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**S**trategically

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**R**oadway

**S**olutions

**Mount Cross Road and  
Stony Mill Road/Tunstall High Road**

**Intersection Analysis Study**

**Pittsylvania County, VA**

May 2014



Prepared for:  
Virginia Department of Transportation



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## 1.0 Introduction

The Virginia Department of Transportation (VDOT) and West Piedmont Planning District Commission (WPPDC) identified the need to evaluate the Mount Cross Road (Route 844) and Stony Mill Road/Tunstall High Road (Route 869) intersection located in Pittsylvania County, Virginia (shown in **Figure 1**). VDOT has received complaints and various inquiries from members of the Pittsylvania County Board of Supervisors, local emergency services personnel, users of Tunstall High School (staff, parents, and students), and local residents. Therefore, a need has been identified to evaluate the existing and future conditions at the study intersection. This evaluation will be used to identify potential transportation improvement solutions at the study intersection and to assist VDOT, Pittsylvania County, and the WPPDC staff in their discussions with property owners and developers as they convey future plans and projects in the vicinity of the study intersection. This study will link future traffic demand and the roadway network together, allowing the local planning agencies to make informed land use, transportation, and economic development decisions. This study provided an assessment of potential future transportation improvements to justify funding to support future traffic growth in the area. Specifically, the intended outcomes of this study were to:

- ❖ Determine the safety and integrity of existing transportation infrastructure, including vehicular, bicycle, and pedestrian infrastructure
- ❖ Provide consensus-based, future recommended improvements that improve safety and mobility for all modes of transportation

The purpose of this study was to evaluate potential improvements to the intersection of Mount Cross Road and Stony Mill Road /Tunstall High Road to enhance intersection safety and operations. This study focused primarily on traffic operations, access management, and safety during typical weekday operations. The limits of this study area are defined by the functional area of the Mount Cross Road and Stony Mill Road intersection, which is approximately 500 feet on each approach.

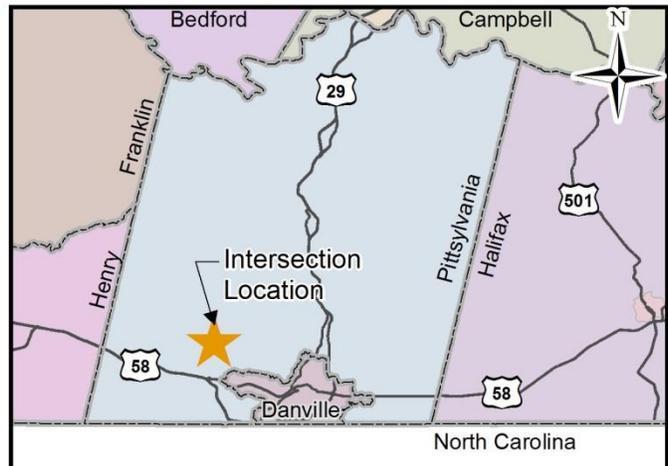
This study documents the following information: data collection and inventory summary; existing conditions analyses; future conditions analyses; development and analysis of the proposed improvements; results of the environmental investigation; and the final recommendations with the plan of action to mitigate study intersection deficiencies. This study will serve as a technical document that describes and illustrates the feasibility of the proposed alternatives as well as the associated potential operational and safety impacts of each. The alternatives were evaluated based on the following criteria: level of service, crash modification factors, pedestrian accommodations, construction cost estimates, environmental impacts, right-of-way impacts, and consistency with future land use plans.

Figure 1: Location Map



**Mount Cross Road (Route 844) and  
Stony Mill Road (Route 869) /  
Tunstall High Road (Route 869)**

**Pittsylvania County, VA**



## 2.0 Existing Conditions

An inventory of existing roadway conditions was prepared along Mount Cross Road and Stony Mill Road based on a field review conducted on December 4, 2013. Traffic, crash and geographic information system (GIS) data was used to document existing conditions. During the field review, the following information was collected and compiled:

- ❖ Digital photographs and video to capture the following elements of interest:
  - Roadway geometrics (lane widths and shoulder widths)
  - Signing and striping
  - Posted speed limits
  - Sight distance issues
  - Operational conditions
  - Safety-related issues
  - Potential constraints
- ❖ Observations of existing roadway conditions to determine opportunities for improvements to increase safety
- ❖ Observations of traffic operations including passenger cars and trucks

The existing conditions analyses were developed using the data collected during the field review as well as visual observations of the operational characteristics. This section of the report describes the analysis of the existing traffic conditions at the study intersection. The intent of the quantitative and qualitative analyses is to understand the current operations and safety issues of the Mount Cross Road and Stony Mill Road intersection to provide a baseline for the comparison of the proposed alternatives.

### 2.1 Existing Roadway Conditions

The following information consists of a brief description of existing roadway characteristics of each facility.

#### 2.1.1 Mount Cross Road (Route 844)

Mount Cross Road is classified as a rural minor collector according to VDOT's Pittsylvania County 2005 Functional Classification map. The section of roadway within the study area is oriented in an east-west direction and is a two-lane, undivided roadway with a paved shoulder ranging from 0 to 1 feet wide and an open ditch cross section.

**Photographs 1** and **2** show the eastbound and westbound approaches, respectively. The Mount Cross Road speed limit ranges from 25 MPH to 55 MPH in the vicinity of Stony Mill Road. **Figure 2** shows the location of the speed limit changes that occur on Mount Cross Road in the vicinity of Stony Mill Road. A combined Cross Road (W2-1) and "WATCH FOR TURNING VEHICLES" warning sign is located approximately 500 feet and 600 feet in advance of Stony Mill Road on the eastbound and westbound approaches, respectively.

#### 2.1.2 Stony Mill Road/Tunstall High Road (Route 869)

Stony Mill Road/Tunstall High Road is classified as a rural major collector according to VDOT's Pittsylvania County 2005 Functional Classification map. The roadway is referred to as Stony Mill Road south of Mount Cross Road and is referred to as Tunstall High Road north of Mount Cross Road. The section of roadway within the study area is oriented in a north-south direction and is a two-lane, undivided roadway with no shoulder and an open ditch cross section. **Photographs 3** and **4** show the northbound and southbound approaches, respectively. The Stony Mill Road/Tunstall Road speed limit ranges from 35 MPH to 45 MPH in the vicinity of Mount Cross Road. Tunstall High Road also has a 25 MPH school speed limit zone in the vicinity of Tunstall High School, north of Mount Cross Road, which is only in effect when flashing. **Figure 3** shows the location of the speed limit changes that occur on Stony Mill Road/Tunstall High Road in the vicinity of Mount Cross Road. A Stop Ahead (W3-1) warning sign is located approximately 500 feet in advance of Mount Cross Road on the northbound approach. Oversized (48 inch by 48

inch) Stop (R1-1) signs are located on the northbound and southbound approaches as shown in **Photograph 5**.



**Photograph 1:**  
Eastbound Approach – Mount Cross Road



**Photograph 2:**  
Westbound Approach – Mount Cross Road



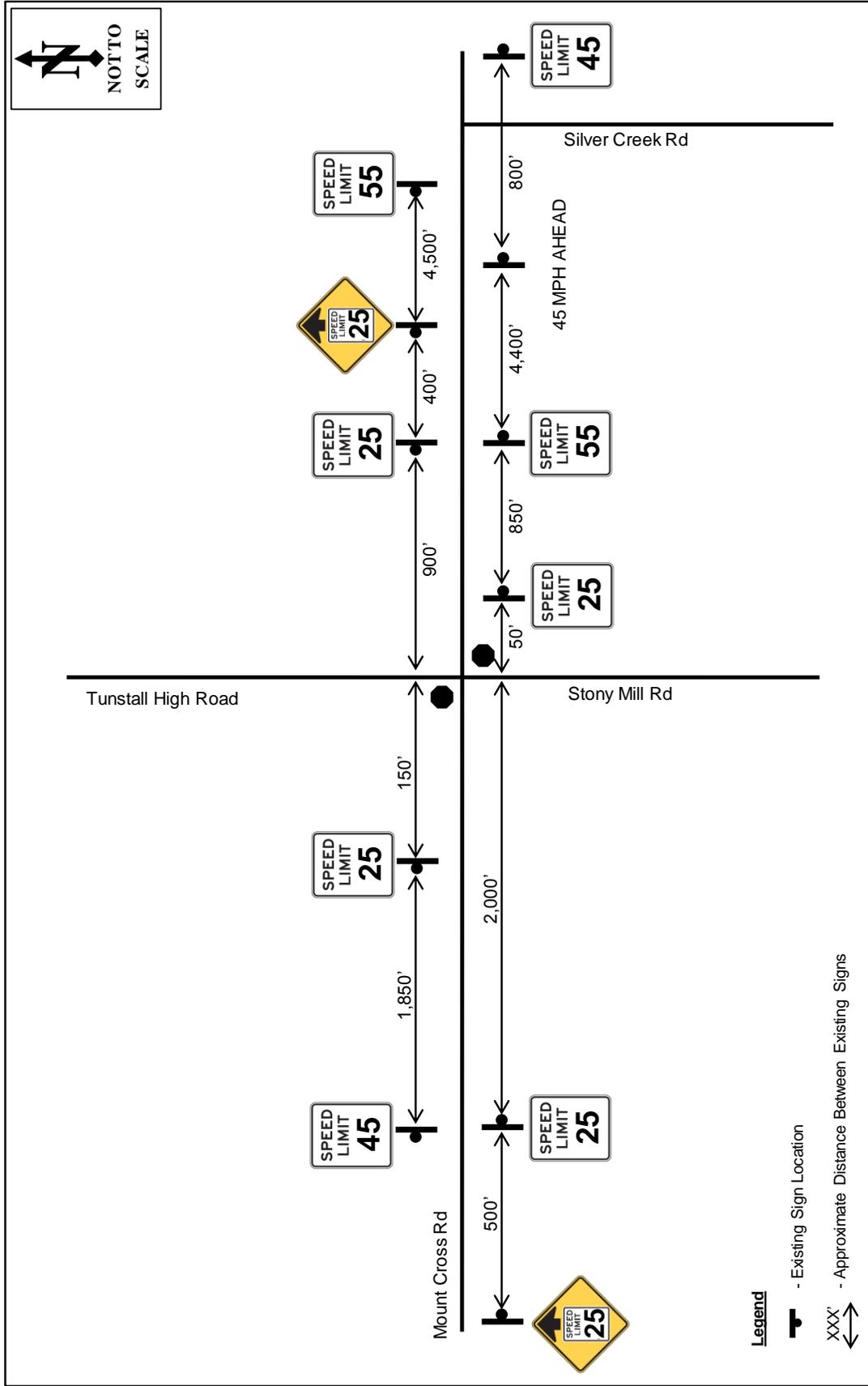
**Photograph 3:**  
Northbound Approach – Stony Mill Road



**Photograph 4:**  
Southbound Approach – Tunstall Road



**Photograph 5:**  
Oversized (48 inch by 48 inch) Stop Sign



**INVENTORY OF SPEED LIMITS ON MOUNT CROSS ROAD**  
 Mount Cross Road (Route 844) & Stony Mill Road (Route 869)  
 Pittsylvania County, Virginia

**FIGURE 2**

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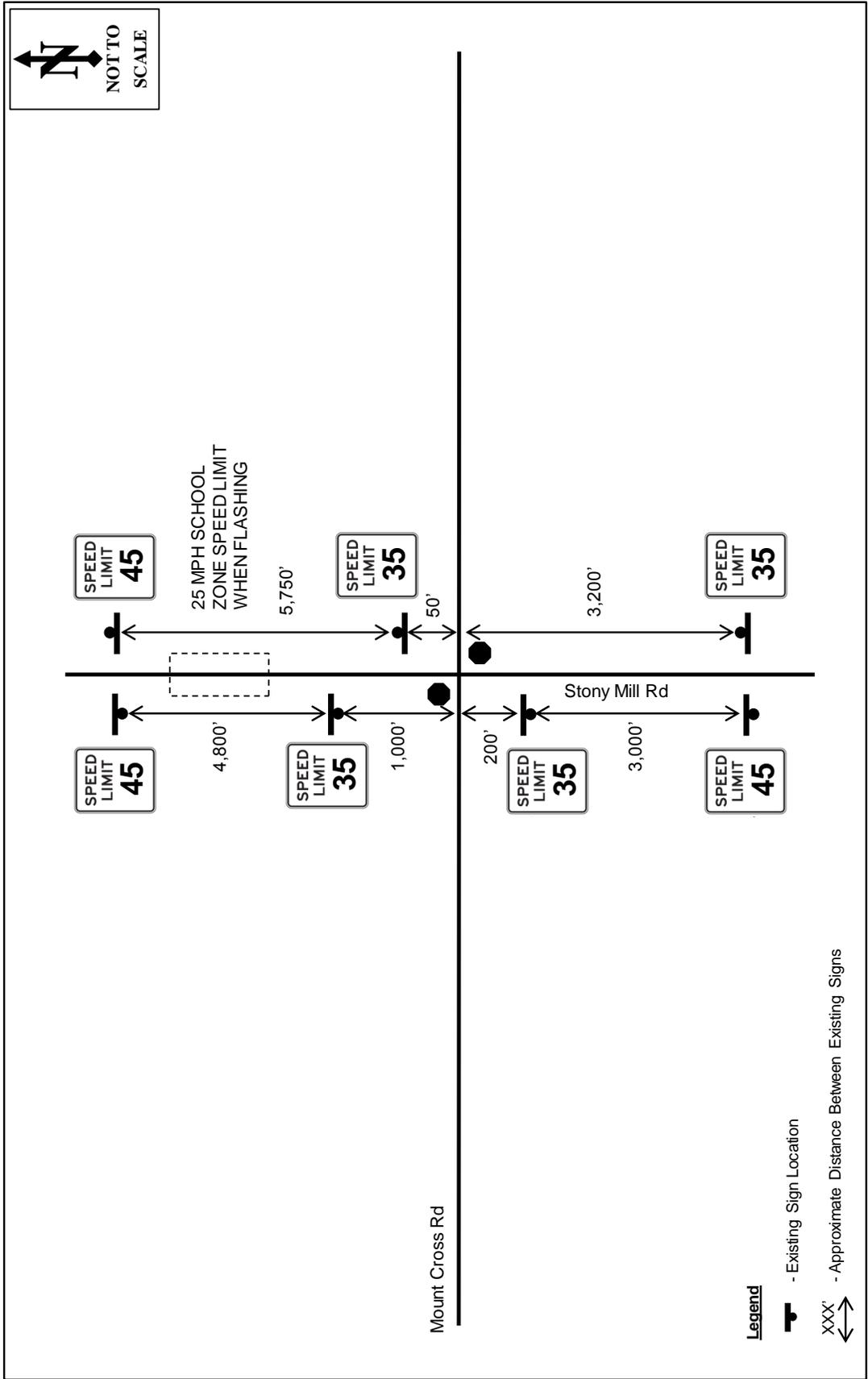


FIGURE  
3

**INVENTORY OF SPEED LIMITS ON STONY MILL RD/TUNSTALL HIGH RD**  
Mount Cross Road (Route 844) & Stony Mill Road (Route 869)  
Pittsylvania County, Virginia



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**2.2 Existing Intersection Conditions**

The study intersection currently operates as a two-way stop intersection. The northbound and southbound approaches are stop-controlled and the eastbound and westbound approaches are free-flow. Turn lanes are not provided at the study intersection; however, a right-turn flare is provided on the northbound approach. Intersection lighting and bicycle and pedestrian accommodations are not provided at the study intersection. The sight distance on the southbound approach exceeds the required 280 feet, which is the minimum sight distance on a 25 MPH roadway (per the *VDOT Road Design Manual*). However, the sight distance on the southbound approach looking to the right and left is near the minimum sight distance required as shown in **Photograph 6** and **7**, respectively. Therefore, if vehicles are traveling above the speed limit on Mount Cross Road, sufficient sight distance would not be provided. A wide variety of land uses are located within the vicinity of the subject intersection, including residential, commercial, and civic (school/fire department/rescue squad) uses.



**Photograph 6:**  
Southbound Approach – Sight Distance Looking Right



**Photograph 7:**  
Southbound Approach – Sight Distance Looking Left

**2.3 Access**

A total of 21 access points are located within a 500-foot radius of the Mount Cross Road and Stony Mill Road intersection, as shown in **Table 1**. A majority of the access points serve residential parcels and therefore typically have a minimal number of vehicle trips entering onto and exiting the roadway network. In addition, wide commercial entrance widths exist on the southwest quadrant of the study intersection at the Mills Grill & Grocery (**Photograph 8** and **9**). Wide commercial entrance widths can lead to driver confusion when multiple vehicles are entering and/or exiting the access point.

**Table 1 – Existing Access Points within 500 Feet of the Study Intersection**

|                                | Mount Cross Rd | Mt Cross Rd | Tunstall High Rd | Stony Mill Rd | Total |
|--------------------------------|----------------|-------------|------------------|---------------|-------|
|                                | East Leg       | West Leg    | North Leg        | South Leg     |       |
| <b>Number of Access Points</b> | 5              | 7           | 3                | 6             | 21    |



**Photograph 8:**  
Eastbound Approach – Access to Mills Grill & Grocery



**Photograph 9:**  
Northbound Approach – Access to Mills Grill & Grocery

### 3.0 Background Traffic Studies

Several relevant traffic engineering studies were previously completed at and within the vicinity of the study area. A brief summary of each study is provided in this section of the report.

#### 3.1 Mount Cross Road 25 MPH Extension

A request was made to VDOT by a local citizen in September 2003 to extend the 25 MPH speed zone on Mount Cross Road past the Sharon Meadows Development entrance. VDOT Traffic Engineering conducted a review on Mount Cross Road and recommended that the existing 25 MPH speed limit be extended 0.15 miles to the west to cover the entrance to Sharon Meadows Development. On September 22, 2003, work was completed to extend the 25 MPH speed zone as recommend by VDOT Traffic Engineering. The resulting 25 MPH speed zone on Mount Cross Road is as follows:

- From: 0.35 miles west of Stony Mill Road
- To: 0.18 miles east of Stony Mill Road
- Total Length: 0.53 miles

#### 3.2 Traffic Signal Study Request

A request was made to VDOT by the Pittsylvania County Schools Director of Transportation in December 2003 to review the School Board’s original request to install a traffic signal at the study intersection. Based on VDOT’s traffic signal warrant analysis report, it was concluded that a traffic signal was not warranted at the subject intersection. However, VDOT documented the following supplementary recommendations, the last two of which were completed on March 3, 2004:

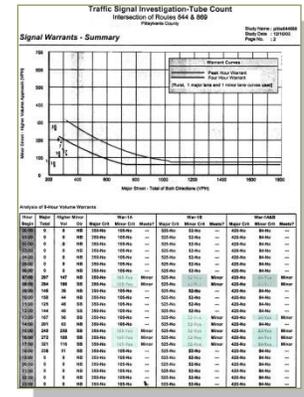
- ❖ Sub-standard entrances to the business on the southwest corner should be brought up to standards should the business change hands or the type of business change
- ❖ No Parking signs should be installed on Stony Mill Road between the two entrances to the business on the southeast corner to mitigate parked vehicles creating sight distance issues
- ❖ Watch for Turning Vehicle signs should be installed under the advanced Crossroad signs on Mount Cross Road

As part of VDOT’s review, it was concluded that sight distance is limited on all four approaches to the subject intersection. Specifically, the sight distance on the southbound approach, looking to the east, is 327 feet. This sight distance could be improved by re-sloping the bank; however, VDOT suggested that this improvement may be cost prohibitive due to right-of-way impacts. VDOT also stated that major intersection reconstruction to adjust the

grades on all approaches to improve sight distance and the addition left-turn lanes on Mount Cross Road were not economically feasible due to other needs in the County. Lastly, VDOT suggested that the School Board consider requesting the Sheriff's Department to monitor traffic or assist the school buses during the peak hours.

### 3.3 Intersection Review

A request was made to VDOT by the Pittsylvania County Administrator in January 2005 to review the subject intersection due to a significant increase in traffic volumes and a safety concern with school traffic during the peak hours. A second request was made to VDOT in February 2005 to review the subject intersection for the possibility of flashing lights or a traffic signal. Based on VDOT's updated review in April 2005, it was concluded that a traffic signal was not warranted at the subject intersection. A sight distance review was conducted on the northbound and southbound approaches and each approach was found to meet the sight distance requirement of 280 feet for a 25 MPH roadway. Speed data collected at the intersection concluded the 85<sup>th</sup> percentile speed on Mount Cross Road was 40 MPH which exceeded the posted 25 MPH speed limit. Based on observations, delays were not excessive at the intersection. VDOT recommended increased enforcement of the 25 MPH speed limit by the Sheriff's Department. VDOT also recommended a Deputy be stationed at the intersection to direct traffic and ensure buses could cross Mount Cross Road without difficulty.

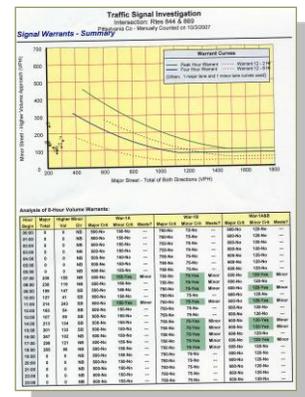


### 3.4 Tunstall High Road Speed Study

A request was made to VDOT by a local citizen in March 2006, stating their concern with the speed of vehicles on Tunstall High Road in the vicinity of the High School and Middle School. VDOT Traffic Engineering conducted a review of the subject corridor from the 35 MPH speed zone at the southern end to the 45 MPH speed zone at Whitmell School Road to the north. VDOT concluded that the speed limit on Tunstall High Road should be reduced to 45 MPH from 0.18 miles north of Mount Cross Road to Whitmell School Road, a total distance of 1.55 miles, due to roadside development (two schools), speed samples, and crash data. VDOT authorized the speed limit adjustment and the 45 MPH speed zone was posted on July 26, 2006.

### 3.5 Mount Cross Road Speed Study

A request was made to VDOT by a local citizen in July 2006, requesting a reduced speed limit on Mount Cross Road from west of Stony Mill Road to Cross Stich Road due to curves and private entrances along Mount Cross Road. VDOT Traffic Engineering conducted a review of the subject corridor and revealed that vehicles were obeying the 55 MPH speed limit (85<sup>th</sup> percentile speed was 54.76 MPH). However, due to significant development and several private entrances with limited sight distance, VDOT concluded that the subject corridor qualified for a 45 MPH speed zone to improve safety. VDOT authorized the speed limit adjustment and the 45 MPH speed zone was posted on October 18, 2006.



### 3.6 Traffic Signal Review

A request was made to VDOT by a Pittsylvania County Board of Supervisor in September 2007 to review the subject intersection for a traffic signal. Based on VDOT's updated crash review, it was concluded a traffic signal was not warranted at the subject intersection. Speed data collected at the intersection concluded the 85<sup>th</sup> percentile speed on Mount Cross Road was 40 MPH which exceeded the posted 25 MPH speed limit. VDOT recommended increased enforcement of the 25 MPH speed limit by the Sheriff's Department.

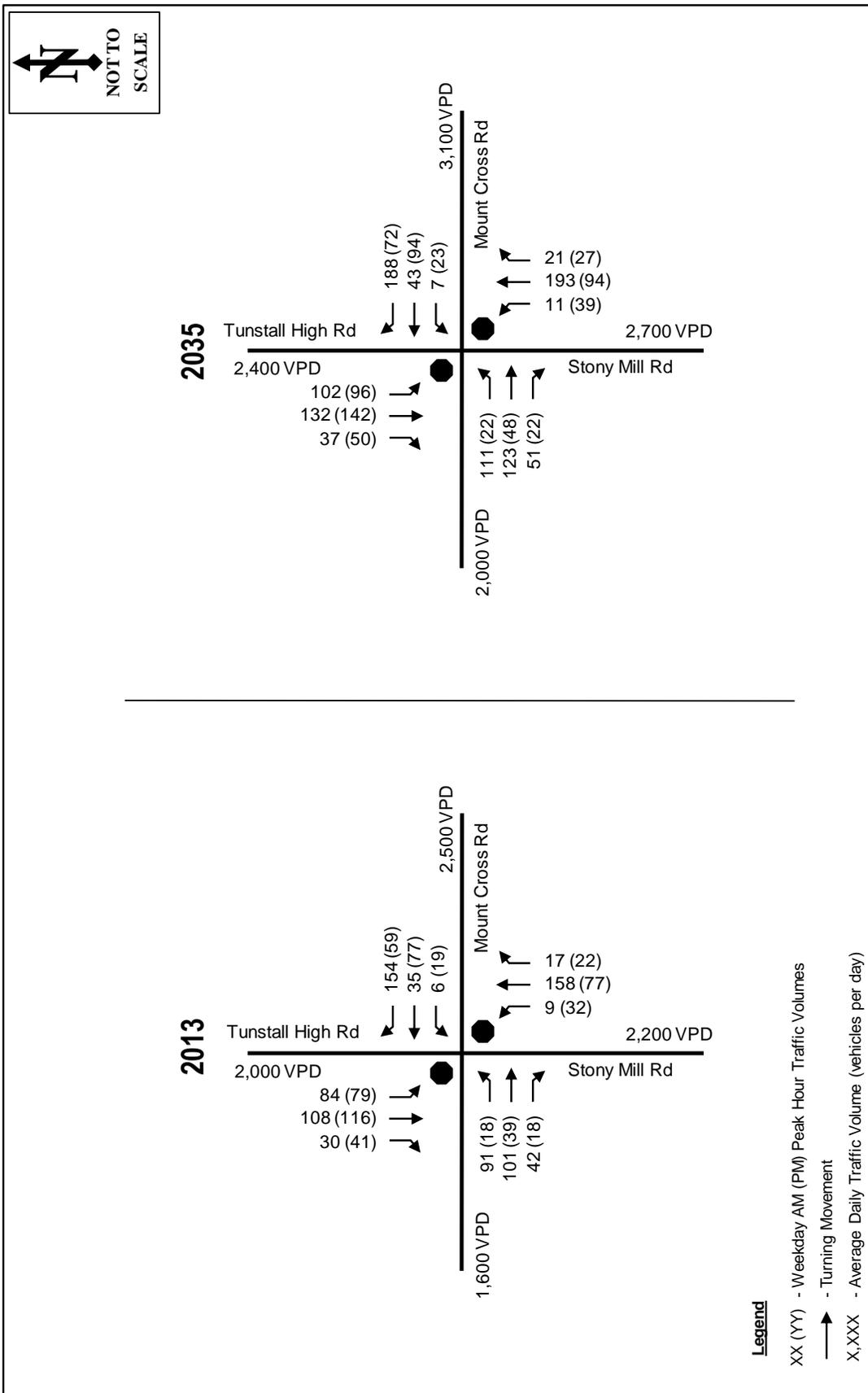
## 4.0 Traffic Volumes

### 4.1 Existing Traffic Volumes

A weekday 12-hour (7:00 AM – 7:00 PM) turning movement count was conducted at the study intersection on Tuesday, December 10, 2013. Using this 12-hour data, the weekday AM and PM peak hours were computed to be 7:30-8:30 AM and 2:45-3:45 PM, respectively. The 2013 Existing AM and PM peak hour volumes at the study intersection are shown in **Figure 4**. The 12-hour turning movement count data is provided in **Appendix A**. Based on the 2012 VDOT published traffic data, the approximate annual average daily traffic (AADT) volume on Mount Cross Road is 2,500 vehicles per day (VPD) to the east of Stony Mill Road and 1,600 VPD to the west of Stony Mill Road. The approximate AADT volume on Stony Mill Road is 2,200 VPD to the south of Mount Cross Road. The approximate AADT on Tunstall Road is 2,000 VPD to the north of Mount Cross Road.

### 4.2 Future 2035 Traffic Volumes

The existing traffic volumes were grown linearly to determine 2035 (Horizon Year) volumes. An annual growth rate of 1.0% was computed based on a review of historic VDOT published traffic data, US census data, and the regional travel demand model. This growth rate was used to forecast traffic volumes to the future year of 2035 at the study intersection. The 2035 AM and PM peak hour traffic volumes at the study intersection are shown in **Figure 4**. Projected 12-hour 2035 traffic volumes are shown in **Appendix A**.



**EXISTING AND PROJECTED TURNING MOVEMENT VOLUMES**  
 Mount Cross Road (Route 844) & Stony Mill Road (Route 869)  
 Pittsylvania County, Virginia

**FIGURE 4**

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5.0 Traffic Signal Warrant and Turn Lane Warrant Analysis

5.1 Traffic Signal Warrant Analysis

A traffic signal warrant analysis was performed under 2013 and 2035 conditions at the study intersection. All traffic signal warrants were performed based on methodologies defined in the Manual of Uniform Traffic Control Devices (MUTCD, 2009 edition). This approach is consistent with methods used by VDOT to determine whether a traffic signal should be considered at an intersection. Nine warrants are documented in the MUTCD, which provides guidance on justification of traffic signal installation. The results of the nine warrants are provided below.

5.1.1 Warrants 1 through 3

Warrant 1 (Eight-Hour Vehicular Volume), Warrant 2 (Four-Hour Vehicular Volume), and Warrant 3 (Peak Hour) were evaluated at the study intersection. The existing and derived 2035 twelve-hour traffic volumes at the study intersection were used to perform the existing and 2035 traffic signal warrant analysis. Warrant 1 contains three conditions which are shown in **Table 2**. The results of warrants 1 through 3 are shown in **Table 3**.

