

APRIL 16, 2018

REFER TO FILE: 1351-4559

VIA EMAIL:

JOEL.DOHERTY@HIPDEVELOPMENTS.COM

2422409 Ontario Inc.
C/o Hip Developments Inc.
700 Rupert Street, Unit A
Waterloo, ON N2V 2B5

Attention: Joel Doherty

**RE: ADDENDUM TRAFFIC LETTER
70 KING STREET NORTH,
CITY OF WATERLOO**

Dear Joel,

Pursuant to your request for transportation analysis regarding the proposed mixed-use residential/commercial development at 70 King Street North, in the City of Waterloo. This addendum traffic letter has been composed to acknowledge the changes to the proposed development per the latest site dated, March 28th, 2018. Additionally, this letter addresses the City of Waterloo comments that was obtained from Hip Developments via email correspondence between Joel Doherty (Hip Developments) and Aaron Wignall (Crozier Consulting Engineers) on, March 28th, 2018.

This study reviews the development plan from a transportation engineering perspective and has been completed in accordance with the procedures set out in the Region of Waterloo Transportation Impact Study Guidelines with the associated analysis and findings outlined herein. The main aspects reviewed in this letter are:

- A summary of the 2017 existing and 2022 future background traffic operations as captured in the original Traffic Impact Study (TIS) for this development, dated November 2017
- Highlights of future road improvements for the boundary road network
- A comparative analysis of the traffic impact forecast due the changes within the new site plan as opposed to the previous site plan used for analysis in the original TIS
- The traffic operations of the intersection of Erb Street East at Regina Street with and without the proposed development under 2022 future background traffic and total traffic conditions

PROJECT PROPOSAL

The subject property (70 King Street North) is located in the north-east quadrant of the King Street North at Bridgeport Road intersection. The subject land is bounded by Bridgeport Road to the north, King Street to the west, Regina Street to the east and a commercial development to the south. Refer to **Figure 1** for the Site location.

The project proposal is for two residential high-rise towers with a common 7-storey podium. Excluding pent floors, tower-A is 11 floors including podium (with 82 condominium units) and tower-B is 22 floors including podium (with 239 condominium units). The commercial uses within the podium are 325.2 m² Gross Floor Area (GFA) of retail space, and 3,692.9 m² GFA for a use classified as "Launch". Per documents provided by Hip development highlighting specifics of the "Launch", it is expected to be an arena of creativity for youth development. Refer to **Figure 2** for the Site Plan Concept prepared by Martin Simmons Architects, dated March 28th, 2018.

TRAFFIC OPERATIONS AT STUDY INTERSECTIONS

The original TIS dated November 2017, studied five boundary intersections which were scoped in consultation with the City of Waterloo and Region of Waterloo. Based on the analysis completed in the original TIS the following conclusions were established regarding operations under the 2017 existing, 2022 future background, and 2022 total traffic conditions:

- Under 2017 existing conditions, all of the study intersections (except Erb Street East at Regina Street) operate at Levels of Service "C" or better during a.m. and p.m. peak hours
- The intersection of Erb Street East at Regina Street operates at a Level of Service "C" and "E" during the weekday a.m. and p.m. peak hours respectively under 2017 existing conditions
- Operations under the 2022 future background was projected to maintain similar levels of service as the 2017 existing operations
- Under 2022 total traffic conditions, the study intersections were projected to operate at levels of service similar to that of the 2022 future background except for the intersection of Erb Street East at Regina Street
- The intersection of Erb Street East at Regina Street is projected to operate at a Level of Service "D" and "F" during the weekday a.m. and p.m. peak hours, respectively

FUTURE ROAD IMPROVEMENTS

A Light-Rail-Transit (LRT) system is currently being implemented along King Street South. Preliminary drawings were available on the Region of Waterloo Website. King Street South will maintain a four-lane cross-section, however two lanes will be allocated to vehicular traffic (one lane per direction) and the two centre lanes will be allocated to the LRT.

COMPARATIVE TRAFFIC IMPACTS

Given the changes to the proposed development as captured in the latest site, the trips generated by the entire development have been recalculated using the Institute of Transportation Engineers (ITE) Trip Generation Manual, 9th Edition. Similar to the original TIS, land used category (LUC) 232 "High-Rise Condominium/Townhouse", was used for the residential units; LUC 820 "Shopping Centre"

was applied to the retail space; and LUC 580 “Museum” was assumed most appropriate for the Launch. **Table 1** summarizes the trips generated by the development based on ITE data.

Table 1: ITE Site Generated Trips

Type of Use	Number of Units or GFA	Peak Hour	Trips per Unit or GFA	In	Out	Total
High-Rise Residential Condominium/Townhouse (LUC 232)	321 Units	Weekday A.M.	Fitted Curve Equation	23 (19%)	99 (81%)	122
		Weekday P.M.	Fitted Curve Equation	77 (62%)	48 (38%)	125
Launch (LUC 580: Museum)	39,500 ft ² (3,692.9 m ²)	Weekday A.M.	0.28/ 1000 ft ²	9 (86%)	2 (14%)	11
		Weekday P.M.	0.18/ 1000 ft ²	1 (16%)	6 (84%)	7
Retail (LUC 820: Shopping Centre)	3,500 ft ² (325.2 m ²)	Weekday A.M.	Fitted Curve Equation	12 (62%)	8 (38%)	20
		Weekday P.M.	Fitted Curve Equation	30 (48%)	33 (52%)	63
Total		Weekday A.M.		44	109	153
		Weekday P.M.		108	87	195

Table 2 below summarizes the trips per the previous site plan dated, October 19th, 2017 used for the original TIS.

Table 2: ITE Site Generated Trips per Original TIS

Type of Use	Number of Units or GFA	Peak Hour	Trips per Unit or GFA	In	Out	Total
High-Rise Residential Condominium/Townhouse (LUC 232)	263 Units	Weekday A.M.	Fitted Curve Equation	20	85	105
		Weekday P.M.	Fitted Curve Equation	65	40	105
General Office Building (LUC 710)	34,980 ft ² (3,249.7 m ²)	Weekday A.M.	0.28/ 1000 ft ²	73	10	83
		Weekday P.M.	0.18/ 1000 ft ²	20	98	118
Retail (LUC 820: Shopping Centre)	8,120 ft ² (754.4 m ²)	Weekday A.M.	Fitted Curve Equation	21	13	34
		Weekday P.M.	Fitted Curve Equation	69	42	111
Total		Weekday A.M.		114	108	222
		Weekday P.M.		154	180	334

Comparing **Tables 1 and 2**, the trips generated by the new site plan are substantially lower than what was used in the original TIS. **Table 3** shows that the trips produced based on the latest site plan are 69 trips and 139 trips less in the a.m. and p.m. peak hours respectively.

