



**BA Group**

# **13 MOUNTAIN STREET & 19 ELM STREET PROPOSED REDEVELOPMENT TRANSPORTATION CONSIDERATIONS STUDY**

Official Plan Amendment and Zoning By-law Amendment Application  
Town of Grimsby

Prepared For: Valentine Coleman 1 Inc. and Valentine Coleman 2 Inc.

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## 1.0 PROJECT OVERVIEW

BA Group is retained by Valentine Coleman 1 Inc. and Valentine Coleman 2 Inc. to provide transportation consulting services related to an Official Plan Amendment ('OPA') and Zoning By-law Amendment ('ZBA') application being made to the Town of Grimsby to permit a mixed-use development (the 'Project') on the lands municipally known as 13 Mountain Street & 19 Elm Street (the 'Site').

The development proposal consists of 74 purpose built residential rental units, including one 3-bedroom rental replace unit, 462m<sup>2</sup> of non-residential uses, including 187m<sup>2</sup> of retail area and 275m<sup>2</sup> of community hub uses. The proposed non-residential uses are located within the two main existing buildings which will be retained and adaptively reused. The development proposal also includes 100 parking spaces (excluding the two off-site parking spaces), 84 bicycle parking spaces and one (1) loading space. All vehicular access is provided from a consolidated access off of Mountain Street. To note, there are planned Regional Road right-of-way improvements along Mountain Street which includes a widening of 4.25 metres.

This report forms part of the OPA and ZBA applications and reviews the urban transportation aspects of the proposed development.

### 1.1 THE SITE TODAY

The site is located in the Town of Grimsby in the Niagara Region, on the northeast corner of the Mountain Street / Elm Street intersection. The site is bound by neighbouring commercial properties to the north, Elm Street to the south, a commercial parking lot and neighbouring residential building to the east, and Mountain Street to the west.

The site is currently occupied by three buildings/structures comprised of community hub uses, residential uses (one 3-bedroom rental unit) and commercial uses. Two surface parking lots (39 spaces) are provided on the site today to service the site today with vehicular access from three driveways (two driveways from Mountain Street and one access from Elm Street). In addition to the 39 on-site parking spaces there are two parking spaces provided off site within the adjacent neighbouring public parking lot located to the east of the site.

The site is within the downtown Grimsby area within walking distance to a number of retail, community and entertainment uses. The site location and context are illustrated in **Figure 1** and **Figure 2**, respectively.

### 1.2 THIS TRANSPORTATION STUDY

BA Group has undertaken a review of the key transportation-related aspects (i.e. traffic, parking, loading, and bicycles) of the proposed Official Plan Amendment and Zoning By-law Amendment application being submitted to the City of Toronto to permit the proposed development at 13 Mountain Street and 19 Elm Street. Key aspects reviewed include:

#### Development Plan

- A review of the proposed building programme; and
- A review of the transportation elements of the proposed development plan including site pedestrian and vehicular access, vehicular and bicycle parking facilities, and loading facilities.



### **Transportation Context**

- A review of the existing and future transportation context of the site considering area road network, area transit services, the surrounding pedestrian environment, and the area cycling network; and
- A discussion related to the existing area travel characteristics.

### **Site Planning**

- A review of the vehicular parking, bicycle parking, and loading supply provisions for the proposed development; and
- A review of the functionality and appropriateness of the proposed vehicular facilities, including loading/garbage collection facility arrangements.

### **Multi-Modal Considerations**

- A review of area transit, pedestrian, and cycling context today;
- An outline of multi-modal travel demand projections for the proposed development based on “first principles” person-trip forecasting methodologies and observed travel characteristics; and
- A discussion related to future site pedestrian, transit, and cyclist activity generated by the proposed development.

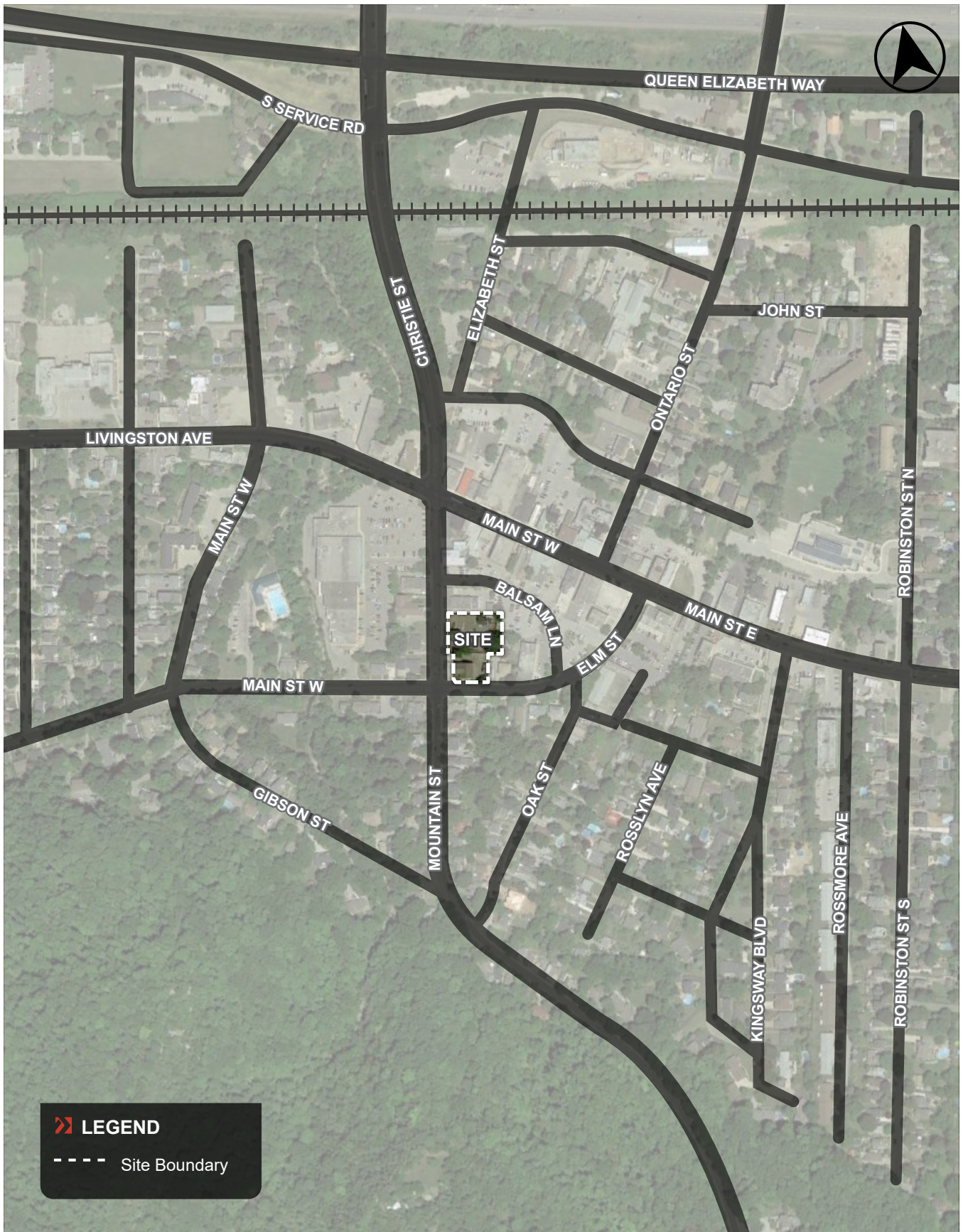
### **Traffic Overview**

- Development of new site-related traffic forecasts and assignments reflecting the proposed development plan; and
- A brief assessment of traffic volume changes on the area street network.

The findings of our report are summarized in the following sections.

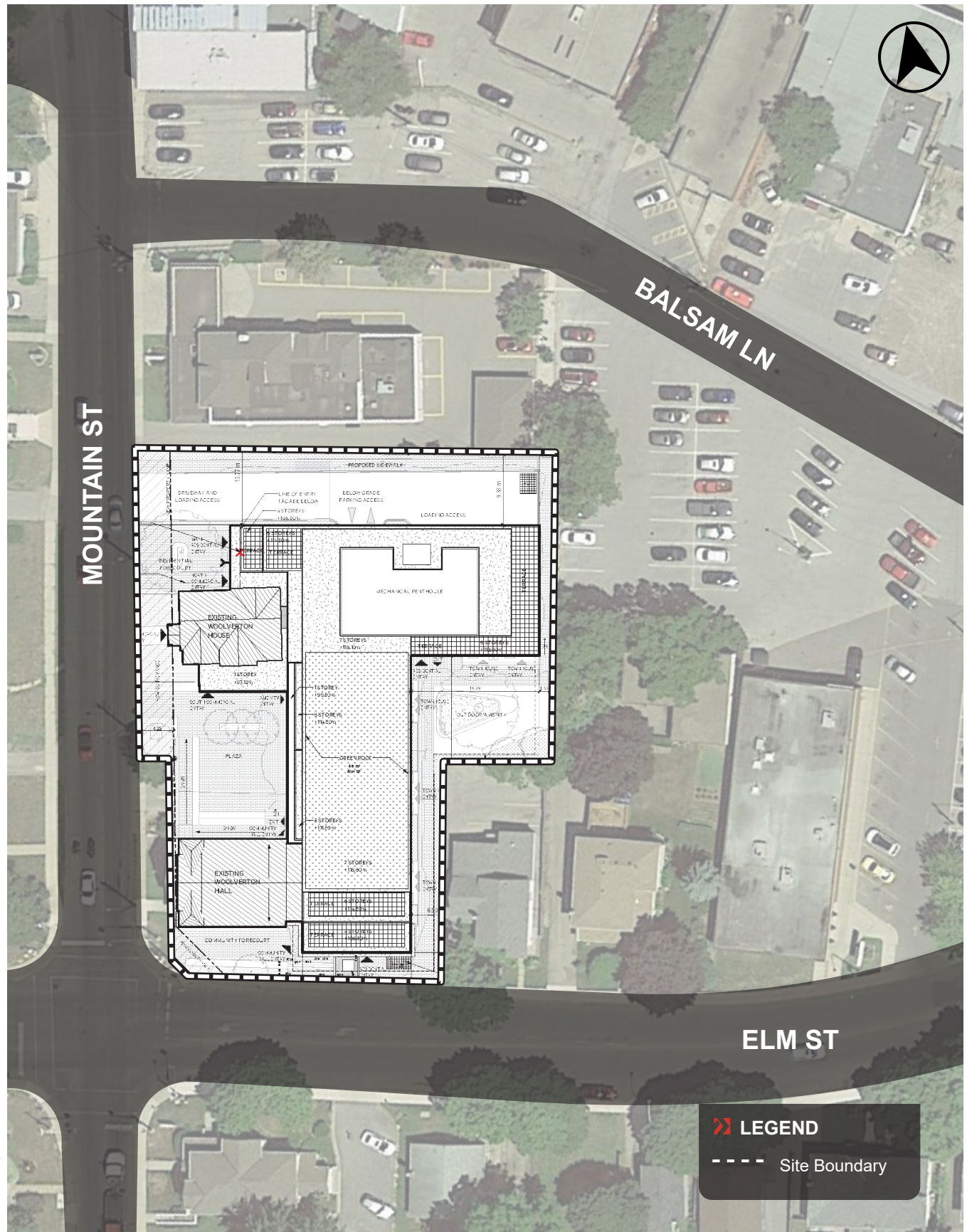






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**FIGURE 1 SITE LOCATION**



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**FIGURE 2 SITE CONCEPT PLAN**

## 2.0 PROPOSED DEVELOPMENT

The proposed development is comprised of a mixed-use development, which includes 74 purpose built rental units, 275m<sup>2</sup> of community hub uses and 187m<sup>2</sup> of retail uses. The proposed non-residential uses are located within the two main existing buildings which will be retained and adaptively reused. Reduced scale architectural plans of the proposed development are provided in **Appendix A**.

### 2.1 SITE ACCESS AND CIRCULATION

#### 2.1.1 Pedestrian Access

The proposed building has primary pedestrian access to/from Mountain Street, located on the west side of the site. There will also be secondary pedestrian access available from Elm Street on the south side of the site; as well as at grade access to the neighbouring municipally owned commercial parking lot located on the east side of the site.

#### 2.1.2 Vehicle Access

The proposed development plan proposes that all vehicular site access is from Mountain Street, at the northwest corner of the site. There currently exists a driveway off of Mountain Street, which will generally remain unchanged.

