



## McGibbon Condominium 69-79 Main Street South Georgetown Traffic Impact Study, Parking Justification and TDM Options

Paradigm Transportation Solutions Limited

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## Client

**Silvercreek Commercial Builders Incorporated**

66 Mill Street  
Georgetown ON L7G 3H7

## Client Contact

Glenn J. Wellings, MCIP, RPP  
Wellings Planning Consultants Inc.  
564 Emerald Street  
Burlington, ON L7R 2N8

## Consultant Project Team

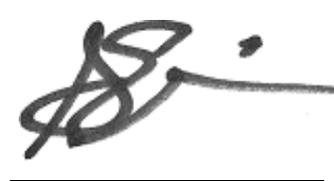
Stewart Elkins, BES, MITE  
Scott Catton, CET, MITE

## McGibbon Condominium

## 69-79 Main Street South Georgetown Traffic Impact Study, Parking Justification and TDM Options

### List of Revisions

Version	Date	Author	Description
1	October 2015	S. Elkins/ S. Catton	For submission



Signature



Engineer's Seal

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## Paradigm Transportation Solutions Limited

22 King Street South Suite 300  
Waterloo ON N2J 1N8  
p: 519.896.3163  
www.ptsl.com



# Executive Summary

## Content

Silvercreek Commercial Builders Incorporated is planning to redevelop the McGibbon Hotel site located at 69-79 Main Street South in the Town of Halton Hills (Georgetown).

The purpose of this study is to determine the impacts of the development traffic on the surrounding road network and identify any improvements necessary to accommodate this traffic. The study also assesses the site's parking needs and Transportation Demand Management measures that will be included in the final site concept plan.

## Development Concept

The redevelopment of the McGibbon Hotel is proposed to consist of 125 condominium apartment units and approximately 1,360 square metres (14,647 square feet) of retail commercial space. The build-out of the site is anticipated to occur by the Year 2018.

The site's parking supply is proposed to consist of 256 total parking spaces contained within an integrated parking structure including tandem and barrier free spaces. The primary point of vehicular access to the parking structure will be provided via Mill Street. A secondary connection to the parking structure will be provided at the rear of the building.

## Conclusions

The main findings and conclusions of this study are as follows:

- ▶ **Development Generated Traffic:** The development of the subject site is estimated to generate approximately 113 total vehicle trips during the AM peak hour and approximately 223 total vehicle trips during the PM peak hour. Pass-by trips are anticipated to reduce the site's PM peak hour generation by approximately 34 percent to 167 trips.
- ▶ **Parking Demand:** The proposed parking supply exceeds the current zoning by-law parking requirements. The site's parking demand can be further mitigated with the Transportation Demand Management measures currently incorporated into the site's design.
- ▶ **Existing Traffic Conditions:** The intersections within the site's study area are currently operating with satisfactory levels of service during both the AM and PM peak hours. Conditions are fairly typical for a downtown environment.
- ▶ **Forecast Background Traffic:** The forecast background traffic volumes in the vicinity of the subject site have been assessed for a



five-year horizon following the anticipated build-out of the subject site, Year 2023. The forecast traffic volumes are estimated to consist of a generalized growth rate of 2.0 percent per annum.

- ▶ **Background Traffic Conditions:** The study area intersections are anticipated to continue to operate with satisfactory levels of service during the AM and PM peak hours. Future localized capacity issues are likely to occur at the Guelph Street intersection with Mill Street. The capacity issues are fairly typical for side street approaches to arterial roadways in downtown environments. These conditions will occur with or without the development of the subject site.
- ▶ **Total Traffic Conditions:** The study area intersections are anticipated to continue to operate with satisfactory levels of service during the AM and PM peak hours. Localized capacity issues are likely to occur at the Guelph Street intersection with Mill Street. The capacity issues are fairly typical for side street approaches to arterial roadways in downtown environments.

No capacity issues are anticipated to occur at the site driveway connection to Mill Street that would warrant the need for improvements to the existing infrastructure.

## Recommendations

Based on the findings of this study, the following is recommended:

- ▶ The Town of Halton Hills monitor the operation of the signalized intersections in the study area to ensure appropriate signal timings are in place to accommodate the future traffic demand within the downtown area of Georgetown.
- ▶ An updated site plan be prepared that details the design of the streetscaping for Mill Street across the site's frontage. The design should reflect the conceptual layout illustrated in **Figure 5.1**.
- ▶ The following Transportation Demand Management measures be incorporated into the site's plan:
  - **Walking Infrastructure** - Enhanced on-site and peripheral pedestrian amenities (benches, landscaping, lighting, and surface treatment). If appropriate site conditions permit.
  - **Parking Infrastructure** - Shared parking with nearby developments or on-street spaces. Allow parking spaces not purchased by residents to be utilized by nearby developments.
  - **Carshare/Bikeshare** - Consider enrolling or assist in developing a carshare/bikeshare program for the Community of Georgetown.
  - **Education/Promotion, Incentives** - Include transit and active transportation maps, carshare and/or bikeshare memberships with new condominium purchases.



- ▶ Paving material for the driveway approach to Mill Street be designed to a high level so to allow for a visual and textural difference between the driveway approach and the adjacent sidewalk facilities. A flashing warning light be implemented at the parking structure entrance to visually alert pedestrians of the parking gate's operation and potential vehicle conflicts.
- ▶ The proposed driveway connection to Mill Street should operate under two-way stop control. A stop sign (Ra-1) should be installed on the side street approach in accordance with the Ontario Traffic Manual Book 5.
- ▶ The Driveway "A" Mill Street Entrance has be designed such that the control gate to the structured parking is offset by approximately 6.0 metres from the near edge of the sidewalk facilities along Mill Street.
- ▶ The internal Driveway "A" Mill Street Entrance approach to the Mill Street be designed with rumble strips and signage to warn drivers of potential pedestrian activity along Mill Street.
- ▶ Convex mirrors and "yield to on coming" traffic signage be provided at all internal turning points of the parking structure to mitigate potential conflicts between circulating vehicles.
- ▶ To support a parking supply that is capable of accommodating the estimated future demand, the TDM measures outlined in **Section 3.3** that are already included in the site plan and those that should be considered during the site plan approval stage be integrated into the final site plan design.
- ▶ The site's 256 parking spaces be assigned as follows:
  - Residents – Limited to 188 parking spaces consisting of 151 regular spaces and 37 tandem spaces. These spaces be unbundled and sold separately from the units.
  - Visitor – 68 parking spaces consisting entirely of regular spaces.
  - To effectively manage the visitor parking supply the entire mid-level parking deck (26 spaces) and 42 of the lower ground level parking spaces should be signed and marked as visitor parking spaces. All other spaces should be reserved for resident parking.

No other roadway or traffic control improvements are required or recommended at this time to accommodate the future traffic within the study area.





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# 1 Introduction

## 1.1 Overview

Paradigm Transportation Solutions Limited was retained by Silvercreek Commercial Builders Incorporated to undertake a traffic impact study, parking review and prepare Travel Demand Management options for the proposed redevelopment of the McGibbon Hotel located at 69-79 Main Street South in Georgetown, Town of Halton Hills, Halton Region.

The purpose of this study is to determine the impacts of the development traffic on the surrounding road network and identify any improvements necessary to accommodate this traffic. The study also assesses the site's parking needs and Transportation Demand Management measures that will need to be included in the final site concept plan. The scope of the study includes determination of:

- ▶ The current traffic and site conditions in the vicinity of the development;
- ▶ Estimates of background traffic growth in the area;
- ▶ Estimates of the additional traffic that will be generated by the development;
- ▶ The impact of the traffic at build-out of the lands;
- ▶ Recommendations on the remedial measures necessary to accommodate the future traffic in a satisfactory manner; and
- ▶ Determining the site's parking needs and providing recommendations on the Transportation Demand Management measures specific to this site as a means to further mitigate parking demands and traffic impacts.

A preliminary site concept plan has been prepared for the proposed development. The subject site is located in the downtown area of Georgetown. The general location of the subject site is illustrated in **Figure 1.1**.



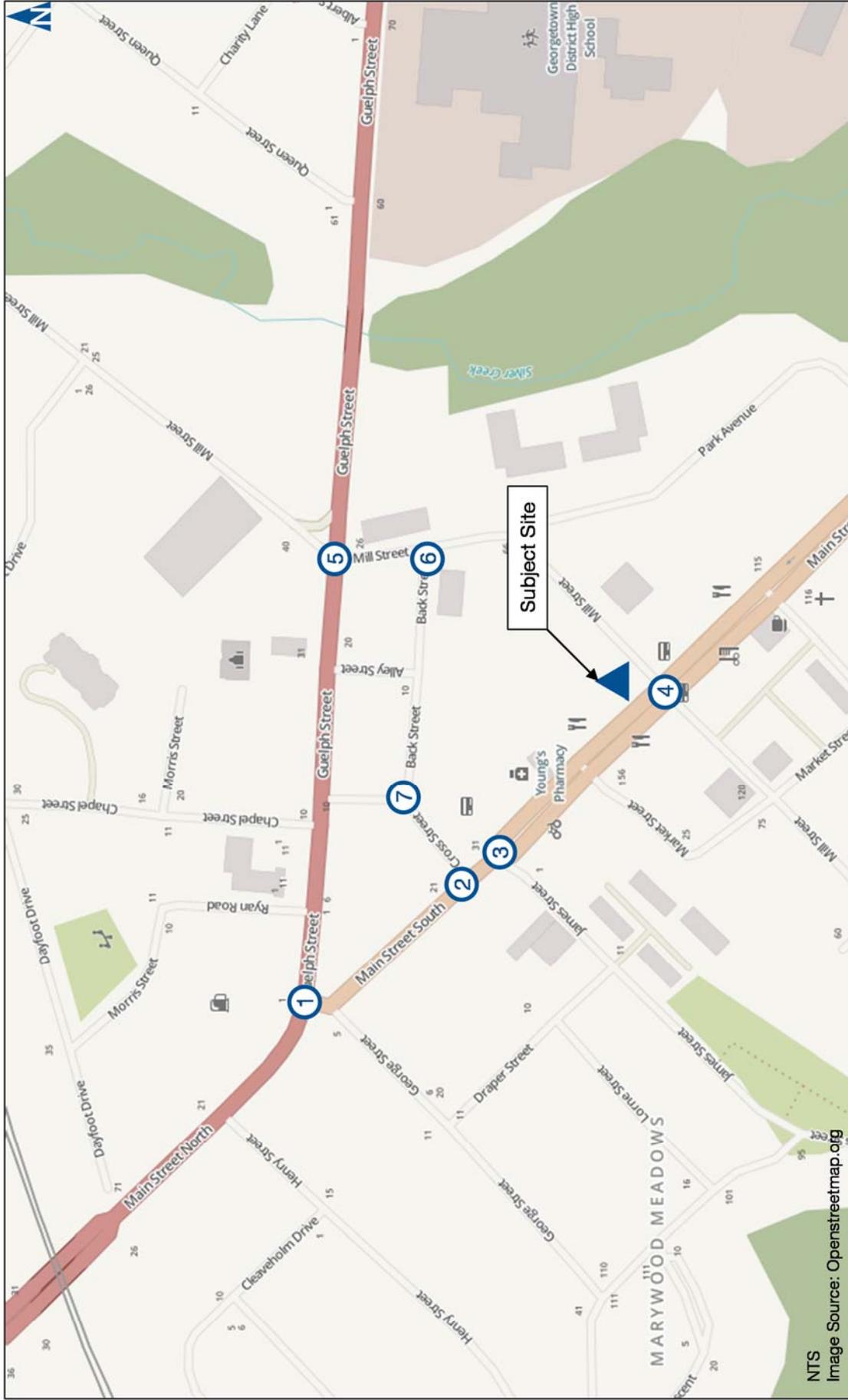
## 1.2 Study Area

The following intersections have been analyzed in this report to examine the impacts of additional traffic due to the development of the subject site:

- ▶ Main Street South and Main Street North/Guelph Street (Highway 7);
- ▶ Main Street and Cross Street;
- ▶ Main Street South and James Street;
- ▶ Main Street South and Mill Street;
- ▶ Mill Street and Guelph Street (Highway 7);
- ▶ Cross Street and Back Street;
- ▶ Mill Street and Back Street; and
- ▶ The proposed driveway connection to Mill Street.

The location of the study area intersections are illustrated in **Figure 1.1**.





## Location of Subject Site and Study Area Intersections

Figure 1.1



## 2 Existing Conditions

This section of the report provides an overview of the existing conditions on the roadways in the study area. The roadways of interest include Main Street South, Mill Street, Guelph Street (Highway 7), James Street, Cross Street, and Back Street.

### 2.1 Existing Roadways

The main roadways in the vicinity of the subject site that have been considered in assessing the traffic impacts of the development are generally described as follows:

- ▶ **Main Street South** is a north-south minor arterial roadway with a basic two-lane cross section and a posted speed limit of 40 km/h. This roadway is the main north/south route through downtown Georgetown. On-street parking is permitted within designated parking bays on both sides of the road. The on-street spaces are marked and signed as two-hour parking. Sidewalks are provided along both sides of this roadway with enhanced pedestrian crosswalks at most intersections within the downtown area. The intersections with Guelph Street and Mill Street are signalized.
- ▶ **Guelph Street** is an east-west multipurpose arterial roadway with a posted speed limit of 50 km/h. Within the study area the roadway's cross section varies from three travel lanes to four travel lanes. Sidewalks are provided along both sides of this roadway with enhanced pedestrian crosswalks at the signalized intersections with Main Street and Mill Street. There are currently peak hour turning restrictions in place at the Main Street South intersection which prohibits westbound left-turn movements.
- ▶ **Mill Street** is a local roadway which provides a connecting link between Guelph Street and Main Street South. The roadway has a basic two-lane cross section and an assumed speed limit of 50 km/h. Sidewalks are provided on both sides of this roadway. On-street parking is permitted along the north side of this roadway between Main Street South and Park Avenue. The on-street spaces are marked and signed as two-hour parking. In total eight vehicles can be parked mid-block between Main Street South and Park Avenue.
- ▶ **James Street** is a collector roadway with a basic two-lane cross section and an assumed speed limit of 50 km/h. Sidewalks are provided along both sides of this roadway. Immediately west of Main Street South, the sidewalk is shifted to be at the store fronts along James Street. Within this area is a small perpendicular parking area for approximately 11 vehicles. West of the downtown area, James Street becomes Princess Anne Drive which provides a connection between Main Street South and Trafalgar Road.



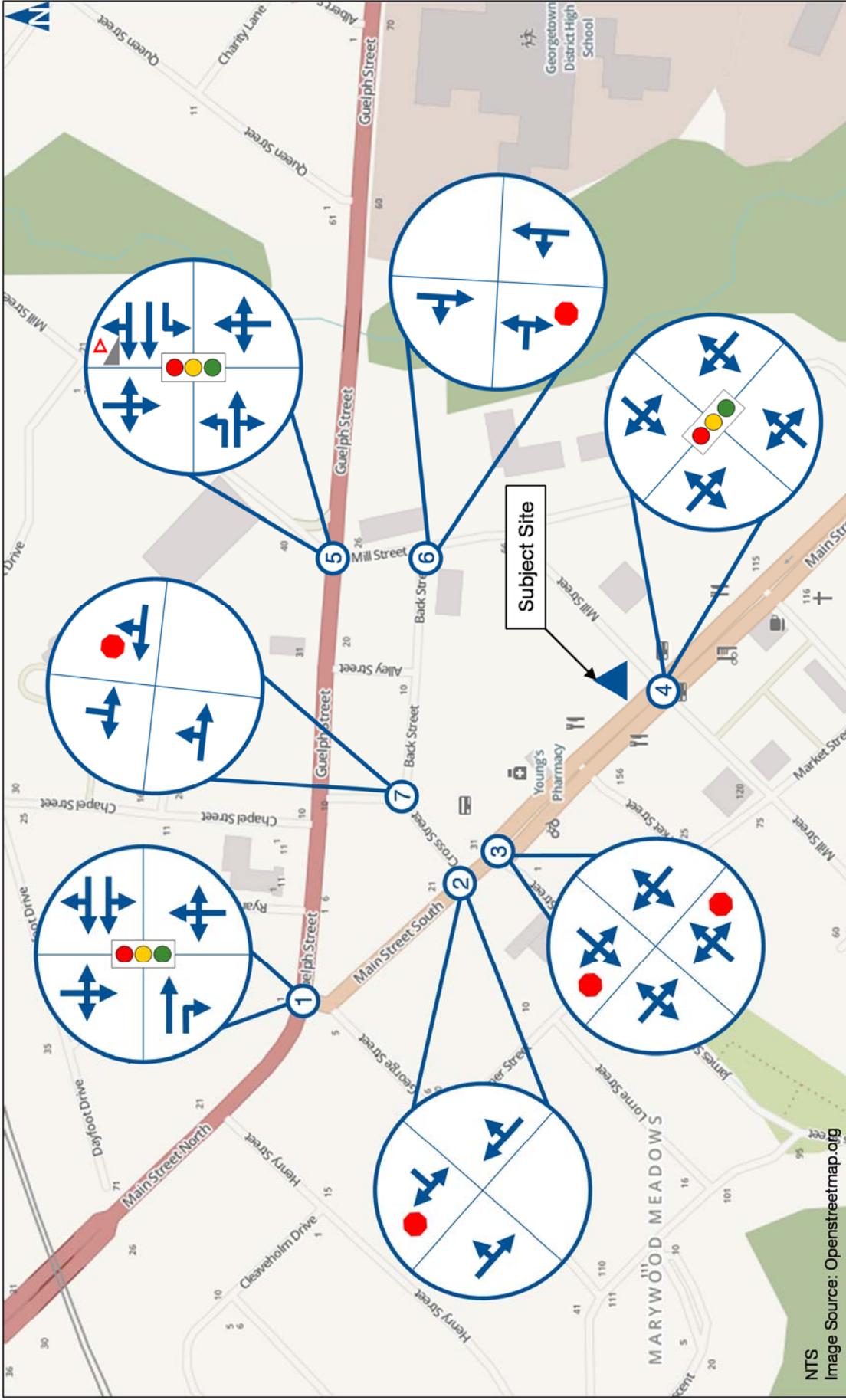
- ▶ **Cross Street** and **Back Street** are local roadways with basic two-lane cross sections. Sidewalks are provided along at least one side of Cross Street between Main Street and Guelph Street. The topography along these roadways is challenging for non-automotive forms of transportation. Parking is generally restricted at all times along these roadways. A small amount of on-street parking is provided in proximity to Mill Street.

The existing intersections that could potentially be impacted by the development of the subject site include the following:

- ▶ Main Street South and Main Street North/Guelph Street (Highway 7);
- ▶ Main Street and Cross Street;
- ▶ Main Street South and James Street;
- ▶ Main Street South and Mill Street;
- ▶ Mill Street and Guelph Street (Highway 7);
- ▶ Cross Street and Back Street;
- ▶ Mill Street and Back Street; and
- ▶ The proposed driveway connection to Mill Street.

**Figure 2.1** illustrates the existing lane configurations and traffic control at the study area intersections.





NTS  
Image Source: [Openstreetmap.org](http://Openstreetmap.org)



# Existing Lane Configurations and Traffic Control

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151850S

Figure 2.1

## 2.2 Existing Transit Service

### 2.1 Local Transit

The Town of Halton Hills does not provide local public transit services. However, within Georgetown there are three (3) types of transit service available:

- ▶ School Bus;
- ▶ Halton Hills ActiVan<sup>1</sup>; and
- ▶ Red Cross Transportation Services<sup>2</sup>.

These forms of transit are generally not regarded as public transit services and often require persons to register and pay for the services.

### 2.2 Interregional Transit Service

The community of Georgetown is serviced by GO Transit service. The Georgetown GO Rail Station is located at 55 Queen Street, approximately a 13 minute walk from the subject site. The station operates a 614 space parking lot with kiss & ride drop-off available. Service is provided Monday to Friday with service in the eastbound and westbound directions with connections to University of Guelph, Guelph, Acton, Brampton, Union Station, Mount Pleasant, and Kitchener GO. The frequency of GO Transit to the community will be improved in the future.

VIA Rail offers Inter-regional rail service along the Québec City-Windsor Corridor with service to Toronto's Union Station.

### 2.3 Future Transit Service and Policies

The Town of Halton Hills Transportation Master Plan (TMP) Report<sup>3</sup> identifies a policies to address the future need for transit services within the Town of Halton Hills.

*The Town shall review the need for a municipal transit system, as permitted by its financial capability and desire of the residents to the policy, and if and when provided, integrate and support other transit systems and co-ordinate transportation planning efforts with Regional, Provincial and Federal transportation initiatives.*

*The Town shall encourage improvements to inter-municipal and inter-regional transit services, in particular the GO Transit system.*

<sup>1</sup> <http://www.haltonhills.ca/transit/>

<sup>2</sup> Canadian Red Cross Society (includes North Halton Rides) – [www.redcross.ca](http://www.redcross.ca)

<sup>3</sup> The Town of Halton Hills Transportation Master Plan Report | November 2011 | Hatch Mott MacDonald



*The Town shall encourage transit-supportive land uses in Nodes, Corridors and new development areas.*

The Town shall encourage and promote the use and expansion of existing specialized transit for persons

In the future, transit service may become a viable means of transportation for the community of Georgetown. The Town of Halton Hills modal split target for Year 2031 is 15-20 percent. Adopting the TMP policies will assist in reaching the target.

## 2.3 Existing Traffic Volumes

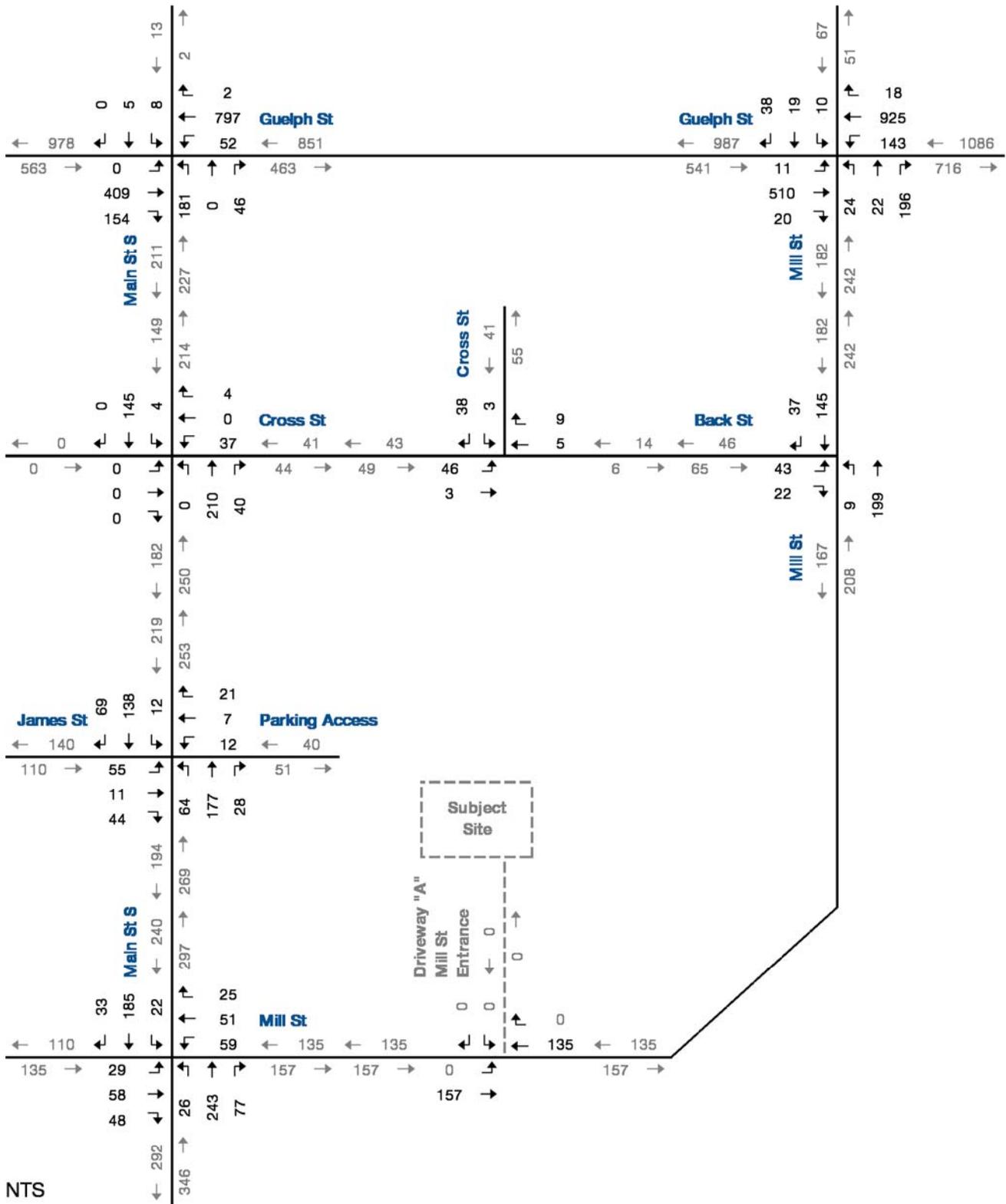
The traffic volumes used to establish the existing traffic conditions have been derived from turning movement counts conducted by Pyramid Traffic Incorporated. The existing turning movement counts are summarized in **Table 2.1**. The existing turning movement count data is considered to be up-to-date and can be found attached in **Appendix A**. The existing traffic volumes are shown graphically in **Figure 2.2A** and **Figure 2.2B**. The observed peak hour traffic volumes between the Mill Street intersections of Back Street and Guelph Street have been balanced to ensure a reasonable flow is maintained. Volumes were increased to account for higher upstream/downstream flow rates.

**TABLE 2.1: EXISTING TURNING MOVEMENT DATA**

Intersection	Date	Traffic Control
Main Street and Guelph Street	Thursday 08 October 2015	Signalized
Main Street and Cross Street	Tuesday 29 September 2015	Unsignalized
Main Street and James Street	Wednesday 30 September 2015	Unsignalized
Main Street and Mill Street	Thursday 01 October 2015	Unsignalized
Guelph Street and Mill Street	Monday 28 September 2015	Signalized
Back Street and Cross Street	Tuesday 29 September 2015	Unsignalized
Main Street and Back Street	Wednesday 30 September 2015	Unsignalized







## Existing Traffic – PM Peak Hour

McGibbon Condominium 69-79 Main Street South  
151850S

Figure 2.2B

## 2.4 Existing Traffic Operations

Intersection Level of Service (LOS) is a recognized method of quantifying the efficiency of traffic flow at intersections. It is based on the delay experienced by individual vehicles executing the various movements. The delay is related to the number of vehicles desiring to make a particular movement, compared to the estimated capacity for that movement. The capacity is based on a number of criteria related to the opposing traffic flows. The highest possible rating is LOS A, under which the average total delay is equal or less than 10.0 seconds per vehicle. When the average delay exceeds 80 seconds at signalized intersections, the movement is classified as LOS F and remedial measures are usually implemented, if they are feasible.

The operation of the intersections in the study area were evaluated using the existing lane geometry and traffic control along with the existing peak hour traffic. The findings are summarized in **Table 2.2**. The intersection analysis considered three separate measures of performance:

- ▶ The level of service (LOS) for each turning movement;
- ▶ The volume to capacity (v/c) ratio for each turning movement; and
- ▶ The 95th percentile queue lengths estimated using Synchro.

The level of service conditions on the existing road network have been assessed using Synchro 9.0 with HCM 2000 procedures. Movements are considered critical under the following conditions:

- ▶ Volume to capacity ratios for overall intersection operations, through movements or shared through/turning movements are greater than or equal to 0.85;
- ▶ Volume to capacity ratios for exclusive turning movements are greater than or equal to 0.95;
- ▶ Queue lengths for individual movements that are projected to exceed the available turning lane storage; and
- ▶ Level of Service E conditions at unsignalized intersections.



Based on the above criteria and the entries in **Table 2.1**, the following is noted:

- ▶ The study area intersections are operating with acceptable levels of service with minimal delay and congestion during both the AM and PM peak hours.
  - During the PM peak hour, the northbound left-turn movement from Main Street to Guelph Street is experiencing a v/c ratio of 0.81.
  - Similarly, the northbound approach of Mill Street to Guelph Street is experiencing delays in the LOS E range. Delays of this extent are fairly typical for side street approaches to arterial roadways in downtown environments.

Detailed Synchro 9.0 output is provided in **Appendix B**.



**TABLE 2.2: EXISTING TRAFFIC OPERATIONS**

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																Overall
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	1 - Main St & Guelph St	TCS	LOS Delay V/C 95th Ex. Avail	A 6 0.56 89 -	A 3 0.20 19 -	A 6 -	< < < < <	A 3 0.15 12 -	< < < < <	A 3 -	D 42 0.59 31 -	C 33 0.03 8 8	> > > > >	D 39 -	< < < < <	C 33 0.02 3 -	> > > > >	C 33 -	A 9 0.57	
	2 - Main St & Cross St	TWSC	LOS Delay V/C 95th	< < < <	B 12 0.01 0	> > > >	B 12 -	< < < <	B 12 0.07 2	> > > >	B 12 -	< < < <	A 0 0.00 0	> > > >	A 0 -	< < < <	A 0 0.00 0	> > > >	A 0 -	
	3 - Main St & James St	TWSC	LOS Delay V/C 95th	< < < <	B 13 0.21 6	> > > >	B 13 -	< < < <	B 12 0.03 1	> > > >	B 12 -	< < < <	A 1 0.02 1	> > > >	A 1 -	< < < <	A 1 0.02 0	> > > >	A 1 -	
	4 - Main St & Mill St	TCS	LOS Delay V/C 95th	< < < <	B 11 0.12 12	> > > >	B 11 -	< < < <	B 11 0.12 11	> > > >	B 11 -	< < < <	B 13 0.37 32	> > > >	B 13 -	< < < <	B 13 0.40 37	> > > >	B 13 -	B 13 0.26
	5 - Guelph St & Mill St	TCS	LOS Delay V/C 95th Ex. Avail	A 2 0.04 2 35 34	A 7 0.73 40 -	> > > > >	A 7 -	A 6 0.29 13 50 37	> > > > >	A 3 0.19 17 -	> > > > >	A 4 -	D 37 0.52 38 -	> > > > >	D 37 -	< < < < <	C 35 0.31 18 -	> > > > >	C 35 -	B 11 0.70
	6 - Back St & Cross St	TWSC	LOS Delay V/C 95th	< < < <	A 0 0.06 0	> > > >	A 0 -	< < < <	A 1 0.00 0	> > > >	A 1 -	A 9 0.01 0	> > > >	A -	> > > >	> > > >	> > > >	> > > >	> > > >	> > > >
	7 - Mill St & Back St	TWSC	LOS Delay V/C 95th	B 11 0.03 1	> > > >	B 11 -	> > > >	> > > >	> > > >	> > > >	> > > >	> > > >	A 0 0.01 0	> > > >	A 0 -	A 0 0.07 0	> > > >	A 0 -	> > > >	A 0 -
PM Peak Hour	1 - Main St & Guelph St	TCS	LOS Delay V/C 95th Ex. Avail	A 7 0.37 54 -	A 5 0.16 19 -	> > > > >	A 6 -	A 6 0.44 74 -	> > > > >	A 6 -	E 58 0.81 79 -	D 39 0.04 0 8 8	> > > > >	D 55 -	< < < < <	D 39 0.05 9 -	> > > > >	D 39 -	B 13 0.54	
	2 - Main St & Cross St	TWSC	LOS Delay V/C 95th	< < < <	A 0 0.00 0	> > > >	A 0 -	< < < <	B 12 0.07 2	> > > >	B 12 -	< < < <	A 0 0.00 0	> > > >	A 0 -	< < < <	A 0 0.00 0	> > > >	A 0 -	
	3 - Main St & James St	TWSC	LOS Delay V/C 95th	< < < <	B 15 0.24 7	> > > >	B 15 -	< < < <	B 13 0.08 2	> > > >	B 13 -	< < < <	A 2 0.05 1	> > > >	A 2 -	< < < <	A 1 0.01 0	> > > >	A 1 -	
	4 - Main St & Mill St	TCS	LOS Delay V/C 95th	< < < <	B 11 0.18 16	> > > >	B 11 -	< < < <	A 10 0.22 14	> > > >	A 10 -	< < < <	B 15 0.52 49	> > > >	B 15 -	< < < <	B 13 0.36 30	> > > >	B 13 -	B 13 0.37
	5 - Guelph St & Mill St	TCS	LOS Delay V/C 95th Ex. Avail	A 3 0.03 3 35 32	A 8 0.48 82 -	> > > > >	A 9 -	A 5 0.29 17 50 33	A 4 0.39 58 -	> > > > >	A 4 -	E 61 0.57 53 -	E 61 -	> > > > >	E 61 -	< < < < <	D 47 0.21 19 -	> > > > >	D 47 -	B 14 0.50
	6 - Back St & Cross St	TWSC	LOS Delay V/C 95th	< < < <	A 0 0.03 0	> > > >	A 0 -	< < < <	A 1 0.00 0	> > > >	A 1 -	A 9 0.02 0	> > > >	A -	> > > >	> > > >	> > > >	> > > >	> > > >	> > > >
	7 - Mill St & Back St	TWSC	LOS Delay V/C 95th	B 11 0.11 3	> > > >	B 11 -	> > > >	> > > >	> > > >	> > > >	> > > >	> > > >	A 0 0.01 0	> > > >	A 0 -	A 0 0.12 0	> > > >	A 0 -	> > > >	A 0 -



## 3 Development Concept

### 3.1 Site Description

The proposed development is located at 69-79 Main Street South in the community of Georgetown. The subject site is known locally as the McGibbon Hotel. The site encompasses an area of approximately 0.27 hectares of land with approximately 40 metres of frontage along Main Street South and 65 metres of frontage along Mill Street.

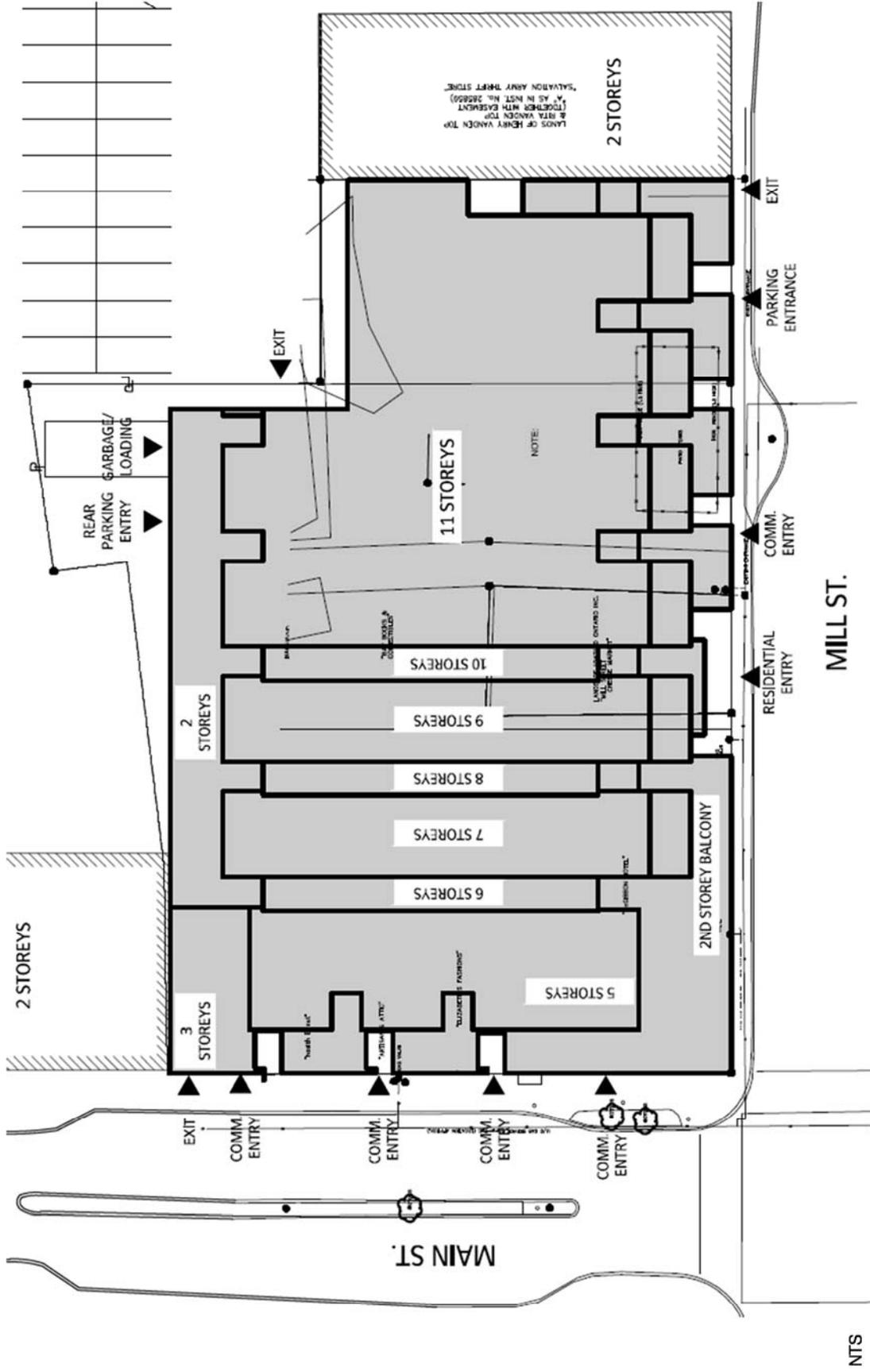
The site is proposed to consist of 125 condominium units with a small mix of ground floor retail commercial space measuring approximately 1,360 square metres (14,647 square feet).

The primary point of vehicular access to the subject site will be provided by a driveway connection to Mill Street, Driveway “A” Mill Street Entrance, located approximately 70 metres (centreline to centreline) east of Main Street South. This driveway connection will provide access to 230 parking spaces, of which 37 are tandem parking spaces, contained within a three level parking structure. To the rear of the proposed building a secondary entrance is proposed to what is referred to as “Mid-Level” parking. This parking area is also contained within the building structure but is segregated from the rest of the parking structure. Within this area approximately 26 parking spaces are provided. It is the applicant’s intention to designate the 26 parking spaces on the mid-level as high-turn over short-term parking spaces available to patrons of the site and the Downtown. In total 256 vehicles can be parked on site. Of the 256 spaces, 8 spaces are designed as barrier free spaces.

Retail commercial loading for the proposed ground floor land uses will continue to occur on-street. This condition is typical for downtown businesses. Refuse collection is proposed to occur at the rear of the building within the municipal parking lot.

The conceptual layout of the development is illustrated in **Figure 3.1**. The build-out of the subject site is anticipated to occur in a single phase by the Year 2018. The ultimate timing and phasing may change to reflect market conditions.





