

SUPPLEMENTARY TRAFFIC STUDY

BERRY HILLS PHASE 8



PREPARED FOR:
ARMCO CAPITAL INC.

SEPTEMBER 3, 2019

Project No. 191-06902



TABLE OF CONTENTS

1	INTRODUCTION.....	1
2	BACKGROUND DATA AND ACCESS MANAGEMENT PLAN	3
3	TRAFFIC ASSESSMENT.....	5
4	RESULTS.....	7
5	RECOMMENDATIONS.....	8

APPENDIX

TRAFFIC VOLUME DATA AND MODELLING RESULTS



1 INTRODUCTION

Background

On March 1st, 2019, Armco Capital Inc. submitted a development application for Berry Hills Phase 8. That application was accompanied by a report titled *Berry Hills Phase 8 Traffic Impact Study* undertaken by Harbourside Transportation Consultants and dated February 12th, 2019.

A review was completed by HRM and, on April 17th, 2019 the applicant was provided with a memo from Sarah Rodger, Program Engineer dated April 17th, 2019. That memo included the line “Approval is not recommended until the first comment (regarding the TIS) is addressed”. The purpose of this report is to address the specific comments raised in that memo.

This is not a full Traffic Impact Study but should be read as a supplement to the original Harbourside report. The assumptions, calculations and background traffic counts contained in the original report, other than those challenged in the HRM comments or as noted in this report, have been adopted for this analysis.

Addressing the Issues Raised

Following is a listing of the HRM comments on the Harbourside report and how those are addressed in this report:

- 1) **“Identification of the transportation system changes needed to mitigate the impact of the proposed development on the transportation network have not been adequately addressed. The report findings show that the proposed development will significantly affect traffic operations. Although there are projected operational issues with background traffic growth, the additional site-generated traffic must not worsen the situation as required in section 6.3 of HRM’s Guidelines for the Preparation of Transportation Impact Studies (8th Revision).”**
 - This report introduces a plan to provide better access management control on Trunk 1 through the signalization of the Trunk 1/Lively Road intersection. The plan diverts traffic away from unsignalized intersections where stopped delay is significant to a signalized intersection that provides adequate level of service. Some of this diversion will occur naturally due to the desire of drivers to migrate towards the intersection with better service and safety and some will be forced through the redesign of the proposed subdivisions connections.
- 2) **“The consultant did offer a potential solution of providing an alternate route into the development area through the construction of a fourth leg of the Sackville Drive/Margeson Drive roundabout. There was no data included to support this recommendation and it was not clear whether the Developer was proposing to build this connection. This road is not in the current capital budget. The road was listed in the last revision of the Regional Municipal Planning Strategy as a “Future Potential” road, meaning the project was identified to be constructed beyond the 25-year horizon of the 2006 Regional Plan. The Integrated Mobility Plan (IMP) has been approved by Regional Council, since the last revision of the Regional Plan. Transportation projects now consider the priorities of the IMP, which aims to limit the expansion of the road network.”**

- Construction of this connection by the developer is impractical and is not being proposed. Future construction of this roadway by the Municipality would provide a great opportunity to relieve traffic issues on Trunk 1 with a simple connection to Wilson Lake Drive. The plan described in this report does not rely, however, on this connection to adequately manage development traffic. It does not result in new roadway length being added, other than internal subdivision streets.
- 3) **“Traffic volumes shown in Appendix C do not match those used in the traffic signal warrants. Are the traffic signal warrants completed for 2024 with or without the proposed development?”**
- This report assesses the warrants for traffic signals for a number of horizons and scenarios. This is well documented in the Appendix of this report.
- 4) **“HRM will be implementing traffic calming measures (speed humps) on Wilson Lake Drive and Lively Road in 2019. As mentioned previously, the recommendation to install a compact roundabout on Wilson Lake Drive at the new intersection to the development would be strongly supported by HRM Traffic. This should also be taken into consideration on the Lively Road side of the development.”**
- Consideration will be given to complimenting proposed traffic calming measures with design of the development roadways and connections.
- 5) **“Intersection analysis results at Sackville Drive and Wilson Lake Drive have changed for existing conditions (2017) and future conditions without development since the original TIS. What changes were made to result in these?”**
- Redistribution of traffic that results from the plan proposed in this report reduces the traffic issues at this intersection.
- 6) **“Multi-family housing (low rise) applies to housing units with at least 3 other units. I don’t believe this is applicable to the semi-detached units (townhouses) in this case. Use of the single-family detached housing code results in a greater number of trips.”**
- We support this comment and have recalculated development trip generation accordingly.

2 BACKGROUND DATA AND ACCESS MANAGEMENT PLAN

Development Site The development site and general access plan has not changed from that shown in Figures 1 and 2 of the Harbourside study. The proposed development consists of 108 single family detached homes and 56 multi-family low-rise units.

Background Traffic Growth An annual 1.5% growth in background traffic used in the Harbourside study was retained for this assessment.

Traffic Counts To supplement the data collected in 2017 for the Harbourside study, WSP undertook a six-hour intersection turning movement count at the Rosemary Drive/Trunk 1 intersection on August 7th, 2019. Volumes on Trunk 1 are equivalent for both sets of counts so no factoring for the two-year gap was applied.

