

Transportation Impact Study

For DEXEL Developments - Spring Garden Road between Robie Street and Carlton Street

August 2016

Submitted by:
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APPENDICIES

- Appendix A: Traffic Counts
- Appendix B: Trip Generation
- Appendix C: Synchro Output



1. INTRODUCTION

This Transportation Impact Study follows HRM’s Guidelines for the Preparation of Transportation Impact Studies, 8th Edition and general Traffic and Transportation Engineering principles for such studies. It is intended to address the transportation impacts that may be expected on the road and active transportation networks resulting from the:

HRM: Transportation Impact Studies are prepared to ensure developments are consistent with the objectives and policies of the Municipal Planning Strategies / Municipal Development Plans and the Regional Plan

- Construction of a 30 story residential condominium development as described in the table below:

Proposed Development	Spring Garden Road, Halifax, Nova Scotia
Owner	DEXEL Developments
Location	South of Spring Garden Road between Robie Street and Carlton Street
Building Details	250 Residential Units 21,200 ft ² Retail Space 61,500 Office Space 10,730 ft ² Amenity
Parking	361 Car Spaces, Bicycle Spaces

Table 1-1:
Project Summary



Figure 1-1:
Building Rendering

2. EXISTING CONDITIONS

2.1 Study Area

The Study Area is defined by the area (roads, intersections and AT network) that may be reasonably expected to be impacted by the proposed development.

The proposed building is located south of Spring Garden Road and between Robie Street and Carlton Street as shown by the yellow rectangle in the figure below. The primary study area for this analysis extends to the limits shown by the blue area, and generally includes Spring Garden Road and the adjacent intersections.

The area is characterized by a number of mid- and high-rise residential buildings on the north side of Spring Garden Road and south of the development, smaller roadside commercial and retail shops on the south side of Spring Garden, and residential neighbourhoods to the east and west of the site.



Figure 2-1: Study Area

2.2 Roadways

The following sections provide a brief summary of each of the key roadways in the study area that are relevant to this study.

Robie Street	<p>Robie Street is classified as an urban arterial roadway and consists of 3 lanes in the northbound and southbound directions separated by a grassed median. There are sidewalks on both sides of the roadway and access to various driveways in the vicinity of Spring Garden Road. At Spring Garden, each approach on Robie Street includes a dedicated right turn lane, through lane, and a shared through/right lane.</p> 
Spring Garden Road	<p>Spring Garden Road is a four lane undivided urban collector with sidewalks on both sides of the roadway. It has numerous driveways to residential and commercial properties and includes parking and bus stop locations along the curb lane in both directions. A well-used midblock crosswalk is located immediately east of Carlton Street.</p> 
Carlton Street	<p>Carlton Street is a two-lane local roadway with parking and sidewalks along both sides of the road. The roadway provides access to various residential properties and small apartment complexes and is approximately 2 blocks in length between College Street and terminating at the Camp Hill Cemetery.</p> 

2.3 Active Transportation (AT)

Peninsular Halifax has documented high cyclist and pedestrian activity (and other AT modes) and this study area is no exception with many local AT origins and destinations in the area. This includes the Halifax Commons, Halifax Public Gardens, Citadel Hill, the Spring Garden commercial corridor, universities, hospitals and more.

As a result, accommodating AT movements past/through the site, as well as connectivity to existing routes, is an important consideration for this development. The majority of routes and intersection crossings are already in place for this development and access points for the development easily connect to existing sidewalk infrastructure. AT elements that should be carefully considered as design progresses:

- Connectivity across Spring Garden Road at the existing signalized (RA-5) crosswalk immediately east of Carlton Street. Volumes counts suggest that close to 100 pedestrian per hour cross this crosswalk and many of the adjacent crosswalks are heavily used. Therefore, detailed design should pay close attention to the movement of pedestrians to and from the development by maintaining or enhancing access to the existing sidewalk network surrounding the building; and,
- Traffic counts showed that there is regular cyclist traffic through the area on Spring Garden Road and Carlton Street. Bike access to and from the building from Spring Garden Road is considered important though consideration should also be given to access from Carlton Street and at the rear of the building.

2.4 Vehicle Traffic

Recent and historical traffic counts were provided from HRM for all intersections in the study area and the counts were supplemented by one automated traffic counts carried out at the intersections of Spring Garden Road and Carlton Street (including the pedestrian cross walk). The baseline counts used in this analysis are provided in Appendix A of this report.

2.5 Transit

The existing Halifax Transit map shows approximately 20 bus routes that run in close proximity to the development including 5 directly past the development on Spring Garden Road and 13 along Summer Street. There are transit stops on both sides of Spring Garden Road included a stop directly in front of the proposed building, which makes this development highly accessible for transit use.

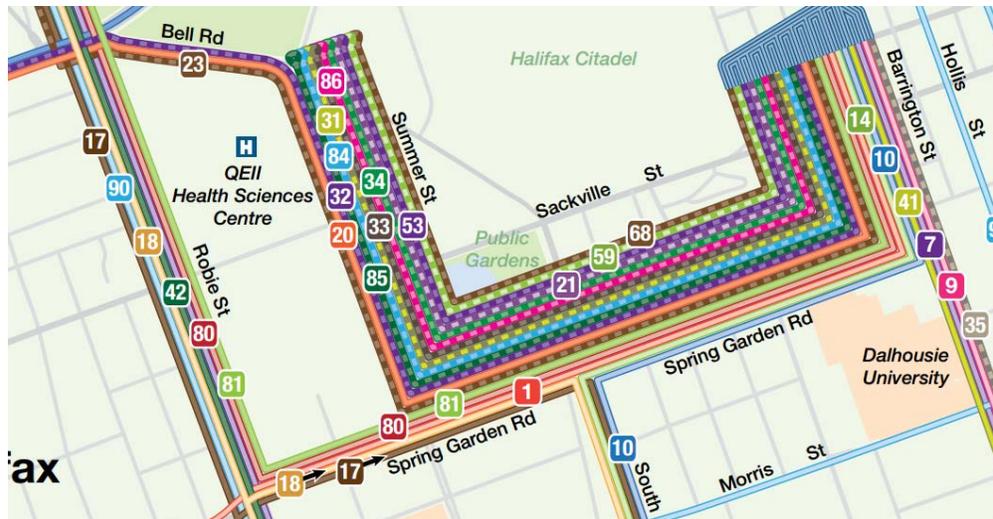


Figure 2-2:
Transit Routes

2.6 Truck Routes

Halifax's By-Law T-400 *Respecting the Establishment of Truck Routes for Certain Trucking Motor Vehicles within the HRM* identifies Bell Road and Robie Street as **Full Time** truck routes (green).

In addition, Spring Garden Road and South Park Street are defined as **Daylight** routes between the hours of 7 AM and 9 PM (blue). These routes provide more than adequate access to the new development.

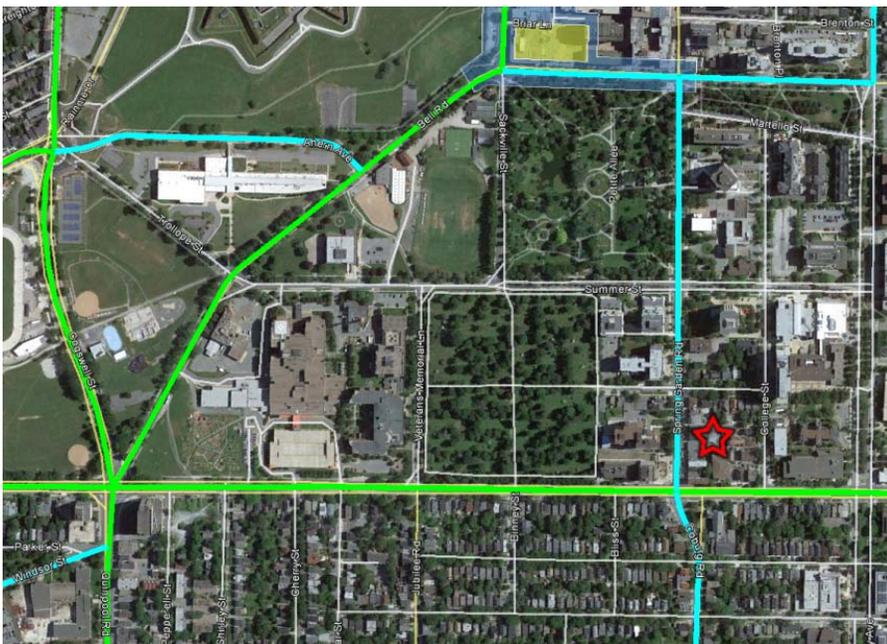


Figure 2-3:
Truck Routes

3. FUTURE CONDITIONS

3.1 Context

3.1.1 Analysis Time Horizon

Based on recommended HRM guidelines, the base year for this study has been established as 2016 and would typically address a 5-year time horizon (2021).

3.1.2 Background Traffic

Traditional background traffic growth rates used for traffic impact studies throughout HRM have been in the 1 – 2% range though actual growth is frequently less than this and even negative in some cases. Historical traffic counts along the Spring Garden Road corridor between 2008 and 2014 actually show a decrease in traffic over this period. For the purposes of this study, a 1% background traffic growth rate was considered reasonable and conservative.

3.1.3 Analysis Period

This area of Halifax is highly commuter oriented therefore, the weekday AM and PM peak hours are considered to be the critical periods for the analysis.

3.2 The Development Traffic

3.2.1 Trip Generation

The addition of new traffic related to the development is summarized in the table below and a more detailed summary of the trip generation rates are provided in Appendix B of this report.

Table 3-1: Trip Generation Table

	ITE Land Use Type	AM Peak			PM Peak		
		Enter	Exit	Total	Enter	Exit	Total
Apartments	ITE 222	15	45	60	43	27	70
Drug Store (or equivalent)	ITE 880	20	11	31	44	45	89
Restaurant	ITE 932	9	8	17	10	6	16
General Office	ITE 710	68	9	77	12	61	73
Internal Capture/Pass-by		0	0	0	-50	-50	-100
Total Volume to Adjacent Streets		112	73	185	59	89	148

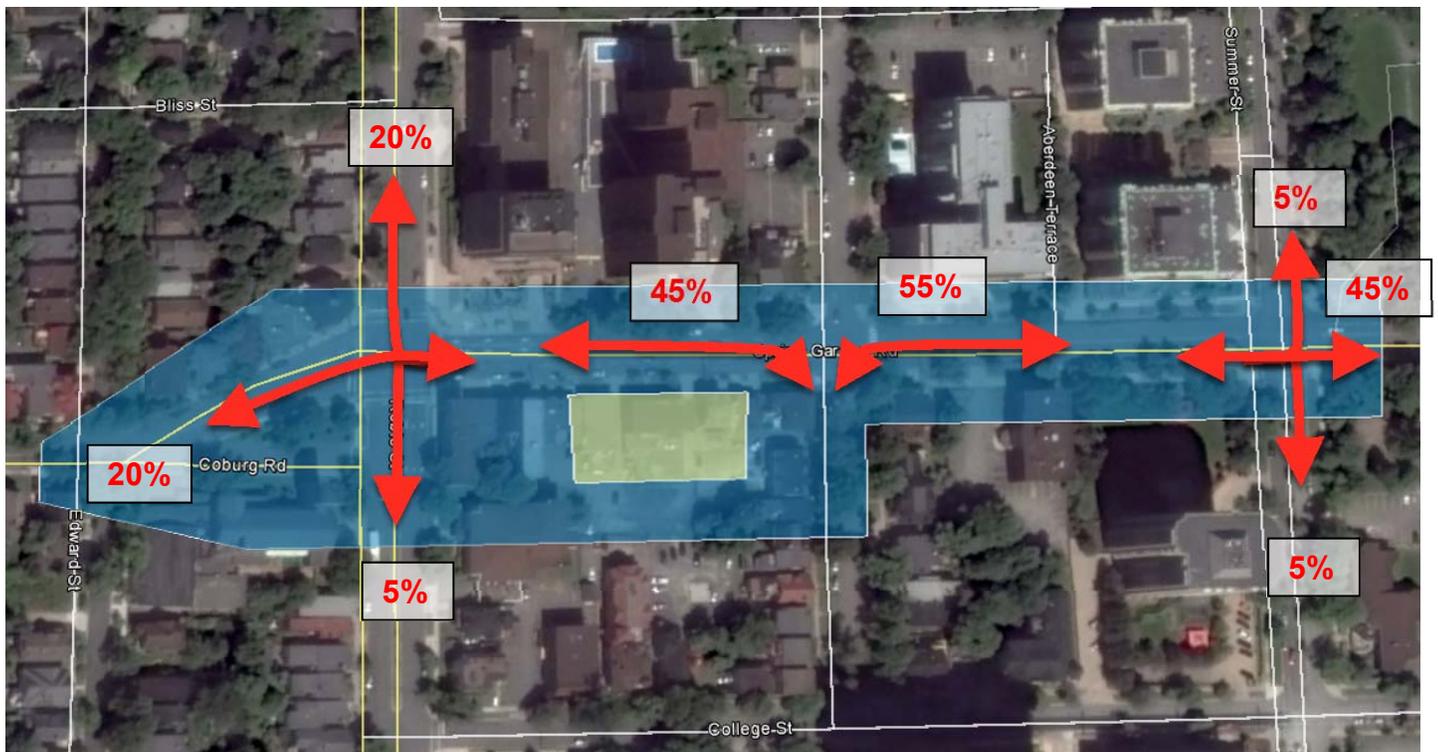
The trip generation rates for residential units and general office space shown above have been reduced approximately 20% to account for a higher than average modal share use from Active Transportation and Transit users, which we consider to be a conservative assumption. In

