# Lauzon Parkway Improvements
# Environmental Assessment
# G.W.P. 3117-09-00

## LAUZON PARKWAY/E.C. ROW EXPRESSWAY INTERCHANGE
## EXISTING & FUTURE CONDITIONS

**FINAL**
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## PREFACE

The Ontario Ministry of Transportation, the City of Windsor and the County of Essex have initiated a Class Environmental Assessment Study to address the future requirements for Lauzon Parkway. The study has the following main components as follows:

the environmental assessment study and preliminary design for:

- Lauzon Parkway from E.C. Row Expressway to County Road 42;
- Lauzon Parkway's extension to Highway 401; and
- Lauzon Parkway's further extension to Highway 3.

the environmental assessment study for:

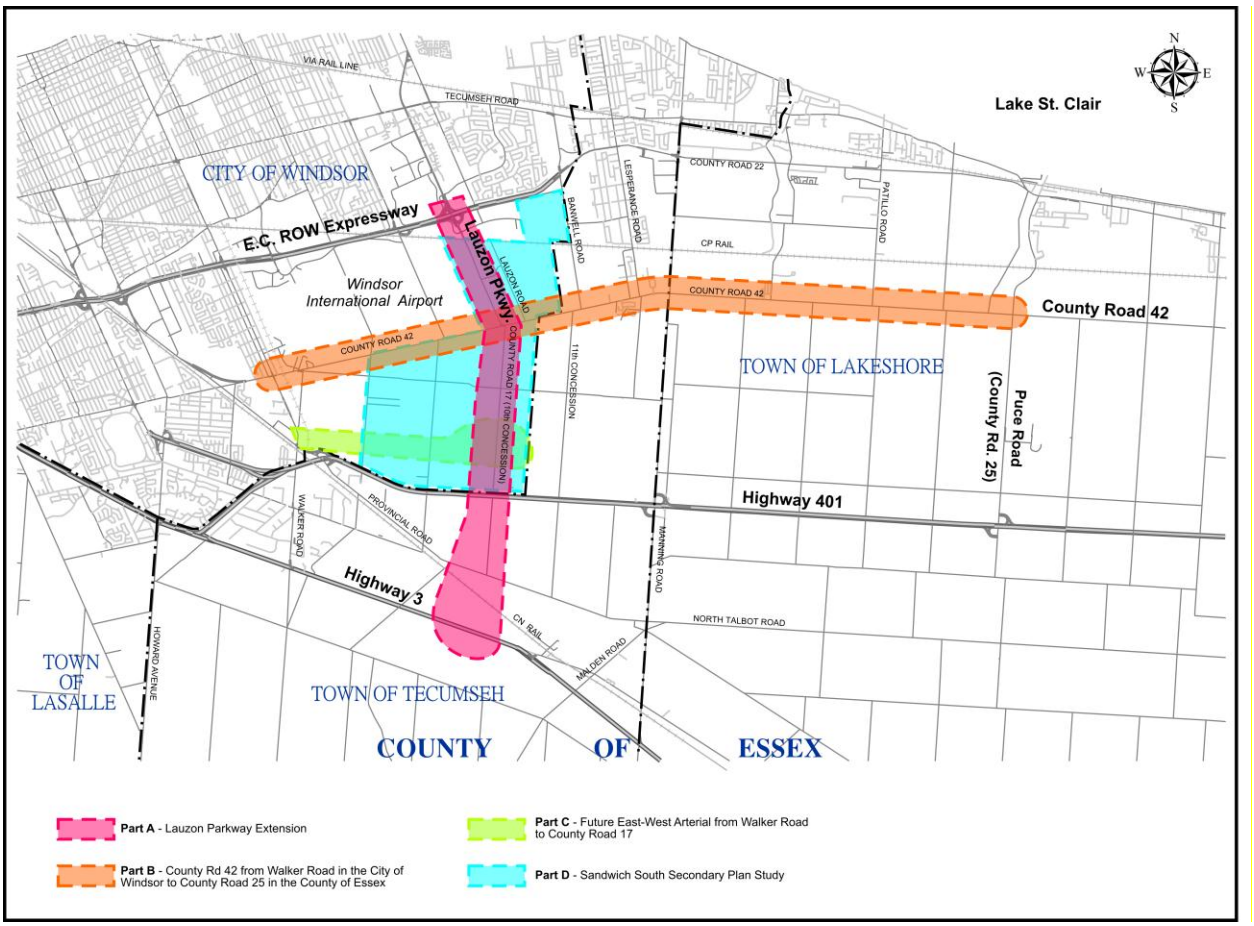
- County Road 42 from Walker Road to County Road 25; and
- the future east-west arterial from Walker Road to Essex County Road 17.

the preparation and approval of a Secondary Plan for the remainder of the lands transferred to the City of Windsor in 2003 (lands are generally bounded by the CPR mainline north of the Windsor International Airport, Lauzon Parkway and the 8th Concession Road, and the City of Windsor boundary).

The study area, as shown in Figure 1, covers lands within the City of Windsor, the Town of Lakeshore and the Town of Tecumseh within the County of Essex. The area is currently rural but the area has been zoned and approved for future Industrial and Residential land uses. The built-up communities of Forest Glade and Fontainebleau are located immediate to the north of E.C. Row Expressway. Windsor International Airport is located just south of the E.C. Row Expressway adjacent the study area.

This study will follow the Ontario Environmental Assessment Act through the application of the Municipal Class Environmental Assessment (October 2000 as amended in May 2007). This study is also subject to the requirements of the Canadian Environmental Assessment Act and will refer to the Environmental Assessment for Provincial Transportation Facilities for potential highway improvements. The preparation and approval of the Secondary Plan will follow the requirements of the Ontario Planning Act.

## Figure 1 - Study Area



# 1 INTRODUCTION

The Lauzon Parkway EA Study is examining the future needs of the existing section of Lauzon Parkway from E.C. Row Expressway to County Road 42, and its potential extension to Highway 401 and Highway 3.

This Technical Report describes the existing and future conditions at the Lauzon Parkway & E.C. Row Expressway Interchange.

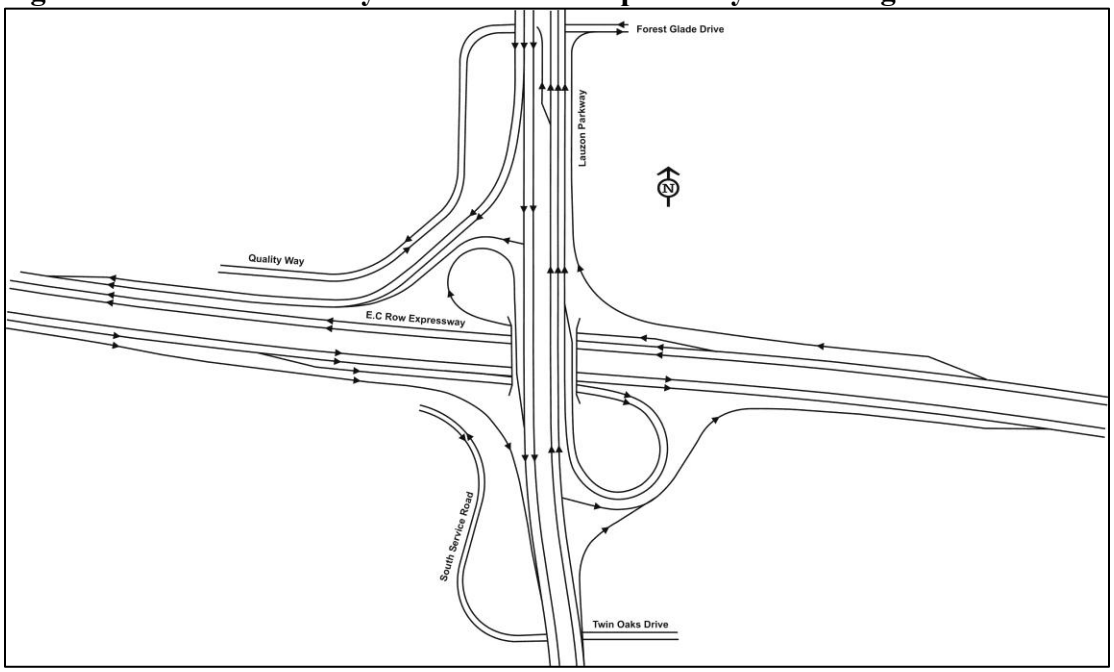
# 2 EXISTING ROADWAY CONDITIONS

## 2.1 Lauzon Parkway

The existing section of Lauzon Parkway, north of Forest Glade Drive/Quality Way is a 6-lane divided Class I arterial road with curb and gutter. From E.C. Row Expressway to the intersection with Forest Glade Drive, Lauzon Parkway is a 5-lane urban divided cross-section (3 northbound lanes and 2 southbound lanes) with turning lanes (**Figure 2**). South of the interchange with E. C. Row Expressway, Lauzon Parkway is a 4-lane divided Class 1 arterial road with curb and gutter cross-section (**Figure 3**) that extends to 350 m south of the CPR Windsor Subdivision Line Overpass, before transitioning to a 2-lane rural cross-section with unpaved shoulders (**Figure 4**).

The posted speed on Lauzon Parkway south of the CPR Overpass is 80 km/h and north of the CPR Overpass, through the interchange and north of Forest Glade Driver the posted speed is 70 km/h. The design speeds of Lauzon Parkway north and south of the CPR Overpass are assumed to be 90 km/h and 100 km/h respectively.

**Figure 2 - Lauzon Parkway and E.C. Row Expressway Lane Diagram**



Through the interchange, the horizontal alignment of Lauzon Parkway is relatively straight, with a slight horizontal curve just south of E. C. Row Expressway. Vertically, Lauzon Parkway increases in elevation over E. C. Row Expressway and again over the CP Rail line south of the intersection at Twin Oaks Drive / South Service Road. The profile of the existing Lauzon Parkway is illustrated in **Appendix A.** The interchange ramp geometry is presented in Section 2.3.

**Figure 3 - Lauzon Parkway South of E.C. Row Expressway - 4-Lane Urban Cross-Section**

**Figure 4 - Lauzon Parkway South of CPR – 2-Lane Rural Cross-Section**

## 2.2 E.C. Row Expressway Mainline

The existing E. C. Row Expressway is currently operating as a 4-lane divided fully-controlled access highway providing east-west service across the City of Windsor. The facility was originally designed based on a design speed of 70 mph (approximately 110 km/h); however the current posted speed is 100 km/h, which typically corresponds to a design speed of 120 km/h.

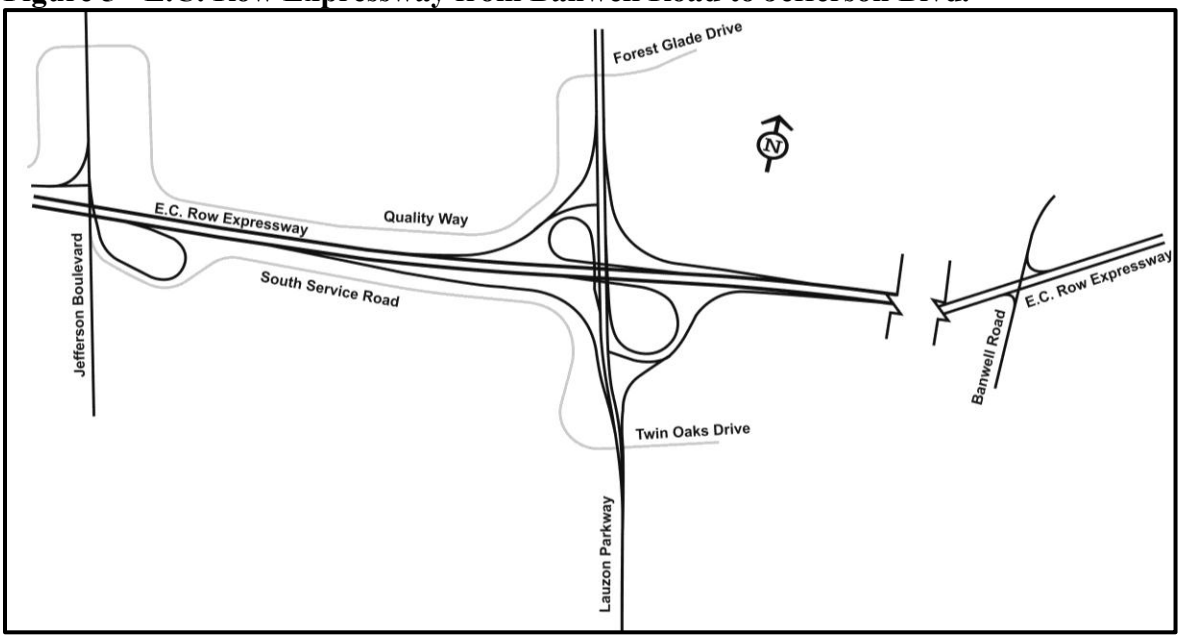
Through the Lauzon Parkway Interchange, the alignment is relatively flat with a slight horizontal curve. The eastbound and westbound lanes are separated by a 12 m to 13 m open ditch median. Lane widths are 3.75 m and all shoulders are paved. Guiderails and concrete barriers are provided along the eastbound off-ramp and on-ramp to provide roadside protection.

Adjacent interchanges/intersections include a partial interchange at Jefferson Boulevard, 1.1 km west of Lauzon Parkway, and an intersection at Banwell Road, 2.4 km to the east of Lauzon Parkway. In the immediate vicinity of E.C Row Expressway, Jefferson Boulevard is a 2 to 5-lane Class II arterial road with a posted speed of 60 km/h on Jefferson Boulevard. The existing Jefferson Boulevard Interchange is a partial interchange to/from the west. Access to/from the east is provided through the Lauzon Parkway Interchange via Quality Way and the South Service Road.

Banwell Road is a 2-lane Class II arterial road with posted speeds north and south of the intersection with E. C. Row Expressway of 50 km/h and 60 km/h, respectively. A future interchange has been identified for Banwell Road and E.C. Row Expressway in the Banwell Road Environmental Study Report (Draft 2011).

The Essex-Windsor Regional Transportation Master Plan (2005) identified a need to widen E.C. Row Expressway from 4 to 6 lanes from Huron Church Road to Banwell Road/CR43 by 2021.

**Figure 5 - E.C. Row Expressway from Banwell Road to Jefferson Blvd.**



## 2.3 Lauzon Parkway & E. C. Row Expressway Interchange

The Lauzon Parkway Interchange is a Parclo B-4 configuration consisting of six ramps (**Figure 6**). The structure over E.C. Row Expressway currently accommodates 2 southbound lanes and 2 northbound lanes plus 2 lanes developed from the W-N ramp. A major rehabilitation of the interchange was undertaken and completed in 2010.

**Figure 6 - Existing Lauzon Parkway E.C. Row Expressway Interchange**

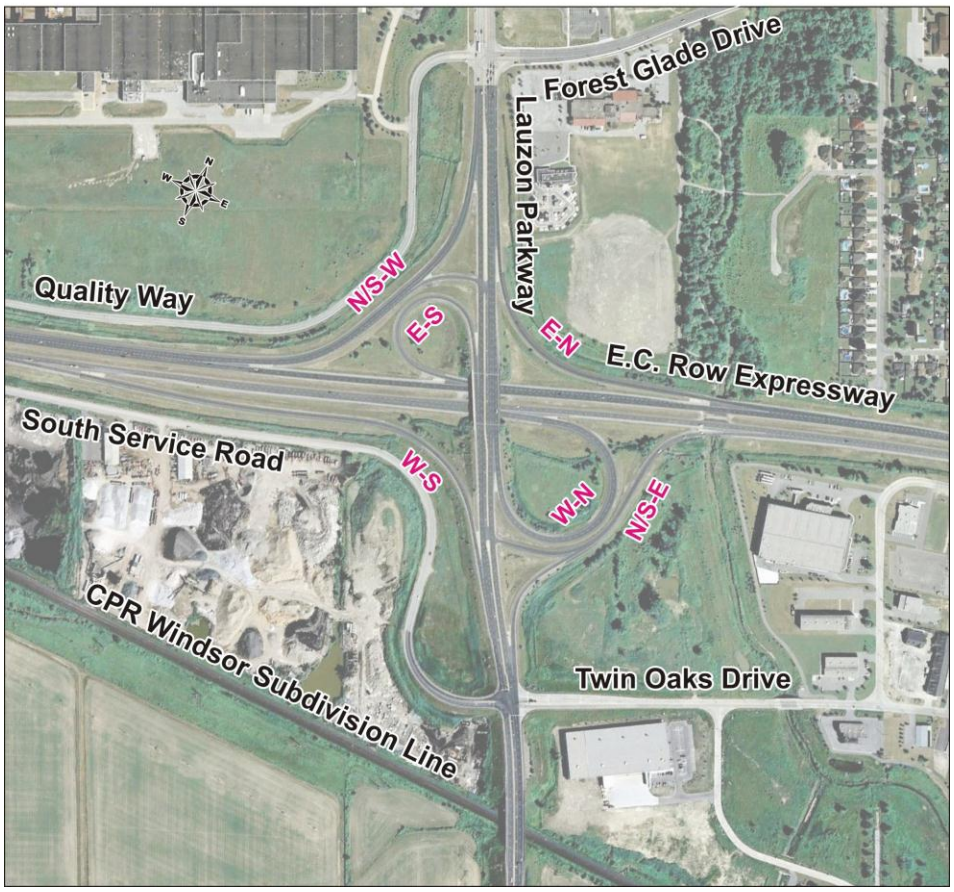



**Table 1** and **Table 2** summarize the existing Lauzon Parkway Interchange geometry and highlight the locations where features, if any, do not meet current MTO standards.

**Table 1 - Lauzon Parkway & E. C. Row Interchange Ramp Geometric Elements**

| Ramps | | Ramp Design Speed (km/h) (standard / minimum) | Standard Ramp Radius (m) (standard / minimum) | Existing Ramp Radius (m) |
|---|---|---|---|---|
| Entry | N/S-E | 70 / 50 | 190 / 90 | 80 |
| Entry | N/S-W | 70 / 50 | 190 / 90 | 170 |
| Exit | W-N | 50[1] | 80 | 70 |
| Exit | W-S | 80 / 60 | 250 / 130 | 145 |
| Exit | E-N | 80 / 60 | 250 / 130 | 155 |
| Exit | E-S | 50[1] | 80 | 45 |

1 - Parclo B inner loop - urban condition

The radii of the N/S-E on-ramp (80 m), the W-N off-ramp (70 m), and the E-S off-ramp (45 m) correspond to a design speed of 40 km/h.

