

TRANSPORTATION STUDY

- Traffic Impact Study
- Parking Study

Proposed Mixed Use Development
820 Saint David Street North
Fergus, ON

October 2020

Prepared for
Harper Dell & Associates Inc.



TRANS-PLAN
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October 2, 2020

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Re: Transportation Study, Proposed Mixed Use Development, 820 Saint David Street North, Fergus, Ontario

TRANS-PLAN is pleased to submit this Traffic Impact Study and Parking Study in support of the proposed residential development, located at 820 Saint David Street North, Fergus, Ontario.

We have prepared a Traffic Impact Study and Parking Study that includes analysis horizon years for existing conditions and five-year traffic volume projections to review traffic operations after development. The TIS report contains an analysis of the intersection capacity and level of service for the boundary roadways. The study intersections surrounding the proposed site were targeted as well as the future road connections to the subject site. Our traffic analysis findings indicate that all intersections are operating within acceptable limits and the introduction of the site will not cause traffic conditions to deteriorate.

The Parking Study contains a review of parking requirements compared to proposed supply. Our findings indicate that the site will function well within the proposed supply. The shared parking nature of the multiple uses of the site will further alleviate parking concerns to ensure parking functions without issue.

Sincerely,



Anil Seegobin, P.Eng.
Partner, Engineer

Trans-Plan Transportation Inc.
Transportation Consultants



Jeffrey Gorman
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1. INTRODUCTION

Trans-Plan has been retained by Harper Dell & Associates Inc. to complete a Traffic Impact and Parking Study for a proposed 2-phase mixed use development. Phase one consists of a mixed-use residential building featuring commercial uses on the ground floor and residential units on the upper floors, and phase two consists of a drive thru restaurant. The site is located at 820 Saint David Street North (Highway 6), just north of Strathallan Street, in the Community of Fergus, Centre Wellington Township.

This transportation study includes the following:

Traffic Impact Study

- Review of the proposed development and site statistics
- Review and assessment of the existing road network and study area intersections
- Assessment of future background conditions based on anticipated traffic growth, area developments and planned transportation improvements in the study area
- Assessment of the impact of site-generated traffic on the adjacent roadway network under future background and total traffic conditions for a five-year study horizon
- Confirmation that the roadway and intersections can accommodate the proposed development for traffic capacity and level of service (LOS)
- Determination of roadway and intersection improvements, as required, to accommodate the proposed development, including future roadways / connections to the subject site

Parking Study

- Review of the site parking requirements for the existing and proposed land uses based on the Township of Centre Wellington Zoning By-Law 2009-45
- Review of similar sites for provided parking relative to size of development
- Justification for the proposed parking supply based on a review of the study area travel characteristics and site context

Prior to commencing this study, Transportation and Planning staff at the County of Wellington were provided with a terms of reference detailing our proposed scope and methodology. Pertinent elements of this discussion are included in this study.

2. BACKGROUND

2.1 Site location

The site is situated in Elora and Fergus (in the community of Fergus), approximately 22km northwest of the City of Guelph. The site, shown in Figure 1, is located at the northeast quadrant of the intersection of Saint David Street North (Highway 6) and Strathallan Street.

The study area contains a mix of highway commercial uses with secondary agricultural areas stretching along the arterial road. The interior streets off Highway 6 contain mainly residential subdivisions with

single-family dwellings. At the intersection of Saint David Street North and Parkside Drive, there is a retail commercial plaza with a Walmart at the northwest corner. St. Joseph's Catholic School and Church are located at the southeast quadrant of the intersection.

The subject site contains the Best Western Plus Fergus Hotel, which is a two-storey building with 40 rooms (and assembly area / amenities, including the Mosaic Spa). The subject site also contains an ESSO gas station and convenience store (C-store) with 4 fuel pumps (8 vehicle fueling positions) plus 2 diesel fuel pumps, as well as two parking spots reserved for air pumping station. The C-store building also includes a Tim Horton's restaurant / coffee-shop with a drive-thru facility.

2.2 Development Proposal

The development proposes to construct a 5-storey mixed use building containing 42 Units and commercial uses on the ground floor (phase 1) and a restaurant with drive through (phase 2). In addition to the construction of the building in phase 1 the parking layout will be updated; this will include the area surrounding the existing hotel. The site will feature three site accesses two on Strathallan Street and one on Saint David Street North. All the site accesses are operating in the existing conditions and service the existing hotel and gas station. The site plan can be seen in Figure 2.

Analysis was completed considering the finished case of both phases of development. The goal was to ensure that the site will function well when all trips and uses were added to the local roadway network. The analysis provides a comprehensive view of the whole development instead of just a piece.

2.3 Roadways

The study area roadways in the immediate vicinity of the site can be described as follows:

Saint David Street North generally runs in a north – south direction. It consists of two travelling lanes one in each direction with a third centre median lane for left turns. There is an assumed speed limit of 50 km/h within the vicinity of the site.

Strathallan Street runs in an east west direction consisting of two travel lanes, one in each direction. The roadway has an assumed speed limit of 50km/h.

The study area roadway characteristics are shown in Figure 3.

3. TRANSPORTATION IMPACT STUDY COMPONENTS

This TIS was completed to analyse the impacts that the proposed development will have on the surrounding network. This analysis took a stepwise approach to making sure that the development would not cause surrounding conditions to deteriorate. First a model was constructed that mirrors the existing conditions to provide baseline judgement. This model was then taken and a growth rate was applied to yield future conditions for a five-year horizon. Then site traffic was generated, distributed across the road network and added to the growth case to yield a total case that reflects the impacts of the site on the surrounding network.

3.1 Study Area Intersections

For the purposes of analysis, a zone of review had to be selected that contained a logical snapshot of the surrounding traffic conditions. The following intersections encompassing the proposed development were selected:

- Saint David Street North & Strathallan Street
- Saint David Street North & Site Access 1
- Strathallan Street & Site Access 2
- Strathallan Street & Site Access 3

3.2 Traffic Counts

To determine existing operating conditions within the study area, Trans-Plan conducted a site visit and intersection turning movement counts (TMCs), as recent counts were not readily available. The traffic counts were all conducted on a typical weekday to capture peak hour roadway traffic volumes (when the residential uses would likely peak). TMC diagrams are provided in Appendix A. The dates and times that TMCs were undertaken, as well as the peak hours obtained, are summarized in Table 1.

Table 1 – Turning Movement Count Details

Survey Dates	Survey Periods	Intersections	Peak Hours
Thursday February 17 th , 2018	Weekday AM 7:00 am – 9:30 am & Weekday PM 4:00 pm – 6:30 pm	Saint David Street North & Strathallan Street	AM: 8:15 – 9:15 PM: 4:15 – 5:15
		Saint David Street North & Site Access 1	AM: 8:00 – 9:00 PM: 4:15 – 5:15
		Strathallan Street & Site Access 2	AM: 8:00 – 9:00 PM: 4:30 – 5:30
		Strathallan Street & Site Access 3	AM: 8:00 – 9:00 PM: 4:15 – 5:15

Considering these traffic volumes were obtained in 2018 the traffic analysis applied a 2% growth rate for two years to adjust the volumes to be consistent with 2020 traffic volumes. This was considered to be more accurate than surveying in 2020 as traffic conditions were found to be uncharacteristically low due to the effects of Covid-19 on local traffic patterns. The existing traffic volumes (adjusted for 2020) for the weekday AM and PM peak hours are shown in Figure 4.

3.3 Traffic Growth & Peak Hour Factors

A typical 2% growth rate was selected for use in this study. This growth rate is consistent with the R.J Burnside & Associates Limited TIS report, prepared in September 2013, for the Township of Centre Wellington North West Fergus Secondary Plan.

Peak hour factors for the local road network were calculated from the hourly traffic count data. The Grand Total column in the detailed count volume summaries (see Appendix A) is used to determine the peak hour for each intersection. Once the peak hour has been found, the peak hour factor (PHF) is calculated

by taking the maximum 15-minute volume, multiplying it by 4 and then the previously found peak hour volume is divided by this number. This PHF is then inputted into the synchro analysis.

3.4 Background Developments

Based on a review of the Township of Wellington County development applications map and a site visit of the study area, there are no other planned developments within our study area. From discussions with Township staff, a commercial development is being contemplated at the southwest corner of Saint David Street North and Side Road 19; however, no formal application has been submitted to the Township at this time.

3.5 Trip Generation

In order to determine the impact of the proposed development on the surrounding road network, trips were generated for the subject site so that these vehicles could be added to the adjacent intersections. The Institute of Transportation Engineers Trip Generation Manuals, 10th Edition was used, the outputs can be found in Table 2.

Table 2 – Site Trip Generation for Residential Units

Land Use Type	Size		AM Peak Hour			PM Peak Hour		
			In	Out	Total	In	Out	Total
Multifamily Housing Mid-Rise (LUC 221)	42 units	Distribution Equation Trips	26% Ln(T)=0.98Ln(x)-0.98 4	74% 11	100% 15	61% Ln(T)=0.96Ln(x)-0.63 11	39% 8	100% 19
Shopping Centre (LUC 820)	429 sq.m.	Distribution Rate Trips		0.87 2	4		2.04 10	18
Restaurant with Drive-thru (LUC 934)	138 sq.m.	Distribution Equation Trips	26% 30	74% 40.19 29	100% 59	61% 25	39% 17.87 23	100% 48
Total			36	42	78	44	41	85

The site is anticipated to generate 78 new trips (36 inbound and 42 outbound) in the weekday AM peak hour and 85 new trips (44 inbound and 41 outbound) in the weekday PM peak hour.

3.6 Trip Distribution and Assignment

The trips were distributed in a way that pointed them towards the largest potential draws (as well as based on a review of traffic patterns from the existing turning movement counts). The majority of site traffic was assigned towards the local major highways, or north/south along Saint David Street North. Some traffic was also assigned to the east as there is a commercial/industrial area that also represents a point of interest for trips to and from this development. The trip assignment scheme can be seen in Figure 6.

3.7 Future Total Traffic Conditions

Site traffic volumes were added to the future background traffic volumes to obtain the future total traffic volumes for a five-year horizon post buildout. Buildout was assumed to occur two years from the current date. The horizons selected were as follows: existing 2020 conditions and 2027 future (background and total) conditions.

3.8 Capacity Analysis

A capacity analysis was performed for the study area intersections using Synchro software to analyse the intersections immediately around the proposed site. Output data sheets for the following cases can be found in Appendix B and Level of Service (LOS) Definitions are provided in Appendix C, The planning horizons assessed include:

- Existing conditions (year 2020)
- Future background conditions for the 5-year horizon post build-out (year 2027)
- Future Total Conditions for the 5-year horizon post build-out (year 2027)

The two phase development is assumed in our analysis to be operational / built-out within approximately two years (by year 2022).

The capacity tables for the existing, background and total (for the 5-year horizon post build-out) are provided in Table 3.

Table 3 - Capacity Analysis Results



Intersection Movement	Existing Traffic Conditions						Background Traffic Conditions						Total Traffic Conditions							
	AM Peak Hour			PM Peak Hour			AM Peak Hour			PM Peak Hour			AM Peak Hour			PM Peak Hour				
	V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS		
Saint David Street North & Site Access 1																				
Westbound Left / Right	1.1	B	B	12	B	B	12	B	B	14	B	B	12	B	B	14	B	B	14	B
Northbound Through / Right	0	A	A	0	A	A	0	A	A	0	A	A	0	A	A	0	A	A	0	A
Southbound Through / Left	1	A	A	1	A	A	1	A	A	1	A	A	1	A	A	2	A	A	2	A
Saint David Street North & Strathallan Street																				
Eastbound Left	0.36	B	B	12	B	B	13	B	B	13	B	B	14	B	B	14	B	B	0.44	B
Eastbound Through / Right	0.07	C	C	35	C	C	29	C	C	36	D	D	27	C	C	36	D	D	0.54	D
Westbound Left	0.05	C	C	30	C	C	28	C	C	30	C	C	27	C	C	30	C	C	0.19	C
Westbound Through / Right	0.51	D	D	31	C	C	36	D	D	31	C	C	33	C	C	32	C	C	0.39	C
Northbound Left	0.16	C	C	29	C	C	29	C	C	29	C	C	28	C	C	29	C	C	0.12	C
Northbound Through / Right	0.06	A	A	4	A	A	4	A	A	4	A	A	6	A	A	4	A	A	0.09	A
Southbound Left	0.21	A	A	5	A	A	5	A	A	6	A	A	7	A	A	6	A	A	0.39	A
Southbound Through	0.12	A	A	7	A	A	8	A	A	8	A	A	10	A	A	8	A	A	0.11	A
Southbound Right	0.33	A	A	9	A	A	10	B	B	9	A	A	12	B	B	9	A	A	0.32	A
Strathallan Street & Site Access 2																				
Eastbound Through / Left	0.02	A	A	7	A	A	7	A	A	7	A	A	9	A	A	7	A	A	0.05	A
Westbound Through / Right	2	A	A	3	A	A	2	A	A	3	A	A	3	A	A	3	A	A	3	A
Southbound Left / Right	0	A	A	0	A	A	0	A	A	0	A	A	0	A	A	0	A	A	0	A
Strathallan Street & Site Access 3																				
Eastbound Through / Left	11	B	B	10	B	B	12	B	B	11	B	B	12	B	B	11	B	B	11	B
Westbound Through / Right	1	A	A	0	A	A	1	A	A	0	A	A	0	A	A	1	A	A	1	A
Southbound Left / Right	0	A	A	0	A	A	0	A	A	0	A	A	0	A	A	0	A	A	0	A
	10	B	B	10	A	A	11	B	B	10	A	A	11	B	B	10	A	A	10	A

Saint David Street North & Strathallan Street

Under existing conditions, this intersection operates at, or above, an average level of service of B with an average delay of 13 seconds. Of special note are the east and west bound movements. In existing and future conditions, they are approaching a level of service of D with delays of up to 35 seconds. This is acceptable at this time and extending to 2027 however in the future (post 2027) signal timing improvements may be necessary to extend the east/west movements as the area continues to develop.

Saint David Street North & Site Access 1

Under existing conditions, this intersection operates at, or above, an average level of service of B with a max delay of 12 seconds. The intersection is expected to operate similarly under future conditions.

Strathallan Street & Site Access 2

Under existing conditions, this intersection operates at, or above, an average level of service of B with a max delay of 12 seconds. The intersection is expected to operate similarly under future conditions.

Strathallan Street & Site Access 3

Under existing conditions, this intersection operates at, or above, an average level of service of B with a max delay of 11 seconds. The intersection is expected to operate similarly under future conditions.

Overall the capacity analysis showed great operating conditions in the study area in both existing and future conditions. There was no indication of any negative effects from the addition of this site and its traffic, to the local road network.

4. PARKING STUDY

4.1 Parking Requirements

The parking requirements for the proposed development are based on the The Township of Centre Wellington Comprehensive Zoning By-Law No. 2009-045 and are shown in Table 4, in comparison to the parking supply. Source information is provided in Appendix D.

For additional clarification the by law states the following for visitor parking spaces in relation to apartment uses:

1.0 space per dwelling unit plus 0.5 spaces per unit for the first 20 units and 0.25 spaces per unit for each additional unit. A minimum of 50% of the additional parking spaces shall be devoted exclusively to visitor parking. For 42 units this equates to the following: 42 units * 1 space per unit = 42 spaces (for residential). 0.5 spaces per unit * first 20 units + 0.25 spaces per unit * 22 remaining units = 16 spaces (divided half for residential and half for visitor). The total then comes to 42 spaces for residential 8 spaces for visitors and 8 spaces that can be assigned to either visitor or residential.

Table 4 – Parking Requirements

Land Use (as per By-law)	Size	By-Law Parking Requirement		Proposed Parking Supply
		Rate	Spaces	
Hotel	40 rooms	1 space per guest room	40	40
Hotel Amenity (Mosaic spa)	32.5 sq.m.	1 space per 10 m2 of accessory services	3	3
Residential Apartment	42 Units	1 space per unit	42	42
Residential Visitor		See above	8	5
Flex spaces (residential or visitor)			8	
Ground Floor Commercial	429 sq.m.	1 space per 30 sq.m	14	10
Restaurant with Drive Thru	138 sq.m.	1 space per 9 sq.m.	15	15
Total			130	115

The overall parking requirement is 130 spaces and the proposed parking supply is 115 spaces, provided at grade distributed evenly over the site between the developments. This results in a shortfall of 15 parking spaces for the development. Justification for this shortfall is presented in the following section. To simplify the justification proxy site surveys were completed for residential uses and will be compared to the residential uses of the proposed site. Therefore the following section will provide justification for a residential supply of 43 spaces inclusive of residential and visitor uses this is a 15 space reduction from the total residential plus visitor rate of 58 spaces required by the by law.

4.2 Proxy Sites for Residential Uses

To demonstrate that the parking supply for the proposed mixed-use development would be sufficient, Trans-Plan reviewed other apartment developments that demonstrated a similar use case and local area characteristics. Like the subject site, the proxy sites are low / mid-rise residential rental apartments located in a sub-urban area. Parking is supplied by an at-grade lot for each of the proxy sites. A comparison of site statistics for each apartment development is shown in Table 5.

Table 5 - Proxy Site Comparison

Site Statistics	Subject Site	Proxy Sites	
	820 Saint David Street North, Fergus	18 Patterson Street, Beeton	Riverview Apartments, 15 Southbank Drive, Bracebridge
No. of Storeys	5	4	3
No. of Units	42	30	35
Parking Supply	43	52	54
Parking Supply Rate	1.02	1.73	1.54

Each site was visited between 11:00 and 12:00 midnight to record peak parking behaviour on May 24, 2019. The results of the parking counts can be seen in Table 6.

