing building materials and/or Recognized Environmental Condition would be considered an issue for the project, and further investigation would be required.</p>
<p>FEMA</p>	<p>This project crosses one tributary with a Federal Emergency Management Agency (FEMA) mapped floodplain, the Sandy River. The existing road bridges the Sandy River, and improvements within the floodplain may require a floodplain study and coordination with FEMA if there are impacts to the regulated floodplain or a rise in the 100-year water surface elevation.</p>
<p>Well and Septic</p>	<p>Well and septic locations within the project corridor are not known at this time. A request to the Virginia Department of Health for records of locations should be submitted once an alternative is identified. There is a potential for a complete parcel take if a septic system has to be removed and an alternative field and/or public utilities hook up cannot be provided.</p>



- LEGEND**
-  HAZMAT LOCATIONS
  -  POTENTIAL WETLANDS/  
STREAMS
  -  POSSIBLE CHURCH/  
CULTURAL SITE
  -  CEMETERY
  -  ENDANGERED SPECIES



**LEGEND**

CRASH SEVERITY

- PROPERTY DAMAGE ONLY
- ▲ INJURY

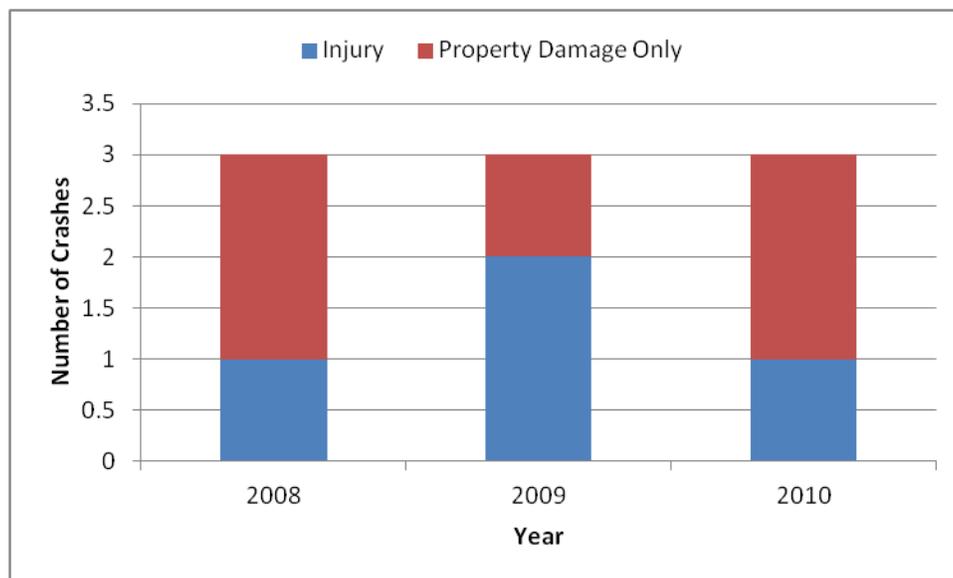
### Traffic Safety/Crash Data Analysis

Crash data from the most recent 3-year period (2008 to 2010) for the corridor were provided by VDOT. After review of the data, the results identified one location along the 2.99-mile segment of Moorefield Bridge Road where multiple crashes occurred. The segment is identified below:

1. Along Moorefield Bridge Road, just north of the Bridge over the Dan River and South of Red Bud Lane.

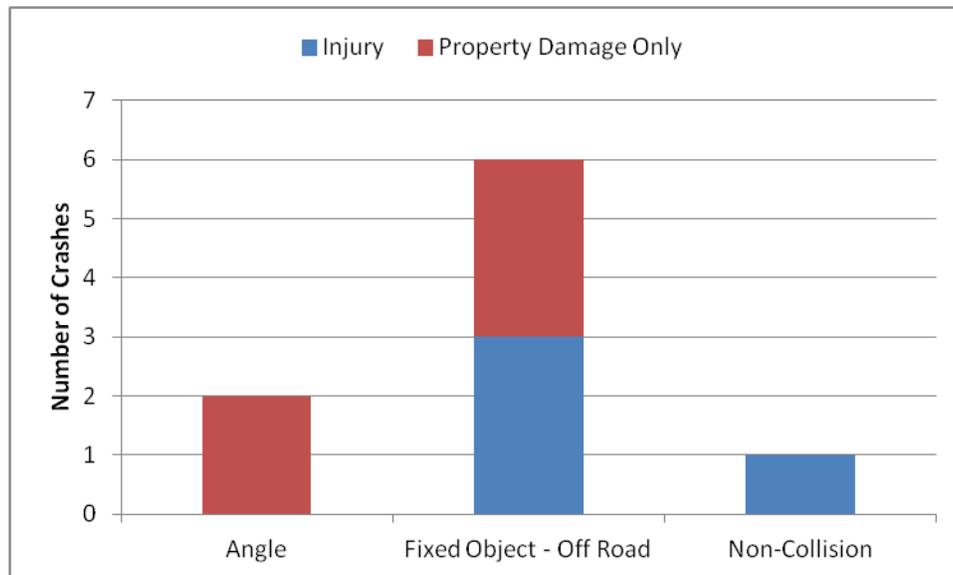
During this period, nine reported crashes occurred along the study corridor. Of the nine total reported crashes, five resulted in property damage only (PDO) and four involved at least one injury. No fatalities were reported. The locations of each individual accident along this section of roadway are shown in Figure 6. This figure also indicates whether the crash was a PDO or resulted in an injury. Figure 7 graphically summarizes the Moorefield Bridge Road crash history by year. Appendix E contains the crash data summary sheet.

Figure 7  
Severity of Crashes per Year



As displayed in Figure 7 above, an equal number of crashes occurred each year. The types of crashes, injury or PDO, were approximately equal as well. In addition to the crash severity and total number, the types and locations of accidents were also analyzed. Figure 8 graphically shows the type and severity of the nine crashes that occurred between 2008 and 2010.

Figure 8  
Type and Severity of Crashes



As displayed in Figure 8 above, most of the crashes were fixed-object, off-road crashes, including both injury and PDO cases. Probable causes for the high number of fixed object off road crashes could be factors such as inadequate signage, pavement markings, and/or roadway design. Potential solutions to consider are the installation of necessary signs, the removal of obstacles or the installation of guardrail, and the examination of existing roadway design factors such as superelevation.

As part of the safety analysis, the Moorefield Bridge Road corridor was analyzed at three intersections. The calculated crash rate for Moorefield Bridge Road between Westover Drive and Route 750 is 171.8 per 100 million (M) vehicle miles traveled. The entire corridor has a slightly lower crash rate compared to the 2008 Statewide Average crash rate of 185 per 100M vehicle miles traveled.

Intersections were examined based on factors such as traffic control method, lane geometry, and the number of approaches. According to the crash summary data sheet, only one of the accidents occurred at the three intersections analyzed within this report.

### III. FUTURE NO-BUILD ALTERNATIVE (YEAR 2035)

Utilizing information obtained from the regional traffic model received from VDOT for this area, RKA projected future no-build traffic volumes. Annual growth rates were approximated for the associated movements based on 2006 and 2035 average daily traffic data at the following intersections.

#### Intersection of Moorefield Bridge Road and Westover Drive

Eastbound and westbound through movements on Westover Drive: 1.0%

All remaining movements on Westover Drive and Moorefield Bridge Road: 4.9%

#### Intersection of Moorefield Bridge Road and River Ridge Road/Pinecrest Drive

Northbound and southbound through movements on Moorefield Bridge Road: 3.7%

All remaining movements on Moorefield Bridge Road, River Ridge Road, and Pinecrest Drive: 1.0%

Intersection of Moorefield Bridge Road/Laniers Mill Road and Mount Cross Road

Eastbound and westbound through movements on Mount Cross Road: 1.7%

Eastbound right-turn movement and westbound left-turn movement on Mount Cross Road, as well as

Northbound left and right-turn movements on Moorefield Bridge Road: 3.7%

All remaining movements on Mount Cross Road, Moorefield Bridge Road, and Lanier Mills Road: 4.1%

From the approximated annual growth rates, the future no-build traffic volumes were determined as shown in Figure 9. Utilizing these traffic volumes, the future no-build intersection LOS analysis was completed. As shown in Figure 10, the LOSs for some approaches will deteriorate to unacceptable levels (LOS D and below) at only one intersection. The LOSs for the no-build alternative are also shown in Table 3 below.

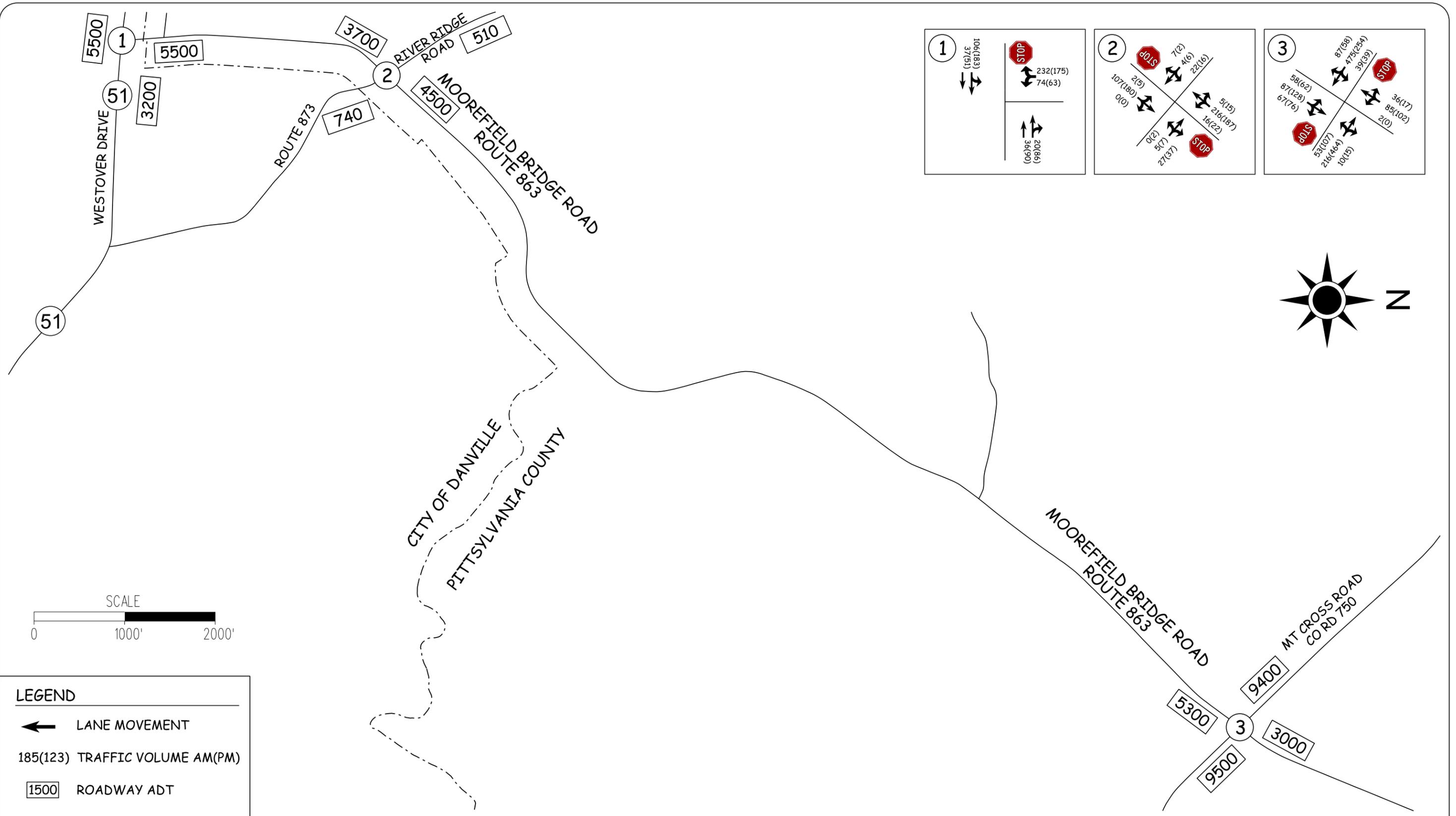
Table 3  
Year 2035 – Future No-Build Intersection Level of Service

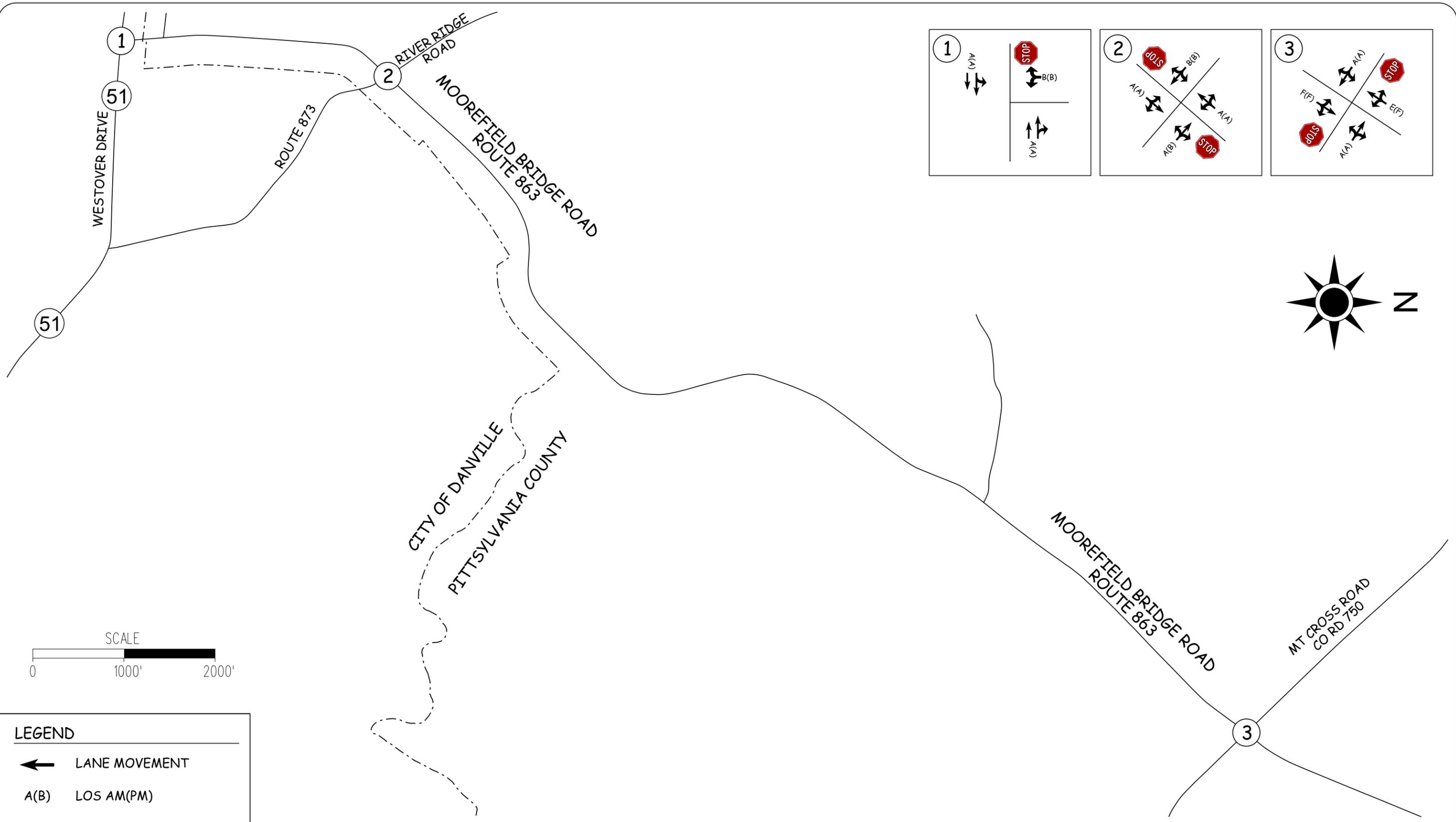
INTERSECTION	TYPE OF CONTROL	MOVEMENT APPROACH	AM PEAK HOUR		PM PEAK HOUR	
			LEVEL OF SERVICE*	DELAY (SEC/VEH)	LEVEL OF SERVICE*	DELAY (SEC/VEH)
Moorefield Bridge Road and Westover Drive	Unsignalized	EB	A	5.6	A	6.3
		WB	A	0.0	A	0.0
		SB	B	11.5	B	13.7
Moorefield Bridge Road and River Ridge Road	Unsignalized	EB	B	11.8	B	13.1
		WB	A	9.5	B	10.3
		NB	A	0.1	A	0.2
		SB	A	0.5	A	0.8
Moorefield Bridge Road and Mount Cross Road	Unsignalized	EB	A	0.5	A	1.0
		WB	A	1.7	A	1.5
		NB	F	186.0	F	668.2
		SB	E	36.5	F	73.6

\* Please note that the LOSs are reported in accordance with the HCM designations.

The complete LOS analysis for the future no-build condition is included in Appendix E.

The most severe deterioration is expected to occur at the intersection of Mount Cross Road on the northbound and southbound approaches. As shown in the table above, the highlighted LOSs are those that have been reduced to unacceptable levels. At this intersection, the poor service levels result from the increase in forecasted traffic volumes along Mount Cross Road, reducing the frequency of adequate gaps in the traffic stream and causing increased delays on the Moorefield Bridge Road approaches before motorists safely enter the traffic stream. As shown by this analysis, improvements to this intersection are required if acceptable LOSs are to be achieved in the year 2035.





**LEGEND**

← LANE MOVEMENT

A(B) LOS AM(PM)

#### IV. STATEMENT OF PURPOSE AND NEED

Considering VDOT Access Management Standards and the results of the existing and forecasted (Year 2035) conditions analysis, the Statement of Purpose and Need for the Moorefield Bridge Road Evaluation of Improvements Study is based upon addressing the following issues:

1. LOSs at intersections, within the study limits, are anticipated to fall below acceptable levels unless improvements are made based on signal warrants and intersection analysis;
2. Safety and mobility shall be preserved or increased through implementation of identified spot improvements; and
3. Accommodations for bicyclists and pedestrians should be considered along Moorefield Bridge Road to adhere to CTB Policy.

The improvement alternatives will be developed to best satisfy the requirements of the above guidelines.

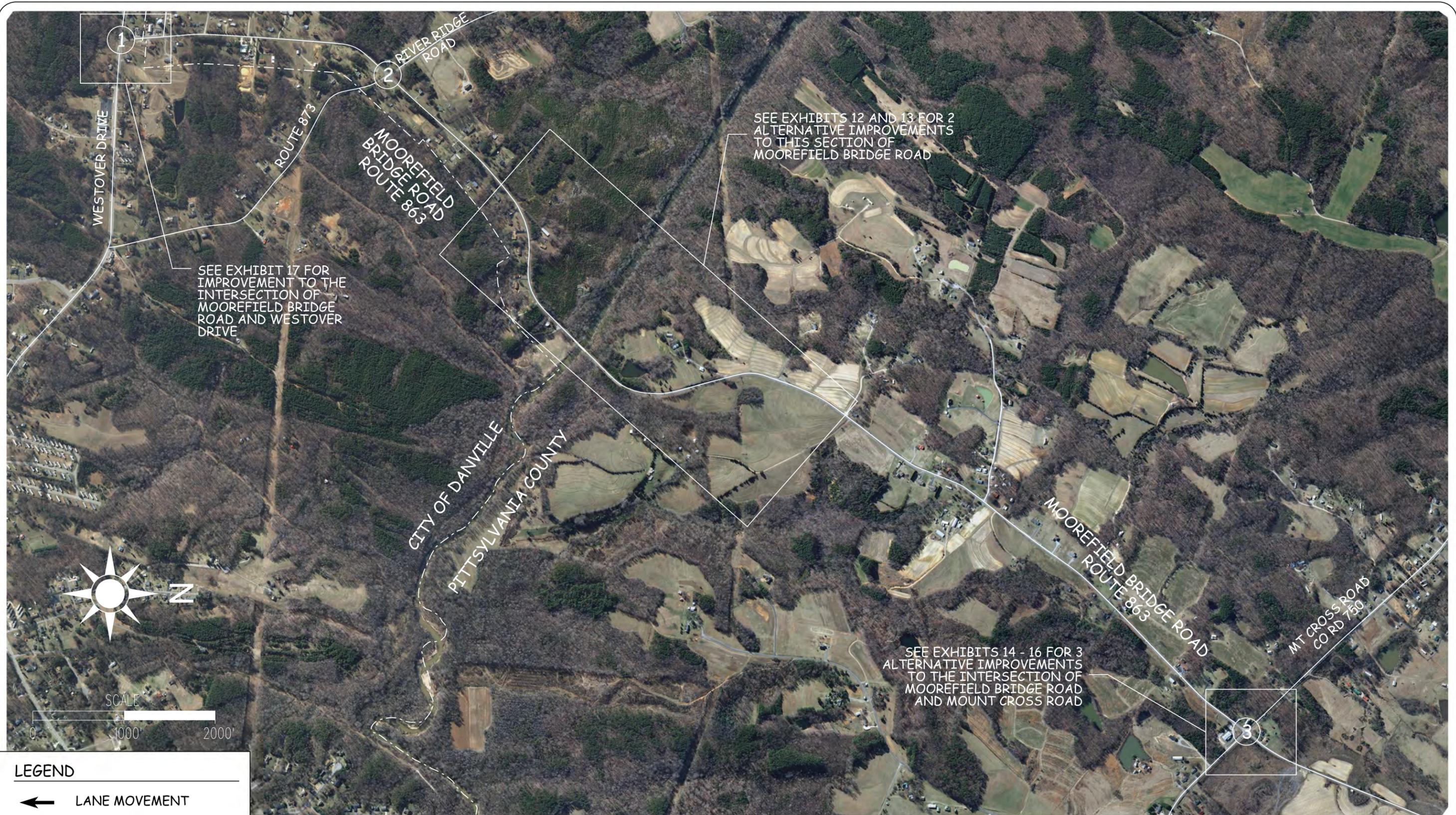
#### V. IMPROVEMENT ALTERNATIVES

Multiple improvement alternatives to this section of Moorefield Bridge Road will be analyzed within this study. In order to determine which alternative best meets the needs of this section of roadway, evaluation criteria were developed. Eight factors were rated by importance on a scale of 1 to 5, with 5 being the most important. These items are shown in Table 4 below.

