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Consulting Engineers

30 STE. ANNE ROAD
City of Greater Sudbury

Traffic Impact Study

prepared by:

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prepared for

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1 Introduction

C.C. Tatham & Associates Ltd. was retained by Autumnwood Mature Lifestyle Communities to address the traffic impacts associated with the proposed rezoning of 30 Ste. Anne Road, located in the City of Greater Sudbury. The location of the subject site and the immediate area road network are illustrated in Figure 1.

The purpose of this study is to address the requirements of the City with respect to the potential transportation impacts of the development on the local road network. In particular, the following will be discussed:

- the operations of the road system through the study area prior to the proposed development;
- an estimation of the growth in the traffic volumes not otherwise attributed to the development (i.e. from overall growth in the area and/or other developments);
- an estimation of the number of new trips the proposed development is likely to generate;
- the operations of the study area road system upon completion of the development; and
- the resulting impacts and need for mitigating measures (if required) to ensure acceptable overall road operations.

Chapter 2 of this report addresses the existing conditions, detailing the road system and corresponding traffic operations. Chapter 3 addresses future conditions, prior to the completion of the proposed development, and will address the expected growth in the traffic levels and the resulting operating conditions. Chapters 4 and 5 address the proposed development, the ensuing vehicle trips that it will generate, and the associated impacts on the road system, whereas Chapter 6 provides an assessment of the proposed site parking. Lastly, Chapter 7 summarizes the report and the key findings.

2 Existing Conditions

This chapter will describe the road network, traffic volumes and operations for the existing conditions.

2.1 Road Network

The road network to be addressed by this study consists of Ste. Anne Road, MacKenzie Street, Elgin Street, Beech Street, Elm Street, Notre Dame Avenue and the following intersections:

- Ste. Anne Road with Elgin Street;
- Beech Street with Elgin Street;
- Elm Street with Elgin Street;
- Notre Dame Avenue with Ste. Anne Road; and
- College Street with Froid Road.

Photographs of the road system are provided in Figure 2.

2.1.1 Road Network

A brief description of the road network is provided in Table 1. The functional classification for each road is based on “Schedule 6 – Transportation Network” of the *City of Greater Sudbury Official Plan*¹.

Table 1: Road Network

Road	Classification	Cross-Section	Speed (km/h)	Capacity ¹ (vphpl)	Direction
Ste. Anne Road	Primary Arterial	4-lane	50	900	E-W
MacKenzie Street	Collector	2-lane	40	600	N-S
Elgin Street	Collector	3-lane ²	50	600	N-S
Beech Street	Local	2-lane	50	400	E-W
Elm Street	Secondary Arterial	4-lane	50	750	E-W
Notre Dame Avenue	Primary Arterial	6-lane	50	900	N-S

¹ capacity is denoted as vehicles per hour per lane

² the 3-lane cross-section includes one lane per direction and a continuous northbound left turn lane

¹ *The City of Greater Sudbury Official Plan*. Planning Services Division, Growth & Development Department, City of Greater Sudbury. June 2006 (updated July 2016)

2.1.2 Key Intersections

The intersection of Ste. Anne Road with Elgin Street is a signalized 3-leg 'T' intersection. The south approach (Elgin Street) consists of exclusive left and right turn lanes. The west approach consists of an exclusive right turn lane and a through lane, whereas the east approach provides a through lane and an exclusive left turn lane.

The intersection of Beech Street with Elgin Street is a signalized 4-leg intersection. The east, west and north approaches each consist of a shared left/through/right turn lane. The south approach provides an exclusive left turn lane and a shared through/right turn lane.

The intersection of Elm Street with Elgin Street is a signalized 4-leg intersection. The north and south approaches each provide an exclusive left turn lane and a shared through/right turn lane. The east and west approaches each consist of a shared left/through lane and a shared through/right turn lane. With respect to signal phases, advanced green phases are provided for the north and south left turn movements. It is noted that the east and west left turn movements from Elm Street to Elgin Street are restricted during specific times of the day. Eastbound left turns are not permitted between 7:00 and 19:00 (7-days a week), whereas westbound left turns are not permitted between 15:00 and 18:00 (Monday thru Friday).

The intersection of Notre Dame Avenue with Ste. Anne Road is a signalized 4-leg intersection. The west approach consists of an exclusive left turn lane, an exclusive through lane and an exclusive right turn lane, whereas the east approach consists of an exclusive left turn lane and a shared through/right turn lane. The north approach provides an exclusive left turn lane, three exclusive through lanes and an exclusive channelized right turn lane. The south approach consists of an exclusive left turn lane, two exclusive through lanes and a shared through/right turn lane. An advanced left turn phase is provided to the northbound left turn movement.

The intersection of College Street with Froot Road is a signalized 4-leg intersection. The west approach (Froot Road) consists of an exclusive left turn lane and a shared through/right turn lane, whereas the east approach consists of an exclusive left turn lane, a through lane and an exclusive right turn lane. The north approach (College Street) provides a single shared left/through/right turn lane. The south approach provides an exclusive left turn lane and a shared through/right turn lane. An advanced green is provided to the westbound left turn movement.

2.2 Existing Traffic Volumes

To determine existing traffic volumes, the following traffic counts were obtained from the City:

- Ste. Anne Road & Elgin Street – Thursday June 23, 2016;
- Beech Street & Elgin Street – Wednesday July 6, 2016;

- Elm Street & Elgin Street – Monday July 4, 2016;
- Ste. Anne Road & Notre Dame Avenue – Wednesday July 13, 2016; and
- College Street & Froad Road – Wednesday June 22, 2016.

The corresponding traffic count details are provided in Appendix A.

The traffic volumes observed during the noted counts are considered reflective of typical peak conditions. Given that the intersections along Elgin Street are relatively close in proximity, minor adjustments have been made to balance the volumes between the intersections. It is noted that there is a fairly significant imbalance along Ste. Anne Road when comparing the volumes at Elgin Street with those at Notre Dame Avenue; however, the imbalance is considered reasonable given that there are significant trip generators located on the southwest corner of Ste. Anne Road and Notre Dame Avenue (the Radisson Hotel and Rainbow Centre Shopping Mall provide access on Ste. Anne Road).

To reflect 2017 conditions, the 2016 volumes were adjusted by an annual growth rate of 1.5%. Additional discussion with respect to growth rates is provided in Section 3.2.1.

The 2017 traffic volumes are illustrated in Figure 3

2.3 Existing Traffic Operations

2.3.1 Intersection Operations

The assessment of existing conditions provides the baseline from which the future traffic volumes and operations (both with and without the subject development) can be assessed. The capacity, and hence operations, of a road system is effectively dictated by its intersections. As such, the analysis focused on the operations of the key intersections. The analysis is based on the 2017 traffic volumes, the existing configuration and intersection control and procedures outlined in the *2000 Highway Capacity Manual*² (using Synchro v.9 software). For signalized intersections, the analysis considers the conditions at each approach and the overall intersection. A summary of the analyses is provided in Table 2. Level of service A corresponds to the best operating condition with minimal delays whereas level of service F corresponds to poor operations resulting from high intersection delays. A v/c ratio of less than 1.0 indicates the intersection movement/approach is operating at less than capacity while a v/c ratio of 1.0 indicates capacity has been reached. It is noted that the signal timings applied to each intersection reflect the signal timing plans provided by the City. Detailed operations worksheets for the existing traffic conditions are included in Appendix B.

² *Highway Capacity Manual*. Transportation Research Board, Washington DC, 2000.

Table 2: Intersection Operations – 2017 Conditions

Intersection and Movement	Control	Weekday AM Peak Hour			Weekday PM Peak Hour			
		delay	LOS	v/c	delay	LOS	v/c	
Ste. Anne Road & Elgin Street	EB	signal	9	A	0.17	12	B	0.18
	WB		10	A	0.20	12	B	0.21
	NB		49	D	0.31	51	D	0.29
	overall	signal	17	B	0.20	22	C	0.20
Beech Street & Elgin Street	EB	signal	33	C	0.13	30	C	0.12
	WB		33	C	0.17	33	C	0.46
	NB		13	B	0.07	16	B	0.12
	SB		5	A	0.13	7	A	0.23
	overall	signal	18	B	0.12	20	C	0.25
Elm Street & Elgin Street	EB	signal	10	A	0.26	13	B	0.36
	WB		10	A	0.22	13	B	0.27
	NB		26	C	0.47	26	C	0.66
	SB		38	D	0.45	38	D	0.60
	overall	signal	16	B	0.34	20	B	0.50
Ste. Anne Road & Notre Dame Avenue	EB	signal	38	D	0.37	39	D	0.73
	WB		38	D	0.27	33	C	0.16
	NB		3	A	0.36	8	A	0.43
	SB		8	A	0.37	13	B	0.34
	overall	signal	10	B	0.37	16	B	0.53
College Street & Froid Road	EB	signal	22	C	0.14	18	B	0.22
	WB		15	B	0.22	11	B	0.12
	NB		15	B	0.34	21	C	0.55
	SB		15	B	0.32	21	C	0.52
	overall	signal	16	B	0.30	20	B	0.36

Based on the existing volumes, the subject intersections provide good overall levels of service (overall LOS C or better) with average delays during both peak hours. All of the intersections are operating well below capacity. As such, no improvements are required to support the existing conditions.

2.3.2 Road Section Operations

As previously noted, the following lane capacities have been considered for the adjacent road network:

- Ste. Anne Road – 900 vphpl;
- MacKenzie Street – 600 vphpl;
- Elgin Street – 600 vphpl;
- Beech Street – 400 vphpl;
- Elm Street – 750 vphpl; and
- Notre Dame Avenue – 900 vphpl.

The existing road section operations are summarized in Table 3. The analysis considers the peak hour peak directional volumes and the noted assumed planning capacities.

Table 3: Road Section Operations – 2017 Conditions

Road and Lanes per Direction	Capacity ¹	Traffic Volumes (vph)		Volume to Capacity		
		NB/EB	SB/WB	NB/EB	SB/WB	
Ste. Anne Road	2	1,800	511	287	0.28	0.16
MacKenzie Street	1	600	287	285	0.48	0.48
Elgin Street	1	600	208	282	0.35	0.47
Beech Street	1	400	100	181	0.25	0.45
Elm Street	2	1,500	636	715	0.42	0.48
Notre Dame Avenue	3	2,700	1504	1252	0.56	0.46

¹ capacity is denoted as vehicles per hour per direction

As noted, the study area road network is operating at 56% of capacity or less (i.e. $v/c \leq 0.56$), thus indicating that the road network has reserve capacity. As such, no improvements are recommended to address capacity under existing conditions.

3 Future Background Conditions

This chapter will describe the road network and background traffic volumes expected for the years 2018, 2023 and 2028. The 2018 horizon year has been adopted to reflect build-out of the subject development, whereas the 2023 and 2028 horizons (i.e. 5 and 10 years beyond build-out) will address the medium and long-term impacts.

3.1 Road Network

3.1.1 Planned Improvements

The *City of Greater Sudbury Transportation Study Report* identifies the extension of Ste. Anne Road from MacKenzie Street to College Street. The intent of this extension is to improve the connection to the existing College Street underpass which crosses under the rail corridor. The timeline for the improvement is noted as 11 to 15 years or more (i.e. long-term improvement); the report illustrates the extension in place by 2031. Given the uncertainty of the timing, the proposed extension has not been considered in this study.

No other planned improvements to the study area road network have been identified and thus the road network as discussed in Section 2.1 will be maintained through all future horizons.

3.2 Background Traffic Volumes

Future background traffic volumes expected for the 2018, 2023 and 2028 horizon years for the study area have been determined based on the existing traffic volumes, historical and projected growth, and additional increases in volumes due to other development within the immediate area (apart from the subject development).

3.2.1 Background Growth

The 2011 census results for the City of Greater Sudbury indicate that the population increased from 157,909 persons in 2006 to 160,376 in 2011, translating to an annual growth rate of 0.31%. Further consideration of the 2001 census shows an annual growth rate of 0.32% from 2001 to 2011. The City commissioned a population and employment growth study in 2013 to inform the review of their Official Plan. The *Growth Outlook to 2036 for the City of Greater Sudbury*³ examined a reference scenario (i.e. stable growth based on historical trends) and a high growth scenario (i.e. optimistic growth based on industry expansion). From 2011 to 2036, the report estimated that the population of Greater Sudbury would increase in the order of 0.25% (reference scenario) to 0.50% (high scenario) per annum. For the same period, employment is forecast to grow at 0.11% to 0.41% per annum. It is

³ *Growth Outlook to 2036 for the City of Greater Sudbury*, Hemson Consulting Ltd. May 2013.

further noted that the *City of Greater Sudbury Transportation Study Report*⁴ is based on the reference scenario projections provided in the *Growth Outlook* report.

Based on the noted growth projections for the City, a background growth rate of 0.5% is considered appropriate, and perhaps conservative, given that the City's *Transportation Study Report* considered the lower growth projections associated with the reference scenario (0.25% per annum) published in the *Growth Outlook* report. Regardless, at the request of City staff, a 1.5% background growth rate has been applied to the road network.

3.2.2 Background Development

Red Oak Village Campus

The Red Oak Village campus is to be comprised of the following properties:

- 20 Ste. Anne Road (Red Oak Villa retirement home);
- 30 Ste. Anne Road (former Catholic diocese property); and
- 162 MacKenzie Street (former St. Louis de Gonzague School site).

For the purpose of establishing future background volumes, the expansion the Red Oak Villa retirement home and the future redevelopment of 162 MacKenzie Street have been considered. While considered part of the overall Red Oak Village Campus, the proposed re-zoning of 30 Ste. Anne Road is the subject of this traffic impact study and thus has not been considered in the background traffic (the re-zoning of 30 Ste. Anne Road is discussed in further in Chapter 4). Details regarding the expansion of Red Oak Villa and the redevelopment of 162 MacKenzie Street are provided below. As previously noted, these two properties, in addition to the subject property, will form the Red Oak Village campus.

Red Oak Villa Retirement Home Expansion

Red Oak Villa is an 84 bed retirement home located at 20 Ste. Anne Road. The proposed expansion of the retirement home will include an additional 123 beds and a 298 m² (3,208 ft²) day care. Access will be provided via two access points – the existing access on Ste. Anne Road and a new access on MacKenzie Street. The MacKenzie Street access will be a shared access that serves the overall Red Oak Village campus. Completion of the Red Oak Villa expansion is anticipated by 2018. Trip estimates for the proposed expansion have been established based on the noted expansion details and in consideration of the ITE trip generation rates for the *assisted living* (ITE code 254) and *day care centre* (ITE code 565) land-uses. The trip rates and estimates are provided Table 4 and Table 5. The Red Oak Villa also includes a small medical services area (100 m²). The trip generation for this area is not explicitly considered, recognizing that the *assisted living* trip rates consider such ancillary services.

⁴ *City of Greater Sudbury Transportation Study Report - Draft*, MMM. April 2015.

Table 4: Trip Generation Rates – Red Oak Villa

Land Use	variable	Weekday AM Peak Hour			Weekday PM Peak Hour		
		in	out	total	in	out	total
assisted living	beds	0.09	0.05	0.14	0.10	0.12	0.22
day care centre	1,000 ft ² GFA	6.46	5.72	12.18	5.80	6.54	12.34

Table 5: Trip Estimates – Red Oak Villa

Land Use	beds/ GFA	Weekday AM Peak Hour			Weekday PM Peak Hour		
		in	out	total	in	out	total
assisted living	123	11	6	17	12	15	27
day care centre	3,208 ft ²	21	18	39	19	21	40
Total		32	24	56	31	36	67

As noted, the Red Oak Villa expansion will generate 56 new trips during the AM peak hour and 67 new trips during the PM peak hour.

162 MacKenzie Street

162 MacKenzie Street is the site of the former St. Louis de Gonzague School. The school is no longer in operation but the building has been maintained on the site. The proposed redevelopment of the site will include repurposing the existing school building to accommodate office uses (medical and general) and a theatre. A small 120 m² (1,300 ft²) expansion is also planned to accommodate a new entrance and lobby to support the proposed theatre use. The building will have a total gross floor area (GFA) of 1,881 m² (20,247 ft²). The redevelopment will consist of the following uses (noted area reflects GFA):

- 669 m² (7,201 ft²) of medical office space;
- 597 m² (6,426 ft²) of general office space; and
- 615 m² (6,620 ft²) theatre (single screen with 180 seat capacity).

Access will be provided via two access points on MacKenzie Street. Trip estimates for the proposed redevelopment of 162 MacKenzie Street have been established based on the noted details and in consideration the ITE trip generation rates for the *movie theatre with matinee* (ITE code 444), *general office building* (ITE code 710) and *medical-dental office building* (ITE code 720) land-uses. The movie theatre will be a single screen theatre with seating for 180 people and will be operated by Sudbury Indie Cinema. The theatre will have weeknight show times at 5:00PM and 7:00PM, with a 9:00PM show added on Friday evenings. Depending on the results of the theatre’s outreach program, a

matinee (1:00PM) show time will be added (geared towards seniors) along with a 3:00PM show time marketed to high school students. The peak operation of the theatre is not expected to coincide with the peak hour of the adjacent street. As is typical with theatre operations, peak operations occur during the evening show times (i.e. 7:00PM and 9:00PM). Regardless, the subject theatre is a small scale operation and not anticipated to generate significant volumes, particularly during the peak hour of the adjacent road network. The ITE trip rates applied reflect the PM peak hour of the adjacent street for a Friday.

The trip rates and estimates are provided in Table 6 and Table 7. Full build-out and occupancy of 162 MacKenzie Street has been assumed by 2023.

Table 6: Trip Generation Rates – 162 MacKenzie Street

Land Use	variable	Weekday AM Peak Hour			Weekday PM Peak Hour		
		in	out	total	in	out	total
movie theatre with matinee	screens	-	-	-	25.25	20.66	45.91
general office building ¹	1,000 ft ² GFA	2.13	0.29	2.42	0.62	3.05	3.67
medical-dental office building ²	1,000 ft ² GFA	1.89	0.50	2.39	1.06	2.73	3.79

¹ the AM & PM trip rates for the general office building are based on the ITE trip generation fitted curve equation

² the AM trip rates for the medical office space are based on the average trip rates (i.e. a fitted curve equation was not provided), whereas the PM rates are based on the fitted curve equation

Table 7: Trip Estimates – 162 MacKenzie Street

Land Use	variable	Weekday AM Peak Hour			Weekday PM Peak Hour		
		in	out	total	in	out	total
movie theatre with matinee	1 screen	-	-	-	25	21	46
general office building	6,426 ft ² GFA	18	3	21	15	71	86
medical-dental office building	7,201 ft ² GFA	14	3	17	8	20	28
Total		32	6	38	48	112	160

As noted, the redevelopment of 162 MacKenzie Street will generate 38 new trips during the AM peak hour and 160 new trips during the PM peak hour. The site trips have been assigned to the study area road network based on the trip distribution and assignment discussed in Section 4.5.2.

Other Developments

A review of the City's subdivision activity and development application maps indicates that there no other planned developments within the immediate study area.

Overall Background Development Traffic

The background trip volumes associated with the Red Oak Villa expansion (including the existing 84 beds) and the redevelopment of 162 MacKenzie Street are illustrated in Figure 4.

3.2.3 Background Traffic Volumes

The resulting 2018, 2023 and 2028 background traffic volumes are illustrated in Figure 5 through Figure 7. The background volumes reflect the 2017 volumes, the noted annual background growth rate and the additional traffic volumes associated with the noted background developments.

3.3 Background Traffic Operations

3.3.1 Intersection Operations

The key intersections were again analyzed for each horizon year given the projected background volumes. The results are summarized in Table 8 through Table 10 (detailed worksheets are provided in Appendix C), assuming the existing intersection configurations and timings are maintained.

As indicated, the key intersections are expected to continue to provide good overall operating conditions (overall intersection LOS C or better) with average delays through the considered horizon periods given the assumed background traffic volumes. While some individual approaches will experience a LOS D with slightly higher delays, such are considered acceptable.

In consideration of the noted intersection operations, no improvements are required to address the future background conditions.

Table 8: Intersection Operations – 2018 Background Conditions

Intersection and Movement	Control	Weekday AM Peak Hour			Weekday PM Peak Hour			
		delay	LOS	v/c	delay	LOS	v/c	
Ste. Anne Road & Elgin Street	EB		10	A	0.19	12	B	0.21
	WB	signal	10	B	0.22	13	B	0.24
	NB		51	D	0.33	53	D	0.39
	overall	signal	18	B	0.21	23	C	0.22
Beech Street & Elgin Street	EB		32	C	0.15	29	C	0.14
	WB	signal	33	C	0.19	33	C	0.47
	NB		13	B	0.09	16	B	0.15
	SB		6	A	0.15	7	A	0.27
overall	signal	18	B	0.14	20	B	0.28	
Elm Street & Elgin Street	EB		11	B	0.27	14	B	0.37
	WB	signal	10	B	0.24	13	B	0.29
	NB		26	C	0.48	26	C	0.69
	SB		38	D	0.47	39	D	0.63
overall	signal	17	B	0.36	21	C	0.52	
Ste. Anne Road & Notre Dame Avenue	EB		37	D	0.39	39	D	0.74
	WB	signal	38	D	0.28	33	C	0.16
	NB		4	A	0.41	9	A	0.44
	SB		9	A	0.38	14	B	0.35
overall	signal	11	B	0.42	16	B	0.54	
College Street & Froid Road	EB		22	C	0.15	18	B	0.23
	WB	signal	15	B	0.23	11	B	0.13
	NB		15	B	0.36	22	C	0.58
	SB		15	B	0.34	22	C	0.56
overall	signal	16	B	0.31	20	B	0.38	

Table 9: Intersection Operations – 2023 Background Conditions

Intersection and Movement	Control	Weekday AM Peak Hour			Weekday PM Peak Hour			
		delay	LOS	v/c	delay	LOS	v/c	
Ste. Anne Road & Elgin Street	EB		10	B	0.21	14	B	0.28
	WB	signal	11	B	0.26	15	B	0.29
	NB		53	D	0.37	54	D	0.34
	overall	signal	20	B	0.25	24	C	0.26
	<hr/>							
Beech Street & Elgin Street	EB		32	C	0.15	28	C	0.13
	WB	signal	32	C	0.18	31	C	0.44
	NB		13	B	0.11	17	B	0.18
	SB		6	A	0.17	9	A	0.35
	overall	signal	17	B	0.15	19	B	0.32
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Elm Street & Elgin Street	EB		11	B	0.30	16	B	0.42
	WB	signal	11	B	0.26	15	B	0.32
	NB		25	C	0.51	27	C	0.74
	SB		39	D	0.49	40	D	0.67
	overall	signal	17	B	0.39	22	C	0.58
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Ste. Anne Road & Notre Dame Avenue	EB		37	D	0.41	40	D	0.75
	WB	signal	37	D	0.27	32	C	0.17
	NB		4	A	0.51	10	B	0.48
	SB		9	A	0.41	16	B	0.39
	overall	signal	11	B	0.51	18	B	0.58
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College Street & Froid Road	EB		22	C	0.15	19	B	0.26
	WB	signal	15	B	0.25	11	B	0.14
	NB		15	B	0.40	23	C	0.65
	SB		15	B	0.37	23	C	0.63
	overall	signal	16	B	0.35	21	C	0.42

Table 10: Intersection Operations – 2028 Background Conditions

Intersection and Movement	Control	Weekday AM Peak Hour			Weekday PM Peak Hour			
		delay	LOS	v/c	delay	LOS	v/c	
Ste. Anne Road & Elgin Street	EB	signal	11	B	0.23	15	B	0.31
	WB		11	B	0.27	16	B	0.27
	NB		55	D	0.38	56	E	0.35
	overall	signal	20	B	0.26	26	C	0.28
Beech Street & Elgin Street	EB	signal	32	C	0.15	28	C	0.14
	WB		32	C	0.18	32	C	0.48
	NB		14	B	0.12	18	B	0.20
	SB	6	A	0.18	9	A	0.38	
overall	signal	17	B	0.16	19	B	0.34	
Elm Street & Elgin Street	EB	signal	12	B	0.33	17	B	0.47
	WB		11	B	0.28	16	B	0.36
	NB		25	C	0.55	27	C	0.76
	SB	39	D	0.51	42	D	0.73	
overall	signal	18	B	0.43	24	C	0.63	
Ste. Anne Road & Notre Dame Avenue	EB	signal	37	D	0.43	41	D	0.78
	WB		37	D	0.26	31	C	0.16
	NB		4	A	0.56	12	B	0.53
	SB	10	B	0.46	17	B	0.43	
overall	signal	12	B	0.56	19	B	0.62	
College Street & Froid Road	EB	signal	22	C	0.17	19	B	0.25
	WB		14	B	0.27	11	B	0.13
	NB		15	B	0.44	25	C	0.61
	SB	15	B	0.41	25	C	0.60	
overall	signal	16	B	0.38	22	C	0.40	

3.3.2 Queue Operations

Queue operations are typically reviewed in instances where the available spacing between signalized intersections is limited and the potential exists for queues to spillback and interfere with the operations of the adjacent intersection. With respect to the study area, the signalized intersections of Elgin Street with Ste. Anne Road, Beech Street and Elm Street are closely spaced, with less than 80 metres of separation between adjacent intersections. As such, the queue operations have been reviewed to identify if the future queue lengths exceed the available spacing. The review has considered the 2028 background conditions as they reflect the critical scenario where peak volumes and queue lengths are greatest. The available spacing and 95th percentile queue lengths for the AM and PM peak hour are presented in Table 11, whereas the detailed worksheets (Synchro) are provided in Appendix C.

Table 11: Queue Operations – 2028 Background Conditions

Intersection and Movement		Available Spacing	95 th Percentile Queue Length	
			AM Peak	PM Peak
Ste. Anne Road & Elgin Street	NB left	78m	29m	29
	NB right		12m	18
Beech Street & Elgin Street	SB left/thru/right	78m	10m	19m
	NB left	78m	9m	12m
	NB thru/right		30m	42m
Elm Street & Elgin Street	SB left	78m	14m	28m
	SB thru/right		39m	73m

As indicated, the AM and PM peak hour 95th percentile queue lengths remain within the available spacing under 2028 background conditions. However, it is noted that the southbound thru/right movement at the intersection of Elm Street with Elgin Street is approaching the limit of available separation during the PM peak hour. Should the queue length extend into the adjacent intersection (Beech Street and Elgin Street), the signal timing plans may require adjusting in order to shorten the queue lengths. It is noted that the area is fully built-out and constrained by the existing urban landscape, thus improvement in terms of additional lane capacity are not feasible.

3.3.3 Road Section Operations

The road section capacity operations have been reviewed for the 2028 future horizon (considered the critical horizon) based on the projected background volumes and the assumed capacity of the existing road network. The results are summarized in Table 12.

As noted, road sections within the study area road network are expected to operate at 77% of capacity or less through the 2028 horizon period (i.e. $v/c \leq 0.77$) under background conditions. Thus no improvements are required to increase road section capacity given the projected background conditions.

Table 12: Road Section Operations – 2028 Background Conditions

Road and Lanes per Direction	Capacity ¹	Traffic Volumes (vph)		Volume to Capacity		
		NB/EB	SB/WB	NB/EB	SB/WB	
Ste. Anne Road	2	1,800	670	390	0.37	0.22
MacKenzie Street	1	600	380	460	0.63	0.77
Elgin Street	1	600	275	380	0.46	0.63
Beech Street	1	400	110	200	0.28	0.50
Elm Street	2	1,500	750	860	0.50	0.57
Notre Dame Avenue	3	2,700	1785	1485	0.66	0.55

¹ capacity is denoted as vehicles per hour per direction

4 Proposed Development

This chapter will provide additional details with respect to the proposed development, including its location, the projected site generated traffic volumes and the assignment of such to the adjacent road network.

4.1 Proposed Land-use

The subject property, formerly owned by the Catholic diocese, is currently zoned “Institutional”. The developer is seeking to re-zone the property as “Institutional – Special” in order to allow additional uses not otherwise permitted under the current zoning. In particular, the re-zoning will allow general office and medical/professional office uses. The intent of the re-zoning, and overall vision for the Red Oak Village campus, is to create a community of businesses/services that complement the existing Red Oak Villa retirement home.

The subject property currently consists of a 5,042 m² (54,271 ft²) building formerly used by the Catholic diocese. The existing building is to remain and will be repurposed for office use. No new construction is proposed, with the exception of a new 254 m² (2,734 ft²) entrance addition. Upon completion of the entrance addition, the building will have a GFA of 5,296 m² (57,005 ft²). The proposed breakdown of office space is as follows:

- medical office space – 1,059 m² (11,399 ft²); and
- general office space – 4,237 m² (45,606 ft²).

A conceptual site plan of the entire Red Oak Village campus (including 30 Ste. Anne Road) is provided in Figure 8. It is noted that 30 Ste. Anne Road is divided into two sections, identified as ‘A’ and ‘B’. This traffic study only considers the west parcel (i.e. 30 Ste. Anne Road ‘A’). There is no development currently planned for 30 Ste. Anne Road ‘B’; as such, it has not been considered in this study.

4.2 Development Phasing

Given that the re-zoning will not include any major construction, full build-out and occupancy is anticipated in 2018.

4.3 Site Access

As per the conceptual site plan, the Red Oak Village campus will have three access points – two on MacKenzie Street and one on Ste. Anne Road. In consideration of the campus layout and internal connections, it has been assumed that the south access on MacKenzie Street (Access 2) will be the primary access for 30 Ste. Anne Road.

As per the *City of Greater Sudbury Zoning By-law 2010-100Z*, the minimum width of an access ramp or driveway accessing a parking area or parking lot shall be 6.0 metres. Similarly, the by-law states that a minimum parking aisle width of 6.0 metres is required where perpendicular parking is provided. As per the site plan, each access to the campus will provide two-way operations (i.e. one lane of travel per direction) with a minimum width of 6.0 metres. The aisle widths throughout the site will also maintain a minimum width of 6.0 metres.

4.4 Site Traffic

4.4.1 Trip Generation

The number of vehicle trips to be generated by the rezoning of 30 Ste. Anne Road for the weekday AM and PM peak hours has been determined based on type of use, development size, and trip generation rates as per the *ITE Trip Generation Manual⁵ 9th Edition*. Based on the proposed development, trip rates for the *general office building* (ITE code 710) and *medical-dental office building* (ITE code 720) land-uses have been applied. The AM & PM trip rates for the *general office building* land-use are based on the ITE trip generation fitted curve equation. For the *medical office building* land-use, the AM trip rates are based on the average trip rates (i.e. a fitted curve equation was not provided), whereas the PM rates are based on the fitted curve equation. The associated trip rates and trip estimates are provided in Table 13 and Table 14.

Overall, the proposed development is expected to generate 130 trips during the weekday AM peak hour and 171 trips during the weekday PM peak hour.

Table 13: Trip Generation Rates

Land Use	variable	Weekday AM Peak Hour			Weekday PM Peak Hour		
		in	out	total	in	out	total
general office building ¹	1,000ft ² GFA	1.97	0.27	2.24	0.48	2.36	2.84
medical-dental office building ²	1,000ft ² GFA	1.89	0.50	2.39	1.01	2.61	3.62

⁵ *ITE Trip Generation Manual, 9th Edition*. Institute of Transportation Engineers, 2012.

Table 14: Trip Estimates

Land Use	GFA	Weekday AM Peak Hour			Weekday PM Peak Hour		
		in	out	total	in	out	total
general office building	45,606 ft ²	90	12	102	22	108	130
medical-dental office building	11,399 ft ²	22	6	28	12	29	41
Total		112	18	130	34	137	171

4.4.2 Trip Distribution & Assignment

The distribution of the new trips to be generated by the site to the area road system was based on observed traffic patterns through the study area (as determined from the traffic counts) and the proximity of the site to surrounding development and outlying suburban areas. The following distribution was assumed (as illustrated in Figure 9):

- 10% to/from the north;
- 40% to/from the south;
- 40% to/from the east; and
- 10% to/from the west.

The assignment of the trips generated by the development to the wider area road network is based on the trip distribution noted above with consideration given to the local arterial road network and expected travel routes. While there are three access points to the overall Red Oak Village campus, all traffic associated with 30 Ste. Anne Road has been assigned to Access 2 (the south access on MacKenzie Street). It is noted that the Access 1 (Ste. Anne Road access) does not provide access to the subject site, whereas Access 3 (the north access on MacKenzie Street) is north of the site and does not provide convenient access to 30 Ste. Anne Road.

The assignment of site generated traffic to the road network is illustrated in Figure 10.

5 Transportation Impacts

This chapter will address the resulting impacts of the proposed development on the adjacent road system. The following areas are to be addressed:

- operations of the key intersections, including the site access;
- road section operations;
- available sight lines along MacKenzie Street at the proposed access; and
- potential improvements to the study area road network, if necessary.

5.1 Future Traffic Volumes

To assess the impacts of the increased traffic volumes resulting from the proposed development, the site generated traffic was combined with the 2018, 2023 and 2028 background traffic volumes. The resulting total traffic volumes are presented in Figure 11 through Figure 13.

5.2 Future Traffic Operations

5.2.1 Intersection Operations

The operations of the key intersections were again investigated considering the total traffic volumes for each horizon year. In addition, the operations of the site access points on MacKenzie Street have also been reviewed, assuming stop control on the minor movement (i.e. the exit movement from the site). The existing intersection configurations and control have been maintained in the analysis. The signal timings have been optimized where appropriate to ensure efficient operations. For the unsignalized intersections the review considers the average delay (measured in seconds), level of service (LOS) and volume to capacity (v/c) for the critical movements, namely the stop movements on the minor street. The results of the operational review are provided in Table 15 through Table 17 for the key intersections, and in Table 18 through Table 20 for the access points (detailed worksheets are provided in Appendix D). It is noted that Access 3 is not assessed until the 2023 horizon, corresponding to the build-out of 162 MacKenzie Street.

As indicated, the subject intersections will provide good overall operations (overall intersection LOS C or better) with average delays through the 2028 horizon given the projected total volumes. The access points will provide acceptable operations (LOS E or better) through 2028. No intersection improvements or access improvements are required to address the operations under future total conditions.

Table 15: Intersection Operations – 2018 Total Conditions

Intersection and Movement	Control	Weekday AM Peak Hour			Weekday PM Peak Hour		
		delay	LOS	v/c	delay	LOS	v/c
Ste. Anne Road & Elgin Street	EB	10	A	0.21	13	B	0.29
	WB	10	B	0.28	13	B	0.27
	NB	46	D	0.42	44	D	0.32
	overall	signal	18	B	0.28	20	C
Beech Street & Elgin Street	EB	28	C	0.14	26	C	0.13
	WB	28	C	0.18	28	C	0.44
	NB	11	B	0.13	14	B	0.17
	SB	6	A	0.17	9	A	0.34
overall	signal	15	B	0.15	17	B	0.32
Elm Street & Elgin Street	EB	10	B	0.27	14	B	0.38
	WB	10	B	0.25	13	B	0.31
	NB	23	C	0.49	25	C	0.72
	SB	33	C	0.46	36	D	0.68
overall	signal	16	B	0.37	20	B	0.55
Ste. Anne Road & Notre Dame Avenue	EB	37	D	0.41	40	D	0.74
	WB	37	D	0.27	32	C	0.15
	NB	4	A	0.52	9	A	0.45
	SB	9	A	0.39	15	B	0.36
overall	signal	11	B	0.52	17	B	0.55
College Street & Froid Road	EB	22	C	0.15	18	B	0.23
	WB	15	B	0.23	11	B	0.13
	NB	15	B	0.40	22	C	0.60
	SB	15	B	0.35	23	C	0.60
overall	signal	16	B	0.34	20	C	0.38

Table 16: Intersection Operations – 2023 Total Conditions

Intersection and Movement	Control	Weekday AM Peak Hour			Weekday PM Peak Hour		
		delay	LOS	v/c	delay	LOS	v/c
Ste. Anne Road & Elgin Street	EB	11	B	0.23	14	B	0.36
	WB	12	B	0.33	14	B	0.32
	NB	47	D	0.46	47	D	0.39
	overall	signal	19	B	0.32	22	C
Beech Street & Elgin Street	EB	27	C	0.14	26	C	0.14
	WB	28	C	0.17	28	C	0.45
	NB	12	B	0.15	14	B	0.20
	SB	7	A	0.19	9	A	0.42
overall	signal	15	B	0.16	17	B	0.36
Elm Street & Elgin Street	EB	11	B	0.31	15	B	0.42
	WB	11	B	0.29	14	B	0.34
	NB	22	C	0.50	29	C	0.81
	SB	34	C	0.48	41	D	0.78
overall	signal	16	B	0.40	23	C	0.61
Ste. Anne Road & Notre Dame Avenue	EB	37	D	0.43	42	D	0.76
	WB	37	D	0.26	32	C	0.16
	NB	5	A	0.60	11	B	0.50
	SB	11	B	0.43	16	B	0.40
overall	signal	12	B	0.60	19	B	0.59
College Street & Froot Road	EB	22	C	0.15	19	B	0.24
	WB	15	B	0.25	11	B	0.13
	NB	15	B	0.44	24	C	0.61
	SB	15	B	0.38	25	C	0.64
overall	signal	16	B	0.37	22	C	0.41

Table 17: Intersection Operations – 2028 Total Conditions

Intersection and Movement	Control	Weekday AM Peak Hour			Weekday PM Peak Hour		
		delay	LOS	v/c	delay	LOS	v/c
Ste. Anne Road & Elgin Street	EB	11	B	0.25	17	B	0.39
	WB	12	B	0.35	17	B	0.34
	NB	47	D	0.46	56	E	0.38
	overall	19	B	0.33	26	C	0.33
Beech Street & Elgin Street	EB	27	C	0.14	28	C	0.13
	WB	27	C	0.17	31	C	0.46
	NB	12	B	0.16	18	B	0.22
	SB	7	A	0.20	9	A	0.45
overall	15	B	0.17	19	B	0.38	
Elm Street & Elgin Street	EB	12	B	0.34	18	B	0.50
	WB	12	B	0.31	17	B	0.38
	NB	22	C	0.54	29	C	0.80
	SB	34	C	0.50	45	D	0.78
overall	17	B	0.44	25	C	0.66	
Ste. Anne Road & Notre Dame Avenue	EB	39	D	0.47	37	D	0.76
	WB	39	D	0.26	29	C	0.15
	NB	5	A	0.61	13	B	0.55
	SB	12	B	0.47	19	B	0.46
overall	13	B	0.61	20	B	0.64	
College Street & Frood Road	EB	22	C	0.17	19	B	0.29
	WB	15	B	0.27	11	B	0.15
	NB	16	B	0.47	25	C	0.70
	SB	15	B	0.42	26	C	0.72
overall	16	B	0.40	23	C	0.47	

Table 18: Access Operations – 2018 Total Conditions

Intersection and Movement	Control	Weekday AM Peak Hour			Weekday PM Peak Hour			
		delay	LOS	v/c	delay	LOS	v/c	
Access 1 & Ste. Anne Road	SB	stop	11	B	0.04	11	B	0.06
Access 2 & MacKenzie Street	WB	stop	14	B	0.09	19	C	0.40

Table 19: Access Operations – 2023 Total Conditions

Intersection and Movement	Control	Weekday AM Peak Hour			Weekday PM Peak Hour			
		delay	LOS	v/c	delay	LOS	v/c	
Access 1 & Ste. Anne Road	SB	stop	11	B	0.04	12	B	0.07
Access 2 & MacKenzie Street	WB	stop	15	B	0.12	34	D	0.69
Access 3 & Mackenzie Street	WB	stop	12	B	0.02	15	B	0.10

Table 20: Access Operations – 2028 Total Conditions

Intersection and Movement	Control	Weekday AM Peak Hour			Weekday PM Peak Hour			
		delay	LOS	v/c	delay	LOS	v/c	
Access 1 & Ste. Anne Road	SB	stop	11	B	0.05	12	B	0.07
Access 2 & MacKenzie Street	WB	stop	16	C	0.12	41	E	0.74
Access 3 & Mackenzie Street	WB	stop	13	B	0.02	15	C	0.11

5.2.2 Queue Operations

The queue operations along Elgin Street were reviewed again to consider the 2028 total conditions, recognizing that they reflect the critical scenario where peak volumes and queue lengths are greatest. The available spacing and 95th percentile queue lengths for the AM and PM peak hour are presented in Table 21, whereas the detailed worksheets (Synchro) are provided in Appendix D

Table 21: Queue Operations – 2028 Total Conditions

Intersection and Movement		Available Spacing	95 th Percentile Queue Length	
			AM Peak	PM Peak
Ste. Anne Road & Elgin Street	NB left	78m	35m	32
	NB right		12m	19
Beech Street & Elgin Street	SB left/thru/right	78m	11m	20m
	NB left	78m	8m	12m
	NB thru/right		31m	44m
Elm Street & Elgin Street	SB left	78m	14m	34m
	SB thru/right		37m	82m

As indicated, the AM and PM peak hour 95th percentile queue lengths remain within the available spacing under 2028 total conditions. The exception is the queue for the southbound thru/right movement at the intersection of Elm Street with Elgin Street which will exceed the available separation during the PM peak hour by 4 metres. As previously noted, the Elgin Street corridor is fully built-out and constrained by the existing urban landscape, thus improvement in terms of additional lane capacity are not feasible. As such, the signal timing plans will require adjustment in 2028 in order to manage the southbound queue lengths at the Elm Street and Elgin Street intersection. It is noted that the queue operations are based on the assumed traffic projections for 2028. Should traffic growth occur at a lower rate (i.e. consistent with growth projections contained in the *City of Greater Sudbury Transportation Study Report and Growth Outlook to 2036 for the City of Greater Sudbury*), the queue lengths will be less than those noted above. It is further noted that the 2023 queue lengths do not extend beyond the available spacing. As such, the queue operations along Elgin Street should be monitored and signal timing plan adjustments considered if deemed necessary.

5.2.3 Road Section Operations

The road section operations were reviewed again with consideration of the projected total traffic volumes for the 2028 horizon period (the considered the critical). The results are provided in Table 22.

As noted, the road network is expected to operate below capacity through 2028. The exception being MacKenzie Street, which will operate at capacity during the PM peak hour ($v/c = 1.00$); however, such is not considered problematic given that the conditions only occur for a small section of road (between Access 2 and Davidson Street) for a short period of time. It is further noted that the study area intersections, considered the pinch points of the area road network, continue to operate acceptably. As such, no improvements are considered necessary to address the available capacity of the road network.

Table 22: Road Section Operations – 2028 Total Conditions

Road and Lanes per Direction	Capacity ¹	Traffic Volumes (vph)		Volume to Capacity		
		NB/EB	SB/WB	NB/EB	SB/WB	
Ste. Anne Road	2	1,800	730	455	0.41	0.25
MacKenzie Street	1	600	495	600	0.83	1.00
Elgin Street	1	600	290	430	0.48	0.72
Beech Street	1	400	110	200	0.28	0.50
Elm Street	2	1,500	750	870	0.50	0.58
Notre Dame Avenue	3	2,700	1795	1505	0.66	0.56

¹ Capacity is denoted as vehicles per hour per direction

5.3 Turn Lane Requirements

Despite the otherwise acceptable levels of service at the proposed access points on MacKenzie Street and Ste. Anne Road, the need for left and right turn lanes to serve the proposed development has been reviewed in consideration of MTO warrants for exclusive left and right turn lanes at unsignalized intersections, assuming design speeds of 50 km/h (MacKenzie Street) and 60 km/h (Ste. Anne Road). The analysis considers the 2028 total volumes given that they reflect the most critical conditions.

MTO guidelines suggest that an exclusive right turn lane be considered where right turn volumes exceed 60 vehicles per hour and/or impede the operations of through traffic. Based on the estimated volume of right turning traffic entering the site at Access 2 (80 to 145 vehicles), a right turn lane is warranted. However, the feasibility of constructing a right turn lane is somewhat restricted given the close proximity (approximately 35 metres) of the library access to the south, the overall urban environment and cross-section (including sidewalks in close proximity to the road) and the limited right-of-way. In context of these considerations, and recognizing that the right turns can be completed with minimal impedance to through traffic (2.5 right turns per minute are anticipated in the busier AM peak hour, with 5-6 through movements per minute that could potentially be impeded), a right turn lane is not considered necessary. It is also noted that Access 2 is expected to operate acceptably without a right turn lane (the operations assessment did not consider a right turn lane). The right turn volumes at Access 1 and Access 3 do not warrant right turn lanes.

With respect to left turn lanes, the needs are based on the volume of left turn traffic, the volume of advancing and opposing traffic and the design speed. A review of the 2028 total volumes indicates that left turn lanes are not warranted at any of the access points (MTO left turn warrants are provided in Appendix E for the critical peak hour based on the projected volumes). Implementation of such would also be problematic given the urban environment.

5.4 Sight Line Analysis

Based on MTO geometric design standards, the minimum stopping sight distance for a design speed of 50 km/h (posted 40 km/h + 10 km/h on MacKenzie Street) is 65 metres, whereas the minimum stopping sight distance for a design speed of 60 km/h (posted 50 km/h + 10 km/h on Ste. Anne Road) is 85 metres. The minimum stopping sight distance provides sufficient distance for an approaching motorist to observe a stationary hazard in the road (i.e. a vehicle stopped on MacKenzie Street or Ste. Anne Road waiting to turn into the site) and bring their vehicle to a complete stop prior to the hazard.

The available sight lines, as determined based on field measurements, are provided in Table 23.

Table 23: Sight Line Assessment

Access	Design Speed	Minimum Stopping Sight Distance	Available Sight Lines	
			to/from N or E	to/from S or W
Access 1	60 km/h	85 m	85 m	85 m
Access 2	50 km/h	65 m	140 m	100 m
Access 3	50 km/h	65 m	150 m	200 m

As noted, the available sight lines at each access satisfy the minimum stopping sight distance requirements for the respective design speeds. It is noted that the available sight lines at Access 1 are limited by the existing horizontal and vertical curvature of the road. Regardless, the sight lines satisfy the minimum requirements as per MTO design standards. No improvements are required to address the sight lines at the proposed the site access.

6 Parking Review

The purpose of this chapter is to review the proposed parking supply of the subject property in context of the City of Greater Sudbury's parking requirements.

6.1 Development Details

While the traffic impact study focused on the re-zoning of 30 Ste. Anne Road, the parking review will consider the parking requirements of the entire Red Oak Village campus. Below is a summary of the campus development with respect to the criteria applied by the City in determining parking requirements (i.e. beds, net floor area, land-use). It is noted that parking requirements are based on net floor area (NFA) as opposed to gross floor area, which is applied in determining trip generation estimates (and thus the respective sizes may vary from the values previously noted). With respect to the theatre use, the parking requirement is based on seating capacity.

20 Ste. Anne Road:

- 207 bed retirement home (includes 84 existing beds);
- 100 m² medical service area; and
- 298 m² day care facility.

30 Ste. Anne Road

- 735 m² medical office space; and
- 2,992 m² general office space.

162 MacKenzie Street

- 617 m² medical office space;
- 505 m² general office space; and
- 180 seat theatre.

6.2 City of Greater Sudbury Parking Requirements

The parking requirements for the City of Greater Sudbury, as published in the *City of Greater Sudbury Zoning By-law 2010-100Z*, are provided in Table 22.

