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

Traffic Analysis Report
Future Traffic Conditions
FINAL

November 2013

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A member of MMM GROUP

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1. INTRODUCTION

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 transportation needs within the study area. The study has the following main components:

- Lauzon Parkway from E.C. Row Expressway to County Road 42 (2.5 km);
- Lauzon Parkway's extension to Highway 401 (3 km);
- Lauzon Parkway's further extension to Highway 3 (2.5 km);
- County Road 42 from Walker Road to City/County Boundary (5.5 km);
- County Road 42 from City/County Boundary to County Road 25 (East Puce Road) (10 km); and
- The future east/west arterial from Walker Road to County Road 17 (10th Concession Road) (5 km)

A parallel study for 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 Winds or International Airport, Lauzon Parkway and the 8th Concession Road, and the City of Windsor boundary).

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*. The preparation and approval of the Secondary Plan will follow the requirements of the *Ontario Planning Act*.

1.1 Background

As part of the April 2005 Ontario/Canada announcement of the Let's Get Windsor Essex Moving Strategy, a commitment was made to conduct an environmental assessment and preliminary design study to examine upgrades and the extension of Lauzon Parkway between the E.C. Row Expressway and Highway 401. In addition, partners have agreed to include planning and design components related to County Road 42, the East-West Arterial and the South Sandwich Secondary Plan Study.

The environmental assessment and preliminary design of improvements to Lauzon Parkway is one of the initiatives to improve the Windsor-Detroit Gateway that was further announced by the Government of Ontario on April 9, 2010.

The Essex Windsor Region Master Transportation Plan (EWRTMP) identifies the need for operational and capacity improvements to the existing section of Lauzon Parkway south of E.C. Row Expressway to County Road 42 and the protection of a new corridor further south to Highway 401. A further extension to Highway 3 was also considered in the regional master plan to provide local and regional transportation benefits. The EWRTMP identifies a new four lane facility to provide sufficient traffic capacity to 2021.

The Windsor/Detroit border functions as the busiest international trade corridor in North America, handling about 30% of the two-way flow of Canada/U.S. trade by value and about 25% by volume. The Government of Ontario, in partnership with the County of Essex and the City of Windsor, are working together to implement infrastructure projects that will help to relieve traffic congestion and improve traffic flows.

The population and employment forecast from the City of Windsor suggests that the City of Windsor population is expected to increase by 30,500 and employment by 11,400 by Year 2031. The Windsor Annexed Area Master Plan study estimated to accommodate about 14,000 residents and 10,000 employments in the Annexed Area during this period. By 2031, the County of Essex population is expected to increase approximately 41,000 and employment by 17,500.

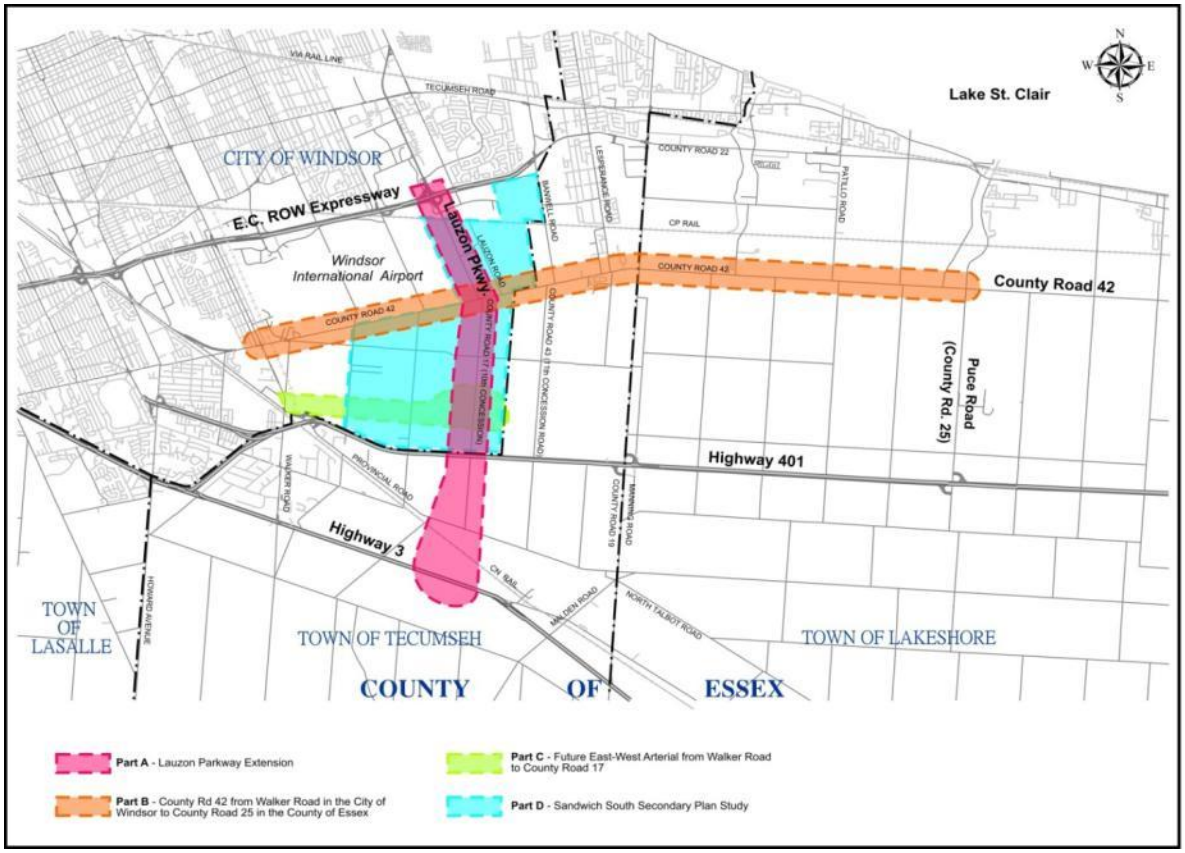
1.2 Study Area

The study area established for the purpose of the transportation planning and traffic analyses is illustrated in **Exhibit 1**. The study area for the detailed traffic condition analysis includes:

- Lauzon Parkway from between E.C. Row Expressway to County Road 42 and proposed southerly extension to Highway 3 including Highway 401 Interchange;
- County Road 42 from Walker Road to County Road 25 (East Puce Road); and
- Future East-West Arterial from Walker Road to Lauzon Parkway.

The transportation planning analysis applies the full *Essex-Windsor Regional Transportation Master Plan* (EWRTMP) demand forecasting model to reflect a broader understanding of transportation demand and the effects on the defined study area road network.

Exhibit 1 Study Area



1.3 Study Approach

The purpose of this study is to identify the transportation problems and opportunities, and develop and evaluate potential solutions. The transportation planning process includes:

- Identifying factors driving *Area Transportation System* needs;
- Determining *Area Transportation System* needs that address the *Area Transportation System* problems and opportunities in the analysis area; and
- Providing strategies to address *Area Transportation System* problems and opportunities.

The first step in the transportation planning process established baseline transportation and socio-economic data that define the corresponding baseline for the Environmental Assessment Study. An understanding of the existing and historical transportation and socio-economic conditions as well as future trends provides a basis for establishing the appropriate scope of the remaining technical and consultation requirements of the Study.

The ***Transportation Planning Report TR1*** was submitted in July 2011; documents factors driving *Area Transportation System* needs and existing transportation network condition.

The ***Transportation Planning Report TR2*** was submitted in December 2012, identifies the *Area Transportation System* needs and provides strategies to address problems and opportunities. Based on the travel demand modelling analysis for the future land use, the future network improvement requirements were identified for the planning horizon years (2016, 2021 and 2031). The transportation planning analysis applies the full *Essex-Windsor Regional Transportation Master Plan* (EWRTMP) demand forecasting model to reflect a broader understanding of transportation demand and the effects on the defined study area road network.

The ***Existing Condition Traffic Analysis Report*** was submitted in August 2011; documents the existing traffic operational analysis and collision data analysis. The existing operational analysis includes an assessment of intersection capacity analysis, queuing, delay and level of service analysis. Collision data analysis was conducted for the study area intersections and mid-block sections.

This report documents the ***Future Condition Traffic Analysis*** includes assessment of capacity utilization, queuing and delays for the future traffic conditions. The capacity analyses were conducted for the preferred intersection/interchange configuration; identified based on various factors for socio-economic, cultural environment, natural environment and technical consideration (traffic operations, cost, and utilities).

1.4 Proposed Network Improvements

The ***Transportation Planning Report TR2*** identifies the improvement requirements and their timings for the study area corridors (Lauzon Parkway, County Road 42 and East-West Arterial). The network improvements were identified considering the proposed development and future land use (population and employment) assumptions provided by the City of Windsor and the County of Essex. The proposed network improvements for the planning horizon years of 2021 and 2031 are described below:

Improvement requirements by 2021:

Lauzon Parkway:

- From E.C. Row Expressway to County Road 42: Widening from 2 lanes to 4 lanes of arterial (Class I) capacity (trigger volume: approximately 800 vph in peak direction);
- From County Road 42 to Highway 401: Southerly extension to Highway 401 to 4 lanes of arterial (Class I) capacity and a new full Interchange at Highway 401;
- From Highway 401 to Highway 3: Further extension to Highway 3 with 4 lanes of arterial (Class I) capacity.

County Road 42:

- From Walker Road to County Road 19 (Manning Road): Widening from 2 lanes to 4 lanes of arterial (Class II) capacity (trigger volume: approximately 700 vph in peak direction - around 2018);

- From County Road 19 (Manning Road) to County Road 25 (East Puce Road): 2-lanes of arterial (Class II) capacity without lane widening.

Additional improvement requirements by 2031:

Lauzon Parkway:

- From E.C. Row Expressway to Highway 401: Widening from 4 lanes to 6 lanes of arterial (Class I) capacity (trigger volume approximately 1,600 vph in peak direction, around 2025).

County Road 42:

- From County Road 19 (Manning Road) to County Road 25 (East Puce Road): Widening from 2 lanes to 4 lanes of arterial (Class II) capacity;
- The need and timing for widening for this segment would be depending upon the pace of development in the Town of Lakeshore and traffic congestion on County Road 22 between 2021 and 2031. Hence, the County of Essex is recommended to review periodically the traffic operations on County Road 42 after 2021 (trigger volume approximately 700 vph in peak direction).

East-West Arterial:

- As the proposed development around this arterial is expected only to begin around 2024, this corridor would require to be built by 2023. This corridor would require 2 lanes of arterial capacity from Walker Road to the east end of the study area;
- Beyond 2031, the East-West Arterial would require to be widened from 2 to 4 lanes when volume reaches approximately 700 vph in peak direction.

2. FUTURE CONDITION ANALYSIS

2.1 Future Traffic Volumes

The travel demand model (TransCAD based) developed for the EWRTMP study was updated and calibrated for the existing (2011) afternoon peak hour condition. Based on the proposed land use and planned network improvement, the model was developed for the 2016, 2021 and 2031 condition. Future turning movement volumes for the study area intersections were estimated using the growth projected by the travel demand model and consideration of the existing traffic volumes.

As the travel demand model was developed only for the afternoon peak hour, the future turning movement volumes for the morning peak hour traffic were estimated by transposing the afternoon peak hour volumes assuming opposite traffic flows. During the existing turning movement surveys, the afternoon peak hour traffic volumes were generally observed 10-15% higher than the morning peak hour traffic volumes. Therefore, projected demand for the morning peak hour by transposing afternoon peak hour is conservative. The estimated future (2031) traffic volumes for the morning and afternoon peak hours are respectively presented in **Exhibit 2** and **Exhibit 3**.

Exhibit 2: 2031 Morning Peak Hour Traffic Volumes

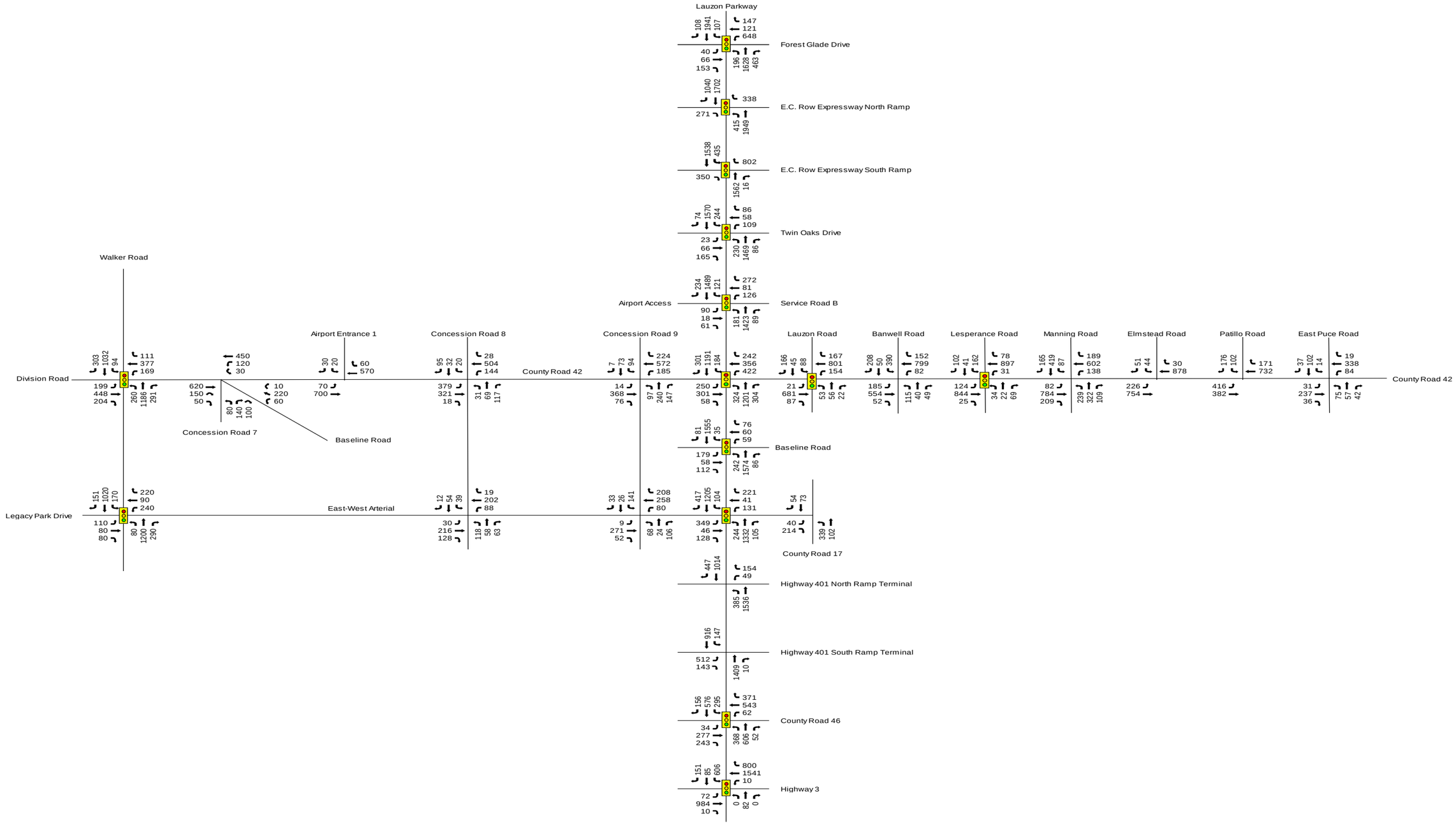
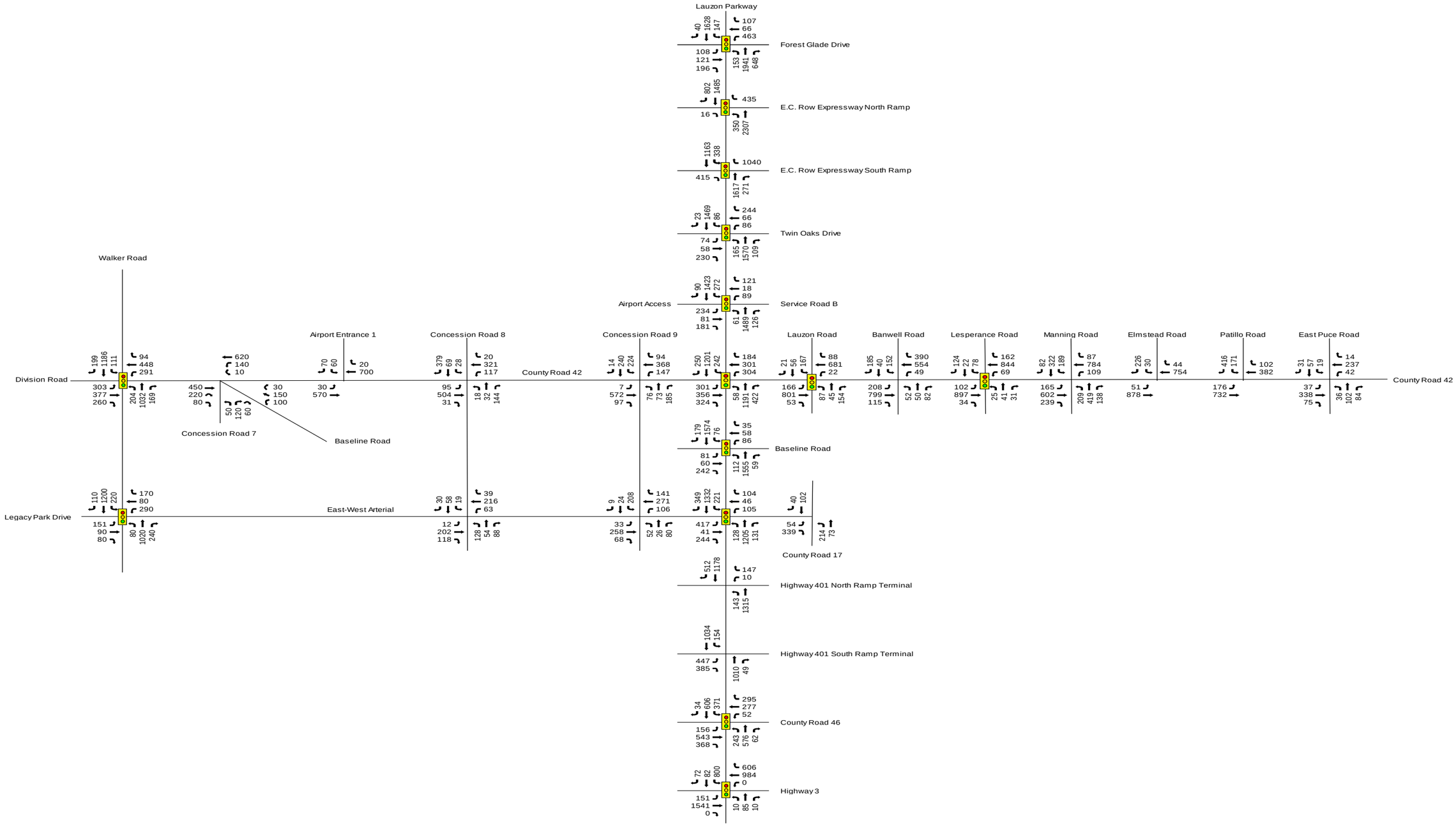


Exhibit 3: 2031 Afternoon Peak Hour Traffic Volumes



2.2 Intersection Capacity Analysis

All the existing and proposed intersections were analyzed to determine the future lane configuration requirements. As the section of Lauzon Parkway from E.C. Row Interchange to Highway 401 is recommended to be widened with 4-lanes by 2021 and further widened to 6-lane by 2031. Therefore, intersections on Lauzon Parkway in this section are also analyzed for the interim condition for Year 2021 and ultimate condition for Year 2031. The proposed interchange at Highway 401 and Lauzon Parkway was also assessed for the full-build out (i.e. corresponding to 100% of Sandwich South development which is expected beyond year 2031) conditions, to identify the interchange configuration requirements with the full-build out condition.

At the study area intersections (existing and proposed), where traffic signals are warranted or expected to be warranted in the existing or future conditions, a modern roundabout configuration was considered. Based on the capacity analysis, if the roundabout provides an acceptable level-of-service (LOS), then a modern roundabout configuration was proposed as the preferred design. In certain situations, this was not preferred due to other factors such as: proximity to other signalized intersections/property requirements, etc.

The intersection capacity analyses for the proposed signalized intersections were analyzed using *Synchro 7/8* model. The capacity analyses for the proposed roundabouts were preliminary analyzed using *Sidra* software. If the intersection capacity analysis result from the *Sidra* software shows an acceptable level of service, and roundabout is the preferred option, then a detailed operational analysis were conducted using the *VISSIM* micro-simulation model.

The intersection capacity analysis results provide queue length (95^{th} percentile conditions), average delay and resulting level-of-service (LOS) and volume to capacity (V/C) ratio (only for signalized intersections). This level of service criteria for un-signalized intersections and signalized intersections (for the automobile mode) are presented in **Exhibit 4**.

For the roundabout configuration, the Highway Capacity Manual 2010 recommends using the level of service criteria of un-signalized intersection, due to the absence of research on traveler perception of quality of service at roundabout.

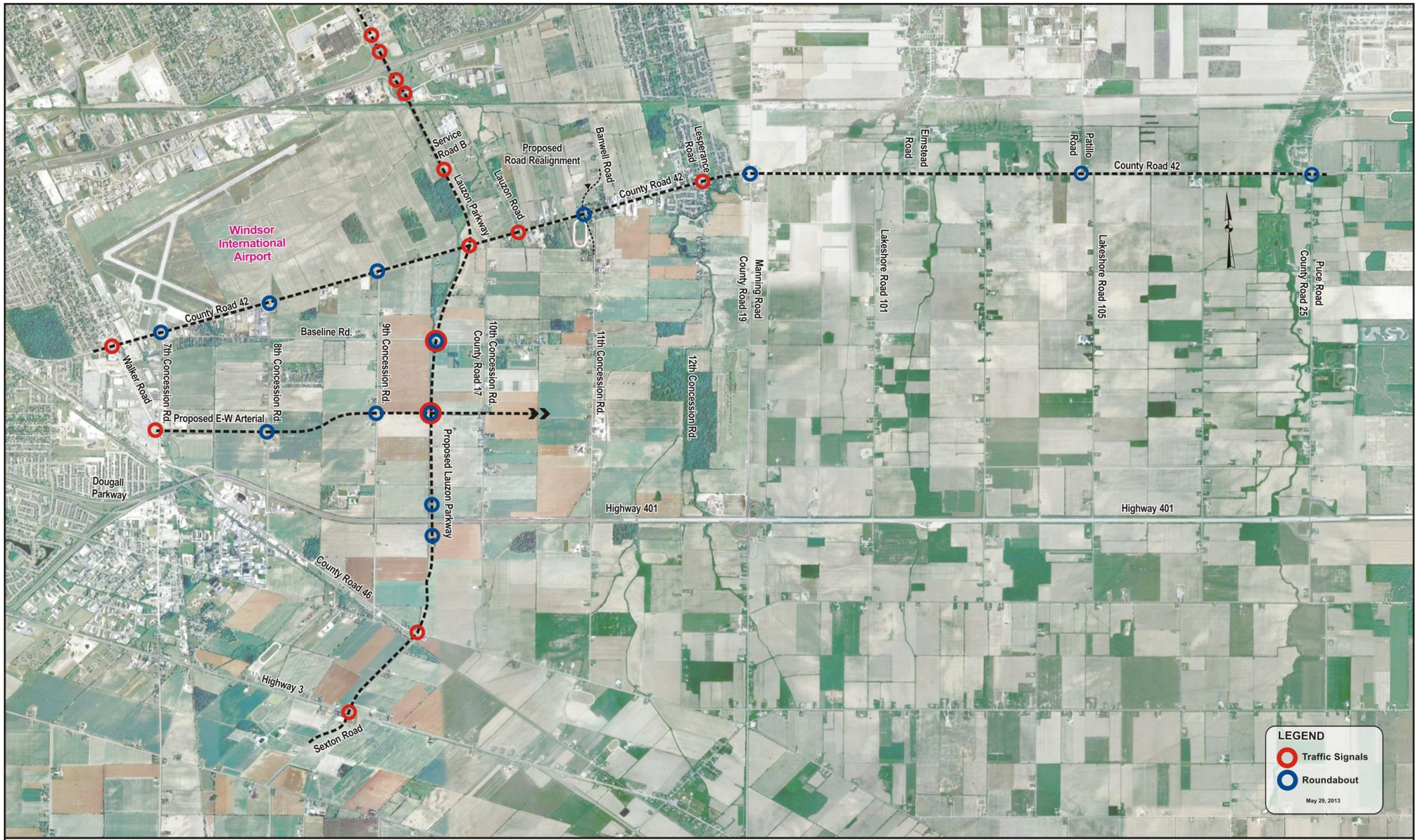
Exhibit 4: Levels-of-Service Criteria for Signalized and Un-signalized Intersections

Level-of-service	Signalized Intersection Average Delay per Vehicles (sec/veh)	Un-signalized Intersection Average Delay per Vehicles (sec/veh)
A	< = 10	< = 10
B	> 10 and < = 20	> 10 and < = 15
C	> 20 and < = 35	> 15 and < = 25
D	> 35 and < = 55	> 25 and < = 35
E	> 55 and < = 80	> 35 and < = 50
F	> 80	> 50

Source: Highway Capacity Manual, 2010

The proposed configuration (i.e. traffic signals/roundabout) for the study area intersections are presented in **Exhibit 5**. The intersection capacity analysis for Lauzon Parkway, County Road 42 and East-West Arterial intersections are presented in Section 3, Section 4 and Section 5, respectively.

Exhibit 5: Recommended Intersection Configuration



3. LAUZON PARKWAY INTERSECTIONS

Lauzon Parkway is proposed to extend southerly to Highway 3 with an interchange at Highway 401. **Exhibit 6** identifies each of the intersections along Lauzon Parkway including: their existing condition; which one was identified as potential roundabout; and recommended intersection control types.

Exhibit 6: Summary of Lauzon Parkway Intersections

Intersecting Road	Existing Intersection	Future Intersection Required	Potential for Roundabout	Acceptable LOS for Roundabout	Proposed Control Type
Interchanges					
E.C. Row Expressway North Ramp Terminal	Unsignalized	Signalized	X		Signalized
E.C. Row Expressway South Ramp Terminal	Unsignalized	Signalized	X		Signalized
Highway 401 Westbound On Ramp	N/A	Signalized	✓	X[1]	Roundabout[1]
Highway 401 Eastbound On Ramp	N/A	Signalized	✓	X[1]	Roundabout[1]
Intersections					
Forest Glade Drive	Signalized	Signalized	X		Signalized
Twin Oaks Drive/ South Service Road	Signalized	Signalized	X		Signalized
Service Road B/ Airport Access	Stop Controlled	Signalized	✓	X	Signalized
County Road 42	Signalized	Signalized	✓	X	Signalized
Baseline Road	N/A	Signalized	✓	X[2]	Roundabout[2]
E-W Arterial	N/A	Signalized	✓	X[2]	Roundabout[2]
County Road 46	N/A	Signalized	✓	X	Signalized
Highway 3	N/A	Signalized	✓	X	Signalized

1. The LOS for a roundabout is acceptable up to 2031, but degrades to an unacceptable level for ultimate built-out (beyond 2031).
2. The LOS for a roundabout is acceptable up to 2021, but a roundabout will not meet 2031 demands.

Detailed intersection capacity analysis results for Lauzon Parkway intersections are described in this section.

3.1 Lauzon Parkway at E.C. Row Interchange

The Lauzon Parkway interchange is a Parclo B-4 configuration consisting of six ramps (refer **Exhibit 7**). A major rehabilitation of the interchange was undertaken and completed in 2010.

Exhibit 7: Existing Lauzon Parkway Interchange at E.C. Row Expressway

The road crossings in close proximity to the Lauzon Parkway interchange with E. C. Row Expressway 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 two-lane Class I collector road and extends west from Lauzon Parkway. Forest Glade Drive is a four-lane (five-lane between Lauzon Parkway and Meadowbrook Lane) Class I collector road that extends east from Lauzon Parkway. The South Service Road is a two-lane Class I collector road and extends west from Lauzon Parkway while Twin Oaks Drive is a two-lane Class I collector road extending east of Lauzon Parkway.

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

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

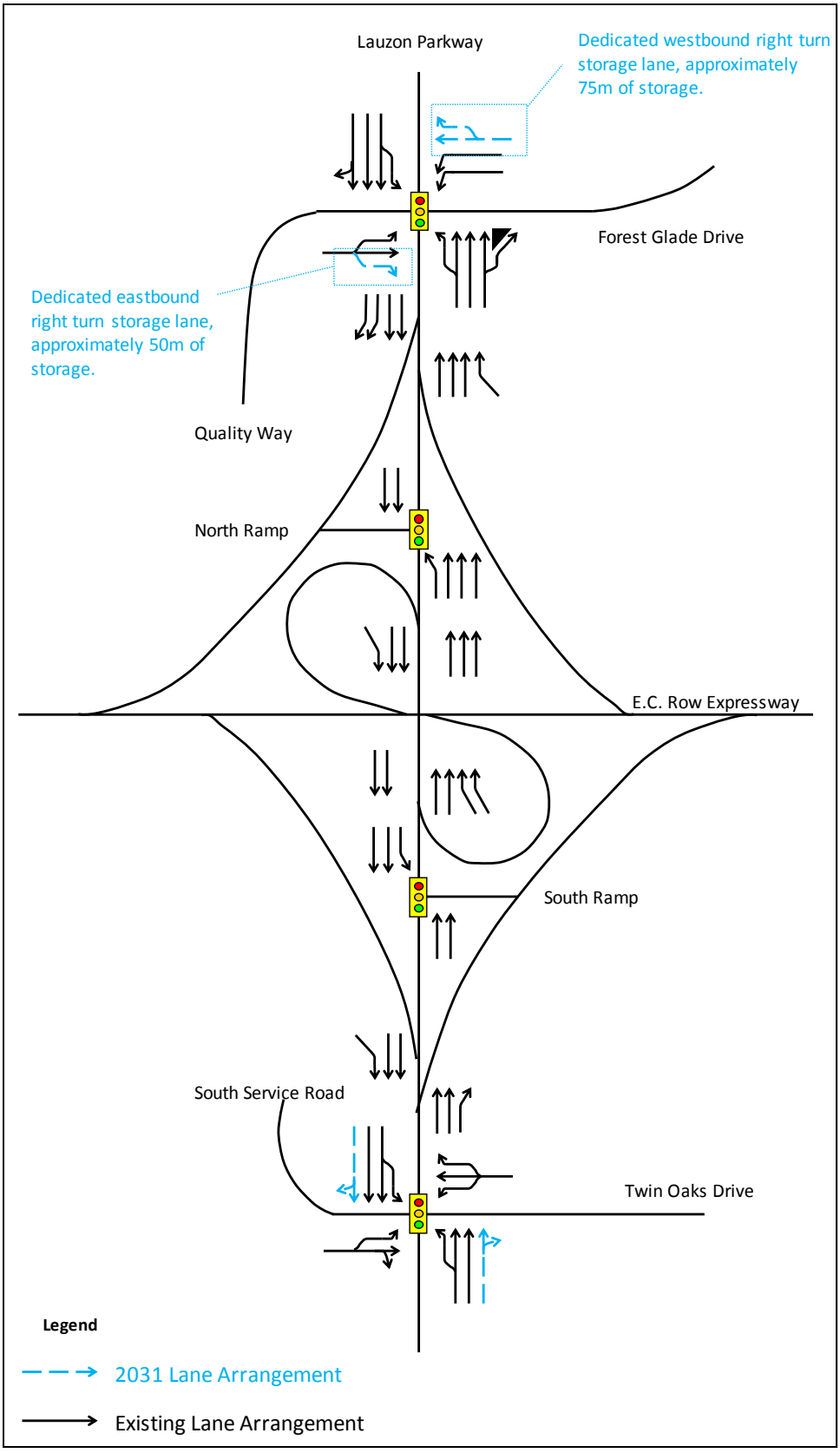
be able to find sufficient gaps and that would result in poor LOS ('F') for the left-turning movement, indicating the need for the signalization of the ramp terminal intersections.

