TRAFFIC IMPACT STUDY
WILLOW TREE TOWER

PREPARED FOR:
ARMCO CAPITAL INC.

Project No. 191-01937

APRIL 2019

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APPENDICES

1 INTRODUCTION

Background

Plans are being prepared for the development of Willow Tree Tower, a multi-use development in Halifax, NS. The proposed development includes 2 developed parcels (PID 00140020 and 00140012) at the northwest corner of Robie Street at Quinpool Road ("Willow Tree Intersection") in Halifax, Nova Scotia (See Figure 1).

The development is planned to include up to 295 residential units and up to 11,500 square feet of commercial space. There will be an underground parking garage with about 94 parking spaces. Completion of the development is anticipated by 2021.

WSP Canada Inc. has been retained to complete a Traffic Impact Study for this development.

A Traffic Impact Study Usually Considers Four Questions

A TIS usually consists of determining answers for the following questions:

1. **What is the existing transportation situation** adjacent to the study site? How have volumes changed historically?
2. **What transportation changes are expected** at key Study Area locations? How many vehicle and active mode trips are expected to be generated by the proposed development during weekday peak hours? What routes are the trips expected to use to travel within and through the Study Area?
3. **What transportation impacts will occur** on Study Area roads, sidewalks, and intersections?
4. **What transportation improvements are required** to mitigate project impacts on Study Area travel? Are there transportation modifications that should be made to improve the travel experience for all users?

Study Objectives

1. Develop projected 2021 background weekday AM and PM peak hourly volumes for Study Area roads that do not include trips generated by proposed site development.
2. Estimate the number of weekday AM and PM peak hour trips that will be generated by the proposed development.
3. Distribute and assign site generated trips to Study Area intersections to project 2021 peak hourly volumes that include site generated trips.
4. Evaluate impacts of site generated traffic on the performance of study intersections.
5. Complete traffic signal and turn lane warrant analyses, as necessary, for Study Area intersections and recommend improvements that may be needed at study intersections to mitigate the impacts of site development.

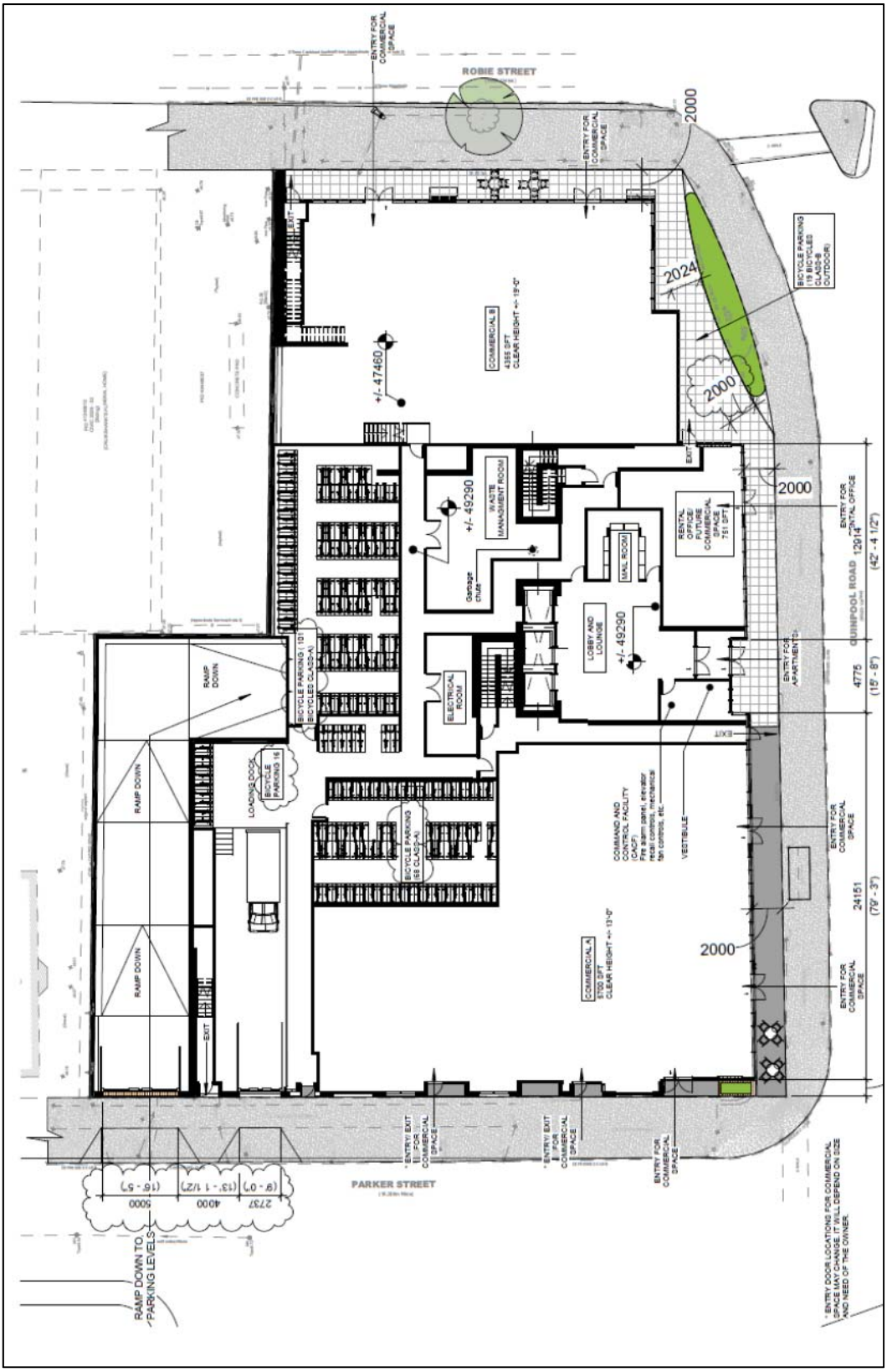


Figure 1 – Site Plan

2 STUDY AREA DESCRIPTIONS

Description of Proposed Development and Site Access

The proposed site is 2 developed parcels bounded by Quinpool Road, Robie Street, Parker Street / Windsor Street, and existing development in the north. The development is planned to include up to 295 residential units and up to 11,500 square feet of commercial space.

Pedestrian access will be provided on Windsor Street, Quinpool Road, and Robie Street.

Vehicular access to the 94 underground parking spaces is planned via one driveway on Windsor Street with driveway configuration similar to that shown conceptually in Figure 2. While alignment and spacing will need to be confirmed during design, it is expected that sight distance is sufficient and that the driveway connection will be at least 30m from Quinpool Road and at least 8m from the realigned Parker Street.

Figure 2 – Driveway Alignment Concept

In addition to the benefit to the site, this realignment could provide the following additional benefits:

- Shorten crossings for pedestrians on the east side of Windsor Street;
- Better accommodate a potential future bicycle connection along Windsor Street to Quinpool Road; and,
- Reduce wrong way movements where traffic on Parker Street were observed turning directly onto Windsor Street during the PM peak (See Table A-4, Appendix).

It is anticipated that buildout of the development will complete by 2021.

Existing Road Descriptions

Robie Street, just to the east of the site is a 6-lane divided arterial roadway with concrete sidewalks on both sides and time restricted parking on the east side. Parking is restricted on the west (site) side during the AM peak period but is otherwise unrestricted. Robie Street is an important north-south corridor on the Halifax Peninsula that provides access to the hospitals and universities and serves as a key link for several bus routes. Robie Street has a 50 km/h speed limit.

Quinpool Road, just to the south of the site is a 4-lane undivided arterial roadway with concrete sidewalks and time restricted parking on both sides. Quinpool Road has a 50 km/h speed limit.

Windsor Street, just to the west of the site is a 2-lane major collector roadway with concrete sidewalks and restricted parking on the west side and permitted parking on the east side. The Windsor Street bicycle lane begins just to the north of the site area. Windsor Street has a 50 km/h speed limit.

Intersection Descriptions

The Robie Street / Quinpool Road / Cogswell Street / Bell Road intersection is signalized with pedestrian crossings on all approaches and general lane configurations illustrated in Figure 3.

The Robie Street – Welsford Street T-intersection is unsignalized with STOP control on Welsford Street. There is an existing RA-5 crosswalk crossing the Robie Street north approach. Welsford Street is right-in, right-out as there is a concrete median along Robie Street.

The Quinpool Road – Windsor Street T-intersection is unsignalized with STOP control on Windsor Street. Windsor Street is right-in, right-out as there is a concrete median along Quinpool Road in this area.

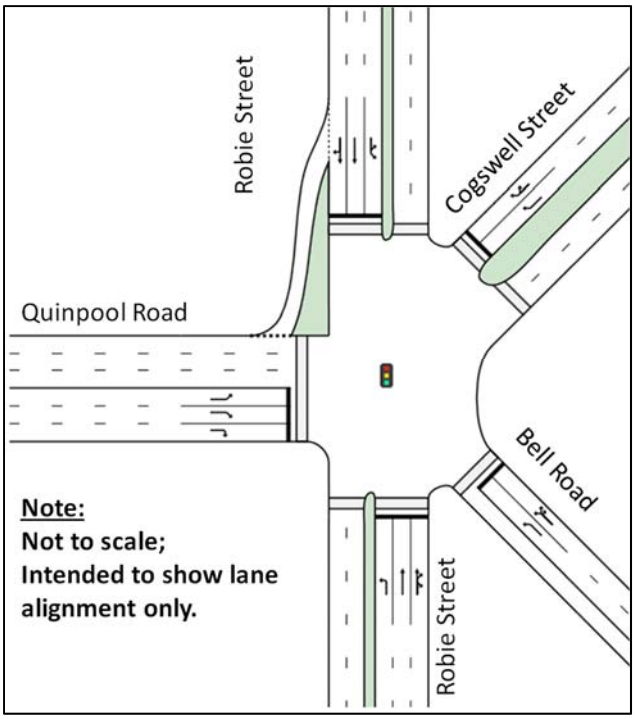


Figure 3 – General Alignment of Quinpool / Robie Intersection

The Windsor Street – Welsford Street T-intersection is unsignalized with STOP control on Welsford Street. There is an existing RA-4 crosswalk crossing the Windsor Street north approach. All approaches are a single lane.

Turning Movement Counts

Intersection Turning Movement Counts were obtained by WSP during morning (7-9 AM) and afternoon (4-6 PM) peak periods in February 2019 at the following intersections:

- Robie / Quinpool / Cogswell / Bell;
- Robie at Welsford; and,
- Windsor at Parker.

Additional intersection Turning Movement Counts were obtained by HRM Traffic Management during AM and PM peak periods at the Windsor Street at Welsford Street intersection on Thursday, June 1, 2017.

Each of the four intersection turning movement counts have been tabulated (See Appendix) in 15-minute intervals with peak hours indicated by shaded areas.

Growth Trends

Traffic volumes collected by HRM for this area were analyzed to develop an understanding of traffic growth trends. Results do not indicate a clear growth trend for traffic volumes on Windsor Street, Quinpool Road, or Robie Street near the site (and in fact indicate a marginal decrease).

Based on a review of the available historical traffic data it was concluded that traffic growth will not be applied to the observed trips to project 2021 traffic volumes for the study.

Projected 2021 Background Volumes

Projected 2021 AM and PM peak hour background traffic volumes are shown diagrammatically in Figure A-1, Appendix.

Active Transportation / Transit

The site has good accessibility for pedestrians, with concrete sidewalks on both sides of all study area streets. There are signalized crosswalks at all approaches of the Robie Street / Quinpool Road intersection, as well as an RA-5 crosswalk crossing Robie Street at Welsford Street and an RA-4 crosswalk crossing Windsor Street at Welsford Street.

The site is well connected for bicyclists with existing bicycle lanes on Windsor Street, approved local street bikeways on Allan Street in the west and Vernon Street in the South, and the Halifax Common is just to the east (See Figure 4). HRM is also planning to provide a local street bikeway or protected bidirectional bikeway along Welsford Street just to the north of the site to connect Windsor Street to the Halifax Common.

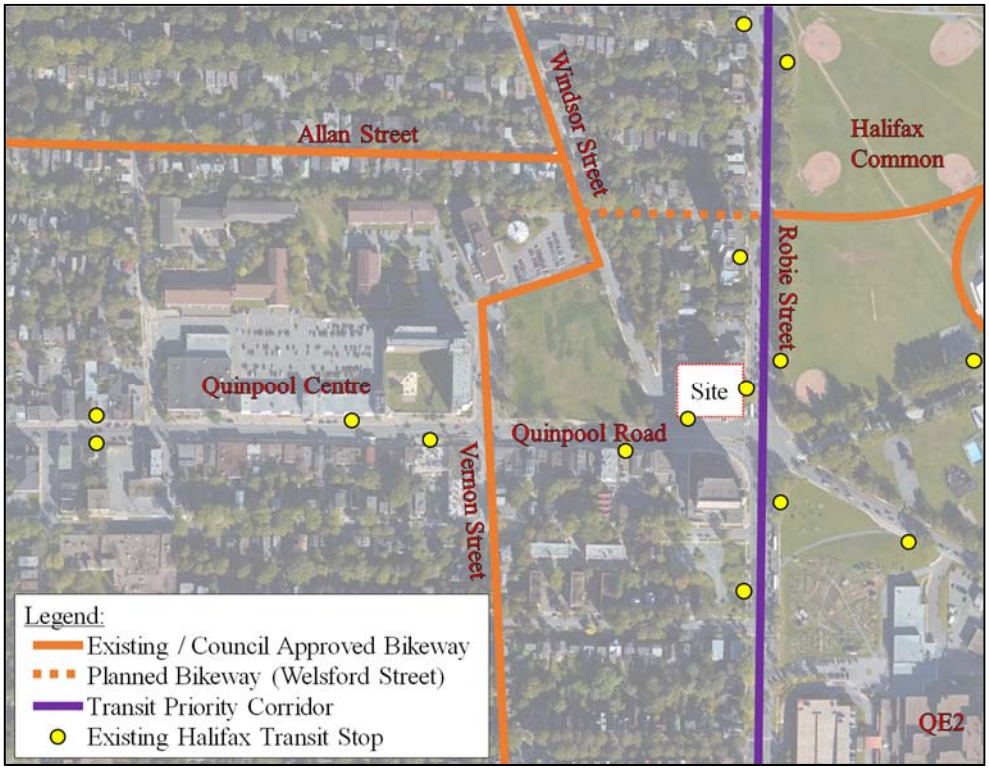


Figure 4 – Area Existing / Planned Bikeways and Transit Infrastructure

Halifax Transit operates Routes #4 (Universities), 7 (Robie), 80 (Sackville), 81 (Hemlock Ravine), and 90 (Larry Uteck) on Robie Street with northbound and southbound stops within 100 metres of the site (See Figure 4).