### 2.2 VEHICULAR PARKING

A three-level underground parking garage provides a total of 100 parking spaces, accessed via the northwest corner of the site to/from Mountain Street.

The first level (P1) of the parking garage is shared between visitor parking and resident parking and contains 30 parking spaces. The second and third levels (P2 and P3) of the parking garage are for residential parking, providing a supply of 43 and 27 parking spaces, respectively.

Two surface parking spots in the adjacent municipal parking off of Balsam Lane are also owned by Owners of 13 Mountain Street and 19 Elm Street.

### 2.3 BICYCLE FACILITIES

The site plan includes 84 bicycle parking spaces. Of these spaces, 74 spaces are for residential uses and 10 spaces are for non-residential uses.

The 74 bicycle parking spaces designated for residential tenant and visitor uses are located on the first level, in a secure bike room close to the main residential entrance with convenient elevator access. In addition, 10 bicycle spaces are located at-grade within a dedicated bicycle parking area.

### 2.4 LOADING AND SERVICING

An enclosed loading area at the north side of the site includes one (1) loading space and meets the requirements outlined in the Town of Grimsby Zoning By-law 14-45.



## 3.0 AREA TRANSPORTATION CONTEXT

### 3.1 AREA STREET NETWORK

**Figure 3** demonstrates the existing area road network classifications. **Figure 4** depicts existing lane configurations and traffic control devices. A brief description of the area public street network is provided in **Table 1**.

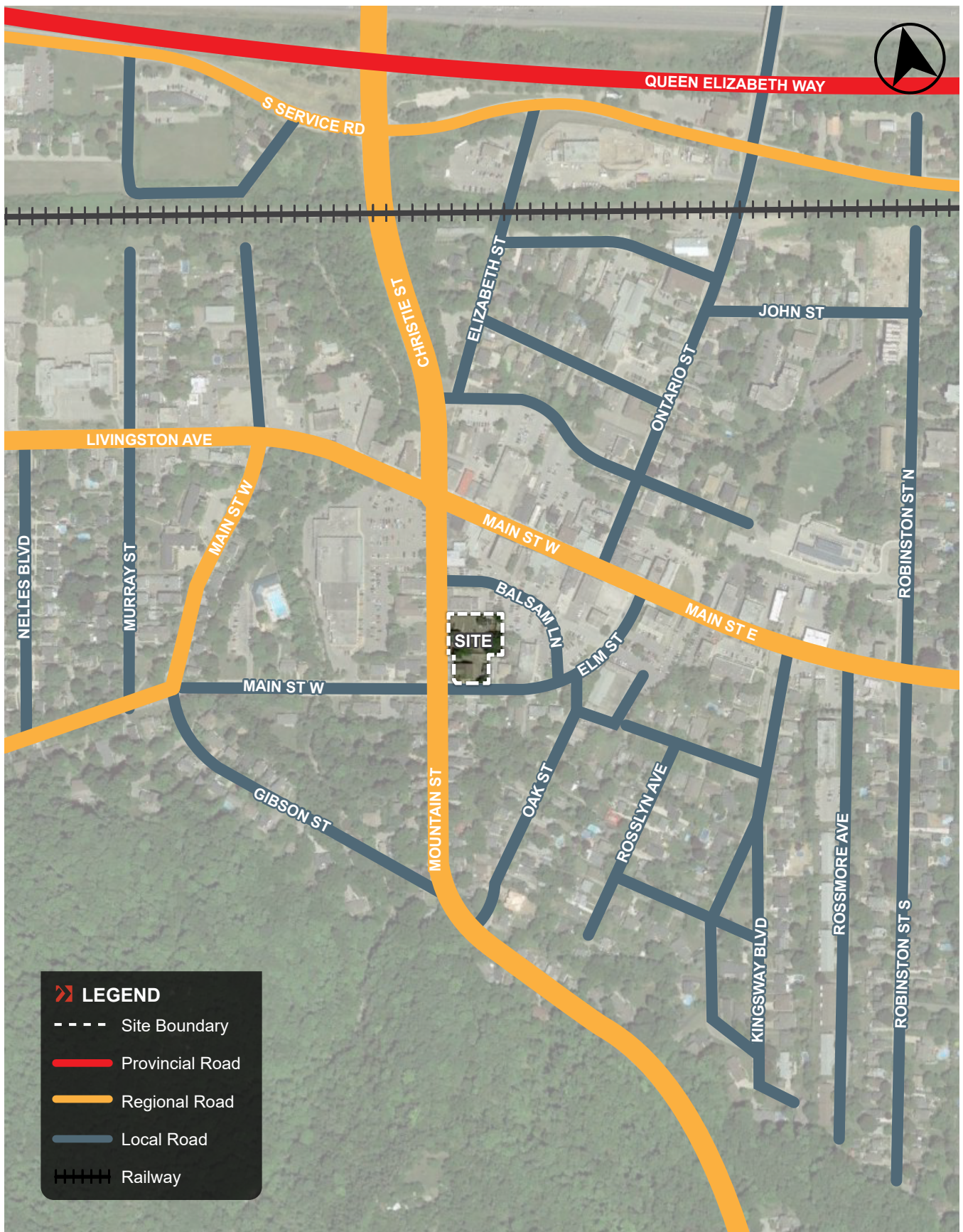
**TABLE 1 SUMMARY OF AREA STREET NETWORK**

		Orientation	Extent of Street	Number of Lanes	Speed Limit	Future Changes
Regional Roads	Mountain Street <sup>1</sup> (Regional Road 12)	North – South	North Limit: Main St. E. & continues as Christie St. South Limit: Mud St. & continues as Grimsby Rd.	2 lanes (one lane in each direction) with centre left turn lanes at the key intersections	40 km/h	Road widening is proposed adjacent to the site. Plans unknown at this time for any future road work.
	Main St. E. <sup>2</sup> (Regional Road 81)	East – West	East Limit: Chardonnay Pl. & continues as King St. West Limit: Main St. W. & continues as Livingston Ave.	4 lane cross section (two lanes in each direction) with one lane used per direction for on-street parking	40 km/h	No Changes
	Main St. W. <sup>1</sup> (Regional Road 81)	Mostly East – West With a small North – South portion of the road between Main Street East & Elm St.	North Limit: Main St. E. West Limit: Lampman Dr.	2 lanes (one lane in each direction)	40 km/h	No Changes
Local Roads	Elm Street <sup>1</sup>	East - West	East Limit: Main St. E. West Limit: Gibson St. & continues as Main St. W.	2 lanes (one lane in each direction) with centre left turn lanes at the key intersections	40 km/h	No Changes
	Balsam Lane <sup>1</sup> Private Lane	Curved Road	North Limit: Mountain St. South Limit: Elm St.	2 lanes (one lane in each direction)	40 km/h	No Changes
	Oak Street <sup>1</sup>	North – South	North Limit: Elm St. South Limit: Mountain St.	2 lanes (one lane in each direction)	40 km/h	No Changes

Notes:

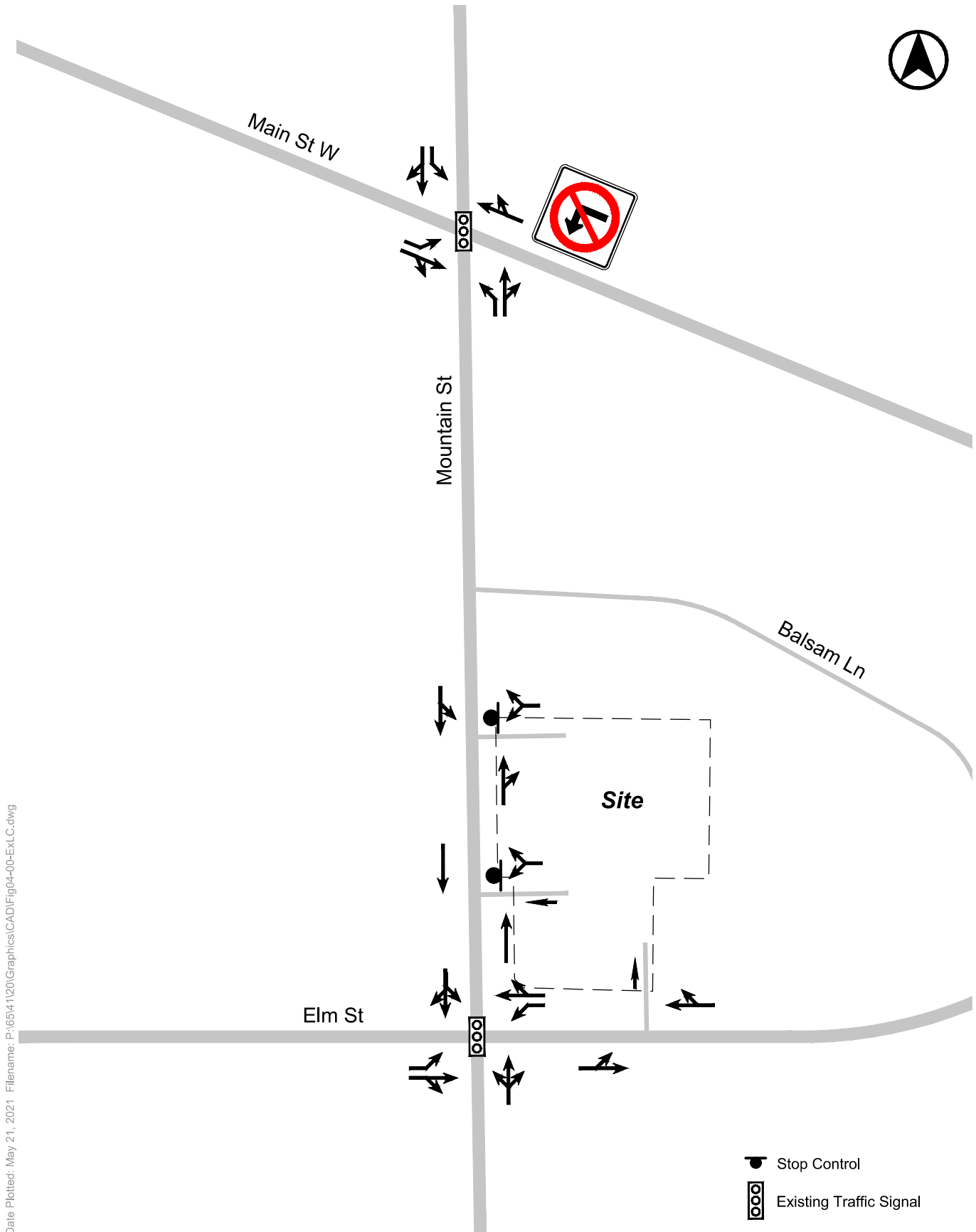
1. No parking is permitted anytime
2. Parking is permitted: 1hr parking permitted Saturday to Wednesday 8 AM to 6 PM & Thursday to Friday 8 AM to 9 PM.





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**FIGURE 3 EXISTING AREA ROAD NETWORK**



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**FIGURE 4 EXISTING LANE CONFIGURATION AND TRAFFIC CONTROL**

## 3.2 AREA TRANSIT NETWORK

### 3.2.1 National Transit Facilities

The Grimsby VIA Rail Station located north of the site approximately a 2 minute drive or a 3 minute cycling ride from the site. The station is on the Toronto – Niagara Falls – New York Line. This train service accesses this station twice a day (once in the morning and in the afternoon).

### 3.2.2 Regional Transit Facilities

Regional transit facilities in the vicinity of the site are serviced from the Grimsby GO Bus Stop at the intersection of Casablanca Boulevard / Queen Elizabeth Parkway (QEW). This stop is serviced by the 12 bus (Niagara Falls to Toronto). This bus service runs all day in both directions during the weekdays and weekends having a one hour headway. This stop is located 3.4 kilometres (or a 5 minute drive) from the site.

As part of the Niagara Falls Rail Service Extension plan proposed by Metrolinx a new Grimsby GO Transit Station is being proposed as part of these plans. This station is part of four new Stations that are being proposed and would expend the Lakeshore West Rail line which would allow for continuous two-way rail service to Niagara Falls and Toronto.

### 3.2.3 Local Transit Facilities

The Niagara Region Transit announced on August 17<sup>th</sup>, 2020 that they have launched a transit solution that is affordable, efficient and accessible for the Town of Grimsby. This transit solution is an on-demand a ride-share service that allows for residents to book a trip to schedule a trip within the Town of Grimsby and within the Niagara Region. These services can also be used to provide local transit connections to existing and future GO Transit facilities.

The existing and future area transit context is illustrated in **Figure 5**.

