



## MEMO

**TO** : Michael Kresin, P.Eng. (Kresin Engineering Corporation)

**FROM** : Giovanni Bottesini, P.Eng., M.Eng. (CIMA+)

**DATE** : September 6, 2018

**SUBJECT** : **Northern Avenue Road Diet and P- Patch Access Traffic Review  
Addendum: Boreal French Immersion Public School Traffic Review  
Our File: B000699A**

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### 1. Introduction

This memorandum is an addendum to the Traffic Report titled *Northern Avenue Road Diet and P-Patch Access Traffic Review*, issued by CIMA+ in September 2017. In response to public feedback received during the EA process, Kresin Engineering retained CIMA+ to complete further review of the potential traffic impacts of the planned re-development of the Boreal French Immersion Public School (located on Northern Avenue between Sackville Road and Great Northern Road). The school re-development is expected to include:

- French Immersion School: 600 to 650 students (served by 15 to 20 school buses);
- Daycare centre: 40 children;
- School staff: 50 employees; and
- Daycare staff: 10 employees.

This memorandum summarizes the results of the additional review, which considers school-related traffic (the school was vacant at the time the original analysis was completed) with the proposed road diet configuration.

### 2. Traffic Operations without School

In the original Traffic Report, the traffic analysis showed that, by the year 2026, most movements at the study area intersections are expected to operate with LOS C or better and acceptable v/c ratios under the proposed road diet configuration. The exceptions were the northbound left-turn and southbound through movements at Northern Avenue & Great Northern Road, which presented v/c ratios of 1.00 and 1.01, respectively, in the PM peak hour, however these issues do not result from the proposed road diet, since the lane configuration at this intersection is not expected to change from existing conditions.

### 3. School-related Trips

#### 3.1 School Re-Development

The proposed school is located on the north side of Northern Avenue between Sackville Road and Great Northern Road, as illustrated in **Figure 1**.



**Figure 1: School Site**

The proposed site plan for the area is provided in **Appendix A**. The site is planned for the Boreal French Immersion Public School, a daycare center, library, shops area and administration offices. Five parking lots are proposed within the development to accommodate the daycare, students and staff. There are four accesses onto Northern Avenue from the site. For the purpose of this review, each access was labeled according to the types of users assumed to be served. These assumptions are, from west to east:

- Student/Bus Driveway
- Daycare Driveway
- West Employee Driveway
- East Employee Driveway

Kresin Engineering provided details regarding the operating hours and capacity of the school and daycare, which are summarized in **Table 1**.

**Table 1: School and Daycare Details**

	School	Daycare
<b>Capacity</b>	600 – 650	40
<b>Staff</b>	50	10
<b>Buses</b>	15-20	N/A
<b>Entry Time</b>	9:00 AM	7:00 AM
<b>Dismissal Time</b>	3:55 PM	5:30 PM
<b>Active Months</b>	Sep. – Jun.	All year

The entry and dismissal time of the school coincide with the peak hours used in the original traffic analysis (08:00 to 09:00 AM and 4:00 to 05:00 PM) and were adopted for the school traffic review. The daycare is expected to have arrivals and departures spread throughout the day.

### 3.2 Site Trip Generation

For the purposes of this assessment, projected site generated traffic was derived based on the estimated student and staff population, and the expected number of buses that will serve the school. **Table 2** provides a summary of projected person trips for an average school day, based on the planned school population and the application of first principles.

**Table 2: Projected Site-Generated Person Trips**

Students	
Total Students	650
5% absent	33
<b>Total Student Person Trips During Peaks</b>	<b>617</b>
Staff	
Total Staff	50
30% arrive/depart outside peak hour	15
5% absent	3
<b>Total Staff Person Trips During Peaks</b>	<b>32</b>
Daycare	
Total Capacity	40
50% arrive/depart outside peak hour	20
<b>Total Daycare Person Trips During Peaks</b>	<b>20</b>

As shown in **Table 2**, assuming a conservative average absenteeism, and a percentage of staff trips arriving/departing the site outside peak hours, the total projected person traffic is 649 person trips per hour during the weekday morning and afternoon peak hours, including 617 students and 32 staff. Additionally, 50% of daycare trips were assumed to occur within the peak hour, resulting in 20 person trips. All staff was assumed to arrive and depart outside of peak hours.

Assuming a school bus capacity of 30 students per bus, 450 person trips (students) can be accommodated by 15 buses. This results in 167 student and 32 staff person trips that are expected to arrive/depart the site by other modes of transportation (i.e. public transit, bike/walk, and auto). **Table 3** includes assumptions for non-auto trips and the resulting auto trips.

**Table 3: Projected Site-Generated Person Trips by Mode**

Student	
Total Person Trips	167
Public Transit (10%)	17
Bike/Walk (20%)	33
2+ Students in same vehicle (15%)	25
<b>Total Auto Student Trips During Peaks</b>	<b>92</b>
Staff	
Total Person Trips	32
Public Transit (10%)	3
Bike/Walk (10%)	3
Auto Passenger (0%)	0
<b>Total Auto Staff Trips During Peaks</b>	<b>26</b>
Daycare	
Total Person Trips	20
Total	
<b>Total Auto Trips During Peaks</b>	<b>138</b>

As shown in **Table 3**, the subject site is projected to generate approximately 138 auto trips during both weekday morning and afternoon peak hours, in addition to 15 school buses. Given that buses and student pick-up/drop-off will account for two trips (inbound and outbound) and staff trips will only account for a single trip (inbound or outbound) during each peak hour, the total projected two-way site-generated traffic is 280 veh/h (i.e. 153 veh/h inbound and 127 veh/h outbound during the morning peak hour, and vice-versa during the afternoon peak hour). It should be noted that these are likely conservative estimates, since an additional 5 school buses could further reduce the number of student auto trips. Additionally, all student auto trips were assumed to be new trips added to the network. Realistically, some of these trips can be expected to consist of pass-by trips (i.e. parents dropping off/picking up the students on their regular route to/from work).

### 3.3 Site-Generated Traffic Distribution and Assignment

Trip distribution was assumed based on the proportion of residential areas within the school catchment area (provided in **Appendix B**). The residential areas used for the trip distribution are illustrated in **Figure 2**, and the resulting trip distribution is the following:

- West: 40%;
- North: 15%;
- Southwest: 15%
- Southeast: 15%; and
- East: 15%.

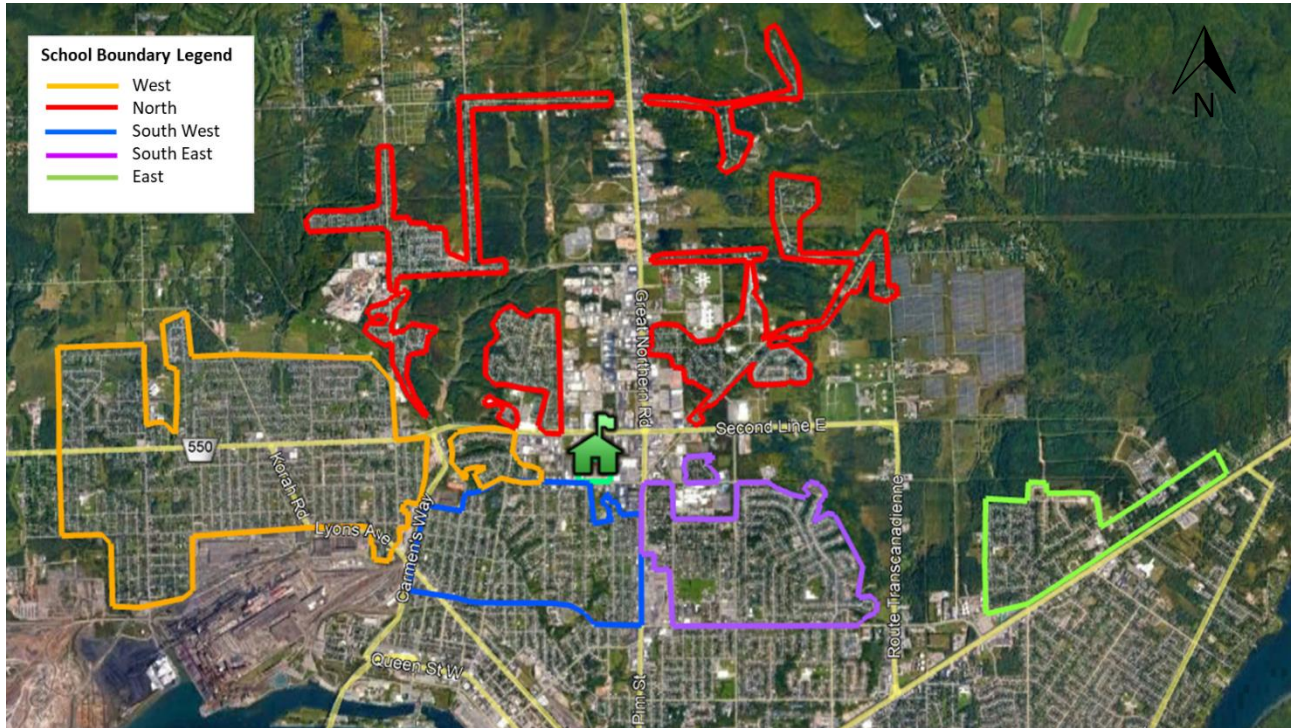


Figure 2: Catchment Areas

Based on this distribution pattern, the projected site-generated traffic assigned to the study area network is illustrated in **Figure 3** and **Figure 4**.

