



Balder Corporation

TRANSPORTATION IMPACT STUDY

PROPOSED RESIDENTIAL
DEVELOPMENT

**315-325 University Avenue West,
Town of Cobourg**

April 2019
20021



April 30th, 2019

Reference Number: 20021/200

Mr. Babak Akbari
Balder Corporation
5140 Yonge Street, Unit 1530
Toronto, ON
M2N 6L7

Dear Mr. Akbari:

**RE: Transportation Impact Study
Proposed Residential Development
325 University Avenue West, Town of Cobourg**

LEA Consulting Ltd. is pleased to present the findings of our Transportation Impact Study (TIS) for the proposed residential development at 325 University Avenue West in the Town of Cobourg. This report concludes that the traffic associated with the proposed development will have minimum traffic impact to the immediate roadways.

Should you have any comments with our assumptions or have any concerns, please contact the undersigned at 905-470-0015.

Yours truly,

LEA CONSULTING LTD.


Pirooz Davoodnia, M.A.Sc., EIT
Senior Transportation Planner/Modeller


Natalie Tsui, B.A.Sc.
Transportation Analyst

Encl.

Disclaimer

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1 INTRODUCTION

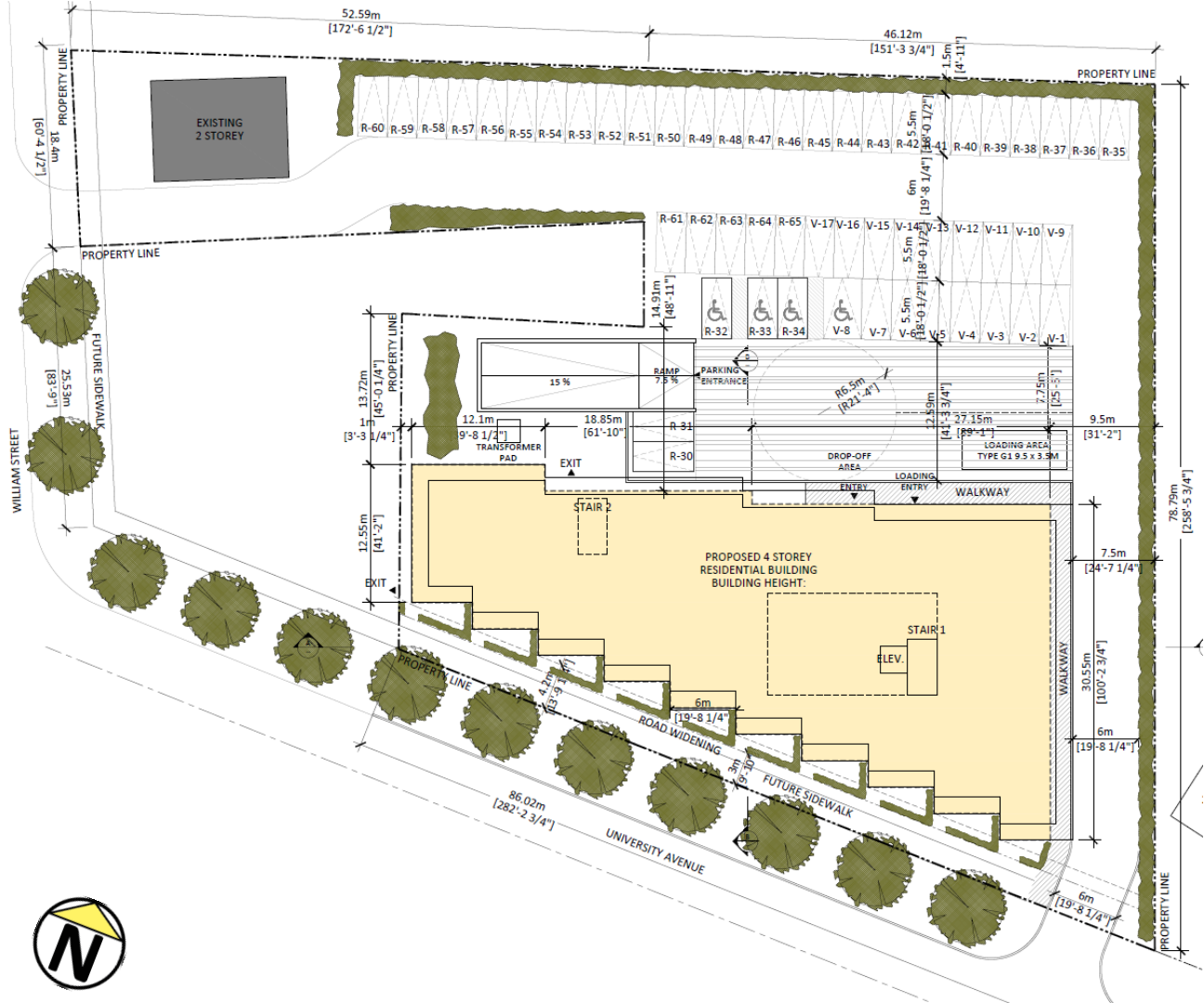
LEA Consulting Ltd. (LEA) was retained by Balder Corporation to prepare a Transportation Impact Study (TIS) in support of the rezoning application for the proposed residential development on 315-325 University Ave West in the Town of Cobourg (herein referred to as the Subject Site). The subject site is currently occupied by existing single-detached residential houses and. **Figure 1.1** shows the subject site and the immediate surrounding area.

Figure 1.1: Site Location



The proposed development consists of a four-storey residential building, composed of 71 units, to be constructed on the subject site. It is proposed that the subject site will be accessible from an access on University Ave W and a shared access with the neighbouring existing two-storey building. The proposed site plan is shown in **Figure 1.2**.

Figure 1.2: Site Plan



Source: Studio JCI (April 2019)

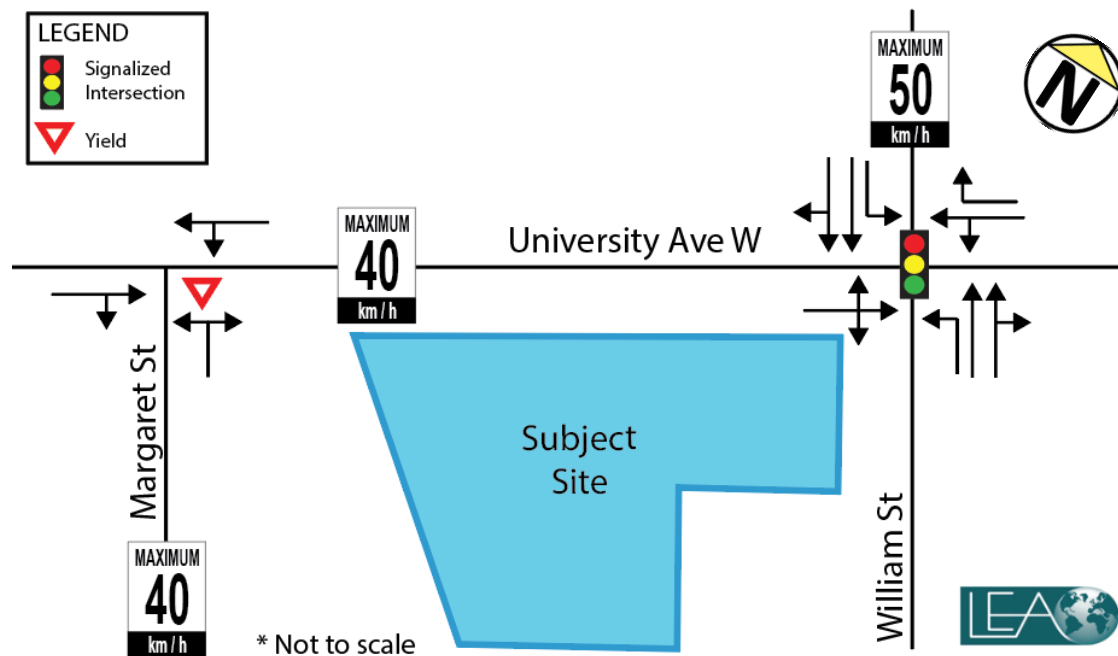
2 EXISTING CONDITIONS

2.1 ROAD NETWORK AND DATA COLLECTION

Figure 2.1 illustrates the intersections and lane configurations within the study area. The following intersections have been included in this study:

- ▶ University Ave W and William St (Signalized); and
- ▶ University Ave W and Margaret St (Unsignalized).

Figure 2.1: Existing Lane Configuration



Below is a detailed description of the roadways in the study area. All turning movement counts (TMC) at the aforementioned intersections were collected on Wednesday, April 24th, 2019 from 7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m. The summarized TMC and traffic data used in the analysis can be found in **Appendix A**. The detailed descriptions of the roadways are described below:

William St is a north-south major arterial road under the jurisdiction of Northumberland County that operates with a four-lane cross section (two lanes per direction) in the study area. This street operates with a posted speed limit of 50 km/h.

University Ave W is an east-west local street under the jurisdiction of the Town of Cobourg. This street operates with a two-lane cross section (one lane per direction) in the study area. University Ave has a posted speed limit of 40 km/h in the area of the subject site.

Margaret St is an east-west local street, operating with a two-lane cross section (one lane per direction). This street is under the jurisdiction of the Town of Cobourg, and does not have a posted speed limit. A speed limit of 40 km/h is assumed since Margaret St is a local road travelling through a residential neighbourhood.

Turning movement counts (TMC) at the aforementioned intersections were collected by LEA on Wednesday, April 24th, 2019.

2.2 TRANSIT NETWORK

The study area is currently serviced by Cobourg Transit, which provides two routes in the Town. Route 2 is currently the only route servicing the study area. **Figure 2.2** illustrates the existing transit network within vicinity of the study area, as of April 2019.

Figure 2.2: Existing Transit Services



Source: Town of Cobourg "Where's My Bus?" (Accessed April 2019)

2.3 EXISTING TRAFFIC CONDITIONS

The existing traffic volumes utilized in the intersection capacity analyses for the AM and PM peak hours are illustrated in **Figure 2.3**. The intersection capacity analysis was performed using Synchro 9.0 which incorporates the Highway Capacity Manual (HCM) 2000 methodology. The Synchro parameters were inputted according to the City of Toronto "Guidelines for the Preparation of Transportation Impact Studies 2013" and "Guidelines for Using Synchro 9". **Table 2.1** summarizes the Levels of Service (LOS) under existing traffic conditions for signalized and signalized intersections. Only movements of interest are shown. For signalized intersections, movements of interests are defined as movements with either a volume-to-capacity (V/C) ratio of 0.85 or higher, or a LOS E or worse are shown. Movements of interest for unsignalized intersections refer to movements that will experience a delay, such as the inbound and outbound movements of the site access or a minor street onto the major street.