Table 6 – Proxy Survey Results

Proxy Site	No. of Units	Time of Peak Parking Demand	Peak Parking Demand (spaces)	Peak Residential Parking Demand Rate (spaces per unit)
18 Patterson Street, Beeton	30	12:00 PM	30	1.0
Riverview Apartments, 15 Southbank Drive, Bracebridge	35	12:00 PM	37	1.06
Average				1.03

From the proxy surveys it was found that the average parking rate of this type of development is 1.03 spaces per unit. If this is applied to the proposed site it results in a requirement of 43 parking spaces. This is consistent with the proposal which will provide 43 spaces. A 15-space reduction in the residential parking requirement results in a reduction to the overall requirement of 15 spaces. Therefore, the proposed parking of 115 spaces meets the reduced requirement of 115 spaces.

This justification aims to prove that the parking is sufficient by just looking at the residential uses however this site also features a hotel, spa, restaurant, gas station and other commercial uses. Through it is not necessary to review each of these uses individually to seek further reductions in parking as the site already meets the requirements for each of these uses, it is useful to discuss the uses and how the site will function as a whole with regards to parking.

The multiple use nature of this site allows each individual amenity to make use of any free spaces that other uses don't need. For example, later at night when commercial and restaurant uses close the hotel and residential visitors can use those spaces. Then when the overnight visitors leave in the morning of the next day and the service businesses open, those spaces can be used by customers visiting the site. While this shared parking between uses on this site is not mandatory for the site to function it does allow the spaces on the site to flex to meet the needs of the site at different times of the day. This will result in more parking availability for visitors while simultaneously allowing for a reduced total parking count.

5. CONCLUSIONS

5.1 Summary

Traffic Impact Study

- The proposal outlines plans to construct a 2 phase development. Phase 1 is a 5 storey mixed use apartment building and phase 2 is a drive thru restaurant.
- Traffic counts at the boundary road intersections were conducted during weekday AM and PM peak periods.
- A 2% growth rate was applied to the study area traffic volumes
- Trips were generated for the site using the Institute of Transportation Engineers Trip Generation Manuals, 10th Edition.
- Trips were distributed to the study area road network, based on the existing TMCs and the location of adjacent municipalities / major travel routes and highways
- The study horizon selected was set to be five years after the build out of the site. The build out was assumed to take two years. The existing 2020 and future 2027 conditions were analyzed using Synchro traffic software.
- The capacity analysis found acceptable traffic conditions. Overall, all movements and intersections are operating, and are expected to continue to operate, at good to acceptable level of service.

Parking Study

- Parking for the development is provided at grade distributed over the site between the different uses.
- The Zoning By-law requires a total of 130 spaces, 115 spaces are proposed to be provided.
- Parking surveys indicated that a rate of 1.03 spaces per unit for the residential (resident + visitor) would be sufficient to serve this site. This results in a residential demand of 43 spaces. The total requirement is 58 spaces, so this represents a 15 space reduction. With this reduction the site both requires and proposes to provide 115 spaces.
- The site features a number of different uses including hotel, residential, commercial, restaurant and gas station. The shared nature of the parking is expected to further reduce the need for parking as visitors can use spaces that are free when they are not in use. For example overnight hotel guests parking during commercial closing hours.

5.2 Conclusion

To conclude, the proposed development is expected to cause negligible impact to the surrounding roadways. Although the parking supply is short of the Zoning By-law parking surveys indicate that the development will function within the proposed supply. In addition to this shared parking behaviour should further reduce the parking demand.

Respectfully submitted,



Anil Seegobin, P.Eng.
Partner, Engineer

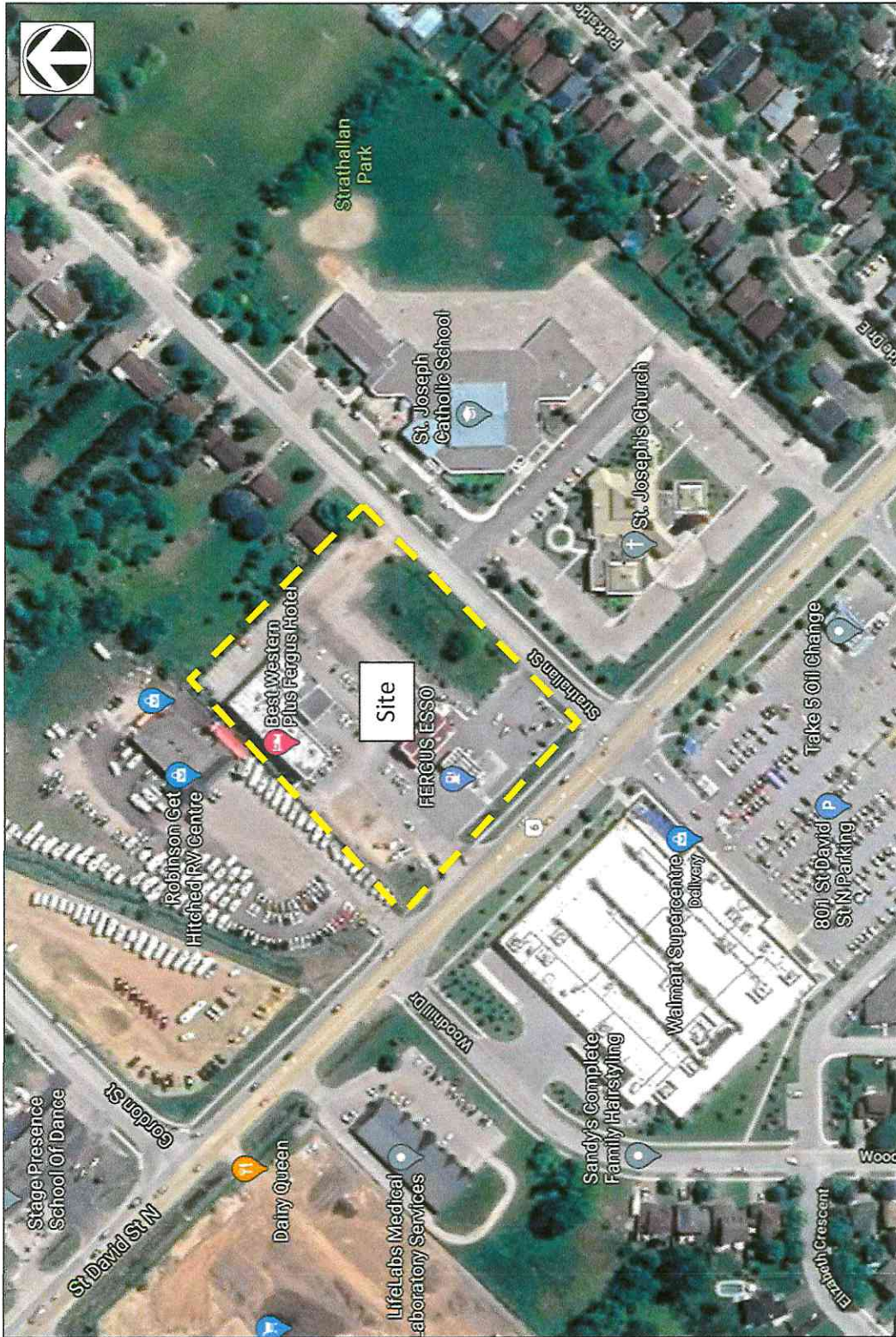
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Traffic Assistant

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Transportation Consultants

Figure 1 – Site Location



Source: Google Maps



Figure 3 - Existing Study Area Roadway Characteristics

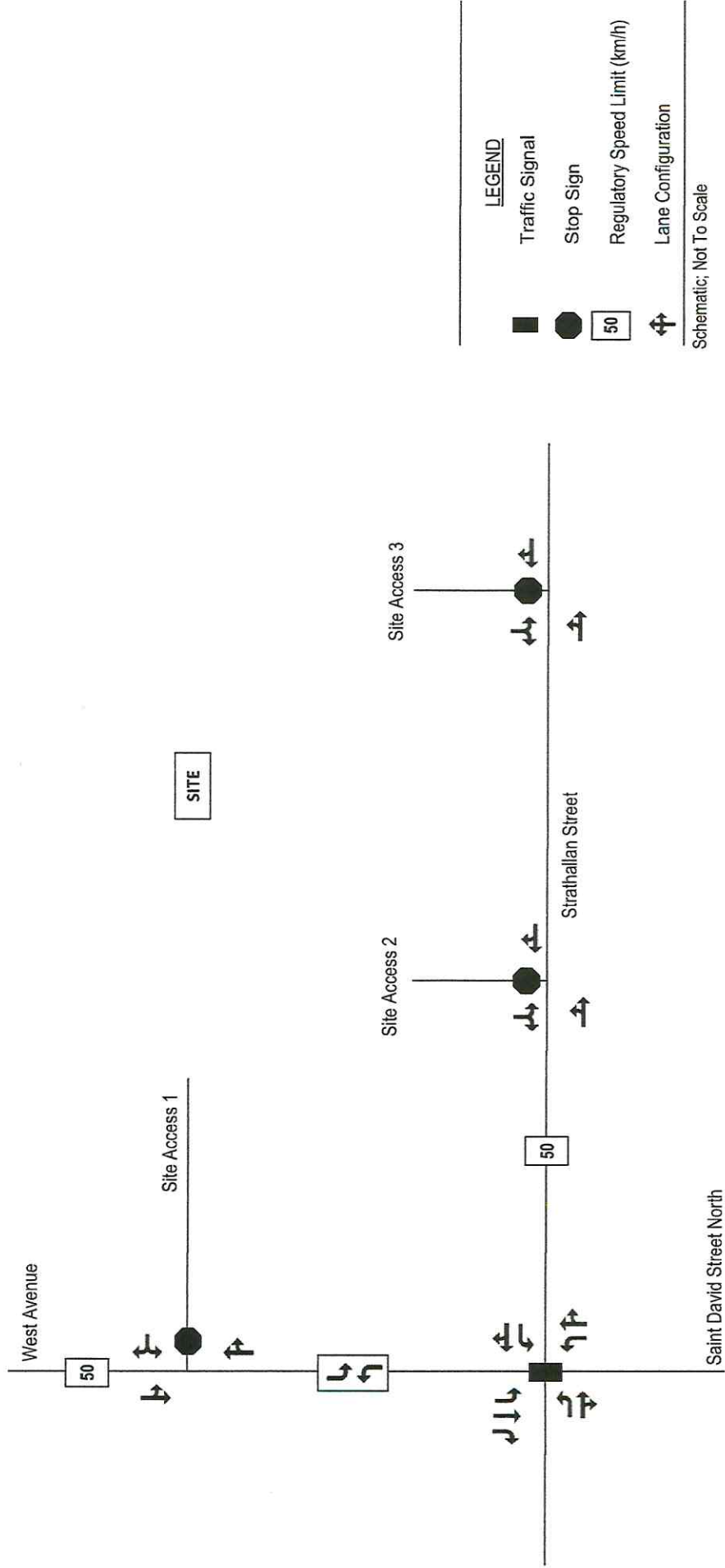




Figure 4 - Existing Traffic Volumes, Weekday AM & PM Peak Hours

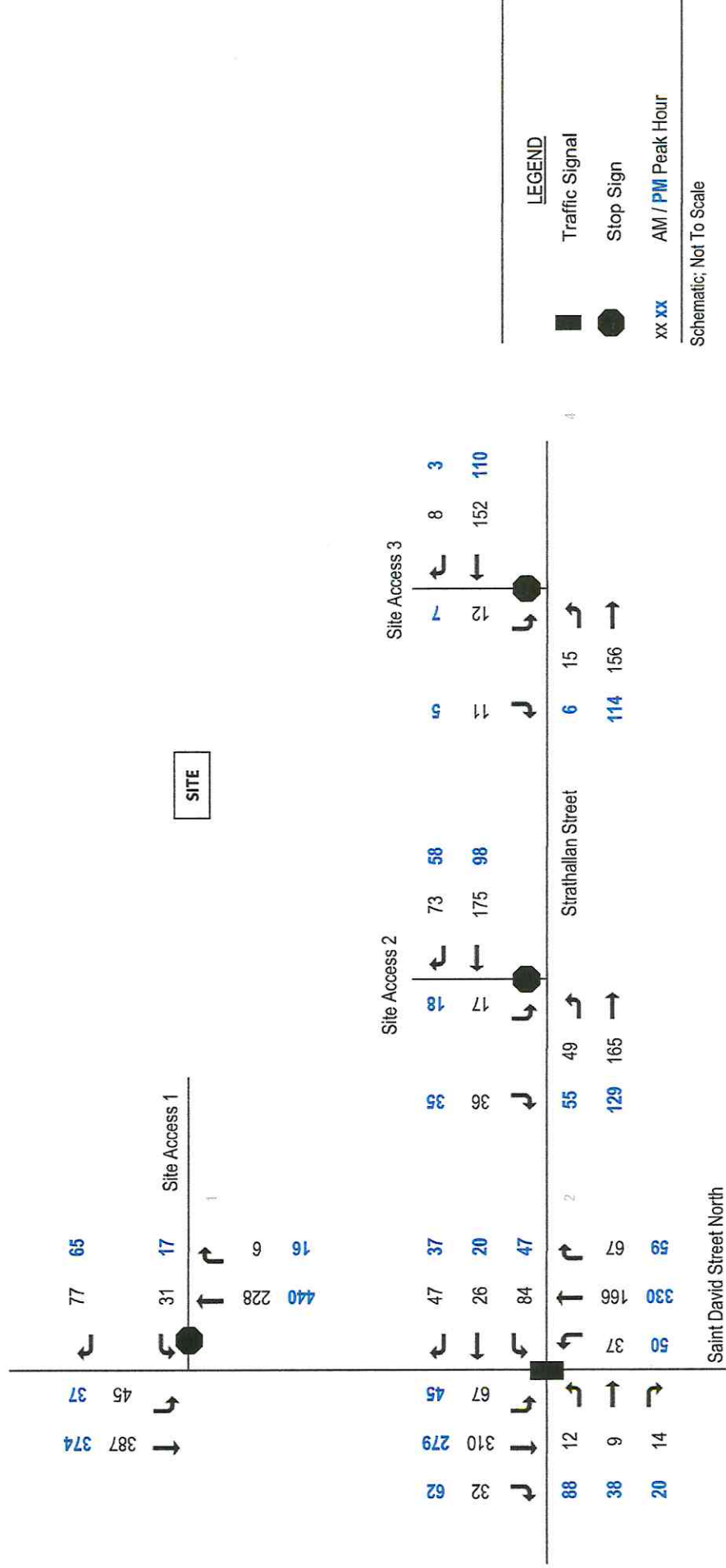
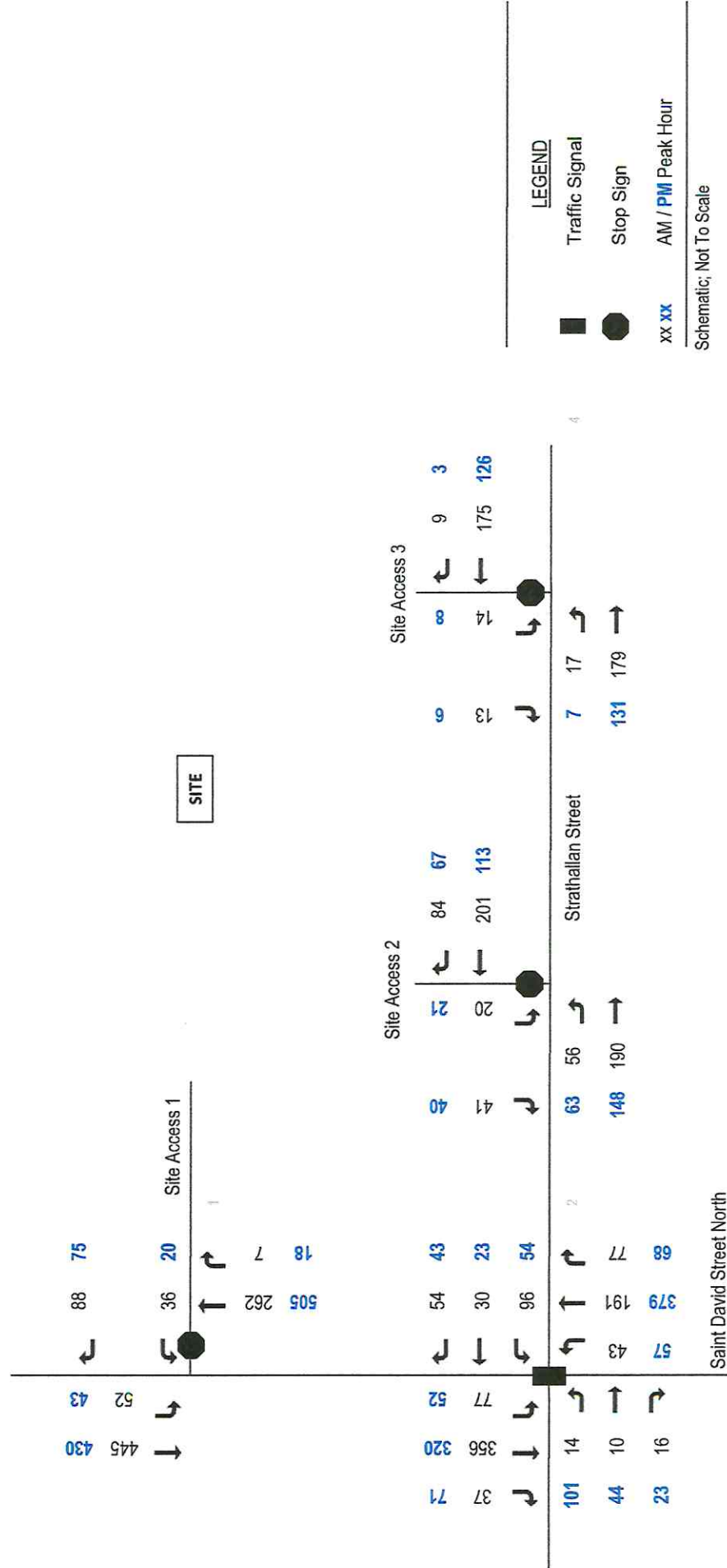




