

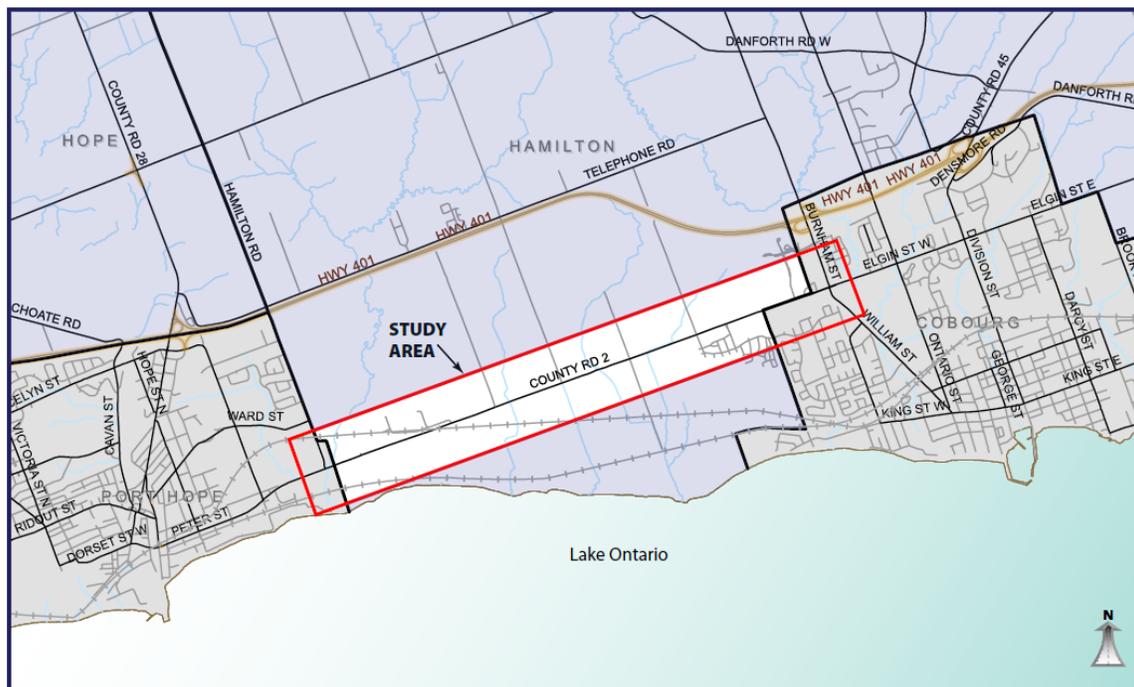
## Memorandum

**To:** Denise Marshall – Northumberland County  
**Cc:**  
**From:** Tony Reitmeier – HDR  
Guinevere Ngau – HDR  
Andrew O'Connor – HDR  
**Date:** August 14, 2015  
**Re:** **County Road 2 - Collision Analysis**

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### 1. INTRODUCTION

County Road 2 is a major transportation corridor linking the Town of Cobourg and Port Hope. The study limits for the County Road 2 Environmental Assessment (EA) is from Hamilton Road (Municipality of Port Hope) to William Street (Town of Cobourg). The study area for the EA is shown in **Exhibit 1-1**.



**Exhibit 1-1: County Road 2 Study Area**

The current land-use adjacent to the County Road 2 study corridor is:

- Predominantly rural west of the Cobourg, and
- Urban from west of Rogers Road easterly into Cobourg.

Currently the road has a two-lane rural cross-section between from just west of Hamilton Road in Port Hope to Wilkins Gate in Cobourg and a four-lane, primarily urban, cross-section east of Wilkins Gate. The section under study is approximately 6 kilometres long. The posted speed limit is 50 to 60 km/h in the urban sections of the Municipality Port Hope and the Town of Cobourg; and 80 km/h in the rural section in the Township of Hamilton.

There are five existing signalized intersections in the study area:

- Hamilton Road,
- New Amherst Boulevard / Lovshin Road,
- Rogers Road,
- Strathy Road and
- Burnham Street / William Street.