In addition to signalization of ramp terminal, some other lane improvements would be required at the Lauzon Parkway Interchange, as presented in **Exhibit 8**.

Currently at Forest Glade intersection, 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-turning lane into a dedicated westbound through lane (i.e. by removing shared left and through movements and providing dedicated dual left-turning lanes) with the provision of a dedicated westbound right-turning storage lane (with approximately 75 m of storage). This intersection would also require dedicated eastbound right-turning storage lane (with approximately of 50 m) in order to reduce the delays for the eastbound through and eastbound right-turning movements.

At Lauzon Parkway and Twin Oaks Drive intersection, additional through lanes would require in both the north and south directions on Lauzon Parkway.

Exhibit 8: 2031 Lane Configurations at E.C. Row Interchange



The intersection capacity analysis with the suggested improvements was performed by using *VISSIM* micro-simulation model. The volume to capacity ratios were derived from *Synchro* model. The intersection level-of-services for the 2031 peak hours are summarized in **Exhibit 9**.

Exhibit 9: 2031 Intersection Capacity Analysis for Lauzon Parkway/E.C. Row Interchange

Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue[1] (m)	V/C	Delay (s)	LOS	Queue[1] (m)
Lauzon Parkway at Forest Glade Drive (Signalized)		***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 (Signalized)		***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 (Signalized)		***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 (Signalized)		***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

Note: 1. Queue length reflects 95th percentile conditions

The intersection capacity analysis indicates that both the ramp terminals at Lauzon Parkway/E.C. Row Expressway would operate at an acceptable LOS with the provision of traffic signals. The two adjacent intersections at Forest Glade Drive and Twin Oaks Drive would also operate at an acceptable LOS. However, the southbound through movement during morning peak hour and northbound through movement during afternoon peak hour on Lauzon Parkway would operate near capacity (v/c ratio > 0.9) at the North Ramp Terminal for 2031 traffic demand, indicating the need for additional lane requirements on Lauzon Parkway beyond 2031. The proposed improvement requirements beyond 2031 are presented in a separate tech. memorandum *(Lauzon Parkway/E.C. Row Expressway Interchange Existing and Future Conditions, November 2013).*

3.2 Lauzon Parkway at Service Road B (Airport Access)

It is of note that Airport Master Plan has proposed an access at this intersection which would require to convert this 3-leg intersection into 4-leg with an addition of a west-approach. At the time of this analysis, the Airport Master Plan does not include any Traffic Impact Studies for the proposed development at Airport. Hence, the City of Windsor is recommended to re-assess the lane configuration requirement at this intersection based on the proposed development and traffic impact study recommendations. Considering the future demand, this intersection would be warranted for traffic signal.

Based on travel demand modelling analysis, Lauzon Parkway is recommended for widening to 4 lanes by 2021 and 6 lanes by 2031 at this intersection. Therefore, traffic operational analysis was conducted for these two planning horizon years (2021 and 2031).

The projected traffic volumes for 2021 planning horizon year is presented in **Exhibit 10**; and intersection capacity analysis results are summarized in **Exhibit 11.**

Exhibit 10: 2021 Traffic Volumes at Lauzon Parkway and Service Road B

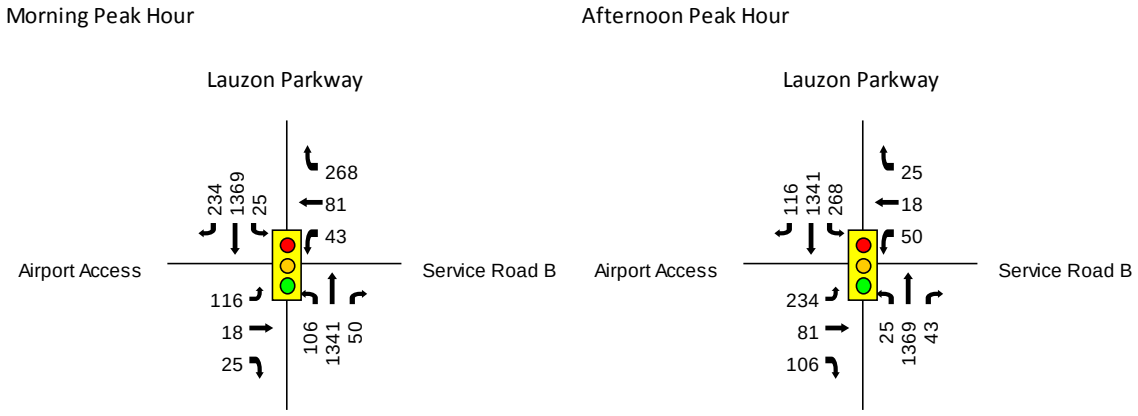
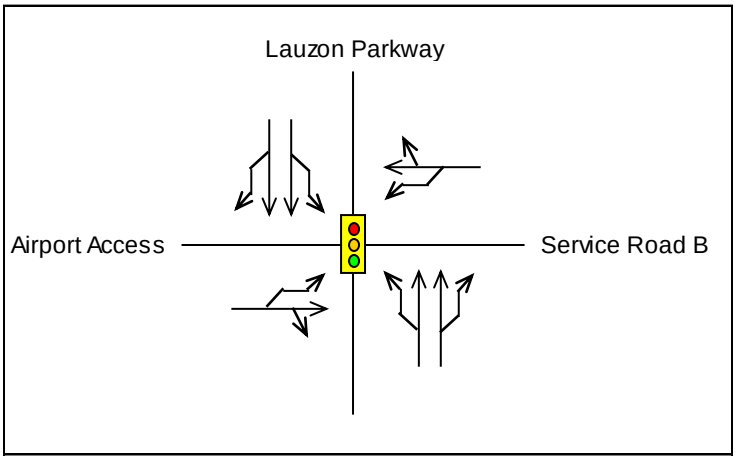


Exhibit 11: 2021 Intersection Capacity Analysis for Lauzon Parkway and Service Road B

Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue[1] (m)	V/C	Delay (s)	LOS	Queue[1] (m)
Lauzon Parkway at Service Road B (Signalized)		***30***	***C***			***30***	***C***	
Eastbound Left	0.46	23	C	26	0.79	47	D	59
Eastbound Through/Right	0.09	15	B	11	0.51	28	C	44
Westbound Left	0.10	17	B	12	0.43	47	D	20
Westbound Through/Right	0.89	50	D	100	0.23	22	C	12
Northbound Left	0.54	21	C	20	0.19	20	C	9
Northbound Through	0.79	21	C	144	1.00	49	D	191
Northbound Right	0.06	5	A	6	0.07	8	A	8
Southbound Left	0.31	31	C	12	0.68	28	C	85
Southbound Through	0.95	40	D	199	0.63	11	B	114
Southbound Right	0.32	8	A	28	0.12	2	A	8

This intersection is expected to operate with LOS 'C' (overall) during 2021 peak hours. All the turning movements at this intersection are expected to operate at an acceptable level of service (LOS 'D' or better). The maximum V/C ratio is 1.00 for northbound through movement (1,369 vehicles) in the afternoon peak hour, indicate the need for additional lane requirements on Lauzon Parkway between year 2021 and 2031. The proposed lane configuration for 2021 planning horizon year is presented in **Exhibit 12**.

Exhibit 12: 2021 Lane Configurations at Lauzon Parkway and Service Road B



By 2031, Lauzon Parkway is recommended to further widen to 6 lanes. The intersection capacity analysis for Year 2031 was analyzed using the projected traffic volumes presented in **Exhibit 2** and **Exhibit 3;** and analysis results for 2031 planning horizon are presented in **Exhibit 13**.

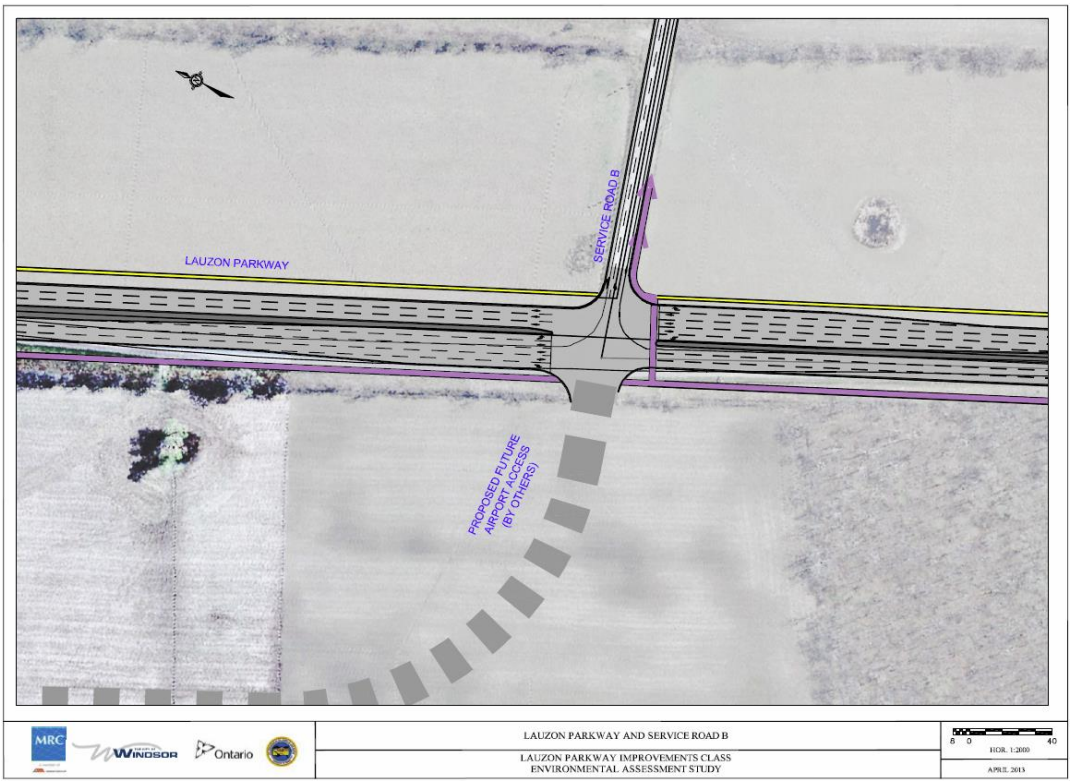
Exhibit 13: 2031 Intersection Capacity Analysis for Lauzon Parkway and Service Road B

Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue[1] (m)	V/C	Delay (s)	LOS	Queue[1] (m)
Lauzon Parkway at Service Road B (Signalized)		***23***	***C***			***23***	***C***	
Eastbound Left	0.47	29	C	23	0.76	42	D	67
Eastbound Through/Right	0.25	12	B	14	0.73	34	C	67
Westbound Left	0.40	26	C	31	0.44	31	C	25
Westbound Through/Right	0.86	39	D	80	0.56	18	B	21
Northbound Left	0.72	30	C	45	0.30	11	B	9
Northbound Through	0.72	24	C	100	0.80	27	C	112
Northbound Right	0.14	5	A	10	0.20	5	A	14
Southbound Left	0.38	16	B	26	0.75	32	C	76
Southbound Through	0.68	22	C	112	0.57	15	B	85
Southbound Right	0.30	5	A	20	0.11	3	A	7

Note: 1. Queue length reflects 95th percentile conditions

With the proposed 6-lane widening on Lauzon Parkway, this intersection is expected to operate at LOS 'C' during both peak hours. All the movements at this intersection are expected to operate with an acceptable level of service (LOS 'D' or better) with the proposed lane configuration. The proposed lane configurations (2031) for this intersection are presented in **Exhibit 14.**

Exhibit 14: 2031 Lane Configurations at Lauzon Parkway and Service Road B



3.3 Lauzon Parkway at County Road 42

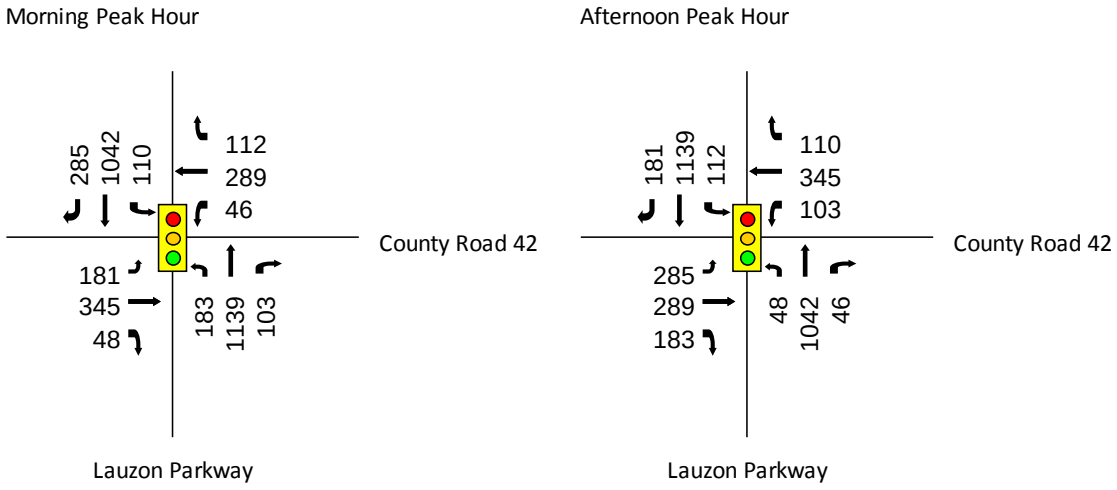
Based on travel demand modelling analysis, segment of County Road 42 (CR 42) from Walker Road to County Road 19 (Manning Road) is recommended for widening to 4 lanes by 2021.

The section of Lauzon Parkway from E.C. Row Expressway to County Road 42 is recommended for widening to 4 lanes by 2021 and also southerly extension to Highway 3 with an interchange at Highway 401. The existing Lauzon Parkway/County Road 42/10th Concession off-set intersection is proposed to be improved as part of the Lauzon Parkway extension. Also, the existing County Road 17/10th Concession Road intersection will be closed for the ultimate 2031 condition; however, it will remain as a right-in/right-out only intersection for the interim 2021 condition.

By 2031, Lauzon Parkway (from E.C. Row Expressway to Highway 401) would require further widening to 6 lanes. Therefore, traffic operational analysis was conducted for planning horizon years of 2021 and 2031.

The projected traffic volume for year 2021 is presented in **Exhibit 15** and capacity analysis results are summarized in **Exhibit 16**.

Exhibit 15: 2021 Traffic Volumes at Lauzon Parkway and CR 42



This intersection is expected to operate at LOS 'C' during both peak hours. All the movements at this intersection are expected to operate with an acceptable level of service (LOS 'D' or better) with the proposed lane configuration. The maximum V/C ratio is 0.76 for northbound through movement during afternoon peak hour.

Exhibit 16: 2021 Intersection Capacity Analysis for Lauzon Parkway and CR 42

Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue[1] (m)	V/C	Delay (s)	LOS	Queue[1] (m)
Lauzon Parkway at CR 42 (Signalized)		***21***	***C***			***23***	***C***	
Eastbound Left	0.62	33	C	42	0.73	32	C	61
Eastbound Through	0.39	28	C	38	0.33	28	C	34
Eastbound Right	0.11	8	A	7	0.40	17	B	32
Westbound Left	0.34	40	D	18	0.35	22	C	22
Westbound Through	0.59	40	D	38	0.66	41	D	45
Westbound Right	0.36	10	A	13	0.34	9	A	13
Northbound Left	0.64	19	B	31	0.40	31	C	18
Northbound Through	0.71	25	C	115	0.76	27	C	113
Northbound Right	0.14	5	A	10	0.07	7	A	7
Southbound Left	0.46	14	B	15	0.55	21	C	20
Southbound Through	0.68	22	C	106	0.66	18	B	105
Southbound Right	0.34	3	A	13	0.21	2	A	9

Note: 1. Queue length reflects 95th percentile conditions

The projected traffic volumes for 2031 planning horizon year for morning and afternoon peak hour are respectively presented in **Exhibit 2** and **Exhibit 3**. The intersection capacity analysis results for 2031 peak hours are summarized in **Exhibit 17**.

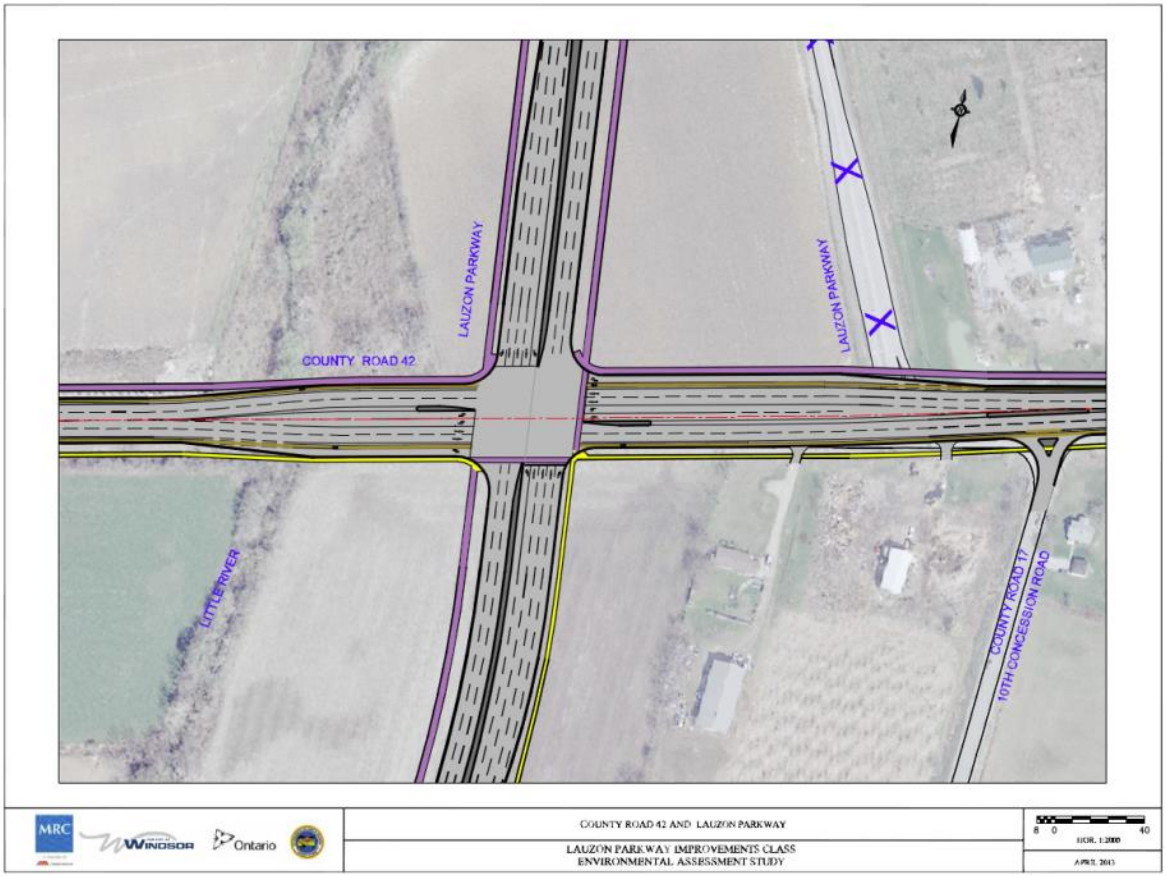
Exhibit 17: 2031 Intersection Capacity Analysis for Lauzon Parkway and CR 42

Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue[1] (m)	V/C	Delay (s)	LOS	Queue[1] (m)
Lauzon Parkway at CR 42 (Signalized)		***31***	***C***			***28***	***C***	
Eastbound Left	0.66	28	C	50	0.79	37	D	69
Eastbound Through	0.57	38	D	39	0.67	41	D	46
Eastbound Right	0.20	11	B	10	0.72	35	D	77
Westbound Left	0.86	54	D	64	0.74	48	D	42
Westbound Through	0.60	37	D	45	0.61	40	D	40
Westbound Right	0.54	11	B	22	0.34	16	B	32
Northbound Left	0.88	46	D	98	0.26	13	B	10
Northbound Through	0.68	26	C	86	0.70	28	C	90
Northbound Right	0.41	4	A	17	0.49	12	B	62
Southbound Left	0.76	37	D	53	0.80	36	D	66
Southbound Through	0.84	36	D	96	0.66	24	C	90
Southbound Right	0.48	7	A	24	0.24	1	A	9

Note: 1. Queue length reflects 95th percentile conditions

All the movements at this intersection are expected to operate with an acceptable level of service (LOS 'D' or better) for 2031 traffic demand. The maximum V/C ratio is 0.88 for the northbound left movement during morning peak hour. Considering the eastbound left turn and westbound left turn demand, dual-left turn lanes are recommended on County Road 42. The proposed lane configurations for Lauzon Parkway and County Road 42 intersection are presented in **Exhibit 18**.

Exhibit 18: 2031 Lane Configurations at Lauzon Parkway and CR 42



3.4 Lauzon Parkway at Baseline Road

With the proposed extension of Lauzon Parkway, intersection at Baseline is recommended with a roundabout configuration for the interim condition. Forecasted traffic volumes for the planning horizon year of 2021 is presented in **Exhibit 19**, and the intersection capacity analysis results are summarized in **Exhibit 20.**

Exhibit 19: 2021 Traffic Volumes at Lauzon Parkway and Baseline Road

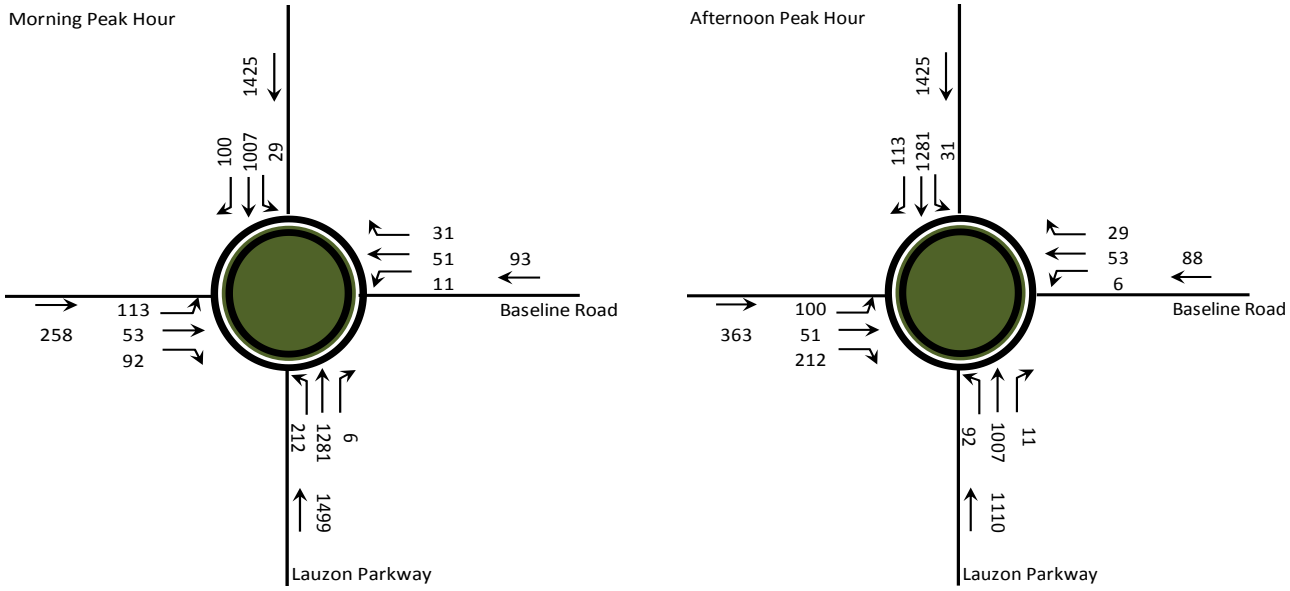


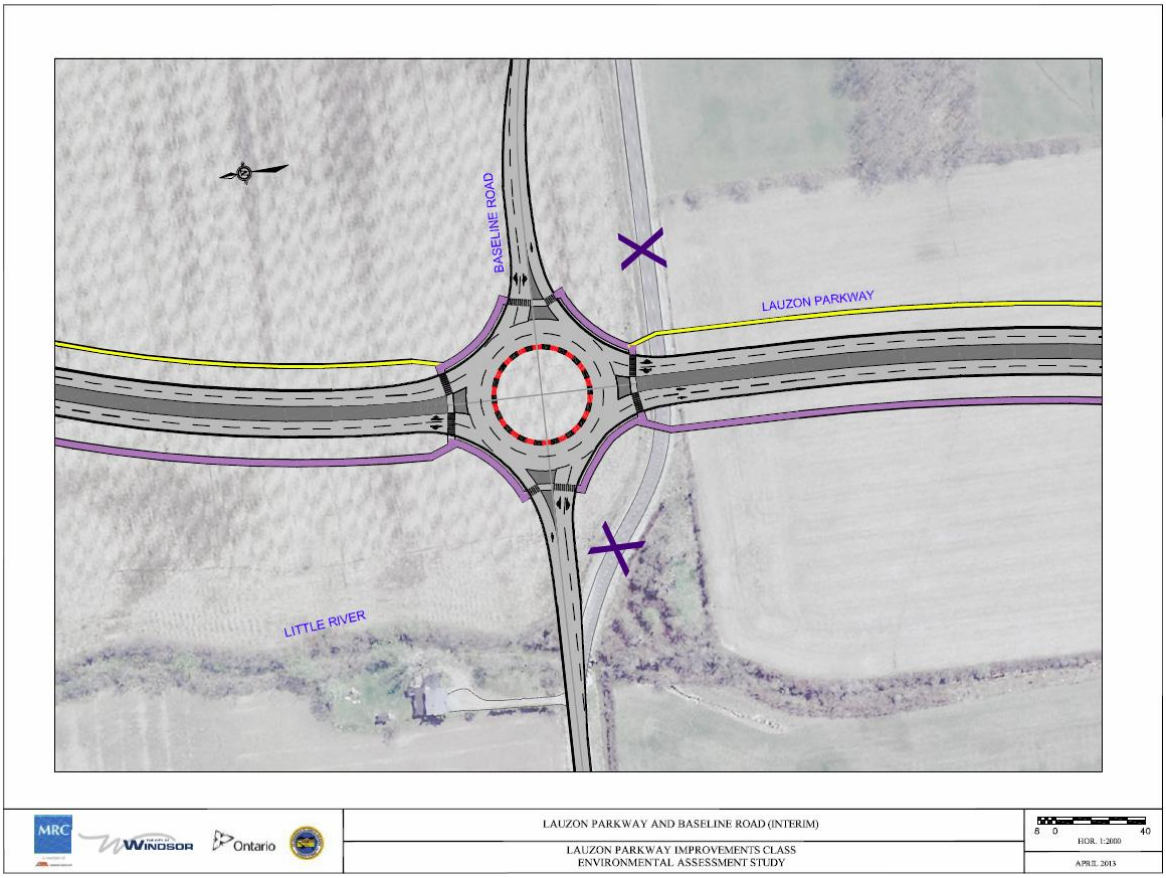
Exhibit 20: 2021 Intersection Capacity Analysis for Lauzon Parkway and Baseline Road

Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue[1] (m)	V/C	Delay (s)	LOS	Queue[1] (m)
Lauzon Parkway at Baseline Road (Roundabout)		***5***	***A***			***5***	***A***	
Eastbound Left	-	9	A	9	-	22	C	24
Eastbound Through	-	7	A	9	-	24	C	24
Eastbound Right	-	4	A	9	-	6	A	24
Westbound Left	-	24	C	12	-	11	B	5
Westbound Through	-	22	C	12	-	11	B	5
Westbound Right	-	9	A	12	-	6	A	5
Northbound Left	-	4	A	27	-	3	A	15
Northbound Through	-	4	A	27	-	3	A	15
Northbound Right	-	4	A	27	-	2	A	15
Southbound Left	-	6	A	28	-	4	A	22
Southbound Through	-	5	A	28	-	4	A	23
Southbound Right	-	3	A	28	-	3	A	23

The proposed 2-lane roundabout is expected to reduce the overall delay and would provide LOS ‘A’ (overall). Various movements at this roundabout are expected to operate with an LOS ‘C’ or better during both peak hours.

The roundabout reduces the severity of collisions by increasing driver attentiveness and decreasing T-Bone collisions. Roundabout reduces speed in intersection, increases the overall throughput of the road and reduces delays, provides shorter crossings for pedestrians, fewer conflict points between vehicles and pedestrians and reduces the operational costs. The proposed lane configurations for the roundabout at this intersection are presented in **Exhibit 21**.

Exhibit 21: 2021 Lane Configurations at Lauzon Parkway and Baseline Road



Considering the traffic operational issues with a 3-lane roundabout and imbalanced traffic volume from various approaches, the roundabout could result in unacceptable delays on minor roads. Therefore, with the widening of Lauzon Parkway from 4 lanes to 6 lanes, this intersection is recommended to be signalized. The intersection capacity analysis is conducted assuming signalized intersection configuration. The intersection capacity analysis results are in **Exhibit 22**.

For 2031 traffic demand, this intersection is expected to operate at good level of service (overall LOS 'B') and all the movements are expected to operate with reasonable delays during both peak hours. With the optimized signal timing plan, the maximum V/C ratio (0.80) was noticed for eastbound through/right movement during afternoon peak hour. The proposed lane configurations for this intersection are presented in **Exhibit 23**.