McGibbon Condominium 69-79 Main Street South  
151850S

# Site Concept Plan

Figure 3.1

## 3.2 Site Traffic Estimates

The site trip generation for the AM and PM peak hours were estimated based on the Institute of Transportation Engineers (ITE) Trip Generation<sup>4</sup>. Land Use Code 232 (High-Rise Residential Condominium) and 820 (Shopping Centre) have been used to estimate the traffic generated by the development of the subject site.

**Table 3.1** indicates that the subject site is estimated to have a total trip generation of approximately 113 vehicle trips during the AM peak hour and approximately 223 vehicle trips during the PM peak hour. The site's net PM peak hour generation is anticipated to be reduced to approximately 167 trips as 34 percent of the total trips are estimated to be pass-by trips<sup>5</sup>.

**TABLE 3.1: ESTIMATED TRIP GENERATION**

Land Use	Units	AM Peak Hour				PM Peak Hour			
		R2	In	Out	Total	R2	In	Out	Total
232 - High-Rise Residential Condominium (Units)	125	0.98	12	53	65	0.99	36	22	58
820 - Shopping Center (1,000 ft <sup>2</sup> GLA)	14,647	0.56	30	18	48	0.81	79	86	165
<b>Total Generation</b>			<b>42</b>	<b>71</b>	<b>113</b>		<b>115</b>	<b>108</b>	<b>223</b>
Pass-By Trips		0%	0	0	0	34%	28	28	56
<b>Net Generation</b>			<b>42</b>	<b>71</b>	<b>113</b>		<b>87</b>	<b>80</b>	<b>167</b>

The estimated trip generation was assigned to the road network based on the observed local trip patterns documented in the existing conditions (**Figure 2.3A** and **Figure 2.3B**) and further refined using the Transportation Tomorrow Survey data<sup>6</sup> for Georgetown. The estimated trip distribution is summarized in **Table 3.2**.

**TABLE 3.2: ESTIMATED TRIP DISTRIBUTION**

Origin/Destination	AM Peak Hour		PM Peak Hour	
	In	Out	In	Out
North via Mill Street	3%	2%	3%	2%
South via Main Street South	14%	15%	15%	13%
East via Guelph Street	25%	56%	47%	31%
West via Guelph Street	47%	21%	24%	43%
West via James Street	7%	4%	5%	6%
West via Mill Street	5%	1%	6%	5%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

<sup>4</sup> Trip Generation Manual 9th Edition Institute of Transportation Engineers Washington DC 2012

<sup>5</sup> ITE Trip Generation Handbook Chapter 5

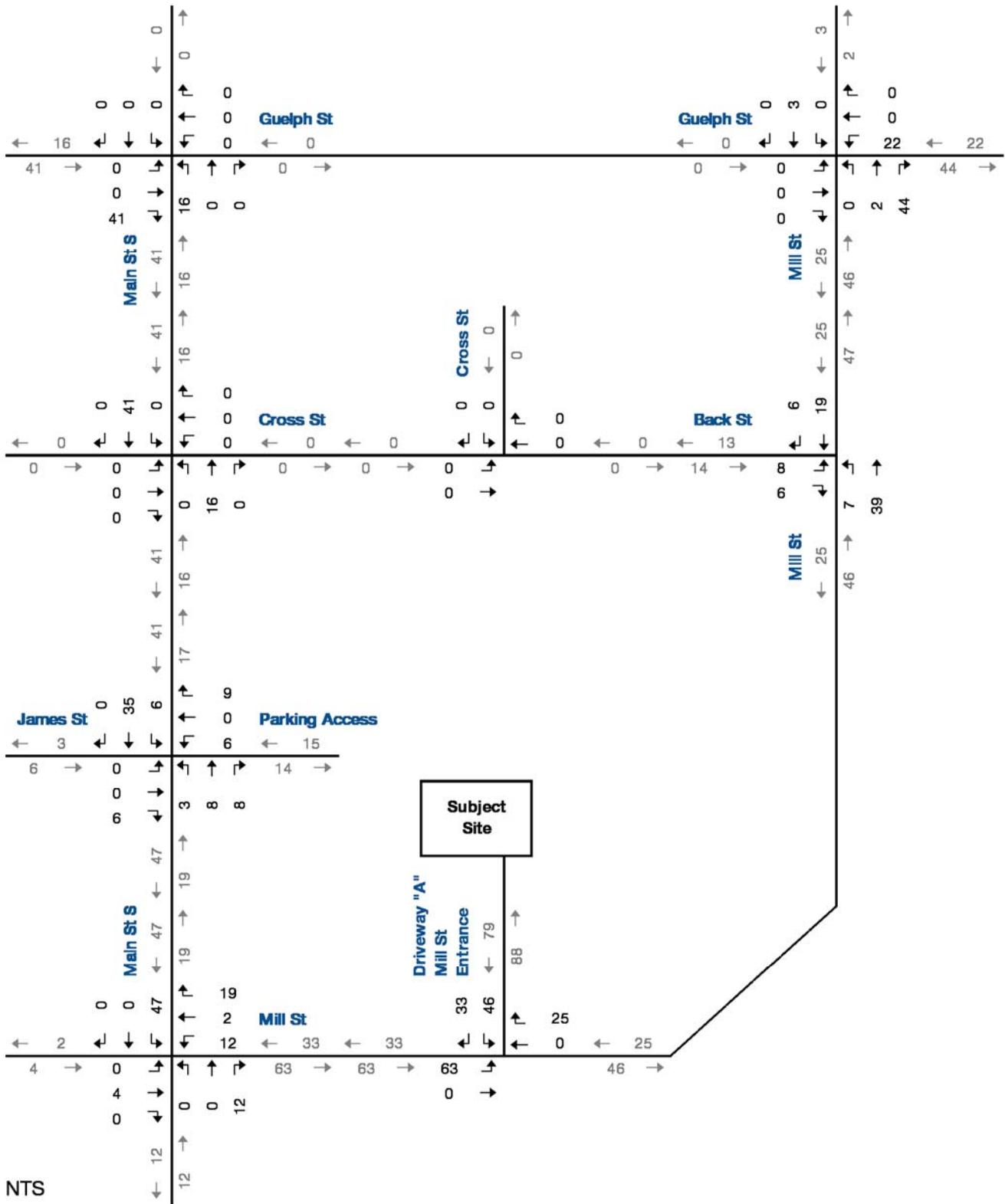
<sup>6</sup> Transportation Tomorrow Survey 2011 TTS V1.0 Trips: 4164, 4163, 4162, 4161, 4159, 4194, 4193, 4157, 4166



Using the trip generation data provided in **Table 3.1** and the trip distribution provided in **Table 3.2** the site generated traffic was assigned to the adjacent road network. The PM peak hour pass-by trips have been assigned to the Town's surface parking lot area located to the rear of the subject site. The site-generated traffic is illustrated in **Figure 3.2A** and **Figure 3.2B**.







## Estimated Site Generated Traffic – PM Peak Hour

### 3.3 Transportation Demand Management

Transportation Demand Management (TDM) refers to ways of making the capacity of our roads more efficient by reducing vehicle demands. TDM approaches consider how people's choices of travel mode are affected by land use patterns, development design, parking availability, parking cost, and the relative cost, convenience and availability of alternative modes of travel. Various TDM strategies are used to influence those factors so that the alternatives are more competitive with driving alone and potentially reduce the reliance on motor vehicles.

TDM strategies at a development can be divided into two basic categories:

- ▶ Pre-occupancy: things that need to be done while a development is being designed and built; and
- ▶ Post-occupancy: things that can be done once people are occupying the development.

The pre-occupancy actions are critical as they are most likely to determine how attractive, convenient, and safe alternative travel will be once the site is occupied. Before a site is occupied, it can be designed to be convenient and safe for pedestrians and cyclists, and vehicle parking can be provided to meet but not exceed demand.

After the development is built, incentives can be offered, but those incentives will not work as well if the site and its surroundings are oriented to cars. The incentives generally include subsidies to use transit, access to rideshare programs, and information about where and how to use alternatives.

The following TDM measures have been included in the current site design.

#### **Cycling Infrastructure**

- ▶ Secure, indoor bicycle parking storage for tenants/residents. The site plan currently provides for approximately 245 square metres of bike/locker room storage space and is easily accessible from the ground floor. Provision of the main floor indoor bicycle storage for residential units promotes cycling through easier access.

#### **Walking Infrastructure**

- ▶ The main building entrances have direct barrier free connections to the adjacent sidewalk facilities within the downtown area.



### **Parking Infrastructure**

- ▶ Shared parking with nearby developments or on-street spaces. Parking spaces not purchased by residents of the site will be assigned as visitor parking with opportunity for these spaces to be utilized by patrons to other downtown businesses;
- ▶ Provision of no more than the minimum number of required spaces for residents and visitors. The site's Zoning By-law parking requirement is 1.50 spaces per unit for residents and 0.25 spaces per unit for visitors;
- ▶ Unbundle parking by selling parking spaces separate from unit costs and do not provide free parking to residents; and
- ▶ Provision of on-site carshare vehicle(s).

### **Wayfinding/Travel Planning**

- ▶ Travel planning resources for residents (individualized marketing, active transportation maps, community resources); and
- ▶ Wayfinding signage.

### **Education/Promotion, Incentives**

- ▶ Contribute to building a strong TDM brand; and

The above TDM measures will assist in mitigating the site's impact on the adjacent road network, assist in prompting a strong/vibrant economy, and create a livable community that has a balanced transportation network that accommodates all modes of transportation.

To further assist in developing a site that caters to all modes of transportation the following TDM measures should be considered during the site plan approval stage.

### **Cycling Infrastructure**

- ▶ Visible, well-lit, short-term bicycle parking for visitors above the minimum provisions or recommendations. Short-term bicycle parking should be provided adjacent to the main entrances;

### **Walking Infrastructure**

- ▶ Enhanced on-site and peripheral pedestrian amenities (benches, landscaping, lighting, and surface treatment). Decorative sidewalk with street brail could be designed along the site's frontage to both Main Street South and Mill Street.



### **Parking Infrastructure**

- ▶ Allow parking spaces not purchased by residents to be utilized by nearby developments and visitors. Limiting the parking supply to the site will assist in lowering travel demand.

### **Carshare/Bikeshare**

- ▶ On-site carshare vehicle(s). A study<sup>7</sup> completed by the City of Toronto on the impacts of carshare programs in relation to their parking standards was completed. The findings suggest that the minimum parking required could be reduced by up to four parking spaces for each dedicated car share space; and
- ▶ Consider enrolling or assist in developing a bikeshare program for the Community of Georgetown.

### **Education/Promotion, Incentives**

- ▶ Include transit and active transportation maps, carshare and/or bikeshare memberships with new condominium purchases.

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<sup>7</sup> Parking Standards Review: Examination of Potential Options and Impacts of Car Share Programs on Parking Standards | Submitted to the City of Toronto by IBI Group | March 2009



## 4 Future Traffic Conditions

The assessment of the future conditions contained in this section includes the following components necessary to assess the traffic implications on the adjacent road network:

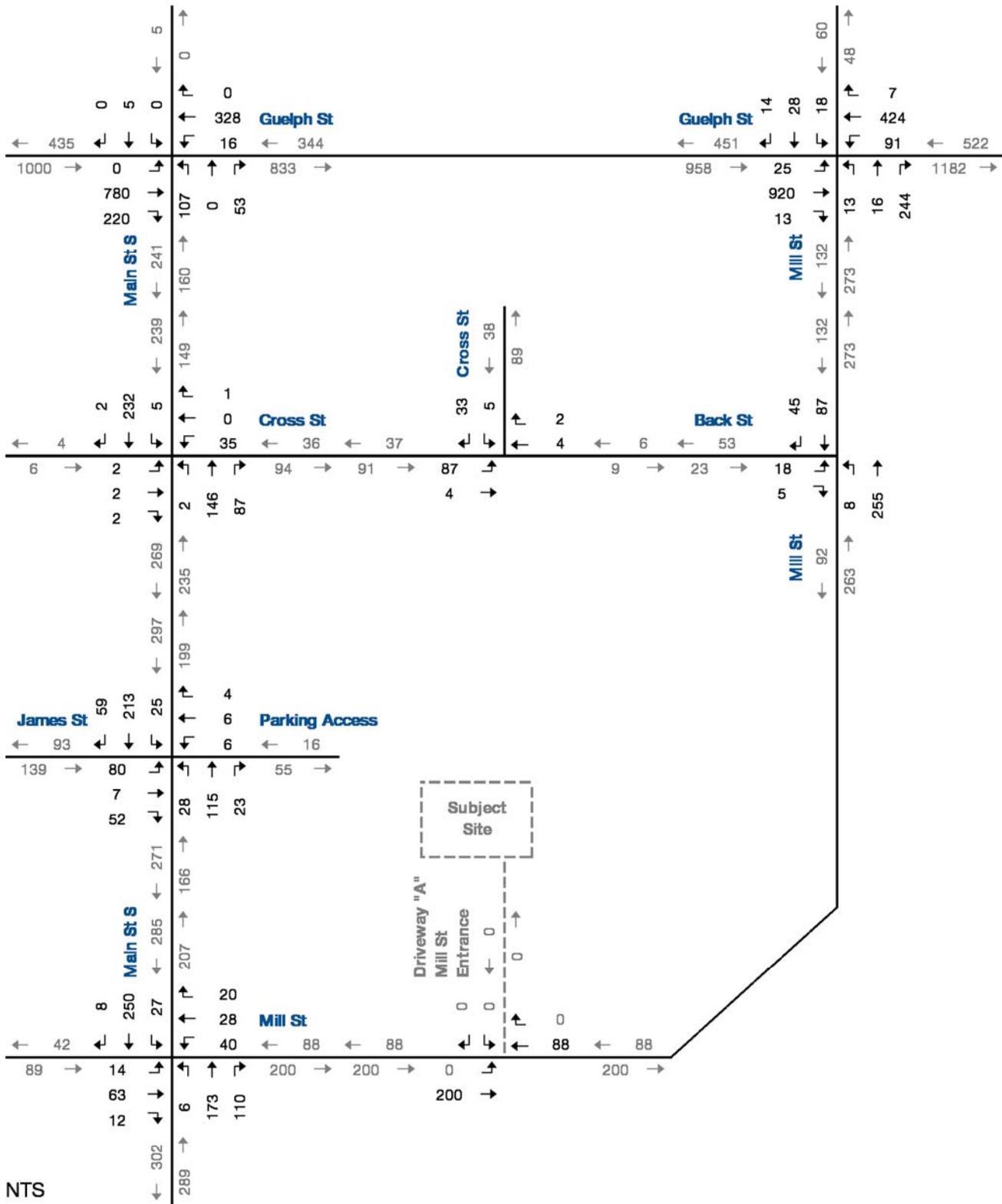
- ▶ Future background traffic estimates;
- ▶ Level of service analysis for background traffic (pre-development); and
- ▶ Level of service analysis for background traffic plus the additional traffic generated by the build-out of the subject site (post-development).

### 4.1 Background Traffic Forecast

For analysis purposes, a five-year horizon (Year 2023) following the anticipated build-out (Year 2018) of the subject site has been assessed in order to determine the impact of the subject site. The likely future background traffic volumes in the vicinity of the subject site are estimated to consist of increased non-site traffic (generalized background traffic growth). The background traffic estimates were derived by applying a growth rate of 2.0 percent per annum to the existing traffic volumes.

The future background traffic volumes reasonably expected to occur for the opening date horizon are shown in **Figure 4.1A** and **Figure 4.1B**.

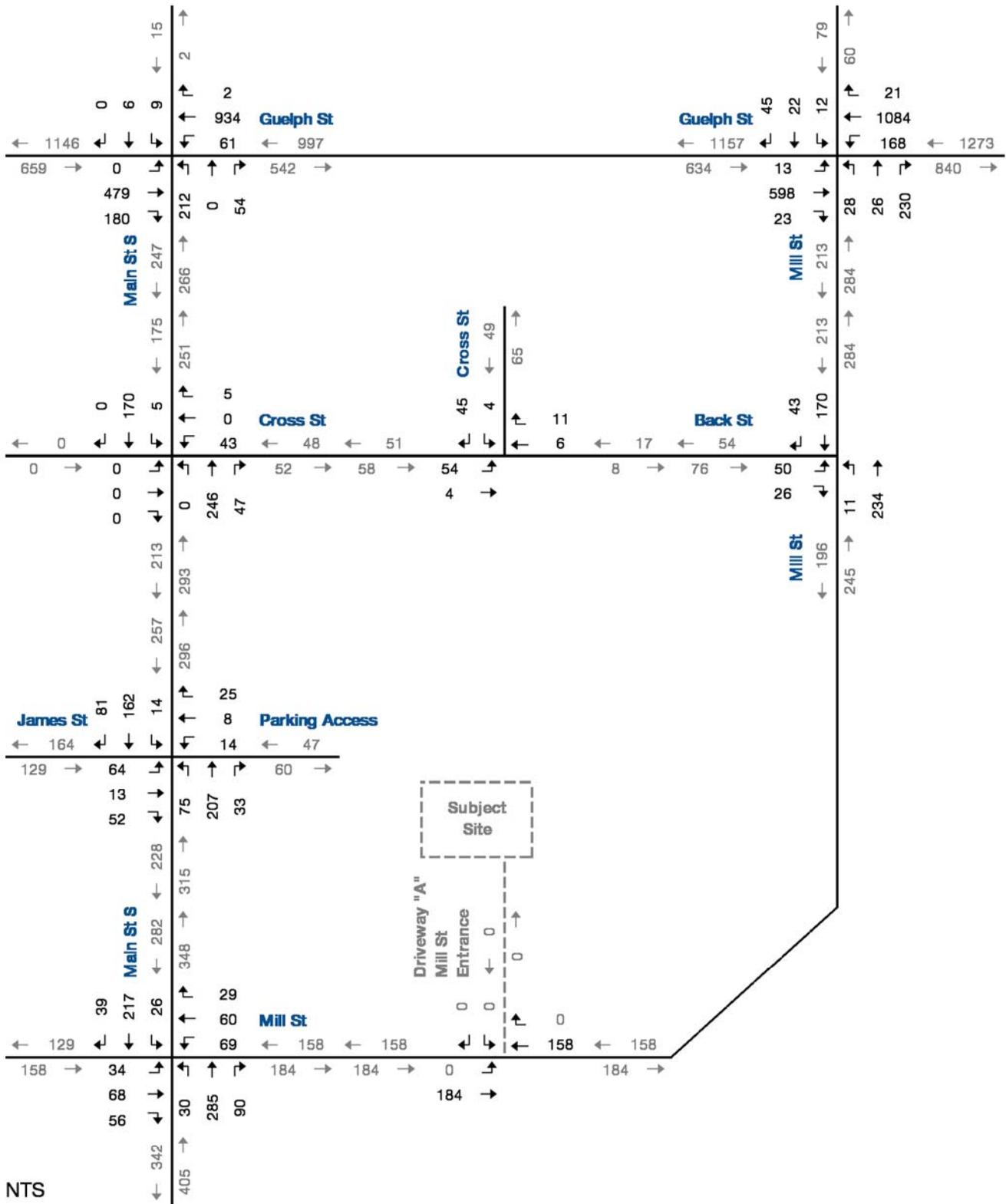




NTS



## Forecast Background Traffic – AM Peak Hour



## Forecast Background Traffic – PM Peak Hour

## 4.2 Background Traffic Operations

The operations of the intersections under the future background traffic conditions were evaluated using the same analytical approach that was used for the existing traffic operations along with the background traffic forecast volumes (**Figure 4.1A** and **Figure 4.1B**). No improvements to the road network are assumed to be in place. Signal timings have been optimized to help ensure that a reasonable level of service is maintained where possible. The resulting level of service conditions for the background traffic horizon are summarized in **Table 4.2** and the following is noted:

### AM Peak Hour

- ▶ The study area intersections are anticipated to continue to operate with acceptable levels of service.
  - The shared eastbound through/left-turn movement from Main Street to Guelph Street is experiencing a v/c ratio of 0.86. A volume to capacity ratio greater than 0.85 would start to suggest that the movement is approaching capacity.
  - The northbound approach of Mill Street to Guelph Street is anticipated to experience delays in the LOS E range. Delays of this extent are fairly typical for side street approaches to arterial roadways in downtown environments.
- ▶ No other movements are considered to be critical.

### PM Peak Hour

- ▶ The study area intersections are anticipated to continue to operate with acceptable levels of service. The minor capacity issues experienced under the existing conditions have been mitigated through use of optimized signal timings.
- ▶ No other movements at the study area intersections are considered to be critical.

Detailed Synchro 9.0 output is provided in **Appendix C**.

It is recommended that the Town of Halton Hills monitor the operation of the signalized intersections in the study area to ensure appropriate signal timings are in place to accommodate the future traffic demand within the downtown area of Georgetown.



**TABLE 4.2: BACKGROUND TRAFFIC OPERATIONS**

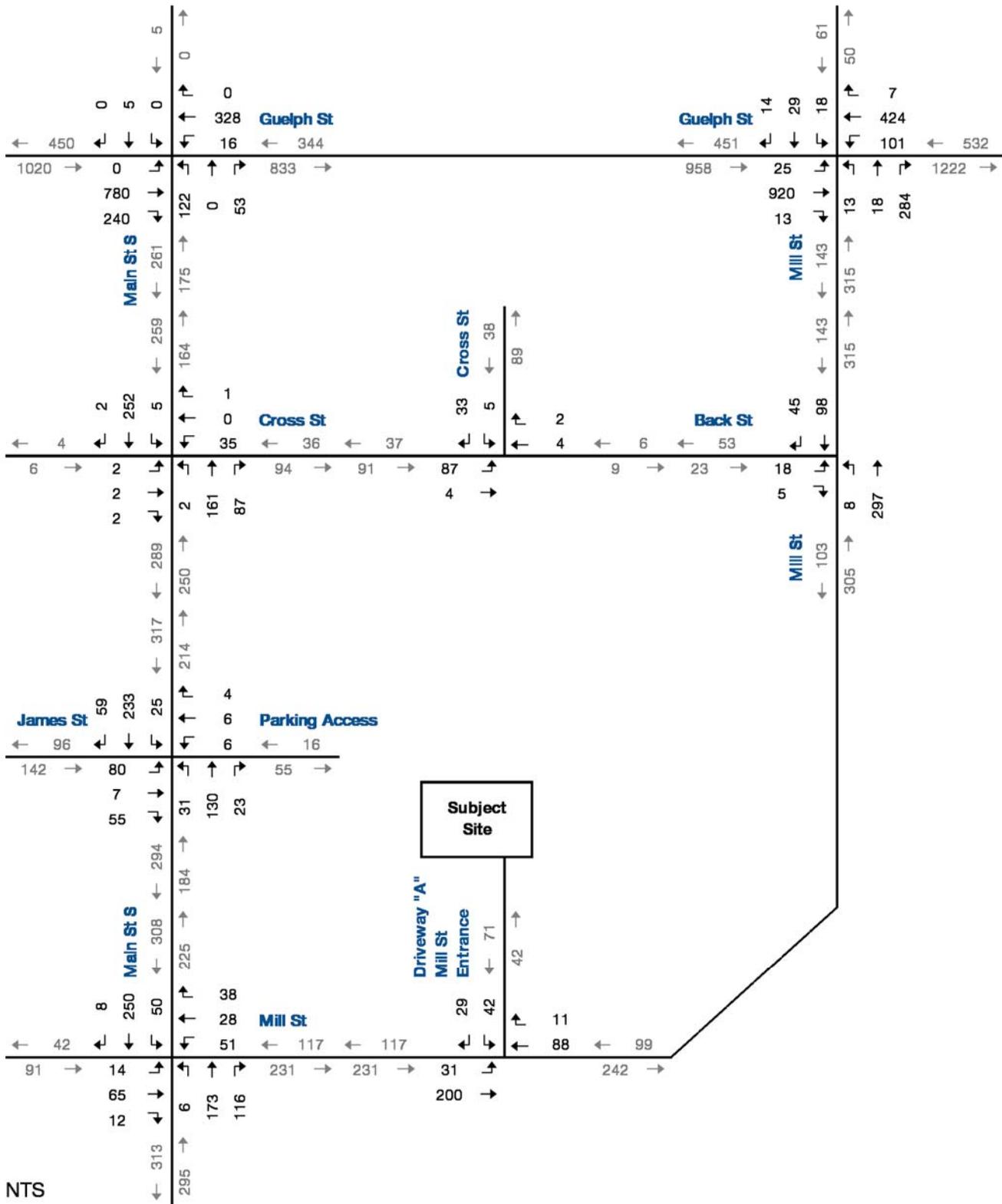
Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																Overall
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	1 - Main St & Guelph St	TCS	LOS Delay V/C 95th Ex. Avail	A 8 0.65 121 -	A 4 0.23 22 -	A 7 < < < <	A 3 < < < <	< < < <	A 3 < < < <	D 54 0.67 43 -	D 40 0.04 8 8	> > > > >	D 49 < < < <	< < < <	D 40 > > >	> > > >	D 40 > > >	B 11 0.65		
	2 - Main St & Cross St	TWSC	LOS Delay V/C 95th	< < < <	B 13 0.01 0	> > > >	B 13 < < <	< < < <	B 13 < < <	< < < <	A 0 0.00 0	> > > >	A 0 < <	< < < <	A 0 0.00 0	> > > >	A 0 > >	A 0		
	3 - Main St & James St	TWSC	LOS Delay V/C 95th	< < < <	B 15 0.28 9	> > > >	B 15 < < <	< < < <	B 13 < < <	< < < <	A 2 0.02 1	> > > >	A 2 < <	< < < <	A 1 0.02 0	> > > >	A 1 > >	A 1		
	4 - Main St & Mill St	TCS	LOS Delay V/C 95th	< < < <	B 14 0.18 16	> > > >	B 14 < < <	< < < <	B 14 < < <	< < < <	A 10 0.37 31	> > > >	A 10 < <	< < < <	B 10 0.39 36	> > > >	B 10 > >	B 11 0.30		
	5 - Guelph St & Mill St	TCS	LOS Delay V/C 95th Ex. Avail	A 3 0.05 3 35 33	B 13 0.86 295 -	> > > >	B 13 < < <	B A 0.48 25 50 25	> > > >	A 6 < < <	E 61 0.80 80 -	> > > >	E 61 < <	< < < <	D 42 0.36 25 -	> > > >	D 42 > >	B 19 0.85		
	6 - Back St & Cross St	TWSC	LOS Delay V/C 95th	< < < <	A 0 0.07 0	> > > >	A 0 < <	A 1 0.00 0	> > > >	A 1 < <	A 9 0.01 0	> > > >	A > >	> > > >	> > > >	> > > >	> > > >	> > > >	> > > >	
	7 - Mill St & Back St	TWSC	LOS Delay V/C 95th	B 11 0.04 1	> > > >	B 11 < <	> > > >	> > > >	> > > >	> > > >	A 0 0.01 0	> > > >	A 0 < <	> > > >	A 0 0.09 0	> > > >	A 0 > >	A 0		
PM Peak Hour	1 - Main St & Guelph St	TCS	LOS Delay V/C 95th Ex. Avail	A 10 0.50 77 -	A 7 0.22 26 -	> > > >	A 9 < < <	A 7 0.60 32 -	> > > >	A 7 < < <	C 33 0.70 53 -	C 22 0.04 8 8	> > > >	C 31 < < <	< < < <	C 22 0.04 6 -	> > > >	C 22 > >	B 11 0.63	
	2 - Main St & Cross St	TWSC	LOS Delay V/C 95th	< < < <	A 0 0.00 0	> > > >	A 0 < <	B 13 < <	< < < <	B 13 < <	A 0 0.00 0	> > > >	A 0 < <	< < < <	A 0 0.00 0	> > > >	A 0 > >	A 0		
	3 - Main St & James St	TWSC	LOS Delay V/C 95th	< < < <	C 17 0.32 11	> > > >	C 17 < <	B 14 0.11 3	> > > >	B 14 < <	A 2 0.06 2	> > > >	A 2 < <	< < < <	A 1 0.01 0	> > > >	A 1 > >	A 1		
	4 - Main St & Mill St	TCS	LOS Delay V/C 95th	< < < <	B 15 0.27 22	> > > >	B 15 < <	B 16 0.34 26	> > > >	B 16 < <	B 12 0.51 49	> > > >	B 12 < <	< < < <	A 10 0.36 32	> > > >	A 10 > >	B 13 0.44		
	5 - Guelph St & Mill St	TCS	LOS Delay V/C 95th Ex. Avail	A 4 0.05 2 35 33	A 7 0.55 68 -	> > > >	A 7 < <	A A 0.40 27 50 23	> > > >	A 5 < <	C 31 0.41 62 -	> > > >	C 31 < <	< < < <	C 30 0.21 15 -	> > > >	C 30 > >	A 10 0.52		
	6 - Back St & Cross St	TWSC	LOS Delay V/C 95th	< < < <	A 0 0.04 0	> > > >	A 0 < <	A 1 0.00 0	> > > >	A 1 < <	A 9 0.02 1	> > > >	A > >	> > > >	> > > >	> > > >	> > > >	> > > >	> > > >	
	7 - Mill St & Back St	TWSC	LOS Delay V/C 95th	B 12 0.14 4	> > > >	B 12 < <	> > > >	> > > >	> > > >	> > > >	A 0 0.01 0	> > > >	A 0 < <	> > > >	A 0 0.14 0	> > > >	A 0 > >	A 0		



### 4.3 Future Total Traffic

The future total traffic volumes anticipated to occur in this study include the future background traffic volumes (**Figure 4.1A** and **Figure 4.1B**) and the site generated traffic volumes (**Figure 3.2A** and **Figure 3.2B**). The future total traffic reasonably expected to occur within the study area is shown in **Figures 4.2A** and **Figure 4.2B**.

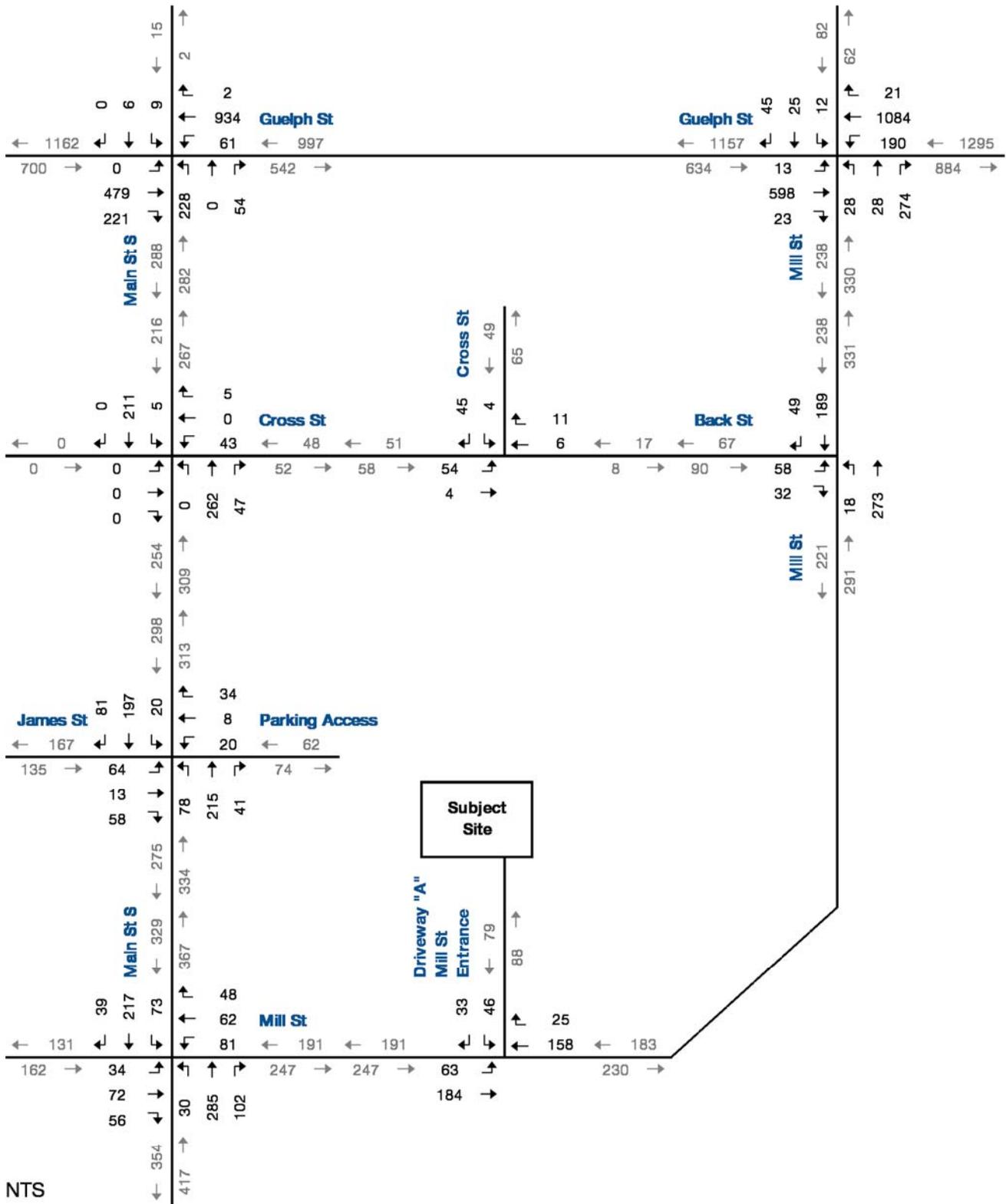




NTS



## Forecast Total Traffic – AM Peak Hour



NTS



## Forecast Total Traffic – PM Peak Hour

## 4.4 Future Total Traffic Operations

The operations of the study area intersections under the future total traffic conditions were evaluated using the same analytical approach that was used for the background traffic operations along with the total traffic forecast volumes (**Figure 4.2A** and **Figure 4.2B**). No improvements to the road network are assumed to be in place. Signal timings have been optimized to help ensure a reasonable level of service is maintained. The resulting level of service conditions for the total traffic horizon is summarized in **Table 4.3** and the following is noted:

### AM Peak Hour

- ▶ The study area intersections are anticipated to continue to operate with acceptable levels of service.
  - The shared eastbound through/left-turn movement from Main Street to Guelph Street is experiencing a v/c ratio of 0.89. A volume to capacity ratio greater than 0.85 would start to suggest that the movement is approaching capacity.
  - The northbound approach of Mill Street to Guelph Street is anticipated to experience delays in the LOS E range. Delays of this extent are fairly typical for side street approaches to arterial roadways in downtown environments.
- ▶ The proposed site driveway connection to Mill Street, that will provide access to the parking structure, is anticipated to operate with fully satisfactory levels of service for a driveway approach. From a capacity perspective, the two-way stop control on the driveway approach and the shared single lane approaches to the intersection would not warrant the need for improvements.
- ▶ No other movements are considered to be critical.

### PM Peak Hour

- ▶ The study area intersections are anticipated to continue to operate with acceptable levels of service. The minor capacity issues experienced under existing conditions have been mitigated through use of optimized signal timings.
- ▶ The proposed site driveway connection to Mill Street, that will provide access to the parking structure, is anticipated to operate with fully satisfactory levels of service for a driveway approach. From a capacity perspective, the two-way stop control on the driveway approach and the shared single lane approaches to the intersection would not warrant the need for improvements.
- ▶ No other movements at the study area intersections are considered to be critical.

Detailed Synchro 9.0 output is provided in **Appendix D**.



It is recommended that the Town of Halton Hills monitor the operation of the signalized intersections in the study area to ensure appropriate signal timings are in place to accommodate the future traffic demand within the downtown area of Georgetown.



**TABLE 4.3: TOTAL TRAFFIC OPERATIONS**

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																Overall
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	1 - Main St & Guelph St	TCS	LOS Delay V/C 95th Ex. Avail	< A 10 0.67 - -	> A 5 0.25 - -	> A 8	< < < <	< A 4 0.18 - -	> > > >	> A 4	< D 52 0.68 - -	> D 38 0.04 8	> > > >	> D 48	< < < <	< D 38 0.02 4 -	> > > >	> D 38	B 12 0.67	
	2 - Main St & Cross St	TWSC	LOS Delay V/C 95th	< < < <	> B 13 0.01 0	> B 13	< < < <	< B 14 0.09 2	> > > >	> B 14	< < < <	> A 14 0.00 0	> > > >	> A 0	< < < <	< A 0 0.00 0	> > > >	> A 0		
	3 - Main St & James St	TWSC	LOS Delay V/C 95th	< < < <	> C 15 0.30 10	> C 15	< < < <	< B 14 0.04 1	> > > >	> B 14	< < < <	> A 2 0.03 1	> > > >	> A 2	< < < <	< A 1 0.02 1	> > > >	> A 1		
	4 - Main St & Mill St	TCS	LOS Delay V/C 95th	< < < <	> B 14 0.18 16	> B 14	< < < <	< B 15 0.22 18	> > > >	> B 15	< < < <	> B 10 0.38 31	> > > >	> B 10	< < < <	< B 11 0.45 41	> > > >	> B 11	B 12 0.36	
	5 - Guelph St & Mill St	TCS	LOS Delay V/C 95th Ex. Avail	A 3 0.05 2 35 33	> B 14 0.89 295 - -	> B 14	< B 20 0.59 41 50 9	> A 5 0.23 22 - -	> > > >	> A 8	< E 77 0.91 105 - -	> E 77	< < < <	> E 77	< < < <	< D 39 0.32 25 -	> > > >	> D 39	C 24 0.89	
	6 - Back St & Cross St	TWSC	LOS Delay V/C 95th	< < < <	> A 0 0.07 0	> A 0	< < < <	< A 1 0.00 0	> > > >	> A 1	< A 9 0.01 0	> > > >	> > > >	> A	< < < <	< < < <	> > > >			
	7 - Mill St & Back St	TWSC	LOS Delay V/C 95th	B 11 0.04 1	> > > >	> B 11	< < < <	< < < <	> > > >	> > > >	< < < <	> A 0 0.01 0	> > > >	> A 0	< < < <	< A 0 0.09 0	> > > >	> A 0		
	8 - Mill St & Driveway "A" Mill St Entrance	TWSC	LOS Delay V/C 95th	< < < <	> A 1 0.02 1	> A 1	< < < <	< A 0 0.06 0	> > > >	> A 0	< < < <	< < < <	< < < <	< < < <	< B 11 0.11 3	> > > >	> B 11			
PM Peak Hour	1 - Main St & Guelph St	TCS	LOS Delay V/C 95th Ex. Avail	< B 10 0.51 - -	> A 8 0.27 32	> A 9	< < < <	< A 7 0.61 35 - -	> > > >	> A 7	< C 34 0.73 57 - -	> C 21 0.04 8	> > > >	> C 31	< < < <	< C 21 0.04 6 -	> > > >	> C 21	B 12 0.64	
	2 - Main St & Cross St	TWSC	LOS Delay V/C 95th	< < < <	> A 0 0.00 0	> A 0	< < < <	< B 13 0.10 3	> > > >	> B 13	< < < <	> A 0 0.00 0	> > > >	> A 0	< < < <	< A 0 0.00 0	> > > >	> A 0		
	3 - Main St & James St	TWSC	LOS Delay V/C 95th	< < < <	> C 19 0.36 13	> C 19	< < < <	< C 15 0.16 4	> > > >	> C 15	< < < <	> A 2 0.07 2	> > > >	> A 2	< < < <	< A 1 0.02 0	> > > >	> A 1		
	4 - Main St & Mill St	TCS	LOS Delay V/C 95th	< < < <	> B 16 0.28 23	> B 16	< < < <	< B 17 0.40 31	> > > >	> B 17	< < < <	> B 12 0.53 51	> > > >	> B 12	< < < <	< B 12 0.48 42	> > > >	> B 12	B 13 0.48	
	5 - Guelph St & Mill St	TCS	LOS Delay V/C 95th Ex. Avail	A 4 0.05 2 35 33	> A 7 0.55 61 - -	> A 7	< A 8 0.45 33 50 17	> A 5 0.50 62 - -	> > > >	> A 6	< C 31 0.45 32 - -	> C 31	< < < <	> C 31	< < < <	< C 29 0.23 16 -	> > > >	> C 29	B 10 0.53	
	6 - Back St & Cross St	TWSC	LOS Delay V/C 95th	< < < <	> A 0 0.04 0	> A 0	< < < <	< A 1 0.00 0	> > > >	> A 1	< A 9 0.02 1	> > > >	> > > >	> A	< < < <	< < < <	> > > >			
	7 - Mill St & Back St	TWSC	LOS Delay V/C 95th	B 13 0.18 5	> > > >	> B 13	< < < <	< < < <	> > > >	> > > >	< < < <	> A 1 0.02 0	> > > >	> A 1	< < < <	< A 0 0.16 0	> > > >	> A 0		
	8 - Mill St & Driveway "A" Mill St Entrance	TWSC	LOS Delay V/C 95th	< < < <	> A 2 0.05 1	> A 2	< < < <	< A 0 0.11 0	> > > >	> A 0	< < < <	< < < <	< < < <	< < < <	< B 12 0.14 4	> > > >	> B 12			



## 5 Assessment of Improvements

The level of service conditions outlined in **Section 4.0** indicate that the study area intersections are anticipated to operate with sufficient levels of service during the AM and PM peak hours. Some movements are estimated to experience higher than ideal v/c ratios. The following section discusses the site's primary point of vehicular access to Mill Street and the secondary connection to the rear of the building.

