Final Report

Transportation Impact Study – Montrose Road, North of McLeod Road, Niagara Falls

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IBI GROUP

Prepared for Gemini Ltd
by IBI Group
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1 Introduction

The ‘development site’ is located on the west side of Montrose Road, approximately 740 metres north of McLeod Road, in the City of Niagara Falls. At this location, Gemini Ltd (the ‘proponent’) proposes to construct a residential development (the ‘proposed development’) consisting of 91 townhome dwellings units.

The purpose of this report is to analyze the impact that the proposed development may have on the surrounding transportation network. This report takes into consideration future road configuration and background traffic growth in the area. The study also examines heavy vehicle circulation and swept paths.

This report is outlined with the following sections:

- **Section 1** through **4** discuss the Transportation Impact Study (TIS);
- **Section 5** discusses the access location analysis;
- **Section 6** and **7** discuss the traffic operations mitigation measures and the traffic analysis summary;
- **Section 8** discusses the vehicle swept path analysis;
- **Section 9** discusses the parking requirements; and
- **Section 10** discusses the study conclusions and recommendations.

This report adheres to the scope of investigation developed by IBI Group and discussed with City of Niagara Falls and Niagara Region staff on May 28, 2021. This correspondence is presented in **Appendix A**.

1.1 Study Area

The proposed development is located on the west side of Montrose Road, approximately 740 metres north of McLeod Road, in the City of Niagara Falls, as illustrated in **Exhibit 1-1**.

Exhibit 1-1: Development Study Area

Base Map Source: Niagara Maps. Retrieved on July 14, 2022 from https://navigator.niagararegion.ca/portal/apps/webappviewer/https://navigator.niagararegion.ca/portal/apps/webappviewer/

The areas immediately surrounding the development site primarily consist of lower-density residential uses, commercial uses, and vacant lands along Montrose Road.

The primary study area intersections were determined through consultation with the Review Agency staff and consist of the following locations (as noted in **Exhibit 1-1)**:

1. Montrose Road & Lundy's Lane (signalized);
2. Montrose Road & Kinsmen Court / Proposed North Site Access (unsignalized);
3. Montrose Road & Proposed South Site Access (unsignalized);
4. Montrose Road & McLeod Road (signalized);

1.2 Analysis Periods

Based on the proposed development's residential land uses, the following analysis periods were used in this study:

- AM Peak Period – 7:00 a.m. to 9:00 a.m. on a typical weekday; and
- PM Peak Period – 3:00 p.m. to 6:00 p.m. on a typical weekday

1.3 Proposed Development

The site statistics of the proposed development are shown in **Exhibit 1-2**.

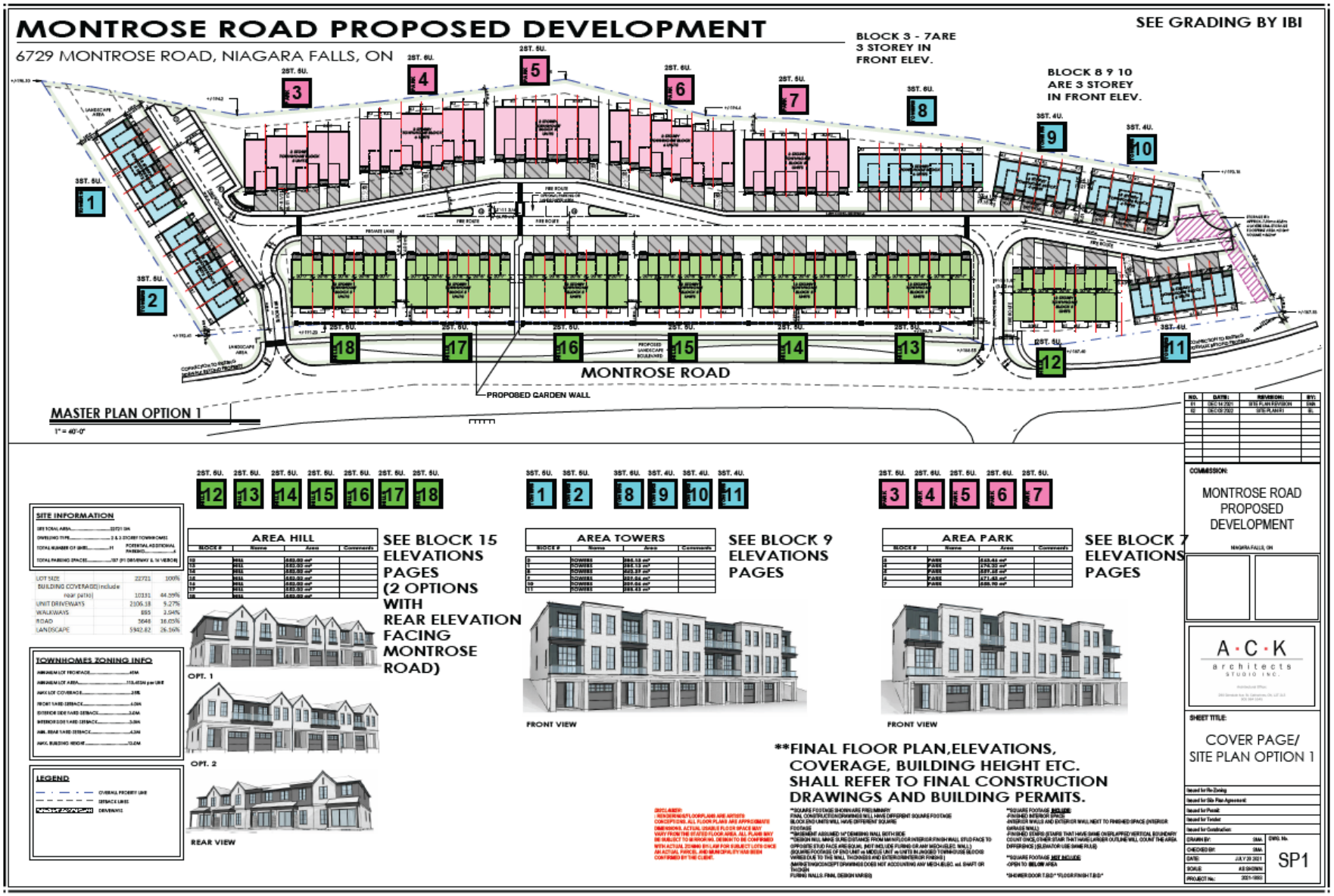
Exhibit 1-2: Site Statistics of the Proposed Development

Site Provisions	Amount Provided
2-Storey Townhomes	62
3-Storey Townhomes	29
Total Dwelling Units	91
Total Parking Spaces	198

As shown in **Exhibit 1-2**, the proposed development contemplates a total of 91 townhome dwelling units split into 62 2-storey townhomes and 29 3-storey townhomes. A total of 198 parking spaces are proposed for this site (91 dedicated driveway spaces and 91 garage spaces for each townhome, and 16 visitor parking spaces). Access to the proposed development is provided via two driveways on Montrose Road, with one of these accesses being the fourth approach of the Montrose Road and Kinsmen Court intersection.

The proposed site plan is illustrated in **Exhibit 1-3**. It must be noted that small changes in building sizes may occur as this development moves through the approval process. However, the assumptions in this report are conservative, and differences in traffic operations from these changes are expected to be negligible.

Exhibit 1-3: Proposed Site Plan



2 2022 Existing Conditions

This section documents the transportation network in the study area in 2022, including existing roadways, traffic control measures, intersection performance, walking and cycling facilities, and transit operations.

2.1 Existing Road Network

Exhibit 2-1 summarized the characteristics of the study area roadways.

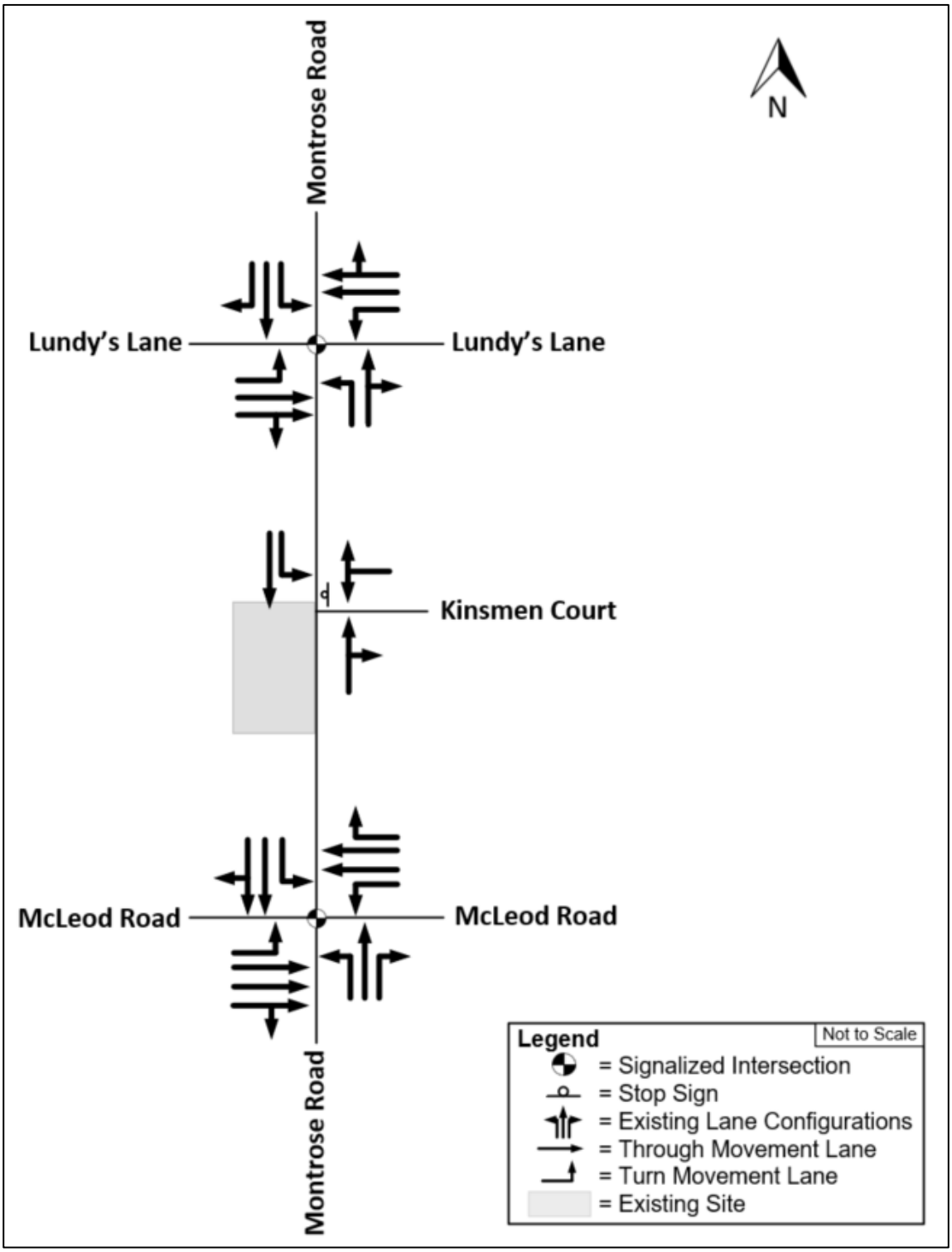
Exhibit 2-1: Study Roadway Characteristics

Street Name	Class.[1]	Orient.	Road Width (Lanes)	Traffic Direction	From	To	On-Street Parking	Speed Limit
Montrose Road	Arterial	North / South	2-4	Two-way	Kalar Road	Netherby Road	Prohibited	50-60 km/h
McLeod Road	Arterial	East / West	4-6	Two-way	Thorold Townline Road	Stanley Avenue	Prohibited	50 km/h
Lundy's Lane	Arterial	East / West	2-4	Two-way	Centre Street	Main Street	Prohibited	50-80 km/h
Kinsmen Court	Local	North / South	2	Two-way	Montrose Road	Cul-de-sac	Prohibited	50 km/h

Lane configurations for study area roadways are illustrated in **Exhibit 2-2**.

[1] Road classifications were obtained from the City of Niagara Falls Transportation Master Plan, dated October 2011. (https://niagarafalls.ca/pdf/transportation/transportation-master-plan-report.pdf)

Exhibit 2-2: Existing Study Area Lane Configurations



2.2 Existing Transit Network

The development site is served by several City of Niagara Falls transit bus routes, which primarily provide north / south service along Montrose Road and east / west service along McLeod Road. The nearest transit stop locates at approximately 25 metres to the south of the intersection of Montrose Road and Kinsmen Court.

Some of the transit services in the development area are illustrated in **Exhibit 2-3**. Service patterns and destinations of the routes in close proximity are illustrated in **Exhibit 2-4**.

Exhibit 2-3: Existing Transit Network

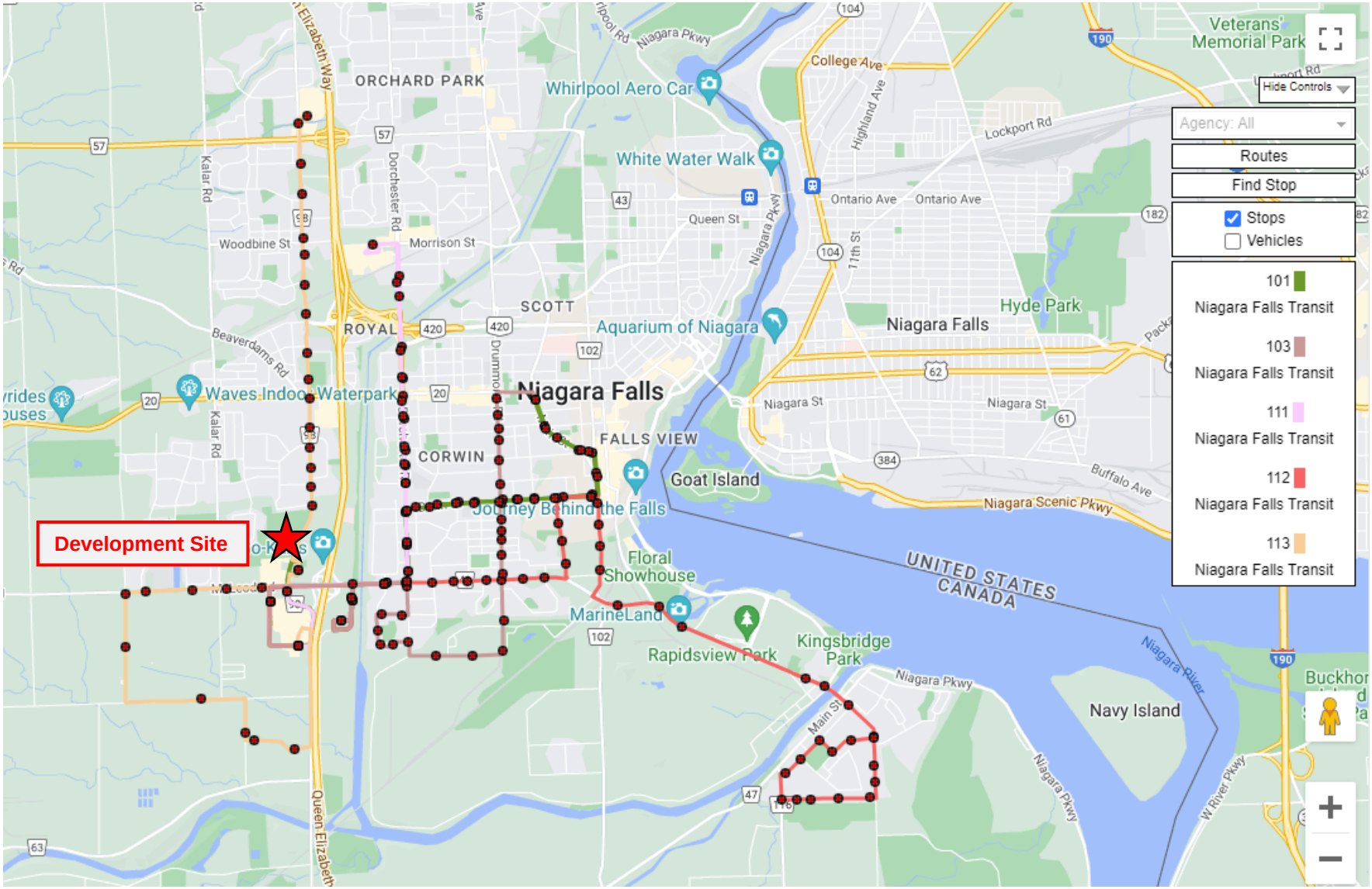


Image Source: Niagara Falls Transit Services. Retrieved August 9, 2022 from http://whereis.yourbus.com/bustime/map/

Exhibit 2-4: Existing Transit Service Patterns

Route	Onward Transit Connections	Approximate Walking Distance to Nearest Bus Stop [2]	Average Peak Hour Bus Service Frequency
113	Canadian Drive Hub, Boys & Girls Club, Montrose & Lundy's Lane, and Mt. Carmel Plaza	Directly Adjacent (< 1 minute)	60 minutes
213	Canadian Drive Hub, Boys & Girls Club, Montrose & Lundy's Lane, and Mt. Carmel Plaza	Directly Adjacent (< 1 minute)	60 minutes
101	Canadian Drive Hub, Walmart Plaza, Dorchester & Dunn, and Main & Ferry Hub	600 metres (10 minutes)	60 minutes
103	Canadian Drive Hub, Walmart Plaza, Dorchester & McLeod, Drummond & McLeod, and Main & Ferry Hub	600 metres (10 minutes)	60 minutes
203	Canadian Drive Hub, Walmart Plaza, Drummond & Dunn, and Main & Ferry Hub	600 metres (10 minutes)	30 minutes
105	Canadian Drive Hub, Elderberry, Kalar & Lundy's Lane, and Mt. Carmel Plaza	600 metres (10 minutes)	60 minutes
205	Canadian Drive Hub, Elderberry, Kalar & Lundy's Lane, and Mt. Carmel Plaza	600 metres (10 minutes)	60 minutes
111	Canadian Drive Hub, Dorchester & Lundy's Lane, and Morrison/Dorchester Hub	600 metres (10 minutes)	30 minutes
211	Canadian Drive Hub, Dorchester & Lundy's Lane, and Morrison/Dorchester Hub	600 metres (10 minutes)	30 minutes
112	Canadian Drive Hub, Walmart Plaza, Ailanthus & McLeod, and Gunning & Willoughby	600 metres (10 minutes)	60 minutes

2.3 Existing Active Transportation Network

The proposed development is well connected to the City of Niagara Falls cycling network and is located in close proximity to painted bicycle lanes. The available cycling routes are illustrated in **Exhibit 2-5**.

[2] Approximate walking speed of 1 m/s.

Exhibit 2-5: City of Niagara Falls Bicycle Route Map

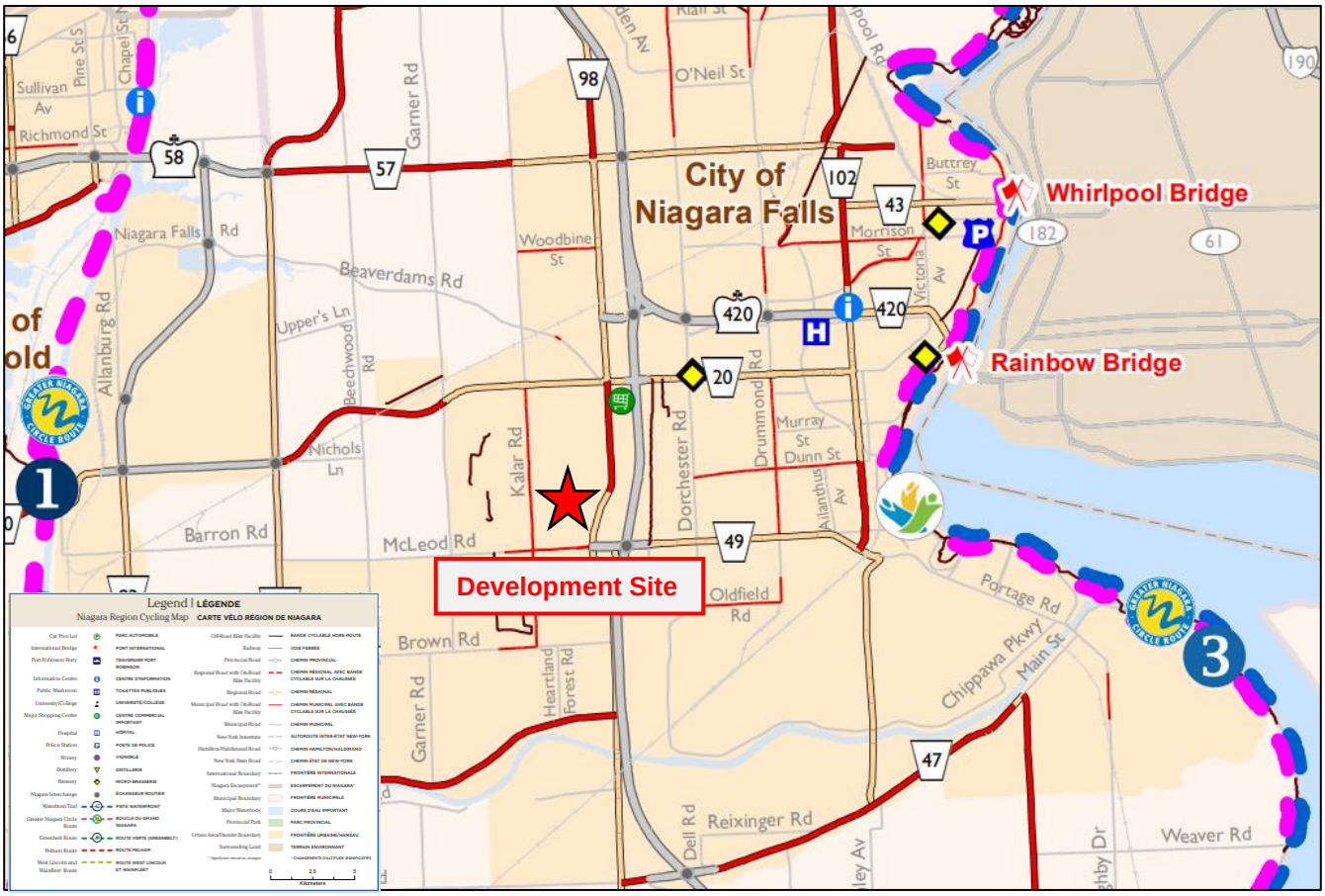


Image Source: Niagara Region. Retrieved July 15, 2022 from https://www.niagararegion.ca/exploring/cycle/bike-map.pdf

2.4 Turning Movement Counts

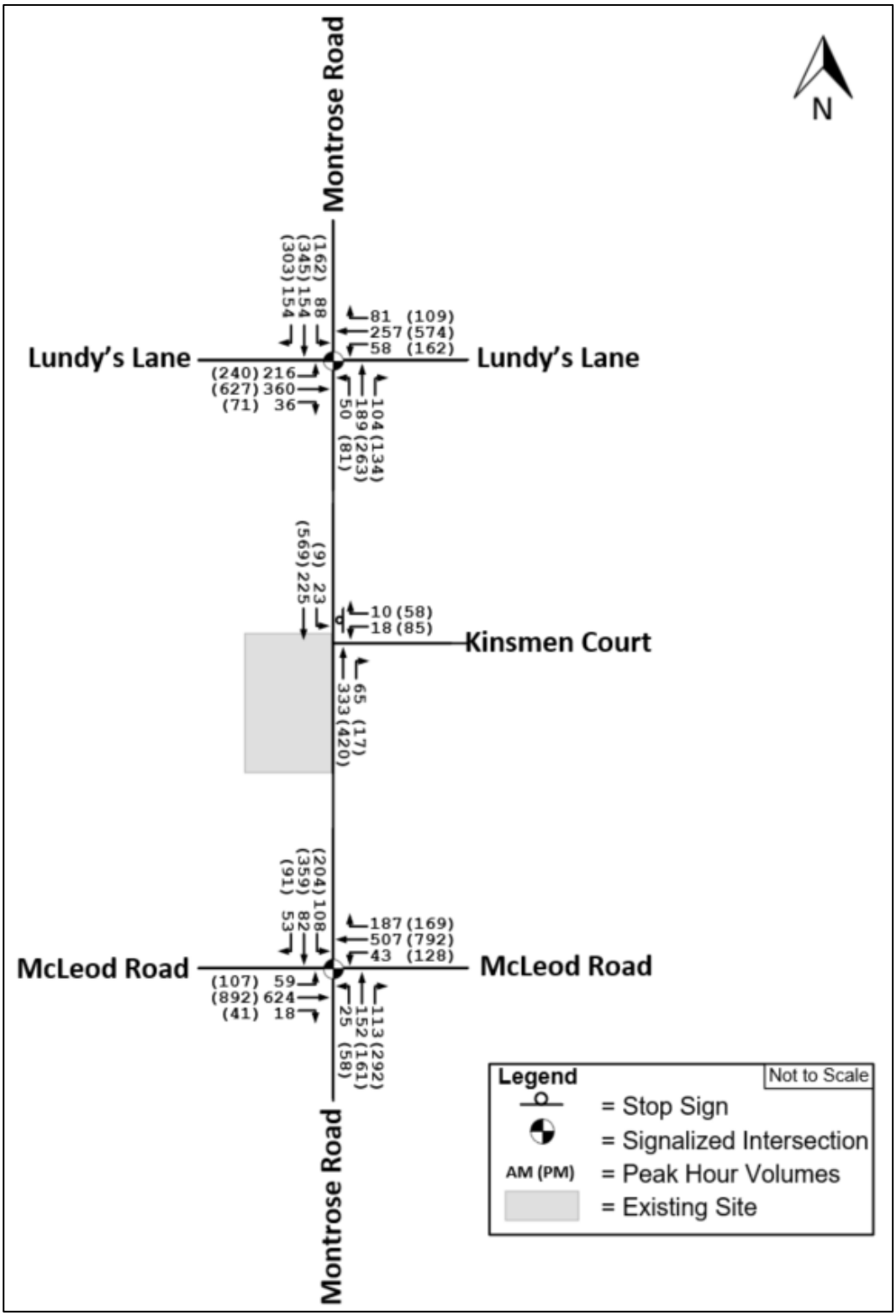
Turning movement counts (TMCs) for the study area signalized intersections were collected by Pyramid Traffic Inc. in August 2022. The TMCs were conducted from 7:00 a.m. to 9:00 a.m. (Weekday AM peak period) and from 4:00 p.m. to 6:00 p.m. (Weekday PM peak period). A summary of the observed vehicle volumes is presented in **Exhibit 2-6**, with full turning movement count data presented in **Appendix B**.

Exhibit 2-6: Traffic Data Information

Intersection	Data Source	Date	Peak Hour	
			AM Peak	PM Peak
Montrose Road & McLeod Road	Pyramid Traffic Inc.	Wednesday, August 10, 2022	8:00 a.m. – 9:00 a.m.	4:30 p.m. - 5:30 p.m.
Montrose Road & Kinsmen Court		Wednesday, August 10, 2022	8:00 a.m. – 9:00 a.m.	4:15 p.m. - 5:15 p.m.
Montrose Road & Lundy's Lane		Wednesday, August 10, 2022	8:00 a.m. – 9:00 a.m.	4:30 p.m. - 5:30 p.m.

A summary of the 2022 Existing Conditions traffic volumes is presented in **Exhibit 2-7**.

Exhibit 2-7: 2022 Existing Conditions Traffic Volumes



2.5 Signal Timing Plans

Signal timing plans for signalized study area intersections were provided by the City and are presented in **Appendix C**.

2.6 2022 Existing Conditions Analysis

Using the turning movement counts described in **Section 2.4**, the study area intersections were analyzed using the software package Synchro 11.0, which is based on the ***Highway Capacity Manual*** methodology. Based on the ***Niagara Region Guidelines for Transportation Impact Studies*** (May 2012), the criteria for identifying critical signalized intersections or movements are as follows:

- Volume to capacity (v/c) ratio exceeds 0.85 for through movements, shared through-right movements, or right-turn movements;
- v/c ratio exceeds 0.90 for dedicated left-turn movements.

Furthermore, the following criteria were used in identifying critical operations at unsignalized intersections:

- Level of service (LOS), based on average delay per vehicle, on the overall intersection or individual movement is “D” or worse; or
- 95th percentile queue for an individual lane exceeds the available queuing space.

Exhibit 2-8 and **Exhibit 2-9** detail existing traffic operations at the signalized intersections, and the unsignalized intersection, respectively, for the Weekday AM and PM Peak Hours. Full Highway Capacity Manual analysis for the Existing Conditions scenario is presented in **Appendix D**.

2.6.1 Signalized Intersections

The results of the 2022 Existing Conditions traffic operations analysis for signalized intersections are presented in **Exhibit 2-8**.

Exhibit 2-8: 2022 Existing Conditions Traffic Operations - Signalized

Intersection	Intersection			Movement	LOS	Delay (s)	v/c Ratio	95th Percentile Queue (m)	Lane Storage Capacity (m)
	LOS	Delay (s)	v/c Ratio						
Weekday AM Peak Hour									
Montrose Rd & McLeod Rd	C	27.6	0.47	EBL	B	14.3	0.22	14	64
				EBT	C	20.5	0.32	59	-
				WBL	B	16.0	0.17	12	164
				WBT	C	22.7	0.37	73	-
				WBR	C	22.9	0.32	60	-
				NBL	D	35.9	0.13	8	126
				NBT	D	53.5	0.75	49	-
				NBR	D	43.5	0.48	41	-
				SBL	C	31.2	0.51	26	148
				SBT	C	33.9	0.22	19	-
Montrose Rd & Lundy's Ln	C	33.7	0.63	EBL	C	30.7	0.68	58	74
				EBT	C	34.2	0.43	64	-
				WBL	C	31.5	0.25	17	45
				WBT	D	41.2	0.44	61	-
				NBL	C	22.6	0.17	14	58
				NBT	D	36.7	0.58	106	-
				SBL	C	23.0	0.32	23	-
				SBT	C	28.5	0.25	44	-
				SBR	C	31.8	0.40	50	93

Intersection	Intersection			Movement	LOS	Delay (s)	v/c Ratio	95th Percentile Queue (m)	Lane Storage Capacity (m)
	LOS	Delay (s)	v/c Ratio						
Weekday PM Peak Hour									
Montrose Rd & McLeod Rd	D	36.3	0.75	EBL	C	26.0	0.54	26	64
				EBT	C	34.9	0.61	89	-
				WBL	C	29.0	0.64	31	164
				WBT	D	37.7	0.70	112	-
				WBR	C	32.8	0.41	52	-
				NBL	C	30.0	0.28	15	126
				NBT	D	37.8	0.43	56	-
				NBR	E	66.0	0.89	128	-
				SBL	C	26.6	0.65	46	148
				SBT	C	30.7	0.49	63	-
Montrose Rd & Lundy's Ln	D	46.5	0.85	EBL	E	59.7	0.91	92	74
				EBT	D	47.5	0.74	127	-
				WBL	D	37.2	0.68	44	45
				WBT	D	54.0	0.81	121	-
				NBL	C	26.4	0.29	22	58
				NBT	D	53.1	0.81	181	-
				SBL	C	28.7	0.62	41	-
				SBT	D	37.0	0.57	116	-
				SBR	D	40.3	0.64	110	93

As shown in **Exhibit 2-8**, no movements exceeding critical thresholds were observed in existing conditions at the study area signalized intersections during the Weekday AM peak hour. During the PM peak hour, the following critical operations have been observed:

- At the Montrose Road and McLeod Road intersection, the NBR turning movement has a critical v/c ratio of 0.89; and
- At the Montrose Road and Lundy's Lane intersection, the EBL turning movement has a critical v/c ratio of 0.91.

2.6.2 Unsignalized Intersections

The results of the 2022 Existing Conditions traffic operations analysis for unsignalized intersections are presented in **Exhibit 2-9**.