Exhibit 22: 2031 Intersection Capacity Analysis for Lauzon Parkway and Baseline Road

Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue[1] (m)	V/C	Delay (s)	LOS	Queue[1] (m)
Lauzon Parkway at Baseline Road (Signalized)		***18***	***B***			***18***	***B***	
Eastbound Left	0.77	50	D	49	0.27	25	C	21
Eastbound Through/Right	0.41	15	B	28	0.80	30	C	49
Westbound Left	0.45	46	D	22	0.45	31	C	22
Westbound Through/Right	0.61	36	D	35	0.35	26	C	23
Northbound Left	0.79	37	D	69	0.52	19	B	24
Northbound Through	0.50	9	A	74	0.59	16	B	108
Northbound Right	0.09	2	A	5	0.07	5	A	8
Southbound Left	0.33	28	C	15	0.36	12	B	12
Southbound Through	0.69	21	C	115	0.63	18	B	115
Southbound Right	0.11	6	A	10	0.21	5	A	16

Note: 1. Queue length reflects 95th percentile conditions

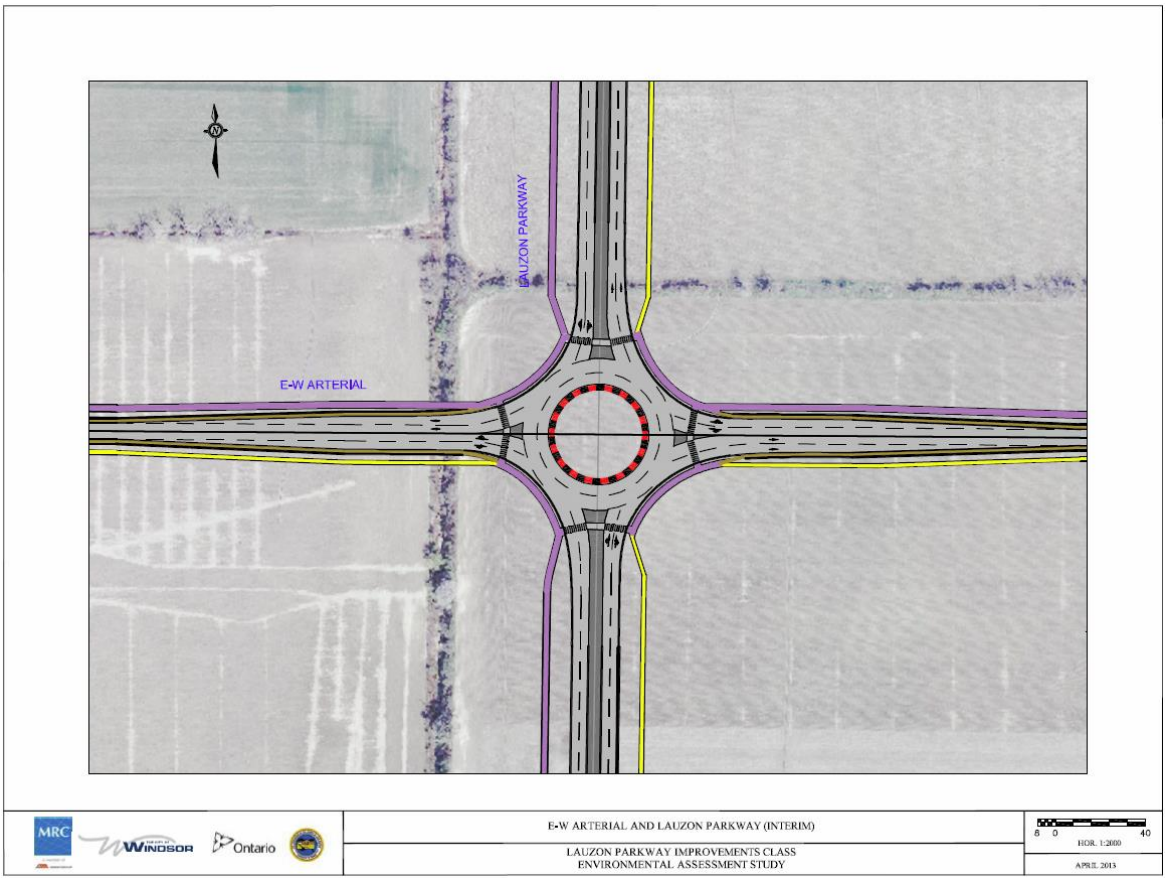
Exhibit 23: 2031 Configurations at Lauzon Parkway and Baseline Road

3.5 Lauzon Parkway at East-West Arterial

East-West Arterial is planned to provide an access for the proposed development in Sandwich South development and East Pelton Secondary Plan. This link will provide connection between Walker Road and County Road 17/10th Concession Road. The proposed development around East-West Arterial is expected to start around year 2024. Hence, this corridor was not included in travel modelling analysis for year 2021. The travel demand modelling analysis for year 2031 confirms that East-West Arterial with 2-lane arterial road Class II capacity would be sufficient.

A roundabout is proposed at East West Arterial and Lauzon Parkway intersection for the interim condition. The proposed lane configurations for this intersection are presented in **Exhibit 24**.

Exhibit 24: Interim Lane Configurations at Lauzon Parkway and E-W Arterial



With the increase of traffic volume (over 1600 vph in peak direction) on Lauzon Parkway, the segment between E.C. Row Interchange and Highway 401 Interchange would require widening to 6 lanes. This high volume on Lauzon Parkway could result in imbalance traffic flows at this intersection and roundabout configuration is expected to result in significant delays and queuing on the eastbound approach of East-West Arterial. Therefore, this intersection would be required to be signalized when Lauzon Parkway widened to 6 lanes.

Detailed traffic operational analysis and sensitivity analysis was conducted with roundabout and signalized configurations. The analysis results are documented in technical memorandum (dated October 21, 2011), included in **Appendix A.**

The ultimate lane configurations are presented in **Exhibit 25** and future (2031) level-of-service for this intersection is summarized in **Exhibit 26**.

Exhibit 25: Ultimate Lane Configurations at Lauzon Parkway and E-W Arterial

Exhibit 26: 2031 Intersection Capacity Analysis for Lauzon Parkway and E-W Arterial

Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue[1] (m)	V/C	Delay (s)	LOS	Queue[1] (m)
Lauzon Parkway at E-W Arterial (Signalized)		***25***	***C***			***24***	***C***	
Eastbound Left	0.68	29	C	71	0.90	49	D	117
Eastbound Through	0.11	27	C	14	0.12	32	C	15
Eastbound Right	0.29	6	A	12	0.50	8	A	19
Westbound Left	0.48	27	C	27	0.37	24	C	24
Westbound Through	0.23	39	D	16	0.30	43	D	18
Westbound Right	0.63	13	B	19	0.47	14	B	14
Northbound Left	0.63	25	C	68	0.50	19	B	25
Northbound Through	0.69	26	C	117	0.67	27	C	94
Northbound Right	0.16	7	A	14	0.21	6	A	14
Southbound Left	0.44	17	B	19	0.70	27	C	43
Southbound Through	0.86	37	D	99	0.69	25	C	100
Southbound Right	0.41	2	A	11	0.46	8	A	33

Note: 1. Queue length reflects 95th percentile conditions

With the optimized signal timing plan, all the movements at this intersection are expected to operate with an acceptable level-of-service during both (morning and afternoon) peak hours. The maximum V/C ratio is 0.90 for eastbound left movement in the afternoon peak hour.

3.6 Lauzon Parkway at Highway 401 Interchange

The proposed interchange at Lauzon Parkway and Highway 401 Extension would provide an opportunity to develop a gateway and community transportation corridor.

Walker Road and County Road 19 (Manning Road) are the only two north-south links with interchanges at Highway 401 and E.C. Row Expressway and these two links are already operating near capacity, indicating the need for a new interchange with Highway 401 for the future traffic demand in the study area. The new interchange at Highway 401 would provide a potential opportunity for an access and gateway to the new Sandwich South developments. Lauzon Parkway is proposed to be constructed with six lanes north of Highway 401 and with four lanes south of Highway 401.

Two alternative designs were developed for the Lauzon Parkway/Highway 401 interchange: a Parclo A4, and a Teardrop Roundabout.

Option 1: Build the Parclo A4 on 'Day 1'

Option 2: Build the Teardrop Roundabout on 'Day 1' and convert to Parclo A4 at a future date. The conversion to the Parclo A4 interchange would require widening of the bridge deck, construction of two loop ramps, and minor ramp modifications

The Parclo A4 is based on the "Parclo A" type configuration, which offers high capacity, operational and safety characteristics as it has mostly free-flow moves. With two direct on and off-ramps for each direction (i.e., S-W loop ramp, N-W, N-E loop ramp, S-E), only the two freeway exit ramps are controlled by 'Stop' sign or traffic signals. However, with six ramps in total, this interchange type has a larger footprint than other alternatives.

The Teardrop Roundabout has two 'teardrop' roundabouts located at the intersection of the interchange on and off ramps. This design only requires four ramps in total, reducing the overall footprint of the interchange and eliminates the need to construct and maintain traffic signals. The proposed lane configurations at Highway 401 ramp terminals are presented in **Exhibit 27** and **Exhibit 28** respectively for north and south ramp terminals**.**

Exhibit 27: Lane Configurations with Teardrop Roundabout at Lauzon Parkway/Highway 401 North Ramp Terminal

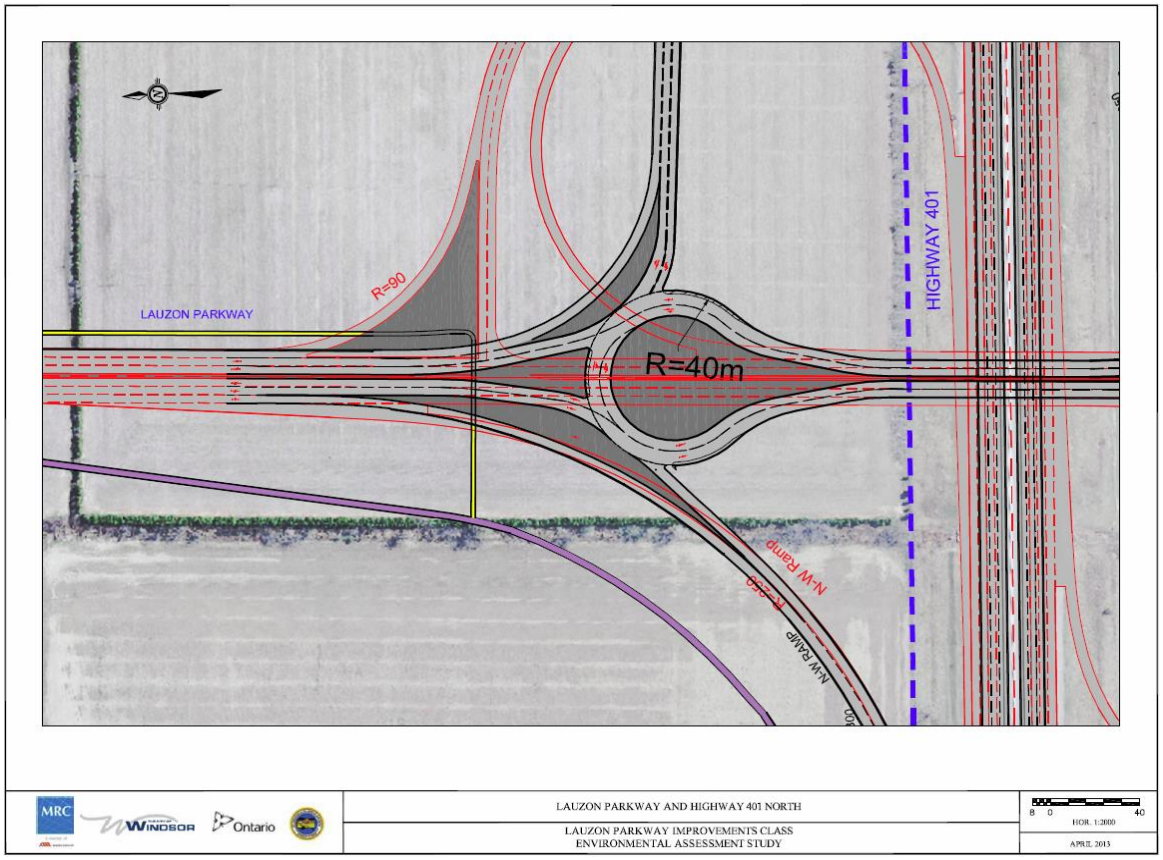
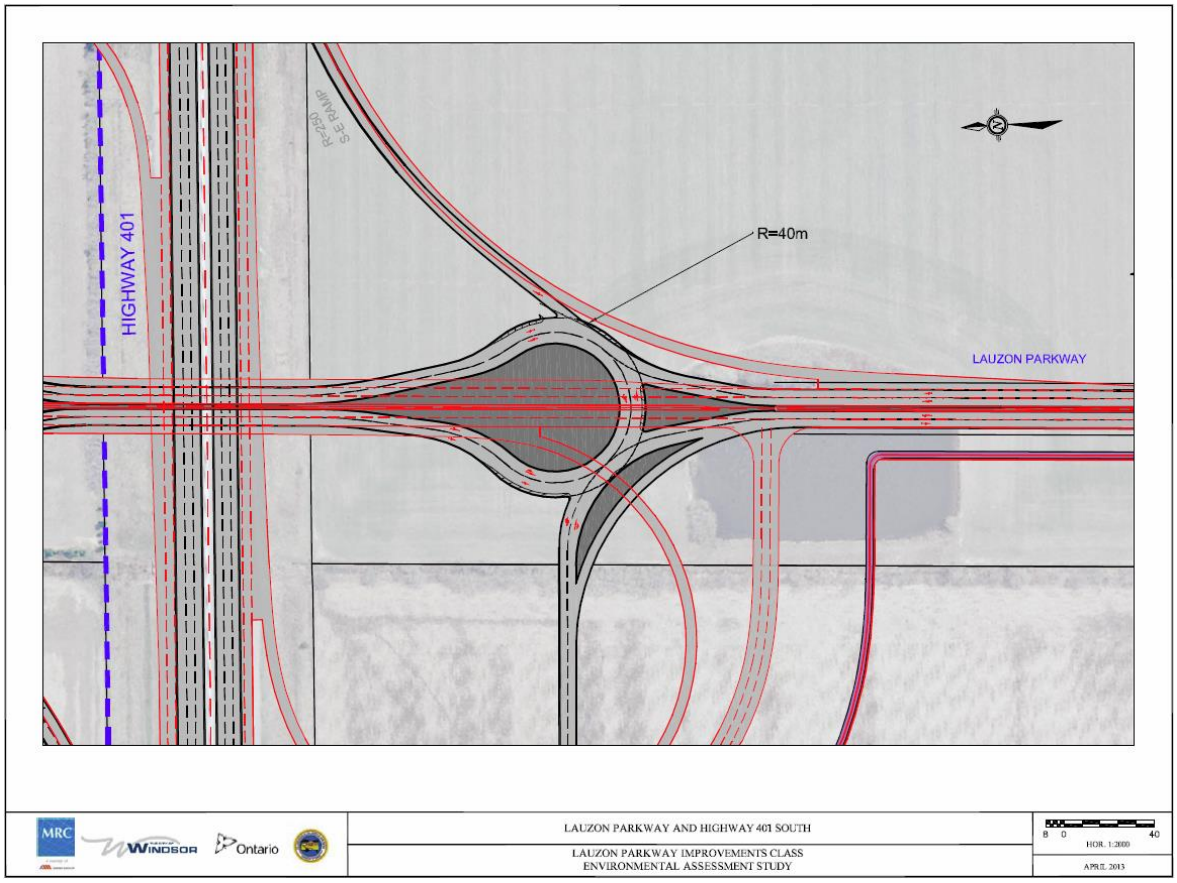


Exhibit 28: Lane Configurations with Teardrop Roundabout at Lauzon Parkway/Highway 401 South Ramp Terminal



The intersection capacity analysis was conducted using VISSIM microsimulation analysis for 2031 traffic demand using teardrop interchange configuration and resulting level-of-service are summarized in **Exhibit 29**.

Exhibit 29: 2031 Intersection Capacity Analysis for Lauzon Parkway and Highway 401 Ramp Terminals

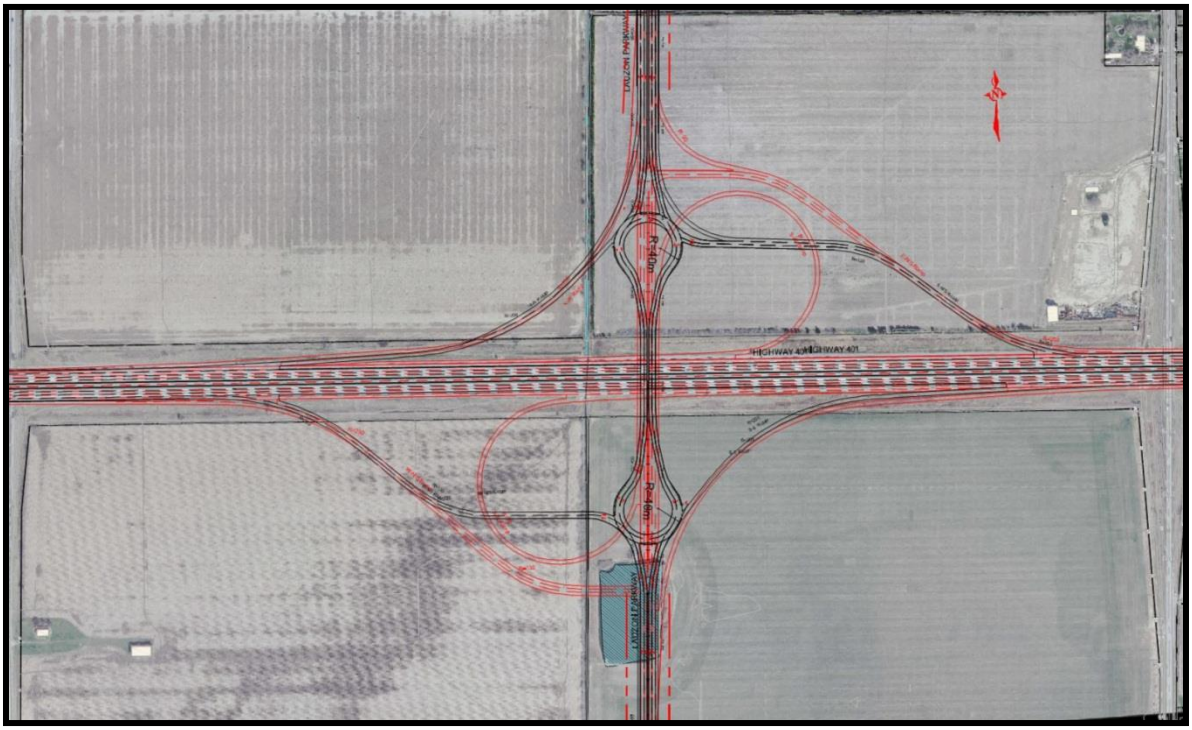
Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue[1] (m)	V/C	Delay (s)	LOS	Queue[1] (m)
Lauzon Parkway at Highway 401 North Ramp (Roundabout)		***5***	***A***			***3***	***A***	
Westbound Left	-	39	E	9	-	21	C	8
Westbound Right	-	0	A	0	-	0	A	0
Northbound Left	-	4	A	0	-	2	A	0
Northbound Through	-	3	A	3	-	2	A	0
Southbound Through	-	9	A	29	-	6	A	6
Southbound Right	-	1	A	0	-	1	A	0
Lauzon Parkway at Highway 401 South Ramp (Roundabout)		***14***	***B***			***8***	***A***	
Eastbound Left	-	16	C	43	-	24	C	51
Eastbound Right	-	1	A	9	-	2	A	20
Northbound Through	-	25	C	122	-	12	B	33
Northbound Right	-	22	C	126	-	11	B	36
Southbound Left	-	2	A	0	-	2	A	0
Southbound Through	-	1	A	0	-	1	A	0

Note: 1. Queue length reflects 95th percentile conditions

The proposed teardrop interchange configuration is expected to provide good level of service (LOS 'A/B') during both peak hours. All the movements at these two ramp terminals are expected to operate with LOS 'C' or better for 2031 traffic volume, with the exception for westbound left-turning movement at north ramp terminal which could result in LOS 'E' with average delay of 39s with average queue length of 9 m. only. Considering the overall intersection delay, roundabout would provide lower delays and result in shorter queues. The roundabout will reduces the severity of collisions by increasing driver attentiveness and decreasing T-Bone collisions. Additionally, the roundabout offers unique and special gateway features for the planned Sandwich South Secondary Plan area, without major differences on impacts to the surrounding properties, cultural or natural environments.

The traffic analysis results indicated that the roundabout design provides an acceptable level-of-service for 2031; however, the analysis indicated an unacceptable level-of-service for the ultimate build-out (i.e. corresponding to 100% of the Sandwich South development traffic forecast). Therefore, provision is made for the Teardrop Roundabout to be converted to a Parclo A4 once the circulating volume of the roundabouts reaches over 2000 vph (estimated to occur beyond 2031). The Parclo A4 will have two inner loop on-ramps added, and two signalized intersections, replacing the two roundabouts, located north and south of Highway 401, presented in **Exhibit 30**.

Exhibit 30: Lane Configurations with Teardrop Roundabout and Protection for Parclo A4 at Lauzon Parkway/Highway 401 Interchange



3.7 Lauzon Parkway at County Road 46

South of Highway 401, Lauzon Parkway is proposed to extend up to Highway 3 with a 4-lane Arterial Class-I capacity.

The travel demand model assumes 2-lane on CR 46 and 4-lane on Lauzon Parkway for Year 2031 analysis. However, recently the County of Essex has indicated they have plans to widen CR 46 to 4 lanes. The roundabout capacity analysis assuming 2-lane approaches (i.e. 4-lane on Lauzon Parkway and CR 46) indicates that roundabout would not provide an acceptable level of service at this intersection. Therefore, this intersection is recommended with the signalized control.

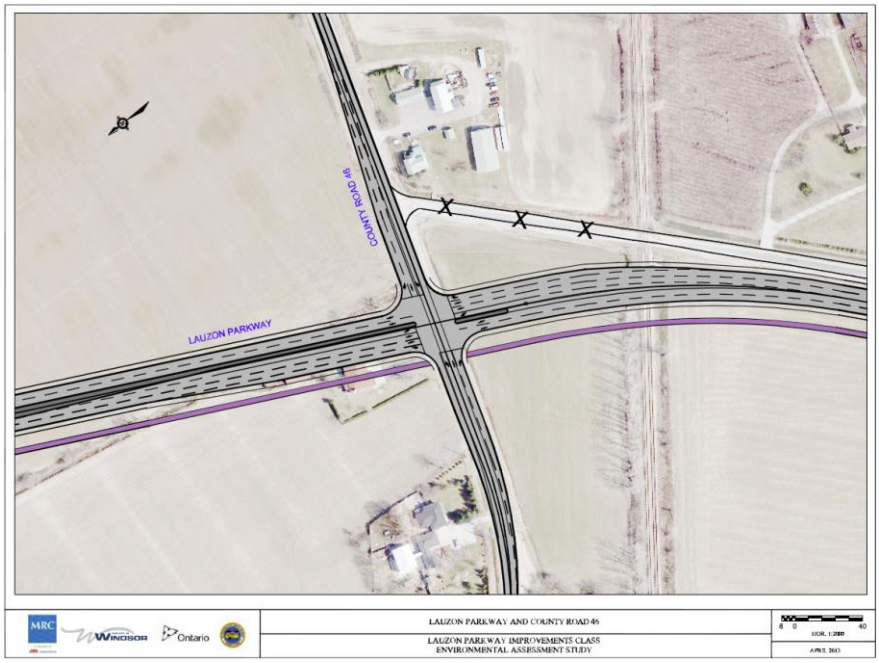
The intersection capacity analysis with signalized configuration was conducted assuming 4-lane on Lauzon Parkway and 2-lane on CR 46 with necessary turning lanes. The intersection capacity analysis results are presented in **Exhibit 31**. The movements at this intersection are expected to operate under an acceptable LOS 'D' or better for 2031 for both morning and afternoon peak hours. The maximum V/C ratio is 0.88 for westbound through movement for the morning peak hour and for southbound left movement for the afternoon peak hour. Dedicated turning lanes are recommended for all movements. The proposed lane configuration for 2031 at this intersection is presented in **Exhibit 32**. With widening of County Road 46 to 4-lane, this intersection could provide further capacity and could result in improved level of service.

Exhibit 31: 2031 Intersection Capacity Analysis for Lauzon Parkway and CR 46

Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue[1] (m)	V/C	Delay (s)	LOS	Queue[1] (m)
Lauzon Parkway at CR 46 (Signalized)		***25***	***C***			***26***	***C***	
Eastbound Left	0.42	37	D	14	0.49	27	C	41
Eastbound Through	0.45	23	C	59	0.81	36	D	146
Eastbound Right	0.27	6	A	25	0.42	11	B	46
Westbound Left	0.22	21	C	17	0.48	38	D	23
Westbound Through	0.88	42	D	146	0.42	22	C	59
Westbound Right	0.43	11	B	47	0.31	7	A	31
Northbound Left	0.80	27	C	78	0.63	20	C	39
Northbound Through	0.60	28	C	70	0.70	36	D	70
Northbound Right	0.11	7	A	8	0.15	8	A	9
Southbound Left	0.70	21	C	48	0.88	34	C	86
Southbound Through	0.65	32	C	70	0.61	29	C	70
Southbound Right	0.31	8	A	17	0.07	8	A	6

Note: 1. Queue length reflects 95th percentile conditions

Exhibit 32: 2031 Lane Configurations at Lauzon Parkway and CR 46



3.8 Lauzon Parkway at Highway 3

The proposed extension of Lauzon Parkway would terminate at Highway 3 and that would result in heavy volume turning to/from Highway 3. As presented in **Exhibit 3**, the southbound left turn demand for 2031 afternoon peak hour could reach at 800 vph. The preliminary analysis result for the roundabout at this intersection presents that roundabout would not able to provide an acceptable level of service due to heavy demand between Lauzon Parkway and Highway 3. Therefore, this intersection is recommended to be signalized and the future level-of-services are summarized in **Exhibit 33**.

Exhibit 33: 2031 Intersection Capacity Analysis for Lauzon Parkway and Highway 3

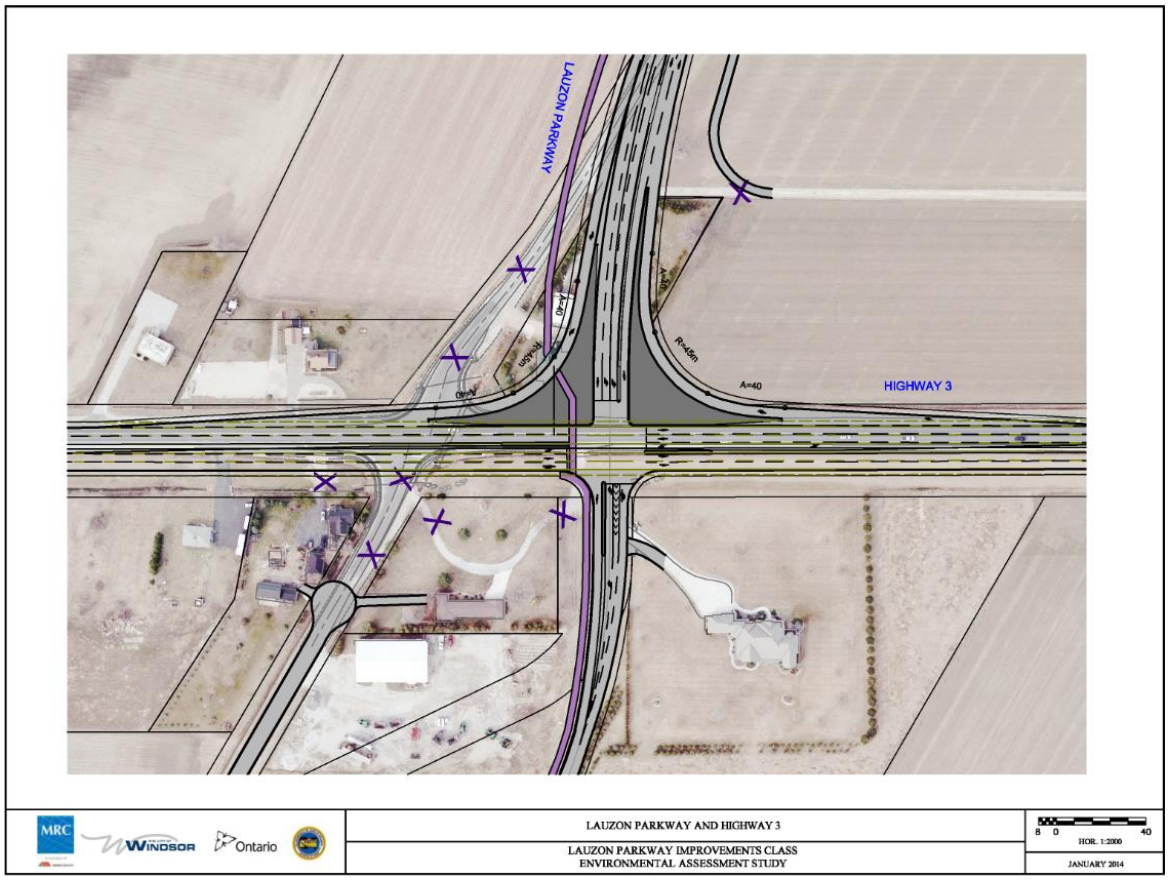
Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue[1] (m)	V/C	Delay (s)	LOS	Queue[1] (m)
Lauzon Parkway at Highway 3 (Signalized)		***31***	***C***			***36***	***D***	
Eastbound Left	0.43	17	B	12	0.75	37	D	42
Eastbound Through/Right	0.56	15	B	82	0.99	44	D	205
Westbound Left	0.06	16	B	4	0.00	0	A	0
Westbound Through	1.00	47	D	213	0.81	31	C	113
Westbound Right	0.67	6	A	83	0.65	5	A	22
Northbound Left	0.00	0	A	0	0.09	38	D	6
Northbound Through/Right	0.55	52	D	29	0.57	49	D	32
Southbound Left	0.92	54	D	91	0.94	52	D	115
Southbound Through	0.15	21	C	21	0.12	17	B	18
Southbound Right	0.28	8	A	18	0.12	4	A	7

Note: 1. Queue length reflects 95th percentile conditions

The *Synchro* analysis results indicate that few movements (eastbound through, westbound through and southbound left turn) would operate with volume to capacity ratio over 0.90. The travel demand modelling analysis results (presented in *Transportation Planning Report TR2)* also indicates that Highway 3 will be operating at the saturated level, and therefore additional capacity may be required on Highway 3. The traffic operational analysis indicates that with the proposed lane configuration, all the movements at this intersection are expected to operate with an acceptable level of service (LOS 'D' or better) for 2031 peak hours.

The intersection is proposed to provide a double left turn lanes for the southbound left turn movement and channelized right turn lane for southbound and westbound right turn movements. The proposed lane configurations at this intersection are presented in **Exhibit 34**.

Exhibit 34: 2031 Lane Configurations at Lauzon Parkway and Highway 3



4. COUNTY ROAD 42 INTERSECTIONS

Based on the travel demand modelling analysis, a section of County Road 42 (CR 42) between Walker Road and County Road 19 (Manning Road) is proposed for widening to 4-lanes by 2021; and another section between County Road 19 (Manning Road) to County Road 25 (East Puce Road) by 2031.

Exhibit 35 identifies each of the intersections along County Road 42 including: their existing condition; which one was identified as potential roundabout; and recommended intersection control types.