Additional transit service (Routes #9 (Herring Cove), 32 (Cowie Hill Express), and 123 (Timberlea Express) is available in front of the site on Quinpool Road with eastbound and westbound stops within 100 metres of the site.

Robie Street is a designated 'Transit Priority Corridor' in this area and a planning study (WSP 2018) has been completed that considered options to implement transit lanes along the full corridor.

3 TRIP GENERATION, DISTRIBUTION, AND ASSIGNMENT

Anticipated Land Use

The proposed development is planned to include:

- Up to 295 apartment units; and,
- Up to 11,500 square feet of leasable retail floor space.

Existing Development

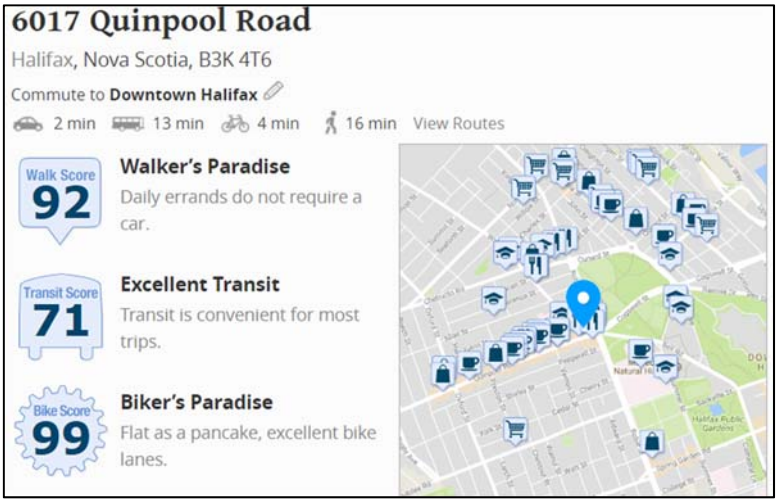
Currently the site is developed with two buildings at 6009 and 6017 Quinpool Road that combine for approximately 52,900 square feet of office space. Since this office space will no longer be operational with redevelopment, trips currently generated by the existing site have been considered as credit for the purposes of estimating the additional vehicle trips generated by the redeveloped site.

Estimation of Total Site Generated Trips

The number of trips that will be generated by the proposed multi-use development has been estimated using rates published in *Trip Generation, 10th Edition* (Institute of Transportation Engineers, Washington, 2017). Trip generation estimates are summarized in Table 1.

A 25% reduction of vehicle trips was used for this development and accounts for:

- *Onsite Synergies*- Since this proposed development includes up to 295 apartment units and up to 11,500 SF of retail space, it is probable that there will be many onsite trips between the complementing land uses.
- *Pedestrian Access*- With good nearby pedestrian infrastructure, the site is located close to Quinpool Centre, Halifax Common, and the QE2 (all within 5-minute walk). The site is a 15-minute walk to the Scotiabank Centre, Public Gardens, and Spring Garden Road.
- *Cycling*- The planned Allan Street, Vernon Street, and considered Welsford Street Bikeway will connect to the existing Windsor Street Bike lane and are all located within 250 metres of the site. Provision of onsite bicycle parking is planned.
- *Public Transit*- With several well served transit routes traveling past the site on Robie Street and Quinpool Road, it is anticipated that the modal share for transit users will be high. Robie Street is designated as a Transit Priority Corridor in the IMP and HRM is planning to implement corridor level transit priority measures.



Source: Walkscore.com

The proposed development is estimated to generate:

- 103 two-way trips (29 entering and 74 exiting) during the AM peak hour; and,
- 150 two-way trips (86 entering and 64 exiting) during the PM peak hour

When estimated trips generated by the existing development and reduction for non-auto modes are considered, the proposed development is estimated to generate:

- 45 new two-way vehicle trips (-6 entering and 51 exiting) during the AM peak hour; and,
- 78 two-way trips (58 entering and 20 exiting) during the PM peak hour.

Table 1 – Trip Generation Estimates

Land Use	Units[2]	Trip Generation Rates				Trips Generated[3]			
		AM Peak		PM Peak		AM Peak		PM Peak	
		In	Out	In	Out	In	Out	In	Out
Trip Generation Estimates for the Proposed Development									
Multifamily Housing (High-Rise)[1] (Land Use 222)	295	0.07	0.24	0.22	0.14	22	70	65	41
Retail[1] (ITE Usage 820)	11.5	0.58	0.36	1.83	1.98	7	4	21	23
Total Estimated Trips Generated by the Proposed Site						**29**	**74**	**86**	**64**
25% Trip Reduction to Account for Internal Site Trips and Non-Auto Modes[5]						-7	-19	-22	-16
New Vehicle Trips Generated By The Proposed Development						**22**	**55**	**64**	**48**
Trip Generation Estimates for the Existing Development									
General Office Building[1,4] (6017 Quinpool) (ITE 710)	8.5	0.71	0.12	0.15	0.72	6	1	1	6
General Office Building[1,4] (6009 Quinpool) (ITE 710)	44.3	0.71	0.12	0.15	0.72	32	5	7	32
Total Estimated Trips Generated by the Existing Site						**38**	**6**	**8**	**38**
25% Trip Reduction to Account for Internal Site Trips and Non-Auto Modes[5]						-10	-2	-2	-10
New Vehicle Trips Generated By The Existing Development						**28**	**4**	**6**	**28**
Net New Vehicle Trips Generated By The Proposed Development						**-6**	**51**	**58**	**20**

Notes:
1. Trip generation rates for the associated Land Use from *Trip Generation, 10th Edition* (Institute of Transportation Engineers, Washington, 2017).
2. Units are 'number of units' for residential, '1000 Sq. Ft Gross Leasable Area' for Retail, '1000 Sq. Ft Gross Floor Area for Office.
3. Vehicles per hour for peak hours.
4. General Office Rates for the Existing Development use rates for 'Dense Multi-Use Urban' (pages 21, 22 of the land use group) to estimate the site's trips.
5. Trip generation estimates have been reduced by 25% to account for trips between complementing land uses within the development as well as non-auto modes. This considers the *Integrated Mobility Plan* (HRM 2017) target of at least 40% non-auto for the Regional Centre.

Trip Distribution and Assignment

New vehicle trips generated by the proposed development were assigned to the roadway network based on counted volumes and local knowledge of the area considering major trip origins and destinations in the region. In the trip distribution, consideration is given to the expected high rate of non-vehicle trips from / to the south and east, due to the shorter distances and higher anticipated active transportation and transit mode shares.

- North 45% (North end Halifax, Dartmouth / Burnside / Bedford / Fall River / Airport via MacKay Bridge, Dartmouth via Macdonald Bridge, etc.)
- East 10% (Downtown Halifax, etc.)
- South 15% (Dalhousie and St. Mary's, Hospitals, etc.)
- West 30% (Halifax Shopping Centre, Bayers Lake, Highway 102, Armdale roundabout, etc.)

Estimated trips generated by the proposed development have been assigned to Study Area intersections and are shown diagrammatically in Figure A-2, Appendix.

Projected 2021 Peak Hour Traffic Volumes that Include Site Generated Trips

Trips generated by the proposed development (Figure A-2, Appendix) have been added to the projected 2021 AM and PM background volumes (Figure A-1, Appendix) to provide projected 2021 AM and PM peak hourly volumes that include site generated trips, illustrated diagrammatically in Figure A-3, Appendix.

4 INTERSECTION OPERATIONAL ANALYSIS

Intersection Analysis was completed to estimate how the intersections may be expected to operate without and with site generated trips.

Intersection Capacity Analysis Results

Synchro 10.0 software has been used for performance evaluation of Study Area intersections for 2021 AM and PM peak hour volumes without and with site development. Analysis results are included in the Appendix and summarized in Tables 2 to 6 below. It is understood that HRM is considering the removal of the southbound right turn channel from Robie Street to Quinpool Road. All scenarios include the removal of this channel at HRM's request.

Robie Street at Quinpool Road (Signalized, Table 2) – While this intersection currently operates near capacity during the peak periods, the trips generated by redevelopment are not expected to have a major impact on the performance of the overall intersection or of the individual movements.

Study Area STOP controlled intersections:

- ***Robie Street at Welsford Street (Table 3)***
- ***Quinpool at Windsor Street (Table 4)***
- ***Windsor Street at Welsford Street (Table 5)***
- ***Windsor Street at Site Driveway (Table 6)***

Overall performance at the STOP controlled intersections is expected to be satisfactory without and with the addition of site generated trips. All movements are expected to operate within HRM acceptable limits.

Table 2 –Intersection Capacity Analysis for Robie Street at Quinpool Road

Intersection Criteria	Control Delay (sec/veh), Level of Service (LOS), v/c Ratio, and 95th %ile Queue (m) by Intersection Movement									Overall Intersection
	Quinpool Road			Cogswell Street	Robie Street				Bell Street	
	EB-T	EB-R	EB-R2	WB-TR	NB-L	NB-TR	SB-L	SB-TR	NW-LR	Delay
AM Peak Hour **without** Site Development (Page A-8)										
Delay	70.7	53.0	7.8	42.9	73.2	49.0	90.3	82.8	80.2	62.8
v/c	0.82	0.90	0.48	0.16	0.72	0.54	0.94	0.99	0.88	
Queue	144.2	245.3	37.7	23.9	62.0	79.2	113.4	167.4	92.6	
AM Peak Hour **with** Site Development (Page A-16)										
Delay	70.7	53.0	7.8	42.9	72.9	49.0	94.8	82.2	79.9	63.0
v/c	0.82	0.90	0.48	0.16	0.72	0.54	0.96	0.99	0.88	
Queue	144.2	245.3	37.7	23.9	61.7	79.2	117.8	167.1	92.3	
PM Peak Hour **without** Site Development (Page A-12)										
Delay	62.9	26.6	3.5	60.4	77.0	62.3	85.7	50.1	89.0	63.9
v/c	0.59	0.42	0.21	0.64	0.88	0.85	0.83	0.59	1.01	
Queue	88.8	73.5	11.4	83.4	106.4	144.7	83.9	88.4	172.9	
PM Peak Hour **with** Site Development (Page A-21)										
Delay	62.9	26.6	3.5	60.4	83.6	62.3	87.4	50.2	89.8	64.8
v/c	0.59	0.42	0.21	0.64	0.91	0.85	0.84	0.60	1.01	
Queue	88.8	73.5	11.4	84.0	115.7	144.7	86.5	89.7	173.6	

Table 3 – Intersection Capacity Analysis for Robie Street at Welsford Street

Intersection Criteria	Control Delay (sec/veh), Level of Service (LOS), v/c Ratio, and 95th %ile Queue (m) by Intersection Movement			Overall Intersection
	Welsford Street	Robie Street		
	EB-R	NB-T	SB-TR	Delay
AM Peak Hour **without** Site Development (Page A-9)				
Delay	12.1	0.0	0.0	1.2
v/c	0.24	0.15	0.19	
Queue	7.3	0.0	0.0	
AM Peak Hour **with** Site Development (Page A-17)				
Delay	12.3	0.0	0.0	1.3
v/c	0.26	0.15	0.19	
Queue	7.9	0.0	0.0	
PM Peak Hour **without** Site Development (Page A-13)				
Delay	10.1	0.0	0.0	0.6
v/c	0.11	0.28	0.12	
Queue	2.9	0.0	0.0	
PM Peak Hour **with** Site Development (Page A-22)				
Delay	10.1	0.0	0.0	0.6
v/c	0.12	0.28	0.12	
Queue	3.2	0.0	0.0	

Table 4 –Intersection Capacity Analysis for Quinpool Road at Windsor Street

Intersection Criteria	Control Delay (sec/veh), Level of Service (LOS), v/c Ratio, and 95th %ile Queue (m) by Intersection Movement				Overall Intersection
	Quinpool Road			Windsor Street	
	EB-T	WB-T	WB-R	SB-R	Delay
AM Peak Hour **without** Site Development (Page A-10)					
Delay	0.0	0.0	0.0	10.7	0.8
v/c	0.39	0.13	0.11	0.20	
Queue	0.0	0.0	0.0	5.6	
AM Peak Hour **with** Site Development (Page A-18)					
Delay	0.0	0.0	0.0	10.8	0.9
v/c	0.39	0.13	0.11	0.22	
Queue	0.0	0.0	0.0	6.2	
PM Peak Hour **without** Site Development (Page A-14)					
Delay	0.0	0.0	0.0	11.1	0.5
v/c	0.19	0.28	0.27	0.14	
Queue	0.0	0.0	0.0	3.7	
PM Peak Hour **with** Site Development (Page A-23)					
Delay	0.0	0.0	0.0	11.2	0.6
v/c	0.19	0.28	0.28	0.16	
Queue	0.0	0.0	0.0	4.3	