addition, we have reduced commercial and retail estimates by half to account for the fact that the majority of traffic to this site is expected to be local traffic. This traffic is most likely to access the site by an active transportation mode similar to what is occurring today. It is likely that the modal share to non-motorized modes may be higher than assumed in this study, though a one-half reduction from ITE rates is considered a worst case estimate.

3.2.2 Trip Distribution and Assignment

It is assumed that traffic will distribute itself through the network in a similar manner to the existing traffic. The trip distribution assumptions based on existing conditions is shown in the Figure below. In general, there does not appear to be any incentives for traffic to alter current travel patterns.

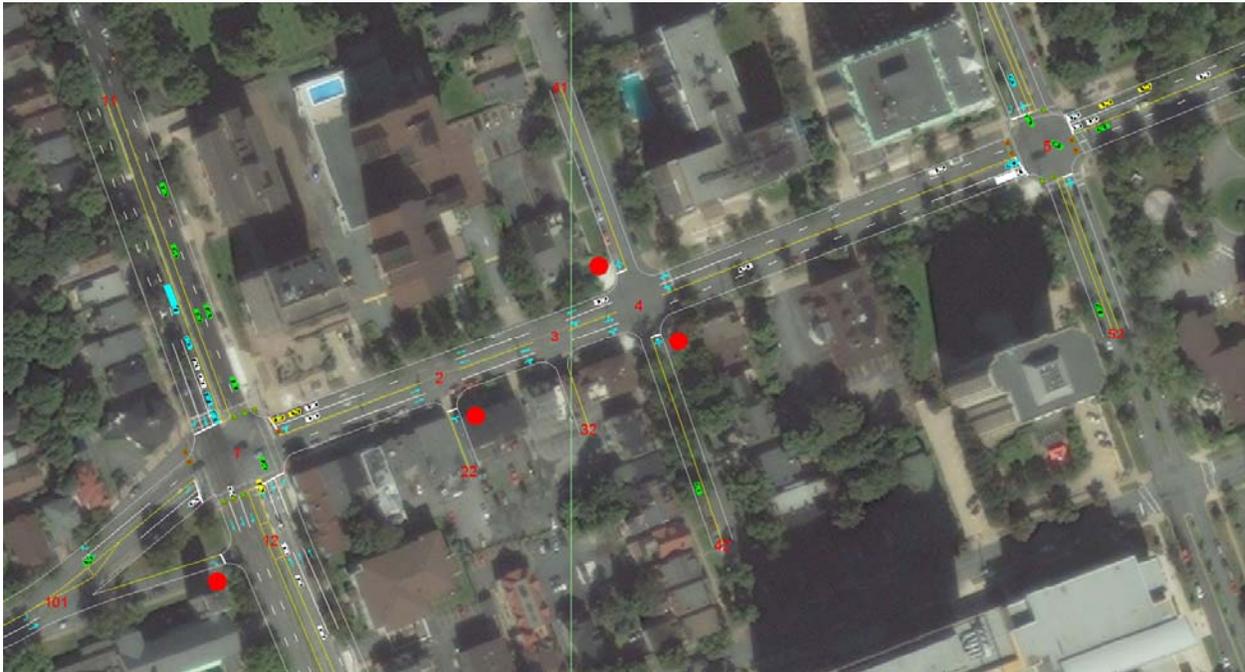
Figure 3-1: Traffic Distribution



4. ANALYSIS

4.1 Transportation Modelling

A microscopic traffic model was prepared using the Synchro/SimTraffic platform for the AM and PM peak hours of analysis. The model extended along the Spring Garden corridor between Robie Street and Summer Street. It also included the intersections at Carlton Street and the entrance and exit driveways to the development.



Spring Garden Road in the vicinity of the development currently operates at a relatively low level of capacity utilization with maximum volume to capacity (v/c) ratios typically being less than 50% under existing and proposed conditions. This results in minimal change in performance measures between the pre- and post-development scenarios.

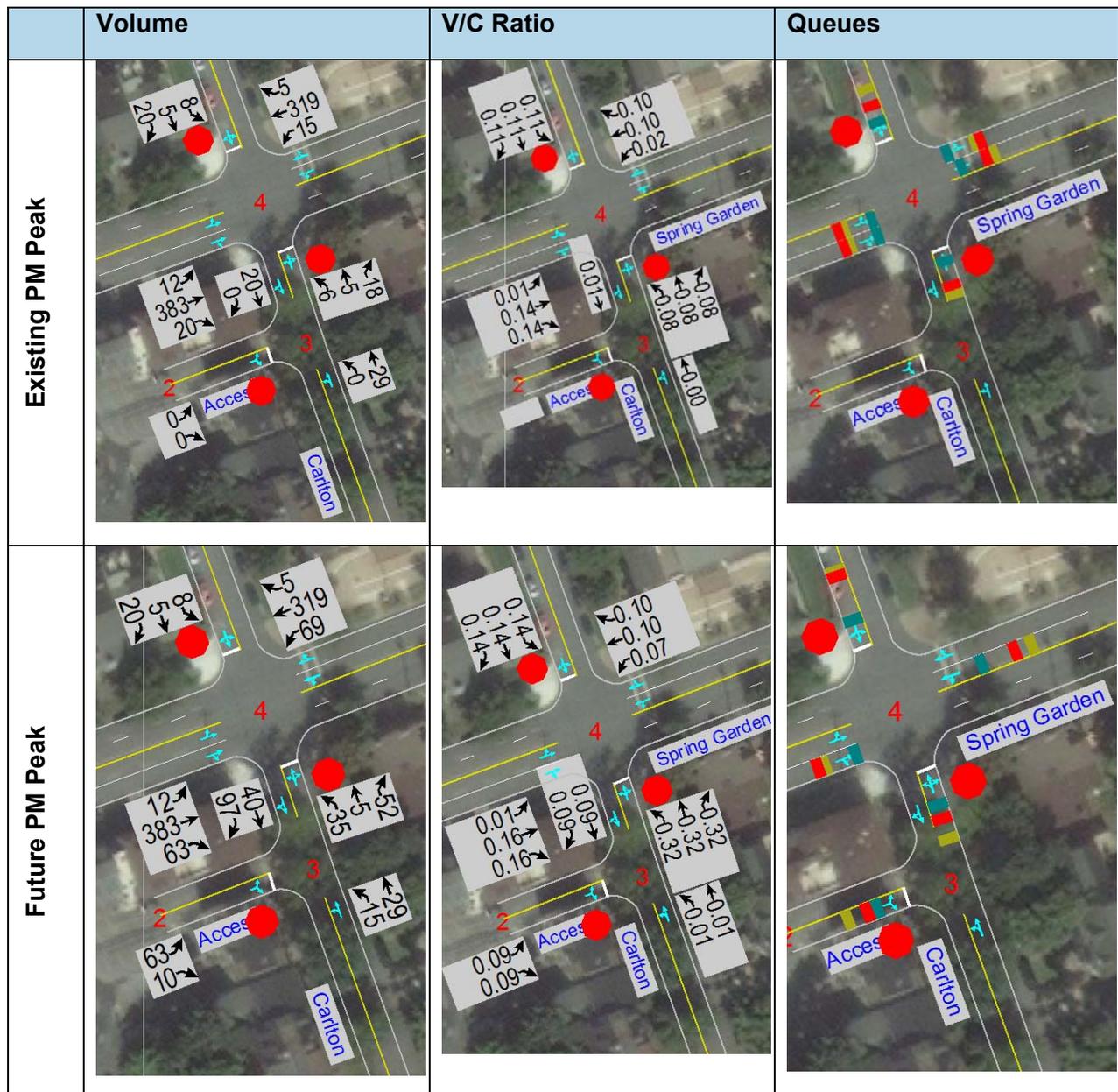
The figures on the following pages summarize the volumes, volume to capacity (v/c) ratios, and approximately queue lengths in each of the scenarios with additional detail being provided in Appendix C of this report.

Figure 4-1: AM Peak Hour – Spring Garden and Robie

	Volume	V/C Ratio	Queues
Existing PM Peak			
Future PM Peak			

This scenario shows minor increases in V/C ratios, delays and queues at the intersection. The most critical movement at the intersection during the AM peak hour is the southbound left turn movement through the development traffic only contributes to a 0.02 increase. As expected, longer queue are experienced on Robie Street during the AM peak hour representing traffic inbound to the major employment centers in the downtown.