## 3.3 AREA PEDESTRIAN & CYCLING NETWORK

Pedestrian sidewalks exist on all streets in the vicinity of the site, while some informal cycling facilities exist along portions of Main Street to the east and west of the site, and along Mountain Street to the south of the site. In addition, there are a number of multi-use path routes in the vicinity of the site, which provides an east – west connection between the Hamilton and Niagara Region. These routes include:

### **Bruce Trail**

A portion of the Bruce Trail passes through the Town of Grimsby. The closest entrance to the site is within Beamer Memorial Conservation area, approximately 300 metres south of the site along Mountain Street.

The Bruce Trail is a hiking trail in the southern Ontario that runs along the Niagara Escarpment from Niagara to Tobermory. The main trail comprised of approximately 910 km of length in addition there are more than 400 km of side trails. This trail system is among the longest and oldest marked hiking trails in Canada.



### **Forty Mile Creek Side Trail**

This trail is a walking trail through downtown Grimsby this is composed of approximately 1.7 km of trail length that connects to both the Bruce Trail and the Waterfront Trail. Access to this trail located to the west of the site off of Elm Street and is within a 1 minute bicycle ride or 2 minute walk from the site.

### **Great Lakes Waterfront Trail**

The Great Lakes Waterfront trail is a cycling trail that is over 3,600 km in length, and is comprised of both on-road and off-road facilities. This trail extends along the waterfront from the Ontario / Quebec border in the east and extends to Sault St. Marie in the west.

In the vicinity of the site, entrance to the trail is at Olive Street / Elizabeth Street, 1.2 km away from the site or a 6 minute bicycle ride.

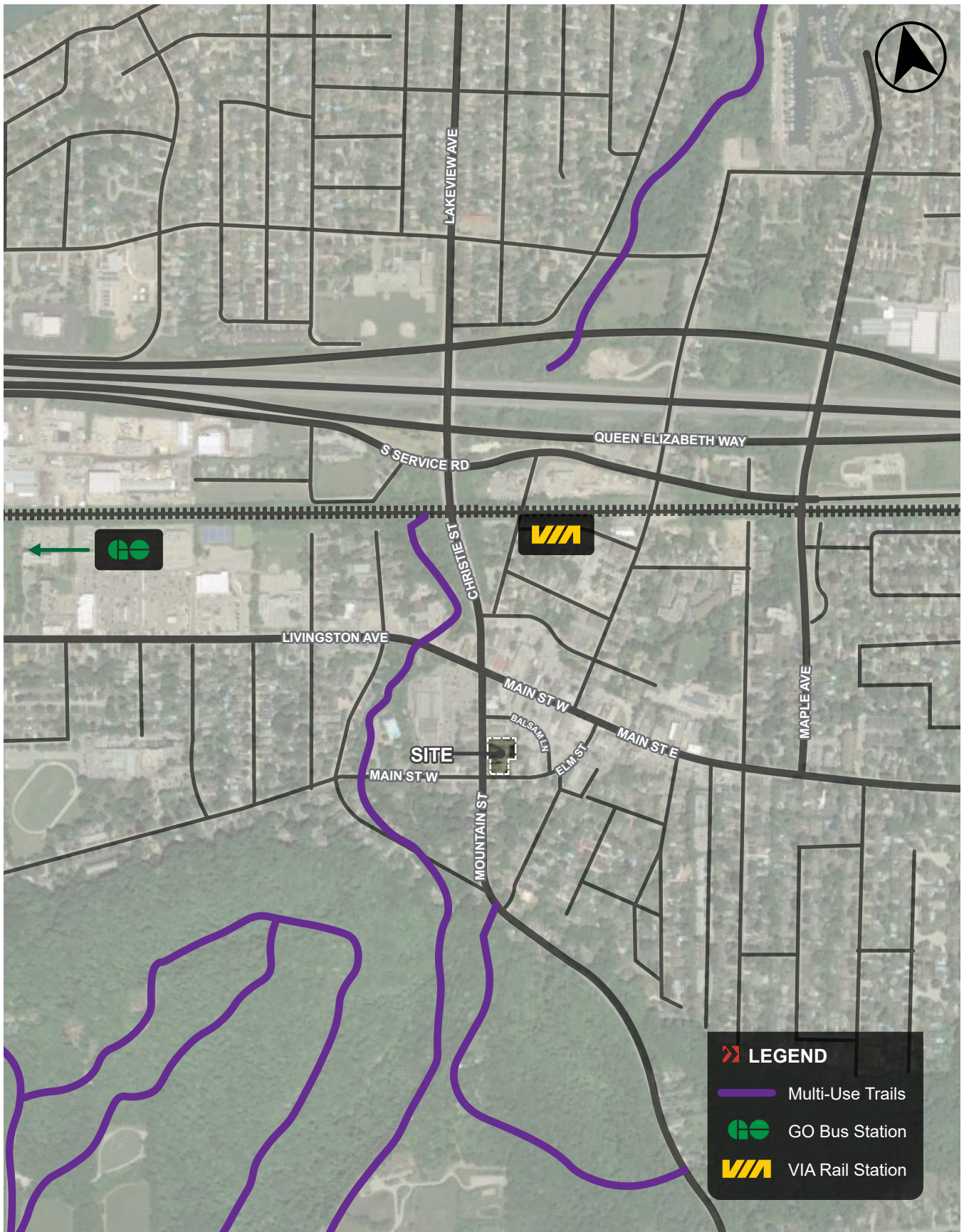
### **Greenbelt Cycle Route**

The greenbelt cycling route includes 475 km of signed routings across Southern Ontario from Niagara to Northumberland. In vicinity of the site the bicycle route is along Ridge Road East and can be accessed off of Mountain Road which is 4 minute bicycle ride from the site.

The existing cycling routes and walking trails are illustrated **Figure 5**.







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**FIGURE 5 EXISTING TRANSIT, PEDESTRIAN AND CYCLING CONTEXT**

## 4.0 TRAVEL CHARACTERISTICS IN THE AREA

The Site is located in the Downtown Grimsby area in the Town of Grimsby and is in close proximity to a transit services and cycling links provide a variety of non-automobile transportation options for area residents and visitors.

A review of travel characteristics provided by the 2016 Transportation Tomorrow Survey (TTS) for residents living in the area travelling to the area for work confirms that a high proportion of travel is currently undertaken using automotive means. The following 2001 TTS Niagara Region zone has been used to apply existing area travel characteristics for the proposed development.

Mode share characteristics for resident (home-based) travel during the weekday morning and afternoon peak periods is illustrated in **Table 2** for the peak direction for work based travel. The detailed TTS queries are attached in **Appendix C**.

**TABLE 2 AREA TRAVEL MODE SPLIT**

Direction	Inbound	Outbound
Auto (Driver)	73%	75%
Auto (Passenger)	22%	20%
Transit	1%	0%
Cycle	0%	0%
Walk	4%	5%
<b>Total</b>	<b>100%</b>	<b>100%</b>

Notes:

1. 2001 TTS Zones in Niagara Region are not identical to those used from 2006 onwards. An approximately equal area was used.



## 5.0 PARKING

BA Group has undertaken a review of the vehicular parking aspects of the proposed development recognizing the area context and readily available alternative transportation options. The following are reviewed:

- A review of the Zoning By-law parking requirements for the proposed development;
- A review of the proposed parking supply for the development as planned; and,
- A review of the adequacy of the proposed parking supply for the proposed development.

The below section sets out the parking standards applicable to the proposed development.

### 5.1 ZONING BY-LAW 14-45 PARKING REQUIREMENTS

The site is subject to the requirements of the Town of Grimsby Zoning By-law 14-45. A summary of the total parking requirement based on the requirements of By-law 14-45 is outlined below in **Table 3**.

Application of the parking supply requirements of Town of Grimsby Zoning By-law 14-45 to the proposed development would require a parking the provision of 127 spaces, comprised of 93 resident spaces and 34 non-residential / residential visitor parking spaces.

**TABLE 3 ZONING BY-LAW 14-45 PARKING REQUIREMENTS**

Building Use	Units / GFA (m <sup>2</sup> )	Parking Rate	Parking Requirement
<b>Resident</b>			
Residential Dwelling Unit (Apartment Building)	74 units	1.25 spaces / unit	93 spaces
<b>Residential Sub-Total</b>			<b>93 spaces</b>
<b>Residential Visitor</b>			
Residential Visitor	74 units	0.25 spaces / unit	19 spaces
<b>Non-Residential</b>			
Community Hub <sup>3</sup>	275 m <sup>2</sup>	1.00 space / 30 m <sup>2</sup> GFA	10 spaces
Retail	187 m <sup>2</sup>	1.00 space / 28 m <sup>2</sup> GFA	7 spaces
Exception 115 of Zoning By-law 14-45	--	--	- 2 spaces
<b>Non-Residential / Residential Visitor Sub-Total</b>			<b>34 spaces</b>
<b>Total</b>			<b>127 spaces</b>

Notes:

1. Site statistics are based upon site plans prepared by SvN Architects, dated May 25<sup>th</sup>, 2021.
2. Vehicular parking calculations resulting in a fraction have been rounded up to the nearest whole number in accordance with the requirements outlined in Section 5.2 of the Town of Grimsby Zoning By-law 14-45.
3. Community Hub uses are not defined in the By-law as such the all other use rate as been adopted for the site.



## 5.2 PROPOSED PARKING STANDARDS

It is proposed to adopt the non-residential parking standards as outlined in the prevailing Zoning By-law 14-45 but adopt reduced the residential visitor and residential tenant parking standards. Reduced residential visitor and tenant parking standards have been adopted based upon the review of other minimum parking standards across the GTA and the recent transit improvements within the Niagara Region. The adopted / recommended minimum parking standards for the proposed development are summarized in **Table 4**.

In addition, the Town of Grimsby takes into account time of day shared parking provisions for sites within Mixed-Use Zones. Given that the site is located within the Downtown Intensification area in the Town of Grimsby's Official Plan (2018) and the fact that the proposed development is comprised of mixed-uses following the redevelopment of the site, it is proposed to adopt shared parking provisions and are also summarized in **Table 4**. Application of these proposed minimum parking rates to the proposed development are provided in **Table 5**.

**TABLE 4 ADOPTED MINIMUM PARKING RATES**

Uses	Minimum Parking Rates (Before Sharing)	Parking Requirements Based Upon Time of Day Shared Parking Provisions		
		Morning	Afternoon	Evening
Residential Dwelling Uses (Apartment Building)	1.0 spaces / unit	80%	80%	100%
Residential Visitor Uses	0.15 spaces / unit	0%	35%	100%
Community Hub Uses	1.0 space / 30 m <sup>2</sup> GFA	100%	100%	100%
Retail Uses	1.0 space / 28 m <sup>2</sup> GFA	40%	100%	90%

**TABLE 5 MINIMUM PARKING REQUIREMENTS BASED UPON ADOPTED PARKING RATES**

Land Use		Minimum Before Sharing		Parking Requirements Based Upon Time of Day Shared Parking Provisions		
		Parking Rates	Parking Supply	Morning	Afternoon	Evening
Residential Uses	Residential Dwelling Uses (74 units)	1.0 sps / unit	74 spaces	60 spaces (80%)	60 spaces (80%)	74 spaces (100%)
	Residential Visitor Uses (74 units)	0.15 sps / unit	11 spaces	0 spaces (0%)	4 spaces (35%)	11 spaces (100%)
Non-Residential Uses	Community Hub Uses (275 m <sup>2</sup> )	1.0 sps / 30 m <sup>2</sup> GFA	10 spaces	10 spaces (100%)	10 spaces (100%)	10 spaces (100%)
	Retail Uses (187 m <sup>2</sup> )	1.0 sps / 28 m <sup>2</sup> GFA	5 spaces	2 spaces (40%)	5 spaces (100%)	4 spaces (90%)
	Exception 115 of Zoning By-law 14-45	- 2 spaces				
<b>Total Parking Requirements</b>			<b>100 sps</b>	<b>72 spaces</b>	<b>80 sps</b>	<b>99 spaces</b>



The proposed redevelopment site includes a total of 100 parking spaces (excluding the two parking spaces provided within the adjacent public parking lot), including 74 residential and 26 resident visitor / non-residential parking spaces. Which meets the above noted minimum parking requirements as noted in **Table 5**. The appropriateness of these parking supply ratios are provided in **Section 4.3**.

