June 9th, 2021 **JDE** Project 20112

Tulloch Engineering Inc.
1942 Regent St. Unit L
Sudbury, ON P3E 5V5

RE: Traffic Impact Study Addendum
Estelle Street Development, City of Greater Sudbury

This letter was prepared by **JD Northcote Engineering Inc.** [JD Engineering] for the account of **Tulloch Engineering Inc.** [Tulloch].

1.0 BACKGROUND

The proposed development is located on the west side of Estelle Street midblock between Bancroft Drive and Rheal Street, in the City of Greater Sudbury [City]. JD Engineering prepared a traffic impact study for the proposed residential development (dated March 2021) [TIS]. The TIS was based on the development plan proposed at the time the study was completed. This letter is intended as an update to the TIS, to address comments provided by the City (email correspondence provided in the **Appendix**).

This letter will provide a supplementary analysis of the study area intersections without the Kingsway Entertainment District [KED] and future business park development for the critical total (2029) scenario.

This letter will also provide a supplementary analysis of the Moonlight Avenue / Kingsway intersection with fully protected phasing for eastbound and westbound left turn phasing in the critical total (2029) scenario (with the KED and future business park development).

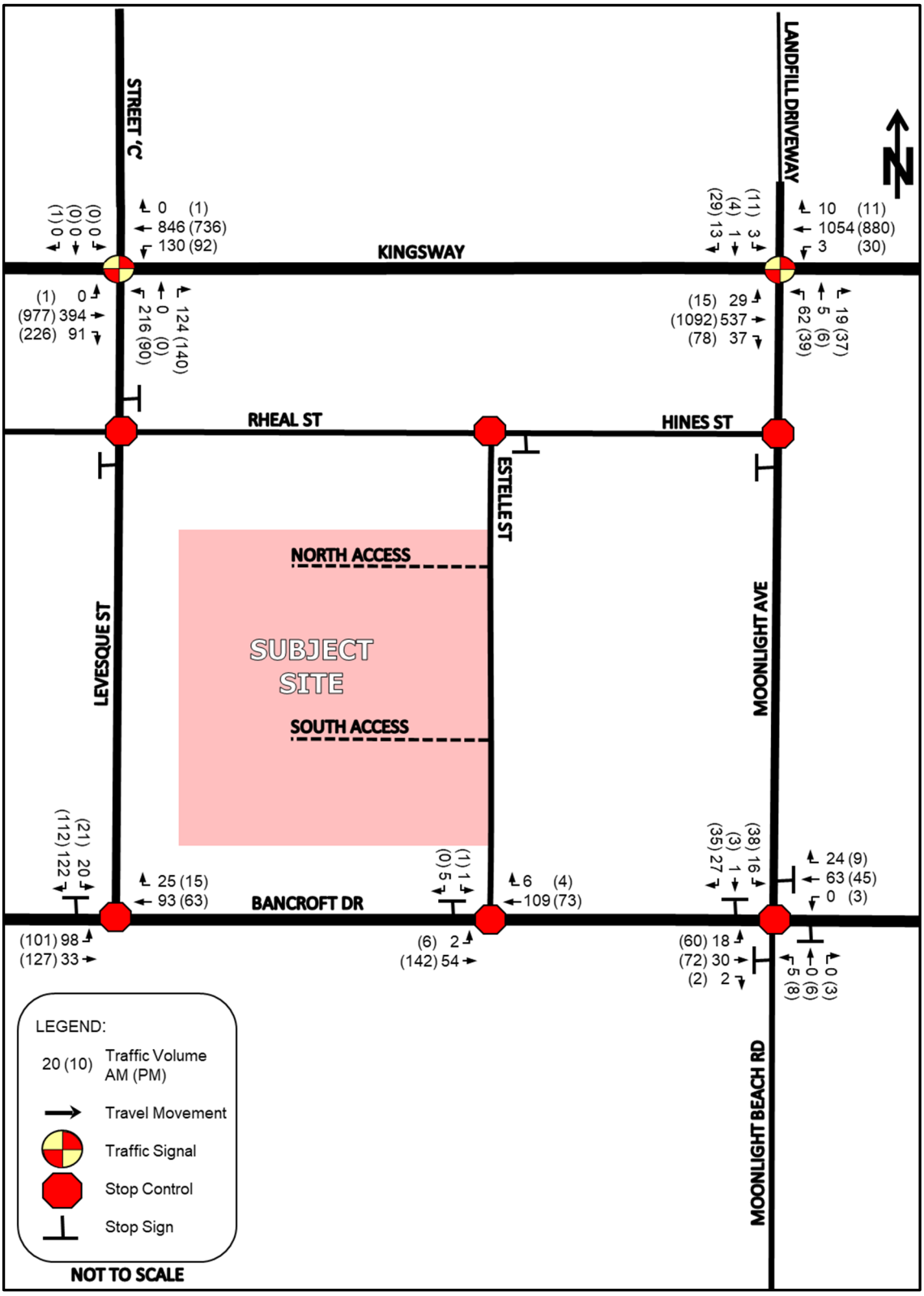
2.0 SUPPLEMENTARY ANALYSIS – TOTAL (2029) TRAFFIC VOLUMES WITHOUT THE KED AND FUTURE BUSINESS PARK DEVELOPMENT

This supplementary analysis assesses the traffic operations at the study area intersections without the KED and future business park development with the critical total (2029) traffic volumes, during the AM and PM peak hour.

For the background (2029) horizon year traffic volumes without the KED and future business park development, were estimated for the AM and PM peak hour by applying the background traffic growth rates (discussed in Section 2.5 of the TIS) to the existing traffic volumes. The resulting background (2029) horizon year traffic volume for the AM and PM peak hour are illustrated in **Figure 1**.

JD Engineering Inc.
Phone: 705.725.4035
Email:Info@JDEngineering.ca

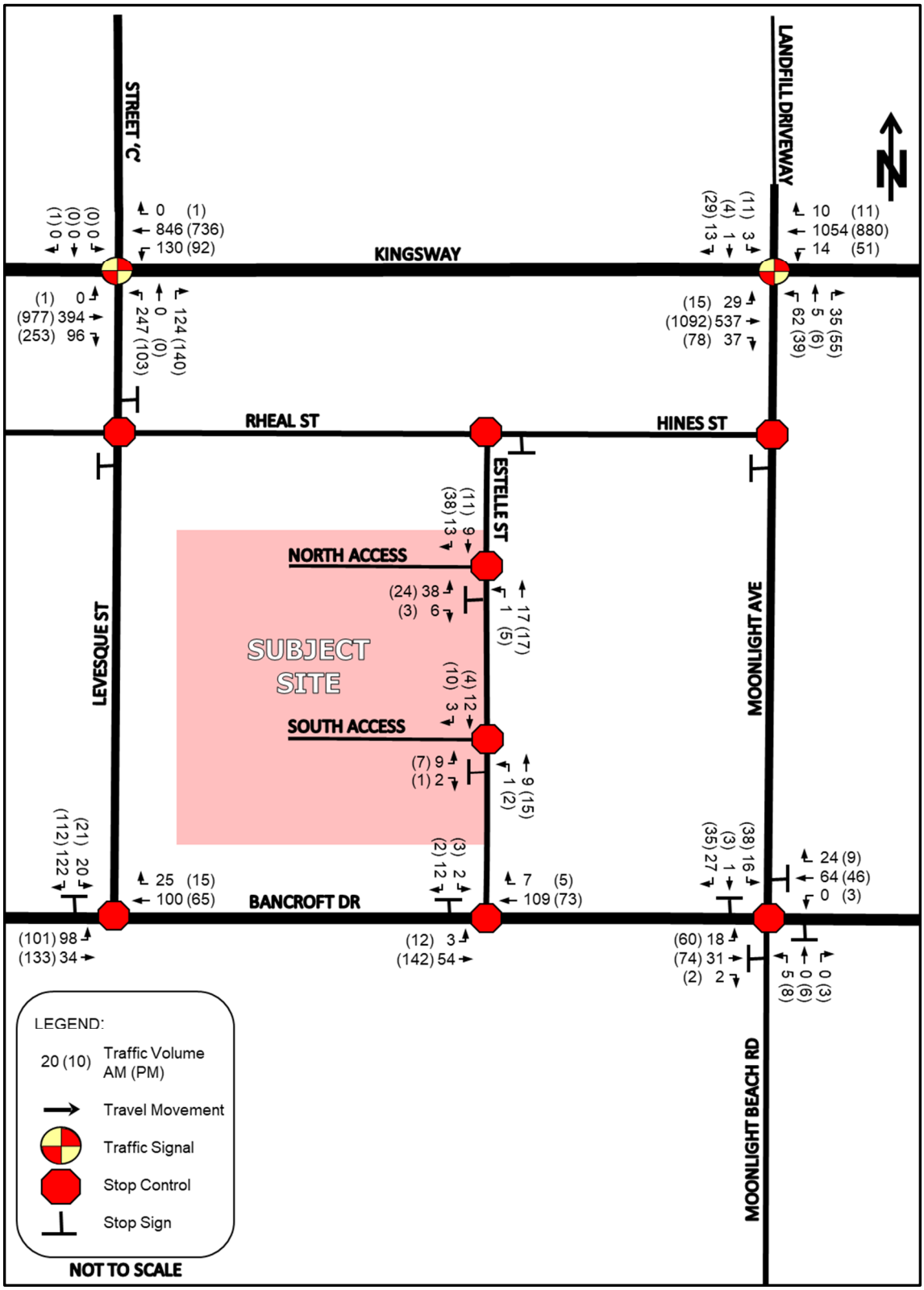
Figure 1 – Background (2029) Traffic Volumes - Without KED and Future Business Park



For the total (2029) horizon year traffic volumes, the proposed development traffic was added to the background (2029) traffic volumes. The resulting total (2029) horizon year traffic volume for the AM and PM peak hour are illustrated in **Figure 2**.

JD Engineering
Phone: 705.725.4035
Email:Info@JDEngineering.ca

Figure 2 – Total (2029) Traffic Volumes - Without KED and Future Business Park



The results of the LOS analysis under total (2029) traffic volumes (without the KED and future business park development) during the AM and PM peak hours can be found below in **Table 1**. The existing intersection geometry and traffic control has been utilized in this scenario. The Moonlight Avenue / Kingsway intersection has been modeled with fully protected phasing for the eastbound and westbound left turn, per the City comment. Detailed output of the Synchro analysis can be found in the **Appendix**.

Table 1 – Total (2029) LOS - Without KED and Future Business Park Development

Location (N-S Street / E-W Street)	Weekday AM Peak Hour					Weekday PM Peak Hour				
	V/C	Delay (s)	LOS	95% Queue (m)		V/C	Delay (s)	LOS	95% Queue (m)	
				Model	Storage				Model	Storage
Levesque Street / Kingsway (signalized)	0.56	21.3	C	-	-	0.48	12.1	B	-	-
EBL	0.00	0.0	A	0	59	0.00	7.3	A	1	59
EBT	0.24	13.5	B	39	-	0.47	11.1	B	88	-
EBR	0.07	12.1	B	9	94	0.17	8.5	A	11	94
WBL	0.22	7.3	A	18	30	0.25	5.4	A	11	30
WBT	0.42	9.6	A	65	-	0.31	5.2	A	43	-
WBR	0.00	0.0	A	0	-	0.00	3.8	A	0	-
NBL	0.92	77.0	E	114	13	0.60	48.4	D	41	13
NBTR	0.09	36.7	D	0	-	0.10	40.3	D	0	-
SB	0.00	0.0	A	0	-	0.00	39.6	D	0	-
Moonlight Avenue / Kingsway (signalized)	0.54	12.1	B	-	-	0.51	11.7	B	-	-
EBL	0.49	52.0	D	17	40	0.33	51.6	D	11	40
EBT	0.27	6.2	A	42	-	0.52	9.8	A	101	-
EBR	0.03	5.0	A	1	22	0.06	6.1	A	7	22
WBL	0.33	52.2	D	10	42	0.45	47.0	D	24	42
WBT	0.54	9.8	A	105	-	0.40	6.7	A	68	-
WBR	0.01	5.8	A	0	51	0.01	4.5	A	0	51
NBL	0.59	51.9	D	28	20	0.43	47.2	D	20	20
NBTR	0.07	42.6	D	11	-	0.09	43.6	D	15	-
SBL	0.04	42.6	D	4	14	0.14	44.2	D	9	14
SBTR	0.02	42.4	D	6	-	0.06	43.3	D	11	-
Levesque Street / Bancroft Drive (unsignalized)	-	5.6	A	-	-	-	5.0	A	-	-
SB	0.19	10.2	B	6	-	0.20	10.4	B	6	-
Moonlight Avenue & Moonlight Beach Road / Bancroft Drive (unsignalized)	-	7.5	A	-	-	-	8.0	A	-	-
EB	0.07	7.6	A	0	-	0.19	8.3	A	1	-
WB	0.11	7.5	A	2	-	0.08	7.6	A	6	-
NB	0.01	7.5	A	4	-	0.02	7.6	A	3	-
SB	0.06	7.5	A	2	-	0.11	7.8	A	5	-

Estelle Street / Bancroft Drive (unsignalized)	-	0.8	A	-	-	-	0.6	A	-	-
SB	0.02	9.1	A	1	-	0.01	9.5	A	1	-
Estelle Street / North Access (unsignalized)	-	2.8	A	-	-	-	2.8	A	-	-
EB	0.01	8.6	A	1	-	0.03	8.9	A	1	-

The results of the analysis indicate that the northbound left turn movement at the Levesque Street / Kingsway intersection is operating outside the typical design limits noted in Section 3.1 (in the TIS) in the AM peak hour. It is recommended the signal timing splits be adjusted at the intersection to optimize the use of the existing infrastructure.