The analysis in the original TIS (with more trips) resulted in 2022 total traffic operations that were similar to the 2022 future background operations. The study intersections were projected to operate at Levels of service “C” or better for all movements except for the intersection of Erb Street East at

Regina Street. It is noted that the analysis in the original TIS were conservative as no reduction to account for pass-by trips or site synergy were applied.

Table 3: Comparison of Generated Trips

Type of Use	Peak Hour	Trips Generated per ITE Manual		
		Inbound	Outbound	Total
Previous Site plan (used for Original TIS)	Weekday A.M.	114	108	222
	Weekday P.M.	154	180	334
Latest Site Plan	Weekday A.M.	44	109	153
	Weekday P.M.	108	87	195

Given that, the analysis of the original TIS which has more trips compared to the latest site plan herein, could be accommodated by the boundary road network, the latest site plan trips can be accommodated by the boundary road network.

ERB STREET EAST AT REGINA STREET

The intersection of Erb Street at Regina Street North is operating at a level of service “E” during the p.m. peak with a high traffic demand on all approaches per analysis presented in the original TIS.

At intersections with high through volumes, left-turning vehicles waiting for gaps in the opposing traffic stream during a permissive phase may only be able to maneuver through the intersection during the intergreen period. This behavior is typically observed in urban environments at left-turn movements approaching capacity and was confirmed via observations of the video camera footage taken during the data collection.

In accounting for the increased capacity of left-turning vehicles at the intersections in the boundary road network, the Canadian Capacity Guide recommends that up to two passenger cars can be reasonably discharged during each inter-green period for permissive phases. The number of vehicles that are expected to discharge per intergreen period is determined by the following formula on page 3-20 in the Canadian Capacity Guide:

$$Q_{LTOI} = n * X_{LTOI}$$

Where:

Q_{LTOI} = left-turn flow on inter-green (pcu/hr)

n = number of cycles per hour

X_{LTOI} = average number of left-turn passenger car units per intergreen period (maximum, 2 assumed)

Left turning volumes were analyzed with a reduction in volumes when movements were found to experience a volume-to-capacity ratio in excess of 1.00 under existing, future background and future total scenarios.

In addition to the left-turn on intergreen adjustments, a lost time adjustment of -2.0 seconds was applied to left-turn and through movements to reflect observed aggressive driver behavior for left-turn and through movements experiencing heavy delays during the peak hours at the intersection of Erb Street at Regina.

Intersection Operations

Table 4 illustrates the operations of the intersection of Erb Street at Regina Street North upon applying the lost time and intergreen adjustments.

Table 4: Levels of Service

Analysis Scenario	Control	Peak Hour	Level of Service	Average Delay per Vehicle(s)	Max V/C Ratio & Ratio(s) > 0.75 (Approach)	95 th %ile Queues > Storage Length
Erb Street at Regina Street (2017 Existing Volumes)	Signalized	Week day A.M.	C	22.3 s	0.67 (EBT)	None
		Week day P.M.	E	58.6 s	0.90 (EBT)	None
Erb Street at Regina Street (2022 Future Background)	Stop	Week day A.M.	C	27.9 s	0.77 (EBT)	None
		Week day P.M.	E	58.9 s	0.93 (EBT)	None
Erb Street at Regina Street (2022 Total Volumes)	Stop	Week day A.M.	C	28.7 s	0.77 (EBT)	None
		Week day P.M.	E	59.3 s	0.94 (EBT)	None

Note: The Level of Service of a stop-controlled intersection is based on the delay associated with the critical minor road approach.

As presented in **Table 4**, the intersection of Erb Street at Regina Street North under 2022 total traffic volumes is projected to operate at the same level of service as the existing conditions.

Conclusion

This letter has compared the trips generated by the latest site plan for the mixed-use residential commercial development at 70 King Street North, in the City of Waterloo to the trips used in the original TIS (dated November 2017). Additionally, the letter re-analyzes the intersection of Erb Street at Regina based on the latest site plan and further applying a less conservative analysis approach which is representative of typical driver behaviour at the intersection.

The anticipated trips produced based on the latest site plan are 69 trips and 139 trips less in the a.m. and p.m. peak hours respectively compared to the previous TIS. Given that, the study intersections presented in the original TIS (except for Erb Street at Regina Street) operated below capacity with acceptable levels of services, they are forecast to operate even better with the lower trips generated by the latest site plan.

The intersection of Erb Street at Regina Street under 2022 total traffic volumes is projected to operate with the same measures of effectiveness as under the 2017 existing and 2022 future background conditions.

The Zoning By-law Amendment to the site development application can be supported from a traffic operations perspective as the site generated traffic can be accommodated by the boundary roadway system.

Respectfully submitted by,

C.F. CROZIER & ASSOCIATES INC.



Peter Apasnore MASC., E.I.T.
Transportation

C.F. CROZIER & ASSOCIATES INC.



R. Aaron Wignall
Project Manager, Transportation

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FIGURES



70 KING STREET NORTH
CITY OF WATERLOO

SITE LOCATION



**CROZIER
& ASSOCIATES**
Consulting Engineers

2800 High Point Drive
Suite 100
Milton, ON L9T 6P4
905 875-0026 T
905 875-4915 F
www.cfcrozier.ca

Drawn	J.K.	Design	J.K.	Project No.	1351-4559	
Check	R.A.W.	Check	R.A.W.	Scale	N.T.S	Dwg. FIG. 01