Table 2: MUTCD Warrant 1 Conditions

| Warrant 1   | Eight-Hour Vehicular Volume                |
|-------------|--|
| Condition A | Minimum Vehicular Volume                   |
| Condition B | Interruption of Continuous Traffic         |
| Combination | Combination of Condition A and Condition B |

Table 3: Traffic Signal Warrant Analysis Results

|                      | Warrant 1A                          | Warrant 1B                          | Warrant 1 Combination               | Warrant 2                           | Warrant 3 |
|----------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-----------|
| <b>2013 Existing</b> | Not Met<br>(0 of 8 hours satisfied) | Not Met<br>(0 of 8 hours satisfied) | Not Met<br>(0 of 8 hours satisfied) | Not Met<br>(1 of 4 hours satisfied) | Not Met   |
| <b>2035</b>          | Not Met<br>(2 of 8 hours satisfied) | Not Met<br>(0 of 8 hours satisfied) | Not Met<br>(0 of 8 hours satisfied) | Not Met<br>(2 of 4 hours satisfied) | Not Met   |

Under existing and 2035 traffic conditions, the study intersection is not projected to meet traffic signal Warrant 1, Warrant 2, or Warrant 3. The study intersection should be monitored if existing traffic patterns and/or land use changes occur within the vicinity of the study intersection. Should future traffic conditions warrant the consideration of a traffic signal, a traffic signal warrant analysis should be conducted at that time. Detailed traffic signal warrant worksheets are included in **Appendix B**.

5.1.2 Warrant 4

Warrant 4 (Pedestrian Volume) is intended for applications where traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street. To meet the requirements for Warrant 4, the pedestrian volume crossing the major street along with the major street traffic volume at an intersection (or midblock location) during an average day are plotted against two charts provided in the MUTCD. On the first chart, each of any four hours must exceed the warrant, while on the second chart any one hour must exceed the

warrant. One pedestrian was counted at the subject intersection during the 12-hour traffic count conducted; therefore, the pedestrian volume requirements of Warrant 4 were not met.

### 5.1.3 Warrant 5

Warrant 5 (School Crossing) is intended for application where school children crossing the major street are the principal reason to install a traffic signal. To meet the requirements for Warrant 5, there must be a minimum of 20 students during the highest crossing hour across the major street. Although there are two schools in the vicinity of the study intersection, the counted volume of pedestrians does not meet the 20 student minimum. Therefore, Warrant 5 was not met.

### 5.1.4 Warrant 6

Warrant 6 (Coordinated Signal System) is applicable in situations where a coordinated signal system necessitates the installation of a traffic control signal to maintain proper platooning of vehicles. The subject intersection is not located within a coordinated network; therefore, Warrant 6 was not met.

### 5.1.5 Warrant 7

Warrant 7 (Crash Experience) is intended for application where the severity and frequency of crashes are the principle reasons to consider installing a traffic control signal. To meet the requirements for Warrant 7, there must be a history of crashes amounting to at least five crashes within the past year resulting in personal injury or property damage above the reporting thresholds. These crashes must also be of such a type that is correctable by the installation of a traffic signal. An adequate trial of alternatives must also have been attempted. In addition to meeting these criteria, certain vehicular and pedestrian volumes must be present for eight hours of the day. Based on a review of the crash data from 2010 through 2012, no single year had more than two crashes occur at the subject intersection; therefore, Warrant 7 was not met.

### 5.1.6 Warrant 8

Warrant 8 (Roadway Network) is intended for application where some intersections might be justified to encourage concentration and organization of traffic flow on a roadway network. To meet the requirements for Warrant 8, the *MUTCD* states that the intersection must have an existing or immediately projected entering volume of at least 1,000 vehicles per hour during the peak hour of a typical weekday and five-year projected traffic volumes that meet one or more of Warrants 1, 2, and 3 during an average weekday or 1,000 vehicles per hour for each of any five hours of a typical weekend (Saturday or Sunday). The projected 2035 AM peak hour is projected to exceed the 1,000 vehicles per hour entering the subject intersection; however, the projected traffic volumes do not meet one or more of Warrants 1, 2, and 3 during an average weekday. Therefore, Warrant 8 was not met.

### 5.1.7 Warrant 9

Warrant 9 (Intersection Near a Grade Crossing) is intended for use at intersections where the conditions described in the other eight traffic signal warrants are not met. To meet the requirements of Warrant 9, close proximity to a railroad grade crossing on an intersection approach controlled by a Stop or Yield sign is the principal reason to consider installing a traffic control signal. As no grade crossings exist within 140 feet of the subject intersection, Warrant 9 was not evaluated.

## 5.2 Traffic Signal Warrant Analysis Results

Based on an analysis of the *MUTCD* Traffic Signal Warrants 1 through 9, a traffic signal is not warranted at the Mount Cross Road and Stony Mill Road/Tunstall High Road intersection. **Table 4** provides a summary of the results

of Warrants 1 through 9.

**Table 4: Traffic Signal Warrant Analysis Results**

| Intersection                   | Warrants |         |         |         |         |         |         |         |         |         |
|--------------------------------|----------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
|                                | 1        | 2       | 3       | 4       | 5       | 6       | 7       | 8       | 9       |         |
| Mount Cross Rd / Stony Mill Rd | Not Met  | Not Met | Not Met | Not Met | Not Met | Not Met | Not Met | Not Met | Not Met | Not Met |

### 5.3 Turn Lane Warrant Analysis

Right- and left-turn lane warrant analyses were performed at the study area intersections under existing and 2035 traffic volume conditions in accordance with turn lane warrant analysis requirements contained in the *VDOT Road Design Manual* (see **Appendix C**). The results of the turn lane warrant analyses are summarized in **Tables 5** and **6**. Turn lane warrant worksheets are included in the **Appendix C**.

**Table 5: Right-Turn Lane Warrant Analysis Results**

|                  | Direction  | Existing (2013)           |                    | 2035                      |                    |
|------------------|------------|---------------------------|--------------------|---------------------------|--------------------|
|                  |            | AM Peak Hour              | PM Peak Hour       | AM Peak Hour              | PM Peak Hour       |
| Mount Cross Rd   | Eastbound  | Not Met                   | Not Met            | Met – Taper (100')        | Not Met            |
| Mount Cross Rd   | Westbound  | Met – Full* (200' x 100') | Met – Taper (100') | Met – Full* (200' x 100') | Met – Taper (100') |
| Stony Mill Rd    | Northbound | Not Met                   | Not Met            | Not Met                   | Not Met            |
| Tunstall High Rd | Southbound | Not Met                   | Not Met            | Not Met                   | Met – Taper (200') |

\*Storage increased to 200 feet as a result of greater than 60 vehicles turning and projected queues exceeding 100 feet.

**Table 6: Left-Turn Lane Warrant Analysis Results**

|                  | Direction  | Existing (2013) |              | 2035                    |              |
|------------------|------------|-----------------|--------------|-------------------------|--------------|
|                  |            | AM Peak Hour    | PM Peak Hour | AM Peak Hour            | PM Peak Hour |
| Mount Cross Rd   | Eastbound  | Not Met         | Not Met      | Met* (200' x 100')      | Not Met      |
| Mount Cross Rd   | Westbound  | Not Met         | Not Met      | Not Met                 | Not Met      |
| Stony Mill Rd    | Northbound | Not Met         | Not Met      | Not Met                 | Not Met      |
| Tunstall High Rd | Southbound | Not Met         | Not Met      | Not Met** (200' x 200') | Not Met      |

\*Storage increased to 200 feet as a result of greater than 60 vehicles turning and projected queues exceeding 100 feet.

\*\*Although the left-turn lane warrant was not met, the *VDOT Road Design Manual* suggests providing an exclusive left-turn lane when left-turn volumes are higher than 100 VPH. The projected 2035 southbound left-turn volume is 102 vehicles. Storage increased to 200 feet as a result of greater than 60 vehicles turning and projected queues exceeding 100 feet.

6.0 Proposed Alternatives

Two proposed alternatives were developed based on improving operations, access management, and safety.

6.1 Alternative 1 – Construct Turn Lanes

As shown in Figure 5, Alternative 1 consists of the construction of the aforementioned warranted turn lanes. Under 2035 traffic volume conditions, the following turn lanes meet the warrant threshold:

- ❖ Northbound Stony Mill Road
  - None
- ❖ Southbound Tunstall High Road
  - Left-Turn Lane
  - Right-Turn Taper
- ❖ Eastbound Mount Cross Road
  - Left-Turn Lane
  - Right-Turn Taper
- ❖ Westbound Mount Cross Road
  - Right-Turn Lane

Figure 5: Alternative 1 – Turn Lanes



In addition to an improvement to intersection capacity, turn lanes also offer a safety benefit. As defined in the Highway Capacity Manual (HCM), intersection turn lanes are desirable on two-lane highways to reduce delay to through vehicles caused by turning vehicles, and to reduce crashes related to turning. Left-turn lanes provide a protected location for turning vehicles to wait for an adequate gap in opposing traffic and reduce the potential for rear-end crashes.

According to VDOT’s Highway Safety Improvement Program (HSIP), the Highway Safety Program (HSP) Proposed Safety Improvements form identifies the associated safety benefit for different improvement types through the use of Crash Reduction Factors (CRF). As defined by the Federal Highway Administration, a CRF “is the percentage crash reduction that might be expected after implementing a given countermeasure at a specific site.” Based on VDOT’s Proposed Safety Improvements form, the addition of a left-turn lane can expect a 43% reduction in all rear-end, left-turn, and overturn crashes while the addition of a right-turn lane can expect a 21% reduction in all rear-end and right-turn crashes.

The planning level cost estimate for Alternative 1 is approximately \$2,920,000 (2014 dollars). The approximate planning level cost estimate is based on the VDOT Transportation and Mobility Planning Division (TMPD) Statewide Planning Level Cost Estimates, cost information from similar projects, and engineering judgment. **Table 7** includes a cost breakdown of the roadway; construction contingency; construction, engineering, and inspection (CEI); preliminary engineering (PE); and right-of-way acquisition and utility relocation costs. The planning level cost estimate is preliminary and is not based on design. Based on a review of available right-of-way near the intersection, it is anticipated Alternative 1 will require the acquisition of additional right-of-way in order to accommodate the roadway widening associated with the proposed turn lanes. Right-of-way impacts can alter the timeframe for implementation and estimated planning level cost.

**Table 7: Alternative 1 Planning Level Cost Estimate**

| Alternative 1 - Turn Lanes<br>Planning Level Cost Estimate (2014 dollars) |  |                     |
|---|--|---------------------|
|   | <b>Roadway Subtotal =</b>  | <b>\$ 1,296,000</b> |
| Construction Contingency  | 25% of Roadway Subtotal  | \$ 324,000          |
|   | <b>Total Cost (Roadway Subtotal + Contingency) =</b>             | <b>\$ 1,620,000</b> |
| Construction, Engineering, & Inspection (CEI)                             | 25% of Total Cost  | \$ 405,000          |
| Preliminary Engineering (Survey, Geotech, Design)                         | 15% of Total Cost  | \$ 243,000          |
| Right-of-Way Acquisition and Utility Relocation                           | 50% of Roadway Subtotal  | \$ 648,000          |
|   | <b>CEI, Preliminary Engineering, and Right-of-Way Subtotal =</b> | <b>\$ 1,296,000</b> |
|   | <b>Project Total (rounded to nearest \$10,000) =</b>             | <b>\$ 2,920,000</b> |

A summary of the pros and cons of Alternative 1 is provided in **Table 8**.

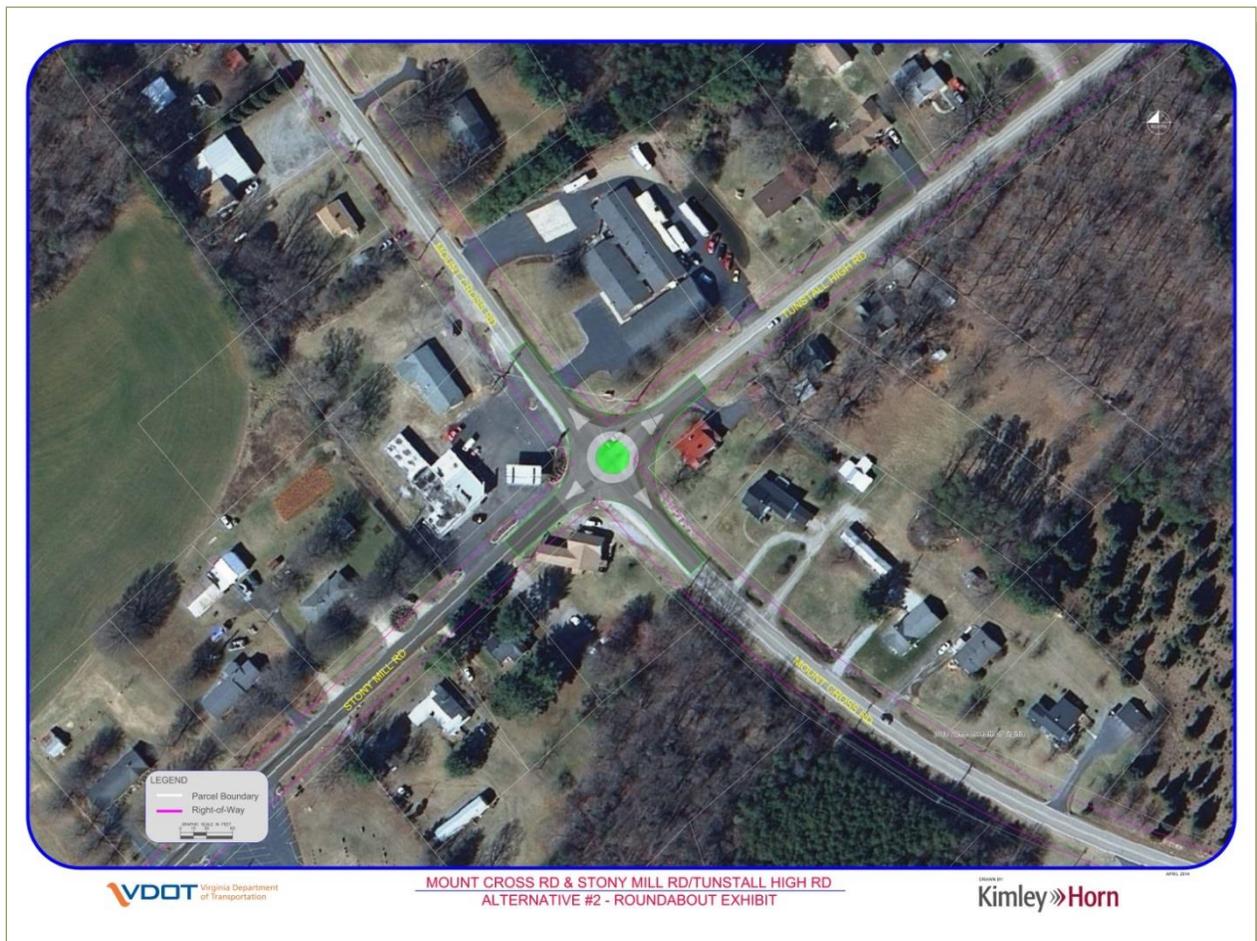
**Table 8: Alternative 1 Pros and Cons Summary**

| Pros   | Cons  |
|--|---|
| <ul style="list-style-type: none"> <li>Increases intersection capacity</li> <li>Improves safety                             <ul style="list-style-type: none"> <li>43% left-turn crash reduction</li> <li>21% right-turn crash reduction</li> </ul> </li> <li>Moves left- and right-turning vehicles out of through vehicles path</li> <li>Allows left-turning vehicles to wait for adequate gaps in traffic without holding up through vehicles</li> <li>Improves sight distance on Tunstall High Road (southbound) approach</li> </ul> | <ul style="list-style-type: none"> <li>Requires right-of-way</li> <li>Does not help reduce vehicle speeds on Mount Cross Road (traffic calming)</li> <li>Significant roadway impacts to transition turn lanes (up to 750 feet in advance of the intersection on each approach)</li> </ul> |

**6.2 Alternative 2 – Single-Lane Roundabout**

As shown in **Figure 6**, Alternative 2 consists of the reconfiguration of the subject intersection to a single-lane roundabout. The proposed roundabout would eliminate the need for turn lanes identified in Alternative 1. In addition to an improvement to intersection capacity, the proposed roundabout will potentially improve safety as well by reducing the number of conflict points in the intersection. Based on VDOT’s Proposed Safety Improvements form, the installation of a roundabout can expect a 72% reduction in all intersection related crashes. The proposed roundabout would also mitigate the limited sight distance on the southbound approach and act as a traffic calming measure. On the other hand, a rural roundabout can cause challenges to unfamiliar drivers and will impact existing access to surrounding developments. The analysis herein was based on minimum design requirements found in the *VDOT Road Design Manual – Appendix F* and the *National Cooperative Highway Research Program (NCHRP) Report 672: Roundabouts: An Informational Guide, Second Edition, 2010*.

**Figure 6: Alternative #2 – Single-Lane Roundabout**



The planning level cost estimate for Alternative 2 is approximately \$2,090,000 (2014 dollars). The approximate planning level cost estimate is based on the VDOT TMPD Statewide Planning Level Cost Estimates, cost information from similar projects, and engineering judgment. **Table 9** includes a cost breakdown of the roadway, contingency, CEI, PE, and right-of-way acquisition and utility relocation costs. The planning level cost estimate is preliminary and is not based on design. The planning level cost estimate also does not include access modifications to the surrounding parcels. Using an inscribed circle diameter of 100 feet (for rural single-lane roundabouts), it was determined that the construction of a roundabout has the potential to impact existing right-of-way, primarily

along the north side of study intersection. However, based on planning level information, Alternative 2 will likely require significantly less right-of-way acquisition than Alternative 1. Right-of-way impacts can alter the timeframe for implementation and estimated planning level cost.

**Table 9: Alternative 2 Planning Level Cost Estimate**

| Alternative 2 - Single-Lane Roundabout<br>Planning Level Cost Estimate (2014 dollars) |  |                     |
|---|--|---------------------|
|   | <b>Roadway Subtotal =</b>  | <b>\$ 928,000</b>   |
| Construction Contingency  | 25% of Roadway Subtotal  | \$ 232,000          |
|   | <b>Total Cost (Roadway Subtotal + Contingency) =</b>             | <b>\$ 1,160,000</b> |
| Construction, Engineering, & Inspection (CEI)   | 25% of Total Cost  | \$ 290,000          |
| Preliminary Engineering (Survey, Geotech, Design)                                     | 15% of Total Cost  | \$ 174,000          |
| Right-of-Way Acquisition and Utility Relocation                                       | 50% of Roadway Subtotal  | \$ 464,000          |
|   | <b>CEI, Preliminary Engineering, and Right-of-Way Subtotal =</b> | <b>\$ 928,000</b>   |
|   | <b>Project Total (rounded to nearest \$10,000) =</b>             | <b>\$ 2,090,000</b> |

A summary of the pros and cons of Alternative 2 is provided in Table 10.

**Table 10: Alternative 2 Pros and Cons Summary**

| Pros   | Cons  |
|--|---|
| <ul style="list-style-type: none"> <li>• Increases intersection capacity</li> <li>• Improves safety                             <ul style="list-style-type: none"> <li>• 72% intersection crash reduction</li> </ul> </li> <li>• Requires vehicles on Mount Cross Road to slow down before entering the roundabout (traffic calming)</li> <li>• Improves sight distance for Tunstall High Road (southbound) approach</li> <li>• Accommodates school buses, fire trucks, and other large vehicles</li> <li>• Limits right-of-way impacts</li> </ul> | <ul style="list-style-type: none"> <li>• Requires right-of-way</li> <li>• Requires modifications to access points in the immediate vicinity of the study intersection</li> <li>• Can be confusing to drivers who are unfamiliar with roundabouts</li> </ul> |

### 6.3 Additional Recommendations

The following recommendations were developed to supplement Alternative 1 and Alternative 2:

- ❖ Access management:
  - Better define the commercial access with new curb and gutter to Mills Grill & Grocery (gas station) in the southwest quadrant of the study intersection, especially along the Mount Cross Road frontage.
  - Provide adequate intersection/access spacing in accordance with VDOT’s Minimum Spacing Standards for Commercial Entrances, Intersections, and Median Crossovers from the *VDOT Road Design Manual*.
- ❖ Reduce the existing 55 MPH speed limit segment on Mount Cross Road in the vicinity of Silver Creek Road (Route 868), east of the study intersection, to 45 MPH.
- ❖ Increase awareness of the 25 MPH reduced speed limit on Mount Cross Road using one or more of the following methods:

- Install flashing beacons on the existing 25 MPH warning signs on the eastbound and westbound approaches.
- Install transverse rumble strips (double mil thickness) on the eastbound and westbound approaches.

### 7.0 Traffic Operational Analysis

Traffic operational analyses were conducted to evaluate the overall performance of the study intersection under existing and future conditions. All traditional intersection configuration analyses were conducted using Synchro Professional 8.0 (heretofore referred to as Synchro) while all roundabout analyses were conducted using SIDRA Intersection 5.1 (heretofore referred to as SIDRA). SimTraffic 8.0 was also used to analyze the queuing impacts at the traditional intersection configuration. Analyses were performed for the following four scenarios:

- ❖ **2013 Existing** – existing traffic demand and roadway configurations
- ❖ **2035 No-Build** – projected 2035 traffic demand with existing roadway configurations
- ❖ **2035 Alternative 1** – projected 2035 traffic demand with proposed Alternative 1 roadway configurations (addition of turn lanes and tapers)
- ❖ **2035 Alternative 2** – projected 2035 traffic demand with proposed Alternative 2 roadway configurations (single-lane roundabout)

### 7.1 Synchro and SIDRA Analyses

Capacity analyses allow traffic engineers to assess the operational conditions and identify the impacts of traffic on the surrounding roadway network. The Transportation Research Board’s (TRB) *Highway Capacity Manual* (HCM) methodologies govern the methodology for evaluating capacity and the quality of service provided to road users traveling through a roadway network. There are six letter grades for Levels of Service (LOS) ranging from A to F, with LOS A representing the best operating conditions and LOS F representing the worst operating conditions.

Intersection level of service is defined in terms of delay (seconds per vehicle), a measure of driver discomfort, frustration, fuel consumption, and lost travel time. **Table 11** summarizes the delay associated with each unsignalized and roundabout intersection LOS category.

**Table 11: Intersection Level of Service Criteria**

| LOS | Intersection Delay (sec/veh) |                       |
|-----|------------------------------|-----------------------|
|     | Unsignalized                 | Roundabout/Signalized |
| A   | 0 - 10                       | 0 - 10                |
| B   | >10 - 15                     | >10 – 20              |
| C   | >15 - 25                     | >20 – 35              |
| D   | >25 – 35                     | >35 – 55              |
| E   | >35 – 50                     | >55 – 80              |
| F   | >50                          | >80                   |

*\* Source: Transportation Research Board, Highway Capacity Manual 2000*

#### 7.1.1 Intersection Capacity Analyses

The unsignalized study intersection was analyzed using Synchro based on methodologies in the HCM 2000. The roundabout study intersection was analyzed using SIDRA based on the SIDRA Model methodologies, which uses the HCM 2000 traffic signal delay thresholds to determine LOS. To evaluate the study intersection, existing and projected traffic volume data was used in conjunction with existing and proposed geometric data to determine the LOS. For the analysis, the following assumptions were made:

- ❖ Heavy vehicle percentages from traffic count data with the following adjustments:
  - Minimum 2% heavy vehicle percentage for all approaches
- ❖ Peak hour factor (PHF) from traffic count data with the following adjustments:
  - Existing Conditions: Minimum PHF of 0.85 for all lane groups
  - Future Conditions: Minimum PHF of 0.92 for all lane groups
- ❖ Under Existing and No-Build conditions, a right-turn flare was analyzed on the northbound Stony Mill Road approach. The approximate 25 foot right-turn flare, allows right-turning vehicles to bypass one vehicle if stopped to make a northbound left or through movement.

The following tables summarize the delay and associated lane group LOS for the study intersection:

- ❖ **Table 12**– Existing Conditions
- ❖ **Table 13** – Projected 2035 No-Build Conditions
- ❖ **Table 14** – Projected 2035 Alternative 1 Conditions
- ❖ **Table 15** – Projected 2035 Alternative 2 Conditions

The corresponding Synchro and SIDRA output sheets are included in **Appendix D**.

### 7.1.2 Queuing Analysis

Queue length, or the distance at which stopped vehicles accumulate at an intersection, is another performance indicator of the intersection’s operational characteristics. Lengthy queues may be indicative of capacity or operational issues such as a needed turn lane, which helps in the identification of potential solutions. A queuing analysis was completed for the study intersection under both AM and PM peak hour conditions for each of the aforementioned scenarios. For unsignalized intersection conditions, SimTraffic was used to perform a 60-minute simulation for the analyses. The maximum observed queue length, measured in feet, was reported for each lane group based on an average of 10 simulation runs. For roundabout intersection conditions, SIDRA was used to compute the 95th percentile queue length, measured in feet, for each lane group.

The following tables summarize the projected maximum queue lengths for each lane group at the study intersection:

- ❖ **Table 12**– Existing Conditions
- ❖ **Table 13** – Projected 2035 No-Build Conditions
- ❖ **Table 14** – Projected 2035 Alternative 1 Conditions
- ❖ **Table 15** – Projected 2035 Alternative 2 Conditions

The corresponding SimTraffic and SIDRA output sheets are included in **Appendix E**.

**Table 12: 2013 Existing Conditions Synchro Results**

| Time of Day    | Delay (sec/veh) | LOS | Max Queue (ft) | Delay (sec/veh) | LOS | Max Queue (ft) |
|----------------|-----------------|-----|----------------|-----------------|-----|----------------|
| Lane Group     | AM Peak Hour    |     |                | PM Peak Hour    |     |                |
| Eastbound LTR  | 3.5             | A   | 76             | 1.9             | A   | 26             |
| Westbound LTR  | 0.3             | A   | 43             | 1.0             | A   | 28             |
| Northbound LTR | 23.9            | C   | 138            | 12.7            | B   | 80             |
| Southbound LTR | 45.7            | E   | 154            | 15.6            | C   | 119            |

**Table 13: 2035 No-Build Conditions Synchro Results**

| Time of Day    | Delay (sec/veh) | LOS | Max Queue (ft) | Delay (sec/veh) | LOS | Max Queue (ft) |
|----------------|-----------------|-----|----------------|-----------------|-----|----------------|
| Lane Group     | AM Peak Hour    |     |                | PM Peak Hour    |     |                |
| Eastbound LTR  | 3.6             | A   | 104            | 1.9             | A   | 40             |
| Westbound LTR  | 0.3             | A   | 36             | 1.0             | A   | 36             |
| Northbound LTR | 34.8            | D   | 183            | 14.0            | B   | 87             |
| Southbound LTR | 128.9           | F   | 200            | 18.8            | C   | 168            |

**Table 14: 2035 Alternative 1 Conditions Synchro Results**

| Time of Day    | Delay (sec/veh) | LOS | Max Queue (ft) | Delay (sec/veh) | LOS | Max Queue (ft) |
|----------------|-----------------|-----|----------------|-----------------|-----|----------------|
| Lane Group     | AM Peak Hour    |     |                | PM Peak Hour    |     |                |
| Eastbound L    | 8.0             | A   | 72             | 7.7             | A   | 28             |
| Eastbound T    | ~               | ~   | 5              | ~               | ~   | 2              |
| Eastbound R    | ~               | ~   | 30             | ~               | ~   | 6              |
| EB Approach    | 3.1             | A   | N/A            | 1.8             | A   | N/A            |
| Westbound LT   | 1.1             | A   | 29             | 1.6             | A   | 27             |
| Westbound R    | ~               | ~   | 46             | ~               | ~   | 19             |
| WB Approach    | 0.2             | A   | N/A            | 1.0             | A   | N/A            |
| Northbound LTR | 31.2            | D   | 180            | 13.5            | B   | 89             |
| NB Approach    | 31.2            | D   | N/A            | 13.5            | B   | N/A            |
| Southbound L   | 40.5            | E   | 89             | 13.8            | B   | 88             |
| Southbound T   | 17.7            | C   | 120            | 13.0            | B   | 92             |
| Southbound R   | 8.7             | A   | 52             | 9.1             | A   | 56             |
| SB Approach    | 25.1            | D   | N/A            | 12.6            | B   | N/A            |

~ Synchro does not report LOS for movements without conflicts

N/A – Max queue reported by lane group, not by approach

**Table 15: 2035 Alternative 2 Conditions SIDRA Results**

| Time of Day    | Delay (sec/veh) | LOS | 95% Queue (ft) | Delay (sec/veh) | LOS | 95% Queue (ft) |
|----------------|-----------------|-----|----------------|-----------------|-----|----------------|
| Lane Group     | AM Peak Hour    |     |                | PM Peak Hour    |     |                |
| Eastbound LTR  | 4.8             | A   | 53             | 3.8             | A   | 16             |
| Westbound LTR  | 4.1             | A   | 48             | 2.5             | A   | 29             |
| Northbound LTR | 5.9             | A   | 47             | 5.3             | A   | 24             |
| Southbound LTR | 5.2             | A   | 41             | 5.9             | A   | 50             |
| Overall        | 5.0             | A   | 53             | 4.7             | A   | 50             |

## 7.2 Traffic Operational Analysis Results

### 7.2.1 Existing Conditions

All of the study intersection lane groups operate at a LOS C or better with queues that do not exceed 150 feet (or approximately six vehicles) during the AM and PM peak hours with the exception of the following approach:

- ❖ Southbound Tunstall High Road approach during the AM peak hour (LOS E, 45.7 sec/veh of delay, 155-foot queue).

### 7.2.2 Projected 2035 No-Build Conditions

All of the study intersection lane groups operate at a LOS C or better with queues that do not exceed 150 feet (or approximately six vehicles) during the AM and PM peak hours with the exception of the following approaches:

- ❖ Northbound Stony Mill Road approach during the AM peak hour (LOS D, 34.8 sec/veh of delay, 183-foot queue).
- ❖ Southbound Tunstall High Road approach during the AM peak hour (LOS F, 128.9 sec/veh of delay, 200-foot queue).
- ❖ Southbound Tunstall High Road approach during the PM peak hour (LOS C, 18.8 sec/veh of delay, 168-foot queue).