Table 4  
Evaluation Criteria

Criteria #	Criteria Description	Criteria Weight (5-1)
1	Traffic LOSs - Capacity	5
2	System Performance	5
3	Safety	5
4	Cost	5
5	Right-of-Way Impacts	4
6	Environmental Impacts	4
7	Preliminary Utility Impacts	3
8	Consistency with Local / Land Use Plans	2

Based on the findings of the future no-build capacity analysis, the Mount Cross Road intersection does not meet adequate capacity requirements. All other intersections analyzed within this study will still operate at acceptable levels in the Year 2035 with no improvements. In addition to the capacity analysis, a review of the crash data was completed and a need for improvements was identified. It is also understood that there are public concerns regarding the current operation at the intersection of Westover Drive and Moorefield Bridge Road. Three locations for alternative spot improvements have been identified along this corridor and are shown in Figure 11.



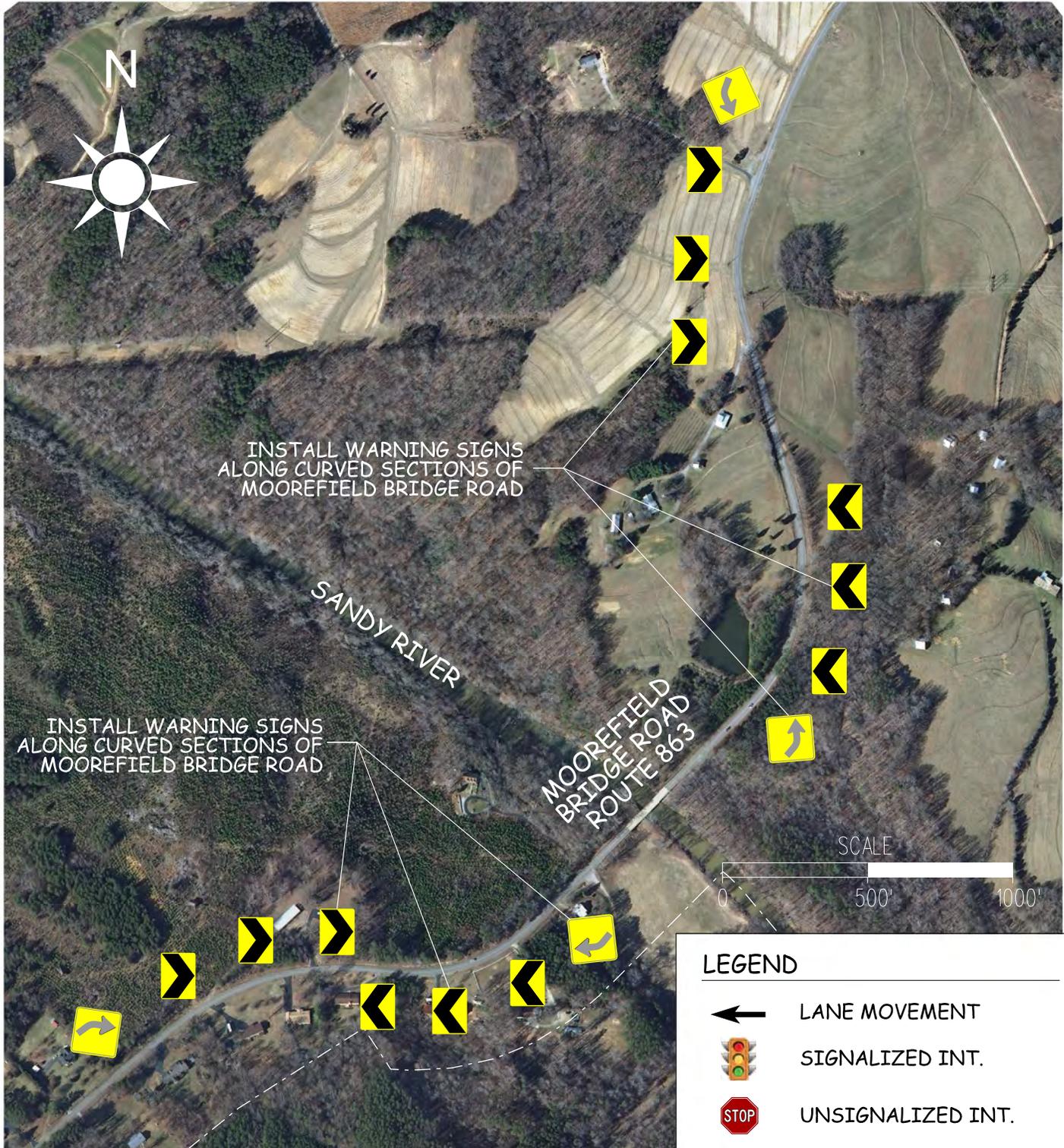
The alternative improvements shown in Figure 11 are divided into three locations. The first area is along the curved sections of Moorefield Bridge Road, between River Ridge Road/Pinecrest Drive and Red Bud Lane. The remaining two locations are at the intersections of Moorefield Bridge Road with Mount Cross Road and Moorefield Bridge Road with Westover Drive. Through the implementation of these improvements, the safety and capacity along this stretch of road should be improved. Because the remaining intersection analyzed within this report will operate at acceptable LOSs in the Year 2035, and the majority of crashes occur within the section identified above, no other improvements are suggested along this corridor.

#### Roadway Spot Improvement Alternatives

As identified in Figure 11, two alternatives for roadway improvements along Moorefield Bridge Road between River Ridge Road/Pinecrest Drive and Red Bud Lane were developed. Alternative 1 consists of installing Chevron Warning Signs, specifically Warning Signs W1-2 and W1-8 from the 2009 Edition of the Manual of Uniform Traffic Control Devices (MUTCD), in strategic locations to inform drivers traveling in either direction of the upcoming horizontal curves. This alternative improvement is shown in Figure 12. With the installation of these signs, the potential for crashes is anticipated to decrease. The preliminary estimate of probable cost indicates that these improvements could cost approximately \$22,300 to design and construct. A more detailed breakdown of the cost is included in Appendix F.

Alternative 2 consists of installing Chevron Warning Signs, as suggested in Alternative 1, as well as pavement widening to add 4-foot paved shoulders on both sides. The pavement widening will be limited to the section of road between River Ridge Road/Pinecrest Drive and Red Bud Lane. These improvements are shown in Figure 13. With the exception of one area, the paved shoulders will be widened from the existing edge of pavement. The one exception is a section of road located adjacent to a cemetery, where the alignment of Moorefield Bridge Road will have to be shifted to the northwest to avoid affecting the cemetery. In conjunction with the realignment and relocation, the vertical alignment in this area should be lowered to improve sight distance. Also, power utility poles are located along this stretch of road and will either need to be avoided or relocated. The preliminary estimate of probable cost indicates that these improvements could cost approximately \$1,550,800 to design and construct. A more detailed breakdown of the cost is included in Appendix F.

In review of the two alternatives described above, both will increase safety, but only one will help increase capacity. Using the Evaluation Criteria identified in Table 4, the two alternatives were compared to determine the preferred alternative. Section VI of this report will show the details of this comparison and indicate the preferred alternative.



MOOREFIELD BRIDGE ROAD (RTE. 863)  
ROADWAY ALTERNATIVE 1 IMPROVEMENTS  
PITTSYLVANIA COUNTY AND DANVILLE, VIRGINIA



**Dewberry**

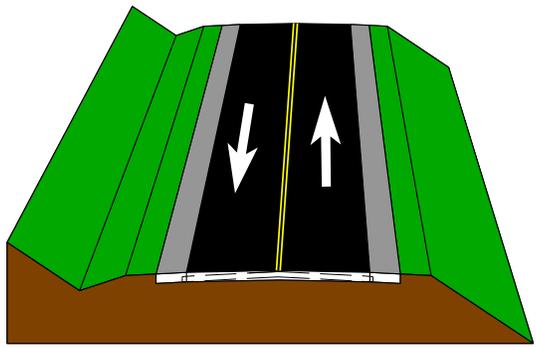


**RAMEY KEMP  
&  
ASSOCIATES**  
TRANSPORTATION ENGINEERS

FIGURE

12

PROPOSED TYPICAL SECTION  
MOOREFIELD BRIDGE ROAD



4+4 EXISTING WIDTH 4+4

ROAD ALIGNMENT TO BE SHIFTED AWAY FROM THE CEMETERY TO ALLOW FOR WIDENING



INSTALL WARNING SIGNS ALONG CURVED SECTIONS OF MOOREFIELD BRIDGE ROAD

INSTALL WARNING SIGNS ALONG CURVED SECTIONS OF MOOREFIELD BRIDGE ROAD

SANDY RIVER

MOOREFIELD BRIDGE ROAD ROUTE 863

WIDEN MOOREFIELD BRIDGE ROAD ALONG CURVED PORTIONS PER TYPICAL SECTION SHOWN ABOVE

SCALE



LEGEND

-  LANE MOVEMENT
-  SIGNALIZED INT.
-  UNSIGNALIZED INT.

MOOREFIELD BRIDGE ROAD (RTE. 863)  
ROADWAY ALTERNATIVE 2 IMPROVEMENTS  
PITTSYLVANIA COUNTY AND DANVILLE, VIRGINIA



**Dewberry**



**RAMEY KEMP & ASSOCIATES**  
TRANSPORTATION ENGINEERS

FIGURE

13

Intersection of Moorefield Bridge and Mount Cross Road Improvement Alternatives

Three alternatives for improvements at the intersection of Moorefield Bridge Road and Mount Cross Road were developed. Alternative 1 consists of the addition of 200-foot left turn lanes on the eastbound and westbound approaches and a 150-foot left-turn lane on the northbound approach. As a result of adding these turn lanes, Mount Cross Road and Moorefield Bridge Road will be widened to the north and east, respectively. These improvements are shown in Figure 14. Because both roads will be widened, the existing power utility poles may have to be relocated, thereby adding to the cost of the improvements. The addition of these turn lanes will reduce delays and improve operation on the stop-controlled approaches, but the northbound approach of Moorefield Bridge Road is expected to operate at LOS E and F during the AM and PM peak hours. The southbound approach of Laniers Mill Road is expected to operate at LOSs D and F. The intersection LOSs are shown in Table 5 below.

Table 5  
Year 2035 – Alternative 1 Intersection Level of Service

<u>INTERSECTION</u>	<u>TYPE OF CONTROL</u>	<u>MOVEMENT APPROACH</u>	<u>AM PEAK HOUR</u>		<u>PM PEAK HOUR</u>	
			<u>LEVEL OF SERVICE*</u>	<u>DELAY (SEC/VEH)</u>	<u>LEVEL OF SERVICE*</u>	<u>DELAY (SEC/VEH)</u>
Moorefield Bridge Road and Mount Cross Road	Unsignalized	EB	A	0.5	A	1.0
		WB	A	1.7	A	1.5
		NB	F	59.2	F	223.3
		SB	D	34.8	F	65.3

\* Please note that the levels of service are reported in accordance with the HCM designations.

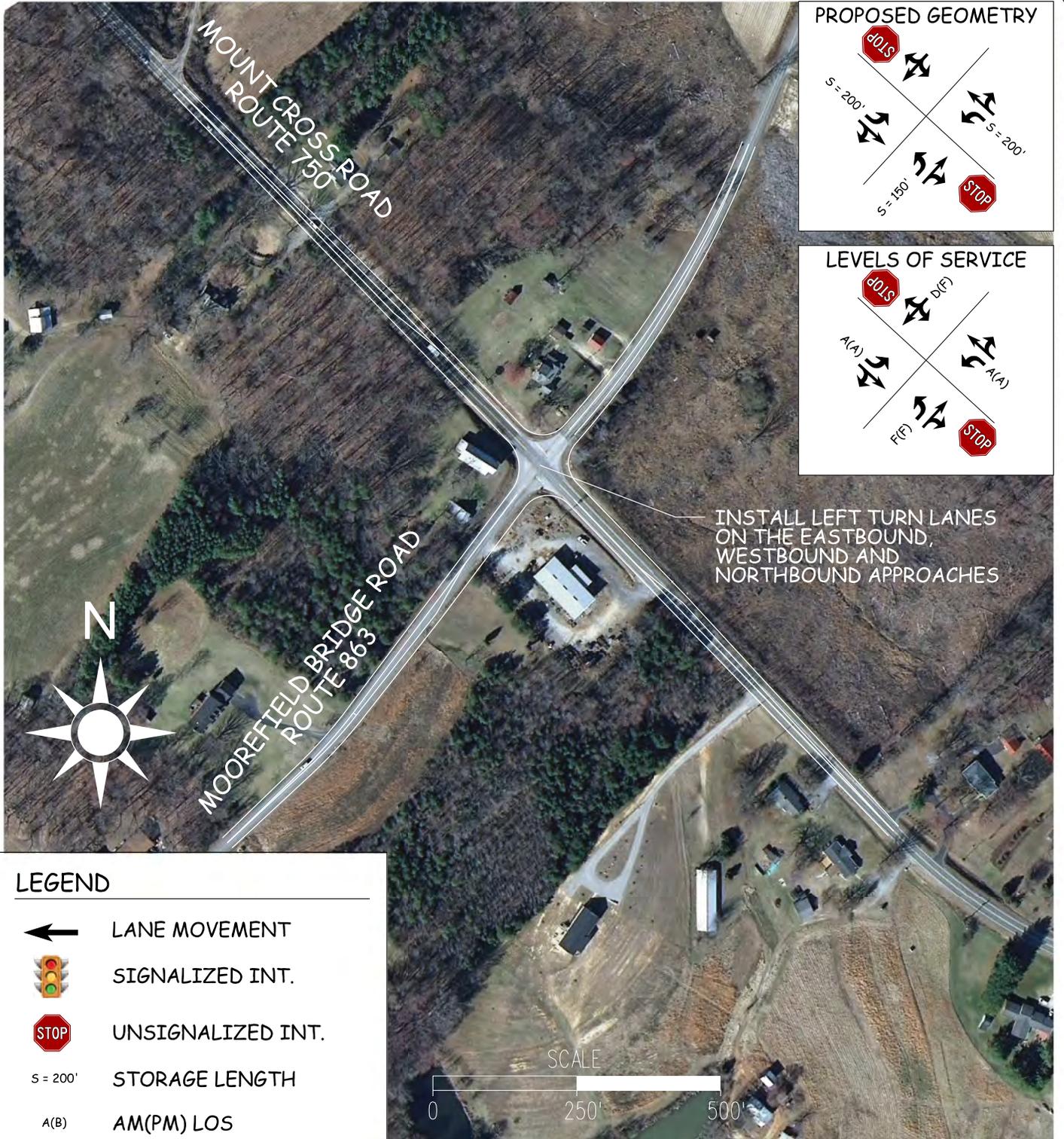
The LOSs for the minor road approaches will still be considered unacceptable for this location. The preliminary estimate of probable cost indicates that these improvements could cost approximately \$1,470,000 to design and construct. A more detailed breakdown of the cost is included in Appendix H.

Alternative 2 consists of constructing a single-lane roundabout with widened approaches of each leg. See Figure 15 for an illustration of these improvements and associated LOSs. These improvements will raise the LOSs to the acceptable range, but will create many conflicts with the existing topography, existing properties, and existing utilities. In particular, the property located in the southwest quadrant of this intersection will be significantly affected. Specifically, the existing building located on this property will have to be removed, potentially requiring additional environmental research and analysis. The intersection LOSs resulting from these improvements are shown in Table 6 below.

Table 6  
Year 2035 – Alternative 2 Intersection Level of Service

<u>INTERSECTION</u>	<u>TYPE OF CONTROL</u>	<u>MOVEMENT APPROACH</u>	<u>AM PEAK HOUR</u>		<u>PM PEAK HOUR</u>	
			<u>LEVEL OF SERVICE*</u>	<u>DELAY (SEC/VEH)</u>	<u>LEVEL OF SERVICE*</u>	<u>DELAY (SEC/VEH)</u>
Moorefield Bridge Road and Mount Cross Road	Roundabout	EB	C	15.0	A	9.3
		WB	A	7.6	C	19.8
		NB	B	10.8	A	8.7
		SB	A	6.4	A	9.8

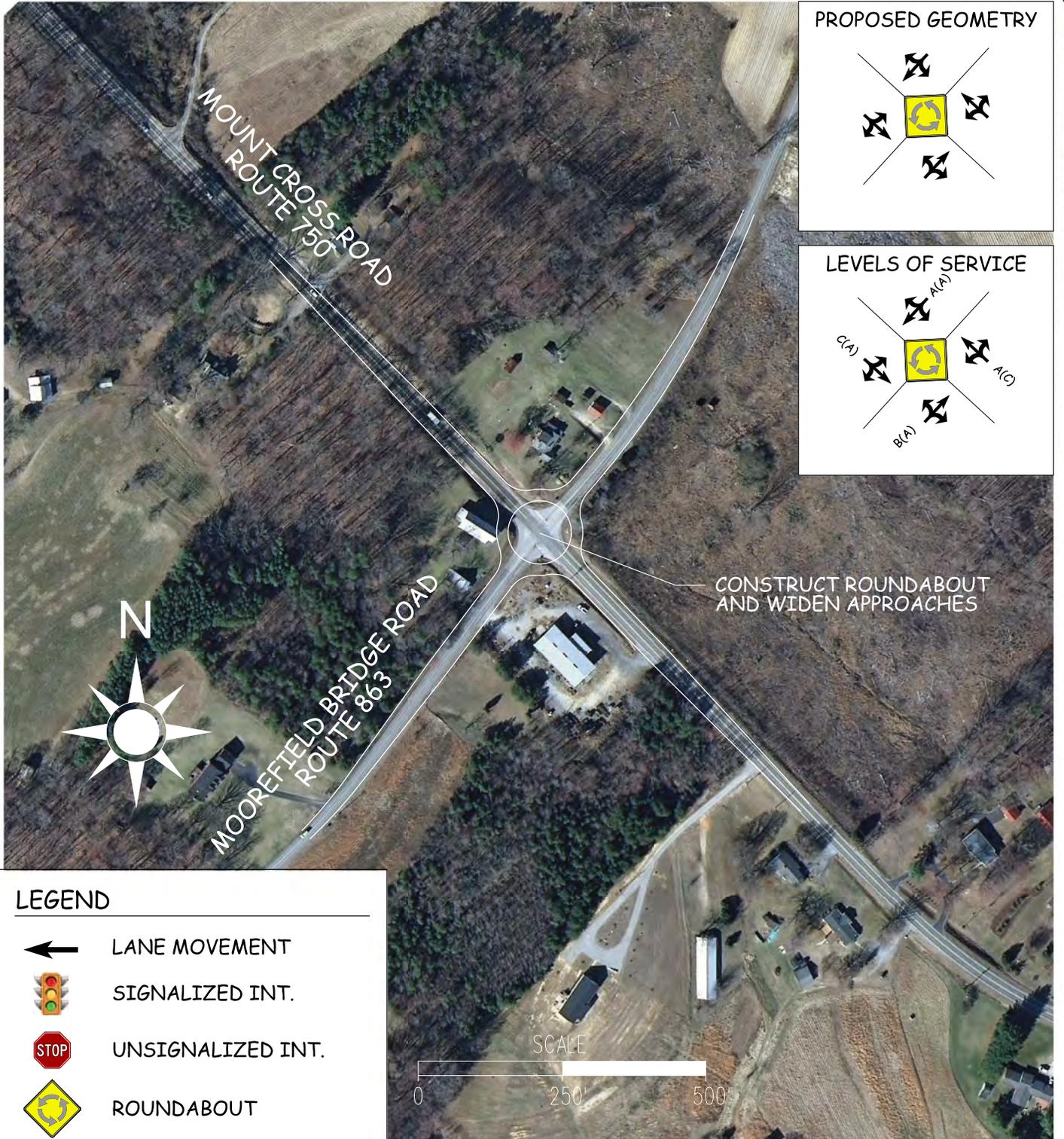
\* Please note that the LOSs are reported in accordance with the HCM designations.



**LEGEND**

-  LANE MOVEMENT
-  SIGNALIZED INT.
-  UNSIGNALIZED INT.
- S = 200' STORAGE LENGTH
- A(B) AM(PM) LOS

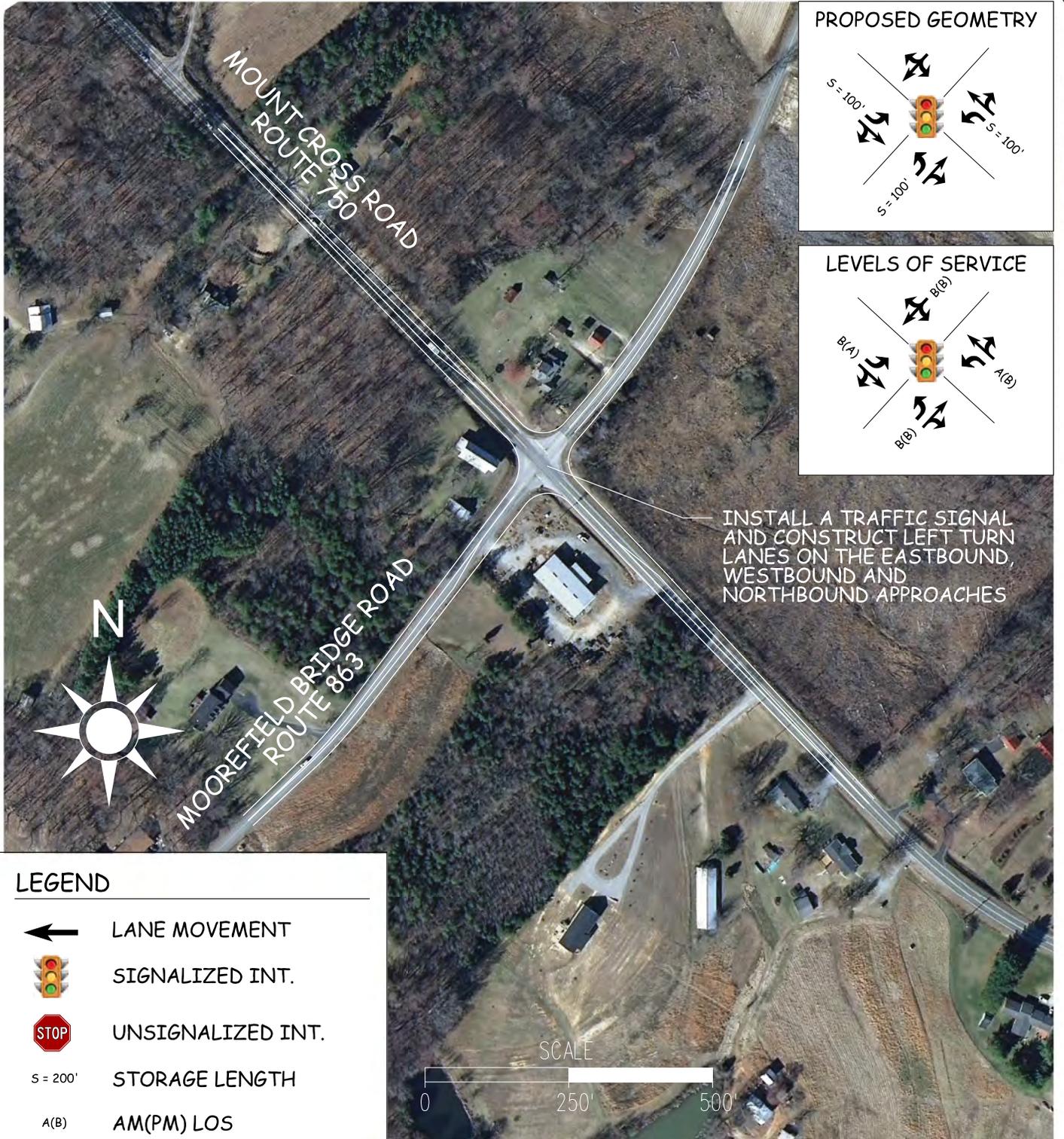
**MOOREFIELD BRIDGE ROAD AND MOUNT CROSS ROAD  
INTERSECTION ALTERNATIVE 1 IMPROVEMENTS  
PITTSYLVANIA COUNTY AND DANVILLE, VIRGINIA**



**LEGEND**

-  LANE MOVEMENT
-  SIGNALIZED INT.
-  UNSIGNALIZED INT.
-  ROUNDABOUT

**MOOREFIELD BRIDGE ROAD AND MOUNT CROSS ROAD  
INTERSECTION ALTERNATIVE 2 IMPROVEMENTS  
PITTSYLVANIA COUNTY AND DANVILLE, VIRGINIA**



**LEGEND**

- LANE MOVEMENT
- SIGNALIZED INT.
- UNSIGNALIZED INT.
- S = 200' STORAGE LENGTH
- A(B) AM(PM) LOS

**MOOREFIELD BRIDGE ROAD AND MOUNT CROSS ROAD INTERSECTION ALTERNATIVE 3 IMPROVEMENTS PITTSYLVANIA COUNTY AND DANVILLE, VIRGINIA**

As can be seen in Table 6, the construction of the roundabout will increase delays along the major route, Mount Cross Road, and reduce the LOS for the eastbound and westbound approaches to LOS C in the AM and PM peak hours, respectively. The preliminary estimate of probable cost indicates that these improvements could cost approximately \$2,009,000 to design and construct. A more detailed breakdown of the cost is included in Appendix H.