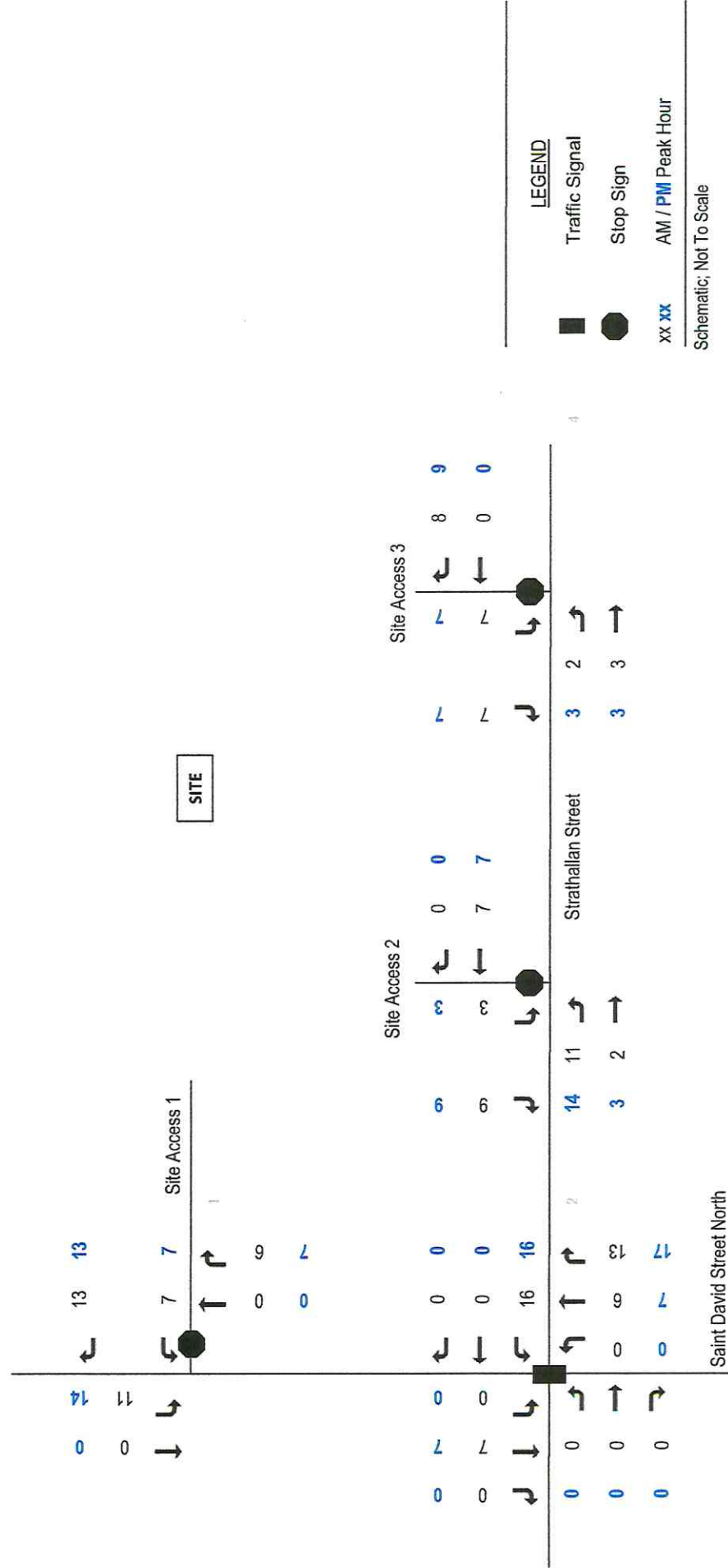
Figure 5 - Background Traffic Volumes, Weekday AM & PM Peak Hours



Schematic; Not To Scale



Figure 6 - Site Traffic Assignment, Weekday AM & PM Peak Hours

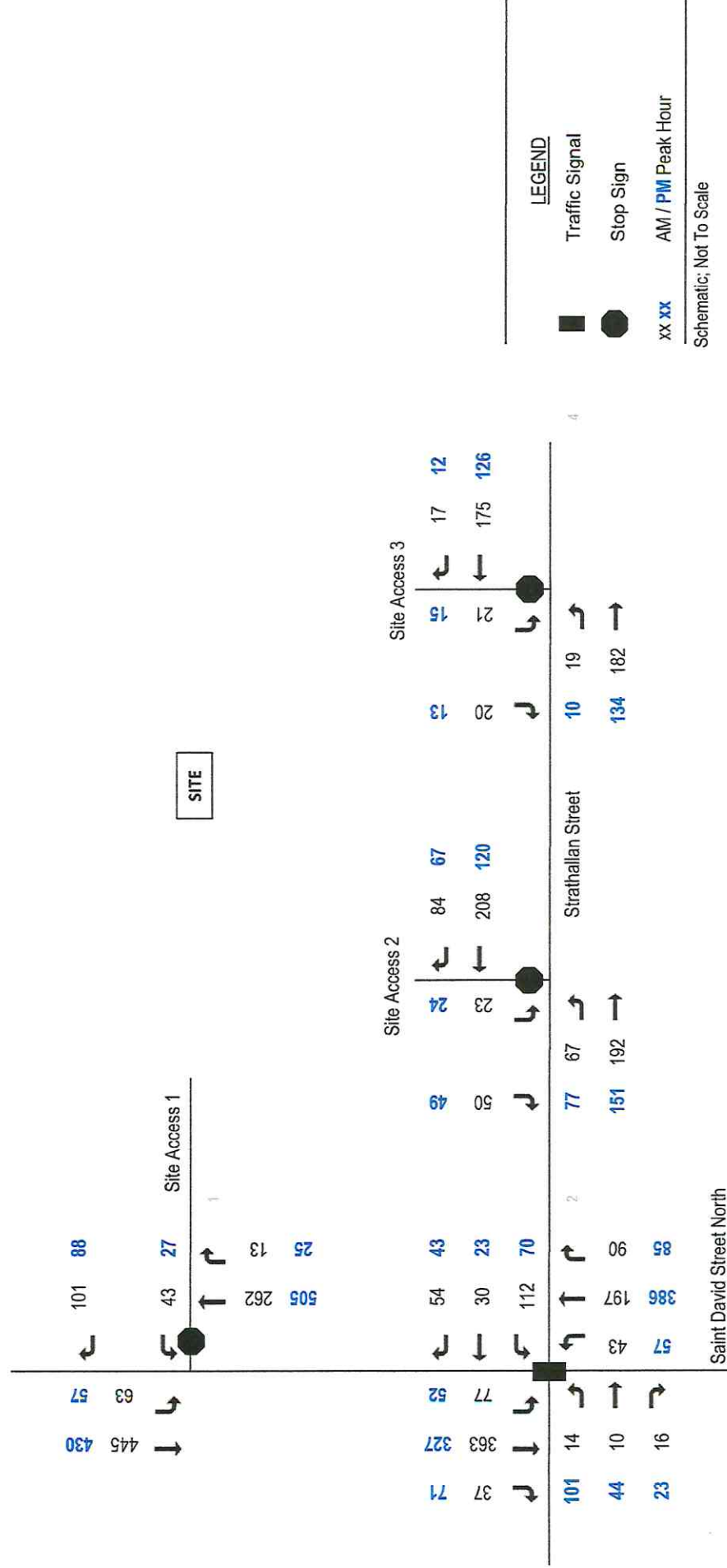


TRANSPORTATION STUDY

Proposed Mixed-Use Development
820 Saint David Street North, Fergus, ON



Figure 7 - Total Traffic Volumes, Weekday AM & PM Peak Hours



LEGEND
 Traffic Signal
 Stop Sign
 xx xx AM / PM Peak Hour
 Schematic: Not To Scale

Appendices

Appendix A – Turning Movement Counts & Signal Timing Plans

Appendix B – Synchro Data Sheets

Appendix C – LOS Definitions

Appendix D – Township of Centre of Wellington Zoning By-Law Parking Requirements



APPENDIX A

Turning Movement Counts & Signal Timing Plans

Turning Movement Count Diagram

Intersection: Easterly Site Access on Strathallan Street
Municipality: Fergus, Ontario

Intersection ID:

Date: Thursday, February 15, 2018



AM Peak Hour: 8:00 to 9:00

MD Peak Hour: - to -

		Strathallan Street					
North Total	249				East Total	0	
North Entering	154	Cyclists	0	0	0	East Entering	0
North Receiving	95	Truck	2	0	0	East Receiving	0
North Peds	0	Cars	6	146	0	East Peds	8
Easterly Site Access							
		0	0	12	→		
		0	0	0	→		
		0	0	11	↓		
West Total	45	14	79	0		South Total	254
West Entering	23	0	4	0		South Entering	97
West Receiving	22	0	0	0		South Receiving	157
West Peds	4					South Peds	8

		Strathallan Street					
North Total	0				East Total	0	
North Entering	0	Cyclists	0	0	0	East Entering	0
North Receiving	0	Truck	0	0	0	East Receiving	0
North Peds	0	Cars	0	0	0	East Peds	0
Easterly Site Access							
		0	0	0	→		
		0	0	0	→		
		0	0	0	↓		
West Total	0	0	0	0		South Total	0
West Entering	0	0	0	0		South Entering	0
West Receiving	0	0	0	0		South Receiving	0
West Peds	0					South Peds	0

PM Peak Hour: 15:30 to 16:30

Total 5-Hour Count

		Strathallan Street					
North Total	226				East Total	0	
North Entering	109	Cyclists	0	0	0	East Entering	0
North Receiving	117	Truck	0	0	0	East Receiving	0
North Peds	0	Cars	3	106	0	East Peds	0
Easterly Site Access							
		0	0	7	→		
		0	0	0	→		
		0	0	5	↓		
West Total	21	6	105	0		South Total	227
West Entering	12	0	5	0		South Entering	116
West Receiving	9	0	0	0		South Receiving	111
West Peds	0					South Peds	4

		Strathallan Street					
North Total	1038				East Total	0	
North Entering	546	Cyclists	0	0	0	East Entering	0
North Receiving	492	Truck	2	0	0	East Receiving	0
North Peds	0	Cars	25	519	0	East Peds	10
Easterly Site Access							
		0	0	58	→		
		0	0	0	→		
		0	0	46	↓		
West Total	185	54	425	0		South Total	1053
West Entering	104	0	9	0		South Entering	488
West Receiving	81	0	0	0		South Receiving	565
West Peds	9					South Peds	26



Turning Movement Count Diagram

Intersection: Strathallan Street and Highway 6

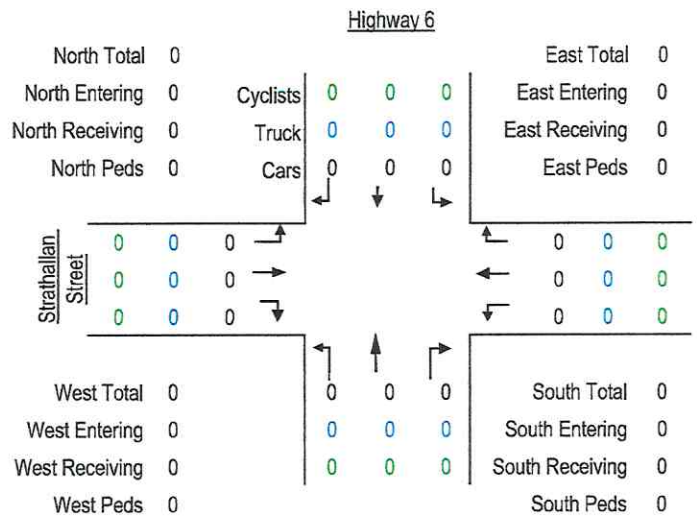
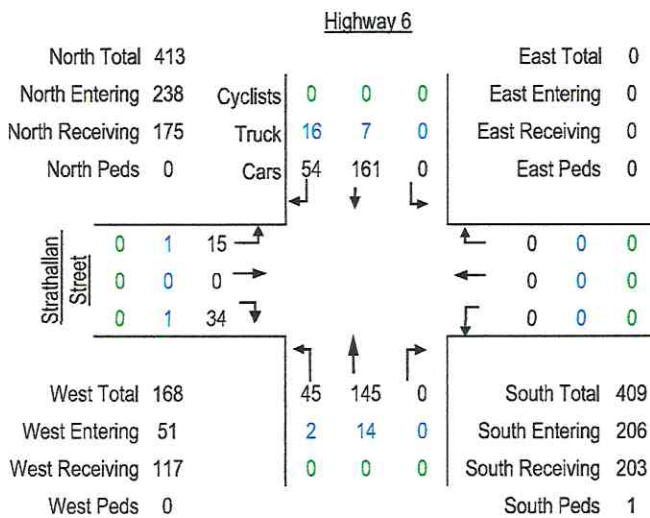
Municipality: Fergus, Ontario

Intersection ID:

Date: Thursday, February 15, 2018

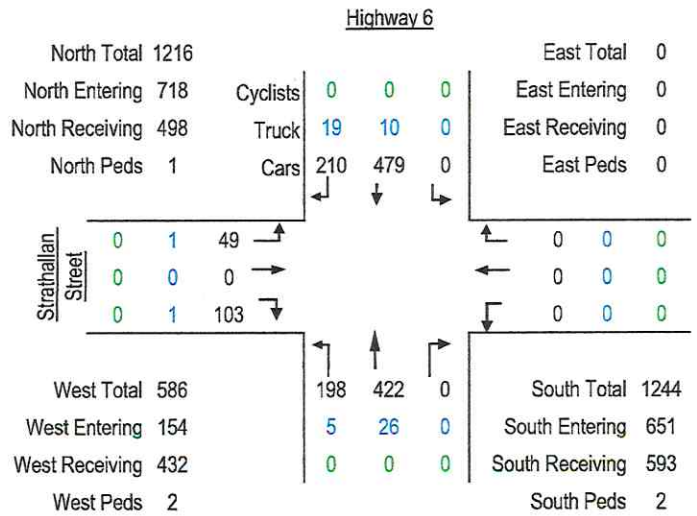
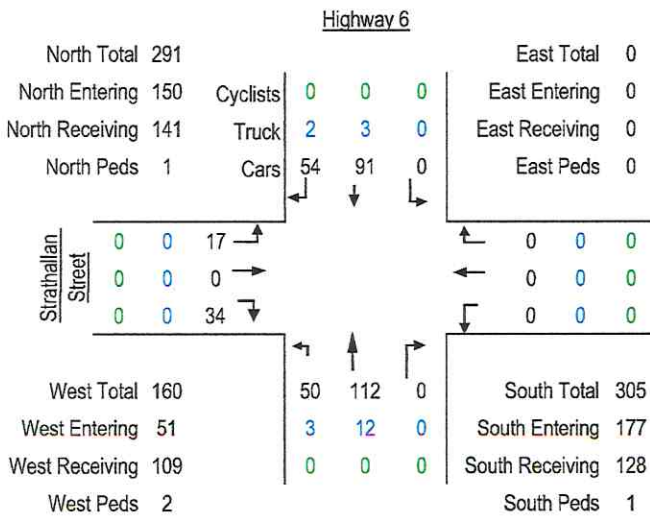
AM Peak Hour: 8:00 to 9:00

MD Peak Hour: - to -



PM Peak Hour: 16:15 to 17:15

Total 5-Hour Count



Trans-Plan Transportation Inc.

