

BOUNDARY PROPERTIES LIMITED

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City of Cornwall

TRAFFIC IMPACT STUDY

# Boundary Properties Ltd. Distribution Centre

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8841/200

October 2010

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## 1.0 INTRODUCTION

LEA Consulting Limited (LEA) was retained by Boundary Properties Ltd. to prepare a traffic impact study for the proposed distribution centre to be located in the vicinity of Boundary Road and Highway 401 in the City of Cornwall.

The subject property is located within a designated employment area known as the Cornwall Industrial Park, which is south of Highway 401 and east of Boundary Road and west of McConnell Avenue. **Figure 1.1** illustrates the site location.

The proposed development consists of a warehouse distribution centre including administration area and a reclaim centre, for a total building GFA of 732,085 sq. ft. Three future planned expansions to the warehouse distribution centre provides for an additional building GFA of 624,885 sq. ft. Traffic conditions are analyzed based on two scenarios: A) The proposed warehouse distribution centre, B) The proposed warehouse distribution centre plus the future planned expansions. The site plan is illustrated in **Figure 1.2**.

Access to the site will be provided via Tenth Street from the south side of the property. In ensuring safe and efficient operations, separate entrances are designated for truck only and employee only use, which are located off of Tenth Street. Parking will be provided as a surface lot with accommodation for 474 automobiles with an additional future 320 automobile spaces. Truck loading spaces total 273 spaces with an additional future 217 truck loading spaces. Truck staging will include 222 spaces with an additional future 159 spaces. Tractor staging will include 58 spaces with an additional future 71 spaces.

The proposed distribution centre will operate 24-hours, 7 days a week. Warehouse employees based at the location will work in 3 shifts. The day shaft will start at 6:00 a.m. and end at 2:00 p.m., the afternoon shift will begin at 2:00 p.m. and end at 10:00 p.m., and the night shift will begin at 10:00 p.m. and end at 6:00 a.m. The transport staff and trucks will be entering and exiting the site throughout the day.

As it is understood, the City of Cornwall is undertaking a Municipal Class Environmental Assessment with respect to alternatives for Industrial Park Drive and Tenth Street, including potential closure at Boundary Road. As such, this report reflects this intent in the future background and the future total traffic conditions for 2015.



Figure 1.1: Site Location



## 2.0 EXISTING TRAFFIC CONDITIONS

### 2.1 EXISTING ROAD NETWORK

**Boundary Road (County Route 44)** is a north-south 2-lane arterial road and provides direct connection to Highway 401 to the north and County Road 2 to the south. Auxiliary southbound right-turn lanes are provided on the approach to SCM Way and further south at Marleau Avenue. Auxiliary northbound left-turn lanes are provided at the signalized intersections of Marleau Avenue and SCM Way intersections and unsignalized intersection of Industrial Park Drive. A northbound no left-turn restriction has been implemented to prevent queues to be extended over the railway tracks at the intersection of Tenth Street. The posted speed limit is 70 km/h.

**Highway 401** is a major 4-lane limited access freeway under the jurisdiction of the Ontario Ministry of Transportation and is part of the Windsor-Quebec City transportation corridor. There are two interchanges situated in the study area, one at McConnell Avenue and a second at Boundary Road.

**Industrial Park Drive** is an east-west 2-lane collector road and provides the main access to the Industrial Park area. Industrial Park Drive connects to Optimum Drive at a T-intersection. This roadway is currently subject to an environmental assessment study which includes a future extension in a westerly direction to connect to Tenth Street (Virginia Drive).

**Marleau Avenue** is a major east-west 2-lane arterial road with a two-way left-turn lane in urban sections. From the east, Marleau Avenue transitions from a rural setting to light industrial to urban area. Marleau Avenue intersects with major north-south routes, extends from Boundary Road in the east and McConnell Avenue in the west and is noted to be one of the busiest routes through Cornwall. Marleau Avenue is currently subject to an ongoing environmental assessment study. The posted speed limit is 70 km/h between Boundary Road to Nick Kaneb Drive and 50 km/h from Nick Kaneb Drive to the western limit.

**McConnell Avenue** is north-south 2-lane major arterial road with a posted speed limit of 50 km/h. It provides access to Highway 401 from the north and Montreal Road from the south. McConnell connects with the western end of Tenth Street.

**Nick Kaneb Drive** is a north-south 2-lane collector road which terminates at Marleau Avenue to the north and Second Street East to the south. As part of the ongoing Marleau Avenue environmental assessment study, a northerly extension of Nick Kaneb Drive is being investigated in joining to Tenth Street (Virginia Drive).

**Optimum Drive** is a 2-lane local road and provides for north-south access between SCM Way and Industrial Park Drive. A very small number of industrial buildings front this roadway, notably the Shoppers Drug Mart Distribution Centre.

**Tenth Street (Virginia Drive)** is a 2-lane rural road and provides an east-west/north-south through route between Boundary Road and McConnell Avenue with a posted speed limit of 60km/h. Tenth Street is a desirable commuter route although it has minimum connections to existing municipal roads. In very close proximity to the intersection of Tenth Street/Boundary Road there is a railway crossing with warning signals. In reference to ongoing safety issues, there are future plans to permanently close Tenth Street at Boundary Road. Although Tenth Street will remain open from McConnell Avenue to join at a

potential new connection at Industrial Park Drive. The closure of Tenth Street is dependent on the extension of Industrial Park Drive.

**SCM Way** is a 2-lane local road providing the most direct access to the SCM Distribution Centre (Wal-Mart) and connects to Optimum Drive.

The existing lane configuration is illustrated in **Figure 2.1**.

## 2.2 EXISTING TRANSIT NETWORK

There are currently no regular transit routes serving the area. However, Cornwall Transit provides a supplementary transit service to the Eastern Industrial Plaza using Route #S2 and #S3. Once a day, Route #S2 provides morning service departing from Second and Cumberland located on Industrial Park Drive to Prince Foods. Route #S3 provides afternoon service leaving Prince Foods and SCM Way at two specified times during the weekdays.

There are opportunities for active transportation improvements, such as sidewalks and bicycle lanes, as these are not currently present within the immediate study area. According to the City of Cornwall, sidewalks and bicycle lanes are planned in specific areas as per the City's Bicycle and Pedestrian Master Plan.

## 2.3 EXISTING TRAFFIC CONDITIONS

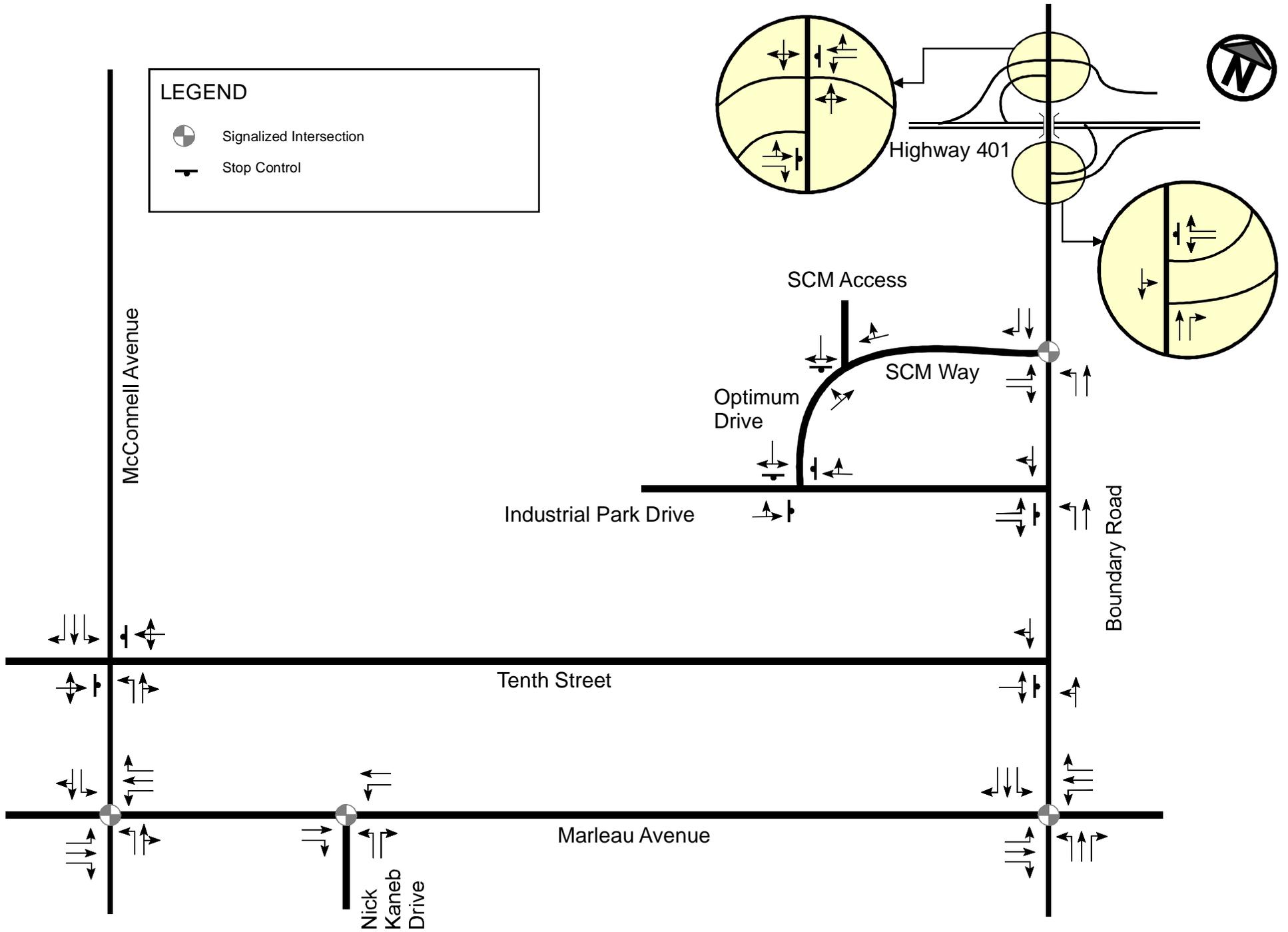
Traffic count data for subject intersections were obtained from the City of Cornwall. Based on the turning movement counts, the a.m. peak hour is 7:30 – 8:30 a.m. and the p.m. peak hour is 3:00 – 4:00 p.m. **Table 2.1** provides a summary of the sources and dates of traffic data utilized in this study.

Intersection	Date of Survey	Source
Boundary Road & Hwy 401 North Ramp	July 13, 2010	City of Cornwall
Boundary Road & Hwy 401 South Ramp	July 13, 2010	City of Cornwall
Boundary Road & SCM Way	June 10, 2010	City of Cornwall
Boundary Road & Industrial Park Drive	July 15, 2010	City of Cornwall
Boundary Road & Tenth Street	July 5, 2010	City of Cornwall
Boundary Road & Marleau Avenue	May 19, 2010	City of Cornwall
McConnell Avenue & Tenth Street	June 21, 2010	City of Cornwall
McConnell Avenue & Marleau Avenue	August 16, 2010	City of Cornwall
Nick Kaneb Drive & Marleau Avenue	May 10, 2010	City of Cornwall

**Table 2.1:** Existing Traffic Data

The approach in balancing traffic volumes was based on the intersections dominant in handling traffic volumes. Balancing of traffic was conducted from the highest peak volume for the north-south through movements carried to the other through volumes at adjoining intersections. In order to preserve cross traffic volumes, no east-west balancing on Marleau Avenue or Tenth Street was performed.

The existing traffic conditions indicate that during the a.m. and p.m. peak hour, there are high volumes of southbound and northbound through traffic along McConnell Avenue and Boundary Road. The northbound traffic primarily travels to Highway 401 heading out of the City and is primarily local traffic from the surrounding residential neighborhoods to the east and west of McConnell Avenue. A high volume of southbound traffic heading into the City is for destinations along Marleau Avenue, where it is surrounded by light industrial and urban areas. **Figure 2.2** and **2.3** illustrates the existing balanced traffic volumes for the weekday a.m. and p.m. peak hours, respectively.



**FIGURE 2.1**  
Existing Lane Configuration





### 2.3.1 Signalized Capacity Analysis

Level of service analysis for signalized intersections was undertaken using *Synchro Version 6* software, Build 614, which applies both signalized and unsignalized capacity analysis methodology outlined in the *Highway Capacity Manual 2000*. The analysis incorporates signal timing plans obtained from the City of Cornwall.

Under existing traffic conditions, the analysis indicates that all signalized intersections are operating at acceptable levels of service during the weekday a.m. and p.m. peak hours, with the exception of the intersection of Marleau Avenue/McConnell Avenue. The intersection of Marleau Avenue/McConnell Avenue is experiencing capacity constraints and noticeable delays due to heavy traffic volumes (primarily local through traffic along Marleau Avenue, as it is a major east-west arterial road, through the City of Cornwall). In addition, with only one through lane in each direction at the intersection of Marleau Avenue/McConnell Avenue, it limits traffic flow further contributing to the congestion and delays, particularly during the p.m. peak hour where the intersection operates at over capacity. The southbound left-turn movement and northbound through-right movement will also experience capacity constraints due to heavy volumes of traffic. **Table 2.2** below summarizes the results of the existing traffic analysis. Detailed results of the existing traffic capacity analysis are summarized in **Appendix A**.

Intersection	Weekday AM Peak Hour								Weekday PM Peak Hour							
	Overall		Movement of Interest (v/c >0.85)						Overall		Movement of Interest (v/c >0.85)					
	Delay (s)	LOS	Movement	V/C	Delay (s)	LOS	Queue (m)		Delay (s)	LOS	Movement	V/C	Delay (s)	LOS	Queue (m)	
							50th	95th							50th	95th
SCM Way & Boundary Road	14.5	B	-	-	-	-	-	-	16.5	B	-	-	-	-	-	-
Marleau Avenue & Boundary Road	16.0	B	-	-	-	-	-	-	13.7	B	-	-	-	-	-	-
Marleau Avenue & Nick Kaneb Drive	22.3	C	EBT	0.86	28.8	C	104.7	221.9	17.3	B	-	-	-	-	-	-
Marleau Avenue & McConnell Avenue	36.7	D	EBT	0.91	58.0	E	92.8	179.7	144.0	F	EBT	1.07	>150	F	140.9	245.5
			WBT	0.86	39.9	D	109.0	206.2			WBT	0.89	45.4	D	124.7	233.9
			NBTR	-	-	-	-	-			NBTR	1.18	>150	F	138.6	241.0
			SBL	0.89	36.9	D	62.6	150.6			SBL	1.10	>150	F	95.4	190.4

**Table 2.2:** Existing Traffic - Signalized Levels of Service

### 2.3.2 Unsignalized Capacity Analysis

Level of service analysis for the unsignalized intersections was also carried out using *Synchro Version 6* software. The analysis results indicate that all unsignalized intersections operate at acceptable levels of service during the a.m. and p.m. peak hour, with exception of the intersection of Tenth Street/McConnell Avenue. At the intersection of Tenth Street/McConnell Avenue, delays are experienced for the eastbound and westbound movements during the a.m. and p.m. peak hours. McConnell Avenue is a major north-south arterial, carrying a significant amount traffic volume, which allows for very limited gaps for the eastbound and westbound movements to proceed.

Highway 401 westbound ramp (also refer to as Glen Road), is a rural road across from the highway entrance and Boundary Road. With the heavy traffic volume entering the highway from northbound Boundary Road it limits the opportunities for the westbound left-turn movement to enter onto Boundary

Road to travel southbound. **Table 2.3** summarizes the result of the unsignalized intersection analysis. The detailed output summarizes are provided in **Appendix A**. It is our understanding that Ministry is current conducting a reviewing of modifying the Boundary Road interchange.

Intersection	Movement of Interest	Weekday AM Peak Hour					Weekday PM Peak Hour				
		Flow Rate (vph)	Capacity (vph)	Vol/Cap Ratio (v/c)	Control Delay (s)	LOS	Flow Rate (vph)	Capacity (vph)	Vol/Cap Ratio (v/c)	Control Delay (s)	LOS
Hwy 401 WB Ramp & Boundary Road	EBLT	3	194	0.02	23.8	C	9	143	0.06	31.8	D
	EBR	97	458	0.21	15.0	B	74	575	0.13	12.2	B
	WBL	61	140	0.44	50.2	F	42	122	0.34	49.8	E
	WBTR	32	266	0.12	20.4	C	26	247	0.11	21.3	C
	NBLTR	38	919	0.04	1.5	A	71	1067	0.07	1.7	A
	SBLTR	15	1292	0.01	0.1	A	10	1004	0.01	0.3	A
Hwy 401 EB Ramp & Boundary Road	WBL	128	224	0.57	41.9	E	55	201	0.27	29.7	D
	WBR	12	742	0.02	9.9	A	46	506	0.09	12.8	B
	SBLT	9	1192	0.01	0.2	A	7	894	0.01	0.2	A
Industrial Park Drive & Boundary Road	EBL	3	150	0.05	29.5	D	55	145	0.38	44.7	E
	EBR	17	331	0.05	16.5	C	177	466	0.38	17.4	C
	NBL	32	767	0.04	9.9	A	72	926	0.08	9.2	A
Industrial Park Drive & Optimum Drive	-	-	-	-	-	-	-	-	-	-	A
Optimum Drive & SCM Way	SBLR	52	979	0.05	8.9	A	128	790	0.16	10.4	B
Tenth Street & Boundary Road	EBLR	50	242	0.21	23.7	C	65	225	0.29	27.5	D
Tenth Street & McConnell Avenue	EBLTR	16	122	0.13	39.0	E	21	17	1.27	>150	F
	WBTLR	58	115	0.51	67.6	F	82	40	2.04	>150	F
	NBL	4	831	0.00	0.1	A	6	785	0.01	0.2	A
	SBL	27	868	0.03	0.8	A	24	559	0.04	1.3	A

**Table 2.3:** Existing Traffic - Unsignalized Levels of Service

### 3.0 FUTURE BACKGROUND TRAFFIC

A five-year horizon to the year 2015 is used for future background traffic conditions with alternative road alignments as described below. The following sections outline assumptions for the future background traffic conditions including, potential signalization of intersections as warranted, the closure of Boundary/Tenth intersection, general traffic road growth, the site traffic that would be generated by the developments in the area and the proposed road improvements.

Future background traffic conditions will be based on the following scenarios for the 2015 horizon year:

- **Scenario 1:** Westerly extension of Industrial Park Drive from Boundary Road to Virginia Drive and closure of Tenth Street/Boundary Road intersection;
- **Scenario 2:** Extension of Industrial Park Drive from Boundary Road to Virginia Drive, extension of Virginia Drive from Tenth Street to Marleau Avenue and closure of Tenth Street/Boundary Road intersection.

### 3.1 TRAFFIC SIGNAL CONTROL AT MCCONNELL/TENTH INTERSECTION

In recognition of the constraints experienced by the westbound and eastbound through movements at the intersection of Tenth Street/McConnell Avenue, particularly during the p.m. peak hour, traffic control signals are recommended as a potential future solution. Furthermore, the extension of Industrial Park Drive will further increase traffic onto Tenth Street. As such, all future analysis scenarios which includes Industrial Park extension have assumed the signalization of this intersection.

Signal warrant analysis was conducted adhering to the methodologies outlined in the *Ontario Ministry of Transportation Book 12 – Traffic Signals* based on 4-hour and 8-hour warrants. The signal warrant analysis was performed for Scenario 1 and Scenario 2 under the future background and future total traffic conditions.

Based on the analysis, signal justification has been met and signalization of the Tenth Street/McConnell Avenue intersection is warranted. A signal timing plan was based on 100 second cycle lengths for the a.m. and p.m. peak hours was derived based on the McConnell Avenue/Marleau Avenue intersection to permit traffic signal coordination to minimize through traffic impacts. The Tenth Street/McConnell Avenue intersection will be presented as a signalized intersection under the future background and future total analysis. Details of the signal warrant analysis is provided in **Appendix B**.

### 3.2 TENTH STREET/BOUNDARY ROAD INTERSECTION CLOSURE AND FUTURE ROADWAY NETWORK

Boundary Road is the major north-south rural arterial road and Tenth Street is under stop control. The intersection is situated approximately 25 meters north of an existing 4-track CN Rail crossing. Northbound vehicles along Boundary Road have been known to queue, often extending across the CN Rail tracks, due to the vehicles making the northbound left-turns onto Tenth Street. In response, the northbound left-turn movements have been prohibited.

The report completed in December, 2008 by GENIVAR, entitled, *Tenth Street East/Boundary Road Intersection Safety and Operational Review, Revision 3, December 2008*<sup>1</sup>, examines safety and operational conditions at and adjacent to the Tenth Street/Boundary Road intersection. Following the aforementioned report, The City of Cornwall is in the process reviewing the closure of this intersection. As we understand the current process, recommendations have been made as a future solution for the closure of Tenth Street and the westerly extension of Industrial Park Drive to Tenth Street.

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<sup>1</sup> *Tenth Street East/Boundary Road Intersection Safety and Operational Review, Revision 3, December 2008*, GENIVAR Constructive People, December 2008

As Tenth Street is the only east-west route between Marleau Avenue and Highway 401, traffic diverted by the permanent closure will be accommodated via the extension of Industrial Park Drive. Industrial Park Drive will be extended to carry the diverted Tenth Street traffic; hence balanced volumes at this intersection were combined with those at the Industrial Park Drive/Boundary Road intersection. Planned future roadway network improvements are identified in the City of Cornwall's Official Plan and are carried into the future background and future total traffic conditions as per the following proposed road improvements:

- The westerly extension of Industrial Park Drive to Tenth Street;
- The southerly extension of Virginia Drive across the CN Rail corridor from Tenth Street to Marleau Avenue.

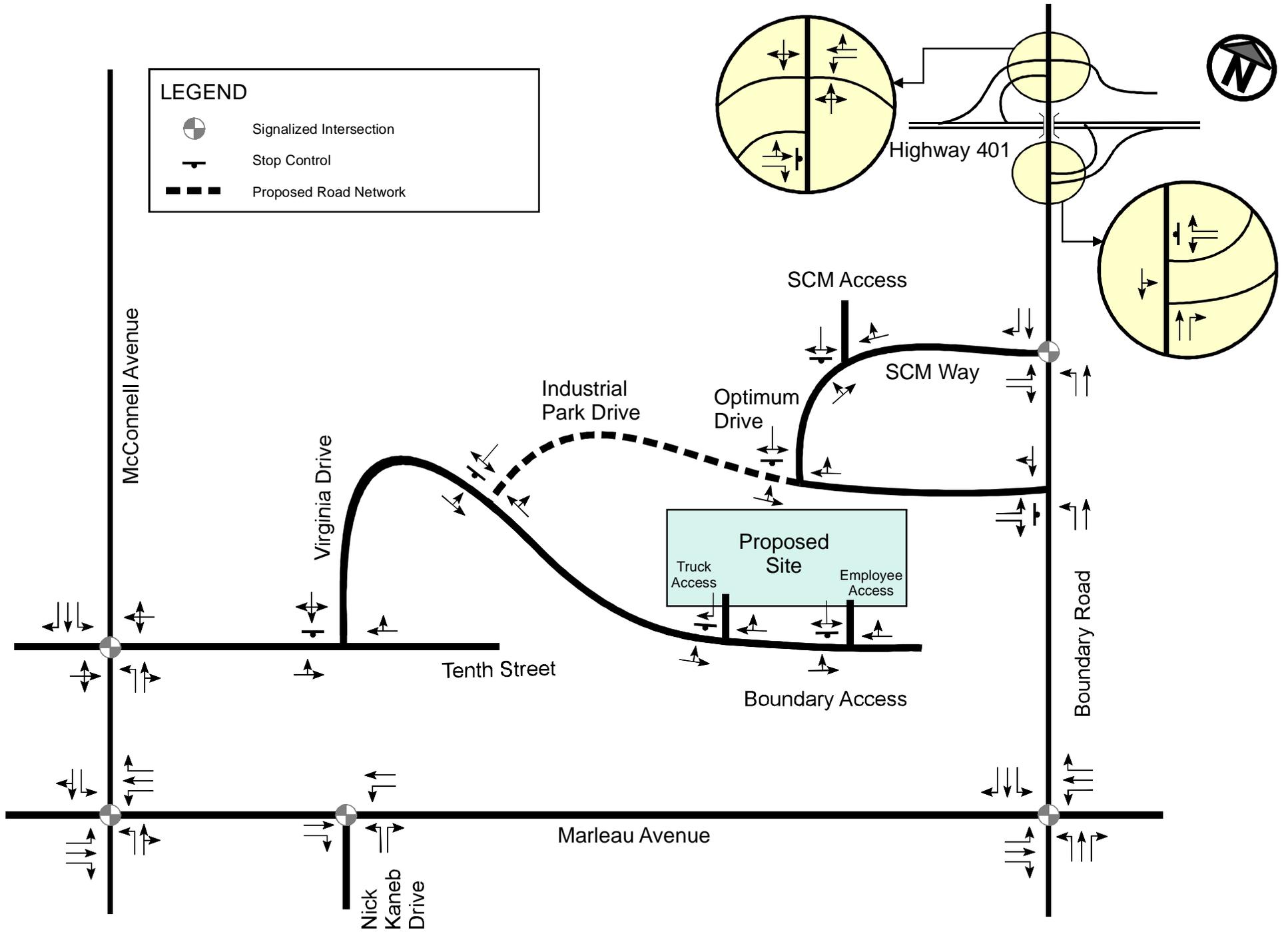
### 3.3 SCENARIO 1: INDUSTRIAL PARK DRIVE TO TENTH STREET ONLY

Scenario 1 traffic conditions will include the following assumptions:

- Westerly extension of Industrial Park Drive from Boundary Road to Virginia Drive;
- Tenth Street will terminate as a cul-de-sac at the eastern limit of proposed development;
- Permanent closure of Tenth Street/Boundary Road intersection.

As part of the environmental assessment study currently being undertaken by the City of Cornwall, a westerly extension of Industrial Park Drive to Virginia Drive is under review. Under Scenario 1 traffic conditions Industrial Park Drive will extend westerly to the intersection of Virginia Drive where the westbound approach (from the subject site) will be under stop control. Similarly, at the Tenth Street/Virginia Drive intersection, the minor approach road travelling westbound and northbound will also be under stop control. The intersection of Tenth Street/McConnell Avenue will be analyzed as a signalized intersection. As noted under existing conditions, signalization of the Tenth Street/McConnell Avenue is warranted as a result of the analysis.

The balanced volumes at Boundary Road/Tenth Street were combined to the Boundary Road/Industrial Park Drive intersection in anticipation of the discontinuity of Tenth Street. The proposed future lane configuration under Scenario 1 traffic conditions is illustrated in **Figure 3.1**.



**FIGURE 3.1**  
Scenario 1: Future Lane Configuration

### 3.4 SCENARIO 2: INDUSTRIAL PARK DRIVE TO TENTH STREET AND VIRGINIA DRIVE EXTENSION

Scenario 2 traffic conditions will include the following assumptions:

- Westerly extension of Industrial Park Drive from Boundary Road to Virginia Drive and the southerly extension of Virginia Drive from Tenth Street to Marleau Avenue;
- Tenth Street will terminate as a cul-de-sac at the eastern end of proposed development;
- Permanent closure of Tenth Street/Boundary Road intersection.

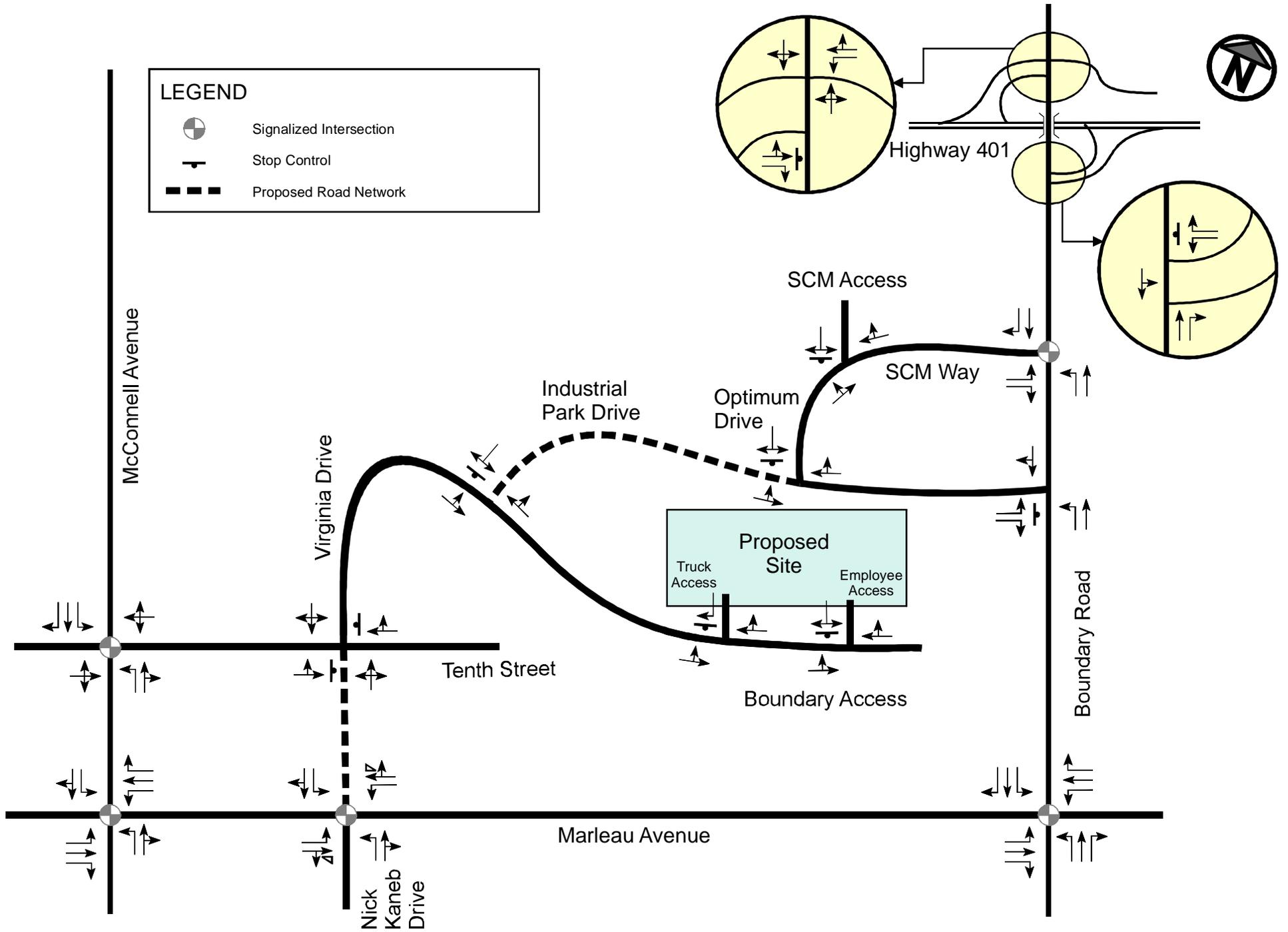
As part of the environmental assessment study currently being undertaken by the City of Cornwall, a westerly extension of Industrial Park Drive to Virginia Drive is currently under study; however the southerly extension of Virginia Drive is subject to another environmental assessment study related to Marleau Avenue. For analysis purposes, the southerly extension of Virginia Drive from Tenth Street to the Marleau Avenue was investigated as a potential route in improving access to the proposed development.

Under Scenario 2, Industrial Park Drive will extend westerly to the intersection with Virginia Drive where the westbound approach (from the site) will be under STOP control. At the Virginia Drive/Tenth Street intersection, a southerly extension of Virginia Drive is proposed to extend to the Marleau Avenue/Nick Kaneb Drive intersection. It is assumed that Virginia Drive will be the free flow through route with the westbound and eastbound movements along Tenth Street under STOP control. Tenth Street will remain as existing conditions.

The intersection of Marleau Avenue/Nick Kaneb Drive is currently signalized. Future lane configurations at the Marleau Avenue/Nick Kaneb Drive intersection are to be designed under the Marleau Avenue environmental assessment study currently being undertaken by the City of Cornwall. For the purpose of the analysis, it is assumed there will be a shared left-turn lane, through lane and a right-turn lane for the southbound approach. Other approaches of the intersection include an eastbound left-turn lane, shared through lane and a channelized right-turn lane; northbound left-turn lane and shared through and right-turn lane; and a westbound shared left-turn and through lane and right-turn lane.

Under Scenario 2, a diversion of traffic between McConnell/Tenth from McConnell Avenue/Marleau Avenue was assigned to use Tenth Street/Virginia Drive. Balanced volumes at Boundary Road/Tenth Street were combined to the Boundary Road/Industrial Park Drive intersection in anticipation of the discontinuity of Tenth Street.

The proposed future lane configuration under Scenario 2 traffic conditions is illustrated in **Figure 3.2**.



**FIGURE 3.2**  
Scenario 2: Future Lane Configuration

### 3.5 PROPOSED BACKGROUND DEVELOPMENTS AND ROAD IMPROVEMENTS

To access the operations of the intersections within the study area under background traffic conditions, the City of Cornwall has provided background development for the Shoppers Drug Mart Distribution Centre. Background traffic volumes were derived from the report completed in January 2009 by Delcan, entitled, *Shoppers Drug Mart Distribution Centre – Transportation Impact Study*. The distribution centre is located at Optimum Drive and SCM Way. The a.m. and p.m. peak hour background development site traffic for the Shoppers Drug Mart distribution centre are provided in **Appendix C**.

The Ministry of Transportation is anticipating for reconstruction of the current Boundary Road interchange over the next year. Improvements at the Highway 401/Boundary Road interchange are planned with construction anticipated to commence in 2011. Minor realignment of the ramps will occur with the replacement of a new bridge to be built east of the existing bridge. New alignments will be adjusted to provide additional pavement area at the ramp terminals for the turning movements of larger commercial vehicles, including double-trailer trucks.

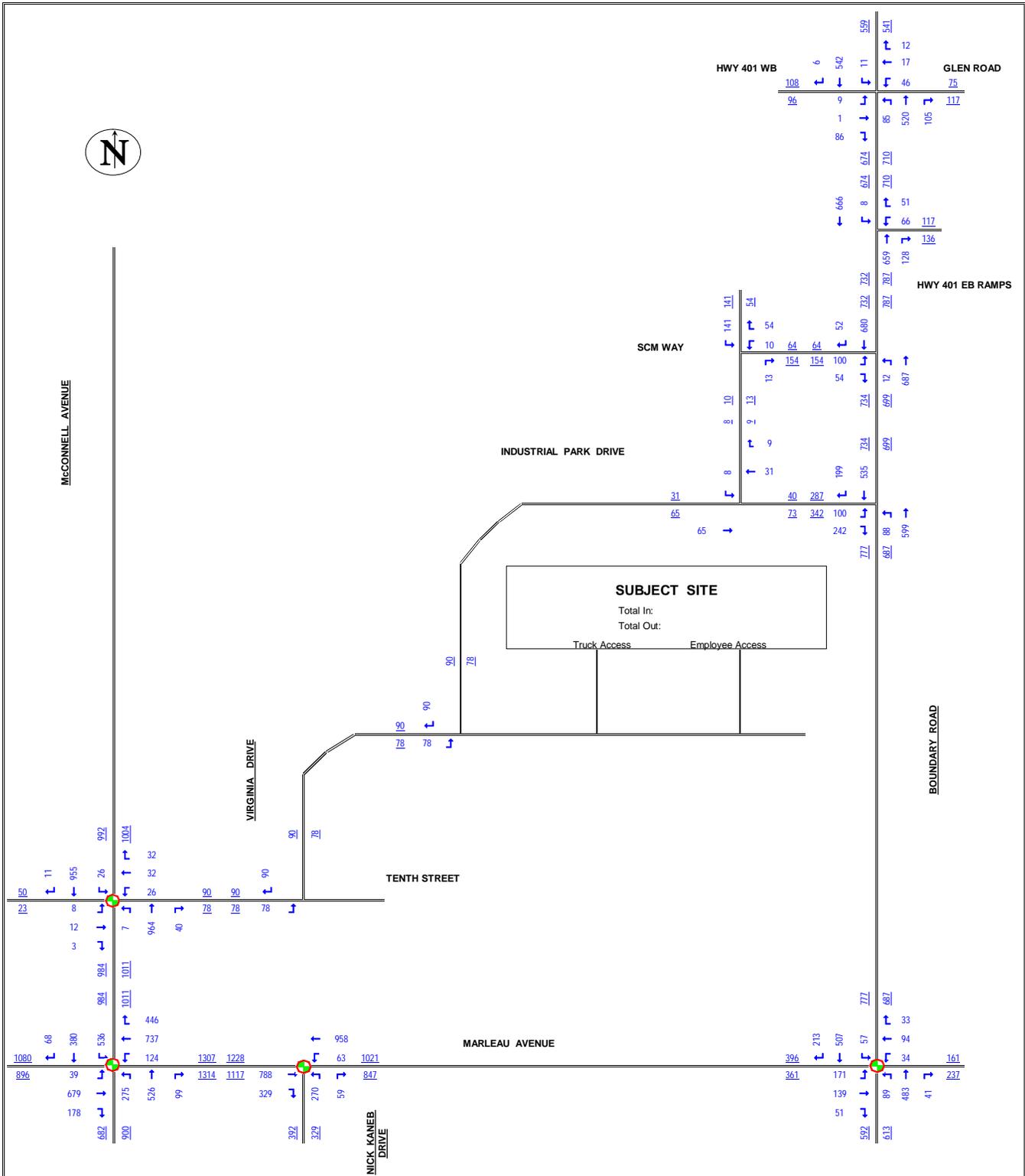
An environmental assessment is currently underway for Marleau Avenue from Marborough Street to Glenview Boulevard with alternative designs that include potential roadway widening. As alternative designs are being finalized, the lane configurations used in this report reflect existing conditions with the exception of the Marleau Avenue/Nick Kaneb Drive intersection where improvements are included for analysis purposes as part of Scenario 2.

### 3.6 CORRIDOR TRAFFIC GROWTH

A compound growth rate of 2% per annum was applied to existing traffic on the road network and calculated accordingly for the 2015 horizon years for future background traffic and is consistent with past background development reports. This background traffic growth is used to account for the increase of development traffic outside of the study area.

**Figure 3.3** and **3.4** illustrates the future background traffic under Scenario 1 traffic conditions for the a.m. and p.m. peak periods, respectively. **Figure 3.5** and **3.6** illustrates the diverted traffic with the extension of Virginia Drive based on a current diversion rate of 30% for both directions. **Figure 3.7** and **3.8** illustrates the future background traffic under Scenario 2 traffic conditions for the a.m. and p.m. peak periods, respectively.





**Boundary Properties Ltd. - Proposed Development at Boundary Road & Highway 401**

FIGURE 3.4  
 FUTURE BACKGROUND TRAFFIC (Scenario 1)  
 Weekday PM





McCONNELL AVENUE

HWY 401 WB RAMPS

GLEN ROAD

HWY 401 EB RAMPS

SCM WAY

INDUSTRIAL PARK DRIVE

SUBJECT SITE

Total In:

Total Out:

Truck Access

Employee Access

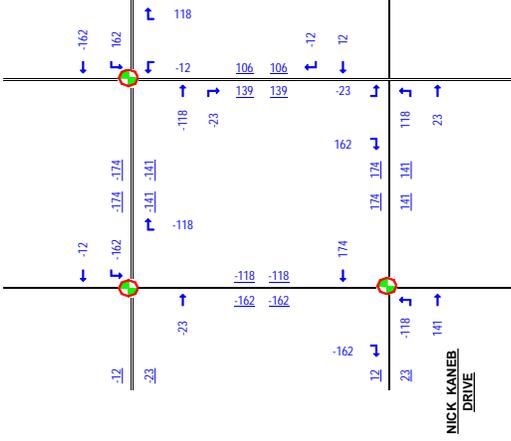
BOUNDARY ROAD

VIRGINIA DRIVE

TENTH STREET

MARLEAU AVENUE

NICK KANE DRIVE



**PEAK HOUR TRAFFIC VOLUME LEVELS**

FIGURE 3.5  
TRAFFIC DIVERSIONS (Scenario 2)  
Weekday AM





McCONNELL AVENUE

HWY 401 WB RAMPS

GLEN ROAD

HWY 401 EB RAMPS

SCM WAY

INDUSTRIAL PARK DRIVE

SUBJECT SITE

Total In:

Total Out:

Truck Access

Employee Access

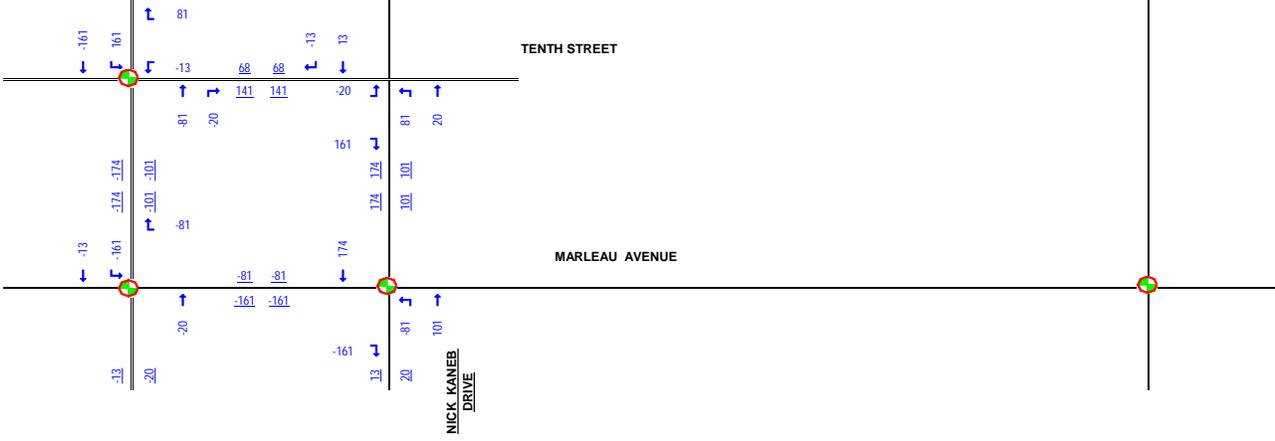
BOUNDARY ROAD

VIRGINIA DRIVE

TENTH STREET

MARLEAU AVENUE

NICK KANE DRIVE



**PEAK HOUR TRAFFIC VOLUME LEVELS**

FIGURE 3.6  
TRAFFIC DIVERSIONS (Scenario 2)  
Weekday PM





McCONNELL AVENUE

VIRGINIA DRIVE

TENTH STREET

MARLEAU AVENUE

NICK KANE DRIVE

INDUSTRIAL PARK DRIVE

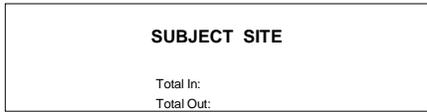
SCM WAY

HWY 401 WB RAMPS

GLEN ROAD

HWY 401 EB RAMPS

BOUNDARY ROAD



**PEAK HOUR TRAFFIC VOLUME LEVELS**

FIGURE 3.7  
 FUTURE BACKGROUND TRAFFIC (Scenario 2)  
 Weekday AM





McCONNELL AVENUE

VIRGINIA DRIVE

TENTH STREET

MARLEAU AVENUE

NICK KANE DRIVE

INDUSTRIAL PARK DRIVE

SCM WAY

HWY 401 WB RAMPS

HWY 401 EB RAMPS

BOUNDARY ROAD

GLEN ROAD

SUBJECT SITE

Total In:

Total Out:

Truck Access

Employee Access

**PEAK HOUR TRAFFIC VOLUME LEVELS**

FIGURE 3.8  
FUTURE BACKGROUND TRAFFIC (Scenario 2)  
Weekday PM



### 3.7 INTERSECTION CAPACITY ANALYSIS

An intersection capacity analysis was conducted under future background traffic conditions roadway improvements and corridor traffic growth. Signal timing plans has been optimized to reflect background traffic growth.

#### 3.7.1 Scenario 1 Traffic Conditions

Under future background traffic scenario, all signalized intersections within the study area will operate at acceptable levels of service with the exception of intersection of Marleau Avenue/McConnell Avenue. Due to the existing heavy southbound left-turn volume, this greatly reduces the capacity of the intersection. To improve the operating condition of this intersection, an additional southbound left-turn lane can be provided to increase turning capacity. With the provision of a dual left-turn lane, individual movements are slightly enhanced, however capacity constraints are still expected during the p.m. peak hour with the localized intersection improvements

**Table 3.1a** summarizes the results of the signalized intersection analysis for the future background weekday a.m. and p.m. peak hours under Scenario 1 traffic conditions and **Table 3.1b** summarizes the analysis with the option of a dual left-turn lane at the intersection of Marleau Avenue/McConnell Avenue. **Table 3.2** summarizes the results of the unsignalized intersection analysis. Detailed results of the future background traffic capacity analysis can be found in **Appendix D**.

Intersection	Weekday AM Peak Hour								Weekday PM Peak Hour							
	Overall		Movement of Interest (v/c >0.85)						Overall		Movement of Interest (v/c >0.85)					
	Delay (s)	LOS	Movement	V/C	Delay (s)	LOS	Queue (m)		Delay (s)	LOS	Movement	V/C	Delay (s)	LOS	Queue (m)	
50th							95th	50th							95th	
SCM Way & Boundary Road	17.4	B	-	-	-	-	-	-	10.3	B	-	-	-	-	-	-
Marleau Avenue & Boundary Road	17.7	B	-	-	-	-	-	-	20.3	C	-	-	-	-	-	-
Marleau Avenue & Nick Kaneb Drive	20.4	C	-	-	-	-	-	-	21.5	C	WBT	0.85	20.4	C	96.8	254.7
Marleau Avenue & McConnell Avenue	68.2	E	EBT	1.01	125.0	F	171.7	281.4	>150	F	EBT	1.23	>150	F	171.7	281.4
			WBT	0.96	65.5	D	149.3	272.4			WBT	1.00	100.9	F	149.3	272.4
			NBTR	0.95	87.4	F	155.1	262.7			NBTR	1.20	>150	F	155.1	262.7
			SBL	1.01	99.9	F	124.8	223.0			SBL	1.29	>150	F	124.8	223.0
Tenth Street & McConnell Avenue	6.8	A	-	-	-	-	-	7.9	A	-	-	-	-	-	-	

**Table 3.1a:** Future Background Traffic – Signalized Levels of Service, Scenario 1

Intersection	Weekday AM Peak Hour								Weekday PM Peak Hour								
	Overall		Movement of Interest (v/c >0.85)						Overall		Movement of Interest (v/c >0.85)						
	Delay (s)	LOS	Movement	V/C	Delay (s)	LOS	Queue (m)		Delay (s)	LOS	Movement	V/C	Delay (s)	LOS	Queue (m)		
50th							95th	50th							95th		
Marleau Avenue & McConnell Avenue	42.8	D	EBT	0.94	67.6	E	104.5	201.8	142.2	F	EBT	1.11	>150	F	159.9	269.6	
			WBT	0.90	45.3	D	124.0	233.4			WBT	0.93	53.7	D	140.1	260.4	
			-	-	-	-	-	-			-	NBTR	1.09	>150	F	142.9	250.5
			SBL	0.90	52.8	D	56.3	104.4			SBL	0.89	>150	F	66.9	117.9	

**Table 3.1b:** Future Background Traffic – Signalized Levels of Service, Scenario 1 (Dual Left-Turn Lane)

Despite the increase in southbound left-turn capacity at the intersection of Marleau Avenue and McConnell Avenue, the eastbound and northbound through movement will continue to operate at capacity during the p.m. peak hour. This suggests that a more significant network improvement is required to either reduce the southbound left-turn demand or increase east/west and north/south lane capacity through this area.

Under the unsignalized intersection capacity analysis for future background traffic conditions, some delays are expected for vehicles exiting from the Highway 401 eastbound and/or westbound Ramps making left-turn movements onto Boundary Road during the a.m. and p.m. peak periods. The eastbound left-turn movement at the intersection of Industrial Park Drive/Boundary Road will also experience some delays due to heavy traffic volumes along Boundary Road.

Intersection	Movement of Interest	Weekday AM Peak Hour					Weekday PM Peak Hour				
		Flow Rate (vph)	Capacity (vph)	Vol/Cap Ratio (v/c)	Control Delay (s)	LOS	Flow Rate (vph)	Capacity (vph)	Vol/Cap Ratio (v/c)	Control Delay (s)	LOS
Hwy 401 WB Ramp & Boundary Road	EBLT	3	156	0.02	28.6	D	10	111	0.09	40.7	E
	EBR	112	420	0.27	16.7	C	86	538	0.16	13.0	B
	WBL	67	104	0.65	97.5	F	46	92	0.50	81.8	F
	WBTR	36	225	0.16	24.0	C	29	205	0.14	25.5	D
	NBLTR	49	867	0.06	1.9	A	85	1021	0.08	2.1	A
	SBLTR	8	1260	0.01	0.2	A	11	956	0.01	0.3	A
Hwy 401 EB Ramp & Boundary Road	WBL	146	188	0.78	83.0	F	66	166	0.40	40.7	E
	WBR	13	705	0.02	10.2	B	51	464	0.11	13.7	B
	SBL	10	1139	0.01	0.2	A	8	832	0.01	0.3	A
Industrial Park Drive & Boundary Road	EBL	32	137	0.23	39.3	E	100	135	0.74	97.4	F
	EBR	56	307	0.18	19.3	C	242	480	0.50	20.1	C
	NBL	44	711	0.06	10.4	B	88	865	0.10	9.6	A
Industrial Park Drive & Optimum Drive	SBLR	8	723	0.01	10.0	B	8	707	0.01	10.1	B
Optimum Drive & SCM Way	SBLR	57	770	0.07	10.0	B	141	787	0.18	10.6	B
Tenth Street & Virginia Drive	EBL	87	1623	0.05	7.3	A	78	1578	0.05	7.4	A
	EBLR	64	1037	0.06	8.7	A	90	1088	0.08	8.6	A
Virginia Drive & Industrial Park Drive	EBL	87	1630	0.05	7.3	A	78	1597	0.05	7.4	A
	SBLR	64	1045	0.06	8.7	A	90	1088	0.08	8.6	A

Table 3.2: Future Background Traffic – Unsignalized Levels of Service, Scenario 1

### 3.7.2 Scenario 2 Traffic Conditions

Under Scenario 2 future background traffic conditions capacity analysis, all signalized intersections will operate at acceptable levels of service, with the exception of the Marleau Avenue/McConnell Avenue intersection. During the p.m. peak hour, the eastbound, westbound and northbound through movements and southbound left-turn movement at the intersection of Marleau Avenue/McConnell Avenue will experience capacity constraints due to heavy traffic volumes as it is a desirable commuter route.

With the extension of the north leg at the Marleau Avenue/Nick Kaneb Drive intersection there is some improvement to the Marleau Avenue/McConnell Avenue intersection, particularly during the a.m. peak hour as it is expected that traffic will divert to avoid increased turning delays at Marleau Avenue.

**Table 3.3a** summarizes the results of the signalized intersection capacity analysis for the future background weekday a.m. and p.m. peak hours under Scenario 2 traffic conditions. Detailed results of the future background traffic capacity analysis can be found in **Appendix D**.

Intersection	Weekday AM Peak Hour								Weekday PM Peak Hour							
	Overall		Movement of Interest						Overall		Movement of Interest					
	Delay (s)	LOS	Movement	V/C	Delay (s)	LOS	Queue (m)		Delay (s)	LOS	Movement	V/C	Delay (s)	LOS	Queue (m)	
50th							95th	50th							95th	
SCM Way & Boundary Road	16.0	B	-	-	-	-	-	-	20.8	c	-	-	-	-	-	-
Marleau Avenue & Boundary Road	17.7	B	-	-	-	-	-	-	20.3	B	-	-	-	-	-	-
Marleau Avenue & Virginia Drive (Nick Kaneb Drive)	23.5	C	NBL	0.87	52.8	D	36.4	90.5	19.3	B	WBT	0.86	22.3	C	101.7	257.8
Marleau Avenue & McConnell Avenue	32.9	C	-	-	-	-	-	-	136.9	F	EBT	1.11	>150	F	159.9	269.6
			-	-	-	-	-	-			WBT	0.98	78.1	E	145.5	268.4
			-	-	-	-	-	-			NBT	1.02	130.0	F	130.4	236.2
			SBL	0.86	29.0	C	48.9	112.7			SBL	1.14	>150	F	73.4	153.6
Tenth Street & McConnell Avenue	10.8	B	-	-	-	-	-	-	12.4	B	-	-	-	-	-	-

**Table 3.3a:** Future Background Traffic – Signalized Level of Service, Scenario 2

A sensitivity analysis was conducted to evaluate the impact to better enhance the traffic operation associated with the intersection of Marleau Avenue/Nick Kaneb Drive and Marleau Avenue/McConnell Avenue. Providing an advanced northbound left-turn signal at the intersection of Marleau Avenue/Nick Kaneb Drive will improve this movement while maintaining a good overall level of service at the aforementioned intersection particularly during the a.m. peak hour. In addition, providing an additional through lane in the eastbound and westbound direction at the intersection of Marleau Avenue/McConnell Avenue will improve the overall operations of this intersection. The provision of the extra through lanes will ultimately increase traffic capacity helping reduce the congestion and delays. Table 3.3b summarizes the future background capacity analysis with improvements to the existing road network. Detailed results of the future background traffic capacity analysis can be found in **Appendix D**.

Intersection	Weekday AM Peak Hour								Weekday PM Peak Hour							
	Overall		Movement of Interest						Overall		Movement of Interest					
	Delay (s)	LOS	Movement	V/C	Delay (s)	LOS	Queue (m)		Delay (s)	LOS	Movement	V/C	Delay (s)	LOS	Queue (m)	
50th							95th	50th							95th	
Marleau Avenue & Virginia Drive (Nick Kaneb Drive)	23.9	C	-	-	-	-	-	-	19.3	B	WBT	0.86	22.3	C	101.7	257.8
Marleau Avenue & McConnell Avenue	25.0	C	-	-	-	-	-	-	35.2	D	NBT	0.93	61.5	E	116.0	224.1
			-	-	-	-	-	-			SBL	0.89	46.1	D	41.2	136.5

**Table 3.3b:** Future Background Traffic – Signalized Level of Service, Scenario 2 (Road Improvements)

The unsignalized capacity analysis under Scenario 2 future background traffic conditions indicates that all intersections will operate at good levels of service. Similar to Scenario 1 traffic conditions, the Highway 401 eastbound and westbound ramps at Boundary Road will experience some delays due to heavy traffic volumes exiting onto Boundary Road during the a.m. and p.m. peak hours. Additionally, eastbound vehicles travelling towards Highway 401 making left-turn movements at the intersection of Industrial Park Drive/Boundary Road will also experience constraints and delays during the p.m. peak hours due to the limited gaps availability

**Table 3.4** summarizes the results of the unsignalized intersection capacity analysis for the future background weekday a.m. and p.m. peak hours under Scenario 2 traffic conditions. Detailed results of the future background traffic capacity analysis can be found in **Appendix D**.

Intersection	Movement of Interest	Weekday AM Peak Hour					Weekday PM Peak Hour				
		Flow Rate (vph)	Capacity (vph)	Vol/Cap Ratio (v/c)	Control Delay (s)	LOS	Flow Rate (vph)	Capacity (vph)	Vol/Cap Ratio (v/c)	Control Delay (s)	LOS
Hwy 401 WB Ramp & Boundary Road	EBLT	3	156	0.02	28.6	D	10	111	0.09	40.7	E
	EBR	112	420	0.27	16.7	C	86	538	0.16	13.0	B
	WBL	67	104	0.65	97.5	F	46	92	0.50	81.8	F
	WBTR	36	225	0.16	24.0	C	29	205	0.14	25.5	D
	NBLTR	49	867	0.06	1.9	A	85	1021	0.08	2.1	A
	SBLTR	8	1260	0.01	0.2	A	11	956	0.01	0.3	A
Hwy 401 EB Ramp & Boundary Road	WBL	146	188	0.78	83.0	F	66	166	0.40	40.7	E
	WBR	13	705	0.02	10.2	B	51	464	0.11	13.7	B
	SBL	10	1139	0.01	0.2	A	8	832	0.01	0.3	A
Industrial Park Drive & Boundary Road	EBL	32	137	0.23	39.3	E	100	135	0.74	97.4	F
	EBR	56	307	0.18	19.3	C	242	480	0.50	20.1	C
	NBL	44	711	0.06	10.4	B	88	865	0.10	9.6	A
Industrial Park Drive & Optimum Drive	SBLR	8	723	0.01	10.0	B	8	591	0.01	11.2	B
Optimum Drive & SCM Way	SBLR	57	770	0.07	10.0	B	141	787	0.18	10.6	B
Tenth Street & Virginia Drive	EBLTR	226	816	0.29	11.2	B	219	901	0.27	10.7	B
	WBLTR	30	546	0.05	12.0	B	30	1700	0.05	11.3	B
	NBL	118	1551	0.08	5.5	A	81	1518	0.01	5.6	A
	SBLTR	10	1572	0.01	1.0	A	10	1596	0.01	0.8	A
Virginia Avenue & Industrial Park Drive	EBLT	87	1630	0.05	7.3	A	78	1597	0.05	7.4	A
	SBLR	64	1045	0.06	8.7	A	90	1088	0.08	8.6	A

**Table 3.4:** Future Background Traffic – Unsignalized Levels of Service, Scenario 2

## 4.0 TRIP GENERATION

LEA Consulting Ltd. has a wide range of experience in working on a number projects for food distribution warehouse facilities, including a traffic report for a similar warehouse distribution centre located in Ajax. In identifying similar operating characteristics, it was determined that the vehicular trips from the Ajax warehouse facility provide a good representation of the potential temporal profile for site traffic to and from the Boundary Properties Ltd. warehouse distribution centre. These characteristics include the size of the facility, types of merchandise, work shifts and transportation modes.

The proposed development will consist of a total building GFA of 732,085 sq. ft. In addition, further expansions in three phases is planned to comprise of building GFA 624,885 sq. ft for the full build-out of 1,356,970 sq. ft.

The traffic impact study derived site trips based upon different trip rates for truck and employee trips separately. Site trips were separated as travel characteristics and patterns differ. Data for vehicles associated with the grocery section of the facility was based on the proposed users of the Cornwall warehouse facility.

The actual trip generation rates were derived from a proxy site; a similar warehouse distribution centre dealing with food distribution activities. In LEA's December 2004 Traffic Impact Study entitled, *Town of Ajax - Warehouse Distribution Centre*, and letter LEA's January 2010 report entitled, *Site Generated Trips for the Proposed Ajax Distribution Warehouse*, trip generation surveys were conducted at existing facilities to determine the validity of rates. The trip rates were compared in relation to other food distribution centres in Ontario to determine an existing trip rate for the Ajax Distribution Centre, constructed to a size of 865,868 sq. ft. Given similar characteristics between the Ajax and Cornwall sites, including types of users, food distribution facilities, shift changes and vehicles to and from the sites, the Ajax warehouse will be utilized as the proxy site in establishing the trip generation rate. The accuracy of the proxy site trip generation rate was confirmed by past surveyed trips observed at two warehouse location dealing with food distribution with the projected employee and truck trips for the proposed development, and considered the highest trip rates both for the employee and truck trips for the subject facility during the weekday a.m. and p.m. peak hours.

The proposed distribution centre will operate 24-hours a day, 7 days a week. Warehouse employees based at the location will arrive in three shifts starting from: 6:00 a.m. to 2:00 p.m., 2:00 p.m. to 10:00 p.m., and 10:00 p.m. to 6:00 a.m. The transport staff and trucks will be entering and exiting the site throughout the day. The period at the end of one shift and the commencement of another shift (i.e. 5:30 a.m. to 6:30 p.m.) would result in the peak generator for employee trips, due to the overlap of employees entering and exiting the site. Although this period would be referred to as a peak hour of generator, it is more likely that the projected volume would be generated in a 15 to 30 minutes "surge." Based on confidential trade information, the site traffic peak hour for truck traffic is at 6:00 a.m. and employee traffic is at 2:00 p.m. The peak hours for the adjacent street traffic (i.e. McConnell Avenue, Boundary Road) occur between 7:30 a.m. to 8:30 a.m. and 3:00 p.m. to 4:00 p.m.

The trip generation rate as derived in LEA's 2004 Traffic Impact Study and 2010 report are based the following four individual criteria and are as follows:

- Employee Trips (Grocery, Produce and Dairy Commodity);

- Employee Trips (Frozen Foods Commodity);
- Truck Trips (Grocery, Produce and Dairy Commodity);
- Truck Trips (Frozen Commodity).

The trip generation rate for the employee trips for the 3-commodity facility (grocery, produce and dairy) is **0.273 trips/1000 sq.ft.** and **0.134 trips/1000 sq.ft.** during the a.m. and p.m. peak hours, respectively. For employee trips for the frozen commodity facility, the trip generation rate is **0.486 trips/1000 sq.ft.** and **0.260 trips/1000 sq.ft.** during the a.m. and p.m. peak hours, respectively. Trip generation rate for the truck components for the 3-commodity facility (grocery, produce and dairy) is **0.078 trips/1000 sq.ft.** and **0.082 trips/1000 sq.ft.** during the a.m. and p.m. peak hours, respectively. The truck trip generation rate for the frozen commodity facility is **0.151 trips/1000 sq.ft.** and **0.051 trips/1000 sq.ft.** during the a.m. and p.m. peak hours, respectively.

Tables 4.1, 4.2 and 4.3 summarizes the trip generation rates for the warehouse and employee trips as well as truck trips based on Phase 1 (to be built), future planned expansion and at full build-out, respectively.

Land Use	Size (sq. ft.)	Weekday AM Peak Hour			Weekday PM Peak Hour		
		In	Out	Total	In	Out	Total
<i>Phase 1</i>		Trip Rate (/1000 sq. ft.)			Trip Rate (/1000 sq. ft.)		
Warehouse and Employee Trips (Grocery, Produce & Dairy)	571,928	0.107	0.167	0.273	0.059	0.075	0.134
		61	96	157	34	43	77
Warehouse and Employee Trips (Frozen Commodity)	151,157	0.302	0.184	0.486	0.07	0.19	0.26
		46	28	73	11	29	40
Truck Trips (Grocery, Produce & Dairy)	571,928	0.037	0.041	0.078	0.045	0.037	0.082
		21	23	45	26	6	31
Truck Trips (Frozen Commodity)	151,157	0.112	0.041	0.151	0.017	0.034	0.051
		17	6	23	3	5	8
<b>Total Trips (Phase 1)</b>		<b>145</b>	<b>153</b>	<b>298</b>	<b>73</b>	<b>82</b>	<b>155</b>

Table 4.1: Trip Generation Summary –Employee and Truck Trips for Phase 1

Phase 1 of the proposed development will generate a total of **298** and **155 two-way trips** employee and truck trips during the a.m. peak and p.m. peak hours, respectively.

Land Use	Size (sq. ft.)	Weekday AM Peak Hour			Weekday PM Peak Hour		
		In	Out	Total	In	Out	Total
<i>Planned Expansion</i>		Trip Rate (/1000 sq. ft.)			Trip Rate (/1000 sq. ft.)		
Warehouse and Employee Trips (Grocery, Produce & Dairy)	608,410	0.107	0.167	0.273	0.059	0.075	0.134
		65	102	167	36	46	82
Warehouse and Employee Trips (Frozen Commodity)	16,475	0.302	0.184	0.486	0.07	0.19	0.26
		5	3	8	1	3	4
Truck Trips (Grocery, Produce & Dairy)	608,410	0.037	0.041	0.078	0.045	0.037	0.082
		23	25	47	27	23	50
Truck Trips (Frozen Commodity)	16,475	0.112	0.041	0.151	0.017	0.034	0.051
		2	1	3	0	1	1
<b>Total Trips (Planned Expansion)</b>		<b>94</b>	<b>130</b>	<b>225</b>	<b>65</b>	<b>72</b>	<b>137</b>

Table 4.2: Trip Generation Summary –Employee and Truck Trips for Planned Expansion

Based on the future planned expansion, an additional **225** and **137 two-way trips** employee and truck trips will be generated during the a.m. peak and p.m. peak hours, respectively.

Land Use	Size (sq. ft.)	Weekday AM Peak Hour			Weekday PM Peak Hour		
		In	Out	Total	In	Out	Total
<b>Full Build-Out</b>		Trip Rate (/1000 sq. ft.)			Trip Rate (/1000 sq. ft.)		
Warehouse and Employee Trips (Grocery, Produce & Dairy)	1,180,338	0.107 126	0.167 197	0.273 323	0.059 70	0.075 89	0.134 158
Warehouse and Employee Trips (Frozen Commodity)	167,632	0.302 51	0.184 31	0.486 81	0.07 12	0.19 32	0.26 44
Truck Trips (Grocery, Produce & Dairy)	1,180,338	0.037 44	0.041 48	0.078 92	0.045 53	0.037 28	0.082 81
Truck Trips (Frozen Commodity)	167,632	0.112 19	0.041 7	0.151 26	0.017 3	0.034 6	0.051 9
<b>Total Site Trips (Phase 1 + Expansion)</b>		<b>239</b>	<b>283</b>	<b>523</b>	<b>138</b>	<b>154</b>	<b>292</b>

**Table 4.3:** Trip Generation Summary – Employee and Truck Trips for Full Build-Out

The full build-out of the proposed development will generate a total of **523** and **292 two-way trips** employee and truck trips during the a.m. peak and p.m. peak hours, respectively.

#### 4.1 TRIP DISTRIBUTION AND ASSIGNMENT

Site traffic for the proposed development was assigned to the road network and proposed site access based on information provided by Boundary Properties Inc. The majority of warehouse and employee site traffic is focused on the City of Cornwall where residential areas lie to the south and west of the site. Truck traffic will mainly be travelling along eastward or westward Highway 401, with some additional trade traffic from the United States also identified. Truck traffic has been assigned to routes ensuring minimal time and distance as well as ease of travel, i.e. fewer left-turns required.

**Tables 4.6** and **4.7** provide the distribution of employee site traffic and truck site traffic, respectively. The detailed trip distribution and assignment are provided in **Appendix E**.

Direction	Inbound/Outbound Percentage Distribution
North	21%
South	46%
East	8%
West	25%
<b>TOTAL</b>	<b>100%</b>

**Table 4.6:** Traffic Distribution – Employee Site Traffic

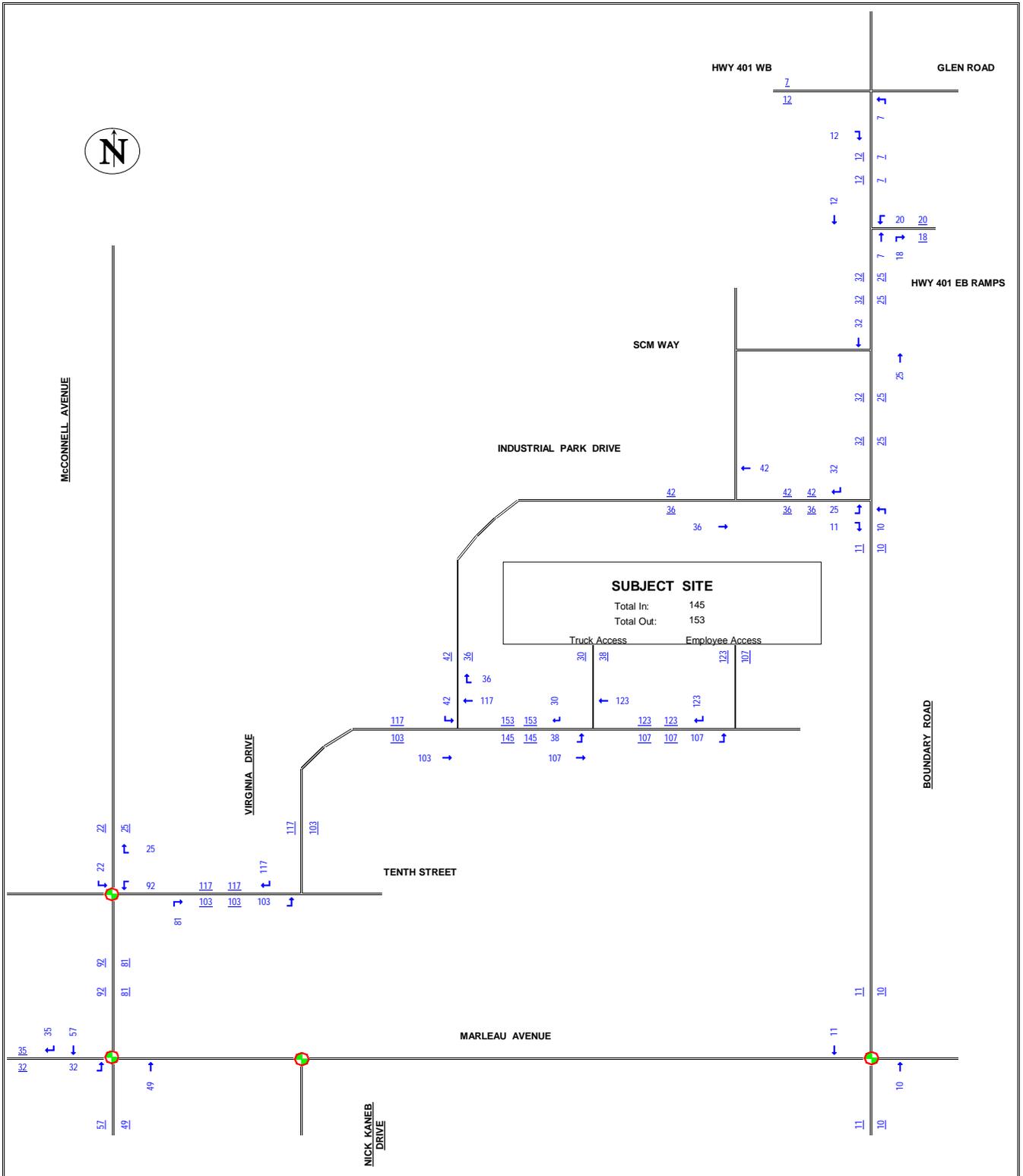
Direction	Inbound/Outbound Percentage Distribution
West via Highway 401	23%
East via Highway 401	62%
Southwest	2%
Southeast	13%
<b>TOTAL</b>	<b>100%</b>

**Table 4.7:** Traffic Distribution - Truck Site Traffic

Based on our review of the proposed road network, trucks travelling from Highway 401 will primarily use Boundary Road to Industrial Park Drive to the proposed development. Boundary Road provides direct access to Industrial Park Drive and the development. A new Highway 401/Boundary Road interchange is anticipated to be constructed within the next year with improvements to accommodate long combination vehicles (LCVs).

Currently, there is a channelized southbound right-turn lane approximately 60 metres north of the intersection of Marleau Avenue/McConnell Avenue which connects directly to Ninth Street. Southbound right-turn traffic along McConnell Avenue will have to utilize this turning lane in order to head westbound. It is noted, in the figures as listed below, the southbound right-turn distribution at the aforementioned intersection are shown for illustrative purposes only to represent the direction of traffic flow. However, the aforementioned movement is excluded in the capacity analysis as it is not a movement which is directly connected to the Marleau Avenue and McConnell Avenue intersection.

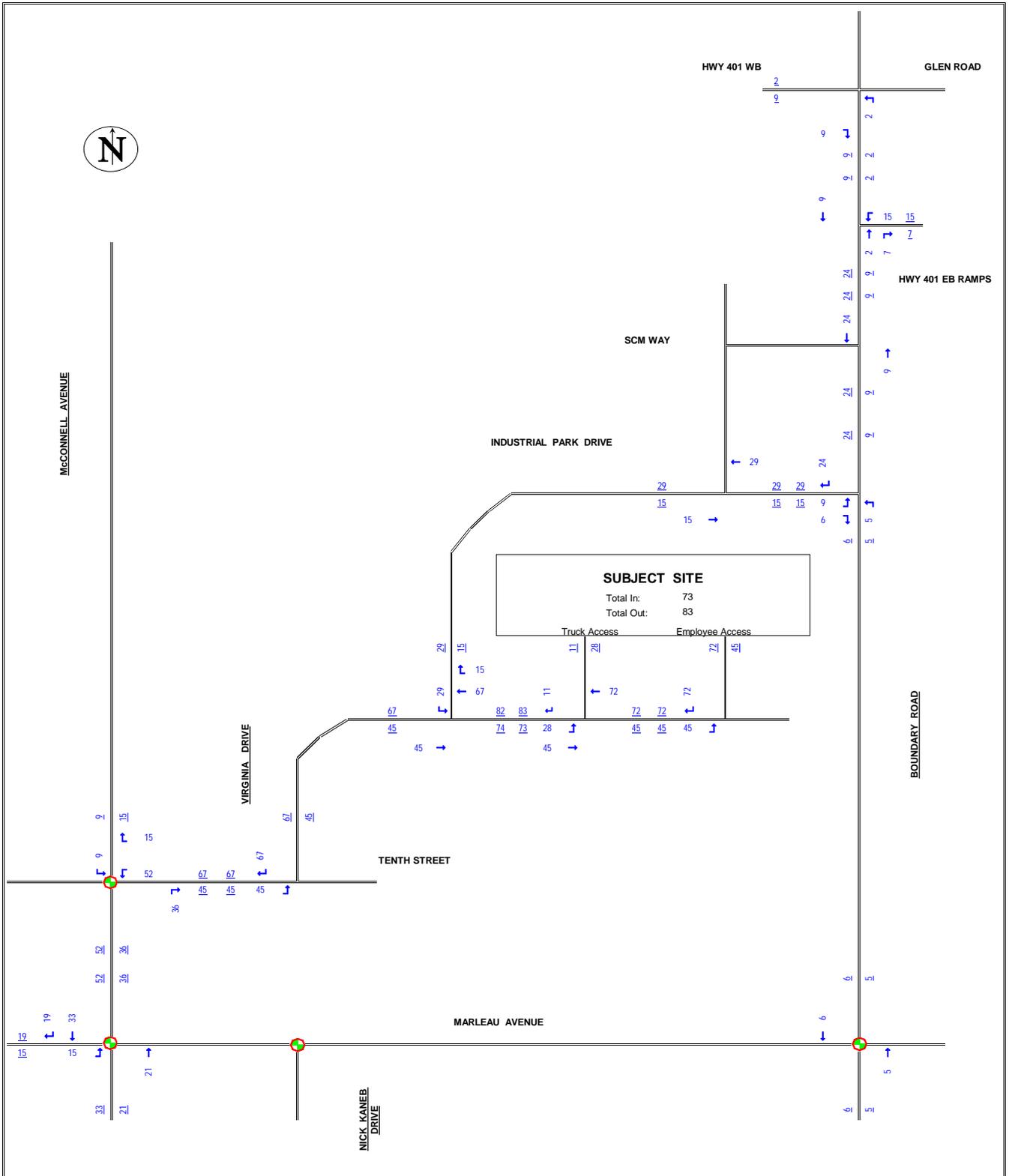
**Figure 4.1, 4.2, 4.3 and 4.4** illustrates the distribution of total site traffic under Scenario 1 and Scenario 2 traffic conditions during the a.m. and p.m. peak hours, respectively. **Figure 4.5, 4.6, 4.7 and 4.8** illustrates the distribution of total site traffic under Scenario 1 and Scenario 2 plus the future expansion traffic conditions during the a.m. and p.m. peak hours, respectively.



**Boundary Properties Ltd. - Proposed Development at Boundary Road & Highway 401**

FIGURE 4.1  
 TOTAL SITE TRAFFIC (Scenario 1)  
 Weekday AM

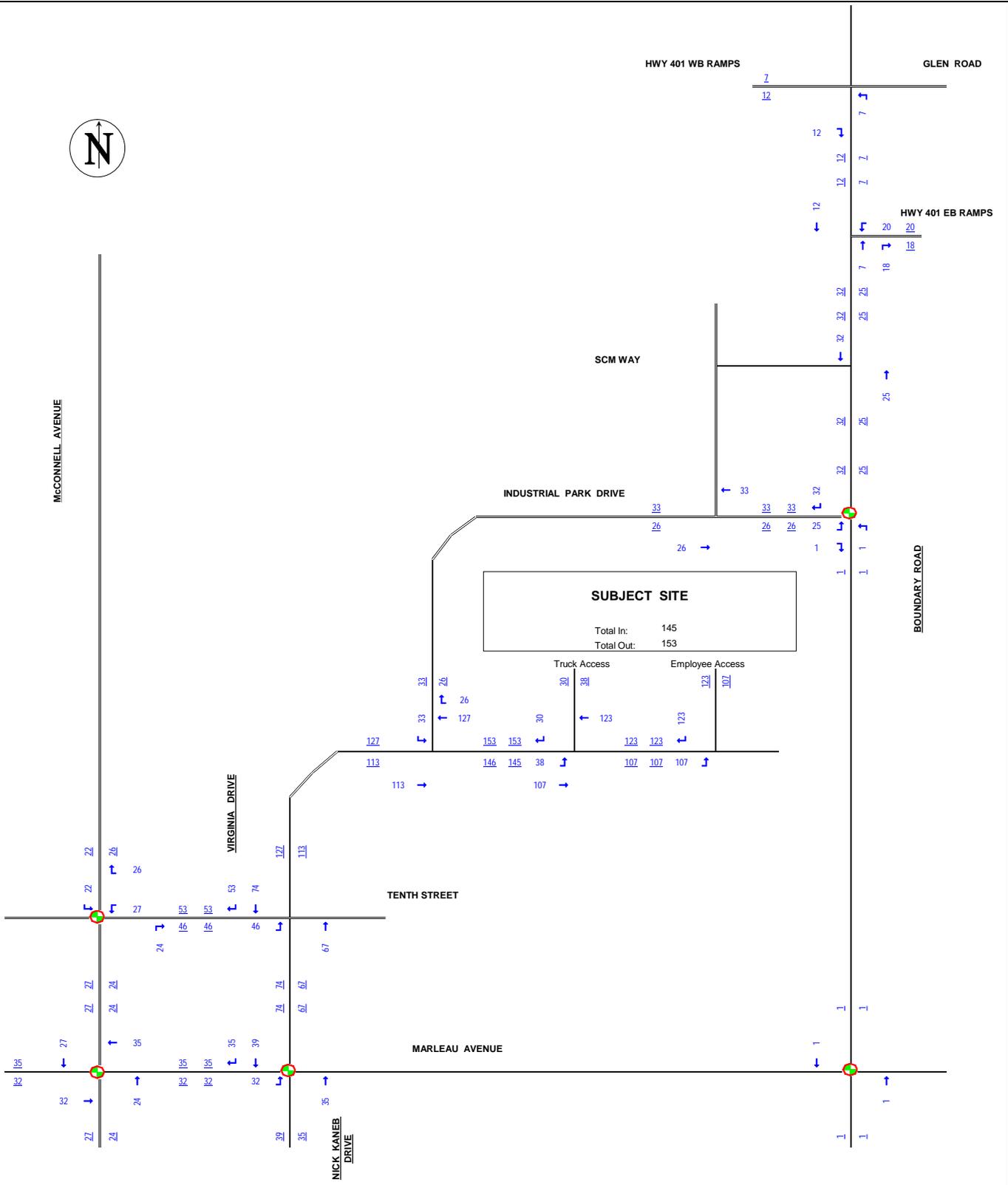




**Boundary Properties Ltd. - Proposed Development at Boundary Road & Highway 401**

FIGURE 4.2  
 TOTAL SITE TRAFFIC (Scenario 1)  
 Weekday PM





**SUBJECT SITE**

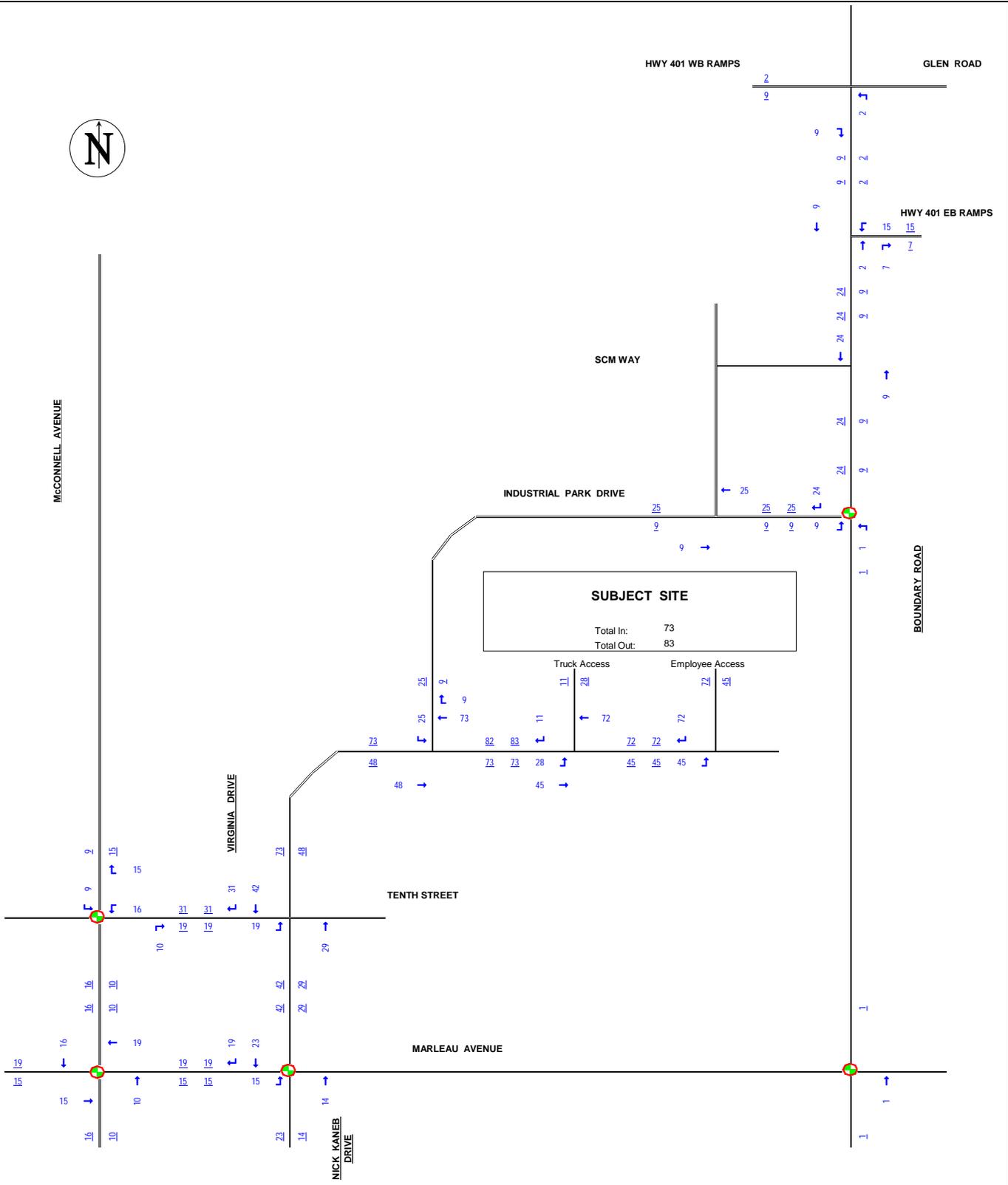
Total In: 145  
Total Out: 153

Truck Access      Employee Access

**PEAK HOUR TRAFFIC VOLUME LEVELS**

FIGURE 4.3  
TOTAL SITE TRAFFIC (Scenario 2)  
Weekday AM

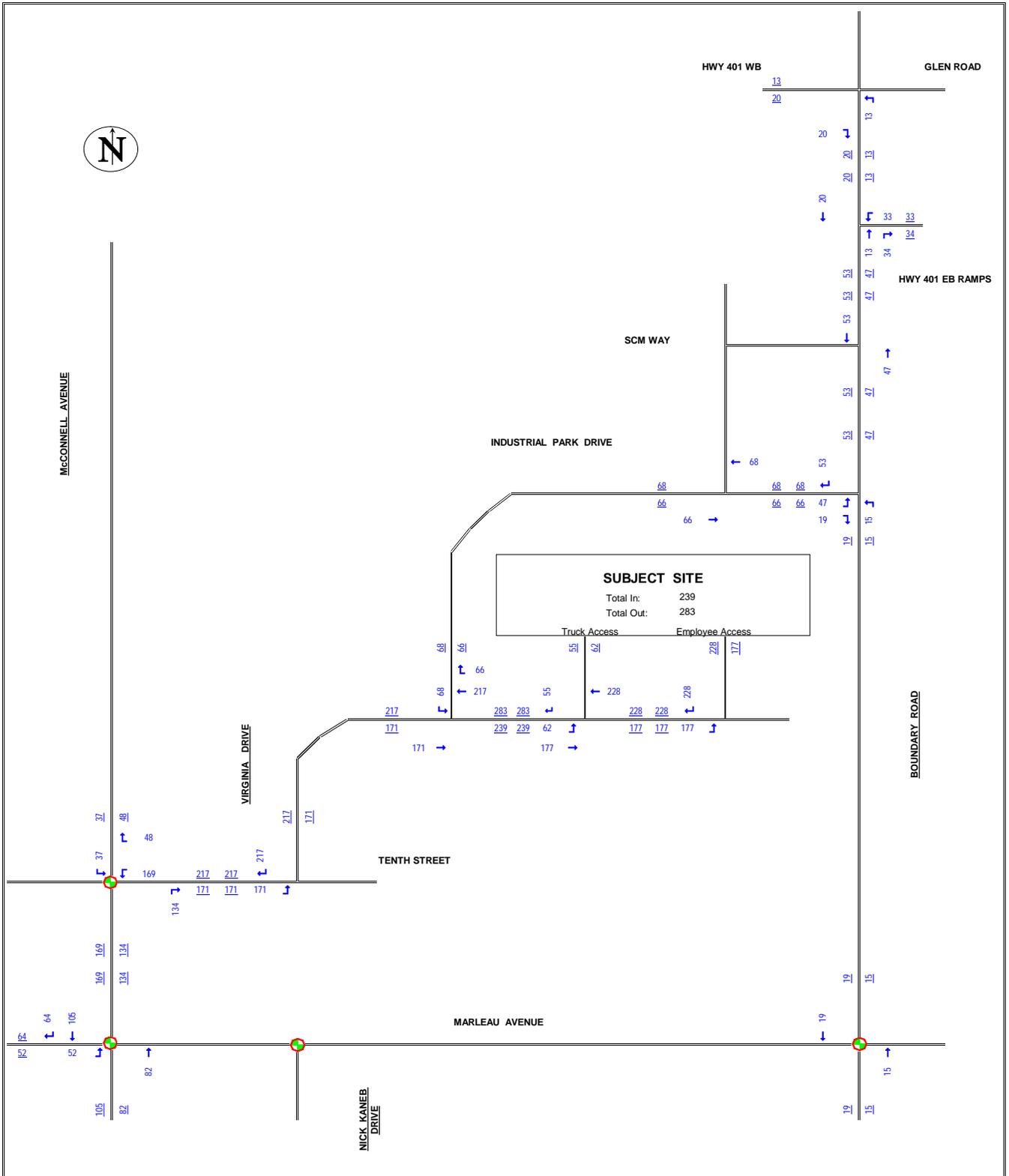




**PEAK HOUR TRAFFIC VOLUME LEVELS**

FIGURE 4.4  
 TOTAL SITE TRAFFIC (Scenario 2)  
 Weekday PM

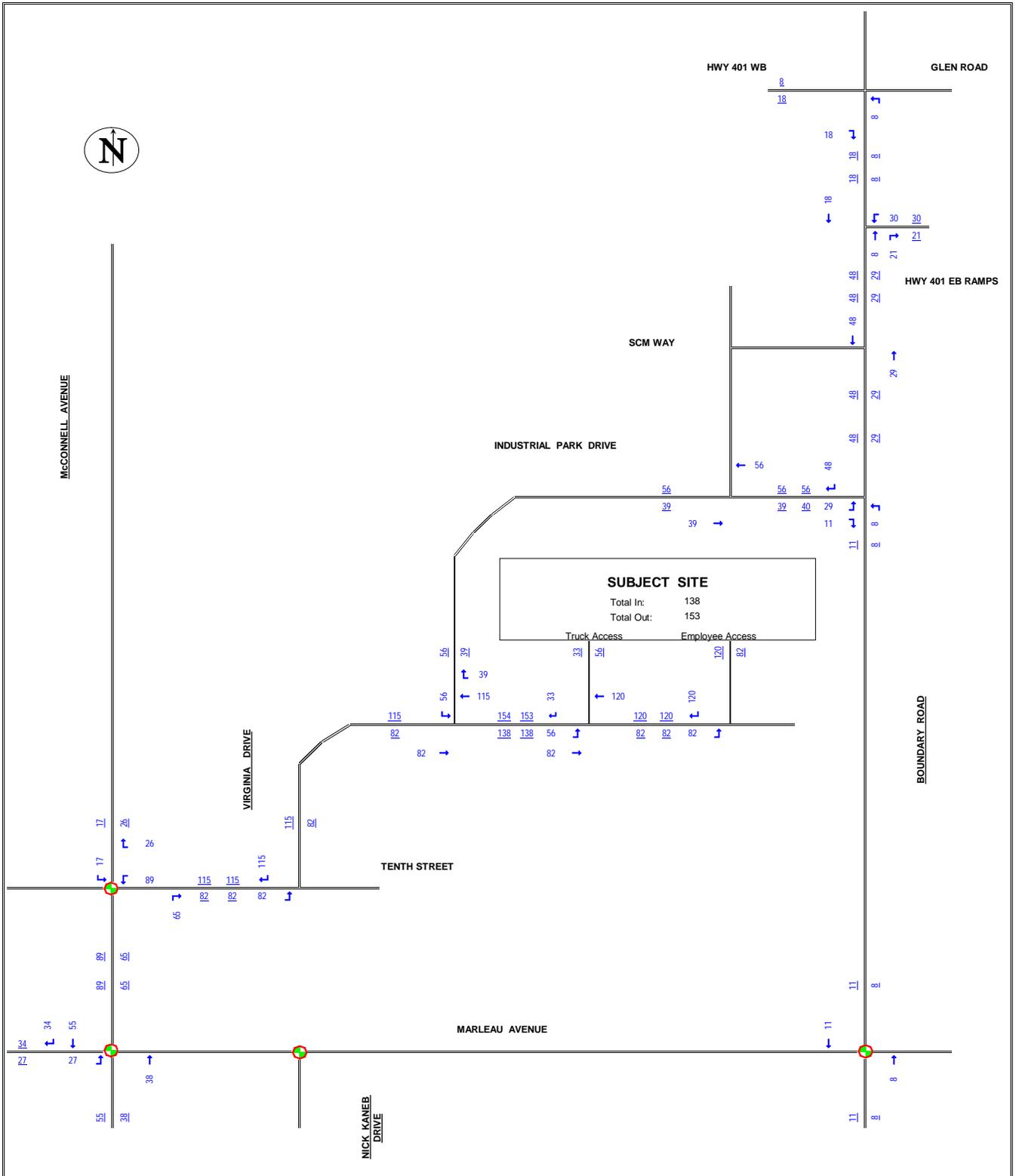




**Boundary Properties Ltd. - Proposed Development at Boundary Road & Highway 401**

FIGURE 4.5  
 TOTAL SITE TRAFFIC (Scenario 1 - Site Expansion)  
 Weekday AM

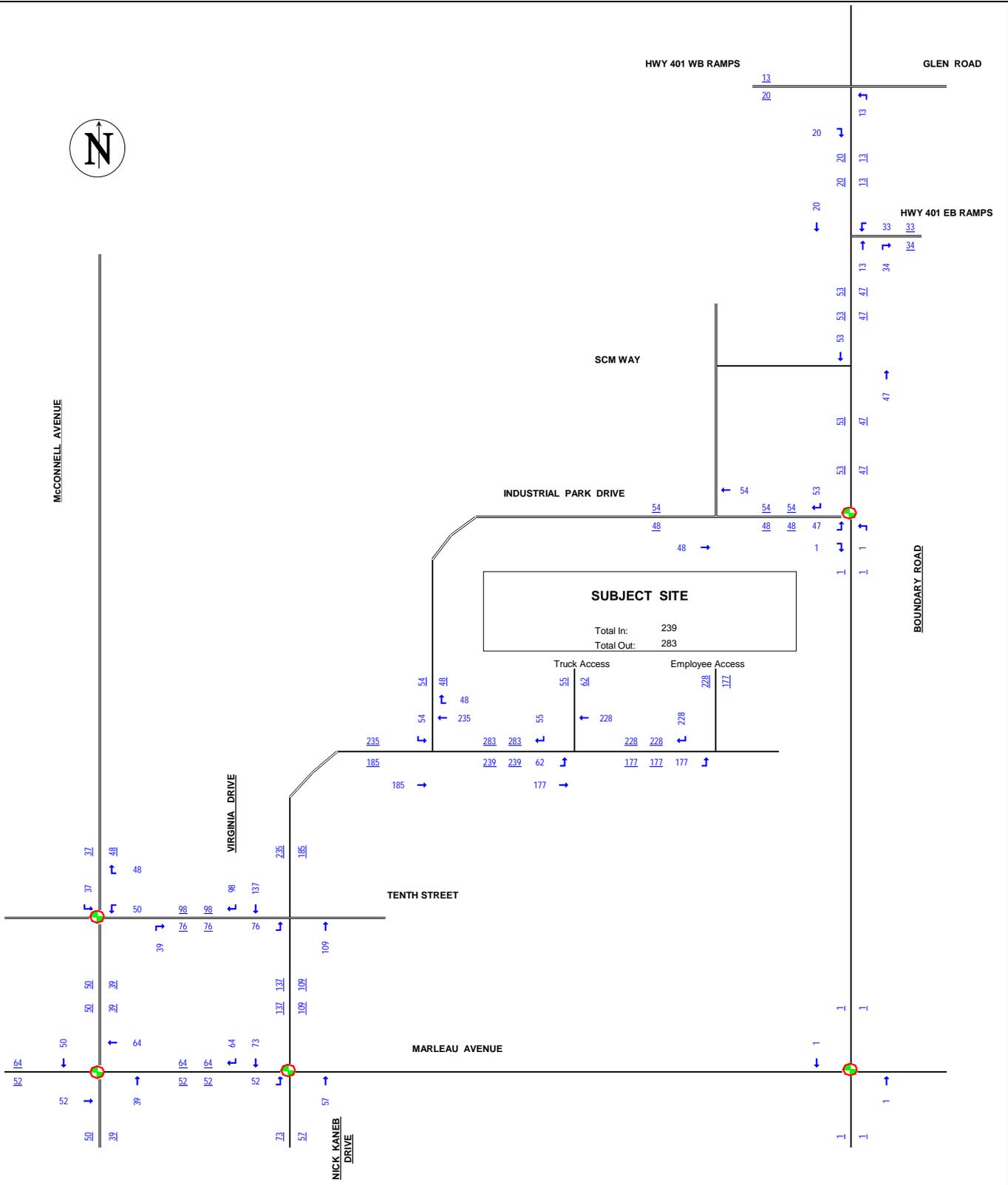




**Boundary Properties Ltd. - Proposed Development at Boundary Road & Highway 401**

FIGURE 4.6  
 TOTAL SITE TRAFFIC (Scenario 1 - Site Expansion)  
 Weekday PM

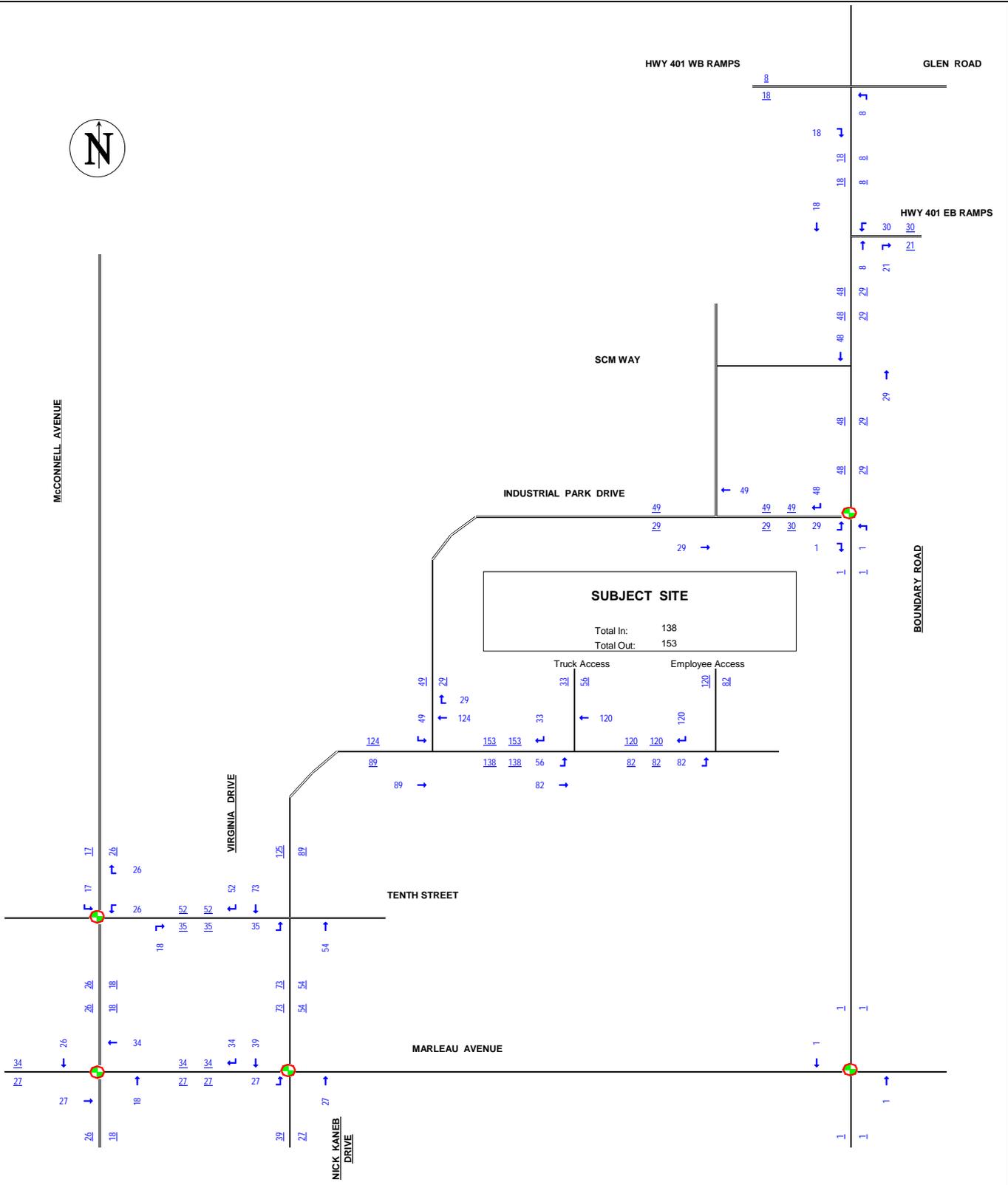




**PEAK HOUR TRAFFIC VOLUME LEVELS**

FIGURE 4.7  
TOTAL SITE TRAFFIC (Scenario 2 - Site Expansion)  
Weekday AM





**PEAK HOUR TRAFFIC VOLUME LEVELS**

FIGURE 4.8  
TOTAL SITE TRAFFIC (Scenario 2 - Site Expansion)  
Weekday PM



## 5.0 FUTURE TOTAL TRAFFIC CONDITIONS

A five-year horizon to the year 2015 is considered under Scenario 1 and 2 future total traffic conditions with alternative road alignments/improvements as described in the future background developments. The following sections outline the assumptions under the future total traffic conditions including the future planned full build-out of the Boundary Properties Ltd. Distribution Centre.