Figure 4-2: AM Peak Hour – Spring Garden and Carlton



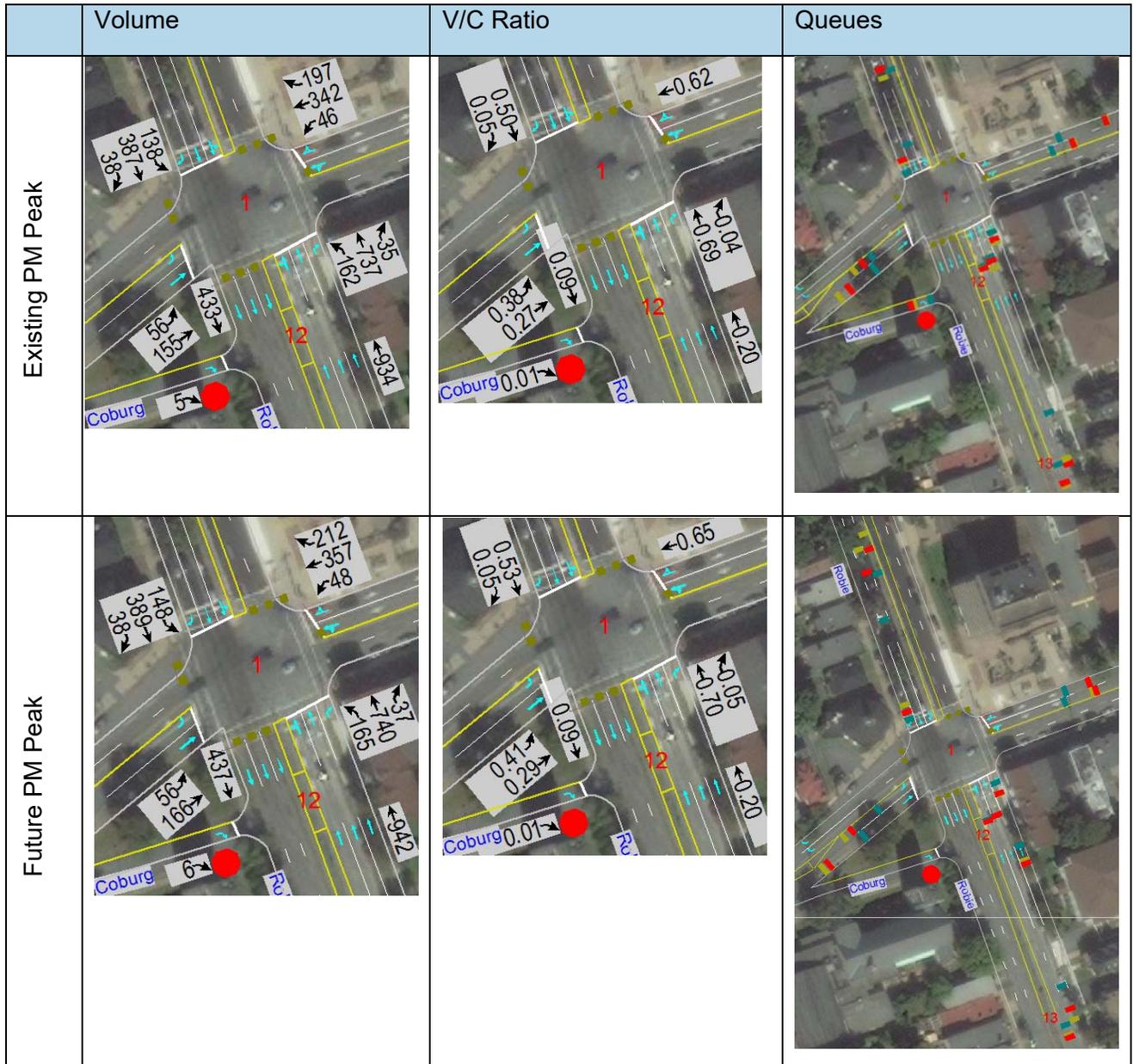
The Carlton intersection and driveway access all operate with high measures of performance under existing and future conditions. The gaps available in traffic on Spring Garden Road allow minor road left turns to be made efficiently with limited delay or resulting queuing.

Figure 4-3: AM Peak Hour – Spring Garden and Summer

	Volume	V/C Ratio	Queues
Existing PM Peak			
Future PM Peak			

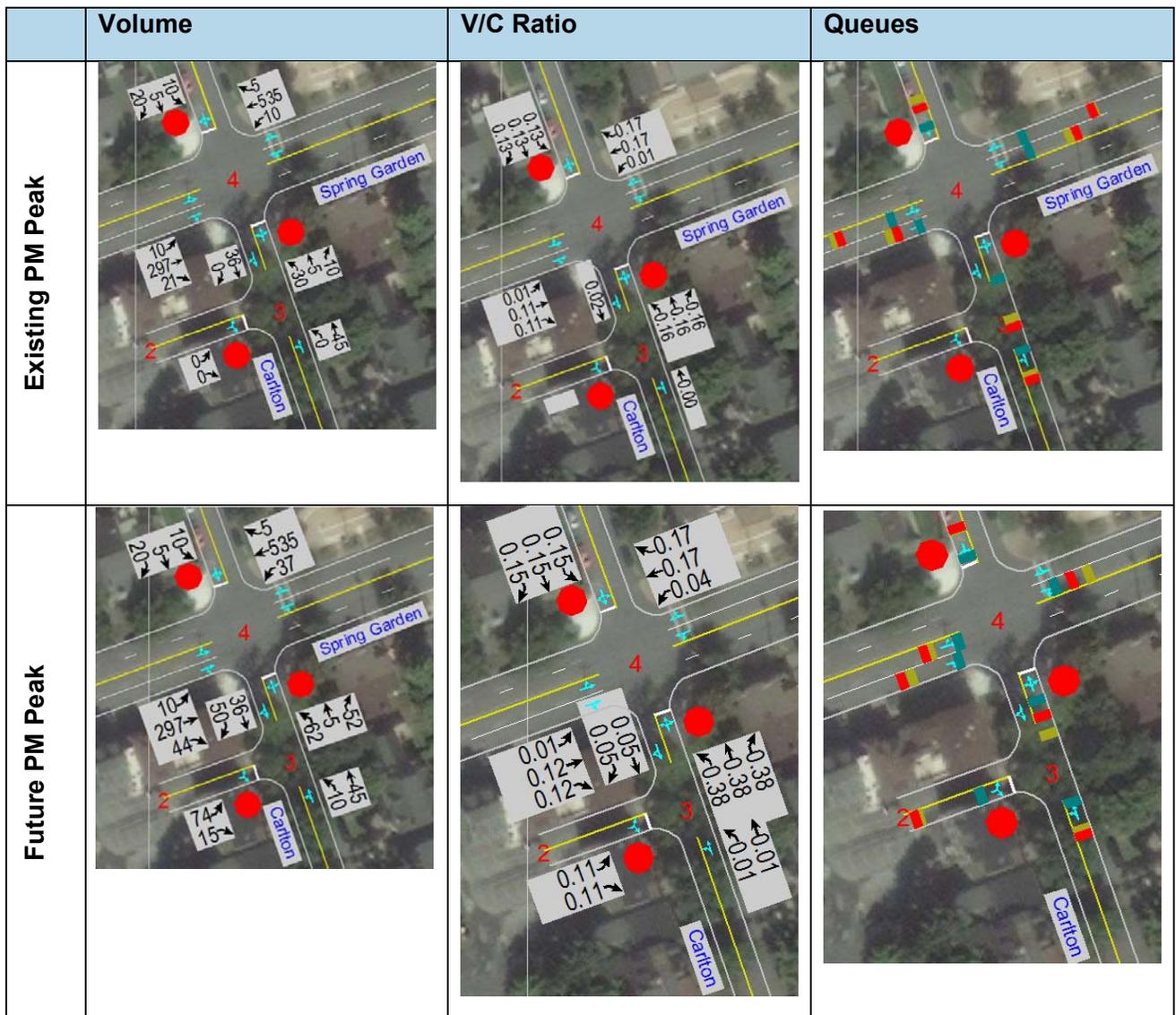
The Summer Road intersection operates well under both existing and future scenario as a result of the existing traffic signals at the intersection. It is unlikely that any changes will be required to the intersection timings as a result of the development traffic. The most significant v/c ratio increase is the peak inbound direction on Spring Garden Road though the increase is only 0.04 (approx. 4%).

Figure 4-4: PM Peak Hour – Spring Garden and Robie



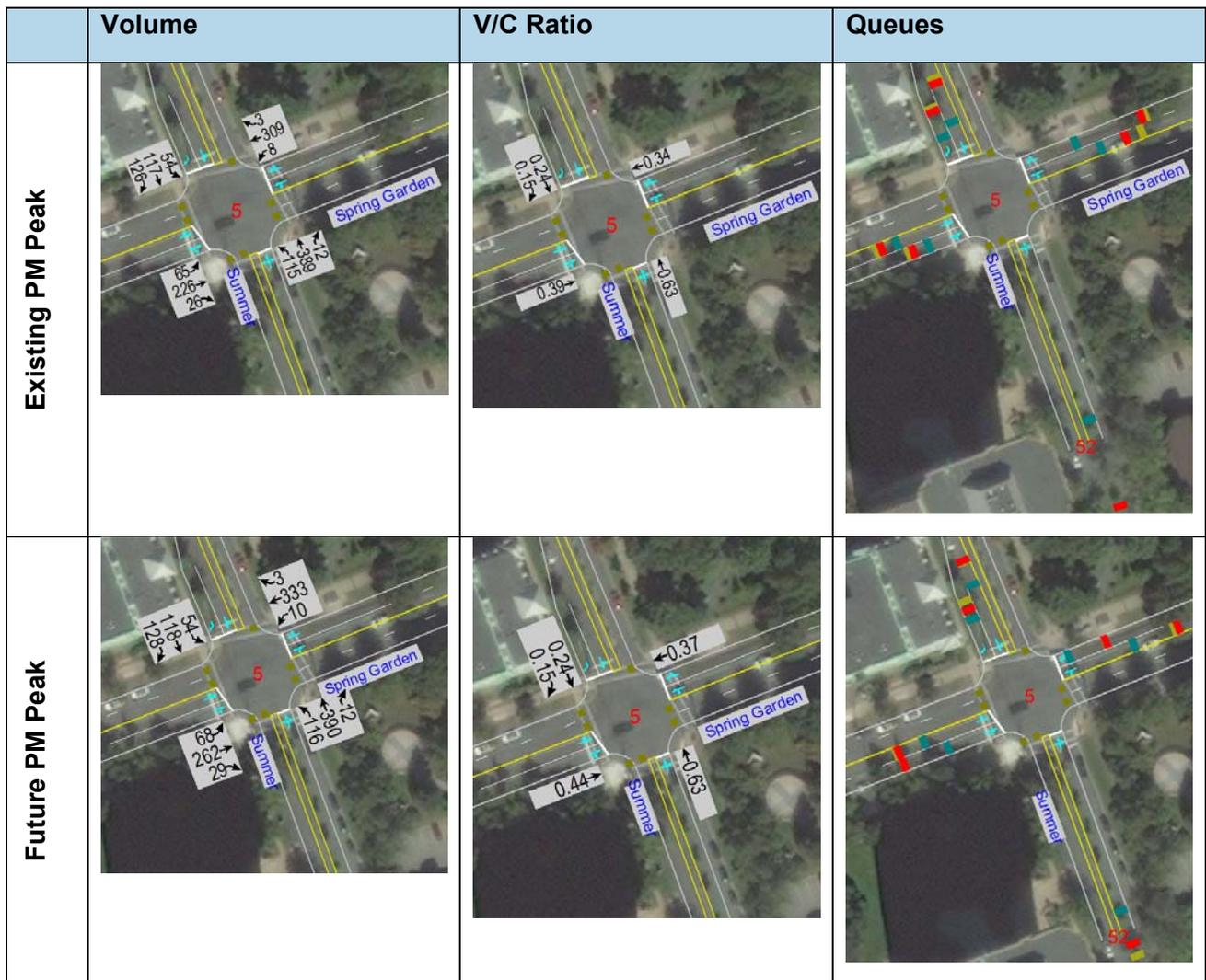
As expected during the PM peak, the higher volumes, delays and queue occur in the outbound direction (westbound Spring Garden and northbound Robie). Again, there is little change in capacity utilization, delays and queues between the existing and future scenarios.

Figure 4-5: PM Peak Hour – Spring Garden and Carlton



The Spring Garden corridor, Carlton intersection and the development access driveway operate at a high level of service similar to the AM peak hour. There are limited increases in any of the standard performance measures.

Figure 4-6: PM Peak Hour – Spring Garden and Summer



Similar to the AM peak, the Summer intersection operates well during the PM peak hour with limited impact from the proposed development. Again, queues, delays and capacity utilization are all well within good operational ranges, and flexibility at the intersection is enhanced by the presence of existing traffic signals.

In general, the Synchro report results contained in Appendix C of this report show that there are only very minor impacts to volume to capacity (v/c) ratios at all intersections in the study area. There are no notable increases in delay or queue lengths as a result of the addition of the development. With respect to the overall magnitude of traffic added to the surrounding road network as a result of the development, volume increases on Spring Garden near Carlton are in the range of 18 - 20% of total traffic. At the Robie Street intersection, development traffic represents between a 5 and 6% increase in traffic volume. It should also be noted that this study did not reduce the traffic related to the removal of existing development in the area, keeping this analysis more conservative.

5. CONCLUSIONS

This development appears to be well suited to this location from a transportation perspective by integrating into a predominately residential neighbourhood that is already characterized by apartment complexes and commercial retail development that supports the community. It is near the intersection of a number of major transportation corridors meaning traffic can conveniently navigate to various parts of the city. Consequently, traffic related to the development is expected to distribute itself widely throughout the network.