### 7.2.3 Projected 2035 Alternative 1 Conditions

All of the study intersection lane groups operate at a LOS C or better with queues that do not exceed 150 feet (or approximately six vehicles) during the AM and PM peak hours with the exception of the following approaches and lane groups groups:

- ❖ Northbound Stony Mill Road approach during the AM peak hour (LOS D, 31.2 sec/veh of delay, 180-foot queue).
- ❖ Southbound left-turn lane (Tunstall High Road) during the AM peak hour (LOS E, 40.5 sec/veh of delay, 89-foot queue).
- ❖ Southbound Tunstall High Road approach during the AM peak hour (LOS D, 25.1 sec/veh of delay).

The construction of the southbound left-turn lane and right-turn taper associated with the Alternative 1 improvements helps mitigate the projected LOS F and corresponding 128.9 seconds of delay per vehicle under projected 2035 No-Build conditions. The resulting delay reduction is approximately 88 sec/veh for left-turning vehicles.

### 7.2.4 Projected 2035 Alternative 2 Conditions

All of the study intersection lane groups operate at LOS A with queues that do not exceed 53 feet (or approximately two vehicles) during the AM and PM peak hours. The construction of a single lane roundabout mitigates the projected LOS F and 128.9 seconds of delay per vehicle under projected 2035 No-Build conditions. The resulting delay reduction is approximately 123 sec/veh for southbound approaching vehicles. No vehicle is projected to experience over 6 seconds of delay to navigate through the single-lane roundabout.

### 7.3 Crash Analysis

Crash analysis for the study intersection was conducted using the latest three years of available crash data. Crash reports dating from January 1, 2010 to December 31, 2012 were obtained from VDOT. Over the three-year time period, five total crashes were reported within a 500-foot radius of the study intersection.

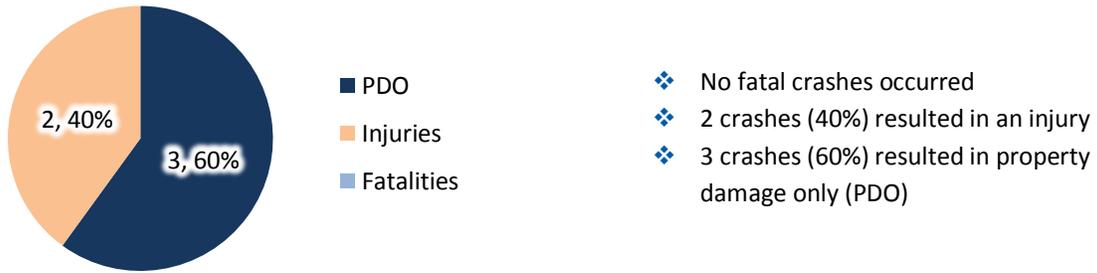
- ❖ In 2010 there were **2** reported crashes in the vicinity of the study intersection.
- ❖ In 2011 there was **1** reported crash in the vicinity of the study intersection.
- ❖ In 2012 there were **2** reported crashes in the vicinity of the study intersection.

Overall, there were no crash patterns identified at the study intersection. The following subsections provide additional information associated with the five total crashes that occurred at the study intersection.

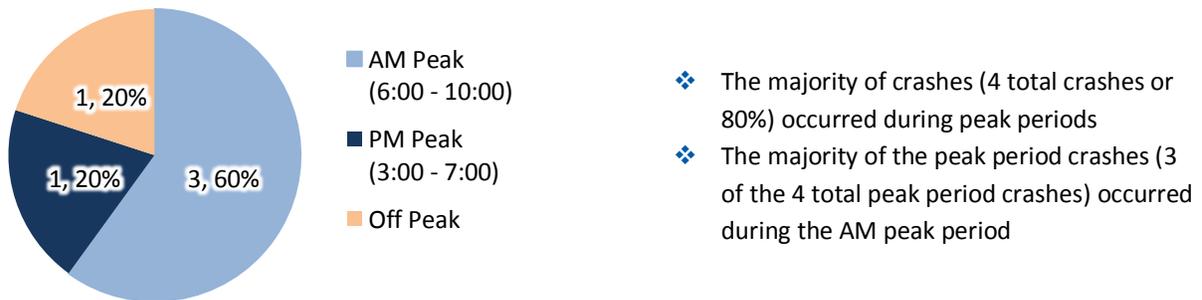
#### Crash Type

All five crashes were angle crashes that occurred at the study intersection between 2010 and 2012.

#### Crash Severity



#### Time of Day



#### Weather Conditions

All five crashes occurred during clear weather conditions at the study intersection.

#### Light Conditions

All five crashes occurred during daylight conditions at the study intersection.

### 8.0 Environmental Analysis

A preliminary environmental analysis was performed at the study intersection to determine potential environmental conflicts. Based on the analysis, two petroleum release sites were identified in the vicinity of the study intersection. One release site is located in the southwest corner and one is located in the southeast corner of the study intersection. A map of the petroleum release sites is provided in **Appendix F**.

### 9.0 Public Involvement

An important component of this study was the involvement of the public. Following the development of the two proposed intersection alternatives, a citizen information meeting was held on April 22, 2014 at the Tunstall Volunteer Fire Department in Pittsylvania County, Virginia. Approximately 32 individuals attended and participated in the meeting, which included a variety of stakeholders, including residents, property owners, business owners, employees, and commuters. The citizen information meeting had the following objectives:

- ❖ To inform and educate the public about the study, its objectives, and its outcomes.
- ❖ To encourage and gather input and feedback from the public regarding issues within the study area, the proposed alternatives, and identify additional improvements for the study intersection to help arrive at a preferred alternative.

Techniques used to educate and obtain input from the public at the citizen information meeting included a presentation, an educational roundabout video, display boards, and a questionnaire.



#### 9.1 Display Boards

At the meeting, display boards containing a preliminary sketch of the proposed alternatives over an aerial map were set up to allow the public to view the proposed alternatives (to scale) and assess the projected impacts associated with each alternative. Informational boards were also provided for each alternative which included traffic volumes, speed limits, levels of service, and pros and cons for the alternative. The display boards for Alternative 1 and Alternative 2 are provided in **Appendix G**.

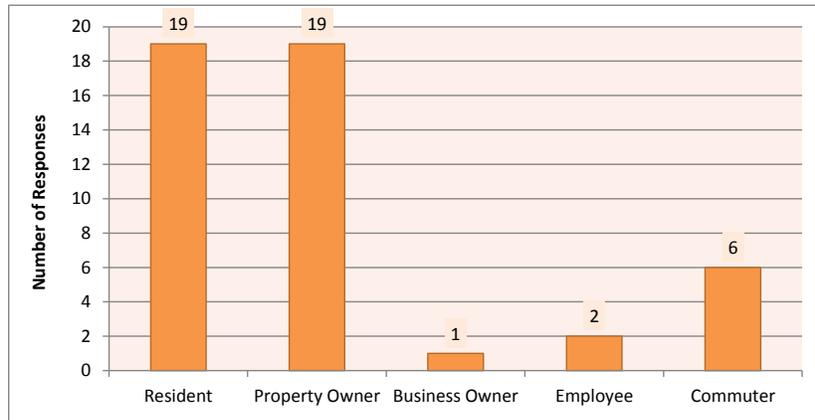
#### 9.2 Questionnaire

Meeting attendees received a questionnaire, a copy of which is included in **Appendix G**, with questions to answer about the study intersection with respect to traffic and safety. The questionnaire also afforded the attendees an opportunity to select a preferred alternative from the two provided alternatives or to specify an “Other” alternative. Attendees were encouraged to take extra copies of the questionnaire to community members who were unable to attend the meeting. Questionnaires could be dropped in a comment box provided at the meeting or mailed to the address provided on the form by April 30, 2014. Twenty-two questionnaire responses were received from the public. This survey should not be considered a random sample of the public opinion; therefore, no statistical significance can be concluded from the results. However, the survey does reflect opinions and responses from interested citizens in the area.

A summary of the interest of the respondents is shown in **Figure 7**. Individuals with multiple interests in the corridor were encouraged to select multiple categories. The

largest number of individuals classified themselves as residents (19) and property owners (19) in the corridor, followed by commuters through the area (6), employees in the area (2), and business owners in the area (1).

**Figure 7: Questionnaire Respondents Interest in the Corridor**

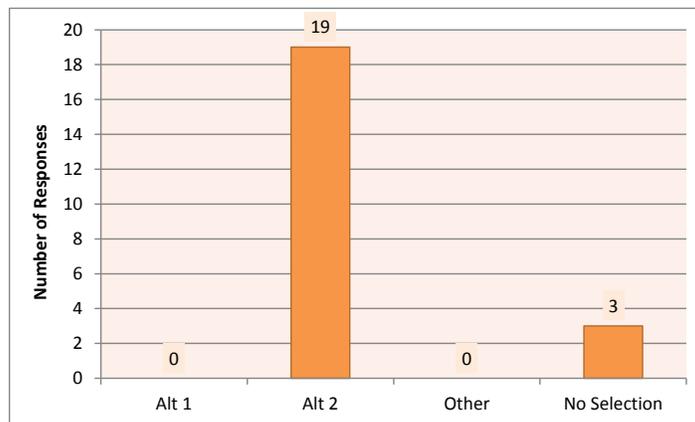


The following common traffic and safety issues were identified through the questionnaire responses:

- ❖ Limited sight distance looking east and west
- ❖ Undefined access points
- ❖ Unpredictable vehicle speeds
- ❖ High traffic volumes
- ❖ Vehicles cutting through private property to jump queues

A summary of the preferred alternative of the respondents is shown in **Figure 8**. Of the 22 responses received, 19 responses (86%) preferred Alternative 2 while three responses (14%) did not select a preferred alternative. No responses indicated Alternative 1 or Other as a preferred alternative.

**Figure 8: Questionnaire Respondents Preferred Alternative**



Results from the Citizen Information Meeting are included in **Appendix G**.

10.0 Evaluation of Alternatives

The following section of the report describes the evaluation results of Alternative 1 and Alternative 2. The purpose of the evaluation is to arrive at a preferred alternative that takes into account cost, traffic operations, environmental impacts, public preference, safety, and overall feasibility.

Based on an evaluation of the proposed alternatives analysis provided herein, the following conclusions are offered. Alternative 2 - construction of a single-lane roundabout, operationally performs with less vehicle delay and queuing than Alternative 1 - construction of turn lanes, as shown in **Table 16**. Alternative 1 and Alternative 2 both provide positive crash reduction factors; however, Alternative 2 provides a greater benefit. Alternative 2 provides a greater benefit to the traveler and its planning level cost is approximately \$830,000 lower than the planning level cost of Alternative 1. An overall comparison of each alternative is also shown in **Table 16**.

Alternative 2 is the preferred alternative and is recommended for construction based on a greater reduction in vehicle delay and queues; a greater crash reduction factor; public preference; reduced amount of right-of-way acquisition; and a lower planning level cost.

Table 16: Evaluation of Alternatives

|                       | Planning Level Cost Est. (\$) | 2035 Critical Approach Delay Reduction | 2035 Critical Approach Queue Reduction | Crash Reduction Factors*                  | Public Preference** | Safety Considerations   |
|-----------------------|-------------------------------|--|--|---|---------------------|---|
|                       |                               | AM (PM)<br>sec/veh                     | AM (PM)<br>ft                          |   |                     |   |
| <b>Alternative #1</b> | \$2,920,000                   | 103.8 (6.2)                            | 80 (76)                                | 43% Left-Turn Lane<br>21% Right-Turn Lane | 0 votes (0%)        | ❖ Provides refuge for right- and left-turning vehicles  |
| <b>Alternative #2</b> | \$2,090,000                   | 123.9 (14.1)                           | 147 (118)                              | 72%                                       | 19 votes (86%)      | ❖ Reduces number of conflict points<br>❖ Mitigates sight distance issues<br>❖ Traffic calming |

\*Crash reduction factors apply to crashes associated with the recommendation, and do not apply to all crash types.

\*\*Three votes (14%) selected neither option.

## 11.0 Conclusions and Recommendations

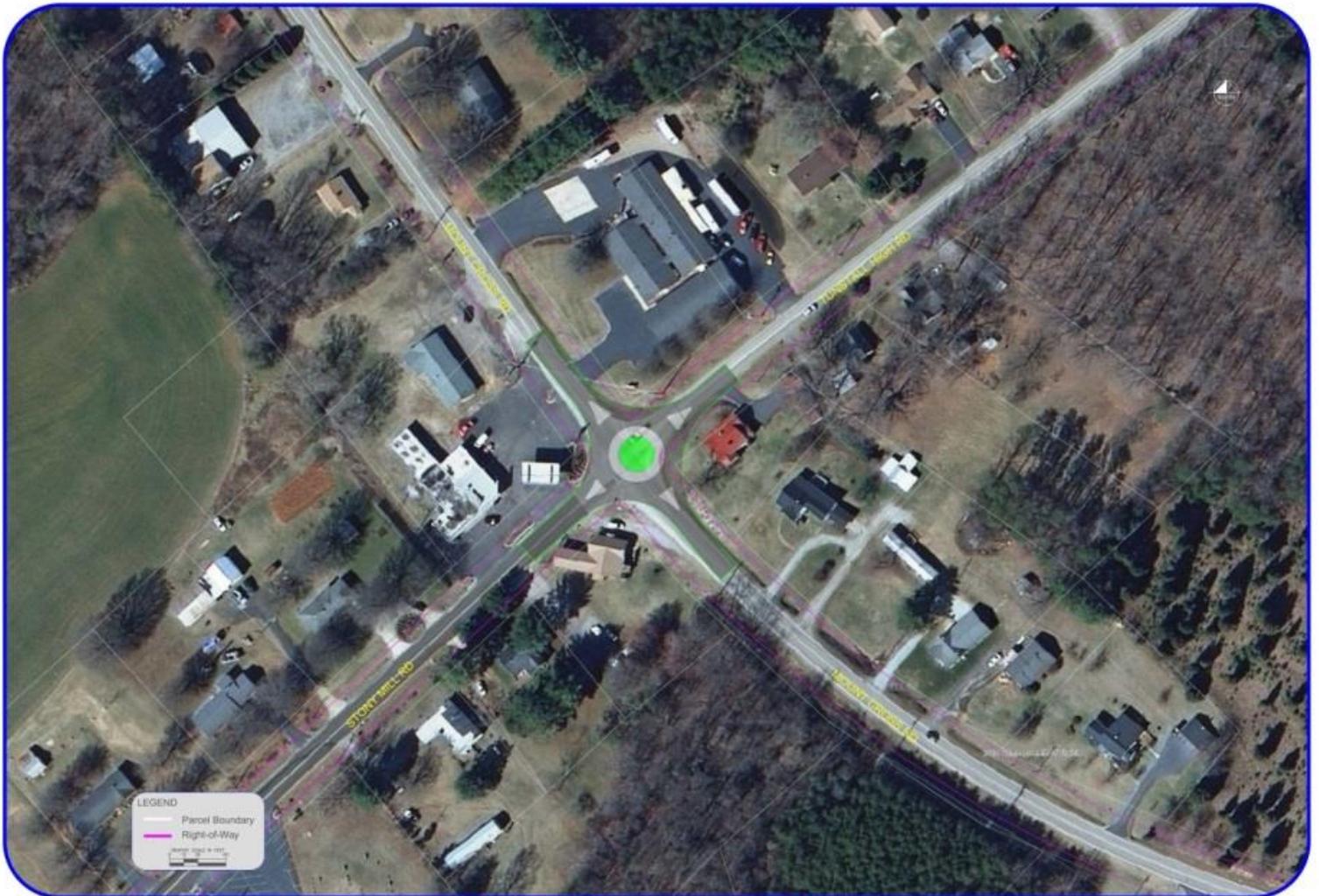
Alternative 2, a single-lane roundabout, is recommended for construction at the Mount Cross Road and Stony Mill Road/Tunstall High Road intersection located in Pittsylvania County, Virginia as shown in **Figure 9**. In addition to the construction of a roundabout, the following improvements are also recommended and should be considered for immediate implementation.

- ❖ Access management:
  - Better define the commercial access with new curb and gutter to Mills Grill & Grocery (gas station) in the southwest quadrant of the study intersection, especially along the Mount Cross Road frontage.
  - Provide adequate intersection/access spacing in accordance with VDOT's Minimum Spacing Standards for Commercial Entrances, Intersections, and Median Crossovers from the *VDOT Road Design Manual*.
- ❖ Reduce the existing 55 MPH speed limit segment on Mount Cross Road in the vicinity of Silver Creek Road (Route 868), east of the study intersection, to 45 MPH.

The following design considerations should be taken into account during the design phase of the proposed single-lane roundabout (Alternative 2).

- ❖ A 4% slope should be maintained through the proposed roundabout. According to the Pittsylvania County geographic information system (GIS), the southbound Tunstall High Road approach has an approximate 5% downgrade on its approach to Mount Cross Road. This approach may need to be re-graded in order to maintain a 4% slope.
- ❖ The proposed roundabout is likely to increase the impervious (paved) area at the study intersection. Current drainage and stormwater management regulations will need to be taken into account.
- ❖ Due to environmental concerns, the roundabout should be shifted to the north side of the intersection so that the southeast and southwest edges of pavement are maintained. If the southeast and southwest parcels are impacted to accommodate the roundabout, a soil conditions analysis should be conducted to investigate the potential for contaminated soil, since the intersection is located next to an active gas station.
- ❖ A retaining wall may be required on the northeast corner should the proposed roundabout cut into the existing slope on the subject parcel.
- ❖ Access to the southwest (Mills Grill and Grocery) and southeast (residential) parcels will need to be modified in order to eliminate access points being located within the approach to the roundabout.
- ❖ Intersection signs will need to be upgraded to appropriately warn drivers of the proposed roundabout.
- ❖ Public education outreach should be performed within the local area to inform drivers the rules of a roundabout.
- ❖ The urban roundabout standards should be considered for the design of the proposed roundabout. This would allow the roundabout to have curb and gutter and reduce the right-of-way impacts at the subject intersection that would be required to maintain an open ditch section.
- ❖ The proposed roundabout should provide pedestrian accommodations.

Figure 9: Alternative #2 – Single-Lane Roundabout



# Appendix A: Turning Movement Count Data

**ALL VEHICLE TURNING MOVEMENT COUNT - SUMMARY**

Intersection of: **Stony Mill Road**  
 and: **Mt. Cross Road**  
 Location: **Danville, VA**

Counted by: **VCU**  
 Date: **December 10, 2013**  
 Weather: **Cloudy/Cool**  
 Entered by: **LW**

Day: **Tuesday**

| TIME                | TRAFFIC FROM NORTH<br>on: Tunstall Hill Road<br>SOUTHBOUND |            |            |          |             | TRAFFIC FROM SOUTH<br>on: Stony Mill Road<br>NORTHBOUND |            |            |          |            | TRAFFIC FROM EAST<br>on: Mt. Cross Road<br>WESTBOUND |            |            |          |             | TRAFFIC FROM WEST<br>on: Mt. Cross Road<br>EASTBOUND |            |            |          |             | TOTAL<br>N + S<br>+<br>E + W |
|---------------------|--|------------|------------|----------|-------------|---|------------|------------|----------|------------|--|------------|------------|----------|-------------|--|------------|------------|----------|-------------|------------------------------|
|                     | RIGHT  | THRU       | LEFT       | U-TN     | TOTAL       | RIGHT   | THRU       | LEFT       | U-TN     | TOTAL      | RIGHT  | THRU       | LEFT       | U-TN     | TOTAL       | RIGHT  | THRU       | LEFT       | U-TN     | TOTAL       |                              |
| <b>AM</b>           |  |            |            |          |             |   |            |            |          |            |  |            |            |          |             |  |            |            |          |             |                              |
| 7:00-7:15           | 0  | 4          | 6          | 0        | 10          | 4   | 8          | 1          | 0        | 13         | 3  | 8          | 0          | 0        | 11          | 4  | 20         | 2          | 0        | 26          | 60                           |
| 7:15-7:30           | 1  | 9          | 4          | 0        | 14          | 6   | 7          | 2          | 0        | 15         | 2  | 4          | 4          | 0        | 10          | 5  | 29         | 6          | 0        | 40          | 79                           |
| 7:30-7:45           | 4  | 8          | 12         | 0        | 24          | 7   | 26         | 0          | 0        | 33         | 13   | 14         | 3          | 0        | 30          | 10   | 31         | 11         | 0        | 52          | 139                          |
| 7:45-8:00           | 1  | 27         | 20         | 0        | 48          | 4   | 56         | 0          | 0        | 60         | 47   | 9          | 0          | 0        | 56          | 12   | 24         | 29         | 0        | 65          | 229                          |
| 8:00-8:15           | 4  | 31         | 10         | 0        | 45          | 2   | 43         | 5          | 0        | 50         | 76   | 8          | 3          | 0        | 87          | 14   | 29         | 39         | 0        | 82          | 264                          |
| 8:15-8:30           | 21   | 42         | 42         | 0        | 105         | 4   | 33         | 4          | 0        | 41         | 18   | 4          | 0          | 0        | 22          | 6  | 17         | 12         | 0        | 35          | 203                          |
| 8:30-8:45           | 0  | 9          | 3          | 0        | 12          | 2   | 3          | 2          | 0        | 7          | 6  | 1          | 3          | 0        | 10          | 5  | 19         | 3          | 0        | 27          | 56                           |
| 8:45-9:00           | 5  | 3          | 3          | 0        | 11          | 6   | 5          | 2          | 0        | 13         | 3  | 7          | 4          | 0        | 14          | 6  | 12         | 2          | 0        | 20          | 58                           |
| 9:00-9:15           | 1  | 5          | 6          | 0        | 12          | 6   | 3          | 3          | 0        | 12         | 3  | 7          | 3          | 0        | 13          | 4  | 17         | 3          | 0        | 24          | 61                           |
| 9:15-9:30           | 2  | 6          | 2          | 0        | 10          | 5   | 5          | 1          | 0        | 11         | 3  | 8          | 1          | 0        | 12          | 3  | 12         | 1          | 0        | 16          | 49                           |
| 9:30-9:45           | 1  | 6          | 2          | 0        | 9           | 3   | 7          | 0          | 0        | 10         | 2  | 5          | 3          | 0        | 10          | 2  | 8          | 0          | 0        | 10          | 39                           |
| 9:45-10:00          | 0  | 5          | 2          | 0        | 7           | 6   | 2          | 2          | 0        | 10         | 2  | 8          | 1          | 0        | 11          | 7  | 15         | 2          | 0        | 24          | 52                           |
| 10:00-10:15         | 1  | 5          | 2          | 0        | 8           | 0   | 3          | 1          | 0        | 4          | 3  | 2          | 1          | 0        | 6           | 4  | 13         | 2          | 0        | 19          | 37                           |
| 10:15-10:30         | 4  | 5          | 3          | 0        | 12          | 3   | 4          | 0          | 1        | 8          | 4  | 7          | 1          | 1        | 13          | 0  | 21         | 0          | 0        | 21          | 54                           |
| 10:30-10:45         | 1  | 2          | 5          | 0        | 8           | 4   | 2          | 2          | 0        | 8          | 3  | 7          | 1          | 0        | 11          | 3  | 17         | 1          | 0        | 21          | 48                           |
| 10:45-11:00         | 3  | 4          | 4          | 0        | 11          | 4   | 4          | 1          | 0        | 9          | 3  | 4          | 1          | 0        | 8           | 2  | 10         | 1          | 0        | 13          | 41                           |
| 11:00-11:15         | 1  | 5          | 4          | 0        | 10          | 4   | 4          | 4          | 0        | 12         | 7  | 9          | 4          | 0        | 20          | 0  | 14         | 3          | 0        | 17          | 59                           |
| 11:15-11:30         | 3  | 5          | 13         | 0        | 21          | 2   | 3          | 1          | 0        | 6          | 2  | 9          | 3          | 0        | 14          | 1  | 8          | 3          | 0        | 12          | 53                           |
| 11:30-11:45         | 0  | 2          | 6          | 0        | 8           | 3   | 4          | 3          | 0        | 10         | 1  | 7          | 2          | 0        | 10          | 5  | 6          | 0          | 0        | 11          | 39                           |
| 11:45-12:00         | 0  | 3          | 3          | 0        | 6           | 5   | 5          | 2          | 0        | 12         | 4  | 19         | 3          | 0        | 26          | 1  | 9          | 1          | 0        | 11          | 55                           |
| 12:00-12:15         | 0  | 3          | 3          | 0        | 6           | 3   | 9          | 3          | 0        | 15         | 3  | 6          | 4          | 0        | 13          | 5  | 7          | 1          | 0        | 13          | 47                           |
| 12:15-12:30         | 2  | 6          | 2          | 0        | 10          | 5   | 4          | 3          | 0        | 12         | 5  | 13         | 5          | 0        | 23          | 3  | 13         | 2          | 0        | 18          | 63                           |
| 12:30-12:45         | 1  | 4          | 6          | 0        | 11          | 2   | 3          | 1          | 0        | 6          | 8  | 12         | 4          | 0        | 24          | 1  | 12         | 0          | 0        | 13          | 54                           |
| 12:45-1:00          | 2  | 5          | 3          | 0        | 10          | 2   | 2          | 3          | 0        | 7          | 1  | 9          | 0          | 0        | 10          | 3  | 11         | 2          | 0        | 16          | 43                           |
| 1:00-1:15           | 1  | 7          | 0          | 0        | 8           | 4   | 5          | 3          | 0        | 12         | 4  | 8          | 2          | 0        | 14          | 2  | 14         | 0          | 0        | 16          | 50                           |
| 1:15-1:30           | 2  | 2          | 1          | 0        | 5           | 4   | 4          | 0          | 0        | 8          | 3  | 16         | 1          | 0        | 20          | 3  | 6          | 3          | 0        | 12          | 45                           |
| 1:30-1:45           | 4  | 14         | 15         | 0        | 33          | 4   | 7          | 6          | 0        | 17         | 2  | 16         | 4          | 0        | 22          | 5  | 12         | 1          | 0        | 18          | 90                           |
| 1:45-2:00           | 3  | 10         | 4          | 0        | 17          | 3   | 3          | 5          | 0        | 11         | 4  | 11         | 4          | 0        | 19          | 2  | 15         | 0          | 0        | 17          | 64                           |
| 2:00-2:15           | 1  | 4          | 3          | 0        | 8           | 5   | 7          | 4          | 0        | 16         | 4  | 12         | 3          | 0        | 19          | 5  | 13         | 2          | 0        | 20          | 63                           |
| 2:15-2:30           | 2  | 6          | 2          | 0        | 10          | 5   | 10         | 0          | 0        | 15         | 7  | 9          | 4          | 0        | 20          | 5  | 7          | 3          | 0        | 15          | 60                           |
| 2:30-2:45           | 2  | 9          | 4          | 0        | 15          | 2   | 24         | 2          | 0        | 28         | 11   | 16         | 7          | 0        | 34          | 5  | 6          | 3          | 0        | 14          | 91                           |
| 2:45-3:00           | 4  | 12         | 3          | 0        | 19          | 3   | 21         | 4          | 0        | 28         | 30   | 18         | 8          | 0        | 56          | 4  | 4          | 4          | 0        | 12          | 115                          |
| 3:00-3:15           | 12   | 39         | 28         | 0        | 79          | 3   | 22         | 15         | 0        | 40         | 15   | 20         | 3          | 0        | 38          | 3  | 8          | 7          | 0        | 18          | 175                          |
| 3:15-3:30           | 23   | 58         | 35         | 0        | 116         | 8   | 21         | 4          | 0        | 33         | 8  | 18         | 2          | 0        | 28          | 2  | 12         | 4          | 0        | 18          | 195                          |
| 3:30-3:45           | 2  | 7          | 13         | 0        | 22          | 8   | 13         | 9          | 0        | 30         | 6  | 21         | 6          | 0        | 33          | 9  | 15         | 3          | 0        | 27          | 112                          |
| 3:45-4:00           | 5  | 11         | 12         | 0        | 28          | 5   | 16         | 4          | 0        | 25         | 6  | 24         | 8          | 0        | 38          | 3  | 8          | 9          | 0        | 20          | 111                          |
| 4:00-4:15           | 8  | 9          | 11         | 0        | 28          | 2   | 18         | 13         | 0        | 33         | 14   | 13         | 3          | 0        | 30          | 5  | 18         | 4          | 0        | 27          | 118                          |
| 4:15-4:30           | 9  | 14         | 7          | 0        | 30          | 5   | 16         | 5          | 0        | 26         | 7  | 26         | 6          | 0        | 39          | 3  | 13         | 1          | 0        | 17          | 112                          |
| 4:30-4:45           | 7  | 18         | 12         | 0        | 37          | 2   | 7          | 5          | 0        | 14         | 10   | 34         | 3          | 0        | 47          | 5  | 13         | 4          | 0        | 22          | 120                          |
| 4:45-5:00           | 2  | 14         | 9          | 0        | 25          | 6   | 12         | 2          | 0        | 20         | 8  | 23         | 4          | 0        | 35          | 1  | 12         | 5          | 0        | 18          | 98                           |
| 5:00-5:15           | 2  | 13         | 7          | 0        | 22          | 1   | 17         | 5          | 0        | 23         | 8  | 26         | 5          | 0        | 39          | 4  | 14         | 2          | 0        | 20          | 104                          |
| 5:15-5:30           | 3  | 14         | 8          | 0        | 25          | 3   | 28         | 12         | 0        | 43         | 18   | 25         | 11         | 0        | 54          | 3  | 8          | 12         | 0        | 23          | 145                          |
| 5:30-5:45           | 4  | 13         | 19         | 0        | 36          | 9   | 14         | 11         | 0        | 34         | 21   | 22         | 8          | 0        | 51          | 0  | 12         | 3          | 0        | 15          | 136                          |
| 5:45-6:00           | 9  | 16         | 9          | 0        | 34          | 9   | 15         | 7          | 0        | 31         | 12   | 20         | 7          | 0        | 39          | 5  | 22         | 6          | 0        | 33          | 137                          |
| 6:00-6:15           | 4  | 4          | 8          | 0        | 16          | 1   | 9          | 8          | 0        | 18         | 3  | 24         | 7          | 0        | 34          | 6  | 11         | 0          | 0        | 17          | 85                           |
| 6:15-6:30           | 3  | 5          | 7          | 0        | 15          | 2   | 17         | 4          | 0        | 23         | 10   | 16         | 1          | 0        | 27          | 4  | 7          | 8          | 0        | 19          | 84                           |
| 6:30-6:45           | 1  | 9          | 3          | 0        | 13          | 2   | 15         | 9          | 0        | 26         | 4  | 14         | 8          | 0        | 26          | 1  | 9          | 2          | 0        | 12          | 77                           |
| 6:45-7:00           | 3  | 5          | 7          | 0        | 15          | 6   | 10         | 3          | 0        | 19         | 4  | 13         | 7          | 0        | 24          | 3  | 5          | 6          | 0        | 14          | 72                           |
| <b>12 Hr Totals</b> | <b>174</b>   | <b>517</b> | <b>393</b> | <b>0</b> | <b>1084</b> | <b>194</b>  | <b>576</b> | <b>186</b> | <b>1</b> | <b>957</b> | <b>441</b>   | <b>632</b> | <b>176</b> | <b>1</b> | <b>1250</b> | <b>194</b>   | <b>638</b> | <b>218</b> | <b>0</b> | <b>1050</b> | <b>4341</b>                  |
| <b>1 Hr Totals</b>  |  |            |            |          |             |   |            |            |          |            |  |            |            |          |             |  |            |            |          |             |                              |
| 7:00-8:00           | 6  | 48         | 42         | 0        | 96          | 21  | 97         | 3          | 0        | 121        | 65   | 35         | 7          | 0        | 107         | 31   | 104        | 48         | 0        | 183         | 507                          |
| 7:15-8:15           | 10   | 75         | 46         | 0        | 131         | 19  | 132        | 7          | 0        | 158        | 138  | 35         | 10         | 0        | 183         | 41   | 113        | 85         | 0        | 239         | 711                          |
| 7:30-8:30           | 30   | 108        | 84         | 0        | 222         | 17  | 158        | 9          | 0        | 184        | 154  | 35         | 6          | 0        | 195         | 42   | 101        | 91         | 0        | 234         | 835                          |
| 7:45-8:45           | 26   | 109        | 75         | 0        | 210         | 12  | 135        | 11         | 0        | 158        | 147  | 22         | 6          | 0        | 175         | 37   | 89         | 83         | 0        | 209         | 752                          |
| 8:00-9:00           | 30   | 85         | 58         | 0        | 173         | 14  | 84         | 13         | 0        | 111        | 103  | 20         | 10         | 0        | 133         | 31   | 77         | 56         | 0        | 164         | 581                          |
| 8:15-9:15           | 27   | 59         | 54         | 0        | 140         | 18  | 44         | 11         | 0        | 73         | 30   | 19         | 10         | 0        | 59          | 21   | 65         | 20         | 0        | 106         | 378                          |
| 8:30-9:30           | 8  | 23         | 14         | 0        | 45          | 19  | 16         | 8          | 0        | 43         | 15   | 23         | 11         | 0        | 49          | 18   | 60         | 9          | 0        | 87          | 224                          |
| 8:45-9:45           | 9  | 20         | 13         | 0        | 42          | 20  | 20         | 6          | 0        | 46         | 11   | 27         | 11         | 0        | 49          | 15   | 49         | 6          | 0        | 70          | 207                          |
| 9:00-10:00          | 4  | 22         | 12         | 0        | 38          | 20  | 17         | 6          | 0        | 43         | 10   | 28         | 8          | 0        | 46          | 16   | 52         | 6          | 0        | 74          | 201                          |
| 9:15-10:15          | 4  | 22         | 8          | 0        | 34          | 14  | 17         | 4          | 0        | 35         | 10   | 23         | 6          | 0        | 39          | 16   | 48         | 5          | 0        | 69          | 177                          |
| 9:30-10:30          | 6  | 21         | 9          | 0        | 36          | 12  | 16         | 3          | 1        | 32         | 11   | 22         | 6          | 1        | 40          | 13   | 57         | 4          | 0        | 74          | 182                          |
| 9:45-10:45          | 6  | 17         | 12         | 0        | 35          | 13  | 11         | 5          | 1        | 30         | 12   | 24         | 4          | 1        | 41          | 14   | 66         | 5          | 0        | 85          | 191                          |
| 10:00-11:00         | 9  | 16         | 14         | 0        | 39          | 11  | 13         | 4          | 1        | 29         | 13   | 20         | 4          | 1        | 38          | 9  | 61         | 4          | 0        | 74          | 180                          |
| 10:15-11:15         | 9  | 16         | 16         | 0        | 41          | 15  | 14         | 7          | 1        | 37         | 17   | 27         | 7          | 1        | 52          | 5  | 62         | 5          | 0        | 72          | 202                          |
| 10:30-11:30         | 8  | 16         | 26         | 0        | 50          | 14  | 13         | 8          | 0        | 35         | 15   | 29         | 9          | 0        | 53          | 6  | 49         | 8          | 0        | 63          | 201                          |
| 10:45-11:45         | 7  | 16         | 27         | 0        | 50          | 13  | 15         | 9          | 0        | 37         | 13   | 29         | 10         | 0        | 52          | 8  | 38         | 7          | 0        | 53          | 192                          |
| 11:00-12:00         | 4  | 15         | 26         | 0        | 45          | 14  | 16         | 10         | 0        | 40         | 14   | 44         | 12         | 0        | 70          | 7  | 37         | 7          | 0        | 51          | 206                          |
| 11:15-12:15         | 3  | 13         | 25         | 0        | 41          | 13  | 21         | 9          | 0        | 43         | 10   | 41         | 12         | 0        | 63          | 12   | 30         | 5          | 0        | 47          | 194                          |
| 11:30-12:30         | 2  | 14         | 14         | 0        | 30          | 16  | 22         | 11         | 0        | 49         | 13   | 45         | 14         | 0        | 72          | 14   | 35         | 4          | 0        | 53          | 204                          |
| 11:45-12:45         | 3  | 16         | 14         | 0        | 33          | 15  | 21         | 9          | 0        | 45         | 20   | 50         | 16         | 0        | 86          | 10   | 41         | 4          | 0        | 55          | 219                          |
| 12:00-1:00          | 5  | 18         | 14         | 0        | 37          | 12  | 18         | 10         | 0        | 40         | 17   | 40         | 13         | 0        | 70          | 12   | 43         | 5          | 0        | 60          |                              |