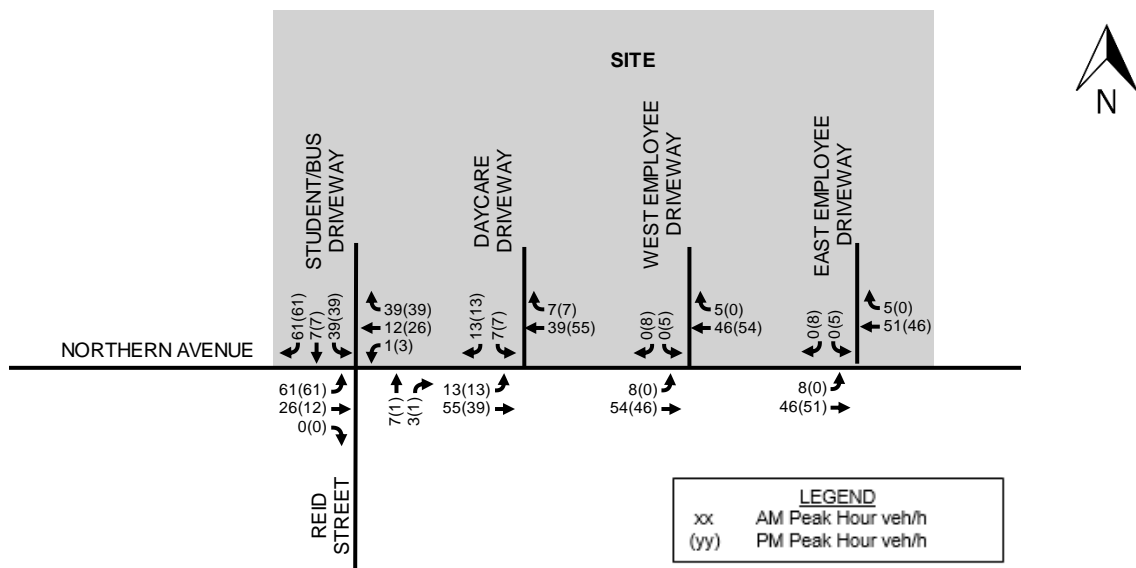
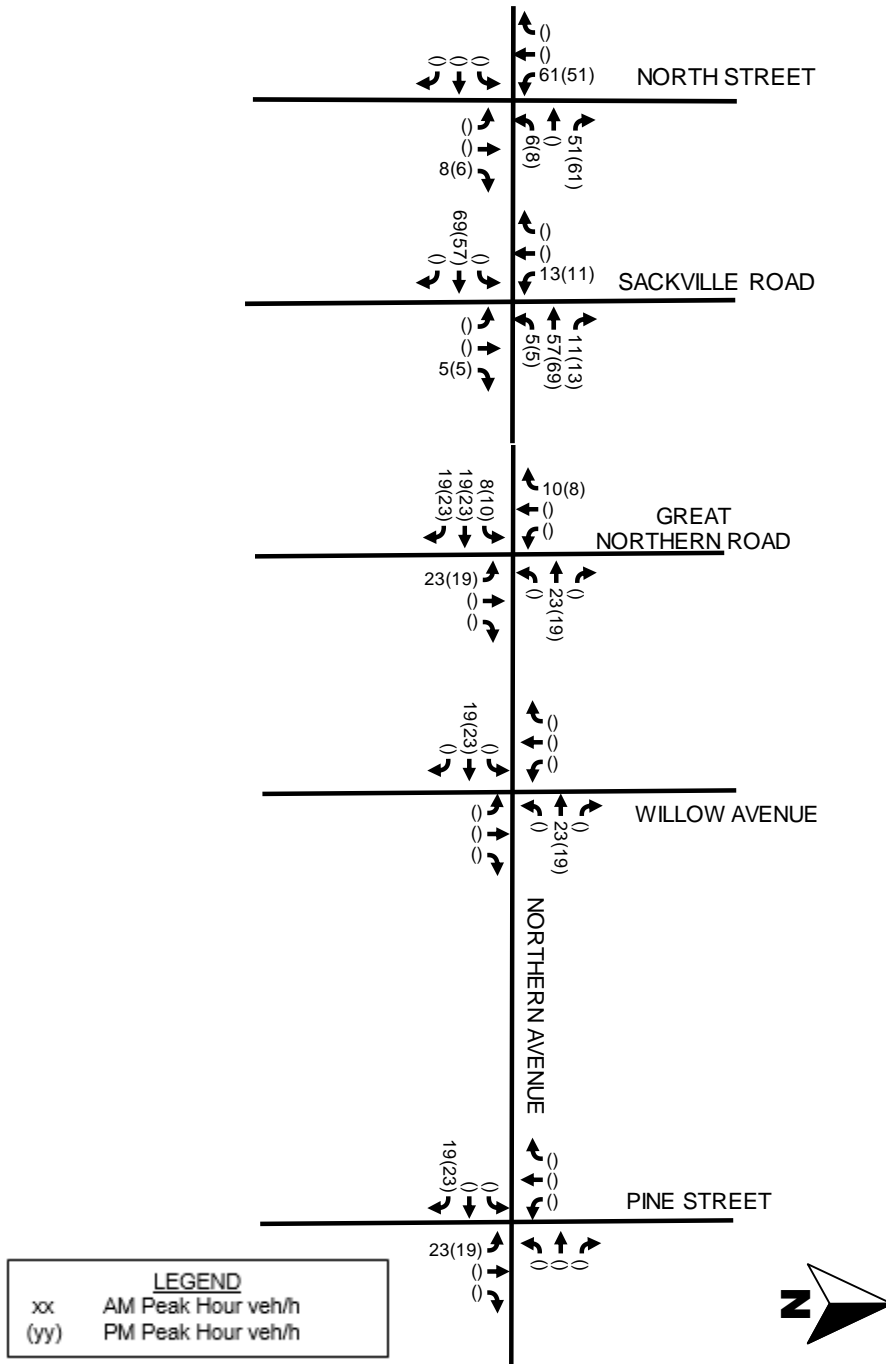


Figure 3: Projected School Traffic at School Entrances

**Northern Avenue Road Diet and P-Patch Access Traffic Review**  
 Addendum: Boreal French Immersion Public School Traffic Review



**Figure 4: Projected School Traffic at Signalized Intersections**

### 3.4 Projected Traffic Operations

Traffic operations at the school entrances were reviewed using Synchro/SimTraffic software. The analysis was completed for the 2026 horizon year by adding the projected school volumes to the 2026 volumes from the original traffic analysis with the road diet configuration (i.e. with the centre left-turn lane in place and 1 through lane per direction).

The results show that all movements at the school entrances are expected to operate with acceptable volume to capacity ratios (0.41 or lower) and LOS (C or better). Additionally, no queuing issues were identified, with 95<sup>th</sup> percentile queues along Northern Avenue not exceeding 14 metres (approximately 2 passenger car lengths), which can be accommodated by the centre left-turn lane.

No major impacts were identified at the signalized intersections in the study area during the AM peak hour with all movements operating with v/c ratio 0.81 or lower, and LOS C or better. The 95<sup>th</sup> percentile queue at the North Street southbound left-turn increased from 31 metres to 41 metres with the additional school traffic (both are longer than the existing storage length of 16 metres). Effectively, the impact of school traffic is approximately 1 additional queued vehicle.

In the PM peak hour, most movements are expected to operate under capacity and with acceptable LOS and 95<sup>th</sup> percentile queues, with the following exceptions at Great Northern Road:

- Northbound left-turn: v/c increased from 1.00 to 1.09, average delay increased from 83 to 108 seconds, and 95<sup>th</sup> percentile queues increased from 74 to 89 metres; and
- Southbound through: v/c remained unchanged at 1.01.

It should be noted, however, that the PM peak hour issues noted above do not result from the proposed road diet, since the lane configuration at the intersection of Northern Avenue and Great Northern Road is not expected to change from existing conditions.

Synchro/SimTraffic reports with detailed operational results can be found in **Appendix C**.

## 4. Conclusions

A total of 280 vehicles trips per hour (153 inbound and 127 outbound during the morning peak hour, and vice-versa during the afternoon peak hour) are expected to be generated by the redevelopment of the Boreal French Immersion Public School. After adding these volumes to the 2026 Road Diet scenario from the original *Northern Avenue Road Diet and P-Patch Access Traffic Review Report*, issued by CIMA+ in September 2017, operational analysis showed that no issues are expected at the four school entrances. It should be noted that the road diet is also expected to provide safety benefits near the school entrances, since the provision of the centre left-turn lane allows entering vehicles to be removed from the through traffic lanes (as discussed in the original report).

Additionally, the conclusions from the original report remain mostly unchanged for the other signalized intersections in the study area. The most significant operational issues are expected to occur at the intersection of Northern Avenue & Great Northern Road, however these issues do not result from the proposed road diet, since the lane configuration at this intersection is not expected to change from existing conditions.

