

A

Appendix A Traffic Operational Analysis

TECHNICAL NOTE

Presented to: Mr. Walter Neubauer

Project: Greenlane Road Schedule 'C' Municipal Class Environmental Assessment

Date: 31-01-2024

O/Ref.: B001569

Subject: Transportation Analysis

Introduction

CIMA+ was retained by the Town of Lincoln (the Town) for the delivery of Professional Services for the Greenlane Road Reconstruction Schedule "C" Environmental Assessment. As part of the EA, a Transportation Analysis was conducted in support of the Environmental Assessment, for the existing and projected conditions along the roadway network surrounding Greenlane Road and Ontario Street. The following intersections were included within the scope of the analysis, which is also illustrated in Figure 1:

- Greenlane and Lincoln Avenue (Unsignalized)
- Greenlane and Cedarbrook Lane (Unsignalized)
- Greenlane and Ontario Street (Signalized)
- Greenlane and Carriage Road (Unsignalized)
- Greenlane and Garden Gate Terrace (Unsignalized)
- Greenlane and Barlett Road (Unsignalized)
- Ontario Street and Homestead Drive (Unsignalized)
- Ontario Street and Drake Avenue (Unsignalized)
- Ontario Street and Friesen Boulevard (Unsignalized)

For this purpose, the following assumptions were considered as part of the analysis:

- Growth rates were established using the information contained in the Additional Transportation Assessment prepared by NexTrans, dated 2023, and the Region's employment and population growth projections (see Appendix A).

- The operational analysis uses the metrics as described within section 3.6.1 of the Region of Niagara's (The Region) Traffic Impact Study (TIS) Guidelines which consider the following movements as critical:
 - o At signalized intersections, movements with v/c ratio greater than 0.85 and/or LOS "E" or worse are deemed to be "critical" in terms of operations. Movements that exceed those thresholds shall be evaluated for possible operational improvements.
 - o At unsignalized intersections, movements expected to operate at LOS "D" or worse and/or where the estimated 95th percentile queue length for an individual movement exceeds the available queuing space.
 - o Any site accesses where entrances or egress is anticipated to be blocked by traffic queues from an upstream/downstream intersection.
 - o An exclusive turning movement in which the 95th percentile queue will exceed the available storage space. Exclusive left and right turn lanes that are inaccessible due to the length of queues in the adjacent through lanes.

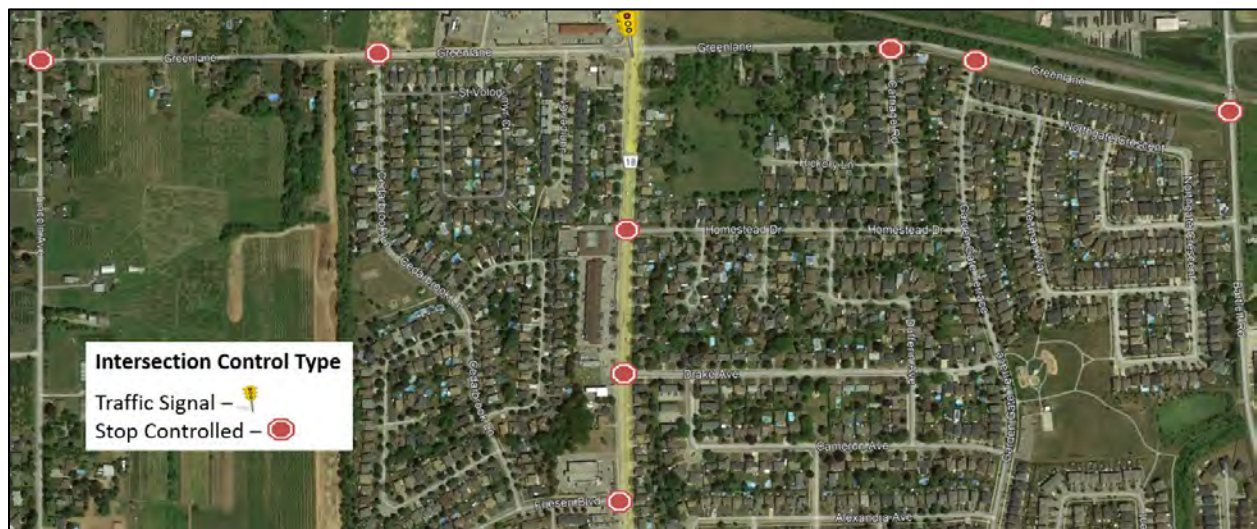


Figure 1: Study Area

Existing Conditions

Existing conditions were established using the Turning Movement Counts provided by the Region, and those extracted from the Additional Transportation Assessment. Outdated counts we're grown using a rate of 3% per year to 2023 Existing Conditions¹.

This percentage was also verified by calculating the 2021 to 2031 employment and population growth rate for the zones within the study area, which was provided by The Region. The intersections were balanced along Ontario Street to reduce any volumes disparities larger than 10% at each intersection.

The following vehicles were added at each intersection during the following peak periods:

- Greenlane and Ontario
 - o NBT – 100 in the AM and PM
 - o SBT – 200 in the PM
- Ontario and Homestead
 - o NBT – 50 in the PM
- Ontario and Friesen
 - o NBT – 187 in the AM and 50 in the PM
 - o SBT – 100 in the PM

The following figures presents a comparison between the balanced and unbalanced AM and PM volumes.

¹ As per the Additional Transportation Assessment by NexTrans, completed in 2023

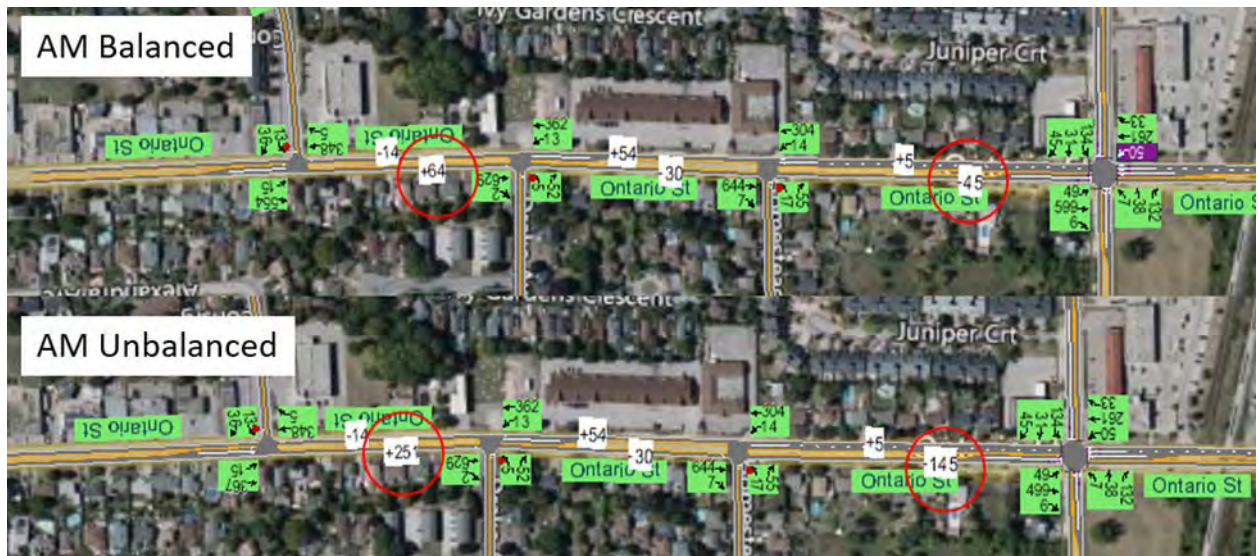


Figure 2: 2023 Existing Conditions AM Volume Balancing

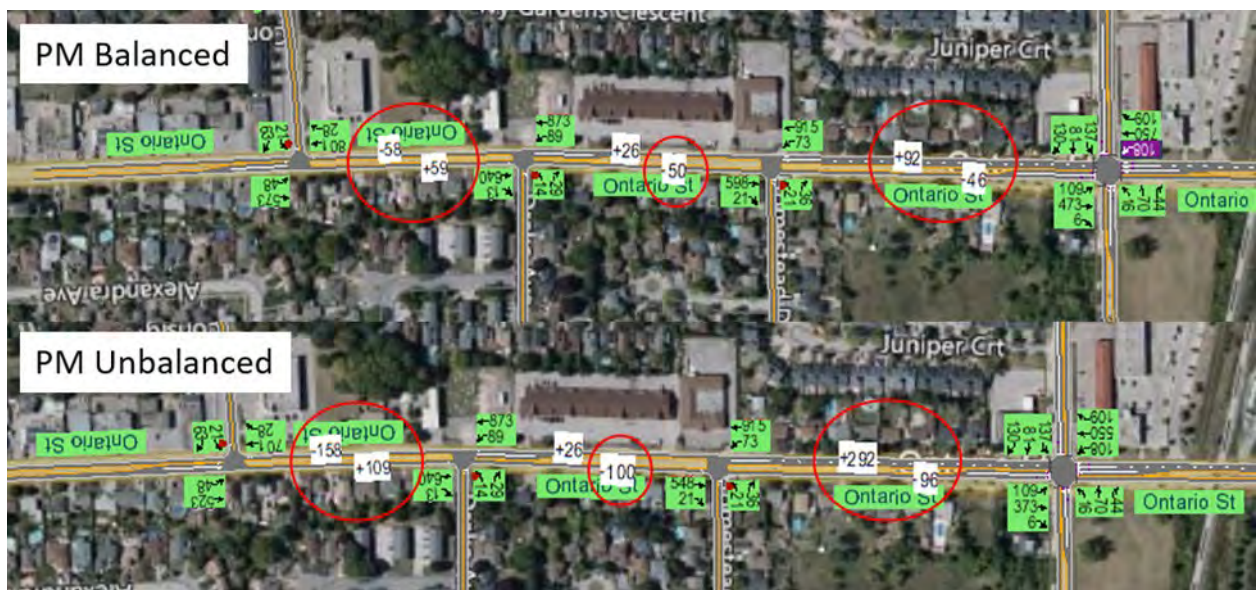


Figure 3: 2023 Existing Conditions PM Volume Balancing

Operational Analysis

Intersection operations were assessed using the Synchro 11 software which utilizes the Highway Capacity Manual (HCM) 2000 methodology published by the Transportation Research Board National Research Council. Synchro 11 can analyze both signalized and unsignalized intersections in a road corridor or network considering the spacing, interaction, queues, and operations between intersections. Intersection operations performance metrics are reported in terms of Level of Service (LOS), volume to capacity (v/c) ratios.

Level of Service is based on the average control delay per vehicle for a given movement. Delay is an indicator of how long a vehicle must wait to complete a movement and is represented by a letter between 'A' and 'F', with 'F' being the longest delay.

Table 1 summarizes the LOS criteria for signalized and unsignalized intersections.

Table 1 Intersection Level of Service Criteria

Level of Service	Average Control Delay per Vehicle (second/vehicle)	
	Signalized Intersection	Unsignalized Intersection
A	≤10	≤10
B	> 10 and ≤ 20	> 10 and ≤ 15
C	> 20 and ≤ 35	> 15 and ≤ 25
D	> 35 and ≤ 55	> 25 and ≤ 35
E	> 55 and ≤ 80	> 35 and ≤ 50
F	> 80	> 50

SimTraffic software was used to calculate the 95th percentile queue length to analyze and assess the available storage capacity and whether queue spillback or lane blockages occur due to long queues. The available storage capacity was based on the best available data collected from aerial imagery as well as the results of a review of existing conditions completed in December 2023.

Table 2 summarizes the results of the operational analysis.

Table 2: Existing Conditions Operations

Approach/Storage		Existing Conditions AM Peak Hour				Existing Conditions PM Peak Hour			
		Delay (sec)	LOS	v/c	95th Q	Delay (sec)	LOS	v/c	95th Q
Ontario St & Greenlane (Signalized)									
EB	EBL (50 m)	33	C	0.65	43.3	32.9	C	0.64	43.3
	EBTR	24.8	C	0.14	21.6	28	C	0.49	21.6
WB	WBL (45 m)	24.2	C	0.03	7.6	25.3	C	0.09	7.6
	WBTR	25.3	C	0.22	39.6	26.4	C	0.29	39.6

Approach/Storage		Existing Conditions AM Peak Hour				Existing Conditions PM Peak Hour			
		Delay (sec)	LOS	v/c	95th Q	Delay (sec)	LOS	v/c	95th Q
NB	NBL (60 m)	6.7	A	0.08	23.4	7.4	A	0.32	23.4
	NBTR	15.8	B	0.66	76.4	14	B	0.54	76.4
SB	SBL (45 m)	8	A	0.15	17.7	7.3	A	0.24	17.7
	SBTR	8.9	A	0.17	36.9	12.7	B	0.51	36.9
Overall Intersection		17.1	B	0.63	-	16.2	B	0.54	-
Bartlett Rd & Greenlane (Unsignalized)									
EB	EBLR	10.3	B	0.09	12.8	10.4	B	0.12	12.8
NB	NBLT	1.7	A	0.03	4.1	2.7	A	0.03	4.1
SB	SBTR	0	A	0.04	-	0	A	0.14	-
Garden Gate Terrace & Greenlane (Unsignalized)									
EB	EBTR	0	A	0.05	1.9	0	A	0.11	-
WB	WBLT	1.1	A	0.01	-	1.2	A	0.01	1.9
NB	NBLR	10.1	B	0.17	18.8	10.3	B	0.12	18.8
Carriage Rd & Greenlane (Unsignalized)									
EB	EBTR	0	A	0.05	-	0	A	0.13	-
WB	WBLT	0.1	A	0	1.2	0.2	A	0	1.2
NB	NBLR	10.2	B	0.03	12.8	10.7	B	0.03	12.8
Lincoln Ave & Greenlane (Unsignalized)									
EB	EBLTR	8	A	0	16	9.3	A	0	16
WB	WBLTR	8.4	A	0	17.6	9.6	A	0	17.6
NB	NBLTR	8.1	A	0	15.5	8.3	A	0	15.5
SB	SBLTR	7.8	A	0	13.2	9.1	A	0	13.2
Cedarbrooke Ln & Greenlane (Unsignalized)									
EB	EBTR	0	A	0.09	-	0	A	0.17	-
WB	WBLT	1.9	A	0.02	7.2	2.5	A	0.06	7.2
NB	NBLR	10.4	B	0.17	18.9	12.3	B	0.13	18.9
Ontario St & Homestead Dr (Unsignalized)									
WB	WBLR	17.5	C	0.21	19.4	79.2	F	0.59	19.4
NB	NBTR	0	A	0.42	-	0	A	0.4	-
SB	SBL	9.1	A	0.02	8.4	9.3	A	0.09	8.4
	SBT	0	A	0.19	-	0	A	0.59	-
Ontario St & Drake Ave (Unsignalized)									
WB	WBLR	15.2	C	0.15	15.7	34.3	D	0.28	15.7
NB	NBTR	0	A	0.4	-	0	A	0.42	-

Approach/Storage		Existing Conditions AM Peak Hour				Existing Conditions PM Peak Hour			
		Delay (sec)	LOS	v/c	95th Q	Delay (sec)	LOS	v/c	95th Q
SB	SBL	9	A	0.02	6.4	9.5	A	0.11	6.4
	SBT	0	A	0.23	-	0	A	0.56	-
Ontario St & Friesen Blvd (Unsignalized)									
EB	EBLR	13.6	B	0.11	14.4	32.4	D	0.41	14.4
NB	NBL	8.1	A	0.01	6.7	10.1	B	0.07	6.7
	NBTR	0	A	0.35	-	0	A	0.37	-
SB	SBTR	0	A	0.23	-	0	A	0.53	-

As shown, most intersections are expected to operate well during both periods, with the exception of Ontario Street and Homestead Drive, Ontario and Drake Avenue, and Ontario and Friesen Boulevard during the PM peak hour.

- Ontario Street and Homestead Drive
 - PM peak hour:
 - WBLR operates with an LOS F.
- Ontario Street and Drake Avenue
 - PM peak hour
 - WBLR operates with an LOS D
- Ontario Street and Friesen Boulevard
 - PM peak hour
 - EBLR operates with an LOS D.

Future Conditions

Background and Development Traffic

To determine the projected traffic to be considered for future scenarios the following stages were completed:

Stage 1. A 2026 future scenario was established by growing the 2023 existing conditions volumes at a rate of 3% per year². Since the Town was not able to confirm the build-out date for all the identified developments (shown in Figure 4), each development was assumed to have a build-out date of 2026 with the corresponding volumes and the trip distribution assumptions present with Greenlane: Capacity Assessment of Updated 2041 Forecasts (Greenlane Capacity Assessment), dated March of 2022. The site traffic's origin/destination was assumed to be the QEW/the

² This rate was agreed upon by the Town, within NexTrans' Proposed Mixed-Use Development Traffic Impact Study, dated June of 2022

development North of Greenlane and Ontario³. The additional volumes used from the assessment are provided below in Figure 5.



Figure 4: Greenlane and Ontario Street: Quadrants and Developments

³ As described within section 3.2 of the Greenlane Capacity Assessment

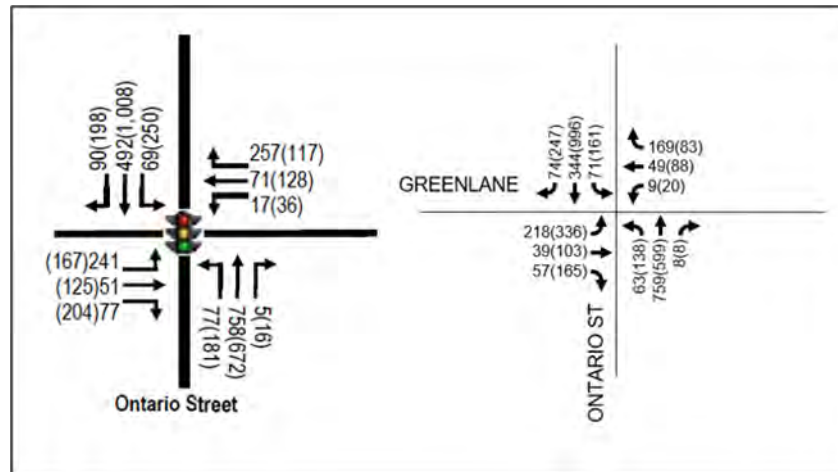


Figure 5: Development Volumes

Stage 2. The 2031 scenario was established by growing the 2026 scenario at a rate of 3% per year. To determine the adequacy of this assumption, the projected volumes (on the right) were compared against the numbers presented by Nextrans within the Additional Transportation Assessment (on the left). The numbers are comparable. As per scenario 4 of the Town's Transportation Master Plan, the intersection of Lincoln Avenue and Greenlane was converted to a two-way stop control on the minor approach for this and all future horizon years.

Table 4: 'Potential' population growth: additional trip productions and attractions

Quadrant	Traffic Zone	Development Number(s)	Trip Productions (from)		Trip Attractions (to)	
			AM	PM	AM	PM
NW	20006	Beamsville North 8, 9, 10	149	66	42	140
NE	20011	Beamsville North 11	28	12	8	26
SW	20007	Beamsville Central 1, 3, 4, 5	42	18	12	39
SE	20009	Beamsville Central 2	-6	-2	-2	-5
Total			213	94	60	199

Stage 3. The 2041 scenario was established by growing the 2031 scenario at a rate of 1% per year. This rate was calculated using the 2031 and 2041 population and employment projections provided by the Region. These growth projections were provided based on zones; however, the Region did not provide the link volumes, or distribution along Ontario Street and Greenlane. The

Town's 2019 Transportation Master Plan provides the Region's expected 2041 link volumes on Ontario Street which are shown in Figure 6. CIMA+'s 2041 projections exceed both the link volumes provided within the TMP, and the volumes provided within the Greenlane: Capacity Assessment. Figure 7 provides a comparison of the Ontario Street at Greenlane intersection, between Dillon's Capacity Assessment (on the left) and CIMA+'s projected volumes (on the right). As shown in the image, CIMA+'s projection anticipates significantly larger volumes, primarily along Ontario Street.