### 5.1 INTERSECTION CAPACITY ANALYSIS

Future total traffic volumes were derived from combining the site traffic volumes with the future background traffic volumes. **Figure 5.1, 5.2, 5.3** and **5.4** illustrates the future total traffic under Scenario 1 and 2 traffic conditions for the weekday a.m. and p.m. peak hours, respectively. **Figure 5.5, 5.6, 5.7** and **5.8** illustrates the future total traffic under Scenario 1 and 2 with the planned expansion traffic conditions for the weekday a.m. and p.m. peak hours, respectively.

#### 5.1.1 Scenario 1 Traffic Conditions

The analysis indicates that the proposed development at all signalized intersections will continue to operate at similar and acceptable levels of service similar to the future background traffic conditions, with minimal increase in delays during the a.m. and p.m. peak hours. The intersection of Marleau Avenue/McConnell Avenue will continue to operate at capacity due to the high level of southbound left-turn during the a.m. and p.m. peak hour.

As indicated in the future background, providing an additional southbound left-turn lane at intersection of Marleau Avenue/McConnell Avenue will help enhance the operating conditions of the intersection. The extension of Virginia Drive from Tenth Street to Marleau Avenue is recommended to ensure acceptable connectivity is provide from the proposed development to the existing road network.

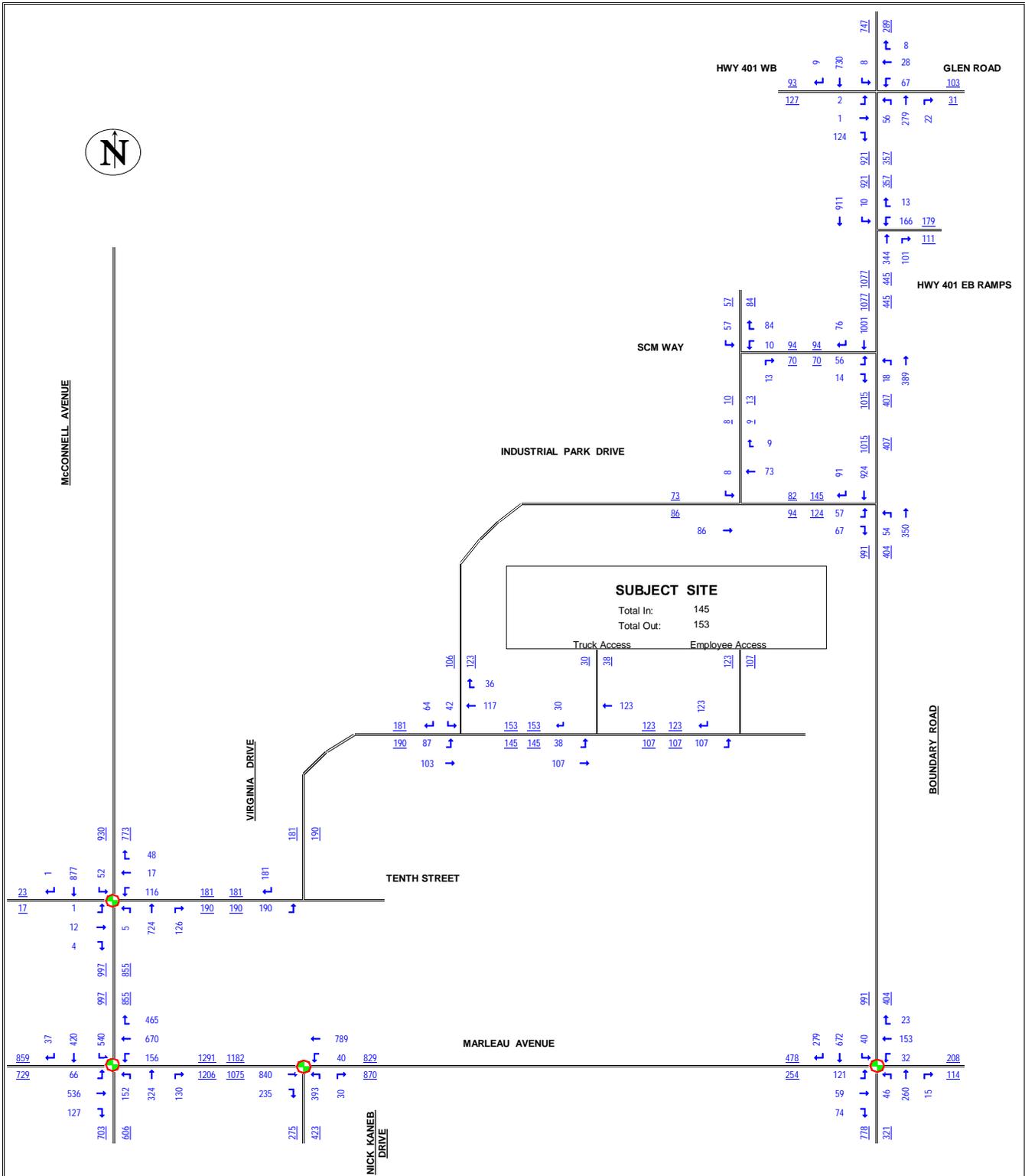
**Tables 5.1a** and **5.1b** summarize the results of the signalized intersection analyses under Scenario 1 traffic conditions with and without the dual left-turn lane at the intersection of Marleau Avenue/McConnell. Details analyses can be found in **Appendix F**.

Intersection	Weekday AM Peak Hour								Weekday PM Peak Hour							
	Overall		Movement of Interest						Overall		Movement of Interest					
	Delay (s)	LOS	Movement	V/C	Delay (s)	LOS	Queue (m)		Delay (s)	LOS	Movement	V/C	Delay (s)	LOS	Queue (m)	
							50th	95th							50th	95th
SCM Way & Boundary Road	19.6	B	-	-	-	-	-	-	10.4	B	-	-	-	-	-	-
Marleau Avenue & Boundary Road	18.1	B	-	-	-	-	-	-	20.5	C	-	-	-	-	-	-
Marleau Avenue & Nick Kaneb Drive	20.4	C	-	-	-	-	-	-	17.2	C	WBT	0.85	20.4	C	96.8	254.7
Marleau Avenue & McConnell Avenue	94.9	F	EBL	0.94	>150	F	13.1	47.5	>150	F	EBT	1.23	>150	F	171.7	281.4
			EBT	1.01	125.0	F	111.5	213.5			-	-	-	-	-	
			WBT	0.96	65.5	E	131.0	245.2			WBT	1.00	100.9	F	149.3	272.4
			NBTR	1.06	>150	F	99.1	190.6			NBTR	1.24	>150	F	164.1	273.1
			SBL	1.06	>150	F	106.9	200.7			SBL	1.29	>150	F	125.2	205.3
Tenth Street & McConnell Avenue	14.1	B	-	-	-	-	-	-	12.8	A	-	-	-	-	-	-

Table 5.1a: Future Total Traffic – Signalized Levels of Service, Scenario 1

Intersection	Weekday AM Peak Hour								Weekday PM Peak Hour								
	Overall		Movement of Interest (v/c >0.85)						Overall		Movement of Interest (v/c >0.85)						
	Delay (s)	LOS	Movement	V/C	Delay (s)	LOS	Queue (m)		Delay (s)	LOS	Movement	V/C	Delay (s)	LOS	Queue (m)		
							50th	95th							50th	95th	
Marleau Avenue & McConnell Avenue	51.5	D	EBT	0.94	67.6	E	104.5	201.8	142.2	F	EBT	1.11	>150	F	159.9	269.6	
			WBT	0.90	45.3	D	124.0	233.4			WBT	0.93	53.7	D	140.1	260.4	
			-	-	-	-	-	-			-	NBTR	1.09	>150	F	142.9	250.5
			SBL	0.90	52.8	D	56.3	104.4			SBL	1.15	>150	F	66.9	117.9	

Table 5.1b: Future Total Traffic – Signalized Levels of Service, Scenario 1 (Dual Left-Turn Lane)



**Boundary Properties Ltd. - Proposed Development at Boundary Road & Highway 401**

FIGURE 5.1  
 FUTURE TOTAL TRAFFIC (Scenario 1)  
 Weekday AM







McCONNELL AVENUE

VIRGINIA DRIVE

TENTH STREET

MARLEAU AVENUE

NICK KANE DRIVE

INDUSTRIAL PARK DRIVE

SCM WAY

HWY 401 WB RAMPS

HWY 401 EB RAMPS

BOUNDARY ROAD

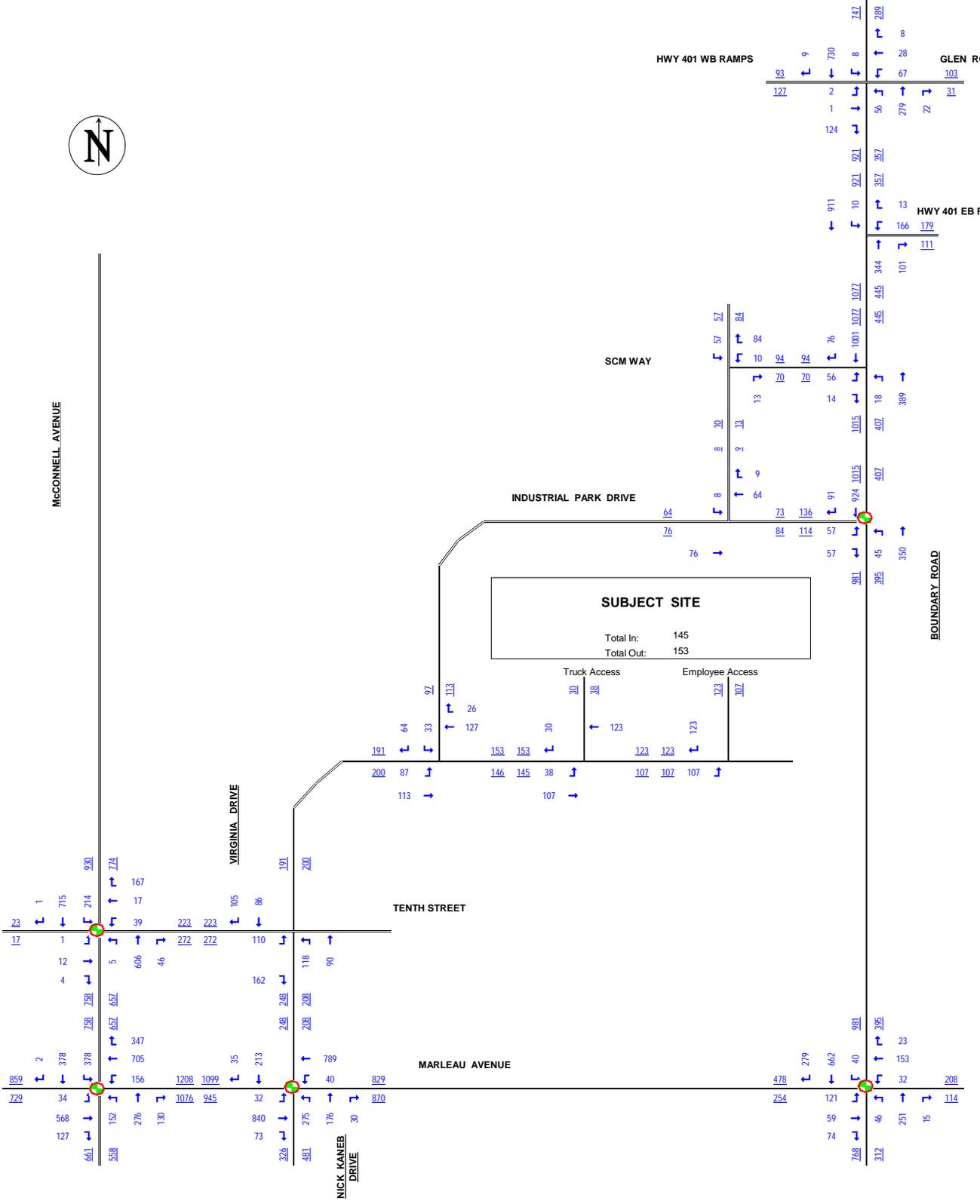
GLEN ROAD

SUBJECT SITE

Total In: 145  
Total Out: 153

Truck Access

Employee Access



**PEAK HOUR TRAFFIC VOLUME LEVELS**

FIGURE 5.3  
FUTURE TOTAL TRAFFIC (Scenario 2)  
Weekday AM





McCONNELL AVENUE

VIRGINIA DRIVE

NICK KANE DRIVE

TENTH STREET

MARLEAU AVENUE

INDUSTRIAL PARK DRIVE

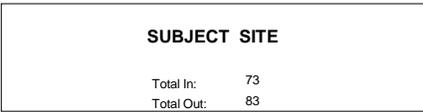
SCM WAY

HWY 401 WB RAMPS

HWY 401 EB RAMPS

BOUNDARY ROAD

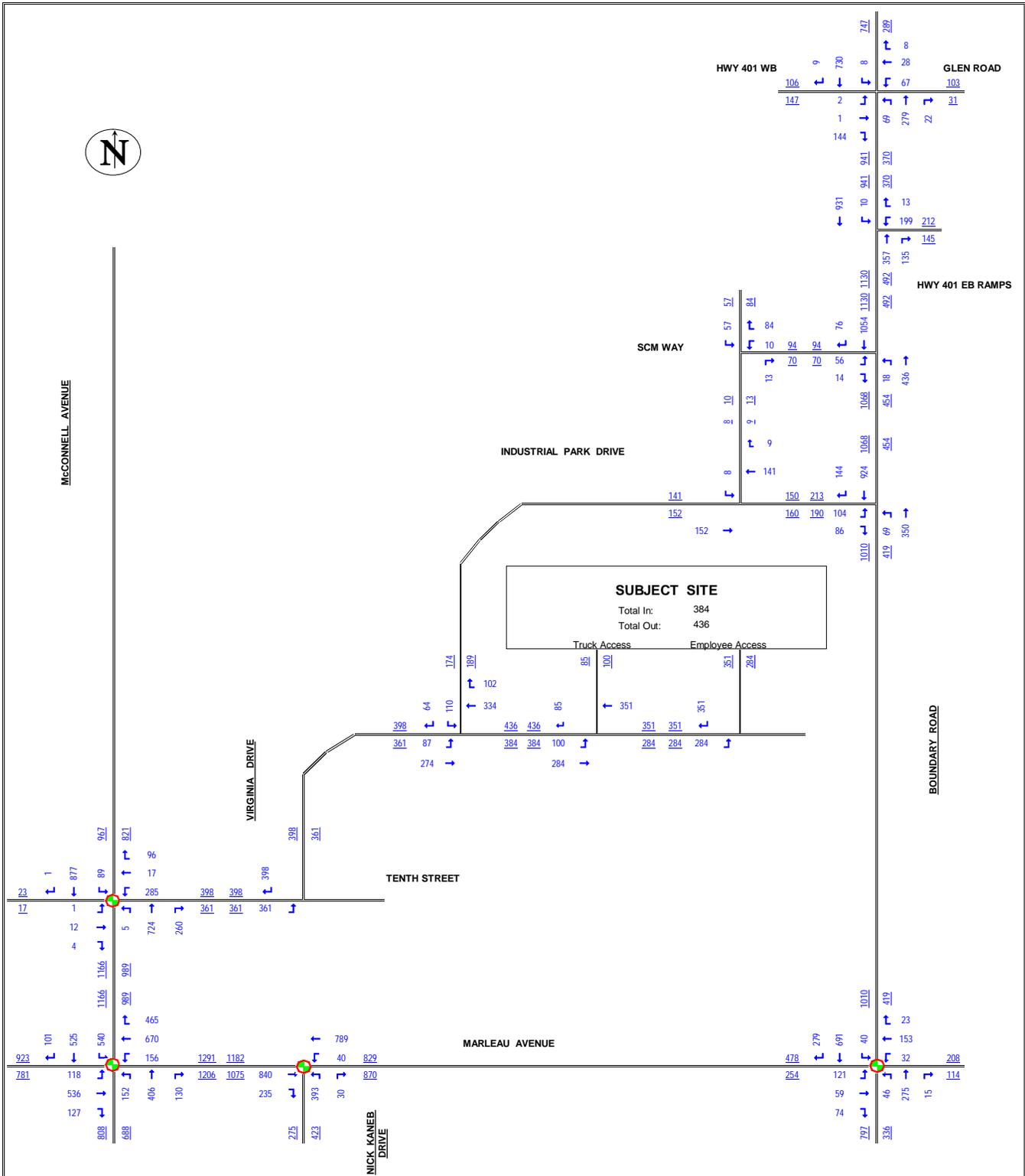
GLEN ROAD



**PEAK HOUR TRAFFIC VOLUME LEVELS**

FIGURE 5.4  
FUTURE TOTAL TRAFFIC (Scenario 2)  
Weekday PM

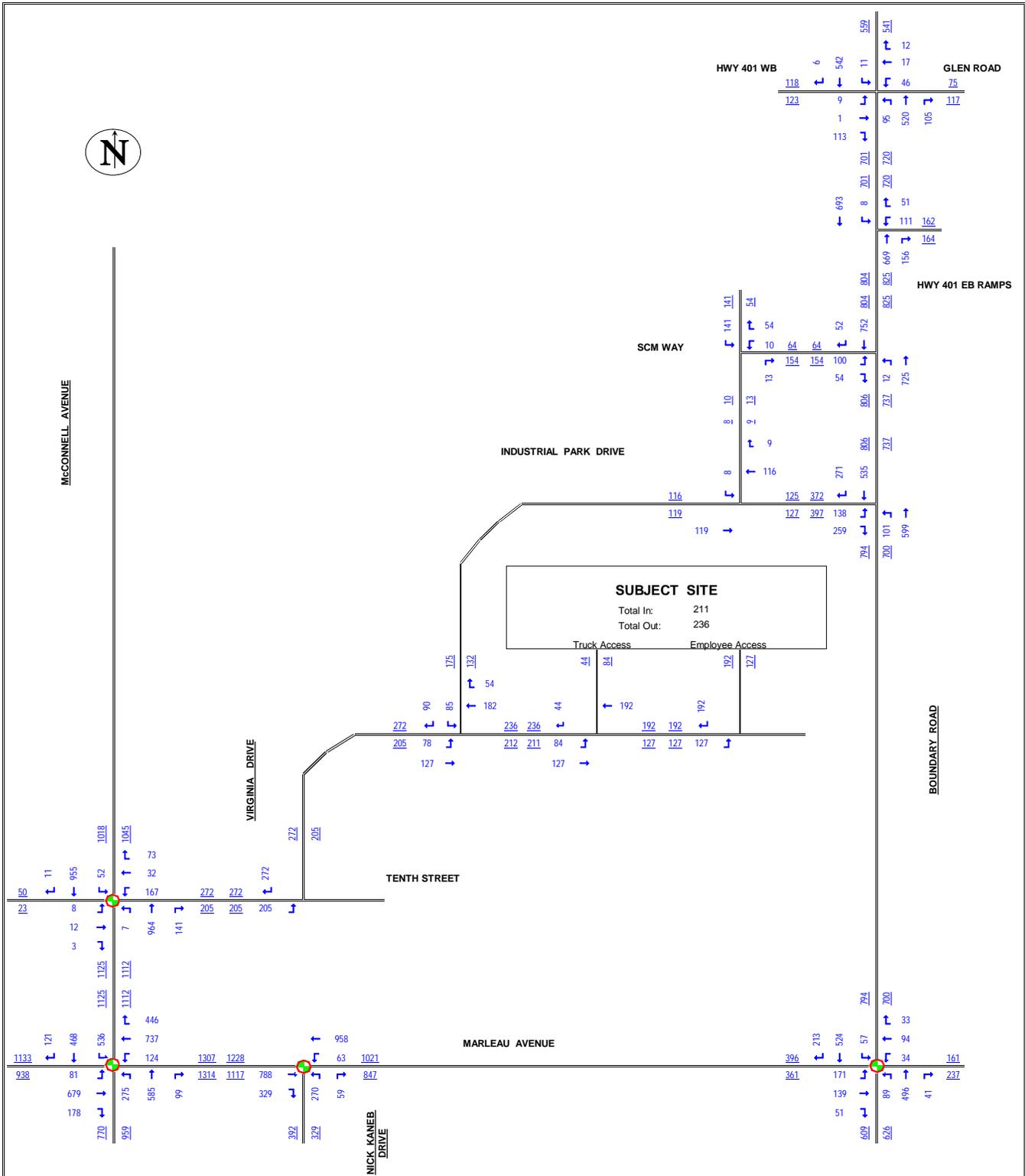




**Boundary Properties Ltd. - Proposed Development at Boundary Road & Highway 401**

FIGURE 5.5  
 FUTURE TOTAL TRAFFIC (Scenario 1 - Site Expansion)  
 Weekday AM





**Boundary Properties Ltd. - Proposed Development at Boundary Road & Highway 401**

FIGURE 5.6  
 FUTURE TOTAL TRAFFIC (Scenario 1 - Site Expansion)  
 Weekday PM







McCONNELL AVENUE

VIRGINIA DRIVE

TENTH STREET

MARLEAU AVENUE

NICK KANE DRIVE

INDUSTRIAL PARK DRIVE

SCM WAY

HWY 401 WB RAMPS

HWY 401 EB RAMPS

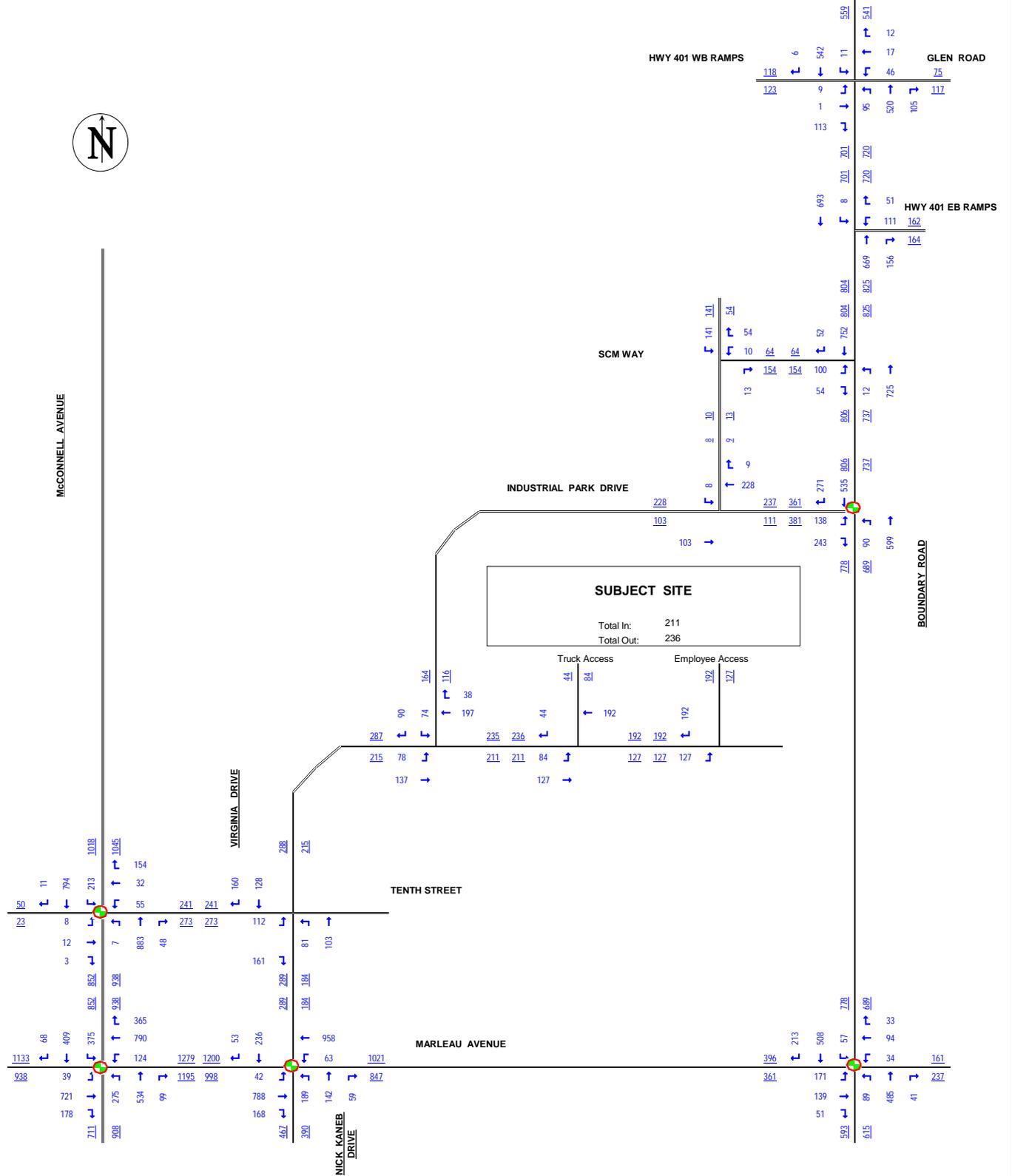
BOUNDARY ROAD

GLEN ROAD

SUBJECT SITE

Total In: 211  
Total Out: 236

Truck Access Employee Access



**PEAK HOUR TRAFFIC VOLUME LEVELS**

FIGURE 5.8  
FUTURE TOTAL TRAFFIC (Scenario 2 - Site Expansion)  
Weekday PM



The unsignalized intersection levels of service analysis under future total traffic conditions yield similar results compared to the future background traffic conditions during the a.m. and p.m. peak hours. **Tables 5.2** summarize the results of the signalized intersection analyses. Detail analyses can be found in **Appendix F**.

Intersection	Movement of Interest	Weekday AM Peak Hour					Weekday PM Peak Hour				
		Flow Rate (vph)	Capacity (vph)	Vol/Cap Ratio (v/c)	Control Delay (s)	LOS	Flow Rate (vph)	Capacity (vph)	Vol/Cap Ratio (v/c)	Control Delay (s)	LOS
Hwy 401 WB Ramp & Boundary Road	EBLTR	3	152	0.02	29.1	D	10	111	0.09	40.7	E
	EBR	124	418	0.30	17.2	C	86	538	0.16	13.0	B
	WBL	67	96	0.70	119.3	F	46	92	0.50	81.8	F
	WBTR	36	221	0.16	24.5	C	29	205	0.14	25.5	D
	NBL	357	841	0.07	2.2	A	710	1021	0.08	2.1	A
	SBL	747	1272	0.01	0.2	A	559	956	0.01	0.3	A
Hwy 401 EB Ramp & Boundary Road	WBL	166	180	0.92	>150	F	66	166	0.40	40.7	E
	WBR	13	703	0.02	10.2	B	51	464	0.11	13.7	B
	SBL	10	1126	0.01	0.2	A	8	832	0.01	0.3	A
Industrial Park Drive & Boundary Road	EBL	57	113	0.51	68.5	F	100	135	0.74	97.4	F
	EBR	67	301	0.22	20.4	C	242	480	0.50	20.1	C
	NBL	54	692	0.08	10.6	B	88	865	0.10	9.6	A
Industrial Park Drive & Optimum Drive	SBLR	8	645	0.01	10.7	B	8	707	0.01	10.1	B
Optimum Drive & SCM Way	SBLR	57	770	0.07	10.0	B	141	787	0.18	10.6	B
Tenth Street & Virginia Drive	EBL	190	1617	0.12	7.5	A	78	1578	0.05	7.4	A
	SBLR	181	1056	0.17	9.1	A	90	1088	0.08	8.6	A
Virginia Drive & Industrial Park Drive	EBL	87	1434	0.06	3.8	A	78	1597	0.05	7.4	A
	SBLR	106	626	0.17	11.9	B	90	1088	0.08	8.6	A

**Table 5.2:** Future Total Traffic – Unsignalized Level of Service, Scenario 1

### 5.1.2 Scenario 2 Traffic Conditions

Under Scenario 2 traffic conditions, the signalized intersections will continue to operate at acceptable levels of service, except for the Marleau Avenue and McConnell Avenue, similar to the future background traffic conditions during the a.m. and p.m. peak hours. The intersection of Marleau Avenue/McConnell Avenue will continue to experience capacity constraints and noticeable delays. The extension of Virginia Drive to Marleau Avenue would be used an alternative means of accessing the site, which will help alleviate some of the congestion at the intersection of Marleau Avenue/McConnell Avenue.

With the recommended road improvements as outlines in the future background traffic conditions, the intersection of Nick Kenab Drive and McConnell Avenue at Marleau Avenue will continue to operate at acceptable levels of service with minimum delays.

**Tables 5.3a** summarize the results of the signalized intersection analyses and **Table 5.3b** summarize the analyses with road improvements. Details analyses can be found in **Appendix F**.

Intersection	Weekday AM Peak Hour								Weekday PM Peak Hour							
	Overall		Movement of Interest						Overall		Movement of Interest					
	Delay (s)	LOS	Movement	V/C	Delay (s)	LOS	Queue (m)		Delay (s)	LOS	Movement	V/C	Delay (s)	LOS	Queue (m)	
50th							95th	50th							95th	
SCM Way & Boundary Road	18.5	B	SBT	0.86	22.3	C	273.6	398.3	21.1	B	SBT	-	-	-	-	-
Marleau Avenue & Boundary Road	17.8	B	-	-	-	-	-	-	19.8	B	-	-	-	-	-	-
Marleau Avenue & Virginia Drive (Nick Kaneb Drive)	27.2	C	EBT	0.87	26.5	C	103.0	219.0	21.9	C	-	-	-	-	-	-
			NBL	0.91	65.8	E	38.1	97.0			NBL	0.87	69.0	E	31.5	78.7
Marleau Avenue & McConnell Avenue	37.6	D	EBT	0.86	45.9	D	106.2	202.4	>150	F	EBT	1.15	>150	E	167.6	278.6
			WBT	0.87	29.4	C	126.8	239.5			WBT	0.98	45.5	F	148.1	273.0
			NBTR	0.87	59.6	E	75.3	156.9			NBTR	1.16	>150	F	148.0	254.8
			SBL	0.90	39.5	D	49.6	121.1			SBL	1.15	>150	F	74.8	158.1
Tenth Street & McConnell Avenue	12.8	B	-	-	-	-	-	-	11.0	B	-	-	-	-	-	-

Table 5.3a: Future Total Traffic – Signalized Level of Service, Scenario 2

Intersection	Weekday AM Peak Hour								Weekday PM Peak Hour							
	Overall		Movement of Interest						Overall		Movement of Interest					
	Delay (s)	LOS	Movement	V/C	Delay (s)	LOS	Queue (m)		Delay (s)	LOS	Movement	V/C	Delay (s)	LOS	Queue (m)	
50th							95th	50th							95th	
Marleau Avenue & Virginia Drive (Nick Kaneb Drive)	26.1	C	EBT	0.85	27.4	C	116.6	262.9	19.9	B	-	-	-	-	-	-
			-	-	-	-	-	-			WBT	0.87	22.7	C	104.2	257.8
Marleau Avenue & McConnell Avenue	26.1	C	-	-	-	-	-	-	38.1	D	NBTR	0.96	73.0	E	118.9	229.1
			-	-	-	-	-	-			SBL	0.92	56.3	E	44.0	139.9

Table 5.3b: Future Total Traffic – Signalized Level of Service, Scenario 2 (Road Improvements)

All unsignalized capacity analysis will continue to operate at acceptable levels of service. The westbound left-turn movements onto Boundary Road will continue to experience capacity constraints during the a.m. and p.m. peak hours due to large amounts of vehicular traffic exiting from Highway 401. **Tables 5.4** summarize the results of the unsignalized intersection analyses. Details analyses can be found in **Appendix F**.

Intersection	Movement of Interest	Weekday AM Peak Hour					Weekday PM Peak Hour				
		Flow Rate (vph)	Capacity (vph)	Vol/Cap Ratio (v/c)	Control Delay (s)	LOS	Flow Rate (vph)	Capacity (vph)	Vol/Cap Ratio (v/c)	Control Delay (s)	LOS
Hwy 401 WB Ramp & Boundary Road	EBLT	3	152	0.02	29.2	D	10	110	0.09	41.0	E
	EBR	124	407	0.30	17.7	C	95	538	0.18	13.1	B
	WBL	67	95	0.71	123.5	F	46	88	0.52	88.3	F
	WBTR	36	220	0.16	24.5	C	29	204	0.14	25.6	D
	NBL	56	819	0.07	2.2	A	87	1021	0.09	2.1	A
	SBL	8	1272	0.01	0.2	A	11	956	0.01	0.3	A
Hwy 401 EB Ramp & Boundary Road	WBL	166	174	0.95	>150	F	81	164	0.49	48.0	E
	WBR	13	703	0.02	10.2	B	51	462	0.11	13.7	B
	SBLT	10	1126	0.01	0.2	A	8	826	0.01	0.3	A
Industrial Park Drive & Boundary Road	EBL	57	111	0.52	70.8	F	109	104	1.05	>150	F
	EBR	57	298	0.19	19.9	C	242	458	0.53	21.6	C
	NBL	45	683	0.07	10.6	B	89	852	0.10	9.7	A
Industrial Park Drive & Optimum Drive	SBLR	8	663	0.01	10.5	B	8	562	0.01	11.5	B
Optimum Drive & SCM Way	SBLR	57	770	0.07	10.0	B	141	787	0.18	10.6	B
Tenth Street & Virginia Drive	EBLTR	292	622	0.85	15.6	C	238	803	0.30	11.4	B
	WBLTR	30	431	0.00	14.0	B	81	1428	0.06	4.9	A
	NBL	118	1395	0.10	4.6	A	-	-	-	-	-
	SBL	10	1505	0.01	0.4	A	-	-	-	-	-
Virginia Avenue & Industrial Park Drive	EBLT	87	1434	0.06	3.6	A	126	1522	0.05	4.8	A
	SBLR	97	630	0.15	11.7	B	115	800	0.14	10.3	B

Table 5.4: Future Total Traffic – Unsignalized Level of Service, Scenario 2

### 5.1.3 Scenario 1 with Planned Expansion Traffic Conditions

Based on analysis results, under Scenario 1 with the distribution expansion all signalized intersections will continue to operate under acceptable levels of service with the exception of the intersection of Marleau Avenue/McConnell Avenue. The eastbound, westbound and northbound through movements will operate near/above capacity during the a.m. and p.m. peak hours, due to heavy volumes of through traffic along these major arterial roads. Site traffic would benefit from the southerly extension of Virginia Drive to Marleau Avenue as it would provide an alternate route to avoid the Marleau Avenue/McConnell Avenue intersection.

With the provision of providing a dual left-turn lane at the intersection of Marleau Avenue/McConnell Avenue, the intersection will slightly enhance in operations to permit improve connectivity into proposed development. Due to the limited capacity at this intersection, traffic congestion at this intersection can be expected. The mixture of development traffic along with existing through traffic will create an undesirable operating condition. A broader review of the road network or provision alternate access into the proposed development will be beneficial.

Tables 5.5a and 5.5b summarize the results of the signalized intersection analyses without/with the option of the dual left-turn lane at the intersection of Marleau Avenue/McConnell Avenue. Details analyses can be found in Appendix F.

Intersection	Weekday AM Peak Hour								Weekday PM Peak Hour							
	Overall		Movement of Interest						Overall		Movement of Interest					
	Delay (s)	LOS	Movement	V/C	Delay (s)	LOS	Queue (m)		Delay (s)	LOS	Movement	V/C	Delay (s)	LOS	Queue (m)	
							50th	95th							50th	95th
SCM Way & Boundary Road	36.6	D	SBT	0.97	50.5	D	~281.5	#404.7	11.2	B	-	-	-	-	-	-
Marleau Avenue & Boundary Road	18.9	B	-	-	-	-	-	-	21.0	C	-	-	-	-	-	-
Marleau Avenue & Nick Kaneb Drive	20.4	C	-	-	-	-	-	-	17.0	B	WBT	0.85	20.2	C	95.9	254.0
Marleau Avenue & McConnell Avenue	>150	F	EBL	1.76	>150	F	36.0	70.0	>150	F	EBL	1.23	>150	F	20.6	58.6
			EBT	1.01	125.0	F	111.5	213.5			EBT	1.23	>150	F	171.7	281.4
			WBT	0.96	65.5	E	131.0	245.2			WBT	1.00	38.4	F	149.3	272.4
			NBTR	1.24	>150	F	134.2	234.6			NBTR	1.31	>150	F	180.5	292.9
			SBL	1.07	>150	F	105.7	143.2			SBL	1.26	>150	F	123.1	178.9
Tenth Street & McConnell Avenue	41.9	D	WBLTR	0.98	107.7	F	91.2	185.0	21.8	C	WBLTR	0.86	63.1	E	49.6	111.6
			NBTR	0.94	26.9	C	184.4	193.9			NBTR	0.90	16.2	E	216.7	209.8
			SBT	0.86	99.4	F	117.8	214.2			-	-	-	-	-	-

Table 5.5a: Future Total Traffic – Signalized Level of Service, Scenario 1 with Full Build-Out

Intersection	Weekday AM Peak Hour								Weekday PM Peak Hour							
	Overall		Movement of Interest (v/c >0.85)						Overall		Movement of Interest (v/c >0.85)					
	Delay (s)	LOS	Movement	V/C	Delay (s)	LOS	Queue (m)		Delay (s)	LOS	Movement	V/C	Delay (s)	LOS	Queue (m)	
							50th	95th							50th	95th
Marleau Avenue & McConnell Avenue	93.8	F	EBT	0.89	49.5	D	102.9	197.9	>150	F	EBT	1.13	>150	F	163.8	273.6
			WBT	1.07	>150	F	152.1	261.0			WBT	1.19	>150	F	186.2	300.6
			NBTR	0.99	106.5	F	105.7	210.6			NBTR	-	-	-	-	-
			SBL	1.07	147.0	F	63.0	82.6			SBL	1.34	>150	F	75.1	105.5

Table 5.5b: Future Total Traffic – Signalized Level of Service, Scenario 1 with Full Build-Out (Dual Left-turn Lane)

Similar to Scenario 1 traffic conditions without the planned expansion, the unsignalized intersections exhibit acceptable levels of service with the exception of certain movements at Highway 401 ramp interchanges and the eastbound movement at the Industrial Park/Boundary intersection. Site traffic would benefit from using alternative routes, including Boundary Road to access the site.

Tables 5.6 summarize the results of the unsignalized intersection analyses. Details analyses can be found in Appendix F.

Intersection	Movement of Interest	Weekday AM Peak Hour					Weekday PM Peak Hour				
		Flow Rate (vph)	Capacity (vph)	Vol/Cap Ratio (v/c)	Control Delay (s)	LOS	Flow Rate (vph)	Capacity (vph)	Vol/Cap Ratio (v/c)	Control Delay (s)	LOS
Hwy 401 WB Ramp & Boundary Road	EBLT	3	142	0.02	30.8	D	10	107	0.09	42.1	E
	EBR	144	389	0.37	19.7	C	113	498	0.23	14.3	B
	WBL	67	78	0.86	>150	F	46	78	0.59	111.2	F
	WBTR	36	208	0.17	25.9	D	29	199	0.15	26.1	D
	NBL	69	757	0.09	2.8	A	95	978	0.10	2.4	A
	SBL	8	1272	0.01	0.2	A	11	966	0.01	0.3	A
Hwy 401 EB Ramp & Boundary Road	WBL	199	154	1.29	>150	F	111	130	0.85	144.6	F
	WBTR	13	692	0.02	10.3	B	51	461	0.11	13.8	B
	SBL	10	1082	0.01	0.2	A	8	814	0.01	0.3	A
Industrial Park Drive & Boundary Road	EBL	104	85	1.22	>150	F	138	106	1.31	>150	F
	EBR	86	290	0.30	22.6	C	259	456	0.57	23.2	C
	NBL	69	649	0.11	11.2	B	101	804	0.13	10.1	B
Industrial Park Drive & Optimum Drive	SBLR	8	529	0.02	11.9	B	8	577	0.01	11.3	B
Optimum Drive & SCM Way	SBLR	57	770	0.07	10.0	B	141	787	0.18	10.6	B
Tenth Street & Virginia Drive	EBLT	-	-	-	-	-	205	1585	0.13	7.6	A
	SBLR	398	677	0.59	17.8	C	272	1085	0.25	9.4	A
Virginia Drive & Industrial Park Drive	EBL	87	1129	0.08	2.6	A	78	1308	0.06	3.3	A
	EBLR	174	352	0.49	25.1	D	175	534	0.33	15.0	C

Table 5.6: Future Total Traffic – Unsignalized Level of Service, Scenario 1 with Full Build-Out

#### 5.1.4 Scenario 2 with Planned Expansion Traffic Conditions

Based on analysis results, all signalized intersections will continue to operate at acceptable levels of service during the a.m. and p.m. peak hours with the exception of Marleau Avenue and McConnell Avenue. The intersection of Marleau Avenue/McConnell Avenue will continue to experience capacity constraints as it is one of the busiest intersections in carrying significant volumes of commuter traffic within the City of Cornwall. Despite the extension of Virginia Drive to Marleau Avenue, the signalized intersection of Marleau Avenue and McConnell Avenue will continue to operate with noticeable delays during the p.m. peak hour. Due to the heavy east/west through traffic volume, the widening of McConnell Avenue is required to alleviate the capacity constraint and delays.

Tables 5.7a summarize the results of the signalized intersection analyses. Details analyses can be found in Appendix F.

Intersection	Weekday AM Peak Hour								Weekday PM Peak Hour							
	Overall		Movement of Interest						Overall		Movement of Interest					
	Delay (s)	LOS	Movement	V/C	Delay (s)	LOS	Queue (m)		Delay (s)	LOS	Movement	V/C	Delay (s)	LOS	Queue (m)	
50th							95th	50th							95th	
SCM Way & Boundary Road	26.7	C	SBT	0.94	35.0	C	281.5	424.1	19.4	B	SBT	-	-	-	-	-
Marleau Avenue & Boundary Road	17.8	B	-	-	-	-	-	-	20.6	C	-	-	-	-	-	-
Marleau Avenue & Virginia Drive (Nick Kaneb Drive)	55.8	E	EBL	0.95	>150	F	11.4	33.2	20.1	C	-	-	-	-	-	-
			EBT	0.98	65.0	E	117.0	234.2			-	-	-	-	-	-
			WBT	0.92	39.7	D	104.2	214.9			-	-	-	-	-	-
			NBL	1.02	>150	F	41.6	103.9			-	-	-	-	-	-
Marleau Avenue & McConnell Avenue	55.6	E	EBT	0.95	68.7	E	121.6	230.6	>150	F	EBT	1.17	>150	F	170.1	281.5
			WBT	0.96	61.3	E	147.7	273.7			WBT	1.02	117.1	F	159.4	281.5
			NBTR	0.95	86.1	F	86.0	177.6			NBTR	1.04	>150	F	136.3	243.5
			SBL	0.96	76.2	E	37.2	129.2			SBL	1.14	>150	F	70.6	153.9
Tenth Street & McConnell Avenue	20.2	C	-	-	-	-	-	-	14.3	B	-	-	-	-	-	-

Table 5.7a: Future Total Traffic – Signalized Levels of Service, Scenario 2 with Full Build-Out

With the full build out the proposed development, providing the additional eastbound and westbound through lane at the intersection of Marleau Avenue/McConnell Avenue will greatly improve the overall operations of this intersection. As summarized in **Table 5.7b** below, the intersection will continue to operate at expectable levels of service with minimum delays. Alternatively, additional connectivity is provided for site traffic with the southerly extension of Virginia Drive and by providing the additional through lanes at Marleau Avenue/McConnell Avenue intersection, it will ensure that there is sufficient capacity to accommodate vehicular traffic to/from eastbound and westbound direction along Marleau Avenue. Details analyses can be found in **Appendix F**.

Intersection	Weekday AM Peak Hour								Weekday PM Peak Hour							
	Overall		Movement of Interest						Overall		Movement of Interest					
	Delay (s)	LOS	Movement	V/C	Delay (s)	LOS	Queue (m)		Delay (s)	LOS	Movement	V/C	Delay (s)	LOS	Queue (m)	
50th							95th	50th							95th	
Marleau Avenue & Virginia Drive (Nick Kaneb Drive)	38.5	D	EBT	0.92	41.1	D	135.2	262.9	20.1	C	-	-	-	-	-	-
			WBT	0.87	31.8	C	120.7	239.6			WBT	0.87	9.6	C	105.1	257.8
			NBL	0.88	49.0	D	34.1	96.8			-	-	-	-	-	-
			SBTR	0.86	51.8	D	63.2	134.4			-	-	-	-	-	-
Marleau Avenue & McConnell Avenue	30.0	C	-	-	-	-	-	39.1	D	NBTR	0.97	77.4	E	120.1	231.2	
			SBL	0.85	34.2	C	44.8			118.0	SBL	0.92	57.7	E	44.3	141.3

Table 5.7b: Future Total Traffic – Signalized Levels of Service, Scenario 2 with Full Build-Out (Road Improvements)

The analysis results indicate that while all unsignalized intersections exhibit an acceptable level of service, the Highway 401 ramp intersections and the Industrial Park Drive/Boundary Road intersection will continue to experience some constraints. At the Highway 401 ramp intersection delays are experienced due to heavy traffic volumes on Boundary Road. The Industrial Park Drive/Boundary Road intersection continues to experience delay due to the number of eastbound left-turn movements and high traffic volumes on Boundary Road during the a.m. and p.m. peak hours. **Tables 5.8** summarize the results

of the signalized intersection analyses with road improvements. Details analyses can be found in Appendix F.

Intersection	Movement of Interest	Weekday AM Peak Hour					Weekday PM Peak Hour				
		Flow Rate (vph)	Capacity (vph)	Vol/Cap Ratio (v/c)	Control Delay (s)	LOS	Flow Rate (vph)	Capacity (vph)	Vol/Cap Ratio (v/c)	Control Delay (s)	LOS
Hwy 401 WB Ramp & Boundary Road	EBLT	3	142	0.02	30.8	D	10	109	0.09	41.2	E
	EBR	144	389	0.37	19.7	C	90	538	0.17	13.0	B
	WBRL	67	78	0.86	>150	F	46	89	0.51	85.9	F
	WBTR	36	208	0.17	25.9	D	29	203	0.14	25.7	D
	NBL	69	757	0.09	2.8	A	88	1021	0.09	2.2	A
	SBL	8	1272	0.01	0.2	A	11	956	0.01	0.3	A
Hwy 401 EB Ramp & Boundary Road	WBL	199	154	1.29	>150	F	71	165	0.43	43.1	E
	WBR	13	692	0.02	10.3	B	51	462	0.11	13.8	B
	SBLT	10	1082	0.01	0.3	A	8	824	0.01	0.3	A
Industrial Park Drive & Boundary Road	EBL	104	95	1.09	>150	F	111	113	0.98	>150	F
	EBR	58	286	0.20	20.8	C	242	475	0.51	20.4	C
	NBL	46	645	0.07	11.0	B	97	845	0.11	9.8	A
Industrial Park Drive & Optimum Drive	SBLR	8	571	0.01	11.4	B	8	567	0.01	11.4	B
Optimum Drive & SCM Way	SBLR	57	770	0.07	10.0	B	141	761	0.19	10.8	B
Tenth Street & Virginia Drive	EBLTR	358	375	0.85	56.1	B	257	730	0.35	12.6	B
	WBLTR	30	270	0.00	0.0	A	30	517	0.06	12.4	B
	NBLTR	118	1144	0.10	3.8	A	81	1414	0.06	4.4	A
	SBL	10	1374	0.01	0.2	A	10	1545	0.01	0.4	A
Virginia Avenue & Industrial Park Drive	EBLT	87	1129	0.08	2.5	A	145	1473	0.05	4.3	A
	SBLR	151	286	0.53	31.4	D	99	891	0.11	9.5	A

Table 5.8: Future Total Traffic – Unsignalized Levels of Service, Scenario 2 with Full Build-Out

## 6.0 SITE ACCESS ASSESSMENT

Access to the development is proposed via two access driveways off Tenth Street. Trucks will access the site via the first access driveway dedicated as “Truck Access” from Tenth Street, which is located approximately 400m east of the Industrial Park Drive/Tenth Street intersection. Employees will access the site via the second access driveway dedicated as “Employee Access”, which is also located off of Tenth Street. It is approximately 100m east from the “Truck Access” driveway. The “Truck Access” and “Employee Access” are private internal roads proposed to facilitate site circulation. The following details the traffic operations assessment of the proposed driveways:

- **Truck Access** – There will be one proposed full movement driveway for trucks. Trucks will pass the access gates on site for direct access to the distribution centre and reclaim building.
- **Employee Access** – Employees will be provided access to the facility via the second driveway with directly access to an exclusive parking lot providing 541 parking spaces.

## 7.0 SITE PARKING AND CIRCULATION

The proposed development will provide on-site parking with access driveways off Tenth Street. A total of **1,167** parking spaces will be provided for both the employees and truck components for Phase 1 and **548** parking spaces for the future planned expansion for a total of **1,715** parking spaces. The number of parking spaces provided confirms to the City of Cornwall's Zoning By-Law 751-1969 parking requirement of a total of **1,652** parking spaces. There will be separate parking lots, for the warehouse employees and for transport employees. The number of warehouse employee parking spaces provided is sufficient to accommodate the parking requirements during shift changes.

**Table 7.1** below summarizes the parking requirements based on the Zoning By-Law and **Tables 7.2** summaries the parking and staging supply that will be provided by the proposed warehouse facility based on the current site plan phase 1 and future planned expansion.

	GFA	Zoning By-Law 751-1969	
		Parking Rate (/1000 sq. ft.)	Parking Spaces Required
Employee Facility	723,085	0.93 <sup>2</sup>	672
Truck Facility	692,945	0.31 <sup>3</sup>	215
<b>Total (Phase 1)</b>			<b>887</b>
Employee Facility	624,885	0.93 <sup>2</sup>	581
Truck Facility	594,745	0.31 <sup>3</sup>	184
<b>Total (Planned Expansion)</b>			<b>765</b>
<b>Total Required</b>			<b>1,652</b>

**Table 7.1:** Required Parking – Phase 1 and Planned Expansion

Parking Type	Number of Parking Spaces Provided (Phase 1)	Number of Parking Spaces Provided (Planned Expansion)
Truck Loading	227	186
Truck Staging	245	225
Tractor Staging	34	-
Cab Parking	120	-
Automobile Parking	541	137
<b>Subtotal</b>	<b>1,167</b>	<b>548</b>
<b>Total Provided</b>	<b>1,715</b>	

**Table 7.2:** Parking and Staging Supply – Phase 1 and Planned Expansion

In calculating the required parking, the subject site is classified as MFR 40: industrial use. Based on the results, the total number of parking spaces satisfies the City of Cornwall Zoning By-law as the number of spaces provided for employee and transport users is in excess of the minimum requirement.

<sup>2</sup> City of Cornwall Zoning By-Law 751-1969 Parking Requirement: One (1) parking space for each 1,076 square feet of gross floor area.

<sup>3</sup> City of Cornwall Zoning By-Law 751-1969 Parking Requirement: One (1) additional space for each 3,229 square feet of gross floor area in excess of 30,140 square feet.

## 8.0 CONCLUSIONS

The proposed development consists of a warehouse distribution centre including administration area and a reclaim centre, for a total building GFA of 732,085 sq. ft. Three future planned expansions to the warehouse distribution centre provides for an additional building GFA of 624,885 sq. ft.

Phase 1 of the proposed development will generate a total of **298** and **155 two-way trips** employee and truck trips during the a.m. peak and p.m. peak hours, respectively. The future planned expansion, will generate an additional **225** and **137 two-way trips** employee and truck trips during the a.m. peak and p.m. peak hours, respectively. The full build-out of the proposed development will generate a total of **523** and **292 two-way trips** employee and truck trips during the a.m. peak and p.m. peak hours, respectively.

- Under Scenario 1 and 2 of the future total traffic conditions, the intersection of Marleau Avenue/McConnell Avenue will experience capacity constraints and noticeable delays due to the existing heavy traffic volumes in the eastbound, westbound and northbound movements. However, less delay is expected with Scenario 2 as alternate routing is made possible with the Virginia Drive to Marleau Avenue.
- Traffic analysis under Scenario 1 and 2 for future total traffic conditions suggest that the external road networks and intersections will be able to accommodate traffic increase due to background traffic growth and the proposed development site traffic, with the exception of the intersection of Marleau Avenue/McConnell Avenue which is already operating at capacity under existing traffic conditions.
- The City of Cornwall is currently in the process of an environmental assessment for future road improvements on Marlaue Avenue, including the potential for road widening. To enhance the operations of the intersection capacity analysis under Scenario 1 traffic conditions a potential option is to provide a dual southbound left-turn at the intersection of Marleau Avenue/McConnell Avenue.
- Under Scenario 2 traffic conditions with the full build out of the development, road improvements are recommended as providing an addition eastbound and westbound through lane in each direction at the intersection of Marleau Avenue/McConnell Avenue will help alleviate the existing traffic congestions and significantly reduce delays. Additionally, with the southerly extension of Virginia Drive from Tenth Street to Marleau Avenue, it will also help reduce congestion at the intersection of Marleau Avenue/McConnell Avenue as traffic will divert to this alternate routes.
- Under the full build-out condition, isolated intersections improvements such as the provision of additional southbound left-turn lane under Scenario 1 is not sufficient to accommodate the added vehicular demand. To accommodate the full build-out, larger area wide network improvement, such as the extension of Virgina Drive to Marleau Avenue, is required. Direct access onto Marleau Avenue will minimize capacity constraints at the intersection of Marleau Avenue/McConnell Avenue and maximize the network connectivity into the propose development. Additional east/west capacity improvement should also be considered to cope with the increase of through traffic flow.
- A signal warrant analysis was conducted for the intersection of Tenth Street/McConnell Avenue and based on the results signalization of the intersection is warranted.
- To conform to the City of Cornwall Zonign By-Law 751-1969, a total of 1,167 parking spaces will be provided for both the employees and truck components for Phase 1 and 548 parking spaces for the future planned expansion for a total of 1,715 parking spaces.

**Appendix A**  
*Levels of Service*  
*Existing Traffic Conditions*

HCM Signalized Intersection Capacity Analysis  
5: SCM Way & Boundary Road

Existing Traffic Conditions  
Weekday A.M. Peak Hour

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↕	↕
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2	6.2	5.2	5.2	5.2	5.2
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frbp, ped/bikes	1.00	0.97	1.00	1.00	1.00	1.00
Flpb, ped/bikes	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	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	940	928	1253	1545	1743	997
Flt Permitted	0.95	1.00	0.20	1.00	1.00	1.00
Satd. Flow (perm)	940	928	262	1545	1743	997
Volume (vph)	39	13	16	328	881	60
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	39	13	16	328	881	60
RTOR Reduction (vph)	0	10	0	0	0	16
Lane Group Flow (vph)	39	3	16	328	881	44
Confl. Peds. (#/hr)	3					
Heavy Vehicles (%)	92%	69%	44%	23%	9%	62%
Turn Type	Perm		Perm		Perm	
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	21.4	21.4	65.2	65.2	65.2	65.2
Effective Green, g (s)	22.4	22.4	66.2	66.2	66.2	66.2
Actuated g/C Ratio	0.22	0.22	0.66	0.66	0.66	0.66
Clearance Time (s)	7.2	7.2	6.2	6.2	6.2	6.2
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	211	208	173	1023	1154	660
v/s Ratio Prot	c0.04			0.21	c0.51	
v/s Ratio Perm		0.00	0.06			0.04
v/c Ratio	0.18	0.01	0.09	0.32	0.76	0.07
Uniform Delay, d1	31.4	30.2	6.1	7.3	11.5	6.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.0	1.1	0.8	5.0	0.2
Delay (s)	31.8	30.2	7.1	8.1	16.5	6.2
Level of Service	C	C	A	A	B	A
Approach Delay (s)	31.4			8.0	15.9	
Approach LOS	C			A	B	

Intersection Summary

HCM Average Control Delay	14.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	11.4
Intersection Capacity Utilization	85.5%	ICU Level of Service	E
Analysis Period (min)	60		
c Critical Lane Group			

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Synchro 6 Report  
16/10/2010

LEA Consulting, Ltd.

Queues  
5: SCM Way & Boundary Road

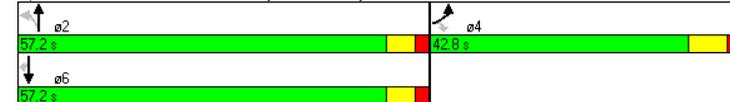
Existing Traffic Conditions  
Weekday A.M. Peak Hour

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↕	↕
Volume (vph)	39	13	16	328	881	60
Lane Group Flow (vph)	39	13	16	328	881	60
Turn Type	Perm		Perm		Perm	
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Detector Phases	4	4	2	2	6	6
Minimum Initial (s)	35.6	35.6	15.0	15.0	15.0	15.0
Minimum Split (s)	42.8	42.8	57.2	57.2	57.2	57.2
Total Split (s)	42.8	42.8	57.2	57.2	57.2	57.2
Total Split (%)	42.8%	42.8%	57.2%	57.2%	57.2%	57.2%
Yellow Time (s)	5.4	5.4	4.1	4.1	4.1	4.1
All-Red Time (s)	1.8	1.8	2.1	2.1	2.1	2.1
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.11	0.04	0.22	0.30	0.71	0.08
Control Delay	22.2	10.2	24.8	11.9	21.7	5.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.2	10.2	24.8	11.9	21.7	5.2
Queue Length 50th (m)	5.2	0.0	1.8	38.9	166.3	1.2
Queue Length 95th (m)	14.4	4.8	#12.2	70.5	#307.7	9.1
Internal Link Dist (m)	265.1		548.2		424.1	
Turn Bay Length (m)	62.0		80.0		65.0	
Base Capacity (vph)	344	348	73	1100	1241	723
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	0.11	0.04	0.22	0.30	0.71	0.08

Intersection Summary

Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green  
 Natural Cycle: 100  
 Control Type: Actuated-Coordinated  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 5: SCM Way & Boundary Road



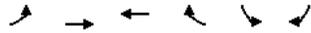
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Synchro 6 Report  
16/10/2010

LEA Consulting, Ltd.

HCM Unsignalized Intersection Capacity Analysis  
6: Optimum Drive & SCM Way

Existing Traffic Conditions  
Weekday A.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		↓	↓
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	0	0	76	52	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	76	52	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)			289			
pX, platoon unblocked						
vC, conflicting volume	76				38	38
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	76				38	38
tC, single (s)	4.1				6.4	7.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	4.2
p0 queue free %	100				95	100
cM capacity (veh/h)	1536				979	812

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	0	76	52
Volume Left	0	0	52
Volume Right	0	76	0
cSH	1700	1700	979
Volume to Capacity	0.00	0.04	0.05
Queue Length 95th (m)	0.0	0.0	1.3
Control Delay (s)	0.0	0.0	8.9
Lane LOS			A
Approach Delay (s)	0.0	0.0	8.9
Approach LOS			A

Intersection Summary			
Average Delay		3.6	
Intersection Capacity Utilization	14.7%		ICU Level of Service A
Analysis Period (min)	60		

HCM Unsignalized Intersection Capacity Analysis  
7: Industrial Park Dr & Boundary Road

Existing Traffic Conditions  
Weekday A.M. Peak Hour



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↓	↑	↓	↑	↑	↓
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	3	17	32	341	871	23
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	3	17	32	341	871	23
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1288	882	894			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1288	882	894			
tC, single (s)	6.7	6.3	4.1			
tC, 2 stage (s)						
tF (s)	3.8	3.4	2.2			
p0 queue free %	98	95	96			
cM capacity (veh/h)	150	331	767			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1
Volume Total	3	17	32	341	894
Volume Left	3	0	32	0	0
Volume Right	0	17	0	0	23
cSH	150	331	767	1700	1700
Volume to Capacity	0.02	0.05	0.04	0.20	0.53
Queue Length 95th (m)	0.5	1.3	1.0	0.0	0.0
Control Delay (s)	29.5	16.5	9.9	0.0	0.0
Lane LOS	D	C	A		
Approach Delay (s)	18.4		0.8		0.0
Approach LOS	C				

Intersection Summary			
Average Delay		0.5	
Intersection Capacity Utilization	57.2%		ICU Level of Service B
Analysis Period (min)	60		

HCM Unsignalized Intersection Capacity Analysis  
9: Industrial Park Dr & Optimum Drive

Existing Traffic Conditions  
Weekday A.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		↓	↓
Sign Control		Stop	Stop		Stop	
Volume (vph)	0	0	0	0	0	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total (vph)	0	0	0			
Volume Left (vph)	0	0	0			
Volume Right (vph)	0	0	0			
Hadj (s)	0.00	0.00	0.00			
Departure Headway (s)	3.9	3.9	3.9			
Degree Utilization, x	0.00	0.00	0.00			
Capacity (veh/h)	917	917	917			
Control Delay (s)	6.9	6.9	6.9			
Approach Delay (s)	0.0	0.0	0.0			
Approach LOS	A	A	A			

Intersection Summary

Delay	0.0
HCM Level of Service	A
Intersection Capacity Utilization	0.0%
ICU Level of Service	A
Analysis Period (min)	60

HCM Unsignalized Intersection Capacity Analysis  
11: Tenth Street & Boundary Road

Existing Traffic Conditions  
Weekday A.M. Peak Hour



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↓	↓		↑	↑	↓
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	24	26	0	349	857	31
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	24	26	0	349	857	31
Pedestrians				2		
Lane Width (m)				3.6		
Walking Speed (m/s)				1.2		
Percent Blockage				0		
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1222	874	888			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1222	874	888			
tC, single (s)	6.6	6.3	4.1			
tC, 2 stage (s)						
tF (s)	3.7	3.4	2.2			
p0 queue free %	87	92	100			
cM capacity (veh/h)	185	340	771			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	50	349	888
Volume Left	24	0	0
Volume Right	26	0	31
cSH	242	1700	1700
Volume to Capacity	0.21	0.21	0.52
Queue Length 95th (m)	6.2	0.0	0.0
Control Delay (s)	23.7	0.0	0.0
Lane LOS	C		
Approach Delay (s)	23.7	0.0	0.0
Approach LOS	C		

Intersection Summary

Average Delay	0.9
Intersection Capacity Utilization	57.6%
ICU Level of Service	B
Analysis Period (min)	60

HCM Signalized Intersection Capacity Analysis  
13: Marleau Avenue & Nick Kaneb Drive

Existing Traffic Conditions  
Weekday A.M. Peak Hour

	→	↖	↗	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	2.0	5.3	5.5	5.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frbp, ped/bikes	1.00	0.97	1.00	1.00	1.00	1.00
Flpb, ped/bikes	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)	1810	1489	1703	1810	1736	1509
Flt Permitted	1.00	1.00	0.15	1.00	0.95	1.00
Satd. Flow (perm)	1810	1489	276	1810	1736	1509
Volume (vph)	764	214	36	717	357	27
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	764	214	36	717	357	27
RTOR Reduction (vph)	0	26	0	0	0	20
Lane Group Flow (vph)	764	188	36	717	357	7
Confl. Peds. (#/hr)	7	7	7	7	2	2
Heavy Vehicles (%)	5%	5%	6%	5%	4%	7%
Turn Type	Perm pm+pt		Perm		Perm	
Protected Phases	4		3	8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	35.8	35.8	43.0	43.0	19.2	19.2
Effective Green, g (s)	36.8	36.8	47.3	44.0	20.2	20.2
Actuated g/C Ratio	0.49	0.49	0.63	0.59	0.27	0.27
Clearance Time (s)	6.3	6.3	3.0	6.3	6.5	6.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	888	731	273	1062	468	406
v/s Ratio Prot	c0.42		0.01	c0.40	c0.21	
v/s Ratio Perm		0.13	0.07			0.00
v/c Ratio	0.86	0.26	0.13	0.68	0.76	0.02
Uniform Delay, d1	16.8	11.1	9.6	10.6	25.2	20.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	11.9	0.8	0.2	3.5	7.6	0.0
Delay (s)	28.8	12.0	9.8	14.1	32.8	20.1
Level of Service	C	B	A	B	C	C
Approach Delay (s)	25.1			13.9	31.9	
Approach LOS	C			B	C	

Intersection Summary

HCM Average Control Delay	22.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	16.1
Intersection Capacity Utilization	69.0%	ICU Level of Service	C
Analysis Period (min)	60		
c Critical Lane Group			

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Synchro 6 Report  
16/10/2010

LEA Consulting, Ltd.

Queues  
13: Marleau Avenue & Nick Kaneb Drive

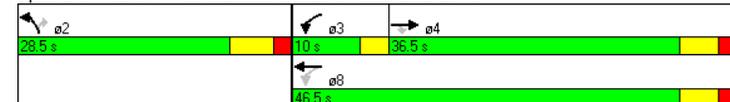
Existing Traffic Conditions  
Weekday A.M. Peak Hour

	→	↖	↗	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Volume (vph)	764	214	36	717	357	27
Lane Group Flow (vph)	764	214	36	717	357	27
Turn Type	Perm pm+pt		Perm		Perm	
Protected Phases	4		3	8	2	
Permitted Phases		4	8			2
Detector Phases	4	4	3	8	2	2
Minimum Initial (s)	15.0	15.0	7.0	15.0	15.0	15.0
Minimum Split (s)	28.3	28.3	10.0	35.7	28.5	28.5
Total Split (s)	36.5	36.5	10.0	46.5	28.5	28.5
Total Split (%)	48.7%	48.7%	13.3%	62.0%	38.0%	38.0%
Yellow Time (s)	4.1	4.1	3.0	4.1	4.5	4.5
All-Red Time (s)	2.2	2.2	0.0	2.2	2.0	2.0
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?						
Recall Mode	C-Min	C-Min	None	C-Min	None	None
v/c Ratio	0.83	0.27	0.13	0.67	0.77	0.06
Control Delay	30.3	11.0	7.1	15.5	37.4	8.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.3	11.0	7.1	15.5	37.4	8.1
Queue Length 50th (m)	104.7	14.4	1.8	67.6	48.2	0.0
Queue Length 95th (m)#	221.9	36.3	6.0	154.8	96.6	6.3
Internal Link Dist (m)	966.8			629.1	360.2	
Turn Bay Length (m)		10.0	25.0		25.0	
Base Capacity (vph)	918	781	285	1063	532	481
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	0.83	0.27	0.13	0.67	0.67	0.06

Intersection Summary

Cycle Length: 75
Actuated Cycle Length: 75
Offset: 20 (27%), Referenced to phase 4:EBT and 8:WBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 13: Marleau Avenue & Nick Kaneb Drive



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Synchro 6 Report  
16/10/2010

LEA Consulting, Ltd.

HCM Unsignalized Intersection Capacity Analysis  
14: Tenth Street & McConnell Avenue

Existing Traffic Conditions  
Weekday A.M. Peak Hour



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↕				↕			↕			↕	
Sign Control	Stop				Stop			Free			Free	
Grade	0%				0%			0%			0%	
Volume (veh/h)	1	11	4	22	15	21	4	658	41	27	797	1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	1	11	4	22	15	21	4	658	41	27	797	1
Pedestrians	2							5				
Lane Width (m)	3.6							3.6				
Walking Speed (m/s)	1.2							1.2				
Percent Blockage	0							0				
Right turn flare (veh)												
Median type	None			None								
Median storage veh												
Upstream signal (m)									308			
pX, platoon unblocked	0.97	0.97		0.97	0.97	0.97				0.97		
vC, conflicting volume	1568	1560	804	1552	1540	678	799			699		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1587	1578	804	1570	1557	668	799			689		
tC, single (s)	7.1	6.5	6.2	7.3	6.5	6.4	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.7	4.0	3.5	2.2			2.2		
p0 queue free %	99	89	99	69	86	95	100			97		
cM capacity (veh/h)	70	103	384	70	106	409	831			868		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	16	58	703	825
Volume Left	1	22	4	27
Volume Right	4	21	41	1
cSH	122	115	831	868
Volume to Capacity	0.13	0.51	0.00	0.03
Queue Length 95th (m)	3.6	22.4	0.1	0.8
Control Delay (s)	39.0	67.6	0.1	0.8
Lane LOS	E	F	A	A
Approach Delay (s)	39.0	67.6	0.1	0.8
Approach LOS	E	F		

Intersection Summary			
Average Delay	3.3		
Intersection Capacity Utilization	77.4%	ICU Level of Service	D
Analysis Period (min)	60		

HCM Signalized Intersection Capacity Analysis  
17: Marleau Avenue & Boundary Road

Existing Traffic Conditions  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.7	6.7	6.7	6.7	6.7	6.7	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	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1597	1827	1553	1543	1881	1468	1612	1638	1417	1703	1759	1553
Flt Permitted	0.67	1.00	1.00	0.72	1.00	1.00	0.28	1.00	1.00	0.62	1.00	1.00
Satd. Flow (perm)	1124	1827	1553	1172	1881	1468	470	1638	1417	1115	1759	1553
Volume (vph)	110	54	67	29	139	21	42	218	14	36	593	254
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	110	54	67	29	139	21	42	218	14	36	593	254
RTOR Reduction (vph)	0	0	44	0	0	14	0	0	7	0	0	133
Lane Group Flow (vph)	110	54	23	29	139	7	42	218	7	36	593	121
Heavy Vehicles (%)	13%	4%	4%	17%	1%	10%	12%	16%	14%	6%	8%	4%
Turn Type	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm
Protected Phases		4			8			2		2		6
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phases	4	4	4	8	8	8	2	2	2	6	6	6
Minimum Initial (s)	29.3	29.3	29.3	29.3	29.3	29.3	15.0	15.0	15.0	15.0	15.0	15.0
Minimum Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	23.0	23.0	23.0	23.0	23.0	23.0
Total Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (%)	52.9%	52.9%	52.9%	52.9%	52.9%	52.9%	47.1%	47.1%	47.1%	47.1%	47.1%	47.1%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	3.2	3.2	3.2	3.2	3.2	3.2	2.9	2.9	2.9	2.9	2.9	2.9
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.23	0.07	0.09	0.06	0.17	0.03	0.25	0.26	0.02	0.06	0.66	0.28
Control Delay	14.1	12.0	3.9	12.0	12.9	5.5	20.8	15.4	7.2	14.3	23.8	3.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.1	12.0	3.9	12.0	12.9	5.5	20.8	15.4	7.2	14.3	23.8	3.2
Queue Length 50th (m)	9.2	4.2	0.0	2.2	11.2	0.0	4.0	20.7	0.0	3.1	73.6	0.3
Queue Length 95th (m)	22.1	11.5	7.8	7.6	24.4	4.2	15.1	42.4	3.7	9.7	158.7	17.9
Internal Link Dist (m)		2051.6			246.6		346.9			417.4		
Turn Bay Length (m)	46.0				68.0		48.0	34.0		68.0		48.0
Base Capacity (vph)	486	791	710	507	814	647	167	833	727	567	894	913
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.23	0.07	0.09	0.06	0.17	0.03	0.25	0.26	0.02	0.06	0.66	0.28

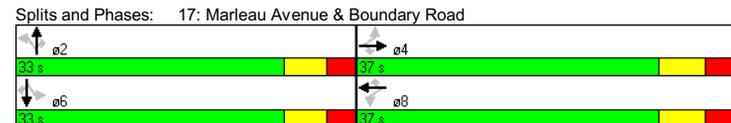
Intersection Summary			
HCM Average Control Delay	16.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.7
Intersection Capacity Utilization	99.9%	ICU Level of Service	F
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
17: Marleau Avenue & Boundary Road

Existing Traffic Conditions  
Weekday A.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	110	54	67	29	139	21	42	218	14	36	593	254
Lane Group Flow (vph)	110	54	67	29	139	21	42	218	14	36	593	254
Turn Type	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm
Protected Phases		4			8			2		2		6
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phases	4	4	4	8	8	8	2	2	2	6	6	6
Minimum Initial (s)	29.3	29.3	29.3	29.3	29.3	29.3	15.0	15.0	15.0	15.0	15.0	15.0
Minimum Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	23.0	23.0	23.0	23.0	23.0	23.0
Total Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (%)	52.9%	52.9%	52.9%	52.9%	52.9%	52.9%	47.1%	47.1%	47.1%	47.1%	47.1%	47.1%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	3.2	3.2	3.2	3.2	3.2	3.2	2.9	2.9	2.9	2.9	2.9	2.9
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.23	0.07	0.09	0.06	0.17	0.03	0.25	0.26	0.02	0.06	0.66	0.28
Control Delay	14.1	12.0	3.9	12.0	12.9	5.5	20.8	15.4	7.2	14.3	23.8	3.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.1	12.0	3.9	12.0	12.9	5.5	20.8	15.4	7.2	14.3	23.8	3.2
Queue Length 50th (m)	9.2	4.2	0.0	2.2	11.2	0.0	4.0	20.7	0.0	3.1	73.6	0.3
Queue Length 95th (m)	22.1	11.5	7.8	7.6	24.4	4.2	15.1	42.4	3.7	9.7	158.7	17.9
Internal Link Dist (m)		2051.6			246.6		346.9			417.4		
Turn Bay Length (m)	46.0				68.0		48.0	34.0		68.0		48.0
Base Capacity (vph)	486	791	710	507	814	647	167	833	727	567	894	913
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.23	0.07	0.09	0.06	0.17	0.03	0.25	0.26	0.02	0.06	0.66	0.28

Intersection Summary	
Cycle Length: 70	
Actuated Cycle Length: 70	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 70	
Control Type: Actuated-Coordinated	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	



HCM Signalized Intersection Capacity Analysis  
18: Marleau Avenue & McConnell Avenue

Existing Traffic Conditions  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.5		2.0	5.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frbp, ped/bikes	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1703	1827	1539	1735	1845	1538	1736	1685		1736	1776	
Flt Permitted	0.18	1.00	1.00	0.16	1.00	1.00	0.56	1.00		0.30	1.00	
Satd. Flow (perm)	315	1827	1539	289	1845	1538	1026	1685		549	1776	
Volume (vph)	31	487	115	142	609	423	138	249	118	491	330	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	31	487	115	142	609	423	138	249	118	491	330	0
RTOR Reduction (vph)	0	0	81	0	0	254	0	17	0	0	0	0
Lane Group Flow (vph)	31	487	34	142	609	169	138	350	0	491	330	0
Confl. Peds. (#/hr)			5	5								
Heavy Vehicles (%)	6%	4%	2%	4%	3%	5%	4%	7%	8%	4%	7%	50%
Turn Type	Perm		Perm pm+pt		Perm pm+pt				pm+pt			
Protected Phases		4		3	8		5	2		1		6
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	28.4	28.4	28.4	37.4	37.4	37.4	38.3	27.0		50.1	35.8	
Effective Green, g (s)	29.4	29.4	29.4	41.4	38.4	38.4	43.8	28.0		54.6	36.8	
Actuated g/C Ratio	0.29	0.29	0.29	0.41	0.38	0.38	0.44	0.28		0.55	0.37	
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.5		3.0	6.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	93	537	452	221	708	591	537	472		550	654	
v/s Ratio Prot		0.27		0.05	c0.33		0.03	c0.21		c0.19	0.19	
v/s Ratio Perm	0.10		0.02	0.22		0.11	0.08			0.30		
v/c Ratio	0.33	0.91	0.07	0.64	0.86	0.29	0.26	0.74		0.89	0.50	
Uniform Delay, d1	27.6	34.0	25.5	21.9	28.3	21.3	17.2	32.7		16.6	24.5	
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	2.1	24.0	0.1	6.4	11.6	0.3	0.3	10.7		20.3	2.8	
Delay (s)	29.8	58.0	25.6	28.3	39.9	21.6	17.4	43.5		36.9	27.3	
Level of Service	C	E	C	C	D	C	B	D		D	C	
Approach Delay (s)		50.7			31.9			36.3			33.0	
Approach LOS		D			C			D			C	

Intersection Summary

HCM Average Control Delay	36.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	113.9%	ICU Level of Service	H
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
18: Marleau Avenue & McConnell Avenue

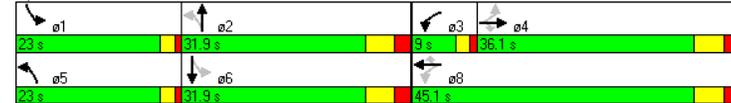
Existing Traffic Conditions  
Weekday A.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	31	487	115	142	609	423	138	249	491	330
Lane Group Flow (vph)	31	487	115	142	609	423	138	367	491	330
Turn Type	Perm		Perm pm+pt		Perm pm+pt				pm+pt	
Protected Phases		4		3	8		5	2	1	6
Permitted Phases	4		4	8		8	2		6	
Detector Phases	4	4	4	3	8	8	5	2	1	6
Minimum Initial (s)	21.7	21.7	21.7	5.0	21.7	21.7	11.0	15.0	10.0	15.0
Minimum Split (s)	36.1	36.1	36.1	9.0	38.7	38.7	14.0	31.9	14.0	31.9
Total Split (s)	36.1	36.1	36.1	9.0	45.1	45.1	23.0	31.9	23.0	31.9
Total Split (%)	36.1%	36.1%	36.1%	9.0%	45.1%	45.1%	23.0%	31.9%	23.0%	31.9%
Yellow Time (s)	4.1	4.1	4.1	2.0	4.1	4.1	2.0	4.1	2.0	4.1
All-Red Time (s)	1.9	1.9	1.9	1.0	1.9	1.9	1.0	2.4	1.0	2.4
Lead/Lag	Lag	Lag	Lag	Lead			Lead	Lag	Lead	Lag
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	None	None	C-Max	None	C-Max
v/c Ratio	0.29	0.91	0.22	0.60	0.86	0.50	0.33	0.75	0.89	0.51
Control Delay	34.9	62.1	5.9	30.3	43.4	4.6	14.8	43.4	41.8	28.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.9	62.1	5.9	30.3	43.4	4.6	14.8	43.4	41.8	28.7
Queue Length 50th (m)	4.8	92.8	0.0	17.5	109.0	1.3	13.7	65.7	62.6	52.8
Queue Length 95th (m)	15.8	#179.7	15.9	#38.9	#206.2	34.0	27.2	#135.9	#150.6	95.4
Internal Link Dist (m)		264.6			966.8			244.0		283.7
Turn Bay Length (m)			84.0	71.0		71.0	77.0		130.0	
Base Capacity (vph)	113	568	558	236	740	864	568	488	552	653
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	0.27	0.86	0.21	0.60	0.82	0.49	0.24	0.75	0.89	0.51

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 96 (96%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 95
Control Type: Actuated-Coordinated
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 18: Marleau Avenue & McConnell Avenue



HCM Unsignalized Intersection Capacity Analysis  
22: Hwy 401 WB Ramp & Boundary Road

Existing Traffic Conditions  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗	↖	↕	↕		↕	↗	↖	↕	↕
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	2	1	97	61	25	7	38	251	20	7	664	8
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	2	1	97	61	25	7	38	251	20	7	664	8
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1038	1029	668	1116	1023	261	672				271	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1038	1029	668	1116	1023	261	672				271	
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
p0 queue free %	99	100	79	56	89	99	96				99	
cM capacity (veh/h)	183	223	458	140	225	778	919				1292	
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>WB 1</b>	<b>WB 2</b>	<b>NB 1</b>	<b>SB 1</b>						
Volume Total	3	97	61	32	309	679						
Volume Left	2	0	61	0	38	7						
Volume Right	0	97	0	7	20	8						
cSH	194	458	140	266	919	1292						
Volume to Capacity	0.02	0.21	0.44	0.12	0.04	0.01						
Queue Length 95th (m)	0.4	6.4	17.6	3.3	1.0	0.1						
Control Delay (s)	23.8	15.0	50.2	20.4	1.5	0.1						
Lane LOS	C	B	F	C	A	A						
Approach Delay (s)	15.2		39.9		1.5	0.1						
Approach LOS	C		E									
<b>Intersection Summary</b>												
Average Delay	4.9											
Intersection Capacity Utilization	56.5%			ICU Level of Service			B					
Analysis Period (min)	60											

HCM Unsignalized Intersection Capacity Analysis  
25: Hwy 401 EB Ramp & Boundary Road

Existing Traffic Conditions  
Weekday A.M. Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations	↖	↗	↕	↖	↖	↕	
Sign Control	Stop	Free	Free	Free	Free	Free	
Grade	0%	0%	0%	0%	0%	0%	
Volume (veh/h)	128	12	297	70	9	813	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly flow rate (vph)	128	12	297	70	9	813	
Pedestrians							
Lane Width (m)							
Walking Speed (m/s)							
Percent Blockage							
Right turn flare (veh)							
Median type	None						
Median storage (veh)							
Upstream signal (m)							
pX, platoon unblocked							
vC, conflicting volume	1128	297			367		
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	1128	297			367		
tC, single (s)	6.4	6.2			4.1		
tC, 2 stage (s)							
tF (s)	3.5	3.3			2.2		
p0 queue free %	43	98			99		
cM capacity (veh/h)	224	742			1192		
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>WB 2</b>	<b>NB 1</b>	<b>NB 2</b>	<b>SB 1</b>		
Volume Total	128	12	297	70	822		
Volume Left	128	0	0	0	9		
Volume Right	0	12	0	70	0		
cSH	224	742	1700	1700	1192		
Volume to Capacity	0.57	0.02	0.17	0.04	0.01		
Queue Length 95th (m)	29.6	0.4	0.0	0.0	0.2		
Control Delay (s)	41.9	9.9	0.0	0.0	0.2		
Lane LOS	E	A			A		
Approach Delay (s)	39.1		0.0		0.2		
Approach LOS	E						
<b>Intersection Summary</b>							
Average Delay	4.2						
Intersection Capacity Utilization	63.7%			ICU Level of Service			B
Analysis Period (min)	60						

HCM Signalized Intersection Capacity Analysis  
5: SCM Way & Boundary Road

Existing Traffic Conditions  
Weekday P.M. Peak Hour

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↕	↕
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2	6.2	5.2	5.2	5.2	5.2
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	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1114	1583	1656	1743	1712	944
Flt Permitted	0.95	1.00	0.31	1.00	1.00	1.00
Satd. Flow (perm)	1114	1583	545	1743	1712	944
Volume (vph)	79	49	11	625	618	38
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	79	49	11	625	618	38
RTOR Reduction (vph)	0	35	0	0	0	16
Lane Group Flow (vph)	79	14	11	625	618	22
Heavy Vehicles (%)	62%	2%	9%	9%	11%	71%
Turn Type	Perm	Perm			Perm	
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	28.5	28.5	58.1	58.1	58.1	58.1
Effective Green, g (s)	29.5	29.5	59.1	59.1	59.1	59.1
Actuated g/C Ratio	0.29	0.29	0.59	0.59	0.59	0.59
Clearance Time (s)	7.2	7.2	6.2	6.2	6.2	6.2
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	329	467	322	1030	1012	558
v/s Ratio Prot	c0.07			0.36	c0.36	
v/s Ratio Perm		0.01	0.02			0.02
v/c Ratio	0.24	0.03	0.03	0.61	0.61	0.04
Uniform Delay, d1	26.7	25.1	8.5	13.0	13.1	8.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.0	0.2	2.7	2.8	0.1
Delay (s)	27.1	25.1	8.7	15.7	15.9	8.7
Level of Service	C	C	A	B	B	A
Approach Delay (s)	26.4			15.6	15.5	
Approach LOS	C			B	B	

Intersection Summary			
HCM Average Control Delay	16.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	11.4
Intersection Capacity Utilization	72.1%	ICU Level of Service	C
Analysis Period (min)	60		
c Critical Lane Group			

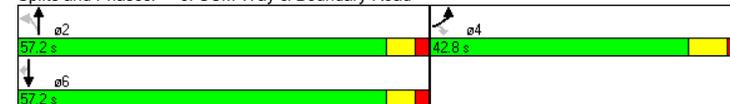
Queues  
5: SCM Way & Boundary Road

Existing Traffic Conditions  
Weekday P.M. Peak Hour

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↕	↕
Volume (vph)	79	49	11	625	618	38
Lane Group Flow (vph)	79	49	11	625	618	38
Turn Type	Perm	Perm			Perm	
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Detector Phases	4	4	2	2	6	6
Minimum Initial (s)	35.6	35.6	15.0	15.0	15.0	15.0
Minimum Split (s)	42.8	42.8	57.2	57.2	57.2	57.2
Total Split (s)	42.8	42.8	57.2	57.2	57.2	57.2
Total Split (%)	42.8%	42.8%	57.2%	57.2%	57.2%	57.2%
Yellow Time (s)	5.4	5.4	4.1	4.1	4.1	4.1
All-Red Time (s)	1.8	1.8	2.1	2.1	2.1	2.1
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.19	0.08	0.04	0.58	0.59	0.06
Control Delay	23.3	6.6	12.5	18.9	19.0	4.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.3	6.6	12.5	18.9	19.0	4.2
Queue Length 50th (m)	10.9	0.0	1.1	91.0	90.3	0.0
Queue Length 95th (m)	25.1	9.2	4.6	162.9	162.5	6.1
Internal Link Dist (m)	265.1			548.2	424.1	
Turn Bay Length (m)	62.0		80.0			65.0
Base Capacity (vph)	408	610	286	1073	1054	596
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	0.19	0.08	0.04	0.58	0.59	0.06

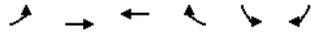
Intersection Summary	
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	100
Control Type:	Actuated-Coordinated

Splits and Phases: 5: SCM Way & Boundary Road



HCM Unsignalized Intersection Capacity Analysis  
6: Optimum Drive & SCM Way

Existing Traffic Conditions  
Weekday P.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	↕
Sign Control	Free	Free	Free		Stop	
Grade	0%	0%	0%		0%	
Volume (veh/h)	0	0	0	49	128	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	49	128	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)			289			
pX, platoon unblocked						
vC, conflicting volume	49				24	24
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	49				24	24
tC, single (s)	4.1				7.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				4.4	3.3
p0 queue free %	100				84	100
cM capacity (veh/h)	1571				790	1058

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	0	49	128
Volume Left	0	0	128
Volume Right	0	49	0
cSH	1700	1700	790
Volume to Capacity	0.00	0.03	0.16
Queue Length 95th (m)	0.0	0.0	4.6
Control Delay (s)	0.0	0.0	10.4
Lane LOS			B
Approach Delay (s)	0.0	0.0	10.4
Approach LOS			B

Intersection Summary			
Average Delay		7.5	
Intersection Capacity Utilization	17.1%		ICU Level of Service A
Analysis Period (min)	60		

HCM Unsignalized Intersection Capacity Analysis  
7: Industrial Park Dr & Boundary Road

Existing Traffic Conditions  
Weekday P.M. Peak Hour



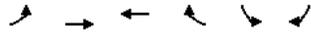
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↕	↕	↕	↕	↕	↕
Sign Control	Stop	Free	Free	Free	Free	Free
Grade	0%			0%	0%	
Volume (veh/h)	55	177	72	581	640	27
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	55	177	72	581	640	27
Pedestrians						
Lane Width (m)		3.6				
Walking Speed (m/s)		1.2				
Percent Blockage		0				
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1380	654	668			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1380	654	668			
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	62	92			
cM capacity (veh/h)	145	466	926			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1
Volume Total	55	177	72	581	667
Volume Left	55	0	72	0	0
Volume Right	0	177	0	0	27
cSH	145	466	926	1700	1700
Volume to Capacity	0.38	0.38	0.08	0.34	0.39
Queue Length 95th (m)	14.1	14.5	2.0	0.0	0.0
Control Delay (s)	44.7	17.4	9.2	0.0	0.0
Lane LOS	E	C	A		
Approach Delay (s)	23.9		1.0		0.0
Approach LOS	C				

Intersection Summary			
Average Delay		4.0	
Intersection Capacity Utilization	53.0%		ICU Level of Service A
Analysis Period (min)	60		

HCM Unsignalized Intersection Capacity Analysis  
9: Industrial Park Dr & Optimum Drive

Existing Traffic Conditions  
Weekday P.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		↓	↓
Sign Control	Free	Free	Free		Stop	
Grade	0%	0%	0%		0%	
Volume (veh/h)	0	0	0	0	0	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0				0	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				0	0
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1623				1023	1085
<b>Direction, Lane #</b>						
	EB 1	WB 1	SB 1			
Volume Total	0	0	0			
Volume Left	0	0	0			
Volume Right	0	0	0			
cSH	1700	1700	1700			
Volume to Capacity	0.00	0.00	0.00			
Queue Length 95th (m)	0.0	0.0	0.0			
Control Delay (s)	0.0	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	0.0	0.0	0.0			
Approach LOS	A					
<b>Intersection Summary</b>						
Average Delay	0.0					
Intersection Capacity Utilization	0.0%		ICU Level of Service		A	
Analysis Period (min)	60					

HCM Unsignalized Intersection Capacity Analysis  
11: Tenth Street & Boundary Road

Existing Traffic Conditions  
Weekday P.M. Peak Hour



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↓			↑	↑	↓
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	35	30	0	618	663	154
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	35	30	0	618	663	154
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1358	740	817			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1358	740	817			
tC, single (s)	6.5	6.2	4.3			
tC, 2 stage (s)						
tF (s)	3.6	3.3	2.4			
p0 queue free %	78	93	100			
cM capacity (veh/h)	161	420	719			
<b>Direction, Lane #</b>						
	EB 1	NB 1	SB 1			
Volume Total	65	618	817			
Volume Left	35	0	0			
Volume Right	30	0	154			
cSH	225	1700	1700			
Volume to Capacity	0.29	0.36	0.48			
Queue Length 95th (m)	9.6	0.0	0.0			
Control Delay (s)	27.5	0.0	0.0			
Lane LOS	D					
Approach Delay (s)	27.5	0.0	0.0			
Approach LOS	D					
<b>Intersection Summary</b>						
Average Delay	1.2					
Intersection Capacity Utilization	54.7%		ICU Level of Service		A	
Analysis Period (min)	60					

HCM Signalized Intersection Capacity Analysis  
13: Marleau Avenue & Nick Kaneb Drive

Existing Traffic Conditions  
Weekday P.M. Peak Hour

	→	↖	↗	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	2.0	5.5	5.3	5.3
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frbp, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
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)	1827	1583	1805	1845	1770	1615
Flt Permitted	1.00	1.00	0.22	1.00	0.95	1.00
Satd. Flow (perm)	1827	1583	412	1845	1770	1615
Volume (vph)	716	299	57	871	245	54
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	716	299	57	871	245	54
RTOR Reduction (vph)	0	37	0	0	0	41
Lane Group Flow (vph)	716	262	57	871	245	13
Confl. Peds. (#/hr)	3					
Heavy Vehicles (%)	4%	2%	0%	3%	2%	0%
Turn Type	Perm		pm+pt		Perm	
Protected Phases	4		3	8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	38.3	38.3	45.6	45.6	16.6	16.6
Effective Green, g (s)	39.3	39.3	50.1	46.6	17.6	17.6
Actuated g/C Ratio	0.52	0.52	0.67	0.62	0.23	0.23
Clearance Time (s)	6.5	6.5	3.0	6.5	6.3	6.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	957	829	374	1146	415	379
v/s Ratio Prot	0.39		0.01	c0.47	c0.14	
v/s Ratio Perm		0.17	0.09			0.01
v/c Ratio	0.75	0.32	0.15	0.76	0.59	0.03
Uniform Delay, d1	14.0	10.2	7.2	10.2	25.5	22.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.5	1.0	0.2	4.9	2.3	0.0
Delay (s)	19.5	11.2	7.4	15.1	27.8	22.2
Level of Service	B	B	A	B	C	C
Approach Delay (s)	17.0		14.6		26.8	
Approach LOS	B		B		C	

Intersection Summary

HCM Average Control Delay	17.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	69.4%	ICU Level of Service	C
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
13: Marleau Avenue & Nick Kaneb Drive

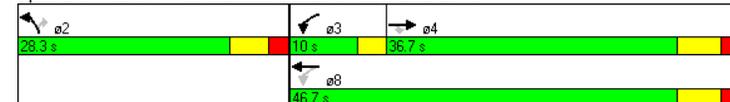
Existing Traffic Conditions  
Weekday P.M. Peak Hour

	→	↖	↗	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Volume (vph)	716	299	57	871	245	54
Lane Group Flow (vph)	716	299	57	871	245	54
Turn Type	Perm		pm+pt		Perm	
Protected Phases	4		3	8	2	
Permitted Phases		4	8			2
Detector Phases	4	4	3	8	2	2
Minimum Initial (s)	18.2	18.2	7.0	18.0	15.0	15.0
Minimum Split (s)	28.5	28.5	10.0	35.7	28.3	28.3
Total Split (s)	36.7	36.7	10.0	46.7	28.3	28.3
Total Split (%)	48.9%	48.9%	13.3%	62.3%	37.7%	37.7%
Yellow Time (s)	4.5	4.5	3.0	4.5	4.1	4.1
All-Red Time (s)	2.0	2.0	0.0	2.0	2.2	2.2
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?	Yes					
Recall Mode	C-Min	C-Min	None	C-Min	None	None
v/c Ratio	0.73	0.34	0.18	0.76	0.59	0.13
Control Delay	21.8	10.0	6.1	17.0	31.5	7.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.8	10.0	6.1	17.0	31.5	7.3
Queue Length 50th (m)	80.7	17.7	2.3	76.4	33.5	0.0
Queue Length 95th (m)#200.1	49.0	8.0	#216.5	58.3	9.3	
Internal Link Dist (m)	966.8		629.1		360.2	
Turn Bay Length (m)	10.0		25.0		25.0	
Base Capacity (vph)	985	889	324	1146	543	533
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	0.73	0.34	0.18	0.76	0.45	0.10

Intersection Summary

Cycle Length: 75
Actuated Cycle Length: 75
Offset: 20 (27%), Referenced to phase 4:EBT and 8:WBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 13: Marleau Avenue & Nick Kaneb Drive



HCM Unsignalized Intersection Capacity Analysis  
14: Tenth Street & McConnell Avenue

Existing Traffic Conditions  
Weekday P.M. Peak Hour



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↕				↕			↕			↕	
Sign Control	Stop				Stop			Free			Free	
Grade	0%				0%			0%			0%	
Volume (veh/h)	7	11	3	24	29	29	6	876	36	24	867	10
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	7	11	3	24	29	29	6	876	36	24	867	10
Pedestrians					2			4			2	
Lane Width (m)					3.6			3.6			3.6	
Walking Speed (m/s)					1.2			1.2			1.2	
Percent Blockage					0			0			0	
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)							308					
pX, platoon unblocked	0.76	0.76		0.76	0.76	0.76				0.76		
vC, conflicting volume	1872	1846	876	1840	1823	898	867			914		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2150	2116	876	2109	2086	865	867			887		
tC, single (s)	7.4	6.5	6.2	7.1	6.5	6.2	4.1			4.2		
tC, 2 stage (s)												
tF (s)	3.8	4.0	3.3	3.5	4.0	3.3	2.2			2.3		
p0 queue free %	4	70	99	0	25	89	99			96		
cM capacity (veh/h)	7	37	350	20	38	269	785			559		
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>								
Volume Total	21	82	918	901								
Volume Left	7	24	6	24								
Volume Right	3	29	36	10								
cSH	17	40	785	559								
Volume to Capacity	1.27	2.04	0.01	0.04								
Queue Length 95th (m)	54.8	205.6	0.2	1.1								
Control Delay (s)	1215.4	2129.7	0.2	1.3								
Lane LOS	F	F	A	A								
Approach Delay (s)	1215.4	2129.7	0.2	1.3								
Approach LOS	F	F										
<b>Intersection Summary</b>												
Average Delay	104.9											
Intersection Capacity Utilization	75.5%		ICU Level of Service		D							
Analysis Period (min)	60											

HCM Signalized Intersection Capacity Analysis  
17: Marleau Avenue & Boundary Road

Existing Traffic Conditions  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.7	6.7	6.7	6.7	6.7	6.7	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	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1684	1810	1553	1597	1810	1436	1719	1712	1524	1612	1759	1509
Flt Permitted	0.70	1.00	1.00	0.68	1.00	1.00	0.43	1.00	1.00	0.44	1.00	1.00
Satd. Flow (perm)	1244	1810	1553	1137	1810	1436	783	1712	1524	755	1759	1509
Volume (vph)	155	126	46	31	85	30	81	433	37	52	447	194
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	155	126	46	31	85	30	81	433	37	52	447	194
RTOR Reduction (vph)	0	0	32	0	21	0	0	18	0	0	0	93
Lane Group Flow (vph)	155	126	14	31	85	9	81	433	19	52	447	101
Confl. Peds. (#/hr)	1				1							
Heavy Vehicles (%)	7%	5%	4%	13%	5%	10%	5%	11%	6%	12%	8%	7%
Turn Type	Perm		Perm	Perm		Perm	Perm		Perm	Perm		Perm
Protected Phases		4			8			2		2		6
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	20.0	20.0	20.0	20.0	20.0	20.0	35.3	35.3	35.3	35.3	35.3	35.3
Effective Green, g (s)	21.0	21.0	21.0	21.0	21.0	21.0	36.3	36.3	36.3	36.3	36.3	36.3
Actuated g/C Ratio	0.30	0.30	0.30	0.30	0.30	0.30	0.52	0.52	0.52	0.52	0.52	0.52
Clearance Time (s)	7.7	7.7	7.7	7.7	7.7	7.7	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	373	543	466	341	543	431	406	888	790	392	912	783
v/s Ratio Prot		0.07			0.05			0.25			0.25	
v/s Ratio Perm	c0.12		0.01	0.03		0.01	0.10		0.01	0.07		0.07
v/c Ratio	0.42	0.23	0.03	0.09	0.16	0.02	0.20	0.49	0.02	0.13	0.49	0.13
Uniform Delay, d1	19.6	18.4	17.3	17.6	18.0	17.3	9.0	10.9	8.2	8.7	10.9	8.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	0.2	0.0	0.1	0.1	0.0	1.1	1.9	0.1	0.7	1.9	0.3
Delay (s)	20.3	18.7	17.3	17.7	18.1	17.3	10.2	12.8	8.3	9.4	12.8	9.0
Level of Service	C	B	B	B	B	B	B	B	A	A	B	A
Approach Delay (s)		19.3			17.9			12.1			11.5	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	13.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.7
Intersection Capacity Utilization	86.5%	ICU Level of Service	E
Analysis Period (min)	60		
c Critical Lane Group			

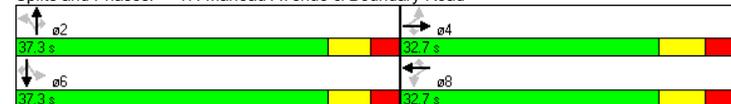
Queues  
17: Marleau Avenue & Boundary Road

Existing Traffic Conditions  
Weekday P.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	155	126	46	31	85	30	81	433	37	52	447	194
Lane Group Flow (vph)	155	126	46	31	85	30	81	433	37	52	447	194
Turn Type	Perm		Perm	Perm		Perm	Perm		Perm	Perm		Perm
Protected Phases		4			8			2		2		6
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phases	4	4	4	8	8	8	2	2	2	6	6	6
Minimum Initial (s)	20.0	20.0	20.0	20.0	20.0	20.0	26.0	26.0	26.0	26.0	26.0	26.0
Minimum Split (s)	27.7	27.7	27.7	27.7	27.7	27.7	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (s)	32.7	32.7	32.7	32.7	32.7	32.7	37.3	37.3	37.3	37.3	37.3	37.3
Total Split (%)	46.7%	46.7%	46.7%	46.7%	46.7%	46.7%	53.3%	53.3%	53.3%	53.3%	53.3%	53.3%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	3.2	3.2	3.2	3.2	3.2	3.2	2.9	2.9	2.9	2.9	2.9	2.9
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.41	0.23	0.09	0.09	0.16	0.07	0.22	0.49	0.05	0.14	0.49	0.22
Control Delay	23.7	19.8	6.7	18.5	19.0	7.6	11.2	13.3	3.4	10.2	13.3	2.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.7	19.8	6.7	18.5	19.0	7.6	11.2	13.3	3.4	10.2	13.3	2.2
Queue Length 50th (m)	16.9	12.9	0.0	3.0	8.5	0.0	5.6	35.8	0.0	3.5	36.9	0.0
Queue Length 95th (m)	38.0	28.6	8.0	10.1	20.7	6.5	15.7	69.7	4.7	10.6	71.4	11.4
Internal Link Dist (m)		2051.6			246.6			346.9			417.4	
Turn Bay Length (m)	46.0			68.0		48.0	34.0			68.0		48.0
Base Capacity (vph)	462	672	606	422	672	552	371	887	807	360	911	875
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.34	0.19	0.08	0.07	0.13	0.05	0.22	0.49	0.05	0.14	0.49	0.22

Intersection Summary	
Cycle Length:	70
Actuated Cycle Length:	70
Offset:	0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle:	65
Control Type:	Actuated-Coordinated

Splits and Phases: 17: Marleau Avenue & Boundary Road



HCM Signalized Intersection Capacity Analysis  
18: Marleau Avenue & McConnell Avenue

Existing Traffic Conditions  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.5		2.0	5.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frbp, ped/bikes	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1703	1845	1560	1770	1881	1568	1784	1806		1752	1845	
Flt Permitted	0.13	1.00	1.00	0.11	1.00	1.00	0.48	1.00		0.13	1.00	
Satd. Flow (perm)	231	1845	1560	206	1881	1568	904	1806		231	1845	
Volume (vph)	35	617	162	113	670	405	250	478	90	487	345	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	35	617	162	113	670	405	250	478	90	487	345	0
RTOR Reduction (vph)	0	0	109	0	0	215	0	7	0	0	0	0
Lane Group Flow (vph)	35	617	53	113	670	190	250	561	0	487	345	0
Confl. Peds. (#/hr)		2	2				3		2	2		3
Heavy Vehicles (%)	6%	3%	1%	2%	1%	3%	1%	2%	4%	3%	3%	11%
Turn Type	Perm		Perm pm+pt		Perm pm+pt				pm+pt			
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	30.1	30.1	30.1	39.1	39.1	39.1	38.9	25.4		48.4	31.9	
Effective Green, g (s)	31.1	31.1	31.1	43.1	40.1	40.1	44.4	26.4		52.9	32.9	
Actuated g/C Ratio	0.31	0.31	0.31	0.43	0.40	0.40	0.44	0.26		0.53	0.33	
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.5		3.0	6.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	72	574	485	198	754	629	529	477		442	607	
v/s Ratio Prot		c0.33		0.04	c0.36		0.07	c0.31		c0.23	0.19	
v/s Ratio Perm	0.15		0.03	0.21		0.12	0.14			0.35		
v/c Ratio	0.49	1.07	0.11	0.57	0.89	0.30	0.47	1.18		1.10	0.57	
Uniform Delay, d1	28.0	34.5	24.6	23.0	27.9	20.4	18.1	36.8		29.6	27.7	
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	23.1	170.4	0.5	4.0	17.5	1.2	0.7	341.8		220.0	1.2	
Delay (s)	51.0	204.9	25.0	27.0	45.4	21.6	18.7	378.6		249.6	28.9	
Level of Service	D	F	C	C	D	C	B	F		F	C	
Approach Delay (s)		162.5			35.5			268.6			158.1	
Approach LOS		F			D			F			F	

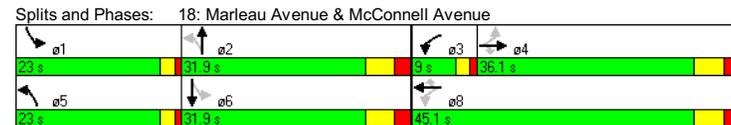
Intersection Summary			
HCM Average Control Delay	144.0	HCM Level of Service	F
HCM Volume to Capacity ratio	1.13		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	17.5
Intersection Capacity Utilization	127.2%	ICU Level of Service	H
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
18: Marleau Avenue & McConnell Avenue

Existing Traffic Conditions  
Weekday P.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	35	617	162	113	670	405	250	478	487	345
Lane Group Flow (vph)	35	617	162	113	670	405	250	568	487	345
Turn Type	Perm		Perm pm+pt		Perm pm+pt				pm+pt	
Protected Phases		4		3	8		5	2	1	6
Permitted Phases	4		4	8		8	2		6	
Detector Phases	4	4	4	3	8	8	5	2	1	6
Minimum Initial (s)	21.7	21.7	21.7	5.0	21.7	21.7	10.0	15.0	10.0	15.0
Minimum Split (s)	36.1	36.1	36.1	9.0	38.7	38.7	14.0	31.9	14.0	31.9
Total Split (s)	36.1	36.1	36.1	9.0	45.1	45.1	23.0	31.9	23.0	31.9
Total Split (%)	36.1%	36.1%	36.1%	9.0%	45.1%	45.1%	23.0%	31.9%	23.0%	31.9%
Yellow Time (s)	4.1	4.1	4.1	2.0	4.1	4.1	2.0	4.1	2.0	4.1
All-Red Time (s)	1.9	1.9	1.9	1.0	1.9	1.9	1.0	2.4	1.0	2.4
Lead/Lag	Lag	Lag	Lag	Lead			Lead	Lag	Lead	Lag
Lead-Lag Optimize?										
Recall Mode	C-Min	C-Min	C-Min	None	C-Min	C-Min	None	Ped	None	Min
v/c Ratio	0.49	1.07	0.27	0.57	0.89	0.48	0.56	1.18	1.09	0.57
Control Delay	55.8	204.9	5.8	29.3	46.5	5.6	18.9	374.1	228.2	33.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	55.8	204.9	5.8	29.3	46.5	5.6	18.9	374.1	228.2	33.0
Queue Length 50th (m)	5.8	~140.9	0.6	13.7	124.7	5.7	26.5	~138.6	~95.4	57.2
Queue Length 95th (m)	#24.4	#245.5	19.9	#34.2	#233.9	40.1	48.1	#241.0	#190.4	#107.7
Internal Link Dist (m)		264.6			966.8		244.0			283.7
Turn Bay Length (m)			84.0	71.0		71.0	77.0		130.0	
Base Capacity (vph)	72	574	594	199	754	844	562	483	447	608
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.49	1.07	0.27	0.57	0.89	0.48	0.44	1.18	1.09	0.57

Intersection Summary	
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	36.9 (37%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle:	145
Control Type:	Actuated-Coordinated
~	Volume exceeds capacity, queue is theoretically infinite. Queue shown is maximum after two cycles.
#	95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.