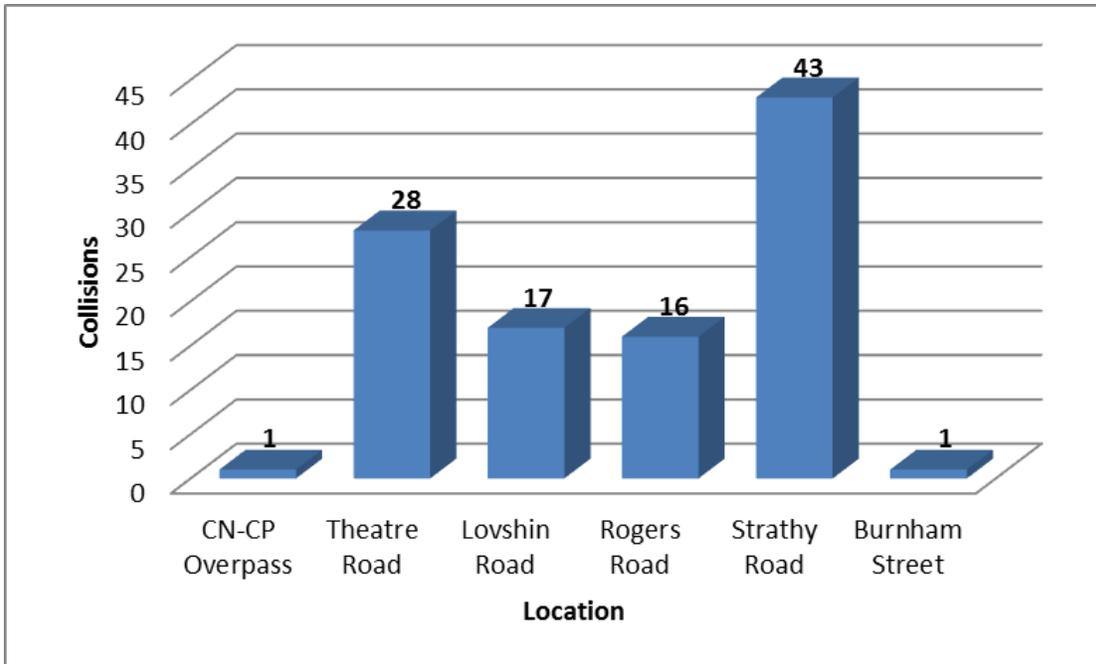
This report focuses on the safety aspects along the County Road 2 study corridor. It is based on an analysis of police intersection collision data provided to the County from 2000 to 2014 within the study limits. This analysis is comprised of an examination of collisions that occurred at key study corridor intersections.

## **2. COLLISION FREQUENCY**

The County of Northumberland provided data detailing collisions that occurred at the following locations over a 15-year period from 2000-2014:

- CN-CP Overpass
- County Road 2 and Theatre Road Intersection
- County Road 2 and Lovshin Road / New Amherst Boulevard Intersection
- County Road 2 and Rogers Road Intersection
- County Road 2 and Strathy Road Intersection
- County Road 2 and Burnham Street / William Street Intersection

The number of collisions at each location is summarized in **Exhibit 2-1**:



**Exhibit 2-1: Total Number of Collisions on County Road 2 (2000-2014)**

Using the Safety Performance Functions (SPF) specified in the *Highway Safety Manual* (AASHTO, 2010), predicted collision frequencies were determined based on the type of intersection and the annual average daily traffic (AADT) on the major and minor roads at the intersection. These **predicted collision frequencies** for the locations for which there was collision data are provided in **Table 2-1**.

As per the methodology specified in the *Highway Safety Manual* (AASHTO, 2010), **predicted collision frequency** and **observed average collision frequency** of each intersection were used to estimate the **expected collision frequency** by using the appropriate over-dispersion parameters. These are also shown in **Table 2-1**.

A comparison between the observed and expected collision frequencies shows that the observed collision frequencies at all the locations within the study area are lower than the expected collision frequencies. This suggests that the observed number of collisions at the intersections within the study area is lower than what is expected at other intersections with similar characteristics.

**Table 2-1: Predicted and Expected Collision Frequency of Intersections within the Study Limits\***

County Road 2 Intersection with	AADT <sub>major</sub> <sup>1</sup> [Veh/ day]	AADT <sub>minor</sub> <sup>2</sup> [Veh / day]	Observed Collision Frequency [Collisions/yr]	Predicted Collision Frequency [Collisions/yr]	Expected Collision Frequency [Collisions/yr]
Theatre Road <sup>3</sup>	11,600	961	1.9	2.5	2.1
Lovshin Road / New Amherst Boulevard <sup>4</sup>	11,600	3,000	1.1	8.1	4.8
Rogers Road <sup>6</sup>	13,748	3,088 <sup>5</sup>	1.1	Not available <sup>7</sup>	Not available <sup>7</sup>
Strathy Road <sup>4</sup>	18,095	3,405	2.9	10.8	6.5
Burnham Street /	19,113	14,109	0.1	14.8	5.7

\*Based on ten year dataset from 2000 to 2014

Notes:

1. AADT of the major roadway
2. AADT of the minor roadway
3. Three-leg, stop-controlled intersection
4. Four-leg, signalised intersection
5. An assumed 50-50 split in the trips originating from the New Amherst Development between Rogers Road and New Amherst Boulevard, *New Amherst Residential Development TIS* (TSH, 2003)
6. Three-leg, signalised intersection
7. SPFs do not currently exist for three-leg, signalised intersections

