Appendix F Transportation Impact Assessment

Total Athabasca Upgrader
Transportation Impact Assessment

Project #: 117200704

Prepared for Fluor Canada Ltd.

December 2007

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1.0 Introduction

Stantec Consulting Ltd. completed a transportation impact assessment (TIA) for the proposed construction and operation of an oil-upgrading facility owned and operated by TOTAL E&P Canada Ltd. (TOTAL).

The study area is located northeast of both Edmonton and Fort Saskatchewan and forms part of Alberta's Industrial Heartland in Strathcona County. The surrounding roadways include Highway 15 to the south, Range Road 220 on the west, Range Road 214 on the east and Township Road 554 north of the site. The study area also includes Range Road 215 running through the middle of the land.

This TIA will address the external roadway impacts of developing the TOTAL site.

2.0 Background

Traffic counts and roadway characteristics for the study area were obtained from Alberta Transportation and Infrastructure (AIT), Strathcona County and a report previously completed by Stantec Consulting Ltd. titled *Strathcona County 2005/2006 Transportation Model Update*. Furthermore, data on long-term plans for the study area was obtained from another report completed by Stantec Consulting Ltd. titled *Strathcona Area Industrial Heartland Transportation Study*"

The Strathcona Industrial Heartland Transportation Study has analyzed three scenarios: 2012, 2017 and 2027. The scenarios have been developed to answer industrial heartland transportation planning issues over the next twenty years and ensure that adequate capacity on the area's roadway network will be planned for. The Strathcona Industrial Heartland Transportation Study examined the operations of all the planned Strathcona Industrial Heartland activities as well a major shutdown of one of the sites at each timeframe.

Scenarios for the TOTAL TIA have been developed to coincide with the same timeframes as the Strathcona Industrial Heartland Transportation Study scenarios. Being that the Strathcona Industrial Heartland Transportation Study analyzed the roadway network at 2012 and assumed full operations of the TOTAL site, the 2012 timeframe has not been analyzed in detail for this analysis. The 2012 Scenario and the 2027 Scenario represent worst-case scenarios – if the 2012 Scenario and the 2027 Scenarios operate adequately, the 2017 can be expected to as well.

All scenarios for the external roadways analysis assume up to three site accesses:

- Material delivery – assumed to be necessary because of possible lengthy delays at site entrance due to inspection / permitting issues.
- Operations Workers – entrance for TOTAL employees and regular contractors necessary to operate the site.
- Construction Entrance – Due to the magnitude, temporary duration and the possibility for labour issues, construction employees have been assumed to have a separate entrance.

2.1 2012 SCENARIO

Construction of the TOTAL site is expected to peak in 2012 up to 4000 full-time equivalent workers. The 2012 Scenario analyzes the impact of TOTAL-related traffic during the peak of construction in both the AM and PM peak periods.

2.1.1 Background Traffic

Because the Strathcona Industrial Heartland Transportation Study only analyzed operations and turnaround traffic, Strathcona Industrial Heartland Transportation Study did not include any traffic from the TOTAL site. The design volumes from the Strathcona Industrial Heartland Transportation Study 2012 operations scenario (Scenario 1) then form the background traffic for the 2012 Scenario. To calculate the PM background traffic volumes, the volumes were reversed.

2.2 2027 SCENARIO

The 2027 Scenario analyzes the TOTAL-related traffic impacts of operations and a major shutdown of the Total site at a time when all of the planned developments within the Strathcona Industrial Heartland are operating. For this scenario, 300 full-time equivalent operations workers and 600 full-time equivalent shutdown employees were expected to be necessary during a major shutdown. This scenario has been analyzed in both the AM and PM Peak periods.

2.2.1 Background Traffic

Background traffic has been developed by using the 2027 operations scenario (Scenario 7) from the Strathcona Industrial Heartland Transportation Study and removing the total traffic from the network. To calculate the PM background traffic volumes, the volumes were reversed.

3.0 Site Characteristics and Trip Generation

It is expected that the TOTAL site will require up to 4000 full-time equivalent workers at the peak of construction.

