SUPPLEMENTARY TRAFFIC STUDY

BERRY HILLS PHASE 8

PREPARED FOR:
ARMCO CAPITAL INC.

Project No. 191-06902

SEPTEMBER 3, 2019

wsp

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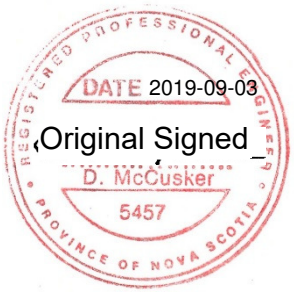
APPENDIX



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.

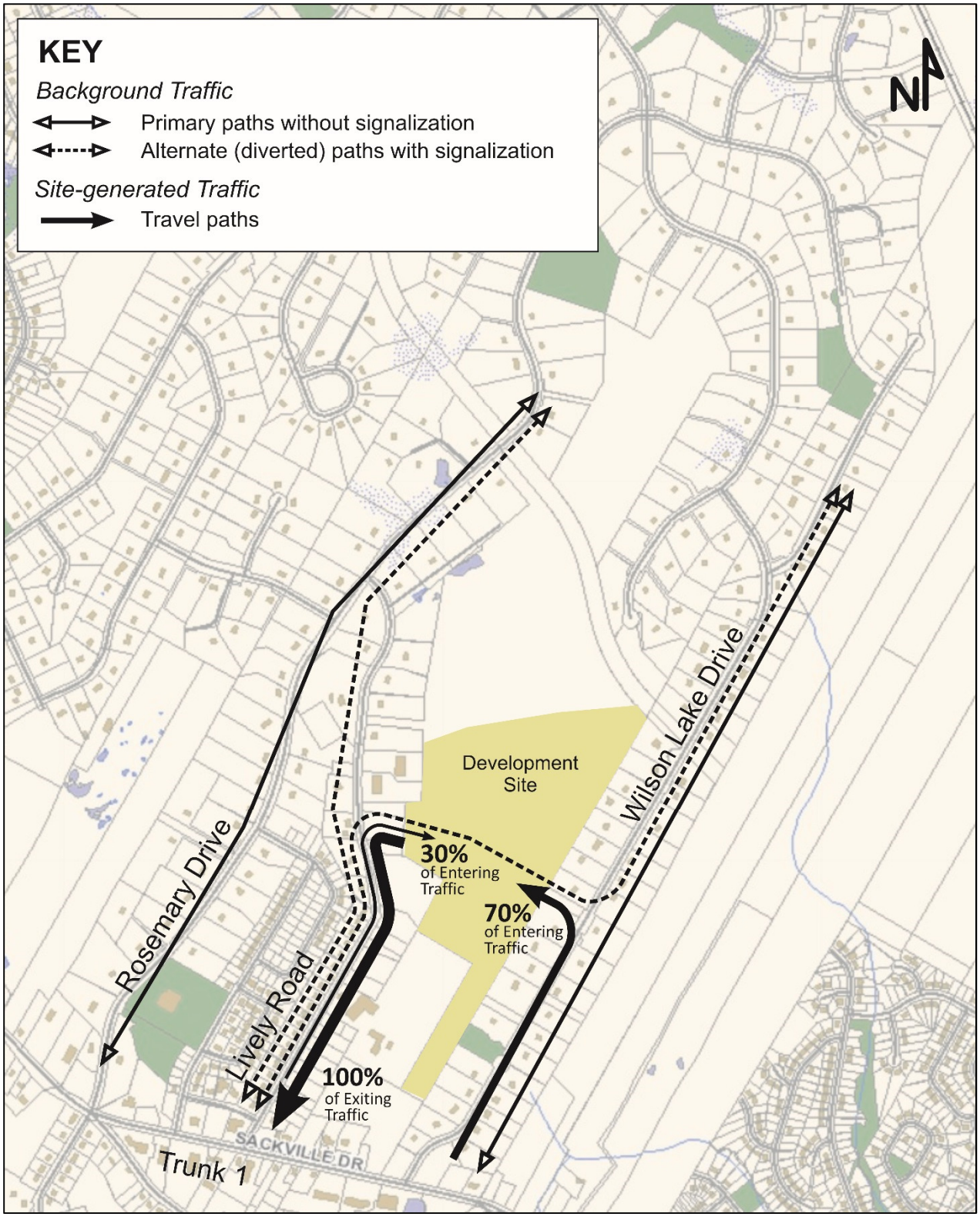


Figure 1: Travel Patterns and Trip Distribution

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
1st AM hour	AM Peak Hour
2nd AM hour	85% of AM Peak Hour
1st Mid-day hour	65% of AM Peak Hour
2nd Mid-day hour	65% of PM Peak Hour
1st PM hour	85% of PM Peak Hour
2nd 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.