**Table 2 - Lauzon Parkway Interchange Speed Change Lane (SCL) Lengths**

| Ramps | # of Lanes | Standard SCL (m) | | Existing SCL (m) | |
|---|---|---|---|---|---|
| | | E. C. Row Expressway[1] | Lauzon Parkway[2] | E. C. Row Expressway | Lauzon Parkway[2] |
| N/S-E | 1 | 500 | 150 | 400 | 90 |
| N/S-W | 2 | 500 | 150 | 400 | N/A[3] |
| W-N | 2 | 535 | 220 | 500 | 140[4] |
| W-S | 1 | 345 | 220 | 358 | 110 |
| E-N | 1 | 345 | 220 | 357 | N/A[5] |
| E-S | 1 | 345 | 220 | 325 | 165 |

1 – Design speed of E.C. Row Expressway Interchange is assumed to be 120 km/h.
2 – Design speed of Lauzon Parkway at E.C. Row Expressway Interchange is assumed to be 90 km/h.
3 – Southbound general travel lane exits to E.C. Row Expressway; no speed change lane.
4 – Two lane off-ramp; one lane ends with speed change lane and other lane develops into third northbound lane.
5 – Ramp lane is carried forward to intersection as right turn lane.

Upon further review, it is noted that the existing speed change lanes on E.C. Row Expressway correspond to the original design speed of 110 km/h, which exceeds the current posted speed of 100 km/h. Also, in reviewing the speed change lanes on Lauzon Parkway, it is noted that all the speed change lanes correspond to a design speed of 70 km/h or higher, which matches the posted speed of 70 km/h through the interchange. The current practice for new road design is that the design speed is 20 km/h over the posted speed for high speed facilities; however, historically this was not always the case, therefore this is acknowledged when reviewing existing facilities and generally if the geometry design speed exceeds the posted speed it is considered acceptable provided collision history does not indicate a safety concern.

## 2.4 Adjacent Local Roads

The road crossings in close proximity to the Lauzon Parkway E.C. Row Expressway Interchange are Quality Way / Forest Glade Drive to the north and South Service Road / Twin Oaks Drive to the south. Each road has a posted speed of 50 km/h and both intersections with Lauzon Parkway are signalized.

Quality Way is a 2-lane Class I collector road and extends west from Lauzon Parkway and Forest Glade Drive is a 4-lane (5-lane from Lauzon Parkway to Meadowbrook Lane) Class I collector road that extends east from Lauzon Parkway. The South Service Road is a 2-lane Class I collector road and extends west from Lauzon Parkway while Twin Oaks Drive is a 2-lane Class I collector road extending east of Lauzon Parkway.

## 2.5 Structures

### 2.5.1 E. C. Row Expressway Bridge (Structure # 151)

The Lauzon Parkway Bridge was constructed in 1980 and is a concrete structure with a post-tensioned concrete deck. The bridge has a total length and deck width of 65 m and 36 m respectively and is a 2-span structure (maximum span of 32 m). The original construction drawings indicate the structure was designed to accommodate the future expansion of E.C. Row Expressway from 4 to 6 lanes.

The bridge was rehabilitated in 2005 to complete spot repairs on severe spalling/delaminated areas of concrete barrier walls. A major rehabilitation to the structure was also undertaken and completed in 2010. The Lauzon Parkway Bridge over E. C. Row Expressway is shown in **Figure 7**.

The bridge carries a total of 5 northbound lanes (2 thru lanes, 1 left turn lane and 2 speed change lane from the W-N loop ramp) and 3 southbound lanes (2 thru lanes and 1 speed change lane from the E-S loop ramp).

**Figure 7 - Lauzon Parkway Bridge over E. C. Row Expressway**

### 2.5.2 CPR Bridge (Structure Number # 160)

The CPR Windsor Subdivision Line runs in an east-west direction crossing under Lauzon Parkway south of E.C. Row Expressway. The CPR structure is a 3-span pre-stressed concrete girder bridge built in 1980. **Figure 8** shows the rail crossing from southbound Lauzon Parkway.

As part of Contract #35-08, the structure was rehabilitated in 2008 by converting the structure to semi-integral abutments. Other work included patching of the girder ends and new approach slabs.

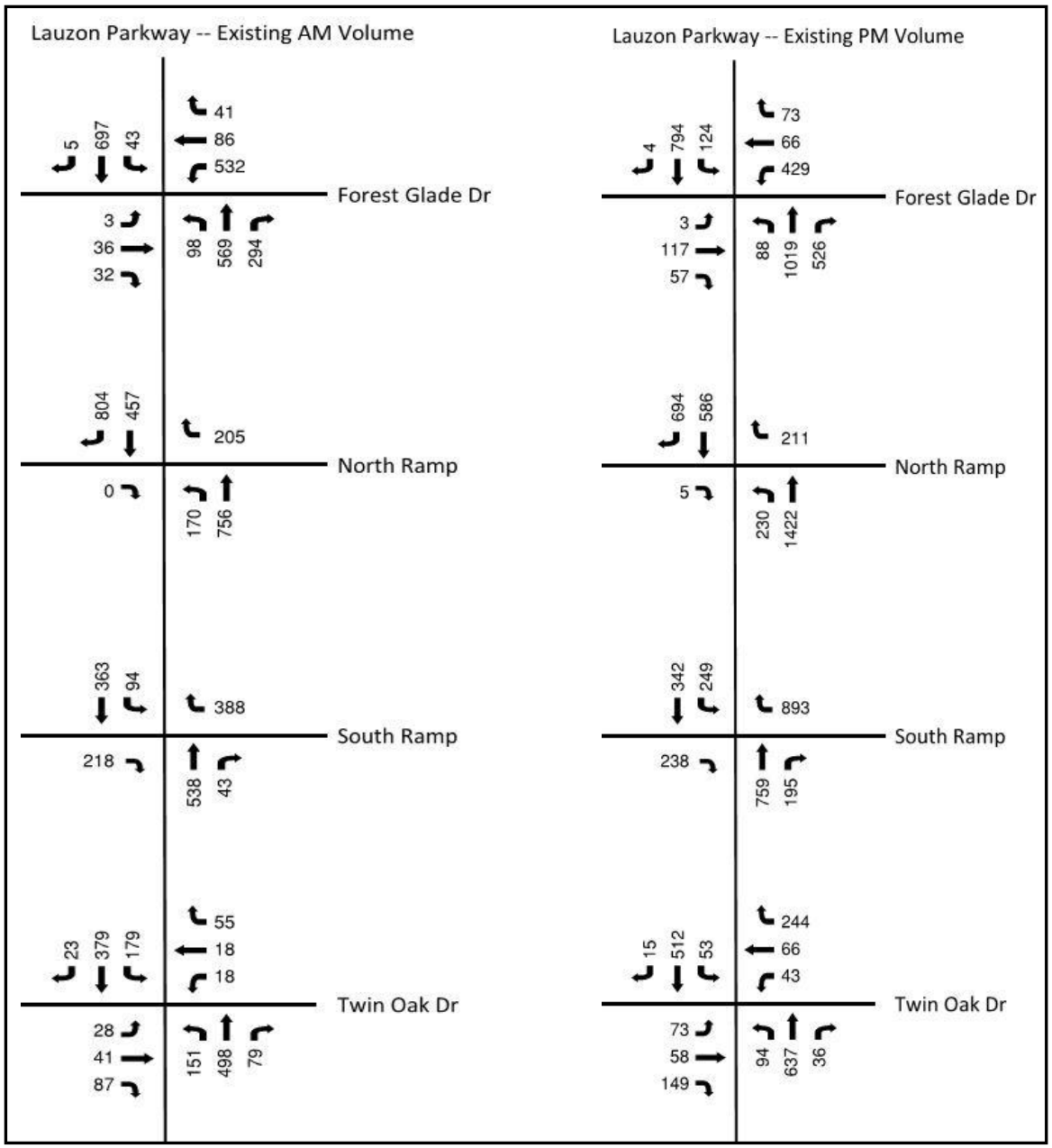
**Figure 8 - Lauzon Parkway Bridge over CPR**

# 3 EXISTING TRAFFIC CONDITIONS

## 3.1 Existing Traffic Volume

Traffic volume data provided by the City of Windsor and County of Essex was used in the analysis. Additional traffic counts for the study area intersections were collected by MRC in March 2011. The existing traffic counts for Lauzon Parkway and E.C. Row Expressway Interchange ramp terminals and two adjacent intersections are presented in **Figure 9.** The traffic volumes during p.m. peak hour are generally higher than the a.m. peak hour in the study area.

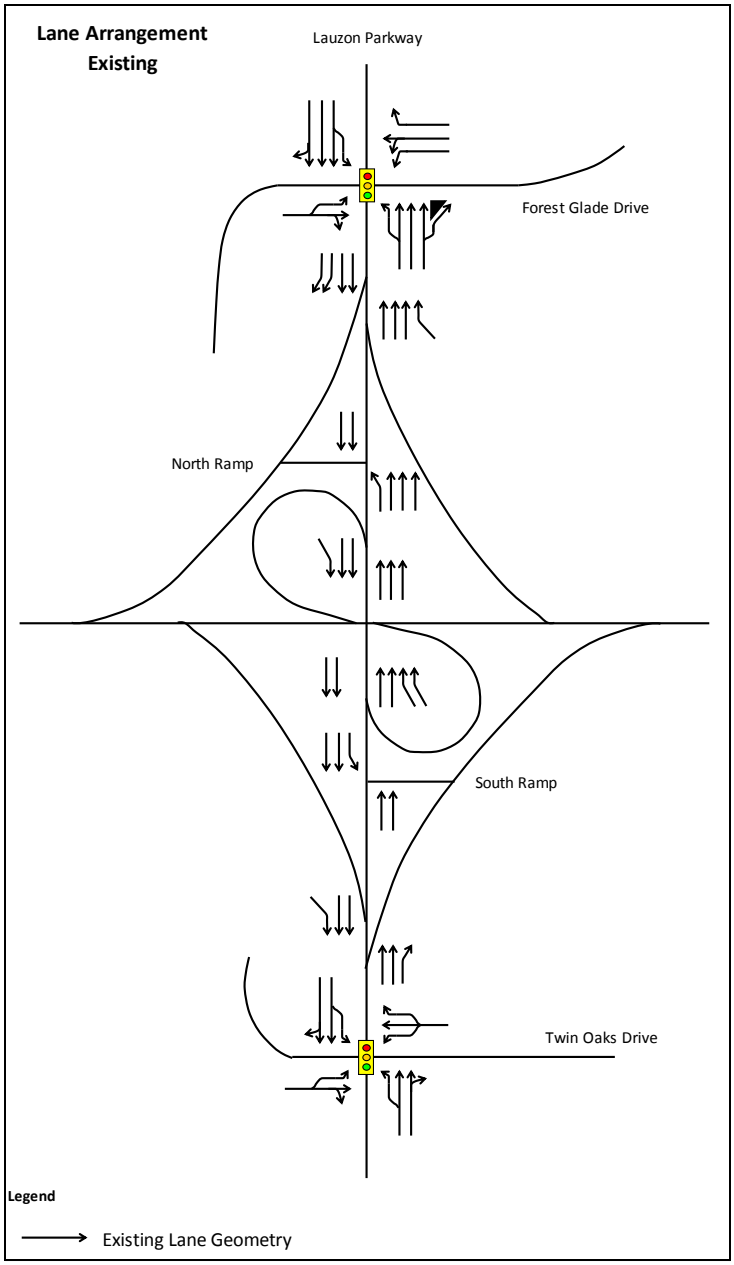
**Figure 9 - Existing (2011) Traffic Volume (a.m. and p.m. peak hours)**



## 3.2 Existing Level-of-Service

Evaluation of level-of-service (LOS) for the study area intersections was undertaken using VISSIM micro-simulation model and reported in the *Traffic Analysis Report - Existing Condition (August 2011)*. The VISSIM microsimulation model provides the system wide analysis by taking in consideration of lane geometry, signal timing plans and network (i.e. distance between traffic signals/intersections, length of storage lane and also driving behaviour). The evaluation of existing LOS was based on the existing traffic volume during a.m. and p.m. peak hour and the existing network configuration. The existing lane geometry is presented in **Figure 10.**

**Figure 10: Existing Lane Configurations**



The intersection capacity analysis (using VISSIM model) is presented in **Table 3.**

**Table 3: Existing (2011) Level-of-Service**

| Location/Movement | Levels of Service | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Weekday A.M. Peak Hour | | | | Weekday P.M. Peak Hour | | | |
| | V/C | Delay (s) | LOS | Queue[1] (m) | V/C | Delay (s) | LOS | Queue[1] (m) |
| *Lauzon Parkway at Forest Glade Drive* | | **21** | **C** | | | **22** | **C** | |
| Eastbound Left | 0.04 | 38 | D | 1 | 0.04 | 42 | D | 0 |
| Eastbound Through/Right | 0.25 | 43/15 | D/B | 17 | 0.64 | 42/244 | D/C | 38 |
| Westbound Left/Through | 0.87 | 41/43 | D/D | 69 | 0.83 | 1/46 | D/D | 58 |
| Westbound Right | 0.12 | 9 | A | 69 | 0.21 | 9 | A | 58 |
| Northbound Left | 0.31 | 15 | B | 13 | 0.28 | 19 | B | 14 |
| Northbound Through | 0.29 | 15 | B | 27 | 0.60 | 21 | C | 50 |
| Northbound Right | 0.37 | 4 | A | 0 | 0.60 | 7 | A | 0 |
| Southbound Left | 0.12 | 15 | B | 7 | 0.51 | 21 | C | 19 |
| Southbound Through/Right | 0.41 | 16/11 | B/B | 34 | 0.44 | 20/19 | B/B | 40 |
| *Lauzon Parkway at North E.C. Row Ramps* | | **2** | **A** | | | **2** | **A** | |
| Eastbound Right | - | 0 | A | 0 | - | 0 | A | 0 |
| Westbound Right | - | 0 | A | 0 | - | 0 | A | 0 |
| Northbound Left | - | 10 | B | 6 | - | 14 | B | 12 |
| Northbound Through | - | 1 | A | 0 | - | 1 | A | 0 |
| Southbound Through/Right | - | 1/1 | A/A | 27 | - | 2/2 | A/A | 35 |
| *Lauzon Parkway at South E.C. Row Ramps* | | **1** | **A** | | | **2** | **A** | |
| Eastbound Right | - | 0 | A | 0 | - | 0 | A | 0 |
| Westbound Right | - | 0 | A | 0 | - | 0 | A | 0 |
| Northbound Through/Right | - | 0/1 | A/A | 0 | - | 1/1 | A/A | 0 |
| Southbound Left | - | 4 | A | 5 | - | 14 | B | 32 |
| Southbound Through | - | 0 | A | 0 | - | 0 | A | 0 |
| *Lauzon Parkway at Twin Oaks Drive* | | **9** | A | | | **12** | **B** | |
| Eastbound Left | 0.15 | 50 | D | 12 | 0.39 | 44 | D | 21 |
| Eastbound Through/Right | 0.46 | 41/16 | D/B | 23 | 0.66 | 44/21 | D/C | 42 |
| Westbound Left | 0.20 | 58 | E | 10 | 0.66 | 38 | D | 13 |
| Westbound Through | 0.07 | 36 | D | 6 | 0.25 | 37 | D | 19 |
| Westbound Right | 0.25 | 5 | A | 0 | 0.57 | 8 | A | 14 |
| Northbound Left | 0.23 | 7 | A | 13 | 0.18 | 8 | A | 7 |
| Northbound Through/Right | 0.31 | 7/4 | A/A | 22 | 0.33 | 7/4 | A/A | 29 |
| Southbound Left | 0.32 | 10 | A | 11 | 0.12 | 10 | B | 6 |
| Southbound Through/Right | 0.22 | 5/3 | A/A | 14 | 0.28 | 8/4 | A/A | 24 |

The intersection at Forest Glade Drive is operating at LOS 'C' in both peak hours. The opposing Forest Glade Drive and Quality Way approaches to Lauzon Parkway operate on split phases with a shared westbound left/through lane group (one dedicated left-turn lane plus one shared left-turn/through lane). Given the nature of split phase operation, intersection capacity is reduced to accommodate the shared lane group. The analysis demonstrates that this westbound lane group

operates adequately under existing conditions and that there is reserve intersection capacity to accommodate traffic growth on all approaches.

With the exception of the north to east and south to west ramps, all other interchange ramps at the E.C. Row Expressway interchange with Lauzon Parkway operate under free-flow conditions with LOS 'A' in all cases. Despite the free flow movements of the north and south traffic, the left turn (north to east and south to west) movements maintain a LOS 'B' or better during each of the morning and afternoon peak periods.

The intersection at Lauzon Parkway at Twin Oaks Drive is operating at LOS B or better in both peak hours. Traffic analysis for the signalized Lauzon Parkway intersection with Twin Oaks Drive/South Service Road reflects side road approach volume to capacity ratios of no more than 0.66. Corresponding volume to capacity ratios on the Lauzon Parkway approaches are all less than 0.40. Despite the morning peak hour westbound left-turn LOS E, this movement is not capacity constrained as the demand is less than 20 vehicles.

# 4 COLLISION HISTORY

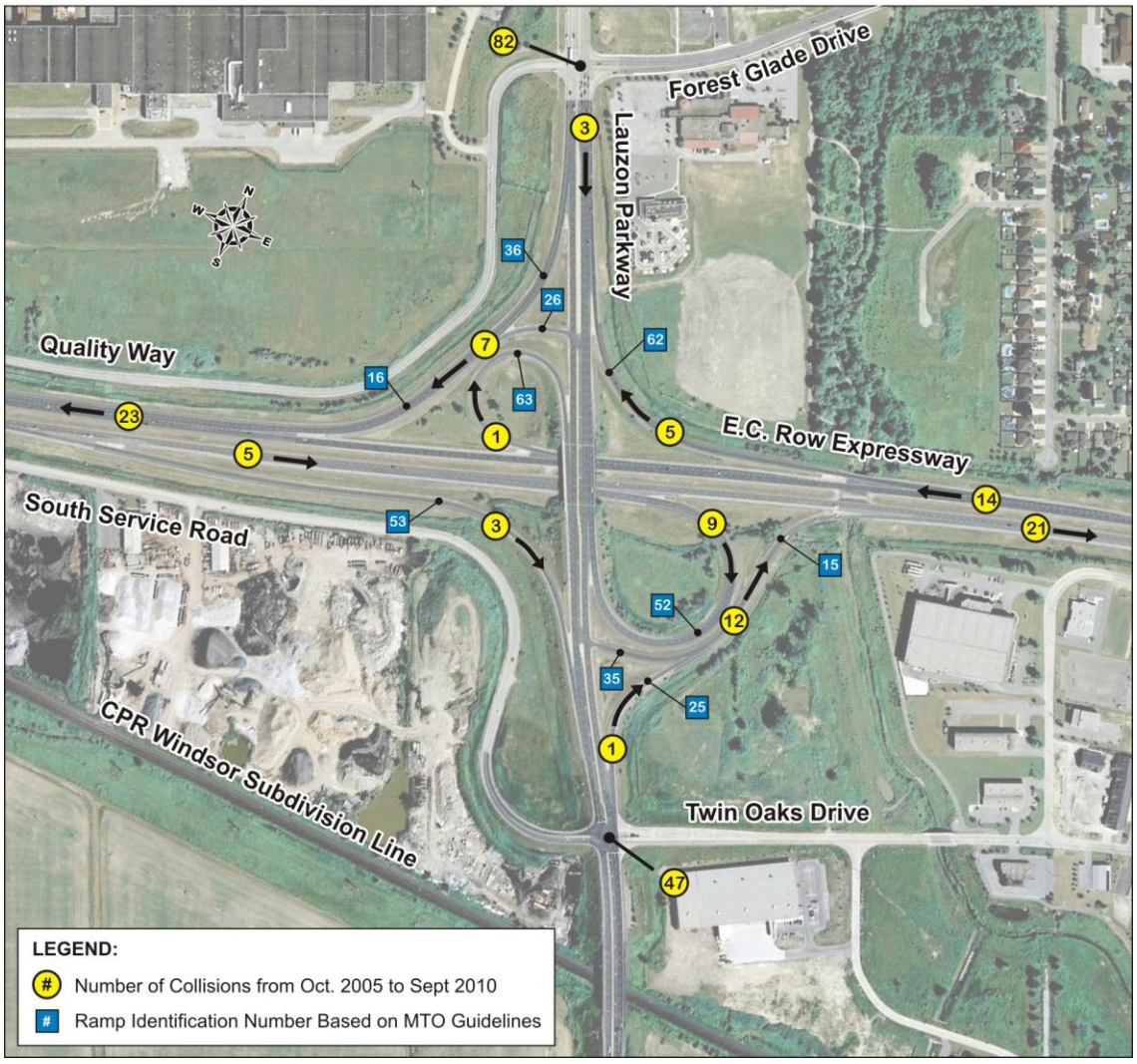
A review of recent collision history (from October 2005 to September 2010) was carried out using summary level collision data available from the City of Windsor. The intent of this preliminary investigation was to identify any potentially collision prone locations and the possible contributing factors to collisions at these sites. This investigation includes only a review of the available collision data and does not constitute a safety audit or an in-service safety review.