A summary of the results of the Synchro analysis with the above-noted improvements, during the AM peak hour, can be found below in **Table 2**; no adjustments were made to the signal time phasing in the PM peak hour as the intersection operates within typical design limits during this period. Detailed output of the Synchro analysis can be found in Appendix.

Table 2 – Total (2029) LOS - Without KED and Future Business Park Development with Improvements

Location (N-S Street / E-W Street)	Weekday AM Peak Hour					Weekday PM Peak Hour				
	V/C	Delay (s)	LOS	95% Queue (m)		V/C	Delay (s)	LOS	95% Queue (m)	
				Model	Storage				Model	Storage
Levesque Street / Kingsway (signalized)	0.58	17.7	B	-	-	-	-	-	-	-
EBL	0.00	0.0	A	0	59	-	-	-	-	59
EBT	0.25	13.1	B	38	-	-	-	-	-	-
EBR	0.07	11.7	B	9	94	-	-	-	-	94
WBL	0.25	8.2	A	21	30	-	-	-	-	30
WBT	0.45	10.7	B	73	-	-	-	-	-	-
WBR	0.00	0.0	A	0	-	-	-	-	-	-
NBL	0.82	50.6	D	83	13	-	-	-	-	13
NBTR	0.09	29.4	C	0	-	-	-	-	-	-
SB	0.00	0.0	A	0	-	-	-	-	-	-

The results of the LOS analysis indicate that all intersections are operating within the typical design limits noted in Section 3.1.

The anticipated queue for the northbound left turn movements at the Street 'C' & Levesque Street / Kingsway and Levesque Street / Kingsway intersections extend past the proposed storage length; furthermore, the northbound queue will extend past existing commercial driveways along Levesque Street. Based on our review of the SimTraffic model, this queue is experienced for a short period of time and will clear at the end of each respective phase and not impact queuing for the adjacent lanes.

JD Engineering
Phone: 705.725.4035
Email:Info@JDEngineering.ca

The anticipated queue for the eastbound through and westbound through movements extend past the storage and taper length for the auxiliary lanes at the Street 'C' & Levesque Street / Kingsway and Moonlight Avenue / Kingsway intersections; however, the queue will not extend past major intersections and based on our review of the SimTraffic model, these queues are experienced for a short period of time and will clear at the end of the eastbound and westbound through phase.

There are no issues regarding the anticipated queuing for all other movements at the study area intersections.

An analysis was completed for left turn movements at the unsignalized intersections in the study area, based on the criteria outlined in Appendix 9A of the MTO DS. Based on the above noted criteria a left-turn lane is not warranted at the unsignalized intersections in the study area (results are provided in **Appendix**).

Based on the above noted criteria, a left-turn lane is not warranted for all other movements at unsignalized intersections in the study area.

A review of the need for additional auxiliary right turn lanes was completed as part of our analysis. The results of the Synchro analysis indicate that there is excess capacity for all right turn movements; consequently, additional right turn lane improvements are not recommended.

Based on the Ontario Traffic Manual Book 12 Signal Justification, traffic signals are not warranted at the unsignalized intersections in the study area (results are provided in **Appendix**).

No further improvements are recommended for the total (2029) scenario without the KED and future business park development.

3.0 MOONLIGHT AVENUE / KINGSWAY – REVISED ANALYSIS TOTAL (2029) TRAFFIC VOLUMES

The analysis of the Moonlight Avenue / Kingsway intersection has been reviewed with fully protected phasing for eastbound and westbound left turn phasing in the critical total (2029) scenario with the KED and future business park development (illustrated in the TIS).

The results of the LOS analysis under total (2029) traffic volumes during the AM and PM peak hours can be found below in **Table 3**. The existing intersection geometry and traffic control at the Moonlight Avenue / Kingsway intersection has been utilized in this scenario. Detailed output of the Synchro analysis can be found in the **Appendix**.

Table 3 – Total (2029) LOS

Location (N-S Street / E-W Street)	Weekday AM Peak Hour					Weekday PM Peak Hour				
	V/C	Delay (s)	LOS	95% Queue (m)		V/C	Delay (s)	LOS	95% Queue (m)	
				Model	Storage				Model	Storage
Moonlight Avenue / Kingsway (signalized)	0.73	14.3	B	-	-	0.68	13.3	B	-	-
EBL	0.49	52.0	D	17	40	0.33	51.6	D	11	40
EBT	0.34	6.7	A	54	-	0.73	13.4	B	177	-
EBR	0.03	5.0	A	1	22	0.06	6.1	A	7	22
WBL	0.33	52.2	D	10	42	0.45	47.0	D	24	42
WBT	0.77	14.2	B	191	-	0.49	7.5	A	89	-
WBR	0.01	5.8	A	0	51	0.01	4.5	A	0	51
NBL	0.59	51.9	D	28	20	0.43	47.2	D	20	20
NBTR	0.07	42.6	D	11	-	0.09	43.6	D	15	-
SBL	0.04	42.6	D	4	14	0.14	44.2	D	9	14
SBTR	0.02	42.4	D	6	-	0.06	43.3	D	11	-

The results of the analysis indicate that the Moonlight Avenue / Kingsway intersection is operating within the typical design limits noted in Section 3.1 in the TIS.

The anticipated queue for the eastbound through and westbound through movements extend past the storage and taper length for the auxiliary lanes at the Moonlight Avenue / Kingsway intersection; however, the queue will not extend past major intersections and based on our review of the SimTraffic model, these queues are experienced for a short period of time and will clear at the end of the eastbound and westbound through phase.

The anticipated queue for the northbound left turn at the Moonlight Avenue / Kingsway intersection will extend past the existing storage length; however, the queuing does not extend beyond the existing left turn taper and no operational issues are anticipated.

There are no issues regarding the anticipated queuing for all other movements at the study area intersections.

No improvements are recommended for the total (2029) scenario.

4.0 CONCLUSION

This chapter summarizes the conclusions and recommendations from the study.

1) The traffic analysis for the total (2029) traffic volumes without the KED and future business park development was completed. Based on our review, signal timing improvements are recommended at the Levesque Street / Kingsway intersection in the AM peak hour for this development scenario. All intersections in the study area will operate efficiently with the existing infrastructure.
2) The traffic analysis at the Moonlight Avenue / Kingsway intersection with protected phasing for eastbound and westbound left turn movements was reviewed during critical the total (2029) scenario. Based on our review no improvements are recommended at this intersection.

We trust you will find this submission acceptable. Should you have any questions or concerns or require any additional information in this regard, please contact our office.

Yours truly,
JD Northcote Engineering Inc.

John Northcote, P.Eng.
President

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. JD Engineering accept no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this project.

JD Engineering
Phone: 705.725.4035
Email:Info@JDEngineering.ca

Appendix

City Response Email

From: David Knutson <David.Knutson@greatersudbury.ca>
Sent: April 28, 2021 11:11 AM
To: Mauro Manzon
Cc: Kim Battisti
Subject: 95 Estelle Street Re-zoning - TIS Review

Mauro,

We have reviewed the TIS which was submitted as part of the re-zoning application and can provide the following comments which are listed below:

-We note that the study assumes that improvements will be made to the road network as part of the KED development. The timing of the KED development is unclear at this time. Please indicate what the phasing of this development will be and what improvements, if any, are required should the KED development not be finalized till after any phase of this development.

-The WBL and EBL turning lanes at Kingsway and Moonlight Avenue operate as fully protected left turn lanes. The Synchro analysis list them as protected/permissive.

We will require these to be addressed prior to providing our final comments on the re-zoning application.

Best,

David Knutson, C.E.T.
Traffic and Transportation Engineering Analyst
Transportation and Innovation Services

P: (705) 674-4455 x3634
F: (705) 560-6109
www.greatersudbury.ca

Synchro Analysis Output – Total (2029) Traffic Volumes

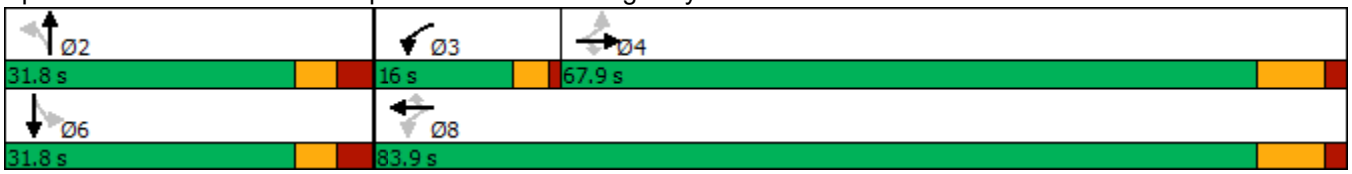
JD Engineering
Phone: 705.725.4035
Email:Info@JDEngineering.ca

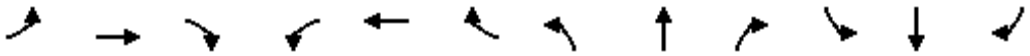
Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	Ø6
Lane Configurations							
Traffic Volume (vph)	394	96	130	846	247	0	
Future Volume (vph)	394	96	130	846	247	0	
Lane Group Flow (vph)	438	107	144	940	274	138	
Turn Type	NA	Perm	pm+pt	NA	Perm	NA	
Protected Phases	4		3	8		2	6
Permitted Phases		4	8		2		
Detector Phase	4	4	3	8	2	2	
Switch Phase							
Minimum Initial (s)	30.0	30.0	5.0	30.0	8.0	8.0	8.0
Minimum Split (s)	37.9	37.9	9.0	37.9	27.8	27.8	27.8
Total Split (s)	67.9	67.9	16.0	83.9	31.8	31.8	31.8
Total Split (%)	58.7%	58.7%	13.8%	72.5%	27.5%	27.5%	27%
Yellow Time (s)	5.9	5.9	3.0	5.9	3.6	3.6	3.6
All-Red Time (s)	2.0	2.0	1.0	2.0	3.2	3.2	3.2
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	7.9	7.9	4.0	7.9	6.8	6.8	
Lead/Lag	Lag	Lag	Lead				
Lead-Lag Optimize?	Yes	Yes	Yes				
Recall Mode	Max	Max	None	Max	None	None	None
v/c Ratio	0.24	0.11	0.21	0.42	0.92	0.19	
Control Delay	14.0	2.8	6.7	9.9	80.9	0.6	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	14.0	2.8	6.7	9.9	80.9	0.6	
Queue Length 50th (m)	27.3	0.0	10.4	51.4	63.9	0.0	
Queue Length 95th (m)	38.7	8.5	17.4	64.2	#113.8	0.0	
Internal Link Dist (m)	516.5			440.7		737.0	
Turn Bay Length (m)		94.0	30.0		13.0		
Base Capacity (vph)	1831	940	714	2236	310	719	
Starvation Cap Reductn	0	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	0	
Reduced v/c Ratio	0.24	0.11	0.20	0.42	0.88	0.19	

Intersection Summary

Cycle Length: 115.7
Actuated Cycle Length: 114.7
Natural Cycle: 75
Control Type: Semi Act-Uncoord
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Levesque St/Street 'C' & Kingsway