Figure 2.3: Existing Traffic Volumes

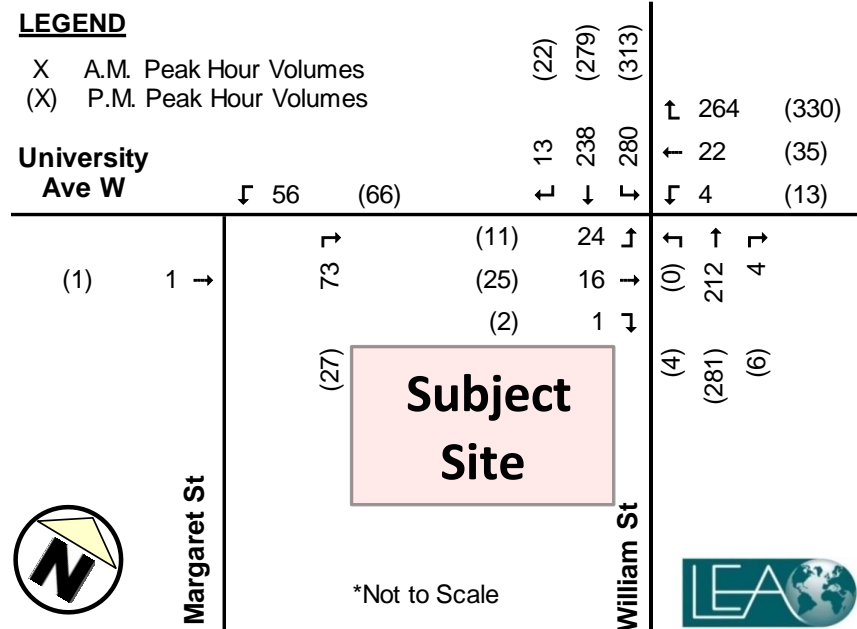


Table 2.1: Existing Intersecting Capacity Analysis

Intersection	Peak Hour	Overall: V/C / Delay / LOS	Movement of Interest	LOS (Delay in seconds)	95 th Queue (m)	V/C
University Ave W & William St (Signalized)	AM	0.35 / 13 / B	-	-	-	-
	PM	0.39 / 15 / B	-	-	-	-
University Ave W & Margaret St (Unsignalized)	AM	-	WBLT NBLR	A (7) A (9)	1 2	0.05 0.09
	PM	-	WBLT NBLR	A (7) A (8)	1 1	0.05 0.03

Under the existing traffic condition, capacity constraints are not identified as all intersection movements are operating with a V/C below 0.85 during the studied peak hours. All movements of interest are operating significantly below capacity as a result. Detailed capacity results can be found in **Appendix B**.

3 FUTURE CONDITIONS

3.1 FUTURE BACKGROUND TRAFFIC CONDITIONS

The future background traffic conditions analyze the traffic conditions for a five-year horizon (year 2024) without the subject development in place. No background developments were identified or provided. The intersection lane configurations within the studied road network is expected to be maintained from the existing conditions. A 2% per year growth rate was applied to the William St corridor to account for background traffic growth to present a conservative analysis.

Future background traffic volumes are derived by combining the existing traffic volumes, background traffic growth rate compounded annually for five years. **Figure 3.1** illustrates the future background traffic volumes for the studied peak hours. Movements of interests are summarized in **Table 3.3**.

Figure 3.1: Future Background Traffic Volumes

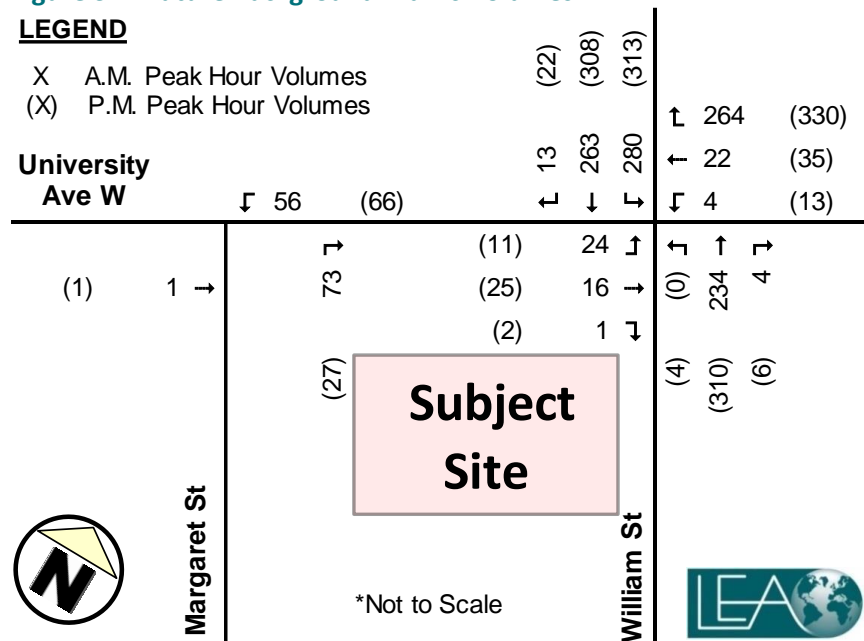


Table 3.1: Future Background Intersection Capacity Analysis

Intersection	Peak Hour	Overall: V/C / Delay / LOS	Movement of Interest	LOS (Delay in seconds)	95 th Queue (m)	V/C
University Ave W & William St (Signalized)	AM	0.36 / 13 / B	-	-	-	-
	PM	0.39 / 15 / B	-	-	-	-
University Ave W & Margaret St (Unsignalized)	AM	-	WBLT NBLR	A (7) B (9)	1 2	0.05 0.09
	PM	-	WBLT NBLR	A (7) A (8)	1 1	0.05 0.03

A minor increase to the overall V/C of the signalized intersection is expected as a result of background traffic growth. As with the existing traffic condition, no capacity constraints are identified as all intersection movements are operating with a V/C below 0.85. All movements of interest are expected to continue operating significantly below capacity in the future background traffic condition. Detailed capacity analysis outputs can be found in **Appendix C**.

3.2 SITE TRAFFIC

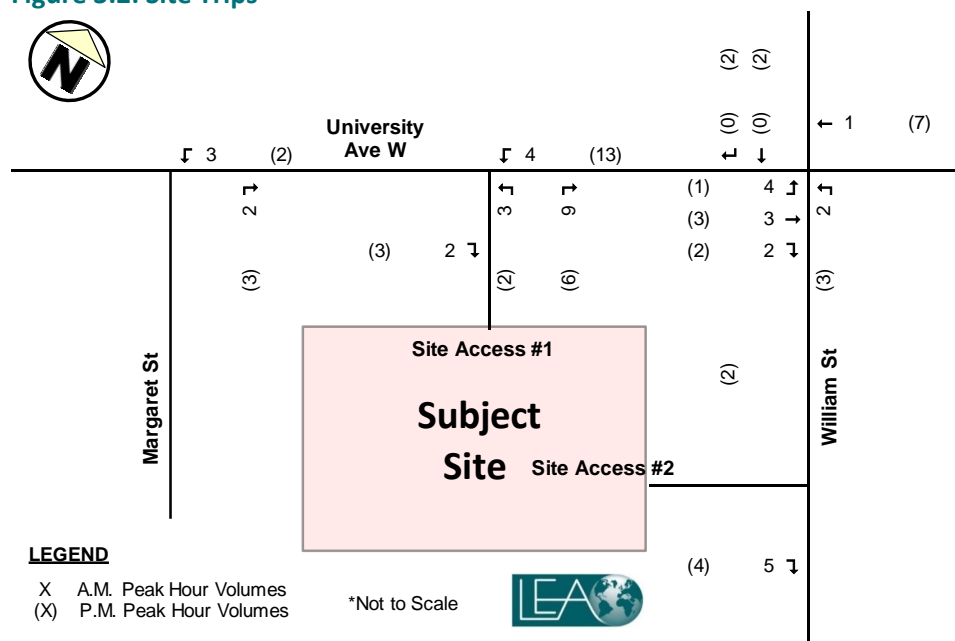
Trip generation for the proposed development is based on the ITE Trip Generation Manual 10th Edition. Given the proposed use, LUC 221 Multifamily Housing (Mid-Rise) was used for the development. **Table 3.2** summarizes the trip generation of the subject site.

Table 3.2: Site Trip Distribution

Proposed Development			Weekday AM Peak Hour (Vehicle Trips/Unit)			Weekday PM Peak Hour (Vehicle Trips/Unit)		
			In	Out	Total	In	Out	Total
Multifamily Housing (Mid-Rise)	71 units	Trips per Unit	0.09	0.23	0.32	0.25	0.16	0.41
		Trips Generated	6	17	23	17	12	29
Total Trips			6	17	23	17	12	29

Trip distribution of these site trips is expected to follow the existing distribution of traffic in the studied network. **Figure 3.2** illustrates the site trips.

Figure 3.2: Site Trips



3.3 FUTURE TOTAL TRAFFIC CONDITIONS

The future total traffic is the sum of the future background volumes and site-generated traffic. Access to the subject site will be provided from the Rear Lane. Future total volumes are illustrated in **Figure 3.3**. Movements of interests are summarized in **Table 3.3**.

Figure 3.3: Future Total Traffic Volumes

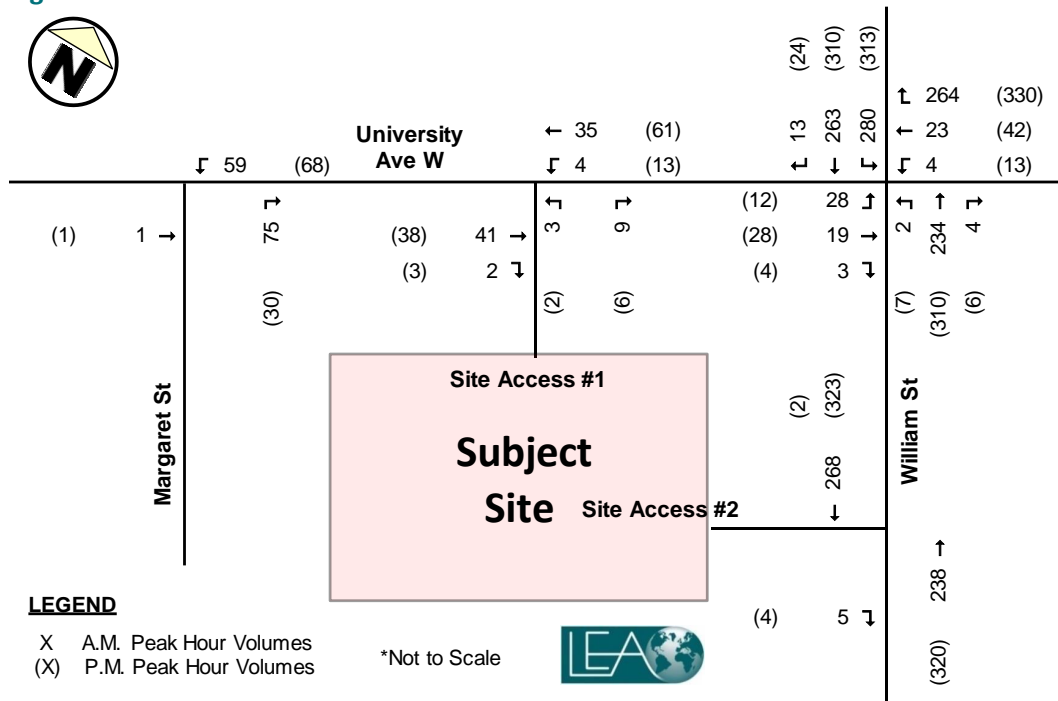


Table 3.3: Future Total Intersection Capacity Analysis

Intersection	Peak Hour	Overall: V/C / Delay / LOS	Movement of Interest	LOS (Delay in seconds)	95 th Queue (m)	V/C
University Ave W & William St (Signalized)	AM	0.36 / 13 / B	-	-	-	-
	PM	0.40 / 15 / B	-	-	-	-
University Ave W & Site Access #1 (Unsignalized)	AM	-	WBLT NBLR	A (1) A (9)	0 0	0.00 0.01
	PM	-	WBLT NBLR	A (1) A (9)	0 0	0.01 0.01
University Ave W & Margaret St (Unsignalized)	AM	-	EBLR NBL	A (7) A (9)	1 2	0.05 0.09
	PM	-	EBLR NBL	A (7) A (8)	1 1	0.06 0.04
Site Access #2 & William St (Unsignalized)	AM	-	EBR	A (9)	0	0.01
	PM	-	EBR	A (9)	0	0.00

Minimal increase to the overall V/C is expected at the signalized intersection when compared to the future background. Despite the minor increase, all intersection movements will remain operating significantly below capacity and with reasonable delay. The proposed development will have minimal impact on the studied network as a result. Detailed capacity analysis outputs can be found in **Appendix D**.