Table 24: City of Greater Sudbury Parking Requirements

Land Use	Minimum Parking Space Requirement
retirement home	<ul style="list-style-type: none"> ▪ 0.25 parking spaces per guest room ▪ plus 1 space per 20 m² net floor area used for medical, health or personal services
institutional use (i.e. day care centre)	<ul style="list-style-type: none"> ▪ 1 space per 20 m² of net floor area
medical office	<ul style="list-style-type: none"> ▪ 5 spaces ▪ OR 1 space per 20 m² of net floor area, whichever is greater.
business office	<ul style="list-style-type: none"> ▪ 1 space per 30 m² of net floor area
theatres	<ul style="list-style-type: none"> ▪ 1 space for every 4 seats

6.3 Proposed Parking Supply

A breakdown of the proposed parking supply for the Red Oak Village campus by property is provided below (and is also evident in Figure 8):

- 20 Ste. Anne Road – 46 spaces;
- 30 Ste. Anne Road – 76 spaces; and
- 162 MacKenzie Street – 180 spaces.

The overall proposed parking supply for the Red Oak Village campus is 302 spaces.

6.4 Parking Review

The parking requirement by property and proposed use, as per the City's by-law, is summarized in Table 25, along with the available on-site parking supply. It is noted that the on-site parking supply reflects the available parking supply within the municipal boundary of each respective property.

As noted, the on-site parking provision for 20 Ste. Anne Road and 30 Ste. Anne Road do not satisfy the City's parking requirements, with short falls of 26 and 61 spaces respectively (for a total of 87 spaces). However, 162 MacKenzie Street will have an excess of parking (87 spaces). Thus the overall parking supply provided within the Red Oak Village campus satisfies the City's parking requirements. A summary of the parking re-allocation is provided in Table 26, and is further illustrated in Figure 8 (designated by the coloured parking stalls). It is noted that all parking spaces are contained within the Red Oak Village campus boundary.

Table 25: Red Oak Village Campus Parking Provision

Property	Land-use	Size ¹	Parking Required	On-Site Parking ²	Net Parking
20 Ste. Anne Road	retirement home	207 units	52		
	medical services	100 m ²	5		
	institutional use	298 m ²	15		
	sub-total		72	46	- 26 spaces
30 Ste. Anne Road	medical offices	739 m ²	37		
	general offices	2,992 m ²	100		
	sub-total		137	76	- 61 spaces
162 MacKenzie Street	medical offices	617 m ²	31		
	general offices	505 m ²	17		
	theatre	180 seats	45		
	sub-total		93	180	+ 87spaces
Total			302	302	0 spaces

¹ m² noted refers to net floor area (NFA)

² parking on-site refers to the parking supply provided within each municipal site boundary

Table 26: Parking Supply Allocation

Property	Parking Required	On-Site Parking ¹	Allocated to Other Site ²	Allocated from Other Site ³	Total Parking
20 Ste. Anne Road	72	46	-	26	72
30 Ste. Anne Road	137	76	-26	87	137
162 MacKenzie Street	93	180	-87	-	93
Total Parking	302	302	-113	+113	302

¹ parking on-site refers to the parking supply provided within the noted municipal site boundary

² refers to parking within the noted municipal site boundary that will be allocated to one of the remaining municipal sites

³ refers to parking to be allocated to the noted municipal site that is located within one of the remaining municipal sites

In consideration of the re-allocation, the following are noted:

- the required parking provision (as per the City by-law) for 20 Ste. Anne Road will be satisfied through allocation of 26 parking spaces located within 30 Ste. Anne Road to the exclusive use of

the Red Oak Villa (as illustrated in Figure 8, the dedicated parking spaces will be located adjacent to the new entrance to the Red Oak Villa expansion);

- the required parking provision for 30 Ste. Anne Road will be satisfied through allocation of 87 parking spaces located within 162 MacKenzie Street to the exclusive use of the 30 Ste. Anne Road; and
- the required parking provision for 162 MacKenzie Street will be wholly satisfied by on-site parking.

Based on the above parking review, the proposed parking supply for the Red Oak Village campus, including the subject property (30 Ste. Anne Road), satisfies the parking requirements of the City of Sudbury.

7 Summary

This study has addressed the transportation impacts associated with the proposed re-zoning of 30 Ste. Anne Road within the City of Greater Sudbury. The mixed use development will consist of 1,059 m² of medical office space and 4,237 m² of general office space (areas are noted as gross floor area). Upon re-zoning and full occupancy, the development is expected to generate a total of 130 trips during the weekday AM peak hour and 171 trips during the weekday PM peak hour.


In addressing the study area operations, the key intersections were analysed under existing conditions (2017) and for the 2018, 2023 and 2028 horizon periods. The results of the operational analysis indicate that the intersections will provide good overall conditions through 2028 under both future background and future total conditions. The site access points on MacKenzie Street and Ste. Anne Road will provide acceptable levels of service through the 2028 horizon period given the projected traffic volumes. No improvements are required to address the operations at the site access points.

The queue operations along Elgin Street were reviewed given the limited separation provided between the signalized intersections along Elgin Street. The 95th percentile queue lengths at each intersection will remain within the available separation, with the exception of the southbound thru/right movement at the intersection of Elgin Street with Elm Street which will approach the available separation length in 2028 under background conditions and exceed the available separation by 4 meters in 2028 under total conditions. Given that the Elgin Street corridor is fully built-out and constrained by the existing urban landscape, improvements to address the queue operations in 2028 will be limited to signal timing plan adjustments.

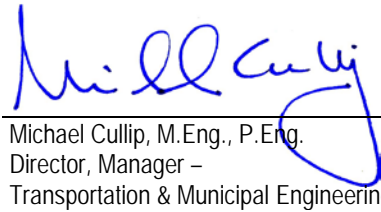
The capacity of the adjacent road network was reviewed under both background and future traffic conditions. The area road network is expected to operate below capacity through 2028. In consideration of the acceptable intersection operations and the available mid-block capacity of the road network, no improvements are recommended to accommodate the projected total volumes.

Sight lines were reviewed at the proposed site access points to ensure that adequate sight distances are provided with respect to MTO design requirements. It was determined that the sight lines along at each site access satisfy MTO requirements for the respective design speed.

The proposed parking provision for the Red Oak Village campus was reviewed in context of the City of Sudbury's parking requirement for the proposed uses. Based on the review, the proposed parking supply satisfies the City's parking requirements, as published in the *City of Greater Sudbury Zoning By-law 2010-100Z*.



Authored by: David Perks, PTP
Transportation Planner

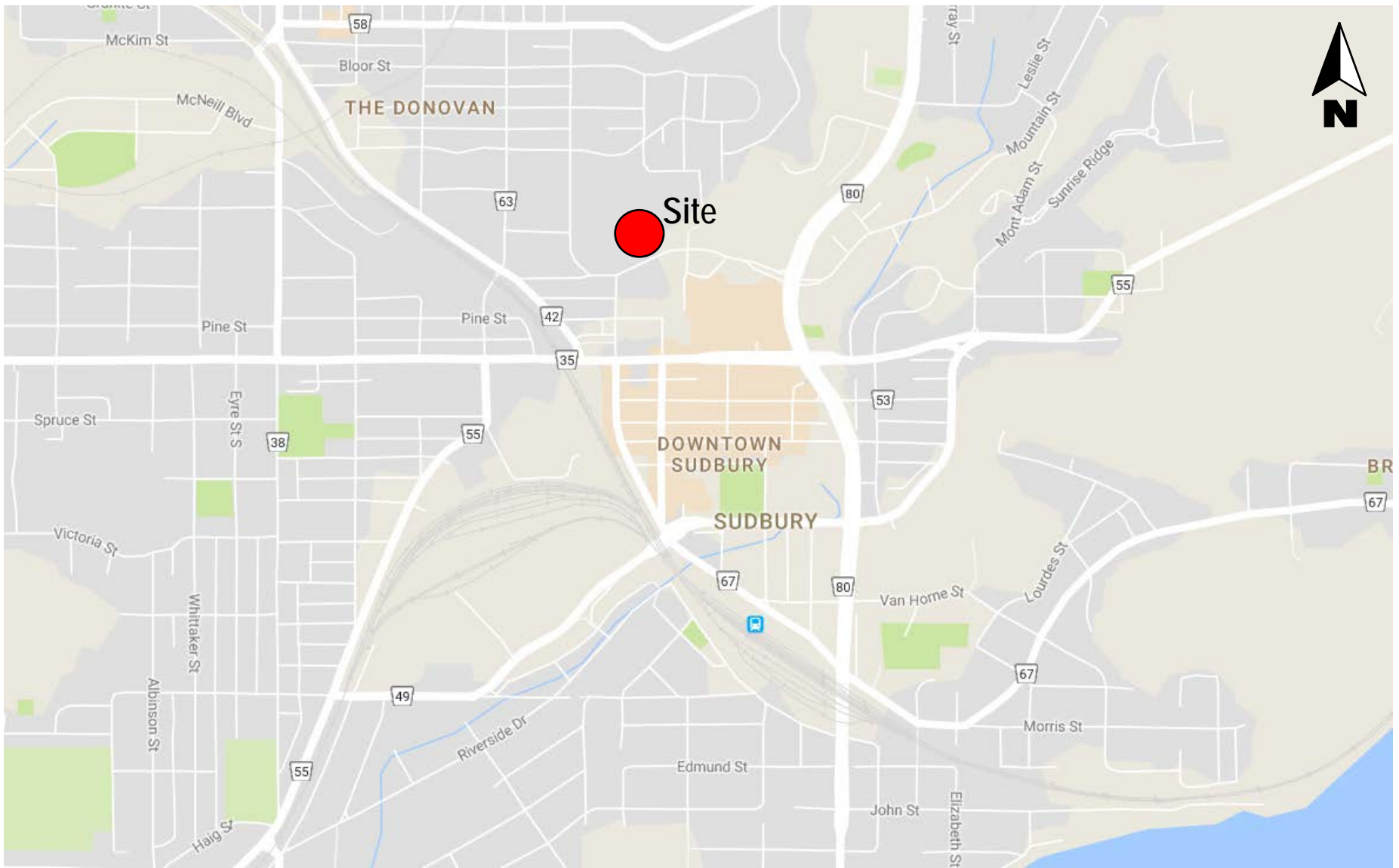


Reviewed by: Michael Cullip, M.Eng., P.Eng.
Director, Manager -
Transportation & Municipal Engineering

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source: maps.google.ca

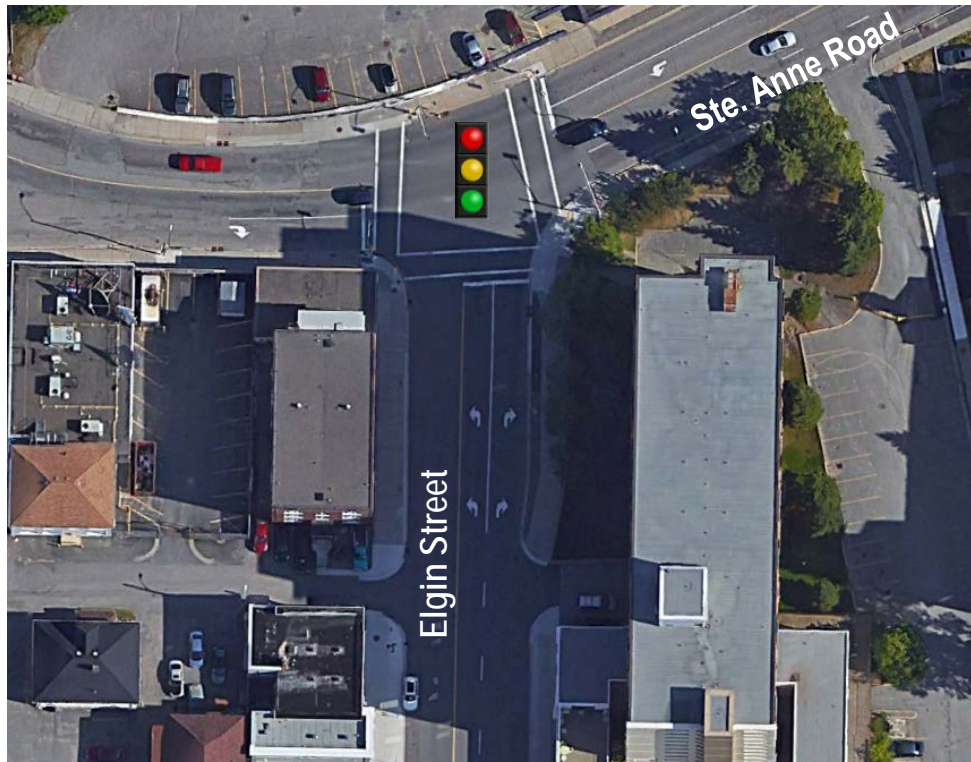


C.C. Tatham & Associates Ltd.
Consulting Engineers

30 Ste. Anne Road, Traffic Impact Study

Site Location

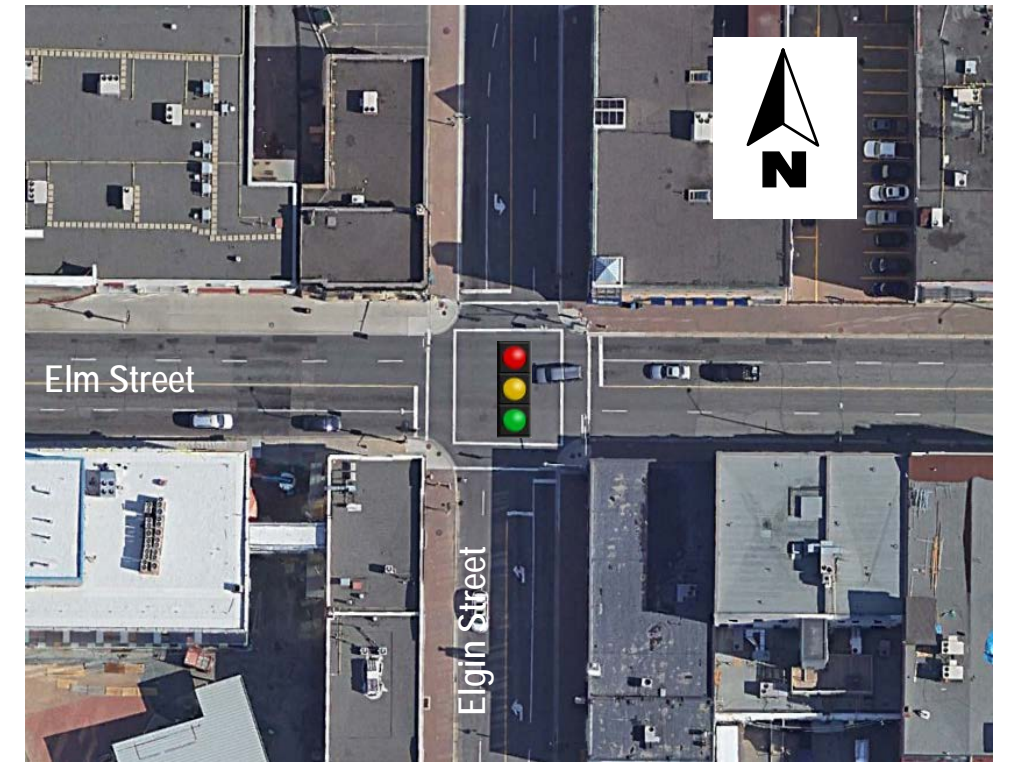
Figure
1



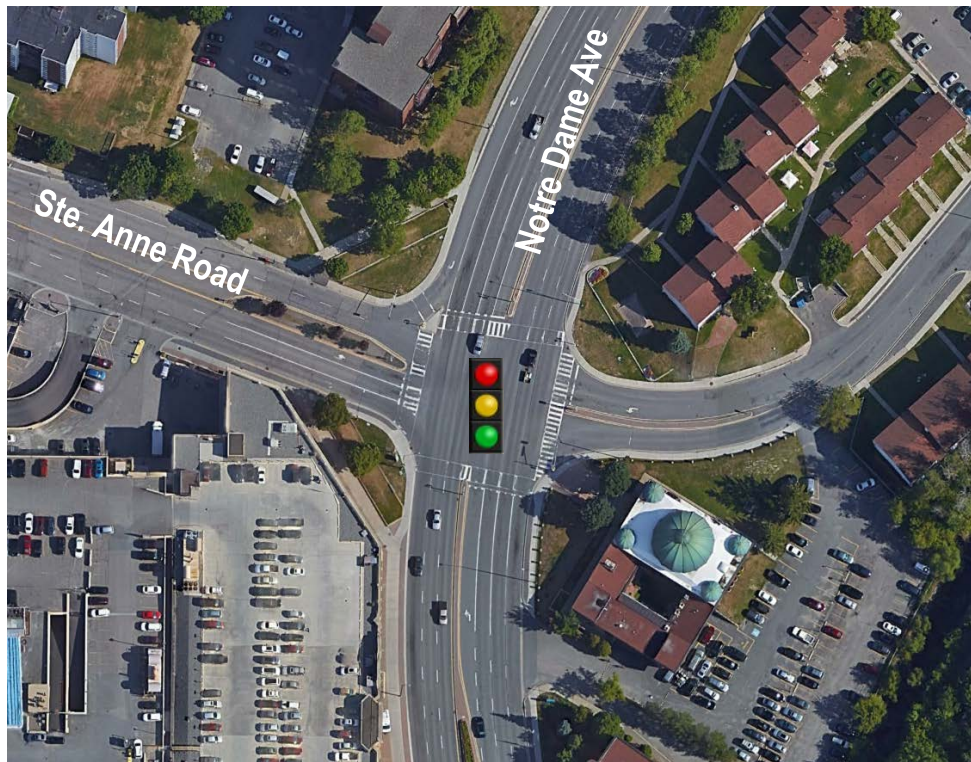
Ste. Anne Road & Elgin Street



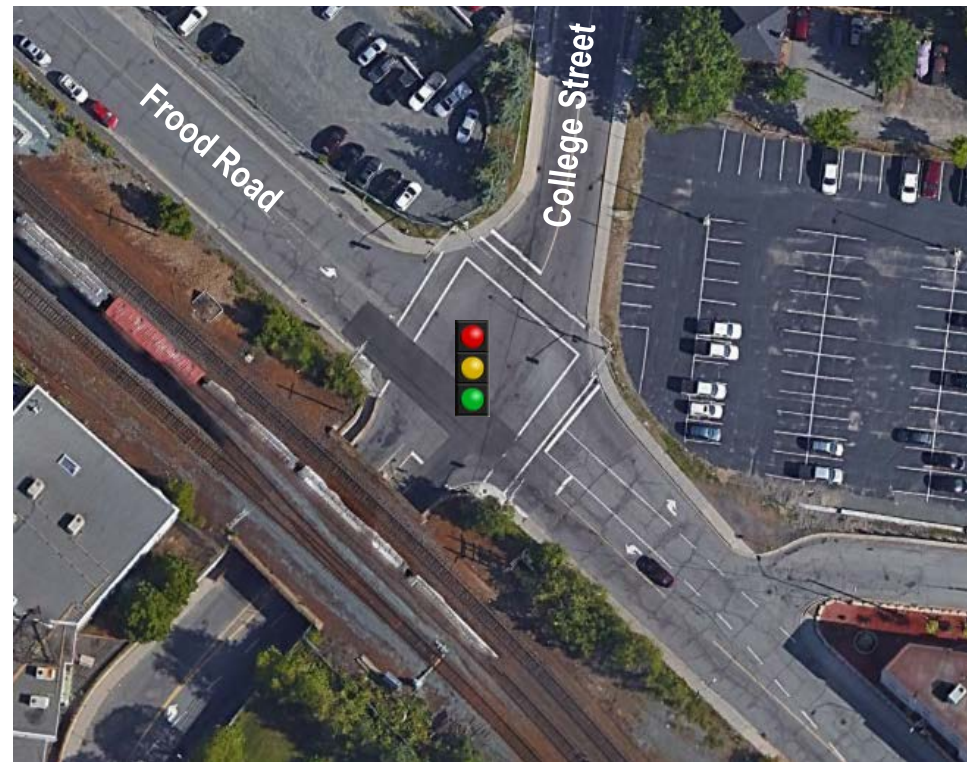
Elgin Street & Beech Street



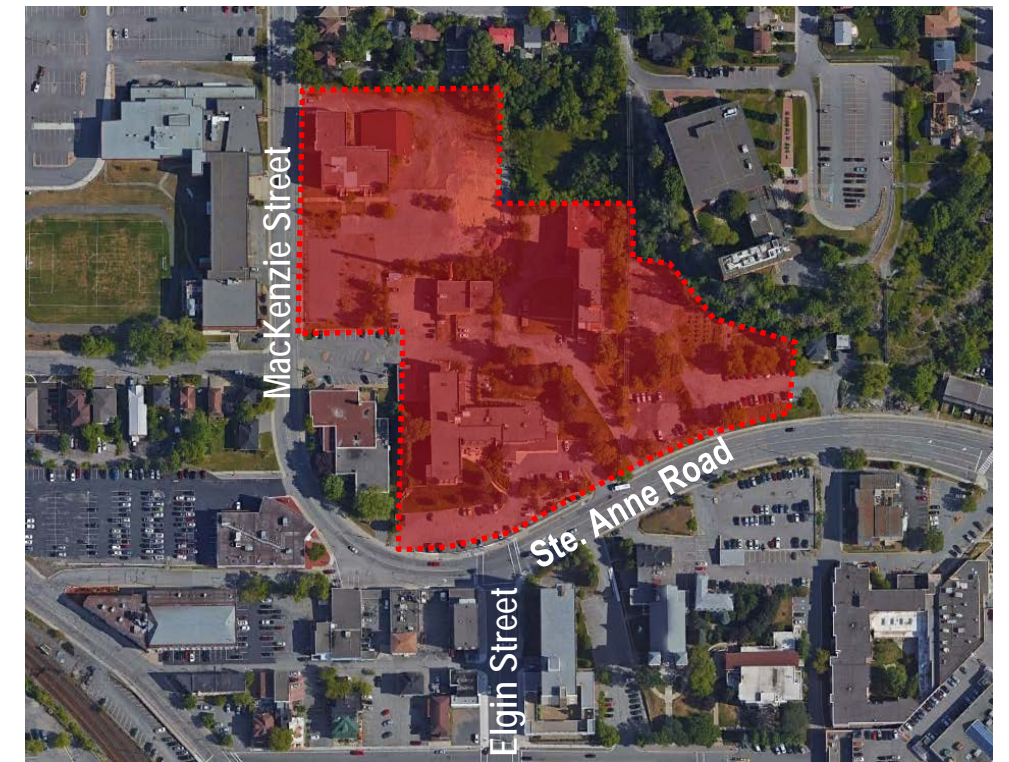
Elgin Street & Elm Street



Ste. Anne Road & Notre Dame Avenue



College Street & Froid Drive



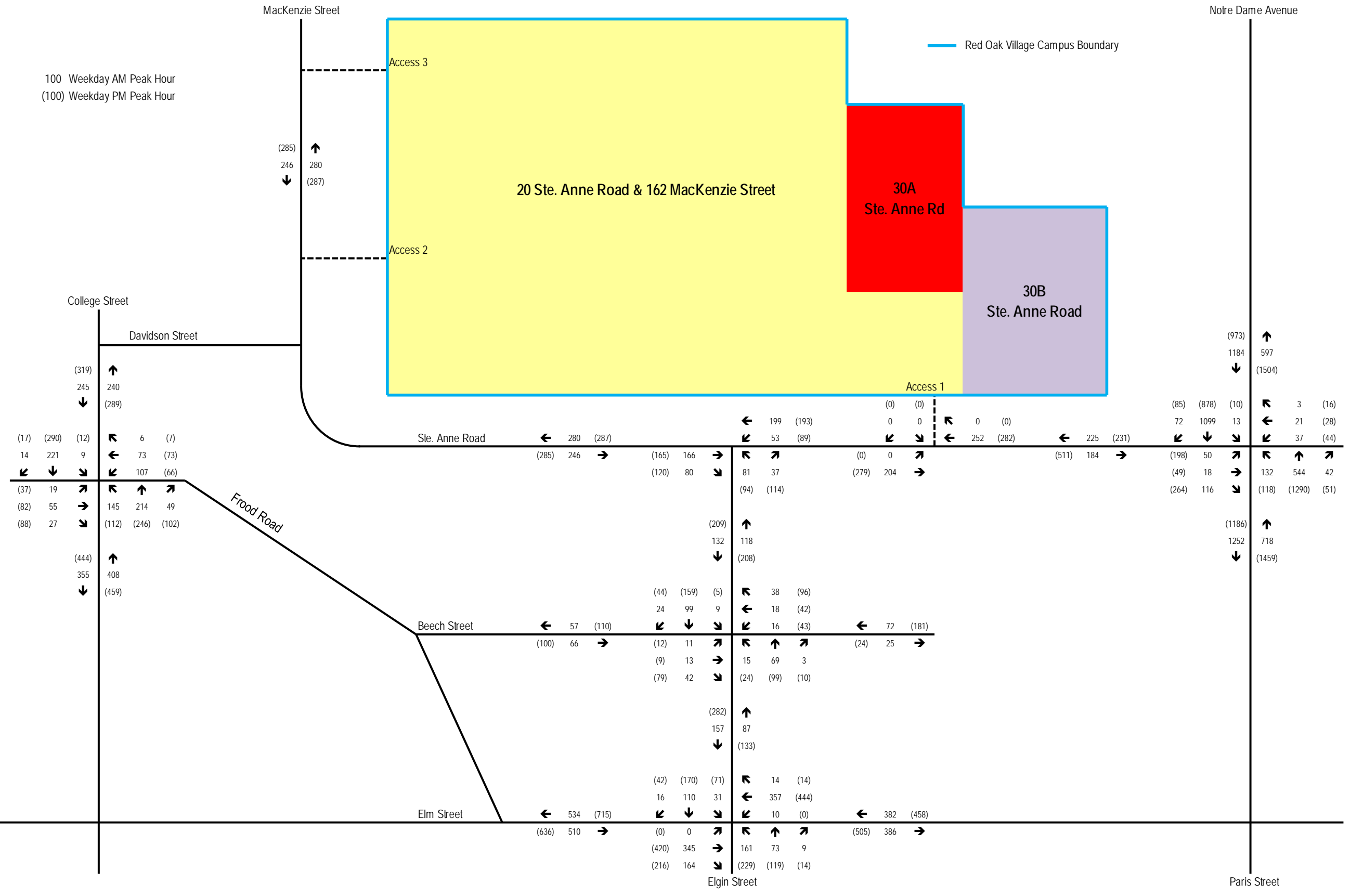
Aerial – Red Oak Village Campus

100 Weekday AM Peak Hour
(100) Weekday PM Peak Hour

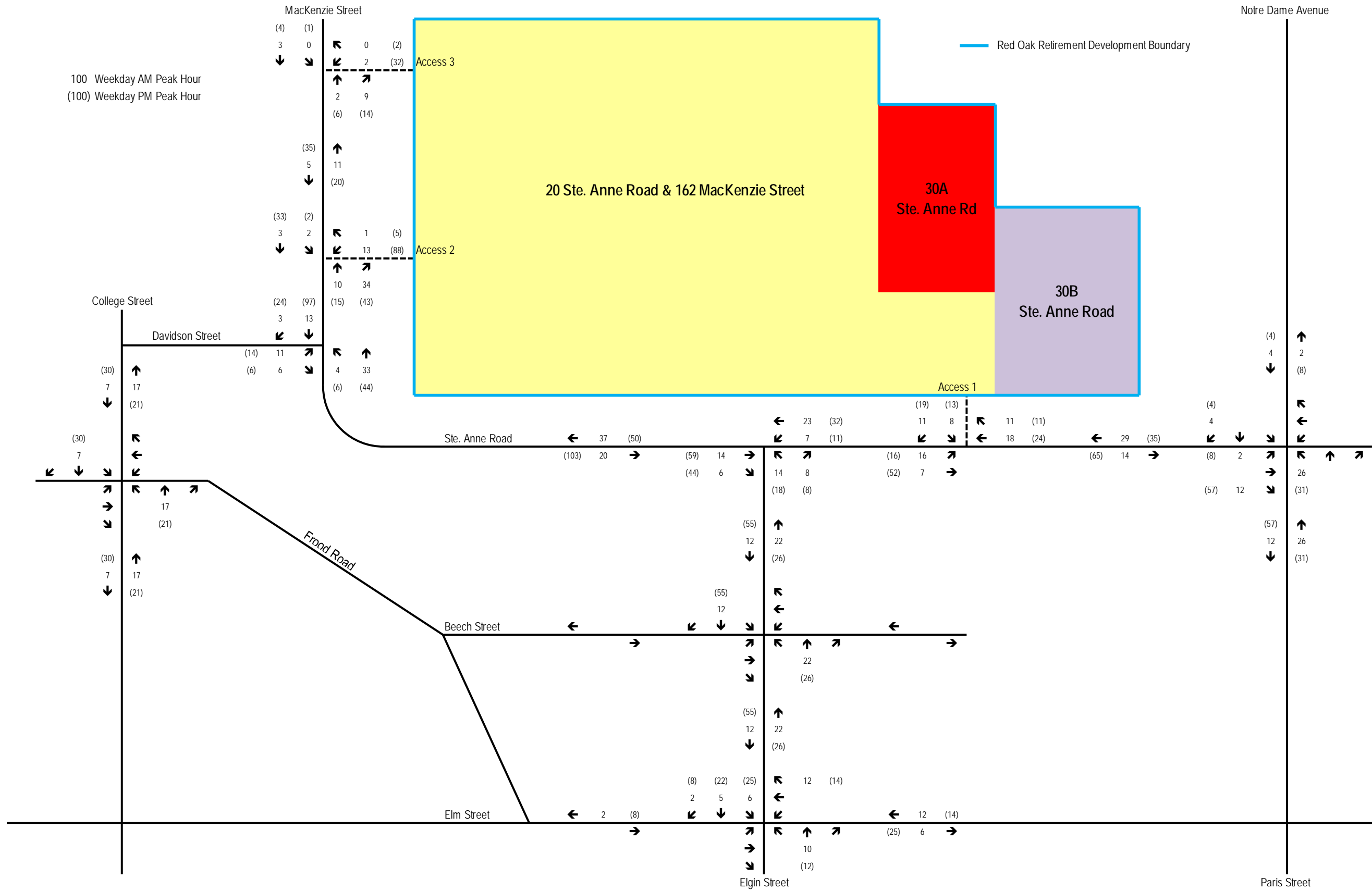
Notre Dame Avenue



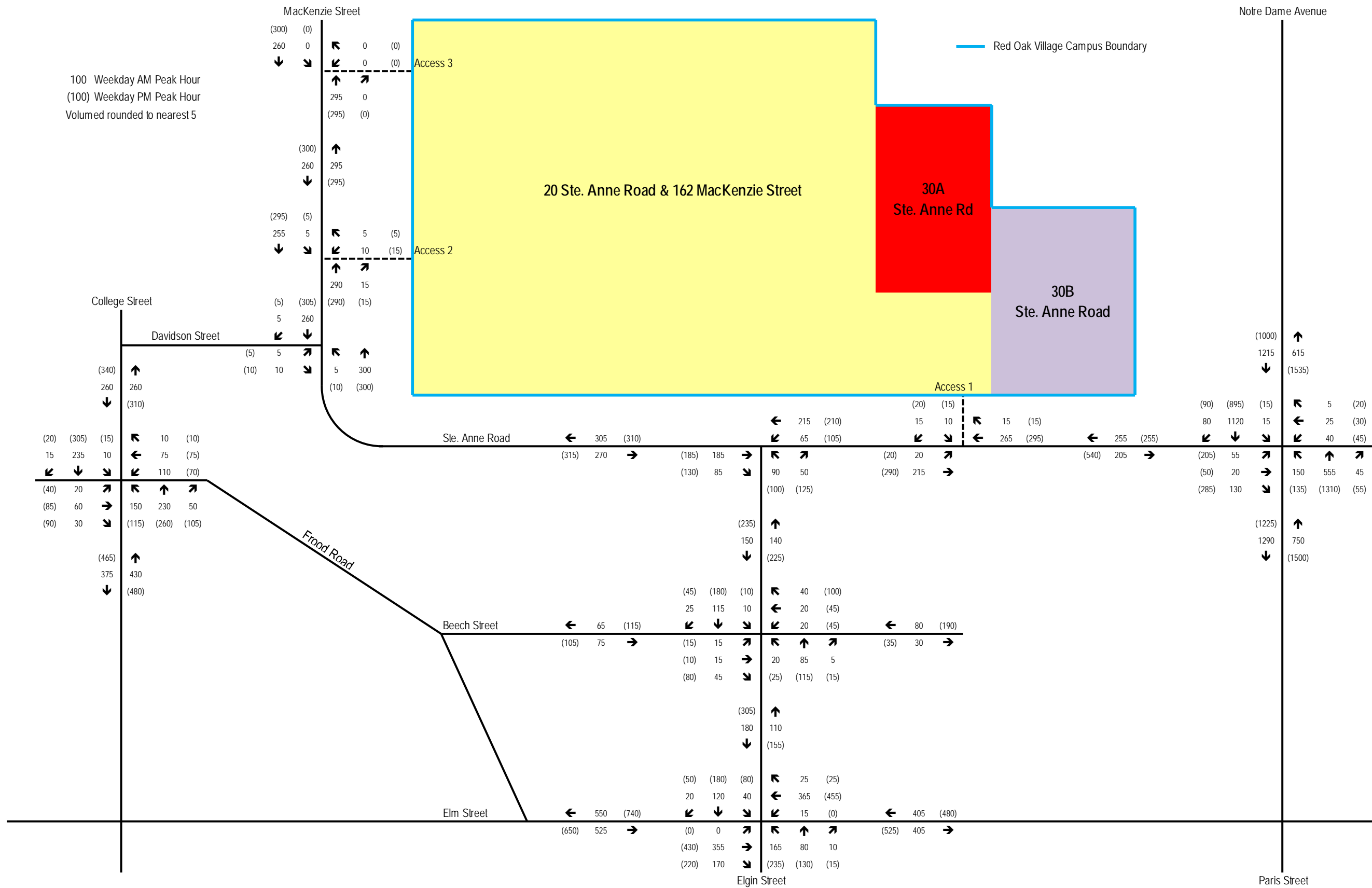
Red Oak Village Campus Boundary



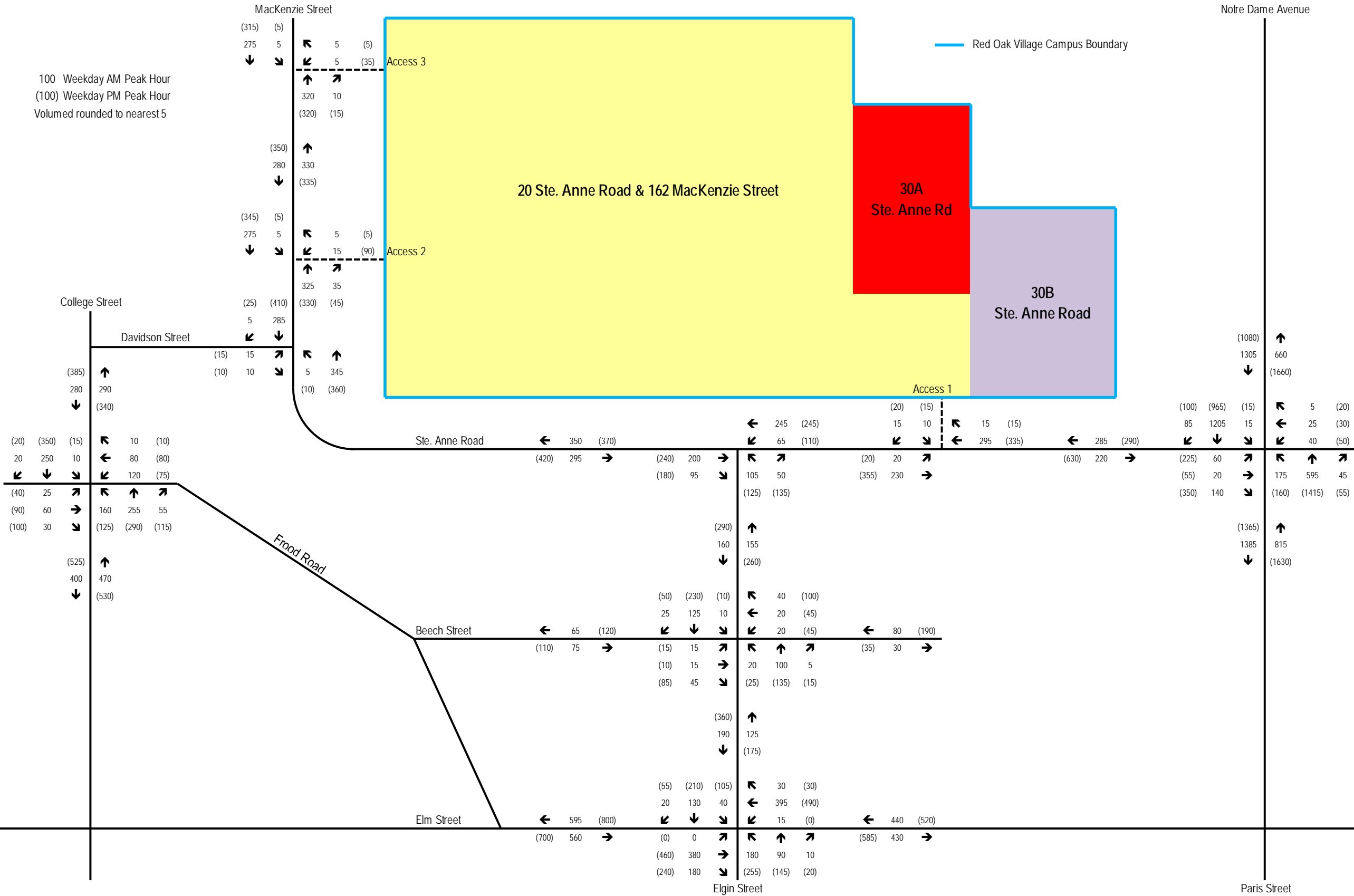
100 Weekday AM Peak Hour
 (100) Weekday PM Peak Hour



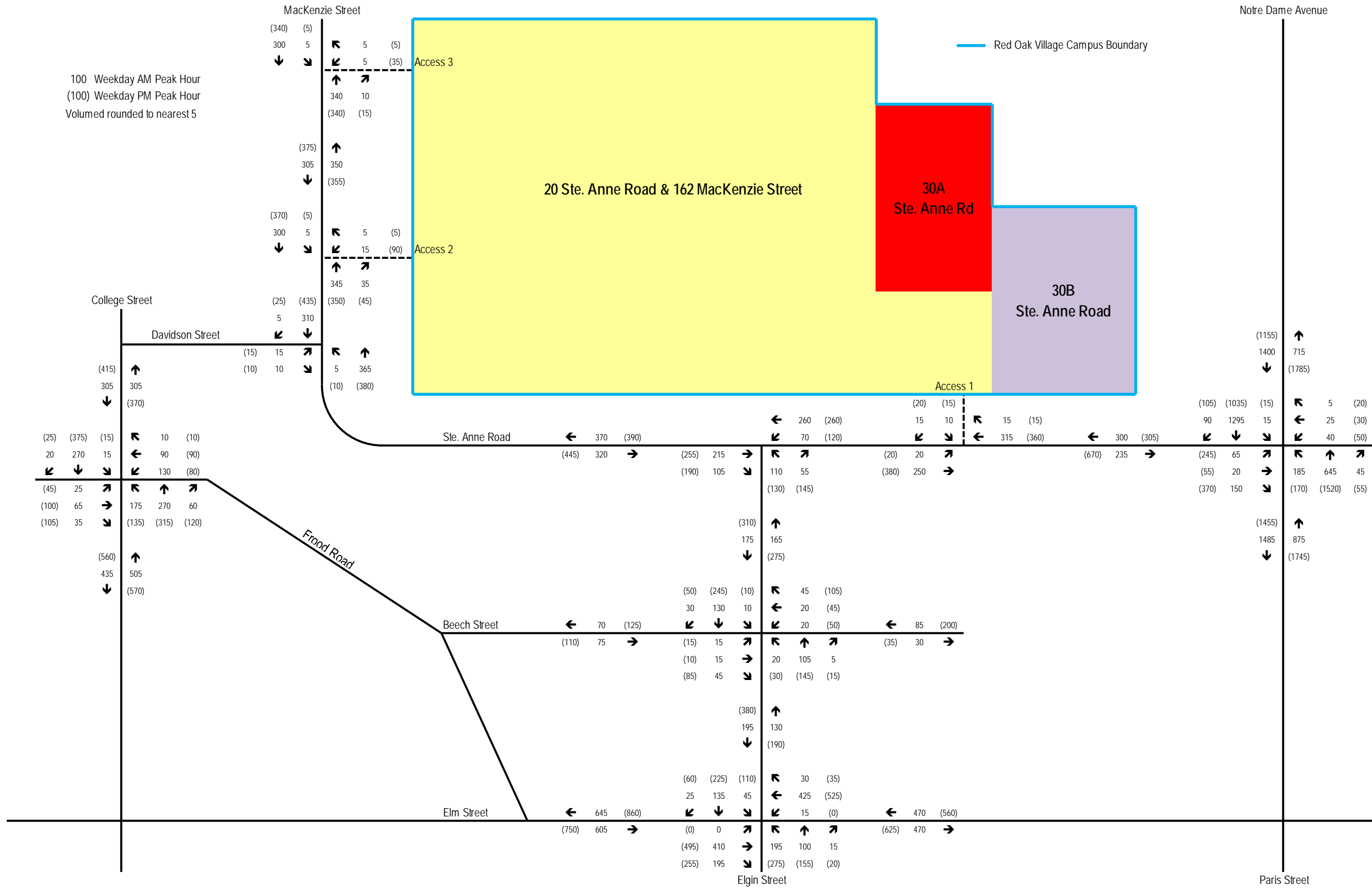
100 Weekday AM Peak Hour
 (100) Weekday PM Peak Hour
 Volumes rounded to nearest 5

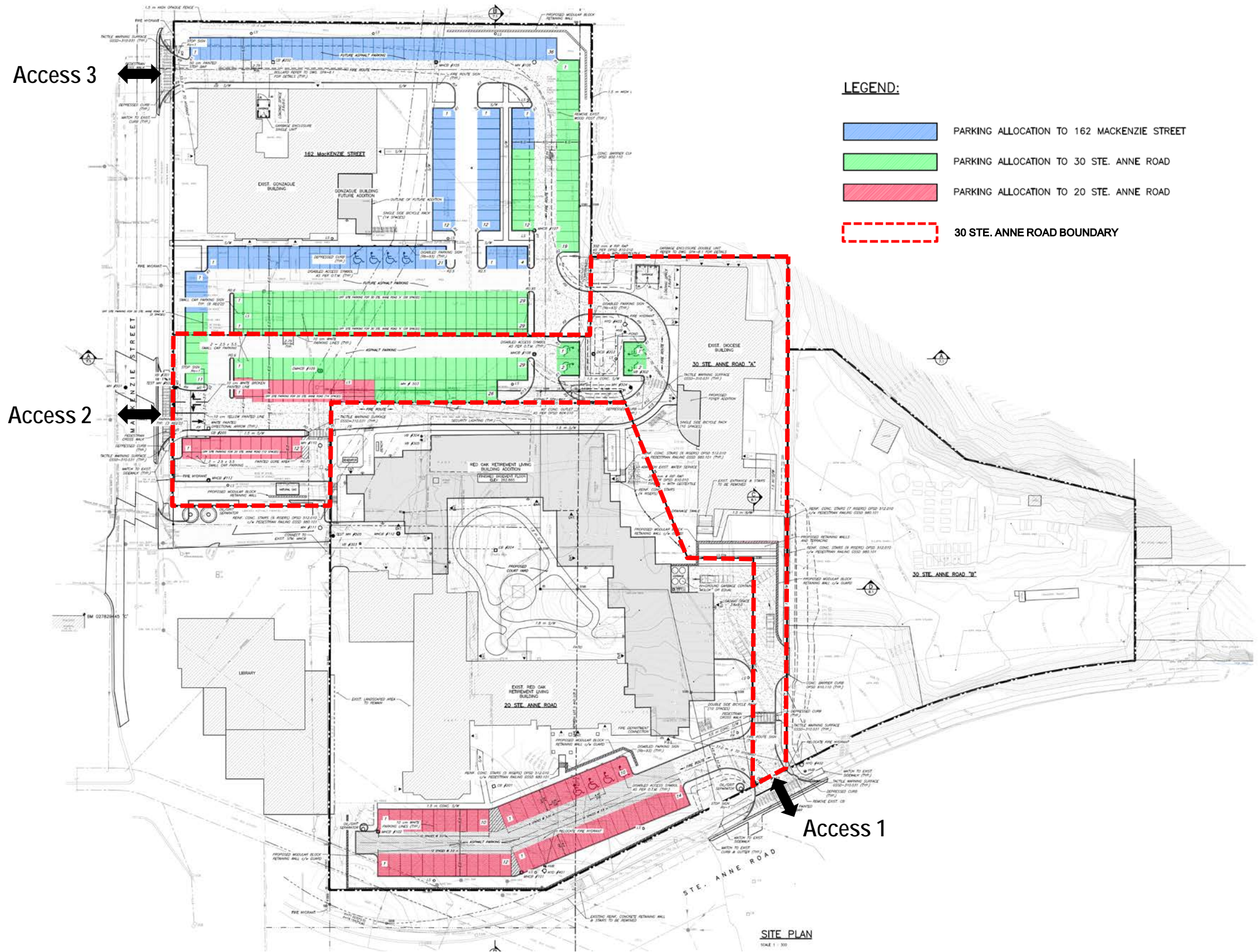


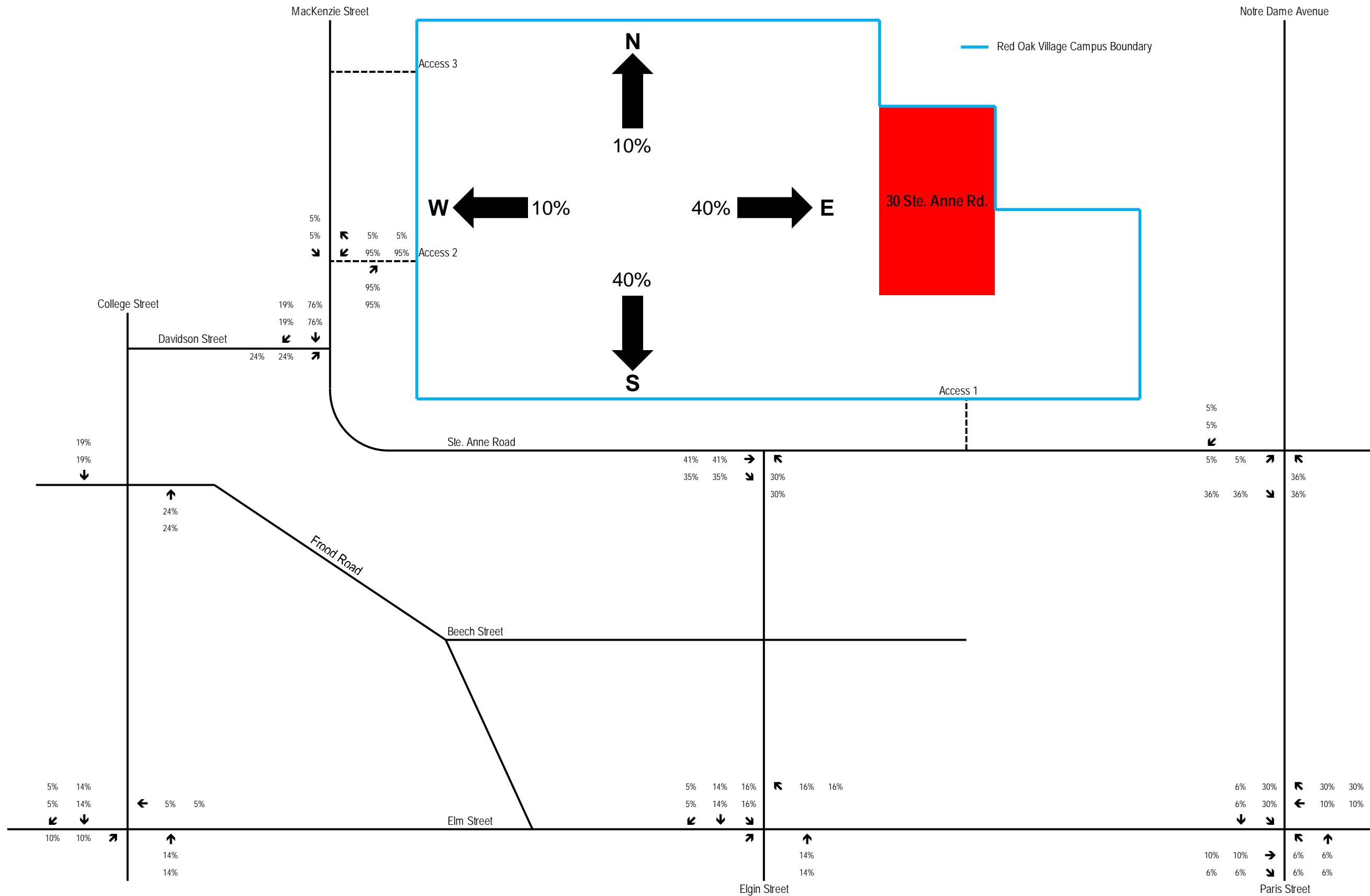
100 Weekday AM Peak Hour
 (100) Weekday PM Peak Hour
 Volumes rounded to nearest 5