HCM Unsignalized Intersection Capacity Analysis  
22: Hwy 401 WB Ramp & Boundary Road

Existing Traffic Conditions  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↕	↗	↖	↕	↗		↕	↗		↕	↗	
Sign Control	Stop			Stop			Free			Free			
Grade	0%			0%			0%			0%			
Volume (veh/h)	8	1	74	42	15	11	71	473	95	10	492	5	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly flow rate (vph)	8	1	74	42	15	11	71	473	95	10	492	5	
Pedestrians													
Lane Width (m)													
Walking Speed (m/s)													
Percent Blockage													
Right turn flare (veh)													
Median type	None			None									
Median storage (veh)													
Upstream signal (m)													
pX, platoon unblocked													
vC, conflicting volume	1196	1224	494	1252	1180	520	497						568
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	1196	1224	494	1252	1180	520	497						568
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1						4.1
tC, 2 stage (s)													
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2						2.2
p0 queue free %	94	99	87	66	91	98	93						99
cM capacity (veh/h)	141	165	575	122	176	556	1067						1004
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>WB 1</b>	<b>WB 2</b>	<b>NB 1</b>	<b>SB 1</b>							
Volume Total	9	74	42	26	639	507							
Volume Left	8	0	42	0	71	10							
Volume Right	0	74	0	11	95	5							
cSH	143	575	122	247	1067	1004							
Volume to Capacity	0.06	0.13	0.34	0.11	0.07	0.01							
Queue Length 95th (m)	1.6	3.5	12.1	2.8	1.7	0.2							
Control Delay (s)	31.8	12.2	49.8	21.3	1.7	0.3							
Lane LOS	D	B	E	C	A	A							
Approach Delay (s)	14.3	38.9		1.7		0.3							
Approach LOS	B	E											
<b>Intersection Summary</b>													
Average Delay	3.9												
Intersection Capacity Utilization	80.3%			ICU Level of Service			D						
Analysis Period (min)	60												

HCM Unsignalized Intersection Capacity Analysis  
25: Hwy 401 EB Ramp & Boundary Road

Existing Traffic Conditions  
Weekday P.M. Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖	↗	↕	↖	↖	↕
Sign Control	Stop	↗	Free	↖		Free
Grade	0%		0%			0%
Volume (veh/h)	55	46	593	111	7	601
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	55	46	593	111	7	601
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1208	593				704
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1208	593				704
tC, single (s)	6.4	6.2				4.1
tC, 2 stage (s)						
tF (s)	3.5	3.3				2.2
p0 queue free %	73	91				99
cM capacity (veh/h)	201	506				894
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>WB 2</b>	<b>NB 1</b>	<b>NB 2</b>	<b>SB 1</b>	
Volume Total	55	46	593	111	608	
Volume Left	55	0	0	0	7	
Volume Right	0	46	0	111	0	
cSH	201	506	1700	1700	894	
Volume to Capacity	0.27	0.09	0.35	0.07	0.01	
Queue Length 95th (m)	8.9	2.4	0.0	0.0	0.2	
Control Delay (s)	29.7	12.8	0.0	0.0	0.2	
Lane LOS	D	B				A
Approach Delay (s)	22.0	0.0		0.2		
Approach LOS	C					
<b>Intersection Summary</b>						
Average Delay	1.7					
Intersection Capacity Utilization	47.2%		ICU Level of Service		A	
Analysis Period (min)	60					

**Appendix B**  
*Traffic Signal Warrant*  
*(McConnell Avenue at Tenth Street)*

**8-HOUR COUNT SUMMARY - McConnell Avenue & Tenth Street  
Future Background Traffic Volumes (Scenario 1)**

HOUR START	MINOR APPROACH (EB)			MAJOR APPROACH (NB)			MINOR APPROACH (WB)			MAJOR APPROACH (SB)			Ped. cross- ing major approach
	Tenth Street			McConnell Avenue			Virginia Avenue			McConnell Avenue			
	LEFT	THRO'	RIGHT										
7 - 8	0	12	3	4	384	43	4	437	96	123	504	3	2
8 - 9	1	13	1	4	397	50	4	444	97	107	474	0	1
9 - 10	3	11	1	2	394	40	2	431	77	102	393	0	0
11 - 12	3	235	25	3	235	25	3	252	42	46	210	0	3
12 - 1	3	454	64	3	454	64	3	497	107	129	442	1	3
3 - 4	3	549	62	3	549	62	3	598	111	135	437	2	1
4 - 5	7	695	47	7	695	47	7	728	80	117	429	12	2
5 - 6	7	537	33	7	537	33	7	578	74	102	504	4	2

# MINIMUM REQUIREMENTS FOR INSTALLATION OF TRAFFIC SIGNAL FOR TWO LANE ROADWAYS

1.

LOCATION: McConnell Avenue AT: Tenth Street

MUNICIPALITY: Cornwall COMMENT: Future Background Traffic (Scenario 1)

DATE OF SURVEY: Weekday ANALYSIS PREPARED BY: AVK ON 05-Oct-10  
03:17 PM

Filename: F:\8841\Traffic\Warrants\Warrant\_2008\_Updated from MTO 2007 Bk12\_McConnell\_Tenth A.xls\Warrant\_8Hr

APPROACH	No. of LANES	DISTANCE TO ADJACENT CONTROLS (SPECIFY TYPE AND LOCATION)
NORTHBOUND	1	
SOUTHBOUND	1	
EASTBOUND	1	
WESTBOUND	1	

Room for L.T. Lane(s) on Major Road: Yes

WARRANT	DESCRIPTION	MINIMUM REQUIRED				COMPLIANCE	
		2-lane Road		3-7 lane Road		Sectional %	Entire %
		Rural	Urban	Rural	Urban		
1. MINIMUM VEHICULAR VOLUME	A. Vehicle Volume, All Approaches for Each of the Heaviest 8 Hours of an Average Day, and	480	720	600	900	100	100
	B. Vehicular Volume, Along Minor Streets for EACH of the Same 8 Hours.	120 (180)	170 (255)	120 (180)	170 (255)	100	
(T-intersection)							
2. DELAY TO CROSS TRAFFIC	A. Vehicle Volume, Major Street for Each of the Heaviest 8 Hours of an Average Day, and	480	720	900		97	97
	B. Combined Vehicular and Pedestrian Volumes Crossing the Major Street for EACH of the Same 8 Hours.	75		75		100	
3. VOLUME/DELAY COMBINATIONS	The above Justifications (1 and 2) Both Satisfied to the Extent of 80% or More	YES OR NO				NO	
4. MINIMUM FOUR HOUR VEHICLE VOLUME	At Plotted Point Representing Hourly Volume for Minor Approach vs. Major Approach for Four Highest Hours of an Average Fall above the Applicable Curve	YES OR NO				Yes	
5. COLLISION EXPERIENCE	A. Total Reported Accidents of Types Susceptible to Correction by a Traffic Signal, per 12 Month Period Averaged Over a 36 Month Period, and	5				0%	
	B. Adequate Trial of Less Restrictive Remedies, Where Satisfactory Observance and Enforcement Have Failed to Reduced the Number of Collisions	YES OR NO				NO	
6. PEDESTRIAN VOLUME AND DELAY	A. Plotted Point Representing 8 Hour Pedestrian Volume vs. 8 Hour Vehicular Volume Fall in Justified zone, and	YES OR NO				NO	
	B. Plotted Point Representing 8 Hour Volume of Pedestrian Experiencing Delays of 10 sec or more vs. 8 Hour Pedestrian Volume Fall in Justified Zone	YES OR NO				NO	

**WARRANT 1: MINIMUM VEHICULAR VOLUME**

TRAFFIC TO BE INCLUDED	MINIMUM REQUIRED		HOURLY VOLUMES								Total Cross
	Free Flow* -->	NO	7 - 8	8 - 9	9 - 10	11 - 12	12 - 1	3 - 4	4 - 5	5 - 6	
A. ALL APPROACHES	No. of LANES-->	2	1st	2nd	3rd	4th	5th	6th	7th	8th	800 0 0
	CAPACITY=	720	1615	1593	1456	1082	2224	2515	2873	2425	
	100% FULFILLED		100	100	100	100	100	100	100	100	
	80% FULFILLED		0	0	0	0	0	0	0	0	
	ACTUAL % IF BELOW 80%		0	0	0	0	0	0	0	0	0

TOTAL 800 /8= 100%

TRAFFIC TO BE INCLUDED	MINIMUM REQUIRED		HOURLY VOLUMES								Total Cross
	Free Flow* -->	No	7 - 8	8 - 9	9 - 10	11 - 12	12 - 1	3 - 4	4 - 5	5 - 6	
B. MINOR STREET - BOTH APPROACHES	No. of LANES-->	2	1st	2nd	3rd	4th	5th	6th	7th	8th	800 0 0
	"T" INTERSECTION-->	NO									
	CAPACITY=	170	552	560	525	560	1128	1326	1564	1236	
	100% FULFILLED		100	100	100	100	100	100	100	100	
	80% FULFILLED		0	0	0	0	0	0	0	0	
	ACTUAL % IF BELOW 80%		0	0	0	0	0	0	0	0	

TOTAL 800 /8= 100%

CONCLUSION WARRANT 1: 100% SATISFIED--> YES

80% SATISFIED--> YES

\* Free Flow: operating speed >= 70km/h

**WARRANT 2: DELAY TO CROSS TRAFFIC**

TRAFFIC TO BE INCLUDED	MINIMUM REQUIRED		HOURLY VOLUMES								Total Cross
	No. of LANES-->	2	7 - 8	8 - 9	9 - 10	11 - 12	12 - 1	3 - 4	4 - 5	5 - 6	
A. MAJOR ROAD BOTH APPROACHES	CAPACITY=	720	1st	2nd	3rd	4th	5th	6th	7th	8th	700 0 72
			1061	1032	931	519	1093	1188	1307	1187	
	100% FULFILLED		100	100	100	0	100	100	100	100	
	80% FULFILLED		0	0	0	0	0	0	0	0	
	ACTUAL % IF BELOW 80%		0	0	0	72	0	0	0	0	0

TOTAL 772 /8= 97%

TRAFFIC TO BE INCLUDED	MINIMUM REQUIRED		HOURLY VOLUMES								Total Cross
	CAPACITY=	75	1st	2nd	3rd	4th	5th	6th	7th	8th	
B. TRAFFIC CROSSING MAJOR STREET			443	450	436	261	506	605	744	594	800 0 0
	100% FULFILLED		100	100	100	100	100	100	100	100	
	80% FULFILLED		0	0	0	0	0	0	0	0	
	ACTUAL % IF BELOW 80%		0	0	0	0	0	0	0	0	

TOTAL 800 /8= 100%

CONCLUSION WARRANT 2: 100% SATISFIED--> NO

80% SATISFIED--> NO

**WARRANT 3: COMBINATION WARRANT**

Used if no warrant satisfied 100%

REQUIREMENT	WARRANT	FULFILLED
TWO WARRANTS SATISFIED 80%	1. Minimum Vehicular Volume 2. Delay to Cross Traffic	YES NO

CONCLUSION WARRANT 3: TRAFFIC SIGNALS WARRANTED ---> NO

**WARRANT 4: MINIMUM FOUR-HOUR VEHICLE VOLUME**

TRAFFIC TO BE INCLUDED	HOURLY VOLUMES			
	1st	2nd	3rd	4th
MAJOR ROAD	1307	1188	1187	1093
MINOR STREET	815	712	659	607

Plot the Four Highest Hour Volumes on Figure 19 (Rural) or Figure 20 (Urban).  
 If all four points lie above the applicable curve then the justification is satisfied

CONCLUSION WARRANT 4: TRAFFIC SIGNALS WARRANTED ---> **Yes**

**WARRANT 5: COLLISION EXPERIENCE**

Reportable Accidents within 12 month period averaged over 36 consecutive months susceptible to correction by a traffic signal		
WARRANT VALUE	AVERAGE NUMBER OF CRASHES	OVERALL % COMPLIANCE
5	0	0%
Adequate trial of less restrictive remedies has failed to reduce accident frequency		<b>NO</b>

CONCLUSION WARRANT 5: 100% SATISFIED--> **NO**

80% SATISFIED--> **NO**

**WARRANT 6: PEDESTRIAN VOLUME AND DELAY**

	ZONE 1		ZONE 2 (if needed)		ZONE 3 (if needed)		TOTAL
	ASSISTED	UNASSISTED	ASSISTED	UNASSISTED	ASSISTED	UNASSISTED	
8 HOUR PED. VOLUME COUNT	0	14					
FACTORED 8 HOUR PED. VOLUME	14		0		0		
% ASSIGNED TO CROSSING RATE*	100%		0%		0%		
NET 8 HOUR PEDESTRIAN VOLUME AT CROSSING							14
NET 8 HOUR VEHICULAR VOLUME ON STREET BEING CROSSED							8318

	ZONE 1		ZONE 2 (if needed)		ZONE 3 (if needed)		TOTAL
	ASSISTED	UNASSISTED	ASSISTED	UNASSISTED	ASSISTED	UNASSISTED	
8 HOUR TOTAL OF PED.	0	14	0	0	0	0	
8 HOUR TOTAL OF PED.	0	0	0	0	0	0	
FACTORED VOLUME OF TOTAL PEDS.	14		0		0		
FACTORED VOLUME OF DELAYED PEDS.	0		0		0		
% ASSIGNED TO CROSSING RATE	100%		0%		0%		
NET 8 HOUR VOLUME OF TOTAL PEDESTRIANS							14
NET 8 HOUR VOLUME OF DELAYED PEDESTRIANS							0

8 HOUR VEHICULAR VOLUME	NET 8 HOUR PEDESTRIAN VOLUME				
	<200	200-275	276-475	476-1000	>1000
>1440	NO	NO	NO	NO	NO
1440-2600	NO	NO	NO	YES	YES
2601-7000	NO	NO	NO	YES	YES
>7000	NO	NO	YES	YES	YES

NET TOTAL 8 HOUR VOL. OF TOTAL PEDESTRIANS	NET TOTAL 8 HOUR VOLUME OF DELAYED PEDESTRIANS		
	<75	75-130	>130
<200	NO	NO	NO
200-300	NO	NO	YES
>300	NO	YES	YES

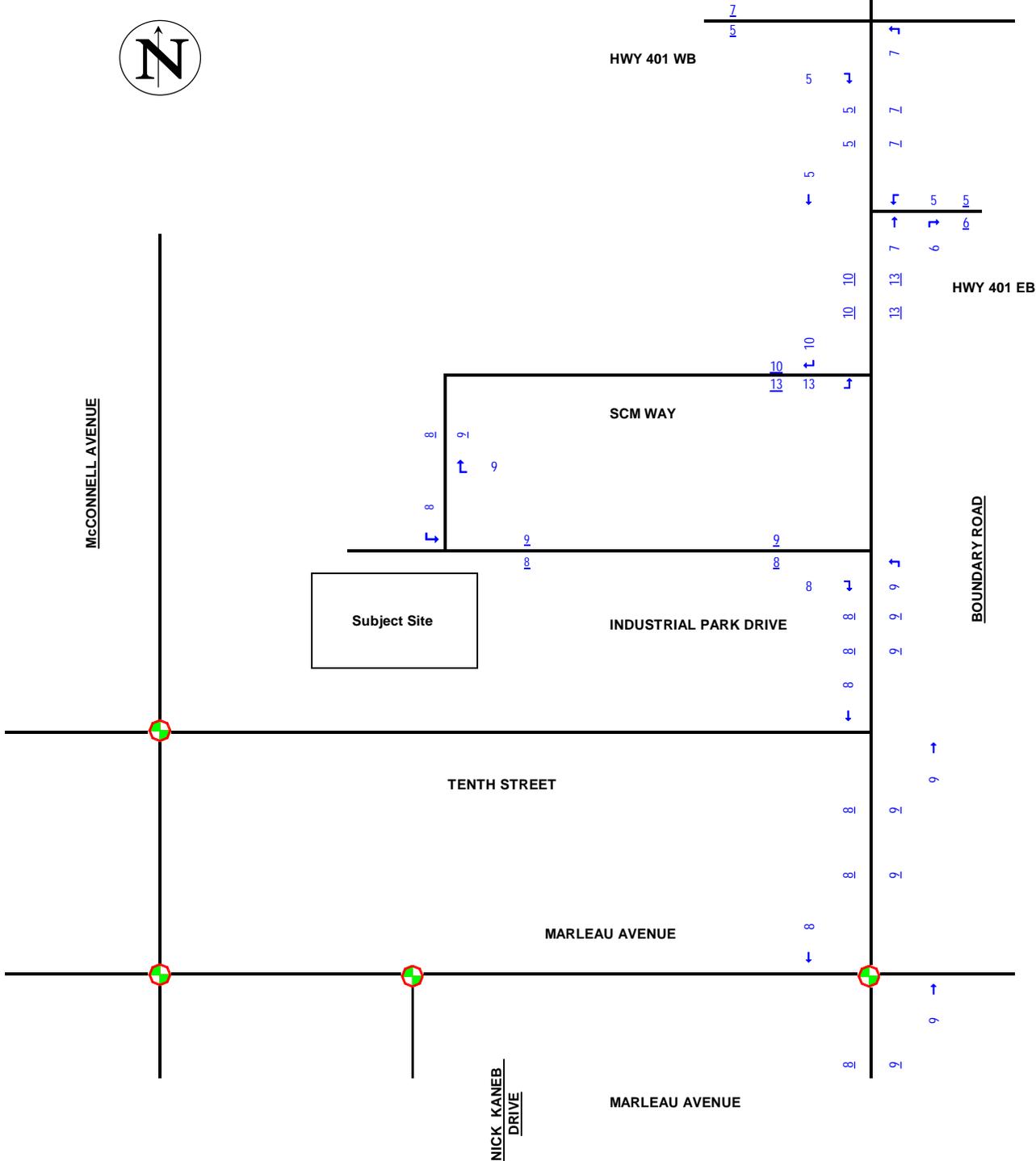
\* If a roadway is crossed by pedestrians in several locations and the introduction of signal-protected crossings at a single point, the road segment may be

CONCLUSION WARRANT 6: PEDESTRIAN VOLUME JUSTIFICATION 6A--> **NO**

PEDESTRIAN VOLUME JUSTIFICATION 6B--> **NO**

**Appendix C**  
*Supplementary Diagrams*  
*Background Traffic Development*





**Boundary Properties Ltd. - Proposed Development at Boundary Road & Highway 401**

FIGURE C2  
 SHOPPERS DRUG MART DC SITE TRAFFIC  
 Weekday PM



**Appendix D**  
*Levels of Service*  
*Future Background Traffic Conditions*

*Future Background - Scenario 1*

HCM Signalized Intersection Capacity Analysis  
5: SCM Way & Boundary Road

Future Background - Scenario 1  
Weekday A.M. Peak Hour

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↕	↕
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2	6.2	5.2	5.2	5.2	5.2
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frbp, ped/bikes	1.00	0.97	1.00	1.00	1.00	1.00
Flpb, ped/bikes	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	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1056	917	1253	1545	1743	1049
Flt Permitted	0.95	1.00	0.15	1.00	1.00	1.00
Satd. Flow (perm)	1056	917	198	1545	1743	1049
Volume (vph)	56	14	18	364	969	76
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	56	14	18	364	969	76
RTOR Reduction (vph)	0	11	0	0	0	18
Lane Group Flow (vph)	56	3	18	364	969	58
Confl. Peds. (#/hr)	3					
Heavy Vehicles (%)	71%	71%	44%	23%	9%	54%
Turn Type	Perm		Perm		Perm	
Protected Phases	4		2		6	
Permitted Phases	4		2		6	
Actuated Green, G (s)	21.4	21.4	65.2	65.2	65.2	65.2
Effective Green, g (s)	22.4	22.4	66.2	66.2	66.2	66.2
Actuated g/C Ratio	0.22	0.22	0.66	0.66	0.66	0.66
Clearance Time (s)	7.2	7.2	6.2	6.2	6.2	6.2
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	237	205	131	1023	1154	694
v/s Ratio Prot	c0.05		0.24		c0.56	
v/s Ratio Perm	0.00		0.09		0.06	
v/c Ratio	0.24	0.02	0.14	0.36	0.84	0.08
Uniform Delay, d1	31.8	30.2	6.3	7.5	12.9	6.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	0.0	2.2	1.0	8.0	0.2
Delay (s)	32.3	30.2	8.5	8.4	20.8	6.3
Level of Service	C	C	A	A	C	A
Approach Delay (s)	31.9		8.4		19.8	
Approach LOS	C		A		B	

Intersection Summary			
HCM Average Control Delay	17.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	11.4
Intersection Capacity Utilization	90.2%	ICU Level of Service	E
Analysis Period (min)	60		
c Critical Lane Group			

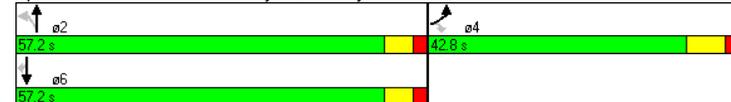
Queues  
5: SCM Way & Boundary Road

Future Background - Scenario 1  
Weekday A.M. Peak Hour

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↕	↕
Volume (vph)	56	14	18	364	969	76
Lane Group Flow (vph)	56	14	18	364	969	76
Turn Type	Perm		Perm		Perm	
Protected Phases	4		2		6	
Permitted Phases	4		2		6	
Detector Phases	4		2		6	
Minimum Initial (s)	35.6	35.6	15.0	15.0	15.0	15.0
Minimum Split (s)	42.8	42.8	57.2	57.2	57.2	57.2
Total Split (s)	42.8	42.8	57.2	57.2	57.2	57.2
Total Split (%)	42.8%	42.8%	57.2%	57.2%	57.2%	57.2%
Yellow Time (s)	5.4	5.4	4.1	4.1	4.1	4.1
All-Red Time (s)	1.8	1.8	2.1	2.1	2.1	2.1
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.15	0.04	0.25	0.33	0.78	0.10
Control Delay	22.6	10.1	26.6	12.3	25.1	5.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.6	10.1	26.6	12.3	25.1	5.5
Queue Length 50th (m)	7.6	0.0	2.0	44.4	~220.2	2.1
Queue Length 95th (m)	19.0	4.9	#14.3	80.2	#351.3	11.3
Internal Link Dist (m)	265.1		548.2 424.1			
Turn Bay Length (m)	62.0		80.0		65.0	
Base Capacity (vph)	386	344	73	1100	1241	762
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	0.15	0.04	0.25	0.33	0.78	0.10

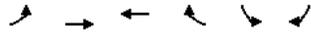
Intersection Summary	
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	110
Control Type:	Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite. Queue shown is maximum after two cycles.	
# 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.	

Splits and Phases: 5: SCM Way & Boundary Road



HCM Unsignalized Intersection Capacity Analysis  
6: Optimum Drive & SCM Way

Future Background - Scenario 1  
Weekday A.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control	Free	Free	Free		Stop	
Grade	0%	0%	0%		0%	
Volume (veh/h)	0	0	0	84	57	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	84	57	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)			289			
pX, platoon unblocked						
vC, conflicting volume	84				42	42
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	84				42	42
tC, single (s)	4.1				7.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				4.4	3.3
p0 queue free %	100				93	100
cM capacity (veh/h)	1526				770	1034

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	0	84	57
Volume Left	0	0	57
Volume Right	0	84	0
cSH	1700	1700	770
Volume to Capacity	0.00	0.05	0.07
Queue Length 95th (m)	0.0	0.0	1.9
Control Delay (s)	0.0	0.0	10.0
Lane LOS			B
Approach Delay (s)	0.0	0.0	10.0
Approach LOS			B

Intersection Summary			
Average Delay		4.1	
Intersection Capacity Utilization	15.2%		ICU Level of Service A
Analysis Period (min)	60		

HCM Unsignalized Intersection Capacity Analysis  
7: Industrial Park Dr & Boundary Road

Future Background - Scenario 1  
Weekday A.M. Peak Hour



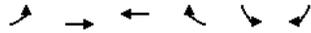
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↕	↕	↕	↕	↕	↕
Sign Control	Stop	Free	Free	Free	Free	Free
Grade	0%			0%	0%	
Volume (veh/h)	32	56	44	350	924	59
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	32	56	44	350	924	59
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1392	954	983			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1392	954	983			
tC, single (s)	6.6	6.3	4.1			
tC, 2 stage (s)						
tF (s)	3.6	3.4	2.2			
p0 queue free %	77	82	94			
cM capacity (veh/h)	137	307	711			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1
Volume Total	32	56	44	350	983
Volume Left	32	0	44	0	0
Volume Right	0	56	0	0	59
cSH	137	307	711	1700	1700
Volume to Capacity	0.23	0.18	0.06	0.21	0.58
Queue Length 95th (m)	7.2	5.3	1.6	0.0	0.0
Control Delay (s)	39.3	19.3	10.4	0.0	0.0
Lane LOS	E	C	B		
Approach Delay (s)	26.6		1.2		0.0
Approach LOS	D				

Intersection Summary			
Average Delay		1.9	
Intersection Capacity Utilization	62.3%		ICU Level of Service B
Analysis Period (min)	60		

HCM Unsignalized Intersection Capacity Analysis  
9: Industrial Park Dr & Optimum Drive

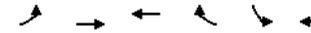
Future Background - Scenario 1  
Weekday A.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control	Free	Free			Stop	
Grade	0%	0%			0%	
Volume (veh/h)	0	50	31	9	8	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	50	31	9	8	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	40				86	36
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	40				86	36
tC, single (s)	4.1				7.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				4.4	3.3
p0 queue free %	100				99	100
cM capacity (veh/h)	1583				723	1043
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	50	40	8			
Volume Left	0	0	8			
Volume Right	0	9	0			
cSH	1583	1700	723			
Volume to Capacity	0.00	0.02	0.01			
Queue Length 95th (m)	0.0	0.0	0.3			
Control Delay (s)	0.0	0.0	10.0			
Lane LOS			B			
Approach Delay (s)	0.0	0.0	10.0			
Approach LOS			B			
<b>Intersection Summary</b>						
Average Delay	0.8					
Intersection Capacity Utilization	13.3%		ICU Level of Service		A	
Analysis Period (min)	60					

HCM Unsignalized Intersection Capacity Analysis  
11: Boundary Access & Truck Access

Future Background - Scenario 1  
Weekday A.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control	Free	Free			Stop	
Grade	0%	0%			0%	
Volume (veh/h)	0	0	0	0	0	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0				0	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				0	0
tC, single (s)	5.1				6.4	7.2
tC, 2 stage (s)						
tF (s)	3.1				3.5	4.2
p0 queue free %	100				100	100
cM capacity (veh/h)	1161				1029	857
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	0	0	0			
Volume Left	0	0	0			
Volume Right	0	0	0			
cSH	1700	1700	1700			
Volume to Capacity	0.00	0.00	0.00			
Queue Length 95th (m)	0.0	0.0	0.0			
Control Delay (s)	0.0	0.0	0.0			
Lane LOS			A			
Approach Delay (s)	0.0	0.0	0.0			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay	0.0					
Intersection Capacity Utilization	0.0%		ICU Level of Service		A	
Analysis Period (min)	60					

HCM Signalized Intersection Capacity Analysis  
13: Marleau Avenue & Nick Kaneb Drive

Future Background - Scenario 1  
Weekday A.M. Peak Hour

	→	↖	↗	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↘	↘	↘	↘
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.3	5.3
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frbp, ped/bikes	1.00	0.97	1.00	1.00	1.00	1.00
Flpb, ped/bikes	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)	1810	1489	1719	1810	1719	1509
Flt Permitted	1.00	1.00	0.17	1.00	0.95	1.00
Satd. Flow (perm)	1810	1489	304	1810	1719	1509
Volume (vph)	840	235	40	789	393	30
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	840	235	40	789	393	30
RTOR Reduction (vph)	0	28	0	0	0	22
Lane Group Flow (vph)	840	207	40	789	393	8
Confl. Peds. (#/hr)	7	7	7	7	2	2
Heavy Vehicles (%)	5%	5%	5%	5%	5%	7%
Turn Type	Perm	Perm			Perm	
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	42.3	42.3	42.3	42.3	19.9	19.9
Effective Green, g (s)	43.1	43.1	43.1	43.1	21.1	21.1
Actuated g/C Ratio	0.57	0.57	0.57	0.57	0.28	0.28
Clearance Time (s)	6.3	6.3	6.3	6.3	6.5	6.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1040	856	175	1040	484	425
v/s Ratio Prot	c0.46		0.44	c0.23		
v/s Ratio Perm		0.14	0.13		0.01	
v/c Ratio	0.81	0.24	0.23	0.76	0.81	0.02
Uniform Delay, d1	12.7	7.9	7.8	12.0	25.1	19.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.1	0.7	3.0	5.4	10.8	0.0
Delay (s)	19.8	8.5	10.9	17.4	35.9	19.5
Level of Service	B	A	B	B	D	B
Approach Delay (s)	17.3			17.1	34.8	
Approach LOS	B			B	C	

Intersection Summary

HCM Average Control Delay	20.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	75.0%	ICU Level of Service	D
Analysis Period (min)	60		
c Critical Lane Group			

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Synchro 6 Report  
16/10/2010

LEA Consulting, Ltd.

Queues  
13: Marleau Avenue & Nick Kaneb Drive

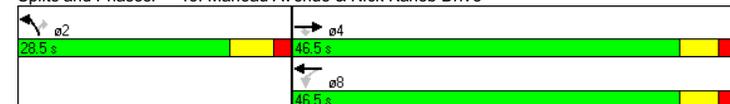
Future Background - Scenario 1  
Weekday A.M. Peak Hour

	→	↖	↗	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↘	↘	↘	↘
Volume (vph)	840	235	40	789	393	30
Lane Group Flow (vph)	840	235	40	789	393	30
Turn Type	Perm	Perm			Perm	
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Detector Phases	4	4	8	8	2	2
Minimum Initial (s)	15.0	15.0	15.0	15.0	15.0	15.0
Minimum Split (s)	28.3	28.3	35.7	35.7	28.5	28.5
Total Split (s)	46.5	46.5	46.5	46.5	28.5	28.5
Total Split (%)	62.0%	62.0%	62.0%	62.0%	38.0%	38.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.5	4.5
All-Red Time (s)	2.2	2.2	2.2	2.2	2.0	2.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	C-Min	C-Min	C-Min	C-Min	None	None
v/c Ratio	0.81	0.27	0.27	0.76	0.81	0.07
Control Delay	22.1	7.0	15.1	19.3	40.8	7.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.1	7.0	15.1	19.3	40.8	7.8
Queue Length 50th (m)	97.7	11.8	3.0	87.1	51.9	0.0
Queue Length 95th (m)#213.2	28.3	12.3	#194.0	#111.5	6.6	
Internal Link Dist (m)	966.8		629.1	393.0		
Turn Bay Length (m)		10.0	25.0	25.0		
Base Capacity (vph)	1039	883	149	1039	532	488
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	0.81	0.27	0.27	0.76	0.74	0.06

Intersection Summary

Cycle Length: 75
Actuated Cycle Length: 75
Offset: 20 (27%), Referenced to phase 4:EBT and 8:WBTL, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
# 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.

Splits and Phases: 13: Marleau Avenue & Nick Kaneb Drive



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Synchro 6 Report  
16/10/2010

LEA Consulting, Ltd.

HCM Signalized Intersection Capacity Analysis  
14: Tenth Street & McConnell Avenue

Future Background - Scenario 1  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔			↕			↕			↕		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0			5.0			5.5			5.5		
Lane Util. Factor	1.00			1.00			1.00			1.00		
Frpb, ped/bikes	0.99			1.00			1.00			1.00		
Flpb, ped/bikes	1.00			1.00			1.00			1.00		
Frt	0.97			0.95			1.00			0.99		
Flt Protected	1.00			0.98			0.95			1.00		
Satd. Flow (prot)	1821			1553			1803			1751		
Flt Permitted	0.98			0.87			0.28			1.00		
Satd. Flow (perm)	1791			1375			534			1751		
Volume (vph)	1	12	4	24	17	23	5	724	45	30	877	1
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	1	12	4	24	17	23	5	724	45	30	877	1
RTOR Reduction (vph)	0	4	0	0	21	0	0	1	0	0	0	0
Lane Group Flow (vph)	0		13	0	0	43	0	5	768	0	30	878
Confl. Peds. (#/hr)			5		5		2				2	
Heavy Vehicles (%)	0%		0%		33%		0%		4%		0%	
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases	4		8		8		2		6		6	
Permitted Phases	4		8		8		2		6		6	
Actuated Green, G (s)	8.4		8.4		79.1		79.1		79.1		79.1	
Effective Green, g (s)	9.4		9.4		80.1		80.1		80.1		80.1	
Actuated g/C Ratio	0.09		0.09		0.80		0.80		0.80		0.80	
Clearance Time (s)	6.0		6.0		6.5		6.5		6.5		6.5	
Vehicle Extension (s)	3.0		3.0		3.0		3.0		3.0		3.0	
Lane Grp Cap (vph)	168		129		428		1403		498		1383	
v/s Ratio Prot			c0.03		0.01		0.05		0.05			
v/s Ratio Perm	0.01		c0.03		0.01		0.05		0.05			
v/c Ratio	0.08		0.33		0.01		0.55		0.06		0.63	
Uniform Delay, d1	41.4		42.4		2.0		3.5		2.1		4.0	
Progression Factor	1.00		1.00		0.46		0.74		1.00		1.00	
Incremental Delay, d2	0.2		1.5		0.0		1.1		0.2		2.3	
Delay (s)	41.6		43.9		1.0		3.7		2.3		6.3	
Level of Service	D		D		A		A		A		A	
Approach Delay (s)	41.6		43.9		3.7		6.2		6.2		6.2	
Approach LOS	D		D		A		A		A		A	

Intersection Summary			
HCM Average Control Delay	6.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	65.3%	ICU Level of Service	C
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
14: Tenth Street & McConnell Avenue

Future Background - Scenario 1  
Weekday A.M. Peak Hour

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↔			↕			↕	
Volume (vph)	1	12	24	17	5	724	30	877
Lane Group Flow (vph)	0	17	0	64	5	769	30	878
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases	4		8		2		6	
Permitted Phases	4		8		2		6	
Detector Phases	4		8		2		6	
Minimum Initial (s)	10.0		10.0		10.0		10.0	
Minimum Split (s)	28.0		28.0		28.5		28.5	
Total Split (s)	28.0		28.0		72.0		72.0	
Total Split (%)	28.0%		28.0%		72.0%		72.0%	
Yellow Time (s)	4.1		4.1		4.1		4.1	
All-Red Time (s)	1.9		1.9		2.4		2.4	
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None		None		C-Min		C-Min	
v/c Ratio	0.08		0.35		0.02		0.53	
Control Delay	33.8		34.0		1.4		4.0	
Queue Delay	0.0		0.0		0.0		0.0	
Total Delay	33.8		34.0		1.4		4.0	
Queue Length 50th (m)	2.4		7.8		0.1		18.2	
Queue Length 95th (m)	10.0		23.6		m0.1m110.9		4.0	
Internal Link Dist (m)	414.9		896.3		283.7		1842.8	
Turn Bay Length (m)			14.0		14.0			
Base Capacity (vph)	419		347		320		1443	
Starvation Cap Reductn	0		0		0		0	
Spillback Cap Reductn	0		0		0		0	
Storage Cap Reductn	0		0		0		0	
Reduced v/c Ratio	0.04		0.18		0.02		0.53	

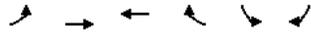
Intersection Summary	
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	34 (34%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle:	80
Control Type:	Actuated-Coordinated
m	Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 14: Tenth Street & McConnell Avenue



HCM Unsignalized Intersection Capacity Analysis  
 16: Virginia Drive & Industrial Park Drive

Future Background - Scenario 1  
 Weekday A.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	87	0	0	0	0	64
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	87	0	0	0	0	64
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0				174	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				174	0
tC, single (s)	4.1				6.4	6.4
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.4
p0 queue free %	95				100	94
cM capacity (veh/h)	1630				777	1045
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	87	0	64			
Volume Left	87	0	0			
Volume Right	0	0	64			
cSH	1630	1700	1045			
Volume to Capacity	0.05	0.00	0.06			
Queue Length 95th (m)	1.4	0.0	1.6			
Control Delay (s)	7.3	0.0	8.7			
Lane LOS	A		A			
Approach Delay (s)	7.3	0.0	8.7			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay			7.9			
Intersection Capacity Utilization		15.4%		ICU Level of Service		A
Analysis Period (min)			60			

HCM Signalized Intersection Capacity Analysis  
17: Marleau Avenue & Boundary Road

Future Background - Scenario 1  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.7	6.7	6.7	6.7	6.7	6.7	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	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1612	1845	1553	1517	1881	1482	1626	1652	1429	1719	1759	1553
Flt Permitted	0.66	1.00	1.00	0.72	1.00	1.00	0.22	1.00	1.00	0.60	1.00	1.00
Satd. Flow (perm)	1119	1845	1553	1147	1881	1482	374	1652	1429	1093	1759	1553
Volume (vph)	121	59	74	32	153	23	46	250	15	40	661	279
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	121	59	74	32	153	23	46	250	15	40	661	279
RTOR Reduction (vph)	0	0	48	0	0	15	0	0	8	0	0	131
Lane Group Flow (vph)	121	59	26	32	153	8	46	250	7	40	661	148
Heavy Vehicles (%)	12%	3%	4%	19%	1%	9%	11%	15%	13%	5%	8%	4%
Turn Type	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm
Protected Phases		4			8			2		2		6
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phases	4	4	4	8	8	8	2	2	2	6	6	6
Minimum Initial (s)	29.3	29.3	29.3	29.3	29.3	29.3	15.0	15.0	15.0	15.0	15.0	15.0
Minimum Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	23.0	23.0	23.0	23.0	23.0	23.0
Total Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (%)	52.9%	52.9%	52.9%	52.9%	52.9%	52.9%	47.1%	47.1%	47.1%	47.1%	47.1%	47.1%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	3.2	3.2	3.2	3.2	3.2	3.2	2.9	2.9	2.9	2.9	2.9	2.9
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.25	0.07	0.10	0.06	0.19	0.04	0.36	0.30	0.02	0.07	0.74	0.31
Control Delay	14.4	12.0	3.8	12.1	13.1	5.3	28.3	15.8	7.2	14.4	27.4	4.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.4	12.0	3.8	12.1	13.1	5.3	28.3	15.8	7.2	14.4	27.4	4.2
Queue Length 50th (m)	10.2	4.6	0.0	2.5	12.5	0.0	4.6	24.2	0.0	3.4	87.2	2.7
Queue Length 95th (m)	24.3	12.3	8.1	8.1	26.7	4.4	#22.7	48.9	3.9	10.6	#183.4	22.5
Internal Link Dist (m)		2051.6			246.6		346.9			725.5		
Turn Bay Length (m)	46.0				68.0		48.0	34.0		68.0		48.0
Base Capacity (vph)	485	799	714	497	814	655	129	840	734	537	894	911
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.07	0.10	0.06	0.19	0.04	0.36	0.30	0.02	0.07	0.74	0.31

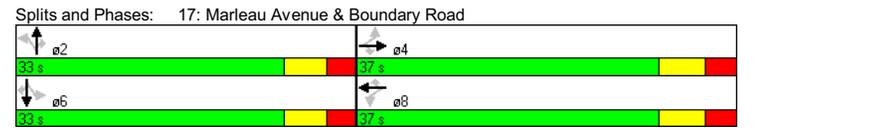
Intersection Summary			
HCM Average Control Delay	17.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.7
Intersection Capacity Utilization	103.2%	ICU Level of Service	G
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
17: Marleau Avenue & Boundary Road

Future Background - Scenario 1  
Weekday A.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	121	59	74	32	153	23	46	250	15	40	661	279
Lane Group Flow (vph)	121	59	74	32	153	23	46	250	15	40	661	279
Turn Type	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm
Protected Phases		4			8			2		2		6
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phases	4	4	4	8	8	8	2	2	2	6	6	6
Minimum Initial (s)	29.3	29.3	29.3	29.3	29.3	29.3	15.0	15.0	15.0	15.0	15.0	15.0
Minimum Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	23.0	23.0	23.0	23.0	23.0	23.0
Total Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (%)	52.9%	52.9%	52.9%	52.9%	52.9%	52.9%	47.1%	47.1%	47.1%	47.1%	47.1%	47.1%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	3.2	3.2	3.2	3.2	3.2	3.2	2.9	2.9	2.9	2.9	2.9	2.9
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.25	0.07	0.10	0.06	0.19	0.04	0.36	0.30	0.02	0.07	0.74	0.31
Control Delay	14.4	12.0	3.8	12.1	13.1	5.3	28.3	15.8	7.2	14.4	27.4	4.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.4	12.0	3.8	12.1	13.1	5.3	28.3	15.8	7.2	14.4	27.4	4.2
Queue Length 50th (m)	10.2	4.6	0.0	2.5	12.5	0.0	4.6	24.2	0.0	3.4	87.2	2.7
Queue Length 95th (m)	24.3	12.3	8.1	8.1	26.7	4.4	#22.7	48.9	3.9	10.6	#183.4	22.5
Internal Link Dist (m)		2051.6			246.6		346.9			725.5		
Turn Bay Length (m)	46.0				68.0		48.0	34.0		68.0		48.0
Base Capacity (vph)	485	799	714	497	814	655	129	840	734	537	894	911
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.07	0.10	0.06	0.19	0.04	0.36	0.30	0.02	0.07	0.74	0.31

**Intersection Summary**  
 Cycle Length: 70  
 Actuated Cycle Length: 70  
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green  
 Natural Cycle: 75  
 Control Type: Actuated-Coordinated  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.



HCM Signalized Intersection Capacity Analysis  
18: Marleau Avenue & McConnell Avenue

Future Background - Scenario 1  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0	5.0	2.0	5.0	5.0	2.0	5.5		2.0	5.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1703	1827	1532	1736	1845	1509	1736	1675		1703	1776	
Flt Permitted	0.12	1.00	1.00	0.12	1.00	1.00	0.54	1.00		0.20	1.00	
Satd. Flow (perm)	224	1827	1532	215	1845	1509	995	1675		363	1776	
Volume (vph)	34	536	127	156	670	465	152	275	130	540	363	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	34	536	127	156	670	465	152	275	130	540	363	0
RTOR Reduction (vph)	0	0	90	0	0	247	0	17	0	0	0	0
Lane Group Flow (vph)	34	536	37	156	670	218	152	388	0	540	363	0
Confl. Peds. (#/hr)			5	5								
Heavy Vehicles (%)	6%	4%	2%	4%	3%	7%	4%	8%	8%	6%	7%	50%
Turn Type	Perm		Perm pm+pt		Perm pm+pt			pm+pt				
Protected Phases		4		3	8		5	2		1		6
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	28.0	28.0	28.0	37.0	37.0	37.0	34.5	23.5		50.5	36.5	
Effective Green, g (s)	32.0	29.0	29.0	41.0	38.0	38.0	40.0	24.5		55.0	37.5	
Actuated g/C Ratio	0.32	0.29	0.29	0.41	0.38	0.38	0.40	0.24		0.55	0.38	
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.5		3.0	6.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	72	530	444	195	701	573	487	410		535	666	
v/s Ratio Prot		0.29		0.06	c0.36		0.04	c0.23		c0.25	0.20	
v/s Ratio Perm	0.15		0.02	0.27		0.14	0.09			0.30		
v/c Ratio	0.47	1.01	0.08	0.80	0.96	0.38	0.31	0.95		1.01	0.55	
Uniform Delay, d1	27.2	35.5	25.8	23.4	30.2	22.5	19.7	37.1		24.6	24.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.86	0.96	
Incremental Delay, d2	4.9	89.5	0.1	23.6	35.4	0.4	0.4	50.3		78.7	2.6	
Delay (s)	32.1	125.0	25.9	47.0	65.5	22.9	20.1	87.4		99.9	26.1	
Level of Service	C	F	C	D	E	C	C	F		F	C	
Approach Delay (s)		102.4			47.9			69.0			70.2	
Approach LOS		F			D			E			E	

Intersection Summary			
HCM Average Control Delay	68.2	HCM Level of Service	E
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	119.7%	ICU Level of Service	H
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
18: Marleau Avenue & McConnell Avenue

Future Background - Scenario 1  
Weekday A.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	34	536	127	156	670	465	152	275	540	363
Lane Group Flow (vph)	34	536	127	156	670	465	152	405	540	363
Turn Type	Perm		Perm pm+pt		Perm pm+pt			pm+pt		
Protected Phases		4		3	8		5	2	1	6
Permitted Phases	4		4	8		8	2		6	
Detector Phases	4	4	4	3	8	8	5	2	1	6
Minimum Initial (s)	20.0	20.0	20.0	5.0	20.0	20.0	11.0	15.0	10.0	15.0
Minimum Split (s)	26.0	26.0	26.0	9.0	26.0	26.0	14.0	26.5	14.0	26.5
Total Split (s)	34.0	34.0	34.0	9.0	43.0	43.0	14.0	30.0	27.0	43.0
Total Split (%)	34.0%	34.0%	34.0%	9.0%	43.0%	43.0%	14.0%	30.0%	27.0%	43.0%
Yellow Time (s)	4.1	4.1	4.1	2.0	4.1	4.1	2.0	4.1	2.0	4.1
All-Red Time (s)	1.9	1.9	1.9	1.0	1.9	1.9	1.0	2.4	1.0	2.4
Lead/Lag	Lag	Lag	Lag	Lead			Lead	Lag	Lead	Lag
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	None	None	C-Max	None	C-Max
v/c Ratio	0.47	1.01	0.24	0.80	0.96	0.57	0.31	0.95	1.01	0.55
Control Delay	53.7	126.2	6.1	56.3	69.2	7.2	14.3	85.6	102.4	26.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	53.7	126.2	6.1	56.3	69.2	7.2	14.3	85.6	102.4	26.6
Queue Length 50th (m)	5.5	~111.5	0.0	20.2	131.0	8.7	14.5	77.5	~88.1	63.7
Queue Length 95th (m)	#24.0	#213.5	17.3	#61.9	#245.2	53.7	28.2	#164.2	#191.8	101.2
Internal Link Dist (m)		264.6			966.8			238.5		283.7
Turn Bay Length (m)			84.0	71.0		71.0	77.0		130.0	
Base Capacity (vph)	72	530	534	195	701	820	487	428	534	666
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	0.47	1.01	0.24	0.80	0.96	0.57	0.31	0.95	1.01	0.55

Intersection Summary	
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	96 (96%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle:	110
Control Type:	Actuated-Coordinated
~	Volume exceeds capacity, queue is theoretically infinite. Queue shown is maximum after two cycles.
#	95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.



HCM Unsignalized Intersection Capacity Analysis  
22: Hwy 401 WB Ramp & Boundary Road

Future Background - Scenario 1  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗	↖	↕	↗		↕	↗		↕	↗
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	2	1	112	67	28	8	49	279	22	8	730	9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	2	1	112	67	28	8	49	279	22	8	730	9
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1160	1150	734	1251	1143	290	739				301	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1160	1150	734	1251	1143	290	739				301	
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
p0 queue free %	99	99	73	35	85	99	94				99	
cM capacity (veh/h)	144	186	420	104	188	749	867				1260	
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	3	112	67	36	350	747						
Volume Left	2	0	67	0	49	8						
Volume Right	0	112	0	8	22	9						
cSH	156	420	104	225	867	1260						
Volume to Capacity	0.02	0.27	0.65	0.16	0.06	0.01						
Queue Length 95th (m)	0.5	8.7	35.2	4.5	1.4	0.2						
Control Delay (s)	28.6	16.7	97.5	24.0	1.9	0.2						
Lane LOS	D	C	F	C	A	A						
Approach Delay (s)	17.0		71.8		1.9	0.2						
Approach LOS	C		F									
<b>Intersection Summary</b>												
Average Delay	7.7											
Intersection Capacity Utilization	65.8%		ICU Level of Service				C					
Analysis Period (min)	60											

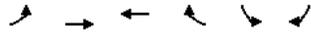
HCM Unsignalized Intersection Capacity Analysis  
25: Hwy 401 EB Ramp & Boundary Road

Future Background - Scenario 1  
Weekday A.M. Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖	↗	↕	↖	↖	↕
Sign Control	Stop	Free	Free	Free	Free	Free
Grade	0%	0%	0%	0%	0%	0%
Volume (veh/h)	146	13	337	83	10	899
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	146	13	337	83	10	899
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1256	337			420	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1256	337			420	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	22	98			99	
cM capacity (veh/h)	188	705			1139	
Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	
Volume Total	146	13	337	83	909	
Volume Left	146	0	0	0	10	
Volume Right	0	13	0	83	0	
cSH	188	705	1700	1700	1139	
Volume to Capacity	0.78	0.02	0.20	0.05	0.01	
Queue Length 95th (m)	61.6	0.5	0.0	0.0	0.2	
Control Delay (s)	83.0	10.2	0.0	0.0	0.2	
Lane LOS	F	B			A	
Approach Delay (s)	77.1		0.0		0.2	
Approach LOS	F					
<b>Intersection Summary</b>						
Average Delay	8.4					
Intersection Capacity Utilization	70.0%		ICU Level of Service		C	
Analysis Period (min)	60					

HCM Unsignalized Intersection Capacity Analysis  
29: Tenth Street & Virginia Drive

Future Background - Scenario 1  
Weekday A.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	87	0	0	0	0	64
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	87	0	0	0	0	64
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0				174	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				174	0
tC, single (s)	4.1				6.4	6.4
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.5
p0 queue free %	95				100	94
cM capacity (veh/h)	1623				777	1037
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	87	0	64			
Volume Left	87	0	0			
Volume Right	0	0	64			
cSH	1623	1700	1037			
Volume to Capacity	0.05	0.00	0.06			
Queue Length 95th (m)	1.4	0.0	1.6			
Control Delay (s)	7.3	0.0	8.7			
Lane LOS	A		A			
Approach Delay (s)	7.3	0.0	8.7			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay			7.9			
Intersection Capacity Utilization		15.4%		ICU Level of Service		A
Analysis Period (min)			60			

HCM Signalized Intersection Capacity Analysis  
5: SCM Way & Boundary Road

Future Background - Scenario 1  
Weekday P.M. Peak Hour

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↕	↕
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2	6.2	5.2	5.2	5.2	5.2
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	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1172	1583	1671	1743	1712	1022
Flt Permitted	0.95	1.00	0.35	1.00	1.00	1.00
Satd. Flow (perm)	1172	1583	618	1743	1712	1022
Volume (vph)	100	54	12	687	680	52
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	100	54	12	687	680	52
RTOR Reduction (vph)	0	47	0	0	0	13
Lane Group Flow (vph)	100	7	12	687	680	39
Heavy Vehicles (%)	54%	2%	8%	9%	11%	58%
Turn Type	Perm	Perm			Perm	
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	12.8	12.8	73.8	73.8	73.8	73.8
Effective Green, g (s)	13.8	13.8	74.8	74.8	74.8	74.8
Actuated g/C Ratio	0.14	0.14	0.75	0.75	0.75	0.75
Clearance Time (s)	7.2	7.2	6.2	6.2	6.2	6.2
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	162	218	462	1304	1281	764
v/s Ratio Prot	c0.09			0.39	c0.40	
v/s Ratio Perm		0.00	0.02			0.04
v/c Ratio	0.62	0.03	0.03	0.53	0.53	0.05
Uniform Delay, d1	40.6	37.3	3.2	5.2	5.3	3.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.0	0.1	0.1	1.5	1.6	0.1
Delay (s)	47.6	37.4	3.3	6.8	6.9	3.4
Level of Service	D	D	A	A	A	A
Approach Delay (s)	44.0			6.7	6.6	
Approach LOS	D			A	A	

Intersection Summary			
HCM Average Control Delay	10.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	11.4
Intersection Capacity Utilization	58.2%	ICU Level of Service	B
Analysis Period (min)	60		
c Critical Lane Group			

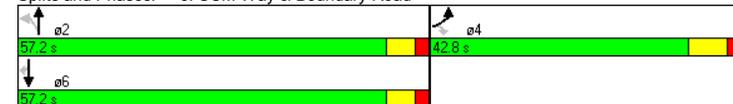
Queues  
5: SCM Way & Boundary Road

Future Background - Scenario 1  
Weekday P.M. Peak Hour

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↕	↕
Volume (vph)	100	54	12	687	680	52
Lane Group Flow (vph)	100	54	12	687	680	52
Turn Type	Perm	Perm			Perm	
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Detector Phases	4	4	2	2	6	6
Minimum Initial (s)	15.0	15.0	20.0	20.0	20.0	20.0
Minimum Split (s)	42.8	42.8	28.2	28.2	28.2	28.2
Total Split (s)	42.8	42.8	57.2	57.2	57.2	57.2
Total Split (%)	42.8%	42.8%	57.2%	57.2%	57.2%	57.2%
Yellow Time (s)	5.4	5.4	4.1	4.1	4.1	4.1
All-Red Time (s)	1.8	1.8	2.1	2.1	2.1	2.1
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	C-Min	C-Min	C-Min	C-Min
v/c Ratio	0.51	0.17	0.04	0.51	0.51	0.06
Control Delay	47.5	11.1	5.0	7.8	7.9	1.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.5	11.1	5.0	7.8	7.9	1.6
Queue Length 50th (m)	19.0	0.0	0.6	54.1	53.7	0.0
Queue Length 95th (m)	39.4	12.6	2.9	116.8	116.9	4.3
Internal Link Dist (m)	265.1			548.2	424.1	
Turn Bay Length (m)	62.0		80.0			65.0
Base Capacity (vph)	429	614	298	1346	1322	801
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	0.23	0.09	0.04	0.51	0.51	0.06

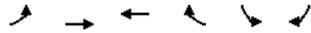
Intersection Summary	
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	80
Control Type:	Actuated-Coordinated

Splits and Phases: 5: SCM Way & Boundary Road



HCM Unsignalized Intersection Capacity Analysis  
6: Optimum Drive & SCM Way

Future Background - Scenario 1  
Weekday P.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		↓	↓
Sign Control	Free	Free	Free		Stop	
Grade	0%	0%	0%		0%	
Volume (veh/h)	0	0	0	54	141	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	54	141	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)			289			
pX, platoon unblocked						
vC, conflicting volume	54				27	27
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	54				27	27
tC, single (s)	4.1				7.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				4.4	3.3
p0 queue free %	100				82	100
cM capacity (veh/h)	1564				787	1054

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	0	54	141
Volume Left	0	0	141
Volume Right	0	54	0
cSH	1700	1700	787
Volume to Capacity	0.00	0.03	0.18
Queue Length 95th (m)	0.0	0.0	5.2
Control Delay (s)	0.0	0.0	10.6
Lane LOS			B
Approach Delay (s)	0.0	0.0	10.6
Approach LOS			B

Intersection Summary			
Average Delay		7.6	
Intersection Capacity Utilization	17.8%		ICU Level of Service A
Analysis Period (min)	60		

HCM Unsignalized Intersection Capacity Analysis  
7: Industrial Park Dr & Boundary Road

Future Background - Scenario 1  
Weekday P.M. Peak Hour



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↓	↑	↑	↑	↑	↓
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	100	242	88	599	535	199
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	100	242	88	599	535	199
Pedestrians						
Lane Width (m)		3.6				
Walking Speed (m/s)		1.2				
Percent Blockage		0				
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1410	636	735			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1410	636	735			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	26	50	90			
cM capacity (veh/h)	135	480	865			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1
Volume Total	100	242	88	599	734
Volume Left	100	0	88	0	0
Volume Right	0	242	0	0	199
cSH	135	480	865	1700	1700
Volume to Capacity	0.74	0.50	0.10	0.35	0.43
Queue Length 95th (m)	50.1	23.9	2.7	0.0	0.0
Control Delay (s)	97.4	20.1	9.6	0.0	0.0
Lane LOS	F	C	A		
Approach Delay (s)	42.7		1.2		0.0
Approach LOS	E				

Intersection Summary			
Average Delay		8.8	
Intersection Capacity Utilization	62.0%		ICU Level of Service B
Analysis Period (min)	60		

HCM Unsignalized Intersection Capacity Analysis  
9: Industrial Park Dr & Optimum Drive

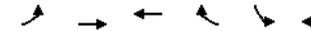
Future Background - Scenario 1  
Weekday P.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	65	31	9	8	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	65	31	9	8	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	40				100	36
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	40				100	36
tC, single (s)	4.1				7.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				4.4	3.3
p0 queue free %	100				99	100
cM capacity (veh/h)	1583				707	1043
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	65	40	8			
Volume Left	0	0	8			
Volume Right	0	9	0			
cSH	1583	1700	707			
Volume to Capacity	0.00	0.02	0.01			
Queue Length 95th (m)	0.0	0.0	0.3			
Control Delay (s)	0.0	0.0	10.1			
Lane LOS			B			
Approach Delay (s)	0.0	0.0	10.1			
Approach LOS			B			
<b>Intersection Summary</b>						
Average Delay	0.7					
Intersection Capacity Utilization	13.4%		ICU Level of Service		A	
Analysis Period (min)	60					

HCM Unsignalized Intersection Capacity Analysis  
11: Boundary Access & Truck Access

Future Background - Scenario 1  
Weekday P.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	0	0	0	0	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0				0	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				0	0
tC, single (s)	5.1				6.4	7.2
tC, 2 stage (s)						
tF (s)	3.1				3.5	4.2
p0 queue free %	100				100	100
cM capacity (veh/h)	1161				1029	857
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	0	0	0			
Volume Left	0	0	0			
Volume Right	0	0	0			
cSH	1700	1700	1700			
Volume to Capacity	0.00	0.00	0.00			
Queue Length 95th (m)	0.0	0.0	0.0			
Control Delay (s)	0.0	0.0	0.0			
Lane LOS			A			
Approach Delay (s)	0.0	0.0	0.0			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay	0.0					
Intersection Capacity Utilization	0.0%		ICU Level of Service		A	
Analysis Period (min)	60					

HCM Signalized Intersection Capacity Analysis  
13: Marleau Avenue & Nick Kaneb Drive

Future Background - Scenario 1  
Weekday P.M. Peak Hour

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	2.0	5.5	5.3	5.3
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frbp, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
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)	1827	1553	1805	1845	1770	1615
Flt Permitted	1.00	1.00	0.16	1.00	0.95	1.00
Satd. Flow (perm)	1827	1553	303	1845	1770	1615
Volume (vph)	788	329	63	958	270	59
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	788	329	63	958	270	59
RTOR Reduction (vph)	0	37	0	0	0	45
Lane Group Flow (vph)	788	293	63	958	270	14
Confl. Peds. (#/hr)	3					
Heavy Vehicles (%)	4%	4%	0%	3%	2%	0%
Turn Type	Perm pm+pt		Perm			
Protected Phases	4		3	8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	37.5	37.5	44.9	44.9	17.3	17.3
Effective Green, g (s)	38.5	38.5	49.4	45.9	18.3	18.3
Actuated g/C Ratio	0.51	0.51	0.66	0.61	0.24	0.24
Clearance Time (s)	6.5	6.5	3.0	6.5	6.3	6.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	938	797	308	1129	432	394
v/s Ratio Prot	0.43		0.01	0.52	0.15	
v/s Ratio Perm		0.19	0.12			0.01
v/c Ratio	0.84	0.37	0.20	0.85	0.62	0.04
Uniform Delay, d1	15.6	10.9	9.1	11.7	25.3	21.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	9.8	1.3	0.3	8.7	2.8	0.0
Delay (s)	25.4	12.3	9.4	20.4	28.1	21.7
Level of Service	C	B	A	C	C	C
Approach Delay (s)	21.5		19.7		27.0	
Approach LOS	C		B		C	

Intersection Summary

HCM Average Control Delay	21.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	74.6%	ICU Level of Service	D
Analysis Period (min)	60		
c Critical Lane Group			

Queues

13: Marleau Avenue & Nick Kaneb Drive

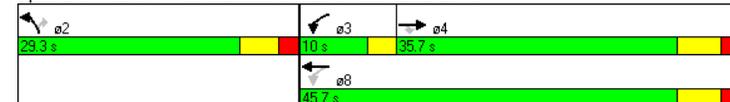
Future Background - Scenario 1  
Weekday P.M. Peak Hour

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Volume (vph)	788	329	63	958	270	59
Lane Group Flow (vph)	788	329	63	958	270	59
Turn Type	Perm pm+pt		Perm			
Protected Phases	4		3	8	2	
Permitted Phases		4	8			2
Detector Phases	4	4	3	8	2	2
Minimum Initial (s)	18.2	18.2	7.0	18.0	15.0	15.0
Minimum Split (s)	35.7	35.7	10.0	35.7	29.3	29.3
Total Split (s)	35.7	35.7	10.0	45.7	29.3	29.3
Total Split (%)	47.6%	47.6%	13.3%	60.9%	39.1%	39.1%
Yellow Time (s)	4.5	4.5	3.0	4.5	4.1	4.1
All-Red Time (s)	2.0	2.0	0.0	2.0	2.2	2.2
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?						
Recall Mode	C-Max	C-Max	None	C-Max	None	None
v/c Ratio	0.81	0.38	0.20	0.85	0.62	0.13
Control Delay	27.4	11.4	6.8	23.1	31.9	6.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.4	11.4	6.8	23.1	31.9	6.7
Queue Length 50th (m)	98.0	21.5	2.7	96.8	36.8	0.0
Queue Length 95th (m)#233.7	59.2	9.1	#254.7	62.7	9.5	
Internal Link Dist (m)	966.8		629.1		388.0	
Turn Bay Length (m)	10.0		25.0		25.0	
Base Capacity (vph)	967	857	314	1128	566	557
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	0.81	0.38	0.20	0.85	0.48	0.11

Intersection Summary

Cycle Length: 75
Actuated Cycle Length: 75
Offset: 0 (0%), Referenced to phase 4:EBT and 8:WBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 13: Marleau Avenue & Nick Kaneb Drive



HCM Signalized Intersection Capacity Analysis  
14: Tenth Street & McConnell Avenue

Future Background - Scenario 1  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↕			↕			↕			↕		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0			5.0			5.5		5.5	5.5		5.5
Lane Util. Factor	1.00			1.00			1.00		1.00	1.00		1.00
Frpb, ped/bikes	1.00			0.99			1.00		1.00	1.00		1.00
Flpb, ped/bikes	1.00			1.00			1.00		1.00	1.00		1.00
Frt	0.98			0.95			1.00		0.99	1.00		1.00
Flt Protected	0.98			0.99			0.95		1.00	0.95		1.00
Satd. Flow (prot)	1679			1723			1805		1823	1786		1774
Flt Permitted	0.89			0.89			0.24		1.00	0.22		1.00
Satd. Flow (perm)	1522			1563			456		1823	421		1774
Volume (vph)	8	12	3	26	32	32	7	964	40	26	955	11
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	8	12	3	26	32	32	7	964	40	26	955	11
RTOR Reduction (vph)	0	3	0	0	23	0	0	1	0	0	0	0
Lane Group Flow (vph)	0	20	0	0	67	0	7	1003	0	26	966	0
Confl. Peds. (#/hr)	2		4		4		2		2		2	
Heavy Vehicles (%)	25%	0%	0%	8%	0%	0%	0%	3%	15%	1%	7%	0%
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases	4		8		8		2		6		6	
Permitted Phases	4		8		8		2		6		6	
Actuated Green, G (s)	8.9		8.9		8.9		78.6		78.6	78.6		78.6
Effective Green, g (s)	9.9		9.9		9.9		79.6		79.6	79.6		79.6
Actuated g/C Ratio	0.10		0.10		0.10		0.80		0.80	0.80		0.80
Clearance Time (s)	6.0		6.0		6.0		6.5		6.5	6.5		6.5
Vehicle Extension (s)	3.0		3.0		3.0		3.0		3.0	3.0		3.0
Lane Grp Cap (vph)	151		155		363		1451		335	1412		
v/s Ratio Prot					c0.55		c0.55		0.54			
v/s Ratio Perm	0.01		c0.04		0.02		0.06		0.06			
v/c Ratio	0.13		0.43		0.02		0.69		0.08		0.68	
Uniform Delay, d1	41.1		42.4		2.1		4.6		2.2		4.6	
Progression Factor	1.00		1.00		0.27		0.72		1.00		1.00	
Incremental Delay, d2	0.4		1.9		0.0		1.2		0.5		2.7	
Delay (s)	41.5		44.3		0.6		4.6		2.7		7.3	
Level of Service	D		D		A		A		A		A	
Approach Delay (s)	41.5		44.3		4.5		7.2		7.2			
Approach LOS	D		D		A		A		A		A	

Intersection Summary			
HCM Average Control Delay	7.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	71.5%	ICU Level of Service	C
Analysis Period (min)	60		
c Critical Lane Group			

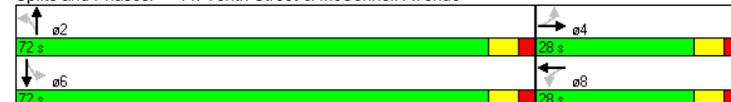
Queues  
14: Tenth Street & McConnell Avenue

Future Background - Scenario 1  
Weekday P.M. Peak Hour

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↕			↕			↕	
Volume (vph)	8	12	26	32	7	964	26	955
Lane Group Flow (vph)	0	23	0	90	7	1004	26	966
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases	4		8		2		6	
Permitted Phases	4		8		2		6	
Detector Phases	4		8		2		6	
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	28.0	28.0	28.0	28.0	28.5	28.5	28.5	28.5
Total Split (s)	28.0	28.0	28.0	28.0	72.0	72.0	72.0	72.0
Total Split (%)	28.0%	28.0%	28.0%	28.0%	72.0%	72.0%	72.0%	72.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	1.9	1.9	1.9	1.9	2.4	2.4	2.4	2.4
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.12	0.42	0.03	0.67	0.13	0.66	0.13	0.66
Control Delay	36.6	35.8	0.9	5.2	4.7	8.1	4.7	8.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.6	35.8	0.9	5.2	4.7	8.1	4.7	8.1
Queue Length 50th (m)	3.7	12.3	0.1	15.3	1.0	73.3	1.0	73.3
Queue Length 95th (m)	12.4	31.1	m0.1m	157.3	4.6	191.0	4.6	191.0
Internal Link Dist (m)	414.9		911.2		283.7		1842.8	
Turn Bay Length (m)			14.0		14.0			
Base Capacity (vph)	363		390		241		1494	
Starvation Cap Reductn	0		0		0		0	
Spillback Cap Reductn	0		0		0		0	
Storage Cap Reductn	0		0		0		0	
Reduced v/c Ratio	0.06	0.23	0.03	0.67	0.13	0.66	0.13	0.66

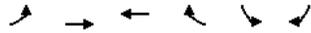
Intersection Summary	
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	95 (95%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle:	80
Control Type:	Actuated-Coordinated
m	Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 14: Tenth Street & McConnell Avenue



HCM Unsignalized Intersection Capacity Analysis  
16: Virginia Drive & Industrial Park Drive

Future Background - Scenario 1  
Weekday P.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	↕
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	78	0	0	0	0	90
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	78	0	0	0	0	90
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0				156	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				156	0
tC, single (s)	4.2				7.3	6.2
tC, 2 stage (s)						
tF (s)	2.3				4.3	3.3
p0 queue free %	95				100	92
cM capacity (veh/h)	1597				639	1088
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	78	0	90			
Volume Left	78	0	0			
Volume Right	0	0	90			
cSH	1597	1700	1088			
Volume to Capacity	0.05	0.00	0.08			
Queue Length 95th (m)	1.2	0.0	2.2			
Control Delay (s)	7.4	0.0	8.6			
Lane LOS	A		A			
Approach Delay (s)	7.4	0.0	8.6			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay			8.0			
Intersection Capacity Utilization		16.6%		ICU Level of Service		A
Analysis Period (min)			60			

HCM Signalized Intersection Capacity Analysis  
17: Marleau Avenue & Boundary Road

Future Background - Scenario 1  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.7	6.7	6.7	6.7	6.7	6.7	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	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1684	1810	1553	1612	1827	1449	1736	1712	1380	1612	1776	1509
Flt Permitted	0.70	1.00	1.00	0.67	1.00	1.00	0.29	1.00	1.00	0.31	1.00	1.00
Satd. Flow (perm)	1234	1810	1553	1134	1827	1449	521	1712	1380	528	1776	1509
Volume (vph)	171	139	51	34	94	33	89	483	41	57	507	213
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	171	139	51	34	94	33	89	483	41	57	507	213
RTOR Reduction (vph)	0	0	29	0	0	19	0	0	25	0	0	131
Lane Group Flow (vph)	171	139	22	34	94	14	89	483	16	57	507	82
Confl. Peds. (#/hr)	1					1						
Heavy Vehicles (%)	7%	5%	4%	12%	4%	9%	4%	11%	17%	12%	7%	7%
Turn Type	Perm		Perm	Perm		Perm	Perm		Perm	Perm		Perm
Protected Phases		4			8			2		2		6
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	29.3	29.3	29.3	29.3	29.3	29.3	26.0	26.0	26.0	26.0	26.0	26.0
Effective Green, g (s)	30.3	30.3	30.3	30.3	30.3	30.3	27.0	27.0	27.0	27.0	27.0	27.0
Actuated g/C Ratio	0.43	0.43	0.43	0.43	0.43	0.43	0.39	0.39	0.39	0.39	0.39	0.39
Clearance Time (s)	7.7	7.7	7.7	7.7	7.7	7.7	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	534	783	672	491	791	627	201	660	532	204	685	582
v/s Ratio Prot		0.08			0.05			0.28			0.29	
v/s Ratio Perm	c0.14		0.01	0.03		0.01	0.17		0.01	0.11		0.05
v/c Ratio	0.32	0.18	0.03	0.07	0.12	0.02	0.44	0.73	0.03	0.28	0.74	0.14
Uniform Delay, d1	13.1	12.2	11.4	11.6	11.9	11.4	15.9	18.4	13.4	14.8	18.5	14.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	0.1	0.0	0.1	0.1	0.0	7.1	7.3	0.1	3.4	7.4	0.5
Delay (s)	13.4	12.3	11.4	11.7	11.9	11.4	23.0	25.7	13.5	18.2	25.9	14.5
Level of Service	B	B	B	B	B	B	C	C	B	B	C	B
Approach Delay (s)		12.7			11.8			24.5			22.2	
Approach LOS		B			B			C			C	

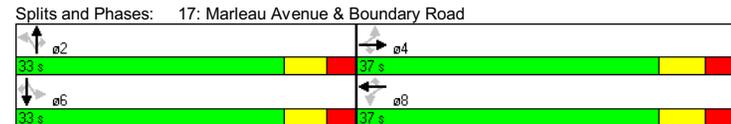
Intersection Summary			
HCM Average Control Delay	20.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.7
Intersection Capacity Utilization	91.7%	ICU Level of Service	F
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
17: Marleau Avenue & Boundary Road

Future Background - Scenario 1  
Weekday P.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	171	139	51	34	94	33	89	483	41	57	507	213
Lane Group Flow (vph)	171	139	51	34	94	33	89	483	41	57	507	213
Turn Type	Perm		Perm	Perm		Perm	Perm		Perm	Perm		Perm
Protected Phases		4			8			2		2		6
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phases	4	4	4	8	8	8	2	2	2	6	6	6
Minimum Initial (s)	29.3	29.3	29.3	29.3	29.3	29.3	15.0	15.0	15.0	15.0	15.0	15.0
Minimum Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	23.0	23.0	23.0	23.0	23.0	23.0
Total Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (%)	52.9%	52.9%	52.9%	52.9%	52.9%	52.9%	47.1%	47.1%	47.1%	47.1%	47.1%	47.1%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	3.2	3.2	3.2	3.2	3.2	3.2	2.9	2.9	2.9	2.9	2.9	2.9
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.32	0.18	0.07	0.07	0.12	0.05	0.44	0.73	0.07	0.28	0.74	0.30
Control Delay	15.2	13.0	4.2	12.2	12.4	4.8	24.8	26.8	5.3	19.5	26.9	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.2	13.0	4.2	12.2	12.4	4.8	24.8	26.8	5.3	19.5	26.9	3.6
Queue Length 50th (m)	14.9	11.3	0.0	2.6	7.4	0.0	8.8	55.3	0.0	5.3	58.3	0.0
Queue Length 95th (m)	33.1	24.6	6.7	8.5	17.6	5.4	26.7	#120.9	6.6	16.6	#126.4	16.0
Internal Link Dist (m)		2051.6			246.6		346.9			725.5		
Turn Bay Length (m)	46.0			68.0		48.0	34.0			68.0		48.0
Base Capacity (vph)	534	783	701	490	791	646	201	660	557	204	685	713
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.32	0.18	0.07	0.07	0.12	0.05	0.44	0.73	0.07	0.28	0.74	0.30

Intersection Summary	
Cycle Length:	70
Actuated Cycle Length:	70
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle:	65
Control Type:	Actuated-Coordinated
#	95th percentile volume exceeds capacity, queue may be longer.
	Queue shown is maximum after two cycles.



HCM Signalized Intersection Capacity Analysis  
18: Marleau Avenue & McConnell Avenue

Future Background - Scenario 1  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.5		2.0	5.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1719	1845	1560	1770	1881	1568	1785	1806		1719	1845	
Flt Permitted	0.13	1.00	1.00	0.11	1.00	1.00	0.44	1.00		0.12	1.00	
Satd. Flow (perm)	241	1845	1560	213	1881	1568	818	1806		213	1845	
Volume (vph)	39	679	178	124	737	446	275	526	99	536	380	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	39	679	178	124	737	446	275	526	99	536	380	0
RTOR Reduction (vph)	0	0	109	0	0	215	0	6	0	0	0	0
Lane Group Flow (vph)	39	679	70	124	737	231	275	619	0	536	380	0
Confl. Peds. (#/hr)			2	2			3		2	2		3
Heavy Vehicles (%)	5%	3%	1%	2%	1%	3%	1%	2%	4%	5%	3%	12%
Turn Type	Perm		Perm pm+pt		Perm pm+pt			pm+pt				
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	29.0	29.0	29.0	38.0	38.0	38.0	40.5	27.5		49.5	33.5	
Effective Green, g (s)	30.0	30.0	30.0	42.0	39.0	39.0	46.0	28.5		54.0	34.5	
Actuated g/C Ratio	0.30	0.30	0.30	0.42	0.39	0.39	0.46	0.28		0.54	0.34	
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.5		3.0	6.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	72	554	468	198	734	612	512	515		416	637	
v/s Ratio Prot		c0.37		0.04	c0.39		0.08	c0.34		c0.26	0.21	
v/s Ratio Perm	0.16		0.04	0.22		0.15	0.17			0.44		
v/c Ratio	0.54	1.23	0.15	0.63	1.00	0.38	0.54	1.20		1.29	0.60	
Uniform Delay, d1	29.3	35.0	25.6	23.5	30.5	21.8	17.5	35.8		29.9	27.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.82	1.08	
Incremental Delay, d2	8.3	423.1	0.1	14.9	70.4	1.8	1.1	381.8		533.3	1.1	
Delay (s)	37.6	458.1	25.8	38.4	100.9	23.6	18.6	417.5		558.0	30.4	
Level of Service	D	F	C	D	F	C	B	F		F	C	
Approach Delay (s)		353.9			68.6			295.6			339.1	
Approach LOS		F			E			F			F	

Intersection Summary

HCM Average Control Delay	244.7	HCM Level of Service	F
HCM Volume to Capacity ratio	1.24		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	17.5
Intersection Capacity Utilization	135.1%	ICU Level of Service	H
Analysis Period (min)	60		
c Critical Lane Group			

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Synchro 6 Report  
16/10/2010

LEA Consulting, Ltd.

Queues  
18: Marleau Avenue & McConnell Avenue

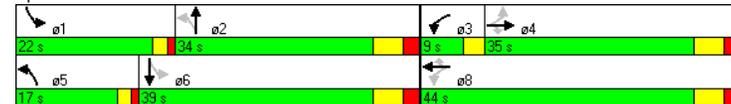
Future Background - Scenario 1  
Weekday P.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	39	679	178	124	737	446	275	526	536	380
Lane Group Flow (vph)	39	679	178	124	737	446	275	625	536	380
Turn Type	Perm		Perm pm+pt		Perm pm+pt			pm+pt		
Protected Phases		4		3	8		5	2	1	6
Permitted Phases	4		4	8		8	2		6	
Detector Phases	4	4	4	3	8	8	5	2	1	6
Minimum Initial (s)	20.0	20.0	20.0	3.0	20.0	20.0	11.0	20.0	11.0	20.0
Minimum Split (s)	28.0	28.0	28.0	7.0	28.0	28.0	14.0	28.5	14.0	28.5
Total Split (s)	35.0	35.0	35.0	9.0	44.0	44.0	17.0	34.0	22.0	39.0
Total Split (%)	35.0%	35.0%	35.0%	9.0%	44.0%	44.0%	17.0%	34.0%	22.0%	39.0%
Yellow Time (s)	4.1	4.1	4.1	3.0	4.1	4.1	2.0	4.1	2.0	4.1
All-Red Time (s)	1.9	1.9	1.9	0.0	1.9	1.9	1.0	2.4	1.0	2.4
Lead/Lag	Lag	Lag	Lag	Lead			Lead	Lag	Lead	Lag
Lead-Lag Optimize?										
Recall Mode	Min	Min	Min	C-Min	C-Min	C-Min	Min	Min	Min	Min
v/c Ratio	0.54	1.23	0.31	0.63	1.00	0.54	0.55	1.20	1.29	0.60
Control Delay	62.7	455.6	7.7	34.2	102.1	7.8	17.7	412.0	552.1	33.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.7	455.6	7.7	34.2	102.1	7.8	17.7	412.0	552.1	33.3
Queue Length 50th (m)	6.6	~171.7	3.3	15.4	~149.3	12.1	28.9	~155.1	~124.8	73.6
Queue Length 95th (m)	#27.7	#281.4	24.9	#41.4	#272.4	55.1	51.8	#262.7	#223.0m	124.9
Internal Link Dist (m)		264.6			966.8		69.2		283.7	
Turn Bay Length (m)			84.0	71.0		71.0	77.0		130.0	
Base Capacity (vph)	72	554	577	198	734	827	516	521	417	637
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	0.54	1.23	0.31	0.63	1.00	0.54	0.53	1.20	1.29	0.60

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 0 (0%), Referenced to phase 3:WBL and 8:WBTL, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 18: Marleau Avenue & McConnell Avenue



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Synchro 6 Report  
16/10/2010

LEA Consulting, Ltd.

HCM Unsignalized Intersection Capacity Analysis  
22: Hwy 401 WB Ramp & Boundary Road

Future Background - Scenario 1  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗	↖	↕	↗		↕	↗		↕	↗
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	9	1	86	46	17	12	85	520	105	11	542	6
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	9	1	86	46	17	12	85	520	105	11	542	6
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1330	1362	545	1396	1312	572	548				625	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1330	1362	545	1396	1312	572	548				625	
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
p0 queue free %	92	99	84	50	88	98	92				99	
cM capacity (veh/h)	109	134	538	92	144	519	1021				956	
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>WB 1</b>	<b>WB 2</b>	<b>NB 1</b>	<b>SB 1</b>						
Volume Total	10	86	46	29	710	559						
Volume Left	9	0	46	0	85	11						
Volume Right	0	86	0	12	105	6						
cSH	111	538	92	205	1021	956						
Volume to Capacity	0.09	0.16	0.50	0.14	0.08	0.01						
Queue Length 95th (m)	2.4	4.6	21.5	3.9	2.2	0.3						
Control Delay (s)	40.7	13.0	81.8	25.5	2.1	0.3						
Lane LOS	E	B	F	D	A	A						
Approach Delay (s)	15.8		60.0		2.1	0.3						
Approach LOS	C		F									
<b>Intersection Summary</b>												
Average Delay	5.3									E		
Intersection Capacity Utilization	87.2%			ICU Level of Service						E		
Analysis Period (min)	60											

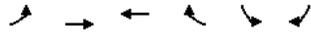
HCM Unsignalized Intersection Capacity Analysis  
25: Hwy 401 EB Ramp & Boundary Road

Future Background - Scenario 1  
Weekday P.M. Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖	↗	↕	↖	↖	↕
Sign Control	Stop	↗	Free	↖		Free
Grade	0%		0%			0%
Volume (veh/h)	66	51	659	128	8	666
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	66	51	659	128	8	666
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1341	659			787	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1341	659			787	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	60	89			99	
cM capacity (veh/h)	166	464			832	
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>WB 2</b>	<b>NB 1</b>	<b>NB 2</b>	<b>SB 1</b>	
Volume Total	66	51	659	128	674	
Volume Left	66	0	0	0	8	
Volume Right	0	51	0	128	0	
cSH	166	464	1700	1700	832	
Volume to Capacity	0.40	0.11	0.39	0.08	0.01	
Queue Length 95th (m)	15.2	3.0	0.0	0.0	0.2	
Control Delay (s)	40.7	13.7	0.0	0.0	0.3	
Lane LOS	E	B			A	
Approach Delay (s)	28.9		0.0		0.3	
Approach LOS	D					
<b>Intersection Summary</b>						
Average Delay	2.3					
Intersection Capacity Utilization	51.8%			ICU Level of Service		
Analysis Period (min)	60					

HCM Unsignalized Intersection Capacity Analysis  
29: Tenth Street & Virginia Drive

Future Background - Scenario 1  
Weekday P.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	↕
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	78	0	0	0	0	90
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	78	0	0	0	0	90
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0				156	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				156	0
tC, single (s)	4.2				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.3				3.5	3.3
p0 queue free %	95				100	92
cM capacity (veh/h)	1578				799	1088
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	78	0	90			
Volume Left	78	0	0			
Volume Right	0	0	90			
cSH	1578	1700	1088			
Volume to Capacity	0.05	0.00	0.08			
Queue Length 95th (m)	1.2	0.0	2.2			
Control Delay (s)	7.4	0.0	8.6			
Lane LOS	A		A			
Approach Delay (s)	7.4	0.0	8.6			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay			8.0			
Intersection Capacity Utilization		16.6%		ICU Level of Service		A
Analysis Period (min)			60			

*Future Background- Scenario 1: Dual Left*

HCM Signalized Intersection Capacity Analysis Future Background - Scenario 1: Dual Left  
18: Marleau Avenue & McConnell Avenue Weekday A.M. Peak Hour

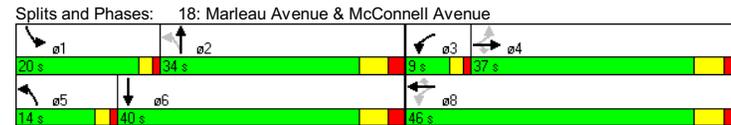
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0	5.0	2.0	5.0	5.0	2.0	5.5		2.0	5.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.97	1.00	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1703	1827	1532	1736	1845	1509	1736	1675		3303	1776	
Flt Permitted	0.15	1.00	1.00	0.13	1.00	1.00	0.47	1.00		0.95	1.00	
Satd. Flow (perm)	274	1827	1532	235	1845	1509	851	1675		3303	1776	
Volume (vph)	34	536	127	156	670	465	152	275	130	540	363	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	34	536	127	156	670	465	152	275	130	540	363	0
RTOR Reduction (vph)	0	0	87	0	0	250	0	17	0	0	0	0
Lane Group Flow (vph)	34	536	40	156	670	215	152	388	0	540	363	0
Confl. Peds. (#/hr)			5	5								
Heavy Vehicles (%)	6%	4%	2%	4%	3%	7%	4%	8%	8%	6%	7%	50%
Turn Type	Perm		Perm pm+pt		Perm pm+pt		Perm pm+pt		Prot			
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2					
Actuated Green, G (s)	30.2	30.2	30.2	39.2	39.2	39.2	39.2	28.2		17.1	34.3	
Effective Green, g (s)	34.2	31.2	31.2	43.2	40.2	40.2	44.7	29.2		18.1	35.3	
Actuated g/C Ratio	0.34	0.31	0.31	0.43	0.40	0.40	0.45	0.29		0.18	0.35	
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.5		3.0	6.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	94	570	478	207	742	607	487	489		598	627	
v/s Ratio Prot		0.29		0.05	c0.36		0.04	c0.23		c0.16	0.20	
v/s Ratio Perm	0.12		0.03	0.27		0.14	0.10					
v/c Ratio	0.36	0.94	0.08	0.75	0.90	0.35	0.31	0.79		0.90	0.58	
Uniform Delay, d1	24.7	33.5	24.3	21.9	28.1	20.8	16.9	32.6		40.1	26.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.89	1.06	
Incremental Delay, d2	2.4	34.1	0.1	15.7	17.3	0.4	0.4	13.6		17.1	3.1	
Delay (s)	27.1	67.6	24.4	37.6	45.3	21.2	17.3	46.3		52.8	31.0	
Level of Service	C	E	C	D	D	C	B	D		D	C	
Approach Delay (s)		57.8			35.7			38.3			44.1	
Approach LOS		E			D			D			D	

Intersection Summary			
HCM Average Control Delay	42.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	105.1%	ICU Level of Service	G
Analysis Period (min)	60		
c Critical Lane Group			

Queues Future Background - Scenario 1: Dual Left  
18: Marleau Avenue & McConnell Avenue Weekday A.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	34	536	127	156	670	465	152	275	540	363
Lane Group Flow (vph)	34	536	127	156	670	465	152	405	540	363
Turn Type	Perm		Perm pm+pt		Perm pm+pt		Perm pm+pt		Prot	
Protected Phases		4		3	8		5	2	1	6
Permitted Phases	4		4	8		8	2			
Detector Phases	4	4	4	3	8	8	5	2	1	6
Minimum Initial (s)	20.0	20.0	20.0	5.0	20.0	20.0	11.0	15.0	10.0	15.0
Minimum Split (s)	26.0	26.0	26.0	9.0	26.0	26.0	14.0	26.5	14.0	26.5
Total Split (s)	37.0	37.0	37.0	9.0	46.0	46.0	14.0	34.0	20.0	40.0
Total Split (%)	37.0%	37.0%	37.0%	9.0%	46.0%	46.0%	14.0%	34.0%	20.0%	40.0%
Yellow Time (s)	4.1	4.1	4.1	2.0	4.1	4.1	2.0	4.1	2.0	4.1
All-Red Time (s)	1.9	1.9	1.9	1.0	1.9	1.9	1.0	2.4	1.0	2.4
Lead/Lag	Lag	Lag	Lag	Lead			Lead	Lag	Lead	Lag
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	None	None	C-Max	None	C-Max
v/c Ratio	0.34	0.94	0.22	0.73	0.90	0.54	0.31	0.80	0.90	0.58
Control Delay	35.5	71.2	5.6	41.5	49.3	5.8	14.8	45.8	56.7	32.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.5	71.2	5.6	41.5	49.3	5.8	14.8	45.8	56.7	32.1
Queue Length 50th (m)	5.1	104.5	0.0	19.1	124.0	5.7	15.6	72.8	56.3	70.0
Queue Length 95th (m)	17.6	#201.8	16.5	#52.5	#233.4	45.6	30.4	#149.4	#104.4	109.4
Internal Link Dist (m)		264.6			966.8			238.5		283.7
Turn Bay Length (m)			84.0	71.0		71.0	77.0		130.0	
Base Capacity (vph)	103	585	577	214	756	865	483	506	599	627
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	0.33	0.92	0.22	0.73	0.89	0.54	0.31	0.80	0.90	0.58

Intersection Summary	
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	96 (96%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	90
Control Type:	Actuated-Coordinated
#	95th percentile volume exceeds capacity, queue may be longer.
	Queue shown is maximum after two cycles.