Collision History HRM provided data acquired from the RCMP for the intersections at Wilson Lake Drive, Lively Road and Rosemary Drive for a three-year period ending July 2019. Three property damage collisions were recorded during that period, two of which can be linked to high stopped delay entering Trunk 1 from an unsignalized approach during peak hours:

- 1) Lively Road 8:05am - Vehicle struck from behind while stopped on Trunk 1 allowing vehicles from Lively Rd. to exit onto Trunk 1, no injuries.
- 2) Wilson Lake Drive 4:45pm - Vehicle turning left from Wilson Lake Dr. onto Trunk 1 struck oncoming Bedford bound vehicle, no injuries.

Access Plan Our access management plan recognizes that a poor level of service is created with traffic attempting to make a left turn from a stop-controlled intersection leg on unsignalized intersections along Trunk 1. Collision history shows some collisions that occurred here are likely related to the difficulty vehicles experience turning onto Trunk 1 from these intersections. For these reasons, we have redesigned the connections from the development site to the roadway network to direct all trips exiting the site to Lively Road. We then propose to signalize the Lively Road/Trunk 1 intersection to safely manage this increased traffic. All trips entering the site will remain as modeled in the Harbourside study.

To achieve this, we will create the connection between Wilson Lake Drive and the development site as a one-way street into the site. All trips exiting the site will be required to use Lively Road. This plan will not affect emergency access into the site and will not force changes to existing traffic patterns (although we expect these patterns to change naturally once signalization is implemented).

This plan is shown in Figure 1.

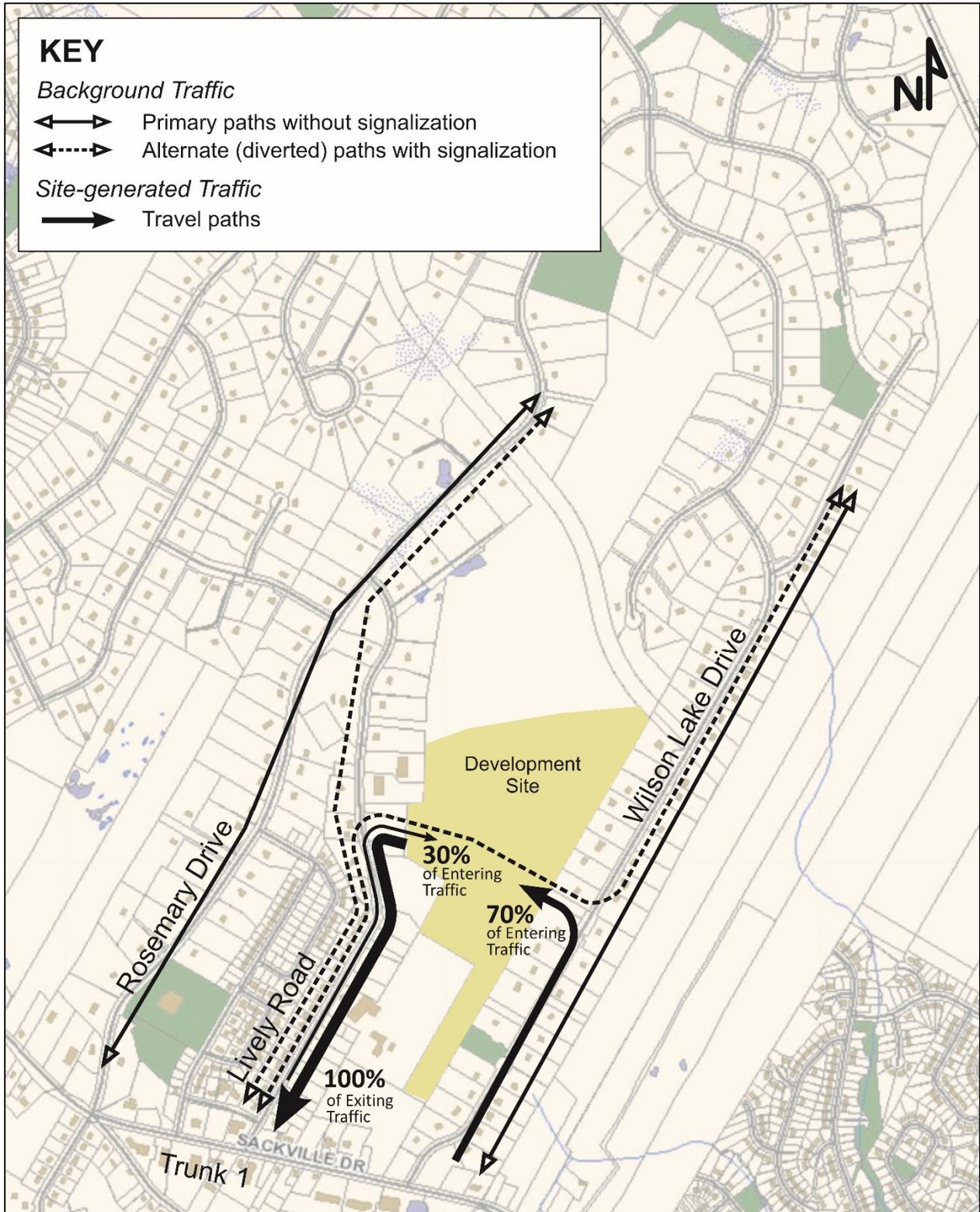


Figure 1: Travel Patterns and Trip Distribution

3 TRAFFIC ASSESSMENT

Trip Generation

Trip generation for the proposed development were taken from rates provided in the 10th edition of the *Trip Generation Manual* published by the Institute of Transportation Engineers. The results are shown in Table 1:

Table 1: Trip Generation Estimates

Land Use	Units	Trip Generation Rates					Trip Generation Estimates				
		AM Peak		PM Peak		Daily	AM Peak		PM Peak		Daily
		In	Out	In	Out	2way	In	Out	In	Out	2way
Single Family incl Small Multi-unit (Land Use 210)	164	0.18	0.56	0.64	0.36	9.44	30	92	105	59	1548

To assess the need for signalization, a six-hour count consisting of two AM peak hours, two mid-day hours, and two PM peak hours is required. These volumes are easily acquired for background traffic through field counts but are not available through trip generation tables. For this study, we have extrapolated the six-hour counts from the two peak hour generation counts based on patterns in our counted data. This relationship is shown in Table 2.

Table 2: Extrapolating Trip Generation Estimates into Six Hour Count

Count Required for Warrant Calculation	Count from ITE Trip Generation
1 st AM hour	AM Peak Hour
2 nd AM hour	85% of AM Peak Hour
1 st Mid-day hour	65% of AM Peak Hour
2 nd Mid-day hour	65% of PM Peak Hour
1 st PM hour	85% of PM Peak Hour
2 nd PM hour	PM Peak Hour

Trip Distribution and Assignment

The Harbourside study assumed that 70% of the generated trips would use Wilson Lake Drive to access Trunk 1 and the remainder would use Lively Road. That distribution was adopted for this study, although only for traffic entering the site. With the proposed street connections, 100% of exiting traffic would use Lively Road.

The Harbourside study used existing patterns at each intersection to determine whether trips would be attracted to/produced from the east or the west resulting in the percentage of trips to/from the west varying anywhere from 7% to 28%. A more standard approach was taken in this analysis, still consistent with existing traffic patterns, that assumed 15% of all newly generated trips would come to/from the west and 85% of trips to/from the east.

**Redistributing
Background
Traffic**

When several interconnected local or collector streets come out to a busy arterial street at unsignalized intersections, stopped delay will be high and traffic will naturally spread out evenly between streets to minimize that delay. When one of those intersections becomes signalized, traffic will naturally migrate towards that intersection to take advantage of the reduced delay and improved safety. The inter-connectedness of Rosemary Drive, Lively Road and Wilson Lake Drive means that signalization of the Lively Road intersection at Trunk 1 will result in traffic migrating to Lively Road from the other two streets. Since left turning traffic out of the stop-controlled street experiences the highest stopped delay, that is the traffic that is most likely to be diverted. To test the sensitivity of assumptions, two scenarios (see Table 3) were produced regarding the redistribution of traffic.

Table 3: Redistribution of Existing Traffic Resulting from Signalization

Street	Movement	Percentage Diverted to Lively Road	
		High Scenario	Low Scenario
Rosemary Drive	Left Turns Out	60%	40%
	Left Turns In	20%	10%
	Right Turns Out	20%	10%
	Right Turns In	0%	0%
Wilson Lake Drive	Left Turns Out	60%	40%
	Left Turns In	20%	10%
	Right Turns Out	20%	10%
	Right Turns In	0%	0%

**Projected
Traffic
Volumes**

Trips generated by the proposed development were added to the projected background volumes to provide projected AM and PM peak hourly and six-hour traffic volumes illustrated diagrammatically in the Appendix.

4 RESULTS

Traffic Signal Warrant

The Canadian Traffic Signal Warrant Matrix Analysis (Transportation Association of Canada (TAC), 2005) considers 100 warrant points as an indication that traffic signals will provide a positive impact. Signal warrant analysis uses vehicular and pedestrian volumes, and intersection, roadway and study area characteristics to calculate a warrant point value. That warrant calculation was applied to the Lively Road intersection with the results shown in Table 4.

Table 4: Two-way Daily Volumes on Key Collector and Local Streets

Scenario	Signal Priority Points
2018/19 without development	55
2024 without development/high redistribution	66
2024 with development/high redistribution	103
2024 with development/low redistribution	89

These results indicate that signalization at Lively Road will be warranted at full build-out of the development. Even with a lower redistribution assumption, signalization should still be considered necessary. Although signalization is not strictly warranted at the development start-up, it would be appropriate to install signalization at that point in anticipation of its impending need.

Intersection Capacity Analysis Results

Synchro 10.0 was used for performance evaluation of a signalized Lively Road/Trunk 1 intersection using projected design hourly volumes with the site development. Analysis results are included in the Appendix and indicate that the intersection will operate at a satisfactory level of service (level of service ‘B’) using the intersection configuration shown in Figure 2.

The capacity of the Wilson Lake Drive unsignalized intersection was not assessed. Since access to the signalized intersection at Lively Road with reduced delay is readily available, any level of service issues for Wilson Lake Drive will “self-correct” with traffic shifting to Lively Road.



Figure 2: Conceptual Layout of Lively/Trunk 1 Intersection

5 RECOMMENDATIONS

**Site
Roadway
Connections**

To help guide traffic exiting the proposed develop and areas around it to Lively Road where better level of service is provided, it is recommended that the connection between the development site and Wilson Lake Drive be one-way westbound (inbound to the development). Figure 3 shows conceptually how that roadway would be designed and signed to enforce one-way flow.