The development is well placed to take advantage of the high levels of local employers and institutions (hospitals, schools, downtown Halifax business area, etc.), all of which are directly connected to robust Active Transportation and Halifax Transit networks immediately adjacent to the site.

We expect that the impacts from this proposed development will negligible on Spring Garden Road and other roads in the area. The intersection most significantly impact is the Carlton Road intersection which has significant excess capacity to accommodate the volumes and is afforded significant gaps in traffic as a result of traffic signals at both Robie Street and Summer Street. The level of new traffic from this site does not warrant any modifications to existing roadway or active transportation infrastructure.

In summary, this development is expected to effectively integrate into the community with very minimal impacts to the existing transportation network.

We trust that this report satisfies the HRM requirements for the preparation of Transportation Impact Studies. Should there be any questions or comments regarding the content of the study, please do not hesitate to contact the undersigned.

Sincerely,

Original Signed

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Aug. 18,
2016

Original Signed



APPENDIX A

Traffic Counts

ΑΝΤΙΣΤΑΣΕΙΣ ΤΩΝ ΑΝΟΩΠΡΟΣΑΤ ΠΡΟΦΕΣΟΥ

ΦΥΛΟΠΡΟΦΕΣΙΑ

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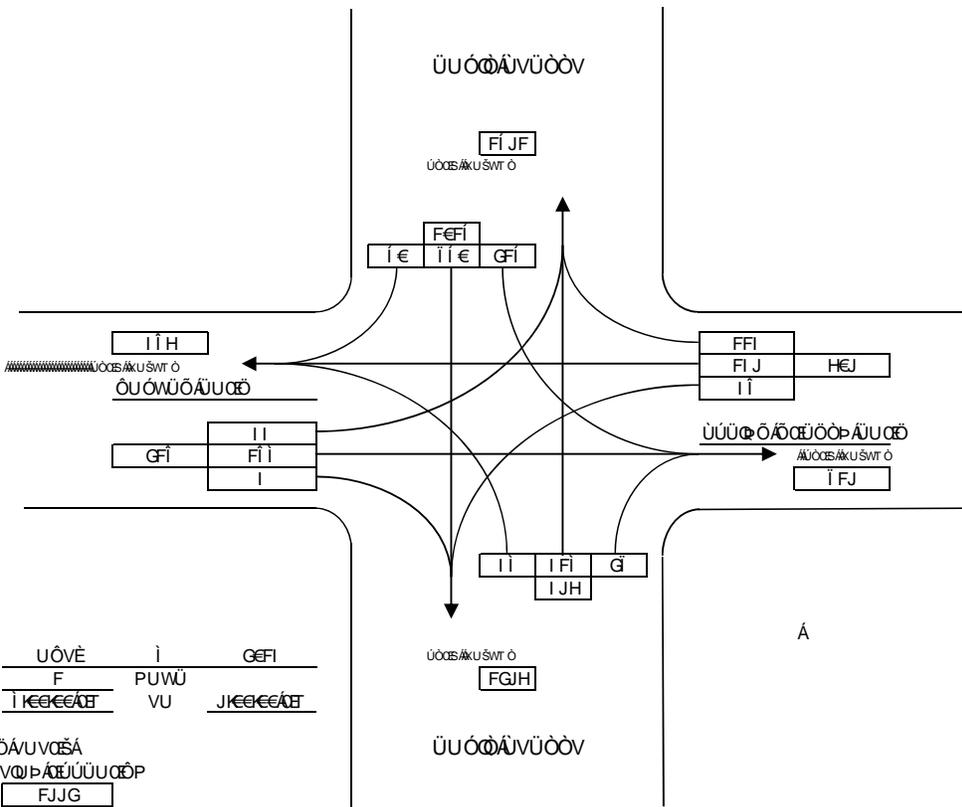
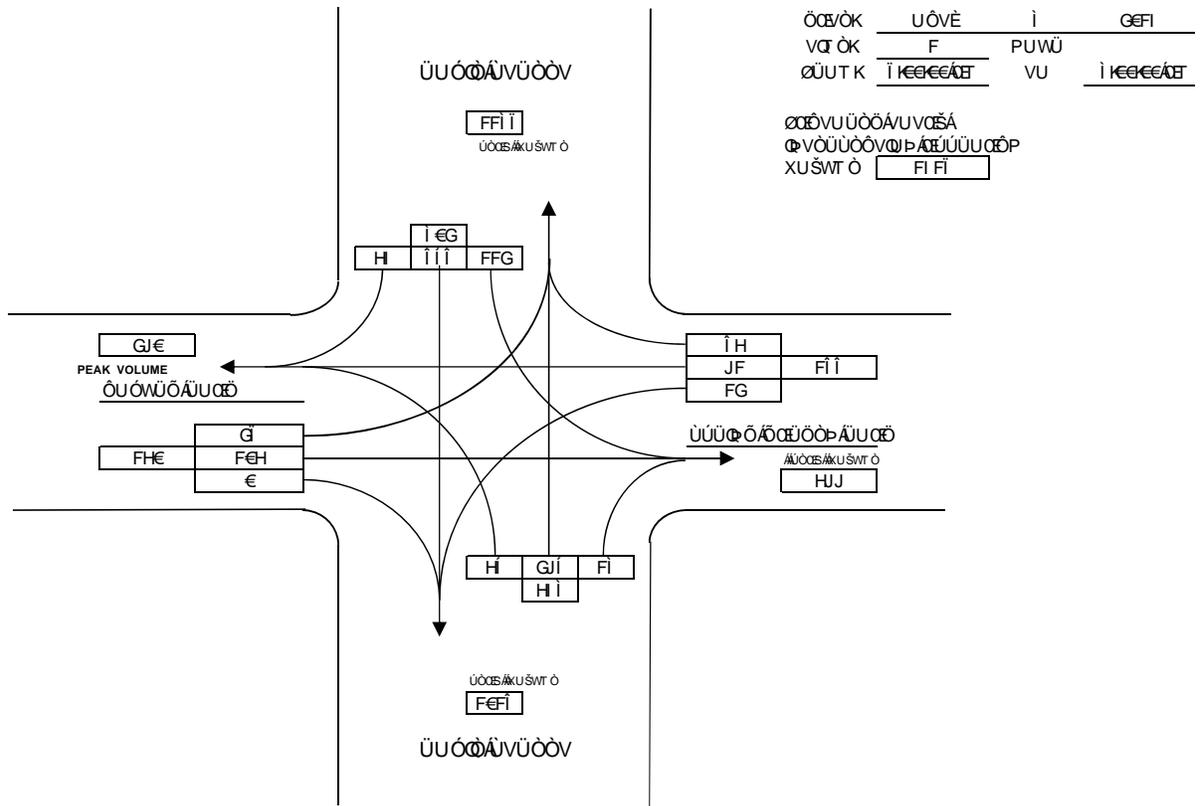
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ΧΟΡΩΣΕΙΣ ΑΥΤΟΠΡΟΑΥΤΟΤΕΛΕΣ

ΦΥΛΟΔΙΑΚΡΙΣΗ

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ΑΝΤΙΣΤΑΣΕΙΣ ΑΝΟΩΠΡΟΣΑΤ ΠΡΟΦΟΡΑΣ

ΦΥΛΟΛΟΓΟΓΡΑΦΙΑ

ΥΠΕΡΥΠΟΥΝΟΠΡΑΒΑΝΟΣΘΑ/ΑΝΤΙΣΤΑΣΕΙΣ ΑΝΟΩΠΡΟΣΑΤ

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ΥΟΥΟΣ

ΟΥΟΣ

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ΥΑ ΟΚ

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Γ	Η	Φ	Φ	Ϊ	Ϊ	Η	Ϊ	Η	Ϊ	Ϊ	Ϊ	Η
Ι	Ϊ	Ϊ	Ϊ	Ϊ	Ϊ	Η	Ϊ	Ϊ	Ϊ	Ϊ	Ϊ	Η
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ΥΟΥΟΣ

ΟΥΟΣ

ΦΙ Α Τ Ο Α Ο Ο Ο

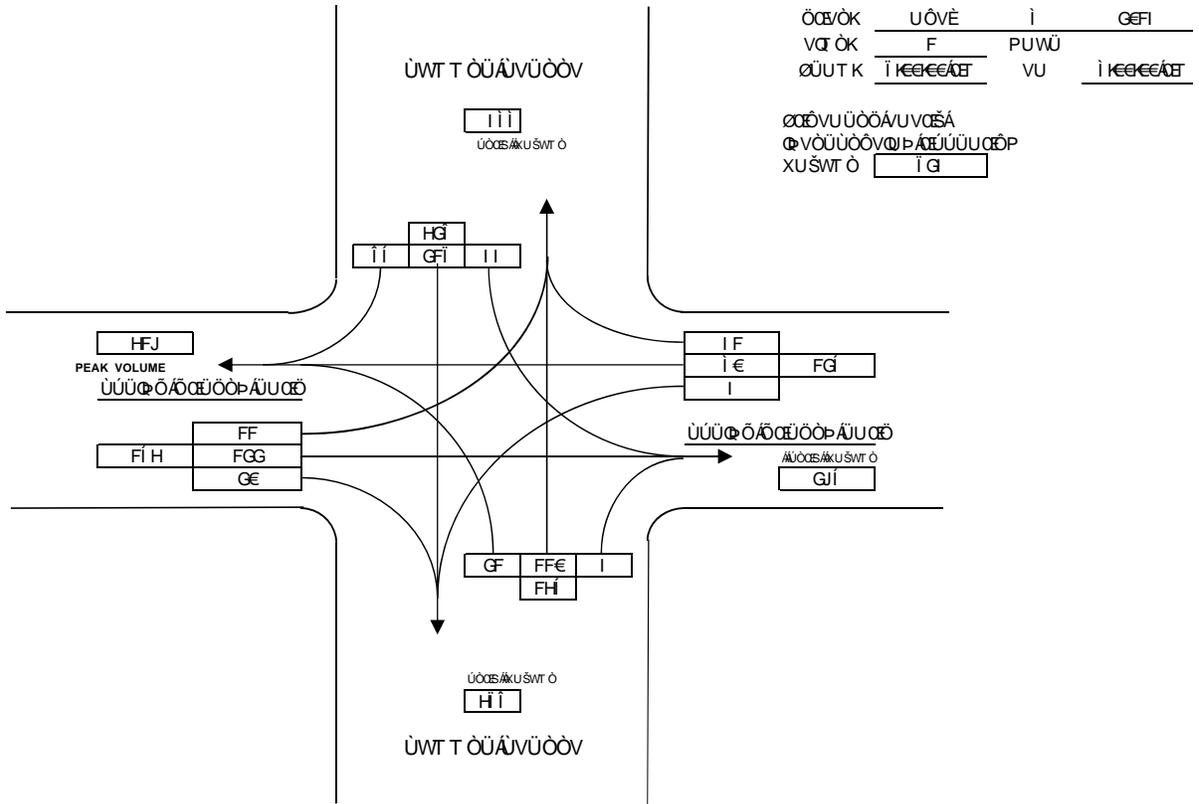
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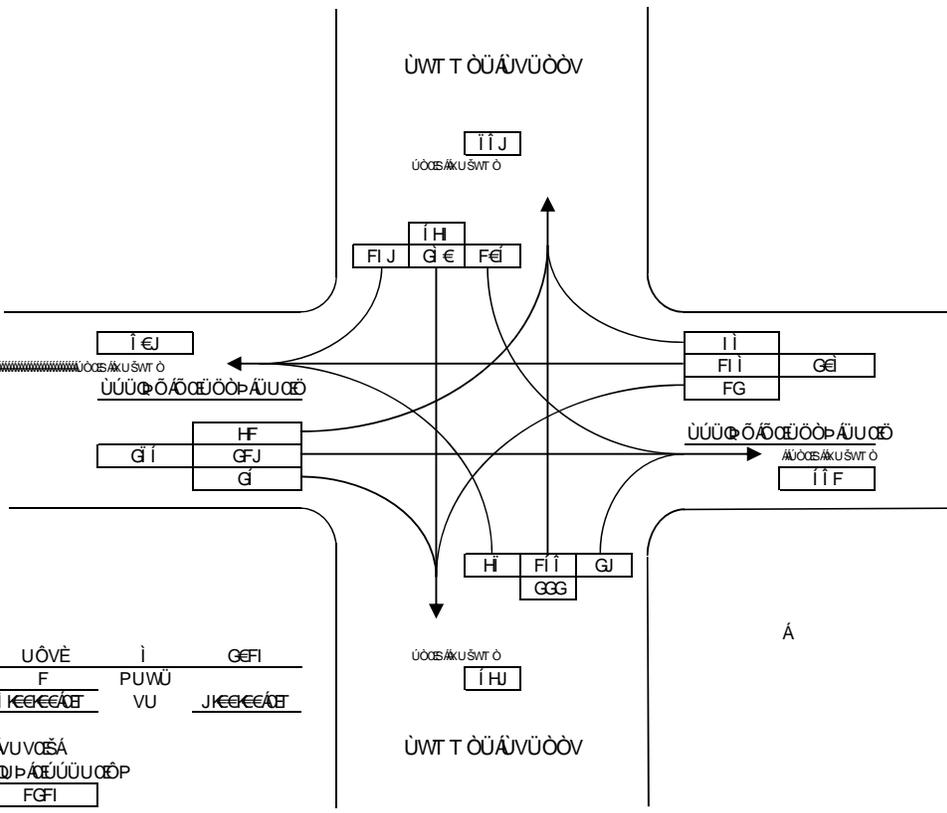
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ΦΟΥΥΟΝΦΑΚ



