5A-150 Pinebush Road
Cambridge ON N1R 8J8
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26 March 2020
Project: (200062)

2596843 Ontario Inc.
c/o Marshall Smith, BES, PMP
KLM Planning Partners Inc.
64 Jardin Drive, Unit 18
Concord ON L4K 3P3

RE: 224 ARDAGH ROAD (204 FERNDALE DRIVE S) PROPOSED MIXED-USE DEVELOPMENT, BARRIE
ADDENDUM TO MAY 2018 TRAFFIC BRIEF

Paradigm Transportation Solutions Limited (Paradigm) has been retained by 2596843 Ontario Inc. to prepare an addendum to the Traffic Brief previously prepared for the proposed mixed-use residential and commercial development at 224 Ardagh Road in Barrie, Ontario.

This addendum addresses comments dated 15 November 2019 provided by the City related to their review of the May 2018 Traffic Brief, specifically comments #1 and #2. **Attachment A** contains the review comments for reference. The City does not support a full movement access onto Ferndale Drive, as the proposed access is within 70 metres of the intersection of Ferndale Drive and Ardagh Road. The City requires this access be restricted to right-in/right-movement only by implementation of a “pork chop” island. This letter summarizes the:

- Assessment of the restricted Ferndale Drive site access;
- Revised total traffic forecasts to reflect the access onto Ferndale Drive being restricted to right-in/right-out;
- Updated total traffic capacity analyses; and
- Amended recommendations regarding any necessary remedial measures required to accommodate the traffic demands in a satisfactory manner.

Ferndale Drive Access

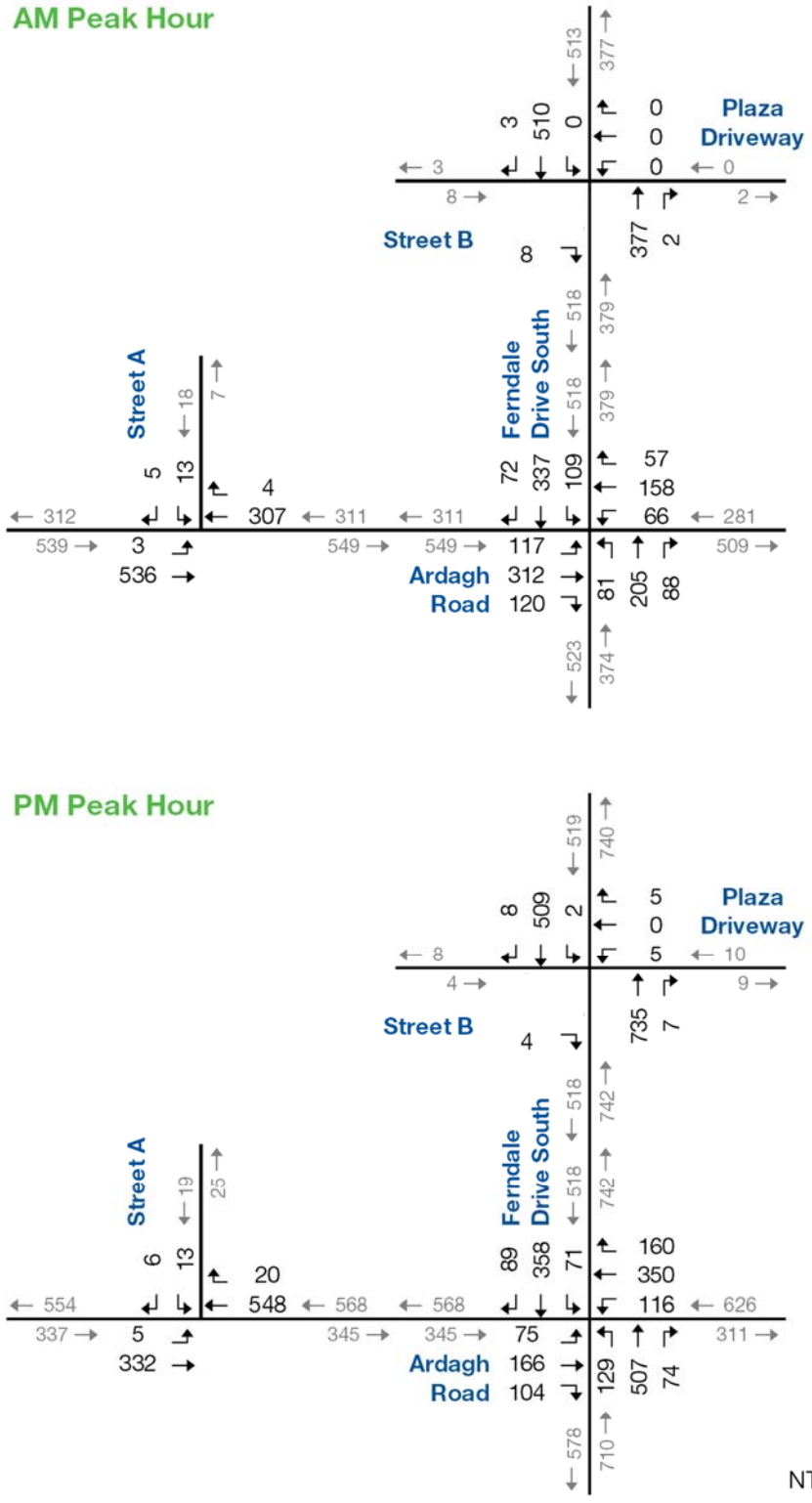
The Ferndale Drive site access, referred to as “Street B” will be restricted to right-in/right-out movements through implementation of a “pork chop” island. The island will be mountable via provision of rolled curbs to permit heavy vehicle movements.

The site access design and vehicle manoeuvres were checked via an AutoTURN analysis. **Attachment B** provides the AutoTURN analysis for reference. The results indicate the largest anticipated design vehicle, a heavy single-unit (HSU) truck (representative of a typical waste collection vehicle) would be able to navigate the access (ingress/egress) with no issues or conflicts.

Development Trip Distribution and Assignment

The site trips generated by the development were reassigned to the adjacent roadway network based on existing traffic patterns and logical routing to/from the site location, reflecting the restricted access at onto Ferndale Drive.

Figure 1 and **Figure 2** illustrate the updated 2020 and 2025 total traffic peak hour forecasts, respectively.