The collision summaries identify the total number of collisions, the estimated collision rate and characteristics related to impact type, severity and lighting, road surface and environmental conditions. The estimated collision rate is based on the best estimate of annual average daily traffic volume based on available turning movement data and mid-block traffic volumes. The collision frequency (presented in **Figure 11**), collision rate and collision characteristics along Lauzon Parkway and County Road 17 are summarized in **Table 4.**

The collision analysis for ramps at Lauzon Parkway/E.C. Row Interchange indicates that N/S -E on-ramp has the highest numbers of collision (12) in five year period compared to the other ramps, resulted in collision rate of 2.08. About 92 % (11 of 12 incidents) occurred in Day-light. Out of 12 incidents, 9 incidents were Property Damage Only and 3 include injuries. Notwithstanding, 67% collisions occurred in Snow and Icy road conditions.

The E-S off-ramp has only one collision in the 5 year period. However, due to very low volume on this ramp, this ramp resulted in high collision rate (number of collisions per million vehicles) of 10.34.

**Figure 11 - Collision Frequency (October 2005 to September 2010) at Lauzon Parkway and E.C. Row Interchange**




Collision history at Forest Glade and Twin Oaks Drive intersections at Lauzon Parkway do not indicate that lighting conditions are a contributing factor as nearly 80% of all collisions occurred in daylight. Similarly, the road surface conditions were described as dry and the environmental conditions were described as clear for more than 80% of the collisions at these intersections. Accordingly, the data do not imply that road surface and environmental conditions have contributed to the higher frequency of collisions at these intersections. There were no fatalities at Lauzon Parkway intersections during the periods represented by the data.

The collision at Forest Glade Drive intersection has resulted in 34% (28 out of 82) in injuries and 66% (54 out of 82) in Property Damage Only. There were 26 (32%) Rear End collisions, 18 (22%) in Angle and 24 (29%) in Turning collisions.

## Table 4 - Vehicle Collision History

| Location | Total Collisions | Collision Rate[1] | Lighting Conditions | | | Collision Type | | | | | | | Severity | | | Road Surface | | | | | Environment Condition | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Daylight | Dark | Other | Rear End | Angle | Single Vehicle | Side Swipe | Turning | Approach | Other | Prop. Damage | Injury | Fatality | Dry | Wet | Snow | Ice | Other | Clear | Rain | Snow | Drifting Snow | Freezing Rain | Fog/Mist | Other |
| **Lauzon Parkway and E.C. Row Interchange Ramp Collisions** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| N-W on-ramp (Ramp # 36/16) | 7 | 0.37 | 1 14% | 5 71% | 1 14% | 1 14% | 0 0% | 0 0% | 2 29% | 1 14% | 1 14% | 2 29% | 5 71% | 2 29% | 0 0% | 4 57% | 2 29% | 1 14% | 0 0% | 0 0% | 5 0% | 1 14% | 1 14% | 0 0% | 0 0% | 0 0% | 0 0% |
| E-N off-ramp (Ramp # 62) | 5 | 0.99 | 5 100% | 0 0% | 0 0% | 2 40% | 1 20% | 0 0% | 1 20% | 0 0% | 1 20% | 0 0% | 3 60% | 2 40% | 0 0% | 4 80% | 0 0% | 1 20% | 0 0% | 0 0% | 3 60% | 1 20% | 1 20% | 0 0% | 0 0% | 0 0% | 0 0% |
| E-S off-ramp (Ramp # 63) | 1 | 10.34[2] | 0 0% | 0 0% | 1 100% | 0 0% | 0 0% | 0 0% | 0 0% | 0 0% | 1 100% | 0 0% | 1 100% | 0 0% | 0 0% | 0 0% | 0 0% | 0 0% | 0 0% | 1 100% | 0 0% | 0 0% | 0 0% | 0 0% | 0 0% | 0 0% | 1 100% |
| S-E on-ramp (Ramp # 25/15) | 1 | 0.49 | 1 100% | 0 0% | 0 0% | 0 0% | 0 0% | 0 0% | 1 100% | 0 0% | 0 0% | 0 0% | 1 100% | 0 0% | 0 0% | 0 0% | 1 100% | 0 0% | 0 0% | 0 0% | 0 0% | 1 100% | 0 0% | 0 0% | 0 0% | 0 0% | 0 0% |
| N/S-E on-ramp (Ramp # 35/15) | 12 | 2.08 | 11 92% | 0 0% | 1 8% | 0 0% | 3 25% | 1 8% | 1 8% | 3 25% | 3 25% | 1 8% | 9 75% | 3 25% | 0 0% | 4 33% | 0 0% | 7 58% | 1 9% | 0 0% | 3 25% | 9 75% | 0 0% | 0 0% | 0 0% | 0 0% | 0 0% |
| W-N off-ramp (Ramp # 52) | 9 | 0.74 | 6 67% | 3 33% | 0 0% | 0 0% | 0 0% | 2 22% | 3 33% | 1 11% | 2 22% | 1 11% | 7 78% | 2 22% | 0 0% | 7 78% | 1 11% | 0 0% | 1 11% | 0 0% | 7 78% | 2 22% | 0 0% | 0 0% | 0 0% | 0 0% | 0 0% |
| W-S off-ramp (Ramp # 53) | 3 | 0.91 | 3 100% | 0 0% | 0 0% | 2 67% | 0 0% | 1 33% | 0 0% | 0 0% | 0 0% | 0 0% | 3 100% | 0 0% | 0 0% | 0 0% | 0 0% | 0 0% | 0 0% | 0 0% | 2 67% | 0 0% | 1 33% | 0 0% | 0 0% | 0 0% | 0 0% |
| **Lauzon Parkway Intersections** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Forest Glade/E.C. Row Ave. | 82 | 1.29 | 64 78% | 13 16% | 5 6% | 26 32% | 18 22% | 0 0% | 7 9% | 24 29% | 6 7% | 1 1% | 54 66% | 28 34% | 0 0% | 66 80% | 10 12% | 3 3% | 1 1% | 0 0% | 71 87% | 7 9% | 4 5% | 0 0% | 0 0% | 0 0% | 0 0% |
| Between Forest Glade Drive and E.C. Row WB on-ramp | 3 | 0.11 | 2 67% | 1 33% | 0 0% | 3 100% | 0 0% | 0 0% | 0 0% | 0 0% | 0 0% | 0 0% | 3 100% | 0 0% | 0 0% | 0 0% | 2 67% | 0 0% | 0 0% | 1 33% | 1 33% | 1 33% | 0 0% | 1 33% | 0 0% | 0 0% | 0 0% |
| E.C. Row WB On-ramp | 4 | 0.10 | 4 100% | 0 0% | 0 0% | 1 25% | 1 25% | 0 0% | 0 0% | 1 25% | 1 25% | 0 0% | 1 25% | 3 75% | 0 0% | 4 100% | 0 0% | 0 0% | 0 0% | 0 0% | 4 100% | 0 0% | 0 0% | 0 0% | 0 0% | 0 0% | 0 0% |
| E.C. Row EB On-ramp | 7 | 0.26 | 5 72% | 1 14% | 1 14% | 3 43% | 0 0% | 1 14% | 2 29% | 0 0% | 1 14% | 0 0% | 6 86% | 1 14% | 0 0% | 6 86% | 0 0% | 0 0% | 0 0% | 1 14% | 5 72% | 1 14% | 1 14% | 0 0% | 0 0% | 0 0% | 0 0% |
| Twin Oaks Drive | 47 | 1.28 | 37 79% | 8 17% | 2 4% | 21 45% | 10 21% | 2 4% | 5 11% | 5 11% | 3 6% | 1 2% | 37 79% | 10 21% | 0 0% | 38 81% | 9 19% | 0 0% | 0 0% | 0 0% | 39 83% | 6 13% | 2 4% | 0 0% | 0 0% | 0 0% | 0 0% |

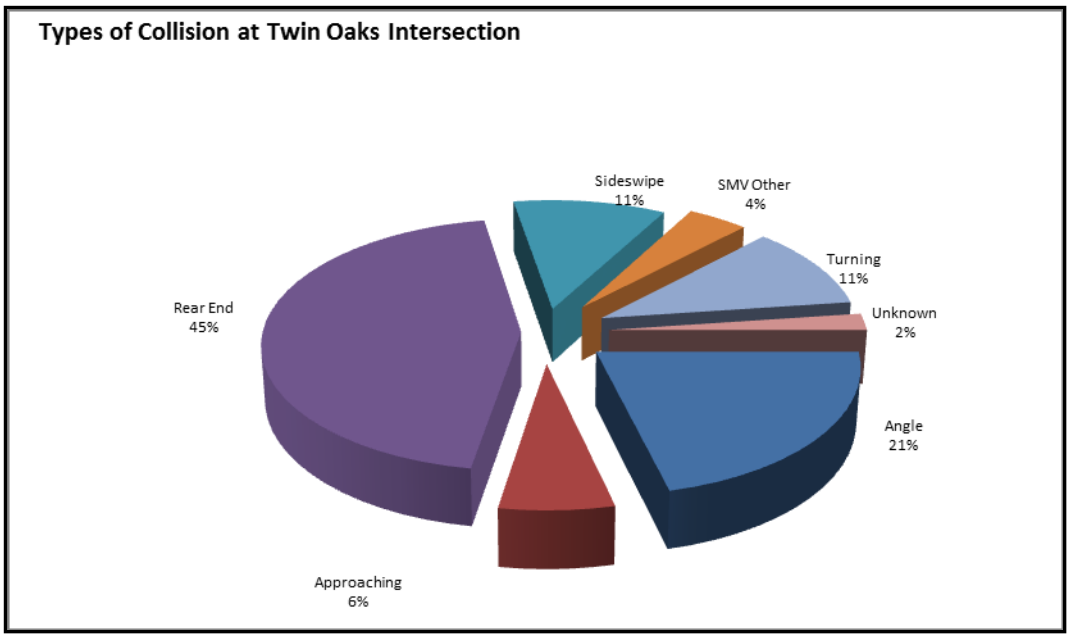
Notes:
1. Collisions/million vehicles entering for intersections/ramps
2. Only one collision reported in a 5 year period and 8-hour volume is only 31. Low traffic volume with one collision results in high collision rate for this ramp.

At Forest Glade Drive intersection, the westbound approach has two left turn lanes (one dedicated left and one shared left/ through lane). Vehicles heading towards E.C. Row westbound on-ramp could potentially have weaving issues due to the short distance between westbound on-ramp and Forest Glade Drive intersection. However, the collision reports indicates that there were only 3 collisions were reported in this segment of Lauzon Parkway (between Forest Glade Drive and westbound on-ramp) in the five year period. All three were Rear End collisions.

At Twin Oaks intersection, approximately 80% of the collisions resulted in Property Damage Only. The collision types at Twin Oaks Drive/Lauzon Parkway intersection is presented in **Figure 12**. Nearly half (45%) of the incidents (21 collisions over five years) involved Rear End collisions and nearly half of these (9 incidents) were in the southbound direction. Six (6) and four (4) of the remaining rear-end collisions occurred on the south and east approaches, respectively. While sight lines and existing vehicle queuing on the south and east intersection approaches do not suggest that the profiles are contributing to the rear-end collision frequency.

The W-S ramp from E.C. Row Expressway merges with Lauzon Parkway only 150m north of Twin Oaks Drive. This proximity and the potential for short distance lane changes to access Twin Oaks Drive may be a contributing factor to some of the 9 southbound rear end collisions on this approach.

**Figure 12 - Collision Types at Twin Oaks Drive/Lauzon Parkway Intersection**



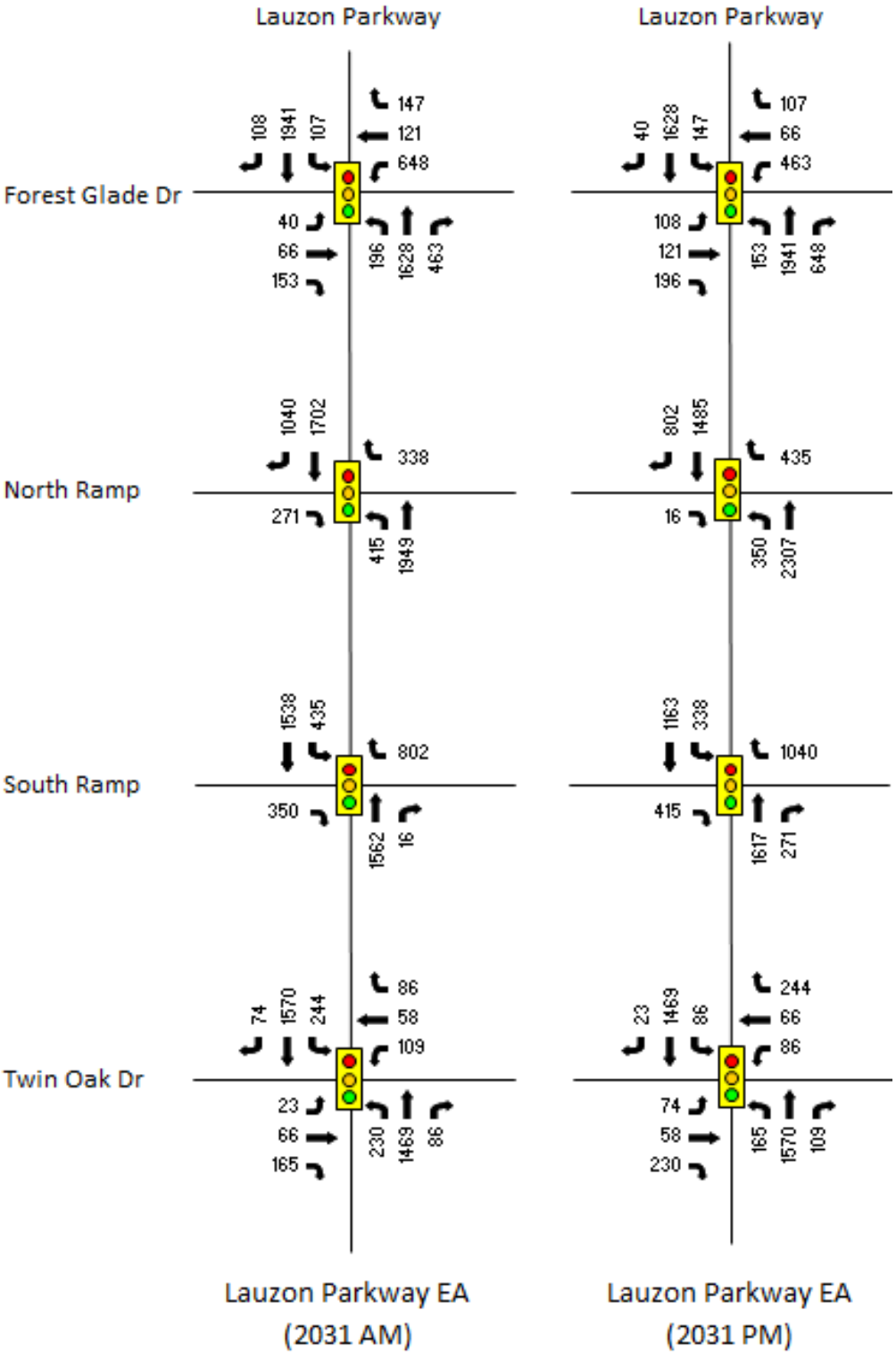
# 5 2031 TRAFFIC CONDITIONS

The 2031 traffic volume was projected using the travel demand model developed based on 2031 land use (population and employment) projections. Approximately 43% of the total development that can be accomplished in the South Sandwich Secondary Plan is assumed for 2031.

As the Windsor-Essex travel demand model is only available for the p.m. peak hour, the traffic demand for a.m. peak hour could not be estimated using model. To assess the traffic operations during a.m. peak hour, the projected traffic volume for the p.m. peak hour was transposed assuming the opposite traffic flow. During the existing condition analysis, the a.m. peak hour was generally observed 10-20% lower than the p.m. peak hour. Hence, the projected demand for the a.m. peak hour by transposing p.m. peak hour would be conservative.