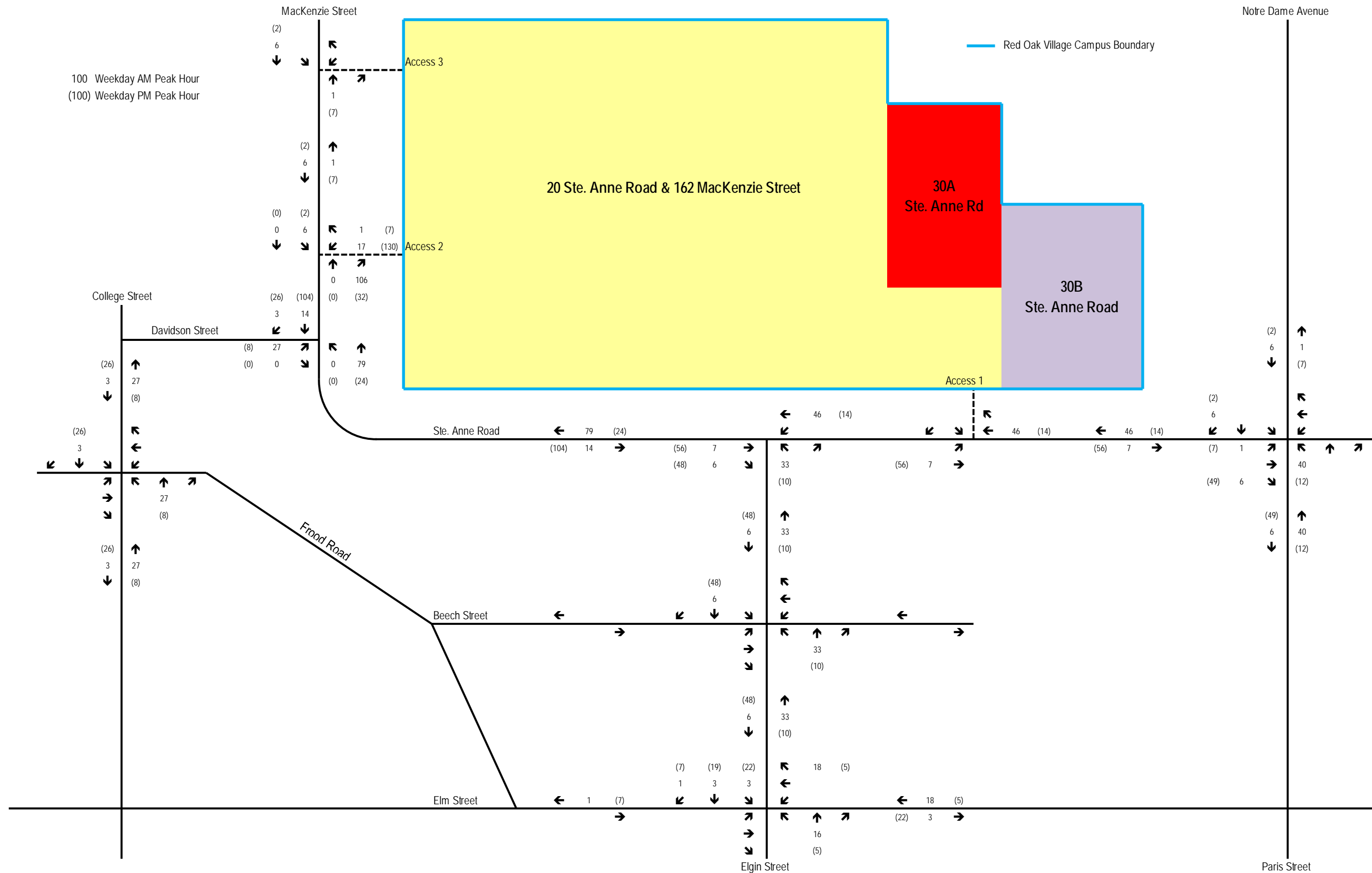


100 Weekday AM Peak Hour
 (100) Weekday PM Peak Hour
 Volumes rounded to nearest 5

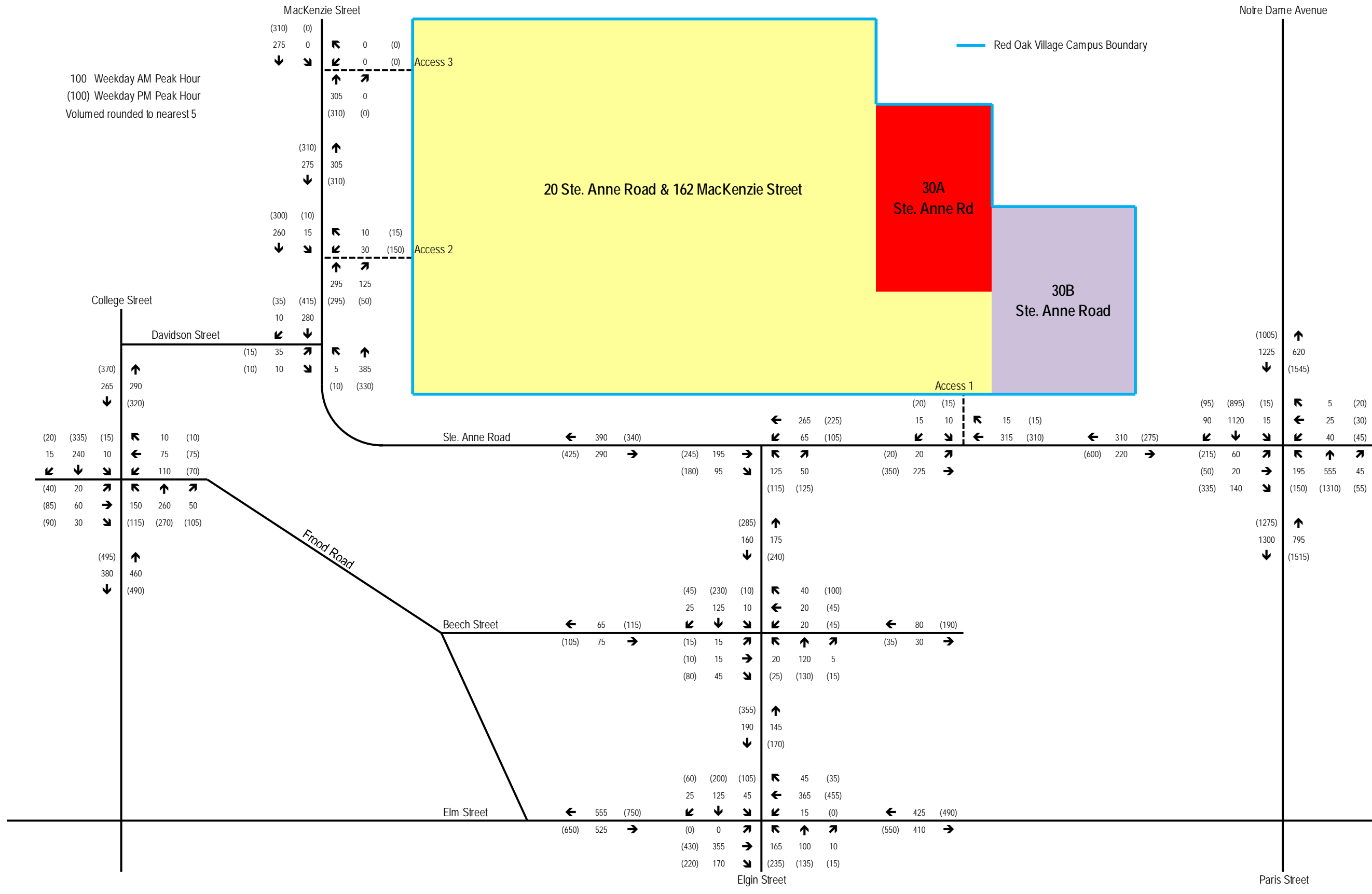




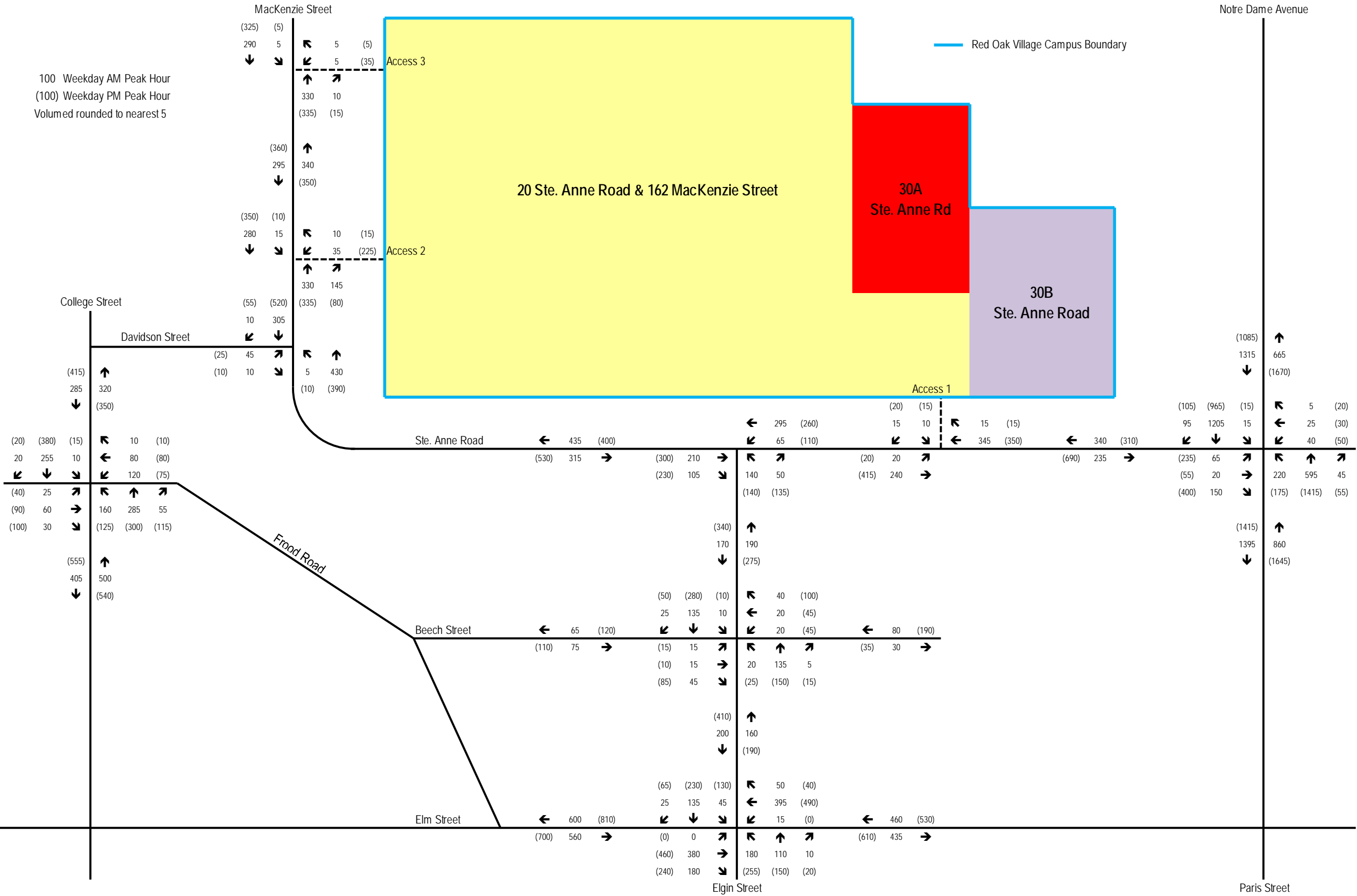




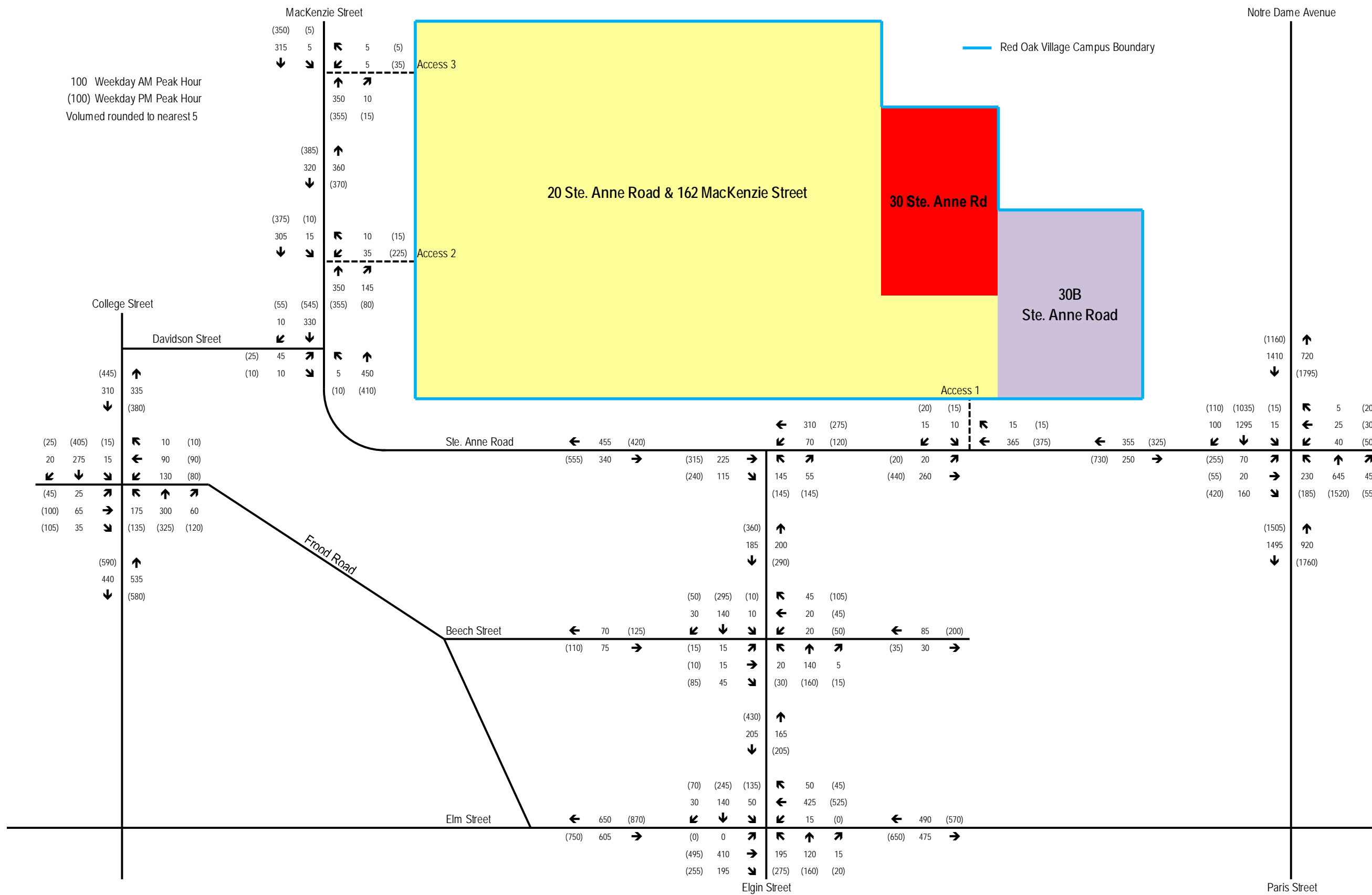
100 Weekday AM Peak Hour
 (100) Weekday PM Peak Hour
 Volumes rounded to nearest 5



100 Weekday AM Peak Hour
 (100) Weekday PM Peak Hour
 Volumes rounded to nearest 5



100 Weekday AM Peak Hour
 (100) Weekday PM Peak Hour
 Volumes rounded to nearest 5



**APPENDIX A:
TRAFFIC COUNTS**

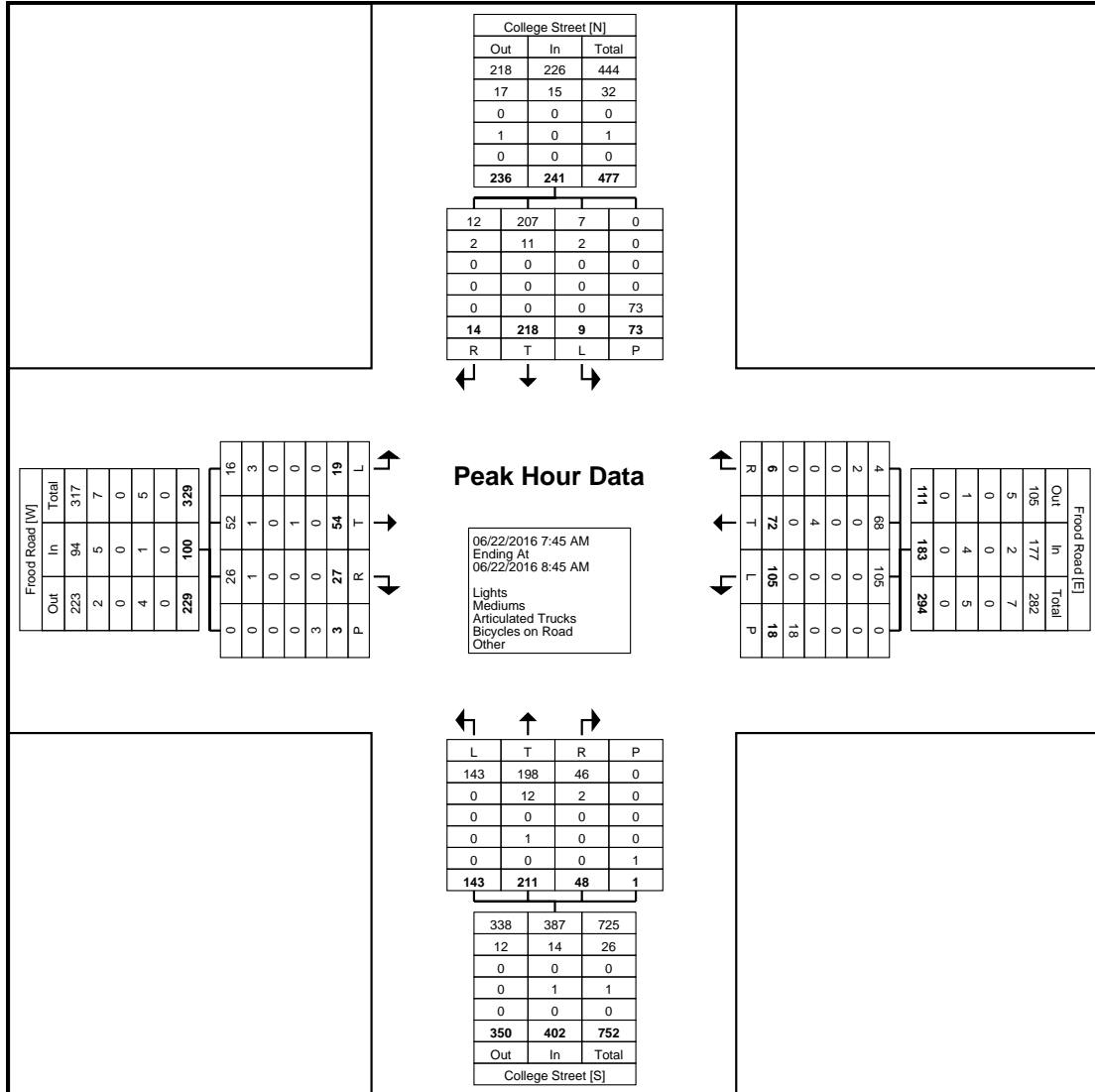


Traffic and Transportation Engineering Services
 1800 Frobisher Street
 PO Box 5000, STN A
 Sudbury, Ontario, Canada P3A 5P3
 705-674-4455

Count Name: College Street at
 Frood Road
 Site Code: 00495103
 Start Date: 06/22/2016
 Page No: 4

Turning Movement Peak Hour Data (7:45 AM)

Start Time	College Street Southbound					Frood Road Westbound					College Street Northbound					Frood Road Eastbound					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
7:45 AM	4	55	0	18	59	2	18	33	6	53	12	61	50	0	123	10	14	7	1	31	266
8:00 AM	6	40	2	10	48	3	12	19	2	34	12	56	34	1	102	6	12	5	1	23	207
8:15 AM	0	64	6	25	70	1	23	21	3	45	14	54	31	0	99	3	13	5	0	21	235
8:30 AM	4	59	1	20	64	0	19	32	7	51	10	40	28	0	78	8	15	2	1	25	218
Total	14	218	9	73	241	6	72	105	18	183	48	211	143	1	402	27	54	19	3	100	926
Approach %	5.8	90.5	3.7	-	-	3.3	39.3	57.4	-	-	11.9	52.5	35.6	-	-	27.0	54.0	19.0	-	-	-
Total %	1.5	23.5	1.0	-	26.0	0.6	7.8	11.3	-	19.8	5.2	22.8	15.4	-	43.4	2.9	5.8	2.1	-	10.8	-
PHF	0.583	0.852	0.375	-	0.861	0.500	0.783	0.795	-	0.863	0.857	0.865	0.715	-	0.817	0.675	0.900	0.679	-	0.806	0.870
Lights	12	207	7	-	226	4	68	105	-	177	46	198	143	-	387	26	52	16	-	94	884
% Lights	85.7	95.0	77.8	-	93.8	66.7	94.4	100.0	-	96.7	95.8	93.8	100.0	-	96.3	96.3	96.3	84.2	-	94.0	95.5
Mediums	2	11	2	-	15	2	0	0	-	2	2	12	0	-	14	1	1	3	-	5	36
% Mediums	14.3	5.0	22.2	-	6.2	33.3	0.0	0.0	-	1.1	4.2	5.7	0.0	-	3.5	3.7	1.9	15.8	-	5.0	3.9
Articulated Trucks	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
% Articulated Trucks	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	0.0	0.0
Bicycles on Road	0	0	0	-	0	0	4	0	-	4	0	1	0	-	1	0	1	0	-	1	6
% Bicycles on Road	0.0	0.0	0.0	-	0.0	0.0	5.6	0.0	-	2.2	0.0	0.5	0.0	-	0.2	0.0	1.9	0.0	-	1.0	0.6
Bicycles on Crosswalk	-	-	-	5	-	-	-	-	1	-	-	-	-	0	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	6.8	-	-	-	-	5.6	-	-	-	-	0.0	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	68	-	-	-	-	17	-	-	-	-	1	-	-	-	-	3	-	-
% Pedestrians	-	-	-	93.2	-	-	-	-	94.4	-	-	-	-	100.0	-	-	-	-	100.0	-	-



Turning Movement Peak Hour Data Plot (7:45 AM)

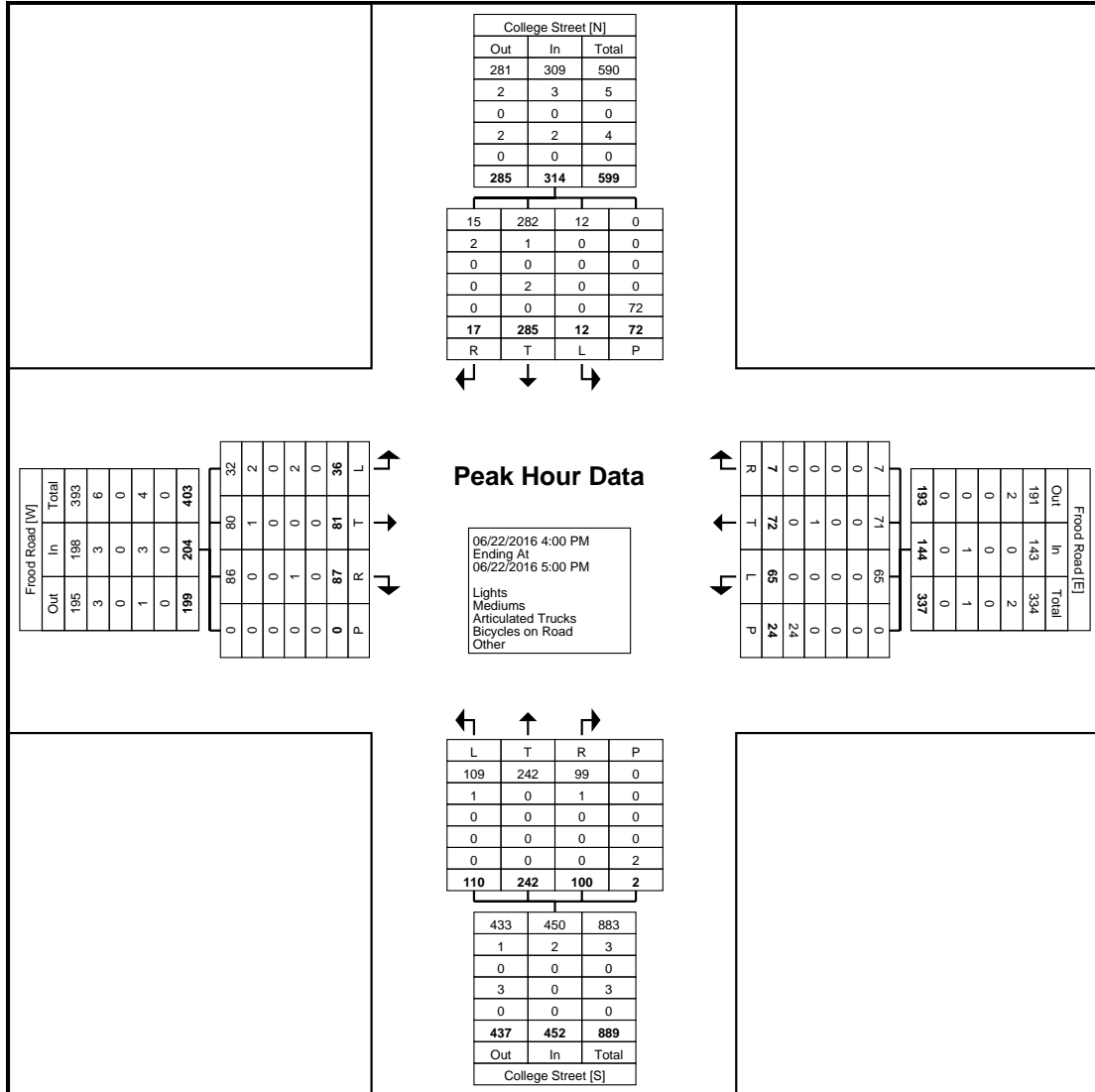


Traffic and Transportation Engineering Services
 1800 Frobisher Street
 PO Box 5000, STN A
 Sudbury, Ontario, Canada P3A 5P3
 705-674-4455

Count Name: College Street at
 Frood Road
 Site Code: 00495103
 Start Date: 06/22/2016
 Page No: 8

Turning Movement Peak Hour Data (4:00 PM)

Start Time	College Street Southbound					Frood Road Westbound					College Street Northbound					Frood Road Eastbound					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
4:00 PM	4	74	4	16	82	1	15	25	6	41	29	69	32	1	130	28	20	9	0	57	310
4:15 PM	4	80	2	9	86	4	15	11	4	30	18	41	17	0	76	22	19	13	0	54	246
4:30 PM	6	65	2	19	73	0	21	15	7	36	32	62	34	1	128	23	23	9	0	55	292
4:45 PM	3	66	4	28	73	2	21	14	7	37	21	70	27	0	118	14	19	5	0	38	266
Total	17	285	12	72	314	7	72	65	24	144	100	242	110	2	452	87	81	36	0	204	1114
Approach %	5.4	90.8	3.8	-	-	4.9	50.0	45.1	-	-	22.1	53.5	24.3	-	-	42.6	39.7	17.6	-	-	-
Total %	1.5	25.6	1.1	-	28.2	0.6	6.5	5.8	-	12.9	9.0	21.7	9.9	-	40.6	7.8	7.3	3.2	-	18.3	-
PHF	0.708	0.891	0.750	-	0.913	0.438	0.857	0.650	-	0.878	0.781	0.864	0.809	-	0.869	0.777	0.880	0.692	-	0.895	0.898
Lights	15	282	12	-	309	7	71	65	-	143	99	242	109	-	450	86	80	32	-	198	1100
% Lights	88.2	98.9	100.0	-	98.4	100.0	98.6	100.0	-	99.3	99.0	100.0	99.1	-	99.6	98.9	98.8	88.9	-	97.1	98.7
Mediums	2	1	0	-	3	0	0	0	-	0	1	0	1	-	2	0	1	2	-	3	8
% Mediums	11.8	0.4	0.0	-	1.0	0.0	0.0	0.0	-	0.0	1.0	0.0	0.9	-	0.4	0.0	1.2	5.6	-	1.5	0.7
Articulated Trucks	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
% Articulated Trucks	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	0.0	0.0
Bicycles on Road	0	2	0	-	2	0	1	0	-	1	0	0	0	-	0	1	0	2	-	3	6
% Bicycles on Road	0.0	0.7	0.0	-	0.6	0.0	1.4	0.0	-	0.7	0.0	0.0	0.0	-	0.0	1.1	0.0	5.6	-	1.5	0.5
Bicycles on Crosswalk	-	-	-	0	-	-	-	-	3	-	-	-	-	0	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	0.0	-	-	-	-	12.5	-	-	-	-	0.0	-	-	-	-	-	-	-
Pedestrians	-	-	-	72	-	-	-	-	21	-	-	-	-	2	-	-	-	-	0	-	-
% Pedestrians	-	-	-	100.0	-	-	-	-	87.5	-	-	-	-	100.0	-	-	-	-	-	-	-



Turning Movement Peak Hour Data Plot (4:00 PM)

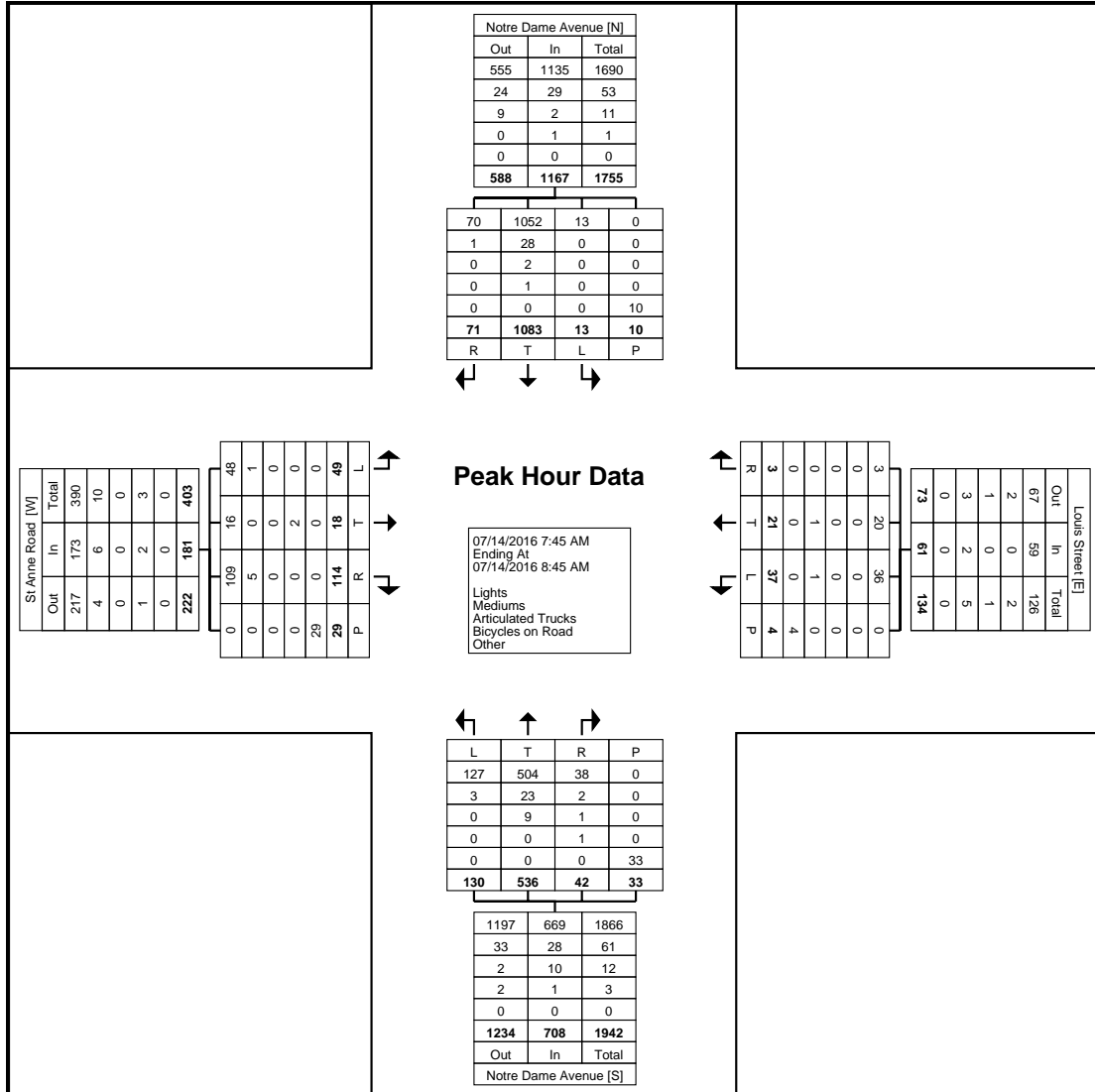


Traffic and Transportation Engineering Services
 1800 Frobisher Street
 PO Box 5000, STN A
 Sudbury, Ontario, Canada P3A 5P3
 705-674-4455

Count Name: Louis Street at
 Notre Dame Avenue & Ste Anne
 Road
 Site Code: 00523103
 Start Date: 07/13/2016
 Page No: 8

Turning Movement Peak Hour Data (7:45 AM)

Start Time	Notre Dame Avenue Southbound					Louis Street Westbound					Notre Dame Avenue Northbound					St Anne Road Eastbound					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
7:45 AM	13	262	3	0	278	1	6	9	0	16	9	152	31	6	192	35	3	13	7	51	537
8:00 AM	8	293	3	1	304	1	4	9	0	14	12	109	26	11	147	25	4	8	6	37	502
8:15 AM	19	270	3	8	292	1	5	10	2	16	8	138	41	10	187	21	5	17	12	43	538
8:30 AM	31	258	4	1	293	0	6	9	2	15	13	137	32	6	182	33	6	11	4	50	540
Total	71	1083	13	10	1167	3	21	37	4	61	42	536	130	33	708	114	18	49	29	181	2117
Approach %	6.1	92.8	1.1	-	-	4.9	34.4	60.7	-	-	5.9	75.7	18.4	-	-	63.0	9.9	27.1	-	-	-
Total %	3.4	51.2	0.6	-	55.1	0.1	1.0	1.7	-	2.9	2.0	25.3	6.1	-	33.4	5.4	0.9	2.3	-	8.5	-
PHF	0.573	0.924	0.813	-	0.960	0.750	0.875	0.925	-	0.953	0.808	0.882	0.793	-	0.922	0.814	0.750	0.721	-	0.887	0.980
Lights	70	1052	13	-	1135	3	20	36	-	59	38	504	127	-	669	109	16	48	-	173	2036
% Lights	98.6	97.1	100.0	-	97.3	100.0	95.2	97.3	-	96.7	90.5	94.0	97.7	-	94.5	95.6	88.9	98.0	-	95.6	96.2
Mediums	1	28	0	-	29	0	0	0	-	0	2	23	3	-	28	5	0	1	-	6	63
% Mediums	1.4	2.6	0.0	-	2.5	0.0	0.0	0.0	-	0.0	4.8	4.3	2.3	-	4.0	4.4	0.0	2.0	-	3.3	3.0
Articulated Trucks	0	2	0	-	2	0	0	0	-	0	1	9	0	-	10	0	0	0	-	0	12
% Articulated Trucks	0.0	0.2	0.0	-	0.2	0.0	0.0	0.0	-	0.0	2.4	1.7	0.0	-	1.4	0.0	0.0	0.0	-	0.0	0.6
Bicycles on Road	0	1	0	-	1	0	1	1	-	2	1	0	0	-	1	0	2	0	-	2	6
% Bicycles on Road	0.0	0.1	0.0	-	0.1	0.0	4.8	2.7	-	3.3	2.4	0.0	0.0	-	0.1	0.0	11.1	0.0	-	1.1	0.3
Bicycles on Crosswalk	-	-	-	0	-	-	-	-	0	-	-	-	-	1	-	-	-	-	-	3	-
% Bicycles on Crosswalk	-	-	-	0.0	-	-	-	-	0.0	-	-	-	-	3.0	-	-	-	-	-	10.3	-
Pedestrians	-	-	-	10	-	-	-	-	4	-	-	-	-	32	-	-	-	-	-	26	-
% Pedestrians	-	-	-	100.0	-	-	-	-	100.0	-	-	-	-	97.0	-	-	-	-	-	89.7	-



Turning Movement Peak Hour Data Plot (7:45 AM)



Traffic and Transportation Engineering Services
 1800 Frobisher Street
 PO Box 5000, STN A
 Sudbury, Ontario, Canada P3A 5P3
 705-674-4455

Count Name: Louis Street at
 Notre Dame Avenue & Ste Anne
 Road
 Site Code: 00523103
 Start Date: 07/13/2016
 Page No: 6

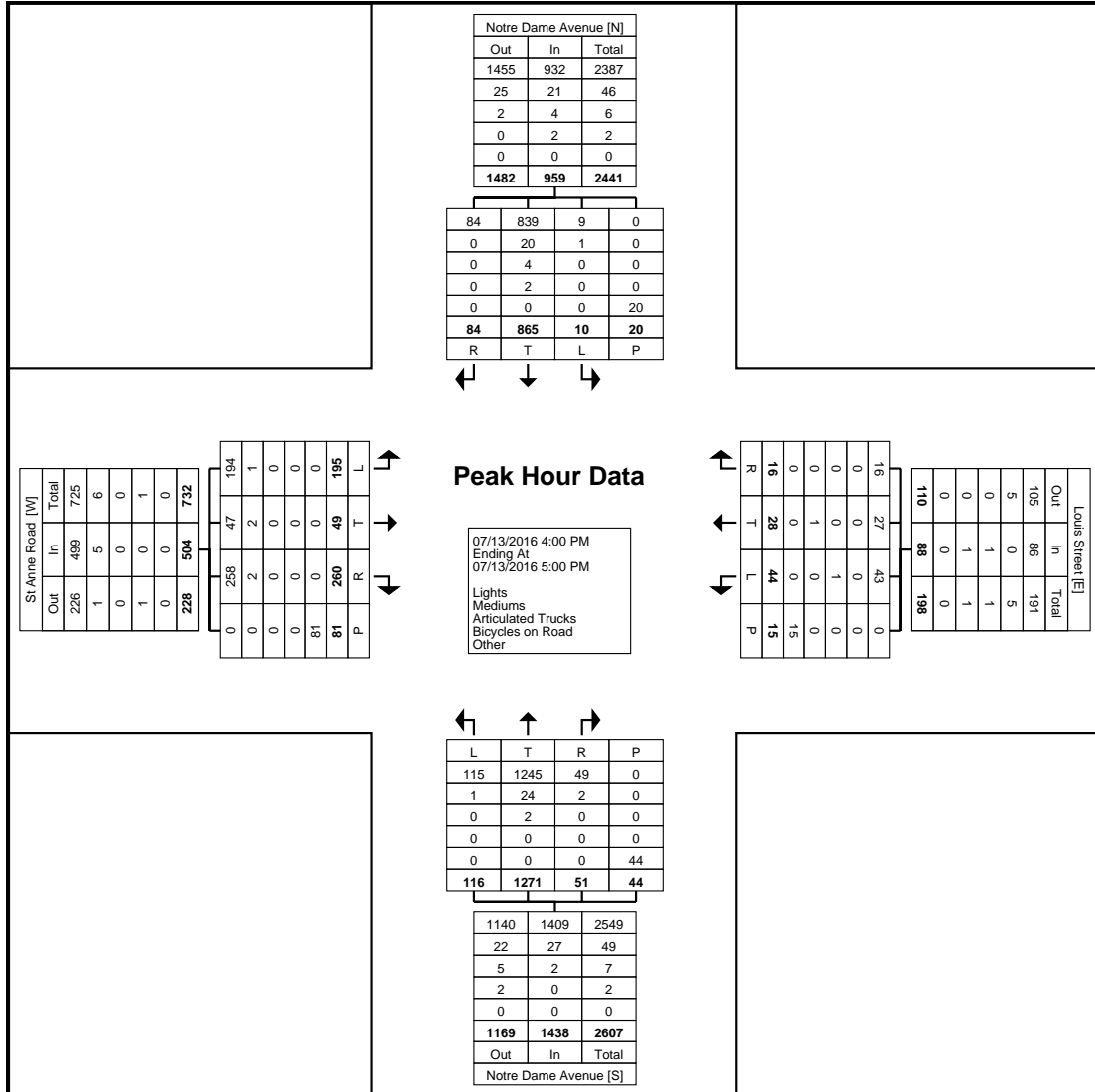
Turning Movement Peak Hour Data (4:00 PM)

Start Time	Notre Dame Avenue Southbound					Louis Street Westbound					Notre Dame Avenue Northbound					St Anne Road Eastbound					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
4:00 PM	30	224	2	6	256	7	6	16	8	29	12	331	29	7	372	79	16	68	26	163	820
4:15 PM	23	214	2	1	239	1	5	10	2	16	14	370	35	20	419	51	14	34	16	99	773
4:30 PM	18	217	5	12	240	2	8	12	4	22	13	264	26	13	303	76	12	62	26	150	715
4:45 PM	13	210	1	1	224	6	9	6	1	21	12	306	26	4	344	54	7	31	13	92	681
Total	84	865	10	20	959	16	28	44	15	88	51	1271	116	44	1438	260	49	195	81	504	2989
Approach %	8.8	90.2	1.0	-	-	18.2	31.8	50.0	-	-	3.5	88.4	8.1	-	-	51.6	9.7	38.7	-	-	-
Total %	2.8	28.9	0.3	-	32.1	0.5	0.9	1.5	-	2.9	1.7	42.5	3.9	-	48.1	8.7	1.6	6.5	-	16.9	-
PHF	0.700	0.965	0.500	-	0.937	0.571	0.778	0.688	-	0.759	0.911	0.859	0.829	-	0.858	0.823	0.766	0.717	-	0.773	0.911
Lights	84	839	9	-	932	16	27	43	-	86	49	1245	115	-	1409	258	47	194	-	499	2926
% Lights	100.0	97.0	90.0	-	97.2	100.0	96.4	97.7	-	97.7	96.1	98.0	99.1	-	98.0	99.2	95.9	99.5	-	99.0	97.9
Mediums	0	20	1	-	21	0	0	0	-	0	2	24	1	-	27	2	2	1	-	5	53
% Mediums	0.0	2.3	10.0	-	2.2	0.0	0.0	0.0	-	0.0	3.9	1.9	0.9	-	1.9	0.8	4.1	0.5	-	1.0	1.8
Articulated Trucks	0	4	0	-	4	0	0	1	-	1	0	2	0	-	2	0	0	0	-	0	7
% Articulated Trucks	0.0	0.5	0.0	-	0.4	0.0	0.0	2.3	-	1.1	0.0	0.2	0.0	-	0.1	0.0	0.0	0.0	-	0.0	0.2
Bicycles on Road	0	2	0	-	2	0	1	0	-	1	0	0	0	-	0	0	0	0	-	0	3
% Bicycles on Road	0.0	0.2	0.0	-	0.2	0.0	3.6	0.0	-	1.1	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	0.0	0.1
Bicycles on Crosswalk	-	-	-	2	-	-	-	-	1	-	-	-	-	6	-	-	-	-	9	-	-
% Bicycles on Crosswalk	-	-	-	10.0	-	-	-	-	6.7	-	-	-	-	13.6	-	-	-	-	11.1	-	-
Pedestrians	-	-	-	18	-	-	-	-	14	-	-	-	-	38	-	-	-	-	72	-	-
% Pedestrians	-	-	-	90.0	-	-	-	-	93.3	-	-	-	-	86.4	-	-	-	-	88.9	-	-



Traffic and Transportation Engineering Services
 1800 Frobisher Street
 PO Box 5000, STN A
 Sudbury, Ontario, Canada P3A 5P3
 705-674-4455

Count Name: Louis Street at
 Notre Dame Avenue & Ste Anne
 Road
 Site Code: 00523103
 Start Date: 07/13/2016
 Page No: 7



Turning Movement Peak Hour Data Plot (4:00 PM)