HCM Signalized Intersection Capacity Analysis Future Background - Scenario 1: Dual Left  
18: Marleau Avenue & McConnell Avenue Weekday P.M. Peak Hour

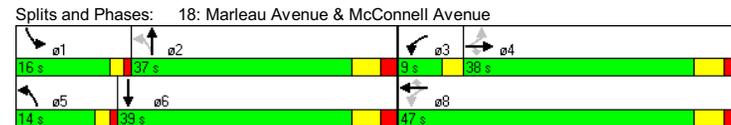
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.5		2.0	5.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.97	1.00	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1719	1845	1560	1770	1881	1568	1785	1806		3335	1845	
Flt Permitted	0.12	1.00	1.00	0.11	1.00	1.00	0.38	1.00		0.95	1.00	
Satd. Flow (perm)	219	1845	1560	196	1881	1568	711	1806		3335	1845	
Volume (vph)	39	679	178	124	737	446	275	526	99	536	380	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	39	679	178	124	737	446	275	526	99	536	380	0
RTOR Reduction (vph)	0	0	109	0	0	215	0	7	0	0	0	0
Lane Group Flow (vph)	39	679	69	124	737	231	275	618	0	536	380	0
Confl. Peds. (#/hr)			2	2			3		2	2		3
Heavy Vehicles (%)	5%	3%	1%	2%	1%	3%	1%	2%	4%	5%	3%	12%
Turn Type	Perm		Perm pm+pt		Perm pm+pt				Prot			
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2					
Actuated Green, G (s)	32.0	32.0	32.0	41.0	41.0	41.0	41.5	30.5		13.0	32.5	
Effective Green, g (s)	33.0	33.0	33.0	45.0	42.0	42.0	47.0	31.5		14.0	33.5	
Actuated g/C Ratio	0.33	0.33	0.33	0.45	0.42	0.42	0.47	0.32		0.14	0.34	
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.5		3.0	6.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	72	609	515	198	790	659	463	569		467	618	
v/s Ratio Prot		c0.37		0.04	c0.39		0.07	c0.34		c0.16	0.21	
v/s Ratio Perm	0.18		0.04	0.24		0.15	0.21					
v/c Ratio	0.54	1.11	0.13	0.63	0.93	0.35	0.59	1.09		1.15	0.61	
Uniform Delay, d1	27.3	33.5	23.5	22.7	27.7	19.7	17.3	34.2		43.0	27.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.89	1.19	
Incremental Delay, d2	8.3	232.4	0.1	14.9	26.1	1.5	2.1	188.3		286.7	1.4	
Delay (s)	35.6	265.9	23.6	37.6	53.7	21.2	19.4	222.6		324.9	34.6	
Level of Service	D	F	C	D	D	C	B	F		F	C	
Approach Delay (s)		207.8			41.1			160.5			204.5	
Approach LOS		F			D			F			F	

Intersection Summary			
HCM Average Control Delay	142.2	HCM Level of Service	F
HCM Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	17.5
Intersection Capacity Utilization	120.7%	ICU Level of Service	H
Analysis Period (min)	60		
c Critical Lane Group			

Queues Future Background - Scenario 1: Dual Left  
18: Marleau Avenue & McConnell Avenue Weekday P.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	39	679	178	124	737	446	275	526	536	380
Lane Group Flow (vph)	39	679	178	124	737	446	275	625	536	380
Turn Type	Perm		Perm pm+pt		Perm pm+pt			Prot		
Protected Phases		4		3	8		5	2	1	6
Permitted Phases	4		4	8		8	2			
Detector Phases	4	4	4	3	8	8	5	2	1	6
Minimum Initial (s)	20.0	20.0	20.0	3.0	20.0	20.0	11.0	20.0	11.0	20.0
Minimum Split (s)	28.0	28.0	28.0	7.0	28.0	28.0	14.0	28.5	14.0	28.5
Total Split (s)	38.0	38.0	38.0	9.0	47.0	47.0	14.0	37.0	16.0	39.0
Total Split (%)	38.0%	38.0%	38.0%	9.0%	47.0%	47.0%	14.0%	37.0%	16.0%	39.0%
Yellow Time (s)	4.1	4.1	4.1	3.0	4.1	4.1	2.0	4.1	2.0	4.1
All-Red Time (s)	1.9	1.9	1.9	0.0	1.9	1.9	1.0	2.4	1.0	2.4
Lead/Lag	Lag	Lag	Lag	Lead			Lead	Lag	Lead	Lag
Lead-Lag Optimize?										
Recall Mode	Min	Min	Min	C-Min	C-Min	C-Min	Min	Min	Min	Min
v/c Ratio	0.54	1.11	0.29	0.63	0.93	0.51	0.59	1.09	1.15	0.61
Control Delay	61.2	265.5	6.4	32.3	55.0	6.2	20.6	222.5	323.1	37.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	61.2	265.5	6.4	32.3	55.0	6.2	20.6	222.5	323.1	37.4
Queue Length 50th (m)	6.4	~159.9	2.2	14.6	140.1	9.1	31.1	~142.9	~66.9	77.9
Queue Length 95th (m)	#27.7	#269.6	22.4	#41.3	#260.4	47.8	55.7	#250.5	#117.9m	123.9
Internal Link Dist (m)		264.6			966.8		69.2		283.7	
Turn Bay Length (m)			84.0	71.0		71.0	77.0		130.0	
Base Capacity (vph)	72	609	623	198	790	874	463	575	467	618
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	0.54	1.11	0.29	0.63	0.93	0.51	0.59	1.09	1.15	0.61

Intersection Summary	
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	4 (4%), Referenced to phase 3:WBL and 8:WBTL, Start of Green
Natural Cycle:	130
Control Type:	Actuated-Coordinated
~	Volume exceeds capacity, queue is theoretically infinite. Queue shown is maximum after two cycles.
#	95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.
m	Volume for 95th percentile queue is metered by upstream signal.



*Future Background - Scenario 2*

HCM Signalized Intersection Capacity Analysis  
5: SCM Way & Boundary Road

Future Background - Scenario 2  
Weekday A.M. Peak Hour

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↕	↕
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2	6.2	5.2	5.2	5.2	5.2
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frbp, ped/bikes	1.00	0.97	1.00	1.00	1.00	1.00
Flpb, ped/bikes	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	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1056	916	1253	1545	1743	1049
Flt Permitted	0.95	1.00	0.17	1.00	1.00	1.00
Satd. Flow (perm)	1056	916	221	1545	1743	1049
Volume (vph)	56	14	18	364	969	76
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	56	14	18	364	969	76
RTOR Reduction (vph)	0	11	0	0	0	17
Lane Group Flow (vph)	56	3	18	364	969	59
Confl. Peds. (#/hr)	3					
Heavy Vehicles (%)	71%	71%	44%	23%	9%	54%
Turn Type	Perm		Perm		Perm	
Protected Phases	4		2		6	
Permitted Phases	4		2		6	
Actuated Green, G (s)	22.5	22.5	76.0	76.0	76.0	76.0
Effective Green, g (s)	23.5	23.5	77.0	77.0	77.0	77.0
Actuated g/C Ratio	0.21	0.21	0.69	0.69	0.69	0.69
Clearance Time (s)	7.2	7.2	6.2	6.2	6.2	6.2
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	222	192	152	1063	1199	722
v/s Ratio Prot	c0.05		0.24		c0.56	
v/s Ratio Perm	0.00		0.08		0.06	
v/c Ratio	0.25	0.02	0.12	0.34	0.81	0.08
Uniform Delay, d1	36.9	35.0	5.9	7.1	12.3	5.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	0.0	1.6	0.9	6.2	0.2
Delay (s)	37.5	35.1	7.5	8.0	18.5	6.0
Level of Service	D	D	A	A	B	A
Approach Delay (s)	37.0		8.0		17.6	
Approach LOS	D		A		B	

Intersection Summary			
HCM Average Control Delay	16.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	111.9	Sum of lost time (s)	11.4
Intersection Capacity Utilization	90.2%	ICU Level of Service	E
Analysis Period (min)	60		
c Critical Lane Group			

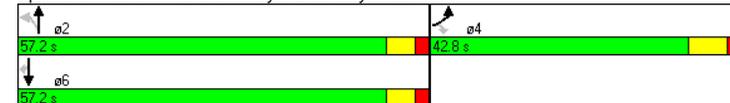
Queues  
5: SCM Way & Boundary Road

Future Background - Scenario 2  
Weekday A.M. Peak Hour

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↕	↕
Volume (vph)	56	14	18	364	969	76
Lane Group Flow (vph)	56	14	18	364	969	76
Turn Type	Perm		Perm		Perm	
Protected Phases	4		2		6	
Permitted Phases	4		2		6	
Detector Phases	4		2		6	
Minimum Initial (s)	35.6	35.6	15.0	15.0	15.0	15.0
Minimum Split (s)	42.8	42.8	57.2	57.2	57.2	57.2
Total Split (s)	42.8	42.8	57.2	57.2	57.2	57.2
Total Split (%)	42.8%	42.8%	57.2%	57.2%	57.2%	57.2%
Yellow Time (s)	5.4	5.4	4.1	4.1	4.1	4.1
All-Red Time (s)	1.8	1.8	2.1	2.1	2.1	2.1
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Max	Max	Max	Max
v/c Ratio	0.17	0.05	0.24	0.33	0.77	0.10
Control Delay	22.9	9.9	26.1	11.9	23.9	5.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.9	9.9	26.1	11.9	23.9	5.3
Queue Length 50th (m)	9.2	0.0	2.0	44.4	203.6	2.1
Queue Length 95th (m)	19.0	4.9	#14.3	80.2	#351.3	11.3
Internal Link Dist (m)	265.1		548.2		424.1	
Turn Bay Length (m)	62.0		80.0		65.0	
Base Capacity (vph)	320	288	74	1116	1259	773
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	0.17	0.05	0.24	0.33	0.77	0.10

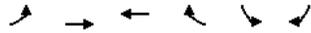
Intersection Summary	
Cycle Length:	100
Actuated Cycle Length:	109.3
Natural Cycle:	110
Control Type:	Semi Act-Uncoord
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	

Splits and Phases: 5: SCM Way & Boundary Road



HCM Unsignalized Intersection Capacity Analysis  
6: Optimum Drive & SCM Way

Future Background - Scenario 2  
Weekday A.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control	Free	Free	Free	Free	Stop	Stop
Grade	0%	0%	0%	0%	0%	0%
Volume (veh/h)	0	0	0	84	57	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	84	57	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)			289			
pX, platoon unblocked						
vC, conflicting volume	84				42	42
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	84				42	42
tC, single (s)	4.1				7.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				4.4	3.3
p0 queue free %	100				93	100
cM capacity (veh/h)	1526				770	1034

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	0	84	57
Volume Left	0	0	57
Volume Right	0	84	0
cSH	1700	1700	770
Volume to Capacity	0.00	0.05	0.07
Queue Length 95th (m)	0.0	0.0	1.9
Control Delay (s)	0.0	0.0	10.0
Lane LOS			B
Approach Delay (s)	0.0	0.0	10.0
Approach LOS			B

Intersection Summary			
Average Delay		4.1	
Intersection Capacity Utilization	15.2%		ICU Level of Service A
Analysis Period (min)		60	

HCM Unsignalized Intersection Capacity Analysis  
7: Industrial Park Dr & Boundary Road

Future Background - Scenario 2  
Weekday A.M. Peak Hour



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↕	↕	↕	↕	↕	↕
Sign Control	Stop	Free	Free	Free	Free	Free
Grade	0%	0%	0%	0%	0%	0%
Volume (veh/h)	32	56	44	350	924	59
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	32	56	44	350	924	59
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1392	954	983			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1392	954	983			
tC, single (s)	6.6	6.3	4.1			
tC, 2 stage (s)						
tF (s)	3.6	3.4	2.2			
p0 queue free %	77	82	94			
cM capacity (veh/h)	137	307	711			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1
Volume Total	32	56	44	350	983
Volume Left	32	0	44	0	0
Volume Right	0	56	0	0	59
cSH	137	307	711	1700	1700
Volume to Capacity	0.23	0.18	0.06	0.21	0.58
Queue Length 95th (m)	7.2	5.3	1.6	0.0	0.0
Control Delay (s)	39.3	19.3	10.4	0.0	0.0
Lane LOS	E	C	B		
Approach Delay (s)	26.6		1.2		0.0
Approach LOS	D				

Intersection Summary			
Average Delay		1.9	
Intersection Capacity Utilization	62.3%		ICU Level of Service B
Analysis Period (min)		60	

HCM Unsignalized Intersection Capacity Analysis  
9: Industrial Park Dr & Optimum Drive

Future Background - Scenario 2  
Weekday A.M. Peak Hour



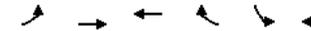
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control	Free	Free	Free	Free	Stop	Stop
Grade	0%	0%	0%	0%	0%	0%
Volume (veh/h)	0	50	31	9	8	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	50	31	9	8	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	40				86	36
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	40				86	36
tC, single (s)	4.1				7.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				4.4	3.3
p0 queue free %	100				99	100
cM capacity (veh/h)	1583				723	1043

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	50	40	8
Volume Left	0	0	8
Volume Right	0	9	0
cSH	1583	1700	723
Volume to Capacity	0.00	0.02	0.01
Queue Length 95th (m)	0.0	0.0	0.3
Control Delay (s)	0.0	0.0	10.0
Lane LOS			B
Approach Delay (s)	0.0	0.0	10.0
Approach LOS			B

Intersection Summary			
Average Delay		0.8	
Intersection Capacity Utilization	13.3%		ICU Level of Service A
Analysis Period (min)	60		

HCM Unsignalized Intersection Capacity Analysis  
11: Boundary Access & Truck Access

Future Background - Scenario 2  
Weekday A.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control	Free	Free	Free	Free	Stop	Stop
Grade	0%	0%	0%	0%	0%	0%
Volume (veh/h)	0	0	0	0	0	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0				0	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				0	0
tC, single (s)	5.1				6.4	7.2
tC, 2 stage (s)						
tF (s)	3.1				3.5	4.2
p0 queue free %	100				100	100
cM capacity (veh/h)	1161				1029	857

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	0	0	0
Volume Left	0	0	0
Volume Right	0	0	0
cSH	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0
Lane LOS			A
Approach Delay (s)	0.0	0.0	0.0
Approach LOS			A

Intersection Summary			
Average Delay		0.0	
Intersection Capacity Utilization	0.0%		ICU Level of Service A
Analysis Period (min)	60		

HCM Signalized Intersection Capacity Analysis  
13: Marleau Avenue & Virginia Avenue

Future Background - Scenario 2  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.3	5.3		5.3	5.3	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1810	1360	1719	1810	1615	1683	1828		1805	1859	
Flt Permitted	0.19	1.00	1.00	0.15	1.00	1.00	0.60	1.00		0.64	1.00	
Satd. Flow (perm)	359	1810	1360	279	1810	1615	1058	1828		1220	1859	
Volume (vph)	25	840	73	40	789	25	275	141	30	25	174	25
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	25	840	73	40	789	25	275	141	30	25	174	25
RTOR Reduction (vph)	0	0	9	0	0	3	0	11	0	0	7	0
Lane Group Flow (vph)	25	840	64	40	789	22	275	160	0	25	192	0
Confl. Peds. (#/hr)			7	7			2					2
Heavy Vehicles (%)	0%	5%	15%	5%	5%	0%	7%	0%	7%	0%	0%	0%
Turn Type	Perm		Perm	Perm		Perm custom				Perm		
Protected Phases		4			8						6	
Permitted Phases	4		4	8		8	2	2		6		
Actuated Green, G (s)	40.9	40.9	40.9	40.9	40.9	40.9	21.3	21.3		21.3	21.3	
Effective Green, g (s)	41.9	41.9	41.9	41.9	41.9	41.9	22.3	22.3		22.3	22.3	
Actuated g/C Ratio	0.56	0.56	0.56	0.56	0.56	0.56	0.30	0.30		0.30	0.30	
Clearance Time (s)	6.5	6.5	6.5	6.5	6.5	6.5	6.3	6.3		6.3	6.3	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	201	1011	760	156	1011	902	315	544		363	553	
v/s Ratio Prot		c0.46			0.44						0.10	
v/s Ratio Perm	0.07		0.05	0.14		0.01	c0.26	0.09		0.02		
v/c Ratio	0.12	0.83	0.08	0.26	0.78	0.02	0.87	0.29		0.07	0.35	
Uniform Delay, d1	7.8	13.6	7.7	8.5	13.0	7.4	25.0	20.3		18.9	20.6	
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	1.3	8.5	0.2	4.0	6.2	0.0	27.7	0.3		0.1	0.4	
Delay (s)	9.1	22.1	7.9	12.5	19.2	7.5	52.8	20.6		19.0	21.0	
Level of Service	A	C	A	B	B	A	D	C		B	C	
Approach Delay (s)		20.7			18.5			40.4			20.8	
Approach LOS		C			B			D			C	

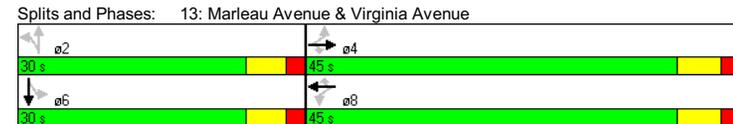
Intersection Summary			
HCM Average Control Delay	23.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	85.7%	ICU Level of Service	E
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
13: Marleau Avenue & Virginia Avenue

Future Background - Scenario 2  
Weekday A.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	25	840	73	40	789	25	275	141	25	174
Lane Group Flow (vph)	25	840	73	40	789	25	275	171	25	199
Turn Type	Perm		Perm	Perm		Perm custom			Perm	
Protected Phases		4			8					6
Permitted Phases	4		4	8		8	2	2	6	
Detector Phases	4	4	4	8	8	8	2	2	6	6
Minimum Initial (s)	18.2	18.2	18.2	18.2	18.2	18.2	15.0	15.0	15.0	15.0
Minimum Split (s)	35.7	35.7	35.7	35.7	35.7	35.7	29.3	29.3	29.3	29.3
Total Split (s)	45.0	45.0	45.0	45.0	45.0	45.0	30.0	30.0	30.0	30.0
Total Split (%)	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	40.0%	40.0%	40.0%	40.0%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.1	4.1	4.1	4.1
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.2	2.2	2.2	2.2
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	C-Min	C-Min	C-Min	C-Min	C-Min	C-Min	Min	Min	None	None
v/c Ratio	0.15	0.83	0.09	0.32	0.78	0.03	0.86	0.31	0.07	0.36
Control Delay	11.8	24.7	7.2	19.1	21.4	7.0	56.6	19.3	18.0	20.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.8	24.7	7.2	19.1	21.4	7.0	56.6	19.3	18.0	20.8
Queue Length 50th (m)	1.8	103.0	3.6	3.2	91.8	1.2	36.4	16.8	2.5	20.7
Queue Length 95th (m)	7.4	#219.0	11.1	14.7	#199.7	5.2	#90.5	36.1	8.6	42.6
Internal Link Dist (m)		914.0			682.0			404.6		283.6
Turn Bay Length (m)	25.0		10.0	25.0		10.0	25.0			
Base Capacity (vph)	171	1011	769	125	1011	906	355	612	406	619
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	0.83	0.09	0.32	0.78	0.03	0.77	0.28	0.06	0.32

Intersection Summary	
Cycle Length: 75	
Actuated Cycle Length: 75	
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	



HCM Signalized Intersection Capacity Analysis  
14: Tenth Street & McConnell Avenue

Future Background - Scenario 2  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔		↔		↔		↔		↔		↔	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5		5.5		5.0		5.0		5.0		5.0	
Lane Util. Factor	1.00		1.00		1.00		1.00		1.00		1.00	
Frpb, ped/bikes	0.99		1.00		1.00		1.00		1.00		1.00	
Flpb, ped/bikes	1.00		1.00		1.00		1.00		1.00		1.00	
Frt	0.97		0.89		1.00		0.99		1.00		1.00	
Flt Protected	1.00		1.00		0.95		1.00		0.95		1.00	
Satd. Flow (prot)	1820		1590		1802		1755		1787		1727	
Flt Permitted	0.97		0.98		0.35		1.00		0.39		1.00	
Satd. Flow (perm)	1766		1557		657		1755		734		1727	
Volume (vph)	1	12	4	12	17	141	5	606	22	192	715	1
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	1	12	4	12	17	141	5	606	22	192	715	1
RTOR Reduction (vph)	0	4	0	0	125	0	0	1	0	0	0	0
Lane Group Flow (vph)	0		13		0		45		5		627	
Confl. Peds. (#/hr)	5		5		2		2		2		2	
Heavy Vehicles (%)	0%		0%		33%		0%		4%		0%	
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases	4		8		8		2		6		6	
Permitted Phases	4		8		2		6		6		6	
Actuated Green, G (s)	10.7		10.7		76.8		76.8		76.8		76.8	
Effective Green, g (s)	11.2		11.2		78.3		78.3		78.3		78.3	
Actuated g/C Ratio	0.11		0.11		0.78		0.78		0.78		0.78	
Clearance Time (s)	6.0		6.0		6.5		6.5		6.5		6.5	
Vehicle Extension (s)	3.0		3.0		3.0		3.0		3.0		3.0	
Lane Grp Cap (vph)	198		174		514		1374		575		1352	
v/s Ratio Prot	c0.41		c0.41		0.36		0.36		0.36		0.36	
v/s Ratio Perm	0.01		c0.03		0.01		0.26		0.26		0.26	
v/c Ratio	0.07		0.26		0.01		0.46		0.33		0.53	
Uniform Delay, d1	39.7		40.6		2.4		3.7		3.2		4.0	
Progression Factor	1.00		1.00		1.92		2.41		1.00		1.00	
Incremental Delay, d2	0.1		0.8		0.0		0.9		1.6		1.5	
Delay (s)	39.9		41.4		4.6		9.8		4.8		5.5	
Level of Service	D		D		A		A		A		A	
Approach Delay (s)	39.9		41.4		9.7		5.4		5.4		5.4	
Approach LOS	D		D		A		A		A		A	

Intersection Summary			
HCM Average Control Delay	10.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	72.7%	ICU Level of Service	C
Analysis Period (min)	60		
c Critical Lane Group			

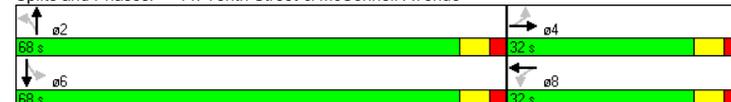
Queues  
14: Tenth Street & McConnell Avenue

Future Background - Scenario 2  
Weekday A.M. Peak Hour

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↔		↔		↔		↔	
Volume (vph)	1	12	12	17	5	606	192	715
Lane Group Flow (vph)	0	17	0	170	5	628	192	716
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases	4		8		2		6	
Permitted Phases	4		8		2		6	
Detector Phases	4		8		2		6	
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	25.0	25.0	25.0	25.0	19.5	19.5	19.5	19.5
Total Split (s)	32.0	32.0	32.0	32.0	68.0	68.0	68.0	68.0
Total Split (%)	32.0%	32.0%	32.0%	32.0%	68.0%	68.0%	68.0%	68.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	1.9	1.9	1.9	1.9	2.4	2.4	2.4	2.4
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.08	0.56	0.01	0.46	0.40	0.40	0.53	0.53
Control Delay	33.5	18.6	5.4	10.4	6.5	5.9	5.9	5.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.5	18.6	5.4	10.4	6.5	5.9	5.9	5.9
Queue Length 50th (m)	2.5	5.5	0.4	67.0	9.3	40.8	40.8	40.8
Queue Length 95th (m)	9.9	32.3	m0.8m	126.4	29.6	94.4	94.4	94.4
Internal Link Dist (m)	414.9	902.0	283.7	1842.8	1842.8	1842.8	1842.8	1842.8
Turn Bay Length (m)			14.0		14.0		14.0	
Base Capacity (vph)	481	520	404	1374	480	1351	1351	1351
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	0.04	0.33	0.01	0.46	0.40	0.53	0.53	0.53

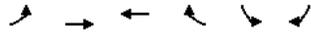
Intersection Summary	
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	1 (1%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	60
Control Type:	Actuated-Coordinated
m	Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 14: Tenth Street & McConnell Avenue



HCM Unsignalized Intersection Capacity Analysis  
16: Virginia Avenue & Industrial Park Drive

Future Background - Scenario 2  
Weekday A.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	↕
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	87	0	0	0	0	64
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	87	0	0	0	0	64
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0				174	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				174	0
tC, single (s)	4.1				7.4	6.4
tC, 2 stage (s)						
tF (s)	2.2				4.4	3.4
p0 queue free %	95				100	94
cM capacity (veh/h)	1630				601	1045
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	87	0	64			
Volume Left	87	0	0			
Volume Right	0	0	64			
cSH	1630	1700	1045			
Volume to Capacity	0.05	0.00	0.06			
Queue Length 95th (m)	1.4	0.0	1.6			
Control Delay (s)	7.3	0.0	8.7			
Lane LOS	A		A			
Approach Delay (s)	7.3	0.0	8.7			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay			7.9			
Intersection Capacity Utilization		15.4%		ICU Level of Service		A
Analysis Period (min)			60			

HCM Signalized Intersection Capacity Analysis  
17: Marleau Avenue & Boundary Road

Future Background - Scenario 2  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.7	6.7	6.7	6.7	6.7	6.7	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	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1612	1845	1553	1517	1881	1482	1626	1652	1429	1719	1759	1553
Flt Permitted	0.66	1.00	1.00	0.72	1.00	1.00	0.22	1.00	1.00	0.60	1.00	1.00
Satd. Flow (perm)	1119	1845	1553	1147	1881	1482	374	1652	1429	1093	1759	1553
Volume (vph)	121	59	74	32	153	23	46	250	15	40	661	279
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	121	59	74	32	153	23	46	250	15	40	661	279
RTOR Reduction (vph)	0	0	48	0	0	15	0	0	8	0	0	131
Lane Group Flow (vph)	121	59	26	32	153	8	46	250	7	40	661	148
Heavy Vehicles (%)	12%	3%	4%	19%	1%	9%	11%	15%	13%	5%	8%	4%
Turn Type	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm
Protected Phases		4			8			2		2		6
Permitted Phases	4		4	8		8	2		2	2	6	6
Detector Phases	4	4	4	8	8	8	2	2	2	2	6	6
Minimum Initial (s)	29.3	29.3	29.3	29.3	29.3	29.3	26.0	26.0	26.0	26.0	26.0	26.0
Minimum Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (%)	52.9%	52.9%	52.9%	52.9%	52.9%	52.9%	47.1%	47.1%	47.1%	47.1%	47.1%	47.1%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	3.2	3.2	3.2	3.2	3.2	3.2	2.9	2.9	2.9	2.9	2.9	2.9
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.25	0.07	0.10	0.06	0.19	0.04	0.36	0.30	0.02	0.07	0.74	0.31
Control Delay	14.4	12.0	3.8	12.1	13.1	5.3	28.3	15.8	7.2	14.4	27.4	4.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.4	12.0	3.8	12.1	13.1	5.3	28.3	15.8	7.2	14.4	27.4	4.2
Queue Length 50th (m)	10.2	4.6	0.0	2.5	12.5	0.0	4.6	24.2	0.0	3.4	87.2	2.7
Queue Length 95th (m)	24.3	12.3	8.1	8.1	26.7	4.4	#22.7	48.9	3.9	10.6	#183.4	22.5
Internal Link Dist (m)		2051.6			246.6		346.9				725.5	
Turn Bay Length (m)	46.0				68.0		48.0	34.0			68.0	48.0
Base Capacity (vph)	485	799	714	497	814	655	129	840	734	537	894	911
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.07	0.10	0.06	0.19	0.04	0.36	0.30	0.02	0.07	0.74	0.31

Intersection Summary			
HCM Average Control Delay	17.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.7
Intersection Capacity Utilization	103.2%	ICU Level of Service	G
Analysis Period (min)	60		
c Critical Lane Group			

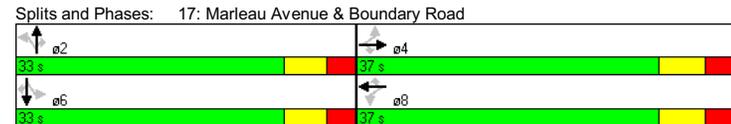
Queues

17: Marleau Avenue & Boundary Road

Future Background - Scenario 2  
Weekday A.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	121	59	74	32	153	23	46	250	15	40	661	279
Lane Group Flow (vph)	121	59	74	32	153	23	46	250	15	40	661	279
Turn Type	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm
Protected Phases		4			8			2		2		6
Permitted Phases	4		4	8		8	2		2	2	6	6
Detector Phases	4	4	4	8	8	8	2	2	2	2	6	6
Minimum Initial (s)	29.3	29.3	29.3	29.3	29.3	29.3	26.0	26.0	26.0	26.0	26.0	26.0
Minimum Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (%)	52.9%	52.9%	52.9%	52.9%	52.9%	52.9%	47.1%	47.1%	47.1%	47.1%	47.1%	47.1%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	3.2	3.2	3.2	3.2	3.2	3.2	2.9	2.9	2.9	2.9	2.9	2.9
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.25	0.07	0.10	0.06	0.19	0.04	0.36	0.30	0.02	0.07	0.74	0.31
Control Delay	14.4	12.0	3.8	12.1	13.1	5.3	28.3	15.8	7.2	14.4	27.4	4.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.4	12.0	3.8	12.1	13.1	5.3	28.3	15.8	7.2	14.4	27.4	4.2
Queue Length 50th (m)	10.2	4.6	0.0	2.5	12.5	0.0	4.6	24.2	0.0	3.4	87.2	2.7
Queue Length 95th (m)	24.3	12.3	8.1	8.1	26.7	4.4	#22.7	48.9	3.9	10.6	#183.4	22.5
Internal Link Dist (m)		2051.6			246.6		346.9				725.5	
Turn Bay Length (m)	46.0				68.0		48.0	34.0			68.0	48.0
Base Capacity (vph)	485	799	714	497	814	655	129	840	734	537	894	911
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.07	0.10	0.06	0.19	0.04	0.36	0.30	0.02	0.07	0.74	0.31

Intersection Summary			
Cycle Length: 70			
Actuated Cycle Length: 70			
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green			
Natural Cycle: 75			
Control Type: Actuated-Coordinated			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			



HCM Signalized Intersection Capacity Analysis  
18: Marleau Avenue & McConnell Avenue

Future Background - Scenario 2  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.5		2.0	5.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1703	1827	1534	1736	1845	1509	1736	1669		1703	1776	
Flt Permitted	0.18	1.00	1.00	0.19	1.00	1.00	0.45	1.00		0.26	1.00	
Satd. Flow (perm)	323	1827	1534	349	1845	1509	820	1669		473	1776	
Volume (vph)	34	536	127	156	670	347	152	252	130	378	351	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	34	536	127	156	670	347	152	252	130	378	351	0
RTOR Reduction (vph)	0	0	81	0	0	184	0	18	0	0	0	0
Lane Group Flow (vph)	34	536	46	156	670	163	152	364	0	378	351	0
Confl. Peds. (#/hr)			5	5								
Heavy Vehicles (%)	6%	4%	2%	4%	3%	7%	4%	8%	8%	6%	7%	50%
Turn Type	Perm		Perm pm+pt		Perm pm+pt			pm+pt				
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	35.0	35.0	35.0	43.0	43.0	43.0	36.1	25.6		44.5	31.0	
Effective Green, g (s)	36.0	36.0	36.0	47.0	44.0	44.0	41.6	26.6		49.0	32.0	
Actuated g/C Ratio	0.36	0.36	0.36	0.47	0.44	0.44	0.42	0.27		0.49	0.32	
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.5		3.0	6.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	116	658	552	247	812	664	446	444		440	568	
v/s Ratio Prot		0.29		0.04	c0.36		0.04	c0.22		c0.15	0.20	
v/s Ratio Perm	0.11		0.03	0.26		0.11	0.10			0.28		
v/c Ratio	0.29	0.81	0.08	0.63	0.83	0.25	0.34	0.82		0.86	0.62	
Uniform Delay, d1	22.9	29.0	21.1	19.0	24.6	17.6	18.9	34.4		18.9	28.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.77	0.86	
Incremental Delay, d2	6.4	11.6	0.3	5.3	10.1	0.9	0.5	17.4		15.4	4.4	
Delay (s)	29.3	40.6	21.4	24.3	34.8	18.5	19.3	51.9		29.9	29.0	
Level of Service	C	D	C	C	C	B	B	D		C	C	
Approach Delay (s)		36.5			28.5			42.6			29.5	
Approach LOS		D			C			D			C	

Intersection Summary

HCM Average Control Delay	32.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	111.7%	ICU Level of Service	H
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
18: Marleau Avenue & McConnell Avenue

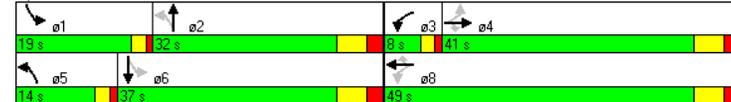
Future Background - Scenario 2  
Weekday A.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	34	536	127	156	670	347	152	252	378	351
Lane Group Flow (vph)	34	536	127	156	670	347	152	382	378	351
Turn Type	Perm		Perm pm+pt		Perm pm+pt			pm+pt		
Protected Phases		4		3	8		5	2	1	6
Permitted Phases	4		4	8		8	2		6	
Detector Phases	4	4	4	3	8	8	5	2	1	6
Minimum Initial (s)	21.7	21.7	21.7	5.0	21.7	21.7	10.0	15.0	10.0	15.0
Minimum Split (s)	36.1	36.1	36.1	8.0	38.7	38.7	14.0	31.9	14.0	31.9
Total Split (s)	41.0	41.0	41.0	8.0	49.0	49.0	14.0	32.0	19.0	37.0
Total Split (%)	41.0%	41.0%	41.0%	8.0%	49.0%	49.0%	14.0%	32.0%	19.0%	37.0%
Yellow Time (s)	4.1	4.1	4.1	2.0	4.1	4.1	2.0	4.1	2.0	4.1
All-Red Time (s)	1.9	1.9	1.9	1.0	1.9	1.9	1.0	2.4	1.0	2.4
Lead/Lag	Lag	Lag	Lag	Lead			Lead	Lag	Lead	Lag
Lead-Lag Optimize?										
Recall Mode	C-Max	C-Max	C-Max	None	C-Max	C-Max	None	Max	None	Max
v/c Ratio	0.29	0.81	0.20	0.63	0.83	0.41	0.34	0.83	0.86	0.62
Control Delay	31.4	41.6	4.9	29.3	35.8	4.1	17.0	50.7	35.6	29.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.4	41.6	4.9	29.3	35.8	4.1	17.0	50.7	35.6	29.7
Queue Length 50th (m)	4.9	97.8	0.0	17.9	117.0	2.0	16.6	69.0	48.9	60.3
Queue Length 95th (m)	16.6	#186.2	15.4	#42.2	#221.6	27.9	32.5	#144.0	#112.7	107.0
Internal Link Dist (m)		264.6		914.0			258.2		283.7	
Turn Bay Length (m)			84.0	71.0		71.0	77.0		130.0	
Base Capacity (vph)	116	658	634	247	812	848	450	463	440	569
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	0.29	0.81	0.20	0.63	0.83	0.41	0.34	0.83	0.86	0.62

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 77 (77%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 18: Marleau Avenue & McConnell Avenue



HCM Unsignalized Intersection Capacity Analysis  
22: Hwy 401 WB Ramp & Boundary Road

Future Background - Scenario 2  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗	↖	↕	↘		↕	↗	↖	↕	↘
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	2	1	112	67	28	8	49	279	22	8	730	9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	2	1	112	67	28	8	49	279	22	8	730	9
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1160	1150	734	1251	1143	290	739				301	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1160	1150	734	1251	1143	290	739				301	
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
p0 queue free %	99	99	73	35	85	99	94				99	
cM capacity (veh/h)	144	186	420	104	188	749	867				1260	
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	3	112	67	36	350	747						
Volume Left	2	0	67	0	49	8						
Volume Right	0	112	0	8	22	9						
cSH	156	420	104	225	867	1260						
Volume to Capacity	0.02	0.27	0.65	0.16	0.06	0.01						
Queue Length 95th (m)	0.5	8.7	35.2	4.5	1.4	0.2						
Control Delay (s)	28.6	16.7	97.5	24.0	1.9	0.2						
Lane LOS	D	C	F	C	A	A						
Approach Delay (s)	17.0		71.8		1.9	0.2						
Approach LOS	C		F									
<b>Intersection Summary</b>												
Average Delay			7.7									
Intersection Capacity Utilization			65.8%		ICU Level of Service		C					
Analysis Period (min)	60											

HCM Unsignalized Intersection Capacity Analysis  
25: Hwy 401 EB Ramp & Boundary Road

Future Background - Scenario 2  
Weekday A.M. Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖	↗	↕	↖	↖	↕
Sign Control	Stop	↗	Free	↖	↖	Free
Grade	0%	0%	0%	0%	0%	0%
Volume (veh/h)	146	13	337	83	10	899
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	146	13	337	83	10	899
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1256	337			420	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1256	337			420	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	22	98			99	
cM capacity (veh/h)	188	705			1139	
Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	
Volume Total	146	13	337	83	909	
Volume Left	146	0	0	0	10	
Volume Right	0	13	0	83	0	
cSH	188	705	1700	1700	1139	
Volume to Capacity	0.78	0.02	0.20	0.05	0.01	
Queue Length 95th (m)	61.6	0.5	0.0	0.0	0.2	
Control Delay (s)	83.0	10.2	0.0	0.0	0.2	
Lane LOS	F	B			A	
Approach Delay (s)	77.1		0.0		0.2	
Approach LOS	F					
<b>Intersection Summary</b>						
Average Delay			8.4			
Intersection Capacity Utilization			70.0%		ICU Level of Service	
Analysis Period (min)	60					

HCM Unsignalized Intersection Capacity Analysis  
29: Tenth Street & Virginia Avenue

Future Background - Scenario 2  
Weekday A.M. Peak Hour



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	64	10	162	10	10	10	118	23	25	10	12	52
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	64	10	162	10	10	10	118	23	25	10	12	52
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage veh												
Upstream signal (m)							308					
pX, platoon unblocked												
vC, conflicting volume	344	342	38	496	356	36	64					48
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	344	342	38	496	356	36	64					48
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1					4.1
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2					2.2
p0 queue free %	89	98	84	97	98	99	92					99
cM capacity (veh/h)	558	536	1040	380	526	1043	1551					1572

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	236	30	166	74
Volume Left	64	10	118	10
Volume Right	162	10	25	52
cSH	816	546	1551	1572
Volume to Capacity	0.29	0.05	0.08	0.01
Queue Length 95th (m)	9.7	1.4	2.0	0.2
Control Delay (s)	11.2	12.0	5.5	1.0
Lane LOS	B	B	A	A
Approach Delay (s)	11.2	12.0	5.5	1.0
Approach LOS	B	B		

Intersection Summary			
Average Delay	7.9		
Intersection Capacity Utilization	39.9%	ICU Level of Service	A
Analysis Period (min)	60		

HCM Signalized Intersection Capacity Analysis  
5: SCM Way & Boundary Road

Future Background - Scenario 2  
Weekday P.M. Peak Hour

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↖	↗	↖	↗
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2	6.2	5.2	5.2	5.2	5.2
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	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1172	1583	1671	1743	1712	1022
Flt Permitted	0.95	1.00	0.28	1.00	1.00	1.00
Satd. Flow (perm)	1172	1583	486	1743	1712	1022
Volume (vph)	100	54	12	687	680	52
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	100	54	12	687	680	52
RTOR Reduction (vph)	0	38	0	0	0	21
Lane Group Flow (vph)	100	16	12	687	680	31
Heavy Vehicles (%)	54%	2%	8%	9%	11%	58%
Turn Type	Perm	Perm			Perm	
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	29.6	29.6	62.5	62.5	62.5	62.5
Effective Green, g (s)	30.6	30.6	63.5	63.5	63.5	63.5
Actuated g/C Ratio	0.29	0.29	0.60	0.60	0.60	0.60
Clearance Time (s)	7.2	7.2	6.2	6.2	6.2	6.2
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	340	459	293	1049	1030	615
v/s Ratio Prot	c0.09			0.39	c0.40	
v/s Ratio Perm		0.01	0.02			0.03
v/c Ratio	0.29	0.03	0.04	0.65	0.66	0.05
Uniform Delay, d1	29.1	26.9	8.6	13.8	13.9	8.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	0.0	0.3	3.2	3.4	0.2
Delay (s)	29.6	26.9	8.8	17.0	17.2	8.8
Level of Service	C	C	A	B	B	A
Approach Delay (s)	28.6			16.9	16.6	
Approach LOS	C			B	B	

Intersection Summary

HCM Average Control Delay	17.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	105.5	Sum of lost time (s)	11.4
Intersection Capacity Utilization	75.3%	ICU Level of Service	D
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
5: SCM Way & Boundary Road

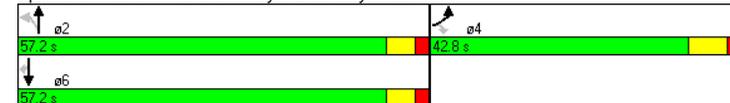
Future Background - Scenario 2  
Weekday P.M. Peak Hour

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↖	↗	↖	↗
Volume (vph)	100	54	12	687	680	52
Lane Group Flow (vph)	100	54	12	687	680	52
Turn Type	Perm	Perm			Perm	
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Detector Phases	4	4	2	2	6	6
Minimum Initial (s)	35.6	35.6	15.0	15.0	15.0	15.0
Minimum Split (s)	42.8	42.8	57.2	57.2	57.2	57.2
Total Split (s)	42.8	42.8	57.2	57.2	57.2	57.2
Total Split (%)	42.8%	42.8%	57.2%	57.2%	57.2%	57.2%
Yellow Time (s)	5.4	5.4	4.1	4.1	4.1	4.1
All-Red Time (s)	1.8	1.8	2.1	2.1	2.1	2.1
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Max	Max	Max	Max
v/c Ratio	0.25	0.09	0.05	0.64	0.64	0.08
Control Delay	24.1	6.2	12.9	20.4	20.6	3.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.1	6.2	12.9	20.4	20.6	3.8
Queue Length 50th (m)	14.0	0.0	1.2	106.0	105.4	0.0
Queue Length 95th (m)	30.6	9.8	4.9	#210.4	#210.0	7.1
Internal Link Dist (m)	265.1			548.2	424.1	
Turn Bay Length (m)	62.0		80.0			65.0
Base Capacity (vph)	395	569	238	1076	1057	651
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	0.25	0.09	0.05	0.64	0.64	0.08

Intersection Summary

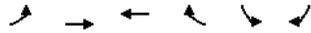
Cycle Length: 100
Actuated Cycle Length: 104.3
Natural Cycle: 100
Control Type: Semi Act-Uncoord
# 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.

Splits and Phases: 5: SCM Way & Boundary Road



HCM Unsignalized Intersection Capacity Analysis  
6: Optimum Drive & SCM Way

Future Background - Scenario 2  
Weekday P.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		↓	↓
Sign Control	Free	Free	Free	Stop	Stop	Stop
Grade	0%	0%	0%	0%	0%	0%
Volume (veh/h)	0	0	0	54	141	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	54	141	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)			289			
pX, platoon unblocked						
vC, conflicting volume	54				27	27
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	54				27	27
tC, single (s)	4.1				7.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				4.4	3.3
p0 queue free %	100				82	100
cM capacity (veh/h)	1564				787	1054

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	0	54	141
Volume Left	0	0	141
Volume Right	0	54	0
cSH	1700	1700	787
Volume to Capacity	0.00	0.03	0.18
Queue Length 95th (m)	0.0	0.0	5.2
Control Delay (s)	0.0	0.0	10.6
Lane LOS			B
Approach Delay (s)	0.0	0.0	10.6
Approach LOS			B

Intersection Summary			
Average Delay		7.6	
Intersection Capacity Utilization	17.8%	ICU Level of Service	A
Analysis Period (min)	60		

HCM Unsignalized Intersection Capacity Analysis  
7: Industrial Park Dr & Boundary Road

Future Background - Scenario 2  
Weekday P.M. Peak Hour



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↓	↑	↑	↑	↑	↓
Sign Control	Stop	Free	Free	Free	Free	Free
Grade	0%	0%	0%	0%	0%	0%
Volume (veh/h)	100	242	88	599	535	199
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	100	242	88	599	535	199
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1410	636	735			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1410	636	735			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	26	50	90			
cM capacity (veh/h)	135	480	865			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1
Volume Total	100	242	88	599	734
Volume Left	100	0	88	0	0
Volume Right	0	242	0	0	199
cSH	135	480	865	1700	1700
Volume to Capacity	0.74	0.50	0.10	0.35	0.43
Queue Length 95th (m)	50.1	23.9	2.7	0.0	0.0
Control Delay (s)	97.4	20.1	9.6	0.0	0.0
Lane LOS	F	C	A		
Approach Delay (s)	42.7		1.2		0.0
Approach LOS	E				

Intersection Summary			
Average Delay		8.8	
Intersection Capacity Utilization	62.0%	ICU Level of Service	B
Analysis Period (min)	60		

HCM Unsignalized Intersection Capacity Analysis  
9: Industrial Park Dr & Optimum Drive

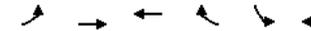
Future Background - Scenario 2  
Weekday P.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	65	154	9	8	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	65	154	9	8	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	163				224	158
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	163				224	158
tC, single (s)	4.1				7.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				4.4	3.3
p0 queue free %	100				99	100
cM capacity (veh/h)	1428				591	892
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	65	163	8			
Volume Left	0	0	8			
Volume Right	0	9	0			
cSH	1428	1700	591			
Volume to Capacity	0.00	0.10	0.01			
Queue Length 95th (m)	0.0	0.0	0.3			
Control Delay (s)	0.0	0.0	11.2			
Lane LOS			B			
Approach Delay (s)	0.0	0.0	11.2			
Approach LOS			B			
<b>Intersection Summary</b>						
Average Delay			0.4			
Intersection Capacity Utilization	18.7%		ICU Level of Service	A		
Analysis Period (min)	60					

HCM Unsignalized Intersection Capacity Analysis  
11: Boundary Access & Truck Access

Future Background - Scenario 2  
Weekday P.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	0	0	0	0	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0				0	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				0	0
tC, single (s)	5.1				6.4	7.2
tC, 2 stage (s)						
tF (s)	3.1				3.5	4.2
p0 queue free %	100				100	100
cM capacity (veh/h)	1161				1029	857
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	0	0	0			
Volume Left	0	0	0			
Volume Right	0	0	0			
cSH	1700	1700	1700			
Volume to Capacity	0.00	0.00	0.00			
Queue Length 95th (m)	0.0	0.0	0.0			
Control Delay (s)	0.0	0.0	0.0			
Lane LOS			A			
Approach Delay (s)	0.0	0.0	0.0			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay			0.0			
Intersection Capacity Utilization	0.0%		ICU Level of Service	A		
Analysis Period (min)	60					

HCM Signalized Intersection Capacity Analysis  
13: Marleau Avenue & Virginia Avenue

Future Background - Scenario 2  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.3	5.3		5.3	5.3	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1827	1553	1805	1845	1615	1763	1795		1805	1858	
Flt Permitted	0.12	1.00	1.00	0.22	1.00	1.00	0.58	1.00		0.65	1.00	
Satd. Flow (perm)	219	1827	1553	423	1845	1615	1073	1795		1236	1858	
Volume (vph)	25	788	168	63	958	25	189	101	59	25	174	25
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	25	788	168	63	958	25	189	101	59	25	174	25
RTOR Reduction (vph)	0	0	20	0	0	2	0	31	0	0	7	0
Lane Group Flow (vph)	25	788	148	63	958	23	189	129	0	25	192	0
Confl. Peds. (#/hr)							3					3
Heavy Vehicles (%)	0%	4%	4%	0%	3%	0%	2%	0%	0%	0%	0%	0%
Turn Type	Perm		Perm	Perm		Perm	custom			Perm		
Protected Phases		4			8						6	
Permitted Phases	4		4	8		8	2	2		6		
Actuated Green, G (s)	44.1	44.1	44.1	44.1	44.1	44.1	18.1	18.1		18.1	18.1	
Effective Green, g (s)	45.1	45.1	45.1	45.1	45.1	45.1	19.1	19.1		19.1	19.1	
Actuated g/C Ratio	0.60	0.60	0.60	0.60	0.60	0.60	0.25	0.25		0.25	0.25	
Clearance Time (s)	6.5	6.5	6.5	6.5	6.5	6.5	6.3	6.3		6.3	6.3	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	132	1099	934	254	1109	971	273	457		315	473	
v/s Ratio Prot		0.43			c0.52						0.10	
v/s Ratio Perm	0.11		0.10	0.15		0.01	c0.18	0.07		0.02		
v/c Ratio	0.19	0.72	0.16	0.25	0.86	0.02	0.69	0.28		0.08	0.40	
Uniform Delay, d1	6.7	10.5	6.6	7.0	12.4	6.0	25.3	22.5		21.3	23.2	
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	3.2	4.1	0.4	2.3	9.9	0.0	7.7	0.3		0.1	0.6	
Delay (s)	9.9	14.6	7.0	9.3	22.3	6.1	33.0	22.8		21.4	23.8	
Level of Service	A	B	A	A	C	A	C	C		C	C	
Approach Delay (s)		13.2			21.1			28.3			23.5	
Approach LOS		B			C			C			C	

Intersection Summary

HCM Average Control Delay	19.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	91.3%	ICU Level of Service	F
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
13: Marleau Avenue & Virginia Avenue

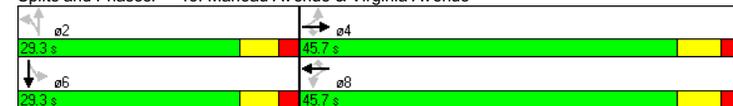
Future Background - Scenario 2  
Weekday P.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	25	788	168	63	958	25	189	101	25	174
Lane Group Flow (vph)	25	788	168	63	958	25	189	160	25	199
Turn Type	Perm		Perm	Perm		Perm	custom		Perm	
Protected Phases		4			8					6
Permitted Phases	4		4	8		8	2	2	6	
Detector Phases	4	4	4	8	8	8	2	2	6	6
Minimum Initial (s)	18.2	18.2	18.2	18.0	18.0	18.0	15.0	15.0	15.0	15.0
Minimum Split (s)	35.7	35.7	35.7	35.7	35.7	35.7	29.3	29.3	29.3	29.3
Total Split (s)	45.7	45.7	45.7	45.7	45.7	45.7	29.3	29.3	29.3	29.3
Total Split (%)	60.9%	60.9%	60.9%	60.9%	60.9%	60.9%	39.1%	39.1%	39.1%	39.1%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.1	4.1	4.1	4.1
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.2	2.2	2.2	2.2
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max	None	None	None	None
v/c Ratio	0.22	0.72	0.18	0.32	0.86	0.03	0.66	0.33	0.08	0.42
Control Delay	14.4	16.5	5.8	14.7	25.1	6.3	37.0	17.8	20.2	24.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.4	16.5	5.8	14.7	25.1	6.3	37.0	17.8	20.2	24.2
Queue Length 50th (m)	1.5	70.7	6.5	4.0	101.7	1.0	25.7	14.4	2.9	23.8
Queue Length 95th (m)	9.3	#195.3	20.5	18.6	#257.8	5.1	50.1	31.0	8.8	43.3
Internal Link Dist (m)		914.0			682.0			404.6		283.6
Turn Bay Length (m)	25.0		10.0	25.0		10.0	25.0			
Base Capacity (vph)	114	1099	955	195	1111	974	359	603	399	601
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	0.22	0.72	0.18	0.32	0.86	0.03	0.53	0.27	0.06	0.33

Intersection Summary

Cycle Length: 75
Actuated Cycle Length: 75
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 13: Marleau Avenue & Virginia Avenue



HCM Signalized Intersection Capacity Analysis  
14: Tenth Street & McConnell Avenue

Future Background - Scenario 2  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔			↕			↔			↕		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5			5.5			5.0			5.0		
Lane Util. Factor	1.00			1.00			1.00			1.00		
Frpb, ped/bikes	1.00			0.98			1.00			1.00		
Flpb, ped/bikes	1.00			1.00			1.00			1.00		
Frt	0.98			0.90			1.00			1.00		
Flt Protected	0.98			1.00			0.95			1.00		
Satd. Flow (prot)	1679			1666			1805			1833		
Flt Permitted	0.77			0.97			0.30			1.00		
Satd. Flow (perm)	1323			1626			574			1833		
Volume (vph)	8	12	3	13	32	113	7	883	20	187	794	11
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	8	12	3	13	32	113	7	883	20	187	794	11
RTOR Reduction (vph)	0	3	0	0	99	0	0	1	0	0	0	0
Lane Group Flow (vph)	0	20	0	0	59	0	7	902	0	187	805	0
Confl. Peds. (#/hr)	2		4		4		2		2		2	
Heavy Vehicles (%)	25%	0%	0%	8%	0%	0%	0%	3%	15%	1%	7%	0%
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases	4		8		8		2		2		6	
Permitted Phases	4		8		8		2		2		6	
Actuated Green, G (s)	11.0		11.0		11.0		76.5		76.5		76.5	
Effective Green, g (s)	11.5		11.5		11.5		78.0		78.0		78.0	
Actuated g/C Ratio	0.12		0.12		0.12		0.78		0.78		0.78	
Clearance Time (s)	6.0		6.0		6.0		6.5		6.5		6.5	
Vehicle Extension (s)	3.0		3.0		3.0		3.0		3.0		3.0	
Lane Grp Cap (vph)	152		187		448		1430		378		1384	
v/s Ratio Prot			c0.04		0.01		0.39					
v/s Ratio Perm	0.02		c0.04		0.01		0.39					
v/c Ratio	0.13		0.31		0.02		0.63		0.49		0.58	
Uniform Delay, d1	39.8		40.6		2.4		4.8		3.9		4.4	
Progression Factor	1.00		1.00		1.94		2.45		1.00		1.00	
Incremental Delay, d2	0.4		1.0		0.0		1.3		4.6		1.8	
Delay (s)	40.2		41.6		4.8		13.0		8.6		6.2	
Level of Service	D		D		A		B		A		A	
Approach Delay (s)	40.2		41.6		12.9		6.7					
Approach LOS	D		D		B		A					

Intersection Summary			
HCM Average Control Delay	12.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	81.2%	ICU Level of Service	D
Analysis Period (min)	60		
c Critical Lane Group			

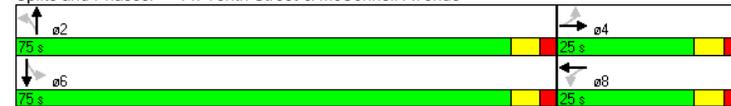
Queues  
14: Tenth Street & McConnell Avenue

Future Background - Scenario 2  
Weekday P.M. Peak Hour

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↔			↕			↕	
Volume (vph)	8	12	13	32	7	883	187	794
Lane Group Flow (vph)	0	23	0	158	7	903	187	805
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases	4		8		2		6	
Permitted Phases	4		8		2		6	
Detector Phases	4		8		2		6	
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	25.0	25.0	25.0	25.0	19.5	19.5	19.5	19.5
Total Split (s)	25.0	25.0	25.0	25.0	75.0	75.0	75.0	75.0
Total Split (%)	25.0%	25.0%	25.0%	25.0%	75.0%	75.0%	75.0%	75.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	1.9	1.9	1.9	1.9	2.4	2.4	2.4	2.4
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.13	0.55	0.02	0.63	0.60	0.60	0.58	
Control Delay	36.9		22.0		5.7		14.4	
Queue Delay	0.0		0.0		0.0		0.0	
Total Delay	36.9		22.0		5.7		14.4	
Queue Length 50th (m)	3.8		8.8		0.5		115.6	
Queue Length 95th (m)	12.3		34.3		m1.0m157.3		#74.3 120.3	
Internal Link Dist (m)	414.9		902.0		283.7		1842.8	
Turn Bay Length (m)			14.0		14.0			
Base Capacity (vph)	301		409		388		1430	
Starvation Cap Reductn	0		0		0		0	
Spillback Cap Reductn	0		0		0		0	
Storage Cap Reductn	0		0		0		0	
Reduced v/c Ratio	0.08		0.39		0.02		0.63	

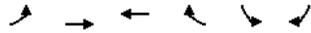
Intersection Summary			
Cycle Length: 100			
Actuated Cycle Length: 100			
Offset: 60 (60%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green			
Natural Cycle: 90			
Control Type: Actuated-Coordinated			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			
m Volume for 95th percentile queue is metered by upstream signal.			

Splits and Phases: 14: Tenth Street & McConnell Avenue



HCM Unsignalized Intersection Capacity Analysis  
16: Virginia Avenue & Industrial Park Drive

Future Background - Scenario 2  
Weekday P.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	↕
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	78	0	0	0	0	90
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	78	0	0	0	0	90
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0				156	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				156	0
tC, single (s)	4.2				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.3				3.5	3.3
p0 queue free %	95				100	92
cM capacity (veh/h)	1597				799	1088
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	78	0	90			
Volume Left	78	0	0			
Volume Right	0	0	90			
cSH	1597	1700	1088			
Volume to Capacity	0.05	0.00	0.08			
Queue Length 95th (m)	1.2	0.0	2.2			
Control Delay (s)	7.4	0.0	8.6			
Lane LOS	A		A			
Approach Delay (s)	7.4	0.0	8.6			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay			8.0			
Intersection Capacity Utilization		16.6%		ICU Level of Service		A
Analysis Period (min)			60			

HCM Signalized Intersection Capacity Analysis  
17: Marleau Avenue & Boundary Road

Future Background - Scenario 2  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.7	6.7	6.7	6.7	6.7	6.7	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	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1684	1810	1553	1612	1827	1449	1736	1712	1380	1612	1776	1509
Flt Permitted	0.70	1.00	1.00	0.67	1.00	1.00	0.29	1.00	1.00	0.31	1.00	1.00
Satd. Flow (perm)	1234	1810	1553	1134	1827	1449	521	1712	1380	528	1776	1509
Volume (vph)	171	139	51	34	94	33	89	483	41	57	507	213
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	171	139	51	34	94	33	89	483	41	57	507	213
RTOR Reduction (vph)	0	0	29	0	0	19	0	0	25	0	0	131
Lane Group Flow (vph)	171	139	22	34	94	14	89	483	16	57	507	82
Confl. Peds. (#/hr)	1					1						
Heavy Vehicles (%)	7%	5%	4%	12%	4%	9%	4%	11%	17%	12%	7%	7%
Turn Type	Perm		Perm	Perm		Perm	Perm		Perm	Perm		Perm
Protected Phases		4			8			2		2		6
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	29.3	29.3	29.3	29.3	29.3	29.3	26.0	26.0	26.0	26.0	26.0	26.0
Effective Green, g (s)	30.3	30.3	30.3	30.3	30.3	30.3	27.0	27.0	27.0	27.0	27.0	27.0
Actuated g/C Ratio	0.43	0.43	0.43	0.43	0.43	0.43	0.39	0.39	0.39	0.39	0.39	0.39
Clearance Time (s)	7.7	7.7	7.7	7.7	7.7	7.7	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	534	783	672	491	791	627	201	660	532	204	685	582
v/s Ratio Prot		0.08			0.05			0.28			0.29	
v/s Ratio Perm	c0.14		0.01	0.03		0.01	0.17		0.01	0.11		0.05
v/c Ratio	0.32	0.18	0.03	0.07	0.12	0.02	0.44	0.73	0.03	0.28	0.74	0.14
Uniform Delay, d1	13.1	12.2	11.4	11.6	11.9	11.4	15.9	18.4	13.4	14.8	18.5	14.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	0.1	0.0	0.1	0.1	0.0	7.1	7.3	0.1	3.4	7.4	0.5
Delay (s)	13.4	12.3	11.4	11.7	11.9	11.4	23.0	25.7	13.5	18.2	25.9	14.5
Level of Service	B	B	B	B	B	B	C	C	B	B	C	B
Approach Delay (s)		12.7			11.8			24.5			22.2	
Approach LOS		B			B			C			C	

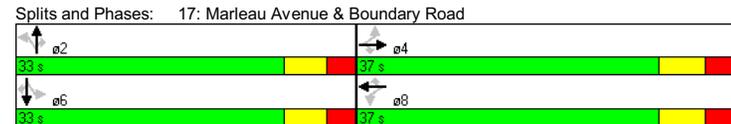
Intersection Summary			
HCM Average Control Delay	20.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.7
Intersection Capacity Utilization	91.7%	ICU Level of Service	F
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
17: Marleau Avenue & Boundary Road

Future Background - Scenario 2  
Weekday P.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	171	139	51	34	94	33	89	483	41	57	507	213
Lane Group Flow (vph)	171	139	51	34	94	33	89	483	41	57	507	213
Turn Type	Perm		Perm	Perm		Perm	Perm		Perm	Perm		Perm
Protected Phases		4			8			2		2		6
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phases	4	4	4	8	8	8	2	2	2	6	6	6
Minimum Initial (s)	29.3	29.3	29.3	29.3	29.3	29.3	15.0	15.0	15.0	15.0	15.0	15.0
Minimum Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	23.0	23.0	23.0	23.0	23.0	23.0
Total Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (%)	52.9%	52.9%	52.9%	52.9%	52.9%	52.9%	47.1%	47.1%	47.1%	47.1%	47.1%	47.1%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	3.2	3.2	3.2	3.2	3.2	3.2	2.9	2.9	2.9	2.9	2.9	2.9
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.32	0.18	0.07	0.07	0.12	0.05	0.44	0.73	0.07	0.28	0.74	0.30
Control Delay	15.2	13.0	4.2	12.2	12.4	4.8	24.8	26.8	5.3	19.5	26.9	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.2	13.0	4.2	12.2	12.4	4.8	24.8	26.8	5.3	19.5	26.9	3.6
Queue Length 50th (m)	14.9	11.3	0.0	2.6	7.4	0.0	8.8	55.3	0.0	5.3	58.3	0.0
Queue Length 95th (m)	33.1	24.6	6.7	8.5	17.6	5.4	26.7	#120.9	6.6	16.6	#126.4	16.0
Internal Link Dist (m)		2051.6			246.6		346.9			725.5		
Turn Bay Length (m)	46.0			68.0		48.0	34.0			68.0		48.0
Base Capacity (vph)	534	783	701	490	791	646	201	660	557	204	685	713
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.32	0.18	0.07	0.07	0.12	0.05	0.44	0.73	0.07	0.28	0.74	0.30

Intersection Summary	
Cycle Length:	70
Actuated Cycle Length:	70
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle:	65
Control Type:	Actuated-Coordinated
#	95th percentile volume exceeds capacity, queue may be longer.
	Queue shown is maximum after two cycles.



HCM Signalized Intersection Capacity Analysis  
18: Marleau Avenue & McConnell Avenue

Future Background - Scenario 2  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.5		2.0	5.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1719	1845	1560	1770	1881	1568	1785	1804		1719	1845	
Flt Permitted	0.12	1.00	1.00	0.11	1.00	1.00	0.42	1.00		0.11	1.00	
Satd. Flow (perm)	219	1845	1560	196	1881	1568	792	1804		190	1845	
Volume (vph)	39	679	178	124	737	365	275	506	99	375	367	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	39	679	178	124	737	365	275	506	99	375	367	0
RTOR Reduction (vph)	0	0	109	0	0	176	0	7	0	0	0	0
Lane Group Flow (vph)	39	679	69	124	737	189	275	598	0	375	367	0
Confl. Peds. (#/hr)		2	2			3			2	2		3
Heavy Vehicles (%)	5%	3%	1%	2%	1%	3%	1%	2%	4%	5%	3%	12%
Turn Type	Perm		Perm pm+pt		Perm pm+pt			pm+pt				
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	32.0	32.0	32.0	39.0	39.0	39.0	42.5	31.5		48.5	34.5	
Effective Green, g (s)	33.0	33.0	33.0	43.0	40.0	40.0	48.0	32.5		53.0	35.5	
Actuated g/C Ratio	0.33	0.33	0.33	0.43	0.40	0.40	0.48	0.32		0.53	0.36	
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.5		3.0	6.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	72	609	515	163	752	627	499	586		330	655	
v/s Ratio Prot		c0.37		0.04	c0.39		0.07	c0.33		c0.17	0.20	
v/s Ratio Perm	0.18		0.04	0.29		0.12	0.20			0.43		
v/c Ratio	0.54	1.11	0.13	0.76	0.98	0.30	0.55	1.02		1.14	0.56	
Uniform Delay, d1	27.3	33.5	23.5	23.9	29.6	20.5	16.4	33.8		29.7	26.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.94	0.82	
Incremental Delay, d2	8.3	232.4	0.1	20.9	48.5	0.3	1.3	96.3		278.3	2.9	
Delay (s)	35.6	265.9	23.6	44.8	78.1	20.7	17.7	130.0		306.2	24.1	
Level of Service	D	F	C	D	E	C	B	F		F	C	
Approach Delay (s)		207.8			57.6			94.9			166.7	
Approach LOS		F			E			F			F	

Intersection Summary

HCM Average Control Delay	123.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	17.5
Intersection Capacity Utilization	125.2%	ICU Level of Service	H
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
18: Marleau Avenue & McConnell Avenue

Future Background - Scenario 2  
Weekday P.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	39	679	178	124	737	365	275	506	375	367
Lane Group Flow (vph)	39	679	178	124	737	365	275	605	375	367
Turn Type	Perm		Perm pm+pt		Perm pm+pt			pm+pt		
Protected Phases		4		3	8		5	2	1	6
Permitted Phases	4		4	8		8	2		6	
Detector Phases	4	4	4	3	8	8	5	2	1	6
Minimum Initial (s)	20.0	20.0	20.0	3.0	20.0	20.0	11.0	20.0	11.0	20.0
Minimum Split (s)	28.0	28.0	28.0	7.0	28.0	28.0	14.0	28.5	14.0	28.5
Total Split (s)	38.0	38.0	38.0	7.0	45.0	45.0	14.0	38.0	17.0	41.0
Total Split (%)	38.0%	38.0%	38.0%	7.0%	45.0%	45.0%	14.0%	38.0%	17.0%	41.0%
Yellow Time (s)	4.1	4.1	4.1	3.0	4.1	4.1	2.0	4.1	2.0	4.1
All-Red Time (s)	1.9	1.9	1.9	0.0	1.9	1.9	1.0	2.4	1.0	2.4
Lead/Lag	Lag	Lag	Lag	Lead			Lead	Lag	Lead	Lag
Lead-Lag Optimize?										
Recall Mode	Min	Min	Min	Min	Min	Min	Min	C-Min	Min	C-Min
v/c Ratio	0.54	1.11	0.29	0.76	0.98	0.45	0.55	1.02	1.14	0.56
Control Delay	61.2	265.5	6.4	54.0	80.4	6.8	18.2	129.3	304.7	24.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	61.2	265.5	6.4	54.0	80.4	6.8	18.2	129.3	304.7	24.6
Queue Length 50th (m)	6.4	~159.9	2.2	15.1	145.5	9.1	29.6	~130.4	~73.4	59.7
Queue Length 95th (m)	#27.7	#269.6	22.4	#49.2	#268.4	42.5	53.1	#236.2	#153.6	103.8
Internal Link Dist (m)		264.6			914.0			245.0		283.7
Turn Bay Length (m)			84.0	71.0		71.0	77.0		130.0	
Base Capacity (vph)	72	609	623	163	752	803	499	593	330	655
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	0.54	1.11	0.29	0.76	0.98	0.45	0.55	1.02	1.14	0.56

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 96 (96%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 140
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite. Queue shown is maximum after two cycles.
# 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.

Splits and Phases: 18: Marleau Avenue & McConnell Avenue



HCM Unsignalized Intersection Capacity Analysis  
22: Hwy 401 WB Ramp & Boundary Road

Future Background - Scenario 2  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗	↖	↕	↗		↕	↗		↕	↗
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	9	1	86	46	17	12	85	520	105	11	542	6
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	9	1	86	46	17	12	85	520	105	11	542	6
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1330	1362	545	1396	1312	572	548				625	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1330	1362	545	1396	1312	572	548				625	
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
p0 queue free %	92	99	84	50	88	98	92				99	
cM capacity (veh/h)	109	134	538	92	144	519	1021				956	
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>WB 1</b>	<b>WB 2</b>	<b>NB 1</b>	<b>SB 1</b>						
Volume Total	10	86	46	29	710	559						
Volume Left	9	0	46	0	85	11						
Volume Right	0	86	0	12	105	6						
cSH	111	538	92	205	1021	956						
Volume to Capacity	0.09	0.16	0.50	0.14	0.08	0.01						
Queue Length 95th (m)	2.4	4.6	21.5	3.9	2.2	0.3						
Control Delay (s)	40.7	13.0	81.8	25.5	2.1	0.3						
Lane LOS	E	B	F	D	A	A						
Approach Delay (s)	15.8		60.0		2.1	0.3						
Approach LOS	C		F									
<b>Intersection Summary</b>												
Average Delay	5.3									E		
Intersection Capacity Utilization	87.2%			ICU Level of Service						E		
Analysis Period (min)	60											

HCM Unsignalized Intersection Capacity Analysis  
25: Hwy 401 EB Ramp & Boundary Road

Future Background - Scenario 2  
Weekday P.M. Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖	↗	↕	↖	↖	↕
Sign Control	Stop	↗	Free	↖		Free
Grade	0%		0%			0%
Volume (veh/h)	66	51	659	128	8	666
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	66	51	659	128	8	666
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1341	659			787	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1341	659			787	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	60	89			99	
cM capacity (veh/h)	166	464			832	
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>WB 2</b>	<b>NB 1</b>	<b>NB 2</b>	<b>SB 1</b>	
Volume Total	66	51	659	128	674	
Volume Left	66	0	0	0	8	
Volume Right	0	51	0	128	0	
cSH	166	464	1700	1700	832	
Volume to Capacity	0.40	0.11	0.39	0.08	0.01	
Queue Length 95th (m)	15.2	3.0	0.0	0.0	0.2	
Control Delay (s)	40.7	13.7	0.0	0.0	0.3	
Lane LOS	E	B			A	
Approach Delay (s)	28.9		0.0		0.3	
Approach LOS	D					
<b>Intersection Summary</b>						
Average Delay	2.3					
Intersection Capacity Utilization	51.8%			ICU Level of Service		
Analysis Period (min)	60					

HCM Unsignalized Intersection Capacity Analysis  
29: Tenth Street & Virginia Avenue

Future Background - Scenario 2  
Weekday P.M. Peak Hour



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↕				↕			↕			↕	
Sign Control	Stop				Stop		Free			Free		
Grade	0%				0%		0%			0%		
Volume (veh/h)	58	10	161	10	10	10	81	20	10	10	13	77
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	58	10	161	10	10	10	81	20	10	10	13	77
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None				None							
Median storage veh												
Upstream signal (m)	308											
pX, platoon unblocked												
vC, conflicting volume	274	264	52	424	297	25	90				30	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	274	264	52	424	297	25	90				30	
tC, single (s)	7.2	6.5	6.2	7.1	6.5	6.2	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
p0 queue free %	91	98	84	98	98	99	95				99	
cM capacity (veh/h)	621	607	1022	432	581	1057	1518				1596	
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	229	30	111	100								
Volume Left	58	10	81	10								
Volume Right	161	10	10	77								
cSH	856	602	1518	1596								
Volume to Capacity	0.27	0.05	0.05	0.01								
Queue Length 95th (m)	8.7	1.3	1.4	0.2								
Control Delay (s)	10.7	11.3	5.6	0.8								
Lane LOS	B	B	A	A								
Approach Delay (s)	10.7	11.3	5.6	0.8								
Approach LOS	B	B										
<b>Intersection Summary</b>												
Average Delay	7.4											
Intersection Capacity Utilization	36.0%		ICU Level of Service				A					
Analysis Period (min)	60											

*Future Background- Scenario 2: Road Improvements*

HCM Signalized Intersection Capacity Analysis Future Background - Scenario 2: Improvements  
13: Marleau Avenue & Virginia Avenue Weekday A.M. Peak Hour

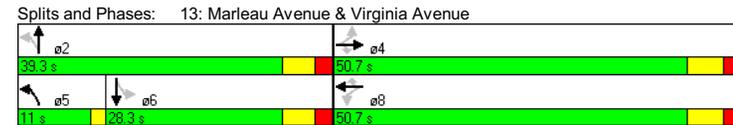
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	5.5	2.0	5.3		5.3	5.3	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1810	1357	1719	1810	1615	1686	1828		1805	1861	
Flt Permitted	0.18	1.00	1.00	0.15	1.00	1.00	0.47	1.00		0.65	1.00	
Satd. Flow (perm)	348	1810	1357	269	1810	1615	834	1828		1233	1861	
Volume (vph)	25	840	73	40	789	25	275	141	30	25	174	25
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	25	840	73	40	789	25	275	141	30	25	174	25
RTOR Reduction (vph)	0	0	7	0	0	3	0	10	0	0	6	0
Lane Group Flow (vph)	25	840	66	40	789	22	275	161	0	25	193	0
Confl. Peds. (#/hr)			7	7			2					2
Heavy Vehicles (%)	0%	5%	15%	5%	5%	0%	7%	0%	7%	0%	0%	0%
Turn Type	Perm		Perm	Perm		Perm	pm+pt		Perm			
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	49.5	49.5	49.5	49.5	49.5	49.5	27.7	27.7		16.1	16.1	
Effective Green, g (s)	50.5	50.5	50.5	50.5	50.5	50.5	32.0	28.7		17.1	17.1	
Actuated g/C Ratio	0.56	0.56	0.56	0.56	0.56	0.56	0.36	0.32		0.19	0.19	
Clearance Time (s)	6.5	6.5	6.5	6.5	6.5	6.5	2.0	6.3		6.3	6.3	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	195	1016	761	151	1016	906	387	583		234	354	
v/s Ratio Prot		c0.46			0.44		c0.08	0.09			c0.10	
v/s Ratio Perm	0.07		0.05	0.15		0.01	0.18			0.02		
v/c Ratio	0.13	0.83	0.09	0.26	0.78	0.02	0.71	0.28		0.11	0.54	
Uniform Delay, d1	9.3	16.2	9.1	10.2	15.4	8.8	23.4	22.9		30.1	32.9	
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	1.4	8.2	0.2	4.3	6.1	0.1	6.3	0.3		0.2	1.7	
Delay (s)	10.7	24.4	9.3	14.5	21.4	8.8	29.6	23.2		30.3	34.6	
Level of Service	B	C	A	B	C	A	C	C		C	C	
Approach Delay (s)		22.9			20.7			27.1			34.2	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	23.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.8
Intersection Capacity Utilization	84.7%	ICU Level of Service	E
Analysis Period (min)	60		
c Critical Lane Group			

Queues Future Background - Scenario 2: Improvements  
13: Marleau Avenue & Virginia Avenue Weekday A.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	25	840	73	40	789	25	275	141	25	174
Lane Group Flow (vph)	25	840	73	40	789	25	275	171	25	199
Turn Type	Perm		Perm	Perm		Perm	pm+pt		Perm	
Protected Phases		4			8		5	2		6
Permitted Phases	4		4	8		8	2		6	
Detector Phases	4	4	4	8	8	8	5	2	6	6
Minimum Initial (s)	18.2	18.2	18.2	18.2	18.2	18.2	4.0	15.0	15.0	15.0
Minimum Split (s)	28.5	28.5	28.5	28.5	28.5	28.5	8.0	28.3	28.3	28.3
Total Split (s)	50.7	50.7	50.7	50.7	50.7	50.7	11.0	39.3	28.3	28.3
Total Split (%)	56.3%	56.3%	56.3%	56.3%	56.3%	56.3%	12.2%	43.7%	31.4%	31.4%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	2.0	4.1	4.1	4.1
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.0	2.2	2.2	2.2
Lead/Lag							Lead		Lag	Lag
Lead-Lag Optimize?							Yes		Yes	Yes
Recall Mode	C-Min	C-Min	C-Min	C-Min	C-Min	C-Min	None	Min	None	None
v/c Ratio	0.18	0.83	0.09	0.44	0.78	0.03	0.67	0.29	0.11	0.55
Control Delay	14.4	25.9	8.0	32.5	22.7	7.8	32.4	22.5	30.6	37.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.4	25.9	8.0	32.5	22.7	7.8	32.4	22.5	30.6	37.8
Queue Length 50th (m)	2.0	111.0	4.2	3.8	99.0	1.4	39.3	21.8	3.9	32.2
Queue Length 95th (m)	9.0	#252.6	13.1	#24.2	#229.2	6.0	#71.1	41.1	11.6	58.7
Internal Link Dist (m)		914.0			682.0			404.6		283.6
Turn Bay Length (m)	25.0		10.0	25.0		10.0	25.0			
Base Capacity (vph)	136	1016	769	90	1016	909	409	699	315	482
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	0.18	0.83	0.09	0.44	0.78	0.03	0.67	0.24	0.08	0.41

Intersection Summary	
Cycle Length:	90
Actuated Cycle Length:	90
Offset:	0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle:	80
Control Type:	Actuated-Coordinated
#	95th percentile volume exceeds capacity, queue may be longer.
	Queue shown is maximum after two cycles.



HCM Signalized Intersection Capacity Analysis Future Background - Scenario 2: Improvements  
18: Marleau Avenue & McConnell Avenue Weekday A.M. Peak Hour

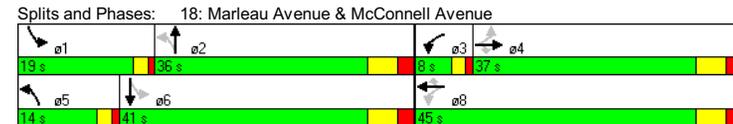
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.5		2.0	5.5	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1703	3471	1534	1733	3505	1509	1736	1669		1703	1776	
Flt Permitted	0.38	1.00	1.00	0.33	1.00	1.00	0.47	1.00		0.31	1.00	
Satd. Flow (perm)	676	3471	1534	611	3505	1509	864	1669		563	1776	
Volume (vph)	34	536	127	156	670	347	152	252	130	378	351	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	34	536	127	156	670	347	152	252	130	378	351	0
RTOR Reduction (vph)	0	0	86	0	208	0	19	0	0	0	0	0
Lane Group Flow (vph)	34	536	41	156	670	139	152	363	0	378	351	0
Confl. Peds. (#/hr)			5	5								
Heavy Vehicles (%)	6%	4%	2%	4%	3%	7%	4%	8%	8%	6%	7%	50%
Turn Type	Perm		Perm pm+pt		Perm pm+pt			pm+pt				
Protected Phases		4		3	8		5	2		1		6
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	31.0	31.0	31.0	39.0	39.0	39.0	40.4	30.0		48.5	35.1	
Effective Green, g (s)	32.0	32.0	32.0	43.0	40.0	40.0	45.9	31.0		53.0	36.1	
Actuated g/C Ratio	0.32	0.32	0.32	0.43	0.40	0.40	0.46	0.31		0.53	0.36	
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.5		3.0	6.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	216	1111	491	330	1402	604	496	517		486	641	
v/s Ratio Prot		0.15		0.03	c0.19		0.03	c0.22		c0.13	0.20	
v/s Ratio Perm	0.05		0.03	0.18		0.09	0.11			0.28		
v/c Ratio	0.16	0.48	0.08	0.47	0.48	0.23	0.31	0.70		0.78	0.55	
Uniform Delay, d1	24.3	27.3	23.7	18.4	22.3	19.8	16.2	30.4		16.1	25.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.74	0.84	
Incremental Delay, d2	1.6	1.5	0.3	1.1	1.2	0.9	0.4	8.1		7.0	2.9	
Delay (s)	25.9	28.8	24.1	19.5	23.4	20.7	16.5	38.5		18.9	24.2	
Level of Service	C	C	C	B	C	C	B	D		B	C	
Approach Delay (s)		27.8			22.1			32.3			21.5	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	25.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	95.0%	ICU Level of Service	F
Analysis Period (min)	60		
c Critical Lane Group			

Queues Future Background - Scenario 2: Improvements  
18: Marleau Avenue & McConnell Avenue Weekday A.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	34	536	127	156	670	347	152	252	378	351
Lane Group Flow (vph)	34	536	127	156	670	347	152	382	378	351
Turn Type	Perm		Perm pm+pt		Perm pm+pt			pm+pt		
Protected Phases		4		3	8		5	2	1	6
Permitted Phases	4		4	8		8	2		6	
Detector Phases	4	4	4	3	8	8	5	2	1	6
Minimum Initial (s)	21.7	21.7	21.7	5.0	21.7	21.7	10.0	15.0	10.0	15.0
Minimum Split (s)	36.1	36.1	36.1	8.0	38.7	38.7	14.0	31.9	14.0	31.9
Total Split (s)	37.0	37.0	37.0	8.0	45.0	45.0	14.0	36.0	19.0	41.0
Total Split (%)	37.0%	37.0%	37.0%	8.0%	45.0%	45.0%	14.0%	36.0%	19.0%	41.0%
Yellow Time (s)	4.1	4.1	4.1	2.0	4.1	4.1	2.0	4.1	2.0	4.1
All-Red Time (s)	1.9	1.9	1.9	1.0	1.9	1.9	1.0	2.4	1.0	2.4
Lead/Lag	Lag	Lag	Lag	Lead			Lead	Lag	Lead	Lag
Lead-Lag Optimize?										
Recall Mode	C-Max	C-Max	C-Max	None	C-Max	C-Max	None	Max	None	Max
v/c Ratio	0.16	0.48	0.22	0.47	0.48	0.43	0.31	0.71	0.78	0.55
Control Delay	26.8	29.1	5.6	23.5	23.7	4.0	14.3	37.4	23.1	24.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.8	29.1	5.6	23.5	23.7	4.0	14.3	37.4	23.1	24.8
Queue Length 50th (m)	4.9	46.0	0.0	19.4	52.3	0.0	15.2	64.5	39.0	56.1
Queue Length 95th (m)	14.7	71.1	16.5	37.7	79.4	27.0	29.7	#129.0	#96.7	100.3
Internal Link Dist (m)		264.6			914.0			258.2		283.7
Turn Bay Length (m)			84.0	71.0		71.0	77.0		130.0	
Base Capacity (vph)	216	1111	577	329	1402	812	503	537	489	641
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	0.16	0.48	0.22	0.47	0.48	0.43	0.30	0.71	0.77	0.55

Intersection Summary	
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	77 (77%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle:	90
Control Type:	Actuated-Coordinated
#	95th percentile volume exceeds capacity, queue may be longer.
	Queue shown is maximum after two cycles.



HCM Signalized Intersection Capacity Analysis Future Background - Scenario 2: Improvements  
13: Marleau Avenue & Virginia Avenue Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.3	5.3		5.3	5.3	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1827	1553	1805	1845	1615	1766	1795		1805	1861	
Flt Permitted	0.12	1.00	1.00	0.22	1.00	1.00	0.58	1.00		0.65	1.00	
Satd. Flow (perm)	219	1827	1553	423	1845	1615	1075	1795		1236	1861	
Volume (vph)	25	788	168	63	958	25	189	101	59	25	174	25
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	25	788	168	63	958	25	189	101	59	25	174	25
RTOR Reduction (vph)	0	0	20	0	0	2	0	31	0	0	7	0
Lane Group Flow (vph)	25	788	148	63	958	23	189	129	0	25	192	0
Confl. Peds. (#/hr)							3					3
Heavy Vehicles (%)	0%	4%	4%	0%	3%	0%	2%	0%	0%	0%	0%	0%
Turn Type	Perm		Perm	Perm		Perm	Perm		Perm		Perm	
Protected Phases		4			8			2				6
Permitted Phases	4		4	8		8	2				6	
Actuated Green, G (s)	44.1	44.1	44.1	44.1	44.1	44.1	18.1	18.1		18.1	18.1	
Effective Green, g (s)	45.1	45.1	45.1	45.1	45.1	45.1	19.1	19.1		19.1	19.1	
Actuated g/C Ratio	0.60	0.60	0.60	0.60	0.60	0.60	0.25	0.25		0.25	0.25	
Clearance Time (s)	6.5	6.5	6.5	6.5	6.5	6.5	6.3	6.3		6.3	6.3	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	132	1099	934	254	1109	971	274	457		315	474	
v/s Ratio Prot		0.43			0.52			0.07			0.10	
v/s Ratio Perm	0.11		0.10	0.15		0.01	0.18			0.02		
v/c Ratio	0.19	0.72	0.16	0.25	0.86	0.02	0.69	0.28		0.08	0.40	
Uniform Delay, d1	6.7	10.5	6.6	7.0	12.4	6.0	25.3	22.5		21.3	23.2	
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	3.2	4.1	0.4	2.3	9.9	0.0	7.3	0.3		0.1	0.6	
Delay (s)	9.9	14.6	7.0	9.3	22.3	6.1	32.6	22.8		21.4	23.8	
Level of Service	A	B	A	A	C	A	C	C		C	C	
Approach Delay (s)		13.2			21.1			28.1			23.5	
Approach LOS		B			C			C			C	

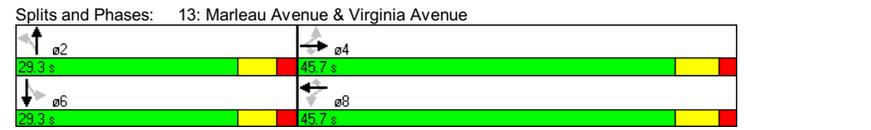
Intersection Summary			
HCM Average Control Delay	19.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	91.3%	ICU Level of Service	F
Analysis Period (min)	60		

c Critical Lane Group

Queues Future Background - Scenario 2: Improvements  
13: Marleau Avenue & Virginia Avenue Weekday P.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	25	788	168	63	958	25	189	101	25	174
Lane Group Flow (vph)	25	788	168	63	958	25	189	160	25	199
Turn Type	Perm		Perm	Perm		Perm	Perm		Perm	
Protected Phases		4			8			2		6
Permitted Phases	4		4	8		8	2		6	6
Detector Phases	4	4	4	8	8	8	2	2	6	6
Minimum Initial (s)	18.2	18.2	18.2	18.0	18.0	18.0	15.0	15.0	15.0	15.0
Minimum Split (s)	35.7	35.7	35.7	35.7	35.7	35.7	29.3	29.3	29.3	29.3
Total Split (s)	45.7	45.7	45.7	45.7	45.7	45.7	29.3	29.3	29.3	29.3
Total Split (%)	60.9%	60.9%	60.9%	60.9%	60.9%	60.9%	39.1%	39.1%	39.1%	39.1%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.1	4.1	4.1	4.1
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.2	2.2	2.2	2.2
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max	None	None	None	None
v/c Ratio	0.22	0.72	0.18	0.32	0.86	0.03	0.66	0.33	0.08	0.41
Control Delay	14.4	16.5	5.8	14.7	25.1	6.3	37.0	17.8	20.2	24.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.4	16.5	5.8	14.7	25.1	6.3	37.0	17.8	20.2	24.2
Queue Length 50th (m)	1.5	70.7	6.5	4.0	101.7	1.0	25.7	14.4	2.9	23.8
Queue Length 95th (m)	9.3	#195.3	20.5	18.6	#257.8	5.1	50.0	31.0	8.8	43.3
Internal Link Dist (m)		914.0			682.0			404.6		283.6
Turn Bay Length (m)	25.0		10.0	25.0		10.0	25.0			
Base Capacity (vph)	114	1099	955	195	1111	974	360	603	399	602
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	0.22	0.72	0.18	0.32	0.86	0.03	0.53	0.27	0.06	0.33

Intersection Summary	
Cycle Length: 75	
Actuated Cycle Length: 75	
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	



HCM Signalized Intersection Capacity Analysis Future Background - Scenario 2: Improvements  
18: Marleau Avenue & McConnell Avenue Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.5		2.0	5.5	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1719	3505	1560	1769	3574	1568	1785	1804		1719	1845	
Flt Permitted	0.29	1.00	1.00	0.19	1.00	1.00	0.51	1.00		0.13	1.00	
Satd. Flow (perm)	519	3505	1560	360	3574	1568	949	1804		230	1845	
Volume (vph)	39	679	178	124	737	365	275	506	99	375	367	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	39	679	178	124	737	365	275	506	99	375	367	0
RTOR Reduction (vph)	0	0	133	0	0	245	0	7	0	0	0	0
Lane Group Flow (vph)	39	679	45	124	737	120	275	598	0	375	367	0
Confl. Peds. (#/hr)			2	2		3			2	2		3
Heavy Vehicles (%)	5%	3%	1%	2%	1%	3%	1%	2%	4%	5%	3%	12%
Turn Type	Perm		Perm pm+pt		Perm pm+pt			pm+pt				
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	24.4	24.4	24.4	32.0	32.0	32.0	45.9	34.6		55.5	41.2	
Effective Green, g (s)	25.4	25.4	25.4	36.0	33.0	33.0	51.4	35.6		60.0	42.2	
Actuated g/C Ratio	0.25	0.25	0.25	0.36	0.33	0.33	0.51	0.36		0.60	0.42	
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.5		3.0	6.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	132	890	396	209	1179	517	591	642		419	779	
v/s Ratio Prot		c0.19		0.03	c0.21		0.06	c0.33		c0.17	0.20	
v/s Ratio Perm	0.08		0.03	0.18		0.08	0.18			0.37		
v/c Ratio	0.30	0.76	0.11	0.59	0.63	0.23	0.47	0.93		0.89	0.47	
Uniform Delay, d1	30.1	34.5	28.7	23.5	28.3	24.3	14.0	31.0		25.6	20.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.93	0.78	
Incremental Delay, d2	1.3	4.0	0.1	4.5	1.0	0.2	0.6	30.5		22.1	1.7	
Delay (s)	31.3	38.5	28.8	28.0	29.3	24.5	14.6	61.5		46.1	18.0	
Level of Service	C	D	C	C	C	C	B	E		D	B	
Approach Delay (s)		36.3			27.8			46.9			32.2	
Approach LOS		D			C			D			C	

Intersection Summary			
HCM Average Control Delay	35.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	17.5
Intersection Capacity Utilization	106.7%	ICU Level of Service	G
Analysis Period (min)	60		
c Critical Lane Group			

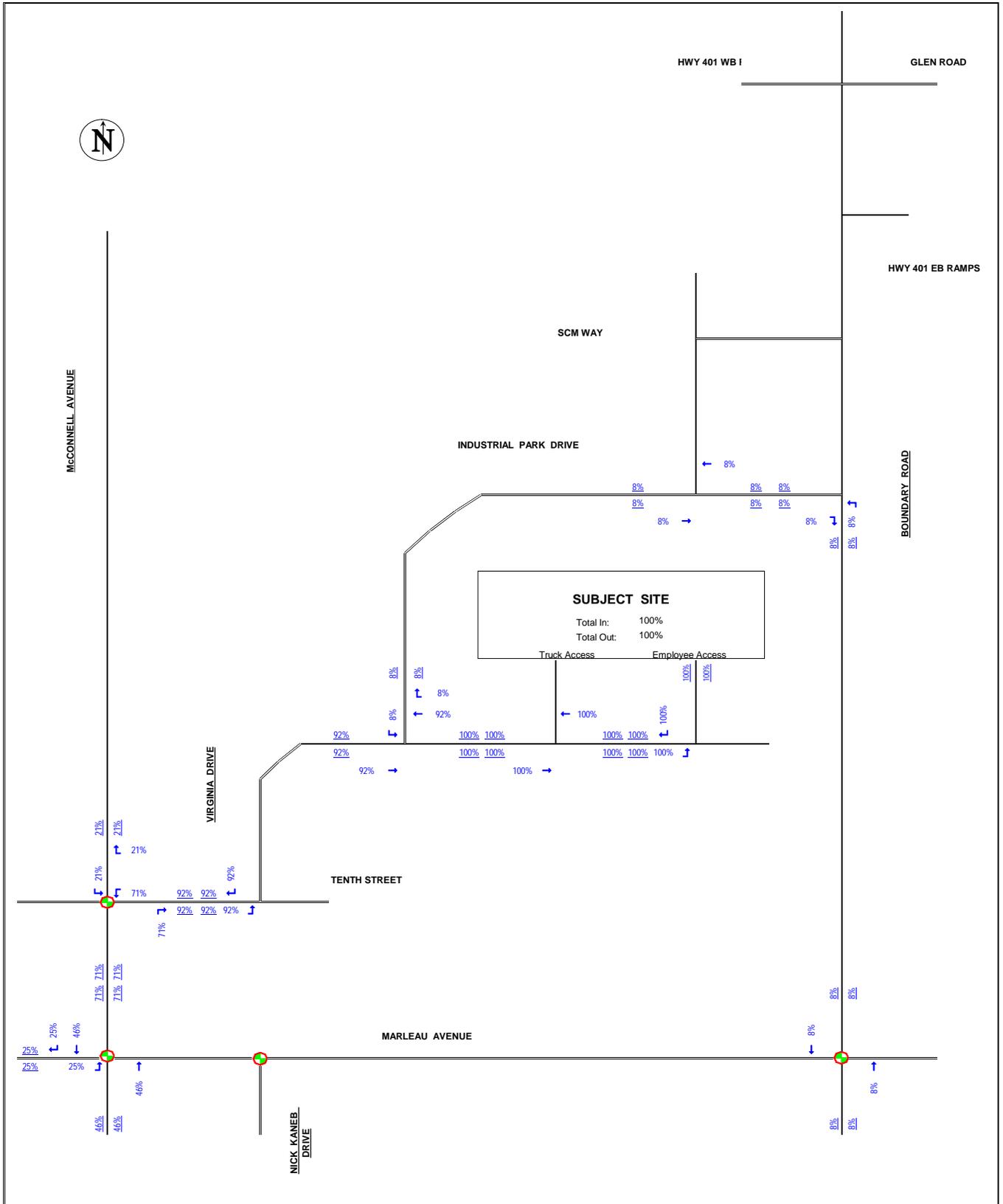
Queues Future Background - Scenario 2: Improvements  
18: Marleau Avenue & McConnell Avenue Weekday P.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	39	679	178	124	737	365	275	506	375	367
Lane Group Flow (vph)	39	679	178	124	737	365	275	605	375	367
Turn Type	Perm		Perm pm+pt		Perm pm+pt			pm+pt		
Protected Phases		4		3	8		5	2	1	6
Permitted Phases	4		4	8		8	2		6	
Detector Phases	4	4	4	3	8	8	5	2	1	6
Minimum Initial (s)	20.0	20.0	20.0	3.0	20.0	20.0	11.0	20.0	11.0	20.0
Minimum Split (s)	28.0	28.0	28.0	7.0	28.0	28.0	14.0	28.5	14.0	28.5
Total Split (s)	33.0	33.0	33.0	7.0	40.0	40.0	14.0	41.0	19.0	46.0
Total Split (%)	33.0%	33.0%	33.0%	7.0%	40.0%	40.0%	14.0%	41.0%	19.0%	46.0%
Yellow Time (s)	4.1	4.1	4.1	3.0	4.1	4.1	2.0	4.1	2.0	4.1
All-Red Time (s)	1.9	1.9	1.9	0.0	1.9	1.9	1.0	2.4	1.0	2.4
Lead/Lag	Lag	Lag	Lag	Lead			Lead	Lag	Lead	Lag
Lead-Lag Optimize?										
Recall Mode	Min	Min	Min	Min	Min	Min	Min	C-Min	Min	C-Min
v/c Ratio	0.29	0.76	0.34	0.56	0.63	0.48	0.48	0.93	0.89	0.47
Control Delay	35.4	40.7	6.2	33.1	30.8	4.8	13.5	62.4	49.5	18.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.4	40.7	6.2	33.1	30.8	4.8	13.5	62.4	49.5	18.7
Queue Length 50th (m)	6.3	66.4	0.0	17.0	65.6	0.0	25.0	116.0	41.2	54.7
Queue Length 95th (m)	18.3	98.5	21.2	#36.4	96.5	31.0	46.7	#224.1	#136.5	88.1
Internal Link Dist (m)		264.6		914.0			245.0		283.7	
Turn Bay Length (m)			84.0	71.0		71.0	77.0		130.0	
Base Capacity (vph)	149	981	565	222	1251	786	569	649	419	779
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	0.26	0.69	0.32	0.56	0.59	0.46	0.48	0.93	0.89	0.47

Intersection Summary	
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	96 (96%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle:	90
Control Type:	Actuated-Coordinated
#	95th percentile volume exceeds capacity, queue may be longer.
	Queue shown is maximum after two cycles.