Alternative 3 consists of the addition of 100-foot left turn lanes on the eastbound, westbound, and northbound approaches, as well as the installation of a traffic signal. Based on an evaluation of the MUTCD Traffic Signal Warrants, Warrants 1A (8-Hour Vehicular Volume), 2 (4-Hour Vehicular Volume), and 3B (Peak Hour) are met. The traffic signal warrant analysis is included in Appendix I for reference. With the addition of these turn lanes, Mount Cross Road and Moorefield Bridge Road will be widened to the north and east, respectively. These improvements will create conflicts with the existing power utility poles, which will need to be relocated adding to the cost of the improvements. Figure 16 shows the improvements for this alternative. Based on these improvements, the LOSs will be increased to acceptable levels with no approaches below an LOS B. The intersection LOSs resulting from these improvements are shown in Table 7 below.

Table 7  
Year 2035 – Alternative 3 Intersection Level of Service

INTERSECTION	TYPE OF CONTROL	MOVEMENT APPROACH	AM PEAK HOUR		PM PEAK HOUR	
			LEVEL OF SERVICE*	DELAY (SEC/VEH)	LEVEL OF SERVICE*	DELAY (SEC/VEH)
Moorefield Bridge Road and Mount Cross Road	Signalized	EB	B	10.2	A	7.9
		WB	A	6.8	B	10.3
		NB	B	15.7	B	16.6
		SB	B	15.4	B	15.5

\* Please note that the LOSs are reported in accordance with the HCM designations.

As can be seen in the Table 7 above, the installation of the traffic signal will increase the delay along the major route, Mount Cross Road, and reduce the LOS for the eastbound and westbound approaches to LOS B in the AM and PM peak hours, respectively. The preliminary estimate of probable cost indicates that these improvements could cost approximately \$1,709,000 to design and construct. A more detailed breakdown of the cost is included in Appendix H.

In review of the three alternatives described above, all will increase the capacity of the intersection, but to different levels. Using the Evaluation Criteria identified in Table 4, the three alternatives were compared to determine the preferred alternative. Section VI of this report shows the details of this comparison and indicates the preferred alternative.

Intersection of Moorefield Bridge and Westover Drive Improvement Alternatives

It is our understanding that there are public concerns regarding the current operation of this intersection. Therefore, a traffic signal warrant analysis was performed at the intersection of Westover Drive and Moorefield Bridge Road as part of this study, although acceptable LOSs are expected. Based on an evaluation of the MUTCD Traffic Signal Warrants, no Warrants are met at this location. The traffic signal warrant analysis is included in Appendix L for reference. However, in order to alleviate these concerns, and separate the anticipated turn movements on Moorefield Bridge Road, Dewberry and RKA recommend that the southbound approach of Moorefield Bridge Road be widened to provide a 100-foot

left turn lane. After reviewing the existing site conditions, it was determined that the addition of a left-turn lane and associated widening to the east be recommended in lieu of a right turn. The right-turn lane would be widened to the west toward existing buildings that could be within the clear zone once the turn lane is constructed, thus increasing the mitigation and right-of-way costs.

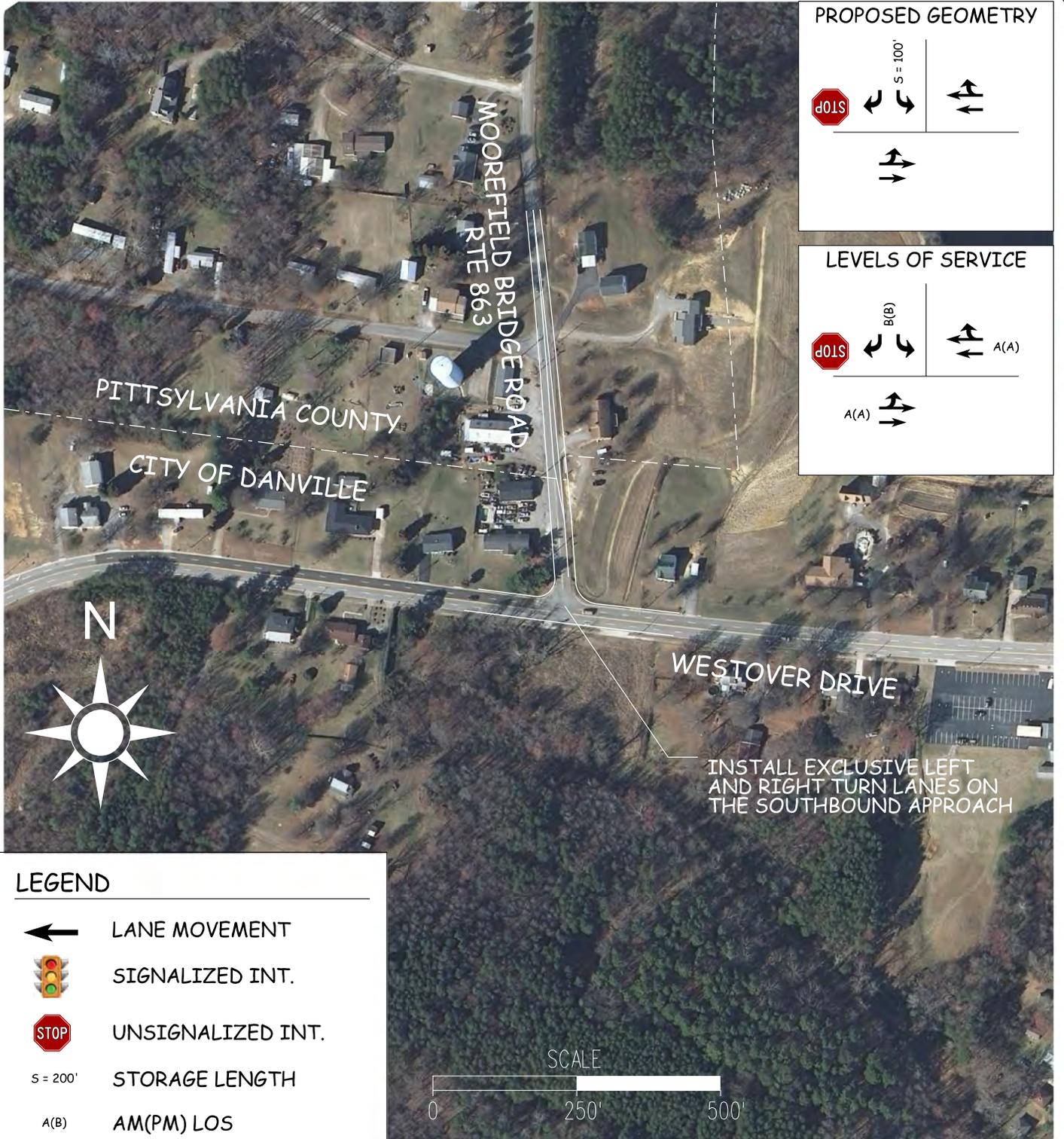
Along with the close proximity of existing buildings, existing utility poles run along the west side of Moorefield Bridge Road that would need to be relocated should the right-turn lane be installed, adding to the cost of the improvements. The recommendation to widen Moorefield Bridge Road to the east for the construction of a left-turn lane, as shown in Figure 17, was based on the lesser impacts to existing utilities and right-of-way, which ultimately would shorten the construction schedule. Because both roads would be widened, any conflicting power utility poles would have to be relocated, adding to the cost of the improvements. The addition of the turn lane will reduce delays and improve operation on the stop-controlled approach. The intersection LOSs are shown in Table 8 below.

Table 8  
Year 2035 – Alternative Intersection Level of Service

<u>INTERSECTION</u>	<u>TYPE OF CONTROL</u>	<u>MOVEMENT APPROACH</u>	<u>AM PEAK HOUR</u>		<u>PM PEAK HOUR</u>	
			<u>LEVEL OF SERVICE*</u>	<u>DELAY (SEC/VEH)</u>	<u>LEVEL OF SERVICE*</u>	<u>DELAY (SEC/VEH)</u>
Moorefield Bridge	Unsignalized	EB	A	5.5	A	6.3
Road and Westover		WB	A	0.0	A	0.0
Drive		SB	B	10.1	B	11.6

\* Please note that the LOSs are reported in accordance with the HCM designations.

The preliminary estimate of probable cost indicates that this improvement could cost approximately \$403,000 to design and construct. more detailed breakdown of the cost is included in Appendix K.



**LEGEND**

-  LANE MOVEMENT
-  SIGNALIZED INT.
-  UNSIGNALIZED INT.
- S = 200' STORAGE LENGTH
- A(B) AM(PM) LOS

**MOOREFIELD BRIDGE ROAD AND WESTOVER DRIVE  
INTERSECTION IMPROVEMENTS  
PITTSYLVANIA COUNTY AND DANVILLE, VIRGINIA**

## VI. PREFERRED SPOT IMPROVEMENTS AND RECOMMENDATIONS

Three locations along this segment of Moorefield Bridge Road have been identified for improvement based on safety and capacity issues. The first area is along the curved sections of Moorefield Bridge Road, between River Ridge Road/Pinecrest Drive and Red Bud Lane. The remaining two locations are at the intersections of Moorefield Bridge Road with Mount Cross Road and Moorefield Bridge Road with Westover Drive. Two alternative improvements are shown for the first location, three alternative improvements are shown for the second location, and one alternative is shown for the third location. As described in the previous section, the alternatives will vary in cost and benefit to the roadway.

Beginning with Location 1, both alternatives will increase safety, but only one will help increase capacity. Dewberry and RKA recommend that Alternative 2 (Figure 13) be selected as the Preferred Alternative. This alternative includes the installation of Warning Signs, as well as pavement widening to add 4-foot paved shoulders on either side. These improvements will not only provide increased safety, but will also increase the capacity and system performance along this section of road. Even with the higher cost, these improvements will have long-lasting impacts. This improvement is primarily focused on increasing the safety along this stretch of road. The alternative improvements at Location 2 are focused on increasing the capacity and bringing the future no-build levels of service up to the acceptable range.

All three alternatives for Location 2 will increase the capacity of the intersection, but to differing levels and costs. Dewberry and RKA recommend that Alternative 3 (Figure 16) be selected as the Preferred Alternative. This alternative includes the addition of 100-foot left-turn lanes on the eastbound, westbound, and northbound approaches, as well as the installation of a traffic signal. These improvements will provide the highest increases in capacity and LOSs at this intersection. Also, based on an evaluation of the MUTCD Traffic Signal Warrants, Warrants 1A (8-Hour Vehicular Volume), 2 (4-Hour Vehicular Volume), and 3B (Peak Hour) are met at this intersection in the Year 2035. The alternative improvement at Location 3 is focused on increasing the capacity.

The alternative for Location 3 will increase the capacity and improve the LOSs on Moorefield Bridge Road at this intersection. This alternative includes the addition of a 100-foot left turn lane on the southbound approach.

With the implementation of these alternative improvements at the three locations, not only will the safety along this segment of Moorefield Bridge Road be improved, but each intersection will operate at an acceptable LOS in the Year 2035.

APPENDIX A  
MANUAL TRAFFIC COUNTS

# RAMEY KEMP & ASSOCIATES, INC.

621 Jonestown Road, Suite 221  
Winston-Salem, North Carolina 27103  
336-725-5470

File Name : Moorefield Bridge&Mt. CrossAM  
Site Code : 02061303  
Start Date : 2/6/2013  
Page No : 1

## Groups Printed- Vehicles

Start Time	Laniers Mill Road From North				Mount Cross Road From East				Moorefield Bridge Road From South				Mount Cross Road From West				Int. Total
	Right	Thru	Left	Trucks	Right	Thru	Left	Trucks	Right	Thru	Left	Trucks	Right	Thru	Left	Trucks	
07:00 AM	0	3	0	0	0	7	2	0	2	3	0	0	4	40	0	0	61
07:15 AM	5	13	0	0	0	15	8	0	3	6	3	0	5	55	2	0	115
07:30 AM	1	10	0	0	0	28	5	0	10	12	5	0	11	86	2	0	170
07:45 AM	7	17	1	0	1	42	6	0	9	11	8	0	10	83	3	0	198
Total	13	43	1	0	1	92	21	0	24	32	16	0	30	264	7	0	544
08:00 AM	4	4	0	0	1	56	3	0	7	5	10	0	7	64	5	0	166
08:15 AM	3	4	0	0	2	23	10	0	4	8	3	0	11	95	6	0	169
08:30 AM	0	12	0	0	0	8	4	0	11	13	2	0	4	55	1	0	110
08:45 AM	0	1	0	0	0	21	5	0	11	7	0	0	5	43	1	0	94
Total	7	21	0	0	3	108	22	0	33	33	15	0	27	257	13	0	539
09:00 AM	0	8	2	0	0	14	6	0	5	5	4	0	1	30	0	0	75
09:15 AM	0	3	0	0	0	13	7	0	3	4	2	0	4	27	0	0	63
09:30 AM	1	2	1	0	1	11	4	0	6	1	4	0	4	32	1	0	68
09:45 AM	1	5	0	0	0	15	4	0	3	5	2	0	0	32	0	0	67
Total	2	18	3	0	1	53	21	0	17	15	12	0	9	121	1	0	273
10:00 AM	0	4	1	0	1	19	0	0	2	5	2	0	0	36	0	0	70
10:15 AM	1	4	0	0	1	22	2	0	6	3	2	0	6	31	3	0	81
10:30 AM	0	7	1	0	0	16	3	0	5	4	3	0	2	32	4	1	78
10:45 AM	1	4	1	0	1	32	4	0	2	6	4	1	6	35	2	0	99
Total	2	19	3	0	3	89	9	0	15	18	11	1	14	134	9	1	328
11:00 AM	0	1	0	0	1	26	7	0	3	6	3	0	1	24	3	1	76
11:15 AM	0	2	0	0	1	16	2	0	5	3	1	0	2	34	0	0	66
11:30 AM	1	4	0	0	0	18	3	0	6	4	1	0	1	26	2	0	66
11:45 AM	1	3	2	0	0	26	6	0	6	4	2	0	5	21	3	0	79
Total	2	10	2	0	2	86	18	0	20	17	7	0	9	105	8	1	287
12:00 PM	0	5	1	0	0	31	9	0	5	3	6	0	3	36	0	0	99
12:15 PM	0	3	1	0	0	28	4	0	4	4	3	0	3	26	0	0	76
12:30 PM	0	5	0	0	0	30	3	0	5	9	4	0	3	25	1	0	85
12:45 PM	1	6	0	0	0	29	1	0	3	8	6	0	2	26	0	0	82
Total	1	19	2	0	0	118	17	0	17	24	19	0	11	113	1	0	342
Grand Total	27	130	11	0	10	546	108	0	126	139	80	1	100	994	39	2	2313
Apprch %	16.1	77.4	6.5	0	1.5	82.2	16.3	0	36.4	40.2	23.1	0.3	8.8	87.6	3.4	0.2	
Total %	1.2	5.6	0.5	0	0.4	23.6	4.7	0	5.4	6	3.5	0	4.3	43	1.7	0.1	

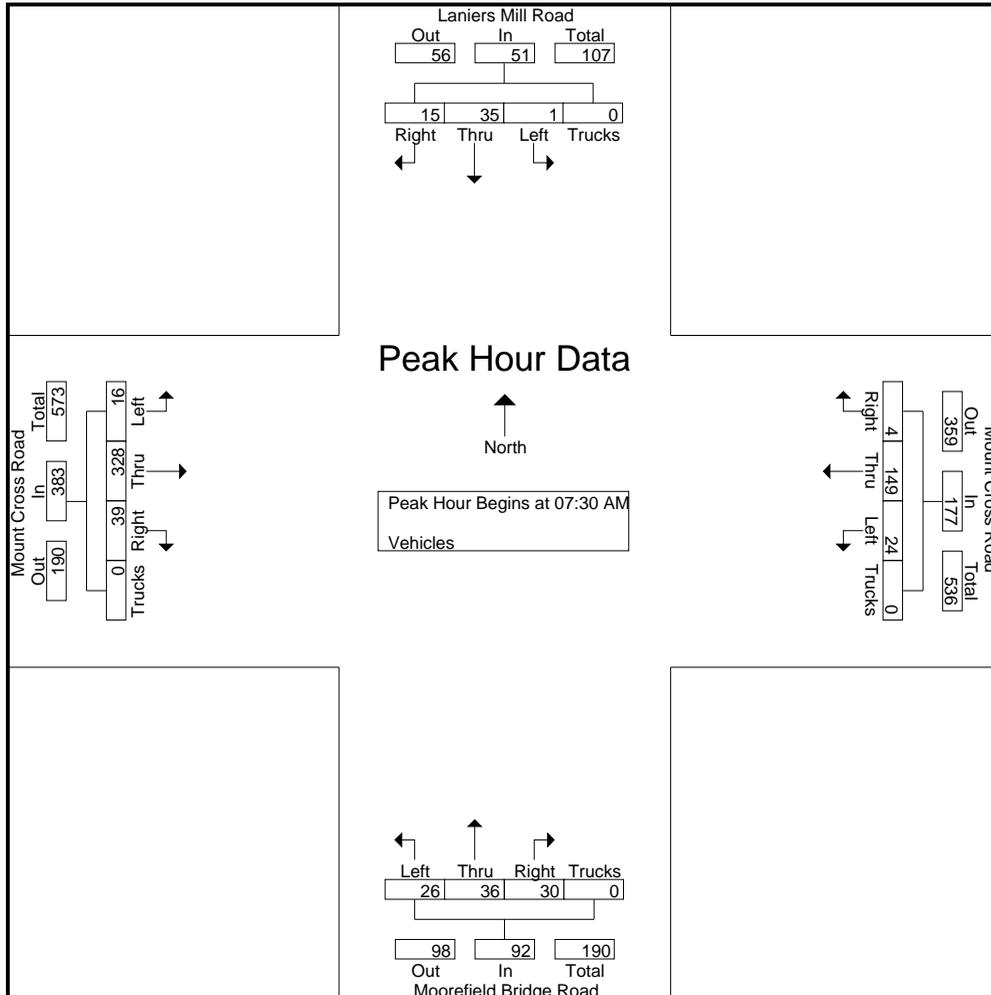
# RAMEY KEMP & ASSOCIATES, INC.