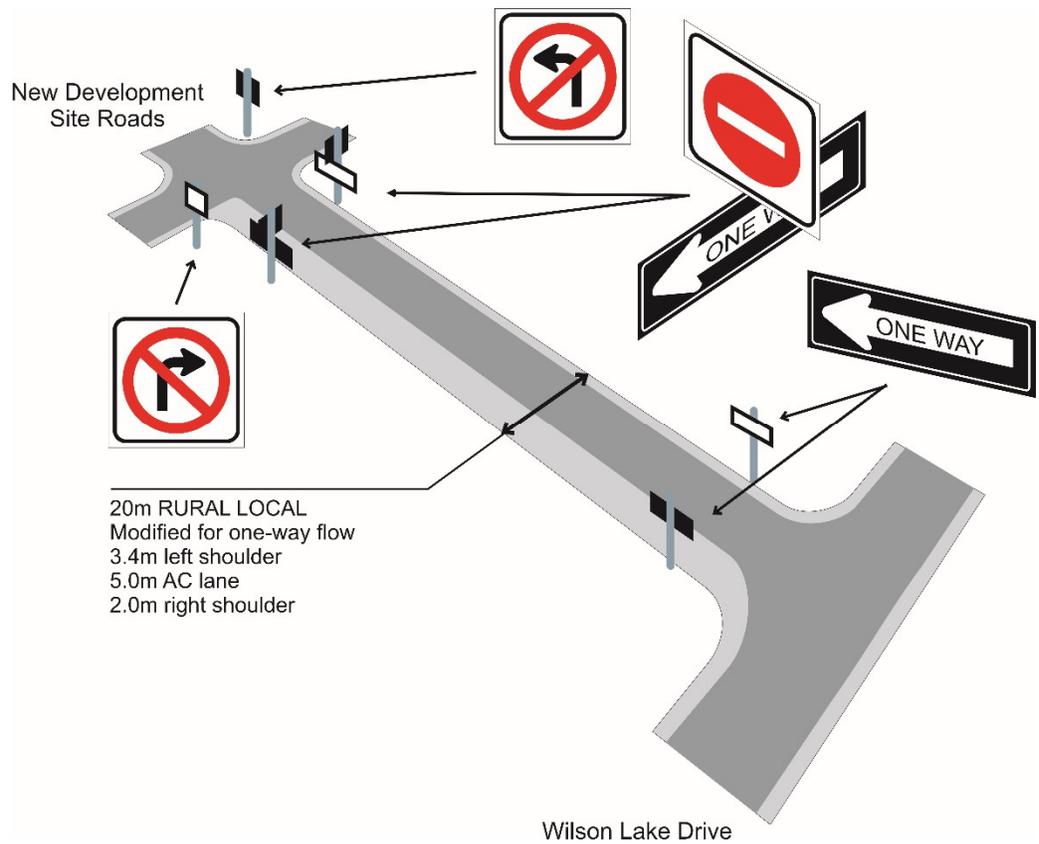


Figure 3: Proposed Layout of One-way Connection to Wilson Lake Drive

**Lively Road/
Trunk 1
Intersection**

The results of our analysis indicate that signalization at Lively Road will be warranted at full build-out of the development. Even with a lower redistribution assumption, signalization should still be considered necessary.

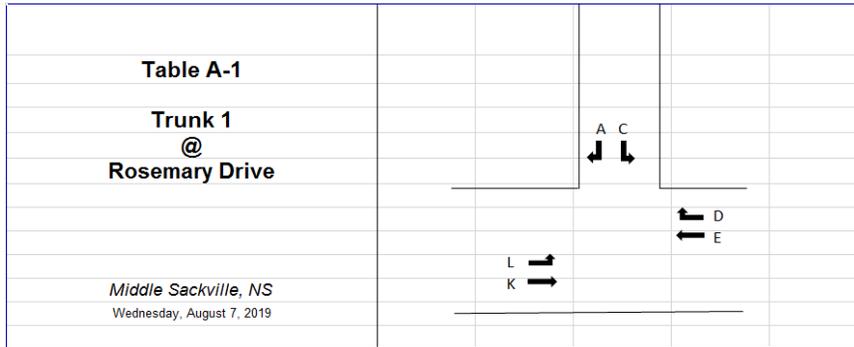
The intersection should be modified to create a left turn storage lane on Trunk 1 and a right turn bay on the Lively Road approach. A schematic of the intersection layout is provided in Figure 2. Queue storage lengths are based on the Synchro modeling results.

APPENDIX

TRAFFIC VOLUME DATA AND MODELLING RESULTS



Exhibit A-1 Turning Movement Count – Trunk 1 @ Rosemary Drive



AM Peak Period Volume Data									
Time		Rosemary Drive		Trunk 1		Trunk 1		Total Vehicles	
		Southbound Approach		Westbound Approach		Eastbound Approach			
		A	C	D	E	K	L		
07:00	07:15	0	17	2	33	95	3	150	
07:15	07:30	1	14	3	23	119	1	161	
07:30	07:45	3	17	2	39	127	1	189	
07:45	08:00	2	15	3	33	100	0	153	
08:00	08:15	1	15	6	35	106	2	165	
08:15	08:30	1	10	2	55	107	1	176	
08:30	08:45	0	6	4	52	100	4	166	
08:45	09:00	1	9	4	60	79	1	154	
AM Peak Hour		7	57	13	162	440	4	683	
07:00	08:00	6	63	10	128	441	5	653	
08:00	09:00	3	40	16	202	392	8	661	
		Ped 1		Ped 3		Ped 4		Total Peds	
07:00	08:00	0		0		0		0	
08:00	09:00	0		0		0		0	