### 5.1 Site Access Provisions

#### 5.1.1 Primary Access Point

The proposed Driveway "A" Mill Street Entrance to Mill Street is located approximately 70 metres east of Main Street. This connection will provide vehicular access to the main parking structure contained within the building. A small portion of the parking structure will be accessed via the rear of the building through the Town's surface parking lot.

The Driveway "A" Mill Street Entrance has been designed such that the control gate to the structured parking is offset by approximately 2.5 metres from the edge of pavement on Mill Street. It would be ideal to shift the control gate to a point approximately 6 metres from the near edge of the sidewalk. This offset would allow for the short-term storage of one typical passenger car vehicle without impeding pedestrian activity along Mill Street. Rumble strips and signage to warn drivers of potential pedestrian activity should be added to the driveway approach within the parking structure.

It is recommended that the paving material for the driveway approach be designed to a high level so to allow for a visual and textural difference between the driveway approach and the adjacent sidewalk facilities. Consideration should also be given to operating a flashing warning light that is activated by the parking gate to warn pedestrians of potential vehicle traffic on the driveway approach.

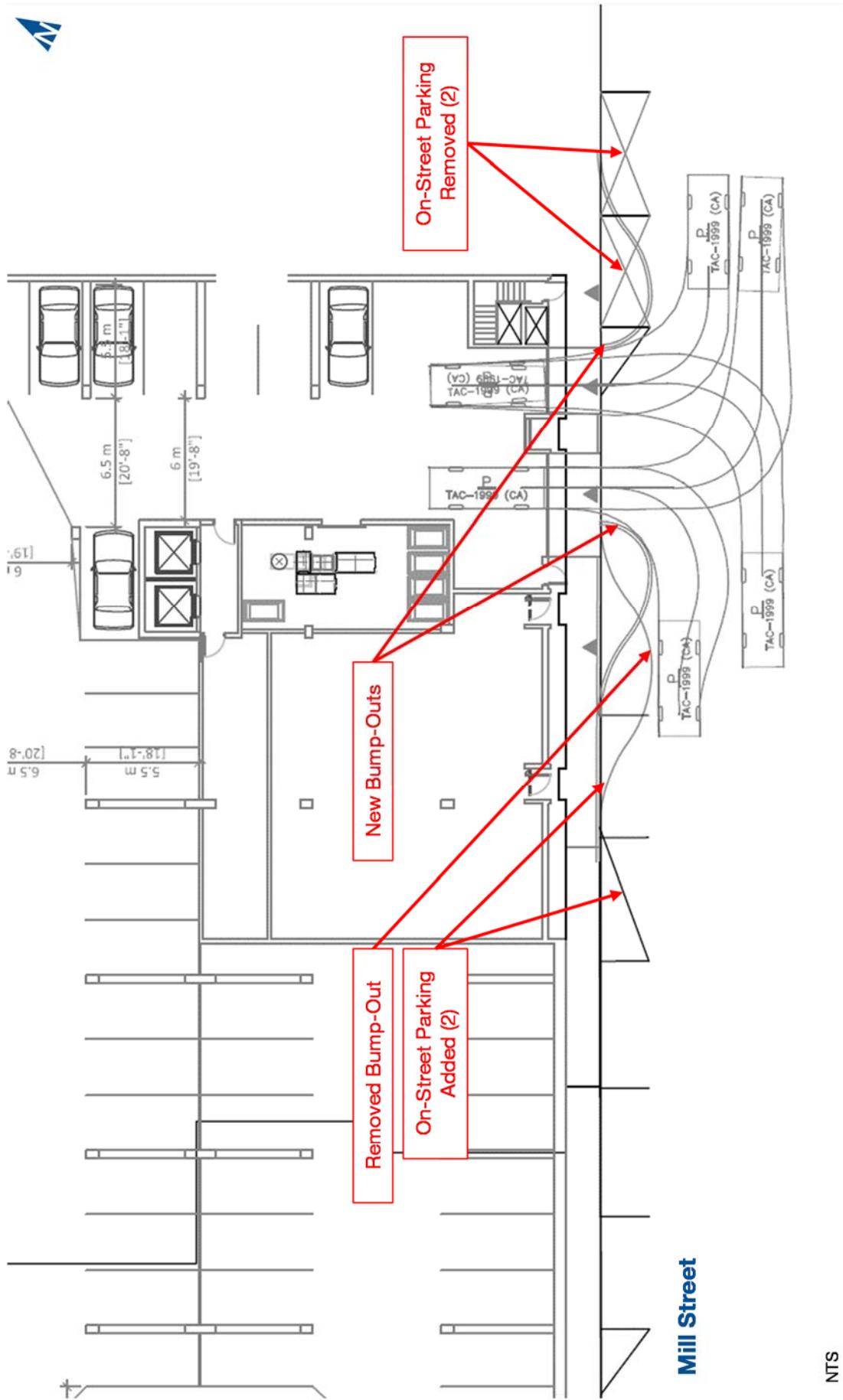
Furthermore, it is recommended that the driveway approach to Mill Street operate under two-way stop control. A stop sign (Ra-1) should be installed on the driveway approach in accordance with the Ontario Traffic Manual Book 5.

The Driveway "A" Mill Street Entrance to Mill Street may present some operational issues with respect to the existing on-street parking along the north side of Mill Street. Some existing parking spaces will need to be remarked to account for the new driveway connection. The site concept plan will impact two existing on-street parking spaces to the east of the driveway. These spaces can be repositioned to the west of the Driveway "A" Mill Street Entrance.



To develop the driveway connection that can operate with sufficient sightlines for motorists, the existing bump-out on Mill Street will have to be reconstructed and repositioned closer to the site driveway connection. **Figure 5.1** illustrates the conceptual layout of Mill Street at the Driveway “A” Mill Street Entrance. It is recommended that detailed design of the streetscaping be prepared for Mill Street across the site’s frontage.





NTS



# Design of Mill Street Driveway

McGibbon Condominium 69-79 Main Street South  
151850S

Figure 5.1

### **5.1.2 Secondary Access Point**

Located at the rear of the building is a secondary point of access to the mid-level parking deck. This level of parking is completely segregated from the remainder of the parking structure. In total 26 vehicles can be accommodated on this level of parking. This area will be accessed via a surface connection to the Town's parking lot which is generally contained by Cross Street and Back Street.

This small parking area is intended to be designed as high-turnover short-term parking spaces for the retail commercial uses on site and potentially for other retail commercial uses within the downtown. This area will also be used for refuse collection for the subject site.

A formalized access agreement will need to be established between the owners of the subject site and the Town of Halton Hills to ensure public access is maintained.



## 6 Parking Requirements

This section addresses the vehicle parking needs of the development as it relates to the proposed site concept plan.

### 6.1 Proposed Parking Supply

The parking supply for the subject site consists of structured parking. Within the structure, 256 parking spaces will be provided. Of the 256 spaces provided, 8 spaces are designated as barrier free accessible spaces and 37 spaces are tandem spaces.

The basic design of the parking structure conforms to the parking space and aisle width dimensions utilized by the City of Hamilton. These design standards have been utilized as the parking space dimensions will allow for a greater number of parking spaces to serve this site and allow for the maximum utility of the lands.

Parking spaces are noted to measure 5.5 metres by 2.6 metres. Aisle widths are designed to maintain a minimum width of 6.0 metres. Due to the structural columns, some parking spaces and aisle widths exceed these dimensions. Overall, the basic parking module measures 17.0 metres and is noted to be consistent with the City of Hamilton's design for parking space and aisle dimensions.

The drive aisle slopes are noted to range from 2 percent to 5 percent and are noted to be fairly typical for structured parking. As ramp grades approach 12-13 percent, transition areas are used and cold weather treatments are usually applied to the ramp.

The constrained operating environment of a parking structure will present some challenges for vehicles circulating the internal drive aisles. Many corners will have reduced visibility and will result in conflicting vehicle swept paths. To mitigate potential conflicts it is recommended that convex mirrors and "yield to on coming" traffic signage be provided at all internal turning points.



## 6.2 Zoning By-Law Requirements

The Zoning By-law requirements for the subject site are noted as follows:

- ▶ Residential Demand
  - Resident – 1.25 spaces per unit;
  - Visitor – 0.25 spaces per unit;
- ▶ Commercial Demand
  - a) Notwithstanding Section 5.1, existing non-residential buildings and structures in the Downtown Commercial One (DC1) Zone in Downtown Georgetown and Downtown Acton are exempt from providing additional parking spaces if they are changing to another non-residential use that would require additional parking spaces. b) Expansions to non-residential buildings and structures within the Downtown Commercial One (DC1) Zone in Downtown Georgetown and Downtown Acton shall not result in the removal of existing parking spaces unless the same number of parking spaces can be provided elsewhere on the lot or in accordance with Section 5.2.5 or Section

The Zoning By-law parking requirement for the subject site would suggest that 219 spaces are required to satisfy the residential parking requirement in addition to the current commercial parking supply for the land uses on-site. The existing commercial land uses that will ultimately be redeveloped as part of the subject site measure approximately 1,479 square metres (15,920 square feet) in area. The redevelopment of the subject site will reduce the commercial GFA to 1,360 square metres (14,647 square feet). To satisfy the commercial parking requirement 20 spaces would be required, as this is the current commercial parking supply for the land that contain the subject site.

Overall, the site will be supplied with 256 spaces and will conform to the Town of Halton Hills zoning by-law requirements.



## 6.3 Parking Supply Assignment

As noted above the subject site will provide parking for 256 vehicles within the integrated parking structure. The following outlines the recommended parking supply for residents, visitors, and retail commercial land uses.

- ▶ Residents – Limited to 188 parking spaces consisting of 151 regular spaces and 37 tandem spaces. These spaces should be unbundled and sold separately from the units. The cost of purchasing the space should reflect the true cost of parking. This measure will encourage residents to be multi-modal and will reduce vehicle ownership rates.
- ▶ Visitor – 68 parking spaces consisting entirely of regular spaces.

For convenience in managing the visitor parking supply, the entire mid-level parking deck (26 spaces) and 42 of the lower ground level parking spaces should be signed and marked as visitor parking spaces. All other spaces should be reserved for resident parking demand.



## 7 Conclusions & Recommendations

### 7.1 Conclusions

The main findings and conclusions of this study are as follows:

- ▶ **Proposed Development:** The proposed development is located at 69-79 Main Street South in the downtown area of Georgetown. The subject site is proposed to consist of 125 high-rise residential condominium units with a small mix of ground floor retail commercial space measuring 1,360 square metres (14,647 square feet) in area.

The subject site's parking demand is anticipated to be accommodated on site through use of an integrated parking structure containing 256 spaces.

The site concept plan does include provisions for Transportation Demand Management measures to mitigate the site's transportation impact, parking demand and encourages all forms of transportation.

Vehicular access to the site's parking structure will be provided primarily by a single driveway connection to Mill Street, Driveway "A" Mill Street Entrance, located approximately 70 metres east of Main Street South. A secondary point of access to the site's parking structure will be provided at the rear of the building with access provided via the Town's surface parking area.

- ▶ **Development Generated Traffic:** The development of the subject site is estimated to generate approximately 113 total vehicle trips during the AM peak hour and approximately 223 total vehicle trips during the PM peak hour. Pass-by trips are anticipated to reduce the site's PM peak hour generation by approximately 34 percent to 167 trips.
- ▶ **Parking Demand:** The proposed parking supply exceeds the current zoning by-law parking requirements. The site's parking demand can be further mitigated with the Transportation Demand Management measures currently incorporated into the site's design.
- ▶ **Existing Traffic Conditions:** The intersections within the site's study area are currently operating with satisfactory levels of service during both the AM and PM peak hours. Conditions are fairly typical for a downtown environment.
- ▶ **Forecast Background Traffic:** The forecast background traffic volumes in the vicinity of the subject site have been assessed for a five-year horizon following the anticipated build-out of the subject site, Year 2023. The forecast traffic volumes are estimated to consist of a generalized growth rate of 2.0 percent per annum.
- ▶ **Background Traffic Conditions:** The study area intersections are anticipated to continue to operate with satisfactory levels of service during the AM and PM peak hours. Future localized capacity issues



are likely to occur at the Guelph Street intersection with Mill Street. The capacity issues are fairly typical for side street approaches to arterial roadways in downtown environments. These conditions will occur with or without the development of the subject site.

- ▶ **Total Traffic Conditions:** The study area intersections are anticipated to continue to operate with satisfactory levels of service during the AM and PM peak hours. Localized capacity issues are likely to occur at the Guelph Street intersection with Mill Street. The capacity issues are fairly typical for side street approaches to arterial roadways in downtown environments.

No capacity issues are anticipated to occur at the site driveway connection to Mill Street that would warrant the need for improvements to the existing infrastructure.

## 7.2 Recommendations

Based on the findings of this study, the following is recommended:

- ▶ The Town of Halton Hills monitor the operation of the signalized intersections in the study area to ensure appropriate signal timings are in place to accommodate the future traffic demand within the downtown area of Georgetown.
- ▶ An updated site plan be prepared that details the design of the streetscaping for Mill Street across the site's frontage. The design should reflect the conceptual layout illustrated in **Figure 5.1**.
- ▶ The following Transportation Demand Management measures be incorporated into the site's plan:
  - **Walking Infrastructure** - Enhanced on-site and peripheral pedestrian amenities (benches, landscaping, lighting, and surface treatment). If appropriate site conditions permit.
  - **Parking Infrastructure** - Shared parking with nearby developments or on-street spaces. Allow parking spaces not purchased by residents to be utilized by nearby developments.
  - **Carshare/Bikeshare** - Consider enrolling or assist in developing a carshare/bikeshare program for the Community of Georgetown.
  - **Education/Promotion, Incentives** - Include transit and active transportation maps, carshare and/or bikeshare memberships with new condominium purchases.
- ▶ Paving material for the driveway approach to Mill Street be designed to a high level so to allow for a visual and textural difference between the driveway approach and the adjacent sidewalk facilities. A flashing warning light be implemented at the parking structure entrance to visually alert pedestrians of the parking gate's operation and potential vehicle conflicts.



- ▶ The proposed driveway connection to Mill Street should operate under two-way stop control. A stop sign (Ra-1) should be installed on the side street approach in accordance with the Ontario Traffic Manual Book 5.
- ▶ The Driveway “A” Mill Street Entrance has been designed such that the control gate to the structured parking is offset by approximately 6.0 metres from the near edge of the sidewalk facilities along Mill Street.
- ▶ The internal Driveway “A” Mill Street Entrance approach to the Mill Street be designed with rumble strips and signage to warn drivers of potential pedestrian activity along Mill Street.
- ▶ Convex mirrors and “yield to on coming” traffic signage be provided at all internal turning points of the parking structure to mitigate potential conflicts between circulating vehicles.
- ▶ To support a parking supply that is capable of accommodating the estimated future demand, the TDM measures outlined in **Section 3.3** that are already included in the site plan and those that should be considered during the site plan approval stage be integrated into the final site plan design.
- ▶ The site’s 256 parking spaces be assigned as follows:
  - Residents – Limited to 188 parking spaces consisting of 151 regular spaces and 37 tandem spaces. These spaces be unbundled and sold separately from the units.
  - Visitor – 68 parking spaces consisting entirely of regular spaces.
  - To effectively manage the visitor parking supply the entire mid-level parking deck (26 spaces) and 42 of the lower ground level parking spaces should be signed and marked as visitor parking spaces. All other spaces should be reserved for resident parking.

No other roadway or traffic control improvements are required or recommended at this time to accommodate the future traffic within the study area.



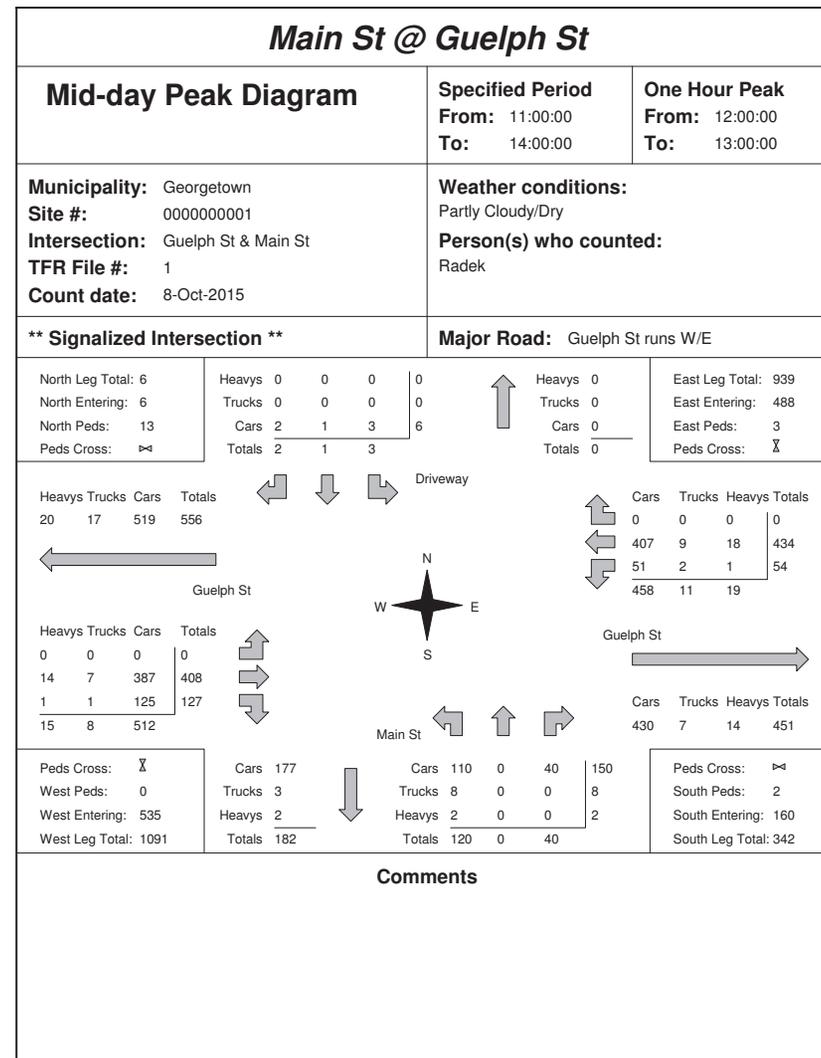
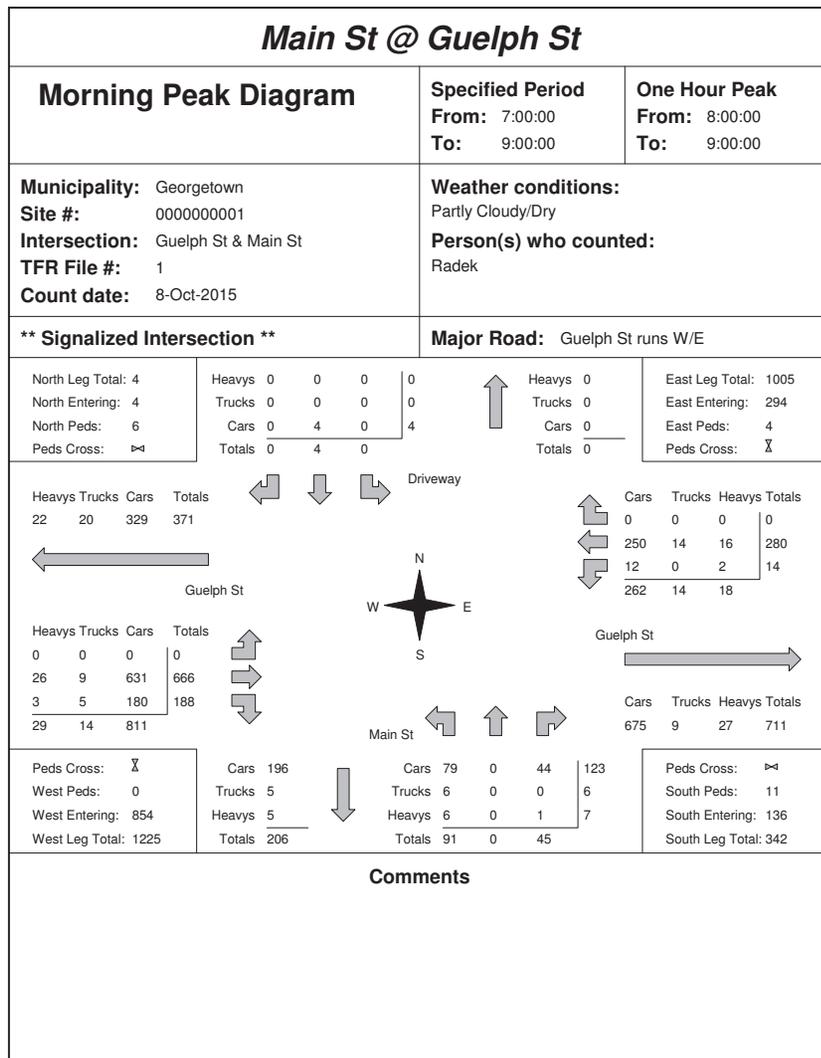


# Appendix A

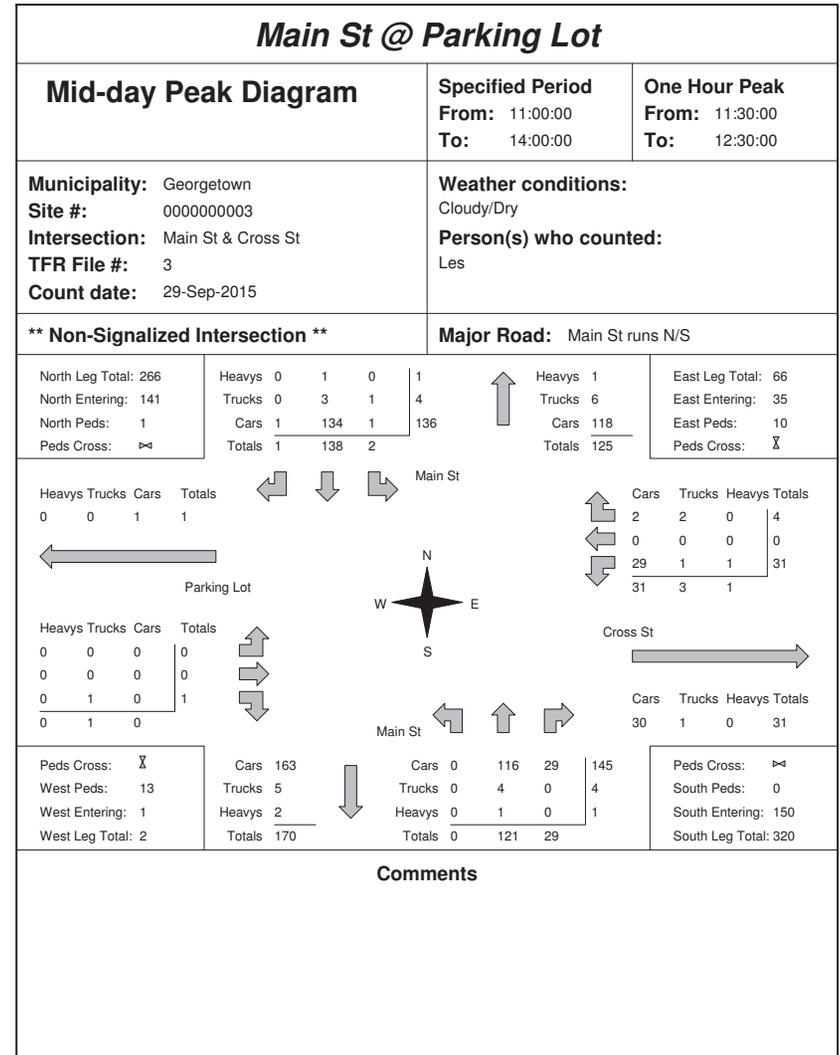
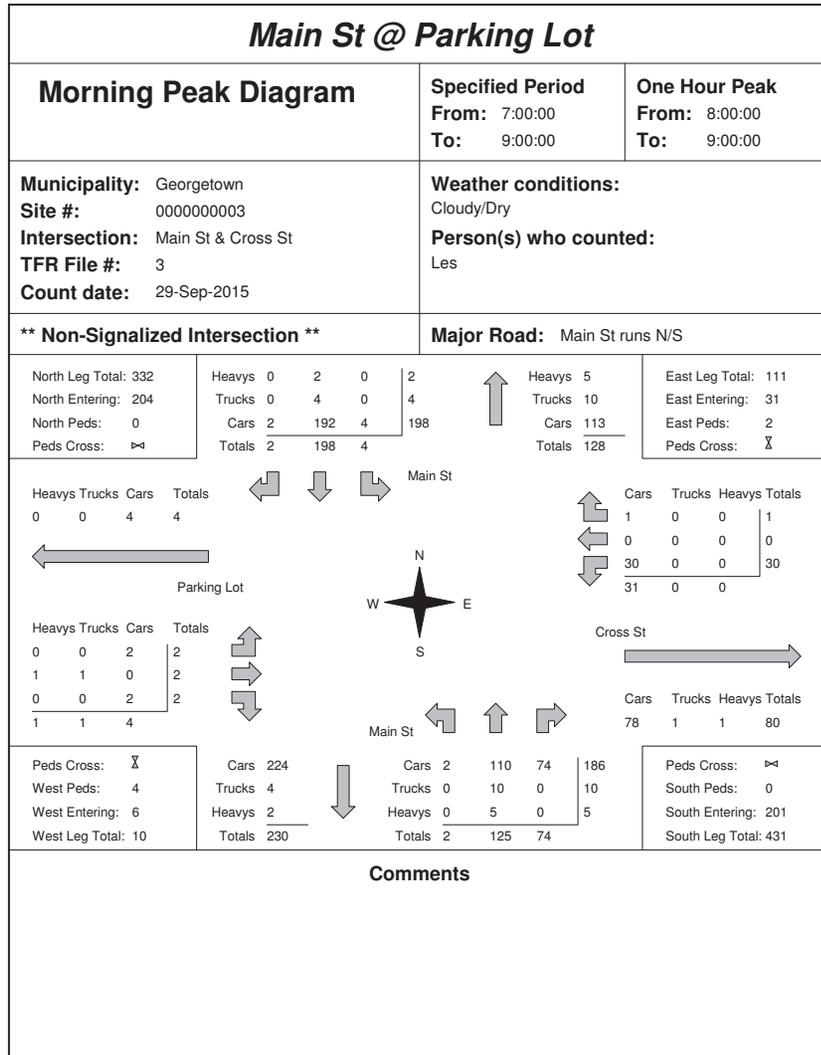
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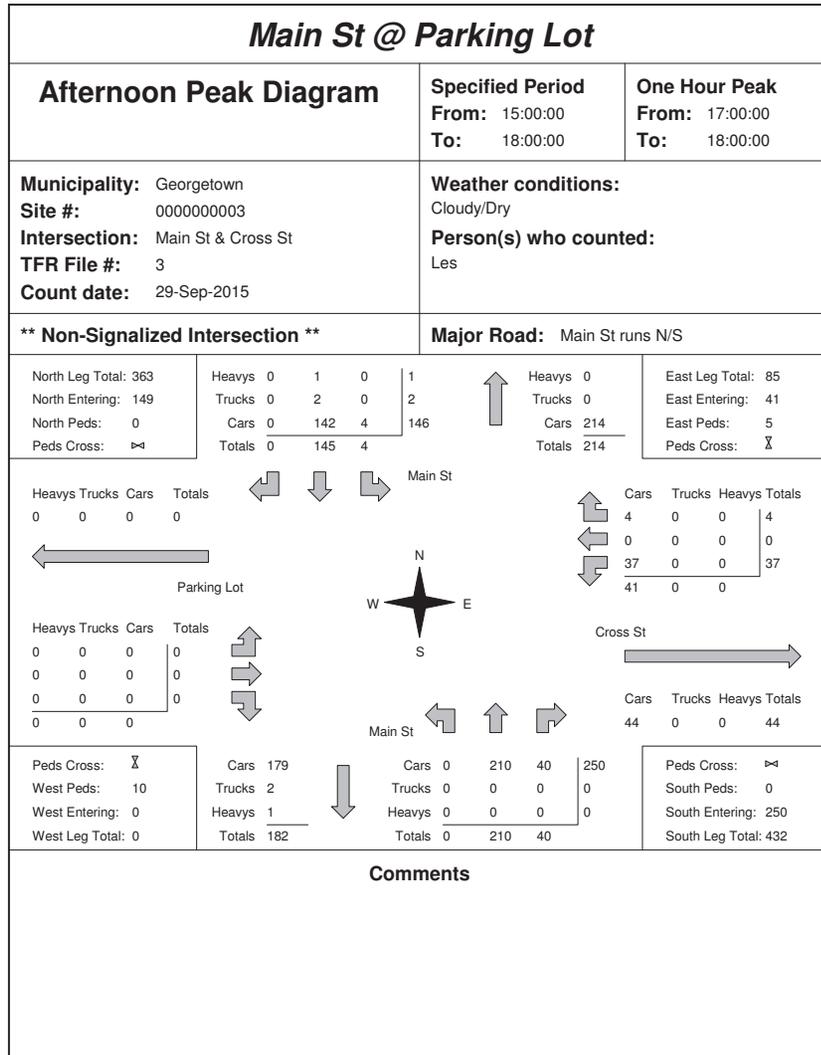


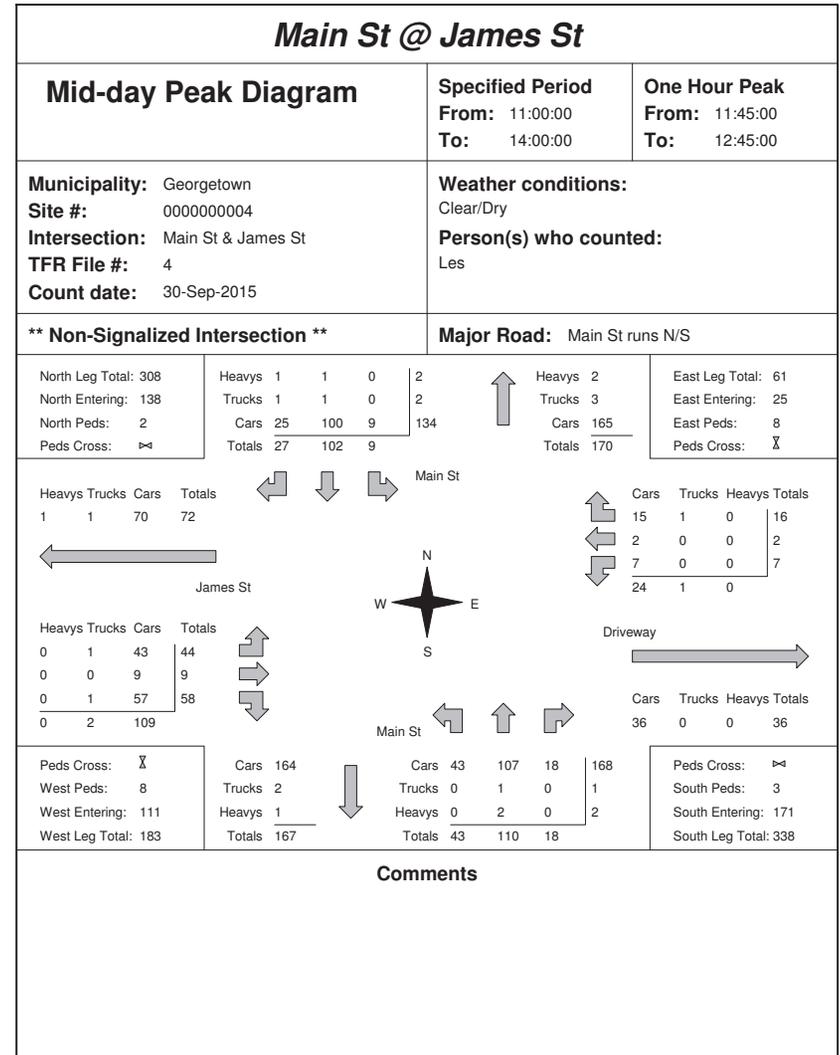
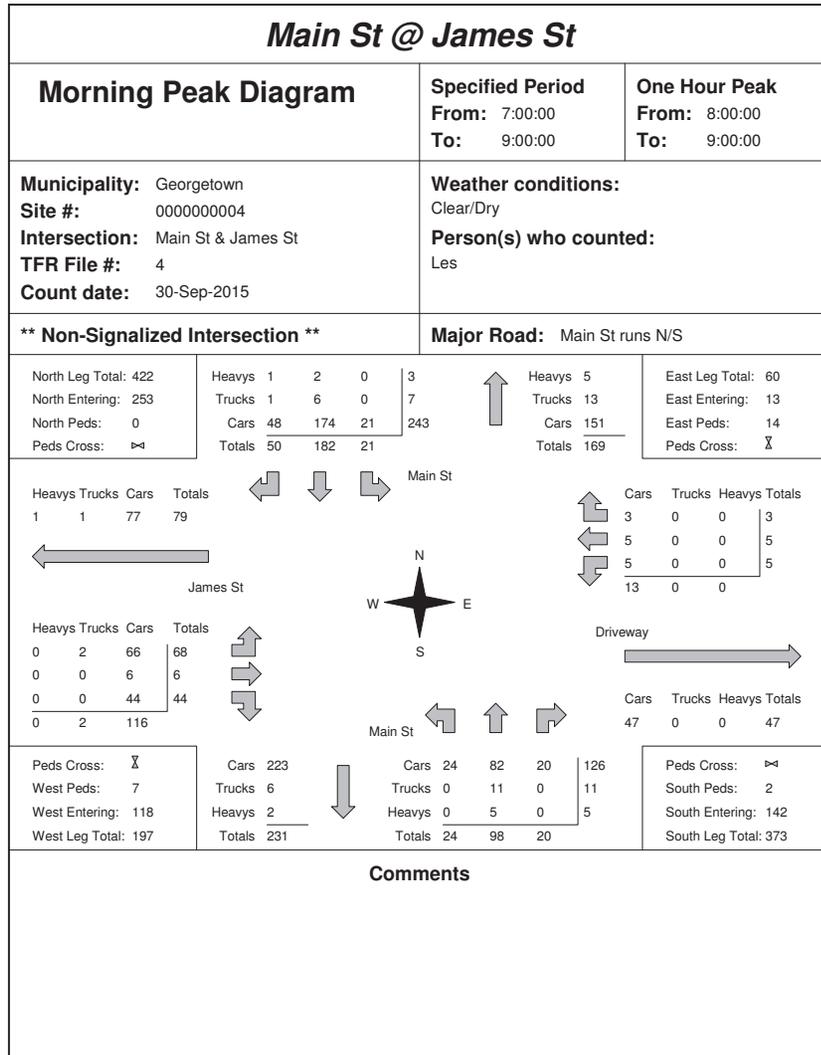












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**To:** 18:00:00

**One Hour Peak**

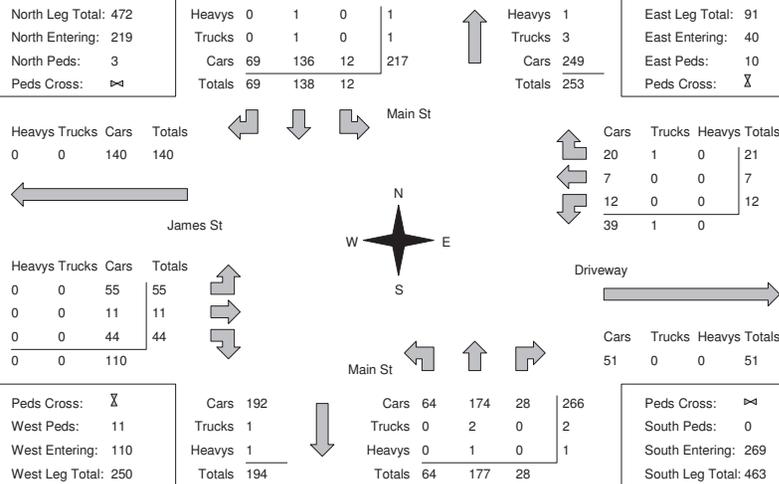
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**To:** 17:30:00

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**Intersection:** Main St & James St  
**TFR File #:** 4  
**Count date:** 30-Sep-2015