621 Jonestown Road, Suite 221  
 Winston-Salem, North Carolina 27103  
 336-725-5470

File Name : Moorefield Bridge&Mt. CrossAM  
 Site Code : 02061303  
 Start Date : 2/6/2013  
 Page No : 2

Start Time	Laniers Mill Road From North					Mount Cross Road From East					Moorefield Bridge Road From South					Mount Cross Road From West					Int. Total
	Right	Thru	Left	Trucks	App. Total	Right	Thru	Left	Trucks	App. Total	Right	Thru	Left	Trucks	App. Total	Right	Thru	Left	Trucks	App. Total	
07:30 AM	1	10	0	0	11	0	28	5	0	33	10	12	5	0	27	11	86	2	0	99	170
07:45 AM	7	17	1	0	25	1	42	6	0	49	9	11	8	0	28	10	83	3	0	96	198
08:00 AM	4	4	0	0	8	1	56	3	0	60	7	5	10	0	22	7	64	5	0	76	166
08:15 AM	3	4	0	0	7	2	23	10	0	35	4	8	3	0	15	11	95	6	0	112	169
Total Volume	15	35	1	0	51	4	149	24	0	177	30	36	26	0	92	39	328	16	0	383	703
% App. Total																					
PHF	.536	.515	.250	.000	.510	.500	.665	.600	.000	.738	.750	.750	.650	.000	.821	.886	.863	.667	.000	.855	.888

Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1  
 Peak Hour for Entire Intersection Begins at 07:30 AM



# RAMEY KEMP & ASSOCIATES, INC.

621 Jonestown Road, Suite 221  
Winston-Salem, North Carolina 27103  
336-725-5470

File Name : Moorefield Bridge&Mt. CrossPM  
Site Code : 02051303  
Start Date : 2/5/2013  
Page No : 1

## Groups Printed- Vehicles

Start Time	Lanier Mills Road From North				Mount Cross Road From East				Moorefield Bridge Road From South				Mount Cross Road From West				Int. Total
	Right	Thru	Left	Trucks	Right	Thru	Left	Trucks	Right	Thru	Left	Trucks	Right	Thru	Left	Trucks	
01:00 PM	1	4	0	0	0	31	3	0	5	6	5	0	4	28	1	0	88
01:15 PM	1	4	0	0	0	34	3	0	4	4	1	0	3	44	0	0	98
01:30 PM	1	3	0	0	1	26	1	0	3	2	2	0	2	41	2	0	84
01:45 PM	1	9	1	0	0	33	5	0	5	5	4	0	3	33	2	0	101
Total	4	20	1	0	1	124	12	0	17	17	12	0	12	146	5	0	371
02:00 PM	3	7	1	1	0	26	5	0	3	4	3	0	4	27	0	0	84
02:15 PM	2	6	1	0	2	28	4	0	6	8	2	1	1	41	2	0	104
02:30 PM	1	7	1	0	0	38	7	0	3	6	1	0	2	24	2	0	92
02:45 PM	1	4	0	0	0	37	12	1	4	5	5	0	3	26	1	0	99
Total	7	24	3	1	2	129	28	1	16	23	11	1	10	118	5	0	379
03:00 PM	4	7	0	1	1	51	6	0	7	12	7	0	5	41	3	0	145
03:15 PM	1	7	0	0	1	55	5	0	3	8	5	0	14	77	2	0	178
03:30 PM	3	9	0	0	1	36	5	0	7	12	7	0	8	58	2	0	148
03:45 PM	5	6	1	0	0	56	9	1	7	5	6	0	4	36	3	0	139
Total	13	29	1	1	3	198	25	1	24	37	25	0	31	212	10	0	610
04:00 PM	2	11	1	0	2	42	5	0	4	11	3	0	5	32	2	0	120
04:15 PM	2	4	0	0	1	65	10	0	10	5	9	0	3	26	2	0	137
04:30 PM	3	11	0	0	0	52	10	0	10	11	6	1	1	39	0	0	144
04:45 PM	3	9	0	0	2	67	10	0	9	14	3	0	8	59	6	0	190
Total	10	35	1	0	5	226	35	0	33	41	21	1	17	156	10	0	591
05:00 PM	3	9	0	0	1	74	11	2	8	9	8	0	3	30	4	0	162
05:15 PM	0	10	0	0	1	107	14	0	5	14	12	0	9	44	3	0	219
05:30 PM	1	14	0	0	2	72	13	0	12	16	5	0	6	42	3	0	186
05:45 PM	6	12	0	0	1	57	11	0	9	4	11	0	12	45	4	0	172
Total	10	45	0	0	5	310	49	2	34	43	36	0	30	161	14	0	739
06:00 PM	4	7	0	0	0	48	7	0	7	6	4	0	9	38	2	0	132
06:15 PM	0	8	1	0	0	58	5	0	6	6	3	0	4	21	1	0	113
06:30 PM	1	5	0	0	1	43	5	0	9	7	9	0	4	21	1	0	106
06:45 PM	1	9	0	0	0	41	7	0	6	7	6	0	2	29	2	0	110
Total	6	29	1	0	1	190	24	0	28	26	22	0	19	109	6	0	461
Grand Total	50	182	7	2	17	1177	173	4	152	187	127	2	119	902	50	0	3151
Apprch %	20.7	75.5	2.9	0.8	1.2	85.8	12.6	0.3	32.5	40	27.1	0.4	11.1	84.2	4.7	0	
Total %	1.6	5.8	0.2	0.1	0.5	37.4	5.5	0.1	4.8	5.9	4	0.1	3.8	28.6	1.6	0	

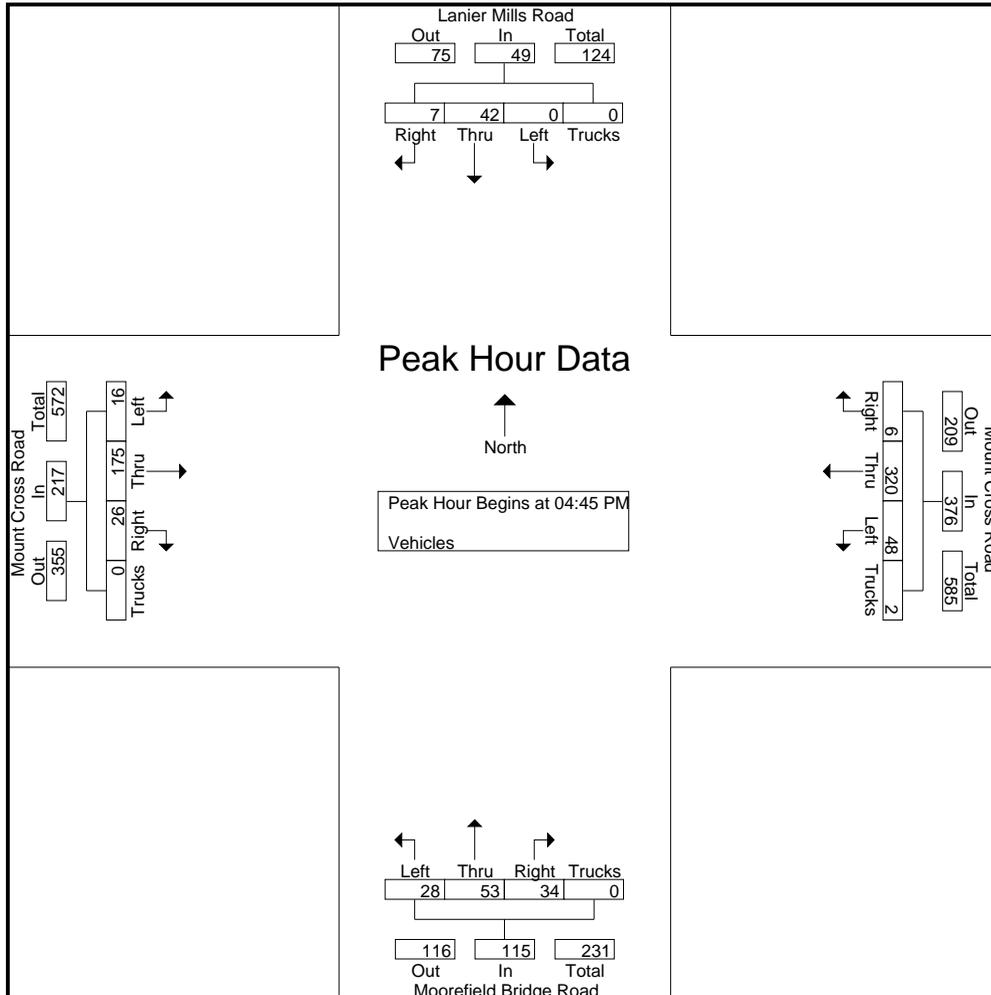
# RAMEY KEMP & ASSOCIATES, INC.

621 Jonestown Road, Suite 221  
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 336-725-5470

File Name : Moorefield Bridge&Mt. CrossPM  
 Site Code : 02051303  
 Start Date : 2/5/2013  
 Page No : 2

Start Time	Lanier Mills Road From North					Mount Cross Road From East					Moorefield Bridge Road From South					Mount Cross Road From West					Int. Total
	Right	Thru	Left	Trucks	App. Total	Right	Thru	Left	Trucks	App. Total	Right	Thru	Left	Trucks	App. Total	Right	Thru	Left	Trucks	App. Total	
04:45 PM	3	9	0	0	12	2	67	10	0	79	9	14	3	0	26	8	59	6	0	73	190
05:00 PM	3	9	0	0	12	1	74	11	2	88	8	9	8	0	25	3	30	4	0	37	162
05:15 PM	0	10	0	0	10	1	107	14	0	122	5	14	12	0	31	9	44	3	0	56	219
05:30 PM	1	14	0	0	15	2	72	13	0	87	12	16	5	0	33	6	42	3	0	51	186
Total Volume	7	42	0	0	49	6	320	48	2	376	34	53	28	0	115	26	175	16	0	217	757
% App. Total																					
PHF	.583	.750	.000	.000	.817	.750	.748	.857	.250	.770	.708	.828	.583	.000	.871	.722	.742	.667	.000	.743	.864

Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1  
 Peak Hour for Entire Intersection Begins at 04:45 PM



# RAMEY KEMP & ASSOCIATES, INC.

621 Jonestown Road, Suite 221  
Winston-Salem, North Carolina 27103  
336-725-5470

File Name : Moorefield Bridge&River RidgeAM  
Site Code : 02060001  
Start Date : 2/6/2013  
Page No : 1

## Groups Printed- Vehicles

Start Time	Moorefield Bridge Road From North				Pinecrest Drive From East				Moorefield Bridge Road From South				River Ridge Road From West				Int. Total
	Right	Thru	Left	Trucks	Right	Thru	Left	Trucks	Right	Thru	Left	Trucks	Right	Thru	Left	Trucks	
07:00 AM	1	10	0	0	1	0	0	0	0	3	0	0	0	0	1	0	16
07:15 AM	1	27	3	0	3	1	0	0	0	10	0	0	1	1	1	0	48
07:30 AM	1	28	3	0	6	0	0	0	0	18	0	0	1	1	6	0	64
07:45 AM	2	29	4	0	9	1	0	0	0	11	1	0	2	1	7	0	67
Total	5	94	10	0	19	2	0	0	0	42	1	0	4	3	15	0	195
08:00 AM	0	13	3	0	4	2	0	0	0	9	1	0	2	0	4	0	38
08:15 AM	1	17	6	0	4	3	0	0	1	8	1	0	2	0	4	0	47
08:30 AM	3	13	2	0	4	1	0	0	0	14	0	0	0	0	7	0	44
08:45 AM	3	6	3	0	4	1	0	0	1	3	0	0	0	1	7	0	29
Total	7	49	14	0	16	7	0	0	2	34	2	0	4	1	22	0	158
Grand Total	12	143	24	0	35	9	0	0	2	76	3	0	8	4	37	0	353
Apprch %	6.7	79.9	13.4	0	79.5	20.5	0	0	2.5	93.8	3.7	0	16.3	8.2	75.5	0	
Total %	3.4	40.5	6.8	0	9.9	2.5	0	0	0.6	21.5	0.8	0	2.3	1.1	10.5	0	

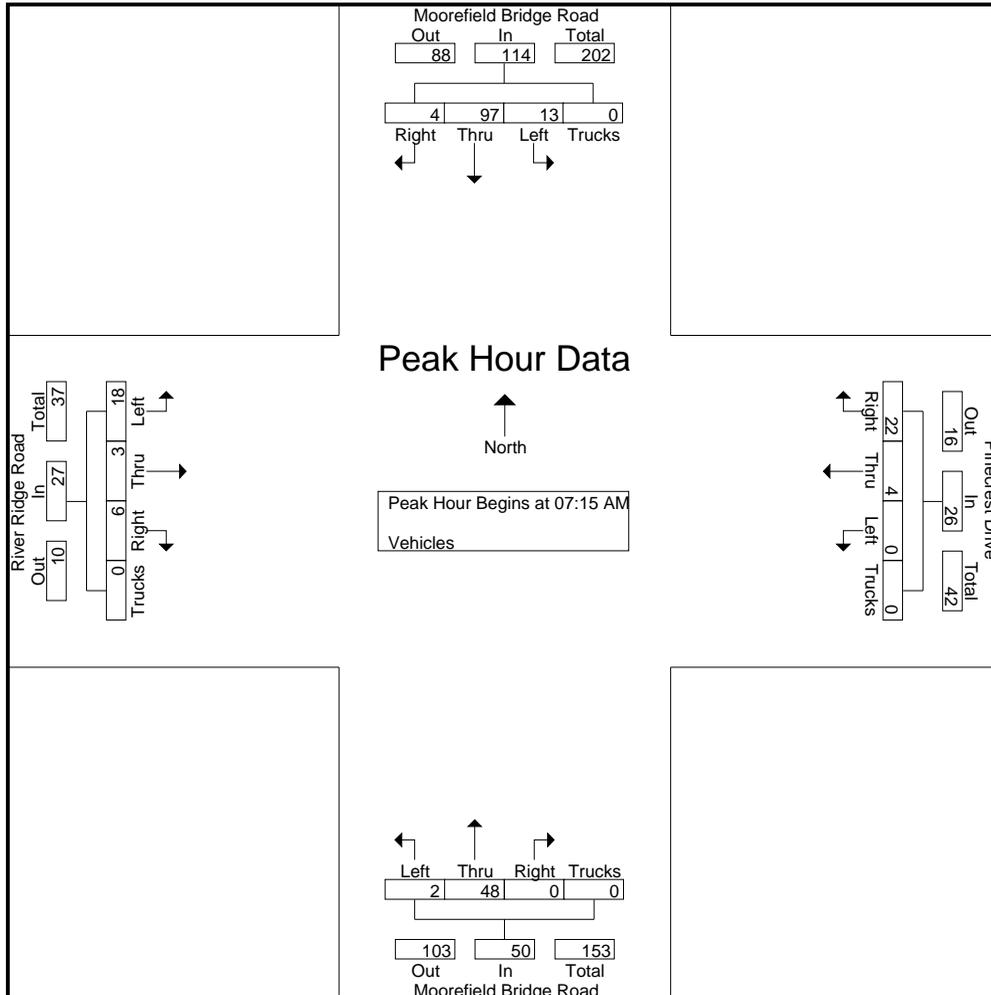
# RAMEY KEMP & ASSOCIATES, INC.

621 Jonestown Road, Suite 221  
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 336-725-5470

File Name : Moorefield Bridge&River RidgeAM  
 Site Code : 02060001  
 Start Date : 2/6/2013  
 Page No : 2

Start Time	Moorefield Bridge Road From North					Pinecrest Drive From East					Moorefield Bridge Road From South					River Ridge Road From West					Int. Total
	Right	Thru	Left	Trucks	App. Total	Right	Thru	Left	Trucks	App. Total	Right	Thru	Left	Trucks	App. Total	Right	Thru	Left	Trucks	App. Total	
07:15 AM	1	27	3	0	31	3	1	0	0	4	0	10	0	0	10	1	1	1	0	3	48
07:30 AM	1	28	3	0	32	6	0	0	0	6	0	18	0	0	18	1	1	6	0	8	64
07:45 AM	2	29	4	0	35	9	1	0	0	10	0	11	1	0	12	2	1	7	0	10	67
08:00 AM	0	13	3	0	16	4	2	0	0	6	0	9	1	0	10	2	0	4	0	6	38
Total Volume	4	97	13	0	114	22	4	0	0	26	0	48	2	0	50	6	3	18	0	27	217
% App. Total																					
PHF	.500	.836	.813	.000	.814	.611	.500	.000	.000	.650	.000	.667	.500	.000	.694	.750	.750	.643	.000	.675	.810

Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1  
 Peak Hour for Entire Intersection Begins at 07:15 AM



# RAMEY KEMP & ASSOCIATES, INC.

621 Jonestown Road, Suite 221  
Winston-Salem, North Carolina 27103  
336-725-5470

File Name : Moorefield Bridge&River RidgePM  
Site Code : 02052013  
Start Date : 2/5/2013  
Page No : 1

## Groups Printed- Vehicles

Start Time	Moorefield Bridge Road From North				Pinecrest Drive From East				Moorefield Bridge Road From South				River Ridge Road From West				Int. Total
	Right	Thru	Left	Trucks	Right	Thru	Left	Trucks	Right	Thru	Left	Trucks	Right	Thru	Left	Trucks	
04:00 PM	0	12	9	0	13	0	1	0	0	14	0	1	3	2	4	0	59
04:15 PM	6	9	4	0	9	1	0	0	0	10	3	0	0	0	0	0	42
04:30 PM	2	15	2	0	10	2	1	0	0	24	1	1	0	1	1	0	60
04:45 PM	5	19	4	0	3	1	0	0	0	21	1	0	0	1	3	0	58
Total	13	55	19	0	35	4	2	0	0	69	5	2	3	4	8	0	219
05:00 PM	4	11	4	0	7	2	0	0	0	23	1	0	1	1	5	0	59
05:15 PM	3	26	5	1	8	0	0	0	0	22	2	0	1	0	3	0	71
05:30 PM	0	28	5	0	12	3	2	0	0	15	0	0	0	3	2	0	70
05:45 PM	4	16	8	0	11	1	0	0	0	13	0	0	0	1	1	0	55
Total	11	81	22	1	38	6	2	0	0	73	3	0	2	5	11	0	255
Grand Total	24	136	41	1	73	10	4	0	0	142	8	2	5	9	19	0	474
Apprch %	11.9	67.3	20.3	0.5	83.9	11.5	4.6	0	0	93.4	5.3	1.3	15.2	27.3	57.6	0	
Total %	5.1	28.7	8.6	0.2	15.4	2.1	0.8	0	0	30	1.7	0.4	1.1	1.9	4	0	

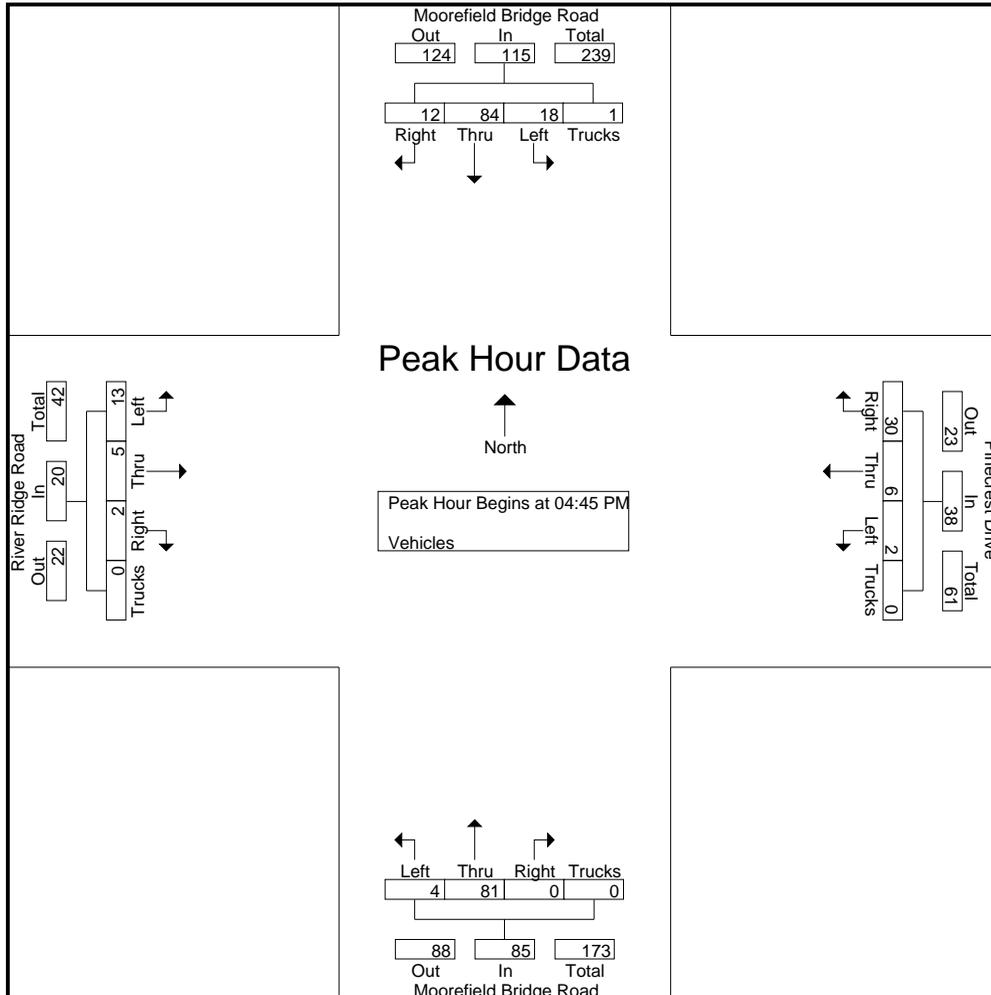
# RAMEY KEMP & ASSOCIATES, INC.