Figure 7: Transportation Master Plan 2041 Link Volumes

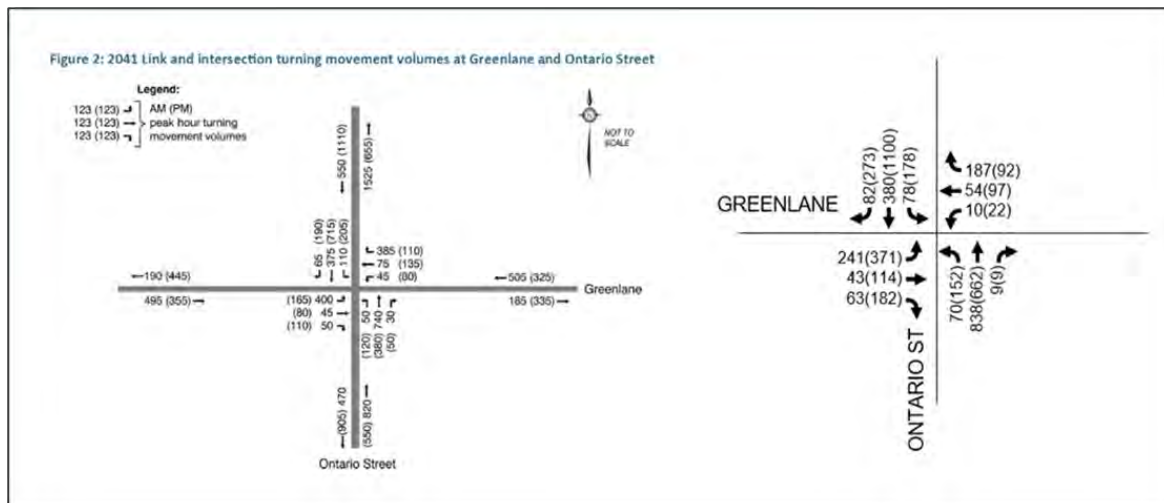


Figure 6: 2041 Greenlane and Ontario Street Volume Comparison

Operational Analysis – Do Nothing

2031 Horizon Year

Table 3 summarizes the results of the operational analysis. As shown, five intersections are expected to operate with at least one movement which can be considered critical, with the majority of these intersections being along Ontario Street. These movements include:

- Ontario Street and Greenlane
 - o AM peak hour
 - EBL operates with an LOS E, a v/c ratio of 0.9 and a 95th percentile queue which exceeds the available storage by 51 metres;
 - NBL operates with a 95th percentile queue which exceeds the available storage by 5 metres;
 - NBTR operates with a v/c ratio of 0.95 and a 95th percentile queue of 173.9 metres which would make the adjacent NBL lane inaccessible; and
 - An overall intersection v/c ratio of 0.89.
 - o PM peak hour
 - EBL operates with an LOS F, a v/c ratio of 1.14 and a 95th percentile queue which exceeds the available storage by 171.3 metres
 - EBTR operates with a 95th percentile queue of 379.6 metres which would make the adjacent EBL lane inaccessible
 - NBL operates with a 95th percentile queue which exceeds the available storage by 6.6 metres
 - NBTR operates with a 95th percentile queue of 108.9 metres which would make the adjacent NBL lane inaccessible
 - SBL operates with a 95th percentile queue which exceeds the available storage by 38.1 metres
 - SBTR operates with a v/c ratio of 0.86 and a 95th percentile queue of 200 metres which would make the adjacent NBL lane inaccessible; and
 - An overall intersection v/c ratio of 0.93.
- Lincoln Avenue and Greenlane;
 - o PM peak hour
 - SBLTR operates with an LOS D.
- Ontario Street and Homestead Drive

- o PM peak hour
 - WBLR operates with an error for the delay and an LOS F.
- Ontario Street and Drake Avenue
 - o PM peak hour
 - WBLR operates with an LOS F.
- Ontario Street and Friesen Boulevard
 - o PM peak hour
 - EBLR operates with an LOS F.

Table 3: 2031 Future Scenario Operational Analysis

Approach/Storage		2031 Future AM Peak Hour				2031 Future PM Peak Hour			
		Delay (sec)	LOS	v/c	95th Q	Delay (sec)	LOS	v/c	95th Q
Ontario St & Greenlane (Signalized)									
EB	EBL (50 m)	58.9	E	0.9	101	123.5	F	1.14	221.3
	EBTR	23.2	C	0.13	25.8	26.5	C	0.49	379.6
WB	WBL (45 m)	22.5	C	0.03	7.9	23.2	C	0.1	13.3
	WBTR	24	C	0.24	43.8	24.8	C	0.31	41.3
NB	NBL (60 m)	9.3	A	0.13	65	20.8	C	0.66	66.6
	NBTR	41.3	D	0.95	173.9	27.4	C	0.79	108.9
SB	SBL (45 m)	16.3	B	0.38	22.2	15.6	B	0.57	83.1
	SBTR	13.4	B	0.27	50.5	27.4	C	0.86	200
Overall Intersection		32	C	0.89	-	37.2	D	0.93	-
Bartlett Rd & Greenlane (Unsignalized)									
EB	EBLR	11.3	B	0.12	13	11.2	B	0.16	16.3
NB	NBLT	1.7	A	0.04	9.1	2.8	A	0.04	12.9
SB	SBTR	0	A	0.05	-	0	A	0.17	-
Garden Gate Terrace & Greenlane (Unsignalized)									
EB	EBTR	0	A	0.07	-	0	A	0.14	-
WB	WBLT	1.2	A	0.01	4.1	1.2	A	0.01	4.8
NB	NBLR	10.9	B	0.25	20.5	11.1	B	0.16	17.6
Carriage Rd & Greenlane (Unsignalized)									
EB	EBTR	0	A	0.07	-	0	A	0.17	-
WB	WBLT	0.1	A	0	-	0.2	A	0	3.8
NB	NBLR	10.8	B	0.05	13.9	11.6	B	0.04	12
Lincoln Ave & Greenlane (Unsignalized)									
EB	EBLTR	0.8	A	0.01	4.1	0.4	A	0.01	7.3

Approach/Storage		2031 Future AM Peak Hour				2031 Future PM Peak Hour			
		Delay (sec)	LOS	v/c	95th Q	Delay (sec)	LOS	v/c	95th Q
W	WBLTR	1.2	A	0.02	8.3	2.3	A	0.06	14.1
NB	NBLTR	13.9	B	0.33	22.8	16.7	C	0.27	18.4
SB	SBLTR	12.7	B	0.17	16.5	30.1	D	0.57	24.3
Cedarbrooke Ln & Greenlane (Unsignalized)									
EB	EBTR	0	A	0.11	-	0	A	0.21	146.7
W	WBLT	2	A	0.03	9.6	2.8	A	0.09	20.5
NB	NBLR	11.3	B	0.24	21.6	14.7	B	0.21	83.8
Ontario St & Homestead Dr (Unsignalized)									
W	WBLR	27.2	D	0.38	24.4	Err	F	3.61	31.5
NB	NBTR	0	A	0.53	-	0	A	0.5	1.6
SB	SBL	9.9	A	0.02	9.2	10.2	B	0.13	18.4
	SBT	0	A	0.25	-	0	A	0.75	71.8
Ontario St & Drake Ave (Unsignalized)									
W	WBLR	20.2	C	0.25	18.7	100.6	F	0.65	27.3
NB	NBTR	0	A	0.51	-	0	A	0.52	1.7
SB	SBL	9.7	A	0.02	9.6	10.6	B	0.16	18.8
	SBT	0	A	0.32	-	0	A	0.71	-
Ontario St & Friesen Blvd (Unsignalized)									
EB	EBLR	16.9	C	0.18	17.7	109.3	F	0.87	37.3
NB	NBL	8.4	A	0.02	8.7	11.6	B	0.11	17.4
	NBTR	0	A	0.45	-	0	A	0.46	-
SB	SBTR	0	A	0.29	-	0	A	0.68	2.5

2041 Horizon Year

Table 4 provides the results of the operational analysis. As shown, some intersections are expected to operate with at least one movement which can be considered critical, with the majority of these intersections being along Ontario Street. These movements include:

- Ontario Street and Greenlane
 - o AM peak hour
 - EBL operates with an LOS F, a v/c ratio of 0.99 and a 95th percentile queue which exceeds the available storage by 170.9 metres
 - EBTR operates with a 95th percentile queue of 256.6 metres which would make the adjacent EBL lane inaccessible.

- NBL operates with a 95th percentile queue which exceeds the available storage by 17.55 metres
 - NBTR operates with an LOS E, a v/c ratio of 1.08 and a 95th percentile queue of 293.6 metres which would make the adjacent NBL lane inaccessible; and
 - An overall intersection v/c ratio of 1.
- o PM peak hour
 - EBL operates with an LOS F, a v/c ratio of 1.33 and a 95th percentile queue which exceeds the available storage by 156.4 metres
 - EBTR operates with a 95th percentile queue of 394.7 metres which would make the adjacent EBL lane inaccessible
 - NBL operates with a 95th percentile queue which exceeds the available storage by 16.6 metres
 - NBTR operates with a v/c ratio of 0.88, and a 95th percentile queue of 152.7 metres which would make the adjacent NBL lane inaccessible
 - SBL operates with a 95th percentile queue which exceeds the available storage by 55.6 metres
 - SBTR operates with a v/c ratio of 0.95 and a 95th percentile queue of 200.3 metres which would make the adjacent NBL lane inaccessible; and
 - An overall intersection v/c ratio of 1.06.
- Lincoln Avenue and Greenlane
 - o PM peak hour
 - SBLTR operates with an LOS E.
- Ontario Street and Homestead Drive
 - o AM peak hour
 - WBLR operates with an LOS E.
 - o PM peak hour
 - WBLR operates with an error for the delay, an LOS F, and a v/c ratio of 9.76.
- Ontario Street and Drake Avenue
 - o PM peak hour
 - WBLR operates with an LOS F.
- Ontario Street and Friesen Boulevard

- o PM peak hour
 - EBLR operates with an LOS F.

Table 4: 2041 Future Scenario Operational Analysis

Approach/Storage		2041 Future AM Peak Hour				2041 Future PM Peak Hour			
		Delay (sec)	LOS	v/c	95th Q	Delay (sec)	LOS	v/c	95th Q
Ontario St & Greenlane (Signalized)									
EB	EBL (50 m)	83.1	F	0.9 9	221.9	198.6	F	1.3 3	206.4
	EBTR	22.7	C	0.1 4	256.6	27.7	C	0.5 5	394.7
WB	WBL (45 m)	21.9	C	0.0 3	11.9	23.5	C	0.1 2	13.9
	WBTR	23.6	C	0.2 6	56.6	25.3	C	0.3 5	44.7
NB	NBL (60 m)	10.1	B	0.1 5	77.5	26	C	0.7 1	76.6
	NBTR	77.9	E	1.0 8	293.6	33.7	C	0.8 8	152.7
SB	SBL (45 m)	18.5	B	0.4 3	26.2	26.9	C	0.7 5	100.6
	SBTR	14.7	B	0.3	35.6	36.4	D	0.9 5	200.3
Overall Intersection		50.3	D	1	59.2	51.8	D	1.0 6	-
Bartlett Rd & Greenlane (Unsignalized)									
EB	EBLR	11.7	B	0.1 4	14.5	11.8	B	0.1 9	18.4
NB	NBLT	1.8	A	0.0 5	9.7	2.8	A	0.0 5	14.6
SB	SBTR	0	A	0.0 6	-	0	A	0.1 9	0.9
Garden Gate Terrace & Greenlane (Unsignalized)									
EB	EBTR	0	A	0.0 7	-	0	A	0.1 5	0.9
WB	WBLT	1.2	A	0.0 1	4.6	1.2	A	0.0 1	5.1
NB	NBLR	11.3	B	0.2 8	21.4	11.5	B	0.1 9	17.3
Carriage Rd & Greenlane (Unsignalized)									
EB	EBTR	0	A	0.0 7	-	0	A	0.1 8	-
WB	WBLT	0.1	A	0	1.2	0.3	A	0.0 1	4.6

Approach/Storage		2041 Future AM Peak Hour				2041 Future PM Peak Hour			
		Delay (sec)	LO S	v/c	95th Q	Delay (sec)	LO S	v/c	95th Q
NB	NBLR	11.1	B	0.0 5	15	12.1	B	0.0 5	13.2
Lincoln Ave & Greenlane (Unsignalized)									
EB	EBLTR	0.8	A	0.0 1	5.4	0.4	A	0.0 1	116.7
WB	WBLTR	1.2	A	0.0 2	5.2	2.4	A	0.0 6	16
NB	NBLTR	15.1	C	0.3 8	22.5	19.4	C	0.3 3	100.4
SB	SBLTR	13.6	B	0.2 1	17.2	44.4	E	0.7 2	88.9
Cedarbrooke Ln & Greenlane (Unsignalized)									
EB	EBTR	0	A	0.1 2	4.9	0	A	0.2 4	451.1
WB	WBLT	2	A	0.0 4	10.6	3	A	0.1	24
NB	NBLR	11.9	B	0.2 7	21.4	16.4	C	0.2 5	191.9
Ontario St & Homestead Dr (Unsignalized)									
WB	WBLR	37	E	0.4 9	117.2	Err	F	9.7 6	59.5
NB	NBTR	0	A	0.5 8	93.8	0	A	0.5 5	3.9
SB	SBL	10.3	B	0.0 3	10.2	10.8	B	0.1 5	60.7
	SBT	0	A	0.2 8	-	0	A	0.8 3	92.4
Ontario St & Drake Ave (Unsignalized)									
WB	WBLR	24.2	C	0.3 2	20.6	250.6	F	1.0 8	28.8
NB	NBTR	0	A	0.5 6	15.6	0	A	0.5 8	-
SB	SBL	10.1	B	0.0 3	11.5	11.3	B	0.1 9	20.7
	SBT	0	A	0.3 5	-	0	A	0.7 9	-
Ontario St & Friesen Blvd (Unsignalized)									
EB	EBLR	13.3	B	0.1 5	15.5	262.1	F	1.2 8	67.3
NB	NBL	8.6	A	0.0 2	8.8	12.6	B	0.1 3	19
	NBTR	0	A	0.0 5	-	0	A	0.5 1	-

Approach/Storage		2041 Future AM Peak Hour				2041 Future PM Peak Hour			
		Delay (sec)	LOS	v/c	95th Q	Delay (sec)	LOS	v/c	95th Q
SB	SBTR	0	A	0.32	-	0	A	0.75	1.9

Operational Analysis -2041 Horizon Year with Improvements

Two different scenarios were considered for the determination of potential improvements for the 2041 horizon year:

- Scenario 1 – in which improvements are considered only to mitigate the effects of the projected growth along Greenlane Road, specifically at the intersection with Ontario Street, but leaving aside any other modifications to the roadway segments.
- Scenario 2 – in which improvements are proposed along specific segments of the roadway network under study to mitigate – when possible, the effects of the projected growth.

Scenario 1 – Greenlane and Ontario Street Intersection Only

The analysis of this scenario considers the following:

- The eastbound left-turn lane was redesigned to a dual eastbound left-turn lane and upgraded to 60 metres of storage – in order to mitigate the effects of additional development volumes and its impact on this approach, and to reduce the capacity constraints.
- The EBL storage length can only be increased to 60 metres before the EBL queues interfere with NBL vehicles at Jupiter Court.
- In addition, the signal timings and splits were optimized.

Table 5 provides a summary of the operational analysis. As shown, the intersection is expected to operate better along the eastbound-westbound movements but worse for north-south metrics. The following movements are considered critical:

Table 5: 2041 Future Scenario - Greenlane and Ontario Improvements

Approach/Storage		2041 Dual Left and Storage - AM Peak Hour				2041 Dual Left and Storage - PM Peak Hour			
		Delay (sec)	LOS	v/c	95th Q	Delay (sec)	LOS	v/c	95th Q
Ontario St & Greenlane (Signalized)									
EB	EBL (60 m)	39.6	D	0.75	47.7	26.8	C	0.67	59.6
	EBTR	28.3	C	0.16	27.8	25.2	C	0.5	56.4
WB	WBL (45 m)	35.6	D	0.07	15.5	31.7	C	0.15	19.4
	WBTR	42.3	D	0.61	75.5	38.3	D	0.64	55.1

Approach/Storage		2041 Dual Left and Storage - AM Peak Hour				2041 Dual Left and Storage - PM Peak Hour			
		Delay (sec)	LOS	v/c	95th Q	Delay (sec)	LOS	v/c	95th Q
NB	NBL (60 m)	8.5	A	0.14	66.4	33.4	C	0.77	84.9
	NBTR	36.1	D	0.93	219.1	42.6	D	0.93	214.7
SB	SBL (45 m)	19.4	B	0.5	25	37.1	D	0.82	89.3
	SBTR	12.2	B	0.26	43.7	44.5	D	0.99	215.7
Overall Intersection		29.9	C	0.89	-	39	D	0.92	-

Scenario 2 – Additional Improvements

A “best case” scenario was analyzed for the 2041 future scenario that considers the following intersections:

- Ontario Street and Greenlane
- Lincoln Avenue and Greenlane
- Ontario Street and Homestead
- Ontario Street and Drake Avenue, and
- Ontario Street and Friesen Boulevard.

The purpose of analyzing this scenario is to provide insight on the infrastructure needed to have these intersections operate reasonably well. Though not all of them may be feasible, the following changes were made;

- The EBL at Greenlane and Ontario Street was upgraded to a dual eastbound left-turn lane, and upgraded to 100 metres of storage, with its signal timing and splits optimized.
- Lincoln Avenue and Greenlane was converted back to an all-way stop.
- Ontario Street was widened between Homestead Drive and Greenlane, to provide an additional NBT lane.
- Homestead Drive was signalized with optimized splits and timing, and widened, separating its WBLR movement into two separate movements.
- Drake Avenue was signalized with optimized splits and timing, and widened, separating its WBLR movement into two separate movements; and
- Friesen Boulevard was signalized with optimized splits and timing, and widened, separating its WBLR movement into two separate movements.

Signal warrants were conducted based on Justifications 1-4, as per Book 12 of the Ontario Traffic Manual, for the intersections of Homestead Drive and Friesen Boulevard. A warrant was not conducted for Drake Avenue because it does not satisfy the typical minimum intersection

spacing along arterial roadways⁴. The warrants used average hourly volume based on the AM peak hour and PM calculations provided within Book 12.

$$AHV = \frac{amPHV + pmPHV}{4}$$

Figure 8: Average Hourly Volume Calculations

Neither Homestead Drive nor Friesen Boulevard satisfied any of the warrant criteria, which is provided within Appendix B.

The results of the analysis are provided in **Table 6**. As shown, the proposed improvements listed above greatly mitigates the effects of the projected traffic throughout the corridor. However, the following movements within this scenario are considered critical:

- Ontario Street and Greenlane
 - o AM peak hour
 - SBL operates with a 95th percentile queue which exceeds the available storage by 17.6 metres.
 - o PM peak hour
 - SBL operates with a 95th percentile queue which exceeds the available storage by 29.4 metres
 - SBTR operates with a v/c ratio of 0.92 and a 95th queue of 180.2 which would make the adjacent NBL lane inaccessible
 - An overall intersection v/c ratio of 0.92.
- Ontario Street and Homestead Drive
 - o PM peak hour
 - SBT operates a v/c ratio of 0.88.
- Ontario Street and Drake Avenue
 - o PM peak hour
 - SBT operates with a v/c ratio of 0.85.

⁴ As per section 2.3.1.7 of the Intersection Spacing Considerations for the Transportation Association of Canada.