The projected traffic volume for 2031 is presented in **Figure 13.**

**Figure 13: Projected Traffic Volume for Year 2031**



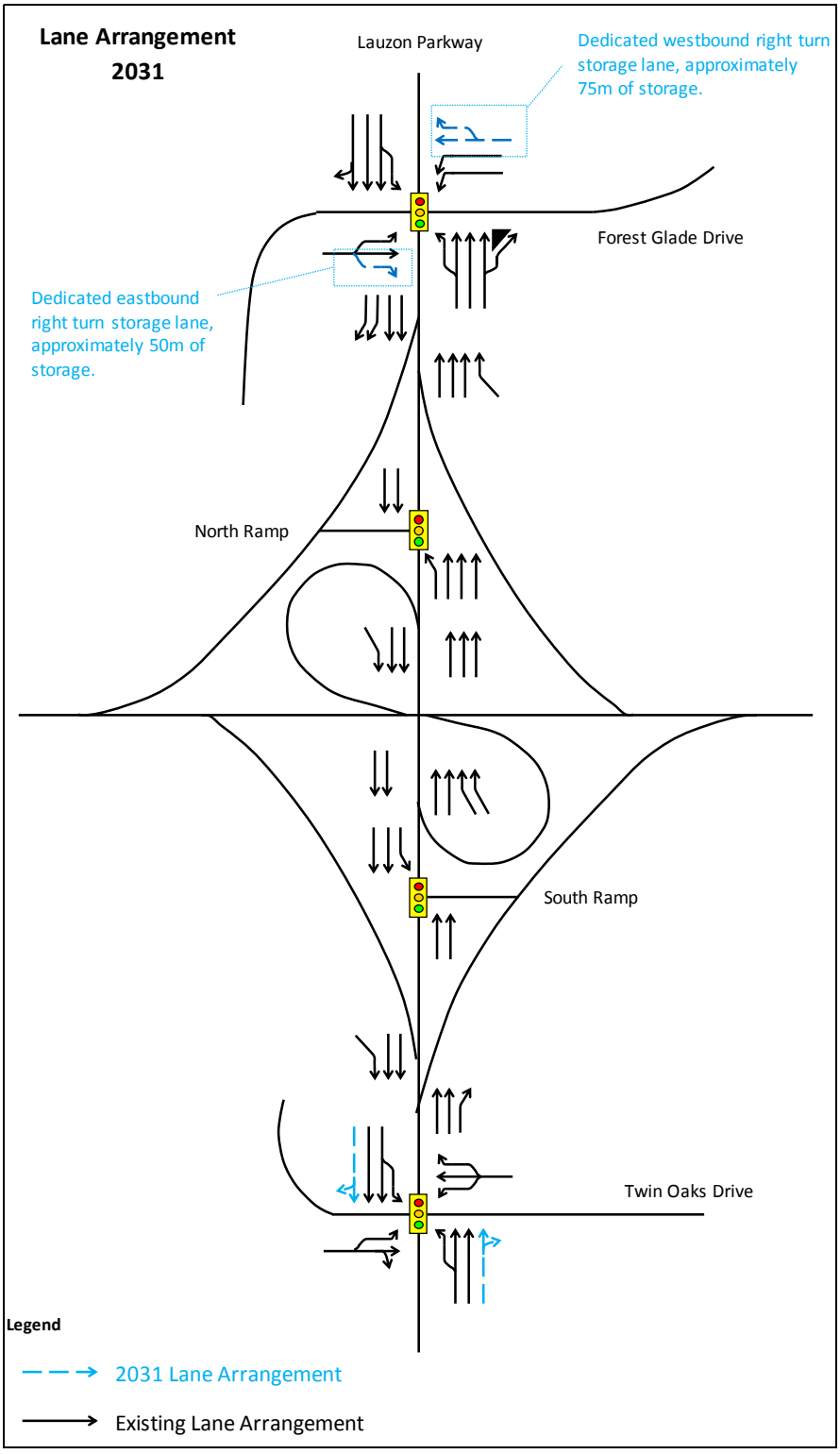
## 5.1 2031 Level-of-Service

The intersection capacity analysis for the future traffic demand for year 2031 was analysed using VISSIM micro-simulation model with the existing network. It is of note that the two ramp terminal intersections are currently not signalized. The intersection capacity analysis for the future traffic demand indicates that the left-turn movements at the ramp terminals (southbound to eastbound and northbound to westbound) would not able to find sufficient gaps and that would result in poor LOS ('F') for the left turn movements, indicates the need for the signalization of the ramp terminal intersections.

In addition to signalization of ramp terminal, minor lane improvements would be required at the Lauzon Parkway and Forest Glade Drive intersection, as presented in **Figure 14**. This intersection would require a dedicated eastbound right turn lane and westbound through lane in order to achieve an acceptable level-of-service with projected traffic demand.

Currently, the westbound left turn and westbound through traffic are sharing the centre lane on the westbound approach. For future traffic demand, the westbound through movement would require a dedicated lane. This could be achieved by converting the existing westbound right turn lane into a dedicated westbound through lane (i.e. by removing shared left and through movements) with provision of a dedicated westbound right turn storage lane (with approximately 75 m of storage). This intersection would also require dedicated eastbound right turn storage lane (with approximately 50 m of storage) in order to reduce the delays for the eastbound through and eastbound right turn movements.

## Figure 14: Proposed 2031 Lane Configurations



The intersection capacity analysis for the 2031 peak hours with the signalization of the ramp terminals and suggested lane geometry improvements are presented in **Table 5.** The volume to capacity ratios were derived from *Synchro* model.

**Table 5: 2031 Level-of-Service with Signalized Ramp Terminals**

| Location/Movement | Levels of Service | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Weekday A.M. Peak Hour | | | | Weekday P.M. Peak Hour | | | |
| | V/C | Delay (s) | LOS | Queue[1] (m) | V/C | Delay (s) | LOS | Queue[1] (m) |
| *Lauzon Parkway at Forest Glade Drive* | | 25 | C | | | 24 | C | |
| Eastbound Left | 0.33 | 44 | D | 13 | 0.49 | 48 | D | 37 |
| Eastbound Through | 0.53 | 45 | D | 20 | 0.53 | 51 | D | 45 |
| Eastbound Right | 0.66 | 11 | B | 20 | 0.58 | 11 | B | 45 |
| Westbound Left | 0.95 | 53 | D | 90 | 0.89 | 49 | D | 65 |
| Westbound Through | 0.32 | 41 | D | 90 | 0.23 | 45 | D | 65 |
| Westbound Right | 0.26 | 11 | B | 13 | 0.07 | 11 | B | 10 |
| Northbound Left | 0.89 | 47 | D | 48 | 0.77 | 34 | C | 30 |
| Northbound Through | 0.78 | 16 | B | 71 | 0.91 | 23 | C | 116 |
| Northbound Right | 0.42 | 3 | A | 0 | 0.64 | 5 | A | 0 |
| Southbound Left | 0.52 | 30 | C | 21 | 0.85 | 37 | D | 29 |
| Southbound Through/Right | 1.03 | 28/23 | C/C | 119 | 0.81 | 23/20 | C/C | 91 |
| *Lauzon Parkway at North E.C. Row Ramps* | | 7 | A | | | 4 | A | |
| Northbound Left | 0.94 | 15 | B | 40 | 0.81 | 16 | B | 37 |
| Northbound Through | 0.41 | 1 | A | 0 | 0.48 | 1 | A | 0 |
| Southbound Through | 0.96 | 13 | B | 90 | 0.84 | 5 | A | 24 |
| *Lauzon Parkway at South E.C. Row Ramps* | | 12 | B | | | 5 | A | |
| Northbound Through | 0.75 | 22 | C | 160 | 0.78 | 7 | A | 48 |
| Southbound Left | 0.82 | 18 | B | 48 | 0.76 | 16 | B | 29 |
| Southbound Through | 0.49 | 2 | A | 0 | 0.37 | 1 | A | 0 |
| *Lauzon Parkway at Twin Oaks Drive* | | 20 | C | | | 11 | B | |
| Eastbound Left | 0.12 | 54 | D | 12 | 0.33 | 22 | C | 16 |
| Eastbound Through/Right | 0.74 | 58/30 | E/C | 60 | 0.66 | 22/11 | C/B | 29 |
| Westbound Left | 0.67 | 36 | D | 27 | 0.47 | 20 | C | 16 |
| Westbound Through | 0.12 | 39 | D | 17 | 0.13 | 19 | B | 13 |
| Westbound Right | 0.12 | 6 | A | 0 | 0.35 | 8 | A | 13 |
| Northbound Left | 0.83 | 34 | C | 46 | 0.68 | 17 | B | 18 |
| Northbound Through/Right | 0.83 | 19/12 | B/B | 75 | 0.95 | 12/8 | B/A | 47 |
| Southbound Left | 0.83 | 40 | D | 57 | 0.33 | 21 | C | 11 |
| Southbound Through/Right | 0.88 | 19/9 | B/A | 56 | 0.87 | 9/7 | A/A | 36 |

The intersection capacity analysis indicates that both ramp terminals at Lauzon Parkway/E.C. Row Expressway will operate at an acceptable LOS with the provision of traffic signals. The two adjacent intersections at Forest Glade Drive and Twin Oaks Drive will also operate at an acceptable LOS. However, the northbound through/right movement at the Twin Oaks intersection would reach near capacity (v/c ratio > 0.9) for 2031 traffic demand; indicates the need for additional lane requirements at this intersection beyond 2031.

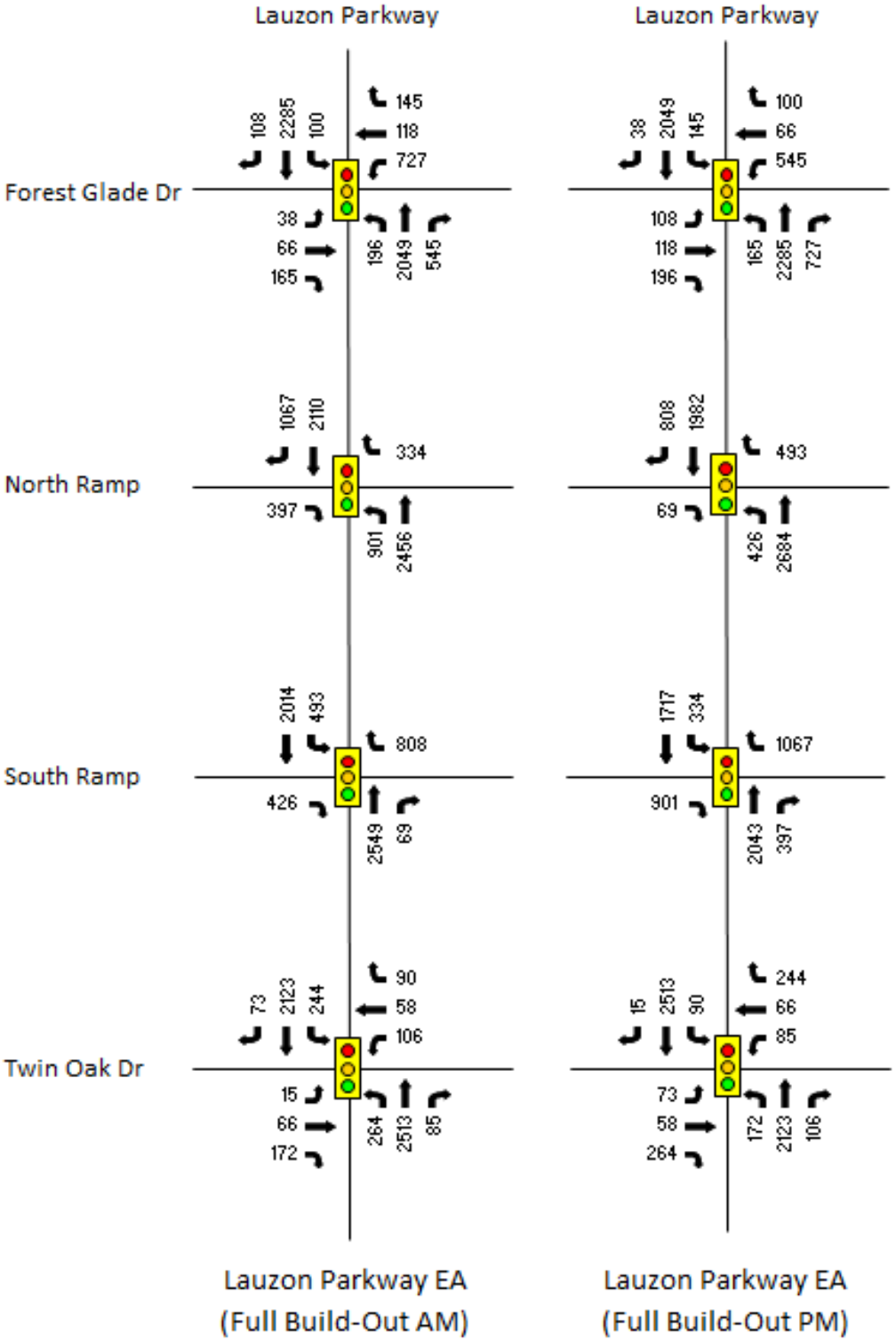
# 6 FULL BUILD-OUT TRAFFIC VOLUME

The City of Windsor requested a review of the operational performance of the interchange and its adjacent intersections for the Full Build-Out scenario beyond the EA planning horizon of 2031. MRC assessed the Full Build-Out scenario in two components – a traffic operational assessment and a detailed safety assessment.

## 6.1 Full Build-Out Traffic Operational Assessment

Approximately 43% of the total development that could be accomplished in the South Sandwich Secondary Plan is assumed for the 2031. The remaining development is assumed to be continued beyond 2031. The full build-out travel demand model was developed assuming that the Secondary Plan would be fully occupied and would achieve the expected density. The resulting traffic volume for the Full Build-out is presented in **Figure 15.**

**Figure 15: Projected Traffic Volume for Full Build-Out**



### 6.1.1 Full Build-Out Level-of-Service

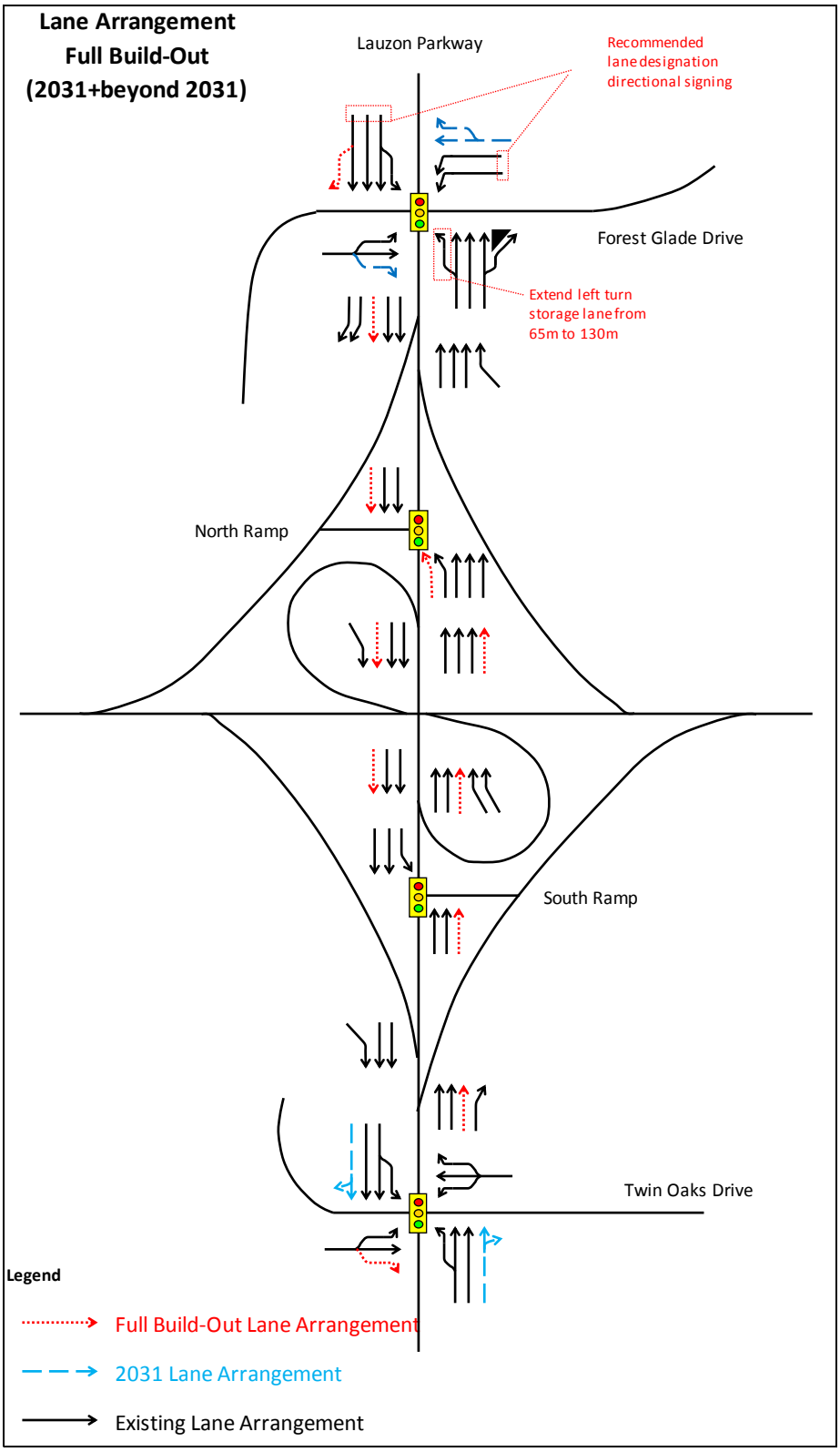
The proposed lane configurations for the Full Build-Out are presented in **Figure 16.** For the Full Build-Out traffic demand, the Lauzon Parkway would require to widen to three lanes in each direction to provide more through capacity at the intersection in order to improve the level of service at Lauzon Parkway intersections.

In addition to 2031 lane improvements, the northbound left turn storage lane at Forest Glade intersection would be required to extend from 65 m to 130 m. This intersection would also require an additional southbound right turn storage lane.

At the north ramp terminal intersection, the northbound left turn demand could result in about 800 to 900 vehicles during a.m. peak hour, which would require dual northbound left turn lanes.

At the Twin Oaks Drive intersection, an additional storage lane for the eastbound right turn movement would be also required.

## Figure 16: Proposed Full Build- Out Lane Configurations



The intersection capacity analysis results for the full build-out traffic demand (using VISSIM micro-simulation model) with the proposed lane geometry are presented in **Table 6**. The volume to capacity ratios were derived from *Synchro* model.