Exhibit 2-9: 2022 Existing Conditions Traffic Operations - Unsignalized Intersections

Intersection	Intersection Delay (s)	Lane	Lane LOS	Lane Delay (s)	Lane v/c Ratio	Lane 95th Percentile Queue (m)	Lane Storage Capacity (m)
Weekday AM Peak Hour							
Montrose Rd & Kinsmen Ct	1.2	WBLR	C	19.2	0.15	4	-
		NBTR	A	0.0	0.00	0	-
		SBL	A	8.8	0.03	1	76.0
Weekday PM Peak Hour							
Montrose Rd & Kinsmen Ct	88.6	WBLR	F	383.9	1.72	185	-
		NBTR	A	0.0	0.00	0	-
		SBL	A	8.5	0.01	0	76.0

As shown in **Exhibit 2-9**, no movements exceeding critical thresholds were observed in existing conditions at the study area's unsignalized intersection during the Weekday AM peak hour. During the PM peak hour, the following critical operation has been observed:

- At the Montrose Road and Kinsmen Court intersection, the WBLR turning movement has a critical LOS of "F".

3 Future Background Conditions

This section discusses the proposed development horizon year, background traffic growth rate, anticipated future road network improvements, and other development-related traffic in the study area under the 2027 horizon year.

3.1 Horizon Year

As per the ***Niagara Region Guidelines for Transportation Impact Studies*** (May 2012), a five-year horizon year from the 2022 date of this TIS (i.e., 2027) was selected for the Future Background Conditions and Future Total Conditions analysis.

3.2 Growth Rate

In lieu of other information, an annual growth rate of 2.0% was assumed to account for the impact of growth occurring outside of the study area. This value was confirmed to be reasonable by City staff.

3.3 Road Network Improvements

Upon review of the ***City of Niagara Falls Transportation Master Plan*** (October 2011), no major road network improvements within the proposed development's study area were found to be anticipated at this time.

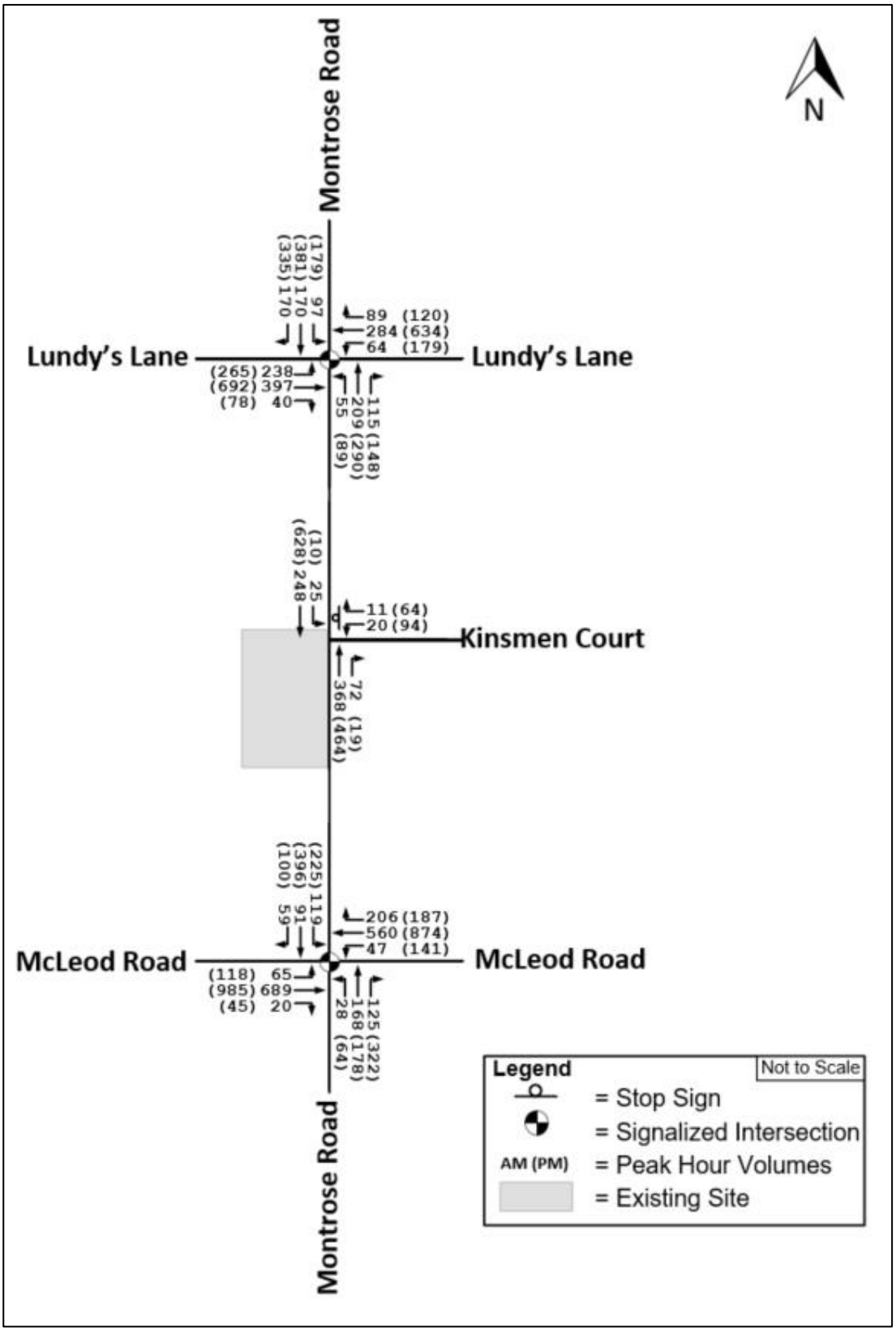
3.4 Background Developments

Upon discussions with staff from the City of Niagara Falls regarding development projects in the vicinity of the study area, no developments likely to introduce large volumes of traffic into the study area were flagged. Therefore, the 2.0% annual growth noted in **Section 3.2** was assumed to account for all sources of traffic growth in the study area.

3.5 2027 Future Background Conditions Analysis

The 2027 Future Background Volumes were calculated by adding the annual growth discussed in **Section 3.2** to the existing conditions scenario. These volumes are presented in **Exhibit 3-1**.

Exhibit 3-1: 2027 Future Background Conditions Traffic Volumes



The results of the 2027 Future Background analysis are summarized in the following subsections. Full Highway Capacity Manual analysis for the 2027 Future Background Conditions scenario is presented in **Appendix E**.

3.5.1 Signalized Intersections

The results of the 2027 Future Background conditions traffic operations analysis for signalized intersections are presented in **Exhibit 3-2**.

Exhibit 3-2: 2027 Future Background Conditions Traffic Operations - Signalized Intersections

Intersection	Intersection			Movement	LOS	Delay (s)	v/c Ratio	95th Percentile Queue (m)	Storage Capacity (m)
	LOS	Delay (s)	v/c Ratio						
Weekday AM Peak Hour									
Montrose Rd & McLeod Rd	C	29.1	0.52	EBL	B	15.5	0.27	16	64
				EBT	C	22.3	0.36	68	-
				WBL	B	17.2	0.20	13	164
				WBT	C	24.9	0.42	85	-
				WBR	C	25.1	0.37	69	-
				NBL	C	34.2	0.14	8	126
				NBT	E	55.8	0.79	53	-
				NBR	D	43.2	0.51	44	-
				SBL	C	31.3	0.56	27	148
				SBT	C	33.8	0.24	20	-
Montrose Rd & Lundy's Ln	D	36.9	0.71	EBL	D	36.0	0.77	64	74
				EBT	D	36.8	0.49	74	-
				WBL	C	31.8	0.28	19	45
				WBT	D	44.1	0.52	67	-
				NBL	C	23.2	0.19	15	58
				NBT	D	42.0	0.68	124	-
				SBL	C	23.9	0.37	25	-
				SBT	C	30.4	0.29	50	-
				SBR	C	34.6	0.46	57	93

Intersection	Intersection			Movement	LOS	Delay (s)	v/c Ratio	95th Percentile Queue (m)	Storage Capacity (m)
	LOS	Delay (s)	v/c Ratio						
Weekday PM Peak Hour									
Montrose Rd & McLeod Rd	D	40.3	0.83	EBL	D	35.3	0.70	28	64
				EBT	D	38.6	0.71	100	-
				WBL	D	43.2	0.79	44	164
				WBT	D	43.3	0.81	127	-
				WBR	D	35.7	0.47	58	-
				NBL	C	28.0	0.29	17	126
				NBT	D	37.0	0.45	61	-
				NBR	E	73.8	0.94	146	-
				SBL	C	27.9	0.71	51	148
				SBT	C	31.5	0.54	70	-
Montrose Rd & Lundy's Ln	E	58	0.99	EBL	F	108.4	1.05	124	74
				EBT	D	54.3	0.85	154	-
				WBL	D	46.6	0.79	55	45
				WBT	E	64.5	0.92	146	-
				NBL	C	27.7	0.34	24	58
				NBT	E	68.9	0.93	217	-
				SBL	D	37.8	0.76	49	-
				SBT	D	39.5	0.64	131	-
				SBR	D	44.2	0.71	126	93

As shown in **Exhibit 3-2**, no movements exceeding critical thresholds were observed in Future Background Conditions at the signalized intersections within the study area during the Weekday AM peak hour. During the PM peak hour, the following critical operations have been observed:

- At the Montrose Road and McLeod Road intersection, the NBR turning movement is anticipated to have critical v/c ratios of 0.94; and
- At the Montrose Road and Lundy's Lane intersection, the EBL, WBT and NBT turning movements are anticipated to have critical v/c ratios of 1.05, 0.92, and 0.93 respectively.

3.5.2 Unsignalized Intersections

The results of the 2027 Future Background conditions traffic operations analysis for unsignalized intersections is presented in **Exhibit 3-3**.

Exhibit 3-3: 2027 Future Background Conditions Traffic Operations - Unsignalized Intersections

Intersection	Intersection Delay (s)	Lane	Lane LOS	Lane Delay (s)	Lane v/c Ratio	Lane 95th Percentile Queue (m)	Lane Storage Capacity (m)
Weekday AM Peak Hour							
Montrose Rd & Kinsmen Ct	1.4	WBLR	C	22.1	0.19	5	-
		NBTR	A	0.0	0.00	0	-
		SBL	A	9.0	0.04	1	76.0
Weekday PM Peak Hour							
Montrose Rd & Kinsmen Ct	147.0	WBLR	F	638.0	2.28	246	-
		NBTR	A	0.0	0.00	0	-
		SBL	A	8.7	0.01	0	76.0

As shown in **Exhibit 3-3**, no movements exceeding critical thresholds were observed in Future Background Conditions at the study area's unsignalized intersection during the Weekday AM peak hour. During the PM peak hour, the following critical operation has been observed:

- At the Montrose Road and Kinsmen Court intersection, the WBLR turning movement has a critical LOS of "F".

4 Future Total Conditions

This section of the report analyzes the impact of the proposed development on the Future Background Traffic Conditions for the 2027 horizon year. This analysis includes the impacts on the traffic conditions including the site traffic associated with the proposed development.

4.1 Future Site Accesses

As discussed in **Section 1.3**, vehicular traffic will access the proposed development via two driveways on Montrose Road, with one of these accesses being the fourth approach of the Montrose Road and Kinsmen Court intersection. Future lane configurations for the study area roadways are illustrated in **Exhibit 4-1**.

4.2 Trip Generation

The gross trips expected to be generated by the proposed development are examined in this section. The net trips generated are then assigned and distributed to the study area road network.

4.2.1 Gross Trip Generation

Trip generation rates from publication Trip Generation Manual, 11th Edition (Institute of Transportation Engineers, October 2021) were used to estimate future automobile trips associated with the proposed development. Based on the nature of the development, its location context, and the data quality, the fitted curve equation for the land use code (LUC) 220: Multifamily Housing (Low-Rise) – General Urban/Suburban was used to calculate the estimated vehicle trips during the Weekday AM and PM Peak Hours. Trip generation source data is presented in **Appendix G**.

Based on a total of 91 townhome dwelling units, the proposed development is expected to generate the inbound and outbound vehicle trips presented in **Exhibit 4-2**.

Exhibit 4-1: Future Study Area Lane Configurations

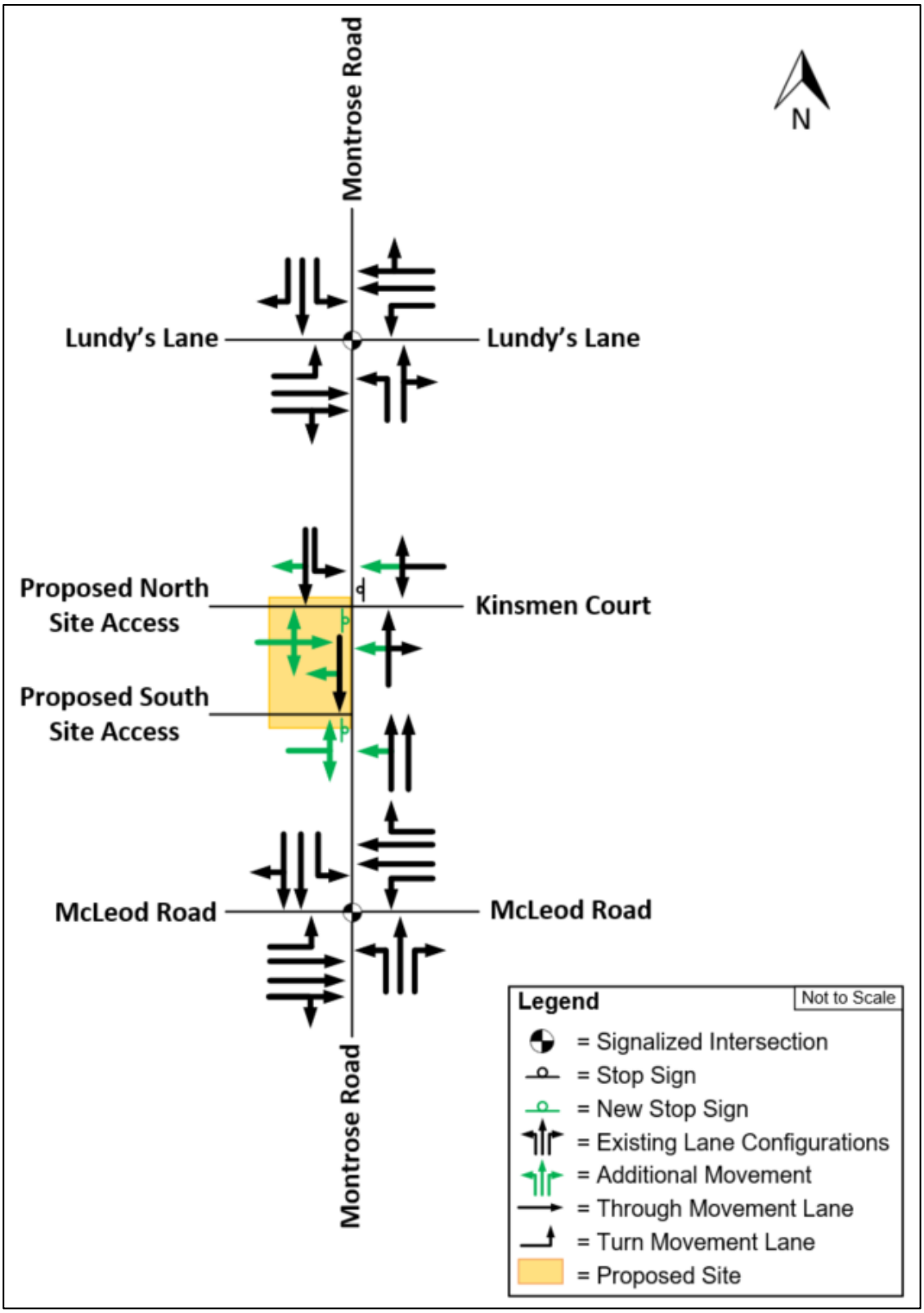


Exhibit 4-2: Proposed Development Trip Generation

Montrose Road, North of Mcleod Road, Niagara Falls - Proposed Development							
LUC 220: Multifamily Housing (Low-Rise) - General Urban/Suburban							
Term	**Dwelling Unit Count (X)**	**Weekday AM Peak Hour**			**Weekday PM Peak Hour**		
		Inbound	**Outbound**	**Total**	**Inbound**	**Outbound**	**Total**
Trip Generation Equation (Fitted Curve)	-	T = 0.31(X)+ 22.85			T = 0.43(X) + 20.55		
Directional Distribution	-	24%	76%	100%	63%	37%	100%
Net New Vehicular Trips	91	**12**	**39**	**51**	**38**	**22**	**60**

As per **Exhibit 4-2**, the proposed development is estimated to generate up to:

- 51 net new vehicle trips during the Weekday AM Peak hour (12 inbound trips and 39 outbound trips); and
- 60 net new vehicle trips during the Weekday PM Peak hour (38 inbound trips and 22 outbound trips).

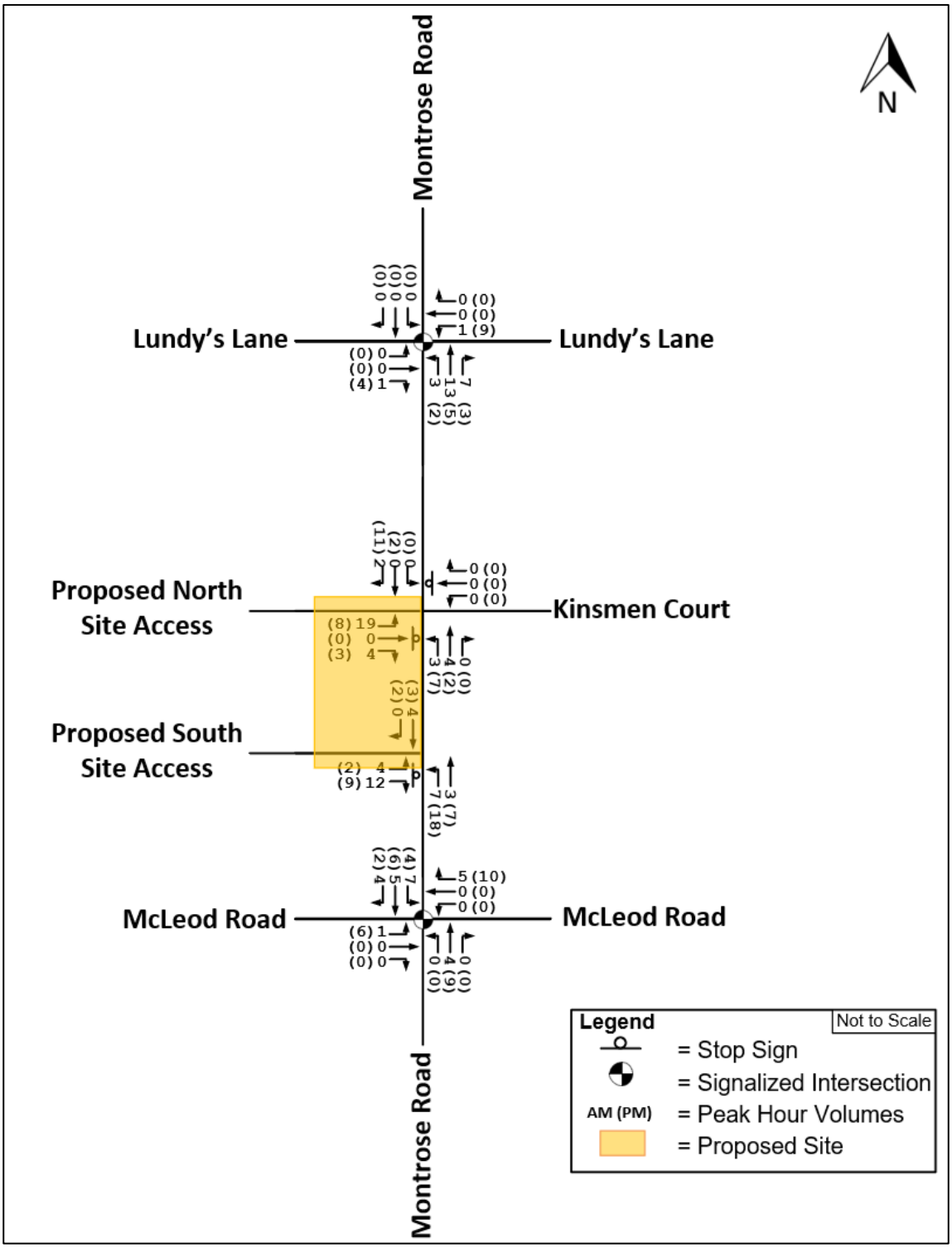
4.2.2 Trip Distribution and Assignment

The trip distribution for site trips was determined based on existing travel patterns and the available road network. This trip distribution is presented in **Exhibit 4-3** and the resulting site-generated volume patterns are illustrated in **Exhibit 4-4.**

Exhibit 4-3: Site Trip Distribution

To / From	Inbound Trips		Outbound Trips	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Montrose Road (north)	22%	34%	32%	23%
Montrose Road (south)	24%	16%	14%	32%
McLeod Road (west)	6%	7%	9%	8%
McLeod Road (east)	9%	16%	18%	18%
Lundy's Lane (west)	9%	11%	9%	7%
Lundy's Lane (east)	30%	17%	18%	12%
Total	**100%**	**100%**	**100%**	**100%**

Exhibit 4-4: Net New Site-Generated Traffic Volumes



4.3 2027 Future Total Conditions Analysis

New trips resulting from the construction of the proposed development were added to the 2027 Future Background Conditions scenario, producing the 2027 Future Total Conditions traffic volumes illustrated in **Exhibit 4-5**.

Using these 2027 Future Total Conditions traffic volumes, traffic operations analysis was conducted to determine future intersection performance with the impact of the proposed development. The results of the traffic operations analysis are presented in the following subsections. Full Highway Capacity Manual analysis for the 2027 Future Total Conditions scenario is presented in **Appendix H**.

4.3.1 Signalized Intersections

The results of the 2027 Future Total Conditions traffic operations analysis for signalized intersections is presented in **Exhibit 4-6**.

Exhibit 4-5: 2027 Future Total Conditions Traffic Volumes

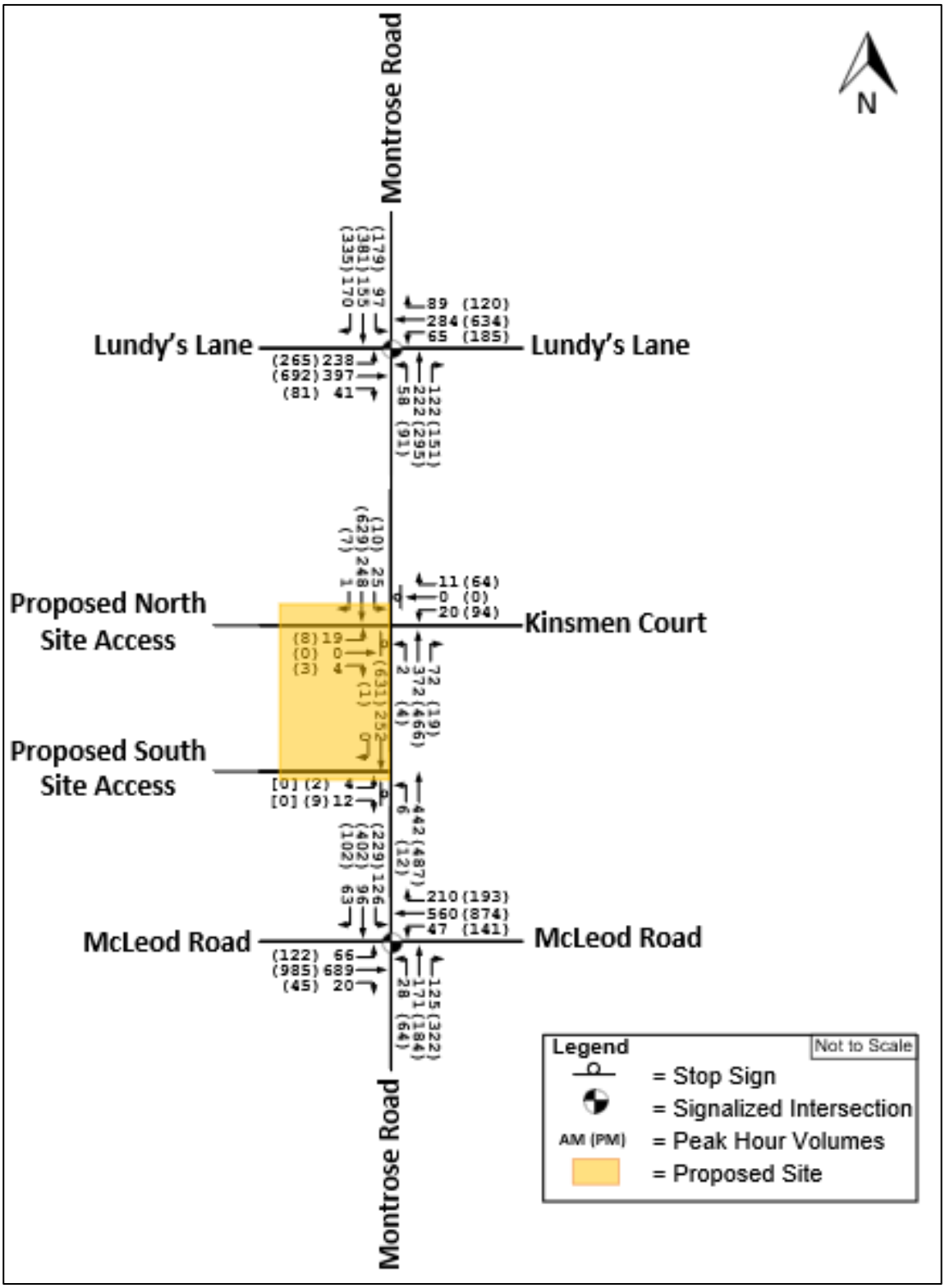


Exhibit 4-6: 2027 Future Total Conditions Traffic Operations - Signalized Intersections

Intersection	Intersection			Movement	LOS	Delay (s)	v/c Ratio	95th Percentile Queue (m)	Storage Capacity (m)
	LOS	Delay (s)	v/c Ratio						
Weekday AM Peak Hour									
Montrose Rd & McLeod Rd	C	29.5	0.54	EBL	B	16.1	0.28	17	64
				EBT	C	22.9	0.37	69	-
				WBL	B	17.5	0.20	13	164
				WBT	C	25.4	0.43	84	-
				WBR	C	25.7	0.38	70	-
				NBL	C	33.9	0.14	8	126
				NBT	E	56.1	0.79	53	-
				NBR	D	42.8	0.51	44	-
				SBL	C	31.3	0.59	28	148
				SBT	C	33.3	0.25	21	-
Montrose Rd & Lundy's Ln	D	37.4	0.73	EBL	D	36.0	0.77	64	74
				EBT	D	36.9	0.50	74	-
				WBL	C	31.8	0.28	19	45
				WBT	D	44.1	0.52	67	-
				NBL	C	23.1	0.20	15	58
				NBT	D	43.9	0.72	133	-
				SBL	C	24.5	0.40	25	-
				SBT	C	30.6	0.29	50	-
				SBR	C	34.9	0.46	57	93

Intersection	Intersection			Movement	LOS	Delay (s)	v/c Ratio	95th Percentile Queue (m)	Storage Capacity (m)
	LOS	Delay (s)	v/c Ratio						
Weekday PM Peak Hour									
Montrose Rd & McLeod Rd	D	40.5	0.84	EBL	D	36.8	0.72	29	64
				EBT	D	38.6	0.71	100	-
				WBL	D	43.2	0.79	44	164
				WBT	D	43.4	0.81	127	-
				WBR	D	36.2	0.49	60	-
				NBL	C	28.1	0.30	17	126
				NBT	D	37.3	0.47	64	-
				NBR	E	74.4	0.94	146	-
				SBL	C	29.1	0.73	52	148
				SBT	C	31.7	0.54	71	-
Montrose Rd & Lundy's Ln	E	59	1.00	EBL	F	108.4	1.05	124	74
				EBT	E	55.6	0.86	156	-
				WBL	D	48.8	0.81	59	45
				WBT	E	64.5	0.92	146	-
				NBL	C	27.7	0.35	24	58
				NBT	E	72.2	0.95	222	-
				SBL	D	40.0	0.77	51	-
				SBT	D	39.6	0.64	132	-
				SBR	D	44.4	0.72	126	93

As shown in **Exhibit 4-6**, no movements exceeding critical thresholds were observed in Future Total Conditions at the signalized intersections within the study area during the Weekday AM peak hour. During the PM peak hour, the following critical operations have been observed:

- At the Montrose Road and McLeod Road intersection, the NBR turning movement has a critical v/c ratio of 0.94; and
- At the Montrose Road and Lundy's Lane intersection, the EBL, EBT, WBT, and NBT turning movements all have critical v/c ratios of 1.05, 0.86, 0.92 and 0.95 respectively.

4.3.2 Unsignalized Intersections

The results of the 2027 Future Total Conditions traffic operations analysis for unsignalized intersections is presented in **Exhibit 4-7**.

Exhibit 4-7: 2027 Future Total Conditions Traffic Operations - Unsignalized Intersections

Intersection	Intersection Delay (s)	Lane	Lane LOS	Lane Delay (s)	Lane v/c Ratio	Lane 95th Percentile Queue (m)	Lane Storage Capacity (m)
Weekday AM Peak Hour							
Montrose Rd & Kinsmen Ct / Proposed North Site Access	3.7	EBLR	D	28.1	0.37	13	-
		WBLR	C	23.8	0.20	6	-
		NBLTR	A	0.2	0.01	0	-
		SBL	A	9.0	0.04	1	76.0
Montrose Rd & Proposed South Site Access	0.3	EBLR	B	10.7	0.03	1	-
		NBL	A	0.4	0.01	0	-
Weekday PM Peak Hour							
Montrose Rd & Kinsmen Ct / Proposed North Site Access	168.0	EBLR	F	77.7	0.49	16	-
		WBLR	F	758.8	2.54	261	-
		NBLTR	A	0.5	0.02	0	-
		SBL	A	8.7	0.01	0	76.0
Montrose Rd & Proposed South Site Access	0.3	EBLR	C	15.4	0.03	1	-
		NBL	A	0.7	0.01	0	-

As shown in **Exhibit 4-7**, the EBLR lane at the Montrose Road and Kinsmen Court / Proposed North Site Access intersection is anticipated to exceed critical thresholds during both the AM and PM peak hours due to an LOS of “D” or higher. For both cases however, high delay from an unsignalized minor approach onto an arterial road is not unexpected and v/c ratios are well below 1.00. During the PM peak hour, the WBLR lane at that intersection is also anticipated to be critical due to a LOS of “F”. This condition is already present in existing conditions and is unrelated to the impact of the proposed development (as per **Exhibit 2-9**). While a traffic control signal is not expected to be warranted due to low minor approach volume, one could be considered in response to high delay from Kinsmen Court, or to improve pedestrian connectivity in the study area.

5 Access Location Analysis

This section discusses the proposed Montrose Road site accesses' sightlines. The Transportation Association of Canada's (TAC) **Geometric Design Guide for Canadian Roads** (June 2017) was used to identify whether the anticipated Montrose Road site accesses' locations fulfill the minimum stopping and intersection sight distances. A design speed of 60 km/h was used for Montrose Road (posted speed limit of 50 km/h + 10 km/h reflective of the urban conditions) at the location of the site accesses.

5.1 Stopping Sight Distance

Stopping sight distance refers to the distance necessary for a driver travelling on a certain roadway to avoid a collision by coming to a complete stop in reaction to a vehicle departing from an access.

This distance is given by Equation 2.5.2 in TAC:

$$SSD = 0.278Vt + 0.039\frac{V^2}{a}$$

Where:

SSD = Stopping sight distance (m)
t = Brake reaction time (2.5 s)
V = Design speed (km/h)
a = Deceleration rate (3.4 m/s^2)

The resulting stopping sight distance requirements for Montrose Road at the proposed site accesses are presented in **Exhibit 5-1**.

Exhibit 5-1: Stopping Sight Distance Summary

Scenario	Minimum TAC Stopping Sight Distance	Meets Minimum TAC Stopping Sight Distance	Maximum Distance Observed on Site
Approaching Montrose Road north site access from the north	85 m	✔	> 105 m
Approaching Montrose Road north site access from the south	85 m	✔	> 105 m
Approaching Montrose Road south site access from the north	85 m	✔	> 105 m
Approaching Montrose Road south site access from the south	85 m	✔	> 105 m

As shown in **Exhibit 5-1**, available and observable stopping sight distances exceed the minimum distances required by TAC guidelines for vehicles approaching the Montrose Road site accesses from both sides. This is

illustrated in site photos of an August 2022 site visit, presented in **Exhibit 5-2** through **Exhibit 5-5**.