4 PARKING AND LOADING

4.1 VEHICULAR PARKING

The subject site is governed by the Town’s Zoning By-law 85-2003. Based on the size of the proposed development, the subject site is required to provide 89 parking spaces. A supply of 82 spaces is proposed for the subject site, which is a shortfall of 7 spaces from the By-law requirements. **Table 4.1** summarizes the minimum requirements and proposed parking supply of the subject site.

Table 4.1: Comparison Between Required and Proposed Parking Supply

Use	# of Units / GFA	Minimum Requirement	Parking Spaces	Proposed Supply
Residential	71	1.25 spaces/unit	89	65 resident + 17 visitor spaces
Total			89 spaces	82 spaces

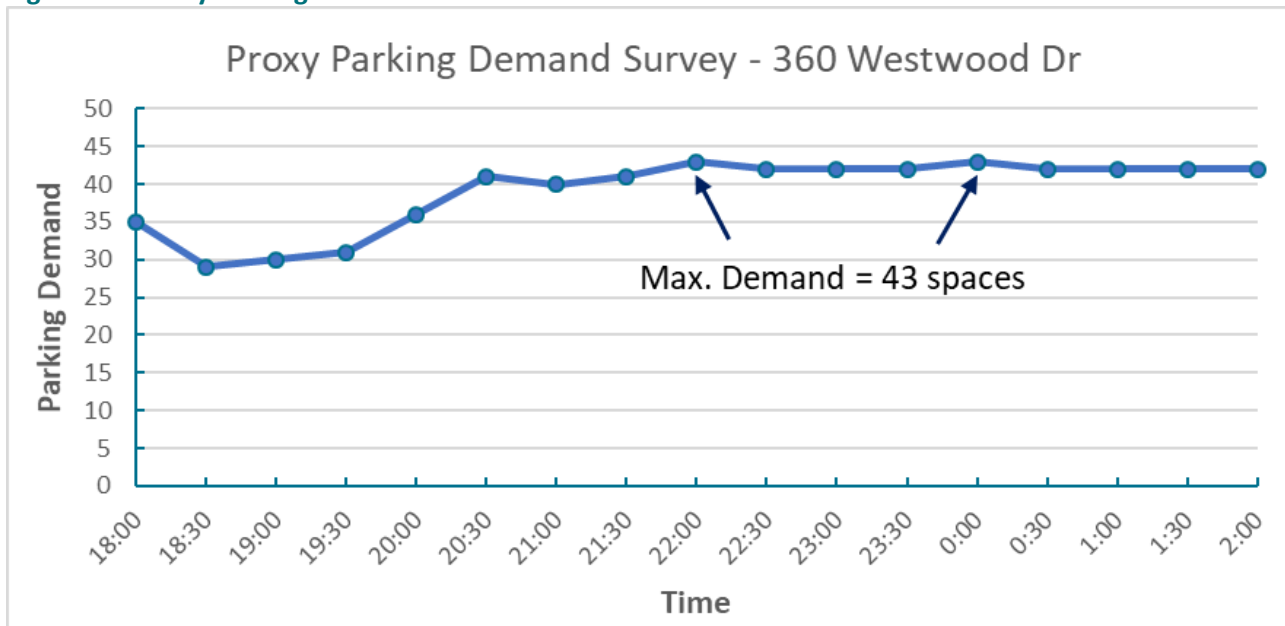
To support the proposed parking shortfall, a parking demand survey was conducted at a proxy site, an existing apartment development (Westwood Gardens) at 360 Westwood Dr, near the subject site. The proxy site contains 47 residential units, which were confirmed to be fully occupied at the time of the survey. **Figure 4.1** illustrates the proximity of the proxy site to the subject site.

Figure 4.1: Proximity of Proxy Site to Subject Site



The proxy survey was conducted on Wednesday, April 24th, 2019 from 6:00 PM to 2:00 AM, with parking demand recorded at half-hour intervals. A peak parking demand of 43 parking spaces was observed at 10:00 PM and 12:00 AM, which equates to 0.91 spaces per unit since all 47 units at the proxy site are occupied. As a result, the subject site is recommended to provide parking supply at a rate of 0.91 spaces per unit. **Figure 4.2** illustrates the parking demand for the proxy site throughout the survey period. Detailed results of the proxy parking demand surveys are enclosed in **Appendix E**.

Figure 4.2: Proxy Parking Demand



A parking supply of 82 parking spaces, equivalent to 1.15 spaces per unit, is proposed on the subject site. **Table 4.2** compares the recommended and proposed parking supply rates. The proposed parking, supplied at a rate of 1.15 spaces per unit, is greater than the recommended requirement of 0.91 spaces per unit. Therefore, the proposed parking supply is determined to be sufficient and appropriate for the proposed uses.

Table 4.2: Comparison of Parking Supply Rates

	Recommended Requirements	Proposed
Number of Units	71 Units	
Parking Supply	65 spaces Proxy Parking Demand Rate: 0.91 sp/unit	82 spaces Rate: 1.15 sp/unit

4.2 LOADING

A loading provision for residential uses is not specified in Section 6.2 of the Town’s Zoning By-law. As a result, loading is assumed to be not required for the proposed development. Despite the By-law not requiring loading provision for the proposed development, one loading space is provided on the subject site.

A functional design review will be included as part of the SPA submission to ensure vehicles can circulate the site in an appropriate manner.

5 CONCLUSION

The subject site, 325 University Ave W, is proposed to be redeveloped from the existing single-detached residential houses into a five-storey residential apartment building containing 71 units.

Existing conditions indicated that all intersection movements operating within capacity and with acceptable LOS. All intersection movements are expected to continue operating within capacity and with acceptable LOS in the future background traffic condition.

It is projected that the proposed development will generate less than 30 trips during the studied peak hours. The expected site-generated trips were distributed based on existing traffic patterns. Delay experienced by the intersection movements is not expected to increase significantly from the future background traffic condition. As such, the proposed development is expected to have minimal impact on the studied network.

It is proposed that parking for the proposed development will be provided at a rate of 1.15 spaces per unit, which exceeds the recommended parking supply rate of 0.91 spaces per unit. As such, the proposed parking supply is appropriate and acceptable for the subject site.

A loading space is not required for residential uses according to the Town's Zoning By-law. One loading space is provided at the subject site which meets the minimum requirements.

APPENDIX A

Existing Traffic Data

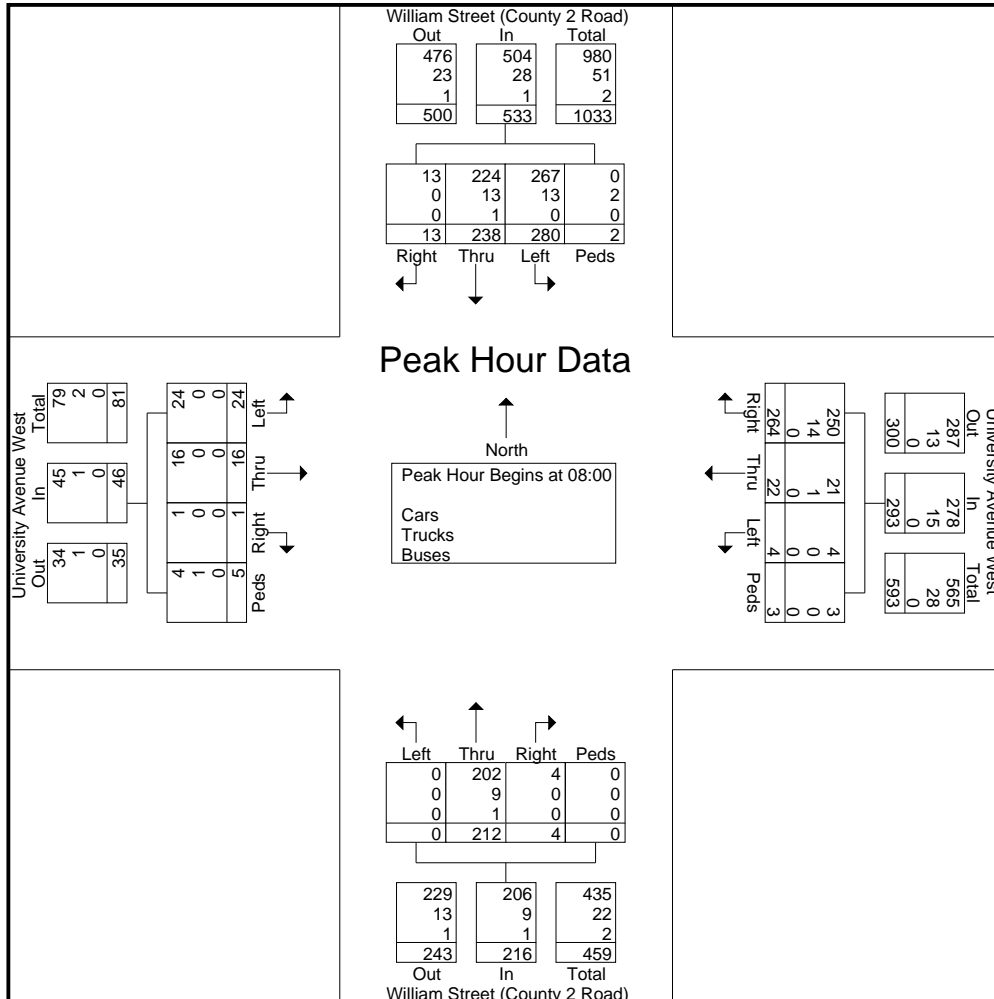


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625 Cochrane Drive 9th Floor
Markham, Ontario, L3R 9R9

File Name : William&University-AM
Site Code : 20021026
Start Date : 2019-04-24
Page No : 3

Start Time	William Street (County 2 Road) Southbound					University Avenue West Westbound					William Street (County 2 Road) Northbound					University Avenue West Eastbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:00																					
08:00	77	72	4	1	154	1	7	57	0	65	0	48	1	0	49	9	7	1	0	17	285
08:15	46	59	1	0	106	1	5	60	2	68	0	64	1	0	65	5	4	0	2	11	250
08:30	79	48	6	0	133	1	6	67	0	74	0	55	1	0	56	3	3	0	2	8	271
08:45	78	59	2	1	140	1	4	80	1	86	0	45	1	0	46	7	2	0	1	10	282
Total Volume	280	238	13	2	533	4	22	264	3	293	0	212	4	0	216	24	16	1	5	46	1088
% App. Total	52.5	44.7	2.4	0.4		1.4	7.5	90.1	1		0	98.1	1.9	0		52.2	34.8	2.2	10.9		
PHF	.886	.826	.542	.500	.865	1.000	.786	.825	.375	.852	.000	.828	1.000	.000	.831	.667	.571	.250	.625	.676	.954
Cars	267	224	13	0	504	4	21	250	3	278	0	202	4	0	206	24	16	1	4	45	1033
% Cars	95.4	94.1	100	0	94.6	100	95.5	94.7	100	94.9	0	95.3	100	0	95.4	100	100	100	80.0	97.8	94.9
Trucks	13	13	0	2	28	0	1	14	0	15	0	9	0	0	9	0	0	0	1	1	53
% Trucks	4.6	5.5	0	100	5.3	0	4.5	5.3	0	5.1	0	4.2	0	0	4.2	0	0	0	20.0	2.2	4.9
Buses	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2
% Buses	0	0.4	0	0	0.2	0	0	0	0	0	0	0.5	0	0	0.5	0	0	0	0	0	0.2