### 3. COLLISION CHARACTERISTICS

The observed collisions within the study area were analyzed by looking at the following collision characteristics:

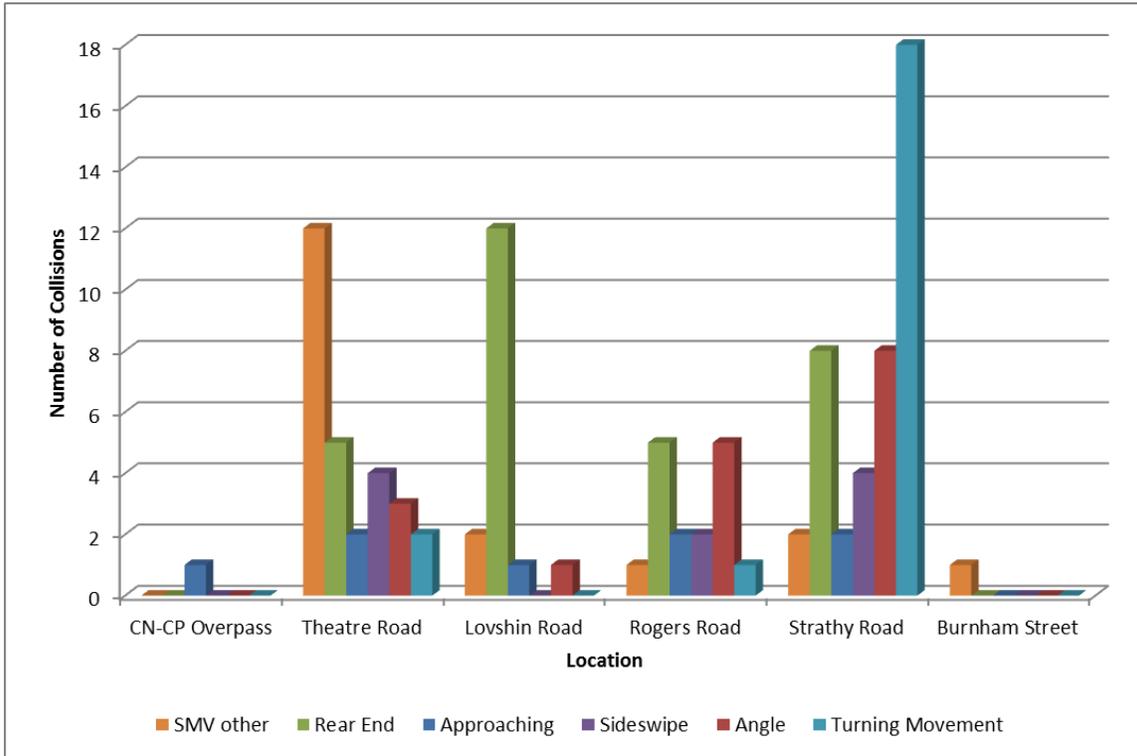
- Collision type
- Collision distribution by season, day of week and time of day
- Collision severity
- Road surface conditions

This section provides a discussion on the possible reasons for these collisions and recommendations based on this general discussion. It is noted that the exact reason for the collisions were not included within the County's collision data set.

#### 3.1 Collision Types

**Exhibit 3-1** shows the different types of collisions that have occurred at the intersections within the study area. Rear-end and turning movement collisions were the most frequently occurring intersection-collision types within the study limits. Angle and single motor vehicle (SMV) collisions were also observed in the 2000 to 2014 collision data. The data showed that turning movement collisions occurred primarily at the Strathy Road and County Road 2 intersection and that SMV collisions occurred mostly at the Theatre Road and County Road 2

intersection. Rear-end collisions were the most common type of collision that occurred at the intersection of Lovshin Road and County Road 2.



**Exhibit 3-1: Initial Impact Type of County Road 2 Collisions (2000 to 2014)**

### 3.1.1 Rear End Collisions

Rear-end collisions are observed in a number of locations within the study corridor. Rear end collisions occur when two vehicles in a position of one behind the other collide, regardless of what movement(s) either vehicle was in the process of making with the exception of one or both vehicles backing.

Rear-end collisions may be a result of sudden and unexpected slowing or stopping as a result of traffic-control issues at intersections. Excess slowing and stopping may be a result of drivers getting caught in an intersection during a red phase due to inadequate traffic control or an inadequate clearance interval. There may also be issues with the conspicuity of traffic signals, which may cause sudden or unexpected slowing and stopping.