Exhibit 5-2: Montrose Road North Site Access – Stopping Sight Distance in Northbound Direction

Red arrow indicates location of the proposed north Site Access.

Exhibit 5-3: Montrose Road North Site Access – Stopping Sight Distance in Southbound Direction

Red arrow indicates location of the proposed north Site Access.

Exhibit 5-4: Montrose Road South Site Access – Stopping Sight Distance in Northbound Direction

Red arrow indicates location of the proposed south Site Access.

Exhibit 5-5: Montrose Road South Site Access – Stopping Sight Distance in Southbound Direction

Red arrow indicates location of the proposed south Site Access.

5.2 Intersection Sight Distance

Intersection Sight Distance refers to the sight distance necessary for a driver to depart from a driveway and merge into traffic without causing a vehicle travelling along the major roadway to have to decrease their speed significantly.

The required departure sight distance for automobiles is given by Equation 9.9.1 in TAC:

$$ISD = 0.278\ (V_{major} \times t_g)$$

Where:

ISD	=	Intersection sight distance (m)
V_{major}	=	Design speed of the major road (km/h)
t_g	=	Time gap for minor road vehicle to enter the major road (s)

It should be mentioned that t_g varies with the amount of lanes that need to be crossed, as well as the type of vehicles being considered. A regular passenger vehicle was used as the design vehicle for the site accesses. The intersection sight distance requirements for the proposed Montrose Road site accesses are illustrated in **Exhibit 5-6**.

Exhibit 5-6: Intersection Sight Distance Summary

Scenario	Minimum TAC Intersection Sight Distance	Meets Minimum TAC Intersection Sight Distance	Maximum Distance Observed on Site
Left-turn from stop on Montrose Road north site access – looking north	135 m	✗	115 m
Right-turn from stop on Montrose Road north site access – looking north	110 m	✓	115 m
Left-turn from stop on Montrose Road north site access – looking south	135 m	✓	> 160 m
Left-turn from stop on Montrose Road south site access – looking north	135 m	✓	> 160 m
Left-turn from stop on Montrose Road south site access – looking south	135 m	✓	> 160 m

As shown in **Exhibit 5-6**, intersection sight distances for the Montrose Road site accesses generally exceed the minimum distances required by TAC guidelines for passenger vehicles. However, sight distance from the north access to the north is constrained by roadway curvature. As a result, while sufficient sight distance for right turns is expected to be present, sight distance for left turns fails to meet the TAC guidelines. As a result, an outbound left-turn restriction at the North Site Access could be considered to mitigate this deficiency.

It should be mentioned that motorists generally tend to slow down as they approach curves in a roadway, and as such, operating speeds may not reach the 60 km/h assumed in this analysis. This is reinforced by the presence of the Kinsman Court intersection, which would be visible to southbound motorists as a potential conflict source. If the operating speed at the bend were to be observed at 50 km/h, then the required ISD for the left turn movement from stop would be 115 meters, while the required ISD for the right turn movement from stop would be 95 meters – both of which would be accommodated by the available 115 meters. Therefore, traffic calming measures intended to increase compliance with the posted speed limit are recommended.

Exhibit 5-7 through **Exhibit 5-10** show the view of drivers at the proposed site accesses and illustrate the observations presented in **Exhibit 5-6**.

Exhibit 5-7: Montrose Road North Site Access – Intersection Sight Distance for Left and Right-turn From Stop – Looking North

Red arrow indicates the available intersection sight distance (115m)

Exhibit 5-8: Montrose Road North Site Access – Intersection Sight Distance for Left-turn From Stop – Looking South

Red arrow indicates the specific intersection sight distance required (160m)

Exhibit 5-9: Montrose Road South Site Access – Intersection Sight Distance for Left-turn From Stop – Looking North

Red arrow indicates the specific intersection sight distance required (160m)

Exhibit 5-10: Montrose Road South Site Access – Intersection Sight Distance for Left-turn From Stop – Looking South

Red arrow indicates the specific intersection sight distance required (160m)

6 Traffic Operations Mitigation Measures

Based on anticipated instances of movements exceeding critical thresholds, signal timing plan changes were considered to improve operations at the Montrose Road and McLeod Road and Montrose Road and Lundy's Lane intersections.

For the PM peak hour at Montrose Road and McLeod Road, 1 second from the protected WBL movement, 1.4 seconds from the EBT movement as well as 14 seconds from the protected SBL movement (for a cumulative 16.4 seconds) were transferred towards the NBT movement. Another 2 seconds from the protected EBL movement, 0.4 seconds from the WBT movement as well as 13 seconds from the protected NBL movement (for a cumulative 15.4 second) were transferred towards the SBT movement.

For the PM peak hour at Montrose Road and Lundy's Lane, 7 seconds from the protected WBL movement as well as 17 seconds from protected SBL movement (for a cumulative 24 second) were transferred towards the EBT / NBT movements. Another 19 seconds from the protect NBL movement were transferred towards the WBT / SBT movements.

The results of the 2027 Future Total Mitigated Conditions traffic operations analysis for signalized intersections is presented in **Exhibit 6-1**. Full Highway Capacity Manual analysis for the 2027 Future Total Mitigated Conditions scenario is presented in **Appendix I**.

Exhibit 6-1: 2027 Future Total Conditions Traffic Operations - Signalized Intersections (Mitigated)

Intersection	Intersection			Movement	LOS	Delay (s)	v/c Ratio	95th Percentile Queue (m)	Storage Capacity (m)
	LOS	Delay (s)	v/c Ratio						
Weekday AM Peak Hour									
Montrose Rd & McLeod Rd	C	29.5	0.53	EBL	B	16.1	0.28	17	64
				EBT	C	22.9	0.37	69	-
				WBL	B	17.5	0.20	13	164
				WBT	C	25.4	0.43	84	-
				WBR	C	25.7	0.38	70	-
				NBL	C	33.9	0.14	8	126
				NBT	E	56.1	0.79	53	-
				NBR	D	42.8	0.51	44	-
				SBL	C	31.3	0.59	28	148
				SBT	C	33.3	0.25	21	-
Montrose Rd & Lundy's Ln	D	37.4	0.73	EBL	D	36.0	0.77	64	74
				EBT	D	36.9	0.50	74	-
				WBL	C	31.8	0.28	19	45
				WBT	D	44.1	0.52	67	-
				NBL	C	23.1	0.20	15	58
				NBT	D	43.9	0.72	133	-
				SBL	C	24.5	0.40	25	-
				SBT	C	30.6	0.29	50	-
				SBR	C	34.9	0.46	57	93

Intersection	Intersection			Movement	LOS	Delay (s)	v/c Ratio	95th Percentile Queue (m)	Storage Capacity (m)
	LOS	Delay (s)	v/c Ratio						
Weekday PM Peak Hour									
Montrose Rd & McLeod Rd	D	37.3	0.81	EBL	C	28.2	0.63	30	64
				EBT	D	35.4	0.66	102	-
				WBL	C	29.9	0.68	45	164
				WBT	D	37.7	0.74	128	-
				WBR	C	32.4	0.45	60	-
				NBL	C	27.0	0.34	16	126
				NBT	C	34.3	0.42	51	-
				NBR	D	53.6	0.85	102	-
				SBL	D	45.6	0.85	49	148
				SBT	C	34.2	0.58	65	-
Montrose Rd & Lundy's Ln	D	37.3	1.02	EBL	F	87.6	1.00	111	74
				EBT	D	43.5	0.73	128	-
				WBL	D	52.0	0.84	56	45
				WBT	D	54.8	0.84	132	-
				NBL	C	27.5	0.40	25	58
				NBT	D	52.4	0.84	168	-
				SBL	F	88.9	0.97	63	-
				SBT	D	38.6	0.63	125	-
				SBR	D	43.0	0.70	119	93

As shown in **Exhibit 6-1**, applying these signal timing plan changes is expected to result in improvements to the critical operations at the Montrose Road and McLeod Road and Montrose Road and Lundy's Lane intersections (during the PM peak hour) when compared to the unmitigated conditions.

While instances of movements exceeding critical thresholds are still expected to be present at the Montrose Road and Lundy's Lane intersection, it must be noted that the most constrained movements – EBL and SBL during the PM peak hour – are expected to be comparable to Future Background Conditions. This suggests that, with signal timing plan changes, the proposed development's impact on traffic operations within the study area is expected to be minimal.

If the proposed signal timing plan changes were applied to the 2027 Future Background Conditions scenario, traffic operations at the study area intersections would be as presented in **Exhibit 6-2**. Full Highway Capacity Manual analysis for the 2027 Future Background Mitigated Conditions scenario is presented in **Appendix F**.

Exhibit 6-2: 2027 Future Background Conditions Traffic Operations - Signalized Intersections - Mitigated

Intersection	Intersection			Movement	LOS	Delay (s)	v/c Ratio	95th Percentile Queue (m)	Storage Capacity (m)
	LOS	Delay (s)	v/c Ratio						
Weekday AM Peak Hour									
Montrose Rd & McLeod Rd	C	29.1	0.52	EBL	B	15.5	0.27	16	64
				EBT	C	22.3	0.36	68	-
				WBL	B	17.2	0.20	13	164
				WBT	C	24.9	0.42	85	-
				WBR	C	25.1	0.37	69	-
				NBL	C	34.2	0.14	8	126
				NBT	E	55.8	0.79	53	-
				NBR	D	43.2	0.51	44	-
				SBL	C	31.3	0.56	27	148
				SBT	C	33.8	0.24	20	-
Montrose Rd & Lundy's Ln	D	36.9	0.71	EBL	D	36.0	0.77	64	74
				EBT	D	36.8	0.49	74	-
				WBL	C	31.8	0.28	19	45
				WBT	D	44.1	0.52	67	-
				NBL	C	23.2	0.19	15	58
				NBT	D	42.0	0.68	124	-
				SBL	C	23.9	0.37	25	-
				SBT	C	30.4	0.29	50	-
				SBR	C	34.6	0.46	57	93

Intersection	Intersection			Movement	LOS	Delay (s)	v/c Ratio	95th Percentile Queue (m)	Storage Capacity (m)
	LOS	Delay (s)	v/c Ratio						
Weekday PM Peak Hour									
Montrose Rd & McLeod Rd	D	36.9	0.8	EBL	C	27.4	0.61	29	64
				EBT	D	35.4	0.66	102	-
				WBL	C	29.9	0.68	45	164
				WBT	D	37.6	0.73	128	-
				WBR	C	32.0	0.43	58	-
				NBL	C	26.9	0.34	16	126
				NBT	C	34.1	0.41	50	-
				NBR	D	53.6	0.85	102	-
				SBL	D	42.1	0.82	48	148
				SBT	C	34.0	0.57	64	-
Montrose Rd & Lundy's Ln	D	51.6	1.01	EBL	F	87.6	1.00	111	74
				EBT	D	43.3	0.73	127	-
				WBL	D	48.6	0.81	51	45
				WBT	D	54.8	0.84	132	-
				NBL	C	27.4	0.39	25	58
				NBT	D	51.0	0.83	163	-
				SBL	E	79.6	0.94	60	-
				SBT	D	38.6	0.63	125	-
				SBR	D	43.0	0.70	119	93

7 Traffic Analysis Summary

The traffic analysis summary is presented in the following subsection.

7.1 Development Traffic Impacts

The proposed development is expected to generate up to 51 and 60 new two-way automobile trips during the Weekday AM Peak and Weekday PM Peak Hours, respectively. Based on a comparison between 2027 Future Background Mitigated Conditions and 2027 Future Total Mitigated Conditions, the traffic generated by the proposed development is generally not expected to have a significant impact on traffic operations at study area intersections as traffic operations are relatively similar. In addition, with mitigation measures applied to the intersections of Montrose Road and McLeod Road as well as Montrose Road and Lundy's Lane during the PM peak hour, the general intersection operations and most individual movements (which were critical even in unmitigated Future Background Conditions) are expected to improve. This suggests that, with signal timing plan changes, the proposed development's impact on traffic operations within the study area is expected to be minimal.

For unsignalized intersections, only the Montrose Road and Kinsmen Court / Proposed North Site Access intersection is expected to experience operations which exceed critical thresholds under Future Total Conditions. As shown in **Exhibit 4-7**, the EBLR lane at this intersection is anticipated to exceed critical thresholds during both the AM and PM peak hours due to an LOS of "D" or higher. For both cases however, high delay from an unsignalized minor approach onto an arterial road is not unexpected and v/c ratios are well below 1.00. During the PM peak hour, the WBLR lane at that intersection is also anticipated to be critical due to a LOS of "F". This condition is already present in existing conditions and is unrelated to the impact of the proposed development. While a traffic control signal is not expected to be warranted due to low minor approach volume, one could be considered in response to high delay from Kinsmen Court, or to improve pedestrian connectivity in the study area.

To demonstrate the potential impacts of development site traffic to traffic operations within the study area, comparisons of signalized (mitigated conditions) and unsignalized intersection operations under 2027 Future Background Conditions and 2027 Future Total Conditions are presented in **Exhibit 7-1** and **Exhibit 7-2**, respectively.

Exhibit 7-1: 2027 Signalized Intersection Traffic Operations Comparison

Intersection	Movement	2027 Future Background Conditions - Mitigated			2027 Future Total Conditions - Mitigated			Difference (Total - Background)		
		Delay (s)	v/c Ratio	95th Percentile Queue Length (m)	Delay (s)	v/c Ratio	95th Percentile Queue Length (m)	Delay (s)	v/c Ratio	95th Percentile Queue Length (m)
Weekday AM Peak Hour										
Montrose Rd & McLeod Rd	EBL	36.0	0.77	64	36.0	0.77	64	0.0	0.0	0.0
	EBT	36.8	0.49	74	36.9	0.50	74	0.1	0.0	0.3
	WBL	31.8	0.28	19	31.8	0.28	19	0.0	0.0	0.0
	WBT	44.1	0.52	67	44.1	0.52	67	0.0	0.0	0.0
	NBL	23.2	0.19	15	23.1	0.20	15	-0.1	0.0	0.6
	NBT	42.0	0.68	124	43.9	0.72	133	1.9	0.0	9.1
	SBL	23.9	0.37	25	24.5	0.40	25	0.6	0.0	0.0
	SBT	30.4	0.29	50	30.6	0.29	50	0.2	0.0	0.2
	SBR	34.6	0.46	57	34.9	0.46	57	0.3	0.0	0.3
	EBL	15.5	0.27	16	16.1	0.28	17	0.6	0.0	0.3
Montrose Rd & Lundy's Ln	EBT	22.3	0.36	68	22.9	0.37	69	0.6	0.0	0.9
	WBL	17.2	0.20	13	17.5	0.20	13	0.3	0.0	0.2
	WBT	24.9	0.42	85	25.4	0.43	84	0.5	0.0	-0.8
	WBR	25.1	0.37	69	25.7	0.38	70	0.6	0.0	1.0
	NBL	34.2	0.14	8	33.9	0.14	8	-0.3	0.0	-0.1
	NBT	55.8	0.79	53	56.1	0.79	53	0.3	0.0	0.7
	NBR	43.2	0.51	44	42.8	0.51	44	-0.4	0.0	-0.3
	SBL	31.3	0.56	27	31.3	0.59	28	0.0	0.0	1.2
	SBT	33.8	0.24	20	33.3	0.25	21	-0.5	0.0	0.7

Intersection	Movement	2027 Future Background Conditions - Mitigated			2027 Future Total Conditions - Mitigated			Difference (Total - Background)		
		Delay (s)	v/c Ratio	95th Percentile Queue Length (m)	Delay (s)	v/c Ratio	95th Percentile Queue Length (m)	Delay (s)	v/c Ratio	95th Percentile Queue Length (m)
Weekday PM Peak Hour										
Montrose Rd & McLeod Rd	EBL	87.6	1.00	111	87.6	1.00	111	0.0	0.0	0.0
	EBT	43.3	0.73	127	43.5	0.73	128	0.2	0.0	0.8
	WBL	48.6	0.81	51	52.0	0.84	56	3.4	0.0	4.8
	WBT	54.8	0.84	132	54.8	0.84	132	0.0	0.0	0.0
	NBL	27.4	0.39	25	27.5	0.40	25	0.1	0.0	0.5
	NBT	51.0	0.83	163	52.4	0.84	168	1.4	0.0	5.1
	SBL	79.6	0.94	60	88.9	0.97	63	9.3	0.0	2.4
	SBT	38.6	0.63	125	38.6	0.63	125	0.0	0.0	0.0
	SBR	43.0	0.70	119	43.0	0.70	119	0.0	0.0	0.0
	EBL	27.4	0.61	29	28.2	0.63	30	0.8	0.0	0.7
Montrose Rd & Lundy's Ln	EBT	35.4	0.66	102	35.4	0.66	102	0.0	0.0	0.0
	WBL	29.9	0.68	45	29.9	0.68	45	0.0	0.0	0.0
	WBT	37.6	0.73	128	37.7	0.74	128	0.1	0.0	0.0
	WBR	32.0	0.43	58	32.4	0.45	60	0.4	0.0	1.7
	NBL	26.9	0.34	16	27.0	0.34	16	0.1	0.0	0.0
	NBT	34.1	0.41	50	34.3	0.42	51	0.2	0.0	1.6
	NBR	53.6	0.85	102	53.6	0.85	102	0.0	0.0	0.0
	SBL	42.1	0.82	48	45.6	0.85	49	3.5	0.0	0.9
	SBT	34.0	0.57	64	34.2	0.58	65	0.2	0.0	1.0
	EBL	87.6	1.00	111	87.6	1.00	111	0.0	0.0	0.0
	EBT	43.3	0.73	127	43.5	0.73	128	0.2	0.0	0.8

Exhibit 7-2: 2027 Unsignalized Intersection Traffic Operations Comparison

Intersection	Mvmnt	2029 Future Background Conditions			2029 Future Total Conditions			Difference (Total - Background)		
		Lane Delay (s)	Lane v/c Ratio	Lane 95th Percentile Queue (m)	Lane Delay (s)	Lane v/c Ratio	Lane 95th Percentile Queue (m)	Lane Delay (s)	Lane v/c Ratio	Lane 95th Percentile Queue (m)
Weekday AM Peak Hour										
Montrose Rd & Kinsmen Ct / Proposed North Site Access	EBLR	-	-	-	28.1	0.37	13	-	-	-
	WBLR	22.1	0.19	5	23.8	0.20	6	1.7	0.01	1
	NBLTR	0.0	0.00	0	0.2	0.01	0	0.2	0.01	0
	SBL	9.0	0.04	1	9.0	0.04	1	0.0	0.0	0
Montrose Rd & Proposed South Site Access	EBLR	-	-	-	10.7	0.03	1	-	-	-
	NBL	-	-	-	0.4	0.01	0	-	-	-
Weekday PM Peak Hour										
Montrose Rd & Kinsmen Ct / Proposed North Site Access	EBLR	-	-	-	77.7	0.49	16	-	-	-
	WBLR	638.0	2.28	246	758.8	2.54	261	120.8	0.26	15
	NBLTR	0.0	0.00	0	0.5	0.02	0	0.5	0.02	0
	SBL	8.7	0.01	0	8.7	0.01	0	0.0	0.0	0
Montrose Rd & Proposed South Site Access	EBLR	-	-	-	15.4	0.03	1	-	-	-
	NBL	-	-	-	0.7	0.01	0	-	-	-

8 Vehicle Swept Path Analysis

Vehicle swept path analysis was completed using AutoTURN to confirm that waste collection and fire services vehicles can enter and exit the site in a forward motion.

This analysis is presented in **Appendix J**.

9 Parking Analysis

The purpose of the parking study is to determine if the proposed parking supply – 91 driveway parking spaces, 91 garage spaces, and 16 visitor parking spaces – is an appropriate supply to accommodate Zoning By-law requirements and anticipated demand from the proposed development.

9.1 Zoning By-law Requirements

The property is presently governed by the City of Niagara Falls Zoning By-Law 79-200 (ZBL). The relevant vehicle parking requirements, as stipulated in the ZBL, are illustrated in **Exhibit 9-1**.

Exhibit 9-1: Minimum Vehicular Parking Spaces Required by ZBL

Land Use	Proposed Number of Units	Parking Rate Requirement	Required Spaces
Townhouse Dwellings	91	1.4 per dwelling unit	128
Proposed Supply			198
Surplus/Deficiency			**+70**

As shown in **Exhibit 9-1**, the development is required to supply 128 vehicular parking spaces based on the ZBL for off-street townhouse dwellings. As the development proposes to supply 198 parking spaces, a ZBL surplus of 70 parking spaces is anticipated.

9.2 Parking Occupancy Observations

In order to confirm the suitability of the proposed parking supply, parking utilization surveys were conducted at a number of residential developments within the City of Barrie. These locations include:

- 8175 McLeod Road;
- 8141 Coventry Road;
- 6910 Kalar Road; and
- 8136 Coventry Road.

Based on the periods when peak parking demand for residents and visitors typically occur, on-site parking occupancy was observed on the following dates and times:

- Thursday, August 11, 2022, between 6:00 p.m. and 12:00 a.m.;
- Friday, August 12, 2022, between 6:00 p.m. and 12:00 a.m.; and
- Saturday, August 13, 202, between 6:00 a.m. and 1:00 p.m.

Observations were collected every 30 minutes, and the observed occupancy was converted to a utilization rate per dwelling unit for comparison purposes. The key findings of the surveys for each location are presented in **Exhibit 9-2**.

Exhibit 9-2: Summary Statistics for Surveyed Sites

Location	Units	Peak Parking Demand (spaces)	Peak Parking Demand (spaces / unit)
8175 McLeod Road (Zone A)	64	72	1.13
8141 Coventry Road (Zone B)	46	64	1.39
6910 Kalar Road (Zone C)	18	22	1.22
8141 Coventry Road (Zone D)	56	69	1.23

As shown in **Exhibit 9-2**, peak parking demand was observed to be 1.39 parking spaces per unit among the proxy sites. If applied to the proposed development then 127 parking spaces would be required. As 198 total parking spaces are proposed, the proposed parking supply is expected to be sufficient to accommodate anticipated demand.

Raw parking observations are presented in **Appendix K**.

9.3 Transportation Demand Management Considerations

Transportation Demand Management (TDM) refers to policies, design features, and incentives which encourage sustainable transportation choices. TDM can reduce the intensity of peak hour trips by encouraging deferred travel, can reduce general automobile trips by encouraging the use of non-automobile transportation modes, and can reduce the demand for parking by reducing the need to own and operate a personal vehicle.

As mentioned in **Section 2.3,** the proposed development is well connected to the City of Niagara Falls cycling network. The development fronts Montrose Road which has (relatively recently) had new bike lanes added. As such, providing additional bike parking spaces can act as an incentive to encourage residents to use cycling as a full-time alternative to maintaining a private automobile.

It should be mentioned too that the site proposes internal sidewalks and crossings which will form a continuous route and which will also connect to the broader external sidewalk network. This may encourage pedestrian activity and reduce dependency on vehicles.

9.4 Parking Analysis Summary

The purpose of the parking study is to determine if the proposed parking supply – 91 driveway parking spaces, 91 garage parking spaces, and 16 visitor parking spaces – is an appropriate supply to accommodate Zoning By-law requirements and anticipated demand from the proposed development. As the ZBL requirements indicate that 128 vehicular parking spaces are to be provided, a ZBL surplus of 70 parking spaces is anticipated. The appropriateness of this parking supply is supported by parking occupancy observations at comparable townhouse developments in the City of Niagara Falls.

10 Conclusions and Recommendations

This section summarizes the key findings of this Transportation Impact Study (TIS).

10.1 TIS Findings

The proposed development which consists of 91 townhouse dwellings is expected to generate up to 51 and 60 new two-way automobile trips during the Weekday AM Peak and Weekday PM Peak hours, respectively. Based on a comparison between 2027 Future Background Mitigated Conditions and 2027 Future Total Mitigated Conditions, the traffic generated by the proposed development is generally not expected to have a significant impact on traffic operations at study area intersections as traffic operations are relatively similar. In addition, with mitigation measures applied to the signalized intersections of Montrose Road and McLeod Road as well as Montrose Road and Lundy's Lane during the PM peak hour, the general intersection operations and most individual movements (which were critical even in unmitigated Future Background Conditions) are expected to improve. This suggests that, with signal timing plan changes, the proposed development's impact on traffic operations within the study area can be further minimized.

For unsignalized intersections, only the Montrose Road and Kinsmen Court / Proposed North Site Access is expected to experience operations which exceed critical thresholds under Future Total Conditions. While the EBLR lane at this intersection is anticipated to exceed critical thresholds during both the AM and PM peak hours due to an LOS of "D" or higher, the operational conditions are acceptable as v/c ratios are well below 1.00 for both conditions. During the PM peak hour, the WBLR lane at that intersection is also anticipated to be critical due to an LOS of "F". However, high delay from an unsignalized minor approach onto an arterial road is not unexpected This condition is already present in existing conditions and is unrelated to the impact of the proposed development. While a traffic control signal is not expected to be warranted due to low minor approach volume, one could be considered in response to high delay from Kinsmen Court, or to improve pedestrian connectivity in the study area.

10.2 Access Location Analysis

Based on on-site analysis, stopping sight distance requirements at the location of the proposed site accesses are expected to be met. With respect to intersection sight distance, the location of the proposed accesses generally exceed the minimum distances required by TAC guidelines for passenger vehicles. However, sight distance from the north access to the north is constrained by roadway curvature. As a result, while sufficient sight distance for right turns is expected to be present, sight distance for left turns fails to meet the TAC guidelines. As a result, an outbound left-turn restriction at the North Site Access could be considered to mitigate this deficiency.

It should be mentioned that motorists generally tend to slow down as they approach curves in a roadway, and as such, operating speeds may not reach the 60 km/h assumed in this analysis. This is reinforced by the presence of the Kinsman Court intersection, which would be visible to southbound motorists as a potential conflict source. If the operating speed at the bend were to be observed at 50 km/h, then the required ISD for the left turn movement from stop would be 115 meters, while the required ISD for the right turn movement from stop would be 95 meters – both of which would be accommodated by the available 115 meters. Therefore, traffic calming measures intended to increase compliance with the posted speed limit are recommended.

10.3 Vehicle Swept Path Analysis

Vehicle swept path analysis was completed using AutoTURN to confirm that waste collection and fire services vehicles can enter and exit the site in a forward motion.

10.4 Parking Analysis

The purpose of the parking study was to determine if the proposed parking supply – 91 driveway parking spaces, 91 garage parking spaces, and 16 visitor parking spaces – is an appropriate supply to accommodate Zoning By-law requirements and anticipated demand from the proposed development. As the City of Niagara Falls ZBL requirements indicate that 128 vehicular parking spaces are to be provided, a ZBL surplus of 70 parking spaces is anticipated. The appropriateness of this parking supply is supported by parking occupancy observations at comparable townhouse developments in the City of Niagara Falls.

With respect to TDM considerations**,** the proposed development is well connected to the City of Niagara Falls cycling network. The development fronts Montrose Road which has (relatively recently) had new bike lanes added. As such, providing additional bike parking spaces can act as an incentive to encourage residents to use cycling as a full-time alternative to maintaining a private automobile.

Appendix A: Scope of Investigation

IBI GROUP
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Toronto ON M4V 2Y7 Canada
tel 416 596 1930 fax 416 596 0644
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May 28, 2021

Mr. John Grubich
Supervisor, Traffic Planning
City of Niagara Falls

8208 Heartland Forest Road
Niagara Falls, ON L2H 0L7

Dear Mr. Grubich:

SCOPE OF WORK FOR TRANSPORTATION IMPACT STUDY FOR PROPOSED RESIDENTIAL DEVELOPMENT ON MONTROSE ROAD, NORTH OF MCLOED ROAD, NIAGARA FALLS, ONTARIO

This letter provides our proposed scope of work for a proposed residential development located on Montrose Road in the City of Niagara Falls. The development would be located on the west side of Montrose Road, approximately 740 metres north of McLeod Road in the City of Niagara Falls, Ontario, and would consist of 104 townhomes. A total of 120 parking spaces are proposed for all users of the proposed development. Access to the site is proposed via two full-movement driveways onto Montrose Road.

While changes to site plan and site statistics may occur as the development progresses through the approval process, we anticipate that transportation impacts will be consistent with the concept described above. Nevertheless, our submission will reflect the most up-to-date information available.

Work Plan – Transportation Impact Study

The tasks that will be completed for the transportation impact study are as follows:

1. **Analysis Time Periods and Intersections:** Based on the proposed development's land uses and size, we plan to analyze the development peak hours which will occur during the weekday AM peak period (7:00 a.m. to 9:00 a.m.) and the weekday PM peak period (4:00 p.m. – 6:00 p.m.).

   The following intersections will be included in this analysis:

   1. McLeod Road (Niagara Regional Road 49) and Montrose Road (Niagara Regional Road 98) (signalized);
   2. Montrose Road (Niagara Regional Road 98) and Lundy's Lane (Niagara Regional Road 20) (signalized);
   3. Montrose Road and Proposed North Site Access (unsignalized); and
   4. Montrose Road and Proposed South Site Access (unsignalized).

2. **2021 Existing Conditions:** The 2021 existing traffic operations will be analyzed using the software program Synchro (version 11) for the weekday AM and weekday PM peak periods, for the intersections listed above. We propose to acquire turning movement count data at the existing study area intersections from the City of Niagara Falls, Region of Niagara, or from other sources (e.g. transportation impact studies for other area developments). It should be noted that, given the ongoing Coronavirus disease (COVID-19) outbreak, newly collected traffic counts may not be representative of typical conditions. Therefore, if data collection is required, we propose to augment collected turning movement count data with historical traffic data to estimate typical 2021 conditions.

3. **2026 Background Traffic Conditions:** The 2026 background traffic volumes will be determined for the study area intersections, which coincides with five years after the 2021 date of the transportation study. This approach is consistent with the Niagara Region Guidelines for Transportation Impact Studies (May 2012). We will identify an applicable background traffic growth rate and other area developments which may introduce traffic into the study area, based on a conversation with the City and the Region. Any future road network or intersection changes proposed by the City or Region, or outlined in a capital works program, will be taken into consideration.

   The 2026 background traffic analysis will identify and determine the impacts of the adjacent developments without the proposed site traffic under existing and future roadway conditions.

4. **Site Traffic Generation and Trip Distribution:** The trip generation for the proposed development will be based on the information presented in the Institute of Transportation Engineers (ITE) publication, *Trip Generation Manual*, 10th Edition. A review of the modal split will also be undertaken to account for the trips being made by non-auto modes of travel.

   The trip distribution for the proposed site will be based on a review of existing travel patterns and the available road network. The forecast site traffic for the proposed development will be added to the road network based on the trip distribution, and assigned to the network based on logical travel routes and available traffic capacity.

5. **2026 Total Traffic Conditions**: The estimated site traffic volumes will be combined with the 2026 background traffic volumes to determine the 2026 total traffic volumes for the study area intersections.

   Intersection operations analysis will be undertaken for the weekday AM and weekday PM peak periods. Any necessary road improvements required to accommodate total traffic volumes will be identified. These improvements may include additional turning lanes, storage length modifications, or traffic control measures.

6. **Parking Demand Review:** While the proposed parking supply has not been finalized, the development concept circulated during the pre-consultation phase contained a small zoning by-law deficiency in visitor parking. Due to the ongoing Coronavirus disease (COVID-19) outbreak, conducting parking observations for visitor parking at a proxy site may not yield valid results. Therefore, if a zoning by-law parking deficiency is anticipated, we propose to discuss options for a parking justification study with City staff. We propose to provide the parking study, if required, as an addendum to the transportation impact study described above.

If you have any questions regarding the proposed scope of work for the Montrose Road development, please do not hesitate to contact me.