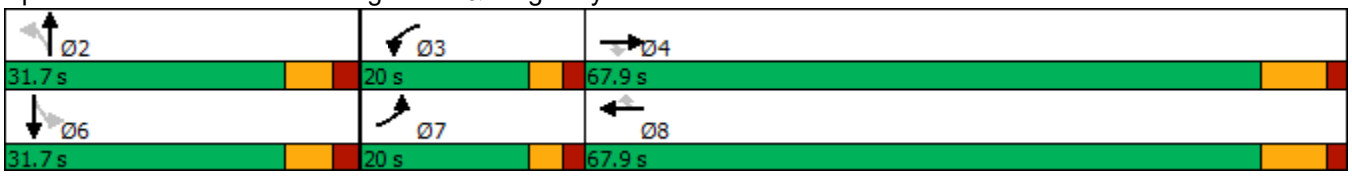
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	394	96	130	846	0	247	0	124	0	0	0
Future Volume (vph)	0	394	96	130	846	0	247	0	124	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.9	7.9	4.0	7.9		6.8	6.8				
Lane Util. Factor		0.95	1.00	1.00	0.95		1.00	1.00				
Frt		1.00	0.85	1.00	1.00		1.00	0.85				
Flt Protected		1.00	1.00	0.95	1.00		0.95	1.00				
Satd. Flow (prot)		3312	1615	1805	3374		1787	1553				
Flt Permitted		1.00	1.00	0.47	1.00		0.76	1.00				
Satd. Flow (perm)		3312	1615	890	3374		1424	1553				
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	438	107	144	940	0	274	0	138	0	0	0
RTOR Reduction (vph)	0	0	48	0	0	0	0	109	0	0	0	0
Lane Group Flow (vph)	0	438	59	144	940	0	274	29	0	0	0	0
Heavy Vehicles (%)	5%	9%	0%	0%	7%	1%	1%	0%	4%	0%	0%	0%
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA				
Protected Phases		4		3	8			2			6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)		63.4	63.4	76.0	76.0		24.0	24.0				
Effective Green, g (s)		63.4	63.4	76.0	76.0		24.0	24.0				
Actuated g/C Ratio		0.55	0.55	0.66	0.66		0.21	0.21				
Clearance Time (s)		7.9	7.9	4.0	7.9		6.8	6.8				
Vehicle Extension (s)		3.0	3.0	3.0	3.0		3.0	3.0				
Lane Grp Cap (vph)		1830	892	658	2235		297	324				
v/s Ratio Prot		0.13		0.02	c0.28			0.02				
v/s Ratio Perm			0.04	0.13			c0.19					
v/c Ratio		0.24	0.07	0.22	0.42		0.92	0.09				
Uniform Delay, d1		13.2	11.9	7.2	9.1		44.4	36.5				
Progression Factor		1.00	1.00	1.00	1.00		1.00	1.00				
Incremental Delay, d2		0.3	0.1	0.2	0.6		32.6	0.1				
Delay (s)		13.5	12.1	7.3	9.6		77.0	36.7				
Level of Service		B	B	A	A		E	D				
Approach Delay (s)		13.2			9.3			63.5			0.0	
Approach LOS		B			A			E			A	

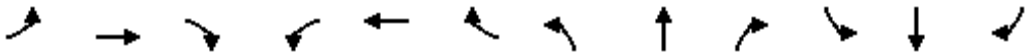
Intersection Summary			
HCM 2000 Control Delay	21.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	114.7	Sum of lost time (s)	18.7
Intersection Capacity Utilization	82.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations										
Traffic Volume (vph)	29	537	37	14	1054	10	62	5	3	1
Future Volume (vph)	29	537	37	14	1054	10	62	5	3	1
Lane Group Flow (vph)	34	624	43	16	1226	12	72	47	3	16
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA	Perm	NA
Protected Phases	7	4		3	8			2		6
Permitted Phases			4			8	2		6	
Detector Phase	7	4	4	3	8	8	2	2	6	6
Switch Phase										
Minimum Initial (s)	5.0	30.0	30.0	5.0	30.0	30.0	8.0	8.0	8.0	8.0
Minimum Split (s)	10.0	37.9	37.9	10.0	37.9	37.9	30.7	30.7	30.7	30.7
Total Split (s)	20.0	67.9	67.9	20.0	67.9	67.9	31.7	31.7	31.7	31.7
Total Split (%)	16.7%	56.8%	56.8%	16.7%	56.8%	56.8%	26.5%	26.5%	26.5%	26.5%
Yellow Time (s)	3.0	5.9	5.9	3.0	5.9	5.9	4.1	4.1	4.1	4.1
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.6	2.6	2.6	2.6
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	7.9	7.9	5.0	7.9	7.9	6.7	6.7	6.7	6.7
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag				
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes				
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None
v/c Ratio	0.32	0.25	0.04	0.13	0.51	0.01	0.46	0.21	0.03	0.11
Control Delay	51.5	6.8	0.6	47.6	11.2	0.0	51.9	17.4	40.3	21.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	51.5	6.8	0.6	47.6	11.2	0.0	51.9	17.4	40.3	21.0
Queue Length 50th (m)	6.5	17.1	0.0	3.1	71.3	0.0	13.8	1.1	0.6	0.2
Queue Length 95th (m)	16.2	41.2	1.0	9.7	104.1	0.0	27.6	11.0	3.3	6.0
Internal Link Dist (m)		440.7			446.3			949.6		204.9
Turn Bay Length (m)	40.0		22.0	42.0		51.0	20.0		14.0	
Base Capacity (vph)	199	2460	972	281	2423	972	361	459	214	322
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.25	0.04	0.06	0.51	0.01	0.20	0.10	0.01	0.05

Intersection Summary
Cycle Length: 119.6
Actuated Cycle Length: 96.8
Natural Cycle: 80
Control Type: Semi Act-Uncoord

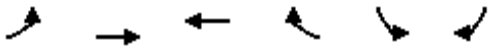
Splits and Phases: 2: Moonlight Ave & Kingsway





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	29	537	37	14	1054	10	62	5	35	3	1	13
Future Volume (vph)	29	537	37	14	1054	10	62	5	35	3	1	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	7.9	7.9	5.0	7.9	7.9	6.7	6.7		6.7	6.7	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.87		1.00	0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1280	3312	1282	1805	3438	1346	1770	1651		1081	1196	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.75	1.00		0.73	1.00	
Satd. Flow (perm)	1280	3312	1282	1805	3438	1346	1392	1651		826	1196	
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	34	624	43	16	1226	12	72	6	41	3	1	15
RTOR Reduction (vph)	0	0	13	0	0	4	0	37	0	0	14	0
Lane Group Flow (vph)	34	624	30	16	1226	8	72	10	0	3	2	0
Heavy Vehicles (%)	41%	9%	26%	0%	5%	20%	2%	0%	0%	67%	0%	39%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases			4			8	2			6		
Actuated Green, G (s)	5.5	70.1	70.1	2.8	67.4	67.4	8.9	8.9		8.9	8.9	
Effective Green, g (s)	5.5	70.1	70.1	2.8	67.4	67.4	8.9	8.9		8.9	8.9	
Actuated g/C Ratio	0.05	0.69	0.69	0.03	0.66	0.66	0.09	0.09		0.09	0.09	
Clearance Time (s)	5.0	7.9	7.9	5.0	7.9	7.9	6.7	6.7		6.7	6.7	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	69	2289	886	49	2285	894	122	144		72	104	
v/s Ratio Prot	c0.03	c0.19		0.01	c0.36			0.01			0.00	
v/s Ratio Perm			0.02			0.01	c0.05			0.00		
v/c Ratio	0.49	0.27	0.03	0.33	0.54	0.01	0.59	0.07		0.04	0.02	
Uniform Delay, d1	46.6	6.0	4.9	48.4	8.9	5.7	44.5	42.4		42.3	42.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	5.4	0.3	0.1	3.9	0.9	0.0	7.4	0.2		0.2	0.1	
Delay (s)	52.0	6.2	5.0	52.2	9.8	5.8	51.9	42.6		42.6	42.4	
Level of Service	D	A	A	D	A	A	D	D		D	D	
Approach Delay (s)		8.4			10.3			48.3			42.4	
Approach LOS		A			B			D			D	

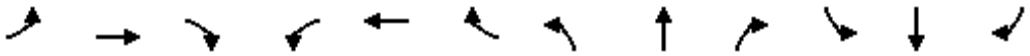
Intersection Summary			
HCM 2000 Control Delay	12.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	101.4	Sum of lost time (s)	19.6
Intersection Capacity Utilization	52.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	98	34	100	25	20	122
Future Volume (Veh/h)	98	34	100	25	20	122
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	109	38	111	28	22	136
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	139				381	125
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	139				381	125
tC, single (s)	4.2				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.3				3.5	3.3
p0 queue free %	92				96	85
cM capacity (veh/h)	1420				577	920

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	147	139	158
Volume Left	109	0	22
Volume Right	0	28	136
cSH	1420	1700	850
Volume to Capacity	0.08	0.08	0.19
Queue Length 95th (m)	2.0	0.0	5.4
Control Delay (s)	5.9	0.0	10.2
Lane LOS	A		B
Approach Delay (s)	5.9	0.0	10.2
Approach LOS			B

Intersection Summary			
Average Delay	5.6		
Intersection Capacity Utilization	32.6%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	18	31	2	0	64	24	5	0	0	16	1	27
Future Volume (vph)	18	31	2	0	64	24	5	0	0	16	1	27
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	21	36	2	0	74	28	6	0	0	18	1	31

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	59	102	6	50
Volume Left (vph)	21	0	6	18
Volume Right (vph)	2	28	0	31
Hadj (s)	0.17	-0.09	0.20	-0.03
Departure Headway (s)	4.3	4.0	4.5	4.2
Degree Utilization, x	0.07	0.11	0.01	0.06
Capacity (veh/h)	819	883	760	818
Control Delay (s)	7.6	7.5	7.5	7.5
Approach Delay (s)	7.6	7.5	7.5	7.5
Approach LOS	A	A	A	A

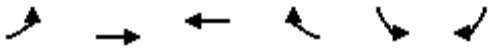
Intersection Summary				
Delay	7.5			
Level of Service	A			
Intersection Capacity Utilization	19.4%	ICU Level of Service	A	
Analysis Period (min)	15			

Intersection	
Intersection Delay, s/veh	7.6
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	18	31	2	0	64	24	5	0	0	16	1	27
Future Vol, veh/h	18	31	2	0	64	24	5	0	0	16	1	27
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Heavy Vehicles, %	13	4	0	0	6	0	0	0	0	15	0	17
Mvmt Flow	21	36	2	0	74	28	6	0	0	18	1	31
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	7.7	7.5	7.5	7.5
HCM LOS	A	A	A	A

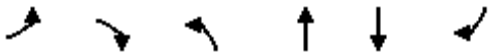
Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	100%	35%	0%	36%
Vol Thru, %	0%	61%	73%	2%
Vol Right, %	0%	4%	27%	61%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	5	51	88	44
LT Vol	5	18	0	16
Through Vol	0	31	64	1
RT Vol	0	2	24	27
Lane Flow Rate	6	59	101	51
Geometry Grp	1	1	1	1
Degree of Util (X)	0.007	0.071	0.112	0.058
Departure Headway (Hd)	4.416	4.343	3.981	4.139
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	799	821	895	854
Service Time	2.507	2.392	2.027	2.219
HCM Lane V/C Ratio	0.008	0.072	0.113	0.06
HCM Control Delay	7.5	7.7	7.5	7.5
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0	0.2	0.4	0.2



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	3	54	109	7	2	12
Future Volume (Veh/h)	3	54	109	7	2	12
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	3	58	117	8	2	13
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	125				185	121
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	125				185	121
tC, single (s)	4.1				6.9	6.2
tC, 2 stage (s)						
tF (s)	2.2				4.0	3.3
p0 queue free %	100				100	99
cM capacity (veh/h)	1474				705	936

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	61	125	15
Volume Left	3	0	2
Volume Right	0	8	13
cSH	1474	1700	897
Volume to Capacity	0.00	0.07	0.02
Queue Length 95th (m)	0.0	0.0	0.4
Control Delay (s)	0.4	0.0	9.1
Lane LOS	A		A
Approach Delay (s)	0.4	0.0	9.1
Approach LOS			A

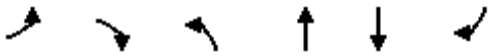
Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	16.2%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	9	2	1	9	12	3
Future Volume (Veh/h)	9	2	1	9	12	3
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)	10	2	1	10	13	3
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	26	14	16			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	26	14	16			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	100	100			
cM capacity (veh/h)	993	1071	1615			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	12	11	16
Volume Left	10	1	0
Volume Right	2	0	3
cSH	1005	1615	1700
Volume to Capacity	0.01	0.00	0.01
Queue Length 95th (m)	0.3	0.0	0.0
Control Delay (s)	8.6	0.7	0.0
Lane LOS	A	A	
Approach Delay (s)	8.6	0.7	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	38	6	1	17	9	13
Future Volume (Veh/h)	38	6	1	17	9	13
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)	41	7	1	18	10	14
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	37	17	24			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	37	17	24			
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	99	100			
cM capacity (veh/h)	980	1068	1604			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	48	19	24
Volume Left	41	1	0
Volume Right	7	0	14
cSH	992	1604	1700
Volume to Capacity	0.05	0.00	0.01
Queue Length 95th (m)	1.2	0.0	0.0
Control Delay (s)	8.8	0.4	0.0
Lane LOS	A	A	
Approach Delay (s)	8.8	0.4	0.0
Approach LOS	A		