### **3.1.2 Angle Collisions**

Angle collisions are also observed in a number of locations along the study corridor. Angle collision type occurs when two vehicles approaching from non-opposing angular directions collide. This type of collision is typically the result of one vehicle:

- Failing to either stop or yield the right-of-way at a Stop or Yield sign,
- Running a red light, or
- Not clearing from the intersection upon the onset of the conflicting movement's green signal.

### **3.1.3 Turning Movement Collisions**

There is a high incidence of turning movement collisions at the Strathy Road and County Road 2 intersection. Turning movement collisions occur when two vehicles approaching from opposite directions collide as a result of at least one vehicle attempting to make a left or U turn in front of the opposing vehicle. This type of collision also occurs at the Theatre Road and County Road 2 intersection and the Rogers Road and County Road 2 intersection.

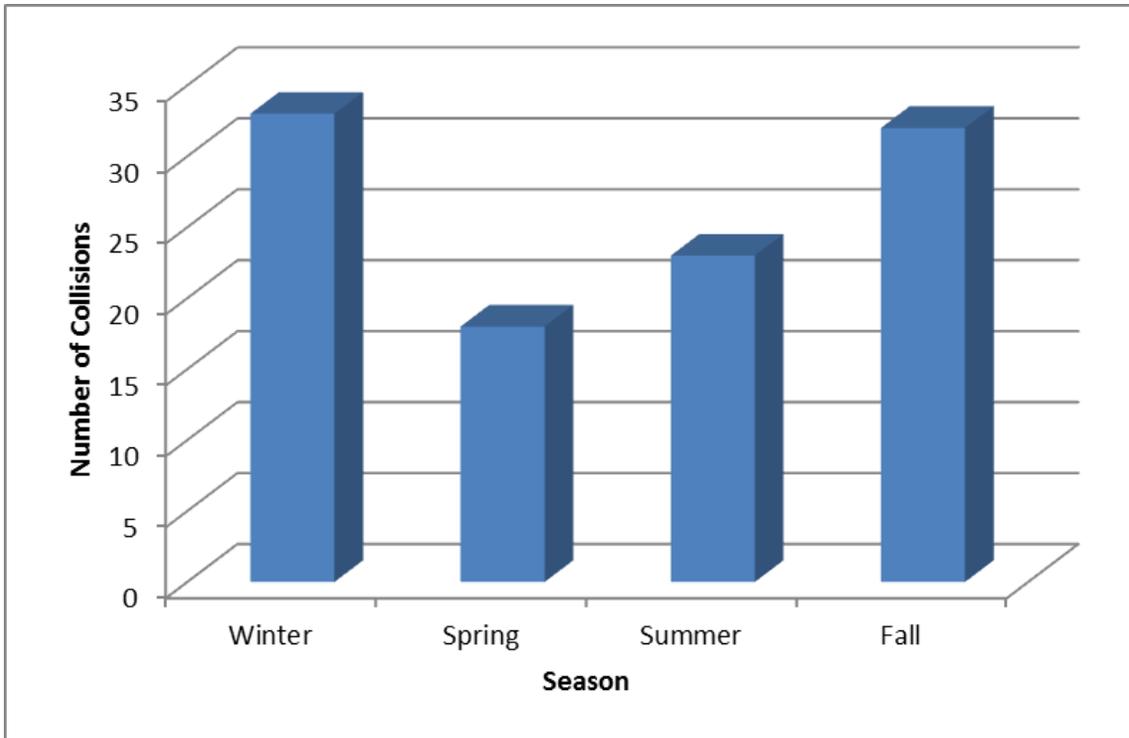
### **3.1.4 Single Motor Vehicle (SMV) Collisions**

There is a high incidence of single motor vehicle (SMV) collisions at both the Theatre Road and the Lovshin Road intersections. This collision type often occurs when there is driver error, which may be a result of many different factors. These include, but are not limited to: distracted driving, speeding, animals or driving under the influence.