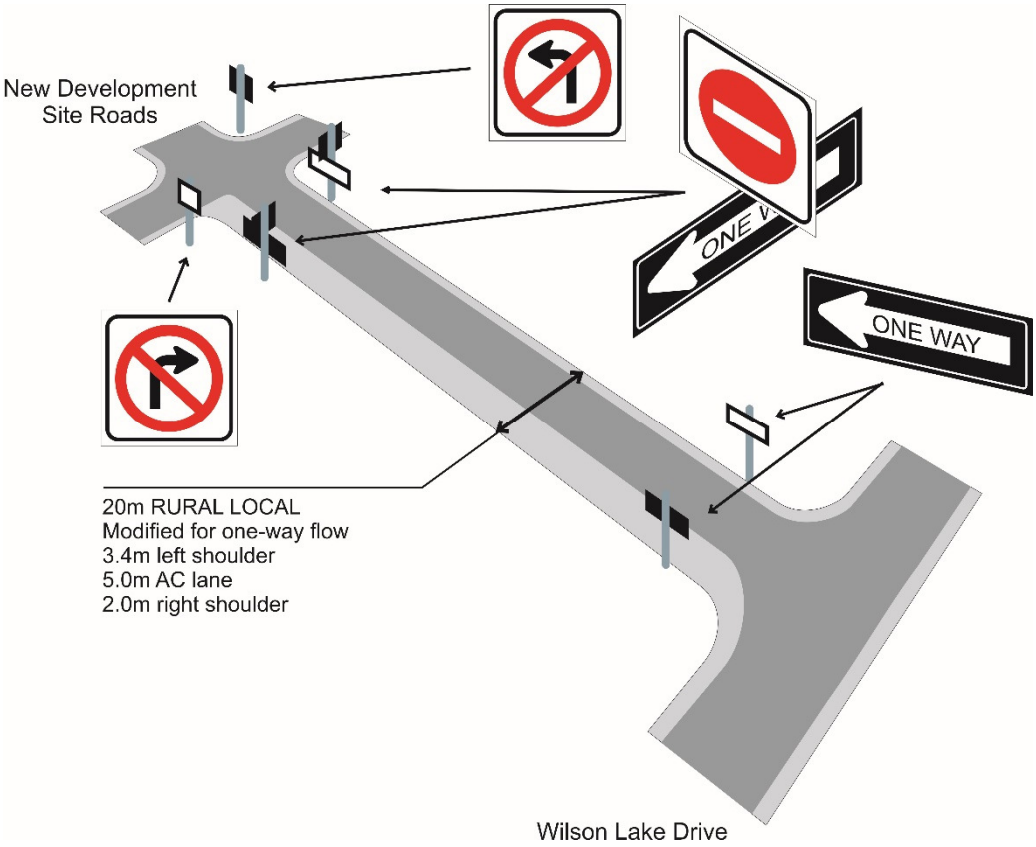


Figure 3: Proposed Layout of One-way Connection to Wilson Lake Drive

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

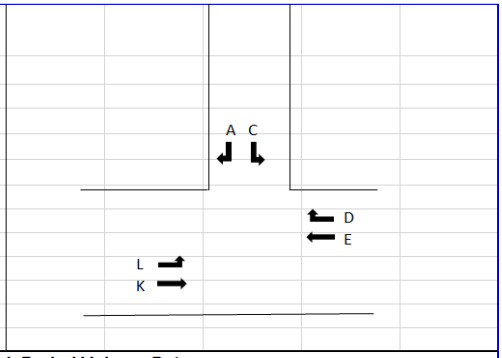
TRAFFIC VOLUME DATA AND MODELLING RESULTS

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

Table A-1

Trunk 1
@
Rosemary Drive

Middle Sackville, NS
Wednesday, August 7, 2019



AM Peak Period Volume Data

Time		Rosemary Drive Southbound Approach		Trunk 1 Westbound Approach		Trunk 1 Eastbound Approach		Total Vehicles
		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