ÖA/OK	UÖVÉ	i	GEFI
VAT OK	F	PUWÚ	
ŠUT K	<u>IKKKKAT</u>	VU	<u>IKKKKAT</u>

ΑΟΥΥΥΟΑΥΥΟΑ
 ΦΟΥΥΟΝΦΑΚΎΥΥΟΑ
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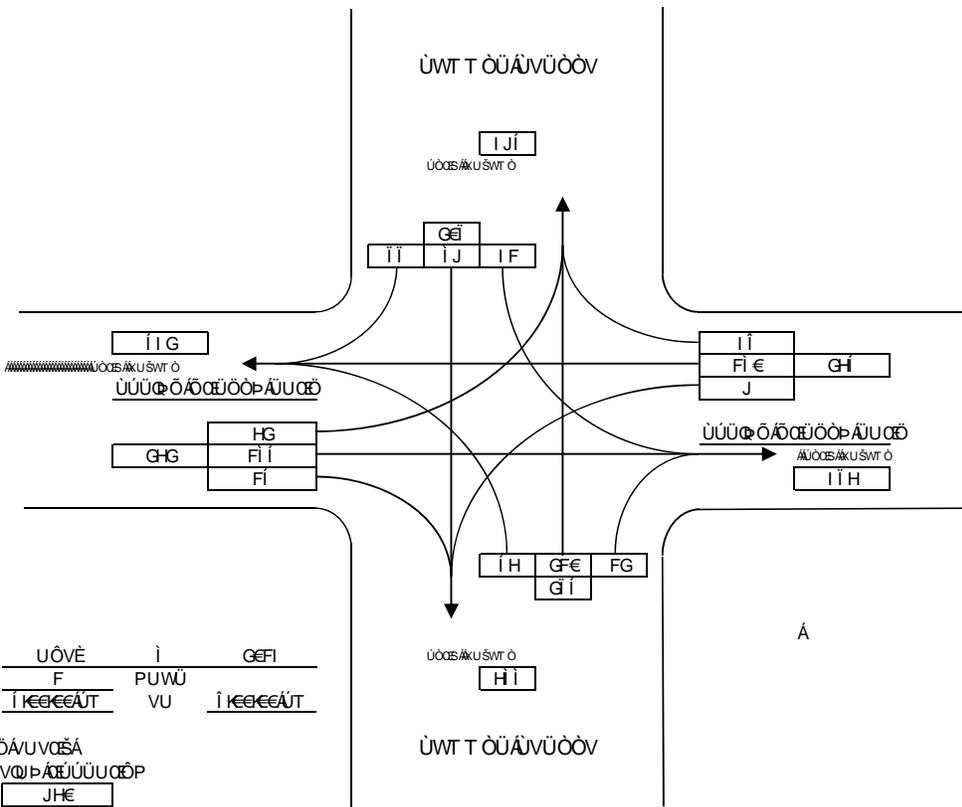
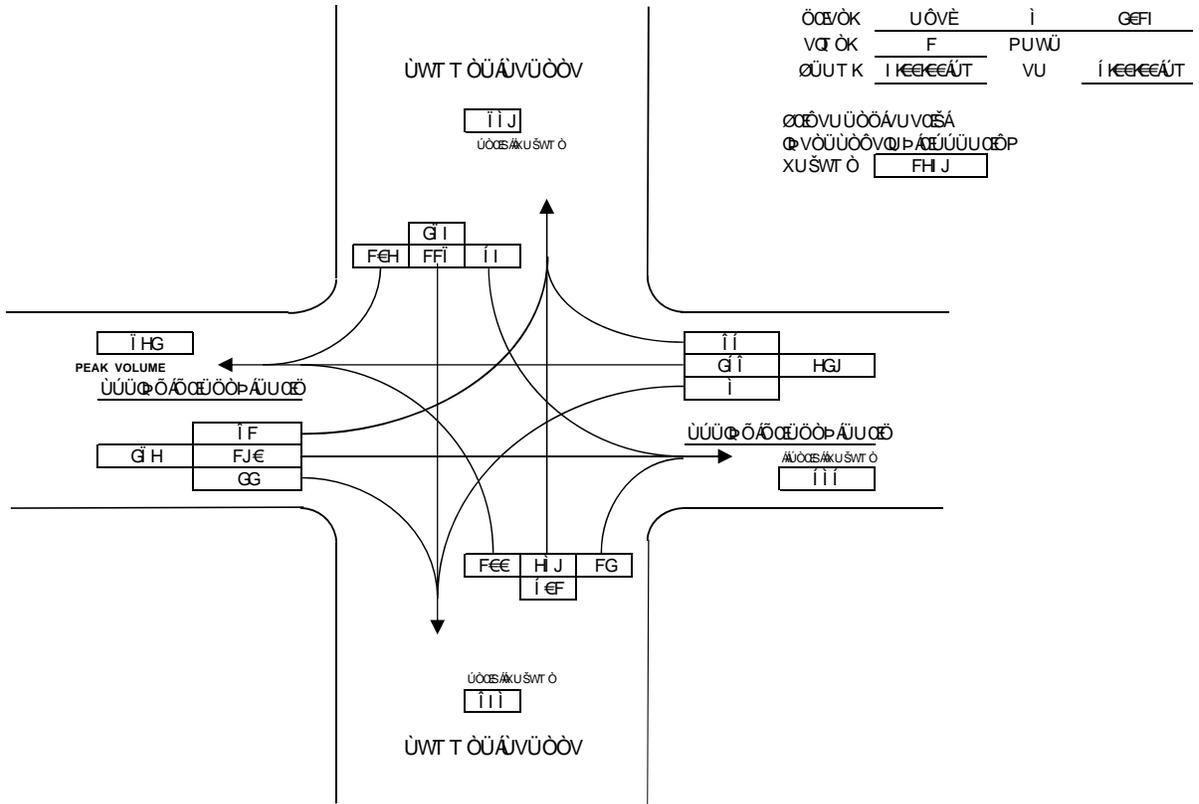
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ÖA/OK	UÖVÉ	i	GEFI
VAT OK	F	PUWÚ	
ŠUT K	<u>IKKKKAT</u>	VU	<u>JKKKKAT</u>

ΑΟΥΥΥΟΑΥΥΟΑ
 ΦΟΥΥΟΝΦΑΚΎΥΥΟΑ
 XUŠWT Ó FGFI

ΧΡΟΝΩΣΕΙΣ ΑΠΟ ΤΗΡΑΤΕΙΑΣ ΤΩΝ ΤΕΤΡΑΓΩΝΩΝ
 ΟΥΝΩΣΕΙΣ ΑΠΟ ΤΗΡΑΤΕΙΑΣ ΤΩΝ ΤΕΤΡΑΓΩΝΩΝ

ΦΩΝΗΤΙΚΑ



Ekistics Plan + Design
1 Starr Lane

Dartmouth, Nova Scotia, Canada B2Y4V7
(902) 461-2525 roger@ekistics.net
Ekistics

Count Name: DEXEL - Spring Garden Road -
PM Peak
Site Code:
Start Date: 05/14/2015
Page No: 3

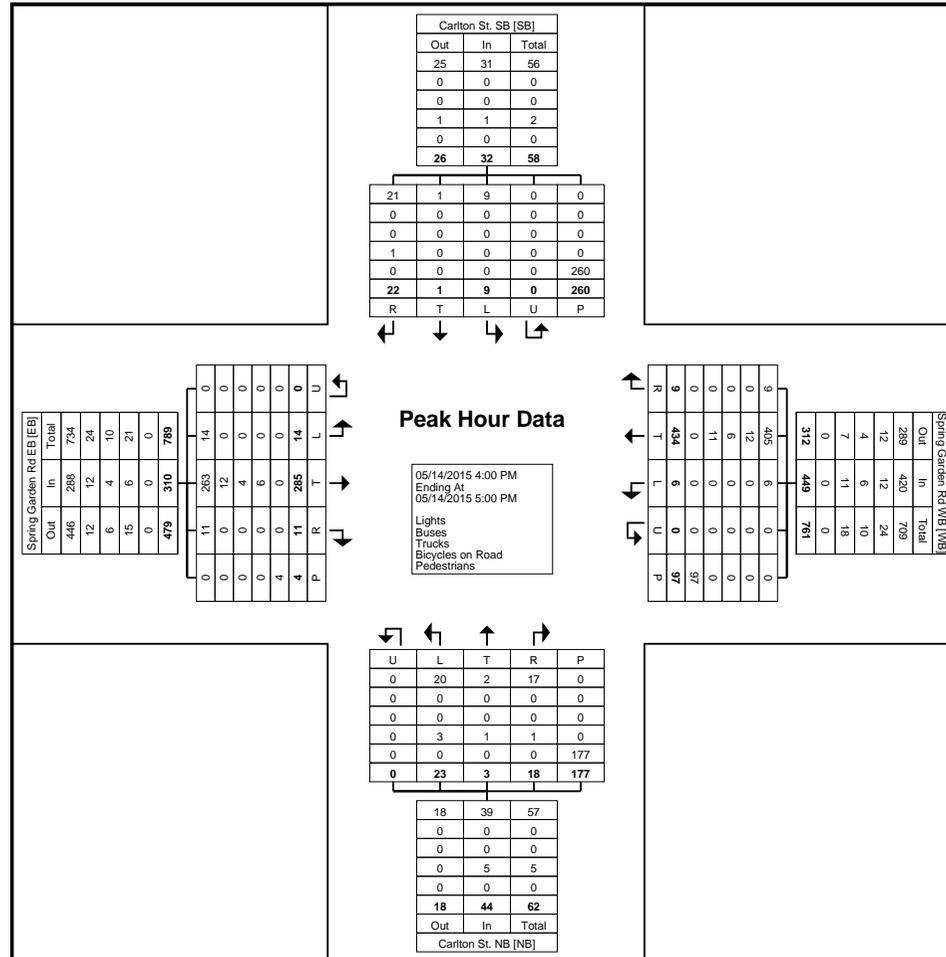
Turning Movement Peak Hour Data (4:00 PM)