Midday Peak Period Volume Data									
Time		Rosemary Drive		Trunk 1		Trunk 1		Total Vehicles	
		Northbound Approach		Southbound Approach		Eastbound Approach			
		A	B	H	I	J	L		
11:00	11:15	0	5	11	62	87	0	165	
11:15	11:30	1	5	6	76	74	2	164	
11:30	11:45	0	12	5	73	98	2	190	
11:45	12:00	0	3	6	79	79	1	168	
12:00	12:15	1	7	4	87	67	2	168	
12:15	12:30	1	6	4	77	74	1	163	
12:30	12:45	0	9	5	85	65	1	165	
12:45	13:00	5	6	5	74	59	1	150	
Midday Peak Hour		2	27	21	315	318	7	690	
11:00	12:00	1	25	28	290	338	5	687	
12:00	13:00	7	28	18	323	265	5	646	
		Ped 1		Ped 3		Ped 4		Total Peds	
11:00	12:00	0		0		4		4	
12:00	13:00	0		0		8		8	

PM Peak Period Volume Data									
Time		Rosemary Drive		Trunk 1		Trunk 1		Total Vehicles	
		Northbound Approach		Southbound Approach		Eastbound Approach			
		A	B	H	I	J	L		
16:00	16:15	0	9	9	142	58	0	218	
16:15	16:30	3	11	18	141	76	2	251	
16:30	16:45	1	10	12	148	101	1	273	
16:45	17:00	2	6	13	142	55	1	219	
17:00	17:15	2	8	12	171	74	1	268	
17:15	17:30	2	14	11	160	86	1	274	
17:30	17:45	0	9	15	132	89	2	247	
17:45	18:00	3	12	8	123	70	1	217	
PM Peak Hour		7	38	48	621	316	4	1034	
16:00	17:00	6	36	52	573	290	4	961	
17:00	18:00	7	43	46	586	319	5	1006	
		Ped 1		Ped 3		Ped 4		Total Peds	
16:00	17:00	0		0		5		5	
17:00	18:00	0		0		0		0	