**Weather conditions:**  
Clear/Dry  
**Person(s) who counted:**  
Les

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

**Major Road:** Main St runs N/S



**Comments**

## Main St @ James St

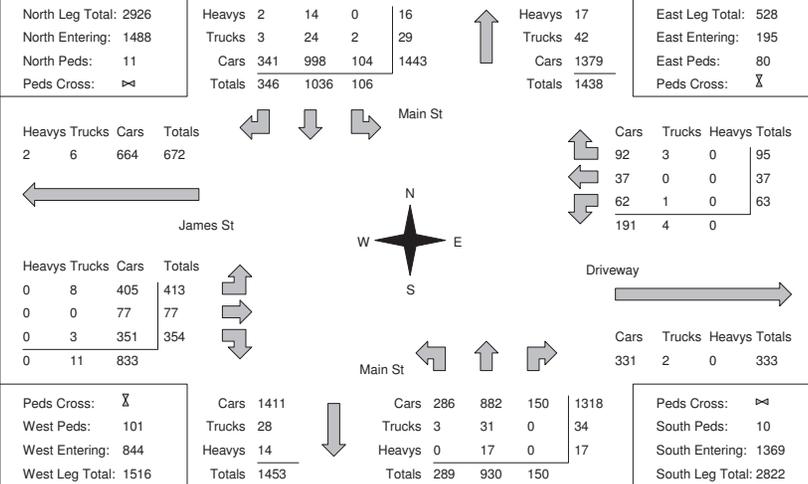
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**Site #:** 000000004  
**Intersection:** Main St & James St  
**TFR File #:** 4  
**Count date:** 30-Sep-2015

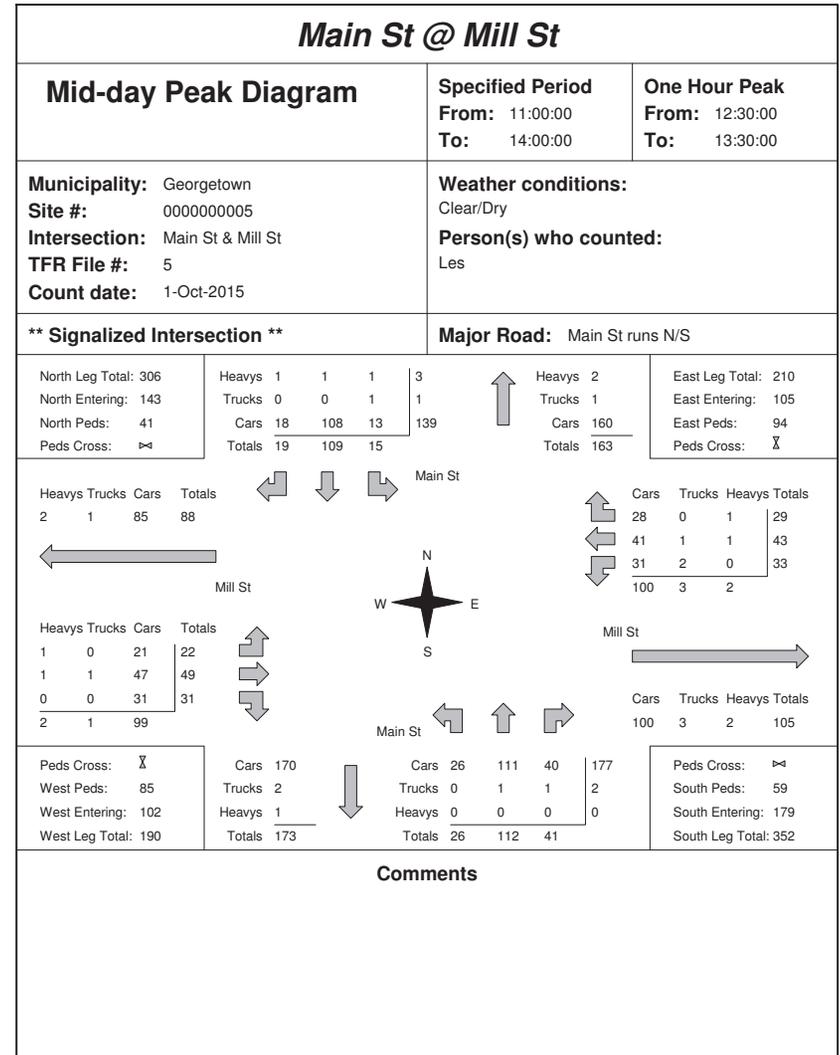
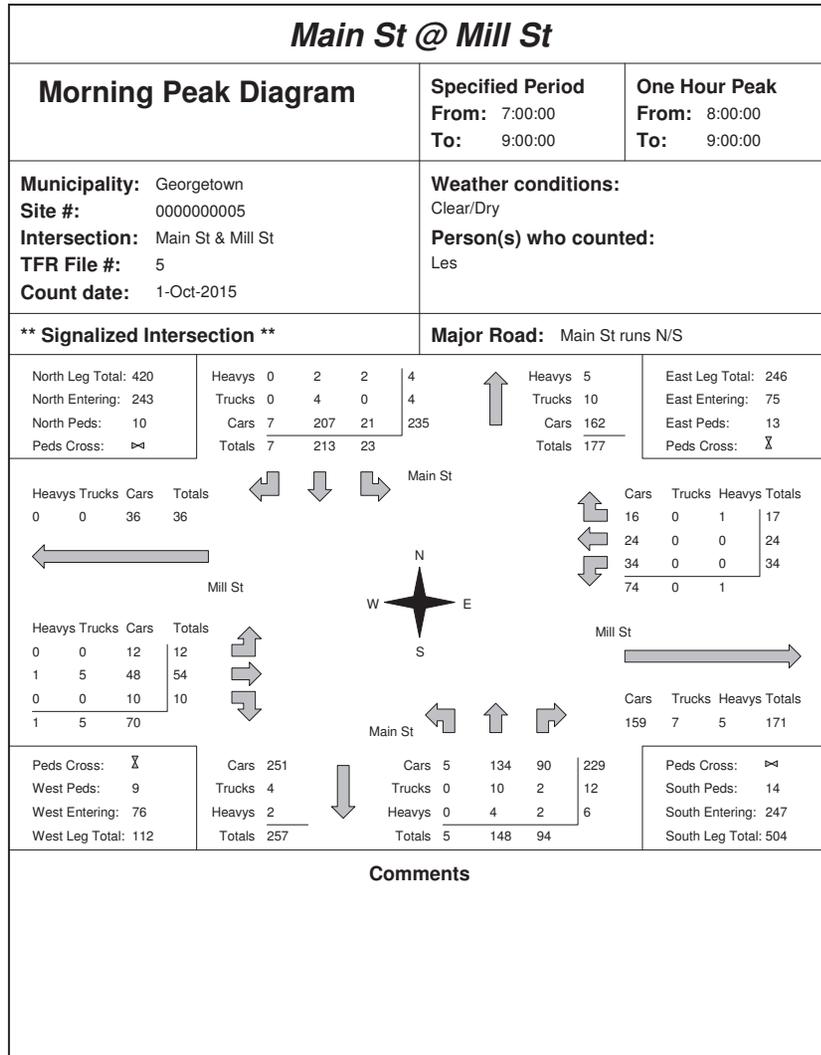
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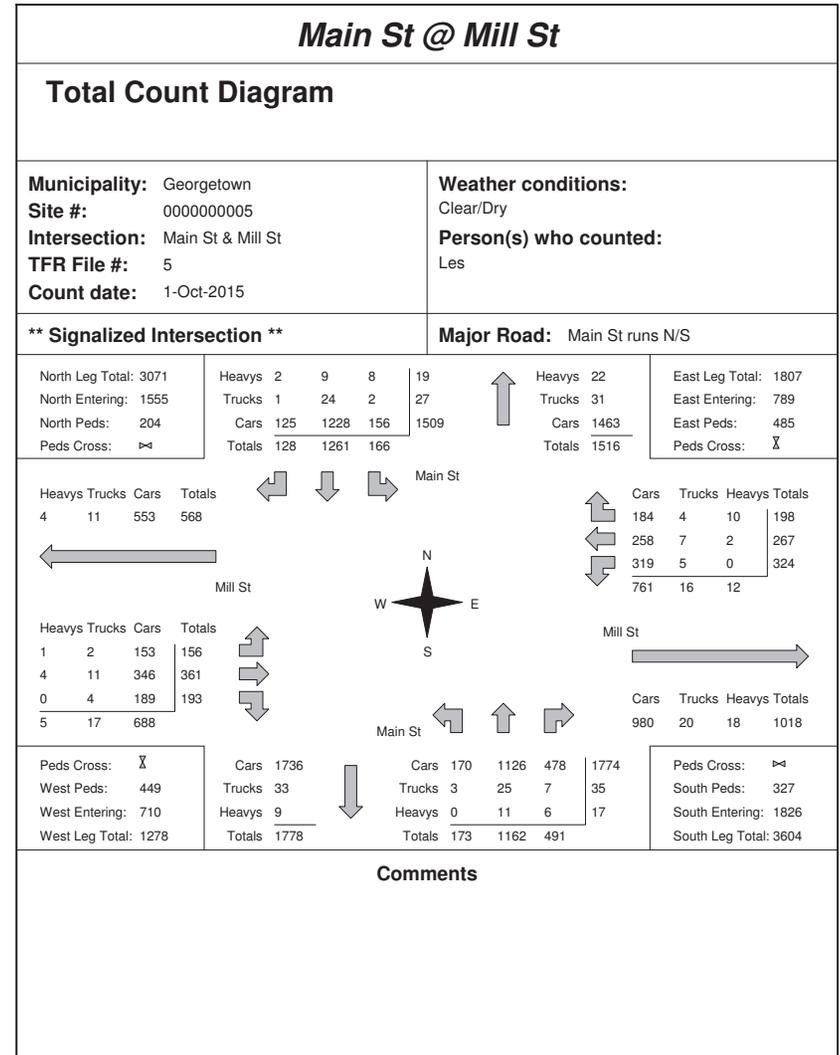
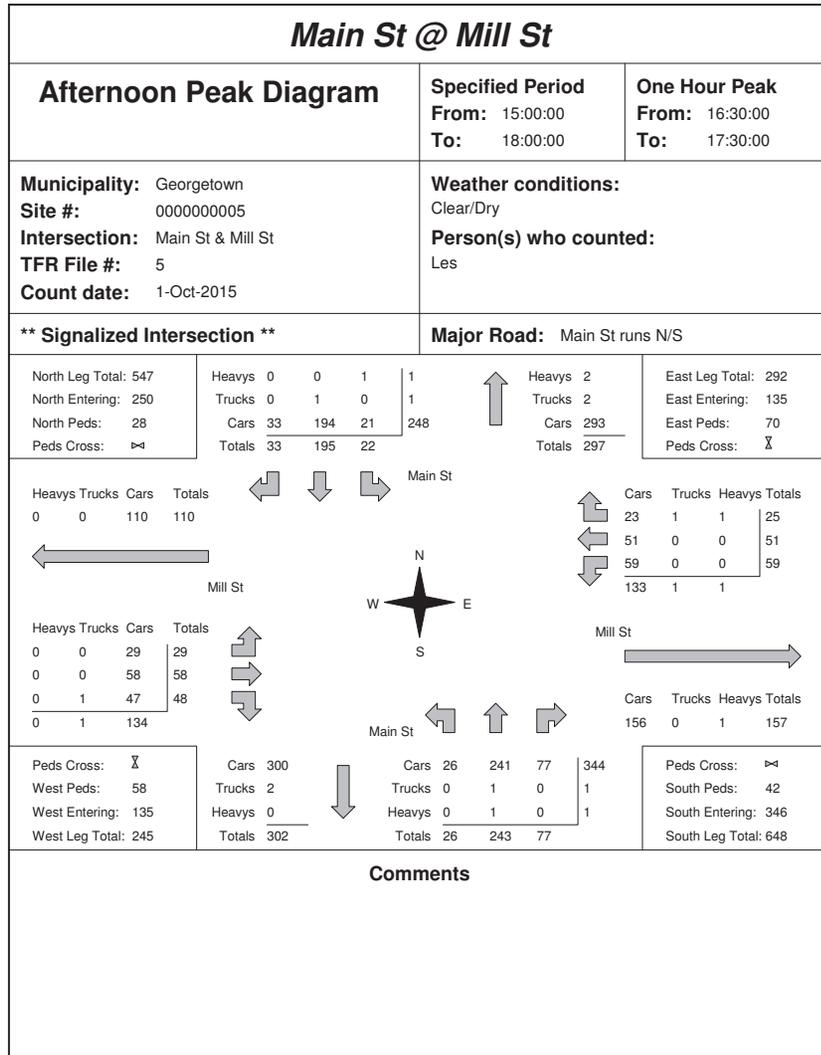
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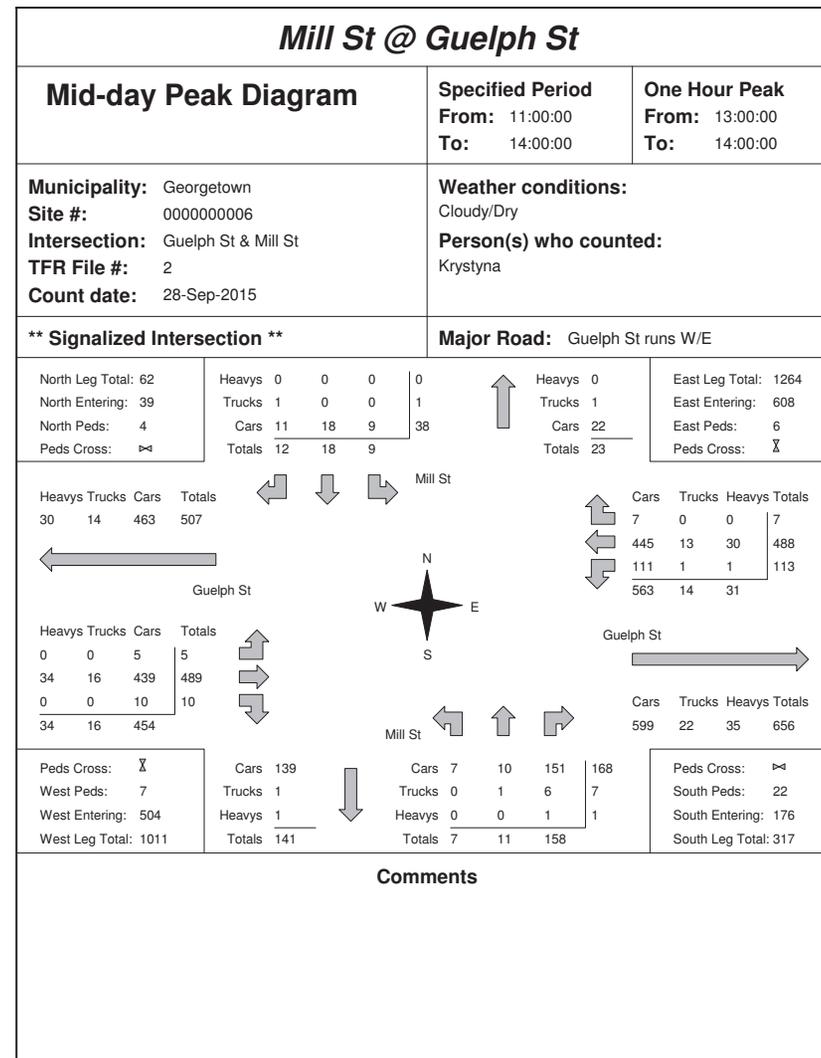
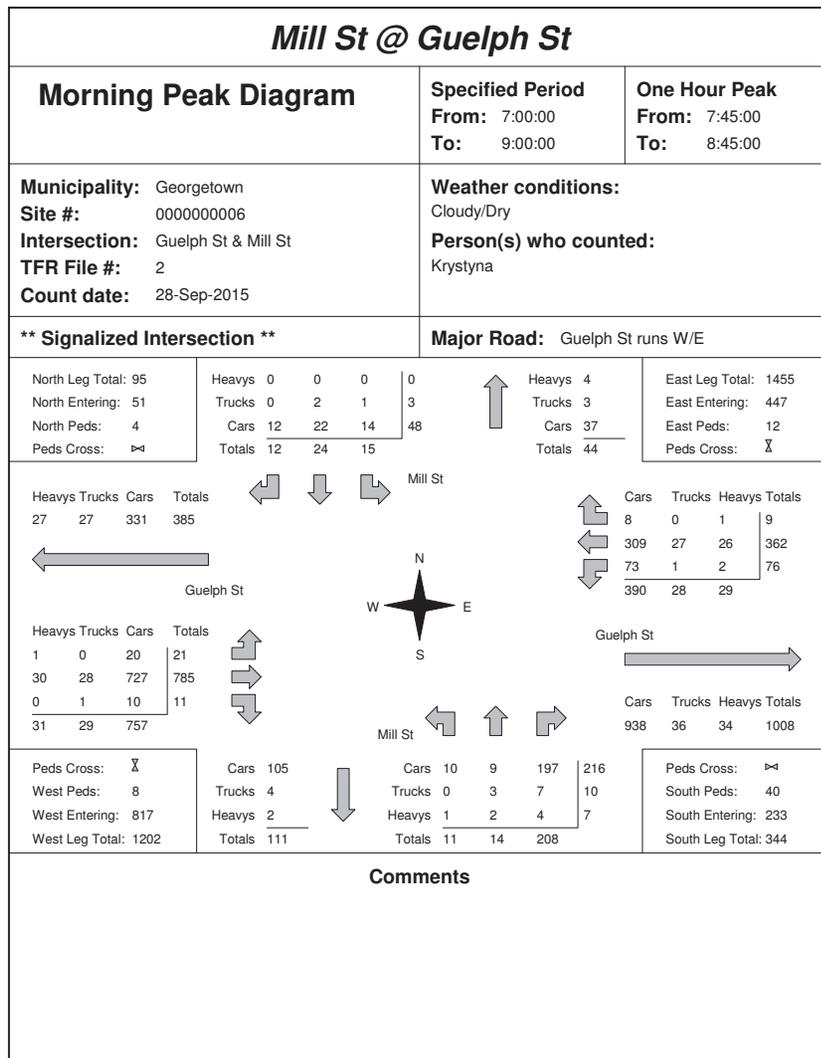
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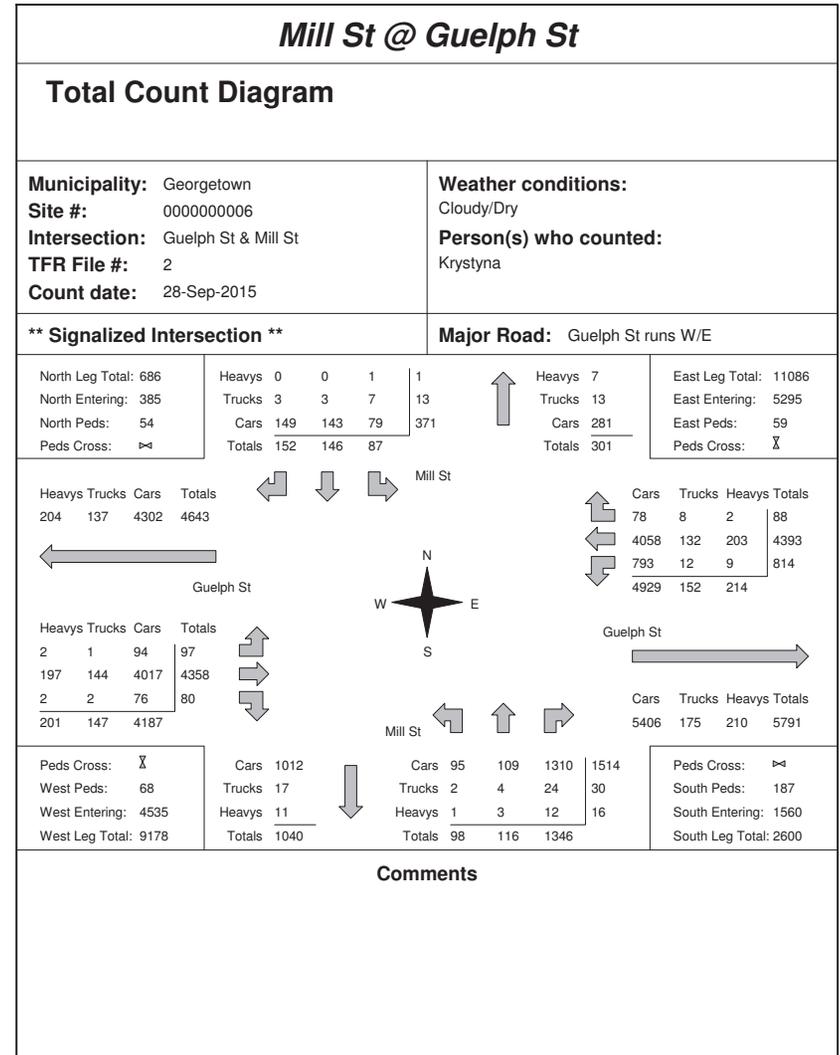
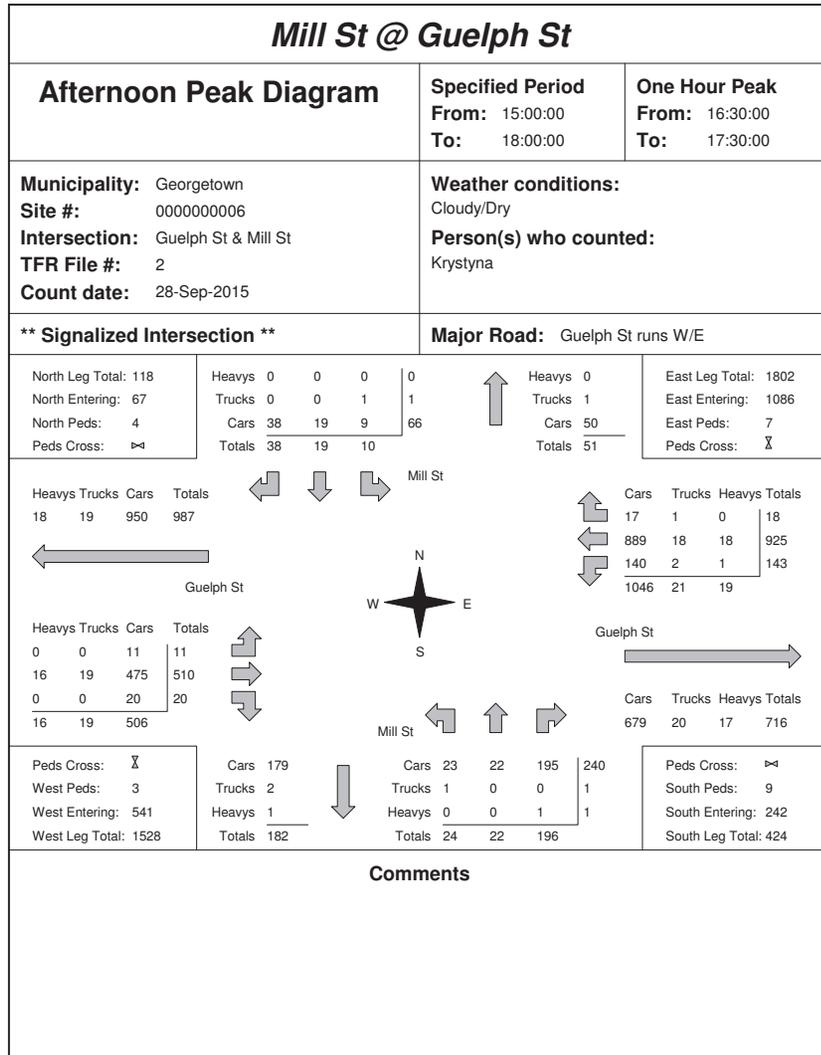


**Comments**



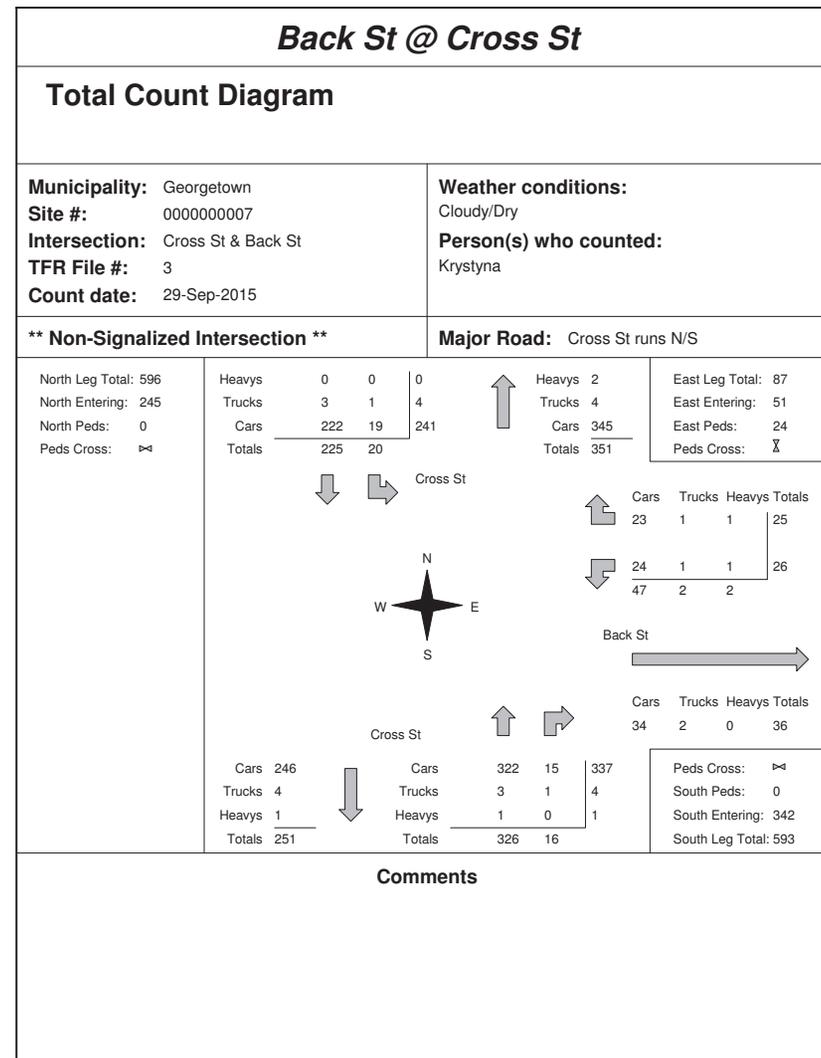
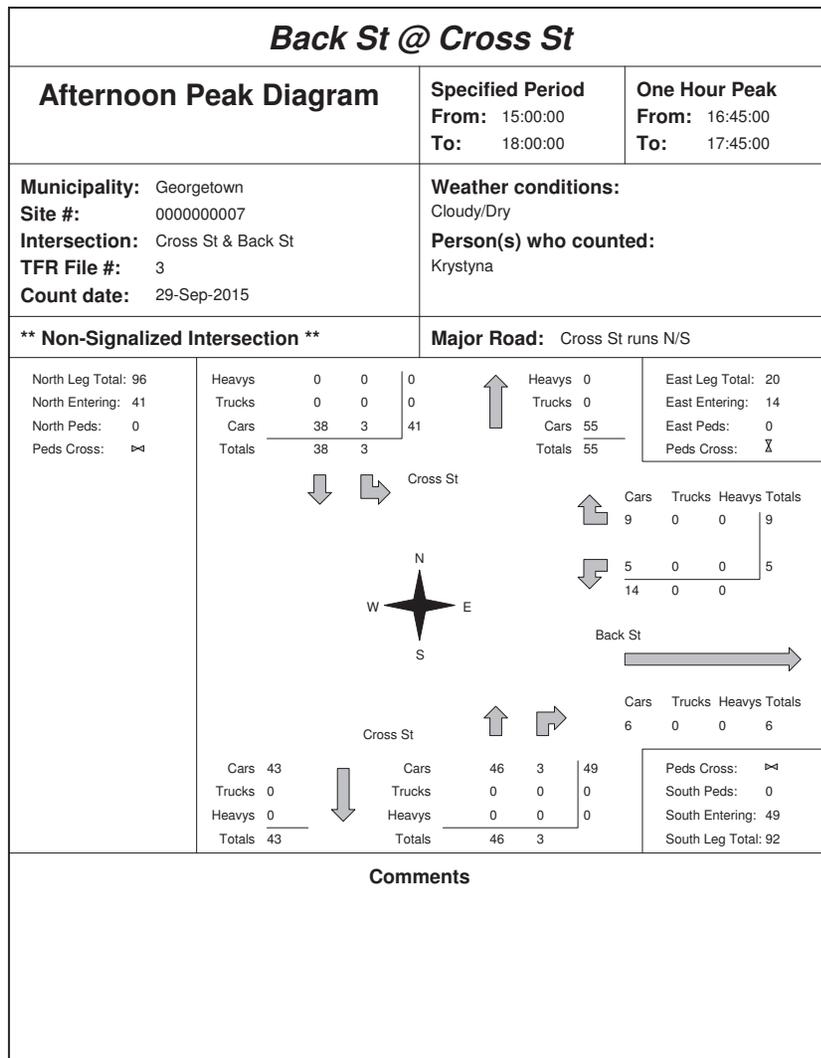


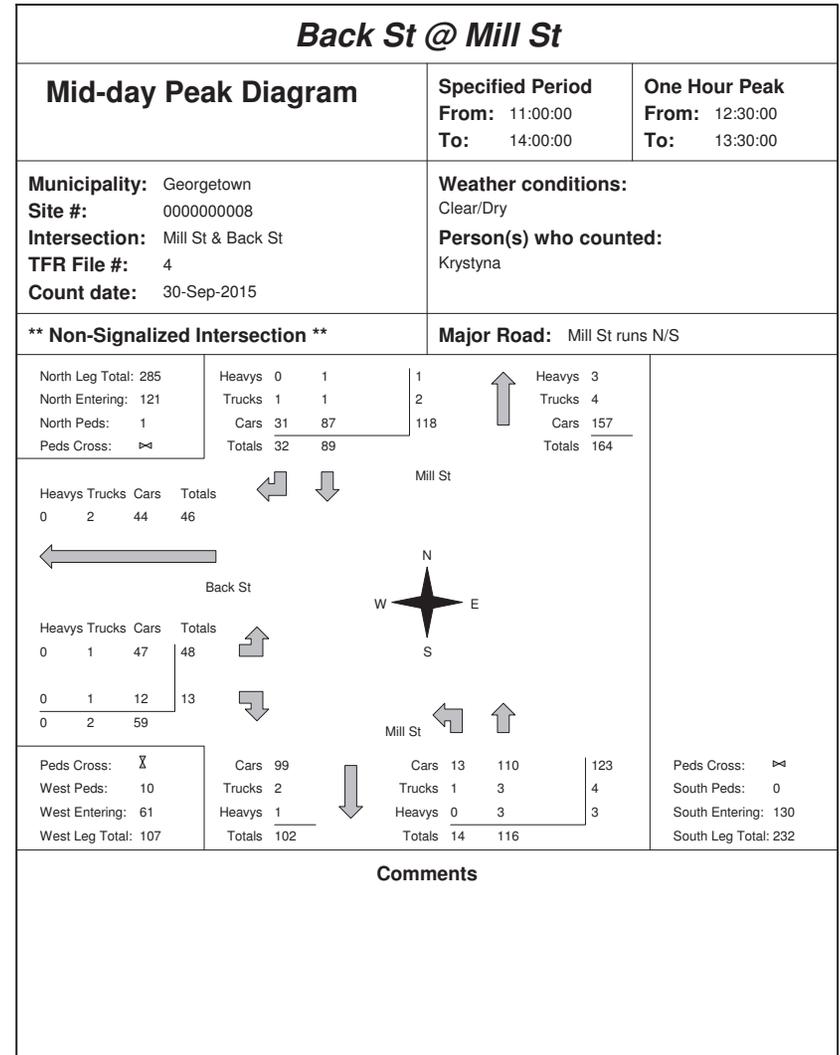
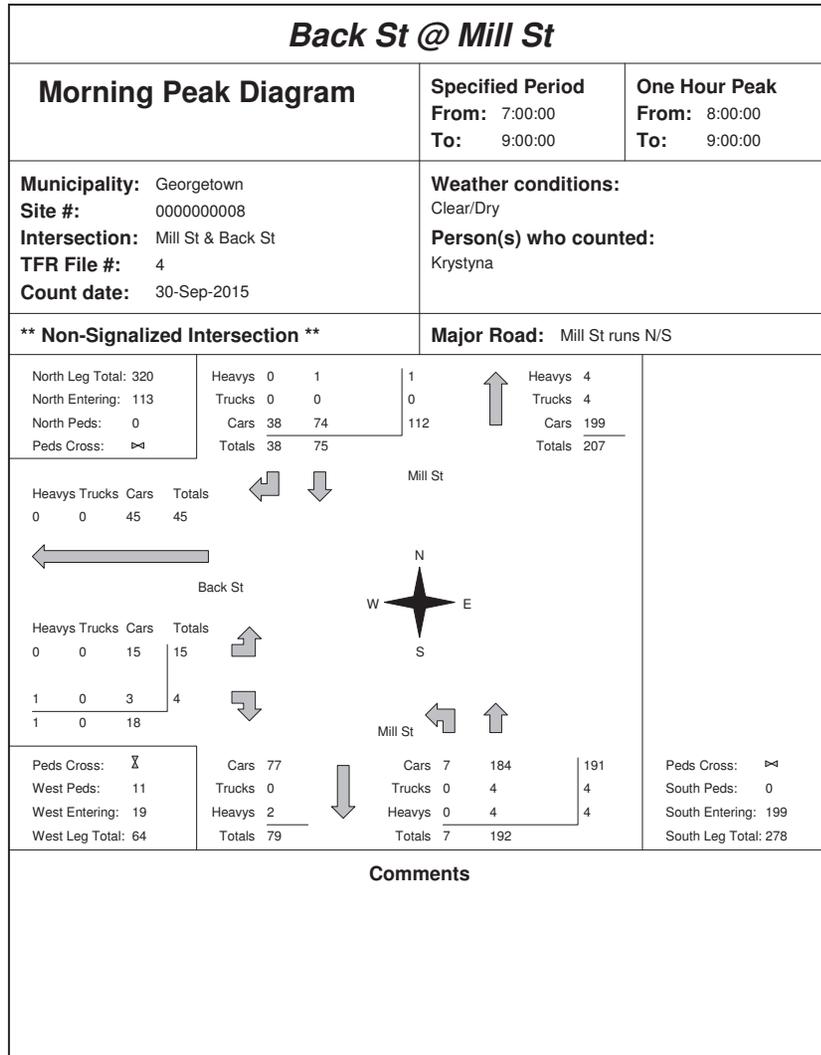


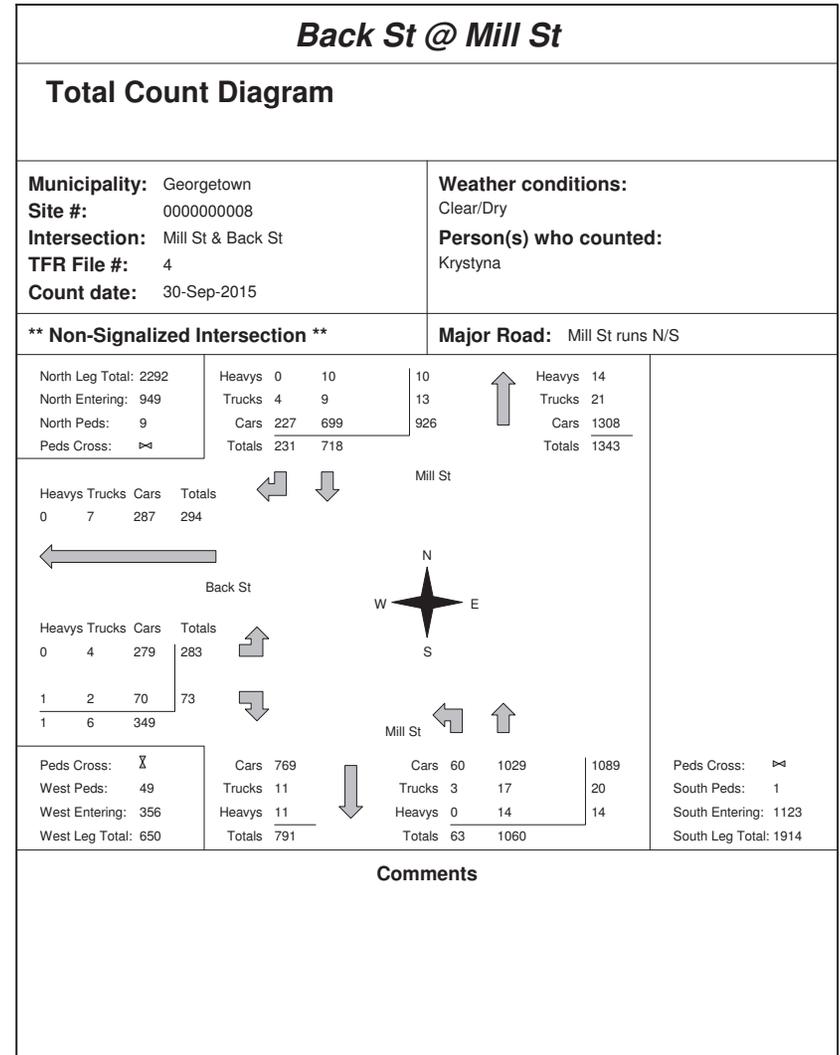
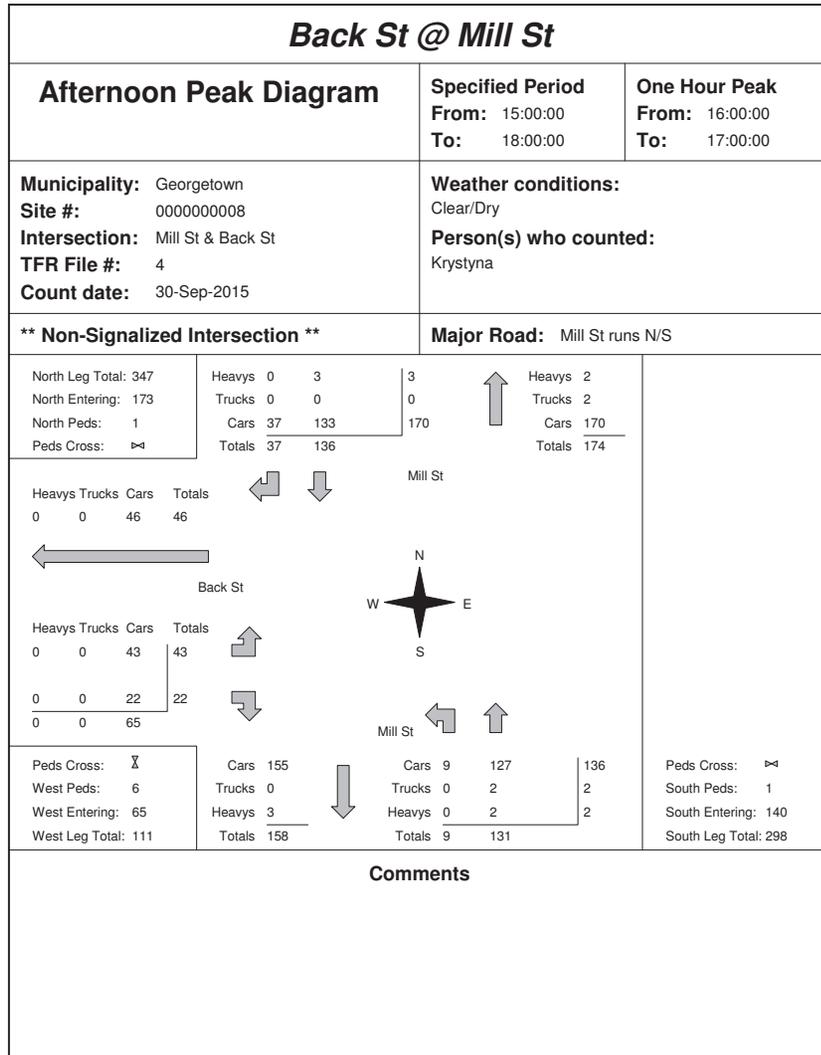