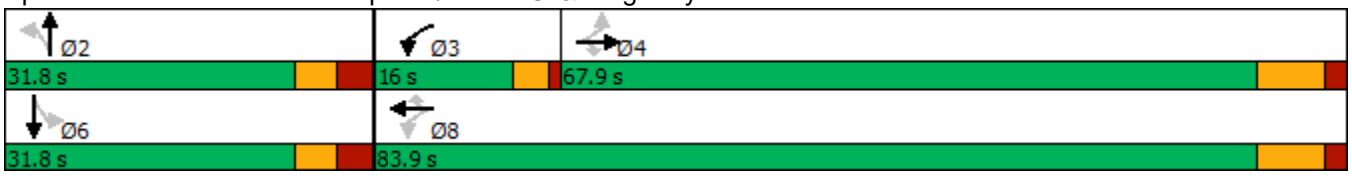
Intersection Summary			
Average Delay	4.7		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		

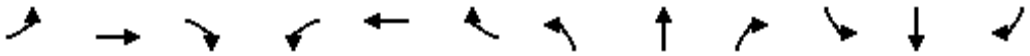
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBT
Lane Configurations									
Traffic Volume (vph)	1	977	253	92	736	1	103	0	0
Future Volume (vph)	1	977	253	92	736	1	103	0	0
Lane Group Flow (vph)	1	1039	269	98	783	1	110	149	1
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	NA
Protected Phases		4		3	8			2	6
Permitted Phases	4		4	8		8	2		
Detector Phase	4	4	4	3	8	8	2	2	6
Switch Phase									
Minimum Initial (s)	30.0	30.0	30.0	5.0	30.0	30.0	8.0	8.0	8.0
Minimum Split (s)	37.9	37.9	37.9	9.0	37.9	37.9	27.8	27.8	27.8
Total Split (s)	67.9	67.9	67.9	16.0	83.9	83.9	31.8	31.8	31.8
Total Split (%)	58.7%	58.7%	58.7%	13.8%	72.5%	72.5%	27.5%	27.5%	27.5%
Yellow Time (s)	5.9	5.9	5.9	3.0	5.9	5.9	3.6	3.6	3.6
All-Red Time (s)	2.0	2.0	2.0	1.0	2.0	2.0	3.2	3.2	3.2
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.9	7.9	7.9	4.0	7.9	7.9	6.8	6.8	6.8
Lead/Lag	Lag	Lag	Lag	Lead					
Lead-Lag Optimize?	Yes	Yes	Yes	Yes					
Recall Mode	Max	Max	Max	None	Max	Max	None	None	None
v/c Ratio	0.00	0.47	0.25	0.24	0.31	0.00	0.60	0.36	0.00
Control Delay	9.0	11.8	1.8	5.0	5.6	0.0	56.7	2.4	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.0	11.8	1.8	5.0	5.6	0.0	56.7	2.4	0.0
Queue Length 50th (m)	0.1	56.4	0.0	4.2	26.0	0.0	22.4	0.0	0.0
Queue Length 95th (m)	0.8	87.1	10.9	10.2	42.3	0.0	40.7	0.0	0.0
Internal Link Dist (m)		516.5			440.7			737.0	303.0
Turn Bay Length (m)	59.0		94.0	30.0		1.0	13.0		
Base Capacity (vph)	421	2213	1090	466	2513	1190	346	563	570
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.00	0.47	0.25	0.21	0.31	0.00	0.32	0.26	0.00

Intersection Summary

Cycle Length: 115.7
Actuated Cycle Length: 104.1
Natural Cycle: 75
Control Type: Semi Act-Uncoord

Splits and Phases: 1: Levesque St/Street 'C' & Kingsway





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	977	253	92	736	1	103	0	140	0	0	1
Future Volume (vph)	1	977	253	92	736	1	103	0	140	0	0	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.9	7.9	7.9	4.0	7.9	7.9	6.8	6.8			6.8	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85			0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00			1.00	
Satd. Flow (prot)	1805	3539	1583	1736	3438	1615	1805	1568			1644	
Flt Permitted	0.36	1.00	1.00	0.22	1.00	1.00	0.76	1.00			1.00	
Satd. Flow (perm)	675	3539	1583	408	3438	1615	1439	1568			1644	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	1	1039	269	98	783	1	110	0	149	0	0	1
RTOR Reduction (vph)	0	0	101	0	0	0	0	130	0	0	1	0
Lane Group Flow (vph)	1	1039	168	98	783	1	110	19	0	0	0	0
Heavy Vehicles (%)	0%	2%	2%	4%	5%	0%	0%	0%	3%	0%	0%	0%
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA			NA	
Protected Phases		4		3	8			2			6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	65.1	65.1	65.1	76.1	76.1	76.1	13.3	13.3			13.3	
Effective Green, g (s)	65.1	65.1	65.1	76.1	76.1	76.1	13.3	13.3			13.3	
Actuated g/C Ratio	0.63	0.63	0.63	0.73	0.73	0.73	0.13	0.13			0.13	
Clearance Time (s)	7.9	7.9	7.9	4.0	7.9	7.9	6.8	6.8			6.8	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)	422	2213	989	387	2513	1180	183	200			210	
v/s Ratio Prot		c0.29		0.02	c0.23			0.01			0.00	
v/s Ratio Perm	0.00		0.11	0.17		0.00	c0.08					
v/c Ratio	0.00	0.47	0.17	0.25	0.31	0.00	0.60	0.10			0.00	
Uniform Delay, d1	7.3	10.3	8.2	5.0	4.9	3.8	42.9	40.1			39.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	
Incremental Delay, d2	0.0	0.7	0.4	0.3	0.3	0.0	5.5	0.2			0.0	
Delay (s)	7.3	11.1	8.5	5.4	5.2	3.8	48.4	40.3			39.6	
Level of Service	A	B	A	A	A	A	D	D			D	
Approach Delay (s)		10.5			5.2			43.7			39.6	
Approach LOS		B			A			D			D	

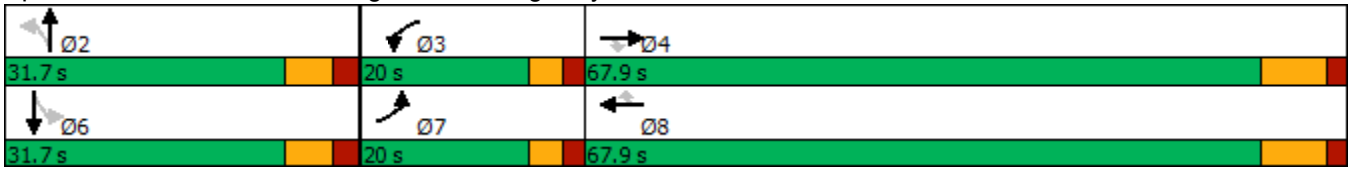
Intersection Summary			
HCM 2000 Control Delay	12.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	104.1	Sum of lost time (s)	18.7
Intersection Capacity Utilization	81.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations										
Traffic Volume (vph)	15	1092	78	51	880	11	39	6	11	4
Future Volume (vph)	15	1092	78	51	880	11	39	6	11	4
Lane Group Flow (vph)	16	1200	86	56	967	12	43	67	12	36
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA	Perm	NA
Protected Phases	7	4		3	8			2		6
Permitted Phases			4			8	2		6	
Detector Phase	7	4	4	3	8	8	2	2	6	6
Switch Phase										
Minimum Initial (s)	5.0	30.0	30.0	5.0	30.0	30.0	8.0	8.0	8.0	8.0
Minimum Split (s)	10.0	37.9	37.9	10.0	37.9	37.9	30.7	30.7	30.7	30.7
Total Split (s)	20.0	67.9	67.9	20.0	67.9	67.9	31.7	31.7	31.7	31.7
Total Split (%)	16.7%	56.8%	56.8%	16.7%	56.8%	56.8%	26.5%	26.5%	26.5%	26.5%
Yellow Time (s)	3.0	5.9	5.9	3.0	5.9	5.9	4.1	4.1	4.1	4.1
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.6	2.6	2.6	2.6
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	7.9	7.9	5.0	7.9	7.9	6.7	6.7	6.7	6.7
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag				
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes				
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None
v/c Ratio	0.14	0.50	0.08	0.36	0.37	0.01	0.32	0.32	0.11	0.21
Control Delay	46.5	11.1	2.7	48.9	6.9	0.0	48.6	17.7	43.4	19.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.5	11.1	2.7	48.9	6.9	0.0	48.6	17.7	43.4	19.4
Queue Length 50th (m)	3.0	65.3	0.5	10.5	26.6	0.0	8.1	1.3	2.2	0.8
Queue Length 95th (m)	10.2	100.3	6.9	23.6	67.1	0.0	19.6	14.1	8.1	10.4
Internal Link Dist (m)		440.7			446.3			949.6		204.9
Turn Bay Length (m)	40.0		22.0	42.0		51.0	20.0		14.0	
Base Capacity (vph)	266	2388	1114	274	2594	1238	367	477	302	422
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.06	0.50	0.08	0.20	0.37	0.01	0.12	0.14	0.04	0.09

Intersection Summary

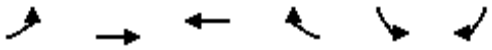
Cycle Length: 119.6
Actuated Cycle Length: 95.3
Natural Cycle: 80
Control Type: Semi Act-Uncoord

Splits and Phases: 2: Moonlight Ave & Kingsway



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	1092	78	51	880	11	39	6	55	11	4	29
Future Volume (vph)	15	1092	78	51	880	11	39	6	55	11	4	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	7.9	7.9	5.0	7.9	7.9	6.7	6.7		6.7	6.7	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.87		1.00	0.87	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1687	3471	1583	1736	3438	1615	1805	1645		1530	1512	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.73	1.00		0.71	1.00	
Satd. Flow (perm)	1687	3471	1583	1736	3438	1615	1394	1645		1149	1512	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	16	1200	86	56	967	12	43	7	60	12	4	32
RTOR Reduction (vph)	0	0	27	0	0	4	0	56	0	0	30	0
Lane Group Flow (vph)	16	1200	59	56	967	8	43	11	0	12	6	0
Heavy Vehicles (%)	7%	4%	2%	4%	5%	0%	0%	0%	0%	18%	0%	10%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases			4			8	2			6		
Actuated Green, G (s)	2.9	65.8	65.8	7.2	70.1	70.1	7.3	7.3		7.3	7.3	
Effective Green, g (s)	2.9	65.8	65.8	7.2	70.1	70.1	7.3	7.3		7.3	7.3	
Actuated g/C Ratio	0.03	0.66	0.66	0.07	0.70	0.70	0.07	0.07		0.07	0.07	
Clearance Time (s)	5.0	7.9	7.9	5.0	7.9	7.9	6.7	6.7		6.7	6.7	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	48	2286	1042	125	2412	1133	101	120		83	110	
v/s Ratio Prot	0.01	c0.35		c0.03	c0.28			0.01			0.00	
v/s Ratio Perm			0.04			0.01	c0.03			0.01		
v/c Ratio	0.33	0.52	0.06	0.45	0.40	0.01	0.43	0.09		0.14	0.06	
Uniform Delay, d1	47.6	8.9	6.0	44.4	6.2	4.5	44.3	43.2		43.4	43.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.1	0.9	0.1	2.5	0.5	0.0	2.9	0.3		0.8	0.2	
Delay (s)	51.6	9.8	6.1	47.0	6.7	4.5	47.2	43.6		44.2	43.3	
Level of Service	D	A	A	D	A	A	D	D		D	D	
Approach Delay (s)		10.0			8.8			45.0			43.5	
Approach LOS		B			A			D			D	

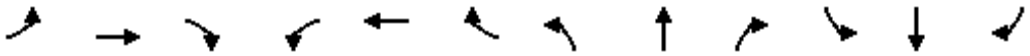
Intersection Summary			
HCM 2000 Control Delay	11.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	99.9	Sum of lost time (s)	19.6
Intersection Capacity Utilization	59.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	101	133	65	15	21	112
Future Volume (Veh/h)	101	133	65	15	21	112
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Hourly flow rate (vph)	126	166	81	19	26	140
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	100				508	90
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	100				508	90
tC, single (s)	4.1				6.5	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.6	3.3
p0 queue free %	92				94	86
cM capacity (veh/h)	1505				471	970

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	292	100	166
Volume Left	126	0	26
Volume Right	0	19	140
cSH	1505	1700	832
Volume to Capacity	0.08	0.06	0.20
Queue Length 95th (m)	2.2	0.0	5.9
Control Delay (s)	3.7	0.0	10.4
Lane LOS	A		B
Approach Delay (s)	3.7	0.0	10.4
Approach LOS			B

Intersection Summary			
Average Delay	5.0		
Intersection Capacity Utilization	34.0%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	60	74	2	3	46	9	8	6	3	38	3	35
Future Volume (vph)	60	74	2	3	46	9	8	6	3	38	3	35
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	70	86	2	3	53	10	9	7	3	44	3	41