UPTOWN POST LANDS

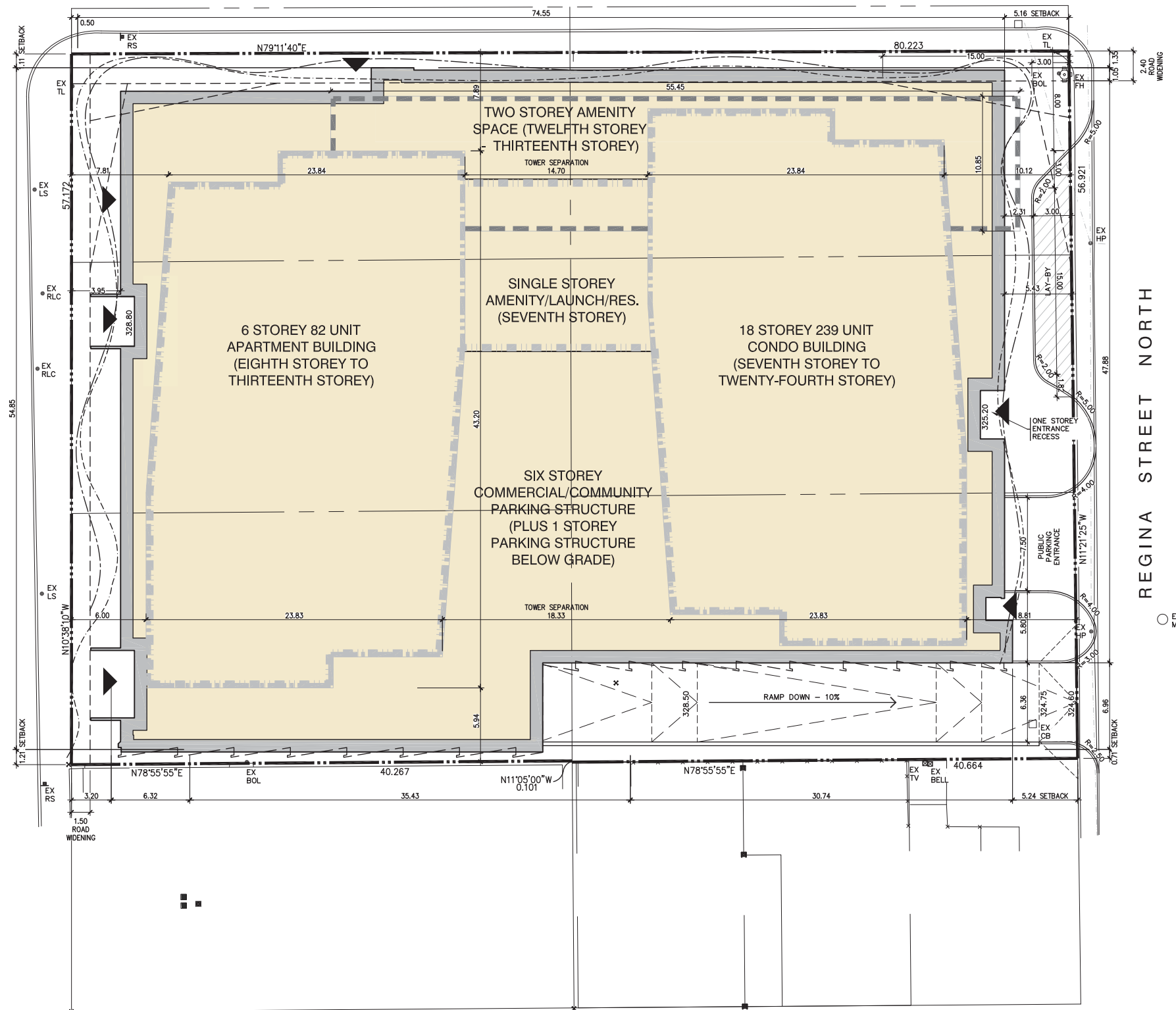
70 King St. N, Waterloo ON
March 28, 2018
1:400

BRIDGEPORT ROAD EAST

KING STREET NORTH

REGINA STREET NORTH

PRINCESS STREET EAST



BUILDING LINE LEGEND:

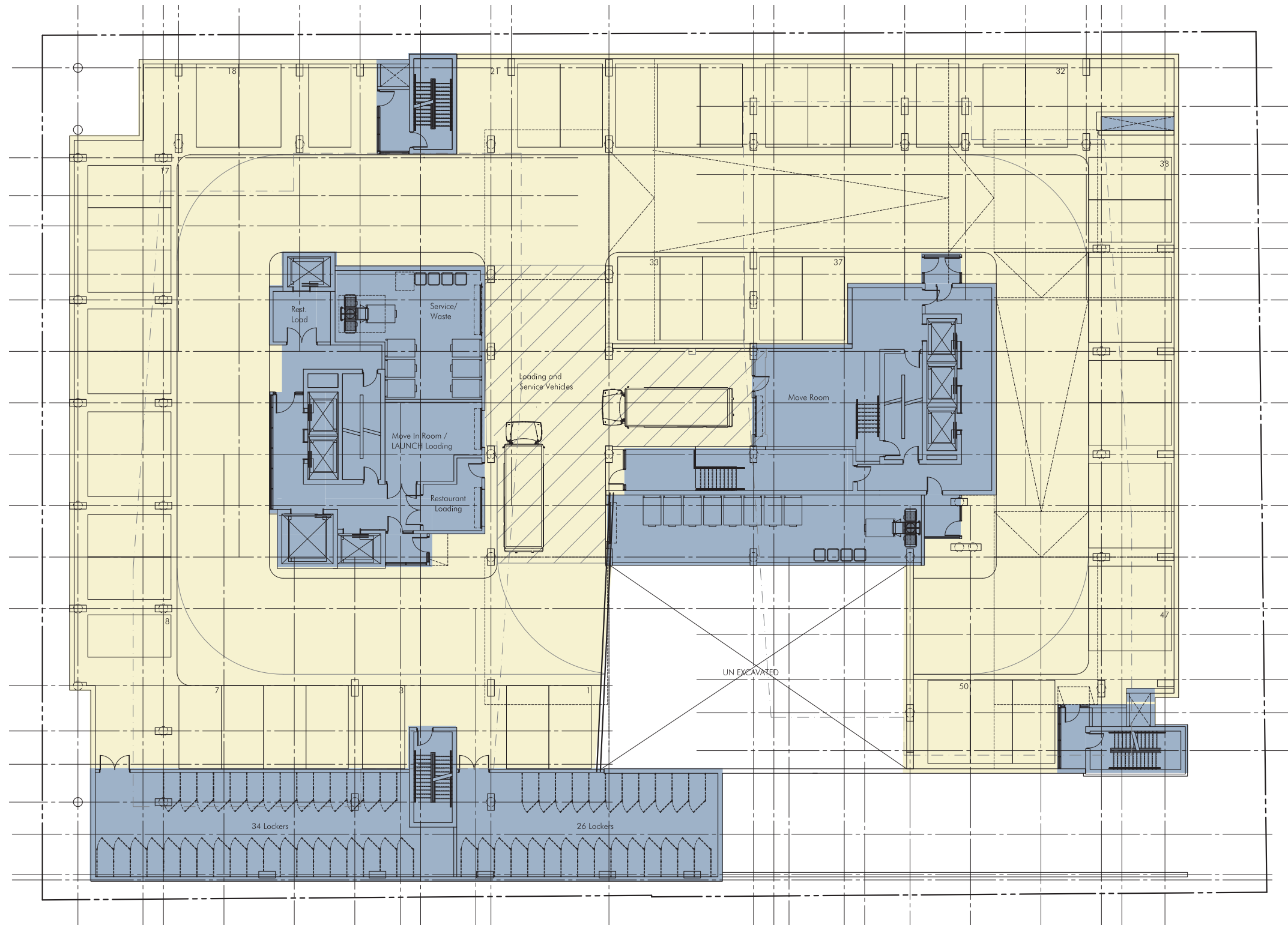
- BUILDING FOOTPRINT AT FIRST FLOOR (GRADE LEVEL) - SECOND FLOOR SIMILAR
- GLASS RIBBON AT 3RD FLOOR
- GLASS RIBBON AT 7TH FLOOR
- BUILDING FOOTPRINT AT SEVENTH FLOOR (AMENITY/LAUNCH/RES. LEVEL)
- 6 STOREY/18 STOREY APARTMENT BUILDING TYPICAL FLOOR FOOTPRINT
- BUILDING FOOTPRINT OF BAR TWELFTH - THIRTEENTH