Table 5 – Intersection Capacity Analysis for Windsor Street at Welsford Street

Intersection Criteria	Control Delay (sec/veh), Level of Service (LOS), v/c Ratio, and 95th %ile Queue (m) by Intersection Movement			Overall Intersection
	Welsford Street	Windsor Street		
	WB-LR	NB-TR	SB-LT	Delay
AM Peak Hour **without** Site Development (Page A-11)				
Delay	10.5	0.0	5.1	3.9
v/c	0.05	0.11	0.27	
Queue	1.3	0.0	4.1	
AM Peak Hour **with** Site Development (Page A-19)				
Delay	10.8	0.0	5.2	3.7
v/c	0.06	0.13	0.29	
Queue	1.4	0.0	4.3	
PM Peak Hour **without** Site Development (Page A-15)				
Delay	12.3	0.0	4.0	1.8
v/c	0.08	0.28	0.18	
Queue	2.0	0.0	1.9	
PM Peak Hour **with** Site Development (Page A-24)				
Delay	12.6	0.0	3.5	1.6
v/c	0.07	0.30	0.23	
Queue	1.6	0.0	1.9	

Table 6 – Intersection Capacity Analysis for Windsor Street at Site Driveway

Intersection Criteria	Control Delay (sec/veh), Level of Service (LOS), v/c Ratio, and 95th %ile Queue (m) by Intersection Movement			Overall Intersection
	Site Access	Windsor Street		
	WB-LR	NB-TR	SB-LT	Delay
AM Peak Hour **with** Site Development (Page A-20)				
Delay	9.9	0.0	0.8	1.7
v/c	0.08	0.11	0.13	
Queue	1.9	0.0	0.3	
PM Peak Hour **with** Site Development (Page A-25)				
Delay	12.3	0.0	3.0	1.6
v/c	0.10	0.28	0.13	
Queue	2.4	0.0	1.0	

5 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.1 SUMMARY

Description of the Proposed Development

1. Plans are being prepared for the development of Willow Tree Tower, a multi-use development at the northwest corner of the Robie Street at Quinpool Road intersection in Halifax, NS. The development is planned to include up to:
   - 295 residential units; and,
   - 11,500 square feet of leasable retail floor space.

   Completion of the development is anticipated by 2021.

Proposed Site Access

2. Vehicular access to the about 94 underground parking spaces within the development will be a single driveway onto Windsor Street.

Study Area Roads

3. ***Robie Street,*** just to the east of the site is a 6-lane arterial roadway in this area. Robie Street is an important north-south corridor on the Halifax Peninsula and serves as a key link for several bus routes. Robie Street is identified as a Transit Priority Corridor.

   Quinpool Road, just to the south of the site is a 4-lane undivided arterial roadway with concrete sidewalks and time restricted parking on both sides.

   Windsor Street, just to the west of the site is a 2-lane major collector roadway with concrete sidewalks and restricted parking on the west side and permitted parking on the east side. The Windsor Street bicycle lane begins just to the north of the site area.

Traffic Volumes

4. February 2019 turning movement counts were completed at the Robie Street intersections with Quinpool Road and Welsford Street as well as Windsor Street at Parker Street. These data supplement HRM collected turning movement counts at the Winsor at Welsford Street intersection.

5. Based on a review of the available historical traffic data it was concluded that traffic growth will not be applied to the observed trips to project 2021 traffic volumes for the study.

Estimation of Site Generated Trips

6. Trip generation estimates, were prepared using rates published in *Trip Generation, 10th Edition* (Institute of Transportation Engineers, Washington, 2017).

   The proposed development is estimated to generate:
   - 103 two-way trips (29 entering and 74 exiting) during the AM peak hour; and,
   - 150 two-way trips (86 entering and 64 exiting) during the PM peak hour.

Estimation of Site Generated Trips (Continued)	When reductions to account for existing development trips and non-auto modes are considered, the proposed development is estimated to generate: • 45 new two-way vehicle trips (-6 entering and 51 exiting) during the AM peak hour; and, • 78 new two-way trips (58 entering and 20 exiting) during the PM peak hour.
Trip Distribution and Assignment	7. New vehicle trips generated by the redevelopment have been assigned to study area streets and intersections based on counted volumes and consideration of major trip origins and destinations in the region. Trips were distributed to the north (45%), east (10%), south (15%), and west (30%).
Summary – Intersection Capacity Analysis	8. While the Robie at Quinpool intersection currently operates near capacity during the peak periods, the trips generated by redevelopment are not expected to have a major impact on the performance of the overall intersection or of the individual movements. 9. The level of performance at the study area STOP controlled intersections is expected to remain within HRM acceptable limits without and with the addition of site generated trips.

5.2 RECOMMENDATIONS

Site Access	10. Access opportunities should be reviewed to provide a two-way site driveway onto Windsor Street. This could include consideration of the potential realignment of the Parker Street connection from Windsor Street to reduce the asphalt area and tighten the intersection.
Active Transportation	11. Continue to plan for added bicycle connections through the area including on Welsford Street. 12. Continue to plan for provision of onsite bicycle parking to promote bicycle trips as an alternate travel mode.
Public Transit	13. Continue to plan for transit priority in this area and promote public transit as an alternate travel mode.

5.3 CONCLUSIONS

Impacts to Vehicular Traffic	14. With implementation of recommendations above, site generated trips are not expected to have a significant impact to levels of performance on adjacent intersections or to the regional road network.
Impacts to Bicycle Connections	15. The site is planned to include onsite bicycle parking and it is expected that several development trips will be made by bicycle. 16. With minimal additional traffic anticipated to use Welsford Street, the redevelopment is not expected to have an impact on the options being considered by HRM for the area.
Impact to Transit	17. The redevelopment of the site is not expected to have an impact on the transit priority corridor recommendations from the recent planning study completed for the area (WSP 2018).

APPENDIX

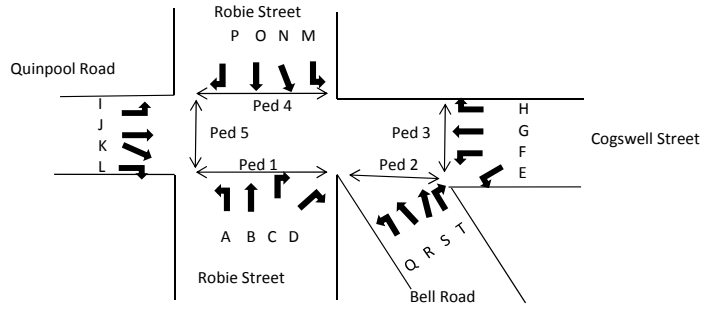
A

TRAFFIC VOLUME DATA AND INTERSECTION PERFORMANCE ANALYSIS

Table A-1

Robie Street
@
Quinpool Road / Cogswell Street / Bell Road

Halifax, NS
Tuesday, February 12, 2019



AM Peak Period Volume Data

Time		Robie Street Northbound Approach				Cogswell Street Westbound Approach				Quinpool Road Eastbound Approach				Robie Street Southbound Approach				Bell Road Northwestbound Approach				Total Vehicles
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	
07:00	07:15	34	72	9	2	0	0	18	2	0	82	123	39	0	52	116	2	0	36	36	0	623
07:15	07:30	31	91	2	0	0	0	20	1	0	68	131	58	4	64	161	2	0	25	15	1	674
07:30	07:45	21	85	3	3	0	0	19	1	0	63	150	62	1	61	194	5	0	52	32	0	752
07:45	08:00	27	87	2	2	0	0	32	2	1	71	136	79	5	63	220	3	0	48	20	0	798
08:00	08:15	28	88	3	6	0	0	22	5	0	67	162	92	6	57	189	9	0	62	30	0	826
08:15	08:30	36	83	5	1	0	0	27	2	0	74	137	78	4	63	169	3	0	52	22	1	757
08:30	08:45	38	98	9	2	0	0	34	4	0	90	132	83	7	57	161	12	0	75	28	0	830
08:45	09:00	50	110	4	4	0	0	22	1	0	77	132	83	5	51	158	14	0	80	28	0	819
AM Peak Hour		**152**	**379**	**21**	**13**	**0**	**0**	**105**	**12**	**0**	**308**	**563**	**336**	**22**	**228**	**677**	**38**	**0**	**269**	**108**	**1**	**3232**
07:00	**08:00**	**113**	**335**	**16**	**7**	**0**	**0**	**89**	**6**	**1**	**284**	**540**	**238**	**10**	**240**	**691**	**12**	**0**	**161**	**103**	**1**	**2847**
08:00	**09:00**	**152**	**379**	**21**	**13**	**0**	**0**	**105**	**12**	**0**	**308**	**563**	**336**	**22**	**228**	**677**	**38**	**0**	**269**	**108**	**1**	**3232**

PM Peak Period Volume Data

Time		Robie Street Northbound Approach				Cogswell Street Westbound Approach				Quinpool Road Eastbound Approach				Robie Street Southbound Approach				Bell Road Northwestbound Approach				Total Vehicles
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	
16:00	16:15	60	192	7	2	0	0	90	0	0	57	62	27	2	43	87	18	0	159	42	1	849
16:15	16:30	62	188	8	3	0	0	105	4	0	56	57	33	2	32	103	18	0	162	48	0	881
16:30	16:45	70	185	8	1	0	0	104	6	0	43	64	31	3	35	102	13	0	157	43	0	865
16:45	17:00	66	145	7	4	0	0	91	1	0	54	57	39	4	48	97	4	0	139	44	0	800
17:00	17:15	65	162	8	4	0	0	92	5	0	46	68	39	4	51	116	12	0	139	43	0	854
17:15	17:30	67	180	11	5	0	0	103	2	0	59	65	36	2	47	89	11	0	130	44	0	851
17:30	17:45	62	165	11	2	0	0	94	5	0	50	63	37	3	40	106	10	0	130	32	0	810
17:45	18:00	53	132	13	5	0	0	66	4	0	60	73	34	3	53	92	10	1	97	34	1	731
PM Peak Hour		**263**	**680**	**31**	**12**	**0**	**0**	**392**	**16**	**0**	**199**	**246**	**142**	**13**	**166**	**418**	**47**	**0**	**597**	**178**	**0**	**3400**
16:00	**17:00**	**258**	**710**	**30**	**10**	**0**	**0**	**390**	**11**	**0**	**210**	**240**	**130**	**11**	**158**	**389**	**53**	**0**	**617**	**177**	**1**	**3395**
17:00	**18:00**	**247**	**639**	**43**	**16**	**0**	**0**	**355**	**16**	**0**	**215**	**269**	**146**	**12**	**191**	**403**	**43**	**1**	**496**	**153**	**1**	**3246**

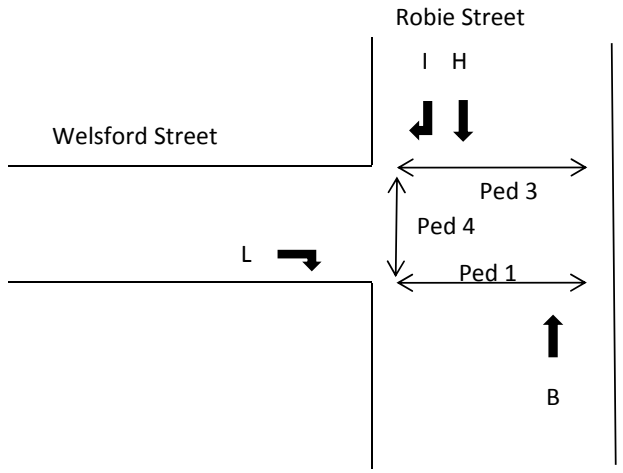
* Count completed by WSP

Table A-2

Robie Street @ Welsford Street

Halifax, NS

Tuesday, February 12, 2019



AM Peak Period Volume Data

Time		Robie Street Northbound Approach	Robie Street Southbound Approach		Welsford Street Eastbound Approach	Total Vehicles
		B	H	I	L	
07:00	07:15	110	151	1	19	281
07:15	07:30	107	205	4	26	342
07:30	07:45	118	224	1	37	380
07:45	08:00	110	251	1	40	402
08:00	08:15	123	223	3	38	387
08:15	08:30	107	204	2	35	348
08:30	08:45	130	200	3	37	370
08:45	09:00	139	189	2	39	369
AM Peak Hour		**458**	**902**	**7**	**150**	**1517**
07:00	**08:00**	**445**	**831**	**7**	**122**	**1405**
08:00	**09:00**	**499**	**816**	**10**	**149**	**1474**
		Ped 1	**Ped 3**		**Ped 4**	**Total Peds**
07:00	**08:00**	**1**	**63**		**24**	**88**
08:00	**09:00**	**0**	**102**		**26**	**128**