**PROJECTED 2035 TURNING MOVEMENT COUNT - SUMMARY**

Intersection of: Stony Mill Road  
and: Mt. Cross Road  
Location: Danville, VA

Linear Growth Rate = 1%  
Number of Years = 22

| TIME                           | TRAFFIC FROM NORTH<br>on: Tunstall Hill Road<br>SOUTHBOUND |      |      |       | TRAFFIC FROM SOUTH<br>on: Stony Mill Road<br>NORTHBOUND |      |      |       | TRAFFIC FROM EAST<br>on: Mt. Cross Road<br>WESTBOUND |      |      |       | TRAFFIC FROM WEST<br>on: Mt. Cross Road<br>EASTBOUND |      |      |       | TOTAL<br>N + S<br>+<br>E + W |
|--------------------------------|--|------|------|-------|---|------|------|-------|--|------|------|-------|--|------|------|-------|------------------------------|
|                                | RIGHT  | THRU | LEFT | TOTAL | RIGHT   | THRU | LEFT | TOTAL | RIGHT  | THRU | LEFT | TOTAL | RIGHT  | THRU | LEFT | TOTAL |                              |
| <b>1 Hr Totals</b>             |  |      |      |       |   |      |      |       |  |      |      |       |  |      |      |       |                              |
| 7:00-8:00                      | 7  | 59   | 51   | 117   | 26  | 118  | 4    | 148   | 79   | 43   | 9    | 131   | 38   | 127  | 59   | 224   | 620                          |
| 8:00-9:00                      | 37   | 104  | 71   | 212   | 17  | 102  | 16   | 135   | 126  | 24   | 12   | 162   | 38   | 94   | 68   | 200   | 709                          |
| 9:00-10:00                     | 5  | 27   | 15   | 47    | 24  | 21   | 7    | 52    | 12   | 34   | 10   | 56    | 20   | 63   | 7    | 90    | 245                          |
| 10:00-11:00                    | 11   | 20   | 17   | 48    | 13  | 16   | 6    | 35    | 16   | 24   | 6    | 46    | 11   | 74   | 5    | 90    | 219                          |
| 11:00-12:00                    | 5  | 18   | 32   | 55    | 17  | 20   | 12   | 49    | 17   | 54   | 15   | 86    | 9  | 45   | 9    | 63    | 253                          |
| 12:00-1:00                     | 6  | 22   | 17   | 45    | 15  | 22   | 12   | 49    | 21   | 49   | 16   | 86    | 15   | 52   | 6    | 73    | 253                          |
| 1:00-2:00                      | 12   | 40   | 24   | 76    | 18  | 23   | 17   | 58    | 16   | 62   | 13   | 91    | 15   | 57   | 5    | 77    | 302                          |
| 2:00-3:00                      | 11   | 38   | 15   | 64    | 18  | 76   | 12   | 106   | 63   | 67   | 27   | 157   | 23   | 37   | 15   | 75    | 402                          |
| 3:00-4:00                      | 51   | 140  | 107  | 298   | 29  | 88   | 39   | 156   | 43   | 101  | 23   | 167   | 21   | 52   | 28   | 101   | 722                          |
| 4:00-5:00                      | 32   | 67   | 48   | 147   | 18  | 65   | 31   | 114   | 48   | 117  | 20   | 185   | 17   | 68   | 17   | 102   | 548                          |
| 5:00-6:00                      | 22   | 68   | 52   | 142   | 27  | 90   | 43   | 160   | 72   | 113  | 38   | 223   | 15   | 68   | 28   | 111   | 636                          |
| 6:00-7:00                      | 13   | 28   | 31   | 72    | 13  | 62   | 29   | 104   | 26   | 82   | 28   | 136   | 17   | 39   | 20   | 76    | 388                          |
| <b>2035 EXISTING PEAK HOUR</b> |  |      |      |       |   |      |      |       |  |      |      |       |  |      |      |       |                              |
| <b>7:30-8:30</b>               | 37   | 132  | 102  | 271   | 21  | 193  | 11   | 225   | 188  | 43   | 7    | 238   | 51   | 123  | 111  | 285   | 1019                         |
| <b>2:45-3:45</b>               | 50   | 142  | 96   | 288   | 27  | 94   | 39   | 160   | 72   | 94   | 23   | 189   | 22   | 48   | 22   | 92    | 729                          |

| Functional Classification Actions | FHWA Approval Date |
|-----------------------------------|--------------------|
| 1995 Functional Classification    | May 10, 1993       |
| 2005 Functional Classification    | March 28, 2007     |
|                                   |                    |
|                                   |                    |

The accuracy or completeness of this map is not guaranteed or warranted. The purpose of this map is to illustrate the Commonwealth of Virginia's official highway functional classification system. Information and mileages stated on this map are relevant to the highway functional classification system only.

Jurisdiction Boundaries, Urban Cluster Boundaries, Urbanized Area Boundaries, and MPO Study Area Boundaries based on Census 2000 data. However, some boundary data has been modified, or smoothed, for transportation planning purposes. Urban Cluster Boundaries are only shown when outside of Urbanized Area Boundaries.

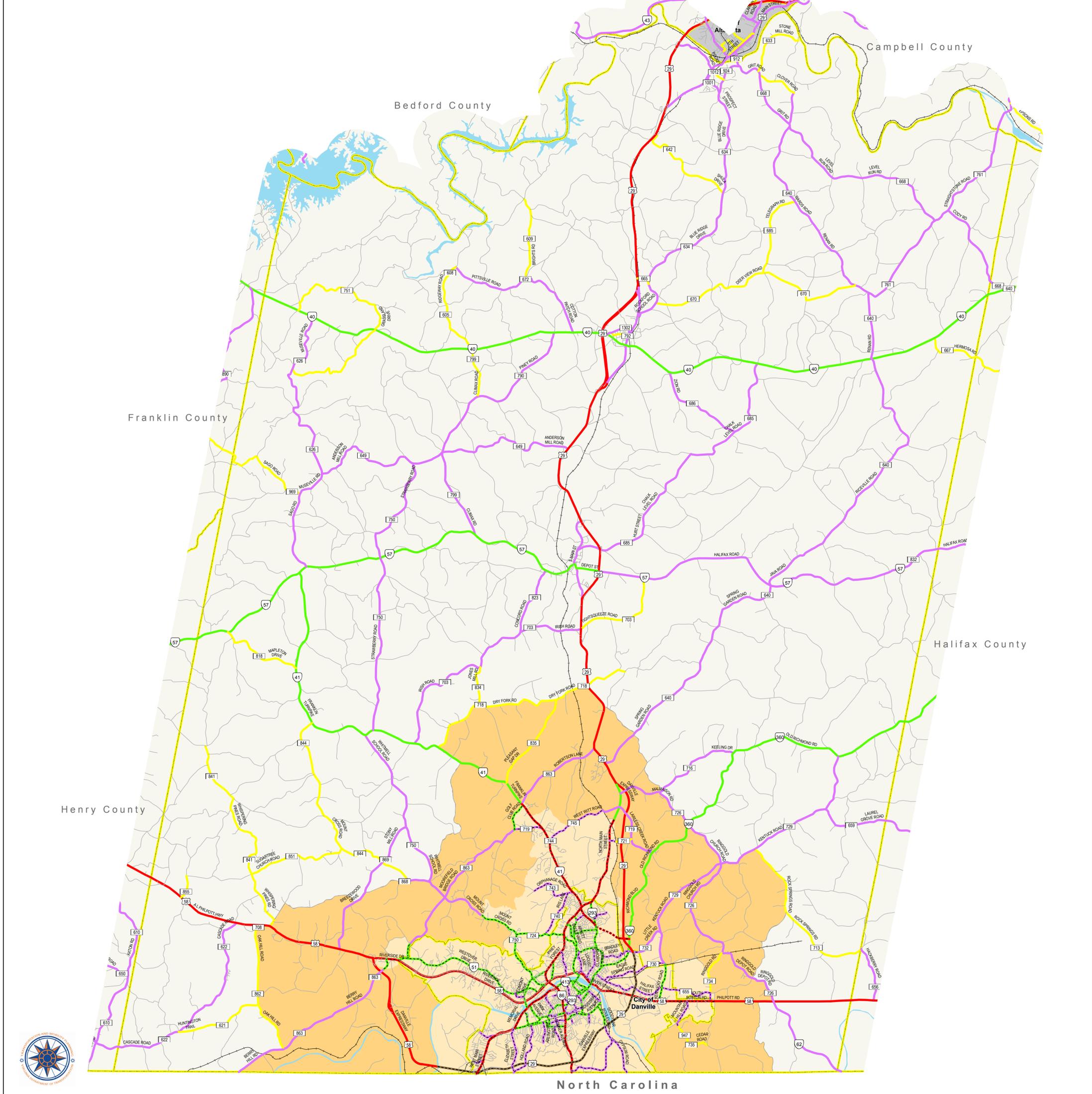
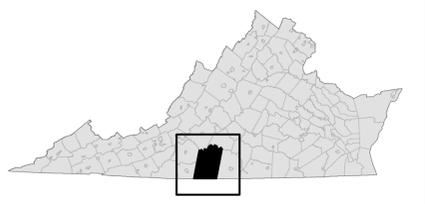
Request for information on the functional classification of roads on this map should be addressed to: Virginia Department of Transportation, Transportation and Mobility Planning Division, State Transportation Planner, 1401 East Broad Street, Richmond VA 23219. 804-786-2985 (TTY users, call 711).

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|  |  |  |
|--|--|--|
|  |  | <b>FUNCTIONAL CLASSIFICATIONS</b>        |
|  |  | Urban Interstate                         |
|  |  | Urban Freeway & Expressway               |
|  |  | Urban Other Principal Arterial           |
|  |  | Urban Minor Arterial                     |
|  |  | Urban Collector                          |
|  |  | Rural Interstate                         |
|  |  | Rural Other Principal Arterial           |
|  |  | Rural Minor Arterial                     |
|  |  | Rural Major Collector                    |
|  |  | Rural Minor Collector                    |
|  |  | Not Classified, Urban Local, Rural Local |
|  |  | <b>HIGHWAY ROUTE SIGNS</b>               |
|  |  | Interstate                               |
|  |  | US Highway                               |
|  |  | VA Primary                               |
|  |  | VA Secondary                             |
|  |  | <b>BOUNDARIES</b>                        |
|  |  | Jurisdiction Boundary                    |
|  |  | Urban Cluster Boundary                   |
|  |  | Urbanized Area Boundary                  |
|  |  | MPO Study Area Boundary                  |
|  |  | <b>OTHER</b>                             |
|  |  | Railroads                                |
|  |  | Major Water Feature                      |

**VIRGINIA HIGHWAY FUNCTIONAL CLASSIFICATION**

**Pittsylvania County  
2005 Functional Classification**



# Appendix B: Traffic Signal Warrant

## 2013 Existing Conditions

### TRAFFIC SIGNAL VOLUME WARRANT ANALYSIS

INTERSECTION NAME: Mount Cross Road and Stony Mill Road/Tunstall Road

COUNT DATE: 12/10/2013

INTERSECTION CONDITION: Unsignalized, two-way stop-controlled

MAJOR STREET: Mount Cross Road (Route 644)

# OF APPROACH LANES: 1

MINOR STREET: Stony Mill Road Tunstall Road (Rt. 869)

# OF APPROACH LANES: 1

ISOLATED COMMUNITY WITH POPULATION LESS THAN 10,000 (Y OR N): Y  
 85TH PERCENTILE SPEED GREATER THAN 40 MPH ON MAJOR STREET (Y OR N): N

|                      | MAJOR ST<br>BOTH<br>APPROACHES | MINOR ST<br>HIGHEST<br>APPROACH | WARRANT 1, Condition A |                 |                                 | WARRANT 1, Condition B |                 |                                 | WARRANT 1, Combination Warrant |                 |             |                 |                 |   | WARRANT 2 | WARRANT 3                     |                              |
|----------------------|--------------------------------|---------------------------------|------------------------|-----------------|---------------------------------|------------------------|-----------------|---------------------------------|--------------------------------|-----------------|-------------|-----------------|-----------------|---|-----------|-------------------------------|------------------------------|
|                      |                                |                                 | MAJOR<br>STREET        | MINOR<br>STREET | BOTH<br>MET                     | MAJOR<br>STREET        | MINOR<br>STREET | BOTH<br>MET                     | CONDITION A                    |                 |             | CONDITION B     |                 |   |           |                               |                              |
|                      |                                |                                 |                        |                 |                                 |                        |                 |                                 | MAJOR<br>STREET                | MINOR<br>STREET | BOTH<br>MET | MAJOR<br>STREET | MINOR<br>STREET | BOTH<br>MET   |           |                               |                              |
| THRESHOLD VALUES     |                                |                                 | 350                    | 105             |                                 | 525                    | 53              |                                 | 400                            | 120             |             | 600             | 60              |   |           |                               |                              |
| 06:00 AM TO 07:00 AM | 0                              | 0                               |                        |                 |                                 |                        |                 |                                 |                                |                 |             |                 |                 |   |           |                               |                              |
| 07:00 AM TO 08:00 AM | 290                            | 121                             |                        | Y               |                                 |                        | Y               |                                 |                                | Y               |             |                 | Y               |   |           |                               |                              |
| 08:00 AM TO 09:00 AM | 297                            | 173                             |                        | Y               |                                 |                        | Y               |                                 |                                | Y               |             |                 | Y               |   |           |                               |                              |
| 09:00 AM TO 10:00 AM | 120                            | 43                              |                        |                 |                                 |                        |                 |                                 |                                |                 |             |                 |                 |   |           |                               |                              |
| 10:00 AM TO 11:00 AM | 112                            | 39                              |                        |                 |                                 |                        |                 |                                 |                                |                 |             |                 |                 |   |           |                               |                              |
| 11:00 AM TO 12:00 PM | 121                            | 45                              |                        |                 |                                 |                        |                 |                                 |                                |                 |             |                 |                 |   |           |                               |                              |
| 12:00 PM TO 01:00 PM | 130                            | 40                              |                        |                 |                                 |                        |                 |                                 |                                |                 |             |                 |                 |   |           |                               |                              |
| 01:00 PM TO 02:00 PM | 138                            | 63                              |                        |                 |                                 |                        | Y               |                                 |                                |                 |             |                 |                 | Y   |           |                               |                              |
| 02:00 PM TO 03:00 PM | 190                            | 87                              |                        |                 |                                 |                        | Y               |                                 |                                |                 |             |                 |                 | Y   |           |                               |                              |
| 03:00 PM TO 04:00 PM | 220                            | 245                             |                        | Y               |                                 |                        | Y               |                                 |                                | Y               |             |                 |                 | Y   |           | Y                             |                              |
| 04:00 PM TO 05:00 PM | 235                            | 120                             |                        | Y               |                                 |                        | Y               |                                 |                                | Y               |             |                 |                 | Y   |           |                               |                              |
| 05:00 PM TO 06:00 PM | 274                            | 131                             |                        | Y               |                                 |                        | Y               |                                 |                                | Y               |             |                 |                 | Y   |           |                               |                              |
| 06:00 PM TO 07:00 PM | 173                            | 86                              |                        |                 |                                 |                        | Y               |                                 |                                |                 |             |                 |                 | Y   |           |                               |                              |
| 07:00 PM TO 08:00 PM | 0                              | 0                               |                        |                 |                                 |                        |                 |                                 |                                |                 |             |                 |                 |   |           |                               |                              |
| 08:00 PM TO 09:00 PM | 0                              | 0                               |                        |                 |                                 |                        |                 |                                 |                                |                 |             |                 |                 |   |           |                               |                              |
| 09:00 PM TO 10:00 PM | 0                              | 0                               |                        |                 |                                 |                        |                 |                                 |                                |                 |             |                 |                 |   |           |                               |                              |
|                      | 2,300                          | 1,193                           |                        |                 | 0                               |                        |                 | 0                               |                                |                 |             |                 |                 | 0   |           | 0                             |                              |
|                      |                                |                                 |                        |                 | 8 HOURS NEEDED<br>NOT SATISFIED |                        |                 | 8 HOURS NEEDED<br>NOT SATISFIED |                                |                 |             |                 |                 | 8 HOURS OF BOTH COND. A AND COND. B NEEDED<br>NOT SATISFIED |           | 4 HRS NEEDED<br>NOT SATISFIED | 1 HR NEEDED<br>NOT SATISFIED |

WARRANT 1 -- Eight-Hour Vehicular Volume Warrant  
 Condition A : Minimum Vehicular Volume  
 Condition B : Interruption of Continuous Traffic  
 Combination : Combination of Condition A and Condition B  
 WARRANT 2 -- Four-Hour Vehicular Volume Warrant  
 WARRANT 3 -- Peak Hour Warrant

## Projected Future 2035 Conditions

### TRAFFIC SIGNAL VOLUME WARRANT ANALYSIS

INTERSECTION NAME: Mount Cross Road and Stony Mill Road/Tunstall Road

COUNT DATE: 12/10/2013

INTERSECTION CONDITION: Unsignalized, two-way stop-controlled

MAJOR STREET: Mount Cross Road (Route 644)

# OF APPROACH LANES: 1

MINOR STREET: Stony Mill Road/Tunstall Road (Rt. 869)

# OF APPROACH LANES: 1

ISOLATED COMMUNITY WITH POPULATION LESS THAN 10,000 (Y OR N): Y  
 85TH PERCENTILE SPEED GREATER THAN 40 MPH ON MAJOR STREET (Y OR N): N

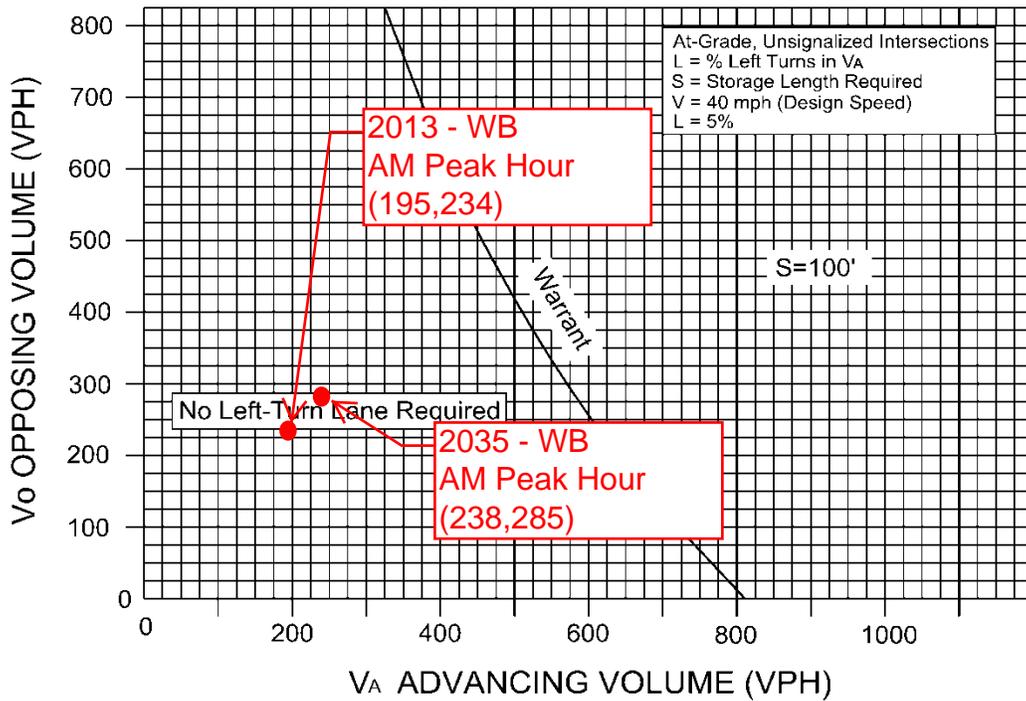
|                      | MAJOR ST<br>BOTH<br>APPROACHES | MINOR ST<br>HIGHEST<br>APPROACH | WARRANT 1, Condition A          |                 |             | WARRANT 1, Condition B          |                 |             | WARRANT 1, Combination Warrant                              |                 |             |                 |                 |             | WARRANT 2                     | WARRANT 3                    |
|----------------------|--------------------------------|---------------------------------|---------------------------------|-----------------|-------------|---------------------------------|-----------------|-------------|---|-----------------|-------------|-----------------|-----------------|-------------|-------------------------------|------------------------------|
|                      |                                |                                 | MAJOR<br>STREET                 | MINOR<br>STREET | BOTH<br>MET | MAJOR<br>STREET                 | MINOR<br>STREET | BOTH<br>MET | CONDITION A   |                 |             | CONDITION B     |                 |             |                               |                              |
|                      |                                |                                 |                                 |                 |             |                                 |                 |             | MAJOR<br>STREET   | MINOR<br>STREET | BOTH<br>MET | MAJOR<br>STREET | MINOR<br>STREET | BOTH<br>MET |                               |                              |
| THRESHOLD VALUES     |                                |                                 | 350                             | 105             |             | 525                             | 53              |             | 400   | 120             |             | 600             | 60              |             |                               |                              |
| 06:00 AM TO 07:00 AM | 0                              | 0                               |                                 |                 |             |                                 |                 |             |   |                 |             |                 |                 |             |                               |                              |
| 07:00 AM TO 08:00 AM | 355                            | 148                             | Y                               | Y               | Y           |                                 | Y               |             |   | Y               |             |                 | Y               |             |                               |                              |
| 08:00 AM TO 09:00 AM | 362                            | 212                             | Y                               | Y               | Y           |                                 | Y               |             |   | Y               |             |                 | Y               |             | Y                             |                              |
| 09:00 AM TO 10:00 AM | 146                            | 52                              |                                 |                 |             |                                 |                 |             |   |                 |             |                 |                 |             |                               |                              |
| 10:00 AM TO 11:00 AM | 136                            | 48                              |                                 |                 |             |                                 |                 |             |   |                 |             |                 |                 |             |                               |                              |
| 11:00 AM TO 12:00 PM | 149                            | 55                              |                                 |                 |             |                                 | Y               |             |   |                 |             |                 |                 |             |                               |                              |
| 12:00 PM TO 01:00 PM | 159                            | 49                              |                                 |                 |             |                                 |                 |             |   |                 |             |                 |                 |             |                               |                              |
| 01:00 PM TO 02:00 PM | 168                            | 76                              |                                 |                 |             |                                 | Y               |             |   |                 |             |                 | Y               |             |                               |                              |
| 02:00 PM TO 03:00 PM | 232                            | 106                             |                                 | Y               |             |                                 | Y               |             |   |                 |             |                 | Y               |             |                               |                              |
| 03:00 PM TO 04:00 PM | 268                            | 298                             |                                 | Y               |             |                                 | Y               |             |   | Y               |             |                 | Y               |             | Y                             |                              |
| 04:00 PM TO 05:00 PM | 287                            | 147                             |                                 | Y               |             |                                 | Y               |             |   | Y               |             |                 | Y               |             |                               |                              |
| 05:00 PM TO 06:00 PM | 334                            | 160                             |                                 | Y               |             |                                 | Y               |             |   | Y               |             |                 | Y               |             |                               |                              |
| 06:00 PM TO 07:00 PM | 212                            | 104                             |                                 |                 |             |                                 | Y               |             |   |                 |             |                 | Y               |             |                               |                              |
| 07:00 PM TO 08:00 PM | 0                              | 0                               |                                 |                 |             |                                 |                 |             |   |                 |             |                 |                 |             |                               |                              |
| 08:00 PM TO 09:00 PM | 0                              | 0                               |                                 |                 |             |                                 |                 |             |   |                 |             |                 |                 |             |                               |                              |
| 09:00 PM TO 10:00 PM | 0                              | 0                               |                                 |                 |             |                                 |                 |             |   |                 |             |                 |                 |             |                               |                              |
|                      | 2,808                          | 1,455                           | 2                               |                 |             | 0                               |                 |             | 0   |                 |             | 0               |                 |             | 2                             | 0                            |
|                      |                                |                                 | 8 HOURS NEEDED<br>NOT SATISFIED |                 |             | 8 HOURS NEEDED<br>NOT SATISFIED |                 |             | 8 HOURS OF BOTH COND. A AND COND. B NEEDED<br>NOT SATISFIED |                 |             |                 |                 |             | 4 HRS NEEDED<br>NOT SATISFIED | 1 HR NEEDED<br>NOT SATISFIED |