Exhibit 35: Summary of CR 42 Intersections

Intersecting Road	Existing Intersection	Future Intersection Required	Potential for Roundabout	Acceptable LOS for Roundabout	Proposed Control Type
Walker Road	Signalized	Signalized	X		Signalized
Riberdy Road	Unsignalized/All Access	Unsignalized/ RIRO	X		Unsignalized
Baseline Road	Unsignalized (only eastbound movement)	Combined with 7th Concession Road	✓	✓	Roundabout
7th Concession Road	Unsignalized	Unsignalized	✓	✓	
Airport Access – West	Unsignalized (inbound only)	Unsignalized	X		Unsignalized
Airport Access – East	Unsignalized (outbound only)	Unsignalized	X		Unsignalized
8th Concession Road	Unsignalized	Signalized	✓	✓	Roundabout
9th Concession Road	Unsignalized	Signalized	✓	✓	Roundabout
Lauzon Parkway	Signalized	Signalized – Realigned	✓	X	Signalized
County Road 17	Signalized	RIRO (median protected)	X		RIRO
Lauzon Road	Unsignalized	Signalized - realigned	✓		Signalized
11th Concession Road	Unsignalized	Signalized – Realigned with Banwell Road	✓	✓	Roundabout
County Road 43 (Banwell Road)	Signalized	Roundabout	✓	✓	
Access to Tecumseh Hamlet	N/A	Unsignalized	X		Unsignalized
Odessa Drive	Unsignalized	Unsignalized	X		Unsignalized

Intersecting Road	Existing Intersection	Future Intersection Required	Potential for Roundabout	Acceptable LOS for Roundabout	Proposed Control Type
Shiff Drive	Unsignalized	Unsignalized	X		Unsignalized
Le Boeuf Avenue	Unsignalized	Unsignalized	X		Unsignalized
St Alphonse Avenue	Unsignalized	Unsignalized	X		Unsignalized
Lesperance Road	Signalized	Signalized	✓	✓	Signalized
Strawberry Drive	Unsignalized	Unsignalized	X		Unsignalized
County Road 19 (Manning Road)	Signalized	Signalized	✓	✓	Roundabout
Lakeshore Road 101	Unsignalized	Unsignalized	X		Unsignalized
Suncrest Court	Unsignalized	Unsignalized	X		Unsignalized
Suncrest Drive	Unsignalized	Unsignalized	X		Unsignalized
County Road 21 (Elmstead Road)	Unsignalized	Unsignalized	X		Unsignalized
Lakeshore Road 103	Unsignalized	Unsignalized	X		Unsignalized
Patillo Road	Signalized	Signalized	✓	✓	Roundabout
Lakeshore Road 105	Unsignalized	Unsignalized	X		Unsignalized
Wallace Road	Unsignalized	Unsignalized	X		Unsignalized
Lakeshore Road 107	Unsignalized	Unsignalized	X		Unsignalized
West Puce Road	Unsignalized	Unsignalized	X		Unsignalized
County Road 25 (East Puce Road)	Signalized	Signalized	✓	✓	Roundabout

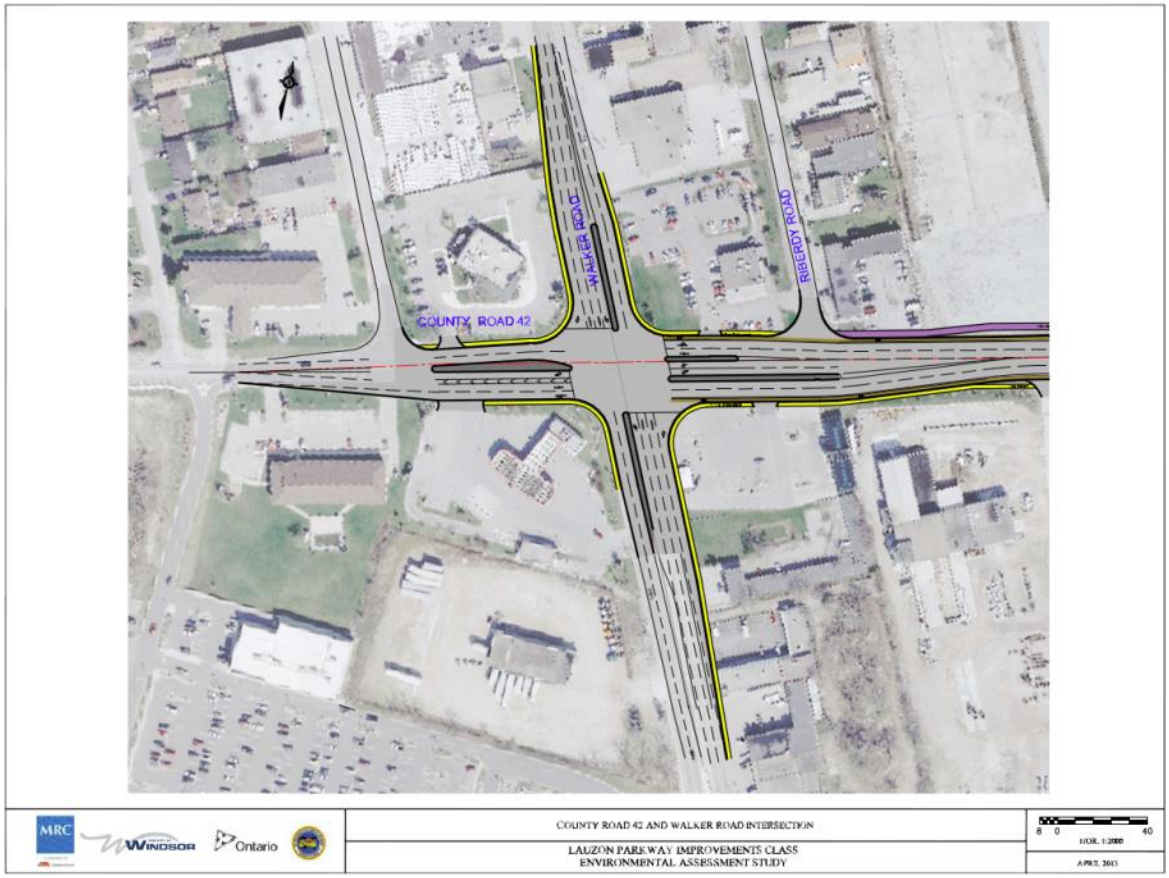
Detailed intersection capacity analysis results for County Road 42 intersections are presented in this section.

4.1 CR 42 at Walker Road

This intersection is currently signalized and with the future demand, this intersection would not provide an acceptable level of service with a roundabout. Therefore, this intersection is recommended to operate with signalized control. The existing condition analysis indicated that many of the movements at this intersection are currently operating with LOS 'D' during afternoon peak hour. And in order to accommodate the future demand, this intersection would require dedicated southbound right turn and northbound right turn lane on Walker Road also double westbound left turn lanes on County Road 42 approach.

The proposed lane configuration for 2031 at this intersection is presented in **Exhibit 36**.

Exhibit 36: 2031 Lane Configuration at CR 42 and Walker Road



The results of intersection capacity analysis for this intersection are presented in **Exhibit** 37.

Exhibit 37: 2031 Intersection Capacity Analysis for CR 42 and Walker Road

Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue[1] (m)	V/C	Delay (s)	LOS	Queue[1] (m)
CR 42 at Walker Road (Signalized)		***34***	***C***			***40***	***D***	
Eastbound Left	0.73	39	D	52	0.89	49	D	90
Eastbound Through/Right	0.91	52	D	102	0.95	52	D	88
Westbound Left	0.70	38	D	47	0.81	38	D	79
Westbound Through/Right	0.72	40	D	68	0.87	48	D	82
Northbound Left	0.87	49	D	84	0.85	46	D	63
Northbound Through	0.81	29	C	160	0.86	34	C	138
Northbound Right	0.31	5	A	27	0.18	1	A	8
Southbound Left	0.42	17	B	18	0.44	16	B	19
Southbound Through	0.83	36	D	141	0.97	47	D	168
Southbound Right	0.36	11	B	42	0.23	6	A	21

Note: 1. Queue length reflects 95th percentile conditions

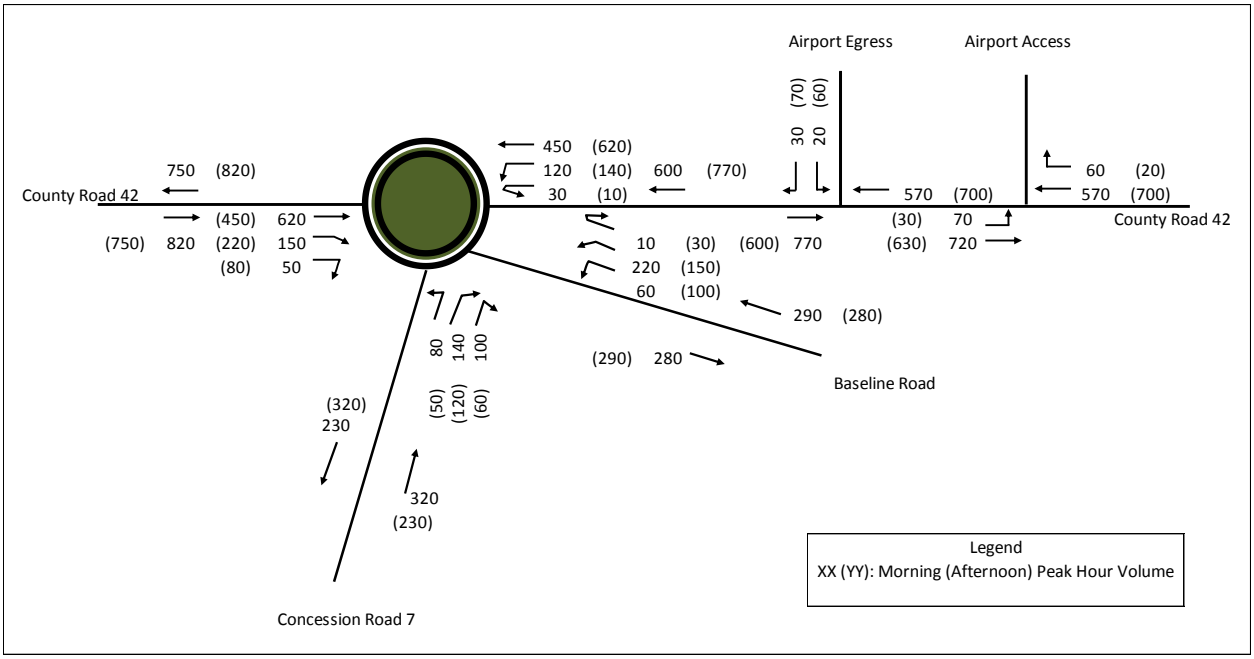
With the proposed lane configurations, this intersection is expected to operate with a LOS 'C' during morning peak hour and LOS 'D' during afternoon peak hour. All the individual movements are expected to operate with an acceptable level of service. We note that few movements are expected to operate with a v/c ratio of more than 0.90. However, considering the operational analysis results and the property constraints, no further mitigation measures are proposed for this intersection.

4.2 CR 42 at Concession Road 7/ Baseline Road / Airport Accesses

With the future widening of County Road 42, intersections with Concession Road 7 and Baseline Road are proposed to realign with a 2-lane roundabout which rationalized two existing closely-spaced intersections into one intersection, while maintaining connectivity of the main roads (County Road 42 and Baseline Road).

For the microsimulation analysis, the adjacent Airport Access and Airport Egress ('Stop-Controlled') intersections are also included. The 2031 projected traffic volume for morning and afternoon peak hours are presented in **Exhibit 38**.

Exhibit 38: 2031 Traffic Volumes at CR 42 and Concession Road 7



The proposed lane configurations at the County Road 42/ Concession Road 7/ Baseline Road intersection is presented in **Exhibit 39** and future (2031) intersection capacity analysis results are summarized in **Exhibit 40.**

Exhibit 39: Lane Configurations at CR 42 and Concession Road 7

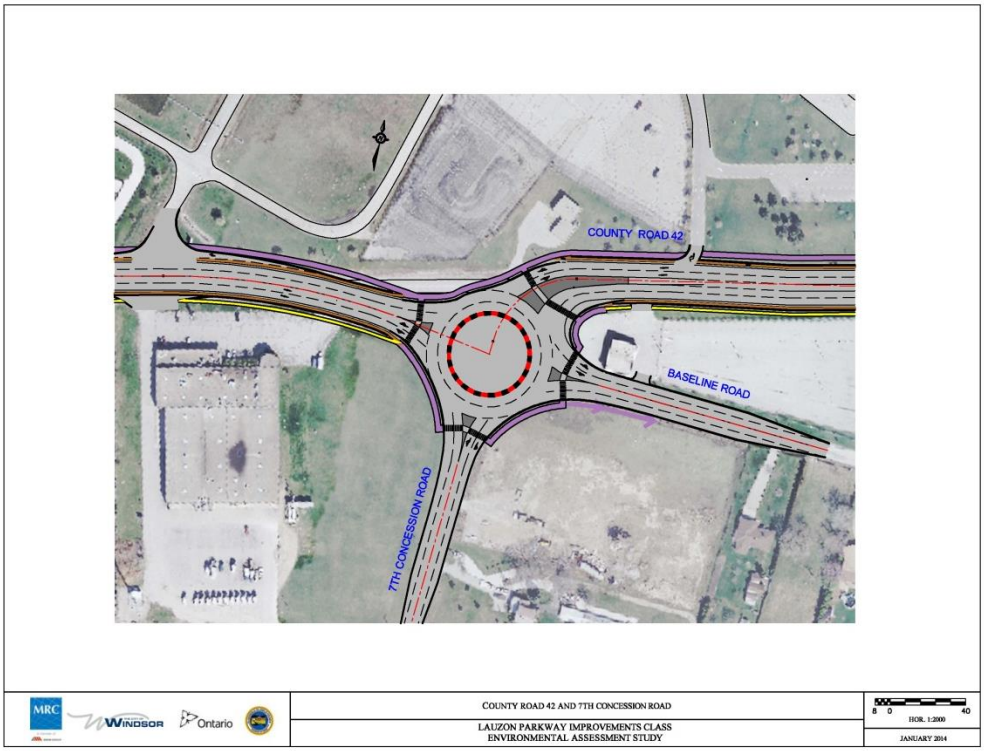


Exhibit 40: 2031 Intersection Capacity Analysis for CR 42/Concession Road 7/Baseline Road

Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue[1] (m)	V/C	Delay (s)	LOS	Queue[1] (m)
CR 42 at Concession Road 7 (Roundabout)		***4***	***A***			***3***	***A***	
Eastbound Left	-	2	A	13	-	3	A	13
Eastbound Through	-	2	A	17	-	2	A	17
Eastbound Right	-	2	A	17	-	2	A	17
Westbound Left	-	2	A	18	-	2	A	19
Westbound Through	-	2	A	18	-	2	A	19
Westbound Right	-	2	A	20	-	2	A	21
Northbound Left	-	14	B	29	-	8	A	14
Northbound Through	-	11	B	29	-	5	A	14
Northbound Right	-	6	A	29	-	3	A	14
North-Westbound Left	-	9	A	22	-	5	A	13
North-Westbound Through	-	8	A	23	-	4	A	15
North-Westbound Right	-	9	A	23	-	4	A	15
CR 42 at Airport Access (Stop-control)		-	-			-	-	
Eastbound Left	-	3	A	6	-	3	A	3
Eastbound Through	-	0	A	0	-	0	A	0
Westbound Through	-	0	A	0	-	0	A	0
Westbound Right	-	0	A	0	-	0	A	0
CR 42 at Airport Egress (Stop-control)		-	-			-	-	
Eastbound Through	-	0	A	0	-	0	A	0
Westbound Through	-	0	A	0	-	0	A	0
Southbound Left	-	13	B	12	-	18	C	21
Southbound Right	-	8	A	13	-	9	A	22

Note: 1. Queue length reflects 95th percentile conditions

The proposed roundabout is expected to provide a good level of service (overall LOS 'A') during both peak hours and improve the traffic operations. All the movements at this roundabout are expected to operate with a LOS 'B' or better for 2031 traffic demand. The queue length for all the movements at roundabout is expected to be less than 30 m.

The critical movement for Airport Access and Airport Egress is the southbound left-turning movement at Airport Egress. This movement would operate at LOS 'B' for the morning peak hour (13 seconds delay) and at LOS 'C' for the afternoon peak hour (18 seconds delay), respectively.

4.3 CR 42 at Concession Road 8

The existing intersection of Concession Road 8 is operating with 'Stop-Controlled'. The proposed development in Sandwich South Secondary Plan and Airport Lands would result in high demand at this intersection and therefore this intersection would be warranted for the signalized controlled. Based on alternative evaluation, this intersection is recommended to improve with 2-lane roundabout.

With the proposed development, the Airport Master Plan recommends a future access to the Airport Lands (north approach) at this intersection. Therefore, this intersection is analyzed assuming 4-leg roundabout. The proposed lane configurations for this intersection are presented in **Exhibit 41**.

Exhibit 41: Lane Configurations at CR 42 and Concession Road 8

The forecasted traffic volumes for 2031 morning and afternoon peak hours are presented respectively in **Exhibit 2** and **Exhibit 3**. The intersection capacity analysis for the proposed roundabout at this intersection was analyzed using the VISSIM microsimulation model. The intersection capacity analysis results are presented in **Exhibit 42**.

Exhibit 42: 2031 Intersection Capacity Analysis for CR 42 and Concession Road 8

Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue[1] (m)	V/C	Delay (s)	LOS	Queue[1] (m)
CR 42 at Concession Road 8 (Roundabout)		***3***	***A***			***2***	***A***	
Eastbound Left								7
Eastbound Through	-	2	A	8	-	2	A	7
Eastbound Right	-	2	A	8	-	2	A	7
Westbound Left	-	1	A	8	-	1	A	3
Westbound Through	-	6	A	22	-	2	A	3
Westbound Right	-	5	A	22	-	2	A	3
Northbound Left	-	3	A	22	-	1	A	0
Northbound Through	-	4	A	0	-	3	A	0
Northbound Right	-	4	A	0	-	3	A	0
Southbound Left	-	4	A	0	-	4	A	0
Southbound Through	-	4	A	0	-	4	A	0
Southbound Right	-	4	A	0	-	3	A	0
	-	2	A	0	-	3	A	0

Note: 1. Queue length reflects 95th percentile conditions

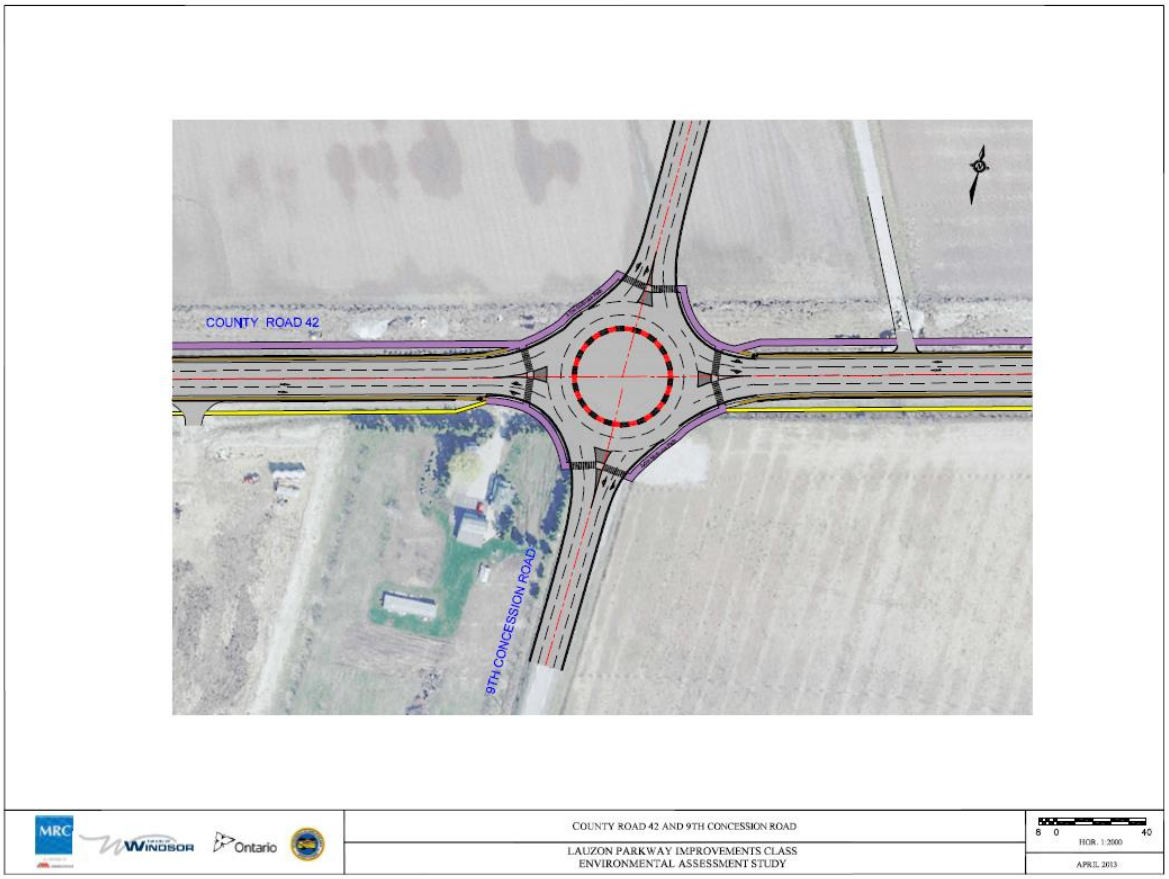
As presented in **Exhibit 42**, the proposed roundabout is expected to provide good level of service (LOS 'A') for the future (2031) traffic demand.

4.4 CR 42 at Concession Road 9

The existing intersection of Concession Road 9 is operating with 'Stop-Controlled'. The proposed development in Sandwich South Secondary Plan and Airport Lands would result in high demand at this intersection, and this intersection could be required traffic signals/roundabout in order to operate with an acceptable level of service. Based on alternative evaluation and intersection capacity analysis, this intersection is recommended to be improved with a provision of a roundabout.

As the Airport Master Plan recommends a future access to the Airport Lands (north approach) at this intersection,, this intersection is analyzed assuming 4-leg roundabout. The proposed lane configuration for 2031 at this intersection is presented in **Exhibit 43**.

Exhibit 43: Lane Configurations at CR 42 and Concession Road 9



The forecasted traffic volumes for 2031 morning and afternoon peak hours are presented in **Exhibit 2** and **Exhibit 3,** respectively. The intersection capacity analysis for the proposed roundabout at this intersection was analyzed using the *VISSIM* model. The future level-of-services are summarized in **Exhibit 44**.

Exhibit 44: 2031 Intersection LOS for CR 42 and Concession Road 9

Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue[1] (m)	V/C	Delay (s)	LOS	Queue[1] (m)
CR 42 at Concession Road 9 (Roundabout)		***4***	***A***			***4***	***A***	
Eastbound Left	-	2	A	7	-	7	A	23
Eastbound Through	-	2	A	7	-	5	A	23
Eastbound Right	-	1	A	7	-	3	A	23
Westbound Left	-	5	A	23	-	2	A	5
Westbound Through	-	5	A	23	-	2	A	5
Westbound Right	-	3	A	23	-	1	A	5
Northbound Left	-	5	A	2	-	5	A	0
Northbound Through	-	6	A	2	-	5	A	0
Northbound Right	-	5	A	2	-	4	A	0
Southbound Left	-	8	A	7	-	6	A	13
Southbound Through	-	7	A	7	-	6	A	13
Southbound Right	-	3	A	7	-	4	A	13

Note: 1. Queue length reflects 95th percentile conditions

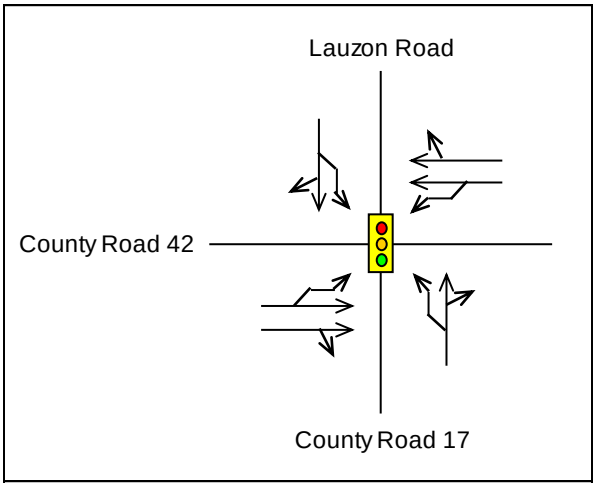
All the movements at this intersection are expected to operate with a good level of service (LOS 'A') during both the morning and afternoon peak hours with the future (2031) traffic demand.

4.5 CR 42 at Concession Road 10/Lauzon Road

The intersection with Lauzon Road is planned to connect with the re-aligned County Road 17/Concession Road 10 at County Road 42. This is expected to occur beyond 2031 and prior to that development, the intersection of CR 17/Concession Road 10 would remain as a right-in-right-out (RIRO).

The intersection at Concession Road 17/Lauzon Road at County Road 42 is recommended as a signalized intersection due to the proximity to Lauzon Parkway intersection. The intersection capacity analysis was conducted assuming 4-leg, as worse-case condition. The proposed lane configurations with realigned CR 17/ Concession Road 10 are presented in **Exhibit 45**.

Exhibit 45: 2031 Lane Configuration at CR 42 and Lauzon Road



The intersection capacity analysis results are presented in **Exhibit 46**.

Exhibit 46: 2031 Intersection LOS for CR 42 and Lauzon Road

Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue[1] (m)	V/C	Delay (s)	LOS	Queue[1] (m)
CR 42 at Lauzon Road (Signalized)		***11***	***B***			***19***	***B***	
Eastbound Left	0.07	5	A	4	0.40	9	A	23
Eastbound Through/Right	0.37	5	A	43	0.47	11	B	70
Westbound Left	0.38	9	A	27	0.09	16	B	8
Westbound Through/Right	0.46	6	A	58	0.53	19	B	82
Northbound Left	0.50	47	D	21	0.28	29	C	26
Northbound Through/Right	0.27	26	C	21	0.66	24	C	36
Southbound Left	0.47	41	D	29	0.72	46	D	50
Southbound Through/Right	0.56	14	B	27	0.29	33	C	26

Note: 1. Queue length reflects 95th percentile conditions

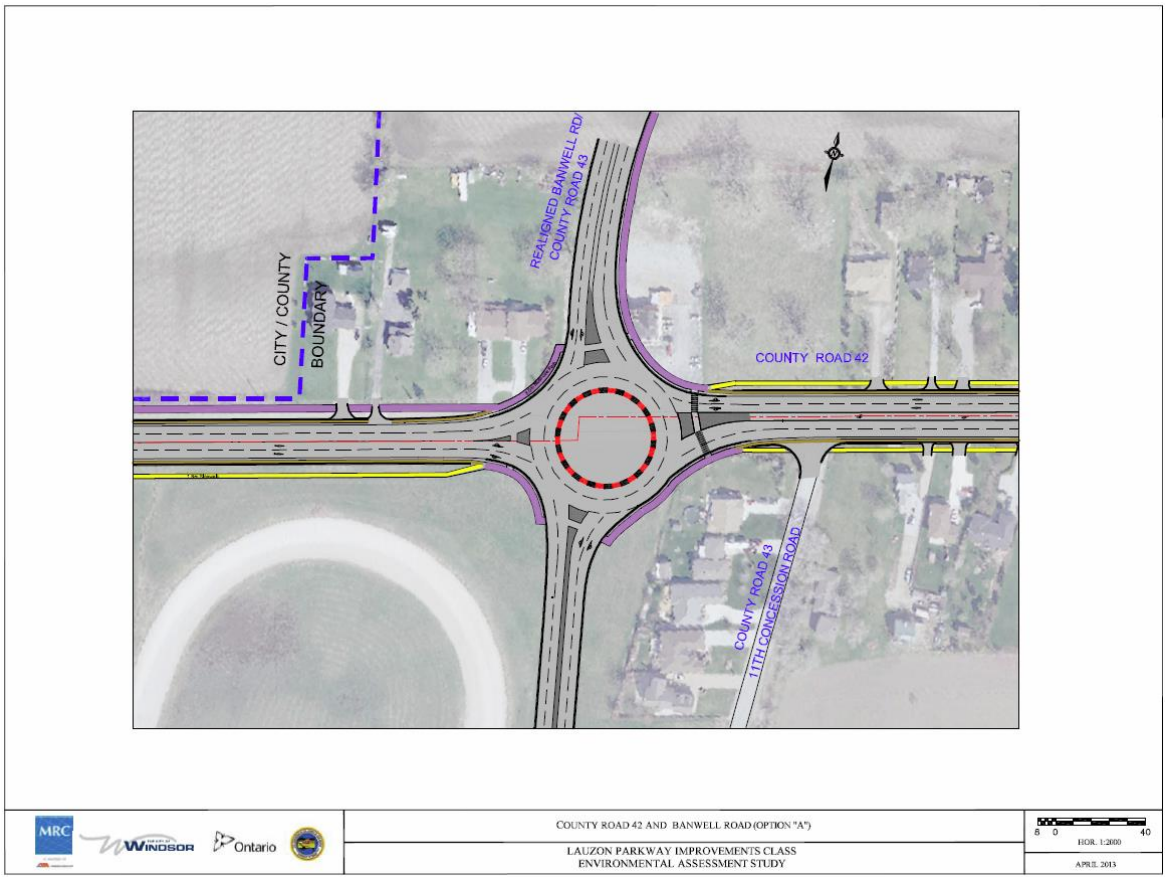
This overall intersection is expected to operate at LOS 'B', and all the movements at this intersection are expected to operate with an acceptable (LOS 'D' or better) during both the peak hours. The maximum V/C ratio is 0.72 for southbound left movement for the afternoon peak hour. Dedicated left-turn storage lanes are recommended on all approaches.

4.6 CR 42 at CR 43 (Banwell Road)

The County's County Road 43 (Banwell Road) EA (2009) recommends re-alignment of Banwell Road and 11th Concession Road at County Road 42. It is anticipated that this proposed improvement for Banwell Road will be planned in concert with the County Road 42 improvements.

The Banwell Road EA recommended signalized intersections. However, based on the proposed road network improvement work-programs (provided by the City of Windsor and the County of Essex and MTO), and updated land use (population and employment provided by the City of Windsor and the County of Essex) assumptions, the intersection capacity analysis undertaken for this EA confirmed that a roundabout (2-lane) at this intersection would provide acceptable level-of-service. The recommended lane configurations at this intersection are presented in **Exhibit 47**.

Exhibit 47: Lane Configurations at CR 42 and CR 43 (Banwell Road)



The intersection capacity analysis was conducted assuming above lane configurations using micro-simulation (VISSIM) model. The projected traffic volume for 2031 morning and afternoon peak hour (presented respectively in **Exhibit 2** and **Exhibit 3**) was used for this analysis. The intersection capacity analysis results are presented in **Exhibit 48**.

Exhibit 48: 2031 Intersection Capacity Analysis for CR 42 and CR 43 (Banwell Road)

Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue[1] (m)	V/C	Delay (s)	LOS	Queue[1] (m)
CR 42 at CR 43 (Banwell Road) (Roundabout)		***8***	***A***			***4***	***A***	
Eastbound Left	-	5	A	23	-	4	A	19
Eastbound Through	-	4	A	23	-	3	A	19
Eastbound Right	-	2	A	23	-	2	A	19
Westbound Left	-	5	A	24	-	5	A	21
Westbound Through	-	5	A	24	-	5	A	21
Westbound Right	-	2	A	24	-	1	A	21
Northbound Left	-	17	C	21	-	14	B	14
Northbound Through	-	12	B	21	-	13	B	14
Northbound Right	-	3	A	21	-	3	A	14
Southbound Left	-	27	D	74	-	5	A	8
Southbound Through	-	9	A	74	-	5	A	8
Southbound Right	-	4	A	74	-	1	A	8

Note: 1. Queue length reflects 95th percentile conditions

The proposed roundabout is expected to provide good level of service (LOS 'A') during both peak hours. All the movements at this intersection are expected to operate with an acceptable level of service (LOS 'D' or better) during both morning and afternoon peak hours of 2031.

It is expected that widening and realigning of County Road 43 (Banwell Road) and widening of County Road 42 may not coincide. In that condition, if County Road 43 widened before County Road 42 or visa-versa; it is recommended that the intersection at this location should be improved with 2-lane roundabout with re-alignment of County Road 43 from Shields Drive to 11th Concession Road and widening of County Road 42 to 4-lanes.