### 5.3 APPROPRIATENESS OF REDUCED RESIDENTIAL PARKING STANDARDS

As noted above, it is proposed to adopt a reduced residential parking supply to 74 parking spaces (or an effective parking supply ratio of 1.0 spaces / unit) this supply ratio is reduced relative to the prevailing Zoning By-law 14-45 of 93 parking spaces or a parking supply ratio of 1.25 spaces / unit. It is our opinion that a reduced residential parking supply is considered appropriate at this location based on the following:

- a comparison of other minimum parking ratios for a selection of municipalities in the GTA within a downtown area context in each of the Town and/or City; and,
- the increase level of transit that is afforded in the vicinity of the site with the newly introduced local transit system and future regional transit improvements occurring within the vicinity of the site.

#### 5.3.1 Comparison of Parking Ratios Across the GTA

**Table 6** provides a summary of comparable residential parking ratios at municipalities across the GTA area that have a similar transportation context as the proposed development.

**TABLE 6 SUMMARY OF COMPARABLE GTA ZONING BY-LAW STANDARDS**

	Resident Parking Rates			Applicable Zoning By-law
City of Burlington	1.0 spaces / unit			By-law 2020 (Downtown)
City of Mississauga	1.0 spaces / unit			By-law 0225-2007 (City Centre)
City of Brampton	0.5 spaces / unit			By-law 270-2004 (Central Area / Downtown)
City of Hamilton	Units < 50 m <sup>2</sup>	1 m <sup>2</sup> to 12 m <sup>2</sup> 13 m <sup>2</sup> +	0.0 sps / unit 0.3 sps / unit	By-law 05-200 (Transit Oriented Corridor Zone)
	Units > 50 m <sup>2</sup>	1 m <sup>2</sup> to 12 m <sup>2</sup> 13 m <sup>2</sup> to 50 m <sup>2</sup> 51 m <sup>2</sup> +	0.0 sps / unit 0.5 sps / unit 0.7 sps / unit	
	Blended		0.7 sps / unit	
City of St. Catharines	No Minimum			By-law 2013-283 (Downtown)
City of Kitchener	No Minimum			By-law 2019-051 (Urban Growth Ctr. / Downtown)
City of Vaughan	Studio		1.0 sps / unit	By-law 1-88 (VMC)
	1 – Bed 2 – Bed 3 - Bed		0.7 sps / unit 0.9 sps / unit 1.0 sps / unit	
	Blended		0.9 sps / unit	
City of Pickering	0.8 spaces / unit			By-law 7553-17 (City Centre)



These comparable residential parking standards within other GTA municipalities range between having no minimum parking standards to a parking standard of 1.0 spaces / unit. The Town of Grimsby's residential parking rate of 1.25 spaces / unit is considered to be conservatively high therefore adopting a residential parking ratio of 1.0 spaces per unit is considered to be more appropriate relative to the parking standard trends that are observed in other municipalities within the GTA.

### **5.3.2 Non-Auto Based Site Context**

#### **Transit Summary**

The level of transit accessibility provided in the area offers non-automobile travel opportunities for both residents and visitors. In 2020, Niagara Region announced a future transit solution of on-demand ride-share service that allows Town of Grimsby residents to schedule a trip anywhere within the Town or Region including to nearby transit stations.

In addition, there are future transit improvements to the Grimsby GO Station being proposed as part of the Niagara Falls Rail Service Extension Plans.

#### **Pedestrian & Cycling Summary**

The site is also well served by bicycle and pedestrian infrastructure through a significant number of multi-use path routes within close proximity to/from the site. The available routes include, the Bruce Trail, Forty Mile Creek Side Trail, Great Lakes Waterfront Trail, and the Greenbelt Cycle Route.

#### **Overall Summary**

Considering the above, the proposed development is situated within walking distance of numerous recreational, commercial, retail, and entertainment amenities and destinations across the Grimsby downtown area. It is also well located relative to cycling and transit infrastructure with connections throughout Niagara Region and to / from Toronto and the site.

### **5.3.3 Summary**

Given the review of other parking standards in other areas in the GTA and the extensive non-auto based context a reduced parking supply ratio of 1.0 spaces / unit or 74 parking spaces is considered to be appropriate.

## **5.4 APPROPRIATENESS OF REDUCED RESIDENTIAL VISITOR PARKING STANDARDS**

As noted above, it is proposed to adopt a reduced residential visitor parking supply to 15 parking spaces (or an effective parking supply ratio of 0.15 spaces / unit) this supply ratio is reduced relative to the prevailing Zoning By-law 14-45 of 93 parking spaces or a parking supply ratio of 0.25 spaces / unit. It is our opinion that a reduced residential parking supply is considered appropriate at this location based on the following a comparison of other minimum parking ratios for a selection of municipalities in the GTA within a downtown area context in each of the municipalities.



### 5.4.1 Comparison of Parking Ratios Across the GTA

**Table 6** provides a summary of comparable residential visitor parking ratios at municipalities across the GTA area that have a similar transportation context as the proposed development.

**TABLE 7 SUMMARY OF COMPARABLE GTA ZONING BY-LAW STANDARDS**

	Resident Visitor Parking Rates	Applicable Zoning By-law
City of Burlington	0.25 spaces / unit	By-law 2020 (Downtown)
City of Mississauga	0.15 spaces / unit	By-law 0225-2007 (City Centre)
City of Brampton	0.10 spaces / unit	By-law 270-2004 (Central Area / Downtown)
City of Hamilton	No Minimum	By-law 05-200 (Transit Oriented Corridor Zone)
City of St. Catharines	No Minimum	By-law 2013-283 (Downtown)
City of Kitchener	No Minimum	By-law 2019-051 (Urban Growth Ctr. / Downtown)
City of Vaughan	0.15 spaces / unit	By-law 1-88 (VMC)
City of Pickering	0.15 spaces / unit	By-law 7553-17 (City Centre)

These comparable residential visitor parking standards other GTA municipalities range between having no minimum parking standards to a parking standard of 0.25 spaces / unit. The Town of Grimsby's residential parking rate of 0.25 spaces / unit is considered to be conservatively high by some margin therefore adopting a reduced residential visitor parking ratio of 0.15 spaces per unit is considered to be more appropriate relative to the parking standard trends that are observed in other municipalities within the GTA.

### 5.4.2 Summary

Based upon the above, although it is proposed to adopt reduced residential and residential visitor parking standards for the proposed development, based upon the site context, future transit improvements and a review of other municipalities in the GTA area are considered appropriate.



## 6.0 LOADING SUPPLY

### 6.1 ZONING BY-LAW 14-45 LOADING REQUIREMENTS

Application of the loading requirements outlined in the Town of Grimsby Zoning By-law 14-45 to the proposed development statistics, results in a requirement of one (1) loading space.

A summary of the minimum loading requirements for the proposed development is provided in **Table 8**.

**TABLE 8 ZONING BY-LAW 14-45 LOADING REQUIREMENTS**

Building Use	Proposed GFA (m <sup>2</sup> )	Range of GFA (m <sup>2</sup> )	Loading Space Requirement
Commercial (Community Hub + Retail)	462	251 – 2,350	1 space
<b>Total Loading Space Requirement</b>			<b>1 space</b>

Notes:

1. Site statistics are based upon site plans prepared by SvN Architects, dated May 25<sup>th</sup>, 2021.

### 6.2 LOADING FACILITIES

Following the above-listed Zoning By-law loading requirement, the proposed development plan incorporates one (1) loading space at-grade, in a designated loading area. The space is provided to facilitate loading/unloading, moving activity, delivery and refuse collection needs of the building.

Refuse and recycling facilities for both residential and non-residential uses are provided within the loading area. The proposed development refuse/recycling collection will be serviced by a private contractor and will not seek the Regional Municipality of Niagara Waste Collection services.

### 6.3 LOADING SUMMARY

The proposed loading supply of one (1) loading space meets the standards outlined in Town of Grimsby Zoning By-law 14-45.





## 7.0 BICYCLE PARKING SUPPLY

The Town of Grimsby Zoning By-law 14-45 bicycle parking standards have been applied to the site's proposed statistics and are summarized in **Table 9**.

**TABLE 9 ZONING BY-LAW 14-45 BICYCLE PARKING REQUIREMENTS**

Building Use	Bicycle Parking Standard	Required Bicycle Spaces
Apartment Building (74 units)	0.3 spaces per unit	23 spaces
Community Hub	7% of required vehicle parking	2 spaces
Retail		
<b>Total Bicycle Parking Requirement</b>		<b>25 spaces</b>

Notes:

1. Site statistics are based upon site plans issued by SvN Architects, dated May 25<sup>th</sup>, 2021.

Application of the Town of Grimsby Zoning By-law 14-45 bicycle parking standards to the proposed development results in a required provision of 25 bicycle parking spaces, 23 spaces for residential tenant and visitor use and two (2) spaces for non-residential uses.

## 7.1 PROPOSED BICYCLE PARKING SUPPLY AND FACILITIES

The development proposal includes a total of 84 bicycle parking spaces, including 74 residential and 10 non-residential bicycle parking spaces.

The proposed residential tenant and visitor use bicycle spaces are located on the first level of the building, in a secure bike room and close to the main entrance with convenient elevator access. The proposed non-residential bicycle spaces are located at-grade within a dedicated bicycle parking area.

The proposed bicycle parking supply facilities and supporting access arrangements, based upon the above, are appropriate and will adequately support the proposed non-residential development as planned.



## 8.0 TRAVEL DEMAND FORECASTS

### 8.1 EXISTING TRAFFIC VOLUMES

Due to the current COVID-19 pandemic, updated existing baseline counts have not been undertaken, nor would these counts be reflective of existing conditions. As a result, existing site driveway counts were not undertaken for this study.

Existing traffic volumes for vehicles, cyclists and pedestrians were established for the weekday morning and afternoon peak hour periods on the area street network based upon intersection traffic count information undertaken by Niagara Region. A summary of the turning movement count dates and sources is provided in **Table 10**. The turning movement counts are located in **Appendix D**.

**TABLE 10 TURNING MOVEMENT COUNT SUMMARY INFORMATION**

Intersections	Count Date	Conducted By
Mountain Street / Main Street	Tuesday, April 9 <sup>th</sup> , 2019	Niagara Region
Mountain Street / Elm Street		

Adopted existing area traffic volumes for the weekday morning and afternoon peak hour periods are illustrated in **Figure 6**.

### 8.2 BACKGROUND TRAFFIC VOLUMES

Background traffic growth forecasts are based solely on general corridor growth, as there are no planned developments near to the study area that would contribute additional traffic volumes.

#### General Corridor Growth

In accordance with the *Niagara Region Guidelines for Transportation Impact Studies (2012)*, a growth rate of 2% per year was applied to each corridor in the study area, including Main Street, Mountain Street, and Elm Street.