3.1 TRIP DISTRIBUTION

Current data shows that approximately 95% of Strathcona Industrial Heartland traffic accesses the area from west on Highway 15. With further development expected in the Bruderheim and Lamont areas, and an increased reliance on Highway 830, the expected use of Highway 15 from/to the west drops to 85% in 2012 and 70% in 2027. Table 3.1 shows the trip distribution used for the analysis presented here:

Table 3.1 – Traffic Distribution by Percentage

Roadway	2012 Scenario	2027 Scenario
Highway 15 – West	85%	70%
Highway 15 – East	5%	10%
Highway 830 – South	7.5%	15%
Other Roadways -- North	2.5%	5%

3.2 TRIP GENERATION

A close correlation with the number of day shift workers and the peak hour traffic in the Industrial Heartland has been noted by the Strathcona Industrial Heartland Transportation Study. Accordingly, an equivalent trip generation rate of 1.0 vehicle trip per hour per worker has been used for this analysis which is consistent with the Strathcona Industrial Heartland Transportation Study.

A nominal amount of materials deliveries have been assumed to enter the site during the peak hours for all scenarios.

Traffic volumes generated by the upgrader are expected to exhibit substantial peaking within the peak hour of analysis. Input from Strathcona Industrial Heartland proponents has suggested that the peak hour is highly peaked, with up to 1/3 of hourly traffic volumes arriving in the peak 15 minutes. As such, a corresponding peak hour factor of 0.75 has been used for this analysis. Since some of the available traffic counts in the area suggest that peaking is less pronounced, this assumed peak hour factor can be considered to be a conservatively-high assumption.

3.2.1 2012 Scenario

For the basis of this analysis we have assumed that the majority of the construction staff will be bused to site. Of the remaining workers that will be expected to drive, most will be expected to arrive and leave in the peak hours – due to night time operations, part-time workers on site and supervisors arriving before the peak and leaving after the peak.

Highway coaches will be used to transport the workers to and from the Total site over the peak hours and will enter and exit via the construction worker access point.

Two-thirds of the Phase 1 operations workforce are expected to be needed on site at the peak of construction. These operations workers are expected to drive themselves to and from site via the operations worker access point.

The design volumes for both the AM and PM peak hours are comprised of the site generated volumes added to the background volumes.

3.2.2 2027 Scenario

For the 2027 scenario, it is assumed that 600 full-time equivalent construction workers will be necessary during a major shutdown. In addition to the construction workers, it is assumed that a full complement of 300 full-time equivalent operations employees will also be on site. All workers in the 2027 Scenario are expected to drive to site. Similar to the 2012 Scenario, most of the full-time equivalent workers will be expected to arrive and leave in the peak hours.

The design volumes for both the AM and PM peak hours are comprised of the site-generated volumes added to the background volumes.

4.0 Analysis

For a summary of the traffic analysis please see:

- Table 4.1 – 2012 Scenario AM – Intersection Analysis Summary
- Table 4.2 – 2012 Scenario PM – Intersection Analysis Summary
- Table 4.3 – 2027 Scenario AM – Intersection Analysis Summary
- Table 4.4 – 2027 Scenario PM – Intersection Analysis Summary

The findings of this analysis are consistent with the Strathcona Industrial Heartland Transportation Study. Most notably:

- Eastbound double-left turn-bays, southbound double-right turn-bays and signals are required at the intersection of Highway 15 – Range Road 220 to accommodate the construction of the TOTAL Site. A diamond interchange is necessary at this intersection by the 2027 timeframe to accommodate future growth and major shutdowns.
- This analysis shows that the construction and operation of the TOTAL site can operate adequately with the current alignment of Range Road 214 and Range Road 213 (i.e. without the realignment of Range Road 214 identified in the Strathcona Industrial Heartland Transportation Study). Similarly, the roadway network can also operate adequately with the proposed realignment of Range Road 214 and Range Road 213 as shown in the Strathcona Industrial Heartland Transportation Study.

Other general findings of this analysis include:

- Right-turn and left-turn bays are necessary for all access points off Range Road 220 and Township Road 554.
- Stop control is adequate for all access points off Range Road 220 and Township Road 554. Temporary signals or another temporary traffic control measure will likely be necessary to control access into/out-of the contractor access the PM peak at the peak of construction. This analysis shows that the stop-controlled access can accommodate approximately 90% of construction workers. Traffic monitoring at this location is recommended during construction.
- The Intersection of Range Road 220 – Township Road 554 requires left-turn bays in all directions. In the 2027 timeframe, a northbound-right turn-bay becomes necessary to accommodate growth north of the TOTAL site. It may make sense to construct this at the same time as the rest of the intersection upgrades. Similar to the contractor access – during the PM peak of the peak of construction this intersection will likely require

temporary signals or other temporary traffic control measure. Traffic monitoring at this location is recommended during construction.