Yours truly,

IBI GROUP

Andrae Griffith, B.Urpl, OCAD
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May 28, 2021

Ms. Susan Dunsmore
Manager, Development Engineering
Regional Municipality of Niagara

1815 Sir. Isaac Brock Way
Thorold, ON L2V 4T7

Dear Ms. Dunsmore:

SCOPE OF WORK FOR TRANSPORTATION IMPACT STUDY FOR PROPOSED RESIDENTIAL DEVELOPMENT ON MONTROSE ROAD, NORTH OF MCLOED ROAD, NIAGARA FALLS, ONTARIO

This letter provides our proposed scope of work for a proposed residential development located on Montrose Road in the City of Niagara Falls. The development would be located on the west side of Montrose Road, approximately 740 metres north of McLeod Road in the City of Niagara Falls, Ontario, and would consist of 104 townhomes. A total of 120 parking spaces are proposed for all users of the proposed development. Access to the site is proposed via two full-movement driveways onto Montrose Road.

While changes to site plan and site statistics may occur as the development progresses through the approval process, we anticipate that transportation impacts will be consistent with the concept described above. Nevertheless, our submission will reflect the most up-to-date information available.

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If you have any questions regarding the proposed scope of work for the Montrose Road development, please do not hesitate to contact me.

Yours truly,

IBI GROUP

Andrae Griffith, B.Urpl, OCAD
Transportation Operations & Safety Analyst
416 596 1930 ext 61450
andrae.griffith@ibigroup.com

Appendix B: Turning Movement Counts

Montrose Rd @ Kinsmen Crt

Morning Peak Diagram

Specified Period
From: 7:00:00
To: 9:00:00

One Hour Peak
From: 8:00:00
To: 9:00:00

Municipality: Niagara Falls
Site #: 0000000002
Intersection: Montrose Rd & Kinsmen Crt
TFR File #: 2
Count date: 10-Aug-2022

Weather conditions:
Cloudy/Dry

Person(s) who counted:
Cam

**** Non-Signalized Intersection ****

Major Road: Montrose Rd runs N/S

North Leg Total: 426
North Entering: 248
North Peds: 0
Peds Cross: ⋈

Heavys	6	1	7
Trucks	2	0	2
Cars	217	22	239
Totals	225	23	

Heavys	7
Trucks	10
Cars	161
Totals	178

East Leg Total: 116
East Entering: 28
East Peds: 6
Peds Cross: ⋈

Montrose Rd

	Cars	Trucks	Heavys	Totals
	10	0	0	10
	16	1	1	18
	26	1	1	

N
W E
S

Kinsmen Crt

Cars	Trucks	Heavys	Totals
84	2	2	88

Montrose Rd

Cars	233
Trucks	3
Heavys	7
Totals	243

Cars	151	62	213
Trucks	10	2	12
Heavys	7	1	8
Totals	168	65	

Peds Cross: ⋈
South Peds: 0
South Entering: 233
South Leg Total: 476

Comments

Montrose Rd @ Kinsmen Crt

Afternoon Peak Diagram

Specified Period
From: 16:00:00
To: 18:00:00

One Hour Peak
From: 16:15:00
To: 17:15:00

Municipality: Niagara Falls
Site #: 0000000002
Intersection: Montrose Rd & Kinsmen Crt
TFR File #: 2
Count date: 10-Aug-2022

Weather conditions:
Cloudy/Dry

Person(s) who counted:
Cam

**** Non-Signalized Intersection ****

Major Road: Montrose Rd runs N/S

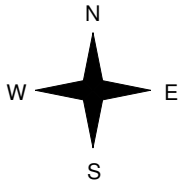
North Leg Total: 817
North Entering: 357
North Peds: 0
Peds Cross: ⋈

Heavys	4	0	4
Trucks	3	0	3
Cars	341	9	350
Totals	348	9	

Heavys	12
Trucks	3
Cars	445
Totals	460

East Leg Total: 169
East Entering: 143
East Peds: 7
Peds Cross: ⋈

	Cars	Trucks	Heavys	Totals
	58	0	0	58
	82	1	2	85
	140	1	2	



	Cars	Trucks	Heavys	Totals
	25	0	1	26

Cars	423
Trucks	4
Heavys	6
Totals	433

Cars	387	16	403
Trucks	3	0	3
Heavys	12	1	13
Totals	402	17	

Peds Cross: ⋈
South Peds: 0
South Entering: 419
South Leg Total: 852

Comments

Montrose Rd @ Kinsmen Crt

Total Count Diagram

Municipality: Niagara Falls
Site #: 0000000002
Intersection: Montrose Rd & Kinsmen Crt
TFR File #: 2
Count date: 10-Aug-2022

Weather conditions:
Cloudy/Dry

Person(s) who counted:
Cam

**** Non-Signalized Intersection ****

Major Road: Montrose Rd runs N/S

North Leg Total: 2320
North Entering: 1171
North Peds: 0
Peds Cross: ⋈

Heavys	16	3	19
Trucks	10	0	10
Cars	1073	69	1142
Totals	1099	72	

Heavys	40
Trucks	18
Cars	1091
Totals	1149

East Leg Total: 482
East Entering: 255
East Peds: 26
Peds Cross: ⋈

Montrose Rd

	Cars	Trucks	Heavys	Totals
	107	1	4	112
	138	2	3	143
	245	3	7	

N
W E
S

Kinsmen Crt

	Cars	Trucks	Heavys	Totals
	217	4	6	227

Montrose Rd

Cars	1211		
Trucks	12		
Heavys	19		
Totals	1242		

Cars	984	148	1132
Trucks	17	4	21
Heavys	36	3	39
Totals	1037	155	

Peds Cross: ⋈
South Peds: 1
South Entering: 1192
South Leg Total: 2434

Comments

Montrose Rd @ Lundy's Ln

Morning Peak Diagram

Specified Period
From: 7:00:00
To: 9:00:00

One Hour Peak
From: 8:00:00
To: 9:00:00

Municipality: Niagara Falls
Site #: 0000000001
Intersection: Lundy's Ln & Montrose Rd
TFR File #: 1
Count date: 10-Aug-2022

Weather conditions:
Cloudy/Dry

Person(s) who counted:
Cam

**** Signalized Intersection ****

Major Road: Lundy's Ln runs W/E

North Leg Total:	868			
North Entering:	382			
North Peds:	9			
Peds Cross:	⋈			
Heavys	10	6	0	16
Trucks	6	1	3	10
Cars	138	133	85	356
Totals	154	140	88	
Heavys	11			
Trucks	5			
Cars	470			
Totals	486			
East Leg Total:	948			
East Entering:	396			
East Peds:	9			
Peds Cross:	⧖			

Montrose Rd

Heavys	Trucks	Cars	Totals
20	16	425	461

Cars	Trucks	Heavys	Totals
81	0	0	81
241	7	9	257
58	0	0	58
380	7	9	

Lundy's Ln

N
W E
S

Heavys	Trucks	Cars	Totals
5	2	209	216
5	7	348	360
1	0	35	36
11	9	592	

Lundy's Ln

Cars	Trucks	Heavys	Totals
535	11	6	552

Montrose Rd

Peds Cross:	⧖			
West Peds:	14			
West Entering:	612			
West Leg Total:	1073			
Cars	226			
Trucks	1			
Heavys	7			
Totals	234			
Cars	46	180	102	328
Trucks	3	3	1	7
Heavys	1	6	1	8
Totals	50	189	104	
Peds Cross:	⋈			
South Peds:	16			
South Entering:	343			
South Leg Total:	577			

Comments

Montrose Rd @ Lundy's Ln

Afternoon Peak Diagram

Specified Period
From: 16:00:00
To: 18:00:00

One Hour Peak
From: 16:30:00
To: 17:30:00

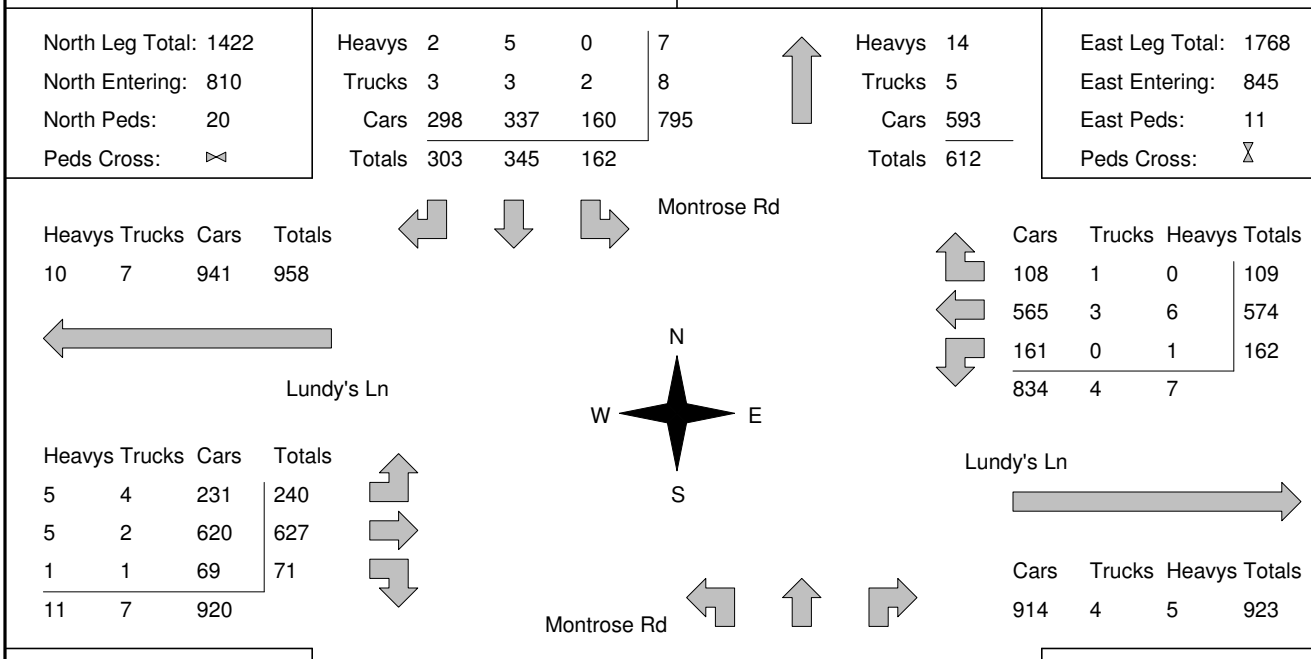
Municipality: Niagara Falls
Site #: 0000000001
Intersection: Lundy's Ln & Montrose Rd
TFR File #: 1
Count date: 10-Aug-2022

Weather conditions:
Cloudy/Dry

Person(s) who counted:
Cam

**** Signalized Intersection ****

Major Road: Lundy's Ln runs W/E



Comments

Montrose Rd @ Lundy's Ln

Total Count Diagram

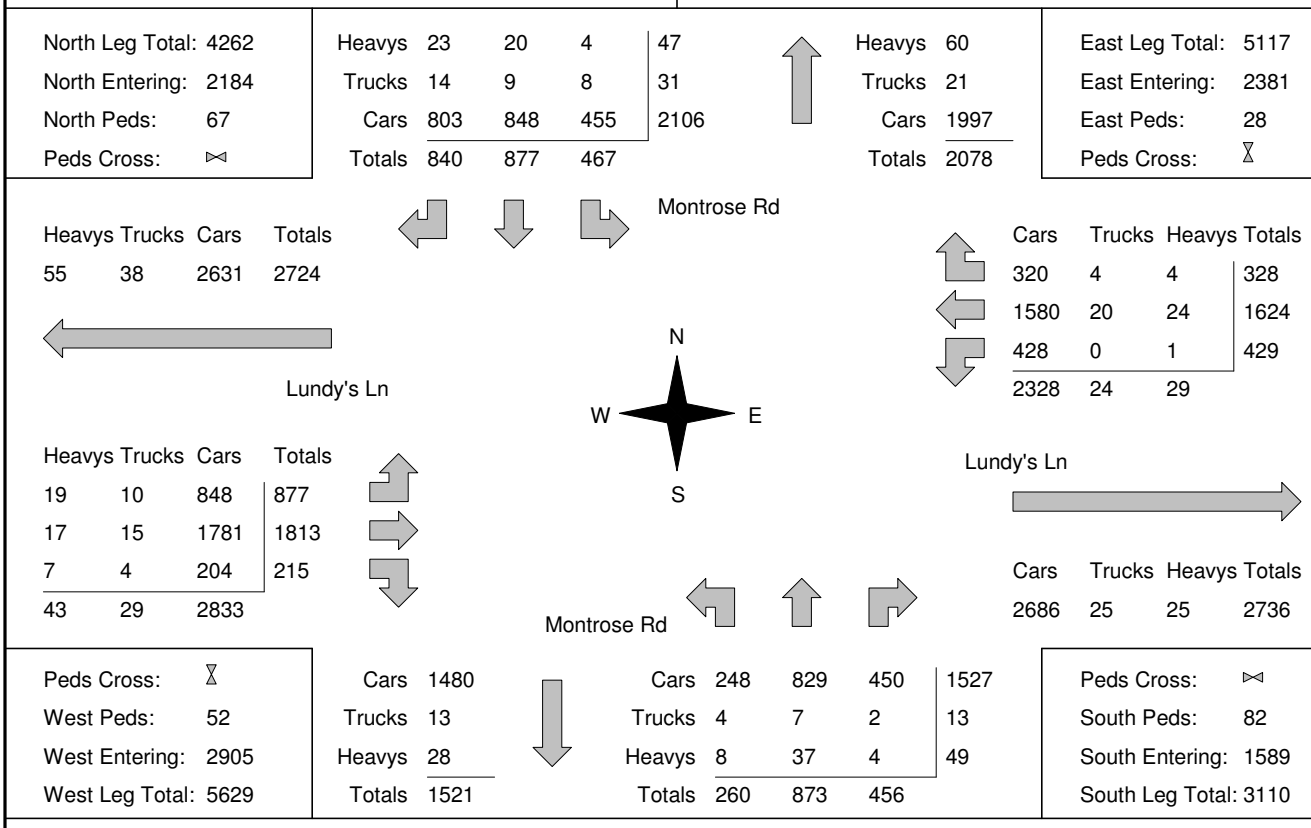
Municipality: Niagara Falls
Site #: 0000000001
Intersection: Lundy's Ln & Montrose Rd
TFR File #: 1
Count date: 10-Aug-2022

Weather conditions:
Cloudy/Dry

Person(s) who counted:
Cam

**** Signalized Intersection ****

Major Road: Lundy's Ln runs W/E



Comments

Montrose Rd @ McLeod Rd

Morning Peak Diagram

Specified Period
From: 7:00:00
To: 9:00:00

One Hour Peak
From: 8:00:00
To: 9:00:00

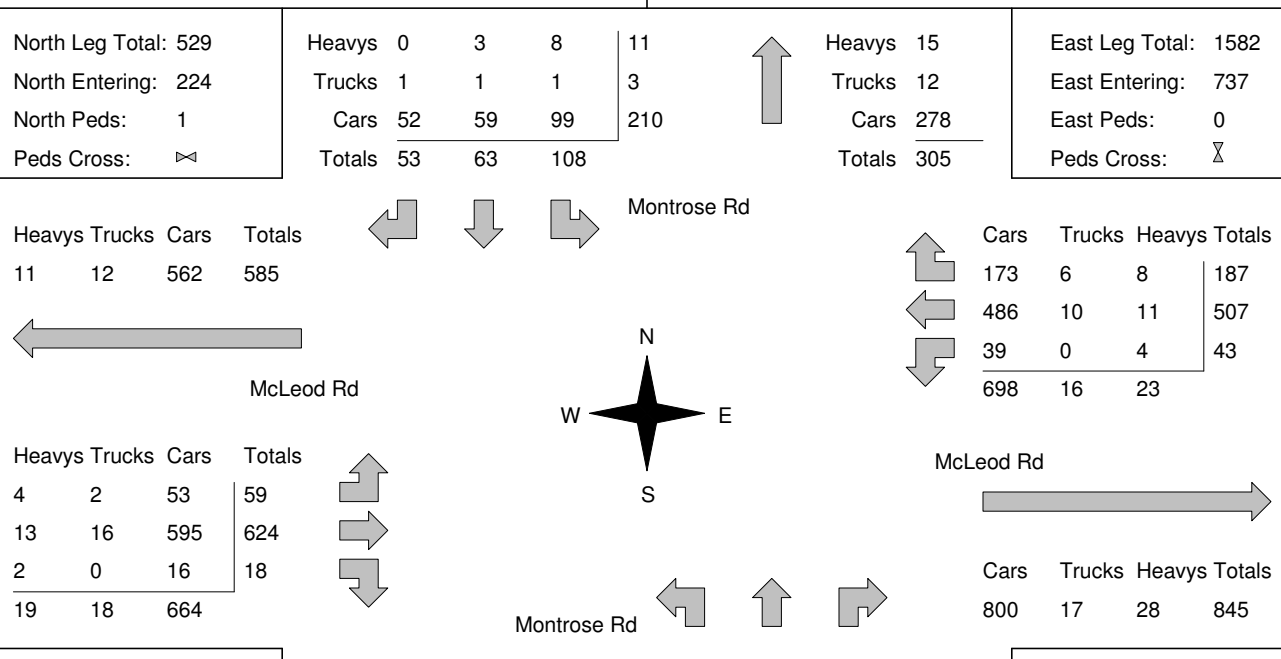
Municipality: Niagara Falls
Site #: 0000000004
Intersection: McLeod Rd & Montrose Rd
TFR File #: 4
Count date: 10-Aug-2022

Weather conditions:
Cloudy/Dry

Person(s) who counted:
Cam

**** Signalized Intersection ****

Major Road: McLeod Rd runs W/E



Comments

Montrose Rd @ McLeod Rd

Afternoon Peak Diagram

Specified Period
From: 16:00:00
To: 18:00:00

One Hour Peak
From: 16:30:00
To: 17:30:00

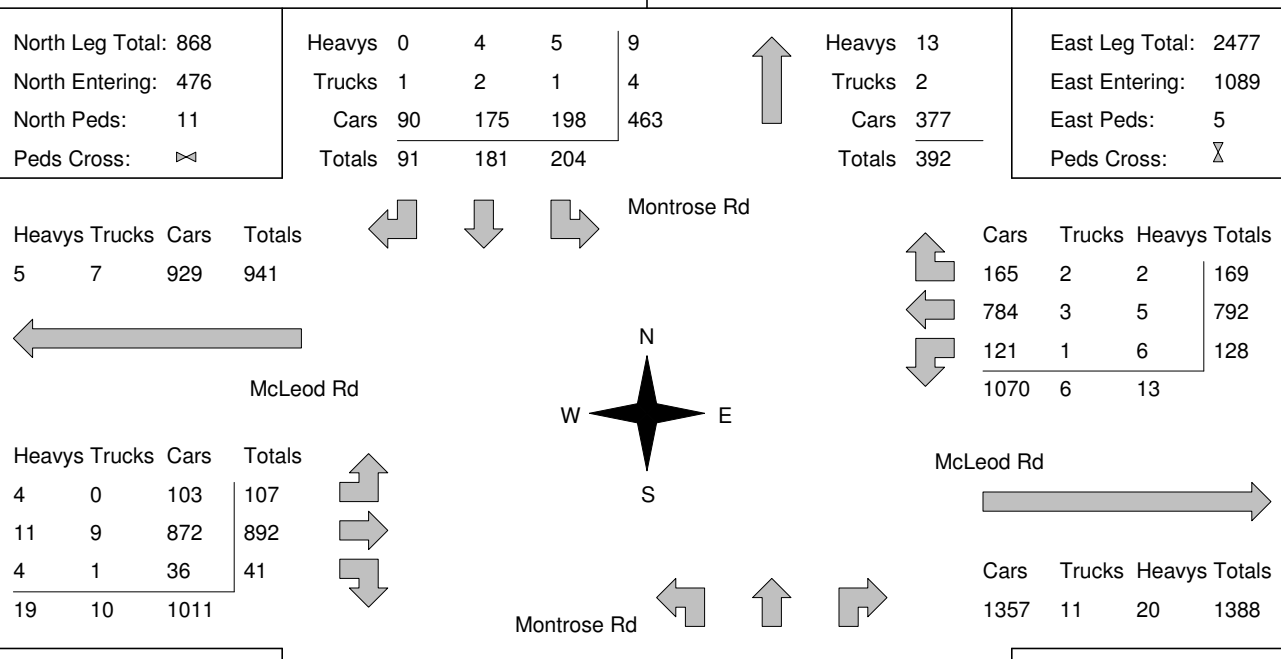
Municipality: Niagara Falls
Site #: 0000000004
Intersection: McLeod Rd & Montrose Rd
TFR File #: 4
Count date: 10-Aug-2022

Weather conditions:
Cloudy/Dry

Person(s) who counted:
Cam

**** Signalized Intersection ****

Major Road: McLeod Rd runs W/E



Comments

Montrose Rd @ McLeod Rd

Total Count Diagram

Municipality: Niagara Falls
Site #: 0000000004
Intersection: McLeod Rd & Montrose Rd
TFR File #: 4
Count date: 10-Aug-2022

Weather conditions:
Cloudy/Dry

Person(s) who counted:
Cam

**** Signalized Intersection ****

Major Road: McLeod Rd runs W/E

North Leg Total:	2586			
North Entering:	1273			
North Peds:	22			
Peds Cross:	⋈			
Heavys	2	13	23	38
Trucks	3	4	7	14
Cars	255	413	553	1221
Totals	260	430	583	
Heavys	55			
Trucks	22			
Cars	1236			
Totals	1313			
East Leg Total:	7527			
East Entering:	3386			
East Peds:	13			
Peds Cross:	⧖			

Montrose Rd

Heavys	Trucks	Cars	Totals
36	31	2774	2841

Cars	Trucks	Heavys	Totals
617	10	23	650
2380	24	34	2438
277	2	19	298
3274	36	76	

McLeod Rd

N
W E
S

Heavys	Trucks	Cars	Totals
15	5	303	323
60	39	2698	2797
14	2	86	102
89	46	3087	

McLeod Rd

Cars	Trucks	Heavys	Totals
3988	52	101	4141

Montrose Rd

Peds Cross:	⧖			
West Peds:	10			
West Entering:	3222			
West Leg Total:	6063			
Cars	776			
Trucks	8			
Heavys	46			
Totals	830			
Cars	139	316	737	1192
Trucks	4	7	6	17
Heavys	0	17	18	35
Totals	143	340	761	
Peds Cross:	⋈			
South Peds:	11			
South Entering:	1244			
South Leg Total:	2074			

Comments

Appendix C: Signal Timing Plans

Signal Code: 020098
Intersection: RR20 (LUNDY'S LANE) & RR98 (MONTROSE RD.)
Municipality: operation
Owner: operation
Last Modified: 7/20/2016 2:57:53 PM

Timing Parameters	EBD & WBD LEFTS LUNDY'S	EBD & WBD LUNDY'S	NBD & SBD LEFTS MONTROSE	NBD & SBD THRU MONTROSE	n/a	n/a
Min Green	6	10	6	8	0	0
Walk	0	10	0	11	0	0
Ped Clearance	0	18	0	18	0	0
Vehicle Ext.	0	2.3	0	2.3	0	0
Max Green	20	35	25	35	0	0
Yellow	3	4.1	3	4.1	0	0
All Red	0	2.9	0	2.9	0	0

		Offset
Minimum Cycle	27.9	0
Pedestrian Cycle	71	
Maximum Cycle	135	0
Operation	operation	

Installed On:
9/29/2009
Count Date:
7/16/2015

FA = Fully Actuated **SA = Semi Actuated** **FT = Fixed Time**

Close Window | Print Entry* | Refresh Entry

***Note: you need to change the paper orientation from Portriat to Landscape**

Signal Code: 098MCL
Intersection: RR98(Montrose Rd.) & McLeod Rd.
Municipality: niagarafalls
Owner: region
Last Modified: 1/10/2019 1:41:05 PM

Timing Parameters	EBD & WBD ADVANCE McLEOD RD.	EBD & WBD THRU McLEOD RD.	NBD & SBD ADVANCE MONTROSE RD.	NBD & SBD THRU MONTROSE RD.	n/a	n/a
Min Green	6	10	6	8	0	0
Walk	0	12	0	14	0	0
Ped Clearance	0	20	0	24	0	0
Vehicle Ext.	2.5	2.5	2.5	2.5	0	0
Max Green	10	40	20	29	0	0
Yellow	3	4.1	3	4.1	0	0
All Red	0	3.3	0	3.5	0	0

		Offset
Minimum Cycle	33	0
Pedestrian Cycle	85	
Maximum Cycle	120	0
Operation	FA	

Installed On:
3/7/2018
Count Date:
9/8/2009

FA = Fully Actuated **SA = Semi Actuated** **FT = Fixed Time**

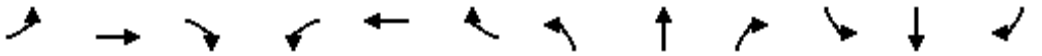
Close Window | Print Entry* | Refresh Entry

***Note: you need to change the paper orientation from Portriat to Landscape**

Appendix D: 2022 Existing Conditions Synchro Reports

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	281	511	79	410	79	378	111	175	208
v/c Ratio	0.65	0.43	0.23	0.44	0.16	0.58	0.30	0.25	0.40
Control Delay	31.9	34.6	23.4	42.3	19.0	37.8	20.8	29.1	32.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.9	34.6	23.4	42.3	19.0	37.8	20.8	29.1	32.7
Queue Length 50th (m)	48.0	53.6	11.7	47.8	10.9	78.9	15.6	30.9	39.2
Queue Length 95th (m)	57.6	64.3	17.2	60.9	13.7	105.8	22.9	43.6	49.6
Internal Link Dist (m)		255.8		297.4		1383.0		343.0	
Turn Bay Length (m)	74.0		45.0		58.0				93.0
Base Capacity (vph)	453	1197	493	923	609	648	502	702	521
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	0.62	0.43	0.16	0.44	0.13	0.58	0.22	0.25	0.40

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	216	360	36	58	257	81	50	189	104	88	140	154
Future Volume (vph)	216	360	36	58	257	81	50	189	104	88	140	154
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.0	3.5	3.0	3.0	3.5	3.0	3.0	3.5	3.0	3.0	3.5	3.0
Total Lost time (s)	3.0	7.0		3.0	7.0		3.0	7.0		3.0	7.0	7.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	0.99		1.00	1.00	0.97
Flpb, ped/bikes	1.00	1.00		0.99	1.00		0.99	1.00		1.00	1.00	1.00
Frt	1.00	0.98		1.00	0.96		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1632	3365		1671	3262		1545	1684		1633	1789	1328
Flt Permitted	0.40	1.00		0.46	1.00		0.64	1.00		0.37	1.00	1.00
Satd. Flow (perm)	683	3365		815	3262		1035	1684		643	1789	1328
Peak-hour factor, PHF	0.77	0.82	0.50	0.73	0.85	0.75	0.63	0.84	0.68	0.79	0.80	0.74
Adj. Flow (vph)	281	439	72	79	302	108	79	225	153	111	175	208
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	281	511	0	79	410	0	79	378	0	111	175	208
Confl. Peds. (#/hr)	9		16	16		9	14		9	9		14
Heavy Vehicles (%)	3%	3%	3%	0%	6%	0%	8%	5%	2%	3%	5%	10%
Bus Blockages (#/hr)	0	0	0	0	0	2	0	0	6	0	0	0
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		8
Actuated Green, G (s)	58.0	48.0		45.2	38.2		59.0	52.0		61.0	53.0	53.0
Effective Green, g (s)	58.0	48.0		45.2	38.2		59.0	52.0		61.0	53.0	53.0
Actuated g/C Ratio	0.43	0.36		0.33	0.28		0.44	0.39		0.45	0.39	0.39
Clearance Time (s)	3.0	7.0		3.0	7.0		3.0	7.0		3.0	7.0	7.0
Vehicle Extension (s)	0.2	2.3		0.2	2.3		0.2	2.3		0.2	2.3	2.3
Lane Grp Cap (vph)	411	1196		317	923		478	648		349	702	521
v/s Ratio Prot	c0.08	0.15		0.01	0.13		0.01	c0.22		c0.02	0.10	
v/s Ratio Perm	c0.21			0.07			0.06			0.12		0.16
v/c Ratio	0.68	0.43		0.25	0.44		0.17	0.58		0.32	0.25	0.40
Uniform Delay, d1	27.0	33.1		31.3	39.7		22.5	32.9		22.8	27.6	29.5
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.7	1.1		0.2	1.5		0.1	3.8		0.2	0.8	2.3
Delay (s)	30.7	34.2		31.5	41.2		22.6	36.7		23.0	28.5	31.8
Level of Service	C	C		C	D		C	D		C	C	C
Approach Delay (s)		32.9			39.7			34.3			28.7	
Approach LOS		C			D			C			C	

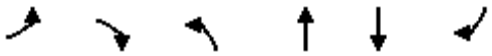
Intersection Summary			
HCM 2000 Control Delay	33.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	82.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	18	0	10	0	333	65	23	225	0
Future Volume (Veh/h)	0	0	0	18	0	10	0	333	65	23	225	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.25	0.25	0.25	0.56	0.25	0.83	0.25	0.74	0.60	0.72	0.79	0.25
Hourly flow rate (vph)	0	0	0	32	0	12	0	450	108	32	285	0
Pedestrians					6							
Lane Width (m)					3.5							
Walking Speed (m/s)					0.4							
Percent Blockage					1							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	865	913	285	859	859	510	285			564		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	865	913	285	859	859	510	285			564		
tC, single (s)	7.1	6.5	6.2	7.2	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.6	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	87	100	98	100			97		
cM capacity (veh/h)	261	263	759	254	282	559	1289			983		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	0	44	558	32	285
Volume Left	0	32	0	32	0
Volume Right	0	12	108	0	0
cSH	1700	298	1289	983	1700
Volume to Capacity	0.00	0.15	0.00	0.03	0.17
Queue Length 95th (m)	0.0	3.9	0.0	0.8	0.0
Control Delay (s)	0.0	19.2	0.0	8.8	0.0
Lane LOS	A	C		A	
Approach Delay (s)	0.0	19.2	0.0	0.9	
Approach LOS	A	C			

Intersection Summary				
Average Delay	1.2			
Intersection Capacity Utilization	31.6%	ICU Level of Service		A
Analysis Period (min)	15			



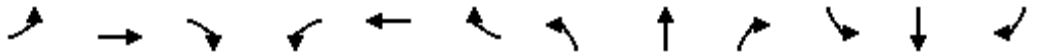
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	0	398	225	0
Future Volume (Veh/h)	0	0	0	398	225	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	433	245	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	462	245	245			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	462	245	245			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	534	762	1333			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	0	144	289	245
Volume Left	0	0	0	0
Volume Right	0	0	0	0
cSH	1700	1333	1700	1700
Volume to Capacity	0.00	0.00	0.17	0.14
Queue Length 95th (m)	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0
Lane LOS	A			
Approach Delay (s)	0.0	0.0		0.0
Approach LOS	A			

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	15.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	92	717	56	563	213	36	249	136	157	193
v/c Ratio	0.21	0.31	0.15	0.36	0.32	0.11	0.79	0.51	0.49	0.22
Control Delay	14.3	21.8	14.4	24.2	25.5	22.7	63.3	49.2	30.5	33.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.3	21.8	14.4	24.2	25.5	22.7	63.3	49.2	30.5	33.6
Queue Length 50th (m)	9.0	37.8	5.4	44.2	31.1	5.5	56.4	29.0	25.9	19.2
Queue Length 95th (m)	14.4	58.7	11.9	72.6	60.0	8.0	49.0	40.8	26.1	19.1
Internal Link Dist (m)		154.4		215.3			382.3			500.9
Turn Bay Length (m)	64.0		164.0			126.0			148.0	
Base Capacity (vph)	460	2326	415	1567	672	480	410	347	376	887
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	0.20	0.31	0.13	0.36	0.32	0.07	0.61	0.39	0.42	0.22