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	158	66	19	88
Volume Left (vph)	70	3	9	44
Volume Right (vph)	2	10	3	41
Hadj (s)	0.08	-0.08	0.00	-0.10
Departure Headway (s)	4.3	4.2	4.5	4.3
Degree Utilization, x	0.19	0.08	0.02	0.11
Capacity (veh/h)	815	820	749	780
Control Delay (s)	8.3	7.6	7.6	7.8
Approach Delay (s)	8.3	7.6	7.6	7.8
Approach LOS	A	A	A	A

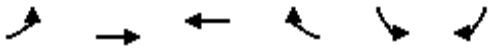
Intersection Summary			
Delay	8.0		
Level of Service	A		
Intersection Capacity Utilization	26.4%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection	
Intersection Delay, s/veh	8
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	60	74	2	3	46	9	8	6	3	38	3	35
Future Vol, veh/h	60	74	2	3	46	9	8	6	3	38	3	35
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	3	0	7
Mvmt Flow	70	86	2	3	53	10	9	7	3	44	3	41
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.3	7.6	7.6	7.8
HCM LOS	A	A	A	A

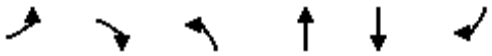
Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	47%	44%	5%	50%
Vol Thru, %	35%	54%	79%	4%
Vol Right, %	18%	1%	16%	46%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	17	136	58	76
LT Vol	8	60	3	38
Through Vol	6	74	46	3
RT Vol	3	2	9	35
Lane Flow Rate	20	158	67	88
Geometry Grp	1	1	1	1
Degree of Util (X)	0.025	0.185	0.079	0.106
Departure Headway (Hd)	4.491	4.221	4.237	4.301
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	801	838	850	838
Service Time	2.497	2.305	2.237	2.305
HCM Lane V/C Ratio	0.025	0.189	0.079	0.105
HCM Control Delay	7.6	8.3	7.6	7.8
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.1	0.7	0.3	0.4



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	12	142	73	5	3	2
Future Volume (Veh/h)	12	142	73	5	3	2
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	13	151	78	5	3	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)						
pX, platoon unblocked						
vC, conflicting volume	83				258	80
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	83				258	80
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				100	100
cM capacity (veh/h)	1527				729	985

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	164	83	5
Volume Left	13	0	3
Volume Right	0	5	2
cSH	1527	1700	814
Volume to Capacity	0.01	0.05	0.01
Queue Length 95th (m)	0.2	0.0	0.1
Control Delay (s)	0.6	0.0	9.5
Lane LOS	A		A
Approach Delay (s)	0.6	0.0	9.5
Approach LOS			A

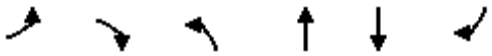
Intersection Summary			
Average Delay		0.6	
Intersection Capacity Utilization		24.8%	ICU Level of Service A
Analysis Period (min)		15	



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	7	1	2	15	4	10
Future Volume (Veh/h)	7	1	2	15	4	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)	8	1	2	16	4	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	30	10	15			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	30	10	15			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	100	100			
cM capacity (veh/h)	989	1078	1616			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	9	18	15
Volume Left	8	2	0
Volume Right	1	0	11
cSH	998	1616	1700
Volume to Capacity	0.01	0.00	0.01
Queue Length 95th (m)	0.2	0.0	0.0
Control Delay (s)	8.6	0.8	0.0
Lane LOS	A	A	
Approach Delay (s)	8.6	0.8	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	24	3	5	17	11	38
Future Volume (Veh/h)	24	3	5	17	11	38
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)	26	3	5	18	12	41
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	60	32	53			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	60	32	53			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	100	100			
cM capacity (veh/h)	948	1047	1566			

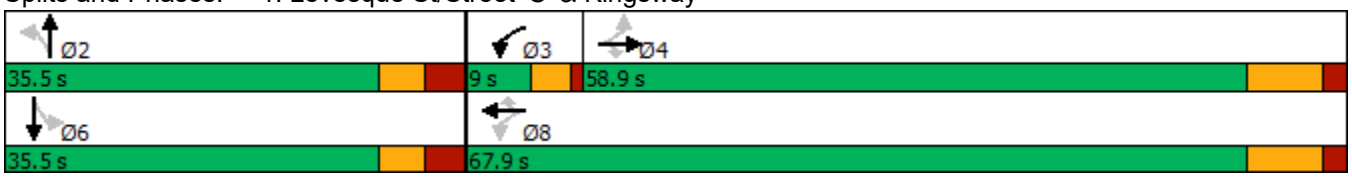
Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	29	23	53
Volume Left	26	5	0
Volume Right	3	0	41
cSH	957	1566	1700
Volume to Capacity	0.03	0.00	0.03
Queue Length 95th (m)	0.7	0.1	0.0
Control Delay (s)	8.9	1.6	0.0
Lane LOS	A	A	
Approach Delay (s)	8.9	1.6	0.0
Approach LOS	A		

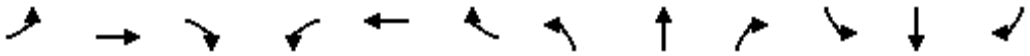
Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	15.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	Ø6
Lane Configurations							
Traffic Volume (vph)	394	96	130	846	247	0	
Future Volume (vph)	394	96	130	846	247	0	
Lane Group Flow (vph)	438	107	144	940	274	138	
Turn Type	NA	Perm	pm+pt	NA	Perm	NA	
Protected Phases	4		3	8		2	6
Permitted Phases		4	8		2		
Detector Phase	4	4	3	8	2	2	
Switch Phase							
Minimum Initial (s)	30.0	30.0	5.0	30.0	8.0	8.0	8.0
Minimum Split (s)	37.9	37.9	9.0	37.9	27.8	27.8	27.8
Total Split (s)	58.9	58.9	9.0	67.9	35.5	35.5	35.5
Total Split (%)	57.0%	57.0%	8.7%	65.7%	34.3%	34.3%	34%
Yellow Time (s)	5.9	5.9	3.0	5.9	3.6	3.6	3.6
All-Red Time (s)	2.0	2.0	1.0	2.0	3.2	3.2	3.2
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	7.9	7.9	4.0	7.9	6.8	6.8	
Lead/Lag	Lag	Lag	Lead				
Lead-Lag Optimize?	Yes	Yes	Yes				
Recall Mode	Max	Max	None	Max	None	None	None
v/c Ratio	0.25	0.12	0.23	0.45	0.82	0.20	
Control Delay	14.1	3.2	8.2	11.6	55.9	0.7	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	14.1	3.2	8.2	11.6	55.9	0.7	
Queue Length 50th (m)	24.5	0.0	10.0	49.7	51.8	0.0	
Queue Length 95th (m)	37.9	8.6	20.1	72.7	82.6	0.0	
Internal Link Dist (m)	516.5			440.7		737.0	
Turn Bay Length (m)		94.0	30.0		13.0		
Base Capacity (vph)	1732	895	623	2076	419	747	
Starvation Cap Reductn	0	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	0	
Reduced v/c Ratio	0.25	0.12	0.23	0.45	0.65	0.18	

Intersection Summary
Cycle Length: 103.4
Actuated Cycle Length: 97.8
Natural Cycle: 75
Control Type: Semi Act-Uncoord

Splits and Phases: 1: Levesque St/Street 'C' & Kingsway





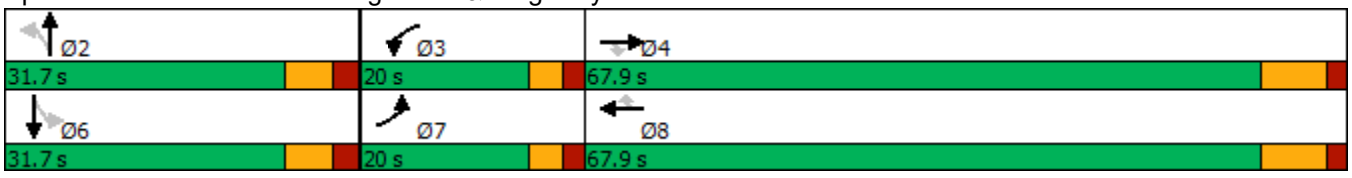
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	394	96	130	846	0	247	0	124	0	0	0
Future Volume (vph)	0	394	96	130	846	0	247	0	124	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.9	7.9	4.0	7.9		6.8	6.8				
Lane Util. Factor		0.95	1.00	1.00	0.95		1.00	1.00				
Frt		1.00	0.85	1.00	1.00		1.00	0.85				
Flt Protected		1.00	1.00	0.95	1.00		0.95	1.00				
Satd. Flow (prot)		3312	1615	1805	3374		1787	1553				
Flt Permitted		1.00	1.00	0.46	1.00		0.76	1.00				
Satd. Flow (perm)		3312	1615	877	3374		1424	1553				
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	438	107	144	940	0	274	0	138	0	0	0
RTOR Reduction (vph)	0	0	51	0	0	0	0	106	0	0	0	0
Lane Group Flow (vph)	0	438	56	144	940	0	274	32	0	0	0	0
Heavy Vehicles (%)	5%	9%	0%	0%	7%	1%	1%	0%	4%	0%	0%	0%
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA				
Protected Phases		4		3	8			2			6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)		51.2	51.2	60.2	60.2		22.9	22.9				
Effective Green, g (s)		51.2	51.2	60.2	60.2		22.9	22.9				
Actuated g/C Ratio		0.52	0.52	0.62	0.62		0.23	0.23				
Clearance Time (s)		7.9	7.9	4.0	7.9		6.8	6.8				
Vehicle Extension (s)		3.0	3.0	3.0	3.0		3.0	3.0				
Lane Grp Cap (vph)		1733	845	587	2076		333	363				
v/s Ratio Prot		0.13		0.01	c0.28			0.02				
v/s Ratio Perm			0.03	0.14			c0.19					
v/c Ratio		0.25	0.07	0.25	0.45		0.82	0.09				
Uniform Delay, d1		12.8	11.5	8.0	10.0		35.5	29.3				
Progression Factor		1.00	1.00	1.00	1.00		1.00	1.00				
Incremental Delay, d2		0.4	0.2	0.2	0.7		15.0	0.1				
Delay (s)		13.1	11.7	8.2	10.7		50.6	29.4				
Level of Service		B	B	A	B		D	C				
Approach Delay (s)		12.9			10.4			43.5			0.0	
Approach LOS		B			B			D			A	

Intersection Summary			
HCM 2000 Control Delay	17.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	97.8	Sum of lost time (s)	18.7
Intersection Capacity Utilization	82.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations										
Traffic Volume (vph)	29	669	37	14	1510	10	62	5	3	1
Future Volume (vph)	29	669	37	14	1510	10	62	5	3	1
Lane Group Flow (vph)	34	778	43	16	1756	12	72	47	3	16
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA	Perm	NA
Protected Phases	7	4		3	8			2		6
Permitted Phases			4			8	2		6	
Detector Phase	7	4	4	3	8	8	2	2	6	6
Switch Phase										
Minimum Initial (s)	5.0	30.0	30.0	5.0	30.0	30.0	8.0	8.0	8.0	8.0
Minimum Split (s)	10.0	37.9	37.9	10.0	37.9	37.9	30.7	30.7	30.7	30.7
Total Split (s)	20.0	67.9	67.9	20.0	67.9	67.9	31.7	31.7	31.7	31.7
Total Split (%)	16.7%	56.8%	56.8%	16.7%	56.8%	56.8%	26.5%	26.5%	26.5%	26.5%
Yellow Time (s)	3.0	5.9	5.9	3.0	5.9	5.9	4.1	4.1	4.1	4.1
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.6	2.6	2.6	2.6
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	7.9	7.9	5.0	7.9	7.9	6.7	6.7	6.7	6.7
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag				
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes				
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None
v/c Ratio	0.32	0.32	0.04	0.13	0.72	0.01	0.46	0.21	0.03	0.11
Control Delay	51.5	7.2	0.6	47.6	16.0	0.0	51.9	17.4	40.3	21.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	51.5	7.2	0.6	47.6	16.0	0.0	51.9	17.4	40.3	21.0
Queue Length 50th (m)	6.5	22.6	0.0	3.1	134.4	0.0	13.8	1.1	0.6	0.2
Queue Length 95th (m)	16.2	53.2	1.0	9.7	190.3	0.0	27.6	11.0	3.3	6.0
Internal Link Dist (m)		440.7			446.3			949.6		204.9
Turn Bay Length (m)	40.0		22.0	42.0		51.0	20.0		14.0	
Base Capacity (vph)	199	2460	972	281	2423	972	361	459	214	322
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.32	0.04	0.06	0.72	0.01	0.20	0.10	0.01	0.05

Intersection Summary
Cycle Length: 119.6
Actuated Cycle Length: 96.8
Natural Cycle: 100
Control Type: Semi Act-Uncoord