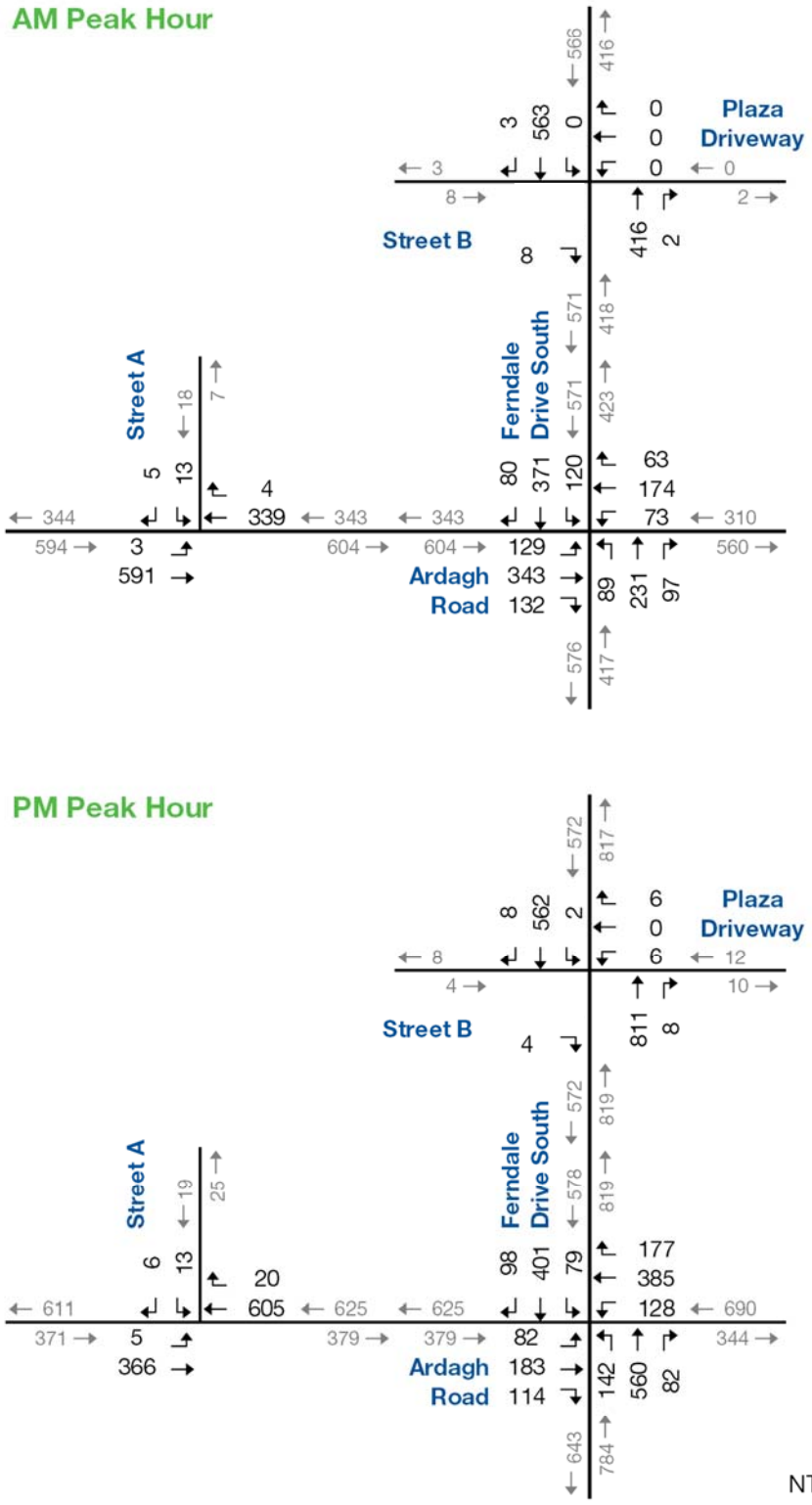


NTS

2020 Total Traffic Forecasts

224 Ardagh Road, Proposed Mixed-Use Development Traffic Brief Addendum
200062

Figure 1



NTS

2025 Total Traffic Forecasts

224 Ardagh Road, Proposed Mixed-Use Development Traffic Brief Addendum
200062

Figure 2

2020 Total Traffic Operations

Table 1 summarizes the 2020 total traffic operational results for the AM and PM peak hours. All intersections and movements within the study area are forecast to operate at acceptable levels of service and well within capacity under 2020 total traffic conditions. The results are consistent with the findings outlined in the May 2018 Traffic Brief.

Attachment C contains the detailed Synchro analysis output reports for reference.

TABLE 1: 2020 PEAK HOUR TOTAL TRAFFIC OPERATIONS SUMMARY

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																	
				Eastbound				Westbound				Northbound				Southbound				OVERALL
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	1 - Ardagh Road & Ferndale Drive South	TCS	LOS	C	D	C	**C**	C	C	C	**C**	B	B	>	**B**	B	C	>	**B**	**C**
			Delay	23	36	26	**30**	24	31	26	**29**	15	19	>	**18**	14	21	>	**20**	**24**
			V/C	0.49	0.72	0.14		0.29	0.54	0.04		0.31	0.24	>		0.23	0.37	>		**0.5**
			Q	26	89	0		17	42	1		17	29	>		24	48	>		
			Storage Avail.	-	-	-		-	-	50		35	-	>		40	-	>		
				-	-	-		-	-	49		19	-	-		16	-	>		
	2 - Ferndale Drive South & Street B/ Commerical Plaza	TWSC	LOS	<	A	>	**A**	<	A	>	**A**	<	A	>	**A**	<	A	>	**A**	**A**
			Delay	<	10	>	**10**	<	0	>	**0**	<	0	>	**0**	<	0	>	**0**	**0**
			V/C	<	0.01	>		<	0.00	>		<	0.16	>		<	0.16	>		
			Q	<	0	>		<	0	>		<	0	>		<	0	>		
	3 - Ardagh Road & Street A	TWSC	LOS	<	A		**A**		A	>	**A**					B		>	**B**	**A**
			Delay	<	0		**0**		0	>	**0**					12		>	**12**	**0**
			V/C	<	0.00				0.20	>						0.03		>		
			Q	<	0				0	>						1		>		
PM Peak Hour	1 - Ardagh Road & Ferndale Drive South	TCS	LOS	C	C	C	**C**	C	D	C	**C**	B	C	>	**B**	B	C	>	**C**	**C**
			Delay	25	30	27	**28**	22	38	26	**32**	15	21	>	**20**	15	21	>	**20**	**25**
			V/C	0.43	0.43	0.07		0.33	0.76	0.12		0.39	0.46	>		0.21	0.36	>		**0.56**
			Q	18	46	12		27	97	14		26	71	>		16	50	>		
			Storage Avail.	-	-	-		-	-	50		35	-	>		40	-	>		
				-	-	-		-	-	36		9	-	-		24	-	>		
	2 - Ferndale Drive South & Street B/ Commerical Plaza	TWSC	LOS	<	A	>	**A**	<	B	>	**B**	<	A	>	**A**	<	A	>	**A**	**A**
			Delay	<	10	>	**10**	<	15	>	**15**	<	0	>	**0**	<	0	>	**0**	**0**
			V/C	<	0.01	>		<	0.03	>		<	0.31	>		<	0.17	>		
			Q	<	0	>		<	1	>		<	0	>		<	0	>		
	3 - Ardagh Road & Street A	TWSC	LOS	<	A		**A**		A	>	**A**					B		>	**B**	**A**
			Delay	<	0		**0**		0	>	**0**					13		>	**13**	**0**
			V/C	<	0.01				0.36	>						0.04		>		
			Q	<	0				0	>						1		>		

MOE - Measure of Effectiveness
LOS - Level of Service
Delay - Average Delay per Vehicle in Seconds

Q - 95th Percentile Queue Length
Ex. Existing Available Storage
Avail. - Available Storage (m)

TCS - Traffic Control Signal
TWSC - Two-Way Stop Control
> - Shared Right-Turn Lane

< - Shared Left-Turn Lane

2025 Total Traffic Operations

Table 2 summarizes the 2025 total traffic operational results for the AM and PM peak hours. All intersections and movements within the study area are forecast to continue operating at acceptable levels of service and well within capacity under 2025 total traffic conditions. The results are consistent with the findings outlined in the May 2018 Traffic Brief.

Attachment D contains the detailed Synchro analysis output reports for reference.