Site ID Code: Site Access on Saint David Street North
 Intersection Location: Fergus, Ontario
 Municipality: Thursday, February 15, 2018
 Count Date: TP
 Weather and Temperature:

IM	NORTH APPROACH						EAST APPROACH						SOUTH APPROACH						WEST APPROACH						Grand Total
	CAR		TRUCKS		CYCLISTS		Peds	CAR		TRUCKS		CYCLISTS		Peds	CAR		TRUCKS		CYCLISTS		Peds	Total			
	L	R	L	R	L	R		L	R	L	R	L	R		L	R	L	R	L	R			L	R	
:00	10	58	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24		
:15	18	74	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50		
:30	16	85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	55		
:45	13	82	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	61		
:00	11	76	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47		
:15	16	89	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	66		
:30	6	95	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	51		
:45	10	97	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	61		
:00	7	79	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45		
:15	4	66	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39		
IM																									
:00	6	84	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	96		
:15	8	87	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	91		
:30	6	90	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	112		
:45	9	92	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	129		
:00	12	83	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	106		
:15	6	68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	85		
:30	5	84	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	97		
:45	6	86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	95		
:00	8	73	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	94		
:15	3	67	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	82		
:30																									
:45																									
:00																									



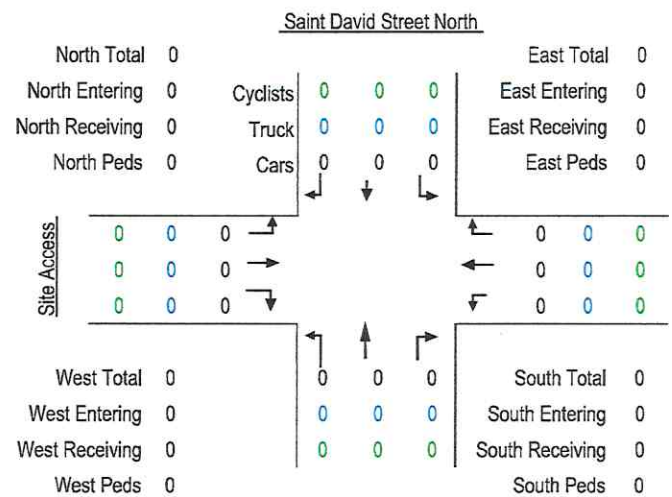
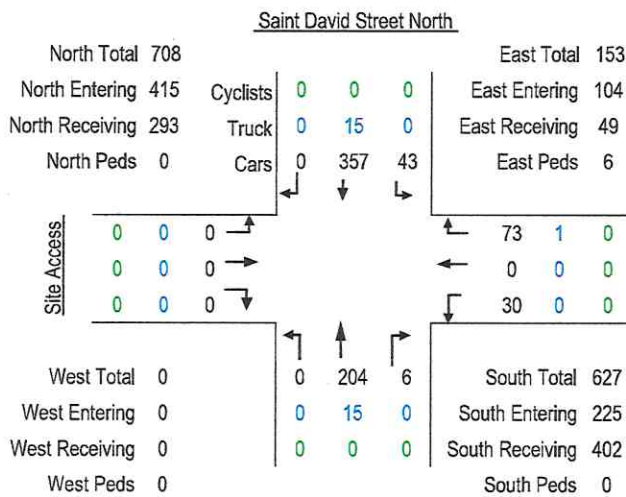
Turning Movement Count Diagram

Intersection: Site Access on Saint David Street North
Municipality: Fergus, Ontario

Intersection ID:
Date: Thursday, February 15, 2018

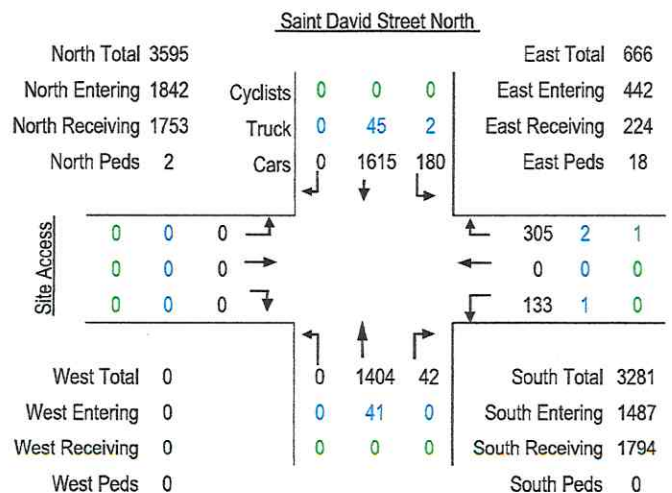
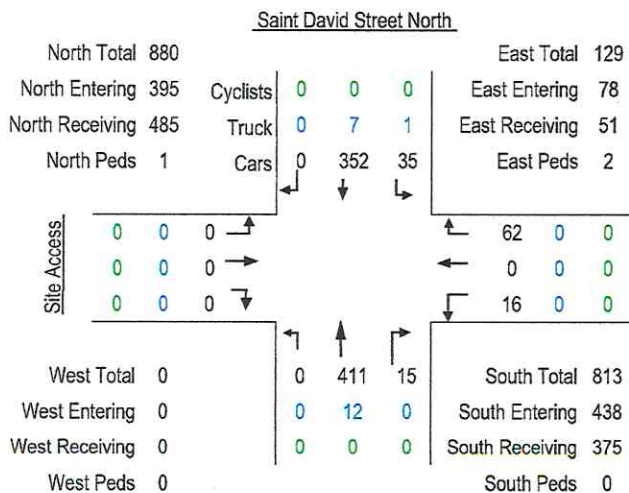
AM Peak Hour: 8:00 to 9:00

MD Peak Hour: - to -



PM Peak Hour: 16:15 to 17:15

Total 5-Hour Count





Turning Movement Count Diagram

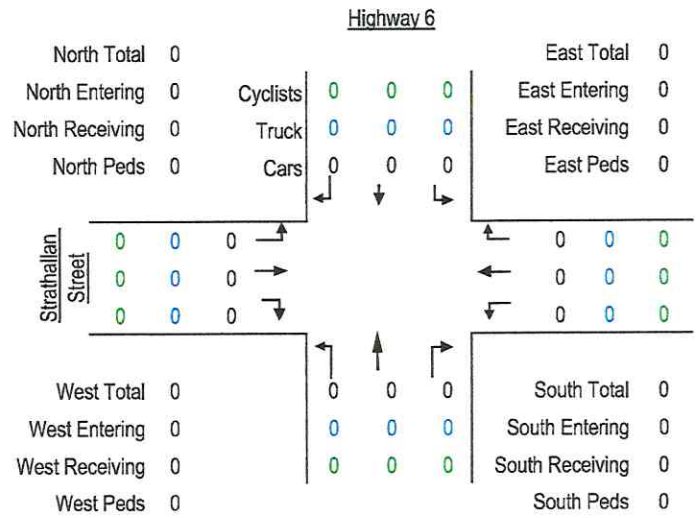
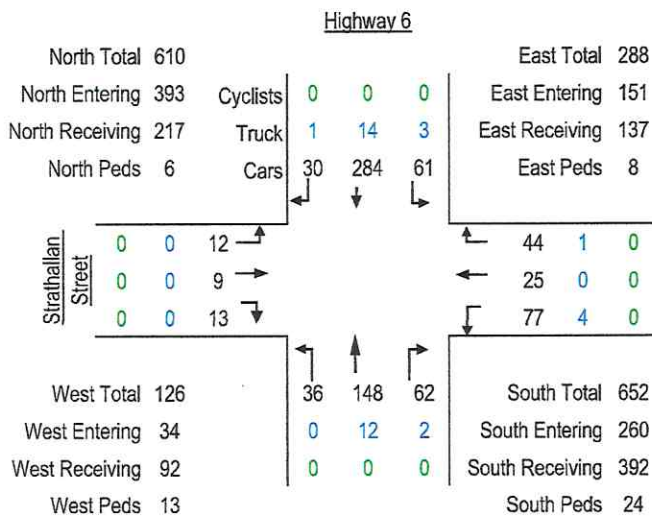
Intersection: Strathallan Street and Highway 6
Municipality: Fergus, Ontario

Intersection ID:

Date: Thursday, February 15, 2018

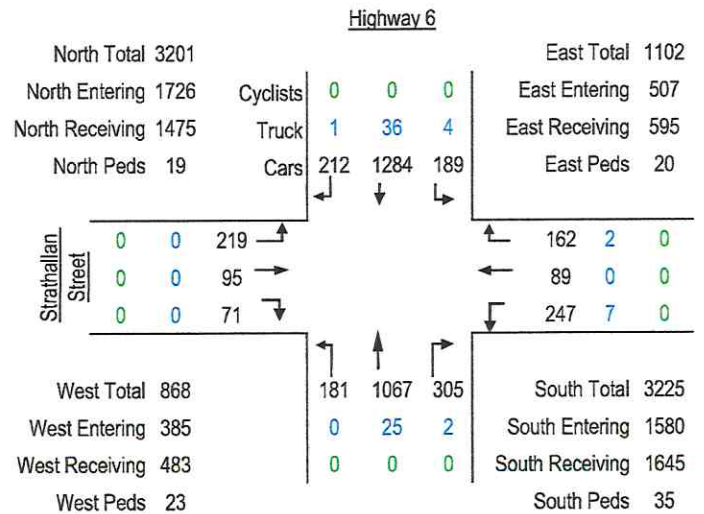
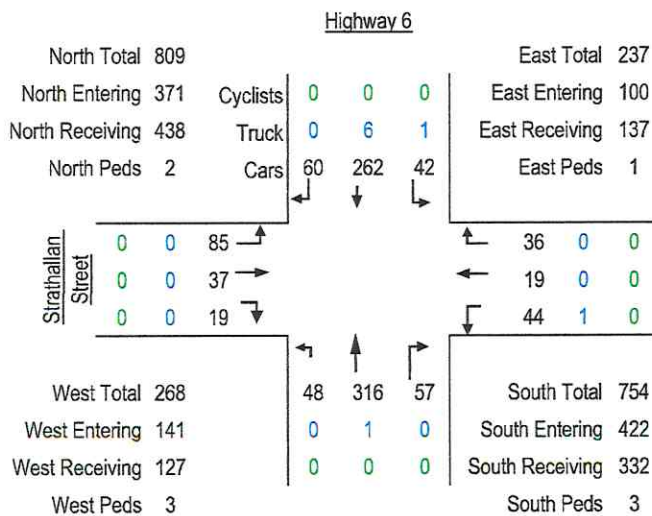
AM Peak Hour: 8:15 to 9:15

MD Peak Hour: - to -



PM Peak Hour: 16:15 to 17:15

Total 5-Hour Count



18. APPENDIX D: PROGRAM REFERENCE CARD

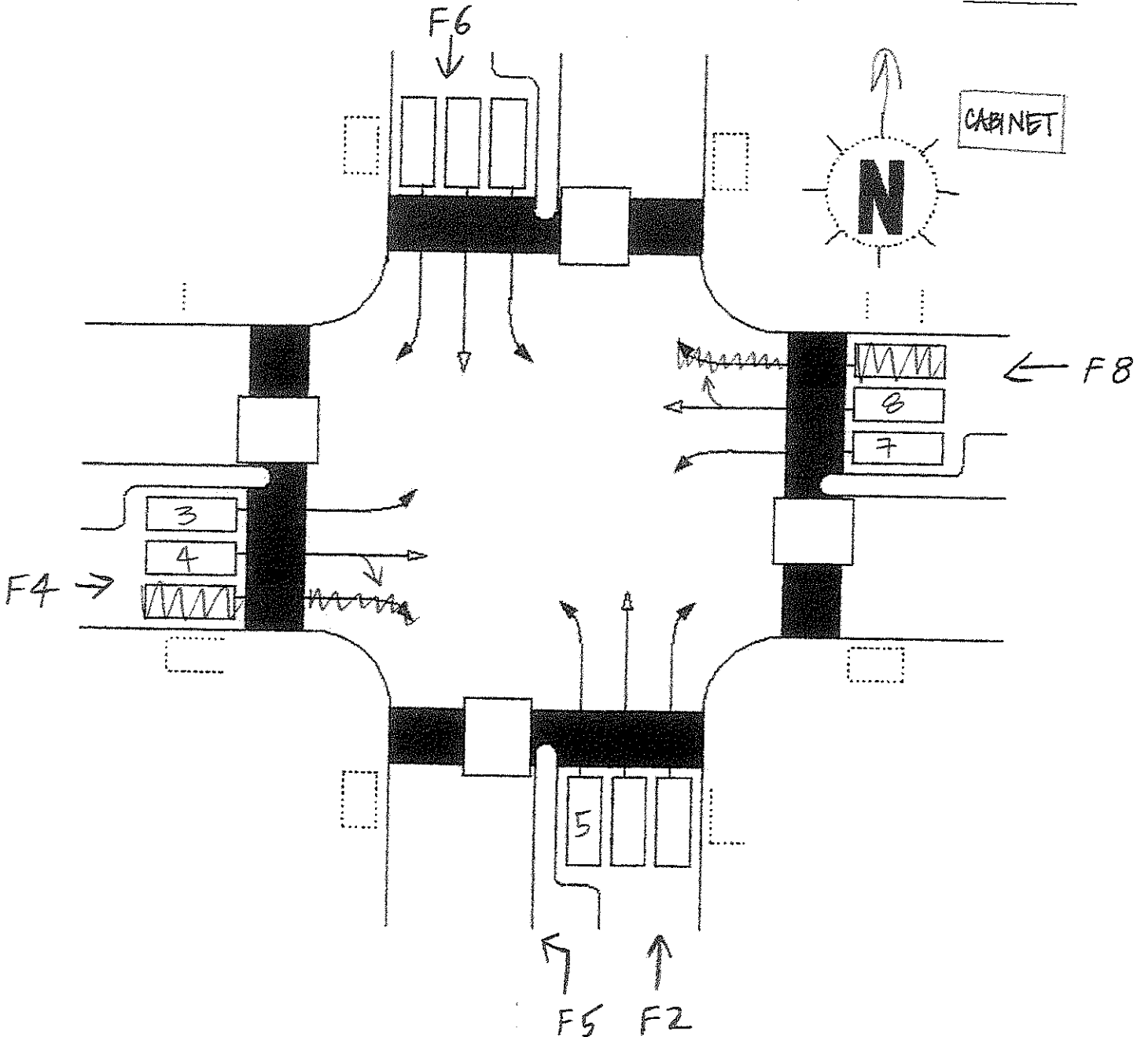
ASC/3

PROGRAM REFERENCE CARD

INTERSECTION ST DAVID / STRATHALLAN - WALMART

CONTROLLER NUMBER _____ ENTERED BY: _____ DATE / /

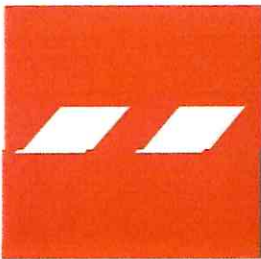
BOOT: _____ MAIN: _____ HELP: _____ DATA BASE _____



CONTROLLER SUBMENU

2-1. CONTROLLER TIMING DATA

TIMING PLAN 1																
PHASE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
MINIMUM GREEN		35		10	7.0	35		10								
BICYCLE MINIMUM GREEN																
CONDITIONAL SERVICE MINIMUM GREEN																
DELAYED GREEN																
WALK																
WALK 2		26		10		26		10								
WALK MAX				15				15								
PEDESTRIAN CLEARANCE																
PEDESTRIAN CLEARANCE 2		9.0		8.0		9.0		8.0								
PEDESTRIAN CLEARANCE MAX																
PEDESTRIAN CARRY OVER																
VEHICLE EXTENSION																
VEHICLE EXTENSION 2				5.0				5.0								
MAX1																
MAX2				25	12			25								
MAX3																
DYNAMIC MAX																
DYNAMIC MAX STEP																
YELLOW CHANGE																
RED CLRANCE		4.0		4.0	3.0	4.0		4.0								
RED MAX		2.9		2.4	1.0	2.9		2.4								
RED REVERT																
ACTUATIONS BEFORE GAP REDUCTION																
SECONDS PER ACTIONS ADDED TO INITIAL																
MAXIMUM ADDED INITIAL GREEN																
TIME BEFORE GAP REDUCTION																
CARS WAITING BEFORE GAP REDUCTION																
STEP TO REDUCE																
TIME TO REDUCE TO MINIMUM																
MINIMUM GAP																



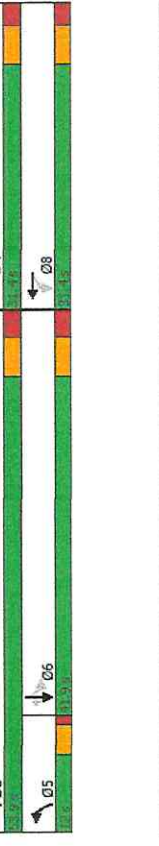
APPENDIX B
Synchro Data Sheets

HCM Unsignalized Intersection Capacity Analysis
 1: Saint David Street North & Site Access 1
 10-01-2020

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		T			T
Traffic Volume (veh/h)	31	77	228	6	45	387
Future Volume (Veh/h)	31	77	228	6	45	387
Sign Control	Stop	Free	Free	Free	Free	Free
Grade	0%	0%	0%	0%	0%	0%
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	33	82	243	6	48	412
Pedestrians	6					
Lane Width (m)	3.6					
Walking Speed (m/s)	1.2					
Percent Blockage	1					
Right turn flare (veh)						TWLT
Median type						TWLT
Median storage (veh)						2
Upstream signal (m)						90
pX, platoon unblocked	1.00	1.00			1.00	
vC, conflicting volume	760	252			255	
vC1, stage 1 conf vol	252					
vC2, stage 2 conf vol	508					
vC, unblocked vol	757	246			249	
IC, single (s)	6.4	6.2			4.1	
IC, 2 stage (s)	5.4					
IF (s)	3.5	3.3			2.2	
p0 queue free %	94	90			96	
cM capacity (veh/h)	539	787			1315	
Direction, Lane #	WBL 1	NB 1	SB 1			
Volume Total	115	249	460			
Volume Left	33	0	48			
Volume Right	82	6	0			
ESH	695	1700	1315			
Volumes to Capacity	0.17	0.15	0.04			
Queue Length 95th (m)	4.7	0.0	0.9			
Control Delay (s)	11.2	0.0	1.2			
Lane LOS	B	A	A			
Approach Delay (s)	11.2	0.0	1.2			
Approach LOS	B	A	A			
Intersection Summary						
Average Delay	2.2					
Intersection Capacity Utilization	51.9%					
Analysis Period (min)	15					
ICU Level of Service	A					