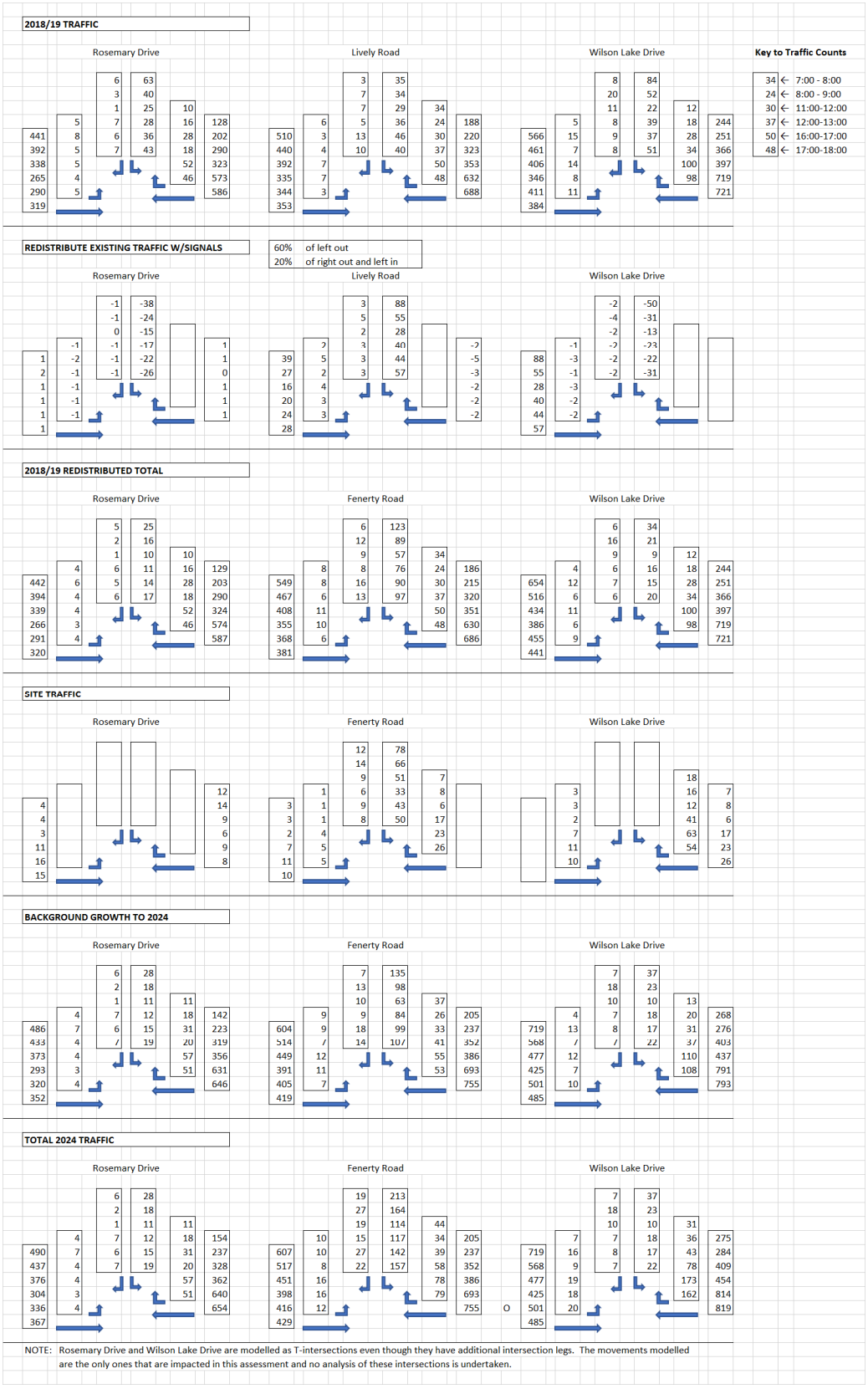
Time		Rosemary Drive Northbound Approach		Trunk 1 Southbound Approach		Trunk 1 Eastbound Approach		Total Vehicles
		A	B	H	I	J	L	
11:00	11:15	0	5	11	62	87	0	165
11:15	11:30	1	5	6	76	74	2	164
11:30	11:45	0	12	5	73	98	2	190
11:45	12:00	0	3	6	79	79	1	168
12:00	12:15	1	7	4	87	67	2	168
12:15	12:30	1	6	4	77	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 Northbound Approach		Trunk 1 Southbound Approach		Trunk 1 Eastbound Approach		Total Vehicles
		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



NOTE: Rosemary Drive and Wilson Lake Drive are modelled as T-intersections even though they have additional intersection legs. The movements modelled are the only ones that are impacted in this assessment and no analysis of these intersections is undertaken.

