The Future of Traffic Monitoring: A New Perspective Using Drones

Caitlin Sowers, MScE
Eric Hildebrand, PhD, PEng

UNB Transportation Group
Introduction
5 Simple Rules for Driving Multi-Lane Roundabouts:

1. Choose your lane in advance of the roundabout;
2. Slow down and yield to pedestrians;
3. Yield to traffic already in the roundabout;
4. Do not change lanes inside the roundabout;
5. Give trucks plenty of room.

Yield:
The “Golden Rule” of driving roundabouts.
- Yield to all circulating traffic (don’t merge) when you enter a roundabout.
- Yield means the other drivers in the roundabout have the right of way.
- Drivers approaching a roundabout should wait for a safe gap in traffic before entering.

Sample Turning Movements:
- Right Turn / Continue Straight
- Continue Straight / Left Turn / U-turn

Fredericton’s First Multi-Lane Roundabout

For more information visit: www.fredericton.ca/roundabouts

ROUTE 8 / SMYTHE STREET ROUNDABOUT
Single-lane roundabouts have been operating successfully in Fredericton since 2010; however, the Route 8 / Smythe Street roundabout will be Fredericton’s first multi-lane roundabout so it is important that local drivers understand how to drive this type of intersection.
City of Fredericton reports only 10 accidents on roundabout opening day

POSTED BY ALEX VIETINGHOFF

Fredericton — In a pleasantly surprising press release, the City of Fredericton reported only 10 motor vehicle accidents on the opening day of the capital city’s new roundabout.

While many speculated that the opening day would have at least 32 accidents and 4 deaths, the city proudly laid to rest any worries in an announcement by Mayor Brad Woodside Wednesday morning.

“They said we couldn’t do it. That we’d be crazy to try. But we showed them that with a little public education and a whole of of luck, anything is possible,” said Woodside.
Data Collection

GoPro on Water Tower
Data Collection

DJI Phantom 3 Professional
VIDEO
UAV Regulation

- Transport Canada is the governing body for the regulation of UAVs in Canadian Airspace

- Restricted Operator (work/research)
  - Simplified Application (14 pg.)

Special Flight Operations Certificate

(tc.gc.ca/SafetyFirst)
Operational Recommendations

- Intersection Studies
- Safety Estimation
- Origin Destination Studies
- Parking Studies
- Spot Speed Studies
Total Driver Errors

![Graph showing the decrease in errors per 1,000 entering vehicles over the number of weeks from opening.](image)

-74% decrease in errors from the start.
## Driver Error Types

<table>
<thead>
<tr>
<th>Error Type</th>
<th>% Reduction (Sept/15 to Sept/16)</th>
<th>% of Total Errors (September/16)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changing lanes within roundabout</td>
<td>81</td>
<td>60</td>
</tr>
<tr>
<td>Not yielding to traffic in roundabout</td>
<td>59</td>
<td>16</td>
</tr>
<tr>
<td>Improper lane usage</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>Stopping within roundabout</td>
<td>39</td>
<td>5</td>
</tr>
<tr>
<td>Not giving ROW to trucks</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Left-turn (wrong way)</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td><strong>All Errors</strong></td>
<td><strong>74</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
Changing Lanes Within Roundabout

Errors per 1,000 entering vehicles

Number of weeks from opening
Other Errors

- Not Yielding
- Improper Lane Usage

Errors per 1,000 entering vehicles vs. Number of weeks from opening.
The Yield Problem
The Yield Problem
Collisions

Number of Collisions

- September 2015 (Sep-15)
- October
- November
- December
- January
- February
- March
- April
- May
- June
- July
- August
- September 2016 (Sep-16)

June has the highest number of collisions with 8.
Collisions

Number of Collisions

- September-15: 1
- October: 2
- November: 3
- December: 2
- January: 1
- February: 1
- March: 3
- April: 1
- May: 1
- June: 8
- July: 8
- August: 4
- September-16: 1
- October: 2
- November: 2
- December: 2
## Collision Performance

<table>
<thead>
<tr>
<th></th>
<th>Expected Collisions (per 12 months)</th>
<th>Observed Collisions (per 12 months)</th>
<th>PFI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PDO</strong></td>
<td>25.6</td>
<td>21</td>
<td>-4.6</td>
</tr>
<tr>
<td><strong>Injury</strong></td>
<td>2.8</td>
<td>2</td>
<td>-0.8</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>28.4</td>
<td>23</td>
<td>-5.4</td>
</tr>
</tbody>
</table>

September/15 – December/16, w/o June, July, Aug.
Collision Configuration

- Lane Change: 41%
- Rear-End: 3%
- Other: 56%
Capacity Analysis
## Capacity Analysis

<table>
<thead>
<tr>
<th>Method</th>
<th>Critical Headway (sec)</th>
<th>Follow-up Headway (sec)</th>
<th>Intersection Delay (sec)</th>
<th>LOS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Right</td>
<td>Left</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCM 2010</td>
<td>4.11</td>
<td>4.29</td>
<td>4.29</td>
<td>56.1</td>
</tr>
<tr>
<td>HCM 6</td>
<td>4.32</td>
<td>4.65</td>
<td>3.19</td>
<td></td>
</tr>
<tr>
<td>Raff</td>
<td>3.2-3.5</td>
<td>3.5-3.8</td>
<td>3.02</td>
<td>23.9</td>
</tr>
<tr>
<td>Wu</td>
<td>3.21</td>
<td>3.35</td>
<td>3.02</td>
<td>21.4</td>
</tr>
</tbody>
</table>
Conclusions

- **Most error reduction by 15-20 weeks (74% reduction)**
  - Most common observed error = *changing lanes* within the roundabout
  - Error causing the most accidents = *drivers not yielding* to traffic already in the roundabout

- Collision data – better than average

- Observed *Critical* Headways different than HCM6

- Pavement markings? (41% of all collisions)
Pavement Markings