- The AM and PM peak analysis periods in the 2027 Scenario show a few areas where the Level of Service (LOS) has dropped to LOS F. Microsimulation was used at these areas to show that due to platooning effects from nearby signals, these intersections operate adequately.

Other considerations to note:

- The railway crossings of Range Road 220 will require the railway company to assess, design and construct adequate crossing control. This may take up to two years to complete.

Table 4.1 – 2012 Scenario AM – Intersection Analysis Summary

Intersection Location	Intersection Movements												Overall Intersection	Comments/Critical Movements
Description	SB			NB			EB			WB				
	L	T	R	L	T	R	L	T	R	L	T	R		
Hwy 15 & RR 214														
Intersection / Laning Characteristics	1	2	2	1	2	1	2	2	1	1	2	1		
Volumes(veh/h)	7	8	7	12	255	5	601	430	10	5	303	88		
Volume/Capacity Ratio (V/C)	0.06	0.02	0.01	0.07	0.59	0.03	0.73	0.26	0.01	0.03	0.45	0.28		
Total Delay	18.7	17.5	1.9	22.1	27.8	14.2	16.6	12.1	5.7	23.2	21.1	13.5	ICU = 45.4%	Cycle Length = 60 seconds
Level of Service (LOS)	B	B	A	C	C	B	B	B	A	C	C	B	B	
Hwy 15 & RR 220														
Intersection / Laning Characteristics	1	1	2	1	1	SH	2	2	1	1	2	1		
Volumes(veh/h)	5	5	32	5	19	13	811	1022	5	5	312	5		
Volume/Capacity Ratio (V/C)	0.18	0.03	0.02	0.04	0.16	-	0.86	0.78	0.01	0.04	0.52	0.02		
Total Delay	38.6	26.2	0	26.4	20.1	-	29.4	18.5	5.4	29.2	26.4	13.2	ICU = 54.9%	Cycle Length = 70 seconds
Level of Service (LOS)	D	C	A	C	C	-	C	B	A	C	C	B	C	
RR 214 & TWP RD 554														
Intersection / Laning Characteristics	1	-	1	-	-	-	2	2	-	-	2	SH		
Volumes(veh/h)	5	-	11	-	-	-	619	325	-	-	10	10		
Volume/Capacity Ratio (V/C)	0.01	-	0.01	-	-	-	0.68	0.28	-	-	0.06	-		
Total Delay	18.4	-	1.5	-	-	-	6.9	3.3	-	-	16.6	-	ICU = 38.5%	Cycle Length = 60 seconds
Level of Service (LOS)	B	-	A	-	-	-	A	A	-	-	B	-	A	
RR 220 & Operations Access														
Intersection / Laning Characteristics	1	1	-	-	1	1	-	-	-	1	-	1		
Volumes(veh/h)	12	29	-	-	735	89	-	-	-	9	-	3		No Signal
Volume/Capacity Ratio (V/C)	0.03	0.03	-	-	0.58	0.07	-	-	-	0.05	-	0.01		
Total Delay	0.3	3.4	-	-	0	0	-	-	-	20.7	-	17.2	ICU = 49.0%	WB - Stop Controlled
Level of Service (LOS)	A	A	-	-	A	A	-	-	-	C	-	C	A	