Timings
 2: Saint David Street North & Strathallan Street
 10-01-2020

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations	T	T	T	T	T	T	T	T	T
Traffic Volume (vph)	12	9	84	26	37	166	67	310	32
Future Volume (vph)	12	9	84	26	37	166	67	310	32
Turn Type	Perm	NA	Perm	NA	pph+pt	NA	Perm	NA	Perm
Protected Phases	4	4	8	8	5	2	6	6	6
Detector Phase	4	4	8	8	5	2	6	6	6
Switch Phase									
Minimum Initial (s)	10.0	10.0	10.0	10.0	7.0	35.0	35.0	35.0	35.0
Minimum Split (s)	29.4	29.4	29.4	29.4	11.0	53.9	41.9	41.9	41.9
Total Split (s)	31.4	31.4	31.4	31.4	12.0	53.9	41.9	41.9	41.9
Total Spill (%)	36.8%	36.8%	36.8%	36.8%	14.1%	63.2%	49.1%	49.1%	49.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.4	2.4	2.4	2.4	1.0	2.9	2.9	2.9	2.9
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.4	6.4	6.4	6.4	4.0	6.9	6.9	6.9	6.9
Lead/Lag									
Lead/Lag Optimize?									
Recall Mode	None	None	None	None	None	Max	Max	Max	Max
Act Effct Green (s)	12.8	12.8	12.8	12.8	53.2	51.7	45.3	45.3	45.3
Actuated g/C Ratio	0.18	0.18	0.18	0.18	0.73	0.71	0.62	0.62	0.62
v/c Ratio	0.06	0.09	0.41	0.24	0.05	0.21	0.11	0.31	0.04
Control Delay	25.1	16.0	32.6	14.2	4.6	5.3	11.1	11.4	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.1	16.0	32.6	14.2	4.6	5.3	11.1	11.4	0.1
LOS	C	B	C	B	A	A	B	B	A
Approach Delay									
Approach LOS									
Intersection Summary									
Cycle Length	85.3								
Actuated Cycle Length	72.9								
Natural Cycle	85								
Control Type	Semi Act-Uncoord								
Maximum v/c Ratio	0.41								
Intersection Signal Delay	11.6								
Intersection Capacity Utilization	61.1%								
Analysis Period (min)	15								



HCM Signalized Intersection Capacity Analysis
 2: Saint David Street North & Strathallan Street
 10-01-2020
 <Existing> AM Peak Hour

Movement	EBL	EBT	EBL	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	12	9	14	84	26	47	37	166	67	67	310	32
Traffic Volume (veh/h)	12	9	14	84	26	47	37	166	67	67	310	32
Future Volume (veh/h)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Ideal Flow (veh/h)	6.4	6.4	6.4	6.4	6.4	6.4	4.0	6.9	6.9	6.9	6.9	6.9
Total Lost time (s)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lane Util. Factor	0.99	1.00	0.96	1.00	0.98	1.00	1.00	0.99	1.00	0.99	1.00	1.00
Fltn. ped/bikes	1.00	0.91	1.00	0.90	1.00	0.96	1.00	0.96	1.00	1.00	0.85	1.00
Fltn. Flow (prot)	1789	1662	1653	1663	1798	1692	1709	1810	1515	1515	1515	1515
Fltn. Permitted	1328	1662	1288	1663	1663	1663	946	1692	1078	1810	1515	1515
Peak-Hour factor, PHF	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Adj. Flow (vph)	13	10	16	93	29	52	41	184	74	74	344	36
RTOR Reduction (vph)	0	14	0	0	45	0	0	12	0	0	0	15
Lane Group Flow (vph)	13	12	0	93	36	0	41	246	0	74	344	21
Conf. Peris. (f/hr)	6	24	24	6	13	6	13	8	8	8	13	13
Heavy Vehicles (%)	0%	0%	0%	5%	0%	2%	0%	8%	3%	5%	5%	3%
Turn Type	Perm	NA	Perm	NA	NA	NA	NA	NA	Perm	NA	NA	Perm
Protected Phases	4		8		8		5	2		6		6
Permitted Phases	4		8		8		5	2		6		6
Actuated Green, G (s)	10.7	10.7	10.7	10.7	10.7	10.7	51.9	51.9	43.8	43.8	43.8	43.8
Effective Green, g (s)	10.7	10.7	10.7	10.7	10.7	10.7	51.9	51.9	43.8	43.8	43.8	43.8
Actuated G/C Ratio	0.14	0.14	0.14	0.14	0.14	0.14	0.68	0.68	0.58	0.58	0.58	0.58
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4	6.4	6.9	6.9	6.9	6.9	6.9	6.9
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	168	234	181	234	234	1156	692	1156	622	1044	874	874
v/s Ratio Prot	0.01		0.02		0.02		0.00	0.15		0.19		0.19
v/s Ratio Perm	0.01		0.07		0.04		0.04		0.07			0.01
v/c Ratio	0.07	0.05	0.51	0.16	0.06	0.21	0.12	0.33	0.02	0.12	0.33	0.02
Uniform Delay, d1	28.3	28.2	30.2	28.6	4.0	4.4	7.3	8.4	6.9	7.3	8.4	6.9
Progression Factor	1.00	1.00	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	0.2	4.8	0.6	0.0	0.4	0.4	0.8	0.1	0.4	0.8	0.1
Delay (s)	28.6	28.4	35.0	29.3	4.1	4.9	7.7	9.2	6.9	7.7	9.2	6.9
Level of Service	C	C	D	C	A	A	A	A	A	A	A	A
Approach Delay (s)	28.5		32.4		32.4		4.8		8.8		8.8	
Approach LOS	C		C		C		A		A		A	
Intersection Summary												
HCM 2000 Control Delay	12.6											
HCM 2000 Volume to Capacity ratio	0.36											
Actuated Cycle Length (s)	75.9											
Sum of lost time (s)	17.3											
Intersection Capacity Utilization	81.1%											
Analysis Period (min)	15											
ICU Level of Service	D											
ICU Level of Service	A											

HCM Unsignalized Intersection Capacity Analysis
 3: Strathallan Street & Site Access 2
 10-01-2020
 <Existing> AM Peak Hour

Movement	EBL	EBT	EBL	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	49	165	175	73	17	36						
Traffic Volume (veh/h)	49	165	175	73	17	36						
Future Volume (veh/h)	49	165	175	73	17	36						
Sign Control	Free	Free	Free	Free	Free	Stop						
Grade	0%	0%	0%	0%	0%	0%						
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91						
Hourly flow rate (vph)	54	181	192	80	19	40						
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None	None	None									
Median storage (veh)												
Upstream signal (m)	42											
PX, platoon unblocked										0.99		
V/C, conflicting volume	272									521	232	
V/C1, stage 1 conf vol												
V/C2, stage 2 conf vol												
V/Cu, unblocked vol	272									514	232	
IC, single (s)	4.1									6.5	6.2	
IC, 2 stage (s)												
IF (s)	2.2									3.6	3.3	
p0 queue free %	96									96	95	
cM capacity (veh/h)	1280									488	805	
Direction, Lane #	EB 1	WB 1	SB 1									
Volume Total	235	272	59									
Volume Left	54	0	19									
Volume Right	0	80	40									
cSH	1280	1700	666									
Volume to Capacity	0.04	0.16	0.09									
Queue Length 95th (m)	1.1	0.0	2.3									
Control Delay (s)	2.1	0.0	10.9									
Lane LOS	A	B	B									
Approach Delay (s)	2.1	0.0	10.9									
Approach LOS	B	B	B									
Intersection Summary												
Average Delay	2.0											
Intersection Capacity Utilization	38.4%											
Analysis Period (min)	15											
ICU Level of Service	A											

HCM Unsignalized Intersection Capacity Analysis
 4: Strathallan Street & Site Access 3

HCM Unsignalized Intersection Capacity Analysis
 1: Saint David Street North & Site Access 1

<Existing> AM Peak Hour
 10-01-2020

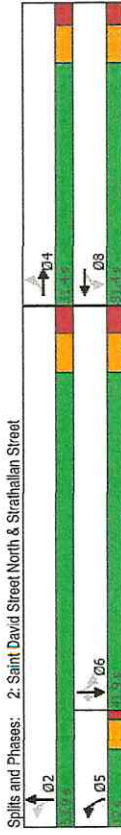
<Existing> PM Peak Hour
 10-01-2020

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	15	156	152	8	12	11
Traffic Volume (veh/h)	15	156	152	8	12	11
Future Volume (Veh/h)		Free	Free	Stop	Stop	Free
Sign Control		0%	0%	0%	0%	0%
Grade		0%	0%	0%	0%	0%
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	17	181	177	9	14	13
Pedestrians		8			4	
Lane Width (m)		3.6		3.6		
Walking Speed (m/s)		1.2		1.2		
Percent Blockage		1		0		
Right turn flare (veh)		None		None		
Median type		None		None		
Median storage (veh)		129				
Upstream signal (m)						
PX, platoon unblocked				400	194	
VC, conflicting volume	190					
VC1, stage 1 conf vol						
VC2, stage 2 conf vol						
VCU, unblocked vol	190			400	194	
IC, single (s)	4.1			6.4	6.2	
IC, 2 stage (s)						
IF (s)	2.2			3.5	3.3	
p0 queue free %	99			98	98	
cM capacity (veh/h)	1391			600	845	
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	198	186	27			
Volume Left	17	0	14			
Volume Right	0	9	13			
CSH	1391	1700	697			
Volume to Capacity	0.01	0.11	0.04			
Queue Length 95th (m)	0.3	0.0	1.0			
Control Delay (s)	0.7	0.0	10.4			
Lane LOS	A	B	B			
Approach Delay (s)	0.7	0.0	10.4			
Approach LOS	B	B	B			
Intersection Summary						
Average Delay			1.0			
Intersection Capacity Utilization			33.0%			
Analysis Period (min)			15			
						ICU Level of Service A

Movement	WBL	WBR	NBT	NBR	SBL	SBR
Lane Configurations	W					4
Traffic Volume (veh/h)	17	65	440	16	37	374
Future Volume (Veh/h)	17	65	440	16	37	374
Sign Control	Stop	Free	Free	Free	Free	Free
Grade	0%	0%	0%	0%	0%	0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	18	71	478	17	40	407
Pedestrians					1	
Lane Width (m)		3.6		3.6		
Walking Speed (m/s)		1.2		1.2		
Percent Blockage		0		0		
Right turn flare (veh)						
Median type			TWLT		TWLT	
Median storage (veh)			2		2	
Upstream signal (m)			90			
PX, platoon unblocked		0.89		0.89		
VC, conflicting volume	976	490		437		
VC1, stage 1 conf vol						
VC2, stage 2 conf vol						
VCU, unblocked vol	911	366		374		
IC, single (s)	6.4	6.2		4.1		
IC, 2 stage (s)						
IF (s)	3.5	3.3		2.2		
p0 queue free %	98	98		96		
cM capacity (veh/h)	484	608		1048		
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	89	495	447			
Volume Left	18	0	40			
Volume Right	71	17	0			
CSH	578	1700	1048			
Volume to Capacity	0.15	0.29	0.04			
Queue Length 95th (m)	4.3	0.0	1.0			
Control Delay (s)	12.4	0.0	1.2			
Lane LOS	B	A	A			
Approach Delay (s)	12.4	0.0	1.2			
Approach LOS	B	B	B			
Intersection Summary						
Average Delay			1.6			
Intersection Capacity Utilization			61.2%			
Analysis Period (min)			15			
						ICU Level of Service B

Timings
2: Saint David Street North & Strathallan Street
10-01-2020
<Existing> PM Peak Hour

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group	4	4	8	8	2	2	6	6	6
Lane Configurations	88	38	47	20	50	330	45	279	62
Traffic Volume (vph)	88	38	47	20	50	330	45	279	62
Future Volume (vph)	88	38	47	20	50	330	45	279	62
Turn Type	Perm	NA	Perm	NA	pm+pl	NA	Perm	NA	Perm
Protected Phases	4								
Permitted Phases	4	4	8	8	2	2	6	6	6
Detector Phase	4	4	8	8	2	2	6	6	6
Switch Phase									
Minimum Initial (s)	10.0	10.0	10.0	10.0	7.0	35.0	35.0	35.0	35.0
Minimum Split (s)	29.4	29.4	29.4	29.4	11.0	53.9	41.9	41.9	41.9
Total Split (s)	31.4	31.4	31.4	31.4	12.0	53.9	41.9	41.9	41.9
Total Split (%)	36.8%	36.8%	36.8%	36.8%	14.1%	63.2%	49.1%	49.1%	49.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.4	2.4	2.4	2.4	1.0	2.9	2.9	2.9	2.9
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.4	6.4	6.4	6.4	4.0	6.9	6.9	6.9	6.9
Lead/Lag					Lead	Lag	Lag	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	Max	Max
Act Effct Green (s)	12.5	12.5	12.5	12.5	53.1	51.7	45.2	45.2	45.2
Actuated g/C Ratio	0.17	0.17	0.17	0.17	0.73	0.71	0.62	0.62	0.62
v/s Ratio	0.40	0.19	0.21	0.19	0.06	0.31	0.08	0.25	0.06
Control Delay	32.0	19.8	28.1	14.3	4.5	6.3	10.9	10.8	1.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.0	19.8	28.1	14.3	4.5	6.3	10.9	10.8	1.5
LOS	C	B	C	B	A	A	B	B	A
Approach Delay		27.2		20.5		6.1		9.3	
Approach LOS		C		C		A		A	
Intersection Summary									
Cycle Length	85.3								
Actuated Cycle Length	72.6								
Natural Cycle	85								
Control Type	Semi Act-Uncoordinated								
Maximum v/s Ratio	0.40								
Intersection Signal Delay	11.5								
Intersection Capacity Utilization	64.9%								
Analysis Period (min)	15								



HCM Signalized Intersection Capacity Analysis
2: Saint David Street North & Strathallan Street
10-01-2020
<Existing> PM Peak Hour

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations	88	38	47	20	37	50	330	45	279
Traffic Volume (vph)	88	38	47	20	37	50	330	45	279
Future Volume (vph)	88	38	47	20	37	50	330	45	279
Ideal Flow (vph)	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.4	6.4	6.4	4.0	6.9	6.9	6.9	6.9
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.99	1.00	1.00	1.00	1.00	1.00	1.00	0.98
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr	1.00	0.95	1.00	0.90	1.00	0.98	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)	1800	1786	1762	1689	1803	1851	1769	1863	1578
Flt Permitted	0.72	1.00	0.72	1.00	0.53	1.00	0.52	1.00	1.00
Satd. Flow (perm)	1360	1786	1330	1689	1009	1851	972	1863	1578
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	83	40	21	49	21	39	53	347	294
RTOR Reduction (vph)	0	18	0	0	34	0	5	0	0
Lane Group Flow (vph)	93	43	0	49	26	0	53	404	0
Confl. Pcts, (#/hr)	2	0	3	3	2	3	1	1	3
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	2%	2%
Turn Type	Perm	NA	Perm	NA	pm+pl	NA	Perm	NA	Perm
Protected Phases	4								
Permitted Phases	4	10.4	10.4	10.4	10.4	51.9	51.9	43.7	43.7
Actuated Green, G (s)	10.4	10.4	10.4	10.4	51.9	51.9	43.7	43.7	43.7
Effective Green, g (s)	10.4	10.4	10.4	10.4	51.9	51.9	43.7	43.7	43.7
Actuated g/C Ratio	0.14	0.14	0.14	0.14	0.69	0.69	0.58	0.58	0.58
Clearance Time (s)	6.4	6.4	6.4	6.4	4.0	6.9	6.9	6.9	6.9
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	5.0	3.0	3.0	3.0
Lane Grp Cap (vph)	187	245	182	232	736	1270	561	1076	912
v/s Ratio Prot	0.02	0.02	0.02	0.02	0.00	0.22	0.05	0.16	0.02
v/s Ratio Perm	0.07	0.18	0.27	0.11	0.07	0.32	0.08	0.27	0.04
Uniform Delay, d1	30.2	28.8	29.2	26.6	3.9	4.8	7.1	8.0	6.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.3	0.7	1.7	0.5	0.0	0.7	0.3	0.6	0.1
Delay (s)	34.5	29.5	30.9	29.0	4.0	5.4	7.4	8.6	7.0
Level of Service	C	C	C	C	A	A	A	A	A
Approach Delay (s)		32.5		29.8		5.2		8.2	
Approach LOS		C		C		A		A	
Intersection Summary									
HCM 2000 Control Delay	12.4								
HCM 2000 Volume to Capacity ratio	0.37								
Actuated Cycle Length (s)	75.6								
Intersection Capacity Utilization	64.9%								
Analysis Period (min)	15								
Critical Lane Group	B								

HCM Unsignalized Intersection Capacity Analysis
 3: Strathallan Street & Site Access 2

HCM Unsignalized Intersection Capacity Analysis
 4: Strathallan Street & Site Access 3