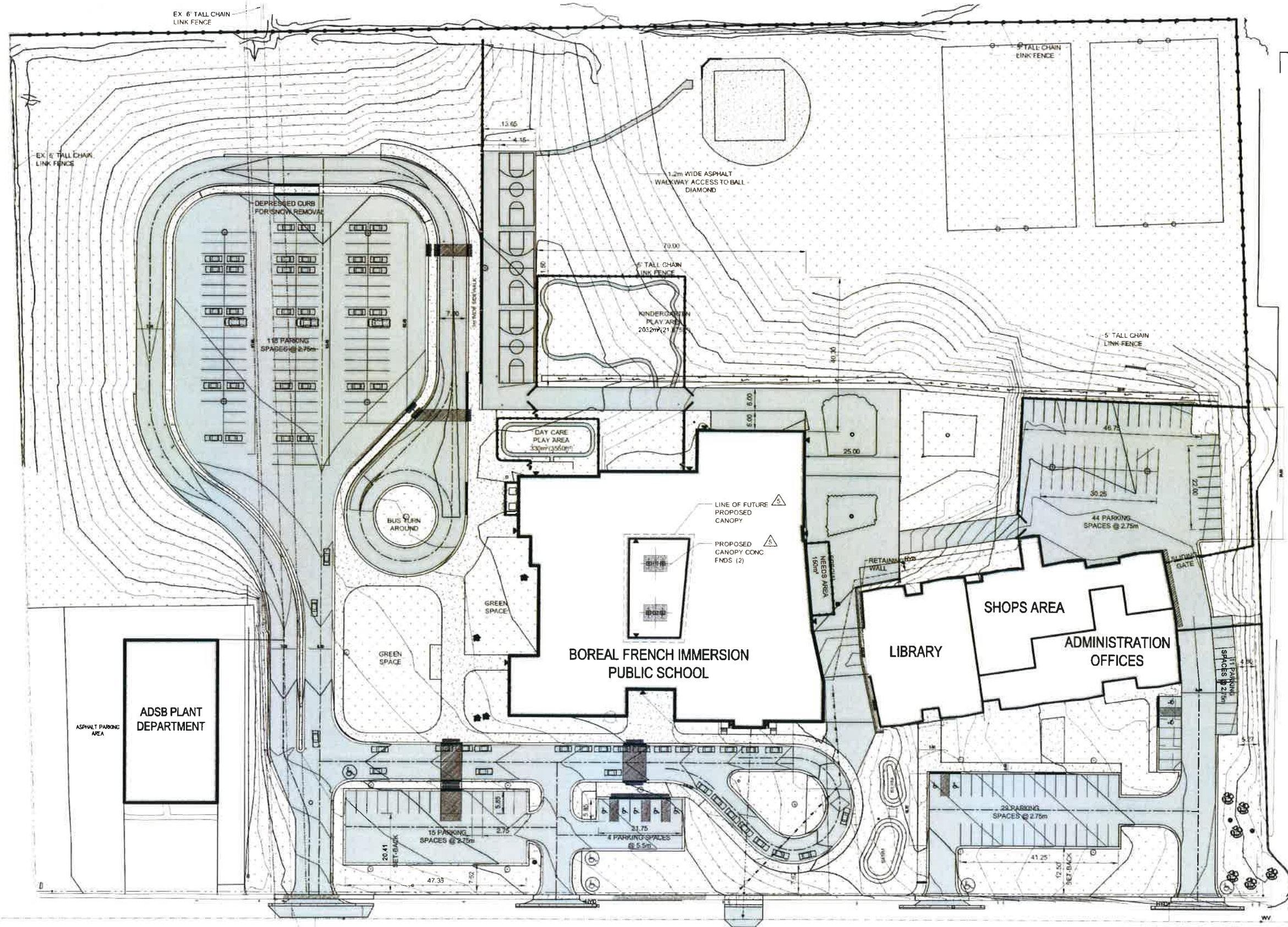
# A

## Appendix A School Site Plan



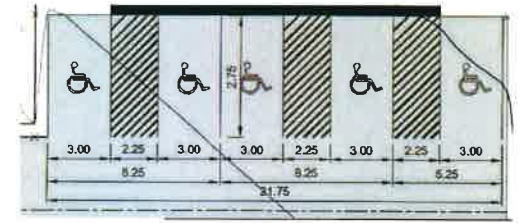


# Schedule B 1.1



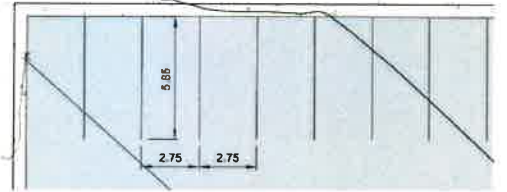
- LEGEND:**
- PROPERTY LINE
  - EDGE OF BUILDING
  - EXISTING ASPHALT/EDGE OF PAVEMENT
  - EXISTING EDGE OF GRAVEL ROAD
  - EXISTING SIDEWALK
  - EXISTING CHAINLINK FENCE/WOOD FENCE
  - TOP OF SLOPE
  - BOTTOM OF SLOPE
  - INDEX CONTOUR (1.00m)
  - INTERMEDIATE CONTOUR (0.25m)
  - UNKNOWN MANHOLE
  - SANITARY MANHOLE
  - STORM MANHOLE
  - CATCH-BASIN
  - ⊕ FIRE HYDRANT
  - ⊕ WATER VALVE
  - ⊕ HYDRO POLE
  - ⊕ GUY WIRE
  - LIGHT POLE BASE
  - ⊕ BELL PEDSTAL
  - ⊕ GAS VALVE
  - ⊕ SQUARE IRON BAR (SB)
  - ⊕ IRON BAR (IB)
  - ⊕ BOLLARD
  - ▲ INDICATES DOOR OPENINGS
  - DECIDUOUS TREE
  - CONIFEROUS TREE
  - BOULDERS
- GEODETIC INFORMATION - UTM WAD 83, ZONE 16

- ASPHALT SURFACE 12.100m<sup>2</sup>
- ASPHALT SURFACE BUS LANE 3.100m<sup>2</sup>
- TOPSOIL & SOIL SURFACE 35.100m<sup>2</sup>
- CONCRETE SURFACE 4.000m<sup>2</sup>
- 1.5m CHAIN LINK FENCE 100m



**PROPOSED BARRIER FREE PARKING SPACES**

NOTE: SPACES SHOWN FOR THE INSTITUTIONAL ZONED PORTION OF THE BUILDING SHALL FOLLOW THIS TEMPLATE



**TYPICAL PARKING SPACES**

NOTE: ALL PARKING SPACES SHALL MEET THE MINIMUM SIZES OF THIS SCHEDULE EXCEPT FOR THE BARRIER FREE SPACES

NORTHERN AVENUE  
**PROPOSED LAYOUT - PLAN - GENERAL ARRANGEMENT**  
 SCALE: 1:500



ADDITIONAL SIGNS SHALL BE PROVIDED DURING LOCATION OF BARRIER FREE PARKING SPACES. APPROXIMATE LOCATIONS SHALL BE SHOWN TO REFLECT LOCATION

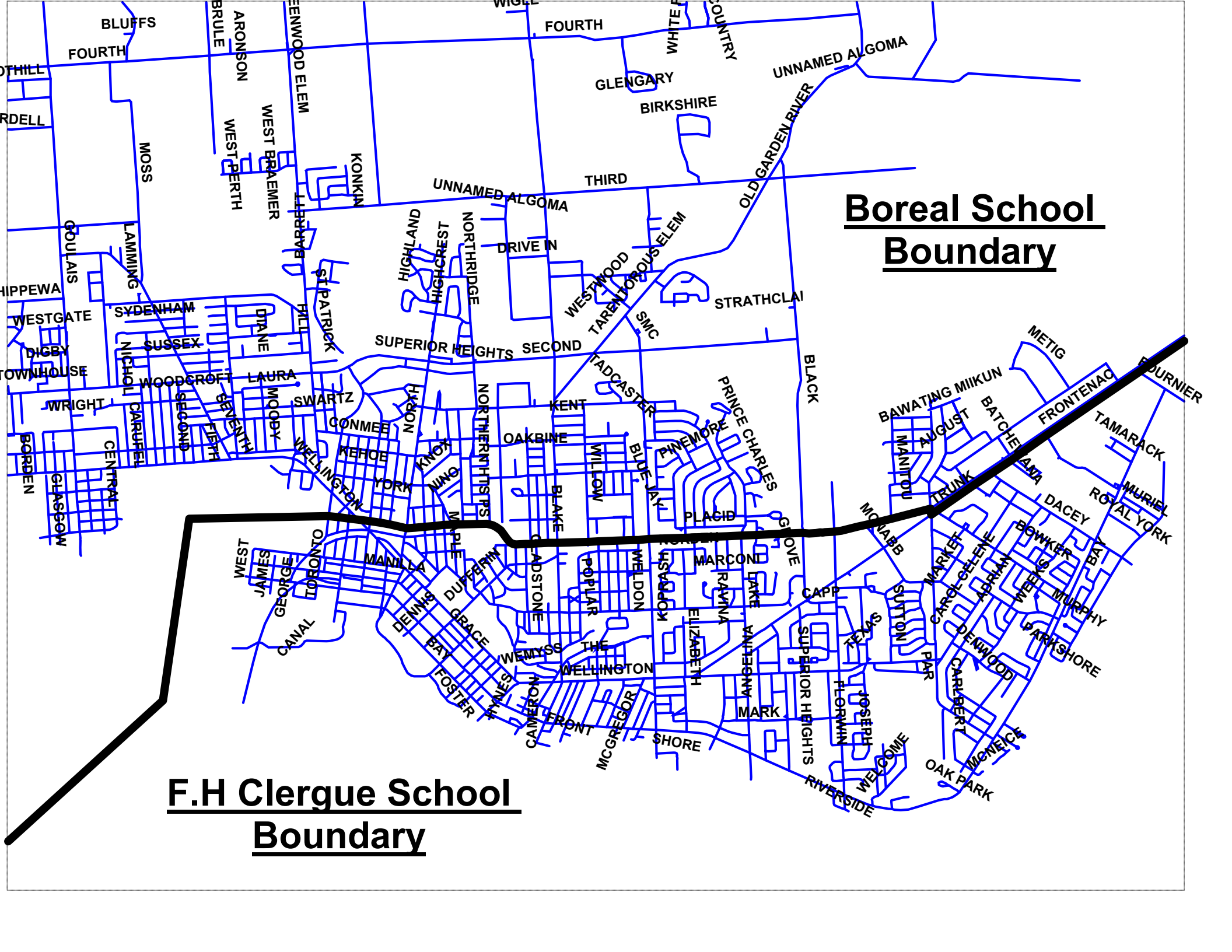
REV	DESCRIPTION	DATE
1	ISSUED FOR PERMIT	2018
2	ISSUED FOR PERMIT	2018
3	ISSUED FOR PERMIT	2017
4	ISSUED FOR PERMIT	2017