**Table 6: Full Build-Out Level-of-Service with Signalized Ramp Terminals**

| Location/Movement | Levels of Service | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Weekday A.M. Peak Hour | | | | Weekday P.M. Peak Hour | | | |
| | V/C | Delay (s) | LOS | Queue[1] (m) | V/C | Delay (s) | LOS | Queue[1] (m) |
| *Lauzon Parkway at Forest Glade Drive* | | **34** | **C** | | | **30** | **C** | |
| Eastbound Left | 0.31 | 62 | E | 18 | 0.62 | 58 | E | 41 |
| Eastbound Through | 0.53 | 65 | E | 20 | 0.65 | 56 | E | 44 |
| Eastbound Right | 0.16 | 16 | B | 0 | 0.18 | 13 | B | 0 |
| Westbound Left | 1.02 | 70 | E | 140 | 0.90 | 60 | E | 89 |
| Westbound Through | 0.30 | 50 | D | 140 | 0.20 | 49 | D | 89 |
| Westbound Right | 0.10 | 15 | B | 0 | 0.07 | 14 | B | 0 |
| Northbound Left | 0.83 | 48 | D | 49 | 0.81 | 50 | D | 42 |
| Northbound Through | 0.89 | 34 | C | 187 | 1.08 | 29 | C | 193 |
| Northbound Right | 0.47 | 8 | A | 0 | 0.69 | 11 | B | 0 |
| Southbound Left | 0.67 | 29 | C | 18 | 0.76 | 43 | D | 34 |
| Southbound Through | 1.12 | 31 | C | 182 | 0.98 | 26 | C | 141 |
| Southbound Right | 0.12 | 9 | A | 0 | 0.04 | 5 | A | 0 |
| *Lauzon Parkway at North E.C. Row Ramps* | | **17** | **B** | | | **4** | **A** | |
| Northbound Left | 0.93 | 56 | E | 186 | 0.73 | 20 | B | 26 |
| Northbound Through | 0.51 | 0 | A | 0 | 0.56 | 1 | A | 0 |
| Southbound Through | 0.95 | 20 | B | 199 | 0.81 | 5 | A | 32 |
| *Lauzon Parkway at South E.C. Row Ramps* | | 6 | A | | | 3 | A | |
| Northbound Through | 0.85 | 2 | A | 22 | 0.67 | 4 | A | 30 |
| Southbound Left | 0.91 | 58 | E | 125 | 0.72 | 16 | B | 45 |
| Southbound Through | 0.64 | 1 | A | 0 | 0.54 | 1 | A | 0 |
| *Lauzon Parkway at Twin Oaks Drive* | | **22** | **C** | | | **18** | **B** | |
| Eastbound Left | 0.12 | 64 | E | 9 | 0.44 | 25 | C | 15 |
| Eastbound Through | 0.42 | 63 | E | 26 | 0.27 | 22 | C | 14 |
| Eastbound Right | 0.42 | 11 | B | 0 | 0.68 | 17 | B | 0 |
| Westbound Left | 0.61 | 52 | D | 33 | 0.68 | 26 | C | 19 |
| Westbound Through | 0.20 | 53 | D | 20 | 0.29 | 23 | C | 14 |
| Westbound Right | 0.18 | 7 | A | 9 | 0.63 | 9 | A | 23 |
| Northbound Left | 0.97 | 44 | D | 58 | 0.66 | 24 | C | 22 |
| Northbound Through/Right | 1.01 | 22/22 | C/C | 160 | 0.87 | 14/17 | B/B | 99 |
| Southbound Left | 0.96 | 57 | E | 79 | 0.36 | 31 | C | 15 |
| Southbound Through/Right | 0.90 | 14/14 | B/B | 89 | 1.02 | 20/17 | B/B | 136 |

The micro-simulation analysis indicates all four intersections would operate at LOS ‘C’ or better by providing good signal coordination for the major movements (north/south). The signal timing plans were optimised using the Synchro software. The signal coordination would reduce delay for the major movements and that would result in good LOS for the overall intersection.

Individual movements at Lauzon Parkway/Forest Glade Drive intersection would operate at LOS 'E' with average delay of about 60 seconds.

## 6.2 Full Build-Out Safety Assessment

A detailed safety analysis was conducted by the Halifax MRC team (Delphi-MRC) using three different safety analysis techniques:

1. Ontario Ramp OPF Analysis – Based on operational performance functions (OPF) developed from MTO facilities in Central Region[1], expected safety performance of various types of interchange ramps can be determined. This facilitates two types of road safety analysis. First, through consideration of site-specific collision data, it can be determined whether or not any given interchange ramp presently operates worse than expected relative to provincial norms. Second, through consideration of current and future traffic volumes, relative expected safety performances and the expected increase in annual collision frequency can be determined.

2. Interchange Safety Analysis Tool (ISAT) – Based on safety performance functions selected from safety literature under two major research projects[2],[3] undertaken by the United States Federal Highway Administration (FHWA) to meet stringent conditions of statistical validity, methodological consistency, and engineering criticality, expected safety performance of a number of interchange components can be determined under current and future traffic volumes. Such components may include ramps, ramp terminal intersections, speed-change lanes, freeway mainlines, and cross-road segments.

3. Surrogate Safety Analysis Model (SSAM) – Based on different scenarios modelled in traffic simulation software (in this case VISSIM software under existing and full build-out traffic volumes), the number, types, and locations of modeled conflicts can be compared, identifying problematic areas with increased risk of collisions. Conflicts are defined as situations where two vehicles come close to a collision unless adjustments to speed and path are made. While the number of simulated conflicts does not directly translate into expected numbers of collisions, there is a correlation between the two.

For convenience in identifying the various interchange ramps, Figure 11 has been modified to only illustrate the ramp identification numbers which are based on the MTO interchange ramp numbering convention. This is summarized in **Figure 17.**

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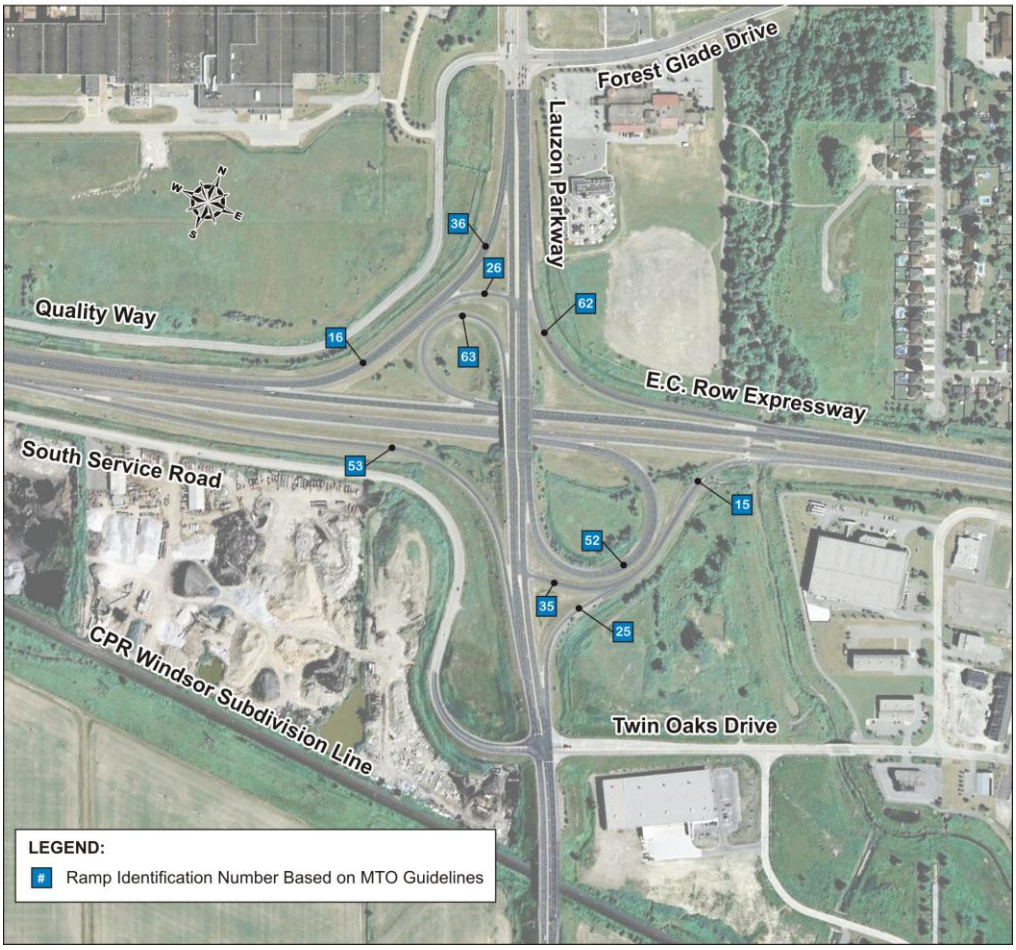
[1] *Prioritization of Central Region Interchanges and Ramps. Final Report (Volume I).* Prepared for Ontario Ministry of Transportation by iTRANS Consulting Inc. Toronto, ON. June 2000.

[2] Bauer, K.M., and D.W. Harwood, *Statistical Models of Accidents on Interchange Ramps and Speed-Change Lanes*, Report No. FHWA-RD-97-106, Federal Highway Administration, June 1998.

[3] Harwood, D.W., K.M. Bauer, K.R. Richard, D.K. Gilmore, B. Persaud, and C. Lyon, *Development of SPFs for Safety Analyst Interim Tools – Technical Memorandum*. Prepared for the Federal Highway Administration by Midwest Research Institute. September 2004.

**Figure 17: Interchange Ramp Numbers**




### 6.2.1 Ontario Ramp OPF Analysis

This analysis indicates that an additional 18 collisions (an 81% increase) are expected on the ramps in a 5-year period on the interchange ramps alone if expected traffic reaches the full build-out traffic forecast. The review of collision history using the Ontario Ramp OPF method indicate that the N/S-E on-ramp (Ramp 15) has the lowest performance worse among all the ramps of E.C. Row and Lauzon Parkway Interchange, compared to similar type of ramps in the MTO Central Region.

This analysis indicates that while collision frequencies on the ramps are expected to increase with the traffic volumes, collision rates may actually be reduced. The expected safety performance of typical ramps under current and full build-out traffic volume is presented in **Table 7**. This is a result of the significant anticipated increase in traffic volumes and non-linear relationship between traffic volume and collision frequency.

**Table 7: Expected 5-year Collision Frequency and Collision Rate of Interchange Ramps by Ontario OPF Method Based on Existing Interchange Configuration**

| Ramp No. | Ramp Desc. | Expected Total Collision in 5-Year Period | | Expected Collision Rate (per million veh. km.) | |
|---|---|---|---|---|---|
| | | Existing Volumes | Full Build-Out Volumes | Existing Volumes | Full Build-Out Volumes |
| 52 | Loop off-ramp (W-N) | 6.82 | 9.15 | 1.10 | 1.01 |
| 63 | Loop off-ramp (E-S) | 0.06 | 2.18 | 3.55 | 1.39 |
| 62 | Flared off-ramp (E-N) | 3.79 | 6.43 | 1.88 | 1.61 |
| 53 | Flared off-ramp (W-S) | 5.68 | 12.95 | 1.84 | 1.45 |
| 15 | Flared on-ramp (N/S-E) | 1.72 | 3.20 | 0.75 | 0.63 |
| 16 | Flared on-ramp (N/S-W) | 4.01 | 5.99 | 0.58 | 0.51 |
| **Total** | **All ramps** | **22.08** | **39.90** | | |

### 6.2.2 Interchange Safety Analysis Tool (ISAT)

This analysis indicates that an additional 15 collisions (a 66% increase) are expected on the ramps in a 5-year period on the interchange ramps alone if expected traffic reaches the full build-out traffic forecast. The expected safety performance for the Interchange ramps by ISAT is presented in **Table 8.** This analysis also suggests that while collision frequencies on the ramps are expected to increase under full build-out traffic volumes, collision rates may be reduced.

**Table 8: Expected 5-year Collision Frequency and Collision Rate of Interchange Ramps by ISAT Based on Existing Interchange Configuration**

| Ramp No. | Ramp Desc. | Expected Total Collision in 5-Year Period | | Expected Collision Rate (per million veh. km.) | |
|---|---|---|---|---|---|
| | | Existing Volumes | Full Build-Out Volumes | Existing Volumes | Full Build-Out Volumes |
| 52 | Loop off-ramp (W-N) | 11.4 | 15.0 | 1.84 | 1.65 |
| 63 | Loop off-ramp (E-S) | 0.1 | 4.0 | 5.92 | 2.54 |
| 62 | Flared off-ramp (E-N) | 2.2 | 3.0 | 1.09 | 0.75 |
| 53 | Flared off-ramp (W-S) | 3.2 | 5.1 | 1.04 | 0.57 |
| 15 | Flared on-ramp (N/S-E) | 1.3 | 2.9 | 0.57 | 0.57 |
| 16 | Flared on-ramp (N/S-W) | 4.1 | 7.1 | 0.59 | 0.61 |
| **Total** | **All ramps** | **22.3** | **37.1** | | |

The expected safety performance for the north and south ramp terminal intersections by ISAT is presented in **Table 9.** This analysis indicates that as the traffic volume increase to full build-out levels, considerable collisions and conflicts are expected to increase at the ramp terminal intersections. This is related to the increase in traffic volumes and the introduction of traffic signals to the ramp terminal intersections resulting in more collisions (particularly rear-end type) that are typical of interrupted traffic flow at intersections.

**Table 9: Expected 5-Year Collision Frequency and Collision Rate of Ramp Terminal-ISAT Based on Existing Interchange Configuration**

| Ramp No. | Ramp Desc. | Expected Total Collision in 5-Year Period | | Expected Collision Rate (per million veh. km.) | |
|---|---|---|---|---|---|
| | | Existing Volumes | Full Build-Out Volumes | Existing Volumes | Full Build-Out Volumes |
| 52 | Loop off-ramp (W-N) | 4.8 | 66.8 | 0.15 | 0.69 |
| 63 | Loop off-ramp (E-S) | 4.9 | 49.8 | 0.23 | 0.65 |
| **Total** | **All ramps** | **9.7** | **116.6** | | |

### 6.2.3 Surrogate Safety Analysis Model (SSAM)

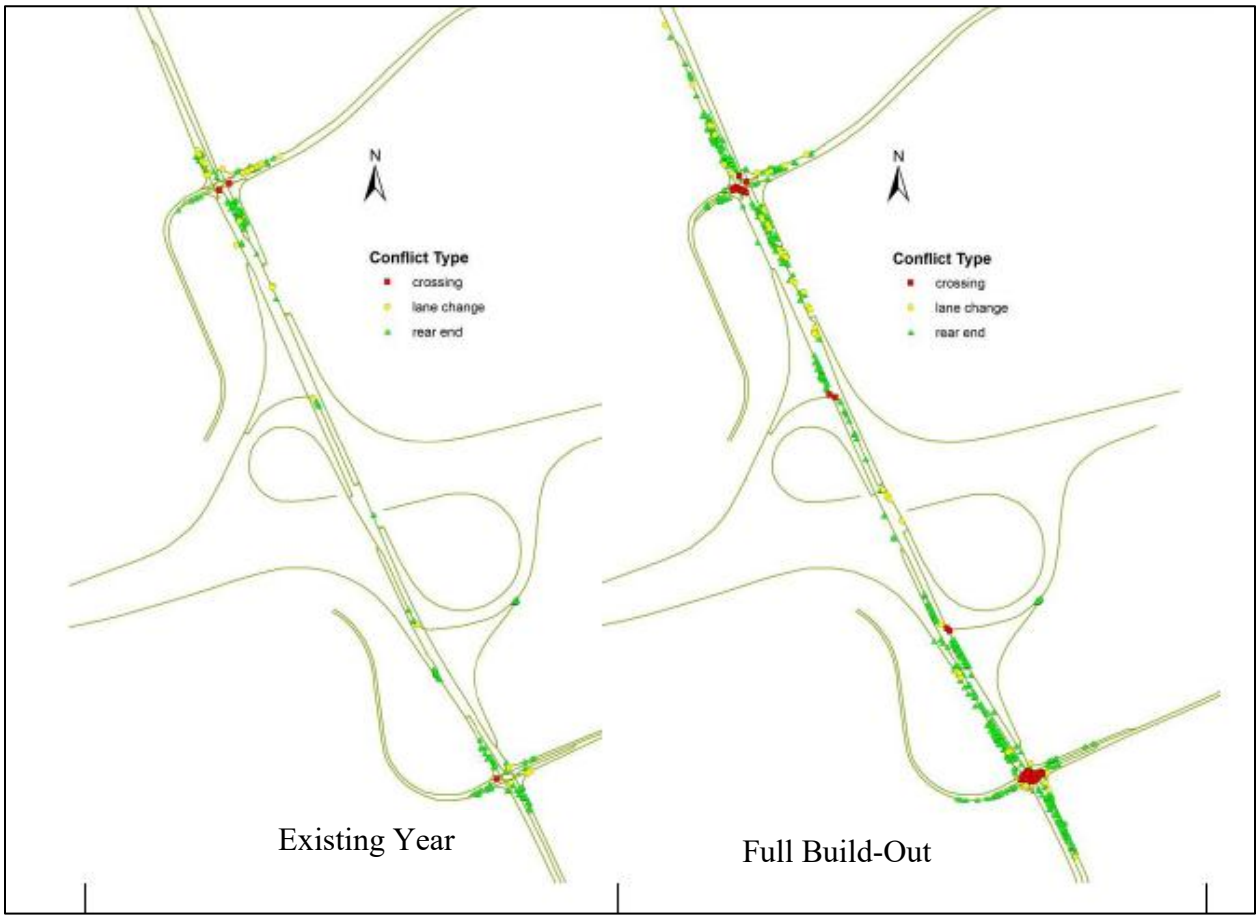
The safety review using SSAM method indicates the number of modelled conflicts is approximately 5.5 times higher in the full build-out scenario than in the existing condition.

The number and locations of modelled conflicts are provided in **Table 10** and Figure 18**.**

**Table 10: Number, Type and Location of Simulated Conflicts**

| Location | | Existing (2011) Traffic Volumes | | | | Full Build-out (2031+) Traffic Volumes | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Rear-end | Lane Change | Crossing | Total | Rear-end | Lane Change | Crossing | Total |
| Intersections | Forest Glade | 74 | 23 | 3 | 100 | 164 | 26 | 40 | 230 |
| | N. Ramp Terminal | 4 | 1 | 0 | 5 | 37 | 1 | 2 | 40 |
| | S. Ramp Terminal | 3 | 3 | 0 | 6 | 64 | 1 | 2 | 67 |
| | Twin Oaks | 64 | 7 | 1 | 72 | 166 | 539 | 77 | 782 |
| | ***Intersection (Sub-Total)*** | ***145*** | ***34*** | ***4*** | ***183*** | ***431*** | ***567*** | ***121*** | ***1119*** |
| Interchanges | Ramp 52 | 1 | 0 | 0 | 1 | 4 | 5 | 0 | 9 |
| | Ramp 63 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 3 |
| | Ramp 62 | 1 | 2 | 0 | 3 | 30 | 17 | 0 | 47 |
| | Ramp 53 | 18 | 0 | 0 | 18 | 27 | 3 | 0 | 30 |
| | Ramp 15 | 11 | 0 | 0 | 11 | 22 | 0 | 0 | 22 |
| | Ramp 16 | 2 | 1 | 0 | 3 | 1 | 0 | 0 | 1 |
| | ***Interchange Ramp Sub-Total*** | ***33*** | ***3*** | ***0*** | ***36*** | ***87*** | ***25*** | ***0*** | ***112*** |
| **Total** | | **178** | **37** | **4** | **219** | **518** | **592** | **121** | **1231** |

**Figure 18: Types and Location of Conflicts VISSIM Network**




The increase in conflicts is attributable to a number of factors:

1. Increased traffic volume traversing existing signalized intersections
2. Introduction of two additional traffic signals at ramp terminal intersections, and the limited distance to manoeuver between these and the existing signalized intersections
3. Increased traffic volumes interacting at ramp merge/diverge areas

At the signalized intersections introduced to accommodate left turns at the terminals of Ramps 15 and 16 under the full build-out scenario, there is a notable increase in the number of rear-end conflicts. At the existing signalized intersection at Forest Glade Drive, there is a notable increase in the number of rear-end and crossing collisions under the full build-out scenario; at the existing signalized intersection at Twin Oaks Drive, there are very significant increases in the number of rear-end, lane-change, and crossing conflicts.