4.7 CR 42 at Lesperance Road

The Lesperance Road intersection will remain signalized. An analysis for this intersection indicated that a roundabout could accommodate the future traffic volume. However, the significant cost of property acquisition for roundabout construction and the negative effect on the surrounding area outweighs the minor benefit to LOS that the roundabout holds. The gas station in the northwest quadrant would have to be removed as well as the structure in the southwest quadrant to make way for the roundabout. Additionally, with a school close by there is potentially a large body of students that cross at this intersection which could be a safety issue. There is adequate distance between Lesperance Road and County Road 19 (Manning Road) so that there are no potential proximity concerns.

The proposed lane configurations at this intersection are presented in **Exhibit 49**.

Exhibit 49: Lane Configurations at CR 42 and Lesperance Road

The intersection capacity analysis for 2031 traffic demand was analyzed using *Synchro* model. The intersection capacity analysis results are presented in **Exhibit 50**.

Exhibit 50: 2031 Intersection Capacity Analysis for CR 42 and Lesperance Road

Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue[1] (m)	V/C	Delay (s)	LOS	Queue[1] (m)
CR 42 at Lesperance Road (Signalized)		***16***	***B***			***9***	***A***	
Eastbound Left								
Eastbound Through/Right	0.36	9	A	18	0.32	9	A	17
Westbound Left	0.48	11	B	73	0.50	8	A	56
Westbound Through	0.12	16	B	10	0.24	8	A	12
Westbound Right	0.60	19	B	100	0.44	7	A	48
Northbound Left	0.11	5	A	9	0.17	1	A	6
Northbound Through/Right	0.11	25	C	12	0.13	26	C	9
Southbound Left	0.35	17	B	18	0.24	18	B	16
Southbound Through/Right	0.54	34	C	44	0.37	31	C	23
	0.45	18	B	27	0.41	11	B	17

Note: 1. Queue length reflects 95th percentile conditions

With the future traffic demand, this intersection is expected to provide good level of service during both peak hours. All the movements at this intersection are expected to operate with LOS 'C' or better. The maximum V/C ratio is 0.60 for westbound through/right movement for the morning peak hour.

4.8 CR 42 at CR 19 (Manning Road)

The County's County Road 19 (Manning Road) EA recommended 4-lane widening of Manning Road and signalized intersections at County Road 42. However, based on the proposed road network improvement work-programs (provided by the City of Windsor and the County of Essex and MTO), and updated land use (population and employment provided by the City of Windsor and the County of Essex) assumptions, the intersection capacity analysis undertaken for this EA confirmed that the intersection at County Road 19 (Manning Road) and County Road 42 would provide acceptable level-of-service with multi-lane (2-lane) roundabout. The proposed lane configurations for this intersection are presented in **Exhibit 51**.

Exhibit 51: Lane Configurations at CR 42 and CR 19 (Manning Road)

The intersection capacity analysis is conducted assuming above lane configurations using VISSIM microsimulation model. The projected traffic volume for 2031 morning and afternoon peak hour (presented respectively in **Exhibit 2** and **Exhibit 3**) was used for this analysis. The intersection capacity analysis results are presented in **Exhibit 52**.

Exhibit 52: 2031 Intersection Capacity Analysis for CR 42 and CR 19 (Manning Road)

Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue[1] (m)	V/C	Delay (s)	LOS	Queue[1] (m)
CR 42 at CR 19 (Manning Road) (Roundabout)		***9***	***A***			***12***	***B***	
Eastbound Left	-	9	A	50	-	7	A	28
Eastbound Through	-	8	A	50	-	6	A	28
Eastbound Right	-	5	A	50	-	3	A	28
Westbound Left	-	9	A	33	-	12	B	58
Westbound Through	-	8	A	33	-	12	B	58
Westbound Right	-	5	A	33	-	9	A	58
Northbound Left	-	12	B	35	-	23	C	73
Northbound Through	-	9	A	35	-	18	C	73
Northbound Right	-	6	A	35	-	11	B	73
Southbound Left	-	21	C	52	-	17	C	40
Southbound Through	-	17	C	52	-	15	B	40
Southbound Right	-	7	A	52	-	9	A	40

Note: 1. Queue length reflects 95th percentile conditions

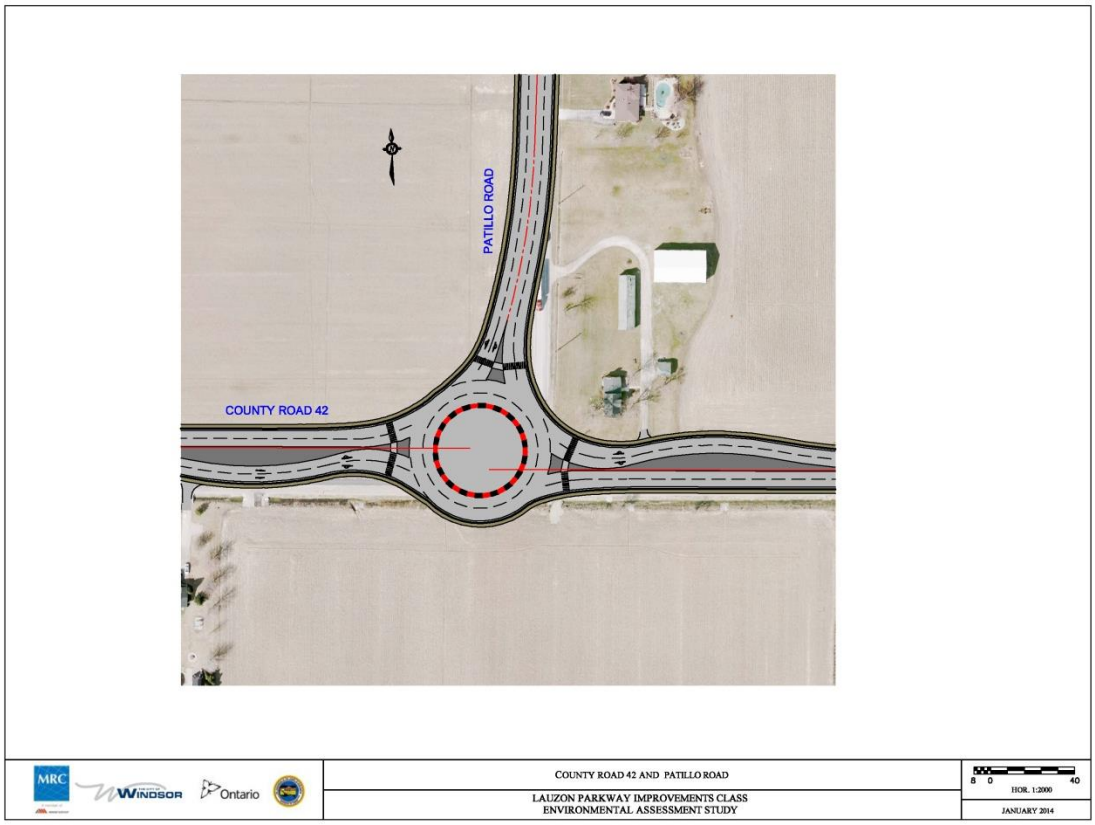
All the movements at this intersection are expected to operate under the LOS 'C' or better during both peak hours for 2031. To assess an impact on this intersection without Lauzon Parkway, a sensitivity analysis was conducted. A technical memorandum presenting this sensitivity analysis is included in **Appendix B.**

It is expected that widening of County Road 19 (Manning Road) and County Road 42 may not coincide. In that condition, if County Road 19 widened before County Road 42 or visa-versa; it is recommended that the intersection at this location should be improved with 2-lane roundabout and both roadways would be widened to 4 lanes approaching this intersection.

4.9 CR 42 at Patillo Road

With the future widening of County Road 42, this intersection is recommended to convert in a 2-lane roundabout. The proposed lane configurations for 2031 at this intersection are presented in **Exhibit 53**.

Exhibit 53: Lane Configurations at CR 42 and Patillo Road



The intersection capacity analysis was conducted assuming above lane configurations using VISSIM microsimulation model. The analysis was conducted for 2031 projected traffic volumes. The intersection capacity analysis results are presented in **Exhibit 54**.

Exhibit 54: 2031 Intersection Capacity Analysis for CR 42 and Patillo Road

Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue[1] (m)	V/C	Delay (s)	LOS	Queue[1] (m)
CR 42 at Patillo Road (Roundabout)		***6***	***A***			***2***	***A***	
Eastbound Left	-	2	A	4	-	3	A	13
Eastbound Through	-	1	A	4	-	2	A	13
Westbound Through	-	12	B	65	-	3	A	10
Westbound Right	-	9	A	65	-	2	A	10
Southbound Left	-	5	A	0	-	3	A	1
Southbound Right	-	2	A	0	-	2	A	1

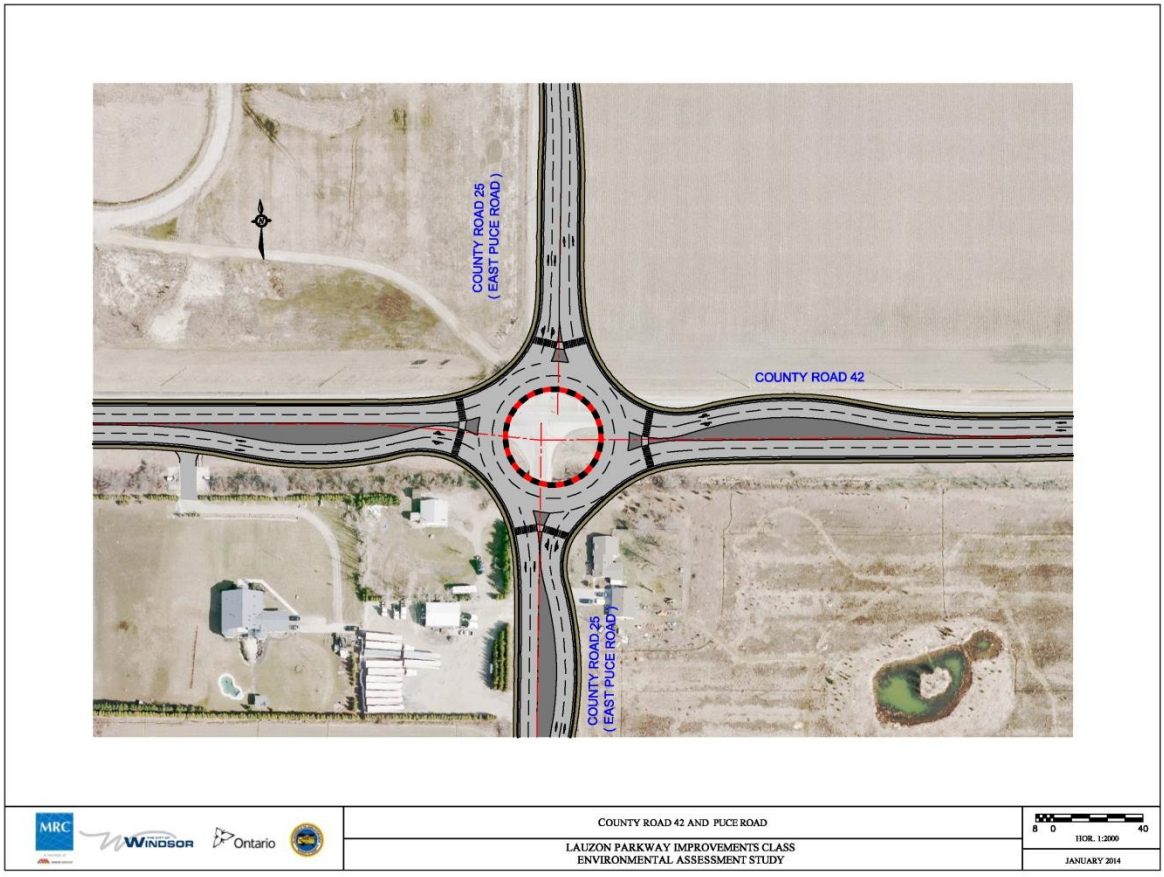
Note: 1. Queue length reflects 95th percentile conditions

The proposed roundabout is expected to provide good level of service (LOS 'A'). All the movements are expected to operate with overall LOS 'A' during both peak hours. All the movements at this roundabout are expected to operate with LOS 'B' or better.

4.10 CR 42 at CR 25 (East Puce Road)

With the future widening of County Road 42, this intersection is recommended to convert in a 2-lane roundabout. The proposed lane configurations for this intersection are presented in **Exhibit 55**.

Exhibit 55: Lane Configurations at CR 42 and CR 25 (East Puce Road)



The intersection capacity analysis was conducted assuming above lane configurations using VISSIM microsimulation model. The analysis was conducted for 2031 projected traffic volumes. The intersection capacity analysis results are presented in **Exhibit 56**.

Exhibit 56: 2031 Intersection Capacity Analysis for CR 42 and CR 25 (East Puce Road)

Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue[1] (m)	V/C	Delay (s)	LOS	Queue[1] (m)
CR 42 at CR 25 (East Puce Road) (Roundabout)		***2***	***A***			***2***	***A***	
Eastbound Left	-	2	A	0	-	1	A	0
Eastbound Through	-	1	A	0	-	1	A	0
Eastbound Right	-	1	A	0	-	1	A	0
Westbound Left	-	2	A	5	-	1	A	0
Westbound Through	-	2	A	5	-	2	A	0
Westbound Right	-	1	A	5	-	1	A	0
Northbound Left	-	2	A	0	-	3	A	3
Northbound Through	-	4	A	0	-	3	A	3
Northbound Right	-	3	A	0	-	3	A	3
Southbound Left	-	3	A	3	-	2	A	0
Southbound Through	-	3	A	3	-	2	A	0
Southbound Right	-	2	A	5	-	1	A	0

Note: 1. Queue length reflects 95th percentile conditions

The movements at this intersection are expected to operate with a good level of service (LOS 'A') during 2031 peak hours.

4.11 Turning Lane Requirement on CR42 at CR21 (Elmstead Road), Wallace Line Road, and West Puce Road

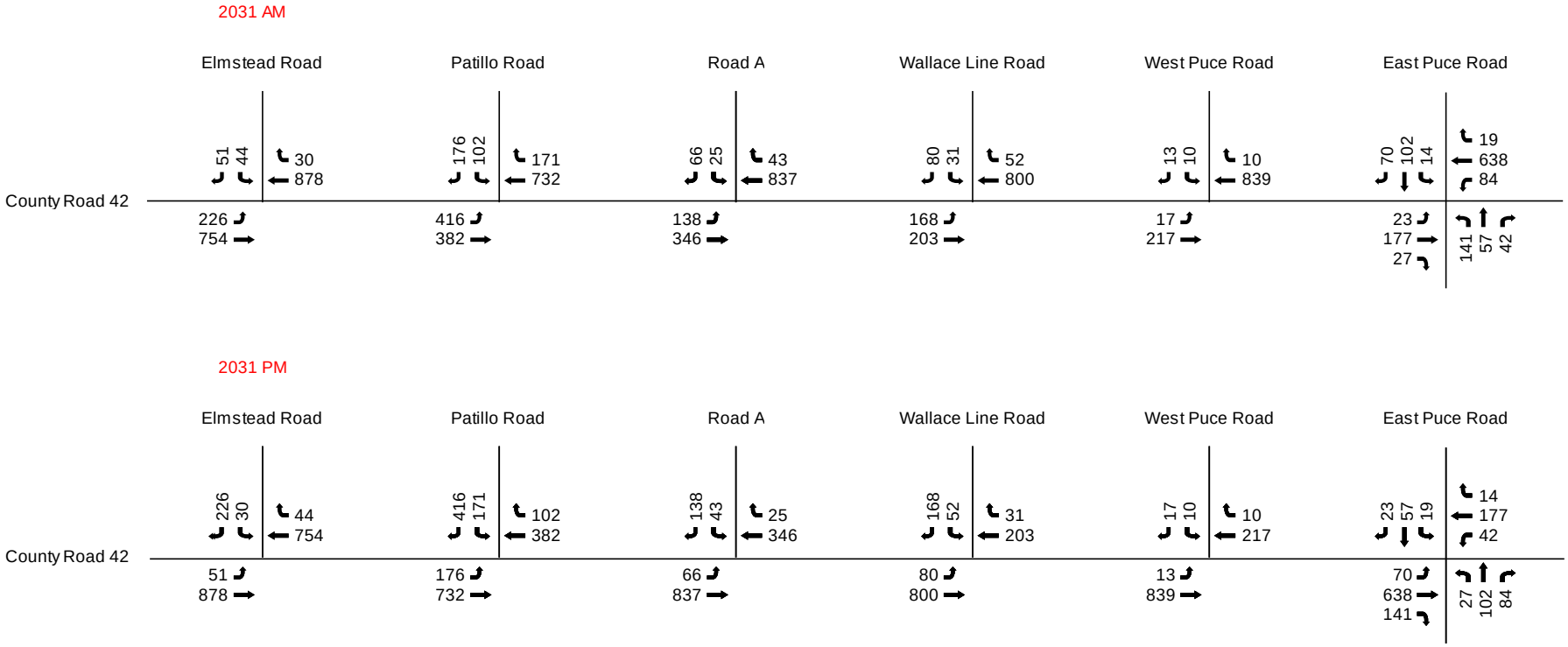
The CR 21 (Elmstead Road), Wallace Line Road, and West Puce Road intersections at CR 42 are operating with a 'Stop' sign. Currently, there are no storage lanes available on CR 42 for the turning traffic. With the increase in traffic demand, the turning traffic could block the through traffic travelling on CR 42, which could lead to some traffic operational issues. As these intersections are not warranted for the traffic signals, the need for the turning lanes requirements are being assessed for these major corridors assuming the unsignalized intersection configuration considering 4-lane on CR 42 with a posted speed of 100 km/h. The left turn lane requirements are being assessed using the *Geometric Design Standards for Ontario Highways*[1] and right-turn lane requirements using the study report for the *County Road 42 – Corridor Protection Strategy*[2], prepared for the County of Essex.

However, with increased traffic volume in the future and additional traffic demand from the proposed development (Advance/Patillo, Wallace Woods, and River Ridge) north of County Road 42, dedicated turning lanes would be required at these three major intersections to provide adequate service.

The projected morning and afternoon peak hour traffic volume for year 2031 at these intersections are presented in **Exhibit 57**.

[1] *Geometric Design Standards for Ontario Highways*, Ministry of Transportation, 1985.
[2] *County Road 42- Corridor Protection Strategy, County of Essex, December 2006*.

Exhibit 57: 2031 Traffic Volumes on CR 42 at CR21 (Elmstead Road), Wallace Line Road, and West Puce Road



As per a previous study *County Road 42 – Corridor Protection Strategy* submitted to the County of Essex, the dedicated right turn lane would be required for a 4-lane arterial if the number of right turn vehicles exceed 50 per hour, and the direct taper would be required if the number of right turn vehicles exceed 10 per hour (refer to **Exhibit 58**). Therefore, parallel lane and taper would be recommended at Wallace Line Road (with 52 vehicles for morning peak hour); direct taper would be recommended at County Road 21 (Elmstead Road) and West Puce Road.

Exhibit 58: Traffic Volume Thresholds for Right Turn Lane Requirement

Facility	Number of Right Turning Vehicles (vph)	
	Right-Turn Lane Threshold	**Right-Turn Direct Taper Threshold**
4-lane Arterial	50	10
2-lane Arterial	40	All

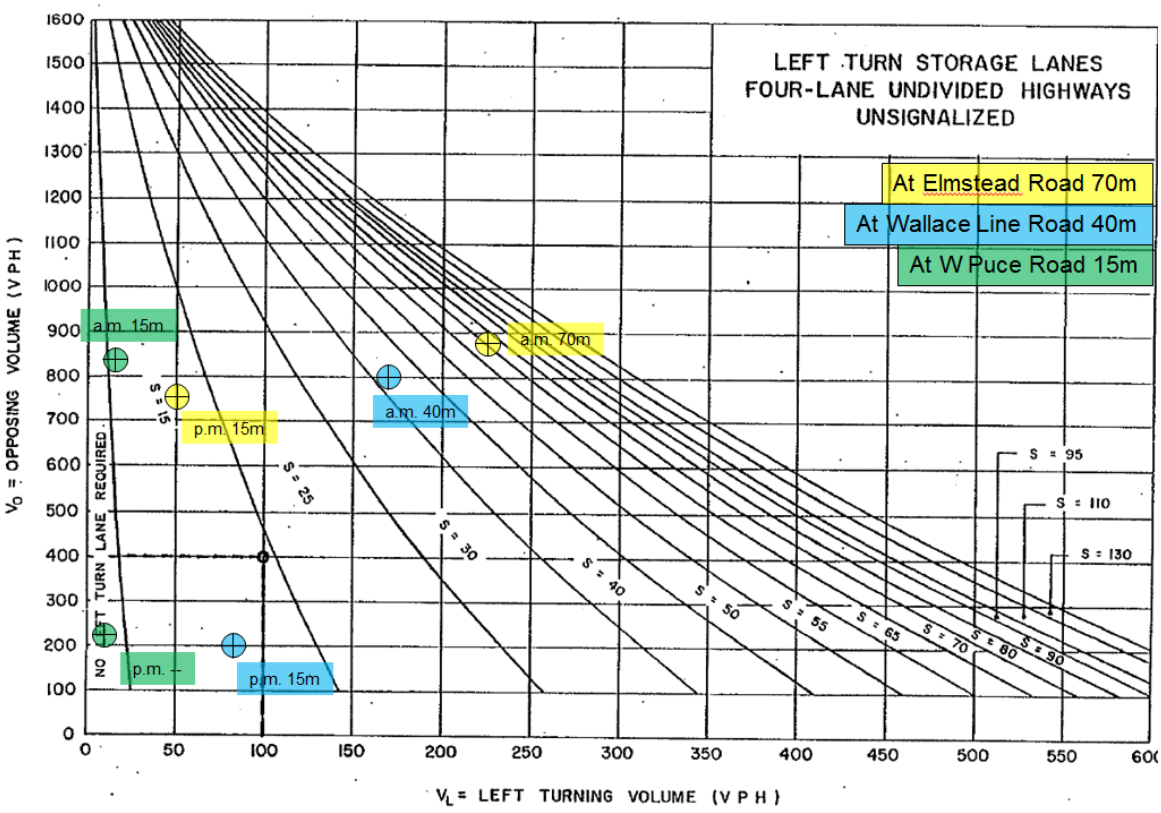
The potential requirement for a separate eastbound left turn lane was assessed on the basis of the left-turn lane warrant criteria for four-lane undivided highways, outlined in the *Geometric Design Standards for Ontario Highway*.

The left-turn lane warrant criteria are a function of the opposing volume (V_O) and the left-turn volume (V_L). The relationship between the opposing and advancing left-turn volume determines whether the warrant for a left-turn lane is satisfied. If the relationship falls to the right of the *warrant line*, then the criteria are satisfied. Right of the warrant line, 'S', indicates the length of the storage lane in metres.

The left turn storage length requirement at the un-signalized intersection of Elmstead Road, Wallace Line Road and West Puce Road is presented in **Exhibit 59**.

Based on the projected traffic volumes, the recommended left-turn storage lane lengths on County Road 42 at these three intersections are plotted on the exhibit: 70 meters at County Road 21 (Elmstead Road), 40 meters at Wallace Line Road, and 15 meters at West Puce Road.

Exhibit 59: Traffic Volume Thresholds for Left-turn Lane Requirement



A summary for the turning lane requirement on County Road 42 at these three intersections is presented in **Exhibit 60.** It is noted that as per the *Ontario Highway Geometric Design Standards*, with 100 km per hour of the design speed on County Road 42, the length requirements for left turn parallel lane and taper are 70 meters and 160 meters, respectively; the length requirements for right turn parallel lane and taper are 85 meters and 80 meters, respectively. Generally, a 60 meter direct taper is of sufficient length for deceleration for right turn movement.

Exhibit 60: Summary of Turning Lane Requirement

CR 42 at Elmstead Road

Peak Hour	2031 Traffic Volumes (vph)			Left Turn Requirement (m)			Right Turn Requirement (m)	
	EB V_L	WB V_O	WB V_R	Storage Length	Parallel Lane	Taper	Parallel Lane	Taper
AM Peak Hour	226	878	30	70	70	160	-	80
PM Peak Hour	51	754	44					

CR 42 at Wallace Line Road

Peak Hour	2031 Traffic Volumes (vph)			Left Turn Requirement (m)			Right Turn Requirement (m)	
	EB V_L	WB V_O	WB V_R	Storage Length	Parallel Lane	Taper	Parallel Lane	Taper
AM Peak Hour	168	800	52	40	70	160	85	80
PM Peak Hour	80	203	31					

CR 42 at West Puce Road

Peak Hour	2031 Traffic Volumes (vph)			Left Turn Requirement (m)			Right Turn Requirement (m)	
	EB V_L	WB V_O	WB V_R	Storage Length	Parallel Lane	Taper	Parallel Lane	Taper
AM Peak Hour	17	839	10	15	70	160	-	80
PM Peak Hour	13	217	10					

V_L: Left turn volume

V_O: Opposite through movement volume

V_R: Right turn volume

- : Parallel Lane not required due to low right turn volume

5. EAST-WEST ARTERIAL INTERSECTIONS

East-West Arterial, a new east-west linkage is needed within the future Sandwich South community, which will provide a spine within the transportation network and support the future development capacity demands of the community. The Future East-West Arterial has been identified in the *Windsor Annexed Area Master Plan Study* (2006) from Walker Road to County Road 17. The section between Walker Road and 8th Concession Road has also been conceptually identified in the *East Pelton Secondary Plan* (2009). As part of the Sandwich South Secondary Plan Study, corridor protection will be included for a potential extension of the roadway from County Road 17/Concession Road 10 to the City boundary, which would provide a potential future opportunity for connection to the Town of Tecumseh.

The proposed development around East-West Arterial is expected to start around year 2024. Based on the travel demand modelling analysis for year 2031, East-West Arterial is proposed with 2-lane arterial road Class II capacity. Beyond 2031, the E-W Arterial would require to be widening from 2 to 4 lanes when volume reaches approximately 700 vph in peak direction. The summary of the proposed intersections on E-W Arterial is presented in **Exhibit 61.**

Exhibit 61: Summary of Proposed East-West Arterial Intersections

Intersecting Road	Existing Intersection	Future Intersection Required	Potential for Roundabout	Acceptable LOS for Roundabout	Proposed Control Type
Walker Road/ Legacy Park Drive/ 7th Concession Road	Signalized	Signalized	✓	X	Signalized
Concession Road 8	N/A	Signalized	✓	✓	Roundabout
Concession Road 9	N/A	Signalized	✓	✓	Roundabout
Lauzon Parkway	N/A	Signalized	✓	X[1]	Roundabout[1]
County Road 17 (Concession Road 10)	N/A	Signalized	✓	✓	Roundabout

Note 1: The LOS for a roundabout is acceptable up to 2021, but a roundabout will not meet 2031 demands.

5.1 East-West Arterial at Walker Road

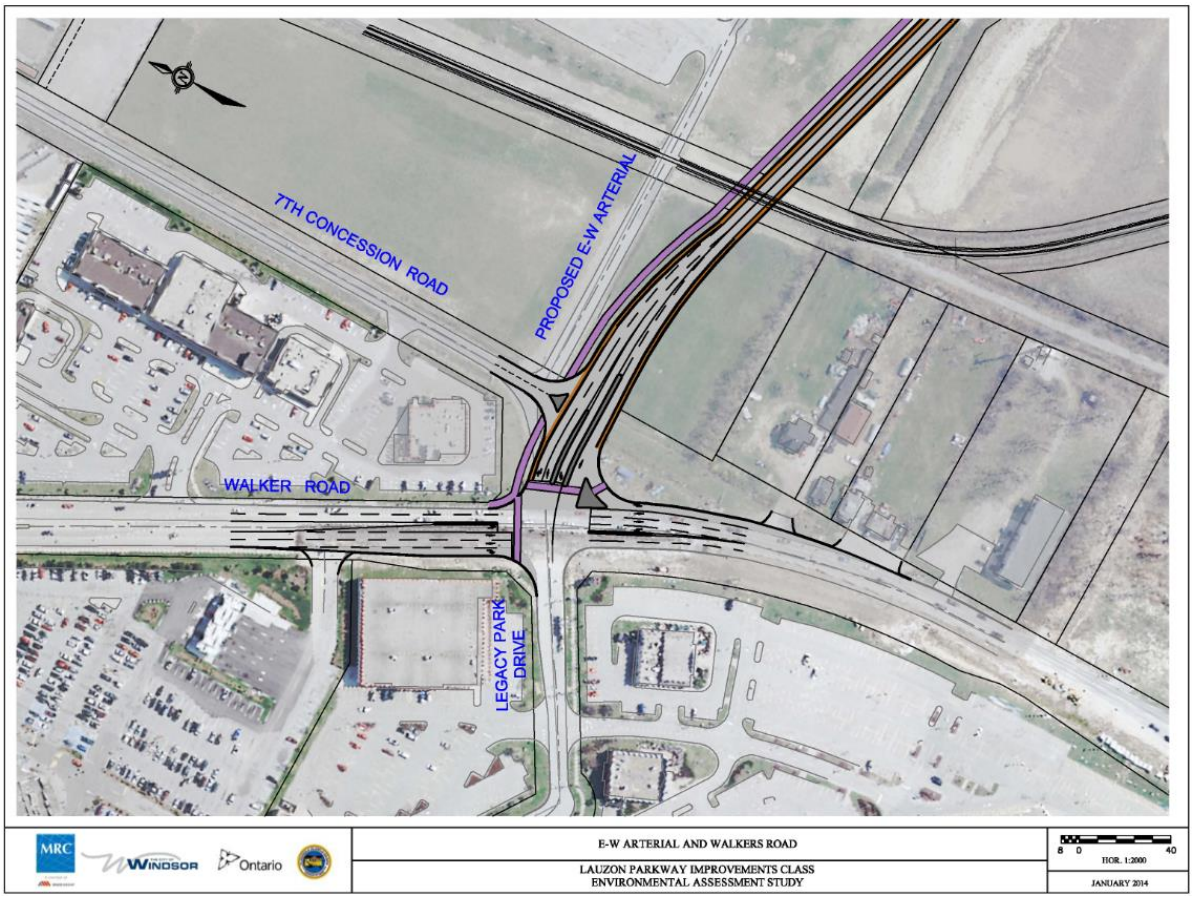
The existing Walker Road/Legacy Park Drive/7th Concession Road intersection is a 4-leg signalized intersection. The E-W Arterial is proposed to connect at this intersection and that could create a complex intersection configuration. To improve the safety and operations of this intersection, consideration is being given to various options including a 5-leg roundabout. The intersection operational analysis results indicated that with the projected traffic volume, the roundabout would not provide an acceptable level-of-service and would result in longer delays and queues. The roundabout option would also result in property impacts to both the Montana's Restaurant (south-west corner) and Staples Store (north-west corner). The details of roundabout analysis are described in a technical memorandum, included in **Appendix C**.

This intersection is recommended to remain signalized by connecting 7th Concession Road to the proposed E-W Arterial with a right-in-right-out (RIRO) connection. At the intersection with Walker Road, a single through lane will be provided for the westbound E-W Arterial, as well as exclusive left and right turn lanes. To address the close proximity of the intersection along the E-W Arterial at Walker Road and 7th Concession Road the following measure are required:

- A median island separating eastbound traffic from westbound traffic will prevent eastbound left-turns onto 7th Concession Road.
- Raised curb separating westbound left-turn traffic will prevent southbound access from 7th Concession Road to Walker Road. These will eliminate unsafe traffic operations.