621 Jonestown Road, Suite 221  
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 336-725-5470

File Name : Moorefield Bridge&River RidgePM  
 Site Code : 02052013  
 Start Date : 2/5/2013  
 Page No : 2

Start Time	Moorefield Bridge Road From North					Pinecrest Drive From East					Moorefield Bridge Road From South					River Ridge Road From West					Int. Total
	Right	Thru	Left	Trucks	App. Total	Right	Thru	Left	Trucks	App. Total	Right	Thru	Left	Trucks	App. Total	Right	Thru	Left	Trucks	App. Total	
04:45 PM	5	19	4	0	28	3	1	0	0	4	0	21	1	0	22	0	1	3	0	4	58
05:00 PM	4	11	4	0	19	7	2	0	0	9	0	23	1	0	24	1	1	5	0	7	59
05:15 PM	3	26	5	1	35	8	0	0	0	8	0	22	2	0	24	1	0	3	0	4	71
05:30 PM	0	28	5	0	33	12	3	2	0	17	0	15	0	0	15	0	3	2	0	5	70
Total Volume	12	84	18	1	115	30	6	2	0	38	0	81	4	0	85	2	5	13	0	20	258
% App. Total	.600	.750	.900	.250	.821	.625	.500	.250	.000	.559	.000	.880	.500	.000	.885	.500	.417	.650	.000	.714	.908

Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1  
 Peak Hour for Entire Intersection Begins at 04:45 PM



# RAMEY KEMP & ASSOCIATES, INC.

621 Jonestown Road, Suite 221  
Winston-Salem, North Carolina 27103  
336-725-5470

File Name : Westover&Moorefield BridgeAM  
Site Code : 00013012  
Start Date : 2/6/2013  
Page No : 1

## Groups Printed- Vehicles

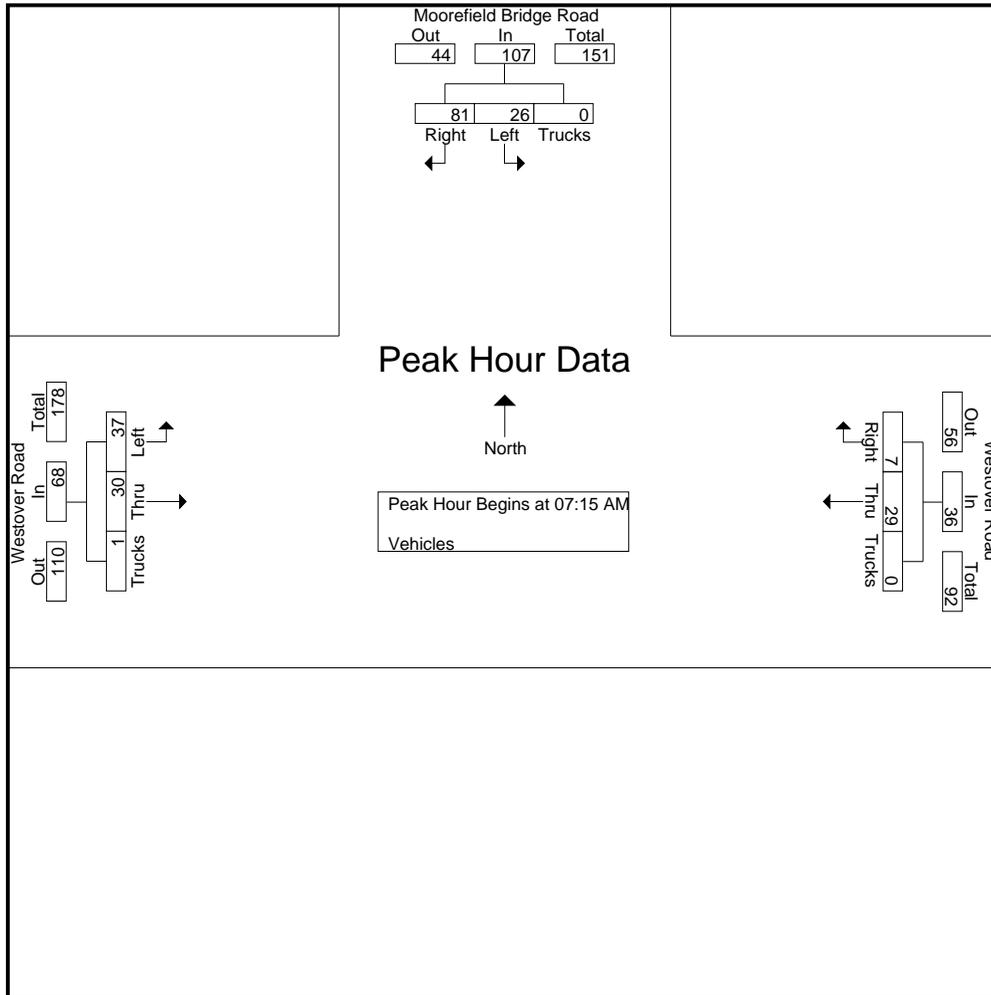
Start Time	Moorefield Bridge Road From North			Westover Road From East			Westover Road From West			Int. Total
	Right	Left	Trucks	Right	Thru	Trucks	Thru	Left	Trucks	
07:00 AM	6	1	0	4	6	0	2	2	0	21
07:15 AM	21	6	0	0	8	0	7	8	0	50
07:30 AM	23	5	0	2	9	0	14	15	0	68
07:45 AM	30	6	0	2	7	0	3	9	0	57
Total	80	18	0	8	30	0	26	34	0	196
08:00 AM	7	9	0	3	5	0	6	5	1	36
08:15 AM	13	6	0	2	3	0	13	9	0	46
08:30 AM	13	2	0	3	6	0	12	5	0	41
08:45 AM	2	4	0	4	10	0	6	5	0	31
Total	35	21	0	12	24	0	37	24	1	154
09:00 AM	13	2	0	3	6	0	9	4	0	37
09:15 AM	7	4	0	1	7	0	12	4	0	35
09:30 AM	4	1	0	6	4	0	10	3	0	28
09:45 AM	12	4	0	4	10	0	13	4	0	47
Total	36	11	0	14	27	0	44	15	0	147
10:00 AM	3	4	0	1	5	0	6	8	0	27
10:15 AM	8	6	0	3	7	0	13	5	0	42
10:30 AM	3	9	0	7	10	0	11	5	0	45
10:45 AM	4	3	1	4	8	0	12	8	1	41
Total	18	22	1	15	30	0	42	26	1	155
11:00 AM	4	10	0	2	8	0	11	6	0	41
11:15 AM	3	5	0	0	8	0	10	3	0	29
11:30 AM	2	7	0	6	13	0	12	5	0	45
11:45 AM	8	2	0	4	13	0	18	4	1	50
Total	17	24	0	12	42	0	51	18	1	165
12:00 PM	8	5	0	2	13	0	12	8	0	48
12:15 PM	2	5	1	2	11	0	8	12	1	42
12:30 PM	5	5	0	3	17	0	11	7	0	48
12:45 PM	5	1	0	1	12	0	10	9	0	38
Total	20	16	1	8	53	0	41	36	1	176
Grand Total	206	112	2	69	206	0	241	153	4	993
Apprch %	64.4	35	0.6	25.1	74.9	0	60.6	38.4	1	
Total %	20.7	11.3	0.2	6.9	20.7	0	24.3	15.4	0.4	

# RAMEY KEMP & ASSOCIATES, INC.

621 Jonestown Road, Suite 221  
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 336-725-5470

File Name : Westover&Moorefield BridgeAM  
 Site Code : 00013012  
 Start Date : 2/6/2013  
 Page No : 2

Start Time	Moorefield Bridge Road From North				Westover Road From East				Westover Road From West				Int. Total
	Right	Left	Trucks	App. Total	Right	Thru	Trucks	App. Total	Thru	Left	Trucks	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:15 AM													
07:15 AM	21	6	0	27	0	8	0	8	7	8	0	15	50
07:30 AM	23	5	0	28	2	9	0	11	14	15	0	29	68
07:45 AM	30	6	0	36	2	7	0	9	3	9	0	12	57
08:00 AM	7	9	0	16	3	5	0	8	6	5	1	12	36
Total Volume	81	26	0	107	7	29	0	36	30	37	1	68	211
% App. Total	75.7	24.3	0		19.4	80.6	0		44.1	54.4	1.5		
PHF	.675	.722	.000	.743	.583	.806	.000	.818	.536	.617	.250	.586	.776



# RAMEY KEMP & ASSOCIATES, INC.

621 Jonestown Road, Suite 221  
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336-725-5470

File Name : Westover&Moorefield BridgePM  
Site Code : 00013012  
Start Date : 2/5/2013  
Page No : 1

## Groups Printed- Vehicles

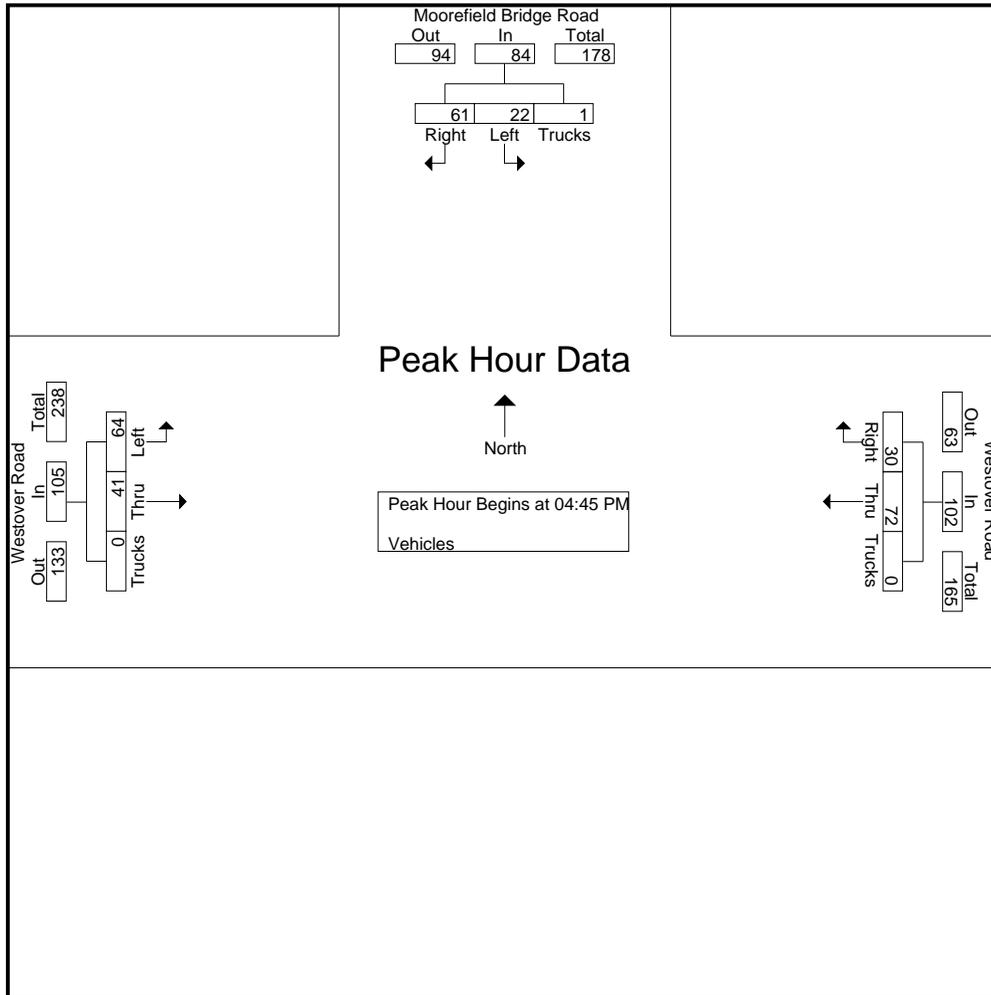
Start Time	Moorefield Bridge Road From North			Westover Road From East			Westover Road From West			Int. Total
	Right	Left	Trucks	Right	Thru	Trucks	Thru	Left	Trucks	
01:00 PM	8	5	0	4	8	0	14	9	1	49
01:15 PM	3	4	0	1	7	0	12	10	1	38
01:30 PM	8	1	0	4	9	0	20	5	0	47
01:45 PM	7	3	0	3	17	0	14	5	0	49
Total	26	13	0	12	41	0	60	29	2	183
02:00 PM	8	3	0	2	10	0	9	11	0	43
02:15 PM	5	5	0	2	8	0	8	9	0	37
02:30 PM	5	8	0	6	19	0	11	11	0	60
02:45 PM	15	7	1	2	18	0	8	3	0	54
Total	33	23	1	12	55	0	36	34	0	194
03:00 PM	10	1	0	3	15	0	7	15	0	51
03:15 PM	7	4	0	1	16	0	11	7	0	46
03:30 PM	5	6	0	8	21	0	21	13	0	74
03:45 PM	8	4	0	4	7	0	16	8	0	47
Total	30	15	0	16	59	0	55	43	0	218
04:00 PM	9	4	0	5	22	1	19	12	1	73
04:15 PM	5	2	0	7	14	0	13	13	0	54
04:30 PM	11	10	0	6	12	0	10	14	0	63
04:45 PM	16	4	0	4	20	0	8	20	0	72
Total	41	20	0	22	68	1	50	59	1	262
05:00 PM	6	3	0	9	16	0	11	16	0	61
05:15 PM	17	9	0	11	22	0	7	15	0	81
05:30 PM	22	6	1	6	14	0	15	13	0	77
05:45 PM	11	9	0	5	16	0	16	13	0	70
Total	56	27	1	31	68	0	49	57	0	289
06:00 PM	12	7	0	2	15	0	12	11	0	59
06:15 PM	11	5	0	3	19	0	6	9	0	53
06:30 PM	11	7	0	6	17	0	6	10	0	57
06:45 PM	11	7	0	6	10	0	8	11	0	53
Total	45	26	0	17	61	0	32	41	0	222
Grand Total	231	124	2	110	352	1	282	263	3	1368
Apprch %	64.7	34.7	0.6	23.8	76	0.2	51.5	48	0.5	
Total %	16.9	9.1	0.1	8	25.7	0.1	20.6	19.2	0.2	

# RAMEY KEMP & ASSOCIATES, INC.

621 Jonestown Road, Suite 221  
Winston-Salem, North Carolina 27103  
336-725-5470

File Name : Westover&Moorefield BridgePM  
Site Code : 00013012  
Start Date : 2/5/2013  
Page No : 2

Start Time	Moorefield Bridge Road From North				Westover Road From East				Westover Road From West				Int. Total
	Right	Left	Trucks	App. Total	Right	Thru	Trucks	App. Total	Thru	Left	Trucks	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 04:45 PM													
04:45 PM	16	4	0	20	4	20	0	24	8	20	0	28	72
05:00 PM	6	3	0	9	9	16	0	25	11	16	0	27	61
05:15 PM	17	9	0	26	11	22	0	33	7	15	0	22	81
05:30 PM	22	6	1	29	6	14	0	20	15	13	0	28	77
Total Volume	61	22	1	84	30	72	0	102	41	64	0	105	291
% App. Total	72.6	26.2	1.2		29.4	70.6	0		39	61	0		
PHF	.693	.611	.250	.724	.682	.818	.000	.773	.683	.800	.000	.938	.898



APPENDIX B  
LEVEL OF SERVICE METHODS AND CRITERIA

## METHODOLOGY AND CRITERIA USED FOR THE LEVEL OF SERVICE ANALYSIS

All analyses were completed using the methodology outlined in the Highway Capacity Manual (HCM) 2010 published by the Transportation Research Board. The computer software package of Synchro (Version 8) was utilized to perform all signalized and unsignalized analyses at the study intersections while SIDRA INTERSECTION 5.1 was utilized for roundabout analysis.

The HCM 2010 defines capacity as “the maximum sustainable hourly flow rate at which persons or vehicles reasonably can be expected to traverse a point or a uniform section of a lane or roadway during a given time period under prevailing roadway, environmental, traffic, and control conditions”. Level of service (LOS) is a term used to represent different driving conditions, and is defined as “a qualitative stratification of a performance measure or measures that represent quality of service”. Level of service varies from Level “A” representing free flow to Level “F” where greater vehicle delays are evident. Refer to the Table below for a summary of levels of service and related average control delay per vehicle for both signalized and unsignalized intersections as well as roundabouts. Control delay as defined by the HCM includes “vehicles slowing in advance of an intersection, the time spent stopped on an intersection approach, the time spent as vehicles move up in the queue, and the time needed for vehicles to accelerate to their desired speed”. As shown in the Table, a control delay of 40 seconds at a signalized intersection results in a LOS D operation.

**TABLE**  
**HCM Levels of Service and Delay**

Level of Service (LOS)	Control Delays (sec/vehc)		
	Signalized	Unsignalized	Roundabouts
<b>A</b>	≤ 10	0-10	0-10
<b>B</b>	> 10-20	> 10-15	> 10-15
<b>C</b>	> 20-35	> 15-25	> 15-25
<b>D</b>	> 35-55	> 25-35	> 25-35
<b>E</b>	> 55-80	> 35-50	> 35-50
<b>F</b>	> 80	> 50	> 50

APPENDIX C  
EXISTING (YEAR 2013)  
INTERSECTION LEVEL OF SERVICE ANALYSIS

Moorefield Bridge Road Study

Existing (2013) Traffic Conditions

1: Moorefield Bridge Road/Laniers Mill Road & Mount Cross Road

AM Peak

Intersection

Intersection Delay, s/veh 3.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	16	328	39	24	149	4	26	36	30	1	35	15
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	18	364	43	27	166	4	29	40	33	1	39	17

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	170	0	0	408	0	0	671	645	386	679	664	168
Stage 1	-	-	-	-	-	-	422	422	-	221	221	-
Stage 2	-	-	-	-	-	-	249	223	-	458	443	-
Follow-up Headway	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Capacity-1 Maneuver	1420	-	-	1162	-	-	373	393	666	368	384	881
Stage 1	-	-	-	-	-	-	613	592	-	786	724	-
Stage 2	-	-	-	-	-	-	759	723	-	587	579	-
Time blocked-Platoon, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-1 Maneuver	1420	-	-	1162	-	-	326	377	666	311	368	881
Mov Capacity-2 Maneuver	-	-	-	-	-	-	326	377	-	311	368	-
Stage 1	-	-	-	-	-	-	603	583	-	773	705	-
Stage 2	-	-	-	-	-	-	685	704	-	511	570	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	1.1	16.4	14.3
HCM LOS			C	B

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	418	1420	-	-	1162	-	-	442
HCM Lane V/C Ratio	0.245	0.013	-	-	0.023	-	-	0.128
HCM Control Delay (s)	16.4	7.567	0	-	8.171	0	-	14.3
HCM Lane LOS	C	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.948	0.038	-	-	0.07	-	-	0.437

Notes

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

Moorefield Bridge Road Study  
 2: Moorefield Bridge Road & River Ridge Road/Pinecrest Drive

Existing (2013) Traffic Conditions  
 AM Peak

Intersection

Intersection Delay, s/veh 2.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	18	3	6	0	4	22	2	48	0	13	97	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	20	3	7	0	4	24	2	53	0	14	108	4

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	211	197	110	202	199	53	112	0	0	53	0	0
Stage 1	139	139	-	58	58	-	-	-	-	-	-	-
Stage 2	72	58	-	144	141	-	-	-	-	-	-	-
Follow-up Headway	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Capacity-1 Maneuver	750	702	949	761	700	1020	1490	-	-	1566	-	-
Stage 1	869	785	-	959	851	-	-	-	-	-	-	-
Stage 2	943	851	-	864	784	-	-	-	-	-	-	-
Time blocked-Platoon, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-1 Maneuver	722	694	949	747	692	1020	1490	-	-	1566	-	-
Mov Capacity-2 Maneuver	722	694	-	747	692	-	-	-	-	-	-	-
Stage 1	868	777	-	958	850	-	-	-	-	-	-	-
Stage 2	915	850	-	846	776	-	-	-	-	-	-	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	9.9			8.9			0.3			0.8		
HCM LOS	A			A								

Minor Lane / Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1490	-	-	759	951	1566	-	-
HCM Lane V/C Ratio	0.001	-	-	0.04	0.03	0.009	-	-
HCM Control Delay (s)	7.42	0	-	9.9	8.9	7.32	0	-
HCM Lane LOS	A	A	-	A	A	A	A	-
HCM 95th %tile Q(veh)	0.004	-	-	0.123	0.094	0.028	-	-

Notes

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

Moorefield Bridge Road Study  
3: Westover Drive & Moorefield Bridge Road

Existing (2013) Traffic Conditions  
AM Peak

Intersection

Intersection Delay, s/veh 5.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	37	30	29	7	26	81
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	1	1	0	0	0	0
Mvmt Flow	41	33	32	8	29	90

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	40	0	20
Stage 1	-	-	-
Stage 2	-	-	-
Follow-up Headway	2.21	-	3.3
Pot Capacity-1 Maneuver	1575	-	1060
Stage 1	-	-	-
Stage 2	-	-	-
Time blocked-Platoon, %	-	-	-
Mov Capacity-1 Maneuver	1575	-	1060
Mov Capacity-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	4.1	0	9.1
HCM LOS			A

Minor Lane / Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1575	-	-	-	992
HCM Lane V/C Ratio	0.026	-	-	-	0.12
HCM Control Delay (s)	7.347	0	-	-	9.1
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0.08	-	-	-	0.407

Notes

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

Moorefield Bridge Road Study

Existing (2013) Traffic Conditions

1: Moorefield Bridge Road/Laniers Mill Road & Mount Cross Road

PM Peak

Intersection

Intersection Delay, s/veh 4.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	16	175	26	48	320	6	28	53	34	0	42	7
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	1	1	1	0	0	0	0	0	0
Mvmt Flow	18	194	29	53	356	7	31	59	38	0	47	8

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	362	0	0	223	0	0	737	713	209	759	725	359
Stage 1	-	-	-	-	-	-	244	244	-	466	466	-
Stage 2	-	-	-	-	-	-	493	469	-	293	259	-
Follow-up Headway	2.2	-	-	2.209	-	-	3.5	4	3.3	3.5	4	3.3
Pot Capacity-1 Maneuver	1208	-	-	1352	-	-	337	360	836	326	354	690
Stage 1	-	-	-	-	-	-	764	708	-	581	566	-
Stage 2	-	-	-	-	-	-	562	564	-	719	697	-
Time blocked-Platoon, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-1 Maneuver	1208	-	-	1352	-	-	283	337	836	256	331	690
Mov Capacity-2 Maneuver	-	-	-	-	-	-	283	337	-	256	331	-
Stage 1	-	-	-	-	-	-	751	696	-	571	538	-
Stage 2	-	-	-	-	-	-	483	536	-	618	685	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.6	1	18.8	16.9
HCM LOS			C	C

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	387	1208	-	-	1352	-	-	358
HCM Lane V/C Ratio	0.33	0.015	-	-	0.039	-	-	0.152
HCM Control Delay (s)	18.8	8.025	0	-	7.772	0	-	16.9
HCM Lane LOS	C	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	1.417	0.045	-	-	0.123	-	-	0.531

Notes

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

Moorefield Bridge Road Study  
 2: Moorefield Bridge Road & River Ridge Road/Pinecrest Drive

Existing (2013) Traffic Conditions

PM Peak

Intersection

Intersection Delay, s/veh 2.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	13	5	2	2	6	30	4	81	0	18	84	12
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	1	1	1
Mvmt Flow	14	6	2	2	7	33	4	90	0	20	93	13

Major/Minor	Minor2		Minor1			Major1			Major2			
Conflicting Flow All	259	239	100	243	246	90	107	0	0	90	0	0
Stage 1	140	140	-	99	99	-	-	-	-	-	-	-
Stage 2	119	99	-	144	147	-	-	-	-	-	-	-
Follow-up Headway	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.209	-	-
Pot Capacity-1 Maneuver	698	666	961	715	660	973	1497	-	-	1512	-	-
Stage 1	868	785	-	912	817	-	-	-	-	-	-	-
Stage 2	890	817	-	864	779	-	-	-	-	-	-	-
Time blocked-Platoon, %								-	-	-	-	-
Mov Capacity-1 Maneuver	660	655	961	700	649	973	1497	-	-	1512	-	-
Mov Capacity-2 Maneuver	660	655	-	700	649	-	-	-	-	-	-	-
Stage 1	865	774	-	909	815	-	-	-	-	-	-	-
Stage 2	850	815	-	844	768	-	-	-	-	-	-	-

Approach	EB		WB			NB			SB		
HCM Control Delay, s	10.5		9.3			0.3			1.2		
HCM LOS	B		A								

Minor Lane / Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1497	-	-	680	885	1512	-	-
HCM Lane V/C Ratio	0.003	-	-	0.033	0.048	0.013	-	-
HCM Control Delay (s)	7.412	0	-	10.5	9.3	7.413	0	-
HCM Lane LOS	A	A	-	B	A	A	A	-
HCM 95th %tile Q(veh)	0.009	-	-	0.101	0.15	0.04	-	-

Notes

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

Moorefield Bridge Road Study  
 3: Westover Drive & Moorefield Bridge Road

Existing (2013) Traffic Conditions  
 PM Peak

Intersection

Intersection Delay, s/veh 4.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	64	41	72	30	22	61
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	0	1	1
Mvmt Flow	71	46	80	33	24	68

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	113	0	57
Stage 1	-	-	-
Stage 2	-	-	-
Follow-up Headway	2.2	-	3.31
Pot Capacity-1 Maneuver	1489	-	1001
Stage 1	-	-	-
Stage 2	-	-	-
Time blocked-Platoon, %	-	-	-
Mov Capacity-1 Maneuver	1489	-	1001
Mov Capacity-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	4.6	0	9.5
HCM LOS			A