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Cars	Trucks	Heavys	Totals																							
2	1	0	3																							
<table border="1"> <tr><td>Cars</td><td>Trucks</td><td>Heavys</td><td>Totals</td></tr> <tr><td>26</td><td>2</td><td>0</td><td>28</td></tr> <tr><td>Trucks</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>Heavys</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>Totals</td><td>28</td><td>0</td><td>28</td></tr> </table>			Cars	Trucks	Heavys	Totals	26	2	0	28	Trucks	0	0	0	Heavys	0	0	0	Totals	28	0	28				
Cars	Trucks	Heavys	Totals																							
26	2	0	28																							
Trucks	0	0	0																							
Heavys	0	0	0																							
Totals	28	0	28																							
<table border="1"> <tr><td>Cars</td><td>Trucks</td><td>Heavys</td><td>Totals</td></tr> <tr><td>31</td><td>0</td><td>0</td><td>31</td></tr> <tr><td>2</td><td>0</td><td>0</td><td>2</td></tr> <tr><td>33</td><td>0</td><td>0</td><td>33</td></tr> </table>			Cars	Trucks	Heavys	Totals	31	0	0	31	2	0	0	2	33	0	0	33								
Cars	Trucks	Heavys	Totals																							
31	0	0	31																							
2	0	0	2																							
33	0	0	33																							
<table border="1"> <tr><td>Peds Cross:</td><td>⇐</td></tr> <tr><td>South Peds:</td><td>0</td></tr> <tr><td>South Entering:</td><td>33</td></tr> <tr><td>South Leg Total:</td><td>61</td></tr> </table>			Peds Cross:	⇐	South Peds:	0	South Entering:	33	South Leg Total:	61																
Peds Cross:	⇐																									
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<b>Comments</b>																										







Guelph Street (Hwy. 7) Corridor - Georgetown - Guelph St. & Main

**Coordination Pattern Data**  
Pattern Data (MM)3-2

Pattern	Split Pattern	TS2	Cycle	Std(COS)	Offset Value	Splits In	Offsets In	Actuated Coord
1	1	0-1	90	111	13	Seconds	Seconds	No
2	2	0-2	95	121	40	Seconds	Seconds	No
5	5	1-2	120	151	30	Seconds	Seconds	No

Pattern	Timing Plan	Actuated Walk Rest	Sequence	Phase Reservice	Action Plan	XArt Pattern	Vehicle Perm 1	Vehicle Perm 2	Vehicle Perm 3
1	0	No	0	No	1	0	0	0	0
2	0	Yes	0	No	2	0	0	0	0
5	0	No	0	No	5	0	0	0	0

Pattern	Ring Split Ext 1	Ring Split Ext 2	Ring Split Ext 3	Ring Split Ext 4	Split Demand Pattern 1	Split Demand Pattern 2	Ring Displ 2	Ring Displ 3	Ring Displ 4
1	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0

**Split Preference Phases**

Pattern	Phase	Preference 1	Preference 2

**Special Functions**

Pattern	Function	Output

**Split Pattern Data (MM)3-3**  
Coord Phases

Split Pattern	Phase	Split
1	2	67
1	4	23
1	6	67
1	8	23
2	1	11
2	2	49
2	4	35
2	6	60
2	8	35
5	1	10
5	2	80
5	4	30
5	6	90
5	8	30

**Split/Modes**

Split Pattern	Mode	Phase															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Coord	X			X												
2	Coord	X			X												
2	Vehicle Recall	X															
5	Coord	X			X												
5	Vehicle Recall	X															

Guelph Street (Hwy. 7) Corridor - Georgetown - Guelph St. & Main

**Time Base Day Plan/Schedule**

**Day Plan (MM)5-3**

Plan	Event	Action Plan	Start Time
1	1	1	7:00 AM
1	2	2	9:00 AM
1	5	5	3:30 PM
1	7	7	7:00 PM
1	9	9	9:30 PM
2	1	2	8:30 AM
2	2	5	10:00 AM
2	3	2	5:00 PM
2	4	9	8:30 PM
3	1	2	10:00 AM
3	2	9	6:00 PM

**Schedule (MM)5-4**

Schedule Number	Day Plan Number	Months	Days of Week	Days of Month
1	1	Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sept, Oct, Nov, Dec	Mon, Tues, Wed, Thurs, Fri	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31
2	2	Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sept, Oct, Nov, Dec	Sat	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31
3	3	Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sept, Oct, Nov, Dec	Sun	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31

Guelph Street (Hwy. 7) Corridor - Georgetown - Guelph St. & Main

Controller Timing Plan (MM)2-1

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Min Green	5	30	5	8	5	30	5	8	5	5	5	5	5	5	5	5
BK Min Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CS Min Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delay Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Walk	0	8	0	9	0	8	0	8	0	10	0	10	0	10	0	10
Walk 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Walk Max	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ped Clear	0	16	0	11	0	16	0	16	0	16	0	16	0	16	0	16
Ped Clear 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ped Clear Max	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ped CO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Ext	3.0	5.0	5.0	3.0	5.0	5.0	5.0	3.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Ext 2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max 1	11	39	35	26	35	57	35	26	35	35	35	35	35	35	35	35
Max 2	11	51	40	26	40	57	40	26	40	40	40	40	40	40	40	40
Max 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DYM Max	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DYM Stp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yellow	3.0	5.0	3.0	4.0	3.0	5.0	3.0	4.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Red Clear	1.5	2.0	1.0	2.0	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Red Max	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Red Revert	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ACT B4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEC/ACT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max Int	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Time B4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cars Wt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STPT Duc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Min Gap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Plan 2

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Min Green	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
BK Min Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CS Min Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delay Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Walk	0	10	0	10	0	10	0	10	0	10	0	10	0	10	0	10
Walk 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Walk Max	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ped Clear	0	16	0	16	0	16	0	16	0	16	0	16	0	16	0	16
Ped Clear 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ped Clear Max	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ped CO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Ext	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Ext 2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max 1	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
Max 2	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Max 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DYM Max	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DYM Stp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yellow	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Red Clear	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Red Max	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Red Revert	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ACT B4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEC/ACT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max Int	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Time B4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cars Wt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STPT Duc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Min Gap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Plan 3

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Min Green	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
BK Min Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CS Min Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delay Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Walk	0	10	0	10	0	10	0	10	0	10	0	10	0	10	0	10
Walk 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Walk Max	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ped Clear	0	16	0	16	0	16	0	16	0	16	0	16	0	16	0	16
Ped Clear 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ped Clear Max	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ped CO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Ext	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Ext 2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max 1	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
Max 2	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Max 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DYM Max	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DYM Stp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yellow	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Red Clear	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Red Max	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Red Revert	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ACT B4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEC/ACT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max Int	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Time B4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cars Wt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STPT Duc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Min Gap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Plan 4

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Min Green	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
BK Min Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CS Min Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delay Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Walk	0	10	0	10	0	10	0	10	0	10	0	10	0	10	0	10
Walk 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Walk Max	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ped Clear	0	16	0	16	0	16	0	16	0	16	0	16	0	16	0	16
Ped Clear 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ped Clear Max	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ped CO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Ext	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Ext 2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max 1	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
Max 2	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Max 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DYM Max	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DYM Stp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yellow	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Red Clear	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Red Max	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Red Revert	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ACT B4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEC/ACT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max Int	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Time B4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cars Wt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STPT Duc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Min Gap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

By-Phase Timing Data

Direction	1		2		3		4		5		Phase		11	12
	WBLT	E/W		N/S			6	7	8	9	10			
Minimum Green	6	30	0	8	0	0	0	0	0	5	5	5	5	
Bike Min Green	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cond Serv Min Grn	0	0	0	0	0	0	0	0	0	0	0	0	0	
Walk	7	10	0	8	0	10	0	10	0	10	0	10	0	
Ped Clearance	7	8	0	10	0	8	0	7	0	10	0	10	0	
Veh Extension	3.0	4.5	0.0	2.8	0.0	0.0	0.0	0.0	0.0	5.0	5.0	5.0	5.0	
Alt Veh Exten	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Max Extension	0	0	0	0	0	0	0	0	0	0	0	0	0	
Max 1	12	57	0	26	0	0	0	0	35	35	35	35	35	
Max 2	0	0	0	0	0	0	0	0	40	40	40	40	40	
Max 3	0	0	0	0	0	0	0	0	0	0	0	0	0	
Det. Fail Max	0	0	0	0	0	0	0	0	0	0	0	0	0	
Yellow Change	3.0	5.0	3.0	4.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Red Clearance	1.5	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Red Revert	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Act. B4 Init	0	0	0	0	0	0	0	0	0	0	0	0	0	
Sec/Actuation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Max Initial	0	0	0	0	0	0	0	0	0	0	0	0	30	
Time B4 Reduction	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cars Waiting	0	0	0	0	0	0	0	0	0	0	0	0	0	
Time To Reduce	0	0	0	0	0	0	0	0	0	0	0	0	0	
Minimum Gap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Coordination Patterns

```

Pattern 1
Cycle Length . . . 90  COS . . . . . 701
Offset . . . . . 13
Vehicle Permissive . . [1] 0 [2] 0
Vehicle Perm 2 Displacement 0 Phase Reservice. . NO
Splits: Phase 1- 0 2- 67 3- 0 4- 23
          Phase 5- 0 6- 67 7- 0 8- 23
          Phase 9- 0 10- 0 11- 0 12- 0 Split Sum: 0
Split Extension/Ring [1] 0 [2] 0
Split Demand Pattern [1] 0 [2] 0
XRT Pattern. . . 0
Phase Number: 1 2 3 4 5 6 7 8 9 10 11 12
Coord Phases . . . X . . . X . . . . .
Veh Recall . . . . . . . . . . . . . . .
Veh Max Recall . . . . . . . . . . . . . . .
Ped Recall . . . . . . . . . . . . . . .
Veh Omit . . . . . . . . . . . . . . .
Alt Sequence . . A: . B: . C: . D: . E: . F: .
    
```

```

Pattern 2
Cycle Length . . . 95  COS . . . . . 702
Offset . . . . . 50
Vehicle Permissive . . [1] 0 [2] 0
Vehicle Perm 2 Displacement 0 Phase Reservice. . NO
Splits: Phase 1- 10 2- 50 3- 0 4- 35
          Phase 5- 0 6- 60 7- 0 8- 35
          Phase 9- 0 10- 0 11- 0 12- 0 Split Sum: 0
Split Extension/Ring [1] 0 [2] 0
Split Demand Pattern [1] 0 [2] 0
XRT Pattern. . . 0
Phase Number: 1 2 3 4 5 6 7 8 9 10 11 12
Coord Phases . . . X . . . X . . . . .
Veh Recall . . . . . . . . . . . . . . .
Veh Max Recall . . . . . . . . . . . . . . .
Ped Recall . . . . . . . . . . . . . . .
Veh Omit . . . . . . . . . . . . . . .
Alt Sequence . . A: . B: . C: . D: . E: . F: .
    
```

```

Pattern 5
Cycle Length . . . 120 COS . . . . . 705
Offset . . . . . 30
Vehicle Permissive . . [1] 0 [2] 0
Vehicle Perm 2 Displacement 0 Phase Reservice. . NO
Splits: Phase 1- 10 2- 80 3- 0 4- 30
          Phase 5- 0 6- 90 7- 0 8- 30
          Phase 9- 0 10- 0 11- 0 12- 0 Split Sum: 0
Split Extension/Ring [1] 0 [2] 0
Split Demand Pattern [1] 0 [2] 0
XRT Pattern. . . 0
Phase Number: 1 2 3 4 5 6 7 8 9 10 11 12
Coord Phases . . . X . . . X . . . . .
Veh Recall . . . . . . . . . . . . . . .
Veh Max Recall . . . . . . . . . . . . . . .
Ped Recall . . . . . . . . . . . . . . .
Veh Omit . . . . . . . . . . . . . . .
Alt Sequence . . A: . B: . C: . D: . E: . F: .
    
```

Coordination Patterns

```

-----
Pattern 7
Cycle Length . . . 95  COS . . . . . 707
Offset . . . . . 38
Vehicle Permissive . . [1] 0 [2] 0
Vehicle Perm 2 Displacement 0 Phase Reservice. . NO
Splits: Phase 1- 0 2- 60 3- 0 4- 35
          Phase 5- 0 6- 60 7- 0 8- 35
          Phase 9- 0 10- 0 11- 0 12- 0 Split Sum: 0
Split Extension/Ring [1] 0 [2] 0
Split Demand Pattern [1] 0 [2] 0
XRT Pattern. . . 0
Phase Number: 1 2 3 4 5 6 7 8 9 10 11 12
Coord Phases . . . X . . . X . . . . .
Veh Recall . . . . .
Veh Max Recall . . . . .
Ped Recall . . . . .
Veh Omit . . . . .
Alt Sequence . . A: . B: . C: . D: . E: . F: .
    
```

```

-----
Pattern 9
Cycle Length . . . 95  COS . . . . . 709
Offset . . . . . 0
Vehicle Permissive . . [1] 0 [2] 0
Vehicle Perm 2 Displacement 0 Phase Reservice. . NO
Splits: Phase 1- 0 2- 0 3- 0 4- 0
          Phase 5- 0 6- 0 7- 0 8- 0
          Phase 9- 0 10- 0 11- 0 12- 0 Split Sum: 0
Split Extension/Ring [1] 0 [2] 0
Split Demand Pattern [1] 0 [2] 0
XRT Pattern. . . 0
Phase Number: 1 2 3 4 5 6 7 8 9 10 11 12
Coord Phases . . . . .
Veh Recall . . . . .
Veh Max Recall . . . . .
Ped Recall . . . . .
Veh Omit . . . . .
Alt Sequence . . A: . B: . C: . D: . E: . F: .
    
```

```

-----
Pattern 10
Cycle Length . . . 95  COS . . . . . 710
Offset . . . . . 38
Vehicle Permissive . . [1] 0 [2] 0
Vehicle Perm 2 Displacement 0 Phase Reservice. . NO
Splits: Phase 1- 0 2- 60 3- 0 4- 35
          Phase 5- 0 6- 60 7- 0 8- 35
          Phase 9- 0 10- 0 11- 0 12- 0 Split Sum: 0
Split Extension/Ring [1] 0 [2] 0
Split Demand Pattern [1] 0 [2] 0
XRT Pattern. . . 0
Phase Number: 1 2 3 4 5 6 7 8 9 10 11 12
Coord Phases . . . X . . . X . . . . .
Veh Recall . . . . .
Veh Max Recall . . . . .
Ped Recall . . . . .
Veh Omit . . . . .
Alt Sequence . . A: . B: . C: . D: . E: . F: .
    
```

Coordination Patterns

```

-----
Pattern 11
Cycle Length . . . 60  COS . . . . . 711
Offset . . . . . 30
Vehicle Permissive . . [1] 0 [2] 0
Vehicle Perm 2 Displacement 0 Phase Reservice. . NO
Splits: Phase 1- 10 2- 27 3- 0 4- 23
          Phase 5- 0 6- 37 7- 0 8- 23
          Phase 9- 0 10- 0 11- 0 12- 0 Split Sum: 0
Split Extension/Ring [1] 0 [2] 0
Split Demand Pattern [1] 0 [2] 0
XRT Pattern. . . 0
Phase Number: 1 2 3 4 5 6 7 8 9 10 11 12
Coord Phases . . . X . . . X . . . . .
Veh Recall . . . . .
Veh Max Recall . . . . .
Ped Recall . . . . .
Veh Omit . . . . .
Alt Sequence . . A: . B: . C: . D: . E: . F: .
    
```

```

-----
Pattern 12
Cycle Length . . . 95  COS . . . . . 712
Offset . . . . . 38
Vehicle Permissive . . [1] 0 [2] 0
Vehicle Perm 2 Displacement 0 Phase Reservice. . NO
Splits: Phase 1- 0 2- 60 3- 0 4- 35
          Phase 5- 0 6- 60 7- 0 8- 35
          Phase 9- 0 10- 0 11- 0 12- 0 Split Sum: 0
Split Extension/Ring [1] 0 [2] 0
Split Demand Pattern [1] 0 [2] 0
XRT Pattern. . . 0
Phase Number: 1 2 3 4 5 6 7 8 9 10 11 12
Coord Phases . . . X . . . X . . . . .
Veh Recall . . . . .
Veh Max Recall . . . . .
Ped Recall . . . . .
Veh Omit . . . . .
Alt Sequence . . A: . B: . C: . D: . E: . F: .
    
```

```

-----
Pattern 13
Cycle Length . . . 120 COS . . . . . FREE
Offset . . . . . 0
Vehicle Permissive . . [1] 0 [2] 0
Vehicle Perm 2 Displacement 0 Phase Reservice. . NO
Splits: Phase 1- 0 2- 0 3- 0 4- 0
          Phase 5- 0 6- 0 7- 0 8- 0
          Phase 9- 0 10- 0 11- 0 12- 0 Split Sum: 0
Split Extension/Ring [1] 0 [2] 0
Split Demand Pattern [1] 0 [2] 0
XRT Pattern. . . 0
Phase Number: 1 2 3 4 5 6 7 8 9 10 11 12
Coord Phases . . . . .
Veh Recall . . . . .
Veh Max Recall . . . . .
Ped Recall . . . . .
Veh Omit . . . . .
Alt Sequence . . A: . B: . C: . D: . E: . F: .
    
```

Coordination Patterns

```

-----
Pattern 14
Cycle Length . . . 95   COS . . . . . 714
Offset . . . . . 25
Vehicle Permissive . . [1] 0 [2] 0
Vehicle Perm 2 Displacement 0 Phase Reservice. . NO
Splits:   Phase 1- 0 2- 60 3- 0 4- 35
          Phase 5- 0 6- 60 7- 0 8- 35
          Phase 9- 0 10- 0 11- 0 12- 0   Split Sum: 0
Split Extension/Ring [1] 0 [2] 0
Split Demand Pattern [1] 0 [2] 0
XRT Pattern. . . 0
  Phase Number: 1 2 3 4 5 6 7 8 9 10 11 12
Coord Phases . . . X . . . X . . . . .
Veh Recall . . . . .
Veh Max Recall . . . . .
Ped Recall . . . . .
Veh Omit . . . . .
Alt Sequence . . A: . B: . C: . D: . E: . F: .
-----
    
```

```

-----
Pattern 15
Cycle Length . . . 120  COS . . . . . FREE
Offset . . . . . 0
Vehicle Permissive . . [1] 0 [2] 0
Vehicle Perm 2 Displacement 0 Phase Reservice. . NO
Splits:   Phase 1- 0 2- 0 3- 0 4- 0
          Phase 5- 0 6- 0 7- 0 8- 0
          Phase 9- 0 10- 0 11- 0 12- 0   Split Sum: 0
Split Extension/Ring [1] 0 [2] 0
Split Demand Pattern [1] 0 [2] 0
XRT Pattern. . . 0
  Phase Number: 1 2 3 4 5 6 7 8 9 10 11 12
Coord Phases . . . . .
Veh Recall . . . . .
Veh Max Recall . . . . .
Ped Recall . . . . .
Veh Omit . . . . .
Alt Sequence . . A: . B: . C: . D: . E: . F: .
-----
    
```

NIC Program Steps

```

-----
Step      Program      Step Begins      Pattern      Override
-----
1         1         0700            1            NO
2         1         0900            2            NO
5         1         1530            5            NO
7         1         1900            2            NO
9         1         2130            9            NO
10        2         0830            2            NO
11        2         1000            5            NO
12        2         1700            2            NO
13        2         2030            9            NO
14        3         1000            2            NO
15        3         1800            9            NO
-----
    
```

# TRAFFIC SIGNAL Timing Form



Date: Aug-15

Intersection: Main St. S. @ Mill St. (Georgetown)

		Ph 1	Ph 2	Ph 3	Ph 4	Ph 5	Ph 6	Ph 7	Ph 8
	<i>Dir&gt;</i>		<i>N   S</i>		<i>E   W</i>				
Min Grn			24		10				
Walk			15		11				
Ped Clr			9		7				
Veh Ext			3.5		3.0				
Max 1			24		24				
Max 2			4		35				
Max 3									
Yel			4.0		4.0				
Red			2.0		2.0				
Red Rvt			2		2				
Act B4									
Sec Act									
Max Init									
T B4 R									
Cars W									
TTR									
Min Gap									

Note: Phase 2 - Pedestrian Recall, TOD Flash Plan in effect for Farmers Market (Saturdays, June -October)

# Appendix B

## Existing Traffic Operational Conditions





Timings  
1: Main St & Guelph St

Existing AM  
151850S

	→	↘	↙	←	↖	↗	↓
Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	SBT
Lane Configurations	↑	↗		↖	↖	↗	↘
Traffic Volume (vph)	666	188	14	280	91	0	4
Future Volume (vph)	666	188	14	280	91	0	4
Turn Type	NA	Perm	Perm	NA	D.Pm	NA	NA
Protected Phases	2			6		4	8
Permitted Phases		2	6		8		
Detector Phase	2	2	6	6	8	4	8
Switch Phase							
Minimum Initial (s)	30.0	30.0	30.0	30.0	8.0	8.0	8.0
Minimum Split (s)	37.0	37.0	37.0	37.0	22.0	23.0	22.0
Total Split (s)	67.0	67.0	67.0	67.0	23.0	23.0	23.0
Total Split (%)	74.4%	74.4%	74.4%	74.4%	25.6%	25.6%	25.6%
Yellow Time (s)	5.0	5.0	5.0	5.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-3.0	-3.0		-3.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0		4.0	4.0	4.0	4.0
Lead/Lag							
Lead-Lag Optimize?							
Recall Mode	C-Max	C-Max	C-Max	C-Max	None	None	None
Act Effct Green (s)	70.8	70.8		70.8	14.8	14.8	14.8
Actuated g/C Ratio	0.79	0.79		0.79	0.16	0.16	0.16
v/c Ratio	0.55	0.19		0.15	0.53	0.10	0.01
Control Delay	7.4	4.3		3.5	44.3	0.4	29.0
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0
Total Delay	7.4	4.3		3.5	44.3	0.4	29.0
LOS	A	A		A	D	A	C
Approach Delay	6.7			3.5		29.9	29.0
Approach LOS	A			A		C	C

Intersection Summary

Cycle Length: 90  
 Actuated Cycle Length: 90  
 Offset: 13 (14%), Referenced to phase 2:EBT and 6:WBT, Start of Green  
 Natural Cycle: 60  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.55  
 Intersection Signal Delay: 8.5      Intersection LOS: A  
 Intersection Capacity Utilization 66.7%      ICU Level of Service C  
 Analysis Period (min) 15

Splits and Phases: 1: Main St & Guelph St



Queues  
1: Main St & Guelph St

Existing AM  
151850S

	→	↘	↙	←	↖	↗	↓
Lane Group	EBT	EBR	WBT	NBL	NBT	SBT	
Lane Group Flow (vph)	701	198	310	96	47	4	
v/c Ratio	0.55	0.19	0.15	0.53	0.10	0.01	
Control Delay	7.4	4.3	3.5	44.3	0.4	29.0	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	7.4	4.3	3.5	44.3	0.4	29.0	
Queue Length 50th (m)	46.8	8.9	6.7	16.1	0.0	0.6	
Queue Length 95th (m)	89.1	18.9	12.4	30.7	0.0	3.4	
Internal Link Dist (m)	62.4		112.6		110.9	29.0	
Turn Bay Length (m)							
Base Capacity (vph)	1280	1042	2109	233	515	361	
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	0.55	0.19	0.15	0.41	0.09	0.01	

Intersection Summary

HCM Signalized Intersection Capacity Analysis  
1: Main St & Guelph St

Existing AM  
151850S

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↑	↑	↔	↔	↔	↑	↑	↔	↔	↔	↔	
Traffic Volume (vph)	0	666	188	14	280	0	91	0	45	0	4	0	
Future Volume (vph)	0	666	188	14	280	0	91	0	45	0	4	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0			
Lane Util. Factor	1.00	1.00		0.95	1.00		1.00	1.00		1.00			
Frpb, ped/bikes	1.00	0.96		1.00	1.00		0.97			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		0.85			1.00			
Flt Protected	1.00	1.00		1.00	0.95		1.00			1.00			
Satd. Flow (prot)	1629	1326		2915	1390		1381			1710			
Flt Permitted	1.00	1.00		0.92	0.76		1.00			1.00			
Satd. Flow (perm)	1629	1326		2684	1105		1381			1710			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Adj. Flow (vph)	0	701	198	15	295	0	96	0	47	0	4	0	
RTOR Reduction (vph)	0	0	0	0	0	0	0	40	0	0	0	0	
Lane Group Flow (vph)	0	701	198	0	310	0	96	7	0	0	4	0	
Confl. Peds. (#/hr)	6	11	11		6		4	4		4			
Heavy Vehicles (%)	0%	5%	4%	14%	11%	0%	13%	0%	2%	0%	0%	0%	
Turn Type	NA	Perm	Perm	NA	D.Pm	NA							
Protected Phases	2			6			4			8			
Permitted Phases		2	6		8			4					
Actuated Green, G (s)	65.8	65.8		65.8	11.2	11.2		11.2					
Effective Green, g (s)	68.8	68.8		68.8	13.2	13.2		13.2					
Actuated g/C Ratio	0.76	0.76		0.76	0.15	0.15		0.15					
Clearance Time (s)	7.0	7.0		7.0	6.0	6.0		6.0					
Vehicle Extension (s)	5.0	5.0		5.0	3.0	3.0		3.0					
Lane Grp Cap (vph)	1245	1013		2051	162	202		250					
v/s Ratio Prot	c0.43						0.00			0.00			
v/s Ratio Perm		0.15		0.12	c0.09								
v/c Ratio	0.56	0.20		0.15	0.59	0.03		0.02					
Uniform Delay, d1	4.4	2.9		2.8	35.9	32.9		32.8					
Progression Factor	1.00	1.00		0.96	1.00	1.00		1.00					
Incremental Delay, d2	1.8	0.4		0.2	5.7	0.1		0.0					
Delay (s)	6.2	3.4		2.9	41.6	33.0		32.9					
Level of Service	A	A		A	D	C		C					
Approach Delay (s)	5.6			2.9	38.8			32.9					
Approach LOS	A			A	D			C					
<b>Intersection Summary</b>													
HCM 2000 Control Delay		8.6		HCM 2000 Level of Service				A					
HCM 2000 Volume to Capacity ratio		0.57											
Actuated Cycle Length (s)		90.0		Sum of lost time (s)				8.0					
Intersection Capacity Utilization		66.7%		ICU Level of Service				C					
Analysis Period (min)		15											
c Critical Lane Group													

HCM Unsignalized Intersection Capacity Analysis  
2: Main St & Cross St

Existing AM  
151850S

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↔			↔			↔			↔		
Traffic Volume (veh/h)	2	2	2	30	0	1	2	125	74	4	198	2	
Future Volume (Veh/h)	2	2	2	30	0	1	2	125	74	4	198	2	
Sign Control	Stop			Stop			Free			Free			
Grade	0%			0%			0%			0%			
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	
Hourly flow rate (vph)	2	2	2	34	0	1	2	142	84	5	225	2	
Pedestrians	4			2									
Lane Width (m)	3.6			3.6									
Walking Speed (m/s)	1.2			1.2									
Percent Blockage	0			0									
Right turn flare (veh)	1710												
Median type	None						None						
Median storage (veh)							177						
Upstream signal (m)							135						
pX, platoon unblocked													
vC, conflicting volume	429	472	230	429	431	186	231						228
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	429	472	230	429	431	186	231						228
tC, single (s)	7.1	7.5	6.2	7.1	6.5	6.2	4.1						4.1
tC, 2 stage (s)													
tF (s)	3.5	4.9	3.3	3.5	4.0	3.3	2.2						2.2
p0 queue free %	100	99	100	94	100	100	100						100
cM capacity (veh/h)	533	369	811	531	515	860	1344						1350
<b>Direction, Lane #</b>													
Volume Total	6	35	228	232									
Volume Left	2	34	2	5									
Volume Right	2	1	84	2									
cSH	515	537	1344	1350									
Volume to Capacity	0.01	0.07	0.00	0.00									
Queue Length 95th (m)	0.3	1.7	0.0	0.1									
Control Delay (s)	12.1	12.2	0.1	0.2									
Lane LOS	B	B	A	A									
Approach Delay (s)	12.1	12.2	0.1	0.2									
Approach LOS	B	B											
<b>Intersection Summary</b>													
Average Delay				1.1									
Intersection Capacity Utilization				25.8%			ICU Level of Service			A			
Analysis Period (min)				15									

HCM Unsignalized Intersection Capacity Analysis  
3: Main St & James St

Existing AM  
151850S

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↔			↔			↔			↔		
Traffic Volume (veh/h)	68	6	44	5	5	3	24	98	20	21	182	50	
Future Volume (Veh/h)	68	6	44	5	5	3	24	98	20	21	182	50	
Sign Control	Stop			Stop			Free			Free			
Grade	0%			0%			0%			0%			
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Hourly flow rate (vph)	72	6	46	5	5	3	25	103	21	22	192	53	
Pedestrians	7			14			2			2			
Lane Width (m)	3.6			3.6			3.6			3.6			
Walking Speed (m/s)	1.2			1.2			1.2			1.2			
Percent Blockage	1			1			0			0			
Right turn flare (veh)													
Median type	None						None						
Median storage (veh)													
Upstream signal (m)	152						160						
pX, platoon unblocked													
vC, conflicting volume	438	458	228	491	474	128	252						138
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	438	458	228	491	474	128	252						138
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 %	86	99	94	99	99	100	98						98
cM capacity (veh/h)	498	477	811	435	467	917	1317						1441
Direction, Lane #	EB 1	WB 1	NB 1	SB 1									
Volume Total	124	13	149	267									
Volume Left	72	5	25	22									
Volume Right	46	3	21	53									
cSH	580	511	1317	1441									
Volume to Capacity	0.21	0.03	0.02	0.02									
Queue Length 95th (m)	6.4	0.6	0.5	0.4									
Control Delay (s)	12.9	12.2	1.4	0.7									
Lane LOS	B	B	A	A									
Approach Delay (s)	12.9	12.2	1.4	0.7									
Approach LOS	B	B											
<b>Intersection Summary</b>													
Average Delay	3.9												
Intersection Capacity Utilization	36.3%			ICU Level of Service	A								
Analysis Period (min)	15												

Timings  
4: Main St & Mill St

Existing AM  
151850S

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↔		↔		↔		↔
Traffic Volume (vph)	12	54	34	24	5	148	23	213
Future Volume (vph)	12	54	34	24	5	148	23	213
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	4		4		2		2	
Permitted Phases	4		4		2		2	
Detector Phase	4		4		2		2	
Switch Phase								
Minimum Initial (s)	10.0	10.0	10.0	10.0	24.0	24.0	24.0	24.0
Minimum Split (s)	24.0	24.0	24.0	24.0	30.0	30.0	30.0	30.0
Total Split (s)	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0		-2.0		-2.0		-2.0	
Total Lost Time (s)	4.0		4.0		4.0		4.0	
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	26.0		26.0		26.0		26.0	
Actuated g/C Ratio	0.43		0.43		0.43		0.43	
v/c Ratio	0.13		0.14		0.40		0.40	
Control Delay	9.8		9.1		10.9		13.7	
Queue Delay	0.0		0.0		0.0		0.0	
Total Delay	9.8		9.1		10.9		13.7	
LOS	A		A		B		B	
Approach Delay	9.8		9.1		10.9		13.7	
Approach LOS	A		A		B		B	
<b>Intersection Summary</b>								
Cycle Length: 60								
Actuated Cycle Length: 60								
Offset: 0 (0%), Referenced to phase 2:NBSB and 6.: Start of Green								
Natural Cycle: 55								
Control Type: Pretimed								
Maximum v/c Ratio: 0.40								
Intersection Signal Delay: 11.6					Intersection LOS: B			
Intersection Capacity Utilization 48.4%					ICU Level of Service A			
Analysis Period (min) 15								
Splits and Phases: 4: Main St & Mill St								

Queues  
4: Main St & Mill St

Existing AM  
151850S

	→	←	↑	↓
Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	84	84	274	271
v/c Ratio	0.13	0.14	0.40	0.40
Control Delay	9.8	9.1	10.9	13.7
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	9.8	9.1	10.9	13.7
Queue Length 50th (m)	4.8	4.3	15.1	20.2
Queue Length 95th (m)	12.0	11.4	31.7	36.9
Internal Link Dist (m)	50.0	122.5	34.0	128.1
Turn Bay Length (m)				
Base Capacity (vph)	652	620	681	682
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	0.13	0.14	0.40	0.40

Intersection Summary

HCM Signalized Intersection Capacity Analysis  
4: Main St & Mill St

Existing AM  
151850S

	↗	→	↘	↙	←	↖	↑	↗	↘	↓	↙	
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (vph)	12	54	10	34	24	17	5	148	94	23	213	7
Future Volume (vph)	12	54	10	34	24	17	5	148	94	23	213	7
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		0.99			0.99			0.99			0.99	
Flpb, ped/bikes		1.00			0.99			1.00			1.00	
FrT		0.98			0.97			0.95			1.00	
FlT Protected		0.99			0.98			1.00			1.00	
Satd. Flow (prot)		1533			1571			1495			1635	
FlT Permitted		0.96			0.88			0.99			0.96	
Satd. Flow (perm)		1490			1407			1486			1570	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	13	60	11	38	27	19	6	164	104	26	237	8
RTOR Reduction (vph)	0	6	0	0	11	0	0	37	0	0	2	0
Lane Group Flow (vph)	0	78	0	0	73	0	0	237	0	0	269	0
Confl. Peds. (#/hr)	10		14	14		10	9		13	13		9
Heavy Vehicles (%)	0%	11%	0%	0%	0%	6%	0%	9%	4%	9%	3%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Actuated Green, G (s)		24.0			24.0			24.0			24.0	
Effective Green, g (s)		26.0			26.0			26.0			26.0	
Actuated g/C Ratio		0.43			0.43			0.43			0.43	
Clearance Time (s)		6.0			6.0			6.0			6.0	
Lane Grp Cap (vph)		645			609			643			680	
v/s Ratio Prot												
v/s Ratio Perm		c0.05			0.05			0.16			c0.17	
v/c Ratio		0.12			0.12			0.37			0.40	
Uniform Delay, d1		10.2			10.2			11.5			11.6	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.4			0.4			1.6			1.7	
Delay (s)		10.5			10.6			13.1			13.4	
Level of Service		B			B			B			B	
Approach Delay (s)		10.5			10.6			13.1			13.4	
Approach LOS		B			B			B			B	

Intersection Summary

HCM 2000 Control Delay	12.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.26		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	48.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Timings  
5: Mill St & Guelph St

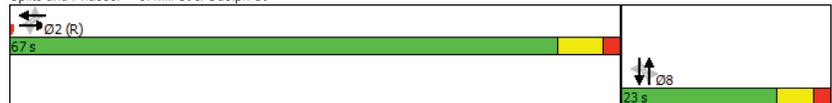
Existing AM  
151850S

	↖	→	↙	←	↘	↑	↗	↓
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖	↖	↖	↖	↖	↖	↖	↖
Traffic Volume (vph)	21	785	78	362	11	14	15	24
Future Volume (vph)	21	785	78	362	11	14	15	24
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		2		2		8		8
Permitted Phases	2		2		8		8	
Detector Phase	2	2	2	2	8	8	8	8
Switch Phase								
Minimum Initial (s)	30.0	30.0	30.0	30.0	8.0	8.0	8.0	8.0
Minimum Split (s)	37.0	37.0	37.0	37.0	23.0	23.0	23.0	23.0
Total Split (s)	67.0	67.0	67.0	67.0	23.0	23.0	23.0	23.0
Total Split (%)	74.4%	74.4%	74.4%	74.4%	25.6%	25.6%	25.6%	25.6%
Yellow Time (s)	5.0	5.0	5.0	5.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-3.0	-3.0	-3.0	-3.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	C-Max	C-Max	C-Max	C-Max	None	None	None	None
Act Effct Green (s)	68.1	68.1	68.1	68.1	13.9	13.9	13.9	13.9
Actuated g/C Ratio	0.76	0.76	0.76	0.76	0.15	0.15	0.15	0.15
v/c Ratio	0.04	0.73	0.29	0.19	0.73	0.73	0.36	0.36
Control Delay	3.0	8.0	7.3	3.7	23.7	23.7	32.8	32.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	3.0	8.0	7.3	3.7	23.7	23.7	32.8	32.8
LOS	A	A	A	A	C	C	C	C
Approach Delay		7.8		4.4		23.7		32.8
Approach LOS		A		A		C		C

Intersection Summary

Cycle Length: 90  
 Actuated Cycle Length: 90  
 Offset: 22.5 (25%), Referenced to phase 2:EBWB and 6., Start of Green  
 Natural Cycle: 70  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.73  
 Intersection Signal Delay: 10.0      Intersection LOS: B  
 Intersection Capacity Utilization 96.0%      ICU Level of Service F  
 Analysis Period (min) 15

Splits and Phases: 5: Mill St & Guelph St



Queues  
5: Mill St & Guelph St

Existing AM  
151850S

	↖	→	↙	←	↘	↑	↓
Lane Group	EBL	EBT	WBL	WBT	NBT	SBT	
Lane Group Flow (vph)	23	884	87	409	259	57	
v/c Ratio	0.04	0.73	0.29	0.19	0.73	0.36	
Control Delay	3.0	8.0	7.3	3.7	23.7	32.8	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	3.0	8.0	7.3	3.7	23.7	32.8	
Queue Length 50th (m)	0.7	28.7	3.8	8.4	12.9	7.3	
Queue Length 95th (m)	m1.5	39.7	13.3	16.8	37.6	17.8	
Internal Link Dist (m)		140.5		110.5	36.7	32.1	
Turn Bay Length (m)	35.0		50.0				
Base Capacity (vph)	606	1205	302	2133	422	213	
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	0.73	0.29	0.19	0.61	0.27	