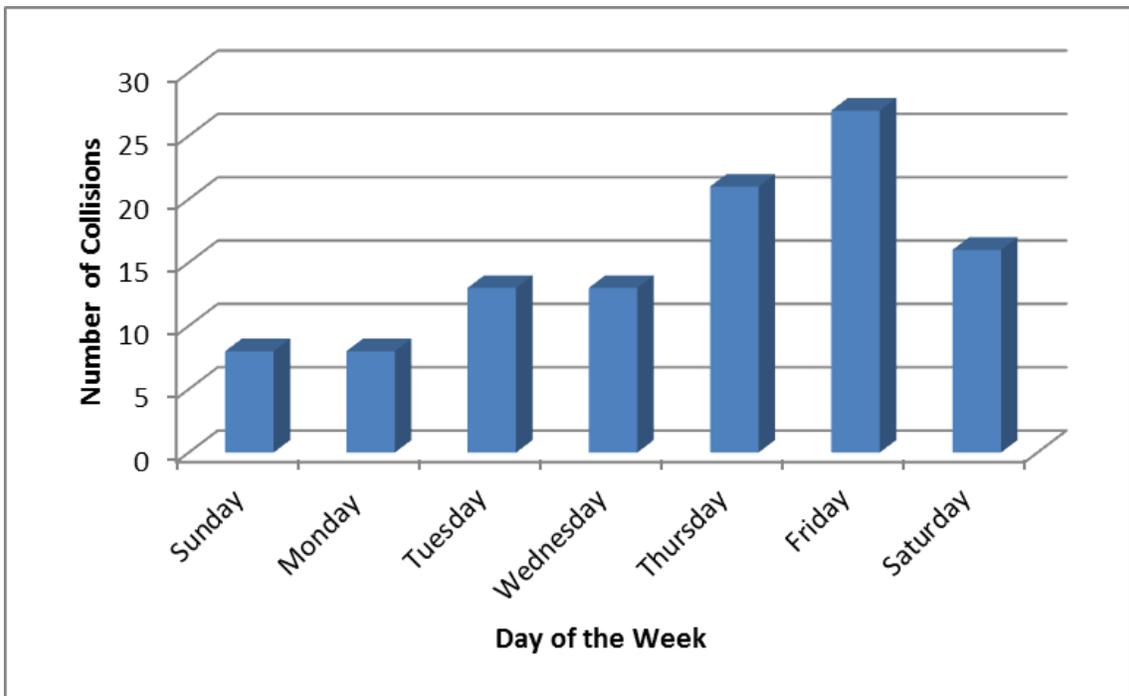
## **3.2 Time of Collisions**

It appears that higher collisions occur during winter and fall seasons, as shown in **Exhibit 3-2**. There also appears to be a higher number of collisions on Fridays, followed by Thursdays and Saturdays as shown in **Exhibit 3-3**. The highest number of collisions occurred between 11 AM and 5 PM and the hour between 9:00 pm and 10:00 pm, as shown in **Exhibit 3-4**. The higher number in collisions at these times may be a result of higher volumes possibly due weekend shopping and dining trips that occur in the evening.

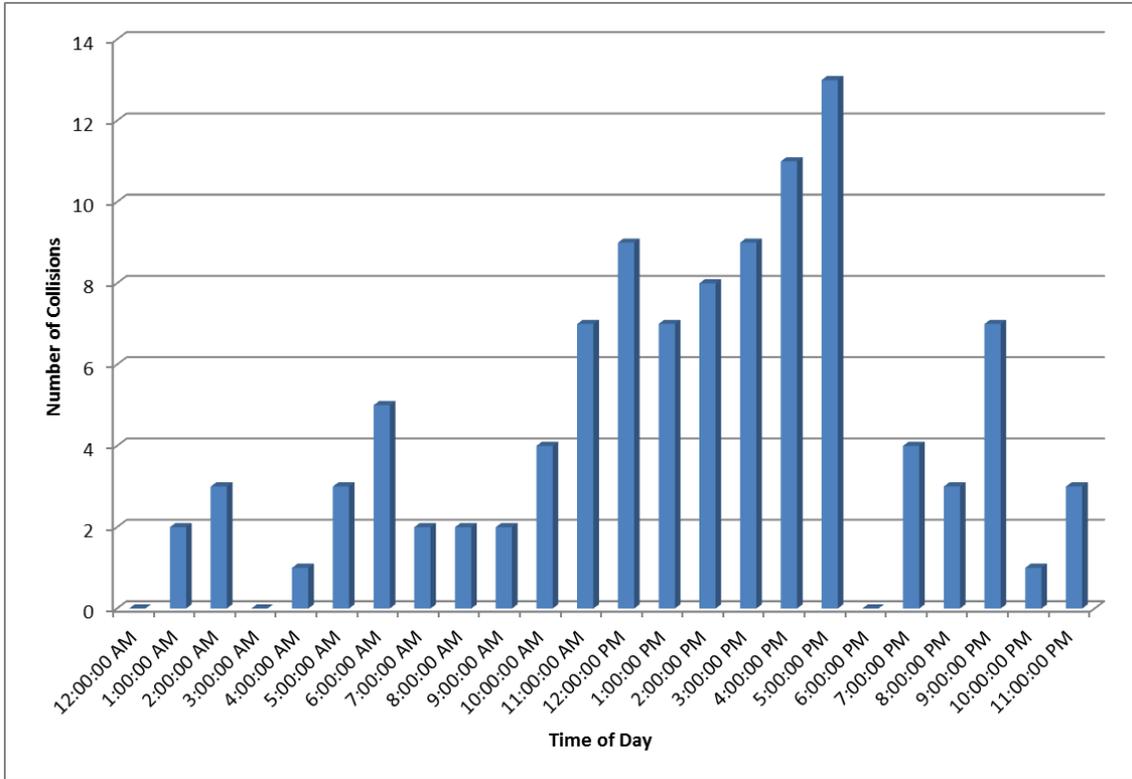
This higher collision frequency can likely be attributed to vehicles accessing the retail shopping mall west of Burnham/William Street. There are a number of dining establishments within the retail mall, which may be a possible explanation for the higher number of collisions during the typical lunch hour between 12:00 pm and 1:00 pm, as well as post-dinner departures between 9:00 pm and 10:00 pm.