**ELLIOTT ENGINEERING INC.**  
 1000 SHEPPARD AVENUE EAST, SUITE 100  
 ALGOMA DISTRICT SCHOOL BOARD  
 300 HURON AVENUE  
 SALT SPRING ISLAND, ON  
 BOREAL FRENCH IMMERSION PUBLIC SCHOOL  
 PROPOSED LAYOUT - GENERAL ARRANGEMENT  
 DRAWN BY: [Name] DATE: 2018-03-12  
 CHECKED BY: [Name] DATE: 2018-03-12  
 ISSUED FOR: SITE PLAN APP. DATE: 2018-03-12  
 PROJECT NO: E16006 SCA-2

# B

## Appendix B Boreal School Boundary





**Boreal School Boundary**

**F.H Clergue School Boundary**

# C

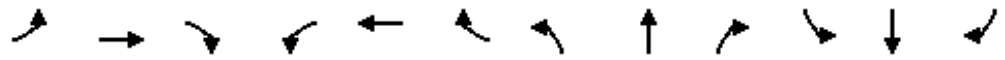
## Appendix C Synchro Reports



# HCM Signalized Intersection Capacity Analysis

## 3: Pine Street & Northern Avenue East

2026 Road Diet  
Timing Plan: AM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	25	8	150	7	6	6	220	434	13	8	305	50
Future Volume (vph)	25	8	150	7	6	6	220	434	13	8	305	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frbp, ped/bikes	1.00	0.96		1.00	0.98		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.98	1.00		0.98	1.00		0.99	1.00		1.00	1.00	
Frt	1.00	0.86		1.00	0.93		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1512	1478		1697	1569		1647	1750		1720	1746	
Flt Permitted	0.75	1.00		0.62	1.00		0.46	1.00		0.38	1.00	
Satd. Flow (perm)	1191	1478		1114	1569		800	1750		689	1746	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	9	163	8	7	7	239	472	14	9	332	54
RTOR Reduction (vph)	0	105	0	0	5	0	0	1	0	0	5	0
Lane Group Flow (vph)	27	67	0	8	9	0	239	485	0	9	381	0
Confl. Peds. (#/hr)	6		7	7		6	5		3	3		5
Heavy Vehicles (%)	12%	6%	1%	0%	5%	5%	4%	3%	11%	0%	1%	3%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	39.0	39.0		39.0	39.0		59.0	59.0		59.0	59.0	
Effective Green, g (s)	39.0	39.0		39.0	39.0		59.0	59.0		59.0	59.0	
Actuated g/C Ratio	0.35	0.35		0.35	0.35		0.54	0.54		0.54	0.54	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	422	524		394	556		429	938		369	936	
v/s Ratio Prot		c0.05			0.01			0.28			0.22	
v/s Ratio Perm	0.02			0.01			c0.30			0.01		
v/c Ratio	0.06	0.13		0.02	0.02		0.56	0.52		0.02	0.41	
Uniform Delay, d1	23.4	24.0		23.1	23.1		16.9	16.4		12.0	15.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	0.5		0.1	0.1		5.1	2.0		0.1	1.3	
Delay (s)	23.7	24.5		23.2	23.1		22.0	18.4		12.1	16.4	
Level of Service	C	C		C	C		C	B		B	B	
Approach Delay (s)		24.4			23.1			19.6			16.3	
Approach LOS		C			C			B			B	

### Intersection Summary

HCM 2000 Control Delay	19.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	70.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 6: Willow Avenue & Northern Avenue East

2026 Road Diet  
Timing Plan: AM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	313	253	39	270	0	138	0	48	0	0	0
Future Volume (vph)	0	313	253	39	270	0	138	0	48	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.0		7.0	7.0		6.0		6.0			
Lane Util. Factor		1.00		1.00	1.00		1.00		1.00			
Frbp, ped/bikes		0.98		1.00	1.00		1.00		0.91			
Flpb, ped/bikes		1.00		0.99	1.00		0.99		1.00			
Frt		0.93		1.00	1.00		1.00		0.85			
Flt Protected		1.00		0.95	1.00		0.95		1.00			
Satd. Flow (prot)		1650		1648	1729		1609		1346			
Flt Permitted		1.00		0.28	1.00		0.76		1.00			
Satd. Flow (perm)		1650		481	1729		1282		1346			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	340	275	42	293	0	150	0	52	0	0	0
RTOR Reduction (vph)	0	24	0	0	0	0	0	0	33	0	0	0
Lane Group Flow (vph)	0	591	0	42	293	0	150	0	19	0	0	0
Confl. Peds. (#/hr)			11	11			4		26	26		4
Heavy Vehicles (%)	0%	1%	0%	4%	5%	0%	6%	0%	4%	0%	0%	0%
Turn Type	Perm	NA		Perm	NA		Perm		Perm			
Protected Phases		4			8						6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		63.0		63.0	63.0		44.0		44.0			
Effective Green, g (s)		63.0		63.0	63.0		44.0		44.0			
Actuated g/C Ratio		0.52		0.52	0.52		0.37		0.37			
Clearance Time (s)		7.0		7.0	7.0		6.0		6.0			
Vehicle Extension (s)		4.0		4.0	4.0		4.0		4.0			
Lane Grp Cap (vph)		866		252	907		470		493			
v/s Ratio Prot		c0.36			0.17							
v/s Ratio Perm				0.09			c0.12		0.01			
v/c Ratio		0.68		0.17	0.32		0.32		0.04			
Uniform Delay, d1		21.1		14.8	16.3		27.3		24.4			
Progression Factor		1.00		1.00	1.00		1.00		1.00			
Incremental Delay, d2		4.3		1.4	0.9		1.8		0.1			
Delay (s)		25.4		16.3	17.2		29.0		24.6			
Level of Service		C		B	B		C		C			
Approach Delay (s)		25.4			17.1			27.9			0.0	
Approach LOS		C			B			C			A	

### Intersection Summary

HCM 2000 Control Delay	23.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	60.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 9: Great Northern Road & Northern Avenue East

2026 Road Diet  
 Timing Plan: AM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	157	187	172	24	157	149	146	460	7	193	712	89
Future Volume (vph)	157	187	172	24	157	149	146	460	7	193	712	89
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		6.0	6.0	6.0	4.0	7.0		4.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frbp, ped/bikes	1.00	0.99		1.00	1.00	0.96	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00		0.99	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.93		1.00	1.00	0.85	1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1659	1652		1716	1798	1444	1723	3341		1706	3309	
Flt Permitted	0.54	1.00		0.53	1.00	1.00	0.19	1.00		0.36	1.00	
Satd. Flow (perm)	945	1652		960	1798	1444	339	3341		642	3309	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	171	203	187	26	171	162	159	500	8	210	774	97
RTOR Reduction (vph)	0	37	0	0	0	117	0	1	0	0	11	0
Lane Group Flow (vph)	171	353	0	26	171	45	159	507	0	210	860	0
Confl. Peds. (#/hr)	23		8	8		23	11		4	4		11
Heavy Vehicles (%)	3%	1%	1%	0%	1%	3%	0%	3%	0%	1%	2%	2%
Turn Type	pm+pt	NA		Perm	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)	36.0	36.0		25.0	25.0	25.0	34.4	26.4		39.6	29.0	
Effective Green, g (s)	36.0	36.0		25.0	25.0	25.0	34.4	26.4		39.6	29.0	
Actuated g/C Ratio	0.40	0.40		0.28	0.28	0.28	0.38	0.29		0.44	0.32	
Clearance Time (s)	4.0	6.0		6.0	6.0	6.0	4.0	7.0		4.0	7.0	
Vehicle Extension (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	433	660		266	499	401	252	980		407	1066	
v/s Ratio Prot	0.03	c0.21			0.10		c0.06	0.15		c0.06	c0.26	
v/s Ratio Perm	0.13			0.03		0.03	0.18			0.17		
v/c Ratio	0.39	0.54		0.10	0.34	0.11	0.63	0.52		0.52	0.81	
Uniform Delay, d1	18.2	20.6		24.1	25.9	24.2	19.9	26.5		16.4	27.9	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.8	3.1		0.7	1.9	0.6	5.7	1.9		1.5	6.6	
Delay (s)	19.0	23.7		24.9	27.8	24.8	25.6	28.4		17.9	34.5	
Level of Service	B	C		C	C	C	C	C		B	C	
Approach Delay (s)		22.3			26.2			27.8			31.3	
Approach LOS		C			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	27.8	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.70	
Actuated Cycle Length (s)	90.0	Sum of lost time (s) 21.0
Intersection Capacity Utilization	79.9%	ICU Level of Service D
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 12: North Street & Northern Avenue West/Northern Avenue East