<Existing> PM Peak Hour
 10-01-2020

<Existing> PM Peak Hour
 10-01-2020

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations					W	
Traffic Volume (veh/h)	55	129	98	58	18	35
Future Volume (Veh/h)	55	129	98	58	18	35
Sign Control	Free	Free	Free	Free	Stop	Stop
Grade	0%	0%	0%	0%	0%	0%
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	59	139	105	62	19	38
Pedestrians		1	1		2	
Lane Width (m)		3.6	3.6		3.6	
Walking Speed (m/s)		1.2	1.2		1.2	
Percent Blockage		0	0		0	
Right turn flare (veh)						
Median type		None	None		None	
Median storage (veh)						
Upstream signal (m)		42				
pX, platoon unblocked						
vC, conflicting volume	169				396	139
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
iCU, unblocked vol	169				396	139
iC, 2 stage (s)	4.2				6.4	6.2
IF (s)	2.3				3.5	3.3
p0 queue free %	98				97	96
cM capacity (veh/h)	1382				585	912
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	198	167	57			
Volume Left	59	0	19			
Volume Right	0	62	38			
CSH	1382	1700	769			
Volume to Capacity	0.04	0.10	0.07			
Queue Length 95th (m)	1.1	0.0	1.9			
Control Delay (s)	2.6	0.0	10.1			
Lane LOS	A	B	B			
Approach Delay (s)	2.6	0.0	10.1			
Approach LOS	B	B	B			
Intersection Summary						
Average Delay			2.6			
Intersection Capacity Utilization			32.6%			ICU Level of Service A
Analysis Period (min)			15			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations					W	
Traffic Volume (veh/h)	6	114	110	3	7	5
Future Volume (Veh/h)	6	114	110	3	7	5
Sign Control	Free	Free	Free	Free	Stop	Stop
Grade	0%	0%	0%	0%	0%	0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	6	120	116	3	7	5
Pedestrians		4				
Lane Width (m)		3.6				
Walking Speed (m/s)		1.2				
Percent Blockage		0				
Right turn flare (veh)						
Median type		None	None		None	
Median storage (veh)						
Upstream signal (m)		129				
pX, platoon unblocked						
vC, conflicting volume	119				250	122
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
iCU, unblocked vol	119				250	122
iC, 2 stage (s)	4.1				6.4	6.2
IF (s)	2.2				3.5	3.3
p0 queue free %	100				99	99
cM capacity (veh/h)	1482				740	932
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	126	119	12			
Volume Left	6	0	7			
Volume Right	0	3	5			
CSH	1482	1700	810			
Volume to Capacity	0.00	0.07	0.01			
Queue Length 95th (m)	0.1	0.0	0.4			
Control Delay (s)	0.4	0.0	9.5			
Lane LOS	A	A	A			
Approach Delay (s)	0.4	0.0	9.5			
Approach LOS	A	A	A			
Intersection Summary						
Average Delay			0.6			
Intersection Capacity Utilization			22.1%			ICU Level of Service A
Analysis Period (min)			15			

1: Saint David Street North & Site Access 1

HCM Unsignalized Intersection Capacity Analysis

10-02-2020

<Background> AM Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	36	86	262	7	52	445
Traffic Volume (veh/h)	36	86	262	7	52	445
Future Volume (Veh/h)	36	86	262	7	52	445
Sign Control	Stop	Free	Free	Free	Free	Free
Grade	0%	0%	0%	0%	0%	0%
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	38	94	279	7	55	473
Pedestrians	6					
Lane Width (m)	3.6					
Walking Speed (m/s)	1.2					
Percent Blockage	1					
Right turn flare (veh)						
Median type						
Median storage (veh)						
Upstream signal (m)						
pX platoon unblocked						
vC, conflicting volume	0.98	0.98			0.98	
vC1, stage 1 conf vol	288				292	
vC2, stage 2 conf vol	583					
vCU, unblocked vol	860	267			271	
IC, single (s)	6.4	6.2			4.1	
IC, 2 stage (s)	5.4					
IF (s)	3.5	3.3			2.2	
p0 queue free %	92	86			96	
cM capacity (veh/h)	483	757			1275	
Direction, Lane #	WBL 1	NBL 1	SB 1			
Volume Total	132	286	528			
Volume Left	38	0	55			
Volume Right	94	7	0			
cSH	656	1700	1275			
Volume to Capacity	0.20	0.17	0.04			
Queue Length 95th (m)	6.0	0.0	1.1			
Control Delay (s)	11.9	0.0	1.3			
Lane LOS	B	A	A			
Approach Delay (s)	11.9	0.0	1.3			
Approach LOS	B	A	A			
Intersection Summary						
Average Delay	2.4					
Intersection Capacity Utilization	57.9%					
Analysis Period (min)	15					
						ICU Level of Service
						B

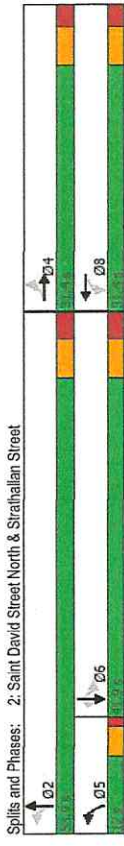
2: Saint David Street North & Strathallan Street

HCM Unsignalized Intersection Capacity Analysis

10-02-2020

<Background> AM Peak Hour

Movement	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations	14	10	96	30	43	191	77	356	37
Traffic Volume (vph)	14	10	96	30	43	191	77	356	37
Future Volume (vph)	14	10	96	30	43	191	77	356	37
Turn Type	Perm	NA	Perm	NA	perm+pl	NA	Perm	NA	Perm
Protected Phases	4	4	8	8	5	2	6	6	6
Permitted Phases	4	4	8	8	5	2	6	6	6
Detector Phase	4	4	8	8	5	2	6	6	6
Switch Phase	4	4	8	8	5	2	6	6	6
Minimum Initial (s)	10.0	10.0	10.0	10.0	7.0	35.0	35.0	35.0	35.0
Minimum Split (s)	29.4	29.4	29.4	29.4	11.0	53.9	41.9	41.9	41.9
Total Split (s)	31.4	31.4	31.4	31.4	12.0	53.9	41.9	41.9	41.9
Total Split (%)	36.8%	36.8%	36.8%	36.8%	14.1%	63.2%	49.1%	49.1%	49.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.4	2.4	2.4	2.4	1.0	2.9	2.9	2.9	2.9
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.4	6.4	6.4	6.4	4.0	6.9	6.9	6.9	6.9
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	None	Max	Max	Max	Max
Act Effct Green (s)	13.6	13.6	13.6	13.6	53.2	51.8	45.3	45.3	45.3
Actuated g/C Ratio	0.18	0.18	0.18	0.18	0.72	0.70	0.61	0.61	0.61
v/c Ratio	0.07	0.09	0.46	0.28	0.07	0.25	0.13	0.56	0.04
Control Delay	24.9	15.4	33.3	13.7	5.0	6.0	11.9	12.5	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.9	15.4	33.3	13.7	5.0	6.0	11.9	12.5	0.1
LOS	C	B	C	B	A	A	B	B	A
Approach Delay	18.8		24.2		5.8		11.4		
Approach LOS	B		C		A		B		
Intersection Summary									
Cycle Length: 85.3									
Actuated Cycle Length: 73.7									
Natural Cycle: 85									
Control Type: Semi Act-Uncoord									
Maximum v/c Ratio: 0.46									
Intersection Signal Delay: 12.3									
Intersection Capacity Utilization 89.4%									
Analysis Period (min) 15									



HCM Signalized Intersection Capacity Analysis
 2. Saint David Street North & Strathallan Street

<Background> AM Peak Hour
 10-02-2020

Movement	EBL	EBT	EBR	VBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	14	10	16	96	30	54	43	191	77	77	356	37
Traffic Volume (vph)	14	10	16	96	30	54	43	191	77	77	356	37
Future Volume (vph)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Ideal Flow (vehpl)	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.9	6.9	6.9	6.9	6.9
Total Lost time (s)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lane Util. Factor	1.00	0.96	1.00	0.98	1.00	0.98	1.00	0.99	1.00	0.99	1.00	0.97
Frbp, ped/bikes	0.99	1.00	0.96	1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00	0.95
Frt	1.00	0.91	1.00	0.90	1.00	0.96	1.00	0.95	1.00	1.00	1.00	0.85
Frt Protected	0.95	1.00	0.95	1.00	0.95	1.00	0.95	1.00	0.95	1.00	1.00	0.85
Satd. Flow (prot)	1789	1660	1653	1662	1799	1692	1709	1810	1515	1515	1515	1515
Frt Permitted	0.70	1.00	0.74	1.00	0.46	1.00	0.68	1.00	1.00	1.00	1.00	1.00
Satd. Flow (perm)	1312	1660	1285	1682	868	1682	1040	1810	1515	1515	1515	1515
Peakhour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	16	11	18	107	33	60	48	212	86	86	396	41
RTOR Reduction (vph)	0	15	0	0	51	0	0	12	0	0	0	18
Lane Group Flow (vph)	16	14	0	107	42	0	48	206	0	86	396	23
Confl. Peds. (ft/yr)	6	24	24	6	13	6	13	8	8	8	13	13
Heavy Vehicles (%)	0%	0%	0%	5%	0%	2%	0%	8%	3%	5%	5%	3%
Turn Type	Perm	NA	NA	Perm	NA	NA	perm+pt	NA	Perm	NA	Perm	NA
Protected Phases	4			8			5	2			6	
Permitted Phases	4			8			2				6	
Actuated Green, G (s)	11.4	11.4	11.4	11.4	11.4	11.4	51.9	51.9	43.8	43.8	43.8	43.8
Effective Green, g (s)	11.4	11.4	11.4	11.4	11.4	11.4	51.9	51.9	43.8	43.8	43.8	43.8
Actuated g/C Ratio	0.15	0.15	0.15	0.15	0.15	0.15	0.68	0.68	0.57	0.57	0.57	0.57
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4	6.4	4.0	6.9	6.9	6.9	6.9	6.9
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	185	247	191	247	0.03	0.03	637	1146	584	1034	886	886
v/s Ratio Prot	0.01			0.03			0.00	0.17			0.22	
v/s Ratio Perm	0.01			0.03			0.05		0.08		0.02	
v/c Ratio	0.08	0.06	0.06	0.17	0.08	0.25	0.08	0.25	0.14	0.38	0.03	0.03
Uniform Delay, d1	28.1	28.0	30.3	28.5	4.4	4.8	7.7	9.0	7.7	9.0	7.1	7.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.2	0.6	0.1	0.7	0.1	0.5	0.5	0.5	1.1	0.1	0.1
Delay (s)	28.5	28.2	36.3	29.2	4.4	5.3	8.2	10.1	7.2	10.1	7.2	7.2
Level of Service	C	C	D	C	A	A	A	A	A	B	A	A
Approach Delay (s)	28.3			33.0			5.2			9.5		
Approach LOS	C			C			A			A		A
Intersection Summary												
HCM 2000 Control Delay	13.2											
HCM 2000 Volume to Capacity ratio	0.41											
Actuated Cycle Length (s)	76.6											
Sum of lost time (s)	17.3											
Intersection Capacity Utilization	88.1%											
ICU Level of Service	E											
Analysis Period (min)	15											
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
 3. Strathallan Street & Site Access 2

<Background> AM Peak Hour
 10-02-2020

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	56	190	201	84	20	41
Traffic Volume (veh/h)	56	190	201	84	20	41
Future Volume (veh/h)	56	190	201	84	20	41
Sign Control	Free	Free	Free	Free	Stop	Stop
Grade	0%	0%	0%	0%	0%	0%
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	62	209	221	92	22	45
Pedestrians						
Lane Width (m)						
Walking Speed (mis)						
Percent Blockage						
Right turn flare (veh)		None	None			
Median type						
Median storage (veh)						
Upstream signal (m)		42				
PX, platoon unblocked					0.93	
vC, conflicting volume	313				600	267
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	313				563	267
IC, single (s)	4.1				6.5	6.2
IC, 2 stage (s)						
IF (s)	2.2				3.6	3.3
p0 queue free %	95				95	94
cM capacity (veh/h)	1236				436	769
Direction_Lane #	EB 1	WB 1	SB 1			
Volume Total	271	313	67			
Volume Left	62	0	22			
Volume Right	0	92	45			
cSH	1236	1700	615			
Volume to Capacity	0.05	0.18	0.11			
Queue Length 95th (m)	1.3	0.0	2.9			
Control Delay (s)	2.2	0.0	11.6			
Lane LOS	A	B	B			
Approach Delay (s)	2.2	0.0	11.6			
Approach LOS	B	B	B			
Intersection Summary						
Average Delay	2.1					
Intersection Capacity Utilization	42.4%					
ICU Level of Service	A					
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis
 4: Strathallan Street & Site Access 3
 10-02-2020

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	17	179	175	9	14	13
Future Volume (Veh/h)	17	179	175	9	14	13
Sign Control	Free	Free	Free	Stop	Stop	Stop
Grade	0%	0%	0%	0%	0%	0%
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	20	208	203	10	16	15
Pedestrians		8			4	
Lane Width (m)		3.6			3.6	
Walking Speed (mis)		1.2			1.2	
Percent Blockage		1			0	
Right turn flare (veh)		None			None	
Median type		None			None	
Median storage (veh)		129				
Upstream signal (m)						
pX platoon unblocked						
vC, conflicting volume	217				460	220
vC1, stage 1 conf vol						
vC2, stage 2 conf vol	217				460	220
vCu, unblocked vol	4.1				6.4	6.2
IC, single (s)						
IC, 2 stage (s)	2.2				3.5	3.3
p0 queue free %	99				97	96
CM capacity (veh/h)	1360				553	816
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	228	213	31			
Volume Left	20	0	16			
Volume Right	0	10	15			
cSH	1360	1700	655			
Volume to Capacity	0.01	0.13	0.05			
Queue Length 95th (m)	0.4	0.0	1.2			
Control Delay (s)	0.8	0.0	10.8			
Lane LOS	A	B	B			
Approach Delay (s)	0.8	0.0	10.8			
Approach LOS	B	B	B			
Intersection Summary						
Average Delay		1.1				
Intersection Capacity Utilization		35.9%				
Analysis Period (min)		15				
					ICU Level of Service	A

HCM Unsignalized Intersection Capacity Analysis
 1: Saint David Street North & Site Access 1
 10-01-2020

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	20	75	505	18	43	430
Future Volume (Veh/h)	20	75	505	18	43	430
Sign Control	Stop	Free	Free	Free	Free	Free
Grade	0%	0%	0%	0%	0%	0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	82	549	20	47	467
Pedestrians		2			1	
Lane Width (m)		3.6			3.6	
Walking Speed (mis)		1.2			1.2	
Percent Blockage		0			0	
Right turn flare (veh)						
Median type						
Median storage (veh)						
Upstream signal (m)						
pX platoon unblocked						
vC, conflicting volume	1122	562			571	
vC1, stage 1 conf vol	561					
vC2, stage 2 conf vol	561					
vCu, unblocked vol	1081	409			420	
IC, single (s)	6.4	6.2			4.1	
IC, 2 stage (s)	5.4	3.3			2.2	
p0 queue free %	95	85			95	
CM capacity (veh/h)	433	555			974	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	104	569	514			
Volume Left	22	0	47			
Volume Right	82	20	0			
cSH	523	1700	974			
Volume to Capacity	0.20	0.33	0.05			
Queue Length 95th (m)	5.9	0.0	1.2			
Control Delay (s)	13.6	0.0	1.3			
Lane LOS	B	B	A			
Approach Delay (s)	13.6	0.0	1.3			
Approach LOS	B	B	B			
Intersection Summary						
Average Delay			1.8			
Intersection Capacity Utilization			68.8%			
Analysis Period (min)			15			
					ICU Level of Service	C

Timings
2: Saint David Street North & Strathallan Street

HCM Signalized Intersection Capacity Analysis
2: Saint David Street North & Strathallan Street

Movement	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations	101	44	54	23	57	379	52	320	71
Traffic Volume (vph)	101	44	54	23	57	379	52	320	71
Future Volume (vph)	101	44	54	23	57	379	52	320	71
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.99	1.00	0.98	1.00	1.00	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.95	1.00	0.90	1.00	0.98	1.00	1.00	0.85
Flt Protected	0.85	1.00	0.95	1.00	0.95	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1800	1787	1762	1688	1803	1850	1769	1863	1578
Flt Permitted	0.71	1.00	0.71	1.00	0.80	1.00	0.49	1.00	1.00
Satd. Flow (perm)	1349	1787	1319	1688	957	1950	918	1863	1578
Peak-hour factor, PHF	0.85	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	106	46	24	57	24	45	60	399	72
RTOR Reduction (vph)	0	21	0	0	38	0	0	0	0
Lane Group Flow (vph)	106	49	0	57	31	0	60	466	0
Conf. Peds. (#/hr)	2	3	3	2	3	2	3	1	1
Heavy Vehicles (%)	0%	0%	2%	0%	0%	0%	0%	2%	0%
Turn Type	Perm	NA	Perm	NA	pm+pt	NA	Perm	NA	Perm
Protected Phases	4		8		5		2		6
Permitted Phases	4		8		5		2		6
Actuated Green, G (s)	11.1	11.1	11.1	11.1	11.1	52.0	52.0	43.8	43.8
Effective Green, g (s)	11.1	11.1	11.1	11.1	11.1	52.0	52.0	43.8	43.8
Actuated g/C Ratio	0.15	0.15	0.15	0.15	0.15	0.88	0.68	0.57	0.57
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	3.0	3.0	3.0	3.0
Lane Grp Cap. (vph)	195	259	191	245	687	1259	526	1068	904
v/s Ratio Prot	0.03		0.02		0.00	0.25		0.18	
v/s Ratio Perm	0.08		0.04		0.05		0.06		0.03
v/c Ratio	0.54	0.19	0.30	0.12	0.09	0.37	0.10	0.32	0.05
Uniform Delay, d1	30.3	28.7	29.2	28.4	4.2	5.2	7.4	8.5	7.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.4	0.8	1.8	0.5	0.1	0.8	0.4	0.8	0.1
Delay (s)	35.7	29.5	31.0	28.9	4.2	6.0	7.8	9.3	7.2
Level of Service	D	C	C	C	A	A	A	A	A
Approach Delay (s)	33.2		28.9		5.8		8.8		
Approach LOS	C		C		A		A		
Intersection Summary									
HCM 2000 Control Delay	12.9 HCM 2000 Level of Service B								
HCM 2000 Volume to Capacity ratio	0.43								
Actuated Cycle Length (s)	76.4 Sum of lost time (s)								
Intersection Capacity Utilization	71.4% ICU Level of Service C								
Analysis Period (min)	15								
c Critical Lane Group									