PM Peak Period Volume Data

Time		Robie Street Northbound Approach	Robie Street Southbound Approach		Welsford Street Eastbound Approach	Total Vehicles
		A	H	I	J	
16:00	16:15	234	138	6	12	390
16:15	16:30	240	134	1	21	396
16:30	16:45	234	140	2	13	389
16:45	17:00	190	132	0	21	343
17:00	17:15	210	155	2	28	395
17:15	17:30	226	128	5	21	380
17:30	17:45	202	140	2	19	363
17:45	18:00	170	129	3	29	331
PM Peak Hour		**874**	**561**	**5**	**83**	**1523**
16:00	**17:00**	**898**	**544**	**9**	**67**	**1518**
17:00	**18:00**	**808**	**552**	**12**	**97**	**1469**
		Ped 1	**Ped 3**		**Ped 4**	**Total Peds**
16:00	**17:00**	**0**	**82**		**32**	**114**
17:00	**18:00**	**0**	**118**		**45**	**163**

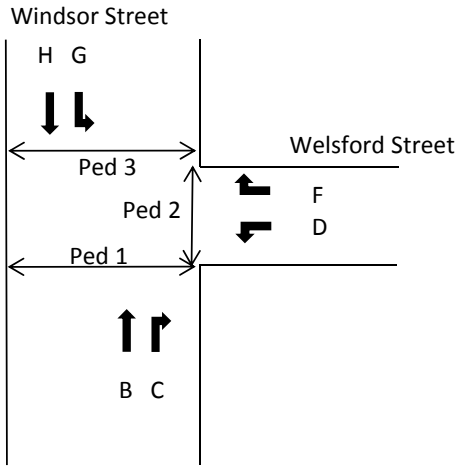
* Count completed by WSP

Table A-3

Windsor Street @ Welsford Street

Halifax, NS

Thursday, June 1, 2017



AM Peak Period Volume Data

Time		Windsor Street Northbound Approach		Welsford Street Westbound Approach		Windsor Street Southbound Approach		Total Vehicles
		B	C	D	F	G	H	
07:00	07:15	32	0	1	1	22	11	67
07:15	07:30	22	0	0	2	25	17	66
07:30	07:45	15	1	0	5	44	21	86
07:45	08:00	29	0	0	6	43	29	107
08:00	08:15	32	0	3	8	39	38	120
08:15	08:30	30	0	1	5	51	39	126
08:30	08:45	33	0	0	7	52	35	127
08:45	09:00	42	0	2	8	52	43	147
AM Peak Hour		**137**	**0**	**6**	**28**	**194**	**155**	**520**
07:00	**08:00**	**98**	**1**	**1**	**14**	**134**	**78**	**326**
08:00	**09:00**	**137**	**0**	**6**	**28**	**194**	**155**	**520**
		Ped 1		**Ped 2**		**Ped 3**		**Total Peds**
07:00	**08:00**	**3**		**16**		**39**		**58**
08:00	**09:00**	**0**		**29**		**80**		**109**

PM Peak Period Volume Data

Time		Windsor Street Northbound Approach		Welsford Street Westbound Approach		Windsor Street Southbound Approach		Total Vehicles
		B	C	D	F	G	H	
16:00	16:15	107	1	1	6	17	25	157
16:15	16:30	109	0	3	10	18	23	163
16:30	16:45	116	0	1	14	17	31	179
16:45	17:00	114	0	0	6	24	24	168
17:00	17:15	84	0	1	4	20	35	144
17:15	17:30	74	1	0	8	18	23	124
17:30	17:45	68	0	7	6	18	31	130
17:45	18:00	53	0	1	4	29	32	119
PM Peak Hour		**446**	**1**	**5**	**36**	**76**	**103**	**667**
16:00	**17:00**	**446**	**1**	**5**	**36**	**76**	**103**	**667**
17:00	**18:00**	**279**	**1**	**9**	**22**	**85**	**121**	**517**
		Ped 1		**Ped 2**		**Ped 3**		**Total Peds**
16:00	**17:00**	**2**		**19**		**103**		**124**
17:00	**18:00**	**2**		**12**		**122**		**136**

* Count completed by HRM Traffic Management

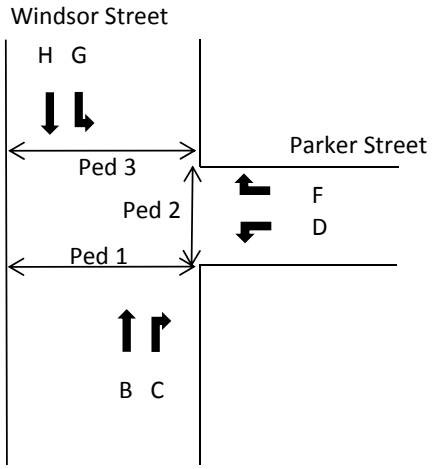
Table A-4

Windsor Street @ Parker Street

Halifax, NS

PM: Tuesday, February 26, 2019

AM: Wednesday, February 27, 2019



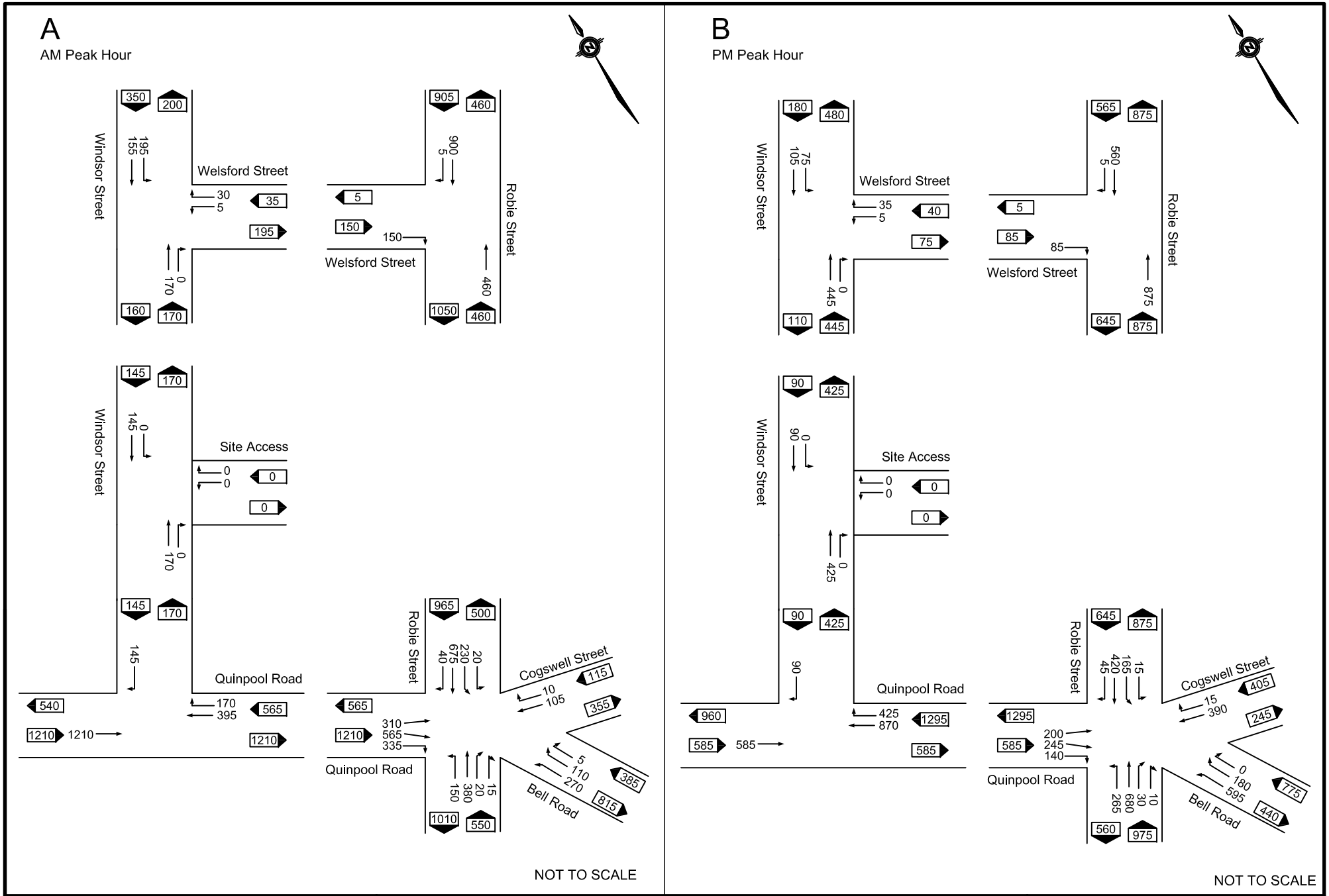
AM Peak Period Volume Data

Time		Windsor Street Northbound Approach		Parker Street Westbound Approach		Windsor Street Southbound Approach		Total Vehicles
		B	C	D	F	G	H	
07:00	07:15	31	0	0	0	2	15	48
07:15	07:30	28	1	0	0	4	15	48
07:30	07:45	22	0	0	0	0	22	44
07:45	08:00	38	1	0	0	2	19	60
08:00	08:15	39	3	0	0	3	33	78
08:15	08:30	39	1	0	0	6	29	75
08:30	08:45	42	5	0	0	3	41	91
08:45	09:00	40	1	0	0	1	40	82
AM Peak Hour		**160**	**10**	**0**	**0**	**13**	**143**	**326**
07:00	**08:00**	**119**	**2**	**0**	**0**	**8**	**71**	**200**
08:00	**09:00**	**160**	**10**	**0**	**0**	**13**	**143**	**326**
		Ped 1		**Ped 2**		**Ped 3**		**Total Peds**
07:00	**08:00**	**0**		**15**		**0**		**15**
08:00	**09:00**	**0**		**18**		**0**		**18**

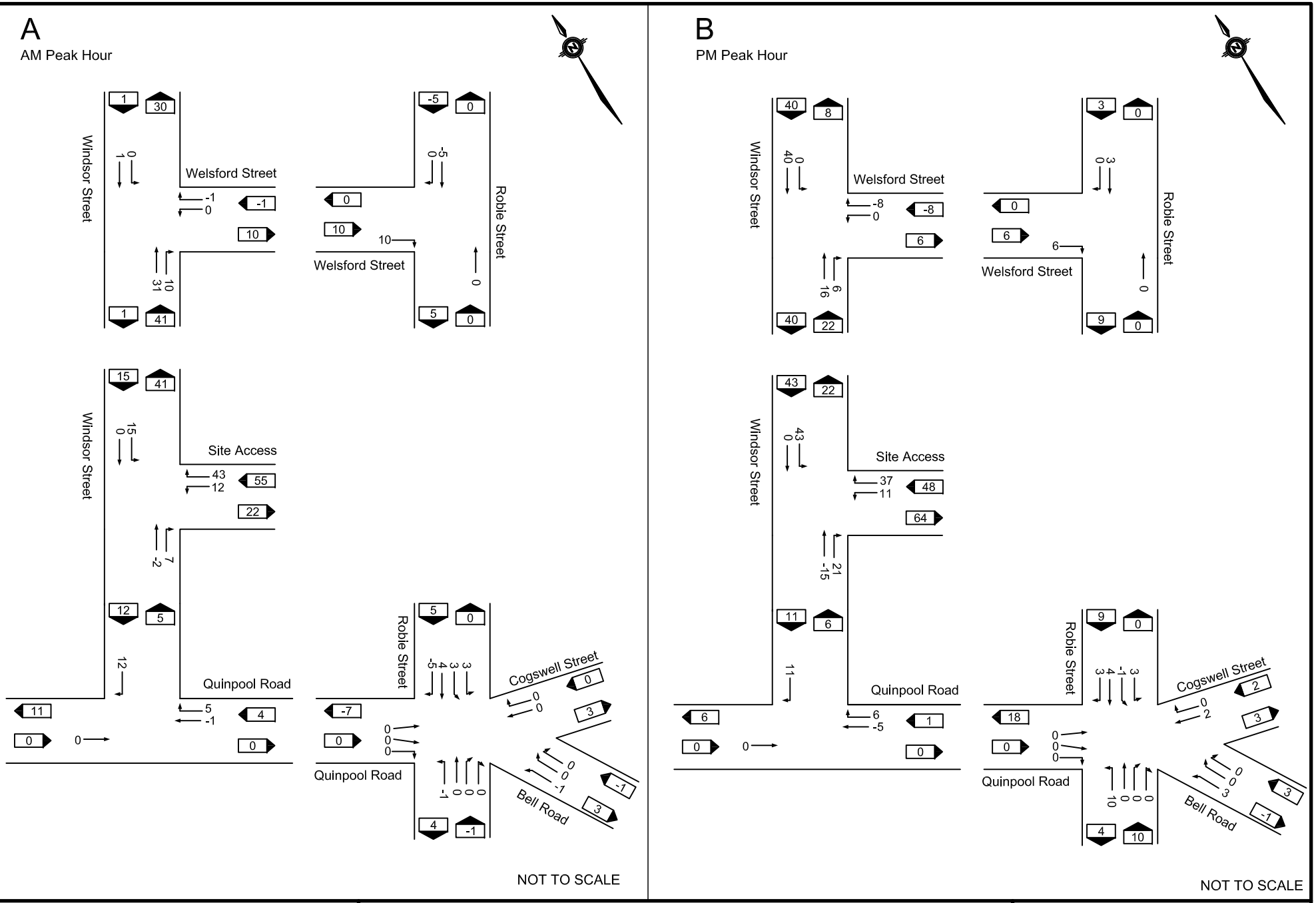
PM Peak Period Volume Data

Time		Windsor Street Northbound Approach		Parker Street Westbound Approach		Windsor Street Southbound Approach		Total Vehicles
		B	C	D	F	G	H	
16:00	16:15	101	3	0	0	0	21	125
16:15	16:30	113	2	1	0	1	23	140
16:30	16:45	115	1	0	0	1	16	133
16:45	17:00	87	3	0	0	1	27	118
17:00	17:15	92	1	0	0	1	23	117
17:15	17:30	76	6	2	0	0	36	120
17:30	17:45	74	1	0	0	1	29	105
17:45	18:00	51	4	0	0	2	11	68
PM Peak Hour		**416**	**9**	**1**	**0**	**3**	**87**	**516**
16:00	**17:00**	**416**	**9**	**1**	**0**	**3**	**87**	**516**
17:00	**18:00**	**293**	**12**	**2**	**0**	**4**	**99**	**410**
		Ped 1		**Ped 2**		**Ped 3**		**Total Peds**
16:00	**17:00**	**0**		**17**		**0**		**17**
17:00	**18:00**	**0**		**8**		**0**		**8**