Intersection Summary



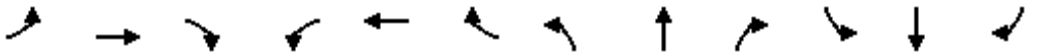
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	59	624	18	43	507	187	25	152	113	108	82	53
Future Volume (vph)	59	624	18	43	507	187	25	152	113	108	82	53
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.5	3.0	3.0	3.5	3.5	3.0	3.5	3.0	3.0	3.5	3.0
Total Lost time (s)	3.0	7.4		3.0	7.4	7.4	3.0	7.6	7.6	3.0	7.6	
Lane Util. Factor	1.00	0.91		1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.99	1.00	1.00	1.00	1.00	1.00	
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	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1622	4849		1545	3433	1473	1619	1678	1422	1560	3209	
Flt Permitted	0.38	1.00		0.36	1.00	1.00	0.63	1.00	1.00	0.36	1.00	
Satd. Flow (perm)	645	4849		584	3433	1473	1074	1678	1422	593	3209	
Peak-hour factor, PHF	0.64	0.90	0.75	0.77	0.90	0.88	0.69	0.61	0.83	0.69	0.68	0.74
Adj. Flow (vph)	92	693	24	56	563	212	36	249	136	157	121	72
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	92	717	0	56	563	213	36	249	136	157	193	0
Confl. Peds. (#/hr)	1		1	1		1	1					1
Heavy Vehicles (%)	10%	5%	11%	9%	4%	7%	4%	12%	6%	8%	6%	2%
Turn Type	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6		6	4		4	8		
Actuated Green, G (s)	64.1	55.8		59.5	53.5	53.5	28.4	23.9	23.9	40.2	32.7	
Effective Green, g (s)	64.1	55.8		59.5	53.5	53.5	28.4	23.9	23.9	40.2	32.7	
Actuated g/C Ratio	0.53	0.46		0.50	0.45	0.45	0.24	0.20	0.20	0.34	0.27	
Clearance Time (s)	3.0	7.4		3.0	7.4	7.4	3.0	7.6	7.6	3.0	7.6	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	
Lane Grp Cap (vph)	412	2254		337	1530	656	274	334	283	305	874	
v/s Ratio Prot	c0.02	0.15		0.01	c0.16		0.00	c0.15		c0.06	0.06	
v/s Ratio Perm	0.10			0.07		0.14	0.03		0.10	0.12		
v/c Ratio	0.22	0.32		0.17	0.37	0.32	0.13	0.75	0.48	0.51	0.22	
Uniform Delay, d1	14.1	20.2		15.8	22.0	21.5	35.8	45.2	42.6	30.1	33.8	
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	0.2	0.4		0.2	0.7	1.3	0.2	8.3	0.9	1.1	0.1	
Delay (s)	14.3	20.5		16.0	22.7	22.9	35.9	53.5	43.5	31.2	33.9	
Level of Service	B	C		B	C	C	D	D	D	C	C	
Approach Delay (s)		19.8			22.3			48.8			32.7	
Approach LOS		B			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	27.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	64.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	276	762	188	728	96	470	195	397	344
v/c Ratio	0.89	0.74	0.66	0.81	0.27	0.82	0.60	0.57	0.64
Control Delay	58.7	48.4	34.4	54.6	20.8	54.6	27.7	38.1	41.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	58.7	48.4	34.4	54.6	20.8	54.6	27.7	38.1	41.7
Queue Length 50th (m)	48.4	96.0	30.0	96.9	13.4	113.2	28.9	83.6	74.7
Queue Length 95th (m)	#92.0	#127.1	43.8	120.6	21.6	#180.7	40.5	115.5	110.0
Internal Link Dist (m)		255.8		297.4		1383.0		343.0	
Turn Bay Length (m)	74.0		45.0		58.0				93.0
Base Capacity (vph)	321	1029	350	902	508	576	422	691	539
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	0.86	0.74	0.54	0.81	0.19	0.82	0.46	0.57	0.64

Intersection Summary

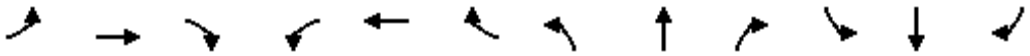
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	240	627	71	162	574	109	81	263	134	162	345	303
Future Volume (vph)	240	627	71	162	574	109	81	263	134	162	345	303
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.0	3.5	3.0	3.0	3.5	3.0	3.0	3.5	3.0	3.0	3.5	3.0
Total Lost time (s)	3.0	7.0		3.0	7.0		3.0	7.0		3.0	7.0	7.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	0.99		1.00	1.00	0.97
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.98		1.00	0.97		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1619	3445		1664	3382		1615	1728		1667	1842	1436
Flt Permitted	0.16	1.00		0.20	1.00		0.40	1.00		0.21	1.00	1.00
Satd. Flow (perm)	266	3445		356	3382		674	1728		366	1842	1436
Peak-hour factor, PHF	0.87	0.92	0.89	0.86	0.97	0.80	0.84	0.87	0.80	0.83	0.87	0.88
Adj. Flow (vph)	276	682	80	188	592	136	96	302	168	195	397	344
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	276	762	0	188	728	0	96	470	0	195	397	344
Confl. Peds. (#/hr)	20		22	22		20	12		11	11		12
Heavy Vehicles (%)	4%	1%	3%	1%	2%	1%	4%	3%	0%	1%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	2	0	0	6	0	0	0
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		8
Actuated Green, G (s)	58.0	40.3		50.7	36.0		54.4	45.1		63.0	50.7	50.7
Effective Green, g (s)	58.0	40.3		50.7	36.0		54.4	45.1		63.0	50.7	50.7
Actuated g/C Ratio	0.43	0.30		0.38	0.27		0.40	0.33		0.47	0.38	0.38
Clearance Time (s)	3.0	7.0		3.0	7.0		3.0	7.0		3.0	7.0	7.0
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	2.5
Lane Grp Cap (vph)	304	1028		276	901		336	577		314	691	539
v/s Ratio Prot	c0.13	0.22		0.07	0.22		0.02	c0.27		c0.07	0.22	
v/s Ratio Perm	c0.26			0.18			0.10			0.22		0.24
v/c Ratio	0.91	0.74		0.68	0.81		0.29	0.81		0.62	0.57	0.64
Uniform Delay, d1	30.8	42.7		31.0	46.3		26.1	41.1		25.4	33.6	34.6
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	28.9	4.8		6.2	7.7		0.3	12.0		3.3	3.5	5.7
Delay (s)	59.7	47.5		37.2	54.0		26.4	53.1		28.7	37.0	40.3
Level of Service	E	D		D	D		C	D		C	D	D
Approach Delay (s)		50.7			50.5			48.6			36.5	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	46.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	88.1%	ICU Level of Service	E
Analysis Period (min)	15		

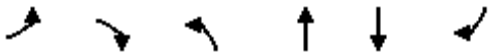
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	85	0	58	0	420	17	9	569	0
Future Volume (Veh/h)	0	0	0	85	0	58	0	420	17	9	569	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.25	0.25	0.25	0.37	0.25	0.45	0.25	0.88	0.53	0.75	0.84	0.25
Hourly flow rate (vph)	0	0	0	230	0	129	0	477	32	12	677	0
Pedestrians					7							
Lane Width (m)					3.5							
Walking Speed (m/s)					0.4							
Percent Blockage					2							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1323	1217	677	1201	1201	500	677			516		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1323	1217	677	1201	1201	500	677			516		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	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	100	0	100	77	100			99		
cM capacity (veh/h)	102	177	456	154	181	565	924			1042		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	0	359	509	12	677
Volume Left	0	230	0	12	0
Volume Right	0	129	32	0	0
cSH	1700	209	924	1042	1700
Volume to Capacity	0.00	1.72	0.00	0.01	0.40
Queue Length 95th (m)	0.0	185.0	0.0	0.3	0.0
Control Delay (s)	0.0	383.9	0.0	8.5	0.0
Lane LOS	A	F		A	
Approach Delay (s)	0.0	383.9	0.0	0.1	
Approach LOS	A	F			

Intersection Summary				
Average Delay	88.6			
Intersection Capacity Utilization	44.9%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	0	437	569	0
Future Volume (Veh/h)	0	0	0	437	569	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	475	618	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	856	618	618			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	856	618	618			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	301	437	972			

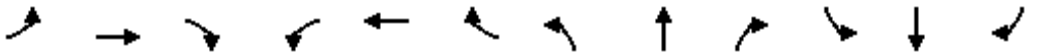
Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	0	158	317	618
Volume Left	0	0	0	0
Volume Right	0	0	0	0
cSH	1700	972	1700	1700
Volume to Capacity	0.00	0.00	0.19	0.36
Queue Length 95th (m)	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0
Lane LOS	A			
Approach Delay (s)	0.0	0.0		0.0
Approach LOS	A			

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	33.3%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	132	1028	144	834	211	79	194	332	324	574
v/c Ratio	0.51	0.60	0.61	0.69	0.40	0.24	0.44	0.91	0.61	0.49
Control Delay	25.5	35.1	29.7	38.0	33.8	20.1	41.5	74.1	26.5	32.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.5	35.1	29.7	38.0	33.8	20.1	41.5	74.1	26.5	32.7
Queue Length 50th (m)	18.2	78.0	20.2	94.3	40.3	9.4	37.2	73.5	45.7	53.2
Queue Length 95th (m)	25.7	89.1	31.1	112.3	52.2	15.2	55.9	#127.6	45.6	62.7
Internal Link Dist (m)		154.4		215.3			382.3			500.9
Turn Bay Length (m)	64.0		164.0			126.0			148.0	
Base Capacity (vph)	271	1742	246	1244	537	477	451	369	541	1182
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	0.49	0.59	0.59	0.67	0.39	0.17	0.43	0.90	0.60	0.49

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



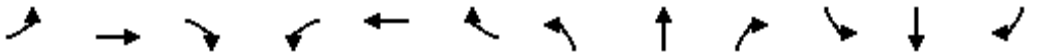
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	107	892	41	128	792	169	58	161	292	204	359	91
Future Volume (vph)	107	892	41	128	792	169	58	161	292	204	359	91
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.5	3.0	3.0	3.5	3.5	3.0	3.5	3.0	3.0	3.5	3.0
Total Lost time (s)	3.0	7.4		3.0	7.4	7.4	3.0	7.6	7.6	3.0	7.6	
Lane Util. Factor	1.00	0.91		1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00	
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	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1716	4967		1604	3535	1528	1604	1773	1453	1633	3371	
Flt Permitted	0.19	1.00		0.18	1.00	1.00	0.44	1.00	1.00	0.52	1.00	
Satd. Flow (perm)	339	4967		297	3535	1528	736	1773	1453	892	3371	
Peak-hour factor, PHF	0.81	0.91	0.85	0.89	0.95	0.80	0.73	0.83	0.88	0.63	0.77	0.84
Adj. Flow (vph)	132	980	48	144	834	211	79	194	332	324	466	108
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	132	1028	0	144	834	211	79	194	332	324	574	0
Confl. Peds. (#/hr)	11		4	4		11	3		5	5		3
Heavy Vehicles (%)	4%	2%	12%	5%	1%	2%	5%	6%	2%	3%	3%	1%
Turn Type	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6		6	4		4	8		
Actuated Green, G (s)	49.6	40.5		50.0	40.7	40.7	37.8	30.7	30.7	52.2	42.1	
Effective Green, g (s)	49.6	40.5		50.0	40.7	40.7	37.8	30.7	30.7	52.2	42.1	
Actuated g/C Ratio	0.41	0.34		0.42	0.34	0.34	0.31	0.26	0.26	0.44	0.35	
Clearance Time (s)	3.0	7.4		3.0	7.4	7.4	3.0	7.6	7.6	3.0	7.6	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	
Lane Grp Cap (vph)	244	1676		225	1198	518	283	453	371	502	1182	
v/s Ratio Prot	0.04	0.21		c0.05	c0.24		0.02	0.11		c0.10	0.17	
v/s Ratio Perm	0.18			0.22		0.14	0.07		c0.23	0.18		
v/c Ratio	0.54	0.61		0.64	0.70	0.41	0.28	0.43	0.89	0.65	0.49	
Uniform Delay, d1	24.1	33.2		23.6	34.3	30.4	29.6	37.3	43.1	24.1	30.5	
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	1.9	1.7		5.4	3.4	2.4	0.4	0.5	22.9	2.5	0.2	
Delay (s)	26.0	34.9		29.0	37.7	32.8	30.0	37.8	66.0	26.6	30.7	
Level of Service	C	C		C	D	C	C	D	E	C	C	
Approach Delay (s)		33.9			35.7			52.2			29.2	
Approach LOS		C			D			D			C	

Intersection Summary			
HCM 2000 Control Delay	36.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	76.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Appendix E: 2027 Future Background Conditions Synchro Reports

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	309	564	88	453	87	418	123	194	230
v/c Ratio	0.74	0.49	0.26	0.52	0.17	0.68	0.36	0.29	0.46
Control Delay	36.3	37.5	23.7	44.8	19.3	43.4	21.7	31.4	35.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.3	37.5	23.7	44.8	19.3	43.4	21.7	31.4	35.9
Queue Length 50th (m)	53.9	62.5	13.1	54.9	12.1	93.3	17.4	35.9	45.8
Queue Length 95th (m)	63.7	73.8	18.8	67.4	14.8	123.9	25.0	49.8	57.0
Internal Link Dist (m)		255.8		297.4		1383.0		343.0	
Turn Bay Length (m)	74.0		45.0		58.0				93.0
Base Capacity (vph)	429	1145	471	877	599	616	468	675	501
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	0.72	0.49	0.19	0.52	0.15	0.68	0.26	0.29	0.46

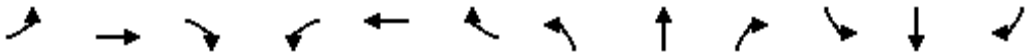
Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	238	397	40	64	284	89	55	209	115	97	155	170
Future Volume (vph)	238	397	40	64	284	89	55	209	115	97	155	170
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.0	3.5	3.0	3.0	3.5	3.0	3.0	3.5	3.0	3.0	3.5	3.0
Total Lost time (s)	3.0	7.0		3.0	7.0		3.0	7.0		3.0	7.0	7.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	0.99		1.00	1.00	0.97
Flpb, ped/bikes	1.00	1.00		0.99	1.00		0.99	1.00		1.00	1.00	1.00
Frt	1.00	0.98		1.00	0.96		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1633	3364		1673	3263		1546	1684		1634	1789	1328
Flt Permitted	0.35	1.00		0.43	1.00		0.62	1.00		0.31	1.00	1.00
Satd. Flow (perm)	606	3364		757	3263		1002	1684		533	1789	1328
Peak-hour factor, PHF	0.77	0.82	0.50	0.73	0.85	0.75	0.63	0.84	0.68	0.79	0.80	0.74
Adj. Flow (vph)	309	484	80	88	334	119	87	249	169	123	194	230
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	309	564	0	88	453	0	87	418	0	123	194	230
Confl. Peds. (#/hr)	9		16	16		9	14		9	9		14
Heavy Vehicles (%)	3%	3%	3%	0%	6%	0%	8%	5%	2%	3%	5%	10%
Bus Blockages (#/hr)	0	0	0	0	0	2	0	0	6	0	0	0
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		8
Actuated Green, G (s)	58.0	46.0		45.3	36.3		58.4	49.4		61.6	51.0	51.0
Effective Green, g (s)	58.0	46.0		45.3	36.3		58.4	49.4		61.6	51.0	51.0
Actuated g/C Ratio	0.43	0.34		0.34	0.27		0.43	0.37		0.46	0.38	0.38
Clearance Time (s)	3.0	7.0		3.0	7.0		3.0	7.0		3.0	7.0	7.0
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	2.5
Lane Grp Cap (vph)	402	1146		315	877		469	616		329	675	501
v/s Ratio Prot	c0.11	0.17		0.02	0.14		0.01	c0.25		c0.03	0.11	
v/s Ratio Perm	c0.22			0.08			0.07			0.14		0.17
v/c Ratio	0.77	0.49		0.28	0.52		0.19	0.68		0.37	0.29	0.46
Uniform Delay, d1	27.8	35.2		31.5	41.9		23.0	36.1		23.4	29.3	31.6
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	8.2	1.5		0.4	2.2		0.1	5.9		0.5	1.1	3.0
Delay (s)	36.0	36.8		31.8	44.1		23.2	42.0		23.9	30.4	34.6
Level of Service	D	D		C	D		C	D		C	C	C
Approach Delay (s)		36.5			42.1			38.8			30.7	
Approach LOS		D			D			D			C	

Intersection Summary			
HCM 2000 Control Delay	36.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	84.4%	ICU Level of Service	E
Analysis Period (min)	15		

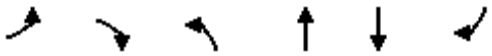
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	20	0	11	0	368	72	25	248	0
Future Volume (Veh/h)	0	0	0	20	0	11	0	368	72	25	248	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.25	0.25	0.25	0.56	0.25	0.83	0.25	0.74	0.60	0.72	0.79	0.25
Hourly flow rate (vph)	0	0	0	36	0	13	0	497	120	35	314	0
Pedestrians					6							
Lane Width (m)					3.5							
Walking Speed (m/s)					0.4							
Percent Blockage					1							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	954	1007	314	947	947	563	314			623		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	954	1007	314	947	947	563	314			623		
tC, single (s)	7.1	6.5	6.2	7.2	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.6	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	84	100	98	100			96		
cM capacity (veh/h)	225	230	731	220	250	522	1258			935		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	0	49	617	35	314
Volume Left	0	36	0	35	0
Volume Right	0	13	120	0	0
cSH	1700	260	1258	935	1700
Volume to Capacity	0.00	0.19	0.00	0.04	0.18
Queue Length 95th (m)	0.0	5.2	0.0	0.9	0.0
Control Delay (s)	0.0	22.1	0.0	9.0	0.0
Lane LOS	A	C		A	
Approach Delay (s)	0.0	22.1	0.0	0.9	
Approach LOS	A	C			

Intersection Summary				
Average Delay	1.4			
Intersection Capacity Utilization	33.8%	ICU Level of Service		A
Analysis Period (min)	15			



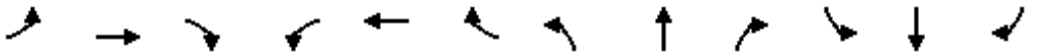
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	0	440	248	0
Future Volume (Veh/h)	0	0	0	440	248	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	478	270	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	509	270	270			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	509	270	270			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	499	734	1305			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	0	159	319	270
Volume Left	0	0	0	0
Volume Right	0	0	0	0
cSH	1700	1305	1700	1700
Volume to Capacity	0.00	0.00	0.19	0.16
Queue Length 95th (m)	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0
Lane LOS	A			
Approach Delay (s)	0.0	0.0		0.0
Approach LOS	A			

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	16.4%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	102	793	61	622	234	41	275	151	172	214
v/c Ratio	0.26	0.36	0.18	0.42	0.37	0.12	0.81	0.52	0.53	0.24
Control Delay	16.0	24.1	15.9	27.0	28.4	21.5	63.0	48.0	30.3	33.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.0	24.1	15.9	27.0	28.4	21.5	63.0	48.0	30.3	33.4
Queue Length 50th (m)	10.6	44.4	6.2	52.3	36.4	6.0	62.2	32.0	27.7	21.0
Queue Length 95th (m)	16.4	68.2	13.2	84.7	69.1	8.4	52.6	44.0	27.1	20.2
Internal Link Dist (m)		154.4		215.3			382.3			500.9
Turn Bay Length (m)	64.0		164.0			126.0			148.0	
Base Capacity (vph)	415	2233	372	1505	646	496	415	352	375	896
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	0.25	0.36	0.16	0.41	0.36	0.08	0.66	0.43	0.46	0.24

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	65	689	20	47	560	206	28	168	125	119	91	59
Future Volume (vph)	65	689	20	47	560	206	28	168	125	119	91	59
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.5	3.0	3.0	3.5	3.5	3.0	3.5	3.0	3.0	3.5	3.0
Total Lost time (s)	3.0	7.4		3.0	7.4	7.4	3.0	7.6	7.6	3.0	7.6	
Lane Util. Factor	1.00	0.91		1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.99	1.00	1.00	1.00	1.00	1.00	
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	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1622	4849		1545	3433	1473	1619	1678	1422	1560	3209	
Flt Permitted	0.34	1.00		0.32	1.00	1.00	0.62	1.00	1.00	0.33	1.00	
Satd. Flow (perm)	574	4849		522	3433	1473	1053	1678	1422	536	3209	
Peak-hour factor, PHF	0.64	0.90	0.75	0.77	0.90	0.88	0.69	0.61	0.83	0.69	0.68	0.74
Adj. Flow (vph)	102	766	27	61	622	234	41	275	151	172	134	80
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	102	793	0	61	622	234	41	275	151	172	214	0
Confl. Peds. (#/hr)	1		1	1		1	1					1
Heavy Vehicles (%)	10%	5%	11%	9%	4%	7%	4%	12%	6%	8%	6%	2%
Turn Type	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6		6	4		4	8		
Actuated Green, G (s)	62.6	53.8		57.6	51.3	51.3	30.8	25.0	25.0	41.9	33.1	
Effective Green, g (s)	62.6	53.8		57.6	51.3	51.3	30.8	25.0	25.0	41.9	33.1	
Actuated g/C Ratio	0.52	0.45		0.48	0.43	0.43	0.26	0.21	0.21	0.35	0.28	
Clearance Time (s)	3.0	7.4		3.0	7.4	7.4	3.0	7.6	7.6	3.0	7.6	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	
Lane Grp Cap (vph)	376	2173		304	1467	629	297	349	296	305	885	
v/s Ratio Prot	c0.02	0.16		0.01	c0.18		0.01	c0.16		c0.07	0.07	
v/s Ratio Perm	0.12			0.09		0.16	0.03		0.11	0.13		
v/c Ratio	0.27	0.36		0.20	0.42	0.37	0.14	0.79	0.51	0.56	0.24	
Uniform Delay, d1	15.2	21.8		16.9	24.0	23.4	34.0	45.0	42.1	29.4	33.7	
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	0.3	0.5		0.2	0.9	1.7	0.2	10.8	1.1	1.9	0.1	
Delay (s)	15.5	22.3		17.2	24.9	25.1	34.2	55.8	43.2	31.3	33.8	
Level of Service	B	C		B	C	C	C	E	D	C	C	
Approach Delay (s)		21.5			24.4			49.8			32.7	
Approach LOS		C			C			D			C	

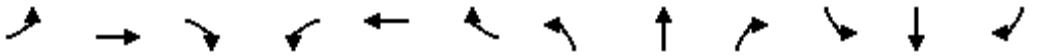
Intersection Summary			
HCM 2000 Control Delay	29.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	66.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	305	840	208	804	106	518	216	438	381
v/c Ratio	1.04	0.85	0.77	0.92	0.33	0.93	0.73	0.64	0.71
Control Delay	100.7	55.1	45.9	64.8	21.8	69.4	37.9	40.7	45.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	100.7	55.1	45.9	64.8	21.8	69.4	37.9	40.7	45.7
Queue Length 50th (m)	~71.4	112.2	33.7	110.2	14.9	132.4	32.5	95.6	86.1
Queue Length 95th (m)	#123.6	#154.4	55.1	#146.3	23.6	#216.5	49.2	131.4	125.7
Internal Link Dist (m)		255.8		297.4		1383.0		343.0	
Turn Bay Length (m)	74.0		45.0		58.0				93.0
Base Capacity (vph)	293	990	317	876	482	556	383	684	533
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	1.04	0.85	0.66	0.92	0.22	0.93	0.56	0.64	0.71

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	265	692	78	179	634	120	89	290	148	179	381	335
Future Volume (vph)	265	692	78	179	634	120	89	290	148	179	381	335
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.0	3.5	3.0	3.0	3.5	3.0	3.0	3.5	3.0	3.0	3.5	3.0
Total Lost time (s)	3.0	7.0		3.0	7.0		3.0	7.0		3.0	7.0	7.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	0.99		1.00	1.00	0.97
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.98		1.00	0.97		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1619	3446		1666	3383		1616	1728		1668	1842	1436
Flt Permitted	0.11	1.00		0.14	1.00		0.35	1.00		0.14	1.00	1.00
Satd. Flow (perm)	179	3446		244	3383		595	1728		241	1842	1436
Peak-hour factor, PHF	0.87	0.92	0.89	0.86	0.97	0.80	0.84	0.87	0.80	0.83	0.87	0.88
Adj. Flow (vph)	305	752	88	208	654	150	106	333	185	216	438	381
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	305	840	0	208	804	0	106	518	0	216	438	381
Confl. Peds. (#/hr)	20		22	22		20	12		11	11		12
Heavy Vehicles (%)	4%	1%	3%	1%	2%	1%	4%	3%	0%	1%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	2	0	0	6	0	0	0
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		8
Actuated Green, G (s)	58.0	38.8		51.2	35.0		53.3	43.5		63.0	50.2	50.2
Effective Green, g (s)	58.0	38.8		51.2	35.0		53.3	43.5		63.0	50.2	50.2
Actuated g/C Ratio	0.43	0.29		0.38	0.26		0.39	0.32		0.47	0.37	0.37
Clearance Time (s)	3.0	7.0		3.0	7.0		3.0	7.0		3.0	7.0	7.0
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	2.5
Lane Grp Cap (vph)	290	990		263	877		309	556		286	684	533
v/s Ratio Prot	c0.16	0.24		0.09	0.24		0.02	c0.30		c0.09	0.24	
v/s Ratio Perm	c0.30			0.21			0.11			0.26		0.27
v/c Ratio	1.05	0.85		0.79	0.92		0.34	0.93		0.76	0.64	0.71
Uniform Delay, d1	41.4	45.3		32.1	48.6		27.2	44.3		27.5	35.0	36.3
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	67.1	9.0		14.4	15.9		0.5	24.5		10.3	4.6	8.0
Delay (s)	108.4	54.3		46.6	64.5		27.7	68.9		37.8	39.5	44.2
Level of Service	F	D		D	E		C	E		D	D	D
Approach Delay (s)		68.7			60.8			61.9			40.9	
Approach LOS		E			E			E			D	

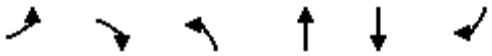
Intersection Summary			
HCM 2000 Control Delay	58.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	90.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	94	0	64	0	464	19	10	628	0
Future Volume (Veh/h)	0	0	0	94	0	64	0	464	19	10	628	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.25	0.25	0.25	0.37	0.25	0.45	0.25	0.88	0.53	0.75	0.84	0.25
Hourly flow rate (vph)	0	0	0	254	0	142	0	527	36	13	748	0
Pedestrians					7							
Lane Width (m)					3.5							
Walking Speed (m/s)					0.4							
Percent Blockage					2							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1461	1344	748	1326	1326	552	748			570		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1461	1344	748	1326	1326	552	748			570		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	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	100	0	100	73	100			99		
cM capacity (veh/h)	77	149	416	126	152	528	870			995		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	0	396	563	13	748
Volume Left	0	254	0	13	0
Volume Right	0	142	36	0	0
cSH	1700	173	870	995	1700
Volume to Capacity	0.00	2.28	0.00	0.01	0.44
Queue Length 95th (m)	0.0	246.3	0.0	0.3	0.0
Control Delay (s)	0.0	638.0	0.0	8.7	0.0
Lane LOS	A	F		A	
Approach Delay (s)	0.0	638.0	0.0	0.1	
Approach LOS	A	F			

Intersection Summary				
Average Delay	147.0			
Intersection Capacity Utilization	48.8%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	0	483	628	0
Future Volume (Veh/h)	0	0	0	483	628	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	525	683	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	946	683	683			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	946	683	683			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	264	396	919			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	0	175	350	683
Volume Left	0	0	0	0
Volume Right	0	0	0	0
cSH	1700	919	1700	1700
Volume to Capacity	0.00	0.00	0.21	0.40
Queue Length 95th (m)	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0
Lane LOS	A			
Approach Delay (s)	0.0	0.0		0.0
Approach LOS	A			

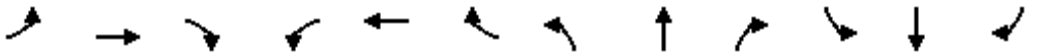
Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	36.4%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	146	1135	158	920	234	88	214	366	357	633
v/c Ratio	0.67	0.71	0.75	0.80	0.47	0.27	0.45	0.94	0.67	0.54
Control Delay	34.3	38.7	43.1	43.5	36.1	20.3	41.4	76.9	27.8	33.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.3	38.7	43.1	43.5	36.1	20.3	41.4	76.9	27.8	33.9
Queue Length 50th (m)	19.3	85.0	21.2	103.2	43.6	11.2	43.7	~93.3	54.7	63.1
Queue Length 95th (m)	28.1	100.2	#44.4	126.8	57.8	16.6	61.4	#145.8	50.5	70.2
Internal Link Dist (m)		154.4		215.3			382.3			500.9
Turn Bay Length (m)	64.0		164.0			126.0			148.0	
Base Capacity (vph)	228	1655	214	1178	509	475	476	390	546	1183
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	0.64	0.69	0.74	0.78	0.46	0.19	0.45	0.94	0.65	0.54

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



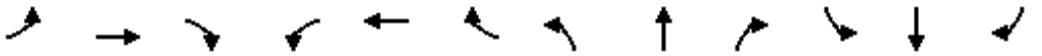
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	118	985	45	141	874	187	64	178	322	225	396	100
Future Volume (vph)	118	985	45	141	874	187	64	178	322	225	396	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.5	3.0	3.0	3.5	3.5	3.0	3.5	3.0	3.0	3.5	3.0
Total Lost time (s)	3.0	7.4		3.0	7.4	7.4	3.0	7.6	7.6	3.0	7.6	
Lane Util. Factor	1.00	0.91		1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00	
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	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1716	4967		1604	3535	1528	1604	1773	1453	1633	3371	
Flt Permitted	0.13	1.00		0.13	1.00	1.00	0.41	1.00	1.00	0.50	1.00	
Satd. Flow (perm)	238	4967		222	3535	1528	691	1773	1453	852	3371	
Peak-hour factor, PHF	0.81	0.91	0.85	0.89	0.95	0.80	0.73	0.83	0.88	0.63	0.77	0.84
Adj. Flow (vph)	146	1082	53	158	920	234	88	214	366	357	514	119
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	146	1135	0	158	920	234	88	214	366	357	633	0
Confl. Peds. (#/hr)	11		4	4		11	3		5	5		3
Heavy Vehicles (%)	4%	2%	12%	5%	1%	2%	5%	6%	2%	3%	3%	1%
Turn Type	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6		6	4		4	8		
Actuated Green, G (s)	47.9	38.5		48.5	38.8	38.8	40.9	32.2	32.2	53.8	42.1	
Effective Green, g (s)	47.9	38.5		48.5	38.8	38.8	40.9	32.2	32.2	53.8	42.1	
Actuated g/C Ratio	0.40	0.32		0.40	0.32	0.32	0.34	0.27	0.27	0.45	0.35	
Clearance Time (s)	3.0	7.4		3.0	7.4	7.4	3.0	7.6	7.6	3.0	7.6	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	
Lane Grp Cap (vph)	210	1593		201	1142	494	301	475	389	503	1182	
v/s Ratio Prot	0.05	0.23		c0.06	c0.26		0.02	0.12		c0.11	0.19	
v/s Ratio Perm	0.22			0.25		0.15	0.08		c0.25	0.21		
v/c Ratio	0.70	0.71		0.79	0.81	0.47	0.29	0.45	0.94	0.71	0.54	
Uniform Delay, d1	26.4	35.9		25.7	37.1	32.4	27.6	36.5	43.0	23.7	31.1	
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	8.9	2.7		17.5	6.1	3.2	0.4	0.5	30.8	4.2	0.4	
Delay (s)	35.3	38.6		43.2	43.3	35.7	28.0	37.0	73.8	27.9	31.5	
Level of Service	D	D		D	D	D	C	D	E	C	C	
Approach Delay (s)		38.2			41.9			56.0			30.2	
Approach LOS		D			D			E			C	

Intersection Summary			
HCM 2000 Control Delay	40.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	78.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Appendix F: 2027 Future Background Conditions Synchro Reports - Mitigated

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	309	564	88	453	87	418	123	194	230
v/c Ratio	0.74	0.49	0.26	0.52	0.17	0.68	0.36	0.29	0.46
Control Delay	36.3	37.5	23.7	44.8	19.3	43.4	21.7	31.4	35.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.3	37.5	23.7	44.8	19.3	43.4	21.7	31.4	35.9
Queue Length 50th (m)	53.9	62.5	13.1	54.9	12.1	93.3	17.4	35.9	45.8
Queue Length 95th (m)	63.7	73.8	18.8	67.4	14.8	123.9	25.0	49.8	57.0
Internal Link Dist (m)		255.8		297.4		1383.0		343.0	
Turn Bay Length (m)	74.0		45.0		58.0				93.0
Base Capacity (vph)	429	1145	471	877	599	616	468	675	501
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	0.72	0.49	0.19	0.52	0.15	0.68	0.26	0.29	0.46