SITE PLAN

MARTIN SIMMONS
ARCHITECTS

UPTOWN POST LANDS

70 King St. N, Waterloo ON
 March 28, 2018
 1:300



LAUNCH Parking - Level P1

Podium Data

Level	Gross	LAUNCH Rest.	Retail	Amty.	Total
P1	31,870	-	-	-	47
L1	39,340	3,500	3,500	1,580	29 (22/9)
L2	39,340	-	-	-	53
L3	41,590	9,500	-	-	53
L4	40,850	9,500	-	-	53
L5	40,850	9,500	-	-	53
L6	12,100	-	-	-	20
L7	22,970	7,750	-	5,125	-
Total	268,910	39,750	3,500	6,705	308

	Residential	Prkg. Req.	Prkg. Prov.
(1.25/unit)	401	252 (.8/unit)	
Non-Res.			
LAUNCH (3.5/100m²)	129	56 (1.5/100m²)	
Rest./Retail (3.5/100m²)	12	-	
Total		542	308

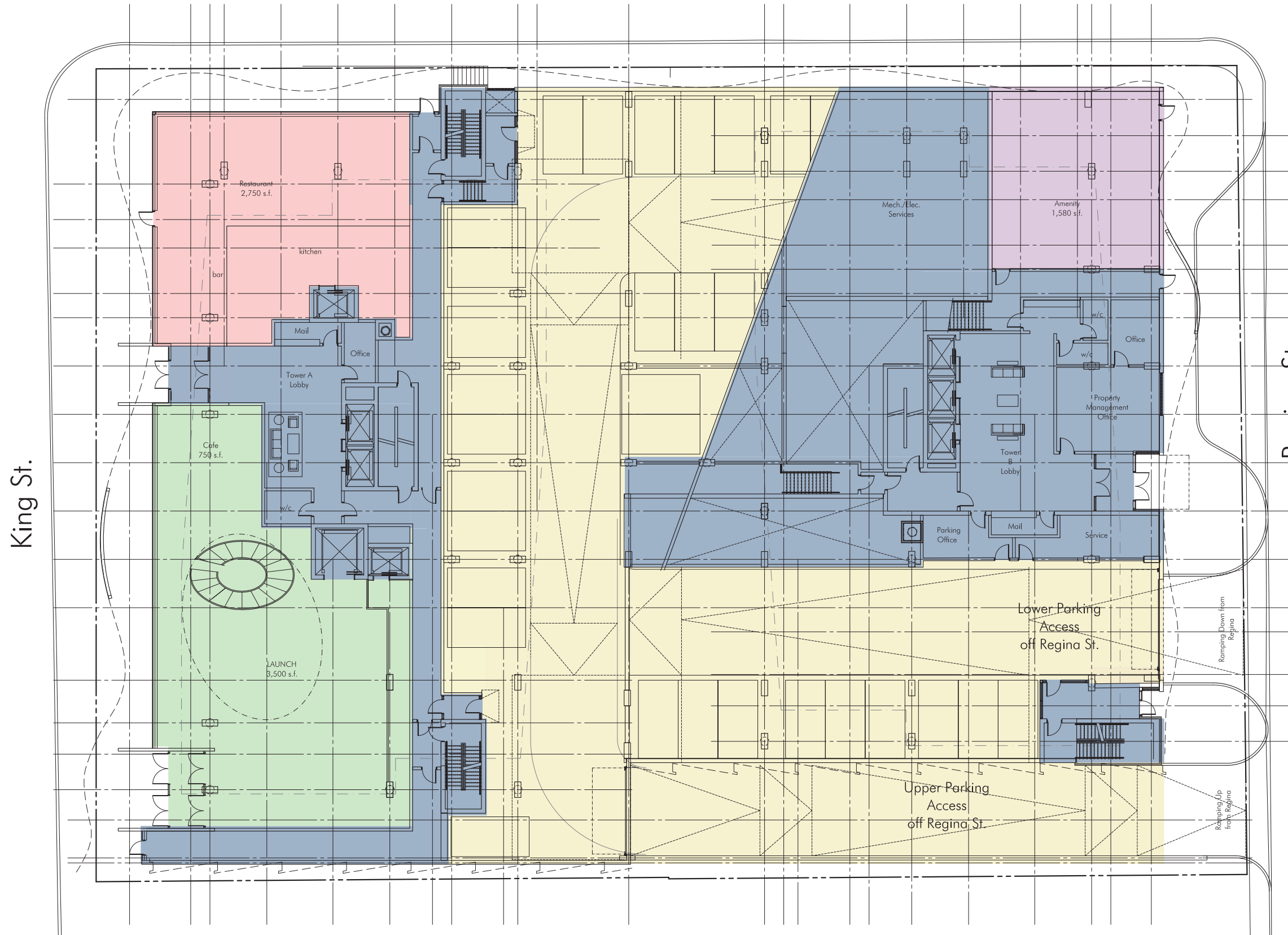
Tower Data

Tower A				Tower B								
Level	Gross	Res. Units	St	1B	2B	Level	Gross	Res. Units	Amty	St	1B	2B
L7						L7	6,250	6,250	-	1	6	2
L8	9,980	8,420	2	10	2	L8	9,900	8,420	-	2	10	2
L9	9,980	8,420	2	10	2	L9	9,900	8,420	-	2	10	2
L10	9,980	8,420	2	10	2	L10	9,900	8,420	-	2	10	2
L11	9,980	8,420	2	10	2	L11	9,900	8,420	-	2	10	2
L12	9,245	7,640	1	11	1	L12	13,400	6,340	5,700	1	7	2
L13	9,245	7,640	1	11	1	L13	7,700	6,340	-	1	7	2
Pent	7,140	-	-	-	-	L14	9,900	8,420	-	2	10	2
						L15	9,900	8,420	-	2	10	2
Total	65,550		10	62	10	L16	9,900	8,420	-	2	10	2
Total Units			82			L17	9,900	8,420	-	2	10	2
Total Beds			92			L18	9,900	8,420	-	2	10	2
						L19	9,900	8,420	-	2	10	2
						L20	9,900	8,420	-	2	10	2
						L21	9,900	8,420	-	2	10	2
						L22	9,900	8,420	-	2	10	2
						L23	9,900	8,420	-	2	10	2
						L24	9,900	8,420	-	2	10	2
						Pent	7,050	-	-	-	-	-
*150 Storage												
Lockers Provided						Total	176,750			33	170	36
						Total Units				239		
						Total Beds				275		

total Gross 242,200 Total Units 321 Total Beds 367 Beds/Hect. 805
 (max. Beds/Hect.750)