Table 6: 2041 Future Scenario Sensitivity Analysis Operations

Approach/Storage		2041 Future Sensitivity - AM Peak				2041 Future Sensitivity - PM Peak			
		Delay (sec)	LO S	v/c	95th Q	Delay (sec)	LO S	v/c	95th Q
Ontario St & Greenlane (Signalized)									
EB	EBL (100 m)	39.6	D	0.75	34.8	38.3	D	0.81	52.2
	EBTR	28.3	C	0.16	28	28.1	C	0.56	63.5
W B	WBL (45 m)	35.6	D	0.07	18.3	31.7	C	0.15	19.2
	WBTR	42.3	D	0.61	68.7	38.3	D	0.64	55.4
NB	NBL (60 m)	8.5	A	0.14	19.3	31.9	C	0.77	53.6
	NBTR	14.7	B	0.49	57.4	16.9	B	0.46	57.7
SB	SBL (45 m)	9.3	A	0.25	62.6	10.8	B	0.47	74.4
	SBTR	12.2	B	0.26	21.8	31.7	C	0.92	180.2
Overall Intersection		20.7	C	0.57	58	28.3	C	0.92	-
Lincoln Ave & Greenlane (Unsignalized)									
EB	EBLTR	9.1	A	0	18.3	16.1	A	0	32.5
W B	WBLTR	10.1	A	0	21.5	14.1	A	0	23.6
NB	NBLTR	9.9	A	0	21.3	10.7	A	0	17.9
SB	SBLTR	9	A	0	16.1	12.4	A	0	21.1
Ontario St & Homestead Dr (Signalized)									
W B	WBL	30.6	C	0.18	13.9	51.5	D	0.31	16.9
	WBR	29.8	C	0.05	16.5	49	D	0.03	15.6
NB	NBT	5.8	A	0.67	45.3	3.7	A	0.58	48.2
SB	SBL	2	A	0.06	12.2	2.7	A	0.25	24.5
	SBT	2.6	A	0.32	29.7	11.8	B	0.88	92.3
Overall Intersection		6.4	A	0.63	-	9.7	A	0.85	-
Ontario St & Drake Ave (Signalized)									
W B	WBL	22.2	C	0.07	7.6	42.5	D	0.25	11.1
	WBR	22.1	C	0.05	18.2	40.7	D	0.03	15.6
NB	NBT	4.5	A	0.68	62.7	2.9	A	0.62	52.3
SB	SBL	1.7	A	0.06	11.7	1.8	A	0.33	31.6
	SBT	2.5	A	0.42	35.8	7.9	A	0.85	53.8
Overall Intersection		4.6	A	0.63	-	6.5	A	0.81	-
Ontario St & Friesen Blvd (Signalized)									
EB	EBL	21.7	C	0.14	12.8	40.8	D	0.27	17.6
	EBR	21.2	C	0.03	16.1	39.3	D	0.06	28.6
NB	NBL	1.9	A	0.04	9.2	6.5	A	0.35	24.4
	NBT	1.9	A	0.06	7	3.9	A	0.56	45.5
SB	SBT	3.3	A	0.39	26.9	9.3	A	0.83	66.6

Approach/Storage	2041 Future Sensitivity - AM Peak				2041 Future Sensitivity - PM Peak			
	Delay (sec)	LO S	v/c	95th Q	Delay (sec)	LO S	v/c	95th Q
Overall Intersection	4.9	A	0.37	-	8.9	A	0.78	-

Summary and Preliminary Conclusions

In summary:

- Greenlane Road appears to operate well in the future without the need for any additional widening at the unsignalized intersections between Lincoln and Bartlett, with no issues or changes required at Cedarbrook, Carriage, Garden Gate or Barlett intersections.
- The intersections along Ontario Street are expected to operate above capacity during AM and/or PM peak hours under the 2031 and 2041 future “do nothing” conditions, with Greenlane and Ontario Street seeing the largest increase in critical movements. This is due to the added development volumes being expected to have an origin/destination to the development north of Ontario Street and Greenlane, or to the QEW (also north of Greenlane).
- The Greenlane Road and Ontario Street will be subject to congestion. An improvement option includes widening the EBL approach to a dual left turn lane, and extending the available storage to 60 metres, the results as shown in the 2041 Future Scenario - Greenlane and Ontario Improvements shown in **Table 5**. However, it is noted this dual left turn requirement is lessened if green time is reallocated and further queuing is allowed on Ontario Street, which can be considered a more typical approach given that Ontario Street is the arterial roadway. Ultimately, Ontario Street and Greenlane Road is a Regional intersection and the understanding is that this intersection will be subject to an EA in the near future. It is therefore recommended, that the Town consult further with the Region in identifying the best course to proceed.

Prepared by:



Jaime Garcia, P.Eng., Ph.D.

A

Appendix A Synchro & SimTraffic Outputs: Existing Conditions

HCM Signalized Intersection Capacity Analysis

1: Ontario St & Greenlane

Timing Plan: AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	134	31	45	7	38	132	49	599	6	50	261	33
Future Volume (vph)	134	31	45	7	38	132	49	599	6	50	261	33
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.9	6.9		6.9	6.9		3.0	6.9		3.0	6.9	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	0.95	
Frt	1.00	0.91		1.00	0.88		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1698		1770	1646		1770	1860		1770	3479	
Flt Permitted	0.64	1.00		0.70	1.00		0.56	1.00		0.28	1.00	
Satd. Flow (perm)	1195	1698		1310	1646		1039	1860		519	3479	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	146	34	49	8	41	143	53	651	7	54	284	36
RTOR Reduction (vph)	0	40	0	0	116	0	0	0	0	0	10	0
Lane Group Flow (vph)	146	43	0	8	68	0	53	658	0	54	310	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	13.8	13.8		13.8	13.8		42.4	38.9		42.4	38.9	
Effective Green, g (s)	13.8	13.8		13.8	13.8		42.4	38.9		42.4	38.9	
Actuated g/C Ratio	0.19	0.19		0.19	0.19		0.58	0.53		0.58	0.53	
Clearance Time (s)	6.9	6.9		6.9	6.9		3.0	6.9		3.0	6.9	
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	225	320		247	311		638	991		361	1853	
v/s Ratio Prot		0.03			0.04		0.00	c0.35		c0.01	0.09	
v/s Ratio Perm	c0.12			0.01			0.04			0.08		
v/c Ratio	0.65	0.14		0.03	0.22		0.08	0.66		0.15	0.17	
Uniform Delay, d1	27.4	24.6		24.2	25.0		6.6	12.3		7.8	8.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	5.6	0.1		0.0	0.3		0.0	3.5		0.1	0.2	
Delay (s)	33.0	24.8		24.2	25.3		6.7	15.8		8.0	8.9	
Level of Service	C	C		C	C		A	B		A	A	
Approach Delay (s)		30.0			25.3			15.1			8.8	
Approach LOS		C			C			B			A	
Intersection Summary												
HCM 2000 Control Delay	17.1			HCM 2000 Level of Service			B					
HCM 2000 Volume to Capacity ratio	0.63											
Actuated Cycle Length (s)	73.0			Sum of lost time (s)			16.8					
Intersection Capacity Utilization	75.0%			ICU Level of Service			D					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

6: Bartlett Rd & Greenlane

Timing Plan: AM Peak

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	34	26	46	179	50	16
Future Volume (Veh/h)	34	26	46	179	50	16
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)	37	28	50	195	54	17
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	358	62	71			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	358	62	71			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	94	97	97			
cM capacity (veh/h)	620	1002	1529			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	65	245	71			
Volume Left	37	50	0			
Volume Right	28	0	17			
cSH	742	1529	1700			
Volume to Capacity	0.09	0.03	0.04			
Queue Length 95th (m)	2.3	0.8	0.0			
Control Delay (s)	10.3	1.7	0.0			
Lane LOS	B	A				
Approach Delay (s)	10.3	1.7	0.0			
Approach LOS	B					
Intersection Summary						
Average Delay			2.9			
Intersection Capacity Utilization		28.8%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

10: Garden Gate Terrace & Greenlane

Timing Plan: AM Peak

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↱	↘↙	
Traffic Volume (veh/h)	50	31	9	53	124	8
Future Volume (Veh/h)	50	31	9	53	124	8
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)	54	34	10	58	135	9
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			88		149	71
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			88		149	71
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		84	99
cM capacity (veh/h)			1508		837	991
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	88	68	144			
Volume Left	0	10	135			
Volume Right	34	0	9			
cSH	1700	1508	846			
Volume to Capacity	0.05	0.01	0.17			
Queue Length 95th (m)	0.0	0.2	4.9			
Control Delay (s)	0.0	1.1	10.1			
Lane LOS		A	B			
Approach Delay (s)	0.0	1.1	10.1			
Approach LOS			B			
Intersection Summary						
Average Delay			5.1			
Intersection Capacity Utilization			24.0%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

12: Carriage Rd & Greenlane

Timing Plan: AM Peak

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↰	↘	↗
Traffic Volume (veh/h)	79	4	3	175	20	2
Future Volume (Veh/h)	79	4	3	175	20	2
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)	86	4	3	190	22	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)	363					
pX, platoon unblocked						
vC, conflicting volume			90		284	88
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			90		284	88
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		97	100
cM capacity (veh/h)			1505		705	970
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	90	193	24			
Volume Left	0	3	22			
Volume Right	4	0	2			
cSH	1700	1505	721			
Volume to Capacity	0.05	0.00	0.03			
Queue Length 95th (m)	0.0	0.0	0.8			
Control Delay (s)	0.0	0.1	10.2			
Lane LOS		A	B			
Approach Delay (s)	0.0	0.1	10.2			
Approach LOS			B			
Intersection Summary						
Average Delay			0.9			
Intersection Capacity Utilization			21.6%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

13: Lincoln Ave & Greenlane

Timing Plan: AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	8	67	6	20	113	14	10	68	26	4	24	4
Future Volume (vph)	8	67	6	20	113	14	10	68	26	4	24	4
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	73	7	22	123	15	11	74	28	4	26	4
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	89	160	113	34								
Volume Left (vph)	9	22	11	4								
Volume Right (vph)	7	15	28	4								
Hadj (s)	0.01	0.01	-0.10	-0.01								
Departure Headway (s)	4.4	4.4	4.4	4.6								
Degree Utilization, x	0.11	0.19	0.14	0.04								
Capacity (veh/h)	777	788	768	726								
Control Delay (s)	8.0	8.4	8.1	7.8								
Approach Delay (s)	8.0	8.4	8.1	7.8								
Approach LOS	A	A	A	A								
Intersection Summary												
Delay				8.2								
Level of Service				A								
Intersection Capacity Utilization				25.4%	ICU Level of Service							A
Analysis Period (min)				15								

HCM Unsignalized Intersection Capacity Analysis

16: Cedarbrooke Ln & Greenlane

Timing Plan: AM Peak

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↰	↰	
Traffic Volume (veh/h)	116	21	32	111	41	88
Future Volume (Veh/h)	116	21	32	111	41	88
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)	126	23	35	121	45	96
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)				356		
pX, platoon unblocked						
vC, conflicting volume			149		328	138
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			149		328	138
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		93	89
cM capacity (veh/h)			1432		650	911
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	149	156	141			
Volume Left	0	35	45			
Volume Right	23	0	96			
cSH	1700	1432	807			
Volume to Capacity	0.09	0.02	0.17			
Queue Length 95th (m)	0.0	0.6	5.0			
Control Delay (s)	0.0	1.9	10.4			
Lane LOS		A	B			
Approach Delay (s)	0.0	1.9	10.4			
Approach LOS			B			
Intersection Summary						
Average Delay		3.9				
Intersection Capacity Utilization		32.7%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

18: Ontario St & Homestead Dr

Timing Plan: AM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	17	55	644	7	14	304
Future Volume (Veh/h)	17	55	644	7	14	304
Sign Control	Stop		Free		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)	18	60	700	8	15	330
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None		None	
Median storage veh						
Upstream signal (m)					259	
pX, platoon unblocked	0.96					
vC, conflicting volume	1064	704			708	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1044	704			708	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	92	86			98	
cM capacity (veh/h)	239	437			891	
Direction, Lane #	WB 1	NB 1	SB 1	SB 2		
Volume Total	78	708	15	330		
Volume Left	18	0	15	0		
Volume Right	60	8	0	0		
cSH	367	1700	891	1700		
Volume to Capacity	0.21	0.42	0.02	0.19		
Queue Length 95th (m)	6.3	0.0	0.4	0.0		
Control Delay (s)	17.5	0.0	9.1	0.0		
Lane LOS	C		A			
Approach Delay (s)	17.5	0.0	0.4			
Approach LOS	C					
Intersection Summary						
Average Delay			1.3			
Intersection Capacity Utilization			45.3%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

20: Ontario St & Drake Ave

Timing Plan: AM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	5	52	629	2	13	362
Future Volume (Veh/h)	5	52	629	2	13	362
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	57	684	2	14	393
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1106	685			686	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1106	685			686	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	87			98	
cM capacity (veh/h)	229	448			908	
Direction, Lane #	WB 1	NB 1	SB 1	SB 2		
Volume Total	62	686	14	393		
Volume Left	5	0	14	0		
Volume Right	57	2	0	0		
cSH	416	1700	908	1700		
Volume to Capacity	0.15	0.40	0.02	0.23		
Queue Length 95th (m)	4.2	0.0	0.4	0.0		
Control Delay (s)	15.2	0.0	9.0	0.0		
Lane LOS	C		A			
Approach Delay (s)	15.2	0.0	0.3			
Approach LOS	C					
Intersection Summary						
Average Delay			0.9			
Intersection Capacity Utilization			43.4%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

22: Ontario St & Friesen Blvd

Timing Plan: AM Peak

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	13	36	15	554	348	5
Future Volume (Veh/h)	13	36	15	554	348	5
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)	14	39	16	602	378	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1014	380	383			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1014	380	383			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	95	94	99			
cM capacity (veh/h)	261	667	1175			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1		
Volume Total	53	16	602	383		
Volume Left	14	16	0	0		
Volume Right	39	0	0	5		
cSH	472	1175	1700	1700		
Volume to Capacity	0.11	0.01	0.35	0.23		
Queue Length 95th (m)	3.0	0.3	0.0	0.0		
Control Delay (s)	13.6	8.1	0.0	0.0		
Lane LOS	B	A				
Approach Delay (s)	13.6	0.2		0.0		
Approach LOS	B					
Intersection Summary						
Average Delay			0.8			
Intersection Capacity Utilization			39.2%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

1: Ontario St & Greenlane

Timing Plan: PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	137	81	130	16	70	44	109	473	6	108	750	109
Future Volume (vph)	137	81	130	16	70	44	109	473	6	108	750	109
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.9	6.9		6.9	6.9		3.0	6.9		3.0	6.9	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	0.95	
Frt	1.00	0.91		1.00	0.94		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1691		1770	1755		1770	1859		1770	3472	
Flt Permitted	0.68	1.00		0.53	1.00		0.26	1.00		0.38	1.00	
Satd. Flow (perm)	1262	1691		986	1755		475	1859		704	3472	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	149	88	141	17	76	48	118	514	7	117	815	118
RTOR Reduction (vph)	0	76	0	0	30	0	0	0	0	0	12	0
Lane Group Flow (vph)	149	153	0	17	94	0	118	521	0	117	921	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	13.7	13.7		13.7	13.7		43.7	38.6		43.7	38.6	
Effective Green, g (s)	13.7	13.7		13.7	13.7		43.7	38.6		43.7	38.6	
Actuated g/C Ratio	0.18	0.18		0.18	0.18		0.59	0.52		0.59	0.52	
Clearance Time (s)	6.9	6.9		6.9	6.9		3.0	6.9		3.0	6.9	
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	233	312		182	324		368	967		487	1806	
v/s Ratio Prot		0.09			0.05		c0.02	c0.28		0.02	0.27	
v/s Ratio Perm	c0.12			0.02			0.17			0.12		
v/c Ratio	0.64	0.49		0.09	0.29		0.32	0.54		0.24	0.51	
Uniform Delay, d1	28.0	27.1		25.1	26.1		7.1	11.9		7.2	11.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	5.0	0.9		0.2	0.4		0.4	2.1		0.2	1.0	
Delay (s)	32.9	28.0		25.3	26.4		7.4	14.0		7.3	12.7	
Level of Service	C	C		C	C		A	B		A	B	
Approach Delay (s)		30.0			26.3			12.8			12.1	
Approach LOS		C			C			B			B	
Intersection Summary												
HCM 2000 Control Delay			16.2			HCM 2000 Level of Service				B		
HCM 2000 Volume to Capacity ratio			0.54									
Actuated Cycle Length (s)			74.2			Sum of lost time (s)				16.8		
Intersection Capacity Utilization			60.3%			ICU Level of Service				B		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

6: Bartlett Rd & Greenlane

Timing Plan: PM Peak

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	23	59	38	78	157	54
Future Volume (Veh/h)	23	59	38	78	157	54
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)	25	64	41	85	171	59
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	368	200	230			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	368	200	230			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	92	97			
cM capacity (veh/h)	613	840	1338			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	89	126	230			
Volume Left	25	41	0			
Volume Right	64	0	59			
cSH	761	1338	1700			
Volume to Capacity	0.12	0.03	0.14			
Queue Length 95th (m)	3.2	0.8	0.0			
Control Delay (s)	10.4	2.7	0.0			
Lane LOS	B	A				
Approach Delay (s)	10.4	2.7	0.0			
Approach LOS	B					
Intersection Summary						
Average Delay		2.8				
Intersection Capacity Utilization		32.7%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

10: Garden Gate Terrace & Greenlane

Timing Plan: PM Peak

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↱	↘↙	
Traffic Volume (veh/h)	74	99	11	64	75	7
Future Volume (Veh/h)	74	99	11	64	75	7
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)	80	108	12	70	82	8
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			188		228	134
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			188		228	134
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		89	99
cM capacity (veh/h)			1386		754	915
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	188	82	90			
Volume Left	0	12	82			
Volume Right	108	0	8			
cSH	1700	1386	766			
Volume to Capacity	0.11	0.01	0.12			
Queue Length 95th (m)	0.0	0.2	3.2			
Control Delay (s)	0.0	1.2	10.3			
Lane LOS		A	B			
Approach Delay (s)	0.0	1.2	10.3			
Approach LOS			B			
Intersection Summary						
Average Delay			2.8			
Intersection Capacity Utilization			24.0%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

12: Carriage Rd & Greenlane

Timing Plan: PM Peak

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↱	↘↗	
Traffic Volume (veh/h)	171	35	4	135	16	2
Future Volume (Veh/h)	171	35	4	135	16	2
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)	186	38	4	147	17	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)	363					
pX, platoon unblocked						
vC, conflicting volume			224		360	205
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			224		360	205
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		97	100
cM capacity (veh/h)			1345		637	836
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	224	151	19			
Volume Left	0	4	17			
Volume Right	38	0	2			
cSH	1700	1345	653			
Volume to Capacity	0.13	0.00	0.03			
Queue Length 95th (m)	0.0	0.1	0.7			
Control Delay (s)	0.0	0.2	10.7			
Lane LOS		A	B			
Approach Delay (s)	0.0	0.2	10.7			
Approach LOS			B			
Intersection Summary						
Average Delay			0.6			
Intersection Capacity Utilization			21.1%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

13: Lincoln Ave & Greenlane

Timing Plan: PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	10	159	6	49	138	25	6	20	38	33	73	11
Future Volume (vph)	10	159	6	49	138	25	6	20	38	33	73	11
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	173	7	53	150	27	7	22	41	36	79	12
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	191	230	70	127								
Volume Left (vph)	11	53	7	36								
Volume Right (vph)	7	27	41	12								
Hadj (s)	0.02	0.01	-0.30	0.03								
Departure Headway (s)	4.7	4.7	4.8	5.0								
Degree Utilization, x	0.25	0.30	0.09	0.18								
Capacity (veh/h)	717	733	673	651								
Control Delay (s)	9.3	9.6	8.3	9.1								
Approach Delay (s)	9.3	9.6	8.3	9.1								
Approach LOS	A	A	A	A								
Intersection Summary												
Delay				9.3								
Level of Service				A								
Intersection Capacity Utilization				43.8%	ICU Level of Service	A						
Analysis Period (min)				15								

HCM Unsignalized Intersection Capacity Analysis

16: Cedarbrooke Ln & Greenlane

Timing Plan: PM Peak

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↰	↰	
Traffic Volume (veh/h)	227	37	75	214	27	41
Future Volume (Veh/h)	227	37	75	214	27	41
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)	247	40	82	233	29	45
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)				356		
pX, platoon unblocked						
vC, conflicting volume			287		664	267
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			287		664	267
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		93	94
cM capacity (veh/h)			1275		398	772
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	287	315	74			
Volume Left	0	82	29			
Volume Right	40	0	45			
cSH	1700	1275	564			
Volume to Capacity	0.17	0.06	0.13			
Queue Length 95th (m)	0.0	1.6	3.6			
Control Delay (s)	0.0	2.5	12.3			
Lane LOS		A	B			
Approach Delay (s)	0.0	2.5	12.3			
Approach LOS			B			
Intersection Summary						
Average Delay		2.5				
Intersection Capacity Utilization		43.6%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