Start Time	Carlton St. SB Southbound						Spring Garden Rd WB Westbound						Carlton St. NB Northbound						Spring Garden Rd EB Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
4:00 PM	2	0	1	0	61	3	3	123	2	0	32	128	8	2	8	0	42	18	3	67	3	0	1	73	222
4:15 PM	11	1	3	0	74	15	0	110	1	0	12	111	5	1	4	0	41	10	5	75	4	0	3	84	220
4:30 PM	3	0	5	0	65	8	5	99	2	0	30	106	2	0	5	0	48	7	1	83	3	0	0	87	208
4:45 PM	6	0	0	0	60	6	1	102	1	0	23	104	3	0	6	0	46	9	2	60	4	0	0	66	185
Total	22	1	9	0	260	32	9	434	6	0	97	449	18	3	23	0	177	44	11	285	14	0	4	310	835
Approach %	68.8	3.1	28.1	0.0	-	-	2.0	96.7	1.3	0.0	-	-	40.9	6.8	52.3	0.0	-	-	3.5	91.9	4.5	0.0	-	-	-
Total %	2.6	0.1	1.1	0.0	-	3.8	1.1	52.0	0.7	0.0	-	53.8	2.2	0.4	2.8	0.0	-	5.3	1.3	34.1	1.7	0.0	-	37.1	-
PHF	0.500	0.250	0.450	0.000	-	0.533	0.450	0.882	0.750	0.000	-	0.877	0.563	0.375	0.719	0.000	-	0.611	0.550	0.858	0.875	0.000	-	0.891	0.940
Lights	21	1	9	0	-	31	9	405	6	0	-	420	17	2	20	0	-	39	11	263	14	0	-	288	778
% Lights	95.5	100.0	100.0	-	-	96.9	100.0	93.3	100.0	-	-	93.5	94.4	66.7	87.0	-	-	88.6	100.0	92.3	100.0	-	-	92.9	93.2
Buses	0	0	0	0	-	0	0	12	0	0	-	12	0	0	0	0	-	0	0	12	0	0	-	12	24
% Buses	0.0	0.0	0.0	-	-	0.0	0.0	2.8	0.0	-	-	2.7	0.0	0.0	0.0	-	-	0.0	0.0	4.2	0.0	-	-	3.9	2.9
Trucks	0	0	0	0	-	0	0	6	0	0	-	6	0	0	0	0	-	0	0	4	0	0	-	4	10
% Trucks	0.0	0.0	0.0	-	-	0.0	0.0	1.4	0.0	-	-	1.3	0.0	0.0	0.0	-	-	0.0	0.0	1.4	0.0	-	-	1.3	1.2
Bicycles on Road	1	0	0	0	-	1	0	11	0	0	-	11	1	1	3	0	-	5	0	6	0	0	-	6	23
% Bicycles on Road	4.5	0.0	0.0	-	-	3.1	0.0	2.5	0.0	-	-	2.4	5.6	33.3	13.0	-	-	11.4	0.0	2.1	0.0	-	-	1.9	2.8
Pedestrians	-	-	-	-	260	-	-	-	-	-	97	-	-	-	-	-	177	-	-	-	-	-	4	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-

Ekistics Plan + Design
1 Starr Lane

Dartmouth, Nova Scotia, Canada B2Y4V7
(902) 461-2525 roger@ekistics.net
Ekistics

Count Name: DEXEL - Spring Garden Road -
PM Peak
Site Code:
Start Date: 05/14/2015
Page No: 4



Turning Movement Peak Hour Data Plot (4:00 PM)



APPENDIX B

Trip Generation

Trip Generation Summary

Alternative: Build Out

Phase:

Open Date: 2015-08-17

Project: DEXEL - Spring Garden Road

Analysis Date: 2015-09-01

ITE	Land Use	Weekday Average Daily Trips			Weekday AM Peak Hour of Adjacent Street Traffic			Weekday PM Peak Hour of Adjacent Street Traffic					
		*	Enter	Exit	Total	*	Enter	Exit	Total	*	Enter	Exit	Total
222	Apartments		420	420	840		15	45	60		43	27	70
	250 Dwelling Units												
710	General Office Space		272	271	543		68	9	77		12	61	73
	61.5 Gross Floor Area 1000 SF												
880	Drug Store		478	477	955		20	11	31		44	45	89
	21.2 Gross Floor Area 1000 SF												
932	Restaurant		102	101	203		9	8	17		10	6	16
	3.2 Gross Floor Area 1000 SF												
Unadjusted Volume			1272	1269	2541		112	73	185		109	139	248
Internal Capture Trips			267	267	534		0	0	0		32	32	64
Pass-By Trips			0	0	0		0	0	0		18	18	36
Volume Added to Adjacent Streets			1005	1002	2007		112	73	185		59	89	148

Total Weekday Average Daily Trips Internal Capture = 21 Percent

Total Weekday AM Peak Hour of Adjacent Street Traffic Internal Capture = 0 Percent

Total Weekday PM Peak Hour of Adjacent Street Traffic Internal Capture = 26 Percent

* - Custom rate used for selected time period.

Source: Institute of Transportation Engineers, Trip Generation Manual 9th Edition, 2012

TRIP GENERATION 2014, TRAFFICWARE, LLC



APPENDIX C

Synchro Output

Timings
1: Spring Garden & Robie

Existing AM Peak
2016-08-16

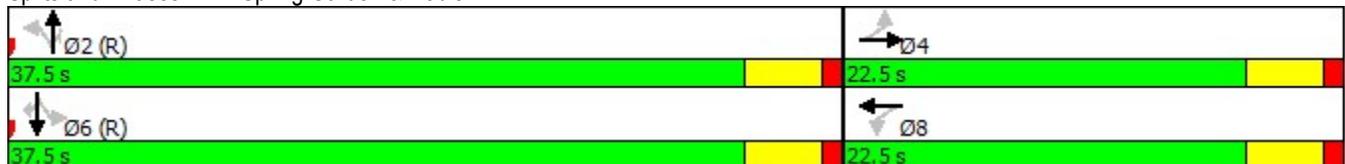


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↑		↕		↕	↗		↕	↗
Traffic Volume (vph)	45	170	51	162	49	422	28	217	758	51
Future Volume (vph)	45	170	51	162	49	422	28	217	758	51
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4		8		2			6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	4	4	8	8	2	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	37.5	37.5	37.5	37.5	37.5	37.5
Total Split (%)	37.5%	37.5%	37.5%	37.5%	62.5%	62.5%	62.5%	62.5%	62.5%	62.5%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	4.5	4.5		4.5		4.5	4.5		4.5	4.5
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	Max									
Act Effct Green (s)	18.0	18.0		18.0		33.0	33.0		33.0	33.0
Actuated g/C Ratio	0.30	0.30		0.30		0.55	0.55		0.55	0.55
v/c Ratio	0.17	0.30		0.38		0.33	0.03		0.77	0.06
Control Delay	17.5	17.8		17.0		8.2	2.8		15.2	2.4
Queue Delay	0.0	0.0		0.0		0.0	0.0		0.0	0.0
Total Delay	17.5	17.8		17.0		8.2	2.8		15.2	2.4
LOS	B	B		B		A	A		B	A
Approach Delay		17.8		17.0		7.9			14.6	
Approach LOS		B		B		A			B	

Intersection Summary

Cycle Length: 60
 Actuated Cycle Length: 60
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 60
 Control Type: Pretimed
 Maximum v/c Ratio: 0.77
 Intersection Signal Delay: 13.7
 Intersection LOS: B
 Intersection Capacity Utilization 74.5%
 ICU Level of Service D
 Analysis Period (min) 15

Splits and Phases: 1: Spring Garden & Robie



Queues
1: Spring Garden & Robie

Existing AM Peak
2016-08-16



Lane Group	EBL	EBT	WBT	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	49	185	374	512	30	1060	55
v/c Ratio	0.17	0.30	0.38	0.33	0.03	0.77	0.06
Control Delay	17.5	17.8	17.0	8.2	2.8	15.2	2.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.5	17.8	17.0	8.2	2.8	15.2	2.4
Queue Length 50th (m)	4.2	16.3	13.6	15.4	0.0	45.0	0.0
Queue Length 95th (m)	11.4	30.6	25.5	23.8	2.9	69.2	3.9
Internal Link Dist (m)		56.0	122.1	8.1		103.6	
Turn Bay Length (m)	30.0						
Base Capacity (vph)	281	614	986	1545	884	1383	886
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.30	0.38	0.33	0.03	0.77	0.06

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis

3: Carlton & Access

Existing AM Peak
2016-08-16



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	0	29	20	0
Future Volume (Veh/h)	0	0	0	29	20	0
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)	0	0	0	32	22	0
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	54	22	22			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	54	22	22			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	954	1055	1593			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	0	32	22			
Volume Left	0	0	0			
Volume Right	0	0	0			
cSH	1700	1593	1700			
Volume to Capacity	0.00	0.00	0.01			
Queue Length 95th (m)	0.0	0.0	0.0			
Control Delay (s)	0.0	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	0.0	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay	0.0					
Intersection Capacity Utilization	6.7%			ICU Level of Service	A	
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis
4: Carlton & Spring Garden

Existing AM Peak
2016-08-16

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	12	383	20	15	319	5	6	5	18	8	5	20
Future Volume (Veh/h)	12	383	20	15	319	5	6	5	18	8	5	20
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	13	416	22	16	347	5	7	5	20	9	5	22
Pedestrians					66			34			122	
Lane Width (m)					3.6			3.6			3.6	
Walking Speed (m/s)					1.2			1.2			1.2	
Percent Blockage					6			3			10	
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (m)		146			150							
pX, platoon unblocked												
vC, conflicting volume	474			472			717	993	319	826	1002	298
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	474			472			717	993	319	826	1002	298
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			98			97	98	97	95	98	96
cM capacity (veh/h)	974			1055			258	207	621	188	205	627
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	221	230	190	178	32	36						
Volume Left	13	0	16	0	7	9						
Volume Right	0	22	0	5	20	22						
cSH	974	1700	1055	1700	383	336						
Volume to Capacity	0.01	0.14	0.02	0.10	0.08	0.11						
Queue Length 95th (m)	0.3	0.0	0.4	0.0	2.2	2.9						
Control Delay (s)	0.6	0.0	0.8	0.0	15.2	17.0						
Lane LOS	A		A		C	C						
Approach Delay (s)	0.3		0.4		15.2	17.0						
Approach LOS					C	C						
Intersection Summary												
Average Delay			1.6									
Intersection Capacity Utilization			39.2%	ICU Level of Service	A							
Analysis Period (min)			15									

Timings
5: Summer & Spring Garden

Existing AM Peak
2016-08-16

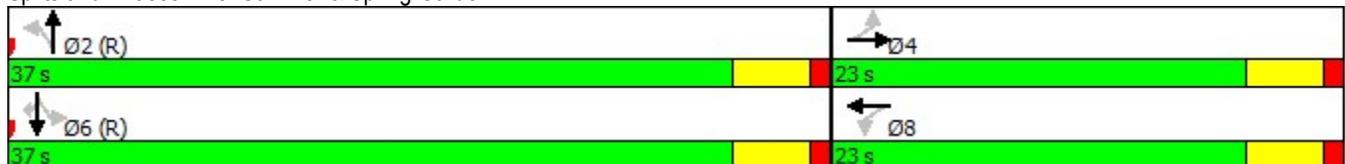


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations		↕↕		↕↕		↕↕		↕	↗
Traffic Volume (vph)	31	353	12	150	38	156	105	280	151
Future Volume (vph)	31	353	12	150	38	156	105	280	151
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA	Perm
Protected Phases		4		8		2		6	
Permitted Phases	4		8		2		6		6
Detector Phase	4	4	8	8	2	2	6	6	6
Switch Phase									
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5
Total Split (s)	23.0	23.0	23.0	23.0	37.0	37.0	37.0	37.0	37.0
Total Split (%)	38.3%	38.3%	38.3%	38.3%	61.7%	61.7%	61.7%	61.7%	61.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)		0.0		0.0		0.0		0.0	0.0
Total Lost Time (s)		4.5		4.5		4.5		4.5	4.5
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	Max								
Act Effect Green (s)		18.5		18.5		32.5		32.5	32.5
Actuated g/C Ratio		0.31		0.31		0.54		0.54	0.54
v/c Ratio		0.45		0.23		0.27		0.49	0.18
Control Delay		20.9		12.5		7.7		11.0	1.9
Queue Delay		0.0		0.0		0.0		0.0	0.0
Total Delay		20.9		12.5		7.7		11.0	1.9
LOS		C		B		A		B	A
Approach Delay		20.9		12.5		7.7		8.4	
Approach LOS		C		B		A		A	