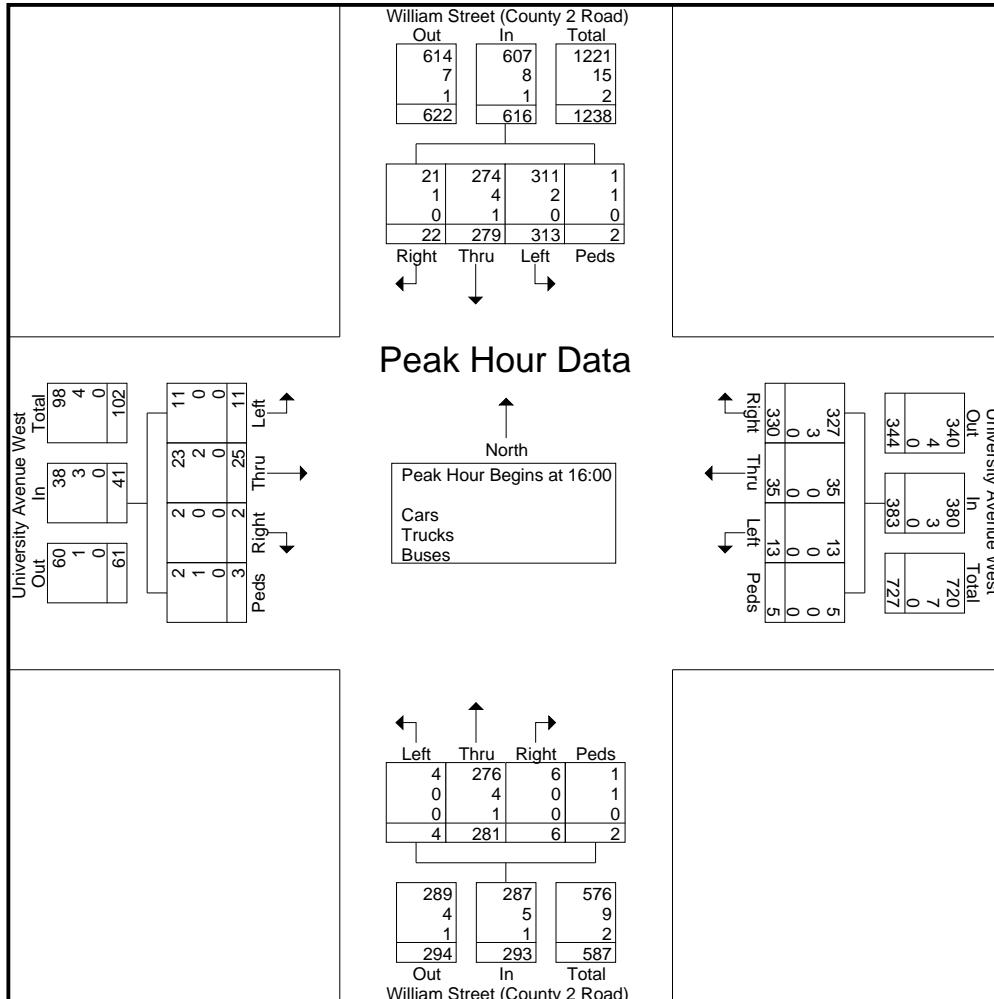


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625 Cochrane Drive 9th Floor
Markham, Ontario, L3R 9R9

File Name : William&University-PM
Site Code : 20021026
Start Date : 2019-04-24
Page No : 3

Start Time	William Street (County 2 Road) Southbound					University Avenue West Westbound					William Street (County 2 Road) Northbound					University Avenue West Eastbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 16:00																					
16:00	83	77	0	0	160	2	13	78	0	93	1	78	3	1	83	4	6	0	1	11	347
16:15	90	68	6	0	164	5	9	83	0	97	1	69	0	0	70	4	2	0	1	7	338
16:30	73	72	13	1	159	4	5	89	4	102	2	72	0	0	74	3	11	1	0	15	350
16:45	67	62	3	1	133	2	8	80	1	91	0	62	3	1	66	0	6	1	1	8	298
Total Volume	313	279	22	2	616	13	35	330	5	383	4	281	6	2	293	11	25	2	3	41	1333
% App. Total	50.8	45.3	3.6	0.3		3.4	9.1	86.2	1.3		1.4	95.9	2	0.7		26.8	61	4.9	7.3		
PHF	.869	.906	.423	.500	.939	.650	.673	.927	.313	.939	.500	.901	.500	.500	.883	.688	.568	.500	.750	.683	.952
Cars	311	274	21	1	607	13	35	327	5	380	4	276	6	1	287	11	23	2	2	38	1312
% Cars	99.4	98.2	95.5	50.0	98.5	100	100	99.1	100	99.2	100	98.2	100	50.0	98.0	100	92.0	100	66.7	92.7	98.4
Trucks	2	4	1	1	8	0	0	3	0	3	0	4	0	1	5	0	2	0	1	3	19
% Trucks	0.6	1.4	4.5	50.0	1.3	0	0	0.9	0	0.8	0	1.4	0	50.0	1.7	0	8.0	0	33.3	7.3	1.4
Buses	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2
% Buses	0	0.4	0	0	0.2	0	0	0	0	0	0	0.4	0	0	0.3	0	0	0	0	0	0.2

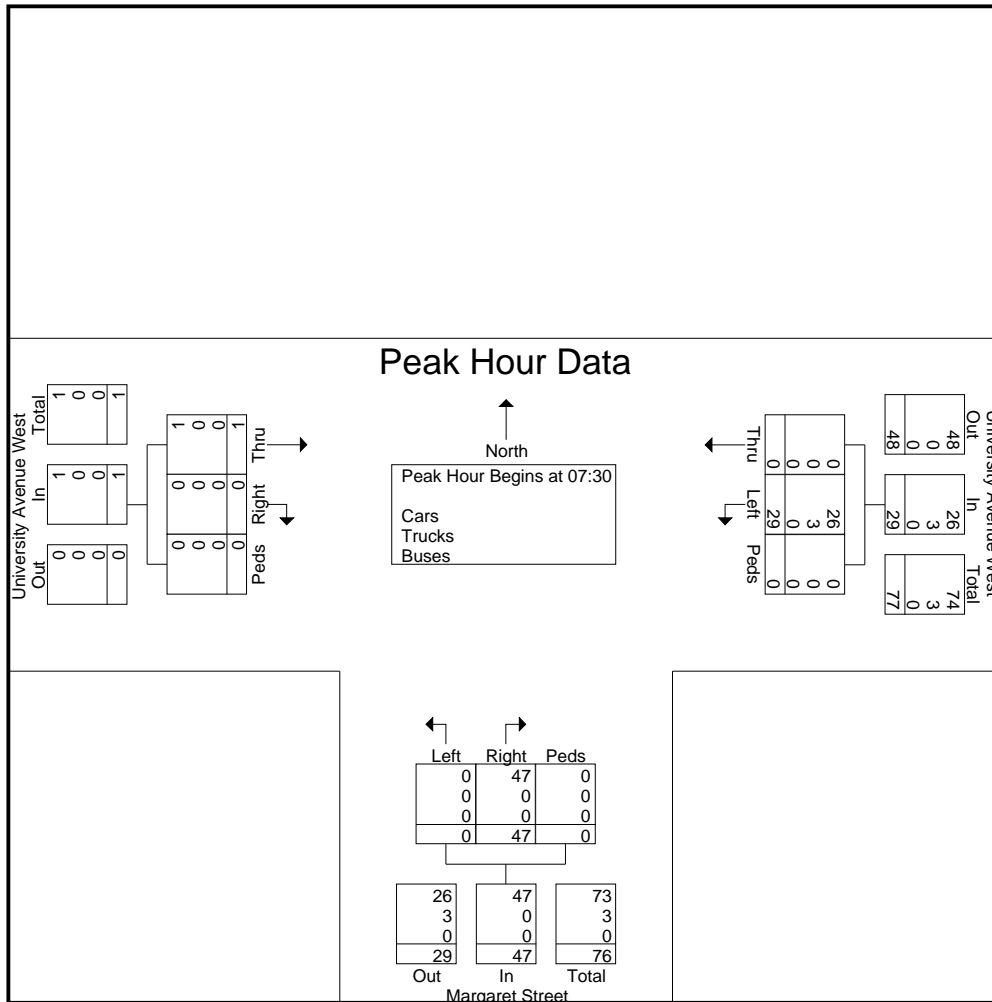


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625 Cochrane Drive 9th Floor
Markham, Ontario, L3R 9R9

File Name : Margaret&University-AM
Site Code : 20021019
Start Date : 2019-04-24
Page No : 3

Start Time	University Avenue West Westbound				Margaret Street Northbound				University Avenue West Eastbound				Int. Total
	Left	Thru	Peds	App. Total	Left	Right	Peds	App. Total	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:30													
07:30	9	0	0	9	0	12	0	12	0	0	0	0	21
07:45	4	0	0	4	0	10	0	10	0	0	0	0	14
08:00	10	0	0	10	0	15	0	15	1	0	0	1	26
08:15	6	0	0	6	0	10	0	10	0	0	0	0	16
Total Volume	29	0	0	29	0	47	0	47	1	0	0	1	77
% App. Total	100	0	0		0	100	0		100	0	0		
PHF	.725	.000	.000	.725	.000	.783	.000	.783	.250	.000	.000	.250	.740
Cars	26	0	0	26	0	47	0	47	1	0	0	1	74
% Cars	89.7	0	0	89.7	0	100	0	100	100	0	0	100	96.1
Trucks	3	0	0	3	0	0	0	0	0	0	0	0	3
% Trucks	10.3	0	0	10.3	0	0	0	0	0	0	0	0	3.9
Buses	0	0	0	0	0	0	0	0	0	0	0	0	0
% Buses	0	0	0	0	0	0	0	0	0	0	0	0	0

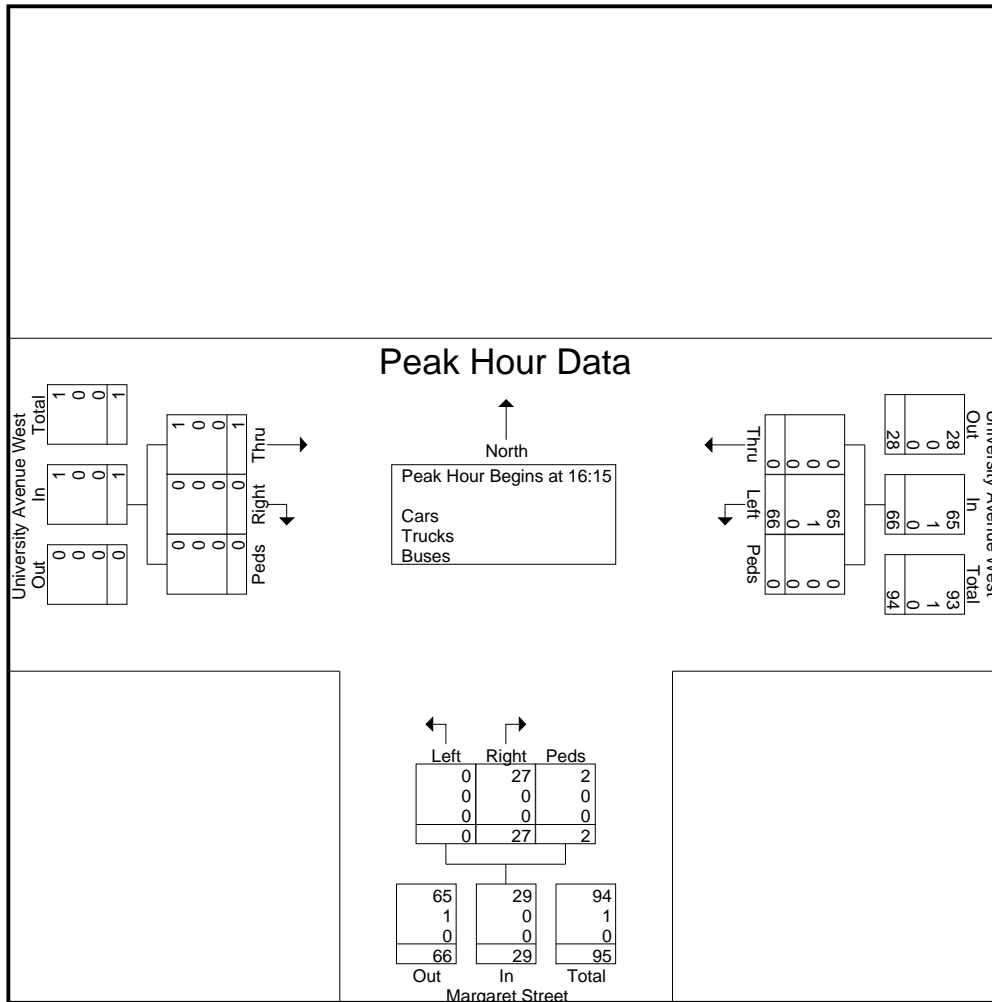


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625 Cochrane Drive 9th Floor
Markham, Ontario, L3R 9R9