* Count completed by WSP

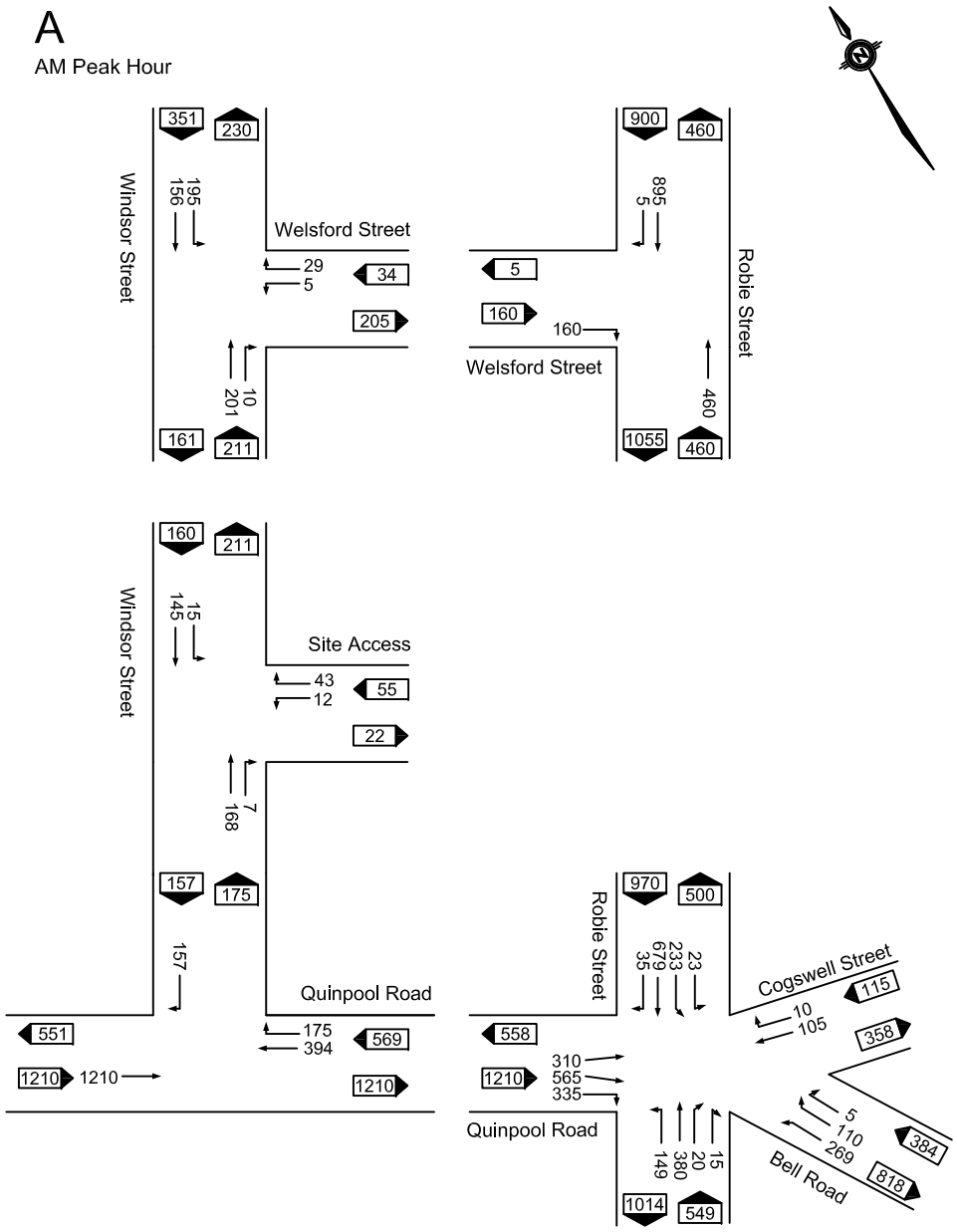


WSP	Traffic Impact Study - Proposed Mutli-Use Development Willow Tree Tower, Halifax, NS	Figure A-1
	Projected Weekday AM and PM Peak Hour Background Traffic Without Site Development	March 2019



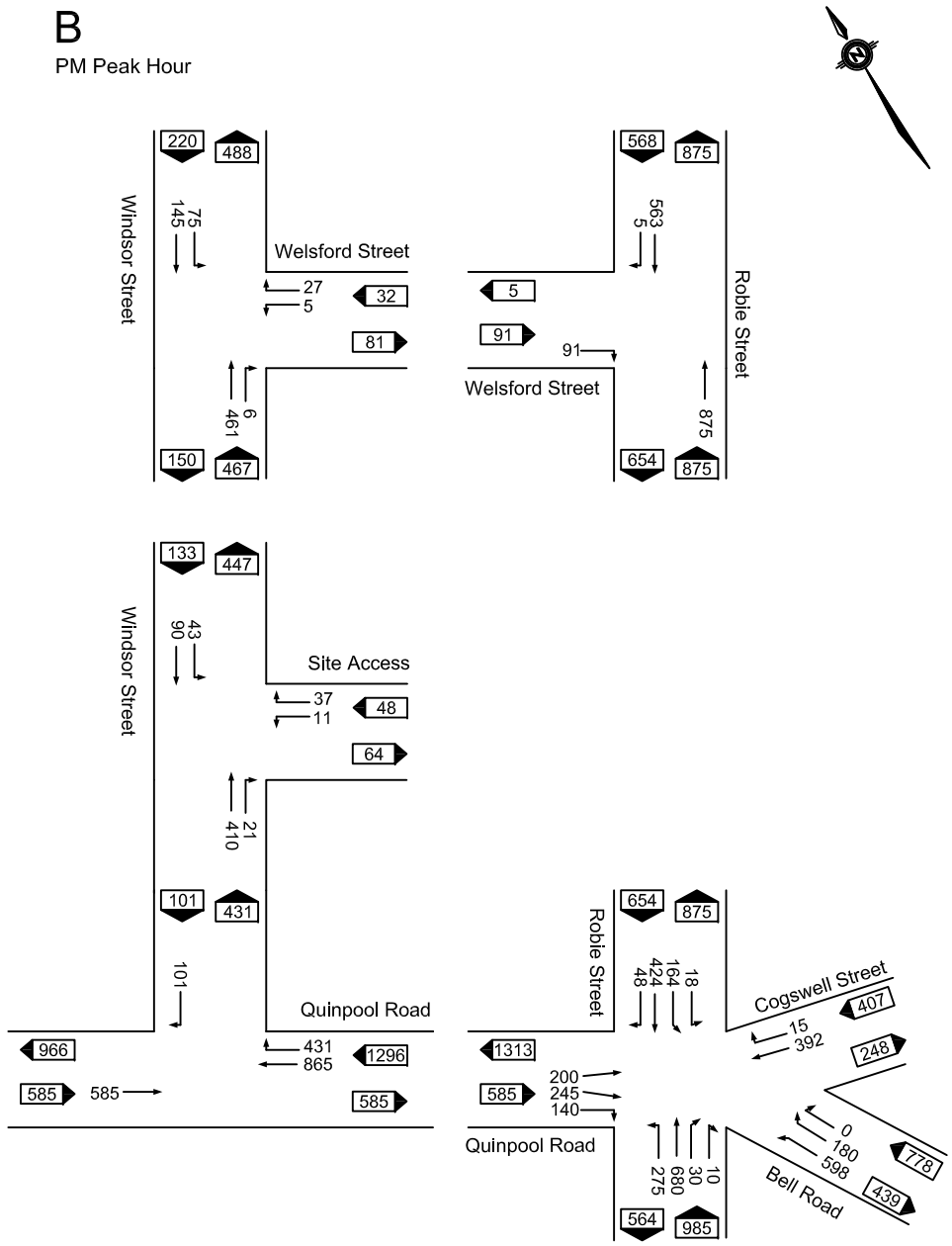
	Traffic Impact Study - Proposed Mutli-Use Development Willow Tree Tower, Halifax, NS	Figure A-2
	Estimated Trip Assignment	March 2019

A
AM Peak Hour



NOT TO SCALE

B
PM Peak Hour



NOT TO SCALE

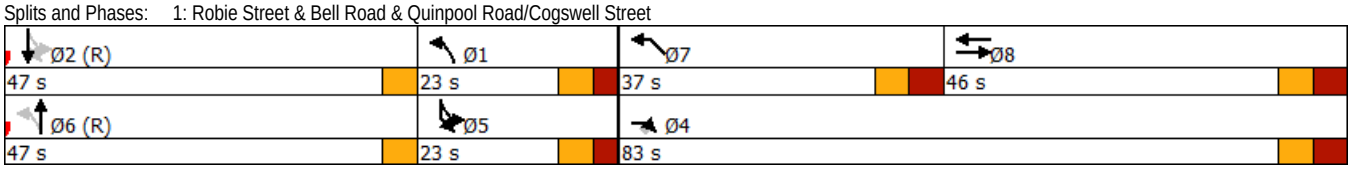
WSP	Traffic Impact Study - Proposed Mutli-Use Development Willow Tree Tower, Halifax, NS	Figure A-3
	Projected Weekday AM and PM Peak Hour Background Traffic With Site Development	March 2019

Lane Group	EBT	EBR	EBR2	WBT	NBL	NBT	SBL2	SBL	SBT	NWL
Lane Configurations										
Traffic Volume (vph)	310	565	335	105	150	380	20	230	675	270
Future Volume (vph)	310	565	335	105	150	380	20	230	675	270
Lane Group Flow (vph)	337	614	364	125	163	451	0	272	777	418
Turn Type	NA	custom	custom	NA	pm+pt	NA	pm+pt	pm+pt	NA	Prot
Protected Phases	8	4		8	1	6	5	5	2	7
Permitted Phases			4		6		2	2		
Minimum Split (s)	36.0	43.0	43.0	36.0	14.0	46.0	14.0	14.0	46.0	37.0
Total Split (s)	46.0	83.0	83.0	46.0	23.0	47.0	23.0	23.0	47.0	37.0
Total Split (%)	30.1%	54.2%	54.2%	30.1%	15.0%	30.7%	15.0%	15.0%	30.7%	24.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	4.0	4.0	4.0	4.0	3.0	0.0	3.0	3.0	0.0	4.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0		-1.0	-1.0	-1.0
Total Lost Time (s)	7.0	7.0	7.0	7.0	6.0	3.0		6.0	3.0	7.0
Lead/Lag					Lag	Lead	Lag	Lag	Lead	
Lead-Lag Optimize?										
Act Effct Green (s)	39.0	76.0	76.0	39.0	58.0	44.0		58.0	44.0	30.0
Actuated g/C Ratio	0.25	0.50	0.50	0.25	0.38	0.29		0.38	0.29	0.20
v/c Ratio	0.82	0.90	0.48	0.16	0.72	0.54		0.94	0.99	0.88
Control Delay	70.7	53.0	7.8	42.9	73.2	49.0		90.3	82.8	80.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	70.7	53.0	7.8	42.9	73.2	49.0		90.3	82.8	80.2
LOS	E	D	A	D	E	D		F	F	F
Approach Delay	45.0			42.9		55.4			84.7	80.2
Approach LOS	D			D		E			F	F
Queue Length 50th (m)	97.1	166.5	13.0	14.8	31.9	61.2		58.1	123.7	64.3
Queue Length 95th (m)	#144.2	#245.3	37.7	23.9	#62.0	79.2		#113.4	#167.4	#92.6
Internal Link Dist (m)	61.0			320.8		379.4			173.2	278.4
Turn Bay Length (m)		70.0	70.0							
Base Capacity (vph)	411	682	756	762	226	828		290	786	474
Starvation Cap Reductn	0	0	0	0	0	0		0	0	0
Spillback Cap Reductn	0	0	0	0	0	0		0	0	0
Storage Cap Reductn	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	0.82	0.90	0.48	0.16	0.72	0.54		0.94	0.99	0.88

Intersection Summary

Cycle Length: 153
Actuated Cycle Length: 153
Offset: 0 (0%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 135
Control Type: Pretimed
Maximum v/c Ratio: 0.99
Intersection Signal Delay: 62.8 Intersection LOS: E
Intersection Capacity Utilization 117.1% ICU Level of Service H
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Robie Street & Bell Road & Quinpool Road/Cogswell Street



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	150	0	460	900	5
Future Volume (Veh/h)	0	150	0	460	900	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	3%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	163	0	500	978	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)				197		
pX, platoon unblocked	0.91					
vC, conflicting volume	1230	328	983			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1054	328	983			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	76	100			
cM capacity (veh/h)	201	667	698			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	163	250	250	391	391	201
Volume Left	0	0	0	0	0	0
Volume Right	163	0	0	0	0	5
cSH	667	1700	1700	1700	1700	1700
Volume to Capacity	0.24	0.15	0.15	0.23	0.23	0.12
Queue Length 95th (m)	7.3	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	12.1	0.0	0.0	0.0	0.0	0.0
Lane LOS	B					
Approach Delay (s)	12.1	0.0		0.0		
Approach LOS	B					