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis  
5: Mill St & Guelph St

Existing AM  
151850S

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔			↔			↔	
Traffic Volume (vph)	21	785	11	78	362	6	11	14	208	15	24	12
Future Volume (vph)	21	785	11	78	362	6	11	14	208	15	24	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	1.00		1.00	0.95			1.00			1.00	
Frbp, ped/bikes	1.00	1.00		1.00	1.00			0.95			0.99	
Flpb, ped/bikes	0.99	1.00		0.98	1.00			1.00			1.00	
Frt	1.00	1.00		1.00	1.00			0.88			0.97	
Flt Protected	0.95	1.00		0.95	1.00			1.00			0.99	
Satd. Flow (prot)	1487	1592		1487	2818			1337			1528	
Flt Permitted	0.51	1.00		0.25	1.00			0.99			0.62	
Satd. Flow (perm)	801	1592		393	2818			1320			963	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	23	872	12	87	402	7	12	16	231	17	27	13
RTOR Reduction (vph)	0	0	0	0	1	0	0	154	0	0	11	0
Lane Group Flow (vph)	23	884	0	87	408	0	0	105	0	0	46	0
Confl. Peds. (#/hr)	4		40	40		4	8		12	12		8
Heavy Vehicles (%)	5%	7%	9%	4%	15%	11%	9%	36%	5%	7%	8%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			8			8	
Permitted Phases	2			2			8			8		
Actuated Green, G (s)	65.1	65.1		65.1	65.1			11.9			11.9	
Effective Green, g (s)	68.1	68.1		68.1	68.1			13.9			13.9	
Actuated g/C Ratio	0.76	0.76		0.76	0.76			0.15			0.15	
Clearance Time (s)	7.0	7.0		7.0	7.0			6.0			6.0	
Vehicle Extension (s)	4.5	4.5		4.5	4.5			2.8			2.8	
Lane Grp Cap (vph)	606	1204		297	2132			203			148	
v/s Ratio Prot		c0.55			0.14							
v/s Ratio Perm	0.03			0.22				c0.08			0.05	
v/c Ratio	0.04	0.73		0.29	0.19			0.52			0.31	
Uniform Delay, d1	2.7	6.0		3.4	3.1			35.0			33.8	
Progression Factor	0.77	0.55		1.00	1.00			1.00			1.00	
Incremental Delay, d2	0.1	3.7		2.5	0.2			2.0			1.1	
Delay (s)	2.2	6.9		5.9	3.3			37.0			34.9	
Level of Service	A	A		A	A			D			C	
Approach Delay (s)		6.8			3.8			37.0			34.9	
Approach LOS		A			A			D			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		11.4										B
HCM 2000 Volume to Capacity ratio		0.70										
Actuated Cycle Length (s)		90.0			Sum of lost time (s)			8.0				
Intersection Capacity Utilization		96.0%										F
Analysis Period (min)		15										
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis  
6: Back St & Cross St

Existing AM  
151850S

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔		↔	↔	↔	
Traffic Volume (veh/h)	74	3	4	28	3	2
Future Volume (Veh/h)	74	3	4	28	3	2
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.73	0.73	0.73	0.73	0.73	0.73
Hourly flow rate (vph)	101	4	5	38	4	3
Pedestrians				5	5	
Lane Width (m)				3.6	3.3	
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)						
pX, platoon unblocked						
vC, conflicting volume			110		156	113
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			110		156	113
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)			1487		834	938
<b>Direction, Lane #</b>						
	EB 1	WB 1	NB 1			
Volume Total	105	43	7			
Volume Left	0	5	4			
Volume Right	4	0	3			
cSH	1700	1487	876			
Volume to Capacity	0.06	0.00	0.01			
Queue Length 95th (m)	0.0	0.1	0.2			
Control Delay (s)	0.0	0.9	9.1			
Lane LOS		A	A			
Approach Delay (s)	0.0	0.9	9.1			
Approach LOS		A	A			
<b>Intersection Summary</b>						
Average Delay			0.7			
Intersection Capacity Utilization		16.9%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis  
7: Mill St & Back St

Existing AM  
151850S

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↕	↕	↔
Traffic Volume (veh/h)	15	4	7	218	75	38
Future Volume (Veh/h)	15	4	7	218	75	38
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	17	4	8	242	83	42
Pedestrians				11		
Lane Width (m)				3.6		
Walking Speed (m/s)				1.2		
Percent Blockage				1		
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)				197	61	
pX, platoon unblocked						
vC, conflicting volume	362	115	125			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	362	115	125			
tC, single (s)	6.4	6.5	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.5	2.2			
p0 queue free %	97	100	99			
cM capacity (veh/h)	638	871	1474			
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	21	250	125			
Volume Left	17	8	0			
Volume Right	4	0	42			
cSH	672	1474	1700			
Volume to Capacity	0.03	0.01	0.07			
Queue Length 95th (m)	0.8	0.1	0.0			
Control Delay (s)	10.5	0.3	0.0			
Lane LOS	B	A				
Approach Delay (s)	10.5	0.3	0.0			
Approach LOS	B					
<b>Intersection Summary</b>						
Average Delay			0.7			
Intersection Capacity Utilization		32.1%		ICU Level of Service	A	
Analysis Period (min)		15				

Timings  
1: Main St & Guelph St

Existing PM  
151850S

Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↕	↕	↔	↔	↕	↕	↔	↔
Traffic Volume (vph)	409	154	52	797	181	0	8	5
Future Volume (vph)	409	154	52	797	181	0	8	5
Turn Type	NA	Perm	pm+pt	NA	D.Pm	NA	D.Pm	NA
Protected Phases	2		1	6		4		8
Permitted Phases		2	6		8		4	
Detector Phase	2	2	1	6	8	4	4	8
Switch Phase								
Minimum Initial (s)	30.0	30.0	5.0	30.0	8.0	8.0	8.0	8.0
Minimum Split (s)	37.0	37.0	9.5	37.0	30.0	26.0	26.0	30.0
Total Split (s)	80.0	80.0	10.0	90.0	30.0	30.0	30.0	30.0
Total Split (%)	66.7%	66.7%	8.3%	75.0%	25.0%	25.0%	25.0%	25.0%
Yellow Time (s)	5.0	5.0	3.0	5.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.5	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-3.0	-3.0		-3.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lag	Lag	Lead					
Lead-Lag Optimize?								
Recall Mode	C-Max	C-Max	None	C-Max	None	None	None	None
Act Effct Green (s)	88.2	88.2		88.2	23.8	23.8		23.8
Actuated g/C Ratio	0.74	0.74		0.74	0.20	0.20		0.20
v/c Ratio	0.37	0.16		0.44	0.81	0.07		0.05
Control Delay	7.2	5.6		7.0	64.6	0.2		37.9
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0
Total Delay	7.2	5.6		7.0	64.6	0.2		37.9
LOS	A	A		A	E	A		D
Approach Delay	6.7			7.0		51.7		37.9
Approach LOS	A			A		D		D
<b>Intersection Summary</b>								
Cycle Length: 120								
Actuated Cycle Length: 120								
Offset: 30 (25%), Referenced to phase 2:EBT and 6:WBT, Start of Green								
Natural Cycle: 80								
Control Type: Actuated-Coordinated								
Maximum v/c Ratio: 0.81								
Intersection Signal Delay: 13.3						Intersection LOS: B		
Intersection Capacity Utilization 77.7%						ICU Level of Service D		
Analysis Period (min) 15								
<b>Splits and Phases: 1: Main St &amp; Guelph St</b>								

Queues  
1: Main St & Guelph St

Existing PM  
151850S

	→	↘	←	↙	↑	↓
Lane Group	EBT	EBR	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	440	166	915	195	49	14
v/c Ratio	0.37	0.16	0.44	0.81	0.07	0.05
Control Delay	7.2	5.6	7.0	64.6	0.2	37.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.2	5.6	7.0	64.6	0.2	37.9
Queue Length 50th (m)	37.7	11.7	55.8	38.0	0.0	2.8
Queue Length 95th (m)	54.3	19.3	73.6	#79.2	m0.0	8.7
Internal Link Dist (m)	62.4		112.6		110.9	29.0
Turn Bay Length (m)						
Base Capacity (vph)	1185	1035	2090	265	679	318
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	0.37	0.16	0.44	0.74	0.07	0.04

Intersection Summary

- # 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  
1: Main St & Guelph St

Existing PM  
151850S

	↘	→	↙	↘	←	↙	↘	↑	↘	↙	↓	↘
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↘		↘↗		↘	↗			↘	↗
Traffic Volume (vph)	0	409	154	52	797	2	181	0	46	8	5	0
Future Volume (vph)	0	409	154	52	797	2	181	0	46	8	5	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0		4.0
Lane Util. Factor	1.00	1.00		0.95	1.00		1.00	1.00		1.00		1.00
Frbp, ped/bikes	1.00	1.00		1.00	1.00		0.95	1.00		1.00		1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00		0.98
Frt	1.00	0.85		1.00	1.00		1.00	0.85		1.00		1.00
Flt Protected	1.00	1.00		1.00	0.95		1.00	1.00		0.97		0.97
Satd. Flow (prot)	1613	1409		3178	1555		1359	1359		1630		1630
Flt Permitted	1.00	1.00		0.89	0.75		1.00	1.00		0.88		0.88
Satd. Flow (perm)	1613	1409		2843	1225		1359	1473		1473		1473
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	0	440	166	56	857	2	195	0	49	9	5	0
RTOR Reduction (vph)	0	0	0	0	0	0	39	0	0	0	0	0
Lane Group Flow (vph)	0	440	166	0	915	0	195	10	0	0	14	0
Confl. Peds. (#/hr)	13					13			9		9	
Heavy Vehicles (%)	0%	6%	2%	0%	2%	0%	1%	0%	2%	0%	0%	0%
Turn Type	NA	Perm	pm+pt	NA	D.Pm	NA	D.Pm	NA	D.Pm	NA	D.Pm	NA
Protected Phases	2		1	6		4		8		4		8
Permitted Phases		2	6				8			4		
Actuated Green, G (s)	85.2	85.2		85.2	21.8	21.8		21.8		21.8		21.8
Effective Green, g (s)	88.2	88.2		88.2	23.8	23.8		23.8		23.8		23.8
Actuated g/C Ratio	0.74	0.74		0.74	0.20	0.20		0.20		0.20		0.20
Clearance Time (s)	7.0	7.0		7.0	6.0	6.0		6.0		6.0		6.0
Vehicle Extension (s)	5.0	5.0		5.0	3.0	3.0		3.0		3.0		3.0
Lane Grp Cap (vph)	1185	1035		2089	242	269		292		292		292
v/s Ratio Prot	0.27					0.01						
v/s Ratio Perm		0.12		c0.32	c0.16							0.01
v/c Ratio	0.37	0.16		0.44	0.81	0.04		0.05		0.05		0.05
Uniform Delay, d1	5.8	4.8		6.2	45.9	38.8		38.9		38.9		38.9
Progression Factor	1.00	1.00		0.96	0.89	1.00		1.00		1.00		1.00
Incremental Delay, d2	0.9	0.3		0.1	17.1	0.1		0.1		0.1		0.1
Delay (s)	6.7	5.1		6.1	57.9	38.9		39.0		39.0		39.0
Level of Service	A	A		A	E	D		D		D		D
Approach Delay (s)	6.3			6.1	54.1			39.0		39.0		39.0
Approach LOS	A			A	D			D		D		D

Intersection Summary

HCM 2000 Control Delay	13.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	77.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis  
2: Main St & Cross St

Existing PM  
151850S

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↔			↔			↔			↔		
Traffic Volume (veh/h)	0	0	0	37	0	4	0	210	40	4	145	0	
Future Volume (Veh/h)	0	0	0	37	0	4	0	210	40	4	145	0	
Sign Control	Stop			Stop			Free			Free			
Grade	0%			0%			0%			0%			
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	
Hourly flow rate (vph)	0	0	0	38	0	4	0	214	41	4	148	0	
Pedestrians	10			5									
Lane Width (m)	3.6			3.6									
Walking Speed (m/s)	1.2			1.2									
Percent Blockage	1			0									
Right turn flare (veh)													
Median type	None						None						
Median storage (veh)													
Upstream signal (m)	177						135						
pX, platoon unblocked													
vC, conflicting volume	404	426	158	396	406	240	158						260
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	404	426	158	396	406	240	158						260
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1						4.1
tC, 2 stage (s)													
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2						2.2
p0 queue free %	100	100	100	93	100	100	100						100
cM capacity (veh/h)	546	515	885	559	529	801	1422						1311
Direction, Lane #	EB 1	WB 1	NB 1	SB 1									
Volume Total	0	42	255	152									
Volume Left	0	38	0	4									
Volume Right	0	4	41	0									
cSH	1700	575	1422	1311									
Volume to Capacity	0.00	0.07	0.00	0.00									
Queue Length 95th (m)	0.0	1.9	0.0	0.1									
Control Delay (s)	0.0	11.7	0.0	0.2									
Lane LOS	A	B		A									
Approach Delay (s)	0.0	11.7	0.0	0.2									
Approach LOS	A	B											
<b>Intersection Summary</b>													
Average Delay				1.2									
Intersection Capacity Utilization				25.1%	ICU Level of Service							A	
Analysis Period (min)				15									

HCM Unsignalized Intersection Capacity Analysis  
3: Main St & James St

Existing PM  
151850S

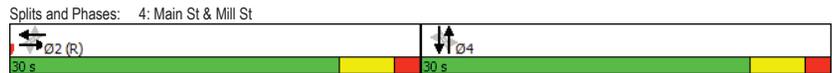
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↔			↔			↔			↔		
Traffic Volume (veh/h)	55	11	44	12	7	21	64	177	28	12	138	69	
Future Volume (Veh/h)	55	11	44	12	7	21	64	177	28	12	138	69	
Sign Control	Stop			Stop			Free			Free			
Grade	0%			0%			0%			0%			
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Hourly flow rate (vph)	58	12	46	13	7	22	67	186	29	13	145	73	
Pedestrians	11			10						3			
Lane Width (m)	3.6			3.6						3.6			
Walking Speed (m/s)	1.2			1.2						1.2			
Percent Blockage	1			1						0			
Right turn flare (veh)													
Median type	None						None						
Median storage (veh)													
Upstream signal (m)	152						160						
pX, platoon unblocked													
vC, conflicting volume	582	578	192	604	600	214	229						225
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	582	578	192	604	600	214	229						225
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 %	85	97	95	96	98	97	95						99
cM capacity (veh/h)	382	397	846	357	386	810	1339						1344
Direction, Lane #	EB 1	WB 1	NB 1	SB 1									
Volume Total	116	42	282	231									
Volume Left	58	13	67	13									
Volume Right	46	22	29	73									
cSH	491	514	1339	1344									
Volume to Capacity	0.24	0.08	0.05	0.01									
Queue Length 95th (m)	7.3	2.1	1.3	0.2									
Control Delay (s)	14.6	12.6	2.2	0.5									
Lane LOS	B	B	A	A									
Approach Delay (s)	14.6	12.6	2.2	0.5									
Approach LOS	B	B											
<b>Intersection Summary</b>													
Average Delay				4.4									
Intersection Capacity Utilization				51.9%	ICU Level of Service							A	
Analysis Period (min)				15									

Timings  
4: Main St & Mill St

Existing PM  
151850S

	↖	→	↗	←	↖	↑	↗	↓
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↕		↕		↕		↕
Traffic Volume (vph)	29	58	59	51	26	243	22	185
Future Volume (vph)	29	58	59	51	26	243	22	185
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		2		2		4		4
Permitted Phases	2		2		4		4	
Detector Phase	2	2	2	2	4	4	4	4
Switch Phase								
Minimum Initial (s)	24.0	24.0	24.0	24.0	10.0	10.0	10.0	10.0
Minimum Split (s)	30.0	30.0	30.0	30.0	24.0	24.0	24.0	24.0
Total Split (s)	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		-2.0		-2.0		-2.0		-2.0
Total Lost Time (s)		4.0		4.0		4.0		4.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	Max							
Act Effct Green (s)		26.0		26.0		26.0		26.0
Actuated g/C Ratio		0.43		0.43		0.43		0.43
v/c Ratio		0.22		0.24		0.53		0.37
Control Delay		8.1		8.2		15.0		12.2
Queue Delay		0.0		0.0		0.0		0.0
Total Delay		8.1		8.2		15.0		12.2
LOS		A		A		B		B
Approach Delay		8.1		8.2		15.0		12.2
Approach LOS		A		A		B		B

Intersection Summary	
Cycle Length:	60
Actuated Cycle Length:	60
Offset:	0 (0%), Referenced to phase 2:EBWB, Start of Green
Natural Cycle:	55
Control Type:	Pretimed
Maximum v/c Ratio:	0.53
Intersection Signal Delay:	12.0
Intersection Capacity Utilization:	54.1%
ICU Level of Service:	A
Intersection LOS:	B
Analysis Period (min):	15



Queues  
4: Main St & Mill St

Existing PM  
151850S

	→	←	↑	↓
Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	143	142	364	253
v/c Ratio	0.22	0.24	0.53	0.37
Control Delay	8.1	8.2	15.0	12.2
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	8.1	8.2	15.0	12.2
Queue Length 50th (m)	6.1	7.0	26.7	18.8
Queue Length 95th (m)	15.7	14.1	49.2	29.8
Internal Link Dist (m)	50.0	122.5	34.0	128.1
Turn Bay Length (m)				
Base Capacity (vph)	658	595	682	679
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	0.22	0.24	0.53	0.37

Intersection Summary

Intersection Summary	
Cycle Length:	60
Actuated Cycle Length:	60
Offset:	0 (0%), Referenced to phase 2:EBWB, Start of Green
Natural Cycle:	55
Control Type:	Pretimed
Maximum v/c Ratio:	0.53
Intersection Signal Delay:	12.0
Intersection Capacity Utilization:	54.1%
ICU Level of Service:	A
Intersection LOS:	B
Analysis Period (min):	15

HCM Signalized Intersection Capacity Analysis  
4: Main St & Mill St

Existing PM  
151850S

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (vph)	29	58	48	59	51	25	26	243	77	22	185	33
Future Volume (vph)	29	58	48	59	51	25	26	243	77	22	185	33
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5
Total Lost time (s)	4.0			4.0			4.0			4.0		
Lane Util. Factor	1.00			1.00			1.00			1.00		
Frbp, ped/bikes	0.97			0.99			0.97			0.98		
Flpb, ped/bikes	0.99			0.98			1.00			0.99		
Frt	0.95			0.98			0.97			0.98		
Flt Protected	0.99			0.98			1.00			1.00		
Satd. Flow (prot)	1549			1563			1585			1616		
Flt Permitted	0.93			0.84			0.97			0.95		
Satd. Flow (perm)	1452			1342			1537			1544		
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	31	61	51	62	54	26	27	256	81	23	195	35
RTOR Reduction (vph)	0	29	0	0	14	0	0	17	0	0	10	0
Lane Group Flow (vph)	0	114	0	0	128	0	0	347	0	0	243	0
Confl. Peds. (#/hr)	28		42	42		28	58		70	70		58
Heavy Vehicles (%)	0%	0%	2%	0%	0%	8%	0%	1%	0%	5%	1%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	2		2		2		4		4		4	
Permitted Phases	2		2		4		4		4		4	
Actuated Green, G (s)	24.0		24.0		24.0		24.0		24.0		24.0	
Effective Green, g (s)	26.0		26.0		26.0		26.0		26.0		26.0	
Actuated g/C Ratio	0.43		0.43		0.43		0.43		0.43		0.43	
Clearance Time (s)	6.0		6.0		6.0		6.0		6.0		6.0	
Lane Grp Cap (vph)	629		581		666		669		669		669	
v/s Ratio Prot	0.08		c0.10		c0.23		0.16		0.16		0.16	
v/c Ratio	0.18		0.22		0.52		0.36		0.36		0.36	
Uniform Delay, d1	10.5		10.7		12.4		11.4		11.4		11.4	
Progression Factor	1.00		0.81		1.00		0.98		0.98		0.98	
Incremental Delay, d2	0.6		0.9		2.9		1.5		1.5		1.5	
Delay (s)	11.1		9.4		15.3		12.7		12.7		12.7	
Level of Service	B		A		B		B		B		B	
Approach Delay (s)	11.1		9.4		15.3		12.7		12.7		12.7	
Approach LOS	B		A		B		B		B		B	

Intersection Summary			
HCM 2000 Control Delay	13.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	54.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

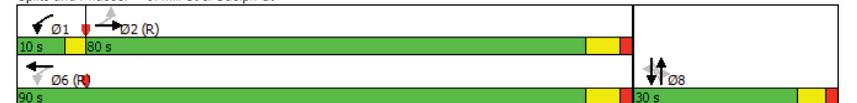
Timings  
5: Mill St & Guelph St

Existing PM  
151850S

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	11	510	143	925	24	22	10	19
Future Volume (vph)	11	510	143	925	24	22	10	19
Turn Type	Perm	NA	pm+pt	NA	Perm	NA	Perm	NA
Protected Phases	2		1		6		8	
Permitted Phases	2		6		8		8	
Detector Phase	2		2		1		6	
Switch Phase	2		1		6		8	
Minimum Initial (s)	30.0	30.0	6.0	30.0	8.0	8.0	8.0	8.0
Minimum Split (s)	37.0	37.0	9.0	37.0	24.0	24.0	24.0	24.0
Total Split (s)	80.0	80.0	10.0	90.0	30.0	30.0	30.0	30.0
Total Split (%)	66.7%	66.7%	8.3%	75.0%	25.0%	25.0%	25.0%	25.0%
Yellow Time (s)	5.0	5.0	3.0	5.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	0.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-3.0	-3.0	1.0	-3.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lag	Lag	Lead					
Lead-Lag Optimize?	Yes	Yes	Yes					
Recall Mode	C-Max	C-Max	None	C-Max	None	None	None	None
Act Effct Green (s)	85.6	85.6	95.4	95.4	16.6	16.6	16.6	16.6
Actuated g/C Ratio	0.71	0.71	0.80	0.80	0.14	0.14	0.14	0.14
v/c Ratio	0.03	0.48	0.28	0.39	0.75	0.35	0.35	0.35
Control Delay	7.7	9.9	4.9	4.8	34.7	26.6	26.6	26.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.7	9.9	4.9	4.8	34.7	26.6	26.6	26.6
LOS	A	A	A	A	C	C	C	C
Approach Delay	9.9		4.8		34.7		26.6	
Approach LOS	A		A		C		C	

Intersection Summary	
Cycle Length:	120
Actuated Cycle Length:	120
Offset:	0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle:	70
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.75
Intersection Signal Delay:	10.7
Intersection Capacity Utilization	84.2%
ICU Level of Service	E
Intersection LOS:	B
Analysis Period (min)	15

Splits and Phases: 5: Mill St & Guelph St



Queues  
5: Mill St & Guelph St

Existing PM  
151850S

Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	11	547	147	973	250	69
v/c Ratio	0.03	0.48	0.28	0.39	0.75	0.35
Control Delay	7.7	9.9	4.9	4.8	34.7	26.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.7	9.9	4.9	4.8	34.7	26.6
Queue Length 50th (m)	0.7	50.1	6.4	29.2	21.6	6.7
Queue Length 95th (m)	m2.7	82.0	16.9	57.8	53.1	19.4
Internal Link Dist (m)		140.5		110.5	36.7	32.1
Turn Bay Length (m)	35.0		50.0			
Base Capacity (vph)	345	1134	536	2473	430	290
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	0.03	0.48	0.27	0.39	0.58	0.24
<b>Intersection Summary</b>						
m Volume for 95th percentile queue is metered by upstream signal.						

HCM Signalized Intersection Capacity Analysis  
5: Mill St & Guelph St

Existing PM  
151850S

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	11	510	20	143	925	18	24	22	196	10	19	38
Future Volume (vph)	11	510	20	143	925	18	24	22	196	10	19	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	1.00		1.00	0.95			1.00			1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00			0.97			0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			1.00	
Flt	1.00	0.99		1.00	1.00			0.89			0.92	
Flt Protected	0.95	1.00		0.95	1.00			1.00			0.99	
Satd. Flow (prot)	1565	1590		1535	3112			1445			1528	
Flt Permitted	0.29	1.00		0.38	1.00			0.97			0.78	
Satd. Flow (perm)	485	1590		613	3112			1406			1197	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	11	526	21	147	954	19	25	23	202	10	20	39
RTOR Reduction (vph)	0	1	0	0	1	0	0	139	0	0	34	0
Lane Group Flow (vph)	11	546	0	147	972	0	0	111	0	0	35	0
Confl. Peds. (#/hr)	4		9	9		4	3		7	7		3
Heavy Vehicles (%)	0%	7%	0%	2%	4%	6%	4%	0%	1%	10%	0%	0%
Turn Type	Perm	NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases		2		1	6			8			8	
Permitted Phases	2			6			8			8		
Actuated Green, G (s)	82.6	82.6		92.4	92.4			14.6			14.6	
Effective Green, g (s)	85.6	85.6		91.4	95.4			16.6			16.6	
Actuated g/C Ratio	0.71	0.71		0.76	0.80			0.14			0.14	
Clearance Time (s)	7.0	7.0		3.0	7.0			6.0			6.0	
Vehicle Extension (s)	4.5	4.5		2.0	4.5			2.8			2.8	
Lane Grp Cap (vph)	345	1134		511	2474			194			165	
v/s Ratio Prot		c0.34		0.01	c0.31							
v/s Ratio Perm	0.02			0.21				c0.08			0.03	
v/c Ratio	0.03	0.48		0.29	0.39			0.57			0.21	
Uniform Delay, d1	5.0	7.5		4.9	3.7			48.4			45.9	
Progression Factor	1.04	0.96		1.00	1.00			1.18			1.00	
Incremental Delay, d2	0.2	1.4		0.1	0.5			3.7			0.6	
Delay (s)	5.4	8.6		5.1	4.1			60.8			46.5	
Level of Service	A	A		A	A			E			D	
Approach Delay (s)		8.5			4.3			60.8			46.5	
Approach LOS		A			A			E			D	
<b>Intersection Summary</b>												
HCM 2000 Control Delay				14.0	HCM 2000 Level of Service			B				
HCM 2000 Volume to Capacity ratio				0.50								
Actuated Cycle Length (s)				120.0	Sum of lost time (s)			12.0				
Intersection Capacity Utilization				84.2%	ICU Level of Service			E				
Analysis Period (min)				15								
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis  
6: Back St & Cross St

Existing PM  
151850S

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔			↔	↔	
Traffic Volume (veh/h)	46	3	3	38	5	9
Future Volume (Veh/h)	46	3	3	38	5	9
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	51	3	3	42	6	10
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			54		100	52
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			54		100	52
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		99	99
cM capacity (veh/h)			1564		901	1021
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>			
Volume Total	54	45	16			
Volume Left	0	3	6			
Volume Right	3	0	10			
cSH	1700	1564	972			
Volume to Capacity	0.03	0.00	0.02			
Queue Length 95th (m)	0.0	0.0	0.4			
Control Delay (s)	0.0	0.5	8.8			
Lane LOS		A	A			
Approach Delay (s)	0.0	0.5	8.8			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay			1.4			
Intersection Capacity Utilization		15.0%		ICU Level of Service	A	
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis  
7: Mill St & Back St

Existing PM  
151850S

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔			↔	↔	
Traffic Volume (veh/h)	43	22	9	199	145	37
Future Volume (Veh/h)	43	22	9	199	145	37
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	48	25	10	224	163	42
Pedestrians				1	1	
Lane Width (m)				3.6	3.6	
Walking Speed (m/s)				1.2	1.2	
Percent Blockage				0	0	
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)				197	61	
pX, platoon unblocked	0.99	0.99	0.99			
vC, conflicting volume	429	185	205			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	414	166	186			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	92	97	99			
cM capacity (veh/h)	586	870	1380			
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	73	234	205			
Volume Left	48	10	0			
Volume Right	25	0	42			
cSH	659	1380	1700			
Volume to Capacity	0.11	0.01	0.12			
Queue Length 95th (m)	3.0	0.2	0.0			
Control Delay (s)	11.1	0.4	0.0			
Lane LOS	B	A				
Approach Delay (s)	11.1	0.4	0.0			
Approach LOS	B					
<b>Intersection Summary</b>						
Average Delay			1.8			
Intersection Capacity Utilization		30.9%		ICU Level of Service	A	
Analysis Period (min)		15				



# Appendix C

## Background Traffic Operational Conditions





Timings  
1: Main St & Guelph St

Background AM  
151850S

	→	↘	↙	←	↖	↗	↓
Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	SBT
Lane Configurations	↑	↘		↖	↖	↗	↗
Traffic Volume (vph)	780	220	16	328	107	0	5
Future Volume (vph)	780	220	16	328	107	0	5
Turn Type	NA	Perm	Perm	NA	D.Pm	NA	NA
Protected Phases	2			6		4	8
Permitted Phases		2	6		8		
Detector Phase	2	2	6	6	8	4	8
Switch Phase							
Minimum Initial (s)	30.0	30.0	30.0	30.0	8.0	8.0	8.0
Minimum Split (s)	37.0	37.0	37.0	37.0	22.0	23.0	22.0
Total Split (s)	86.0	86.0	86.0	86.0	24.0	24.0	24.0
Total Split (%)	78.2%	78.2%	78.2%	78.2%	21.8%	21.8%	21.8%
Yellow Time (s)	5.0	5.0	5.0	5.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-3.0	-3.0		-3.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0		4.0	4.0	4.0	4.0
Lead/Lag							
Lead-Lag Optimize?							
Recall Mode	C-Max	C-Max	C-Max	C-Max	None	None	None
Act Effct Green (s)	85.1	85.1		85.1	16.9	16.9	16.9
Actuated g/C Ratio	0.77	0.77		0.77	0.15	0.15	0.15
v/c Ratio	0.65	0.23		0.18	0.67	0.13	0.02
Control Delay	9.3	4.4		3.3	62.6	0.6	37.4
Queue Delay	0.1	0.0		0.0	0.0	0.0	0.0
Total Delay	9.4	4.4		3.3	62.6	0.6	37.4
LOS	A	A		A	E	A	D
Approach Delay	8.3			3.3		42.0	37.4
Approach LOS	A			A		D	D

Intersection Summary

Cycle Length: 110  
 Actuated Cycle Length: 110  
 Offset: 108 (98%), Referenced to phase 2:EBT and 6:WBTL, Start of Green  
 Natural Cycle: 60  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.67  
 Intersection Signal Delay: 10.9      Intersection LOS: B  
 Intersection Capacity Utilization 66.7%      ICU Level of Service C  
 Analysis Period (min) 15

Splits and Phases: 1: Main St & Guelph St



Queues  
1: Main St & Guelph St

Background AM  
151850S

	→	↘	↙	←	↖	↗	↓
Lane Group	EBT	EBR	WBL	NBL	NBT	SBT	
Lane Group Flow (vph)	821	232	362	113	56	5	
v/c Ratio	0.65	0.23	0.18	0.67	0.13	0.02	
Control Delay	9.3	4.4	3.3	62.6	0.6	37.4	
Queue Delay	0.1	0.0	0.0	0.0	0.0	0.0	
Total Delay	9.4	4.4	3.3	62.6	0.6	37.4	
Queue Length 50th (m)	75.3	12.8	8.8	23.9	0.0	1.0	
Queue Length 95th (m)	121.0	22.3	m11.8	43.4	0.0	4.4	
Internal Link Dist (m)	62.4		112.6		110.9	29.0	
Turn Bay Length (m)							
Base Capacity (vph)	1260	1021	2050	200	454	310	
Starvation Cap Reductn	0	0	0	0	0	0	
Spillback Cap Reductn	50	0	0	0	7	0	
Storage Cap Reductn	0	0	0	0	0	0	
Reduced v/c Ratio	0.68	0.23	0.18	0.56	0.13	0.02	

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis  
1: Main St & Guelph St

Background AM  
151850S

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↑		↔		↑	↑			↔	
Traffic Volume (vph)	0	780	220	16	328	0	107	0	53	0	5	0
Future Volume (vph)	0	780	220	16	328	0	107	0	53	0	5	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0		
Lane Util. Factor	1.00	1.00		0.95	1.00		1.00	1.00		1.00		
Frbp, ped/bikes	1.00	0.96		1.00	1.00		0.97	1.00		1.00		
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00		
Frt	1.00	0.85		1.00	1.00		0.85	1.00		1.00		
Flt Protected	1.00	1.00		1.00	0.95		1.00	1.00		1.00		
Satd. Flow (prot)	1629	1320		2916	1390		1377	1710		1710		
Flt Permitted	1.00	1.00		0.91	0.75		1.00	1.00		1.00		
Satd. Flow (perm)	1629	1320		2651	1104		1377	1710		1710		
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	821	232	17	345	0	113	0	56	0	5	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	47	0	0	0	0
Lane Group Flow (vph)	0	821	232	0	362	0	113	9	0	0	5	0
Confl. Peds. (#/hr)	6	11	11		6		4	4		4		
Heavy Vehicles (%)	0%	5%	4%	14%	11%	0%	13%	0%	2%	0%	0%	0%
Turn Type	NA	Perm	Perm	NA	D.Pm	NA	NA	NA		NA		
Protected Phases	2			6			4			8		
Permitted Phases		2	6		8			4				
Actuated Green, G (s)	82.1	82.1		82.1	14.9	14.9		14.9		14.9		
Effective Green, g (s)	85.1	85.1		85.1	16.9	16.9		16.9		16.9		
Actuated g/C Ratio	0.77	0.77		0.77	0.15	0.15		0.15		0.15		
Clearance Time (s)	7.0	7.0		7.0	6.0	6.0		6.0		6.0		
Vehicle Extension (s)	5.0	5.0		5.0	3.0	3.0		3.0		3.0		
Lane Grp Cap (vph)	1260	1021		2050	169	211		262		262		
v/s Ratio Prot	c0.50						0.01			0.00		
v/s Ratio Perm		0.18		0.14	c0.10							
v/c Ratio	0.65	0.23		0.18	0.67	0.04		0.02		0.02		
Uniform Delay, d1	5.7	3.4		3.3	43.9	39.6		39.5		39.5		
Progression Factor	1.00	1.00		0.88	1.00	1.00		1.00		1.00		
Incremental Delay, d2	2.6	0.5		0.2	9.6	0.1		0.0		0.0		
Delay (s)	8.3	3.9		3.0	53.5	39.7		39.5		39.5		
Level of Service	A	A		A	D	D		D		D		
Approach Delay (s)	7.3			3.0	48.9			39.5		39.5		
Approach LOS	A			A	D			D		D		
<b>Intersection Summary</b>												
HCM 2000 Control Delay		10.9			HCM 2000 Level of Service			B				
HCM 2000 Volume to Capacity ratio		0.65										
Actuated Cycle Length (s)		110.0			Sum of lost time (s)			8.0				
Intersection Capacity Utilization		66.7%			ICU Level of Service			C				
Analysis Period (min)		15										
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis  
2: Main St & Cross St

Background AM  
151850S

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (veh/h)	2	2	2	35	0	1	2	146	87	5	232	2
Future Volume (Veh/h)	2	2	2	35	0	1	2	146	87	5	232	2
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	2	2	2	40	0	1	2	166	99	6	264	2
Pedestrians	4			2								
Lane Width (m)	3.6			3.6								
Walking Speed (m/s)	1.2			1.2								
Percent Blockage	0			0								
Right turn flare (veh)	1710											
Median type	None						None					
Median storage (veh)							177					
Upstream signal (m)							135					
pX, platoon unblocked												
vC, conflicting volume	502	552	269	502	504	218	270			267		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	502	552	269	502	504	218	270			267		
tC, single (s)	7.1	7.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.9	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	99	100	92	100	100	100			100		
cM capacity (veh/h)	477	327	772	475	468	826	1301			1306		
<b>Direction, Lane #</b>												
Volume Total	6	41	267	272								
Volume Left	2	40	2	6								
Volume Right	2	1	99	2								
cSH	465	480	1301	1306								
Volume to Capacity	0.01	0.09	0.00	0.00								
Queue Length 95th (m)	0.3	2.2	0.0	0.1								
Control Delay (s)	12.8	13.2	0.1	0.2								
Lane LOS	B	B	A	A								
Approach Delay (s)	12.8	13.2	0.1	0.2								
Approach LOS	B	B										
<b>Intersection Summary</b>												
Average Delay				1.2								
Intersection Capacity Utilization	29.4%			ICU Level of Service			A					
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis  
3: Main St & James St

Background AM  
151850S

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (veh/h)	80	7	52	6	6	4	28	115	23	25	213	59
Future Volume (Veh/h)	80	7	52	6	6	4	28	115	23	25	213	59
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	84	7	55	6	6	4	29	121	24	26	224	62
Pedestrians		7			14			2			2	
Lane Width (m)		3.6			3.6			3.6			3.6	
Walking Speed (m/s)		1.2			1.2			1.2			1.2	
Percent Blockage		1			1			0			0	
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (m)								152			160	
pX, platoon unblocked												
vC, conflicting volume	512	531	264	572	550	147	293			159		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	512	531	264	572	550	147	293			159		
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 %	81	98	93	98	99	100	98			98		
cM capacity (veh/h)	441	431	774	375	420	895	1273			1416		
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>								
Volume Total	146	16	174	312								
Volume Left	84	6	29	26								
Volume Right	55	4	24	62								
cSH	525	461	1273	1416								
Volume to Capacity	0.28	0.03	0.02	0.02								
Queue Length 95th (m)	9.0	0.9	0.6	0.4								
Control Delay (s)	14.5	13.1	1.5	0.8								
Lane LOS	B	B	A	A								
Approach Delay (s)	14.5	13.1	1.5	0.8								
Approach LOS	B	B										
<b>Intersection Summary</b>												
Average Delay				4.4								
Intersection Capacity Utilization			41.6%		ICU Level of Service	A						
Analysis Period (min)				15								

Timings  
4: Main St & Mill St

Background AM  
151850S

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↔		↔		↔		↔
Traffic Volume (vph)	14	63	40	28	6	173	27	250
Future Volume (vph)	14	63	40	28	6	173	27	250
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		4		2		2
Permitted Phases	4		4		2		2	
Detector Phase	4	4	4	4	2	2	2	2
Switch Phase								
Minimum Initial (s)	10.0	10.0	10.0	10.0	24.0	24.0	24.0	24.0
Minimum Split (s)	24.0	24.0	24.0	24.0	30.0	30.0	30.0	30.0
Total Split (s)	25.0	25.0	25.0	25.0	35.0	35.0	35.0	35.0
Total Split (%)	41.7%	41.7%	41.7%	41.7%	58.3%	58.3%	58.3%	58.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		-2.0		-2.0		-2.0		-2.0
Total Lost Time (s)		4.0		4.0		4.0		4.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)		21.0		21.0		31.0		31.0
Actuated g/C Ratio		0.35		0.35		0.52		0.52
v/c Ratio		0.19		0.20		0.40		0.39
Control Delay		13.3		12.3		8.4		10.5
Queue Delay		0.0		0.0		0.0		0.0
Total Delay		13.3		12.3		8.4		10.5
LOS		B		B		A		B
Approach Delay		13.3		12.3		8.4		10.5
Approach LOS		B		B		A		B
<b>Intersection Summary</b>								
Cycle Length: 60								
Actuated Cycle Length: 60								
Offset: 0 (0%), Referenced to phase 2:NBSB and 6.: Start of Green								
Natural Cycle: 55								
Control Type: Pretimed								
Maximum v/c Ratio: 0.40								
Intersection Signal Delay: 10.2					Intersection LOS: B			
Intersection Capacity Utilization 52.9%					ICU Level of Service A			
Analysis Period (min) 15								
Splits and Phases: 4: Main St & Mill St								