File Name : Margaret&University-PM
Site Code : 20021019
Start Date : 2019-04-24
Page No : 3

Start Time	University Avenue West Westbound				Margaret Street Northbound				University Avenue West Eastbound				Int. Total
	Left	Thru	Peds	App. Total	Left	Right	Peds	App. Total	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 16:15													
16:15	18	0	0	18	0	5	0	5	0	0	0	0	23
16:30	18	0	0	18	0	6	0	6	0	0	0	0	24
16:45	12	0	0	12	0	4	0	4	1	0	0	1	17
17:00	18	0	0	18	0	12	2	14	0	0	0	0	32
Total Volume	66	0	0	66	0	27	2	29	1	0	0	1	96
% App. Total	100	0	0		0	93.1	6.9		100	0	0		
PHF	.917	.000	.000	.917	.000	.563	.250	.518	.250	.000	.000	.250	.750
Cars	65	0	0	65	0	27	2	29	1	0	0	1	95
% Cars	98.5	0	0	98.5	0	100	100	100	100	0	0	100	99.0
Trucks	1	0	0	1	0	0	0	0	0	0	0	0	1
% Trucks	1.5	0	0	1.5	0	0	0	0	0	0	0	0	1.0
Buses	0	0	0	0	0	0	0	0	0	0	0	0	0
% Buses	0	0	0	0	0	0	0	0	0	0	0	0	0



APPENDIX B

Intersection Capacity Analysis – Existing Traffic Condition



Queues
1: William St & University Ave W

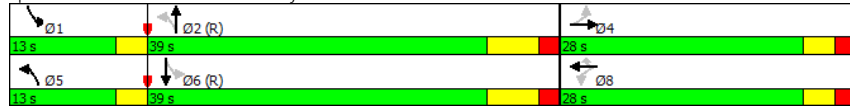
20021 | 325 University Ave W, Cobourg
Ex AM

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	SBL	SBT	Ø5
Lane Configurations		↔		↕	↕	↕	↕	↕	
Traffic Volume (vph)	24	16	4	22	264	212	280	238	
Future Volume (vph)	24	16	4	22	264	212	280	238	
Lane Group Flow (vph)	0	43	0	27	278	227	295	265	
Turn Type	Perm	NA	Perm	NA	Perm	NA	pm+pt	NA	
Protected Phases		4		8		8	2	1	6
Permitted Phases	4		8		8			6	
Detector Phase	4	4	8	8	8	2	1	6	
Switch Phase									
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0	15.0	7.0	15.0	7.0
Minimum Split (s)	28.0	28.0	28.0	28.0	28.0	37.0	10.0	37.0	10.0
Total Split (s)	28.0	28.0	28.0	28.0	28.0	39.0	13.0	39.0	13.0
Total Split (%)	35.0%	35.0%	35.0%	35.0%	35.0%	48.8%	16.3%	48.8%	16%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	5.0	3.0	5.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.0	2.0	0.0
Lost Time Adjust (s)		0.0		0.0		0.0		0.0	
Total Lost Time (s)		5.0		5.0		5.0		3.0	7.0
Lead/Lag						Lag	Lead	Lag	Lead
Lead-Lag Optimize?						Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	C-Max	None	C-Max	None
v/c Ratio		0.25		0.14		0.66		0.33	
Control Delay		34.3		32.1		12.6		8.5	
Queue Delay		0.0		0.0		0.0		0.0	
Total Delay		34.3		32.1		12.6		8.5	
Queue Length 50th (m)		6.4		4.1		0.0		7.0	
Queue Length 95th (m)		14.7		10.5		20.1		16.6	
Internal Link Dist (m)		114.3		91.9		176.6		111.5	
Turn Bay Length (m)							38.0		
Base Capacity (vph)		439		500		640		2005	
Starvation Cap Reductn		0		0		0		0	
Spillback Cap Reductn		0		0		0		0	
Storage Cap Reductn		0		0		0		0	
Reduced v/c Ratio		0.10		0.05		0.43		0.11	

Intersection Summary

Cycle Length: 80
 Actuated Cycle Length: 80
 Offset: 45 (56%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 75
 Control Type: Actuated-Coordinated

Splits and Phases: 1: William St & University Ave W



HCM Signalized Intersection Capacity Analysis
1: William St & University Ave W

20021 | 325 University Ave W, Cobourg
Ex AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↕	↕	↕	↕	↕	↕	↕	↕
Traffic Volume (vph)	24	16	1	4	22	264	0	212	4	280	238	13
Future Volume (vph)	24	16	1	4	22	264	0	212	4	280	238	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0	5.0		7.0		3.0	7.0	
Lane Util. Factor		1.00			1.00	1.00		0.95		1.00	0.95	
Flt		1.00			1.00	0.85		1.00		1.00	0.99	
Flt Protected		0.97			0.99	1.00		1.00		0.95	1.00	
Satd. Flow (prot)		1841			1809	1538		3432		1719	3385	
Flt Permitted		0.81			0.96	1.00		1.00		0.57	1.00	
Satd. Flow (perm)		1525			1741	1538		3432		1037	3385	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	25	17	1	4	23	278	0	223	4	295	251	14
RTOR Reduction (vph)	0	1	0	0	0	247	0	1	0	0	2	0
Lane Group Flow (vph)	0	42	0	0	27	31	0	226	0	295	263	0
Heavy Vehicles (%)	0%	0%	0%	0%	5%	5%	0%	5%	0%	5%	6%	2%
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		9.0			9.0	9.0		46.7		59.0	59.0	
Effective Green, g (s)		9.0			9.0	9.0		46.7		59.0	59.0	
Actuated g/C Ratio		0.11			0.11	0.11		0.58		0.74	0.74	
Clearance Time (s)		5.0			5.0	5.0		7.0		3.0	7.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)		171			195	173		2003		844	2496	
v/s Ratio Prot								0.07		c0.04	0.08	
v/s Ratio Perm		c0.03			0.02	0.02				c0.22		
v/c Ratio		0.25			0.14	0.18		0.11		0.35	0.11	
Uniform Delay, d1		32.4			32.0	32.2		7.4		3.4	3.0	
Progression Factor		1.00			1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2		0.8			0.3	0.5		0.1		0.3	0.1	
Delay (s)		33.2			32.3	32.7		7.5		3.7	3.1	
Level of Service		C			C	C		A		A	A	
Approach Delay (s)		33.2			32.6			7.5			3.4	
Approach LOS		C			C			A			A	

Intersection Summary

HCM 2000 Control Delay: 13.2
 HCM 2000 Level of Service: B
 HCM 2000 Volume to Capacity ratio: 0.35
 Actuated Cycle Length (s): 80.0
 Sum of lost time (s): 15.0
 Intersection Capacity Utilization: 50.2%
 ICU Level of Service: A
 Analysis Period (min): 15
 c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis 20021 | 325 University Ave W, Cobourg
 3: Margaret St & University Ave W Ex AM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔	↘	↙	↔	↙	↘
Traffic Volume (veh/h)	1	0	56	0	0	73
Future Volume (Veh/h)	1	0	56	0	0	73
Sign Control	Free		Free		Yield	
Grade	0%		0%		0%	
Peak Hour Factor	0.74	0.74	0.74	0.74	0.74	0.74
Hourly flow rate (vph)	1	0	76	0	0	99
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage (veh)						
Upstream signal (m)	138					
pX, platoon unblocked						
vC, conflicting volume			1	153		1
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1	153		1
tC, single (s)			4.2	6.4		6.2
tC, 2 stage (s)						
tF (s)			2.3	3.5		3.3
p0 queue free %			95	100		91
cM capacity (veh/h)			1589	803		1090
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	1	76	99			
Volume Left	0	76	0			
Volume Right	0	0	99			
cSH	1700	1589	1090			
Volume to Capacity	0.00	0.05	0.09			
Queue Length 95th (m)	0.0	1.2	2.4			
Control Delay (s)	0.0	7.4	8.6			
Lane LOS	A		A			
Approach Delay (s)	0.0	7.4	8.6			
Approach LOS	A					
Intersection Summary						
Average Delay			8.0			
Intersection Capacity Utilization			21.0%		ICU Level of Service A	
Analysis Period (min)	15					

Queues
1: William St & University Ave W

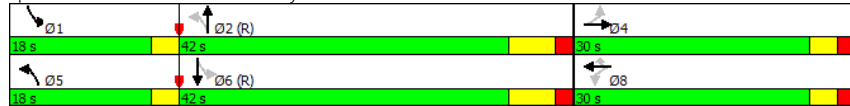
20021 | 325 University Ave W, Cobourg
Ex PM

	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations		↔		↕	↕	↕	↕↔	↕	↕↔
Traffic Volume (vph)	11	25	13	35	330	4	281	313	279
Future Volume (vph)	11	25	13	35	330	4	281	313	279
Lane Group Flow (vph)	0	40	0	51	347	4	302	329	317
Turn Type	Perm	NA	Perm	NA	Perm	pm+pt	NA	pm+pt	NA
Protected Phases		4		8		5	2	1	6
Permitted Phases	4		8		8	2		6	
Detector Phase	4	4	8	8	8	5	2	1	6
Switch Phase									
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0	7.0	15.0	7.0	15.0
Minimum Split (s)	30.0	30.0	30.0	30.0	30.0	10.0	37.0	10.0	37.0
Total Split (s)	30.0	30.0	30.0	30.0	30.0	18.0	42.0	18.0	42.0
Total Split (%)	33.3%	33.3%	33.3%	33.3%	33.3%	20.0%	46.7%	20.0%	46.7%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	5.0	3.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	0.0	2.0	0.0	2.0
Lost Time Adjust (s)		0.0		0.0		0.0	0.0		0.0
Total Lost Time (s)		5.0		5.0		5.0	7.0		7.0
Lead/Lag						Lead	Lag	Lead	Lag
Lead-Lag Optimize?						Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	C-Max	None	C-Max
v/c Ratio		0.23		0.28	0.72	0.00	0.14	0.37	0.12
Control Delay		37.0		39.4	13.5	3.0	8.3	3.7	4.4
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		37.0		39.4	13.5	3.0	8.3	3.7	4.4
Queue Length 50th (m)		6.6		8.9	0.0	0.1	10.0	9.0	5.5
Queue Length 95th (m)		14.9		18.3	23.8	1.0	22.6	25.4	19.0
Internal Link Dist (m)		114.3		91.9			176.6		111.5
Turn Bay Length (m)						38.0		38.0	
Base Capacity (vph)		448		478	694	974	2182	944	2580
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		0.09		0.11	0.50	0.00	0.14	0.35	0.12

Intersection Summary

Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 45 (50%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 80
 Control Type: Actuated-Coordinated