Spills and Phases: 2: Saint David Street North & Strathallan Street



HCM Unsignalized Intersection Capacity Analysis
 3: Strathallan Street & Site Access 2

10-01-2020

HCM Unsignalized Intersection Capacity Analysis
 4: Strathallan Street & Site Access 3

10-01-2020

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	63	148	113	67	21	40
Future Volume (Veh/h)	63	148	113	67	21	40
Sign Control	Free	Free	Free	Free	Stop	Stop
Grade	0%	0%	0%	0%	0%	0%
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	68	159	122	72	23	43
Pedestrians	1	1	1	1	2	2
Lane Width (m)	3.6	3.6	3.6	3.6	3.6	3.6
Walking Speed (m/s)	1.2	1.2	1.2	1.2	1.2	1.2
Percent Blockage	0	0	0	0	0	0
Right turn flare (veh)						
Median type	None	None	None	None	None	None
Median storage (veh)						
Upstream signal (m)	42					
PX, platoon unblocked					1.00	
VC, conflicting volume	196				456	161
VC1, stage 1 conf vol						
VC2, stage 2 conf vol						
VCu, unblocked vol	196				453	161
IC, single (s)	4.2				5.4	6.2
IC, 2 stage (s)						
IF (s)	2.3				3.5	3.3
p0 queue free %	95				96	95
cM capacity (veh/h)	1351				537	887
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	227	194	66			
Volume Left	66	0	23			
Volume Right	0	72	43			
cSH	1351	1700	723			
Volume to Capacity	0.05	0.11	0.09			
Queue Length 95th (m)	1.3	0.0	2.4			
Control Delay (s)	2.6	0.0	10.5			
Lane LOS	A	B	B			
Approach Delay (s)	2.6	0.0	10.5			
Approach LOS	B	B	B			
Intersection Summary						
Average Delay		2.7				
Intersection Capacity Utilization		35.0%				
Analysis Period (min)		15				
						ICU Level of Service
						A

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	7	131	126	3	8	6
Future Volume (Veh/h)	7	131	126	3	8	6
Sign Control	Free	Free	Free	Free	Stop	Stop
Grade	0%	0%	0%	0%	0%	0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	7	138	133	3	8	6
Pedestrians	4					
Lane Width (m)	3.6	3.6	3.6	3.6	3.6	3.6
Walking Speed (m/s)	1.2	1.2	1.2	1.2	1.2	1.2
Percent Blockage	0	0	0	0	0	0
Right turn flare (veh)						
Median type	None	None	None	None	None	None
Median storage (veh)						
Upstream signal (m)	129					
PX, platoon unblocked						
VC, conflicting volume	136				286	138
VC1, stage 1 conf vol						
VC2, stage 2 conf vol						
VCu, unblocked vol	136				286	138
IC, single (s)	4.1				6.4	6.2
IC, 2 stage (s)						
IF (s)	2.2				3.5	3.3
p0 queue free %	100				99	99
cM capacity (veh/h)	1461				705	912
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	145	136	14			
Volume Left	7	0	8			
Volume Right	0	3	6			
cSH	1461	1700	781			
Volume to Capacity	0.00	0.08	0.02			
Queue Length 95th (m)	0.1	0.0	0.4			
Control Delay (s)	0.4	0.0	9.7			
Lane LOS	A	A	A			
Approach Delay (s)	0.4	0.0	9.7			
Approach LOS	A	A	A			
Intersection Summary						
Average Delay		0.7				
Intersection Capacity Utilization		23.9%				
Analysis Period (min)		15				
						ICU Level of Service
						A

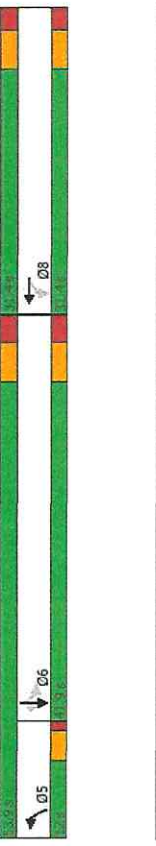
1: Saint David Street North & Site Access 1

2: Saint David Street North & Strathallan Street

Timings <Total> AM Peak Hour 10-01-2020

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	4	4	4	4	4	4
Traffic Volume (veh/h)	43	101	262	13	63	445
Future Volume (Veh/h)	43	101	262	13	63	445
Sign Control	Stop	Free	Free	Free	Free	Free
Grade	0%	0%	0%	0%	0%	0%
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	46	107	279	14	67	473
Pedestrians	6					
Lane Width (m)	3.6					
Walking Speed (m/s)	1.2					
Percent Blockage	1					
Right turn flare (veh)						
Median type						TWTL
Median storage (veh)						2
Upstream signal (m)						
pX, platoon unblocked	0.97	0.97			0.97	
vC, conflicting volume	899	292			299	
vC1, stage 1 conf vol	292					
vC2, stage 2 conf vol	607					
vCU, unblocked vol	883	259			287	
IC, single (s)	6.4	6.2			4.1	
IC, 2 stage (s)	5.4					
IF (s)	3.5	3.3			2.2	
pQ, queue free %	90	86			95	
cM, capacity (veh/h)	477	757			1268	
Direction, Lane #	WBL 1	NBT 3	SBL 1			
Volume Total	153	293	540			
Volume Left	46	0	67			
Volume Right	107	14	0			
ESH	644	1700	1268			
Volume to Capacity	0.24	0.17	0.05			
Queue Length, 95th (m)	7.4	0.0	1.3			
Control Delay (s)	12.3	0.0	1.5			
Lane LOS	B	A	A			
Approach Delay (s)	12.3	0.0	1.5			
Approach LOS	B	A	A			
Intersection Summary						
Average Delay	2.7					
Intersection Capacity Utilization	60.1%					
Analysis Period (min)	15					
ICU Level of Service	B					

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations	4	4	4	4	4	4	4	4	4
Traffic Volume (vph)	14	10	112	30	43	197	77	363	37
Future Volume (vph)	14	10	112	30	43	197	77	363	37
Turn Type	Perm	INA	Perm	INA	pm+pt	NA	Perm	NA	Perm
Protected Phases	4	4	8	8	5	2	6	6	6
Detector Phase	4	4	8	8	5	2	6	6	6
Switch Phase									
Minimum Initial (s)	10.0	10.0	10.0	10.0	7.0	35.0	35.0	35.0	35.0
Minimum Split (s)	29.4	29.4	29.4	29.4	11.0	53.9	41.9	41.9	41.9
Total Split (s)	31.4	31.4	31.4	31.4	12.0	53.9	41.9	41.9	41.9
Total Split (%)	36.8%	36.8%	36.8%	36.8%	14.1%	63.2%	49.1%	49.1%	49.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.4	2.4	2.4	2.4	1.0	2.9	2.9	2.9	2.9
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.4	6.4	6.4	6.4	4.0	6.9	6.9	6.9	6.9
Lead/Lag									
Lead/Lag Optimize?									
Recall Mode	None	None	None	None	None	Max	Max	Max	Max
Act Effl Green (s)	14.7	14.7	14.7	14.7	52.8	49.9	43.2	43.2	43.2
Actualized g/C Ratio	0.19	0.19	0.19	0.19	0.68	0.64	0.55	0.55	0.55
v/c Ratio	0.07	0.09	0.52	0.26	0.07	0.29	0.15	0.40	0.05
Control Delay	24.4	15.0	35.2	13.1	5.4	6.8	12.5	13.8	0.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.4	15.0	35.2	13.1	5.4	6.8	12.5	13.8	0.2
LOS	C	B	D	B	A	A	B	B	A
Approach Delay	18.3								
Approach LOS	B								
Intersection Summary									
Cycle Length	85.3								
Actualized Cycle Length	77.9								
Natural Cycle	85								
Control Type	Semi Act-Uncoord								
Maximum v/c Ratio	0.52								
Intersection Signal Delay	13.3								
Intersection Capacity Utilization	89.4%								
Analysis Period (min)	15								
ICU Level of Service E	B								



Spills and Phases: 2: Saint David Street North & Strathallan Street

820 St. Davis St N, Proposed Mixed-Use Development

HCM Signalized Intersection Capacity Analysis
 2: Saint David Street North & Strathallan Street

<Total> AM Peak Hour
 10-01-2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	14	10	16	112	30	54	43	197	90	77	363	37
Traffic Volume (vph)	14	10	16	112	30	54	43	197	90	77	363	37
Future Volume (vph)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Ideal Flow (vphpl)	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.9	6.9	6.9	6.9	6.9
Total Lost time (s)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lane Util. Factor	1.00	0.96	1.00	0.98	1.00	0.98	1.00	0.99	1.00	1.00	0.97	1.00
Flpb, ped/bikes	0.99	1.00	0.96	1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00	1.00
Frt	1.00	0.91	1.00	0.90	1.00	0.95	1.00	1.00	1.00	1.00	0.85	1.00
Frt Protected	0.95	1.00	0.95	1.00	0.95	1.00	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1789	1658	1651	1661	1799	1686	1709	1810	1514	1514	1514	1514
Flt Permitted	0.70	1.00	0.74	1.00	0.74	1.00	0.57	1.00	1.00	1.00	1.00	1.00
Satd. Flow (perm)	1312	1658	1283	1661	835	1666	1020	1810	1514	1514	1514	1514
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	16	11	18	124	33	60	48	219	100	86	403	41
RTOR Reduction (vph)	0	15	0	0	49	0	0	15	0	0	0	19
Lane Group Flow (vph)	16	14	0	124	44	0	48	304	0	86	403	22
Confl. Peds. (#/hr)	6	24	24	24	24	6	13	8	8	8	8	13
Heavy Vehicles (%)	0%	0%	0%	5%	0%	2%	0%	8%	3%	5%	5%	3%
Turn Type	Perm	NA	NA	Perm	NA	pm+pt	NA	Perm	NA	Perm	NA	Perm
Protected Phases	4			8		5	2			6		6
Permitted Phases	4			8		2				6		6
Actuated Green, G (s)	14.7	14.7	14.7	14.7	14.7	51.5	51.5	43.2	43.2	43.2	43.2	43.2
Effective Green, g (s)	14.7	14.7	14.7	14.7	14.7	51.5	51.5	43.2	43.2	43.2	43.2	43.2
Actuated g/C Ratio	0.18	0.18	0.18	0.18	0.18	0.65	0.65	0.54	0.54	0.54	0.54	0.54
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4	6.9	6.9	6.9	6.9	6.9	6.9	6.9
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	242	306	237	307	307	593	1092	564	983	822	822	822
v/s Ratio Prot	0.01			0.03		0.00	c0.18			c0.22		
v/s Ratio Perm	0.01			c0.10		0.05		0.08		0.08		0.01
v/c Ratio	0.07	0.05	0.52	0.14	0.08	0.28	0.16	0.41	0.03	0.16	0.41	0.03
Uniform Delay, d1	26.7	26.6	29.2	27.1	5.4	6.0	9.1	10.7	8.4	9.1	10.7	8.4
Progression Factor	1.00	1.00	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	0.1	3.9	0.5	0.1	0.6	0.6	1.3	0.1	0.6	1.3	0.1
Delay (s)	27.0	26.8	33.2	27.6	5.5	6.6	9.6	11.9	8.5	9.6	11.9	8.5
Level of Service	C	C	C	C	A	A	A	B	A	A	B	A
Approach Delay (s)	26.8			30.8		6.5		11.3		6.5		11.3
Approach LOS	C			C		A		B		A		B
Intersection Summary												
HCM 2000 Control Delay	14.0											
HCM 2000 Volume to Capacity ratio	0.43											
Actuated Cycle Length (s)	79.5											
Intersection Capacity Utilization	89.4%											
Analysis Period (min)	15											
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
 3: Strathallan Street & Site Access 2

<Total> AM Peak Hour
 10-01-2020

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	67	192	208	84	23	50
Traffic Volume (veh/h)	67	192	208	84	23	50
Future Volume (veh/h)	67	192	208	84	23	50
Sign Control	Free	Free	Free	Free	Stop	Stop
Grade	0%	0%	0%	0%	0%	0%
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	74	211	229	92	25	55
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)		None	None	None		
Median type		None	None	None		
Median storage (veh)						
Upstream signal (m)		42				
pX platform unblocked					0.99	
vC, conflicting volume	321				634	275
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vC2, unblocked vol	321				621	275
IC, single (s)	4.1				6.5	6.2
IC, 2 stage (s)						
IF (s)	2.2				3.6	3.3
p0 queue free %	94				94	93
cM capacity (veh/h)	1228				412	761
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	285	321	80			
Volume Left	74	0	25			
Volume Right	0	92	55			
ESH	1228	1700	602			
Volume to Capacity	0.06	0.19	0.13			
Queue Length 50th (m)	1.5	0.0	3.7			
Control Delay (s)	2.5	0.0	11.9			
Lane LOS	A	B	B			
Approach Delay (s)	2.5	0.0	11.9			
Approach LOS	A	B	B			
Intersection Summary						
Average Delay	2.4					
Intersection Capacity Utilization	44.2%					
Analysis Period (min)	15					
ICU Level of Service	A					

HCM Unsignalized Intersection Capacity Analysis
 4: Strathallan Street & Site Access 3

HCM Unsignalized Intersection Capacity Analysis
 1: Saint David Street North & Site Access 1

10-01-2020

10-01-2020

<Total> AM Peak Hour

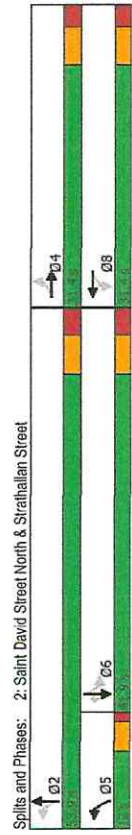
<Total> PM Peak Hour

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		4				
Traffic Volume (veh/h)	19	182	175	17	21	20
Future Volume (Veh/h)	19	182	175	17	21	20
Sign Control	Free	Free	Free	Free	Stop	Stop
Grade	0%	0%	0%	0%	0%	0%
Peak Hour Factor	0.86	0.96	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	22	212	203	20	24	23
Pedestrians	8				4	
Lane Width (m)	3.6	3.6	3.6	3.6	3.6	3.6
Walking Speed (m/s)	1.2	1.2	1.2	1.2	1.2	1.2
Percent Blockage	0				0	
Right turn flare (veh)	None	None	None	None	None	None
Median type	None	None	None	None	None	None
Median storage (veh)		129				
Upstream signal (m)						
pX platoon unblocked						
vC conflicting volume	227				473	225
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	227				473	225
IC, single (s)	4.1				6.4	6.2
IC, 2 stage (s)						
IF (s)	2.2				3.5	3.3
p0 queue free %	86				96	97
cM capacity (veh/h)	1349				543	811
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	234	223	47			
Volume Left	22	0	24			
Volume Right	0	20	23			
cSH	1349	1700	648			
Volume to Capacity	0.02	0.13	0.07			
Queue Length 95th (m)	0.4	0.0	1.9			
Control Delay (s)	0.9	0.0	11.0			
Lane LOS	A	B	B			
Approach Delay (s)	0.9	0.0	11.0			
Approach LOS	B	B	B			
Intersection Summary						
Average Delay	1.4					
Intersection Capacity Utilization	37.0%					
Analysis Period (min)	15					
ICU Level of Service	A					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W					4
Traffic Volume (veh/h)	27	88	505	25	57	430
Future Volume (Veh/h)	27	88	505	25	57	430
Sign Control	Stop	Free	Free	Free	Free	Free
Grade	0%	0%	0%	0%	0%	0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	29	96	549	27	62	467
Pedestrians	2				1	
Lane Width (m)	3.6	3.6	3.6	3.6	3.6	3.6
Walking Speed (m/s)	1.2	1.2	1.2	1.2	1.2	1.2
Percent Blockage	0				0	
Right turn flare (veh)						
Median type	None	None	None	None	None	None
Median storage (veh)						
Upstream signal (m)						
pX platoon unblocked						
vC conflicting volume	1166	566			90	0.85
vC1, stage 1 conf vol	584					
vC2, stage 2 conf vol	1087	407			422	
vCu, unblocked vol	6.4	6.2			4.1	
IC, single (s)	5.4				2.2	
IC, 2 stage (s)						
IF (s)	3.5	3.3			2.2	
p0 queue free %	83	83			94	
cM capacity (veh/h)	416	553			966	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	125	576	529			
Volume Left	29	0	62			
Volume Right	66	27	0			
cSH	514	1700	968			
Volume to Capacity	0.24	0.34	0.06			
Queue Length 95th (m)	7.6	0.0	1.6			
Control Delay (s)	14.2	0.0	1.8			
Lane LOS	B	A	A			
Approach Delay (s)	14.2	0.0	1.8			
Approach LOS	B	B	B			
Intersection Summary						
Average Delay	2.2					
Intersection Capacity Utilization	71.1%					
Analysis Period (min)	15					
ICU Level of Service	C					

Timings
 2: Saint David Street North & Strathallan Street
 10-01-2020
 <Total> PM Peak Hour