**Exhibit 3-2: Seasonality of Collisions on County Road 2 (2000-2014)**



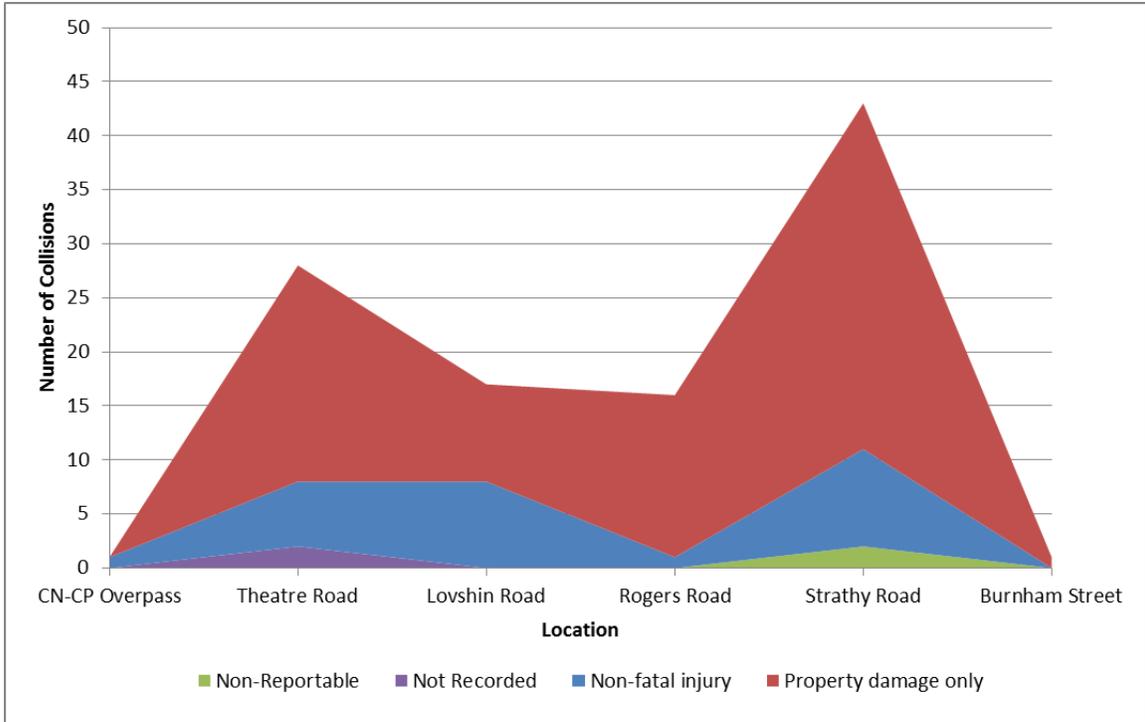
**Exhibit 3-3: Day of the week of County Road 2 Collisions (2000 to 2014)**