Splits and Phases: 1: William St & University Ave W



HCM Signalized Intersection Capacity Analysis
1: William St & University Ave W

20021 | 325 University Ave W, Cobourg
Ex PM

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔		↕	↕	↕	↕	↕↔	↕	↕↔	↕	↕↔
Traffic Volume (vph)	11	25	2	13	35	330	4	281	6	313	279	22
Future Volume (vph)	11	25	2	13	35	330	4	281	6	313	279	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0	3.0	7.0		3.0	7.0		
Lane Util. Factor		1.00		1.00	1.00	1.00	0.95		1.00	0.95		
Friction		0.99		1.00	0.85	1.00	1.00		1.00	0.99		
Flt Protected		0.99		0.99	1.00	0.95	1.00		0.95	1.00		
Satd. Flow (prot)		1767		1874	1599	1805	3530		1787	3493		
Flt Permitted		0.90		0.91	1.00	0.56	1.00		0.54	1.00		
Satd. Flow (perm)		1611		1722	1599	1063	3530		1013	3493		
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	12	26	2	14	37	347	4	296	6	329	294	23
RTOR Reduction (vph)	0	2	0	0	0	310	0	1	0	0	3	0
Lane Group Flow (vph)	0	38	0	0	51	37	4	301	0	329	314	0
Heavy Vehicles (%)	0%	8%	0%	0%	0%	1%	0%	2%	0%	1%	2%	5%
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		9.6			9.6	9.6	57.0	55.6		68.4	64.0	
Effective Green, g (s)		9.6			9.6	9.6	57.0	55.6		68.4	64.0	
Actuated g/C Ratio		0.11			0.11	0.11	0.63	0.62		0.76	0.71	
Clearance Time (s)		5.0			5.0	5.0	3.0	7.0		3.0	7.0	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		171			183	170	684	2180		854	2483	
v/s Ratio Prot							0.00	0.09		c0.04	0.09	
v/s Ratio Perm		0.02			c0.03	0.02	0.00			c0.25		
v/c Ratio		0.22			0.28	0.22	0.01	0.14		0.39	0.13	
Uniform Delay, d1		36.8			37.0	36.8	6.1	7.2		3.2	4.1	
Progression Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.7			0.8	0.6	0.0	0.1		0.3	0.1	
Delay (s)		37.5			37.8	37.4	6.1	7.3		3.5	4.2	
Level of Service		D			D	D	A	A		A	A	
Approach Delay (s)		37.5			37.5		7.3			3.9		
Approach LOS		D			D		A			A		

Intersection Summary

HCM 2000 Control Delay: 15.2
 HCM 2000 Level of Service: B
 HCM 2000 Volume to Capacity ratio: 0.39
 Actuated Cycle Length (s): 90.0
 Sum of lost time (s): 15.0
 Intersection Capacity Utilization: 52.9%
 ICU Level of Service: A
 Analysis Period (min): 15
 c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis 20021 | 325 University Ave W, Cobourg
 3: Margaret St & University Ave W Ex PM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	1	0	66	0	0	27
Traffic Volume (veh/h)	1	0	66	0	0	27
Future Volume (Veh/h)	1	0	66	0	0	27
Sign Control	Free		Free		Yield	
Grade	0%		0%		0%	
Peak Hour Factor	0.75	0.75	0.75	0.75	0.75	0.75
Hourly flow rate (vph)	1	0	88	0	0	36
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage (veh)						
Upstream signal (m)	138					
pX, platoon unblocked						
vC, conflicting volume			1	177	1	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1	177	1	
tC, single (s)			4.1	6.4	6.2	
tC, 2 stage (s)						
tF (s)			2.2	3.5	3.3	
p0 queue free %			95	100	97	
cM capacity (veh/h)			1622	773	1090	
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	1	88	36			
Volume Left	0	88	0			
Volume Right	0	0	36			
cSH	1700	1622	1090			
Volume to Capacity	0.00	0.05	0.03			
Queue Length 95th (m)	0.0	1.4	0.8			
Control Delay (s)	0.0	7.3	8.4			
Lane LOS	A		A			
Approach Delay (s)	0.0	7.3	8.4			
Approach LOS	A		A			
Intersection Summary						
Average Delay			7.6			
Intersection Capacity Utilization			20.3%	ICU Level of Service		A
Analysis Period (min)			15			

APPENDIX C

Intersection Capacity Analysis – Future Background Traffic Condition



Queues
1: William St & University Ave W

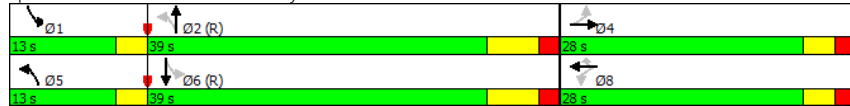
20021 | 325 University Ave W, Cobourg
FB AM

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	SBL	SBT	Ø5
Lane Configurations		↔		↕	↕	↕	↕	↕	
Traffic Volume (vph)	24	16	4	22	264	234	280	263	
Future Volume (vph)	24	16	4	22	264	234	280	263	
Lane Group Flow (vph)	0	43	0	27	278	250	295	291	
Turn Type	Perm	NA	Perm	NA	Perm	NA	pm+pt	NA	
Protected Phases		4		8		8	2	1	6
Permitted Phases	4		8		8			6	
Detector Phase	4	4	8	8	8	2	1	6	
Switch Phase									
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0	15.0	7.0	15.0	7.0
Minimum Split (s)	28.0	28.0	28.0	28.0	28.0	37.0	10.0	37.0	10.0
Total Split (s)	28.0	28.0	28.0	28.0	28.0	39.0	13.0	39.0	13.0
Total Split (%)	35.0%	35.0%	35.0%	35.0%	35.0%	48.8%	16.3%	48.8%	16%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	5.0	3.0	5.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.0	2.0	0.0
Lost Time Adjust (s)		0.0		0.0		0.0		0.0	
Total Lost Time (s)		5.0		5.0		7.0		3.0	7.0
Lead/Lag						Lag	Lead	Lag	Lead
Lead-Lag Optimize?						Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	C-Max	None	C-Max	None
v/c Ratio		0.25		0.14	0.66	0.12	0.33	0.12	
Control Delay		34.3		32.1	12.6	8.6	3.6	3.4	
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay		34.3		32.1	12.6	8.6	3.6	3.4	
Queue Length 50th (m)		6.4		4.1	0.0	7.8	7.5	4.8	
Queue Length 95th (m)		14.7		10.5	20.1	18.2	21.3	11.5	
Internal Link Dist (m)		114.3		91.9		176.6		111.5	
Turn Bay Length (m)							38.0		
Base Capacity (vph)		439		500	640	2007	893	2502	
Starvation Cap Reductn		0		0	0	0	0	0	
Spillback Cap Reductn		0		0	0	0	0	0	
Storage Cap Reductn		0		0	0	0	0	0	
Reduced v/c Ratio		0.10		0.05	0.43	0.12	0.33	0.12	

Intersection Summary

Cycle Length: 80
 Actuated Cycle Length: 80
 Offset: 45 (56%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 75
 Control Type: Actuated-Coordinated

Splits and Phases: 1: William St & University Ave W



HCM Signalized Intersection Capacity Analysis
1: William St & University Ave W

20021 | 325 University Ave W, Cobourg
FB AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↕	↕	↕	↕	↕	↕	↕	↕
Traffic Volume (vph)	24	16	1	4	22	264	0	234	4	280	263	13
Future Volume (vph)	24	16	1	4	22	264	0	234	4	280	263	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0	5.0		7.0		3.0	7.0	
Lane Util. Factor		1.00			1.00	1.00		0.95		1.00	0.95	
Flt		1.00			1.00	0.85		1.00		1.00	0.99	
Flt Protected		0.97			0.99	1.00		1.00		0.95	1.00	
Satd. Flow (prot)		1841			1809	1538		3432		1719	3387	
Flt Permitted		0.81			0.96	1.00		1.00		0.56	1.00	
Satd. Flow (perm)		1525			1741	1538		3432		1015	3387	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	25	17	1	4	23	278	0	246	4	295	277	14
RTOR Reduction (vph)	0	1	0	0	0	247	0	1	0	0	2	0
Lane Group Flow (vph)	0	42	0	0	27	31	0	249	0	295	289	0
Heavy Vehicles (%)	0%	0%	0%	0%	5%	5%	0%	5%	0%	5%	6%	2%
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		9.0			9.0	9.0		46.7		59.0	59.0	
Effective Green, g (s)		9.0			9.0	9.0		46.7		59.0	59.0	
Actuated g/C Ratio		0.11			0.11	0.11		0.58		0.74	0.74	
Clearance Time (s)		5.0			5.0	5.0		7.0		3.0	7.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)		171			195	173		2003		830	2497	
v/s Ratio Prot								0.07		c0.04	0.09	
v/s Ratio Perm		c0.03			0.02	0.02				c0.22		
v/c Ratio		0.25			0.14	0.18		0.12		0.36	0.12	
Uniform Delay, d1		32.4			32.0	32.2		7.5		3.4	3.0	
Progression Factor		1.00			1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2		0.8			0.3	0.5		0.1		0.3	0.1	
Delay (s)		33.2			32.3	32.7		7.6		3.7	3.1	
Level of Service		C			C	C		A		A	A	
Approach Delay (s)		33.2			32.6			7.6			3.4	
Approach LOS		C			C			A			A	

Intersection Summary

HCM 2000 Control Delay: 12.9
 HCM 2000 Level of Service: B
 HCM 2000 Volume to Capacity ratio: 0.36
 Actuated Cycle Length (s): 80.0
 Sum of lost time (s): 15.0
 Intersection Capacity Utilization: 50.2%
 ICU Level of Service: A
 Analysis Period (min): 15
 c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis 20021 | 325 University Ave W, Cobourg
 3: Margaret St & University Ave W FB AM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔			↔	↔	
Traffic Volume (veh/h)	1	0	56	0	0	73
Future Volume (Veh/h)	1	0	56	0	0	73
Sign Control	Free		Free		Yield	
Grade	0%		0%		0%	
Peak Hour Factor	0.74	0.74	0.74	0.74	0.74	0.74
Hourly flow rate (vph)	1	0	76	0	0	99
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage (veh)						
Upstream signal (m)	138					
pX, platoon unblocked						
vC, conflicting volume			1	153	1	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1	153	1	
tC, single (s)			4.2	6.4	6.2	
tC, 2 stage (s)						
tF (s)			2.3	3.5	3.3	
p0 queue free %			95	100	91	
cM capacity (veh/h)			1589	803	1090	
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	1	76	99			
Volume Left	0	76	0			
Volume Right	0	0	99			
cSH	1700	1589	1090			
Volume to Capacity	0.00	0.05	0.09			
Queue Length 95th (m)	0.0	1.2	2.4			
Control Delay (s)	0.0	7.4	8.6			
Lane LOS	A		A			
Approach Delay (s)	0.0	7.4	8.6			
Approach LOS	A					
Intersection Summary						
Average Delay			8.0			
Intersection Capacity Utilization			21.0%	ICU Level of Service	A	
Analysis Period (min)	15					

Queues
1: William St & University Ave W

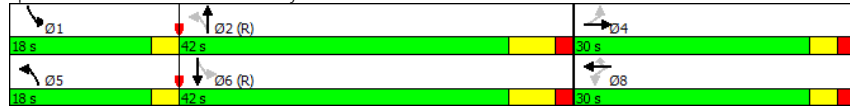
20021 | 325 University Ave W, Cobourg
FB PM