The lane configurations for this intersection are presented in **Exhibit 62.**

Exhibit 62: Lane Configuration at East-West Arterial and Walker Road



The intersection capacity analysis with signalized control is analyzed using Synchro software for the forecasted traffic volumes. The analysis results are summarized in **Exhibit 63**.

Exhibit 63: 2031 Intersection Capacity Analysis for East-West Arterial and Walker Road

Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue[1] (m)	V/C	Delay (s)	LOS	Queue[1] (m)
East-West Arterial at Walker Road (Signalized)		***25***	***C***			***33***	***C***	
Eastbound Left	0.29	26	C	29	0.33	22	C	35
Eastbound Through/Right	0.65	41	D	44	0.56	36	D	48
Westbound Left	0.71	38	D	60	0.73	35	D	70
Westbound Through	0.35	41	D	32	0.21	34	C	27
Westbound Right	0.54	10	A	21	0.38	7	A	17
Northbound Left	0.30	12	B	15	0.40	18	B	17
Northbound Through	0.86	34	C	185	0.94	49	D	171
Northbound Right	0.40	10	A	38	0.28	2	A	14
Southbound Left	0.60	25	C	44	0.67	29	C	58
Southbound Through	0.62	21	C	126	0.86	34	C	194
Southbound Right	0.14	2	A	8	0.12	1	A	9

Note: 1. Queue length reflects 95th percentile conditions

With the optimized signal timing and recommended lane configurations, this intersection is expected to operate with an (overall) LOS 'C' during both peak hours for 2031 traffic demand. All the movements are expected to operate with LOS 'D' or better during both peak hours. The maximum V/C ratio is 0.86 for northbound through movement for the afternoon peak hour and 0.94 during afternoon peak hour. Dedicated left-turning storage lanes are recommended on all approaches. Dedicated right-turn lanes are recommended for northbound and southbound approaches on Walker Road and for westbound approach on E-W Arterial.

5.2 East-West Arterial at Concession Road 8

A single lane roundabout is proposed at E-W Arterial and Concession Road 8 intersection. The proposed lane configurations are presented in **Exhibit 64**.

Exhibit 64: Lane Configuration at E-W Arterial and Concession Road 8

The intersection capacity analysis was conducted using VISSIM model and resulting level of service are presented in **Exhibit 65**.

Exhibit 65: 2031 Intersection Capacity Analysis for E-W Arterial and Concession Road 8

Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue[1] (m)	V/C	Delay (s)	LOS	Queue[1] (m)
East-West Arterial at Concession Road 8 (Roundabout)		***5***	***A***			***4***	***A***	
Eastbound Left	-	4	A	20	-	4	A	15
Eastbound Through	-	5	A	20	-	4	A	15
Eastbound Right	-	5	A	20	-	4	A	15
Westbound Left	-	5	A	9	-	5	A	11
Westbound Through	-	3	A	9	-	3	A	11
Westbound Right	-	2	A	9	-	2	A	11
Northbound Left	-	6	A	14	-	4	A	14
Northbound Through	-	5	A	14	-	4	A	14
Northbound Right	-	4	A	14	-	4	A	14
Southbound Left	-	5	A	6	-	6	A	8
Southbound Through	-	5	A	6	-	5	A	8
Southbound Right	-	4	A	6	-	5	A	8

Note: 1. Queue length reflects 95th percentile conditions

All the movements at this intersection are expected to operate with a good level of service (LOS 'A') during both peak hours in 2031.

5.3 East-West Arterial at Concession Road 9

A single lane roundabout is proposed at E-W Arterial and Concession Road 8 intersection. The proposed lane configurations are presented in **Exhibit 66**.

Exhibit 66: Lane Configuration at East-West Arterial and Concession Road 9

The intersection capacity analysis was conducted using VISSIM model and resulting level of service are presented in **Exhibit 67**.

Exhibit 67: 2031 Intersection Capacity Analysis for E-W Arterial and Concession Road 9

Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue[1] (m)	V/C	Delay (s)	LOS	Queue[1] (m)
East-West Arterial at Concession Road 9 (Roundabout)		***6***	***A***			***7***	***A***	
Eastbound Left	-	5	A	26	-	9	A	34
Eastbound Through	-	7	A	26	-	9	A	34
Eastbound Right	-	7	A	26	-	9	A	34
Westbound Left	-	7	A	18	-	7	A	18
Westbound Through	-	6	A	18	-	5	A	18
Westbound Right	-	2	A	18	-	2	A	18
Northbound Left	-	8	A	16	-	12	B	17
Northbound Through	-	7	A	16	-	11	B	17
Northbound Right	-	7	A	16	-	9	A	17
Southbound Left	-	7	A	17	-	8	A	20
Southbound Through	-	6	A	17	-	7	A	20
Southbound Right	-	7	A	17	-	8	A	20

Note: 1. Queue length reflects 95th percentile conditions

All the movements at this intersection are expected to operate with a good level of service (LOS 'A') during both peak hours in 2031.

5.4 East-West Arterial at CR 17 (Concession Road 10)

The intersection at E-W Arterial/Concession Road 10 is proposed with a single lane roundabout. By 2031, this intersection would 3-leg roundabout with a provision for a future extension of the E-W Arterial past County Road 17/Concession Road 10. The proposed lane configurations are presented in **Exhibit 68** and intersection capacity analysis results are presented in **Exhibit 69**.

Exhibit 68: Lane Configuration at E-W Arterial and CR 17 (Concession Road 10)

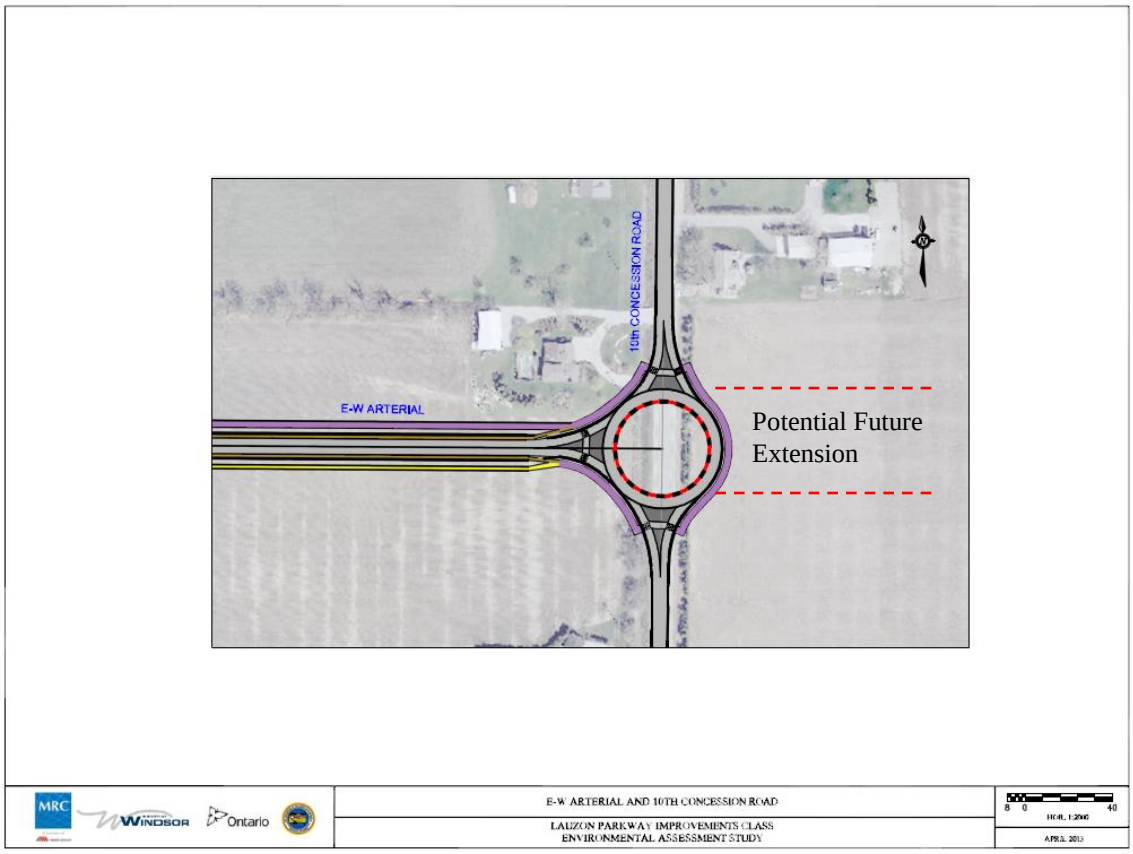


Exhibit 69: 2031 Intersection Capacity Analysis for E-W Arterial and CR 17

Location/Movement	Levels of Service							
	Weekday A.M. Peak Hour				Weekday P.M. Peak Hour			
	V/C	Delay (s)	LOS	Queue1 (m)	V/C	Delay (s)	LOS	Queue1 (m)
E-W Arterial at 10th Concession Road (Roundabout)		3	A			7	A	
Eastbound Left	-	4	A	8	-	3	A	12
Eastbound Right	-	3	A	8	-	3	A	12
Northbound Left	-	2	A	6	-	2	A	6
Northbound Through	-	2	A	6	-	2	A	6
Southbound Through	-	5	A	6	-	3	A	6
Southbound Right	-	4	A	6	-	3	A	6

Note: 1. Queue length reflects 95th percentile conditions

The proposed intersection with single lane roundabout is expected to operate with a good level of service (LOS ‘A’) for the projected traffic volume for year 2031.

6. STUDY FINDINGS

The population and employment forecast from the City of Windsor suggests that the City of Windsor population is expected to increase by 30,500 and employment by 11,400 by Year 2031. The Windsor Annexed Area Master Plan study estimated to accommodate about 14,000 residents and 10,000 employments in the Annexed Area during this period. By 2031, the County of Essex population is expected to increase approximately 41,000 and employment by 17,500

The proposed extension of Lauzon Parkway to Highway 3 with a new interchange at Highway 401 would provide an opportunity to access the Sandwich South Secondary Plan Area. The proposed extension would remove an off-set at County Road 42 and County Road 17/Concession Road 10 intersection; would remove the bottleneck and will enhance traffic operation on CR 42 and Lauzon Parkway. The proposed extension of Lauzon Parkway would help in reducing congestion from the existing corridors.

County Road 42 provides the continuous connection between the Town of Tecumseh, Town of Lakeshore and the City of Windsor. The proposed widening would provide additional capacity on County Road 42 and improved traffic operations with reduced delay. With the widening of County Road 42, some of the existing intersections would be upgraded with the modern roundabout. Roundabout reduces the severity of collisions by increasing driver attentiveness and decreasing T-Bone collisions. Roundabout reduces speed in intersection, increases the overall throughput of the road and reduces delays, provides shorter crossings for pedestrians, fewer conflict points between vehicles and pedestrians and reduces the operational costs.

The future traffic volumes are forecasted using the growth projected by the travel demand model and consideration of the existing traffic volumes. The future demand would depend upon the pace of the development in the study area and therefore, City and County is recommended to review the traffic operations periodically in the study area intersections. The future intersection operational analyses are performed for both morning and afternoon peak hours. With the proposed road network improvements, the study area intersections are expected to operate with an acceptable level of service.

Some notable intersections and their critical movements are presented below:

- At Lauzon Parkway and Forest Glade Drive intersection, a dedicated eastbound right-turn lane and a westbound right turn lane are recommended in order to achieve an acceptable level-of-service with the projected traffic demand.
- With the projected traffic demand, the ramp terminals at Lauzon Parkway/E.C. Row Interchange would require signalization.
- At the Lauzon Parkway and Twin Oaks Drive intersection, additional through lanes would require in both the north and south directions on Lauzon Parkway.
- With the proposed access for Airport lands at Service Road B, the existing intersection would be converted to a 4-leg intersection. Considering the future demand, this intersection would require traffic signals.

- With the proposed extension of Lauzon Parkway and widening of County Road 42, the intersection at Lauzon Parkway and County Road 42 is expected to operate with a high traffic volume (6 lanes for Lauzon Parkway and 4 lanes for County Road 42). Considering the high traffic volume and pedestrian activities, this intersection is recommended to operate with traffic signals.

- Lauzon Parkway intersections at E-W Arterial Road and Baseline Road are recommended to operate with roundabout for the 'interim' condition. With widening of Lauzon Parkway to 6 lanes, this intersection is recommended to operate with traffic signals.

- Double teardrop roundabouts are proposed at the ramp terminals for Highway 401 Interchange. This design provides an acceptable level of service for 2031. However, the analysis for the full build-out scenario for the Sandwich South development, this interchange may require converting with a Parclo A4 configuration once the circulating volume of the roundabouts reaches at about 2000 vph.

- Roundabouts would not provide an acceptable level of service for the Lauzon Parkway intersections at County Road 46 and Highway 3. Therefore, these intersections are recommended with traffic signals. Due to heavy movements between Lauzon Parkway and Highway 3, dual-left turn lanes are proposed for the southbound left turn movement and channelized right turn lane for southbound and westbound right turn movements.

- At the County Road 42 and Walker Road intersection, provision of dedicated right-turning storage lanes are recommended for northbound and southbound approaches on Walker Road to accommodate future demand. Double westbound left turn lanes are recommended on County Road 42 approach.

- With the future widening of County Road 42, intersections with Concession Road 7 and Baseline Road are proposed to realign with a 2-lane roundabout which rationalized two existing closely-spaced intersections into one, while maintaining connectivity of the main roads (County Road 42 and Baseline Road).

- With widening of County Road 42, intersections at Concession Road 8 and Concession Road 9 are proposed to upgrade with a 2-lane roundabout.

- Intersection at County Road 42 and Lauzon Road is planned to connect with a realigned County Road 17 (Concession Road 10). This improvement is expected to occur beyond EA planning horizon year (i.e. 2031). Prior to this improvement, the CR 42 and Concession Road 17 (Concession Road 10) intersection is recommended to operate with a right-in-right-out (RIRO) configuration.

- With the widening of County Road 42, the existing intersections at County Road 43 (Banwell Road), County Road 19 (Manning Road), Patillo Road and County Road 25 (East Puce Road) are proposed to upgrade with a 2-lane roundabout.

- East-West Arterial would provide an access to the proposed development in Sandwich South Secondary Plan and East Pelton Secondary Plan. This arterial

will provide connection between Walker Road and County Road 17 (Concession Road 10).

- The proposed intersection at Walker Road and E-W Arterial is recommended to operate with a provision of traffic signals.
- The single lane roundabouts are proposed at E-W Arterial intersections with Concession Road 8, Concession Road 9 and Concession Road 10.

Appendices

Appendix I

Technical Memorandum: Roundabout Analysis for the Lauzon Parkway/E-W Arterial Intersection

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MEMO TO FILE

FILE: 3211012 – Lauzon Parkway

BY: Mark VanderSluis, Keyur Shah

DATE: October 21, 2011 (Updated on January 30, 2012)

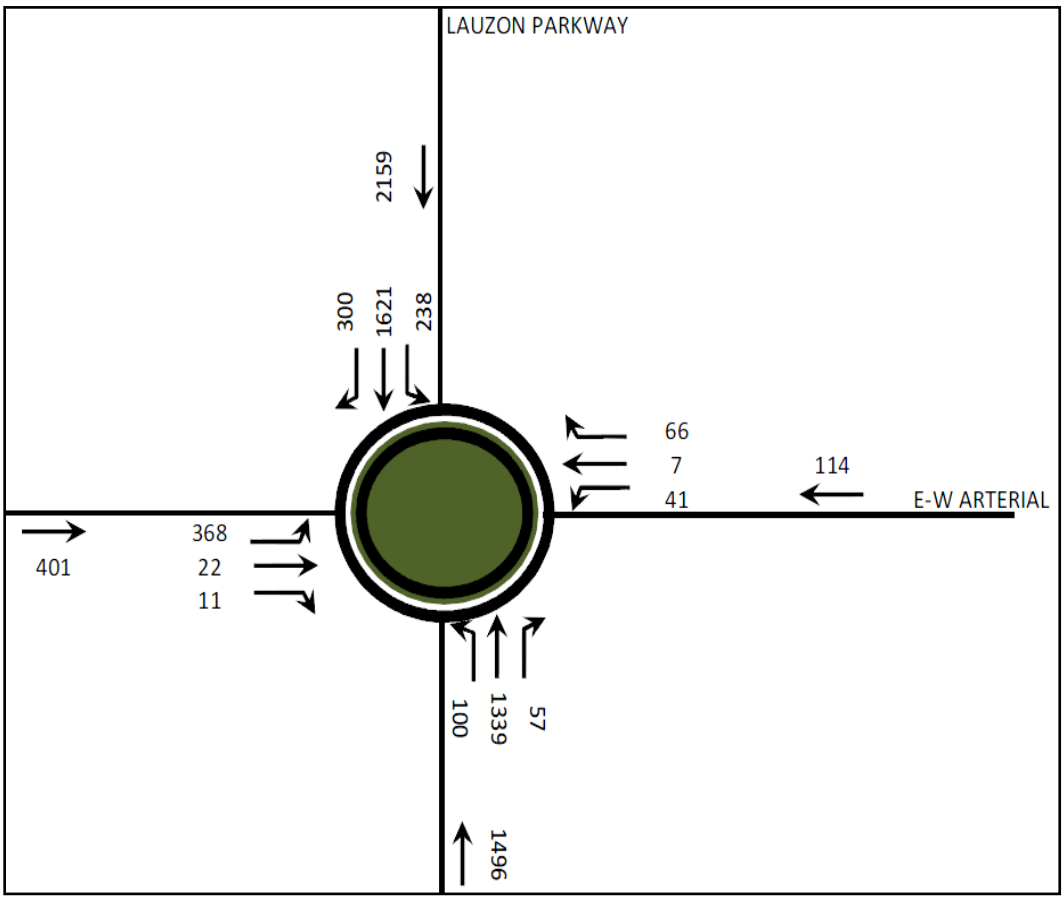
COPIES:

SUBJECT: Lauzon Parkway Improvements Environmental Assessment: Traffic Review for the Proposed Roundabout at E-W Arterial and Lauzon Parkway

1. 2031 Demand:

The future traffic conditions have been assessed based on the anticipated development scenario for a 20-year horizon, to Year 2031. **Exhibit 1** presents the projected turning movement volumes for the E-W Arterial and Lauzon Parkway intersection for 2031 travel demand.

Exhibit 1: Projected 2031 PM Peak Hour Turning Movements



The operational analysis for the proposed roundabout configuration was evaluated using VISSIM microsimulation software. The intersection operational analysis for Lauzon Parkway at East-West Arterial was conducted using two different lane configurations for Roundabout. .

The proposed roundabout would have 3 northbound/southbound lanes and 2 eastbound/ westbound lanes. Two scenarios were developed based upon the eastbound left turning movement:

- Scenario 1 - single eastbound left turn lane (refer **Exhibit 2**), and
- Scenario 2 - double east bound left turn lanes (refer **Exhibit 3**).

Exhibit 2: Lane Configuration Scenario 1 – Single Left Turn Lane

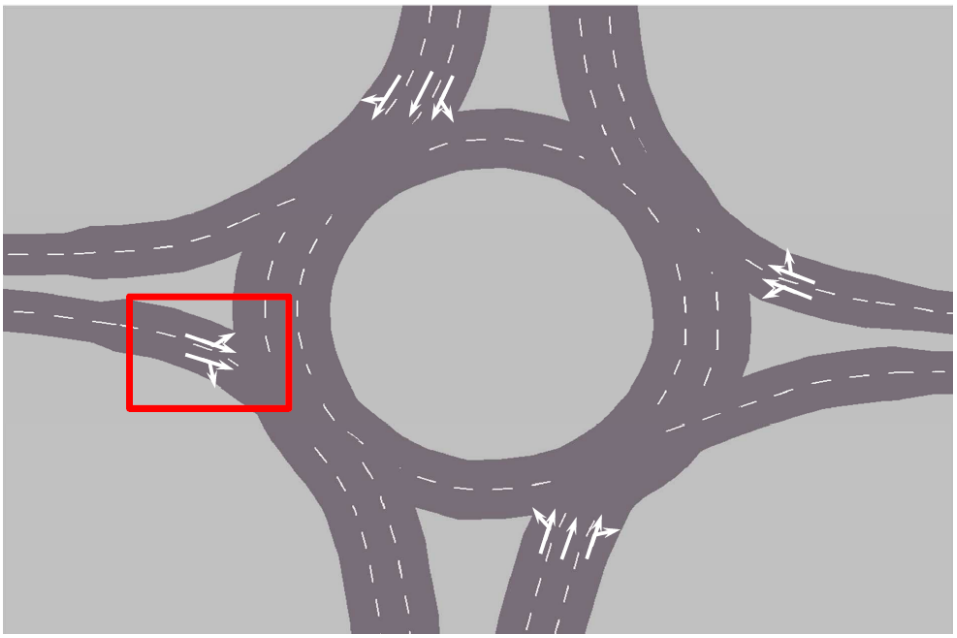
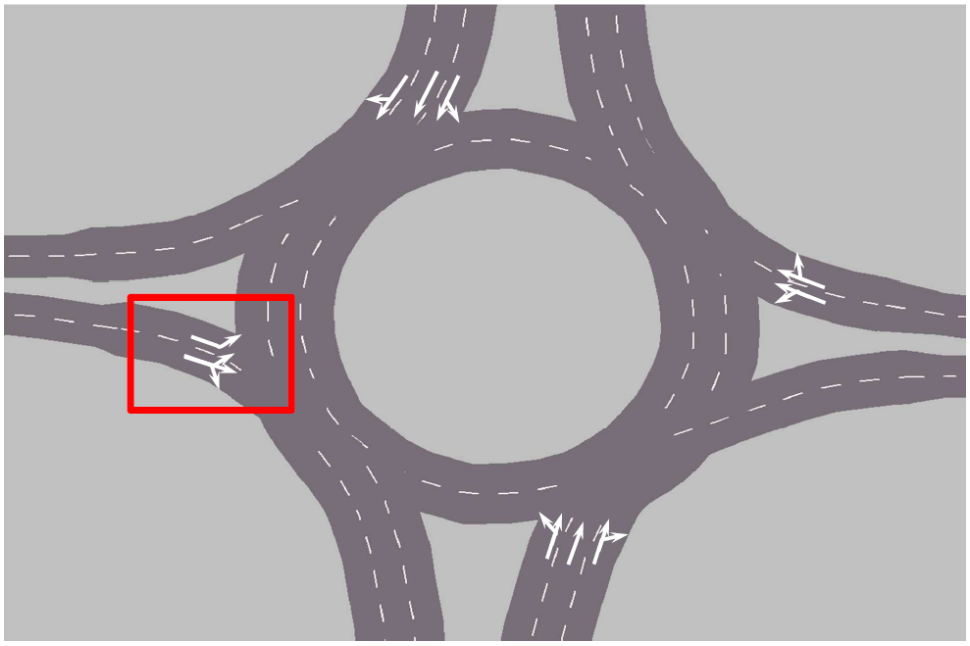


Exhibit 3: Lane Configuration Scenario 2 – Double Left Turn Lane



Micro-simulation analysis was conducted for both scenarios the VISSIM software. **Table 1** provides an overview of the level-of-service results for the Roundabout option with two different lane configurations.

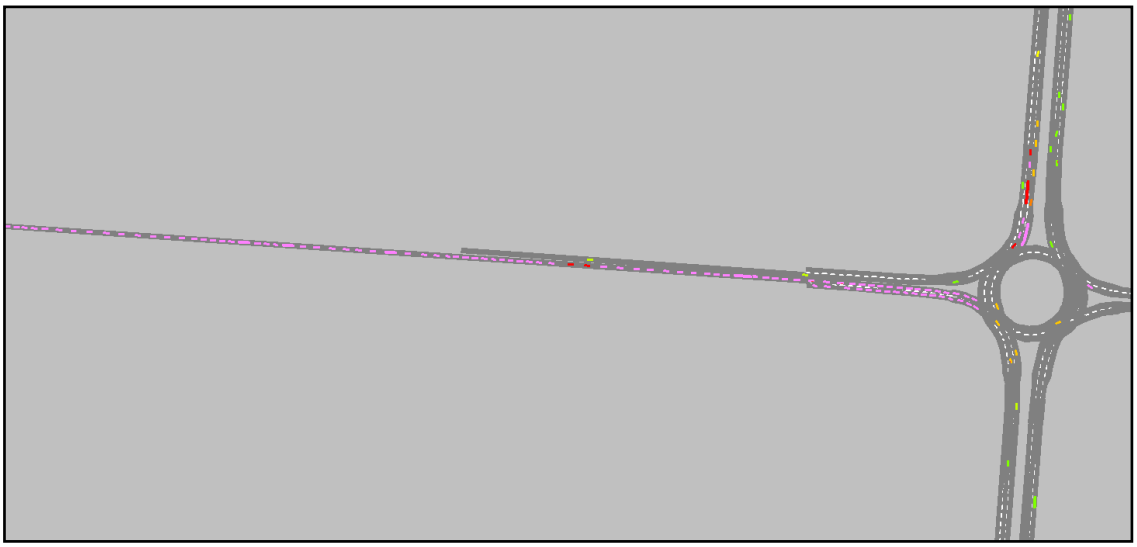
Table 1: Levels of Service Analysis for Roundabout Options (2031 p.m. peak hour) -VISSIM

Location Movement	Scenario 1 (Single EB Left Turn)			Scenario 2 (Double EB Left Turn)		
	Delay (seconds)	LOS	Queue[1] (metres)	Delay (seconds)	LOS	Queue[1] (metres)
Lauzon Parkway at E-W Arterial	*67*	*F*		*57*	*F*	
Eastbound Left	1654	F	920	739	F	921
Eastbound Through	1656	F	920	678	F	921
Eastbound Right	1559	F	920	632	F	921
Westbound Left	10	A	10	12	B	0
Westbound Through	8	A	10	11	B	0
Westbound Right	2	A	10	2	A	0
Northbound Left	8	A	26	8	A	31
Northbound Through	7	A	26	8	A	31
Northbound Right	7	A	26	7	A	31
Southbound Left	13	B	32	17	C	46
Southbound Through	10	B	32	13	B	46
Southbound Right	6	A	32	8	A	46

Note: 1. Queue length reflects 95th percentile conditions

The analysis shows that for both eastbound traffic configurations would experience heavy delays and long queues. The high volume of traffic travelling southbound on Lauzon Parkway prevents most of the eastbound vehicles from entering the roundabout, causing significant delays and backups. For the scenario with a single eastbound left turn lane, the average delay was over 1,600 s and the 95th percentile queue length was over 900 m. (For the analysis purpose, the existing approach has been assumed to 900 m long to assess the extent of potential queue. The actual queue length could extend to local roads feeding to East-West Arterial.). While the addition of the double left turn lane reduces delay by over half, the delay and queue lengths are still significantly high. **Exhibit 4** shows the eastbound queue length resulting from the microsimulation of the roundabout for Scenario 2. This result indicates the proposed intersection with the roundabout configuration would result in heavy delay for the eastbound approach (East-West Arterial).

Exhibit 4: Eastbound Queue Length for Scenario 2



Level-of-service Comparison to a Signalized Intersection

For comparison purposes, the intersection assuming a conventional signalized intersection was also analyzed using Synchro/SimTraffic software. The analysis result is presented in **Table 2**. The detailed Synchro output is presented in the **Appendix**.

Table 2: Levels of Service Analaysis for Signalized Configuration (2031 p.m. peak hour) -SimTraffic

Location Movement	Scenario 1 (Double EB Left Turn)			
	V/C	Delay (seconds)	LOS	Queue[1] (metres)
Lauzon Parkway at E-W Arterial		*19*	*B/C*	
Eastbound Left	0.58	39	D	48
Eastbound Through	0.07	38	D	11
Eastbound Right	0.07	26	C	11
Westbound Left	0.19	35	C	18
Westbound Through	0.41	36	D	18
Westbound Right	0.41	12	B	18
Northbound Left	0.52	53	D	26
Northbound Through	0.66	21	C	79
Northbound Right	0.09	8	A	11
Southbound Left	0.74	27	C	53
Southbound Through	0.53	12	B	67
Southbound Right	0.28	8	A	23

Note: 1. Queue length reflects 95th percentile conditions

The intersection capacity analysis for a signalized configuration using Synchro/SimTraffic indicates that the proposed intersection of Lauzon Parkway and East-West Arterial would operate at overall of level-of-service ‘C’ compared to level-of-service ‘F’ with roundabout configuration.

2. Intermediate Demand:

The proposed development in the study area is expected to commence after 2021 and that would continue beyond 2031. For the interim condition prior to 2031, the sensitivity analysis for various range of traffic volume was assessed for roundabout configuration using 'Sidra' software, is presented in **Table 3**.

Table 3: Sensitivity Analysis for the Roundabout at Lauzon Parkway and East-West Arterial

Traffic Volume	Direction	4- Lane Corridor							6-lane Corridor	
		2-Lane Roundabout							3-Lane Roundabout	
		2021 Volume	Between 2021 Volume and 2031 Volume							2031 Volume
Approach 1	NB	1100	1100	1100	1100	1100	1200	1200	1200	1500
Approach 2	WB	N.A	50	50	50	50	50	110	110	50
Approach 3	SB	1400	1400	1400	1400	1400	1600	1600	1600	1850
Approach 4	EB	N.A	100	200	300	400	300	400	400	550
Total			**2,650**	**2,750**	**2,850**	**2,950**	**3,150**	**3,310**	**3,310**	**3,950**
% of 2031 projected volume			**67%**	**70%**	**72%**	**75%**	**80%**	**84%**	**84%**	**100%**
% of Total Development in South Sandwich Area		11%	29%	30%	31%	32%	34%	36%	36%	43%
Level-of-Service			**B**	**C**	**C**	**C**	**C**	**F**	**C**	**F**

The sensitivity analysis result indicates that 2-lane roundabout could operate with acceptable level-of-service up to 80% of the 2031 traffic demand. A roundabout cannot accommodate the projected 2031 traffic demand. As the development and resulting traffic along Lauzon Parkway and E-W Arterial increase and result into poor level of service, this intersection would require to be signalized. This need is entirely dependent on the scale and timing of development along Lauzon Parkway and E-W Arterial. With a conventional signalized intersection configuration and projected traffic volume, the proposed intersection could operate with overall level-of-service 'C'.