Intersection Location	Intersection Movements												Overall Intersection	Comments/Critical Movements
Description	SB			NB			EB			WB				
	L	T	R	L	T	R	L	T	R	L	T	R		
RR 220 & Materials Access														
Intersection / Laning Characteristics	1	1	-	-	1	1	-	-	-	1	-	1		
Volumes(veh/h)	4	40	-	-	714	22	-	-	-	1	-	0		No Signal
Volume/Capacity Ratio (V/C)	0.01	0.01	-	-	0.56	.0.2	-	-	-	0.01	-	0		
Total Delay	0.1	1	-	-	0	0	-	-	-	19	-	0	ICU = 48.0%	WB - Stop Controlled
Level of Service (LOS)	A	A	-	-	A	A	-	-	-	C	-	0	A	
TWP 554 & Contracters Access														
Intersection / Laning Characteristics	-	-	-	1	-	1	-	1	1	1	1	-		
Volumes(veh/h)	-	-	-	28	-	6	-	0	713	147	14	-		No Signal
Volume/Capacity Ratio (V/C)	-	-	-	0.09	-	0.01	-	0	0.56	0.28	0.01	-		
Total Delay	-	-	-	14.2	-	8.4	-	0	0	12	0	-	ICU = 59.0%	NB - Stop Controlled
Level of Service (LOS)	-	-	-	B	-	A	-	A	A	B	A	-	A	
TWP 554 & RR 220														
Intersection / Laning Characteristics	1	1	SH	1	1	SH	1	1	SH	1	1	SH		
Volumes(veh/h)	5	5	5	5	5	714	5	5	5	43	5	5		No Signal
Volume/Capacity Ratio (V/C)	0.01	0.01	0.01	0	0.56	0.56	0.01	0.03	0.03	0.13	0.03	0.03		
Total Delay	0.1	3.4	3.4	7.3	0	0	9	14.6	14.6	14.4	12.3	12.3	ICU = 59.0%	EB-WB - Stop Controlled
Level of Service (LOS)	A	A	A	A	A	A	A	B	B	B	B	B	A	

Table 4.2 – 2012 Scenario PM – Intersection Analysis Summary

Intersection Location	Intersection Movements												Overall Intersection	Comments/Critical Movements
Description	SB			NB			EB			WB				
	L	T	R	L	T	R	L	T	R	L	T	R		
Hwy 15 & RR 214														
Intersection / Laning Characteristics	1	2	2	1	2	1	2	2	1	1	2	1		
Volumes(veh/h)	88	255	601	10	8	5	7	309	12	5	430	7		
Volume/Capacity Ratio (V/C)	0.3	0.35	0.55	0.05	0.01	0.02	0.02	0.23	0.02	0.03	0.49	0.02		
Total Delay	15.6	15.2	7.7	16.3	15.6	10.6	33.6	5.8	2.7	23.2	17.8	8.7	ICU = 51.2%	Cycle Length = 60 seconds
Level of Service (LOS)	B	B	A	B	B	B	C	A	A	C	B	A	B	
Hwy 15 & RR 220														
Intersection / Laning Characteristics	1	1	2	1	1	SH	2	2	1	1	2	1		
Volumes(veh/h)	5	10	811	5	15	15	32	310	5	5	1031	5		
Volume/Capacity Ratio (V/C)	0.16	0.04	0.39	0.03	0.13	-	0.17	0.19	0.01	0.07	0.65	0.01		
Total Delay	52.2	42.6	0.4	42.6	27	-	53.8	9.8	4.8	52.6	14.5	4.2	ICU = 44.3%	Cycle Length = 120 seconds
Level of Service (LOS)	D	D	A	D	C	-	D	A	A	D	B	A	A	
RR 214 & TWP RD 554														
Intersection / Laning Characteristics	1	-	1	-	-	-	2	2	-	-	2	SH		
Volumes(veh/h)	10	-	619	-	-	-	11	10	-	-	325	5		
Volume/Capacity Ratio (V/C)	0.02	-	0.77	-	-	-	0.03	0.01	-	-	0.84	-		
Total Delay	8.8	-	12.8	-	-	-	23.2	13.3	-	-	42	-	ICU = 55.8%	Cycle Length = 60 seconds
Level of Service (LOS)	A	-	B	-	-	-	C	B	-	-	D	-	C	
RR 220 & Operations Access														
Intersection / Laning Characteristics	1	1	-	-	1	1	-	-	-	1	-	1		
Volumes(veh/h)	0	736	-	-	29	4	-	-	-	89	-	12		No Signal
Volume/Capacity Ratio (V/C)	0	0	-	-	0.02	0	-	-	-	46	-	0.02		
Total Delay	0	0	-	-	0	0	-	-	-	30.2	-	8.6	ICU = 50.0%	WB - Stop Controlled
Level of Service (LOS)	A	A	-	-	A	A	-	-	-	D	-	A	A	