	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations		↔		↕	↕	↕	↕↔	↕	↕↔
Traffic Volume (vph)	11	25	13	35	330	4	310	313	308
Future Volume (vph)	11	25	13	35	330	4	310	313	308
Lane Group Flow (vph)	0	40	0	51	347	4	332	329	347
Turn Type	Perm	NA	Perm	NA	Perm	pm+pt	NA	pm+pt	NA
Protected Phases		4		8		5	2	1	6
Permitted Phases	4		8		8	2		6	
Detector Phase	4	4	8	8	8	5	2	1	6
Switch Phase									
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0	7.0	15.0	7.0	15.0
Minimum Split (s)	30.0	30.0	30.0	30.0	30.0	10.0	37.0	10.0	37.0
Total Split (s)	30.0	30.0	30.0	30.0	30.0	18.0	42.0	18.0	42.0
Total Split (%)	33.3%	33.3%	33.3%	33.3%	33.3%	20.0%	46.7%	20.0%	46.7%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	5.0	3.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	0.0	2.0	0.0	2.0
Lost Time Adjust (s)		0.0		0.0		0.0	0.0		0.0
Total Lost Time (s)		5.0		5.0		5.0	7.0		7.0
Lead/Lag						Lead	Lag	Lead	Lag
Lead-Lag Optimize?						Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	C-Max	None	C-Max
v/c Ratio		0.23		0.28	0.72	0.00	0.15	0.37	0.13
Control Delay		37.0		39.4	13.5	3.0	8.4	3.8	4.5
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		37.0		39.4	13.5	3.0	8.4	3.8	4.5
Queue Length 50th (m)		6.6		8.9	0.0	0.1	11.1	9.0	6.1
Queue Length 95th (m)		14.9		18.3	23.8	1.0	24.8	25.4	20.7
Internal Link Dist (m)		114.3		91.9			176.6		111.5
Turn Bay Length (m)						38.0		38.0	
Base Capacity (vph)		448		478	694	955	2182	925	2583
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		0.09		0.11	0.50	0.00	0.15	0.36	0.13

Intersection Summary

Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 45 (50%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 80
 Control Type: Actuated-Coordinated

Splits and Phases: 1: William St & University Ave W



HCM Signalized Intersection Capacity Analysis
1: William St & University Ave W

20021 | 325 University Ave W, Cobourg
FB PM

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔		↕	↕	↕	↕	↕↔	↕	↕↔	↕	↕
Traffic Volume (vph)	11	25	2	13	35	330	4	310	6	313	308	22
Future Volume (vph)	11	25	2	13	35	330	4	310	6	313	308	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0	3.0	7.0		3.0	7.0		
Lane Util. Factor		1.00		1.00	1.00	1.00	0.95		1.00	0.95		
Friction		0.99		1.00	0.85	1.00	1.00		1.00	0.99		
Flt Protected		0.99		0.99	1.00	0.95	1.00		0.95	1.00		
Satd. Flow (prot)		1767		1874	1599	1805	3531		1787	3497		
Flt Permitted		0.90		0.91	1.00	0.54	1.00		0.52	1.00		
Satd. Flow (perm)		1611		1722	1599	1033	3531		984	3497		
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	12	26	2	14	37	347	4	326	6	329	324	23
RTOR Reduction (vph)	0	2	0	0	0	310	0	1	0	0	3	0
Lane Group Flow (vph)	0	38	0	0	51	37	4	331	0	329	344	0
Heavy Vehicles (%)	0%	8%	0%	0%	0%	1%	0%	2%	0%	1%	2%	5%
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		9.6			9.6	9.6	57.0	55.6		68.4	64.0	
Effective Green, g (s)		9.6			9.6	9.6	57.0	55.6		68.4	64.0	
Actuated g/C Ratio		0.11			0.11	0.11	0.63	0.62		0.76	0.71	
Clearance Time (s)		5.0			5.0	5.0	3.0	7.0		3.0	7.0	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		171			183	170	666	2181		835	2486	
v/s Ratio Prot							0.00	0.09		c0.04	0.10	
v/s Ratio Perm		0.02			c0.03	0.02	0.00			c0.26		
v/c Ratio		0.22			0.28	0.22	0.01	0.15		0.39	0.14	
Uniform Delay, d1		36.8			37.0	36.8	6.1	7.3		3.3	4.2	
Progression Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.7			0.8	0.6	0.0	0.1		0.3	0.1	
Delay (s)		37.5			37.8	37.4	6.1	7.4		3.6	4.3	
Level of Service		D			D	D	A	A		A	A	
Approach Delay (s)		37.5			37.5		7.4			3.9		
Approach LOS		D			D		A			A		

Intersection Summary

HCM 2000 Control Delay: 14.9, HCM 2000 Level of Service: B
 HCM 2000 Volume to Capacity ratio: 0.39
 Actuated Cycle Length (s): 90.0, Sum of lost time (s): 15.0
 Intersection Capacity Utilization: 52.9%, ICU Level of Service: A
 Analysis Period (min): 15

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis 20021 | 325 University Ave W, Cobourg
 3: Margaret St & University Ave W FB PM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	1	0	66	0	0	27
Traffic Volume (veh/h)	1	0	66	0	0	27
Future Volume (Veh/h)	1	0	66	0	0	27
Sign Control	Free			Free	Yield	
Grade	0%			0%	0%	
Peak Hour Factor	0.75	0.75	0.75	0.75	0.75	0.75
Hourly flow rate (vph)	1	0	88	0	0	36
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage (veh)						
Upstream signal (m)				138		
pX, platoon unblocked						
vC, conflicting volume			1		177	1
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1		177	1
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			95		100	97
cM capacity (veh/h)			1622		773	1090
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	1	88	36			
Volume Left	0	88	0			
Volume Right	0	0	36			
cSH	1700	1622	1090			
Volume to Capacity	0.00	0.05	0.03			
Queue Length 95th (m)	0.0	1.4	0.8			
Control Delay (s)	0.0	7.3	8.4			
Lane LOS		A	A			
Approach Delay (s)	0.0	7.3	8.4			
Approach LOS			A			
Intersection Summary						
Average Delay			7.6			
Intersection Capacity Utilization			20.3%		ICU Level of Service	A
Analysis Period (min)			15			

APPENDIX D

Intersection Capacity Analysis – Future Total Traffic Condition



Queues
1: William St & University Ave W

20021 | 325 University Ave W, Cobourg
FT AM

	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations		↔		↕	↕	↕	↕↔	↕	↕↔
Traffic Volume (vph)	28	19	4	23	264	2	234	280	263
Future Volume (vph)	28	19	4	23	264	2	234	280	263
Lane Group Flow (vph)	0	52	0	28	278	2	250	295	291
Turn Type	Perm	NA	Perm	NA	Perm	pm+pt	NA	pm+pt	NA
Protected Phases		4		8		5	2	1	6
Permitted Phases	4		8		8	2		6	
Detector Phase	4	4	8	8	8	5	2	1	6
Switch Phase									
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0	7.0	15.0	7.0	15.0
Minimum Split (s)	28.0	28.0	28.0	28.0	28.0	10.0	37.0	10.0	37.0
Total Split (s)	28.0	28.0	28.0	28.0	28.0	13.0	39.0	13.0	39.0
Total Split (%)	35.0%	35.0%	35.0%	35.0%	35.0%	16.3%	48.8%	16.3%	48.8%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	5.0	3.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	0.0	2.0	0.0	2.0
Lost Time Adjust (s)		0.0		0.0		0.0	0.0		0.0
Total Lost Time (s)		5.0		5.0		5.0	7.0		7.0
Lead/Lag						Lead	Lag	Lead	Lag
Lead-Lag Optimize?						Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	C-Max	None	C-Max
v/c Ratio		0.30		0.14	0.66	0.00	0.12	0.33	0.12
Control Delay		34.4		32.1	12.5	3.0	8.7	3.6	4.7
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		34.4		32.1	12.5	3.0	8.7	3.6	4.7
Queue Length 50th (m)		7.5		4.2	0.0	0.1	7.9	7.8	5.0
Queue Length 95th (m)		16.7		10.7	20.1	0.6	18.2	21.3	17.1
Internal Link Dist (m)		64.3		91.9			11.1		111.5
Turn Bay Length (m)						38.0		38.0	
Base Capacity (vph)		441		500	640	916	2002	892	2414
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		0.12		0.06	0.43	0.00	0.12	0.33	0.12

Intersection Summary

Cycle Length: 80
 Actuated Cycle Length: 80
 Offset: 45 (56%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 75
 Control Type: Actuated-Coordinated

Splits and Phases: 1: William St & University Ave W



HCM Signalized Intersection Capacity Analysis
1: William St & University Ave W

20021 | 325 University Ave W, Cobourg
FT AM

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↕	↕	↕	↕↔	↕	↕	↕↔	↕
Traffic Volume (vph)	28	19	3	4	23	264	2	234	4	280	263	13
Future Volume (vph)	28	19	3	4	23	264	2	234	4	280	263	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0	5.0	3.0	7.0		3.0	7.0	
Lane Util. Factor		1.00			1.00	1.00	1.00	0.95		1.00	0.95	
Friction		0.99			1.00	0.85	1.00	1.00		1.00	0.99	
Flt Protected		0.97			0.99	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1834			1809	1538	1805	3432		1719	3387	
Flt Permitted		0.81			0.96	1.00	0.57	1.00		0.56	1.00	
Satd. Flow (perm)		1529			1741	1538	1090	3432		1015	3387	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	29	20	3	4	24	278	2	246	4	295	277	14
RTOR Reduction (vph)	0	3	0	0	0	247	0	1	0	0	3	0
Lane Group Flow (vph)	0	49	0	0	28	31	2	249	0	295	288	0
Heavy Vehicles (%)	0%	0%	0%	0%	5%	5%	0%	5%	0%	5%	6%	2%
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		9.0			9.0	9.0	48.1	46.7		59.0	54.6	
Effective Green, g (s)		9.0			9.0	9.0	48.1	46.7		59.0	54.6	
Actuated g/C Ratio		0.11			0.11	0.11	0.60	0.58		0.74	0.68	
Clearance Time (s)		5.0			5.0	5.0	3.0	7.0		3.0	7.0	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		172			195	173	667	2003		830	2311	
v/s Ratio Prot							0.00	0.07		c0.04	0.09	
v/s Ratio Perm		c0.03			0.02	0.02	0.00			c0.22		
v/c Ratio		0.29			0.14	0.18	0.00	0.12		0.36	0.12	
Uniform Delay, d1		32.6			32.0	32.2	6.4	7.5		3.4	4.4	
Progression Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.9			0.3	0.5	0.0	0.1		0.3	0.1	
Delay (s)		33.5			32.4	32.7	6.4	7.6		3.7	4.5	
Level of Service		C			C	C	A	A		A	A	
Approach Delay (s)		33.5			32.6		7.6			4.1		
Approach LOS		C			C		A			A		

Intersection Summary

HCM 2000 Control Delay: 13.4, HCM 2000 Level of Service: B
 HCM 2000 Volume to Capacity ratio: 0.36
 Actuated Cycle Length (s): 80.0, Sum of lost time (s): 15.0
 Intersection Capacity Utilization: 50.7%, ICU Level of Service: A
 Analysis Period (min): 15

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis 2021 | 325 University Ave W, Cobourg
 2: University Ave W FT AM

	→	↖	↙	←	↘	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↖			↗	↘	
Traffic Volume (veh/h)	41	2	4	35	3	9
Future Volume (Veh/h)	41	2	4	35	3	9
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)	45	2	4	38	3	10
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)				88		
pX, platoon unblocked						
vC, conflicting volume			47		92	46
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			47		92	46
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	99
cM capacity (veh/h)			1560		906	1023
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	47	42	13			
Volume Left	0	4	3			
Volume Right	2	0	10			
cSH	1700	1560	994			
Volume to Capacity	0.03	0.00	0.01			
Queue Length 95th (m)	0.0	0.1	0.3			
Control Delay (s)	0.0	0.7	8.7			
Lane LOS		A	A			
Approach Delay (s)	0.0	0.7	8.7			
Approach LOS			A			
Intersection Summary						
Average Delay		1.4				
Intersection Capacity Utilization		15.2%	ICU Level of Service	A		
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis 2021 | 325 University Ave W, Cobourg
 3: Margaret St & University Ave W FT AM