WARRANT 1 -- Eight-Hour Vehicular Volume Warrant  
 Condition A : Minimum Vehicular Volume  
 Condition B : Interruption of Continuous Traffic  
 Combination : Combination of Condition A and Condition B  
 WARRANT 2 -- Four-Hour Vehicular Volume Warrant  
 WARRANT 3 -- Peak Hour Warrant

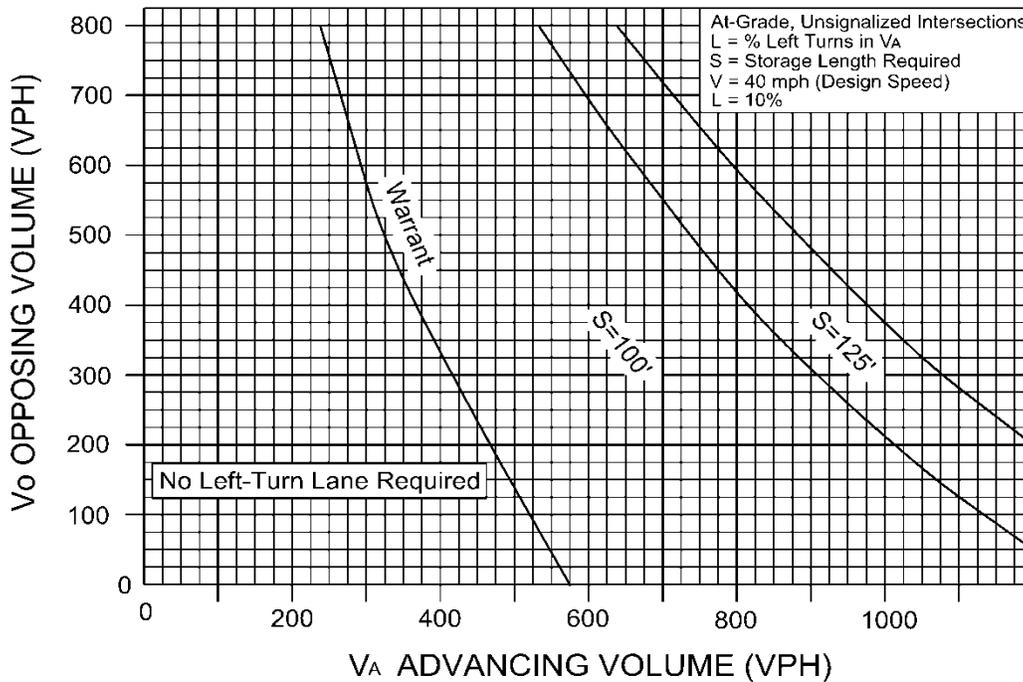
# Appendix C: Turn Lane Warrants

**EXISTING 2013 AND FUTURE 2035  
MOUNT CROSS ROAD**

**WARRANT FOR LEFT-TURN STORAGE LANES ON TWO-LANE HIGHWAY**



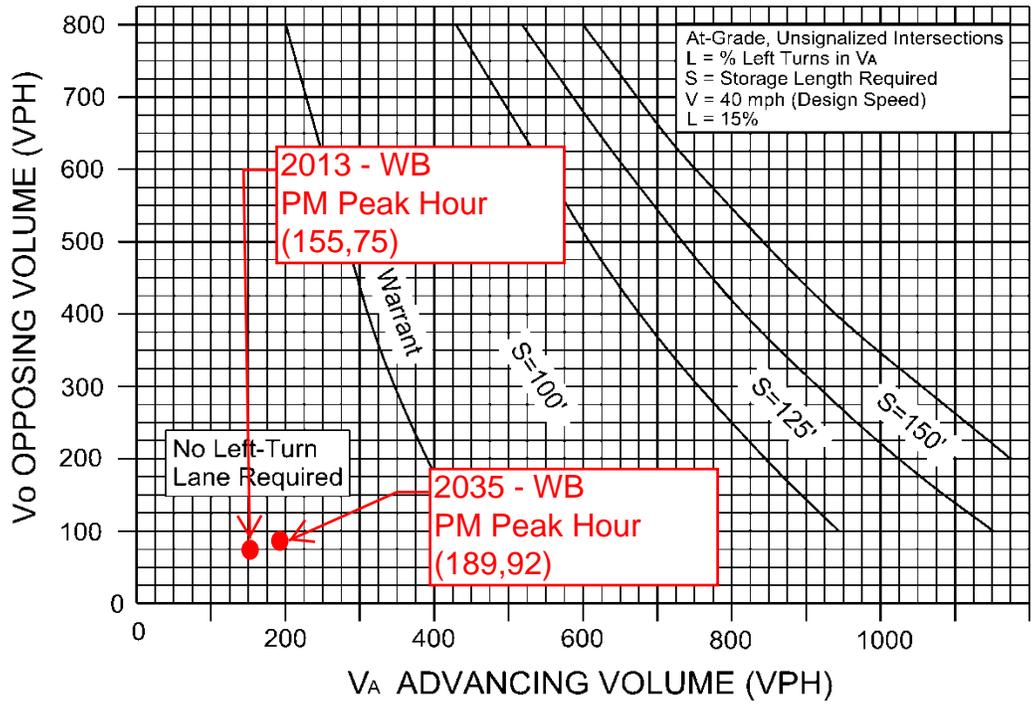
**FIGURE 3-5**



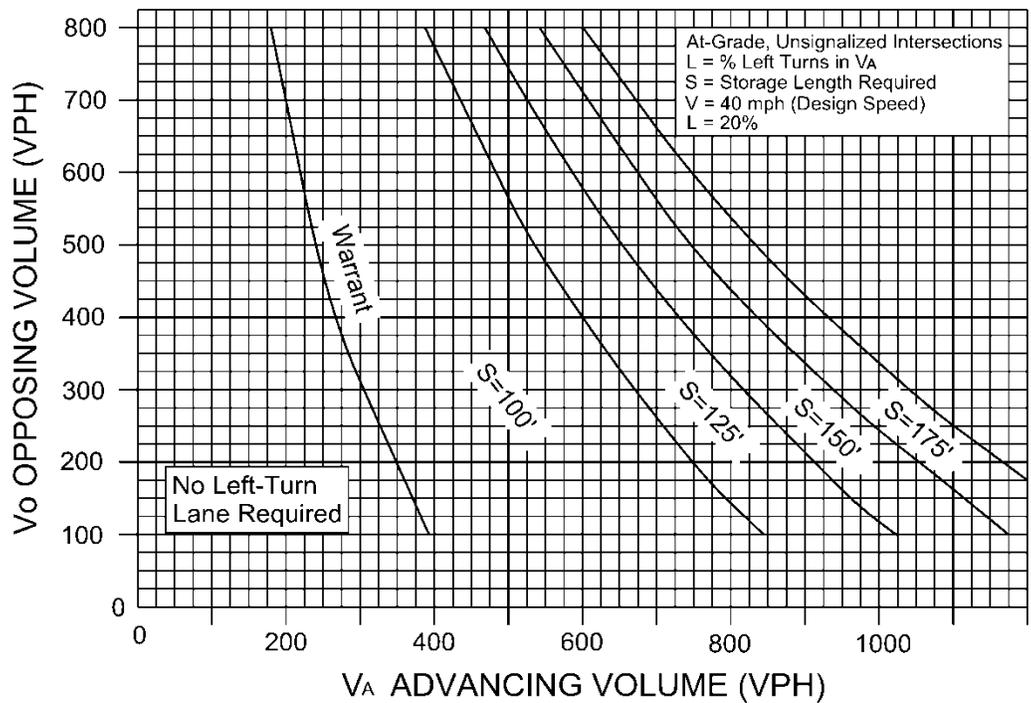
**FIGURE 3-6**

**EXISTING 2013 AND FUTURE 2035  
MOUNT CROSS ROAD**

**WARRANT FOR LEFT-TURN STORAGE LANES ON TWO-LANE HIGHWAY**



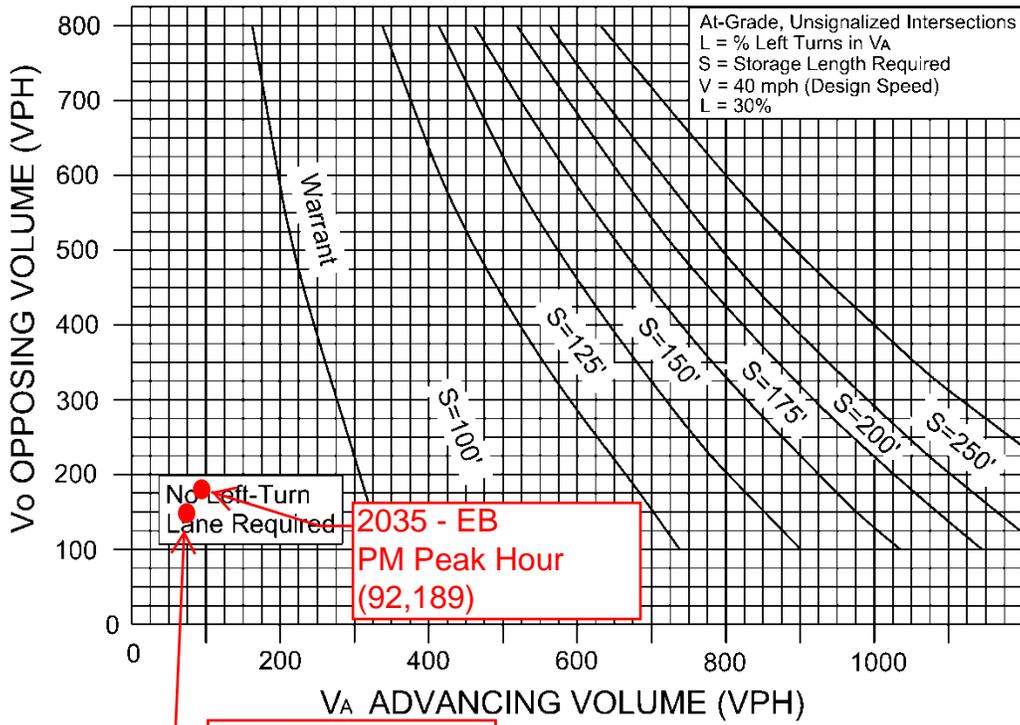
**FIGURE 3-7**



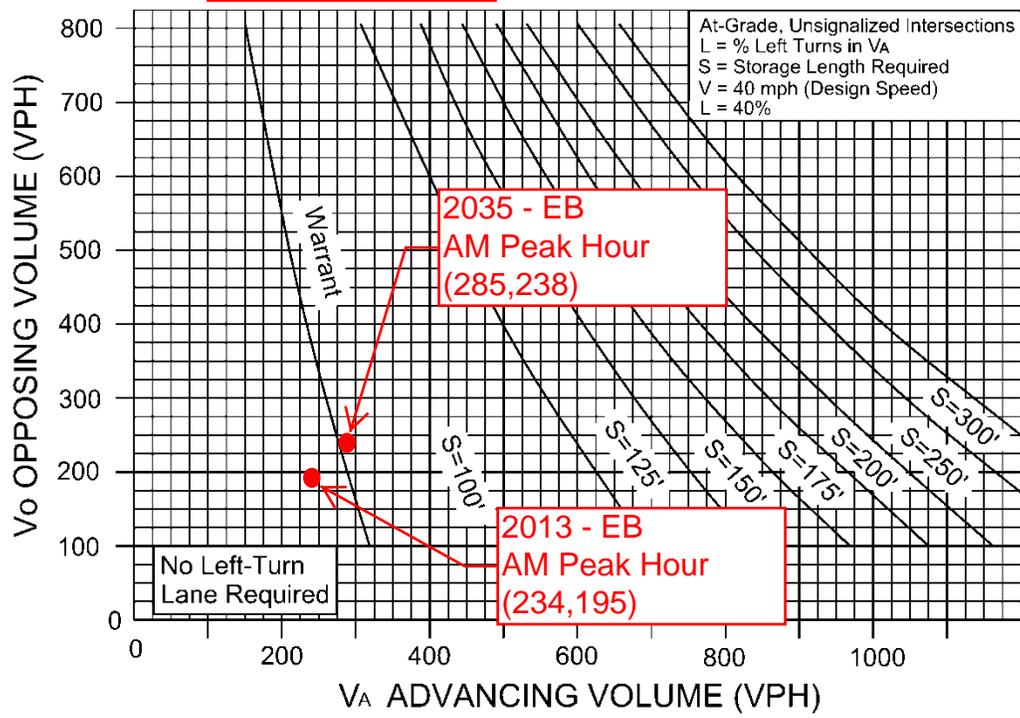
**FIGURE 3-8**

**EXISTING 2013 AND FUTURE 2035  
MOUNT CROSS ROAD**

**WARRANT FOR LEFT-TURN STORAGE LANES ON TWO-LANE HIGHWAY**



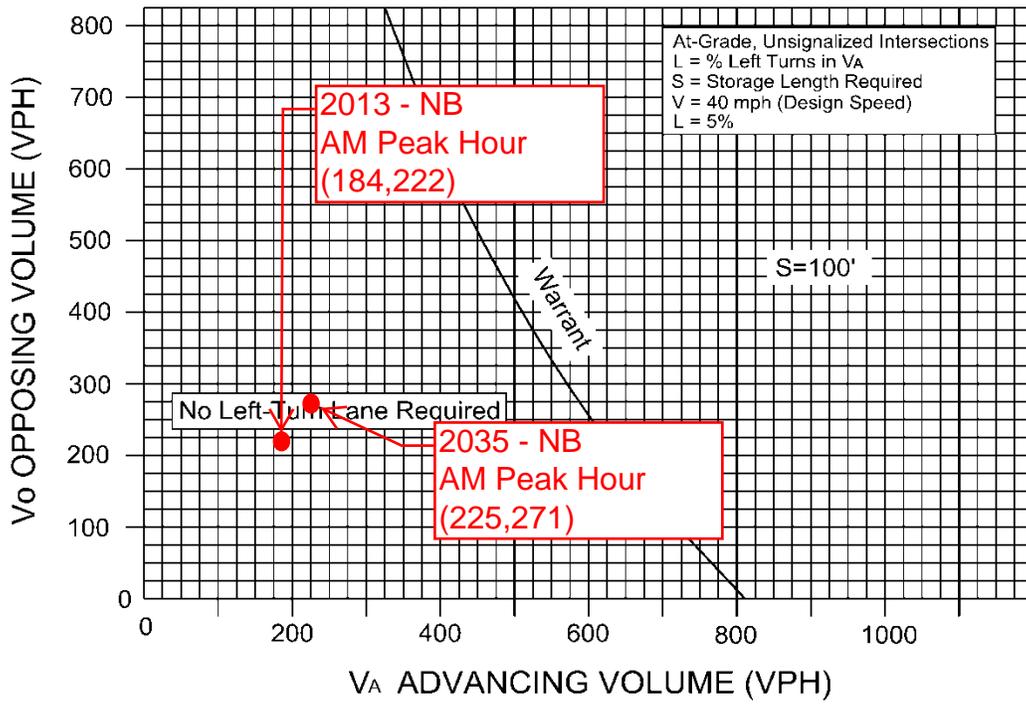
**FIGURE 3-9**



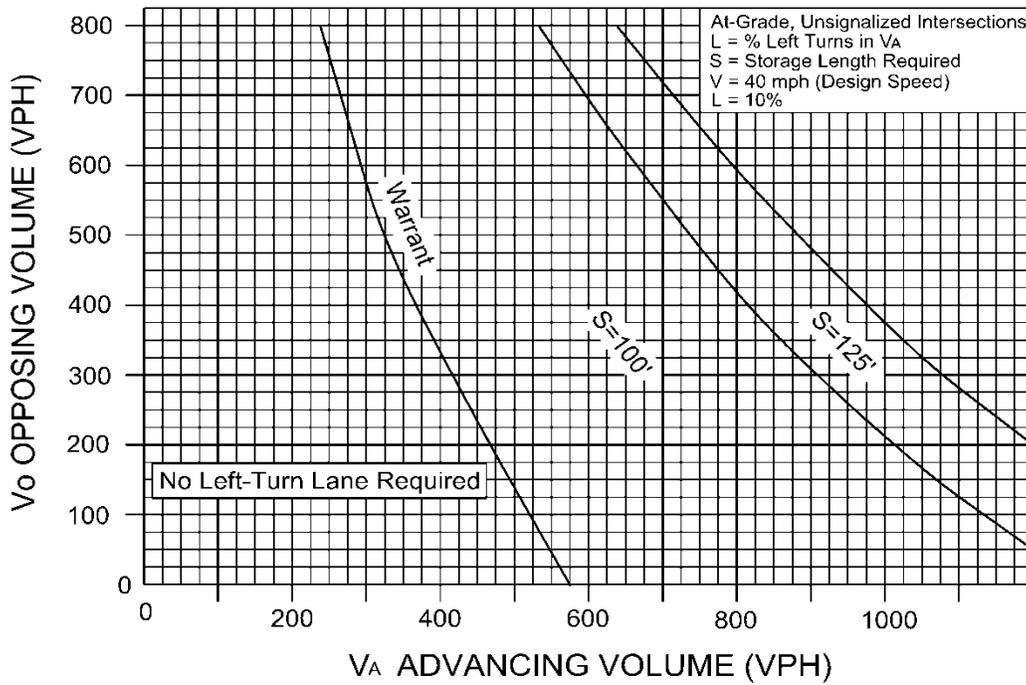
**FIGURE 3-10**

**EXISTING 2013 AND FUTURE 2035  
STONY MILL ROAD/TUNSTALL HIGH ROAD**

**WARRANT FOR LEFT-TURN STORAGE LANES ON TWO-LANE HIGHWAY**



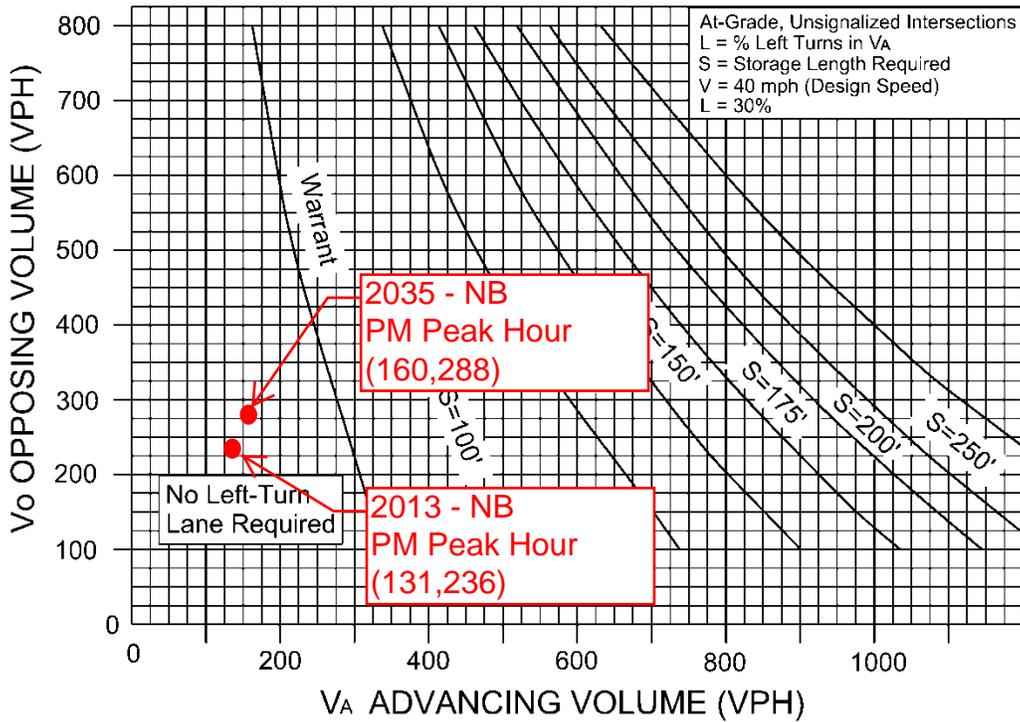
**FIGURE 3-5**



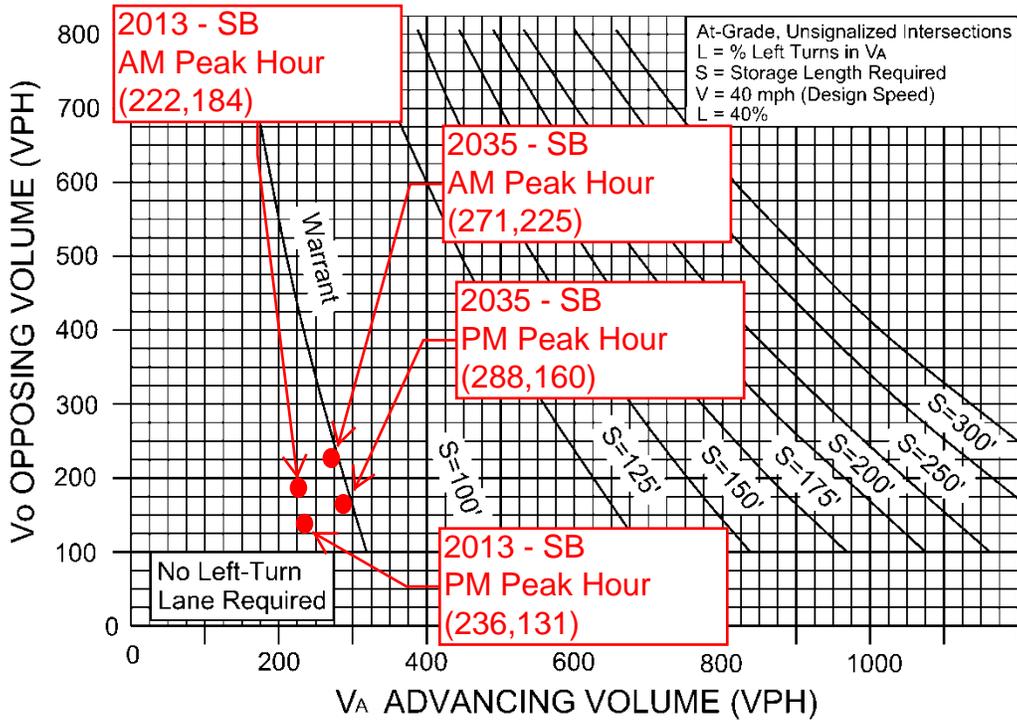
**FIGURE 3-6**

**EXISTING 2013 AND FUTURE 2035  
STONY MILL ROAD/TUNSTALL HIGH ROAD**

**WARRANT FOR LEFT-TURN STORAGE LANES ON TWO-LANE HIGHWAY**



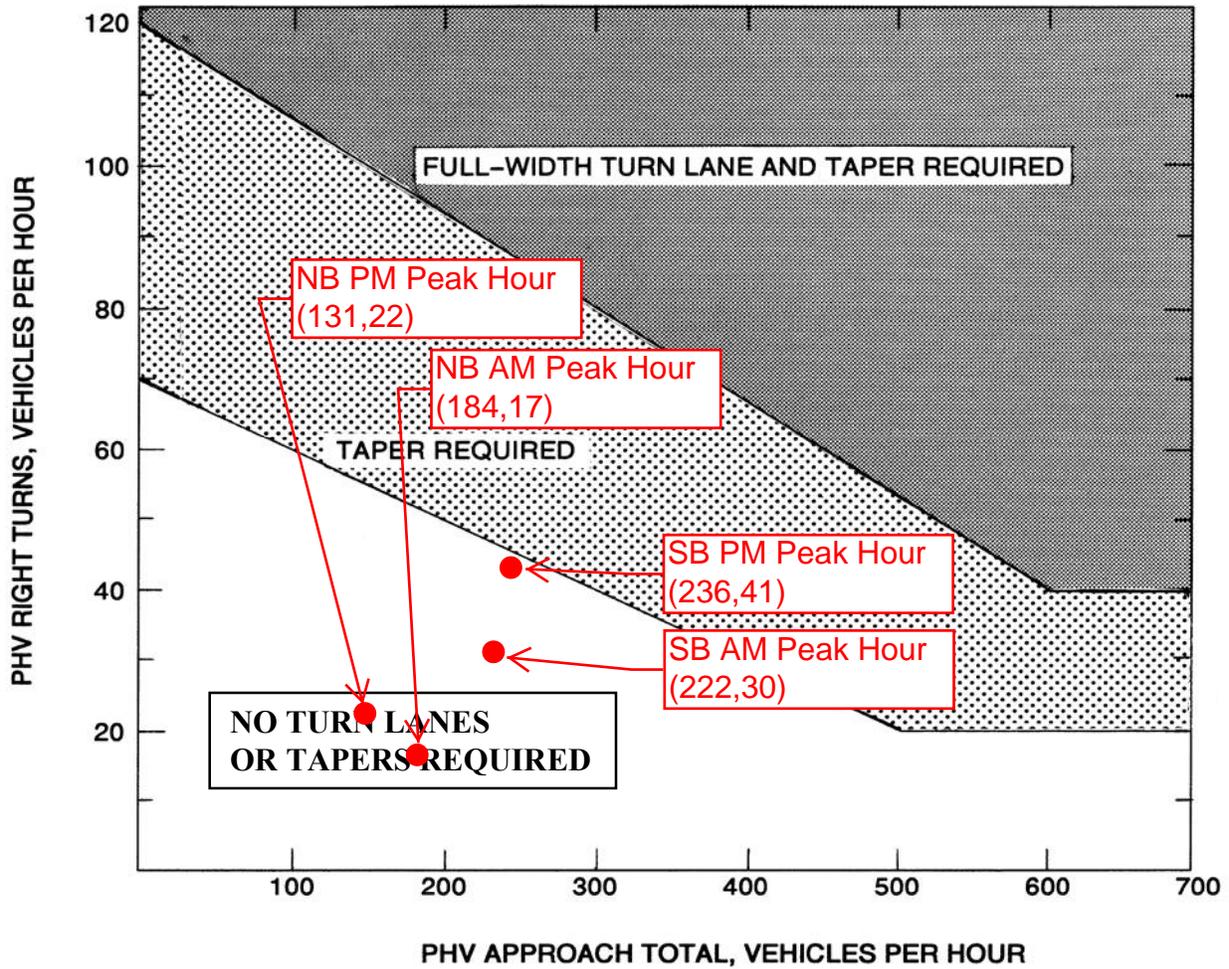
**FIGURE 3-9**



**FIGURE 3-10**

**EXISTING 2013**

**STONY MILL ROAD/TUNSTALL HIGH ROAD AT MOUNT CROSS ROAD**



Appropriate Radius required at all Intersections and Entrances (Commercial or Private).

**LEGEND**

**PHV** - Peak Hour Volume (also Design Hourly Volume equivalent)

**Adjustment for Right Turns**

For posted speeds at or under 45 mph, PHV right turns > 40, and PHV total < 300.