UPTOWN POST LANDS

70 King St. N, Waterloo ON
 March 28, 2018
 1:300



Ground Floor - Level 1

Podium Data

Level	Gross	LAUNCH Rest.	Retail	Amty.	Total
P1	31,870	-	-	-	47
L1	39,340	3,500	3,500	1,580	29 (22/9)
L2	39,340	-	-	-	53
L3	41,590	9,500	-	-	53
L4	40,850	9,500	-	-	53
L5	40,850	9,500	-	-	53
L6	12,100	-	-	-	20
L7	22,970	7,750	-	5,125	-
Total	268,910	39,750	3,500	6,705	308

	Prkg. Req.	Prkg. Prov.
Residential (1.25/unit)	401	252 (.8/unit)
Non-Res.		
LAUNCH (3.5/100m²)	129	56 (1.5/100m²)
Rest./Retail (3.5/100m²)	12	-
Total	542	308

Tower Data

Tower A				Tower B								
Level	Gross	Res. Units	St	1B	2B	Level	Gross	Res. Units	Amty	St	1B	2B
L7						L7	6,250	6,250	-	1	6	2
L8	9,980	8,420	2	10	2	L8	9,900	8,420	-	2	10	2
L9	9,980	8,420	2	10	2	L9	9,900	8,420	-	2	10	2
L10	9,980	8,420	2	10	2	L10	9,900	8,420	-	2	10	2
L11	9,980	8,420	2	10	2	L11	9,900	8,420	-	2	10	2
L12	9,245	7,640	1	11	1	L12	13,400	6,340	5,700	1	7	2
L13	9,245	7,640	1	11	1	L13	7,700	6,340	-	1	7	2
Pent	7,140	-	-	-	-	L14	9,900	8,420	-	2	10	2
						L15	9,900	8,420	-	2	10	2
Total	65,550		10	62	10	L16	9,900	8,420	-	2	10	2
Total Units						L17	9,900	8,420	-	2	10	2
Total Beds						L18	9,900	8,420	-	2	10	2
						L19	9,900	8,420	-	2	10	2
						L20	9,900	8,420	-	2	10	2
						L21	9,900	8,420	-	2	10	2
						L22	9,900	8,420	-	2	10	2
						L23	9,900	8,420	-	2	10	2
						L24	9,900	8,420	-	2	10	2
						Pent	7,050	-	-	-	-	-

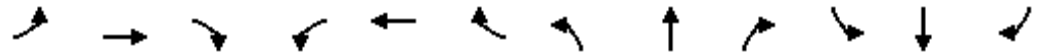
*150 Storage Lockers Provided	Total 176,750	33	170	36
		Total Units	239	
		Total Beds	275	

total Gross 242,200 Total Units 321 Total Beds 367 Beds/Hect. 805
 (max. Beds/Hect.750)

ATTACHMENTS

Lanes, Volumes, Timings
 14: Regina St.S/Regina St.N & Erb St. E/Erb St E

2017 Existing AM
 04/16/2018



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑						↑	↗		↖	
Traffic Volume (vph)	111	880	120	0	0	0	0	64	41	17	260	0
Future Volume (vph)	111	880	120	0	0	0	0	64	41	17	260	0
Ideal Flow (vphpl)	1735	1735	1735	1000	1000	1000	1775	1900	1750	1650	1650	1650
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Lane Util. Factor	0.91	0.91	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.99							0.97		1.00	
Frt		0.984							0.850			
Flt Protected		0.995									0.997	
Satd. Flow (prot)	0	4414	0	0	0	0	0	1842	1471	0	1607	0
Flt Permitted		0.995									0.988	
Satd. Flow (perm)	0	4400	0	0	0	0	0	1842	1424	0	1590	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		32							95			
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		91.6			402.5			82.6			181.0	
Travel Time (s)		6.6			29.0			5.9			13.0	
Confl. Peds. (#/hr)	25		12	12		25	20		24	24		20
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	9%	3%	2%	0%	0%	0%	0%	2%	0%	5%	1%	0%
Adj. Flow (vph)	123	978	133	0	0	0	0	71	46	19	289	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1234	0	0	0	0	0	71	46	0	308	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	1.14	1.14	1.14	2.20	2.20	2.20	1.11	1.01	1.13	1.21	1.21	1.21
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Turn Type	Perm	NA						NA	Perm	pm+pt	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4								2	6		
Minimum Split (s)	37.0	37.0						34.0	34.0	8.5	40.0	
Total Split (s)	37.0	37.0						34.0	34.0	9.0	43.0	
Total Split (%)	46.3%	46.3%						42.5%	42.5%	11.3%	53.8%	
Maximum Green (s)	31.0	31.0						28.0	28.0	5.0	37.0	
Yellow Time (s)	4.0	4.0						4.0	4.0	4.0	4.0	
All-Red Time (s)	2.0	2.0						2.0	2.0	0.0	2.0	
Lost Time Adjust (s)		-2.0						-2.0	0.0		-2.0	
Total Lost Time (s)		4.0						4.0	6.0		4.0	
Lead/Lag								Lag	Lag	Lead		
Lead-Lag Optimize?								Yes	Yes	Yes		
Walk Time (s)	24.0	24.0						23.0	23.0		23.0	
Flash Dont Walk (s)	7.0	7.0						5.0	5.0		5.0	
Pedestrian Calls (#/hr)	0	0						0	0		0	
Act Effct Green (s)		33.0						30.0	28.0		39.0	
Actuated g/C Ratio		0.41						0.38	0.35		0.49	

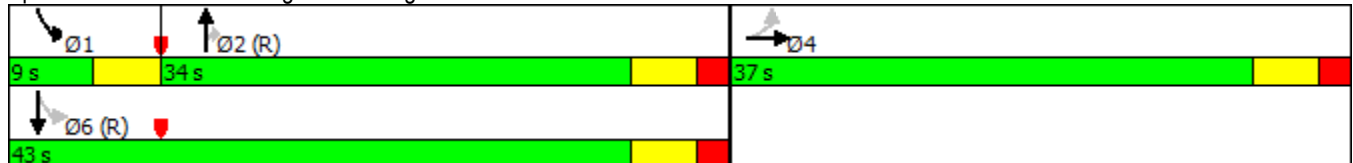


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
v/c Ratio		0.67						0.10	0.08			0.40
Control Delay		20.8						16.9	0.9			15.0
Queue Delay		4.4						0.0	0.0			0.0
Total Delay		25.2						16.9	0.9			15.0
LOS		C						B	A			B
Approach Delay		25.2						10.6				15.0
Approach LOS		C						B				B

Intersection Summary

Area Type:	Other
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle:	80
Control Type:	Pretimed
Maximum v/c Ratio:	0.67
Intersection Signal Delay:	22.3
Intersection LOS:	C
Intersection Capacity Utilization	84.2%
ICU Level of Service	E
Analysis Period (min)	15