2026 Road Diet  
 Timing Plan: AM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	24	292	30	71	109	121	16	174	76	144	215	31
Future Volume (vph)	24	292	30	71	109	121	16	174	76	144	215	31
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0			7.0		7.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			0.95		1.00	1.00	
Frbp, ped/bikes	1.00	1.00		1.00	0.99			0.98		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00		0.97	1.00	
Frt	1.00	0.99		1.00	0.92			0.96		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00			1.00		0.95	1.00	
Satd. Flow (prot)	1720	1746		1640	1641			2977		1570	1644	
Flt Permitted	0.57	1.00		0.46	1.00			0.93		0.57	1.00	
Satd. Flow (perm)	1031	1746		798	1641			2771		950	1644	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	26	317	33	77	118	132	17	189	83	157	234	34
RTOR Reduction (vph)	0	4	0	0	45	0	0	48	0	0	6	0
Lane Group Flow (vph)	26	346	0	77	205	0	0	241	0	157	262	0
Confl. Peds. (#/hr)	3		2	2		3	11		18	18		11
Heavy Vehicles (%)	0%	2%	6%	5%	0%	2%	0%	11%	5%	7%	8%	6%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	39.0	39.0		39.0	39.0			38.0		38.0	38.0	
Effective Green, g (s)	39.0	39.0		39.0	39.0			38.0		38.0	38.0	
Actuated g/C Ratio	0.43	0.43		0.43	0.43			0.42		0.42	0.42	
Clearance Time (s)	6.0	6.0		6.0	6.0			7.0		7.0	7.0	
Vehicle Extension (s)	4.0	4.0		4.0	4.0			4.0		4.0	4.0	
Lane Grp Cap (vph)	446	756		345	711			1169		401	694	
v/s Ratio Prot		c0.20			0.13						0.16	
v/s Ratio Perm	0.03			0.10				0.09		c0.17		
v/c Ratio	0.06	0.46		0.22	0.29			0.21		0.39	0.38	
Uniform Delay, d1	14.8	18.0		16.0	16.5			16.5		18.0	17.9	
Progression Factor	1.00	1.00		1.00	1.00			1.00		1.00	1.00	
Incremental Delay, d2	0.2	2.0		1.5	1.0			0.4		2.9	1.6	
Delay (s)	15.1	20.0		17.5	17.5			16.9		20.9	19.4	
Level of Service	B	C		B	B			B		C	B	
Approach Delay (s)		19.7			17.5			16.9			20.0	
Approach LOS		B			B			B			B	

Intersection Summary

HCM 2000 Control Delay	18.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	86.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group



# HCM Signalized Intersection Capacity Analysis

## 15: Grand Boulevard/Sackville Road & Northern Avenue East

2026 Road Diet  
Timing Plan: AM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	37	298	20	22	195	95	16	86	34	116	60	33
Future Volume (vph)	37	298	20	22	195	95	16	86	34	116	60	33
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0		7.0	7.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.95		1.00	0.96		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1725	1782		1725	1698		1675	1738		1691	1718	
Flt Permitted	0.52	1.00		0.48	1.00		0.69	1.00		0.67	1.00	
Satd. Flow (perm)	940	1782		877	1698		1219	1738		1199	1718	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	40	324	22	24	212	103	17	93	37	126	65	36
RTOR Reduction (vph)	0	3	0	0	22	0	0	18	0	0	21	0
Lane Group Flow (vph)	40	343	0	24	293	0	17	112	0	126	80	0
Heavy Vehicles (%)	0%	1%	0%	0%	1%	3%	3%	0%	0%	2%	0%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	33.0	33.0		33.0	33.0		34.0	34.0		34.0	34.0	
Effective Green, g (s)	33.0	33.0		33.0	33.0		34.0	34.0		34.0	34.0	
Actuated g/C Ratio	0.41	0.41		0.41	0.41		0.42	0.42		0.42	0.42	
Clearance Time (s)	7.0	7.0		7.0	7.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	387	735		361	700		518	738		509	730	
v/s Ratio Prot		c0.19			0.17			0.06			0.05	
v/s Ratio Perm	0.04			0.03			0.01			c0.11		
v/c Ratio	0.10	0.47		0.07	0.42		0.03	0.15		0.25	0.11	
Uniform Delay, d1	14.4	17.1		14.2	16.7		13.4	14.1		14.8	13.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.5	2.1		0.4	1.8		0.1	0.4		1.2	0.3	
Delay (s)	15.0	19.2		14.6	18.5		13.5	14.6		15.9	14.2	
Level of Service	B	B		B	B		B	B		B	B	
Approach Delay (s)		18.8			18.2			14.5			15.2	
Approach LOS		B			B			B			B	

### Intersection Summary

HCM 2000 Control Delay	17.3	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)	13.0
Intersection Capacity Utilization	54.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis  
 19: Reid Street/Student Entrance & Northern Avenue East

2026 Road Diet  
 Timing Plan: AM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	61	387	0	1	251	39	0	7	3	39	7	61
Future Volume (Veh/h)	61	387	0	1	251	39	0	7	3	39	7	61
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	66	421	0	1	273	42	0	8	3	42	8	66
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		TWLTL			TWLTL							
Median storage veh		2			2							
Upstream signal (m)		205										
pX, platoon unblocked				0.91			0.91	0.91	0.91	0.91	0.91	
vC, conflicting volume	315			421			898	870	421	856	849	294
vC1, stage 1 conf vol							553	553		296	296	
vC2, stage 2 conf vol							345	317		560	553	
vCu, unblocked vol	315			310			836	805	310	790	782	294
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	95			100			100	98	100	91	98	91
cM capacity (veh/h)	1245			1134			410	430	662	443	444	745

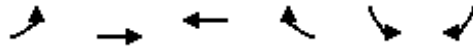
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	66	421	1	315	11	116
Volume Left	66	0	1	0	0	42
Volume Right	0	0	0	42	3	66
cSH	1245	1700	1134	1700	476	576
Volume to Capacity	0.05	0.25	0.00	0.19	0.02	0.20
Queue Length 95th (m)	1.3	0.0	0.0	0.0	0.6	6.0
Control Delay (s)	8.1	0.0	8.2	0.0	12.7	12.8
Lane LOS	A		A		B	B
Approach Delay (s)	1.1		0.0		12.7	12.8
Approach LOS					B	B

Intersection Summary

Average Delay		2.3				
Intersection Capacity Utilization		46.6%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis  
 21: Northern Avenue East & Daycare Entrance

2026 Road Diet  
 Timing Plan: AM Peak



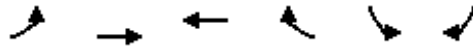
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	13	416	278	7	7	13
Future Volume (Veh/h)	13	416	278	7	7	13
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	14	452	302	8	8	14
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL		TWLTL			
Median storage veh	2		2			
Upstream signal (m)	272					
pX, platoon unblocked					0.94	
vC, conflicting volume	310			786		306
vC1, stage 1 conf vol					306	
vC2, stage 2 conf vol					480	
vCu, unblocked vol	310			738		306
tC, single (s)	4.1			6.4		6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2			3.5		3.3
p0 queue free %	99			99		98
cM capacity (veh/h)	1250			550		734

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	14	452	310	22
Volume Left	14	0	0	8
Volume Right	0	0	8	14
cSH	1250	1700	1700	654
Volume to Capacity	0.01	0.27	0.18	0.03
Queue Length 95th (m)	0.3	0.0	0.0	0.8
Control Delay (s)	7.9	0.0	0.0	10.7
Lane LOS	A		B	
Approach Delay (s)	0.2	0.0		10.7
Approach LOS			B	

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	31.9%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis  
 23: Northern Avenue East & Employee Entrance West

2026 Road Diet  
 Timing Plan: AM Peak



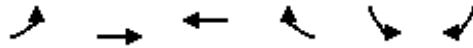
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	8	415	285	5	0	0
Future Volume (Veh/h)	8	415	285	5	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	451	310	5	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage (veh)		2	2			
Upstream signal (m)		382	378			
pX, platoon unblocked					0.99	
vC, conflicting volume	315				782	312
vC1, stage 1 conf vol					312	
vC2, stage 2 conf vol					469	
vCu, unblocked vol	315				775	312
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	99				100	100
cM capacity (veh/h)	1245				553	728

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	9	451	315	0
Volume Left	9	0	0	0
Volume Right	0	0	5	0
cSH	1245	1700	1700	1700
Volume to Capacity	0.01	0.27	0.19	0.00
Queue Length 95th (m)	0.2	0.0	0.0	0.0
Control Delay (s)	7.9	0.0	0.0	0.0
Lane LOS	A			A
Approach Delay (s)	0.2		0.0	0.0
Approach LOS				A

Intersection Summary			
Average Delay		0.1	
Intersection Capacity Utilization		25.2%	ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis  
 25: Northern Avenue East & Employee Entrance East

2026 Road Diet  
 Timing Plan: AM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	8	407	290	5	0	0
Future Volume (Veh/h)	8	407	290	5	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	442	315	5	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type						
		TWLTL	TWLTL			
Median storage (veh)		2	2			
Upstream signal (m)			299			
pX, platoon unblocked						
vC, conflicting volume	320				778	318
vC1, stage 1 conf vol					318	
vC2, stage 2 conf vol					460	
vCu, unblocked vol	320				778	318
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	99				100	100
cM capacity (veh/h)	1240				556	723

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	9	442	320	0
Volume Left	9	0	0	0
Volume Right	0	0	5	0
cSH	1240	1700	1700	1700
Volume to Capacity	0.01	0.26	0.19	0.00
Queue Length 95th (m)	0.2	0.0	0.0	0.0
Control Delay (s)	7.9	0.0	0.0	0.0
Lane LOS	A			A
Approach Delay (s)	0.2		0.0	0.0
Approach LOS				A