**Appendix E**  
*Trip Distribution and Assignment*

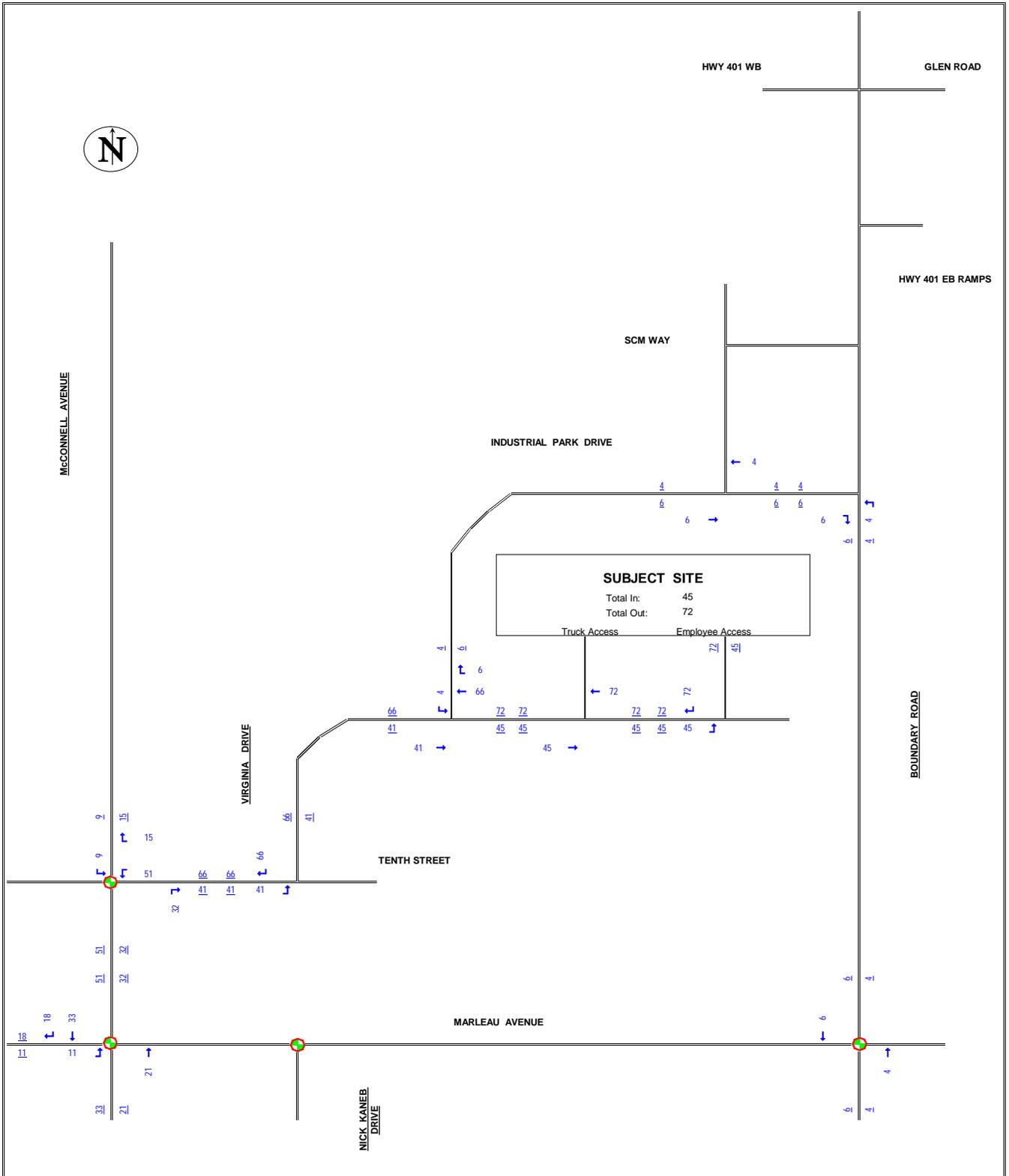


**Boundary Properties Ltd. - Proposed Development at Boundary Road & Highway 401**

FIGURE E1  
 WAREHOUSE & EMPLOYEE SITE DISTRIBUTION (Scenario 1)  
 Weekday AM Peak Hours



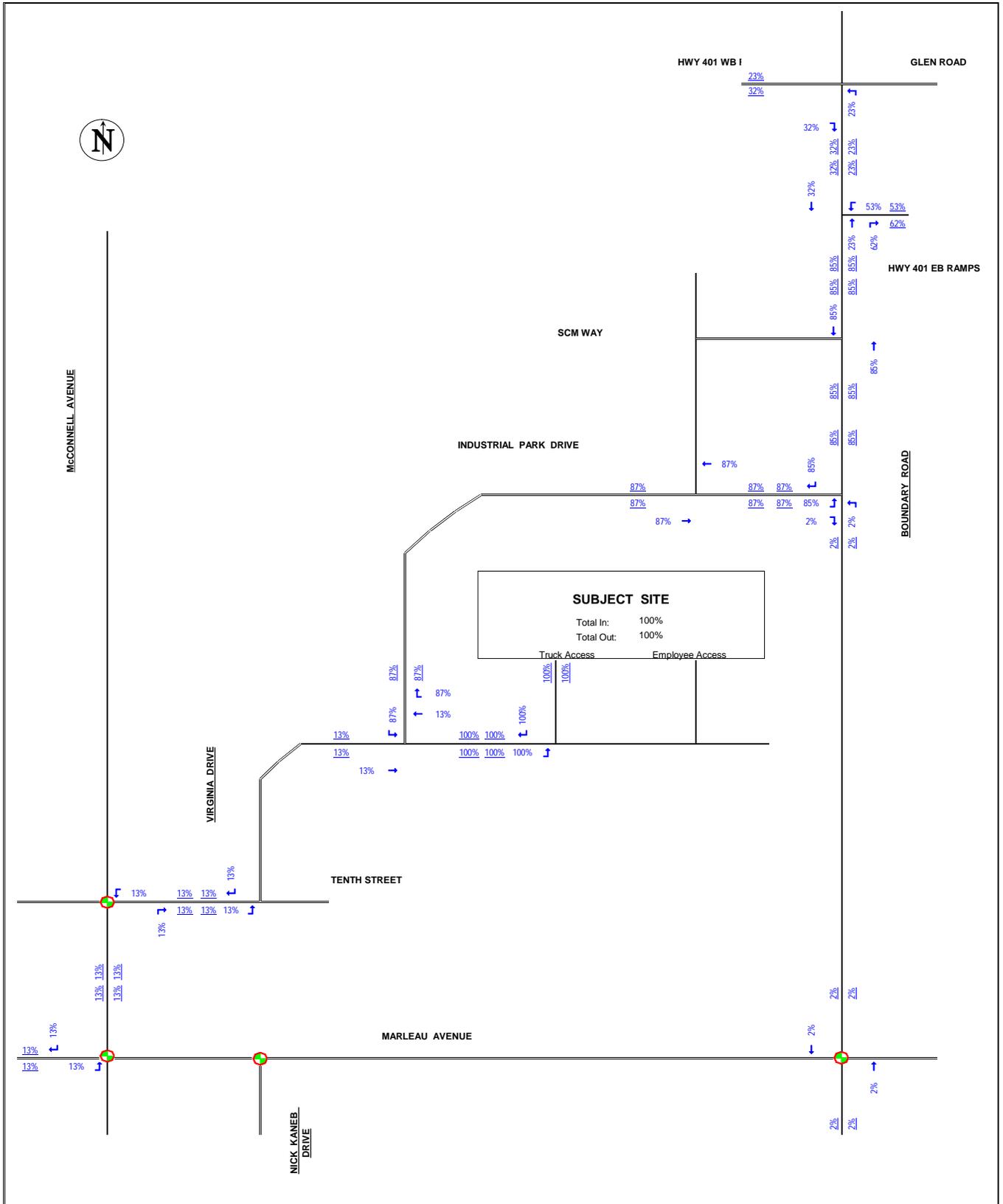




**Boundary Properties Ltd. - Proposed Development at Boundary Road & Highway 401**

FIGURE E3  
 WAREHOUSE AND EMPLOYEE SITE TRIPS (Scenario 1)  
 Weekday PM

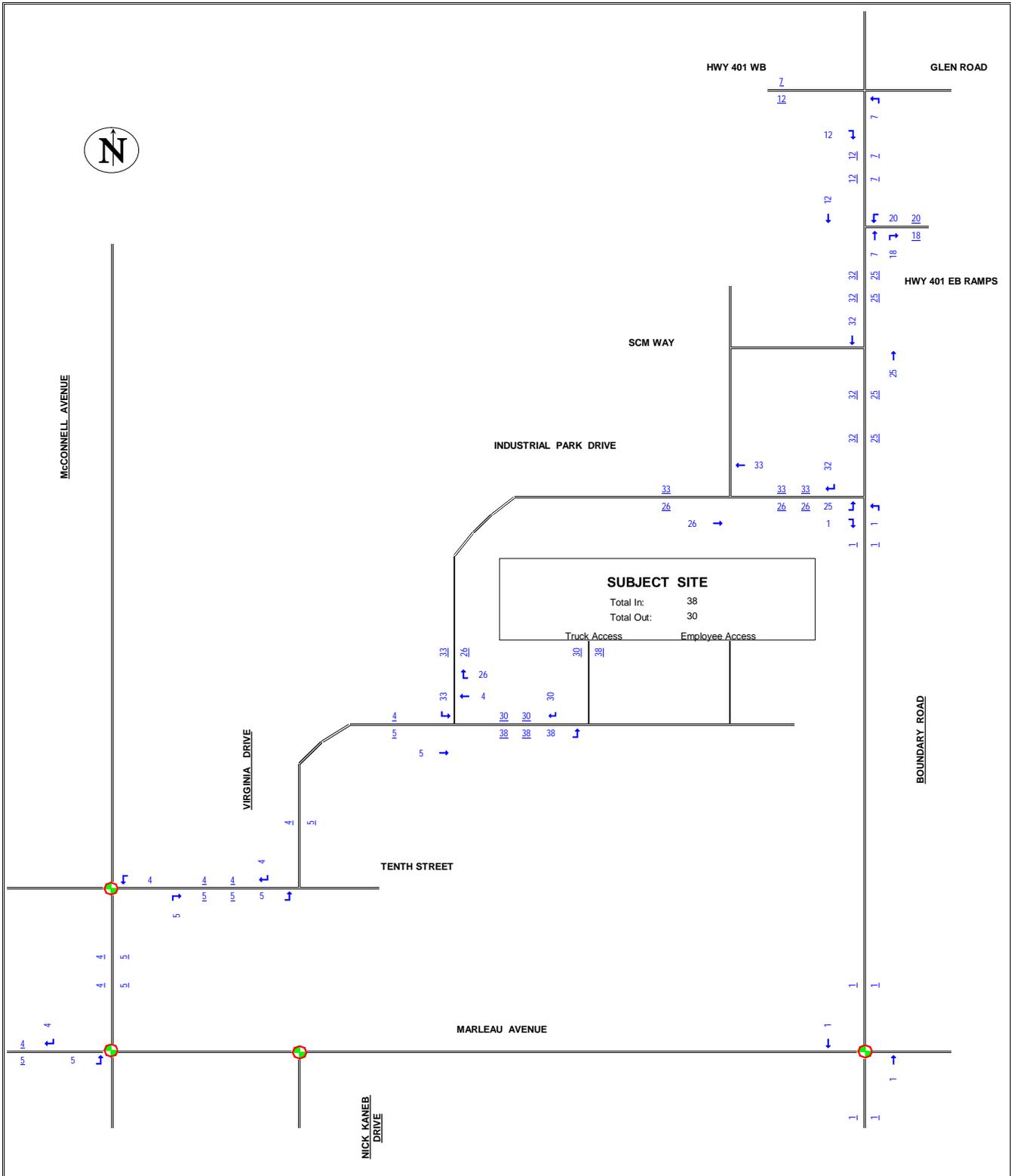




**Boundary Properties Ltd. - Proposed Development at Boundary Road & Highway 401**

FIGURE E4  
 TRUCK SITE DISTRIBUTION (Scenario 1)  
 Weekday AM Peak Hours

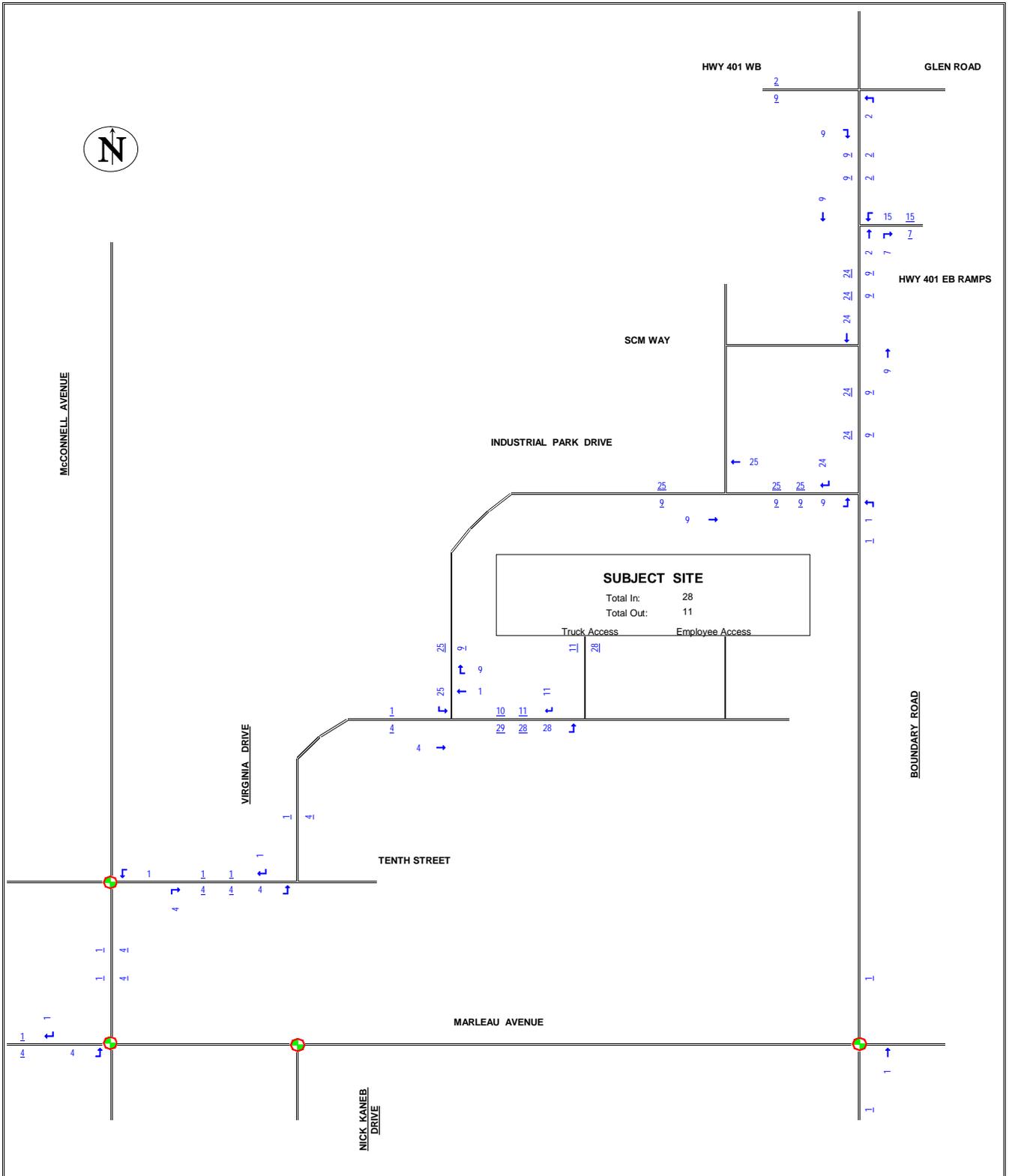




**Boundary Properties Ltd. - Proposed Development at Boundary Road & Highway 401**

FIGURE E5  
 TRUCK SITE TRAFFIC (Scenario 1)  
 Weekday AM

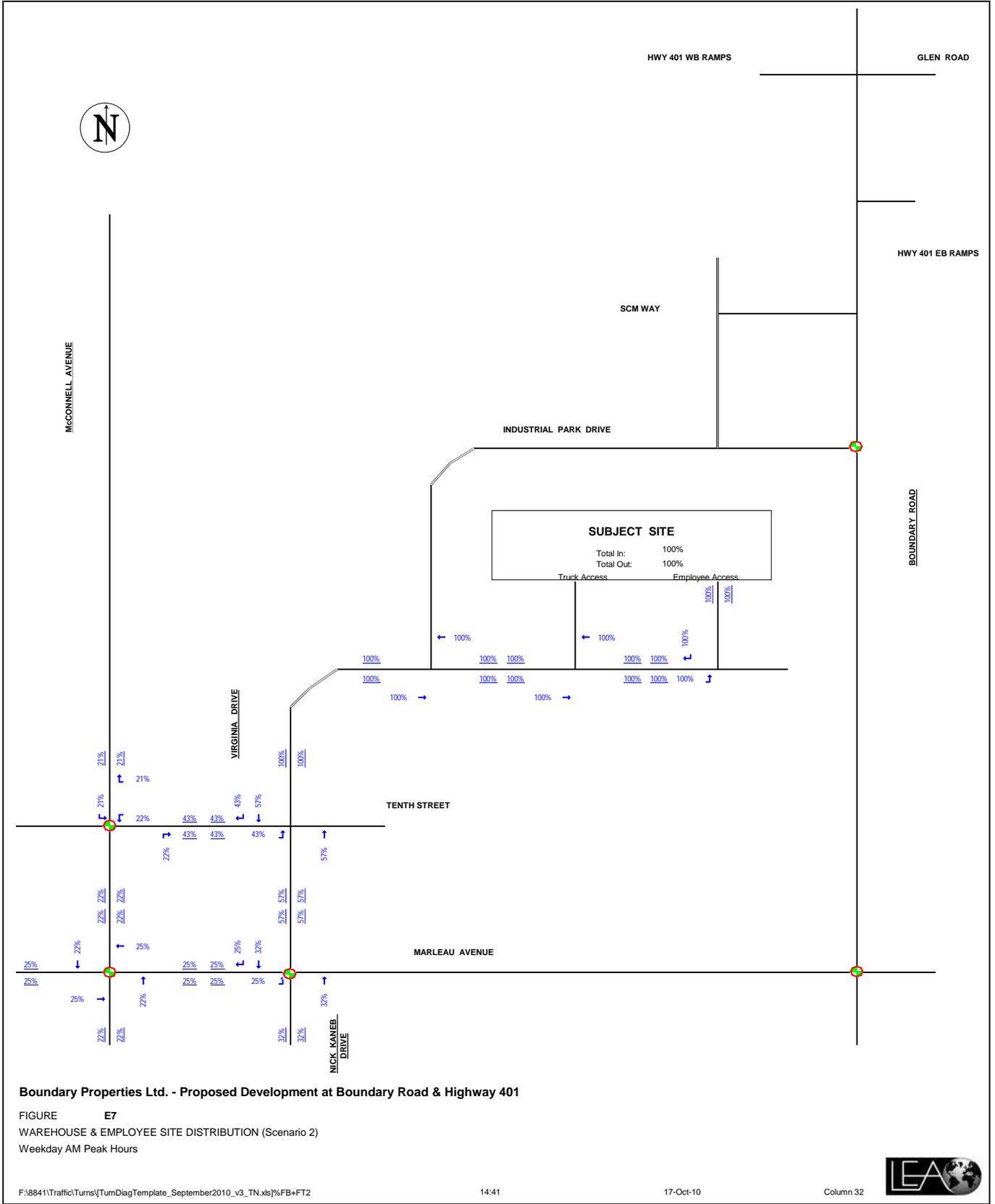




**Boundary Properties Ltd. - Proposed Development at Boundary Road & Highway 401**

FIGURE E6  
 TRUCK SITE TRAFFIC (Scenario 1)  
 Weekday PM







McCONNELL AVENUE

HWY 401 WB RAMPS

GLEN ROAD

HWY 401 EB RAMPS

SCM WAY

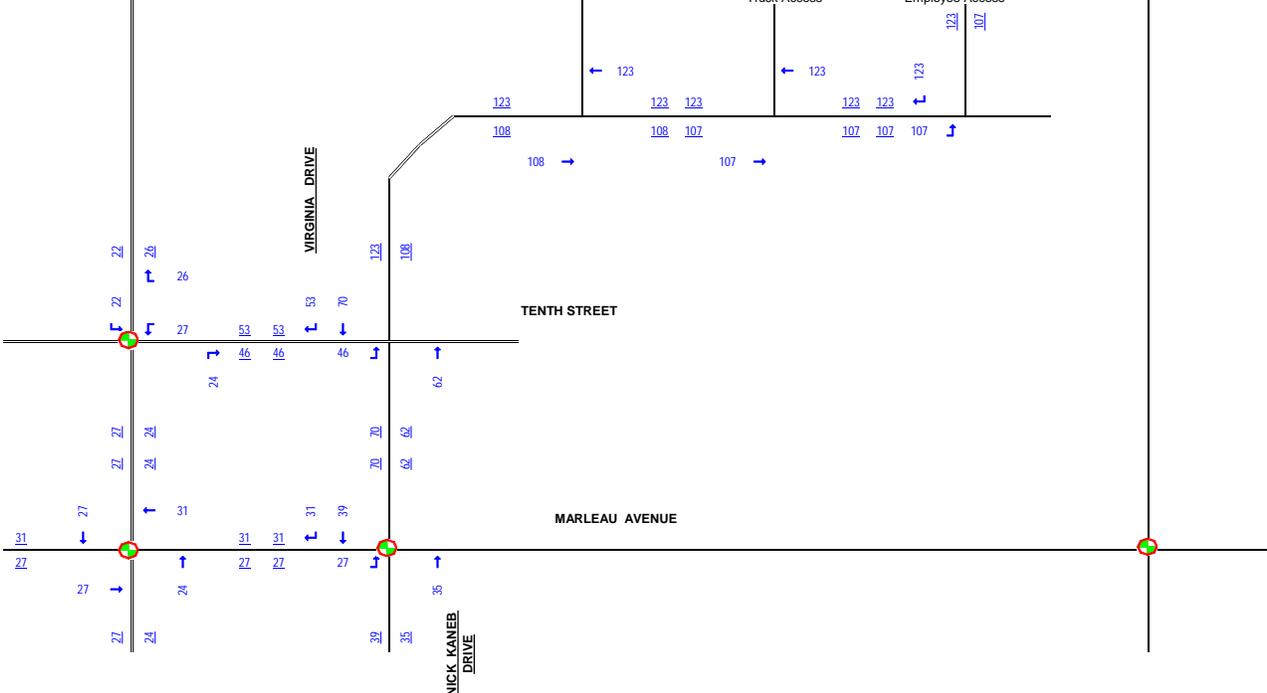
INDUSTRIAL PARK DRIVE

BOUNDARY ROAD

**SUBJECT SITE**

Total In: 107  
Total Out: 123

Truck Access Employee Access



**PEAK HOUR TRAFFIC VOLUME LEVELS**

FIGURE E8  
WAREHOUSE AND EMPLOYEE SITE TRIPS (Scenario 2)  
Weekday AM





McCONNELL AVENUE

HWY 401 WB RAMPS

GLEN ROAD

HWY 401 EB RAMPS

SCM WAY

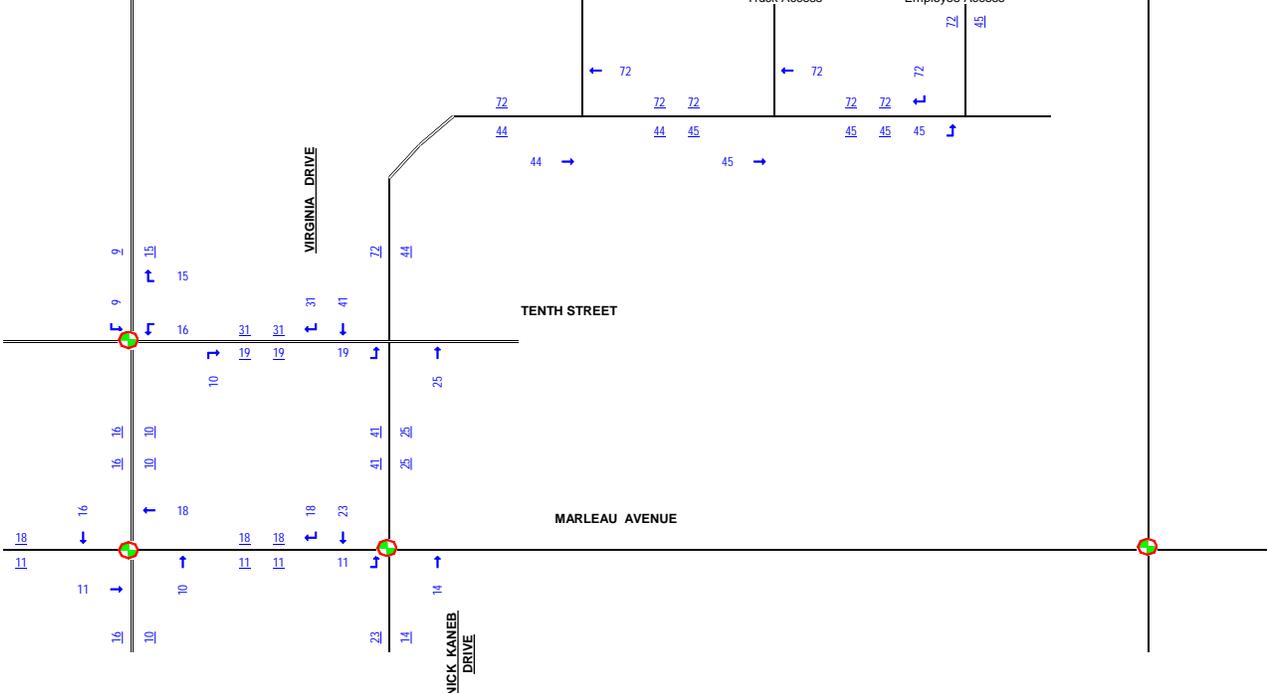
INDUSTRIAL PARK DRIVE

BOUNDARY ROAD

**SUBJECT SITE**

Total In: 45  
Total Out: 72

Truck Access Employee Access

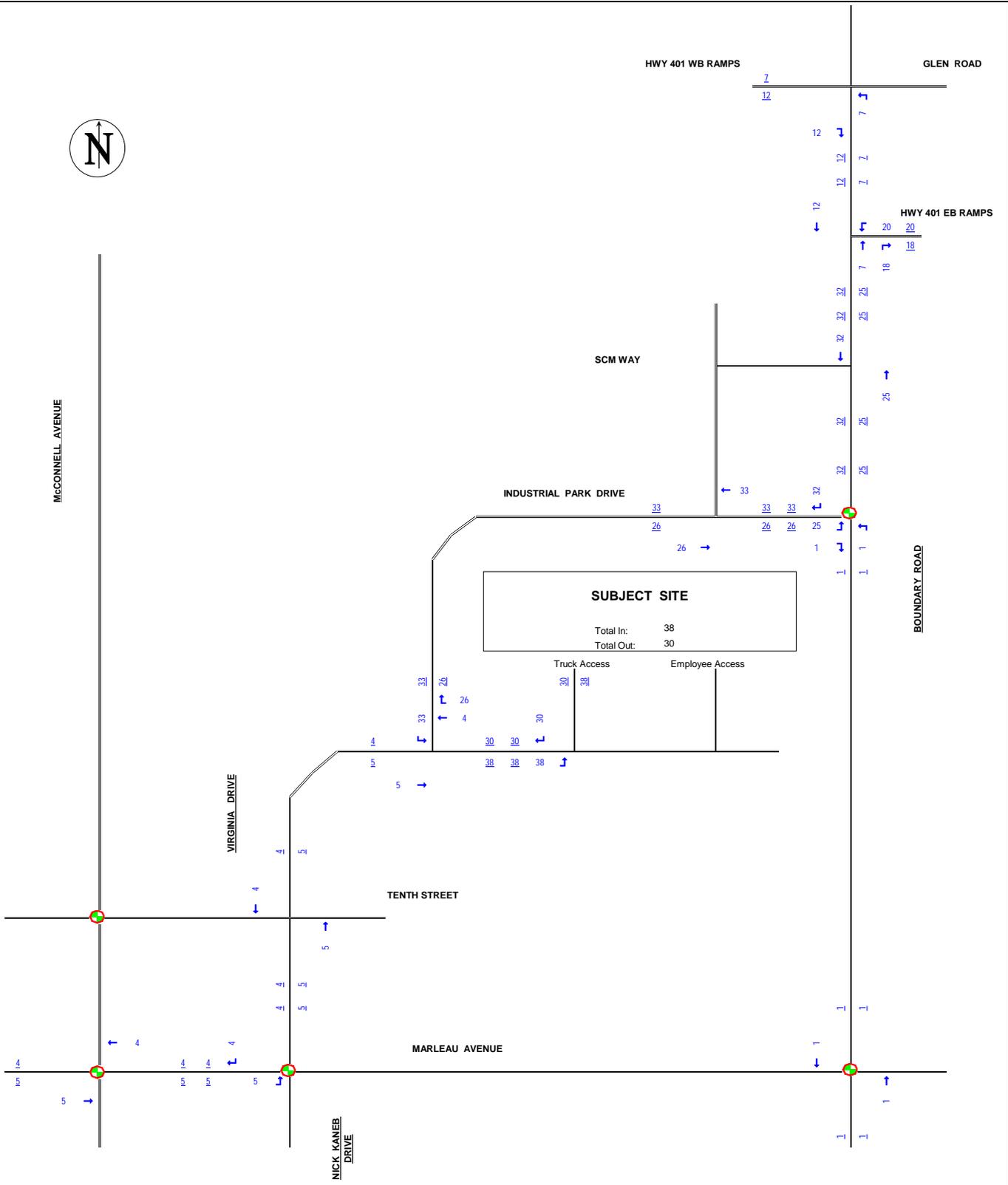


**PEAK HOUR TRAFFIC VOLUME LEVELS**

FIGURE E9  
WAREHOUSE AND EMPLOYEE SITE TRIPS (Scenario 2)  
Weekday PM



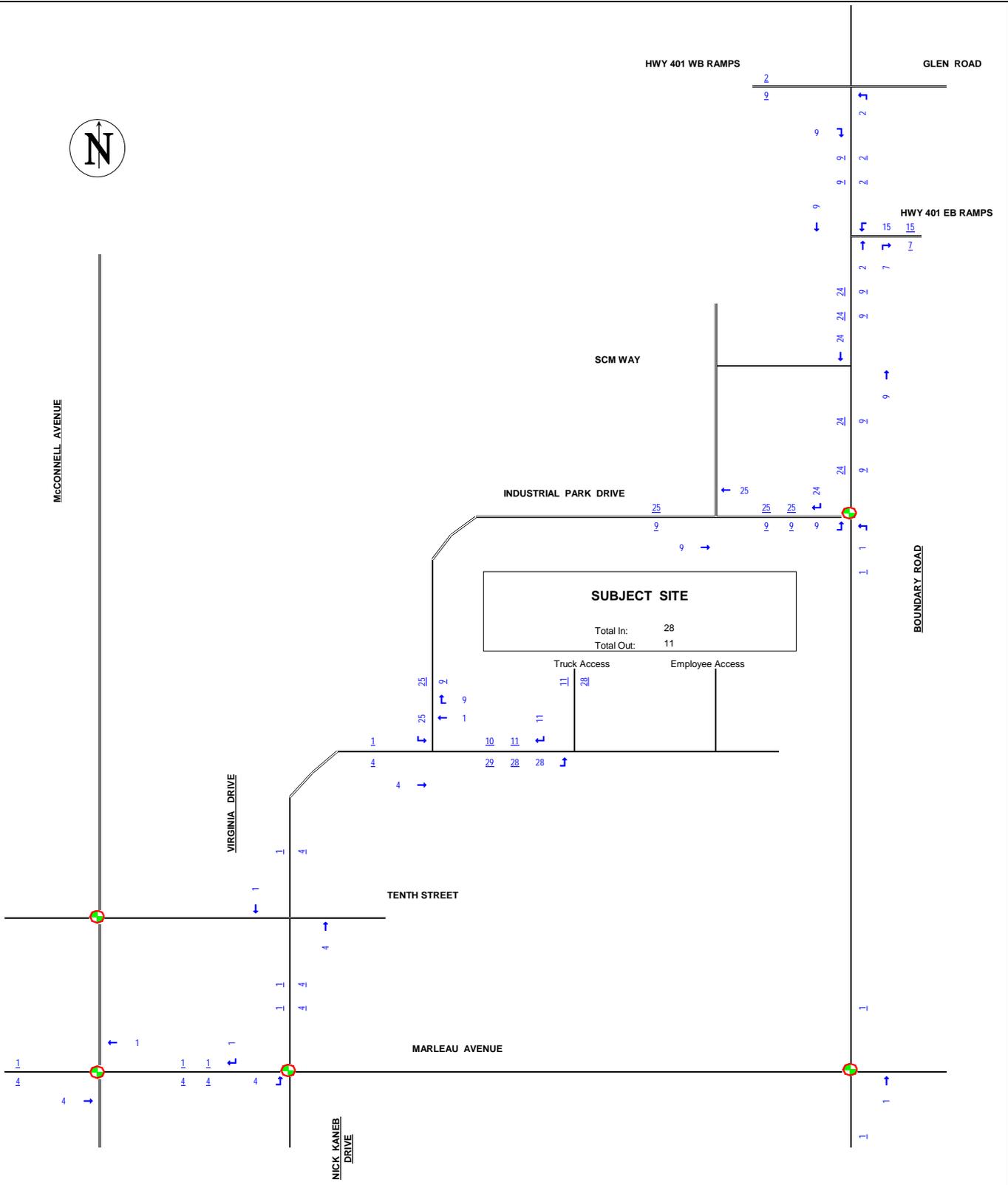




**PEAK HOUR TRAFFIC VOLUME LEVELS**

FIGURE E11  
TRUCK SITE TRIPS (Scenario 2)  
Weekday AM

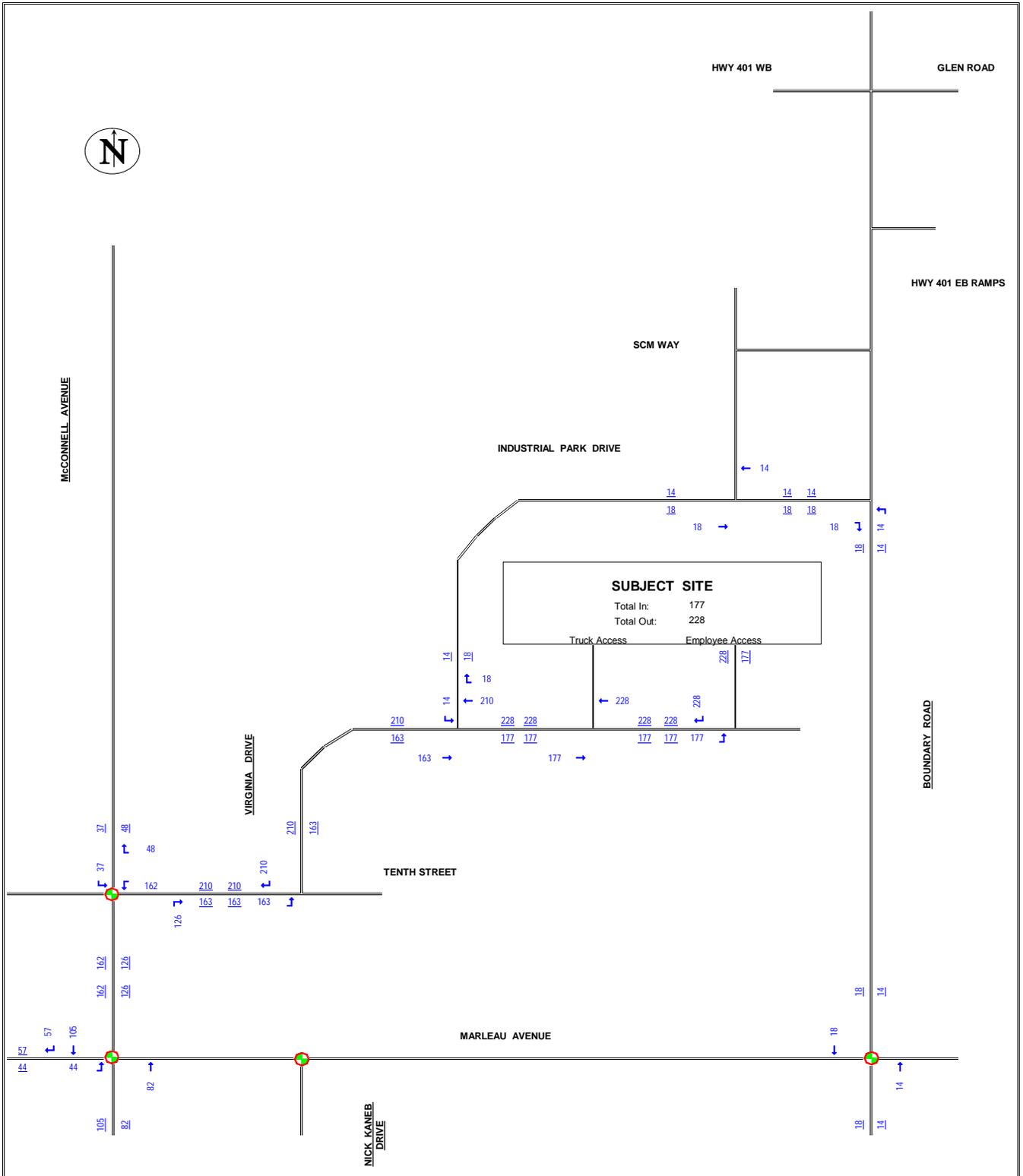




**PEAK HOUR TRAFFIC VOLUME LEVELS**

FIGURE E12  
TRUCK SITE TRIPS (Scenario 2)  
Weekday PM

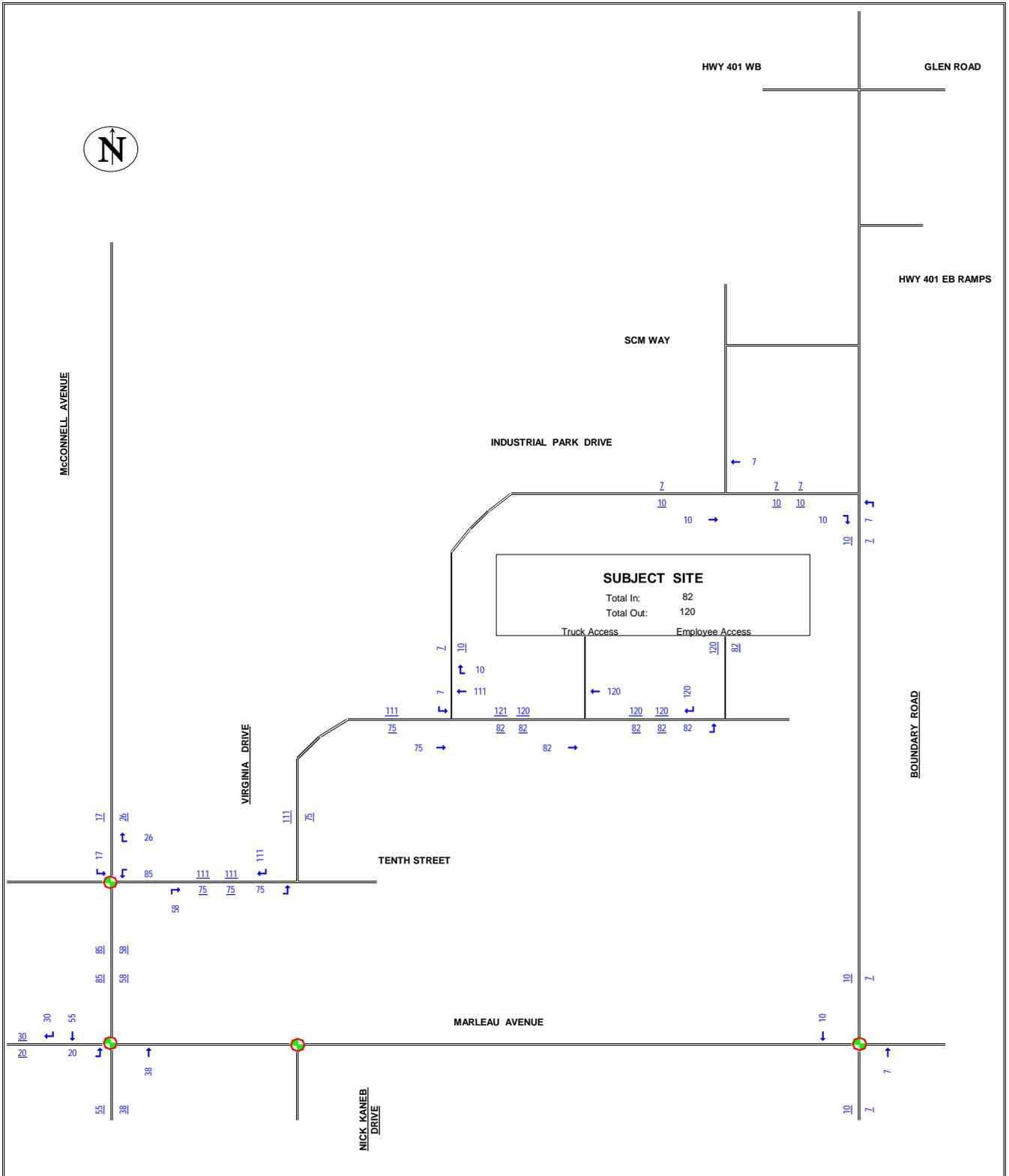




**Boundary Properties Ltd. - Proposed Development at Boundary Road & Highway 401**

FIGURE E13  
 WAREHOUSE AND EMPLOYEE SITE TRIPS (Scenario 1 - Site Expansion)  
 Weekday AM

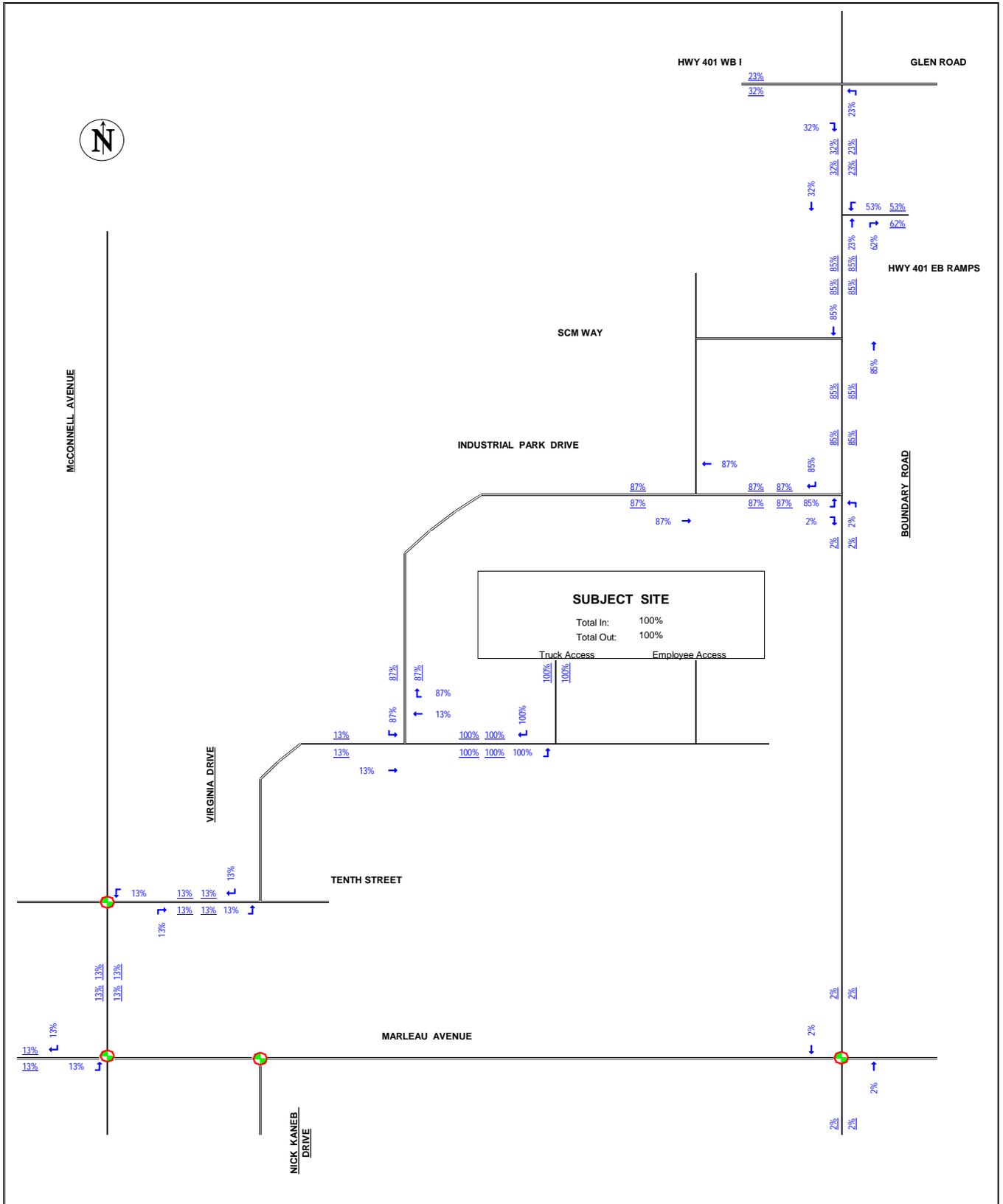




**Boundary Properties Ltd. - Proposed Development at Boundary Road & Highway 401**

FIGURE E14  
 WAREHOUSE AND EMPLOYEE SITE TRIPS (Scenario 1 - Site Expansion)  
 Weekday PM

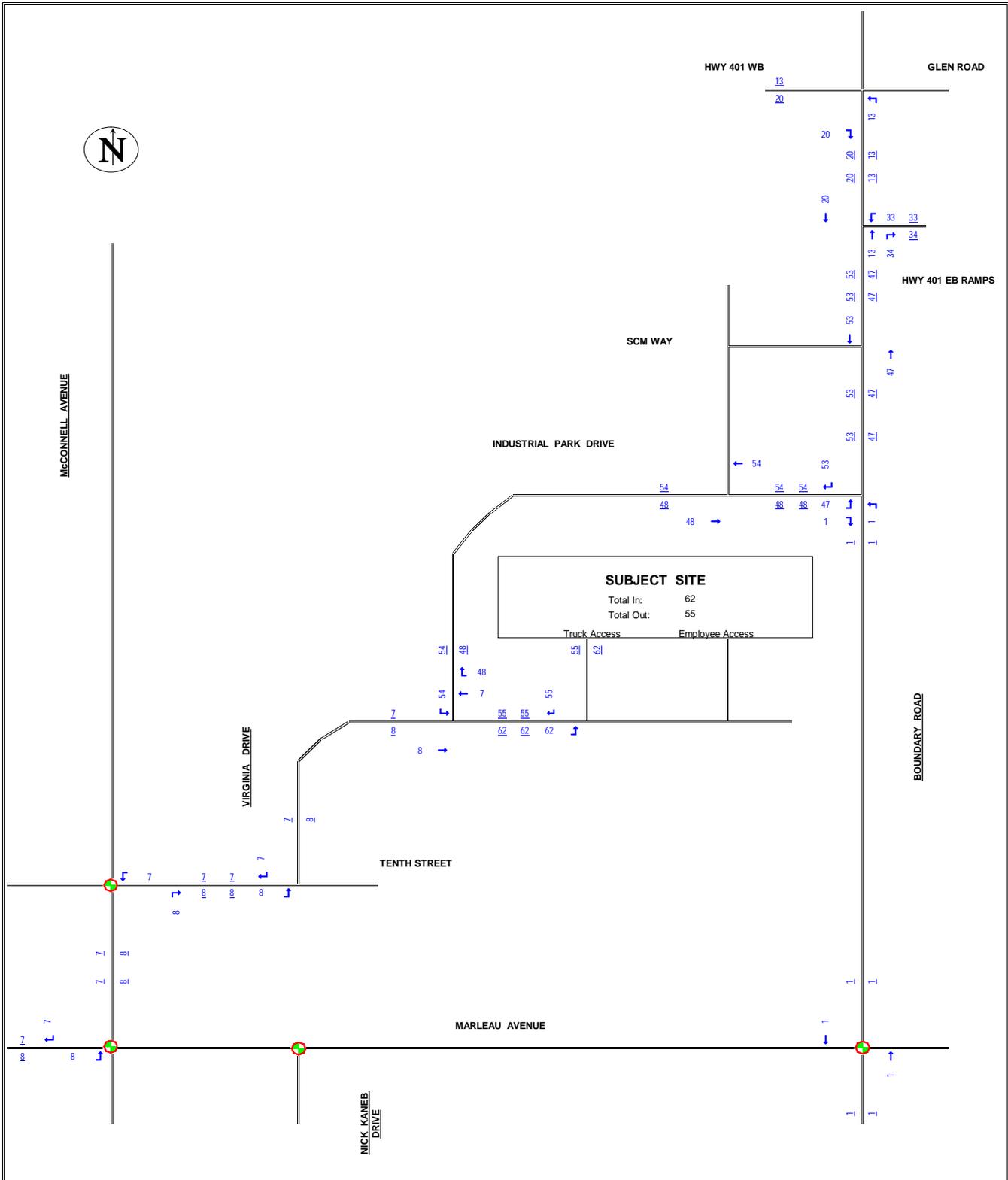




**Boundary Properties Ltd. - Proposed Development at Boundary Road & Highway 401**

FIGURE E15  
 TRUCK SITE DISTRIBUTION (Scenario 1 - Site Expansion)  
 Weekday AM



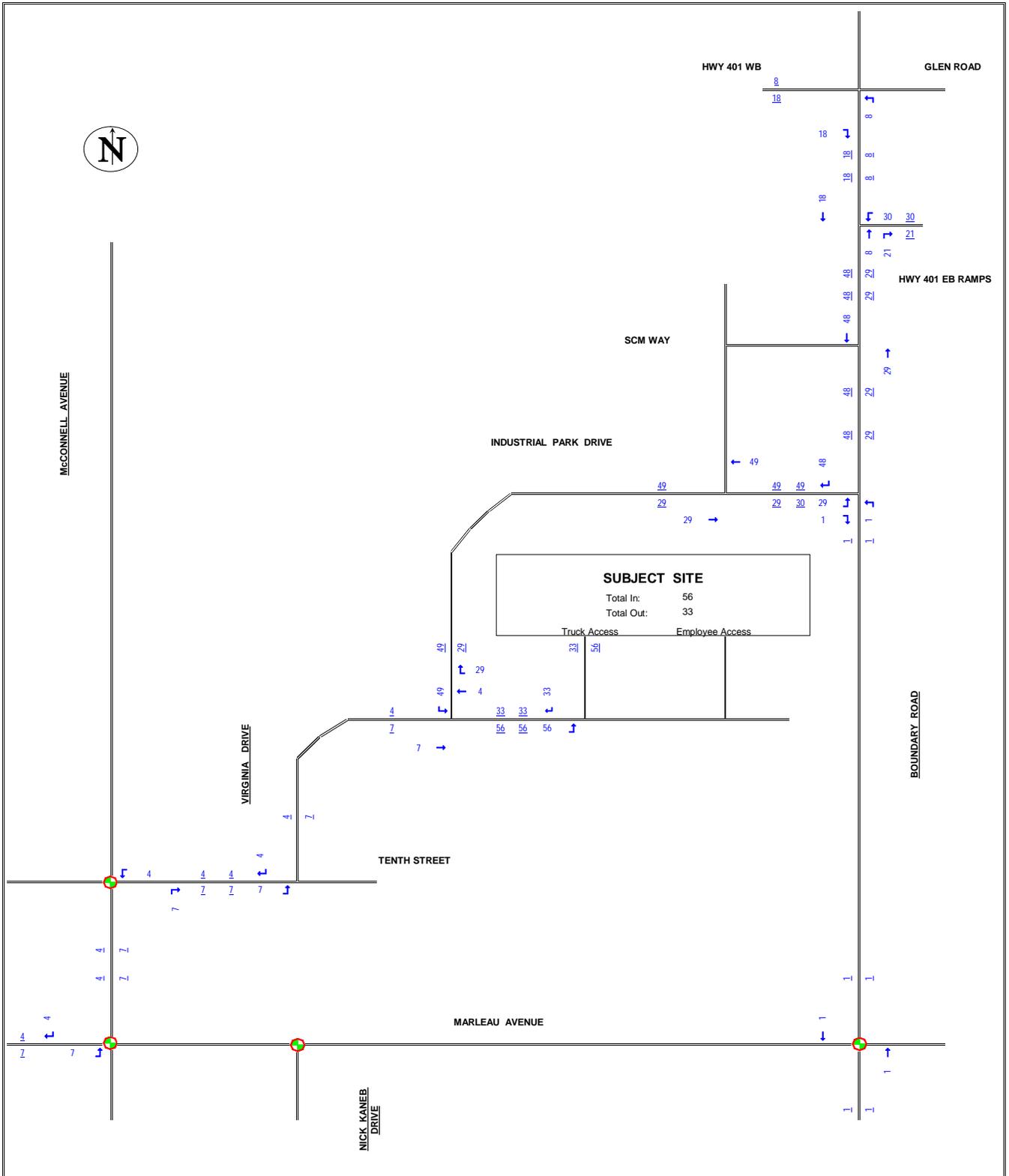


**SUBJECT SITE**  
 Total In: 62  
 Total Out: 55  
 Truck Access  
 Employee Access

**Boundary Properties Ltd. - Proposed Development at Boundary Road & Highway 401**

FIGURE E16  
 TRUCK SITE TRIPS (Scenario 1 - Site Expansion)  
 Weekday AM





**Boundary Properties Ltd. - Proposed Development at Boundary Road & Highway 401**

FIGURE E17  
 TRUCK SITE TRIPS (Scenario 1 - Site Expansion)  
 Weekday PM





McCONNELL AVENUE

HWY 401 WB RAMPS

GLEN ROAD

HWY 401 EB RAMPS

SCM WAY

INDUSTRIAL PARK DRIVE

**SUBJECT SITE**

Total In: 177  
Total Out: 228

Truck Access Employee Access

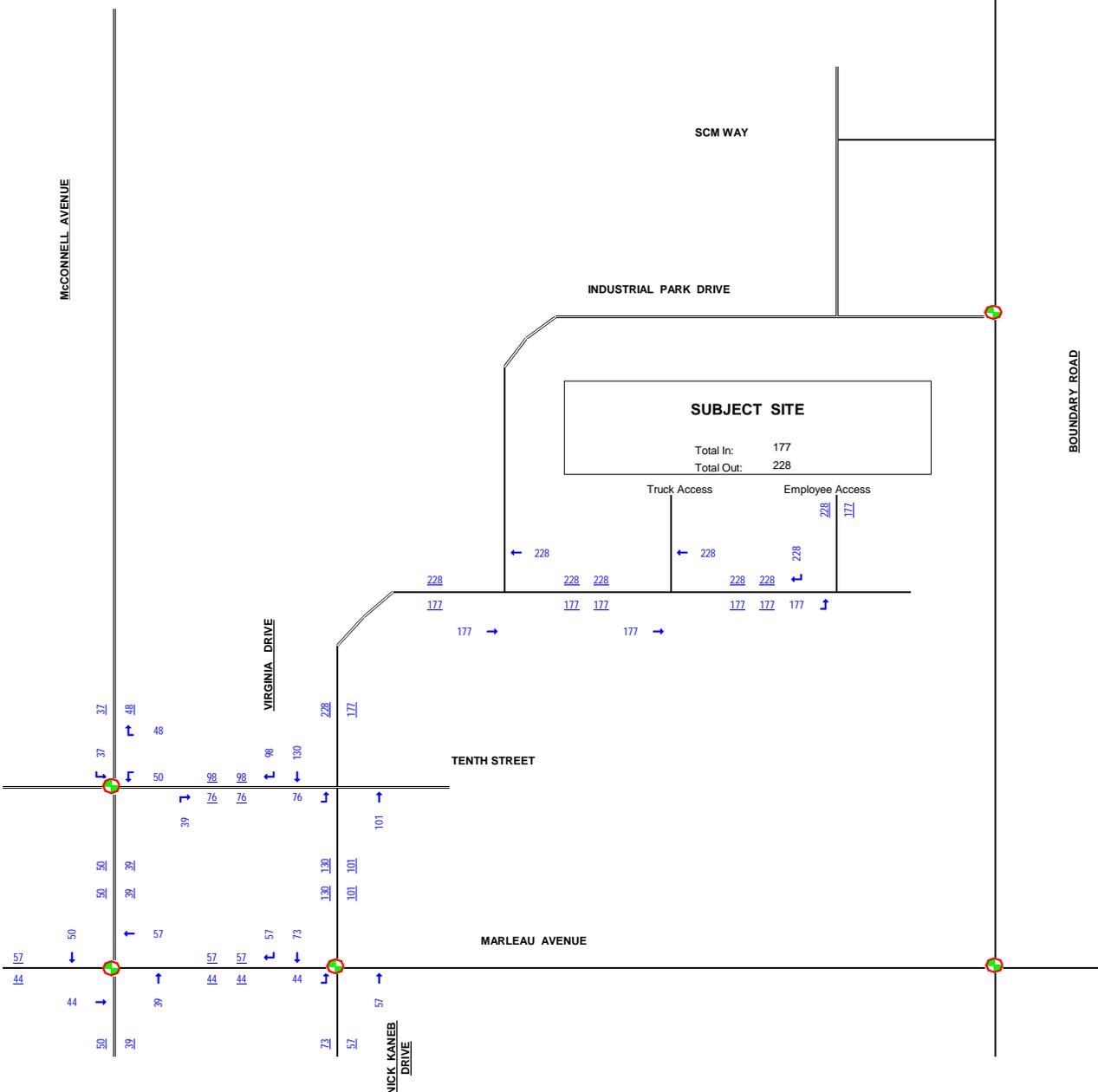
BOUNDARY ROAD

VIRGINIA DRIVE

TENTH STREET

MARLEAU AVENUE

NICK KANE DRIVE

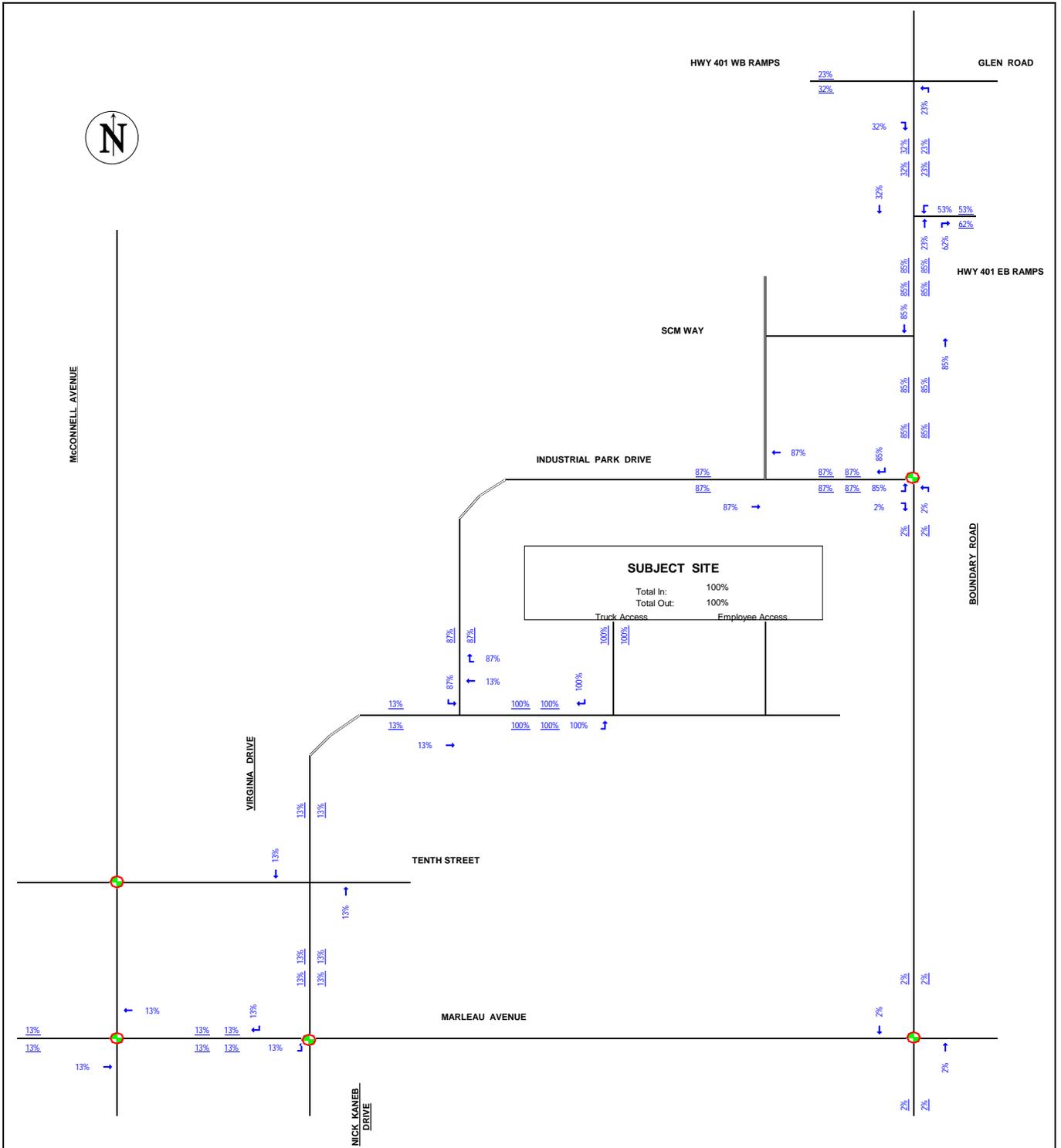


**PEAK HOUR TRAFFIC VOLUME LEVELS**

FIGURE E18  
WAREHOUSE AND EMPLOYEE SITE TRIPS (Scenario 2 - Site Expansion)  
Weekday AM



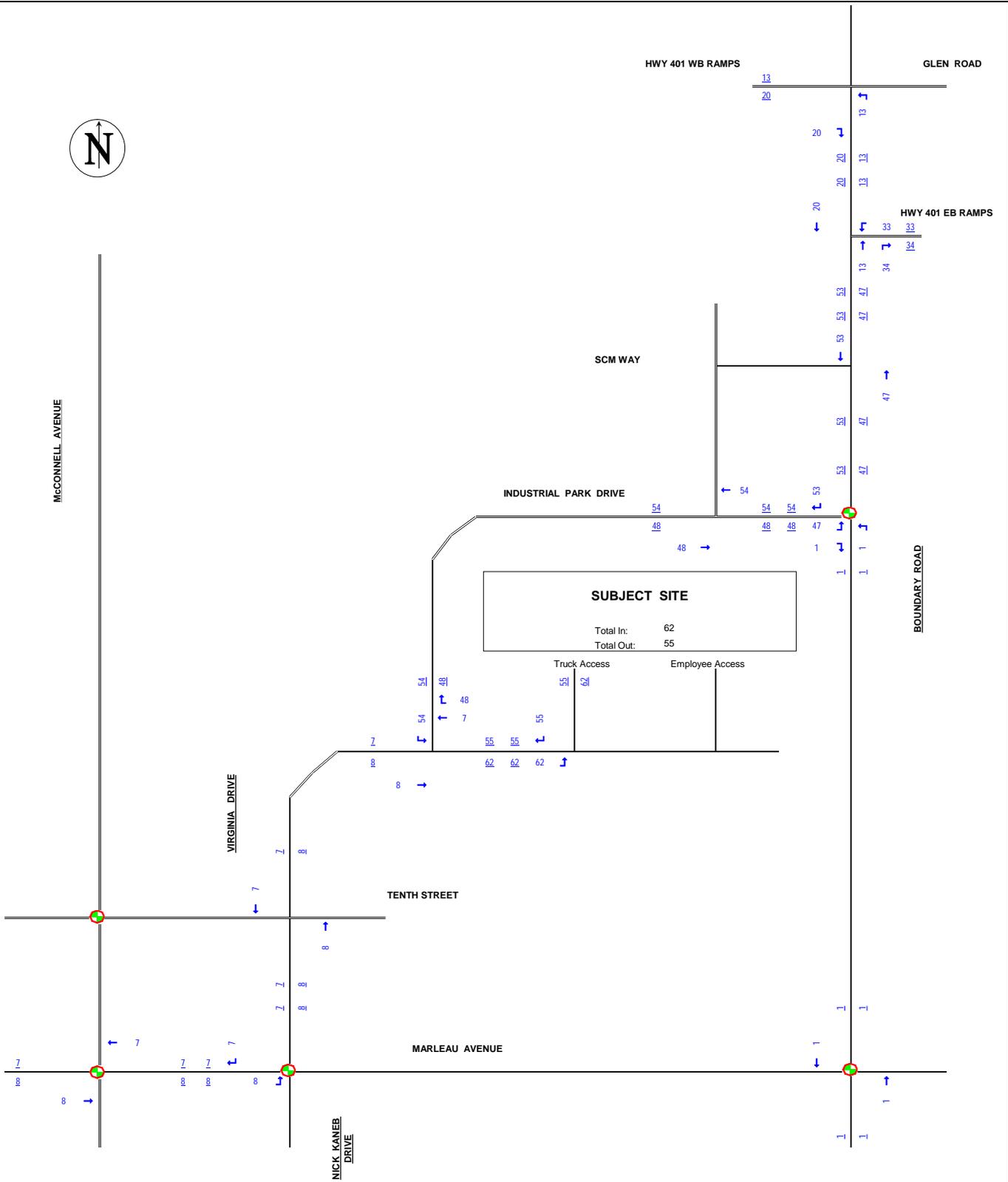




**Boundary Properties Ltd. - Proposed Development at Boundary Road & Highway 401**

FIGURE E20  
 TRUCK SITE DISTRIBUTION (Scenario 2 - Site Expansion)  
 Weekday AM





**SUBJECT SITE**

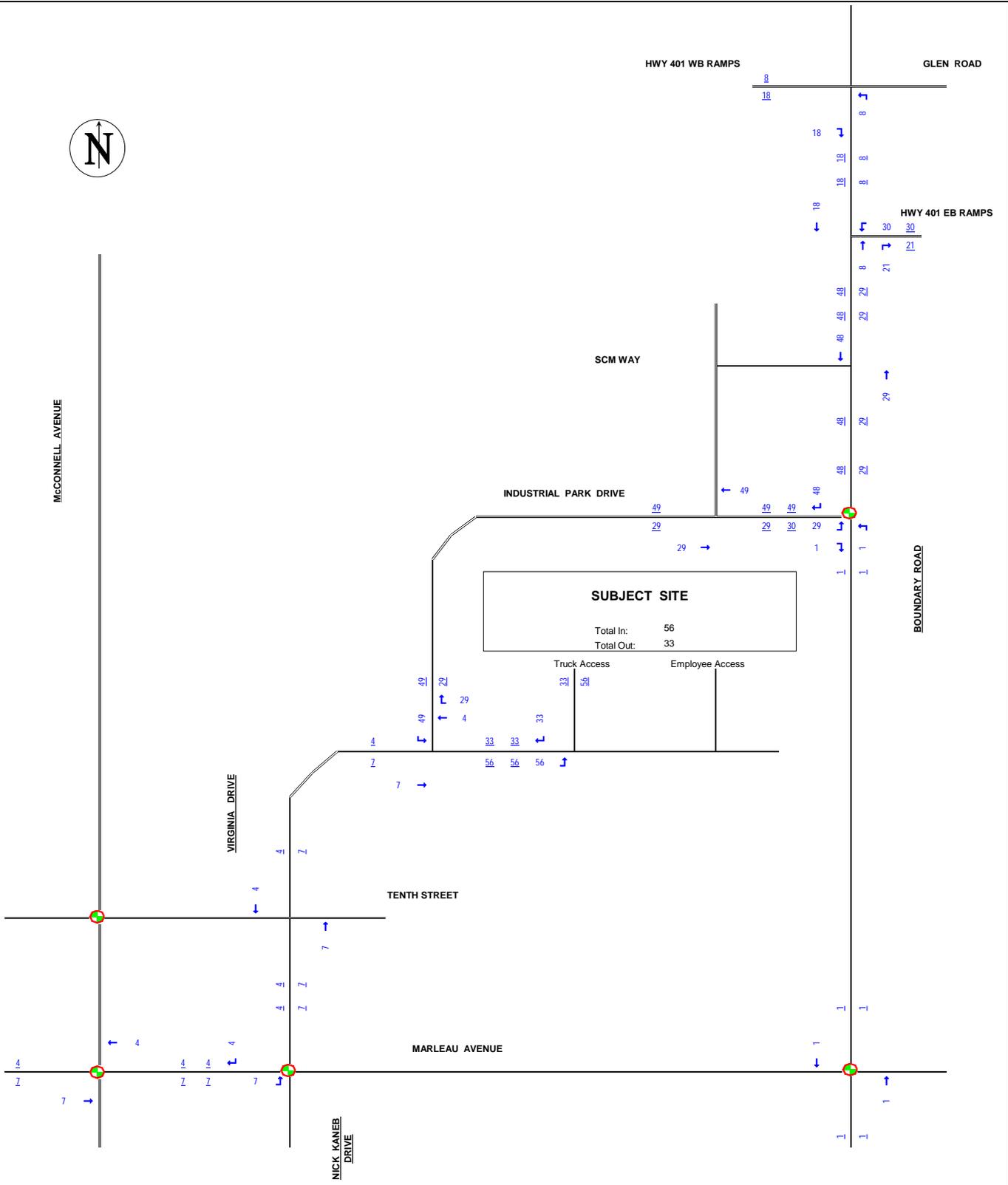
Total In: 62  
 Total Out: 55

Truck Access  
 Employee Access

**PEAK HOUR TRAFFIC VOLUME LEVELS**

FIGURE E21  
 TRUCK SITE TRIPS (Scenario 2 - Site Expansion)  
 Weekday AM





**PEAK HOUR TRAFFIC VOLUME LEVELS**

FIGURE E22  
 TRUCK SITE TRIPS (Scenario 2 - Site Expansion)  
 Weekday PM



**Appendix F**  
*Levels of Services*  
*Future Total Traffic Conditions*

*Future Total- Scenario 1*

HCM Signalized Intersection Capacity Analysis  
5: SCM Way & Boundary Road

Future Total - Scenario 1  
Weekday A.M. Peak Hour

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↕	↕
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2	6.2	5.2	5.2	5.2	5.2
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frbp, ped/bikes	1.00	0.97	1.00	1.00	1.00	1.00
Flpb, ped/bikes	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	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1056	917	1253	1508	1727	1049
Flt Permitted	0.95	1.00	0.13	1.00	1.00	1.00
Satd. Flow (perm)	1056	917	174	1508	1727	1049
Volume (vph)	56	14	18	389	1001	76
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	56	14	18	389	1001	76
RTOR Reduction (vph)	0	11	0	0	0	18
Lane Group Flow (vph)	56	3	18	389	1001	58
Confl. Peds. (#/hr)	3					
Heavy Vehicles (%)	71%	71%	44%	26%	10%	54%
Turn Type	Perm		Perm		Perm	
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	21.4	21.4	65.2	65.2	65.2	65.2
Effective Green, g (s)	22.4	22.4	66.2	66.2	66.2	66.2
Actuated g/C Ratio	0.22	0.22	0.66	0.66	0.66	0.66
Clearance Time (s)	7.2	7.2	6.2	6.2	6.2	6.2
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	237	205	115	998	1143	694
v/s Ratio Prot	c0.05			0.26	c0.58	
v/s Ratio Perm		0.00	0.10			0.06
v/c Ratio	0.24	0.02	0.16	0.39	0.88	0.08
Uniform Delay, d1	31.8	30.2	6.4	7.7	13.6	6.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	0.0	2.9	1.2	10.6	0.2
Delay (s)	32.3	30.2	9.3	8.8	24.2	6.3
Level of Service	C	C	A	A	C	A
Approach Delay (s)	31.9			8.9	22.9	
Approach LOS	C			A	C	

Intersection Summary			
HCM Average Control Delay	19.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	11.4
Intersection Capacity Utilization	91.9%	ICU Level of Service	F
Analysis Period (min)	60		
c Critical Lane Group			

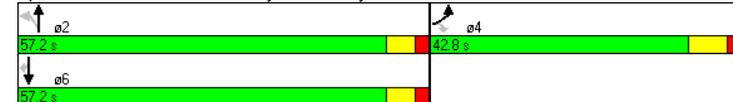
Queues  
5: SCM Way & Boundary Road

Future Total - Scenario 1  
Weekday A.M. Peak Hour

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↕	↕
Volume (vph)	56	14	18	389	1001	76
Lane Group Flow (vph)	56	14	18	389	1001	76
Turn Type	Perm		Perm		Perm	
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Detector Phases	4	4	2	2	6	6
Minimum Initial (s)	35.6	35.6	15.0	15.0	15.0	15.0
Minimum Split (s)	42.8	42.8	57.2	57.2	57.2	57.2
Total Split (s)	42.8	42.8	57.2	57.2	57.2	57.2
Total Split (%)	42.8%	42.8%	57.2%	57.2%	57.2%	57.2%
Yellow Time (s)	5.4	5.4	4.1	4.1	4.1	4.1
All-Red Time (s)	1.8	1.8	2.1	2.1	2.1	2.1
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.15	0.04	0.25	0.36	0.81	0.10
Control Delay	22.6	10.1	26.6	12.9	27.0	5.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.6	10.1	26.6	12.9	27.0	5.7
Queue Length 50th (m)	7.6	0.0	2.0	49.0	~235.6	2.3
Queue Length 95th (m)	19.0	4.9	#14.3	89.1	#368.8	11.5
Internal Link Dist (m)	265.1		548.2		424.1	
Turn Bay Length (m)	62.0		80.0		65.0	
Base Capacity (vph)	386	344	73	1074	1230	762
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	0.15	0.04	0.25	0.36	0.81	0.10

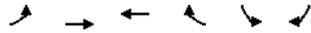
Intersection Summary	
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	110
Control Type:	Actuated-Coordinated
~	Volume exceeds capacity, queue is theoretically infinite. Queue shown is maximum after two cycles.
#	95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.

Splits and Phases: 5: SCM Way & Boundary Road



HCM Unsignalized Intersection Capacity Analysis  
6: Optimum Drive & SCM Way

Future Total - Scenario 1  
Weekday A.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		↓	↓
Sign Control	Free	Free			Stop	
Grade	0%	0%			0%	
Volume (veh/h)	0	0	0	84	57	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	84	57	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)			289			
pX, platoon unblocked						
vC, conflicting volume	84				42	42
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	84				42	42
tC, single (s)	4.1				7.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				4.4	3.3
p0 queue free %	100				93	100
cM capacity (veh/h)	1526				770	1034

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	0	84	57
Volume Left	0	0	57
Volume Right	0	84	0
cSH	1700	1700	770
Volume to Capacity	0.00	0.05	0.07
Queue Length 95th (m)	0.0	0.0	1.9
Control Delay (s)	0.0	0.0	10.0
Lane LOS			B
Approach Delay (s)	0.0	0.0	10.0
Approach LOS			B

Intersection Summary			
Average Delay		4.1	
Intersection Capacity Utilization	15.2%		ICU Level of Service A
Analysis Period (min)		60	

HCM Unsignalized Intersection Capacity Analysis  
7: Industrial Park Dr & Boundary Road

Future Total - Scenario 1  
Weekday A.M. Peak Hour



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↓	↑	↑	↑	↑	↓
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	57	67	54	350	924	91
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	57	67	54	350	924	91
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1428	970	1015			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1428	970	1015			
tC, single (s)	6.8	6.3	4.1			
tC, 2 stage (s)						
tF (s)	3.9	3.4	2.2			
p0 queue free %	49	78	92			
cM capacity (veh/h)	113	301	691			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1
Volume Total	57	67	54	350	1015
Volume Left	57	0	54	0	0
Volume Right	0	67	0	0	91
cSH	113	301	691	1700	1700
Volume to Capacity	0.51	0.22	0.08	0.21	0.60
Queue Length 95th (m)	22.3	6.8	2.0	0.0	0.0
Control Delay (s)	68.5	20.4	10.6	0.0	0.0
Lane LOS	F	C	B		
Approach Delay (s)	42.5		1.4		0.0
Approach LOS	E				

Intersection Summary			
Average Delay		3.8	
Intersection Capacity Utilization	65.0%		ICU Level of Service C
Analysis Period (min)		60	

HCM Unsignalized Intersection Capacity Analysis  
9: Industrial Park Dr & Optimum Drive

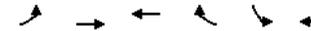
Future Total - Scenario 1  
Weekday A.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	86	73	9	8	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	86	73	9	8	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	82			164	78	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	82			164	78	
tC, single (s)	4.1			7.4	6.2	
tC, 2 stage (s)						
tF (s)	2.2			4.4	3.3	
p0 queue free %	100			99	100	
cM capacity (veh/h)	1528			645	989	
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	86	82	8			
Volume Left	0	0	8			
Volume Right	0	9	0			
cSH	1528	1700	645			
Volume to Capacity	0.00	0.05	0.01			
Queue Length 95th (m)	0.0	0.0	0.3			
Control Delay (s)	0.0	0.0	10.7			
Lane LOS			B			
Approach Delay (s)	0.0	0.0	10.7			
Approach LOS			B			
<b>Intersection Summary</b>						
Average Delay	0.5					
Intersection Capacity Utilization	14.5%			ICU Level of Service	A	
Analysis Period (min)	60					

HCM Unsignalized Intersection Capacity Analysis  
11: Boundary Access & Truck Access

Future Total - Scenario 1  
Weekday A.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	0	0	0	0	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0			0	0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0			0	0	
tC, single (s)	5.1			6.4	7.2	
tC, 2 stage (s)						
tF (s)	3.1			3.5	4.2	
p0 queue free %	100			100	100	
cM capacity (veh/h)	1161			1029	857	
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	0	0	0			
Volume Left	0	0	0			
Volume Right	0	0	0			
cSH	1700	1700	1700			
Volume to Capacity	0.00	0.00	0.00			
Queue Length 95th (m)	0.0	0.0	0.0			
Control Delay (s)	0.0	0.0	0.0			
Lane LOS			A			
Approach Delay (s)	0.0	0.0	0.0			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay	0.0					
Intersection Capacity Utilization	0.0%			ICU Level of Service	A	
Analysis Period (min)	60					

HCM Signalized Intersection Capacity Analysis  
13: Marleau Avenue & Nick Kaneb Drive

Future Total - Scenario 1  
Weekday A.M. Peak Hour

	→	↖	↗	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.3	5.3
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frbp, ped/bikes	1.00	0.97	1.00	1.00	1.00	1.00
Flpb, ped/bikes	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)	1810	1489	1719	1810	1719	1509
Flt Permitted	1.00	1.00	0.17	1.00	0.95	1.00
Satd. Flow (perm)	1810	1489	304	1810	1719	1509
Volume (vph)	840	235	40	789	393	30
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	840	235	40	789	393	30
RTOR Reduction (vph)	0	28	0	0	0	22
Lane Group Flow (vph)	840	207	40	789	393	8
Confl. Peds. (#/hr)	7	7	7	7	2	2
Heavy Vehicles (%)	5%	5%	5%	5%	5%	7%
Turn Type	Perm	Perm			Perm	
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	42.3	42.3	42.3	42.3	19.9	19.9
Effective Green, g (s)	43.1	43.1	43.1	43.1	21.1	21.1
Actuated g/C Ratio	0.57	0.57	0.57	0.57	0.28	0.28
Clearance Time (s)	6.3	6.3	6.3	6.3	6.5	6.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1040	856	175	1040	484	425
v/s Ratio Prot	c0.46		0.44	c0.23		
v/s Ratio Perm		0.14	0.13		0.01	
v/c Ratio	0.81	0.24	0.23	0.76	0.81	0.02
Uniform Delay, d1	12.7	7.9	7.8	12.0	25.1	19.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.1	0.7	3.0	5.4	10.8	0.0
Delay (s)	19.8	8.5	10.9	17.4	35.9	19.5
Level of Service	B	A	B	B	D	B
Approach Delay (s)	17.3			17.1	34.8	
Approach LOS	B			B	C	

Intersection Summary

HCM Average Control Delay	20.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	75.0%	ICU Level of Service	D
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
13: Marleau Avenue & Nick Kaneb Drive

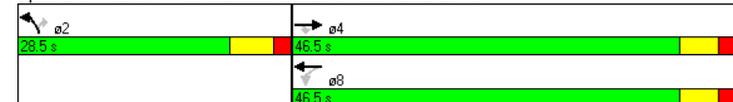
Future Total - Scenario 1  
Weekday A.M. Peak Hour

	→	↖	↗	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Volume (vph)	840	235	40	789	393	30
Lane Group Flow (vph)	840	235	40	789	393	30
Turn Type	Perm	Perm			Perm	
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Detector Phases	4	4	8	8	2	2
Minimum Initial (s)	15.0	15.0	15.0	15.0	15.0	15.0
Minimum Split (s)	28.3	28.3	35.7	35.7	28.5	28.5
Total Split (s)	46.5	46.5	46.5	46.5	28.5	28.5
Total Split (%)	62.0%	62.0%	62.0%	62.0%	38.0%	38.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.5	4.5
All-Red Time (s)	2.2	2.2	2.2	2.2	2.0	2.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	C-Min	C-Min	C-Min	C-Min	None	None
v/c Ratio	0.81	0.27	0.27	0.76	0.81	0.07
Control Delay	22.1	7.0	15.1	19.3	40.8	7.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.1	7.0	15.1	19.3	40.8	7.8
Queue Length 50th (m)	97.7	11.8	3.0	87.1	51.9	0.0
Queue Length 95th (m)#213.2	28.3	12.3	#194.0	#111.5	6.6	
Internal Link Dist (m)	966.8		629.1	393.0		
Turn Bay Length (m)		10.0	25.0	25.0		
Base Capacity (vph)	1039	883	149	1039	532	488
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	0.81	0.27	0.27	0.76	0.74	0.06

Intersection Summary

Cycle Length: 75
Actuated Cycle Length: 75
Offset: 20 (27%), Referenced to phase 4:EBT and 8:WBTL, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
# 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.

Splits and Phases: 13: Marleau Avenue & Nick Kaneb Drive



HCM Signalized Intersection Capacity Analysis  
14: Tenth Street & McConnell Avenue

Future Total - Scenario 1  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔		↔		↔		↔		↔		↔	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0		5.0		5.5		5.5		5.5		5.5	
Lane Util. Factor	1.00		1.00		1.00		1.00		1.00		1.00	
Frpb, ped/bikes	0.99		1.00		1.00		1.00		1.00		1.00	
Flpb, ped/bikes	1.00		0.99		1.00		1.00		1.00		1.00	
Frt	0.97		0.96		1.00		0.98		1.00		1.00	
Flt Protected	1.00		0.97		0.95		1.00		0.95		1.00	
Satd. Flow (prot)	1821		1571		1804		1746		1752		1759	
Flt Permitted	0.98		0.80		0.24		1.00		0.25		1.00	
Satd. Flow (perm)	1798		1290		447		1746		461		1759	
Volume (vph)	1	12	4	116	17	48	5	724	126	52	877	1
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	1	12	4	116	17	48	5	724	126	52	877	1
RTOR Reduction (vph)	0	3	0	0	14	0	0	5	0	0	0	0
Lane Group Flow (vph)	0		14		0		167		0		5	
Confl. Peds. (#/hr)	5		5		2		2		2		2	
Heavy Vehicles (%)	0%		0%		12%		0%		17%		0%	
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases	4		8		8		2		6		6	
Permitted Phases	4		8		2		6		6		6	
Actuated Green, G (s)	17.0		17.0		70.5		70.5		70.5		70.5	
Effective Green, g (s)	18.0		18.0		71.5		71.5		71.5		71.5	
Actuated g/C Ratio	0.18		0.18		0.72		0.72		0.72		0.72	
Clearance Time (s)	6.0		6.0		6.5		6.5		6.5		6.5	
Vehicle Extension (s)	3.0		3.0		3.0		3.0		3.0		3.0	
Lane Grp Cap (vph)	324		232		320		1248		330		1258	
v/s Ratio Prot	c0.50		c0.13		0.01		0.11		0.16		0.70	
v/s Ratio Perm	0.01		0.72		0.02		0.68		4.6		8.1	
v/c Ratio	0.04		38.6		4.1		7.9		1.0		3.3	
Uniform Delay, d1	33.9		49.7		2.7		9.4		5.6		11.4	
Progression Factor	1.00		1.00		0.65		0.97		1.00		1.00	
Incremental Delay, d2	0.1		11.1		0.1		1.8		1.0		3.3	
Delay (s)	33.9		49.7		2.7		9.4		5.6		11.4	
Level of Service	C		D		A		A		A		B	
Approach Delay (s)	33.9		49.7		9.4		11.1		11.1		11.1	
Approach LOS	C		D		A		B		B		B	

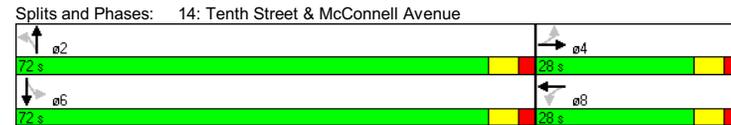
Intersection Summary			
HCM Average Control Delay	14.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	71.9%	ICU Level of Service	C
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
14: Tenth Street & McConnell Avenue

Future Total - Scenario 1  
Weekday A.M. Peak Hour

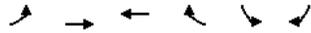
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↔		↔		↔		↔	
Volume (vph)	1	12	116	17	5	724	52	877
Lane Group Flow (vph)	0	17	0	181	5	850	52	878
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases	4		8		2		6	
Permitted Phases	4		8		2		6	
Detector Phases	4		8		2		6	
Minimum Initial (s)	10.0		10.0		10.0		10.0	
Minimum Split (s)	28.0		28.0		28.5		28.5	
Total Split (s)	28.0		28.0		72.0		72.0	
Total Split (%)	28.0%		28.0%		72.0%		72.0%	
Yellow Time (s)	4.1		4.1		4.1		4.1	
All-Red Time (s)	1.9		1.9		2.4		2.4	
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Min	C-Min	C-Min	C-Min
v/c Ratio	0.05	0.74	0.02	0.68	0.18	0.70	0.18	0.70
Control Delay	26.3	53.8	3.8	10.7	7.7	13.0	7.7	13.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.3	53.8	3.8	10.7	7.7	13.0	7.7	13.0
Queue Length 50th (m)	2.2	31.7	0.1	115.6	3.1	90.4	3.1	90.4
Queue Length 95th (m)	8.8	#62.9	m0.4m	190.2	10.8	#214.2	10.8	#214.2
Internal Link Dist (m)	414.9	896.3	283.7	1842.8				
Turn Bay Length (m)			14.0	14.0				
Base Capacity (vph)	418	310	278	1254	289	1257	289	1257
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	0.04	0.58	0.02	0.68	0.18	0.70	0.18	0.70

Intersection Summary	
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	34 (34%), Referenced to phase 2:NBL and 6:SBTL, Start of Green
Natural Cycle:	75
Control Type:	Actuated-Coordinated
#	95th percentile volume exceeds capacity, queue may be longer.
m	Queue shown is maximum after two cycles.
m	Volume for 95th percentile queue is metered by upstream signal.



HCM Unsignalized Intersection Capacity Analysis  
 16: Virginia Drive & Industrial Park Drive

Future Total - Scenario 1  
 Weekday A.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	↕
Sign Control		Free	Free		Stop	Stop
Grade		0%	0%		0%	0%
Volume (veh/h)	87	103	117	36	42	64
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	87	103	117	36	42	64
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	153				412	135
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	153				412	135
tC, single (s)	4.1				7.3	6.4
tC, 2 stage (s)						
tF (s)	2.2				4.3	3.4
p0 queue free %	94				90	93
cM capacity (veh/h)	1434				436	878
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	190	153	106			
Volume Left	87	0	42			
Volume Right	0	36	64			
cSH	1434	1700	626			
Volume to Capacity	0.06	0.09	0.17			
Queue Length 95th (m)	1.5	0.0	4.9			
Control Delay (s)	3.8	0.0	11.9			
Lane LOS	A		B			
Approach Delay (s)	3.8	0.0	11.9			
Approach LOS			B			
<b>Intersection Summary</b>						
Average Delay			4.4			
Intersection Capacity Utilization		34.8%		ICU Level of Service		A
Analysis Period (min)			60			

HCM Signalized Intersection Capacity Analysis  
17: Marleau Avenue & Boundary Road

Future Total - Scenario 1  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.7	6.7	6.7	6.7	6.7	6.7	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	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1612	1845	1553	1517	1881	1482	1626	1652	1429	1719	1759	1553
Flt Permitted	0.66	1.00	1.00	0.72	1.00	1.00	0.21	1.00	1.00	0.59	1.00	1.00
Satd. Flow (perm)	1119	1845	1553	1147	1881	1482	358	1652	1429	1074	1759	1553
Volume (vph)	121	59	74	32	153	23	46	260	15	40	672	279
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	121	59	74	32	153	23	46	260	15	40	672	279
RTOR Reduction (vph)	0	0	48	0	0	15	0	0	8	0	0	129
Lane Group Flow (vph)	121	59	26	32	153	8	46	260	7	40	672	150
Heavy Vehicles (%)	12%	3%	4%	19%	1%	9%	11%	15%	13%	5%	8%	4%
Turn Type	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm
Protected Phases		4			8			2		2		6
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phases	4	4	4	8	8	8	2	2	2	6	6	6
Minimum Initial (s)	29.3	29.3	29.3	29.3	29.3	29.3	15.0	15.0	15.0	15.0	15.0	15.0
Minimum Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	23.0	23.0	23.0	23.0	23.0	23.0
Total Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (%)	52.9%	52.9%	52.9%	52.9%	52.9%	52.9%	47.1%	47.1%	47.1%	47.1%	47.1%	47.1%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	3.2	3.2	3.2	3.2	3.2	3.2	2.9	2.9	2.9	2.9	2.9	2.9
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.25	0.07	0.10	0.06	0.19	0.04	0.36	0.31	0.02	0.08	0.75	0.31
Control Delay	14.4	12.0	3.8	12.1	13.1	5.3	28.3	15.9	7.2	14.5	28.1	4.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.4	12.0	3.8	12.1	13.1	5.3	28.3	15.9	7.2	14.5	28.1	4.3
Queue Length 50th (m)	10.2	4.6	0.0	2.5	12.5	0.0	4.6	25.4	0.0	3.4	89.4	3.0
Queue Length 95th (m)	24.3	12.3	8.1	8.1	26.7	4.4	#22.7	50.9	3.9	10.7	#187.5	23.1
Internal Link Dist (m)		2051.6			246.6		346.9				725.5	
Turn Bay Length (m)	46.0				68.0		48.0	34.0			68.0	48.0
Base Capacity (vph)	485	799	714	497	814	655	129	840	734	525	894	909
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.07	0.10	0.06	0.19	0.04	0.36	0.31	0.02	0.08	0.75	0.31

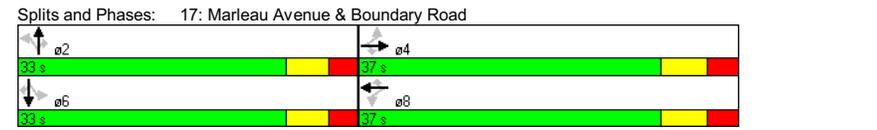
Intersection Summary			
HCM Average Control Delay	18.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.7
Intersection Capacity Utilization	103.2%	ICU Level of Service	G
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
17: Marleau Avenue & Boundary Road

Future Total - Scenario 1  
Weekday A.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	121	59	74	32	153	23	46	260	15	40	672	279
Lane Group Flow (vph)	121	59	74	32	153	23	46	260	15	40	672	279
Turn Type	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm
Protected Phases		4			8			2		2		6
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phases	4	4	4	8	8	8	2	2	2	6	6	6
Minimum Initial (s)	29.3	29.3	29.3	29.3	29.3	29.3	15.0	15.0	15.0	15.0	15.0	15.0
Minimum Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	23.0	23.0	23.0	23.0	23.0	23.0
Total Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (%)	52.9%	52.9%	52.9%	52.9%	52.9%	52.9%	47.1%	47.1%	47.1%	47.1%	47.1%	47.1%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	3.2	3.2	3.2	3.2	3.2	3.2	2.9	2.9	2.9	2.9	2.9	2.9
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.25	0.07	0.10	0.06	0.19	0.04	0.36	0.31	0.02	0.08	0.75	0.31
Control Delay	14.4	12.0	3.8	12.1	13.1	5.3	28.3	15.9	7.2	14.5	28.1	4.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.4	12.0	3.8	12.1	13.1	5.3	28.3	15.9	7.2	14.5	28.1	4.3
Queue Length 50th (m)	10.2	4.6	0.0	2.5	12.5	0.0	4.6	25.4	0.0	3.4	89.4	3.0
Queue Length 95th (m)	24.3	12.3	8.1	8.1	26.7	4.4	#22.7	50.9	3.9	10.7	#187.5	23.1
Internal Link Dist (m)		2051.6			246.6		346.9				725.5	
Turn Bay Length (m)	46.0				68.0		48.0	34.0			68.0	48.0
Base Capacity (vph)	485	799	714	497	814	655	129	840	734	525	894	909
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.07	0.10	0.06	0.19	0.04	0.36	0.31	0.02	0.08	0.75	0.31

**Intersection Summary**  
 Cycle Length: 70  
 Actuated Cycle Length: 70  
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green  
 Natural Cycle: 75  
 Control Type: Actuated-Coordinated  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.



HCM Signalized Intersection Capacity Analysis  
18: Marleau Avenue & McConnell Avenue

Future Total - Scenario 1  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0	5.0	2.0	5.0	5.0	2.0	5.5		2.0	5.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1656	1827	1532	1736	1845	1538	1736	1695		1736	1776	
Flt Permitted	0.12	1.00	1.00	0.12	1.00	1.00	0.51	1.00		0.13	1.00	
Satd. Flow (perm)	218	1827	1532	215	1845	1538	927	1695		245	1776	
Volume (vph)	66	536	127	156	670	465	152	324	130	540	420	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	66	536	127	156	670	465	152	324	130	540	420	0
RTOR Reduction (vph)	0	0	90	0	0	247	0	14	0	0	0	0
Lane Group Flow (vph)	66	536	37	156	670	218	152	440	0	540	420	0
Confl. Peds. (#/hr)	5											
Heavy Vehicles (%)	9%	4%	2%	4%	3%	5%	4%	7%	8%	4%	7%	23%
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt			pm+pt		
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	28.0	28.0	28.0	37.0	37.0	37.0	34.5	23.5		50.5	36.5	
Effective Green, g (s)	32.0	29.0	29.0	41.0	38.0	38.0	40.0	24.5		55.0	37.5	
Actuated g/C Ratio	0.32	0.29	0.29	0.41	0.38	0.38	0.40	0.24		0.55	0.38	
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.5		3.0	6.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	70	530	444	195	701	584	468	415		508	666	
v/s Ratio Prot		0.29		0.06	c0.36		0.04	c0.26		c0.27	0.24	
v/s Ratio Perm	0.30		0.02	0.27		0.14	0.09			0.32		
v/c Ratio	0.94	1.01	0.08	0.80	0.96	0.37	0.32	1.06		1.06	0.63	
Uniform Delay, d1	33.1	35.5	25.8	23.4	30.2	22.4	19.7	37.8		28.6	25.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.86	0.93	
Incremental Delay, d2	153.7	89.5	0.1	23.6	35.4	0.4	0.4	159.0		146.0	3.2	
Delay (s)	186.9	125.0	25.9	47.0	65.5	22.8	20.1	196.7		170.5	27.0	
Level of Service	F	F	C	D	E	C	C	F		F	C	
Approach Delay (s)	113.3			47.9			152.4			107.7		
Approach LOS	F			D			F			F		

Intersection Summary

HCM Average Control Delay	94.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	122.2%	ICU Level of Service	H
Analysis Period (min)	60		
c Critical Lane Group			

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Synchro 6 Report  
16/10/2010

LEA Consulting, Ltd.

Queues  
18: Marleau Avenue & McConnell Avenue

Future Total - Scenario 1  
Weekday A.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	66	536	127	156	670	465	152	324	540	420
Lane Group Flow (vph)	66	536	127	156	670	465	152	454	540	420
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		pm+pt	
Protected Phases		4		3	8		5	2	1	6
Permitted Phases	4		4	8		8	2		6	
Detector Phases	4	4	4	3	8	8	5	2	1	6
Minimum Initial (s)	20.0	20.0	20.0	5.0	20.0	20.0	11.0	15.0	10.0	15.0
Minimum Split (s)	26.0	26.0	26.0	9.0	26.0	26.0	14.0	26.5	14.0	26.5
Total Split (s)	34.0	34.0	34.0	9.0	43.0	43.0	14.0	30.0	27.0	43.0
Total Split (%)	34.0%	34.0%	34.0%	9.0%	43.0%	43.0%	14.0%	30.0%	27.0%	43.0%
Yellow Time (s)	4.1	4.1	4.1	2.0	4.1	4.1	2.0	4.1	2.0	4.1
All-Red Time (s)	1.9	1.9	1.9	1.0	1.9	1.9	1.0	2.4	1.0	2.4
Lead/Lag	Lag	Lag	Lag	Lead			Lead	Lag	Lead	Lag
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	None	None	C-Max	None	C-Max
v/c Ratio	0.94	1.01	0.24	0.80	0.96	0.56	0.32	1.06	1.06	0.63
Control Delay	203.0	126.2	6.1	56.3	69.2	7.0	14.5	189.1	171.2	27.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	203.0	126.2	6.1	56.3	69.2	7.0	14.5	189.1	171.2	27.6
Queue Length 50th (m)	13.1	~111.5	0.0	20.2	131.0	8.7	14.5	~99.1	~106.9	78.0
Queue Length 95th (m)	#47.5	#213.5	17.3	#61.9	#245.2	52.8	28.2	#190.6	#200.7	107.2
Internal Link Dist (m)	264.6		966.8		69.2		283.7			
Turn Bay Length (m)	84.0		71.0		71.0		130.0			
Base Capacity (vph)	70	530	534	195	701	831	468	430	508	666
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	0.94	1.01	0.24	0.80	0.96	0.56	0.32	1.06	1.06	0.63

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 96 (96%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 120
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 18: Marleau Avenue & McConnell Avenue



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Synchro 6 Report  
16/10/2010

LEA Consulting, Ltd.