Intersection Summary

Cycle Length: 60
 Actuated Cycle Length: 60
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 45
 Control Type: Pretimed
 Maximum v/c Ratio: 0.49
 Intersection Signal Delay: 12.6
 Intersection Capacity Utilization 65.1%
 Analysis Period (min) 15
 Intersection LOS: B
 ICU Level of Service C

Splits and Phases: 5: Summer & Spring Garden



Queues
5: Summer & Spring Garden

Existing AM Peak
2016-08-16



Lane Group	EBT	WBT	NBT	SBT	SBR
Lane Group Flow (vph)	445	228	243	418	164
v/c Ratio	0.45	0.23	0.27	0.49	0.18
Control Delay	20.9	12.5	7.7	11.0	1.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	20.9	12.5	7.7	11.0	1.9
Queue Length 50th (m)	24.0	7.7	12.3	27.2	0.0
Queue Length 95th (m)	m31.6	15.1	23.5	47.7	6.8
Internal Link Dist (m)	125.6	70.4	44.3	45.0	
Turn Bay Length (m)					20.0
Base Capacity (vph)	1000	1009	900	856	932
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	0.45	0.23	0.27	0.49	0.18

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Timings
1: Spring Garden & Robie

With Development AM Peak
2016-08-16

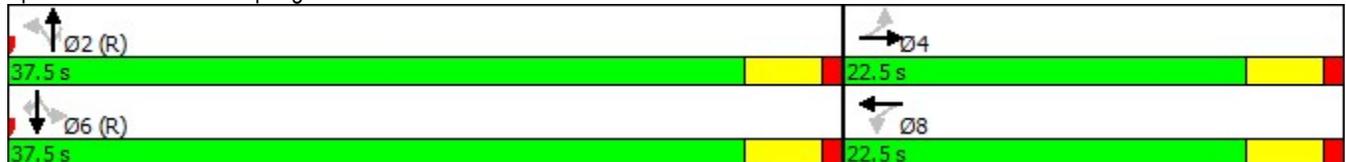


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↑		↕		↕	↗		↕	↗
Traffic Volume (vph)	45	190	52	175	49	422	32	236	761	51
Future Volume (vph)	45	190	52	175	49	422	32	236	761	51
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4		8		2			6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	4	4	8	8	2	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	37.5	37.5	37.5	37.5	37.5	37.5
Total Split (%)	37.5%	37.5%	37.5%	37.5%	62.5%	62.5%	62.5%	62.5%	62.5%	62.5%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	4.5	4.5		4.5		4.5	4.5		4.5	4.5
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	Max									
Act Effct Green (s)	18.0	18.0		18.0		33.0	33.0		33.0	33.0
Actuated g/C Ratio	0.30	0.30		0.30		0.55	0.55		0.55	0.55
v/c Ratio	0.19	0.34		0.41		0.33	0.04		0.79	0.06
Control Delay	17.8	18.3		18.1		8.2	2.7		16.4	2.4
Queue Delay	0.0	0.0		0.0		0.0	0.0		0.0	0.0
Total Delay	17.8	18.3		18.1		8.2	2.7		16.4	2.4
LOS	B	B		B		A	A		B	A
Approach Delay		18.2		18.1		7.8			15.7	
Approach LOS		B		B		A			B	

Intersection Summary

Cycle Length: 60
 Actuated Cycle Length: 60
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 60
 Control Type: Pretimed
 Maximum v/c Ratio: 0.79
 Intersection Signal Delay: 14.6
 Intersection Capacity Utilization 77.0%
 Analysis Period (min) 15
 Intersection LOS: B
 ICU Level of Service D

Splits and Phases: 1: Spring Garden & Robie



Queues
1: Spring Garden & Robie

With Development AM Peak
2016-08-16



Lane Group	EBL	EBT	WBT	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	49	207	407	512	35	1084	55
v/c Ratio	0.19	0.34	0.41	0.33	0.04	0.79	0.06
Control Delay	17.8	18.3	18.1	8.2	2.7	16.4	2.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.8	18.3	18.1	8.2	2.7	16.4	2.4
Queue Length 50th (m)	4.2	18.4	15.1	15.4	0.0	47.2	0.0
Queue Length 95th (m)	11.5	33.9	27.5	23.8	3.1	72.9	3.9
Internal Link Dist (m)		56.0	122.1	8.1		103.6	
Turn Bay Length (m)	30.0						
Base Capacity (vph)	264	614	994	1540	886	1368	886
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.19	0.34	0.41	0.33	0.04	0.79	0.06

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
4: Carlton & Spring Garden

With Development AM Peak
2016-08-16

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	12	383	63	69	319	5	35	5	52	8	5	20
Future Volume (Veh/h)	12	383	63	69	319	5	35	5	52	8	5	20
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	13	416	68	75	347	5	38	5	57	9	5	22
Pedestrians					66			34			122	
Lane Width (m)					3.6			3.6			3.6	
Walking Speed (m/s)					1.2			1.2			1.2	
Percent Blockage					6			3			10	
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (m)		146			150							
pX, platoon unblocked												
vC, conflicting volume	474			518			858	1134	342	981	1166	298
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	474			518			858	1134	342	981	1166	298
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			93			80	97	91	93	97	96
cM capacity (veh/h)	974			1015			194	161	600	129	154	627
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	221	276	248	178	100	36						
Volume Left	13	0	75	0	38	9						
Volume Right	0	68	0	5	57	22						
cSH	974	1700	1015	1700	310	262						
Volume to Capacity	0.01	0.16	0.07	0.10	0.32	0.14						
Queue Length 95th (m)	0.3	0.0	1.9	0.0	10.9	3.8						
Control Delay (s)	0.6	0.0	3.2	0.0	22.0	20.9						
Lane LOS	A		A		C	C						
Approach Delay (s)	0.3		1.8		22.0	20.9						
Approach LOS					C	C						
Intersection Summary												
Average Delay			3.7									
Intersection Capacity Utilization			49.8%	ICU Level of Service	A							
Analysis Period (min)			15									

Queues
5: Summer & Spring Garden

With Development AM Peak
2016-08-16



Lane Group	EBT	WBT	NBT	SBT	SBR
Lane Group Flow (vph)	481	282	248	422	167
v/c Ratio	0.49	0.28	0.28	0.49	0.18
Control Delay	21.2	13.9	7.8	11.1	1.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	21.2	13.9	7.8	11.1	1.9
Queue Length 50th (m)	25.8	10.5	12.8	27.6	0.0
Queue Length 95th (m)	m34.1	18.9	24.1	48.3	6.9
Internal Link Dist (m)	125.6	70.4	44.3	45.0	
Turn Bay Length (m)					20.0
Base Capacity (vph)	991	1007	888	856	934
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	0.49	0.28	0.28	0.49	0.18

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Timings
1: Spring Garden & Robie

Existing PM Peak
2016-08-16

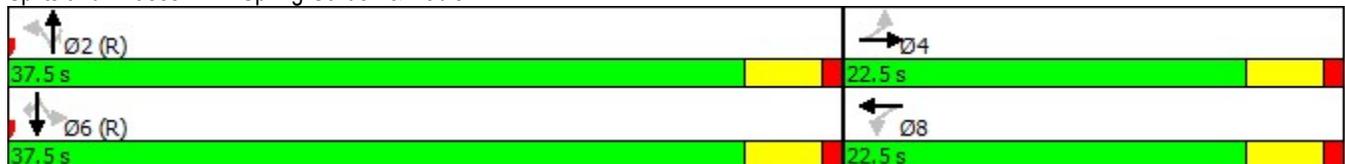


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↑		↕		↕	↗		↕	↗
Traffic Volume (vph)	56	155	46	342	162	737	35	138	387	38
Future Volume (vph)	56	155	46	342	162	737	35	138	387	38
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4		8		2			6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	4	4	8	8	2	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	37.5	37.5	37.5	37.5	37.5	37.5
Total Split (%)	37.5%	37.5%	37.5%	37.5%	62.5%	62.5%	62.5%	62.5%	62.5%	62.5%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	4.5	4.5		4.5		4.5	4.5		4.5	4.5
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	Max									
Act Effct Green (s)	18.0	18.0		18.0		33.0	33.0		33.0	33.0
Actuated g/C Ratio	0.30	0.30		0.30		0.55	0.55		0.55	0.55
v/c Ratio	0.38	0.27		0.62		0.69	0.04		0.50	0.05
Control Delay	24.7	17.5		25.9		13.0	2.6		10.4	2.6
Queue Delay	0.0	0.0		0.0		0.0	0.0		0.0	0.0
Total Delay	24.7	17.5		25.9		13.0	2.6		10.4	2.6
LOS	C	B		C		B	A		B	A
Approach Delay		19.4		25.9		12.6			9.9	
Approach LOS		B		C		B			A	

Intersection Summary

Cycle Length: 60
 Actuated Cycle Length: 60
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 55
 Control Type: Pretimed
 Maximum v/c Ratio: 0.69
 Intersection Signal Delay: 15.9
 Intersection Capacity Utilization 80.0%
 Analysis Period (min) 15
 Intersection LOS: B
 ICU Level of Service D

Splits and Phases: 1: Spring Garden & Robie



Queues
1: Spring Garden & Robie

Existing PM Peak
2016-08-16



Lane Group	EBL	EBT	WBT	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	61	168	636	977	38	571	41
v/c Ratio	0.38	0.27	0.62	0.69	0.04	0.50	0.05
Control Delay	24.7	17.5	25.9	13.0	2.6	10.4	2.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.7	17.5	25.9	13.0	2.6	10.4	2.6
Queue Length 50th (m)	5.5	14.7	31.9	38.6	0.0	19.4	0.0
Queue Length 95th (m)	15.8	28.2	47.7	58.4	3.3	31.3	3.4
Internal Link Dist (m)		56.0	122.1	8.1		103.6	
Turn Bay Length (m)	30.0						
Base Capacity (vph)	162	614	1022	1421	887	1131	879
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.38	0.27	0.62	0.69	0.04	0.50	0.05

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
4: Carlton & Spring Garden

Existing PM Peak
2016-08-16

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	297	21	10	535	5	30	5	10	10	5	20
Future Volume (Veh/h)	10	297	21	10	535	5	30	5	10	10	5	20
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	323	23	11	582	5	33	5	11	11	5	22
Pedestrians					66			34			122	
Lane Width (m)					3.6			3.6			3.6	
Walking Speed (m/s)					1.2			1.2			1.2	
Percent Blockage					6			3			10	
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (m)		146			150							
pX, platoon unblocked	0.96						0.96	0.96		0.96	0.96	0.96
vC, conflicting volume	709			380			728	1122	273	992	1130	416
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	604			380			624	1036	273	900	1045	297
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			99			89	97	98	93	97	96
cM capacity (veh/h)	833			1142			288	188	665	162	185	600
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	172	184	302	296	49	38						
Volume Left	11	0	11	0	33	11						
Volume Right	0	23	0	5	11	22						
cSH	833	1700	1142	1700	310	289						
Volume to Capacity	0.01	0.11	0.01	0.17	0.16	0.13						
Queue Length 95th (m)	0.3	0.0	0.2	0.0	4.4	3.6						
Control Delay (s)	0.7	0.0	0.4	0.0	18.8	19.3						
Lane LOS	A		A		C	C						
Approach Delay (s)	0.4		0.2		18.8	19.3						
Approach LOS					C	C						
Intersection Summary												
Average Delay			1.8									
Intersection Capacity Utilization			41.4%	ICU Level of Service	A							
Analysis Period (min)			15									