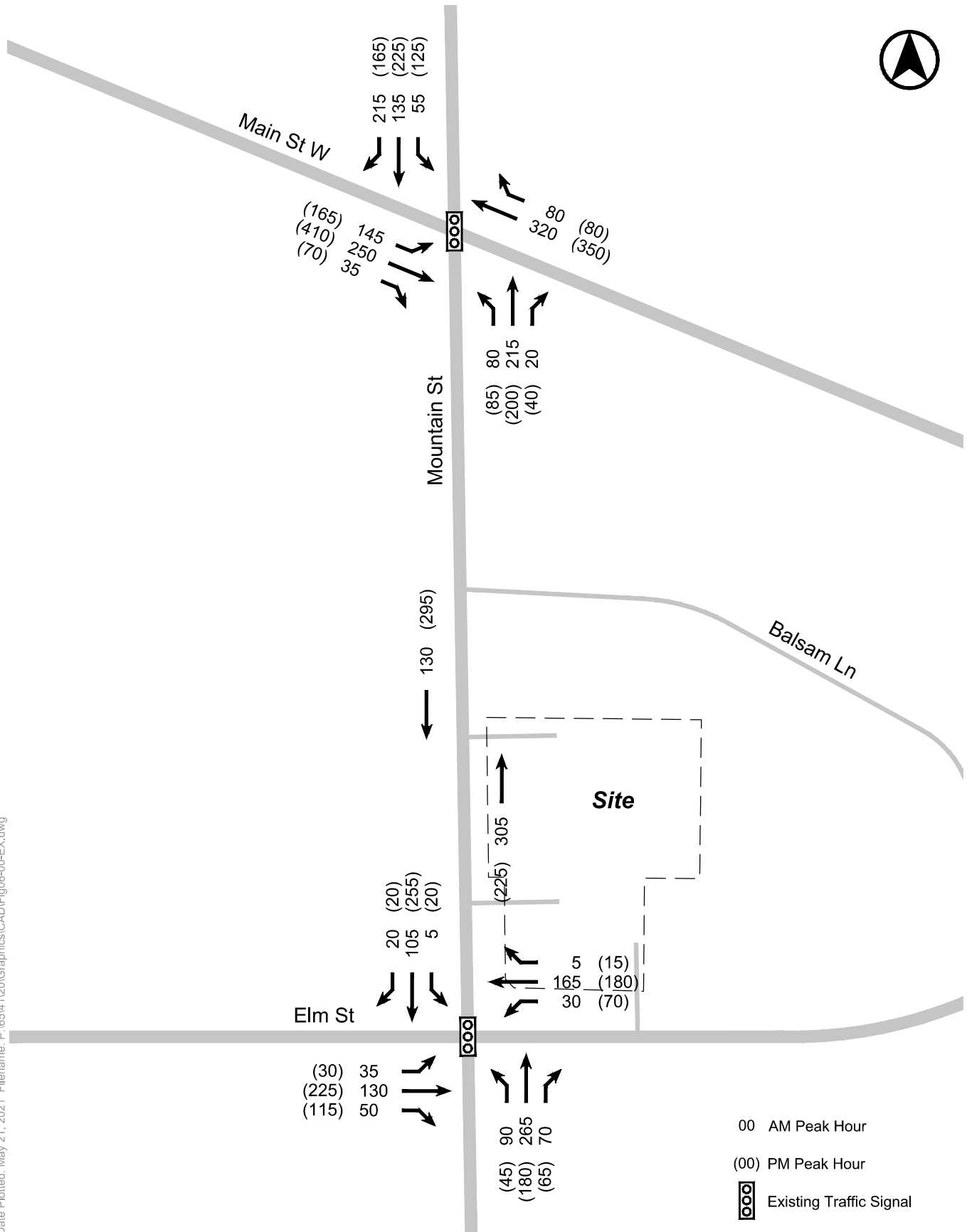
Corridor growth traffic allowances are illustrated in **Figure 7**.

#### Future Background Traffic Volumes

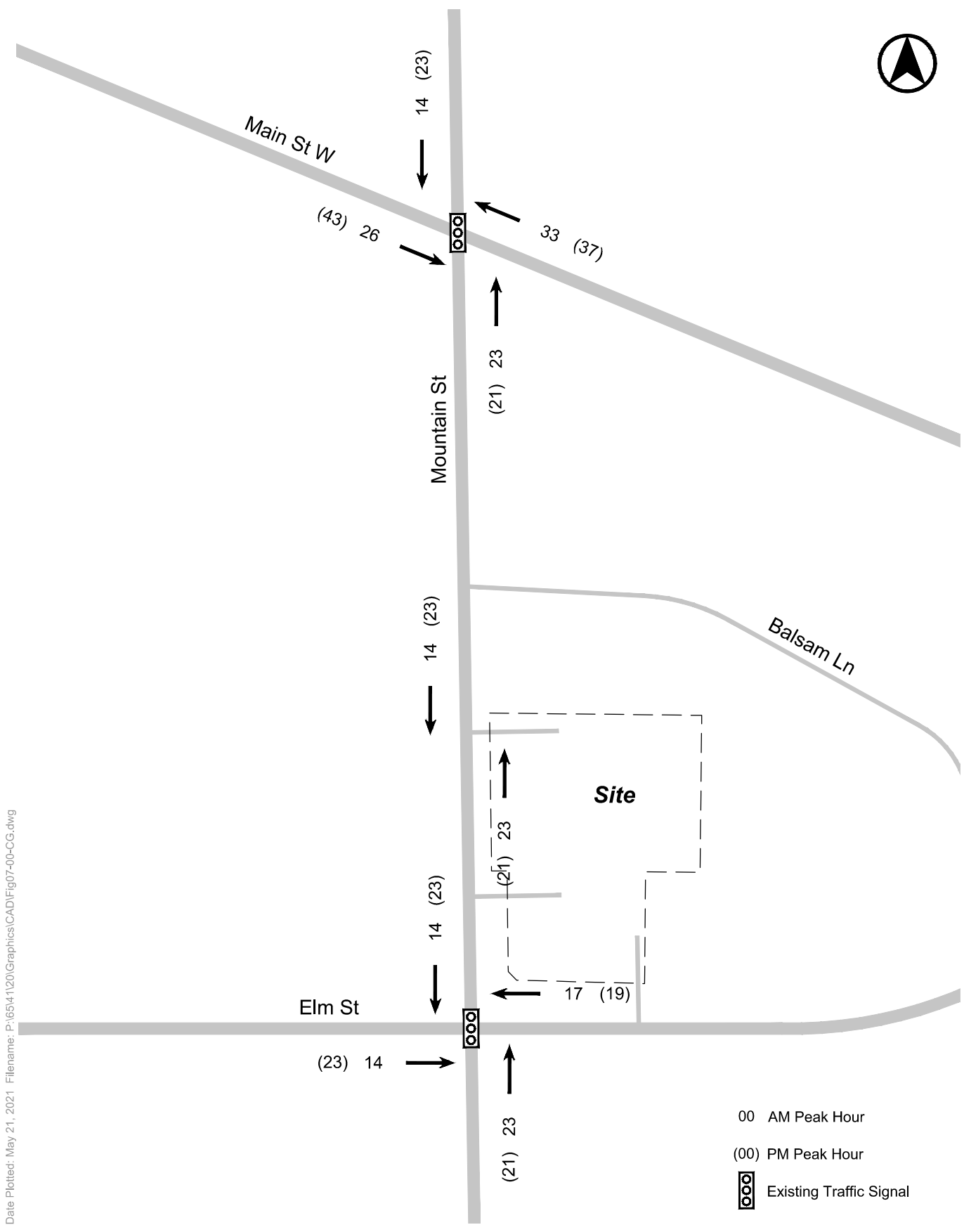
Future background traffic volumes are the sum of existing traffic and general corridor growth traffic allowances, and are illustrated for the weekday morning and afternoon peak hours in **Figure 8**.



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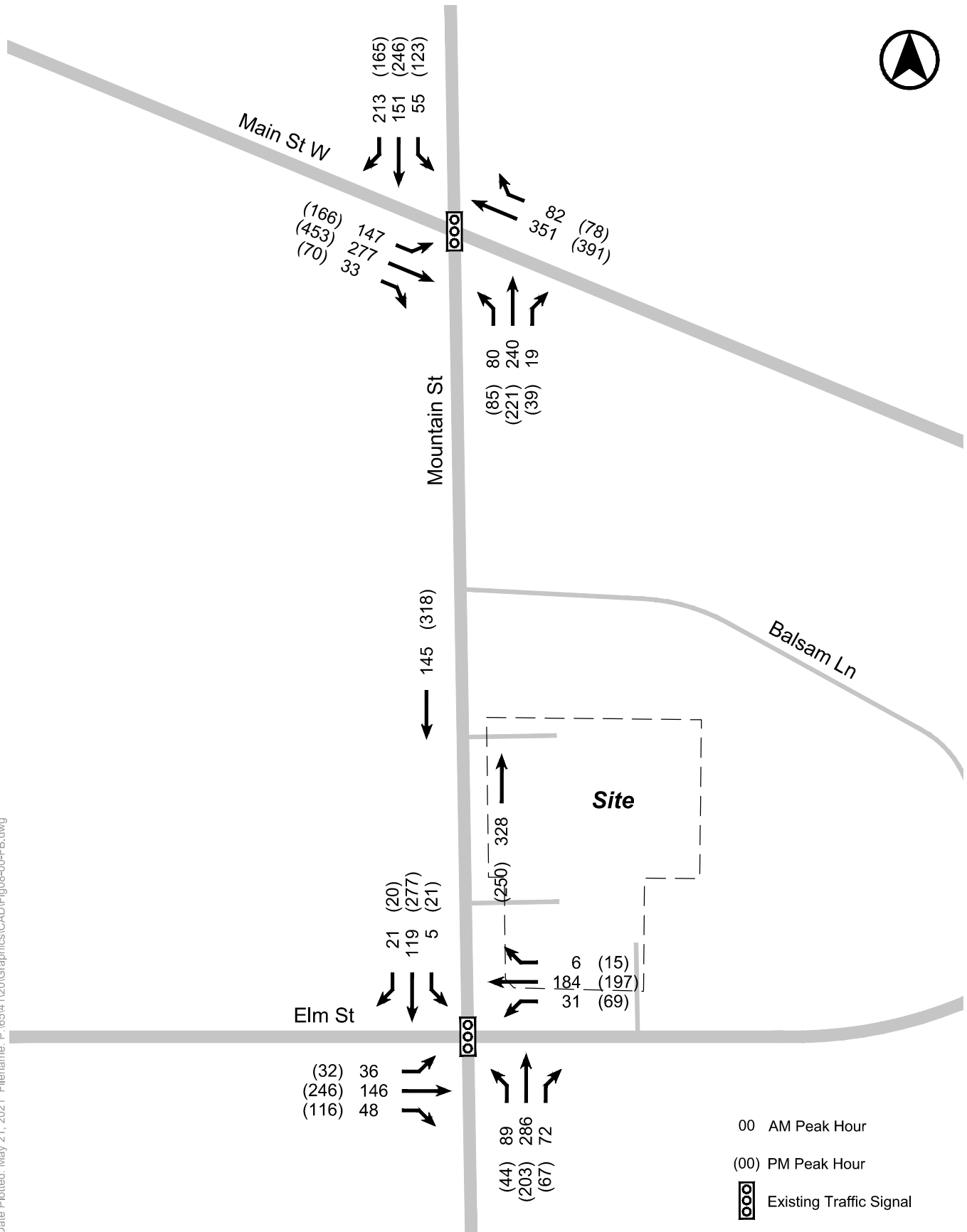
**FIGURE 6 EXISTING TRAFFIC VOLUMES**



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**FIGURE 7 CORRIDOR GROWTH VOLUMES**

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**FIGURE 8 FUTURE BACKGROUND TRAFFIC VOLUMES**

## 8.3 SITE TRAFFIC VOLUMES

### 8.3.1 Existing Site Traffic

The site is currently occupied by low-density commercial uses that are unlikely to generate substantial traffic during the weekday morning and afternoon peak hours. As such, no associated vehicle trips have been removed from the existing network during the weekday peak hours as part of this analysis. This represents a conservative approach for analysis purposes.

### 8.3.2 Site Vehicle Trips

Residential site vehicle trip generation rates are selected based upon ITE Trip Generation Manual (10<sup>th</sup> Edition) code 221 – Multifamily Housing (Mid-Rise). Non-residential trips during the peak hours are assumed to be associated with the retail component of the site, which is not expected to generate trips during the morning peak hour. A turnover rate of 2 vehicles per hour per retail parking space is used to conservatively estimate non-residential trips during the weekday afternoon peak hour.

**TABLE 11 SITE VEHICLE TRIPS**

	AM Peak Hour			PM Peak Hour		
	In	Out	2-Way	In	Out	2-Way
ITE Code 221 – Multifamily Housing (Mid-Rise)	0.09	0.27	0.36	0.27	0.17	0.44
<b>Residential Vehicle Trips (74 units<sup>1</sup>)</b>	<b>7</b>	<b>20</b>	<b>27</b>	<b>20</b>	<b>13</b>	<b>33</b>
Weekday Peak Hour Turnover Rate for Non-Residential Parking Spaces (vehicles/hour/space)	0	0	0	2	2	4
<b>Non-Residential Vehicle Trips (5 spaces<sup>2</sup>)</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>10</b>	<b>10</b>	<b>20</b>
<b>Total Site-Generated Vehicle Trips</b>	<b>7</b>	<b>20</b>	<b>27</b>	<b>30</b>	<b>23</b>	<b>53</b>

Notes:

1. Site statistics are based upon site plans prepared by SvN Architects, dated May 25<sup>th</sup>, 2021.
2. Number of spaces is based on the afternoon parking requirements for retail uses outlined in Table 5.

On this basis, the site will generate in the order of 27 and 69 two-way vehicle trips during the weekday morning and afternoon peak hours, respectively.

### 8.3.3 Trip Distribution and Assignment

The residential and non-residential travel patterns for site generated traffic have been developed based on a review of the peak period peak direction traffic patterns derived from the 2016 TTS data set for the 2006 traffic zones 6008-6010 and 6014-6017. Detailed TTS queries are attached in **Appendix C**.

**Table 12** summarizes the distribution of the inbound and outbound residential site traffic adopted for the purpose of this analysis.