Splits and Phases: 2: Moonlight Ave & Kingsway



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	29	669	37	14	1510	10	62	5	35	3	1	13
Future Volume (vph)	29	669	37	14	1510	10	62	5	35	3	1	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	7.9	7.9	5.0	7.9	7.9	6.7	6.7		6.7	6.7	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.87		1.00	0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1280	3312	1282	1805	3438	1346	1770	1651		1081	1196	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.75	1.00		0.73	1.00	
Satd. Flow (perm)	1280	3312	1282	1805	3438	1346	1392	1651		826	1196	
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	34	778	43	16	1756	12	72	6	41	3	1	15
RTOR Reduction (vph)	0	0	13	0	0	4	0	37	0	0	14	0
Lane Group Flow (vph)	34	778	30	16	1756	8	72	10	0	3	2	0
Heavy Vehicles (%)	41%	9%	26%	0%	5%	20%	2%	0%	0%	67%	0%	39%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases			4			8	2			6		
Actuated Green, G (s)	5.5	70.1	70.1	2.8	67.4	67.4	8.9	8.9		8.9	8.9	
Effective Green, g (s)	5.5	70.1	70.1	2.8	67.4	67.4	8.9	8.9		8.9	8.9	
Actuated g/C Ratio	0.05	0.69	0.69	0.03	0.66	0.66	0.09	0.09		0.09	0.09	
Clearance Time (s)	5.0	7.9	7.9	5.0	7.9	7.9	6.7	6.7		6.7	6.7	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	69	2289	886	49	2285	894	122	144		72	104	
v/s Ratio Prot	c0.03	c0.23		0.01	c0.51			0.01			0.00	
v/s Ratio Perm			0.02			0.01	c0.05			0.00		
v/c Ratio	0.49	0.34	0.03	0.33	0.77	0.01	0.59	0.07		0.04	0.02	
Uniform Delay, d1	46.6	6.3	4.9	48.4	11.7	5.7	44.5	42.4		42.3	42.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	5.4	0.4	0.1	3.9	2.6	0.0	7.4	0.2		0.2	0.1	
Delay (s)	52.0	6.7	5.0	52.2	14.2	5.8	51.9	42.6		42.6	42.4	
Level of Service	D	A	A	D	B	A	D	D		D	D	
Approach Delay (s)		8.4			14.5			48.3			42.4	
Approach LOS		A			B			D			D	

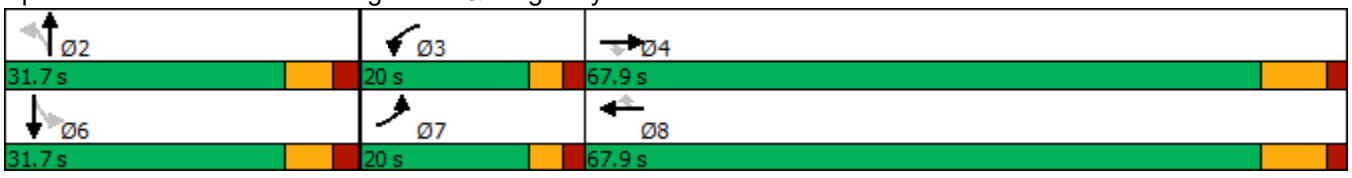
Intersection Summary			
HCM 2000 Control Delay	14.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	101.4	Sum of lost time (s)	19.6
Intersection Capacity Utilization	64.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

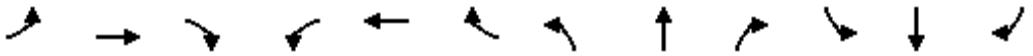
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations										
Traffic Volume (vph)	15	1527	78	51	1070	11	39	6	11	4
Future Volume (vph)	15	1527	78	51	1070	11	39	6	11	4
Lane Group Flow (vph)	16	1678	86	56	1176	12	43	67	12	36
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA	Perm	NA
Protected Phases	7	4		3	8			2		6
Permitted Phases			4			8	2		6	
Detector Phase	7	4	4	3	8	8	2	2	6	6
Switch Phase										
Minimum Initial (s)	5.0	30.0	30.0	5.0	30.0	30.0	8.0	8.0	8.0	8.0
Minimum Split (s)	10.0	37.9	37.9	10.0	37.9	37.9	30.7	30.7	30.7	30.7
Total Split (s)	20.0	67.9	67.9	20.0	67.9	67.9	31.7	31.7	31.7	31.7
Total Split (%)	16.7%	56.8%	56.8%	16.7%	56.8%	56.8%	26.5%	26.5%	26.5%	26.5%
Yellow Time (s)	3.0	5.9	5.9	3.0	5.9	5.9	4.1	4.1	4.1	4.1
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.6	2.6	2.6	2.6
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	7.9	7.9	5.0	7.9	7.9	6.7	6.7	6.7	6.7
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag				
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes				
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None
v/c Ratio	0.14	0.70	0.08	0.36	0.45	0.01	0.32	0.32	0.11	0.21
Control Delay	46.5	15.1	2.7	48.9	7.7	0.0	48.6	17.7	43.4	19.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.5	15.1	2.7	48.9	7.7	0.0	48.6	17.7	43.4	19.4
Queue Length 50th (m)	3.0	115.6	0.5	10.5	35.4	0.0	8.1	1.3	2.2	0.8
Queue Length 95th (m)	10.2	176.6	6.9	23.6	88.3	0.0	19.6	14.1	8.1	10.4
Internal Link Dist (m)		440.7			446.3			949.6		204.9
Turn Bay Length (m)	40.0		22.0	42.0		51.0	20.0		14.0	
Base Capacity (vph)	266	2388	1114	274	2594	1238	367	477	302	422
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.06	0.70	0.08	0.20	0.45	0.01	0.12	0.14	0.04	0.09

Intersection Summary

Cycle Length: 119.6
Actuated Cycle Length: 95.3
Natural Cycle: 90
Control Type: Semi Act-Uncoord

Splits and Phases: 2: Moonlight Ave & Kingsway





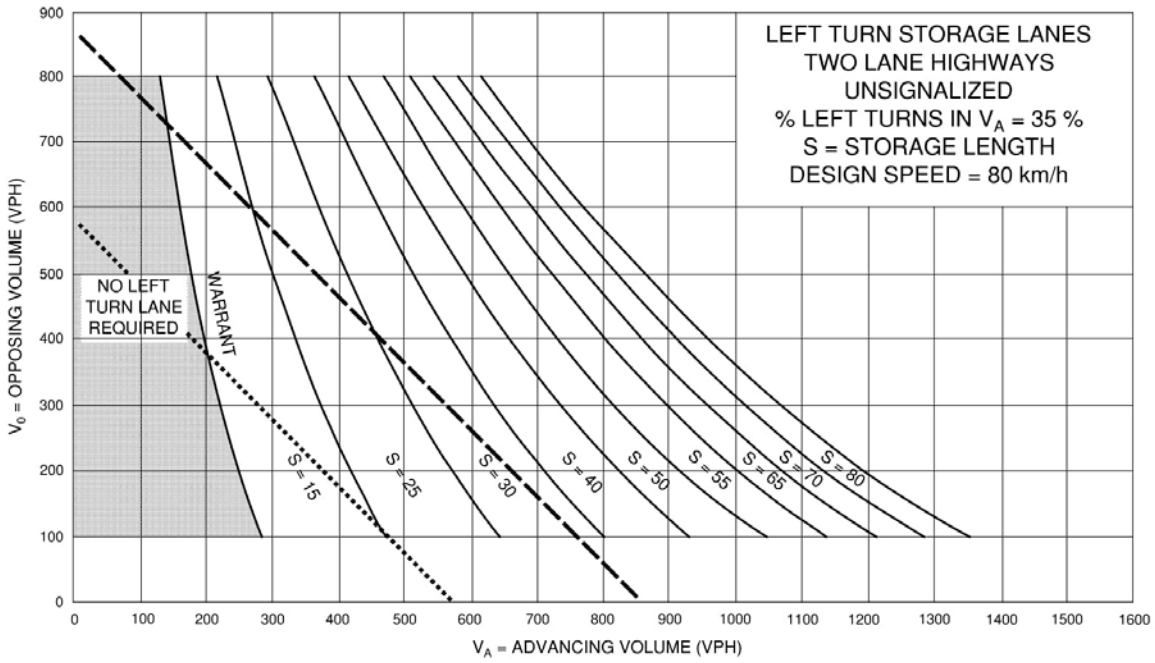
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	1527	78	51	1070	11	39	6	55	11	4	29
Future Volume (vph)	15	1527	78	51	1070	11	39	6	55	11	4	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	7.9	7.9	5.0	7.9	7.9	6.7	6.7		6.7	6.7	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.87		1.00	0.87	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1687	3471	1583	1736	3438	1615	1805	1645		1530	1512	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.73	1.00		0.71	1.00	
Satd. Flow (perm)	1687	3471	1583	1736	3438	1615	1394	1645		1149	1512	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	16	1678	86	56	1176	12	43	7	60	12	4	32
RTOR Reduction (vph)	0	0	27	0	0	4	0	56	0	0	30	0
Lane Group Flow (vph)	16	1678	59	56	1176	8	43	11	0	12	6	0
Heavy Vehicles (%)	7%	4%	2%	4%	5%	0%	0%	0%	0%	18%	0%	10%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases			4			8	2			6		
Actuated Green, G (s)	2.9	65.8	65.8	7.2	70.1	70.1	7.3	7.3		7.3	7.3	
Effective Green, g (s)	2.9	65.8	65.8	7.2	70.1	70.1	7.3	7.3		7.3	7.3	
Actuated g/C Ratio	0.03	0.66	0.66	0.07	0.70	0.70	0.07	0.07		0.07	0.07	
Clearance Time (s)	5.0	7.9	7.9	5.0	7.9	7.9	6.7	6.7		6.7	6.7	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	48	2286	1042	125	2412	1133	101	120		83	110	
v/s Ratio Prot	0.01	c0.48		c0.03	c0.34			0.01			0.00	
v/s Ratio Perm			0.04			0.01	c0.03			0.01		
v/c Ratio	0.33	0.73	0.06	0.45	0.49	0.01	0.43	0.09		0.14	0.06	
Uniform Delay, d1	47.6	11.3	6.0	44.4	6.8	4.5	44.3	43.2		43.4	43.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.1	2.1	0.1	2.5	0.7	0.0	2.9	0.3		0.8	0.2	
Delay (s)	51.6	13.4	6.1	47.0	7.5	4.5	47.2	43.6		44.2	43.3	
Level of Service	D	B	A	D	A	A	D	D		D	D	
Approach Delay (s)		13.4			9.2			45.0			43.5	
Approach LOS		B			A			D			D	

Intersection Summary			
HCM 2000 Control Delay	13.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	99.9	Sum of lost time (s)	19.6
Intersection Capacity Utilization	63.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