Intersection Summary				
Average Delay	1.2			
Intersection Capacity Utilization	36.6%	ICU Level of Service		A
Analysis Period (min)	15			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	1210	395	170	0	145
Future Volume (Veh/h)	0	1210	395	170	0	145
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	1315	429	185	0	158
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			85			
pX, platoon unblocked						
vC, conflicting volume	614				1086	214
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	614				1086	214
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	80
cM capacity (veh/h)	961				211	790

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	SB 1
Volume Total	658	658	214	214	185	158
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	185	158
cSH	1700	1700	1700	1700	1700	790
Volume to Capacity	0.39	0.39	0.13	0.13	0.11	0.20
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	5.6
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	10.7
Lane LOS						B
Approach Delay (s)	0.0		0.0			10.7
Approach LOS						B

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	40.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	5	30	170	0	195	155
Future Volume (Veh/h)	5	30	170	0	195	155
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	33	185	0	212	168
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	777	185			185	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	777	185			185	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	96			85	
cM capacity (veh/h)	310	857			1390	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	38	185	380
Volume Left	5	0	212
Volume Right	33	0	0
cSH	695	1700	1390
Volume to Capacity	0.05	0.11	0.15
Queue Length 95th (m)	1.3	0.0	4.1
Control Delay (s)	10.5	0.0	5.1
Lane LOS	B		A
Approach Delay (s)	10.5	0.0	5.1
Approach LOS	B		

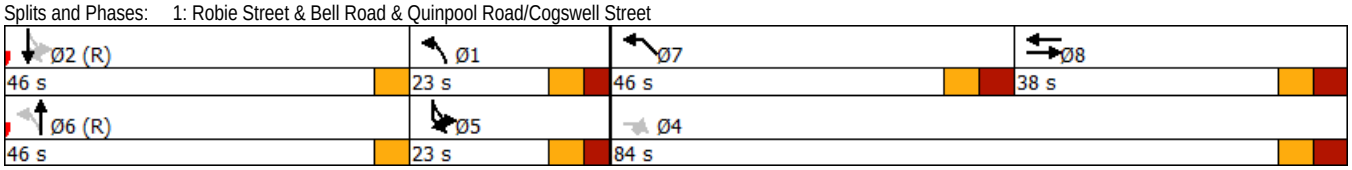
Intersection Summary			
Average Delay	3.9		
Intersection Capacity Utilization	44.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	EBR	EBR2	WBT	NBL	NBT	SBL2	SBL	SBT	NWL
Lane Configurations										
Traffic Volume (vph)	200	245	140	390	265	680	15	165	420	595
Future Volume (vph)	200	245	140	390	265	680	15	165	420	595
Lane Group Flow (vph)	217	266	152	440	288	783	0	195	506	843
Turn Type	NA	custom	custom	NA	pm+pt	NA	pm+pt	pm+pt	NA	Prot
Protected Phases	8			8	1	6	5	5	2	7
Permitted Phases		4	4		6		2	2		
Minimum Split (s)	36.0	43.0	43.0	36.0	14.0	46.0	14.0	14.0	46.0	37.0
Total Split (s)	38.0	84.0	84.0	38.0	23.0	46.0	23.0	23.0	46.0	46.0
Total Split (%)	24.8%	54.9%	54.9%	24.8%	15.0%	30.1%	15.0%	15.0%	30.1%	30.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	4.0	4.0	4.0	4.0	3.0	0.0	3.0	3.0	0.0	4.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0		-1.0	-1.0	-1.0
Total Lost Time (s)	7.0	7.0	7.0	7.0	6.0	3.0		6.0	3.0	7.0
Lead/Lag					Lag	Lead	Lag	Lag	Lead	
Lead-Lag Optimize?										
Act Effct Green (s)	31.0	77.0	77.0	31.0	57.0	43.0		57.0	43.0	39.0
Actuated g/C Ratio	0.20	0.50	0.50	0.20	0.37	0.28		0.37	0.28	0.25
v/c Ratio	0.59	0.42	0.21	0.64	0.88	0.85		0.83	0.59	1.01
Control Delay	62.9	26.6	3.5	60.4	77.0	62.3		85.7	50.1	89.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	62.9	26.6	3.5	60.4	77.0	62.3		85.7	50.1	89.0
LOS	E	C	A	E	E	E		F	D	F
Approach Delay	33.4			60.4		66.2			60.0	89.0
Approach LOS	C			E		E			E	F
Queue Length 50th (m)	60.4	49.9	0.0	64.8	61.2	119.0		43.1	69.1	~130.7
Queue Length 95th (m)	88.8	73.5	11.4	83.4	#106.6	144.7		#83.9	88.4	#172.9
Internal Link Dist (m)	61.0			229.8		476.3			175.9	271.5
Turn Bay Length (m)		70.0	70.0		200.0					
Base Capacity (vph)	366	631	739	692	329	917		235	856	836
Starvation Cap Reductn	0	0	0	0	0	0		0	0	0
Spillback Cap Reductn	0	0	0	0	0	0		0	0	0
Storage Cap Reductn	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	0.59	0.42	0.21	0.64	0.88	0.85		0.83	0.59	1.01

Intersection Summary

Cycle Length: 153
Actuated Cycle Length: 153
Offset: 0 (0%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 135
Control Type: Pretimed
Maximum v/c Ratio: 1.01
Intersection Signal Delay: 63.9 Intersection LOS: E
Intersection Capacity Utilization 112.3% ICU Level of Service H
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Robie Street & Bell Road & Quinpool Road/Cogswell Street



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	85	0	875	560	5
Future Volume (Veh/h)	0	85	0	875	560	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	3%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	92	0	951	609	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)				200		
pX, platoon unblocked	0.78					
vC, conflicting volume	1087	206	614			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	563	206	614			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	89	100			
cM capacity (veh/h)	358	801	961			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	92	476	476	244	244	127
Volume Left	0	0	0	0	0	0
Volume Right	92	0	0	0	0	5
cSH	801	1700	1700	1700	1700	1700
Volume to Capacity	0.11	0.28	0.28	0.14	0.14	0.07
Queue Length 95th (m)	2.9	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	10.1	0.0	0.0	0.0	0.0	0.0
Lane LOS	B					
Approach Delay (s)	10.1	0.0		0.0		
Approach LOS	B					

Intersection Summary				
Average Delay	0.6			
Intersection Capacity Utilization	27.5%	ICU Level of Service		A
Analysis Period (min)	15			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑	↱		↱
Traffic Volume (veh/h)	0	585	870	425	0	90
Future Volume (Veh/h)	0	585	870	425	0	90
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	636	946	462	0	98
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			85			
pX, platoon unblocked	0.92				0.92	0.92
vC, conflicting volume	1408				1264	473
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1266				1109	248
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	86
cM capacity (veh/h)	500				187	691

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	SB 1
Volume Total	318	318	473	473	462	98
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	462	98
cSH	1700	1700	1700	1700	1700	691
Volume to Capacity	0.19	0.19	0.28	0.28	0.27	0.14
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	3.7
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	11.1
Lane LOS						B
Approach Delay (s)	0.0		0.0			11.1
Approach LOS						B

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	36.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	5	35	445	0	75	105
Future Volume (Veh/h)	5	35	445	0	75	105
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	38	484	0	82	114
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	762	484			484	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	762	484			484	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	93			92	
cM capacity (veh/h)	345	583			1079	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	43	484	196
Volume Left	5	0	82
Volume Right	38	0	0
cSH	539	1700	1079
Volume to Capacity	0.08	0.28	0.08
Queue Length 95th (m)	2.0	0.0	1.9
Control Delay (s)	12.3	0.0	4.0
Lane LOS	B		A
Approach Delay (s)	12.3	0.0	4.0
Approach LOS	B		

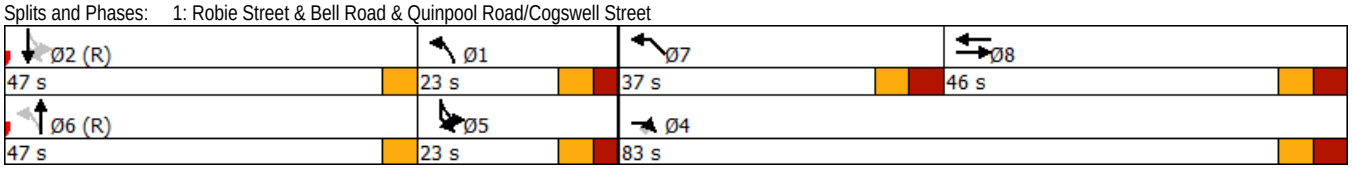
Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	46.4%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	EBR	EBR2	WBT	NBL	NBT	SBL2	SBL	SBT	NWL
Lane Configurations										
Traffic Volume (vph)	310	565	335	105	149	380	23	233	679	269
Future Volume (vph)	310	565	335	105	149	380	23	233	679	269
Lane Group Flow (vph)	337	614	364	125	162	451	0	278	776	417
Turn Type	NA	custom	custom	NA	pm+pt	NA	pm+pt	pm+pt	NA	Prot
Protected Phases	8	4		8	1	6	5	5	2	7
Permitted Phases			4		6		2	2		
Minimum Split (s)	36.0	43.0	43.0	36.0	14.0	46.0	14.0	14.0	46.0	37.0
Total Split (s)	46.0	83.0	83.0	46.0	23.0	47.0	23.0	23.0	47.0	37.0
Total Split (%)	30.1%	54.2%	54.2%	30.1%	15.0%	30.7%	15.0%	15.0%	30.7%	24.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	4.0	4.0	4.0	4.0	3.0	0.0	3.0	3.0	0.0	4.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0		-1.0	-1.0	-1.0
Total Lost Time (s)	7.0	7.0	7.0	7.0	6.0	3.0		6.0	3.0	7.0
Lead/Lag					Lag	Lead	Lag	Lag	Lead	
Lead-Lag Optimize?										
Act Effct Green (s)	39.0	76.0	76.0	39.0	58.0	44.0		58.0	44.0	30.0
Actuated g/C Ratio	0.25	0.50	0.50	0.25	0.38	0.29		0.38	0.29	0.20
v/c Ratio	0.82	0.90	0.48	0.16	0.72	0.54		0.96	0.99	0.88
Control Delay	70.7	53.0	7.8	42.9	72.9	49.0		94.8	82.2	79.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	70.7	53.0	7.8	42.9	72.9	49.0		94.8	82.2	79.9
LOS	E	D	A	D	E	D		F	F	E
Approach Delay	45.0			42.9		55.3			85.6	79.9
Approach LOS	D			D		E			F	E
Queue Length 50th (m)	97.1	166.5	13.0	14.8	31.7	61.2		59.7	123.5	64.1
Queue Length 95th (m)	#144.2	#245.3	37.7	23.9	#61.7	79.2		#117.8	#167.1	#92.3
Internal Link Dist (m)	61.0			320.8		379.4			173.2	278.4
Turn Bay Length (m)		70.0	70.0							
Base Capacity (vph)	411	682	756	762	226	828		290	787	474
Starvation Cap Reductn	0	0	0	0	0	0		0	0	0
Spillback Cap Reductn	0	0	0	0	0	0		0	0	0
Storage Cap Reductn	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	0.82	0.90	0.48	0.16	0.72	0.54		0.96	0.99	0.88

Intersection Summary

Cycle Length: 153
Actuated Cycle Length: 153
Offset: 0 (0%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 135
Control Type: Pretimed
Maximum v/c Ratio: 0.99
Intersection Signal Delay: 63.0 Intersection LOS: E
Intersection Capacity Utilization 117.5% ICU Level of Service H
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Robie Street & Bell Road & Quinpool Road/Cogswell Street



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	160	0	460	895	5
Future Volume (Veh/h)	0	160	0	460	895	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	3%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	174	0	500	973	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)				197		
pX, platoon unblocked	0.91					
vC, conflicting volume	1226	327	978			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1048	327	978			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	74	100			
cM capacity (veh/h)	203	669	701			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	174	250	250	389	389	200
Volume Left	0	0	0	0	0	0
Volume Right	174	0	0	0	0	5
cSH	669	1700	1700	1700	1700	1700
Volume to Capacity	0.26	0.15	0.15	0.23	0.23	0.12
Queue Length 95th (m)	7.9	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	12.3	0.0	0.0	0.0	0.0	0.0
Lane LOS	B					
Approach Delay (s)	12.3	0.0		0.0		
Approach LOS	B					

Intersection Summary				
Average Delay	1.3			
Intersection Capacity Utilization	37.2%	ICU Level of Service		A
Analysis Period (min)	15			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	1210	394	175	0	157
Future Volume (Veh/h)	0	1210	394	175	0	157
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	1315	428	190	0	171
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			85			
pX, platoon unblocked						
vC, conflicting volume	618				1086	214
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	618				1086	214
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	78
cM capacity (veh/h)	958				211	791

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	SB 1
Volume Total	658	658	214	214	190	171
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	190	171
cSH	1700	1700	1700	1700	1700	791
Volume to Capacity	0.39	0.39	0.13	0.13	0.11	0.22
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	6.2
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	10.8
Lane LOS						B
Approach Delay (s)	0.0		0.0			10.8
Approach LOS						B

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	40.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	5	29	201	10	195	156
Future Volume (Veh/h)	5	29	201	10	195	156
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	32	218	11	212	170
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	818	224			229	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	818	224			229	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	96			84	
cM capacity (veh/h)	291	816			1339	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	37	229	382
Volume Left	5	0	212
Volume Right	32	11	0
cSH	656	1700	1339
Volume to Capacity	0.06	0.13	0.16
Queue Length 95th (m)	1.4	0.0	4.3
Control Delay (s)	10.8	0.0	5.2
Lane LOS	B		A
Approach Delay (s)	10.8	0.0	5.2
Approach LOS	B		