Intersection Summary			
Average Delay		0.1	
Intersection Capacity Utilization		24.8%	ICU Level of Service A
Analysis Period (min)		15	

**Intersection: 3: Pine Street & Northern Avenue East**

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	24.0	33.3	9.0	10.4	92.8	109.2	10.4	83.9
Average Queue (m)	4.6	15.2	1.3	2.3	37.4	54.7	2.1	36.8
95th Queue (m)	15.9	29.0	6.3	8.9	68.1	89.8	8.3	65.5
Link Distance (m)		579.8		394.1		337.4		379.2
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)	40.0		40.0		42.0		30.0	
Storage Blk Time (%)	0	0			9	14		12
Queuing Penalty (veh)	0	0			39	30		1

**Intersection: 6: Willow Avenue & Northern Avenue East**

Movement	EB	WB	WB	NB	NB
Directions Served	TR	L	TR	L	R
Maximum Queue (m)	125.0	39.8	84.6	45.7	45.4
Average Queue (m)	71.7	12.3	35.3	20.9	8.5
95th Queue (m)	114.9	32.1	78.7	38.2	26.1
Link Distance (m)	257.1		579.8		331.1
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (m)		40.0		23.0	
Storage Blk Time (%)	19	0	7	12	0
Queuing Penalty (veh)	0	1	3	6	0

**Intersection: 9: Great Northern Road & Northern Avenue East**

Movement	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	T	R	L	T	TR	L	T	TR
Maximum Queue (m)	39.8	75.4	12.9	47.6	38.9	43.9	53.3	51.5	49.9	79.0	76.4
Average Queue (m)	23.1	31.0	3.1	19.7	15.2	17.6	31.0	24.3	20.1	46.0	44.5
95th Queue (m)	41.3	63.5	9.5	38.7	28.7	33.7	49.8	44.9	41.8	69.2	71.1
Link Distance (m)		273.3		257.1			329.5	329.5		372.7	372.7
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (m)	40.0		26.0		50.0	80.0			80.0		
Storage Blk Time (%)	1	4		6	0				0	0	
Queuing Penalty (veh)	2	7		11	0				0	1	

Intersection: 12: North Street & Northern Avenue West/Northern Avenue East

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	LT	TR	L	TR
Maximum Queue (m)	19.7	75.7	39.8	58.0	51.9	22.7	39.9	79.8
Average Queue (m)	4.9	35.8	13.7	22.7	23.1	9.8	21.7	32.4
95th Queue (m)	16.9	62.5	30.4	45.0	43.5	19.5	40.5	62.6
Link Distance (m)		294.0		523.7	346.2	346.2		73.3
Upstream Blk Time (%)								0
Queuing Penalty (veh)								0
Storage Bay Dist (m)	20.0		40.0				16.0	
Storage Blk Time (%)	0	23	0	1			16	19
Queuing Penalty (veh)	0	5	0	1			39	27

Intersection: 15: Grand Boulevard/Sackville Road & Northern Avenue East

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	39.7	68.4	33.9	59.7	12.8	37.4	34.3	39.0
Average Queue (m)	9.3	31.0	5.2	27.9	2.5	11.8	14.8	11.3
95th Queue (m)	27.5	56.3	17.0	50.6	8.9	26.7	28.3	25.6
Link Distance (m)		523.7		186.5		344.3		375.1
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)	40.0		40.0		21.0		30.0	
Storage Blk Time (%)	0	4	0	3		2	1	0
Queuing Penalty (veh)	0	1	0	1		0	1	0

Intersection: 19: Reid Street/Student Entrance & Northern Avenue East

Movement	EB	EB	WB	NB	SB
Directions Served	L	TR	TR	LTR	LTR
Maximum Queue (m)	13.9	3.0	1.3	9.2	22.0
Average Queue (m)	3.7	0.1	0.0	2.4	11.4
95th Queue (m)	11.5	2.1	0.9	9.0	18.3
Link Distance (m)		186.5	53.4	97.3	139.2
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (m)	15.0				
Storage Blk Time (%)	0	0			
Queuing Penalty (veh)	0	0			

Intersection: 21: Northern Avenue East & Daycare Entrance

Movement	EB	SB
Directions Served	L	LR
Maximum Queue (m)	9.2	13.2
Average Queue (m)	0.7	4.6
95th Queue (m)	4.5	12.2
Link Distance (m)		59.2
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)	15.0	
Storage Blk Time (%)	0	
Queuing Penalty (veh)	0	

Intersection: 23: Northern Avenue East & Employee Entrance West

Movement	EB
Directions Served	L
Maximum Queue (m)	9.0
Average Queue (m)	0.7
95th Queue (m)	4.7
Link Distance (m)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (m)	15.0
Storage Blk Time (%)	0
Queuing Penalty (veh)	0

Intersection: 25: Northern Avenue East & Employee Entrance East

Movement	EB
Directions Served	L
Maximum Queue (m)	7.2
Average Queue (m)	0.4
95th Queue (m)	3.5
Link Distance (m)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (m)	15.0
Storage Blk Time (%)	0
Queuing Penalty (veh)	0

Network Summary

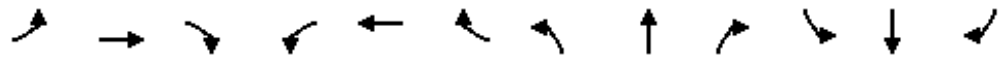
Network wide Queuing Penalty: 178
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# HCM Signalized Intersection Capacity Analysis

## 3: Pine Street & Northern Avenue East

2026 Road Diet  
Timing Plan: PM peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	37	19	338	25	24	25	169	334	20	20	402	35
Future Volume (vph)	37	19	338	25	24	25	169	334	20	20	402	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frbp, ped/bikes	1.00	0.96		1.00	0.98		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.98	1.00		0.99	1.00		0.99	1.00		1.00	1.00	
Frt	1.00	0.86		1.00	0.92		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1514	1479		1711	1566		1650	1737		1718	1768	
Flt Permitted	0.72	1.00		0.35	1.00		0.39	1.00		0.46	1.00	
Satd. Flow (perm)	1151	1479		627	1566		676	1737		836	1768	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	40	21	367	27	26	27	184	363	22	22	437	38
RTOR Reduction (vph)	0	237	0	0	17	0	0	2	0	0	3	0
Lane Group Flow (vph)	40	151	0	27	36	0	184	383	0	22	472	0
Confl. Peds. (#/hr)	6		7	7		6	5		3	3		5
Heavy Vehicles (%)	12%	6%	1%	0%	5%	5%	4%	3%	11%	0%	1%	3%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	39.0	39.0		39.0	39.0		59.0	59.0		59.0	59.0	
Effective Green, g (s)	39.0	39.0		39.0	39.0		59.0	59.0		59.0	59.0	
Actuated g/C Ratio	0.35	0.35		0.35	0.35		0.54	0.54		0.54	0.54	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	408	524		222	555		362	931		448	948	
v/s Ratio Prot		c0.10			0.02			0.22			0.27	
v/s Ratio Perm	0.03			0.04			c0.27			0.03		
v/c Ratio	0.10	0.29		0.12	0.06		0.51	0.41		0.05	0.50	
Uniform Delay, d1	23.7	25.5		23.9	23.4		16.3	15.2		12.1	16.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.5	1.4		1.1	0.2		5.0	1.3		0.2	1.9	
Delay (s)	24.2	26.9		25.1	23.7		21.3	16.5		12.3	18.0	
Level of Service	C	C		C	C		C	B		B	B	
Approach Delay (s)		26.7			24.1			18.1			17.8	
Approach LOS		C			C			B			B	

### Intersection Summary

HCM 2000 Control Delay	20.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	77.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 6: Willow Avenue & Northern Avenue East

2026 Road Diet  
Timing Plan: PM peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	392	172	51	358	0	351	0	59	0	0	1
Future Volume (vph)	0	392	172	51	358	0	351	0	59	0	0	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.0		7.0	7.0		6.0		6.0		6.0	
Lane Util. Factor		1.00		1.00	1.00		1.00		1.00		1.00	
Frbp, ped/bikes		0.99		1.00	1.00		1.00		0.91		0.97	
Flpb, ped/bikes		1.00		0.99	1.00		0.99		1.00		1.00	
Frt		0.95		1.00	1.00		1.00		0.85		0.86	
Flt Protected		1.00		0.95	1.00		0.95		1.00		1.00	
Satd. Flow (prot)		1696		1648	1729		1609		1346		1521	
Flt Permitted		1.00		0.28	1.00		0.76		1.00		1.00	
Satd. Flow (perm)		1696		483	1729		1282		1346		1521	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	426	187	55	389	0	382	0	64	0	0	1
RTOR Reduction (vph)	0	13	0	0	0	0	0	0	41	0	1	0
Lane Group Flow (vph)	0	600	0	55	389	0	382	0	23	0	0	0
Confl. Peds. (#/hr)			11	11			4		26	26		4
Heavy Vehicles (%)	0%	1%	0%	4%	5%	0%	6%	0%	4%	0%	0%	0%
Turn Type	Perm	NA		Perm	NA		Perm		Perm		NA	
Protected Phases		4			8						6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		63.0		63.0	63.0		44.0		44.0		44.0	
Effective Green, g (s)		63.0		63.0	63.0		44.0		44.0		44.0	
Actuated g/C Ratio		0.52		0.52	0.52		0.37		0.37		0.37	
Clearance Time (s)		7.0		7.0	7.0		6.0		6.0		6.0	
Vehicle Extension (s)		4.0		4.0	4.0		4.0		4.0		4.0	
Lane Grp Cap (vph)		890		253	907		470		493		557	
v/s Ratio Prot		c0.35			0.22						0.00	
v/s Ratio Perm				0.11			c0.30		0.02			
v/c Ratio		0.67		0.22	0.43		0.81		0.05		0.00	
Uniform Delay, d1		20.9		15.3	17.5		34.3		24.5		24.1	
Progression Factor		1.00		1.00	1.00		1.00		1.00		1.00	
Incremental Delay, d2		4.1		2.0	1.5		14.2		0.2		0.0	
Delay (s)		25.0		17.2	19.0		48.5		24.7		24.1	
Level of Service		C		B	B		D		C		C	
Approach Delay (s)		25.0			18.7			45.1			24.1	
Approach LOS		C			B			D			C	