HCM Unsignalized Intersection Capacity Analysis  
22: Hwy 401 WB Ramp & Boundary Road

Future Total - Scenario 1  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↕	↗	↖	↕	↘		↕	↗	↖	↕	↘	
Sign Control	Stop			Stop			Free			Free			
Grade	0%			0%			0%			0%			
Volume (veh/h)	2	1	124	67	28	8	56	279	22	8	730	9	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly flow rate (vph)	2	1	124	67	28	8	56	279	22	8	730	9	
Pedestrians													
Lane Width (m)													
Walking Speed (m/s)													
Percent Blockage													
Right turn flare (veh)													
Median type	None			None									
Median storage (veh)													
Upstream signal (m)													
pX, platoon unblocked													
vC, conflicting volume	1174	1164	734	1277	1157	290	739						301
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	1174	1164	734	1277	1157	290	739						301
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.2						4.1
tC, 2 stage (s)													
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.3						2.2
p0 queue free %	99	99	70	30	85	99	93						99
cM capacity (veh/h)	141	182	418	96	184	754	841						1272
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>WB 1</b>	<b>WB 2</b>	<b>NB 1</b>	<b>SB 1</b>							
Volume Total	3	124	67	36	357	747							
Volume Left	2	0	67	0	56	8							
Volume Right	0	124	0	8	22	9							
cSH	152	418	96	221	841	1272							
Volume to Capacity	0.02	0.30	0.70	0.16	0.07	0.01							
Queue Length 95th (m)	0.5	10.0	41.2	4.6	1.7	0.2							
Control Delay (s)	29.1	17.2	119.3	24.5	2.2	0.2							
Lane LOS	D	C	F	C	A	A							
Approach Delay (s)	17.5		86.2		2.2	0.2							
Approach LOS	C		F										
<b>Intersection Summary</b>													
Average Delay	9.0												
Intersection Capacity Utilization	70.8%			ICU Level of Service			C						
Analysis Period (min)	60												

HCM Unsignalized Intersection Capacity Analysis  
25: Hwy 401 EB Ramp & Boundary Road

Future Total - Scenario 1  
Weekday A.M. Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖	↗	↕	↖	↖	↖
Sign Control	Stop	↗	Free	↖	↖	Free
Grade	0%		0%			0%
Volume (veh/h)	166	13	344	101	10	911
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	166	13	344	101	10	911
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1275	344			445	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1275	344			445	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	8	98			99	
cM capacity (veh/h)	180	703			1126	
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>WB 2</b>	<b>NB 1</b>	<b>NB 2</b>	<b>SB 1</b>	
Volume Total	166	13	344	101	921	
Volume Left	166	0	0	0	10	
Volume Right	0	13	0	101	0	
cSH	180	703	1700	1700	1126	
Volume to Capacity	0.92	0.02	0.20	0.06	0.01	
Queue Length 95th (m)	101.4	0.5	0.0	0.0	0.2	
Control Delay (s)	150.3	10.2	0.0	0.0	0.2	
Lane LOS	F	B			A	
Approach Delay (s)	140.1		0.0		0.2	
Approach LOS	F					
<b>Intersection Summary</b>						
Average Delay	16.4					
Intersection Capacity Utilization	71.8%			ICU Level of Service		
Analysis Period (min)	60					

HCM Unsignalized Intersection Capacity Analysis  
29: Tenth Street & Virginia Drive

Future Total - Scenario 1  
Weekday A.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	↕
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	190	0	0	0	0	181
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	190	0	0	0	0	181
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0				380	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				380	0
tC, single (s)	4.1				6.4	6.3
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.4
p0 queue free %	88				100	83
cM capacity (veh/h)	1617				552	1056
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	190	0	181			
Volume Left	190	0	0			
Volume Right	0	0	181			
cSH	1617	1700	1056			
Volume to Capacity	0.12	0.00	0.17			
Queue Length 95th (m)	3.2	0.0	5.0			
Control Delay (s)	7.5	0.0	9.1			
Lane LOS	A		A			
Approach Delay (s)	7.5	0.0	9.1			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay			8.3			
Intersection Capacity Utilization		28.4%		ICU Level of Service		A
Analysis Period (min)			60			

HCM Signalized Intersection Capacity Analysis  
5: SCM Way & Boundary Road

Future Total - Scenario 1  
Weekday P.M. Peak Hour

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↕	↕
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2	6.2	5.2	5.2	5.2	5.2
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	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1172	1583	1671	1743	1712	1022
Flt Permitted	0.95	1.00	0.34	1.00	1.00	1.00
Satd. Flow (perm)	1172	1583	597	1743	1712	1022
Volume (vph)	100	54	12	696	704	52
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	100	54	12	696	704	52
RTOR Reduction (vph)	0	47	0	0	0	13
Lane Group Flow (vph)	100	7	12	696	704	39
Heavy Vehicles (%)	54%	2%	8%	9%	11%	58%
Turn Type	Perm		Perm		Perm	
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	12.8	12.8	73.8	73.8	73.8	73.8
Effective Green, g (s)	13.8	13.8	74.8	74.8	74.8	74.8
Actuated g/C Ratio	0.14	0.14	0.75	0.75	0.75	0.75
Clearance Time (s)	7.2	7.2	6.2	6.2	6.2	6.2
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	162	218	447	1304	1281	764
v/s Ratio Prot	c0.09		0.40		c0.41	
v/s Ratio Perm	0.00		0.02		0.04	
v/c Ratio	0.62	0.03	0.03	0.53	0.55	0.05
Uniform Delay, d1	40.6	37.3	3.2	5.3	5.4	3.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.0	0.1	0.1	1.6	1.7	0.1
Delay (s)	47.6	37.4	3.4	6.9	7.1	3.4
Level of Service	D	D	A	A	A	A
Approach Delay (s)	44.0		6.8		6.8	
Approach LOS	D		A		A	

Intersection Summary

HCM Average Control Delay	10.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	11.4
Intersection Capacity Utilization	59.1%	ICU Level of Service	B
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
5: SCM Way & Boundary Road

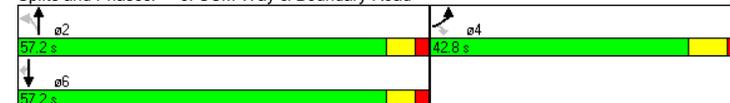
Future Total - Scenario 1  
Weekday P.M. Peak Hour

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↕	↕
Volume (vph)	100	54	12	696	704	52
Lane Group Flow (vph)	100	54	12	696	704	52
Turn Type	Perm		Perm		Perm	
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Detector Phases	4	4	2	2	6	6
Minimum Initial (s)	15.0	15.0	20.0	20.0	20.0	20.0
Minimum Split (s)	42.8	42.8	28.2	28.2	28.2	28.2
Total Split (s)	42.8	42.8	57.2	57.2	57.2	57.2
Total Split (%)	42.8%	42.8%	57.2%	57.2%	57.2%	57.2%
Yellow Time (s)	5.4	5.4	4.1	4.1	4.1	4.1
All-Red Time (s)	1.8	1.8	2.1	2.1	2.1	2.1
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	C-Min	C-Min	C-Min	C-Min
v/c Ratio	0.51	0.17	0.04	0.52	0.53	0.06
Control Delay	47.5	11.1	5.1	7.9	8.1	1.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.5	11.1	5.1	7.9	8.1	1.6
Queue Length 50th (m)	19.0	0.0	0.6	55.1	57.0	0.1
Queue Length 95th (m)	39.4	12.6	3.0	119.7	125.5	4.4
Internal Link Dist (m)	265.1		548.2		424.1	
Turn Bay Length (m)	62.0		80.0		65.0	
Base Capacity (vph)	429	614	274	1346	1322	801
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	0.23	0.09	0.04	0.52	0.53	0.06

Intersection Summary

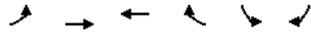
Cycle Length: 100
Actuated Cycle Length: 100
Offset: 0 (0%). Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 5: SCM Way & Boundary Road



HCM Unsignalized Intersection Capacity Analysis  
6: Optimum Drive & SCM Way

Future Total - Scenario 1  
Weekday P.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	↕
Sign Control	Free	Free	Free	Free	Stop	Stop
Grade	0%	0%	0%	0%	0%	0%
Volume (veh/h)	0	0	0	54	141	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	54	141	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)			289			
pX, platoon unblocked						
vC, conflicting volume	54				27	27
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	54				27	27
tC, single (s)	4.1				7.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				4.4	3.3
p0 queue free %	100				82	100
cM capacity (veh/h)	1564				787	1054

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	0	54	141
Volume Left	0	0	141
Volume Right	0	54	0
cSH	1700	1700	787
Volume to Capacity	0.00	0.03	0.18
Queue Length 95th (m)	0.0	0.0	5.2
Control Delay (s)	0.0	0.0	10.6
Lane LOS			B
Approach Delay (s)	0.0	0.0	10.6
Approach LOS			B

Intersection Summary			
Average Delay		7.6	
Intersection Capacity Utilization	17.8%	ICU Level of Service	A
Analysis Period (min)	60		

HCM Unsignalized Intersection Capacity Analysis  
7: Industrial Park Dr & Boundary Road

Future Total - Scenario 1  
Weekday P.M. Peak Hour



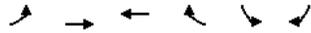
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↕	↕	↕	↕	↕	↕
Sign Control	Stop	Free	Free	Free	Free	Free
Grade	0%	0%	0%	0%	0%	0%
Volume (veh/h)	109	248	93	599	535	223
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	109	248	93	599	535	223
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1432	648	759			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1432	648	759			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	16	47	89			
cM capacity (veh/h)	130	472	847			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1
Volume Total	109	248	93	599	758
Volume Left	109	0	93	0	0
Volume Right	0	248	0	0	223
cSH	130	472	847	1700	1700
Volume to Capacity	0.84	0.53	0.11	0.35	0.45
Queue Length 95th (m)	68.4	25.8	3.0	0.0	0.0
Control Delay (s)	137.7	21.0	9.8	0.0	0.0
Lane LOS	F	C	A		
Approach Delay (s)	56.6		1.3		0.0
Approach LOS	F				

Intersection Summary			
Average Delay		11.7	
Intersection Capacity Utilization	63.8%	ICU Level of Service	B
Analysis Period (min)	60		

HCM Unsignalized Intersection Capacity Analysis  
9: Industrial Park Dr & Optimum Drive

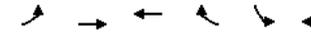
Future Total - Scenario 1  
Weekday P.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	80	60	9	8	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	80	60	9	8	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	69			144	64	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	69			144	64	
tC, single (s)	4.1			7.4	6.2	
tC, 2 stage (s)						
tF (s)	2.2			4.4	3.3	
p0 queue free %	100			99	100	
cM capacity (veh/h)	1545			663	1005	
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	80	69	8			
Volume Left	0	0	8			
Volume Right	0	9	0			
cSH	1545	1700	663			
Volume to Capacity	0.00	0.04	0.01			
Queue Length 95th (m)	0.0	0.0	0.3			
Control Delay (s)	0.0	0.0	10.5			
Lane LOS			B			
Approach Delay (s)	0.0	0.0	10.5			
Approach LOS			B			
<b>Intersection Summary</b>						
Average Delay	0.5					
Intersection Capacity Utilization	14.2%			ICU Level of Service	A	
Analysis Period (min)	60					

HCM Unsignalized Intersection Capacity Analysis  
11: Boundary Access & Truck Access

Future Total - Scenario 1  
Weekday P.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	0	0	0	0	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0			0	0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0			0	0	
tC, single (s)	5.1			6.4	7.2	
tC, 2 stage (s)						
tF (s)	3.1			3.5	4.2	
p0 queue free %	100			100	100	
cM capacity (veh/h)	1161			1029	857	
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	0	0	0			
Volume Left	0	0	0			
Volume Right	0	0	0			
cSH	1700	1700	1700			
Volume to Capacity	0.00	0.00	0.00			
Queue Length 95th (m)	0.0	0.0	0.0			
Control Delay (s)	0.0	0.0	0.0			
Lane LOS			A			
Approach Delay (s)	0.0	0.0	0.0			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay	0.0					
Intersection Capacity Utilization	0.0%			ICU Level of Service	A	
Analysis Period (min)	60					

HCM Signalized Intersection Capacity Analysis  
13: Marleau Avenue & Nick Kaneb Drive

Future Total - Scenario 1  
Weekday P.M. Peak Hour

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↓	↓	↓	↓
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.3	5.3
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frbp, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
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)	1827	1553	1805	1845	1770	1615
Flt Permitted	1.00	1.00	0.23	1.00	0.95	1.00
Satd. Flow (perm)	1827	1553	437	1845	1770	1615
Volume (vph)	788	329	63	958	270	59
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	788	329	63	958	270	59
RTOR Reduction (vph)	0	38	0	0	0	45
Lane Group Flow (vph)	788	291	63	958	270	14
Confl. Peds. (#/hr)	3					
Heavy Vehicles (%)	4%	4%	0%	3%	2%	0%
Turn Type	Perm		Perm		Perm	
Protected Phases	4		8		2	
Permitted Phases	4		8		2	
Actuated Green, G (s)	44.9	44.9	44.9	44.9	17.3	17.3
Effective Green, g (s)	45.9	45.9	45.9	45.9	18.3	18.3
Actuated g/C Ratio	0.61	0.61	0.61	0.61	0.24	0.24
Clearance Time (s)	6.5	6.5	6.5	6.5	6.3	6.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1118	950	267	1129	432	394
v/s Ratio Prot	0.43		c0.52		c0.15	
v/s Ratio Perm	0.19		0.14		0.01	
v/c Ratio	0.70	0.31	0.24	0.85	0.62	0.04
Uniform Delay, d1	9.9	6.9	6.6	11.7	25.3	21.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.8	0.8	2.1	8.7	2.8	0.0
Delay (s)	13.7	7.8	8.7	20.4	28.1	21.7
Level of Service	B	A	A	C	C	C
Approach Delay (s)	12.0		19.7		27.0	
Approach LOS	B		B		C	

Intersection Summary

HCM Average Control Delay	17.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	76.3%	ICU Level of Service	D
Analysis Period (min)	60		
c Critical Lane Group			

Queues

13: Marleau Avenue & Nick Kaneb Drive

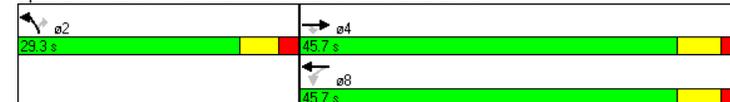
Future Total - Scenario 1  
Weekday P.M. Peak Hour

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↓	↓	↓	↓
Volume (vph)	788	329	63	958	270	59
Lane Group Flow (vph)	788	329	63	958	270	59
Turn Type	Perm		Perm		Perm	
Protected Phases	4		8		2	
Permitted Phases	4		8		2	
Detector Phases	4		8		2	
Minimum Initial (s)	18.2	18.2	18.0	18.0	15.0	15.0
Minimum Split (s)	35.7	35.7	35.7	35.7	29.3	29.3
Total Split (s)	45.7	45.7	45.7	45.7	29.3	29.3
Total Split (%)	60.9%	60.9%	60.9%	60.9%	39.1%	39.1%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.1	4.1
All-Red Time (s)	2.0	2.0	2.0	2.0	2.2	2.2
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	C-Max	C-Max	C-Max	C-Max	None	None
v/c Ratio	0.71	0.33	0.32	0.85	0.62	0.13
Control Delay	15.5	6.4	13.9	23.1	31.9	6.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.5	6.4	13.9	23.1	31.9	6.7
Queue Length 50th (m)	67.2	13.2	3.8	96.8	36.8	0.0
Queue Length 95th (m)#	192.2	39.8	18.1	254.7	62.7	9.5
Internal Link Dist (m)	966.8		629.1		393.0	
Turn Bay Length (m)	10.0		25.0		25.0	
Base Capacity (vph)	1117	987	198	1128	566	557
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	0.71	0.33	0.32	0.85	0.48	0.11

Intersection Summary

Cycle Length: 75
Actuated Cycle Length: 75
Offset: 0 (0%), Referenced to phase 4:EBT and 8:WBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 13: Marleau Avenue & Nick Kaneb Drive



HCM Signalized Intersection Capacity Analysis  
14: Tenth Street & McConnell Avenue

Future Total - Scenario 1  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔			↕			↕			↕		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0			5.0			5.5			5.5		
Lane Util. Factor	1.00			1.00			1.00			1.00		
Frpb, ped/bikes	1.00			0.99			1.00			1.00		
Flpb, ped/bikes	1.00			1.00			1.00			1.00		
Frt	0.98			0.96			1.00			0.99		
Flt Protected	0.98			0.98			0.95			1.00		
Satd. Flow (prot)	1680			1691			1805			1806		
Flt Permitted	0.91			0.83			0.21			1.00		
Satd. Flow (perm)	1551			1440			390			1806		
Volume (vph)	8	12	3	78	32	47	7	964	76	35	955	11
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	8	12	3	78	32	47	7	964	76	35	955	11
RTOR Reduction (vph)	0	3	0	0	17	0	0	2	0	0	0	0
Lane Group Flow (vph)	0	20	0	0	140	0	7	1038	0	35	966	0
Confl. Peds. (#/hr)	2		4		4		2		2		2	
Heavy Vehicles (%)	25%	0%	0%	8%	0%	0%	0%	3%	15%	1%	7%	0%
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases	4		8		8		2		6		6	
Permitted Phases	4		8		8		2		6		6	
Actuated Green, G (s)	14.9		14.9		72.6		72.6		72.6		72.6	
Effective Green, g (s)	15.9		15.9		73.6		73.6		73.6		73.6	
Actuated g/C Ratio	0.16		0.16		0.74		0.74		0.74		0.74	
Clearance Time (s)	6.0		6.0		6.5		6.5		6.5		6.5	
Vehicle Extension (s)	3.0		3.0		3.0		3.0		3.0		3.0	
Lane Grp Cap (vph)	247		229		287		1329		235		1306	
v/s Ratio Prot			c0.10		0.02		0.11					
v/s Ratio Perm	0.01		0.61		0.02		0.78		0.15		0.74	
Uniform Delay, d1	35.8		39.2		3.5		8.2		3.9		7.6	
Progression Factor	1.00		1.00		0.31		0.89		1.00		1.00	
Incremental Delay, d2	0.1		4.9		0.1		1.9		1.3		3.9	
Delay (s)	36.0		44.1		1.2		9.1		5.3		11.5	
Level of Service	D		D		A		A		A		B	
Approach Delay (s)	36.0		44.1		9.1		11.3					
Approach LOS	D		D		A		B					

Intersection Summary			
HCM Average Control Delay	12.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	78.1%	ICU Level of Service	D
Analysis Period (min)	60		
c Critical Lane Group			

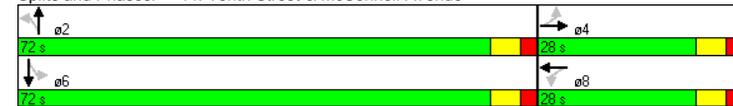
Queues  
14: Tenth Street & McConnell Avenue

Future Total - Scenario 1  
Weekday P.M. Peak Hour

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↔			↕			↕	
Volume (vph)	8	12	78	32	7	964	35	955
Lane Group Flow (vph)	0	23	0	157	7	1040	35	966
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases	4		8		2		6	
Permitted Phases	4		8		2		6	
Detector Phases	4		8		2		6	
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	28.0	28.0	28.0	28.0	28.5	28.5	28.5	28.5
Total Split (s)	28.0	28.0	28.0	28.0	72.0	72.0	72.0	72.0
Total Split (%)	28.0%	28.0%	28.0%	28.0%	72.0%	72.0%	72.0%	72.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	1.9	1.9	1.9	1.9	2.4	2.4	2.4	2.4
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.09	0.64	0.03	0.78	0.22	0.74	0.22	0.74
Control Delay	31.0		45.8		1.7		11.0	
Queue Delay	0.0		0.0		0.0		0.0	
Total Delay	31.0		45.8		1.7		11.0	
Queue Length 50th (m)	3.5		26.5		0.1		184.3	
Queue Length 95th (m)	11.2		51.4		m0.1m211.1		9.8 #289.3	
Internal Link Dist (m)	414.9		896.3		283.7		1842.8	
Turn Bay Length (m)			14.0		14.0			
Base Capacity (vph)	358		348		216		1331	
Starvation Cap Reductn	0		0		0		0	
Spillback Cap Reductn	0		0		0		0	
Storage Cap Reductn	0		0		0		0	
Reduced v/c Ratio	0.06		0.45		0.03		0.78	

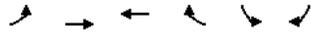
Intersection Summary	
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	95 (95%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle:	90
Control Type:	Actuated-Coordinated
#	95th percentile volume exceeds capacity, queue may be longer.
	Queue shown is maximum after two cycles.
m	Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 14: Tenth Street & McConnell Avenue



HCM Unsignalized Intersection Capacity Analysis  
 16: Virginia Drive & Industrial Park Drive

Future Total - Scenario 1  
 Weekday P.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	↕
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	78	45	67	15	29	90
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	78	45	67	15	29	90
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	82				276	74
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	82				276	74
tC, single (s)	4.2				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.3				3.5	3.3
p0 queue free %	95				96	91
cM capacity (veh/h)	1490				681	990
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	123	82	119			
Volume Left	78	0	29			
Volume Right	0	15	90			
cSH	1490	1700	891			
Volume to Capacity	0.05	0.05	0.13			
Queue Length 95th (m)	1.3	0.0	3.7			
Control Delay (s)	4.9	0.0	9.7			
Lane LOS	A		A			
Approach Delay (s)	4.9	0.0	9.7			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay			5.4			
Intersection Capacity Utilization		27.2%		ICU Level of Service		A
Analysis Period (min)			60			

HCM Signalized Intersection Capacity Analysis  
17: Marleau Avenue & Boundary Road

Future Total - Scenario 1  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.7	6.7	6.7	6.7	6.7	6.7	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	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1684	1810	1553	1612	1827	1449	1736	1712	1380	1612	1776	1509
Flt Permitted	0.70	1.00	1.00	0.67	1.00	1.00	0.28	1.00	1.00	0.31	1.00	1.00
Satd. Flow (perm)	1234	1810	1553	1134	1827	1449	509	1712	1380	519	1776	1509
Volume (vph)	171	139	51	34	94	33	89	488	41	57	513	213
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	171	139	51	34	94	33	89	488	41	57	513	213
RTOR Reduction (vph)	0	0	29	0	0	19	0	0	25	0	0	131
Lane Group Flow (vph)	171	139	22	34	94	14	89	488	16	57	513	82
Confl. Peds. (#/hr)	1					1						
Heavy Vehicles (%)	7%	5%	4%	12%	4%	9%	4%	11%	17%	12%	7%	7%
Turn Type	Perm		Perm	Perm		Perm	Perm		Perm	Perm		Perm
Protected Phases		4			8			2		2		6
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	29.3	29.3	29.3	29.3	29.3	29.3	26.0	26.0	26.0	26.0	26.0	26.0
Effective Green, g (s)	30.3	30.3	30.3	30.3	30.3	30.3	27.0	27.0	27.0	27.0	27.0	27.0
Actuated g/C Ratio	0.43	0.43	0.43	0.43	0.43	0.43	0.39	0.39	0.39	0.39	0.39	0.39
Clearance Time (s)	7.7	7.7	7.7	7.7	7.7	7.7	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	534	783	672	491	791	627	196	660	532	200	685	582
v/s Ratio Prot		0.08			0.05			0.29			0.29	
v/s Ratio Perm	c0.14		0.01	0.03		0.01	0.17		0.01	0.11		0.05
v/c Ratio	0.32	0.18	0.03	0.07	0.12	0.02	0.45	0.74	0.03	0.28	0.75	0.14
Uniform Delay, d1	13.1	12.2	11.4	11.6	11.9	11.4	16.0	18.5	13.4	14.8	18.6	14.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	0.1	0.0	0.1	0.1	0.0	7.6	7.6	0.1	3.6	7.7	0.5
Delay (s)	13.4	12.3	11.4	11.7	11.9	11.4	23.6	26.1	13.5	18.4	26.3	14.5
Level of Service	B	B	B	B	B	B	C	C	B	B	C	B
Approach Delay (s)		12.7			11.8			24.9			22.5	
Approach LOS		B			B			C			C	

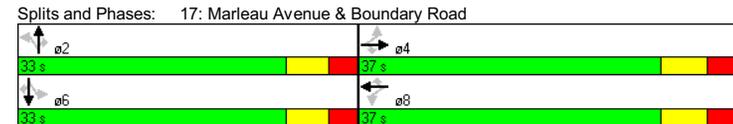
Intersection Summary			
HCM Average Control Delay	20.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.7
Intersection Capacity Utilization	92.5%	ICU Level of Service	F
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
17: Marleau Avenue & Boundary Road

Future Total - Scenario 1  
Weekday P.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	171	139	51	34	94	33	89	488	41	57	513	213
Lane Group Flow (vph)	171	139	51	34	94	33	89	488	41	57	513	213
Turn Type	Perm		Perm	Perm		Perm	Perm		Perm	Perm		Perm
Protected Phases		4			8			2		2		6
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phases	4	4	4	8	8	8	2	2	2	6	6	6
Minimum Initial (s)	29.3	29.3	29.3	29.3	29.3	29.3	26.0	26.0	26.0	26.0	26.0	26.0
Minimum Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (%)	52.9%	52.9%	52.9%	52.9%	52.9%	52.9%	47.1%	47.1%	47.1%	47.1%	47.1%	47.1%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	3.2	3.2	3.2	3.2	3.2	3.2	2.9	2.9	2.9	2.9	2.9	2.9
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.32	0.18	0.07	0.07	0.12	0.05	0.45	0.74	0.07	0.28	0.75	0.30
Control Delay	15.2	13.0	4.2	12.2	12.4	4.8	25.4	27.2	5.3	19.7	27.4	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.2	13.0	4.2	12.2	12.4	4.8	25.4	27.2	5.3	19.7	27.4	3.6
Queue Length 50th (m)	14.9	11.3	0.0	2.6	7.4	0.0	8.9	56.1	0.0	5.3	59.3	0.0
Queue Length 95th (m)	33.1	24.6	6.7	8.5	17.6	5.4	#27.9	#123.0	6.6	16.7	#128.4	16.0
Internal Link Dist (m)		2051.6			246.6			346.9			725.5	
Turn Bay Length (m)	46.0			68.0		48.0	34.0			68.0		48.0
Base Capacity (vph)	534	783	701	490	791	646	197	660	557	200	685	713
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.32	0.18	0.07	0.07	0.12	0.05	0.45	0.74	0.07	0.28	0.75	0.30

Intersection Summary	
Cycle Length:	70
Actuated Cycle Length:	70
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle:	70
Control Type:	Actuated-Coordinated
#	95th percentile volume exceeds capacity, queue may be longer.
	Queue shown is maximum after two cycles.



HCM Signalized Intersection Capacity Analysis  
18: Marleau Avenue & McConnell Avenue

Future Total - Scenario 1  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.5		2.0	5.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00		
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00		1.00	1.00		
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00		
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00		
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00		
Satd. Flow (prot)	1719	1845	1560	1770	1881	1568	1785	1808		1719	1845		
Flt Permitted	0.13	1.00	1.00	0.11	1.00	1.00	0.39	1.00		0.12	1.00		
Satd. Flow (perm)	241	1845	1560	213	1881	1568	733	1808		213	1845		
Volume (vph)	54	679	178	124	737	446	275	547	99	536	413	0	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Adj. Flow (vph)	54	679	178	124	737	446	275	547	99	536	413	0	
RTOR Reduction (vph)	0	0	109	0	0	215	0	6	0	0	0	0	
Lane Group Flow (vph)	54	679	70	124	737	231	275	640	0	536	413	0	
Confl. Peds. (#/hr)			2	2			3		2	2		3	
Heavy Vehicles (%)	5%	3%	1%	2%	1%	3%	1%	2%	4%	5%	3%	12%	
Turn Type	Perm		Perm pm+pt		Perm pm+pt			pm+pt					
Protected Phases		4		3	8		5	2		1	6		
Permitted Phases	4		4	8		8	2			6			
Actuated Green, G (s)	29.0	29.0	29.0	38.0	38.0	38.0	40.5	27.5		49.5	33.5		
Effective Green, g (s)	30.0	30.0	30.0	42.0	39.0	39.0	46.0	28.5		54.0	34.5		
Actuated g/C Ratio	0.30	0.30	0.30	0.42	0.39	0.39	0.46	0.28		0.54	0.34		
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.5		3.0	6.5		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		
Lane Grp Cap (vph)	72	554	468	198	734	612	484	515		416	637		
v/s Ratio Prot		c0.37		0.04	c0.39		0.08	c0.35		c0.26	0.22		
v/s Ratio Perm	0.22		0.04	0.22		0.15	0.18			0.44			
v/c Ratio	0.75	1.23	0.15	0.63	1.00	0.38	0.57	1.24		1.29	0.65		
Uniform Delay, d1	31.6	35.0	25.6	23.5	30.5	21.8	17.7	35.8		29.9	27.6		
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.81	1.01		
Incremental Delay, d2	41.9	423.1	0.1	14.9	70.4	1.8	1.5	452.6		531.8	1.5		
Delay (s)	73.5	458.1	25.8	38.4	100.9	23.6	19.2	488.4		556.1	29.4		
Level of Service	E	F	C	D	F	C	B	F		F	C		
Approach Delay (s)	350.8			68.6				348.3			326.9		
Approach LOS	F			E				F			F		

Intersection Summary

HCM Average Control Delay	254.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.26		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	17.5
Intersection Capacity Utilization	136.2%	ICU Level of Service	H
Analysis Period (min)	60		
c Critical Lane Group			

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Synchro 6 Report  
16/10/2010

LEA Consulting, Ltd.

Queues  
18: Marleau Avenue & McConnell Avenue

Future Total - Scenario 1  
Weekday P.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	54	679	178	124	737	446	275	547	536	413
Lane Group Flow (vph)	54	679	178	124	737	446	275	646	536	413
Turn Type	Perm		Perm pm+pt		Perm pm+pt			pm+pt		
Protected Phases		4		3	8		5	2	1	6
Permitted Phases	4		4	8		8	2		6	
Detector Phases	4	4	4	3	8	8	5	2	1	6
Minimum Initial (s)	20.0	20.0	20.0	3.0	20.0	20.0	11.0	20.0	11.0	20.0
Minimum Split (s)	28.0	28.0	28.0	7.0	28.0	28.0	14.0	28.5	14.0	28.5
Total Split (s)	35.0	35.0	35.0	9.0	44.0	44.0	17.0	34.0	22.0	39.0
Total Split (%)	35.0%	35.0%	35.0%	9.0%	44.0%	44.0%	17.0%	34.0%	22.0%	39.0%
Yellow Time (s)	4.1	4.1	4.1	3.0	4.1	4.1	2.0	4.1	2.0	4.1
All-Red Time (s)	1.9	1.9	1.9	0.0	1.9	1.9	1.0	2.4	1.0	2.4
Lead/Lag	Lag	Lag	Lag	Lead			Lead	Lag	Lead	Lag
Lead-Lag Optimize?										
Recall Mode	Min	Min	Min	C-Min	C-Min	C-Min	Min	Min	Min	Min
v/c Ratio	0.75	1.23	0.31	0.63	1.00	0.54	0.58	1.24	1.29	0.65
Control Delay	103.0	455.6	7.7	34.2	102.1	7.8	18.6	477.3	550.4	32.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	103.0	455.6	7.7	34.2	102.1	7.8	18.6	477.3	550.4	32.3
Queue Length 50th (m)	9.9	~171.7	3.3	15.4	~149.3	12.1	28.9	~164.1	~125.2	80.0
Queue Length 95th (m)	#38.8	#281.4	24.9	#41.4	#272.4	55.1	51.8	#273.4	#205.3	121.5
Internal Link Dist (m)		264.6			966.8		188.8		283.7	
Turn Bay Length (m)			84.0	71.0		71.0	77.0		130.0	
Base Capacity (vph)	72	554	577	198	734	827	489	522	417	637
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	0.75	1.23	0.31	0.63	1.00	0.54	0.56	1.24	1.29	0.65

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 0 (0%), Referenced to phase 3:WBL and 8:WBTL, Start of Green
Natural Cycle: 130
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 18: Marleau Avenue & McConnell Avenue



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Synchro 6 Report  
16/10/2010

LEA Consulting, Ltd.

HCM Unsignalized Intersection Capacity Analysis  
22: Hwy 401 WB Ramp & Boundary Road

Future Total - Scenario 1  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗	↖	↕	↗		↕	↗		↕	↗
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	9	1	95	46	17	12	87	520	105	11	542	6
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	9	1	95	46	17	12	87	520	105	11	542	6
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1334	1366	545	1409	1316	572	548				625	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1334	1366	545	1409	1316	572	548				625	
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
p0 queue free %	92	99	82	48	88	98	91				99	
cM capacity (veh/h)	108	133	538	88	142	519	1021				956	
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	10	95	46	29	712	559						
Volume Left	9	0	46	0	87	11						
Volume Right	0	95	0	12	105	6						
cSH	110	538	88	204	1021	956						
Volume to Capacity	0.09	0.18	0.52	0.14	0.09	0.01						
Queue Length 95th (m)	2.4	5.1	23.0	4.0	2.2	0.3						
Control Delay (s)	41.0	13.1	88.3	25.6	2.1	0.3						
Lane LOS	E	B	F	D	A	A						
Approach Delay (s)	15.8		64.1		2.1	0.3						
Approach LOS	C		F									
Intersection Summary												
Average Delay	5.6									E		
Intersection Capacity Utilization	87.3%			ICU Level of Service						E		
Analysis Period (min)	60											

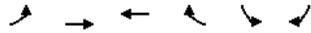
HCM Unsignalized Intersection Capacity Analysis  
25: Hwy 401 EB Ramp & Boundary Road

Future Total - Scenario 1  
Weekday P.M. Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖	↗	↕	↖	↖	↕
Sign Control	Stop	Free	Free	Free	Free	Free
Grade	0%	0%	0%	0%	0%	0%
Volume (veh/h)	81	51	661	135	8	675
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	81	51	661	135	8	675
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1352	661			796	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1352	661			796	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	51	89			99	
cM capacity (veh/h)	164	462			826	
Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	
Volume Total	81	51	661	135	683	
Volume Left	81	0	0	0	8	
Volume Right	0	51	0	135	0	
cSH	164	462	1700	1700	826	
Volume to Capacity	0.49	0.11	0.39	0.08	0.01	
Queue Length 95th (m)	22.0	3.0	0.0	0.0	0.2	
Control Delay (s)	48.0	13.7	0.0	0.0	0.3	
Lane LOS	E	B			A	
Approach Delay (s)	34.8		0.0		0.3	
Approach LOS	D					
Intersection Summary						
Average Delay	3.0					
Intersection Capacity Utilization	53.1%			ICU Level of Service		
Analysis Period (min)	60					

HCM Unsignalized Intersection Capacity Analysis  
29: Tenth Street & Virginia Drive

Future Total - Scenario 1  
Weekday P.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	↕
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	123	0	0	0	0	157
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	123	0	0	0	0	157
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0				246	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				246	0
tC, single (s)	4.2				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.3				3.5	3.3
p0 queue free %	92				100	86
cM capacity (veh/h)	1578				689	1088
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	123	0	157			
Volume Left	123	0	0			
Volume Right	0	0	157			
cSH	1578	1700	1088			
Volume to Capacity	0.08	0.00	0.14			
Queue Length 95th (m)	2.0	0.0	4.0			
Control Delay (s)	7.5	0.0	8.9			
Lane LOS	A		A			
Approach Delay (s)	7.5	0.0	8.9			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay			8.3			
Intersection Capacity Utilization		23.2%		ICU Level of Service		A
Analysis Period (min)			60			

*Future Total- Scenario 1: Dual Left*

HCM Signalized Intersection Capacity Analysis  
18: Marleau Avenue & McConnell Avenue

Future Total - Scenario 1: Dual Left  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0	5.0	2.0	5.0	5.0	2.0	5.5		3.0	5.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.97	1.00	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1656	1827	1531	1736	1845	1538	1736	1695		3367	1733	
Flt Permitted	0.11	1.00	1.00	0.18	1.00	1.00	0.35	1.00		0.95	1.00	
Satd. Flow (perm)	192	1827	1531	333	1845	1538	635	1695		3367	1733	
Volume (vph)	66	536	127	156	670	465	152	324	130	540	420	37
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	66	536	127	156	670	465	152	324	130	540	420	37
RTOR Reduction (vph)	0	0	81	0	0	204	0	12	0	0	3	0
Lane Group Flow (vph)	66	536	46	156	670	261	152	442	0	540	454	0
Confl. Peds. (#/hr)			5	5								
Heavy Vehicles (%)	9%	4%	2%	4%	3%	5%	4%	7%	8%	4%	7%	23%
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2					
Actuated Green, G (s)	44.9	42.5	42.5	51.9	46.5	46.5	42.8	31.8		18.8	41.6	
Effective Green, g (s)	49.9	43.5	43.5	55.9	47.5	47.5	48.3	32.8		20.8	42.6	
Actuated g/C Ratio	0.42	0.36	0.36	0.47	0.40	0.40	0.40	0.27		0.17	0.36	
Clearance Time (s)	3.0	6.0	6.0	3.0	6.0	6.0	3.0	6.5		5.0	6.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	121	662	555	242	730	609	366	463		584	615	
v/s Ratio Prot	0.02	0.29		c0.04	c0.36		0.04	c0.26		c0.16	0.26	
v/s Ratio Perm	0.21		0.03	0.26		0.17	0.13					
v/c Ratio	0.55	0.81	0.08	0.64	0.92	0.43	0.42	0.95		0.92	0.74	
Uniform Delay, d1	26.6	34.5	25.1	23.2	34.4	26.4	24.1	42.9		48.8	33.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.94	1.15	
Incremental Delay, d2	5.0	11.2	0.3	5.9	23.7	2.2	0.8	47.2		20.6	3.4	
Delay (s)	31.7	45.7	25.4	29.2	58.1	28.6	24.9	90.0		66.6	42.3	
Level of Service	C	D	C	C	E	C	C	F		E	D	
Approach Delay (s)		40.9			44.0			73.7			55.4	
Approach LOS		D			D			E			E	

Intersection Summary			
HCM Average Control Delay	51.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	94.7%	ICU Level of Service	F
Analysis Period (min)	60		
c Critical Lane Group			

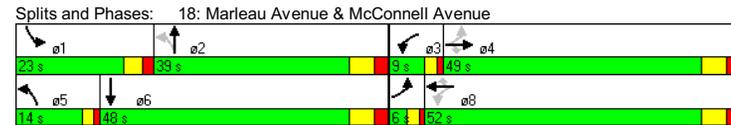
Queues

18: Marleau Avenue & McConnell Avenue

Future Total - Scenario 1: Dual Left  
Weekday A.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	66	536	127	156	670	465	152	324	540	420
Lane Group Flow (vph)	66	536	127	156	670	465	152	454	540	457
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Prot	
Protected Phases	7	4		3	8		5	2	1	6
Permitted Phases	4		4	8		8	2			
Detector Phases	7	4	4	3	8	8	5	2	1	6
Minimum Initial (s)	3.0	30.1	30.1	3.0	31.1	31.1	11.0	25.4	11.0	25.4
Minimum Split (s)	6.0	36.1	36.1	6.0	37.1	37.1	14.0	31.9	16.0	31.9
Total Split (s)	6.0	49.0	49.0	9.0	52.0	52.0	14.0	39.0	23.0	48.0
Total Split (%)	5.0%	40.8%	40.8%	7.5%	43.3%	43.3%	11.7%	32.5%	19.2%	40.0%
Yellow Time (s)	2.0	4.1	4.1	2.0	4.1	4.1	2.0	4.1	3.0	4.1
All-Red Time (s)	1.0	1.9	1.9	1.0	1.9	1.9	1.0	2.4	2.0	2.4
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes			Yes	Yes					
Recall Mode	None	C-Min	C-Min	Min	C-Min	C-Min	Min	Min	Min	Min
v/c Ratio	0.50	0.81	0.20	0.64	0.91	0.57	0.42	0.95	0.92	0.74
Control Delay	33.2	46.5	5.1	33.1	56.0	10.5	21.0	91.2	70.0	45.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.2	46.5	5.1	33.1	56.0	10.5	21.0	91.2	70.0	45.3
Queue Length 50th (m)	8.9	118.0	0.0	22.1	156.7	20.7	20.0	106.5	70.0	108.3
Queue Length 95th (m)	#23.3	#211.5	17.0	#49.1	#279.4	75.9	37.2	#206.1	#123.6	#176.2
Internal Link Dist (m)		264.6			966.8		69.2			283.7
Turn Bay Length (m)			84.0	71.0		71.0	77.0		130.0	
Base Capacity (vph)	132	670	642	245	739	819	361	485	584	618
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	0.50	0.80	0.20	0.64	0.91	0.57	0.42	0.94	0.92	0.74

Intersection Summary	
Cycle Length:	120
Actuated Cycle Length:	120
Offset:	77 (64%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle:	95
Control Type:	Actuated-Coordinated
#	95th percentile volume exceeds capacity, queue may be longer.
m	Queue shown is maximum after two cycles.
m	Volume for 95th percentile queue is metered by upstream signal.



HCM Signalized Intersection Capacity Analysis  
18: Marleau Avenue & McConnell Avenue

Future Total - Scenario 1: Dual Left  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.5		2.0	5.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.97	1.00	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1719	1845	1560	1770	1881	1568	1786	1808		3335	1845	
Flt Permitted	0.12	1.00	1.00	0.11	1.00	1.00	0.34	1.00		0.95	1.00	
Satd. Flow (perm)	219	1845	1560	196	1881	1568	634	1808		3335	1845	
Volume (vph)	54	679	178	124	737	446	275	547	99	536	413	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	54	679	178	124	737	446	275	547	99	536	413	0
RTOR Reduction (vph)	0	0	109	0	0	213	0	7	0	0	0	0
Lane Group Flow (vph)	54	679	69	124	737	233	275	639	0	536	413	0
Confl. Peds. (#/hr)			2	2			3		2	2		3
Heavy Vehicles (%)	5%	3%	1%	2%	1%	3%	1%	2%	4%	5%	3%	12%
Turn Type	Perm		Perm pm+pt		Perm pm+pt				Prot			
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2					
Actuated Green, G (s)	32.0	32.0	32.0	41.0	41.0	41.0	41.5	30.5		13.0	32.5	
Effective Green, g (s)	33.0	33.0	33.0	45.0	42.0	42.0	47.0	31.5		14.0	33.5	
Actuated g/C Ratio	0.33	0.33	0.33	0.45	0.42	0.42	0.47	0.32		0.14	0.34	
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.5		3.0	6.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	72	609	515	198	790	659	436	570		467	618	
v/s Ratio Prot		c0.37		0.04	c0.39		0.08	c0.35		c0.16	0.22	
v/s Ratio Perm	0.25		0.04	0.24		0.15	0.22					
v/c Ratio	0.75	1.11	0.13	0.63	0.93	0.35	0.63	1.12		1.15	0.67	
Uniform Delay, d1	29.8	33.5	23.5	22.7	27.7	19.7	17.7	34.2		43.0	28.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.88	1.01	
Incremental Delay, d2	41.9	232.4	0.1	14.9	26.1	1.5	3.0	244.4		284.6	1.9	
Delay (s)	71.7	265.9	23.6	37.6	53.7	21.2	20.7	278.7		322.6	30.6	
Level of Service	E	F	C	D	D	C	C	F		F	C	
Approach Delay (s)		207.1			41.1			201.6			195.5	
Approach LOS		F			D			F			F	

Intersection Summary

HCM Average Control Delay	150.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	17.5
Intersection Capacity Utilization	121.8%	ICU Level of Service	H
Analysis Period (min)	60		
c Critical Lane Group			

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Synchro 6 Report  
16/10/2010

LEA Consulting, Ltd.

Queues  
18: Marleau Avenue & McConnell Avenue

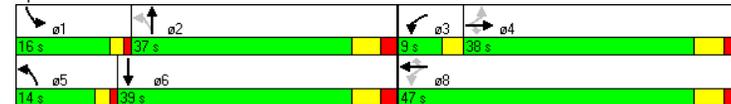
Future Total - Scenario 1: Dual Left  
Weekday P.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	54	679	178	124	737	446	275	547	536	413
Lane Group Flow (vph)	54	679	178	124	737	446	275	646	536	413
Turn Type	Perm		Perm pm+pt		Perm pm+pt		Perm pm+pt		Prot	
Protected Phases		4		3	8		5	2	1	6
Permitted Phases	4		4	8		8	2			
Detector Phases	4	4	4	3	8	8	5	2	1	6
Minimum Initial (s)	20.0	20.0	20.0	3.0	20.0	20.0	11.0	20.0	11.0	20.0
Minimum Split (s)	28.0	28.0	28.0	7.0	28.0	28.0	14.0	28.5	14.0	28.5
Total Split (s)	38.0	38.0	38.0	9.0	47.0	47.0	14.0	37.0	16.0	39.0
Total Split (%)	38.0%	38.0%	38.0%	9.0%	47.0%	47.0%	14.0%	37.0%	16.0%	39.0%
Yellow Time (s)	4.1	4.1	4.1	3.0	4.1	4.1	2.0	4.1	2.0	4.1
All-Red Time (s)	1.9	1.9	1.9	0.0	1.9	1.9	1.0	2.4	1.0	2.4
Lead/Lag	Lag	Lag	Lag	Lead			Lead	Lag	Lead	Lag
Lead-Lag Optimize?										
Recall Mode	Min	Min	Min	C-Min	C-Min	C-Min	Min	Min	Min	Min
v/c Ratio	0.75	1.11	0.29	0.63	0.93	0.51	0.63	1.12	1.15	0.67
Control Delay	101.6	265.5	6.4	32.3	55.0	6.4	22.0	277.6	320.8	33.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	101.6	265.5	6.4	32.3	55.0	6.4	22.0	277.6	320.8	33.4
Queue Length 50th (m)	9.7	~159.9	2.2	14.6	140.1	9.5	31.1	~151.8	~67.1	80.2
Queue Length 95th (m)	#38.8	#269.6	22.4	#41.3	#260.4	48.4	#56.5	#261.8	#108.4m	121.5
Internal Link Dist (m)		264.6			966.8			188.8		283.7
Turn Bay Length (m)			84.0	71.0		71.0	77.0		130.0	
Base Capacity (vph)	72	609	623	198	790	872	436	576	467	618
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	0.75	1.11	0.29	0.63	0.93	0.51	0.63	1.12	1.15	0.67

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 0 (0%), Referenced to phase 3:WBL and 8:WBTL, Start of Green
Natural Cycle: 140
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 18: Marleau Avenue & McConnell Avenue



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Synchro 6 Report  
16/10/2010

LEA Consulting, Ltd.

*Future Total- Scenario 2*

HCM Signalized Intersection Capacity Analysis  
5: SCM Way & Boundary Road

Future Total - Scenario 2  
Weekday A.M. Peak Hour

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↕	↕
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2	6.2	5.2	5.2	5.2	5.2
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frbp, ped/bikes	1.00	0.97	1.00	1.00	1.00	1.00
Flpb, ped/bikes	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	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1056	916	1253	1484	1696	1049
Flt Permitted	0.95	1.00	0.15	1.00	1.00	1.00
Satd. Flow (perm)	1056	916	198	1484	1696	1049
Volume (vph)	56	14	18	389	1001	76
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	56	14	18	389	1001	76
RTOR Reduction (vph)	0	11	0	0	0	16
Lane Group Flow (vph)	56	3	18	389	1001	60
Confl. Peds. (#/hr)	3			3		
Heavy Vehicles (%)	71%	71%	44%	28%	12%	54%
Turn Type	Perm		Perm		Perm	
Protected Phases	4		2		6	
Permitted Phases	4		2		6	
Actuated Green, G (s)	22.5	22.5	76.0	76.0	76.0	76.0
Effective Green, g (s)	23.5	23.5	77.0	77.0	77.0	77.0
Actuated g/C Ratio	0.21	0.21	0.69	0.69	0.69	0.69
Clearance Time (s)	7.2	7.2	6.2	6.2	6.2	6.2
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	222	192	136	1021	1167	722
v/s Ratio Prot	c0.05		0.26		c0.59	
v/s Ratio Perm	0.00		0.09		0.06	
v/c Ratio	0.25	0.02	0.13	0.38	0.86	0.08
Uniform Delay, d1	36.9	35.0	6.0	7.4	13.3	5.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	0.0	2.0	1.1	9.0	0.2
Delay (s)	37.5	35.1	8.0	8.5	22.3	6.0
Level of Service	D	D	A	A	C	A
Approach Delay (s)	37.0		8.4		21.1	
Approach LOS	D		A		C	

Intersection Summary

HCM Average Control Delay	18.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	111.9	Sum of lost time (s)	11.4
Intersection Capacity Utilization	91.9%	ICU Level of Service	F
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
5: SCM Way & Boundary Road

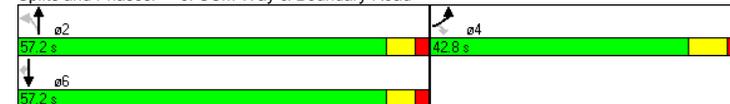
Future Total - Scenario 2  
Weekday A.M. Peak Hour

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↕	↕
Volume (vph)	56	14	18	389	1001	76
Lane Group Flow (vph)	56	14	18	389	1001	76
Turn Type	Perm		Perm		Perm	
Protected Phases	4		2		6	
Permitted Phases	4		2		6	
Detector Phases	4		2		6	
Minimum Initial (s)	35.6	35.6	15.0	15.0	15.0	15.0
Minimum Split (s)	42.8	42.8	57.2	57.2	57.2	57.2
Total Split (s)	42.8	42.8	57.2	57.2	57.2	57.2
Total Split (%)	42.8%	42.8%	57.2%	57.2%	57.2%	57.2%
Yellow Time (s)	5.4	5.4	4.1	4.1	4.1	4.1
All-Red Time (s)	1.8	1.8	2.1	2.1	2.1	2.1
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Max	Max	Max	Max
v/c Ratio	0.17	0.05	0.24	0.36	0.82	0.10
Control Delay	22.9	9.9	26.1	12.5	26.8	5.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.9	9.9	26.1	12.5	26.8	5.5
Queue Length 50th (m)	9.2	0.0	2.0	49.2	~248.1	2.3
Queue Length 95th (m)	19.0	4.9	#14.3	90.0	#372.3	11.5
Internal Link Dist (m)	265.1		548.2		424.1	
Turn Bay Length (m)	62.0		80.0		65.0	
Base Capacity (vph)	320	288	74	1072	1225	772
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	0.17	0.05	0.24	0.36	0.82	0.10

Intersection Summary

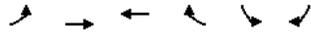
Cycle Length: 100
Actuated Cycle Length: 109.3
Natural Cycle: 110
Control Type: Semi Act-Uncoord
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 5: SCM Way & Boundary Road



HCM Unsignalized Intersection Capacity Analysis  
6: Optimum Drive & SCM Way

Future Total - Scenario 2  
Weekday A.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	↕
Sign Control	Free	Free	Free	Stop	Stop	Stop
Grade	0%	0%	0%	0%	0%	0%
Volume (veh/h)	0	0	0	84	57	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	84	57	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)			289			
pX, platoon unblocked						
vC, conflicting volume	84				42	42
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	84				42	42
tC, single (s)	4.1				7.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				4.4	3.3
p0 queue free %	100				93	100
cM capacity (veh/h)	1526				770	1034

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	0	84	57
Volume Left	0	0	57
Volume Right	0	84	0
cSH	1700	1700	770
Volume to Capacity	0.00	0.05	0.07
Queue Length 95th (m)	0.0	0.0	1.9
Control Delay (s)	0.0	0.0	10.0
Lane LOS			B
Approach Delay (s)	0.0	0.0	10.0
Approach LOS			B

Intersection Summary			
Average Delay		4.1	
Intersection Capacity Utilization	15.2%		ICU Level of Service A
Analysis Period (min)		60	

HCM Unsignalized Intersection Capacity Analysis  
7: Industrial Park Dr & Boundary Road

Future Total - Scenario 2  
Weekday A.M. Peak Hour



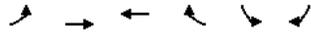
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↕	↕	↕	↕	↕	↕
Sign Control	Stop	Free	Free	Free	Free	Free
Grade	0%	0%	0%	0%	0%	0%
Volume (veh/h)	57	57	45	350	924	91
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	57	57	45	350	924	91
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1410	970	1015			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1410	970	1015			
tC, single (s)	6.9	6.3	4.1			
tC, 2 stage (s)						
tF (s)	4.0	3.4	2.2			
p0 queue free %	48	81	93			
cM capacity (veh/h)	111	298	683			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1
Volume Total	57	57	45	350	1015
Volume Left	57	0	45	0	0
Volume Right	0	57	0	0	91
cSH	111	298	683	1700	1700
Volume to Capacity	0.52	0.19	0.07	0.21	0.60
Queue Length 95th (m)	23.0	5.6	1.7	0.0	0.0
Control Delay (s)	70.8	19.9	10.6	0.0	0.0
Lane LOS	F	C	B		
Approach Delay (s)	45.4		1.2		0.0
Approach LOS	E				

Intersection Summary			
Average Delay		3.7	
Intersection Capacity Utilization	64.3%		ICU Level of Service C
Analysis Period (min)		60	

HCM Unsignalized Intersection Capacity Analysis  
9: Industrial Park Dr & Optimum Drive

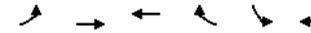
Future Total - Scenario 2  
Weekday A.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	76	64	9	8	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	76	64	9	8	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	73			144	68	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	73			144	68	
tC, single (s)	4.1			7.4	6.2	
tC, 2 stage (s)						
tF (s)	2.2			4.4	3.3	
p0 queue free %	100			99	100	
cM capacity (veh/h)	1540			663	1000	
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	76	73	8			
Volume Left	0	0	8			
Volume Right	0	9	0			
cSH	1540	1700	663			
Volume to Capacity	0.00	0.04	0.01			
Queue Length 95th (m)	0.0	0.0	0.3			
Control Delay (s)	0.0	0.0	10.5			
Lane LOS			B			
Approach Delay (s)	0.0	0.0	10.5			
Approach LOS			B			
<b>Intersection Summary</b>						
Average Delay	0.5					
Intersection Capacity Utilization	14.0%			ICU Level of Service	A	
Analysis Period (min)	60					

HCM Unsignalized Intersection Capacity Analysis  
11: Boundary Access & Truck Access

Future Total - Scenario 2  
Weekday A.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	0	0	0	0	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0			0	0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0			0	0	
tC, single (s)	5.1			6.4	7.2	
tC, 2 stage (s)						
tF (s)	3.1			3.5	4.2	
p0 queue free %	100			100	100	
cM capacity (veh/h)	1161			1029	857	
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	0	0	0			
Volume Left	0	0	0			
Volume Right	0	0	0			
cSH	1700	1700	1700			
Volume to Capacity	0.00	0.00	0.00			
Queue Length 95th (m)	0.0	0.0	0.0			
Control Delay (s)	0.0	0.0	0.0			
Lane LOS			A			
Approach Delay (s)	0.0	0.0	0.0			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay	0.0					
Intersection Capacity Utilization	0.0%			ICU Level of Service	A	
Analysis Period (min)	60					

HCM Signalized Intersection Capacity Analysis  
13: Marleau Avenue & Virginia Avenue

Future Total - Scenario 2  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.3	5.3		5.3	5.3	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1556	1810	1360	1719	1810	1615	1683	1840		1805	1825	
Flt Permitted	0.17	1.00	1.00	0.13	1.00	1.00	0.53	1.00		0.59	1.00	
Satd. Flow (perm)	277	1810	1360	240	1810	1615	945	1840		1130	1825	
Volume (vph)	32	840	73	40	789	25	275	176	30	25	213	35
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	32	840	73	40	789	25	275	176	30	25	213	35
RTOR Reduction (vph)	0	0	9	0	0	3	0	8	0	0	8	0
Lane Group Flow (vph)	32	840	64	40	789	22	275	198	0	25	240	0
Confl. Peds. (#/hr)			7	7			2					2
Heavy Vehicles (%)	16%	5%	15%	5%	5%	0%	7%	0%	7%	0%	0%	11%
Turn Type	Perm		Perm	Perm		Perm custom			Perm			
Protected Phases		4			8						6	
Permitted Phases	4		4	8		8	2	2		6		
Actuated Green, G (s)	39.2	39.2	39.2	39.2	39.2	39.2	23.0	23.0		23.0	23.0	
Effective Green, g (s)	40.2	40.2	40.2	40.2	40.2	40.2	24.0	24.0		24.0	24.0	
Actuated g/C Ratio	0.54	0.54	0.54	0.54	0.54	0.54	0.32	0.32		0.32	0.32	
Clearance Time (s)	6.5	6.5	6.5	6.5	6.5	6.5	6.3	6.3		6.3	6.3	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	148	970	729	129	970	866	302	589		362	584	
v/s Ratio Prot		0.46			0.44						0.13	
v/s Ratio Perm	0.12		0.05	0.17		0.01	0.29	0.11		0.02		
v/c Ratio	0.22	0.87	0.09	0.31	0.81	0.03	0.91	0.34		0.07	0.41	
Uniform Delay, d1	9.1	15.1	8.5	9.7	14.3	8.2	24.5	19.4		17.7	20.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.3	11.4	0.2	6.2	7.9	0.1	41.3	0.3		0.1	0.5	
Delay (s)	12.5	26.5	8.7	15.9	22.2	8.2	65.8	19.8		17.8	20.4	
Level of Service	B	C	A	B	C	A	E	B		B	C	
Approach Delay (s)		24.7			21.5			46.1			20.2	
Approach LOS		C			C			D			C	

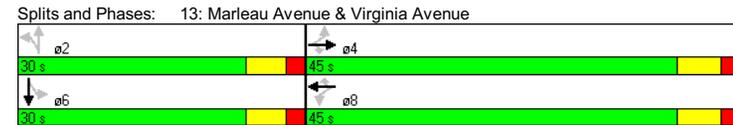
Intersection Summary			
HCM Average Control Delay	27.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	86.5%	ICU Level of Service	E
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
13: Marleau Avenue & Virginia Avenue

Future Total - Scenario 2  
Weekday A.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	32	840	73	40	789	25	275	176	25	213
Lane Group Flow (vph)	32	840	73	40	789	25	275	206	25	248
Turn Type	Perm		Perm	Perm		Perm custom		Perm		
Protected Phases		4			8					6
Permitted Phases	4		4	8		8	2	2	6	
Detector Phases	4	4	4	8	8	8	2	2	6	6
Minimum Initial (s)	18.2	18.2	18.2	18.2	18.2	18.2	15.0	15.0	15.0	15.0
Minimum Split (s)	35.7	35.7	35.7	35.7	35.7	35.7	29.3	29.3	29.3	29.3
Total Split (s)	45.0	45.0	45.0	45.0	45.0	45.0	30.0	30.0	30.0	30.0
Total Split (%)	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	40.0%	40.0%	40.0%	40.0%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.1	4.1	4.1	4.1
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.2	2.2	2.2	2.2
Lead-Lag										
Lead-Lag Optimize?										
Recall Mode	C-Min	C-Min	C-Min	C-Min	C-Min	C-Min	Min	Min	None	None
v/c Ratio	0.23	0.87	0.10	0.33	0.81	0.03	0.90	0.35	0.07	0.42
Control Delay	14.8	28.6	7.4	20.1	24.0	7.0	70.4	19.9	18.0	21.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.8	28.6	7.4	20.1	24.0	7.0	70.4	19.9	18.0	21.2
Queue Length 50th (m)	2.4	103.0	3.6	3.2	91.8	1.2	38.1	21.4	2.5	26.8
Queue Length 95th (m)	9.9	#219.0	11.1	14.7	#199.7	5.2	#97.0	43.9	8.7	53.2
Internal Link Dist (m)		914.0			682.0			404.6		283.6
Turn Bay Length (m)	25.0		10.0	25.0		10.0	25.0			
Base Capacity (vph)	143	979	745	121	979	877	319	624	380	619
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	0.22	0.86	0.10	0.33	0.81	0.03	0.86	0.33	0.07	0.40

Intersection Summary	
Cycle Length: 75	
Actuated Cycle Length: 75	
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	



HCM Signalized Intersection Capacity Analysis  
14: Tenth Street & McConnell Avenue

Future Total - Scenario 2  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔			↕			↕			↕		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5			5.5			5.0			5.0		
Lane Util. Factor	1.00			1.00			1.00			1.00		
Frpb, ped/bikes	0.99			1.00			1.00			1.00		
Flpb, ped/bikes	1.00			1.00			1.00			1.00		
Frt	0.97			0.90			1.00			0.99		
Flt Protected	1.00			0.99			0.95			1.00		
Satd. Flow (prot)	1820			1624			1802			1750		
Flt Permitted	0.96			0.93			0.34			1.00		
Satd. Flow (perm)	1754			1531			644			1750		
Volume (vph)	1	12	4	39	17	167	5	606	46	214	715	1
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	1	12	4	39	17	167	5	606	46	214	715	1
RTOR Reduction (vph)	0	3	0	0	127	0	0	2	0	0	0	0
Lane Group Flow (vph)	0	14	0	0	96	0	5	650	0	214	716	0
Confl. Peds. (#/hr)	5		5	2		2		2		2		2
Heavy Vehicles (%)	0%	0%	0%	10%	0%	3%	0%	8%	0%	0%	10%	0%
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases	4		8		8		2		6		6	
Permitted Phases	4		8		8		2		6		6	
Actuated Green, G (s)	12.4		12.4		75.1		75.1		75.1		75.1	
Effective Green, g (s)	12.9		12.9		76.6		76.6		76.6		76.6	
Actuated g/C Ratio	0.13		0.13		0.77		0.77		0.77		0.77	
Clearance Time (s)	6.0		6.0		6.5		6.5		6.5		6.5	
Vehicle Extension (s)	3.0		3.0		3.0		3.0		3.0		3.0	
Lane Grp Cap (vph)	226		197		493		1341		542		1323	
v/s Ratio Prot					0.37		0.37		c0.41		c0.41	
v/s Ratio Perm	0.01		c0.06		0.01		0.01		0.30		0.30	
v/c Ratio	0.06		0.49		0.01		0.48		0.39		0.54	
Uniform Delay, d1	38.2		40.5		2.8		4.4		3.9		4.7	
Progression Factor	1.00		1.00		1.86		2.37		1.00		1.00	
Incremental Delay, d2	0.1		1.9		0.0		1.0		2.2		1.6	
Delay (s)	38.3		42.4		5.2		11.3		6.1		6.3	
Level of Service	D		D		A		B		A		A	
Approach Delay (s)	38.3		42.4		11.3		6.2		6.2		6.2	
Approach LOS	D		D		B		A		A		A	

Intersection Summary

HCM Average Control Delay	12.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	79.5%	ICU Level of Service	D
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
14: Tenth Street & McConnell Avenue

Future Total - Scenario 2  
Weekday A.M. Peak Hour

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↔			↕			↕	
Volume (vph)	1	12	39	17	5	606	214	715
Lane Group Flow (vph)	0	17	0	223	5	652	214	716
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases	4		8		2		6	
Permitted Phases	4		8		2		6	
Detector Phases	4		8		2		6	
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	25.0	25.0	25.0	25.0	19.5	19.5	19.5	19.5
Total Split (s)	32.0	32.0	32.0	32.0	68.0	68.0	68.0	68.0
Total Split (%)	32.0%	32.0%	32.0%	32.0%	68.0%	68.0%	68.0%	68.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	1.9	1.9	1.9	1.9	2.4	2.4	2.4	2.4
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.07	0.68	0.01	0.49	0.47	0.54		
Control Delay	30.8	26.6	7.0	12.8	9.2	7.0		
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		
Total Delay	30.8	26.6	7.0	12.8	9.2	7.0		
Queue Length 50th (m)	2.4	15.0	0.4	74.9	11.4	41.6		
Queue Length 95th (m)	9.3	46.7	m0.8m	137.5	46.9	117.1		
Internal Link Dist (m)	414.9	902.0	283.7	1842.8				
Turn Bay Length (m)					14.0	14.0		
Base Capacity (vph)	480	519	396	1341	453	1323		
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	0.04	0.43	0.01	0.49	0.47	0.54		

Intersection Summary

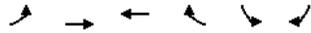
Cycle Length: 100
Actuated Cycle Length: 100
Offset: 1 (1%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 65
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 14: Tenth Street & McConnell Avenue



HCM Unsignalized Intersection Capacity Analysis  
 16: Virginia Avenue & Industrial Park Drive

Future Total - Scenario 2  
 Weekday A.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	↕
Sign Control		Free	Free		Stop	Stop
Grade		0%	0%		0%	0%
Volume (veh/h)	87	113	127	26	33	64
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	87	113	127	26	33	64
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	153				427	140
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	153				427	140
tC, single (s)	4.1				7.4	6.4
tC, 2 stage (s)						
tF (s)	2.2				4.4	3.4
p0 queue free %	94				92	93
cM capacity (veh/h)	1434				410	872
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	200	153	97			
Volume Left	87	0	33			
Volume Right	0	26	64			
cSH	1434	1700	630			
Volume to Capacity	0.06	0.09	0.15			
Queue Length 95th (m)	1.5	0.0	4.4			
Control Delay (s)	3.6	0.0	11.7			
Lane LOS	A		B			
Approach Delay (s)	3.6	0.0	11.7			
Approach LOS			B			
<b>Intersection Summary</b>						
Average Delay		4.1				
Intersection Capacity Utilization		34.8%		ICU Level of Service	A	
Analysis Period (min)		60				

HCM Signalized Intersection Capacity Analysis  
17: Marleau Avenue & Boundary Road

Future Total - Scenario 2  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.7	6.7	6.7	6.7	6.7	6.7	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	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1612	1845	1553	1517	1881	1482	1626	1638	1429	1719	1759	1553
Flt Permitted	0.66	1.00	1.00	0.72	1.00	1.00	0.22	1.00	0.60	1.00	1.00	1.00
Satd. Flow (perm)	1119	1845	1553	1147	1881	1482	372	1638	1429	1092	1759	1553
Volume (vph)	121	59	74	32	153	23	46	251	15	40	662	279
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	121	59	74	32	153	23	46	251	15	40	662	279
RTOR Reduction (vph)	0	0	48	0	0	15	0	0	8	0	0	131
Lane Group Flow (vph)	121	59	26	32	153	8	46	251	7	40	662	148
Heavy Vehicles (%)	12%	3%	4%	19%	1%	9%	11%	16%	13%	5%	8%	4%
Turn Type	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm
Protected Phases		4			8			2		2		6
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phases	4	4	4	8	8	8	2	2	2	6	6	6
Minimum Initial (s)	29.3	29.3	29.3	29.3	29.3	29.3	26.0	26.0	26.0	26.0	26.0	26.0
Minimum Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (%)	52.9%	52.9%	52.9%	52.9%	52.9%	52.9%	47.1%	47.1%	47.1%	47.1%	47.1%	47.1%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	3.2	3.2	3.2	3.2	3.2	3.2	2.9	2.9	2.9	2.9	2.9	2.9
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.25	0.07	0.10	0.06	0.19	0.04	0.36	0.30	0.02	0.07	0.74	0.31
Control Delay	14.4	12.0	3.8	12.1	13.1	5.3	28.3	15.9	7.2	14.4	27.5	4.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.4	12.0	3.8	12.1	13.1	5.3	28.3	15.9	7.2	14.4	27.5	4.2
Queue Length 50th (m)	10.2	4.6	0.0	2.5	12.5	0.0	4.6	24.4	0.0	3.4	87.3	2.7
Queue Length 95th (m)	24.3	12.3	8.1	8.1	26.7	4.4	#22.7	49.1	3.9	10.6	#184.0	22.5
Internal Link Dist (m)		2051.6			246.6		346.9			725.5		
Turn Bay Length (m)	46.0				68.0		48.0	34.0		68.0		48.0
Base Capacity (vph)	485	799	714	497	814	655	129	833	734	535	894	911
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.07	0.10	0.06	0.19	0.04	0.36	0.30	0.02	0.07	0.74	0.31

Intersection Summary

HCM Average Control Delay	17.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.7
Intersection Capacity Utilization	103.2%	ICU Level of Service	G
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
17: Marleau Avenue & Boundary Road

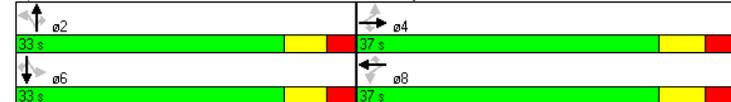
Future Total - Scenario 2  
Weekday A.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	121	59	74	32	153	23	46	251	15	40	662	279
Lane Group Flow (vph)	121	59	74	32	153	23	46	251	15	40	662	279
Turn Type	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm
Protected Phases		4			8			2		2		6
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phases	4	4	4	8	8	8	2	2	2	6	6	6
Minimum Initial (s)	29.3	29.3	29.3	29.3	29.3	29.3	26.0	26.0	26.0	26.0	26.0	26.0
Minimum Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (%)	52.9%	52.9%	52.9%	52.9%	52.9%	52.9%	47.1%	47.1%	47.1%	47.1%	47.1%	47.1%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	3.2	3.2	3.2	3.2	3.2	3.2	2.9	2.9	2.9	2.9	2.9	2.9
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.25	0.07	0.10	0.06	0.19	0.04	0.36	0.30	0.02	0.07	0.74	0.31
Control Delay	14.4	12.0	3.8	12.1	13.1	5.3	28.3	15.9	7.2	14.4	27.5	4.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.4	12.0	3.8	12.1	13.1	5.3	28.3	15.9	7.2	14.4	27.5	4.2
Queue Length 50th (m)	10.2	4.6	0.0	2.5	12.5	0.0	4.6	24.4	0.0	3.4	87.3	2.7
Queue Length 95th (m)	24.3	12.3	8.1	8.1	26.7	4.4	#22.7	49.1	3.9	10.6	#184.0	22.5
Internal Link Dist (m)		2051.6			246.6		346.9			725.5		
Turn Bay Length (m)	46.0				68.0		48.0	34.0		68.0		48.0
Base Capacity (vph)	485	799	714	497	814	655	129	833	734	535	894	911
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.07	0.10	0.06	0.19	0.04	0.36	0.30	0.02	0.07	0.74	0.31

Intersection Summary

Cycle Length: 70
Actuated Cycle Length: 70
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 17: Marleau Avenue & Boundary Road



HCM Signalized Intersection Capacity Analysis  
18: Marleau Avenue & McConnell Avenue

Future Total - Scenario 2  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.5		2.0	5.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1703	1827	1534	1736	1845	1509	1736	1685		1703	1776	
Flt Permitted	0.14	1.00	1.00	0.16	1.00	1.00	0.41	1.00		0.23	1.00	
Satd. Flow (perm)	256	1827	1534	291	1845	1509	750	1685		413	1776	
Volume (vph)	34	568	127	156	705	347	152	276	130	378	378	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	34	568	127	156	705	347	152	276	130	378	378	0
RTOR Reduction (vph)	0	0	81	0	0	175	0	17	0	0	0	0
Lane Group Flow (vph)	34	568	46	156	705	172	152	389	0	378	378	0
Confl. Peds. (#/hr)			5	5								
Heavy Vehicles (%)	6%	4%	2%	4%	3%	7%	4%	7%	8%	6%	7%	50%
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt			pm+pt		
Protected Phases		4			3		8	5	2		1	6
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	35.0	35.0	35.0	43.0	43.0	43.0	36.0	25.5		44.5	31.0	
Effective Green, g (s)	36.0	36.0	36.0	47.0	44.0	44.0	41.5	26.5		49.0	32.0	
Actuated g/C Ratio	0.36	0.36	0.36	0.47	0.44	0.44	0.42	0.26		0.49	0.32	
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.5		3.0	6.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	92	658	552	223	812	664	425	447		422	568	
v/s Ratio Prot		0.31		0.04	c0.38		0.04	c0.23		c0.15	0.21	
v/s Ratio Perm	0.13		0.03	0.29		0.11	0.11			0.29		
v/c Ratio	0.37	0.86	0.08	0.70	0.87	0.26	0.36	0.87		0.90	0.67	
Uniform Delay, d1	23.6	29.7	21.1	19.8	25.4	17.7	19.0	35.1		19.4	29.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.86	0.84	
Incremental Delay, d2	11.4	16.2	0.3	9.7	13.8	0.9	0.5	24.5		22.8	5.3	
Delay (s)	35.0	45.9	21.4	29.4	39.2	18.6	19.6	59.6		39.5	29.9	
Level of Service	C	D	C	C	D	B	B	E		D	C	
Approach Delay (s)		41.1			32.0			48.7			34.7	
Approach LOS		D			C			D			C	

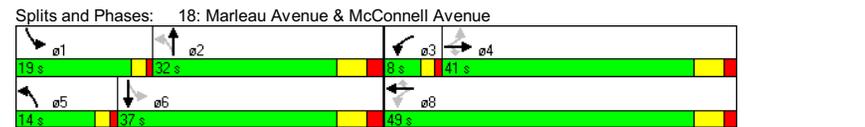
Intersection Summary			
HCM Average Control Delay	37.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	114.8%	ICU Level of Service	H
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
18: Marleau Avenue & McConnell Avenue

Future Total - Scenario 2  
Weekday A.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	
Volume (vph)	34	568	127	156	705	347	152	276	378	378	
Lane Group Flow (vph)	34	568	127	156	705	347	152	406	378	378	
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		pm+pt		
Protected Phases		4			3	8		5	2	1	6
Permitted Phases	4		4	8		8	2		6		
Detector Phases	4	4	4	3	8	8	5	2	1	6	
Minimum Initial (s)	21.7	21.7	21.7	5.0	21.7	21.7	10.0	15.0	10.0	15.0	
Minimum Split (s)	36.1	36.1	36.1	8.0	38.7	38.7	14.0	31.9	14.0	31.9	
Total Split (s)	41.0	41.0	41.0	8.0	49.0	49.0	14.0	32.0	19.0	37.0	
Total Split (%)	41.0%	41.0%	41.0%	8.0%	49.0%	49.0%	14.0%	32.0%	19.0%	37.0%	
Yellow Time (s)	4.1	4.1	4.1	2.0	4.1	4.1	2.0	4.1	2.0	4.1	
All-Red Time (s)	1.9	1.9	1.9	1.0	1.9	1.9	1.0	2.4	1.0	2.4	
Lead/Lag	Lag	Lag	Lag	Lead			Lead	Lag	Lead	Lag	
Lead-Lag Optimize?											
Recall Mode	C-Max	C-Max	C-Max	None	C-Max	C-Max	None	Max	None	Max	
v/c Ratio	0.37	0.86	0.20	0.70	0.87	0.41	0.36	0.88	0.90	0.66	
Control Delay	38.0	47.0	4.9	36.2	40.3	4.6	17.3	59.3	44.6	30.6	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	38.0	47.0	4.9	36.2	40.3	4.6	17.3	59.3	44.6	30.6	
Queue Length 50th (m)	5.1	106.2	0.0	17.9	126.8	4.0	16.6	75.3	49.6	66.5	
Queue Length 95th (m)	18.5	#202.4	15.4	#47.9	#239.5	31.2	32.5	#156.8	#121.1	#120.5	
Internal Link Dist (m)		264.6			914.0			258.2		283.7	
Turn Bay Length (m)			84.0	71.0		71.0	77.0		130.0		
Base Capacity (vph)	92	658	634	223	812	839	427	463	422	569	
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	0.37	0.86	0.20	0.70	0.87	0.41	0.36	0.88	0.90	0.66	

Intersection Summary	
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	77 (77%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle:	90
Control Type:	Actuated-Coordinated
#	95th percentile volume exceeds capacity, queue may be longer.
m	Queue shown is maximum after two cycles.
m	Volume for 95th percentile queue is metered by upstream signal.



HCM Unsignalized Intersection Capacity Analysis  
22: Hwy 401 WB Ramp & Boundary Road

Future Total - Scenario 2  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗	↖	↕	↗		↕	↗	↖	↕	↗
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	2	1	124	67	28	8	56	279	22	8	730	9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	2	1	124	67	28	8	56	279	22	8	730	9
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1174	1164	734	1277	1157	290	739				301	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1174	1164	734	1277	1157	290	739				301	
tC, single (s)	7.1	6.5	6.3	7.1	6.5	6.2	4.2				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.4	3.5	4.0	3.3	2.3				2.2	
p0 queue free %	99	99	70	29	85	99	93				99	
cM capacity (veh/h)	140	182	407	95	183	754	819				1272	
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>WB 1</b>	<b>WB 2</b>	<b>NB 1</b>	<b>SB 1</b>						
Volume Total	3	124	67	36	357	747						
Volume Left	2	0	67	0	56	8						
Volume Right	0	124	0	8	22	9						
cSH	152	407	95	220	819	1272						
Volume to Capacity	0.02	0.30	0.71	0.16	0.07	0.01						
Queue Length 95th (m)	0.5	10.4	42.2	4.7	1.8	0.2						
Control Delay (s)	29.2	17.7	123.5	24.5	2.2	0.2						
Lane LOS	D	C	F	C	A	A						
Approach Delay (s)	18.0		88.9		2.2	0.2						
Approach LOS	C		F									
<b>Intersection Summary</b>												
Average Delay				9.3								
Intersection Capacity Utilization	70.8%			ICU Level of Service			C					
Analysis Period (min)	60											

HCM Unsignalized Intersection Capacity Analysis  
25: Hwy 401 EB Ramp & Boundary Road

Future Total - Scenario 2  
Weekday A.M. Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖	↗	↕	↖	↖	↕
Sign Control	Stop	↗	Free	↖		Free
Grade	0%		0%			0%
Volume (veh/h)	166	13	344	101	10	911
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	166	13	344	101	10	911
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1275	344			445	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1275	344			445	
tC, single (s)	6.5	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.6	3.3			2.2	
p0 queue free %	5	98			99	
cM capacity (veh/h)	174	703			1126	
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>WB 2</b>	<b>NB 1</b>	<b>NB 2</b>	<b>SB 1</b>	
Volume Total	166	13	344	101	921	
Volume Left	166	0	0	0	10	
Volume Right	0	13	0	101	0	
cSH	174	703	1700	1700	1126	
Volume to Capacity	0.95	0.02	0.20	0.06	0.01	
Queue Length 95th (m)	111.2	0.5	0.0	0.0	0.2	
Control Delay (s)	177.1	10.2	0.0	0.0	0.2	
Lane LOS	F	B			A	
Approach Delay (s)	165.0		0.0		0.2	
Approach LOS	F					
<b>Intersection Summary</b>						
Average Delay			19.3			
Intersection Capacity Utilization	71.8%		ICU Level of Service		C	
Analysis Period (min)	60					

HCM Unsignalized Intersection Capacity Analysis  
29: Tenth Street & Virginia Avenue

Future Total - Scenario 2  
Weekday A.M. Peak Hour



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	110	10	162	10	10	10	118	90	10	10	86	105
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	110	10	162	10	10	10	118	90	10	10	86	105
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage veh												
Upstream signal (m)							308					
pX, platoon unblocked												
vC, conflicting volume	504	494	138	656	542	95	191				100	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	504	494	138	656	542	95	191				100	
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
p0 queue free %	75	98	82	97	98	99	92				99	
cM capacity (veh/h)	434	436	915	287	409	967	1395				1505	
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	282	30	218	201								
Volume Left	110	10	118	10								
Volume Right	162	10	10	105								
cSH	622	431	1395	1505								
Volume to Capacity	0.45	0.07	0.08	0.01								
Queue Length 95th (m)	19.6	1.8	2.2	0.2								
Control Delay (s)	15.6	14.0	4.6	0.4								
Lane LOS	C	B	A	A								
Approach Delay (s)	15.6	14.0	4.6	0.4								
Approach LOS	C	B										
Intersection Summary												
Average Delay				8.1								
Intersection Capacity Utilization	56.5%			ICU Level of Service			B					
Analysis Period (min)	60											

HCM Signalized Intersection Capacity Analysis  
5: SCM Way & Boundary Road

Future Total - Scenario 2  
Weekday P.M. Peak Hour

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↖	↗	↖	↗
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2	6.2	5.2	5.2	5.2	5.2
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	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1056	944	1253	1484	1696	1049
Flt Permitted	0.95	1.00	0.26	1.00	1.00	1.00
Satd. Flow (perm)	1056	944	345	1484	1696	1049
Volume (vph)	100	54	12	696	704	52
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	100	54	12	696	704	52
RTOR Reduction (vph)	0	38	0	0	0	20
Lane Group Flow (vph)	100	16	12	696	704	32
Heavy Vehicles (%)	71%	71%	44%	28%	12%	54%
Turn Type	Perm		Perm		Perm	
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	29.6	29.6	62.5	62.5	62.5	62.5
Effective Green, g (s)	30.6	30.6	63.5	63.5	63.5	63.5
Actuated g/C Ratio	0.29	0.29	0.60	0.60	0.60	0.60
Clearance Time (s)	7.2	7.2	6.2	6.2	6.2	6.2
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	306	274	208	893	1021	631
v/s Ratio Prot	c0.09			c0.47	0.41	
v/s Ratio Perm		0.02	0.03			0.03
v/c Ratio	0.33	0.06	0.06	0.78	0.69	0.05
Uniform Delay, d1	29.4	27.0	8.7	15.7	14.3	8.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	0.1	0.5	7.0	3.9	0.2
Delay (s)	30.0	27.1	9.2	22.7	18.2	8.8
Level of Service	C	C	A	C	B	A
Approach Delay (s)	29.0		22.5		17.5	
Approach LOS	C		C		B	

Intersection Summary			
HCM Average Control Delay	20.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	105.5	Sum of lost time (s)	11.4
Intersection Capacity Utilization	76.2%	ICU Level of Service	D
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
5: SCM Way & Boundary Road

Future Total - Scenario 2  
Weekday P.M. Peak Hour

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↖	↗	↖	↗
Volume (vph)	100	54	12	696	704	52
Lane Group Flow (vph)	100	54	12	696	704	52
Turn Type	Perm		Perm		Perm	
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Detector Phases	4	4	2	2	6	6
Minimum Initial (s)	35.6	35.6	15.0	15.0	15.0	15.0
Minimum Split (s)	42.8	42.8	57.2	57.2	57.2	57.2
Total Split (s)	42.8	42.8	57.2	57.2	57.2	57.2
Total Split (%)	42.8%	42.8%	57.2%	57.2%	57.2%	57.2%
Yellow Time (s)	5.4	5.4	4.1	4.1	4.1	4.1
All-Red Time (s)	1.8	1.8	2.1	2.1	2.1	2.1
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Max	Max	Max	Max
v/c Ratio	0.28	0.15	0.07	0.76	0.67	0.08
Control Delay	24.8	6.9	13.8	26.7	21.8	3.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.8	6.9	13.8	26.7	21.8	3.9
Queue Length 50th (m)	14.1	0.0	1.2	122.4	112.4	0.1
Queue Length 95th (m)	31.3	10.1	5.2	#243.4	#224.2	7.2
Internal Link Dist (m)	265.1		548.2		424.1	
Turn Bay Length (m)	62.0		80.0		65.0	
Base Capacity (vph)	355	354	165	916	1047	667
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	0.28	0.15	0.07	0.76	0.67	0.08

Intersection Summary	
Cycle Length:	100
Actuated Cycle Length:	104.3
Natural Cycle:	100
Control Type:	Semi Act-Uncoord
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	



HCM Unsignalized Intersection Capacity Analysis  
6: Optimum Drive & SCM Way

Future Total - Scenario 2  
Weekday P.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	↕
Sign Control	Free	Free	Free	Free	Stop	Stop
Grade	0%	0%	0%	0%	0%	0%
Volume (veh/h)	0	0	0	54	141	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	54	141	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)			289			
pX, platoon unblocked						
vC, conflicting volume	54				27	27
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	54				27	27
tC, single (s)	4.1				7.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				4.4	3.3
p0 queue free %	100				82	100
cM capacity (veh/h)	1564				787	1054
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	0	54	141			
Volume Left	0	0	141			
Volume Right	0	54	0			
cSH	1700	1700	787			
Volume to Capacity	0.00	0.03	0.18			
Queue Length 95th (m)	0.0	0.0	5.2			
Control Delay (s)	0.0	0.0	10.6			
Lane LOS			B			
Approach Delay (s)	0.0	0.0	10.6			
Approach LOS			B			
<b>Intersection Summary</b>						
Average Delay			7.6			
Intersection Capacity Utilization	17.8%		ICU Level of Service	A		
Analysis Period (min)	60					

HCM Unsignalized Intersection Capacity Analysis  
7: Industrial Park Dr & Boundary Road

Future Total - Scenario 2  
Weekday P.M. Peak Hour



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↕	↕	↕	↕	↕	↕
Sign Control	Stop	Free	Free	Free	Free	Free
Grade	0%	0%	0%	0%	0%	0%
Volume (veh/h)	109	242	89	599	535	223
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	109	242	89	599	535	223
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1424	648	759			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1424	648	759			
tC, single (s)	6.9	6.3	4.1			
tC, 2 stage (s)						
tF (s)	4.0	3.4	2.2			
p0 queue free %	0	47	90			
cM capacity (veh/h)	104	458	852			
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>NB 1</b>	<b>NB 2</b>	<b>SB 1</b>	
Volume Total	109	242	89	599	758	
Volume Left	109	0	89	0	0	
Volume Right	0	242	0	0	223	
cSH	104	458	852	1700	1700	
Volume to Capacity	1.05	0.53	0.10	0.35	0.45	
Queue Length 95th (m)	113.7	26.1	2.8	0.0	0.0	
Control Delay (s)	347.5	21.6	9.7	0.0	0.0	
Lane LOS	F	C	A			
Approach Delay (s)	122.8		1.3		0.0	
Approach LOS	F					
<b>Intersection Summary</b>						
Average Delay			24.5			
Intersection Capacity Utilization	63.4%		ICU Level of Service	B		
Analysis Period (min)	60					

HCM Unsignalized Intersection Capacity Analysis  
9: Industrial Park Dr & Optimum Drive

Future Total - Scenario 2  
Weekday P.M. Peak Hour



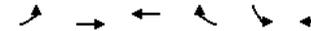
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	74	179	9	8	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	74	179	9	8	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	188				258	184
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	188				258	184
tC, single (s)	4.1				7.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				4.4	3.3
p0 queue free %	100				99	100
cM capacity (veh/h)	1398				562	864

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	74	188	8
Volume Left	0	0	8
Volume Right	0	9	0
cSH	1398	1700	562
Volume to Capacity	0.00	0.11	0.01
Queue Length 95th (m)	0.0	0.0	0.3
Control Delay (s)	0.0	0.0	11.5
Lane LOS			B
Approach Delay (s)	0.0	0.0	11.5
Approach LOS			B

Intersection Summary			
Average Delay		0.3	
Intersection Capacity Utilization	20.0%		ICU Level of Service A
Analysis Period (min)	60		

HCM Unsignalized Intersection Capacity Analysis  
11: Boundary Access & Truck Access

Future Total - Scenario 2  
Weekday P.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	0	0	0	0	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0				0	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				0	0
tC, single (s)	5.1				6.4	7.2
tC, 2 stage (s)						
tF (s)	3.1				3.5	4.2
p0 queue free %	100				100	100
cM capacity (veh/h)	1161				1029	857

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	0	0	0
Volume Left	0	0	0
Volume Right	0	0	0
cSH	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0
Lane LOS			A
Approach Delay (s)	0.0	0.0	0.0
Approach LOS			A

Intersection Summary			
Average Delay		0.0	
Intersection Capacity Utilization	0.0%		ICU Level of Service A
Analysis Period (min)	60		

HCM Signalized Intersection Capacity Analysis  
13: Marleau Avenue & Virginia Avenue

Future Total - Scenario 2  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5		5.3	5.3			5.3	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.95			0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00			1.00	
Satd. Flow (prot)	1556	1810	1404	1719	1810		1680	1762			1853	
Flt Permitted	0.14	1.00	1.00	0.24	1.00		0.51	1.00			1.00	
Satd. Flow (perm)	231	1810	1404	435	1810		900	1762			1853	
Volume (vph)	15	788	168	63	958	0	189	115	59	0	197	19
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	15	788	168	63	958	0	189	115	59	0	197	19
RTOR Reduction (vph)	0	0	18	0	0	0	0	21	0	0	4	0
Lane Group Flow (vph)	15	788	150	63	958	0	189	153	0	0	212	0
Confl. Peds. (#/hr)							3					3
Heavy Vehicles (%)	16%	5%	15%	5%	5%	0%	7%	0%	7%	0%	0%	11%
Turn Type	Perm		Perm	Perm		Perm	custom		Perm			
Protected Phases		4			8						6	
Permitted Phases	4		4	8		8	2	2			6	
Actuated Green, G (s)	56.4	56.4	56.4	56.4	56.4		20.8	20.8			20.8	
Effective Green, g (s)	57.4	57.4	57.4	57.4	57.4		21.8	21.8			21.8	
Actuated g/C Ratio	0.64	0.64	0.64	0.64	0.64		0.24	0.24			0.24	
Clearance Time (s)	6.5	6.5	6.5	6.5	6.5		6.3	6.3			6.3	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)	147	1154	895	277	1154		218	427			449	
v/s Ratio Prot		0.44			c0.53						0.11	
v/s Ratio Perm	0.07		0.11	0.14			c0.21	0.09				
v/c Ratio	0.10	0.68	0.17	0.23	0.83		0.87	0.36			0.47	
Uniform Delay, d1	6.3	10.5	6.6	6.9	12.5		32.7	28.3			29.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	1.4	3.3	0.4	1.9	7.4		36.3	0.5			0.8	
Delay (s)	7.7	13.8	7.0	8.8	20.0		69.0	28.8			30.0	
Level of Service	A	B	A	A	B		E	C			C	
Approach Delay (s)		12.5			19.3			49.7			30.0	
Approach LOS		B			B			D			C	

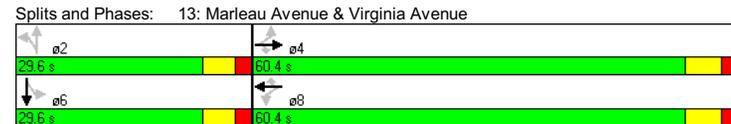
Intersection Summary			
HCM Average Control Delay	21.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	91.3%	ICU Level of Service	F
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
13: Marleau Avenue & Virginia Avenue

Future Total - Scenario 2  
Weekday P.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	15	788	168	63	958	189	115	197
Lane Group Flow (vph)	15	788	168	63	958	189	174	216
Turn Type	Perm		Perm	Perm		custom		
Protected Phases		4			8			6
Permitted Phases	4		4	8		2	2	
Detector Phases	4	4	4	8	8	2	2	6
Minimum Initial (s)	18.2	18.2	18.2	18.0	18.0	15.0	15.0	15.0
Minimum Split (s)	35.7	35.7	35.7	35.7	35.7	29.3	29.3	29.3
Total Split (s)	60.4	60.4	60.4	60.4	60.4	29.6	29.6	29.6
Total Split (%)	67.1%	67.1%	67.1%	67.1%	67.1%	32.9%	32.9%	32.9%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.1	4.1	4.1
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.2	2.2	2.2
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	C-Max	C-Max	C-Max	C-Max	C-Max	None	None	None
v/c Ratio	0.12	0.68	0.18	0.25	0.83	0.83	0.39	0.48
Control Delay	10.4	15.1	5.8	11.1	22.2	69.0	25.7	31.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	10.4	15.1	5.8	11.1	22.2	69.0	25.7	31.7
Queue Length 50th (m)	1.1	90.3	8.4	4.8	131.7	31.5	21.1	31.6
Queue Length 95th (m)	5.0	173.4	20.1	14.9	#278.4	#78.7	45.2	60.3
Internal Link Dist (m)		914.0			682.0		404.6	283.6
Turn Bay Length (m)	25.0		10.0	25.0		25.0		
Base Capacity (vph)	122	1154	913	255	1154	252	496	504
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	0.12	0.68	0.18	0.25	0.83	0.75	0.35	0.43

Intersection Summary	
Cycle Length:	90
Actuated Cycle Length:	90
Offset:	0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle:	80
Control Type:	Actuated-Coordinated
#	95th percentile volume exceeds capacity, queue may be longer.
	Queue shown is maximum after two cycles.