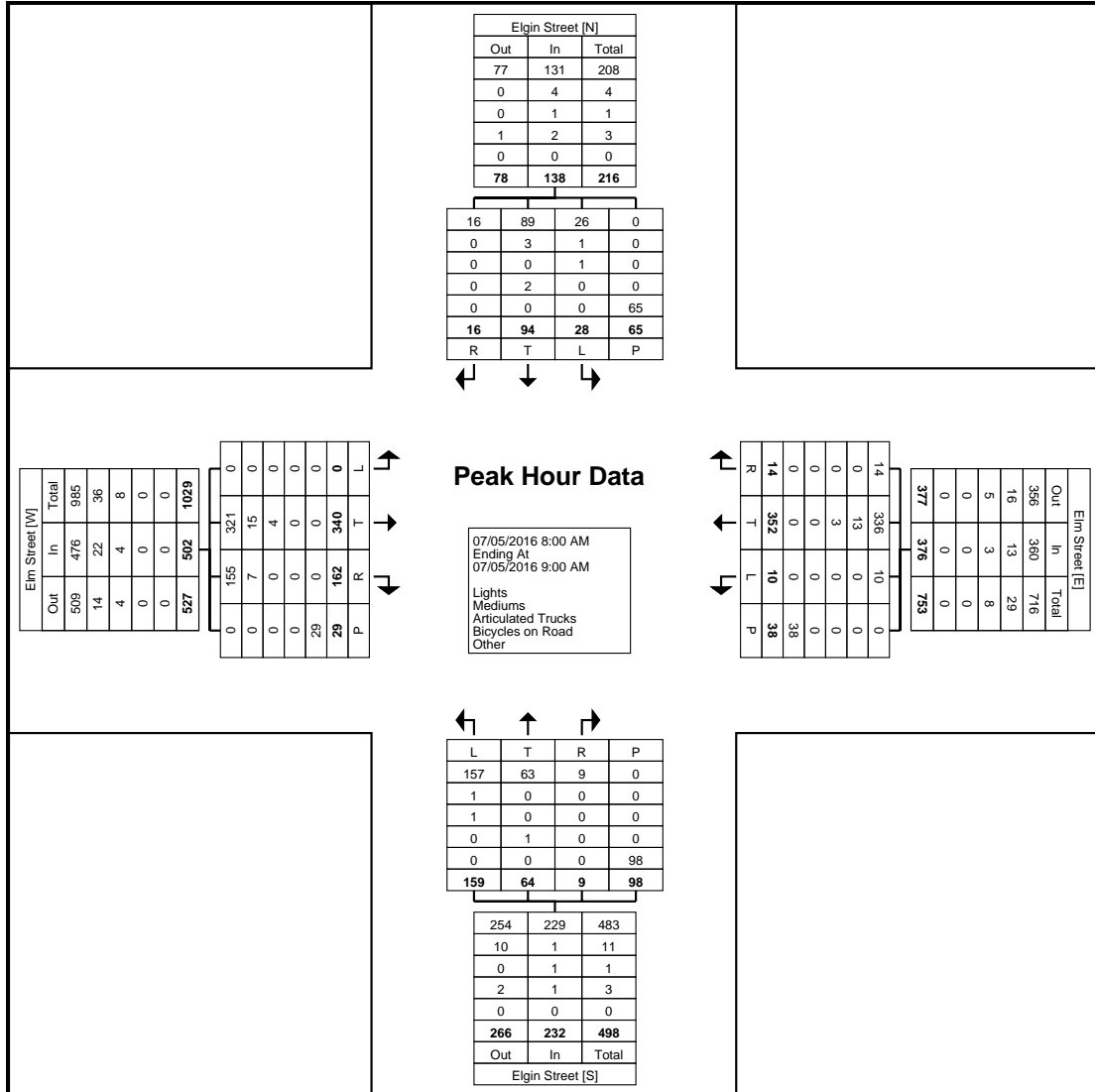


Traffic and Transportation Engineering Services
 1800 Frobisher Street
 PO Box 5000, STN A
 Sudbury, Ontario, Canada P3A 5P3
 705-674-4455

Count Name: Elm Street @
 Elgin Street
 Site Code: 00512103
 Start Date: 07/04/2016
 Page No: 6

Turning Movement Peak Hour Data (8:00 AM)

Start Time	Elgin Street Southbound					Elm Street Westbound					Elgin Street Northbound					Elm Street Eastbound					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
8:00 AM	5	21	7	10	33	5	84	2	9	91	2	16	34	18	52	36	77	0	5	113	289
8:15 AM	3	17	2	24	22	4	95	1	8	100	1	19	35	31	55	39	90	0	7	129	306
8:30 AM	5	24	9	8	38	1	77	3	7	81	2	13	46	31	61	46	87	0	7	133	313
8:45 AM	3	32	10	23	45	4	96	4	14	104	4	16	44	18	64	41	86	0	10	127	340
Total	16	94	28	65	138	14	352	10	38	376	9	64	159	98	232	162	340	0	29	502	1248
Approach %	11.6	68.1	20.3	-	-	3.7	93.6	2.7	-	-	3.9	27.6	68.5	-	-	32.3	67.7	0.0	-	-	-
Total %	1.3	7.5	2.2	-	11.1	1.1	28.2	0.8	-	30.1	0.7	5.1	12.7	-	18.6	13.0	27.2	0.0	-	40.2	-
PHF	0.800	0.734	0.700	-	0.767	0.700	0.917	0.625	-	0.904	0.563	0.842	0.864	-	0.906	0.880	0.944	0.000	-	0.944	0.918
Lights	16	89	26	-	131	14	336	10	-	360	9	63	157	-	229	155	321	0	-	476	1196
% Lights	100.0	94.7	92.9	-	94.9	100.0	95.5	100.0	-	95.7	100.0	98.4	98.7	-	98.7	95.7	94.4	-	-	94.8	95.8
Mediums	0	3	1	-	4	0	13	0	-	13	0	0	1	-	1	7	15	0	-	22	40
% Mediums	0.0	3.2	3.6	-	2.9	0.0	3.7	0.0	-	3.5	0.0	0.0	0.6	-	0.4	4.3	4.4	-	-	4.4	3.2
Articulated Trucks	0	0	1	-	1	0	3	0	-	3	0	0	1	-	1	0	4	0	-	4	9
% Articulated Trucks	0.0	0.0	3.6	-	0.7	0.0	0.9	0.0	-	0.8	0.0	0.0	0.6	-	0.4	0.0	1.2	-	-	0.8	0.7
Bicycles on Road	0	2	0	-	2	0	0	0	-	0	0	1	0	-	1	0	0	0	-	0	3
% Bicycles on Road	0.0	2.1	0.0	-	1.4	0.0	0.0	0.0	-	0.0	0.0	1.6	0.0	-	0.4	0.0	0.0	-	-	0.0	0.2
Bicycles on Crosswalk	-	-	-	0	-	-	-	-	2	-	-	-	-	4	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	0.0	-	-	-	-	5.3	-	-	-	-	4.1	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	65	-	-	-	-	36	-	-	-	-	94	-	-	-	-	29	-	-
% Pedestrians	-	-	-	100.0	-	-	-	-	94.7	-	-	-	-	95.9	-	-	-	-	100.0	-	-



Turning Movement Peak Hour Data Plot (8:00 AM)

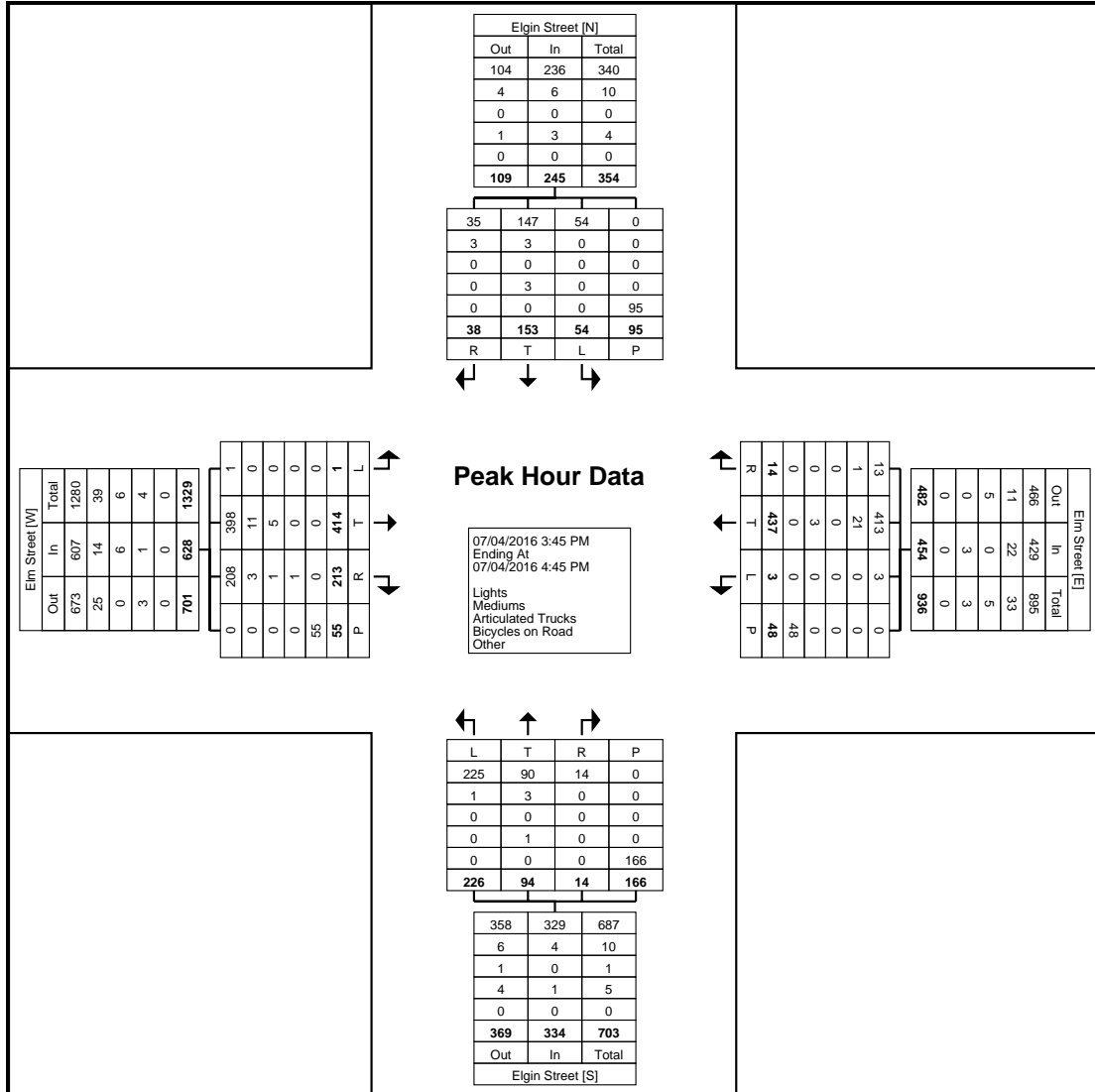


Traffic and Transportation Engineering Services
 1800 Frobisher Street
 PO Box 5000, STN A
 Sudbury, Ontario, Canada P3A 5P3
 705-674-4455

Count Name: Elm Street @
 Elgin Street
 Site Code: 00512103
 Start Date: 07/04/2016
 Page No: 4

Turning Movement Peak Hour Data (3:45 PM)

Start Time	Elgin Street Southbound					Elm Street Westbound					Elgin Street Northbound					Elm Street Eastbound					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
3:45 PM	7	32	12	26	51	4	92	1	15	97	3	24	54	25	81	47	89	0	12	136	365
4:00 PM	13	36	16	25	65	5	128	1	15	134	3	24	62	47	89	58	124	1	13	183	471
4:15 PM	9	42	11	22	62	2	114	1	8	117	4	22	45	48	71	55	101	0	12	156	406
4:30 PM	9	43	15	22	67	3	103	0	10	106	4	24	65	46	93	53	100	0	18	153	419
Total	38	153	54	95	245	14	437	3	48	454	14	94	226	166	334	213	414	1	55	628	1661
Approach %	15.5	62.4	22.0	-	-	3.1	96.3	0.7	-	-	4.2	28.1	67.7	-	-	33.9	65.9	0.2	-	-	-
Total %	2.3	9.2	3.3	-	14.8	0.8	26.3	0.2	-	27.3	0.8	5.7	13.6	-	20.1	12.8	24.9	0.1	-	37.8	-
PHF	0.731	0.890	0.844	-	0.914	0.700	0.854	0.750	-	0.847	0.875	0.979	0.869	-	0.898	0.918	0.835	0.250	-	0.858	0.882
Lights	35	147	54	-	236	13	413	3	-	429	14	90	225	-	329	208	398	1	-	607	1601
% Lights	92.1	96.1	100.0	-	96.3	92.9	94.5	100.0	-	94.5	100.0	95.7	99.6	-	98.5	97.7	96.1	100.0	-	96.7	96.4
Mediums	3	3	0	-	6	1	21	0	-	22	0	3	1	-	4	3	11	0	-	14	46
% Mediums	7.9	2.0	0.0	-	2.4	7.1	4.8	0.0	-	4.8	0.0	3.2	0.4	-	1.2	1.4	2.7	0.0	-	2.2	2.8
Articulated Trucks	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	1	5	0	-	6	6
% Articulated Trucks	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	0.0	0.5	1.2	0.0	-	1.0	0.4
Bicycles on Road	0	3	0	-	3	0	3	0	-	3	0	1	0	-	1	1	0	0	-	1	8
% Bicycles on Road	0.0	2.0	0.0	-	1.2	0.0	0.7	0.0	-	0.7	0.0	1.1	0.0	-	0.3	0.5	0.0	0.0	-	0.2	0.5
Bicycles on Crosswalk	-	-	-	13	-	-	-	-	3	-	-	-	-	5	-	-	-	-	2	-	-
% Bicycles on Crosswalk	-	-	-	13.7	-	-	-	-	6.3	-	-	-	-	3.0	-	-	-	-	3.6	-	-
Pedestrians	-	-	-	82	-	-	-	-	45	-	-	-	-	161	-	-	-	-	53	-	-
% Pedestrians	-	-	-	86.3	-	-	-	-	93.8	-	-	-	-	97.0	-	-	-	-	96.4	-	-



Turning Movement Peak Hour Data Plot (3:45 PM)

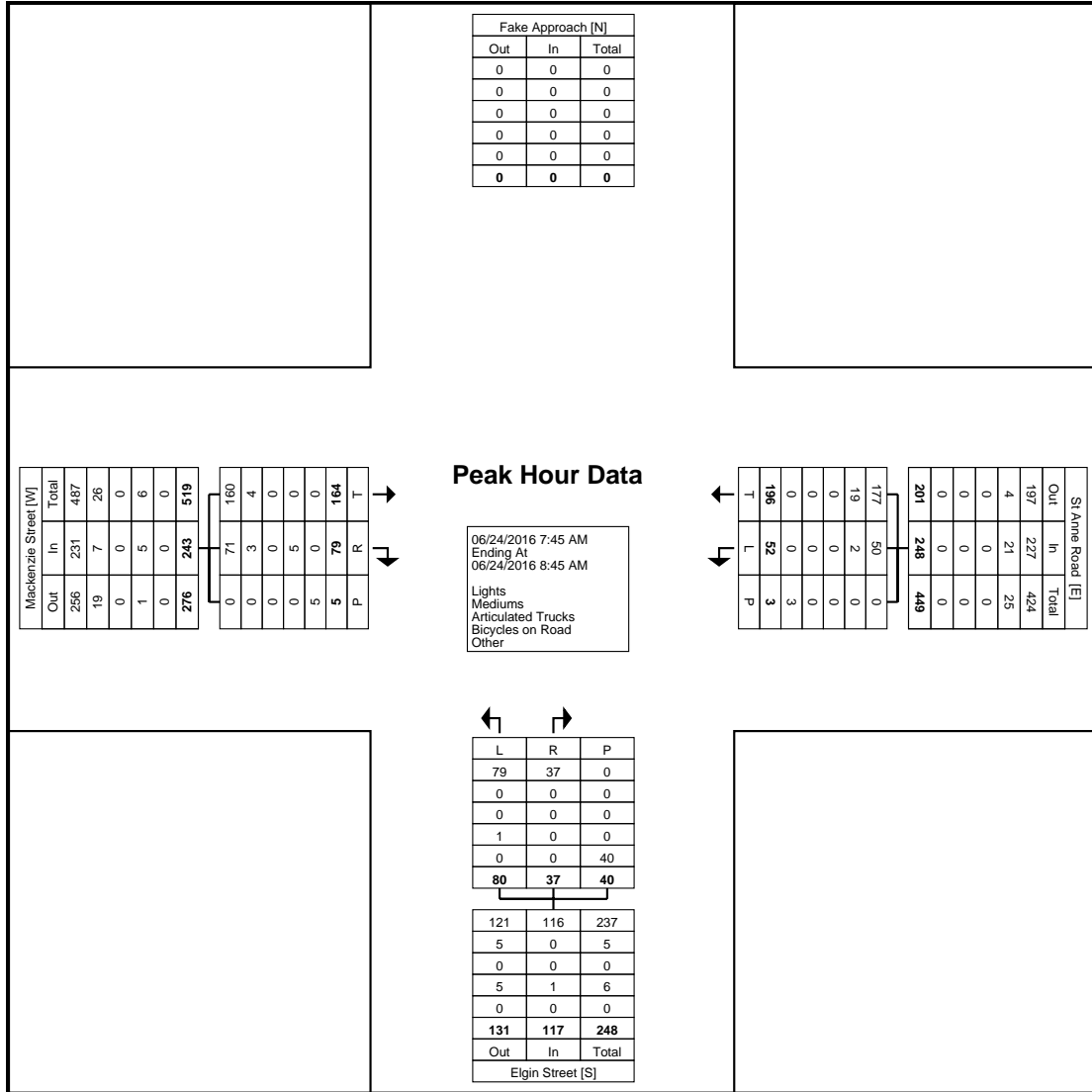


Traffic and Transportation Engineering Services
 1800 Frobisher Street
 PO Box 5000, STN A
 Sudbury, Ontario, Canada P3A 5P3
 705-674-4455

Count Name: Elgin Street at
 Mackenzie Street & St Anne
 Road
 Site Code: 00499103
 Start Date: 06/23/2016
 Page No: 5

Turning Movement Peak Hour Data (7:45 AM)

Start Time	St Anne Road Westbound				Elgin Street Northbound				Mackenzie Street Eastbound				Int. Total
	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	
7:45 AM	50	15	1	65	7	19	5	26	27	48	2	75	166
8:00 AM	52	10	0	62	13	21	12	34	16	46	0	62	158
8:15 AM	55	9	1	64	8	23	16	31	17	36	3	53	148
8:30 AM	39	18	1	57	9	17	7	26	19	34	0	53	136
Total	196	52	3	248	37	80	40	117	79	164	5	243	608
Approach %	79.0	21.0	-	-	31.6	68.4	-	-	32.5	67.5	-	-	-
Total %	32.2	8.6	-	40.8	6.1	13.2	-	19.2	13.0	27.0	-	40.0	-
PHF	0.891	0.722	-	0.954	0.712	0.870	-	0.860	0.731	0.854	-	0.810	0.916
Lights	177	50	-	227	37	79	-	116	71	160	-	231	574
% Lights	90.3	96.2	-	91.5	100.0	98.8	-	99.1	89.9	97.6	-	95.1	94.4
Mediums	19	2	-	21	0	0	-	0	3	4	-	7	28
% Mediums	9.7	3.8	-	8.5	0.0	0.0	-	0.0	3.8	2.4	-	2.9	4.6
Articulated Trucks	0	0	-	0	0	0	-	0	0	0	-	0	0
% Articulated Trucks	0.0	0.0	-	0.0	0.0	0.0	-	0.0	0.0	0.0	-	0.0	0.0
Bicycles on Road	0	0	-	0	0	1	-	1	5	0	-	5	6
% Bicycles on Road	0.0	0.0	-	0.0	0.0	1.3	-	0.9	6.3	0.0	-	2.1	1.0
Bicycles on Crosswalk	-	-	0	-	-	-	0	-	-	-	1	-	-
% Bicycles on Crosswalk	-	-	0.0	-	-	-	0.0	-	-	-	20.0	-	-
Pedestrians	-	-	3	-	-	-	40	-	-	-	4	-	-
% Pedestrians	-	-	100.0	-	-	-	100.0	-	-	-	80.0	-	-



Turning Movement Peak Hour Data Plot (7:45 AM)



Traffic and Transportation Engineering Services
 1800 Frobisher Street
 PO Box 5000, STN A
 Sudbury, Ontario, Canada P3A 5P3
 705-674-4455

Count Name: Elgin Street at
 Mackenzie Street & St Anne
 Road
 Site Code: 00499103
 Start Date: 06/23/2016
 Page No: 3

Turning Movement Peak Hour Data (3:45 PM)

Start Time	St Anne Road Westbound				Elgin Street Northbound				Mackenzie Street Eastbound				Int. Total
	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	
3:45 PM	41	18	4	59	24	21	9	45	34	31	2	65	169
4:00 PM	53	29	11	82	37	26	15	63	24	49	5	73	218
4:15 PM	38	17	5	55	30	17	11	47	35	31	3	66	168
4:30 PM	58	24	6	82	21	29	14	50	25	51	3	76	208
Total	190	88	26	278	112	93	49	205	118	162	13	280	763
Approach %	68.3	31.7	-	-	54.6	45.4	-	-	42.1	57.9	-	-	-
Total %	24.9	11.5	-	36.4	14.7	12.2	-	26.9	15.5	21.2	-	36.7	-
PHF	0.819	0.759	-	0.848	0.757	0.802	-	0.813	0.843	0.794	-	0.921	0.875
Lights	186	88	-	274	106	88	-	194	114	157	-	271	739
% Lights	97.9	100.0	-	98.6	94.6	94.6	-	94.6	96.6	96.9	-	96.8	96.9
Mediums	2	0	-	2	4	2	-	6	1	4	-	5	13
% Mediums	1.1	0.0	-	0.7	3.6	2.2	-	2.9	0.8	2.5	-	1.8	1.7
Articulated Trucks	0	0	-	0	0	0	-	0	0	0	-	0	0
% Articulated Trucks	0.0	0.0	-	0.0	0.0	0.0	-	0.0	0.0	0.0	-	0.0	0.0
Bicycles on Road	2	0	-	2	2	3	-	5	3	1	-	4	11
% Bicycles on Road	1.1	0.0	-	0.7	1.8	3.2	-	2.4	2.5	0.6	-	1.4	1.4
Bicycles on Crosswalk	-	-	1	-	-	-	0	-	-	-	2	-	-
% Bicycles on Crosswalk	-	-	3.8	-	-	-	0.0	-	-	-	15.4	-	-
Pedestrians	-	-	25	-	-	-	49	-	-	-	11	-	-
% Pedestrians	-	-	96.2	-	-	-	100.0	-	-	-	84.6	-	-

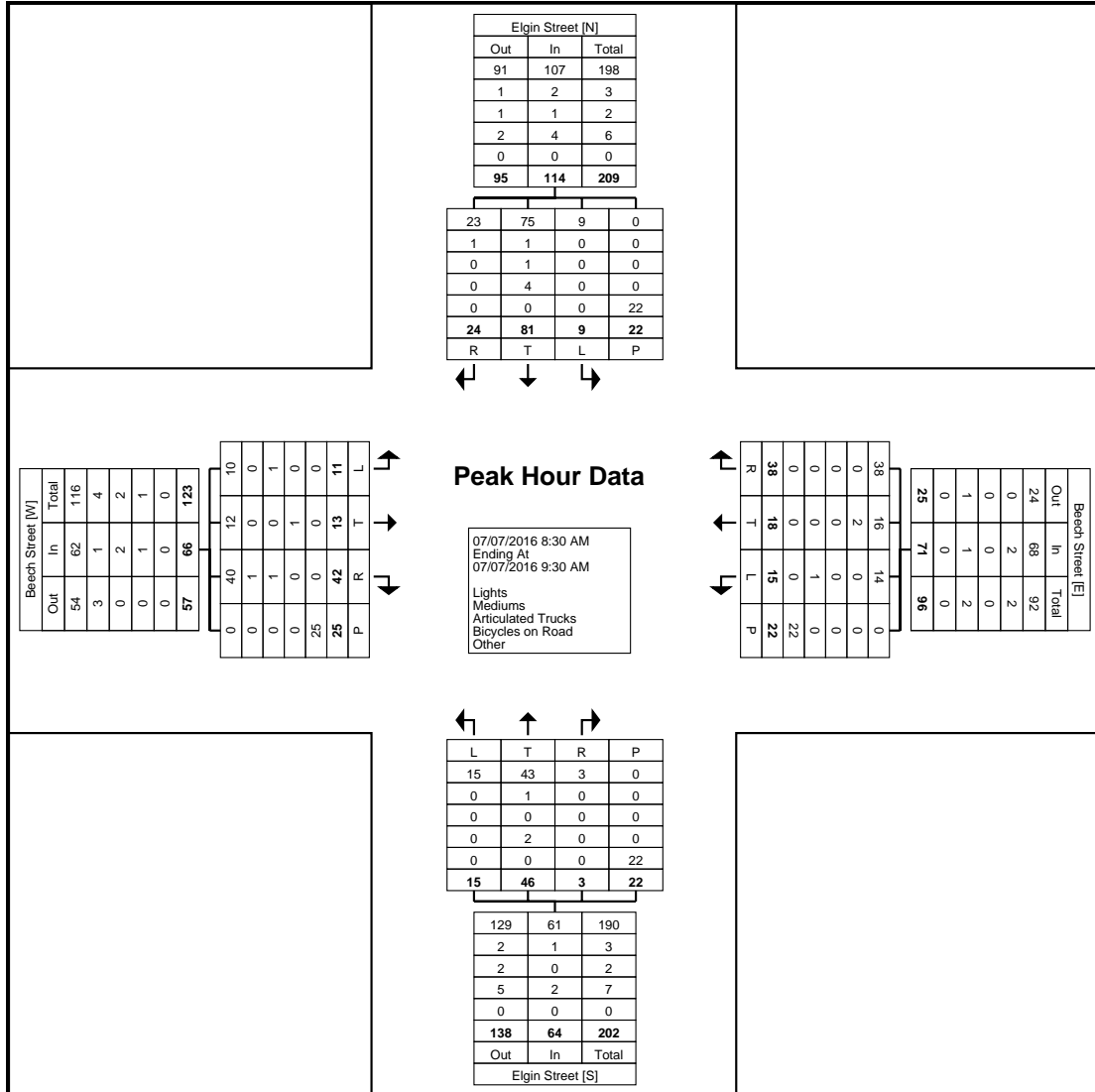


Traffic and Transportation Engineering Services
 1800 Frobisher Street
 PO Box 5000, STN A
 Sudbury, Ontario, Canada P3A 5P3
 705-674-4455

Count Name: Elgin Street @
 Beech Street
 Site Code: 00513103
 Start Date: 07/06/2016
 Page No: 8

Turning Movement Peak Hour Data (8:30 AM)

Start Time	Elgin Street Southbound					Beech Street Westbound					Elgin Street Northbound					Beech Street Eastbound					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
8:30 AM	7	20	0	5	27	12	1	5	8	18	0	10	2	5	12	11	4	3	3	18	75
8:45 AM	10	22	4	8	36	7	6	2	8	15	1	12	3	5	16	11	3	5	6	19	86
9:00 AM	3	12	4	4	19	10	4	3	2	17	1	14	5	7	20	9	4	2	9	15	71
9:15 AM	4	27	1	5	32	9	7	5	4	21	1	10	5	5	16	11	2	1	7	14	83
Total	24	81	9	22	114	38	18	15	22	71	3	46	15	22	64	42	13	11	25	66	315
Approach %	21.1	71.1	7.9	-	-	53.5	25.4	21.1	-	-	4.7	71.9	23.4	-	-	63.6	19.7	16.7	-	-	-
Total %	7.6	25.7	2.9	-	36.2	12.1	5.7	4.8	-	22.5	1.0	14.6	4.8	-	20.3	13.3	4.1	3.5	-	21.0	-
PHF	0.600	0.750	0.563	-	0.792	0.792	0.643	0.750	-	0.845	0.750	0.821	0.750	-	0.800	0.955	0.813	0.550	-	0.868	0.916
Lights	23	75	9	-	107	38	16	14	-	68	3	43	15	-	61	40	12	10	-	62	298
% Lights	95.8	92.6	100.0	-	93.9	100.0	88.9	93.3	-	95.8	100.0	93.5	100.0	-	95.3	95.2	92.3	90.9	-	93.9	94.6
Mediums	1	1	0	-	2	0	2	0	-	2	0	1	0	-	1	1	0	0	-	1	6
% Mediums	4.2	1.2	0.0	-	1.8	0.0	11.1	0.0	-	2.8	0.0	2.2	0.0	-	1.6	2.4	0.0	0.0	-	1.5	1.9
Articulated Trucks	0	1	0	-	1	0	0	0	-	0	0	0	0	-	0	1	0	1	-	2	3
% Articulated Trucks	0.0	1.2	0.0	-	0.9	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	0.0	2.4	0.0	9.1	-	3.0	1.0
Bicycles on Road	0	4	0	-	4	0	0	1	-	1	0	2	0	-	2	0	1	0	-	1	8
% Bicycles on Road	0.0	4.9	0.0	-	3.5	0.0	0.0	6.7	-	1.4	0.0	4.3	0.0	-	3.1	0.0	7.7	0.0	-	1.5	2.5
Bicycles on Crosswalk	-	-	-	0	-	-	-	-	1	-	-	-	-	0	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	0.0	-	-	-	-	4.5	-	-	-	-	0.0	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	22	-	-	-	-	21	-	-	-	-	22	-	-	-	-	25	-	-
% Pedestrians	-	-	-	100.0	-	-	-	-	95.5	-	-	-	-	100.0	-	-	-	-	100.0	-	-



Turning Movement Peak Hour Data Plot (8:30 AM)



Traffic and Transportation Engineering Services
 1800 Frobisher Street
 PO Box 5000, STN A
 Sudbury, Ontario, Canada P3A 5P3
 705-674-4455

Count Name: Elgin Street @
 Beech Street
 Site Code: 00513103
 Start Date: 07/06/2016
 Page No: 6

Turning Movement Peak Hour Data (4:00 PM)























Start Time	Elgin Street Southbound					Beech Street Westbound					Elgin Street Northbound					Beech Street Eastbound					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
4:00 PM	18	42	0	6	60	24	16	14	4	54	3	26	1	3	30	18	7	1	5	26	170
4:15 PM	9	29	0	6	38	20	8	11	4	39	3	25	9	2	37	22	1	3	6	26	140
4:30 PM	9	35	5	11	49	23	8	13	10	44	0	19	9	1	28	13	0	5	10	18	139
4:45 PM	8	36	0	10	44	29	9	5	7	43	4	17	5	7	26	17	1	3	6	21	134
Total	44	142	5	33	191	96	41	43	25	180	10	87	24	13	121	70	9	12	27	91	583
Approach %	23.0	74.3	2.6	-	-	53.3	22.8	23.9	-	-	8.3	71.9	19.8	-	-	76.9	9.9	13.2	-	-	-
Total %	7.5	24.4	0.9	-	32.8	16.5	7.0	7.4	-	30.9	1.7	14.9	4.1	-	20.8	12.0	1.5	2.1	-	15.6	-
PHF	0.611	0.845	0.250	-	0.796	0.828	0.641	0.768	-	0.833	0.625	0.837	0.667	-	0.818	0.795	0.321	0.600	-	0.875	0.857
Lights	44	137	5	-	186	95	39	43	-	177	9	83	24	-	116	68	9	12	-	89	568
% Lights	100.0	96.5	100.0	-	97.4	99.0	95.1	100.0	-	98.3	90.0	95.4	100.0	-	95.9	97.1	100.0	100.0	-	97.8	97.4
Mediums	0	2	0	-	2	1	2	0	-	3	0	1	0	-	1	2	0	0	-	2	8
% Mediums	0.0	1.4	0.0	-	1.0	1.0	4.9	0.0	-	1.7	0.0	1.1	0.0	-	0.8	2.9	0.0	0.0	-	2.2	1.4
Articulated Trucks	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
% Articulated Trucks	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	0.0	0.0
Bicycles on Road	0	3	0	-	3	0	0	0	-	0	1	3	0	-	4	0	0	0	-	0	7
% Bicycles on Road	0.0	2.1	0.0	-	1.6	0.0	0.0	0.0	-	0.0	10.0	3.4	0.0	-	3.3	0.0	0.0	0.0	-	0.0	1.2
Bicycles on Crosswalk	-	-	-	1	-	-	-	-	2	-	-	-	-	0	-	-	-	-	2	-	-
% Bicycles on Crosswalk	-	-	-	3.0	-	-	-	-	8.0	-	-	-	-	0.0	-	-	-	-	7.4	-	-
Pedestrians	-	-	-	32	-	-	-	-	23	-	-	-	-	13	-	-	-	-	25	-	-
% Pedestrians	-	-	-	97.0	-	-	-	-	92.0	-	-	-	-	100.0	-	-	-	-	92.6	-	-

**APPENDIX B:
EXISTING OPERATIONS**

HCM Signalized Intersection Capacity Analysis

6: Notre Dame Ave & Ste. Anne Rd/Louis St

2017 Existing Conditions
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	18	116	37	21	3	132	544	42	13	1099	72
Future Volume (vph)	50	18	116	37	21	3	132	544	42	13	1099	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.4	6.4	6.4	6.4		4.0	6.2		6.2	6.2	6.2
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	0.91		1.00	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1738	1830	1555	1738	1797		1738	4941		1738	4995	1555
Flt Permitted	0.74	1.00	1.00	0.75	1.00		0.20	1.00		0.41	1.00	1.00
Satd. Flow (perm)	1356	1830	1555	1363	1797		370	4941		745	4995	1555
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	53	19	122	39	22	3	139	573	44	14	1157	76
RTOR Reduction (vph)	0	0	109	0	3	0	0	4	0	0	0	28
Lane Group Flow (vph)	53	19	13	39	22	0	139	613	0	14	1157	48
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		Perm	NA	Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	9.8	9.8	9.8	9.8	9.8		69.1	69.1		57.8	57.8	57.8
Effective Green, g (s)	9.8	9.8	9.8	9.8	9.8		69.1	69.1		57.8	57.8	57.8
Actuated g/C Ratio	0.11	0.11	0.11	0.11	0.11		0.76	0.76		0.63	0.63	0.63
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4		4.0	6.2		6.2	6.2	6.2
Vehicle Extension (s)	3.5	3.5	3.5	3.5	3.5		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	145	196	166	145	192		388	3731		470	3155	982
v/s Ratio Prot		0.01			0.01		c0.03	0.12			0.23	
v/s Ratio Perm	c0.04		0.01	0.03			c0.24			0.02		0.03
v/c Ratio	0.37	0.10	0.08	0.27	0.12		0.36	0.16		0.03	0.37	0.05
Uniform Delay, d1	38.0	36.9	36.8	37.6	36.9		3.5	3.1		6.3	8.1	6.4
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.8	0.3	0.2	1.2	0.3		0.6	0.1		0.1	0.3	0.1
Delay (s)	39.8	37.1	37.0	38.7	37.3		4.1	3.2		6.4	8.4	6.5
Level of Service	D	D	D	D	D		A	A		A	A	A
Approach Delay (s)		37.8			38.2			3.4			8.3	
Approach LOS		D			D			A			A	

























Intersection Summary

HCM 2000 Control Delay	10.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	91.5	Sum of lost time (s)	16.6
Intersection Capacity Utilization	51.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Elgin St & Elm St

2017 Existing Conditions
 AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 		 	 		 	 	
Traffic Volume (vph)	0	345	164	10	357	14	161	73	9	31	110	16
Future Volume (vph)	0	345	164	10	357	14	161	73	9	31	110	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.7			5.7		4.0	5.7		4.0	5.7	
Lane Util. Factor		0.95			0.95		1.00	1.00		1.00	1.00	
Frt		0.95			0.99		1.00	0.98		1.00	0.98	
Flt Protected		1.00			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3308			3452		1738	1801		1738	1795	
Flt Permitted		1.00			0.94		0.51	1.00		0.70	1.00	
Satd. Flow (perm)		3308			3245		934	1801		1283	1795	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	363	173	11	376	15	169	77	9	33	116	17
RTOR Reduction (vph)	0	47	0	0	2	0	0	5	0	0	7	0
Lane Group Flow (vph)	0	489	0	0	400	0	169	81	0	33	126	0
Turn Type		NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)		51.5			51.5		27.1	20.0		17.2	14.1	
Effective Green, g (s)		51.5			51.5		27.1	20.0		17.2	14.1	
Actuated g/C Ratio		0.57			0.57		0.30	0.22		0.19	0.16	
Clearance Time (s)		5.7			5.7		4.0	5.7		4.0	5.7	
Vehicle Extension (s)		3.0			0.2		0.2	0.2		0.2	3.0	
Lane Grp Cap (vph)		1892			1856		361	400		260	281	
v/s Ratio Prot		c0.15					c0.05	0.05		0.00	0.07	
v/s Ratio Perm					0.12		c0.09			0.02		
v/c Ratio		0.26			0.22		0.47	0.20		0.13	0.45	
Uniform Delay, d1		9.7			9.4		24.5	28.5		30.0	34.4	
Progression Factor		1.00			1.00		1.00	1.00		1.19	1.09	
Incremental Delay, d2		0.3			0.3		0.4	0.1		0.1	1.1	
Delay (s)		10.0			9.7		24.8	28.6		35.7	38.8	
Level of Service		A			A		C	C		D	D	
Approach Delay (s)		10.0			9.7			26.1			38.2	
Approach LOS		A			A			C			D	
Intersection Summary												
HCM 2000 Control Delay			16.4				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.34									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			15.4		
Intersection Capacity Utilization			59.3%				ICU Level of Service			B		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Elgin St & MacKenzie St/Ste. Anne Rd

2017 Existing Conditions
 AM Peak Hour

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↘	↑	↘	↗
Traffic Volume (vph)	166	80	53	199	81	37
Future Volume (vph)	166	80	53	199	81	37
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7	5.7	5.7	5.7	5.7
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1830	1555	1738	1830	1738	1555
Flt Permitted	1.00	1.00	0.65	1.00	0.95	1.00
Satd. Flow (perm)	1830	1555	1183	1830	1738	1555
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	175	84	56	209	85	39
RTOR Reduction (vph)	0	36	0	0	0	33
Lane Group Flow (vph)	175	48	56	209	85	6
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	2			2	4	
Permitted Phases		2	2			4
Actuated Green, G (s)	51.5	51.5	51.5	51.5	14.1	14.1
Effective Green, g (s)	51.5	51.5	51.5	51.5	14.1	14.1
Actuated g/C Ratio	0.57	0.57	0.57	0.57	0.16	0.16
Clearance Time (s)	5.7	5.7	5.7	5.7	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1047	889	676	1047	272	243
v/s Ratio Prot	0.10			c0.11	c0.05	
v/s Ratio Perm		0.03	0.05			0.00
v/c Ratio	0.17	0.05	0.08	0.20	0.31	0.03
Uniform Delay, d1	9.1	8.5	8.6	9.3	33.7	32.1
Progression Factor	1.00	1.00	1.00	1.00	1.24	1.96
Incremental Delay, d2	0.3	0.1	0.2	0.4	0.7	0.0
Delay (s)	9.5	8.6	8.9	9.7	42.3	63.0
Level of Service	A	A	A	A	D	E
Approach Delay (s)	9.2			9.5	48.8	
Approach LOS	A			A	D	


















Intersection Summary

HCM 2000 Control Delay	16.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.20		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.4
Intersection Capacity Utilization	61.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Elgin St & Beech St

2017 Existing Conditions
AM Peak Hour























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	11	13	42	16	18	38	15	69	3	9	99	24
Future Volume (vph)	11	13	42	16	18	38	15	69	3	9	99	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.7			5.7		5.7	5.7			5.7	
Lane Util. Factor		1.00			1.00		1.00	1.00			1.00	
Flt		0.92			0.93		1.00	0.99			0.98	
Flt Protected		0.99			0.99		0.95	1.00			1.00	
Satd. Flow (prot)		1660			1681		1738	1819			1779	
Flt Permitted		0.94			0.92		0.67	1.00			0.99	
Satd. Flow (perm)		1579			1567		1224	1819			1763	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	12	14	44	17	19	40	16	73	3	9	104	25
RTOR Reduction (vph)	0	37	0	0	34	0	0	1	0	0	6	0
Lane Group Flow (vph)	0	33	0	0	42	0	16	75	0	0	132	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			4			2				2
Permitted Phases	4			4			2			2		
Actuated Green, G (s)		14.1			14.1		51.5	51.5			51.5	
Effective Green, g (s)		14.1			14.1		51.5	51.5			51.5	
Actuated g/C Ratio		0.16			0.16		0.57	0.57			0.57	
Clearance Time (s)		5.7			5.7		5.7	5.7			5.7	
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		247			245		700	1040			1008	
v/s Ratio Prot								0.04				
v/s Ratio Perm		0.02			c0.03		0.01				c0.07	
v/c Ratio		0.13			0.17		0.02	0.07			0.13	
Uniform Delay, d1		32.7			32.9		8.3	8.6			8.9	
Progression Factor		1.00			1.00		1.46	1.56			0.57	
Incremental Delay, d2		0.2			0.3		0.1	0.1			0.3	
Delay (s)		32.9			33.2		12.2	13.5			5.4	
Level of Service		C			C		B	B			A	
Approach Delay (s)		32.9			33.2			13.3			5.4	
Approach LOS		C			C			B			A	
Intersection Summary												
HCM 2000 Control Delay			18.1				HCM 2000 Level of Service				B	
HCM 2000 Volume to Capacity ratio			0.12									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			15.4		
Intersection Capacity Utilization			42.8%				ICU Level of Service			A		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

23: College St & Froid Rd

2017 Existing Conditions
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	19	55	27	107	73	6	145	214	49	9	221	14
Future Volume (vph)	19	55	27	107	73	6	145	214	49	9	221	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7		4.0	5.7	5.7	5.7	5.7			5.7	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00			1.00	
Frt	1.00	0.95		1.00	1.00	0.85	1.00	0.97			0.99	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00			1.00	
Satd. Flow (prot)	1738	1740		1738	1830	1555	1738	1778			1812	
Flt Permitted	0.71	1.00		0.59	1.00	1.00	0.58	1.00			0.99	
Satd. Flow (perm)	1293	1740		1086	1830	1555	1070	1778			1793	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	20	58	28	113	77	6	153	225	52	9	233	15
RTOR Reduction (vph)	0	20	0	0	0	4	0	8	0	0	2	0
Lane Group Flow (vph)	20	66	0	113	77	2	153	269	0	0	255	0
Turn Type	Perm	NA		pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2		1	6			8				4
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)	22.0	22.0		33.3	33.3	33.3	36.0	36.0			36.0	
Effective Green, g (s)	22.0	22.0		33.3	33.3	33.3	36.0	36.0			36.0	
Actuated g/C Ratio	0.27	0.27		0.41	0.41	0.41	0.45	0.45			0.45	
Clearance Time (s)	5.7	5.7		4.0	5.7	5.7	5.7	5.7			5.7	
Vehicle Extension (s)	0.2	0.2		0.2	0.2	0.2	0.2	0.2			0.2	
Lane Grp Cap (vph)	352	474		507	755	641	477	793			799	
v/s Ratio Prot		0.04		c0.02	0.04			c0.15				
v/s Ratio Perm	0.02			c0.07		0.00	0.14				0.14	
v/c Ratio	0.06	0.14		0.22	0.10	0.00	0.32	0.34			0.32	
Uniform Delay, d1	21.7	22.2		15.0	14.5	13.9	14.4	14.6			14.4	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00			1.00	
Incremental Delay, d2	0.0	0.0		0.1	0.0	0.0	0.1	0.1			0.1	
Delay (s)	21.7	22.2		15.1	14.6	13.9	14.6	14.7			14.5	
Level of Service	C	C		B	B	B	B	B			B	
Approach Delay (s)		22.1			14.8			14.6			14.5	
Approach LOS		C			B			B			B	

Intersection Summary
























HCM 2000 Control Delay	15.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	80.7	Sum of lost time (s)	15.4
Intersection Capacity Utilization	89.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

6: Notre Dame Ave & Ste. Anne Rd/Louis St

2017 Existing Conditions
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	198	49	264	44	28	16	118	1290	51	10	878	85
Future Volume (vph)	198	49	264	44	28	16	118	1290	51	10	878	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.4	6.4	6.4	6.4		4.0	6.2		6.2	6.2	6.2
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	0.91		1.00	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1738	1830	1555	1738	1728		1738	4966		1738	4995	1555
Flt Permitted	0.73	1.00	1.00	0.72	1.00		0.25	1.00		0.18	1.00	1.00
Satd. Flow (perm)	1330	1830	1555	1323	1728		465	4966		326	4995	1555
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	208	52	278	46	29	17	124	1358	54	11	924	89
RTOR Reduction (vph)	0	0	191	0	13	0	0	3	0	0	0	40
Lane Group Flow (vph)	208	52	87	46	33	0	124	1409	0	11	924	49
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		Perm	NA	Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	21.9	21.9	21.9	21.9	21.9		68.1	68.1		56.0	56.0	56.0
Effective Green, g (s)	21.9	21.9	21.9	21.9	21.9		68.1	68.1		56.0	56.0	56.0
Actuated g/C Ratio	0.21	0.21	0.21	0.21	0.21		0.66	0.66		0.55	0.55	0.55
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4		4.0	6.2		6.2	6.2	6.2
Vehicle Extension (s)	3.5	3.5	3.5	3.5	3.5		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	283	390	331	282	368		409	3296		177	2726	848
v/s Ratio Prot		0.03			0.02		0.02	c0.28			0.18	
v/s Ratio Perm	c0.16		0.06	0.03			0.18			0.03		0.03
v/c Ratio	0.73	0.13	0.26	0.16	0.09		0.30	0.43		0.06	0.34	0.06
Uniform Delay, d1	37.6	32.7	33.6	32.9	32.3		6.7	8.1		11.0	13.0	10.9
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	9.8	0.2	0.5	0.3	0.1		0.4	0.4		0.7	0.3	0.1
Delay (s)	47.5	32.9	34.1	33.2	32.5		7.1	8.5		11.6	13.3	11.1
Level of Service	D	C	C	C	C		A	A		B	B	B
Approach Delay (s)		39.2			32.8			8.4			13.1	
Approach LOS		D			C			A			B	




















Intersection Summary

HCM 2000 Control Delay	15.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	102.6	Sum of lost time (s)	16.6
Intersection Capacity Utilization	71.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Elgin St & Elm St