Queues  
4: Main St & Mill St

Background AM  
151850S

	→	←	↑	↓
Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	99	97	321	317
v/c Ratio	0.19	0.20	0.40	0.39
Control Delay	13.3	12.3	8.4	10.5
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	13.3	12.3	8.4	10.5
Queue Length 50th (m)	6.7	5.8	15.0	20.0
Queue Length 95th (m)	16.0	15.0	30.5	36.2
Internal Link Dist (m)	50.0	122.5	34.0	128.1
Turn Bay Length (m)				
Base Capacity (vph)	525	495	805	810
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	0.19	0.20	0.40	0.39

Intersection Summary

HCM Signalized Intersection Capacity Analysis  
4: Main St & Mill St

Background AM  
151850S

	↗	→	↘	↙	←	↖	↑	↗	↘	↓	↙	
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (vph)	14	63	12	40	28	20	6	173	110	27	250	8
Future Volume (vph)	14	63	12	40	28	20	6	173	110	27	250	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frbp, ped/bikes		0.99			0.99			0.99			1.00	
Flpb, ped/bikes		1.00			0.99			1.00			1.00	
Frt		0.98			0.97			0.95			1.00	
Flt Protected		0.99			0.98			1.00			1.00	
Satd. Flow (prot)		1534			1572			1495			1635	
Flt Permitted		0.96			0.86			0.99			0.95	
Satd. Flow (perm)		1477			1376			1485			1565	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	16	70	13	44	31	22	7	192	122	30	278	9
RTOR Reduction (vph)	0	8	0	0	14	0	0	37	0	0	2	0
Lane Group Flow (vph)	0	91	0	0	83	0	0	284	0	0	315	0
Confl. Peds. (#/hr)	10		14	14		10	9		13	13		9
Heavy Vehicles (%)	0%	11%	0%	0%	0%	6%	0%	9%	4%	9%	3%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Actuated Green, G (s)		19.0			19.0			29.0			29.0	
Effective Green, g (s)		21.0			21.0			31.0			31.0	
Actuated g/C Ratio		0.35			0.35			0.52			0.52	
Clearance Time (s)		6.0			6.0			6.0			6.0	
Lane Grp Cap (vph)		516			481			767			808	
v/s Ratio Prot												
v/s Ratio Perm		c0.06			0.06			0.19			c0.20	
v/c Ratio		0.18			0.17			0.37			0.39	
Uniform Delay, d1		13.5			13.5			8.7			8.8	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.7			0.8			1.4			1.4	
Delay (s)		14.2			14.3			10.0			10.2	
Level of Service		B			B			B			B	
Approach Delay (s)		14.2			14.3			10.0			10.2	
Approach LOS		B			B			B			B	

Intersection Summary

HCM 2000 Control Delay	11.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	52.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Timings  
5: Mill St & Guelph St

Background AM  
151850S

	↖	→	↙	←	↘	↑	↗	↓
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖	↖	↖	↖↗		↖↗		↖↗
Traffic Volume (vph)	25	920	91	424	13	16	18	28
Future Volume (vph)	25	920	91	424	13	16	18	28
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		2		6		8		4
Permitted Phases	2		6		8		4	
Detector Phase	2	2	6	6	8	8	4	4
Switch Phase								
Minimum Initial (s)	30.0	30.0	5.0	5.0	8.0	8.0	5.0	5.0
Minimum Split (s)	37.0	37.0	25.0	25.0	23.0	23.0	24.0	24.0
Total Split (s)	84.0	84.0	84.0	84.0	26.0	26.0	26.0	26.0
Total Split (%)	76.4%	76.4%	76.4%	76.4%	23.6%	23.6%	23.6%	23.6%
Yellow Time (s)	5.0	5.0	5.0	5.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-3.0	-3.0	-3.0	-3.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	C-Max	C-Max	C-Max	C-Max	None	None	None	None
Act Effct Green (s)	83.0	83.0	83.0	83.0				19.0
Actuated g/C Ratio	0.75	0.75	0.75	0.75		0.17		0.17
v/c Ratio	0.05	0.86	0.48	0.23		0.87		0.40
Control Delay	4.2	14.8	15.2	4.6		46.9		39.2
Queue Delay	0.0	0.0	0.0	0.0		0.0		0.0
Total Delay	4.2	14.8	15.2	4.6		46.9		39.2
LOS	A	B	B	A		D		D
Approach Delay		14.5		6.5		46.9		39.2
Approach LOS		B		A		D		D

Intersection Summary

Cycle Length: 110  
 Actuated Cycle Length: 110  
 Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green  
 Natural Cycle: 90  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.87  
 Intersection Signal Delay: 17.9      Intersection LOS: B  
 Intersection Capacity Utilization 90.4%      ICU Level of Service E  
 Analysis Period (min) 15

Splits and Phases: 5: Mill St & Guelph St



Queues  
5: Mill St & Guelph St

Background AM  
151850S

	↖	→	↙	←	↘	↑	↓
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	28	1036	101	479	303	303	67
v/c Ratio	0.05	0.86	0.48	0.23	0.87	0.87	0.40
Control Delay	4.2	14.8	15.2	4.6	46.9	39.2	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	4.2	14.8	15.2	4.6	46.9	39.2	
Queue Length 50th (m)	1.4	59.7	8.4	16.0	34.2	10.5	
Queue Length 95th (m)	m2.5	#295.3	25.1	22.0	#79.6	24.6	
Internal Link Dist (m)		140.5		110.5	36.7	32.1	
Turn Bay Length (m)	35.0		50.0				
Base Capacity (vph)	561	1202	212	2126	380	193	
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.05	0.86	0.48	0.23	0.80	0.35	

Intersection Summary

# 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  
5: Mill St & Guelph St

Background AM  
151805S

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔			↔			↔	
Traffic Volume (vph)	25	920	13	91	424	7	13	16	244	18	28	14
Future Volume (vph)	25	920	13	91	424	7	13	16	244	18	28	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	1.00		1.00	0.95			1.00			1.00	
Frbp, ped/bikes	1.00	1.00		1.00	1.00			0.95			0.99	
Flpb, ped/bikes	0.99	1.00		1.00	1.00			1.00			1.00	
Frt	1.00	1.00		1.00	1.00			0.88			0.97	
Flt Protected	0.95	1.00		0.95	1.00			1.00			0.99	
Satd. Flow (prot)	1486	1591		1510	2818			1328			1532	
Flt Permitted	0.48	1.00		0.18	1.00			0.99			0.59	
Satd. Flow (perm)	745	1591		281	2818			1312			916	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	28	1022	14	101	471	8	14	18	271	20	31	16
RTOR Reduction (vph)	0	0	0	0	1	0	0	122	0	0	11	0
Lane Group Flow (vph)	28	1036	0	101	478	0	0	181	0	0	56	0
Confl. Peds. (#/hr)	4		40	40		4	8		12	12		8
Heavy Vehicles (%)	5%	7%	9%	4%	15%	11%	9%	36%	5%	7%	8%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	80.0	80.0		80.0	80.0			17.0			17.0	
Effective Green, g (s)	83.0	83.0		83.0	83.0			19.0			19.0	
Actuated g/C Ratio	0.75	0.75		0.75	0.75			0.17			0.17	
Clearance Time (s)	7.0	7.0		7.0	7.0			6.0			6.0	
Vehicle Extension (s)	4.5	4.5		3.0	3.0			2.8			3.0	
Lane Grp Cap (vph)	562	1200		212	2126			226			158	
v/s Ratio Prot		c0.65			0.17							
v/s Ratio Perm	0.04			0.36				c0.14			0.06	
v/c Ratio	0.05	0.86		0.48	0.22			0.80			0.36	
Uniform Delay, d1	3.4	9.5		5.2	4.0			43.7			40.1	
Progression Factor	0.94	0.58		1.00	1.00			1.00			1.00	
Incremental Delay, d2	0.1	7.4		7.5	0.2			17.4			1.4	
Delay (s)	3.4	12.9		12.7	4.2			61.1			41.5	
Level of Service	A	B		B	A			E			D	
Approach Delay (s)		12.6			5.7			61.1			41.5	
Approach LOS		B			A			E			D	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		18.9										B
HCM 2000 Volume to Capacity ratio		0.85										
Actuated Cycle Length (s)		110.0			Sum of lost time (s)			8.0				
Intersection Capacity Utilization		90.4%										E
Analysis Period (min)		15										
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis  
6: Back St & Cross St

Background AM  
151805S

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔		↔	↔	↔	
Traffic Volume (veh/h)	87	4	5	33	4	2
Future Volume (Veh/h)	87	4	5	33	4	2
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.73	0.73	0.73	0.73	0.73	0.73
Hourly flow rate (vph)	119	5	7	45	5	3
Pedestrians				5	5	
Lane Width (m)				3.6	3.3	
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)						
pX, platoon unblocked						
vC, conflicting volume			129		186	132
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			129		186	132
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		99	100
cM capacity (veh/h)			1464		801	916
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>			
Volume Total	124	52	8			
Volume Left	0	7	5			
Volume Right	5	0	3			
cSH	1700	1464	841			
Volume to Capacity	0.07	0.00	0.01			
Queue Length 95th (m)	0.0	0.1	0.2			
Control Delay (s)	0.0	1.0	9.3			
Lane LOS	A	A	A			
Approach Delay (s)	0.0	1.0	9.3			
Approach LOS		A				
<b>Intersection Summary</b>						
Average Delay			0.7			
Intersection Capacity Utilization		18.2%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis  
7: Mill St & Back St

Background AM  
151850S

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↘	↙	↕	↕	↙
Traffic Volume (veh/h)	18	5	8	255	87	45
Future Volume (Veh/h)	18	5	8	255	87	45
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	20	6	9	283	97	50
Pedestrians				11		
Lane Width (m)				3.6		
Walking Speed (m/s)				1.2		
Percent Blockage				1		
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)				197	61	
pX, platoon unblocked	1.00	1.00	1.00			
vC, conflicting volume	423	133	147			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	422	131	145			
tC, single (s)	6.4	6.5	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.5	2.2			
p0 queue free %	97	99	99			
cM capacity (veh/h)	588	851	1447			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	26	292	147			
Volume Left	20	9	0			
Volume Right	6	0	50			
cSH	633	1447	1700			
Volume to Capacity	0.04	0.01	0.09			
Queue Length 95th (m)	1.0	0.2	0.0			
Control Delay (s)	10.9	0.3	0.0			
Lane LOS	B	A				
Approach Delay (s)	10.9	0.3	0.0			
Approach LOS	B					
<b>Intersection Summary</b>						
Average Delay			0.8			
Intersection Capacity Utilization		35.2%		ICU Level of Service	A	
Analysis Period (min)		15				

Timings  
1: Main St & Guelph St

Background PM  
151850S

Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↔	↘	↙	↕	↕	↕	↙	↘
Traffic Volume (vph)	479	180	61	934	212	0	9	6
Future Volume (vph)	479	180	61	934	212	0	9	6
Turn Type	NA	Perm	Perm	NA	D.Pm	NA	D.Pm	NA
Protected Phases	2			6		4		8
Permitted Phases		2	6		8		4	
Detector Phase	2	2	6	6	8	4	4	8
Switch Phase								
Minimum Initial (s)	30.0	30.0	30.0	30.0	8.0	8.0	8.0	8.0
Minimum Split (s)	37.0	37.0	37.0	37.0	22.0	23.0	23.0	22.0
Total Split (s)	49.0	49.0	49.0	49.0	31.0	31.0	31.0	31.0
Total Split (%)	61.3%	61.3%	61.3%	61.3%	38.8%	38.8%	38.8%	38.8%
Yellow Time (s)	5.0	5.0	5.0	5.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-3.0	-3.0		-3.0	-2.0	-2.0		-2.0
Total Lost Time (s)	4.0	4.0		4.0	4.0	4.0		4.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	C-Max	C-Max	C-Max	C-Max	None	None	None	None
Act Effct Green (s)	50.6	50.6		50.6	21.4	21.4		21.4
Actuated g/C Ratio	0.63	0.63		0.63	0.27	0.27		0.27
v/c Ratio	0.50	0.22		0.60	0.70	0.10		0.04
Control Delay	11.2	8.1		7.4	37.5	0.3		19.2
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0
Total Delay	11.2	8.1		7.4	37.5	0.3		19.2
LOS	B	A		A	D	A		B
Approach Delay	10.4			7.4		30.0		19.2
Approach LOS	B			A		C		B
<b>Intersection Summary</b>								
Cycle Length: 80								
Actuated Cycle Length: 80								
Offset: 10 (13%), Referenced to phase 2:EBT and 6:WBT, Start of Green								
Natural Cycle: 60								
Control Type: Actuated-Coordinated								
Maximum v/c Ratio: 0.70								
Intersection Signal Delay: 11.6						Intersection LOS: B		
Intersection Capacity Utilization 88.3%						ICU Level of Service E		
Analysis Period (min) 15								
<b>Splits and Phases: 1: Main St &amp; Guelph St</b>								
↔ D2 (R)	49 s							
↘ D5 (R)	49 s							
↕ D4					31 s			
↕ D3						31 s		

Queues  
1: Main St & Guelph St

Background PM  
151850S

	→	↘	←	↙	↑	↓
Lane Group	EBT	EBR	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	515	194	1072	228	58	16
v/c Ratio	0.50	0.22	0.60	0.70	0.10	0.04
Control Delay	11.2	8.1	7.4	37.5	0.3	19.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.2	8.1	7.4	37.5	0.3	19.2
Queue Length 50th (m)	40.6	12.1	25.6	32.3	0.0	1.9
Queue Length 95th (m)	77.4	25.9	32.2	52.5	0.0	5.9
Internal Link Dist (m)	62.4		112.6		110.9	29.0
Turn Bay Length (m)						
Base Capacity (vph)	1021	891	1790	412	681	500
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	0.50	0.22	0.60	0.55	0.09	0.03

Intersection Summary

HCM Signalized Intersection Capacity Analysis  
1: Main St & Guelph St

Background PM  
151850S

	↘	→	↙	↘	←	↙	↘	↑	↘	↙	↓	↘
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↘		↘↗		↘	↗			↘	↗
Traffic Volume (vph)	0	479	180	61	934	2	212	0	54	9	6	0
Future Volume (vph)	0	479	180	61	934	2	212	0	54	9	6	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0		4.0
Lane Util. Factor	1.00	1.00		0.95	1.00		1.00	1.00		1.00		1.00
Frbp, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.96		1.00		1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00		0.99
Frt	1.00	0.85		1.00	1.00		1.00	0.85		1.00		1.00
Flt Protected	1.00	1.00		1.00	0.95		1.00	1.00		1.00		0.97
Satd. Flow (prot)	1613	1409		3178	1555		1365	1365		1637		1637
Flt Permitted	1.00	1.00		0.89	0.75		1.00	1.00		0.88		0.88
Satd. Flow (perm)	1613	1409		2827	1223		1365	1484		1484		1484
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	0	515	194	66	1004	2	228	0	58	10	6	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	42	0	0	0	0
Lane Group Flow (vph)	0	515	194	0	1072	0	228	16	0	0	16	0
Confl. Peds. (#/hr)	13					13			9		9	
Heavy Vehicles (%)	0%	6%	2%	0%	2%	0%	1%	0%	2%	0%	0%	0%
Turn Type	NA	Perm	Perm	NA			D.Pm	NA		D.Pm	NA	
Protected Phases	2			6			4				8	
Permitted Phases		2	6				8			4		
Actuated Green, G (s)	47.6	47.6		47.6			19.4	19.4			19.4	
Effective Green, g (s)	50.6	50.6		50.6			21.4	21.4			21.4	
Actuated g/C Ratio	0.63	0.63		0.63			0.27	0.27			0.27	
Clearance Time (s)	7.0	7.0		7.0			6.0	6.0			6.0	
Vehicle Extension (s)	5.0	5.0		5.0			3.0	3.0			3.0	
Lane Grp Cap (vph)	1020	891		1788			327	365			396	
v/s Ratio Prot	0.32							0.01				
v/s Ratio Perm		0.14		c0.38			c0.19				0.01	
v/c Ratio	0.50	0.22		0.60			0.70	0.04			0.04	
Uniform Delay, d1	7.9	6.3		8.7			26.4	21.7			21.7	
Progression Factor	1.00	1.00		0.61			1.00	1.00			1.00	
Incremental Delay, d2	1.8	0.6		1.3			6.3	0.0			0.0	
Delay (s)	9.7	6.8		6.6			32.7	21.8			21.7	
Level of Service	A	A		A			C	C			C	
Approach Delay (s)	8.9			6.6			30.5				21.7	
Approach LOS	A			A			C				C	

Intersection Summary

HCM 2000 Control Delay	10.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	88.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis  
2: Main St & Cross St

Background PM  
151850S

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔		↔	↔			↔		↔	↔	
Traffic Volume (veh/h)	0	0	0	43	0	5	0	246	47	5	170	0
Future Volume (Veh/h)	0	0	0	43	0	5	0	246	47	5	170	0
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	0	0	0	44	0	5	0	251	48	5	173	0
Pedestrians	10			5								
Lane Width (m)	3.6			3.6								
Walking Speed (m/s)	1.2			1.2								
Percent Blockage	1			0								
Right turn flare (veh)												
Median type	None						None					
Median storage (veh)												
Upstream signal (m)	177						135					
pX, platoon unblocked												
vC, conflicting volume	473	497	183	463	473	280	183				304	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	473	497	183	463	473	280	183				304	
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
p0 queue free %	100	100	100	91	100	99	100				100	
cM capacity (veh/h)	491	470	857	504	485	760	1392				1263	
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	0	49	299	178								
Volume Left	0	44	0	5								
Volume Right	0	5	48	0								
cSH	1700	522	1392	1263								
Volume to Capacity	0.00	0.09	0.00	0.00								
Queue Length 95th (m)	0.0	2.5	0.0	0.1								
Control Delay (s)	0.0	12.6	0.0	0.3								
Lane LOS	A	B		A								
Approach Delay (s)	0.0	12.6	0.0	0.3								
Approach LOS	A	B										
Intersection Summary												
Average Delay				1.3								
Intersection Capacity Utilization	27.6%			ICU Level of Service	A							
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis  
3: Main St & James St

Background PM  
151850S

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔		↔	↔			↔		↔	↔	
Traffic Volume (veh/h)	64	13	52	14	8	25	75	207	33	14	162	81
Future Volume (Veh/h)	64	13	52	14	8	25	75	207	33	14	162	81
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	67	14	55	15	8	26	79	218	35	15	171	85
Pedestrians	11			10						3		
Lane Width (m)	3.6			3.6						3.6		
Walking Speed (m/s)	1.2			1.2						1.2		
Percent Blockage	1			1						0		
Right turn flare (veh)												
Median type	None						None					
Median storage (veh)												
Upstream signal (m)	152						160					
pX, platoon unblocked												
vC, conflicting volume	681	676	224	709	700	248	267				263	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	681	676	224	709	700	248	267				263	
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 %	79	96	93	95	98	97	94				99	
cM capacity (veh/h)	321	345	812	294	333	774	1296				1302	
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	136	49	332	271								
Volume Left	67	15	79	15								
Volume Right	55	26	35	85								
cSH	429	451	1296	1302								
Volume to Capacity	0.32	0.11	0.06	0.01								
Queue Length 95th (m)	10.7	2.9	1.6	0.3								
Control Delay (s)	17.2	13.9	2.3	0.5								
Lane LOS	C	B	A	A								
Approach Delay (s)	17.2	13.9	2.3	0.5								
Approach LOS	C	B										
Intersection Summary												
Average Delay				5.0								
Intersection Capacity Utilization	59.0%			ICU Level of Service	B							
Analysis Period (min)	15											

Timings  
4: Main St & Mill St

Background PM  
151850S

	↖	→	↙	←	↘	↑	↗	↓
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↕		↕		↕		↕
Traffic Volume (vph)	34	68	69	60	30	285	26	217
Future Volume (vph)	34	68	69	60	30	285	26	217
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		4		2		2
Permitted Phases	4		4		2		2	
Detector Phase	4	4	4	4	2	2	2	2
Switch Phase								
Minimum Initial (s)	10.0	10.0	10.0	10.0	24.0	24.0	24.0	24.0
Minimum Split (s)	24.0	24.0	24.0	24.0	30.0	30.0	30.0	30.0
Total Split (s)	25.0	25.0	25.0	25.0	35.0	35.0	35.0	35.0
Total Split (%)	41.7%	41.7%	41.7%	41.7%	58.3%	58.3%	58.3%	58.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		-2.0		-2.0		-2.0		-2.0
Total Lost Time (s)		4.0		4.0		4.0		4.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	Max							
Act Effct Green (s)		21.0		21.0		31.0		31.0
Actuated g/C Ratio		0.35		0.35		0.52		0.52
v/c Ratio		0.32		0.36		0.52		0.37
Control Delay		12.0		15.3		11.6		9.7
Queue Delay		0.0		0.0		0.0		0.0
Total Delay		12.0		15.3		11.6		9.7
LOS		B		B		B		A
Approach Delay		12.0		15.3		11.6		9.7
Approach LOS		B		B		B		A

Intersection Summary

Cycle Length: 60  
 Actuated Cycle Length: 60  
 Offset: 0 (0%), Referenced to phase 2:NBSB and 6.: Start of Green  
 Natural Cycle: 55  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.52  
 Intersection Signal Delay: 11.7  
 Intersection Capacity Utilization 57.2%  
 Analysis Period (min) 15  
 Intersection LOS: B  
 ICU Level of Service B

Splits and Phases: 4: Main St & Mill St



Queues  
4: Main St & Mill St

Background PM  
151850S

	→	←	↑	↓
Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	167	167	427	296
v/c Ratio	0.32	0.36	0.52	0.37
Control Delay	12.0	15.3	11.6	9.7
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	12.0	15.3	11.6	9.7
Queue Length 50th (m)	9.4	12.1	27.0	17.2
Queue Length 95th (m)	22.3	26.2	49.2	32.1
Internal Link Dist (m)	50.0	122.5	34.0	128.1
Turn Bay Length (m)				
Base Capacity (vph)	529	465	815	806
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	0.32	0.36	0.52	0.37

Intersection Summary

HCM Signalized Intersection Capacity Analysis  
4: Main St & Mill St

Background PM  
151850S

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (vph)	34	68	56	69	60	29	30	285	90	26	217	39
Future Volume (vph)	34	68	56	69	60	29	30	285	90	26	217	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5
Total Lost time (s)	4.0			4.0			4.0			4.0		
Lane Util. Factor	1.00			1.00			1.00			1.00		
Frbp, ped/bikes	0.97			0.99			0.98			0.99		
Flpb, ped/bikes	0.99			0.98			1.00			1.00		
Frt	0.95			0.97			0.97			0.98		
Flt Protected	0.99			0.98			1.00			1.00		
Satd. Flow (prot)	1538			1552			1597			1623		
Flt Permitted	0.91			0.81			0.96			0.95		
Satd. Flow (perm)	1422			1292			1543			1543		
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	36	72	59	73	63	31	32	300	95	27	228	41
RTOR Reduction (vph)	0	33	0	0	14	0	0	17	0	0	10	0
Lane Group Flow (vph)	0	135	0	0	153	0	0	410	0	0	286	0
Confl. Peds. (#/hr)	28		42	42		28	58		70	70		58
Heavy Vehicles (%)	0%	0%	2%	0%	0%	8%	0%	1%	0%	5%	1%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	4		4		4		2		2		2	
Permitted Phases	4		4		2		2		2		2	
Actuated Green, G (s)	19.0		19.0		29.0		29.0		29.0		29.0	
Effective Green, g (s)	21.0		21.0		31.0		31.0		31.0		31.0	
Actuated g/C Ratio	0.35		0.35		0.52		0.52		0.52		0.52	
Clearance Time (s)	6.0		6.0		6.0		6.0		6.0		6.0	
Lane Grp Cap (vph)	497		452		797		797		797		797	
v/s Ratio Prot	0.09		c0.12		c0.27		0.19		0.19		0.19	
v/c Ratio	0.27		0.34		0.51		0.36		0.36		0.36	
Uniform Delay, d1	14.0		14.4		9.5		8.6		8.6		8.6	
Progression Factor	1.00		1.00		1.00		1.00		1.00		1.00	
Incremental Delay, d2	1.3		2.0		2.4		1.3		1.3		1.3	
Delay (s)	15.3		16.4		11.9		9.9		9.9		9.9	
Level of Service	B		B		B		A		A		A	
Approach Delay (s)	15.3		16.4		11.9		9.9		9.9		9.9	
Approach LOS	B		B		B		A		A		A	

Intersection Summary			
HCM 2000 Control Delay	12.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	57.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Timings  
5: Mill St & Guelph St

Background PM  
151850S

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	13	598	168	1084	28	26	12	22
Future Volume (vph)	13	598	168	1084	28	26	12	22
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	2		6		8		4	
Permitted Phases	2		6		8		4	
Detector Phase	2		6		8		4	
Switch Phase								
Minimum Initial (s)	30.0	30.0	5.0	5.0	8.0	8.0	5.0	5.0
Minimum Split (s)	37.0	37.0	25.0	25.0	23.0	23.0	24.0	24.0
Total Split (s)	56.0	56.0	56.0	56.0	24.0	24.0	24.0	24.0
Total Split (%)	70.0%	70.0%	70.0%	70.0%	30.0%	30.0%	30.0%	30.0%
Yellow Time (s)	5.0	5.0	5.0	5.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-3.0	-3.0	-3.0	-3.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	C-Max	C-Max	C-Max	C-Max	None	None	None	None
Act Effct Green (s)	58.8	58.8	58.8	58.8	13.2	13.2	13.2	13.2
Actuated g/C Ratio	0.74	0.74	0.74	0.74	0.16	0.16	0.16	0.16
v/c Ratio	0.05	0.55	0.40	0.50	0.68	0.68	0.34	0.34
Control Delay	6.0	8.1	8.3	5.9	15.8	15.8	18.3	18.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	6.0	8.1	8.3	5.9	15.8	15.8	18.3	18.3
LOS	A	A	A	A	B	B	B	B
Approach Delay	8.1		6.2		15.8		18.3	
Approach LOS	A		A		B		B	

Intersection Summary	
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle:	65
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.68
Intersection Signal Delay:	8.4
Intersection Capacity Utilization	92.5%
ICU Level of Service	F
Analysis Period (min)	15



Queues  
5: Mill St & Guelph St

Background PM  
151850S

Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	13	640	173	1140	293	81
v/c Ratio	0.05	0.55	0.40	0.50	0.68	0.34
Control Delay	6.0	8.1	8.3	5.9	15.8	18.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	6.0	8.1	8.3	5.9	15.8	18.3
Queue Length 50th (m)	0.4	29.9	7.1	27.3	8.2	5.1
Queue Length 95th (m)	m2.1	67.7	27.1	62.2	29.6	15.4
Internal Link Dist (m)		140.5		110.5	36.7	32.1
Turn Bay Length (m)	35.0		50.0			
Base Capacity (vph)	268	1170	434	2289	530	337
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	0.05	0.55	0.40	0.50	0.55	0.24
<b>Intersection Summary</b>						
m Volume for 95th percentile queue is metered by upstream signal.						

HCM Signalized Intersection Capacity Analysis  
5: Mill St & Guelph St

Background PM  
151850S

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	13	598	23	168	1084	21	28	26	230	12	22	45
Future Volume (vph)	13	598	23	168	1084	21	28	26	230	12	22	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	1.00		1.00	0.95			1.00			1.00	
Frbp, ped/bikes	1.00	1.00		1.00	1.00			0.97			0.99	
Flpb, ped/bikes	1.00	1.00		0.99	1.00			1.00			1.00	
Frt	1.00	0.99		1.00	1.00			0.89			0.92	
Flt Protected	0.95	1.00		0.95	1.00			1.00			0.99	
Satd. Flow (prot)	1568	1591		1530	3112			1453			1529	
Flt Permitted	0.22	1.00		0.37	1.00			0.96			0.79	
Satd. Flow (perm)	365	1591		590	3112			1409			1212	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	13	616	24	173	1118	22	29	27	237	12	23	46
RTOR Reduction (vph)	0	1	0	0	1	0	0	198	0	0	38	0
Lane Group Flow (vph)	13	639	0	173	1139	0	0	95	0	0	43	0
Confl. Peds. (#/hr)	4		9	9		4	3		7	7		3
Heavy Vehicles (%)	0%	7%	0%	2%	4%	6%	4%	0%	1%	10%	0%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	55.8	55.8		55.8	55.8			11.2			11.2	
Effective Green, g (s)	58.8	58.8		58.8	58.8			13.2			13.2	
Actuated g/C Ratio	0.73	0.73		0.73	0.73			0.16			0.16	
Clearance Time (s)	7.0	7.0		7.0	7.0			6.0			6.0	
Vehicle Extension (s)	4.5	4.5		3.0	3.0			2.8			3.0	
Lane Grp Cap (vph)	268	1169		433	2287			232			199	
v/s Ratio Prot		c0.40			0.37							
v/s Ratio Perm	0.04			0.29				c0.07			0.04	
v/c Ratio	0.05	0.55		0.40	0.50			0.41			0.21	
Uniform Delay, d1	2.9	4.7		4.0	4.4			29.9			28.9	
Progression Factor	1.28	1.10		1.00	1.00			1.00			1.00	
Incremental Delay, d2	0.3	1.7		2.7	0.8			1.1			0.5	
Delay (s)	4.1	6.9		6.7	5.2			31.0			29.5	
Level of Service	A	A		A	A			C			C	
Approach Delay (s)		6.8			5.4			31.0			29.5	
Approach LOS		A			A			C			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay	9.8		HCM 2000 Level of Service				A					
HCM 2000 Volume to Capacity ratio	0.52											
Actuated Cycle Length (s)	80.0		Sum of lost time (s)				8.0					
Intersection Capacity Utilization	92.5%		ICU Level of Service				F					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis  
6: Back St & Cross St

Background PM  
151850S

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔		↔		↔	
Traffic Volume (veh/h)	54	4	4	45	6	11
Future Volume (Veh/h)	54	4	4	45	6	11
Sign Control	Free		Free		Stop	
Grade	0%		0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	60	4	4	50	7	12
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			64		120	62
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			64		120	62
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		99	99
cM capacity (veh/h)			1551		878	1009
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>			
Volume Total	64	54	19			
Volume Left	0	4	7			
Volume Right	4	0	12			
cSH	1700	1551	956			
Volume to Capacity	0.04	0.00	0.02			
Queue Length 95th (m)	0.0	0.1	0.5			
Control Delay (s)	0.0	0.6	8.8			
Lane LOS	A		A			
Approach Delay (s)	0.0	0.6	8.8			
Approach LOS	A		A			
<b>Intersection Summary</b>						
Average Delay			1.4			
Intersection Capacity Utilization			16.3%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
7: Mill St & Back St

Background PM  
151850S

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔		↔		↔	
Traffic Volume (veh/h)	50	26	11	234	170	43
Future Volume (Veh/h)	50	26	11	234	170	43
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	56	29	12	263	191	48
Pedestrians			1		1	
Lane Width (m)			3.6		3.6	
Walking Speed (m/s)			1.2		1.2	
Percent Blockage			0		0	
Right turn flare (veh)						
Median type			None		None	
Median storage (veh)						
Upstream signal (m)			197		61	
pX, platoon unblocked	0.98	0.98	0.98			
vC, conflicting volume	503	216	239			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	487	195	218			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	89	97	99			
cM capacity (veh/h)	530	837	1341			
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	85	275	239			
Volume Left	56	12	0			
Volume Right	29	0	48			
cSH	605	1341	1700			
Volume to Capacity	0.14	0.01	0.14			
Queue Length 95th (m)	3.9	0.2	0.0			
Control Delay (s)	11.9	0.4	0.0			
Lane LOS	B		A			
Approach Delay (s)	11.9	0.4	0.0			
Approach LOS	B		A			
<b>Intersection Summary</b>						
Average Delay			1.9			
Intersection Capacity Utilization			35.4%	ICU Level of Service	A	
Analysis Period (min)			15			



# Appendix D

## Total Traffic Operational Conditions





Timings  
1: Main St & Guelph St

Total AM  
151850S

	→	↘	↙	←	↖	↗	↓
Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	SBT
Lane Configurations	↑	↘		↕	↖	↗	↕
Traffic Volume (vph)	780	240	16	328	122	0	5
Future Volume (vph)	780	240	16	328	122	0	5
Turn Type	NA	Perm	Perm	NA	D.Pm	NA	NA
Protected Phases	2			6		4	8
Permitted Phases		2	6		8		
Detector Phase	2	2	6	6	8	4	8
Switch Phase							
Minimum Initial (s)	30.0	30.0	30.0	30.0	8.0	8.0	8.0
Minimum Split (s)	37.0	37.0	37.0	37.0	22.0	23.0	22.0
Total Split (s)	83.0	83.0	83.0	83.0	27.0	27.0	27.0
Total Split (%)	75.5%	75.5%	75.5%	75.5%	24.5%	24.5%	24.5%
Yellow Time (s)	5.0	5.0	5.0	5.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-3.0	-3.0		-3.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0		4.0	4.0	4.0	4.0
Lead/Lag							
Lead-Lag Optimize?							
Recall Mode	C-Max	C-Max	C-Max	C-Max	None	None	None
Act Effct Green (s)	83.1	83.1		83.1	18.9	18.9	18.9
Actuated g/C Ratio	0.76	0.76		0.76	0.17	0.17	0.17
v/c Ratio	0.67	0.25		0.18	0.68	0.13	0.02
Control Delay	10.8	5.3		4.1	60.1	0.6	35.2
Queue Delay	0.2	0.0		0.0	0.0	0.0	0.0
Total Delay	10.9	5.3		4.1	60.1	0.6	35.2
LOS	B	A		A	E	A	D
Approach Delay	9.6			4.1		42.0	35.2
Approach LOS	A			A		D	D

Intersection Summary

Cycle Length: 110  
 Actuated Cycle Length: 110  
 Offset: 104 (95%), Referenced to phase 2:EBT and 6:WBTL, Start of Green  
 Natural Cycle: 60  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.68  
 Intersection Signal Delay: 12.1      Intersection LOS: B  
 Intersection Capacity Utilization 66.7%      ICU Level of Service C  
 Analysis Period (min) 15

Splits and Phases: 1: Main St & Guelph St



Queues  
1: Main St & Guelph St

Total AM  
151850S

	→	↘	↙	←	↖	↗	↓
Lane Group	EBT	EBR	WBT	NBL	NBT	SBT	
Lane Group Flow (vph)	821	253	362	128	56	5	
v/c Ratio	0.67	0.25	0.18	0.68	0.13	0.02	
Control Delay	10.8	5.3	4.1	60.1	0.6	35.2	
Queue Delay	0.2	0.0	0.0	0.0	0.0	0.0	
Total Delay	10.9	5.3	4.1	60.1	0.6	35.2	
Queue Length 50th (m)	80.7	15.3	10.2	27.1	0.0	1.0	
Queue Length 95th (m)	137.6	27.9	15.5	47.0	0.0	4.2	
Internal Link Dist (m)	62.4		112.6		110.9	29.0	
Turn Bay Length (m)							
Base Capacity (vph)	1230	997	2003	230	473	357	
Starvation Cap Reductn	0	0	0	0	0	0	
Spillback Cap Reductn	48	0	0	0	6	0	
Storage Cap Reductn	0	0	0	0	0	0	
Reduced v/c Ratio	0.69	0.25	0.18	0.56	0.12	0.01	

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis  
1: Main St & Guelph St

Total AM  
151850S

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↑		↔		↑	↑			↔	
Traffic Volume (vph)	0	780	240	16	328	0	122	0	53	0	5	0
Future Volume (vph)	0	780	240	16	328	0	122	0	53	0	5	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0		
Lane Util. Factor	1.00	1.00		0.95	1.00		1.00	1.00		1.00		
Frpb, ped/bikes	1.00	0.96		1.00	1.00		0.97			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		0.85			1.00		
Flt Protected	1.00	1.00		1.00	0.95		1.00			1.00		
Satd. Flow (prot)	1629	1320		2916	1390		1377			1710		
Flt Permitted	1.00	1.00		0.91	0.75		1.00			1.00		
Satd. Flow (perm)	1629	1320		2651	1104		1377			1710		
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	821	253	17	345	0	128	0	56	0	5	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	46	0	0	0	0
Lane Group Flow (vph)	0	821	253	0	362	0	128	10	0	0	5	0
Confl. Peds. (#/hr)	6	11	11		6		4	4		4		
Heavy Vehicles (%)	0%	5%	4%	14%	11%	0%	13%	0%	2%	0%	0%	0%
Turn Type	NA	Perm	Perm	NA	D.Pm	NA						
Protected Phases	2			6			4			8		
Permitted Phases		2	6		8			4				
Actuated Green, G (s)	80.1	80.1		80.1	16.9		16.9			16.9		
Effective Green, g (s)	83.1	83.1		83.1	18.9		18.9			18.9		
Actuated g/C Ratio	0.76	0.76		0.76	0.17		0.17			0.17		
Clearance Time (s)	7.0	7.0		7.0	6.0		6.0			6.0		
Vehicle Extension (s)	5.0	5.0		5.0	3.0		3.0			3.0		
Lane Grp Cap (vph)	1230	997		2002	189		236			293		
v/s Ratio Prot	c0.50						0.01			0.00		
v/s Ratio Perm		0.19		0.14	c0.12							
v/c Ratio	0.67	0.25		0.18	0.68		0.04			0.02		
Uniform Delay, d1	6.6	4.1		3.8	42.7		38.0			37.8		
Progression Factor	1.00	1.00		0.92	1.00		1.00			1.00		
Incremental Delay, d2	2.9	0.6		0.2	9.2		0.1			0.0		
Delay (s)	9.5	4.7		3.7	51.9		38.1			37.9		
Level of Service	A	A		A	D		D			D		
Approach Delay (s)	8.4			3.7			47.7			37.9		
Approach LOS	A			A			D			D		
<b>Intersection Summary</b>												
HCM 2000 Control Delay		11.9			HCM 2000 Level of Service		B					
HCM 2000 Volume to Capacity ratio		0.67										
Actuated Cycle Length (s)		110.0			Sum of lost time (s)		8.0					
Intersection Capacity Utilization		66.7%			ICU Level of Service		C					
Analysis Period (min)		15										
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis  
2: Main St & Cross St