**Exhibit 3-4: Time of County Road 2 Collisions (2000 to 2014)**

### **3.3 Collision Severity**

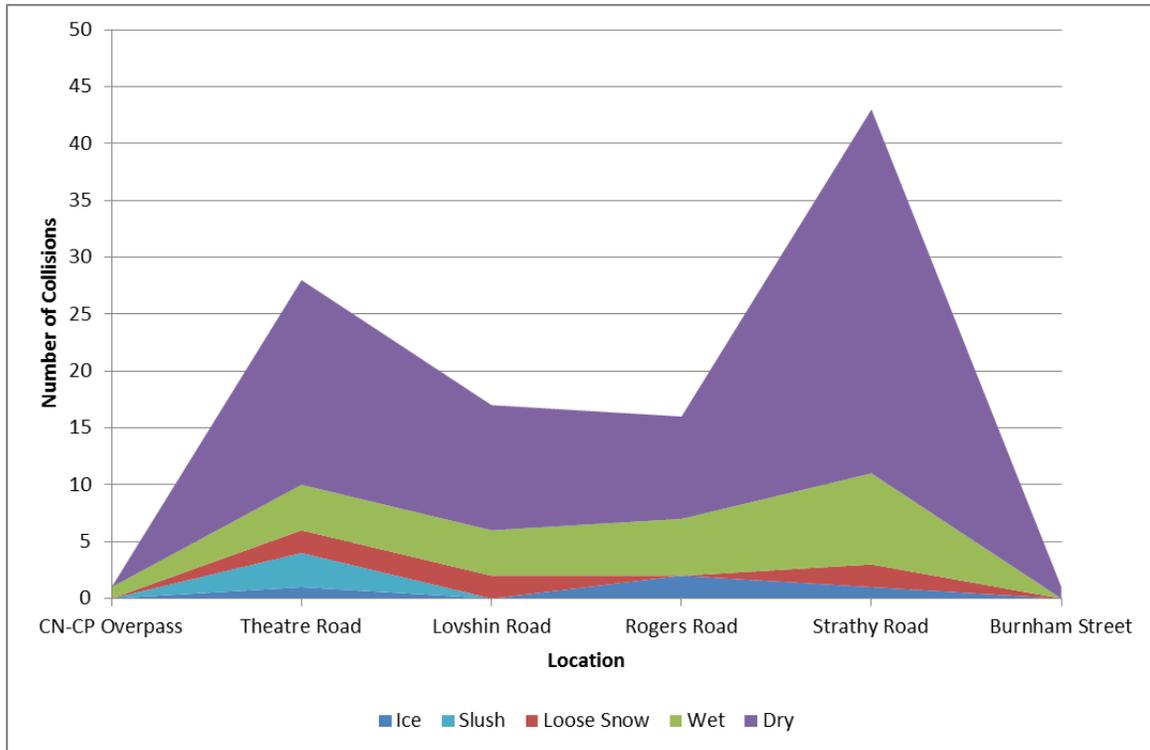
The collisions within the study area are predominantly property damage-only incidents with less than a quarter being non-fatal injury collisions, as shown in **Exhibit 3-5**. The lower collision severity may be a result the collisions being predominately single-motor vehicle collisions observed at the Theatre Road and County Road 2 intersection and the slow-speed collisions such as the observed rear-end collisions at the Strathy Road and County Road 2 intersection.



**Exhibit 3-5: Classification of County Road 2 Collisions (2000 to 2014)**

### **3.4 Road Surface Conditions**

The majority of the collisions within the study area occurred when the surface conditions of the road were dry. This suggests collisions within the study area are with less than a third being non-surface condition related collisions as shown in **Exhibit 3-6**.



**Exhibit 3-6: Road Surface Conditions for County Road 2 Collisions (2000 to 2014)**

This result suggests that drivers may have too much confidence when they are driving on the dry surfaces and may take on riskier behaviour such as speeding. This agrees with the results of a 2010 study that found drivers create much longer spacing to avoid rear-end collisions on icy surfaces as opposed to dry surfaces.<sup>1</sup>

#### **4. OBSERVATIONS**

The following conclusions can be made from the 2000 to 2014 County Road 2 collision data that the County provided to HDR:

- The observed collision frequencies at the intersections in the study area are lower than the predicted collision frequencies at intersections with similar characteristics.
- It was noted that along the corridor, the most frequent collision types were:
  - Rear-end collisions
  - Angle collisions
  - Turning movement collisions

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<sup>1</sup> Tanaka, M., Ranjitkar, P. and Nakatsuji, T. (2010). “Comparison of Driving Behavior and Safety in Car-Following Platoons under Icy and Dry Surface Conditions.” *Transportation Research Board Annual Meeting 2010 Paper #10-0504.*

- SMV collisions
- It appears that there are slightly more collisions during the fall and winter seasons
- There also appeared to be a higher incidence of collisions on Fridays and weekends, when there were higher traffic volumes.
- The collision severity did not appear to be high; however, further improvements to the overall safety of the corridor are desirable.

## **5. CONCLUSIONS AND RECOMMENDATIONS**

The collision frequencies based on the data from 2000 to 2014 indicate that there is a lower occurrence of collisions at intersections within the study corridor than what is expected for intersections of similar type and with similar traffic volumes. Even though there are a higher number of collisions at the Strathy Road / County Road 2 and the Theatre Road / County Road 2 intersections relative to the other intersections in the study corridor, the observed versus predicted frequencies suggest that the higher number of collisions is not statistically relevant. Even though the overall collision occurrence is considered low on County Road 2, the following safety improvements are recommended to further improve safety along the corridor based on the safety concerns identified in this assessment.