2017 Existing Conditions
 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	420	216	0	444	14	229	119	14	71	170	42
Future Volume (vph)	0	420	216	0	444	14	229	119	14	71	170	42
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.7			5.7		4.0	5.7		4.0	5.7	
Lane Util. Factor		0.95			0.95		1.00	1.00		1.00	1.00	
Flt		0.95			1.00		1.00	0.98		1.00	0.97	
Flt Protected		1.00			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3299			3460		1738	1800		1738	1775	
Flt Permitted		1.00			1.00		0.38	1.00		0.67	1.00	
Satd. Flow (perm)		3299			3460		691	1800		1222	1775	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	442	227	0	467	15	241	125	15	75	179	44
RTOR Reduction (vph)	0	61	0	0	2	0	0	5	0	0	11	0
Lane Group Flow (vph)	0	608	0	0	480	0	241	135	0	75	212	0
Turn Type		NA			NA		pm+pt	NA		pm+pt	NA	
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)		46.6			46.6		32.0	23.4		22.4	17.8	
Effective Green, g (s)		46.6			46.6		32.0	23.4		22.4	17.8	
Actuated g/C Ratio		0.52			0.52		0.36	0.26		0.25	0.20	
Clearance Time (s)		5.7			5.7		4.0	5.7		4.0	5.7	
Vehicle Extension (s)		3.0			0.2		0.2	0.2		0.2	3.0	
Lane Grp Cap (vph)		1708			1791		364	468		330	351	
v/s Ratio Prot		c0.18			0.14		c0.07	0.07		0.01	0.12	
v/s Ratio Perm							c0.16			0.04		
v/c Ratio		0.36			0.27		0.66	0.29		0.23	0.60	
Uniform Delay, d1		12.8			12.2		22.2	26.6		26.5	32.9	
Progression Factor		1.00			1.00		1.00	1.00		1.22	1.12	
Incremental Delay, d2		0.6			0.4		3.5	0.1		0.1	2.9	
Delay (s)		13.4			12.5		25.7	26.8		32.6	39.6	
Level of Service		B			B		C	C		C	D	
Approach Delay (s)		13.4			12.5			26.1			37.9	
Approach LOS		B			B			C			D	
Intersection Summary												
HCM 2000 Control Delay			19.8				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.50									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			15.4		
Intersection Capacity Utilization			66.2%				ICU Level of Service			C		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Elgin St & MacKenzie St/Ste. Anne Rd

2017 Existing Conditions
 PM Peak Hour

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↘	↑	↘	↗
Traffic Volume (vph)	165	120	89	193	94	114
Future Volume (vph)	165	120	89	193	94	114
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7	5.7	5.7	5.7	5.7
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1830	1555	1738	1830	1738	1555
Flt Permitted	1.00	1.00	0.65	1.00	0.95	1.00
Satd. Flow (perm)	1830	1555	1184	1830	1738	1555
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	174	126	94	203	99	120
RTOR Reduction (vph)	0	61	0	0	0	96
Lane Group Flow (vph)	174	65	94	203	99	24
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	2			2	4	
Permitted Phases		2	2			4
Actuated Green, G (s)	46.6	46.6	46.6	46.6	17.8	17.8
Effective Green, g (s)	46.6	46.6	46.6	46.6	17.8	17.8
Actuated g/C Ratio	0.52	0.52	0.52	0.52	0.20	0.20
Clearance Time (s)	5.7	5.7	5.7	5.7	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	947	805	613	947	343	307
v/s Ratio Prot	0.10			c0.11	c0.06	
v/s Ratio Perm		0.04	0.08			0.02
v/c Ratio	0.18	0.08	0.15	0.21	0.29	0.08
Uniform Delay, d1	11.6	10.9	11.4	11.8	30.7	29.4
Progression Factor	1.00	1.00	1.00	1.00	1.11	2.17
Incremental Delay, d2	0.4	0.2	0.5	0.5	0.5	0.1
Delay (s)	12.0	11.1	11.9	12.3	34.6	64.1
Level of Service	B	B	B	B	C	E
Approach Delay (s)	11.6			12.2	50.7	
Approach LOS	B			B	D	


















Intersection Summary

HCM 2000 Control Delay	22.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.20		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.4
Intersection Capacity Utilization	72.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Elgin St & Beech St

2017 Existing Conditions
PM Peak Hour























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	12	9	79	43	42	96	24	99	10	5	159	44
Future Volume (vph)	12	9	79	43	42	96	24	99	10	5	159	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.7			5.7		5.7	5.7			5.7	
Lane Util. Factor		1.00			1.00		1.00	1.00			1.00	
Frt		0.89			0.93		1.00	0.99			0.97	
Flt Protected		0.99			0.99		0.95	1.00			1.00	
Satd. Flow (prot)		1624			1678		1738	1803			1775	
Flt Permitted		0.96			0.91		0.63	1.00			1.00	
Satd. Flow (perm)		1564			1545		1153	1803			1770	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	13	9	83	45	44	101	25	104	11	5	167	46
RTOR Reduction (vph)	0	67	0	0	51	0	0	3	0	0	9	0
Lane Group Flow (vph)	0	38	0	0	139	0	25	112	0	0	209	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			4			2				2
Permitted Phases	4			4			2			2		
Actuated Green, G (s)		17.8			17.8		46.6	46.6			46.6	
Effective Green, g (s)		17.8			17.8		46.6	46.6			46.6	
Actuated g/C Ratio		0.20			0.20		0.52	0.52			0.52	
Clearance Time (s)		5.7			5.7		5.7	5.7			5.7	
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		309			305		596	933			916	
v/s Ratio Prot								0.06				
v/s Ratio Perm		0.02			c0.09		0.02				c0.12	
v/c Ratio		0.12			0.46		0.04	0.12			0.23	
Uniform Delay, d1		29.7			31.8		10.7	11.2			11.9	
Progression Factor		1.00			1.00		1.36	1.48			0.53	
Incremental Delay, d2		0.2			1.1		0.1	0.3			0.6	
Delay (s)		29.9			32.9		14.7	16.7			6.9	
Level of Service		C			C		B	B			A	
Approach Delay (s)		29.9			32.9			16.4			6.9	
Approach LOS		C			C			B			A	
Intersection Summary												
HCM 2000 Control Delay			20.2				HCM 2000 Level of Service				C	
HCM 2000 Volume to Capacity ratio			0.25									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			15.4		
Intersection Capacity Utilization			51.6%				ICU Level of Service			A		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

23: College St & Froid Rd

2017 Existing Conditions
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	37	82	88	66	73	7	112	246	102	12	290	17
Future Volume (vph)	37	82	88	66	73	7	112	246	102	12	290	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7		4.0	5.7	5.7	5.7	5.7			5.7	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00			1.00	
Fr _t	1.00	0.92		1.00	1.00	0.85	1.00	0.96			0.99	
Fl _t Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00			1.00	
Satd. Flow (prot)	1738	1687		1738	1830	1555	1738	1749			1813	
Fl _t Permitted	0.71	1.00		0.57	1.00	1.00	0.46	1.00			0.98	
Satd. Flow (perm)	1293	1687		1035	1830	1555	848	1749			1781	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	39	86	93	69	77	7	118	259	107	13	305	18
RTOR Reduction (vph)	0	43	0	0	0	3	0	17	0	0	3	0
Lane Group Flow (vph)	39	136	0	69	77	4	118	349	0	0	333	0
Turn Type	Perm	NA		pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2		1	6			8				4
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)	30.2	30.2		41.9	41.9	41.9	30.2	30.2			30.2	
Effective Green, g (s)	30.2	30.2		41.9	41.9	41.9	30.2	30.2			30.2	
Actuated g/C Ratio	0.36	0.36		0.50	0.50	0.50	0.36	0.36			0.36	
Clearance Time (s)	5.7	5.7		4.0	5.7	5.7	5.7	5.7			5.7	
Vehicle Extension (s)	0.2	0.2		0.2	0.2	0.2	0.2	0.2			0.2	
Lane Grp Cap (vph)	467	610		584	918	780	306	632			644	
v/s Ratio Prot		c0.08		c0.01	0.04			c0.20				
v/s Ratio Perm	0.03			0.05		0.00	0.14				0.19	
v/c Ratio	0.08	0.22		0.12	0.08	0.00	0.39	0.55			0.52	
Uniform Delay, d ₁	17.5	18.5		10.9	10.8	10.4	19.8	21.3			20.9	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00			1.00	
Incremental Delay, d ₂	0.0	0.1		0.0	0.0	0.0	0.3	0.6			0.3	
Delay (s)	17.6	18.6		10.9	10.8	10.4	20.1	21.9			21.2	
Level of Service	B	B		B	B	B	C	C			C	
Approach Delay (s)		18.4			10.9			21.4			21.2	
Approach LOS		B			B			C			C	

Intersection Summary

HCM 2000 Control Delay	19.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	83.5	Sum of lost time (s)	15.4
Intersection Capacity Utilization	119.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group
























**APPENDIX C:
FUTURE BACKGROUND OPERATIONS**

HCM Signalized Intersection Capacity Analysis

6: Notre Dame Ave & Ste. Anne Rd/Louis St

2018 Background Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	55	20	130	40	25	5	150	555	45	15	1120	80
Future Volume (vph)	55	20	130	40	25	5	150	555	45	15	1120	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.4	6.4	6.4	6.4		4.0	6.2		6.2	6.2	6.2
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	0.91		1.00	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1738	1830	1555	1738	1785		1738	4939		1738	4995	1555
Flt Permitted	0.74	1.00	1.00	0.74	1.00		0.20	1.00		0.40	1.00	1.00
Satd. Flow (perm)	1348	1830	1555	1361	1785		357	4939		734	4995	1555
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	58	21	137	42	26	5	158	584	47	16	1179	84
RTOR Reduction (vph)	0	0	122	0	4	0	0	5	0	0	0	32
Lane Group Flow (vph)	58	21	15	42	27	0	158	627	0	16	1179	52
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		Perm	NA	Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	10.1	10.1	10.1	10.1	10.1		68.1	68.1		56.5	56.5	56.5
Effective Green, g (s)	10.1	10.1	10.1	10.1	10.1		68.1	68.1		56.5	56.5	56.5
Actuated g/C Ratio	0.11	0.11	0.11	0.11	0.11		0.75	0.75		0.62	0.62	0.62
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4		4.0	6.2		6.2	6.2	6.2
Vehicle Extension (s)	3.5	3.5	3.5	3.5	3.5		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	149	203	172	151	198		383	3704		456	3108	967
v/s Ratio Prot		0.01			0.01		c0.03	0.13			0.24	
v/s Ratio Perm	c0.04		0.01	0.03			c0.27			0.02		0.03
v/c Ratio	0.39	0.10	0.09	0.28	0.13		0.41	0.17		0.04	0.38	0.05
Uniform Delay, d1	37.5	36.3	36.2	37.0	36.4		3.8	3.2		6.6	8.5	6.7
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.0	0.3	0.3	1.2	0.4		0.7	0.1		0.1	0.4	0.1
Delay (s)	39.5	36.5	36.5	38.2	36.8		4.5	3.3		6.8	8.8	6.8
Level of Service	D	D	D	D	D		A	A		A	A	A
Approach Delay (s)		37.3			37.6			3.6			8.7	
Approach LOS		D			D			A			A	





















Intersection Summary

HCM 2000 Control Delay	10.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	90.8	Sum of lost time (s)	16.6
Intersection Capacity Utilization	53.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Elgin St & Elm St

2018 Background Conditions
 AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 							
Traffic Volume (vph)	0	355	170	15	365	25	165	80	10	40	120	20
Future Volume (vph)	0	355	170	15	365	25	165	80	10	40	120	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.7			5.7		4.0	5.7		4.0	5.7	
Lane Util. Factor		0.95			0.95		1.00	1.00		1.00	1.00	
Frt		0.95			0.99		1.00	0.98		1.00	0.98	
Flt Protected		1.00			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3308			3438		1738	1798		1738	1790	
Flt Permitted		1.00			0.93		0.49	1.00		0.70	1.00	
Satd. Flow (perm)		3308			3197		896	1798		1272	1790	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	374	179	16	384	26	174	84	11	42	126	21
RTOR Reduction (vph)	0	49	0	0	4	0	0	5	0	0	8	0
Lane Group Flow (vph)	0	504	0	0	422	0	174	90	0	42	140	0
Turn Type		NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)		50.5			50.5		28.1	20.9		18.2	15.0	
Effective Green, g (s)		50.5			50.5		28.1	20.9		18.2	15.0	
Actuated g/C Ratio		0.56			0.56		0.31	0.23		0.20	0.17	
Clearance Time (s)		5.7			5.7		4.0	5.7		4.0	5.7	
Vehicle Extension (s)		3.0			0.2		0.2	0.2		0.2	3.0	
Lane Grp Cap (vph)		1856			1793		364	417		273	298	
v/s Ratio Prot		c0.15					c0.05	0.05		0.01	0.08	
v/s Ratio Perm					0.13		c0.10			0.03		
v/c Ratio		0.27			0.24		0.48	0.21		0.15	0.47	
Uniform Delay, d1		10.2			10.0		23.8	27.9		29.3	33.9	
Progression Factor		1.00			1.00		1.00	1.00		1.21	1.12	
Incremental Delay, d2		0.4			0.3		0.4	0.1		0.1	1.2	
Delay (s)		10.6			10.3		24.2	28.0		35.7	39.0	
Level of Service		B			B		C	C		D	D	
Approach Delay (s)		10.6			10.3			25.5			38.2	
Approach LOS		B			B			C			D	
Intersection Summary												
HCM 2000 Control Delay			16.9				HCM 2000 Level of Service				B	
HCM 2000 Volume to Capacity ratio			0.36									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			15.4		
Intersection Capacity Utilization			59.5%				ICU Level of Service			B		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Elgin St & MacKenzie St/Ste. Anne Rd

2018 Background Conditions
 AM Peak Hour

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↘	↑	↘	↗
Traffic Volume (vph)	185	85	65	215	90	50
Future Volume (vph)	185	85	65	215	90	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7	5.7	5.7	5.7	5.7
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1830	1555	1738	1830	1738	1555
Flt Permitted	1.00	1.00	0.64	1.00	0.95	1.00
Satd. Flow (perm)	1830	1555	1162	1830	1738	1555
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	195	89	68	226	95	53
RTOR Reduction (vph)	0	39	0	0	0	44
Lane Group Flow (vph)	195	50	68	226	95	9
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	2			2	4	
Permitted Phases		2	2			4
Actuated Green, G (s)	50.5	50.5	50.5	50.5	15.0	15.0
Effective Green, g (s)	50.5	50.5	50.5	50.5	15.0	15.0
Actuated g/C Ratio	0.56	0.56	0.56	0.56	0.17	0.17
Clearance Time (s)	5.7	5.7	5.7	5.7	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1026	872	652	1026	289	259
v/s Ratio Prot	0.11			c0.12	c0.05	
v/s Ratio Perm		0.03	0.06			0.01
v/c Ratio	0.19	0.06	0.10	0.22	0.33	0.03
Uniform Delay, d1	9.7	9.0	9.2	9.9	33.1	31.4
Progression Factor	1.00	1.00	1.00	1.00	1.24	2.17
Incremental Delay, d2	0.4	0.1	0.3	0.5	0.7	0.1
Delay (s)	10.1	9.1	9.5	10.4	41.7	68.3
Level of Service	B	A	A	B	D	E
Approach Delay (s)	9.8			10.2	51.2	
Approach LOS	A			B	D	


















Intersection Summary

HCM 2000 Control Delay	18.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.21		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.4
Intersection Capacity Utilization	71.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 13: Elgin St & Beech St

2018 Background Conditions
 AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	15	45	20	20	40	20	85	5	10	115	25
Future Volume (vph)	15	15	45	20	20	40	20	85	5	10	115	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.7			5.7		5.7	5.7			5.7	
Lane Util. Factor		1.00			1.00		1.00	1.00			1.00	
Flt		0.92			0.93		1.00	0.99			0.98	
Flt Protected		0.99			0.99		0.95	1.00			1.00	
Satd. Flow (prot)		1666			1685		1738	1815			1783	
Flt Permitted		0.93			0.91		0.69	1.00			0.98	
Satd. Flow (perm)		1564			1552		1268	1815			1762	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	16	47	21	21	42	21	89	5	11	121	26
RTOR Reduction (vph)	0	39	0	0	35	0	0	2	0	0	6	0
Lane Group Flow (vph)	0	40	0	0	49	0	21	92	0	0	152	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			4			2				2
Permitted Phases	4			4			2			2		
Actuated Green, G (s)		15.0			15.0		50.5	50.5			50.5	
Effective Green, g (s)		15.0			15.0		50.5	50.5			50.5	
Actuated g/C Ratio		0.17			0.17		0.56	0.56			0.56	
Clearance Time (s)		5.7			5.7		5.7	5.7			5.7	
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		260			258		711	1018			988	
v/s Ratio Prot								0.05				
v/s Ratio Perm		0.03			c0.03		0.02				c0.09	
v/c Ratio		0.15			0.19		0.03	0.09			0.15	
Uniform Delay, d1		32.1			32.3		8.8	9.1			9.5	
Progression Factor		1.00			1.00		1.30	1.40			0.56	
Incremental Delay, d2		0.3			0.4		0.1	0.2			0.3	
Delay (s)		32.3			32.6		11.5	13.0			5.7	
Level of Service		C			C		B	B			A	
Approach Delay (s)		32.3			32.6			12.7			5.7	
Approach LOS		C			C			B			A	
Intersection Summary												
HCM 2000 Control Delay			17.5				HCM 2000 Level of Service				B	
HCM 2000 Volume to Capacity ratio			0.14									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			15.4		
Intersection Capacity Utilization			42.8%				ICU Level of Service			A		
Analysis Period (min)			15									























c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

2018 Background Conditions

23: College St & Froid Rd

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	60	30	110	75	10	150	230	50	10	235	15
Future Volume (vph)	20	60	30	110	75	10	150	230	50	10	235	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7		4.0	5.7	5.7	5.7	5.7			5.7	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00			1.00	
Frt	1.00	0.95		1.00	1.00	0.85	1.00	0.97			0.99	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00			1.00	
Satd. Flow (prot)	1738	1737		1738	1830	1555	1738	1780			1812	
Flt Permitted	0.71	1.00		0.59	1.00	1.00	0.57	1.00			0.98	
Satd. Flow (perm)	1291	1737		1077	1830	1555	1041	1780			1787	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	21	63	32	116	79	11	158	242	53	11	247	16
RTOR Reduction (vph)	0	23	0	0	0	6	0	8	0	0	2	0
Lane Group Flow (vph)	21	72	0	116	79	5	158	287	0	0	272	0
Turn Type	Perm	NA		pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2		1	6			8				4
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)	22.0	22.0		33.3	33.3	33.3	36.0	36.0			36.0	
Effective Green, g (s)	22.0	22.0		33.3	33.3	33.3	36.0	36.0			36.0	
Actuated g/C Ratio	0.27	0.27		0.41	0.41	0.41	0.45	0.45			0.45	
Clearance Time (s)	5.7	5.7		4.0	5.7	5.7	5.7	5.7			5.7	
Vehicle Extension (s)	0.2	0.2		0.2	0.2	0.2	0.2	0.2			0.2	
Lane Grp Cap (vph)	351	473		504	755	641	464	794			797	
v/s Ratio Prot		0.04		c0.02	0.04			c0.16				
v/s Ratio Perm	0.02			c0.07		0.00	0.15				0.15	
v/c Ratio	0.06	0.15		0.23	0.10	0.01	0.34	0.36			0.34	
Uniform Delay, d1	21.7	22.3		15.0	14.5	14.0	14.6	14.8			14.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00			1.00	
Incremental Delay, d2	0.0	0.1		0.1	0.0	0.0	0.2	0.1			0.1	
Delay (s)	21.7	22.3		15.1	14.6	14.0	14.8	14.9			14.7	
Level of Service	C	C		B	B	B	B	B			B	
Approach Delay (s)		22.2			14.8			14.8			14.7	
Approach LOS		C			B			B			B	

Intersection Summary
























HCM 2000 Control Delay	15.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	80.7	Sum of lost time (s)	15.4
Intersection Capacity Utilization	89.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

6: Notre Dame Ave & Ste. Anne Rd/Louis St

2018 Background Conditions
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	205	50	285	45	30	20	135	1310	55	15	895	90
Future Volume (vph)	205	50	285	45	30	20	135	1310	55	15	895	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.4	6.4	6.4	6.4		4.0	6.2		6.2	6.2	6.2
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	0.91		1.00	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1738	1830	1555	1738	1721		1738	4965		1738	4995	1555
Flt Permitted	0.72	1.00	1.00	0.72	1.00		0.25	1.00		0.17	1.00	1.00
Satd. Flow (perm)	1322	1830	1555	1322	1721		451	4965		317	4995	1555
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	216	53	300	47	32	21	142	1379	58	16	942	95
RTOR Reduction (vph)	0	0	187	0	16	0	0	3	0	0	0	44
Lane Group Flow (vph)	216	53	113	47	37	0	142	1434	0	16	942	51
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		Perm	NA	Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	23.0	23.0	23.0	23.0	23.0		68.1	68.1		55.6	55.6	55.6
Effective Green, g (s)	23.0	23.0	23.0	23.0	23.0		68.1	68.1		55.6	55.6	55.6
Actuated g/C Ratio	0.22	0.22	0.22	0.22	0.22		0.66	0.66		0.54	0.54	0.54
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4		4.0	6.2		6.2	6.2	6.2
Vehicle Extension (s)	3.5	3.5	3.5	3.5	3.5		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	293	405	344	293	381		401	3260		169	2678	833
v/s Ratio Prot		0.03			0.02		0.03	c0.29			0.19	
v/s Ratio Perm	c0.16		0.07	0.04			0.20			0.05		0.03
v/c Ratio	0.74	0.13	0.33	0.16	0.10		0.35	0.44		0.09	0.35	0.06
Uniform Delay, d1	37.5	32.3	33.9	32.6	32.1		7.2	8.6		11.8	13.7	11.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	9.6	0.2	0.7	0.3	0.1		0.5	0.4		1.1	0.4	0.1
Delay (s)	47.1	32.5	34.5	32.9	32.2		7.8	9.0		12.9	14.1	11.7
Level of Service	D	C	C	C	C		A	A		B	B	B
Approach Delay (s)		39.1			32.5			8.9			13.9	
Approach LOS		D			C			A			B	

























Intersection Summary

HCM 2000 Control Delay	16.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	103.7	Sum of lost time (s)	16.6
Intersection Capacity Utilization	72.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Elgin St & Elm St

2018 Background Conditions
 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 					 	 	 
Traffic Volume (vph)	0	430	220	0	455	25	235	130	15	80	180	50
Future Volume (vph)	0	430	220	0	455	25	235	130	15	80	180	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.7			5.7		4.0	5.7		4.0	5.7	
Lane Util. Factor		0.95			0.95		1.00	1.00		1.00	1.00	
Flt		0.95			0.99		1.00	0.98		1.00	0.97	
Flt Protected		1.00			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3300			3449		1738	1801		1738	1770	
Flt Permitted		1.00			1.00		0.35	1.00		0.66	1.00	
Satd. Flow (perm)		3300			3449		648	1801		1207	1770	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	453	232	0	479	26	247	137	16	84	189	53
RTOR Reduction (vph)	0	62	0	0	4	0	0	4	0	0	13	0
Lane Group Flow (vph)	0	623	0	0	501	0	247	149	0	84	229	0
Turn Type		NA			NA		pm+pt	NA		pm+pt	NA	
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)		45.8			45.8		32.8	23.9		23.4	18.5	
Effective Green, g (s)		45.8			45.8		32.8	23.9		23.4	18.5	
Actuated g/C Ratio		0.51			0.51		0.36	0.27		0.26	0.21	
Clearance Time (s)		5.7			5.7		4.0	5.7		4.0	5.7	
Vehicle Extension (s)		3.0			0.2		0.2	0.2		0.2	3.0	
Lane Grp Cap (vph)		1679			1755		360	478		342	363	
v/s Ratio Prot		c0.19			0.15		c0.08	0.08		0.01	0.13	
v/s Ratio Perm							c0.17			0.05		
v/c Ratio		0.37			0.29		0.69	0.31		0.25	0.63	
Uniform Delay, d1		13.4			12.7		21.8	26.5		25.9	32.6	
Progression Factor		1.00			1.00		1.00	1.00		1.25	1.14	
Incremental Delay, d2		0.6			0.4		4.3	0.1		0.1	3.5	
Delay (s)		14.0			13.1		26.1	26.6		32.4	40.8	
Level of Service		B			B		C	C		C	D	
Approach Delay (s)		14.0			13.1			26.3			38.6	
Approach LOS		B			B			C			D	
Intersection Summary												
HCM 2000 Control Delay			20.5				HCM 2000 Level of Service				C	
HCM 2000 Volume to Capacity ratio			0.52									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			15.4		
Intersection Capacity Utilization			67.5%				ICU Level of Service			C		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Elgin St & MacKenzie St/Ste. Anne Rd


















2018 Background Conditions
 PM Peak Hour

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↘	↑	↘	↗
Traffic Volume (vph)	185	130	105	210	100	125
Future Volume (vph)	185	130	105	210	100	125
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7	5.7	5.7	5.7	5.7
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1830	1555	1738	1830	1738	1555
Flt Permitted	1.00	1.00	0.64	1.00	0.95	1.00
Satd. Flow (perm)	1830	1555	1162	1830	1738	1555
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	195	137	111	221	105	132
RTOR Reduction (vph)	0	67	0	0	0	105
Lane Group Flow (vph)	195	70	111	221	105	27
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	2			2	4	
Permitted Phases		2	2			4
Actuated Green, G (s)	45.8	45.8	45.8	45.8	18.5	18.5
Effective Green, g (s)	45.8	45.8	45.8	45.8	18.5	18.5
Actuated g/C Ratio	0.51	0.51	0.51	0.51	0.21	0.21
Clearance Time (s)	5.7	5.7	5.7	5.7	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	931	791	591	931	357	319
v/s Ratio Prot	0.11			c0.12	c0.06	
v/s Ratio Perm		0.04	0.10			0.02
v/c Ratio	0.21	0.09	0.19	0.24	0.29	0.09
Uniform Delay, d1	12.1	11.4	12.0	12.3	30.2	28.9
Progression Factor	1.00	1.00	1.00	1.00	1.13	2.33
Incremental Delay, d2	0.5	0.2	0.7	0.6	0.5	0.1
Delay (s)	12.7	11.6	12.7	12.9	34.5	67.4
Level of Service	B	B	B	B	C	E
Approach Delay (s)	12.2			12.9	52.8	
Approach LOS	B			B	D	
Intersection Summary						
HCM 2000 Control Delay			23.1		HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.22			
Actuated Cycle Length (s)			90.0		Sum of lost time (s)	15.4
Intersection Capacity Utilization			72.6%		ICU Level of Service	C
Analysis Period (min)			15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Elgin St & Beech St























2018 Background Conditions
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	10	80	45	45	100	25	115	15	10	180	45
Future Volume (vph)	15	10	80	45	45	100	25	115	15	10	180	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.7			5.7		5.7	5.7			5.7	
Lane Util. Factor		1.00			1.00		1.00	1.00			1.00	
Frt		0.90			0.93		1.00	0.98			0.97	
Flt Protected		0.99			0.99		0.95	1.00			1.00	
Satd. Flow (prot)		1631			1679		1738	1798			1779	
Flt Permitted		0.95			0.91		0.60	1.00			0.99	
Satd. Flow (perm)		1556			1544		1102	1798			1762	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	11	84	47	47	105	26	121	16	11	189	47
RTOR Reduction (vph)	0	67	0	0	49	0	0	4	0	0	8	0
Lane Group Flow (vph)	0	44	0	0	150	0	26	133	0	0	239	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			4			2				2
Permitted Phases	4			4			2			2		
Actuated Green, G (s)		18.5			18.5		45.8	45.8			45.8	
Effective Green, g (s)		18.5			18.5		45.8	45.8			45.8	
Actuated g/C Ratio		0.21			0.21		0.51	0.51			0.51	
Clearance Time (s)		5.7			5.7		5.7	5.7			5.7	
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		319			317		560	914			896	
v/s Ratio Prot								0.07				
v/s Ratio Perm		0.03			c0.10		0.02				c0.14	
v/c Ratio		0.14			0.47		0.05	0.15			0.27	
Uniform Delay, d1		29.2			31.5		11.1	11.7			12.6	
Progression Factor		1.00			1.00		1.28	1.39			0.53	
Incremental Delay, d2		0.2			1.1		0.2	0.3			0.7	
Delay (s)		29.4			32.6		14.3	16.6			7.3	
Level of Service		C			C		B	B			A	
Approach Delay (s)		29.4			32.6			16.2			7.3	
Approach LOS		C			C			B			A	
Intersection Summary												
HCM 2000 Control Delay			19.7				HCM 2000 Level of Service				B	
HCM 2000 Volume to Capacity ratio			0.28									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			15.4		
Intersection Capacity Utilization			52.2%				ICU Level of Service			A		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 23: College St & Froid Rd

2018 Background Conditions
 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	40	85	90	70	75	10	115	260	105	15	305	20
Future Volume (vph)	40	85	90	70	75	10	115	260	105	15	305	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7		4.0	5.7	5.7	5.7	5.7			5.7	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00			1.00	
Flt	1.00	0.92		1.00	1.00	0.85	1.00	0.96			0.99	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00			1.00	
Satd. Flow (prot)	1738	1688		1738	1830	1555	1738	1751			1811	
Flt Permitted	0.71	1.00		0.56	1.00	1.00	0.44	1.00			0.97	
Satd. Flow (perm)	1291	1688		1024	1830	1555	812	1751			1770	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	42	89	95	74	79	11	121	274	111	16	321	21
RTOR Reduction (vph)	0	43	0	0	0	5	0	16	0	0	3	0
Lane Group Flow (vph)	42	141	0	74	79	6	121	369	0	0	355	0
Turn Type	Perm	NA		pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2		1	6			8				4
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)	30.2	30.2		41.9	41.9	41.9	30.2	30.2			30.2	
Effective Green, g (s)	30.2	30.2		41.9	41.9	41.9	30.2	30.2			30.2	
Actuated g/C Ratio	0.36	0.36		0.50	0.50	0.50	0.36	0.36			0.36	
Clearance Time (s)	5.7	5.7		4.0	5.7	5.7	5.7	5.7			5.7	
Vehicle Extension (s)	0.2	0.2		0.2	0.2	0.2	0.2	0.2			0.2	
Lane Grp Cap (vph)	466	610		579	918	780	293	633			640	
v/s Ratio Prot		c0.08		c0.01	0.04			c0.21				
v/s Ratio Perm	0.03			0.05		0.00	0.15				0.20	
v/c Ratio	0.09	0.23		0.13	0.09	0.01	0.41	0.58			0.56	
Uniform Delay, d1	17.6	18.6		10.9	10.8	10.4	20.0	21.6			21.3	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00			1.00	
Incremental Delay, d2	0.0	0.1		0.0	0.0	0.0	0.3	0.9			0.6	
Delay (s)	17.6	18.6		11.0	10.8	10.4	20.3	22.4			21.9	
Level of Service	B	B		B	B	B	C	C			C	
Approach Delay (s)		18.4			10.9			21.9			21.9	
Approach LOS		B			B			C			C	
























Intersection Summary			
HCM 2000 Control Delay	19.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	83.5	Sum of lost time (s)	15.4
Intersection Capacity Utilization	119.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

6: Notre Dame Ave & Ste. Anne Rd/Louis St

2023 Background Conditions
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	60	20	140	40	25	5	175	595	45	15	1205	85
Future Volume (vph)	60	20	140	40	25	5	175	595	45	15	1205	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.4	6.4	6.4	6.4		4.0	6.2		6.2	6.2	6.2
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	0.91		1.00	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1738	1830	1555	1738	1785		1738	4943		1738	4995	1555
Flt Permitted	0.74	1.00	1.00	0.74	1.00		0.17	1.00		0.38	1.00	1.00
Satd. Flow (perm)	1348	1830	1555	1361	1785		315	4943		703	4995	1555
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	63	21	147	42	26	5	184	626	47	16	1268	89
RTOR Reduction (vph)	0	0	130	0	4	0	0	4	0	0	0	35
Lane Group Flow (vph)	63	21	17	42	27	0	184	669	0	16	1268	54
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		Perm	NA	Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	10.4	10.4	10.4	10.4	10.4		67.8	67.8		55.6	55.6	55.6
Effective Green, g (s)	10.4	10.4	10.4	10.4	10.4		67.8	67.8		55.6	55.6	55.6
Actuated g/C Ratio	0.11	0.11	0.11	0.11	0.11		0.75	0.75		0.61	0.61	0.61
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4		4.0	6.2		6.2	6.2	6.2
Vehicle Extension (s)	3.5	3.5	3.5	3.5	3.5		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	154	209	178	155	204		363	3690		430	3058	952
v/s Ratio Prot		0.01			0.01		c0.05	0.14			0.25	
v/s Ratio Perm	c0.05		0.01	0.03			c0.33			0.02		0.04
v/c Ratio	0.41	0.10	0.09	0.27	0.13		0.51	0.18		0.04	0.41	0.06
Uniform Delay, d1	37.3	36.0	36.0	36.7	36.1		4.3	3.4		7.0	9.1	7.1
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.1	0.2	0.3	1.1	0.3		1.1	0.1		0.2	0.4	0.1
Delay (s)	39.4	36.3	36.3	37.9	36.5		5.5	3.5		7.1	9.6	7.2
Level of Service	D	D	D	D	D		A	A		A	A	A
Approach Delay (s)		37.1			37.3			3.9			9.4	
Approach LOS		D			D			A			A	





















Intersection Summary

HCM 2000 Control Delay	10.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	90.8	Sum of lost time (s)	16.6
Intersection Capacity Utilization	56.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Elgin St & Elm St







2023 Background Conditions
 AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 							
Traffic Volume (vph)	0	380	180	15	395	30	180	90	10	40	130	20
Future Volume (vph)	0	380	180	15	395	30	180	90	10	40	130	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.7			5.7		4.0	5.7		4.0	5.7	
Lane Util. Factor		0.95			0.95		1.00	1.00		1.00	1.00	
Flt		0.95			0.99		1.00	0.98		1.00	0.98	
Flt Protected		1.00			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3309			3434		1738	1801		1738	1793	
Flt Permitted		1.00			0.93		0.47	1.00		0.69	1.00	
Satd. Flow (perm)		3309			3194		865	1801		1260	1793	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	400	189	16	416	32	189	95	11	42	137	21
RTOR Reduction (vph)	0	49	0	0	5	0	0	5	0	0	7	0
Lane Group Flow (vph)	0	540	0	0	459	0	189	101	0	42	151	0
Turn Type		NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)		49.7			49.7		28.9	21.7		18.7	15.5	
Effective Green, g (s)		49.7			49.7		28.9	21.7		18.7	15.5	
Actuated g/C Ratio		0.55			0.55		0.32	0.24		0.21	0.17	
Clearance Time (s)		5.7			5.7		4.0	5.7		4.0	5.7	
Vehicle Extension (s)		3.0			0.2		0.2	0.2		0.2	3.0	
Lane Grp Cap (vph)		1827			1763		368	434		278	308	
v/s Ratio Prot		c0.16					c0.05	0.06		0.01	0.08	
v/s Ratio Perm					0.14		c0.11			0.03		
v/c Ratio		0.30			0.26		0.51	0.23		0.15	0.49	
Uniform Delay, d1		10.8			10.5		23.5	27.5		28.9	33.7	
Progression Factor		1.00			1.00		1.00	1.00		1.26	1.15	
Incremental Delay, d2		0.4			0.4		0.5	0.1		0.1	1.2	
Delay (s)		11.2			10.9		24.0	27.6		36.5	39.9	
Level of Service		B			B		C	C		D	D	
Approach Delay (s)		11.2			10.9			25.3			39.2	
Approach LOS		B			B			C			D	
Intersection Summary												
HCM 2000 Control Delay			17.4				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.39									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			15.4		
Intersection Capacity Utilization			60.3%				ICU Level of Service			B		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Elgin St & MacKenzie St/Ste. Anne Rd

2023 Background Conditions
 AM Peak Hour

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	200	95	65	245	105	50
Future Volume (vph)	200	95	65	245	105	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7	5.7	5.7	5.7	5.7
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1830	1555	1738	1830	1738	1555
Flt Permitted	1.00	1.00	0.63	1.00	0.95	1.00
Satd. Flow (perm)	1830	1555	1145	1830	1738	1555
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	211	100	68	258	111	53
RTOR Reduction (vph)	0	44	0	0	0	44
Lane Group Flow (vph)	211	56	68	258	111	9
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	2			2	4	
Permitted Phases		2	2			4
Actuated Green, G (s)	49.7	49.7	49.7	49.7	15.5	15.5
Effective Green, g (s)	49.7	49.7	49.7	49.7	15.5	15.5
Actuated g/C Ratio	0.55	0.55	0.55	0.55	0.17	0.17
Clearance Time (s)	5.7	5.7	5.7	5.7	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1010	858	632	1010	299	267
v/s Ratio Prot	0.12			c0.14	c0.06	
v/s Ratio Perm		0.04	0.06			0.01
v/c Ratio	0.21	0.06	0.11	0.26	0.37	0.03
Uniform Delay, d1	10.2	9.4	9.6	10.5	32.9	31.0
Progression Factor	1.00	1.00	1.00	1.00	1.29	2.38
Incremental Delay, d2	0.5	0.1	0.3	0.6	0.8	0.1
Delay (s)	10.7	9.5	9.9	11.1	43.3	73.8
Level of Service	B	A	A	B	D	E
Approach Delay (s)	10.3			10.9	53.1	
Approach LOS	B			B	D	


















Intersection Summary

HCM 2000 Control Delay	19.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.25		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.4
Intersection Capacity Utilization	71.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Elgin St & Beech St

2023 Background Conditions
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	15	45	20	20	40	20	100	5	10	125	25
Future Volume (vph)	15	15	45	20	20	40	20	100	5	10	125	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.7			5.7		5.7	5.7			5.7	
Lane Util. Factor		1.00			1.00		1.00	1.00			1.00	
Frt		0.92			0.93		1.00	0.99			0.98	
Flt Protected		0.99			0.99		0.95	1.00			1.00	
Satd. Flow (prot)		1666			1685		1738	1817			1786	
Flt Permitted		0.93			0.91		0.68	1.00			0.99	
Satd. Flow (perm)		1566			1555		1247	1817			1765	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	16	47	21	21	42	21	105	5	11	132	26
RTOR Reduction (vph)	0	39	0	0	35	0	0	1	0	0	6	0
Lane Group Flow (vph)	0	40	0	0	49	0	21	109	0	0	163	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			4			2				2
Permitted Phases	4			4			2			2		
Actuated Green, G (s)		15.5			15.5		49.7	49.7			49.7	
Effective Green, g (s)		15.5			15.5		49.7	49.7			49.7	
Actuated g/C Ratio		0.17			0.17		0.55	0.55			0.55	
Clearance Time (s)		5.7			5.7		5.7	5.7			5.7	
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		269			267		688	1003			974	
v/s Ratio Prot								0.06				
v/s Ratio Perm		0.03			c0.03		0.02				c0.09	
v/c Ratio		0.15			0.18		0.03	0.11			0.17	
Uniform Delay, d1		31.6			31.8		9.2	9.6			9.9	
Progression Factor		1.00			1.00		1.30	1.39			0.58	
Incremental Delay, d2		0.3			0.3		0.1	0.2			0.4	
Delay (s)		31.9			32.2		12.0	13.6			6.1	
Level of Service		C			C		B	B			A	
Approach Delay (s)		31.9			32.2			13.3			6.1	
Approach LOS		C			C			B			A	
Intersection Summary												
HCM 2000 Control Delay			17.3				HCM 2000 Level of Service				B	
HCM 2000 Volume to Capacity ratio			0.15									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			15.4		
Intersection Capacity Utilization			42.8%				ICU Level of Service			A		
Analysis Period (min)			15									























c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

2023 Background Conditions

23: College St & Froid Rd

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	25	60	30	120	80	10	160	255	55	10	250	20
Future Volume (vph)	25	60	30	120	80	10	160	255	55	10	250	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7		4.0	5.7	5.7	5.7	5.7			5.7	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00			1.00	
Fr _t	1.00	0.95		1.00	1.00	0.85	1.00	0.97			0.99	
Fl _t Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00			1.00	
Satd. Flow (prot)	1738	1737		1738	1830	1555	1738	1781			1809	
Fl _t Permitted	0.70	1.00		0.59	1.00	1.00	0.55	1.00			0.98	
Satd. Flow (perm)	1285	1737		1076	1830	1555	1005	1781			1784	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	26	63	32	126	84	11	168	268	58	11	263	21
RTOR Reduction (vph)	0	23	0	0	0	6	0	8	0	0	3	0
Lane Group Flow (vph)	26	72	0	126	84	5	168	318	0	0	292	0
Turn Type	Perm	NA		pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2		1	6			8				4
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)	21.9	21.9		33.2	33.2	33.2	35.6	35.6			35.6	
Effective Green, g (s)	21.9	21.9		33.2	33.2	33.2	35.6	35.6			35.6	
Actuated g/C Ratio	0.27	0.27		0.41	0.41	0.41	0.44	0.44			0.44	
Clearance Time (s)	5.7	5.7		4.0	5.7	5.7	5.7	5.7			5.7	
Vehicle Extension (s)	0.2	0.2		0.2	0.2	0.2	0.2	0.2			0.2	
Lane Grp Cap (vph)	350	474		505	757	643	446	790			791	
v/s Ratio Prot		0.04		c0.02	0.05			c0.18				
v/s Ratio Perm	0.02			c0.08		0.00	0.17				0.16	
v/c Ratio	0.07	0.15		0.25	0.11	0.01	0.38	0.40			0.37	
Uniform Delay, d ₁	21.6	22.1		15.0	14.4	13.8	14.9	15.1			14.8	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00			1.00	
Incremental Delay, d ₂	0.0	0.1		0.1	0.0	0.0	0.2	0.1			0.1	
Delay (s)	21.7	22.2		15.1	14.5	13.8	15.1	15.2			14.9	
Level of Service	C	C		B	B	B	B	B			B	
Approach Delay (s)		22.1			14.8			15.2			14.9	
Approach LOS		C			B			B			B	

Intersection Summary
























HCM 2000 Control Delay	15.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	80.2	Sum of lost time (s)	15.4
Intersection Capacity Utilization	89.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

6: Notre Dame Ave & Ste. Anne Rd/Louis St

2023 Background Conditions
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	225	55	350	50	30	20	160	1415	55	15	965	100
Future Volume (vph)	225	55	350	50	30	20	160	1415	55	15	965	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.4	6.4	6.4	6.4		4.0	6.2		6.2	6.2	6.2
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	0.91		1.00	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1738	1830	1555	1738	1721		1738	4967		1738	4995	1555
Flt Permitted	0.72	1.00	1.00	0.72	1.00		0.22	1.00		0.15	1.00	1.00
Satd. Flow (perm)	1322	1830	1555	1316	1721		401	4967		282	4995	1555
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	237	58	368	53	32	21	168	1489	58	16	1016	105
RTOR Reduction (vph)	0	0	174	0	16	0	0	3	0	0	0	51
Lane Group Flow (vph)	237	58	194	53	37	0	168	1544	0	16	1016	54
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		Perm	NA	Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	25.5	25.5	25.5	25.5	25.5		68.2	68.2		55.1	55.1	55.1
Effective Green, g (s)	25.5	25.5	25.5	25.5	25.5		68.2	68.2		55.1	55.1	55.1
Actuated g/C Ratio	0.24	0.24	0.24	0.24	0.24		0.64	0.64		0.52	0.52	0.52
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4		4.0	6.2		6.2	6.2	6.2
Vehicle Extension (s)	3.5	3.5	3.5	3.5	3.5		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	317	438	373	315	412		371	3186		146	2589	806
v/s Ratio Prot		0.03			0.02		0.04	c0.31			0.20	
v/s Ratio Perm	c0.18		0.12	0.04			0.25			0.06		0.03
v/c Ratio	0.75	0.13	0.52	0.17	0.09		0.45	0.48		0.11	0.39	0.07
Uniform Delay, d1	37.4	31.7	35.1	32.0	31.4		8.4	9.9		13.1	15.5	12.8
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	9.6	0.2	1.4	0.3	0.1		0.9	0.5		1.5	0.4	0.2
Delay (s)	47.0	31.9	36.5	32.3	31.5		9.3	10.4		14.6	15.9	12.9
Level of Service	D	C	D	C	C		A	B		B	B	B
Approach Delay (s)		39.8			31.9			10.3			15.6	
Approach LOS		D			C			B			B	




















Intersection Summary

HCM 2000 Control Delay	18.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	106.3	Sum of lost time (s)	16.6
Intersection Capacity Utilization	75.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Elgin St & Elm St

2023 Background Conditions
 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	460	240	0	490	30	255	145	20	105	210	55
Future Volume (vph)	0	460	240	0	490	30	255	145	20	105	210	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.7			5.7		4.0	5.7		4.0	5.7	
Lane Util. Factor		0.95			0.95		1.00	1.00		1.00	1.00	
Flt		0.95			0.99		1.00	0.98		1.00	0.97	
Flt Protected		1.00			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3297			3446		1738	1797		1738	1773	
Flt Permitted		1.00			1.00		0.32	1.00		0.65	1.00	
Satd. Flow (perm)		3297			3446		585	1797		1184	1773	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	484	253	0	516	32	268	153	21	111	221	58
RTOR Reduction (vph)	0	67	0	0	5	0	0	6	0	0	12	0
Lane Group Flow (vph)	0	670	0	0	543	0	268	168	0	111	267	0
Turn Type		NA			NA		pm+pt	NA		pm+pt	NA	
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)		43.8			43.8		34.8	25.3		25.8	20.3	
Effective Green, g (s)		43.8			43.8		34.8	25.3		25.8	20.3	
Actuated g/C Ratio		0.49			0.49		0.39	0.28		0.29	0.23	
Clearance Time (s)		5.7			5.7		4.0	5.7		4.0	5.7	
Vehicle Extension (s)		3.0			0.2		0.2	0.2		0.2	3.0	
Lane Grp Cap (vph)		1604			1677		360	505		373	399	
v/s Ratio Prot		c0.20			0.16		c0.09	0.09		0.02	0.15	
v/s Ratio Perm							c0.20			0.07		
v/c Ratio		0.42			0.32		0.74	0.33		0.30	0.67	
Uniform Delay, d1		14.9			14.1		20.9	25.7		24.5	31.8	
Progression Factor		1.00			1.00		1.00	1.00		1.34	1.21	
Incremental Delay, d2		0.8			0.5		7.1	0.1		0.2	4.2	
Delay (s)		15.7			14.6		28.1	25.8		32.9	42.8	
Level of Service		B			B		C	C		C	D	
Approach Delay (s)		15.7			14.6			27.2			40.0	
Approach LOS		B			B			C			D	
Intersection Summary												
HCM 2000 Control Delay			22.3				HCM 2000 Level of Service			C		
HCM 2000 Volume to Capacity ratio			0.58									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			15.4		
Intersection Capacity Utilization			70.5%				ICU Level of Service			C		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Elgin St & MacKenzie St/Ste. Anne Rd


















2023 Background Conditions
 PM Peak Hour

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↘	↑	↘	↗
Traffic Volume (vph)	240	180	110	245	125	135
Future Volume (vph)	240	180	110	245	125	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7	5.7	5.7	5.7	5.7
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1830	1555	1738	1830	1738	1555
Flt Permitted	1.00	1.00	0.58	1.00	0.95	1.00
Satd. Flow (perm)	1830	1555	1055	1830	1738	1555
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	253	189	116	258	132	142
RTOR Reduction (vph)	0	80	0	0	0	110
Lane Group Flow (vph)	253	109	116	258	132	32
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	2			2	4	
Permitted Phases		2	2			4
Actuated Green, G (s)	43.8	43.8	43.8	43.8	20.3	20.3
Effective Green, g (s)	43.8	43.8	43.8	43.8	20.3	20.3
Actuated g/C Ratio	0.49	0.49	0.49	0.49	0.23	0.23
Clearance Time (s)	5.7	5.7	5.7	5.7	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	890	756	513	890	392	350
v/s Ratio Prot	0.14			c0.14	c0.08	
v/s Ratio Perm		0.07	0.11			0.02
v/c Ratio	0.28	0.14	0.23	0.29	0.34	0.09
Uniform Delay, d1	13.8	12.8	13.3	13.8	29.2	27.6
Progression Factor	1.00	1.00	1.00	1.00	1.17	2.61
Incremental Delay, d2	0.8	0.4	1.0	0.8	0.5	0.1
Delay (s)	14.6	13.2	14.3	14.6	34.8	72.0
Level of Service	B	B	B	B	C	E
Approach Delay (s)	14.0			14.5	54.1	
Approach LOS	B			B	D	
Intersection Summary						
HCM 2000 Control Delay			24.2		HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.26			
Actuated Cycle Length (s)			90.0		Sum of lost time (s)	15.4
Intersection Capacity Utilization			72.6%		ICU Level of Service	C
Analysis Period (min)			15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 13: Elgin St & Beech St