Splits and Phases: 14: Regina St.S/Regina St.N & Erb St. E/Erb St E



Lanes, Volumes, Timings
14: Regina St.S/Regina St.N & Erb St E

2022 FB AM
04/16/2018



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕↕						↑	↗		↖	
Traffic Volume (vph)	114	902	123	0	0	0	0	71	45	24	287	0
Future Volume (vph)	114	902	123	0	0	0	0	71	45	24	287	0
Ideal Flow (vphpl)	1735	1735	1735	1000	1000	1000	1775	1900	1750	1650	1650	1650
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Lane Util. Factor	0.91	0.91	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.99							0.97		1.00	
Frt		0.984							0.850			
Flt Protected		0.995									0.996	
Satd. Flow (prot)	0	3973	0	0	0	0	0	1658	1324	0	1444	0
Flt Permitted		0.995									0.981	
Satd. Flow (perm)	0	3960	0	0	0	0	0	1658	1281	0	1420	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		32							95			
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		91.6			402.5			82.6			181.0	
Travel Time (s)		6.6			29.0			5.9			13.0	
Confl. Peds. (#/hr)	25		12	12		25	20		24	24		20
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	9%	3%	2%	0%	0%	0%	0%	2%	0%	5%	1%	0%
Adj. Flow (vph)	127	1002	137	0	0	0	0	79	50	27	319	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1266	0	0	0	0	0	79	50	0	346	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	1.30	1.30	1.30	2.48	2.48	2.48	1.26	1.16	1.29	1.38	1.38	1.38
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Turn Type	Perm	NA						NA	Perm	pm+pt	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4								2	6		
Minimum Split (s)	37.0	37.0						34.0	34.0	8.5	40.0	
Total Split (s)	37.0	37.0						34.0	34.0	9.0	43.0	
Total Split (%)	46.3%	46.3%						42.5%	42.5%	11.3%	53.8%	
Maximum Green (s)	31.0	31.0						28.0	28.0	5.0	37.0	
Yellow Time (s)	4.0	4.0						4.0	4.0	4.0	4.0	
All-Red Time (s)	2.0	2.0						2.0	2.0	0.0	2.0	
Lost Time Adjust (s)		-2.0						-2.0	0.0		-2.0	
Total Lost Time (s)		4.0						4.0	6.0		4.0	
Lead/Lag								Lag	Lag	Lead		
Lead-Lag Optimize?								Yes	Yes	Yes		
Walk Time (s)	24.0	24.0						23.0	23.0		23.0	
Flash Dont Walk (s)	7.0	7.0						5.0	5.0		5.0	
Pedestrian Calls (#/hr)	0	0						0	0		0	
Act Effct Green (s)		33.0						30.0	28.0		39.0	
Actuated g/C Ratio		0.41						0.38	0.35		0.49	

Lanes, Volumes, Timings
 14: Regina St.S/Regina St.N & Erb St E

2022 FB AM
 04/16/2018

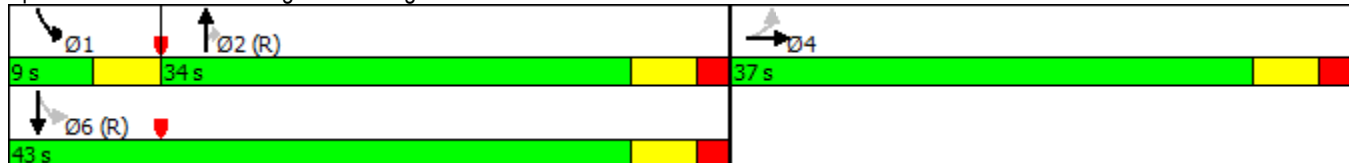


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
v/c Ratio		0.77						0.13	0.10			0.50
Control Delay		23.4						17.2	1.4			17.0
Queue Delay		9.1						0.0	0.0			0.0
Total Delay		32.6						17.2	1.4			17.0
LOS		C						B	A			B
Approach Delay		32.6						11.1				17.0
Approach LOS		C						B				B

Intersection Summary

Area Type:	CBD
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle:	80
Control Type:	Pretimed
Maximum v/c Ratio:	0.77
Intersection Signal Delay:	27.9
Intersection Capacity Utilization	85.8%
Analysis Period (min)	15
Intersection LOS:	C
ICU Level of Service	E

Splits and Phases: 14: Regina St.S/Regina St.N & Erb St E



Lanes, Volumes, Timings
14: Regina St.S/Regina St.N & Erb St E

2022 Total AM
04/16/2018



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕↕						↑	↗		↖	
Traffic Volume (vph)	121	902	123	0	0	0	0	75	45	51	322	0
Future Volume (vph)	121	902	123	0	0	0	0	75	45	51	322	0
Ideal Flow (vphpl)	1735	1735	1735	1000	1000	1000	1775	1900	1750	1650	1650	1650
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Lane Util. Factor	0.91	0.91	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.99							0.97		1.00	
Frt		0.984							0.850			
Flt Protected		0.995									0.993	
Satd. Flow (prot)	0	3972	0	0	0	0	0	1658	1324	0	1436	0
Flt Permitted		0.995									0.955	
Satd. Flow (perm)	0	3958	0	0	0	0	0	1658	1281	0	1378	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		32							95			
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		91.6			402.5			82.6			181.0	
Travel Time (s)		6.6			29.0			5.9			13.0	
Confl. Peds. (#/hr)	25		12	12		25	20		24	24		20
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	9%	3%	2%	0%	0%	0%	0%	2%	0%	5%	1%	0%
Adj. Flow (vph)	134	1002	137	0	0	0	0	83	50	57	358	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1273	0	0	0	0	0	83	50	0	415	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	1.30	1.30	1.30	2.48	2.48	2.48	1.26	1.16	1.29	1.38	1.38	1.38
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Turn Type	Perm	NA						NA	Perm	pm+pt	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4								2	6		
Minimum Split (s)	37.0	37.0						34.0	34.0	8.5	40.0	
Total Split (s)	37.0	37.0						34.0	34.0	9.0	43.0	
Total Split (%)	46.3%	46.3%						42.5%	42.5%	11.3%	53.8%	
Maximum Green (s)	31.0	31.0						28.0	28.0	5.0	37.0	
Yellow Time (s)	4.0	4.0						4.0	4.0	4.0	4.0	
All-Red Time (s)	2.0	2.0						2.0	2.0	0.0	2.0	
Lost Time Adjust (s)		-2.0						-2.0	0.0		-2.0	
Total Lost Time (s)		4.0						4.0	6.0		4.0	
Lead/Lag								Lag	Lag	Lead		
Lead-Lag Optimize?								Yes	Yes	Yes		
Walk Time (s)	24.0	24.0						23.0	23.0		23.0	
Flash Dont Walk (s)	7.0	7.0						5.0	5.0		5.0	
Pedestrian Calls (#/hr)	0	0						0	0		0	
Act Effct Green (s)		33.0						30.0	28.0		39.0	
Actuated g/C Ratio		0.41						0.38	0.35		0.49	