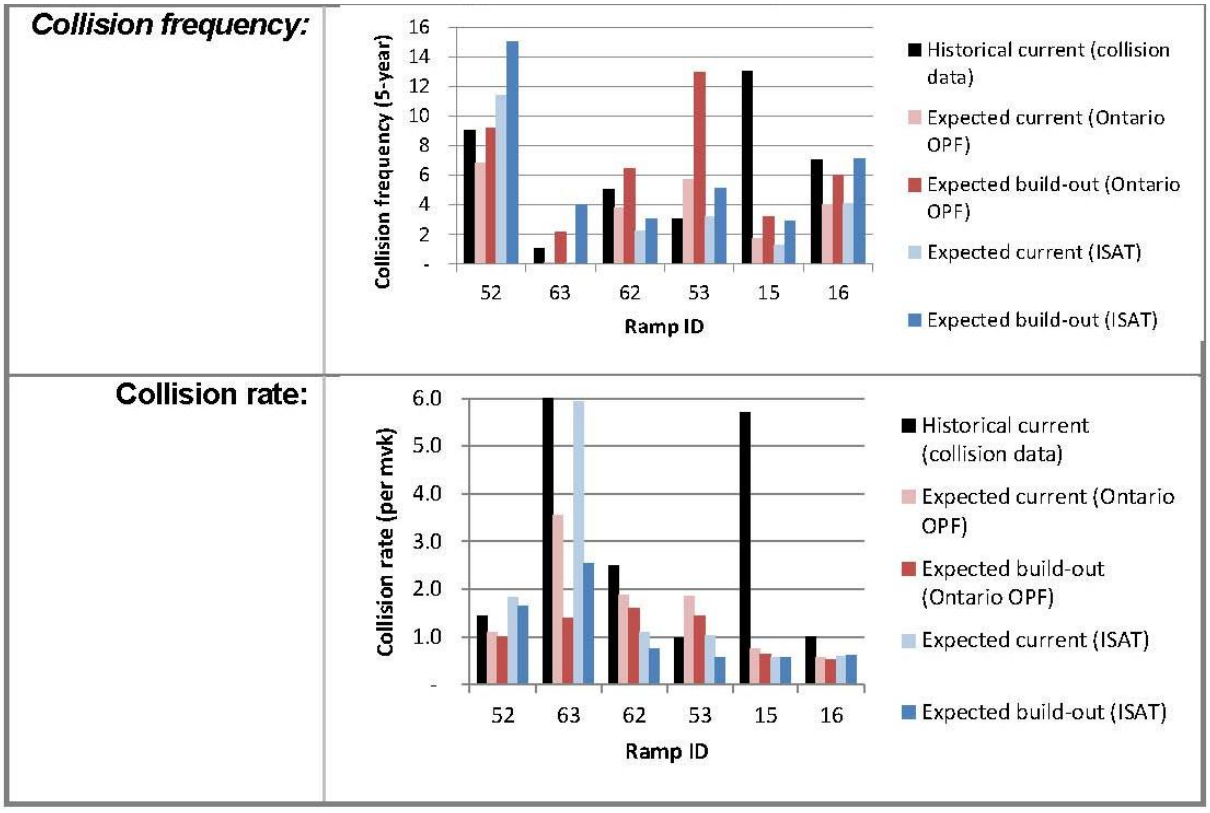
Of all the interchange ramps, Ramp 62 demonstrates the greatest increase in conflicts under full build-out traffic volumes, with a higher number of rear-end and lane-change conflicts. This is largely related to the merge area on Lauzon Parkway and the potential need to make a number of lane changes across relatively dense traffic prior to Forest Glade Drive. Ramps 53 and 15 also experience an increase in rear-end collisions, once again likely attributable to conflicts at merge/diverge areas on Lauzon Parkway and the need to make lane changes across relatively short distances.

### 6.2.4 Conclusions

The OPF and ISAT safety performance functions suggests 65% to 80% collisions are expected to increase on interchange ramps as volume increase to levels predicted by the full build-out model. In terms of collision rates on interchange ramps, the collision rates may actually be lower with increase in traffic volume.

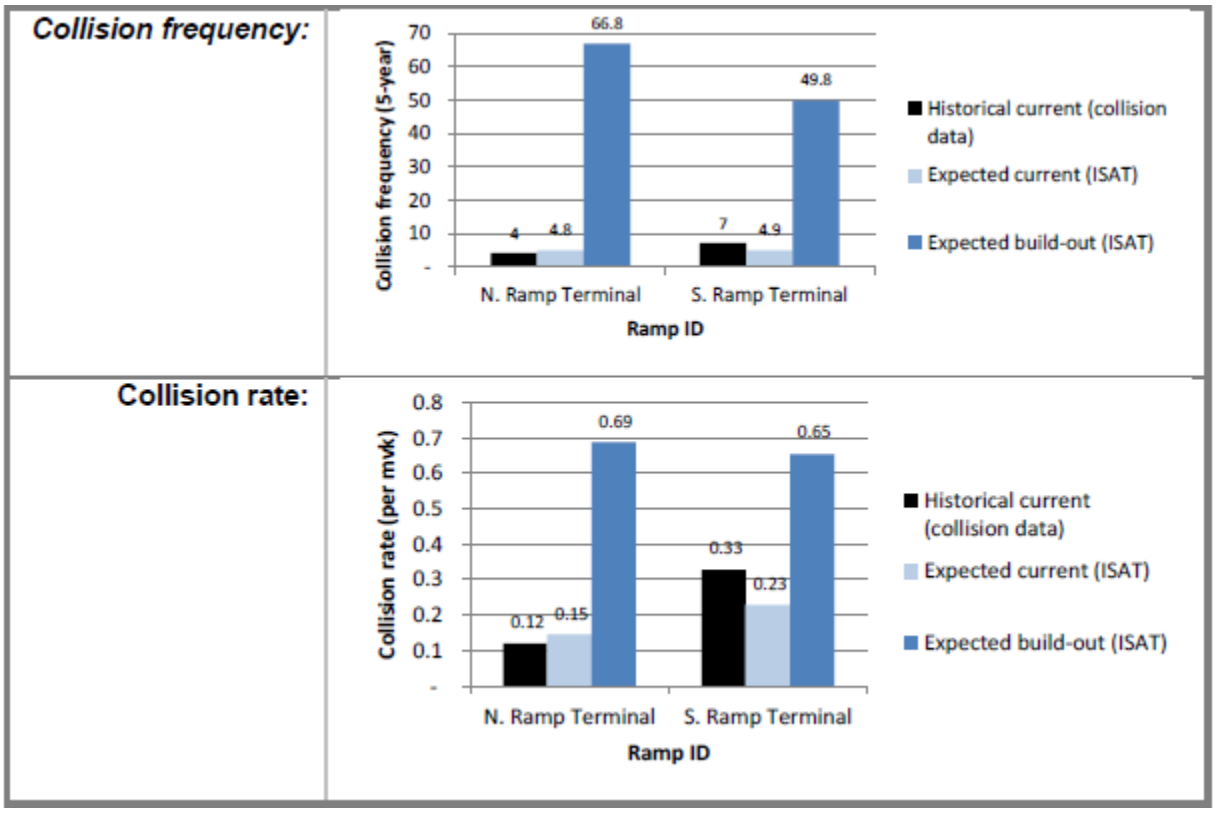
The Ramps 63 and 15 have experienced the highest collision rate based on the 5-year collision history. Based on the Ontario OPF collision prediction models, Ramps 53, 62, and 63 are expected to have highest collision rates under existing and full build-out traffic volumes. Based on ISAT collision prediction models, Ramps 52 and 63 are expected to have highest collision rates. The historical and expected collision frequencies and rates based on Ontario OPF and ISAT collision prediction models are presented in **Figure 19.**

**Figure 19: Historical and Expected Safety Performance of Interchange Ramps**



The ISAT prediction models indicates that as the traffic volume increase to full build-out levels, considerable collisions and conflicts are expected to increase at the ramp terminal intersections, due to the increase in traffic volumes and introduction of traffic signals. The historical and expected collision frequencies and rates based on ISAT collision prediction models are presented in **Figure 20.**

**Figure 20: Historical and Expected Safety Performance of Ramp Terminal Intersections**




The SSAM conflict analysis also suggests there will be a significant increase in conflicts between vehicles throughout the study area as traffic volumes increase from existing to full build-out levels. Many of these conflicts are associated with the introduction of new traffic signals, increased traffic at existing traffic signals, and limited distance to manoeuver between traffic signals. Some are attributable to merge/diverge areas between interchange ramps and Lauzon Parkway.

The lane configuration/designation and the close proximity of the Forest Glade Drive intersection to the southbound to westbound on-ramp (Ramp 36 & 16) may lead to last-minute lane change conflicts and increased collision potential between the intersection and the interchange. In particular, these issues are as follows:

- The westbound Forest Glade Drive approach to the signalized intersection makes use of a double left-turn lane. Vehicles in the left-most left turn lane destined for westbound E.C. Row Expressway need to make a lane change across relatively dense traffic over a distance of only 100 meters.
- The southbound Lauzon Parkway approach to the E.C. Row Expressway interchange comprises three basic through lanes that extend a considerable distance to the north. At the interchange, the outer-most through lane terminates as an exit-only lane for the southbound to westbound on-ramp, with no advance warning or information.

It appears that lane designation directional signage in advance of the Forest Glade Drive intersection indicating which lanes vehicles should be in based on their desired destination at the interchange would help to alleviate such conflicts. Overhead lane designation directional signs would likely be most effective.

The need for this signage is not tied to the forecasted traffic growth at this location. Therefore this signage can be implemented as an immediate/short-term improvement to address the existing potential weaving conflicts on southbound Lauzon Parkway between Forest Glade Drive and the N-W on ramp.

Detailed assessment of the Safety Performance for the Existing and Full Build-Out is documented in a technical memo appended to this report.

# 7 CONCLUSIONS

## 7.1 Environmental Assessment – 2031 Planning Horizon

A review of the existing Lauzon Parkway and E.C. Row Expressway Interchange has been completed considering the existing interchange geometry, existing and future traffic conditions, and a review of historical collision rates.

The review of the existing Parclo B Interchange geometry noted that three of the six interchange ramps have curve radii which do not meet current MTO standards for the assumed design speeds of 120 km/h for E.C. Row Expressway and 90 km/h for Lauzon Parkway. Also, four of the six ramp speed change lanes along Lauzon Parkway do not meet MTO design standards for a design speed of 90 km/h. However, these speed change lanes correspond to a design speed of 70 km/h which matches the posted speed on Lauzon Parkway through the interchange area. The current practice for new road design is that the design speed is 20 km/h over the posted speed for high speed facilities; however, historically this was not always the case, therefore this is acknowledged when reviewing existing facilities and generally if the geometry design speed exceeds the posted speed it is considered acceptable provided collision history does not indicate a safety concern. It is also noted the N/S-E on-ramp is unusual in that it has three successive curves rather than the usual 2 successive curves for this type of ramp.

The review of existing traffic conditions assessed the existing level-of-service (LOS) at four intersections along Lauzon Parkway for both am and pm peak hours and found that all four intersections are operating at an acceptable LOS in the peak hours: Forest Glade Drive/Quality Way (LOS C); North Ramp Terminal (LOS B); South Ramp Terminal (LOS B); and Twin Oaks Drive/South Service Road (LOS B).

For future (2031) traffic conditions, the capacity of these four intersections along Lauzon Parkway was assessed. Both the ramp terminals at the E.C. Row Expressway Interchange are currently unsignalized and would operate at LOS F under future traffic conditions. With the provision of traffic signals, both ramp terminal intersections will operate at an acceptable level-of-service. The existing signalized intersections at Forest Glade Drive and Twin Oaks Drive will also operate at an acceptable level-of-service. The spacing of these four intersections will remain as existing with the addition of traffic signals at the two ramp terminal intersections.

A collision history review was also completed for the interchange ramps and the two adjacent intersections. The total number of collision reported on the interchange ramps ranged between 1 and 12 collisions, which was reported on the eastbound on-ramp. The collision history of the interchange ramps is noted to be relatively benign; however it is recommended opportunities to improve the existing radii of the N/S-E on-ramp.

At the Twin Oaks Drive intersection, nearly half of the incidents involved Rear End collisions and nearly half of these were in the southbound direction. The west to south ramp from E.C. Row Expressway merges with Lauzon Parkway only 150 metres north of Twin Oaks Drive. This

proximity and the potential for short distance lane changes to access Twin Oaks Drive may be a contributing factor to some of the 9 southbound rear end collisions on this approach. Therefore, to minimize conflicts associated with the minimal distance from the ramp to the intersection, it is recommended the W-S on-ramp continue through the intersection and develop into lane 3 for southbound Lauzon Parkway.

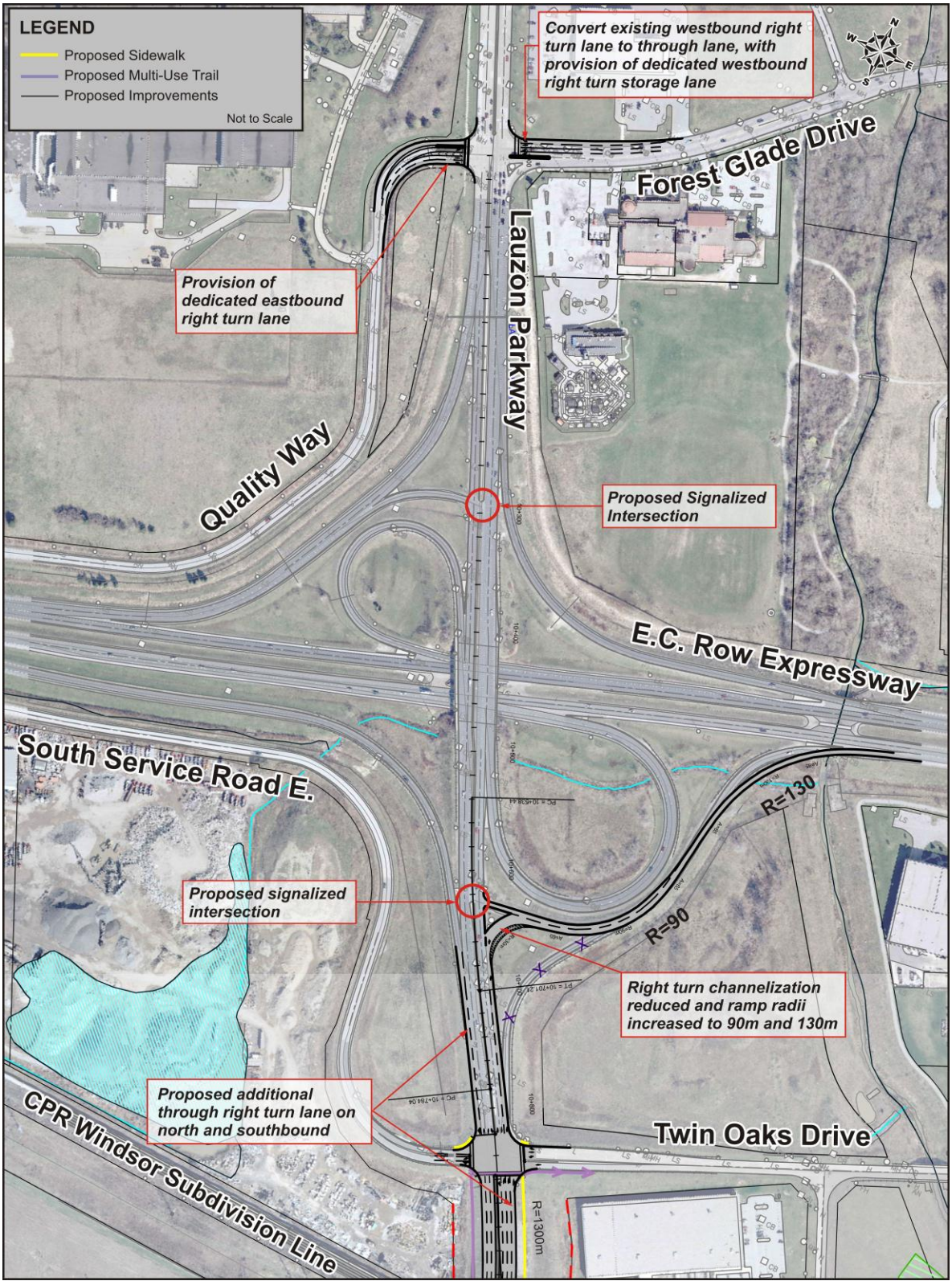
At the Forest Glade Drive intersection, the majority of incidents noted involved Rear End and Turning collisions. The westbound approach has two left turn lanes (one dedicated left and one shared left/ through lane). The two-lane westbound on-ramp to E.C. Row Expressway is located just over 100 m south of this intersection. The third southbound lane becomes a must exit south of this intersection. Although only 3 collisions have been reported south of this intersection before this on-ramp, there are potential weaving conflicts between the southbound Lauzon Parkway traffic and the left-turning traffic to the on-ramp. It is recommended that new directional signing be provided on westbound Forest Glade Drive and southbound Lauzon Parkway approaching the Forest Glade Drive intersection to give drivers advance way-finding information, thereby minimizing weaving potential between Forest Glade Drive and the E.C Row Expressway ramps. The proposed recommendations for the 2031 horizon year are illustrated in **Figure 21**.

It is also recommended the existing eastbound on-ramps at the Lauzon Parkway north and south ramp terminals be improved by reducing the existing right-turn channelizations to the minimum in order to reduce potential for weaving conflicts with the adjacent intersections.

Therefore, based on the review of the proposed 2031 Interchange Improvements shown in **Figure** 21, it is proposed that the N/S-E on-ramp right turn channelization be reduced and the ramp radii increased to 90 and 130 respectively. In addition, it is proposed new lane designation directional signing, preferably overhead, be provided on westbound Forest Glad Drive and southbound Lauzon parkway approaching the Forest Glade Drive intersection.

The need for this signage is not tied to the forecasted traffic growth at this location. Therefore this signage can be implemented as an immediate/short-term improvement to address the existing potential weaving conflicts on southbound Lauzon Parkway between Forest Glade Drive and the N-W on ramp.

**Figure 21: Proposed 2031 Lauzon Parkway / E.C. Row Expressway Interchange Improvements**



## 7.2 Beyond EA – South Sandwich Full Build-out

The City of Winsor requested a review of the operational performance of the interchange and its adjacent intersections for the Full Build-Out scenario beyond the EA planning horizon of 2031. MRC assessed the Full Build-Out scenario in two components – a traffic operational assessment and a detailed safety assessment.