2023 Background Conditions
 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	10	85	45	45	100	25	135	15	10	230	50
Future Volume (vph)	15	10	85	45	45	100	25	135	15	10	230	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.7			5.7		5.7	5.7			5.7	
Lane Util. Factor		1.00			1.00		1.00	1.00			1.00	
Frt		0.90			0.93		1.00	0.98			0.98	
Flt Protected		0.99			0.99		0.95	1.00			1.00	
Satd. Flow (prot)		1629			1679		1738	1802			1784	
Flt Permitted		0.94			0.91		0.55	1.00			0.99	
Satd. Flow (perm)		1550			1539		998	1802			1769	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	11	89	47	47	105	26	142	16	11	242	53
RTOR Reduction (vph)	0	69	0	0	48	0	0	4	0	0	8	0
Lane Group Flow (vph)	0	47	0	0	151	0	26	154	0	0	298	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			4			2				2
Permitted Phases	4			4			2			2		
Actuated Green, G (s)		20.3			20.3		43.8	43.8			43.8	
Effective Green, g (s)		20.3			20.3		43.8	43.8			43.8	
Actuated g/C Ratio		0.23			0.23		0.49	0.49			0.49	
Clearance Time (s)		5.7			5.7		5.7	5.7			5.7	
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		349			347		485	876			860	
v/s Ratio Prot								0.09				
v/s Ratio Perm		0.03			c0.10		0.03				c0.17	
v/c Ratio		0.13			0.44		0.05	0.18			0.35	
Uniform Delay, d1		27.8			29.9		12.2	13.0			14.3	
Progression Factor		1.00			1.00		1.19	1.31			0.52	
Incremental Delay, d2		0.2			0.9		0.2	0.4			1.1	
Delay (s)		28.0			30.8		14.7	17.3			8.6	
Level of Service		C			C		B	B			A	
Approach Delay (s)		28.0			30.8			17.0			8.6	
Approach LOS		C			C			B			A	
Intersection Summary												
HCM 2000 Control Delay			18.8				HCM 2000 Level of Service				B	
HCM 2000 Volume to Capacity ratio			0.32									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)				15.4	
Intersection Capacity Utilization			52.2%				ICU Level of Service				A	
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
23: College St & Froid Rd

2023 Background Conditions
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	40	90	100	75	80	10	125	290	115	15	350	20
Future Volume (vph)	40	90	100	75	80	10	125	290	115	15	350	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7		4.0	5.7	5.7	5.7	5.7			5.7	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00			1.00	
Fr _t	1.00	0.92		1.00	1.00	0.85	1.00	0.96			0.99	
Fl _t Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00			1.00	
Satd. Flow (prot)	1738	1686		1738	1830	1555	1738	1752			1813	
Fl _t Permitted	0.70	1.00		0.54	1.00	1.00	0.40	1.00			0.98	
Satd. Flow (perm)	1285	1686		989	1830	1555	735	1752			1773	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	42	95	105	79	84	11	132	305	121	16	368	21
RTOR Reduction (vph)	0	44	0	0	0	5	0	16	0	0	2	0
Lane Group Flow (vph)	42	156	0	79	84	6	132	410	0	0	403	0
Turn Type	Perm	NA		pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2		1	6			8				4
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)	30.2	30.2		41.9	41.9	41.9	30.2	30.2			30.2	
Effective Green, g (s)	30.2	30.2		41.9	41.9	41.9	30.2	30.2			30.2	
Actuated g/C Ratio	0.36	0.36		0.50	0.50	0.50	0.36	0.36			0.36	
Clearance Time (s)	5.7	5.7		4.0	5.7	5.7	5.7	5.7			5.7	
Vehicle Extension (s)	0.2	0.2		0.2	0.2	0.2	0.2	0.2			0.2	
Lane Grp Cap (vph)	464	609		565	918	780	265	633			641	
v/s Ratio Prot		c0.09		c0.01	0.05			c0.23				
v/s Ratio Perm	0.03			0.06		0.00	0.18				0.23	
v/c Ratio	0.09	0.26		0.14	0.09	0.01	0.50	0.65			0.63	
Uniform Delay, d1	17.6	18.7		11.0	10.9	10.4	20.7	22.2			22.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00			1.00	
Incremental Delay, d2	0.0	0.1		0.0	0.0	0.0	0.5	1.7			1.4	
Delay (s)	17.6	18.8		11.1	10.9	10.4	21.3	23.9			23.4	
Level of Service	B	B		B	B	B	C	C			C	
Approach Delay (s)		18.6			10.9			23.3			23.4	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM 2000 Control Delay	21.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	83.5	Sum of lost time (s)	15.4
Intersection Capacity Utilization	119.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Notre Dame Ave & Ste. Anne Rd/Louis St

2028 Background Conditions
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	65	20	150	40	25	5	185	645	45	15	1295	90
Future Volume (vph)	65	20	150	40	25	5	185	645	45	15	1295	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.4	6.4	6.4	6.4		4.0	6.2		6.2	6.2	6.2
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	0.91		1.00	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1738	1830	1555	1738	1785		1738	4946		1738	4995	1555
Flt Permitted	0.74	1.00	1.00	0.74	1.00		0.15	1.00		0.36	1.00	1.00
Satd. Flow (perm)	1348	1830	1555	1361	1785		274	4946		666	4995	1555
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	68	21	158	42	26	5	195	679	47	16	1363	95
RTOR Reduction (vph)	0	0	139	0	4	0	0	4	0	0	0	38
Lane Group Flow (vph)	68	21	19	42	27	0	195	722	0	16	1363	57
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		Perm	NA	Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	10.7	10.7	10.7	10.7	10.7		67.9	67.9		54.7	54.7	54.7
Effective Green, g (s)	10.7	10.7	10.7	10.7	10.7		67.9	67.9		54.7	54.7	54.7
Actuated g/C Ratio	0.12	0.12	0.12	0.12	0.12		0.74	0.74		0.60	0.60	0.60
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4		4.0	6.2		6.2	6.2	6.2
Vehicle Extension (s)	3.5	3.5	3.5	3.5	3.5		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	158	214	182	159	209		351	3682		399	2995	932
v/s Ratio Prot		0.01			0.01		c0.06	0.15			0.27	
v/s Ratio Perm	c0.05		0.01	0.03			c0.36			0.02		0.04
v/c Ratio	0.43	0.10	0.10	0.26	0.13		0.56	0.20		0.04	0.46	0.06
Uniform Delay, d1	37.4	35.9	36.0	36.7	36.1		5.1	3.5		7.5	10.0	7.6
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.2	0.2	0.3	1.1	0.3		1.9	0.1		0.2	0.5	0.1
Delay (s)	39.6	36.2	36.2	37.7	36.4		7.0	3.6		7.7	10.5	7.7
Level of Service	D	D	D	D	D		A	A		A	B	A
Approach Delay (s)		37.2			37.2			4.3			10.3	
Approach LOS		D			D			A			B	























Intersection Summary

HCM 2000 Control Delay	11.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	91.2	Sum of lost time (s)	16.6
Intersection Capacity Utilization	59.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Elgin St & Elm St

2028 Background Conditions
 AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 					 	 	
Traffic Volume (vph)	0	410	195	15	425	30	195	100	15	45	135	25
Future Volume (vph)	0	410	195	15	425	30	195	100	15	45	135	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.7			5.7		4.0	5.7		4.0	5.7	
Lane Util. Factor		0.95			0.95		1.00	1.00		1.00	1.00	
Flt		0.95			0.99		1.00	0.98		1.00	0.98	
Flt Protected		1.00			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3308			3437		1738	1793		1738	1787	
Flt Permitted		1.00			0.93		0.46	1.00		0.68	1.00	
Satd. Flow (perm)		3308			3194		834	1793		1243	1787	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	432	205	16	447	32	205	105	16	47	142	26
RTOR Reduction (vph)	0	50	0	0	5	0	0	6	0	0	8	0
Lane Group Flow (vph)	0	587	0	0	490	0	205	115	0	47	160	0
Turn Type		NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)		49.1			49.1		29.5	22.3		19.0	15.8	
Effective Green, g (s)		49.1			49.1		29.5	22.3		19.0	15.8	
Actuated g/C Ratio		0.55			0.55		0.33	0.25		0.21	0.18	
Clearance Time (s)		5.7			5.7		4.0	5.7		4.0	5.7	
Vehicle Extension (s)		3.0			0.2		0.2	0.2		0.2	3.0	
Lane Grp Cap (vph)		1804			1742		370	444		280	313	
v/s Ratio Prot		c0.18					c0.06	0.06		0.01	0.09	
v/s Ratio Perm					0.15		c0.12			0.03		
v/c Ratio		0.33			0.28		0.55	0.26		0.17	0.51	
Uniform Delay, d1		11.3			11.0		23.3	27.2		28.8	33.6	
Progression Factor		1.00			1.00		1.00	1.00		1.26	1.15	
Incremental Delay, d2		0.5			0.4		1.0	0.1		0.1	1.4	
Delay (s)		11.8			11.4		24.3	27.3		36.3	40.2	
Level of Service		B			B		C	C		D	D	
Approach Delay (s)		11.8			11.4			25.4			39.3	
Approach LOS		B			B			C			D	
Intersection Summary												
HCM 2000 Control Delay			17.9				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.43									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			15.4		
Intersection Capacity Utilization			61.4%				ICU Level of Service			B		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Elgin St & MacKenzie St/Ste. Anne Rd


















2028 Background Conditions
 AM Peak Hour

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↘	↑	↘	↗
Traffic Volume (vph)	215	105	70	260	110	55
Future Volume (vph)	215	105	70	260	110	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7	5.7	5.7	5.7	5.7
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1830	1555	1738	1830	1738	1555
Flt Permitted	1.00	1.00	0.62	1.00	0.95	1.00
Satd. Flow (perm)	1830	1555	1126	1830	1738	1555
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	226	111	74	274	116	58
RTOR Reduction (vph)	0	46	0	0	0	48
Lane Group Flow (vph)	226	65	74	274	116	10
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	2			2	4	
Permitted Phases		2	2			4
Actuated Green, G (s)	49.1	49.1	49.1	49.1	15.8	15.8
Effective Green, g (s)	49.1	49.1	49.1	49.1	15.8	15.8
Actuated g/C Ratio	0.55	0.55	0.55	0.55	0.18	0.18
Clearance Time (s)	5.7	5.7	5.7	5.7	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	998	848	614	998	305	272
v/s Ratio Prot	0.12			c0.15	c0.07	
v/s Ratio Perm		0.04	0.07			0.01
v/c Ratio	0.23	0.08	0.12	0.27	0.38	0.04
Uniform Delay, d1	10.6	9.7	9.9	10.9	32.8	30.8
Progression Factor	1.00	1.00	1.00	1.00	1.30	2.49
Incremental Delay, d2	0.5	0.2	0.4	0.7	0.8	0.1
Delay (s)	11.1	9.9	10.3	11.6	43.4	76.7
Level of Service	B	A	B	B	D	E
Approach Delay (s)	10.7			11.3	54.5	
Approach LOS	B			B	D	
Intersection Summary						
HCM 2000 Control Delay			19.8		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.26			
Actuated Cycle Length (s)			90.0		Sum of lost time (s)	15.4
Intersection Capacity Utilization			72.6%		ICU Level of Service	C
Analysis Period (min)			15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 13: Elgin St & Beech St

2028 Background Conditions
 AM Peak Hour





















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	15	45	20	20	45	20	105	5	10	130	30
Future Volume (vph)	15	15	45	20	20	45	20	105	5	10	130	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.7			5.7		5.7	5.7			5.7	
Lane Util. Factor		1.00			1.00		1.00	1.00			1.00	
Frt		0.92			0.93		1.00	0.99			0.98	
Flt Protected		0.99			0.99		0.95	1.00			1.00	
Satd. Flow (prot)		1666			1679		1738	1818			1780	
Flt Permitted		0.93			0.92		0.67	1.00			0.99	
Satd. Flow (perm)		1565			1557		1227	1818			1760	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	16	47	21	21	47	21	111	5	11	137	32
RTOR Reduction (vph)	0	39	0	0	39	0	0	1	0	0	7	0
Lane Group Flow (vph)	0	40	0	0	50	0	21	115	0	0	173	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			4			2				2
Permitted Phases	4			4			2			2		
Actuated Green, G (s)		15.8			15.8		49.1	49.1			49.1	
Effective Green, g (s)		15.8			15.8		49.1	49.1			49.1	
Actuated g/C Ratio		0.18			0.18		0.55	0.55			0.55	
Clearance Time (s)		5.7			5.7		5.7	5.7			5.7	
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		274			273		669	991			960	
v/s Ratio Prot								0.06				
v/s Ratio Perm		0.03			c0.03		0.02				c0.10	
v/c Ratio		0.15			0.18		0.03	0.12			0.18	
Uniform Delay, d1		31.4			31.6		9.5	9.9			10.3	
Progression Factor		1.00			1.00		1.30	1.41			0.54	
Incremental Delay, d2		0.2			0.3		0.1	0.2			0.4	
Delay (s)		31.6			31.9		12.4	14.2			6.0	
Level of Service		C			C		B	B			A	
Approach Delay (s)		31.6			31.9			13.9			6.0	
Approach LOS		C			C			B			A	
Intersection Summary												
HCM 2000 Control Delay			17.2				HCM 2000 Level of Service				B	
HCM 2000 Volume to Capacity ratio			0.16									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			15.4		
Intersection Capacity Utilization			42.8%				ICU Level of Service			A		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

23: College St & Froid Rd

2028 Background Conditions
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	25	65	35	130	90	10	175	270	60	15	270	20
Future Volume (vph)	25	65	35	130	90	10	175	270	60	15	270	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7		4.0	5.7	5.7	5.7	5.7			5.7	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00			1.00	
Frt	1.00	0.95		1.00	1.00	0.85	1.00	0.97			0.99	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00			1.00	
Satd. Flow (prot)	1738	1733		1738	1830	1555	1738	1780			1809	
Flt Permitted	0.70	1.00		0.58	1.00	1.00	0.53	1.00			0.98	
Satd. Flow (perm)	1272	1733		1062	1830	1555	965	1780			1770	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	26	68	37	137	95	11	184	284	63	16	284	21
RTOR Reduction (vph)	0	25	0	0	0	6	0	8	0	0	2	0
Lane Group Flow (vph)	26	80	0	137	95	5	184	339	0	0	319	0
Turn Type	Perm	NA		pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2		1	6			8				4
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)	21.3	21.3		32.4	32.4	32.4	34.1	34.1			34.1	
Effective Green, g (s)	21.3	21.3		32.4	32.4	32.4	34.1	34.1			34.1	
Actuated g/C Ratio	0.27	0.27		0.42	0.42	0.42	0.44	0.44			0.44	
Clearance Time (s)	5.7	5.7		4.0	5.7	5.7	5.7	5.7			5.7	
Vehicle Extension (s)	0.2	0.2		0.2	0.2	0.2	0.2	0.2			0.2	
Lane Grp Cap (vph)	347	473		503	761	646	422	779			774	
v/s Ratio Prot		0.05		c0.02	0.05			0.19				
v/s Ratio Perm	0.02			c0.09		0.00	c0.19				0.18	
v/c Ratio	0.07	0.17		0.27	0.12	0.01	0.44	0.44			0.41	
Uniform Delay, d1	21.0	21.6		14.5	14.0	13.3	15.2	15.2			15.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00			1.00	
Incremental Delay, d2	0.0	0.1		0.1	0.0	0.0	0.3	0.1			0.1	
Delay (s)	21.0	21.6		14.6	14.0	13.3	15.5	15.4			15.2	
Level of Service	C	C		B	B	B	B	B			B	
Approach Delay (s)		21.5			14.4			15.4			15.2	
Approach LOS		C			B			B			B	

Intersection Summary

HCM 2000 Control Delay	15.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	77.9	Sum of lost time (s)	15.4
Intersection Capacity Utilization	89.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Notre Dame Ave & Ste. Anne Rd/Louis St

2028 Background Conditions
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	245	55	370	50	30	20	170	1520	55	15	1035	105
Future Volume (vph)	245	55	370	50	30	20	170	1520	55	15	1035	105
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.4	6.4	6.4	6.4		4.0	6.2		6.2	6.2	6.2
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	0.91		1.00	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1738	1830	1555	1738	1721		1738	4969		1738	4995	1555
Flt Permitted	0.72	1.00	1.00	0.72	1.00		0.20	1.00		0.14	1.00	1.00
Satd. Flow (perm)	1322	1830	1555	1316	1721		357	4969		247	4995	1555
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	258	58	389	53	32	21	179	1600	58	16	1089	111
RTOR Reduction (vph)	0	0	165	0	16	0	0	3	0	0	0	55
Lane Group Flow (vph)	258	58	224	53	37	0	179	1655	0	16	1089	56
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		Perm	NA	Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	27.2	27.2	27.2	27.2	27.2		68.2	68.2		54.9	54.9	54.9
Effective Green, g (s)	27.2	27.2	27.2	27.2	27.2		68.2	68.2		54.9	54.9	54.9
Actuated g/C Ratio	0.25	0.25	0.25	0.25	0.25		0.63	0.63		0.51	0.51	0.51
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4		4.0	6.2		6.2	6.2	6.2
Vehicle Extension (s)	3.5	3.5	3.5	3.5	3.5		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	332	460	391	331	433		344	3137		125	2539	790
v/s Ratio Prot		0.03			0.02		0.04	c0.33			0.22	
v/s Ratio Perm	c0.20		0.14	0.04			0.28			0.06		0.04
v/c Ratio	0.78	0.13	0.57	0.16	0.09		0.52	0.53		0.13	0.43	0.07
Uniform Delay, d1	37.6	31.2	35.3	31.5	30.9		9.4	11.0		14.0	16.7	13.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	11.2	0.1	2.2	0.3	0.1		1.4	0.6		2.1	0.5	0.2
Delay (s)	48.8	31.4	37.5	31.8	31.0		10.9	11.6		16.1	17.2	13.7
Level of Service	D	C	D	C	C		B	B		B	B	B
Approach Delay (s)		41.1			31.4			11.6			16.9	
Approach LOS		D			C			B			B	

























Intersection Summary

HCM 2000 Control Delay	19.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	108.0	Sum of lost time (s)	16.6
Intersection Capacity Utilization	79.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Elgin St & Elm St

2028 Background Conditions
 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 		 	 		 	 	
Traffic Volume (vph)	0	495	255	0	525	35	275	155	20	110	225	60
Future Volume (vph)	0	495	255	0	525	35	275	155	20	110	225	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.7			5.7		4.0	5.7		4.0	5.7	
Lane Util. Factor		0.95			0.95		1.00	1.00		1.00	1.00	
Flt		0.95			0.99		1.00	0.98		1.00	0.97	
Flt Protected		1.00			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3299			3444		1738	1618		1738	1772	
Flt Permitted		1.00			1.00		0.28	1.00		0.64	1.00	
Satd. Flow (perm)		3299			3444		518	1618		1174	1772	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	521	268	0	553	37	289	163	21	116	237	63
RTOR Reduction (vph)	0	65	0	0	5	0	0	6	0	0	11	0
Lane Group Flow (vph)	0	724	0	0	585	0	289	178	0	116	289	0
Parking (#/hr)								0				
Turn Type		NA			NA		pm+pt	NA		pm+pt	NA	
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)		42.0			42.0		36.6	26.5		26.2	20.1	
Effective Green, g (s)		42.0			42.0		36.6	26.5		26.2	20.1	
Actuated g/C Ratio		0.47			0.47		0.41	0.29		0.29	0.22	
Clearance Time (s)		5.7			5.7		4.0	5.7		4.0	5.7	
Vehicle Extension (s)		3.0			0.2		0.2	0.2		0.2	3.0	
Lane Grp Cap (vph)		1539			1607		380	476		379	395	
v/s Ratio Prot		c0.22			0.17		c0.11	0.11		0.02	0.16	
v/s Ratio Perm							c0.20			0.07		
v/c Ratio		0.47			0.36		0.76	0.37		0.31	0.73	
Uniform Delay, d1		16.4			15.4		20.2	25.2		24.2	32.4	
Progression Factor		1.00			1.00		1.00	1.00		1.35	1.22	
Incremental Delay, d2		1.0			0.6		7.9	0.2		0.2	6.5	
Delay (s)		17.4			16.1		28.0	25.4		33.0	46.1	
Level of Service		B			B		C	C		C	D	
Approach Delay (s)		17.4			16.1			27.0			42.4	
Approach LOS		B			B			C			D	
Intersection Summary												
HCM 2000 Control Delay			23.7				HCM 2000 Level of Service				C	
HCM 2000 Volume to Capacity ratio			0.63									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			15.4		
Intersection Capacity Utilization			72.7%				ICU Level of Service				C	
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 12: Elgin St & MacKenzie St/Ste. Anne Rd


















2028 Background Conditions
 PM Peak Hour

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↘	↑	↘	↗
Traffic Volume (vph)	255	190	120	260	130	145
Future Volume (vph)	255	190	120	260	130	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7	5.7	5.7	5.7	5.7
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1830	1555	1738	1830	1738	1555
Flt Permitted	1.00	1.00	0.56	1.00	0.95	1.00
Satd. Flow (perm)	1830	1555	1017	1830	1738	1555
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	268	200	126	274	137	153
RTOR Reduction (vph)	0	78	0	0	0	119
Lane Group Flow (vph)	268	122	126	274	137	34
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	2			2	4	
Permitted Phases		2	2			4
Actuated Green, G (s)	42.0	42.0	42.0	42.0	20.1	20.1
Effective Green, g (s)	42.0	42.0	42.0	42.0	20.1	20.1
Actuated g/C Ratio	0.47	0.47	0.47	0.47	0.22	0.22
Clearance Time (s)	5.7	5.7	5.7	5.7	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	854	725	474	854	388	347
v/s Ratio Prot	0.15			c0.15	c0.08	
v/s Ratio Perm		0.08	0.12			0.02
v/c Ratio	0.31	0.17	0.27	0.32	0.35	0.10
Uniform Delay, d1	15.0	13.9	14.6	15.1	29.5	27.8
Progression Factor	1.00	1.00	1.00	1.00	1.17	2.69
Incremental Delay, d2	1.0	0.5	1.4	1.0	0.5	0.1
Delay (s)	16.0	14.4	16.0	16.0	35.1	74.9
Level of Service	B	B	B	B	D	E
Approach Delay (s)	15.3			16.0	56.1	
Approach LOS	B			B	E	
Intersection Summary						
HCM 2000 Control Delay			25.8		HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.28			
Actuated Cycle Length (s)			90.0		Sum of lost time (s)	15.4
Intersection Capacity Utilization			72.6%		ICU Level of Service	C
Analysis Period (min)			15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Elgin St & Beech St

2028 Background Conditions
PM Peak Hour























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	10	85	50	45	105	30	145	15	10	245	50
Future Volume (vph)	15	10	85	50	45	105	30	145	15	10	245	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.7			5.7		5.7	5.7			5.7	
Lane Util. Factor		1.00			1.00		1.00	1.00			1.00	
Frt		0.90			0.93		1.00	0.99			0.98	
Flt Protected		0.99			0.99		0.95	1.00			1.00	
Satd. Flow (prot)		1629			1679		1738	1804			1786	
Flt Permitted		0.95			0.90		0.52	1.00			0.99	
Satd. Flow (perm)		1555			1531		960	1804			1772	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	11	89	53	47	111	32	153	16	11	258	53
RTOR Reduction (vph)	0	69	0	0	47	0	0	4	0	0	7	0
Lane Group Flow (vph)	0	47	0	0	164	0	32	165	0	0	315	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			4			2				2
Permitted Phases	4			4			2			2		
Actuated Green, G (s)		20.1			20.1		42.0	42.0			42.0	
Effective Green, g (s)		20.1			20.1		42.0	42.0			42.0	
Actuated g/C Ratio		0.22			0.22		0.47	0.47			0.47	
Clearance Time (s)		5.7			5.7		5.7	5.7			5.7	
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		347			341		448	841			826	
v/s Ratio Prot								0.09				
v/s Ratio Perm		0.03			c0.11		0.03				c0.18	
v/c Ratio		0.14			0.48		0.07	0.20			0.38	
Uniform Delay, d1		28.0			30.4		13.2	14.1			15.6	
Progression Factor		1.00			1.00		1.18	1.24			0.49	
Incremental Delay, d2		0.2			1.1		0.3	0.5			1.3	
Delay (s)		28.2			31.5		15.9	17.9			8.9	
Level of Service		C			C		B	B			A	
Approach Delay (s)		28.2			31.5			17.6			8.9	
Approach LOS		C			C			B			A	
Intersection Summary												
HCM 2000 Control Delay			19.2				HCM 2000 Level of Service				B	
HCM 2000 Volume to Capacity ratio			0.34									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)				15.4	
Intersection Capacity Utilization			52.7%				ICU Level of Service				A	
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

23: College St & Froid Rd

2028 Background Conditions
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	45	100	105	80	90	10	135	315	120	15	375	25
Future Volume (vph)	45	100	105	80	90	10	135	315	120	15	375	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7		4.0	5.7	5.7	5.7	5.7			5.7	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00			1.00	
Frt	1.00	0.92		1.00	1.00	0.85	1.00	0.96			0.99	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00			1.00	
Satd. Flow (prot)	1738	1689		1738	1830	1555	1738	1754			1812	
Flt Permitted	0.70	1.00		0.52	1.00	1.00	0.38	1.00			0.98	
Satd. Flow (perm)	1272	1689		954	1830	1555	687	1754			1772	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	47	105	111	84	95	11	142	332	126	16	395	26
RTOR Reduction (vph)	0	42	0	0	0	5	0	15	0	0	3	0
Lane Group Flow (vph)	47	174	0	84	95	6	142	443	0	0	434	0
Turn Type	Perm	NA		pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2		1	6			8				4
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)	30.2	30.2		41.9	41.9	41.9	30.2	30.2			30.2	
Effective Green, g (s)	30.2	30.2		41.9	41.9	41.9	30.2	30.2			30.2	
Actuated g/C Ratio	0.36	0.36		0.50	0.50	0.50	0.36	0.36			0.36	
Clearance Time (s)	5.7	5.7		4.0	5.7	5.7	5.7	5.7			5.7	
Vehicle Extension (s)	0.2	0.2		0.2	0.2	0.2	0.2	0.2			0.2	
Lane Grp Cap (vph)	460	610		551	918	780	248	634			640	
v/s Ratio Prot		c0.10		c0.01	0.05			c0.25				
v/s Ratio Perm	0.04			0.06		0.00	0.21				0.25	
v/c Ratio	0.10	0.29		0.15	0.10	0.01	0.57	0.70			0.68	
Uniform Delay, d1	17.7	19.0		11.1	10.9	10.4	21.5	22.8			22.5	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00			1.00	
Incremental Delay, d2	0.0	0.1		0.0	0.0	0.0	2.0	2.7			2.3	
Delay (s)	17.7	19.1		11.1	10.9	10.4	23.4	25.5			24.8	
Level of Service	B	B		B	B	B	C	C			C	
Approach Delay (s)		18.8			11.0			25.0			24.8	
Approach LOS		B			B			C			C	

Intersection Summary











HCM 2000 Control Delay	22.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	83.5	Sum of lost time (s)	15.4
Intersection Capacity Utilization	119.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Queues
6: Notre Dame Ave & Ste. Anne Rd/Louis St

2028 Background Conditions

AM Peak Hour

										
Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	68	21	158	42	31	195	726	16	1363	95
v/c Ratio	0.43	0.10	0.49	0.26	0.15	0.55	0.20	0.04	0.45	0.10
Control Delay	46.1	36.4	11.8	40.7	32.9	10.1	3.7	9.3	11.1	2.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.1	36.4	11.8	40.7	32.9	10.1	3.7	9.3	11.1	2.4
Queue Length 50th (m)	11.3	3.3	0.0	6.8	4.1	6.9	10.9	1.0	43.2	0.0
Queue Length 95th (m)	23.9	9.8	16.6	16.4	12.0	18.8	17.6	4.2	63.5	6.4
Internal Link Dist (m)		336.0			265.5		169.1		392.6	
Turn Bay Length (m)	135.0		115.0			25.0		75.0		85.0
Base Capacity (vph)	586	795	765	591	779	387	3685	399	2997	971
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.12	0.03	0.21	0.07	0.04	0.50	0.20	0.04	0.45	0.10
Intersection Summary										

Queues
11: Elgin St & Elm St

2028 Background Conditions
AM Peak Hour

	→	←	↖	↑	↘	↓
Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	637	495	205	121	47	168
v/c Ratio	0.33	0.27	0.55	0.27	0.15	0.58
Control Delay	10.0	11.4	27.7	26.9	25.0	45.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	10.0	11.4	27.7	26.9	25.0	45.3
Queue Length 50th (m)	23.5	21.4	26.5	16.5	6.4	25.3
Queue Length 95th (m)	40.8	36.3	38.9	28.6	14.0	38.6
Internal Link Dist (m)	420.7	420.2		182.5		72.6
Turn Bay Length (m)			25.0		20.0	
Base Capacity (vph)	1911	1802	385	504	429	503
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.33	0.27	0.53	0.24	0.11	0.33
Intersection Summary						

Queues
12: Elgin St & MacKenzie St/Ste. Anne Rd

2028 Background Conditions
AM Peak Hour

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	226	111	74	274	116	58
v/c Ratio	0.22	0.12	0.12	0.27	0.42	0.20
Control Delay	11.8	3.4	11.7	12.2	47.9	22.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.8	3.4	11.7	12.2	47.9	22.8
Queue Length 50th (m)	18.4	0.7	5.6	22.9	18.0	1.0
Queue Length 95th (m)	36.3	8.9	14.5	44.0	29.1	11.7
Internal Link Dist (m)	200.0			62.9	81.4	
Turn Bay Length (m)		15.0	35.0			
Base Capacity (vph)	1030	920	633	1030	482	473
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.22	0.12	0.12	0.27	0.24	0.12
Intersection Summary						









Queues
13: Elgin St & Beech St

2028 Background Conditions
AM Peak Hour

	→	←	↙	↑	↓
Lane Group	EBT	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	79	89	21	116	180
v/c Ratio	0.28	0.31	0.03	0.11	0.18
Control Delay	17.9	19.9	14.5	15.1	5.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	17.9	19.9	14.5	15.1	5.9
Queue Length 50th (m)	4.9	6.5	2.8	16.0	7.8
Queue Length 95th (m)	15.5	17.7	8.7	29.9	10.1
Internal Link Dist (m)	118.6	120.4		72.6	81.4
Turn Bay Length (m)					
Base Capacity (vph)	468	466	690	1025	998
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.17	0.19	0.03	0.11	0.18
Intersection Summary					

Queues
23: College St & Froid Rd











2028 Background Conditions
AM Peak Hour

								
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBT
Lane Group Flow (vph)	26	105	137	95	11	184	347	321
v/c Ratio	0.05	0.13	0.22	0.09	0.01	0.40	0.40	0.38
Control Delay	18.9	14.5	11.2	11.0	0.9	25.7	22.0	22.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.9	14.5	11.2	11.0	0.9	25.7	22.0	22.3
Queue Length 50th (m)	2.8	7.7	10.6	7.5	0.0	23.7	42.9	40.4
Queue Length 95th (m)	8.0	18.4	19.6	15.0	0.6	44.6	68.5	64.4
Internal Link Dist (m)		174.4		243.5			197.1	355.4
Turn Bay Length (m)	15.0		20.0		20.0	30.0		
Base Capacity (vph)	570	795	642	1159	997	466	868	858
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.05	0.13	0.21	0.08	0.01	0.39	0.40	0.37
Intersection Summary								

Queues
6: Notre Dame Ave & Ste. Anne Rd/Louis St

2028 Background Conditions

PM Peak Hour

										
Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	258	58	389	53	53	179	1658	16	1089	111
v/c Ratio	0.78	0.13	0.70	0.16	0.12	0.51	0.53	0.13	0.43	0.13
Control Delay	53.5	30.4	22.0	31.3	20.4	14.1	12.8	21.5	18.8	4.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Total Delay	53.5	30.4	22.0	31.3	20.4	14.1	13.0	21.5	18.8	4.0
Queue Length 50th (m)	50.4	9.4	31.7	8.7	5.1	13.3	64.4	1.7	51.1	0.0
Queue Length 95th (m)	78.7	19.1	63.7	18.3	14.2	29.7	102.4	7.5	78.6	10.0
Internal Link Dist (m)		336.0			265.5		169.1		392.6	
Turn Bay Length (m)	135.0		115.0			25.0		75.0		85.0
Base Capacity (vph)	486	674	711	484	647	373	3137	125	2533	843
Starvation Cap Reductn	0	0	0	0	0	0	578	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.53	0.09	0.55	0.11	0.08	0.48	0.65	0.13	0.43	0.13
Intersection Summary										

Queues
11: Elgin St & Elm St

2028 Background Conditions
PM Peak Hour

	→	←	↖	↑	↘	↓
Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	789	590	289	184	116	300
v/c Ratio	0.49	0.37	0.74	0.38	0.29	0.74
Control Delay	16.3	17.3	28.9	25.1	22.2	47.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.9
Total Delay	16.3	17.3	28.9	25.1	22.2	48.7
Queue Length 50th (m)	41.6	34.1	32.1	23.3	15.9	45.3
Queue Length 95th (m)	63.5	51.4	46.1	38.3	27.6	73.0
Internal Link Dist (m)	420.7	420.2		182.5		72.6
Turn Bay Length (m)			25.0		20.0	
Base Capacity (vph)	1603	1611	424	577	419	482
Starvation Cap Reductn	0	0	0	0	0	46
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.49	0.37	0.68	0.32	0.28	0.69
Intersection Summary						

Queues
12: Elgin St & MacKenzie St/Ste. Anne Rd

2028 Background Conditions
PM Peak Hour

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	268	200	126	274	137	153
v/c Ratio	0.31	0.25	0.27	0.32	0.35	0.33
Control Delay	18.0	6.4	18.9	18.1	35.8	14.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.0	6.4	18.9	18.1	35.8	14.5
Queue Length 50th (m)	29.1	5.1	13.3	29.8	17.9	2.3
Queue Length 95th (m)	51.1	18.8	28.4	52.3	28.8	18.0
Internal Link Dist (m)	200.0			62.9	81.4	
Turn Bay Length (m)		15.0	35.0			
Base Capacity (vph)	853	803	474	853	463	526
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.31	0.25	0.27	0.32	0.30	0.29
Intersection Summary						

Queues
13: Elgin St & Beech St









2028 Background Conditions

PM Peak Hour

	→	←	↙	↑	↓
Lane Group	EBT	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	116	211	32	169	322
v/c Ratio	0.28	0.54	0.07	0.20	0.39
Control Delay	10.8	26.4	19.7	19.9	9.6
Queue Delay	0.1	0.4	0.0	0.0	0.1
Total Delay	10.9	26.8	19.7	19.9	9.8
Queue Length 50th (m)	3.6	22.3	4.7	25.3	16.4
Queue Length 95th (m)	15.9	42.0	12.4	41.8	18.6
Internal Link Dist (m)	118.6	120.4		72.6	81.4
Turn Bay Length (m)					
Base Capacity (vph)	480	452	447	845	833
Starvation Cap Reductn	0	0	0	0	87
Spillback Cap Reductn	47	46	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.27	0.52	0.07	0.20	0.43
Intersection Summary					

Queues
23: College St & Froid Rd























2028 Background Conditions
PM Peak Hour

								
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBT
Lane Group Flow (vph)	47	216	84	95	11	142	458	437
v/c Ratio	0.10	0.33	0.14	0.10	0.01	0.57	0.70	0.67
Control Delay	19.6	15.5	10.5	11.1	0.9	33.2	28.8	29.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	19.6	15.5	10.5	11.1	0.9	33.2	28.8	29.0
Queue Length 50th (m)	5.1	17.2	6.3	7.5	0.0	18.7	60.9	59.9
Queue Length 95th (m)	12.4	34.3	13.0	15.0	0.6	39.0	95.0	92.5
Internal Link Dist (m)		174.4		243.5			197.1	355.4
Turn Bay Length (m)	15.0		20.0		20.0	30.0		
Base Capacity (vph)	468	663	607	1030	890	252	662	654
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.33	0.14	0.09	0.01	0.56	0.69	0.67
Intersection Summary								

**APPENDIX D:
FUTURE TOTAL OPERATIONS**

HCM Signalized Intersection Capacity Analysis
6: Notre Dame Ave & Ste. Anne Rd/Louis St

2018 Total Conditions
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	60	20	140	40	25	5	195	555	45	15	1120	90
Future Volume (vph)	60	20	140	40	25	5	195	555	45	15	1120	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.4	6.4	6.4	6.4		4.0	6.2		6.2	6.2	6.2
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	0.91		1.00	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1738	1830	1555	1738	1785		1738	4939		1738	4995	1555
Flt Permitted	0.74	1.00	1.00	0.74	1.00		0.19	1.00		0.40	1.00	1.00
Satd. Flow (perm)	1348	1830	1555	1361	1785		353	4939		734	4995	1555
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	63	21	147	42	26	5	205	584	47	16	1179	95
RTOR Reduction (vph)	0	0	130	0	4	0	0	5	0	0	0	37
Lane Group Flow (vph)	63	21	17	42	27	0	205	626	0	16	1179	58
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		Perm	NA	Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	10.4	10.4	10.4	10.4	10.4		67.8	67.8		55.2	55.2	55.2
Effective Green, g (s)	10.4	10.4	10.4	10.4	10.4		67.8	67.8		55.2	55.2	55.2
Actuated g/C Ratio	0.11	0.11	0.11	0.11	0.11		0.75	0.75		0.61	0.61	0.61
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4		4.0	6.2		6.2	6.2	6.2
Vehicle Extension (s)	3.5	3.5	3.5	3.5	3.5		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	154	209	178	155	204		394	3687		446	3036	945
v/s Ratio Prot		0.01			0.01		c0.05	0.13			0.24	
v/s Ratio Perm	c0.05		0.01	0.03			c0.34			0.02		0.04
v/c Ratio	0.41	0.10	0.09	0.27	0.13		0.52	0.17		0.04	0.39	0.06
Uniform Delay, d1	37.3	36.0	36.0	36.7	36.1		4.2	3.3		7.1	9.1	7.2
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.1	0.2	0.3	1.1	0.3		1.2	0.1		0.2	0.4	0.1
Delay (s)	39.4	36.3	36.3	37.9	36.5		5.4	3.4		7.3	9.5	7.4
Level of Service	D	D	D	D	D		A	A		A	A	A
Approach Delay (s)		37.1			37.3			3.9			9.3	
Approach LOS		D			D			A			A	




















Intersection Summary

HCM 2000 Control Delay	11.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	90.8	Sum of lost time (s)	16.6
Intersection Capacity Utilization	56.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Elgin St & Elm St

2018 Total Conditions
 AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	355	170	15	365	45	165	100	10	45	125	25
Future Volume (vph)	0	355	170	15	365	45	165	100	10	45	125	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.7			5.7		4.0	5.7		4.0	5.7	
Lane Util. Factor		0.95			0.95		1.00	1.00		1.00	1.00	
Flt		0.95			0.98		1.00	0.99		1.00	0.98	
Flt Protected		1.00			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3308			3415		1738	1804		1738	1784	
Flt Permitted		1.00			0.93		0.51	1.00		0.68	1.00	
Satd. Flow (perm)		3308			3181		935	1804		1248	1784	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	374	179	16	384	47	174	105	11	47	132	26
RTOR Reduction (vph)	0	60	0	0	10	0	0	5	0	0	10	0
Lane Group Flow (vph)	0	493	0	0	437	0	174	111	0	47	148	0
Turn Type		NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)		43.4			43.4		24.6	18.0		17.8	14.6	
Effective Green, g (s)		43.4			43.4		24.6	18.0		17.8	14.6	
Actuated g/C Ratio		0.54			0.54		0.31	0.22		0.22	0.18	
Clearance Time (s)		5.7			5.7		4.0	5.7		4.0	5.7	
Vehicle Extension (s)		3.0			0.2		0.2	0.2		0.2	3.0	
Lane Grp Cap (vph)		1794			1725		353	405		297	325	
v/s Ratio Prot		c0.15					c0.04	0.06		0.01	0.08	
v/s Ratio Perm					0.14		c0.11			0.03		
v/c Ratio		0.27			0.25		0.49	0.27		0.16	0.46	
Uniform Delay, d1		9.8			9.7		21.4	25.6		24.9	29.2	
Progression Factor		1.00			1.00		1.00	1.00		1.20	1.12	
Incremental Delay, d2		0.4			0.4		0.4	0.1		0.1	1.0	
Delay (s)		10.2			10.1		21.8	25.7		30.0	33.6	
Level of Service		B			B		C	C		C	C	
Approach Delay (s)		10.2			10.1			23.4			32.8	
Approach LOS		B			B			C			C	
Intersection Summary												
HCM 2000 Control Delay			15.8				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.37									
Actuated Cycle Length (s)			80.0				Sum of lost time (s)			15.4		
Intersection Capacity Utilization			59.5%				ICU Level of Service			B		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Elgin St & MacKenzie St/Ste. Anne Rd

2018 Total Conditions
 AM Peak Hour


















	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↘	↑	↘	↗
Traffic Volume (vph)	195	95	65	265	125	50
Future Volume (vph)	195	95	65	265	125	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7	5.7	5.7	5.7	5.7
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1830	1555	1738	1830	1738	1555
Flt Permitted	1.00	1.00	0.63	1.00	0.95	1.00
Satd. Flow (perm)	1830	1555	1151	1830	1738	1555
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	205	100	68	279	132	53
RTOR Reduction (vph)	0	46	0	0	0	43
Lane Group Flow (vph)	205	54	68	279	132	10
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	2			2	4	
Permitted Phases		2	2			4
Actuated Green, G (s)	43.4	43.4	43.4	43.4	14.6	14.6
Effective Green, g (s)	43.4	43.4	43.4	43.4	14.6	14.6
Actuated g/C Ratio	0.54	0.54	0.54	0.54	0.18	0.18
Clearance Time (s)	5.7	5.7	5.7	5.7	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	992	843	624	992	317	283
v/s Ratio Prot	0.11			c0.15	c0.08	
v/s Ratio Perm		0.03	0.06			0.01
v/c Ratio	0.21	0.06	0.11	0.28	0.42	0.03
Uniform Delay, d1	9.4	8.7	8.9	9.9	28.9	26.9
Progression Factor	1.00	1.00	1.00	1.00	1.30	2.40
Incremental Delay, d2	0.5	0.1	0.4	0.7	0.9	0.0
Delay (s)	9.9	8.8	9.3	10.6	38.4	64.5
Level of Service	A	A	A	B	D	E
Approach Delay (s)	9.5			10.3	45.9	
Approach LOS	A			B	D	

Intersection Summary			
HCM 2000 Control Delay	17.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.28		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	15.4
Intersection Capacity Utilization	71.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Elgin St & Beech St

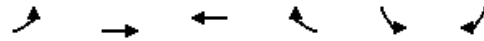
2018 Total Conditions
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	15	45	20	20	40	20	120	5	10	125	25
Future Volume (vph)	15	15	45	20	20	40	20	120	5	10	125	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.7			5.7		5.7	5.7			5.7	
Lane Util. Factor		1.00			1.00		1.00	1.00			1.00	
Flt		0.92			0.93		1.00	0.99			0.98	
Flt Protected		0.99			0.99		0.95	1.00			1.00	
Satd. Flow (prot)		1666			1685		1738	1819			1786	
Flt Permitted		0.93			0.91		0.69	1.00			0.98	
Satd. Flow (perm)		1565			1555		1266	1819			1764	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	16	47	21	21	42	21	126	5	11	132	26
RTOR Reduction (vph)	0	38	0	0	34	0	0	1	0	0	7	0
Lane Group Flow (vph)	0	41	0	0	50	0	21	130	0	0	162	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			4			2				2
Permitted Phases	4			4			2			2		
Actuated Green, G (s)		14.6			14.6		43.4	43.4			43.4	
Effective Green, g (s)		14.6			14.6		43.4	43.4			43.4	
Actuated g/C Ratio		0.18			0.18		0.54	0.54			0.54	
Clearance Time (s)		5.7			5.7		5.7	5.7			5.7	
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		285			283		686	986			956	
v/s Ratio Prot								0.07				
v/s Ratio Perm		0.03			c0.03		0.02				c0.09	
v/c Ratio		0.14			0.18		0.03	0.13			0.17	
Uniform Delay, d1		27.4			27.6		8.5	9.0			9.2	
Progression Factor		1.00			1.00		1.05	1.19			0.59	
Incremental Delay, d2		0.2			0.3		0.1	0.3			0.4	
Delay (s)		27.7			27.9		9.0	11.0			5.8	
Level of Service		C			C		A	B			A	
Approach Delay (s)		27.7			27.9			10.7			5.8	
Approach LOS		C			C			B			A	
Intersection Summary												
HCM 2000 Control Delay			14.8				HCM 2000 Level of Service				B	
HCM 2000 Volume to Capacity ratio			0.15									
Actuated Cycle Length (s)			80.0				Sum of lost time (s)			15.4		
Intersection Capacity Utilization			42.8%				ICU Level of Service			A		
Analysis Period (min)			15									

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
 16: Ste. Anne Rd & Access 1

2018 Total Conditions
 AM Peak Hour












Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕↕	↕↕		↕	
Traffic Volume (veh/h)	20	225	315	15	10	15
Future Volume (Veh/h)	20	225	315	15	10	15
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	21	237	332	16	11	16
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)		87	360			
pX, platoon unblocked						
vC, conflicting volume	348				500	174
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	348				500	174
tC, single (s)	4.2				6.9	7.0
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				98	98
cM capacity (veh/h)	1186				484	830

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	100	158	221	127	27
Volume Left	21	0	0	0	11
Volume Right	0	0	0	16	16
cSH	1186	1700	1700	1700	642
Volume to Capacity	0.02	0.09	0.13	0.07	0.04
Queue Length 95th (m)	0.4	0.0	0.0	0.0	1.0
Control Delay (s)	1.8	0.0	0.0	0.0	10.8
Lane LOS	A				B
Approach Delay (s)	0.7		0.0		10.8
Approach LOS					B

Intersection Summary						
Average Delay			0.7			
Intersection Capacity Utilization			29.3%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
 18: MacKenzie St & Access 2