Timings
5: Summer & Spring Garden

Existing PM Peak
2016-08-16

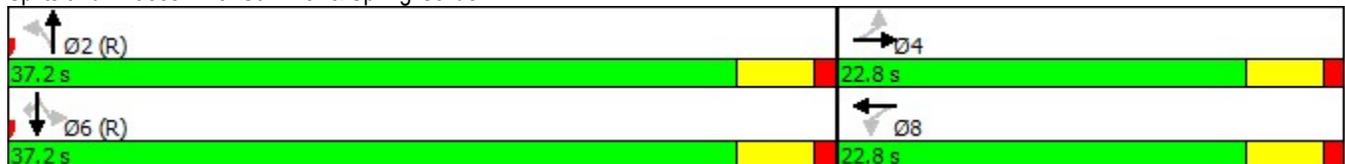


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations		↕↕		↕↕		↕↕		↕	↗
Traffic Volume (vph)	65	226	8	309	115	389	54	117	126
Future Volume (vph)	65	226	8	309	115	389	54	117	126
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA	Perm
Protected Phases		4		8		2		6	
Permitted Phases	4		8		2		6		6
Detector Phase	4	4	8	8	2	2	6	6	6
Switch Phase									
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5
Total Split (s)	22.8	22.8	22.8	22.8	37.2	37.2	37.2	37.2	37.2
Total Split (%)	38.0%	38.0%	38.0%	38.0%	62.0%	62.0%	62.0%	62.0%	62.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)		0.0		0.0		0.0		0.0	0.0
Total Lost Time (s)		4.5		4.5		4.5		4.5	4.5
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	Max								
Act Effct Green (s)		18.3		18.3		32.7		32.7	32.7
Actuated g/C Ratio		0.30		0.30		0.54		0.54	0.54
v/c Ratio		0.39		0.34		0.63		0.24	0.15
Control Delay		23.4		17.3		13.3		8.1	1.9
Queue Delay		0.0		0.0		0.0		0.0	0.0
Total Delay		23.4		17.3		13.3		8.1	1.9
LOS		C		B		B		A	A
Approach Delay		23.4		17.3		13.3		5.5	
Approach LOS		C		B		B		A	

Intersection Summary

Cycle Length: 60
 Actuated Cycle Length: 60
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 55
 Control Type: Pretimed
 Maximum v/c Ratio: 0.63
 Intersection Signal Delay: 14.8
 Intersection Capacity Utilization 63.3%
 Analysis Period (min) 15
 Intersection LOS: B
 ICU Level of Service B

Splits and Phases: 5: Summer & Spring Garden



Queues
5: Summer & Spring Garden

Existing PM Peak
2016-08-16



Lane Group	EBT	WBT	NBT	SBT	SBR
Lane Group Flow (vph)	345	348	561	186	137
v/c Ratio	0.39	0.34	0.63	0.24	0.15
Control Delay	23.4	17.3	13.3	8.1	1.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	23.4	17.3	13.3	8.1	1.9
Queue Length 50th (m)	19.4	16.1	40.0	10.1	0.0
Queue Length 95th (m)	31.2	26.1	69.5	19.8	6.2
Internal Link Dist (m)	125.6	70.4	44.3	45.0	
Turn Bay Length (m)					20.0
Base Capacity (vph)	880	1018	897	788	925
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	0.39	0.34	0.63	0.24	0.15

Intersection Summary

Timings
1: Spring Garden & Robie

With Development PM Peak
2016-08-16

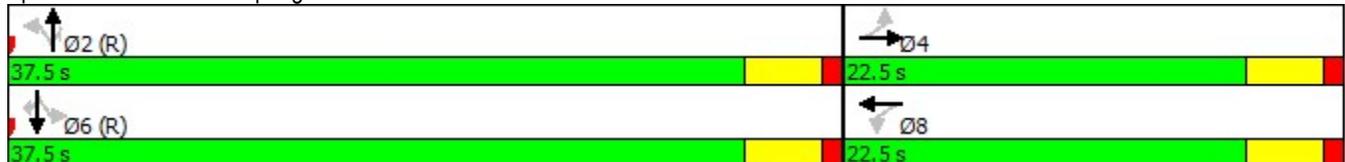


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↑		↕		↕	↗		↕	↗
Traffic Volume (vph)	56	166	48	357	165	740	37	148	389	38
Future Volume (vph)	56	166	48	357	165	740	37	148	389	38
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4		8		2			6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	4	4	8	8	2	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	37.5	37.5	37.5	37.5	37.5	37.5
Total Split (%)	37.5%	37.5%	37.5%	37.5%	62.5%	62.5%	62.5%	62.5%	62.5%	62.5%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	4.5	4.5		4.5		4.5	4.5		4.5	4.5
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	Max									
Act Effct Green (s)	18.0	18.0		18.0		33.0	33.0		33.0	33.0
Actuated g/C Ratio	0.30	0.30		0.30		0.55	0.55		0.55	0.55
v/c Ratio	0.41	0.29		0.65		0.70	0.05		0.53	0.05
Control Delay	26.7	17.7		26.3		13.3	2.6		10.8	2.6
Queue Delay	0.0	0.0		0.0		0.0	0.0		0.0	0.0
Total Delay	26.7	17.7		26.3		13.3	2.6		10.8	2.6
LOS	C	B		C		B	A		B	A
Approach Delay		20.0		26.3		12.9			10.2	
Approach LOS		C		C		B			B	

Intersection Summary

Cycle Length: 60
 Actuated Cycle Length: 60
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 60
 Control Type: Pretimed
 Maximum v/c Ratio: 0.70
 Intersection Signal Delay: 16.4
 Intersection LOS: B
 Intersection Capacity Utilization 82.1%
 ICU Level of Service E
 Analysis Period (min) 15

Splits and Phases: 1: Spring Garden & Robie



Queues
1: Spring Garden & Robie

With Development PM Peak
2016-08-16

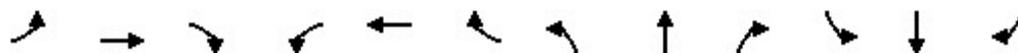


Lane Group	EBL	EBT	WBT	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	61	180	670	983	40	584	41
v/c Ratio	0.41	0.29	0.65	0.70	0.05	0.53	0.05
Control Delay	26.7	17.7	26.3	13.3	2.6	10.8	2.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.7	17.7	26.3	13.3	2.6	10.8	2.6
Queue Length 50th (m)	5.6	15.8	33.7	39.2	0.0	20.2	0.0
Queue Length 95th (m)	16.4	29.9	50.3	59.7	3.4	32.9	3.4
Internal Link Dist (m)		56.0	122.1	8.1		103.6	
Turn Bay Length (m)	30.0						
Base Capacity (vph)	149	614	1025	1405	888	1102	879
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.41	0.29	0.65	0.70	0.05	0.53	0.05

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
4: Carlton & Spring Garden

With Development PM Peak
2016-08-16



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↔			↔↔			↔			↔	
Traffic Volume (veh/h)	10	297	44	37	535	5	62	5	52	10	5	20
Future Volume (Veh/h)	10	297	44	37	535	5	62	5	52	10	5	20
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	323	48	40	582	5	67	5	57	11	5	22
Pedestrians					66			34			122	
Lane Width (m)					3.6			3.6			3.6	
Walking Speed (m/s)					1.2			1.2			1.2	
Percent Blockage					6			3			10	
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (m)		146			150							
pX, platoon unblocked	0.95						0.95	0.95		0.95	0.95	0.95
vC, conflicting volume	709			405			798	1192	286	1096	1214	416
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	581			405			676	1091	286	989	1114	272
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			96			74	97	91	91	97	96
cM capacity (veh/h)	841			1118			256	168	653	125	163	618
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	172	210	331	296	129	38						
Volume Left	11	0	40	0	67	11						
Volume Right	0	48	0	5	57	22						
cSH	841	1700	1118	1700	341	247						
Volume to Capacity	0.01	0.12	0.04	0.17	0.38	0.15						
Queue Length 95th (m)	0.3	0.0	0.9	0.0	13.7	4.3						
Control Delay (s)	0.7	0.0	1.3	0.0	21.9	22.2						
Lane LOS	A		A		C	C						
Approach Delay (s)	0.3		0.7		21.9	22.2						
Approach LOS					C	C						
Intersection Summary												
Average Delay			3.6									
Intersection Capacity Utilization			52.7%		ICU Level of Service				A			
Analysis Period (min)			15									

Timings
5: Summer & Spring Garden

With Development PM Peak
2016-08-16

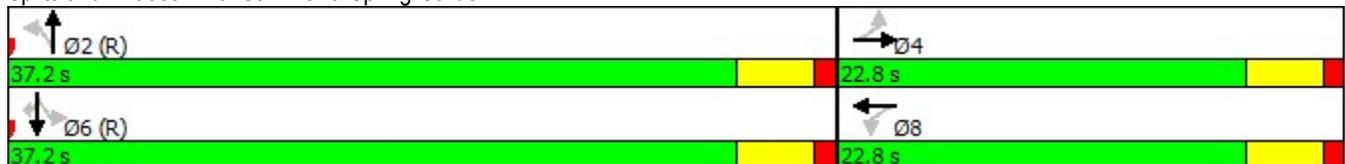


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations		↕↕		↕↕		↕↕		↕	↗
Traffic Volume (vph)	68	262	10	333	116	390	54	118	128
Future Volume (vph)	68	262	10	333	116	390	54	118	128
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA	Perm
Protected Phases		4		8		2		6	
Permitted Phases	4		8		2		6		6
Detector Phase	4	4	8	8	2	2	6	6	6
Switch Phase									
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5
Total Split (s)	22.8	22.8	22.8	22.8	37.2	37.2	37.2	37.2	37.2
Total Split (%)	38.0%	38.0%	38.0%	38.0%	62.0%	62.0%	62.0%	62.0%	62.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)		0.0		0.0		0.0		0.0	0.0
Total Lost Time (s)		4.5		4.5		4.5		4.5	4.5
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	Max								
Act Effct Green (s)		18.3		18.3		32.7		32.7	32.7
Actuated g/C Ratio		0.30		0.30		0.54		0.54	0.54
v/c Ratio		0.44		0.37		0.63		0.24	0.15
Control Delay		23.4		17.6		13.3		8.1	1.9
Queue Delay		0.0		0.0		0.0		0.0	0.0
Total Delay		23.4		17.6		13.3		8.1	1.9
LOS		C		B		B		A	A
Approach Delay		23.4		17.6		13.3		5.5	
Approach LOS		C		B		B		A	

Intersection Summary

Cycle Length: 60
 Actuated Cycle Length: 60
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 55
 Control Type: Pretimed
 Maximum v/c Ratio: 0.63
 Intersection Signal Delay: 15.1
 Intersection LOS: B
 Intersection Capacity Utilization 65.3%
 ICU Level of Service C
 Analysis Period (min) 15

Splits and Phases: 5: Summer & Spring Garden



Queues
5: Summer & Spring Garden

With Development PM Peak
2016-08-16



Lane Group	EBT	WBT	NBT	SBT	SBR
Lane Group Flow (vph)	391	376	563	187	139
v/c Ratio	0.44	0.37	0.63	0.24	0.15
Control Delay	23.4	17.6	13.3	8.1	1.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	23.4	17.6	13.3	8.1	1.9
Queue Length 50th (m)	22.0	17.6	40.3	10.2	0.0
Queue Length 95th (m)	34.5	28.1	69.8	19.9	6.2
Internal Link Dist (m)	125.6	70.4	44.3	45.0	
Turn Bay Length (m)					20.0
Base Capacity (vph)	879	1014	896	788	925
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	0.44	0.37	0.63	0.24	0.15

Intersection Summary