Intersection Summary			
Average Delay	3.7		
Intersection Capacity Utilization	47.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	12	43	168	7	15	145
Future Volume (Veh/h)	12	43	168	7	15	145
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	13	47	183	8	16	158
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	377	187			191	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	377	187			191	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	95			99	
cM capacity (veh/h)	617	855			1383	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	60	191	174
Volume Left	13	0	16
Volume Right	47	8	0
cSH	789	1700	1383
Volume to Capacity	0.08	0.11	0.01
Queue Length 95th (m)	1.9	0.0	0.3
Control Delay (s)	9.9	0.0	0.8
Lane LOS	A		A
Approach Delay (s)	9.9	0.0	0.8
Approach LOS	A		

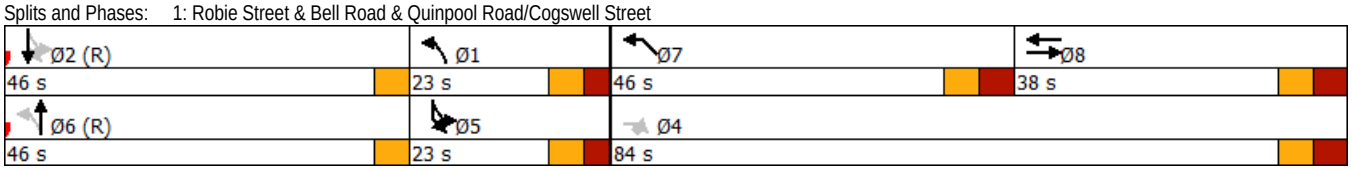
Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	32.9%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	EBR	EBR2	WBT	NBL	NBT	SBL2	SBL	SBT	NWL
Lane Configurations										
Traffic Volume (vph)	200	245	140	392	275	680	18	164	424	598
Future Volume (vph)	200	245	140	392	275	680	18	164	424	598
Lane Group Flow (vph)	217	266	152	442	299	783	0	198	513	846
Turn Type	NA	custom	custom	NA	pm+pt	NA	pm+pt	pm+pt	NA	Prot
Protected Phases	8			8	1	6	5	5	2	7
Permitted Phases		4	4		6		2	2		
Minimum Split (s)	36.0	43.0	43.0	36.0	14.0	46.0	14.0	14.0	46.0	37.0
Total Split (s)	38.0	84.0	84.0	38.0	23.0	46.0	23.0	23.0	46.0	46.0
Total Split (%)	24.8%	54.9%	54.9%	24.8%	15.0%	30.1%	15.0%	15.0%	30.1%	30.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	4.0	4.0	4.0	4.0	3.0	0.0	3.0	3.0	0.0	4.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0		-1.0	-1.0	-1.0
Total Lost Time (s)	7.0	7.0	7.0	7.0	6.0	3.0		6.0	3.0	7.0
Lead/Lag					Lag	Lead	Lag	Lag	Lead	
Lead-Lag Optimize?										
Act Effct Green (s)	31.0	77.0	77.0	31.0	57.0	43.0		57.0	43.0	39.0
Actuated g/C Ratio	0.20	0.50	0.50	0.20	0.37	0.28		0.37	0.28	0.25
v/c Ratio	0.59	0.42	0.21	0.64	0.91	0.85		0.84	0.60	1.01
Control Delay	62.9	26.6	3.5	60.4	83.6	62.3		87.4	50.2	89.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	62.9	26.6	3.5	60.4	83.6	62.3		87.4	50.2	89.8
LOS	E	C	A	E	F	E		F	D	F
Approach Delay	33.4			60.4		68.2			60.6	89.8
Approach LOS	C			E		E			E	F
Queue Length 50th (m)	60.4	49.9	0.0	65.1	64.1	119.0		44.1	70.2	~131.9
Queue Length 95th (m)	88.8	73.5	11.4	84.0	#115.7	144.7		#86.5	89.7	#173.6
Internal Link Dist (m)	61.0			229.8		476.3			175.9	271.5
Turn Bay Length (m)		70.0	70.0		200.0					
Base Capacity (vph)	366	631	739	692	327	917		235	857	836
Starvation Cap Reductn	0	0	0	0	0	0		0	0	0
Spillback Cap Reductn	0	0	0	0	0	0		0	0	0
Storage Cap Reductn	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	0.59	0.42	0.21	0.64	0.91	0.85		0.84	0.60	1.01

Intersection Summary

Cycle Length: 153
Actuated Cycle Length: 153
Offset: 0 (0%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 135
Control Type: Pretimed
Maximum v/c Ratio: 1.01
Intersection Signal Delay: 64.8 Intersection LOS: E
Intersection Capacity Utilization 112.5% ICU Level of Service H
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Robie Street & Bell Road & Quinpool Road/Cogswell Street



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	91	0	875	563	5
Future Volume (Veh/h)	0	91	0	875	563	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	3%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	99	0	951	612	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)				200		
pX, platoon unblocked	0.78					
vC, conflicting volume	1090	206	617			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	566	206	617			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	88	100			
cM capacity (veh/h)	356	800	959			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	99	476	476	245	245	127
Volume Left	0	0	0	0	0	0
Volume Right	99	0	0	0	0	5
cSH	800	1700	1700	1700	1700	1700
Volume to Capacity	0.12	0.28	0.28	0.14	0.14	0.07
Queue Length 95th (m)	3.2	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	10.1	0.0	0.0	0.0	0.0	0.0
Lane LOS	B					
Approach Delay (s)	10.1	0.0		0.0		
Approach LOS	B					

Intersection Summary				
Average Delay	0.6			
Intersection Capacity Utilization	27.5%	ICU Level of Service		A
Analysis Period (min)	15			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	585	865	431	0	101
Future Volume (Veh/h)	0	585	865	431	0	101
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	636	940	468	0	110
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			85			
pX, platoon unblocked	0.92				0.92	0.92
vC, conflicting volume	1408				1258	470
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1272				1109	254
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	84
cM capacity (veh/h)	499				188	687

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	SB 1
Volume Total	318	318	470	470	468	110
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	468	110
cSH	1700	1700	1700	1700	1700	687
Volume to Capacity	0.19	0.19	0.28	0.28	0.28	0.16
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	4.3
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	11.2
Lane LOS						B
Approach Delay (s)	0.0		0.0			11.2
Approach LOS						B

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	36.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	5	27	461	6	75	145
Future Volume (Veh/h)	5	27	461	6	75	145
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	29	501	7	82	158
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	826	504			508	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	826	504			508	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	95			92	
cM capacity (veh/h)	315	567			1057	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	34	508	240
Volume Left	5	0	82
Volume Right	29	7	0
cSH	508	1700	1057
Volume to Capacity	0.07	0.30	0.08
Queue Length 95th (m)	1.6	0.0	1.9
Control Delay (s)	12.6	0.0	3.5
Lane LOS	B		A
Approach Delay (s)	12.6	0.0	3.5
Approach LOS	B		

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	49.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	11	37	410	21	43	90
Future Volume (Veh/h)	11	37	410	21	43	90
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	12	40	446	23	47	98
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	650	458			469	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	650	458			469	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	97	93			96	
cM capacity (veh/h)	415	603			1093	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	52	469	145
Volume Left	12	0	47
Volume Right	40	23	0
cSH	546	1700	1093
Volume to Capacity	0.10	0.28	0.04
Queue Length 95th (m)	2.4	0.0	1.0
Control Delay (s)	12.3	0.0	3.0
Lane LOS	B		A
Approach Delay (s)	12.3	0.0	3.0
Approach LOS	B		

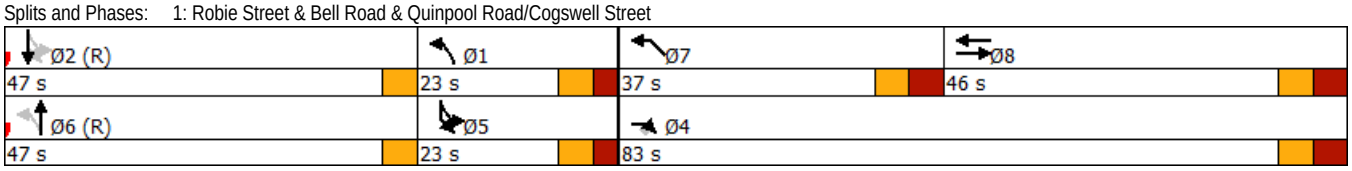
Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	43.3%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	EBR	EBR2	WBT	WBR	NBL	NBT	NBR	NBR2	SBL2	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	310	565	335	105	10	150	380	20	15	20	230	675
Future Volume (vph)	310	565	335	105	10	150	380	20	15	20	230	675
Satd. Flow (prot)	1616	1374	1374	2975	0	1559	2880	0	0	0	1513	2726
Flt Permitted						0.121					0.340	
Satd. Flow (perm)	1616	1374	1236	2975	0	199	2880	0	0	0	455	2726
Satd. Flow (RTOR)			283	6								4
Lane Group Flow (vph)	337	614	364	125	0	163	451	0	0	0	272	777
Turn Type	NA	custom	custom	NA		pm+pt	NA			pm+pt	pm+pt	NA
Protected Phases	8	4		8		1	6			5	5	2
Permitted Phases			4			6				2	2	
Total Split (s)	46.0	83.0	83.0	46.0		23.0	47.0			23.0	23.0	47.0
Total Lost Time (s)	7.0	7.0	7.0	7.0		6.0	3.0				6.0	3.0
Act Effct Green (s)	39.0	76.0	76.0	39.0		58.0	44.0				58.0	44.0
Actuated g/C Ratio	0.25	0.50	0.50	0.25		0.38	0.29				0.38	0.29
v/c Ratio	0.82	0.90	0.48	0.16		0.72	0.54				0.94	0.99
Control Delay	70.7	53.0	7.8	42.9		73.2	49.0				90.3	82.8
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.0				0.0	0.0
Total Delay	70.7	53.0	7.8	42.9		73.2	49.0				90.3	82.8
LOS	E	D	A	D		E	D				F	F
Approach Delay	45.0			42.9			55.4					84.7
Approach LOS	D			D			E					F
Queue Length 50th (m)	97.1	166.5	13.0	14.8		31.9	61.2				58.1	123.7
Queue Length 95th (m)	#144.2	#245.3	37.7	23.9		#62.0	79.2				#113.4	#167.4
Internal Link Dist (m)	61.0			320.8			379.4					173.2
Turn Bay Length (m)		70.0	70.0									
Base Capacity (vph)	411	682	756	762		226	828				290	786
Starvation Cap Reductn	0	0	0	0		0	0				0	0
Spillback Cap Reductn	0	0	0	0		0	0				0	0
Storage Cap Reductn	0	0	0	0		0	0				0	0
Reduced v/c Ratio	0.82	0.90	0.48	0.16		0.72	0.54				0.94	0.99

Intersection Summary

Cycle Length: 153
Actuated Cycle Length: 153
Offset: 0 (0%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Control Type: Pretimed
Maximum v/c Ratio: 0.99
Intersection Signal Delay: 62.8
Intersection LOS: E
Intersection Capacity Utilization 117.1%
ICU Level of Service H
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Robie Street & Bell Road & Quinpool Road/Cogswell Street



Lane Group	SBR	NWL	NWR	NWR2
Lane Configurations				
Traffic Volume (vph)	40	270	110	5
Future Volume (vph)	40	270	110	5
Satd. Flow (prot)	0	2421	0	0
Flt Permitted		0.966		
Satd. Flow (perm)	0	2363	0	0
Satd. Flow (RTOR)				
Lane Group Flow (vph)	0	418	0	0
Turn Type		Prot		
Protected Phases		7		
Permitted Phases				
Total Split (s)		37.0		
Total Lost Time (s)		7.0		
Act Effct Green (s)		30.0		
Actuated g/C Ratio		0.20		
v/c Ratio		0.88		
Control Delay		80.2		
Queue Delay		0.0		
Total Delay		80.2		
LOS		F		
Approach Delay		80.2		
Approach LOS		F		
Queue Length 50th (m)		64.3		
Queue Length 95th (m)		#92.6		
Internal Link Dist (m)		278.4		
Turn Bay Length (m)				
Base Capacity (vph)		474		
Starvation Cap Reductn		0		
Spillback Cap Reductn		0		
Storage Cap Reductn		0		
Reduced v/c Ratio		0.88		