Intersection Location	Intersection Movements												Overall Intersection	Comments/Critical Movements
Description	SB			NB			EB			WB				
	L	T	R	L	T	R	L	T	R	L	T	R		
RR 220 & Materials Access														
Intersection / Laning Characteristics	1	1	-	-	1	1	-	-	-	1	-	1		
Volumes(veh/h)	0	714	-	-	40	1	-	-	-	22	-	4		No Signal
Volume/Capacity Ratio (V/C)	0	0.56	-	-	0.03	0	-	-	-	0.11	-	0.01		
Total Delay	0	0	-	-	0	0	-	-	-	20.3	-	8.6	ICU = 48.0%	WB - Stop Controlled
Level of Service (LOS)	A	A	-	-	A	A	-	-	-	C	-	A	A	
TWP 554 & Contractors Access														
Intersection / Laning Characteristics			-	1		1		1	1	1	1			
Volumes(veh/h)			-	713		174	-	14	28	6	10			No Signal
Volume/Capacity Ratio (V/C)			-	**1**		0.22	-	0.01	0.02	0.01	0.01			
Total Delay			-	**50.5**		9.4	-	0	0	7.4	0		ICU = 51.0%	NB - Stop Controlled
Level of Service (LOS)			-	**F**		A	-	A	A	A	A		A	
TWP 554 & RR 220														
Intersection / Laning Characteristics	1	1	SH	1	1	SH	1	1	SH	1	1	SH		
Volumes(veh/h)	5	5	5	5	5	43	5	5	5	714	5	5		No Signal
Volume/Capacity Ratio (V/C)	0	0	0	0	0.04	0.04	0.01	0.01	0.01	**1.08**	0.01	0.01		
Total Delay	0	2.5	2.5	7.3	0	0	8.9	9.1	9.1	**75.4**	9.1	9.1	ICU = 58.0%	EB-WB - Stop Controlled
Level of Service (LOS)	A	A	A	A	A	A	A	A	A	**F**	A	A	B	

Table 4.3 – 2027 Scenario AM – Intersection Analysis Summary

Intersection Location	Intersection Movements												Overall Intersection	Comments/Critical Movements
Description	SB			NB			EB			WB				
	L	T	R	L	T	R	L	T	R	L	T	R		
Hwy 15 & RR 214														
Intersection / Laning Characteristics	1	2	2	1	2	1	2	2	1	1	2	1		
Volumes(veh/h)	5	5	5	30	490	80	1185	945	10	5	445	173		
Volume/Capacity Ratio (V/C)	0.11	0.01	0	0.14	0.94	0.29	0.97	0.52	0.01	0.06	0.89	0.78		
Total Delay	44.8	38.6	2.6	41.3	69.8	14.5	46.7	12.9	5.7	53.8	64.1	63.6	ICU = 72.2%	Cycle Length = 120 seconds
Level of Service (LOS)	D	D	A	D	E	B	D	B	A	D	E	E	D	
HWY 15 WB Ramp & RR 220														
Intersection / Laning Characteristics	0	2	1	1	2	0	0	0	0	1	1	1		
Volumes(veh/h)	0	10	25	5	1464	0	0	0	0	5	0	51		
Volume/Capacity Ratio (V/C)	-	0.01	0.03	0.01	0.77	-	-	-	-	0.04	-	0.05		
Total Delay	-	2.6	1.1	3.8	10.5	-	-	-	-	29.2	-	0.1	ICU = 68.0%	Cycle Length = 70 seconds
Level of Service (LOS)	-	A	A	A	B	-	-	-	-	C	-	A	A	
HWY 15 EB Ramp & RR 220														
Intersection / Laning Characteristics	1	2	0	0	2	1	2	1	1	0	0	0		
Volumes(veh/h)	10	10	0	0	19	5	1450	0	5	0	0	0		
Volume/Capacity Ratio (V/C)	0.1	0.04	-	-	0.07	0.04	0.79	-	0.01	-	-	-		
Total Delay	38.6	36.9	-	-	29.2	18.2	9.1	-	0	-	-	-	ICU = 68.0%	Cycle Length = 70 seconds
Level of Service (LOS)	D	D	-	-	C	B	A	-	A	-	-	-	A	
RR 214 & RR 213														
Intersection / Laning Characteristics	1	-	1	-	-	-	2	2	-	-	2	SH		
Volumes(veh/h)	5	-	5	-	-	-	948	900	-	-	10	5		
Volume/Capacity Ratio (V/C)	0.01	-	0	-	-	-	0.73	0.6	-	-	0.07	-		
Total Delay	30.6	-	1	-	-	-	19.3	13.6	-	-	29.7	-	ICU = 47.9%	Cycle Length = 90 seconds
Level of Service (LOS)	C	-	A	-	-	-	B	B	-	-	C	-	B	