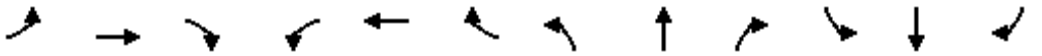
Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	238	397	40	64	284	89	55	209	115	97	155	170
Future Volume (vph)	238	397	40	64	284	89	55	209	115	97	155	170
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.0	3.5	3.0	3.0	3.5	3.0	3.0	3.5	3.0	3.0	3.5	3.0
Total Lost time (s)	3.0	7.0		3.0	7.0		3.0	7.0		3.0	7.0	7.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	0.99		1.00	1.00	0.97
Flpb, ped/bikes	1.00	1.00		0.99	1.00		0.99	1.00		1.00	1.00	1.00
Frt	1.00	0.98		1.00	0.96		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1633	3364		1673	3263		1546	1684		1634	1789	1328
Flt Permitted	0.35	1.00		0.43	1.00		0.62	1.00		0.31	1.00	1.00
Satd. Flow (perm)	606	3364		757	3263		1002	1684		533	1789	1328
Peak-hour factor, PHF	0.77	0.82	0.50	0.73	0.85	0.75	0.63	0.84	0.68	0.79	0.80	0.74
Adj. Flow (vph)	309	484	80	88	334	119	87	249	169	123	194	230
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	309	564	0	88	453	0	87	418	0	123	194	230
Confl. Peds. (#/hr)	9		16	16		9	14		9	9		14
Heavy Vehicles (%)	3%	3%	3%	0%	6%	0%	8%	5%	2%	3%	5%	10%
Bus Blockages (#/hr)	0	0	0	0	0	2	0	0	6	0	0	0
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		8
Actuated Green, G (s)	58.0	46.0		45.3	36.3		58.4	49.4		61.6	51.0	51.0
Effective Green, g (s)	58.0	46.0		45.3	36.3		58.4	49.4		61.6	51.0	51.0
Actuated g/C Ratio	0.43	0.34		0.34	0.27		0.43	0.37		0.46	0.38	0.38
Clearance Time (s)	3.0	7.0		3.0	7.0		3.0	7.0		3.0	7.0	7.0
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	2.5
Lane Grp Cap (vph)	402	1146		315	877		469	616		329	675	501
v/s Ratio Prot	c0.11	0.17		0.02	0.14		0.01	c0.25		c0.03	0.11	
v/s Ratio Perm	c0.22			0.08			0.07			0.14		0.17
v/c Ratio	0.77	0.49		0.28	0.52		0.19	0.68		0.37	0.29	0.46
Uniform Delay, d1	27.8	35.2		31.5	41.9		23.0	36.1		23.4	29.3	31.6
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	8.2	1.5		0.4	2.2		0.1	5.9		0.5	1.1	3.0
Delay (s)	36.0	36.8		31.8	44.1		23.2	42.0		23.9	30.4	34.6
Level of Service	D	D		C	D		C	D		C	C	C
Approach Delay (s)		36.5			42.1			38.8			30.7	
Approach LOS		D			D			D			C	

Intersection Summary			
HCM 2000 Control Delay	36.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	84.4%	ICU Level of Service	E
Analysis Period (min)	15		

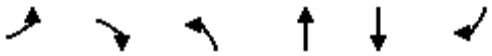
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	20	0	11	0	368	72	25	248	0
Future Volume (Veh/h)	0	0	0	20	0	11	0	368	72	25	248	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.25	0.25	0.25	0.56	0.25	0.83	0.25	0.74	0.60	0.72	0.79	0.25
Hourly flow rate (vph)	0	0	0	36	0	13	0	497	120	35	314	0
Pedestrians					6							
Lane Width (m)					3.5							
Walking Speed (m/s)					0.4							
Percent Blockage					1							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	954	1007	314	947	947	563	314			623		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	954	1007	314	947	947	563	314			623		
tC, single (s)	7.1	6.5	6.2	7.2	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.6	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	84	100	98	100			96		
cM capacity (veh/h)	225	230	731	220	250	522	1258			935		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	0	49	617	35	314
Volume Left	0	36	0	35	0
Volume Right	0	13	120	0	0
cSH	1700	260	1258	935	1700
Volume to Capacity	0.00	0.19	0.00	0.04	0.18
Queue Length 95th (m)	0.0	5.2	0.0	0.9	0.0
Control Delay (s)	0.0	22.1	0.0	9.0	0.0
Lane LOS	A	C		A	
Approach Delay (s)	0.0	22.1	0.0	0.9	
Approach LOS	A	C			

Intersection Summary				
Average Delay	1.4			
Intersection Capacity Utilization	33.8%	ICU Level of Service		A
Analysis Period (min)	15			



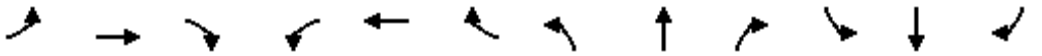
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	0	440	248	0
Future Volume (Veh/h)	0	0	0	440	248	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	478	270	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	509	270	270			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	509	270	270			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	499	734	1305			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	0	159	319	270
Volume Left	0	0	0	0
Volume Right	0	0	0	0
cSH	1700	1305	1700	1700
Volume to Capacity	0.00	0.00	0.19	0.16
Queue Length 95th (m)	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0
Lane LOS	A			
Approach Delay (s)	0.0	0.0		0.0
Approach LOS	A			

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	16.4%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	102	793	61	622	234	41	275	151	172	214
v/c Ratio	0.26	0.36	0.18	0.42	0.37	0.12	0.81	0.52	0.53	0.24
Control Delay	16.0	24.1	15.9	27.0	28.4	21.5	63.0	48.0	30.3	33.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.0	24.1	15.9	27.0	28.4	21.5	63.0	48.0	30.3	33.4
Queue Length 50th (m)	10.6	44.4	6.2	52.3	36.4	6.0	62.2	32.0	27.7	21.0
Queue Length 95th (m)	16.4	68.2	13.2	84.7	69.1	8.4	52.6	44.0	27.1	20.2
Internal Link Dist (m)		154.4		215.3			382.3			500.9
Turn Bay Length (m)	64.0		164.0			126.0			148.0	
Base Capacity (vph)	415	2233	372	1505	646	496	415	352	375	896
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	0.25	0.36	0.16	0.41	0.36	0.08	0.66	0.43	0.46	0.24

Intersection Summary



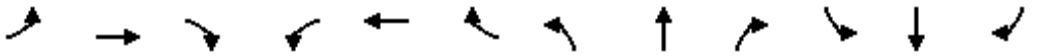
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	65	689	20	47	560	206	28	168	125	119	91	59
Future Volume (vph)	65	689	20	47	560	206	28	168	125	119	91	59
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.5	3.0	3.0	3.5	3.5	3.0	3.5	3.0	3.0	3.5	3.0
Total Lost time (s)	3.0	7.4		3.0	7.4	7.4	3.0	7.6	7.6	3.0	7.6	
Lane Util. Factor	1.00	0.91		1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.99	1.00	1.00	1.00	1.00	1.00	
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	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1622	4849		1545	3433	1473	1619	1678	1422	1560	3209	
Flt Permitted	0.34	1.00		0.32	1.00	1.00	0.62	1.00	1.00	0.33	1.00	
Satd. Flow (perm)	574	4849		522	3433	1473	1053	1678	1422	536	3209	
Peak-hour factor, PHF	0.64	0.90	0.75	0.77	0.90	0.88	0.69	0.61	0.83	0.69	0.68	0.74
Adj. Flow (vph)	102	766	27	61	622	234	41	275	151	172	134	80
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	102	793	0	61	622	234	41	275	151	172	214	0
Confl. Peds. (#/hr)	1		1	1		1	1					1
Heavy Vehicles (%)	10%	5%	11%	9%	4%	7%	4%	12%	6%	8%	6%	2%
Turn Type	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6		6	4		4	8		
Actuated Green, G (s)	62.6	53.8		57.6	51.3	51.3	30.8	25.0	25.0	41.9	33.1	
Effective Green, g (s)	62.6	53.8		57.6	51.3	51.3	30.8	25.0	25.0	41.9	33.1	
Actuated g/C Ratio	0.52	0.45		0.48	0.43	0.43	0.26	0.21	0.21	0.35	0.28	
Clearance Time (s)	3.0	7.4		3.0	7.4	7.4	3.0	7.6	7.6	3.0	7.6	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	
Lane Grp Cap (vph)	376	2173		304	1467	629	297	349	296	305	885	
v/s Ratio Prot	c0.02	0.16		0.01	c0.18		0.01	c0.16		c0.07	0.07	
v/s Ratio Perm	0.12			0.09		0.16	0.03		0.11	0.13		
v/c Ratio	0.27	0.36		0.20	0.42	0.37	0.14	0.79	0.51	0.56	0.24	
Uniform Delay, d1	15.2	21.8		16.9	24.0	23.4	34.0	45.0	42.1	29.4	33.7	
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	0.3	0.5		0.2	0.9	1.7	0.2	10.8	1.1	1.9	0.1	
Delay (s)	15.5	22.3		17.2	24.9	25.1	34.2	55.8	43.2	31.3	33.8	
Level of Service	B	C		B	C	C	C	E	D	C	C	
Approach Delay (s)		21.5			24.4			49.8			32.7	
Approach LOS		C			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	29.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	66.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	305	840	208	804	106	518	216	438	381
v/c Ratio	0.97	0.72	0.78	0.85	0.37	0.83	0.90	0.63	0.70
Control Delay	78.0	43.8	43.7	55.2	24.7	51.9	64.9	39.2	43.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	78.0	43.8	43.7	55.2	24.7	51.9	64.9	39.2	43.9
Queue Length 50th (m)	60.8	103.7	32.1	106.6	15.6	125.1	34.1	94.7	85.4
Queue Length 95th (m)	#111.3	127.3	#51.0	131.7	24.7	163.0	#60.4	124.5	119.2
Internal Link Dist (m)		255.8		297.4		1383.0		343.0	
Turn Bay Length (m)	74.0		45.0		58.0				93.0
Base Capacity (vph)	313	1159	271	951	286	626	239	695	542
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	0.97	0.72	0.77	0.85	0.37	0.83	0.90	0.63	0.70

Intersection Summary

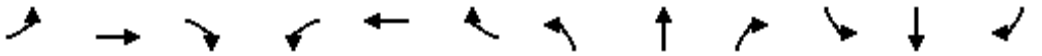
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	265	692	78	179	634	120	89	290	148	179	381	335
Future Volume (vph)	265	692	78	179	634	120	89	290	148	179	381	335
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.0	3.5	3.0	3.0	3.5	3.0	3.0	3.5	3.0	3.0	3.5	3.0
Total Lost time (s)	3.0	7.0		3.0	7.0		3.0	7.0		3.0	7.0	7.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	0.99		1.00	1.00	0.97
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.98		1.00	0.97		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1619	3446		1665	3383		1617	1728		1668	1842	1436
Flt Permitted	0.13	1.00		0.21	1.00		0.32	1.00		0.20	1.00	1.00
Satd. Flow (perm)	220	3446		360	3383		547	1728		346	1842	1436
Peak-hour factor, PHF	0.87	0.92	0.89	0.86	0.97	0.80	0.84	0.87	0.80	0.83	0.87	0.88
Adj. Flow (vph)	305	752	88	208	654	150	106	333	185	216	438	381
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	305	840	0	208	804	0	106	518	0	216	438	381
Confl. Peds. (#/hr)	20		22	22		20	12		11	11		12
Heavy Vehicles (%)	4%	1%	3%	1%	2%	1%	4%	3%	0%	1%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	2	0	0	6	0	0	0
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		8
Actuated Green, G (s)	61.0	45.4		50.6	38.0		55.0	49.0		59.0	51.0	51.0
Effective Green, g (s)	61.0	45.4		50.6	38.0		55.0	49.0		59.0	51.0	51.0
Actuated g/C Ratio	0.45	0.34		0.37	0.28		0.41	0.36		0.44	0.38	0.38
Clearance Time (s)	3.0	7.0		3.0	7.0		3.0	7.0		3.0	7.0	7.0
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	2.5
Lane Grp Cap (vph)	306	1158		256	952		270	627		229	695	542
v/s Ratio Prot	c0.15	0.24		0.08	0.24		0.02	0.30		c0.06	0.24	
v/s Ratio Perm	c0.30			0.23			0.14			c0.36		0.27
v/c Ratio	1.00	0.73		0.81	0.84		0.39	0.83		0.94	0.63	0.70
Uniform Delay, d1	37.4	39.3		31.4	45.7		26.7	39.1		36.0	34.3	35.6
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	50.2	4.0		17.2	9.1		0.7	11.8		43.6	4.3	7.4
Delay (s)	87.6	43.3		48.6	54.8		27.4	51.0		79.6	38.6	43.0
Level of Service	F	D		D	D		C	D		E	D	D
Approach Delay (s)		55.1			53.5			47.0			48.8	
Approach LOS		E			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	51.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	90.9%	ICU Level of Service	E
Analysis Period (min)	15		

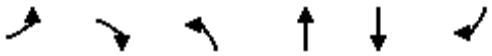
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	94	0	64	0	464	19	10	628	0
Future Volume (Veh/h)	0	0	0	94	0	64	0	464	19	10	628	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.25	0.25	0.25	0.37	0.25	0.45	0.25	0.88	0.53	0.75	0.84	0.25
Hourly flow rate (vph)	0	0	0	254	0	142	0	527	36	13	748	0
Pedestrians					7							
Lane Width (m)					3.5							
Walking Speed (m/s)					0.4							
Percent Blockage					2							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1461	1344	748	1326	1326	552	748			570		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1461	1344	748	1326	1326	552	748			570		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	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	100	0	100	73	100			99		
cM capacity (veh/h)	77	149	416	126	152	528	870			995		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	0	396	563	13	748
Volume Left	0	254	0	13	0
Volume Right	0	142	36	0	0
cSH	1700	173	870	995	1700
Volume to Capacity	0.00	2.28	0.00	0.01	0.44
Queue Length 95th (m)	0.0	246.3	0.0	0.3	0.0
Control Delay (s)	0.0	638.0	0.0	8.7	0.0
Lane LOS	A	F		A	
Approach Delay (s)	0.0	638.0	0.0	0.1	
Approach LOS	A	F			

Intersection Summary				
Average Delay	147.0			
Intersection Capacity Utilization	48.8%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	0	483	628	0
Future Volume (Veh/h)	0	0	0	483	628	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	525	683	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	946	683	683			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	946	683	683			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	264	396	919			

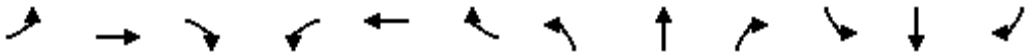
Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	0	175	350	683
Volume Left	0	0	0	0
Volume Right	0	0	0	0
cSH	1700	919	1700	1700
Volume to Capacity	0.00	0.00	0.21	0.40
Queue Length 95th (m)	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0
Lane LOS	A			
Approach Delay (s)	0.0	0.0		0.0
Approach LOS	A			

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	36.4%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	146	1135	158	920	234	88	214	366	357	633
v/c Ratio	0.58	0.66	0.66	0.73	0.43	0.31	0.41	0.85	0.79	0.57
Control Delay	28.7	36.2	33.3	38.6	33.5	21.5	34.6	57.2	41.2	35.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.7	36.2	33.3	38.6	33.5	21.5	34.6	57.2	41.2	35.4
Queue Length 50th (m)	18.3	84.5	20.1	100.6	42.5	11.8	39.8	80.1	57.6	65.8
Queue Length 95th (m)	29.4	102.1	#45.4	127.5	58.2	15.9	49.6	101.6	48.4	63.7
Internal Link Dist (m)		154.4		215.3			382.3			500.9
Turn Bay Length (m)	64.0		164.0			126.0			148.0	
Base Capacity (vph)	251	1716	241	1257	543	286	670	549	453	1247
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	0.58	0.66	0.66	0.73	0.43	0.31	0.32	0.67	0.79	0.51

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	118	985	45	141	874	187	64	178	322	225	396	100
Future Volume (vph)	118	985	45	141	874	187	64	178	322	225	396	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.5	3.0	3.0	3.5	3.5	3.0	3.5	3.0	3.0	3.5	3.0
Total Lost time (s)	3.0	7.4		3.0	7.4	7.4	3.0	7.6	7.6	3.0	7.6	
Lane Util. Factor	1.00	0.91		1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00	
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	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1716	4967		1604	3535	1528	1604	1773	1453	1633	3371	
Flt Permitted	0.16	1.00		0.14	1.00	1.00	0.33	1.00	1.00	0.51	1.00	
Satd. Flow (perm)	291	4967		238	3535	1528	556	1773	1453	885	3371	
Peak-hour factor, PHF	0.81	0.91	0.85	0.89	0.95	0.80	0.73	0.83	0.88	0.63	0.77	0.84
Adj. Flow (vph)	146	1082	53	158	920	234	88	214	366	357	514	119
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	146	1135	0	158	920	234	88	214	366	357	633	0
Confl. Peds. (#/hr)	11		4	4		11	3		5	5		3
Heavy Vehicles (%)	4%	2%	12%	5%	1%	2%	5%	6%	2%	3%	3%	1%
Turn Type	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6		6	4		4	8		
Actuated Green, G (s)	51.2	41.4		53.6	42.6	42.6	43.0	35.7	35.7	49.6	39.3	
Effective Green, g (s)	51.2	41.4		53.6	42.6	42.6	43.0	35.7	35.7	49.6	39.3	
Actuated g/C Ratio	0.43	0.34		0.45	0.36	0.36	0.36	0.30	0.30	0.41	0.33	
Clearance Time (s)	3.0	7.4		3.0	7.4	7.4	3.0	7.6	7.6	3.0	7.6	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	
Lane Grp Cap (vph)	240	1713		231	1254	542	262	527	432	433	1104	
v/s Ratio Prot	0.05	0.23		c0.06	c0.26		0.02	0.12		c0.07	0.19	
v/s Ratio Perm	0.21			0.24		0.15	0.10		0.25	c0.27		
v/c Ratio	0.61	0.66		0.68	0.73	0.43	0.34	0.41	0.85	0.82	0.57	
Uniform Delay, d1	23.8	33.4		22.5	33.8	29.5	26.4	33.7	39.6	30.3	33.4	
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	3.7	2.0		7.4	3.8	2.5	0.6	0.4	14.0	11.8	0.6	
Delay (s)	27.4	35.4		29.9	37.6	32.0	26.9	34.1	53.6	42.1	34.0	
Level of Service	C	D		C	D	C	C	C	D	D	C	
Approach Delay (s)		34.5			35.7			43.8			36.9	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	36.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	78.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Appendix G: ITE Trip Generation Manual Source Data

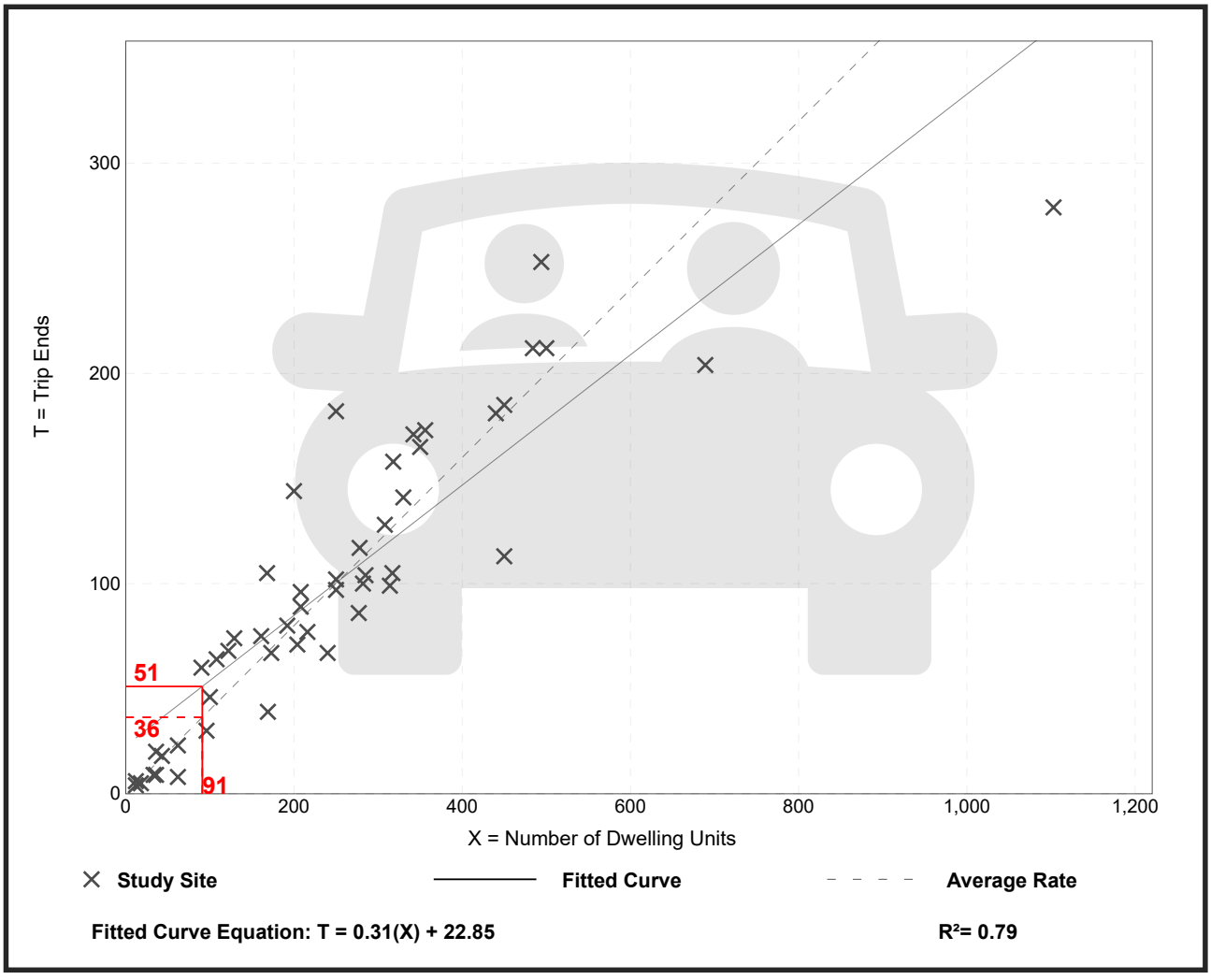
Multifamily Housing (Low-Rise)
Not Close to Rail Transit (220)

Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 49
Avg. Num. of Dwelling Units: 249
Directional Distribution: 24% entering, 76% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.40	0.13 - 0.73	0.12

Data Plot and Equation



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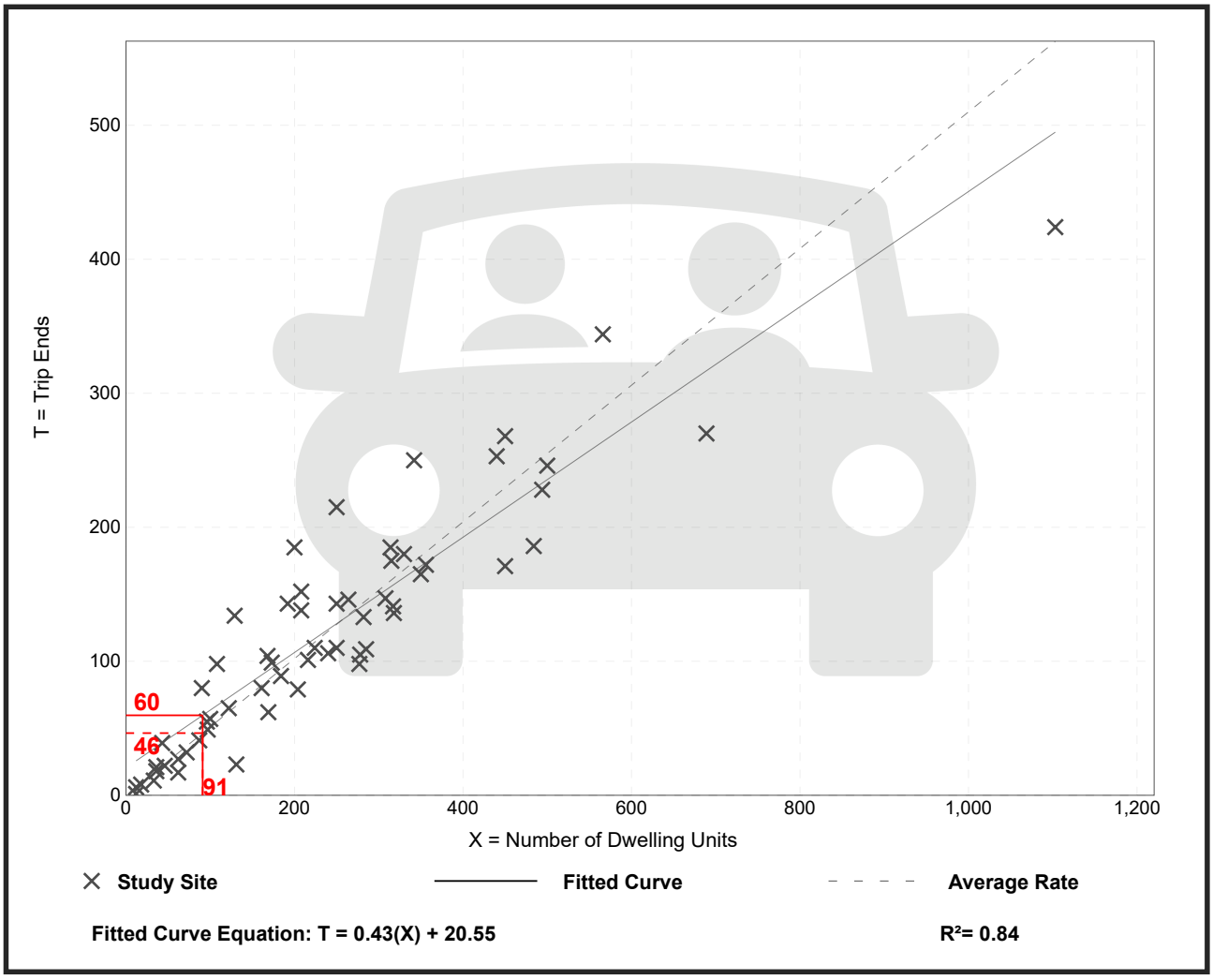
Multifamily Housing (Low-Rise)
Not Close to Rail Transit (220)

Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 59
Avg. Num. of Dwelling Units: 241
Directional Distribution: 63% entering, 37% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.51	0.08 - 1.04	0.15

Data Plot and Equation



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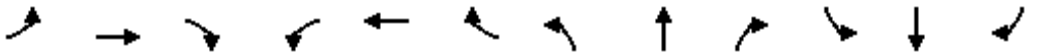
Appendix H: 2027 Future Total Conditions Synchro Reports

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	309	566	89	453	92	443	123	194	230
v/c Ratio	0.74	0.50	0.26	0.52	0.18	0.72	0.38	0.29	0.46
Control Delay	36.3	37.5	23.7	44.8	19.3	45.3	22.1	31.6	36.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.3	37.5	23.7	44.8	19.3	45.3	22.1	31.6	36.2
Queue Length 50th (m)	53.9	62.7	13.3	54.9	12.8	101.0	17.4	36.0	46.0
Queue Length 95th (m)	63.7	74.1	18.8	67.4	15.4	133.0	25.0	50.0	57.3
Internal Link Dist (m)		255.8		297.4		1383.0		343.0	
Turn Bay Length (m)	74.0		45.0		58.0				93.0
Base Capacity (vph)	429	1143	470	877	596	616	454	672	498
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	0.72	0.50	0.19	0.52	0.15	0.72	0.27	0.29	0.46

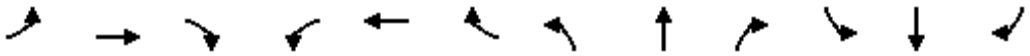
Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	238	397	41	65	284	89	58	222	122	97	155	170
Future Volume (vph)	238	397	41	65	284	89	58	222	122	97	155	170
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.0	3.5	3.0	3.0	3.5	3.0	3.0	3.5	3.0	3.0	3.5	3.0
Total Lost time (s)	3.0	7.0		3.0	7.0		3.0	7.0		3.0	7.0	7.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	0.99		1.00	1.00	0.97
Flpb, ped/bikes	1.00	1.00		0.99	1.00		0.99	1.00		1.00	1.00	1.00
Frt	1.00	0.98		1.00	0.96		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1633	3362		1673	3263		1547	1684		1634	1789	1328
Flt Permitted	0.35	1.00		0.43	1.00		0.61	1.00		0.28	1.00	1.00
Satd. Flow (perm)	606	3362		751	3263		995	1684		489	1789	1328
Peak-hour factor, PHF	0.77	0.82	0.50	0.73	0.85	0.75	0.63	0.84	0.68	0.79	0.80	0.74
Adj. Flow (vph)	309	484	82	89	334	119	92	264	179	123	194	230
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	309	566	0	89	453	0	92	443	0	123	194	230
Confl. Peds. (#/hr)	9		16	16		9	14		9	9		14
Heavy Vehicles (%)	3%	3%	3%	0%	6%	0%	8%	5%	2%	3%	5%	10%
Bus Blockages (#/hr)	0	0	0	0	0	2	0	0	6	0	0	0
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		8
Actuated Green, G (s)	58.0	45.9		45.4	36.3		58.7	49.4		61.3	50.7	50.7
Effective Green, g (s)	58.0	45.9		45.4	36.3		58.7	49.4		61.3	50.7	50.7
Actuated g/C Ratio	0.43	0.34		0.34	0.27		0.43	0.37		0.45	0.38	0.38
Clearance Time (s)	3.0	7.0		3.0	7.0		3.0	7.0		3.0	7.0	7.0
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	2.5
Lane Grp Cap (vph)	402	1143		314	877		470	616		311	671	498
v/s Ratio Prot	c0.11	0.17		0.02	0.14		0.01	c0.26		c0.03	0.11	
v/s Ratio Perm	c0.22			0.08			0.07			0.15		0.17
v/c Ratio	0.77	0.50		0.28	0.52		0.20	0.72		0.40	0.29	0.46
Uniform Delay, d1	27.8	35.4		31.4	41.9		22.9	36.8		23.9	29.5	31.8
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	8.2	1.5		0.4	2.2		0.1	7.1		0.6	1.1	3.1
Delay (s)	36.0	36.9		31.8	44.1		23.1	43.9		24.5	30.6	34.9
Level of Service	D	D		C	D		C	D		C	C	C
Approach Delay (s)		36.6			42.1			40.3			31.0	
Approach LOS		D			D			D			C	

Intersection Summary			
HCM 2000 Control Delay	37.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	84.4%	ICU Level of Service	E
Analysis Period (min)	15		

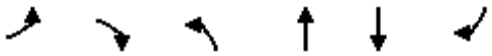
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	19	0	4	20	0	11	2	372	72	25	248	1
Future Volume (Veh/h)	19	0	4	20	0	11	2	372	72	25	248	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.25	0.25	0.25	0.56	0.25	0.83	0.25	0.74	0.60	0.72	0.79	0.25
Hourly flow rate (vph)	76	0	16	36	0	13	8	503	120	35	314	4
Pedestrians					6							
Lane Width (m)					3.5							
Walking Speed (m/s)					0.4							
Percent Blockage					1							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	978	1031	316	985	973	569	318			629		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	978	1031	316	985	973	569	318			629		
tC, single (s)	7.1	6.5	6.2	7.2	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.6	4.0	3.3	2.2			2.2		
p0 queue free %	65	100	98	82	100	97	99			96		
cM capacity (veh/h)	216	221	729	201	239	518	1253			930		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	92	49	631	35	318
Volume Left	76	36	8	35	0
Volume Right	16	13	120	0	4
cSH	246	240	1253	930	1700
Volume to Capacity	0.37	0.20	0.01	0.04	0.19
Queue Length 95th (m)	12.5	5.7	0.1	0.9	0.0
Control Delay (s)	28.1	23.8	0.2	9.0	0.0
Lane LOS	D	C	A	A	
Approach Delay (s)	28.1	23.8	0.2	0.9	
Approach LOS	D	C			