Approximately 43% of the total development that could be accomplished in the South Sandwich Secondary Plan is assumed for the 2031. The remaining development is assumed to continue beyond 2031. The full build-out travel demand model was developed assuming that the Secondary Plan would be fully occupied and would achieve the expected density.

The full build-out traffic operations analysis indicates that additional capacity is required along Lauzon Parkway through the interchange. To accommodate the full build-out traffic demands, the ultimate 6-lane plan for Lauzon Parkway will need to extend fully through the interchange, matching the 6-lanes south of Twin Oaks Drive planned by 2031 and the existing 6-lanes north of Forest Glade Drive. The four signalized intersections, the two ramp terminals, Forest Glade Drive and Twin Oaks Driver will require additional turning lanes to accommodate the full build-out traffic demands. Most notably, the signalized north ramp terminal intersection will require a double left-turn for northbound Lauzon Parkway to eastbound E.C. Row Expressway. These additional lane requirements are illustrated in Figure 16.

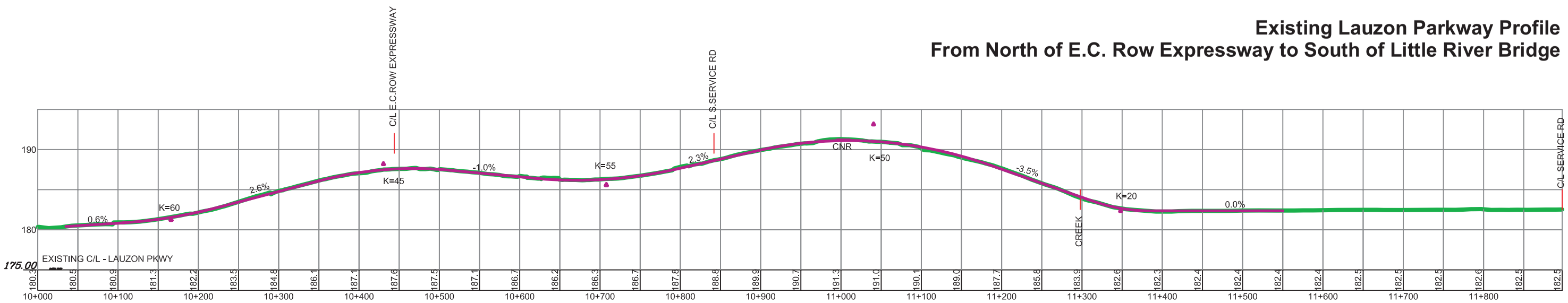
The existing Lauzon Parkway Bridge over E.C. Row Expressway currently carries 5 northbound lanes (2 thru lanes, 1 left turn lanes and 2 speed change lanes) and 3 southbound lanes (2 thru lanes and 1 speed change lane) and does not have available width to accommodate the additional lanes required to accommodate the full build-out demand. Therefore, the existing bridge will require widening or replacement to accommodate the future 7 northbound lanes (3 thru lanes, 2 left turn lanes and 2 speed change lanes) and the future 4 southbound lanes (2 through lanes, 1 through/left turn lane, and 1 speed change lane). However, the timing of the full build-out and the need to widen the Lauzon Parkway Bridge will be potentially beyond 30 or 40 years. In 40 years the existing bridge will be approaching its 75 year life span and could be replaced with a new structure to accommodate the full build-out lane requirements.

The Safety Assessment has not identified any significant safety performance issues associated with the existing interchange ramps. Therefore, the existing interchange configuration with the above recommended changes will be able to accommodate the projected traffic volumes for the full build-out scenario.

# APPENDIX A

EXISTING PROFILE OF LAUZON PARKWAY

# Existing Lauzon Parkway Profile
# From North of E.C. Row Expressway to South of Little River Bridge



# APPENDIX B

Safety Assessment Technical Memo

**DRAFT**

McCORMICK RANKIN
A member of MMM GROUP

# Technical Memorandum

| | | | |
|---|---|---|---|
| **To:** | Michael Chiu, P.Eng. | **Date:** | 30 May 2012 |
| **From:** | Greg Chisholm, P.Eng. | **Our File:** | 3211012-000 |
| **Subject:** | Lauzon Parkway & EC Row Interchange Safety Review | **Copies:** | Geoff Millen, P.Eng. |

## 1. Background

### 1.1. Introduction

At the request of the MRC project team, Delphi-MRC conducted a quantitative road safety evaluation of the existing interchange between the Lauzon Parkway and E.C. Row Expressway in Windsor, ON. This evaluation examined anticipated changes in safety performance resulting from potential increases in traffic volumes.

Two traffic volume scenarios were considered in this analysis as described below:

1. Existing baseline – This scenario represents existing (2011) traffic volumes based on data provided by the City of Windsor, the County of Essex, and counts conducted by the MRC project team.

2. Full build-out – This scenario represents long-term future traffic volumes (beyond 2031) based on a travel demand model and projected population and employment growth throughout the region.

Quantitative road safety analysis typically makes use of statistical models and techniques that have been developed through research for a specific set of conditions and/or in particular jurisdictions. As all of these conditions may not necessarily translate directly from one study to the next, or may not encapsulate the entire safety-related problem being considered, it is prudent to approach safety-related problems using a number of techniques. Each technique can help to fill in different pieces of the safety puzzle and can also reinforce and increase the level of confidence in the overall analysis when they point to common conclusions. Three distinct safety analysis techniques were applied in this analysis:



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1. Ontario Ramp OPF Analysis – Based on operational performance functions developed from MTO facilities in Central Region[1], expected safety performance of various types of interchange ramps can be determined. This facilitates two types of road safety analysis. First, through consideration of site-specific collision data, it can be determined whether or not any given interchange ramp presently operates worse than expected relative to provincial norms. Second, through consideration of current and future traffic volumes, relative expected safety performances and the expected increase in annual collision frequency can be determined.

2. Interchange Safety Analysis Tool (ISAT) – Based on safety performance functions selected from safety literature under two major research projects[2,3] undertaken by the United States Federal Highway Administration (FHWA) to meet stringent conditions of statistical validity, methodological consistency, and engineering criticality, expected safety performance of a number of interchange components can be determined under current and future traffic volumes. Such components may include ramps, ramp terminal intersections, speed-change lanes, freeway mainlines, and cross-road segments.

3. Surrogate Safety Analysis Model (SSAM) – Based on different scenarios modeled in traffic simulation software (in this case VISSIM software under existing and full build-out traffic volumes), the number, types, and locations of modeled conflicts can be compared, identifying problematic areas with increased risk of collisions. Conflicts are defined as situations where two vehicles come close to a collision unless adjustments to speed and path are made. While the number of simulated conflicts does not directly translate into expected numbers of collisions, there is a correlation between the two.

### 1.2. Basis of the review

The following data and information was provided by the MRC project team and forms the basis of this review:

1. A traffic report summarizing existing (2011) traffic volumes throughout the study area during morning and afternoon peak hour conditions, existing levels of service, and collision history information for the most recently available five-year period.

2. Estimated traffic volumes under full build-out conditions, during morning and afternoon peak hour conditions.

3. The relationship between peak hour traffic volumes and daily traffic volumes, expressed as a "k-factor" of 10%.

4. VISSIM traffic simulation models of the existing interchange configuration during afternoon peak hour conditions, under existing baseline and full build-out traffic volumes. Differences between the existing and full build-out models include the signalization of the left-turns from Lauzon Parkway to the interchange on-ramps and additional through lanes on Lauzon Parkway in the vicinity of and south of Twin Oaks Drive in the full build-out scenario.

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[1] *Prioritization of Central Region Interchanges and Ramps. Final Report (Volume I).* Prepared for Ontario Ministry of Transportation by iTRANS Consulting Inc. Toronto, ON. June 2000.

[2] Bauer, K.M., and D.W. Harwood, *Statistical Models of Accidents on Interchange Ramps and Speed-Change Lanes*, Report No. FHWA-RD-97-106, Federal Highway Administration, June 1998.

[3] Harwood, D.W., K.M. Bauer, K.R. Richard, D.K. Gilmore, B. Persaud, and C. Lyon, *Development of SPFs for Safety Analyst Interim Tools – Technical Memorandum*. Prepared for the Federal Highway Administration by Midwest Research Institute. September 2004.

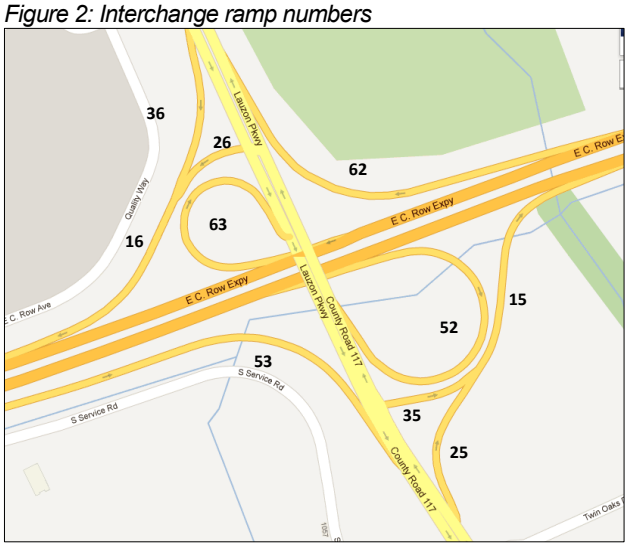
### 1.3. Study area

The study area for this particular exercise includes the interchange between the Lauzon Parkway and E.C. Row Expressway and the nearby signalized intersections of Forest Glade Drive (to the north) and Twin Oaks Drive (to the south), as shown in the following figure:

*Figure 1: Study area*


For convenience in identifying the various interchange ramps, each ramp was assigned an identification number based on the MTO interchange ramp numbering convention. This is summarized in the following figure:

*Figure 2: Interchange ramp numbers*



## 2. Analysis & Findings

### 2.1. Ontario Ramp OPF Analysis

The various interchange ramps were evaluated with respect to their historical safety performance. This process uses operational performance functions developed for flared/direct and loop on- and off-ramps based on traffic and collision data from Ontario freeway facilities and considers site-specific collision data through the application of an Empirical-Bayes (EB) procedure. The EB procedure overcomes some of the statistical weakness associated with regression-based crash prediction models and random short-term variability associated with collision occurrence. The result is an indication of whether each ramp is performing *as expected* or *worse than expected,* relative to provincial norms. This analysis is summarized by a "potential for operational improvement" or POI index. Ramps with a POI index of zero operate as expected. Ramps with a POI index greater than zero operate worse than expected; in other words the safety performance is worse than the average of similar facilities in the province. The greater the POI value, the worse the relative safety performance. Findings from this analysis are provided in the following table:

*Table 1: Potential for safety improvement*

| Ramp No. | Ramp Desc. | As/Worse than Expected | POI | Rank (Potential for safety improvement) | Historical collision rate (per mvk) |
|---|---|---|---|---|---|
| **52** | Loop off-ramp (EB-NB) | Worse than expected | 0.46 | 3 | 1.45 |
| **63** | Loop off-ramp (WB-SB) | ~ As expected | 0.01 | 5 | 59.24** |
| **62** | Flared off-ramp (WB-NB) | Worse than expected | 0.34 | 4 | 2.49 |
| **53** | Flared off-ramp (EB-SB) | As expected | 0.00 | N/A | 0.97 |
| **15*** | Flared on-ramp (NB/SB-EB) | Worse than expected | 1.38 | 1 | 5.70 |
| **16*** | Flared on-ramp (NB/SB-WB) | Worse than expected | 0.60 | 2 | 1.01 |

* Individual on-ramp components from NB and SB directions have been combined for analysis due to model limitations

** Current ADT estimate for Ramp 63 was very low, resulting in the calculation of a very high collision rate

This analysis suggests that under existing 2011 traffic volumes, four of the six interchange ramps are performing worse than expected from a safety perspective relative to provincial norms, albeit to a relatively small degree as indicated by the magnitude of the POI values. These ramps experience a safety performance that is slightly worse than average. To put this into perspective, in the study[1] that developed the safety performance functions being applied, 479 similar MTO interchange ramps had POI values greater than zero; 126 had POI values greater than 1.38, 210 had POI values greater than 0.60, 247 had POI values greater than 0.46, and 280 had POI values greater than 0.34. This suggests about 13% of similar MTO interchange ramps operate worse than Ramp 15, 22% operate worse than

[1] *Prioritization of Central Region Interchanges and Ramps. Final Report (Volume I).* Prepared for Ontario Ministry of Transportation by iTRANS Consulting Inc. Toronto, ON. June 2000.

Ramp 16, 26% operate worse than Ramp 52, and 29% operate worse than Ramp 62. The POI value of the worst performing MTO ramp in the Central Region study was 17.4.

At this interchange, the two worst-performing ramps, from a road safety perspective, are the on-ramps from Lauzon Parkway to E.C. Row Expressway. The eastbound loop off-ramp and westbound flared off-ramp are also underperforming. As this type of analysis relies on collision history information, it cannot be used to predict the future performance of the ramps under full build-out traffic volumes.

Another type of analysis was undertaken using this tool by relying solely on the established relationship between annual traffic volume and annual collision frequency for various types of ramps. This analysis examines the expected frequency of fatal, injury, and PDO[1] collisions under existing (2011) and full build-out traffic volume scenarios over a period of time, in this case 5-years. Setting the collision history aside, this analysis compares the expected safety performance of "average" ramps under current and full build-out traffic volumes.

*Table 2: Expected 5-year collision frequency of interchange ramps – existing traffic volumes (Ontario OPF)*

| Ramp No. | Ramp Desc. | Expected Fatal/Injury Collisions in 5 years | Expected PDO Collisions in 5 Years | Expected Total Collisions in 5 Years | Expected collision rate (per mvk) |
|---|---|---|---|---|---|
| **52** | Loop off-ramp (EB-NB) | 1.56 (23%) | 5.26 (77%) | 6.82 | 1.10 |
| **63** | Loop off-ramp (WB-SB) | 0.01 (17%) | 0.05 (83%) | 0.06 | 3.55 |
| **62** | Flared off-ramp (WB-NB) | 0.83 (22%) | 2.96 (78%) | 3.79 | 1.88 |
| **53** | Flared off-ramp (EB-SB) | 1.25 (22%) | 4.43 (78%) | 5.68 | 1.84 |
| **15** | Flared on-ramp (NB/SB-EB) | 0.45 (26%) | 1.27 (74%) | 1.72 | 0.75 |
| **16** | Flared on-ramp (NB/SB-WB) | 1.06 (26%) | 2.95 (74%) | 4.01 | 0.58 |
| **Total** | All ramps | 5.16 (23%) | 16.92 (77%) | 22.08 | |

[1] Collisions involving property damage only and no personal injury

*Table 3: Expected 5-year collision frequency of interchange ramps –full build-out traffic volumes (Ontario OPF)*

| Ramp No. | Ramp Desc. | Expected Fatal/Injury Collisions in 5 years | Expected PDO Collisions in 5 Years | Expected Total Collisions in 5 Years | Increase in Expected Collisions (5 Year Period) | Expected collision rate (per mvk) |
|---|---|---|---|---|---|---|
| **52** | Loop off-ramp (EB-NB) | 2.09 (23%) | 7.06 (77%) | 9.15 | 2.33 | 1.01 |
| **63** | Loop off-ramp (WB-SB) | 0.50 (23%) | 1.68 (77%) | 2.18 | 2.12 | 1.39 |
| **62** | Flared off-ramp (WB-NB) | 1.41 (22%) | 5.02 (78%) | 6.43 | 2.64 | 1.61 |
| **53** | Flared off-ramp (EB-SB) | 2.85 (22%) | 10.10 (78%) | 12.95 | 7.27 | 1.45 |
| **15** | Flared on-ramp (NB/SB-EB) | 0.84 (26%) | 2.36 (74%) | 3.20 | 1.48 | 0.63 |
| **16** | Flared on-ramp (NB/SB-WB) | 1.58 (26%) | 4.41 (74%) | 5.99 | 1.98 | 0.51 |
| **Total** | All ramps | 9.27 (23%) | 30.63 (77%) | 39.90 | 17.82 | |

This analysis suggests that an additional 18 collisions in a 5-year period can be expected on interchange ramps alone if traffic volumes reach levels expected in the full build-out scenario (an 81% increase). This does not include collisions at speed change lanes, merge/diverge areas, or intersection ramp terminals. Approximately 4 of these collisions are expected to involve personal injury while the remaining 14 are expected to involve property damage only. Increases in the number of collisions are expected as traffic volumes increase. Collision rates (collisions per million vehicle-km of travel) provide one means of rationalizing collision frequency with traffic volumes. The analysis indicates that while collision frequencies on the ramps are expected to increase under full build-out traffic volumes, collision rates may actually be reduced. This is a result of the significant anticipated increases in traffic volumes and the non-linear relationship between traffic volume and collision frequency.

### 2.2. Interchange Safety Analysis Tool (ISAT)

A similar analysis was conducted using the ISAT tool. In this analysis expected collision frequencies over a 5-year period were estimated for both interchange ramps and interchange ramp terminals, based on safety performance functions developed for similar facilities throughout the United States. Results of this analysis are provided in the following tables and discussed below.