Intersection Location	Intersection Movements												Overall Intersection	Comments/Critical Movements
Description	SB			NB			EB			WB				
	L	T	R	L	T	R	L	T	R	L	T	R		
RR 220 & Operations Access														
Intersection / Laning Characteristics	1	1	-	-	1	1	-	-	-	1	-	1		
Volumes(veh/h)	48	29	-	-	1353	162	-	-	-	6	-	2		No Signal
Volume/Capacity Ratio (V/C)	0.23	0.02	-	-	**1.06**	0.13	-	-	-	0.15	-	0.03		
Total Delay	22	0	-	-	0	0	-	-	-	**87**	-	43.2	ICU = 50.0%	WB - Stop Controlled
Level of Service (LOS)	C	A	-	-	A	A	-	-	-	**F**	-	E	A	
RR 220 & Materials Access														
Intersection / Laning Characteristics	1	1	-	-	1	1	-	-	-	1	-	1		
Volumes(veh/h)	4	91	-	-	1158	22	-	-	-	1	-	0		No Signal
Volume/Capacity Ratio (V/C)	0.01	0.07	-	-	0.91	0.02	-	-	-	0.01	-	0		
Total Delay	13.9	0	-	-	0	0	-	-	-	40.9	-	0	ICU = 48.0%	WB - Stop Controlled
Level of Service (LOS)	B	A	-	-	A	A	-	-	-	E	-	A	A	
TWP 554 & Contractors Access														
Intersection / Laning Characteristics			-	1		1		1	1	1	1			
Volumes(veh/h)			-	14		3	-	15	341	75	58			No Signal
Volume/Capacity Ratio (V/C)			-	0.3		0	-	0.01	0.27	0.09	0.05			
Total Delay			-	11		8.4	-	0	0	8.7	0		ICU = 32.0%	NB - Stop Controlled
Level of Service (LOS)			-	B		A	-	A	A	A	A		A	
TWP 554 & RR 220														
Intersection / Laning Characteristics	1	1	SH	1	1	1	1	1	SH	1	1	SH		
Volumes(veh/h)	15	85	5	5	817	341	5	5	5	72	5	5		No Signal
Volume/Capacity Ratio (V/C)	0.05	0.07	0.07	0	0.73	0.73	0.05	0.09	0.09	0.75	0.07	0.07		
Total Delay	14	0	0	7.5	0	0	34.3	30.5	30.5	**88.1**	24.6	24.6	ICU = 67.0%	EB-WB - Stop Controlled
Level of Service (LOS)	B	A	A	A	A	A	D	D	D	**F**	A	A	B	

Table 4.4 – 2027 Scenario PM – Intersection Analysis Summary

Intersection Location	Intersection Movements												Overall Intersection	Comments/Critical Movements
Description	SB			NB			EB			WB				
	L	T	R	L	T	R	L	T	R	L	T	R		
Hwy 15 & RR 214														
Intersection / Laning Characteristics	1	2	2	1	2	1	2	2	1	1	2	1		
Volumes(veh/h)	124	383	800	10	7	5	6	356	30	80	865	6		
Volume/Capacity Ratio (V/C)	0.51	0.63	0.85	0.08	0.01	0.02	0.02	0.33	0.06	0.43	0.88	0.01		
Total Delay	26.5	24.5	22.7	19.8	17.9	12	22.8	13.9	5.4	29.5	26.8	7.7	ICU = 70.2%	Cycle Length = 60 seconds
Level of Service (LOS)	C	C	C	B	B	B	C	B	A	C	C	A	C	
HWY 15 EB Ramp & RR 220														
Intersection / Laning Characteristics	1	1	0	0	2	1	2	1	1	0	0	0		
Volumes(veh/h)	51	19	0	0	10	5	25	0	5	0	0	0		
Volume/Capacity Ratio (V/C)	0.09	0.03	-	-	0.01	0.01	0.03	-	0.01	-	-	-		
Total Delay	14.4	13.3	-	-	7.8	4.8	17.5	-	0	-	-	-	ICU = 81.6%	Cycle Length = 70 seconds
Level of Service (LOS)	B	B	-	-	A	A	B	-	A	-	-	-	B	
HWY 15 WB Ramp & RR 220														
Intersection / Laning Characteristics	0	2	1	1	1	0	0	0	0	1	1	1		
Volumes(veh/h)	0	65	887	5	30	0	0	0	0	5	0	5		
Volume/Capacity Ratio (V/C)	-	0.03	0.83	0.01	0.03	-	-	-	-	0.04	-	0.01		
Total Delay	-	2.7	7.1	7.2	7.7	-	-	-	-	29.2	-	0	ICU = 81.6%	Cycle Length = 70 seconds
Level of Service (LOS)	-	A	A	A	A	-	-	-	-	C	-	A	A	
RR 214 & RR 213														
Intersection / Laning Characteristics	1	-	1	-	-	-	2	2	-	-	2	SH		
Volumes(veh/h)	5	-	845	-	-	-	5	10	-	-	450	5		
Volume/Capacity Ratio (V/C)	0.01	-	1.02	-	-	-	0.02	0.01	-	-	1.07	-		
Total Delay	8.2	-	45	-	-	-	32.8	18.4	-	-	93.7	-	ICU = 73.3%	Cycle Length = 80 seconds
Level of Service (LOS)	A	-	D	-	-	-	C	B	-	-	F	-	E	