Technical Appendix

Synchro/SimTraffic Results

Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	6:50	6:50	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2
# of Recorded Intvls	1	1	1	1	1	1
Vehs Entered	3948	3892	3904	3856	3894	3899
Vehs Exited	3945	3912	3911	3851	3870	3898
Starting Vehs	191	210	199	189	192	196
Ending Vehs	194	190	192	194	216	198
Denied Entry Before	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0
Travel Distance (km)	8166	8139	8106	8023	8071	8101
Travel Time (hr)	203.5	204.2	200.6	199.5	201.2	201.8
Total Delay (hr)	27.7	28.8	26.5	26.7	27.3	27.4
Total Stops	2189	2321	2182	2144	2184	2204
Fuel Used (l)	630.0	632.9	628.4	620.7	624.1	627.2

Interval #0 Information Seeding

Start Time	6:50
End Time	7:00
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	3948	3892	3904	3856	3894	3899
Vehs Exited	3945	3912	3911	3851	3870	3898
Starting Vehs	191	210	199	189	192	196
Ending Vehs	194	190	192	194	216	198
Denied Entry Before	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0
Travel Distance (km)	8166	8139	8106	8023	8071	8101
Travel Time (hr)	203.5	204.2	200.6	199.5	201.2	201.8
Total Delay (hr)	27.7	28.8	26.5	26.7	27.3	27.4
Total Stops	2189	2321	2182	2144	2184	2204
Fuel Used (l)	630.0	632.9	628.4	620.7	624.1	627.2

1: Int Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Delay (hr)	3.9	0.2	0.0	0.4	0.0	0.2	0.8	7.4	0.1	1.7	5.0	0.6
Delay / Veh (s)	39.3	38.2	25.5	34.6	35.9	12.4	52.8	21.2	7.6	27.2	11.8	7.5
Total Stops	336	17	3	37	5	64	52	772	29	203	576	106
Travel Dist (km)	508.1	29.1	4.5	58.7	6.8	100.6	44.9	1085.4	49.5	184.4	1254.2	241.3
Travel Time (hr)	14.8	0.8	0.1	1.6	0.2	2.4	1.7	30.3	1.2	5.6	31.3	5.9
Avg Speed (kph)	34	35	39	36	35	41	26	36	41	33	40	41
Fuel Used (l)	35.7	2.0	0.3	4.1	0.5	6.6	3.5	77.3	3.4	13.3	88.2	16.3
HC Emissions (g)	69	2	0	6	1	18	5	173	9	33	205	38
CO Emissions (g)	1124	44	9	93	8	282	103	3190	199	601	4089	828
NOx Emissions (g)	185	6	1	17	1	50	15	508	26	92	609	111
Vehicles Entered	362	20	3	40	5	69	53	1260	58	224	1513	292
Vehicles Exited	361	20	3	41	5	69	53	1263	57	221	1519	291
Hourly Exit Rate	361	20	3	41	5	69	53	1263	57	221	1519	291
Input Volume	360	21	1	39	7	63	50	1275	54	227	1544	286
% of Volume	100	95	300	105	71	110	106	99	106	97	98	102
Denied Entry Before	0	0	0	0	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0	0	0	0	0

1: Int Performance by movement

Movement	All
Total Delay (hr)	20.4
Delay / Veh (s)	18.9
Total Stops	2200
Travel Dist (km)	3567.4
Travel Time (hr)	96.1
Avg Speed (kph)	37
Fuel Used (l)	251.1
HC Emissions (g)	562
CO Emissions (g)	10568
NOx Emissions (g)	1623
Vehicles Entered	3899
Vehicles Exited	3903
Hourly Exit Rate	3903
Input Volume	3927
% of Volume	99
Denied Entry Before	0
Denied Entry After	0

Total Network Performance

Total Delay (hr)	27.4
Delay / Veh (s)	25.3
Total Stops	2204
Travel Dist (km)	8100.7
Travel Time (hr)	201.8
Avg Speed (kph)	40
Fuel Used (l)	627.2
HC Emissions (g)	1569
CO Emissions (g)	37770
NOx Emissions (g)	4893
Vehicles Entered	3899
Vehicles Exited	3898
Hourly Exit Rate	3898
Input Volume	19463
% of Volume	20
Denied Entry Before	0
Denied Entry After	0

Intersection: 1: Int

Movement	EB	EB	EB	WB	WB	NB	NB	NB	NB	NB	B4	B4
Directions Served	L	L	TR	L	TR	L	T	T	T	R	T	T
Maximum Queue (m)	54.1	53.8	17.3	19.3	24.5	33.2	65.6	77.6	85.8	13.5	59.9	79.1
Average Queue (m)	27.4	30.6	3.5	7.7	8.6	13.0	40.0	48.8	55.6	4.6	3.3	4.0
95th Queue (m)	44.4	47.9	11.1	17.6	18.4	25.9	61.2	71.9	79.1	11.2	32.9	35.9
Link Distance (m)			1392.2		1451.0		834.5	834.5	834.5		95.2	95.2
Upstream Blk Time (%)											0	0
Queuing Penalty (veh)											0	0
Storage Bay Dist (m)	150.0	150.0		100.0		150.0				100.0		
Storage Blk Time (%)									0			
Queuing Penalty (veh)									0			

Intersection: 1: Int

Movement	B4	SB	SB	SB	SB	SB	B3	B3	B3
Directions Served	T	L	T	T	T	R	T	T	T
Maximum Queue (m)	59.2	70.7	52.4	72.0	76.1	31.5	79.2	97.5	97.4
Average Queue (m)	2.0	29.3	27.9	37.4	46.6	12.3	8.5	10.4	4.5
95th Queue (m)	24.8	52.9	45.0	59.9	66.9	22.6	53.7	59.8	38.3
Link Distance (m)	95.2		814.1	814.1	814.1		92.9	92.9	92.9
Upstream Blk Time (%)	0						0	0	0
Queuing Penalty (veh)	0						0	0	0
Storage Bay Dist (m)		150.0				150.0			
Storage Blk Time (%)									
Queuing Penalty (veh)									

Network Summary

Network wide Queuing Penalty: 0

Intersection: 1: Int

Phase	1	2	3	4	6	7	8
Movement(s) Served	SBL	NBTL	WBL	EBTL	SBTL	EBL	WBTL
Maximum Green (s)	11.0	33.0	6.0	18.0	50.0	12.0	12.0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Recall	None	C-Max	None	Min	C-Max	Min	Min
Avg. Green (s)	12.5	40.6	5.9	16.4	56.8	11.8	5.4
g/C Ratio	0.11	0.45	0.04	0.18	0.63	0.13	0.06
Cycles Skipped (%)	19	0	46	0	0	0	0
Cycles @ Minimum (%)	0	0	0	0	0	0	65
Cycles Maxed Out (%)	19	100	44	3	100	85	3
Cycles with Peds (%)	0	0	0	0	0	0	0

Controller Summary
Average Cycle Length (s): 90.0
Number of Complete Cycles : 39

Appendix II

Technical Memorandum: Roundabout Analysis for the CR 42/CR 19 (Manning Road) Intersection

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MEMO

FROM:	Keyur Shah, Qingjie Zeng
DATE:	February 08, 2013
COPIES:	--
OUR FILE:	3211012.500
SUBJECT:	Sensitivity Analysis for Roundabout at County Road 42 and Manning Road (without Lauzon Parkway) W:\2011\32\3211012 Lauzon Parkway EA\3211012.500-Transportation\3211012.509-Memos\3211012-CR 42Manning Rd-Wo Lauzon Pkwy-V4.Docx

This memorandum documents the traffic operational analysis results conducted for the sensitivity analysis for roundabout at County Road 42 (CR 42) and Manning Road (CR 19), for the future 2021 demand and 2031 demand without the proposed Lauzon Parkway Extension (between CR 42 and Highway 3 with interchange at Highway 401).

The sensitivity analysis was conducted to assess the impact on Manning Road and CR 42 roundabout without proposed extension of Lauzon Parkway.

Sensitivity Analysis for 2021 Traffic Demand

The 2021 traffic volumes at this roundabout were projected using two methods:

- Scenario A: Assuming 2% growth per annum i.e. 20% growth from existing (2011) traffic volume
- Scenario B: Using 2021 TransCAD Model without Lauzon Parkway Extension

Scenario A: Assuming 2% Growth per annum

For this scenario (Scenario A), the traffic volume is projected by assuming 2% growth per annum from existing (2011) volume, for both morning and afternoon peak hours. Therefore, this method assumes 2021 traffic volume 20% higher than the existing traffic volume. The projected traffic volumes are presented in **Figure 1**.

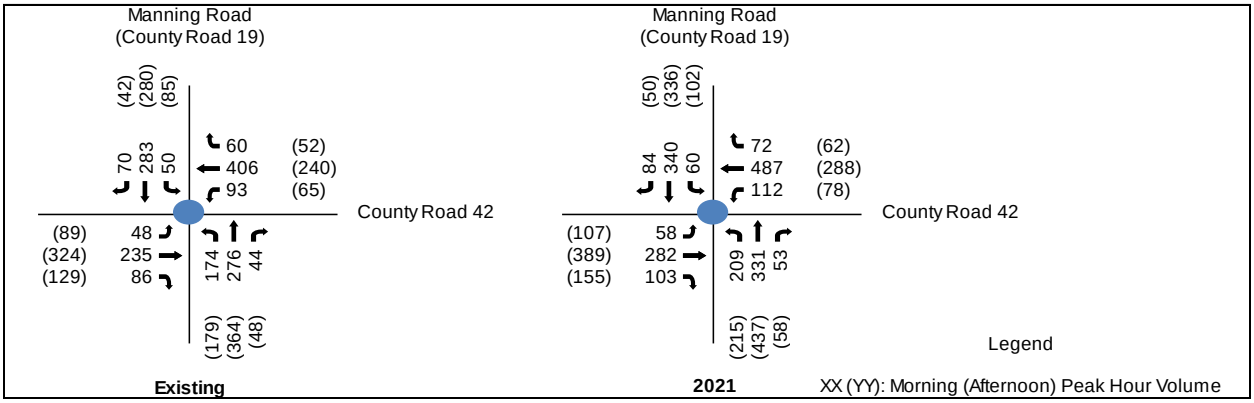

Figure 1: Traffic Volume Projection for 2021 Scenario A

The total approach volume at proposed roundabout for 2021 Scenario A is 2,190 vehicles for morning peak hour and 2,276 vehicles for afternoon peak hour.

Traffic Operational Analysis Result for Scenario A

The traffic operational analysis was conducted using the projected traffic volumes using VISSIM microsimulation model. It is assumed by 2021; both CR 42 and CR 19 will be widened to four lanes (i.e. two lanes in each direction). Hence, the roundabout at this intersection would be 2-lane roundabout. The microsimulation analysis results (delay, level-of-services and 95th % queue length) for this scenario are summarized in **Table 1** and **Table 2** for morning and afternoon peak hour respectively.

Table 1: Simulation Results for 2021 Scenario A (Morning Peak Hour)

County Road 42 and Manning Road (2021 Scenario A Morning Peak Hour)

	County Road 42 (EB)				County Road 42 (WB)				Manning Road (NB)				Manning Road (SB)				Overall
	EBL	EBT	EBR	All	WBL	WBT	WBR	All	NBL	NBT	NBR	All	SBL	SBT	SBR	All	
Volume (vph)	57	294	101	451	114	491	71	676	207	333	52	592	59	348	83	490	2208
Delay (sec)	3	3	1	3	6	6	4	6	4	4	2	4	8	8	4	7	5
LOS	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**
95th% Queue (m)	11	11	11		24	24	24		11	11	11		18	18	18		
MAX Queue (m)	26	26	26		46	46	46		28	28	28		36	36	36		

Table 2: Simulation Results for 2021 Scenario A (Afternoon Peak Hour)

County Road 42 and Manning Road (2021 Scenario A Afternoon Peak Hour)

	County Road 42 (EB)				County Road 42 (WB)				Manning Road (NB)				Manning Road (SB)				Overall
	EBL	EBT	EBR	All	WBL	WBT	WBR	All	NBL	NBT	NBR	All	SBL	SBT	SBR	All	
Volume (vph)	109	396	149	654	75	297	59	431	214	439	58	711	102	345	46	493	2289
Delay (sec)	4	3	2	3	6	6	4	5	7	6	4	6	5	5	3	5	5
LOS	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**
95th% Queue (m)	14	14	14		17	17	17		23	23	23		13	13	13		
MAX Queue (m)	37	37	37		34	34	34		48	48	48		27	27	27		

The analysis results for both peak hours show that the proposed roundabout would provide a good level-of-service (LOS ‘A’).

Scenario B: Using 2021 TransCAD Model without Lauzon Parkway Extension

For conducting a sensitivity analysis without Lauzon Parkway extension for year 2021, the travel demand model for this year was used. The segment of Lauzon Parkway between CR 42 and Highway 3 was closed for the vehicular movement, as the blue color link presented in **Figure 2**.

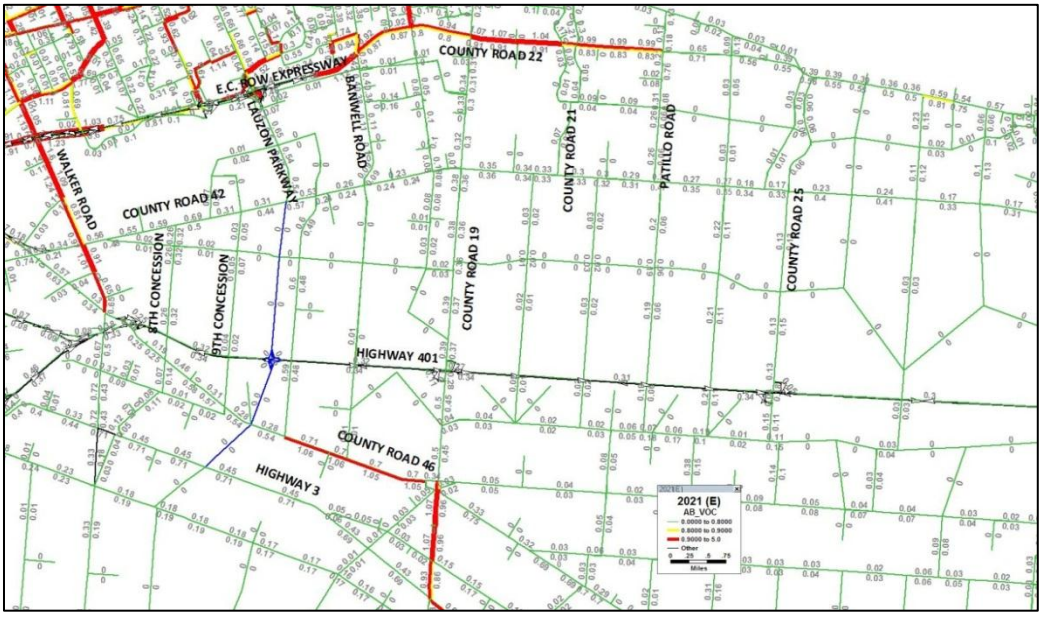

Figure 2: Screenshot of Model Volume in 2021 without Lauzon Parkway Extension

The model is developed for the afternoon peak hour only, therefore, the morning peak hour traffic volume was projected by transposing the afternoon peak hour traffic demand assuming opposite traffic flow. The projected traffic volumes for 2021 Scenario B at this roundabout without Lauzon Parkway improvement are presented in **Figure 3**.

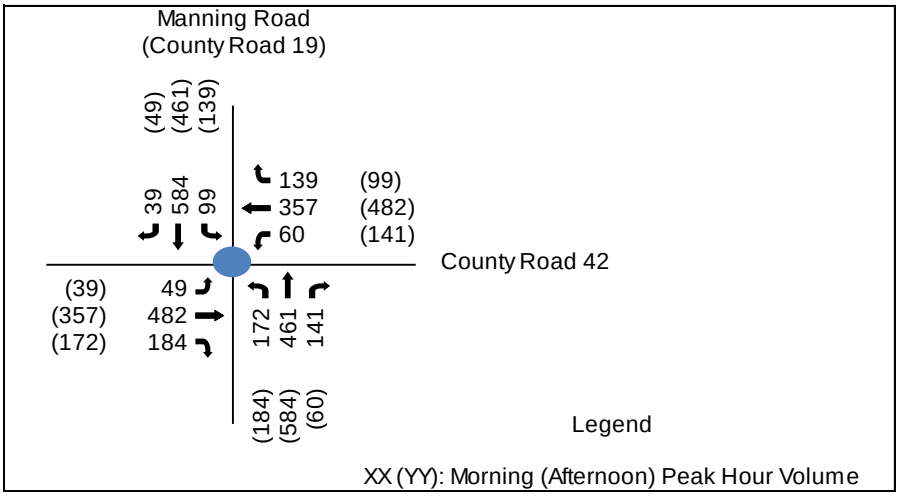

Figure 3: Traffic Volume Projection for 2021 Scenario B

Traffic Operational Analysis Result for Scenario B

The total approaching volume for this scenario is 2,767 vehicles for peak hours, which is higher than Scenario A. Using the above projected volume for Scenario B, the microsimulation analysis was conducted using VISSIM model. The results for 2021 Scenario B are summarized in **Table 3** and **Table 4** respectively for morning and afternoon peak hour volume.

Table 3: Simulation Results for 2021 Scenario B (Morning Peak Hour)

County Road 42 and Manning Road (2021 Scenario B Morning Peak Hour)

	County Road 42 (EB)				County Road 42 (WB)				Manning Road (NB)				Manning Road (SB)				Overall
	EBL	EBT	EBR	All	WBL	WBT	WBR	All	NBL	NBT	NBR	All	SBL	SBT	SBR	All	
Volume (vph)	49	490	179	718	60	368	134	563	173	464	141	777	99	586	40	725	2783
Delay (sec)	6	5	3	5	6	5	3	5	8	7	4	6	7	7	4	7	6
LOS	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**
95th% Queue (m)	21	21	21		18	18	18		25	25	25		22	22	22		
MAX Queue (m)	45	45	45		36	36	36		57	57	57		43	43	43		

Table 4: Simulation Results for 2021 Scenario B (Afternoon Peak Hour)

County Road 42 and Manning Road (2021 Scenario B Afternoon Peak Hour)

	County Road 42 (EB)				County Road 42 (WB)				Manning Road (NB)				Manning Road (SB)				Overall
	EBL	EBT	EBR	All	WBL	WBT	WBR	All	NBL	NBT	NBR	All	SBL	SBT	SBR	All	
Volume (vph)	38	367	168	573	140	487	95	723	183	589	61	833	139	469	47	655	2784
Delay (sec)	6	5	2	4	10	9	6	8	7	6	4	6	10	10	6	9	7
LOS	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**
95th% Queue (m)	18	18	18		34	34	34		25	25	25		29	29	29		
MAX Queue (m)	35	35	35		59	59	59		55	55	55		52	52	52		

The traffic operational analysis results for this scenario also indicate that without Lauzon Parkway extension, the roundabout at CR 42 and Manning Road for 2021 traffic volume would provide a good level-of-service (LOS ‘A’) on each approach for both peak hours.

Sensitivity Analysis for 2031 Traffic Demand

The 2031 traffic volumes at this roundabout were projected using two methods:

- Scenario A: Assuming 2% growth per annum i.e. 40% growth from existing (2011) traffic volume
- Scenario B: Using 2031 TransCAD Model without Lauzon Parkway Extension

Scenario A: Assuming 2% Growth per annum

For this scenario (Scenario A), the traffic volume is projected by assuming 2% growth per annum from existing (2011) volume, for both morning and afternoon peak hours. Therefore, this method assumes 2031 traffic volume 40% higher than the existing traffic volume. The projected traffic volumes are presented in **Figure 4**.

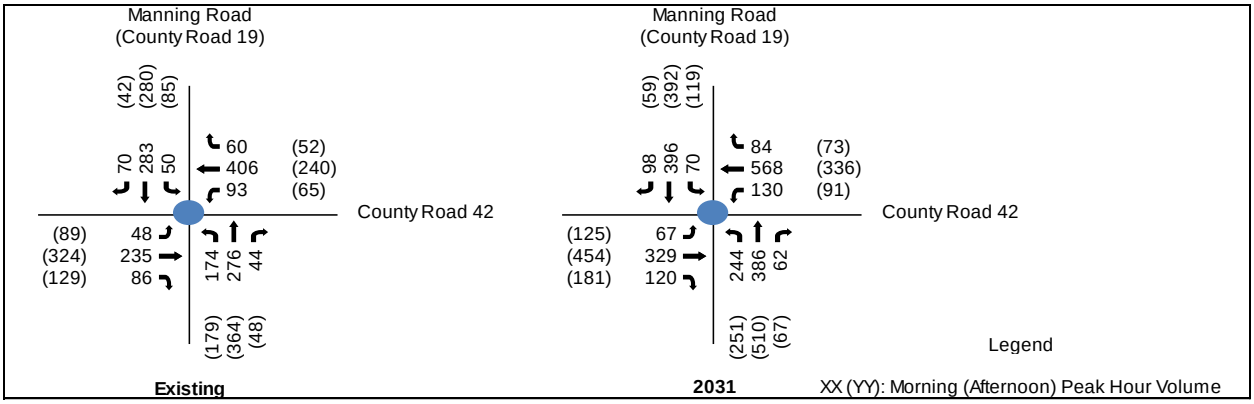

Figure 4: Traffic Volume Projection for 2031 Scenario A

The total approaching volume for 2031 Scenario A is 2,555 for morning peak hour and 2,656 for afternoon peak hour.

Traffic Operational Analysis Result for Scenario A

The traffic operational analysis was conducted using the projected traffic volumes using VISSIM microsimulation model. The microsimulation analysis results (delay, level-of-services and 95th % queue length) for this scenario are summarized in **Table 5** and **Table 6** respectively for morning and afternoon peak hour volume.

Table 5: Simulation Results for 2031 Scenario A (Morning Peak Hour)

County Road 42 and Manning Road (2031 Scenario A Morning Peak Hour)

	County Road 42 (EB)				County Road 42 (WB)				Manning Road (NB)				Manning Road (SB)				Overall
	EBL	EBT	EBR	All	WBL	WBT	WBR	All	NBL	NBT	NBR	All	SBL	SBT	SBR	All	
Volume (vph)	65	340	117	522	132	576	82	789	245	385	62	692	69	404	97	570	2573
Delay (sec)	4	3	2	3	8	8	6	8	5	4	3	5	12	12	6	11	7
LOS	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**B**	**B**	**A**	**B**	**A**
95th% Queue (m)	12	12	12		36	36	36		16	16	16		32	32	32		
MAX Queue (m)	29	29	29		66	66	66		36	36	36		53	53	53		

Table 6: Simulation Results for 2031 Scenario A (Afternoon Peak Hour)

County Road 42 and Manning Road (2031 Scenario A Afternoon Peak Hour)

	County Road 42 (EB)				County Road 42 (WB)				Manning Road (NB)				Manning Road (SB)				Overall
	EBL	EBT	EBR	All	WBL	WBT	WBR	All	NBL	NBT	NBR	All	SBL	SBT	SBR	All	
Volume (vph)	127	458	178	763	89	342	70	501	252	509	69	830	119	404	56	578	2673
Delay (sec)	5	5	3	4	8	7	5	7	10	9	7	9	7	7	4	7	7
LOS	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**
95th% Queue (m)	21	21	21		22	22	22		38	38	38		20	20	20		
MAX Queue (m)	45	45	45		46	46	46		68	68	68		39	39	39		

The traffic operational analysis result for 2031 Scenario A indicates that the proposed roundabout could provide good LOS (LOS A) with the projected traffic demand.

Scenario B: Using 2031 TransCAD Model without Lauzon Parkway Extension

For 2031 Scenario B, traffic volume is projected based on the 2031 afternoon peak hour TransCAD Model. For the sensitivity analysis, the segment of Lauzon Parkway between CR 42 and Highway 3 was not allowed for the vehicular movement, as the blue color link presented in **Figure 5**. The closure of Lauzon Parkway segment would force the traffic to the other alternative north-south corridors CR 17, Walker Road and Manning Road.

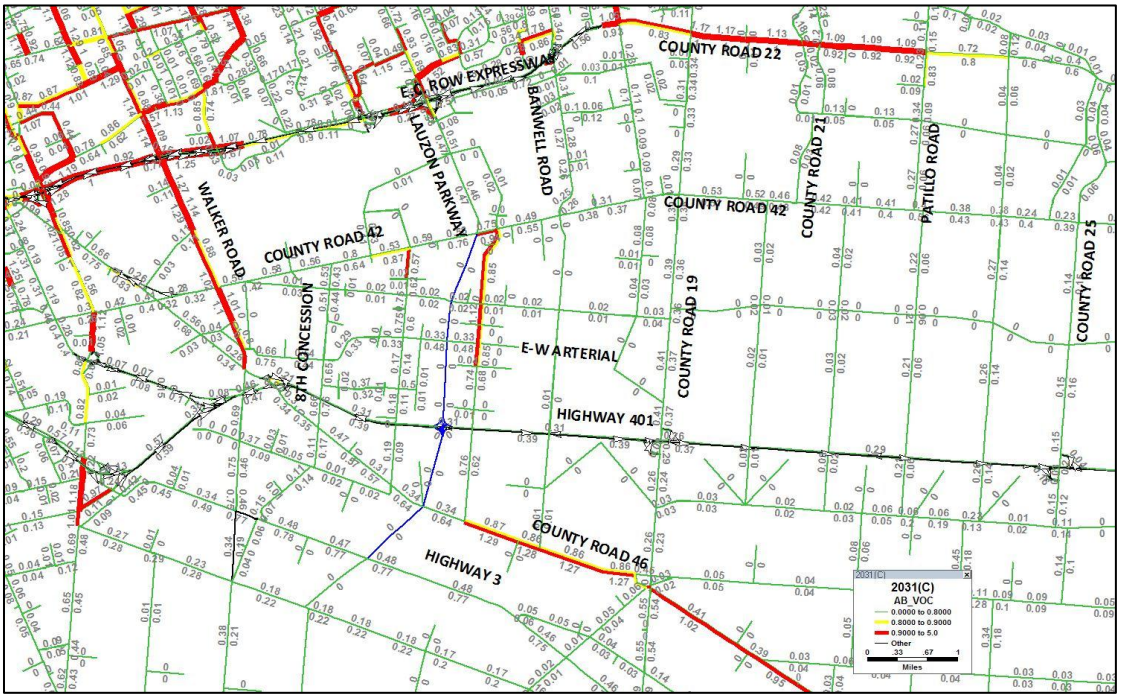

Figure 5: Screenshot of Model Volume in 2031 without Lauzon Parkway Extension

The model is developed for the afternoon peak hour only, therefore, the morning peak hour traffic volume was projected by transposing the p.m. peak hour traffic demand assuming opposite traffic flow. The projected traffic volumes for 2031 Scenario B at this roundabout without Lauzon Parkway improvement are presented in **Figure 6**.

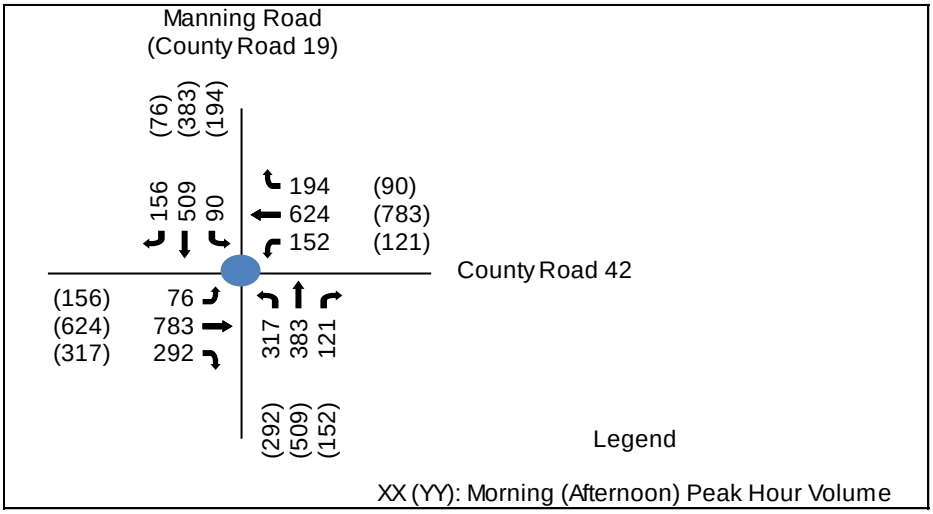

Figure 6: Traffic Volume Projection for 2031 Scenario B

The total approaching volume for 2031 Scenario B is 3,697 for peak hours, which is higher than the total approaching volume for 2031 Scenario A. It is also noted that traffic on Manning Road is also higher than the scenario with Lauzon Parkway for 2031.

Traffic Operational Analysis Result for Scenario B

The traffic operational analysis was conducted using VISSIM microsimulation model using the projected traffic volume for this scenario. The analysis results are summarized in **Table 7** and **Table 8** respectively for morning and afternoon peak hour volume.

Table 7: Simulation Results for 2031 Scenario B (Morning Peak Hour)

County Road 42 and Manning Road (2031 Scenario B Morning Peak Hour)

	County Road 42 (EB)				County Road 42 (WB)				Manning Road (NB)				Manning Road (SB)				Overall
	EBL	EBT	EBR	All	WBL	WBT	WBR	All	NBL	NBT	NBR	All	SBL	SBT	SBR	All	
Volume (vph)	78	794	292	1164	156	632	193	981	315	385	122	822	88	515	158	761	3728
Delay (sec)	13	11	6	10	12	11	7	10	16	13	10	13	41	35	24	34	16
LOS	B	B	A	A	B	B	A	B	C	B	A	B	E	E	C	D	C
95th% Queue (m)	73	73	73		55	55	55		58	58	58		110	110	110		
MAX Queue (m)	133	133	133		103	103	103		87	87	87		143	143	143		

Table 8: Simulation Results for 2031 Scenario B (Afternoon Peak Hour)

County Road 42 and Manning Road (2031 Scenario B Afternoon Peak Hour)

	County Road 42 (EB)				County Road 42 (WB)				Manning Road (NB)				Manning Road (SB)				Overall
	EBL	EBT	EBR	All	WBL	WBT	WBR	All	NBL	NBT	NBR	All	SBL	SBT	SBR	All	
Volume (vph)	161	630	313	1104	123	791	90	1003	293	512	151	957	194	389	74	657	3721
Delay (sec)	9	7	4	7	19	17	13	17	43	35	31	37	29	28	22	28	21
LOS	A	A	A	A	C	C	B	C	E	D	D	E	D	D	C	D	C
95th% Queue (m)	42	42	42		86	86	86		158	158	158		73	73	73		
MAX Queue (m)	87	87	87		123	123	123		208	208	208		104	104	104		

The analysis result indicates that some of the traffic movements (southbound left and through movements during morning peak hour; northbound left movement during afternoon peak hour) at this roundabout would operate with average delay of about 40s (i.e. LOS 'E' for roundabout configuring) without extension of Lauzon Parkway. The roundabout is expected to provide overall LOS 'C' with about 20s of average delay per vehicle.

This analysis considered the level-of-service criteria for un-signalized intersections. Considering the same delay with signalized intersection, the 40s of delay would be considered as LOS 'D' instead of LOS 'E'; refer Table 9 presents the LOS criteria for signalized and un-signalized intersections.

Table 9: Levels-of-Service Criteria for Signalized and Un-signalized Intersections

Level-of-service	Signalized Intersection Average Delay per Vehicles (sec/veh)	Un-signalized Intersection Average Delay per Vehicles (sec/veh)
A	< = 10	< = 10
B	> 10 and < = 20	> 10 and < = 15
C	> 20 and < = 35	> 15 and < = 25
D	> 35 and < = 55	> 25 and < = 35
E	> 55 and < = 80	> 35 and < = 50
F	> 80	> 50

Even with signalized intersection configuration, some of the movements (particularly the left turn movements) are expected to operate with similar delay. And again, the Scenario B assumes 43% of the Sandwich South Secondary Plan and does not assume the extension of Lauzon Parkway, which is a very unlikely condition.

Conclusion

Considering all the sensitivity scenarios conducted, it is evident that roundabout at CR 42 and Manning Road would provide a good level-of-service (LOS 'A') with 40% of traffic growth; and expected to provide reasonable level-of-service with the most conservative scenario (with 43% of Sandwich South Development without Lauzon Parkway extension). Hence, the roundabout is recommended at the CR 42 and Manning Road intersection.