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations	101	44	70	23	57	386	52	327	71
Traffic Volume (vph)	101	44	70	23	57	386	52	327	71
Future Volume (vph)	101	44	70	23	57	386	52	327	71
Turn Type	Perm	NA	Perm	NA	pm+pl	NA	Perm	NA	Perm
Protected Phases	4	4	8	8	5	2	6	6	6
Permitted Phases	4	4	8	8	5	2	6	6	6
Switch Phase	4	4	8	8	5	2	6	6	6
Minimum Initial (s)	10.0	10.0	10.0	10.0	7.0	35.0	35.0	35.0	35.0
Minimum Split (s)	29.4	29.4	29.4	29.4	11.0	53.9	41.9	41.9	41.9
Total Split (s)	31.4	31.4	31.4	31.4	12.0	53.9	41.9	41.9	41.9
Total Split (%)	36.8%	36.8%	36.8%	36.8%	14.1%	63.2%	49.1%	49.1%	49.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.4	2.4	2.4	2.4	1.0	2.9	2.9	2.9	2.9
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.4	6.4	6.4	6.4	4.0	6.9	6.9	6.9	6.9
Lead/Lag					Lead	Lag	Lag	Lag	Lag
Lead/Lag Optimize?					Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	Max	Max
Act/Flt Green (s)	13.2	13.2	13.2	13.2	53.2	51.7	45.2	45.2	45.2
Actuated g/C Ratio	0.18	0.18	0.18	0.18	0.73	0.71	0.62	0.62	0.62
v/c Ratio	0.44	0.21	0.31	0.20	0.08	0.38	0.10	0.30	0.07
Control Delay	32.7	19.7	29.7	13.8	4.8	7.2	11.7	11.7	2.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.7	19.7	29.7	13.8	4.8	7.2	11.7	11.7	2.2
LOS	C	B	C	B	A	A	B	B	A
Approach Delay	27.5		22.0	C	A	A	10.2		
Approach LOS	C		C	C	A	A	B		
Intersection Summary									
Cycle Length	85.3								
Actuated Cycle Length	73.3								
Natural Cycle	85								
Control Type	Semi Act-Uncoordinated								
Maximum v/c Ratio	0.44								
Intersection Signal Delay	12.4								
Intersection Capacity Utilization	71.4%								
Analysis Period (min)	15								



HCM Signalized Intersection Capacity Analysis
 2: Saint David Street North & Strathallan Street
 10-01-2020
 <Total> PM Peak Hour

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations	101	44	23	70	23	43	57	386	85
Traffic Volume (vph)	101	44	23	70	23	43	57	386	85
Future Volume (vph)	101	44	23	70	23	43	57	386	85
Ideal Flow (vph/s)	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost Time (s)	6.4	6.4	6.4	6.4	4.0	6.9	6.9	6.9	6.9
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.99	1.00	0.98	1.00	1.00	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt	1.00	0.95	1.00	0.90	1.00	0.97	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)	1800	1787	1762	1688	1803	1842	1769	1863	1578
Flt Permitted	0.71	1.00	0.71	1.00	0.50	1.00	0.48	1.00	1.00
Satd. Flow (perm)	1349	1787	1319	1688	946	1842	898	1863	1578
Peak-Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	106	46	24	74	24	45	60	406	89
RTOR Reduction (vph)	0	21	0	0	38	0	0	7	0
Lane Group Flow (vph)	106	49	0	74	31	0	60	488	0
Confl. Peds. (fl/rpl)	2	0	3	3	2	3	1	1	3
Heavy Vehicles (%)	0%	0%	0%	2%	0%	0%	0%	2%	0%
Turn Type	Perm	NA	Perm	NA	pm+pl	NA	Perm	NA	Perm
Protected Phases	4	4	8	8	5	2	6	6	6
Actuated Green, G (s)	11.1	11.1	11.1	11.1	52.0	52.0	43.8	43.8	43.8
Effective Green, g (s)	11.1	11.1	11.1	11.1	52.0	52.0	43.8	43.8	43.8
Actuated g/C Ratio	0.15	0.15	0.15	0.15	0.68	0.68	0.57	0.57	0.57
Clearance Time (s)	6.4	6.4	6.4	6.4	4.0	6.9	6.9	6.9	6.9
Vehicle Extension (s)	5.0	5.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	185	259	181	245	690	1263	514	1068	904
v/s Ratio Prot	0.03	0.03	0.02	0.02	0.00	0.27	0.18	0.18	0.03
v/c Ratio	0.08	0.19	0.06	0.06	0.09	0.39	0.11	0.32	0.05
Uniform Delay, d1	30.3	28.7	29.6	28.4	4.2	5.3	7.4	8.5	7.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.4	0.8	2.7	0.5	0.1	0.9	0.4	0.8	0.1
Delay (s)	35.7	29.5	32.3	28.9	4.2	6.2	7.8	9.3	7.2
Level of Service	D	C	C	C	A	A	A	A	A
Approach Delay (s)	33.2		30.7	C	6.0	A	8.8		
Approach LOS	C		C	C	A	A	A		
Intersection Summary									
HCM 2000 Control Delay	13.2								
HCM 2000 Volume to Capacity ratio	0.44								
Actuated Cycle Length (s)	76.4								
Intersection Capacity Utilization	71.4%								
Analysis Period (min)	15								
Critical Lane Group	B								

HCM Unsignalized Intersection Capacity Analysis
 3: Strathallan Street & Site Access 2

<Total> PM Peak Hour
 10-01-2020

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	77	151	120	67	24	49
Traffic Volume (veh/h)	77	151	120	67	24	49
Future Volume (Veh/h)	77	151	120	67	24	49
Sign Control	Free	Free	Free	Free	Stop	Stop
Grade	0%	0%	0%	0%	0%	0%
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	83	162	129	72	26	53
Pedestrians	1	1	1	2	2	2
Lane Width (m)	3.6	3.6	3.6	3.6	3.6	3.6
Walking Speed (m/s)	1.2	1.2	1.2	1.2	1.2	1.2
Percent Blockage	0	0	0	0	0	0
Right turn flare (veh)	None	None	None	None	None	None
Median type	None	None	None	None	None	None
Median storage (veh)	42					
Upstream signal (m)					1.00	
pX, platoon unblocked					496	168
vC, conflicting volume	203					
vC1, stage 1 cont vol						
vC2, stage 2 cont vol						
vCU, unblocked vol	203				493	168
IC, single (s)	4.2				6.4	6.2
IC, 2 stage (s)						
IF (s)	2.3				3.5	3.3
p0 queue free %	94				95	94
cM capacity (veh/h)	1343				503	879
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	245	201	79			
Volume Left	83	0	26			
Volume Right	0	72	53			
cSH	1343	1700	705			
Volume to Capacity	0.06	0.12	0.11			
Queue Length 95th (m)	1.6	0.0	3.0			
Control Delay (s)	3.0	0.0	10.7			
Lane LOS	A	B	B			
Approach Delay (s)	3.0	0.0	10.7			
Approach LOS	B	B	B			
Intersection Summary						
Average Delay		3.0				
Intersection Capacity Utilization		37.6%				A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis
 4: Strathallan Street & Site Access 3

<Total> PM Peak Hour
 10-01-2020

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	10	134	126	12	15	13
Traffic Volume (veh/h)	10	134	126	12	15	13
Future Volume (Veh/h)	10	134	126	12	15	13
Sign Control	Free	Free	Free	Free	Stop	Stop
Grade	0%	0%	0%	0%	0%	0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	11	141	133	13	16	14
Pedestrians	4					
Lane Width (m)	3.6					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)	None	None	None	None	None	None
Median type	None	None	None	None	None	None
Median storage (veh)	129					
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	146				302	144
vC1, stage 1 cont vol						
vC2, stage 2 cont vol						
vCU, unblocked vol	146				302	144
IC, single (s)	4.1				6.4	6.2
IC, 2 stage (s)						
IF (s)	2.2				3.5	3.3
p0 queue free %	99				98	98
cM capacity (veh/h)	1448				688	906
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	152	146	30			
Volume Left	11	0	16			
Volume Right	0	13	14			
cSH	1448	1700	775			
Volume to Capacity	0.01	0.09	0.04			
Queue Length 95th (m)	0.2	0.0	1.0			
Control Delay (s)	0.6	0.0	9.8			
Lane LOS	A	A	A			
Approach Delay (s)	0.6	0.0	9.8			
Approach LOS	A	A	A			
Intersection Summary						
Average Delay		1.2				
Intersection Capacity Utilization		26.5%				A
Analysis Period (min)		15				



APPENDIX C

LOS Definitions

LEVEL OF SERVICE ANALYSIS AT SIGNALIZED INTERSECTIONS

To assist in clarifying the arithmetic analysis associated with traffic engineering, it is often useful to refer to "Level of Service". The term Level of Service implies a qualitative measure of traffic flow at an intersection. It is dependent upon vehicle delay and vehicle queue lengths at the approaches. Specifically, Level of Service criteria are stated in terms of the average stopped delay per vehicle for a 15-minute analysis period. The following table describes the characteristics of each level:

<u>Level of Service</u>	<u>Features</u>	<u>Stopped Delay per Vehicle (sec)</u>
A	At this level of service, almost no signal phase is fully utilized by traffic. Very seldom does a vehicle wait longer than one red indication. The approach appears open, turning movements are easily made and drivers have freedom of operation.	≤ 5.0
B	At this level, an occasional signal phase is fully utilized and many phases approach full use. Many drivers begin to feel somewhat restricted within platoons of vehicles approaching the intersection.	> 5.0 and ≤ 15.0
C	At this level, the operation is stable though with more frequent fully utilized signal phases. Drivers feel more restricted and occasionally may have to wait more than one red signal indication, and queues may develop behind turning vehicles. This level is normally employed in urban intersection design.	> 15.0 and ≤ 25.0
D	At this level, the motorist experiences increasing restriction and instability of flow. There are substantial delays to approaching vehicles during short peaks within the peak period, but there are enough cycles with lower demand to permit occasional clearance of developing queues and prevent excessive backups.	> 25.0 and ≤ 40.0
E	At this level, capacity is reached. There are long queues of vehicles waiting upstream of the intersection and delays to vehicles may extend to several signal cycles.	> 40.0 and ≤ 60.0
F	At this level, saturation occurs, with vehicle demand exceeding the available capacity.	> 60.0

LEVEL OF SERVICE ANALYSIS AT UNSIGNALIZED INTERSECTIONS⁽¹⁾

The term "level of service" implies a qualitative measure of traffic flow at an intersection. It is dependent upon the vehicle delay and vehicle queue lengths at approaches. The level of service at unsignalized intersections is often related to the delay accumulated by flows on the minor streets, caused by all other conflicting movements. The following table describes the characteristics of each level.

Level of Service	Features
A	Little or no traffic delay occurs. Approaches appear open, turning movements are easily made, and drivers have freedom of operation.
B	Short traffic delays occur. Many drivers begin to feel somewhat restricted in terms of freedom of operation.
C	Average traffic delays occur. Operations are generally stable, but drivers emerging from the minor street may experience difficulty in completing their movement. This may occasionally impact on the stability of flow on the major street.
D	Long traffic delays occur. Motorists emerging from the minor street experience significant restriction and frustration. Drivers on the major street will experience congestion and delay as drivers emerging from the minor street interfere with the major through movements.
E	Very long traffic delays occur. Operations approach the capacity of the intersection.
F	Saturation occurs, with vehicle demand exceeding the available capacity. Very long traffic delays occur.

⁽¹⁾ Highway Capacity Manual - Special Report No. 209, Transportation Research Board, 1985.



APPENDIX D

Zoning By-law Excerpts

5.4.4 Every above-ground structure containing a parking area shall conform to the provisions applying to a main building for the Zone where such structure is located.

5.4.5 Nothing in this by-law shall prevent the location of an underground parking area in any part of a required side yard or rear yard on a lot provided such underground parking area is not within 1.5 m (4.9 ft) of a lot line.

5.5 OFF-STREET PARKING CALCULATION

5.5.1 Except as provided for in Section 5.3.1.5, parking spaces shall not be less than 2.75 m (9 ft) in width nor less than 5.5 m (18 ft) in length and the number of required parking spaces shall be determined in accordance with the following table:

TABLE 5A OFF-STREET PARKING REQUIREMENTS	
Type of Use	Number of Required Off-Street Parking Spaces (GLA=Gross Leasable Area)
Residential Uses	
Single detached dwelling Semi-detached dwelling Duplex dwelling Triplex dwelling Fourplex A Street Townhouse dwelling where each such unit has a parking space accessed by a driveway which crosses a public street	1 space per dwelling unit
A Cluster Townhouse dwelling	1.0 space per dwelling unit plus 0.5 spaces per unit for the first 20 units and 0.25 spaces per unit for each additional unit. A minimum of 50% of the additional parking spaces shall be devoted exclusively to visitor parking
An Apartment Dwelling A Stacked Townhouse Dwelling	1.0 space per dwelling unit plus 0.5 spaces per unit for the first 20 units and 0.25 spaces per unit for each additional unit. A minimum of 50% of the additional parking spaces shall be devoted exclusively to visitor parking
Dwelling Unit Above a Ground Floor Commercial Use	1 space per dwelling unit
Accessory Apartment Units	1 space per accessory apartment dwelling unit
Bed and Breakfast Establishments	1 parking space for each room or suite used for the purposes of lodging for the travelling public, in addition to the required parking for the dwelling unit

Group Homes	1 parking space for every staff member on-site from 11 p.m. to 6 a.m., in addition to the required parking for the dwelling unit
Private Home Daycare	No requirement
Non-Residential Uses	
Adult Entertainment Establishment	The greater of: 1 space per 4 person capacity; or, 1 space per 10 m ² (107 ft ²) GLA
Gas Bar	1 parking space for every 45 m ² (484 ft ²) GLA devoted to accessory retail sales
Automobile Sales and Service	1 space per 25 m ² (269 ft ²) GLA or a minimum of 2 spaces, whichever is greater
Business or Professional Office	1 space per 30 m ² (323 ft ²) GLA
Automobile Wash Automatic Wash Manual Wash	1 space plus 6 waiting spaces per wash bay 1 space plus 3 waiting spaces per wash bay
Automobile Body Repair and Painting Automobile Service Station	3 spaces per service bay
Church Assembly Hall Banquet Hall Place of Entertainment Auditorium Arena Community Centre Private or Commercial Club Commercial Recreation	The greater of: 1 space per 4 person capacity; or, 1 space per 10 m ² (107 ft ²) GLA
Any Commercial Uses not otherwise specified	1 space per 30 m ² (323 ft ²) GLA
Day Care Centre Day Nursery	2 spaces + 1 space per 10 children capacity
Financial Establishment	1 space per 15 m ² (161ft ²) GLA
Funeral Home	The greater of: 1 space per 7 person seating capacity, or 30 spaces for the first 93 m ² (1,001 ft ²) GLA plus 1 space for each additional 20 m ² (215 ft ²) of GLA
Garden Centre Commercial Greenhouse	<i>Interior Retail</i> – 1 space per 20 m ² (215 ft ²) GLA for building

Nursery	<i>Outdoor Retail</i> – 1 space per 50 m ² (538 ft ²) GLA for outdoor sales and display area
Golf Course	12 spaces per hole
Golf Driving Range Miniature Golf Course	1.5 spaces per tee
Home Occupation Farm Business	1 space for the residence plus 1 space for each non-resident employee
Hospital	3 parking spaces for every four beds
Nursing Home Home for the Aged	1 space per 2 beds
Retirement Residence	1 space for every 2 dwelling units/suites
Hotel / Motel	1 space per guest room plus 1 space per 10 m ² (107 ft ²) GLA of accessory services accessible to the public (i.e. restaurants, meeting facilities)
Industrial Use	For the first 1000m ² (10,764 ft ²), 1 parking space for each 30 m ² (323 ft ²) GLA For additional floor area between 1000m ² and 5,000 m ² (53,821 ft ²), 1 parking space per 100 m ² (1,076 ft ²) GLA For any floor area in excess of 5000 m ² , 1 parking space per 200 m ² (2,153 ft ²) GLA
Retail Store Retail Food Store Convenience Store Hardware Store Home Improvement Centre Specialty Food Store Beer, Liquor or Wine Store Department Store Video Rental Outlet Or Similar Retail Uses	1 space per 20 m ² (215 ft ²) GLA
Building or Lumber Supply Outlet Farm Implement Sales and Service Establishment	1 space per 30 m ² (323 ft ²) GLA for retail floor area
Medical Clinic Veterinarian Clinic	1 space per 16.7 m ² (180 ft ²) GLA
Monument Sales	1 space per 50 m ² (538 ft ²) GLA
Museum	1 space per 30 m ² (323 ft ²) GLA

Art Gallery Library Public Buildings	
Personal Service Shop Dry Cleaning Depot Laundromat Photofinishing Establishment Postal or Courier Outlet	1 space per 30 m ² (323 ft ²) GLA
Office Supply Printing, Publishing or Packaging Establishment	1 space per 50 m ² (538 ft ²) GLA
Service or Repair Shop Rental Outlet	1 per 50 m ² (538 ft ²) GLA
Restaurant Tavern	1 parking space per 9 m ² (97 ft ²) GLA plus 1 parking space per 18 m ² (194 ft ²) of patio area
Elementary School	2 spaces per classroom
Secondary School	5 spaces per classroom
Commercial School or Studio	1 space per 20 m ² (215 ft ²) GLA
Shopping Centre Multi-Unit Commercial Building or Site	1 space per 20 m ² (215 ft ²) GLA
Storage Facility Mini-Storage Warehouse	1 space per 5 m ² of office use, plus 1 space per 100 m ² (1,076 ft ²) GLA. However, no additional parking for building area is required if the driveway access to individual storage units has a width of at least 7 m.
Transport, Trucking or Distribution Establishment Contractor's Yard	1 space per 50 m ² (538 ft ²) GLA
Warehouse	1 space per 200 m ² (2,153 ft ²) GLA
Any other use permitted by this by-law other than those listed above	1 space per 30 m ² (323 ft ²) GLA

5.5.2 Parking For More Than One Use in a Building

Where a building or structure accommodates more than one type of use, the parking space requirements for the whole building shall be the sum of the requirements of the separate parts of the building so occupied.

5.5.3 Calculation of Parking Regulations