Intersection Location	Intersection Movements												Overall Intersection	Comments/Critical Movements
Description	SB			NB			EB			WB				
	L	T	R	L	T	R	L	T	R	L	T	R		
RR 220 & Operations Access														
Intersection / Laning Characteristics	1	1	-	-	1	1	-	-	-	1	-	1		
Volumes(veh/h)	2	790	-	-	29	6	-	-	-	162	-	48		No Signal
Volume/Capacity Ratio (V/C)	0	0.62	-	-	0.02	0	-	-	-	0.93	-	0.06		
Total Delay	7.3	0	-	-	7.3	0	-	-	-	**86.9**	-	8.7	ICU = 57.0%	WB - Stop Controlled
Level of Service (LOS)	A	A	-	-	A	A	-	-	-	**F**	-	E	A	
RR 220 & Materials Access														
Intersection / Laning Characteristics	1	1	-	-	1	1	-	-	-	1	-	1		
Volumes(veh/h)	4	599	-	-	91	1	-	-	-	18	-	7		No Signal
Volume/Capacity Ratio (V/C)	0	0.47	-	-	0.07	0	-	-	-	0.08	-	0.01		
Total Delay	7.5	0	-	-	0	0	-	-	-	18.4	-	8.9	ICU = 42.0%	WB - Stop Controlled
Level of Service (LOS)	A	A	-	-	A	A	-	-	-	C	-	A	A	
TWP 554 & Contractors Access														
Intersection / Laning Characteristics			-	1		1		1	1	1	1			
Volumes(veh/h)			-	341		70	-	84	14	3	7			No Signal
Volume/Capacity Ratio (V/C)			-	0.53		0.1	-	0.07	0.01	0	0.01			
Total Delay			-	13.9		9.3	-	0	0	7.5	0		ICU = 30.0%	NB - Stop Controlled
Level of Service (LOS)			-	B		A	-	A	A	A	A		A	
TWP 554 & RR 220														
Intersection / Laning Characteristics	1	1	SH	1	1	1	1	1	SH	1	1	SH		
Volumes(veh/h)	15	260	5	5	5	93	5	5	5	343	5	5		No Signal
Volume/Capacity Ratio (V/C)	0	0.21	0.21	0.01	0	0.07	0.01	0.02	0.02	0.83	0.02	0.02		
Total Delay	7.5	0	0	8	0	0	11.7	11.7	11.7	36.5	10.1	10.1	ICU = 46.0%	EB-WB - Stop Controlled
Level of Service (LOS)	A	A	A	A	A	A	B	B	B	E	B	B	A	

5.0 Conclusions

Based on the above assumptions and analysis, the following conclusions can be reached for the external roadway network:

- Single left or right turn bays, as appropriate, are required at all access points to the site.
- The area wide analysis of the Strathcona Industrial Heartlands Transportation Study and recommendations contained within it, allow for the operation and construction of the Total site.
- Temporary traffic control measures will be required, as traffic warrants, near the peak of construction at the main construction access point.
- The intersection of Range Road 220 – Township Road 554 will require left-turn bays for all directions in addition to a northbound right-turn bay in the future.