Total AM  
151850S

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (veh/h)	2	2	2	35	0	1	2	161	87	5	252	2
Future Volume (Veh/h)	2	2	2	35	0	1	2	161	87	5	252	2
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	2	2	2	40	0	1	2	183	99	6	286	2
Pedestrians	4			2								
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)							177			135		
pX, platoon unblocked												
vC, conflicting volume	540	591	291	540	542	234	292			284		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	540	591	291	540	542	234	292			284		
tC, single (s)	7.1	7.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.9	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	99	100	91	100	100	100			100		
cM capacity (veh/h)	449	309	750	447	445	808	1277			1288		
<b>Direction, Lane #</b>												
	EB 1	WB 1	NB 1	SB 1								
Volume Total	6	41	284	294								
Volume Left	2	40	2	6								
Volume Right	2	1	99	2								
cSH	441	452	1277	1288								
Volume to Capacity	0.01	0.09	0.00	0.00								
Queue Length 95th (m)	0.3	2.4	0.0	0.1								
Control Delay (s)	13.3	13.8	0.1	0.2								
Lane LOS	B	B	A	A								
Approach Delay (s)	13.3	13.8	0.1	0.2								
Approach LOS	B	B										
<b>Intersection Summary</b>												
Average Delay				1.2								
Intersection Capacity Utilization				30.6%			ICU Level of Service			A		
Analysis Period (min)				15								

HCM Unsignalized Intersection Capacity Analysis  
3: Main St & James St

Total AM  
151850S

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↔			↔			↔			↔		
Traffic Volume (veh/h)	80	7	55	6	6	4	31	130	23	25	233	59	
Future Volume (Veh/h)	80	7	55	6	6	4	31	130	23	25	233	59	
Sign Control	Stop			Stop			Free			Free			
Grade	0%			0%			0%			0%			
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Hourly flow rate (vph)	84	7	58	6	6	4	33	137	24	26	245	62	
Pedestrians	7			14			2			2			
Lane Width (m)	3.6			3.6			3.6			3.6			
Walking Speed (m/s)	1.2			1.2			1.2			1.2			
Percent Blockage	1			1			0			0			
Right turn flare (veh)													
Median type	None						None						
Median storage (veh)													
Upstream signal (m)	152						160						
pX, platoon unblocked													
vC, conflicting volume	557	576	285	620	595	163	314						175
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	557	576	285	620	595	163	314						175
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 %	80	98	92	98	98	100	97						98
cM capacity (veh/h)	410	404	753	345	394	877	1250						1397
Direction, Lane #	EB 1	WB 1	NB 1	SB 1									
Volume Total	149	16	194	333									
Volume Left	84	6	33	26									
Volume Right	58	4	24	62									
cSH	498	431	1250	1397									
Volume to Capacity	0.30	0.04	0.03	0.02									
Queue Length 95th (m)	10.0	0.9	0.7	0.5									
Control Delay (s)	15.3	13.7	1.5	0.8									
Lane LOS	C	B	A	A									
Approach Delay (s)	15.3	13.7	1.5	0.8									
Approach LOS	C	B											
<b>Intersection Summary</b>													
Average Delay	4.4												
Intersection Capacity Utilization	42.9%			ICU Level of Service			A						
Analysis Period (min)	15												

Timings  
4: Main St & Mill St

Total AM  
151850S

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↔		↔		↔		↔
Traffic Volume (vph)	14	65	51	28	6	173	50	250
Future Volume (vph)	14	65	51	28	6	173	50	250
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	4		4		2		2	
Permitted Phases	4		4		2		2	
Detector Phase	4		4		2		2	
Switch Phase								
Minimum Initial (s)	10.0	10.0	10.0	10.0	24.0	24.0	24.0	24.0
Minimum Split (s)	24.0	24.0	24.0	24.0	30.0	30.0	30.0	30.0
Total Split (s)	25.0	25.0	25.0	25.0	35.0	35.0	35.0	35.0
Total Split (%)	41.7%	41.7%	41.7%	41.7%	58.3%	58.3%	58.3%	58.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0		-2.0		-2.0		-2.0	
Total Lost Time (s)	4.0		4.0		4.0		4.0	
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	21.0		21.0		31.0		31.0	
Actuated g/C Ratio	0.35		0.35		0.52		0.52	
v/c Ratio	0.19		0.26		0.41		0.45	
Control Delay	13.3		11.5		8.4		11.4	
Queue Delay	0.0		0.0		0.0		0.0	
Total Delay	13.3		11.5		8.4		11.4	
LOS	B		B		A		B	
Approach Delay	13.3		11.5		8.4		11.4	
Approach LOS	B		B		A		B	
<b>Intersection Summary</b>								
Cycle Length: 60								
Actuated Cycle Length: 60								
Offset: 0 (0%), Referenced to phase 2:NBSB and 6.: Start of Green								
Natural Cycle: 55								
Control Type: Pretimed								
Maximum v/c Ratio: 0.45								
Intersection Signal Delay: 10.5					Intersection LOS: B			
Intersection Capacity Utilization 65.0%					ICU Level of Service C			
Analysis Period (min) 15								
Splits and Phases: 4: Main St & Mill St								

Queues  
4: Main St & Mill St

Total AM  
151850S

	→	←	↑	↓
Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	101	130	328	343
v/c Ratio	0.19	0.26	0.41	0.45
Control Delay	13.3	11.5	8.4	11.4
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	13.3	11.5	8.4	11.4
Queue Length 50th (m)	6.9	6.9	15.3	22.6
Queue Length 95th (m)	16.3	17.9	31.1	40.9
Internal Link Dist (m)	50.0	48.2	34.0	128.1
Turn Bay Length (m)				
Base Capacity (vph)	524	494	804	766
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	0.19	0.26	0.41	0.45

Intersection Summary

HCM Signalized Intersection Capacity Analysis  
4: Main St & Mill St

Total AM  
151850S

	↖	→	↘	↙	←	↖	↘	↑	↙	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (vph)	14	65	12	51	28	38	6	173	116	50	250	8
Future Volume (vph)	14	65	12	51	28	38	6	173	116	50	250	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frbp, ped/bikes		0.99			0.99			0.99			1.00	
Flpb, ped/bikes		1.00			0.99			1.00			1.00	
Frt		0.98			0.96			0.95			1.00	
Flt Protected		0.99			0.98			1.00			0.99	
Satd. Flow (prot)		1534			1538			1492			1623	
Flt Permitted		0.95			0.85			0.99			0.90	
Satd. Flow (perm)		1472			1335			1482			1480	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	16	72	13	57	31	42	7	192	129	56	278	9
RTOR Reduction (vph)	0	8	0	0	27	0	0	39	0	0	1	0
Lane Group Flow (vph)	0	93	0	0	103	0	0	289	0	0	342	0
Confl. Peds. (#/hr)	10		14	14		10	9		13	13		9
Heavy Vehicles (%)	0%	11%	0%	0%	0%	6%	0%	9%	4%	9%	3%	0%
Turn Type	Perm	NA										
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Actuated Green, G (s)		19.0			19.0			29.0			29.0	
Effective Green, g (s)		21.0			21.0			31.0			31.0	
Actuated g/C Ratio		0.35			0.35			0.52			0.52	
Clearance Time (s)		6.0			6.0			6.0			6.0	
Lane Grp Cap (vph)		515			467			765			764	
v/s Ratio Prot												
v/s Ratio Perm		0.06			0.08			0.20			0.23	
v/c Ratio		0.18			0.22			0.38			0.45	
Uniform Delay, d1		13.5			13.7			8.7			9.1	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.8			1.1			1.4			1.9	
Delay (s)		14.3			14.8			10.1			11.0	
Level of Service		B			B			B			B	
Approach Delay (s)		14.3			14.8			10.1			11.0	
Approach LOS		B			B			B			B	

Intersection Summary

HCM 2000 Control Delay	11.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	65.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Timings  
5: Mill St & Guelph St

Total AM  
151850S

	↖	→	↙	←	↘	↑	↗	↓
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖	↖	↖	↖↗		↖↗		↖↗
Traffic Volume (vph)	25	920	101	424	13	18	18	29
Future Volume (vph)	25	920	101	424	13	18	18	29
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		2		6		8		4
Permitted Phases	2		6		8		4	
Detector Phase	2	2	6	6	8	8	4	4
Switch Phase								
Minimum Initial (s)	30.0	30.0	5.0	5.0	8.0	8.0	5.0	5.0
Minimum Split (s)	37.0	37.0	25.0	25.0	23.0	23.0	24.0	24.0
Total Split (s)	84.0	84.0	84.0	84.0	26.0	26.0	26.0	26.0
Total Split (%)	76.4%	76.4%	76.4%	76.4%	23.6%	23.6%	23.6%	23.6%
Yellow Time (s)	5.0	5.0	5.0	5.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-3.0	-3.0	-3.0	-3.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	C-Max	C-Max	C-Max	C-Max	None	None	None	None
Act Effct Green (s)	80.8	80.8	80.8	80.8				21.2
Actuated g/C Ratio	0.73	0.73	0.73	0.73		0.19		0.19
v/c Ratio	0.05	0.89	0.59	0.23		0.94		0.36
Control Delay	3.6	15.9	22.9	5.0		59.6		37.2
Queue Delay	0.0	0.0	0.0	0.0		0.0		0.0
Total Delay	3.6	15.9	22.9	5.0		59.6		37.2
LOS	A	B	C	A		E		D
Approach Delay		15.5		8.4		59.6		37.2
Approach LOS		B		A		E		D

Intersection Summary

Cycle Length: 110  
 Actuated Cycle Length: 110  
 Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green  
 Natural Cycle: 90  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.94  
 Intersection Signal Delay: 21.7  
 Intersection Capacity Utilization 93.9%  
 Analysis Period (min) 15  
 Intersection LOS: C  
 ICU Level of Service F

Splits and Phases: 5: Mill St & Guelph St



Queues  
5: Mill St & Guelph St

Total AM  
151850S

	↖	→	↙	←	↘	↑	↓
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	28	1036	112	479	350	350	68
v/c Ratio	0.05	0.89	0.59	0.23	0.94	0.94	0.36
Control Delay	3.6	15.9	22.9	5.0	59.6	59.6	37.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	3.6	15.9	22.9	5.0	59.6	59.6	37.2
Queue Length 50th (m)	1.1	45.1	10.5	16.0	47.5	47.5	10.7
Queue Length 95th (m)	m1.8	#295.4	#41.0	22.0	#105.0	#105.0	24.8
Internal Link Dist (m)		140.5		110.5	36.7	32.1	
Turn Bay Length (m)	35.0		50.0				
Base Capacity (vph)	544	1170	190	2070	381	381	196
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.05	0.89	0.59	0.23	0.92	0.92	0.35

Intersection Summary

# 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  
5: Mill St & Guelph St

Total AM  
151850S

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔			↔			↔	
Traffic Volume (vph)	25	920	13	101	424	7	13	18	284	18	29	14
Future Volume (vph)	25	920	13	101	424	7	13	18	284	18	29	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	1.00		1.00	0.95			1.00			1.00	
Frbp, ped/bikes	1.00	1.00		1.00	1.00			0.95			0.99	
Flpb, ped/bikes	0.99	1.00		1.00	1.00			1.00			1.00	
Frt	1.00	1.00		1.00	1.00			0.88			0.97	
Flt Protected	0.95	1.00		0.95	1.00			1.00			0.99	
Satd. Flow (prot)	1486	1591		1510	2818			1327			1532	
Flt Permitted	0.47	1.00		0.16	1.00			0.99			0.60	
Satd. Flow (perm)	741	1591		259	2818			1314			929	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	28	1022	14	112	471	8	14	20	316	20	32	16
RTOR Reduction (vph)	0	1	0	0	1	0	0	119	0	0	10	0
Lane Group Flow (vph)	28	1035	0	112	478	0	0	231	0	0	58	0
Confl. Peds. (#/hr)	4		40	40		4	8		12	12		8
Heavy Vehicles (%)	5%	7%	9%	4%	15%	11%	9%	36%	5%	7%	8%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	77.8	77.8		77.8	77.8			19.2			19.2	
Effective Green, g (s)	80.8	80.8		80.8	80.8			21.2			21.2	
Actuated g/C Ratio	0.73	0.73		0.73	0.73			0.19			0.19	
Clearance Time (s)	7.0	7.0		7.0	7.0			6.0			6.0	
Vehicle Extension (s)	4.5	4.5		3.0	3.0			2.8			3.0	
Lane Grp Cap (vph)	544	1168		190	2069			253			179	
v/s Ratio Prot		c0.65			0.17							
v/s Ratio Perm	0.04			0.43				c0.18			0.06	
v/c Ratio	0.05	0.89		0.59	0.23			0.91			0.32	
Uniform Delay, d1	4.0	11.1		6.8	4.7			43.5			38.2	
Progression Factor	0.78	0.50		1.00	1.00			1.00			1.00	
Incremental Delay, d2	0.2	8.9		12.7	0.3			33.8			1.0	
Delay (s)	3.3	14.4		19.6	4.9			77.3			39.3	
Level of Service	A	B		B	A			E			D	
Approach Delay (s)		14.1			7.7			77.3			39.3	
Approach LOS		B			A			E			D	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		23.8										C
HCM 2000 Volume to Capacity ratio		0.89										
Actuated Cycle Length (s)		110.0			Sum of lost time (s)			8.0				
Intersection Capacity Utilization		93.9%										F
Analysis Period (min)		15										
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis  
6: Back St & Cross St

Total AM  
151850S

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔			↔	↔	
Traffic Volume (veh/h)	87	4	5	33	4	2
Future Volume (Veh/h)	87	4	5	33	4	2
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.73	0.73	0.73	0.73	0.73	0.73
Hourly flow rate (vph)	119	5	7	45	5	3
Pedestrians				5	5	
Lane Width (m)				3.6	3.3	
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)						
pX, platoon unblocked						
vC, conflicting volume			129		186	132
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			129		186	132
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		99	100
cM capacity (veh/h)			1464		801	916
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>			
Volume Total	124	52	8			
Volume Left	0	7	5			
Volume Right	5	0	3			
cSH	1700	1464	841			
Volume to Capacity	0.07	0.00	0.01			
Queue Length 95th (m)	0.0	0.1	0.2			
Control Delay (s)	0.0	1.0	9.3			
Lane LOS	A	A	A			
Approach Delay (s)	0.0	1.0	9.3			
Approach LOS		A				
<b>Intersection Summary</b>						
Average Delay			0.7			
Intersection Capacity Utilization		18.2%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis  
7: Mill St & Back St

Total AM  
151850S

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	18	5	8	297	98	45
Future Volume (Veh/h)	18	5	8	297	98	45
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	20	6	9	330	109	50
Pedestrians				11		
Lane Width (m)				3.6		
Walking Speed (m/s)				1.2		
Percent Blockage				1		
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)				197	61	
pX, platoon unblocked	0.99	0.99	0.99			
vC, conflicting volume	482	145	159			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	475	136	150			
tC, single (s)	6.4	6.5	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.5	2.2			
p0 queue free %	96	99	99			
cM capacity (veh/h)	545	841	1434			
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	26	339	159			
Volume Left	20	9	0			
Volume Right	6	0	50			
cSH	593	1434	1700			
Volume to Capacity	0.04	0.01	0.09			
Queue Length 95th (m)	1.1	0.2	0.0			
Control Delay (s)	11.3	0.3	0.0			
Lane LOS	B	A				
Approach Delay (s)	11.3	0.3	0.0			
Approach LOS	B					
<b>Intersection Summary</b>						
Average Delay		0.7				
Intersection Capacity Utilization		37.6%		ICU Level of Service	A	
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis  
8: Mill St & Driveway "A" Mill St Entrance

Total AM  
151850S

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	31	200	88	11	42	29
Future Volume (Veh/h)	31	200	88	11	42	29
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	34	222	98	12	47	32
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)		72	186			
pX, platoon unblocked						
vC, conflicting volume	110				394	104
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	110				394	104
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				92	97
cM capacity (veh/h)	1493				601	956
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	256	110	79			
Volume Left	34	0	47			
Volume Right	0	12	32			
cSH	1493	1700	707			
Volume to Capacity	0.02	0.06	0.11			
Queue Length 95th (m)	0.6	0.0	3.0			
Control Delay (s)	1.2	0.0	10.7			
Lane LOS	A		B			
Approach Delay (s)	1.2	0.0	10.7			
Approach LOS			B			
<b>Intersection Summary</b>						
Average Delay		2.6				
Intersection Capacity Utilization		29.7%		ICU Level of Service	A	
Analysis Period (min)		15				

Timings  
1: Main St & Guelph St

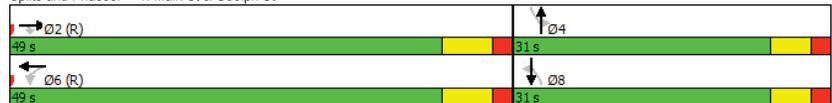
Total PM  
151850S

	→	↘	↙	←	↖	↗	↑	↘	↓
Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	
Lane Configurations	↑	↘		↖	↗	↘		↖	
Traffic Volume (vph)	479	221	61	934	228	0	9	6	
Future Volume (vph)	479	221	61	934	228	0	9	6	
Turn Type	NA	Perm	Perm	NA	D.Pm	NA	D.Pm	NA	
Protected Phases	2			6			4		8
Permitted Phases		2	6		8		4		
Detector Phase	2	2	6	6	8	4	4	8	
Switch Phase									
Minimum Initial (s)	30.0	30.0	30.0	30.0	8.0	8.0	8.0	8.0	
Minimum Split (s)	37.0	37.0	37.0	37.0	22.0	23.0	23.0	22.0	
Total Split (s)	49.0	49.0	49.0	49.0	31.0	31.0	31.0	31.0	
Total Split (%)	61.3%	61.3%	61.3%	61.3%	38.8%	38.8%	38.8%	38.8%	
Yellow Time (s)	5.0	5.0	5.0	5.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	-3.0	-3.0		-3.0	-2.0	-2.0	-2.0	-2.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	C-Max	C-Max	C-Max	C-Max	None	None	None	None	
Act Effct Green (s)	49.9	49.9		49.9	22.1	22.1		22.1	
Actuated g/C Ratio	0.62	0.62		0.62	0.28	0.28		0.28	
v/c Ratio	0.51	0.27		0.61	0.72	0.09		0.04	
Control Delay	11.7	8.9		8.0	38.3	0.3		18.9	
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0	
Total Delay	11.7	8.9		8.0	38.3	0.3		18.9	
LOS	B	A		A	D	A		B	
Approach Delay	10.8			8.0		31.0		18.9	
Approach LOS	B			A		C		B	

Intersection Summary

Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 8 (10%), Referenced to phase 2:EBT and 6:WBL, Start of Green  
 Natural Cycle: 60  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.72  
 Intersection Signal Delay: 12.3      Intersection LOS: B  
 Intersection Capacity Utilization 89.4%      ICU Level of Service E  
 Analysis Period (min) 15

Splits and Phases: 1: Main St & Guelph St



Queues  
1: Main St & Guelph St

Total PM  
151850S

	→	↘	↙	←	↖	↗	↑	↘	↓
Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	
Lane Group Flow (vph)	515	238	1072	245	58	16			
v/c Ratio	0.51	0.27	0.61	0.72	0.09	0.04			
Control Delay	11.7	8.9	8.0	38.3	0.3	18.9			
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0			
Total Delay	11.7	8.9	8.0	38.3	0.3	18.9			
Queue Length 50th (m)	42.2	16.0	28.1	34.7	0.0	1.8			
Queue Length 95th (m)	77.4	32.0	35.0	56.7	0.0	5.9			
Internal Link Dist (m)	62.4		112.6		110.9	29.0			
Turn Bay Length (m)									
Base Capacity (vph)	1005	878	1760	412	681	501			
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	0.51	0.27	0.61	0.59	0.09	0.03			

Intersection Summary

HCM Signalized Intersection Capacity Analysis  
1: Main St & Guelph St

Total PM  
151850S

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↑		↔		↑	↑			↔	
Traffic Volume (vph)	0	479	221	61	934	2	228	0	54	9	6	0
Future Volume (vph)	0	479	221	61	934	2	228	0	54	9	6	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5
Total Lost time (s)	4.0	4.0		4.0		4.0	4.0		4.0		4.0	
Lane Util. Factor	1.00	1.00		0.95		1.00	1.00		1.00		1.00	
Frbp, ped/bikes	1.00	1.00		1.00		1.00	0.96		1.00		1.00	
Flpb, ped/bikes	1.00	1.00		1.00		1.00	1.00		0.99		1.00	
Frt	1.00	0.85		1.00		1.00	0.85		1.00		1.00	
Flt Protected	1.00	1.00		1.00		0.95	1.00		0.97		0.97	
Satd. Flow (prot)	1613	1409		3178		1555	1365		1637		1637	
Flt Permitted	1.00	1.00		0.89		0.75	1.00		0.88		0.88	
Satd. Flow (perm)	1613	1409		2826		1223	1365		1487		1487	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	0	515	238	66	1004	2	245	0	58	10	6	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	42	0	0	0	0
Lane Group Flow (vph)	0	515	238	0	1072	0	245	16	0	0	16	0
Confl. Peds. (#/hr)	13					13			9		9	
Heavy Vehicles (%)	0%	6%	2%	0%	2%	0%	1%	0%	2%	0%	0%	0%
Turn Type		NA	Perm	Perm	NA		D.Pm	NA		D.Pm	NA	
Protected Phases		2			6			4			8	
Permitted Phases			2	6			8			4		
Actuated Green, G (s)		46.9	46.9		46.9		20.1	20.1			20.1	
Effective Green, g (s)		49.9	49.9		49.9		22.1	22.1			22.1	
Actuated g/C Ratio		0.62	0.62		0.62		0.28	0.28			0.28	
Clearance Time (s)		7.0	7.0		7.0		6.0	6.0			6.0	
Vehicle Extension (s)		5.0	5.0		5.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		1006	878		1762		337	377			410	
v/s Ratio Prot		0.32						0.01				
v/s Ratio Perm			0.17		c0.38		c0.20				0.01	
v/c Ratio		0.51	0.27		0.61		0.73	0.04			0.04	
Uniform Delay, d1		8.3	6.8		9.1		26.2	21.2			21.2	
Progression Factor		1.00	1.00		0.63		1.00	1.00			1.00	
Incremental Delay, d2		1.9	0.8		1.4		7.6	0.0			0.0	
Delay (s)		10.2	7.6		7.2		33.8	21.2			21.2	
Level of Service		B	A		A		C	C			C	
Approach Delay (s)		9.4			7.2		31.4				21.2	
Approach LOS		A			A		C				C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		11.5									B	
HCM 2000 Volume to Capacity ratio		0.64										
Actuated Cycle Length (s)		80.0			Sum of lost time (s)		8.0					
Intersection Capacity Utilization		89.4%			ICU Level of Service		E					
Analysis Period (min)		15										
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis  
2: Main St & Cross St

Total PM  
151850S

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (veh/h)	0	0	0	43	0	5	0	262	47	5	211	0
Future Volume (Veh/h)	0	0	0	43	0	5	0	262	47	5	211	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	0	0	0	44	0	5	0	267	48	5	215	0
Pedestrians		10			5							
Lane Width (m)		3.6			3.6							
Walking Speed (m/s)		1.2			1.2							
Percent Blockage		1			0							
Right turn flare (veh)												
Median type							None				None	
Median storage (veh)												
Upstream signal (m)							177				135	
pX, platoon unblocked												
vC, conflicting volume	531	555	225	521	531	296	225			320		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	531	555	225	521	531	296	225			320		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	90	100	99	100			100		
cM capacity (veh/h)	449	435	813	461	449	745	1344			1246		
<b>Direction, Lane #</b>												
	EB 1	WB 1	NB 1	SB 1								
Volume Total	0	49	315	220								
Volume Left	0	44	0	5								
Volume Right	0	5	48	0								
cSH	1700	480	1344	1246								
Volume to Capacity	0.00	0.10	0.00	0.00								
Queue Length 95th (m)	0.0	2.7	0.0	0.1								
Control Delay (s)	0.0	13.4	0.0	0.2								
Lane LOS	A	B		A								
Approach Delay (s)	0.0	13.4	0.0	0.2								
Approach LOS	A	B										
<b>Intersection Summary</b>												
Average Delay				1.2								
Intersection Capacity Utilization			28.6%		ICU Level of Service		A					
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis  
3: Main St & James St

Total PM  
151850S

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↔			↔			↔			↔		
Traffic Volume (veh/h)	64	13	58	20	8	34	78	215	41	20	197	81	
Future Volume (Veh/h)	64	13	58	20	8	34	78	215	41	20	197	81	
Sign Control	Stop			Stop			Free			Free			
Grade	0%			0%			0%			0%			
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Hourly flow rate (vph)	67	14	61	21	8	36	82	226	43	21	207	85	
Pedestrians	11			10			3			0			
Lane Width (m)	3.6			3.6			3.6			3.6			
Walking Speed (m/s)	1.2			1.2			1.2			1.2			
Percent Blockage	1			1			0			0			
Right turn flare (veh)													
Median type	None						None						
Median storage (veh)													
Upstream signal (m)	152						160						
pX, platoon unblocked													
vC, conflicting volume	757	746	260	781	766	260	303						279
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	757	746	260	781	766	260	303						279
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 %	76	96	92	92	97	95	93						98
cM capacity (veh/h)	279	311	776	257	303	763	1258						1285
Direction, Lane #	EB 1	WB 1	NB 1	SB 1									
Volume Total	142	65	351	313									
Volume Left	67	21	82	21									
Volume Right	61	36	43	85									
cSH	390	419	1258	1285									
Volume to Capacity	0.36	0.16	0.07	0.02									
Queue Length 95th (m)	13.0	4.4	1.7	0.4									
Control Delay (s)	19.4	15.2	2.4	0.7									
Lane LOS	C	C	A	A									
Approach Delay (s)	19.4	15.2	2.4	0.7									
Approach LOS	C	C											
<b>Intersection Summary</b>													
Average Delay	5.5												
Intersection Capacity Utilization	62.3%			ICU Level of Service			B						
Analysis Period (min)	15												

Timings  
4: Main St & Mill St

Total PM  
151850S

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↔		↔		↔		↔
Traffic Volume (vph)	34	72	81	62	30	285	73	217
Future Volume (vph)	34	72	81	62	30	285	73	217
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	4		4		2		2	
Permitted Phases	4		4		2		2	
Detector Phase	4		4		2		2	
Switch Phase								
Minimum Initial (s)	10.0	10.0	10.0	10.0	24.0	24.0	24.0	24.0
Minimum Split (s)	24.0	24.0	24.0	24.0	30.0	30.0	30.0	30.0
Total Split (s)	25.0	25.0	25.0	25.0	35.0	35.0	35.0	35.0
Total Split (%)	41.7%	41.7%	41.7%	41.7%	58.3%	58.3%	58.3%	58.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0		-2.0		-2.0		-2.0	
Total Lost Time (s)	4.0		4.0		4.0		4.0	
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	21.0		21.0		31.0		31.0	
Actuated g/C Ratio	0.35		0.35		0.52		0.52	
v/c Ratio	0.32		0.43		0.54		0.49	
Control Delay	12.2		16.0		11.9		11.8	
Queue Delay	0.0		0.0		0.0		0.0	
Total Delay	12.2		16.0		11.9		11.8	
LOS	B		B		B		B	
Approach Delay	12.2		16.0		11.9		11.8	
Approach LOS	B		B		B		B	
<b>Intersection Summary</b>								
Cycle Length: 60								
Actuated Cycle Length: 60								
Offset: 0 (0%), Referenced to phase 2:NBSB and 6.: Start of Green								
Natural Cycle: 55								
Control Type: Pretimed								
Maximum v/c Ratio: 0.54								
Intersection Signal Delay: 12.6					Intersection LOS: B			
Intersection Capacity Utilization 71.3%					ICU Level of Service C			
Analysis Period (min) 15								
Splits and Phases: 4: Main St & Mill St								
								

Queues  
4: Main St & Mill St

Total PM  
151850S

	→	←	↑	↓
Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	171	201	439	346
v/c Ratio	0.32	0.43	0.54	0.49
Control Delay	12.2	16.0	11.9	11.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	12.2	16.0	11.9	11.8
Queue Length 50th (m)	9.8	14.4	27.8	22.3
Queue Length 95th (m)	23.0	30.8	51.1	42.0
Internal Link Dist (m)	50.0	48.2	34.0	128.1
Turn Bay Length (m)				
Base Capacity (vph)	527	469	810	709
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	0.32	0.43	0.54	0.49

Intersection Summary

HCM Signalized Intersection Capacity Analysis  
4: Main St & Mill St

Total PM  
151850S

	↖	→	↗	↙	←	↖	↗	↑	↙	↗	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (vph)	34	72	56	81	62	48	30	285	102	73	217	39
Future Volume (vph)	34	72	56	81	62	48	30	285	102	73	217	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frbp, ped/bikes		0.97			0.98			0.97			0.99	
Flpb, ped/bikes		0.99			0.98			1.00			0.99	
Frt		0.95			0.97			0.97			0.98	
Flt Protected		0.99			0.98			1.00			0.99	
Satd. Flow (prot)		1543			1525			1590			1603	
Flt Permitted		0.91			0.83			0.96			0.84	
Satd. Flow (perm)		1418			1285			1532			1358	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	36	76	59	85	65	51	32	300	107	77	228	41
RTOR Reduction (vph)	0	32	0	0	20	0	0	19	0	0	8	0
Lane Group Flow (vph)	0	139	0	0	181	0	0	420	0	0	338	0
Confl. Peds. (#/hr)	28		42	42		28	58		70	70		58
Heavy Vehicles (%)	0%	0%	2%	0%	0%	8%	0%	1%	0%	5%	1%	0%
Turn Type	Perm	NA										
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Actuated Green, G (s)		19.0			19.0			29.0			29.0	
Effective Green, g (s)		21.0			21.0			31.0			31.0	
Actuated g/C Ratio		0.35			0.35			0.52			0.52	
Clearance Time (s)		6.0			6.0			6.0			6.0	
Lane Grp Cap (vph)		496			449			791			701	
v/s Ratio Prot												
v/s Ratio Perm		0.10			0.14			0.27			0.25	
v/c Ratio		0.28			0.40			0.53			0.48	
Uniform Delay, d1		14.1			14.8			9.7			9.3	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		1.4			2.7			2.5			2.4	
Delay (s)		15.5			17.4			12.2			11.7	
Level of Service		B			B			B			B	
Approach Delay (s)		15.5			17.4			12.2			11.7	
Approach LOS		B			B			B			B	

Intersection Summary

HCM 2000 Control Delay	13.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	71.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Timings  
5: Mill St & Guelph St

Total PM  
151850S

	↖	→	↙	←	↘	↑	↗	↓
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖	↖	↖	↖↗		↖	↖	↖
Traffic Volume (vph)	13	598	190	1084	28	28	12	25
Future Volume (vph)	13	598	190	1084	28	28	12	25
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		2		6		8		4
Permitted Phases	2		6		8		4	
Detector Phase	2	2	6	6	8	8	4	4
Switch Phase								
Minimum Initial (s)	30.0	30.0	5.0	5.0	8.0	8.0	5.0	5.0
Minimum Split (s)	37.0	37.0	25.0	25.0	23.0	23.0	24.0	24.0
Total Split (s)	56.0	56.0	56.0	56.0	24.0	24.0	24.0	24.0
Total Split (%)	70.0%	70.0%	70.0%	70.0%	30.0%	30.0%	30.0%	30.0%
Yellow Time (s)	5.0	5.0	5.0	5.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-3.0	-3.0	-3.0	-3.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	C-Max	C-Max	C-Max	C-Max	None	None	None	None
Act Effct Green (s)	58.6	58.6	58.6	58.6	13.4	13.4	13.4	13.4
Actuated g/C Ratio	0.73	0.73	0.73	0.73	0.17	0.17	0.17	0.17
v/c Ratio	0.05	0.55	0.45	0.50	0.72	0.72	0.35	0.35
Control Delay	5.6	7.8	9.6	6.0	16.0	16.0	18.7	18.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	5.6	7.8	9.6	6.0	16.0	16.0	18.7	18.7
LOS	A	A	A	A	B	B	B	B
Approach Delay		7.8		6.5		16.0		18.7
Approach LOS		A		A		B		B

Intersection Summary

Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green  
 Natural Cycle: 65  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.72  
 Intersection Signal Delay: 8.6      Intersection LOS: A  
 Intersection Capacity Utilization 95.7%      ICU Level of Service F  
 Analysis Period (min) 15

Splits and Phases: 5: Mill St & Guelph St



Queues  
5: Mill St & Guelph St

Total PM  
151850S

	↖	→	↙	←	↘	↑	↓
Lane Group	EBL	EBT	WBL	WBT	NBT	SBT	
Lane Group Flow (vph)	13	640	196	1140	340	84	
v/c Ratio	0.05	0.55	0.45	0.50	0.72	0.35	
Control Delay	5.6	7.8	9.6	6.0	16.0	18.7	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	5.6	7.8	9.6	6.0	16.0	18.7	
Queue Length 50th (m)	0.4	30.5	8.6	27.6	8.5	5.5	
Queue Length 95th (m)	m1.9	60.7	33.1	62.2	32.3	16.2	
Internal Link Dist (m)		140.5		110.5	36.7	32.1	
Turn Bay Length (m)	35.0		50.0				
Base Capacity (vph)	267	1166	432	2281	564	337	
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	0.05	0.55	0.45	0.50	0.60	0.25	

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis  
5: Mill St & Guelph St

Total PM  
151850S

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔			↔			↔	
Traffic Volume (vph)	13	598	23	190	1084	21	28	28	274	12	25	45
Future Volume (vph)	13	598	23	190	1084	21	28	28	274	12	25	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	1.00		1.00	0.95			1.00			1.00	
Frbp, ped/bikes	1.00	1.00		1.00	1.00			0.97			0.99	
Flpb, ped/bikes	1.00	1.00		0.99	1.00			1.00			1.00	
Frt	1.00	0.99		1.00	1.00			0.89			0.93	
Flt Protected	0.95	1.00		0.95	1.00			1.00			0.99	
Satd. Flow (prot)	1568	1591		1530	3112			1449			1535	
Flt Permitted	0.22	1.00		0.37	1.00			0.97			0.78	
Satd. Flow (perm)	364	1591		589	3112			1411			1210	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	13	616	24	196	1118	22	29	29	282	12	26	46
RTOR Reduction (vph)	0	1	0	0	1	0	0	235	0	0	38	0
Lane Group Flow (vph)	13	639	0	196	1139	0	0	105	0	0	46	0
Confl. Peds. (#/hr)	4		9	9		4	3		7	7		3
Heavy Vehicles (%)	0%	7%	0%	2%	4%	6%	4%	0%	1%	10%	0%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	55.6	55.6		55.6	55.6			11.4			11.4	
Effective Green, g (s)	58.6	58.6		58.6	58.6			13.4			13.4	
Actuated g/C Ratio	0.73	0.73		0.73	0.73			0.17			0.17	
Clearance Time (s)	7.0	7.0		7.0	7.0			6.0			6.0	
Vehicle Extension (s)	4.5	4.5		3.0	3.0			2.8			3.0	
Lane Grp Cap (vph)	266	1165		431	2279			236			202	
v/s Ratio Prot		c0.40			0.37							
v/s Ratio Perm	0.04			0.33				c0.07			0.04	
v/c Ratio	0.05	0.55		0.45	0.50			0.45			0.23	
Uniform Delay, d1	3.0	4.8		4.3	4.5			30.0			28.8	
Progression Factor	1.18	1.02		1.00	1.00			1.00			1.00	
Incremental Delay, d2	0.3	1.7		3.4	0.8			1.2			0.6	
Delay (s)	3.8	6.6		7.7	5.3			31.2			29.4	
Level of Service	A	A		A	A			C			C	
Approach Delay (s)		6.6			5.7			31.2			29.4	
Approach LOS		A			A			C			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		10.3			HCM 2000 Level of Service			B				
HCM 2000 Volume to Capacity ratio		0.53										
Actuated Cycle Length (s)		80.0			Sum of lost time (s)			8.0				
Intersection Capacity Utilization		95.7%			ICU Level of Service			F				
Analysis Period (min)		15										
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis  
6: Back St & Cross St

Total PM  
151850S

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔		↔	↔	↔	
Traffic Volume (veh/h)	54	4	4	45	6	11
Future Volume (Veh/h)	54	4	4	45	6	11
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	60	4	4	50	7	12
<b>Pedestrians</b>						
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			64		120	62
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			64		120	62
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		99	99
cM capacity (veh/h)			1551		878	1009
<b>Direction, Lane #</b>						
Volume Total	64	54	19			
Volume Left	0	4	7			
Volume Right	4	0	12			
cSH	1700	1551	956			
Volume to Capacity	0.04	0.00	0.02			
Queue Length 95th (m)	0.0	0.1	0.5			
Control Delay (s)	0.0	0.6	8.8			
Lane LOS		A	A			
Approach Delay (s)	0.0	0.6	8.8			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay			1.4			
Intersection Capacity Utilization			16.3%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
7: Mill St & Back St

Total PM  
151850S

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	W			↑	↑	
Traffic Volume (veh/h)	58	32	18	273	189	49
Future Volume (Veh/h)	58	32	18	273	189	49
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	65	36	20	307	212	55
Pedestrians				1	1	
Lane Width (m)				3.6	3.6	
Walking Speed (m/s)				1.2	1.2	
Percent Blockage				0	0	
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)				197	61	
pX, platoon unblocked	0.98	0.98	0.98			
vC, conflicting volume	588	240	267			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	566	211	238			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	86	96	98			
cM capacity (veh/h)	470	815	1310			
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	101	327	267			
Volume Left	65	20	0			
Volume Right	36	0	55			
cSH	553	1310	1700			
Volume to Capacity	0.18	0.02	0.16			
Queue Length 95th (m)	5.3	0.4	0.0			
Control Delay (s)	13.0	0.6	0.0			
Lane LOS	B	A				
Approach Delay (s)	13.0	0.6	0.0			
Approach LOS	B					
<b>Intersection Summary</b>						
Average Delay			2.2			
Intersection Capacity Utilization		45.1%		ICU Level of Service	A	
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis  
8: Mill St & Driveway "A" Mill St Entrance

Total PM  
151850S

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		W	
Traffic Volume (veh/h)	63	184	158	25	46	33
Future Volume (Veh/h)	63	184	158	25	46	33
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	66	194	166	26	48	35
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)		72	186			
pX, platoon unblocked						
vC, conflicting volume	192				505	179
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	192				505	179
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				91	96
cM capacity (veh/h)	1394				505	869
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>SB 1</b>			
Volume Total	260	192	83			
Volume Left	66	0	48			
Volume Right	0	26	35			
cSH	1394	1700	614			
Volume to Capacity	0.05	0.11	0.14			
Queue Length 95th (m)	1.2	0.0	3.7			
Control Delay (s)	2.3	0.0	11.8			
Lane LOS	A		B			
Approach Delay (s)	2.3	0.0	11.8			
Approach LOS			B			
<b>Intersection Summary</b>						
Average Delay			2.9			
Intersection Capacity Utilization		37.6%		ICU Level of Service	A	
Analysis Period (min)		15				