MTO Left Turn Analysis

JD Engineering
Phone: 705.725.4035
Email:Info@JDEngineering.ca

Exhibit 9A-17



Levesque Street / Bancroft Drive

2029 Total (Without KED and Future Business Park Development) - Eastbound AM Peak Hour

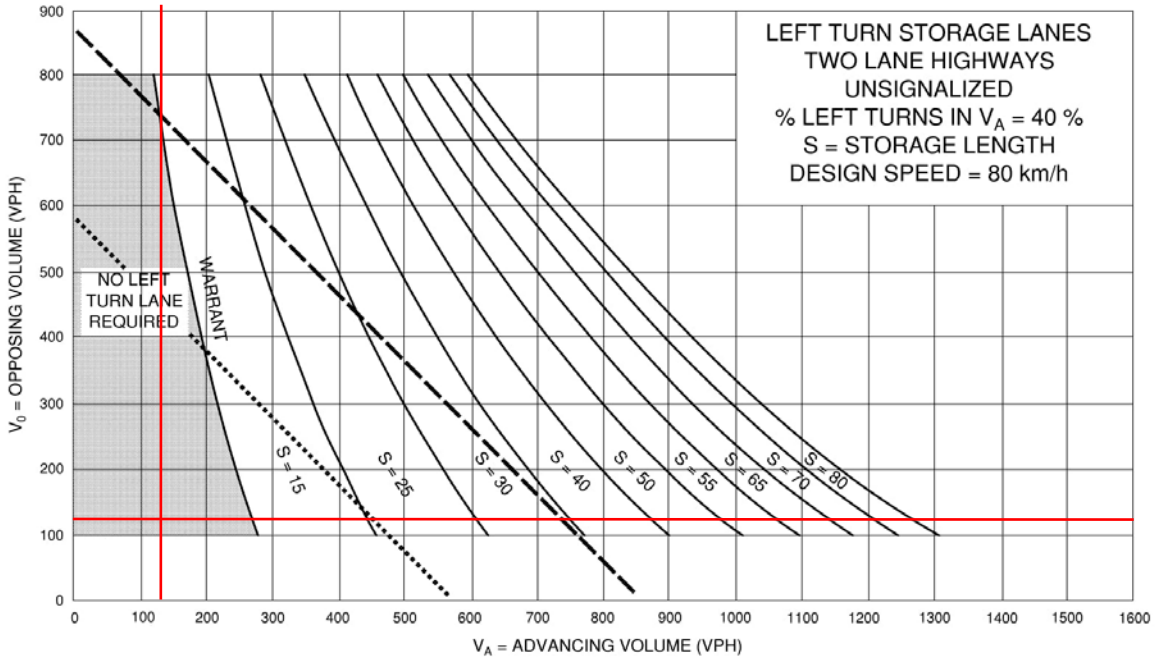
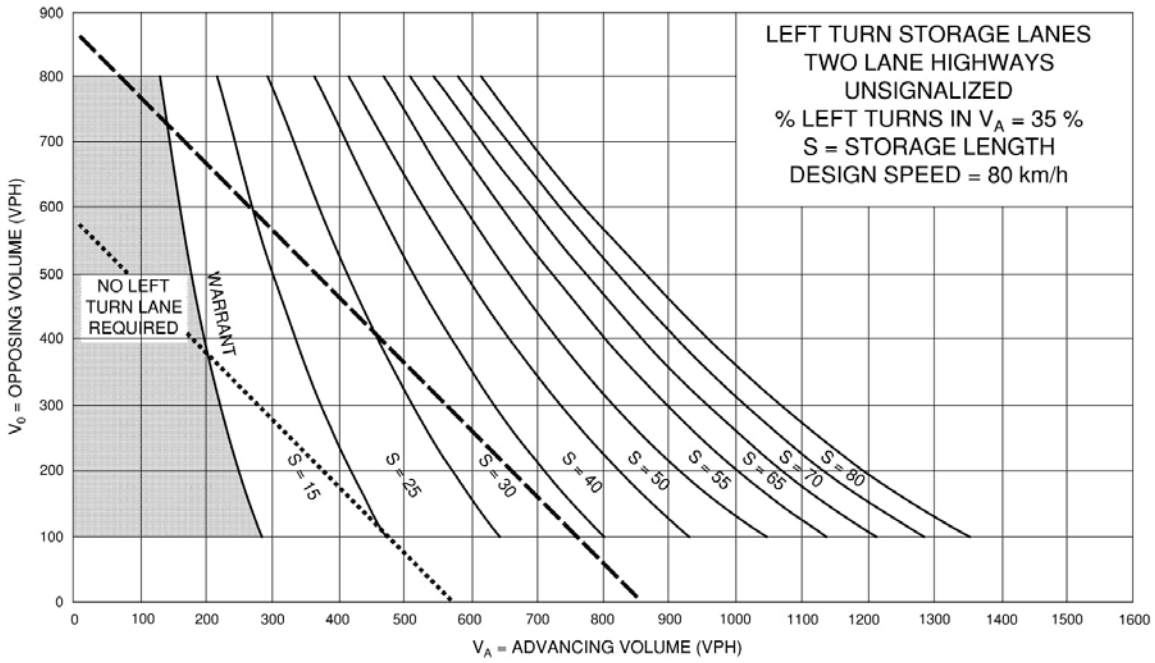


Exhibit 9A-17



TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW

TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

Levesque Street / Bancroft Drive

2029 Total (Without KED and Future Business Park Development) - Eastbound PM Peak Hour

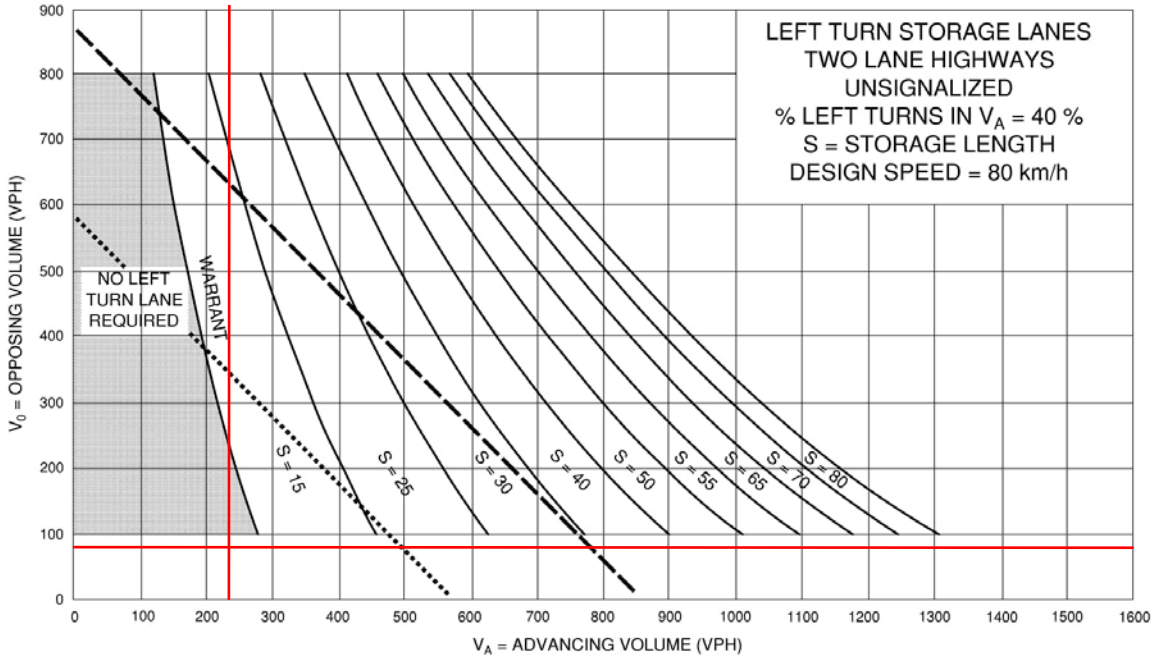
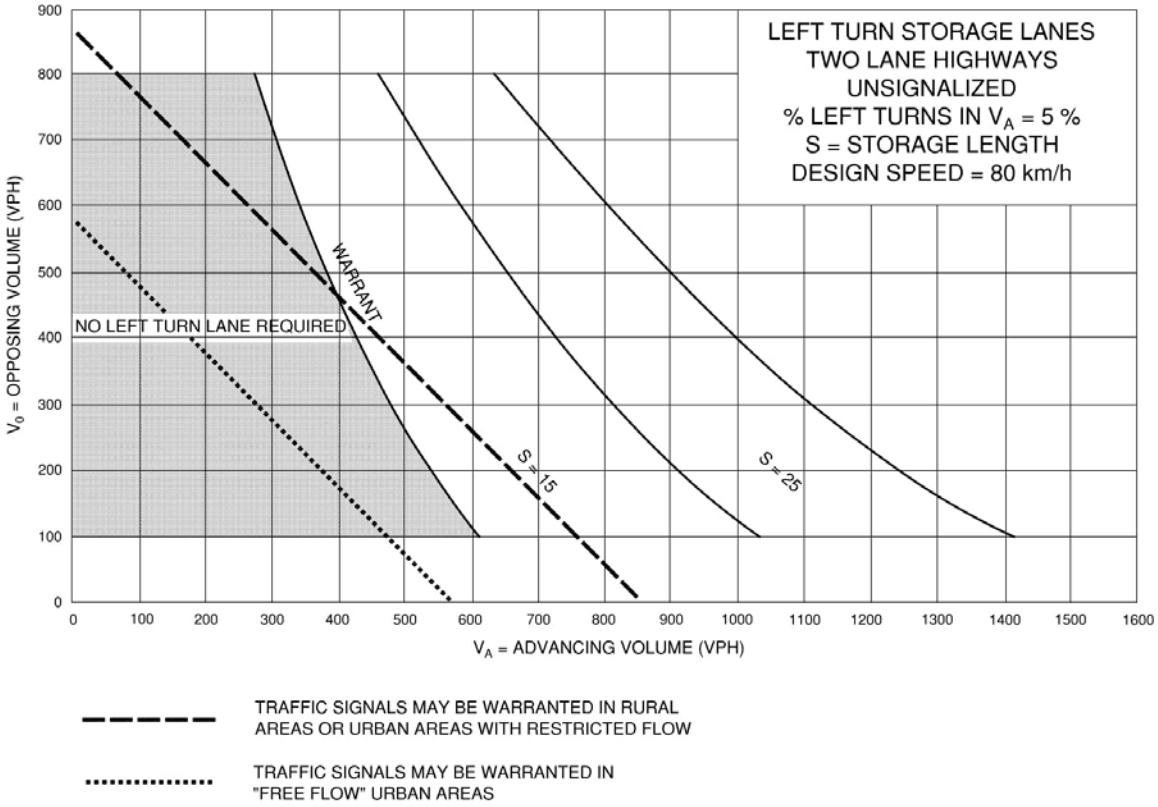


Exhibit 9A-14



Estelle Street / Bancroft Drive

2029 Total (Without KED and Future Business Park Development) - Eastbound Critical Case - PM Peak Hour

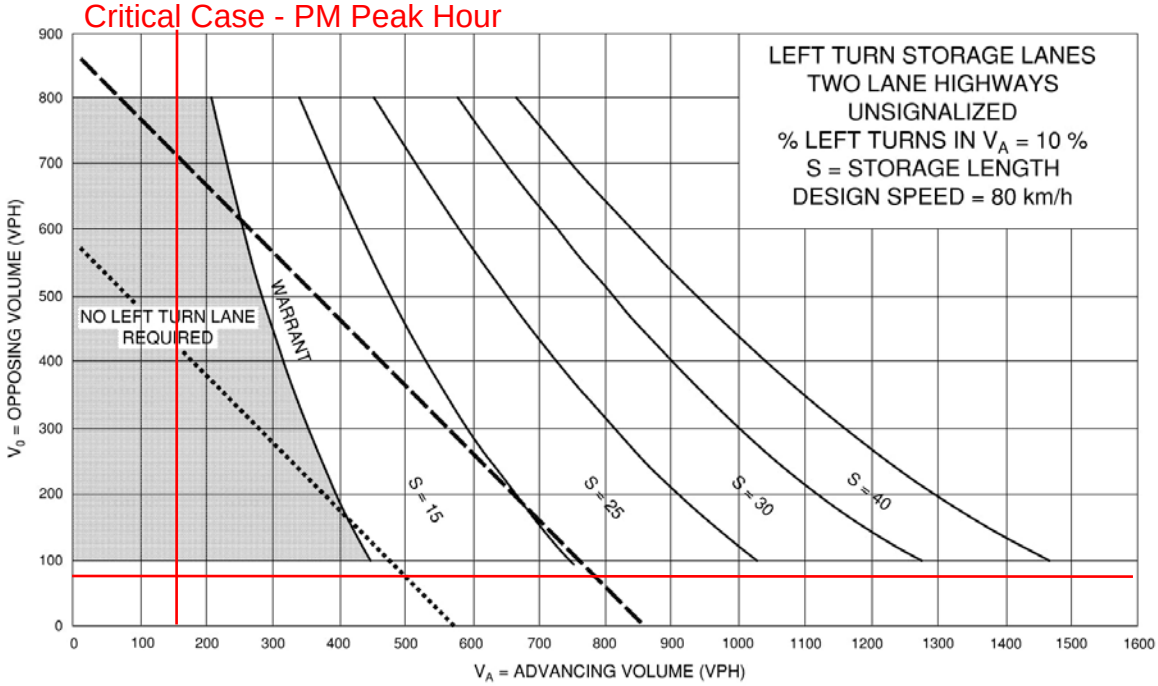
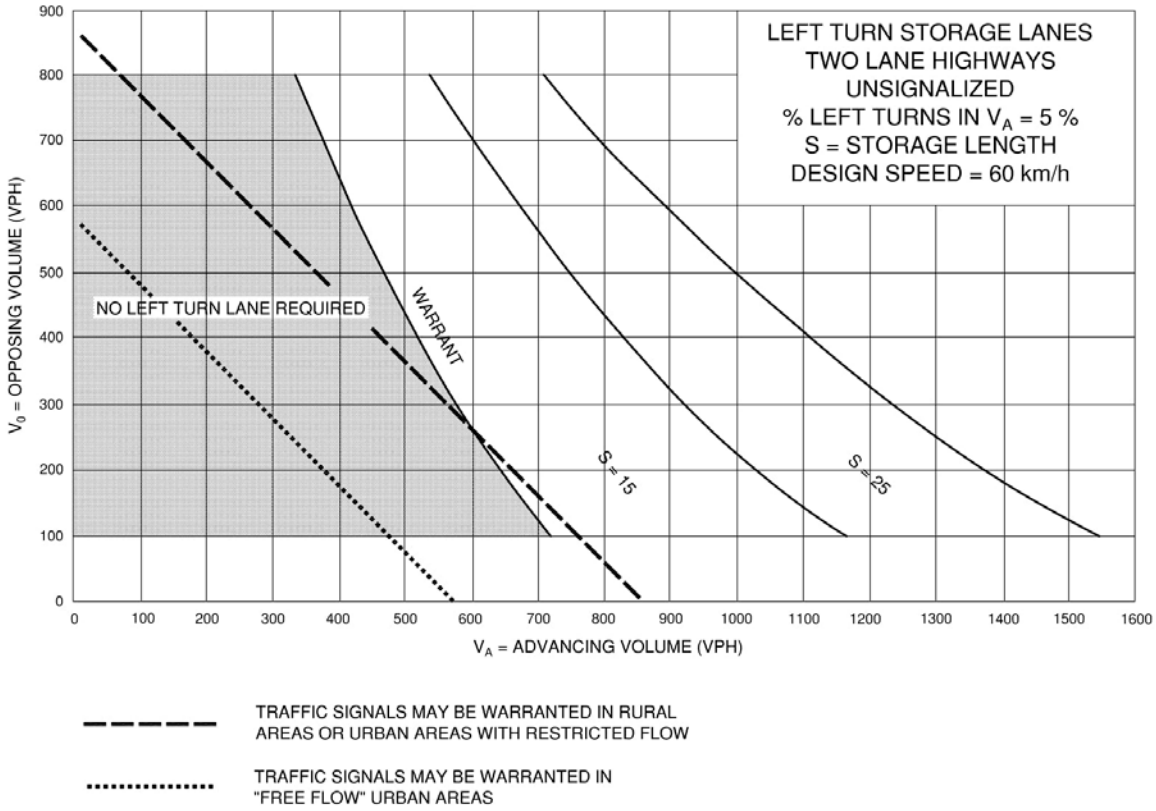