***Existing 2011 traffic volume scenario***

*Table 4: Expected 5-year collision frequency of interchange ramps – existing traffic volumes (ISAT)*

| Ramp No. | Ramp Desc. | Expected Fatal/Injury Collisions in 5 years | Expected PDO Collisions in 5 Years | Expected Total Collisions in 5 Years | Expected collision rate (per mvk) |
|---|---|---|---|---|---|
| **52** | Loop off-ramp (EB-NB) | 4.7 (41%) | 6.7 (59%) | 11.4 | 1.84 |
| | Loop off-ramp (WB-SB) | 0.1 (100%) | 0.0 (0%) | 0.1 | 5.92 |
| **62** | Flared off-ramp (WB-NB) | 0.7 (32%) | 1.5 (68%) | 2.2 | 1.09 |
| **53** | Flared off-ramp (EB-SB) | 1.0 (31%) | 2.2 (69%) | 3.2 | 1.04 |
| **15** | Flared on-ramp (NB/SB-EB) | 0.3 (23%) | 1.0 (77%) | 1.3 | 0.57 |
| **16** | Flared on-ramp (NB/SB-WB) | 1.9 (46%) | 2.2 (54%) | 4.1 | 0.59 |
| | All ramps | 8.7 (39%) | 13.6 (61%) | 22.3 | |

*Table 5: Expected 5-year collision frequency of ramp terminal intersections – existing traffic volumes (ISAT)*

| Ramp Terminal | Expected Fatal/Injury Collisions in 5 years | Expected PDO Collisions in 5 Years | Expected Total Collisions in 5 Years | Historical collision rate (per mvk) | Expected collision rate (per mvk) |
|---|---|---|---|---|---|
| **North** | 2.0 (42%) | 2.8 (58%) | 4.8 | 1.01 | 0.15 |
| **South** | 2.1 (43%) | 2.8 (57%) | 4.9 | 0.12 | 0.23 |
| **Total** | 4.1 (42%) | 5.6 (58%) | 9.7 | 0.33 | |

***Full build-out traffic volume scenario***

*Table 6: Expected 5-year collision frequency of interchange ramps – full build-out traffic volumes (ISAT)*

| Ramp No. | Ramp Desc. | Expected Fatal/Injury Collisions in 5 years | Expected PDO Collisions in 5 Years | Expected Total Collisions in 5 Years | Increase in Expected Collisions (5 Year Period) | Expected collision rate (per mvk) |
|---|---|---|---|---|---|---|
| **52** | Loop off-ramp (EB-NB) | 5.7 (38%) | 9.3 (62%) | 15.0 | 3.6 | 1.65 |
| | Loop off-ramp (WB-SB) | 2.0 (50%) | 2.0 (50%) | 4.0 | 3.9 | 2.54 |
| **62** | Flared off-ramp (WB-NB) | 1.2 (40%) | 1.8 (60%) | 3.0 | 0.8 | 0.75 |
| **53** | Flared off-ramp (EB-SB) | 2.3 (45%) | 2.8 (55%) | 5.1 | 1.9 | 0.57 |
| **15** | Flared on-ramp (NB/SB-EB) | 1.1 (38%) | 1.8 (62%) | 2.9 | 1.6 | 0.57 |
| **16** | Flared on-ramp (NB/SB-WB) | 4.4 (62%) | 2.7 (38%) | 7.1 | 3.0 | 0.61 |
| | All ramps | 16.7 (45%) | 20.4 (55%) | 37.1 | 14.8 | |

*Table 7: Expected 5-year collision frequency of ramp terminal intersections – full build-out traffic volumes (ISAT)*

| Ramp Terminal | Expected Fatal/Injury Collisions in 5 years | Expected PDO Collisions in 5 Years | Expected Total Collisions in 5 Years | Increase in Expected Collisions (5 Year Period) | Expected collision rate (per mvk) |
|---|---|---|---|---|---|
| **North** | 30.7 (46%) | 36.1 (54%) | 66.8 | 62.0 | 0.69 |
| **South** | 22.9 (46%) | 26.9 (54%) | 49.8 | 44.9 | 0.65 |
| **Total** | 53.6 (46%) | 63.0 (54%) | 116.6 | 106.9 | |

***Discussion of ISAT findings***

This analysis suggests that an additional 15 collisions in a 5-year period can be expected on interchange ramps if traffic volumes reach levels expected in the full build-out scenario (a 66% increase). This does not include collisions at speed change lanes, merge/diverge areas, or intersection ramp terminals. Approximately 8 of these collisions are expected to involve personal injury while the remaining 7 are expected to involve property damage only. This analysis also suggests that while

collision frequencies on the ramps are expected to increase under full build-out traffic volumes, collision rates may be reduced.

Interestingly, this analysis suggests that the greatest detriment to safety performance at this interchange as traffic volumes increase to full build-out levels may be related to the ramp terminal intersections on Lauzon Parkway as opposed to interchange ramps. These ramp terminal intersections will require signalization to maintain traffic operations at adequate levels of service under full build-out traffic volumes and this, in addition to significantly higher volumes on Lauzon Parkway, is expected to result in considerably more traffic conflicts and collisions. Between the two ramp terminal intersections, an additional 107 collisions are expected in a 5-year period. Of these collisions, 50 are expected to involve personal injury while the remaining 57 are expected to involve property damage only. Unlike the interchange ramps, both collision frequency and collision rates at these intersections are expected to increase substantially. This is a result of the increases in traffic volumes and the change in traffic control resulting in more collisions (particularly rear-end type) that are typical of interrupted traffic flow at intersections.

### 2.3. Surrogate Safety Analysis Model (SSAM)

A final analysis of relative safety performance at the study area interchange between existing 2011 and full build-out traffic volumes was conducted using the SSAM tool, based on VISSIM simulation models of traffic operations for both scenarios prepared by the MRC project team. This analysis examines the number, type and location of conflicts – simulated collisions or near-misses between two or more vehicles recorded in the simulation – and provides a surrogate for understanding any increase in collision potential associated with increased traffic volumes. The SSAM tool also allows problematic areas to be identified. To maintain adequate traffic operations under full build-out traffic volumes, the MRC project team applied two changes to the existing transportation network in the full build-out model:

1. Introduction of traffic signals at the north and south on-ramp terminals (Ramps 15 and 16) to accommodate left turns from Lauzon Parkway

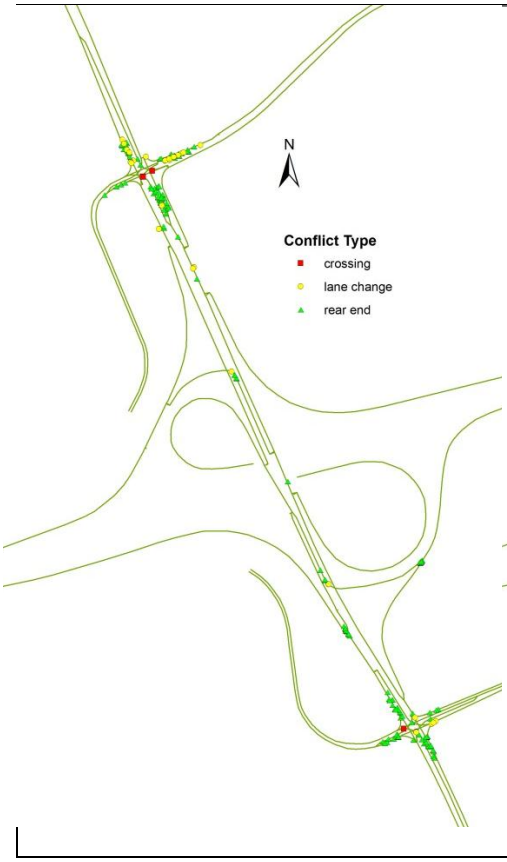
2. Widening Lauzon Parkway to three lanes in each direction in the vicinity of and south of the Twin Oaks Drive intersection to maintain satisfactory traffic operations.

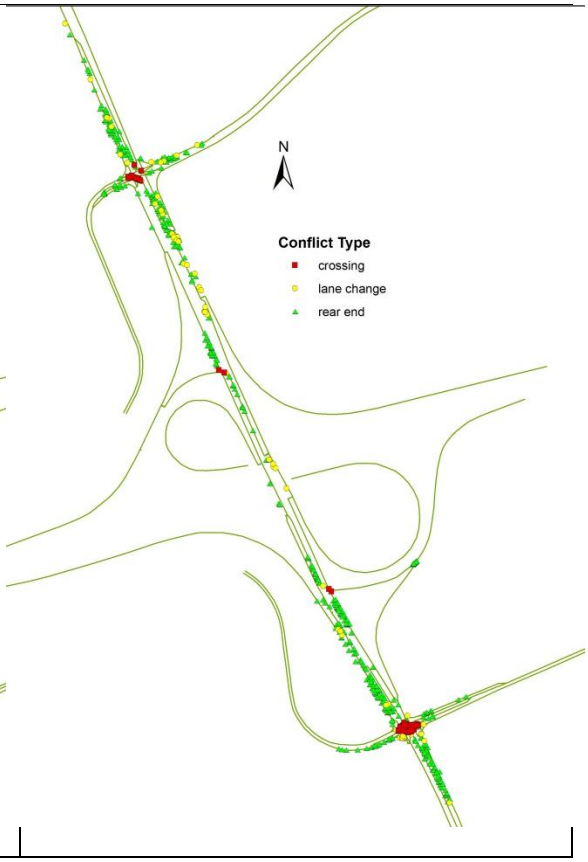
The number and location of modelled conflicts are provided in the table below. It is important to note that this type of analysis only models conflicts between two or more vehicles that typically take place near intersections and merge/diverge areas, and does not address single-vehicle run-off-road collisions that may be prone to occur, for example, on interchange ramps.

Findings from this analysis are summarized in the following table and then discussed.

*Table 8: Number, type, and location of simulated conflicts*

| | | Existing (2011) Traffic Volumes | | | | Future Build-Out Traffic Volumes | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | ***Total*** | Rear-end | Lane change | Crossing | ***Total*** | Rear-end | Lane change | Crossing |
| Intersections | Forest Glade | ***100*** | 74 | 23 | 3 | ***230*** | 164 | 26 | 40 |
| | N Ramp Terminal | ***5*** | 4 | 1 | 0 | ***40*** | 37 | 1 | 2 |
| | S Ramp Terminal | ***6*** | 3 | 3 | 0 | ***67*** | 64 | 1 | 2 |
| | Twin Oaks | ***72*** | 64 | 7 | 1 | ***782*** | 166 | 539 | 77 |
| | *Intersection Sub-total* | ***183*** | *145* | *34* | *4* | ***1119*** | *431* | *567* | *121* |
| Interchange Ramps | Ramp 52 (EB loop off) | ***1*** | 1 | 0 | 0 | ***9*** | 4 | 5 | 0 |
| | Ramp 63 (WB loop off) | ***0*** | 0 | 0 | 0 | ***3*** | 3 | 0 | 0 |
| | Ramp 62 (WB flared off) | ***3*** | 1 | 2 | 0 | ***47*** | 30 | 17 | 0 |
| | Ramp 53 (EB flared off) | ***18*** | 18 | 0 | 0 | ***30*** | 27 | 3 | 0 |
| | Ramp 15 (EB flared on) | ***11*** | 11 | 0 | 0 | ***22*** | 22 | 0 | 0 |
| | Ramp 16 (WB flared on) | ***3*** | 2 | 1 | 0 | ***1*** | 1 | 0 | 0 |
| | *Interchange Ramp Sub-total* | ***36*** | *33* | *3* | *0* | ***112*** | *87* | *25* | *0* |
| ***Total*** | | ***219*** | ***178*** | ***37*** | ***4*** | ***1231*** | ***518*** | ***592*** | ***121*** |



***Discussion of SSAM findings***

The SSAM analysis indicates a significant increase in conflicts between vehicles is expected as traffic volumes increase from existing levels to those anticipated in the full build-out scenario. The number of modelled conflicts is approximately 5.5 times higher in the full build-out scenario than in the existing scenario. The increase in conflicts is attributable to a number of factors:

1. Increased traffic volumes traversing existing signalized intersections

2. Introduction of two additional traffic signals at ramp terminal intersections, and the limited distance to manoeuver between these and the existing signalized intersections

3. Increased traffic volumes interacting at ramp merge/diverge areas

A more detailed examination suggests that the greatest increase in conflicts in the study area is associated with signalized intersections as opposed to interchange ramps. Comparing the full build-out scenario to the existing traffic scenario, there are approximately 6 times more conflicts associated with signalized intersections and approximately 3 times more conflicts associated with interchange ramps.

At the signalized intersections introduced to accommodate left turns at the terminals of Ramps 15 and 16 under the full build-out scenario, there is a notable increase in the number of rear-end conflicts.

At the existing signalized intersection at Forest Glade Drive, there is a notable increase in the number of rear-end and crossing collisions under the full build-out scenario; at the existing signalized intersection at Twin Oaks Drive, there are very significant increases in the number of rear-end, lane-change, and crossing conflicts.

Of all the interchange ramps, Ramp 62 demonstrates the greatest increase in conflicts under full build-out traffic volumes, with a higher number of rear-end and lane-change conflicts. This is largely related to the merge area on Lauzon Parkway and the potential need to make a number of lane changes across relatively dense traffic prior to Forest Glade Drive. Ramps 53 and 15 also experience an increase in rear-end collisions, once again likely attributable to conflicts at merge/diverge areas on Lauzon Parkway and the need to make lane changes across relatively short distances.

Readers are once again reminded that the SSAM analysis uses conflicts between vehicles in a simulation model as a proxy to future safety performance. This type of analysis is not capable of modelling the increase in risk associated with single vehicle run-off-road collisions, for example as a result of increased traffic volumes traversing loop ramps with challenging geometrics.

## 3. Synthesis and Conclusions

A statistically reliable Empirical-Bayes procedure using a weighted combination of Ontario operational (safety) performance functions and historical collision data suggests four of the six interchange ramps are not performing as expected from a safety standpoint at current traffic volumes. While the safety performance of these ramps is worse than "average", approximately 13% to 29% of similar interchange ramps in the province have a worse safety performance.

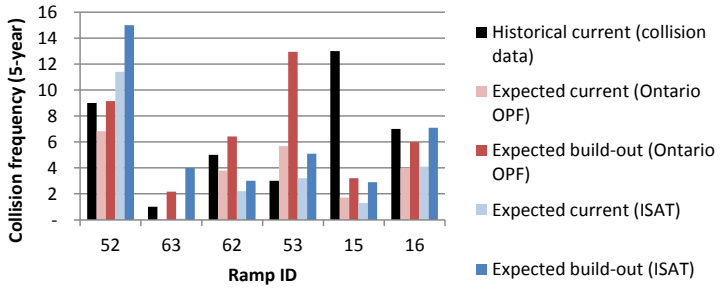
A before-and-after comparison of predicted collision frequency using both Ontario and ISAT safety performance functions suggests collisions will increase on interchange ramps as volumes increase to the levels predicted by the full build-out model. This increase is expected to be in the range of approximately 65% to 80% above current levels. Increases in collision frequency can be expected as traffic volumes increase. When accounting for the increased traffic volumes through analysis of collision rates, expected collision rates under full build-out traffic volumes may actually be lower on interchange ramps than under current volumes. However both collision frequencies and collision rates at ramp terminal intersections are expected to increase due to the need to introduce traffic signals to maintain efficient traffic operations and accommodate left turns onto the interchange ramps.

In terms of collision rates on interchange ramps, Ramps 63, 15, and 62 have experienced the highest collision rate based on the 5-year collision history. Based on Ontario OPF collision prediction models, Ramps 53, 62, and 63 are expected to have the highest collision rates under current and full build-out traffic volumes; Ramps 52 and 63 are expected to have the highest collision rates based on ISAT collision prediction models.

Collision frequencies and rates that have been experienced and are expected based on Ontario OPF and ISAT collision prediction models are summarized in the tables below for current and full-build out traffic volume scenarios.

*Figure 3: Historical and expected safety performance of interchange ramps*

***Collision frequency:***




**Collision rate:**

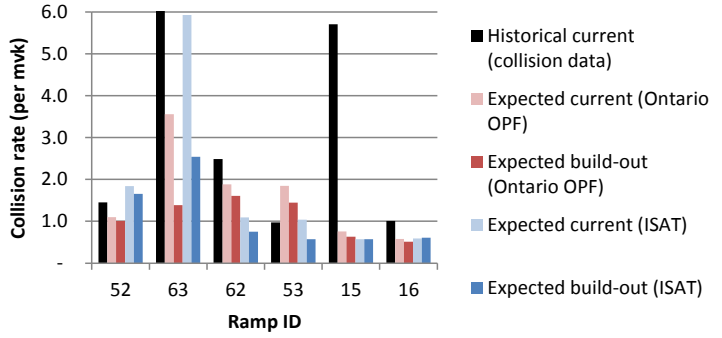
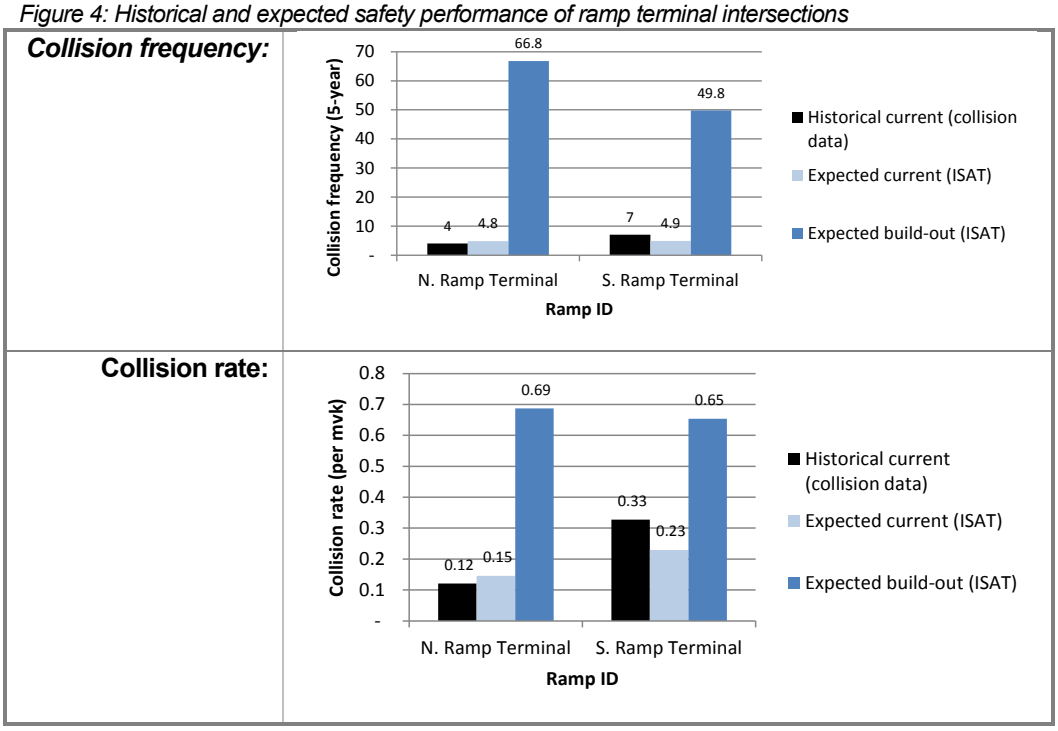


*Figure 4: Historical and expected safety performance of ramp terminal intersections*




The SSAM conflict analysis also suggests there will be a significant increase in conflicts between vehicles throughout the study area as traffic volumes increase from existing to full build-out levels. Many of these conflicts are associated with the introduction of new traffic signals, increased traffic at existing traffic signals, and limited distance to manoeuver between traffic signals. Some are attributable to merge/diverge areas between interchange ramps and Lauzon Parkway.

## 4. Other Considerations

Additional concerns related to lane configuration/designation and the close proximity of the Forest Glade Drive intersection to the southbound to westbound on-ramp (Ramp 36 & 16) may lead to last-minute lane change conflicts and increased collision potential between the intersection and the interchange. In particular, these issues are as follows:

- The westbound Forest Glade Drive approach to the signalized intersection makes use of a double left-turn lane. Vehicles in the left-most left turn lane destined for westbound E.C. Row Expressway need to make a lane change across relatively dense traffic over a distance of only 100 meters.

- The southbound Lauzon Parkway approach to the E.C. Row Expressway interchange comprises three basic through lanes that extend a considerable distance to the north. At the interchange, the outer-most through lane terminates as an exit-only lane for the southbound to westbound on-ramp, with no advance warning or information.

It appears that lane designation signage in advance of the Forest Glade Drive intersection indicating which lanes vehicles should be in based on their desired destination at the interchange would help to alleviate such conflicts. Overhead lane designation signs would likely be most effective.