**TABLE 12 SITE TRIP DISTRIBUTION**

Direction	Residential Trips <sup>1</sup>		Non-Residential Trips <sup>2</sup>	
	Inbound	Outbound	Inbound	Outbound
North - Mountain Street	54%	57%	50%	32%
South – Mountain Street	3%	3%	4%	8%
East – Main Street	0% <sup>3</sup>	9%	0% <sup>3</sup>	21%
West – Main Street	13%	12%	10%	7%
East – Elm Street	20%	9%	28%	21%
West – Elm Street	10%	10%	8%	11%

Notes:

1. For residential traffic, the inbound distribution is based on weekday afternoon peak hour, while the outbound distribution is based on weekday morning peak hour.
2. Inbound and outbound distributions for non-residential traffic are based on weekday afternoon peak hour.
3. No traffic is assigned to approach from the east on Main Street, since westbound left-turn movements are restricted at Mountain Street / Main Street.

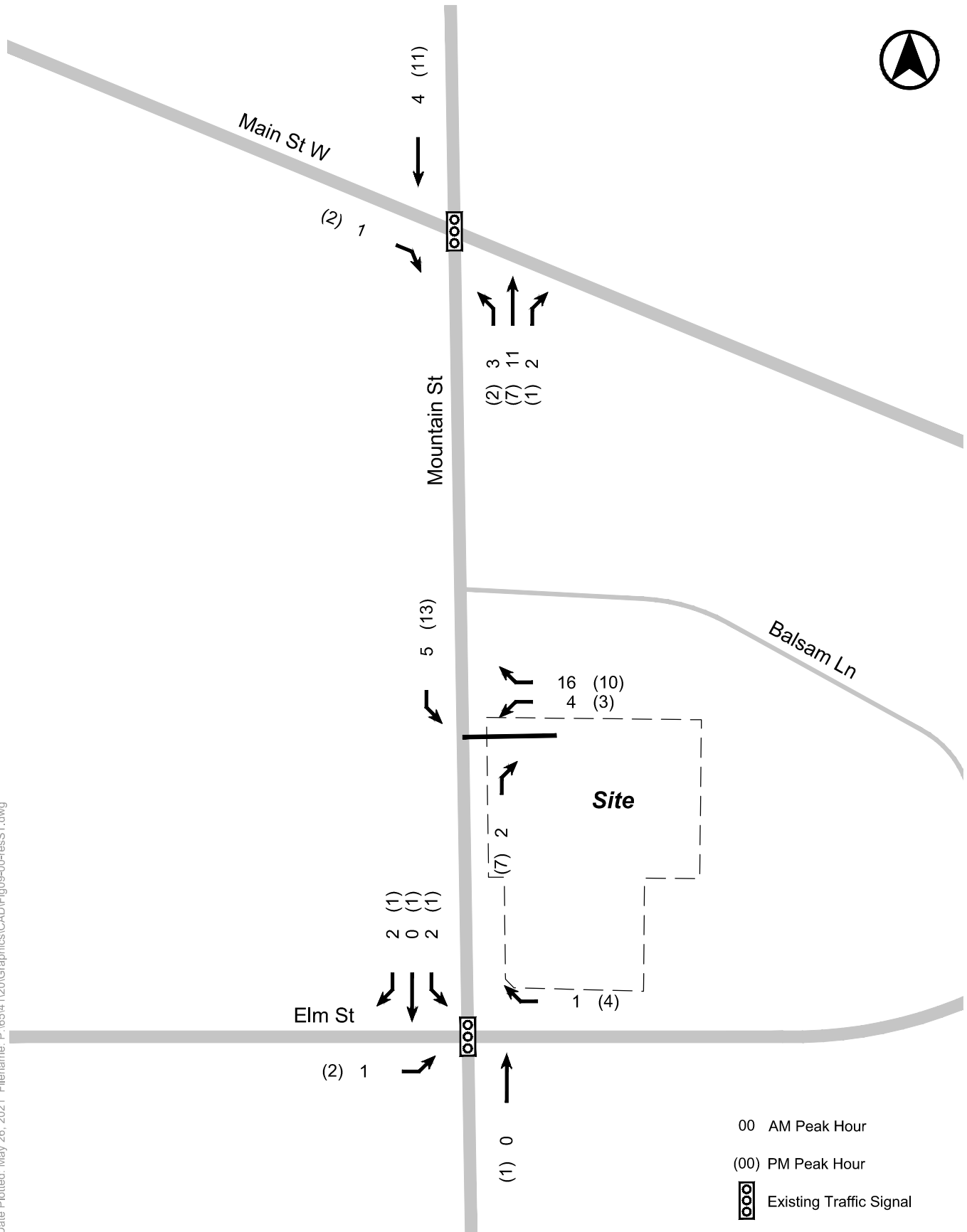
New site traffic has been assigned to the area street network based on the above distribution. Residential and non-residential volumes are illustrated on **Figure 9** and **Figure 10**, respectively. Total site traffic volumes are illustrated on **Figure 11**.

## 8.4 FUTURE TOTAL TRAFFIC VOLUMES

Future total traffic volumes represent the sum of future background traffic volumes and total new site traffic volumes and are illustrated in **Figure 12**.



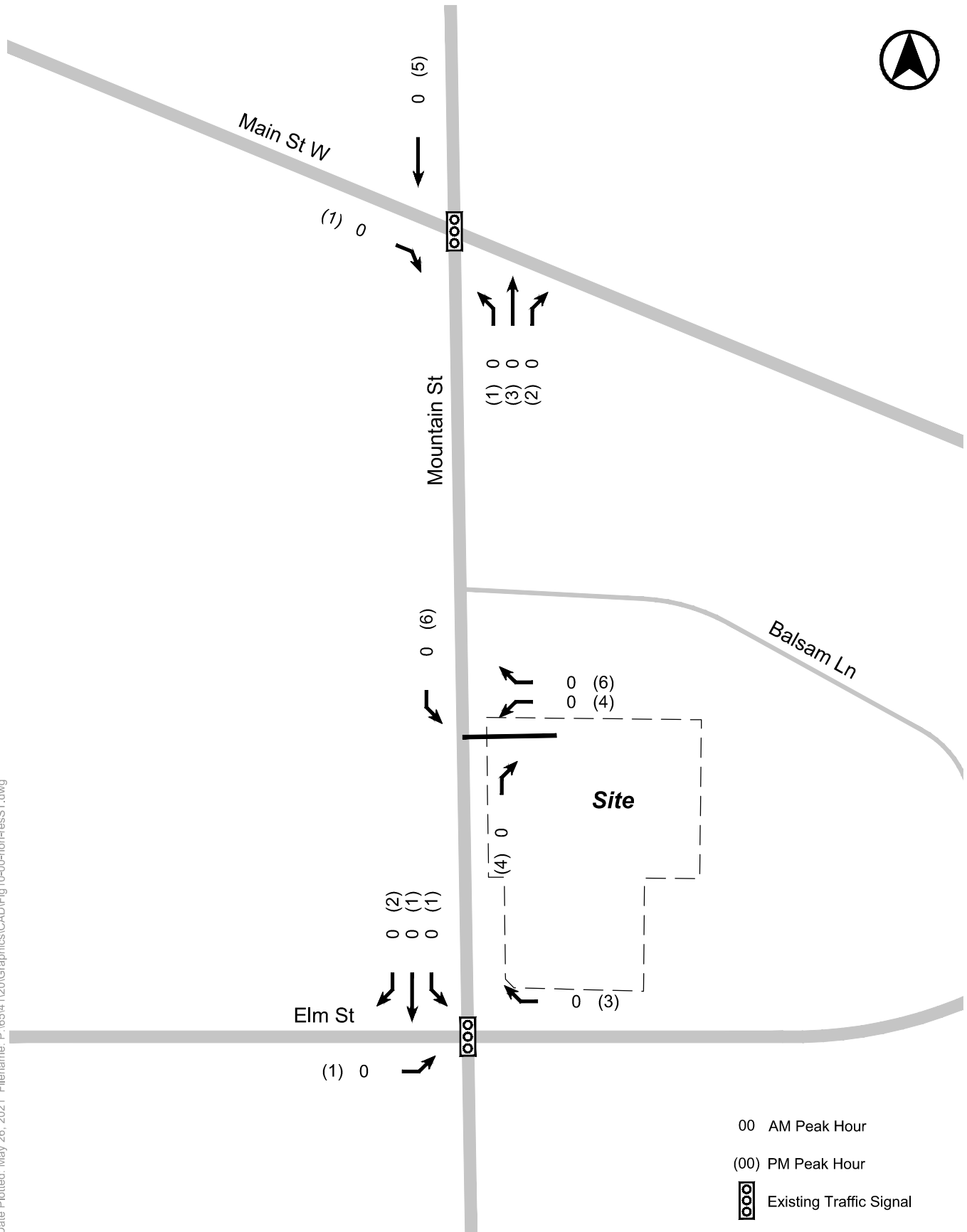
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**FIGURE 9 RESIDENTIAL SITE TRAFFIC VOLUMES**