18: Ontario St & Homestead Dr

Timing Plan: PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	21	36	598	21	73	915
Future Volume (Veh/h)	21	36	598	21	73	915
Sign Control	Stop		Free		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)	23	39	650	23	79	995
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)						259
pX, platoon unblocked	0.70					
vC, conflicting volume	1814	662			673	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1947	662			673	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	50	92			91	
cM capacity (veh/h)	46	462			918	
Direction, Lane #	WB 1	NB 1	SB 1	SB 2		
Volume Total	62	673	79	995		
Volume Left	23	0	79	0		
Volume Right	39	23	0	0		
cSH	105	1700	918	1700		
Volume to Capacity	0.59	0.40	0.09	0.59		
Queue Length 95th (m)	22.5	0.0	2.3	0.0		
Control Delay (s)	79.2	0.0	9.3	0.0		
Lane LOS	F		A			
Approach Delay (s)	79.2	0.0	0.7			
Approach LOS	F					
Intersection Summary						
Average Delay			3.1			
Intersection Capacity Utilization			58.2%		ICU Level of Service	B
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

20: Ontario St & Drake Ave

Timing Plan: PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	14	29	640	13	89	873
Future Volume (Veh/h)	14	29	640	13	89	873
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)	15	32	696	14	97	949
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1846	703			710	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1846	703			710	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	80	93			89	
cM capacity (veh/h)	73	438			889	
Direction, Lane #	WB 1	NB 1	SB 1	SB 2		
Volume Total	47	710	97	949		
Volume Left	15	0	97	0		
Volume Right	32	14	0	0		
cSH	169	1700	889	1700		
Volume to Capacity	0.28	0.42	0.11	0.56		
Queue Length 95th (m)	8.6	0.0	2.9	0.0		
Control Delay (s)	34.3	0.0	9.5	0.0		
Lane LOS	D		A			
Approach Delay (s)	34.3	0.0	0.9			
Approach LOS	D					
Intersection Summary						
Average Delay			1.4			
Intersection Capacity Utilization			55.9%		ICU Level of Service	B
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

22: Ontario St & Friesen Blvd

Timing Plan: PM Peak

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	21	63	48	573	801	28
Future Volume (Veh/h)	21	63	48	573	801	28
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)	23	68	52	623	871	30
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1613	886	901			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1613	886	901			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	78	80	93			
cM capacity (veh/h)	107	343	754			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1		
Volume Total	91	52	623	901		
Volume Left	23	52	0	0		
Volume Right	68	0	0	30		
cSH	220	754	1700	1700		
Volume to Capacity	0.41	0.07	0.37	0.53		
Queue Length 95th (m)	15.2	1.8	0.0	0.0		
Control Delay (s)	32.4	10.1	0.0	0.0		
Lane LOS	D	B				
Approach Delay (s)	32.4	0.8		0.0		
Approach LOS	D					
Intersection Summary						
Average Delay				2.1		
Intersection Capacity Utilization				55.6%	ICU Level of Service	B
Analysis Period (min)				15		

Queuing and Blocking Report

Greenlane EA

AM Peak

Intersection: 1: Ontario St & Greenlane

Movement	EB	EB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	T	TR
Maximum Queue (m)	50.8	27.1	9.0	50.7	41.0	91.8	21.7	17.2	42.4
Average Queue (m)	23.7	10.9	1.9	21.9	7.7	43.9	8.4	2.9	19.3
95th Queue (m)	43.3	21.6	7.6	39.6	23.4	76.4	17.7	11.7	36.9
Link Distance (m)		334.6		342.2		241.4		169.6	169.6
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (m)	100.0		45.0		60.0		45.0		
Storage Blk Time (%)				0		2			
Queuing Penalty (veh)				0		1			

Intersection: 6: Bartlett Rd & Greenlane

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (m)	17.3	7.0
Average Queue (m)	6.9	0.5
95th Queue (m)	12.8	4.1
Link Distance (m)	359.2	80.6
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 10: Garden Gate Terrace & Greenlane

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (m)	3.7	25.0
Average Queue (m)	0.1	11.4
95th Queue (m)	1.9	18.8
Link Distance (m)	359.2	234.8
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Queuing and Blocking Report Greenlane EA

AM Peak

Intersection: 12: Carriage Rd & Greenlane

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (m)	1.7	11.8
Average Queue (m)	0.1	5.2
95th Queue (m)	1.2	12.8
Link Distance (m)	13.4	233.6
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	0	
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 13: Lincoln Ave & Greenlane

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (m)	18.3	18.2	18.6	10.4
Average Queue (m)	9.4	11.8	9.9	6.7
95th Queue (m)	16.0	17.6	15.5	13.2
Link Distance (m)	194.7	457.4	171.2	130.4
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 16: Cedarbrooke Ln & Greenlane

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (m)	13.0	28.1
Average Queue (m)	1.3	11.3
95th Queue (m)	7.2	18.9
Link Distance (m)	334.6	193.2
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Queuing and Blocking Report

Greenlane EA

AM Peak

Intersection: 18: Ontario St & Homestead Dr

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (m)	22.9	12.2
Average Queue (m)	10.6	1.8
95th Queue (m)	19.4	8.4
Link Distance (m)	339.4	241.4
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 20: Ontario St & Drake Ave

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (m)	18.9	9.1
Average Queue (m)	8.3	1.3
95th Queue (m)	15.7	6.4
Link Distance (m)	341.9	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		45.0
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 22: Ontario St & Friesen Blvd

Movement	EB	NB
Directions Served	LR	L
Maximum Queue (m)	14.9	9.2
Average Queue (m)	7.3	1.4
95th Queue (m)	14.4	6.7
Link Distance (m)	330.4	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		45.0
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 1

Queuing and Blocking Report

Greenlane EA

PM Peak

Intersection: 1: Ontario St & Greenlane

Movement	EB	EB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	T	TR
Maximum Queue (m)	47.1	57.7	13.8	33.3	48.9	82.2	38.6	73.6	102.1
Average Queue (m)	23.0	24.9	3.8	15.1	15.6	40.7	14.2	32.7	64.1
95th Queue (m)	39.8	43.4	12.1	27.4	31.4	68.2	27.8	69.4	97.2
Link Distance (m)		334.6		342.2		241.4		169.6	169.6
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (m)	100.0		45.0		60.0		45.0		
Storage Blk Time (%)				0		1		1	
Queuing Penalty (veh)				0		1		1	

Intersection: 6: Bartlett Rd & Greenlane

Movement	EB	NB	SB
Directions Served	LR	LT	TR
Maximum Queue (m)	16.4	13.0	1.3
Average Queue (m)	7.6	2.4	0.0
95th Queue (m)	13.2	9.3	0.9
Link Distance (m)	359.2	80.6	90.4
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 10: Garden Gate Terrace & Greenlane

Movement	EB	WB	NB
Directions Served	TR	LT	LR
Maximum Queue (m)	2.7	10.3	20.7
Average Queue (m)	0.1	0.8	9.7
95th Queue (m)	1.3	5.1	16.5
Link Distance (m)	68.7	359.2	234.8
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Queuing and Blocking Report

Greenlane EA

PM Peak

Intersection: 12: Carriage Rd & Greenlane

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (m)	5.4	9.3
Average Queue (m)	0.3	4.2
95th Queue (m)	3.0	11.5
Link Distance (m)	13.4	233.6
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	0	
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 13: Lincoln Ave & Greenlane

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (m)	23.5	25.3	14.7	18.5
Average Queue (m)	11.9	13.8	8.4	10.1
95th Queue (m)	19.1	21.1	13.9	15.4
Link Distance (m)	194.7	457.4	171.2	130.4
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 16: Cedarbrooke Ln & Greenlane

Movement	EB	WB	NB
Directions Served	TR	LT	LR
Maximum Queue (m)	2.7	28.6	19.8
Average Queue (m)	0.1	6.3	9.0
95th Queue (m)	1.4	18.5	16.0
Link Distance (m)	457.4	334.6	193.2
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Queuing and Blocking Report

Greenlane EA

PM Peak

Intersection: 18: Ontario St & Homestead Dr

Movement	WB	NB	SB
Directions Served	LR	TR	L
Maximum Queue (m)	25.7	2.7	22.6
Average Queue (m)	11.4	0.1	7.5
95th Queue (m)	22.0	1.4	17.4
Link Distance (m)	339.4	175.0	241.4
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 20: Ontario St & Drake Ave

Movement	WB	NB	SB
Directions Served	LR	TR	L
Maximum Queue (m)	22.6	2.6	27.4
Average Queue (m)	9.1	0.1	9.0
95th Queue (m)	18.2	1.3	19.4
Link Distance (m)	341.9	155.5	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			45.0
Storage Blk Time (%)			0
Queuing Penalty (veh)			0

Intersection: 22: Ontario St & Friesen Blvd

Movement	EB	NB	SB
Directions Served	LR	L	TR
Maximum Queue (m)	26.9	16.5	1.3
Average Queue (m)	12.3	7.2	0.0
95th Queue (m)	22.6	16.2	0.9
Link Distance (m)	330.4		155.5
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)		45.0	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 2

B

Appendix B Synchro & SimTraffic Outputs: 2031 Future Scenario

HCM Signalized Intersection Capacity Analysis

1: Ontario St & Greenlane

Timing Plan: AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	218	39	57	9	49	169	63	759	8	71	344	74
Future Volume (vph)	218	39	57	9	49	169	63	759	8	71	344	74
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.9	6.9		6.9	6.9		3.0	6.9		3.0	6.9	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	0.95	
Frt	1.00	0.91		1.00	0.88		1.00	1.00		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1696		1770	1646		1770	1860		1770	3446	
Flt Permitted	0.55	1.00		0.69	1.00		0.49	1.00		0.10	1.00	
Satd. Flow (perm)	1018	1696		1285	1646		913	1860		194	3446	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	237	42	62	10	53	184	68	825	9	77	374	80
RTOR Reduction (vph)	0	46	0	0	136	0	0	1	0	0	21	0
Lane Group Flow (vph)	237	58	0	10	101	0	68	833	0	77	433	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	21.2	21.2		21.2	21.2		43.4	38.4		43.6	38.5	
Effective Green, g (s)	21.2	21.2		21.2	21.2		43.4	38.4		43.6	38.5	
Actuated g/C Ratio	0.26	0.26		0.26	0.26		0.53	0.47		0.53	0.47	
Clearance Time (s)	6.9	6.9		6.9	6.9		3.0	6.9		3.0	6.9	
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	264	441		334	428		538	876		202	1627	
v/s Ratio Prot		0.03			0.06		0.01	c0.45		c0.02	0.13	
v/s Ratio Perm	c0.23			0.01			0.06			0.18		
v/c Ratio	0.90	0.13		0.03	0.24		0.13	0.95		0.38	0.27	
Uniform Delay, d1	29.1	23.1		22.5	23.8		9.3	20.7		15.4	13.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	29.8	0.1		0.0	0.2		0.1	20.7		0.9	0.4	
Delay (s)	58.9	23.2		22.5	24.0		9.3	41.3		16.3	13.4	
Level of Service	E	C		C	C		A	D		B	B	
Approach Delay (s)		48.0			23.9			38.9			13.8	
Approach LOS		D			C			D			B	
Intersection Summary												
HCM 2000 Control Delay			32.0			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.89									
Actuated Cycle Length (s)			81.5			Sum of lost time (s)				16.8		
Intersection Capacity Utilization			91.1%			ICU Level of Service				F		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

6: Bartlett Rd & Greenlane

Timing Plan: AM Peak

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	43	32	58	243	64	20
Future Volume (Veh/h)	43	32	58	243	64	20
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)	47	35	63	264	70	22
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	471	81	92			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	471	81	92			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	91	96	96			
cM capacity (veh/h)	528	979	1503			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	82	327	92			
Volume Left	47	63	0			
Volume Right	35	0	22			
cSH	657	1503	1700			
Volume to Capacity	0.12	0.04	0.05			
Queue Length 95th (m)	3.4	1.0	0.0			
Control Delay (s)	11.3	1.7	0.0			
Lane LOS	B	A				
Approach Delay (s)	11.3	1.7	0.0			
Approach LOS	B					
Intersection Summary						
Average Delay			3.0			
Intersection Capacity Utilization		33.7%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

10: Garden Gate Terrace & Greenlane

Timing Plan: AM Peak

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↶			↷	↶	↷
Traffic Volume (veh/h)	64	39	12	67	157	32
Future Volume (Veh/h)	64	39	12	67	157	32
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)	70	42	13	73	171	35
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			112		190	91
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			112		190	91
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		78	96
cM capacity (veh/h)			1478		792	967
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	112	86	206			
Volume Left	0	13	171			
Volume Right	42	0	35			
cSH	1700	1478	817			
Volume to Capacity	0.07	0.01	0.25			
Queue Length 95th (m)	0.0	0.2	8.0			
Control Delay (s)	0.0	1.2	10.9			
Lane LOS		A	B			
Approach Delay (s)	0.0	1.2	10.9			
Approach LOS			B			
Intersection Summary						
Average Delay			5.8			
Intersection Capacity Utilization			28.2%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

12: Carriage Rd & Greenlane

Timing Plan: AM Peak

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↰			↱	↘	↗
Traffic Volume (veh/h)	100	5	3	221	26	2
Future Volume (Veh/h)	100	5	3	221	26	2
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)	109	5	3	240	28	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)	363					
pX, platoon unblocked						
vC, conflicting volume			114		358	112
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			114		358	112
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		96	100
cM capacity (veh/h)			1475		640	942
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	114	243	30			
Volume Left	0	3	28			
Volume Right	5	0	2			
cSH	1700	1475	654			
Volume to Capacity	0.07	0.00	0.05			
Queue Length 95th (m)	0.0	0.0	1.2			
Control Delay (s)	0.0	0.1	10.8			
Lane LOS		A	B			
Approach Delay (s)	0.0	0.1	10.8			
Approach LOS			B			
Intersection Summary						
Average Delay			0.9			
Intersection Capacity Utilization			24.0%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

13: Lincoln Ave & Greenlane

Timing Plan: AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	85	8	26	143	17	13	134	32	5	79	5
Future Volume (Veh/h)	10	85	8	26	143	17	13	134	32	5	79	5
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	92	9	28	155	18	14	146	35	5	86	5
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	173			101			386	348	96	446	343	164
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	173			101			386	348	96	446	343	164
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			98			97	74	96	99	85	99
cM capacity (veh/h)	1404			1491			492	561	960	394	564	881
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	112	201	195	96								
Volume Left	11	28	14	5								
Volume Right	9	18	35	5								
cSH	1404	1491	600	562								
Volume to Capacity	0.01	0.02	0.33	0.17								
Queue Length 95th (m)	0.2	0.5	11.3	4.9								
Control Delay (s)	0.8	1.2	13.9	12.7								
Lane LOS	A	A	B	B								
Approach Delay (s)	0.8	1.2	13.9	12.7								
Approach LOS			B	B								
Intersection Summary												
Average Delay			7.0									
Intersection Capacity Utilization			34.8%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

16: Cedarbrooke Ln & Greenlane

Timing Plan: AM Peak

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↰	↰	↱
Traffic Volume (veh/h)	147	27	41	140	52	111
Future Volume (Veh/h)	147	27	41	140	52	111
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)	160	29	45	152	57	121
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)				356		
pX, platoon unblocked						
vC, conflicting volume			189		416	174
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			189		416	174
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			97		90	86
cM capacity (veh/h)			1385		573	869
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	189	197	178			
Volume Left	0	45	57			
Volume Right	29	0	121			
cSH	1700	1385	746			
Volume to Capacity	0.11	0.03	0.24			
Queue Length 95th (m)	0.0	0.8	7.4			
Control Delay (s)	0.0	2.0	11.3			
Lane LOS		A	B			
Approach Delay (s)	0.0	2.0	11.3			
Approach LOS			B			
Intersection Summary						
Average Delay			4.3			
Intersection Capacity Utilization			38.7%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

18: Ontario St & Homestead Dr

Timing Plan: AM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	22	67	816	9	17	391
Future Volume (Veh/h)	22	67	816	9	17	391
Sign Control	Stop		Free		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)	24	73	887	10	18	425
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None		None	
Median storage veh						
Upstream signal (m)					259	
pX, platoon unblocked	0.89					
vC, conflicting volume	1353	892			897	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1336	892			897	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	84	79			98	
cM capacity (veh/h)	148	341			757	
Direction, Lane #	WB 1	NB 1	SB 1	SB 2		
Volume Total	97	897	18	425		
Volume Left	24	0	18	0		
Volume Right	73	10	0	0		
cSH	258	1700	757	1700		
Volume to Capacity	0.38	0.53	0.02	0.25		
Queue Length 95th (m)	13.4	0.0	0.6	0.0		
Control Delay (s)	27.2	0.0	9.9	0.0		
Lane LOS	D		A			
Approach Delay (s)	27.2	0.0	0.4			
Approach LOS	D					
Intersection Summary						
Average Delay		2.0				
Intersection Capacity Utilization		55.5%		ICU Level of Service	B	
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

20: Ontario St & Drake Ave

Timing Plan: AM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	6	66	788	2	16	494
Future Volume (Veh/h)	6	66	788	2	16	494
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)	7	72	857	2	17	537
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1429	858			859	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1429	858			859	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	95	80			98	
cM capacity (veh/h)	145	357			782	
Direction, Lane #	WB 1	NB 1	SB 1	SB 2		
Volume Total	79	859	17	537		
Volume Left	7	0	17	0		
Volume Right	72	2	0	0		
cSH	316	1700	782	1700		
Volume to Capacity	0.25	0.51	0.02	0.32		
Queue Length 95th (m)	7.8	0.0	0.5	0.0		
Control Delay (s)	20.2	0.0	9.7	0.0		
Lane LOS	C		A			
Approach Delay (s)	20.2	0.0	0.3			
Approach LOS	C					
Intersection Summary						
Average Delay			1.2			
Intersection Capacity Utilization			52.7%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

22: Ontario St & Friesen Blvd

Timing Plan: AM Peak

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	16	45	19	701	437	10
Future Volume (Veh/h)	16	45	19	701	437	10
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)	17	49	21	762	475	11
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1284	480	486			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1284	480	486			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	90	92	98			
cM capacity (veh/h)	178	585	1077			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1		
Volume Total	66	21	762	486		
Volume Left	17	21	0	0		
Volume Right	49	0	0	11		
cSH	369	1077	1700	1700		
Volume to Capacity	0.18	0.02	0.45	0.29		
Queue Length 95th (m)	5.1	0.5	0.0	0.0		
Control Delay (s)	16.9	8.4	0.0	0.0		
Lane LOS	C	A				
Approach Delay (s)	16.9	0.2		0.0		
Approach LOS	C					
Intersection Summary						
Average Delay			1.0			
Intersection Capacity Utilization			47.2%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

1: Ontario St & Greenlane

Timing Plan: PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	336	103	165	20	88	83	138	599	8	161	996	247
Future Volume (vph)	336	103	165	20	88	83	138	599	8	161	996	247
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.9	6.9		6.9	6.9		3.0	6.9		3.0	6.9	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	0.95	
Frt	1.00	0.91		1.00	0.93		1.00	1.00		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1691		1770	1728		1770	1859		1770	3434	
Flt Permitted	0.63	1.00		0.46	1.00		0.10	1.00		0.20	1.00	
Satd. Flow (perm)	1182	1691		849	1728		196	1859		364	3434	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	365	112	179	22	96	90	150	651	9	175	1083	268
RTOR Reduction (vph)	0	68	0	0	40	0	0	1	0	0	25	0
Lane Group Flow (vph)	365	223	0	22	146	0	150	659	0	175	1326	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	23.1	23.1		23.1	23.1		44.9	38.1		44.9	38.1	
Effective Green, g (s)	23.1	23.1		23.1	23.1		44.9	38.1		44.9	38.1	
Actuated g/C Ratio	0.27	0.27		0.27	0.27		0.53	0.45		0.53	0.45	
Clearance Time (s)	6.9	6.9		6.9	6.9		3.0	6.9		3.0	6.9	
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	321	460		231	470		229	835		305	1542	
v/s Ratio Prot		0.13			0.08		c0.05	0.35		0.05	c0.39	
v/s Ratio Perm	c0.31			0.03			0.29			0.26		
v/c Ratio	1.14	0.49		0.10	0.31		0.66	0.79		0.57	0.86	
Uniform Delay, d1	30.8	25.9		23.0	24.5		14.9	19.9		13.5	21.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	92.7	0.6		0.1	0.3		5.9	7.5		2.1	6.5	
Delay (s)	123.5	26.5		23.2	24.8		20.8	27.4		15.6	27.4	
Level of Service	F	C		C	C		C	C		B	C	
Approach Delay (s)		80.5			24.6			26.2			26.1	
Approach LOS		F			C			C			C	
Intersection Summary												
HCM 2000 Control Delay	37.2			HCM 2000 Level of Service			D					
HCM 2000 Volume to Capacity ratio	0.93											
Actuated Cycle Length (s)	84.8			Sum of lost time (s)			16.8					
Intersection Capacity Utilization	92.0%			ICU Level of Service			F					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