Adjusted right turns = PHV Right Turns - 20

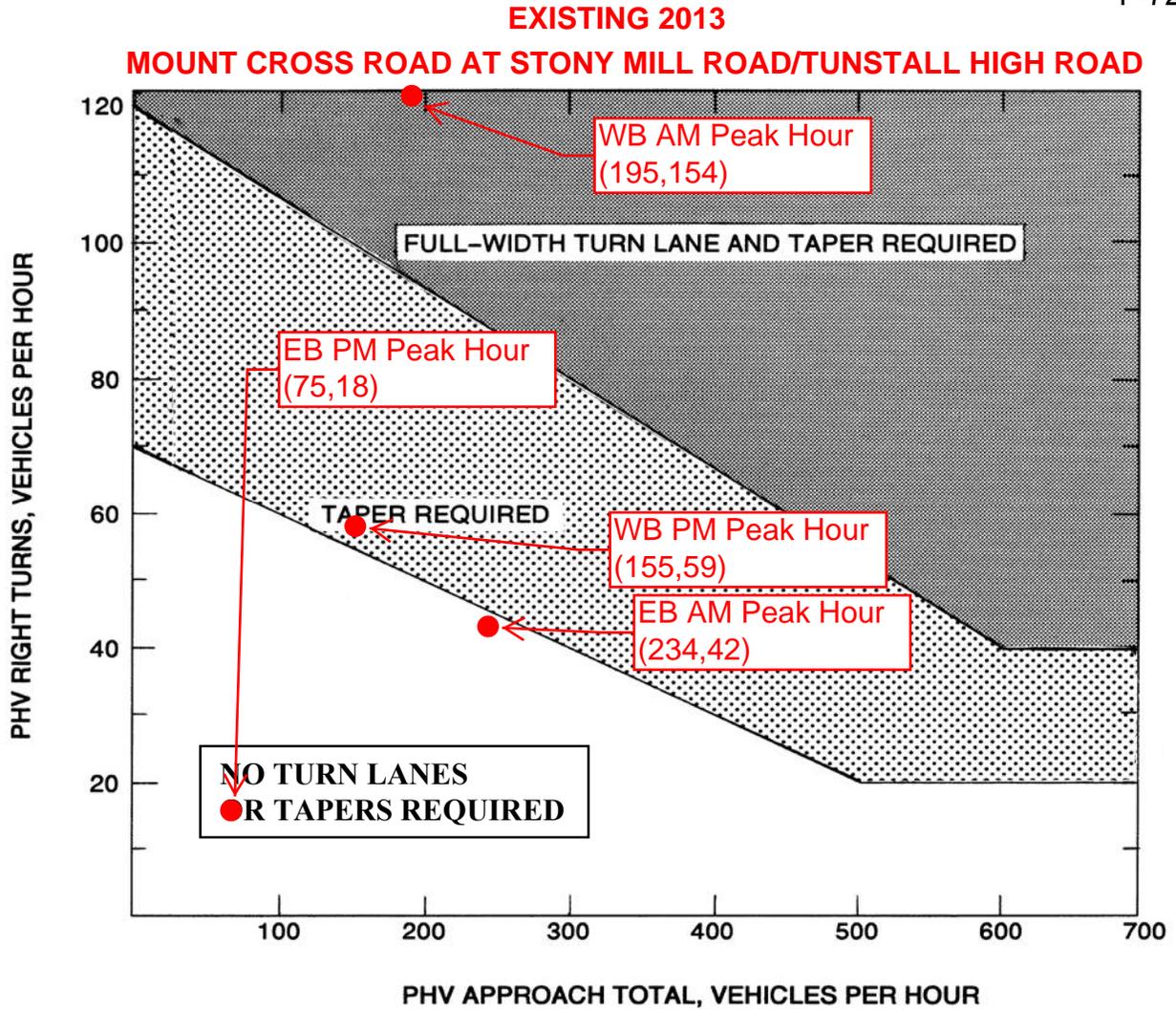
If PHV is not known use formula:  $PHV = ADT \times K \times D$

K = the percent of AADT occurring in the peak hour

D = the percent of traffic in the peak direction of flow

Note: An average of 11% for K x D will suffice.

**FIGURE 3-26 GUIDELINES FOR RIGHT TURN TREATMENT (2-LANE HIGHWAY)**



Appropriate Radius required at all Intersections and Entrances (Commercial or Private).

**LEGEND**

**PHV** - Peak Hour Volume (also Design Hourly Volume equivalent)

**Adjustment for Right Turns**

For posted speeds at or under 45 mph, PHV right turns > 40, and PHV total < 300.

Adjusted right turns = PHV Right Turns - 20

If PHV is not known use formula:  $PHV = ADT \times K \times D$

K = the percent of AADT occurring in the peak hour

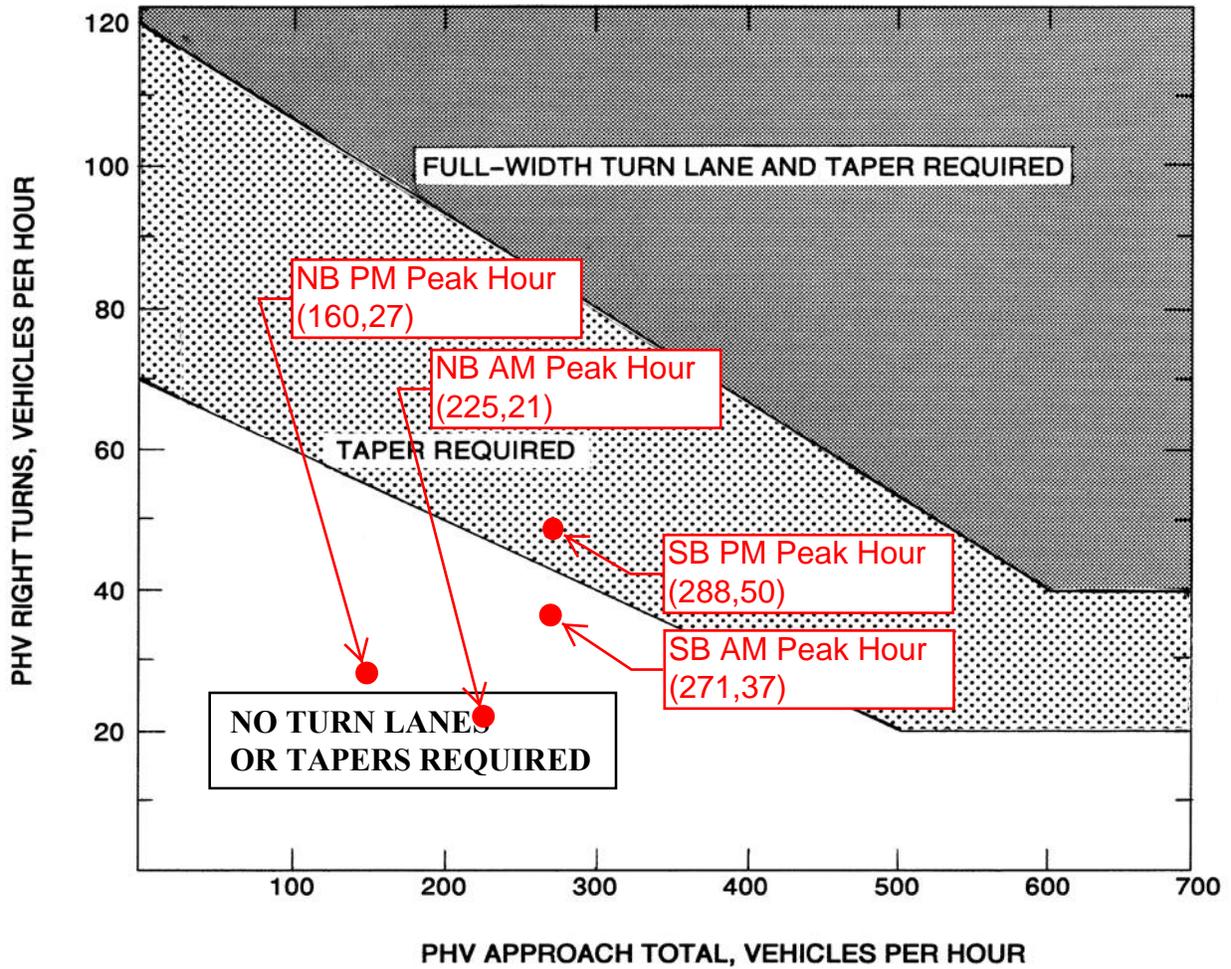
D = the percent of traffic in the peak direction of flow

Note: An average of 11% for K x D will suffice.

**FIGURE 3-26 GUIDELINES FOR RIGHT TURN TREATMENT (2-LANE HIGHWAY)**

**FUTURE 2035**

**STONY MILL ROAD/TUNSTALL HIGH ROAD AT MOUNT CROSS ROAD**



Appropriate Radius required at all Intersections and Entrances (Commercial or Private).

**LEGEND**

**PHV** - Peak Hour Volume (also Design Hourly Volume equivalent)

**Adjustment for Right Turns**

For posted speeds at or under 45 mph, PHV right turns > 40, and PHV total < 300.

Adjusted right turns = PHV Right Turns - 20

If PHV is not known use formula:  $PHV = ADT \times K \times D$

K = the percent of AADT occurring in the peak hour

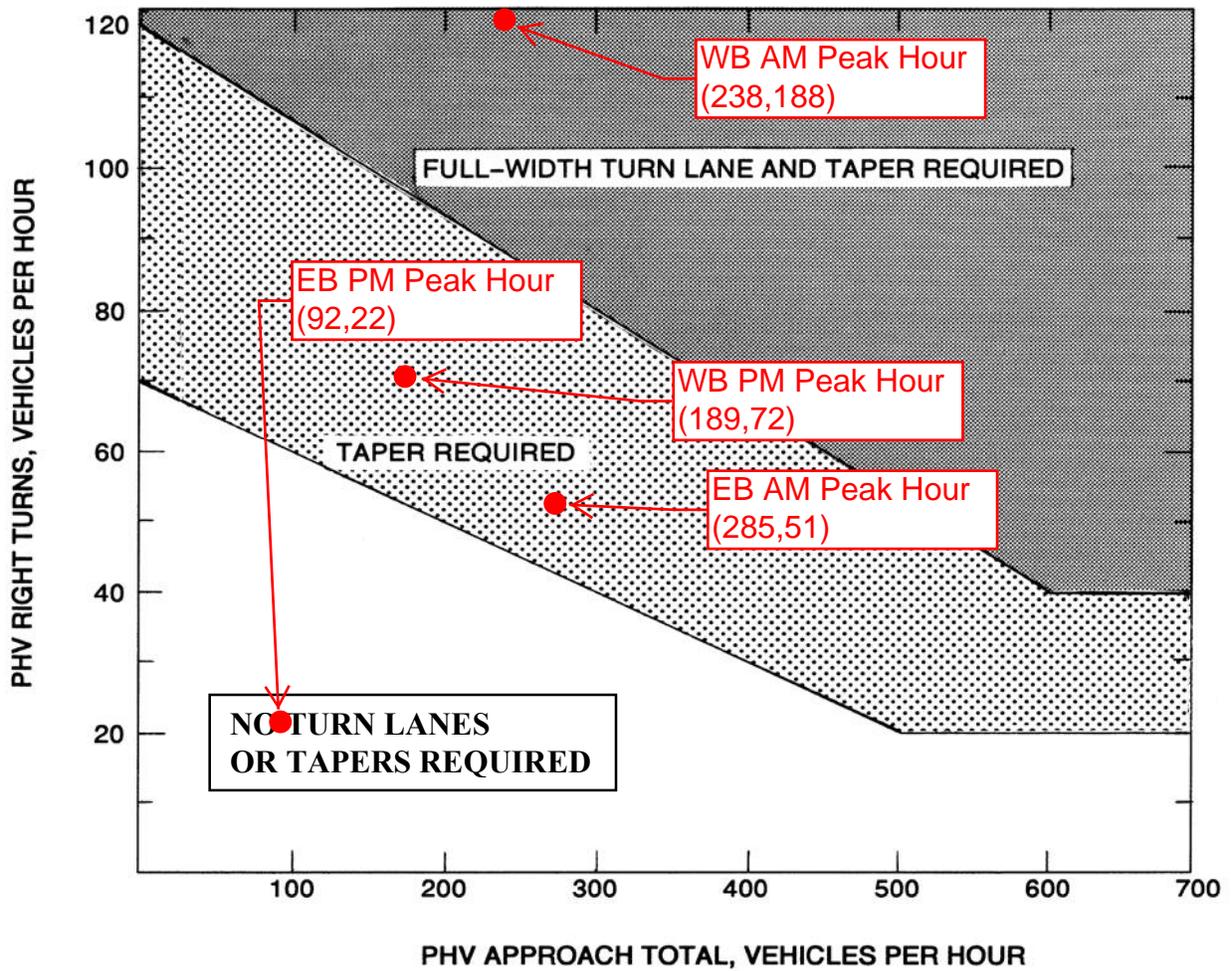
D = the percent of traffic in the peak direction of flow

Note: An average of 11% for K x D will suffice.

**FIGURE 3-26 GUIDELINES FOR RIGHT TURN TREATMENT (2-LANE HIGHWAY)**

**FUTURE 2035**

**MOUNT CROSS ROAD AT STONY MILL ROAD/TUNSTALL HIGH ROAD**



Appropriate Radius required at all Intersections and Entrances (Commercial or Private).

**LEGEND**

**PHV** - Peak Hour Volume (also Design Hourly Volume equivalent)

**Adjustment for Right Turns**

For posted speeds at or under 45 mph, PHV right turns > 40, and PHV total < 300.

Adjusted right turns = PHV Right Turns - 20

If PHV is not known use formula:  $PHV = ADT \times K \times D$

K = the percent of AADT occurring in the peak hour

D = the percent of traffic in the peak direction of flow

Note: An average of 11% for K x D will suffice.

**FIGURE 3-26 GUIDELINES FOR RIGHT TURN TREATMENT (2-LANE HIGHWAY)**

# Appendix D: Level of Service Worksheets

HCM Unsignalized Intersection Capacity Analysis  
 3: Stony Mill Rd/Tunstall High Rd & Mt Cross Rd

2013 Existing Conditions  
 AM Peak Hour



| Movement               | EBL  | EBT  | EBR  | WBL  | WBT  | WBR  | NBL  | NBT  | NBR  | SBL  | SBT  | SBR  |
|------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations    |      | ↕    |      |      | ↕    |      |      | ↕    | ↕    |      | ↕    |      |
| Volume (veh/h)         | 91   | 101  | 42   | 6    | 35   | 154  | 9    | 158  | 17   | 84   | 108  | 30   |
| Sign Control           |      | Free |      |      | Free |      |      | Stop |      |      | Stop |      |
| Grade                  |      | 0%   |      |      | 0%   |      |      | 0%   |      |      | 0%   |      |
| Peak Hour Factor       | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Hourly flow rate (vph) | 107  | 119  | 49   | 7    | 41   | 181  | 11   | 186  | 20   | 99   | 127  | 35   |
| Pedestrians            |      |      |      |      |      |      |      |      |      |      |      |      |
| Lane Width (ft)        |      |      |      |      |      |      |      |      |      |      |      |      |
| Walking Speed (ft/s)   |      |      |      |      |      |      |      |      |      |      |      |      |
| Percent Blockage       |      |      |      |      |      |      |      |      |      |      |      |      |
| Right turn flare (veh) |      |      |      |      |      |      |      |      | 1    |      |      |      |
| Median type            |      | None |      |      | None |      |      |      |      |      |      |      |
| Median storage (veh)   |      |      |      |      |      |      |      |      |      |      |      |      |
| Upstream signal (ft)   |      |      |      |      |      |      |      |      |      |      |      |      |
| pX, platoon unblocked  |      |      |      |      |      |      |      |      |      |      |      |      |
| vC, conflicting volume | 222  |      |      | 168  |      |      | 602  | 594  | 144  | 606  | 528  | 132  |
| vC1, stage 1 conf vol  |      |      |      |      |      |      |      |      |      |      |      |      |
| vC2, stage 2 conf vol  |      |      |      |      |      |      |      |      |      |      |      |      |
| vCu, unblocked vol     | 222  |      |      | 168  |      |      | 602  | 594  | 144  | 606  | 528  | 132  |
| tC, single (s)         | 4.1  |      |      | 4.1  |      |      | 7.1  | 6.5  | 6.2  | 7.2  | 6.6  | 6.3  |
| tC, 2 stage (s)        |      |      |      |      |      |      |      |      |      |      |      |      |
| tF (s)                 | 2.2  |      |      | 2.2  |      |      | 3.5  | 4.0  | 3.3  | 3.6  | 4.1  | 3.4  |
| p0 queue free %        | 92   |      |      | 99   |      |      | 96   | 51   | 98   | 56   | 69   | 96   |
| cM capacity (veh/h)    | 1341 |      |      | 1397 |      |      | 279  | 379  | 896  | 227  | 411  | 904  |

| Direction, Lane #      | EB 1 | WB 1 | NB 1 | SB 1 |
|------------------------|------|------|------|------|
| Volume Total           | 275  | 229  | 216  | 261  |
| Volume Left            | 107  | 7    | 11   | 99   |
| Volume Right           | 49   | 181  | 20   | 35   |
| cSH                    | 1341 | 1397 | 402  | 333  |
| Volume to Capacity     | 0.08 | 0.01 | 0.54 | 0.78 |
| Queue Length 95th (ft) | 6    | 0    | 77   | 159  |
| Control Delay (s)      | 3.5  | 0.3  | 23.9 | 45.7 |
| Lane LOS               | A    | A    | C    | E    |
| Approach Delay (s)     | 3.5  | 0.3  | 23.9 | 45.7 |
| Approach LOS           |      |      | C    | E    |

| Intersection Summary              |       |      |                        |
|-----------------------------------|-------|------|------------------------|
| Average Delay                     |       | 18.5 |                        |
| Intersection Capacity Utilization | 62.8% |      | ICU Level of Service B |
| Analysis Period (min)             | 15    |      |                        |

HCM Unsignalized Intersection Capacity Analysis  
 3: Stony Mill Rd/Tunstall High Rd & Mt Cross Rd

2013 Existing Conditions  
 PM Peak Hour



| Movement               | EBL  | EBT  | EBR  | WBL  | WBT  | WBR  | NBL  | NBT  | NBR  | SBL  | SBT  | SBR  |
|------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations    |      | ↕    |      |      | ↕    |      |      | ↕    | ↕    |      | ↕    |      |
| Volume (veh/h)         | 18   | 39   | 18   | 19   | 77   | 59   | 32   | 77   | 22   | 79   | 116  | 41   |
| Sign Control           |      | Free |      |      | Free |      |      | Stop |      |      | Stop |      |
| Grade                  |      | 0%   |      |      | 0%   |      |      | 0%   |      |      | 0%   |      |
| Peak Hour Factor       | 0.85 | 0.85 | 0.85 | 0.85 | 0.92 | 0.85 | 0.85 | 0.88 | 0.85 | 0.85 | 0.85 | 0.85 |
| Hourly flow rate (vph) | 21   | 46   | 21   | 22   | 84   | 69   | 38   | 88   | 26   | 93   | 136  | 48   |
| Pedestrians            |      |      |      |      |      |      |      |      |      |      |      |      |
| Lane Width (ft)        |      |      |      |      |      |      |      |      |      |      |      |      |
| Walking Speed (ft/s)   |      |      |      |      |      |      |      |      |      |      |      |      |
| Percent Blockage       |      |      |      |      |      |      |      |      |      |      |      |      |
| Right turn flare (veh) |      |      |      |      |      |      |      |      | 1    |      |      |      |
| Median type            |      | None |      |      | None |      |      |      |      |      |      |      |
| Median storage (veh)   |      |      |      |      |      |      |      |      |      |      |      |      |
| Upstream signal (ft)   |      |      |      |      |      |      |      |      |      |      |      |      |
| pX, platoon unblocked  |      |      |      |      |      |      |      |      |      |      |      |      |
| vC, conflicting volume | 153  |      |      | 67   |      |      | 378  | 297  | 56   | 319  | 273  | 118  |
| vC1, stage 1 conf vol  |      |      |      |      |      |      |      |      |      |      |      |      |
| vC2, stage 2 conf vol  |      |      |      |      |      |      |      |      |      |      |      |      |
| vCu, unblocked vol     | 153  |      |      | 67   |      |      | 378  | 297  | 56   | 319  | 273  | 118  |
| tC, single (s)         | 4.1  |      |      | 4.1  |      |      | 7.1  | 6.5  | 6.2  | 7.2  | 6.6  | 6.3  |
| tC, 2 stage (s)        |      |      |      |      |      |      |      |      |      |      |      |      |
| tF (s)                 | 2.2  |      |      | 2.2  |      |      | 3.5  | 4.0  | 3.3  | 3.6  | 4.1  | 3.4  |
| p0 queue free %        | 98   |      |      | 99   |      |      | 92   | 85   | 97   | 82   | 78   | 95   |
| cM capacity (veh/h)    | 1409 |      |      | 1528 |      |      | 443  | 595  | 1007 | 530  | 609  | 923  |

| Direction, Lane #      | EB 1 | WB 1 | NB 1 | SB 1 |
|------------------------|------|------|------|------|
| Volume Total           | 88   | 175  | 151  | 278  |
| Volume Left            | 21   | 22   | 38   | 93   |
| Volume Right           | 21   | 69   | 26   | 48   |
| cSH                    | 1409 | 1528 | 663  | 615  |
| Volume to Capacity     | 0.02 | 0.01 | 0.23 | 0.45 |
| Queue Length 95th (ft) | 1    | 1    | 22   | 59   |
| Control Delay (s)      | 1.9  | 1.0  | 12.7 | 15.6 |
| Lane LOS               | A    | A    | B    | C    |
| Approach Delay (s)     | 1.9  | 1.0  | 12.7 | 15.6 |
| Approach LOS           |      |      | B    | C    |

| Intersection Summary              |       |     |                      |
|-----------------------------------|-------|-----|----------------------|
| Average Delay                     |       | 9.5 |                      |
| Intersection Capacity Utilization | 38.2% |     | ICU Level of Service |
| Analysis Period (min)             | 15    |     | A                    |

HCM Unsignalized Intersection Capacity Analysis  
 3: Stony Mill Rd/Tunstall High Rd & Mt Cross Rd

2035 No-Build Conditions  
 AM Peak Hour



| Movement               | EBL  | EBT  | EBR  | WBL  | WBT  | WBR  | NBL  | NBT  | NBR  | SBL  | SBT  | SBR  |
|------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations    |      | ↕    |      |      | ↕    |      |      | ↕    | ↗    |      | ↕    |      |
| Volume (veh/h)         | 111  | 123  | 51   | 7    | 43   | 188  | 11   | 193  | 21   | 102  | 132  | 37   |
| Sign Control           |      | Free |      |      | Free |      |      | Stop |      |      | Stop |      |
| Grade                  |      | 0%   |      |      | 0%   |      |      | 0%   |      |      | 0%   |      |
| Peak Hour Factor       | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 121  | 134  | 55   | 8    | 47   | 204  | 12   | 210  | 23   | 111  | 143  | 40   |
| Pedestrians            |      |      |      |      |      |      |      |      |      |      |      |      |
| Lane Width (ft)        |      |      |      |      |      |      |      |      |      |      |      |      |
| Walking Speed (ft/s)   |      |      |      |      |      |      |      |      |      |      |      |      |
| Percent Blockage       |      |      |      |      |      |      |      |      |      |      |      |      |
| Right turn flare (veh) |      |      |      |      |      |      |      |      | 1    |      |      |      |
| Median type            |      | None |      |      | None |      |      |      |      |      |      |      |
| Median storage (veh)   |      |      |      |      |      |      |      |      |      |      |      |      |
| Upstream signal (ft)   |      |      |      |      |      |      |      |      |      |      |      |      |
| pX, platoon unblocked  |      |      |      |      |      |      |      |      |      |      |      |      |
| vC, conflicting volume | 251  |      |      | 189  |      |      | 679  | 669  | 161  | 683  | 595  | 149  |
| vC1, stage 1 conf vol  |      |      |      |      |      |      |      |      |      |      |      |      |
| vC2, stage 2 conf vol  |      |      |      |      |      |      |      |      |      |      |      |      |
| vCu, unblocked vol     | 251  |      |      | 189  |      |      | 679  | 669  | 161  | 683  | 595  | 149  |
| tC, single (s)         | 4.1  |      |      | 4.1  |      |      | 7.1  | 6.5  | 6.2  | 7.2  | 6.6  | 6.3  |
| tC, 2 stage (s)        |      |      |      |      |      |      |      |      |      |      |      |      |
| tF (s)                 | 2.2  |      |      | 2.2  |      |      | 3.5  | 4.0  | 3.3  | 3.6  | 4.1  | 3.4  |
| p0 queue free %        | 91   |      |      | 99   |      |      | 95   | 38   | 97   | 32   | 61   | 95   |
| cM capacity (veh/h)    | 1309 |      |      | 1373 |      |      | 225  | 338  | 876  | 164  | 371  | 885  |

| Direction, Lane #      | EB 1 | WB 1 | NB 1 | SB 1  |
|------------------------|------|------|------|-------|
| Volume Total           | 310  | 259  | 245  | 295   |
| Volume Left            | 121  | 8    | 12   | 111   |
| Volume Right           | 55   | 204  | 23   | 40    |
| cSH                    | 1309 | 1373 | 355  | 266   |
| Volume to Capacity     | 0.09 | 0.01 | 0.69 | 1.11  |
| Queue Length 95th (ft) | 8    | 0    | 122  | 312   |
| Control Delay (s)      | 3.6  | 0.3  | 34.8 | 128.9 |
| Lane LOS               | A    | A    | D    | F     |
| Approach Delay (s)     | 3.6  | 0.3  | 34.8 | 128.9 |
| Approach LOS           |      |      | D    | F     |

| Intersection Summary              |  |       |                      |
|-----------------------------------|--|-------|----------------------|
| Average Delay                     |  | 43.0  |                      |
| Intersection Capacity Utilization |  | 73.7% | ICU Level of Service |
| Analysis Period (min)             |  | 15    | D                    |

HCM Unsignalized Intersection Capacity Analysis  
 3: Stony Mill Rd/Tunstall High Rd & Mt Cross Rd

2035 No-Build Conditions  
 PM Peak Hour



| Movement               | EBL  | EBT  | EBR  | WBL  | WBT  | WBR  | NBL  | NBT  | NBR  | SBL  | SBT  | SBR  |
|------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations    |      | ↕    |      |      | ↕    |      |      | ↕    | ↕    |      | ↕    |      |
| Volume (veh/h)         | 22   | 48   | 22   | 23   | 94   | 72   | 39   | 94   | 27   | 96   | 142  | 50   |
| Sign Control           |      | Free |      |      | Free |      |      | Stop |      |      | Stop |      |
| Grade                  |      | 0%   |      |      | 0%   |      |      | 0%   |      |      | 0%   |      |
| Peak Hour Factor       | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 24   | 52   | 24   | 25   | 102  | 78   | 42   | 102  | 29   | 104  | 154  | 54   |
| Pedestrians            |      |      |      |      |      |      |      |      |      |      |      |      |
| Lane Width (ft)        |      |      |      |      |      |      |      |      |      |      |      |      |
| Walking Speed (ft/s)   |      |      |      |      |      |      |      |      |      |      |      |      |
| Percent Blockage       |      |      |      |      |      |      |      |      |      |      |      |      |
| Right turn flare (veh) |      |      |      |      |      |      |      |      | 1    |      |      |      |
| Median type            |      | None |      |      | None |      |      |      |      |      |      |      |
| Median storage (veh)   |      |      |      |      |      |      |      |      |      |      |      |      |
| Upstream signal (ft)   |      |      |      |      |      |      |      |      |      |      |      |      |
| pX, platoon unblocked  |      |      |      |      |      |      |      |      |      |      |      |      |
| vC, conflicting volume | 180  |      |      | 76   |      |      | 435  | 342  | 64   | 369  | 315  | 141  |
| vC1, stage 1 conf vol  |      |      |      |      |      |      |      |      |      |      |      |      |
| vC2, stage 2 conf vol  |      |      |      |      |      |      |      |      |      |      |      |      |
| vCu, unblocked vol     | 180  |      |      | 76   |      |      | 435  | 342  | 64   | 369  | 315  | 141  |
| tC, single (s)         | 4.1  |      |      | 4.1  |      |      | 7.1  | 6.5  | 6.2  | 7.2  | 6.6  | 6.3  |
| tC, 2 stage (s)        |      |      |      |      |      |      |      |      |      |      |      |      |
| tF (s)                 | 2.2  |      |      | 2.2  |      |      | 3.5  | 4.0  | 3.3  | 3.6  | 4.1  | 3.4  |
| p0 queue free %        | 98   |      |      | 98   |      |      | 89   | 82   | 97   | 78   | 73   | 94   |
| cM capacity (veh/h)    | 1377 |      |      | 1517 |      |      | 385  | 559  | 997  | 472  | 574  | 896  |

| Direction, Lane #      | EB 1 | WB 1 | NB 1 | SB 1 |
|------------------------|------|------|------|------|
| Volume Total           | 100  | 205  | 174  | 313  |
| Volume Left            | 24   | 25   | 42   | 104  |
| Volume Right           | 24   | 78   | 29   | 54   |
| cSH                    | 1377 | 1517 | 575  | 569  |
| Volume to Capacity     | 0.02 | 0.02 | 0.30 | 0.55 |
| Queue Length 95th (ft) | 1    | 1    | 32   | 83   |
| Control Delay (s)      | 1.9  | 1.0  | 14.0 | 18.8 |
| Lane LOS               | A    | A    | B    | C    |
| Approach Delay (s)     | 1.9  | 1.0  | 14.0 | 18.8 |
| Approach LOS           |      |      | B    | C    |

| Intersection Summary              |       |                      |   |
|-----------------------------------|-------|----------------------|---|
| Average Delay                     |       | 11.0                 |   |
| Intersection Capacity Utilization | 43.6% | ICU Level of Service | A |
| Analysis Period (min)             | 15    |                      |   |

HCM Unsignalized Intersection Capacity Analysis  
 3: Stony Mill Rd/Tunstall High Rd & Mt Cross Rd