### Intersection Summary

HCM 2000 Control Delay	29.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	82.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 9: Great Northern Road & Northern Avenue East

2026 Road Diet  
 Timing Plan: PM peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	200	297	209	40	234	169	233	735	7	222	810	188
Future Volume (vph)	200	297	209	40	234	169	233	735	7	222	810	188
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		6.0	6.0	6.0	4.0	7.0		4.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frbp, ped/bikes	1.00	0.99		1.00	1.00	0.96	1.00	1.00		1.00	0.99	
Flpb, ped/bikes	0.99	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.94		1.00	1.00	0.85	1.00	1.00		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1665	1672		1719	1798	1444	1724	3344		1707	3260	
Flt Permitted	0.42	1.00		0.33	1.00	1.00	0.15	1.00		0.16	1.00	
Satd. Flow (perm)	739	1672		605	1798	1444	278	3344		287	3260	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	217	323	227	43	254	184	253	799	8	241	880	204
RTOR Reduction (vph)	0	28	0	0	0	133	0	1	0	0	22	0
Lane Group Flow (vph)	217	522	0	43	254	51	253	806	0	241	1062	0
Confl. Peds. (#/hr)	23		8	8		23	11		4	4		11
Heavy Vehicles (%)	3%	1%	1%	0%	1%	3%	0%	3%	0%	1%	2%	2%
Turn Type	pm+pt	NA		Perm	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)	36.0	36.0		25.0	25.0	25.0	34.1	26.1		39.9	29.0	
Effective Green, g (s)	36.0	36.0		25.0	25.0	25.0	34.1	26.1		39.9	29.0	
Actuated g/C Ratio	0.40	0.40		0.28	0.28	0.28	0.38	0.29		0.44	0.32	
Clearance Time (s)	4.0	6.0		6.0	6.0	6.0	4.0	7.0		4.0	7.0	
Vehicle Extension (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	367	668		168	499	401	233	969		299	1050	
v/s Ratio Prot	0.05	c0.31			0.14		c0.10	0.24		c0.10	c0.33	
v/s Ratio Perm	0.19			0.07		0.04	0.31			0.26		
v/c Ratio	0.59	0.78		0.26	0.51	0.13	1.09	0.83		0.81	1.01	
Uniform Delay, d1	20.1	23.6		25.3	27.3	24.3	23.9	29.9		18.4	30.5	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.0	8.8		3.6	3.7	0.7	83.7	8.3		15.3	30.5	
Delay (s)	23.0	32.4		28.9	31.0	25.0	107.6	38.2		33.8	61.0	
Level of Service	C	C		C	C	C	F	D		C	E	
Approach Delay (s)		29.7			28.5			54.8			56.1	
Approach LOS		C			C			D			E	

Intersection Summary			
HCM 2000 Control Delay	46.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	98.6%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 12: North Street & Northern Avenue West/Northern Avenue East

2026 Road Diet  
 Timing Plan: PM peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗			↕		↖	↗	
Traffic Volume (vph)	5	228	19	89	312	158	27	181	99	113	131	20
Future Volume (vph)	5	228	19	89	312	158	27	181	99	113	131	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0			7.0		7.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			0.95		1.00	1.00	
Frbp, ped/bikes	1.00	1.00		1.00	0.99			0.98		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00		0.97	1.00	
Frt	1.00	0.99		1.00	0.95			0.95		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00			1.00		0.95	1.00	
Satd. Flow (prot)	1723	1752		1640	1703			2957		1569	1641	
Flt Permitted	0.30	1.00		0.54	1.00			0.92		0.55	1.00	
Satd. Flow (perm)	545	1752		935	1703			2725		909	1641	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	248	21	97	339	172	29	197	108	123	142	22
RTOR Reduction (vph)	0	3	0	0	18	0	0	57	0	0	6	0
Lane Group Flow (vph)	5	266	0	97	493	0	0	277	0	123	158	0
Confl. Peds. (#/hr)	3		2	2		3	11		18	18		11
Heavy Vehicles (%)	0%	2%	6%	5%	0%	2%	0%	11%	5%	7%	8%	6%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	44.0	44.0		44.0	44.0			43.0		43.0	43.0	
Effective Green, g (s)	44.0	44.0		44.0	44.0			43.0		43.0	43.0	
Actuated g/C Ratio	0.44	0.44		0.44	0.44			0.43		0.43	0.43	
Clearance Time (s)	6.0	6.0		6.0	6.0			7.0		7.0	7.0	
Vehicle Extension (s)	4.0	4.0		4.0	4.0			4.0		4.0	4.0	
Lane Grp Cap (vph)	239	770		411	749			1171		390	705	
v/s Ratio Prot		0.15			c0.29						0.10	
v/s Ratio Perm	0.01			0.10				0.10		c0.14		
v/c Ratio	0.02	0.35		0.24	0.66			0.24		0.32	0.22	
Uniform Delay, d1	15.8	18.5		17.5	22.1			18.1		18.8	18.0	
Progression Factor	1.00	1.00		0.47	0.35			1.00		1.00	1.00	
Incremental Delay, d2	0.2	1.2		0.8	2.7			0.5		2.1	0.7	
Delay (s)	16.0	19.7		9.0	10.5			18.6		20.9	18.7	
Level of Service	B	B		A	B			B		C	B	
Approach Delay (s)		19.7			10.3			18.6			19.7	
Approach LOS		B			B			B			B	

Intersection Summary

HCM 2000 Control Delay	15.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	95.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 15: Grand Boulevard/Sackville Road & Northern Avenue East

2026 Road Diet  
 Timing Plan: PM peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	37	435	30	31	463	174	33	86	27	189	129	37
Future Volume (vph)	37	435	30	31	463	174	33	86	27	189	129	37
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0		7.0	7.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.96		1.00	0.96		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1725	1781		1725	1715		1675	1751		1691	1755	
Flt Permitted	0.13	1.00		0.31	1.00		0.64	1.00		0.68	1.00	
Satd. Flow (perm)	244	1781		559	1715		1129	1751		1208	1755	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	40	473	33	34	503	189	36	93	29	205	140	40
RTOR Reduction (vph)	0	2	0	0	14	0	0	11	0	0	10	0
Lane Group Flow (vph)	40	504	0	34	678	0	36	111	0	205	170	0
Heavy Vehicles (%)	0%	1%	0%	0%	1%	3%	3%	0%	0%	2%	0%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	43.0	43.0		43.0	43.0		44.0	44.0		44.0	44.0	
Effective Green, g (s)	43.0	43.0		43.0	43.0		44.0	44.0		44.0	44.0	
Actuated g/C Ratio	0.43	0.43		0.43	0.43		0.44	0.44		0.44	0.44	
Clearance Time (s)	7.0	7.0		7.0	7.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	104	765		240	737		496	770		531	772	
v/s Ratio Prot		0.28			c0.40			0.06			0.10	
v/s Ratio Perm	0.16			0.06			0.03			c0.17		
v/c Ratio	0.38	0.66		0.14	0.92		0.07	0.14		0.39	0.22	
Uniform Delay, d1	19.5	22.7		17.3	26.9		16.2	16.7		18.9	17.4	
Progression Factor	0.83	0.83		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	10.2	4.3		1.2	18.6		0.3	0.4		2.1	0.7	
Delay (s)	26.2	23.1		18.5	45.5		16.5	17.1		21.0	18.0	
Level of Service	C	C		B	D		B	B		C	B	
Approach Delay (s)		23.3			44.2			17.0			19.6	
Approach LOS		C			D			B			B	

Intersection Summary

HCM 2000 Control Delay	30.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	73.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis  
 19: Reid St/Student Entrance & Northern Avenue East

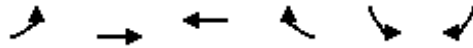
2026 Road Diet  
 Timing Plan: PM peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	61	590	0	3	607	39	0	1	1	39	7	61
Future Volume (Veh/h)	61	590	0	3	607	39	0	1	1	39	7	61
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	66	641	0	3	660	42	0	1	1	42	8	66
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
	TWLTL			TWLTL								
Median storage veh	2			2								
Upstream signal (m)	202											
pX, platoon unblocked				0.75			0.75			0.75		
vC, conflicting volume	702			641			1509			1481		
vC1, stage 1 conf vol							773			773		
vC2, stage 2 conf vol							736			708		
vCu, unblocked vol	702			362			1512			1475		
tC, single (s)	4.1			4.1			7.1			6.5		
tC, 2 stage (s)							6.1			5.5		
tF (s)	2.2			2.2			3.5			4.0		
p0 queue free %	93			100			100			100		
cM capacity (veh/h)	895			903			222			268		
Direction, Lane #												
	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	66	641	3	702	2	116						
Volume Left	66	0	3	0	0	42						
Volume Right	0	0	0	42	1	66						
cSH	895	1700	903	1700	353	359						
Volume to Capacity	0.07	0.38	0.00	0.41	0.01	0.32						
Queue Length 95th (m)	1.9	0.0	0.1	0.0	0.1	11.0						
Control Delay (s)	9.3	0.0	9.0	0.0	15.3	19.8						
Lane LOS	A		A		C	C						
Approach Delay (s)	0.9		0.0		15.3	19.8						
Approach LOS					C	C						
Intersection Summary												
Average Delay			1.9									
Intersection Capacity Utilization			60.6%		ICU Level of Service		B					
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis  
 21: Northern Avenue East & Daycare Entrance