TABLE 2: 2025 PEAK HOUR TOTAL TRAFFIC OPERATIONS SUMMARY

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																	
				Eastbound				Westbound				Northbound				Southbound				OVERALL
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	1 - Ardagh Road & Ferndale Drive South	TCS	LOS	C	D	C	**C**	C	C	C	**C**	B	C	>	**B**	B	C	>	**C**	**C**
			Delay	24	37	26	**31**	24	31	26	**29**	16	21	>	**19**	15	22	>	**21**	**25**
			V/C	0.55	0.76	0.15		0.34	0.57	0.05		0.37	0.28	>		0.27	0.41	>		**0.55**
			Q	28	99	0		18	46	2		18	33	>		26	53	>		
			Storage Avail.	-	-	-		-	-	50		35	-	>		40	-	>		
				-	-	-		-	-	48		17	-	-		15	-	>		
	2 - Ferndale Drive South & Street B/ Commerical Plaza	TWSC	LOS	<	B	>	**B**	<	A	>	**A**	<	A	>	**A**	<	A	>	**A**	**A**
			Delay	<	10	>	**10**	<	0	>	**0**	<	0	>	**0**	<	0	>	**0**	**0**
			V/C	<	0.01	>		<	0.00	>		<	0.18	>		<	0.18	>		
			Q	<	0	>		<	0	>		<	0	>		<	0	>		
	3 - Ardagh Road & Street A	TWSC	LOS	<	A		**A**		A	>	**A**					B		>	**B**	**A**
			Delay	<	0		**0**		0	>	**0**					12		>	**12**	**0**
			V/C	<	0.00				0.22	>						0.04		>		
			Q	<	0				0	>						1		>		
PM Peak Hour	1 - Ardagh Road & Ferndale Drive South	TCS	LOS	C	C	C	**C**	C	D	C	**C**	B	C	>	**C**	B	C	>	**C**	**C**
			Delay	26	30	26	**28**	22	40	26	**33**	16	23	>	**21**	16	22	>	**22**	**26**
			V/C	0.51	0.45	0.08		0.37	0.80	0.15		0.47	0.52	>		0.27	0.41	>		**0.62**
			Q	19	51	13		29	109	17		28	79	>		17	57	>		
			Storage Avail.	-	-	-		-	-	50		35	-	>		40	-	>		
				-	-	-		-	-	33		7	-	-		23	-	>		
	2 - Ferndale Drive South & Street B/ Commerical Plaza	TWSC	LOS	<	B	>	**B**	<	C	>	**C**	<	A	>	**A**	<	A	>	**A**	**A**
			Delay	<	10	>	**10**	<	16	>	**16**	<	0	>	**0**	<	0	>	**0**	**0**
			V/C	<	0.01	>		<	0.04	>		<	0.35	>		<	0.18	>		
			Q	<	0	>		<	1	>		<	0	>		<	0	>		
	3 - Ardagh Road & Street A	TWSC	LOS	<	A		**A**		A	>	**A**					B		>	**B**	**A**
			Delay	<	0		**0**		0	>	**0**					13		>	**13**	**0**
			V/C	<	0.01				0.40	>						0.05		>		
			Q	<	0				0	>						1		>		

MOE - Measure of Effectiveness
LOS - Level of Service
Delay - Average Delay per Vehicle in Seconds

Q - 95th Percentile Queue Length
Ex. Existing Available Storage
Avail. - Available Storage (m)

TCS - Traffic Control Signal
TWSC - Two-Way Stop Control
> - Shared Right-Turn Lane

< - Shared Left-Turn Lane

Conclusions and Recommendations

For the 2020 and 2025 future traffic conditions, all intersections and movements within the study area are forecast to operate at acceptable levels of service and well within capacity during the weekday AM and PM peak hours. The proposed development can be accommodated by the existing transportation road network with no improvements required from an operational or volume perspective. The overall conclusions remain consistent with the findings previously outlined in the May 2018 Traffic Brief. The restriction of the Ferndale Drive access to right-in/right-out is concluded not to adversely impact traffic operations in the study area.

Based on the findings of this addendum, it is recommended the City of Barrie recognize the conclusions drawn above and that the development be approved as proposed with no conditions related to off-site transportation improvements.

Yours very truly,

PARADIGM TRANSPORTATION SOLUTIONS LIMITED

Adrian Soo
P.Eng.
Senior Project Manager

Attachment A – City of Barrie Traffic and Parking Services Comments

Traffic and Parking Services
Pre-Consultation Application

To:	**F. Palka, C.E.T., Manager of Development Services**
From:	**J. MacDonald C.E.T., Senior Transportation Operations Technologist (Ext. 5178)**
Date:	**November 15, 2019**
Re:	**D11-021-2019 – 224 Ardagh Road**

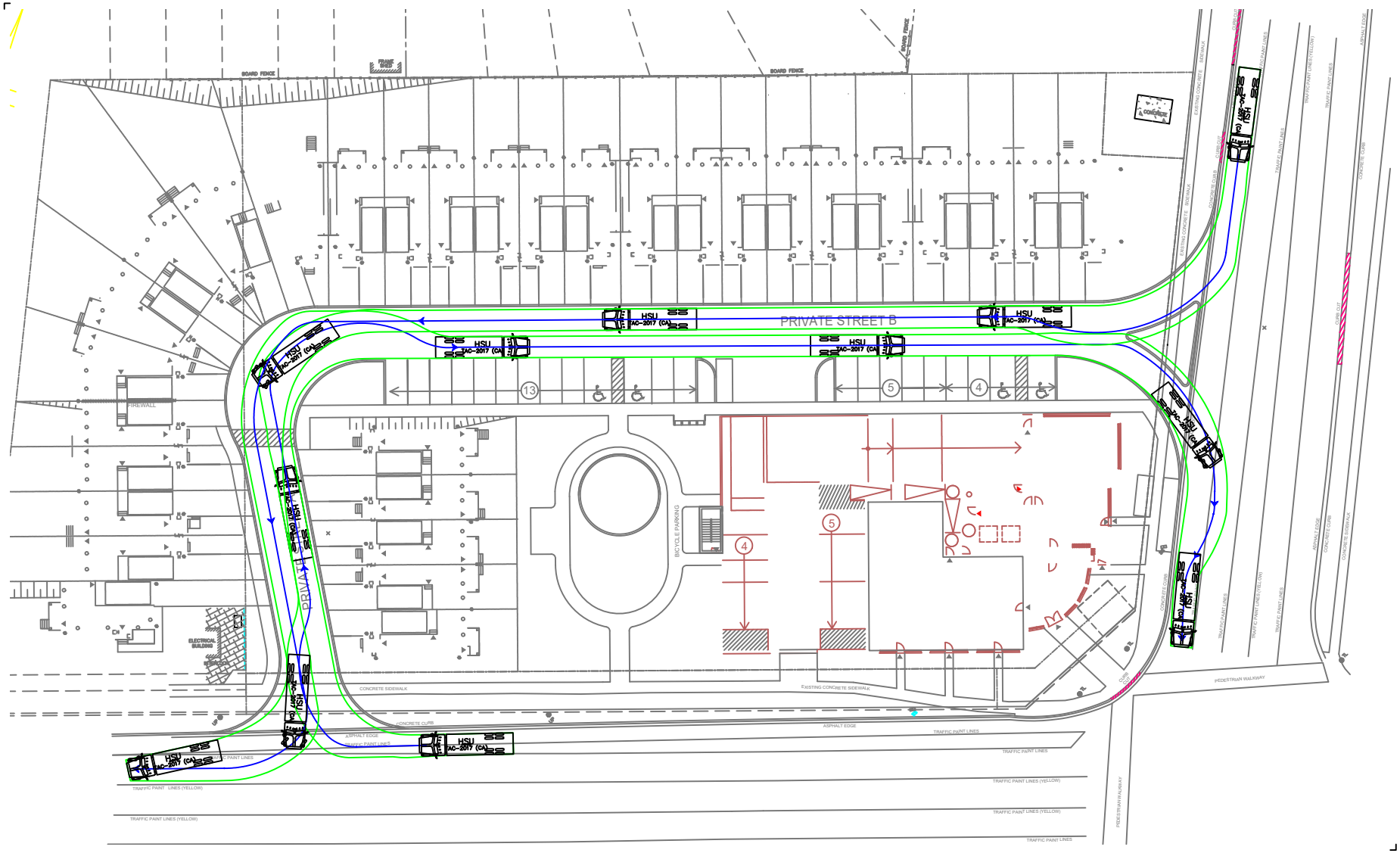
Staff reviewed the proposed site plan D11-021-2019 for 224 Ardagh Road and have the following comments:

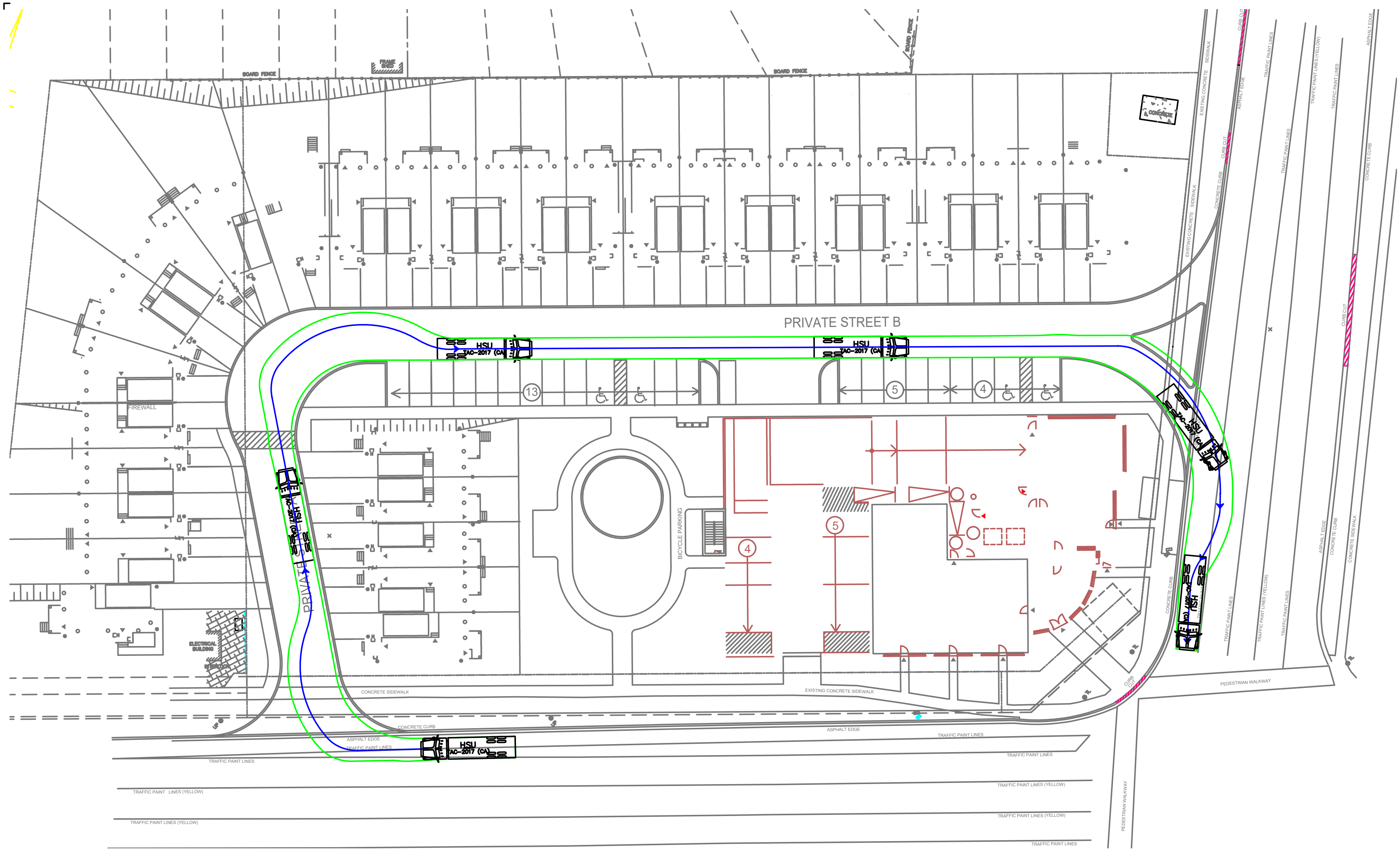
1. The submitted Traffic Impact Study shall be updated to reflect the access onto Ferndale Drive being restricted to right turn in/right turn out only.
2. Staff do not support a full move access onto Ferndale Drive, as the proposed access is within 70 m of the intersection of Ferndale Drive and Ardagh Road. Staff require this access be restricted to right turn in/right turn out only by implementation of a “pork chop” island.
3. The proposed accesses on Ardagh Road shall be 9.0m wide with 8.0m curb radius, and 15m in length and terminate 0.3m offset from property.
4. That the Owner/Applicant provides a drawing that clearly identify on the site plan all proposed pavement markings and traffic signs. All pavement markings and traffic signs shall conform to the Ontario Traffic Manuals.
5. Pavement markings for parking stalls shall be painted white and conform to OPSS 1712.
6. The proposed exterior light fixtures are full cut off.
7. Staff require to photometric plan to be updated to show the lighting levels extended to property line to ensure there is no light pollution on the adjacent property.
8. Clarification is required regarding waste collection, please confirm all waste receptacles will be transportation to the loading zone for collection as the garbage room is located in the underground parking with no vehicle access.
9. Label all curb cuts.
10. Hatch out all “dead space” adjacent to parking stalls to notify drivers this is not a parking space.
11. Hatching should be provided adjacent to all doorways to notify drivers pedestrians may be present.
12. Staff recommend implement short term surface bicycle parking to promote active transportation.