Lanes, Volumes, Timings
 14: Regina St.S/Regina St.N & Erb St E

2022 Total AM
 04/16/2018



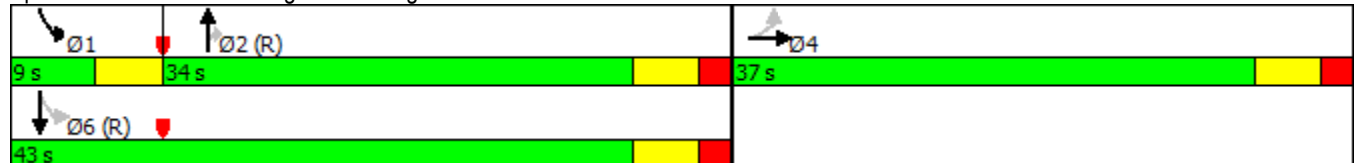
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
v/c Ratio		0.77						0.13	0.10			0.61
Control Delay		23.6						17.3	1.4			19.8
Queue Delay		9.8						0.0	0.0			0.0
Total Delay		33.4						17.3	1.4			19.8
LOS		C						B	A			B
Approach Delay		33.4						11.3				19.8
Approach LOS		C						B				B

Intersection Summary

Area Type: CBD
 Cycle Length: 80
 Actuated Cycle Length: 80
 Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
 Natural Cycle: 80
 Control Type: Pretimed
 Maximum v/c Ratio: 0.77
 Intersection Signal Delay: 28.7
 Intersection Capacity Utilization 88.0%
 Analysis Period (min) 15

Intersection LOS: C
 ICU Level of Service E

Splits and Phases: 14: Regina St.S/Regina St.N & Erb St E



Lanes, Volumes, Timings
 14: Regina St.S/Regina St.N & Erb St. E/Erb St E

2017 Existing PM
 04/16/2018



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑						↑	↗		↖	
Traffic Volume (vph)	84	1186	87	0	0	0	0	195	149	79	162	0
Future Volume (vph)	84	1186	87	0	0	0	0	195	149	79	162	0
Ideal Flow (vphpl)	1735	1735	1735	1000	1000	1000	1775	1900	1750	1650	1650	1650
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Lane Util. Factor	0.91	0.91	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.99							0.96		0.99	
Frt		0.990							0.850			
Flt Protected		0.997									0.984	
Satd. Flow (prot)	0	4041	0	0	0	0	0	1691	1324	0	1435	0
Flt Permitted		0.997									0.843	
Satd. Flow (perm)	0	4026	0	0	0	0	0	1691	1276	0	1223	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		16							126			
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		91.6			402.5			82.6			181.0	
Travel Time (s)		6.6			29.0			5.9			13.0	
Confl. Peds. (#/hr)	48		26	26		48	23		29	29		23
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	14%	2%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%
Adj. Flow (vph)	93	1318	97	0	0	0	0	217	166	88	180	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1508	0	0	0	0	0	217	166	0	268	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	1.30	1.30	1.30	2.48	2.48	2.48	1.26	1.16	1.29	1.38	1.38	1.38
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Turn Type	Perm	NA						NA	Perm	pm+pt	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4								2	6		
Minimum Split (s)	37.0	37.0						34.0	34.0	8.5	40.0	
Total Split (s)	37.0	37.0						34.0	34.0	9.0	43.0	
Total Split (%)	46.3%	46.3%						42.5%	42.5%	11.3%	53.8%	
Maximum Green (s)	31.0	31.0						28.0	28.0	5.0	37.0	
Yellow Time (s)	4.0	4.0						4.0	4.0	4.0	4.0	
All-Red Time (s)	2.0	2.0						2.0	2.0	0.0	2.0	
Lost Time Adjust (s)		-2.0						-2.0	0.0		-2.0	
Total Lost Time (s)		4.0						4.0	6.0		4.0	
Lead/Lag								Lag	Lag	Lead		
Lead-Lag Optimize?								Yes	Yes	Yes		
Walk Time (s)	24.0	24.0						23.0	23.0		23.0	
Flash Dont Walk (s)	7.0	7.0						5.0	5.0		5.0	
Pedestrian Calls (#/hr)	0	0						0	0		0	
Act Effct Green (s)		33.0						30.0	28.0		39.0	
Actuated g/C Ratio		0.41						0.38	0.35		0.49	

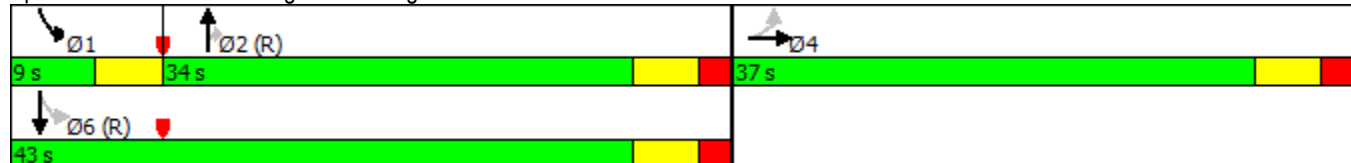


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
v/c Ratio		0.90						0.34	0.31		0.44	
Control Delay		31.0						19.9	7.8		15.9	
Queue Delay		46.3						0.0	0.0		0.0	
Total Delay		77.3						19.9	7.8		15.9	
LOS		E						B	A		B	
Approach Delay		77.3						14.6			15.9	
Approach LOS		E						B			B	

Intersection Summary

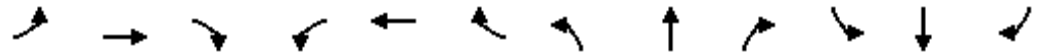
Area Type:	CBD
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	9 (11%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle:	80
Control Type:	Pretimed
Maximum v/c Ratio:	0.90
Intersection Signal Delay:	58.6
Intersection Capacity Utilization	91.3%
Analysis Period (min)	15
Intersection LOS:	E
ICU Level of Service	F