6: Bartlett Rd & Greenlane

Timing Plan: PM Peak

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	29	74	49	105	199	68
Future Volume (Veh/h)	29	74	49	105	199	68
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)	32	80	53	114	216	74
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	473	253	290			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	473	253	290			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	94	90	96			
cM capacity (veh/h)	527	786	1272			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	112	167	290			
Volume Left	32	53	0			
Volume Right	80	0	74			
cSH	689	1272	1700			
Volume to Capacity	0.16	0.04	0.17			
Queue Length 95th (m)	4.6	1.0	0.0			
Control Delay (s)	11.2	2.8	0.0			
Lane LOS	B	A				
Approach Delay (s)	11.2	2.8	0.0			
Approach LOS	B					
Intersection Summary						
Average Delay			3.0			
Intersection Capacity Utilization		39.0%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

10: Garden Gate Terrace & Greenlane

Timing Plan: PM Peak

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↱	↘↗	
Traffic Volume (veh/h)	94	125	14	81	95	9
Future Volume (Veh/h)	94	125	14	81	95	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)	102	136	15	88	103	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)						
pX, platoon unblocked						
vC, conflicting volume			238		288	170
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			238		288	170
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		85	99
cM capacity (veh/h)			1329		695	874
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	238	103	113			
Volume Left	0	15	103			
Volume Right	136	0	10			
cSH	1700	1329	707			
Volume to Capacity	0.14	0.01	0.16			
Queue Length 95th (m)	0.0	0.3	4.5			
Control Delay (s)	0.0	1.2	11.1			
Lane LOS		A	B			
Approach Delay (s)	0.0	1.2	11.1			
Approach LOS			B			
Intersection Summary						
Average Delay			3.0			
Intersection Capacity Utilization			28.6%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

12: Carriage Rd & Greenlane

Timing Plan: PM Peak

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↰	↘	↗
Traffic Volume (veh/h)	217	44	5	172	20	2
Future Volume (Veh/h)	217	44	5	172	20	2
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)	236	48	5	187	22	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)	363					
pX, platoon unblocked						
vC, conflicting volume			284	457		260
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			284	457		260
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	96		100
cM capacity (veh/h)			1278	559		779
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	284	192	24			
Volume Left	0	5	22			
Volume Right	48	0	2			
cSH	1700	1278	573			
Volume to Capacity	0.17	0.00	0.04			
Queue Length 95th (m)	0.0	0.1	1.0			
Control Delay (s)	0.0	0.2	11.6			
Lane LOS			A	B		
Approach Delay (s)	0.0	0.2	11.6			
Approach LOS			B			
Intersection Summary						
Average Delay			0.6			
Intersection Capacity Utilization			24.1%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

13: Lincoln Ave & Greenlane

Timing Plan: PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	13	299	6	63	175	31	8	46	49	42	114	14
Future Volume (Veh/h)	13	299	6	63	175	31	8	46	49	42	114	14
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	14	325	7	68	190	34	9	50	53	46	124	15
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None				None							
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	224			332			776	716	328	778	703	207
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	224			332			776	716	328	778	703	207
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			94			96	85	93	81	63	98
cM capacity (veh/h)	1345			1227			210	332	713	245	338	833
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	346	292	112	185								
Volume Left	14	68	9	46								
Volume Right	7	34	53	15								
cSH	1345	1227	419	323								
Volume to Capacity	0.01	0.06	0.27	0.57								
Queue Length 95th (m)	0.3	1.4	8.5	26.9								
Control Delay (s)	0.4	2.3	16.7	30.1								
Lane LOS	A	A	C	D								
Approach Delay (s)	0.4	2.3	16.7	30.1								
Approach LOS			C	D								
Intersection Summary												
Average Delay			8.8									
Intersection Capacity Utilization			57.2%		ICU Level of Service				B			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

16: Cedarbrooke Ln & Greenlane

Timing Plan: PM Peak

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↰			↱	↰	↱
Traffic Volume (veh/h)	287	46	95	271	35	53
Future Volume (Veh/h)	287	46	95	271	35	53
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)	312	50	103	295	38	58
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)				356		
pX, platoon unblocked						
vC, conflicting volume			362		838	337
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			362		838	337
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			91		88	92
cM capacity (veh/h)			1197		307	705
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	362	398	96			
Volume Left	0	103	38			
Volume Right	50	0	58			
cSH	1700	1197	466			
Volume to Capacity	0.21	0.09	0.21			
Queue Length 95th (m)	0.0	2.3	6.1			
Control Delay (s)	0.0	2.8	14.7			
Lane LOS		A	B			
Approach Delay (s)	0.0	2.8	14.7			
Approach LOS			B			
Intersection Summary						
Average Delay			2.9			
Intersection Capacity Utilization			52.6%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

18: Ontario St & Homestead Dr

Timing Plan: PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	26	44	750	27	93	1176
Future Volume (Veh/h)	26	44	750	27	93	1176
Sign Control	Stop		Free		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)	28	48	815	29	101	1278
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None		None	
Median storage veh						
Upstream signal (m)					259	
pX, platoon unblocked	0.56					
vC, conflicting volume	2310	830			844	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2942	830			844	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	87			87	
cM capacity (veh/h)	8	370			792	
Direction, Lane #	WB 1	NB 1	SB 1	SB 2		
Volume Total	76	844	101	1278		
Volume Left	28	0	101	0		
Volume Right	48	29	0	0		
cSH	21	1700	792	1700		
Volume to Capacity	3.61	0.50	0.13	0.75		
Queue Length 95th (m)	Err	0.0	3.5	0.0		
Control Delay (s)	Err	0.0	10.2	0.0		
Lane LOS	F		B			
Approach Delay (s)	Err	0.0	0.7			
Approach LOS	F					
Intersection Summary						
Average Delay		331.0				
Intersection Capacity Utilization		72.7%		ICU Level of Service	C	
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

20: Ontario St & Drake Ave

Timing Plan: PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	17	37	802	16	112	1118
Future Volume (Veh/h)	17	37	802	16	112	1118
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)	18	40	872	17	122	1215
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	2340	880			889	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2340	880			889	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	47	88			84	
cM capacity (veh/h)	34	346			762	
Direction, Lane #	WB 1	NB 1	SB 1	SB 2		
Volume Total	58	889	122	1215		
Volume Left	18	0	122	0		
Volume Right	40	17	0	0		
cSH	89	1700	762	1700		
Volume to Capacity	0.65	0.52	0.16	0.71		
Queue Length 95th (m)	24.8	0.0	4.5	0.0		
Control Delay (s)	100.6	0.0	10.6	0.0		
Lane LOS	F		B			
Approach Delay (s)	100.6	0.0	1.0			
Approach LOS	F					
Intersection Summary						
Average Delay			3.1			
Intersection Capacity Utilization			68.8%		ICU Level of Service	C
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

22: Ontario St & Friesen Blvd

Timing Plan: PM Peak

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	27	80	60	726	1006	51
Future Volume (Veh/h)	27	80	60	726	1006	51
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)	29	87	65	789	1093	55
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	2040	1120	1148			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2040	1120	1148			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	48	65	89			
cM capacity (veh/h)	56	251	609			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1		
Volume Total	116	65	789	1148		
Volume Left	29	65	0	0		
Volume Right	87	0	0	55		
cSH	134	609	1700	1700		
Volume to Capacity	0.87	0.11	0.46	0.68		
Queue Length 95th (m)	44.7	2.9	0.0	0.0		
Control Delay (s)	109.3	11.6	0.0	0.0		
Lane LOS	F	B				
Approach Delay (s)	109.3	0.9		0.0		
Approach LOS	F					
Intersection Summary						
Average Delay			6.3			
Intersection Capacity Utilization			69.1%	ICU Level of Service		C
Analysis Period (min)			15			

Queuing and Blocking Report

Greenlane EA

AM Peak

Intersection: 1: Ontario St & Greenlane

Movement	EB	EB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	T	TR
Maximum Queue (m)	126.3	35.5	11.6	51.9	74.8	197.5	24.5	30.0	57.9
Average Queue (m)	52.1	13.0	1.9	26.5	20.6	99.0	12.0	6.7	29.9
95th Queue (m)	101.0	25.8	7.9	43.8	65.0	173.9	22.2	21.9	50.5
Link Distance (m)		334.6		342.2		241.4		169.6	169.6
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (m)	100.0		45.0		60.0		45.0		
Storage Blk Time (%)	6			1	0	24		0	
Queuing Penalty (veh)	5			0	0	15		0	

Intersection: 6: Bartlett Rd & Greenlane

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (m)	15.4	14.7
Average Queue (m)	7.4	2.0
95th Queue (m)	13.0	9.1
Link Distance (m)	359.2	80.6
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 10: Garden Gate Terrace & Greenlane

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (m)	7.3	23.5
Average Queue (m)	0.5	13.2
95th Queue (m)	4.1	20.5
Link Distance (m)	359.2	234.8
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Queuing and Blocking Report Greenlane EA

AM Peak

Intersection: 12: Carriage Rd & Greenlane

Movement	NB
Directions Served	LR
Maximum Queue (m)	14.7
Average Queue (m)	5.8
95th Queue (m)	13.9
Link Distance (m)	233.6
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (m)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 13: Lincoln Ave & Greenlane

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (m)	9.0	11.8	30.5	20.1
Average Queue (m)	0.6	1.5	13.7	10.0
95th Queue (m)	4.1	8.3	22.8	16.5
Link Distance (m)	194.7	457.4	171.2	130.4
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 16: Cedarbrooke Ln & Greenlane

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (m)	15.2	30.3
Average Queue (m)	2.3	12.6
95th Queue (m)	9.6	21.6
Link Distance (m)	334.6	193.2
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Queuing and Blocking Report

Greenlane EA

AM Peak

Intersection: 18: Ontario St & Homestead Dr

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (m)	36.1	10.7
Average Queue (m)	12.5	2.4
95th Queue (m)	24.4	9.2
Link Distance (m)	339.4	241.4
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 20: Ontario St & Drake Ave

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (m)	21.9	11.6
Average Queue (m)	10.1	2.6
95th Queue (m)	18.7	9.6
Link Distance (m)	341.9	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		45.0
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 22: Ontario St & Friesen Blvd

Movement	EB	NB
Directions Served	LR	L
Maximum Queue (m)	21.9	11.6
Average Queue (m)	9.6	2.1
95th Queue (m)	17.7	8.7
Link Distance (m)	330.4	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		45.0
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 20

Queuing and Blocking Report

Greenlane EA

PM Peak

Intersection: 1: Ontario St & Greenlane

Movement	EB	EB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	T	TR
Maximum Queue (m)	200.0	318.6	16.8	50.9	74.8	135.6	74.9	180.3	179.6
Average Queue (m)	191.3	248.3	4.6	24.1	31.5	67.5	38.7	126.2	147.1
95th Queue (m)	221.3	379.6	13.3	41.3	66.6	108.9	83.1	199.0	200.0
Link Distance (m)		334.6		342.2		241.4		169.6	169.6
Upstream Blk Time (%)		13						11	22
Queuing Penalty (veh)		43						0	0
Storage Bay Dist (m)	100.0		45.0		60.0		45.0		
Storage Blk Time (%)	95	0		1	0	10	0	22	
Queuing Penalty (veh)	255	1		0	1	13	2	36	

Intersection: 6: Bartlett Rd & Greenlane

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (m)	19.6	17.2
Average Queue (m)	9.0	3.9
95th Queue (m)	16.3	12.9
Link Distance (m)	359.2	80.6
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 10: Garden Gate Terrace & Greenlane

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (m)	9.2	21.1
Average Queue (m)	0.7	10.5
95th Queue (m)	4.8	17.6
Link Distance (m)	359.2	234.8
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Queuing and Blocking Report Greenlane EA

PM Peak

Intersection: 12: Carriage Rd & Greenlane

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (m)	8.7	10.4
Average Queue (m)	0.4	4.4
95th Queue (m)	3.8	12.0
Link Distance (m)	13.4	233.6
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	0	
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 13: Lincoln Ave & Greenlane

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (m)	13.4	18.5	23.2	28.0
Average Queue (m)	1.4	4.7	11.1	14.9
95th Queue (m)	7.3	14.1	18.4	24.3
Link Distance (m)	194.7	457.4	171.2	130.4
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 16: Cedarbrooke Ln & Greenlane

Movement	EB	WB	NB
Directions Served	TR	LT	LR
Maximum Queue (m)	122.3	26.4	69.4
Average Queue (m)	27.3	7.7	23.0
95th Queue (m)	146.7	20.5	83.8
Link Distance (m)	457.4	334.6	193.2
Upstream Blk Time (%)			0
Queuing Penalty (veh)			0
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Queuing and Blocking Report

Greenlane EA

PM Peak

Intersection: 18: Ontario St & Homestead Dr

Movement	WB	NB	SB	SB
Directions Served	LR	TR	L	T
Maximum Queue (m)	42.3	2.6	21.7	143.9
Average Queue (m)	15.5	0.1	9.2	9.0
95th Queue (m)	31.5	1.6	18.4	71.8
Link Distance (m)	339.4	175.0	241.4	241.4
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 20: Ontario St & Drake Ave

Movement	WB	NB	SB
Directions Served	LR	TR	L
Maximum Queue (m)	36.1	2.7	23.9
Average Queue (m)	11.8	0.1	10.5
95th Queue (m)	27.3	1.7	18.8
Link Distance (m)	341.9	155.5	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)		45.0	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 22: Ontario St & Friesen Blvd

Movement	EB	NB	SB
Directions Served	LR	L	TR
Maximum Queue (m)	50.1	18.4	6.5
Average Queue (m)	17.6	8.5	0.3
95th Queue (m)	37.3	17.4	2.5
Link Distance (m)	330.4		155.5
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)		45.0	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 352

C

Appendix C Synchro & SimTraffic Outputs: 2041 Future Scenario – Do Nothing

HCM Signalized Intersection Capacity Analysis

1: Ontario St & Greenlane

Timing Plan: AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	241	43	63	10	54	187	70	838	9	78	380	82
Future Volume (vph)	241	43	63	10	54	187	70	838	9	78	380	82
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.9	6.9		6.9	6.9		3.0	6.9		3.0	6.9	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	0.95	
Frt	1.00	0.91		1.00	0.88		1.00	1.00		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1698		1770	1646		1770	1860		1770	3445	
Flt Permitted	0.51	1.00		0.68	1.00		0.46	1.00		0.10	1.00	
Satd. Flow (perm)	952	1698		1272	1646		851	1860		195	3445	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	262	47	68	11	59	203	76	911	10	85	413	89
RTOR Reduction (vph)	0	49	0	0	144	0	0	1	0	0	21	0
Lane Group Flow (vph)	262	66	0	11	118	0	76	920	0	85	481	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	23.2	23.2		23.2	23.2		43.4	38.2		43.4	38.2	
Effective Green, g (s)	23.2	23.2		23.2	23.2		43.4	38.2		43.4	38.2	
Actuated g/C Ratio	0.28	0.28		0.28	0.28		0.52	0.46		0.52	0.46	
Clearance Time (s)	6.9	6.9		6.9	6.9		3.0	6.9		3.0	6.9	
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	264	472		353	457		500	851		199	1577	
v/s Ratio Prot		0.04			0.07		0.01	c0.49		c0.03	0.14	
v/s Ratio Perm	c0.28			0.01			0.07			0.19		
v/c Ratio	0.99	0.14		0.03	0.26		0.15	1.08		0.43	0.30	
Uniform Delay, d1	30.0	22.6		21.9	23.4		10.0	22.6		17.4	14.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	53.1	0.1		0.0	0.2		0.1	55.3		1.1	0.5	
Delay (s)	83.1	22.7		21.9	23.6		10.1	77.9		18.5	14.7	
Level of Service	F	C		C	C		B	E		B	B	
Approach Delay (s)		64.7			23.6			72.8			15.3	
Approach LOS		E			C			E			B	
Intersection Summary												
HCM 2000 Control Delay	50.3			HCM 2000 Level of Service			D					
HCM 2000 Volume to Capacity ratio	1.00											
Actuated Cycle Length (s)	83.4			Sum of lost time (s)			16.8					
Intersection Capacity Utilization	97.9%			ICU Level of Service			F					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

6: Bartlett Rd & Greenlane

Timing Plan: AM Peak

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	47	35	64	268	71	22
Future Volume (Veh/h)	47	35	64	268	71	22
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)	51	38	70	291	77	24
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	520	89	101			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	520	89	101			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	90	96	95			
cM capacity (veh/h)	492	969	1491			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	89	361	101			
Volume Left	51	70	0			
Volume Right	38	0	24			
cSH	623	1491	1700			
Volume to Capacity	0.14	0.05	0.06			
Queue Length 95th (m)	4.0	1.2	0.0			
Control Delay (s)	11.7	1.8	0.0			
Lane LOS	B	A				
Approach Delay (s)	11.7	1.8	0.0			
Approach LOS	B					
Intersection Summary						
Average Delay		3.1				
Intersection Capacity Utilization		35.7%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

10: Garden Gate Terrace & Greenlane

Timing Plan: AM Peak

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↶			↷	↶	↷
Traffic Volume (veh/h)	71	43	13	74	173	35
Future Volume (Veh/h)	71	43	13	74	173	35
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)	77	47	14	80	188	38
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			124		208	100
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			124		208	100
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		76	96
cM capacity (veh/h)			1463		772	955
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	124	94	226			
Volume Left	0	14	188			
Volume Right	47	0	38			
cSH	1700	1463	798			
Volume to Capacity	0.07	0.01	0.28			
Queue Length 95th (m)	0.0	0.2	9.3			
Control Delay (s)	0.0	1.2	11.3			
Lane LOS		A	B			
Approach Delay (s)	0.0	1.2	11.3			
Approach LOS			B			
Intersection Summary						
Average Delay		6.0				
Intersection Capacity Utilization		29.7%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

12: Carriage Rd & Greenlane

Timing Plan: AM Peak

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↰	↘	↗
Traffic Volume (veh/h)	110	6	3	244	29	2
Future Volume (Veh/h)	110	6	3	244	29	2
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)	120	7	3	265	32	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)	363					
pX, platoon unblocked						
vC, conflicting volume			127		394	124
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			127		394	124
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		95	100
cM capacity (veh/h)			1459		609	927
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	127	268	34			
Volume Left	0	3	32			
Volume Right	7	0	2			
cSH	1700	1459	622			
Volume to Capacity	0.07	0.00	0.05			
Queue Length 95th (m)	0.0	0.0	1.4			
Control Delay (s)	0.0	0.1	11.1			
Lane LOS		A	B			
Approach Delay (s)	0.0	0.1	11.1			
Approach LOS			B			
Intersection Summary						
Average Delay			0.9			
Intersection Capacity Utilization			25.2%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

13: Lincoln Ave & Greenlane

Timing Plan: AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	11	94	9	29	158	19	14	148	35	6	87	6
Future Volume (Veh/h)	11	94	9	29	158	19	14	148	35	6	87	6
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	12	102	10	32	172	21	15	161	38	7	95	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)												
pX, platoon unblocked												
vC, conflicting volume	193			112			432	388	107	496	382	182
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	193			112			432	388	107	496	382	182
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			98			97	70	96	98	82	99
cM capacity (veh/h)	1380			1478			447	530	947	348	534	860
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	124	225	214	109								
Volume Left	12	32	15	7								
Volume Right	10	21	38	7								
cSH	1380	1478	567	529								
Volume to Capacity	0.01	0.02	0.38	0.21								
Queue Length 95th (m)	0.2	0.5	14.0	6.1								
Control Delay (s)	0.8	1.2	15.1	13.6								
Lane LOS	A	A	C	B								
Approach Delay (s)	0.8	1.2	15.1	13.6								
Approach LOS			C	B								
Intersection Summary												
Average Delay												
Intersection Capacity Utilization												
Analysis Period (min)												