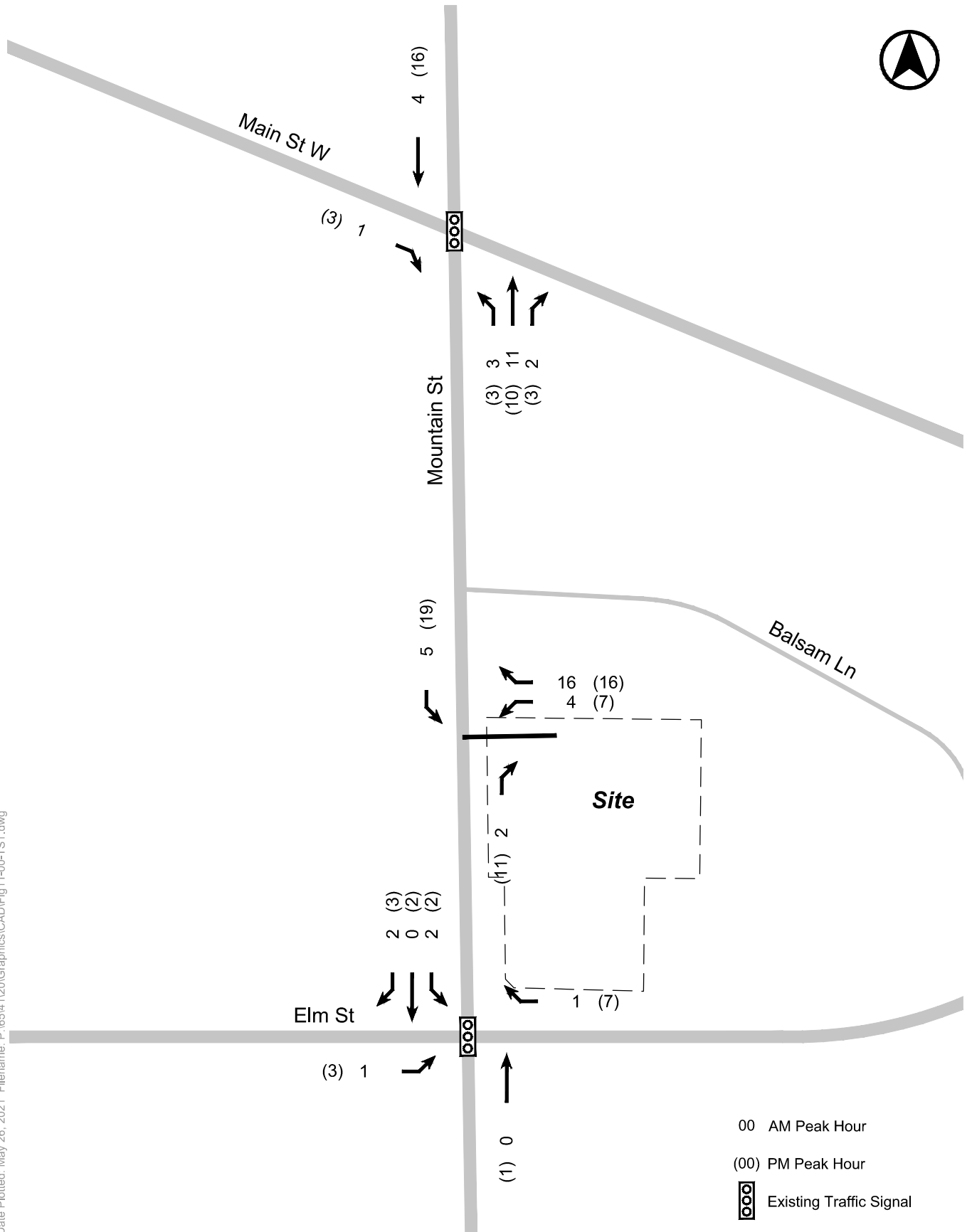


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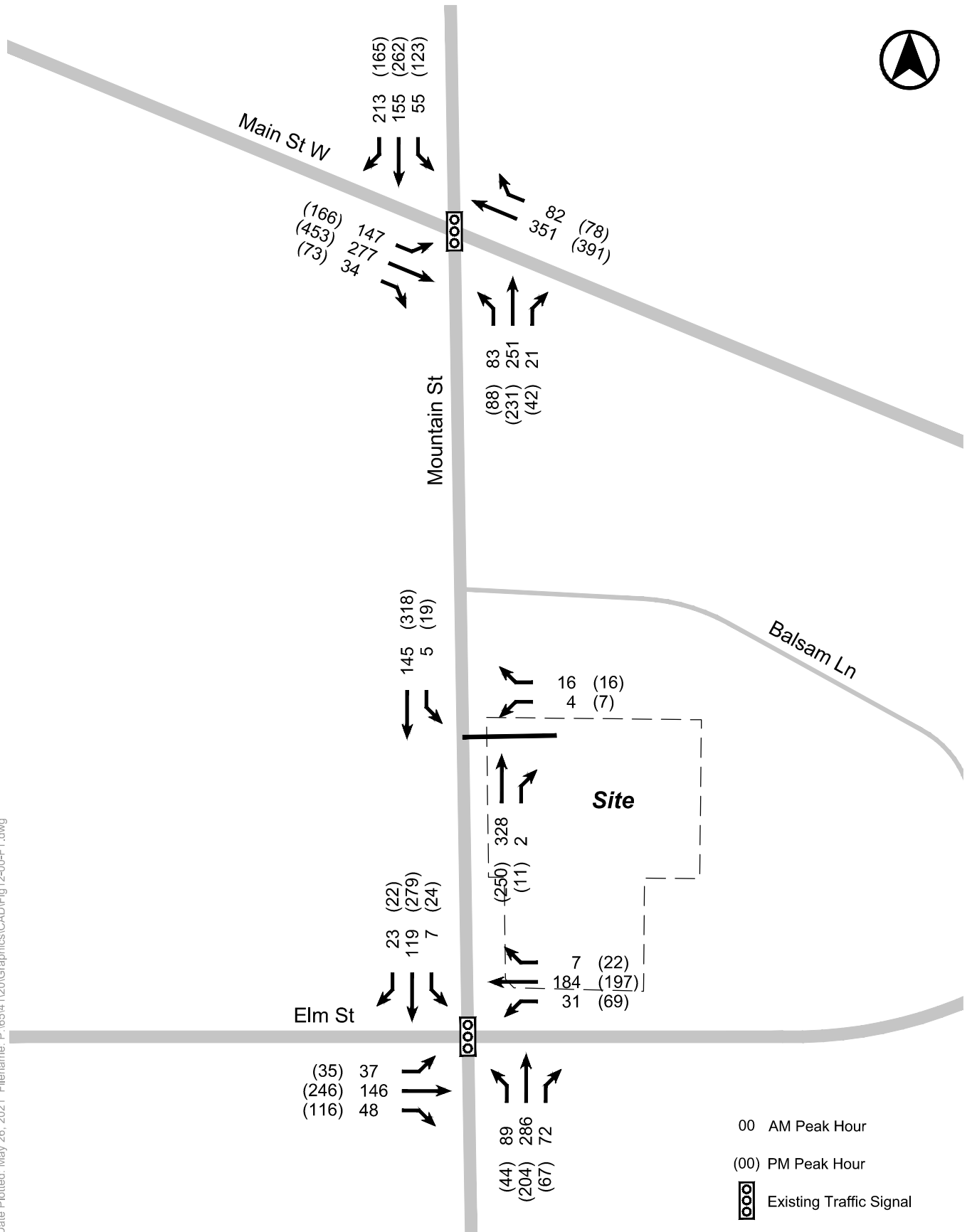
**FIGURE 10 NON-RESIDENTIAL SITE TRAFFIC VOLUMES**

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**FIGURE 11 TOTAL SITE TRAFFIC VOLUMES**

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**FIGURE 12 FUTURE TOTAL TRAFFIC VOLUMES**

## 9.0 TRAFFIC OPERATIONS ANALYSIS

### 9.1 ANALYSIS METHODOLOGY

Intersection capacity analysis has been completed using Synchro Version 11 and the Highway Capacity Manual (HCM) methodology.

For signalized intersections, the volume-to-capacity ratio ( $v/c$ ) is an indicator of the capacity utilization for the key movements in the intersection. A  $v/c$  of 1.0 indicates that certain governing traffic movements through the intersection are operating at or near maximum capacity. The primary overall level of service (LOS) indicator is delay, both on individual movements and expressed as an average for all vehicles processed. Many busy urban intersections operate at LOS D to E, which reflect average (control) delays in the range of 35 to 80 seconds.

For unsignalized intersections, level of service (LOS) characterizes operational conditions for key movements in terms of delay within the traffic stream. LOS A represents a good level of service with short delays. LOS F represents a poor level of service with long delays. The volume to capacity ratio ( $v/c$ ) is an indicator of the capacity utilization for key movements at the intersection and resultant residual capacity potential.

### 9.2 ANALYSIS PARAMETERS

Existing signal timings, phasing plans, and cycle lengths were obtained from Niagara Region. These parameters were maintained for analysis of existing and future conditions. Existing signal timings plans are provided in **Appendix E**.

#### Heavy Vehicle Assumptions

Heavy and medium truck percentages incorporated into the analysis were based upon information provided as part of intersection turning movement counts.

#### Saturation Flow Assumptions

The *Niagara Region Guidelines for Transportation Impact Studies* (2012) specify a base saturation flow rate of 1,750 passenger cars per hour of green time per lane (pcphgpl) for signalized and unsignalized intersections.

#### Lost Time Adjustments

The *Niagara Region Guidelines for Transportation Impact Studies* (2012) do not specify a lost time adjustment factor, but rather specify that a total lost time of 4 seconds be used where applicable. The default lost time adjustment of 0 seconds was assumed for all intersections in the analysis.

#### Peak Hour Factor

The *Niagara Region Guidelines for Transportation Impact Studies* (2012) specify that a default value of 0.92 should be used as the Peak Hour Factor (PHF) at an intersection. This value was thus used for all intersections in the analysis



## Lane Utilization Factors

Under existing conditions, default Synchro lane utilization factors were adopted, which take into consideration the distribution of individual lane usage within each movement group.

## 9.3 SIGNALIZED INTERSECTIONS

The intersection of **Mountain Street / Main Street** operates under actuated signal control with a maximum cycle length of 149.7 seconds during the morning and afternoon peak hour periods.

**Table 13** summarizes analysis results. Detailed analysis worksheets are provided in **Appendix F**.

**TABLE 13 MOUNTAIN STREET / MAIN STREET – CAPACITY ANALYSIS SUMMARY**

Movement	Existing		Future Background		Future Total	
	V/C	LOS	V/C	LOS	V/C	LOS
EBL	0.46 (0.55)	C (C)	0.49 (0.59)	C (D)	0.49 (0.59)	C (D)
EBTR	0.40 (0.64)	C (C)	0.44 (0.70)	C (C)	0.44 (0.70)	C (D)
WBTR	0.77 (0.84)	D (E)	0.83 (0.92)	E (E)	0.83 (0.92)	E (E)
NBL	0.33 (0.34)	C (C)	0.35 (0.36)	C (C)	0.36 (0.40)	C (D)
NBTR	0.48 (0.49)	D (D)	0.53 (0.54)	D (D)	0.56 (0.56)	D (D)
SBL	0.16 (0.35)	C (C)	0.17 (0.37)	C (C)	0.17 (0.38)	C (C)
SBTR	0.70 (0.79)	D (E)	0.74 (0.84)	D (E)	0.75 (0.88)	D (E)
<b>Overall</b>	<b>0.66 (0.76)</b>	<b>D (D)</b>	<b>0.71 (0.82)</b>	<b>D (D)</b>	<b>0.71 (0.83)</b>	<b>D (D)</b>

Notes:

1. xx (xx) – Weekday Morning Peak Hour (Weekday Afternoon Peak Hour).

Under existing conditions, the intersection operates with overall v/c ratios of 0.66 and 0.76 during the weekday morning and afternoon peak hours, respectively.

Under the future background conditions, the intersection is forecasted to operate with overall v/c ratios of 0.71 and 0.82 during the weekday morning and afternoon peak hours, respectively.

Under the future total traffic conditions, with the addition of site generated traffic, the intersection is forecasted to operate at overall v/c ratios of 0.71 and 0.83 during the weekday morning and afternoon peak hours, respectively. Compared to future background conditions, site traffic will have a marginal impact on the operations of the intersection.

The intersection of **Mountain Street / Elm Street** operates under actuated signal control with a maximum cycle length of 60.2 seconds during the morning and afternoon peak hour periods.

**Table 14** summarizes analysis results. Detailed analysis worksheets are provided in **Appendix F**.



**TABLE 14 MOUNTAIN STREET / ELM STREET – CAPACITY ANALYSIS SUMMARY**

Movement	Existing		Future Background		Future Total	
	V/C	LOS	V/C	LOS	V/C	LOS
EBL	0.09 (0.08)	B (B)	0.09 (0.08)	B (B)	0.09 (0.09)	B (B)
EBTR	0.27 (0.50)	B (B)	0.29 (0.54)	B (B)	0.29 (0.54)	B (B)
WBL	0.07 (0.22)	B (B)	0.08 (0.23)	B (B)	0.08 (0.23)	B (B)
WBTR	0.27 (0.29)	B (B)	0.29 (0.32)	B (B)	0.29 (0.33)	B (B)
NBLTR	0.86 (0.56)	C (B)	0.90 (0.60)	D (B)	0.91 (0.61)	D (B)
SBLTR	0.24 (0.53)	B (B)	0.27 (0.57)	B (B)	0.28 (0.58)	B (B)
<b>Overall</b>	<b>0.55 (0.53)</b>	<b>C (B)</b>	<b>0.58 (0.57)</b>	<b>C (B)</b>	<b>0.59 (0.57)</b>	<b>C (B)</b>

Notes:

- xx (xx) – Weekday Morning Peak Hour (Weekday Afternoon Peak Hour).

Under existing conditions, the intersection operates with overall v/c ratios of 0.55 and 0.53 during the weekday morning and afternoon peak hours, respectively.

Under the future background conditions, the intersection is forecasted to operate with overall v/c ratios of 0.58 and 0.57 during the weekday morning and afternoon peak hours, respectively.

Under the future total traffic conditions, with the addition of site generated traffic, the intersection is forecasted to operate at overall v/c ratios of 0.59 and 0.57 during the weekday morning and afternoon peak hours, respectively. Compared to future background conditions, site traffic will have a marginal impact on the operations of the intersection.

## 9.4 UNSIGNALIZED INTERSECTIONS

**Table 15** summarizes analysis results for the only unsignalized intersection in the study area, where the site driveway intersects with Mountain Street. Detailed analysis worksheets are provided in **Appendix F**.

Under future total conditions, this intersection operates at LOS B or better during both the weekday morning and afternoon peak hours.

**TABLE 15 MOUNTAIN STREET / SITE DRIVEWAY – CAPACITY ANALYSIS SUMMARY**

Movement	Existing		Future Background		Future Total	
	Control Delay (s)	LOS	Control Delay (s)	LOS	Control Delay (s)	LOS
WBLR	0.0 (0.0)	A (A)	0.0 (0.0)	A (A)	10.8 (11.2)	B (B)
SBLT	-- (--)	-- (--)	-- (--)	-- (--)	0.3 (0.6)	A (A)

Notes:

- xx (xx) – Weekday Morning Peak Hour (Weekday Afternoon Peak Hour)



# 10.0 SUMMARY AND CONCLUSIONS

The following provides a summary overview of the study findings of our assessment of the transportation related aspects of the proposed development.

## Transportation Context

1. The site consists of the properties known as 19 Elm Street and 13 Mountain Street. The site is bounded by Mountain Street to the west, a funeral home to the north, a municipal surface parking lot to the east, and Elm Street to the south.
2. There are currently three (3) buildings on the site today used for a mix of residential (one 3-bedroom rental unit), community, and commercial uses. Surface parking is provided behind each of the existing main buildings accessed by two (2) driveways on Mountain Street and one (1) driveway on Elm Street. An ancillary building, currently used for retail, is located to the rear of 13 Mountain Street.
3. The site is located within the downtown intensification area of the Town of Grimsby.