J. MacDonald

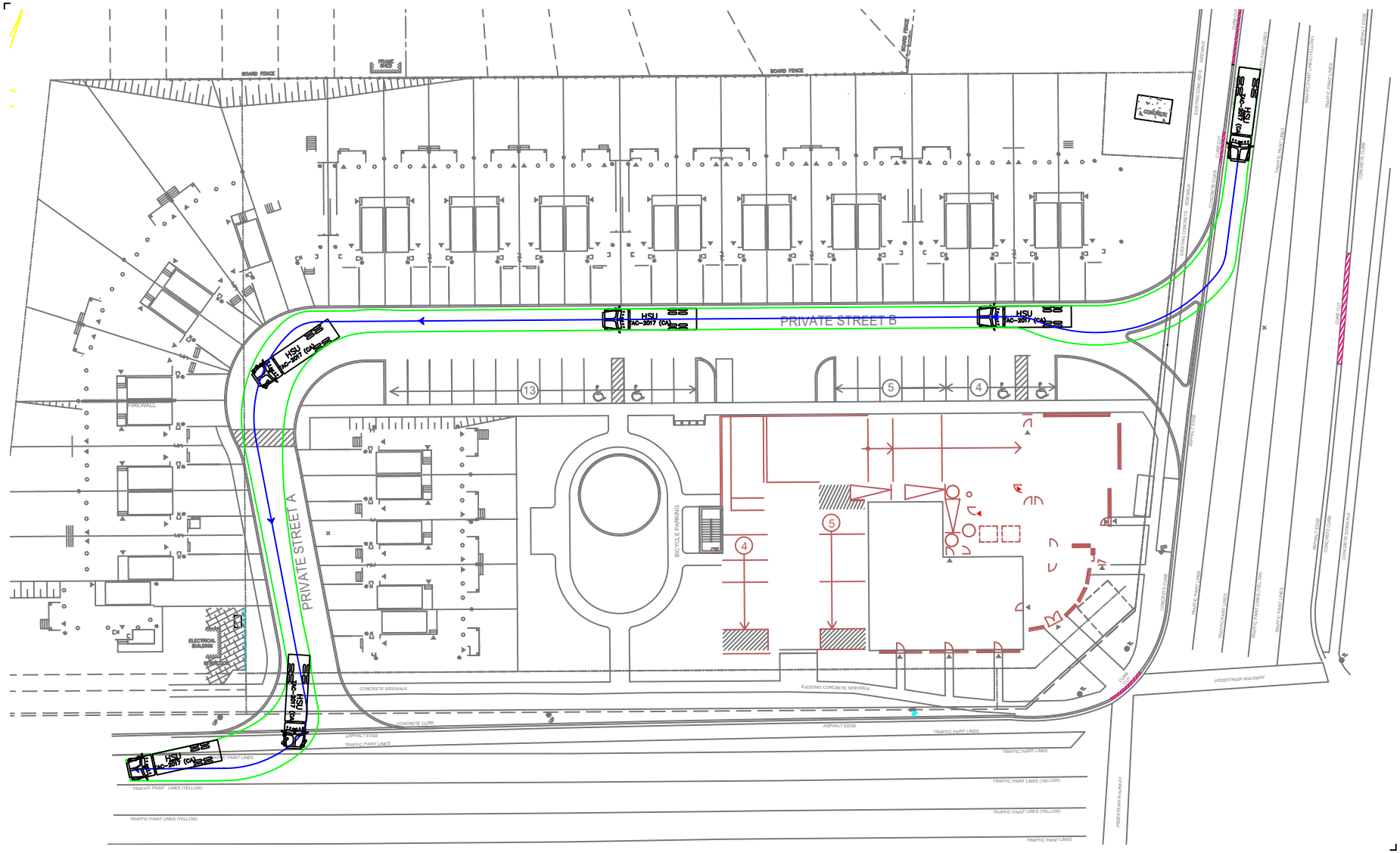
Justin MacDonald, C.E.T.
Senior Transportation Operations Technologist

Attachment B – AutoTURN Vehicle Diagrams


PRIVATE STREET B
HSU
AC-2017 (CA)
BOARD FENCE
TRANSFORMER
CONCRETE
EXISTING CONCRETE SIDEWALK
CONCRETE CURB
ASPHALT EDGE
TRAFFIC PAINT LINES
TRAFFIC PAINT LINES (YELLOW)
CONCRETE SIDEWALK
FIREWALL
ELECTRICAL BUILDING
BICYCLE PARKING
PEDESTRIAN WALKWAY
DRIVEWAY
13
5
4



PRIVATE STREET B
PRIVATE
BOARD FENCE
FRAME SHED
CONCRETE
FIREWALL
ELECTRICAL BUILDING
BICYCLE PARKING
13
5
4
HSU
TAC-2017 (CA)
CONCRETE SIDEWALK
EXISTING CONCRETE SIDEWALK
CONCRETE CURB
ASPHALT EDGE
TRAFFIC PAINT LINES
TRAFFIC PAINT LINES (YELLOW)
PEDESTRIAN WALKWAY
CURB CUT


PRIVATE STREET B
PRIVATE STREET A
BOARD FENCE
HSU (AC-2017 (CA))
BICYCLE PARKING
CONCRETE SIDEWALK
EXISTING CONCRETE SIDEWALK
ASPHALT EDGE
CONCRETE CURB
TRAFFIC PAINT LINES
TRAFFIC PAINT LINES (YELLOW)
PEDESTRIAN WALKWAY
FIREWALL
ELECTRICAL BUILDING
CONCRETE

Attachment C – 2020 Total Traffic Operations Reports

Queues
1: Ferndale Drive & Ardagh Road

03-13-2020

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	170	347	214	74	236	62	135	350	121	486
v/c Ratio	0.48	0.72	0.38	0.25	0.56	0.14	0.30	0.26	0.22	0.38
Control Delay	23.8	39.6	5.8	19.3	35.0	0.8	14.3	16.7	13.3	20.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.8	39.6	5.8	19.3	35.0	0.8	14.3	16.7	13.3	20.4
Queue Length 50th (m)	20.5	58.7	0.0	8.4	37.4	0.0	11.9	17.9	10.6	30.3
Queue Length 95th (m)	25.6	89.1	0.0	16.8	42.0	0.7	16.5	28.5	23.6	47.8
Internal Link Dist (m)		85.5			159.1			146.2		32.5
Turn Bay Length (m)	50.0		60.0	50.0		50.0	35.0		40.0	
Base Capacity (vph)	357	631	677	300	613	585	455	1330	549	1292
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	0.48	0.55	0.32	0.25	0.38	0.11	0.30	0.26	0.22	0.38

Intersection Summary

HCM Signalized Intersection Capacity Analysis
1: Ferndale Drive & Ardagh Road

03-13-2020

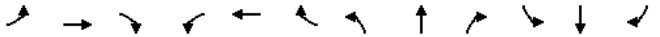
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	117	312	120	66	158	57	81	205	88	109	337	72
Future Volume (vph)	117	312	120	66	158	57	81	205	88	109	337	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.99	1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	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	0.96		1.00	0.97	
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)	1735	1863	1583	1767	1810	1490	1732	3358		1781	3313	
Flt Permitted	0.46	1.00	1.00	0.34	1.00	1.00	0.43	1.00		0.54	1.00	
Satd. Flow (perm)	834	1863	1583	633	1810	1490	785	3358		1006	3313	
Peak-hour factor, PHF	0.69	0.90	0.56	0.89	0.67	0.92	0.60	0.82	0.88	0.90	0.87	0.73
Adj. Flow (vph)	170	347	214	74	236	62	135	250	100	121	387	99
RTOR Reduction (vph)	0	0	159	0	0	47	0	41	0	0	22	0
Lane Group Flow (vph)	170	347	55	74	236	15	135	309	0	121	464	0
Confl. Peds. (#/hr)	1		8	8		1	6		7	7		6
Heavy Vehicles (%)	4%	2%	0%	2%	5%	7%	4%	2%	2%	1%	4%	9%
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	30.2	23.2	23.2	27.0	21.6	21.6	41.2	34.2		41.2	34.2	
Effective Green, g (s)	30.2	23.2	23.2	27.0	21.6	21.6	41.2	34.2		41.2	34.2	
Actuated g/C Ratio	0.34	0.26	0.26	0.30	0.24	0.24	0.46	0.38		0.46	0.38	
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0		4.0	6.0	
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)	350	481	408	258	435	358	433	1278		521	1261	
v/s Ratio Prot	c0.04	c0.19		0.02	0.13		c0.02	0.09		0.02	c0.14	
v/s Ratio Perm	0.13		0.03	0.07		0.01	0.12			0.09		
v/c Ratio	0.49	0.72	0.14	0.29	0.54	0.04	0.31	0.24		0.23	0.37	
Uniform Delay, d1	22.2	30.4	25.6	23.3	29.8	26.2	14.3	19.0		14.1	20.0	
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	1.1	5.3	0.2	0.6	1.4	0.0	0.4	0.4		0.2	0.8	
Delay (s)	23.2	35.6	25.7	23.9	31.2	26.2	14.7	19.4		14.3	20.8	
Level of Service	C	D	C	C	C	C	B	B		B	C	
Approach Delay (s)		29.9			28.9			18.1			19.6	
Approach LOS		C			C			B			B	