HCM Unsignalized Intersection Capacity Analysis

16: Cedarbrooke Ln & Greenlane

Timing Plan: AM Peak

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↰	↰	↱
Traffic Volume (veh/h)	162	30	45	155	57	123
Future Volume (Veh/h)	162	30	45	155	57	123
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)	176	33	49	168	62	134
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage veh						
Upstream signal (m)			356			
pX, platoon unblocked						
vC, conflicting volume			209		458	192
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			209		458	192
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			96		89	84
cM capacity (veh/h)			1362		540	849
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	209	217	196			
Volume Left	0	49	62			
Volume Right	33	0	134			
cSH	1700	1362	719			
Volume to Capacity	0.12	0.04	0.27			
Queue Length 95th (m)	0.0	0.9	8.8			
Control Delay (s)	0.0	2.0	11.9			
Lane LOS		A	B			
Approach Delay (s)	0.0	2.0	11.9			
Approach LOS			B			
Intersection Summary						
Average Delay			4.4			
Intersection Capacity Utilization			41.7%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

18: Ontario St & Homestead Dr

Timing Plan: AM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	24	74	901	10	19	432
Future Volume (Veh/h)	24	74	901	10	19	432
Sign Control	Stop		Free		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)	26	80	979	11	21	470
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)						259
pX, platoon unblocked	0.87					
vC, conflicting volume	1496	984			990	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1496	984			990	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	77	73			97	
cM capacity (veh/h)	114	301			698	
Direction, Lane #	WB 1	NB 1	SB 1	SB 2		
Volume Total	106	990	21	470		
Volume Left	26	0	21	0		
Volume Right	80	11	0	0		
cSH	215	1700	698	1700		
Volume to Capacity	0.49	0.58	0.03	0.28		
Queue Length 95th (m)	19.8	0.0	0.7	0.0		
Control Delay (s)	37.0	0.0	10.3	0.0		
Lane LOS	E		B			
Approach Delay (s)	37.0	0.0	0.4			
Approach LOS	E					
Intersection Summary						
Average Delay			2.6			
Intersection Capacity Utilization			60.6%		ICU Level of Service	B
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

20: Ontario St & Drake Ave

Timing Plan: AM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	7	73	870	2	18	546
Future Volume (Veh/h)	7	73	870	2	18	546
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)	8	79	946	2	20	593
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1580	947			948	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1580	947			948	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	93	75			97	
cM capacity (veh/h)	117	317			724	
Direction, Lane #	WB 1	NB 1	SB 1	SB 2		
Volume Total	87	948	20	593		
Volume Left	8	0	20	0		
Volume Right	79	2	0	0		
cSH	274	1700	724	1700		
Volume to Capacity	0.32	0.56	0.03	0.35		
Queue Length 95th (m)	10.6	0.0	0.7	0.0		
Control Delay (s)	24.2	0.0	10.1	0.0		
Lane LOS	C		B			
Approach Delay (s)	24.2	0.0	0.3			
Approach LOS	C					
Intersection Summary						
Average Delay		1.4				
Intersection Capacity Utilization		57.5%		ICU Level of Service	B	
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

22: Ontario St & Friesen Blvd

Timing Plan: AM Peak

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	18	50	21	74	483	11
Future Volume (Veh/h)	18	50	21	74	483	11
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)	20	54	23	80	525	12
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	657	531	537			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	657	531	537			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	95	90	98			
cM capacity (veh/h)	420	548	1031			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1		
Volume Total	74	23	80	537		
Volume Left	20	23	0	0		
Volume Right	54	0	0	12		
cSH	506	1031	1700	1700		
Volume to Capacity	0.15	0.02	0.05	0.32		
Queue Length 95th (m)	4.1	0.5	0.0	0.0		
Control Delay (s)	13.3	8.6	0.0	0.0		
Lane LOS	B	A				
Approach Delay (s)	13.3	1.9		0.0		
Approach LOS	B					
Intersection Summary						
Average Delay			1.7			
Intersection Capacity Utilization			36.8%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

1: Ontario St & Greenlane

Timing Plan: PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	371	114	182	22	97	92	152	662	9	178	1100	273
Future Volume (vph)	371	114	182	22	97	92	152	662	9	178	1100	273
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.9	6.9		6.9	6.9		3.0	6.9		3.0	6.9	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	0.95	
Frt	1.00	0.91		1.00	0.93		1.00	1.00		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1691		1770	1726		1770	1859		1770	3434	
Flt Permitted	0.60	1.00		0.40	1.00		0.10	1.00		0.13	1.00	
Satd. Flow (perm)	1119	1691		753	1726		196	1859		246	3434	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	403	124	198	24	105	100	165	720	10	193	1196	297
RTOR Reduction (vph)	0	68	0	0	40	0	0	1	0	0	26	0
Lane Group Flow (vph)	403	254	0	24	165	0	165	729	0	193	1467	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	23.1	23.1		23.1	23.1		45.0	38.1		45.2	38.2	
Effective Green, g (s)	23.1	23.1		23.1	23.1		45.0	38.1		45.2	38.2	
Actuated g/C Ratio	0.27	0.27		0.27	0.27		0.53	0.45		0.53	0.45	
Clearance Time (s)	6.9	6.9		6.9	6.9		3.0	6.9		3.0	6.9	
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	304	459		204	469		231	833		256	1543	
v/s Ratio Prot		0.15			0.10		0.06	0.39		0.06	0.43	
v/s Ratio Perm	0.36			0.03			0.32			0.34		
v/c Ratio	1.33	0.55		0.12	0.35		0.71	0.88		0.75	0.95	
Uniform Delay, d1	30.9	26.5		23.3	24.9		16.6	21.3		15.6	22.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	167.6	1.2		0.2	0.3		9.4	12.5		11.3	13.9	
Delay (s)	198.6	27.7		23.5	25.3		26.0	33.7		26.9	36.4	
Level of Service	F	C		C	C		C	C		C	D	
Approach Delay (s)		122.7			25.1			32.3			35.3	
Approach LOS		F			C			C			D	
Intersection Summary												
HCM 2000 Control Delay			51.8				HCM 2000 Level of Service			D		
HCM 2000 Volume to Capacity ratio			1.06									
Actuated Cycle Length (s)			85.0				Sum of lost time (s)			16.8		
Intersection Capacity Utilization			99.4%				ICU Level of Service			F		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

6: Bartlett Rd & Greenlane

Timing Plan: PM Peak

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	32	82	54	116	220	75
Future Volume (Veh/h)	32	82	54	116	220	75
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)	35	89	59	126	239	82
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	524	280	321			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	524	280	321			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	93	88	95			
cM capacity (veh/h)	489	759	1239			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	124	185	321			
Volume Left	35	59	0			
Volume Right	89	0	82			
cSH	657	1239	1700			
Volume to Capacity	0.19	0.05	0.19			
Queue Length 95th (m)	5.5	1.2	0.0			
Control Delay (s)	11.8	2.8	0.0			
Lane LOS	B	A				
Approach Delay (s)	11.8	2.8	0.0			
Approach LOS	B					
Intersection Summary						
Average Delay		3.2				
Intersection Capacity Utilization		42.1%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

10: Garden Gate Terrace & Greenlane

Timing Plan: PM Peak

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↶			↷	↶	↷
Traffic Volume (veh/h)	104	138	15	89	105	15
Future Volume (Veh/h)	104	138	15	89	105	15
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)	113	150	16	97	114	16
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			263		317	188
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			263		317	188
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		83	98
cM capacity (veh/h)			1301		668	854
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	263	113	130			
Volume Left	0	16	114			
Volume Right	150	0	16			
cSH	1700	1301	686			
Volume to Capacity	0.15	0.01	0.19			
Queue Length 95th (m)	0.0	0.3	5.6			
Control Delay (s)	0.0	1.2	11.5			
Lane LOS		A	B			
Approach Delay (s)	0.0	1.2	11.5			
Approach LOS			B			
Intersection Summary						
Average Delay			3.2			
Intersection Capacity Utilization			30.8%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

12: Carriage Rd & Greenlane

Timing Plan: PM Peak

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↰	↘	↗
Traffic Volume (veh/h)	240	49	6	190	22	2
Future Volume (Veh/h)	240	49	6	190	22	2
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)	261	53	7	207	24	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)	363					
pX, platoon unblocked						
vC, conflicting volume			314		508	288
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			314		508	288
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		95	100
cM capacity (veh/h)			1246		521	752
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	314	214	26			
Volume Left	0	7	24			
Volume Right	53	0	2			
cSH	1700	1246	534			
Volume to Capacity	0.18	0.01	0.05			
Queue Length 95th (m)	0.0	0.1	1.2			
Control Delay (s)	0.0	0.3	12.1			
Lane LOS		A	B			
Approach Delay (s)	0.0	0.3	12.1			
Approach LOS			B			
Intersection Summary						
Average Delay			0.7			
Intersection Capacity Utilization			25.6%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

13: Lincoln Ave & Greenlane

Timing Plan: PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	14	330	9	70	193	34	9	51	54	46	126	15
Future Volume (Veh/h)	14	330	9	70	193	34	9	51	54	46	126	15
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	15	359	10	76	210	37	10	55	59	50	137	16
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	247			369			859	793	364	861	780	228
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	247			369			859	793	364	861	780	228
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			94			94	81	91	75	55	98
cM capacity (veh/h)	1319			1190			166	297	681	204	303	811
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	384	323	124	203								
Volume Left	15	76	10	50								
Volume Right	10	37	59	16								
cSH	1319	1190	373	283								
Volume to Capacity	0.01	0.06	0.33	0.72								
Queue Length 95th (m)	0.3	1.6	11.4	40.5								
Control Delay (s)	0.4	2.4	19.4	44.4								
Lane LOS	A	A	C	E								
Approach Delay (s)	0.4	2.4	19.4	44.4								
Approach LOS			C	E								
Intersection Summary												
Average Delay	11.9											
Intersection Capacity Utilization	61.5%			ICU Level of Service					B			
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis

16: Cedarbrooke Ln & Greenlane

Timing Plan: PM Peak

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↱	↘↗	
Traffic Volume (veh/h)	317	51	105	299	39	59
Future Volume (Veh/h)	317	51	105	299	39	59
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)	345	55	114	325	42	64
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)				356		
pX, platoon unblocked						
vC, conflicting volume			400		926	372
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			400		926	372
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			90		84	90
cM capacity (veh/h)			1159		269	673
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	400	439	106			
Volume Left	0	114	42			
Volume Right	55	0	64			
cSH	1700	1159	422			
Volume to Capacity	0.24	0.10	0.25			
Queue Length 95th (m)	0.0	2.6	7.9			
Control Delay (s)	0.0	3.0	16.4			
Lane LOS		A	C			
Approach Delay (s)	0.0	3.0	16.4			
Approach LOS			C			
Intersection Summary						
Average Delay			3.2			
Intersection Capacity Utilization			57.1%	ICU Level of Service		B
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

18: Ontario St & Homestead Dr

Timing Plan: PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	29	49	828	30	103	1299
Future Volume (Veh/h)	29	49	828	30	103	1299
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)	32	53	900	33	112	1412
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)						259
pX, platoon unblocked	0.53					
vC, conflicting volume	2552	916			933	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	3471	916			933	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	84			85	
cM capacity (veh/h)	3	330			734	
Direction, Lane #	WB 1	NB 1	SB 1	SB 2		
Volume Total	85	933	112	1412		
Volume Left	32	0	112	0		
Volume Right	53	33	0	0		
cSH	9	1700	734	1700		
Volume to Capacity	9.76	0.55	0.15	0.83		
Queue Length 95th (m)	Err	0.0	4.3	0.0		
Control Delay (s)	Err	0.0	10.8	0.0		
Lane LOS	F		B			
Approach Delay (s)	Err	0.0	0.8			
Approach LOS	F					
Intersection Summary						
Average Delay		334.8				
Intersection Capacity Utilization		79.7%		ICU Level of Service		D
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

20: Ontario St & Drake Ave

Timing Plan: PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	19	41	886	18	124	1235
Future Volume (Veh/h)	19	41	886	18	124	1235
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)	21	45	963	20	135	1342
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	2585	973			983	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2585	973			983	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	7	85			81	
cM capacity (veh/h)	23	306			703	
Direction, Lane #	WB 1	NB 1	SB 1	SB 2		
Volume Total	66	983	135	1342		
Volume Left	21	0	135	0		
Volume Right	45	20	0	0		
cSH	61	1700	703	1700		
Volume to Capacity	1.08	0.58	0.19	0.79		
Queue Length 95th (m)	42.2	0.0	5.7	0.0		
Control Delay (s)	250.6	0.0	11.3	0.0		
Lane LOS	F		B			
Approach Delay (s)	250.6	0.0	1.0			
Approach LOS	F					
Intersection Summary						
Average Delay			7.2			
Intersection Capacity Utilization			75.2%		ICU Level of Service	D
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

22: Ontario St & Friesen Blvd

Timing Plan: PM Peak

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	30	88	66	802	1111	56
Future Volume (Veh/h)	30	88	66	802	1111	56
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)	33	96	72	872	1208	61
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	2254	1238	1269			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2254	1238	1269			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	16	55	87			
cM capacity (veh/h)	39	214	548			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1		
Volume Total	129	72	872	1269		
Volume Left	33	72	0	0		
Volume Right	96	0	0	61		
cSH	100	548	1700	1700		
Volume to Capacity	1.28	0.13	0.51	0.75		
Queue Length 95th (m)	71.7	3.6	0.0	0.0		
Control Delay (s)	262.1	12.6	0.0	0.0		
Lane LOS	F	B				
Approach Delay (s)	262.1	1.0		0.0		
Approach LOS	F					
Intersection Summary						
Average Delay			14.8			
Intersection Capacity Utilization			75.6%		ICU Level of Service	
Analysis Period (min)			15			
			D			

Queuing and Blocking Report

Greenlane EA

AM Peak

Intersection: 1: Ontario St & Greenlane

Movement	EB	EB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	T	TR
Maximum Queue (m)	170.3	195.3	20.3	65.7	75.0	245.1	33.5	49.7	66.4
Average Queue (m)	127.9	88.4	2.2	34.7	28.6	190.6	14.1	12.2	36.0
95th Queue (m)	221.9	256.6	11.9	56.6	77.5	293.6	26.2	35.6	59.2
Link Distance (m)		334.6		342.2		241.4		169.6	169.6
Upstream Blk Time (%)		1				5			
Queuing Penalty (veh)		2				46			
Storage Bay Dist (m)	100.0		45.0		60.0		45.0		
Storage Blk Time (%)	54	0		4		45	0	0	
Queuing Penalty (veh)	58	0		0		31	0	0	

Intersection: 6: Bartlett Rd & Greenlane

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (m)	19.9	14.6
Average Queue (m)	8.4	2.1
95th Queue (m)	14.5	9.7
Link Distance (m)	359.2	80.6
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 10: Garden Gate Terrace & Greenlane

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (m)	8.7	26.2
Average Queue (m)	0.6	13.5
95th Queue (m)	4.6	21.4
Link Distance (m)	359.2	234.8
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Queuing and Blocking Report Greenlane EA

AM Peak

Intersection: 12: Carriage Rd & Greenlane

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (m)	1.7	17.8
Average Queue (m)	0.1	6.5
95th Queue (m)	1.2	15.0
Link Distance (m)	13.4	233.6
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 13: Lincoln Ave & Greenlane

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (m)	10.4	9.1	28.3	20.0
Average Queue (m)	0.9	0.9	13.9	10.6
95th Queue (m)	5.4	5.2	22.5	17.2
Link Distance (m)	194.7	457.4	171.2	130.4
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 16: Cedarbrooke Ln & Greenlane

Movement	EB	WB	NB
Directions Served	TR	LT	LR
Maximum Queue (m)	4.5	15.9	26.2
Average Queue (m)	0.4	2.5	13.0
95th Queue (m)	4.9	10.6	21.4
Link Distance (m)	457.4	334.6	193.2
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Queuing and Blocking Report

Greenlane EA

AM Peak

Intersection: 18: Ontario St & Homestead Dr

Movement	WB	NB	SB
Directions Served	LR	TR	L
Maximum Queue (m)	108.3	118.8	11.7
Average Queue (m)	43.2	26.2	2.9
95th Queue (m)	117.2	93.8	10.2
Link Distance (m)	339.4	175.0	241.4
Upstream Blk Time (%)		0	
Queuing Penalty (veh)		1	
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 20: Ontario St & Drake Ave

Movement	WB	NB	SB
Directions Served	LR	TR	L
Maximum Queue (m)	23.7	16.5	11.7
Average Queue (m)	11.4	1.0	3.8
95th Queue (m)	20.6	15.6	11.5
Link Distance (m)	341.9	155.5	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)		45.0	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 22: Ontario St & Friesen Blvd

Movement	EB	NB
Directions Served	LR	L
Maximum Queue (m)	18.3	9.3
Average Queue (m)	8.8	2.3
95th Queue (m)	15.5	8.8
Link Distance (m)	330.4	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		45.0
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 139

Queuing and Blocking Report

Greenlane EA

PM Peak

Intersection: 1: Ontario St & Greenlane

Movement	EB	EB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	T	TR
Maximum Queue (m)	200.0	339.3	15.3	49.8	74.9	175.9	75.0	184.4	185.2
Average Queue (m)	198.8	314.8	5.1	25.9	37.5	85.8	60.3	171.5	174.3
95th Queue (m)	206.4	394.7	13.9	44.7	76.6	152.7	100.6	200.3	189.1
Link Distance (m)		334.6		342.2		241.4		169.6	169.6
Upstream Blk Time (%)		45				0		51	71
Queuing Penalty (veh)		170				1		0	0
Storage Bay Dist (m)	100.0		45.0		60.0		45.0		
Storage Blk Time (%)	97	1		1		18	2	38	
Queuing Penalty (veh)	288	4		0		27	10	68	

Intersection: 6: Bartlett Rd & Greenlane

Movement	EB	NB	SB
Directions Served	LR	LT	TR
Maximum Queue (m)	26.6	17.3	1.3
Average Queue (m)	9.0	5.3	0.0
95th Queue (m)	18.4	14.6	0.9
Link Distance (m)	359.2	80.6	90.4
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 10: Garden Gate Terrace & Greenlane

Movement	EB	WB	NB
Directions Served	TR	LT	LR
Maximum Queue (m)	1.3	10.4	21.2
Average Queue (m)	0.0	0.8	10.5
95th Queue (m)	0.9	5.1	17.3
Link Distance (m)	68.7	359.2	234.8
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Queuing and Blocking Report

Greenlane EA

PM Peak

Intersection: 12: Carriage Rd & Greenlane

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (m)	9.7	11.7
Average Queue (m)	0.5	6.0
95th Queue (m)	4.6	13.2
Link Distance (m)	13.4	233.6
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	0	
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 13: Lincoln Ave & Greenlane

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (m)	74.2	20.8	82.4	78.0
Average Queue (m)	23.9	5.3	27.6	30.1
95th Queue (m)	116.7	16.0	100.4	88.9
Link Distance (m)	194.7	457.4	171.2	130.4
Upstream Blk Time (%)	5		2	8
Queuing Penalty (veh)	0		0	0
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 16: Cedarbrooke Ln & Greenlane

Movement	EB	WB	NB
Directions Served	TR	LT	LR
Maximum Queue (m)	351.3	40.2	160.2
Average Queue (m)	165.7	7.3	76.4
95th Queue (m)	451.1	24.0	191.9
Link Distance (m)	457.4	334.6	193.2
Upstream Blk Time (%)	9		12
Queuing Penalty (veh)	40		0
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Queuing and Blocking Report

Greenlane EA

PM Peak

Intersection: 18: Ontario St & Homestead Dr

Movement	WB	NB	SB	SB
Directions Served	LR	TR	L	T
Maximum Queue (m)	68.8	5.6	104.2	179.1
Average Queue (m)	25.7	0.5	14.5	13.2
95th Queue (m)	59.5	3.9	60.7	92.4
Link Distance (m)	339.4	175.0	241.4	241.4
Upstream Blk Time (%)				0
Queuing Penalty (veh)				0
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 20: Ontario St & Drake Ave