2035 Alternative #1 Conditions  
 AM Peak Hour

|                                   |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Movement                          | EBL   | EBT   | EBR   | WBL   | WBT   | WBR   | NBL  | NBT   | NBR   | SBL   | SBT   | SBR   |
| Lane Configurations               |  |  |  |   |  |  |  |    |  |  |  |  |
| Volume (veh/h)                    | 111   | 123   | 51  | 7   | 43  | 188   | 11   | 193   | 21  | 102   | 132   | 37  |
| Sign Control                      |   | Free  |   |   | Free  |   |  | Stop  |   |   | Stop  |   |
| Grade                             |   | 0%  |   |   | 0%  |   |  | 0%  |   |   | 0%  |   |
| Peak Hour Factor                  | 0.92  | 0.92  | 0.92  | 0.92  | 0.92  | 0.92  | 0.92   | 0.92  | 0.92  | 0.92  | 0.92  | 0.92  |
| Hourly flow rate (vph)            | 121   | 134   | 55  | 8   | 47  | 204   | 12   | 210   | 23  | 111   | 143   | 40  |
| Pedestrians                       |   |   |   |   |   |   |  |   |   |   |   |   |
| Lane Width (ft)                   |   |   |   |   |   |   |  |   |   |   |   |   |
| Walking Speed (ft/s)              |   |   |   |   |   |   |  |   |   |   |   |   |
| Percent Blockage                  |   |   |   |   |   |   |  |   |   |   |   |   |
| Right turn flare (veh)            |   |   |   |   |   |   |  |   | 1   |   |   |   |
| Median type                       |   | None  |   |   | None  |   |  |   |   |   |   |   |
| Median storage (veh)              |   |   |   |   |   |   |  |   |   |   |   |   |
| Upstream signal (ft)              |   |   |   |   |   |   |  |   |   |   |   |   |
| pX, platoon unblocked             |   |   |   |   |   |   |  |   |   |   |   |   |
| vC, conflicting volume            | 251   |   |   | 189   |   |   | 549  | 641   | 134   | 553   | 492   | 47  |
| vC1, stage 1 conf vol             |   |   |   |   |   |   |  |   |   |   |   |   |
| vC2, stage 2 conf vol             |   |   |   |   |   |   |  |   |   |   |   |   |
| vCu, unblocked vol                | 251   |   |   | 189   |   |   | 549  | 641   | 134   | 553   | 492   | 47  |
| tC, single (s)                    | 4.1   |   |   | 4.1   |   |   | 7.1  | 6.5   | 6.2   | 7.2   | 6.6   | 6.3   |
| tC, 2 stage (s)                   |   |   |   |   |   |   |  |   |   |   |   |   |
| tF (s)                            | 2.2   |   |   | 2.2   |   |   | 3.5  | 4.0   | 3.3   | 3.6   | 4.1   | 3.4   |
| p0 queue free %                   | 91  |   |   | 99  |   |   | 96   | 40  | 97  | 47  | 66  | 96  |
| cM capacity (veh/h)               | 1309  |   |   | 1373  |   |   | 291  | 351   | 907   | 208   | 424   | 1008  |
| Direction, Lane #                 | EB 1  | EB 2  | EB 3  | WB 1  | WB 2  | NB 1  | SB 1   | SB 2  | SB 3  |   |   |   |
| Volume Total                      | 121   | 134   | 55  | 54  | 204   | 245   | 111  | 143   | 40  |   |   |   |
| Volume Left                       | 121   | 0   | 0   | 8   | 0   | 12  | 111  | 0   | 0   |   |   |   |
| Volume Right                      | 0   | 0   | 55  | 0   | 204   | 23  | 0  | 0   | 40  |   |   |   |
| cSH                               | 1309  | 1700  | 1700  | 1373  | 1700  | 373   | 208  | 424   | 1008  |   |   |   |
| Volume to Capacity                | 0.09  | 0.08  | 0.03  | 0.01  | 0.12  | 0.65  | 0.53   | 0.34  | 0.04  |   |   |   |
| Queue Length 95th (ft)            | 8   | 0   | 0   | 0   | 0   | 111   | 70   | 37  | 3   |   |   |   |
| Control Delay (s)                 | 8.0   | 0.0   | 0.0   | 1.1   | 0.0   | 31.2  | 40.5   | 17.7  | 8.7   |   |   |   |
| Lane LOS                          | A   |   |   | A   |   | D   | E  | C   | A   |   |   |   |
| Approach Delay (s)                | 3.1   |   |   | 0.2   |   | 31.2  | 25.1   |   |   |   |   |   |
| Approach LOS                      |   |   |   |   |   | D   | D  |   |   |   |   |   |
| Intersection Summary              |   |   |   |   |   |   |  |   |   |   |   |   |
| Average Delay                     |   |   | 14.5  |   |   |   |  |   |   |   |   |   |
| Intersection Capacity Utilization |   |   | 42.6%   |   |   | ICU Level of Service  |  |   | A   |   |   |   |
| Analysis Period (min)             |   |   | 15  |   |   |   |  |   |   |   |   |   |

HCM Unsignalized Intersection Capacity Analysis  
 3: Stony Mill Rd/Tunstall High Rd & Mt Cross Rd

2035 Alternative #1 Conditions  
 PM Peak Hour

|                                   |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Movement                          | EBL   | EBT   | EBR   | WBL   | WBT   | WBR   | NBL  | NBT   | NBR   | SBL   | SBT   | SBR   |
| Lane Configurations               |  |  |  |   |  |  |  |    |  |  |  |  |
| Volume (veh/h)                    | 22  | 48  | 22  | 23  | 94  | 72  | 39   | 94  | 27  | 96  | 142   | 50  |
| Sign Control                      |   | Free  |   |   | Free  |   |  | Stop  |   |   | Stop  |   |
| Grade                             |   | 0%  |   |   | 0%  |   |  | 0%  |   |   | 0%  |   |
| Peak Hour Factor                  | 0.92  | 0.92  | 0.92  | 0.92  | 0.92  | 0.92  | 0.92   | 0.92  | 0.92  | 0.92  | 0.92  | 0.92  |
| Hourly flow rate (vph)            | 24  | 52  | 24  | 25  | 102   | 78  | 42   | 102   | 29  | 104   | 154   | 54  |
| Pedestrians                       |   |   |   |   |   |   |  |   |   |   |   |   |
| Lane Width (ft)                   |   |   |   |   |   |   |  |   |   |   |   |   |
| Walking Speed (ft/s)              |   |   |   |   |   |   |  |   |   |   |   |   |
| Percent Blockage                  |   |   |   |   |   |   |  |   |   |   |   |   |
| Right turn flare (veh)            |   |   |   |   |   |   |  |   | 1   |   |   |   |
| Median type                       |   | None  |   |   | None  |   |  |   |   |   |   |   |
| Median storage (veh)              |   |   |   |   |   |   |  |   |   |   |   |   |
| Upstream signal (ft)              |   |   |   |   |   |   |  |   |   |   |   |   |
| pX, platoon unblocked             |   |   |   |   |   |   |  |   |   |   |   |   |
| vC, conflicting volume            | 180   |   |   | 76  |   |   | 384  | 330   | 52  | 318   | 276   | 102   |
| vC1, stage 1 conf vol             |   |   |   |   |   |   |  |   |   |   |   |   |
| vC2, stage 2 conf vol             |   |   |   |   |   |   |  |   |   |   |   |   |
| vCu, unblocked vol                | 180   |   |   | 76  |   |   | 384  | 330   | 52  | 318   | 276   | 102   |
| tC, single (s)                    | 4.1   |   |   | 4.1   |   |   | 7.1  | 6.5   | 6.2   | 7.2   | 6.6   | 6.3   |
| tC, 2 stage (s)                   |   |   |   |   |   |   |  |   |   |   |   |   |
| tF (s)                            | 2.2   |   |   | 2.2   |   |   | 3.5  | 4.0   | 3.3   | 3.6   | 4.1   | 3.4   |
| p0 queue free %                   | 98  |   |   | 98  |   |   | 90   | 82  | 97  | 80  | 74  | 94  |
| cM capacity (veh/h)               | 1377  |   |   | 1517  |   |   | 423  | 568   | 1013  | 512   | 604   | 942   |
| Direction, Lane #                 | EB 1  | EB 2  | EB 3  | WB 1  | WB 2  | NB 1  | SB 1   | SB 2  | SB 3  |   |   |   |
| Volume Total                      | 24  | 52  | 24  | 127   | 78  | 174   | 104  | 154   | 54  |   |   |   |
| Volume Left                       | 24  | 0   | 0   | 25  | 0   | 42  | 104  | 0   | 0   |   |   |   |
| Volume Right                      | 0   | 0   | 24  | 0   | 78  | 29  | 0  | 0   | 54  |   |   |   |
| cSH                               | 1377  | 1700  | 1700  | 1517  | 1700  | 597   | 512  | 604   | 942   |   |   |   |
| Volume to Capacity                | 0.02  | 0.03  | 0.01  | 0.02  | 0.05  | 0.29  | 0.20   | 0.26  | 0.06  |   |   |   |
| Queue Length 95th (ft)            | 1   | 0   | 0   | 1   | 0   | 30  | 19   | 25  | 5   |   |   |   |
| Control Delay (s)                 | 7.7   | 0.0   | 0.0   | 1.6   | 0.0   | 13.5  | 13.8   | 13.0  | 9.1   |   |   |   |
| Lane LOS                          | A   |   |   | A   |   | B   | B  | B   | A   |   |   |   |
| Approach Delay (s)                | 1.8   |   |   | 1.0   |   | 13.5  | 12.6   |   |   |   |   |   |
| Approach LOS                      |   |   |   |   |   | B   | B  |   |   |   |   |   |
| Intersection Summary              |   |   |   |   |   |   |  |   |   |   |   |   |
| Average Delay                     |   |   | 8.4   |   |   |   |  |   |   |   |   |   |
| Intersection Capacity Utilization |   |   | 39.2%   |   |   | ICU Level of Service  |  |   | A   |   |   |   |
| Analysis Period (min)             |   |   | 15  |   |   |   |  |   |   |   |   |   |

# MOVEMENT SUMMARY

Site: 2035 Alt #2 AM Peak Hour

Mount Cross Road / Stony Mill Road / Tunstall High Road  
Roundabout

| Movement Performance - Vehicles |      |                   |      |               |                   |                  |                                |                   |              |                             |                   |
|---------------------------------|------|-------------------|------|---------------|-------------------|------------------|--------------------------------|-------------------|--------------|-----------------------------|-------------------|
| Mov ID                          | Turn | Demand Flow veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | Queue Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
| South: Stony Mill Road          |      |                   |      |               |                   |                  |                                |                   |              |                             |                   |
| 3                               | L    | 12                | 5.0  | 0.303         | 11.1              | LOS B            | 1.8                            | 46.7              | 0.62         | 0.91                        | 27.0              |
| 8                               | T    | 210               | 5.0  | 0.303         | 5.5               | LOS A            | 1.8                            | 46.7              | 0.62         | 0.60                        | 28.9              |
| 18                              | R    | 23                | 5.0  | 0.303         | 6.7               | LOS A            | 1.8                            | 46.7              | 0.62         | 0.67                        | 28.9              |
| Approach                        |      | 245               | 5.0  | 0.303         | 5.9               | LOS A            | 1.8                            | 46.7              | 0.62         | 0.62                        | 28.8              |
| East: Mount Cross Road          |      |                   |      |               |                   |                  |                                |                   |              |                             |                   |
| 1                               | L    | 8                 | 4.0  | 0.310         | 8.7               | LOS A            | 1.9                            | 48.1              | 0.61         | 0.82                        | 21.9              |
| 6                               | T    | 47                | 4.0  | 0.310         | 3.0               | LOS A            | 1.9                            | 48.1              | 0.61         | 0.46                        | 22.7              |
| 16                              | R    | 204               | 4.0  | 0.310         | 4.2               | LOS A            | 1.9                            | 48.1              | 0.61         | 0.56                        | 22.7              |
| Approach                        |      | 259               | 4.0  | 0.310         | 4.1               | LOS A            | 1.9                            | 48.1              | 0.61         | 0.55                        | 22.7              |
| North: Tunstall High Road       |      |                   |      |               |                   |                  |                                |                   |              |                             |                   |
| 7                               | L    | 111               | 7.0  | 0.251         | 8.6               | LOS A            | 1.6                            | 41.2              | 0.27         | 0.73                        | 27.5              |
| 4                               | T    | 143               | 7.0  | 0.251         | 3.0               | LOS A            | 1.6                            | 41.2              | 0.27         | 0.29                        | 30.4              |
| 14                              | R    | 40                | 7.0  | 0.251         | 4.1               | LOS A            | 1.6                            | 41.2              | 0.27         | 0.39                        | 30.0              |
| Approach                        |      | 295               | 7.0  | 0.251         | 5.2               | LOS A            | 1.6                            | 41.2              | 0.27         | 0.47                        | 29.1              |
| West: Mount Cross Road          |      |                   |      |               |                   |                  |                                |                   |              |                             |                   |
| 5                               | L    | 121               | 3.0  | 0.338         | 8.1               | LOS A            | 2.1                            | 52.7              | 0.55         | 0.77                        | 22.0              |
| 2                               | T    | 134               | 3.0  | 0.338         | 2.4               | LOS A            | 2.1                            | 52.7              | 0.55         | 0.39                        | 22.8              |
| 12                              | R    | 55                | 3.0  | 0.338         | 3.6               | LOS A            | 2.1                            | 52.7              | 0.55         | 0.49                        | 22.8              |
| Approach                        |      | 310               | 3.0  | 0.338         | 4.8               | LOS A            | 2.1                            | 52.7              | 0.55         | 0.56                        | 22.4              |
| All Vehicles                    |      | 1108              | 4.7  | 0.338         | 5.0               | LOS A            | 2.1                            | 52.7              | 0.50         | 0.55                        | 25.3              |

Level of Service (LOS) Method: Delay (HCM 2000).

Roundabout LOS Method: Same as Signalised Intersections.

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model used.

# MOVEMENT SUMMARY

Site: 2035 Alt #2 PM Peak Hour

Mount Cross Road / Stony Mill Road / Tunstall High Road  
Roundabout

| Movement Performance - Vehicles |      |                      |      |                  |                      |                  |                                      |                         |              |                                |                      |
|---------------------------------|------|----------------------|------|------------------|----------------------|------------------|--------------------------------------|-------------------------|--------------|--------------------------------|----------------------|
| Mov ID                          | Turn | Demand Flow<br>veh/h | HV % | Deg. Satn<br>v/c | Average Delay<br>sec | Level of Service | 95% Back of Queue<br>Vehicles<br>veh | Queue<br>Distance<br>ft | Prop. Queued | Effective Stop Rate<br>per veh | Average Speed<br>mph |
| South: Stony Mill Road          |      |                      |      |                  |                      |                  |                                      |                         |              |                                |                      |
| 3                               | L    | 42                   | 3.0  | 0.175            | 9.3                  | LOS A            | 0.9                                  | 24.0                    | 0.41         | 0.79                           | 27.4                 |
| 8                               | T    | 102                  | 3.0  | 0.175            | 3.8                  | LOS A            | 0.9                                  | 24.0                    | 0.41         | 0.40                           | 29.7                 |
| 18                              | R    | 29                   | 3.0  | 0.175            | 4.9                  | LOS A            | 0.9                                  | 24.0                    | 0.41         | 0.49                           | 29.5                 |
| Approach                        |      | 174                  | 3.0  | 0.175            | 5.3                  | LOS A            | 0.9                                  | 24.0                    | 0.41         | 0.51                           | 29.0                 |
| East: Mount Cross Road          |      |                      |      |                  |                      |                  |                                      |                         |              |                                |                      |
| 1                               | L    | 25                   | 3.0  | 0.204            | 7.1                  | LOS A            | 1.1                                  | 29.1                    | 0.40         | 0.79                           | 22.4                 |
| 6                               | T    | 102                  | 3.0  | 0.204            | 1.4                  | LOS A            | 1.1                                  | 29.1                    | 0.40         | 0.23                           | 23.4                 |
| 16                              | R    | 78                   | 3.0  | 0.204            | 2.6                  | LOS A            | 1.1                                  | 29.1                    | 0.40         | 0.34                           | 23.3                 |
| Approach                        |      | 205                  | 3.0  | 0.204            | 2.5                  | LOS A            | 1.1                                  | 29.1                    | 0.40         | 0.34                           | 23.2                 |
| North: Tunstall High Road       |      |                      |      |                  |                      |                  |                                      |                         |              |                                |                      |
| 7                               | L    | 104                  | 6.0  | 0.311            | 9.5                  | LOS A            | 1.9                                  | 49.9                    | 0.44         | 0.76                           | 27.3                 |
| 4                               | T    | 154                  | 6.0  | 0.311            | 3.9                  | LOS A            | 1.9                                  | 49.9                    | 0.44         | 0.42                           | 29.4                 |
| 14                              | R    | 54                   | 6.0  | 0.311            | 5.0                  | LOS A            | 1.9                                  | 49.9                    | 0.44         | 0.50                           | 29.2                 |
| Approach                        |      | 313                  | 6.0  | 0.311            | 5.9                  | LOS A            | 1.9                                  | 49.9                    | 0.44         | 0.55                           | 28.6                 |
| West: Mount Cross Road          |      |                      |      |                  |                      |                  |                                      |                         |              |                                |                      |
| 5                               | L    | 24                   | 5.0  | 0.115            | 7.9                  | LOS A            | 0.6                                  | 15.6                    | 0.49         | 0.78                           | 22.1                 |
| 2                               | T    | 52                   | 5.0  | 0.115            | 2.2                  | LOS A            | 0.6                                  | 15.6                    | 0.49         | 0.34                           | 23.1                 |
| 12                              | R    | 24                   | 5.0  | 0.115            | 3.3                  | LOS A            | 0.6                                  | 15.6                    | 0.49         | 0.44                           | 23.0                 |
| Approach                        |      | 100                  | 5.0  | 0.115            | 3.8                  | LOS A            | 0.6                                  | 15.6                    | 0.49         | 0.47                           | 22.8                 |
| All Vehicles                    |      | 792                  | 4.4  | 0.311            | 4.7                  | LOS A            | 1.9                                  | 49.9                    | 0.43         | 0.48                           | 26.3                 |

Level of Service (LOS) Method: Delay (HCM 2000).

Roundabout LOS Method: Same as Signalised Intersections.

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model used.

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**SIDRA  
INTERSECTION**

# Appendix E: Queuing Worksheets

# Queuing and Blocking Report

## AM Peak Hour

2/10/2014

### Intersection: 3: Mt Cross Rd & Tunstall High Rd

| Movement              | EB   | WB   | NB   | NB | SB   |
|-----------------------|------|------|------|----|------|
| Directions Served     | LTR  | LTR  | LT   | R  | LTR  |
| Maximum Queue (ft)    | 76   | 43   | 138  | 56 | 154  |
| Average Queue (ft)    | 20   | 4    | 57   | 18 | 65   |
| 95th Queue (ft)       | 57   | 23   | 107  | 52 | 117  |
| Link Distance (ft)    | 1478 | 1930 | 1731 |    | 1931 |
| Upstream Blk Time (%) |      |      |      |    |      |
| Queuing Penalty (veh) |      |      |      |    |      |
| Storage Bay Dist (ft) |      |      |      | 25 |      |
| Storage Blk Time (%)  |      |      | 26   | 2  |      |
| Queuing Penalty (veh) |      |      | 4    | 3  |      |

### Network Summary

Network wide Queuing Penalty: 7

# Queuing and Blocking Report

## PM Peak Hour

2/10/2014

### Intersection: 3: Mt Cross Rd & Tunstall High Rd

| Movement              | EB   | WB   | NB   | NB | SB   |
|-----------------------|------|------|------|----|------|
| Directions Served     | LTR  | LTR  | LT   | R  | LTR  |
| Maximum Queue (ft)    | 26   | 28   | 80   | 60 | 119  |
| Average Queue (ft)    | 3    | 2    | 38   | 21 | 58   |
| 95th Queue (ft)       | 18   | 15   | 64   | 54 | 97   |
| Link Distance (ft)    | 1478 | 1930 | 1731 |    | 1931 |
| Upstream Blk Time (%) |      |      |      |    |      |
| Queuing Penalty (veh) |      |      |      |    |      |
| Storage Bay Dist (ft) |      |      |      | 25 |      |
| Storage Blk Time (%)  |      |      | 10   | 2  |      |
| Queuing Penalty (veh) |      |      | 2    | 2  |      |

### Network Summary

Network wide Queuing Penalty: 5

# Queuing and Blocking Report

## AM Peak Hour

2/10/2014

### Intersection: 3: Mt Cross Rd & Tunstall High Rd

| Movement              | EB   | WB   | NB   | NB | SB   |
|-----------------------|------|------|------|----|------|
| Directions Served     | LTR  | LTR  | LT   | R  | LTR  |
| Maximum Queue (ft)    | 104  | 36   | 183  | 52 | 200  |
| Average Queue (ft)    | 31   | 5    | 76   | 21 | 86   |
| 95th Queue (ft)       | 79   | 21   | 142  | 57 | 155  |
| Link Distance (ft)    | 1478 | 1930 | 1731 |    | 1931 |
| Upstream Blk Time (%) |      |      |      |    |      |
| Queuing Penalty (veh) |      |      |      |    |      |
| Storage Bay Dist (ft) |      |      |      | 25 |      |
| Storage Blk Time (%)  |      |      | 39   | 2  |      |
| Queuing Penalty (veh) |      |      | 8    | 5  |      |

### Network Summary

Network wide Queuing Penalty: 13

Queuing and Blocking Report  
PM Peak Hour

2/10/2014

Intersection: 3: Mt Cross Rd & Tunstall High Rd

| Movement              | EB   | WB   | NB   | NB | SB   |
|-----------------------|------|------|------|----|------|
| Directions Served     | LTR  | LTR  | LT   | R  | LTR  |
| Maximum Queue (ft)    | 40   | 36   | 87   | 55 | 168  |
| Average Queue (ft)    | 6    | 4    | 42   | 22 | 70   |
| 95th Queue (ft)       | 27   | 20   | 71   | 55 | 125  |
| Link Distance (ft)    | 1478 | 1930 | 1731 |    | 1931 |
| Upstream Blk Time (%) |      |      |      |    |      |
| Queuing Penalty (veh) |      |      |      |    |      |
| Storage Bay Dist (ft) |      |      |      | 25 |      |
| Storage Blk Time (%)  |      |      | 14   | 2  |      |
| Queuing Penalty (veh) |      |      | 4    | 3  |      |

Network Summary

Network wide Queuing Penalty: 7

Queuing and Blocking Report  
 AM Peak Hour

3/11/2014

Intersection: 3: Mt Cross Rd & Tunstall High Rd

| Movement              | EB  | EB   | EB | WB   | WB  | NB   | NB | SB  | SB   | SB |
|-----------------------|-----|------|----|------|-----|------|----|-----|------|----|
| Directions Served     | L   | T    | R  | LT   | R   | LT   | R  | L   | T    | R  |
| Maximum Queue (ft)    | 72  | 5    | 30 | 29   | 46  | 180  | 52 | 89  | 120  | 52 |
| Average Queue (ft)    | 23  | 0    | 1  | 2    | 11  | 70   | 20 | 39  | 45   | 17 |
| 95th Queue (ft)       | 55  | 3    | 15 | 14   | 31  | 137  | 55 | 73  | 85   | 40 |
| Link Distance (ft)    |     | 1458 |    | 1926 |     | 1715 |    |     | 1912 |    |
| Upstream Blk Time (%) |     |      |    |      |     |      |    |     |      |    |
| Queuing Penalty (veh) |     |      |    |      |     |      |    |     |      |    |
| Storage Bay Dist (ft) | 200 |      | 5  |      | 200 |      | 25 | 200 |      | 5  |
| Storage Blk Time (%)  |     | 0    | 0  |      |     | 39   | 3  |     | 19   | 3  |
| Queuing Penalty (veh) |     | 0    | 0  |      |     | 8    | 5  |     | 26   | 7  |

Network Summary

Network wide Queuing Penalty: 46

Queuing and Blocking Report  
 PM Peak Hour

3/11/2014

Intersection: 3: Mt Cross Rd & Tunstall High Rd

| Movement              | EB  | EB   | EB | WB   | WB  | NB   | NB | SB  | SB   | SB |
|-----------------------|-----|------|----|------|-----|------|----|-----|------|----|
| Directions Served     | L   | T    | R  | LT   | R   | LT   | R  | L   | T    | R  |
| Maximum Queue (ft)    | 28  | 2    | 6  | 27   | 19  | 89   | 54 | 88  | 92   | 56 |
| Average Queue (ft)    | 4   | 0    | 0  | 3    | 1   | 39   | 21 | 37  | 39   | 20 |
| 95th Queue (ft)       | 18  | 2    | 3  | 16   | 10  | 70   | 53 | 68  | 69   | 42 |
| Link Distance (ft)    |     | 1458 |    | 1926 |     | 1715 |    |     | 1912 |    |
| Upstream Blk Time (%) |     |      |    |      |     |      |    |     |      |    |
| Queuing Penalty (veh) |     |      |    |      |     |      |    |     |      |    |
| Storage Bay Dist (ft) | 200 |      | 5  |      | 200 |      | 25 | 200 |      | 5  |
| Storage Blk Time (%)  |     | 0    | 0  |      |     | 15   | 2  |     | 12   | 4  |
| Queuing Penalty (veh) |     | 0    | 0  |      |     | 4    | 3  |     | 18   | 9  |

Network Summary

Network wide Queuing Penalty: 35

# MOVEMENT SUMMARY

Site: 2035 Alt #2 AM Peak Hour

Mount Cross Road / Stony Mill Road / Tunstall High Road  
Roundabout

| Movement Performance - Vehicles |      |                   |      |               |                   |                  |                                |                   |              |                             |                   |
|---------------------------------|------|-------------------|------|---------------|-------------------|------------------|--------------------------------|-------------------|--------------|-----------------------------|-------------------|
| Mov ID                          | Turn | Demand Flow veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | Queue Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
| South: Stony Mill Road          |      |                   |      |               |                   |                  |                                |                   |              |                             |                   |
| 3                               | L    | 12                | 5.0  | 0.303         | 11.1              | LOS B            | 1.8                            | 46.7              | 0.62         | 0.91                        | 27.0              |
| 8                               | T    | 210               | 5.0  | 0.303         | 5.5               | LOS A            | 1.8                            | 46.7              | 0.62         | 0.60                        | 28.9              |
| 18                              | R    | 23                | 5.0  | 0.303         | 6.7               | LOS A            | 1.8                            | 46.7              | 0.62         | 0.67                        | 28.9              |
| Approach                        |      | 245               | 5.0  | 0.303         | 5.9               | LOS A            | 1.8                            | 46.7              | 0.62         | 0.62                        | 28.8              |
| East: Mount Cross Road          |      |                   |      |               |                   |                  |                                |                   |              |                             |                   |
| 1                               | L    | 8                 | 4.0  | 0.310         | 8.7               | LOS A            | 1.9                            | 48.1              | 0.61         | 0.82                        | 21.9              |
| 6                               | T    | 47                | 4.0  | 0.310         | 3.0               | LOS A            | 1.9                            | 48.1              | 0.61         | 0.46                        | 22.7              |
| 16                              | R    | 204               | 4.0  | 0.310         | 4.2               | LOS A            | 1.9                            | 48.1              | 0.61         | 0.56                        | 22.7              |
| Approach                        |      | 259               | 4.0  | 0.310         | 4.1               | LOS A            | 1.9                            | 48.1              | 0.61         | 0.55                        | 22.7              |
| North: Tunstall High Road       |      |                   |      |               |                   |                  |                                |                   |              |                             |                   |
| 7                               | L    | 111               | 7.0  | 0.251         | 8.6               | LOS A            | 1.6                            | 41.2              | 0.27         | 0.73                        | 27.5              |
| 4                               | T    | 143               | 7.0  | 0.251         | 3.0               | LOS A            | 1.6                            | 41.2              | 0.27         | 0.29                        | 30.4              |
| 14                              | R    | 40                | 7.0  | 0.251         | 4.1               | LOS A            | 1.6                            | 41.2              | 0.27         | 0.39                        | 30.0              |
| Approach                        |      | 295               | 7.0  | 0.251         | 5.2               | LOS A            | 1.6                            | 41.2              | 0.27         | 0.47                        | 29.1              |
| West: Mount Cross Road          |      |                   |      |               |                   |                  |                                |                   |              |                             |                   |
| 5                               | L    | 121               | 3.0  | 0.338         | 8.1               | LOS A            | 2.1                            | 52.7              | 0.55         | 0.77                        | 22.0              |
| 2                               | T    | 134               | 3.0  | 0.338         | 2.4               | LOS A            | 2.1                            | 52.7              | 0.55         | 0.39                        | 22.8              |
| 12                              | R    | 55                | 3.0  | 0.338         | 3.6               | LOS A            | 2.1                            | 52.7              | 0.55         | 0.49                        | 22.8              |
| Approach                        |      | 310               | 3.0  | 0.338         | 4.8               | LOS A            | 2.1                            | 52.7              | 0.55         | 0.56                        | 22.4              |
| All Vehicles                    |      | 1108              | 4.7  | 0.338         | 5.0               | LOS A            | 2.1                            | 52.7              | 0.50         | 0.55                        | 25.3              |

Level of Service (LOS) Method: Delay (HCM 2000).

Roundabout LOS Method: Same as Signalised Intersections.

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model used.