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)	**Fenerty Road**	**Direction (EW or NS)**	**NS**	**City:**	
Quadrant (if appl)					

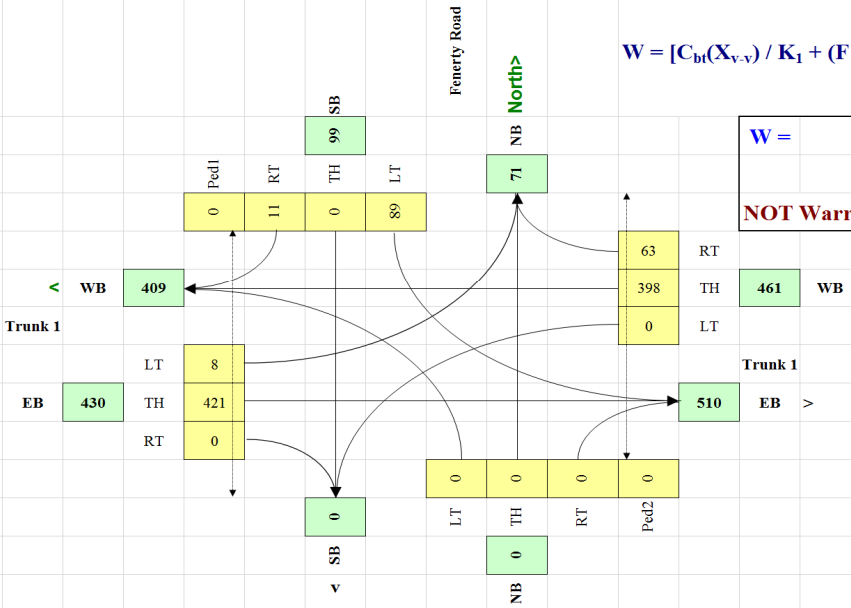
Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes	
Trunk 1	WB	1		1				1	
Trunk 1	EB				1			1	
Fenerty Road	NB								
Fenerty Road	SB	1				1			

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				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



$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F\ (X_{v\text{-}p})\ L) / K_2] \times C_i$$

W =	**55**	**55**	**0**
		Veh	***Ped***
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)	**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			

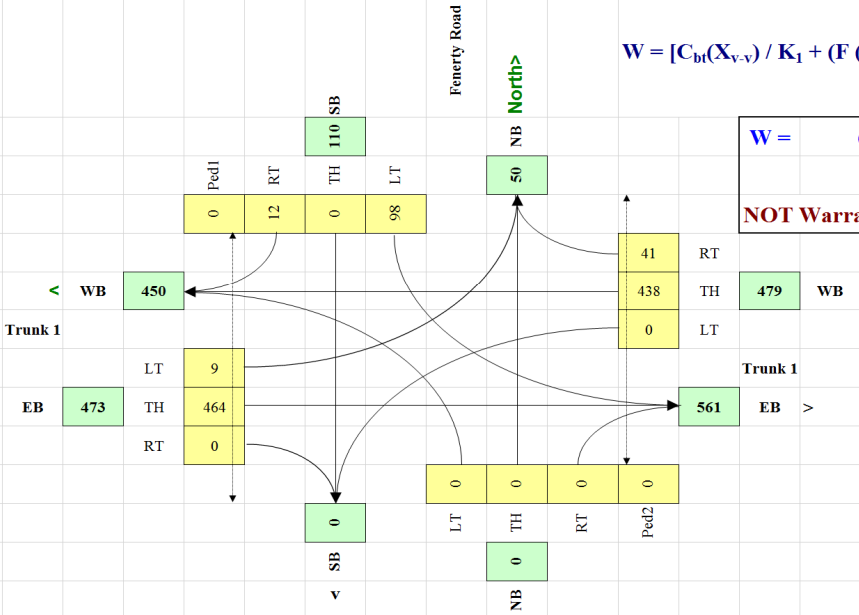
Demographics		
Elementary School	(y/n)	y
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	y
Metro Area Population	(#)	10
Central Business District	(y/n)	n

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				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

$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F\,(X_{v\text{-}p})\,L) / K_2] \times C_i$$



W =	**66**	**66**	**0**
		Veh	***Ped***
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 appl)					