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (m)	33.6	26.4
Average Queue (m)	13.3	10.9
95th Queue (m)	28.8	20.7
Link Distance (m)	341.9	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		45.0
Storage Blk Time (%)		0
Queuing Penalty (veh)		0

Intersection: 22: Ontario St & Friesen Blvd

Movement	EB	NB	SB
Directions Served	LR	L	TR
Maximum Queue (m)	73.0	23.3	4.0
Average Queue (m)	28.7	10.0	0.2
95th Queue (m)	67.3	19.0	1.9
Link Distance (m)	330.4		155.5
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)		45.0	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 608

D

Appendix D Synchro & SimTraffic Outputs: 2041 Future Scenario – Greenlane and Ontario Improvements

Queuing and Blocking Report

Greenlane EA

AM Peak

Intersection: 1: Ontario St & Greenlane

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	L	TR	L	TR	L	TR	L	T	TR
Maximum Queue (m)	43.9	51.1	34.2	20.7	87.6	74.9	235.8	29.4	49.6	40.4
Average Queue (m)	14.4	30.9	14.4	3.0	39.8	22.0	122.4	13.1	25.9	16.6
95th Queue (m)	34.8	47.7	27.8	15.5	75.5	66.4	219.1	25.0	43.7	34.5
Link Distance (m)			313.4		356.2		248.9		217.7	217.7
Upstream Blk Time (%)							2			
Queuing Penalty (veh)							0			
Storage Bay Dist (m)	60.0	60.0		45.0		60.0		45.0		
Storage Blk Time (%)					14		25		1	
Queuing Penalty (veh)					1		18		0	

Network Summary

Network wide Queuing Penalty: 19

HCM Signalized Intersection Capacity Analysis

1: Ontario St & Greenlane

Timing Plan: AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	241	43	63	10	54	187	70	838	9	78	380	82
Future Volume (vph)	241	43	63	10	54	187	70	838	9	78	380	82
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.9		6.9	6.9		3.0	6.9		3.0	6.9	
Lane Util. Factor	0.97	1.00		1.00	1.00		1.00	1.00		1.00	0.95	
Frt	1.00	0.91		1.00	0.88		1.00	1.00		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1698		1770	1646		1770	1860		1770	3445	
Flt Permitted	0.24	1.00		0.68	1.00		0.46	1.00		0.08	1.00	
Satd. Flow (perm)	866	1698		1272	1646		861	1860		150	3445	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	262	47	68	11	59	203	76	911	10	85	413	89
RTOR Reduction (vph)	0	52	0	0	131	0	0	0	0	0	17	0
Lane Group Flow (vph)	262	63	0	11	131	0	76	921	0	85	485	0
Turn Type	pm+pt	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	22.0	22.0		12.2	12.2		54.3	49.6		54.3	49.6	
Effective Green, g (s)	22.0	22.0		12.2	12.2		54.3	49.6		54.3	49.6	
Actuated g/C Ratio	0.24	0.24		0.13	0.13		0.58	0.53		0.58	0.53	
Clearance Time (s)	4.5	6.9		6.9	6.9		3.0	6.9		3.0	6.9	
Vehicle Extension (s)	3.0	2.5		2.5	2.5		2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	350	401		166	215		548	990		169	1835	
v/s Ratio Prot	c0.04	0.04			0.08		0.01	c0.49		c0.03	0.14	
v/s Ratio Perm	c0.13			0.01			0.07			0.27		
v/c Ratio	0.75	0.16		0.07	0.61		0.14	0.93		0.50	0.26	
Uniform Delay, d1	31.1	28.2		35.5	38.2		8.4	20.1		17.7	11.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	8.5	0.1		0.1	4.1		0.1	16.0		1.7	0.4	
Delay (s)	39.6	28.3		35.6	42.3		8.5	36.1		19.4	12.2	
Level of Service	D	C		D	D		A	D		B	B	
Approach Delay (s)		36.2			42.0			34.0			13.2	
Approach LOS		D			D			C			B	
Intersection Summary												
HCM 2000 Control Delay	29.9			HCM 2000 Level of Service			C					
HCM 2000 Volume to Capacity ratio	0.89											
Actuated Cycle Length (s)	93.1			Sum of lost time (s)			21.3					
Intersection Capacity Utilization	89.5%			ICU Level of Service			E					
Analysis Period (min)	15											
c Critical Lane Group												

Queuing and Blocking Report

Greenlane EA

PM Peak

Intersection: 1: Ontario St & Greenlane

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	L	TR	L	TR	L	TR	L	T	TR
Maximum Queue (m)	58.7	70.1	65.4	25.6	67.2	74.9	216.1	75.0	187.1	183.8
Average Queue (m)	24.0	39.9	33.8	6.1	31.8	42.3	117.9	46.6	120.3	119.9
95th Queue (m)	50.1	59.6	56.4	19.4	55.1	84.9	214.7	89.3	215.7	212.9
Link Distance (m)			313.4		356.2		248.9		217.7	217.7
Upstream Blk Time (%)							4		3	3
Queuing Penalty (veh)							0		0	0
Storage Bay Dist (m)	60.0	60.0		45.0		60.0		45.0		
Storage Blk Time (%)	0	0	0		4	4	30	3	38	
Queuing Penalty (veh)	0	1	2		1	26	45	18	67	

Network Summary

Network wide Queuing Penalty: 160

HCM Signalized Intersection Capacity Analysis

1: Ontario St & Greenlane

Timing Plan: PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	371	114	182	22	97	92	152	662	9	178	1100	273
Future Volume (vph)	371	114	182	22	97	92	152	662	9	178	1100	273
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.9		6.9	6.9		3.0	6.9		3.0	6.9	
Lane Util. Factor	0.97	1.00		1.00	1.00		1.00	1.00		1.00	0.95	
Frt	1.00	0.91		1.00	0.93		1.00	1.00		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1691		1770	1726		1770	1859		1770	3434	
Flt Permitted	0.38	1.00		0.57	1.00		0.11	1.00		0.11	1.00	
Satd. Flow (perm)	1368	1691		1053	1726		209	1859		203	3434	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	403	124	198	24	105	100	165	720	10	193	1196	297
RTOR Reduction (vph)	0	68	0	0	41	0	0	1	0	0	23	0
Lane Group Flow (vph)	403	254	0	24	164	0	165	729	0	193	1470	0
Turn Type	pm+pt	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	25.2	25.2		12.7	12.7		41.7	35.7		43.7	36.7	
Effective Green, g (s)	25.2	25.2		12.7	12.7		41.7	35.7		43.7	36.7	
Actuated g/C Ratio	0.30	0.30		0.15	0.15		0.49	0.42		0.52	0.43	
Clearance Time (s)	4.5	6.9		6.9	6.9		3.0	6.9		3.0	6.9	
Vehicle Extension (s)	3.0	2.5		2.5	2.5		2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	602	503		157	258		213	783		234	1487	
v/s Ratio Prot	c0.06	0.15			0.10		0.05	0.39		c0.07	c0.43	
v/s Ratio Perm	c0.14			0.02			0.33			0.36		
v/c Ratio	0.67	0.50		0.15	0.64		0.77	0.93		0.82	0.99	
Uniform Delay, d1	24.0	24.6		31.3	33.8		17.9	23.3		17.0	23.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.8	0.6		0.3	4.4		15.4	19.3		20.1	20.7	
Delay (s)	26.8	25.2		31.7	38.3		33.4	42.6		37.1	44.5	
Level of Service	C	C		C	D		C	D		D	D	
Approach Delay (s)		26.1			37.6			40.9			43.7	
Approach LOS		C			D			D			D	
Intersection Summary												
HCM 2000 Control Delay			39.0			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			0.92									
Actuated Cycle Length (s)			84.7			Sum of lost time (s)			21.3			
Intersection Capacity Utilization			92.0%			ICU Level of Service			F			
Analysis Period (min)			15									
c Critical Lane Group												

E

Appendix E Synchro & SimTraffic Outputs: 2041 Future Scenario – Sensitivity Analysis

HCM Signalized Intersection Capacity Analysis

1: Ontario St & Greenlane

Timing Plan: AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	241	43	63	10	54	187	70	838	9	78	380	82
Future Volume (vph)	241	43	63	10	54	187	70	838	9	78	380	82
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.9		6.9	6.9		3.0	6.9		3.0	6.9	
Lane Util. Factor	0.97	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.91		1.00	0.88		1.00	1.00		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1698		1770	1646		1770	3533		1770	3445	
Flt Permitted	0.24	1.00		0.68	1.00		0.46	1.00		0.25	1.00	
Satd. Flow (perm)	866	1698		1272	1646		861	3533		471	3445	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	262	47	68	11	59	203	76	911	10	85	413	89
RTOR Reduction (vph)	0	52	0	0	131	0	0	0	0	0	17	0
Lane Group Flow (vph)	262	63	0	11	131	0	76	921	0	85	485	0
Turn Type	pm+pt	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	22.0	22.0		12.2	12.2		54.3	49.6		54.3	49.6	
Effective Green, g (s)	22.0	22.0		12.2	12.2		54.3	49.6		54.3	49.6	
Actuated g/C Ratio	0.24	0.24		0.13	0.13		0.58	0.53		0.58	0.53	
Clearance Time (s)	4.5	6.9		6.9	6.9		3.0	6.9		3.0	6.9	
Vehicle Extension (s)	3.0	2.5		2.5	2.5		2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	350	401		166	215		548	1882		340	1835	
v/s Ratio Prot	c0.04	0.04			0.08		0.01	c0.26		c0.01	0.14	
v/s Ratio Perm	c0.13			0.01			0.07			0.13		
v/c Ratio	0.75	0.16		0.07	0.61		0.14	0.49		0.25	0.26	
Uniform Delay, d1	31.1	28.2		35.5	38.2		8.4	13.7		9.0	11.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	8.5	0.1		0.1	4.1		0.1	0.9		0.3	0.4	
Delay (s)	39.6	28.3		35.6	42.3		8.5	14.7		9.3	12.2	
Level of Service	D	C		D	D		A	B		A	B	
Approach Delay (s)		36.2			42.0			14.2			11.8	
Approach LOS		D			D			B			B	
Intersection Summary												
HCM 2000 Control Delay	20.7			HCM 2000 Level of Service			C					
HCM 2000 Volume to Capacity ratio	0.57											
Actuated Cycle Length (s)	93.1			Sum of lost time (s)			21.3					
Intersection Capacity Utilization	68.3%			ICU Level of Service			C					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

18: Ontario St & Homestead Dr

Timing Plan: AM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	24	74	901	10	19	432
Future Volume (vph)	24	74	901	10	19	432
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5		4.5	4.5
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	1.00		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	1860		1770	1863
Flt Permitted	0.95	1.00	1.00		0.23	1.00
Satd. Flow (perm)	1770	1583	1860		428	1863
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	26	80	979	11	21	470
RTOR Reduction (vph)	0	73	0	0	0	0
Lane Group Flow (vph)	26	7	990	0	21	470
Turn Type	Prot	Perm	NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	5.7	5.7	55.3		55.3	55.3
Effective Green, g (s)	5.7	5.7	55.3		55.3	55.3
Actuated g/C Ratio	0.08	0.08	0.79		0.79	0.79
Clearance Time (s)	4.5	4.5	4.5		4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	144	128	1469		338	1471
v/s Ratio Prot	c0.01		c0.53			0.25
v/s Ratio Perm		0.00			0.05	
v/c Ratio	0.18	0.05	0.67		0.06	0.32
Uniform Delay, d1	30.0	29.7	3.3		1.6	2.1
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.6	0.2	2.5		0.4	0.6
Delay (s)	30.6	29.8	5.8		2.0	2.6
Level of Service	C	C	A		A	A
Approach Delay (s)	30.0		5.8			2.6
Approach LOS	C		A			A

Intersection Summary

HCM 2000 Control Delay	6.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	60.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

20: Ontario St & Drake Ave

Timing Plan: AM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	7	73	870	2	18	546
Future Volume (vph)	7	73	870	2	18	546
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5		4.5	4.5
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	1.00		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	1862		1770	1863
Flt Permitted	0.95	1.00	1.00		0.24	1.00
Satd. Flow (perm)	1770	1583	1862		443	1863
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	8	79	946	2	20	593
RTOR Reduction (vph)	0	74	0	0	0	0
Lane Group Flow (vph)	8	5	948	0	20	593
Turn Type	Prot	Perm	NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	3.5	3.5	38.0		38.0	38.0
Effective Green, g (s)	3.5	3.5	38.0		38.0	38.0
Actuated g/C Ratio	0.07	0.07	0.75		0.75	0.75
Clearance Time (s)	4.5	4.5	4.5		4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	122	109	1401		333	1401
v/s Ratio Prot	c0.00		c0.51			0.32
v/s Ratio Perm		0.00			0.05	
v/c Ratio	0.07	0.05	0.68		0.06	0.42
Uniform Delay, d1	22.0	21.9	3.2		1.6	2.3
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.2	0.2	1.3		0.1	0.2
Delay (s)	22.2	22.1	4.5		1.7	2.5
Level of Service	C	C	A		A	A
Approach Delay (s)	22.1		4.5			2.5
Approach LOS	C		A			A
Intersection Summary						
HCM 2000 Control Delay			4.6		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.63			
Actuated Cycle Length (s)			50.5		Sum of lost time (s)	9.0
Intersection Capacity Utilization			57.9%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

22: Ontario St & Friesen Blvd

Timing Plan: AM Peak



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	18	50	21	74	483	11
Future Volume (vph)	18	50	21	74	483	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	1863	1857	
Flt Permitted	0.95	1.00	0.45	1.00	1.00	
Satd. Flow (perm)	1770	1583	839	1863	1857	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	20	54	23	80	525	12
RTOR Reduction (vph)	0	50	0	0	1	0
Lane Group Flow (vph)	20	4	23	80	536	0
Turn Type	Prot	Perm	Perm	NA	NA	
Protected Phases	4			2	6	
Permitted Phases		4	2			
Actuated Green, G (s)	4.1	4.1	36.9	36.9	36.9	
Effective Green, g (s)	4.1	4.1	36.9	36.9	36.9	
Actuated g/C Ratio	0.08	0.08	0.74	0.74	0.74	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	145	129	619	1374	1370	
v/s Ratio Prot	c0.01			0.04	c0.29	
v/s Ratio Perm		0.00	0.03			
v/c Ratio	0.14	0.03	0.04	0.06	0.39	
Uniform Delay, d1	21.3	21.1	1.8	1.8	2.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.4	0.1	0.1	0.1	0.8	
Delay (s)	21.7	21.2	1.9	1.9	3.3	
Level of Service	C	C	A	A	A	
Approach Delay (s)	21.4			1.9	3.3	
Approach LOS	C			A	A	

Intersection Summary

HCM 2000 Control Delay	4.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	37.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis

6: Bartlett Rd & Greenlane

Timing Plan: AM Peak

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	47	35	64	268	71	22
Future Volume (Veh/h)	47	35	64	268	71	22
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)	51	38	70	291	77	24
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	520	89	101			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	520	89	101			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	90	96	95			
cM capacity (veh/h)	492	969	1491			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	89	361	101			
Volume Left	51	70	0			
Volume Right	38	0	24			
cSH	623	1491	1700			
Volume to Capacity	0.14	0.05	0.06			
Queue Length 95th (m)	4.0	1.2	0.0			
Control Delay (s)	11.7	1.8	0.0			
Lane LOS	B	A				
Approach Delay (s)	11.7	1.8	0.0			
Approach LOS	B					
Intersection Summary						
Average Delay			3.1			
Intersection Capacity Utilization			35.7%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

10: Garden Gate Terrace & Greenlane

Timing Plan: AM Peak

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↱	↘↙	
Traffic Volume (veh/h)	71	43	13	74	173	35
Future Volume (Veh/h)	71	43	13	74	173	35
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)	77	47	14	80	188	38
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			124		208	100
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			124		208	100
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		76	96
cM capacity (veh/h)			1463		772	955
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	124	94	226			
Volume Left	0	14	188			
Volume Right	47	0	38			
cSH	1700	1463	798			
Volume to Capacity	0.07	0.01	0.28			
Queue Length 95th (m)	0.0	0.2	9.3			
Control Delay (s)	0.0	1.2	11.3			
Lane LOS		A	B			
Approach Delay (s)	0.0	1.2	11.3			
Approach LOS			B			
Intersection Summary						
Average Delay			6.0			
Intersection Capacity Utilization			29.7%		ICU Level of Service	
Analysis Period (min)			15		A	

HCM Unsignalized Intersection Capacity Analysis

12: Carriage Rd & Greenlane

Timing Plan: AM Peak

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↱	↘↗	
Traffic Volume (veh/h)	110	6	3	244	29	2
Future Volume (Veh/h)	110	6	3	244	29	2
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)	120	7	3	265	32	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)	363					
pX, platoon unblocked						
vC, conflicting volume			127		394	124
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			127		394	124
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		95	100
cM capacity (veh/h)			1459		609	927
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	127	268	34			
Volume Left	0	3	32			
Volume Right	7	0	2			
cSH	1700	1459	622			
Volume to Capacity	0.07	0.00	0.05			
Queue Length 95th (m)	0.0	0.0	1.4			
Control Delay (s)	0.0	0.1	11.1			
Lane LOS		A	B			
Approach Delay (s)	0.0	0.1	11.1			
Approach LOS			B			
Intersection Summary						
Average Delay			0.9			
Intersection Capacity Utilization			25.2%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

13: Lincoln Ave & Greenlane

Timing Plan: AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	11	94	9	29	158	19	14	148	35	6	87	6
Future Volume (vph)	11	94	9	29	158	19	14	148	35	6	87	6
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	12	102	10	32	172	21	15	161	38	7	95	7
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	124	225	214	109								
Volume Left (vph)	12	32	15	7								
Volume Right (vph)	10	21	38	7								
Hadj (s)	0.00	0.01	-0.06	0.01								
Departure Headway (s)	5.0	4.9	4.9	5.1								
Degree Utilization, x	0.17	0.31	0.29	0.15								
Capacity (veh/h)	650	685	688	641								
Control Delay (s)	9.1	10.1	9.9	9.0								
Approach Delay (s)	9.1	10.1	9.9	9.0								
Approach LOS	A	B	A	A								
Intersection Summary												
Delay				9.7								
Level of Service				A								
Intersection Capacity Utilization				37.5%	ICU Level of Service	A						
Analysis Period (min)				15								

HCM Unsignalized Intersection Capacity Analysis

16: Cedarbrooke Ln & Greenlane

Timing Plan: AM Peak

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↰			↱	↰	↱
Traffic Volume (veh/h)	162	30	45	155	57	123
Future Volume (Veh/h)	162	30	45	155	57	123
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)	176	33	49	168	62	134
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)				356		
pX, platoon unblocked						
vC, conflicting volume			209		458	192
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			209		458	192
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			96		89	84
cM capacity (veh/h)			1362		540	849
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	209	217	196			
Volume Left	0	49	62			
Volume Right	33	0	134			
cSH	1700	1362	719			
Volume to Capacity	0.12	0.04	0.27			
Queue Length 95th (m)	0.0	0.9	8.8			
Control Delay (s)	0.0	2.0	11.9			
Lane LOS		A	B			
Approach Delay (s)	0.0	2.0	11.9			
Approach LOS			B			
Intersection Summary						
Average Delay			4.4			
Intersection Capacity Utilization			41.7%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