2018 Total Conditions
 AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	30	10	295	125	15	260
Future Volume (Veh/h)	30	10	295	125	15	260
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	32	11	311	132	16	274
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)			224			
pX, platoon unblocked	0.94	0.94			0.94	
vC, conflicting volume	683	377			443	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	635	310			380	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	92	98			99	
cM capacity (veh/h)	408	682			1097	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	43	443	290			
Volume Left	32	0	16			
Volume Right	11	132	0			
cSH	454	1700	1097			
Volume to Capacity	0.09	0.26	0.01			
Queue Length 95th (m)	2.4	0.0	0.3			
Control Delay (s)	13.8	0.0	0.6			
Lane LOS	B		A			
Approach Delay (s)	13.8	0.0	0.6			
Approach LOS	B					
Intersection Summary						
Average Delay			1.0			
Intersection Capacity Utilization			35.9%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

23: College St & Froid Rd

2018 Total Conditions
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	60	30	110	75	10	150	260	50	10	240	15
Future Volume (vph)	20	60	30	110	75	10	150	260	50	10	240	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7		4.0	5.7	5.7	5.7	5.7				5.7
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00				1.00
Fr _t	1.00	0.95		1.00	1.00	0.85	1.00	0.98				0.99
Fl _t Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00				1.00
Satd. Flow (prot)	1738	1737		1738	1830	1555	1738	1785				1812
Fl _t Permitted	0.71	1.00		0.59	1.00	1.00	0.56	1.00				0.98
Satd. Flow (perm)	1291	1737		1077	1830	1555	1030	1785				1786
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	21	63	32	116	79	11	158	274	53	11	253	16
RTOR Reduction (vph)	0	23	0	0	0	6	0	7	0	0	2	0
Lane Group Flow (vph)	21	72	0	116	79	5	158	320	0	0	278	0
Turn Type	Perm	NA		pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2		1	6			8				4
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)	22.0	22.0		33.3	33.3	33.3	36.0	36.0				36.0
Effective Green, g (s)	22.0	22.0		33.3	33.3	33.3	36.0	36.0				36.0
Actuated g/C Ratio	0.27	0.27		0.41	0.41	0.41	0.45	0.45				0.45
Clearance Time (s)	5.7	5.7		4.0	5.7	5.7	5.7	5.7				5.7
Vehicle Extension (s)	0.2	0.2		0.2	0.2	0.2	0.2	0.2				0.2
Lane Grp Cap (vph)	351	473		504	755	641	459	796				796
v/s Ratio Prot		0.04		c0.02	0.04			c0.18				
v/s Ratio Perm	0.02			c0.07		0.00	0.15					0.16
v/c Ratio	0.06	0.15		0.23	0.10	0.01	0.34	0.40				0.35
Uniform Delay, d ₁	21.7	22.3		15.0	14.5	14.0	14.6	15.1				14.7
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00				1.00
Incremental Delay, d ₂	0.0	0.1		0.1	0.0	0.0	0.2	0.1				0.1
Delay (s)	21.7	22.3		15.1	14.6	14.0	14.8	15.2				14.8
Level of Service	C	C		B	B	B	B	B				B
Approach Delay (s)		22.2			14.8			15.1				14.8
Approach LOS		C			B			B				B

Intersection Summary
























HCM 2000 Control Delay	15.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	80.7	Sum of lost time (s)	15.4
Intersection Capacity Utilization	89.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

6: Notre Dame Ave & Ste. Anne Rd

2018 Total Conditions
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	215	50	335	45	30	20	150	1310	55	15	895	95
Future Volume (vph)	215	50	335	45	30	20	150	1310	55	15	895	95
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.4	6.4	6.4	6.4		4.0	6.2		6.2	6.2	6.2
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	0.91		1.00	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1738	1830	1555	1738	1721		1738	4965		1738	4995	1555
Flt Permitted	0.72	1.00	1.00	0.72	1.00		0.24	1.00		0.17	1.00	1.00
Satd. Flow (perm)	1322	1830	1555	1322	1721		447	4965		317	4995	1555
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	226	53	353	47	32	21	158	1379	58	16	942	100
RTOR Reduction (vph)	0	0	185	0	16	0	0	3	0	0	0	47
Lane Group Flow (vph)	226	53	168	47	37	0	158	1434	0	16	942	53
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		Perm	NA	Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	24.3	24.3	24.3	24.3	24.3		68.2	68.2		55.4	55.4	55.4
Effective Green, g (s)	24.3	24.3	24.3	24.3	24.3		68.2	68.2		55.4	55.4	55.4
Actuated g/C Ratio	0.23	0.23	0.23	0.23	0.23		0.65	0.65		0.53	0.53	0.53
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4		4.0	6.2		6.2	6.2	6.2
Vehicle Extension (s)	3.5	3.5	3.5	3.5	3.5		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	305	423	359	305	397		398	3221		167	2632	819
v/s Ratio Prot		0.03			0.02		0.03	c0.29			0.19	
v/s Ratio Perm	c0.17		0.11	0.04			0.22			0.05		0.03
v/c Ratio	0.74	0.13	0.47	0.15	0.09		0.40	0.45		0.10	0.36	0.06
Uniform Delay, d1	37.5	32.0	34.8	32.2	31.7		7.7	9.1		12.4	14.5	12.2
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	9.6	0.2	1.1	0.3	0.1		0.7	0.4		1.1	0.4	0.2
Delay (s)	47.1	32.1	36.0	32.5	31.9		8.4	9.6		13.5	14.9	12.3
Level of Service	D	C	D	C	C		A	A		B	B	B
Approach Delay (s)		39.6			32.2			9.4			14.6	
Approach LOS		D			C			A			B	





















Intersection Summary

HCM 2000 Control Delay	17.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	105.1	Sum of lost time (s)	16.6
Intersection Capacity Utilization	73.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Elgin St & Elm St

2018 Total Conditions
 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 							
Traffic Volume (vph)	0	430	220	0	455	35	235	135	15	105	200	60
Future Volume (vph)	0	430	220	0	455	35	235	135	15	105	200	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.7			5.7		4.0	5.7		4.0	5.7	
Lane Util. Factor		0.95			0.95		1.00	1.00		1.00	1.00	
Flt		0.95			0.99		1.00	0.98		1.00	0.97	
Flt Protected		1.00			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3300			3439		1738	1802		1738	1767	
Flt Permitted		1.00			1.00		0.33	1.00		0.66	1.00	
Satd. Flow (perm)		3300			3439		607	1802		1202	1767	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	453	232	0	479	37	247	142	16	111	211	63
RTOR Reduction (vph)	0	76	0	0	7	0	0	5	0	0	14	0
Lane Group Flow (vph)	0	609	0	0	509	0	247	153	0	111	260	0
Turn Type		NA			NA		pm+pt	NA		pm+pt	NA	
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)		38.8			38.8		29.4	20.9		22.2	17.3	
Effective Green, g (s)		38.8			38.8		29.4	20.9		22.2	17.3	
Actuated g/C Ratio		0.48			0.48		0.37	0.26		0.28	0.22	
Clearance Time (s)		5.7			5.7		4.0	5.7		4.0	5.7	
Vehicle Extension (s)		3.0			0.2		0.2	0.2		0.2	3.0	
Lane Grp Cap (vph)		1600			1667		343	470		366	382	
v/s Ratio Prot		c0.18			0.15		c0.08	0.08		0.02	0.15	
v/s Ratio Perm							c0.19			0.07		
v/c Ratio		0.38			0.31		0.72	0.33		0.30	0.68	
Uniform Delay, d1		13.0			12.5		19.3	23.9		22.3	28.8	
Progression Factor		1.00			1.00		1.00	1.00		1.29	1.18	
Incremental Delay, d2		0.7			0.5		6.2	0.1		0.2	4.7	
Delay (s)		13.7			12.9		25.5	24.0		29.0	38.7	
Level of Service		B			B		C	C		C	D	
Approach Delay (s)		13.7			12.9			24.9			35.9	
Approach LOS		B			B			C			D	
Intersection Summary												
HCM 2000 Control Delay			20.1				HCM 2000 Level of Service				C	
HCM 2000 Volume to Capacity ratio			0.55									
Actuated Cycle Length (s)			80.0				Sum of lost time (s)			15.4		
Intersection Capacity Utilization			69.2%				ICU Level of Service			C		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Elgin St & Ste. Anne Rd

2018 Total Conditions
 PM Peak Hour

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↘	↑	↘	↗
Traffic Volume (vph)	245	180	105	225	115	125
Future Volume (vph)	245	180	105	225	115	125
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7	5.7	5.7	5.7	5.7
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1830	1555	1738	1830	1738	1555
Flt Permitted	1.00	1.00	0.58	1.00	0.95	1.00
Satd. Flow (perm)	1830	1555	1063	1830	1738	1555
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	258	189	111	237	121	132
RTOR Reduction (vph)	0	92	0	0	0	103
Lane Group Flow (vph)	258	97	111	237	121	29
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	2			2	4	
Permitted Phases		2	2			4
Actuated Green, G (s)	38.8	38.8	38.8	38.8	17.3	17.3
Effective Green, g (s)	38.8	38.8	38.8	38.8	17.3	17.3
Actuated g/C Ratio	0.48	0.48	0.48	0.48	0.22	0.22
Clearance Time (s)	5.7	5.7	5.7	5.7	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	887	754	515	887	375	336
v/s Ratio Prot	c0.14			0.13	c0.07	
v/s Ratio Perm		0.06	0.10			0.02
v/c Ratio	0.29	0.13	0.22	0.27	0.32	0.08
Uniform Delay, d1	12.4	11.3	11.8	12.2	26.4	25.0
Progression Factor	1.00	1.00	1.00	1.00	1.14	2.25
Incremental Delay, d2	0.8	0.4	1.0	0.7	0.5	0.1
Delay (s)	13.2	11.7	12.8	12.9	30.7	56.5
Level of Service	B	B	B	B	C	E
Approach Delay (s)	12.5			12.9	44.1	
Approach LOS	B			B	D	


















Intersection Summary

HCM 2000 Control Delay	20.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.26		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	15.4
Intersection Capacity Utilization	72.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 13: Elgin St & Beech St

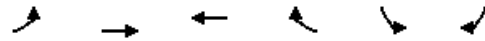
2018 Total Conditions
 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	10	80	45	45	100	25	130	15	10	230	45
Future Volume (vph)	15	10	80	45	45	100	25	130	15	10	230	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.7			5.7		5.7	5.7			5.7	
Lane Util. Factor		1.00			1.00		1.00	1.00			1.00	
Frt		0.90			0.93		1.00	0.98			0.98	
Flt Protected		0.99			0.99		0.95	1.00			1.00	
Satd. Flow (prot)		1631			1679		1738	1801			1788	
Flt Permitted		0.95			0.90		0.56	1.00			0.99	
Satd. Flow (perm)		1553			1536		1025	1801			1773	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	11	84	47	47	105	26	137	16	11	242	47
RTOR Reduction (vph)	0	66	0	0	52	0	0	5	0	0	8	0
Lane Group Flow (vph)	0	45	0	0	147	0	26	148	0	0	292	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			4			2				2
Permitted Phases	4			4			2			2		
Actuated Green, G (s)		17.3			17.3		38.8	38.8			38.8	
Effective Green, g (s)		17.3			17.3		38.8	38.8			38.8	
Actuated g/C Ratio		0.22			0.22		0.48	0.48			0.48	
Clearance Time (s)		5.7			5.7		5.7	5.7			5.7	
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		335			332		497	873			859	
v/s Ratio Prot								0.08				
v/s Ratio Perm		0.03			c0.10		0.03				c0.16	
v/c Ratio		0.13			0.44		0.05	0.17			0.34	
Uniform Delay, d1		25.3			27.2		10.9	11.6			12.7	
Progression Factor		1.00			1.00		1.09	1.19			0.58	
Incremental Delay, d2		0.2			0.9		0.2	0.4			1.1	
Delay (s)		25.5			28.1		12.1	14.1			8.5	
Level of Service		C			C		B	B			A	
Approach Delay (s)		25.5			28.1			13.8			8.5	
Approach LOS		C			C			B			A	
Intersection Summary												
HCM 2000 Control Delay			17.0				HCM 2000 Level of Service				B	
HCM 2000 Volume to Capacity ratio			0.32									
Actuated Cycle Length (s)			80.0				Sum of lost time (s)				15.4	
Intersection Capacity Utilization			52.2%				ICU Level of Service				A	
Analysis Period (min)			15									

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
 16: Ste. Anne Rd & Access 1

2018 Total Conditions
 PM Peak Hour












Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕↕	↕↕		↕	
Traffic Volume (veh/h)	20	350	310	15	15	20
Future Volume (Veh/h)	20	350	310	15	15	20
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	21	368	326	16	16	21
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)		87	360			
pX, platoon unblocked						
vC, conflicting volume	342				560	171
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	342				560	171
tC, single (s)	4.2				6.9	7.0
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				96	97
cM capacity (veh/h)	1192				443	834

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	144	245	217	125	37
Volume Left	21	0	0	0	16
Volume Right	0	0	0	16	21
cSH	1192	1700	1700	1700	604
Volume to Capacity	0.02	0.14	0.13	0.07	0.06
Queue Length 95th (m)	0.4	0.0	0.0	0.0	1.5
Control Delay (s)	1.3	0.0	0.0	0.0	11.4
Lane LOS	A				B
Approach Delay (s)	0.5		0.0		11.4
Approach LOS					B

Intersection Summary						
Average Delay			0.8			
Intersection Capacity Utilization			32.6%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
 18: Ste. Anne Rd & Access 2

2018 Total Conditions
 PM Peak Hour























						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	150	15	295	50	10	300
Future Volume (Veh/h)	150	15	295	50	10	300
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	158	16	311	53	11	316
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)			224			
pX, platoon unblocked	0.95	0.95			0.95	
vC, conflicting volume	676	338			364	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	635	281			309	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	62	98			99	
cM capacity (veh/h)	413	716			1178	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	174	364	327			
Volume Left	158	0	11			
Volume Right	16	53	0			
cSH	430	1700	1178			
Volume to Capacity	0.40	0.21	0.01			
Queue Length 95th (m)	14.6	0.0	0.2			
Control Delay (s)	18.9	0.0	0.4			
Lane LOS	C		A			
Approach Delay (s)	18.9	0.0	0.4			
Approach LOS	C					
Intersection Summary						
Average Delay			3.9			
Intersection Capacity Utilization			39.8%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

23: College St & Froid Rd

2018 Total Conditions

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	40	85	90	70	75	10	115	270	105	15	330	20
Future Volume (vph)	40	85	90	70	75	10	115	270	105	15	330	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7		4.0	5.7	5.7	5.7	5.7			5.7	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00			1.00	
Fr _t	1.00	0.92		1.00	1.00	0.85	1.00	0.96			0.99	
Fl _t Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00			1.00	
Satd. Flow (prot)	1738	1688		1738	1830	1555	1738	1753			1812	
Fl _t Permitted	0.71	1.00		0.56	1.00	1.00	0.42	1.00			0.98	
Satd. Flow (perm)	1291	1688		1024	1830	1555	769	1753			1773	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	42	89	95	74	79	11	121	284	111	16	347	21
RTOR Reduction (vph)	0	43	0	0	0	5	0	15	0	0	3	0
Lane Group Flow (vph)	42	141	0	74	79	6	121	380	0	0	381	0
Turn Type	Perm	NA		pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2		1	6			8				4
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)	30.2	30.2		41.9	41.9	41.9	30.2	30.2			30.2	
Effective Green, g (s)	30.2	30.2		41.9	41.9	41.9	30.2	30.2			30.2	
Actuated g/C Ratio	0.36	0.36		0.50	0.50	0.50	0.36	0.36			0.36	
Clearance Time (s)	5.7	5.7		4.0	5.7	5.7	5.7	5.7			5.7	
Vehicle Extension (s)	0.2	0.2		0.2	0.2	0.2	0.2	0.2			0.2	
Lane Grp Cap (vph)	466	610		579	918	780	278	634			641	
v/s Ratio Prot		c0.08		c0.01	0.04			c0.22				
v/s Ratio Perm	0.03			0.05		0.00	0.16				0.22	
v/c Ratio	0.09	0.23		0.13	0.09	0.01	0.44	0.60			0.60	
Uniform Delay, d ₁	17.6	18.6		10.9	10.8	10.4	20.2	21.7			21.7	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00			1.00	
Incremental Delay, d ₂	0.0	0.1		0.0	0.0	0.0	0.4	1.0			1.0	
Delay (s)	17.6	18.6		11.0	10.8	10.4	20.6	22.7			22.7	
Level of Service	B	B		B	B	B	C	C			C	
Approach Delay (s)		18.4			10.9			22.2			22.7	
Approach LOS		B			B			C			C	

Intersection Summary
























HCM 2000 Control Delay	20.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	83.5	Sum of lost time (s)	15.4
Intersection Capacity Utilization	119.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

6: Notre Dame Ave & Ste. Anne Rd/Louis St

2023 Total Conditions
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	65	20	150	40	25	5	220	595	45	15	1205	95
Future Volume (vph)	65	20	150	40	25	5	220	595	45	15	1205	95
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.4	6.4	6.4	6.4		4.0	6.2		6.2	6.2	6.2
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	0.91		1.00	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1738	1830	1555	1738	1785		1738	4943		1738	4995	1555
Flt Permitted	0.74	1.00	1.00	0.74	1.00		0.17	1.00		0.38	1.00	1.00
Satd. Flow (perm)	1348	1830	1555	1361	1785		309	4943		703	4995	1555
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	68	21	158	42	26	5	232	626	47	16	1268	100
RTOR Reduction (vph)	0	0	139	0	4	0	0	4	0	0	0	41
Lane Group Flow (vph)	68	21	19	42	27	0	232	669	0	16	1268	59
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		Perm	NA	Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	10.7	10.7	10.7	10.7	10.7		67.8	67.8		53.8	53.8	53.8
Effective Green, g (s)	10.7	10.7	10.7	10.7	10.7		67.8	67.8		53.8	53.8	53.8
Actuated g/C Ratio	0.12	0.12	0.12	0.12	0.12		0.74	0.74		0.59	0.59	0.59
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4		4.0	6.2		6.2	6.2	6.2
Vehicle Extension (s)	3.5	3.5	3.5	3.5	3.5		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	158	214	182	159	209		386	3678		415	2949	918
v/s Ratio Prot		0.01			0.01		c0.07	0.14			0.25	
v/s Ratio Perm	c0.05		0.01	0.03			c0.38			0.02		0.04
v/c Ratio	0.43	0.10	0.10	0.26	0.13		0.60	0.18		0.04	0.43	0.06
Uniform Delay, d1	37.4	35.9	35.9	36.6	36.0		5.1	3.4		7.8	10.2	7.9
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.2	0.2	0.3	1.1	0.3		2.6	0.1		0.2	0.5	0.1
Delay (s)	39.6	36.1	36.2	37.7	36.3		7.7	3.6		8.0	10.7	8.1
Level of Service	D	D	D	D	D		A	A		A	B	A
Approach Delay (s)		37.1			37.1			4.6			10.5	
Approach LOS		D			D			A			B	





















Intersection Summary

HCM 2000 Control Delay	11.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	91.1	Sum of lost time (s)	16.6
Intersection Capacity Utilization	59.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Elgin St & Elm St

2023 Total Conditions
 AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	380	180	15	395	50	180	110	10	45	135	25
Future Volume (vph)	0	380	180	15	395	50	180	110	10	45	135	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.7			5.7		4.0	5.7		4.0	5.7	
Lane Util. Factor		0.95			0.95		1.00	1.00		1.00	1.00	
Frt		0.95			0.98		1.00	0.99		1.00	0.98	
Flt Protected		1.00			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3309			3414		1738	1806		1738	1787	
Flt Permitted		1.00			0.93		0.48	1.00		0.68	1.00	
Satd. Flow (perm)		3309			3179		876	1806		1236	1787	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	400	189	16	416	53	189	116	11	47	142	26
RTOR Reduction (vph)	0	62	0	0	11	0	0	5	0	0	9	0
Lane Group Flow (vph)	0	527	0	0	474	0	189	122	0	47	159	0
Turn Type		NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)		41.7			41.7		26.9	19.8		18.0	14.9	
Effective Green, g (s)		41.7			41.7		26.9	19.8		18.0	14.9	
Actuated g/C Ratio		0.52			0.52		0.34	0.25		0.22	0.19	
Clearance Time (s)		5.7			5.7		4.0	5.7		4.0	5.7	
Vehicle Extension (s)		3.0			0.2		0.2	0.2		0.2	3.0	
Lane Grp Cap (vph)		1724			1657		380	446		297	332	
v/s Ratio Prot		c0.16					c0.05	0.07		0.01	0.09	
v/s Ratio Perm					0.15		c0.12			0.03		
v/c Ratio		0.31			0.29		0.50	0.27		0.16	0.48	
Uniform Delay, d1		10.9			10.8		20.0	24.3		24.7	29.1	
Progression Factor		1.00			1.00		1.00	1.00		1.26	1.16	
Incremental Delay, d2		0.5			0.4		0.4	0.1		0.1	1.1	
Delay (s)		11.4			11.2		20.3	24.4		31.2	34.8	
Level of Service		B			B		C	C		C	C	
Approach Delay (s)		11.4			11.2			22.0			34.0	
Approach LOS		B			B			C			C	
Intersection Summary												
HCM 2000 Control Delay			16.4				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.40									
Actuated Cycle Length (s)			80.0				Sum of lost time (s)			15.4		
Intersection Capacity Utilization			60.6%				ICU Level of Service			B		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Elgin St & MacKenzie St/Ste. Anne Rd

2023 Total Conditions
 AM Peak Hour

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↘	↑	↘	↗
Traffic Volume (vph)	210	105	65	295	140	50
Future Volume (vph)	210	105	65	295	140	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7	5.7	5.7	5.7	5.7
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1830	1555	1738	1830	1738	1555
Flt Permitted	1.00	1.00	0.62	1.00	0.95	1.00
Satd. Flow (perm)	1830	1555	1135	1830	1738	1555
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	221	111	68	311	147	53
RTOR Reduction (vph)	0	53	0	0	0	43
Lane Group Flow (vph)	221	58	68	311	147	10
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	2			2	4	
Permitted Phases		2	2			4
Actuated Green, G (s)	41.7	41.7	41.7	41.7	14.9	14.9
Effective Green, g (s)	41.7	41.7	41.7	41.7	14.9	14.9
Actuated g/C Ratio	0.52	0.52	0.52	0.52	0.19	0.19
Clearance Time (s)	5.7	5.7	5.7	5.7	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	953	810	591	953	323	289
v/s Ratio Prot	0.12			c0.17	c0.08	
v/s Ratio Perm		0.04	0.06			0.01
v/c Ratio	0.23	0.07	0.12	0.33	0.46	0.03
Uniform Delay, d1	10.4	9.5	9.8	11.0	28.9	26.7
Progression Factor	1.00	1.00	1.00	1.00	1.32	2.54
Incremental Delay, d2	0.6	0.2	0.4	0.9	1.0	0.0
Delay (s)	11.0	9.7	10.1	12.0	39.3	67.7
Level of Service	B	A	B	B	D	E
Approach Delay (s)	10.6			11.6	46.8	
Approach LOS	B			B	D	


















Intersection Summary

HCM 2000 Control Delay	19.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	15.4
Intersection Capacity Utilization	71.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Elgin St & Beech St










2023 Total Conditions
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	15	45	20	20	40	20	135	5	10	135	25
Future Volume (vph)	15	15	45	20	20	40	20	135	5	10	135	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.7			5.7		5.7	5.7			5.7	
Lane Util. Factor		1.00			1.00		1.00	1.00			1.00	
Flt		0.92			0.93		1.00	0.99			0.98	
Flt Protected		0.99			0.99		0.95	1.00			1.00	
Satd. Flow (prot)		1666			1685		1738	1820			1788	
Flt Permitted		0.93			0.91		0.68	1.00			0.98	
Satd. Flow (perm)		1567			1556		1243	1820			1766	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	16	47	21	21	42	21	142	5	11	142	26
RTOR Reduction (vph)	0	38	0	0	34	0	0	1	0	0	7	0
Lane Group Flow (vph)	0	41	0	0	50	0	21	146	0	0	172	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			4			2				2
Permitted Phases	4			4			2			2		
Actuated Green, G (s)		14.9			14.9		41.7	41.7			41.7	
Effective Green, g (s)		14.9			14.9		41.7	41.7			41.7	
Actuated g/C Ratio		0.19			0.19		0.52	0.52			0.52	
Clearance Time (s)		5.7			5.7		5.7	5.7			5.7	
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		291			289		647	948			920	
v/s Ratio Prot								0.08				
v/s Ratio Perm		0.03			c0.03		0.02				c0.10	
v/c Ratio		0.14			0.17		0.03	0.15			0.19	
Uniform Delay, d1		27.2			27.4		9.3	10.0			10.2	
Progression Factor		1.00			1.00		1.06	1.18			0.59	
Incremental Delay, d2		0.2			0.3		0.1	0.3			0.4	
Delay (s)		27.4			27.7		10.0	12.1			6.5	
Level of Service		C			C		A	B			A	
Approach Delay (s)		27.4			27.7			11.8			6.5	
Approach LOS		C			C			B			A	
Intersection Summary												
HCM 2000 Control Delay			15.0				HCM 2000 Level of Service				B	
HCM 2000 Volume to Capacity ratio			0.16									
Actuated Cycle Length (s)			80.0				Sum of lost time (s)			15.4		
Intersection Capacity Utilization			42.8%				ICU Level of Service			A		
Analysis Period (min)			15									

c Critical Lane Group

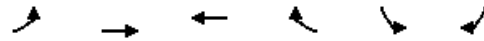
HCM Unsignalized Intersection Capacity Analysis
 14: MacKenzie St & Access 3

2023 Total Conditions
 AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	5	5	330	10	5	290
Future Volume (Veh/h)	5	5	330	10	5	290
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	5	5	347	11	5	305
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)			319			
pX, platoon unblocked						
vC, conflicting volume	668	352			358	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	668	352			358	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	99			100	
cM capacity (veh/h)	417	684			1184	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	10	358	310			
Volume Left	5	0	5			
Volume Right	5	11	0			
cSH	518	1700	1184			
Volume to Capacity	0.02	0.21	0.00			
Queue Length 95th (m)	0.4	0.0	0.1			
Control Delay (s)	12.1	0.0	0.2			
Lane LOS	B		A			
Approach Delay (s)	12.1	0.0	0.2			
Approach LOS	B					
Intersection Summary						
Average Delay			0.3			
Intersection Capacity Utilization		29.3%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis
 16: Ste. Anne Rd & Access 1










2023 Total Conditions
 AM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔↕	↕↔		↕↔	
Traffic Volume (veh/h)	20	240	345	15	10	15
Future Volume (Veh/h)	20	240	345	15	10	15
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	21	253	363	16	11	16
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)		87	360			
pX, platoon unblocked						
vC, conflicting volume	379			540	190	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	379			540	190	
tC, single (s)	4.2			6.9	7.0	
tC, 2 stage (s)						
tF (s)	2.2			3.5	3.3	
p0 queue free %	98			98	98	
cM capacity (veh/h)	1155			456	811	
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	
Volume Total	105	169	242	137	27	
Volume Left	21	0	0	0	11	
Volume Right	0	0	0	16	16	
cSH	1155	1700	1700	1700	616	
Volume to Capacity	0.02	0.10	0.14	0.08	0.04	
Queue Length 95th (m)	0.4	0.0	0.0	0.0	1.0	
Control Delay (s)	1.8	0.0	0.0	0.0	11.1	
Lane LOS	A					B
Approach Delay (s)	0.7	0.0				11.1
Approach LOS					B	
Intersection Summary						
Average Delay			0.7			
Intersection Capacity Utilization			30.6%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
 18: MacKenzie St & Access 2























2023 Total Conditions
 AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	35	10	330	145	15	280
Future Volume (Veh/h)	35	10	330	145	15	280
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	37	11	347	153	16	295
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)			224			
pX, platoon unblocked	0.92	0.92			0.92	
vC, conflicting volume	750	424			500	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	686	331			414	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	90	98			98	
cM capacity (veh/h)	370	648			1040	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	48	500	311			
Volume Left	37	0	16			
Volume Right	11	153	0			
cSH	411	1700	1040			
Volume to Capacity	0.12	0.29	0.02			
Queue Length 95th (m)	3.0	0.0	0.4			
Control Delay (s)	14.9	0.0	0.6			
Lane LOS	B		A			
Approach Delay (s)	14.9	0.0	0.6			
Approach LOS	B					
Intersection Summary						
Average Delay			1.0			
Intersection Capacity Utilization			37.0%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

23: College St & Froid Rd

2023 Total Conditions
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	25	60	30	120	80	10	160	285	55	10	255	20
Future Volume (vph)	25	60	30	120	80	10	160	285	55	10	255	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7		4.0	5.7	5.7	5.7	5.7				5.7
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00				1.00
Fr _t	1.00	0.95		1.00	1.00	0.85	1.00	0.98				0.99
Fl _t Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00				1.00
Satd. Flow (prot)	1738	1737		1738	1830	1555	1738	1785				1809
Fl _t Permitted	0.70	1.00		0.59	1.00	1.00	0.54	1.00				0.98
Satd. Flow (perm)	1285	1737		1076	1830	1555	997	1785				1783
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	26	63	32	126	84	11	168	300	58	11	268	21
RTOR Reduction (vph)	0	23	0	0	0	6	0	7	0	0	3	0
Lane Group Flow (vph)	26	72	0	126	84	5	168	351	0	0	297	0
Turn Type	Perm	NA		pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2		1	6			8				4
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)	21.9	21.9		33.2	33.2	33.2	35.6	35.6				35.6
Effective Green, g (s)	21.9	21.9		33.2	33.2	33.2	35.6	35.6				35.6
Actuated g/C Ratio	0.27	0.27		0.41	0.41	0.41	0.44	0.44				0.44
Clearance Time (s)	5.7	5.7		4.0	5.7	5.7	5.7	5.7				5.7
Vehicle Extension (s)	0.2	0.2		0.2	0.2	0.2	0.2	0.2				0.2
Lane Grp Cap (vph)	350	474		505	757	643	442	792				791
v/s Ratio Prot		0.04		c0.02	0.05			c0.20				
v/s Ratio Perm	0.02			c0.08		0.00	0.17					0.17
v/c Ratio	0.07	0.15		0.25	0.11	0.01	0.38	0.44				0.38
Uniform Delay, d ₁	21.6	22.1		15.0	14.4	13.8	14.9	15.4				14.9
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00				1.00
Incremental Delay, d ₂	0.0	0.1		0.1	0.0	0.0	0.2	0.1				0.1
Delay (s)	21.7	22.2		15.1	14.5	13.8	15.1	15.6				15.0
Level of Service	C	C		B	B	B	B	B				B
Approach Delay (s)		22.1			14.8			15.4				15.0
Approach LOS		C			B			B				B

Intersection Summary
























HCM 2000 Control Delay	15.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	80.2	Sum of lost time (s)	15.4
Intersection Capacity Utilization	89.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

6: Notre Dame Ave & Ste. Anne Rd/Louis St

2023 Total Conditions
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	235	55	400	50	30	20	175	1415	55	15	965	105
Future Volume (vph)	235	55	400	50	30	20	175	1415	55	15	965	105
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.4	6.4	6.4	6.4		4.0	6.2		6.2	6.2	6.2
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	0.91		1.00	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1738	1830	1555	1738	1721		1738	4967		1738	4995	1555
Flt Permitted	0.72	1.00	1.00	0.72	1.00		0.22	1.00		0.15	1.00	1.00
Satd. Flow (perm)	1322	1830	1555	1316	1721		398	4967		282	4995	1555
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	247	58	421	53	32	21	184	1489	58	16	1016	111
RTOR Reduction (vph)	0	0	173	0	16	0	0	3	0	0	0	54
Lane Group Flow (vph)	247	58	248	53	37	0	184	1544	0	16	1016	57
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		Perm	NA	Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	26.4	26.4	26.4	26.4	26.4		68.2	68.2		54.9	54.9	54.9
Effective Green, g (s)	26.4	26.4	26.4	26.4	26.4		68.2	68.2		54.9	54.9	54.9
Actuated g/C Ratio	0.25	0.25	0.25	0.25	0.25		0.64	0.64		0.51	0.51	0.51
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4		4.0	6.2		6.2	6.2	6.2
Vehicle Extension (s)	3.5	3.5	3.5	3.5	3.5		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	325	450	382	324	423		369	3159		144	2558	796
v/s Ratio Prot		0.03			0.02		0.04	c0.31			0.20	
v/s Ratio Perm	c0.19		0.16	0.04			c0.27			0.06		0.04
v/c Ratio	0.76	0.13	0.65	0.16	0.09		0.50	0.49		0.11	0.40	0.07
Uniform Delay, d1	37.5	31.4	36.3	31.7	31.1		8.9	10.3		13.5	16.0	13.2
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	10.3	0.2	4.1	0.3	0.1		1.1	0.5		1.6	0.5	0.2
Delay (s)	47.8	31.6	40.4	32.0	31.2		10.0	10.8		15.1	16.5	13.4
Level of Service	D	C	D	C	C		A	B		B	B	B
Approach Delay (s)		42.2			31.6			10.7			16.2	
Approach LOS		D			C			B			B	






















Intersection Summary

HCM 2000 Control Delay	19.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	107.2	Sum of lost time (s)	16.6
Intersection Capacity Utilization	76.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Elgin St & Elm St

2023 Total Conditions
 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 					 		
Traffic Volume (vph)	0	460	240	0	490	40	255	150	20	130	230	65
Future Volume (vph)	0	460	240	0	490	40	255	150	20	130	230	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.7			5.7		4.0	5.7		4.0	5.7	
Lane Util. Factor		0.95			0.95		1.00	1.00		1.00	1.00	
Frt		0.95			0.99		1.00	0.98		1.00	0.97	
Flt Protected		1.00			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3297			3437		1738	1797		1738	1769	
Flt Permitted		1.00			1.00		0.28	1.00		0.64	1.00	
Satd. Flow (perm)		3297			3437		504	1797		1179	1769	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	484	253	0	516	42	268	158	21	137	242	68
RTOR Reduction (vph)	0	80	0	0	7	0	0	6	0	0	13	0
Lane Group Flow (vph)	0	657	0	0	551	0	268	173	0	137	297	0
Turn Type		NA			NA		pm+pt	NA		pm+pt	NA	
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)		38.0			38.0		29.8	20.4		23.4	17.2	
Effective Green, g (s)		38.0			38.0		29.8	20.4		23.4	17.2	
Actuated g/C Ratio		0.48			0.48		0.37	0.25		0.29	0.21	
Clearance Time (s)		5.7			5.7		4.0	5.7		4.0	5.7	
Vehicle Extension (s)		3.0			0.2		0.2	0.2		0.2	3.0	
Lane Grp Cap (vph)		1566			1632		332	458		388	380	
v/s Ratio Prot		c0.20			0.16		c0.09	0.10		0.03	0.17	
v/s Ratio Perm							c0.21			0.08		
v/c Ratio		0.42			0.34		0.81	0.38		0.35	0.78	
Uniform Delay, d1		13.8			13.1		19.6	24.6		21.7	29.6	
Progression Factor		1.00			1.00		1.00	1.00		1.35	1.22	
Incremental Delay, d2		0.8			0.6		12.7	0.2		0.2	9.4	
Delay (s)		14.6			13.7		32.2	24.8		29.6	45.5	
Level of Service		B			B		C	C		C	D	
Approach Delay (s)		14.6			13.7			29.2			40.6	
Approach LOS		B			B			C			D	
Intersection Summary												
HCM 2000 Control Delay			22.7				HCM 2000 Level of Service			C		
HCM 2000 Volume to Capacity ratio			0.61									
Actuated Cycle Length (s)			80.0				Sum of lost time (s)			15.4		
Intersection Capacity Utilization			72.2%				ICU Level of Service			C		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Elgin St & MacKenzie St/Ste. Anne Rd

2023 Total Conditions
 PM Peak Hour

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↘	↑	↘	↗
Traffic Volume (vph)	300	230	110	260	140	135
Future Volume (vph)	300	230	110	260	140	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7	5.7	5.7	5.7	5.7
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1830	1555	1738	1830	1738	1555
Flt Permitted	1.00	1.00	0.52	1.00	0.95	1.00
Satd. Flow (perm)	1830	1555	952	1830	1738	1555
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	316	242	116	274	147	142
RTOR Reduction (vph)	0	97	0	0	0	111
Lane Group Flow (vph)	316	145	116	274	147	31
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	2			2	4	
Permitted Phases		2	2			4
Actuated Green, G (s)	38.0	38.0	38.0	38.0	17.2	17.2
Effective Green, g (s)	38.0	38.0	38.0	38.0	17.2	17.2
Actuated g/C Ratio	0.48	0.48	0.48	0.48	0.21	0.21
Clearance Time (s)	5.7	5.7	5.7	5.7	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	869	738	452	869	373	334
v/s Ratio Prot	c0.17			0.15	c0.08	
v/s Ratio Perm		0.09	0.12			0.02
v/c Ratio	0.36	0.20	0.26	0.32	0.39	0.09
Uniform Delay, d1	13.3	12.2	12.6	13.0	26.9	25.1
Progression Factor	1.00	1.00	1.00	1.00	1.18	2.46
Incremental Delay, d2	1.2	0.6	1.4	1.0	0.7	0.1
Delay (s)	14.5	12.8	13.9	13.9	32.5	62.0
Level of Service	B	B	B	B	C	E
Approach Delay (s)	13.7			13.9	47.0	
Approach LOS	B			B	D	


















Intersection Summary			
HCM 2000 Control Delay	21.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	15.4
Intersection Capacity Utilization	72.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

13: Elgin St & Beech St










2023 Total Conditions
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	10	85	45	45	100	25	150	15	10	280	50
Future Volume (vph)	15	10	85	45	45	100	25	150	15	10	280	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.7			5.7		5.7	5.7			5.7	
Lane Util. Factor		1.00			1.00		1.00	1.00			1.00	
Flt		0.90			0.93		1.00	0.99			0.98	
Flt Protected		0.99			0.99		0.95	1.00			1.00	
Satd. Flow (prot)		1629			1679		1738	1804			1790	
Flt Permitted		0.95			0.91		0.51	1.00			0.99	
Satd. Flow (perm)		1555			1539		930	1804			1777	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	11	89	47	47	105	26	158	16	11	295	53
RTOR Reduction (vph)	0	70	0	0	52	0	0	4	0	0	7	0
Lane Group Flow (vph)	0	46	0	0	147	0	26	170	0	0	352	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			4			2				2
Permitted Phases	4			4			2			2		
Actuated Green, G (s)		17.2			17.2		38.0	38.0			38.0	
Effective Green, g (s)		17.2			17.2		38.0	38.0			38.0	
Actuated g/C Ratio		0.21			0.21		0.48	0.48			0.48	
Clearance Time (s)		5.7			5.7		5.7	5.7			5.7	
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		334			330		441	856			844	
v/s Ratio Prot								0.09				
v/s Ratio Perm		0.03			c0.10		0.03				c0.20	
v/c Ratio		0.14			0.45		0.06	0.20			0.42	
Uniform Delay, d1		25.4			27.3		11.3	12.2			13.7	
Progression Factor		1.00			1.00		1.07	1.13			0.56	
Incremental Delay, d2		0.2			1.0		0.2	0.5			1.5	
Delay (s)		25.6			28.2		12.3	14.3			9.1	
Level of Service		C			C		B	B			A	
Approach Delay (s)		25.6			28.2			14.0			9.1	
Approach LOS		C			C			B			A	
Intersection Summary												
HCM 2000 Control Delay			16.8				HCM 2000 Level of Service				B	
HCM 2000 Volume to Capacity ratio			0.36									
Actuated Cycle Length (s)			80.0				Sum of lost time (s)				15.4	
Intersection Capacity Utilization			53.2%				ICU Level of Service				A	
Analysis Period (min)			15									

c Critical Lane Group

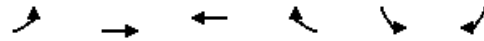
HCM Unsignalized Intersection Capacity Analysis
 14: MacKenzie St & Access 3

2023 Total Conditions
 PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	35	5	330	10	5	325
Future Volume (Veh/h)	35	5	330	10	5	325
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	37	5	347	11	5	342
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)			319			
pX, platoon unblocked						
vC, conflicting volume	704	352			358	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	704	352			358	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	91	99			100	
cM capacity (veh/h)	397	684			1184	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	42	358	347			
Volume Left	37	0	5			
Volume Right	5	11	0			
cSH	418	1700	1184			
Volume to Capacity	0.10	0.21	0.00			
Queue Length 95th (m)	2.5	0.0	0.1			
Control Delay (s)	14.6	0.0	0.2			
Lane LOS	B		A			
Approach Delay (s)	14.6	0.0	0.2			
Approach LOS	B					
Intersection Summary						
Average Delay			0.9			
Intersection Capacity Utilization			31.1%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
 16: Ste. Anne Rd & Access 1

2023 Total Conditions
 PM Peak Hour












Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕↕	↕↕		↕	
Traffic Volume (veh/h)	20	415	350	15	15	20
Future Volume (Veh/h)	20	415	350	15	15	20
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	21	437	368	16	16	21
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)		87	360			
pX, platoon unblocked						
vC, conflicting volume	384				636	192
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	384				636	192
tC, single (s)	4.2				6.9	7.0
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				96	97
cM capacity (veh/h)	1150				396	808

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	167	291	245	139	37
Volume Left	21	0	0	0	16
Volume Right	0	0	0	16	21
cSH	1150	1700	1700	1700	557
Volume to Capacity	0.02	0.17	0.14	0.08	0.07
Queue Length 95th (m)	0.4	0.0	0.0	0.0	1.6
Control Delay (s)	1.2	0.0	0.0	0.0	11.9
Lane LOS	A				B
Approach Delay (s)	0.4		0.0		11.9
Approach LOS					B

Intersection Summary						
Average Delay			0.7			
Intersection Capacity Utilization			35.5%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
 18: MacKenzie St & Access 2

2023 Total Conditions
 PM Peak Hour























						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	225	15	335	80	10	350
Future Volume (Veh/h)	225	15	335	80	10	350
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	237	16	353	84	11	368
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)			224			
pX, platoon unblocked	0.93	0.93			0.93	
vC, conflicting volume	785	395			437	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	731	312			357	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	33	98			99	
cM capacity (veh/h)	354	671			1102	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	253	437	379			
Volume Left	237	0	11			
Volume Right	16	84	0			
cSH	365	1700	1102			
Volume to Capacity	0.69	0.26	0.01			
Queue Length 95th (m)	38.0	0.0	0.2			
Control Delay (s)	34.4	0.0	0.3			
Lane LOS	D		A			
Approach Delay (s)	34.4	0.0	0.3			
Approach LOS	D					
Intersection Summary						
Average Delay			8.3			
Intersection Capacity Utilization			46.5%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

23: College St & Froid Rd

2023 Total Conditions

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	40	90	100	75	80	10	125	300	115	15	380	20
Future Volume (vph)	40	90	100	75	80	10	125	300	115	15	380	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7		4.0	5.7	5.7	5.7	5.7			5.7	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00			1.00	
Frt	1.00	0.92		1.00	1.00	0.85	1.00	0.96			0.99	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00			1.00	
Satd. Flow (prot)	1738	1686		1738	1830	1555	1738	1754			1814	
Flt Permitted	0.70	1.00		0.54	1.00	1.00	0.38	1.00			0.98	
Satd. Flow (perm)	1285	1686		989	1830	1555	687	1754			1776	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	42	95	105	79	84	11	132	316	121	16	400	21
RTOR Reduction (vph)	0	44	0	0	0	5	0	15	0	0	2	0
Lane Group Flow (vph)	42	156	0	79	84	6	132	422	0	0	435	0
Turn Type	Perm	NA		pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2		1	6			8				4
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)	30.2	30.2		41.9	41.9	41.9	30.2	30.2			30.2	
Effective Green, g (s)	30.2	30.2		41.9	41.9	41.9	30.2	30.2			30.2	
Actuated g/C Ratio	0.36	0.36		0.50	0.50	0.50	0.36	0.36			0.36	
Clearance Time (s)	5.7	5.7		4.0	5.7	5.7	5.7	5.7			5.7	
Vehicle Extension (s)	0.2	0.2		0.2	0.2	0.2	0.2	0.2			0.2	
Lane Grp Cap (vph)	464	609		565	918	780	248	634			642	
v/s Ratio Prot		c0.09		c0.01	0.05			0.24				
v/s Ratio Perm	0.03			0.06		0.00	0.19				c0.24	
v/c Ratio	0.09	0.26		0.14	0.09	0.01	0.53	0.67			0.68	
Uniform Delay, d1	17.6	18.7		11.0	10.9	10.4	21.1	22.4			22.5	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00			1.00	
Incremental Delay, d2	0.0	0.1		0.0	0.0	0.0	1.1	2.0			2.2	
Delay (s)	17.6	18.8		11.1	10.9	10.4	22.2	24.4			24.8	
Level of Service	B	B		B	B	B	C	C			C	
Approach Delay (s)		18.6			10.9			23.9			24.8	
Approach LOS		B			B			C			C	

Intersection Summary

HCM 2000 Control Delay	21.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	83.5	Sum of lost time (s)	15.4
Intersection Capacity Utilization	119.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

6: Notre Dame Ave & Ste. Anne Rd/Louis St

2028 Total Conditions
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	70	20	160	40	25	5	230	645	45	15	1295	100
Future Volume (vph)	70	20	160	40	25	5	230	645	45	15	1295	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.4	6.4	6.4	6.4		4.0	6.2		6.2	6.2	6.2
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	0.91		1.00	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1738	1830	1555	1738	1785		1738	4946		1738	4995	1555
Flt Permitted	0.74	1.00	1.00	0.74	1.00		0.15	1.00		0.36	1.00	1.00
Satd. Flow (perm)	1348	1830	1555	1361	1785		266	4946		666	4995	1555
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	74	21	168	42	26	5	242	679	47	16	1363	105
RTOR Reduction (vph)	0	0	148	0	4	0	0	4	0	0	0	44
Lane Group Flow (vph)	74	21	20	42	27	0	242	722	0	16	1363	61
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		Perm	NA	Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	11.2	11.2	11.2	11.2	11.2		71.9	71.9		55.2	55.2	55.2
Effective Green, g (s)	11.2	11.2	11.2	11.2	11.2		71.9	71.9		55.2	55.2	55.2
Actuated g/C Ratio	0.12	0.12	0.12	0.12	0.12		0.75	0.75		0.58	0.58	0.58
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4		4.0	6.2		6.2	6.2	6.2
Vehicle Extension (s)	3.5	3.5	3.5	3.5	3.5		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	157	214	181	159	208		395	3715		384	2881	896
v/s Ratio Prot		0.01			0.01		c0.08	0.15			0.27	
v/s Ratio Perm	c0.05		0.01	0.03			c0.38			0.02		0.04
v/c Ratio	0.47	0.10	0.11	0.26	0.13		0.61	0.19		0.04	0.47	0.07
Uniform Delay, d1	39.5	37.7	37.8	38.5	37.9		6.6	3.5		8.8	11.8	8.9
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.6	0.2	0.3	1.1	0.3		2.8	0.1		0.2	0.6	0.1
Delay (s)	42.1	38.0	38.1	39.5	38.2		9.4	3.6		9.0	12.3	9.1
Level of Service	D	D	D	D	D		A	A		A	B	A
Approach Delay (s)		39.2			39.0			5.0			12.1	
Approach LOS		D			D			A			B	






