Intersection Summary				
Average Delay	3.7			
Intersection Capacity Utilization	35.7%	ICU Level of Service		A
Analysis Period (min)	15			



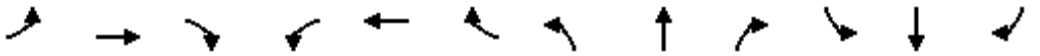
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	4	12	6	442	252	0
Future Volume (Veh/h)	4	12	6	442	252	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	13	7	480	274	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	528	274	274			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	528	274	274			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	98	99			
cM capacity (veh/h)	482	730	1301			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	17	167	320	274
Volume Left	4	7	0	0
Volume Right	13	0	0	0
cSH	651	1301	1700	1700
Volume to Capacity	0.03	0.01	0.19	0.16
Queue Length 95th (m)	0.6	0.1	0.0	0.0
Control Delay (s)	10.7	0.4	0.0	0.0
Lane LOS	B	A		
Approach Delay (s)	10.7	0.1		0.0
Approach LOS	B			

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	26.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	103	793	61	622	239	41	280	151	183	226
v/c Ratio	0.26	0.36	0.18	0.42	0.38	0.12	0.81	0.52	0.55	0.25
Control Delay	16.6	24.7	16.3	27.4	28.9	21.0	62.9	47.5	30.3	32.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.6	24.7	16.3	27.4	28.9	21.0	62.9	47.5	30.3	32.9
Queue Length 50th (m)	10.9	45.0	6.3	53.1	37.9	6.0	63.3	31.9	29.4	22.0
Queue Length 95th (m)	16.7	69.1	13.4	83.9	70.1	8.3	53.3	43.7	28.3	20.9
Internal Link Dist (m)		154.4		215.3			382.3			500.9
Turn Bay Length (m)	64.0		164.0			126.0			148.0	
Base Capacity (vph)	407	2204	368	1484	637	500	416	353	377	914
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	0.25	0.36	0.17	0.42	0.38	0.08	0.67	0.43	0.49	0.25

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	66	689	20	47	560	210	28	171	125	126	96	63
Future Volume (vph)	66	689	20	47	560	210	28	171	125	126	96	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.5	3.0	3.0	3.5	3.5	3.0	3.5	3.0	3.0	3.5	3.0
Total Lost time (s)	3.0	7.4		3.0	7.4	7.4	3.0	7.6	7.6	3.0	7.6	
Lane Util. Factor	1.00	0.91		1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.99	1.00	1.00	1.00	1.00	1.00	
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	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1622	4849		1545	3433	1473	1619	1678	1422	1560	3208	
Flt Permitted	0.34	1.00		0.32	1.00	1.00	0.61	1.00	1.00	0.32	1.00	
Satd. Flow (perm)	574	4849		517	3433	1473	1041	1678	1422	527	3208	
Peak-hour factor, PHF	0.64	0.90	0.75	0.77	0.90	0.88	0.69	0.61	0.83	0.69	0.68	0.74
Adj. Flow (vph)	103	766	27	61	622	239	41	280	151	183	141	85
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	103	793	0	61	622	239	41	280	151	183	226	0
Confl. Peds. (#/hr)	1		1	1		1	1					1
Heavy Vehicles (%)	10%	5%	11%	9%	4%	7%	4%	12%	6%	8%	6%	2%
Turn Type	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6		6	4		4	8		
Actuated Green, G (s)	61.4	52.9		57.0	50.7	50.7	31.1	25.3	25.3	42.8	34.0	
Effective Green, g (s)	61.4	52.9		57.0	50.7	50.7	31.1	25.3	25.3	42.8	34.0	
Actuated g/C Ratio	0.51	0.44		0.48	0.42	0.42	0.26	0.21	0.21	0.36	0.28	
Clearance Time (s)	3.0	7.4		3.0	7.4	7.4	3.0	7.6	7.6	3.0	7.6	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	
Lane Grp Cap (vph)	367	2137		299	1450	622	297	353	299	312	908	
v/s Ratio Prot	c0.02	0.16		0.01	c0.18		0.01	c0.17		c0.07	0.07	
v/s Ratio Perm	0.12			0.09		0.16	0.03		0.11	0.14		
v/c Ratio	0.28	0.37		0.20	0.43	0.38	0.14	0.79	0.51	0.59	0.25	
Uniform Delay, d1	15.8	22.4		17.3	24.4	23.9	33.8	44.9	41.8	29.0	33.2	
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	0.3	0.5		0.2	0.9	1.8	0.2	11.2	1.0	2.3	0.1	
Delay (s)	16.1	22.9		17.5	25.4	25.7	33.9	56.1	42.8	31.3	33.3	
Level of Service	B	C		B	C	C	C	E	D	C	C	
Approach Delay (s)		22.1			24.9			49.9			32.4	
Approach LOS		C			C			D			C	

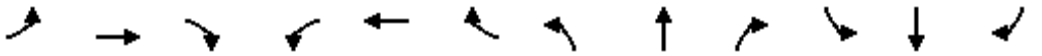
Intersection Summary			
HCM 2000 Control Delay	29.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	66.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	305	843	215	804	108	528	216	438	381
v/c Ratio	1.04	0.86	0.80	0.92	0.33	0.95	0.76	0.64	0.72
Control Delay	101.0	56.2	49.6	64.8	21.9	72.7	40.8	40.9	45.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	101.0	56.2	49.6	64.8	21.9	72.7	40.8	40.9	45.9
Queue Length 50th (m)	~71.8	113.6	36.2	110.2	15.2	136.1	32.5	95.7	86.3
Queue Length 95th (m)	#123.6	#155.6	58.5	#146.3	24.1	#222.0	51.4	131.8	126.0
Internal Link Dist (m)		255.8		297.4		1383.0		343.0	
Turn Bay Length (m)	74.0		45.0		58.0				93.0
Base Capacity (vph)	293	980	313	876	481	556	377	683	532
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	1.04	0.86	0.69	0.92	0.22	0.95	0.57	0.64	0.72

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

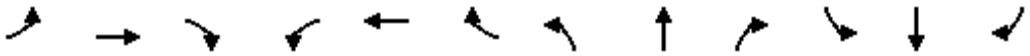
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	265	692	81	185	634	120	91	295	151	179	381	335
Future Volume (vph)	265	692	81	185	634	120	91	295	151	179	381	335
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.0	3.5	3.0	3.0	3.5	3.0	3.0	3.5	3.0	3.0	3.5	3.0
Total Lost time (s)	3.0	7.0		3.0	7.0		3.0	7.0		3.0	7.0	7.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	0.99		1.00	1.00	0.97
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.98		1.00	0.97		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1619	3443		1667	3383		1616	1728		1668	1842	1436
Flt Permitted	0.11	1.00		0.13	1.00		0.35	1.00		0.13	1.00	1.00
Satd. Flow (perm)	179	3443		232	3383		593	1728		221	1842	1436
Peak-hour factor, PHF	0.87	0.92	0.89	0.86	0.97	0.80	0.84	0.87	0.80	0.83	0.87	0.88
Adj. Flow (vph)	305	752	91	215	654	150	108	339	189	216	438	381
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	305	843	0	215	804	0	108	528	0	216	438	381
Confl. Peds. (#/hr)	20		22	22		20	12		11	11		12
Heavy Vehicles (%)	4%	1%	3%	1%	2%	1%	4%	3%	0%	1%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	2	0	0	6	0	0	0
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		8
Actuated Green, G (s)	58.0	38.4		51.6	35.0		53.4	43.5		63.0	50.1	50.1
Effective Green, g (s)	58.0	38.4		51.6	35.0		53.4	43.5		63.0	50.1	50.1
Actuated g/C Ratio	0.43	0.28		0.38	0.26		0.40	0.32		0.47	0.37	0.37
Clearance Time (s)	3.0	7.0		3.0	7.0		3.0	7.0		3.0	7.0	7.0
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	2.5
Lane Grp Cap (vph)	290	979		265	877		309	556		279	683	532
v/s Ratio Prot	c0.16	0.24		0.10	0.24		0.03	c0.31		c0.09	0.24	
v/s Ratio Perm	c0.30			0.21			0.11			0.27		0.27
v/c Ratio	1.05	0.86		0.81	0.92		0.35	0.95		0.77	0.64	0.72
Uniform Delay, d1	41.4	45.8		32.2	48.6		27.2	44.7		27.9	35.0	36.4
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	67.1	9.8		16.6	15.9		0.5	27.6		12.1	4.6	8.0
Delay (s)	108.4	55.6		48.8	64.5		27.7	72.2		40.0	39.6	44.4
Level of Service	F	E		D	E		C	E		D	D	D
Approach Delay (s)		69.6			61.2			64.7			41.4	
Approach LOS		E			E			E			D	

Intersection Summary			
HCM 2000 Control Delay	59.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	91.4%	ICU Level of Service	F
Analysis Period (min)	15		

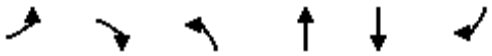
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	0	3	94	0	64	4	466	19	10	629	7
Future Volume (Veh/h)	8	0	3	94	0	64	4	466	19	10	629	7
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.25	0.25	0.25	0.37	0.25	0.45	0.25	0.88	0.53	0.75	0.84	0.25
Hourly flow rate (vph)	32	0	12	254	0	142	16	530	36	13	749	28
Pedestrians					7							
Lane Width (m)					3.5							
Walking Speed (m/s)					0.4							
Percent Blockage					2							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1511	1394	763	1374	1390	555	777			573		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1511	1394	763	1374	1390	555	777			573		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	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 %	54	100	97	0	100	73	98			99		
cM capacity (veh/h)	70	136	408	112	137	526	848			993		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	44	396	582	13	777
Volume Left	32	254	16	13	0
Volume Right	12	142	36	0	28
cSH	91	156	848	993	1700
Volume to Capacity	0.49	2.54	0.02	0.01	0.46
Queue Length 95th (m)	15.9	261.1	0.4	0.3	0.0
Control Delay (s)	77.7	758.8	0.5	8.7	0.0
Lane LOS	F	F	A	A	
Approach Delay (s)	77.7	758.8	0.5	0.1	
Approach LOS	F	F			

Intersection Summary				
Average Delay	168.0			
Intersection Capacity Utilization	49.9%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	2	9	12	487	631	1
Future Volume (Veh/h)	2	9	12	487	631	1
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)	2	10	13	529	686	1
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	977	686	687			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	977	686	687			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	97	99			
cM capacity (veh/h)	248	394	916			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	12	189	353	687
Volume Left	2	13	0	0
Volume Right	10	0	0	1
cSH	359	916	1700	1700
Volume to Capacity	0.03	0.01	0.21	0.40
Queue Length 95th (m)	0.8	0.3	0.0	0.0
Control Delay (s)	15.4	0.7	0.0	0.0
Lane LOS	C	A		
Approach Delay (s)	15.4	0.3		0.0
Approach LOS	C			

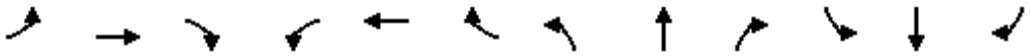
Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	43.3%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	151	1135	158	920	241	88	222	366	363	643
v/c Ratio	0.69	0.71	0.76	0.81	0.49	0.27	0.47	0.94	0.69	0.54
Control Delay	36.4	38.7	43.1	43.6	36.5	20.4	41.8	77.4	28.7	34.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.4	38.7	43.1	43.6	36.5	20.4	41.8	77.4	28.7	34.1
Queue Length 50th (m)	20.1	85.0	21.2	103.2	45.2	11.2	45.6	~93.3	55.8	64.3
Queue Length 95th (m)	28.9	100.2	#44.4	126.8	59.5	16.6	63.5	#145.8	51.5	71.4
Internal Link Dist (m)		154.4		215.3			382.3			500.9
Turn Bay Length (m)	64.0		164.0			126.0			148.0	
Base Capacity (vph)	226	1655	213	1178	509	471	474	389	539	1183
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	0.67	0.69	0.74	0.78	0.47	0.19	0.47	0.94	0.67	0.54

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



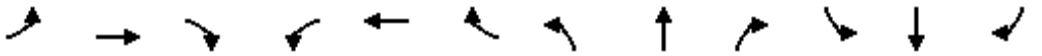
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	122	985	45	141	874	193	64	184	322	229	402	102
Future Volume (vph)	122	985	45	141	874	193	64	184	322	229	402	102
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.5	3.0	3.0	3.5	3.5	3.0	3.5	3.0	3.0	3.5	3.0
Total Lost time (s)	3.0	7.4		3.0	7.4	7.4	3.0	7.6	7.6	3.0	7.6	
Lane Util. Factor	1.00	0.91		1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00	
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	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1716	4967		1604	3535	1528	1604	1773	1453	1633	3371	
Flt Permitted	0.13	1.00		0.13	1.00	1.00	0.40	1.00	1.00	0.48	1.00	
Satd. Flow (perm)	236	4967		223	3535	1528	679	1773	1453	830	3371	
Peak-hour factor, PHF	0.81	0.91	0.85	0.89	0.95	0.80	0.73	0.83	0.88	0.63	0.77	0.84
Adj. Flow (vph)	151	1082	53	158	920	241	88	222	366	363	522	121
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	151	1135	0	158	920	241	88	222	366	363	643	0
Confl. Peds. (#/hr)	11		4	4		11	3		5	5		3
Heavy Vehicles (%)	4%	2%	12%	5%	1%	2%	5%	6%	2%	3%	3%	1%
Turn Type	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6		6	4		4	8		
Actuated Green, G (s)	48.0	38.5		48.4	38.7	38.7	40.8	32.1	32.1	53.8	42.1	
Effective Green, g (s)	48.0	38.5		48.4	38.7	38.7	40.8	32.1	32.1	53.8	42.1	
Actuated g/C Ratio	0.40	0.32		0.40	0.32	0.32	0.34	0.27	0.27	0.45	0.35	
Clearance Time (s)	3.0	7.4		3.0	7.4	7.4	3.0	7.6	7.6	3.0	7.6	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	
Lane Grp Cap (vph)	211	1593		201	1140	492	297	474	388	497	1182	
v/s Ratio Prot	0.06	0.23		c0.06	c0.26		0.02	0.13		c0.11	0.19	
v/s Ratio Perm	0.23			0.25		0.16	0.08		c0.25	0.21		
v/c Ratio	0.72	0.71		0.79	0.81	0.49	0.30	0.47	0.94	0.73	0.54	
Uniform Delay, d1	26.5	35.9		25.7	37.2	32.7	27.7	36.8	43.1	23.9	31.2	
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	10.3	2.7		17.5	6.2	3.5	0.4	0.5	31.3	5.2	0.4	
Delay (s)	36.8	38.6		43.2	43.4	36.2	28.1	37.3	74.4	29.1	31.7	
Level of Service	D	D		D	D	D	C	D	E	C	C	
Approach Delay (s)		38.4			42.1			56.2			30.7	
Approach LOS		D			D			E			C	

Intersection Summary			
HCM 2000 Control Delay	40.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	79.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Appendix I: 2027 Future Total Conditions Synchro Reports - Mitigated

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	309	566	89	453	92	443	123	194	230
v/c Ratio	0.74	0.50	0.26	0.52	0.18	0.72	0.38	0.29	0.46
Control Delay	36.3	37.5	23.7	44.8	19.3	45.3	22.1	31.6	36.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.3	37.5	23.7	44.8	19.3	45.3	22.1	31.6	36.2
Queue Length 50th (m)	53.9	62.7	13.3	54.9	12.8	101.0	17.4	36.0	46.0
Queue Length 95th (m)	63.7	74.1	18.8	67.4	15.4	133.0	25.0	50.0	57.3
Internal Link Dist (m)		255.8		297.4		1383.0		343.0	
Turn Bay Length (m)	74.0		45.0		58.0				93.0
Base Capacity (vph)	429	1143	470	877	596	616	454	672	498
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	0.72	0.50	0.19	0.52	0.15	0.72	0.27	0.29	0.46

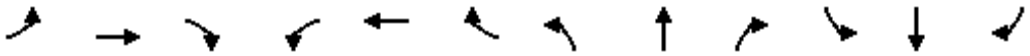
Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	238	397	41	65	284	89	58	222	122	97	155	170
Future Volume (vph)	238	397	41	65	284	89	58	222	122	97	155	170
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.0	3.5	3.0	3.0	3.5	3.0	3.0	3.5	3.0	3.0	3.5	3.0
Total Lost time (s)	3.0	7.0		3.0	7.0		3.0	7.0		3.0	7.0	7.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	0.99		1.00	1.00	0.97
Flpb, ped/bikes	1.00	1.00		0.99	1.00		0.99	1.00		1.00	1.00	1.00
Frt	1.00	0.98		1.00	0.96		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1633	3362		1673	3263		1547	1684		1634	1789	1328
Flt Permitted	0.35	1.00		0.43	1.00		0.61	1.00		0.28	1.00	1.00
Satd. Flow (perm)	606	3362		751	3263		995	1684		489	1789	1328
Peak-hour factor, PHF	0.77	0.82	0.50	0.73	0.85	0.75	0.63	0.84	0.68	0.79	0.80	0.74
Adj. Flow (vph)	309	484	82	89	334	119	92	264	179	123	194	230
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	309	566	0	89	453	0	92	443	0	123	194	230
Confl. Peds. (#/hr)	9		16	16		9	14		9	9		14
Heavy Vehicles (%)	3%	3%	3%	0%	6%	0%	8%	5%	2%	3%	5%	10%
Bus Blockages (#/hr)	0	0	0	0	0	2	0	0	6	0	0	0
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		8
Actuated Green, G (s)	58.0	45.9		45.4	36.3		58.7	49.4		61.3	50.7	50.7
Effective Green, g (s)	58.0	45.9		45.4	36.3		58.7	49.4		61.3	50.7	50.7
Actuated g/C Ratio	0.43	0.34		0.34	0.27		0.43	0.37		0.45	0.38	0.38
Clearance Time (s)	3.0	7.0		3.0	7.0		3.0	7.0		3.0	7.0	7.0
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	2.5
Lane Grp Cap (vph)	402	1143		314	877		470	616		311	671	498
v/s Ratio Prot	c0.11	0.17		0.02	0.14		0.01	c0.26		c0.03	0.11	
v/s Ratio Perm	c0.22			0.08			0.07			0.15		0.17
v/c Ratio	0.77	0.50		0.28	0.52		0.20	0.72		0.40	0.29	0.46
Uniform Delay, d1	27.8	35.4		31.4	41.9		22.9	36.8		23.9	29.5	31.8
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	8.2	1.5		0.4	2.2		0.1	7.1		0.6	1.1	3.1
Delay (s)	36.0	36.9		31.8	44.1		23.1	43.9		24.5	30.6	34.9
Level of Service	D	D		C	D		C	D		C	C	C
Approach Delay (s)		36.6			42.1			40.3			31.0	
Approach LOS		D			D			D			C	

Intersection Summary			
HCM 2000 Control Delay	37.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	84.4%	ICU Level of Service	E
Analysis Period (min)	15		

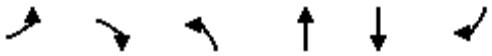
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	19	0	4	20	0	11	2	372	72	25	248	1
Future Volume (Veh/h)	19	0	4	20	0	11	2	372	72	25	248	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.25	0.25	0.25	0.56	0.25	0.83	0.25	0.74	0.60	0.72	0.79	0.25
Hourly flow rate (vph)	76	0	16	36	0	13	8	503	120	35	314	4
Pedestrians					6							
Lane Width (m)					3.5							
Walking Speed (m/s)					0.4							
Percent Blockage					1							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	978	1031	316	985	973	569	318			629		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	978	1031	316	985	973	569	318			629		
tC, single (s)	7.1	6.5	6.2	7.2	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.6	4.0	3.3	2.2			2.2		
p0 queue free %	65	100	98	82	100	97	99			96		
cM capacity (veh/h)	216	221	729	201	239	518	1253			930		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	92	49	631	35	318
Volume Left	76	36	8	35	0
Volume Right	16	13	120	0	4
cSH	246	240	1253	930	1700
Volume to Capacity	0.37	0.20	0.01	0.04	0.19
Queue Length 95th (m)	12.5	5.7	0.1	0.9	0.0
Control Delay (s)	28.1	23.8	0.2	9.0	0.0
Lane LOS	D	C	A	A	
Approach Delay (s)	28.1	23.8	0.2	0.9	
Approach LOS	D	C			

Intersection Summary				
Average Delay	3.7			
Intersection Capacity Utilization	35.7%	ICU Level of Service		A
Analysis Period (min)	15			



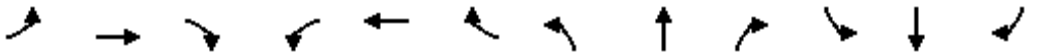
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	4	12	6	442	252	0
Future Volume (Veh/h)	4	12	6	442	252	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	13	7	480	274	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	528	274	274			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	528	274	274			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	98	99			
cM capacity (veh/h)	482	730	1301			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	17	167	320	274
Volume Left	4	7	0	0
Volume Right	13	0	0	0
cSH	651	1301	1700	1700
Volume to Capacity	0.03	0.01	0.19	0.16
Queue Length 95th (m)	0.6	0.1	0.0	0.0
Control Delay (s)	10.7	0.4	0.0	0.0
Lane LOS	B	A		
Approach Delay (s)	10.7	0.1		0.0
Approach LOS	B			

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	26.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	103	793	61	622	239	41	280	151	183	226
v/c Ratio	0.26	0.36	0.18	0.42	0.38	0.12	0.81	0.52	0.55	0.25
Control Delay	16.6	24.7	16.3	27.4	28.9	21.0	62.9	47.5	30.3	32.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.6	24.7	16.3	27.4	28.9	21.0	62.9	47.5	30.3	32.9
Queue Length 50th (m)	10.9	45.0	6.3	53.1	37.9	6.0	63.3	31.9	29.4	22.0
Queue Length 95th (m)	16.7	69.1	13.4	83.9	70.1	8.3	53.3	43.7	28.3	20.9
Internal Link Dist (m)		154.4		215.3			382.3			500.9
Turn Bay Length (m)	64.0		164.0			126.0			148.0	
Base Capacity (vph)	407	2204	368	1484	637	500	416	353	377	914
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	0.25	0.36	0.17	0.42	0.38	0.08	0.67	0.43	0.49	0.25

Intersection Summary



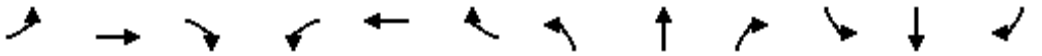
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	66	689	20	47	560	210	28	171	125	126	96	63
Future Volume (vph)	66	689	20	47	560	210	28	171	125	126	96	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.5	3.0	3.0	3.5	3.5	3.0	3.5	3.0	3.0	3.5	3.0
Total Lost time (s)	3.0	7.4		3.0	7.4	7.4	3.0	7.6	7.6	3.0	7.6	
Lane Util. Factor	1.00	0.91		1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.99	1.00	1.00	1.00	1.00	1.00	
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	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1622	4849		1545	3433	1473	1619	1678	1422	1560	3208	
Flt Permitted	0.34	1.00		0.32	1.00	1.00	0.61	1.00	1.00	0.32	1.00	
Satd. Flow (perm)	574	4849		517	3433	1473	1041	1678	1422	527	3208	
Peak-hour factor, PHF	0.64	0.90	0.75	0.77	0.90	0.88	0.69	0.61	0.83	0.69	0.68	0.74
Adj. Flow (vph)	103	766	27	61	622	239	41	280	151	183	141	85
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	103	793	0	61	622	239	41	280	151	183	226	0
Confl. Peds. (#/hr)	1		1	1		1	1					1
Heavy Vehicles (%)	10%	5%	11%	9%	4%	7%	4%	12%	6%	8%	6%	2%
Turn Type	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6		6	4		4	8		
Actuated Green, G (s)	61.4	52.9		57.0	50.7	50.7	31.1	25.3	25.3	42.8	34.0	
Effective Green, g (s)	61.4	52.9		57.0	50.7	50.7	31.1	25.3	25.3	42.8	34.0	
Actuated g/C Ratio	0.51	0.44		0.48	0.42	0.42	0.26	0.21	0.21	0.36	0.28	
Clearance Time (s)	3.0	7.4		3.0	7.4	7.4	3.0	7.6	7.6	3.0	7.6	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	
Lane Grp Cap (vph)	367	2137		299	1450	622	297	353	299	312	908	
v/s Ratio Prot	c0.02	0.16		0.01	c0.18		0.01	c0.17		c0.07	0.07	
v/s Ratio Perm	0.12			0.09		0.16	0.03		0.11	0.14		
v/c Ratio	0.28	0.37		0.20	0.43	0.38	0.14	0.79	0.51	0.59	0.25	
Uniform Delay, d1	15.8	22.4		17.3	24.4	23.9	33.8	44.9	41.8	29.0	33.2	
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	0.3	0.5		0.2	0.9	1.8	0.2	11.2	1.0	2.3	0.1	
Delay (s)	16.1	22.9		17.5	25.4	25.7	33.9	56.1	42.8	31.3	33.3	
Level of Service	B	C		B	C	C	C	E	D	C	C	
Approach Delay (s)		22.1			24.9			49.9			32.4	
Approach LOS		C			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	29.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	66.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	305	843	215	804	108	528	216	438	381
v/c Ratio	0.97	0.73	0.81	0.85	0.38	0.84	0.93	0.63	0.70
Control Delay	78.0	44.0	46.9	55.2	24.9	53.3	71.0	39.2	43.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	78.0	44.0	46.9	55.2	24.9	53.3	71.0	39.2	43.9
Queue Length 50th (m)	60.8	104.2	33.3	106.6	15.9	128.5	34.1	94.7	85.4
Queue Length 95th (m)	#111.3	128.1	#55.8	131.7	25.2	#168.1	#62.8	124.5	119.2
Internal Link Dist (m)		255.8		297.4		1383.0		343.0	
Turn Bay Length (m)	74.0		45.0		58.0				93.0
Base Capacity (vph)	313	1157	269	951	286	626	232	695	542
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	0.97	0.73	0.80	0.85	0.38	0.84	0.93	0.63	0.70

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	265	692	81	185	634	120	91	295	151	179	381	335
Future Volume (vph)	265	692	81	185	634	120	91	295	151	179	381	335
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.0	3.5	3.0	3.0	3.5	3.0	3.0	3.5	3.0	3.0	3.5	3.0
Total Lost time (s)	3.0	7.0		3.0	7.0		3.0	7.0		3.0	7.0	7.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	0.99		1.00	1.00	0.97
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.98		1.00	0.97		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1619	3443		1665	3383		1617	1728		1668	1842	1436
Flt Permitted	0.13	1.00		0.20	1.00		0.32	1.00		0.19	1.00	1.00
Satd. Flow (perm)	220	3443		354	3383		547	1728		327	1842	1436
Peak-hour factor, PHF	0.87	0.92	0.89	0.86	0.97	0.80	0.84	0.87	0.80	0.83	0.87	0.88
Adj. Flow (vph)	305	752	91	215	654	150	108	339	189	216	438	381
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	305	843	0	215	804	0	108	528	0	216	438	381
Confl. Peds. (#/hr)	20		22	22		20	12		11	11		12
Heavy Vehicles (%)	4%	1%	3%	1%	2%	1%	4%	3%	0%	1%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	2	0	0	6	0	0	0
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		8
Actuated Green, G (s)	61.0	45.3		50.7	38.0		55.0	49.0		59.0	51.0	51.0
Effective Green, g (s)	61.0	45.3		50.7	38.0		55.0	49.0		59.0	51.0	51.0
Actuated g/C Ratio	0.45	0.34		0.38	0.28		0.41	0.36		0.44	0.38	0.38
Clearance Time (s)	3.0	7.0		3.0	7.0		3.0	7.0		3.0	7.0	7.0
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	2.5
Lane Grp Cap (vph)	306	1155		256	952		270	627		222	695	542
v/s Ratio Prot	c0.15	0.24		0.08	0.24		0.02	0.31		c0.06	0.24	
v/s Ratio Perm	c0.30			0.24			0.14			c0.37		0.27
v/c Ratio	1.00	0.73		0.84	0.84		0.40	0.84		0.97	0.63	0.70
Uniform Delay, d1	37.4	39.5		31.5	45.7		26.8	39.5		36.5	34.3	35.6
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	50.2	4.1		20.5	9.1		0.7	13.0		52.4	4.3	7.4
Delay (s)	87.6	43.5		52.0	54.8		27.5	52.4		88.9	38.6	43.0
Level of Service	F	D		D	D		C	D		F	D	D
Approach Delay (s)		55.3			54.2			48.2			50.7	
Approach LOS		E			D			D			D	

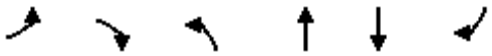
Intersection Summary			
HCM 2000 Control Delay	52.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	91.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	0	3	94	0	64	4	466	19	10	629	7
Future Volume (Veh/h)	8	0	3	94	0	64	4	466	19	10	629	7
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.25	0.25	0.25	0.37	0.25	0.45	0.25	0.88	0.53	0.75	0.84	0.25
Hourly flow rate (vph)	32	0	12	254	0	142	16	530	36	13	749	28
Pedestrians					7							
Lane Width (m)					3.5							
Walking Speed (m/s)					0.4							
Percent Blockage					2							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1511	1394	763	1374	1390	555	777			573		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1511	1394	763	1374	1390	555	777			573		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	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 %	54	100	97	0	100	73	98			99		
cM capacity (veh/h)	70	136	408	112	137	526	848			993		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	44	396	582	13	777
Volume Left	32	254	16	13	0
Volume Right	12	142	36	0	28
cSH	91	156	848	993	1700
Volume to Capacity	0.49	2.54	0.02	0.01	0.46
Queue Length 95th (m)	15.9	261.1	0.4	0.3	0.0
Control Delay (s)	77.7	758.8	0.5	8.7	0.0
Lane LOS	F	F	A	A	
Approach Delay (s)	77.7	758.8	0.5	0.1	
Approach LOS	F	F			

Intersection Summary				
Average Delay	168.0			
Intersection Capacity Utilization	49.9%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	2	9	12	487	631	1
Future Volume (Veh/h)	2	9	12	487	631	1
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)	2	10	13	529	686	1
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	977	686	687			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	977	686	687			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	97	99			
cM capacity (veh/h)	248	394	916			

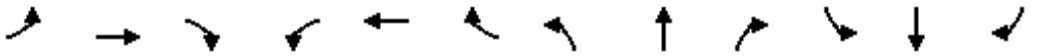
Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	12	189	353	687
Volume Left	2	13	0	0
Volume Right	10	0	0	1
cSH	359	916	1700	1700
Volume to Capacity	0.03	0.01	0.21	0.40
Queue Length 95th (m)	0.8	0.3	0.0	0.0
Control Delay (s)	15.4	0.7	0.0	0.0
Lane LOS	C	A		
Approach Delay (s)	15.4	0.3		0.0
Approach LOS	C			

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	43.3%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	151	1135	158	920	241	88	222	366	363	643
v/c Ratio	0.60	0.66	0.66	0.74	0.45	0.32	0.42	0.85	0.81	0.58
Control Delay	29.5	36.2	33.4	38.8	34.0	21.6	35.0	57.2	43.7	35.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.5	36.2	33.4	38.8	34.0	21.6	35.0	57.2	43.7	35.6
Queue Length 50th (m)	19.0	84.4	20.1	100.8	44.1	11.8	41.6	80.1	58.9	67.2
Queue Length 95th (m)	30.1	102.1	#45.4	127.5	59.9	15.9	51.2	101.6	49.3	64.7
Internal Link Dist (m)		154.4		215.3			382.3			500.9
Turn Bay Length (m)	64.0		164.0			126.0			148.0	
Base Capacity (vph)	253	1715	240	1250	540	282	670	549	446	1247
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	0.60	0.66	0.66	0.74	0.45	0.31	0.33	0.67	0.81	0.52