1: Ontario St & Greenlane

Timing Plan: PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	371	114	182	22	97	92	152	662	9	178	1100	273
Future Volume (vph)	371	114	182	22	97	92	152	662	9	178	1100	273
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.9		6.9	6.9		3.0	6.9		3.0	6.9	
Lane Util. Factor	0.97	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.91		1.00	0.93		1.00	1.00		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1691		1770	1726		1770	3532		1770	3434	
Flt Permitted	0.38	1.00		0.57	1.00		0.10	1.00		0.31	1.00	
Satd. Flow (perm)	1368	1691		1053	1726		194	3532		581	3434	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	403	124	198	24	105	100	165	720	10	193	1196	297
RTOR Reduction (vph)	0	68	0	0	41	0	0	1	0	0	23	0
Lane Group Flow (vph)	403	254	0	24	164	0	165	729	0	193	1470	0
Turn Type	pm+pt	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	22.6	22.6		12.7	12.7		44.4	38.4		46.2	39.3	
Effective Green, g (s)	22.6	22.6		12.7	12.7		44.4	38.4		46.2	39.3	
Actuated g/C Ratio	0.27	0.27		0.15	0.15		0.52	0.45		0.55	0.46	
Clearance Time (s)	4.5	6.9		6.9	6.9		3.0	6.9		3.0	6.9	
Vehicle Extension (s)	3.0	2.5		2.5	2.5		2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	496	451		157	258		213	1601		413	1593	
v/s Ratio Prot	c0.05	0.15			0.10		c0.05	0.21		c0.04	c0.43	
v/s Ratio Perm	c0.16			0.02			0.35			0.22		
v/c Ratio	0.81	0.56		0.15	0.64		0.77	0.46		0.47	0.92	
Uniform Delay, d1	28.5	26.8		31.3	33.8		16.4	15.9		10.2	21.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	9.8	1.3		0.3	4.4		15.4	0.9		0.6	10.4	
Delay (s)	38.3	28.1		31.7	38.3		31.9	16.9		10.8	31.7	
Level of Service	D	C		C	D		C	B		B	C	
Approach Delay (s)		33.8			37.6			19.6			29.3	
Approach LOS		C			D			B			C	
Intersection Summary												
HCM 2000 Control Delay	28.3			HCM 2000 Level of Service			C					
HCM 2000 Volume to Capacity ratio	0.92											
Actuated Cycle Length (s)	84.7			Sum of lost time (s)			21.3					
Intersection Capacity Utilization	92.0%			ICU Level of Service			F					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

18: Ontario St & Homestead Dr

Timing Plan: PM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	29	49	828	30	103	1299
Future Volume (vph)	29	49	828	30	103	1299
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5		4.5	4.5
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	1.00		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	1854		1770	1863
Flt Permitted	0.95	1.00	1.00		0.28	1.00
Satd. Flow (perm)	1770	1583	1854		521	1863
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	32	53	900	33	112	1412
RTOR Reduction (vph)	0	50	1	0	0	0
Lane Group Flow (vph)	32	3	932	0	112	1412
Turn Type	Prot	Perm	NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	6.4	6.4	94.6		94.6	94.6
Effective Green, g (s)	6.4	6.4	94.6		94.6	94.6
Actuated g/C Ratio	0.06	0.06	0.86		0.86	0.86
Clearance Time (s)	4.5	4.5	4.5		4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	102	92	1594		448	1602
v/s Ratio Prot	c0.02		0.50			c0.76
v/s Ratio Perm		0.00			0.21	
v/c Ratio	0.31	0.03	0.58		0.25	0.88
Uniform Delay, d1	49.7	48.9	2.2		1.4	4.5
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.8	0.1	1.6		1.3	7.3
Delay (s)	51.5	49.0	3.7		2.7	11.8
Level of Service	D	D	A		A	B
Approach Delay (s)	49.9		3.7			11.1
Approach LOS	D		A			B

Intersection Summary

HCM 2000 Control Delay	9.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	80.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

20: Ontario St & Drake Ave

Timing Plan: PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	19	41	886	18	124	1235
Future Volume (vph)	19	41	886	18	124	1235
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5		4.5	4.5
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	1.00		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	1858		1770	1863
Flt Permitted	0.95	1.00	1.00		0.26	1.00
Satd. Flow (perm)	1770	1583	1858		484	1863
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	21	45	963	20	135	1342
RTOR Reduction (vph)	0	43	0	0	0	0
Lane Group Flow (vph)	21	2	983	0	135	1342
Turn Type	Prot	Perm	NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	4.3	4.3	76.0		76.0	76.0
Effective Green, g (s)	4.3	4.3	76.0		76.0	76.0
Actuated g/C Ratio	0.05	0.05	0.85		0.85	0.85
Clearance Time (s)	4.5	4.5	4.5		4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	85	76	1581		411	1585
v/s Ratio Prot	c0.01		0.53			c0.72
v/s Ratio Perm		0.00			0.28	
v/c Ratio	0.25	0.03	0.62		0.33	0.85
Uniform Delay, d1	40.9	40.5	2.1		1.4	3.5
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.5	0.2	0.8		0.5	4.4
Delay (s)	42.5	40.7	2.9		1.8	7.9
Level of Service	D	D	A		A	A
Approach Delay (s)	41.2		2.9			7.4
Approach LOS	D		A			A
Intersection Summary						
HCM 2000 Control Delay			6.5		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.81			
Actuated Cycle Length (s)			89.3		Sum of lost time (s)	9.0
Intersection Capacity Utilization			76.7%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

22: Ontario St & Friesen Blvd

Timing Plan: PM Peak



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	30	88	66	802	1111	56
Future Volume (vph)	30	88	66	802	1111	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	1863	1851	
Flt Permitted	0.95	1.00	0.13	1.00	1.00	
Satd. Flow (perm)	1770	1583	248	1863	1851	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	33	96	72	872	1208	61
RTOR Reduction (vph)	0	89	0	0	1	0
Lane Group Flow (vph)	33	7	72	872	1268	0
Turn Type	Prot	Perm	Perm	NA	NA	
Protected Phases	4			2	6	
Permitted Phases		4	2			
Actuated Green, G (s)	6.3	6.3	74.7	74.7	74.7	
Effective Green, g (s)	6.3	6.3	74.7	74.7	74.7	
Actuated g/C Ratio	0.07	0.07	0.83	0.83	0.83	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	123	110	205	1546	1536	
v/s Ratio Prot	c0.02			0.47	c0.69	
v/s Ratio Perm		0.00	0.29			
v/c Ratio	0.27	0.06	0.35	0.56	0.83	
Uniform Delay, d1	39.7	39.1	1.8	2.4	4.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.2	0.2	4.7	1.5	5.2	
Delay (s)	40.8	39.3	6.5	3.9	9.3	
Level of Service	D	D	A	A	A	
Approach Delay (s)	39.7			4.1	9.3	
Approach LOS	D			A	A	

Intersection Summary

HCM 2000 Control Delay	8.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	74.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis

6: Bartlett Rd & Greenlane

Timing Plan: PM Peak

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	32	82	54	116	220	75
Future Volume (Veh/h)	32	82	54	116	220	75
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)	35	89	59	126	239	82
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	524	280	321			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	524	280	321			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	93	88	95			
cM capacity (veh/h)	489	759	1239			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	124	185	321			
Volume Left	35	59	0			
Volume Right	89	0	82			
cSH	657	1239	1700			
Volume to Capacity	0.19	0.05	0.19			
Queue Length 95th (m)	5.5	1.2	0.0			
Control Delay (s)	11.8	2.8	0.0			
Lane LOS	B	A				
Approach Delay (s)	11.8	2.8	0.0			
Approach LOS	B					
Intersection Summary						
Average Delay		3.2				
Intersection Capacity Utilization		42.1%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

10: Garden Gate Terrace & Greenlane

Timing Plan: PM Peak

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↱	↘↗	
Traffic Volume (veh/h)	104	138	15	89	105	15
Future Volume (Veh/h)	104	138	15	89	105	15
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)	113	150	16	97	114	16
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			263		317	188
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			263		317	188
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		83	98
cM capacity (veh/h)			1301		668	854
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	263	113	130			
Volume Left	0	16	114			
Volume Right	150	0	16			
cSH	1700	1301	686			
Volume to Capacity	0.15	0.01	0.19			
Queue Length 95th (m)	0.0	0.3	5.6			
Control Delay (s)	0.0	1.2	11.5			
Lane LOS		A	B			
Approach Delay (s)	0.0	1.2	11.5			
Approach LOS			B			
Intersection Summary						
Average Delay		3.2				
Intersection Capacity Utilization		30.8%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

12: Carriage Rd & Greenlane

Timing Plan: PM Peak

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↰	↘	↗
Traffic Volume (veh/h)	240	49	6	190	22	2
Future Volume (Veh/h)	240	49	6	190	22	2
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)	261	53	7	207	24	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)	363					
pX, platoon unblocked						
vC, conflicting volume			314		508	288
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			314		508	288
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		95	100
cM capacity (veh/h)			1246		521	752
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	314	214	26			
Volume Left	0	7	24			
Volume Right	53	0	2			
cSH	1700	1246	534			
Volume to Capacity	0.18	0.01	0.05			
Queue Length 95th (m)	0.0	0.1	1.2			
Control Delay (s)	0.0	0.3	12.1			
Lane LOS		A	B			
Approach Delay (s)	0.0	0.3	12.1			
Approach LOS			B			
Intersection Summary						
Average Delay			0.7			
Intersection Capacity Utilization			25.6%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

13: Lincoln Ave & Greenlane

Timing Plan: PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	14	330	9	70	193	34	9	51	54	46	126	15
Future Volume (vph)	14	330	9	70	193	34	9	51	54	46	126	15
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	15	359	10	76	210	37	10	55	59	50	137	16
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	384	323	124	203								
Volume Left (vph)	15	76	10	50								
Volume Right (vph)	10	37	59	16								
Hadj (s)	0.03	0.01	-0.24	0.04								
Departure Headway (s)	5.5	5.6	6.1	6.2								
Degree Utilization, x	0.59	0.50	0.21	0.35								
Capacity (veh/h)	619	605	494	519								
Control Delay (s)	16.1	14.1	10.7	12.4								
Approach Delay (s)	16.1	14.1	10.7	12.4								
Approach LOS	C	B	B	B								
Intersection Summary												
Delay			14.1									
Level of Service			B									
Intersection Capacity Utilization			61.5%		ICU Level of Service				B			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

16: Cedarbrooke Ln & Greenlane

Timing Plan: PM Peak

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↰	↰	↱
Traffic Volume (veh/h)	317	51	105	299	39	59
Future Volume (Veh/h)	317	51	105	299	39	59
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)	345	55	114	325	42	64
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)				356		
pX, platoon unblocked						
vC, conflicting volume			400		926	372
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			400		926	372
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			90		84	90
cM capacity (veh/h)			1159		269	673
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	400	439	106			
Volume Left	0	114	42			
Volume Right	55	0	64			
cSH	1700	1159	422			
Volume to Capacity	0.24	0.10	0.25			
Queue Length 95th (m)	0.0	2.6	7.9			
Control Delay (s)	0.0	3.0	16.4			
Lane LOS		A	C			
Approach Delay (s)	0.0	3.0	16.4			
Approach LOS			C			
Intersection Summary						
Average Delay			3.2			
Intersection Capacity Utilization			57.1%	ICU Level of Service		B
Analysis Period (min)			15			

Queuing and Blocking Report

Greenlane EA

AM Peak

Intersection: 1: Ontario St & Greenlane

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	L	TR	L	TR	L	T	TR	L	T	TR
Maximum Queue (m)	35.8	37.5	36.3	40.6	86.9	22.5	67.3	68.6	26.7	47.6	65.2
Average Queue (m)	17.5	23.2	14.5	3.4	37.3	9.6	36.7	39.0	11.8	12.4	35.9
95th Queue (m)	31.7	34.8	28.0	18.3	68.7	19.3	57.4	62.6	21.8	37.5	58.0
Link Distance (m)			334.5		338.6		235.8	235.8		167.8	167.8
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (m)	100.0	100.0		45.0		60.0			45.0		
Storage Blk Time (%)					9		0			0	
Queuing Penalty (veh)					1		0			0	

Intersection: 6: Bartlett Rd & Greenlane

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (m)	19.4	16.0
Average Queue (m)	7.8	2.2
95th Queue (m)	14.5	9.8
Link Distance (m)	359.2	80.6
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 10: Garden Gate Terrace & Greenlane

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (m)	5.5	26.5
Average Queue (m)	0.4	13.5
95th Queue (m)	3.6	21.4
Link Distance (m)	359.2	234.8
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Queuing and Blocking Report Greenlane EA

AM Peak

Intersection: 12: Carriage Rd & Greenlane

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (m)	1.8	15.6
Average Queue (m)	0.1	6.5
95th Queue (m)	1.3	14.4
Link Distance (m)	13.4	233.6
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	0	
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 13: Lincoln Ave & Greenlane

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (m)	23.7	25.4	24.6	19.5
Average Queue (m)	10.7	13.8	13.5	10.2
95th Queue (m)	18.3	21.5	21.3	16.1
Link Distance (m)	194.7	457.3	171.2	130.3
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 16: Cedarbrooke Ln & Greenlane

Movement	EB	WB	NB
Directions Served	TR	LT	LR
Maximum Queue (m)	1.3	15.9	23.6
Average Queue (m)	0.0	2.8	13.4
95th Queue (m)	0.9	11.1	21.4
Link Distance (m)	457.3	334.5	191.4
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Queuing and Blocking Report

Greenlane EA

AM Peak

Intersection: 18: Ontario St & Homestead Dr

Movement	WB	WB	NB	SB	SB
Directions Served	L	R	TR	L	T
Maximum Queue (m)	18.2	18.8	57.7	14.7	47.2
Average Queue (m)	5.5	9.0	17.0	4.1	8.4
95th Queue (m)	13.9	16.5	45.3	12.2	29.7
Link Distance (m)	335.3	335.3	171.4	235.8	235.8
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 20: Ontario St & Drake Ave

Movement	WB	WB	NB	SB	SB
Directions Served	L	R	TR	L	T
Maximum Queue (m)	9.3	23.8	82.3	14.4	48.5
Average Queue (m)	1.7	9.9	29.9	3.7	15.3
95th Queue (m)	7.6	18.2	62.7	11.7	35.8
Link Distance (m)	341.8	341.8	155.5		171.4
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (m)				45.0	
Storage Blk Time (%)					0
Queuing Penalty (veh)					0

Intersection: 22: Ontario St & Friesen Blvd

Movement	EB	EB	NB	NB	SB
Directions Served	L	R	L	T	TR
Maximum Queue (m)	16.4	19.5	9.3	11.7	39.1
Average Queue (m)	4.6	8.3	2.5	1.3	8.9
95th Queue (m)	12.8	16.1	9.2	7.0	26.9
Link Distance (m)	330.2	330.2		195.0	155.5
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (m)			45.0		
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 1

Queuing and Blocking Report

Greenlane EA

PM Peak

Intersection: 1: Ontario St & Greenlane

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	L	TR	L	TR	L	T	TR	L	T	TR
Maximum Queue (m)	51.4	57.4	73.0	29.5	69.8	61.0	61.7	65.6	74.9	184.6	183.3
Average Queue (m)	27.3	35.4	38.3	6.6	30.7	30.5	30.9	35.2	33.1	173.6	174.5
95th Queue (m)	43.9	52.2	63.5	19.2	55.4	53.6	52.0	57.7	74.4	178.7	180.2
Link Distance (m)			334.5		338.6		235.8	235.8		167.8	167.8
Upstream Blk Time (%)										53	81
Queuing Penalty (veh)										0	0
Storage Bay Dist (m)	100.0	100.0		45.0		60.0			45.0		
Storage Blk Time (%)					4	1	0		1	24	
Queuing Penalty (veh)					1	4	0		3	43	

Intersection: 6: Bartlett Rd & Greenlane

Movement	EB	NB	SB
Directions Served	LR	LT	TR
Maximum Queue (m)	18.3	17.2	1.4
Average Queue (m)	8.5	4.0	0.0
95th Queue (m)	15.5	13.0	1.0
Link Distance (m)	359.2	80.6	90.4
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 10: Garden Gate Terrace & Greenlane

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (m)	13.2	21.0
Average Queue (m)	1.7	11.0
95th Queue (m)	8.1	17.8
Link Distance (m)	359.2	234.8
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Queuing and Blocking Report

Greenlane EA

PM Peak

Intersection: 12: Carriage Rd & Greenlane

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (m)	7.4	10.5
Average Queue (m)	0.5	5.0
95th Queue (m)	3.8	12.5
Link Distance (m)	13.4	233.6
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	0	
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 13: Lincoln Ave & Greenlane

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (m)	42.2	27.8	23.1	25.9
Average Queue (m)	19.3	16.0	11.2	13.5
95th Queue (m)	32.5	23.6	17.9	21.1
Link Distance (m)	194.7	457.3	171.2	130.3
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 16: Cedarbrooke Ln & Greenlane

Movement	EB	WB	NB
Directions Served	TR	LT	LR
Maximum Queue (m)	2.7	26.9	21.5
Average Queue (m)	0.1	8.5	10.9
95th Queue (m)	1.4	19.8	18.7
Link Distance (m)	457.3	334.5	191.4
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Queuing and Blocking Report

Greenlane EA

PM Peak

Intersection: 18: Ontario St & Homestead Dr

Movement	WB	WB	NB	SB	SB
Directions Served	L	R	TR	L	T
Maximum Queue (m)	24.5	18.3	75.6	32.7	153.4
Average Queue (m)	6.5	7.9	16.2	12.0	28.1
95th Queue (m)	16.9	15.6	48.2	24.5	92.3
Link Distance (m)	335.3	335.3	171.4	235.8	235.8
Upstream Blk Time (%)					0
Queuing Penalty (veh)					0
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 20: Ontario St & Drake Ave

Movement	WB	WB	NB	SB	SB
Directions Served	L	R	TR	L	T
Maximum Queue (m)	12.8	18.1	71.8	46.5	64.0
Average Queue (m)	3.5	6.7	21.2	15.0	24.0
95th Queue (m)	11.1	15.6	52.3	31.6	53.8
Link Distance (m)	341.8	341.8	155.5		171.4
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (m)				45.0	
Storage Blk Time (%)				0	1
Queuing Penalty (veh)				1	1

Intersection: 22: Ontario St & Friesen Blvd

Movement	EB	EB	NB	NB	SB
Directions Served	L	R	L	T	TR
Maximum Queue (m)	21.0	38.3	28.6	57.6	90.2
Average Queue (m)	7.3	14.4	12.0	18.2	25.7
95th Queue (m)	17.6	28.6	24.4	45.5	66.6
Link Distance (m)	330.2	330.2		195.0	155.5
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (m)			45.0		
Storage Blk Time (%)			1	0	
Queuing Penalty (veh)			4	0	

Network Summary

Network wide Queuing Penalty: 57

F

Appendix F 2041 Traffic Signal Warrants

Summary Results

Justification			Compliance		Signal Justified?	
					YES	NO
1. Minimum Vehicular Volume	A	Total Volume	100	%	☐	☒
	B	Crossing Volume	18	%		
2. Delay to Cross Traffic	A	Main Road	100	%	☐	☒
	B	Crossing Road	16	%		
3. Combination	A	Justificaton 1	18	%	☐	☒
	B	Justification 2	16	%		
4. 4-Hr Volume			33	%	☐	☒

Intersection: Ontario St/Homestead

Count Date: 2041-01-01

Summary Results

Justification		Compliance		Signal Justified?	
				YES	NO
1. Minimum Vehicular Volume	A Total Volume	100	%	☐	☒
	B Crossing Volume	30	%		
2. Delay to Cross Traffic	A Main Road	100	%	☐	☒
	B Crossing Road	26	%		
3. Combination	A Justificaton 1	30	%	☐	☒
	B Justification 2	26	%		
4. 4-Hr Volume		36	%	☐	☒

G

Appendix G Halton Region's Population and Employment Projections

FID	nrz21	area	pop_16_bas	pop_21_bas	pop_31	pop_41	pop_51
164	6165	1190025.765	2615	2782.3155	2791.866	2941.866	3024.806
165	6166	821791.973	55	40.692	563.3448	1056.961	1507.641
166	6167	794292.931	20	10.173	942.573	942.573	952.211
168	6169	770054.771	1400	1480.1715	1577.811	1670.027	2400.074
169	6170	861571.721	3480	3509.685	3732.382	3942.707	4174.398
287	6288	516709.447	1010	1037.646	1039.032	1040.341	1051.248
419	6420	2370540.637	283	366.228	366.6597	363.1212	362.7476
580	6581	979180.234	117	76.2975	76.47581	75.01426	74.77412

emp_16_b	emp_21_bas	emp_31	emp_41
664.72	885	893.5299	901.5267
778.43	510	899.3658	1264.396
903.21	1325	1503.595	1671.028
827.82	515	523.5299	531.5267
81.03	465	470.5978	475.8457
560.66	1160	1287.52	1370.409
273.2	190	294.8849	296.2583
112.57	85	128.3225	128.8897