Minor Lane / Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1489	-	-	-	886
HCM Lane V/C Ratio	0.048	-	-	-	0.104
HCM Control Delay (s)	7.539	0	-	-	9.5
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0.15	-	-	-	0.347

Notes

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

APPENDIX D  
CRASH DATA SUMMARY

**Route 863 - Route 51 to Route 750 (2.99 miles)**

Document Number	Jurisdiction	Route Number	Crash Date	Crash Time	Day Of Week	Collision Type	Crash Severity	At Intersection ?	Roadway Alignment Type	Light Condition	Roadway Surface Cond Type	Weather Condition Type	Crash Location
83455272	Pittsylvania County	863	5/31/2008	13:45	Sat	9. Fixed Object - Off Road	property damage crash		3. Grade - Straight	2. Daylight	1. Dry	1. No Adverse Condition (Clear/Cloudy)	.5 miles West of Rt 750
90715286	Pittsylvania County	863	7/10/2008	23:45	Thu	9. Fixed Object - Off Road	property damage crash		4. Grade - Curve	5. Darkness - Road Not Lighted	1. Dry	1. No Adverse Condition (Clear/Cloudy)	.8 miles North of Rt 873
90435347	Pittsylvania County	863	7/10/2008	16:00	Thu	9. Fixed Object - Off Road	injury crash		4. Grade - Curve	2. Daylight	1. Dry	1. No Adverse Condition (Clear/Cloudy)	1 mile West of Red Bud Ln
92050283	Pittsylvania County	863	2/8/2009	8:00	Sun	9. Fixed Object - Off Road	injury crash	No	1. Straight - Level	2. Daylight	1. Dry	1. No Adverse Condition (Clear/Cloudy)	.5 miles West of Rt 1530
92460733	Pittsylvania County	863	4/15/2009	0:25	Wed	8. Non-Collision	injury crash	No	5. Hillcrest - Straight	5. Darkness - Road Not Lighted	1. Dry	1. No Adverse Condition (Clear/Cloudy)	.5 miles South of Rt 1530
93490186	Pittsylvania County	863	10/7/2009	8:45	Wed	2. Angle	property damage crash	Yes	1. Straight - Level	2. Daylight	1. Dry	1. No Adverse Condition (Clear/Cloudy)	at Rt 873
100971238	Pittsylvania County	863	1/17/2010	5:45	Sun	9. Fixed Object - Off Road	property damage crash	No	1. Straight - Level	1. Dawn	2. Wet	5. Rain	2 miles North of Rt 51
101940549	Pittsylvania County	863	5/28/2010	12:25	Fri	9. Fixed Object - Off Road	injury crash	No	2. Curve - Level	2. Daylight	1. Dry	1. No Adverse Condition (Clear/Cloudy)	1 mile North of Rt 873
110460485	Pittsylvania County	863	12/25/2010	12:30	Sat	2. Angle	property damage crash	No	3. Grade - Straight	2. Daylight	2. Wet	6. Snow	100 feet South of Rt 1648
Westover to Rt 750													Crash Rate = 171.8 per 100M miles traveled
2008 Statewide Average													Crash Rate = 185 per 100M miles traveled

APPENDIX E  
FUTURE NO BUILD (YEAR 2035)  
INTERSECTION LEVEL OF SERVICE ANALYSIS

Moorefield Bridge Road Study  
 1: Moorefield Bridge Road/Laniers Mill Road & Mount Cross Road

Future (2035) Traffic Conditions

AM Peak

Intersection

Intersection Delay, s/veh 36.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	39	475	87	53	216	10	58	87	67	2	85	36
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	43	528	97	59	240	11	64	97	74	2	94	40

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	251	0	0	624	0	0	1094	1032	576	1111	1074	246
Stage 1	-	-	-	-	-	-	663	663	-	363	363	-
Stage 2	-	-	-	-	-	-	431	369	-	748	711	-
Follow-up Headway	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Capacity-1 Maneuver	1326	-	-	967	-	-	193	235	521	188	222	798
Stage 1	-	-	-	-	-	-	454	462	-	660	628	-
Stage 2	-	-	-	-	-	-	607	624	-	408	439	-
Time blocked-Platoon, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-1 Maneuver	1326	-	-	967	-	-	105	207	521	94	196	798
Mov Capacity-2 Maneuver	-	-	-	-	-	-	105	207	-	94	196	-
Stage 1	-	-	-	-	-	-	431	439	-	627	583	-
Stage 2	-	-	-	-	-	-	449	580	-	259	417	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.5	1.7	186	36.5
HCM LOS			F	E

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	193	1326	-	-	967	-	-	246
HCM Lane V/C Ratio	1.22	0.033	-	-	0.061	-	-	0.556
HCM Control Delay (s)	186	7.807	0	-	8.964	0	-	36.5
HCM Lane LOS	F	A	A	-	A	A	-	E
HCM 95th %tile Q(veh)	12.427	0.101	-	-	0.194	-	-	3.063

Notes

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

Moorefield Bridge Road Study  
 2: Moorefield Bridge Road & River Ridge Road/Pinecrest Drive

Future (2035) Traffic Conditions  
 AM Peak

Intersection

Intersection Delay, s/veh 2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	22	4	7	0	5	27	2	107	0	16	216	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	24	4	8	0	6	30	2	119	0	18	240	6

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	419	401	243	407	404	119	246	0	0	119	0	0
Stage 1	278	278	-	123	123	-	-	-	-	-	-	-
Stage 2	141	123	-	284	281	-	-	-	-	-	-	-
Follow-up Headway	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Capacity-1 Maneuver	548	541	801	558	539	938	1332	-	-	1482	-	-
Stage 1	733	684	-	886	798	-	-	-	-	-	-	-
Stage 2	867	798	-	727	682	-	-	-	-	-	-	-
Time blocked-Platoon, %								-	-	-	-	-
Mov Capacity-1 Maneuver	520	532	801	542	530	938	1332	-	-	1482	-	-
Mov Capacity-2 Maneuver	520	532	-	542	530	-	-	-	-	-	-	-
Stage 1	732	674	-	884	796	-	-	-	-	-	-	-
Stage 2	832	796	-	705	672	-	-	-	-	-	-	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	11.8			9.5			0.1			0.5		
HCM LOS	B			A								

Minor Lane / Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1332	-	-	563	837	1482	-	-
HCM Lane V/C Ratio	0.002	-	-	0.065	0.042	0.012	-	-
HCM Control Delay (s)	7.707	0	-	11.8	9.5	7.459	0	-
HCM Lane LOS	A	A	-	B	A	A	A	-
HCM 95th %tile Q(veh)	0.005	-	-	0.208	0.133	0.036	-	-

Notes

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

Moorefield Bridge Road Study  
 3: Westover Drive & Moorefield Bridge Road

Future (2035) Traffic Conditions  
 AM Peak

Intersection

Intersection Delay, s/veh 8.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	106	37	36	20	74	232
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	1	1	0	0	0	0
Mvmt Flow	118	41	40	22	82	258

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	62	0	31
Stage 1	-	-	-
Stage 2	-	-	-
Follow-up Headway	2.21	-	3.3
Pot Capacity-1 Maneuver	1546	-	1043
Stage 1	-	-	-
Stage 2	-	-	-
Time blocked-Platoon, %	-	-	-
Mov Capacity-1 Maneuver	1546	-	1043
Mov Capacity-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	5.6	0	11.5
HCM LOS			B

Minor Lane / Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1546	-	-	-	892
HCM Lane V/C Ratio	0.076	-	-	-	0.381
HCM Control Delay (s)	7.521	0	-	-	11.5
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0.247	-	-	-	1.801

Notes

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

Moorefield Bridge Road Study  
 1: Moorefield Bridge Road/Laniers Mill Road & Mount Cross Road

Future (2035) Traffic Conditions

PM Peak

Intersection

Intersection Delay, s/veh 142

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	39	254	58	107	464	15	62	128	76	0	102	17
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	1	1	1	0	0	0	0	0	0
Mvmt Flow	43	282	64	119	516	17	69	142	84	0	113	19

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	532	0	0	347	0	0	1229	1171	314	1276	1195	524
Stage 1	-	-	-	-	-	-	401	401	-	762	762	-
Stage 2	-	-	-	-	-	-	828	770	-	514	433	-
Follow-up Headway	2.2	-	-	2.209	-	-	3.5	4	3.3	3.5	4	3.3
Pot Capacity-1 Maneuver	1046	-	-	1218	-	-	156	194	731	145	188	557
Stage 1	-	-	-	-	-	-	630	604	-	400	416	-
Stage 2	-	-	-	-	-	-	368	413	-	547	585	-
Time blocked-Platoon, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-1 Maneuver	1046	-	-	1218	-	-	# 53	159	731	26	154	557
Mov Capacity-2 Maneuver	-	-	-	-	-	-	# 53	159	-	26	154	-
Stage 1	-	-	-	-	-	-	598	573	-	380	358	-
Stage 2	-	-	-	-	-	-	209	356	-	345	555	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1	1.5	\$ 668.2	73.6
HCM LOS			F	F

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	128	1046	-	-	1218	-	-	172
HCM Lane V/C Ratio	2.309	0.041	-	-	0.098	-	-	0.769
HCM Control Delay (s)	\$ 668.2	8.59	0	-	8.275	0	-	73.6
HCM Lane LOS	F	A	A	-	A	A	-	F
HCM 95th %tile Q(veh)	25.321	0.13	-	-	0.324	-	-	4.981

Notes

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

Moorefield Bridge Road Study  
 2: Moorefield Bridge Road & River Ridge Road/Pinecrest Drive

Future (2035) Traffic Conditions  
 PM Peak

Intersection

Intersection Delay, s/veh 2.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	16	6	2	2	7	37	5	180	0	22	187	15
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	1	1	1
Mvmt Flow	18	7	2	2	8	41	6	200	0	24	208	17

Major/Minor	Minor2	Minor1	Major1	Major2
Conflicting Flow All	501	476	216	480
Stage 1	265	265	-	211
Stage 2	236	211	-	269
Follow-up Headway	3.5	4	3.3	3.5
Pot Capacity-1 Maneuver	484	491	829	499
Stage 1	745	693	-	796
Stage 2	772	731	-	741
Time blocked-Platoon, %				
Mov Capacity-1 Maneuver	446	479	829	483
Mov Capacity-2 Maneuver	446	479	-	483
Stage 1	741	679	-	792
Stage 2	723	727	-	717

Approach	EB	WB	NB	SB
HCM Control Delay, s	13.1	10.3	0.2	0.8
HCM LOS	B	B		

Minor Lane / Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1357	-	-	472	734	1378	-	-
HCM Lane V/C Ratio	0.004	-	-	0.056	0.07	0.018	-	-
HCM Control Delay (s)	7.664	0	-	13.1	10.3	7.66	0	-
HCM Lane LOS	A	A	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0.012	-	-	0.179	0.224	0.054	-	-

Notes

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

Moorefield Bridge Road Study  
3: Westover Drive & Moorefield Bridge Road

Future (2035) Traffic Conditions  
PM Peak

Intersection

Intersection Delay, s/veh 7.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	183	51	90	86	63	175
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	0	1	1
Mvmt Flow	203	57	100	96	70	194

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	196	0	98
Stage 1	-	-	-
Stage 2	-	-	-
Follow-up Headway	2.2	-	3.31
Pot Capacity-1 Maneuver	1389	-	942
Stage 1	-	-	-
Stage 2	-	-	-
Time blocked-Platoon, %	-	-	-
Mov Capacity-1 Maneuver	1389	-	942
Mov Capacity-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	6.3	0	13.7
HCM LOS			B

Minor Lane / Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1389	-	-	-	676
HCM Lane V/C Ratio	0.146	-	-	-	0.391
HCM Control Delay (s)	8.036	0.1	-	-	13.7
HCM Lane LOS	A	A			B
HCM 95th %tile Q(veh)	0.513	-	-	-	1.86

Notes

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

APPENDIX F  
ROADWAY ALTERNATIVE  
PRELIMINARY ESTIMATES OF PROBABLE COST

MOOREFIELD BRIDGE ROAD - PLANNING LEVEL STUDY

**MOOREFIELD BRIDGE ROAD - ROADWAY ALTERNATIVE 1**  
PRELIMINARY ESTIMATE OF PROBABLE COST

ITEM	QUANTITY	UNIT	UNIT PRICE	COST
WARNING SIGNS	134	SF	\$ 30.00	\$ 4,020.00
SIGN POSTS W/ FOUNDATIONS	25	EA	\$ 500.00	\$ 12,500.00
			<b>SUB TOTAL</b>	<b>\$ 16,520.00</b>
			15% FOR ENGINEERING	\$ 3,304.00
			18% FOR CONSTRUCTION INSPECTION	\$ 2,478.00
			<b>TOTAL</b>	<b>\$ 22,302.00</b>

\* This cost estimate was prepared using the VDOT Transportation and Mobility Planning Division's Statewide Planning Level Cost Estimates.

MOOREFIELD BRIDGE ROAD - PLANNING LEVEL STUDY

**MOOREFIELD BRIDGE ROAD - ROADWAY ALTERNATIVE 2**  
PRELIMINARY ESTIMATE OF PROBABLE COST

ITEM	QUANTITY	UNIT	UNIT PRICE	COST
WARNING SIGNS	134	SF	\$ 30.00	\$ 4,020.00
SIGN POSTS W/ FOUNDATIONS	25	EA	\$ 500.00	\$ 12,500.00
WIDEN EXISTING LOCAL ROAD ADDING 4 FT PAVED SHLDRS.	4000	LF	\$ 110.00	\$ 440,000.00
REALIGN & LOWER PORTION OF ROAD BY EX. CEMETERY	1000	LF	\$ 380.00	\$ 380,000.00
STORMWATER MANAGEMENT - BASINS	2	EA	\$ 27,500.00	\$ 55,000.00
ENTRANCE IMPROVEMENTS	12	EA	\$ 7,500.00	\$ 90,000.00
			<b>SUB TOTAL</b>	<b>\$ 981,520.00</b>
			25% FOR RIGHT OF WAY AND UTILITY RELOCATIONS	\$ 245,380.00
			15% FOR ENGINEERING	\$ 147,228.00
			18% FOR CONSTRUCTION INSPECTION	\$ 176,673.60
			<b>TOTAL</b>	<b>\$ 1,550,801.60</b>

\* This cost estimate was prepared using the VDOT Transportation and Mobility Planning Division's Statewide Planning Level Cost Estimates.

APPENDIX G  
MOOREFIELD BRIDGE AND MOUNT CROSS ROAD INTERSECTION ALTERNATIVES  
LEVEL OF SERVICE ANALYSIS

Moorefield Bridge Road Study

Future (2035) Traffic Conditions with Turn Lanes

1: Moorefield Bridge Road/Laniers Mill Road & Mount Cross Road

AM Peak

Intersection

Intersection Delay, s/veh 14.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	39	475	87	53	216	10	58	87	67	2	85	36
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	200	-	-	200	-	-	150	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	43	528	97	59	240	11	64	97	74	2	94	40

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	251	0	0	624	0	0	1094	1032	576	1111	1074	246
Stage 1	-	-	-	-	-	-	663	663	-	363	363	-
Stage 2	-	-	-	-	-	-	431	369	-	748	711	-
Follow-up Headway	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Capacity-1 Maneuver	1326	-	-	967	-	-	193	235	521	188	222	798
Stage 1	-	-	-	-	-	-	454	462	-	660	628	-
Stage 2	-	-	-	-	-	-	607	624	-	408	439	-
Time blocked-Platoon, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-1 Maneuver	1326	-	-	967	-	-	109	214	521	97	202	798
Mov Capacity-2 Maneuver	-	-	-	-	-	-	109	214	-	97	202	-
Stage 1	-	-	-	-	-	-	439	447	-	639	590	-
Stage 2	-	-	-	-	-	-	455	586	-	265	425	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.5			1.7			59.2			34.8		
HCM LOS							F			D		

Minor Lane / Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	109	243	1326	-	-	967	-	-	253
HCM Lane V/C Ratio	0.394	0.793	0.033	-	-	0.061	-	-	0.54
HCM Control Delay (s)	58	59.5	7.807	-	-	8.964	-	-	34.8
HCM Lane LOS	F	F	A	-	-	A	-	-	D
HCM 95th %tile Q(veh)	1.63	5.913	0.101	-	-	0.194	-	-	2.933

Notes

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

Moorefield Bridge Road Study

Future (2035) Traffic Conditions with Turn Lanes

1: Moorefield Bridge Road/Laniers Mill Road & Mount Cross Road

PM Peak

Intersection

Intersection Delay, s/veh 51.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	39	254	58	107	464	15	62	128	76	0	102	17
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	200	-	-	200	-	-	150	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	1	1	1	0	0	0	0	0	0
Mvmt Flow	43	282	64	119	516	17	69	142	84	0	113	19

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	532	0	0	347	0	0	1229	1171	314	1276	1195	524
Stage 1	-	-	-	-	-	-	401	401	-	762	762	-
Stage 2	-	-	-	-	-	-	828	770	-	514	433	-
Follow-up Headway	2.2	-	-	2.209	-	-	3.5	4	3.3	3.5	4	3.3
Pot Capacity-1 Maneuver	1046	-	-	1218	-	-	156	194	731	145	188	557
Stage 1	-	-	-	-	-	-	630	604	-	400	416	-
Stage 2	-	-	-	-	-	-	368	413	-	547	585	-
Time blocked-Platoon, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-1 Maneuver	1046	-	-	1218	-	-	# 60	168	731	34	163	557
Mov Capacity-2 Maneuver	-	-	-	-	-	-	# 60	168	-	34	163	-
Stage 1	-	-	-	-	-	-	604	579	-	384	375	-
Stage 2	-	-	-	-	-	-	224	373	-	350	561	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	1			1.5			223.3			65.3		
HCM LOS							F			F		

Minor Lane / Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	60	186	1046	-	-	1218	-	-	181
HCM Lane V/C Ratio	0.765	1.342	0.041	-	-	0.098	-	-	0.731
HCM Control Delay (s)	165.4	234	8.59	-	-	8.275	-	-	65.3
HCM Lane LOS	F	F	A	-	-	A	-	-	F
HCM 95th %tile Q(veh)	3.363	14.438	0.13	-	-	0.324	-	-	4.625

Notes

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

# LANE SUMMARY

Site: AM - Mount Cross Rd and Laniers Mill Rd

AM - Mount Cross Road and Laniers Mill Road Roundabout

Lane Use and Performance																
	Demand Flows			Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Lane Length ft	SL Type	Cap. Adj. %	Prob. Block. %
	L veh/h	T veh/h	R veh/h													
South: Moorefield Bridge Road																
Lane 1	64	97	74	236	0.0	637	P	100	10.8	LOS B	1.6	39.5	1600	-	0.0	0.0
Approach	64	97	74	236	0.0		0.370		10.8	LOS B	1.6	39.5				
East: Mount Cross Road																
Lane 1	59	240	11	310	0.0	921	P	100	7.6	LOS A	1.5	38.5	1600	-	0.0	0.0
Approach	59	240	11	310	0.0		0.337		7.6	LOS A	1.5	38.5				
North: Laniers Mill Road																
Lane 1	2	94	40	137	0.0	786	P	100	6.4	LOS A	0.6	16.2	1600	-	0.0	0.0
Approach	2	94	40	137	0.0		0.174		6.4	LOS A	0.6	16.2				
West: Mount Cross Road																
Lane 1	43	528	97	668	0.0	967	P	100	15.0	LOS C	6.1	153.7	1600	-	0.0	0.0
Approach	43	528	97	668	0.0		0.690		15.0	LOS C	6.1	153.7				
Intersection				1350	0.0		0.690		11.7	LOS B	6.1	153.7				

P: You need to Process this Site (F9) for this variable to be computed.

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Roundabout LOS Method: Same as Sign Control.

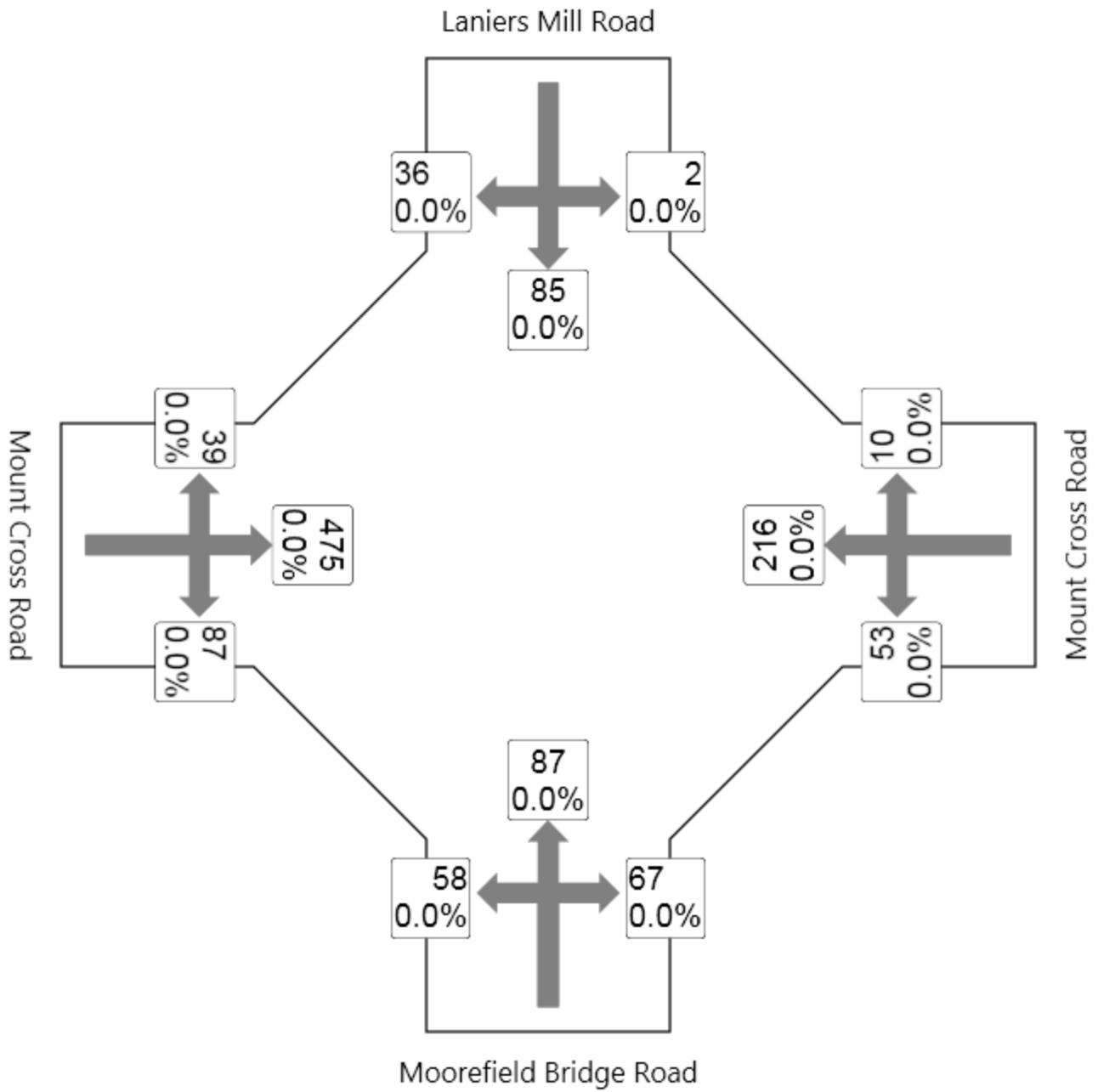
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).