Intersection Summary					
HCM 2000 Control Delay	24.2	HCM 2000 Level of Service		C	
HCM 2000 Volume to Capacity ratio	0.50				
Actuated Cycle Length (s)	89.8	Sum of lost time (s)		20.0	
Intersection Capacity Utilization	74.7%	ICU Level of Service		D	
Analysis Period (min)	15				

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
2: Ferndale Drive & Street B/Commercial Plaza

03-13-2020



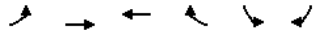
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	8	0	0	0	0	377	2	0	510	3
Future Volume (Veh/h)	0	0	8	0	0	0	0	377	2	0	510	3
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	9	0	0	0	0	410	2	0	554	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)								56				
pX, platoon unblocked	0.99	0.99		0.99	0.99	0.99				0.99		
vC, conflicting volume	760	968	278	697	968	206	557			412		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	739	948	278	675	948	179	557			387		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	99	100	100	100	100			100		
cM capacity (veh/h)	306	260	725	336	260	831	1024			1171		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	9	0	273	139	277	280
Volume Left	0	0	0	0	0	0
Volume Right	9	0	0	2	0	3
cSH	725	1700	1700	1700	1171	1700
Volume to Capacity	0.01	0.00	0.16	0.08	0.00	0.16
Queue Length 95th (m)	0.3	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	10.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	A				
Approach Delay (s)	10.0	0.0	0.0		0.0	
Approach LOS	B	A				

Intersection Summary				
Average Delay	0.1			
Intersection Capacity Utilization	24.2%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
3: Ardagh Road & Street A

03-13-2020



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	3	536	307	4	13	5
Future Volume (Veh/h)	3	536	307	4	13	5
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)	3	583	334	4	14	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage veh)		2	2			
Upstream signal (m)			109			
pX, platoon unblocked	0.92				0.92	0.92
vC, conflicting volume	338				925	336
vC1, stage 1 conf vol					336	
vC2, stage 2 conf vol					589	
vCu, unblocked vol	234				874	232
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	100				97	99
cM capacity (veh/h)	1235				499	746

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	586	338	19
Volume Left	3	0	14
Volume Right	0	4	5
cSH	1235	1700	546
Volume to Capacity	0.00	0.20	0.03
Queue Length 95th (m)	0.1	0.0	0.9
Control Delay (s)	0.1	0.0	11.8
Lane LOS	A		B
Approach Delay (s)	0.1	0.0	11.8
Approach LOS			B

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	40.6%	ICU Level of Service	A
Analysis Period (min)	15		

Queues
1: Ferndale Drive & Ardagh Road

03-13-2020

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	101	195	116	132	376	182	174	653	76	498
v/c Ratio	0.36	0.44	0.25	0.32	0.75	0.33	0.38	0.46	0.19	0.37
Control Delay	21.2	31.6	5.9	20.1	41.0	5.8	15.8	22.1	13.8	20.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.2	31.6	5.9	20.1	41.0	5.8	15.8	22.1	13.8	20.5
Queue Length 50th (m)	11.7	30.0	0.0	15.5	64.7	0.0	16.4	46.3	6.7	31.7
Queue Length 95th (m)	17.7	46.2	11.5	26.9	97.0	14.2	25.9	70.5	16.0	50.4
Internal Link Dist (m)		85.5			159.1			146.2		32.5
Turn Bay Length (m)	50.0		60.0	50.0		50.0	35.0		40.0	
Base Capacity (vph)	278	625	611	412	631	649	456	1435	401	1332
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	0.36	0.31	0.19	0.32	0.60	0.28	0.38	0.46	0.19	0.37

Intersection Summary

HCM Signalized Intersection Capacity Analysis
1: Ferndale Drive & Ardagh Road

03-13-2020

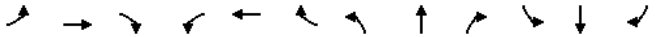
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	75	166	104	116	350	160	129	507	74	71	358	89
Future Volume (vph)	75	166	104	116	350	160	129	507	74	71	358	89
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.98	1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	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	0.98		1.00	0.97	
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)	1752	1863	1581	1799	1881	1573	1803	3485		1801	3437	
Flt Permitted	0.29	1.00	1.00	0.53	1.00	1.00	0.40	1.00		0.34	1.00	
Satd. Flow (perm)	539	1863	1581	1002	1881	1573	765	3485		649	3437	
Peak-hour factor, PHF	0.74	0.85	0.90	0.88	0.93	0.88	0.74	0.90	0.82	0.93	0.92	0.82
Adj. Flow (vph)	101	195	116	132	376	182	174	563	90	76	389	109
RTOR Reduction (vph)	0	0	88	0	0	134	0	12	0	0	25	0
Lane Group Flow (vph)	101	195	28	132	376	48	174	641	0	76	473	0
Confl. Peds. (#/hr)	4		9	9		4	4		14	14		4
Heavy Vehicles (%)	3%	2%	0%	0%	1%	1%	0%	1%	0%	0%	1%	1%
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	27.8	22.4	22.4	31.0	24.0	24.0	43.7	36.7		40.5	35.1	
Effective Green, g (s)	27.8	22.4	22.4	31.0	24.0	24.0	43.7	36.7		40.5	35.1	
Actuated g/C Ratio	0.30	0.24	0.24	0.34	0.26	0.26	0.48	0.40		0.44	0.38	
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0		4.0	6.0	
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)	235	456	387	400	493	412	444	1397		355	1318	
v/s Ratio Prot	c0.03	0.10		c0.03	c0.20		c0.03	c0.18		0.01	0.14	
v/s Ratio Perm	0.10		0.02	0.09		0.03	0.16			0.08		
v/c Ratio	0.43	0.43	0.07	0.33	0.76	0.12	0.39	0.46		0.21	0.36	
Uniform Delay, d1	24.2	29.1	26.6	21.7	31.1	25.7	14.0	20.1		15.0	20.2	
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	1.3	0.6	0.1	0.5	6.9	0.1	0.6	1.1		0.3	0.8	
Delay (s)	25.4	29.8	26.7	22.2	38.0	25.8	14.6	21.2		15.3	20.9	
Level of Service	C	C	C	C	D	C	B	C		B	C	
Approach Delay (s)		27.8			31.8			19.8			20.2	
Approach LOS		C			C			B			C	

Intersection Summary						
HCM 2000 Control Delay	24.5	HCM 2000 Level of Service	C			
HCM 2000 Volume to Capacity ratio	0.56					
Actuated Cycle Length (s)	91.5	Sum of lost time (s)	20.0			
Intersection Capacity Utilization	76.9%	ICU Level of Service	D			
Analysis Period (min)	15					

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
2: Ferndale Drive & Street B/Commercial Plaza