* Count completed by WSP

Exhibit A-2 Traffic Distribution Model

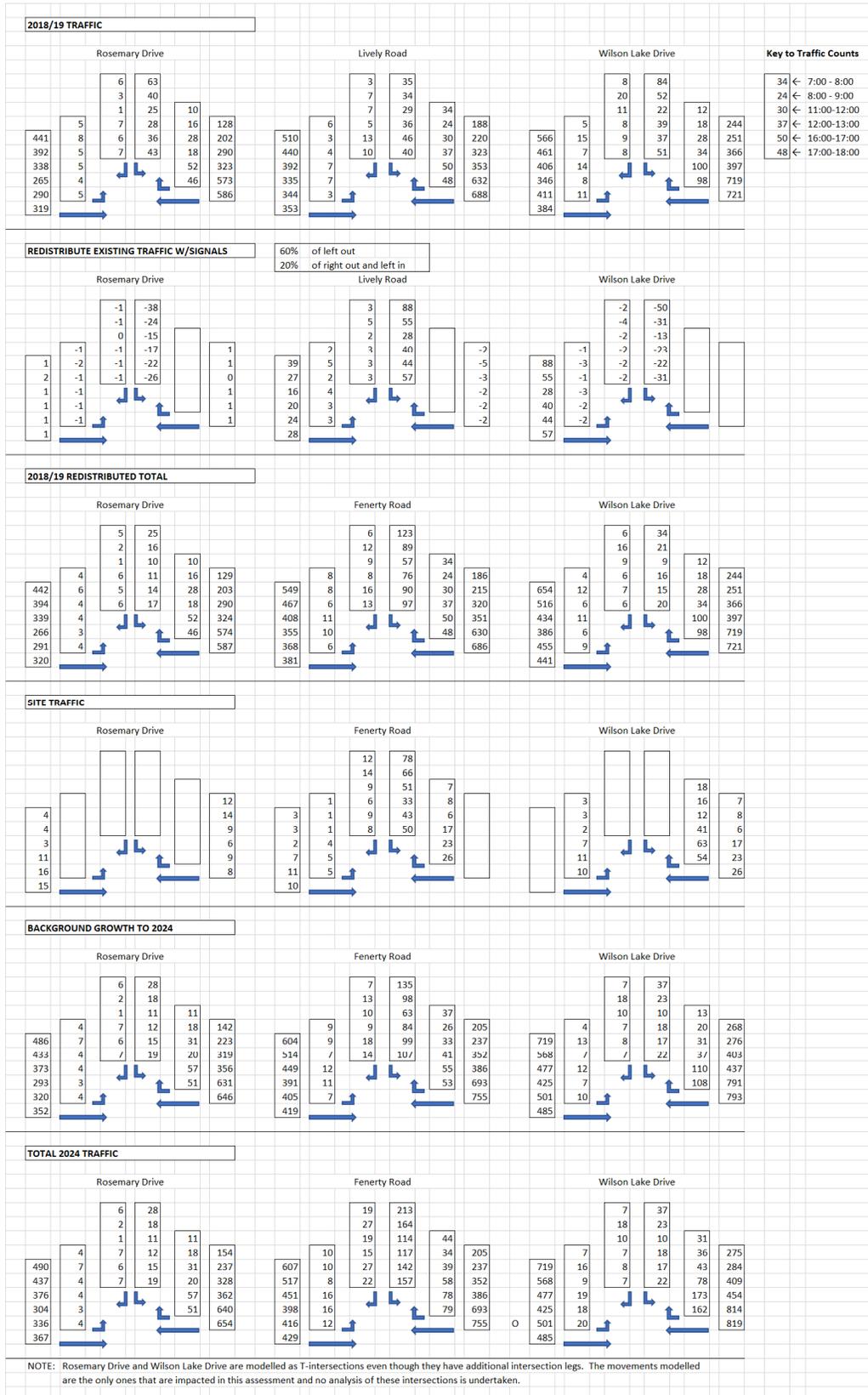


Exhibit A-3 Signal Warrant Calculation – 2019 Traffic

2005 Canadian Traffic Signal Warrant Matrix Analysis																								
Main Street (name)	Trunk 1			Direction (EW or NS)	EW	Date:																		
Side Street (name)	Fenery Road			Direction (EW or NS)	NS	City:																		
Quadrant (if appl)																								
Lane Configuration		Excl LT	Th & LT	Through or Thru RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes																
	Trunk 1	WB	1	1				1																
	Trunk 1	EB			1			1																
	Fenery Road	NB																						
	Fenery Road	SB	1			1																		
										Demographics Elementary School (y/n) y Senior's Complex (y/n) n Pathway to School (y/n) y Metro Area Population (#) 10 Central Business District (y/n) n														
Other input										Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)											
Trunk 1										EW	70	2.0%	y	0.0										
Fenery Road										NS	0	n												
Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW								
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S side								
7:30 - 8:30				123		6		186	49	8	549													
8:30 - 9:30				89		12		215	36	8	467													
11:30 - 12:30				57		9		320	41	6	408													
12:30 - 13:30				76		8		351	67	11	355													
16:00 - 17:00				90		16		630	95	10	368													
17:00 - 18:00				97		13		686	89	6	381													
Total (6-hour peak)	0	0	0	532	0	64	0	2,388	377	49	2,528	0	0	0	0	0								
Average (6-hour peak)	0	0	0	89	0	11	0	398	63	8	421	0	0	0	0	0								
Average 6-hour Peak Turning Movements																								
$W = [C_{bt}(X_{v-v}) / K_1 + (F(X_{v-p})L) / K_2] \times C_i$																								
<table border="1"> <tr> <td>W =</td> <td>55</td> <td>55</td> <td>0</td> </tr> <tr> <td></td> <td></td> <td><i>Veh</i></td> <td><i>Ped</i></td> </tr> </table>																	W =	55	55	0			<i>Veh</i>	<i>Ped</i>
W =	55	55	0																					
		<i>Veh</i>	<i>Ped</i>																					
NOT Warranted																								

Exhibit A-4 – Signal Warrant Calculation – 2024 Without Site Traffic

2005 Canadian Traffic Signal Warrant Matrix Analysis																										
Main Street (name)	Trunk 1				Direction (EW or NS)		EW		Date: 																	
Side Street (name)	Fenery Road				Direction (EW or NS)		NS		City: 																	
Quadrant (if appl)																										
Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes																		
Trunk 1	WB	1		1				1																		
Trunk 1	EB				1																					
Fenery Road	NB																									
Fenery Road	SB	1																								
Demographics																										
Elementary School															(y/n)	y										
Senior's Complex															(y/n)	n										
Pathway to School															(y/n)	y										
Metro Area Population															(#)	10										
Central Business District															(y/n)	n										
Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)																					
Trunk 1	EW	70	2.0%	y	0.0																					
Fenery Road	NS	0	0	n																						
Traffic Input	NB		SB			WB		EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW												
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side										
7:30 - 8:30				135		7	205	37	9	604																
8:30 - 9:30				98		13	237	26	9	514																
11:30 - 12:30				63		10	352	33	7	449																
12:30 - 13:30				84		9	386	41	12	391																
16:00 - 17:00				99		18	693	55	11	405																
17:00 - 18:00				107		14	755	53	7	419																
Total (6-hour peak)	0	0	0	586	0	71	0	2,628	245	55	2,782	0	0	0	0	0										
Average (6-hour peak)	0	0	0	98	0	12	0	438	41	9	464	0	0	0	0	0										
Average 6-hour Peak Turning Movements																										
$W = [C_{bt}(X_{v-v}) / K_1 + (F(X_{v-p})L) / K_2] \times C_i$																										
<p>The diagram shows the intersection of Trunk 1 and Fenery Road. Trunk 1 has Westbound (WB) and Eastbound (EB) lanes. Fenery Road has Northbound (NB) and Southbound (SB) lanes. Pedestrian crossings are shown for all four directions. Traffic volumes are indicated in green boxes, and turning movements are shown in yellow boxes. A 'NOT Warranted' box is present on the right side of the diagram.</p>																										
<table border="1" style="margin-left: auto;"> <tr> <td style="background-color: #D9E1F2;">$W =$</td> <td style="background-color: #D9E1F2; color: green;">66</td> <td style="background-color: #D9E1F2; color: green;">66</td> <td style="background-color: #D9E1F2; color: green;">0</td> </tr> <tr> <td></td> <td></td> <td style="background-color: #D9E1F2; color: green; text-align: center;"><i>Veh</i></td> <td style="background-color: #D9E1F2; color: green; text-align: center;"><i>Ped</i></td> </tr> <tr> <td colspan="4" style="background-color: #D9E1F2; color: red; text-align: center;">NOT Warranted</td> </tr> </table>															$W =$	66	66	0			<i>Veh</i>	<i>Ped</i>	NOT Warranted			
$W =$	66	66	0																							
		<i>Veh</i>	<i>Ped</i>																							
NOT Warranted																										