Exhibit 9A-6



South Access / Estelle Street

2029 Total (Without KED and Future Business Park Development) - Northbound Critical Case - PM Peak Hour

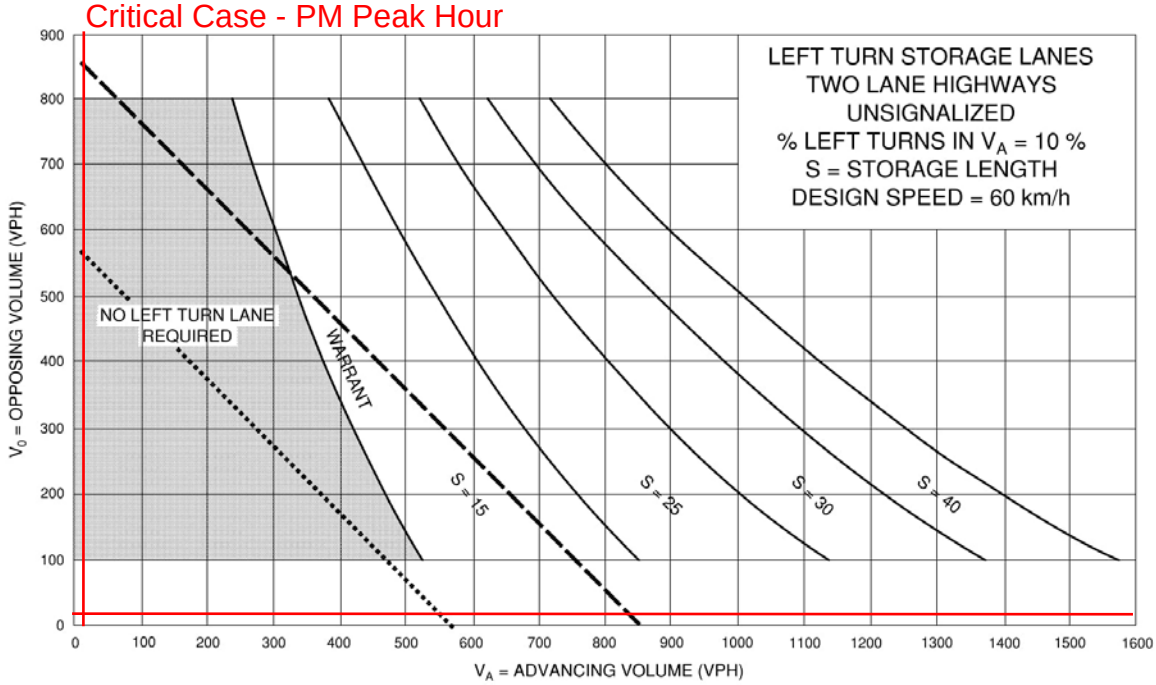
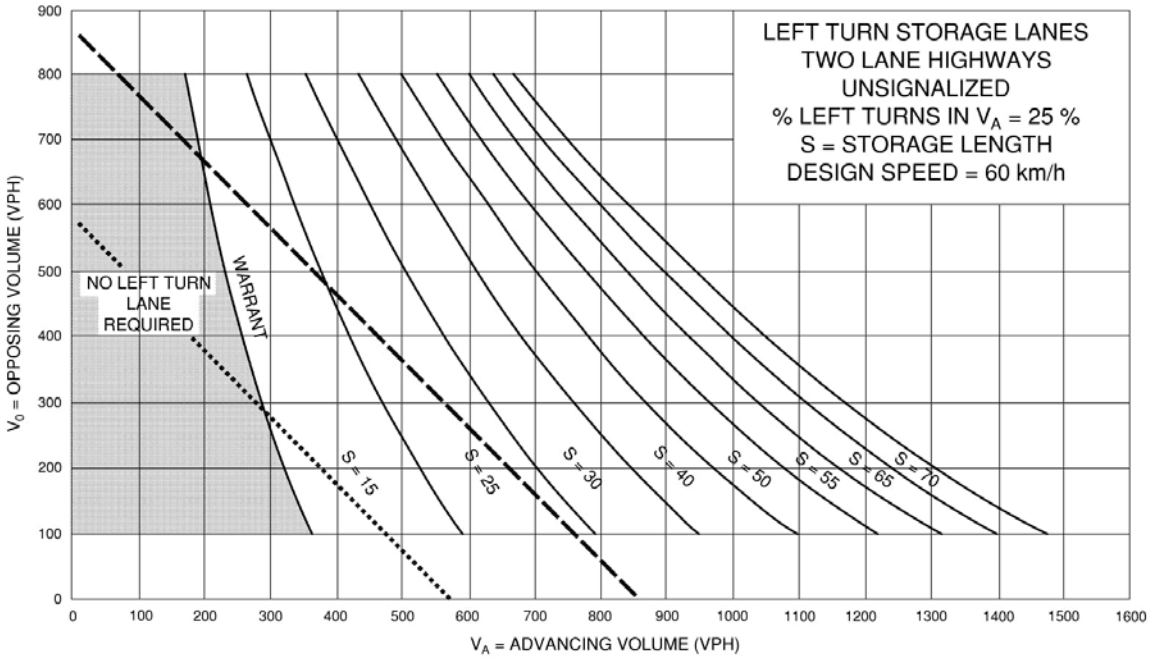


Exhibit 9A-8

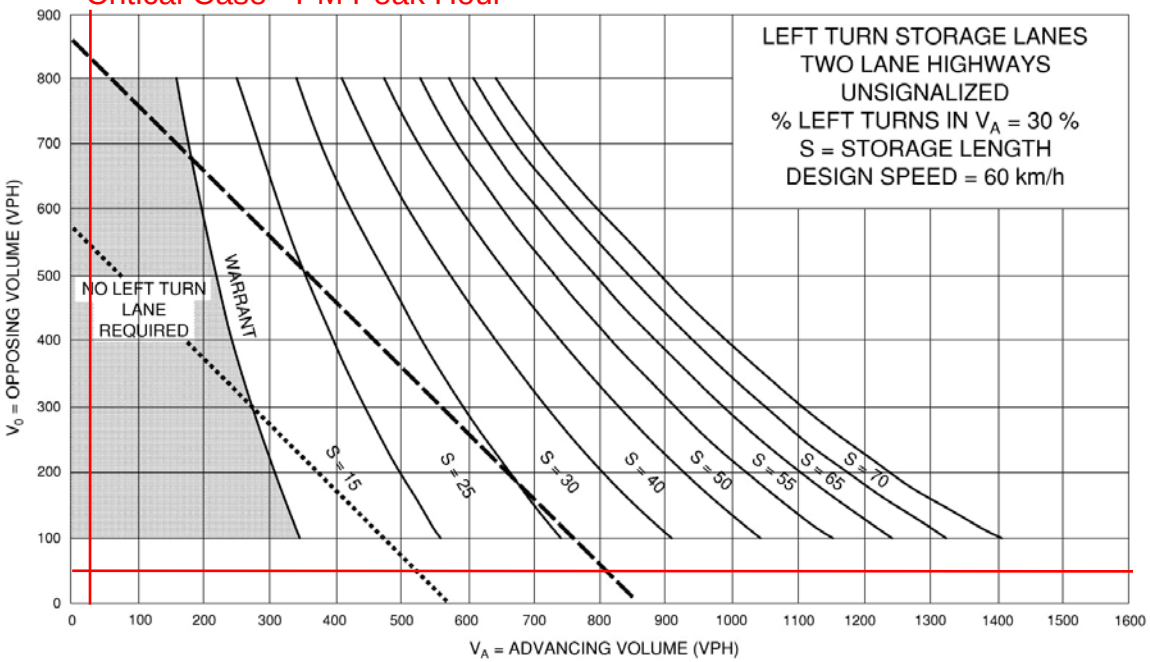


TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW

TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

North Access / Estelle Street

2029 Total (Without KED and Future Business Park Development) - Northbound Critical Case - PM Peak Hour



OTM Signal Justification Sheets

Justification No. 7 - 2029 Total Traffic (Critical Case) - Without KED and Future Business Park Development

Levesque Street / Bancroft Drive

Justification	Description		Compliance			Signal Warrant	Underground Provisions Warrant
			Sectional		Entire %		
		Rest. Flow	Numerical	%			
1. Minimum Vehicluar Volume	A. Vehicle volume, all aproaches (average hour)	720	212	29%	22%	NO	NO
	B. Vehicle volume, along minor streets (average hour)	255	69	27%		NO	NO
2. Delay to cross traffic	A. Vehicle volume, major street (average hour)	720	133	18%	12%	NO	NO
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	75	10	14%		NO	NO

Justification No. 7 - 2029 Total Traffic (Critical Case) - Without KED and Future Business Park Developmen

Moonlight Avenue & Moonlight Beach Road / Bancroft Drive

Justification	Description		Compliance			Signal Warrant	Underground Provisions Warrant
			Sectional		Entire %		
		Rest. Flow	Numerical	%			
1. Minimum Vehicluar Volume	A. Vehicle volume, all aproaches (average hour)	720	119	17%	14%	NO	NO
	B. Vehicle volume, along minor streets (average hour)	170	35	21%		NO	NO
2. Delay to cross traffic	A. Vehicle volume, major street (average hour)	720	74	10%	9%	NO	NO
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	75	18	24%		NO	NO

Justification No. 7 - 2029 Total Traffic (Critical Case) - Without KED and Future Business Park Developmen

Estelle Street / Bancroft Drive

Justification	Description		Compliance			Signal Warrant	Underground Provisions Warrant
			Sectional		Entire %		
		Rest. Flow	Numerical	%			
1. Minimum Vehicluar Volume	A. Vehicle volume, all aproaches (average hour)	720	106	15%	2%	NO	NO
	B. Vehicle volume, along minor streets (average hour)	255	5	2%		NO	NO
2. Delay to cross traffic	A. Vehicle volume, major street (average hour)	720	98	14%	1%	NO	NO
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	75	1	2%		NO	NO

Justification No. 7 - 2029 Total Traffic (Critical Case) - Without KED and Future Business Park Developmen

Estelle Street / North Access

Justification	Description		Compliance			Signal Warrant	Underground Provisions Warrant
			Sectional		Entire %		
		Rest. Flow	Numerical	%			
1. Minimum Vehicluar Volume	A. Vehicle volume, all aproaches (average hour)	720	46	6%	4%	NO	NO
	B. Vehicle volume, along minor streets (average hour)	255	18	7%		NO	NO
2. Delay to cross traffic	A. Vehicle volume, major street (average hour)	720	15	2%	1%	NO	NO
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	75	16	21%		NO	NO

Justification No. 7 - 2029 Total Traffic (Critical Case) - Without KED and Future Business Park Developmen

Estelle Street / South Access

Justification	Description		Compliance			Signal Warrant	Underground Provisions Warrant
			Sectional		Entire %		
		Rest. Flow	Numerical	%			
1. Minimum Vehicluar Volume	A. Vehicle volume, all aproaches (average hour)	720	19	3%	1%	NO	NO
	B. Vehicle volume, along minor streets (average hour)	255	5	2%		NO	NO
2. Delay to cross traffic	A. Vehicle volume, major street (average hour)	720	11	1%	1%	NO	NO
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	75	4	5%		NO	NO