03-13-2020



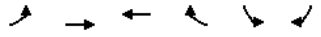
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	4	5	0	5	0	735	7	2	509	8
Future Volume (Veh/h)	0	0	4	5	0	5	0	735	7	2	509	8
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	4	5	0	5	0	799	8	2	553	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)								56				
pX, platoon unblocked	0.87	0.87		0.87	0.87	0.87				0.87		
vC, conflicting volume	966	1368	281	1088	1369	404	562			807		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	673	1133	281	812	1134	29	562			491		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	99	98	100	99	100			100		
cM capacity (veh/h)	300	178	722	238	178	914	1019			947		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	4	10	533	274	278	286
Volume Left	0	5	0	0	2	0
Volume Right	4	5	0	8	0	9
cSH	722	378	1700	1700	947	1700
Volume to Capacity	0.01	0.03	0.31	0.16	0.00	0.17
Queue Length 95th (m)	0.1	0.7	0.0	0.0	0.1	0.0
Control Delay (s)	10.0	14.8	0.0	0.0	0.1	0.0
Lane LOS	B	B			A	
Approach Delay (s)	10.0	14.8	0.0		0.0	
Approach LOS	B	B				

Intersection Summary				
Average Delay	0.2			
Intersection Capacity Utilization	31.0%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
3: Ardagh Road & Street A

03-13-2020



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	5	332	548	20	13	6
Future Volume (Veh/h)	5	332	548	20	13	6
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	361	596	22	14	7
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage veh)		2	2			
Upstream signal (m)			109			
pX, platoon unblocked	0.77				0.77	0.77
vC, conflicting volume	618				978	607
vC1, stage 1 conf vol					607	
vC2, stage 2 conf vol					371	
vCu, unblocked vol	349				819	335
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	99				97	99
cM capacity (veh/h)	936				484	545

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	366	618	21
Volume Left	5	0	14
Volume Right	0	22	7
cSH	936	1700	503
Volume to Capacity	0.01	0.36	0.04
Queue Length 95th (m)	0.1	0.0	1.0
Control Delay (s)	0.2	0.0	12.5
Lane LOS	A		B
Approach Delay (s)	0.2	0.0	12.5
Approach LOS			B

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	40.1%	ICU Level of Service	A
Analysis Period (min)	15		

Attachment D – 2025 Total Traffic Operations Reports

Queues
1: Ferndale Drive & Ardagh Road

03-13-2020

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	187	381	236	82	260	68	148	392	133	536
v/c Ratio	0.53	0.75	0.39	0.29	0.59	0.15	0.35	0.30	0.26	0.42
Control Delay	25.3	40.8	5.6	19.7	35.3	1.4	15.7	18.2	14.3	21.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.3	40.8	5.6	19.7	35.3	1.4	15.7	18.2	14.3	21.7
Queue Length 50th (m)	22.8	66.0	0.0	9.4	41.9	0.0	13.9	21.9	12.3	35.7
Queue Length 95th (m)	27.9	98.8	0.0	18.2	46.0	1.8	17.8	32.6	25.5	53.2
Internal Link Dist (m)		85.5			159.1			146.2		32.5
Turn Bay Length (m)	50.0		60.0	50.0		50.0	35.0		40.0	
Base Capacity (vph)	350	620	684	284	602	577	419	1308	511	1271
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	0.53	0.61	0.35	0.29	0.43	0.12	0.35	0.30	0.26	0.42

Intersection Summary

HCM Signalized Intersection Capacity Analysis
1: Ferndale Drive & Ardagh Road

03-13-2020

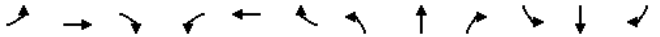
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	129	343	132	73	174	63	89	231	97	120	371	80
Future Volume (vph)	129	343	132	73	174	63	89	231	97	120	371	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.99	1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	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	0.96		1.00	0.97	
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)	1735	1863	1583	1768	1810	1490	1733	3361		1782	3311	
Flt Permitted	0.43	1.00	1.00	0.30	1.00	1.00	0.39	1.00		0.50	1.00	
Satd. Flow (perm)	778	1863	1583	553	1810	1490	714	3361		936	3311	
Peak-hour factor, PHF	0.69	0.90	0.56	0.89	0.67	0.92	0.60	0.82	0.88	0.90	0.87	0.73
Adj. Flow (vph)	187	381	236	82	260	68	148	282	110	133	426	110
RTOR Reduction (vph)	0	0	172	0	0	51	0	40	0	0	23	0
Lane Group Flow (vph)	187	381	64	82	260	17	148	352	0	133	513	0
Confl. Peds. (#/hr)	1		8	8		1	6		7	7		6
Heavy Vehicles (%)	4%	2%	0%	2%	5%	7%	4%	2%	2%	1%	4%	9%
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	31.7	24.7	24.7	28.5	23.1	23.1	41.2	34.2		41.2	34.2	
Effective Green, g (s)	31.7	24.7	24.7	28.5	23.1	23.1	41.2	34.2		41.2	34.2	
Actuated g/C Ratio	0.35	0.27	0.27	0.31	0.25	0.25	0.45	0.37		0.45	0.37	
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0		4.0	6.0	
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)	343	504	428	244	457	376	400	1258		487	1240	
v/s Ratio Prot	c0.04	c0.20		0.02	0.14		c0.03	0.10		0.02	c0.16	
v/s Ratio Perm	0.15		0.04	0.08		0.01	0.14			0.10		
v/c Ratio	0.55	0.76	0.15	0.34	0.57	0.05	0.37	0.28		0.27	0.41	
Uniform Delay, d1	22.3	30.5	25.3	23.3	29.8	25.8	15.2	19.9		14.9	21.1	
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	1.8	6.4	0.2	0.8	1.6	0.1	0.6	0.6		0.3	1.0	
Delay (s)	24.1	36.9	25.5	24.1	31.4	25.8	15.8	20.5		15.2	22.2	
Level of Service	C	D	C	C	C	C	B	C		B	C	
Approach Delay (s)		30.6			29.0			19.2			20.8	
Approach LOS		C			C			B			C	

Intersection Summary						
HCM 2000 Control Delay	25.1	HCM 2000 Level of Service	C			
HCM 2000 Volume to Capacity ratio	0.55					
Actuated Cycle Length (s)	91.3	Sum of lost time (s)	20.0			
Intersection Capacity Utilization	76.6%	ICU Level of Service	D			
Analysis Period (min)	15					

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
2: Ferndale Drive & Street B/Commercial Plaza

03-13-2020



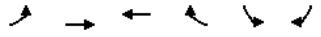
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	8	0	0	0	0	416	2	0	563	3
Future Volume (Veh/h)	0	0	8	0	0	0	0	416	2	0	563	3
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	9	0	0	0	0	452	2	0	612	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)								56				
pX, platoon unblocked	0.98	0.98		0.98	0.98	0.98				0.98		
vC, conflicting volume	840	1068	308	768	1068	227	615			454		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	797	1029	308	724	1030	172	615			404		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	99	100	100	100	100			100		
cM capacity (veh/h)	276	231	694	307	231	832	974			1143		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	9	0	301	153	306	309
Volume Left	0	0	0	0	0	0
Volume Right	9	0	0	2	0	3
cSH	694	1700	1700	1700	1143	1700
Volume to Capacity	0.01	0.00	0.18	0.09	0.00	0.18
Queue Length 95th (m)	0.3	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	10.3	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	A				
Approach Delay (s)	10.3	0.0	0.0		0.0	
Approach LOS	B	A				

Intersection Summary				
Average Delay	0.1			
Intersection Capacity Utilization	25.7%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
3: Ardagh Road & Street A