Exhibit A-5 – Signal Warrant Calculation – 2024 With Site Traffic (High Redistribution)

2005 Canadian Traffic Signal Warrant Matrix Analysis																											
Main Street (name)	Trunk 1			Direction (EW or NS)		EW		Date:																			
Side Street (name)	Fenerty Road			Direction (EW or NS)		NS		City:																			
Quadrant (if app)																											
Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes																			
	Trunk 1	WB	1	1				1																			
	Trunk 1	EB			1			1																			
	Fenerty Road	NB																									
Fenerty Road	SB	1				1																					
Demographics																											
										Elementary School	(y/n)	y															
										Senior's Complex	(y/n)	n															
										Pathway to School	(y/n)	y															
										Metro Area Population	(#)	10															
										Central Business District	(y/n)	n															
Other input																											
		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)																						
Trunk 1	EW	70	2.0%	y	0.0																						
Fenerty Road	NS		0	n																							
Traffic Input	NB			SB			WB		EB		Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW													
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S side											
7:30 - 8:30				213		19	205	44	10	607																	
8:30 - 9:30				164		27	237	34	10	517																	
11:30 - 12:30				114		19	352	39	8	451																	
12:30 - 13:30				117		15	386	58	16	396																	
16:00 - 17:00				142		27	693	78	16	416																	
17:00 - 18:00				157		22	755	79	12	429																	
Total (6-hour peak)	0	0	0	907	0	129	2,628	332	72	2,816	0	0	0	0	0	0											
Average (6-hour peak)	0	0	0	151	0	22	438	55	12	469	0	0	0	0	0	0											
Average 6-hour Peak Turning Movements											$W = [C_{bt}(X_{v-v}) / K_1 + (F(X_{v-p})L) / K_2] \times C_i$																
											<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: right;">W =</td> <td style="text-align: center;">103</td> <td style="text-align: center;">103</td> <td style="text-align: center;">0</td> </tr> <tr> <td></td> <td></td> <td style="text-align: center;"><i>Veh</i></td> <td style="text-align: center;"><i>Ped</i></td> </tr> <tr> <td colspan="4" style="text-align: center;">Warranted</td> </tr> </table>					W =	103	103	0			<i>Veh</i>	<i>Ped</i>	Warranted			
W =	103	103	0																								
		<i>Veh</i>	<i>Ped</i>																								
Warranted																											

Exhibit A-6 – Traffic Signal Warrant – 2024 With Site Traffic (Low Redistribution)

2005 Canadian Traffic Signal Warrant Matrix Analysis																															
Main Street (name)	Trunk 1			Direction (EW or NS)		EW		Date:																							
Side Street (name)	Fenerty Road			Direction (EW or NS)		NS		City:																							
Quadrant (if appl)																															
Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes																							
	Trunk 1	WB	1	1				1																							
	Trunk 1	EB			1			1																							
	Fenerty Road	NB																													
	Fenerty Road	SB	1				1																								
												Demographics																			
												Elementary School	(y/n)	y																	
												Senior's Complex	(y/n)	n																	
												Pathway to School	(y/n)	y																	
												Metro Area Population (#)		10																	
												Central Business District	(y/n)	n																	
Other input												Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)																
												Trunk 1	EW	70	2.0%	y	0.0														
												Fenerty Road	NS		0	n															
Traffic Input												NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW				
												LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S side				
												7:30 - 8:30			181		18		205	44	10	586									
												8:30 - 9:30			144		24		237	34	8	502									
												11:30 - 12:30			104		18		352	39	8	443									
												12:30 - 13:30			102		14		386	58	14	383									
												16:00 - 17:00			126		26		693	78	14	401									
												17:00 - 18:00			135		21		755	79	11	421									
												Total (6-hour peak)	0	0	792	0	121	0	2,628	332	65	2,736	0	0	0	0	0	0			
												Average (6-hour peak)	0	0	132	0	20	0	438	55	11	456	0	0	0	0	0	0			
Average 6-hour Peak Turning Movements																															
												$W = [C_{bt}(X_{v-v}) / K_1 + (F(X_{v-p})L) / K_2] \times C_i$																			
												<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="font-weight: bold;">W =</td> <td style="font-size: 1.2em; color: blue;">89</td> <td style="font-size: 1.2em; color: green;">89</td> <td style="font-size: 1.2em; color: green;">0</td> </tr> <tr> <td></td> <td></td> <td style="color: green; text-align: center;"><i>Veh</i></td> <td style="color: green; text-align: center;"><i>Ped</i></td> </tr> </table>												W =	89	89	0			<i>Veh</i>	<i>Ped</i>
W =	89	89	0																												
		<i>Veh</i>	<i>Ped</i>																												
												NOT Warranted																			
												<p>The diagram illustrates the flow of traffic between Trunk 1 and Fenerty Road. Trunk 1 has Westbound (WB) and Eastbound (EB) lanes. Fenerty Road has Northbound (NB) and Southbound (SB) lanes. Pedestrian crossings are also indicated. The diagram shows the following turning movements and volumes:</p> <ul style="list-style-type: none"> WB Trunk 1: Ped1 (0), RT (20), TH (0), LT (132) EB Trunk 1: LT (11), TH (456), RT (0) NB Fenerty Road: Ped2 (0), LT (0), TH (0), RT (0) SB Fenerty Road: Ped1 (0), RT (20), TH (0), LT (132) WB Trunk 1: Total Volume 458 EB Trunk 1: Total Volume 467 NB Fenerty Road: Total Volume 66 SB Fenerty Road: Total Volume 152 																			