### **5.1 Traffic Calming**

The collision data shows that SMV collisions occur predominately at Theatre Road. Driver behaviour, particularly speeding, is often a factor in SMV collisions. Traffic calming along County Road in proximity to Theatre Road may be a means of slowing drivers and reducing the incidence of SMV-related collisions at this location.

Roundabouts are considered an effective design modification and traffic calming measure to slow down traffic. A study published in London showed a 65% reduction in accidents when an intersection was converted to a roundabout.<sup>1</sup> A study of American roundabouts found that the introduction of roundabouts results in a reduced number of collisions. This study assessed rural, urban and suburban contexts separately. For rural locations where an intersection with a two-way stop on the minor street is converted to a roundabout, the study found a 71% reduction in all collisions and an 87% reduction in more severe Injury Collisions<sup>2</sup>.

Some of the reasons why roundabouts reduce collisions include:

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<sup>1</sup> Schoon, C. and van Minnen, J., "The Safety of Roundabouts in The Netherlands." *Traffic Engineering & Control*, Vol. 35, No. 3, London, United Kingdom, Hemming Information Services, (1994) pp. 142-148

<sup>2</sup> Rodegerdts, L. A., Blogg, M., Wemple, E., Myers, E., Kyte, M., Dixon, M., List, G., Flannery, A., Troutbeck, R., Brilon, W., Wu, N., Persaud, B., Lyon, C., Harkey, D., and Carter, D., "NCHRP Report 572: Applying Roundabouts in the United States." Washington, D.C., Transportation Research Board, National Research Council, (2007)

- Roundabouts force drivers to slow down because of the horizontal changes in alignment, but does not require them to stop
- Roundabouts reduce the number of conflict points for turning movements at intersections

## **5.2 Traffic Signal Coordination**

The coordination of traffic signals along County Road 2 can alleviate the queuing of vehicles by allowing vehicle platoons to proceed without stopping at multiple signalized intersections. Reducing the number and frequency of required stops and maintaining constant speeds for all vehicles reduce rear-end conflicts. Signal coordination also improves the operation of turning movements.

## **5.3 Red Clearance Interval**

The *Signalized Intersections: Informational Guide* (FHWA, 2004) describes the red clearance interval is an optional interval that follows the yellow change interval and precedes the next conflicting green interval. The red clearance interval, or an all-red phase, provides additional time following the yellow change interval for drivers to clear an intersection before conflicting traffic is released.

Increasing the all-red phase may be considered where:

- A high number of angle / left-turn collisions occur due to through/left-turning drivers failing to clear the intersection or stop before entering the intersection at onset of the red.
- A high number of rear-end collisions occur because drivers brake sharply to avoid entering the intersection at the onset of the red.
- A high incidence of red-light violations is recorded.

The number of observed angle, turning movement and rear end collisions within the study corridor suggest that increasing the red clearance interval may be a means of addressing these collision types. A study in Southeast Michigan found that adding an all-red clearance interval resulted in a 15 to 30% estimated reduction in all collisions.<sup>1</sup>

## **5.4 Red Light Running**

The uphill grade on the south leg approach to the Strathy Road and County Road 2 intersection may contribute to the occurrence of angle and turning movement collisions. Such collisions typically occur when drivers:

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<sup>1</sup> Southeast Michigan Council of Governments. *SEMCOG Traffic Safety Manual, Third Edition*. 1998

- Have inadequate sight lines of oncoming vehicles for turning vehicles,
- Run a red light and / or
- Become impatient and accept a gap that is smaller than needed or run a red to complete a safe manoeuvre.

The uphill grade on the south leg may impact a driver's ability to see eastbound or westbound traffic on County Road 2 that is approaching the intersection, particularly if this driver is in a queue. An impatient northbound driver may attempt to make a turn as the traffic signal changes from amber to red, enter the intersection during a red phase and collide with either eastbound or westbound drivers who are travelling on their green phase.

Correcting the uphill upgrade on the south leg of the intersection for the purpose of improving sight lines was deemed to be infeasible because of the costs of regrading the approach on the south leg. A more cost effective solution is to increase the all-red phase at the Strathy Road and County Road 2 intersection, which will increase the clearance interval for northbound turning drivers. This allows northbound drivers to complete their turning movement while minimizing their conflict with eastbound and westbound drivers on County Road 2.

## **5.5 Summary of Recommendations**

The following is a summary of measures that can be implemented to improve the overall safety of the County Road 2 study corridor:

- Implement traffic calming measures to limit speeding, particularly at Theatre Road. Roundabouts are an example of a traffic calming design feature that can be implemented within the study corridor.
- Optimize traffic signals to alleviate vehicle queuing.
- Increase the all-red phase at the Strathy Road and County Road 2 intersection.