03-13-2020



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	3	591	339	4	13	5
Future Volume (Veh/h)	3	591	339	4	13	5
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)	3	642	368	4	14	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage veh)		2	2			
Upstream signal (m)			109			
pX, platoon unblocked	0.90				0.90	0.90
vC, conflicting volume	372				1018	370
vC1, stage 1 conf vol					370	
vC2, stage 2 conf vol					648	
vCu, unblocked vol	243				963	241
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	100				97	99
cM capacity (veh/h)	1198				466	721

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	645	372	19
Volume Left	3	0	14
Volume Right	0	4	5
cSH	1198	1700	513
Volume to Capacity	0.00	0.22	0.04
Queue Length 95th (m)	0.1	0.0	0.9
Control Delay (s)	0.1	0.0	12.3
Lane LOS	A		B
Approach Delay (s)	0.1	0.0	12.3
Approach LOS			B

Intersection Summary				
Average Delay	0.3			
Intersection Capacity Utilization	43.5%	ICU Level of Service	A	
Analysis Period (min)	15			

Queues
1: Ferndale Drive & Ardagh Road

03-13-2020

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	111	215	127	145	414	201	192	722	85	556
v/c Ratio	0.43	0.46	0.26	0.36	0.79	0.35	0.46	0.51	0.23	0.42
Control Delay	22.6	31.6	6.2	20.5	43.0	6.8	18.1	23.7	14.9	22.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.6	31.6	6.2	20.5	43.0	6.8	18.1	23.7	14.9	22.0
Queue Length 50th (m)	12.9	33.5	0.0	17.2	73.1	2.1	19.3	55.0	8.0	38.1
Queue Length 95th (m)	19.2	50.7	12.8	29.2	108.5	17.1	28.2	79.3	17.4	57.2
Internal Link Dist (m)		85.5			159.1			146.2		32.5
Turn Bay Length (m)	50.0		60.0	50.0		50.0	35.0		40.0	
Base Capacity (vph)	259	616	607	405	621	644	416	1415	362	1313
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	0.43	0.35	0.21	0.36	0.67	0.31	0.46	0.51	0.23	0.42

Intersection Summary

HCM Signalized Intersection Capacity Analysis
1: Ferndale Drive & Ardagh Road

03-13-2020

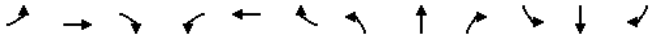
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	82	183	114	128	385	177	142	560	82	79	401	98
Future Volume (vph)	82	183	114	128	385	177	142	560	82	79	401	98
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.98	1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	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	0.98		1.00	0.97	
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)	1752	1863	1581	1800	1881	1573	1803	3484		1802	3439	
Flt Permitted	0.25	1.00	1.00	0.50	1.00	1.00	0.36	1.00		0.30	1.00	
Satd. Flow (perm)	455	1863	1581	945	1881	1573	683	3484		565	3439	
Peak-hour factor, PHF	0.74	0.85	0.90	0.88	0.93	0.88	0.74	0.90	0.82	0.93	0.92	0.82
Adj. Flow (vph)	111	215	127	145	414	201	192	622	100	85	436	120
RTOR Reduction (vph)	0	0	95	0	0	135	0	12	0	0	24	0
Lane Group Flow (vph)	111	215	32	145	414	66	192	710	0	85	532	0
Confl. Peds. (#/hr)	4		9	9		4	4		14	14		4
Heavy Vehicles (%)	3%	2%	0%	0%	1%	1%	0%	1%	0%	0%	1%	1%
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	29.2	23.8	23.8	32.6	25.5	25.5	43.9	36.8		40.5	35.1	
Effective Green, g (s)	29.2	23.8	23.8	32.6	25.5	25.5	43.9	36.8		40.5	35.1	
Actuated g/C Ratio	0.31	0.26	0.26	0.35	0.27	0.27	0.47	0.40		0.44	0.38	
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0		4.0	6.0	
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)	217	476	404	396	515	430	407	1377		317	1296	
v/s Ratio Prot	c0.03	0.12		c0.03	c0.22		c0.04	c0.20		0.02	0.15	
v/s Ratio Perm	0.13		0.02	0.10		0.04	0.19			0.10		
v/c Ratio	0.51	0.45	0.08	0.37	0.80	0.15	0.47	0.52		0.27	0.41	
Uniform Delay, d1	24.4	29.2	26.3	21.5	31.5	25.6	14.9	21.4		15.9	21.4	
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	2.0	0.7	0.1	0.6	8.9	0.2	0.9	1.4		0.5	1.0	
Delay (s)	26.4	29.8	26.4	22.1	40.3	25.8	15.8	22.8		16.4	22.3	
Level of Service	C	C	C	C	D	C	B	C		B	C	
Approach Delay (s)		28.0			33.0			21.3			21.5	
Approach LOS		C			C			C			C	

Intersection Summary					
HCM 2000 Control Delay	25.7	HCM 2000 Level of Service		C	
HCM 2000 Volume to Capacity ratio	0.62				
Actuated Cycle Length (s)	93.1	Sum of lost time (s)		20.0	
Intersection Capacity Utilization	79.2%	ICU Level of Service		D	
Analysis Period (min)	15				

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
2: Ferndale Drive & Street B/Commercial Plaza

03-13-2020



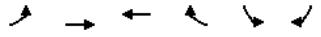
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	4	6	0	6	0	811	8	2	562	8
Future Volume (Veh/h)	0	0	4	6	0	6	0	811	8	2	562	8
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	4	7	0	7	0	882	9	2	611	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)								56				
pX, platoon unblocked	0.85	0.85		0.85	0.85	0.85				0.85		
vC, conflicting volume	1068	1510	310	1200	1510	446	620			891		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	736	1255	310	891	1255	7	620			529		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	99	97	100	99	100			100		
cM capacity (veh/h)	263	147	692	203	147	921	970			895		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	4	14	588	303	308	314
Volume Left	0	7	0	0	2	0
Volume Right	4	7	0	9	0	9
cSH	692	333	1700	1700	895	1700
Volume to Capacity	0.01	0.04	0.35	0.18	0.00	0.18
Queue Length 95th (m)	0.1	1.0	0.0	0.0	0.1	0.0
Control Delay (s)	10.2	16.3	0.0	0.0	0.1	0.0
Lane LOS	B	C			A	
Approach Delay (s)	10.2	16.3	0.0		0.0	
Approach LOS	B	C				

Intersection Summary					
Average Delay	0.2				
Intersection Capacity Utilization	32.7%	ICU Level of Service		A	
Analysis Period (min)	15				

HCM Unsignalized Intersection Capacity Analysis
3: Ardagh Road & Street A

03-13-2020



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	5	366	605	20	13	6
Future Volume (Veh/h)	5	366	605	20	13	6
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	398	658	22	14	7
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage veh)		2	2			
Upstream signal (m)			109			
pX, platoon unblocked	0.74				0.74	0.74
vC, conflicting volume	680				1077	669
vC1, stage 1 conf vol					669	
vC2, stage 2 conf vol					408	
vCu, unblocked vol	385				925	370
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	99				97	99
cM capacity (veh/h)	871				445	500

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	403	680	21
Volume Left	5	0	14
Volume Right	0	22	7
cSH	871	1700	462
Volume to Capacity	0.01	0.40	0.05
Queue Length 95th (m)	0.1	0.0	1.1
Control Delay (s)	0.2	0.0	13.2
Lane LOS	A		B
Approach Delay (s)	0.2	0.0	13.2
Approach LOS			B

Intersection Summary				
Average Delay	0.3			
Intersection Capacity Utilization	43.1%	ICU Level of Service		A
Analysis Period (min)	15			