Exhibit A-7 SYNCHRO Output for 2024 AM Peak with Site Traffic

Trunk 7 & Lively Road

						
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	10	607	237	44	213	27
Future Volume (vph)	10	607	237	44	213	27
Satd. Flow (prot)	1770	1863	1824	0	1770	1583
Flt Permitted	0.564				0.950	
Satd. Flow (perm)	1051	1863	1824	0	1770	1583
Satd. Flow (RTOR)			20			29
Lane Group Flow (vph)	11	660	306	0	232	29
Turn Type	Perm	NA	NA		Prot	Perm
Protected Phases		2	6		4	
Permitted Phases	2					4
Total Split (s)	62.0	62.0	62.0		28.0	28.0
Total Lost Time (s)	6.0	6.0	6.0		6.0	6.0
Act Effct Green (s)	56.0	56.0	56.0		22.0	22.0
Actuated g/C Ratio	0.62	0.62	0.62		0.24	0.24
v/c Ratio	0.02	0.57	0.27		0.54	0.07
Control Delay	6.6	12.4	7.9		34.9	10.5
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	6.6	12.4	7.9		34.9	10.5
LOS	A	B	A		C	B
Approach Delay		12.3	7.9		32.2	
Approach LOS		B	A		C	
Queue Length 50th (m)	0.7	63.7	21.1		36.8	0.0
Queue Length 95th (m)	2.7	94.1	34.0		60.3	6.8
Internal Link Dist (m)		336.5	345.9		279.0	
Turn Bay Length (m)	30.0					30.0
Base Capacity (vph)	653	1159	1142		432	408
Starvation Cap Reductn	0	0	0		0	0
Spillback Cap Reductn	0	0	0		0	0
Storage Cap Reductn	0	0	0		0	0
Reduced v/c Ratio	0.02	0.57	0.27		0.54	0.07

Intersection Summary

Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green
 Control Type: Pretimed
 Maximum v/c Ratio: 0.57
 Intersection Signal Delay: 15.4
 Intersection Capacity Utilization 53.7%
 Analysis Period (min) 15
 Intersection LOS: B
 ICU Level of Service A

Splits and Phases: 3: Trunk 7 & Lively Road

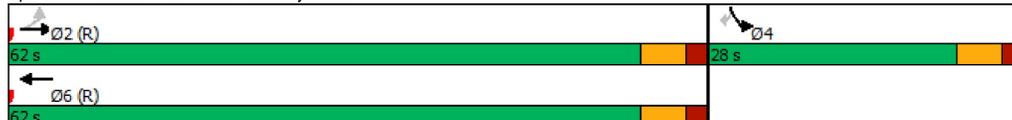


Exhibit A-8 SYNCHRO Output for 2024 PM Peak with Site Traffic

Trunk 7 & Lively Road

						
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	16	429	755	79	157	27
Future Volume (vph)	16	429	755	79	157	27
Satd. Flow (prot)	1770	1863	1839	0	1770	1583
Flt Permitted	0.161				0.950	
Satd. Flow (perm)	300	1863	1839	0	1770	1583
Satd. Flow (RTOR)			11			29
Lane Group Flow (vph)	17	466	907	0	171	29
Turn Type	Perm	NA	NA		Prot	Perm
Protected Phases		2	6		4	
Permitted Phases	2					4
Total Split (s)	62.0	62.0	62.0		28.0	28.0
Total Lost Time (s)	6.0	6.0	6.0		6.0	6.0
Act Effct Green (s)	56.0	56.0	56.0		22.0	22.0
Actuated g/C Ratio	0.62	0.62	0.62		0.24	0.24
v/c Ratio	0.09	0.40	0.79		0.40	0.07
Control Delay	8.3	9.9	18.9		31.7	10.5
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	8.3	9.9	18.9		31.7	10.5
LOS	A	A	B		C	B
Approach Delay		9.8	18.9		28.7	
Approach LOS		A	B		C	
Queue Length 50th (m)	1.1	38.7	109.7		26.1	0.0
Queue Length 95th (m)	4.1	58.1	167.9		45.1	6.8
Internal Link Dist (m)		336.5	345.9		279.0	
Turn Bay Length (m)	30.0					30.0
Base Capacity (vph)	186	1159	1148		432	408
Starvation Cap Reductn	0	0	0		0	0
Spillback Cap Reductn	0	0	0		0	0
Storage Cap Reductn	0	0	0		0	0
Reduced v/c Ratio	0.09	0.40	0.79		0.40	0.07

Intersection Summary

Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green
 Control Type: Pretimed
 Maximum v/c Ratio: 0.79
 Intersection Signal Delay: 17.4
 Intersection Capacity Utilization 63.2%
 Analysis Period (min) 15

Intersection LOS: B
 ICU Level of Service B

Splits and Phases: 3: Trunk 7 & Lively Road