Intersection Summary

HCM 2000 Control Delay	12.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	95.7	Sum of lost time (s)	16.6
Intersection Capacity Utilization	62.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Elgin St & Elm St

2028 Total Conditions
 AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 							
Traffic Volume (vph)	0	410	195	15	425	50	195	120	15	50	140	30
Future Volume (vph)	0	410	195	15	425	50	195	120	15	50	140	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.7			5.7		4.0	5.7		4.0	5.7	
Lane Util. Factor		0.95			0.95		1.00	1.00		1.00	1.00	
Flt		0.95			0.98		1.00	0.98		1.00	0.97	
Flt Protected		1.00			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3308			3417		1738	1799		1738	1781	
Flt Permitted		1.00			0.93		0.46	1.00		0.67	1.00	
Satd. Flow (perm)		3308			3180		846	1799		1219	1781	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	432	205	16	447	53	205	126	16	53	147	32
RTOR Reduction (vph)	0	63	0	0	10	0	0	6	0	0	11	0
Lane Group Flow (vph)	0	574	0	0	506	0	205	136	0	53	168	0
Turn Type		NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)		41.1			41.1		27.5	20.3		18.5	15.3	
Effective Green, g (s)		41.1			41.1		27.5	20.3		18.5	15.3	
Actuated g/C Ratio		0.51			0.51		0.34	0.25		0.23	0.19	
Clearance Time (s)		5.7			5.7		4.0	5.7		4.0	5.7	
Vehicle Extension (s)		3.0			0.2		0.2	0.2		0.2	3.0	
Lane Grp Cap (vph)		1699			1633		382	456		302	340	
v/s Ratio Prot		c0.17					c0.05	0.08		0.01	0.09	
v/s Ratio Perm					0.16		c0.13			0.03		
v/c Ratio		0.34			0.31		0.54	0.30		0.18	0.50	
Uniform Delay, d1		11.4			11.2		19.8	24.1		24.4	28.9	
Progression Factor		1.00			1.00		1.00	1.00		1.26	1.16	
Incremental Delay, d2		0.5			0.5		0.7	0.1		0.1	1.1	
Delay (s)		12.0			11.7		20.5	24.2		30.8	34.7	
Level of Service		B			B		C	C		C	C	
Approach Delay (s)		12.0			11.7			22.0			33.9	
Approach LOS		B			B			C			C	
Intersection Summary												
HCM 2000 Control Delay			16.9				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.44									
Actuated Cycle Length (s)			80.0				Sum of lost time (s)			15.4		
Intersection Capacity Utilization			62.0%				ICU Level of Service			B		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Elgin St & MacKenzie St/Ste. Anne Rd

2028 Total Conditions
 AM Peak Hour


















	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↘	↑	↘	↗
Traffic Volume (vph)	225	115	70	310	145	55
Future Volume (vph)	225	115	70	310	145	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7	5.7	5.7	5.7	5.7
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1830	1555	1738	1830	1738	1555
Flt Permitted	1.00	1.00	0.61	1.00	0.95	1.00
Satd. Flow (perm)	1830	1555	1113	1830	1738	1555
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	237	121	74	326	153	58
RTOR Reduction (vph)	0	59	0	0	0	47
Lane Group Flow (vph)	237	62	74	326	153	11
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	2			2	4	
Permitted Phases		2	2			4
Actuated Green, G (s)	41.1	41.1	41.1	41.1	15.3	15.3
Effective Green, g (s)	41.1	41.1	41.1	41.1	15.3	15.3
Actuated g/C Ratio	0.51	0.51	0.51	0.51	0.19	0.19
Clearance Time (s)	5.7	5.7	5.7	5.7	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	940	798	571	940	332	297
v/s Ratio Prot	0.13			c0.18	c0.09	
v/s Ratio Perm		0.04	0.07			0.01
v/c Ratio	0.25	0.08	0.13	0.35	0.46	0.04
Uniform Delay, d1	10.9	9.9	10.1	11.5	28.7	26.4
Progression Factor	1.00	1.00	1.00	1.00	1.32	2.61
Incremental Delay, d2	0.6	0.2	0.5	1.0	1.0	0.1
Delay (s)	11.5	10.0	10.6	12.5	38.9	68.7
Level of Service	B	B	B	B	D	E
Approach Delay (s)	11.0			12.2	47.1	
Approach LOS	B			B	D	

Intersection Summary			
HCM 2000 Control Delay	19.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	15.4
Intersection Capacity Utilization	72.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Elgin St & Beech St










2028 Total Conditions
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	15	45	20	20	45	20	140	5	10	140	30
Future Volume (vph)	15	15	45	20	20	45	20	140	5	10	140	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.7			5.7		5.7	5.7			5.7	
Lane Util. Factor		1.00			1.00		1.00	1.00			1.00	
Flt		0.92			0.93		1.00	1.00			0.98	
Flt Protected		0.99			0.99		0.95	1.00			1.00	
Satd. Flow (prot)		1666			1679		1738	1821			1783	
Flt Permitted		0.93			0.92		0.67	1.00			0.98	
Satd. Flow (perm)		1567			1559		1221	1821			1761	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	16	47	21	21	47	21	147	5	11	147	32
RTOR Reduction (vph)	0	38	0	0	38	0	0	1	0	0	8	0
Lane Group Flow (vph)	0	41	0	0	51	0	21	151	0	0	182	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			4			2				2
Permitted Phases	4			4			2			2		
Actuated Green, G (s)		15.3			15.3		41.1	41.1			41.1	
Effective Green, g (s)		15.3			15.3		41.1	41.1			41.1	
Actuated g/C Ratio		0.19			0.19		0.51	0.51			0.51	
Clearance Time (s)		5.7			5.7		5.7	5.7			5.7	
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		299			298		627	935			904	
v/s Ratio Prot								0.08				
v/s Ratio Perm		0.03			c0.03		0.02				c0.10	
v/c Ratio		0.14			0.17		0.03	0.16			0.20	
Uniform Delay, d1		26.9			27.0		9.6	10.3			10.5	
Progression Factor		1.00			1.00		1.06	1.18			0.59	
Incremental Delay, d2		0.2			0.3		0.1	0.4			0.5	
Delay (s)		27.1			27.3		10.3	12.5			6.7	
Level of Service		C			C		B	B			A	
Approach Delay (s)		27.1			27.3			12.3			6.7	
Approach LOS		C			C			B			A	
Intersection Summary												
HCM 2000 Control Delay			15.0				HCM 2000 Level of Service				B	
HCM 2000 Volume to Capacity ratio			0.17									
Actuated Cycle Length (s)			80.0				Sum of lost time (s)				15.4	
Intersection Capacity Utilization			42.8%				ICU Level of Service				A	
Analysis Period (min)			15									

c Critical Lane Group

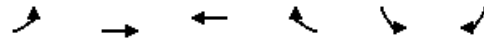
HCM Unsignalized Intersection Capacity Analysis
 14: MacKenzie St & Access 3

2028 Total Conditions
 AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	5	5	350	10	5	315
Future Volume (Veh/h)	5	5	350	10	5	315
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	5	5	368	11	5	332
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)			319			
pX, platoon unblocked						
vC, conflicting volume	716	374			379	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	716	374			379	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	99			100	
cM capacity (veh/h)	391	666			1163	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	10	379	337			
Volume Left	5	0	5			
Volume Right	5	11	0			
cSH	493	1700	1163			
Volume to Capacity	0.02	0.22	0.00			
Queue Length 95th (m)	0.5	0.0	0.1			
Control Delay (s)	12.5	0.0	0.2			
Lane LOS	B		A			
Approach Delay (s)	12.5	0.0	0.2			
Approach LOS	B					
Intersection Summary						
Average Delay			0.2			
Intersection Capacity Utilization			30.6%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
 16: Ste. Anne Rd & Access 1










2028 Total Conditions
 AM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕↕	↕↕		↕↕	
Traffic Volume (veh/h)	20	260	365	15	10	15
Future Volume (Veh/h)	20	260	365	15	10	15
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	21	274	384	16	11	16
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)		87	360			
pX, platoon unblocked						
vC, conflicting volume	400				571	200
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	400				571	200
tC, single (s)	4.2				6.9	7.0
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				97	98
cM capacity (veh/h)	1134				436	798
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	
Volume Total	112	183	256	144	27	
Volume Left	21	0	0	0	11	
Volume Right	0	0	0	16	16	
cSH	1134	1700	1700	1700	596	
Volume to Capacity	0.02	0.11	0.15	0.08	0.05	
Queue Length 95th (m)	0.4	0.0	0.0	0.0	1.1	
Control Delay (s)	1.7	0.0	0.0	0.0	11.3	
Lane LOS	A				B	
Approach Delay (s)	0.6		0.0		11.3	
Approach LOS					B	
Intersection Summary						
Average Delay			0.7			
Intersection Capacity Utilization			31.7%		ICU Level of Service	A
Analysis Period (min)			15			























HCM Unsignalized Intersection Capacity Analysis
 18: MacKenzie St & Access 2

2028 Total Conditions
 AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	35	10	350	145	15	305
Future Volume (Veh/h)	35	10	350	145	15	305
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	37	11	368	153	16	321
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)			224			
pX, platoon unblocked	0.91	0.91			0.91	
vC, conflicting volume	798	444			521	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	729	341			425	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	89	98			98	
cM capacity (veh/h)	346	633			1019	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	48	521	337			
Volume Left	37	0	16			
Volume Right	11	153	0			
cSH	386	1700	1019			
Volume to Capacity	0.12	0.31	0.02			
Queue Length 95th (m)	3.2	0.0	0.4			
Control Delay (s)	15.7	0.0	0.6			
Lane LOS	C		A			
Approach Delay (s)	15.7	0.0	0.6			
Approach LOS	C					
Intersection Summary						
Average Delay			1.0			
Intersection Capacity Utilization			38.3%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis
23: College St & Froid Rd

2028 Total Conditions
AM Peak Hour























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	25	65	35	130	90	10	175	300	60	15	275	20
Future Volume (vph)	25	65	35	130	90	10	175	300	60	15	275	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7		4.0	5.7	5.7	5.7	5.7			5.7	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00			1.00	
Fr _t	1.00	0.95		1.00	1.00	0.85	1.00	0.98			0.99	
Fl _t Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00			1.00	
Satd. Flow (prot)	1738	1733		1738	1830	1555	1738	1784			1809	
Fl _t Permitted	0.70	1.00		0.58	1.00	1.00	0.52	1.00			0.97	
Satd. Flow (perm)	1272	1733		1061	1830	1555	959	1784			1768	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	26	68	37	137	95	11	184	316	63	16	289	21
RTOR Reduction (vph)	0	24	0	0	0	6	0	7	0	0	2	0
Lane Group Flow (vph)	26	81	0	137	95	5	184	372	0	0	324	0
Turn Type	Perm	NA		pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2		1	6			8				4
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)	21.2	21.2		32.3	32.3	32.3	34.4	34.4			34.4	
Effective Green, g (s)	21.2	21.2		32.3	32.3	32.3	34.4	34.4			34.4	
Actuated g/C Ratio	0.27	0.27		0.41	0.41	0.41	0.44	0.44			0.44	
Clearance Time (s)	5.7	5.7		4.0	5.7	5.7	5.7	5.7			5.7	
Vehicle Extension (s)	0.2	0.2		0.2	0.2	0.2	0.2	0.2			0.2	
Lane Grp Cap (vph)	345	470		500	756	643	422	785			778	
v/s Ratio Prot		0.05		c0.02	0.05			c0.21				
v/s Ratio Perm	0.02			c0.09		0.00	0.19				0.18	
v/c Ratio	0.08	0.17		0.27	0.13	0.01	0.44	0.47			0.42	
Uniform Delay, d ₁	21.2	21.7		14.7	14.2	13.5	15.1	15.5			15.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00			1.00	
Incremental Delay, d ₂	0.0	0.1		0.1	0.0	0.0	0.3	0.2			0.1	
Delay (s)	21.2	21.8		14.8	14.2	13.5	15.4	15.6			15.1	
Level of Service	C	C		B	B	B	B	B			B	
Approach Delay (s)		21.7			14.5			15.5			15.1	
Approach LOS		C			B			B			B	

Intersection Summary			
HCM 2000 Control Delay	15.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	78.1	Sum of lost time (s)	15.4
Intersection Capacity Utilization	89.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Notre Dame Ave & Ste. Anne Rd/Louis St

2028 Total Conditions
PM Peak Hour






















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	255	55	420	50	30	20	185	1520	65	15	1035	110
Future Volume (vph)	255	55	420	50	30	20	185	1520	65	15	1035	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.4	6.4	6.4	6.4		4.0	6.2		6.2	6.2	6.2
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	0.91		1.00	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1738	1830	1555	1738	1721		1738	4964		1738	4995	1555
Flt Permitted	0.72	1.00	1.00	0.72	1.00		0.19	1.00		0.14	1.00	1.00
Satd. Flow (perm)	1322	1830	1555	1316	1721		341	4964		248	4995	1555
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	268	58	442	53	32	21	195	1600	68	16	1089	116
RTOR Reduction (vph)	0	0	236	0	13	0	0	3	0	0	0	61
Lane Group Flow (vph)	268	58	206	53	40	0	195	1665	0	16	1089	55
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		Perm	NA	Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	27.9	27.9	27.9	27.9	27.9		64.2	64.2		49.4	49.4	49.4
Effective Green, g (s)	27.9	27.9	27.9	27.9	27.9		64.2	64.2		49.4	49.4	49.4
Actuated g/C Ratio	0.27	0.27	0.27	0.27	0.27		0.61	0.61		0.47	0.47	0.47
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4		4.0	6.2		6.2	6.2	6.2
Vehicle Extension (s)	3.5	3.5	3.5	3.5	3.5		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	352	487	414	350	458		353	3043		117	2356	733
v/s Ratio Prot		0.03			0.02		0.06	c0.34			0.22	
v/s Ratio Perm	c0.20		0.13	0.04			c0.28			0.06		0.04
v/c Ratio	0.76	0.12	0.50	0.15	0.09		0.55	0.55		0.14	0.46	0.07
Uniform Delay, d1	35.3	29.1	32.5	29.4	28.8		10.3	11.8		15.6	18.7	15.1
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	9.6	0.1	1.1	0.2	0.1		1.9	0.7		2.4	0.7	0.2
Delay (s)	45.0	29.2	33.6	29.6	28.9		12.2	12.5		18.0	19.3	15.3
Level of Service	D	C	C	C	C		B	B		B	B	B
Approach Delay (s)		37.2			29.3			12.5			18.9	
Approach LOS		D			C			B			B	

Intersection Summary		
HCM 2000 Control Delay	19.7	HCM 2000 Level of Service B
HCM 2000 Volume to Capacity ratio	0.64	
Actuated Cycle Length (s)	104.7	Sum of lost time (s) 16.6
Intersection Capacity Utilization	79.8%	ICU Level of Service D
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Elgin St & Elm St

2028 Total Conditions
 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 							
Traffic Volume (vph)	0	495	255	0	525	45	275	160	20	135	245	70
Future Volume (vph)	0	495	255	0	525	45	275	160	20	135	245	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.7			5.7		4.0	5.7		4.0	5.7	
Lane Util. Factor		0.95			0.95		1.00	1.00		1.00	1.00	
Frt		0.95			0.99		1.00	0.98		1.00	0.97	
Flt Protected		1.00			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3134			3435		1738	1799		1738	1768	
Flt Permitted		1.00			1.00		0.25	1.00		0.64	1.00	
Satd. Flow (perm)		3134			3435		452	1799		1168	1768	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	521	268	0	553	47	289	168	21	142	258	74
RTOR Reduction (vph)	0	65	0	0	6	0	0	6	0	0	12	0
Lane Group Flow (vph)	0	724	0	0	594	0	289	183	0	142	320	0
Parking (#/hr)		0										
Turn Type		NA			NA		pm+pt	NA		pm+pt	NA	
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)		41.4			41.4		37.2	26.8		27.3	20.9	
Effective Green, g (s)		41.4			41.4		37.2	26.8		27.3	20.9	
Actuated g/C Ratio		0.46			0.46		0.41	0.30		0.30	0.23	
Clearance Time (s)		5.7			5.7		4.0	5.7		4.0	5.7	
Vehicle Extension (s)		3.0			0.2		0.2	0.2		0.2	3.0	
Lane Grp Cap (vph)		1441			1580		362	535		394	410	
v/s Ratio Prot		c0.23			0.17		c0.11	0.10		0.03	0.18	
v/s Ratio Perm							c0.22			0.08		
v/c Ratio		0.50			0.38		0.80	0.34		0.36	0.78	
Uniform Delay, d1		17.1			15.9		20.1	24.7		23.8	32.4	
Progression Factor		1.00			1.00		1.00	1.00		1.43	1.25	
Incremental Delay, d2		1.3			0.7		10.9	0.1		0.2	8.5	
Delay (s)		18.3			16.5		31.0	24.9		34.1	49.2	
Level of Service		B			B		C	C		C	D	
Approach Delay (s)		18.3			16.5			28.6			44.7	
Approach LOS		B			B			C			D	
Intersection Summary												
HCM 2000 Control Delay			25.3				HCM 2000 Level of Service			C		
HCM 2000 Volume to Capacity ratio			0.66									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			15.4		
Intersection Capacity Utilization			74.4%				ICU Level of Service			D		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 12: Elgin St & MacKenzie St/Ste. Anne Rd

2028 Total Conditions
 PM Peak Hour


















	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↘	↑	↘	↗
Traffic Volume (vph)	315	240	120	275	145	145
Future Volume (vph)	315	240	120	275	145	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7	5.7	5.7	5.7	5.7
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1830	1555	1738	1830	1738	1555
Flt Permitted	1.00	1.00	0.49	1.00	0.95	1.00
Satd. Flow (perm)	1830	1555	894	1830	1738	1555
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	332	253	126	289	153	153
RTOR Reduction (vph)	0	82	0	0	0	117
Lane Group Flow (vph)	332	171	126	289	153	36
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	2			2	4	
Permitted Phases		2	2			4
Actuated Green, G (s)	41.4	41.4	41.4	41.4	20.9	20.9
Effective Green, g (s)	41.4	41.4	41.4	41.4	20.9	20.9
Actuated g/C Ratio	0.46	0.46	0.46	0.46	0.23	0.23
Clearance Time (s)	5.7	5.7	5.7	5.7	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	841	715	411	841	403	361
v/s Ratio Prot	c0.18			0.16	c0.09	
v/s Ratio Perm		0.11	0.14			0.02
v/c Ratio	0.39	0.24	0.31	0.34	0.38	0.10
Uniform Delay, d1	16.0	14.7	15.3	15.6	29.1	27.1
Progression Factor	1.00	1.00	1.00	1.00	1.20	2.84
Incremental Delay, d2	1.4	0.8	1.9	1.1	0.6	0.1
Delay (s)	17.4	15.5	17.2	16.7	35.5	77.2
Level of Service	B	B	B	B	D	E
Approach Delay (s)	16.6			16.9	56.4	
Approach LOS	B			B	E	

Intersection Summary			
HCM 2000 Control Delay	26.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.4
Intersection Capacity Utilization	72.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Elgin St & Beech St










2028 Total Conditions
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	10	85	50	45	105	30	160	15	10	295	50
Future Volume (vph)	15	10	85	50	45	105	30	160	15	10	295	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.7			5.7		5.7	5.7			5.7	
Lane Util. Factor		1.00			1.00		1.00	1.00			1.00	
Frt		0.90			0.93		1.00	0.99			0.98	
Flt Protected		0.99			0.99		0.95	1.00			1.00	
Satd. Flow (prot)		1629			1679		1738	1806			1792	
Flt Permitted		0.94			0.90		0.48	1.00			0.99	
Satd. Flow (perm)		1549			1530		877	1806			1779	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	11	89	53	47	111	32	168	16	11	311	53
RTOR Reduction (vph)	0	68	0	0	46	0	0	3	0	0	6	0
Lane Group Flow (vph)	0	48	0	0	165	0	32	181	0	0	369	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			4			2				2
Permitted Phases	4			4			2			2		
Actuated Green, G (s)		20.9			20.9		41.4	41.4			41.4	
Effective Green, g (s)		20.9			20.9		41.4	41.4			41.4	
Actuated g/C Ratio		0.23			0.23		0.46	0.46			0.46	
Clearance Time (s)		5.7			5.7		5.7	5.7			5.7	
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		359			355		403	830			818	
v/s Ratio Prot								0.10				
v/s Ratio Perm		0.03			c0.11		0.04				c0.21	
v/c Ratio		0.13			0.46		0.08	0.22			0.45	
Uniform Delay, d1		27.4			29.7		13.6	14.6			16.6	
Progression Factor		1.00			1.00		1.15	1.20			0.46	
Incremental Delay, d2		0.2			1.0		0.4	0.6			1.7	
Delay (s)		27.5			30.7		16.1	18.0			9.4	
Level of Service		C			C		B	B			A	
Approach Delay (s)		27.5			30.7			17.7			9.4	
Approach LOS		C			C			B			A	
Intersection Summary												
HCM 2000 Control Delay			18.5				HCM 2000 Level of Service				B	
HCM 2000 Volume to Capacity ratio			0.38									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)				15.4	
Intersection Capacity Utilization			54.5%				ICU Level of Service				A	
Analysis Period (min)			15									

c Critical Lane Group

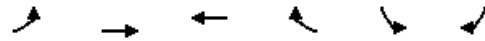
HCM Unsignalized Intersection Capacity Analysis
 14: MacKenzie St & Access 3

2028 Total Conditions
 PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	35	5	355	15	5	350
Future Volume (Veh/h)	35	5	355	15	5	350
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	37	5	374	16	5	368
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)			319			
pX, platoon unblocked	0.98	0.98			0.98	
vC, conflicting volume	760	382			390	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	742	356			364	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	90	99			100	
cM capacity (veh/h)	368	666			1151	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	42	390	373			
Volume Left	37	0	5			
Volume Right	5	16	0			
cSH	389	1700	1151			
Volume to Capacity	0.11	0.23	0.00			
Queue Length 95th (m)	2.7	0.0	0.1			
Control Delay (s)	15.4	0.0	0.2			
Lane LOS	C		A			
Approach Delay (s)	15.4	0.0	0.2			
Approach LOS	C					
Intersection Summary						
Average Delay			0.9			
Intersection Capacity Utilization			32.4%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
 16: Ste. Anne Rd & Access 1

2028 Total Conditions
 PM Peak Hour












Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔↕	↕↔		↕↔	
Traffic Volume (veh/h)	20	440	375	15	15	20
Future Volume (Veh/h)	20	440	375	15	15	20
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	21	463	395	16	16	21
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)		87	360			
pX, platoon unblocked						
vC, conflicting volume	411				676	206
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	411				676	206
tC, single (s)	4.2				6.9	7.0
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				96	97
cM capacity (veh/h)	1123				373	792

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	175	309	263	148	37
Volume Left	21	0	0	0	16
Volume Right	0	0	0	16	21
cSH	1123	1700	1700	1700	533
Volume to Capacity	0.02	0.18	0.15	0.09	0.07
Queue Length 95th (m)	0.4	0.0	0.0	0.0	1.7
Control Delay (s)	1.1	0.0	0.0	0.0	12.3
Lane LOS	A				B
Approach Delay (s)	0.4		0.0		12.3
Approach LOS					B

Intersection Summary						
Average Delay			0.7			
Intersection Capacity Utilization			36.9%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
 18: MacKenzie St & Access 2

2028 Total Conditions
 PM Peak Hour























						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	225	15	355	80	10	375
Future Volume (Veh/h)	225	15	355	80	10	375
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	237	16	374	84	11	395
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)			224			
pX, platoon unblocked	0.91	0.91			0.91	
vC, conflicting volume	833	416			458	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	769	312			358	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	28	98			99	
cM capacity (veh/h)	330	658			1081	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	253	458	406			
Volume Left	237	0	11			
Volume Right	16	84	0			
cSH	341	1700	1081			
Volume to Capacity	0.74	0.27	0.01			
Queue Length 95th (m)	43.3	0.0	0.2			
Control Delay (s)	40.7	0.0	0.3			
Lane LOS	E		A			
Approach Delay (s)	40.7	0.0	0.3			
Approach LOS	E					
Intersection Summary						
Average Delay			9.3			
Intersection Capacity Utilization			47.8%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

23: College St & Froid Rd

2028 Total Conditions

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	45	100	105	80	90	10	135	320	120	15	405	25
Future Volume (vph)	45	100	105	80	90	10	135	320	120	15	405	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7		4.0	5.7	5.7	5.7	5.7			5.7	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00			1.00	
Frt	1.00	0.92		1.00	1.00	0.85	1.00	0.96			0.99	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00			1.00	
Satd. Flow (prot)	1738	1689		1738	1830	1555	1738	1755			1813	
Flt Permitted	0.70	1.00		0.52	1.00	1.00	0.35	1.00			0.98	
Satd. Flow (perm)	1272	1689		953	1830	1555	647	1755			1776	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	47	105	111	84	95	11	142	337	126	16	426	26
RTOR Reduction (vph)	0	41	0	0	0	6	0	15	0	0	3	0
Lane Group Flow (vph)	47	175	0	84	95	5	142	448	0	0	465	0
Turn Type	Perm	NA		pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2		1	6			8				4
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)	30.2	30.2		41.9	41.9	41.9	30.6	30.6			30.6	
Effective Green, g (s)	30.2	30.2		41.9	41.9	41.9	30.6	30.6			30.6	
Actuated g/C Ratio	0.36	0.36		0.50	0.50	0.50	0.36	0.36			0.36	
Clearance Time (s)	5.7	5.7		4.0	5.7	5.7	5.7	5.7			5.7	
Vehicle Extension (s)	0.2	0.2		0.2	0.2	0.2	0.2	0.2			0.2	
Lane Grp Cap (vph)	457	607		547	913	776	235	640			647	
v/s Ratio Prot		c0.10		c0.01	0.05			0.26				
v/s Ratio Perm	0.04			0.06		0.00	0.22				c0.26	
v/c Ratio	0.10	0.29		0.15	0.10	0.01	0.60	0.70			0.72	
Uniform Delay, d1	17.8	19.2		11.2	11.1	10.5	21.7	22.7			23.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00			1.00	
Incremental Delay, d2	0.0	0.1		0.0	0.0	0.0	3.0	2.8			3.2	
Delay (s)	17.9	19.3		11.3	11.1	10.6	24.7	25.6			26.2	
Level of Service	B	B		B	B	B	C	C			C	
Approach Delay (s)		19.0			11.2			25.4			26.2	
Approach LOS		B			B			C			C	











Intersection Summary

HCM 2000 Control Delay	22.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	83.9	Sum of lost time (s)	15.4
Intersection Capacity Utilization	119.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Queues
6: Notre Dame Ave & Ste. Anne Rd/Louis St

2028 Total Conditions
AM Peak Hour

										
Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	74	21	168	42	31	242	726	16	1363	105
v/c Ratio	0.47	0.10	0.51	0.26	0.14	0.61	0.20	0.04	0.47	0.11
Control Delay	49.3	38.1	11.9	42.4	34.3	13.4	3.7	12.2	13.6	3.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.3	38.1	11.9	42.4	34.3	13.4	3.7	12.2	13.6	3.0
Queue Length 50th (m)	13.0	3.5	0.0	7.2	4.4	9.2	11.2	1.2	49.3	0.0
Queue Length 95th (m)	26.5	10.1	17.3	16.9	12.4	32.0	18.2	5.2	79.6	8.1
Internal Link Dist (m)		336.0			265.5		169.1		392.6	
Turn Bay Length (m)	135.0		115.0			25.0		75.0		85.0
Base Capacity (vph)	501	681	684	506	668	559	3716	384	2881	941
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.15	0.03	0.25	0.08	0.05	0.43	0.20	0.04	0.47	0.11
Intersection Summary										

Queues
11: Elgin St & Elm St

2028 Total Conditions
AM Peak Hour

	→	←	↖	↑	↘	↓
Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	637	516	205	142	53	179
v/c Ratio	0.35	0.30	0.54	0.31	0.15	0.57
Control Delay	9.7	11.4	24.1	24.8	21.5	39.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.7	11.4	24.1	24.8	21.5	39.1
Queue Length 50th (m)	20.7	20.4	22.8	17.5	6.6	23.7
Queue Length 95th (m)	37.5	35.7	34.1	30.0	14.1	36.9
Internal Link Dist (m)	420.7	420.2		182.5		72.6
Turn Bay Length (m)			25.0		20.0	
Base Capacity (vph)	1828	1708	390	496	387	439
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.30	0.53	0.29	0.14	0.41
Intersection Summary						

Queues
12: Elgin St & MacKenzie St/Ste. Anne Rd

2028 Total Conditions
AM Peak Hour

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	237	121	74	326	153	58
v/c Ratio	0.24	0.14	0.12	0.33	0.52	0.18
Control Delay	12.0	3.0	11.8	12.9	44.9	21.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.0	3.0	11.8	12.9	44.9	21.2
Queue Length 50th (m)	17.9	0.0	5.2	26.1	22.0	0.8
Queue Length 95th (m)	36.4	8.3	14.0	50.8	34.6	11.8
Internal Link Dist (m)	200.0			62.9	81.4	
Turn Bay Length (m)		15.0	35.0			
Base Capacity (vph)	977	887	594	977	419	419
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.14	0.12	0.33	0.37	0.14
Intersection Summary						









Queues
13: Elgin St & Beech St

2028 Total Conditions
AM Peak Hour

	→	←	↙	↑	↓
Lane Group	EBT	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	79	89	21	152	190
v/c Ratio	0.26	0.29	0.03	0.16	0.20
Control Delay	15.5	17.2	11.8	13.1	6.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	15.5	17.2	11.8	13.1	6.5
Queue Length 50th (m)	4.2	5.6	2.3	17.6	8.3
Queue Length 95th (m)	14.0	16.0	7.6	31.4	11.1
Internal Link Dist (m)	118.6	120.4		72.6	81.4
Turn Bay Length (m)					
Base Capacity (vph)	413	412	652	973	948
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.19	0.22	0.03	0.16	0.20
Intersection Summary					











Queues
23: College St & Froid Rd

2028 Total Conditions
AM Peak Hour

								
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBT
Lane Group Flow (vph)	26	105	137	95	11	184	379	326
v/c Ratio	0.04	0.12	0.22	0.09	0.01	0.40	0.44	0.38
Control Delay	19.3	14.9	11.5	11.3	0.8	25.5	22.6	22.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	19.3	14.9	11.5	11.3	0.8	25.5	22.6	22.2
Queue Length 50th (m)	2.8	7.9	10.6	7.5	0.0	23.8	48.4	41.1
Queue Length 95th (m)	8.4	19.1	20.6	15.7	0.6	44.2	75.8	65.0
Internal Link Dist (m)		174.4		243.5			197.1	355.4
Turn Bay Length (m)	15.0		20.0		20.0	30.0		
Base Capacity (vph)	574	801	643	1154	993	461	865	853
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.05	0.13	0.21	0.08	0.01	0.40	0.44	0.38
Intersection Summary								

Queues
6: Notre Dame Ave & Ste. Anne Rd/Louis St

2028 Total Conditions
PM Peak Hour

										
Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	268	58	442	53	53	195	1668	16	1089	116
v/c Ratio	0.76	0.12	0.68	0.15	0.11	0.54	0.55	0.14	0.46	0.15
Control Delay	49.6	28.2	14.6	29.0	20.2	15.4	13.8	25.7	21.6	4.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Total Delay	49.6	28.2	14.6	29.0	20.2	15.4	14.0	25.7	21.6	4.8
Queue Length 50th (m)	50.0	8.9	19.3	8.2	5.3	15.1	66.8	1.8	52.6	0.0
Queue Length 95th (m)	77.6	18.1	51.9	17.3	14.0	34.3	109.2	8.5	89.8	11.9
Internal Link Dist (m)		336.0			265.5		169.1		392.6	
Turn Bay Length (m)	135.0		115.0			25.0		75.0		85.0
Base Capacity (vph)	553	766	838	551	731	444	3046	117	2353	794
Starvation Cap Reductn	0	0	0	0	0	0	469	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.48	0.08	0.53	0.10	0.07	0.44	0.65	0.14	0.46	0.15
Intersection Summary										

Queues
11: Elgin St & Elm St

2028 Total Conditions
PM Peak Hour

	→	←	↙	↑	↘	↓
Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	789	600	289	189	142	332
v/c Ratio	0.52	0.38	0.78	0.35	0.34	0.78
Control Delay	17.1	17.6	31.4	24.3	23.9	51.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	2.0
Total Delay	17.1	17.6	31.4	24.3	23.9	53.1
Queue Length 50th (m)	43.3	35.4	31.4	23.7	20.7	54.5
Queue Length 95th (m)	65.0	52.2	46.1	38.3	33.9	82.2
Internal Link Dist (m)	420.7	420.2		182.5		72.6
Turn Bay Length (m)			25.0		20.0	
Base Capacity (vph)	1505	1584	409	640	428	483
Starvation Cap Reductn	0	0	0	0	0	59
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.52	0.38	0.71	0.30	0.33	0.78
Intersection Summary						

Queues
12: Elgin St & MacKenzie St/Ste. Anne Rd

2028 Total Conditions
PM Peak Hour

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	332	253	126	289	153	153
v/c Ratio	0.40	0.32	0.31	0.34	0.38	0.32
Control Delay	19.4	8.6	20.1	18.7	36.6	15.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	19.4	8.6	20.1	18.7	36.6	15.1
Queue Length 50th (m)	38.4	10.3	13.9	32.5	20.3	3.0
Queue Length 95th (m)	64.5	27.7	29.5	55.3	32.3	19.3
Internal Link Dist (m)	200.0			62.9	81.4	
Turn Bay Length (m)		15.0	35.0			
Base Capacity (vph)	840	796	411	840	463	526
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.40	0.32	0.31	0.34	0.33	0.29
Intersection Summary						









Queues
13: Elgin St & Beech St

2028 Total Conditions
PM Peak Hour

	→	←	↙	↑	↓
Lane Group	EBT	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	116	211	32	184	375
v/c Ratio	0.27	0.53	0.08	0.22	0.46
Control Delay	10.6	25.6	19.6	19.9	10.1
Queue Delay	0.2	0.6	0.0	0.0	0.1
Total Delay	10.8	26.2	19.6	19.9	10.2
Queue Length 50th (m)	3.6	21.8	4.5	26.9	18.3
Queue Length 95th (m)	16.0	42.0	12.2	43.5	20.4
Internal Link Dist (m)	118.6	120.4		72.6	81.4
Turn Bay Length (m)					
Base Capacity (vph)	478	452	402	833	823
Starvation Cap Reductn	0	0	0	0	38
Spillback Cap Reductn	67	65	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.28	0.55	0.08	0.22	0.48
Intersection Summary					

Queues
23: College St & Froid Rd

2028 Total Conditions
PM Peak Hour

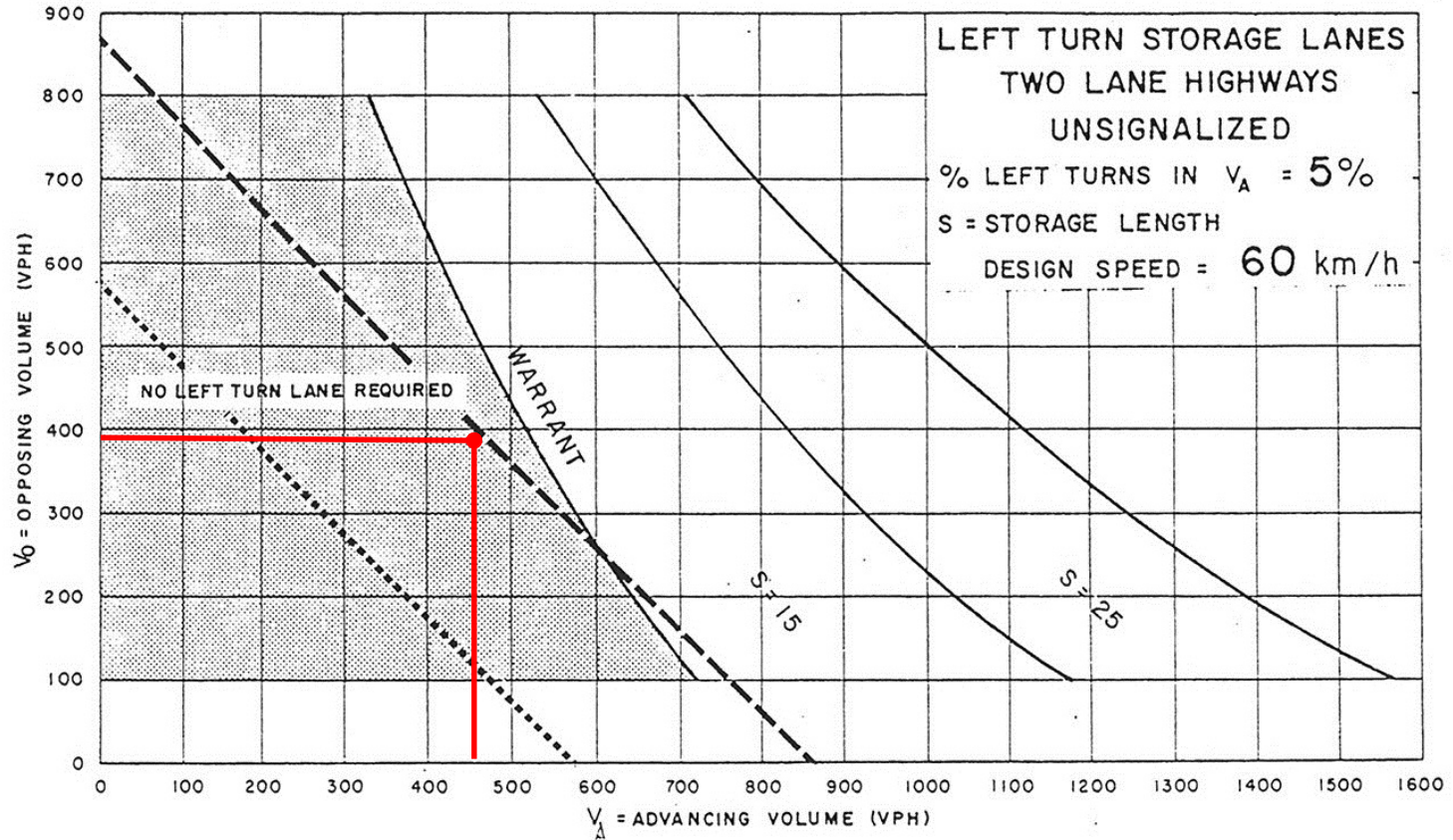
								
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBT
Lane Group Flow (vph)	47	216	84	95	11	142	463	468
v/c Ratio	0.10	0.33	0.14	0.11	0.01	0.60	0.70	0.71
Control Delay	20.0	15.9	10.8	11.4	0.8	35.0	28.8	30.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.0	15.9	10.8	11.4	0.8	35.0	28.8	30.4
Queue Length 50th (m)	5.1	17.4	6.3	7.5	0.0	19.0	62.0	65.7
Queue Length 95th (m)	12.7	35.8	13.7	15.7	0.6	#40.7	96.2	100.2
Internal Link Dist (m)		174.4		243.5			197.1	355.4
Turn Bay Length (m)	15.0		20.0		20.0	30.0		
Base Capacity (vph)	466	660	604	1026	886	253	700	696
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.33	0.14	0.09	0.01	0.56	0.66	0.67

Intersection Summary

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

**APPENDIX E:
MTO LEFT TURN WARRANTS**

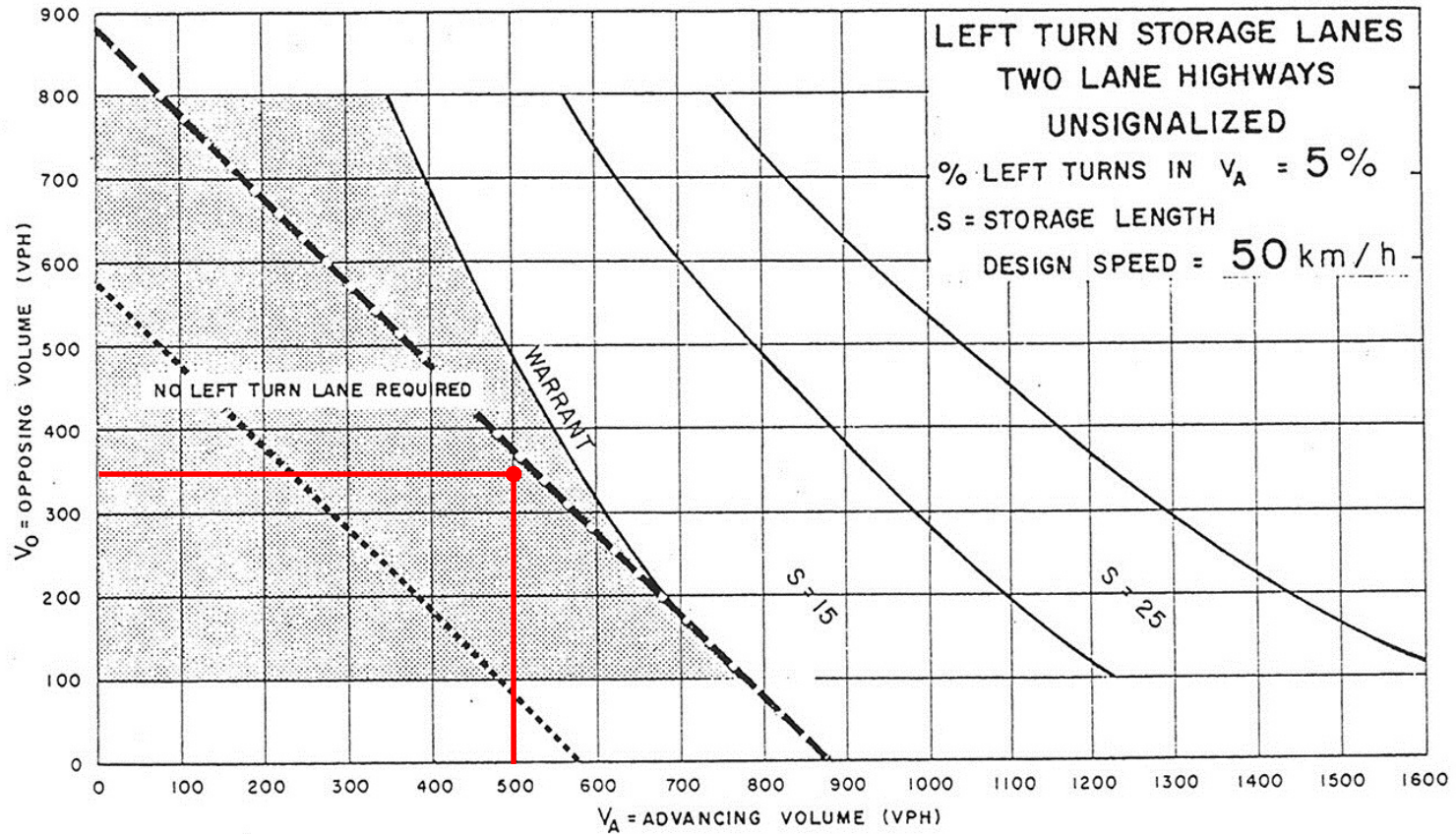
PM Peak Hour



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



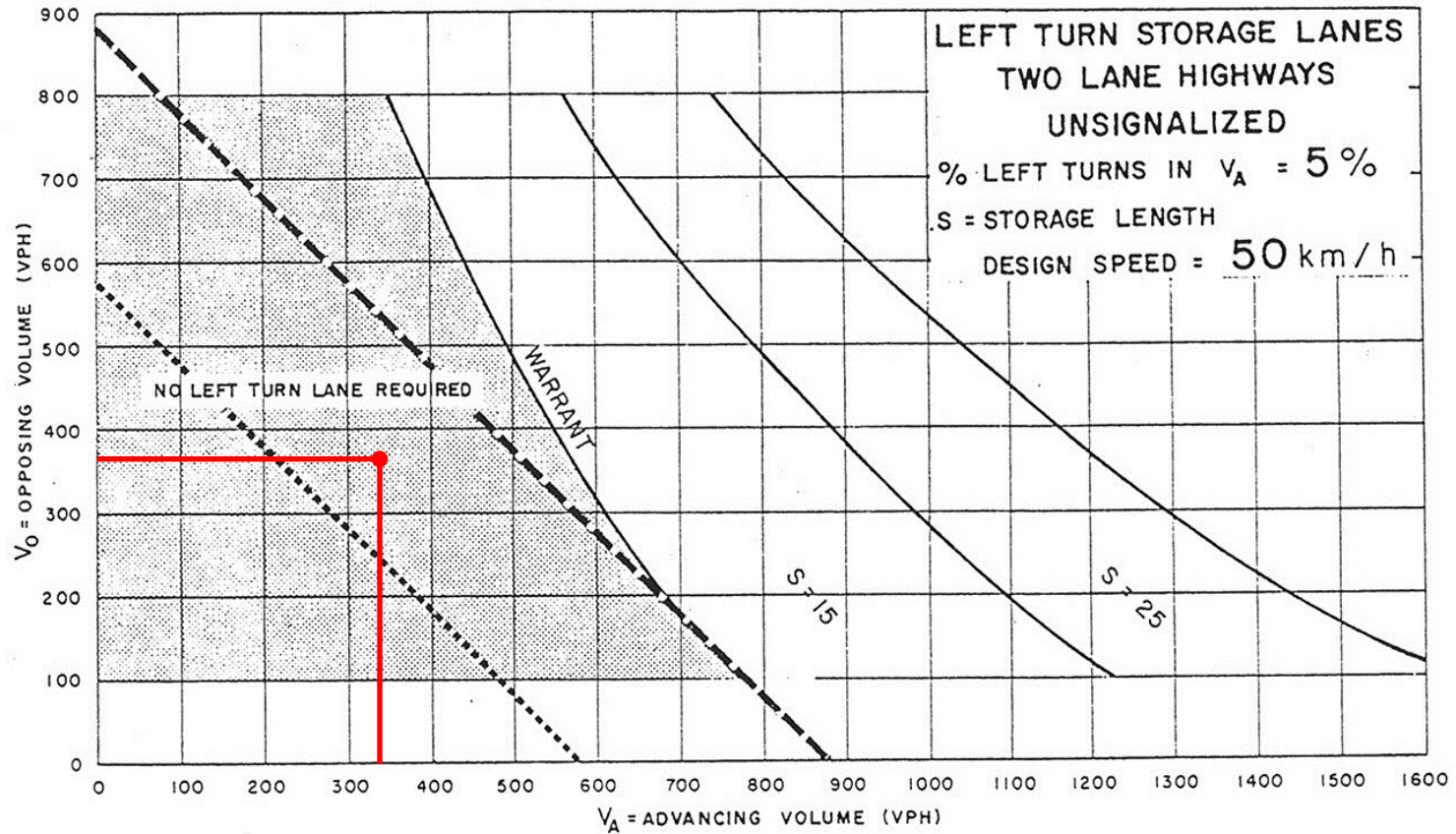
AM Peak Hour



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



AM Peak Hour



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