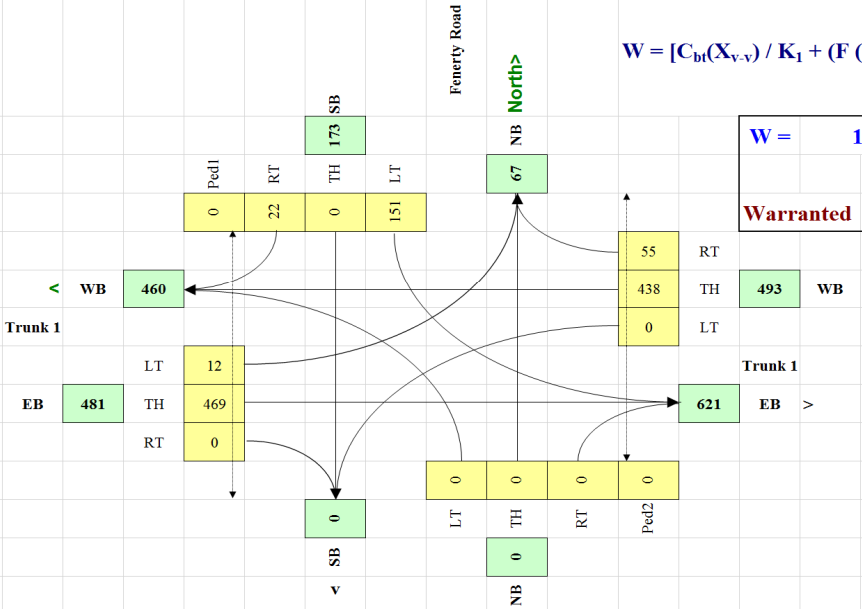
Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes	
Trunk 1	WB	1		1				1	
Trunk 1	EB				1			1	
Fenerty Road	NB								
Fenerty Road	SB	1				1			

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				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**	**0**	**2,628**	**332**	**72**	**2,816**	**0**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**0**	**0**	**0**	**151**	**0**	**22**	**0**	**438**	**55**	**12**	**469**	**0**	**0**	**0**	**0**	**0**

Average 6-hour Peak Turning Movements



$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F\ (X_{v\text{-}p})\ L) / K_2] \times C_i$$

W =	**103**	**103**	**0**
		Veh	***Ped***
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**	**0**	**792**	**0**	**121**	**0**	**2,628**	**332**	**65**	**2,736**	**0**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**0**	**0**	**0**	**132**	**0**	**20**	**0**	**438**	**55**	**11**	**456**	**0**	**0**	**0**	**0**	**0**

Average 6-hour Peak Turning Movements

$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F\,(X_{v\text{-}p})\,L) / K_2] \times C_i$$

W =	**89**	**89**	**0**
		Veh	*Ped*
NOT Warranted			

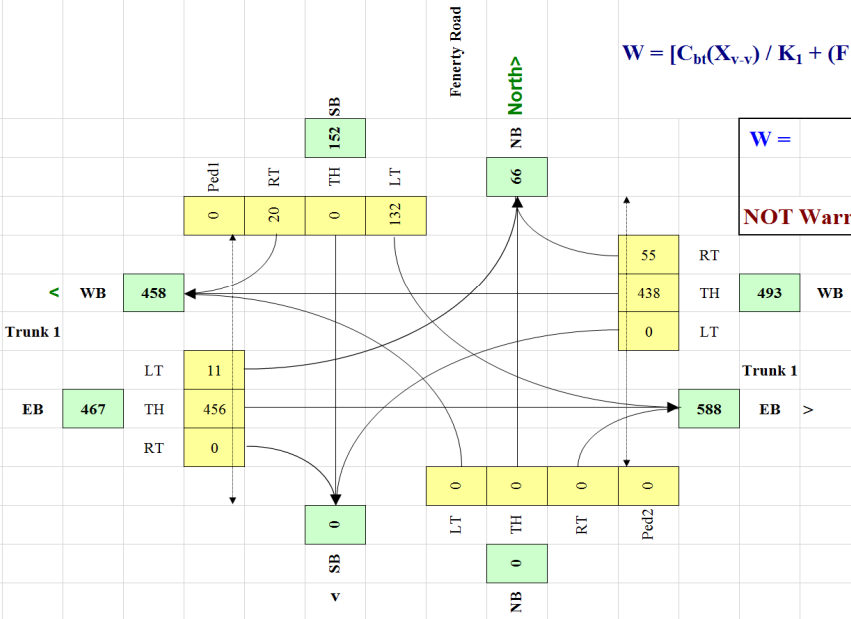


Exhibit A-7 SYNCHRO Output for 2024 AM Peak with Site Traffic

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 LOS: B
Intersection Capacity Utilization 53.7% — ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 3: Trunk 7 & Lively Road

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

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 LOS: B
Intersection Capacity Utilization 63.2% — ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 3: Trunk 7 & Lively Road