Splits and Phases: 14: Regina St.S/Regina St.N & Erb St. E/Erb St E



Lanes, Volumes, Timings
 14: Regina St.S/Regina St.N & Erb St. E/Erb St E

2022 FB PM
 04/16/2018



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕↕						↑	↗		↖	
Traffic Volume (vph)	86	1216	89	0	0	0	0	215	165	97	179	0
Future Volume (vph)	86	1216	89	0	0	0	0	215	165	97	179	0
Ideal Flow (vphpl)	1735	1735	1735	1000	1000	1000	1775	1900	1750	1650	1650	1650
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Lane Util. Factor	0.91	0.91	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.99							0.96		0.99	
Frt		0.990							0.850			
Flt Protected		0.997									0.983	
Satd. Flow (prot)	0	4041	0	0	0	0	0	1691	1324	0	1434	0
Flt Permitted		0.997									0.783	
Satd. Flow (perm)	0	4025	0	0	0	0	0	1691	1276	0	1136	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		16							116			
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		91.6			402.5			82.6			181.0	
Travel Time (s)		6.6			29.0			5.9			13.0	
Confl. Peds. (#/hr)	48		26	26		48	23		29	29		23
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	14%	2%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%
Adj. Flow (vph)	96	1351	99	0	0	0	0	239	183	108	199	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1546	0	0	0	0	0	239	183	0	307	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	1.30	1.30	1.30	2.48	2.48	2.48	1.26	1.16	1.29	1.38	1.38	1.38
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Turn Type	Perm	NA						NA	Perm	pm+pt	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4								2	6		
Minimum Split (s)	37.0	37.0						34.0	34.0	8.5	40.0	
Total Split (s)	37.0	37.0						34.0	34.0	9.0	43.0	
Total Split (%)	46.3%	46.3%						42.5%	42.5%	11.3%	53.8%	
Maximum Green (s)	31.0	31.0						28.0	28.0	5.0	37.0	
Yellow Time (s)	4.0	4.0						4.0	4.0	4.0	4.0	
All-Red Time (s)	2.0	2.0						2.0	2.0	0.0	2.0	
Lost Time Adjust (s)		-2.0						-2.0	0.0		-2.0	
Total Lost Time (s)		4.0						4.0	6.0		4.0	
Lead/Lag								Lag	Lag	Lead		
Lead-Lag Optimize?								Yes	Yes	Yes		
Walk Time (s)	24.0	24.0						23.0	23.0		23.0	
Flash Dont Walk (s)	7.0	7.0						5.0	5.0		5.0	
Pedestrian Calls (#/hr)	0	0						0	0		0	
Act Effct Green (s)		33.0						30.0	28.0		39.0	
Actuated g/C Ratio		0.41						0.38	0.35		0.49	

Lanes, Volumes, Timings
 14: Regina St.S/Regina St.N & Erb St. E/Erb St E

2022 FB PM
 04/16/2018



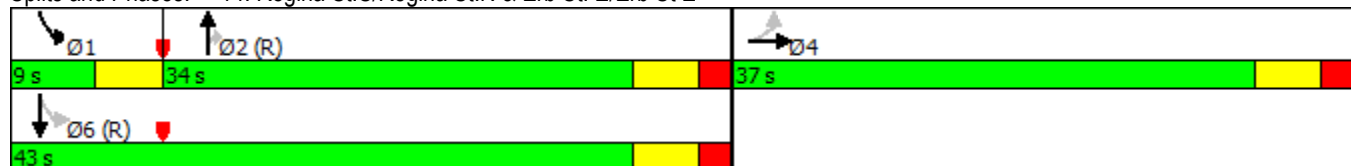
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
v/c Ratio		0.93						0.38	0.35		0.54	
Control Delay		33.4						20.4	9.9		18.1	
Queue Delay		45.4						0.0	0.0		0.0	
Total Delay		78.8						20.4	9.9		18.1	
LOS		E						C	A		B	
Approach Delay		78.8						15.8			18.1	
Approach LOS		E						B			B	

Intersection Summary

Area Type: CBD
 Cycle Length: 80
 Actuated Cycle Length: 80
 Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
 Natural Cycle: 80
 Control Type: Pretimed
 Maximum v/c Ratio: 0.93
 Intersection Signal Delay: 58.9
 Intersection Capacity Utilization 92.2%
 Analysis Period (min) 15

Intersection LOS: E
 ICU Level of Service F

Splits and Phases: 14: Regina St.S/Regina St.N & Erb St. E/Erb St E



Lanes, Volumes, Timings
 14: Regina St.S/Regina St.N & Erb St. E/Erb St E

2022 Total PM
 04/16/2018



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑						↑	↗		↖	
Traffic Volume (vph)	100	1216	89	0	0	0	0	232	165	114	197	0
Future Volume (vph)	100	1216	89	0	0	0	0	232	165	114	197	0
Ideal Flow (vphpl)	1735	1735	1735	1000	1000	1000	1775	1900	1750	1650	1650	1650
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Lane Util. Factor	0.91	0.91	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.99							0.96		0.99	
Frt		0.990							0.850			
Flt Protected		0.996									0.982	
Satd. Flow (prot)	0	4033	0	0	0	0	0	1691	1324	0	1433	0
Flt Permitted		0.996									0.715	
Satd. Flow (perm)	0	4015	0	0	0	0	0	1691	1276	0	1037	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		16							106			
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		91.6			402.5			82.6			181.0	
Travel Time (s)		6.6			29.0			5.9			13.0	
Confl. Peds. (#/hr)	48		26	26		48	23		29	29		23
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	14%	2%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%
Adj. Flow (vph)	111	1351	99	0	0	0	0	258	183	127	219	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1561	0	0	0	0	0	258	183	0	346	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	1.30	1.30	1.30	2.48	2.48	2.48	1.26	1.16	1.29	1.38	1.38	1.38
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Turn Type	Perm	NA						NA	Perm	pm+pt	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4								2	6		
Minimum Split (s)	37.0	37.0						34.0	34.0	8.5	40.0	
Total Split (s)	37.0	37.0						34.0	34.0	9.0	43.0	
Total Split (%)	46.3%	46.3%						42.5%	42.5%	11.3%	53.8%	
Maximum Green (s)	31.0	31.0						28.0	28.0	5.0	37.0	
Yellow Time (s)	4.0	4.0						4.0	4.0	4.0	4.0	
All-Red Time (s)	2.0	2.0						2.0	2.0	0.0	2.0	
Lost Time Adjust (s)		-2.0						-2.0	0.0		-2.0	
Total Lost Time (s)		4.0						4.0	6.0		4.0	
Lead/Lag								Lag	Lag	Lead		
Lead-Lag Optimize?								Yes	Yes	Yes		
Walk Time (s)	24.0	24.0						23.0	23.0		23.0	
Flash Dont Walk (s)	7.0	7.0						5.0	5.0		5.0	
Pedestrian Calls (#/hr)	0	0						0	0		0	
Act Effct Green (s)		33.0						30.0	28.0		39.0	
Actuated g/C Ratio		0.41						0.38	0.35		0.49	

Lanes, Volumes, Timings
 14: Regina St.S/Regina St.N & Erb St. E/Erb St E

2022 Total PM
 04/16/2018



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
v/c Ratio		0.94						0.41	0.36		0.65	
Control Delay		34.8						20.9	10.8		21.8	
Queue Delay		44.9						0.0	0.0		0.0	
Total Delay		79.7						20.9	10.8		21.8	
LOS		E						C	B		C	
Approach Delay		79.7						16.7			21.8	
Approach LOS		E						B			C	

Intersection Summary

Area Type: CBD
 Cycle Length: 80
 Actuated Cycle Length: 80
 Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
 Natural Cycle: 80
 Control Type: Pretimed
 Maximum v/c Ratio: 0.94
 Intersection Signal Delay: 59.3
 Intersection Capacity Utilization 92.5%
 Analysis Period (min) 15

Intersection LOS: E
 ICU Level of Service F

Splits and Phases: 14: Regina St.S/Regina St.N & Erb St. E/Erb St E