Appendix III

Technical Memorandum: Roundabout Analysis for the Walker Road/7th Concession Road/E-W Arterial Intersection

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MEMO TO FILE

BY:	Leslie Green Keyur Shah
DATE:	October 2011
OUR FILE:	3211012 – Lauzon Parkway Improvements Class Environmental Assessment
SUBJECT:	Roundabout Analysis at Walker Road/Legacy Park Drive/7th Concession Road/East-West Arterial Intersection

The existing Walker Road/Legacy Park Drive/7th Concession Road intersection is a 4-leg signalized intersection. As part of the proposed improvement included in the Lauzon Parkway Improvements Class Environmental Assessment study, a new east-west connection (Future East-West Arterial) is required to support the future development of the Sandwich South community and provide an effective grid transportation system for the area. The west connection of the Future East-West Arterial would be at the existing Walker Road/Legacy Park Drive/7th Concession Road intersection.

The connection of the Future East-West Arterial to the existing Walker Road/Legacy Park Drive/7th Concession Road intersection is complex. To improve the safety and operations of this intersection, consideration is being given to various options including a roundabout.

As shown in Figure 1, the roundabout option would maintain access from all intersecting roads, which would result in a 5-leg roundabout. The roundabout would be 2 lanes with an inscribed diameter of 70 m. Due to the high truck volume, the roundabout would be required to accommodate truck traffic (WB-20.5). The existing share of commercial vehicles on Walker Road during the a.m. peak hour is approximately 8 to 10% and during the p.m. peak hour is approximately 5%.

To accommodate the 5 approaches to the roundabout, the Future East-West Arterial would be realigned south from its designated right-of-way.

Traffic Capacity and Operational Analysis for Proposed Roundabout:

The roundabout capacity analysis was assessed for the 2031 p.m. peak hour traffic demand. The future p.m. peak hour traffic volume on Walker Road (major arterial) is approximately 1,500 vehicles on the southbound approach and approximately 1,300 vehicles on the northbound approach with minor volume on Legacy Park Drive (approximately 300 vehicles) and 7th Concession Road (approximately 150 vehicles). For this analysis, the existing traffic volume observed during weekday p.m. peak hour was used for the Legacy Park Drive and 7th Concession Road approach. In future, the future East-West Arterial would connect to this intersection and could add about 500 vehicles to the existing intersection. Considering future traffic demand, the overall intersection traffic volume would increase to around 3,700 vehicles.

The design configuration used in the traffic operational analysis is presented in **Figure 1.** The intersection capacity analysis for the roundabouts was assessed using three traffic engineering software: (1) Arcady, (2) SimTraffic/Synchro and (3) VISSIM.

These are industry standard software which consider the traffic demand and network geometry for the capacity analysis. The Arcady is renowned software used in U.K. and Europe for roundabout analysis. The Arcady (UK) and Rodel (US) software are analyzing the roundabout capacity using Empirical Method using six geometric parameters. These parameters include entry width, approach width, effective flare length, entry radius, entry angle and inside circle diameter. The Arcady is appropriate tool for designing and operational analysis for usual configuration without significant imbalance approach traffic volumes. In this condition, the use of micro-simulation models should be considered.

The SimTraffic is the micro-simulation model under Synchro software. The SimTraffic and Arcady provides preliminary analysis results for roundabouts. As both of the software have different methods for estimating delay, the analysis results could vary slightly compared to each other; however, they generally generate similar overall outcomes. The approach delay from the Arcady analysis is presented in **Table 1** and from SimTraffic is presented in **Table 2**. The outputs from Arcady and SimTraffic are included in **Appendix A** and **Appendix B**, respectively.

Table 1: Roundabout Capacity Analysis using ARCADY

Approach				
ID	Name (Direction)	Volume	Delay (Veh/Sec)	LOS
1	Walker Road (NB)	1,340	14	B
2	Future E-W Arterial (WB)	410	157	F
3	7th Concession Road (SWB)	140	18	C
4	Walker Road (SB)	1,530	35	D/E
5	Legacy Park Drive (EB)	320	184	F
	Total/Average	**3,740**	**53**	**F**

Table 2: Roundabout Capacity Analysis using SimTraffic

Approach				
ID	Name (Direction)	Simulated Volume	Delay (Veh/Sec)	LOS
1	Walker Road (NB)	1,316	46	E
2	Future E-W Arterial (WB)	435	110	F
3	7th Concession Road (SWB)	150	13	B
4	Walker Road (SB)	1,507	35	E
5	Legacy Park Drive (EB)	300	234	F
	Total/Average	**3,708**	**63**	**F**

The capacity analysis results from both methods indicate that the roundabout configuration at this intersection would result in the overall level-of-service (LOS) **'F'** i.e. high delay resulting in very congested conditions. The average delays for vehicle on the Legacy Park Drive and the Future East-West Arterial approaches would be un-reasonably high (about 3 to 4 minutes of average delay). In addition to preliminary analysis using Arcady and SimTraffic, a detailed microsimulation analysis was conducted using VISSIM software.

The VISSIM is a well renowned microsimulation model in the North America. The VISSIM microsimulation model includes the driver behaviour parameters, vehicle parameters, network/geometry and interaction of vehicles. With its unique high level of detail it accurately simulates urban and highway traffic, including pedestrians, cyclists and motorized vehicles. The VISSIM microsimulation model is used for many traffic and transportation engineering projects to simulate different traffic scenarios and options for various kinds of projects. The VISSIM model combines traffic engineering expertise and state-of-art presentation options with 3D animations.

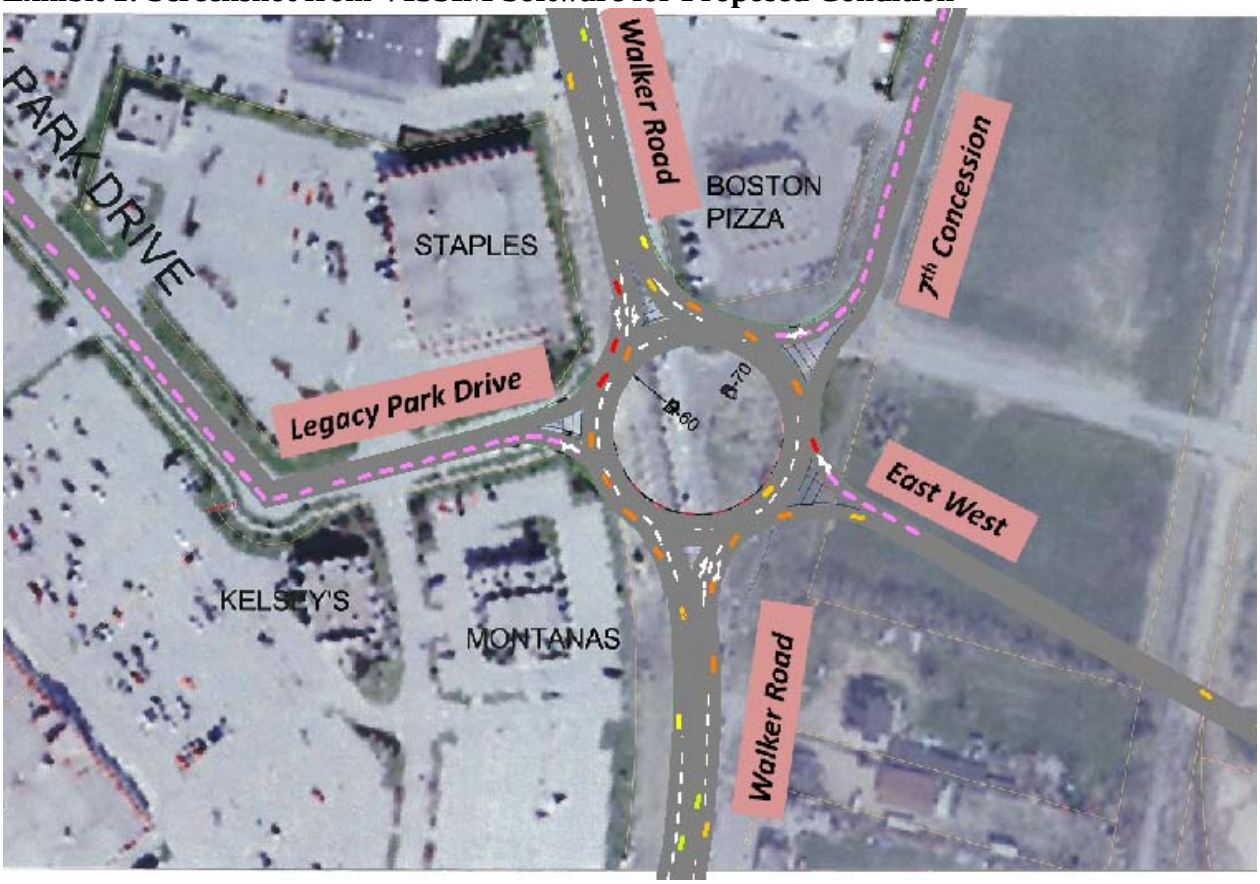
The analysis result from VISSIM software is presented in **Table 3**. The detailed VISSIM analysis result is presented in **Appendix C.** This analysis indicates that proposed roundabout at Walker Road/East-West Arterial/7th Concession/Legacy Park Drive would result in high delay (LOS'F'). This result confirms the preliminary analysis results evaluated from Arcady and SimTraffic.

Table 3: Roundabout Microsimulation Analysis using VISSIM

Approach					
ID	Name (Direction)	Volume	Delay (Sec/Veh)	LOS	Queue (meters)
1	Walker Road (NB)	1,353	18	C	117
2	Future E-W Arterial (WB)	413	73	**F**	189
3	7th Concession Road (SWB)	66	1117	**F**	449
4	Walker Road (SB)	1,536	26	D	168
5	Legacy Park Drive (EB)	252	350	**F**	447
	Total/Average	**3,620**	**71**	**F**	

The screenshot from the VISSIM microsimulation is presented in **Exhibit 1**; demonstrates the long queues (high delay) for the 7th Concession Road and Legacy Park Drive.

Exhibit 1: Screenshot from VISSIM Software for Proposed Condition



In addition to capacity constraints on approaches, the proposed roundabout would result in other traffic operational issues with respect to:

- 5-leg roundabout configuration with high total volume;
- Imbalanced traffic demand at this intersection - high-volume at major arterials with lower volume on minor collectors/local streets such as the case of Walker Road, which has a significantly higher volume than Legacy Park Drive, 7th Concession Road and the Future E-W Arterial. Roundabout tends to treat all movements at an intersection equally, with no priority provided based on the traffic demand; and
- In addition, the existing signal progression on Walker Road could be also be disrupted by the roundabout, thus reducing the efficiency of downstream intersections.

Property Impacts

The roundabout configuration cannot be accommodated within the existing intersection footprint. In addition, in order to improve the spacing of the 5-leg roundabout, in particular the 7th Concession Road leg, Future East-West Arterial leg and the south Walker Road leg, it was shifted slightly to the southeast of the existing intersection.

As shown in Figure 2, property is required from the Montanas Restaurant (south-west corner), Staples Store (north-west corner) and Boston Pizza Restaurant (north-east corner). Property impacts to Montanas and Boston Pizza includes the removal of approximately 10 parking spaces from each of the properties. The removal of the parking may also affect the parking supply

required for the properties as required by the zoning bylaw, which may require a zoning variance. In addition, due to the property impacts at the corner of the two parking lots, there may be a disruption to the flow of the parking lots.

In addition to potentially removing 1 parking space from the Staples Store property to accommodate the roundabout at this location, the southeast corner of the Staples building may be impacted.

It should be noted that Figure 2 represents only a planning level of the roundabout. Details such as cycling and pedestrian requirements have not been included; therefore, property impacts may be more significant than shown.

In addition, the City of Windsor has protected property for the alignment of the Future East-West arterial from Walker Road to approximately 650 m easterly. In order to accommodate the 7th Concession Road leg and the Future East-West Arterial leg, the Future East-West Arterial is on a new alignment (outside the area protected for the roadway) from Walker Road to approximately 300 m easterly.

Summary

A roundabout is not preferred at this location. This option is set-aside due to:

- An overall level-of-service (LOS) 'F' resulting in high delay and very congested conditions.
- Operational concerns associated with a 5-leg roundabout that connects to a major arterial roadway (Walker Road) with significant traffic volumes.
- Un-balanced traffic demand at the intersection - high-volume at major arterials with lower volume on minor collectors/local streets such as the case of Walker Road, which has a significantly higher volume than Legacy Park Drive, 7th Concession Road and the Future E-W Arterial. Roundabout tends to treat all movements at an intersection equally, with no priority provided based on the traffic demand; and
- Property impacts to both the Montanas Restaurant (south-west corner) and removal of parking supply.
- Property impacts to Staples Store (north-west corner) and removal of parking supply and impacts to the southeast corner of the building.
- The Future East-West Arterial would need to be realigned south from its designated right-of-way to accommodate the 5 approaches to the roundabout.

Figure 1 - Roundabout Layout

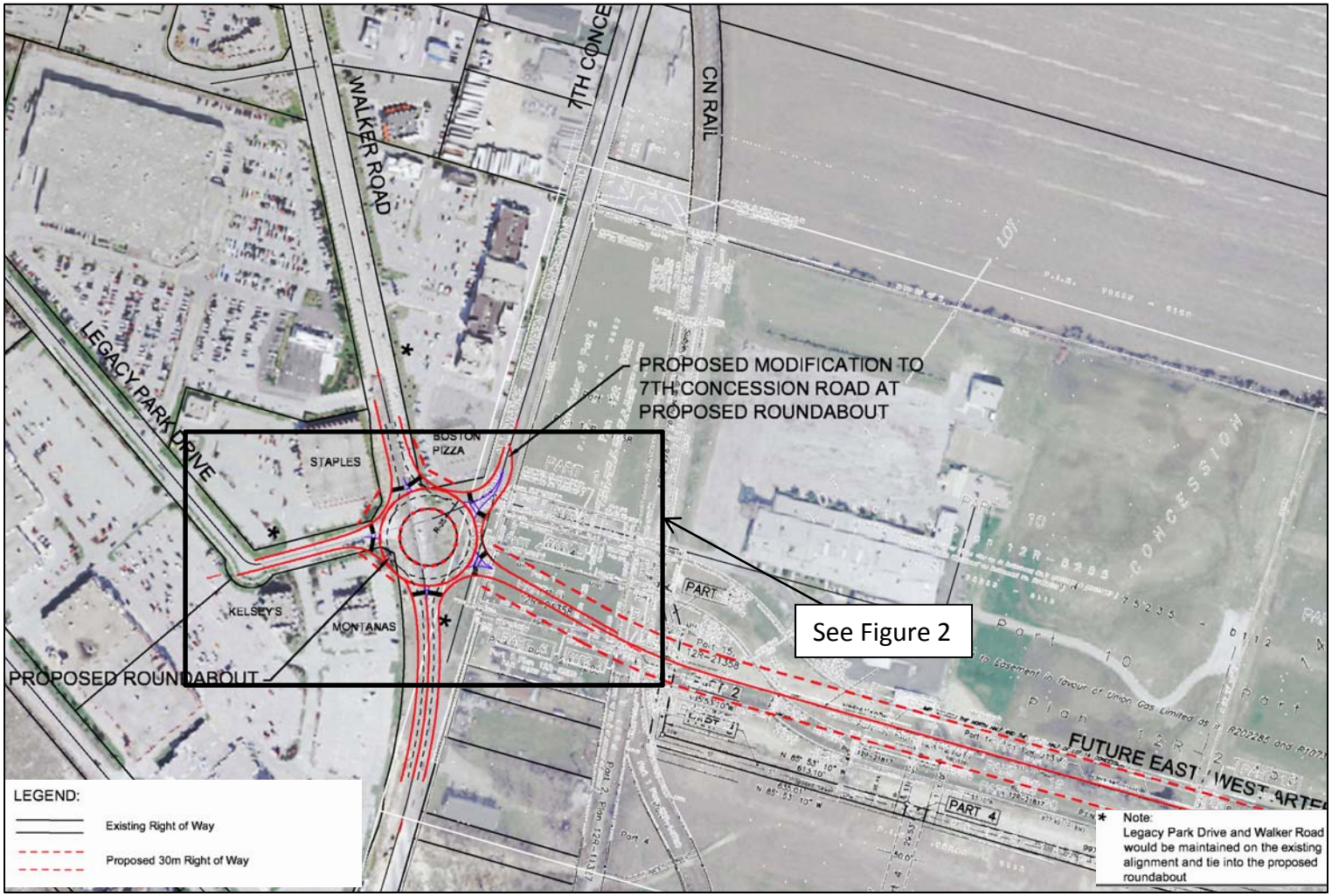
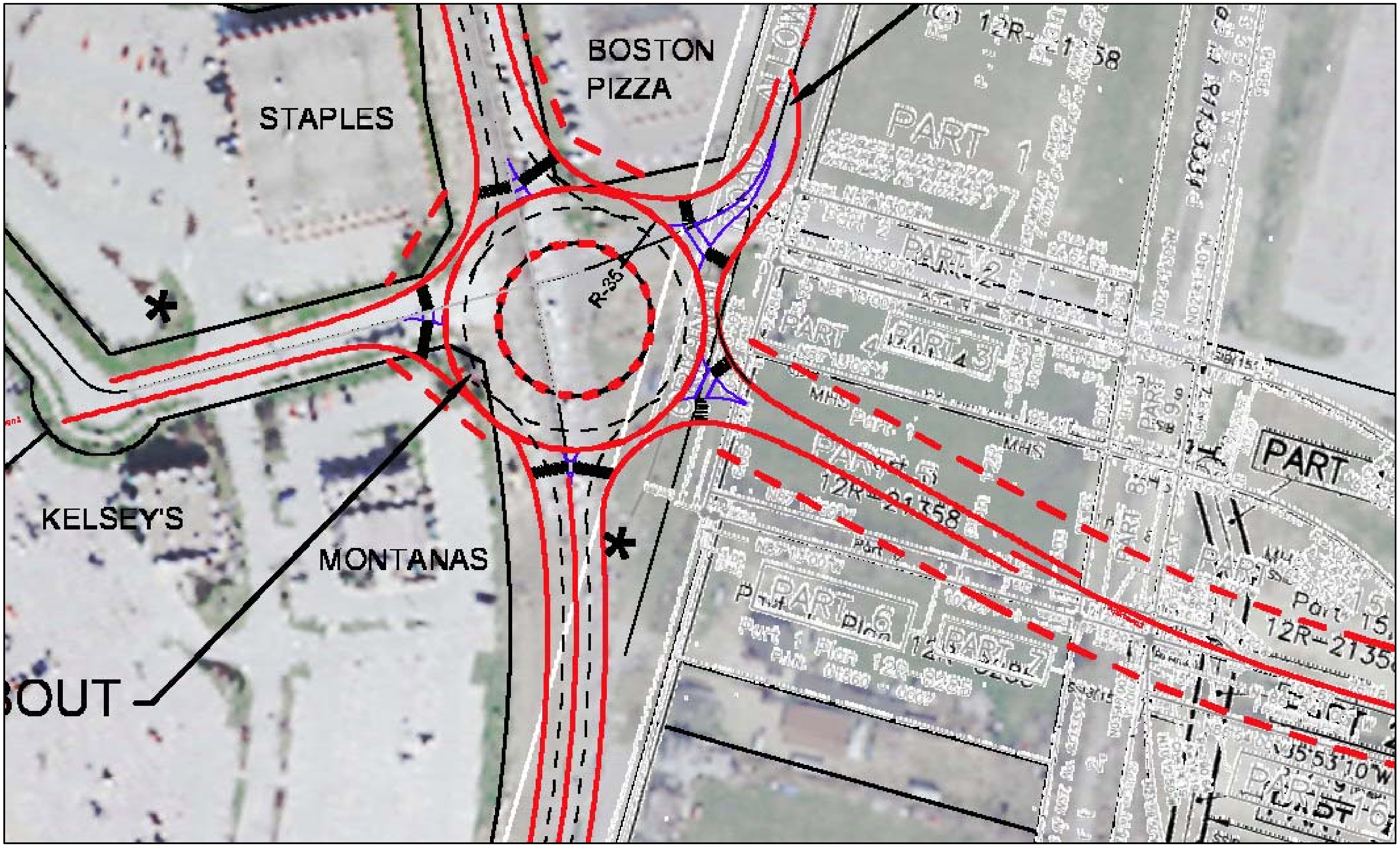


Figure 2 - Roundabout Layout



Appendix A – Arcady Output

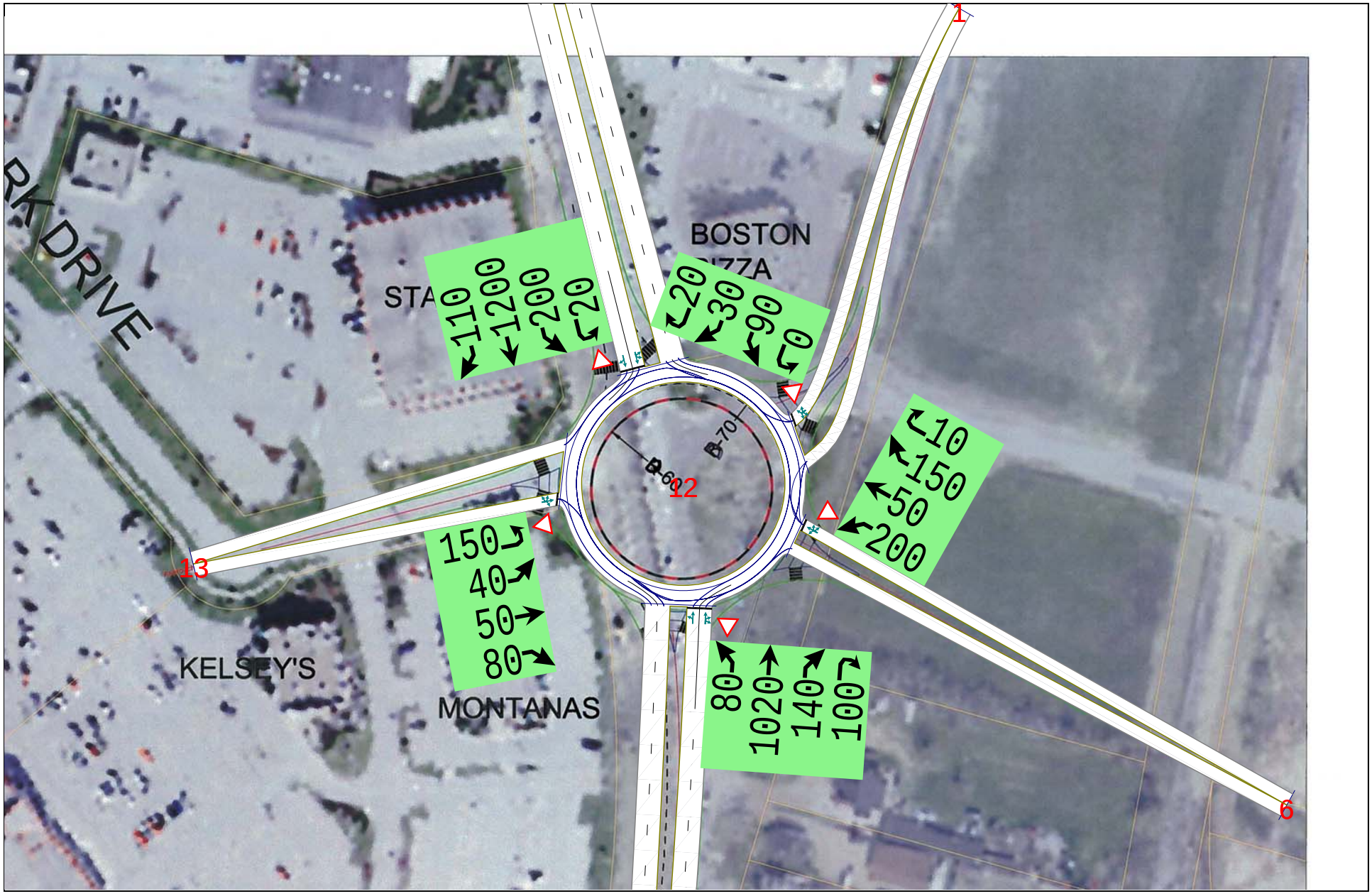
	PM Peak Hour			
	Queue (PCU)	Delay (s)	RFC	LOS
	2031 - 2031 Forecast			
Arm 1	5.45	13.74	0.84	B
Arm 2	26.56	157.36	1.03	F
Arm 3	0.75	18.46	0.42	C
Arm 4	17.37	34.67	0.95	D
Arm 5	24.14	183.85	1.03	F

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.

2031 Forecast - PM Peak Hour runs from 17:00:00 to 18:00:00

Appendix B - SimTraffic Output

Walker Road/Legacy Park/E-W Arterial/7th Concession Road **2031 p.m. peak hour**



9/16/2011

Summary of All Intervals

Start Time	4:50
End Time	6:00
Total Time (min)	70
Time Recorded (min)	60
# of Intervals	2
# of Recorded Intvls	1
Vehs Entered	3708
Vehs Exited	3697
Starting Vehs	137
Ending Vehs	148
Denied Entry Before	0
Denied Entry After	21
Travel Distance (km)	2870
Travel Time (hr)	135.1
Total Delay (hr)	68.5
Total Stops	3664
Fuel Used (l)	320.5

Interval #0 Information Seeding

Start Time	4:50
End Time	5:00
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	5:00
End Time	6:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Vehs Entered	3708
Vehs Exited	3697
Starting Vehs	137
Ending Vehs	148
Denied Entry Before	0
Denied Entry After	21
Travel Distance (km)	2870
Travel Time (hr)	135.1
Total Delay (hr)	68.5
Total Stops	3664
Fuel Used (l)	320.5

12: Int Performance by movement

Movement	EBL2	EBL	EBT	EBR	WBL	WBT	WBR	WBR2	NBL	NBT	NBR	NBR2
Total Delay (hr)	7.8	1.9	3.6	5.7	6.2	1.6	5.1	0.3	0.9	12.7	1.8	1.4
Delay / Veh (s)	227.4	230.3	270.2	223.8	108.1	112.9	111.8	115.1	46.1	46.0	44.4	45.2
Total Stops	27	9	6	23	169	52	134	8	79	1042	146	112
Travel Dist (km)	13.6	3.2	5.4	9.8	33.8	8.3	27.1	1.6	28.2	409.1	59.0	45.1
Travel Time (hr)	8.2	1.9	3.7	5.9	7.1	1.8	5.8	0.4	1.5	21.7	3.1	2.4
Avg Speed (kph)	2	2	2	2	5	5	5	5	19	19	19	19
Fuel Used (l)	7.7	1.8	3.4	5.6	8.1	2.1	6.6	0.4	3.1	44.5	6.2	4.7
HC Emissions (g)	24	5	4	5	16	11	20	3	8	242	29	28
CO Emissions (g)	417	92	102	162	438	186	439	45	293	5894	751	658
NOx Emissions (g)	32	7	7	13	43	19	46	5	26	675	81	76
Vehicles Entered	127	29	51	93	207	52	166	10	71	990	145	110
Vehicles Exited	122	29	46	89	205	51	162	10	70	1000	145	108
Hourly Exit Rate	122	29	46	89	205	51	162	10	70	1000	145	108
Input Volume	150	40	50	80	200	50	150	10	80	1020	140	100
% of Volume	81	72	92	111	102	102	108	100	88	98	104	108
Denied Entry Before	0	0	0	0	0	0	0	0	0	0	0	0
Denied Entry After	3	3	2	7	3	0	2	1	0	0	0	0

12: Int Performance by movement

Movement	SBL2	SBL	SBT	SBR	SWL	SWR	SWR2	All
Total Delay (hr)	0.3	2.4	11.1	1.1	0.4	0.1	0.1	64.3
Delay / Veh (s)	41.4	40.9	34.7	31.8	13.4	13.6	10.4	62.5
Total Stops	23	200	1038	111	79	24	15	3297
Travel Dist (km)	9.2	82.0	450.1	49.7	11.9	4.1	3.0	1254.4
Travel Time (hr)	0.5	4.2	20.9	2.2	0.7	0.2	0.2	92.5
Avg Speed (kph)	19	20	22	22	18	17	20	15
Fuel Used (l)	1.0	8.9	46.9	4.8	1.7	0.6	0.4	158.7
HC Emissions (g)	1	41	238	20	6	2	2	705
CO Emissions (g)	65	1103	6065	552	235	78	69	17645
NOx Emissions (g)	6	119	686	60	22	8	8	1939
Vehicles Entered	24	210	1146	127	94	32	24	3708
Vehicles Exited	24	209	1150	125	94	32	24	3695
Hourly Exit Rate	24	209	1150	125	94	32	24	3695
Input Volume	20	200	1200	110	90	30	20	3740
% of Volume	120	104	96	114	104	107	120	99
Denied Entry Before	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	21

Total Network Performance

Total Delay (hr)	68.5
Delay / Veh (s)	66.6
Total Stops	3664
Travel Dist (km)	2870.4
Travel Time (hr)	135.1
Avg Speed (kph)	23
Fuel Used (l)	320.5
HC Emissions (g)	1583
CO Emissions (g)	38997
NOx Emissions (g)	4603
Vehicles Entered	3708
Vehicles Exited	3697
Hourly Exit Rate	3697
Input Volume	7480
% of Volume	49
Denied Entry Before	0
Denied Entry After	21

Intersection: 12: Int

Movement	EB	WB	NB	NB	SB	SB	SW
Directions Served	<LTR	LTR>	LT	TR>	<LT	TR	<LR>
Maximum Queue (m)	127.7	180.1	416.0	416.0	396.7	396.7	46.3
Average Queue (m)	109.7	122.6	114.0	122.7	167.4	126.3	14.4
95th Queue (m)	143.9	215.9	270.8	278.6	402.1	318.9	29.4
Link Distance (m)	108.5	164.2	411.4	411.4	392.1	392.1	126.2
Upstream Blk Time (%)	76	30	0	0	1	0	
Queuing Penalty (veh)	0	0	0	0	0	0	
Storage Bay Dist (m)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

Network Summary

Network wide Queuing Penalty: 0

Appendix C – VISSIM Output

LOS Summary for Walker Road/Legacy Park Drive Roundabout from VISSIM Software (2031 p.m. peak hour)

Walker Road at Legacy Park

	Legacy Park (EB)					EW Arterial (WB)					7th Concession (SWB)				
	EBL	EBTL	EBTR	EBR	All	WBL	WBTL	WBTR	WBR	All	SBL	SBTL	SBTR	SBR	All
Travel Time Section	1	2	3	4		9	10	11	12		13	14	15	16	
Queue Counter	1	1	1	1		3	3	3	3		4	4	4	4	
Volume (vph)	116	32	40	64	252	200	55	148	11	413	0	42	15	9	66
Delay (sec)	345	357	358	351	350	75	75	70	67	73	0	1070	1196	1212	1117
LOS	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**		**F**	**F**	**F**	**F**
95th% Queue (m)	447	447	447	447		189	189	189	189		449	449	449	449	
MAX Queue (m)	451	451	451	451		239	239	239	239		457	457	457	457	

	Walker Road (NB)					Walker Road (SB)					Overall
	NBL	NBTL	NBTR	NBR	All	SBL	SBTL	SBTR	SBR	All	
Travel Time Section	5	6	7	8		17	18	19	20		
Queue Counter	2	2	2	2		5	5	5	5		
Volume (vph)	78	1029	144	102	1353	21	196	1208	111	1536	3620
Delay (sec)	23	19	16	15	18	27	26	26	21	26	71
LOS	**C**	**C**	**C**	**C**	**C**	**D**	**D**	**D**	**C**	**D**	**F**
95th% Queue (m)	117	117	117	117		168	168	168	168		
MAX Queue (m)	162	162	162	162		231	231	231	231		