Roundabout Capacity Model: US HCM 2010.

HCM Delay Model used. Geometric Delay not included.



# LANE SUMMARY

Site: PM - Mount Cross Rd and Laniers Mill Rd

AM - Mount Cross Road and Laniers Mill Road Roundabout

Lane Use and Performance																
	Demand Flows			Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Lane Length ft	SL Type	Cap. Adj. %	Prob. Block. %
	L veh/h	T veh/h	R veh/h													
South: Moorefield Bridge Road																
Lane 1	69	142	84	296	0.0	815	P	100	8.7	LOS A	1.6	40.4	1600	-	0.0	0.0
Approach	69	142	84	296	0.0		0.363		8.7	LOS A	1.6	40.4				
East: Mount Cross Road																
Lane 1	119	516	17	651	2.0	859	P	100	19.8	LOS C	7.8	197.8	1600	-	0.0	0.0
Approach	119	516	17	651	2.0		0.758		19.8	LOS C	7.8	197.8				
North: Laniers Mill Road																
Lane 1	1	113	19	133	0.0	552	P	100	9.8	LOS A	0.9	21.7	1600	-	0.0	0.0
Approach	1	113	19	133	0.0		0.241		9.8	LOS A	0.9	21.7				
West: Mount Cross Road																
Lane 1	43	282	64	390	0.0	893	P	100	9.3	LOS A	2.2	55.3	1600	-	0.0	0.0
Approach	43	282	64	390	0.0		0.437		9.3	LOS A	2.2	55.3				
Intersection				1470	0.9		0.758		13.9	LOS B	7.8	197.8				

P: You need to Process this Site (F9) for this variable to be computed.

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Roundabout LOS Method: Same as Sign Control.

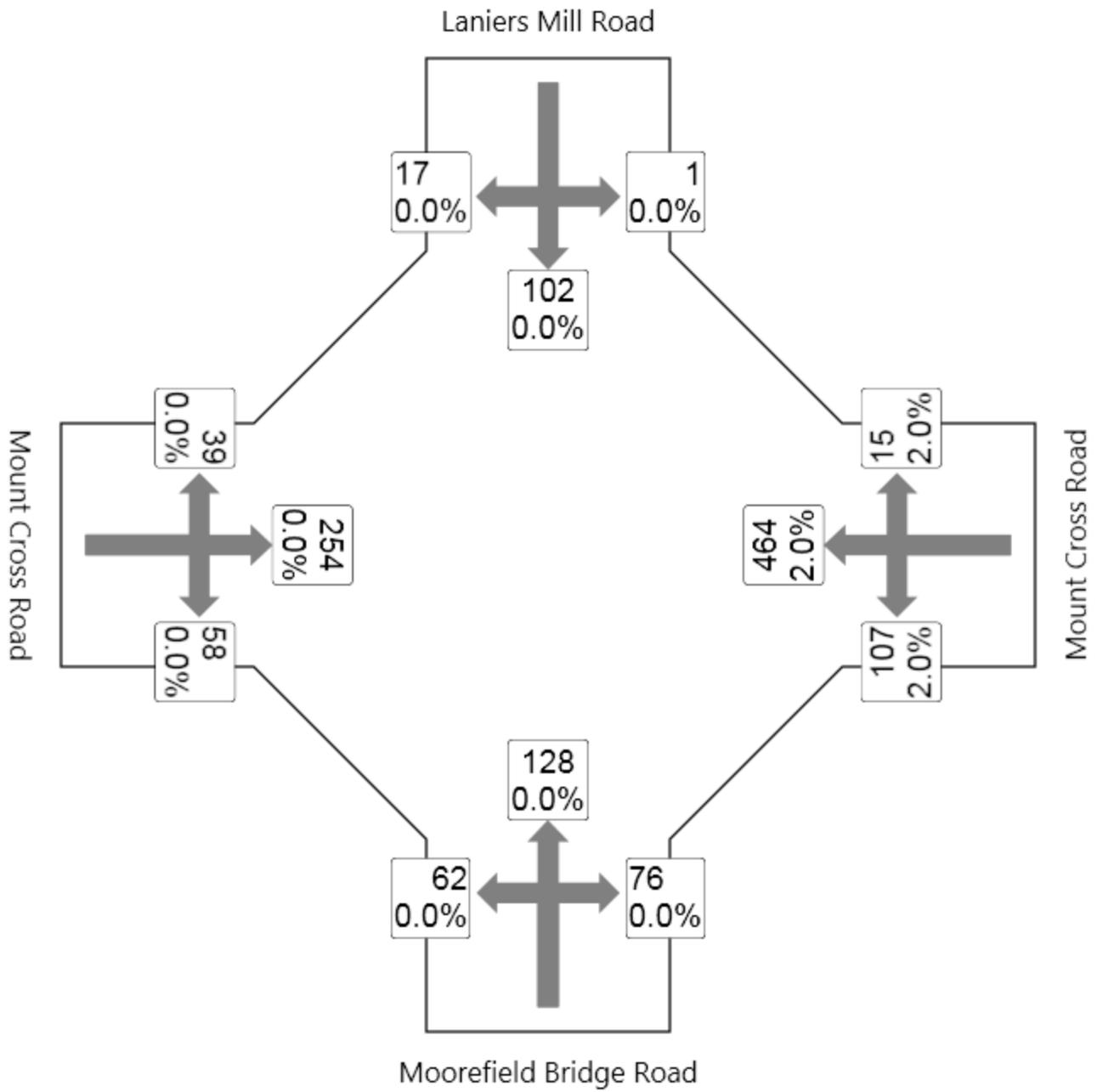
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).

Roundabout Capacity Model: US HCM 2010.

HCM Delay Model used. Geometric Delay not included.



Moorefield Bridge Road Study

Future (2035) Traffic Conditions with Traffic Signal

1: Moorefield Bridge Road/Laniers Mill Road & Mount Cross Road

AM Peak

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	39	475	87	53	216	10	58	87	67	2	85	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		0	200		0	150		0	0		0
Storage Lanes	1		0	1		0	1		0	0		0
Taper Length (ft)	200			200			200			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.977			0.993			0.935			0.960	
Flt Protected	0.950			0.950			0.950				0.999	
Satd. Flow (prot)	1685	1733	0	1685	1761	0	1685	1658	0	0	1701	0
Flt Permitted	0.603			0.351			0.670				0.991	
Satd. Flow (perm)	1069	1733	0	622	1761	0	1188	1658	0	0	1687	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		24			6			62			34	
Link Speed (mph)		45			45			45			45	
Link Distance (ft)		1303			1463			499			577	
Travel Time (s)		19.7			22.2			7.6			8.7	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	43	528	97	59	240	11	64	97	74	2	94	40
Shared Lane Traffic (%)												
Lane Group Flow (vph)	43	625	0	59	251	0	64	171	0	0	136	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		6			2			4			8	
Permitted Phases	6			2			4			8		
Detector Phase	6	6		2	2		4	4		8	8	
Switch Phase												
Minimum Initial (s)	12.0	12.0		12.0	12.0		7.0	7.0		7.0	7.0	
Minimum Split (s)	26.5	26.5		22.0	22.0		22.0	22.0		22.0	22.0	
Total Split (s)	38.0	38.0		38.0	38.0		22.0	22.0		22.0	22.0	
Total Split (%)	63.3%	63.3%		63.3%	63.3%		36.7%	36.7%		36.7%	36.7%	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0			0.0	
Total Lost Time (s)	6.0	6.0		6.0	6.0		6.0	6.0			6.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Act Effect Green (s)	25.3	25.3		25.3	25.3		9.1	9.1			9.1	
Actuated g/C Ratio	0.60	0.60		0.60	0.60		0.22	0.22			0.22	
v/c Ratio	0.07	0.60		0.16	0.24		0.25	0.42			0.35	
Control Delay	6.1	10.5		7.4	6.7		18.7	14.6			15.4	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0			0.0	
Total Delay	6.1	10.5		7.4	6.7		18.7	14.6			15.4	
LOS	A	B		A	A		B	B			B	
Approach Delay		10.2			6.8			15.7			15.4	
Approach LOS		B			A			B			B	
Queue Length 50th (ft)	4	91		6	28		12	20			19	
Queue Length 95th (ft)	18	222		25	72		46	76			69	
Internal Link Dist (ft)		1223			1383			419			497	

Moorefield Bridge Road Study

Future (2035) Traffic Conditions with Traffic Signal

1: Moorefield Bridge Road/Laniers Mill Road & Mount Cross Road

AM Peak

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Bay Length (ft)	200			200			150					
Base Capacity (vph)	849	1381		494	1400		472	695			690	
Starvation Cap Reductn	0	0		0	0		0	0			0	
Spillback Cap Reductn	0	0		0	0		0	0			0	
Storage Cap Reductn	0	0		0	0		0	0			0	
Reduced v/c Ratio	0.05	0.45		0.12	0.18		0.14	0.25			0.20	

Intersection Summary

Area Type: Other

Cycle Length: 60

Actuated Cycle Length: 42.1

Natural Cycle: 60

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.60

Intersection Signal Delay: 10.9

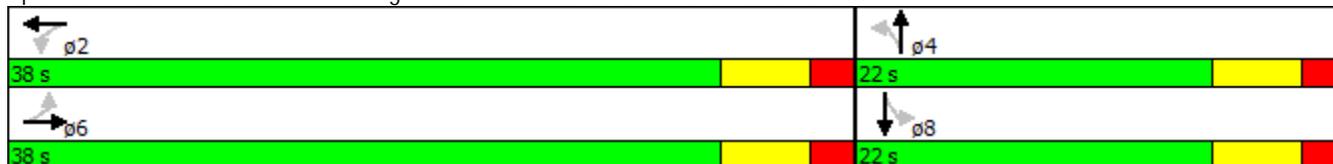
Intersection LOS: B

Intersection Capacity Utilization 74.5%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 1: Moorefield Bridge Road/Laniers Mill Road & Mount Cross Road



Moorefield Bridge Road Study

Future (2035) Traffic Conditions with Traffic Signal

1: Moorefield Bridge Road/Laniers Mill Road & Mount Cross Road

PM Peak

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	39	254	58	107	464	15	62	128	76	0	102	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		0	200		0	150		0	0		0
Storage Lanes	1		0	1		0	1		0	0		0
Taper Length (ft)	200			200			200			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.972			0.995			0.944			0.981	
Flt Protected	0.950			0.950			0.950					
Satd. Flow (prot)	1685	1724	0	1668	1747	0	1685	1674	0	0	1740	0
Flt Permitted	0.411			0.553			0.673					
Satd. Flow (perm)	729	1724	0	971	1747	0	1193	1674	0	0	1740	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		29			4			48			14	
Link Speed (mph)		45			45			45			45	
Link Distance (ft)		1303			1463			499			577	
Travel Time (s)		19.7			22.2			7.6			8.7	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	0%	0%	0%	1%	1%	1%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	43	282	64	119	516	17	69	142	84	0	113	19
Shared Lane Traffic (%)												
Lane Group Flow (vph)	43	346	0	119	533	0	69	226	0	0	132	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		6			2			4			8	
Permitted Phases	6			2			4			8		
Detector Phase	6	6		2	2		4	4		8	8	
Switch Phase												
Minimum Initial (s)	12.0	12.0		12.0	12.0		7.0	7.0		7.0	7.0	
Minimum Split (s)	22.0	22.0		22.0	22.0		22.0	22.0		22.0	22.0	
Total Split (s)	38.0	38.0		38.0	38.0		22.0	22.0		22.0	22.0	
Total Split (%)	63.3%	63.3%		63.3%	63.3%		36.7%	36.7%		36.7%	36.7%	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0			0.0	
Total Lost Time (s)	6.0	6.0		6.0	6.0		6.0	6.0			6.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Act Effect Green (s)	24.1	24.1		24.1	24.1		10.4	10.4			10.4	
Actuated g/C Ratio	0.57	0.57		0.57	0.57		0.25	0.25			0.25	
v/c Ratio	0.10	0.35		0.21	0.53		0.23	0.50			0.30	
Control Delay	7.6	8.0		8.5	10.7		17.1	16.5			15.5	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0			0.0	
Total Delay	7.6	8.0		8.5	10.7		17.1	16.5			15.5	
LOS	A	A		A	B		B	B			B	
Approach Delay		7.9			10.3			16.6			15.5	
Approach LOS		A			B			B			B	
Queue Length 50th (ft)	5	42		15	83		12	33			21	
Queue Length 95th (ft)	21	107		47	197		48	109			72	

Moorefield Bridge Road Study

Future (2035) Traffic Conditions with Traffic Signal

1: Moorefield Bridge Road/Laniers Mill Road & Mount Cross Road

PM Peak

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		1223			1383			419			497	
Turn Bay Length (ft)	200			200			150					
Base Capacity (vph)	582	1382		775	1396		481	704			711	
Starvation Cap Reductn	0	0		0	0		0	0			0	
Spillback Cap Reductn	0	0		0	0		0	0			0	
Storage Cap Reductn	0	0		0	0		0	0			0	
Reduced v/c Ratio	0.07	0.25		0.15	0.38		0.14	0.32			0.19	

Intersection Summary

Area Type: Other

Cycle Length: 60

Actuated Cycle Length: 42

Natural Cycle: 50

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.53

Intersection Signal Delay: 11.4

Intersection LOS: B

Intersection Capacity Utilization 61.7%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 1: Moorefield Bridge Road/Laniers Mill Road & Mount Cross Road



APPENDIX H  
MOOREFIELD BRIDGE AND MOUNT CROSS ROAD INTERSECTION ALTERNATIVES  
PRELIMINARY ESTIMATES OF PROBABLE COST

MOOREFIELD BRIDGE ROAD - PLANNING LEVEL STUDY

**MOOREFIELD BRIDGE ROAD - INTERSECTION OF MOOREFIELD BRIDGE AND MOUNT CROSS ROAD ALTERNATIVE 1**  
PRELIMINARY ESTIMATE OF PROBABLE COST

ITEM	QUANTITY	UNIT	UNIT PRICE	COST
INSTALL LEFT TURN LANE - NORTHBOUND	790	LF	\$ 335.00	\$ 264,650.00
INSTALL LEFT TURN LANE - EASTBOUND	840	LF	\$ 335.00	\$ 281,400.00
INSTALL LEFT TURN LANE - WESTBOUND	840	LF	\$ 335.00	\$ 281,400.00
INSTALL TAPER - SOUTHBOUND	590	LF	\$ 335.00	\$ 197,650.00
STORMWATER MANAGEMENT - BASINS	1	EA	\$ 27,500.00	\$ 27,500.00
ENTRANCE IMPROVEMENTS	7	EA	\$ 7,500.00	\$ 52,500.00
			<b>SUB TOTAL</b>	<b>\$ 1,105,100.00</b>
			25% FOR RIGHT OF WAY AND UTILITY RELOCATIONS	\$ 276,275.00
			15% FOR ENGINEERING	\$ 165,765.00
			18% FOR CONSTRUCTION INSPECTION	\$ 198,918.00
			<b>TOTAL</b>	<b>\$ 1,469,783.00</b>

\* This cost estimate was prepared using the VDOT Transportation and Mobility Planning Division's Statewide Planning Level Cost Estimates.

MOOREFIELD BRIDGE ROAD - PLANNING LEVEL STUDY

**MOOREFIELD BRIDGE ROAD - INTERSECTION OF MOOREFIELD BRIDGE AND MOUNT CROSS ROAD ALTERNATIVE 2**  
 PRELIMINARY ESTIMATE OF PROBABLE COST

ITEM	QUANTITY	UNIT	UNIT PRICE	COST
ROUNDBABOUT	1	EA	\$ 625,000.00	\$ 625,000.00
WIDEN APPROACHES	2360	LF	\$ 335.00	\$ 790,600.00
STORMWATER MANAGEMENT - BASINS	1	EA	\$ 27,500.00	\$ 27,500.00
ENTRANCE IMPROVEMENTS	9	EA	\$ 7,500.00	\$ 67,500.00
			<b>SUB TOTAL</b>	<b>\$ 1,510,600.00</b>
			25% FOR RIGHT OF WAY AND UTILITY RELOCATIONS	\$ 377,650.00
			15% FOR ENGINEERING	\$ 226,590.00
			18% FOR CONSTRUCTION INSPECTION	\$ 271,908.00
			<b>TOTAL</b>	<b>\$ 2,009,098.00</b>

\* This cost estimate was prepared using the VDOT Transportation and Mobility Planning Division's Statewide Planning Level Cost Estimates.

MOOREFIELD BRIDGE ROAD - PLANNING LEVEL STUDY

**MOOREFIELD BRIDGE ROAD - INTERSECTION OF MOOREFIELD BRIDGE AND MOUNT CROSS ROAD ALTERNATIVE 3**  
 PRELIMINARY ESTIMATE OF PROBABLE COST

ITEM	QUANTITY	UNIT	UNIT PRICE	COST
INSTALL LEFT TURN LANE - NORTHBOUND	790	LF	\$ 335.00	\$ 264,650.00
INSTALL LEFT TURN LANE - EASTBOUND	840	LF	\$ 335.00	\$ 281,400.00
INSTALL LEFT TURN LANE - WESTBOUND	840	LF	\$ 335.00	\$ 281,400.00
INSTALL TAPER - SOUTHBOUND	590	LF	\$ 335.00	\$ 197,650.00
INSTALL TRAFFIC SIGNAL	1	EA	\$ 180,000.00	\$ 180,000.00
STORMWATER MANAGEMENT - BASINS	1	EA	\$ 27,500.00	\$ 27,500.00
ENTRANCE IMPROVEMENTS	7	EA	\$ 7,500.00	\$ 52,500.00
			<b>SUB TOTAL</b>	<b>\$ 1,285,100.00</b>
			25% FOR RIGHT OF WAY AND UTILITY RELOCATIONS	\$ 321,275.00
			15% FOR ENGINEERING	\$ 192,765.00
			18% FOR CONSTRUCTION INSPECTION	\$ 231,318.00
			<b>TOTAL</b>	<b>\$ 1,709,183.00</b>

\* This cost estimate was prepared using the VDOT Transportation and Mobility Planning Division's Statewide Planning Level Cost Estimates.

APPENDIX I  
SIGNAL WARRANT ANALYSIS FOR  
INTERSECTION OF MOOREFIELD BRIDGE ROAD AND MOUNT CROSS ROAD

**Ramey Kemp & Associates, Inc.**  
 Mount Cross Rd & Moorefield Bridge Rd/Laniers Mill Rd  
 Future Traffic Conditions

**Signal Warrants - Summary**

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**Major Street Approaches**

**Eastbound: Mount Cross Road**

Number of Lanes: 2  
 85% Speed > 40 MPH.  
 Total Approach Volume: **3,448**

**Westbound: Mount Cross Road**

Number of Lanes: 2  
 85% Speed > 40 MPH.  
 Total Approach Volume: **3,182**

**Minor Street Approaches**

**Northbound: Moorefield Bridge Road**

Number of Lanes: 2  
  
 Total Approach Volume: **1,869**

**Southbound: Laniers Mill Road**

Number of Lanes: 1  
  
 Total Approach Volume: **975**

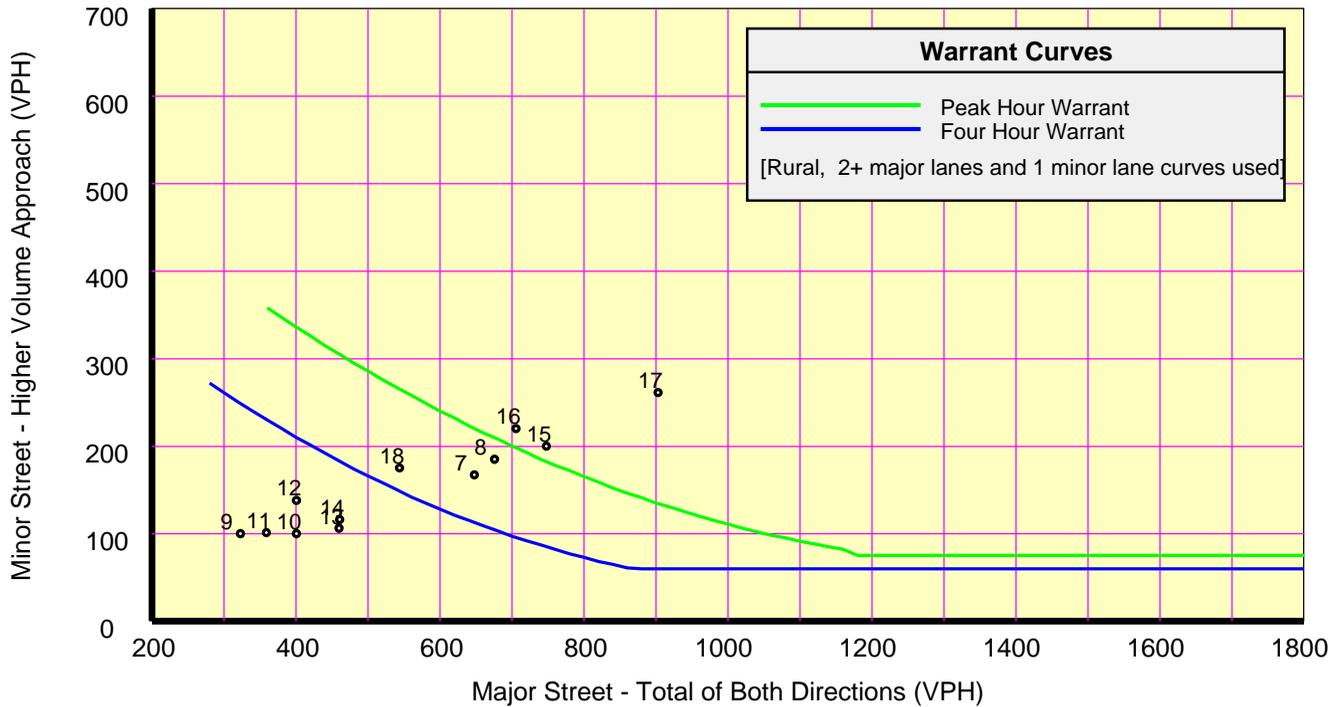
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**Warrant Summary** (Rural values apply.)