2026 Road Diet  
 Timing Plan: PM peak



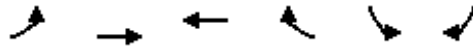
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	13	617	636	7	7	13
Future Volume (Veh/h)	13	617	636	7	7	13
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	14	671	691	8	8	14
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type						
		TWLTL	TWLTL			
Median storage veh		2	2			
Upstream signal (m)		276				
pX, platoon unblocked					0.79	
vC, conflicting volume	699				1394	695
vC1, stage 1 conf vol					695	
vC2, stage 2 conf vol					699	
vCu, unblocked vol	699				1366	695
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	98				98	97
cM capacity (veh/h)	898				359	442

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	14	671	699	22
Volume Left	14	0	0	8
Volume Right	0	0	8	14
cSH	898	1700	1700	408
Volume to Capacity	0.02	0.39	0.41	0.05
Queue Length 95th (m)	0.4	0.0	0.0	1.4
Control Delay (s)	9.1	0.0	0.0	14.3
Lane LOS	A			B
Approach Delay (s)	0.2		0.0	14.3
Approach LOS				B

Intersection Summary			
Average Delay		0.3	
Intersection Capacity Utilization		43.9%	ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis  
 23: Northern Avenue East & Employee Entrance West

2026 Road Diet  
 Timing Plan: PM peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	624	635	0	5	8
Future Volume (Veh/h)	0	624	635	0	5	8
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	678	690	0	5	9
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type						
		TWLTL	TWLTL			
Median storage (veh)		2	2			
Upstream signal (m)		387	372			
pX, platoon unblocked	0.87				0.89	0.87
vC, conflicting volume	690				1368	690
vC1, stage 1 conf vol					690	
vC2, stage 2 conf vol					678	
vCu, unblocked vol	571				1029	571
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	98
cM capacity (veh/h)	873				398	454

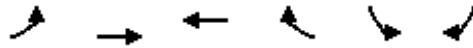
Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	0	678	690	14
Volume Left	0	0	0	5
Volume Right	0	0	0	9
cSH	1700	1700	1700	432
Volume to Capacity	0.00	0.40	0.41	0.03
Queue Length 95th (m)	0.0	0.0	0.0	0.8
Control Delay (s)	0.0	0.0	0.0	13.6
Lane LOS				B
Approach Delay (s)	0.0		0.0	13.6
Approach LOS				B

Intersection Summary			
Average Delay		0.1	
Intersection Capacity Utilization		43.4%	ICU Level of Service A
Analysis Period (min)		15	



HCM Unsignalized Intersection Capacity Analysis  
 25: Northern Avenue East & Employee Entrance East

2026 Road Diet  
 Timing Plan: PM peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	629	627	0	5	8
Future Volume (Veh/h)	0	629	627	0	5	8
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	684	682	0	5	9
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type						
		TWLTL	TWLTL			
Median storage (veh)		2	2			
Upstream signal (m)			297			
pX, platoon unblocked	0.83				0.83	0.83
vC, conflicting volume	682				1366	682
vC1, stage 1 conf vol					682	
vC2, stage 2 conf vol					684	
vCu, unblocked vol	518				1339	518
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	98
cM capacity (veh/h)	873				371	464

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	0	684	682	14
Volume Left	0	0	0	5
Volume Right	0	0	0	9
cSH	1700	1700	1700	426
Volume to Capacity	0.00	0.40	0.40	0.03
Queue Length 95th (m)	0.0	0.0	0.0	0.8
Control Delay (s)	0.0	0.0	0.0	13.7
Lane LOS				B
Approach Delay (s)	0.0		0.0	13.7
Approach LOS				B

Intersection Summary			
Average Delay		0.1	
Intersection Capacity Utilization		43.1%	ICU Level of Service A
Analysis Period (min)		15	

**Intersection: 3: Pine Street & Northern Avenue East**

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	39.8	93.0	26.0	23.0	60.2	76.6	14.1	84.5
Average Queue (m)	11.7	37.4	6.2	7.3	28.6	36.9	3.8	43.6
95th Queue (m)	34.4	72.7	17.6	19.1	50.6	64.3	12.0	71.7
Link Distance (m)		579.8		394.1		337.4		379.2
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)	40.0		40.0		42.0		30.0	
Storage Blk Time (%)	0	10			4	5	0	16
Queuing Penalty (veh)	0	4			16	9	0	3

**Intersection: 6: Willow Avenue & Northern Avenue East**

Movement	EB	WB	WB	NB	NB	SB
Directions Served	TR	L	TR	L	R	LTR
Maximum Queue (m)	116.2	39.7	104.6	53.8	120.5	3.4
Average Queue (m)	65.3	13.6	45.9	48.6	49.3	0.2
95th Queue (m)	108.1	32.9	85.8	59.9	114.2	2.2
Link Distance (m)	257.1		579.8		331.1	331.7
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (m)		40.0		23.0		
Storage Blk Time (%)	21	0	12	39	0	
Queuing Penalty (veh)	0	0	6	23	1	

**Intersection: 9: Great Northern Road & Northern Avenue East**

Movement	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	T	R	L	T	TR	L	T	TR
Maximum Queue (m)	39.9	161.1	28.2	63.3	50.8	79.8	132.6	112.7	79.9	145.0	133.6
Average Queue (m)	32.1	76.7	6.0	31.9	17.6	53.0	63.2	54.8	38.7	73.4	74.4
95th Queue (m)	48.7	138.6	17.8	55.4	37.0	88.7	117.2	101.8	81.0	120.5	117.5
Link Distance (m)		271.0		257.1			329.4	329.4		372.7	372.7
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (m)	40.0		26.0		50.0	80.0			80.0		
Storage Blk Time (%)	4	23	0	19	0	8	5		0	7	
Queuing Penalty (veh)	19	45	0	40	0	31	11		1	14	

Intersection: 12: North Street & Northern Avenue West/Northern Avenue East

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	LT	TR	L	TR
Maximum Queue (m)	16.6	58.1	39.7	64.3	57.8	47.5	35.4	53.7
Average Queue (m)	1.5	27.5	12.1	31.2	24.8	12.8	16.8	20.9
95th Queue (m)	8.4	49.6	30.8	54.0	46.5	31.0	31.7	42.5
Link Distance (m)		294.0		523.7	346.2	346.2		73.3
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)	20.0		40.0				16.0	
Storage Blk Time (%)	0	17	0	7			12	11
Queuing Penalty (veh)	0	1	0	6			19	13

Intersection: 15: Grand Boulevard/Sackville Road & Northern Avenue East

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	39.8	111.4	39.8	161.4	16.1	28.0	48.6	43.7
Average Queue (m)	13.9	63.5	12.9	94.1	4.3	11.4	24.3	21.0
95th Queue (m)	35.7	96.4	36.3	155.3	12.9	23.6	41.8	39.4
Link Distance (m)		523.7		184.5		344.3		375.1
Upstream Blk Time (%)				0				
Queuing Penalty (veh)				0				
Storage Bay Dist (m)	40.0		40.0		21.0		30.0	
Storage Blk Time (%)	0	18	0	36	0	2	6	3
Queuing Penalty (veh)	0	7	0	11	0	1	9	6

Intersection: 19: Reid St/Student Entrance & Northern Avenue East

Movement	EB	WB	WB	NB	SB
Directions Served	L	L	TR	LTR	LTR
Maximum Queue (m)	15.9	7.2	3.5	5.0	33.6
Average Queue (m)	6.6	0.4	0.2	0.3	14.2
95th Queue (m)	14.3	3.2	2.0	2.6	25.6
Link Distance (m)			59.0	113.6	203.3
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (m)	15.0	15.0			
Storage Blk Time (%)	0				
Queuing Penalty (veh)	2				

**Intersection: 21: Northern Avenue East & Daycare Entrance**

Movement	EB	WB	SB
Directions Served	L	TR	LR
Maximum Queue (m)	9.1	1.7	13.5
Average Queue (m)	1.1	0.1	4.5
95th Queue (m)	5.8	1.2	12.1
Link Distance (m)		94.3	50.1
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)	15.0		
Storage Blk Time (%)	0		
Queuing Penalty (veh)	0		

**Intersection: 23: Northern Avenue East & Employee Entrance West**

Movement	SB
Directions Served	LR
Maximum Queue (m)	10.5
Average Queue (m)	3.6
95th Queue (m)	10.8
Link Distance (m)	46.7
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (m)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

**Intersection: 25: Northern Avenue East & Employee Entrance East**

Movement	SB
Directions Served	LR
Maximum Queue (m)	10.5
Average Queue (m)	2.7
95th Queue (m)	9.4
Link Distance (m)	142.5
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (m)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

**Network Summary**

Network wide Queuing Penalty: 298