	→	↖	↙	←	↘	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↖			↗	↘	
Traffic Volume (veh/h)	1	0	59	0	0	75
Future Volume (Veh/h)	1	0	59	0	0	75
Sign Control	Free			Free	Yield	
Grade	0%			0%	0%	
Peak Hour Factor	0.74	0.74	0.74	0.74	0.74	0.74
Hourly flow rate (vph)	1	0	80	0	0	101
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)				138		
pX, platoon unblocked						
vC, conflicting volume			1		161	1
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1		161	1
tC, single (s)			4.2		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.3		3.5	3.3
p0 queue free %			95		100	91
cM capacity (veh/h)			1589		793	1090
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	1	80	101			
Volume Left	0	80	0			
Volume Right	0	0	101			
cSH	1700	1589	1090			
Volume to Capacity	0.00	0.05	0.09			
Queue Length 95th (m)	0.0	1.3	2.4			
Control Delay (s)	0.0	7.4	8.6			
Lane LOS		A	A			
Approach Delay (s)	0.0	7.4	8.6			
Approach LOS			A			
Intersection Summary						
Average Delay		8.0				
Intersection Capacity Utilization		21.2%	ICU Level of Service	A		
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis 20021 | 325 University Ave W, Cobourg
 4: William St FT AM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↑		↑↑	↑↑	
Traffic Volume (veh/h)	0	5	0	238	268	0
Future Volume (Veh/h)	0	5	0	238	268	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	5	0	259	291	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)	35					
pX, platoon unblocked	0.98	0.98	0.98			
vC, conflicting volume	420	146	291			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	361	80	229			
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	99	100			
cM capacity (veh/h)	597	942	1306			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	5	130	130	194	97	
Volume Left	0	0	0	0	0	
Volume Right	5	0	0	0	0	
cSH	942	1700	1700	1700	1700	
Volume to Capacity	0.01	0.08	0.08	0.11	0.06	
Queue Length 95th (m)	0.1	0.0	0.0	0.0	0.0	
Control Delay (s)	8.8	0.0	0.0	0.0	0.0	
Lane LOS	A					
Approach Delay (s)	8.8	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay	0.1					
Intersection Capacity Utilization	17.4%		ICU Level of Service		A	
Analysis Period (min)	15					

Queues
1: William St & University Ave W

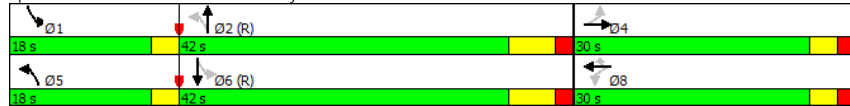
20021 | 325 University Ave W, Cobourg
FT PM

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations		↔		↕	↗	↖	↕	↗	↖
Traffic Volume (vph)	12	28	13	42	330	7	310	313	310
Future Volume (vph)	12	28	13	42	330	7	310	313	310
Lane Group Flow (vph)	0	46	0	58	347	7	332	329	351
Turn Type	Perm	NA	Perm	NA	Perm	pm+pt	NA	pm+pt	NA
Protected Phases		4		8		5	2	1	6
Permitted Phases	4		8		8	2		6	
Detector Phase	4	4	8	8	8	5	2	1	6
Switch Phase									
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0	15.0	7.0	15.0	
Minimum Split (s)	30.0	30.0	30.0	30.0	30.0	10.0	37.0	10.0	37.0
Total Split (s)	30.0	30.0	30.0	30.0	30.0	18.0	42.0	18.0	42.0
Total Split (%)	33.3%	33.3%	33.3%	33.3%	33.3%	20.0%	46.7%	20.0%	46.7%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	5.0	3.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	0.0	2.0	0.0	2.0
Lost Time Adjust (s)		0.0		0.0		0.0	0.0		0.0
Total Lost Time (s)		5.0		5.0		5.0	7.0		7.0
Lead/Lag						Lead	Lag	Lead	Lag
Lead-Lag Optimize?						Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	C-Max	None	C-Max
v/c Ratio		0.26		0.31	0.72	0.01	0.15	0.37	0.14
Control Delay		36.6		40.2	13.4	3.0	8.5	3.8	4.5
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		36.6		40.2	13.4	3.0	8.5	3.8	4.5
Queue Length 50th (m)		7.3		10.1	0.0	0.3	11.2	9.3	6.3
Queue Length 95th (m)		16.3		20.0	23.8	1.3	24.8	25.4	20.9
Internal Link Dist (m)		75.5		91.9			9.8		111.5
Turn Bay Length (m)						38.0		38.0	
Base Capacity (vph)		449		482	694	951	2180	924	2578
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		0.10		0.12	0.50	0.01	0.15	0.36	0.14

Intersection Summary

Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 45 (50%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 80
 Control Type: Actuated-Coordinated

Splits and Phases: 1: William St & University Ave W



HCM Signalized Intersection Capacity Analysis
1: William St & University Ave W

20021 | 325 University Ave W, Cobourg
FT PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↕	↗	↖	↕	↗	↖	↕	↗
Traffic Volume (vph)	12	28	4	13	42	330	7	310	6	313	310	24
Future Volume (vph)	12	28	4	13	42	330	7	310	6	313	310	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0	3.0	7.0		3.0	7.0		
Lane Util. Factor		1.00		1.00	1.00	1.00	0.95		1.00	0.95		
Friction		0.99		1.00	0.85	1.00	1.00		1.00	0.99		
Flt Protected		0.99		0.99	1.00	0.95	1.00		0.95	1.00		
Satd. Flow (prot)		1763		1877	1599	1805	3531		1787	3494		
Flt Permitted		0.90		0.91	1.00	0.54	1.00		0.52	1.00		
Satd. Flow (perm)		1608		1738	1599	1029	3531		984	3494		
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	13	29	4	14	44	347	7	326	6	329	326	25
RTOR Reduction (vph)	0	4	0	0	0	310	0	1	0	0	3	0
Lane Group Flow (vph)	0	42	0	0	58	37	7	331	0	329	348	0
Heavy Vehicles (%)	0%	8%	0%	0%	0%	1%	0%	2%	0%	1%	2%	5%
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		9.6			9.6	9.6	57.0	55.6		68.4	64.0	
Effective Green, g (s)		9.6			9.6	9.6	57.0	55.6		68.4	64.0	
Actuated g/C Ratio		0.11			0.11	0.11	0.63	0.62		0.76	0.71	
Clearance Time (s)		5.0			5.0	5.0	3.0	7.0		3.0	7.0	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		171			185	170	663	2181		835	2484	
v/s Ratio Prot							0.00	0.09		c0.04	0.10	
v/s Ratio Perm		0.03			c0.03	0.02	0.01			c0.26		
v/c Ratio		0.25			0.31	0.22	0.01	0.15		0.39	0.14	
Uniform Delay, d1		36.9			37.2	36.8	6.1	7.3		3.3	4.2	
Progression Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.8			1.0	0.6	0.0	0.1		0.3	0.1	
Delay (s)		37.7			38.1	37.4	6.1	7.4		3.6	4.3	
Level of Service		D			D	D	A	A		A	A	
Approach Delay (s)		37.7			37.5		7.4			3.9		
Approach LOS		D			D		A			A		

Intersection Summary

HCM 2000 Control Delay: 15.0
 HCM 2000 Level of Service: B
 HCM 2000 Volume to Capacity ratio: 0.40
 Actuated Cycle Length (s): 90.0
 Sum of lost time (s): 15.0
 Intersection Capacity Utilization: 52.9%
 ICU Level of Service: A
 Analysis Period (min): 15
 Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
2: University Ave W

20021 | 325 University Ave W, Cobourg
FT PM

	→	↖	↗	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↖			↖	↗	
Traffic Volume (veh/h)	38	3	13	61	2	6
Future Volume (Veh/h)	38	3	13	61	2	6
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)	41	3	14	66	2	7
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage (veh)						
Upstream signal (m)				99		
pX, platoon unblocked						
vC, conflicting volume			44		136	42
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			44		136	42
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		100	99
cM capacity (veh/h)			1564		849	1028
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	44	80	9			
Volume Left	0	14	2			
Volume Right	3	0	7			
cSH	1700	1564	982			
Volume to Capacity	0.03	0.01	0.01			
Queue Length 95th (m)	0.0	0.2	0.2			
Control Delay (s)	0.0	1.3	8.7			
Lane LOS		A	A			
Approach Delay (s)	0.0	1.3	8.7			
Approach LOS			A			
Intersection Summary						
Average Delay			1.4			
Intersection Capacity Utilization			20.6%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
3: Margaret St & University Ave W

20021 | 325 University Ave W, Cobourg
FT PM

	→	↖	↗	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↖			↖	↗	
Traffic Volume (veh/h)	1	0	68	0	0	30
Future Volume (Veh/h)	1	0	68	0	0	30
Sign Control	Free			Free	Yield	
Grade	0%			0%	0%	
Peak Hour Factor	0.75	0.75	0.75	0.75	0.75	0.75
Hourly flow rate (vph)	1	0	91	0	0	40
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage (veh)						
Upstream signal (m)				138		
pX, platoon unblocked						
vC, conflicting volume			1		183	1
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1		183	1
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			94		100	96
cM capacity (veh/h)			1622		765	1090
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	1	91	40			
Volume Left	0	91	0			
Volume Right	0	0	40			
cSH	1700	1622	1090			
Volume to Capacity	0.00	0.06	0.04			
Queue Length 95th (m)	0.0	1.4	0.9			
Control Delay (s)	0.0	7.4	8.4			
Lane LOS		A	A			
Approach Delay (s)	0.0	7.4	8.4			
Approach LOS			A			
Intersection Summary						
Average Delay			7.6			
Intersection Capacity Utilization			20.4%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis 20021 | 325 University Ave W, Cobourg
 4: William St FT PM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↑		↑↑	↑↑	
Traffic Volume (veh/h)	0	4	0	320	323	2
Future Volume (Veh/h)	0	4	0	320	323	2
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	4	0	348	351	2
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None	None		
Median storage (veh)						
Upstream signal (m)	34					
pX, platoon unblocked	0.97	0.97	0.97			
vC, conflicting volume	526	176	353			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	458	99	280			
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	100	100			
cM capacity (veh/h)	517	913	1245			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	4	174	174	234	119	
Volume Left	0	0	0	0	0	
Volume Right	4	0	0	0	2	
cSH	913	1700	1700	1700	1700	
Volume to Capacity	0.00	0.10	0.10	0.14	0.07	
Queue Length 95th (m)	0.1	0.0	0.0	0.0	0.0	
Control Delay (s)	9.0	0.0	0.0	0.0	0.0	
Lane LOS	A					
Approach Delay (s)	9.0	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			0.1			
Intersection Capacity Utilization			19.0%	ICU Level of Service	A	
Analysis Period (min)			15			

APPENDIX E

Parking Survey Results



20021.220 - 325 University Ave W Proxy Parking Survey

Proxy Location: 360 Westwood Drive, Cobourg
of Units (% Occupancy): 47 (100%)
Max. Parking Demand: 43
Max.Demand Ratio: 0.91
Survey Date: Wednesday, April 24, 2019
Surveyor: Tevin Luu

Time Beginning	Parking Demand	Parking Demand Ratio (Spaces per unit)
18:00	35	0.74
18:30	29	0.62
19:00	30	0.64
19:30	31	0.66
20:00	36	0.77
20:30	41	0.87
21:00	40	0.85
21:30	41	0.87
22:00	43	0.91
22:30	42	0.89
23:00	42	0.89
23:30	42	0.89
0:00	43	0.91
0:30	42	0.89
1:00	42	0.89
1:30	42	0.89
2:00	42	0.89

Note: Peak Demand Intervals are shown in bold italic font