# MOVEMENT SUMMARY

Site: 2035 Alt #2 PM Peak Hour

Mount Cross Road / Stony Mill Road / Tunstall High Road  
Roundabout

| Movement Performance - Vehicles |      |                      |      |                  |                      |                  |                                      |                         |              |                                |                      |
|---------------------------------|------|----------------------|------|------------------|----------------------|------------------|--------------------------------------|-------------------------|--------------|--------------------------------|----------------------|
| Mov ID                          | Turn | Demand Flow<br>veh/h | HV % | Deg. Satn<br>v/c | Average Delay<br>sec | Level of Service | 95% Back of Queue<br>Vehicles<br>veh | Queue<br>Distance<br>ft | Prop. Queued | Effective Stop Rate<br>per veh | Average Speed<br>mph |
| South: Stony Mill Road          |      |                      |      |                  |                      |                  |                                      |                         |              |                                |                      |
| 3                               | L    | 42                   | 3.0  | 0.175            | 9.3                  | LOS A            | 0.9                                  | 24.0                    | 0.41         | 0.79                           | 27.4                 |
| 8                               | T    | 102                  | 3.0  | 0.175            | 3.8                  | LOS A            | 0.9                                  | 24.0                    | 0.41         | 0.40                           | 29.7                 |
| 18                              | R    | 29                   | 3.0  | 0.175            | 4.9                  | LOS A            | 0.9                                  | 24.0                    | 0.41         | 0.49                           | 29.5                 |
| Approach                        |      | 174                  | 3.0  | 0.175            | 5.3                  | LOS A            | 0.9                                  | 24.0                    | 0.41         | 0.51                           | 29.0                 |
| East: Mount Cross Road          |      |                      |      |                  |                      |                  |                                      |                         |              |                                |                      |
| 1                               | L    | 25                   | 3.0  | 0.204            | 7.1                  | LOS A            | 1.1                                  | 29.1                    | 0.40         | 0.79                           | 22.4                 |
| 6                               | T    | 102                  | 3.0  | 0.204            | 1.4                  | LOS A            | 1.1                                  | 29.1                    | 0.40         | 0.23                           | 23.4                 |
| 16                              | R    | 78                   | 3.0  | 0.204            | 2.6                  | LOS A            | 1.1                                  | 29.1                    | 0.40         | 0.34                           | 23.3                 |
| Approach                        |      | 205                  | 3.0  | 0.204            | 2.5                  | LOS A            | 1.1                                  | 29.1                    | 0.40         | 0.34                           | 23.2                 |
| North: Tunstall High Road       |      |                      |      |                  |                      |                  |                                      |                         |              |                                |                      |
| 7                               | L    | 104                  | 6.0  | 0.311            | 9.5                  | LOS A            | 1.9                                  | 49.9                    | 0.44         | 0.76                           | 27.3                 |
| 4                               | T    | 154                  | 6.0  | 0.311            | 3.9                  | LOS A            | 1.9                                  | 49.9                    | 0.44         | 0.42                           | 29.4                 |
| 14                              | R    | 54                   | 6.0  | 0.311            | 5.0                  | LOS A            | 1.9                                  | 49.9                    | 0.44         | 0.50                           | 29.2                 |
| Approach                        |      | 313                  | 6.0  | 0.311            | 5.9                  | LOS A            | 1.9                                  | 49.9                    | 0.44         | 0.55                           | 28.6                 |
| West: Mount Cross Road          |      |                      |      |                  |                      |                  |                                      |                         |              |                                |                      |
| 5                               | L    | 24                   | 5.0  | 0.115            | 7.9                  | LOS A            | 0.6                                  | 15.6                    | 0.49         | 0.78                           | 22.1                 |
| 2                               | T    | 52                   | 5.0  | 0.115            | 2.2                  | LOS A            | 0.6                                  | 15.6                    | 0.49         | 0.34                           | 23.1                 |
| 12                              | R    | 24                   | 5.0  | 0.115            | 3.3                  | LOS A            | 0.6                                  | 15.6                    | 0.49         | 0.44                           | 23.0                 |
| Approach                        |      | 100                  | 5.0  | 0.115            | 3.8                  | LOS A            | 0.6                                  | 15.6                    | 0.49         | 0.47                           | 22.8                 |
| All Vehicles                    |      | 792                  | 4.4  | 0.311            | 4.7                  | LOS A            | 1.9                                  | 49.9                    | 0.43         | 0.48                           | 26.3                 |

Level of Service (LOS) Method: Delay (HCM 2000).

Roundabout LOS Method: Same as Signalised Intersections.

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model used.

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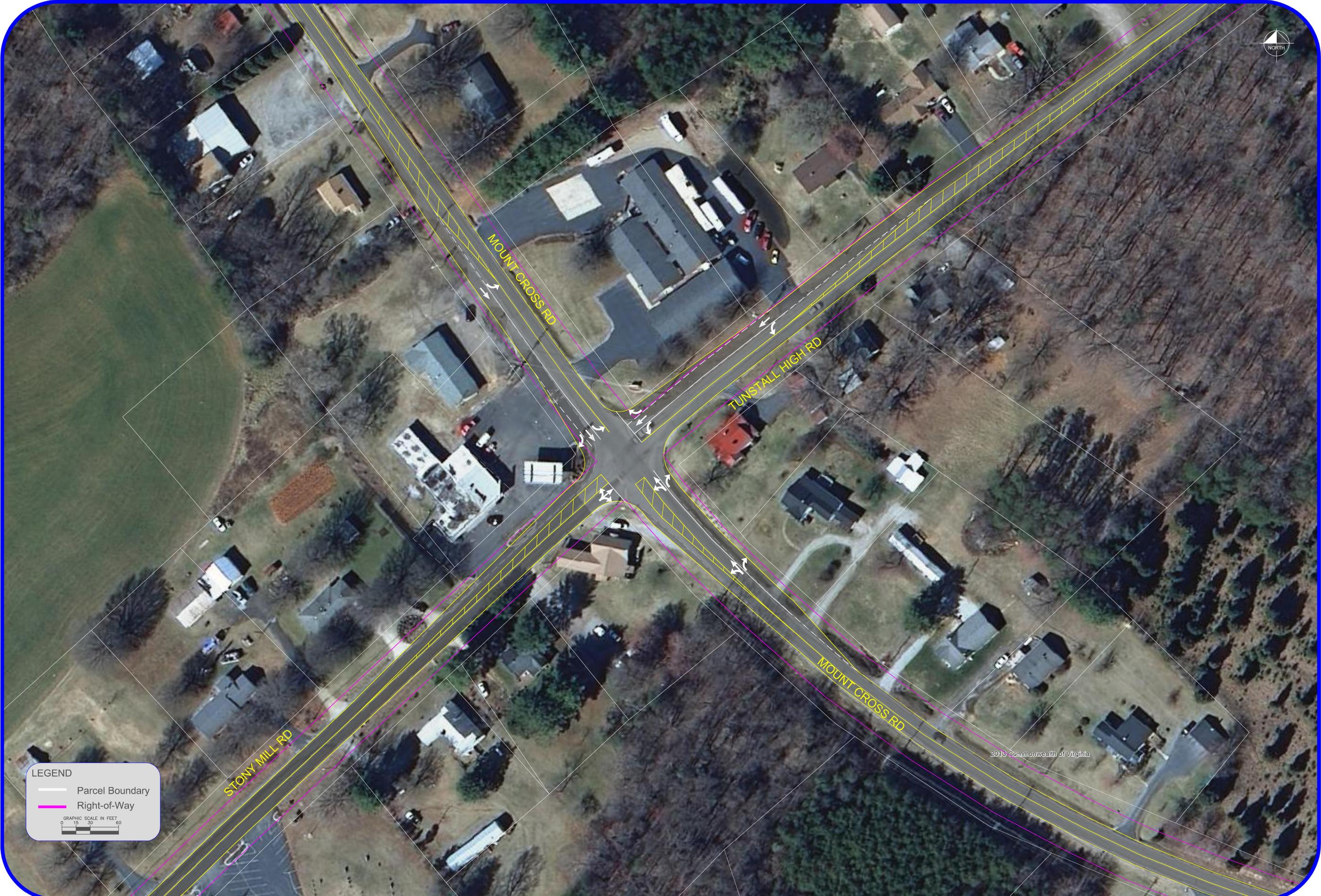
**SIDRA  
INTERSECTION**

# Appendix F: Environmental Map

# Mt Cross Rd & Stony Mill Rd/Tunstall High Rd Intersection



# Appendix G: Citizen Information Meeting Materials and Results



**LEGEND**

- Parcel Boundary
- Right-of-Way

GRAPHIC SCALE IN FEET

0 15 30 60

2013 Commonwealth of Virginia

# ALTERNATIVE #1



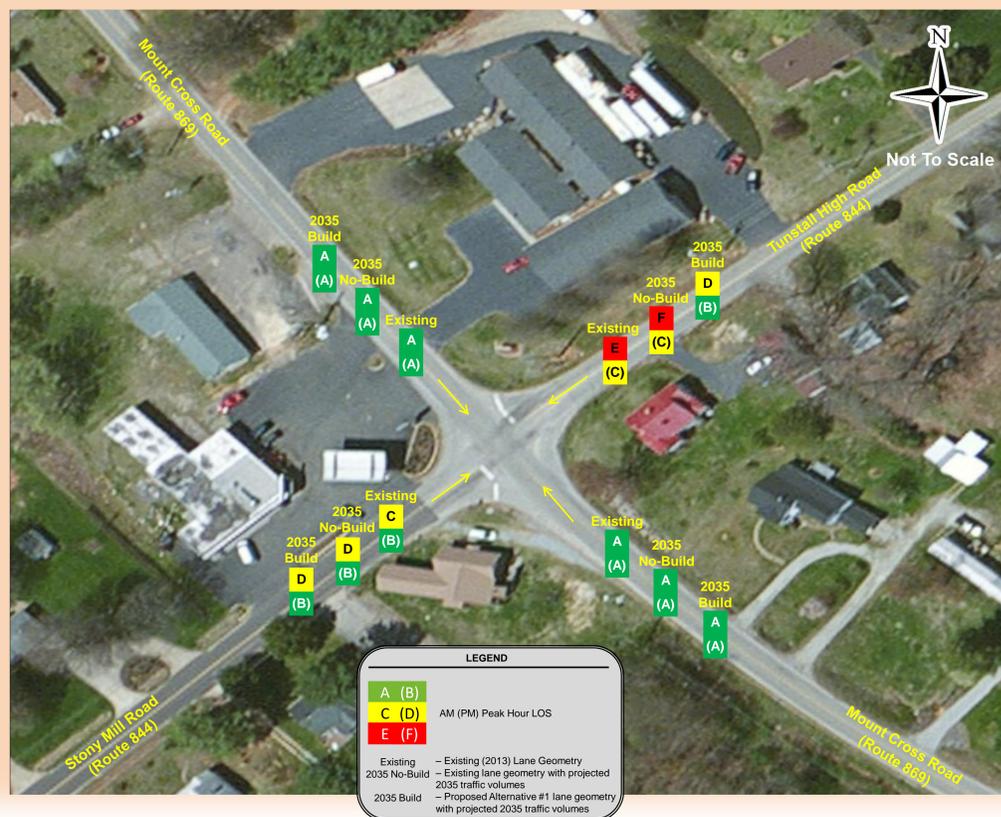
## Other Recommendations

- ❖ Access Management – define access (e.g. curb and gutter) to Mills Grill & Grocery in the southwest corner
- ❖ Reduce the existing 55 MPH segment on Mount Cross Road in the vicinity of Silver Creek Road (east of the study intersection) to 45 MPH
- ❖ Increase the awareness of the 25 MPH reduced speed limit on the eastbound and westbound Mount Cross Road approaches using the following two strategies:
  - Installation of flashing beacons on the two existing reduced speed limit ahead signs located approximately 1,300 feet and 2,500 feet east and west of the study intersection, respectively
  - Install transverse rumble strips in the pavement on the eastbound and westbound approaches to the study intersection

# TRAFFIC VOLUMES & SPEED LIMITS



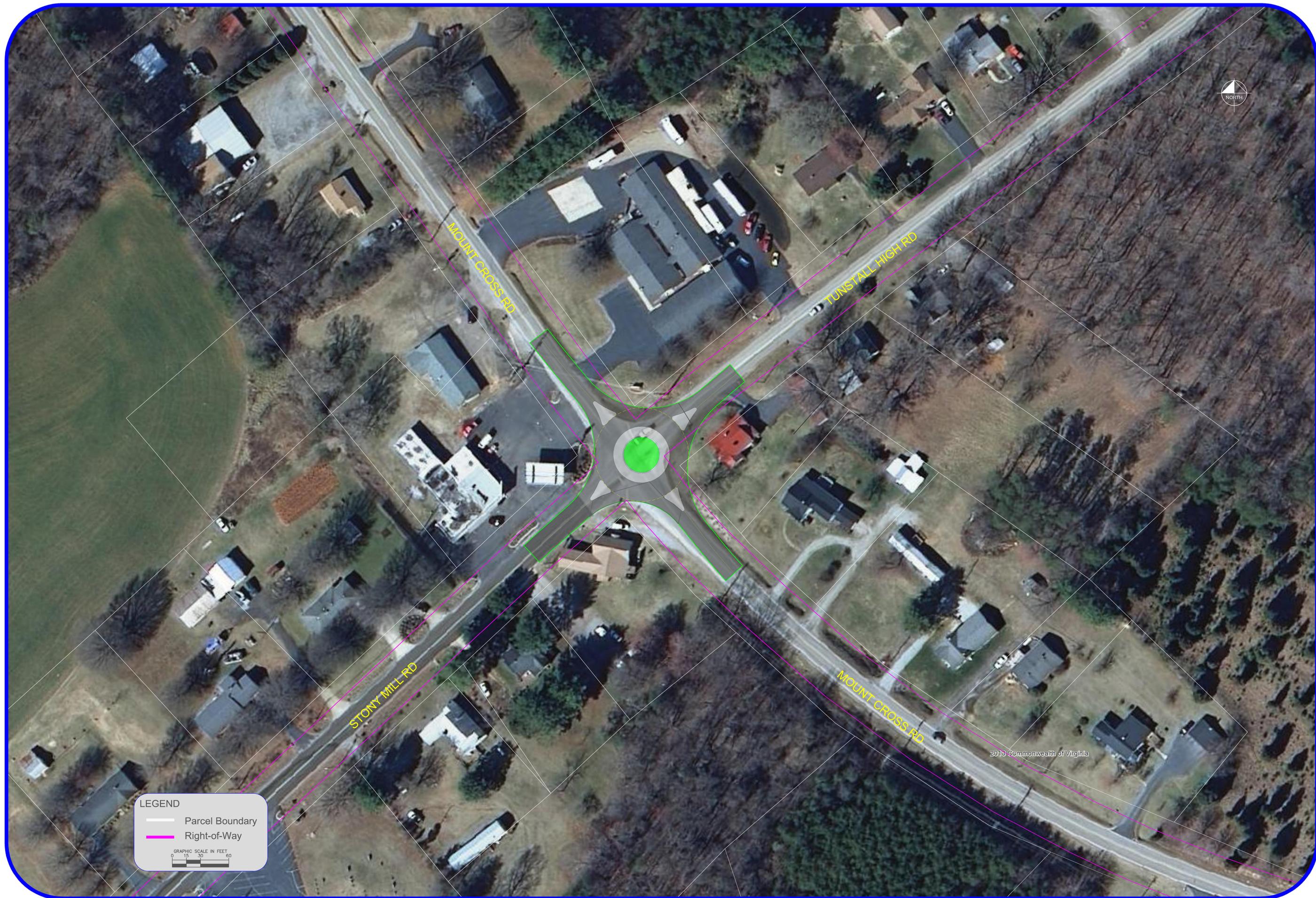
# Level of Service



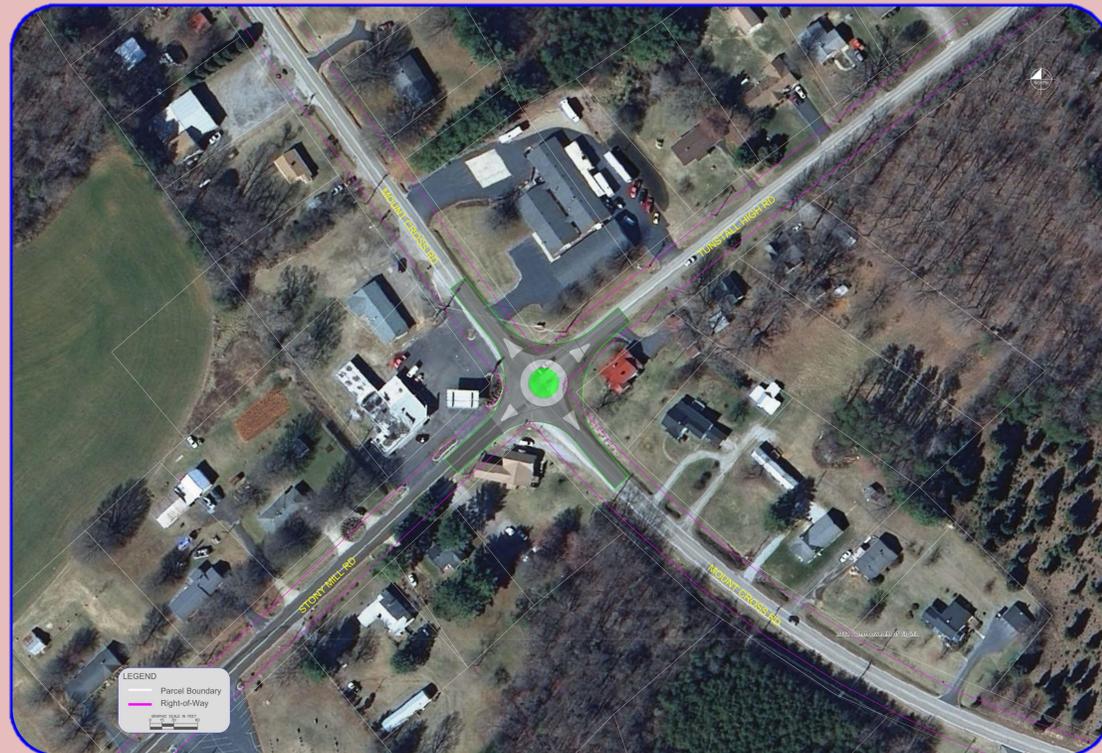
# Other Information

| Purpose of Study  | Intersection Facts   |
|---|--|
| <ul style="list-style-type: none"> <li>Identify and evaluate potential improvements to the intersection</li> <li>Enhance intersection safety and operations</li> </ul>  | <ul style="list-style-type: none"> <li>5 total crashes between 2010 and 2012</li> <li>Crash rate significantly below similar roadways throughout Virginia</li> <li>Traffic signal not warranted under 2013 or 2035 conditions</li> <li>85% of the motorists on Mount Cross Road exceed 40 MPH (posted speed limit is 25 MPH)</li> <li>21 access points within 500 feet of subject intersection (mostly residential)</li> <li>Sight distance provided meets current VDOT standards</li> </ul> |
| PROS  | CONS   |
| <ul style="list-style-type: none"> <li>Increases intersection capacity</li> <li>Improves safety                             <ul style="list-style-type: none"> <li>43% left-turn crash reduction</li> <li>21% right-turn crash reduction</li> </ul> </li> <li>Moves left- and right-turning vehicles out of through vehicle pathway</li> <li>Allows left-turns to wait for adequate gap without holding up through vehicles</li> <li>Improves sight distance for Tunstall High Road approach</li> </ul> | <ul style="list-style-type: none"> <li>Requires right-of-way</li> <li>Does not help reduce vehicle speed (traffic calming)</li> <li>Significant roadway impacts to transition turn lanes (up to 750 feet in advance of each approach)</li> </ul>   |





## ALTERNATIVE #2



### Other Recommendations

- ❖ Access Management – define access (e.g. curb and gutter) to Mills Grill & Grocery in the southwest corner
- ❖ Reduce the existing 55 MPH segment on Mount Cross Road in the vicinity of Silver Creek Road (east of the study intersection) to 45 MPH
- ❖ Increase the awareness of the 25 MPH reduced speed limit on the eastbound and westbound Mount Cross Road approaches using the following two strategies:
  - Installation of flashing beacons on the two existing reduced speed limit ahead signs located approximately 1,300 feet and 2,500 feet east and west of the study intersection, respectively
  - Install transverse rumble strips in the pavement on the eastbound and westbound approaches to the study intersection

## TRAFFIC VOLUMES & SPEED LIMITS



## Level of Service



## Other Information

| Purpose of Study  | Intersection Facts   |
|---|--|
| <ul style="list-style-type: none"> <li>Identify and evaluate potential improvements to the intersection</li> <li>Enhance intersection safety and operations</li> </ul>  | <ul style="list-style-type: none"> <li>5 total crashes between 2010 and 2012</li> <li>Crash rate significantly below similar roadways throughout Virginia</li> <li>Traffic signal not warranted under 2013 or 2035 conditions</li> <li>85% of the motorists on Mount Cross Road exceed 40 MPH (posted speed limit is 25 MPH)</li> <li>21 access points within 500 feet of subject intersection (mostly residential)</li> <li>Sight distance provided meets current VDOT standards</li> </ul> |
| PROS  | CONS   |
| <ul style="list-style-type: none"> <li>Increases intersection capacity</li> <li>Improves safety                             <ul style="list-style-type: none"> <li>72% intersection crash reduction</li> </ul> </li> <li>Requires vehicles on Mount Cross Road to slow down before entering the roundabout (traffic calming)</li> <li>Improves sight distance for Tunstall High Road approach</li> <li>Can accommodate school buses, fire trucks, and other large vehicles</li> <li>Limited right-of-way impacts</li> </ul> | <ul style="list-style-type: none"> <li>Requires modifications to access points in immediate vicinity of study intersection</li> <li>Can be confusing to drivers who are unfamiliar with roundabouts</li> </ul>   |



**Mount Cross Road and Stony Mill Road/Tunstall High Road Intersection Study  
Comments Due by April 30, 2014**

Thank you for your participation in the Mount Cross Road and Stony Mill Road/Tunstall High Road Intersection Study process! Please drop this form in the comment box before you leave. You also may mail this form to the address on the reverse side or email to [lynchburginfo@vdot.virginia.gov](mailto:lynchburginfo@vdot.virginia.gov) by **April 30, 2014**.

**Name/Address Information**

Name: \_\_\_\_\_ Organization/Affiliation: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_  
 Email: \_\_\_\_\_

**About You**

1. **Check those that best describe your interest in the study intersection** (check all that apply)
- |   |   |   |
|---|---|---|
| <input type="checkbox"/> Resident in the area | <input type="checkbox"/> Property owner in the area | <input type="checkbox"/> Business owner in the area |
| <input type="checkbox"/> Employee in the area | <input type="checkbox"/> Commuter through the area  | <input type="checkbox"/> Other _____                |

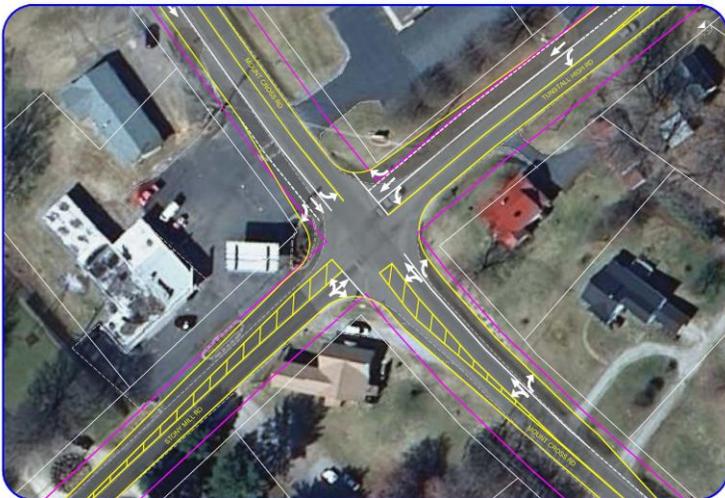
**Traffic**

2. Describe the traffic issues at the intersection in which you are primarily concerned? (please be specific – i.e., hard to turn from Tunstall High Road, sight distance looking east is an issue, high traffic volumes, etc.)

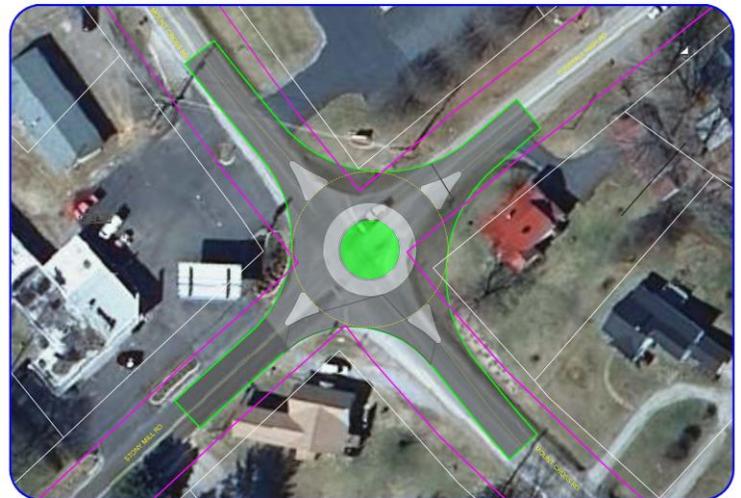
\_\_\_\_\_  
 \_\_\_\_\_

**Preferred Alternative**

3. Please indicate your preferred alternative:
- Alternative 1 – Turn Lanes       Alternative 2 – Roundabout       Other (please specify below)



Alternative #1 – Turn Lanes



Alternative #2 – Roundabout

Other: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**Please drop this form in the comment response box at the public meeting or mail the completed form to the following address:**

Virginia Department of Transportation  
Mount Cross Road and Stony Mill Rd/Tunstall High Rd Study  
Attn: Mr. Rick Youngblood  
4219 Campbell Avenue  
Lynchburg, VA 24501

Citizen Information Meeting - Questionnaire Responses

#1 Check those that best describe your interest in the study intersection (check all that apply)

| Resident in the area | Property owner in the area | Business owner in the area | Employee in the area | Commuter through the area | Other                              |
|----------------------|----------------------------|----------------------------|----------------------|---------------------------|------------------------------------|
| x                    | x                          |                            |                      |                           | Retired                            |
| x                    | x                          |                            | x                    |                           |                                    |
| x                    | x                          |                            |                      |                           | Fire Dept. Volunteer               |
| x                    | x                          |                            |                      |                           |                                    |
| x                    | x                          |                            |                      |                           |                                    |
| x                    | x                          |                            |                      | x                         |                                    |
| x                    | x                          |                            |                      | x                         |                                    |
| x                    | x                          |                            | x                    |                           |                                    |
| x                    | x                          |                            |                      |                           |                                    |
| x                    | x                          |                            |                      |                           |                                    |
|                      | x                          |                            |                      |                           |                                    |
| x                    | x                          |                            |                      | x                         |                                    |
| x                    | x                          |                            |                      |                           |                                    |
| x                    | x                          | x                          |                      |                           |                                    |
| x                    | x                          |                            |                      | x                         |                                    |
|                      |                            |                            |                      | x                         | Children in school in area         |
| x                    | x                          |                            |                      |                           |                                    |
|                      |                            |                            |                      | x                         | Parents live on Tunstall High Road |
| x                    | x                          |                            |                      |                           |                                    |
| x                    |                            |                            |                      |                           |                                    |
| <b>19</b>            | <b>19</b>                  | <b>1</b>                   | <b>2</b>             | <b>6</b>                  |                                    |

**#2 Describe the traffic issues at the intersection in which you are primarily concerned?**

Sight distance, both east and west

Undefined access points to Mill's, unpredictable vehicle speeds

All the above (i.e., hard to turn from Tunstall High Road, sight distance looking east, high traffic volumes)

Hard to turn from Tunstall High Road, sight distance looking east, high traffic volumes

Hard to turn from Tunstall High Road, sight distance looking east, high traffic volumes

High traffic volumes

Speed + school traffic

All the above (i.e., hard to turn from Tunstall High Road, sight distance looking east, high traffic volumes), dangerous intersection. I've been hit here.

High volume of traffic, people cutting through store property to go toward Mt. Cross

High volumes of traffic, careless driving - cutting through private property to access the road

Bad

Morning school traffic and evening school traffic

All the above (i.e., hard to turn from Tunstall High Road, sight distance looking east, high traffic volumes), also excess speed, double stacking on State 869 both ways

Speed + school time backups

Morning school traffic and evening school traffic

Sight distance, unsafe drivers, speeds, carbon emissions, time wasted waiting in long lines during school hours

Can see no car coming and try to crossover Mt. Cross from Tunstall High Road - get in intersection & car appears from west before I can get across (going >25mph). Also sight distance a problem from the east. Also cars pulling out of Mills Grill are a concern, they pull out in front of you.

Hard to see on Tunstall High Road looking south (east). Speed limit not followed. Bus traffic.

Hard to turn from Tunstall High Road; High traffic volumes before school & after school & after sports event.

Hard to turn from Tunstall High Road; High traffic volumes before school & after school & after sports event

Speeding and running stop signs.

Citizen Information Meeting - Questionnaire Responses

| <b>#3 Please indicate your preferred alternative:</b> |              |  |                     |
|---|--------------|--|---------------------|
| <b>Alt 1</b>  | <b>Alt 2</b> | <b>Other</b>   | <b>No Selection</b> |
|   | x            |  |                     |
|   | x            |  |                     |
|   | x            |  |                     |
|   | x            |  |                     |
|   | x            |  |                     |
|   | x            |  |                     |
|   | x            |  |                     |
|   | x            | What about the 18 wheelers that come through during the night & early morning?   |                     |
|   | x            |  |                     |
|   |              |  | x                   |
|   | x            |  |                     |
|   | x            |  |                     |
|   | x            | We travel through several communities with roundabouts. It definitely will slow traffic giving drivers more reaction time when need. Overall I believe it would be a safer road to travel. It will take time to adjust but will be well worth the effort. Hopefully a safer intersection.                |                     |
|   | x            |  |                     |
|   | x            |  |                     |
|   | x            | Roundabout would be most effective, least expensive to maintain + safest   |                     |
|   |              | Do not like #1 because you cannot see around vehicle turning left when you want to go straight. Do not like #2, roundabout is too confusing. So I don't like either one. 4-way stop would work better - or preferably a stoplight. AFTER PRESENTATION - I like the roundabout better than turning lanes. | x                   |
|   | x            | Will hill need to be shaved to improve sight distance looking south (east)?  |                     |
|   | x            | I live halfway between this intersection & the schools. Before school & after school traffic is back up past my driveway. I can't leave my house for about 15 minutes each morning & afternoon.  |                     |
|   | x            | With either alternative, traffic volume is still going to be a problem at certain times (before & after school & after sporting events).   |                     |
|   | x            | Why we need something: there are at least 150 cars coming from Tunstall schools on a school day as well as buses. I live between the cross roads & the schools.  |                     |
|   |              | Do not want to lose any part of my yard.   | x                   |
| <b>0</b>  | <b>19</b>    |  | <b>0 3</b>          |