HCM Signalized Intersection Capacity Analysis  
14: Tenth Street & McConnell Avenue

Future Total - Scenario 2  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔			↕			↔			↕		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5			5.5			5.0			5.0		
Lane Util. Factor	1.00			1.00			1.00			1.00		
Frpb, ped/bikes	1.00			0.98			1.00			1.00		
Flpb, ped/bikes	1.00			1.00			1.00			1.00		
Frt	0.98			0.91			1.00			1.00		
Flt Protected	0.98			0.99			0.95			1.00		
Satd. Flow (prot)	1825			1623			1805			1753		
Flt Permitted	0.80			0.94			0.29			1.00		
Satd. Flow (perm)	1481			1543			558			1753		
Volume (vph)	8	12	3	29	32	128	7	883	30	196	794	11
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	8	12	3	29	32	128	7	883	30	196	794	11
RTOR Reduction (vph)	0	3	0	0	81	0	0	1	0	0	0	0
Lane Group Flow (vph)	0	20	0	0	108	0	7	912	0	196	805	0
Confl. Peds. (#/hr)	2		4		4		2		2		2	
Heavy Vehicles (%)	0%		0%		10%		0%		3%		0%	
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases	4		8		8		2		6		6	
Permitted Phases	4		8		8		2		6		6	
Actuated Green, G (s)	12.9		12.9		74.6		74.6		74.6		74.6	
Effective Green, g (s)	13.4		13.4		76.1		76.1		76.1		76.1	
Actuated g/C Ratio	0.13		0.13		0.76		0.76		0.76		0.76	
Clearance Time (s)	6.0		6.0		6.5		6.5		6.5		6.5	
Vehicle Extension (s)	3.0		3.0		3.0		3.0		3.0		3.0	
Lane Grp Cap (vph)	198		207		425		1334		351		1313	
v/s Ratio Prot					c0.52		c0.52		0.47		0.47	
v/s Ratio Perm	0.01		c0.07		0.01		0.43		0.43		0.43	
v/c Ratio	0.10		0.52		0.02		0.68		0.56		0.61	
Uniform Delay, d1	38.0		40.3		2.9		6.0		5.0		5.4	
Progression Factor	1.00		1.00		0.32		0.92		1.00		1.00	
Incremental Delay, d2	0.2		2.2		0.0		1.4		6.4		2.2	
Delay (s)	38.3		42.5		1.0		6.9		11.4		7.5	
Level of Service	D		D		A		A		B		A	
Approach Delay (s)	38.3		42.5		6.9		8.3		8.3		8.3	
Approach LOS	D		D		A		A		A		A	

Intersection Summary			
HCM Average Control Delay	11.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	84.6%	ICU Level of Service	E
Analysis Period (min)	60		
c Critical Lane Group			

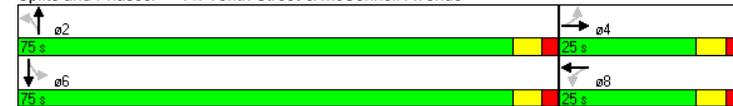
Queues  
14: Tenth Street & McConnell Avenue

Future Total - Scenario 2  
Weekday P.M. Peak Hour

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↔			↕			↕	
Volume (vph)	8	12	29	32	7	883	196	794
Lane Group Flow (vph)	0	23	0	189	7	913	196	805
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases	4		8		2		6	
Permitted Phases	4		8		2		6	
Detector Phases	4		8		2		6	
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	25.0	25.0	25.0	25.0	19.5	19.5	19.5	19.5
Total Split (s)	25.0	25.0	25.0	25.0	75.0	75.0	75.0	75.0
Total Split (%)	25.0%	25.0%	25.0%	25.0%	75.0%	75.0%	75.0%	75.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	1.9	1.9	1.9	1.9	2.4	2.4	2.4	2.4
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.10	0.10	0.65	0.02	0.68	0.66	0.61	0.61
Control Delay	33.4	33.4	31.6	1.3	8.0	21.3	8.5	8.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.4	33.4	31.6	1.3	8.0	21.3	8.5	8.5
Queue Length 50th (m)	3.7	3.7	18.4	0.1	149.1	14.4	55.3	55.3
Queue Length 95th (m)	11.6	11.6	46.9	m0.1m	170.7	#84.0	154.3	154.3
Internal Link Dist (m)	414.9	414.9	902.0	283.7	1842.8	1842.8	1842.8	1842.8
Turn Bay Length (m)					14.0	14.0	14.0	14.0
Base Capacity (vph)	327		379		1334	297	1313	1313
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	0.07		0.50		0.02	0.68	0.66	0.61

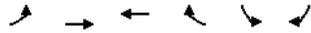
Intersection Summary	
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	60 (60%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle:	90
Control Type:	Actuated-Coordinated
#	95th percentile volume exceeds capacity, queue may be longer.
m	Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 14: Tenth Street & McConnell Avenue



HCM Unsignalized Intersection Capacity Analysis  
 16: Virginia Avenue & Industrial Park Drive

Future Total - Scenario 2  
 Weekday P.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	↕
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	78	48	73	9	25	90
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	78	48	73	9	25	90
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	82				282	78
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	82				282	78
tC, single (s)	4.1				7.4	6.4
tC, 2 stage (s)						
tF (s)	2.2				4.4	3.4
p0 queue free %	95				95	90
cM capacity (veh/h)	1522				514	946
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	126	82	115			
Volume Left	78	0	25			
Volume Right	0	9	90			
cSH	1522	1700	800			
Volume to Capacity	0.05	0.05	0.14			
Queue Length 95th (m)	1.3	0.0	4.0			
Control Delay (s)	4.8	0.0	10.3			
Lane LOS	A		B			
Approach Delay (s)	4.8	0.0	10.3			
Approach LOS			B			
<b>Intersection Summary</b>						
Average Delay			5.5			
Intersection Capacity Utilization		27.1%		ICU Level of Service		A
Analysis Period (min)			60			

HCM Signalized Intersection Capacity Analysis  
17: Marleau Avenue & Boundary Road

Future Total - Scenario 2  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.7	6.7	6.7	6.7	6.7	6.7	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	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1608	1845	1553	1517	1881	1449	1626	1638	1429	1719	1759	1553
Flt Permitted	0.70	1.00	1.00	0.67	1.00	1.00	0.30	1.00	1.00	0.33	1.00	1.00
Satd. Flow (perm)	1179	1845	1553	1067	1881	1449	516	1638	1429	588	1759	1553
Volume (vph)	171	139	51	34	94	33	89	484	41	57	507	213
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	171	139	51	34	94	33	89	484	41	57	507	213
RTOR Reduction (vph)	0	0	30	0	0	19	0	0	24	0	0	126
Lane Group Flow (vph)	171	139	21	34	94	14	89	484	17	57	507	87
Confl. Peds. (#/hr)	1					1						
Heavy Vehicles (%)	12%	3%	4%	19%	1%	9%	11%	16%	13%	5%	8%	4%
Turn Type	Perm		Perm	Perm		Perm	Perm		Perm	Perm		Perm
Protected Phases		4			8			2		2		6
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	29.5	29.5	29.5	29.5	29.5	29.5	28.7	28.7	28.7	28.7	28.7	28.7
Effective Green, g (s)	30.5	30.5	30.5	30.5	30.5	30.5	29.7	29.7	29.7	29.7	29.7	29.7
Actuated g/C Ratio	0.42	0.42	0.42	0.42	0.42	0.42	0.41	0.41	0.41	0.41	0.41	0.41
Clearance Time (s)	7.7	7.7	7.7	7.7	7.7	7.7	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	493	772	650	446	787	606	210	667	582	240	717	633
v/s Ratio Prot		0.08			0.05		c0.30				0.29	
v/s Ratio Perm	c0.15		0.01	0.03		0.01	0.17		0.01	0.10		0.06
v/c Ratio	0.35	0.18	0.03	0.08	0.12	0.02	0.42	0.73	0.03	0.24	0.71	0.14
Uniform Delay, d1	14.4	13.3	12.5	12.7	13.0	12.4	15.5	18.2	13.0	14.2	18.0	13.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.1	0.0	0.1	0.1	0.0	6.3	7.0	0.1	2.3	6.0	0.5
Delay (s)	14.8	13.4	12.5	12.8	13.0	12.5	21.7	25.2	13.0	16.5	24.0	14.0
Level of Service	B	B	B	B	B	B	C	C	B	B	C	B
Approach Delay (s)		14.0			12.9			23.9			20.7	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM Average Control Delay	19.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	72.9	Sum of lost time (s)	12.7
Intersection Capacity Utilization	92.2%	ICU Level of Service	F
Analysis Period (min)	60		
c Critical Lane Group			

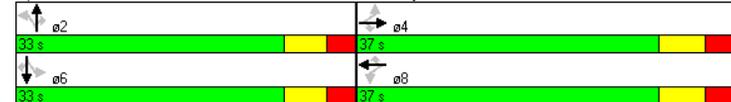
Queues  
17: Marleau Avenue & Boundary Road

Future Total - Scenario 2  
Weekday P.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	171	139	51	34	94	33	89	484	41	57	507	213
Lane Group Flow (vph)	171	139	51	34	94	33	89	484	41	57	507	213
Turn Type	Perm		Perm	Perm		Perm	Perm		Perm	Perm		Perm
Protected Phases		4			8			2		2		6
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phases	4	4	4	8	8	8	2	2	2	6	6	6
Minimum Initial (s)	29.3	29.3	29.3	29.3	29.3	29.3	26.0	26.0	26.0	26.0	26.0	26.0
Minimum Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (%)	52.9%	52.9%	52.9%	52.9%	52.9%	52.9%	47.1%	47.1%	47.1%	47.1%	47.1%	47.1%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	3.2	3.2	3.2	3.2	3.2	3.2	2.9	2.9	2.9	2.9	2.9	2.9
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	Max	Max	Max	Max	Max	Max
v/c Ratio	0.35	0.18	0.08	0.08	0.12	0.05	0.45	0.73	0.07	0.25	0.71	0.28
Control Delay	15.7	13.0	4.2	12.3	12.4	4.8	25.4	26.9	5.3	18.5	25.4	3.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.7	13.0	4.2	12.3	12.4	4.8	25.4	26.9	5.3	18.5	25.4	3.5
Queue Length 50th (m)	15.0	11.3	0.0	2.7	7.4	0.0	9.0	56.5	0.0	5.2	58.6	0.0
Queue Length 95th (m)	33.7	24.5	6.7	8.6	17.5	5.4	#31.1	#125.7	6.6	16.2	#127.3	15.9
Internal Link Dist (m)		2051.6			246.6			346.9			725.5	
Turn Bay Length (m)	46.0			68.0		48.0	34.0			68.0		48.0
Base Capacity (vph)	492	771	678	446	786	625	198	667	606	228	716	759
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.18	0.08	0.08	0.12	0.05	0.45	0.73	0.07	0.25	0.71	0.28

Intersection Summary	
Cycle Length:	70
Actuated Cycle Length:	72.9
Natural Cycle:	70
Control Type:	Semi Act-Uncoord
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	

Splits and Phases: 17: Marleau Avenue & Boundary Road



HCM Signalized Intersection Capacity Analysis  
18: Marleau Avenue & McConnell Avenue

Future Total - Scenario 2  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.5		2.0	5.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1703	1827	1545	1736	1845	1509	1734	1723		1703	1630	
Flt Permitted	0.12	1.00	1.00	0.11	1.00	1.00	0.30	1.00		0.11	1.00	
Satd. Flow (perm)	217	1827	1545	192	1845	1509	554	1723		199	1630	
Volume (vph)	39	694	178	124	756	365	275	516	99	375	383	68
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	39	694	178	124	756	365	275	516	99	375	383	68
RTOR Reduction (vph)	0	0	106	0	0	172	0	7	0	0	7	0
Lane Group Flow (vph)	39	694	72	124	756	193	275	608	0	375	444	0
Confl. Peds. (#/hr)			2	2			3		2	2		3
Heavy Vehicles (%)	6%	4%	2%	4%	3%	7%	4%	7%	8%	6%	7%	50%
Turn Type	Perm		Perm pm+pt		Perm pm+pt			pm+pt				
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	32.0	32.0	32.0	41.0	41.0	41.0	40.3	29.5		46.5	32.7	
Effective Green, g (s)	33.0	33.0	33.0	45.0	42.0	42.0	45.8	30.5		51.0	33.7	
Actuated g/C Ratio	0.33	0.33	0.33	0.45	0.42	0.42	0.46	0.30		0.51	0.34	
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.5		3.0	6.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	72	603	510	194	775	634	393	526		327	549	
v/s Ratio Prot		c0.38		0.04	c0.41		0.08	c0.35		c0.17	0.27	
v/s Ratio Perm	0.18		0.05	0.24		0.13	0.24			0.41		
v/c Ratio	0.54	1.15	0.14	0.64	0.98	0.30	0.70	1.16		1.15	0.81	
Uniform Delay, d1	27.3	33.5	23.5	22.7	28.5	19.3	18.8	34.8		29.7	30.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.81	1.11	
Incremental Delay, d2	28.6	292.8	0.6	7.0	45.5	1.2	5.5	304.2		294.7	10.7	
Delay (s)	55.9	326.3	24.1	29.7	74.0	20.5	24.3	338.9		318.8	44.1	
Level of Service	E	F	C	C	E	C	C	F		F	D	
Approach Delay (s)		255.7			53.9			241.7			168.8	
Approach LOS		F			D			F			F	

Intersection Summary

HCM Average Control Delay	169.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	17.5
Intersection Capacity Utilization	126.7%	ICU Level of Service	H
Analysis Period (min)	60		
c Critical Lane Group			

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Synchro 6 Report  
16/10/2010

LEA Consulting, Ltd.

Queues  
18: Marleau Avenue & McConnell Avenue

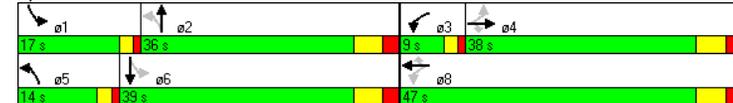
Future Total - Scenario 2  
Weekday P.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	39	694	178	124	756	365	275	516	375	383
Lane Group Flow (vph)	39	694	178	124	756	365	275	615	375	451
Turn Type	Perm		Perm pm+pt		Perm pm+pt			pm+pt		
Protected Phases		4		3	8		5	2	1	6
Permitted Phases	4		4	8		8	2		6	
Detector Phases	4	4	4	3	8	8	5	2	1	6
Minimum Initial (s)	20.0	20.0	20.0	5.0	20.0	20.0	10.0	15.0	10.0	15.0
Minimum Split (s)	28.0	28.0	28.0	9.0	28.0	28.0	14.0	28.5	14.0	28.5
Total Split (s)	38.0	38.0	38.0	9.0	47.0	47.0	14.0	36.0	17.0	39.0
Total Split (%)	38.0%	38.0%	38.0%	9.0%	47.0%	47.0%	14.0%	36.0%	17.0%	39.0%
Yellow Time (s)	4.1	4.1	4.1	2.0	4.1	4.1	2.0	4.1	2.0	4.1
All-Red Time (s)	1.9	1.9	1.9	1.0	1.9	1.9	1.0	2.4	1.0	2.4
Lead/Lag	Lag	Lag	Lag	Lead			Lead	Lag	Lead	Lag
Lead-Lag Optimize?										
Recall Mode	C-Max	C-Max	C-Max	None	C-Max	C-Max	None	Max	None	Max
v/c Ratio	0.54	1.15	0.29	0.64	0.98	0.45	0.70	1.15	1.15	0.81
Control Delay	61.3	325.3	6.7	33.8	75.3	6.4	26.5	333.3	318.7	44.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	61.3	325.3	6.7	33.8	75.3	6.4	26.5	333.3	318.7	44.6
Queue Length 50th (m)	6.4	~167.6	2.8	14.6	148.1	8.4	31.3	~148.0	~74.8	93.6
Queue Length 95th (m)	#27.8	#278.6	23.2	#42.5	#273.0	41.0	#62.2	#254.8	#158.1	#167.8
Internal Link Dist (m)		264.6			914.0		69.2			283.7
Turn Bay Length (m)			84.0	71.0		71.0	77.0		130.0	
Base Capacity (vph)	72	603	616	194	775	805	394	533	327	555
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	0.54	1.15	0.29	0.64	0.98	0.45	0.70	1.15	1.15	0.81

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 77 (77%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 140
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite. Queue shown is maximum after two cycles.
# 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.

Splits and Phases: 18: Marleau Avenue & McConnell Avenue



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Synchro 6 Report  
16/10/2010

LEA Consulting, Ltd.

HCM Unsignalized Intersection Capacity Analysis  
22: Hwy 401 WB Ramp & Boundary Road

Future Total - Scenario 2  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗	↖	↕	↗		↕	↗		↕	↗
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	9	1	95	46	17	12	87	520	105	11	542	6
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	9	1	95	46	17	12	87	520	105	11	542	6
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1334	1366	545	1409	1316	572	548				625	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1334	1366	545	1409	1316	572	548				625	
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
p0 queue free %	92	99	82	48	88	98	91				99	
cM capacity (veh/h)	108	133	538	88	142	519	1021				956	
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	10	95	46	29	712	559						
Volume Left	9	0	46	0	87	11						
Volume Right	0	95	0	12	105	6						
cSH	110	538	88	204	1021	956						
Volume to Capacity	0.09	0.18	0.52	0.14	0.09	0.01						
Queue Length 95th (m)	2.4	5.1	23.0	4.0	2.2	0.3						
Control Delay (s)	41.0	13.1	88.3	25.6	2.1	0.3						
Lane LOS	E	B	F	D	A	A						
Approach Delay (s)	15.8		64.1		2.1	0.3						
Approach LOS	C		F									
Intersection Summary												
Average Delay	5.6									E		
Intersection Capacity Utilization	87.3%			ICU Level of Service						E		
Analysis Period (min)	60											

HCM Unsignalized Intersection Capacity Analysis  
25: Hwy 401 EB Ramp & Boundary Road

Future Total - Scenario 2  
Weekday P.M. Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖	↗	↕	↖	↖	↗
Sign Control	Stop	↗	Free	↖	Free	↗
Grade	0%		0%		0%	
Volume (veh/h)	81	51	661	135	8	675
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	81	51	661	135	8	675
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1352	661			796	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1352	661			796	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	51	89			99	
cM capacity (veh/h)	164	462			826	
Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	
Volume Total	81	51	661	135	683	
Volume Left	81	0	0	0	8	
Volume Right	0	51	0	135	0	
cSH	164	462	1700	1700	826	
Volume to Capacity	0.49	0.11	0.39	0.08	0.01	
Queue Length 95th (m)	22.0	3.0	0.0	0.0	0.2	
Control Delay (s)	48.0	13.7	0.0	0.0	0.3	
Lane LOS	E	B			A	
Approach Delay (s)	34.8		0.0		0.3	
Approach LOS	D					
Intersection Summary						
Average Delay	3.0					
Intersection Capacity Utilization	53.1%			ICU Level of Service		
Analysis Period (min)	60					

HCM Unsignalized Intersection Capacity Analysis  
29: Tenth Street & Virginia Avenue

Future Total - Scenario 2  
Weekday P.M. Peak Hour



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	77	0	161	0	0	0	81	49	0	0	55	108
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	77	0	161	0	0	0	81	49	0	0	55	108
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage veh												
Upstream signal (m)							308					
pX, platoon unblocked												
vC, conflicting volume	320	320	109	481	374	49	163				49	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	320	320	109	481	374	49	163				49	
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
p0 queue free %	87	100	83	100	100	100	94				100	
cM capacity (veh/h)	607	566	950	396	528	1025	1428				1571	
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	238	0	130	163								
Volume Left	77	0	81	0								
Volume Right	161	0	0	108								
cSH	803	1700	1428	1571								
Volume to Capacity	0.30	0.00	0.06	0.00								
Queue Length 95th (m)	10.1	0.0	1.4	0.0								
Control Delay (s)	11.4	0.0	4.9	0.0								
Lane LOS	B	A	A									
Approach Delay (s)	11.4	0.0	4.9	0.0								
Approach LOS	B	A										
Intersection Summary												
Average Delay				6.3								
Intersection Capacity Utilization	40.8%			ICU Level of Service			A					
Analysis Period (min)	60											

*Future Total- Scenario 2: Road Improvements*

HCM Signalized Intersection Capacity Analysis  
13: Marleau Avenue & Virginia Avenue

Future Total - Scenario 2: Improvements  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	5.5	2.0	5.3		5.3	5.3	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1556	1810	1357	1719	1810	1615	1686	1840		1805	1828	
Flt Permitted	0.17	1.00	1.00	0.13	1.00	1.00	0.40	1.00		0.63	1.00	
Satd. Flow (perm)	278	1810	1357	243	1810	1615	707	1840		1195	1828	
Volume (vph)	32	840	73	40	789	25	275	176	30	25	213	35
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	32	840	73	40	789	25	275	176	30	25	213	35
RTOR Reduction (vph)	0	0	7	0	0	3	0	7	0	0	7	0
Lane Group Flow (vph)	32	840	66	40	789	22	275	199	0	25	241	0
Confl. Peds. (#/hr)			7	7			2					2
Heavy Vehicles (%)	16%	5%	15%	5%	5%	0%	7%	0%	7%	0%	0%	11%
Turn Type	Perm		Perm	Perm		Perm	pm+pt		Perm			
Protected Phases		4			8		5	2				6
Permitted Phases	4		4	8		8	2				6	
Actuated Green, G (s)	48.1	48.1	48.1	48.1	48.1	48.1	29.1	29.1		17.5	17.5	
Effective Green, g (s)	49.1	49.1	49.1	49.1	49.1	49.1	33.4	30.1		18.5	18.5	
Actuated g/C Ratio	0.55	0.55	0.55	0.55	0.55	0.55	0.37	0.33		0.21	0.21	
Clearance Time (s)	6.5	6.5	6.5	6.5	6.5	6.5	2.0	6.3		6.3	6.3	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	152	987	740	133	987	881	367	615		246	376	
v/s Ratio Prot		c0.46			0.44		c0.08	0.11			c0.13	
v/s Ratio Perm	0.12		0.05	0.16		0.01	0.20			0.02		
v/c Ratio	0.21	0.85	0.09	0.30	0.80	0.03	0.75	0.32		0.10	0.64	
Uniform Delay, d1	10.5	17.3	9.8	11.1	16.5	9.4	22.7	22.3		29.0	32.7	
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	3.2	10.0	0.2	5.8	7.1	0.1	8.6	0.3		0.2	3.8	
Delay (s)	13.7	27.4	10.0	16.9	23.6	9.5	31.3	22.7		29.2	36.5	
Level of Service	B	C	B	B	C	A	C	C		C	D	
Approach Delay (s)		25.6			22.9			27.6			35.8	
Approach LOS		C			C			C			D	

Intersection Summary

HCM Average Control Delay	26.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.8
Intersection Capacity Utilization	85.5%	ICU Level of Service	E
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
13: Marleau Avenue & Virginia Avenue

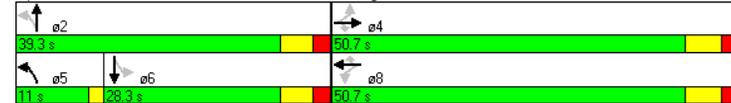
Future Total - Scenario 2: Improvements  
Weekday A.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	32	840	73	40	789	25	275	176	25	213
Lane Group Flow (vph)	32	840	73	40	789	25	275	206	25	248
Turn Type	Perm		Perm	Perm		Perm	pm+pt		Perm	
Protected Phases		4			8		5	2		6
Permitted Phases	4		4	8		8	2		6	
Detector Phases	4	4	4	8	8	8	5	2	6	6
Minimum Initial (s)	18.2	18.2	18.2	18.2	18.2	18.2	4.0	15.0	15.0	15.0
Minimum Split (s)	28.5	28.5	28.5	28.5	28.5	28.5	8.0	28.3	28.3	28.3
Total Split (s)	50.7	50.7	50.7	50.7	50.7	50.7	11.0	39.3	28.3	28.3
Total Split (%)	56.3%	56.3%	56.3%	56.3%	56.3%	56.3%	12.2%	43.7%	31.4%	31.4%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	2.0	4.1	4.1	4.1
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.0	2.2	2.2	2.2
Lead/Lag							Lead		Lag	Lag
Lead-Lag Optimize?							Yes		Yes	Yes
Recall Mode	C-Min	C-Min	C-Min	C-Min	C-Min	C-Min	None	Min	None	None
v/c Ratio	0.28	0.85	0.10	0.45	0.80	0.03	0.71	0.33	0.10	0.65
Control Delay	20.2	29.2	9.0	35.8	25.3	8.8	33.3	22.5	28.6	39.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.2	29.2	9.0	35.8	25.3	8.8	33.3	22.5	28.6	39.9
Queue Length 50th (m)	2.8	116.6	4.4	4.0	103.9	1.4	38.1	26.9	3.8	40.7
Queue Length 95th (m)	13.9	#262.9	14.1	#25.1	#239.6	6.4	#70.6	47.2	11.2	70.4
Internal Link Dist (m)		914.0			682.0			404.6		283.6
Turn Bay Length (m)	25.0		10.0	25.0		10.0	25.0			
Base Capacity (vph)	115	988	748	88	988	884	389	702	305	474
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	0.28	0.85	0.10	0.45	0.80	0.03	0.71	0.29	0.08	0.52

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 13: Marleau Avenue & Virginia Avenue



HCM Signalized Intersection Capacity Analysis  
18: Marleau Avenue & McConnell Avenue

Future Total - Scenario 2: Improvements  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.5		2.0	5.5	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1703	3471	1534	1734	3505	1509	1736	1685		1703	1776	
Flt Permitted	0.35	1.00	1.00	0.31	1.00	1.00	0.44	1.00		0.29	1.00	
Satd. Flow (perm)	632	3471	1534	572	3505	1509	800	1685		512	1776	
Volume (vph)	34	568	127	156	705	347	152	276	130	378	378	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	34	568	127	156	705	347	152	276	130	378	378	0
RTOR Reduction (vph)	0	0	86	0	0	208	0	17	0	0	0	0
Lane Group Flow (vph)	34	568	41	156	705	139	152	389	0	378	378	0
Confl. Peds. (#/hr)			5	5								
Heavy Vehicles (%)	6%	4%	2%	4%	3%	7%	4%	7%	8%	6%	7%	50%
Turn Type	Perm		Perm pm+pt		Perm pm+pt			pm+pt				
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	31.0	31.0	31.0	39.0	39.0	39.0	40.4	30.0		48.5	35.1	
Effective Green, g (s)	32.0	32.0	32.0	43.0	40.0	40.0	45.9	31.0		53.0	36.1	
Actuated g/C Ratio	0.32	0.32	0.32	0.43	0.40	0.40	0.46	0.31		0.53	0.36	
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.5		3.0	6.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	202	1111	491	316	1402	604	474	522		468	641	
v/s Ratio Prot		0.16		0.03	c0.20		0.04	c0.23		c0.13	0.21	
v/s Ratio Perm	0.05		0.03	0.18		0.09	0.11			0.30		
v/c Ratio	0.17	0.51	0.08	0.49	0.50	0.23	0.32	0.75		0.81	0.59	
Uniform Delay, d1	24.4	27.6	23.7	18.5	22.5	19.8	16.3	31.0		16.5	25.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.86	0.82	
Incremental Delay, d2	1.8	1.7	0.3	1.2	1.3	0.9	0.4	9.9		9.1	3.4	
Delay (s)	26.2	29.3	24.1	19.8	23.8	20.7	16.7	40.9		23.3	24.6	
Level of Service	C	C	C	B	C	C	B	D		C	C	
Approach Delay (s)		28.3			22.4			34.3			23.9	
Approach LOS		C			C			C			C	

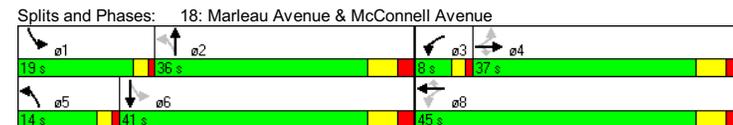
Intersection Summary			
HCM Average Control Delay	26.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	97.2%	ICU Level of Service	F
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
18: Marleau Avenue & McConnell Avenue

Future Total - Scenario 2: Improvements  
Weekday A.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	34	568	127	156	705	347	152	276	378	378
Lane Group Flow (vph)	34	568	127	156	705	347	152	406	378	378
Turn Type	Perm		Perm pm+pt		Perm pm+pt			pm+pt		
Protected Phases		4		3	8		5	2	1	6
Permitted Phases	4		4	8		8	2		6	
Detector Phases	4	4	4	3	8	8	5	2	1	6
Minimum Initial (s)	21.7	21.7	21.7	5.0	21.7	21.7	10.0	15.0	10.0	15.0
Minimum Split (s)	36.1	36.1	36.1	8.0	38.7	38.7	14.0	31.9	14.0	31.9
Total Split (s)	37.0	37.0	37.0	8.0	45.0	45.0	14.0	36.0	19.0	41.0
Total Split (%)	37.0%	37.0%	37.0%	8.0%	45.0%	45.0%	14.0%	36.0%	19.0%	41.0%
Yellow Time (s)	4.1	4.1	4.1	2.0	4.1	4.1	2.0	4.1	2.0	4.1
All-Red Time (s)	1.9	1.9	1.9	1.0	1.9	1.9	1.0	2.4	1.0	2.4
Lead/Lag	Lag	Lag	Lag	Lead			Lead	Lag	Lead	Lag
Lead-Lag Optimize?										
Recall Mode	C-Max	C-Max	C-Max	None	C-Max	C-Max	None	Max	None	Max
v/c Ratio	0.17	0.51	0.22	0.50	0.50	0.43	0.32	0.75	0.81	0.59
Control Delay	27.2	29.6	5.6	24.3	24.1	4.0	14.5	40.3	27.7	25.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.2	29.6	5.6	24.3	24.1	4.0	14.5	40.3	27.7	25.2
Queue Length 50th (m)	5.0	49.2	0.0	19.4	55.7	0.0	15.2	70.6	39.6	62.1
Queue Length 95th (m)	14.9	75.7	16.5	37.7	84.4	27.0	29.7	#142.0m#99.7m109.9		
Internal Link Dist (m)		264.6			914.0		258.2		283.7	
Turn Bay Length (m)			84.0	71.0		71.0	77.0		130.0	
Base Capacity (vph)	203	1111	577	315	1402	812	481	539	470	641
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	0.17	0.51	0.22	0.50	0.50	0.43	0.32	0.75	0.80	0.59

Intersection Summary	
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	77 (77%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle:	90
Control Type:	Actuated-Coordinated
#	95th percentile volume exceeds capacity, queue may be longer.
m	Queue shown is maximum after two cycles.
m	Volume for 95th percentile queue is metered by upstream signal.



HCM Signalized Intersection Capacity Analysis  
13: Marleau Avenue & Virginia Avenue

Future Total - Scenario 2: Improvements  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5		5.3	5.3			5.3	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.95			0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00			1.00	
Satd. Flow (prot)	1433	1827	1553	1805	1845		1766	1803			1858	
Flt Permitted	0.11	1.00	1.00	0.22	1.00		0.55	1.00			1.00	
Satd. Flow (perm)	170	1827	1553	419	1845		1020	1803			1858	
Volume (vph)	15	788	168	63	958	0	189	115	59	0	197	19
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	15	788	168	63	958	0	189	115	59	0	197	19
RTOR Reduction (vph)	0	0	20	0	0	0	0	27	0	0	5	0
Lane Group Flow (vph)	15	788	148	63	958	0	189	147	0	0	211	0
Confl. Peds. (#/hr)							3					3
Heavy Vehicles (%)	26%	4%	4%	0%	3%	0%	2%	0%	0%	0%	0%	9%
Turn Type	Perm		Perm	Perm		Perm	Perm			Perm		
Protected Phases		4			8			2				6
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	43.9	43.9	43.9	43.9	43.9		18.3	18.3			18.3	
Effective Green, g (s)	44.9	44.9	44.9	44.9	44.9		19.3	19.3			19.3	
Actuated g/C Ratio	0.60	0.60	0.60	0.60	0.60		0.26	0.26			0.26	
Clearance Time (s)	6.5	6.5	6.5	6.5	6.5		6.3	6.3			6.3	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)	102	1094	930	251	1105		262	464			478	
v/s Ratio Prot		0.43			0.52			0.08			0.11	
v/s Ratio Perm	0.09		0.10	0.15			0.19					
v/c Ratio	0.15	0.72	0.16	0.25	0.87		0.72	0.32			0.44	
Uniform Delay, d1	6.6	10.6	6.7	7.1	12.6		25.4	22.5			23.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	3.0	4.2	0.4	2.4	10.2		9.9	0.4			0.7	
Delay (s)	9.7	14.8	7.0	9.5	22.7		35.3	22.9			24.0	
Level of Service	A	B	A	A	C		D	C			C	
Approach Delay (s)		13.4			21.9			29.4			24.0	
Approach LOS		B			C			C			C	

Intersection Summary

HCM Average Control Delay	19.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	91.3%	ICU Level of Service	F
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
13: Marleau Avenue & Virginia Avenue

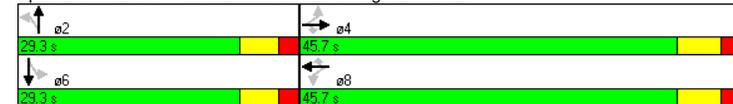
Future Total - Scenario 2: Improvements  
Weekday P.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	15	788	168	63	958	189	115	197
Lane Group Flow (vph)	15	788	168	63	958	189	174	216
Turn Type	Perm		Perm	Perm		Perm		
Protected Phases		4			8		2	6
Permitted Phases	4		4	8		2		
Detector Phases	4	4	4	8	8	2	2	6
Minimum Initial (s)	18.2	18.2	18.2	18.0	18.0	15.0	15.0	15.0
Minimum Split (s)	35.7	35.7	35.7	35.7	35.7	29.3	29.3	29.3
Total Split (s)	45.7	45.7	45.7	45.7	45.7	29.3	29.3	29.3
Total Split (%)	60.9%	60.9%	60.9%	60.9%	60.9%	39.1%	39.1%	39.1%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.1	4.1	4.1
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.2	2.2	2.2
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	C-Max	C-Max	C-Max	C-Max	C-Max	None	None	None
v/c Ratio	0.17	0.72	0.18	0.33	0.87	0.68	0.35	0.45
Control Delay	14.0	16.9	6.0	15.0	25.9	38.3	19.1	25.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.0	16.9	6.0	15.0	25.9	38.3	19.1	25.0
Queue Length 50th (m)	0.9	72.4	6.7	4.1	104.2	25.6	16.7	26.3
Queue Length 95th (m)	6.2	#195.3	20.5	18.6	#257.8	#51.3	34.6	47.3
Internal Link Dist (m)		914.0			682.0		404.6	283.6
Turn Bay Length (m)	25.0		10.0	25.0		25.0		
Base Capacity (vph)	90	1093	949	193	1104	345	601	599
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	0.17	0.72	0.18	0.33	0.87	0.55	0.29	0.36

Intersection Summary

Cycle Length: 75  
Actuated Cycle Length: 75  
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green  
Natural Cycle: 80  
Control Type: Actuated-Coordinated  
# 95th percentile volume exceeds capacity, queue may be longer.  
Queue shown is maximum after two cycles.

Splits and Phases: 13: Marleau Avenue & Virginia Avenue



HCM Signalized Intersection Capacity Analysis  
18: Marleau Avenue & McConnell Avenue

Future Total - Scenario 2: Improvements  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.5		2.0	5.5	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1719	3438	1561	1769	3539	1568	1786	1805		1719	1790	
Flt Permitted	0.27	1.00	1.00	0.19	1.00	1.00	0.41	1.00		0.11	1.00	
Satd. Flow (perm)	496	3438	1561	350	3539	1568	775	1805		203	1790	
Volume (vph)	39	694	178	124	756	365	275	516	99	375	383	68
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	39	694	178	124	756	365	275	516	99	375	383	68
RTOR Reduction (vph)	0	0	132	0	0	243	0	7	0	0	6	0
Lane Group Flow (vph)	39	694	46	124	756	122	275	608	0	375	445	0
Confl. Peds. (#/hr)			2	2			3		2	2		3
Heavy Vehicles (%)	5%	5%	1%	2%	2%	3%	1%	2%	4%	5%	2%	12%
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt			pm+pt		
Protected Phases		4			3		8		5		2	1
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	24.8	24.8	24.8	32.3	32.3	32.3	45.3	34.2		55.2	41.1	
Effective Green, g (s)	25.8	25.8	25.8	36.3	33.3	33.3	50.8	35.2		59.7	42.1	
Actuated g/C Ratio	0.26	0.26	0.26	0.36	0.33	0.33	0.51	0.35		0.60	0.42	
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.5		3.0	6.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	128	887	403	205	1178	522	516	635		409	754	
v/s Ratio Prot		c0.20		0.03	c0.21		0.06	c0.34		c0.17	0.25	
v/s Ratio Perm	0.08		0.03	0.19		0.08	0.21			0.37		
v/c Ratio	0.30	0.78	0.11	0.60	0.64	0.23	0.53	0.96		0.92	0.59	
Uniform Delay, d1	29.9	34.5	28.4	23.3	28.3	24.1	14.6	31.7		27.6	22.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.02	0.76	
Incremental Delay, d2	1.4	4.7	0.1	5.1	1.2	0.2	1.1	41.3		28.2	2.8	
Delay (s)	31.2	39.2	28.5	28.4	29.5	24.3	15.7	73.0		56.3	19.6	
Level of Service	C	D	C	C	C	C	B	E		E	B	
Approach Delay (s)		36.8			27.9			55.3			36.3	
Approach LOS		D			C			E			D	

Intersection Summary

HCM Average Control Delay	38.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	17.5
Intersection Capacity Utilization	107.8%	ICU Level of Service	G
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
18: Marleau Avenue & McConnell Avenue

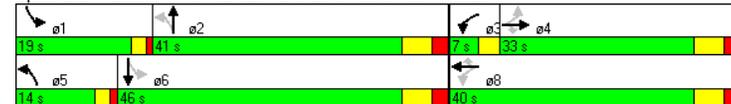
Future Total - Scenario 2: Improvements  
Weekday P.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	39	694	178	124	756	365	275	516	375	383
Lane Group Flow (vph)	39	694	178	124	756	365	275	615	375	451
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		pm+pt	
Protected Phases		4			3		8		5	2
Permitted Phases	4		4	8		8	2		6	
Detector Phases	4	4	4	3	8	8	5	2	1	6
Minimum Initial (s)	20.0	20.0	20.0	3.0	20.0	20.0	11.0	20.0	11.0	20.0
Minimum Split (s)	33.0	33.0	33.0	7.0	28.0	28.0	14.0	33.5	14.0	28.5
Total Split (s)	33.0	33.0	33.0	7.0	40.0	40.0	14.0	41.0	19.0	46.0
Total Split (%)	33.0%	33.0%	33.0%	7.0%	40.0%	40.0%	14.0%	41.0%	19.0%	46.0%
Yellow Time (s)	4.1	4.1	4.1	3.0	4.1	4.1	2.0	4.1	2.0	4.1
All-Red Time (s)	1.9	1.9	1.9	0.0	1.9	1.9	1.0	2.4	1.0	2.4
Lead/Lag	Lag	Lag	Lag	Lead			Lead	Lag	Lead	Lag
Lead-Lag Optimize?										
Recall Mode	Min	C-Min	Min	C-Min						
v/c Ratio	0.30	0.78	0.33	0.57	0.64	0.48	0.56	0.96	0.91	0.59
Control Delay	35.8	41.7	6.2	33.8	31.1	4.8	15.3	73.2	55.9	20.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.8	41.7	6.2	33.8	31.1	4.8	15.3	73.2	55.9	20.0
Queue Length 50th (m)	6.2	67.6	0.0	16.8	66.8	0.0	25.7	118.9	44.0	70.6
Queue Length 95th (m)	18.5	101.9	21.2	#37.7	99.8	31.0	46.7	#229.1	#139.9	109.1
Internal Link Dist (m)		264.6			914.0			195.9		283.7
Turn Bay Length (m)			84.0	71.0		71.0	77.0		130.0	
Base Capacity (vph)	142	963	565	217	1239	786	493	648	413	760
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	0.27	0.72	0.32	0.57	0.61	0.46	0.56	0.95	0.91	0.59

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 96 (96%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 18: Marleau Avenue & McConnell Avenue



*Future Total- Scenario 1 with Expansion*

HCM Signalized Intersection Capacity Analysis  
5: SCM Way & Boundary Road

Future Total - Scenario 1 + Expansion  
Weekday A.M. Peak Hour

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↕	↕
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2	6.2	5.2	5.2	5.2	5.2
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frbp, ped/bikes	1.00	0.97	1.00	1.00	1.00	1.00
Flpb, ped/bikes	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	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1056	917	1253	1397	1638	1049
Flt Permitted	0.95	1.00	0.10	1.00	1.00	1.00
Satd. Flow (perm)	1056	917	135	1397	1638	1049
Volume (vph)	56	14	18	436	1054	76
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	56	14	18	436	1054	76
RTOR Reduction (vph)	0	11	0	0	0	17
Lane Group Flow (vph)	56	3	18	436	1054	59
Confl. Peds. (#/hr)	3					
Heavy Vehicles (%)	71%	71%	44%	36%	16%	54%
Turn Type	Perm		Perm		Perm	
Protected Phases	4		2		6	
Permitted Phases	4		2		6	
Actuated Green, G (s)	21.4	21.4	65.2	65.2	65.2	65.2
Effective Green, g (s)	22.4	22.4	66.2	66.2	66.2	66.2
Actuated g/C Ratio	0.22	0.22	0.66	0.66	0.66	0.66
Clearance Time (s)	7.2	7.2	6.2	6.2	6.2	6.2
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	237	205	89	925	1084	694
v/s Ratio Prot	c0.05		0.31		c0.64	
v/s Ratio Perm	0.00		0.13		0.06	
v/c Ratio	0.24	0.02	0.20	0.47	0.97	0.09
Uniform Delay, d1	31.8	30.2	6.6	8.3	16.0	6.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	0.0	5.1	1.7	34.5	0.2
Delay (s)	32.3	30.2	11.7	10.0	50.5	6.3
Level of Service	C	C	B	B	D	A
Approach Delay (s)	31.9		10.1		47.5	
Approach LOS	C		B		D	

Intersection Summary			
HCM Average Control Delay	36.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	11.4
Intersection Capacity Utilization	94.6%	ICU Level of Service	F
Analysis Period (min)	60		
c Critical Lane Group			

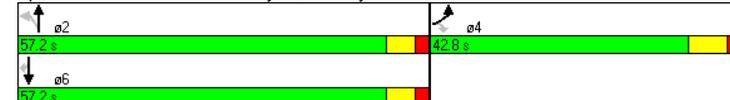
Queues  
5: SCM Way & Boundary Road

Future Total - Scenario 1 + Expansion  
Weekday A.M. Peak Hour

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↕	↕
Volume (vph)	56	14	18	436	1054	76
Lane Group Flow (vph)	56	14	18	436	1054	76
Turn Type	Perm		Perm		Perm	
Protected Phases	4		2		6	
Permitted Phases	4		2		6	
Detector Phases	4		2		6	
Minimum Initial (s)	35.6	35.6	15.0	15.0	15.0	15.0
Minimum Split (s)	42.8	42.8	57.2	57.2	57.2	57.2
Total Split (s)	42.8	42.8	57.2	57.2	57.2	57.2
Total Split (%)	42.8%	42.8%	57.2%	57.2%	57.2%	57.2%
Yellow Time (s)	5.4	5.4	4.1	4.1	4.1	4.1
All-Red Time (s)	1.8	1.8	2.1	2.1	2.1	2.1
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.15	0.04	0.25	0.44	0.90	0.10
Control Delay	22.6	10.1	26.6	14.4	36.0	6.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.6	10.1	26.6	14.4	36.0	6.0
Queue Length 50th (m)	7.6	0.0	2.0	59.2	~268.1	2.6
Queue Length 95th (m)	19.0	4.9	#14.3	111.1	#404.7	11.8
Internal Link Dist (m)	265.1		548.2 424.1			
Turn Bay Length (m)	62.0		80.0		65.0	
Base Capacity (vph)	386	344	73	994	1166	761
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	0.15	0.04	0.25	0.44	0.90	0.10

Intersection Summary	
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	130
Control Type:	Actuated-Coordinated
~	Volume exceeds capacity, queue is theoretically infinite. Queue shown is maximum after two cycles.
#	95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.

Splits and Phases: 5: SCM Way & Boundary Road



HCM Unsignalized Intersection Capacity Analysis Future Total - Scenario 1 + Expansion  
6: Optimum Drive & SCM Way Weekday A.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control	Free	Free	Free	Free	Stop	Stop
Grade	0%	0%	0%	0%	0%	0%
Volume (veh/h)	0	0	0	84	57	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	84	57	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)	289					
pX, platoon unblocked						
vC, conflicting volume	84					42 42
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	84					42 42
tC, single (s)	4.1					7.4 6.2
tC, 2 stage (s)						
tF (s)	2.2					4.4 3.3
p0 queue free %	100					93 100
cM capacity (veh/h)	1526					770 1034

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	0	84	57
Volume Left	0	0	57
Volume Right	0	84	0
cSH	1700	1700	770
Volume to Capacity	0.00	0.05	0.07
Queue Length 95th (m)	0.0	0.0	1.9
Control Delay (s)	0.0	0.0	10.0
Lane LOS	B		
Approach Delay (s)	0.0	0.0	10.0
Approach LOS	B		

Intersection Summary			
Average Delay	4.1		
Intersection Capacity Utilization	15.2%	ICU Level of Service	A
Analysis Period (min)	60		

HCM Unsignalized Intersection Capacity Analysis Future Total - Scenario 1 + Expansion  
7: Industrial Park Dr & Boundary Road Weekday A.M. Peak Hour

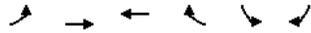


Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↕	↕	↕	↕	↕	↕
Sign Control	Stop	Free	Free	Free	Free	Free
Grade	0%	0%	0%	0%	0%	0%
Volume (veh/h)	104	86	69	350	924	144
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	104	86	69	350	924	144
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1484	996	1068			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1484	996	1068			
tC, single (s)	7.1	6.3	4.1			
tC, 2 stage (s)						
tF (s)	4.2	3.4	2.2			
p0 queue free %	0	70	89			
cM capacity (veh/h)	85	290	649			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1
Volume Total	104	86	69	350	1068
Volume Left	104	0	69	0	0
Volume Right	0	86	0	0	144
cSH	85	290	649	1700	1700
Volume to Capacity	1.22	0.30	0.11	0.21	0.63
Queue Length 95th (m)	144.4	10.0	2.9	0.0	0.0
Control Delay (s)	610.2	22.6	11.2	0.0	0.0
Lane LOS	F	C	B		
Approach Delay (s)	344.2		1.8	0.0	
Approach LOS	F				

Intersection Summary			
Average Delay	39.5		
Intersection Capacity Utilization	69.8%	ICU Level of Service	C
Analysis Period (min)	60		

HCM Unsignalized Intersection Capacity Analysis Future Total - Scenario 1 + Expansion  
 9: Industrial Park Dr & Optimum Drive Weekday A.M. Peak Hour

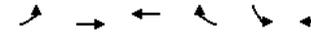


Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	152	141	9	8	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	152	141	9	8	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	150				298	146
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	150				298	146
tC, single (s)	4.1				7.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				4.4	3.3
p0 queue free %	100				98	100
cM capacity (veh/h)	1444				529	907

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	152	150	8
Volume Left	0	0	8
Volume Right	0	9	0
cSH	1444	1700	529
Volume to Capacity	0.00	0.09	0.02
Queue Length 95th (m)	0.0	0.0	0.4
Control Delay (s)	0.0	0.0	11.9
Lane LOS			B
Approach Delay (s)	0.0	0.0	11.9
Approach LOS			B

Intersection Summary			
Average Delay		0.3	
Intersection Capacity Utilization	18.0%		ICU Level of Service A
Analysis Period (min)		60	

HCM Unsignalized Intersection Capacity Analysis Future Total - Scenario 1 + Expansion  
 11: Boundary Access & Truck Access Weekday A.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	0	0	0	0	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0				0	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				0	0
tC, single (s)	5.1				6.4	7.2
tC, 2 stage (s)						
tF (s)	3.1				3.5	4.2
p0 queue free %	100				100	100
cM capacity (veh/h)	1161				1029	857

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	0	0	0
Volume Left	0	0	0
Volume Right	0	0	0
cSH	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0
Lane LOS			A
Approach Delay (s)	0.0	0.0	0.0
Approach LOS			A

Intersection Summary			
Average Delay		0.0	
Intersection Capacity Utilization	0.0%		ICU Level of Service A
Analysis Period (min)		60	

HCM Signalized Intersection Capacity Analysis  
13: Marleau Avenue & Nick Kaneb Drive

Future Total - Scenario 1 + Expansion  
Weekday A.M. Peak Hour

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.3	5.3
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.97	1.00	1.00	1.00	1.00
Flpb, ped/bikes	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)	1810	1489	1719	1810	1719	1509
Flt Permitted	1.00	1.00	0.17	1.00	0.95	1.00
Satd. Flow (perm)	1810	1489	304	1810	1719	1509
Volume (vph)	840	235	40	789	393	30
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	840	235	40	789	393	30
RTOR Reduction (vph)	0	28	0	0	0	22
Lane Group Flow (vph)	840	207	40	789	393	8
Confl. Peds. (#/hr)	7	7	7	7	2	2
Heavy Vehicles (%)	5%	5%	5%	5%	5%	7%
Turn Type	Perm	Perm			Perm	
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	42.3	42.3	42.3	42.3	19.9	19.9
Effective Green, g (s)	43.1	43.1	43.1	43.1	21.1	21.1
Actuated g/C Ratio	0.57	0.57	0.57	0.57	0.28	0.28
Clearance Time (s)	6.3	6.3	6.3	6.3	6.5	6.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1040	856	175	1040	484	425
v/s Ratio Prot	c0.46			0.44	c0.23	
v/s Ratio Perm		0.14	0.13			0.01
v/c Ratio	0.81	0.24	0.23	0.76	0.81	0.02
Uniform Delay, d1	12.7	7.9	7.8	12.0	25.1	19.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.1	0.7	3.0	5.4	10.8	0.0
Delay (s)	19.8	8.5	10.9	17.4	35.9	19.5
Level of Service	B	A	B	B	D	B
Approach Delay (s)	17.3			17.1	34.8	
Approach LOS	B			B	C	

Intersection Summary

HCM Average Control Delay	20.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	75.0%	ICU Level of Service	D
Analysis Period (min)	60		
c Critical Lane Group			

Queues

13: Marleau Avenue & Nick Kaneb Drive

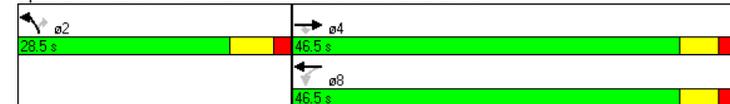
Future Total - Scenario 1 + Expansion  
Weekday A.M. Peak Hour

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Volume (vph)	840	235	40	789	393	30
Lane Group Flow (vph)	840	235	40	789	393	30
Turn Type	Perm	Perm			Perm	
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Detector Phases	4	4	8	8	2	2
Minimum Initial (s)	15.0	15.0	15.0	15.0	15.0	15.0
Minimum Split (s)	28.3	28.3	35.7	35.7	28.5	28.5
Total Split (s)	46.5	46.5	46.5	46.5	28.5	28.5
Total Split (%)	62.0%	62.0%	62.0%	62.0%	38.0%	38.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.5	4.5
All-Red Time (s)	2.2	2.2	2.2	2.2	2.0	2.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	C-Min	C-Min	C-Min	C-Min	None	None
v/c Ratio	0.81	0.27	0.27	0.76	0.81	0.07
Control Delay	22.1	7.0	15.1	19.3	40.8	7.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.1	7.0	15.1	19.3	40.8	7.8
Queue Length 50th (m)	97.7	11.8	3.0	87.1	51.9	0.0
Queue Length 95th (m)#213.2	28.3	12.3	#194.0	#111.5	6.6	
Internal Link Dist (m)	966.8		629.1	393.0		
Turn Bay Length (m)		10.0	25.0	25.0		
Base Capacity (vph)	1039	883	149	1039	532	488
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	0.81	0.27	0.27	0.76	0.74	0.06

Intersection Summary

Cycle Length: 75  
Actuated Cycle Length: 75  
Offset: 20 (27%), Referenced to phase 4:EBT and 8:WBTL, Start of Green  
Natural Cycle: 70  
Control Type: Actuated-Coordinated  
# 95th percentile volume exceeds capacity, queue may be longer.  
Queue shown is maximum after two cycles.

Splits and Phases: 13: Marleau Avenue & Nick Kaneb Drive



HCM Signalized Intersection Capacity Analysis  
14: Tenth Street & McConnell Avenue

Future Total - Scenario 1 + Expansion  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔			↕			↕			↕		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0			5.0			5.5			5.5		
Lane Util. Factor	1.00			1.00			1.00			1.00		
Frpb, ped/bikes	0.99			1.00			1.00			1.00		
Flpb, ped/bikes	1.00			0.99			1.00			1.00		
Frt	0.97			0.97			1.00			0.96		
Flt Protected	1.00			0.97			0.95			1.00		
Satd. Flow (prot)	1821			1680			1805			1714		
Flt Permitted	0.98			0.78			0.16			1.00		
Satd. Flow (perm)	1795			1352			298			1714		
Volume (vph)	1	12	4	285	17	96	5	724	260	89	877	1
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	1	12	4	285	17	96	5	724	260	89	877	1
RTOR Reduction (vph)	0	3	0	0	11	0	0	15	0	0	0	0
Lane Group Flow (vph)	0		14		0		0		387		0	
Confl. Peds. (#/hr)	5		5		2		2		2		2	
Heavy Vehicles (%)	0%		0%		5%		0%		5%		0%	
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases	4		8		8		2		2		6	
Permitted Phases	4		8		8		2		2		6	
Actuated Green, G (s)	28.2		28.2		59.3		59.3		59.3		59.3	
Effective Green, g (s)	29.2		29.2		60.3		60.3		60.3		60.3	
Actuated g/C Ratio	0.29		0.29		0.60		0.60		0.60		0.60	
Clearance Time (s)	6.0		6.0		6.5		6.5		6.5		6.5	
Vehicle Extension (s)	3.0		3.0		3.0		3.0		3.0		3.0	
Lane Grp Cap (vph)	524		395		180		1034		103		1061	
v/s Ratio Prot	c0.01		c0.29		0.02		0.52		0.86		0.83	
v/c Ratio	0.03		0.98		0.03		0.94		0.86		0.83	
Uniform Delay, d1	25.3		35.1		8.0		18.1		16.5		15.7	
Progression Factor	1.00		1.00		0.72		1.12		1.00		1.00	
Incremental Delay, d2	0.0		72.6		0.1		6.5		83.0		7.9	
Delay (s)	25.3		107.7		5.8		26.9		99.4		23.7	
Level of Service	C		F		A		C		F		C	
Approach Delay (s)	25.3		107.7		26.8		30.6		30.6		30.6	
Approach LOS	C		F		C		C		C		C	

Intersection Summary			
HCM Average Control Delay	41.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	104.8%	ICU Level of Service	G
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
14: Tenth Street & McConnell Avenue

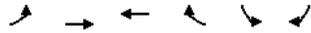
Future Total - Scenario 1 + Expansion  
Weekday A.M. Peak Hour

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↔			↕			↕	
Volume (vph)	1	12	285	17	5	724	89	877
Lane Group Flow (vph)	0	17	0	398	5	984	89	878
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases	4		8		2		6	
Permitted Phases	4		8		2		6	
Detector Phases	4		8		2		6	
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	28.0	28.0	28.0	28.0	28.5	28.5	28.5	28.5
Total Split (s)	28.0	28.0	28.0	28.0	72.0	72.0	72.0	72.0
Total Split (%)	28.0%	28.0%	28.0%	28.0%	72.0%	72.0%	72.0%	72.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	1.9	1.9	1.9	1.9	2.4	2.4	2.4	2.4
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Min	C-Min	C-Min	C-Min
v/c Ratio	0.03	0.98	0.02	0.94	0.54	0.83	0.54	0.83
Control Delay	25.2	111.9	4.4	25.9	24.2	23.3	24.2	23.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.2	111.9	4.4	25.9	24.2	23.3	24.2	23.3
Queue Length 50th (m)	2.0	~91.2	0.3	184.1	8.9	117.8	8.9	117.8
Queue Length 95th (m)	8.8	#185.0	m0.4m	193.9	#33.7	#214.2	#33.7	#214.2
Internal Link Dist (m)	414.9	896.3	283.7	1842.8	1842.8	1842.8	1842.8	1842.8
Turn Bay Length (m)			14.0		14.0			
Base Capacity (vph)	528	405	258	1152	182	1170	182	1170
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	0.03	0.98	0.02	0.85	0.49	0.75	0.49	0.75

Intersection Summary	
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	34 (34%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle:	90
Control Type:	Actuated-Coordinated
~	Volume exceeds capacity, queue is theoretically infinite.
	Queue shown is maximum after two cycles.
#	95th percentile volume exceeds capacity, queue may be longer.
	Queue shown is maximum after two cycles.
m	Volume for 95th percentile queue is metered by upstream signal.



HCM Unsignalized Intersection Capacity Analysis      Future Total - Scenario 1 + Expansion  
 16: Virginia Drive & Industrial Park Drive      Weekday A.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	↕
Sign Control		Free	Free		Stop	Stop
Grade		0%	0%		0%	0%
Volume (veh/h)	87	274	334	102	110	64
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	87	274	334	102	110	64
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	436				833	385
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	436				833	385
tC, single (s)	4.1				6.6	7.0
tC, 2 stage (s)						
tF (s)	2.2				3.6	4.0
p0 queue free %	92				63	88
cM capacity (veh/h)	1129				296	523
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	361	436	174			
Volume Left	87	0	110			
Volume Right	0	102	64			
cSH	1129	1700	352			
Volume to Capacity	0.08	0.26	0.49			
Queue Length 95th (m)	2.0	0.0	22.7			
Control Delay (s)	2.6	0.0	25.1			
Lane LOS	A		D			
Approach Delay (s)	2.6	0.0	25.1			
Approach LOS			D			
<b>Intersection Summary</b>						
Average Delay			5.5			
Intersection Capacity Utilization		63.0%		ICU Level of Service		B
Analysis Period (min)			60			

HCM Signalized Intersection Capacity Analysis  
17: Marleau Avenue & Boundary Road

Future Total - Scenario 1 + Expansion  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.7	6.7	6.7	6.7	6.7	6.7	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	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1612	1845	1553	1517	1881	1482	1626	1652	1429	1719	1759	1553
Flt Permitted	0.66	1.00	1.00	0.72	1.00	1.00	0.19	1.00	1.00	0.58	1.00	1.00
Satd. Flow (perm)	1119	1845	1553	1147	1881	1482	330	1652	1429	1046	1759	1553
Volume (vph)	121	59	74	32	153	23	46	275	15	40	691	279
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	121	59	74	32	153	23	46	275	15	40	691	279
RTOR Reduction (vph)	0	0	48	0	0	15	0	0	8	0	0	126
Lane Group Flow (vph)	121	59	26	32	153	8	46	275	7	40	691	153
Heavy Vehicles (%)	12%	3%	4%	19%	1%	9%	11%	15%	13%	5%	8%	4%
Turn Type	Perm											
Protected Phases		4		8	8		2	2		6	6	
Permitted Phases	4		4	8	8	2		2	6	6		6
Actuated Green, G (s)	23.4	23.4	23.4	23.4	23.4	31.9	31.9	31.9	31.9	31.9	31.9	31.9
Effective Green, g (s)	24.4	24.4	24.4	24.4	24.4	32.9	32.9	32.9	32.9	32.9	32.9	32.9
Actuated g/C Ratio	0.35	0.35	0.35	0.35	0.35	0.47	0.47	0.47	0.47	0.47	0.47	0.47
Clearance Time (s)	7.7	7.7	7.7	7.7	7.7	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	390	643	541	400	656	517	155	776	672	492	827	730
v/s Ratio Prot		0.03			0.08			0.17			0.39	
v/s Ratio Perm	0.11		0.02	0.03		0.01	0.14		0.00	0.04		0.10
v/c Ratio	0.31	0.09	0.05	0.08	0.23	0.02	0.30	0.35	0.01	0.08	0.84	0.21
Uniform Delay, d1	16.7	15.3	15.1	15.3	16.2	14.9	11.4	11.8	9.9	10.2	16.2	10.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	0.1	0.0	0.1	0.2	0.0	4.9	1.3	0.0	0.3	10.7	0.7
Delay (s)	17.1	15.4	15.1	15.4	16.4	14.9	16.3	13.1	9.9	10.5	26.9	11.6
Level of Service	B	B	B	B	B	B	B	A	B	C	B	B
Approach Delay (s)		16.1			16.0			13.4			22.0	
Approach LOS		B			B			B			C	

Intersection Summary			
HCM Average Control Delay	18.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.7
Intersection Capacity Utilization	103.2%	ICU Level of Service	G
Analysis Period (min)	60		
c Critical Lane Group			

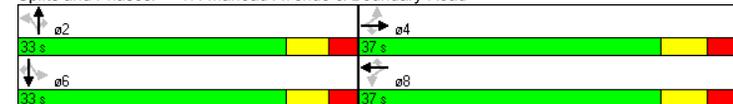
Queues  
17: Marleau Avenue & Boundary Road

Future Total - Scenario 1 + Expansion  
Weekday A.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	121	59	74	32	153	23	46	275	15	40	691	279
Lane Group Flow (vph)	121	59	74	32	153	23	46	275	15	40	691	279
Turn Type	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm
Protected Phases		4		8	8		2	2		6	6	
Permitted Phases	4		4	8	8	2		2	6	6		6
Detector Phases	4	4	4	8	8	8	2	2	2	6	6	6
Minimum Initial (s)	29.3	29.3	29.3	29.3	29.3	29.3	15.0	15.0	15.0	15.0	15.0	15.0
Minimum Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	23.0	23.0	23.0	23.0	23.0	23.0
Total Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (%)	52.9%	52.9%	52.9%	52.9%	52.9%	52.9%	47.1%	47.1%	47.1%	47.1%	47.1%	47.1%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	3.2	3.2	3.2	3.2	3.2	3.2	2.9	2.9	2.9	2.9	2.9	2.9
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.25	0.07	0.10	0.06	0.19	0.04	0.36	0.33	0.02	0.08	0.77	0.31
Control Delay	14.4	12.0	3.8	12.1	13.1	5.3	28.3	16.1	7.2	14.5	29.4	4.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.4	12.0	3.8	12.1	13.1	5.3	28.3	16.1	7.2	14.5	29.4	4.6
Queue Length 50th (m)	10.2	4.6	0.0	2.5	12.5	0.0	4.6	27.1	0.0	3.4	~96.5	3.6
Queue Length 95th (m)	24.3	12.3	8.1	8.1	26.7	4.4	#22.7	54.2	3.9	10.7	#194.3	23.9
Internal Link Dist (m)		2051.6			246.6			346.9			725.5	
Turn Bay Length (m)	46.0			68.0		48.0	34.0			68.0		48.0
Base Capacity (vph)	485	799	714	497	814	655	129	840	734	508	894	907
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.07	0.10	0.06	0.19	0.04	0.36	0.33	0.02	0.08	0.77	0.31

Intersection Summary	
Cycle Length:	70
Actuated Cycle Length:	70
Offset:	0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle:	75
Control Type:	Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite. Queue shown is maximum after two cycles.	
# 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.	

Splits and Phases: 17: Marleau Avenue & Boundary Road



HCM Signalized Intersection Capacity Analysis  
18: Marleau Avenue & McConnell Avenue

Future Total - Scenario 1 + Expansion  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0	5.0	2.0	5.0	5.0	2.0	5.5		2.0	5.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1597	1827	1532	1736	1845	1538	1736	1732		1736	1810	
Flt Permitted	0.12	1.00	1.00	0.12	1.00	1.00	0.35	1.00		0.13	1.00	
Satd. Flow (perm)	210	1827	1532	215	1845	1538	636	1732		244	1810	
Volume (vph)	118	536	127	156	670	465	152	406	130	540	525	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	118	536	127	156	670	465	152	406	130	540	525	0
RTOR Reduction (vph)	0	0	90	0	247	0	11	0	0	0	0	0
Lane Group Flow (vph)	118	536	37	156	670	218	152	525	0	540	525	0
Confl. Peds. (#/hr)			5	5								
Heavy Vehicles (%)	13%	4%	2%	4%	3%	5%	4%	5%	8%	4%	5%	12%
Turn Type	Perm		Perm pm+pt		Perm pm+pt			pm+pt				
Protected Phases		4		3	8		5	2		1		6
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	28.0	28.0	28.0	37.0	37.0	37.0	34.5	23.5		50.5	36.5	
Effective Green, g (s)	32.0	29.0	29.0	41.0	38.0	38.0	40.0	24.5		55.0	37.5	
Actuated g/C Ratio	0.32	0.29	0.29	0.41	0.38	0.38	0.40	0.24		0.55	0.38	
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.5		3.0	6.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	67	530	444	195	701	584	386	424		507	679	
v/s Ratio Prot		0.29		0.06	0.36		0.05	0.30		0.27	0.29	
v/s Ratio Perm	0.56		0.02	0.27		0.14	0.11			0.32		
v/c Ratio	1.76	1.01	0.08	0.80	0.96	0.37	0.39	1.24		1.07	0.77	
Uniform Delay, d1	34.0	35.5	25.8	23.4	30.2	22.4	20.0	37.8		29.0	27.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.73	0.89	
Incremental Delay, d2	1429.7	89.5	0.1	23.6	35.4	0.4	0.7	448.5		140.3	4.3	
Delay (s)	1463.7	125.0	25.9	47.0	65.5	22.8	20.7	486.2		161.5	28.8	
Level of Service	F	F	C	D	E	C	C	F		F	C	
Approach Delay (s)		311.1			47.9			383.4			96.1	
Approach LOS		F			D			F			F	

Intersection Summary

HCM Average Control Delay	175.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.38		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	14.5
Intersection Capacity Utilization	126.5%	ICU Level of Service	H
Analysis Period (min)	60		
c Critical Lane Group			

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Synchro 6 Report  
16/10/2010

LEA Consulting, Ltd.

Queues

18: Marleau Avenue & McConnell Avenue

Future Total - Scenario 1 + Expansion  
Weekday A.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	118	536	127	156	670	465	152	406	540	525
Lane Group Flow (vph)	118	536	127	156	670	465	152	536	540	525
Turn Type	Perm		Perm pm+pt		Perm pm+pt			pm+pt		
Protected Phases		4		3	8		5	2	1	6
Permitted Phases	4		4	8		8	2		6	
Detector Phases	4	4	4	3	8	8	5	2	1	6
Minimum Initial (s)	20.0	20.0	20.0	5.0	20.0	20.0	11.0	15.0	10.0	15.0
Minimum Split (s)	26.0	26.0	26.0	9.0	26.0	26.0	14.0	26.5	14.0	26.5
Total Split (s)	34.0	34.0	34.0	9.0	43.0	43.0	14.0	30.0	27.0	43.0
Total Split (%)	34.0%	34.0%	34.0%	9.0%	43.0%	43.0%	14.0%	30.0%	27.0%	43.0%
Yellow Time (s)	4.1	4.1	4.1	2.0	4.1	4.1	2.0	4.1	2.0	4.1
All-Red Time (s)	1.9	1.9	1.9	1.0	1.9	1.9	1.0	2.4	1.0	2.4
Lead/Lag	Lag	Lag	Lag	Lead			Lead	Lag	Lead	Lag
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	None	None	C-Max	None	C-Max
v/c Ratio	1.76	1.01	0.24	0.80	0.96	0.56	0.39	1.23	1.07	0.77
Control Delay	1456.0	126.2	6.1	56.3	69.2	7.0	15.9	467.4	162.9	29.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	1456.0	126.2	6.1	56.3	69.2	7.0	15.9	467.4	162.9	29.7
Queue Length 50th (m)	~36.0	~111.5	0.0	20.2	131.0	8.7	14.5	~134.2	~105.7	100.5
Queue Length 95th (m)	#70.0	#213.5	17.3	#61.9	#245.2	52.8	28.2	#234.0	#143.2	#116.4
Internal Link Dist (m)		264.6			966.8			256.5		283.7
Turn Bay Length (m)			84.0	71.0		71.0	77.0		130.0	
Base Capacity (vph)	67	530	534	195	701	831	386	436	507	679
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	1.76	1.01	0.24	0.80	0.96	0.56	0.39	1.23	1.07	0.77

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 96 (96%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 18: Marleau Avenue & McConnell Avenue



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Synchro 6 Report  
16/10/2010

LEA Consulting, Ltd.

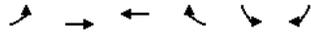
HCM Unsignalized Intersection Capacity Analysis Future Total - Scenario 1 + Expansion  
 22: Hwy 401 WB Ramp & Boundary Road Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗	↖	↕	↗		↕	↗		↕	↗
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	2	1	144	67	28	8	69	279	22	8	730	9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	2	1	144	67	28	8	69	279	22	8	730	9
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1200	1190	734	1323	1183	290	739			301		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1200	1190	734	1323	1183	290	739			301		
tC, single (s)	7.1	6.5	6.4	7.1	6.5	6.2	4.4			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.5	3.5	4.0	3.3	2.5			2.2		
p0 queue free %	98	99	63	14	84	99	91			99		
cM capacity (veh/h)	131	171	389	78	173	754	757			1272		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	3	144	67	36	370	747						
Volume Left	2	0	67	0	69	8						
Volume Right	0	144	0	8	22	9						
cSH	142	389	78	208	757	1272						
Volume to Capacity	0.02	0.37	0.86	0.17	0.09	0.01						
Queue Length 95th (m)	0.5	13.9	61.1	5.0	2.4	0.2						
Control Delay (s)	30.8	19.7	219.6	25.9	2.8	0.2						
Lane LOS	D	C	F	D	A	A						
Approach Delay (s)	19.9		151.9		2.8	0.2						
Approach LOS	C		F									
<b>Intersection Summary</b>												
Average Delay			14.4									
Intersection Capacity Utilization	79.6%				ICU Level of Service		D					
Analysis Period (min)	60											

HCM Unsignalized Intersection Capacity Analysis Future Total - Scenario 1 + Expansion  
 25: Hwy 401 EB Ramp & Boundary Road Weekday A.M. Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖	↗	↕	↖	↖	↕
Sign Control	Stop	↗	Free	↖		Free
Grade	0%		0%			0%
Volume (veh/h)	199	13	357	135	10	931
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	199	13	357	135	10	931
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1308	357			492	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1308	357			492	
tC, single (s)	6.7	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.7	3.3			2.2	
p0 queue free %	0	98			99	
cM capacity (veh/h)	154	692			1082	
Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	
Volume Total	199	13	357	135	941	
Volume Left	199	0	0	0	10	
Volume Right	0	13	0	135	0	
cSH	154	692	1700	1700	1082	
Volume to Capacity	1.29	0.02	0.21	0.08	0.01	
Queue Length 95th (m)	253.4	0.5	0.0	0.0	0.2	
Control Delay (s)	635.8	10.3	0.0	0.0	0.3	
Lane LOS	F	B			A	
Approach Delay (s)	597.4		0.0		0.3	
Approach LOS	F					
<b>Intersection Summary</b>						
Average Delay			77.1			
Intersection Capacity Utilization	74.7%				ICU Level of Service	
Analysis Period (min)	60					

HCM Unsignalized Intersection Capacity Analysis      Future Total - Scenario 1 + Expansion  
 29: Tenth Street & Virginia Drive      Weekday A.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	↕
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	0	361	0	0	398
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	361	0	0	398
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	361				361	361
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	361				361	361
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	41
cM capacity (veh/h)	1209				642	677
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	0	361	398			
Volume Left	0	0	0			
Volume Right	0	0	398			
cSH	1700	1700	677			
Volume to Capacity	0.00	0.21	0.59			
Queue Length 95th (m)	0.0	0.0	33.3			
Control Delay (s)	0.0	0.0	17.8			
Lane LOS			C			
Approach Delay (s)	0.0	0.0	17.8			
Approach LOS			C			
<b>Intersection Summary</b>						
Average Delay			9.4			
Intersection Capacity Utilization		50.3%		ICU Level of Service		A
Analysis Period (min)			60			

HCM Signalized Intersection Capacity Analysis  
5: SCM Way & Boundary Road

Future Total - Scenario 1 + Expansion  
Weekday P.M. Peak Hour

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖ ↗	↖ ↗	↖ ↗	↖ ↗	↖ ↗	↖ ↗
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2	6.2	5.2	5.2	5.2	5.2
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	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1172	1583	1671	1667	1597	1022
Flt Permitted	0.95	1.00	0.31	1.00	1.00	1.00
Satd. Flow (perm)	1172	1583	553	1667	1597	1022
Volume (vph)	100	54	12	725	752	52
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	100	54	12	725	752	52
RTOR Reduction (vph)	0	47	0	0	0	12
Lane Group Flow (vph)	100	7	12	725	752	40
Heavy Vehicles (%)	54%	2%	8%	14%	19%	58%
Turn Type	Perm	Perm			Perm	
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	12.8	12.8	73.8	73.8	73.8	73.8
Effective Green, g (s)	13.8	13.8	74.8	74.8	74.8	74.8
Actuated g/C Ratio	0.14	0.14	0.75	0.75	0.75	0.75
Clearance Time (s)	7.2	7.2	6.2	6.2	6.2	6.2
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	162	218	414	1247	1195	764
v/s Ratio Prot	c0.09			0.43	c0.47	
v/s Ratio Perm		0.00	0.02			0.04
v/c Ratio	0.62	0.03	0.03	0.58	0.63	0.05
Uniform Delay, d1	40.6	37.3	3.2	5.6	6.0	3.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.0	0.1	0.1	2.0	2.5	0.1
Delay (s)	47.6	37.4	3.4	7.6	8.5	3.4
Level of Service	D	D	A	A	A	A
Approach Delay (s)	44.0			7.5	8.2	
Approach LOS	D			A	A	

Intersection Summary

HCM Average Control Delay	11.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	11.4
Intersection Capacity Utilization	61.6%	ICU Level of Service	B
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
5: SCM Way & Boundary Road

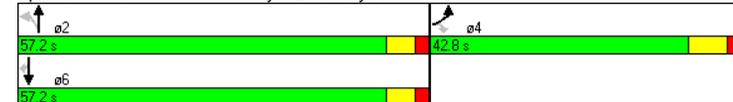
Future Total - Scenario 1 + Expansion  
Weekday P.M. Peak Hour

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖ ↗	↖ ↗	↖ ↗	↖ ↗	↖ ↗	↖ ↗
Volume (vph)	100	54	12	725	752	52
Lane Group Flow (vph)	100	54	12	725	752	52
Turn Type	Perm	Perm			Perm	
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Detector Phases	4	4	2	2	6	6
Minimum Initial (s)	15.0	15.0	20.0	20.0	20.0	20.0
Minimum Split (s)	42.8	42.8	28.2	28.2	28.2	28.2
Total Split (s)	42.8	42.8	57.2	57.2	57.2	57.2
Total Split (%)	42.8%	42.8%	57.2%	57.2%	57.2%	57.2%
Yellow Time (s)	5.4	5.4	4.1	4.1	4.1	4.1
All-Red Time (s)	1.8	1.8	2.1	2.1	2.1	2.1
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	C-Min	C-Min	C-Min	C-Min
v/c Ratio	0.51	0.17	0.05	0.56	0.61	0.07
Control Delay	47.5	11.1	5.3	8.7	9.8	1.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.5	11.1	5.3	8.7	9.8	1.8
Queue Length 50th (m)	19.0	0.0	0.6	61.2	67.6	0.2
Queue Length 95th (m)	39.4	12.6	3.1	138.0	161.1	4.7
Internal Link Dist (m)	265.1			548.2	424.1	
Turn Bay Length (m)	62.0		80.0			65.0
Base Capacity (vph)	429	614	225	1288	1233	800
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	0.23	0.09	0.05	0.56	0.61	0.07

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 5: SCM Way & Boundary Road



HCM Unsignalized Intersection Capacity Analysis Future Total - Scenario 1 + Expansion  
 6: Optimum Drive & SCM Way Weekday P.M. Peak Hour

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	↕
Sign Control	Free	Free	Free	Free	Stop	Stop
Grade	0%	0%	0%	0%	0%	0%
Volume (veh/h)	0	0	0	54	141	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	54	141	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)			289			
pX, platoon unblocked						
vC, conflicting volume	54				27	27
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	54				27	27
tC, single (s)	4.1				7.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				4.4	3.3
p0 queue free %	100				82	100
cM capacity (veh/h)	1564				787	1054
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	0	54	141			
Volume Left	0	0	141			
Volume Right	0	54	0			
cSH	1700	1700	787			
Volume to Capacity	0.00	0.03	0.18			
Queue Length 95th (m)	0.0	0.0	5.2			
Control Delay (s)	0.0	0.0	10.6			
Lane LOS			B			
Approach Delay (s)	0.0	0.0	10.6			
Approach LOS			B			
<b>Intersection Summary</b>						
Average Delay	7.6					
Intersection Capacity Utilization	17.8%			ICU Level of Service	A	
Analysis Period (min)	60					

HCM Unsignalized Intersection Capacity Analysis Future Total - Scenario 1 + Expansion  
 7: Industrial Park Dr & Boundary Road Weekday P.M. Peak Hour

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↕	↕	↕	↕	↕	↕
Sign Control	Stop	Free	Free	Free	Free	Free
Grade	0%	0%	0%	0%	0%	0%
Volume (veh/h)	138	259	101	599	535	271
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	138	259	101	599	535	271
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1472	672	807			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1472	672	807			
tC, single (s)	6.7	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.8	3.3	2.2			
p0 queue free %	0	43	87			
cM capacity (veh/h)	106	456	804			
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>NB 1</b>	<b>NB 2</b>	<b>SB 1</b>	
Volume Total	138	259	101	599	806	
Volume Left	138	0	101	0	0	
Volume Right	0	259	0	0	271	
cSH	106	456	804	1700	1700	
Volume to Capacity	1.31	0.57	0.13	0.35	0.47	
Queue Length 95th (m)	196.8	30.4	3.4	0.0	0.0	
Control Delay (s)	710.1	23.2	10.1	0.0	0.0	
Lane LOS	F	C	B			
Approach Delay (s)	262.0		1.5		0.0	
Approach LOS	F					
<b>Intersection Summary</b>						
Average Delay	55.2					
Intersection Capacity Utilization	68.0%			ICU Level of Service	C	
Analysis Period (min)	60					

HCM Unsignalized Intersection Capacity Analysis Future Total - Scenario 1 + Expansion  
 9: Industrial Park Dr & Optimum Drive Weekday P.M. Peak Hour

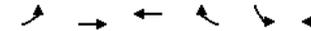


Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	119	116	9	8	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	119	116	9	8	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	125				240	120
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	125				240	120
tC, single (s)	4.1				7.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				4.4	3.3
p0 queue free %	100				99	100
cM capacity (veh/h)	1474				577	936

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	119	125	8
Volume Left	0	0	8
Volume Right	0	9	0
cSH	1474	1700	577
Volume to Capacity	0.00	0.07	0.01
Queue Length 95th (m)	0.0	0.0	0.3
Control Delay (s)	0.0	0.0	11.3
Lane LOS			B
Approach Delay (s)	0.0	0.0	11.3
Approach LOS			B

Intersection Summary			
Average Delay		0.4	
Intersection Capacity Utilization	16.7%	ICU Level of Service	A
Analysis Period (min)	60		

HCM Unsignalized Intersection Capacity Analysis Future Total - Scenario 1 + Expansion  
 11: Boundary Access & Truck Access Weekday P.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	0	0	0	0	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0				0	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				0	0
tC, single (s)	5.1				6.4	7.2
tC, 2 stage (s)						
tF (s)	3.1				3.5	4.2
p0 queue free %	100				100	100
cM capacity (veh/h)	1161				1029	857

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	0	0	0
Volume Left	0	0	0
Volume Right	0	0	0
cSH	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0
Lane LOS			A
Approach Delay (s)	0.0	0.0	0.0
Approach LOS			A

Intersection Summary			
Average Delay		0.0	
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	60		

HCM Signalized Intersection Capacity Analysis  
13: Marleau Avenue & Nick Kaneb Drive

Future Total - Scenario 1 + Expansion  
Weekday P.M. Peak Hour

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↓	↓	↓	↓
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.3	5.3
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
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)	1827	1583	1805	1845	1787	1615
Flt Permitted	1.00	1.00	0.23	1.00	0.95	1.00
Satd. Flow (perm)	1827	1583	439	1845	1787	1615
Volume (vph)	788	329	63	958	270	59
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	788	329	63	958	270	59
RTOR Reduction (vph)	0	38	0	0	0	45
Lane Group Flow (vph)	788	291	63	958	270	14
Confl. Peds. (#/hr)	3					
Heavy Vehicles (%)	4%	2%	0%	3%	1%	0%
Turn Type	Perm		Perm		Perm	
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	45.0	45.0	45.0	45.0	17.2	17.2
Effective Green, g (s)	46.0	46.0	46.0	46.0	18.2	18.2
Actuated g/C Ratio	0.61	0.61	0.61	0.61	0.24	0.24
Clearance Time (s)	6.5	6.5	6.5	6.5	6.3	6.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1121	971	269	1132	434	392
v/s Ratio Prot	0.43			0.52	0.15	
v/s Ratio Perm		0.18	0.14			0.01
v/c Ratio	0.70	0.30	0.23	0.85	0.62	0.04
Uniform Delay, d1	9.9	6.9	6.5	11.7	25.3	21.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.8	0.8	2.0	8.5	2.8	0.0
Delay (s)	13.6	7.7	8.6	20.2	28.1	21.7
Level of Service	B	A	A	C	C	C
Approach Delay (s)	11.9			19.4	27.0	
Approach LOS	B			B	C	

Intersection Summary

HCM Average Control Delay	17.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	76.3%	ICU Level of Service	D
Analysis Period (min)	60		
c Critical Lane Group			

Queues

13: Marleau Avenue & Nick Kaneb Drive

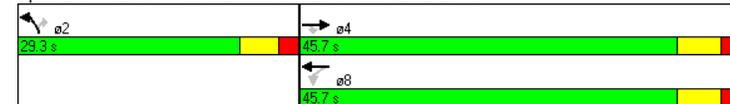
Future Total - Scenario 1 + Expansion  
Weekday P.M. Peak Hour

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↓	↓	↓	↓
Volume (vph)	788	329	63	958	270	59
Lane Group Flow (vph)	788	329	63	958	270	59
Turn Type	Perm		Perm		Perm	
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Detector Phases	4	4	8	8	2	2
Minimum Initial (s)	18.2	18.2	18.0	18.0	15.0	15.0
Minimum Split (s)	35.7	35.7	35.7	35.7	29.3	29.3
Total Split (s)	45.7	45.7	45.7	45.7	29.3	29.3
Total Split (%)	60.9%	60.9%	60.9%	60.9%	39.1%	39.1%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.1	4.1
All-Red Time (s)	2.0	2.0	2.0	2.0	2.2	2.2
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	C-Max	C-Max	C-Max	C-Max	None	None
v/c Ratio	0.70	0.33	0.32	0.85	0.62	0.14
Control Delay	15.3	6.3	13.8	22.9	31.8	6.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.3	6.3	13.8	22.9	31.8	6.8
Queue Length 50th (m)	66.6	13.1	3.8	95.9	36.9	0.0
Queue Length 95th (m)#191.4	39.1	18.0	#254.0	62.8	9.5	
Internal Link Dist (m)	966.8		629.1		393.0	
Turn Bay Length (m)	10.0		25.0		25.0	
Base Capacity (vph)	1120	1008	198	1131	572	557
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	0.70	0.33	0.32	0.85	0.47	0.11

Intersection Summary

Cycle Length: 75
Actuated Cycle Length: 75
Offset: 0 (0%), Referenced to phase 4:EBT and 8:WBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 13: Marleau Avenue & Nick Kaneb Drive



HCM Signalized Intersection Capacity Analysis  
14: Tenth Street & McConnell Avenue

Future Total - Scenario 1 + Expansion  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔		↔		↔		↔		↔		↔	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0		5.0		5.5		5.5		5.5		5.5	
Lane Util. Factor	1.00		1.00		1.00		1.00		1.00		1.00	
Frpb, ped/bikes	1.00		0.99		1.00		1.00		1.00		1.00	
Flpb, ped/bikes	1.00		0.99		1.00		1.00		1.00		1.00	
Frt	0.98		0.96		1.00		0.98		1.00		1.00	
Flt Protected	0.98		0.97		0.95		1.00		0.95		1.00	
Satd. Flow (prot)	1680		1713		1805		1788		1736		1791	
Flt Permitted	0.90		0.80		0.17		1.00		0.09		1.00	
Satd. Flow (perm)	1533		1411		319		1788		169		1791	
Volume (vph)	8	12	3	167	32	73	7	964	141	52	955	11
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	8	12	3	167	32	73	7	964	141	52	955	11
RTOR Reduction (vph)	0	2	0	0	13	0	0	5	0	0	0	0
Lane Group Flow (vph)	0	21	0	0	259	0	7	1100	0	52	966	0
Confl. Peds. (#/hr)	2		4		4		2		2		2	
Heavy Vehicles (%)	25%		0%		0%		0%		3%		10%	
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases	4		8		8		2		6		6	
Permitted Phases	4		8		8		2		6		6	
Actuated Green, G (s)	20.3		20.3		67.2		67.2		67.2		67.2	
Effective Green, g (s)	21.3		21.3		68.2		68.2		68.2		68.2	
Actuated g/C Ratio	0.21		0.21		0.68		0.68		0.68		0.68	
Clearance Time (s)	6.0		6.0		6.5		6.5		6.5		6.5	
Vehicle Extension (s)	3.0		3.0		3.0		3.0		3.0		3.0	
Lane Grp Cap (vph)	327		301		218		1219		115		1221	
v/s Ratio Prot					c0.62				0.54			
v/s Ratio Perm	0.01		c0.18		0.02		0.31					
v/c Ratio	0.06		0.86		0.03		0.90		0.45		0.79	
Uniform Delay, d1	31.4		37.9		5.2		13.1		7.3		11.0	
Progression Factor	1.00		1.00		0.36		1.00		1.00		1.00	
Incremental Delay, d2	0.1		25.2		0.1		3.1		12.8		5.5	
Delay (s)	31.5		63.1		1.9		16.2		20.1		16.5	
Level of Service	C		E		A		B		C		B	
Approach Delay (s)	31.5		63.1		16.1		16.7					
Approach LOS	C		E		B		B					

Intersection Summary			
HCM Average Control Delay	21.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	90.2%	ICU Level of Service	E
Analysis Period (min)	60		
c	Critical Lane Group		

Queues

14: Tenth Street & McConnell Avenue

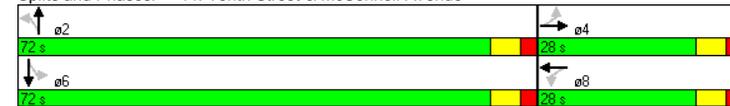
Future Total - Scenario 1 + Expansion

Weekday P.M. Peak Hour

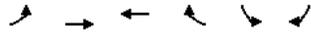
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↔		↔		↔		↔	
Volume (vph)	8	12	167	32	7	964	52	955
Lane Group Flow (vph)	0	23	0	272	7	1105	52	966
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases	4		8		2		6	
Permitted Phases	4		8		2		6	
Detector Phases	4	4	8	8	2	2	6	6
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	28.0	28.0	28.0	28.0	28.5	28.5	28.5	28.5
Total Split (s)	28.0	28.0	28.0	28.0	72.0	72.0	72.0	72.0
Total Split (%)	28.0%	28.0%	28.0%	28.0%	72.0%	72.0%	72.0%	72.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	1.9	1.9	1.9	1.9	2.4	2.4	2.4	2.4
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.07	0.86	0.03	0.90	0.54	0.79		
Control Delay	28.1	68.3	2.3	18.1	36.3	18.0		
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		
Total Delay	28.1	68.3	2.3	18.1	36.3	18.0		
Queue Length 50th (m)	3.2	49.6	0.2	216.7	5.0	128.2		
Queue Length 95th (m)	11.1	#111.6	m0.2m	209.8	#32.5	#289.9		
Internal Link Dist (m)	414.9	896.3	283.7	1842.8				
Turn Bay Length (m)			14.0	14.0				
Base Capacity (vph)	356	338	201	1224	96	1221		
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	0.06	0.80	0.03	0.90	0.54	0.79		

Intersection Summary	
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	95 (95%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle:	90
Control Type:	Actuated-Coordinated
#	95th percentile volume exceeds capacity, queue may be longer.
m	Queue shown is maximum after two cycles.
m	Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 14: Tenth Street & McConnell Avenue



HCM Unsignalized Intersection Capacity Analysis      Future Total - Scenario 1 + Expansion  
 16: Virginia Drive & Industrial Park Drive      Weekday P.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		↓	↓
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	78	127	182	54	85	90
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	78	127	182	54	85	90
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	236				492	209
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	236				492	209
tC, single (s)	4.2				7.3	6.2
tC, 2 stage (s)						
tF (s)	2.3				4.3	3.3
p0 queue free %	94				78	89
cM capacity (veh/h)	1308				387	834
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	205	236	175			
Volume Left	78	0	85			
Volume Right	0	54	90			
cSH	1308	1700	534			
Volume to Capacity	0.06	0.14	0.33			
Queue Length 95th (m)	1.5	0.0	11.6			
Control Delay (s)	3.3	0.0	15.0			
Lane LOS	A		C			
Approach Delay (s)	3.3	0.0	15.0			
Approach LOS			C			
<b>Intersection Summary</b>						
Average Delay			5.4			
Intersection Capacity Utilization		44.1%		ICU Level of Service		A
Analysis Period (min)			60			

HCM Signalized Intersection Capacity Analysis  
17: Marleau Avenue & Boundary Road

Future Total - Scenario 1 + Expansion  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.7	6.7	6.7	6.7	6.7	6.7	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	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.30	1.00	1.00
Satd. Flow (prot)	1684	1810	1553	1612	1827	1449	1736	1712	1380	1612	1776	1509
Flt Permitted	0.70	1.00	1.00	0.67	1.00	1.00	0.27	1.00	1.00	0.30	1.00	1.00
Satd. Flow (perm)	1234	1810	1553	1134	1827	1449	488	1712	1380	504	1776	1509
Volume (vph)	171	139	51	34	94	33	89	496	41	57	524	213
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	171	139	51	34	94	33	89	496	41	57	524	213
RTOR Reduction (vph)	0	0	29	0	0	19	0	0	25	0	0	131
Lane Group Flow (vph)	171	139	22	34	94	14	89	496	16	57	524	82
Confl. Peds. (#/hr)	1					1						
Heavy Vehicles (%)	7%	5%	4%	12%	4%	9%	4%	11%	17%	12%	7%	7%
Turn Type	Perm		Perm	Perm		Perm	Perm		Perm	Perm		Perm
Protected Phases		4			8			2		2		6
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	29.3	29.3	29.3	29.3	29.3	29.3	26.0	26.0	26.0	26.0	26.0	26.0
Effective Green, g (s)	30.3	30.3	30.3	30.3	30.3	30.3	27.0	27.0	27.0	27.0	27.0	27.0
Actuated g/C Ratio	0.43	0.43	0.43	0.43	0.43	0.43	0.39	0.39	0.39	0.39	0.39	0.39
Clearance Time (s)	7.7	7.7	7.7	7.7	7.7	7.7	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	534	783	672	491	791	627	188	660	532	194	685	582
v/s Ratio Prot		0.08			0.05			0.29			0.30	
v/s Ratio Perm	c0.14		0.01	0.03		0.01	0.18		0.01	0.11		0.05
v/c Ratio	0.32	0.18	0.03	0.07	0.12	0.02	0.47	0.75	0.03	0.29	0.76	0.14
Uniform Delay, d1	13.1	12.2	11.4	11.6	11.9	11.4	16.2	18.6	13.4	14.9	18.7	14.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	0.1	0.0	0.1	0.1	0.0	8.5	8.1	0.1	3.8	8.4	0.5
Delay (s)	13.4	12.3	11.4	11.7	11.9	11.4	24.7	26.7	13.5	18.7	27.1	14.5
Level of Service	B	B	B	B	B	B	C	C	B	B	C	B
Approach Delay (s)		12.7			11.8			25.5			23.1	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM Average Control Delay	21.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.7
Intersection Capacity Utilization	93.1%	ICU Level of Service	F
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
17: Marleau Avenue & Boundary Road

Future Total - Scenario 1 + Expansion  
Weekday P.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	171	139	51	34	94	33	89	496	41	57	524	213
Lane Group Flow (vph)	171	139	51	34	94	33	89	496	41	57	524	213
Turn Type	Perm		Perm	Perm		Perm	Perm		Perm	Perm		Perm
Protected Phases		4			8			2		2		6
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phases	4	4	4	8	8	8	2	2	2	6	6	6
Minimum Initial (s)	29.3	29.3	29.3	29.3	29.3	29.3	26.0	26.0	26.0	26.0	26.0	26.0
Minimum Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (%)	52.9%	52.9%	52.9%	52.9%	52.9%	52.9%	47.1%	47.1%	47.1%	47.1%	47.1%	47.1%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	3.2	3.2	3.2	3.2	3.2	3.2	2.9	2.9	2.9	2.9	2.9	2.9
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.32	0.18	0.07	0.07	0.12	0.05	0.47	0.75	0.07	0.29	0.76	0.30
Control Delay	15.2	13.0	4.2	12.2	12.4	4.8	26.7	27.9	5.3	20.1	28.4	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.2	13.0	4.2	12.2	12.4	4.8	26.7	27.9	5.3	20.1	28.4	3.6
Queue Length 50th (m)	14.9	11.3	0.0	2.6	7.4	0.0	9.0	57.5	0.0	5.3	61.1	0.0
Queue Length 95th (m)	33.1	24.6	6.7	8.5	17.6	5.4	#31.1	#125.9	6.6	16.9	#132.6	16.0
Internal Link Dist (m)		2051.6			246.6			346.9			725.5	
Turn Bay Length (m)	46.0			68.0		48.0	34.0			68.0		48.0
Base Capacity (vph)	534	783	701	490	791	646	188	660	557	194	685	713
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.32	0.18	0.07	0.07	0.12	0.05	0.47	0.75	0.07	0.29	0.76	0.30

Intersection Summary	
Cycle Length:	70
Actuated Cycle Length:	70
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle:	70
Control Type:	Actuated-Coordinated
#	95th percentile volume exceeds capacity, queue may be longer.
	Queue shown is maximum after two cycles.



HCM Signalized Intersection Capacity Analysis  
18: Marleau Avenue & McConnell Avenue

Future Total - Scenario 1 + Expansion  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0	5.0	2.0	5.0	5.0	2.0	5.5		2.0	5.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1556	1845	1560	1770	1881	1568	1786	1811		1752	1863	
Flt Permitted	0.12	1.00	1.00	0.11	1.00	1.00	0.32	1.00		0.12	1.00	
Satd. Flow (perm)	199	1845	1560	213	1881	1568	595	1811		217	1863	
Volume (vph)	81	679	178	124	737	446	275	585	99	536	468	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	81	679	178	124	737	446	275	585	99	536	468	0
RTOR Reduction (vph)	0	0	109	0	0	215	0	6	0	0	0	0
Lane Group Flow (vph)	81	679	70	124	737	231	275	678	0	536	468	0
Confl. Peds. (#/hr)			2	2			3		2	2		3
Heavy Vehicles (%)	16%	3%	1%	2%	1%	3%	1%	2%	4%	3%	2%	11%
Turn Type	Perm		Perm pm+pt		Perm pm+pt			pm+pt				
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	29.0	29.0	29.0	38.0	38.0	38.0	40.5	27.5		49.5	33.5	
Effective Green, g (s)	33.0	30.0	30.0	42.0	39.0	39.0	46.0	28.5		54.0	34.5	
Actuated g/C Ratio	0.33	0.30	0.30	0.42	0.39	0.39	0.46	0.28		0.54	0.34	
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.5		3.0	6.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	66	554	468	198	734	612	440	516		424	643	
v/s Ratio Prot		0.37		0.04	0.39		0.09	0.37		0.25	0.25	
v/s Ratio Perm	0.41		0.04	0.22		0.15	0.20			0.43		
v/c Ratio	1.23	1.23	0.15	0.63	1.00	0.38	0.62	1.31		1.26	0.73	
Uniform Delay, d1	33.5	35.0	25.6	23.5	30.5	21.8	18.2	35.8		29.9	28.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.78	1.01	
Incremental Delay, d2	524.1	423.1	0.1	14.9	70.4	1.8	2.8	577.9		486.8	2.4	
Delay (s)	557.6	458.1	25.8	38.4	100.9	23.6	21.0	613.6		510.1	31.3	
Level of Service	F	F	C	D	F	C	C	F		F	C	
Approach Delay (s)		384.6			68.6			443.7			286.9	
Approach LOS		F			E			F			F	

Intersection Summary

HCM Average Control Delay	276.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.27		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	14.5
Intersection Capacity Utilization	137.4%	ICU Level of Service	H
Analysis Period (min)	60		
c Critical Lane Group			

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Synchro 6 Report  
16/10/2010

LEA Consulting, Ltd.

Queues

18: Marleau Avenue & McConnell Avenue

Future Total - Scenario 1 + Expansion  
Weekday P.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	81	679	178	124	737	446	275	585	536	468
Lane Group Flow (vph)	81	679	178	124	737	446	275	684	536	468
Turn Type	Perm		Perm pm+pt		Perm pm+pt			pm+pt		
Protected Phases		4		3	8		5	2	1	6
Permitted Phases	4		4	8		8	2		6	
Detector Phases	4	4	4	3	8	8	5	2	1	6
Minimum Initial (s)	20.0	20.0	20.0	3.0	20.0	20.0	11.0	20.0	11.0	20.0
Minimum Split (s)	28.0	28.0	28.0	7.0	28.0	28.0	14.0	28.5	14.0	28.5
Total Split (s)	35.0	35.0	35.0	9.0	44.0	44.0	17.0	34.0	22.0	39.0
Total Split (%)	35.0%	35.0%	35.0%	9.0%	44.0%	44.0%	17.0%	34.0%	22.0%	39.0%
Yellow Time (s)	4.1	4.1	4.1	3.0	4.1	4.1	2.0	4.1	2.0	4.1
All-Red Time (s)	1.9	1.9	1.9	0.0	1.9	1.9	1.0	2.4	1.0	2.4
Lead/Lag	Lag	Lag	Lag	Lead			Lead	Lag	Lead	Lag
Lead-Lag Optimize?										
Recall Mode	Min	Min	Min	C-Min	C-Min	C-Min	Min	Min	Min	Min
v/c Ratio	1.25	1.23	0.31	0.63	1.00	0.54	0.64	1.31	1.26	0.73
Control Delay	588.9	455.6	7.7	34.2	102.1	7.8	21.0	604.2	505.2	34.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	588.9	455.6	7.7	34.2	102.1	7.8	21.0	604.2	505.2	34.2
Queue Length 50th (m)	~20.6	~171.7	3.3	15.4	~149.3	12.1	28.9	~180.5	~123.1	93.6
Queue Length 95th (m)	#58.6	#281.4	24.9	#41.4	#272.4	55.1	51.8	#292.8	#178.9	125.2
Internal Link Dist (m)		264.6			966.8		69.2		283.7	
Turn Bay Length (m)			84.0	71.0		71.0	77.0		130.0	
Base Capacity (vph)	65	554	577	198	734	827	446	522	425	643
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	1.25	1.23	0.31	0.63	1.00	0.54	0.62	1.31	1.26	0.73

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 0 (0%), Referenced to phase 3:WBL and 8:WBTL, Start of Green
Natural Cycle: 120
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 18: Marleau Avenue & McConnell Avenue



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Synchro 6 Report  
16/10/2010

LEA Consulting, Ltd.