<b>Warrant 1 - Eight Hour Vehicular Volumes</b> .....	<b>Satisfied</b>
<b>Warrant 1A - Minimum Vehicular Volume</b> ..... <b>Satisfied</b>	
Required volumes reached for 8 hours, 8 are needed	
<b>Warrant 1B - Interruption of Continuous Traffic</b> ..... <b>Not Satisfied</b>	
Required volumes reached for 6 hours, 8 are needed	
<b>Warrant 1 A&amp;B - Combination of Warrants</b> ..... <b>Not Satisfied</b>	
Required volumes reached for 6 hours, 8 are needed	
<b>Warrant 2 - Four Hour Volumes</b> .....	<b>Satisfied</b>
Number of hours (6) volumes exceed minimum < minimum required (4).	
<b>Warrant 3 - Peak Hour</b> .....	<b>Satisfied</b>
<b>Warrant 3A - Peak Hour Delay</b> ..... <b>Satisfied</b>	
Number of hours (20) volumes exceed minimum >= required (1). Delay data not evaluated.	
<b>Warrant 3B - Peak Hour Volumes</b> ..... <b>Satisfied</b>	
Volumes exceed minimums for at least one hour.	
<b>Warrant 4 - Pedestrian Volumes</b> .....	<b>Not Evaluated</b>
<b>Warrant 5 - School Crossing</b> .....	<b>Not Evaluated</b>
<b>Warrant 6 - Coordinated Signal System</b> .....	<b>Not Evaluated</b>
<b>Warrant 7 - Crash Experience</b> .....	<b>Not Evaluated</b>
<b>Warrant 8 - Roadway Network</b> .....	<b>Not Evaluated</b>
<b>Warrant 9 - Intersection Near a Grade Crossing</b> .....	<b>Not Evaluated</b>

**Ramey Kemp & Associates, Inc.**  
 Mount Cross Rd & Moorefield Bridge Rd/Laniers Mill Rd  
 Future Traffic Conditions

**Signal Warrants - Summary**



**Analysis of 8-Hour Volume Warrants:**

**War 1A-Minimum Volume**

**War 1B-Interruption of Traffic**

**War 1C-Combination of Warrants**

Hour Begin	Major Total	Minor Vol Dir	Maj 420	Min 0	Hour Begin	Major Total	Minor Vol Dir	Maj 630	Min 0	Hour Begin	Major Total	Minor Vol Dir	Maj 504	Min 0
16:45	935	268 NB	Yes	Yes	16:30	872	253 NB	Yes	Yes	17:15	875	243 NB	Yes	Yes
07:45	785	209 NB	Yes	Yes	17:30	732	206 NB	Yes	Yes	16:15	761	235 NB	Yes	Yes
14:45	707	191 NB	Yes	Yes	08:00	676	185 NB	Yes	Yes	15:15	721	182 NB	Yes	Yes
15:45	632	200 NB	Yes	Yes	14:30	650	154 NB	Yes	Yes	08:00	676	185 NB	Yes	Yes
17:45	629	186 NB	Yes	Yes	15:30	648	199 NB	Yes	Yes	07:00	648	167 NB	Yes	Yes
13:45	452	116 NB	Yes	Yes	07:00	648	167 NB	Yes	Yes	14:15	530	153 NB	Yes	Yes
12:45	427	113 NB	Yes	Yes	14:15	530	153 NB	No	Yes	14:00	461	116 NB	No	Yes
06:45	423	102 NB	Yes	Yes	14:00	461	116 NB	No	Yes	13:00	460	106 NB	No	Yes
10:15	419	109 NB	No	Yes	13:00	460	106 NB	No	Yes	13:15	453	93 NB	No	Yes
11:45	414	126 NB	No	Yes	13:15	453	93 NB	No	Yes	13:45	452	116 NB	No	Yes
12:30	413	139 NB	No	Yes	13:45	452	116 NB	No	Yes	13:30	447	108 NB	No	Yes
12:00	401	138 NB	No	Yes	13:30	447	108 NB	No	Yes	12:45	427	113 NB	No	Yes
10:00	401	100 NB	No	Yes	12:45	427	113 NB	No	Yes	06:45	423	102 NB	No	Yes
10:30	398	105 NB	No	Yes	06:45	423	102 NB	No	Yes	10:15	419	109 NB	No	Yes
11:30	396	109 NB	No	Yes	10:15	419	109 NB	No	Yes	11:45	414	126 NB	No	Yes
10:45	386	102 NB	No	Yes	11:45	414	126 NB	No	Yes	12:30	413	139 NB	No	Yes
11:15	383	103 NB	No	Yes	12:30	413	139 NB	No	Yes	12:00	401	138 NB	No	Yes
12:15	381	144 NB	No	Yes	12:00	401	138 NB	No	Yes	10:00	401	100 NB	No	Yes
08:45	362	118 NB	No	Yes	10:00	401	100 NB	No	Yes	10:30	398	105 NB	No	Yes
11:00	359	101 NB	No	Yes	10:30	398	105 NB	No	Yes	11:30	396	109 NB	No	Yes
09:45	352	95 NB	No	Yes	11:30	396	109 NB	No	Yes	10:45	386	102 NB	No	Yes
09:30	346	91 NB	No	Yes	10:45	386	102 NB	No	Yes	11:15	383	103 NB	No	Yes
09:15	326	88 NB	No	Yes	11:15	383	103 NB	No	Yes	12:15	381	144 NB	No	Yes
09:00	323	100 NB	No	Yes	12:15	381	144 NB	No	Yes	18:15	378	135 NB	No	Yes

APPENDIX J  
MOOREFIELD BRIDGE AND WESTOVER DRIVE INTERSECTION  
LEVEL OF SERVICE ANALYSIS

Moorefield Bridge Road Study  
3: Westover Drive & Moorefield Bridge Road

Future (2035) Traffic Conditions with Turn Lanes  
AM Peak

Intersection

Intersection Delay, s/veh 7.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	103	37	36	20	74	232
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	100	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	1	1	0	0	0	0
Mvmt Flow	114	41	40	22	82	258

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	62	0	31
Stage 1	-	-	-
Stage 2	-	-	-
Follow-up Headway	2.21	-	3.3
Pot Capacity-1 Maneuver	1546	-	1043
Stage 1	-	-	-
Stage 2	-	-	-
Time blocked-Platoon, %	-	-	-
Mov Capacity-1 Maneuver	1546	-	1043
Mov Capacity-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	5.5	0	10.1
HCM LOS			B

Minor Lane / Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1546	-	-	-	623	1043
HCM Lane V/C Ratio	0.074	-	-	-	0.132	0.247
HCM Control Delay (s)	7.515	0	-	-	11.7	9.6
HCM Lane LOS	A	A	-	-	B	A
HCM 95th %tile Q(veh)	0.24	-	-	-	0.453	0.975

Notes

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

Moorefield Bridge Road Study  
3: Westover Drive & Moorefield Bridge Road

Future (2035) Traffic Conditions with Turn Lanes  
PM Peak

Intersection

Intersection Delay, s/veh 6.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	183	51	90	86	63	175
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	100	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	0	1	1
Mvmt Flow	203	57	100	96	70	194

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	196	0	98
Stage 1	-	-	-
Stage 2	-	-	-
Follow-up Headway	2.2	-	3.31
Pot Capacity-1 Maneuver	1389	-	942
Stage 1	-	-	-
Stage 2	-	-	-
Time blocked-Platoon, %	-	-	-
Mov Capacity-1 Maneuver	1389	-	942
Mov Capacity-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	6.3	0	11.6
HCM LOS			B

Minor Lane / Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1389	-	-	-	379	942
HCM Lane V/C Ratio	0.146	-	-	-	0.185	0.206
HCM Control Delay (s)	8.036	0.1	-	-	16.6	9.8
HCM Lane LOS	A	A	-	-	C	A
HCM 95th %tile Q(veh)	0.513	-	-	-	0.668	0.774

Notes

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

APPENDIX K  
MOOREFIELD BRIDGE AND WESTOVER DRIVE INTERSECTION  
PRELIMINARY ESTIMATES OF PROBABLE COST

MOOREFIELD BRIDGE ROAD - PLANNING LEVEL STUDY

**MOOREFIELD BRIDGE ROAD - INTERSECTION OF MOOREFIELD BRIDGE AND WESTOVER DRIVE ALTERNATIVE**  
 PRELIMINARY ESTIMATE OF PROBABLE COST

ITEM	QUANTITY	UNIT	UNIT PRICE	COST
INSTALL LEFT TURN LANE - SOUTHBOUND	680	LF	\$ 335.00	\$ 227,800.00
STORMWATER MANAGEMENT	1	EA	\$ 15,000.00	\$ 15,000.00
ENTRANCE IMPROVEMENTS	8	EA	\$ 7,500.00	\$ 60,000.00
			<b>SUB TOTAL</b>	<b>\$ 302,800.00</b>
			25% FOR RIGHT OF WAY AND UTILITY RELOCATIONS	\$ 75,700.00
			15% FOR ENGINEERING	\$ 45,420.00
			18% FOR CONSTRUCTION INSPECTION	\$ 54,504.00
			<b>TOTAL</b>	<b>\$ 402,724.00</b>

\* This cost estimate was prepared using the VDOT Transportation and Mobility Planning Division's Statewide Planning Level Cost Estimates.

APPENDIX L  
SIGNAL WARRANT ANALYSIS FOR  
INTERSECTION OF MOOREFIELD BRIDGE ROAD AND WESTOVER DRIVE

**Ramey Kemp & Associates, Inc.**  
 Westover Road & Moorefield Bridge Road  
 Future Traffic Conditions

**Signal Warrants - Summary**

**Major Street Approaches**

**Eastbound: Westover Road**  
 Number of Lanes: 2  
 85% Speed > 40 MPH.  
 Total Approach Volume: 1,835

**Westbound: Westover Road**  
 Number of Lanes: 2  
 85% Speed > 40 MPH.  
 Total Approach Volume: 1,204

**Minor Street Approaches**

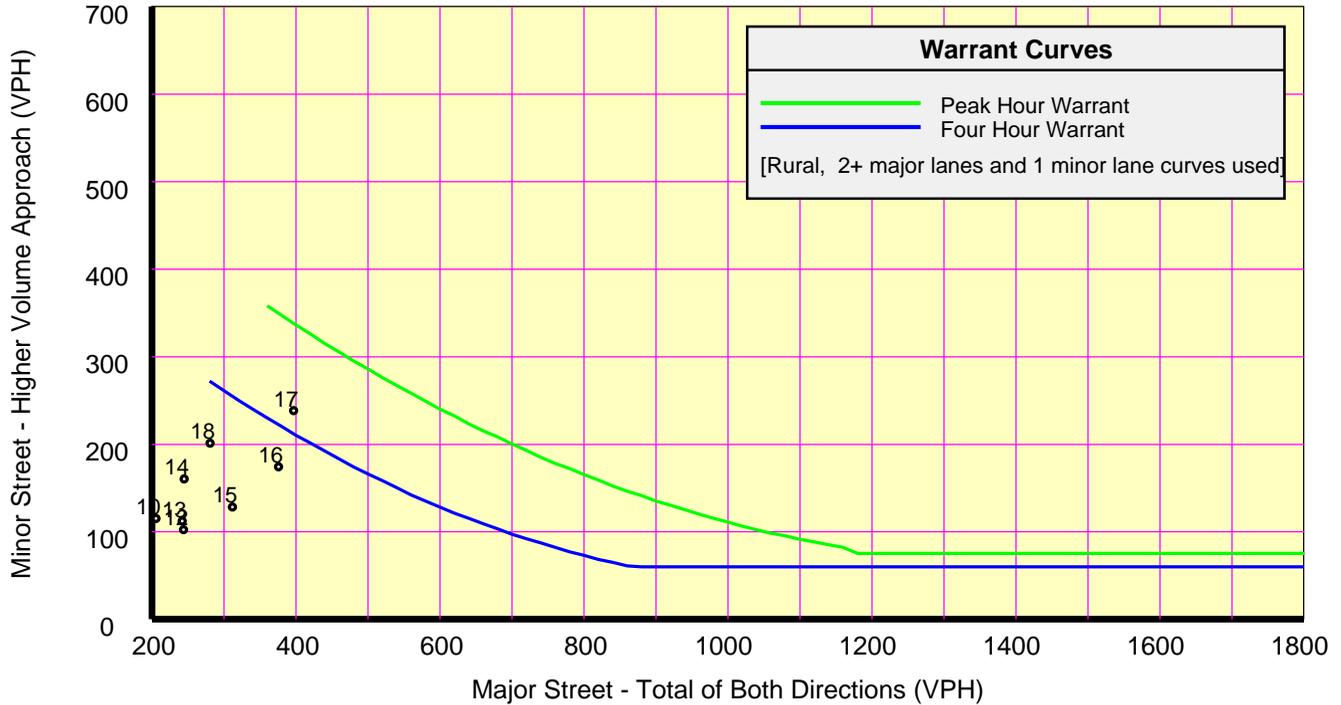
**Southbound: Moorefield Bridge Road**  
 Number of Lanes: 1  
 Total Approach Volume: 1,921

**Warrant Summary** (Rural values apply.)

<b>Warrant 1 - Eight Hour Vehicular Volumes</b> .....	<b>Not Satisfied</b>
<b>Warrant 1A - Minimum Vehicular Volume</b> ..... <b>Not Satisfied</b>	
Required volumes reached for 0 hours, 8 are needed	
<b>Warrant 1B - Interruption of Continuous Traffic</b> ..... <b>Not Satisfied</b>	
Required volumes reached for 0 hours, 8 are needed	
<b>Warrant 1 A&amp;B - Combination of Warrants</b> ..... <b>Not Satisfied</b>	
Required volumes reached for 0 hours, 8 are needed	
<b>Warrant 2 - Four Hour Volumes</b> .....	<b>Not Satisfied</b>
Number of hours (1) volumes exceed minimum < minimum required (4).	
<b>Warrant 3 - Peak Hour</b> .....	<b>Not Satisfied</b>
<b>Warrant 3A - Peak Hour Delay</b> ..... <b>Not Satisfied</b>	
Approach volumes on minor street don't exceed minimums for any hour. Delay data not evaluated.	
<b>Warrant 3B - Peak Hour Volumes</b> ..... <b>Not Satisfied</b>	
Volumes do not exceed minimums for any hour.	
<b>Warrant 4 - Pedestrian Volumes</b> .....	<b>Not Evaluated</b>
<b>Warrant 5 - School Crossing</b> .....	<b>Not Evaluated</b>
<b>Warrant 6 - Coordinated Signal System</b> .....	<b>Not Evaluated</b>
<b>Warrant 7 - Crash Experience</b> .....	<b>Not Evaluated</b>
<b>Warrant 8 - Roadway Network</b> .....	<b>Not Evaluated</b>
<b>Warrant 9 - Intersection Near a Grade Crossing</b> .....	<b>Not Evaluated</b>

**Ramey Kemp & Associates, Inc.**  
Westover Road & Moorefield Bridge Road  
Future Traffic Conditions

**Signal Warrants - Summary**



**Analysis of 8-Hour Volume Warrants:**

**War 1A-Minimum Volume**

**War 1B-Interruption of Traffic**

**War 1C-Combination of Warrants**

Hour Begin	Major Total	Minor Vol	Dir	Maj 420	Min 105	Hour Begin	Major Total	Minor Vol	Dir	Maj 630	Min 53	Hour Begin	Major Total	Minor Vol	Dir	Maj 504	Min 84
16:45	409	238	SB	No	Yes	16:45	409	238	SB	No	Yes	16:45	409	238	SB	No	Yes
16:30	403	218	SB	No	Yes	16:30	403	218	SB	No	Yes	16:30	403	218	SB	No	Yes
17:00	397	238	SB	No	Yes	17:00	397	238	SB	No	Yes	17:00	397	238	SB	No	Yes
16:15	383	163	SB	No	Yes	16:15	383	163	SB	No	Yes	16:15	383	163	SB	No	Yes
16:00	376	174	SB	No	Yes	16:00	376	174	SB	No	Yes	16:00	376	174	SB	No	Yes
15:30	364	122	SB	No	Yes	15:30	364	122	SB	No	Yes	15:30	364	122	SB	No	Yes
17:15	362	266	SB	No	Yes	17:15	362	266	SB	No	Yes	17:15	362	266	SB	No	Yes
15:45	336	151	SB	No	Yes	15:45	336	151	SB	No	Yes	15:45	336	151	SB	No	Yes
15:15	331	133	SB	No	Yes	15:15	331	133	SB	No	Yes	15:15	331	133	SB	No	Yes
17:30	318	236	SB	No	Yes	17:30	318	236	SB	No	Yes	17:30	318	236	SB	No	Yes
15:00	312	128	SB	No	Yes	15:00	312	128	SB	No	Yes	15:00	312	128	SB	No	Yes
17:45	302	207	SB	No	Yes	17:45	302	207	SB	No	Yes	17:45	302	207	SB	No	Yes
14:45	296	157	SB	No	Yes	14:45	296	157	SB	No	Yes	14:45	296	157	SB	No	Yes
18:00	281	201	SB	No	Yes	18:00	281	201	SB	No	Yes	18:00	281	201	SB	No	Yes
14:30	270	163	SB	No	Yes	14:30	270	163	SB	No	Yes	14:30	270	163	SB	No	Yes
14:15	265	160	SB	No	Yes	14:15	265	160	SB	No	Yes	14:15	265	160	SB	No	Yes
13:45	259	126	SB	No	Yes	13:45	259	126	SB	No	Yes	13:45	259	126	SB	No	Yes
12:15	248	102	SB	No	No	12:15	248	102	SB	No	Yes	12:15	248	102	SB	No	Yes
11:45	248	114	SB	No	Yes	11:45	248	114	SB	No	Yes	11:45	248	114	SB	No	Yes
11:30	246	112	SB	No	Yes	11:30	246	112	SB	No	Yes	11:30	246	112	SB	No	Yes
14:00	245	160	SB	No	Yes	14:00	245	160	SB	No	Yes	14:00	245	160	SB	No	Yes
12:00	244	102	SB	No	No	12:00	244	102	SB	No	Yes	12:00	244	102	SB	No	Yes
13:00	242	112	SB	No	Yes	13:00	242	112	SB	No	Yes	13:00	242	112	SB	No	Yes
12:30	240	102	SB	No	No	12:30	240	102	SB	No	Yes	12:30	240	102	SB	No	Yes

APPENDIX M  
SITE PHOTOGRAPHS



**LEGEND**



PHOTOGRAPH LOCATION AND NUMBER



**Dewberry**



**RAMEY KEMP & ASSOCIATES**  
TRANSPORTATION ENGINEERS

MOOREFIELD BRIDGE ROAD (RTE. 863) PHOTOGRAPH LOCATIONS  
PITTSYLVANIA COUNTY AND DANVILLE, VIRGINIA

APPENDIX

**M**



Photo #1: Intersection of Moorefield Bridge Road and Westover Drive Looking West



Photo #2: Intersection of Moorefield Bridge Road and Westover Drive Looking East



Photo #3: Intersection of Moorefield Bridge Road and Westover Drive Looking North



Photo #4: Intersection of Moorefield Bridge Road and River Ridge Road Looking South



Photo #5: Intersection of Moorefield Bridge Road and River Ridge Road Looking North



Photo #6: Intersection of Moorefield Bridge Road and River Ridge Road Looking South



Photo #7: Intersection of Moorefield Bridge Road and River Ridge Road Looking North



Photo #8: Moorefield Bridge Road Looking North



Photo #9: Moorefield Bridge Road Looking South

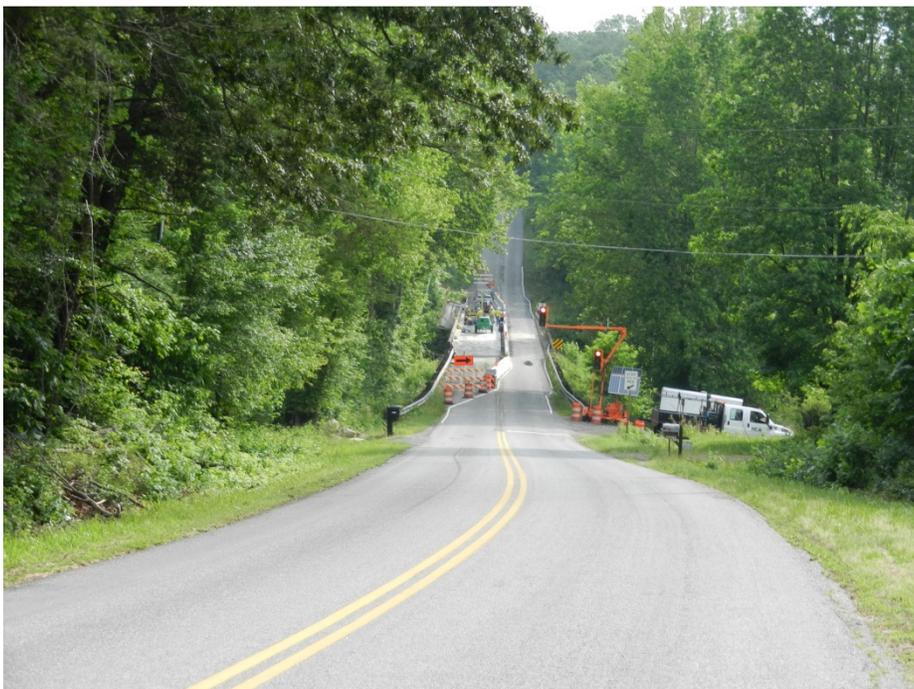


Photo #10: Moorefield Bridge Road Bridge Over Sandy River



Photo #11: Moorefield Bridge Road Looking North



Photo #12: Moorefield Bridge Road Looking South and Existing Cemetery



Photo #13: Moorefield Bridge Road Looking South



Photo #14: Moorefield Bridge Road Looking North



Photo #15: Intersection of Moorefield Bridge Road and Mount Cross Road Looking East



Photo #16: Intersection of Moorefield Bridge Road and Mount Cross Road Looking West



Photo #17: Intersection of Moorefield Bridge Road and Mount Cross Road Looking West



Photo #18: Intersection of Moorefield Bridge Road and Mount Cross Road Looking East



Photo #19: Moorefield Bridge Road Looking North to the Intersection with Mount Cross Road



Photo #20: Moorefield Bridge Road Looking South to the Intersection with Mount Cross Road