Intersection Summary

Lane Group	EBT	EBR	EBR2	WBT	WBR	NBL	NBT	NBR	NBR2	SBL2	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	200	245	140	390	15	265	680	30	10	15	165	420
Future Volume (vph)	200	245	140	390	15	265	680	30	10	15	165	420
Satd. Flow (prot)	1807	1536	1536	3408	0	1742	3263	0	0	0	1691	3031
Flt Permitted						0.291					0.110	
Satd. Flow (perm)	1807	1255	1320	3408	0	519	3263	0	0	0	182	3031
Satd. Flow (RTOR)			152	2								7
Lane Group Flow (vph)	217	266	152	440	0	288	783	0	0	0	195	506
Turn Type	NA	custom	custom	NA		pm+pt	NA			pm+pt	pm+pt	NA
Protected Phases	8			8		1	6			5	5	2
Permitted Phases		4	4			6				2	2	
Total Split (s)	38.0	84.0	84.0	38.0		23.0	46.0			23.0	23.0	46.0
Total Lost Time (s)	7.0	7.0	7.0	7.0		6.0	3.0				6.0	3.0
Act Effct Green (s)	31.0	77.0	77.0	31.0		57.0	43.0				57.0	43.0
Actuated g/C Ratio	0.20	0.50	0.50	0.20		0.37	0.28				0.37	0.28
v/c Ratio	0.59	0.42	0.21	0.64		0.88	0.85				0.83	0.59
Control Delay	62.9	26.6	3.5	60.4		77.0	62.3				85.7	50.1
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.0				0.0	0.0
Total Delay	62.9	26.6	3.5	60.4		77.0	62.3				85.7	50.1
LOS	E	C	A	E		E	E				F	D
Approach Delay	33.4			60.4			66.2					60.0
Approach LOS	C			E			E					E
Queue Length 50th (m)	60.4	49.9	0.0	64.8		61.2	119.0				43.1	69.1
Queue Length 95th (m)	88.8	73.5	11.4	83.4		#106.6	144.7				#83.9	88.4
Internal Link Dist (m)	61.0			229.8			476.3					175.9
Turn Bay Length (m)		70.0	70.0			200.0						
Base Capacity (vph)	366	631	739	692		329	917				235	856
Starvation Cap Reductn	0	0	0	0		0	0				0	0
Spillback Cap Reductn	0	0	0	0		0	0				0	0
Storage Cap Reductn	0	0	0	0		0	0				0	0
Reduced v/c Ratio	0.59	0.42	0.21	0.64		0.88	0.85				0.83	0.59

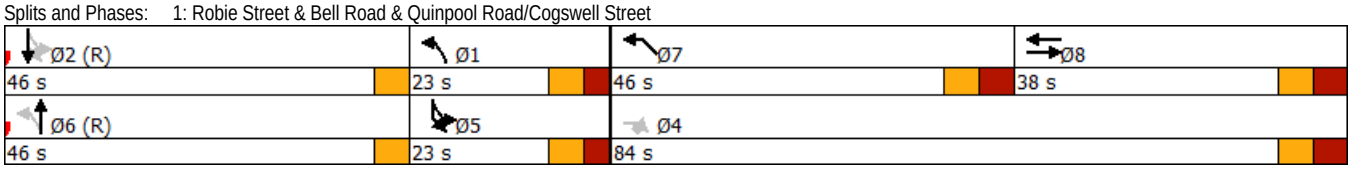
Intersection Summary

Cycle Length: 153
Actuated Cycle Length: 153
Offset: 0 (0%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Control Type: Pretimed
Maximum v/c Ratio: 1.01
Intersection Signal Delay: 63.9 Intersection LOS: E
Intersection Capacity Utilization 112.3% ICU Level of Service H
Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Robie Street & Bell Road & Quinpool Road/Cogswell Street



Lane Group	SBR	NWL	NWR
Lane Configurations			
Traffic Volume (vph)	45	595	180
Future Volume (vph)	45	595	180
Satd. Flow (prot)	0	3282	0
Flt Permitted		0.963	
Satd. Flow (perm)	0	3174	0
Satd. Flow (RTOR)			
Lane Group Flow (vph)	0	843	0
Turn Type		Prot	
Protected Phases		7	
Permitted Phases			
Total Split (s)		46.0	
Total Lost Time (s)		7.0	
Act Effct Green (s)		39.0	
Actuated g/C Ratio		0.25	
v/c Ratio		1.01	
Control Delay		89.0	
Queue Delay		0.0	
Total Delay		89.0	
LOS		F	
Approach Delay		89.0	
Approach LOS		F	
Queue Length 50th (m)		~130.7	
Queue Length 95th (m)		#172.9	
Internal Link Dist (m)		271.5	
Turn Bay Length (m)			
Base Capacity (vph)		836	
Starvation Cap Reductn		0	
Spillback Cap Reductn		0	
Storage Cap Reductn		0	
Reduced v/c Ratio		1.01	

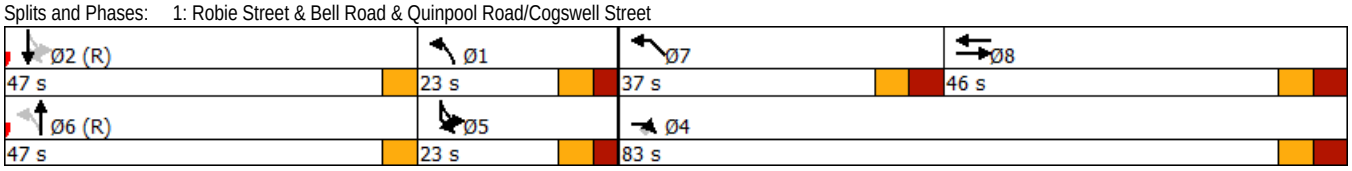
Intersection Summary

Lane Group	EBT	EBR	EBR2	WBT	WBR	NBL	NBT	NBR	NBR2	SBL2	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	310	565	335	105	10	149	380	20	15	23	233	679
Future Volume (vph)	310	565	335	105	10	149	380	20	15	23	233	679
Satd. Flow (prot)	1616	1374	1374	2975	0	1559	2880	0	0	0	1513	2731
Flt Permitted						0.122					0.340	
Satd. Flow (perm)	1616	1374	1236	2975	0	197	2880	0	0	0	455	2731
Satd. Flow (RTOR)			283	6								3
Lane Group Flow (vph)	337	614	364	125	0	162	451	0	0	0	278	776
Turn Type	NA	custom	custom	NA		pm+pt	NA			pm+pt	pm+pt	NA
Protected Phases	8	4		8		1	6			5	5	2
Permitted Phases			4			6				2	2	
Total Split (s)	46.0	83.0	83.0	46.0		23.0	47.0			23.0	23.0	47.0
Total Lost Time (s)	7.0	7.0	7.0	7.0		6.0	3.0				6.0	3.0
Act Effct Green (s)	39.0	76.0	76.0	39.0		58.0	44.0				58.0	44.0
Actuated g/C Ratio	0.25	0.50	0.50	0.25		0.38	0.29				0.38	0.29
v/c Ratio	0.82	0.90	0.48	0.16		0.72	0.54				0.96	0.99
Control Delay	70.7	53.0	7.8	42.9		72.9	49.0				94.8	82.2
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.0				0.0	0.0
Total Delay	70.7	53.0	7.8	42.9		72.9	49.0				94.8	82.2
LOS	E	D	A	D		E	D				F	F
Approach Delay	45.0			42.9			55.3					85.6
Approach LOS	D			D			E					F
Queue Length 50th (m)	97.1	166.5	13.0	14.8		31.7	61.2				59.7	123.5
Queue Length 95th (m)	#144.2	#245.3	37.7	23.9		#61.7	79.2				#117.8	#167.1
Internal Link Dist (m)	61.0			320.8			379.4					173.2
Turn Bay Length (m)		70.0	70.0									
Base Capacity (vph)	411	682	756	762		226	828				290	787
Starvation Cap Reductn	0	0	0	0		0	0				0	0
Spillback Cap Reductn	0	0	0	0		0	0				0	0
Storage Cap Reductn	0	0	0	0		0	0				0	0
Reduced v/c Ratio	0.82	0.90	0.48	0.16		0.72	0.54				0.96	0.99

Intersection Summary

Cycle Length: 153
Actuated Cycle Length: 153
Offset: 0 (0%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Control Type: Pretimed
Maximum v/c Ratio: 0.99
Intersection Signal Delay: 63.0
Intersection LOS: E
Intersection Capacity Utilization 117.5%
ICU Level of Service H
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Robie Street & Bell Road & Quinpool Road/Cogswell Street



Lane Group	SBR	NWL	NWR	NWR2
Lane Configurations				
Traffic Volume (vph)	35	269	110	5
Future Volume (vph)	35	269	110	5
Satd. Flow (prot)	0	2420	0	0
Flt Permitted		0.966		
Satd. Flow (perm)	0	2362	0	0
Satd. Flow (RTOR)				
Lane Group Flow (vph)	0	417	0	0
Turn Type		Prot		
Protected Phases		7		
Permitted Phases				
Total Split (s)		37.0		
Total Lost Time (s)		7.0		
Act Effct Green (s)		30.0		
Actuated g/C Ratio		0.20		
v/c Ratio		0.88		
Control Delay		79.9		
Queue Delay		0.0		
Total Delay		79.9		
LOS		E		
Approach Delay		79.9		
Approach LOS		E		
Queue Length 50th (m)		64.1		
Queue Length 95th (m)		#92.3		
Internal Link Dist (m)		278.4		
Turn Bay Length (m)				
Base Capacity (vph)		474		
Starvation Cap Reductn		0		
Spillback Cap Reductn		0		
Storage Cap Reductn		0		
Reduced v/c Ratio		0.88		

Intersection Summary

Lane Group	EBT	EBR	EBR2	WBT	WBR	NBL	NBT	NBR	NBR2	SBL2	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	200	245	140	392	15	275	680	30	10	18	164	424
Future Volume (vph)	200	245	140	392	15	275	680	30	10	18	164	424
Satd. Flow (prot)	1807	1536	1536	3408	0	1742	3263	0	0	0	1691	3030
Flt Permitted						0.286					0.110	
Satd. Flow (perm)	1807	1255	1320	3408	0	511	3263	0	0	0	182	3030
Satd. Flow (RTOR)			152	2								8
Lane Group Flow (vph)	217	266	152	442	0	299	783	0	0	0	198	513
Turn Type	NA	custom	custom	NA		pm+pt	NA			pm+pt	pm+pt	NA
Protected Phases	8			8		1	6			5	5	2
Permitted Phases		4	4			6				2	2	
Total Split (s)	38.0	84.0	84.0	38.0		23.0	46.0			23.0	23.0	46.0
Total Lost Time (s)	7.0	7.0	7.0	7.0		6.0	3.0				6.0	3.0
Act Effct Green (s)	31.0	77.0	77.0	31.0		57.0	43.0				57.0	43.0
Actuated g/C Ratio	0.20	0.50	0.50	0.20		0.37	0.28				0.37	0.28
v/c Ratio	0.59	0.42	0.21	0.64		0.91	0.85				0.84	0.60
Control Delay	62.9	26.6	3.5	60.4		83.6	62.3				87.4	50.2
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.0				0.0	0.0
Total Delay	62.9	26.6	3.5	60.4		83.6	62.3				87.4	50.2
LOS	E	C	A	E		F	E				F	D
Approach Delay	33.4			60.4			68.2					60.6
Approach LOS	C			E			E					E
Queue Length 50th (m)	60.4	49.9	0.0	65.1		64.1	119.0				44.1	70.2
Queue Length 95th (m)	88.8	73.5	11.4	84.0		#115.7	144.7				#86.5	89.7
Internal Link Dist (m)	61.0			229.8			476.3					175.9
Turn Bay Length (m)		70.0	70.0			200.0						
Base Capacity (vph)	366	631	739	692		327	917				235	857
Starvation Cap Reductn	0	0	0	0		0	0				0	0
Spillback Cap Reductn	0	0	0	0		0	0				0	0
Storage Cap Reductn	0	0	0	0		0	0				0	0
Reduced v/c Ratio	0.59	0.42	0.21	0.64		0.91	0.85				0.84	0.60

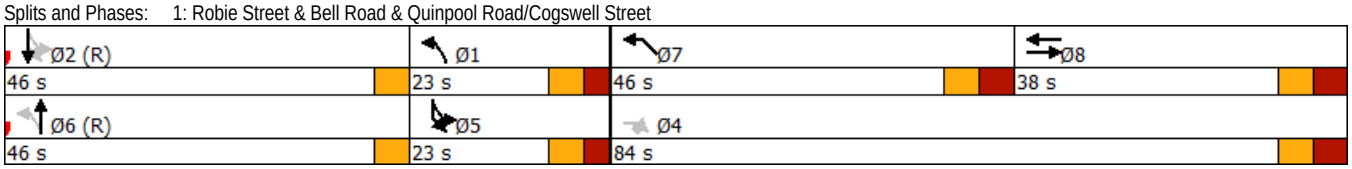
Intersection Summary

Cycle Length: 153
Actuated Cycle Length: 153
Offset: 0 (0%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Control Type: Pretimed
Maximum v/c Ratio: 1.01
Intersection Signal Delay: 64.8 — Intersection LOS: E
Intersection Capacity Utilization 112.5% — ICU Level of Service H
Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Robie Street & Bell Road & Quinpool Road/Cogswell Street



Lane Group	SBR	NWL	NWR
Lane Configurations			
Traffic Volume (vph)	48	598	180
Future Volume (vph)	48	598	180
Satd. Flow (prot)	0	3282	0
Flt Permitted		0.963	
Satd. Flow (perm)	0	3174	0
Satd. Flow (RTOR)			
Lane Group Flow (vph)	0	846	0
Turn Type		Prot	
Protected Phases		7	
Permitted Phases			
Total Split (s)		46.0	
Total Lost Time (s)		7.0	
Act Effct Green (s)		39.0	
Actuated g/C Ratio		0.25	
v/c Ratio		1.01	
Control Delay		89.8	
Queue Delay		0.0	
Total Delay		89.8	
LOS		F	
Approach Delay		89.8	
Approach LOS		F	
Queue Length 50th (m)		~131.9	
Queue Length 95th (m)		#173.6	
Internal Link Dist (m)		271.5	
Turn Bay Length (m)			
Base Capacity (vph)		836	
Starvation Cap Reductn		0	
Spillback Cap Reductn		0	
Storage Cap Reductn		0	
Reduced v/c Ratio		1.01	

Intersection Summary