Intersection Summary

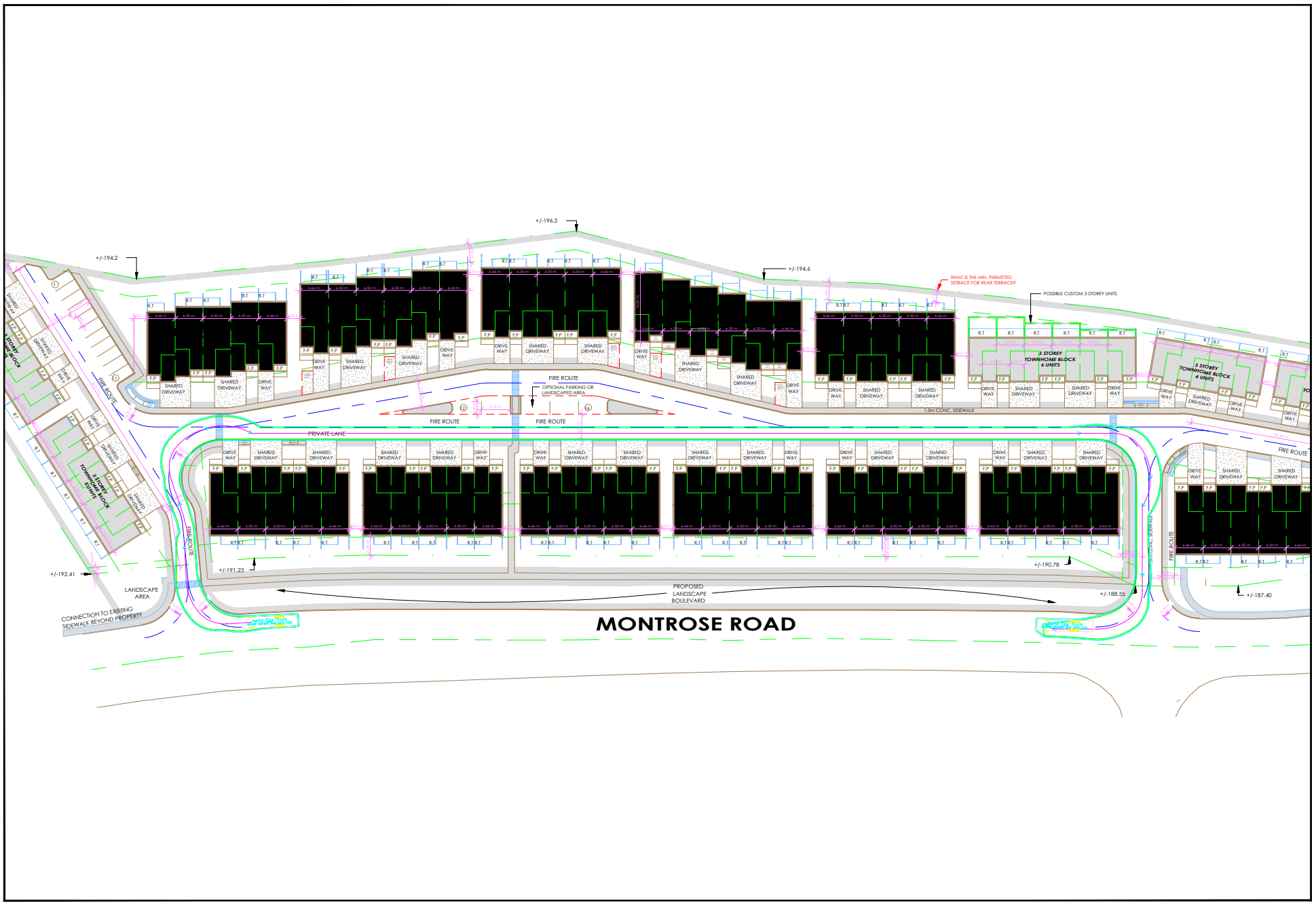
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	122	985	45	141	874	193	64	184	322	229	402	102
Future Volume (vph)	122	985	45	141	874	193	64	184	322	229	402	102
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.5	3.0	3.0	3.5	3.5	3.0	3.5	3.0	3.0	3.5	3.0
Total Lost time (s)	3.0	7.4		3.0	7.4	7.4	3.0	7.6	7.6	3.0	7.6	
Lane Util. Factor	1.00	0.91		1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00	
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	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1716	4967		1604	3535	1528	1604	1773	1453	1633	3371	
Flt Permitted	0.16	1.00		0.14	1.00	1.00	0.32	1.00	1.00	0.50	1.00	
Satd. Flow (perm)	289	4967		239	3535	1528	544	1773	1453	865	3371	
Peak-hour factor, PHF	0.81	0.91	0.85	0.89	0.95	0.80	0.73	0.83	0.88	0.63	0.77	0.84
Adj. Flow (vph)	151	1082	53	158	920	241	88	222	366	363	522	121
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	151	1135	0	158	920	241	88	222	366	363	643	0
Confl. Peds. (#/hr)	11		4	4		11	3		5	5		3
Heavy Vehicles (%)	4%	2%	12%	5%	1%	2%	5%	6%	2%	3%	3%	1%
Turn Type	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6		6	4		4	8		
Actuated Green, G (s)	51.3	41.4		53.5	42.5	42.5	43.0	35.7	35.7	49.6	39.3	
Effective Green, g (s)	51.3	41.4		53.5	42.5	42.5	43.0	35.7	35.7	49.6	39.3	
Actuated g/C Ratio	0.43	0.34		0.45	0.35	0.35	0.36	0.30	0.30	0.41	0.33	
Clearance Time (s)	3.0	7.4		3.0	7.4	7.4	3.0	7.6	7.6	3.0	7.6	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	
Lane Grp Cap (vph)	241	1713		231	1251	541	259	527	432	427	1104	
v/s Ratio Prot	0.05	0.23		c0.06	c0.26		0.02	0.13		c0.08	0.19	
v/s Ratio Perm	0.22			0.24		0.16	0.10		0.25	c0.27		
v/c Ratio	0.63	0.66		0.68	0.74	0.45	0.34	0.42	0.85	0.85	0.58	
Uniform Delay, d1	23.8	33.4		22.5	33.8	29.7	26.4	33.9	39.6	30.8	33.5	
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	4.3	2.0		7.4	3.9	2.6	0.6	0.4	14.0	14.7	0.7	
Delay (s)	28.2	35.4		29.9	37.7	32.4	27.0	34.3	53.6	45.6	34.2	
Level of Service	C	D		C	D	C	C	C	D	D	C	
Approach Delay (s)		34.6			35.8			43.8			38.3	
Approach LOS		C			D			D			D	

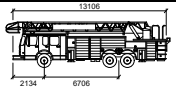
Intersection Summary			
HCM 2000 Control Delay	37.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	79.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Appendix J: Vehicle Swept Path Analysis



No.	REVISION	DATE
1	VEHICLE CIRCULATION FIRST DRAFT	2022/08/02

IBI



Aerial Fire Truck

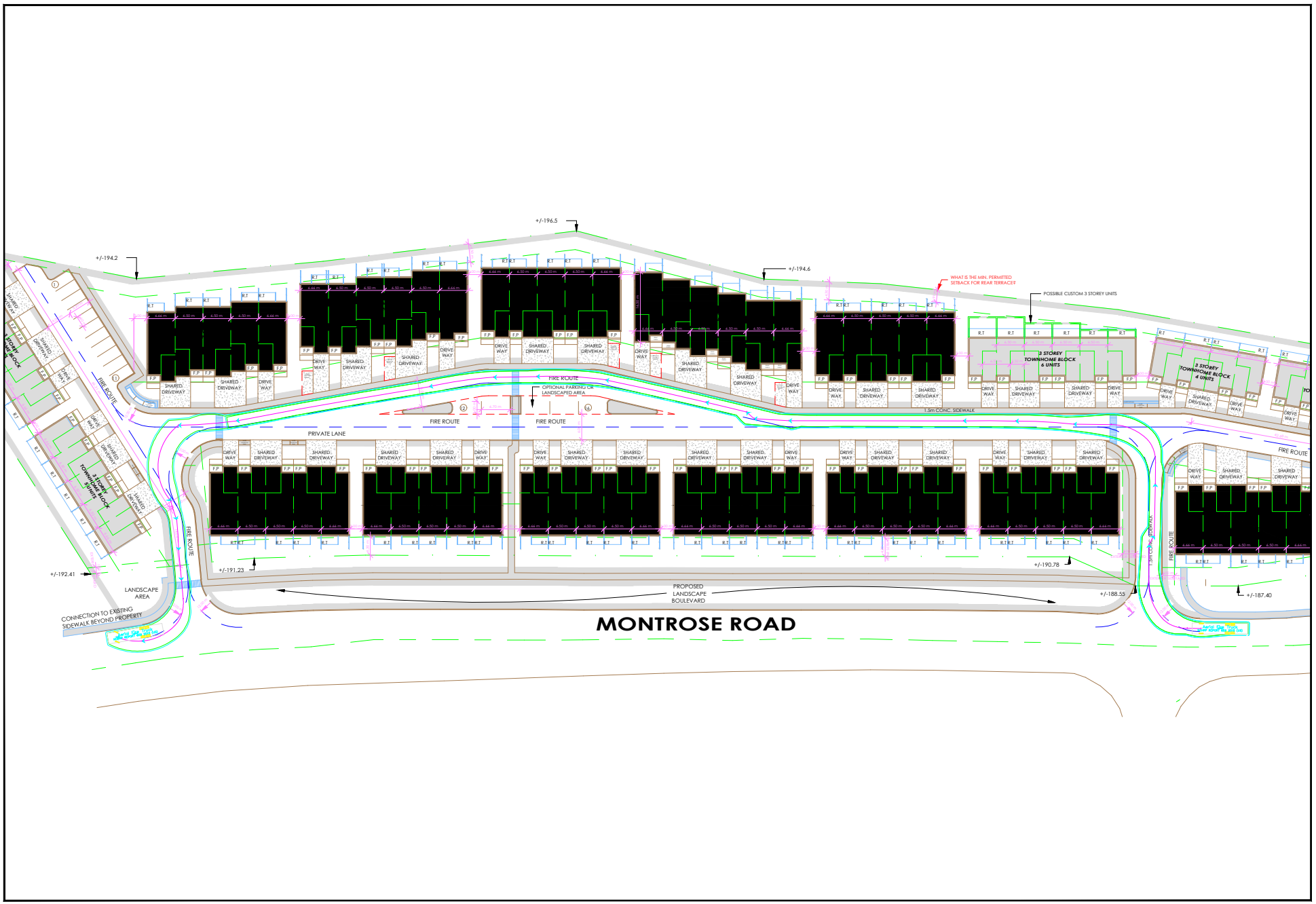
	mm
Width	: 2591
Track	: 2591
Lock to Lock Time	: 6.0
Steering Angle	: 33.3

PROPOSED DEVELOPMENT
6729 Montrose Road, Niagara

Fire Truck (Aerial REDG)

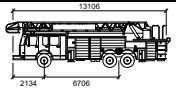
SITE CIRCULATION

DRAWN BY:	H.O.
DESIGNED BY:	-
CHECKED BY:	A.G.
APPROVED BY:	-
DATE:	2022-08-08
SCALE:	1:1200
DRAWING No.	05



No.	REVISION	DATE
1	VEHICLE CIRCULATION FIRST DRAFT	2022/08/02

IBI



Aerial Fire Truck

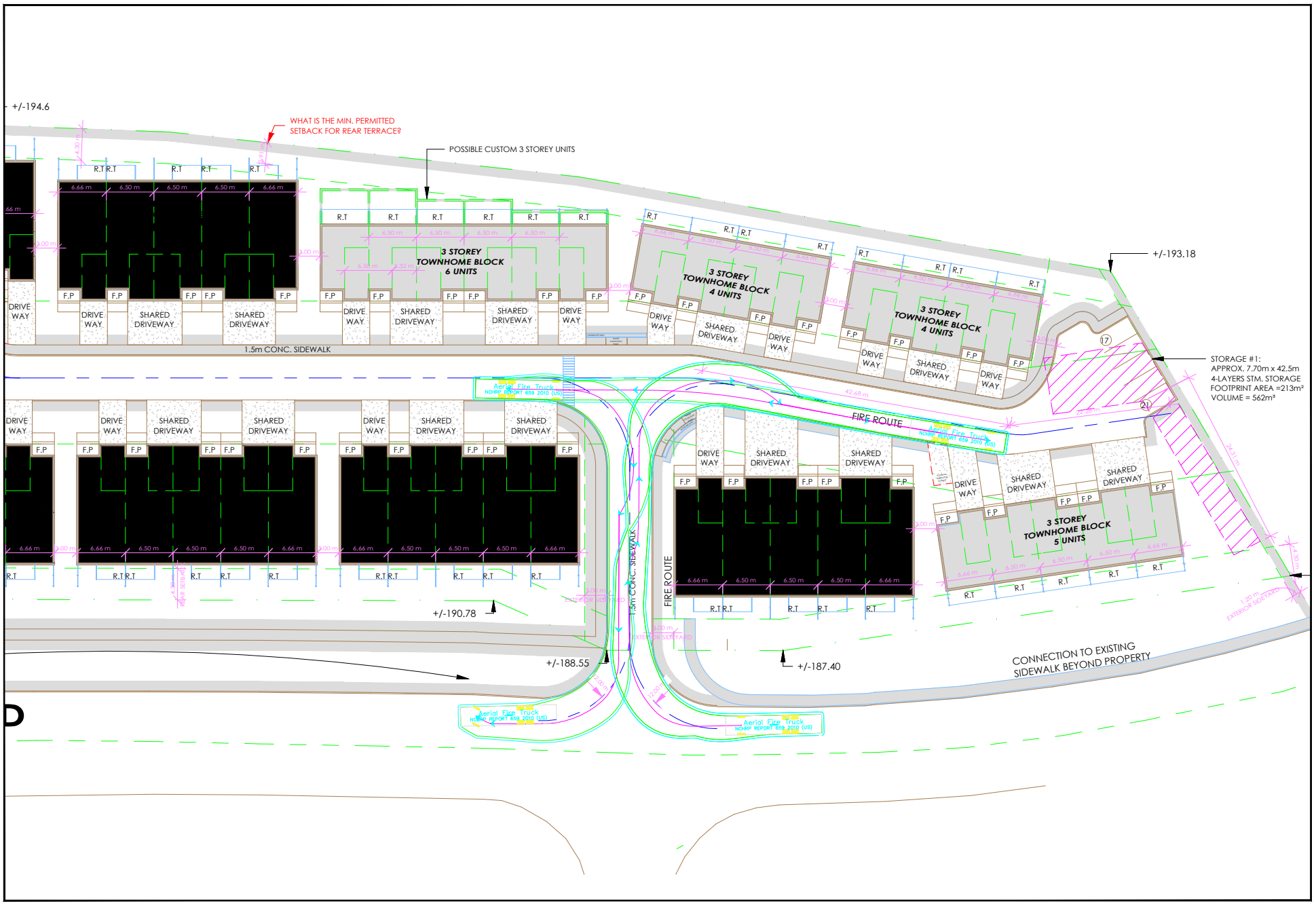
	mm
Width	: 2591
Track	: 2591
Lock to Lock Time	: 6.0
Steering Angle	: 33.3

PROPOSED DEVELOPMENT
6729 Montrose Road, Niagara

Fire Truck (Aerial REDG)

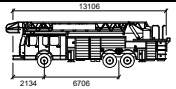
SITE CIRCULATION

DRAWN BY:	H.O.
DESIGNED BY:	-
CHECKED BY:	A.G.
APPROVED BY:	-
DATE:	2022-08-08
SCALE:	1:1200
DRAWING No.	06



No.	REVISION	DATE
1	VEHICLE CIRCULATION FIRST DRAFT	2022/08/02

IBI



Aerial Fire Truck

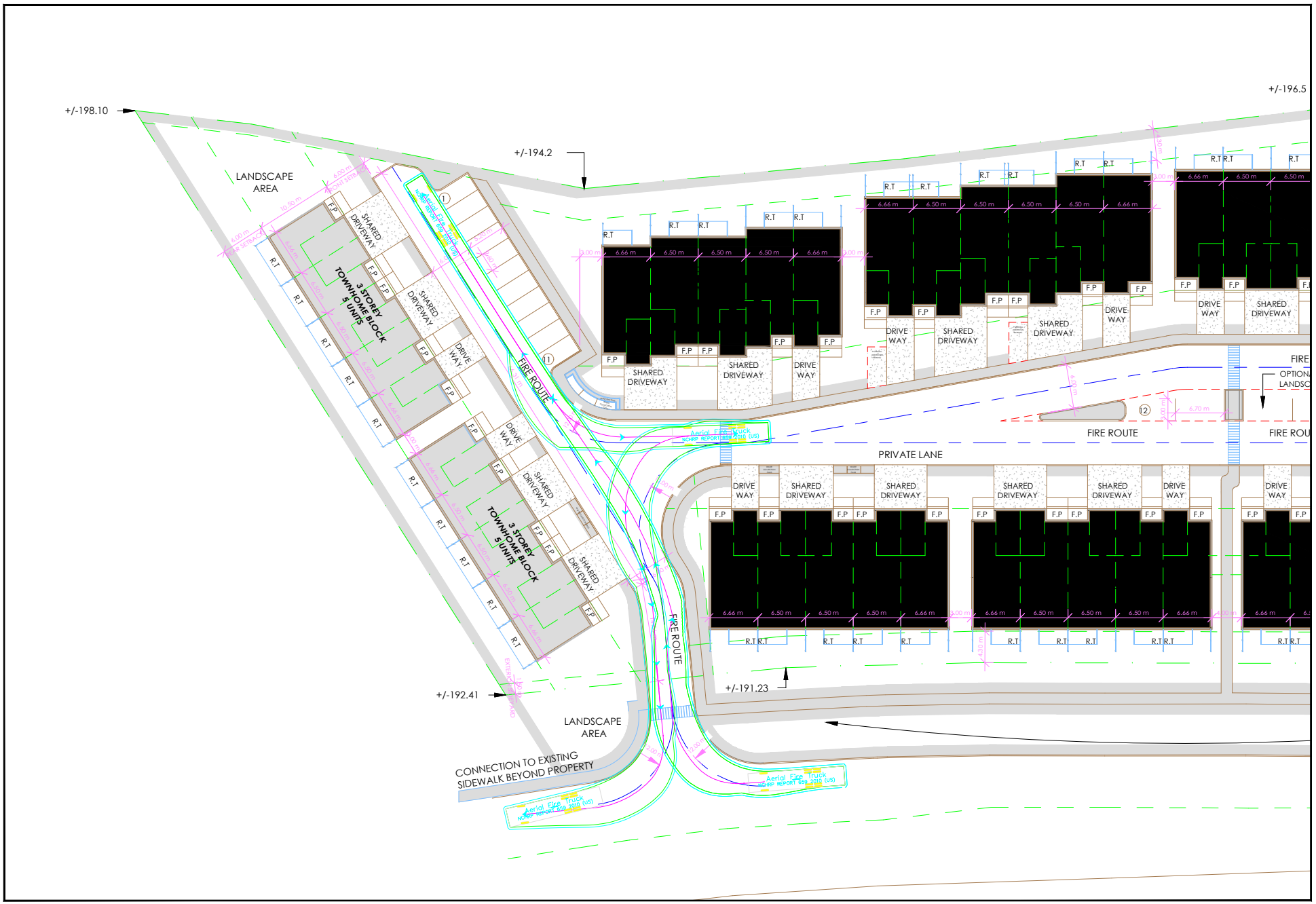
	mm
Width	: 2591
Track	: 2591
Lock to Lock Time	: 6.0
Steering Angle	: 33.3

PROPOSED DEVELOPMENT
6729 Montrose Road, Niagara

Fire Truck (Aerial REDG)

SITE CIRCULATION

DRAWN BY:	H.O.
DESIGNED BY:	-
CHECKED BY:	A.G.
APPROVED BY:	-
DATE:	2022-08-08
SCALE:	1:700
DRAWING No.	04



No.	REVISION	DATE
1	VEHICLE CIRCULATION FIRST DRAFT	2022/08/02

IBI

13106
2134
6706

Aerial Fire Truck

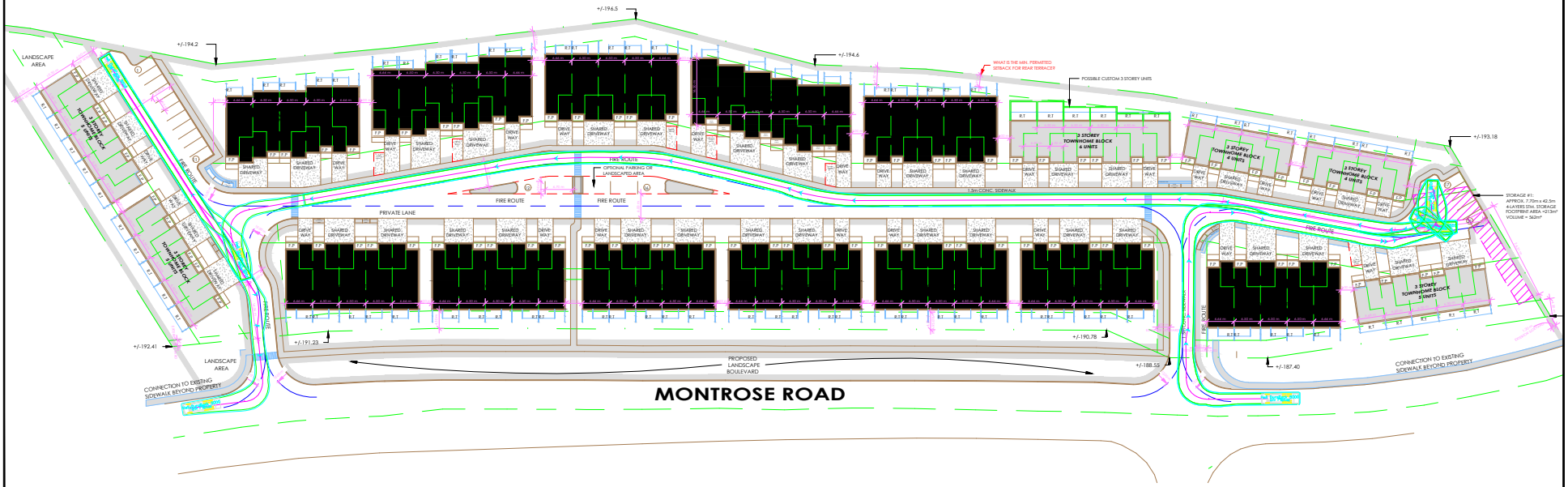
	mm
Width	: 2591
Track	: 2591
Lock to Lock Time	: 6.0
Steering Angle	: 33.3

PROPOSED DEVELOPMENT
6729 Montrose Road, Niagara

Fire Truck (Aerial REDG)

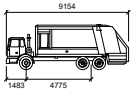
SITE CIRCULATION

DRAWN BY:	H.O.
DESIGNED BY:	-
CHECKED BY:	A.G.
APPROVED BY:	-
DATE:	2022-08-08
SCALE:	1:700
DRAWING No.	03



No.	REVISION	DATE
1	VEHICLE CIRCULATION FIRST DRAFT	2022/08/02

IBI



Heil DuraPack 5000

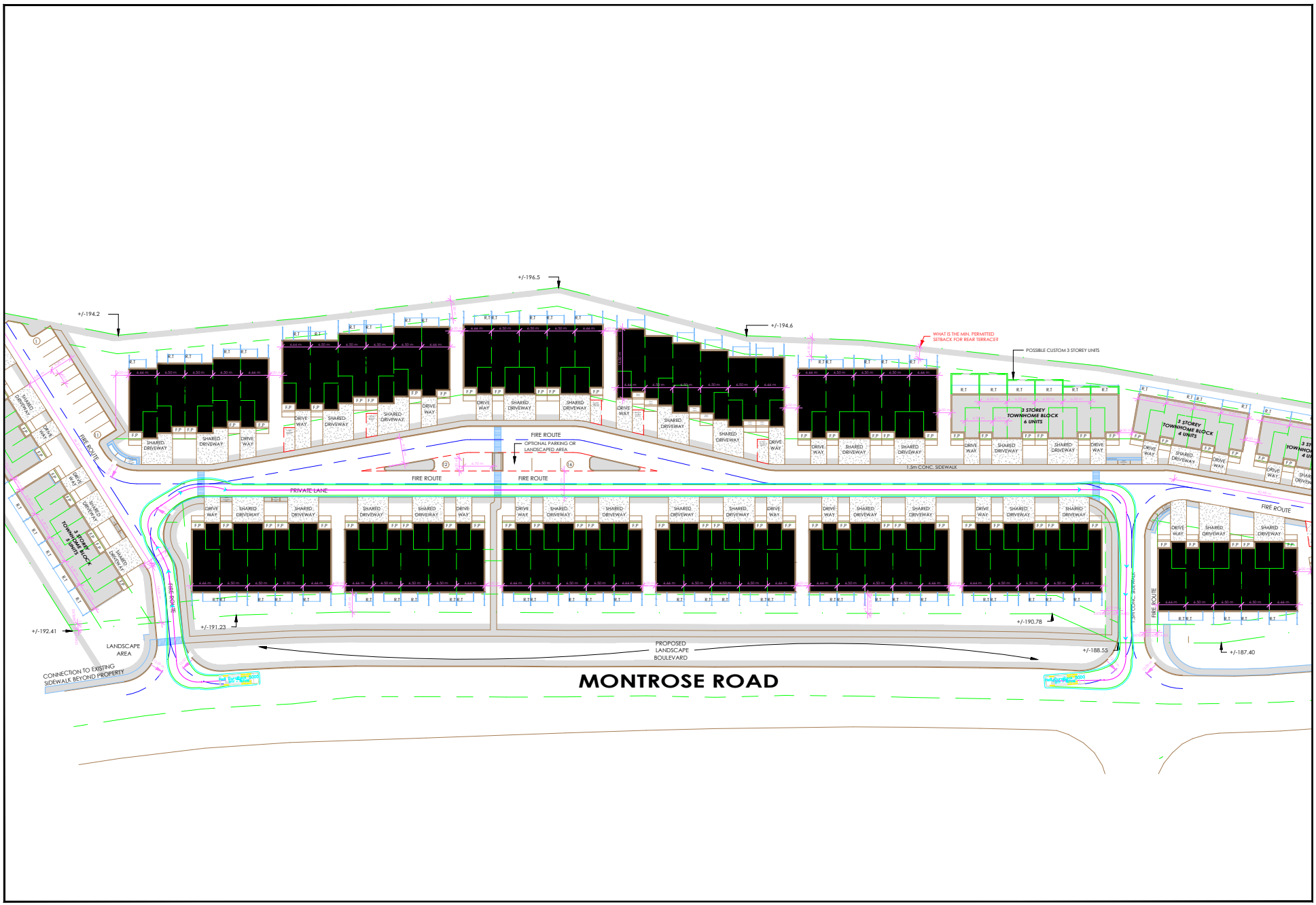
	mm
Width	: 2438
Track	: 2438
Lock to Lock Time	: 6.0
Steering Angle	: 45.0

PROPOSED DEVELOPMENT
6729 Montrose Road, Niagara

Rear Loading Waste Collection

SITE CIRCULATION

DRAWN BY:	H.O.
DESIGNED BY:	-
CHECKED BY:	A.G.
APPROVED BY:	-
DATE:	2022-08-08
SCALE:	1:1500
DRAWING No.	02



No.	REVISION	DATE
1	VEHICLE CIRCULATION FIRST DRAFT	2022/08/02

IBI

9154
1483
4775

Heil DuraPack 5000

	mm
Width	: 2438
Track	: 2438
Lock to Lock Time	: 6.0
Steering Angle	: 45.0

PROPOSED DEVELOPMENT
6729 Montrose Road, Niagara

Rear Loading Waste Collection

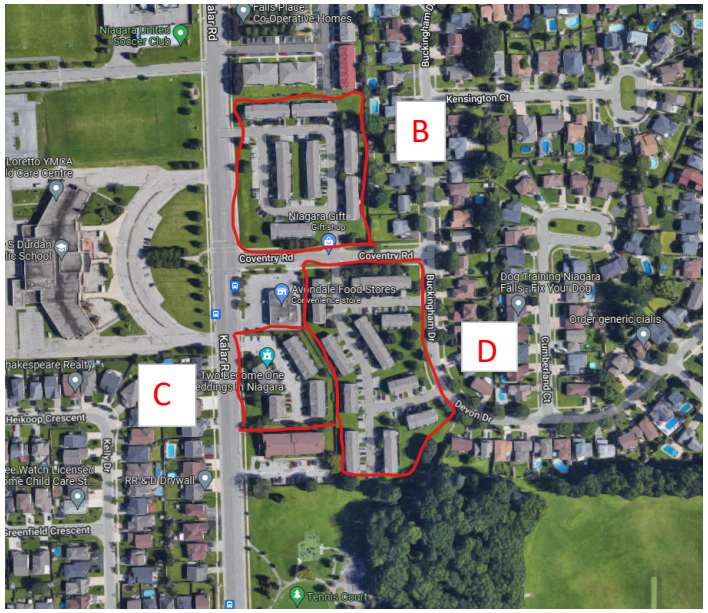
SITE CIRCULATION

DRAWN BY:	H.O.
DESIGNED BY:	-
CHECKED BY:	A.G.
APPROVED BY:	-
DATE:	2022-08-08
SCALE:	1:1200
DRAWING No.	02

Appendix K: Parking Occupancy Observations

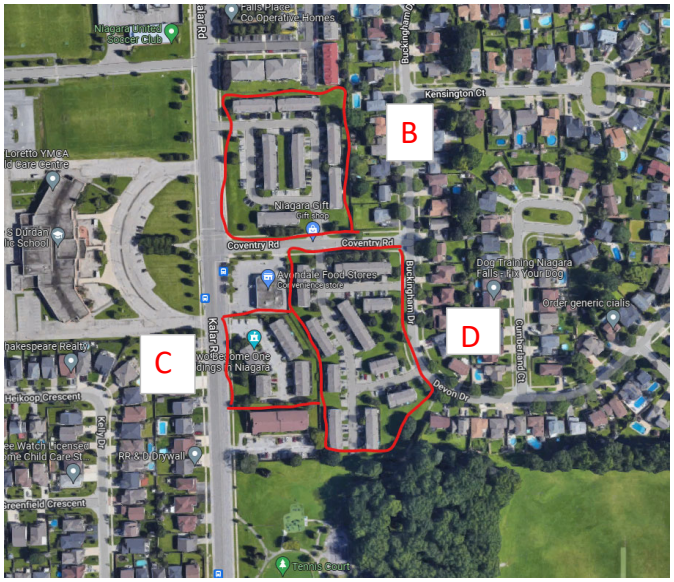
Thursday Count - Parking Study

TIME	ZONE A	ZONE B	ZONE C	ZONE D
18:00	49	41	11	39
18:30	50	42	12	42
19:00	49	38	12	38
19:30	49	37	12	39
20:00	50	40	12	44
20:30	44	43	12	46
21:00	54	48	15	50
21:30	62	54	19	53
22:00	63	56	19	55
22:30	72	62	20	57
23:00	72	62	20	58
23:30	72	63	20	59
0:00	72	64	20	60



Friday Count - Parking Study

TIME	ZONE A	ZONE B	ZONE C	ZONE D
18:00	47	31	12	47
18:30	48	33	12	49
19:00	46	37	12	41
19:30	38	37	13	40
20:00	43	39	15	47
20:30	45	42	18	49
21:00	48	44	17	50
21:30	50	45	20	50
22:00	48	42	20	53
22:30	49	42	21	56
23:00	58	48	20	58
23:30	58	48	21	60
0:00	56	52	21	61



Saturday Count - Parking Study

TIME	ZONE A	ZONE B	ZONE C	ZONE D
6:00	59	60	22	69
6:30	60	60	22	69
7:00	58	58	22	66
7:30	56	54	20	68
8:00	53	52	21	66
8:30	52	51	21	64
9:00	42	41	20	69
9:30	43	42	19	63
10:00	43	40	20	57
10:30	44	41	19	54
11:00	42	38	18	55
11:30	39	38	17	54
12:00	34	38	17	49
12:30	40	38	17	50
13:00	39	37	17	50