HCM Unsignalized Intersection Capacity Analysis Future Total - Scenario 1 + Expansion  
 22: Hwy 401 WB Ramp & Boundary Road Weekday P.M. Peak Hour

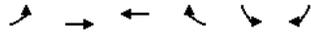
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗	↖	↕	↗		↕	↗		↕	↗
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	9	1	113	46	17	12	95	520	105	11	542	6
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	9	1	113	46	17	12	95	520	105	11	542	6
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage veh												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1350	1382	545	1443	1332	572	548				625	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1350	1382	545	1443	1332	572	548				625	
tC, single (s)	7.1	6.5	6.4	7.1	6.5	6.2	4.2				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.5	3.5	4.0	3.3	2.3				2.2	
p0 queue free %	91	99	77	41	88	98	90				99	
cM capacity (veh/h)	105	130	498	78	139	523	978				966	
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	10	113	46	29	720	559						
Volume Left	9	0	46	0	95	11						
Volume Right	0	113	0	12	105	6						
cSH	107	498	78	199	978	966						
Volume to Capacity	0.09	0.23	0.59	0.15	0.10	0.01						
Queue Length 95th (m)	2.5	7.0	28.0	4.1	2.6	0.3						
Control Delay (s)	42.1	14.3	111.2	26.1	2.4	0.3						
Lane LOS	E	B	F	D	A	A						
Approach Delay (s)	16.6		78.3		2.4	0.3						
Approach LOS	C		F									
<b>Intersection Summary</b>												
Average Delay	6.7											
Intersection Capacity Utilization	87.7%		ICU Level of Service				E					
Analysis Period (min)	60											

HCM Unsignalized Intersection Capacity Analysis Future Total - Scenario 1 + Expansion  
 25: Hwy 401 EB Ramp & Boundary Road Weekday P.M. Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖	↗	↕	↖	↖	↕
Sign Control	Stop	↗	Free	↖	↖	Free
Grade	0%	0%	0%	0%	0%	0%
Volume (veh/h)	111	51	669	156	8	693
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	111	51	669	156	8	693
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1378	669			825	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1378	669			825	
tC, single (s)	6.8	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.9	3.3			2.2	
p0 queue free %	15	89			99	
cM capacity (veh/h)	130	461			814	
Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	
Volume Total	111	51	669	156	701	
Volume Left	111	0	0	0	8	
Volume Right	0	51	0	156	0	
cSH	130	461	1700	1700	814	
Volume to Capacity	0.85	0.11	0.39	0.09	0.01	
Queue Length 95th (m)	71.6	3.0	0.0	0.0	0.2	
Control Delay (s)	144.6	13.8	0.0	0.0	0.3	
Lane LOS	F	B			A	
Approach Delay (s)	103.4		0.0		0.3	
Approach LOS	F					
<b>Intersection Summary</b>						
Average Delay	10.0					
Intersection Capacity Utilization	55.7%		ICU Level of Service		B	
Analysis Period (min)	60					

HCM Unsignalized Intersection Capacity Analysis  
29: Tenth Street & Virginia Drive

Future Total - Scenario 1 + Expansion  
Weekday P.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	↕
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	205	0	0	0	0	272
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	205	0	0	0	0	272
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0				410	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				410	0
tC, single (s)	4.2				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.3				3.5	3.3
p0 queue free %	87				100	75
cM capacity (veh/h)	1585				524	1085
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	205	0	272			
Volume Left	205	0	0			
Volume Right	0	0	272			
cSH	1585	1700	1085			
Volume to Capacity	0.13	0.00	0.25			
Queue Length 95th (m)	3.6	0.0	8.0			
Control Delay (s)	7.6	0.0	9.4			
Lane LOS	A		A			
Approach Delay (s)	7.6	0.0	9.4			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay			8.6			
Intersection Capacity Utilization		34.9%		ICU Level of Service		A
Analysis Period (min)			60			

*Future Total- Scenario 1 with Expansion: Dual Left*

HCM Signalized Intersection Capacity Analysis Future Total - Scenario 1 + Expansion: Dual Left  
18: Marleau Avenue & McConnell Avenue Weekday A.M. Peak Hour

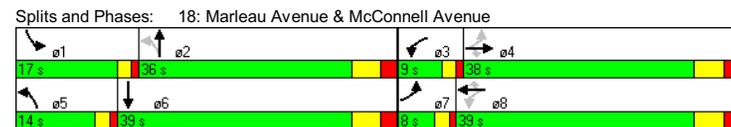
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0	5.0	2.0	5.0	5.0	2.0	5.5		2.0	5.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.97	1.00	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1597	1827	1532	1736	1845	1538	1736	1732		3367	1810	
Flt Permitted	0.11	1.00	1.00	0.16	1.00	1.00	0.21	1.00		0.95	1.00	
Satd. Flow (perm)	187	1827	1532	289	1845	1538	381	1732		3367	1810	
Volume (vph)	118	536	127	156	670	465	152	406	130	540	525	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	118	536	127	156	670	465	152	406	130	540	525	0
RTOR Reduction (vph)	0	0	85	0	247	0	12	0	0	0	0	0
Lane Group Flow (vph)	118	536	42	156	670	218	152	524	0	540	525	0
Confl. Peds. (#/hr)			5	5								
Heavy Vehicles (%)	13%	4%	2%	4%	3%	5%	4%	5%	8%	4%	5%	12%
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Prot			
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2					
Actuated Green, G (s)	37.0	32.0	32.0	39.0	33.0	33.0	40.5	29.5		14.0	32.5	
Effective Green, g (s)	42.0	33.0	33.0	44.0	34.0	34.0	46.0	30.5		15.0	33.5	
Actuated g/C Ratio	0.42	0.33	0.33	0.44	0.34	0.34	0.46	0.30		0.15	0.34	
Clearance Time (s)	3.0	6.0	6.0	3.0	6.0	6.0	3.0	6.5		3.0	6.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	163	603	506	228	627	523	338	528		505	606	
v/s Ratio Prot	c0.04	0.29		c0.05	c0.36		0.05	c0.30		c0.16	0.29	
v/s Ratio Perm	0.26		0.03	0.25		0.14	0.15					
v/c Ratio	0.72	0.89	0.08	0.68	1.07	0.42	0.45	0.99		1.07	0.87	
Uniform Delay, d1	23.9	31.8	23.1	20.9	33.0	25.4	18.1	34.6		42.5	31.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.83	1.02	
Incremental Delay, d2	15.9	17.7	0.1	8.6	158.3	0.5	1.0	71.8		147.0	8.9	
Delay (s)	39.8	49.5	23.1	29.4	191.3	25.9	19.1	106.5		182.3	40.7	
Level of Service	D	D	C	C	F	C	B	F		F	D	
Approach Delay (s)		43.7			112.2			87.2			112.5	
Approach LOS		D			F			F			F	

Intersection Summary			
HCM Average Control Delay	93.8	HCM Level of Service	F
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	11.5
Intersection Capacity Utilization	101.9%	ICU Level of Service	G
Analysis Period (min)	60		
c Critical Lane Group			

Queues Future Total - Scenario 1 + Expansion: Dual Left  
18: Marleau Avenue & McConnell Avenue Weekday A.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	118	536	127	156	670	465	152	406	540	525
Lane Group Flow (vph)	118	536	127	156	670	465	152	536	540	525
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt	Prot		
Protected Phases	7	4		3	8		5	2	1	6
Permitted Phases	4		4	8		8	2			
Detector Phases	7	4	4	3	8	8	5	2	1	6
Minimum Initial (s)	4.0	20.0	20.0	5.0	20.0	20.0	11.0	15.0	10.0	15.0
Minimum Split (s)	8.0	26.0	26.0	9.0	26.0	26.0	14.0	26.5	14.0	26.5
Total Split (s)	8.0	38.0	38.0	9.0	39.0	39.0	14.0	36.0	17.0	39.0
Total Split (%)	8.0%	38.0%	38.0%	9.0%	39.0%	39.0%	14.0%	36.0%	17.0%	39.0%
Yellow Time (s)	2.0	4.1	4.1	2.0	4.1	4.1	2.0	4.1	2.0	4.1
All-Red Time (s)	1.0	1.9	1.9	1.0	1.9	1.9	1.0	2.4	1.0	2.4
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes									
Recall Mode	None	None	None	None	None	None	None	C-Max	None	C-Max
v/c Ratio	0.72	0.89	0.21	0.68	1.07	0.60	0.45	0.99	1.07	0.87
Control Delay	47.2	54.5	5.4	35.3	191.6	9.5	18.0	105.7	182.7	41.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.2	54.5	5.4	35.3	191.6	9.5	18.0	105.7	182.7	41.8
Queue Length 50th (m)	13.9	102.9	0.0	18.7	~152.1	12.9	15.9	105.7	~63.0	110.2
Queue Length 95th (m)	#46.8	#197.9	16.2	#46.3	#261.0	63.6	31.1	#210.6m	#82.6m	#136.4
Internal Link Dist (m)		264.6			966.8			256.5		283.7
Turn Bay Length (m)			84.0	71.0		71.0	77.0		130.0	
Base Capacity (vph)	163	603	591	228	627	770	338	540	505	606
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	0.72	0.89	0.21	0.68	1.07	0.60	0.45	0.99	1.07	0.87

Intersection Summary	
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	96 (96%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	120
Control Type:	Actuated-Coordinated
~	Volume exceeds capacity, queue is theoretically infinite.
	Queue shown is maximum after two cycles.
#	95th percentile volume exceeds capacity, queue may be longer.
	Queue shown is maximum after two cycles.
m	Volume for 95th percentile queue is metered by upstream signal.



HCM Signalized Intersection Capacity Analysis Future Total - Scenario 1 + Expansion: Dual Left  
18: Marleau Avenue & McConnell Avenue Weekday P.M. Peak Hour

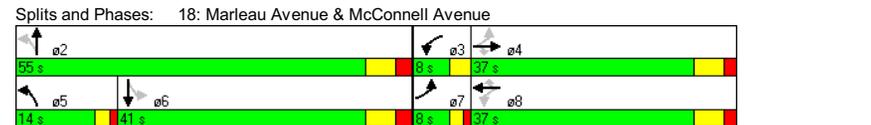
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0	5.0	2.0	5.0	5.0	2.0	5.5		2.0	5.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.97	1.00	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1556	1845	1560	1770	1881	1568	1786	1811		3395	1863	
Flt Permitted	0.11	1.00	1.00	0.11	1.00	1.00	0.26	1.00		0.29	1.00	
Satd. Flow (perm)	184	1845	1560	207	1881	1568	495	1811		1022	1863	
Volume (vph)	81	679	178	124	737	446	275	585	99	536	468	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	81	679	178	124	737	446	275	585	99	536	468	0
RTOR Reduction (vph)	0	0	108	0	0	165	0	6	0	0	0	0
Lane Group Flow (vph)	81	679	70	124	737	281	275	678	0	536	468	0
Confl. Peds. (#/hr)			2	2			3		2	2		3
Heavy Vehicles (%)	16%	3%	1%	2%	1%	3%	1%	2%	4%	3%	2%	11%
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm			
Protected Phases	7	4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	35.6	31.6	31.6	36.4	32.0	32.0	48.5	48.5		34.5	34.5	
Effective Green, g (s)	40.6	32.6	32.6	41.4	33.0	33.0	53.0	49.5		39.0	35.5	
Actuated g/C Ratio	0.41	0.33	0.33	0.41	0.33	0.33	0.53	0.50		0.39	0.36	
Clearance Time (s)	3.0	6.0	6.0	3.0	6.0	6.0	3.0	6.5		6.5	6.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	143	601	509	170	621	517	417	896		399	661	
v/s Ratio Prot	0.03	0.37		c0.04	c0.39		0.08	c0.37			0.25	
v/s Ratio Perm	0.20		0.04	0.26		0.18	0.27			c0.52		
v/c Ratio	0.57	1.13	0.14	0.73	1.19	0.54	0.66	0.76		1.34	0.71	
Uniform Delay, d1	24.1	33.7	23.8	24.2	33.5	27.3	15.7	20.4		30.5	27.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.03	0.98	
Incremental Delay, d2	5.2	257.3	0.1	27.0	353.7	4.1	3.8	3.8		628.0	2.0	
Delay (s)	29.3	291.0	23.9	51.2	387.2	31.4	19.5	24.2		659.3	29.2	
Level of Service	C	F	C	D	F	C	B	C		F	C	
Approach Delay (s)		217.7			234.0			22.8			365.6	
Approach LOS		F			F			C			F	

Intersection Summary			
HCM Average Control Delay	213.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	11.5
Intersection Capacity Utilization	112.2%	ICU Level of Service	H
Analysis Period (min)	60		
c Critical Lane Group			

Queues Future Total - Scenario 1 + Expansion: Dual Left  
18: Marleau Avenue & McConnell Avenue Weekday P.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	81	679	178	124	737	446	275	585	536	468
Lane Group Flow (vph)	81	679	178	124	737	446	275	684	536	468
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	
Protected Phases	7	4		3	8		5	2		6
Permitted Phases	4		4	8		8	2		6	
Detector Phases	7	4	4	3	8	8	5	2	6	6
Minimum Initial (s)	4.0	20.0	20.0	3.0	20.0	20.0	11.0	20.0	20.0	20.0
Minimum Split (s)	8.0	28.0	28.0	7.0	28.0	28.0	14.0	28.5	28.5	28.5
Total Split (s)	8.0	37.0	37.0	8.0	37.0	37.0	14.0	55.0	41.0	41.0
Total Split (%)	8.0%	37.0%	37.0%	8.0%	37.0%	37.0%	14.0%	55.0%	41.0%	41.0%
Yellow Time (s)	2.0	4.1	4.1	3.0	4.1	4.1	2.0	4.1	4.1	4.1
All-Red Time (s)	1.0	1.9	1.9	0.0	1.9	1.9	1.0	2.4	2.4	2.4
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lag
Lead-Lag Optimize?	Yes			Yes	Yes					
Recall Mode	None	Min	Min	C-Min	C-Min	C-Min	Min	Min	Min	Min
v/c Ratio	0.51	1.15	0.29	0.69	1.17	0.65	0.66	0.76	1.34	0.71
Control Delay	29.2	326.0	6.8	40.9	350.4	17.6	21.8	27.0	656.9	31.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.2	326.0	6.8	40.9	350.4	17.6	21.8	27.0	656.9	31.6
Queue Length 50th (m)	9.7	~163.8	2.5	15.1	~186.2	33.7	29.6	106.7	~75.1	91.2
Queue Length 95th (m)	#24.1	#273.6	23.1	#45.4	#300.6	90.7	#58.8	#208.6	#105.5	118.3
Internal Link Dist (m)		264.6			966.8		69.2		283.7	
Turn Bay Length (m)			84.0	71.0		71.0	77.0		130.0	
Base Capacity (vph)	159	590	608	181	632	691	417	902	399	661
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	0.51	1.15	0.29	0.69	1.17	0.65	0.66	0.76	1.34	0.71

Intersection Summary	
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	4 (4%), Referenced to phase 3:WBL and 8:WBTL, Start of Green
Natural Cycle:	150
Control Type:	Actuated-Coordinated
~	Volume exceeds capacity, queue is theoretically infinite.
	Queue shown is maximum after two cycles.
#	95th percentile volume exceeds capacity, queue may be longer.
	Queue shown is maximum after two cycles.
m	Volume for 95th percentile queue is metered by upstream signal.



*Future Total- Scenario 2 with Expansion*

HCM Signalized Intersection Capacity Analysis  
5: SCM Way & Boundary Road

Future Total - Scenario 2 + Expansion  
Weekday A.M. Peak Hour

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↕	↕
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2	6.2	5.2	5.2	5.2	5.2
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frbp, ped/bikes	1.00	0.97	1.00	1.00	1.00	1.00
Flpb, ped/bikes	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	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1056	916	1253	1397	1638	1049
Flt Permitted	0.95	1.00	0.12	1.00	1.00	1.00
Satd. Flow (perm)	1056	916	161	1397	1638	1049
Volume (vph)	56	14	18	436	1054	76
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	56	14	18	436	1054	76
RTOR Reduction (vph)	0	11	0	0	0	15
Lane Group Flow (vph)	56	3	18	436	1054	61
Confl. Peds. (#/hr)	3					
Heavy Vehicles (%)	71%	71%	44%	36%	16%	54%
Turn Type	Perm		Perm		Perm	
Protected Phases	4		2		6	
Permitted Phases	4		2		6	
Actuated Green, G (s)	22.5	22.5	76.0	76.0	76.0	76.0
Effective Green, g (s)	23.5	23.5	77.0	77.0	77.0	77.0
Actuated g/C Ratio	0.21	0.21	0.69	0.69	0.69	0.69
Clearance Time (s)	7.2	7.2	6.2	6.2	6.2	6.2
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	222	192	111	961	1127	722
v/s Ratio Prot	c0.05		0.31		c0.64	
v/s Ratio Perm	0.00		0.11		0.06	
v/c Ratio	0.25	0.02	0.16	0.45	0.94	0.08
Uniform Delay, d1	36.9	35.0	6.1	7.9	15.3	5.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	0.0	3.1	1.6	19.7	0.2
Delay (s)	37.5	35.1	9.3	9.5	35.0	6.0
Level of Service	D	D	A	A	C	A
Approach Delay (s)	37.0		9.5		33.0	
Approach LOS	D		A		C	

Intersection Summary

HCM Average Control Delay	26.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	111.9	Sum of lost time (s)	11.4
Intersection Capacity Utilization	94.6%	ICU Level of Service	F
Analysis Period (min)	60		
c Critical Lane Group			

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Synchro 6 Report  
16/10/2010

LEA Consulting, Ltd.

Queues  
5: SCM Way & Boundary Road

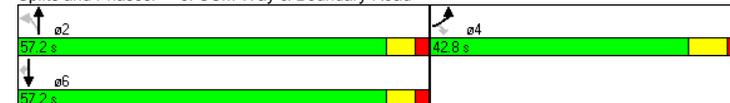
Future Total - Scenario 2 + Expansion  
Weekday A.M. Peak Hour

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↕	↕
Volume (vph)	56	14	18	436	1054	76
Lane Group Flow (vph)	56	14	18	436	1054	76
Turn Type	Perm		Perm		Perm	
Protected Phases	4		2		6	
Permitted Phases	4		2		6	
Detector Phases	4		2		6	
Minimum Initial (s)	35.6	35.6	15.0	15.0	15.0	15.0
Minimum Split (s)	42.8	42.8	57.2	57.2	57.2	57.2
Total Split (s)	42.8	42.8	57.2	57.2	57.2	57.2
Total Split (%)	42.8%	42.8%	57.2%	57.2%	57.2%	57.2%
Yellow Time (s)	5.4	5.4	4.1	4.1	4.1	4.1
All-Red Time (s)	1.8	1.8	2.1	2.1	2.1	2.1
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Max	Max	Max	Max
v/c Ratio	0.17	0.05	0.24	0.43	0.89	0.10
Control Delay	22.9	9.9	26.1	13.9	33.5	5.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.9	9.9	26.1	13.9	33.5	5.8
Queue Length 50th (m)	9.2	0.0	2.0	59.2	~281.5	2.6
Queue Length 95th (m)	19.0	4.9	#14.3	111.1	#404.7	11.8
Internal Link Dist (m)	265.1		548.2		424.1	
Turn Bay Length (m)	62.0		80.0		65.0	
Base Capacity (vph)	320	288	74	1009	1184	771
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	0.17	0.05	0.24	0.43	0.89	0.10

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 109.3
Natural Cycle: 130
Control Type: Semi Act-Uncoord
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 5: SCM Way & Boundary Road

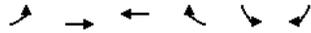


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Synchro 6 Report  
16/10/2010

LEA Consulting, Ltd.

HCM Unsignalized Intersection Capacity Analysis Future Total - Scenario 2 + Expansion  
 6: Optimum Drive & SCM Way Weekday A.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control	Free	Free	Free	Stop	Stop	Stop
Grade	0%	0%	0%	0%	0%	0%
Volume (veh/h)	0	0	0	84	57	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	84	57	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)			289			
pX, platoon unblocked						
vC, conflicting volume	84				42	42
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	84				42	42
tC, single (s)	4.1				7.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				4.4	3.3
p0 queue free %	100				93	100
cM capacity (veh/h)	1526				770	1034

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	0	84	57
Volume Left	0	0	57
Volume Right	0	84	0
cSH	1700	1700	770
Volume to Capacity	0.00	0.05	0.07
Queue Length 95th (m)	0.0	0.0	1.9
Control Delay (s)	0.0	0.0	10.0
Lane LOS			B
Approach Delay (s)	0.0	0.0	10.0
Approach LOS			B

Intersection Summary			
Average Delay		4.1	
Intersection Capacity Utilization	15.2%		ICU Level of Service A
Analysis Period (min)	60		

HCM Unsignalized Intersection Capacity Analysis Future Total - Scenario 2 + Expansion  
 7: Industrial Park Dr & Boundary Road Weekday A.M. Peak Hour



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↕	↕	↕	↕	↕	↕
Sign Control	Stop	Free	Free	Free	Free	Free
Grade	0%	0%	0%	0%	0%	0%
Volume (veh/h)	104	58	46	350	924	144
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	104	58	46	350	924	144
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1438	996	1068			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1438	996	1068			
tC, single (s)	7.1	6.3	4.1			
tC, 2 stage (s)						
tF (s)	4.2	3.4	2.2			
p0 queue free %	0	80	93			
cM capacity (veh/h)	95	286	645			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1
Volume Total	104	58	46	350	1068
Volume Left	104	0	46	0	0
Volume Right	0	58	0	0	144
cSH	95	286	645	1700	1700
Volume to Capacity	1.09	0.20	0.07	0.21	0.63
Queue Length 95th (m)	119.3	6.1	1.8	0.0	0.0
Control Delay (s)	412.8	20.8	11.0	0.0	0.0
Lane LOS	F	C	B		
Approach Delay (s)	272.4		1.3		0.0
Approach LOS	F				

Intersection Summary			
Average Delay		27.5	
Intersection Capacity Utilization	69.8%		ICU Level of Service C
Analysis Period (min)	60		

HCM Unsignalized Intersection Capacity Analysis Future Total - Scenario 2 + Expansion  
 9: Industrial Park Dr & Optimum Drive Weekday A.M. Peak Hour

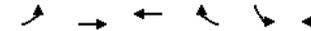


Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	124	118	9	8	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	124	118	9	8	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	127				246	122
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	127				246	122
tC, single (s)	4.1				7.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				4.4	3.3
p0 queue free %	100				99	100
cM capacity (veh/h)	1472				571	934

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	124	127	8
Volume Left	0	0	8
Volume Right	0	9	0
cSH	1472	1700	571
Volume to Capacity	0.00	0.07	0.01
Queue Length 95th (m)	0.0	0.0	0.3
Control Delay (s)	0.0	0.0	11.4
Lane LOS			B
Approach Delay (s)	0.0	0.0	11.4
Approach LOS			B

Intersection Summary			
Average Delay		0.4	
Intersection Capacity Utilization	16.8%	ICU Level of Service	A
Analysis Period (min)	60		

HCM Unsignalized Intersection Capacity Analysis Future Total - Scenario 2 + Expansion  
 11: Boundary Access & Truck Access Weekday A.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	0	0	0	0	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0				0	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				0	0
tC, single (s)	5.1				6.4	7.2
tC, 2 stage (s)						
tF (s)	3.1				3.5	4.2
p0 queue free %	100				100	100
cM capacity (veh/h)	1161				1029	857

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	0	0	0
Volume Left	0	0	0
Volume Right	0	0	0
cSH	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0
Lane LOS			A
Approach Delay (s)	0.0	0.0	0.0
Approach LOS			A

Intersection Summary			
Average Delay		0.0	
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	60		

HCM Signalized Intersection Capacity Analysis  
13: Marleau Avenue & Virginia Avenue

Future Total - Scenario 2 + Expansion  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.3	5.3		5.3	5.3	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00		1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1570	1810	1360	1719	1810	1615	1684	1853		1805	1766	
Flt Permitted	0.11	1.00	1.00	0.11	1.00	1.00	0.40	1.00		0.54	1.00	
Satd. Flow (perm)	186	1810	1360	204	1810	1615	706	1853		1030	1766	
Volume (vph)	84	840	73	40	789	25	275	233	30	25	286	99
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	84	840	73	40	789	25	275	233	30	25	286	99
RTOR Reduction (vph)	0	0	9	0	0	3	0	6	0	0	17	0
Lane Group Flow (vph)	84	840	64	40	789	22	275	257	0	25	368	0
Confl. Peds. (#/hr)			7	7			2					2
Heavy Vehicles (%)	15%	5%	15%	5%	5%	0%	7%	0%	7%	0%	0%	11%
Turn Type	Perm		Perm	Perm		Perm	Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	34.5	34.5	34.5	34.5	34.5	34.5	27.7	27.7		27.7	27.7	
Effective Green, g (s)	35.5	35.5	35.5	35.5	35.5	35.5	28.7	28.7		28.7	28.7	
Actuated g/C Ratio	0.47	0.47	0.47	0.47	0.47	0.47	0.38	0.38		0.38	0.38	
Clearance Time (s)	6.5	6.5	6.5	6.5	6.5	6.5	6.3	6.3		6.3	6.3	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	88	857	644	97	857	764	270	709		394	676	
v/s Ratio Prot		c0.46			0.44		0.14				0.21	
v/s Ratio Perm	0.45		0.05	0.20		0.01	c0.39			0.02		
v/c Ratio	0.95	0.98	0.10	0.41	0.92	0.03	1.02	0.36		0.06	0.54	
Uniform Delay, d1	19.0	19.4	10.9	12.9	18.4	10.5	23.1	16.6		14.6	18.1	
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	151.0	45.6	0.3	12.9	21.2	0.1	128.5	0.3		0.1	0.9	
Delay (s)	169.9	65.0	11.2	25.8	39.7	10.6	151.6	16.9		14.7	19.0	
Level of Service	F	E	B	C	D	B	F	B		B	B	
Approach Delay (s)		69.9			38.2			85.8			18.7	
Approach LOS		E			D			F			B	

Intersection Summary			
HCM Average Control Delay	55.8	HCM Level of Service	E
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	113.7%	ICU Level of Service	H
Analysis Period (min)	60		
c Critical Lane Group			

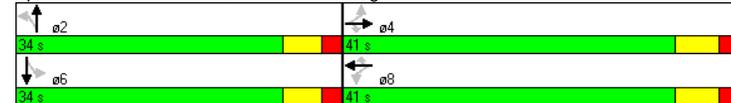
Queues  
13: Marleau Avenue & Virginia Avenue

Future Total - Scenario 2 + Expansion  
Weekday A.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	84	840	73	40	789	25	275	233	25	286
Lane Group Flow (vph)	84	840	73	40	789	25	275	263	25	385
Turn Type	Perm		Perm	Perm		Perm	Perm		Perm	
Protected Phases		4			8			2		6
Permitted Phases	4		4	8		8	2		6	6
Detector Phases	4	4	4	8	8	8	2	2	6	6
Minimum Initial (s)	18.2	18.2	18.2	18.2	18.2	18.2	15.0	15.0	15.0	15.0
Minimum Split (s)	28.5	28.5	28.5	28.5	28.5	28.5	28.3	28.3	28.3	28.3
Total Split (s)	41.0	41.0	41.0	41.0	41.0	41.0	34.0	34.0	34.0	34.0
Total Split (%)	54.7%	54.7%	54.7%	54.7%	54.7%	54.7%	45.3%	45.3%	45.3%	45.3%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.1	4.1	4.1	4.1
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.2	2.2	2.2	2.2
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	C-Min	C-Min	C-Min	C-Min	C-Min	C-Min	Min	Min	None	None
v/c Ratio	0.94	0.98	0.11	0.41	0.92	0.03	1.02	0.37	0.06	0.56
Control Delay	170.4	67.4	9.4	29.3	41.7	9.0	156.1	17.8	15.3	20.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	170.4	67.4	9.4	29.3	41.7	9.0	156.1	17.8	15.3	20.6
Queue Length 50th (m)	11.4	117.0	4.3	3.7	104.2	1.4	~41.6	26.2	2.3	40.7
Queue Length 95th (m)	#33.2	#234.2	12.8	#20.1	#214.9	5.9	#103.9	51.6	8.0	79.2
Internal Link Dist (m)		914.0			682.0		404.6		283.6	
Turn Bay Length (m)	25.0		10.0	25.0		10.0	25.0			
Base Capacity (vph)	89	857	653	97	857	768	270	715	394	692
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	0.94	0.98	0.11	0.41	0.92	0.03	1.02	0.37	0.06	0.56

Intersection Summary	
Cycle Length:	75
Actuated Cycle Length:	75
Offset:	0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle:	80
Control Type:	Actuated-Coordinated
~	Volume exceeds capacity, queue is theoretically infinite. Queue shown is maximum after two cycles.
#	95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.

Splits and Phases: 13: Marleau Avenue & Virginia Avenue



HCM Signalized Intersection Capacity Analysis  
14: Tenth Street & McConnell Avenue

Future Total - Scenario 2 + Expansion  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔			↕			↕			↕		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5			5.5			5.0			5.0		
Lane Util. Factor	1.00			1.00			1.00			1.00		
Frpb, ped/bikes	0.99			1.00			1.00			1.00		
Flpb, ped/bikes	1.00			1.00			1.00			1.00		
Frt	0.97			0.91			1.00			0.98		
Flt Protected	1.00			0.99			0.95			1.00		
Satd. Flow (prot)	1820			1658			1805			1743		
Flt Permitted	0.98			0.90			0.31			1.00		
Satd. Flow (perm)	1798			1513			584			1743		
Volume (vph)	1	12	4	89	17	215	5	606	85	251	715	1
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	1	12	4	89	17	215	5	606	85	251	715	1
RTOR Reduction (vph)	0	3	0	0	79	0	0	4	0	0	0	0
Lane Group Flow (vph)	0		14		0		5		687		0	
Confl. Peds. (#/hr)	5		5		2		2		2		2	
Heavy Vehicles (%)	0%		0%		4%		0%		2%		0%	
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases	4		8		8		2		2		6	
Permitted Phases	4		8		8		2		2		6	
Actuated Green, G (s)	19.5		19.5		68.0		68.0		68.0		68.0	
Effective Green, g (s)	20.0		20.0		69.5		69.5		69.5		69.5	
Actuated g/C Ratio	0.20		0.20		0.70		0.70		0.70		0.70	
Clearance Time (s)	6.0		6.0		6.5		6.5		6.5		6.5	
Vehicle Extension (s)	3.0		3.0		3.0		3.0		3.0		3.0	
Lane Grp Cap (vph)	360		303		406		1211		424		1200	
v/s Ratio Prot	0.01		c0.16		0.01		0.41		0.59		0.60	
v/c Ratio	0.04		0.80		0.01		0.57		0.59		0.60	
Uniform Delay, d1	32.2		38.1		4.7		7.7		7.9		7.9	
Progression Factor	1.00		1.00		1.85		2.06		1.00		1.00	
Incremental Delay, d2	0.0		15.0		0.0		1.4		6.1		2.2	
Delay (s)	32.3		53.1		8.7		17.3		14.0		10.2	
Level of Service	C		D		A		B		B		B	
Approach Delay (s)	32.3		53.1		17.2		11.2		11.2		11.2	
Approach LOS	C		D		B		B		B		B	

Intersection Summary			
HCM Average Control Delay	20.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	89.6%	ICU Level of Service	E
Analysis Period (min)	60		
c Critical Lane Group			

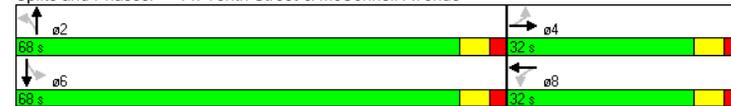
Queues  
14: Tenth Street & McConnell Avenue

Future Total - Scenario 2 + Expansion  
Weekday A.M. Peak Hour

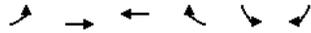
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↔			↕			↕	
Volume (vph)	1	12	89	17	5	606	251	715
Lane Group Flow (vph)	0	17	0	321	5	691	251	716
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases	4		8		2		6	
Permitted Phases	4		8		2		6	
Detector Phases	4		8		2		6	
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	25.0	25.0	25.0	25.0	19.5	19.5	19.5	19.5
Total Split (s)	32.0	32.0	32.0	32.0	68.0	68.0	68.0	68.0
Total Split (%)	32.0%	32.0%	32.0%	32.0%	68.0%	68.0%	68.0%	68.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	1.9	1.9	1.9	1.9	2.4	2.4	2.4	2.4
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.05	0.84	0.01	0.57	0.66	0.60	0.60	0.60
Control Delay	24.3	48.5	12.2	19.9	22.1	11.7	11.7	11.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.3	48.5	12.2	19.9	22.1	11.7	11.7	11.7
Queue Length 50th (m)	2.1	44.2	0.5	104.3	26.3	68.8	68.8	68.8
Queue Length 95th (m)	8.3	#95.4	m1.1m	155.1	#100.5	156.3	156.3	156.3
Internal Link Dist (m)	414.9	902.0	283.7	1842.8				
Turn Bay Length (m)			14.0	14.0				
Base Capacity (vph)	479	474	359	1216	379	1200	1200	1200
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	0.04	0.68	0.01	0.57	0.66	0.60	0.60	0.60

Intersection Summary	
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	1 (1%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	75
Control Type:	Actuated-Coordinated
#	95th percentile volume exceeds capacity, queue may be longer.
	Queue shown is maximum after two cycles.
m	Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 14: Tenth Street & McConnell Avenue



HCM Unsignalized Intersection Capacity Analysis      Future Total - Scenario 2 + Expansion  
 16: Virginia Avenue & Industrial Park Drive      Weekday A.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		↓	↓
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	87	298	362	74	87	64
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	87	298	362	74	87	64
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	436				871	399
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	436				871	399
tC, single (s)	4.1				7.4	6.4
tC, 2 stage (s)						
tF (s)	2.2				4.4	3.4
p0 queue free %	92				58	90
cM capacity (veh/h)	1129				205	621
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	385	436	151			
Volume Left	87	0	87			
Volume Right	0	74	64			
cSH	1129	1700	286			
Volume to Capacity	0.08	0.26	0.53			
Queue Length 95th (m)	2.0	0.0	25.6			
Control Delay (s)	2.5	0.0	31.4			
Lane LOS	A		D			
Approach Delay (s)	2.5	0.0	31.4			
Approach LOS			D			
<b>Intersection Summary</b>						
Average Delay			5.9			
Intersection Capacity Utilization		62.8%		ICU Level of Service		B
Analysis Period (min)			60			

HCM Signalized Intersection Capacity Analysis  
17: Marleau Avenue & Boundary Road

Future Total - Scenario 2 + Expansion  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.7	6.7	6.7	6.7	6.7	6.7	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	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1612	1845	1553	1517	1881	1482	1626	1638	1429	1719	1759	1553
Flt Permitted	0.66	1.00	1.00	0.72	1.00	1.00	0.22	1.00	0.60	1.00	1.00	1.00
Satd. Flow (perm)	1119	1845	1553	1147	1881	1482	371	1638	1429	1090	1759	1553
Volume (vph)	121	59	74	32	153	23	46	252	15	40	663	279
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	121	59	74	32	153	23	46	252	15	40	663	279
RTOR Reduction (vph)	0	0	48	0	0	15	0	0	8	0	0	131
Lane Group Flow (vph)	121	59	26	32	153	8	46	252	7	40	663	148
Heavy Vehicles (%)	12%	3%	4%	19%	1%	9%	11%	16%	13%	5%	8%	4%
Turn Type	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm
Protected Phases		4		8	8		2	2		6	6	
Permitted Phases	4		4	8	8	2		2	6	6		6
Detector Phases	4	4	4	8	8	8	2	2	2	6	6	6
Minimum Initial (s)	29.3	29.3	29.3	29.3	29.3	29.3	26.0	26.0	26.0	26.0	26.0	26.0
Minimum Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (%)	52.9%	52.9%	52.9%	52.9%	52.9%	52.9%	47.1%	47.1%	47.1%	47.1%	47.1%	47.1%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	3.2	3.2	3.2	3.2	3.2	3.2	2.9	2.9	2.9	2.9	2.9	2.9
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.25	0.07	0.10	0.06	0.19	0.04	0.36	0.30	0.02	0.07	0.74	0.31
Control Delay	14.4	12.0	3.8	12.1	13.1	5.3	28.3	15.9	7.2	14.4	27.6	4.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.4	12.0	3.8	12.1	13.1	5.3	28.3	15.9	7.2	14.4	27.6	4.2
Queue Length 50th (m)	10.2	4.6	0.0	2.5	12.5	0.0	4.6	24.5	0.0	3.4	87.6	2.7
Queue Length 95th (m)	24.3	12.3	8.1	8.1	26.7	4.4	#22.7	49.3	3.9	10.6	#184.3	22.5
Internal Link Dist (m)		2051.6			246.6		346.9			725.5		
Turn Bay Length (m)	46.0			68.0		48.0	34.0			68.0		48.0
Base Capacity (vph)	485	799	714	497	814	655	129	833	734	534	894	911
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.07	0.10	0.06	0.19	0.04	0.36	0.30	0.02	0.07	0.74	0.31

Intersection Summary

HCM Average Control Delay	17.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.7
Intersection Capacity Utilization	103.2%	ICU Level of Service	G
Analysis Period (min)	60		
c Critical Lane Group			

Queues

17: Marleau Avenue & Boundary Road

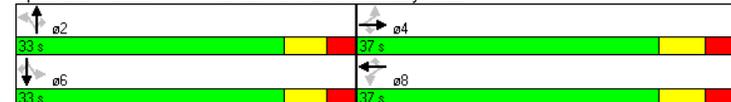
Future Total - Scenario 2 + Expansion  
Weekday A.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	121	59	74	32	153	23	46	252	15	40	663	279
Lane Group Flow (vph)	121	59	74	32	153	23	46	252	15	40	663	279
Turn Type	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm
Protected Phases		4		8	8		2	2		6	6	
Permitted Phases	4		4	8	8	2		2	6	6		6
Detector Phases	4	4	4	8	8	8	2	2	2	6	6	6
Minimum Initial (s)	29.3	29.3	29.3	29.3	29.3	29.3	26.0	26.0	26.0	26.0	26.0	26.0
Minimum Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (%)	52.9%	52.9%	52.9%	52.9%	52.9%	52.9%	47.1%	47.1%	47.1%	47.1%	47.1%	47.1%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	3.2	3.2	3.2	3.2	3.2	3.2	2.9	2.9	2.9	2.9	2.9	2.9
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.25	0.07	0.10	0.06	0.19	0.04	0.36	0.30	0.02	0.07	0.74	0.31
Control Delay	14.4	12.0	3.8	12.1	13.1	5.3	28.3	15.9	7.2	14.4	27.6	4.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.4	12.0	3.8	12.1	13.1	5.3	28.3	15.9	7.2	14.4	27.6	4.2
Queue Length 50th (m)	10.2	4.6	0.0	2.5	12.5	0.0	4.6	24.5	0.0	3.4	87.6	2.7
Queue Length 95th (m)	24.3	12.3	8.1	8.1	26.7	4.4	#22.7	49.3	3.9	10.6	#184.3	22.5
Internal Link Dist (m)		2051.6			246.6		346.9			725.5		
Turn Bay Length (m)	46.0			68.0		48.0	34.0			68.0		48.0
Base Capacity (vph)	485	799	714	497	814	655	129	833	734	534	894	911
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.07	0.10	0.06	0.19	0.04	0.36	0.30	0.02	0.07	0.74	0.31

Intersection Summary

Cycle Length: 70
Actuated Cycle Length: 70
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 17: Marleau Avenue & Boundary Road



HCM Signalized Intersection Capacity Analysis  
18: Marleau Avenue & McConnell Avenue

Future Total - Scenario 2 + Expansion  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.5		2.0	5.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1703	1810	1534	1736	1827	1509	1736	1705		1703	1792	
Flt Permitted	0.11	1.00	1.00	0.11	1.00	1.00	0.34	1.00		0.18	1.00	
Satd. Flow (perm)	199	1810	1534	199	1827	1509	618	1705		321	1792	
Volume (vph)	34	620	127	156	769	347	152	315	130	378	428	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	34	620	127	156	769	347	152	315	130	378	428	0
RTOR Reduction (vph)	0	0	81	0	0	160	0	15	0	0	0	0
Lane Group Flow (vph)	34	620	46	156	769	187	152	430	0	378	428	0
Confl. Peds. (#/hr)			5	5								
Heavy Vehicles (%)	6%	5%	2%	4%	4%	7%	4%	6%	8%	6%	6%	50%
Turn Type	Perm		Perm pm+pt		Perm pm+pt			pm+pt				
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	35.0	35.0	35.0	43.0	43.0	43.0	36.0	25.5		44.5	31.0	
Effective Green, g (s)	36.0	36.0	36.0	47.0	44.0	44.0	41.5	26.5		49.0	32.0	
Actuated g/C Ratio	0.36	0.36	0.36	0.47	0.44	0.44	0.42	0.26		0.49	0.32	
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.5		3.0	6.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	72	652	552	186	804	664	385	452		392	573	
v/s Ratio Prot		0.34		0.05	0.42		0.05	0.25		0.16	0.24	
v/s Ratio Perm	0.17		0.03	0.35		0.12				0.31		
v/c Ratio	0.47	0.95	0.08	0.84	0.96	0.28	0.39	0.95		0.96	0.75	
Uniform Delay, d1	24.7	31.1	21.1	21.3	27.1	17.9	19.4	36.1		23.5	30.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.08	0.77	
Incremental Delay, d2	21.9	37.5	0.3	32.9	34.2	1.1	0.7	50.0		50.8	7.2	
Delay (s)	46.5	68.7	21.4	54.2	61.3	19.0	20.0	86.1		76.2	30.5	
Level of Service	D	E	C	D	E	B	C	F		E	C	
Approach Delay (s)		60.0			48.9			69.3			51.9	
Approach LOS		E			D			E			D	

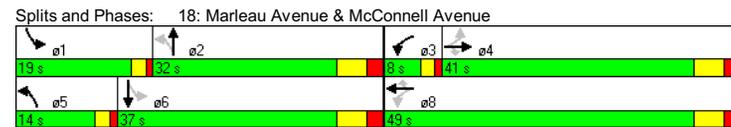
Intersection Summary			
HCM Average Control Delay	55.6	HCM Level of Service	E
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	120.2%	ICU Level of Service	H
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
18: Marleau Avenue & McConnell Avenue

Future Total - Scenario 2 + Expansion  
Weekday A.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	34	620	127	156	769	347	152	315	378	428
Lane Group Flow (vph)	34	620	127	156	769	347	152	445	378	428
Turn Type	Perm		Perm pm+pt		Perm pm+pt			pm+pt		
Protected Phases		4		3	8		5	2	1	6
Permitted Phases	4		4	8		8	2		6	
Detector Phases	4	4	4	3	8	8	5	2	1	6
Minimum Initial (s)	21.7	21.7	21.7	5.0	21.7	21.7	10.0	15.0	10.0	15.0
Minimum Split (s)	36.1	36.1	36.1	8.0	38.7	38.7	14.0	31.9	14.0	31.9
Total Split (s)	41.0	41.0	41.0	8.0	49.0	49.0	14.0	32.0	19.0	37.0
Total Split (%)	41.0%	41.0%	41.0%	8.0%	49.0%	49.0%	14.0%	32.0%	19.0%	37.0%
Yellow Time (s)	4.1	4.1	4.1	2.0	4.1	4.1	2.0	4.1	2.0	4.1
All-Red Time (s)	1.9	1.9	1.9	1.0	1.9	1.9	1.0	2.4	1.0	2.4
Lead/Lag	Lag	Lag	Lag	Lead			Lead	Lag	Lead	Lag
Lead-Lag Optimize?										
Recall Mode	C-Max	C-Max	C-Max	None	C-Max	C-Max	None	Max	None	Max
v/c Ratio	0.47	0.95	0.20	0.84	0.96	0.42	0.40	0.95	0.96	0.75
Control Delay	51.5	70.0	4.9	63.8	62.6	5.6	18.1	86.4	78.1	31.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	51.5	70.0	4.9	63.8	62.6	5.6	18.1	86.4	78.1	31.4
Queue Length 50th (m)	5.3	121.6	0.0	17.9	147.7	7.1	16.6	86.0	37.2	79.1
Queue Length 95th (m)	#24.0	#230.6	15.4	#62.1	#273.7	36.2	32.5	#177.6	#129.8	#140.1
Internal Link Dist (m)		264.6			914.0			270.6		283.7
Turn Bay Length (m)			84.0	71.0		71.0	77.0		130.0	
Base Capacity (vph)	72	652	634	186	804	824	387	466	392	574
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	0.47	0.95	0.20	0.84	0.96	0.42	0.39	0.95	0.96	0.75

Intersection Summary	
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	77 (77%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle:	90
Control Type:	Actuated-Coordinated
#	95th percentile volume exceeds capacity, queue may be longer.
m	Queue shown is maximum after two cycles.
m	Volume for 95th percentile queue is metered by upstream signal.



HCM Unsignalized Intersection Capacity Analysis Future Total - Scenario 2 + Expansion  
 22: Hwy 401 WB Ramp & Boundary Road Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗	↖	↕	↕		↕	↗	↖	↕	↕
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	2	1	144	67	28	8	69	279	22	8	730	9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	2	1	144	67	28	8	69	279	22	8	730	9
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1200	1190	734	1323	1183	290	739			301		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1200	1190	734	1323	1183	290	739			301		
tC, single (s)	7.1	6.5	6.4	7.1	6.5	6.2	4.4			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.5	3.5	4.0	3.3	2.5			2.2		
p0 queue free %	98	99	63	14	84	99	91			99		
cM capacity (veh/h)	131	171	389	78	173	754	757			1272		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	3	144	67	36	370	747						
Volume Left	2	0	67	0	69	8						
Volume Right	0	144	0	8	22	9						
cSH	142	389	78	208	757	1272						
Volume to Capacity	0.02	0.37	0.86	0.17	0.09	0.01						
Queue Length 95th (m)	0.5	13.9	61.1	5.0	2.4	0.2						
Control Delay (s)	30.8	19.7	219.6	25.9	2.8	0.2						
Lane LOS	D	C	F	D	A	A						
Approach Delay (s)	19.9		151.9		2.8	0.2						
Approach LOS	C		F									
<b>Intersection Summary</b>												
Average Delay			14.4									
Intersection Capacity Utilization	79.6%				ICU Level of Service		D					
Analysis Period (min)	60											

HCM Unsignalized Intersection Capacity Analysis Future Total - Scenario 2 + Expansion  
 25: Hwy 401 EB Ramp & Boundary Road Weekday A.M. Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖	↗	↕	↖	↖	↕
Sign Control	Stop	↗	Free	↖		Free
Grade	0%		0%			0%
Volume (veh/h)	199	13	357	135	10	931
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	199	13	357	135	10	931
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1308	357			492	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1308	357			492	
tC, single (s)	6.7	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.7	3.3			2.2	
p0 queue free %	0	98			99	
cM capacity (veh/h)	154	692			1082	
Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	
Volume Total	199	13	357	135	941	
Volume Left	199	0	0	0	10	
Volume Right	0	13	0	135	0	
cSH	154	692	1700	1700	1082	
Volume to Capacity	1.29	0.02	0.21	0.08	0.01	
Queue Length 95th (m)	253.4	0.5	0.0	0.0	0.2	
Control Delay (s)	635.8	10.3	0.0	0.0	0.3	
Lane LOS	F	B			A	
Approach Delay (s)	597.4		0.0		0.3	
Approach LOS	F					
<b>Intersection Summary</b>						
Average Delay			77.1			
Intersection Capacity Utilization	74.7%				ICU Level of Service	
Analysis Period (min)	60					

HCM Unsignalized Intersection Capacity Analysis      Future Total - Scenario 2 + Expansion  
 29: Tenth Street & Virginia Avenue      Weekday A.M. Peak Hour



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	186	10	162	10	10	10	118	199	10	10	223	203
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	186	10	162	10	10	10	118	199	10	10	223	203
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage veh												
Upstream signal (m)							308					
pX, platoon unblocked												
vC, conflicting volume	800	790	324	952	886	204	426				209	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	800	790	324	952	886	204	426				209	
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
p0 queue free %	30	97	78	94	96	99	90				99	
cM capacity (veh/h)	268	289	721	167	254	842	1144				1374	

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	358	30	327	436
Volume Left	186	10	118	10
Volume Right	162	10	10	203
cSH	375	270	1144	1374
Volume to Capacity	0.95	0.11	0.10	0.01
Queue Length 95th (m)	154.3	3.0	2.8	0.2
Control Delay (s)	108.4	20.0	3.7	0.2
Lane LOS	F	C	A	A
Approach Delay (s)	108.4	20.0	3.7	0.2
Approach LOS	F	C		

Intersection Summary			
Average Delay	35.4		
Intersection Capacity Utilization	79.7%	ICU Level of Service	D
Analysis Period (min)	60		

HCM Signalized Intersection Capacity Analysis  
5: SCM Way & Boundary Road

Future Total - Scenario 2 + Expansion  
Weekday P.M. Peak Hour

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖ ↗	↖ ↗	↖ ↗	↖ ↗	↖ ↗	↖ ↗
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2	6.2	5.2	5.2	5.2	5.2
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	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1172	1583	1671	1667	1597	1022
Flt Permitted	0.95	1.00	0.27	1.00	1.00	1.00
Satd. Flow (perm)	1172	1583	476	1667	1597	1022
Volume (vph)	100	54	12	698	689	52
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	100	54	12	698	689	52
RTOR Reduction (vph)	0	38	0	0	0	21
Lane Group Flow (vph)	100	16	12	698	689	31
Heavy Vehicles (%)	54%	2%	8%	14%	19%	58%
Turn Type	Perm	Perm			Perm	
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	29.6	29.6	62.5	62.5	62.5	62.5
Effective Green, g (s)	30.6	30.6	63.5	63.5	63.5	63.5
Actuated g/C Ratio	0.29	0.29	0.60	0.60	0.60	0.60
Clearance Time (s)	7.2	7.2	6.2	6.2	6.2	6.2
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	340	459	287	1003	961	615
v/s Ratio Prot	c0.09			0.42	c0.43	
v/s Ratio Perm		0.01	0.03			0.03
v/c Ratio	0.29	0.03	0.04	0.70	0.72	0.05
Uniform Delay, d1	29.1	26.9	8.6	14.4	14.7	8.6
Progression Factor	0.99	0.97	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	0.0	0.3	4.1	4.7	0.2
Delay (s)	29.2	26.2	8.8	18.5	19.4	8.8
Level of Service	C	C	A	B	B	A
Approach Delay (s)	28.2			18.3	18.7	
Approach LOS	C			B	B	

Intersection Summary

HCM Average Control Delay	19.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	105.5	Sum of lost time (s)	11.4
Intersection Capacity Utilization	75.9%	ICU Level of Service	D
Analysis Period (min)	60		
c Critical Lane Group			

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Synchro 6 Report  
16/10/2010

LEA Consulting, Ltd.

Queues  
5: SCM Way & Boundary Road

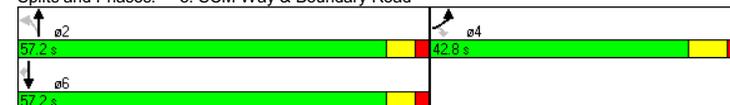
Future Total - Scenario 2 + Expansion  
Weekday P.M. Peak Hour

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖ ↗	↖ ↗	↖ ↗	↖ ↗	↖ ↗	↖ ↗
Volume (vph)	100	54	12	698	689	52
Lane Group Flow (vph)	100	54	12	698	689	52
Turn Type	Perm	Perm			Perm	
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Detector Phases	4	4	2	2	6	6
Minimum Initial (s)	35.6	35.6	15.0	15.0	15.0	15.0
Minimum Split (s)	42.8	42.8	57.2	57.2	57.2	57.2
Total Split (s)	42.8	42.8	57.2	57.2	57.2	57.2
Total Split (%)	42.8%	42.8%	57.2%	57.2%	57.2%	57.2%
Yellow Time (s)	5.4	5.4	4.1	4.1	4.1	4.1
All-Red Time (s)	1.8	1.8	2.1	2.1	2.1	2.1
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Max	Max	Max	Max
v/c Ratio	0.25	0.09	0.05	0.68	0.70	0.08
Control Delay	23.8	6.0	12.9	22.1	23.2	3.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.8	6.0	12.9	22.1	23.2	3.8
Queue Length 50th (m)	14.1	0.2	1.2	112.1	113.2	0.0
Queue Length 95th (m)	m30.3	m9.4	4.9	#224.4	#227.5	7.1
Internal Link Dist (m)	265.1			548.2	424.1	
Turn Bay Length (m)	62.0		80.0			65.0
Base Capacity (vph)	395	569	232	1029	986	651
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	0.25	0.09	0.05	0.68	0.70	0.08

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 104.3
Natural Cycle: 100
Control Type: Semi Act-Uncoord
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: SCM Way & Boundary Road



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Synchro 6 Report  
16/10/2010

LEA Consulting, Ltd.

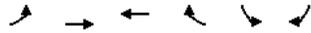
HCM Unsignalized Intersection Capacity Analysis Future Total - Scenario 2 + Expansion  
 6: Optimum Drive & SCM Way Weekday P.M. Peak Hour

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	↕
Sign Control	Free	Free	Free	Free	Stop	Stop
Grade	0%	0%	0%	0%	0%	0%
Volume (veh/h)	0	13	10	54	141	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	13	10	54	141	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)			289			
pX, platoon unblocked						
vC, conflicting volume	64				50	37
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	64				50	37
tC, single (s)	4.1				7.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				4.4	3.3
p0 queue free %	100				81	100
cM capacity (veh/h)	1551				761	1041
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	13	64	141			
Volume Left	0	0	141			
Volume Right	0	54	0			
cSH	1551	1700	761			
Volume to Capacity	0.00	0.04	0.19			
Queue Length 95th (m)	0.0	0.0	5.4			
Control Delay (s)	0.0	0.0	10.8			
Lane LOS			B			
Approach Delay (s)	0.0	0.0	10.8			
Approach LOS			B			
<b>Intersection Summary</b>						
Average Delay			7.0			
Intersection Capacity Utilization		18.3%		ICU Level of Service		A
Analysis Period (min)			60			

HCM Unsignalized Intersection Capacity Analysis Future Total - Scenario 2 + Expansion  
 7: Industrial Park Dr & Boundary Road Weekday P.M. Peak Hour

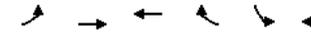
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↕	↕	↕	↕	↕	↕
Sign Control	Stop	Free	Free	Free	Free	Free
Grade	0%	0%	0%	0%	0%	0%
Volume (veh/h)	111	242	97	599	535	208
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	111	242	97	599	535	208
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1433	640	744			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1433	640	744			
tC, single (s)	6.7	6.2	4.2			
tC, 2 stage (s)						
tF (s)	3.8	3.3	2.3			
p0 queue free %	2	49	89			
cM capacity (veh/h)	113	475	845			
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>NB 1</b>	<b>NB 2</b>	<b>SB 1</b>	
Volume Total	111	242	97	599	743	
Volume Left	111	0	97	0	0	
Volume Right	0	242	0	0	208	
cSH	113	475	845	1700	1700	
Volume to Capacity	0.98	0.51	0.11	0.35	0.44	
Queue Length 95th (m)	98.7	24.3	3.1	0.0	0.0	
Control Delay (s)	255.9	20.4	9.8	0.0	0.0	
Lane LOS	F	C	A			
Approach Delay (s)	94.4		1.4		0.0	
Approach LOS	F					
<b>Intersection Summary</b>						
Average Delay				19.1		
Intersection Capacity Utilization		62.5%		ICU Level of Service		B
Analysis Period (min)				60		

HCM Unsignalized Intersection Capacity Analysis Future Total - Scenario 2 + Expansion  
 9: Industrial Park Dr & Optimum Drive Weekday P.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	76	171	9	8	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	76	171	9	8	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	180				252	176
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	180				252	176
tC, single (s)	4.1				7.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				4.4	3.3
p0 queue free %	100				99	100
cM capacity (veh/h)	1408				567	873
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	76	180	8			
Volume Left	0	0	8			
Volume Right	0	9	0			
cSH	1408	1700	567			
Volume to Capacity	0.00	0.11	0.01			
Queue Length 95th (m)	0.0	0.0	0.3			
Control Delay (s)	0.0	0.0	11.4			
Lane LOS			B			
Approach Delay (s)	0.0	0.0	11.4			
Approach LOS			B			
<b>Intersection Summary</b>						
Average Delay			0.3			
Intersection Capacity Utilization			19.5%	ICU Level of Service	A	
Analysis Period (min)			60			

HCM Unsignalized Intersection Capacity Analysis Future Total - Scenario 2 + Expansion  
 11: Boundary Access & Truck Access Weekday P.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	11	65	83	0	0	13
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	11	65	83	0	0	13
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	83				170	83
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	83				170	83
tC, single (s)	5.1				6.4	7.2
tC, 2 stage (s)						
tF (s)	3.1				3.5	4.2
p0 queue free %	99				100	98
cM capacity (veh/h)	1070				816	762
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	76	83	13			
Volume Left	11	0	0			
Volume Right	0	0	13			
cSH	1070	1700	762			
Volume to Capacity	0.01	0.05	0.02			
Queue Length 95th (m)	0.2	0.0	0.4			
Control Delay (s)	1.3	0.0	9.8			
Lane LOS	A		A			
Approach Delay (s)	1.3	0.0	9.8			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay			1.3			
Intersection Capacity Utilization			20.7%	ICU Level of Service	A	
Analysis Period (min)			60			

HCM Signalized Intersection Capacity Analysis  
13: Marleau Avenue & Virginia Avenue

Future Total - Scenario 2 + Expansion  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.3	5.3		5.3	5.3	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1433	1827	1553	1805	1845	1615	1763	1807		1805	1849	
Flt Permitted	0.11	1.00	1.00	0.22	1.00	1.00	0.54	1.00		0.61	1.00	
Satd. Flow (perm)	166	1827	1553	416	1845	1615	999	1807		1165	1849	
Volume (vph)	18	788	168	63	958	25	189	122	59	25	200	23
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	18	788	168	63	958	25	189	122	59	25	200	23
RTOR Reduction (vph)	0	0	20	0	0	2	0	25	0	0	6	0
Lane Group Flow (vph)	18	788	148	63	958	23	189	156	0	25	217	0
Confl. Peds. (#/hr)							3					3
Heavy Vehicles (%)	26%	4%	4%	0%	3%	0%	2%	0%	0%	0%	0%	9%
Turn Type	Perm		Perm	Perm		Perm	Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	43.7	43.7	43.7	43.7	43.7	43.7	18.5	18.5		18.5	18.5	
Effective Green, g (s)	44.7	44.7	44.7	44.7	44.7	44.7	19.5	19.5		19.5	19.5	
Actuated g/C Ratio	0.60	0.60	0.60	0.60	0.60	0.60	0.26	0.26		0.26	0.26	
Clearance Time (s)	6.5	6.5	6.5	6.5	6.5	6.5	6.3	6.3		6.3	6.3	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	99	1089	926	248	1100	963	260	470		303	481	
v/s Ratio Prot		0.43			c0.52			0.09			0.12	
v/s Ratio Perm	0.11		0.10	0.15		0.01	c0.19			0.02		
v/c Ratio	0.18	0.72	0.16	0.25	0.87	0.02	0.73	0.33		0.08	0.45	
Uniform Delay, d1	6.9	10.8	6.8	7.2	12.7	6.2	25.3	22.5		21.0	23.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.0	4.3	0.4	2.5	10.6	0.0	10.3	0.4		0.1	0.7	
Delay (s)	10.9	15.1	7.1	9.7	23.3	6.3	35.6	22.9		21.1	23.9	
Level of Service	B	B	A	A	C	A	D	C		C	C	
Approach Delay (s)		13.6			22.1		29.4				23.7	
Approach LOS		B			C		C				C	

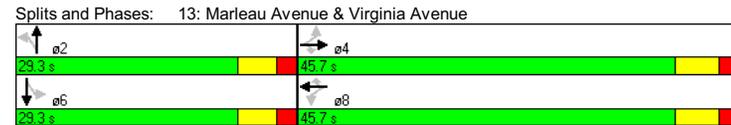
Intersection Summary			
HCM Average Control Delay	20.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	91.3%	ICU Level of Service	F
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
13: Marleau Avenue & Virginia Avenue

Future Total - Scenario 2 + Expansion  
Weekday P.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	18	788	168	63	958	25	189	122	25	200
Lane Group Flow (vph)	18	788	168	63	958	25	189	181	25	223
Turn Type	Perm		Perm	Perm		Perm	Perm		Perm	
Protected Phases		4			8			2		6
Permitted Phases	4		4	8		8	2		6	
Detector Phases	4	4	4	8	8	8	2	2	6	6
Minimum Initial (s)	18.2	18.2	18.2	18.0	18.0	18.0	15.0	15.0	15.0	15.0
Minimum Split (s)	35.7	35.7	35.7	35.7	35.7	35.7	29.3	29.3	29.3	29.3
Total Split (s)	45.7	45.7	45.7	45.7	45.7	45.7	29.3	29.3	29.3	29.3
Total Split (%)	60.9%	60.9%	60.9%	60.9%	60.9%	60.9%	39.1%	39.1%	39.1%	39.1%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.1	4.1	4.1	4.1
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.2	2.2	2.2	2.2
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max	None	None	None	None
v/c Ratio	0.20	0.72	0.18	0.33	0.87	0.03	0.69	0.37	0.08	0.46
Control Delay	15.6	17.0	6.0	15.1	26.3	6.5	39.0	19.7	19.9	25.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.6	17.0	6.0	15.1	26.3	6.5	39.0	19.7	19.9	25.0
Queue Length 50th (m)	1.1	73.1	6.7	4.1	105.1	1.0	25.6	17.8	2.8	27.1
Queue Length 95th (m)	7.5	#195.3	20.5	18.6	#257.8	5.1	#53.2	36.3	8.8	48.8
Internal Link Dist (m)		914.0			682.0			404.6		283.6
Turn Bay Length (m)	25.0		10.0	25.0		10.0	25.0			
Base Capacity (vph)	90	1090	947	193	1101	966	339	601	384	597
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.20	0.72	0.18	0.33	0.87	0.03	0.56	0.30	0.07	0.37

Intersection Summary	
Cycle Length:	75
Actuated Cycle Length:	75
Offset:	0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle:	80
Control Type:	Actuated-Coordinated
#	95th percentile volume exceeds capacity, queue may be longer.
	Queue shown is maximum after two cycles.



HCM Signalized Intersection Capacity Analysis  
14: Tenth Street & McConnell Avenue

Future Total - Scenario 2 + Expansion  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔			↕			↕			↕		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5			5.5			5.0			5.0		
Lane Util. Factor	1.00			1.00			1.00			1.00		
Frpb, ped/bikes	1.00			0.98			1.00			1.00		
Flpb, ped/bikes	1.00			1.00			1.00			1.00		
Frt	0.98			0.91			1.00			0.99		
Flt Protected	0.98			0.99			0.95			1.00		
Satd. Flow (prot)	1679			1676			1805			1831		
Flt Permitted	0.79			0.94			0.29			1.00		
Satd. Flow (perm)	1354			1589			557			1831		
Volume (vph)	8	12	3	31	32	131	7	883	34	201	794	11
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	8	12	3	31	32	131	7	883	34	201	794	11
RTOR Reduction (vph)	0	3	0	0	80	0	0	1	0	0	0	0
Lane Group Flow (vph)	0	20	0	0	114	0	7	916	0	201	805	0
Confl. Peds. (#/hr)	2		4		4		2		2		2	
Heavy Vehicles (%)	25%	0%	0%	2%	0%	0%	0%	3%	6%	1%	7%	0%
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases	4		8		8		2		6		6	
Permitted Phases	4		8		8		2		6		6	
Actuated Green, G (s)	13.0		13.0		74.5		74.5		74.5		74.5	
Effective Green, g (s)	13.5		13.5		76.0		76.0		76.0		76.0	
Actuated g/C Ratio	0.14		0.14		0.76		0.76		0.76		0.76	
Clearance Time (s)	6.0		6.0		6.5		6.5		6.5		6.5	
Vehicle Extension (s)	3.0		3.0		3.0		3.0		3.0		3.0	
Lane Grp Cap (vph)	183		215		423		1392		344		1348	
v/s Ratio Prot					c0.50		c0.50		0.45		0.45	
v/s Ratio Perm	0.02		c0.07		0.01		0.44					
v/c Ratio	0.11		0.53		0.02		0.66		0.58		0.60	
Uniform Delay, d1	38.0		40.3		2.9		5.8		5.2		5.3	
Progression Factor	1.00		1.00		1.87		2.24		1.00		1.00	
Incremental Delay, d2	0.3		2.4		0.0		1.5		7.3		2.0	
Delay (s)	38.3		42.6		5.5		14.3		12.5		7.2	
Level of Service	D		D		A		B		B		A	
Approach Delay (s)	38.3		42.6		14.3		8.3		A		A	
Approach LOS	D		D		B		A		A		A	

Intersection Summary			
HCM Average Control Delay	14.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	85.5%	ICU Level of Service	E
Analysis Period (min)	60		
c Critical Lane Group			

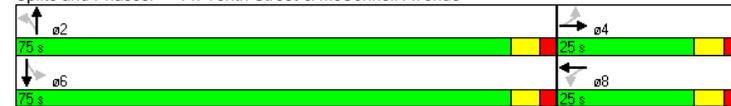
Queues  
14: Tenth Street & McConnell Avenue

Future Total - Scenario 2 + Expansion  
Weekday P.M. Peak Hour

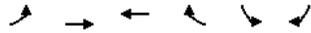
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↔			↕			↕	
Volume (vph)	8	12	31	32	7	883	201	794
Lane Group Flow (vph)	0	23	0	194	7	917	201	805
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases	4		8		2		6	
Permitted Phases	4		8		2		6	
Detector Phases	4	4	8	8	2	2	6	6
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	25.0	25.0	25.0	25.0	19.5	19.5	19.5	19.5
Total Split (s)	25.0	25.0	25.0	25.0	75.0	75.0	75.0	75.0
Total Split (%)	25.0%	25.0%	25.0%	25.0%	75.0%	75.0%	75.0%	75.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	1.9	1.9	1.9	1.9	2.4	2.4	2.4	2.4
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.11	0.11	0.65	0.02	0.66	0.69	0.60	0.60
Control Delay	33.6		32.0		7.6	16.7	23.9	8.2
Queue Delay	0.0		0.0		0.0	0.0	0.0	0.0
Total Delay	33.6		32.0		7.6	16.7	23.9	8.2
Queue Length 50th (m)	3.7		19.6		0.5	123.7	15.7	54.6
Queue Length 95th (m)	11.6		48.2		m1.0m	166.3	#88.1	147.6
Internal Link Dist (m)	414.9		902.0		283.7		1842.8	
Turn Bay Length (m)			14.0		14.0			
Base Capacity (vph)	303		387		378	1392	292	1348
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	0.08		0.50		0.02	0.66	0.69	0.60

Intersection Summary	
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	60 (60%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle:	90
Control Type:	Actuated-Coordinated
#	95th percentile volume exceeds capacity, queue may be longer.
m	Volume shown is maximum after two cycles.
m	Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 14: Tenth Street & McConnell Avenue



HCM Unsignalized Intersection Capacity Analysis      Future Total - Scenario 2 + Expansion  
 16: Virginia Avenue & Industrial Park Drive      Weekday P.M. Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	↕
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	78	67	85	11	9	90
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	78	67	85	11	9	90
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	96				314	90
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	96				314	90
tC, single (s)	4.2				7.4	6.2
tC, 2 stage (s)						
tF (s)	2.3				4.4	3.3
p0 queue free %	95				98	91
cM capacity (veh/h)	1473				490	970
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	145	96	99			
Volume Left	78	0	9			
Volume Right	0	11	90			
cSH	1473	1700	891			
Volume to Capacity	0.05	0.06	0.11			
Queue Length 95th (m)	1.3	0.0	3.0			
Control Delay (s)	4.3	0.0	9.5			
Lane LOS	A		A			
Approach Delay (s)	4.3	0.0	9.5			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay			4.6			
Intersection Capacity Utilization		27.2%		ICU Level of Service		A
Analysis Period (min)			60			

HCM Signalized Intersection Capacity Analysis  
17: Marleau Avenue & Boundary Road

Future Total - Scenario 2 + Expansion  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.7	6.7	6.7	6.7	6.7	6.7	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	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1684	1810	1553	1612	1827	1449	1736	1712	1380	1612	1759	1509
Flt Permitted	0.70	1.00	1.00	0.67	1.00	1.00	0.29	1.00	1.00	0.30	1.00	1.00
Satd. Flow (perm)	1234	1810	1553	1134	1827	1449	521	1712	1380	511	1759	1509
Volume (vph)	171	139	51	34	94	33	89	492	41	57	507	213
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	171	139	51	34	94	33	89	492	41	57	507	213
RTOR Reduction (vph)	0	0	29	0	0	19	0	0	25	0	0	131
Lane Group Flow (vph)	171	139	22	34	94	14	89	492	16	57	507	82
Confl. Peds. (#/hr)	1					1						
Heavy Vehicles (%)	7%	5%	4%	12%	4%	9%	4%	11%	17%	12%	8%	7%
Turn Type	Perm		Perm	Perm		Perm	Perm		Perm	Perm		Perm
Protected Phases		4			8			2		2		6
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	29.3	29.3	29.3	29.3	29.3	29.3	26.0	26.0	26.0	26.0	26.0	26.0
Effective Green, g (s)	30.3	30.3	30.3	30.3	30.3	30.3	27.0	27.0	27.0	27.0	27.0	27.0
Actuated g/C Ratio	0.43	0.43	0.43	0.43	0.43	0.43	0.39	0.39	0.39	0.39	0.39	0.39
Clearance Time (s)	7.7	7.7	7.7	7.7	7.7	7.7	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	534	783	672	491	791	627	201	660	532	197	678	582
v/s Ratio Prot		0.08			0.05			0.29			0.29	
v/s Ratio Perm	c0.14		0.01	0.03		0.01	0.17		0.01	0.11		0.05
v/c Ratio	0.32	0.18	0.03	0.07	0.12	0.02	0.44	0.75	0.03	0.29	0.75	0.14
Uniform Delay, d1	13.1	12.2	11.4	11.6	11.9	11.4	15.9	18.5	13.4	14.9	18.6	14.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	0.1	0.0	0.1	0.1	0.0	7.1	7.9	0.1	3.7	7.7	0.5
Delay (s)	13.4	12.3	11.4	11.7	11.9	11.4	23.0	26.4	13.5	18.6	26.3	14.5
Level of Service	B	B	B	B	B	B	C	C	B	B	C	B
Approach Delay (s)		12.7			11.8			25.1			22.5	
Approach LOS		B			B			C			C	

Intersection Summary

HCM Average Control Delay	20.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.7
Intersection Capacity Utilization	91.7%	ICU Level of Service	F
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
17: Marleau Avenue & Boundary Road

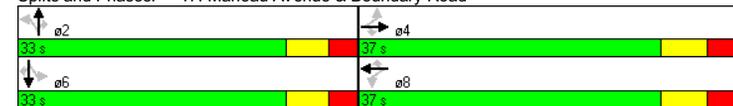
Future Total - Scenario 2 + Expansion  
Weekday P.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	171	139	51	34	94	33	89	492	41	57	507	213
Lane Group Flow (vph)	171	139	51	34	94	33	89	492	41	57	507	213
Turn Type	Perm		Perm	Perm		Perm	Perm		Perm	Perm		Perm
Protected Phases		4			8			2		2		6
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phases	4	4	4	8	8	8	2	2	2	6	6	6
Minimum Initial (s)	29.3	29.3	29.3	29.3	29.3	29.3	15.0	15.0	15.0	15.0	15.0	15.0
Minimum Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	23.0	23.0	23.0	23.0	23.0	23.0
Total Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (%)	52.9%	52.9%	52.9%	52.9%	52.9%	52.9%	47.1%	47.1%	47.1%	47.1%	47.1%	47.1%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	3.2	3.2	3.2	3.2	3.2	3.2	2.9	2.9	2.9	2.9	2.9	2.9
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.32	0.18	0.07	0.07	0.12	0.05	0.44	0.75	0.07	0.29	0.75	0.30
Control Delay	15.2	13.0	4.2	12.2	12.4	4.8	24.8	27.6	5.3	19.9	27.5	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.2	13.0	4.2	12.2	12.4	4.8	24.8	27.6	5.3	19.9	27.5	3.6
Queue Length 50th (m)	14.9	11.3	0.0	2.6	7.4	0.0	8.8	56.8	0.0	5.3	58.6	0.0
Queue Length 95th (m)	33.1	24.6	6.7	8.5	17.6	5.4	26.7	#124.4	6.6	16.8	#127.3	16.0
Internal Link Dist (m)		2051.6			246.6		346.9			725.5		
Turn Bay Length (m)	46.0			68.0		48.0	34.0			68.0		48.0
Base Capacity (vph)	534	783	701	490	791	646	201	660	557	197	678	713
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.32	0.18	0.07	0.07	0.12	0.05	0.44	0.75	0.07	0.29	0.75	0.30

Intersection Summary

Cycle Length: 70
Actuated Cycle Length: 70
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 65
Control Type: Actuated-Coordinated
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 17: Marleau Avenue & Boundary Road



HCM Signalized Intersection Capacity Analysis  
18: Marleau Avenue & McConnell Avenue

Future Total - Scenario 2 + Expansion  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.5		2.0	5.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1719	1810	1560	1770	1863	1568	1785	1805		1719	1863	
Flt Permitted	0.12	1.00	1.00	0.11	1.00	1.00	0.40	1.00		0.11	1.00	
Satd. Flow (perm)	219	1810	1560	196	1863	1568	751	1805		190	1863	
Volume (vph)	39	697	178	124	760	365	275	520	99	375	385	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	39	697	178	124	760	365	275	520	99	375	385	0
RTOR Reduction (vph)	0	0	106	0	0	171	0	7	0	0	0	0
Lane Group Flow (vph)	39	697	72	124	760	194	275	612	0	375	385	0
Confl. Peds. (#/hr)		2	2			3			2	2		3
Heavy Vehicles (%)	5%	5%	1%	2%	2%	3%	1%	2%	4%	5%	2%	12%
Turn Type	Perm		Perm pm+pt		Perm pm+pt				pm+pt			
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	32.0	32.0	32.0	39.0	39.0	39.0	42.5	31.5		48.5	34.5	
Effective Green, g (s)	33.0	33.0	33.0	43.0	40.0	40.0	48.0	32.5		53.0	35.5	
Actuated g/C Ratio	0.33	0.33	0.33	0.43	0.40	0.40	0.48	0.32		0.53	0.36	
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.5		3.0	6.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	72	597	515	163	745	627	485	587		330	661	
v/s Ratio Prot		c0.39		0.04	c0.41		0.07	c0.34		c0.17	0.21	
v/s Ratio Perm	0.18		0.05	0.29		0.12	0.20			0.43		
v/c Ratio	0.54	1.17	0.14	0.76	1.02	0.31	0.57	1.04		1.14	0.58	
Uniform Delay, d1	27.3	33.5	23.5	23.9	30.0	20.5	16.5	33.8		29.9	26.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.01	0.78	
Incremental Delay, d2	8.3	321.2	0.1	20.9	87.1	0.3	1.5	123.9		277.8	3.0	
Delay (s)	35.6	354.7	23.7	44.8	117.1	20.8	18.1	157.6		308.0	23.6	
Level of Service	D	F	C	D	F	C	B	F		F	C	
Approach Delay (s)		276.6			81.8			114.7			163.9	
Approach LOS		F			F			F			F	

Intersection Summary

HCM Average Control Delay	152.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.13		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	17.5
Intersection Capacity Utilization	127.1%	ICU Level of Service	H
Analysis Period (min)	60		
c Critical Lane Group			

Queues

18: Marleau Avenue & McConnell Avenue

Future Total - Scenario 2 + Expansion  
Weekday P.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	39	697	178	124	760	365	275	520	375	385
Lane Group Flow (vph)	39	697	178	124	760	365	275	619	375	385
Turn Type	Perm		Perm pm+pt		Perm pm+pt				pm+pt	
Protected Phases		4		3	8		5	2	1	6
Permitted Phases	4		4	8		8	2		6	
Detector Phases	4	4	4	3	8	8	5	2	1	6
Minimum Initial (s)	20.0	20.0	20.0	3.0	20.0	20.0	11.0	20.0	11.0	20.0
Minimum Split (s)	28.0	28.0	28.0	7.0	28.0	28.0	14.0	28.5	14.0	28.5
Total Split (s)	38.0	38.0	38.0	7.0	45.0	45.0	14.0	38.0	17.0	41.0
Total Split (%)	38.0%	38.0%	38.0%	7.0%	45.0%	45.0%	14.0%	38.0%	17.0%	41.0%
Yellow Time (s)	4.1	4.1	4.1	3.0	4.1	4.1	2.0	4.1	2.0	4.1
All-Red Time (s)	1.9	1.9	1.9	0.0	1.9	1.9	1.0	2.4	1.0	2.4
Lead/Lag	Lag	Lag	Lag	Lead			Lead	Lag	Lead	Lag
Lead-Lag Optimize?										
Recall Mode	Min	Min	Min	Min	Min	Min	Min	C-Min	Min	C-Min
v/c Ratio	0.54	1.17	0.29	0.76	1.02	0.46	0.57	1.04	1.14	0.58
Control Delay	61.2	353.5	6.7	54.0	118.2	7.2	18.6	158.5	305.5	24.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	61.2	353.5	6.7	54.0	118.2	7.2	18.6	158.5	305.5	24.1
Queue Length 50th (m)	6.4	~170.1	2.8	15.1	~159.4	10.1	29.6	~136.3	~70.6	63.6
Queue Length 95th (m)	#27.7	#281.5	23.1	#49.2	#281.5	44.1	53.1	#243.5	#153.9	93.5
Internal Link Dist (m)		264.6			914.0			195.9		283.7
Turn Bay Length (m)			84.0	71.0		71.0	77.0		130.0	
Base Capacity (vph)	72	597	621	163	745	798	484	593	330	661
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	0.54	1.17	0.29	0.76	1.02	0.46	0.57	1.04	1.14	0.58

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 96 (96%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 140
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite. Queue shown is maximum after two cycles.
# 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.

Splits and Phases: 18: Marleau Avenue & McConnell Avenue



HCM Unsignalized Intersection Capacity Analysis Future Total - Scenario 2 + Expansion  
 22: Hwy 401 WB Ramp & Boundary Road Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↕		↗	↖	↕		↕		↕		↕	
Sign Control	Stop				Stop		Free		Free		Free	
Grade	0%				0%		0%		0%		0%	
Volume (veh/h)	9	1	90	46	17	12	88	520	105	11	542	6
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	9	1	90	46	17	12	88	520	105	11	542	6
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None				None							
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1336	1368	545	1406	1318	572	548			625		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1336	1368	545	1406	1318	572	548			625		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	92	99	83	49	88	98	91			99		
cM capacity (veh/h)	107	133	538	89	142	519	1021			956		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	10	90	46	29	713	559						
Volume Left	9	0	46	0	88	11						
Volume Right	0	90	0	12	105	6						
cSH	109	538	89	203	1021	956						
Volume to Capacity	0.09	0.17	0.51	0.14	0.09	0.01						
Queue Length 95th (m)	2.4	4.8	22.5	4.0	2.3	0.3						
Control Delay (s)	41.2	13.0	85.9	25.7	2.2	0.3						
Lane LOS	E	B	F	D	A	A						
Approach Delay (s)	15.8		62.6		2.2	0.3						
Approach LOS	C		F									
Intersection Summary												
Average Delay			5.5									
Intersection Capacity Utilization			87.3%		ICU Level of Service		E					
Analysis Period (min)			60									

HCM Unsignalized Intersection Capacity Analysis Future Total - Scenario 2 + Expansion  
 25: Hwy 401 EB Ramp & Boundary Road Weekday P.M. Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖	↗	↕	↖	↗	↕
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	71	51	662	136	8	670
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	71	51	662	136	8	670
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1348	662			798	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1348	662			798	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	57	89			99	
cM capacity (veh/h)	165	462			824	
Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	
Volume Total	71	51	662	136	678	
Volume Left	71	0	0	0	8	
Volume Right	0	51	0	136	0	
cSH	165	462	1700	1700	824	
Volume to Capacity	0.43	0.11	0.39	0.08	0.01	
Queue Length 95th (m)	17.4	3.0	0.0	0.0	0.2	
Control Delay (s)	43.1	13.8	0.0	0.0	0.3	
Lane LOS	E	B			A	
Approach Delay (s)	30.9		0.0		0.3	
Approach LOS	D					
Intersection Summary						
Average Delay			2.5			
Intersection Capacity Utilization			52.2%		ICU Level of Service	
Analysis Period (min)			60		A	

HCM Unsignalized Intersection Capacity Analysis      Future Total - Scenario 2 + Expansion  
 29: Tenth Street & Virginia Avenue      Weekday P.M. Peak Hour



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	86	10	161	10	10	10	81	59	10	10	62	113
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	86	10	161	10	10	10	81	59	10	10	62	113
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage veh												
Upstream signal (m)	308											
pX, platoon unblocked												
vC, conflicting volume	380	370	118	530	421	64	175			69		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	380	370	118	530	421	64	175			69		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	84	98	83	97	98	99	94			99		
cM capacity (veh/h)	533	527	939	359	494	1006	1414			1545		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	257	30	150	185
Volume Left	86	10	81	10
Volume Right	161	10	10	113
cSH	730	517	1414	1545
Volume to Capacity	0.35	0.06	0.06	0.01
Queue Length 95th (m)	12.9	1.5	1.5	0.2
Control Delay (s)	12.6	12.4	4.4	0.4
Lane LOS	B	B	A	A
Approach Delay (s)	12.6	12.4	4.4	0.4
Approach LOS	B	B		

Intersection Summary			
Average Delay	7.0		
Intersection Capacity Utilization	48.9%	ICU Level of Service	A
Analysis Period (min)	60		

*Future Total- Scenario 2 with Expansion: Road Improvements*

HCM Signalized Intersection Capacity Analysis  
13: Marleau Avenue & Virginia Avenue

Future Total - Scenario 2: Improvements  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	5.5	2.0	5.3		5.3	5.3	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1570	1810	1357	1719	1810	1615	1687	1853		1805	1770	
Flt Permitted	0.13	1.00	1.00	0.09	1.00	1.00	0.23	1.00		0.60	1.00	
Satd. Flow (perm)	213	1810	1357	163	1810	1615	414	1853		1134	1770	
Volume (vph)	84	840	73	40	789	25	275	233	30	25	286	99
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	84	840	73	40	789	25	275	233	30	25	286	99
RTOR Reduction (vph)	0	0	8	0	0	3	0	5	0	0	14	0
Lane Group Flow (vph)	84	840	65	40	789	22	275	258	0	25	371	0
Confl. Peds. (#/hr)			7	7			2					2
Heavy Vehicles (%)	15%	5%	15%	5%	5%	0%	7%	0%	7%	0%	0%	11%
Turn Type	Perm		Perm	Perm		Perm	pm+pt		Perm			
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	44.3	44.3	44.3	44.3	44.3	44.3	32.9	32.9		20.8	20.8	
Effective Green, g (s)	45.3	45.3	45.3	45.3	45.3	45.3	37.2	33.9		21.8	21.8	
Actuated g/C Ratio	0.50	0.50	0.50	0.50	0.50	0.50	0.41	0.38		0.24	0.24	
Clearance Time (s)	6.5	6.5	6.5	6.5	6.5	6.5	2.0	6.3		6.3	6.3	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	107	911	683	82	911	813	314	698		275	429	
v/s Ratio Prot		c0.46			0.44		c0.10	0.14			c0.21	
v/s Ratio Perm	0.39		0.05	0.24		0.01	0.26			0.02		
v/c Ratio	0.79	0.92	0.10	0.49	0.87	0.03	0.88	0.37		0.09	0.86	
Uniform Delay, d1	18.4	20.7	11.7	14.7	19.7	11.3	20.6	20.3		26.4	32.7	
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	53.9	20.4	0.3	20.5	12.2	0.1	28.4	0.3		0.1	19.2	
Delay (s)	72.3	41.1	11.9	35.2	31.8	11.3	49.0	20.6		26.6	51.8	
Level of Service	E	D	B	D	C	B	D	C		C	D	
Approach Delay (s)		41.6			31.4			35.1			50.3	
Approach LOS		D			C			D			D	

Intersection Summary

HCM Average Control Delay	38.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.8
Intersection Capacity Utilization	112.7%	ICU Level of Service	H
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
13: Marleau Avenue & Virginia Avenue

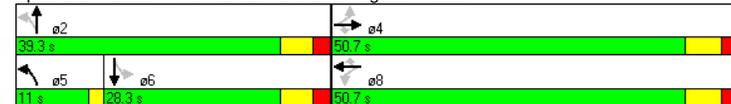
Future Total - Scenario 2: Improvements  
Weekday A.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	84	840	73	40	789	25	275	233	25	286
Lane Group Flow (vph)	84	840	73	40	789	25	275	263	25	385
Turn Type	Perm		Perm	Perm		Perm	pm+pt		Perm	
Protected Phases		4			8		5	2		6
Permitted Phases	4		4	8		8	2		6	
Detector Phases	4	4	4	8	8	8	5	2	6	6
Minimum Initial (s)	18.2	18.2	18.2	18.2	18.2	18.2	4.0	15.0	15.0	15.0
Minimum Split (s)	28.5	28.5	28.5	28.5	28.5	28.5	8.0	28.3	28.3	28.3
Total Split (s)	50.7	50.7	50.7	50.7	50.7	50.7	11.0	39.3	28.3	28.3
Total Split (%)	56.3%	56.3%	56.3%	56.3%	56.3%	56.3%	12.2%	43.7%	31.4%	31.4%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	2.0	4.1	4.1	4.1
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.0	2.2	2.2	2.2
Lead/Lag							Lead		Lag	Lag
Lead-Lag Optimize?							Yes		Yes	Yes
Recall Mode	C-Min	C-Min	C-Min	C-Min	C-Min	C-Min	None	Min	None	None
v/c Ratio	0.79	0.92	0.11	0.49	0.87	0.03	0.85	0.37	0.09	0.87
Control Delay	81.6	42.5	10.0	41.6	33.1	9.6	51.7	21.6	26.7	56.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	81.6	42.5	10.0	41.6	33.1	9.6	51.7	21.6	26.7	56.6
Queue Length 50th (m)	12.1	135.2	5.1	4.6	120.7	1.7	34.1	32.9	3.5	63.2
Queue Length 95th (m)	#48.2	#262.9	14.1	#25.1	#239.6	6.4	#96.8	61.4	11.2	#134.4
Internal Link Dist (m)		914.0			682.0			404.6		283.6
Turn Bay Length (m)	25.0		10.0	25.0		10.0	25.0			
Base Capacity (vph)	106	912	691	81	912	817	323	705	290	466
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	0.79	0.92	0.11	0.49	0.87	0.03	0.85	0.37	0.09	0.83

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 13: Marleau Avenue & Virginia Avenue



HCM Signalized Intersection Capacity Analysis  
18: Marleau Avenue & McConnell Avenue

Future Total - Scenario 2: Improvements  
Weekday A.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.5		2.0	5.5	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1703	3438	1537	1734	3471	1509	1736	1705		1703	1792	
Flt Permitted	0.31	1.00	1.00	0.28	1.00	1.00	0.38	1.00		0.24	1.00	
Satd. Flow (perm)	557	3438	1537	513	3471	1509	690	1705		424	1792	
Volume (vph)	34	620	127	156	769	347	152	315	130	378	428	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	34	620	127	156	769	347	152	315	130	378	428	0
RTOR Reduction (vph)	0	0	86	0	0	208	0	15	0	0	0	0
Lane Group Flow (vph)	34	620	41	156	769	139	152	430	0	378	428	0
Confl. Peds. (#/hr)			5	5								
Heavy Vehicles (%)	6%	5%	2%	4%	4%	7%	4%	6%	8%	6%	6%	50%
Turn Type	Perm		Perm pm+pt		Perm pm+pt			pm+pt				
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	31.0	31.0	31.0	39.0	39.0	39.0	40.1	29.7		48.5	35.1	
Effective Green, g (s)	32.0	32.0	32.0	43.0	40.0	40.0	45.6	30.7		53.0	36.1	
Actuated g/C Ratio	0.32	0.32	0.32	0.43	0.40	0.40	0.46	0.31		0.53	0.36	
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.5		3.0	6.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	178	1100	492	294	1388	604	434	523		440	647	
v/s Ratio Prot		0.18		0.03	c0.22		0.04	c0.25		c0.14	0.24	
v/s Ratio Perm	0.06		0.03	0.20		0.09	0.12			0.31		
v/c Ratio	0.19	0.56	0.08	0.53	0.55	0.23	0.35	0.82		0.86	0.66	
Uniform Delay, d1	24.6	28.2	23.7	18.8	23.1	19.8	16.7	32.1		17.4	26.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.26	0.74	
Incremental Delay, d2	2.4	2.1	0.3	1.9	1.6	0.9	0.5	15.3		14.1	4.2	
Delay (s)	27.0	30.3	24.1	20.6	24.7	20.7	17.2	47.4		36.0	24.1	
Level of Service	C	C	C	C	C	C	B	D		D	C	
Approach Delay (s)		29.2			23.1			39.7			29.7	
Approach LOS		C			C			D			C	

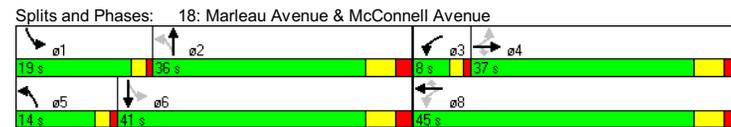
Intersection Summary			
HCM Average Control Delay	28.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	101.0%	ICU Level of Service	G
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
18: Marleau Avenue & McConnell Avenue

Future Total - Scenario 2: Improvements  
Weekday A.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	34	620	127	156	769	347	152	315	378	428
Lane Group Flow (vph)	34	620	127	156	769	347	152	445	378	428
Turn Type	Perm		Perm pm+pt		Perm pm+pt			pm+pt		
Protected Phases		4		3	8		5	2	1	6
Permitted Phases	4		4	8		8	2		6	
Detector Phases	4	4	4	3	8	8	5	2	1	6
Minimum Initial (s)	21.7	21.7	21.7	5.0	21.7	21.7	10.0	15.0	10.0	15.0
Minimum Split (s)	36.1	36.1	36.1	8.0	38.7	38.7	14.0	33.5	14.0	31.9
Total Split (s)	37.0	37.0	37.0	8.0	45.0	45.0	14.0	36.0	19.0	41.0
Total Split (%)	37.0%	37.0%	37.0%	8.0%	45.0%	45.0%	14.0%	36.0%	19.0%	41.0%
Yellow Time (s)	4.1	4.1	4.1	2.0	4.1	4.1	2.0	4.1	2.0	4.1
All-Red Time (s)	1.9	1.9	1.9	1.0	1.9	1.9	1.0	2.4	1.0	2.4
Lead/Lag	Lag	Lag	Lag	Lead			Lead	Lag	Lead	Lag
Lead-Lag Optimize?										
Recall Mode	C-Max	C-Max	C-Max	None	C-Max	C-Max	None	Max	None	Max
v/c Ratio	0.19	0.56	0.22	0.53	0.55	0.43	0.36	0.83	0.86	0.66
Control Delay	28.2	30.6	5.6	25.7	25.0	4.0	15.0	47.2	39.7	24.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.2	30.6	5.6	25.7	25.0	4.0	15.0	47.2	39.7	24.7
Queue Length 50th (m)	5.0	54.8	0.0	19.4	62.3	0.0	15.2	80.7	25.7	74.3
Queue Length 95th (m)	15.2	83.8	16.5	37.7	94.2	27.0	29.7	#162.6#107.9	m98.6	
Internal Link Dist (m)		264.6			914.0			270.6		283.7
Turn Bay Length (m)			84.0	71.0		71.0	77.0		130.0	
Base Capacity (vph)	178	1100	578	294	1388	812	438	537	440	647
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	0.19	0.56	0.22	0.53	0.55	0.43	0.35	0.83	0.86	0.66

Intersection Summary	
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	77 (77%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle:	95
Control Type:	Actuated-Coordinated
#	95th percentile volume exceeds capacity, queue may be longer.
	Queue shown is maximum after two cycles.
m	Volume for 95th percentile queue is metered by upstream signal.



HCM Signalized Intersection Capacity Analysis  
13: Marleau Avenue & Virginia Avenue

Future Total - Scenario 2: Improvements  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.3	5.3		5.3	5.3	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1433	1827	1553	1805	1845	1615	1766	1807		1805	1851	
Flt Permitted	0.11	1.00	1.00	0.22	1.00	1.00	0.54	1.00		0.61	1.00	
Satd. Flow (perm)	168	1827	1553	417	1845	1615	999	1807		1164	1851	
Volume (vph)	18	788	168	63	958	25	189	122	59	25	200	23
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	18	788	168	63	958	25	189	122	59	25	200	23
RTOR Reduction (vph)	0	0	20	0	0	2	0	25	0	0	6	0
Lane Group Flow (vph)	18	788	148	63	958	23	189	156	0	25	217	0
Confl. Peds. (#/hr)							3					3
Heavy Vehicles (%)	26%	4%	4%	0%	3%	0%	2%	0%	0%	0%	0%	9%
Turn Type	Perm		Perm	Perm		Perm	Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	43.8	43.8	43.8	43.8	43.8	43.8	18.4	18.4		18.4	18.4	
Effective Green, g (s)	44.8	44.8	44.8	44.8	44.8	44.8	19.4	19.4		19.4	19.4	
Actuated g/C Ratio	0.60	0.60	0.60	0.60	0.60	0.60	0.26	0.26		0.26	0.26	
Clearance Time (s)	6.5	6.5	6.5	6.5	6.5	6.5	6.3	6.3		6.3	6.3	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	100	1091	928	249	1102	965	258	467		301	479	
v/s Ratio Prot		0.43			0.52			0.09			0.12	
v/s Ratio Perm	0.11		0.10	0.15		0.01	0.19			0.02		
v/c Ratio	0.18	0.72	0.16	0.25	0.87	0.02	0.73	0.33		0.08	0.45	
Uniform Delay, d1	6.8	10.7	6.7	7.2	12.6	6.2	25.4	22.6		21.1	23.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.9	4.3	0.4	2.4	10.4	0.0	10.9	0.4		0.1	0.7	
Delay (s)	10.8	14.9	7.1	9.6	23.1	6.2	36.3	23.0		21.2	24.0	
Level of Service	B	B	A	A	C	A	D	C		C	C	
Approach Delay (s)		13.5			21.8			29.8			23.7	
Approach LOS		B			C			C			C	

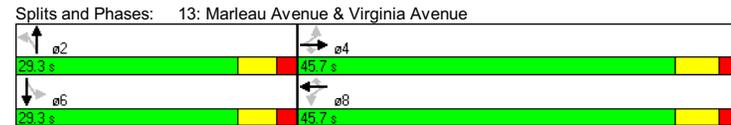
Intersection Summary			
HCM Average Control Delay	20.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	91.3%	ICU Level of Service	F
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
13: Marleau Avenue & Virginia Avenue

Future Total - Scenario 2: Improvements  
Weekday P.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	18	788	168	63	958	25	189	122	25	200
Lane Group Flow (vph)	18	788	168	63	958	25	189	181	25	223
Turn Type	Perm		Perm	Perm		Perm	Perm		Perm	
Protected Phases		4			8			2		6
Permitted Phases	4		4	8		8	2		6	6
Detector Phases	4	4	4	8	8	8	2	2	6	6
Minimum Initial (s)	18.2	18.2	18.2	18.0	18.0	18.0	15.0	15.0	15.0	15.0
Minimum Split (s)	35.7	35.7	35.7	35.7	35.7	35.7	29.3	29.3	29.3	29.3
Total Split (s)	45.7	45.7	45.7	45.7	45.7	45.7	29.3	29.3	29.3	29.3
Total Split (%)	60.9%	60.9%	60.9%	60.9%	60.9%	60.9%	39.1%	39.1%	39.1%	39.1%
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.1	4.1	4.1	4.1
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.2	2.2	2.2	2.2
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max	None	None	None	None
v/c Ratio	0.20	0.72	0.18	0.33	0.87	0.03	0.69	0.37	0.08	0.46
Control Delay	15.6	17.0	6.0	15.1	26.3	6.4	39.0	19.7	19.9	25.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.6	17.0	6.0	15.1	26.3	6.4	39.0	19.7	19.9	25.1
Queue Length 50th (m)	1.1	73.1	6.7	4.1	105.1	1.0	25.6	17.8	2.8	27.1
Queue Length 95th (m)	7.5	#195.3	20.5	18.6	#257.8	5.1	#53.1	36.3	8.8	48.8
Internal Link Dist (m)		914.0			682.0			404.6		283.6
Turn Bay Length (m)	25.0		10.0	25.0		10.0	25.0			
Base Capacity (vph)	90	1090	947	193	1101	966	339	601	384	598
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.20	0.72	0.18	0.33	0.87	0.03	0.56	0.30	0.07	0.37

Intersection Summary	
Cycle Length: 75	
Actuated Cycle Length: 75	
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	



HCM Signalized Intersection Capacity Analysis  
18: Marleau Avenue & McConnell Avenue

Future Total - Scenario 2: Improvements  
Weekday P.M. Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.5		2.0	5.5	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1719	3438	1561	1769	3539	1568	1785	1806		1719	1863	
Flt Permitted	0.27	1.00	1.00	0.19	1.00	1.00	0.49	1.00		0.11	1.00	
Satd. Flow (perm)	487	3438	1561	346	3539	1568	922	1806		193	1863	
Volume (vph)	39	697	178	124	760	365	275	520	99	375	385	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	39	697	178	124	760	365	275	520	99	375	385	0
RTOR Reduction (vph)	0	0	132	0	0	244	0	7	0	0	0	0
Lane Group Flow (vph)	39	697	46	124	760	121	275	612	0	375	385	0
Confl. Peds. (#/hr)			2	2			3		2	2		3
Heavy Vehicles (%)	5%	5%	1%	2%	2%	3%	1%	2%	4%	5%	2%	12%
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt			pm+pt		
Protected Phases		4			3		8		5		2	1
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	24.8	24.8	24.8	32.2	32.2	32.2	45.2	34.1		55.3	41.2	
Effective Green, g (s)	25.8	25.8	25.8	36.2	33.2	33.2	50.7	35.1		59.8	42.2	
Actuated g/C Ratio	0.26	0.26	0.26	0.36	0.33	0.33	0.51	0.35		0.60	0.42	
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.5		3.0	6.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	126	887	403	202	1175	521	572	634		408	786	
v/s Ratio Prot		c0.20		0.03	c0.21		0.06	c0.34		c0.18	0.21	
v/s Ratio Perm	0.08		0.03	0.19		0.08	0.19			0.37		
v/c Ratio	0.31	0.79	0.11	0.61	0.65	0.23	0.48	0.97		0.92	0.49	
Uniform Delay, d1	29.9	34.5	28.4	23.4	28.4	24.2	14.4	31.8		28.2	21.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.03	0.74	
Incremental Delay, d2	1.4	4.8	0.1	5.6	1.2	0.2	0.6	45.5		28.8	1.8	
Delay (s)	31.3	39.3	28.5	29.0	29.7	24.4	15.1	77.4		57.7	17.4	
Level of Service	C	D	C	C	C	C	B	E		E	B	
Approach Delay (s)		36.9			28.1			58.2			37.3	
Approach LOS		D			C			E			D	

Intersection Summary

HCM Average Control Delay	39.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	17.5
Intersection Capacity Utilization	108.1%	ICU Level of Service	G
Analysis Period (min)	60		
c Critical Lane Group			

Queues  
18: Marleau Avenue & McConnell Avenue

Future Total - Scenario 2: Improvements  
Weekday P.M. Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	39	697	178	124	760	365	275	520	375	385
Lane Group Flow (vph)	39	697	178	124	760	365	275	619	375	385
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		pm+pt	
Protected Phases		4			3	8		5	2	1
Permitted Phases	4		4	8		8	2		6	
Detector Phases	4	4	4	3	8	8	5	2	1	6
Minimum Initial (s)	20.0	20.0	20.0	3.0	20.0	20.0	11.0	20.0	11.0	20.0
Minimum Split (s)	33.0	33.0	33.0	7.0	28.0	28.0	14.0	33.5	14.0	28.5
Total Split (s)	33.0	33.0	33.0	7.0	40.0	40.0	14.0	41.0	19.0	46.0
Total Split (%)	33.0%	33.0%	33.0%	7.0%	40.0%	40.0%	14.0%	41.0%	19.0%	46.0%
Yellow Time (s)	4.1	4.1	4.1	3.0	4.1	4.1	2.0	4.1	2.0	4.1
All-Red Time (s)	1.9	1.9	1.9	0.0	1.9	1.9	1.0	2.4	1.0	2.4
Lead/Lag	Lag	Lag	Lag	Lead			Lead	Lag	Lead	Lag
Lead-Lag Optimize?										
Recall Mode	Min	C-Min	Min	C-Min						
v/c Ratio	0.30	0.79	0.33	0.58	0.65	0.48	0.50	0.96	0.91	0.49
Control Delay	36.0	41.8	6.2	34.4	31.2	4.8	14.0	77.0	57.1	18.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.0	41.8	6.2	34.4	31.2	4.8	14.0	77.0	57.1	18.1
Queue Length 50th (m)	6.2	67.9	0.0	16.8	67.2	0.0	25.7	120.1	44.3	58.5
Queue Length 95th (m)	18.5	102.5	21.2	#38.0	100.6	31.0	46.7	#231.2	#141.3	76.6
Internal Link Dist (m)		264.6			914.0			195.9		283.7
Turn Bay Length (m)			84.0	71.0		71.0	77.0		130.0	
Base Capacity (vph)	141	963	565	213	1239	786	547	648	412	788
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	0.28	0.72	0.32	0.58	0.61	0.46	0.50	0.96	0.91	0.49

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 96 (96%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 18: Marleau Avenue & McConnell Avenue