## Development Proposal

4. The development proposal consists of the adaptive reuse of two existing buildings on site and a 7-storey mixed-use building, with a proposed total of 74 residential units (including one 3-bedroom rental replacement unit), and 462m<sup>2</sup> of commercial area (187m<sup>2</sup> of retail area and 275m<sup>2</sup> of community hub area) on the first level of the building. Access to the site is proposed via one driveway on Mountain Street.
5. The current proposal includes provision of 100 parking spaces located within a three-level underground parking garage, one (1) loading space, and 84 bicycle parking spaces.

## Vehicular Parking

6. Application of the applicable Zoning By-law 14-45 requires the provision of 127 vehicular parking spaces, of which 93 are resident spaces (1.25 spaces per unit), 19 residential spaces (0.25 spaces per unit), and 15 commercial spaces (excluding the two parking spaces provided within the adjacent public parking lot).
7. It is proposed to reduce the supplied parking given that the parking standards are, in our view, considered to overstate the parking needs of the proposed development by some margin given the following;
  - the site's location to the downtown area of Grimsby and general context;
  - the site's proximity to transit;
  - the extent of recent approvals provided for reduced resident parking supply at other mixed-use buildings in a similar area to the proposed development; and
  - the availability of nearby on-street parking and municipal parking lots.
8. A total of 100 parking spaces are proposed of which 74 are resident spaces (1.0 space per unit) and 26 are non-resident spaces.



9. There are two additional parking spaces owned by the Owner of 13 Mountain Street and 19 Elm Street on the adjacent municipal parking lot.
10. The proposed parking supply is, in our opinion, appropriate and meets the needs of the proposed development for both resident and visitor parking.

### **Bicycle Parking**

11. The Town of Grimsby Zoning By-law 14-45 requires a total of 25 bicycle parking spaces, 23 spaces for residential tenant and visitor use and two (2) spaces for non-residential uses.
12. The proposed development includes a provision for 84 bicycle parking spaces consisting of 74 spaces for residential tenant and visitor use and 10 spaces for non-residential uses.

### **Loading**

13. One (1) loading space with dimensions 3.5m in width, 9m in length, and a height clearance of 6.1m is proposed per the requirements outlined in the Town of Grimsby Zoning By-law 14-45.
14. It is proposed that refuse/recycling collection is to be serviced by a private contractor.

### **Traffic Volumes and Operations**

15. BA Group has conducted a review of the traffic related impacts of the proposed development.
16. Existing weekday morning and afternoon peak hour traffic activity levels were established for the study area based upon traffic count information collected by Niagara Region.
17. Traffic growth allowances have been made within the future traffic volume projections to account for an overall two percent yearly growth rate on all roads, as per the Region's TIS guidelines.
18. The proposed development is forecast to generate 27 and 69 two-way trips during the weekday morning and afternoon peak hours, respectively.
19. Traffic operations at the area intersections within the study area are acceptable today and will remain acceptable in the future with redevelopment of the site as planned.
20. Site related impacts on traffic operations are minor in comparison to future background traffic conditions. Site related volume changes can, as such and based on the above, be acceptably and appropriately accommodated at the area intersections and proposed site driveway.





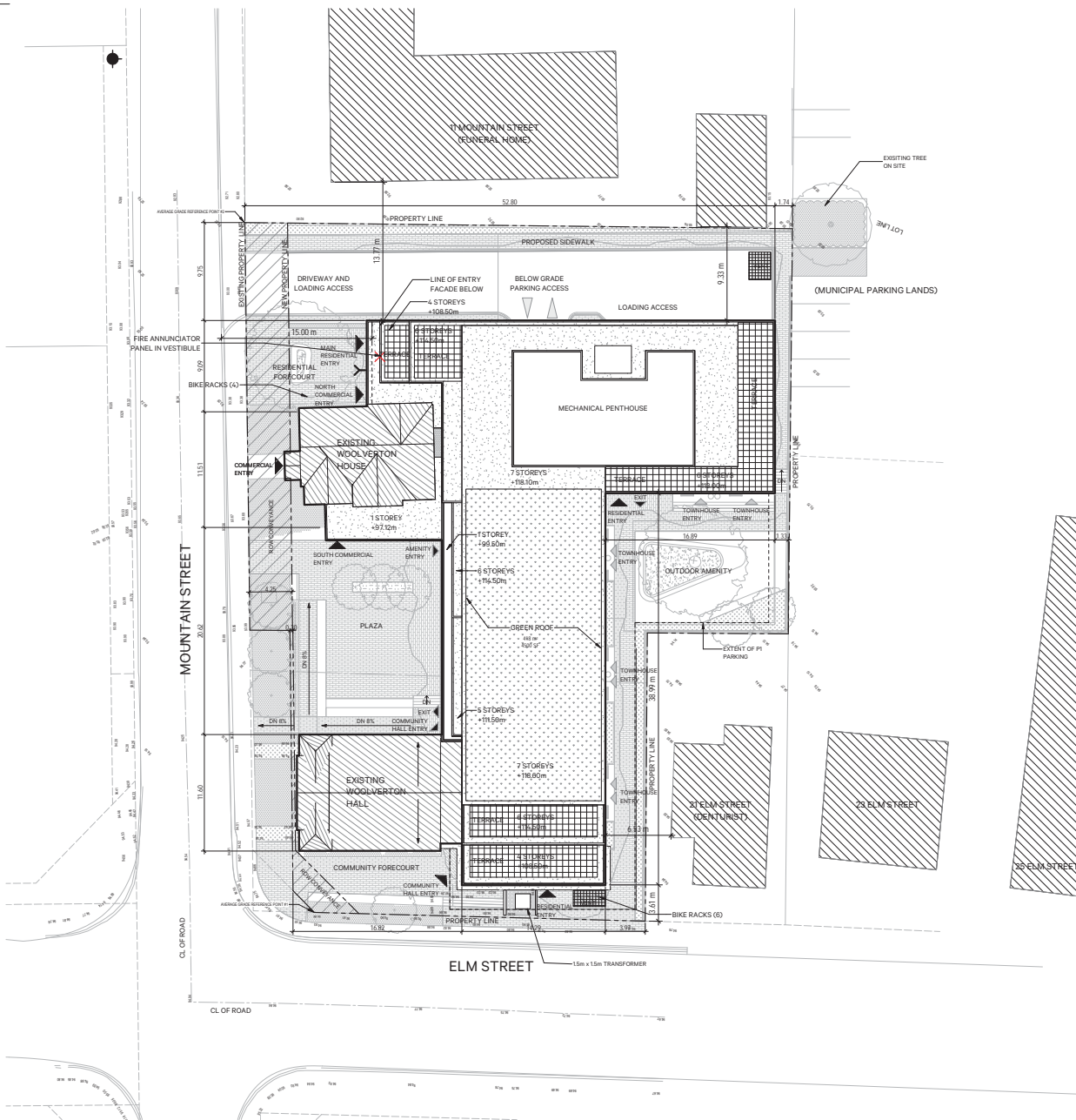
## Overall

21. The development proposed includes a 7-storey building with a total of 74 residential units, 462 m<sup>2</sup> of commercial area, and a total of 100 parking spaces located within a three-level underground parking garage. The proposed non-residential uses are located within the two main existing buildings which will be retained and adaptively reused.
22. The proposed loading supply of one (1) loading space is provided to accommodate the loading demands generated by the proposed development.
23. The proposed bicycle parking supply and arrangements are appropriate and provide residents and visitors with greater non-auto transportation options.
24. Site-related traffic volumes can acceptably and appropriately be accommodated on the surrounding road network with no improvements needed.
25. The proposed driveway, circulation, and parking arrangements are functional and will appropriately support the redevelopment of the site following the construction of the development proposal as planned.



## **APPENDIX A: Reduced Scale Architectural Plans**





1 OVERALL SITE PLAN  
1: 200



2 CONTEXT PLAN  
A010

PROJECT SUMMARY	
MUNICIPAL ADDRESS	13 Mountain Street & 19 Elm Street
LOT AREA	3,188 m <sup>2</sup> 34,978 sf
EXISTING SITE AREA	195 m <sup>2</sup> 2,101 sf
NEW SITE AREA	2,993 m <sup>2</sup> 32,877 sf

ZONING	
DESIGNATION	D1 - DOWNTOWN INTENSIFICATION
BUILDING AREA AT GRADE	1,541 m <sup>2</sup> 16,582 sf
LOT COVERAGE	51.5%
FBI	2.33
HEIGHT + (EXCLUDING MECHANICAL PENTHOUSE)	25.24 m 76.4 ft
NUMBER OF STOREYS	7

GROSS FLOOR AREA (GFA) †	
EXISTING WOOLVERTON HOUSE (Second Floor)	100 m <sup>2</sup> 1,080 sf
NEW RESIDENTIAL GFA*	6,431 m <sup>2</sup> 69,224 sf
TOTAL RESIDENTIAL GFA*	6,531 m <sup>2</sup> 70,304 sf
EXISTING WOOLVERTON HOUSE (Ground Floor)	118 m <sup>2</sup> 1,267 sf
NEW COMMERCIAL/RETAIL	69 m <sup>2</sup> 743 sf
TOTAL COMMERCIAL/RETAIL (NON-RES)	187 m <sup>2</sup> 2,010 sf
EXISTING WOOLVERTON HALL	154 m <sup>2</sup> 1,660 sf
NEW COMMUNITY HUB	121 m <sup>2</sup> 1,296 sf
TOTAL COMMUNITY HUB (NON-RES)	275 m <sup>2</sup> 2,956 sf
TOTAL NON-RESIDENTIAL	462 m <sup>2</sup> 4,966 sf
TOTAL GFA	6,993 m <sup>2</sup> 75,272 sf

RESIDENTIAL UNITS	
1B (900-900 sq ft)	26 35%
2B & 2B Townhouse (900-1,000 sq ft)	41 59%
3B & 3B Townhouse (1,000-1,200 sq ft)	7 9%
TOTAL UNITS	74

AMENITY	
INDOOR RES. AMENITY SPACE	135 m <sup>2</sup> 1,452 sf
OUTDOOR RES. AMENITY SPACE	123 m <sup>2</sup> 1,321 sf

PARKING AREAS (GCA)	
P1 (area not included in GFA)	31 spaces 1,210 m <sup>2</sup> 13,025 sf
P2 (area not included in GFA)	43 spaces 1,645 m <sup>2</sup> 17,706 sf
P3 (area not included in GFA)	26 spaces 961 m <sup>2</sup> 10,347 sf

PARKING	
RESIDENTIAL	By-Law Required 93 74
RESIDENTIAL VISITOR	19
COMMERCIAL/RETAIL	7
COMMUNITY HUB	10
ADDITIONAL PARKING AT MUNICIPAL LOT*	n/a 2
TIME OF DAY SHARED PARKING	128 102
TOTAL	

BICYCLE PARKING	
RESIDENTIAL BIKE PARKING	By-Law Required 23 74
NON-RES BIKE PARKING	2 10

LOADING	
LOADING SPACE (3.5 x 9.0m)	By-Law Required 1 1

† Height measured from average grade along Mountain Street to top of 7th Floor  
 \* GFA assumes efficiency rate of 85% of GCA for Residential  
 † By-Law Required Parking Rate: Residential: 1.25 per unit; visitor: 0.25 per unit; Commercial/Retail: 1 per 28 sq m GFA; Community Hub: 1 per 30 sq m GFA  
 † Proposed Parking Rate: refer to Transportation Consultations Study  
 \* 2 parking spaces on adjacent municipal lot owned by Valentine Coleman 1 and Valentine Coleman 2

3 PROJECT STATISTICS  
A010

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 THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS AND APPROVALS FROM THE RELEVANT AUTHORITIES.

NO.	DATE	DESCRIPTION/COMMENTS
1	2021-09-25	ISSUED FOR OPA/23A

LEGEND

- ROW CONVEYANCE
- EXISTING BUILDING
- PRIMARY BUILDING ENTRANCE
- SECONDARY BUILDING ENTRANCE/EXIT
- PRIVATE RESIDENTIAL BUILDING ENTRANCE
- PARKING ENTRANCE
- FIRE DEPARTMENT CONNECTION
- FIRE ANNUNCIATOR PANEL
- FIRE HYDRANT LOCATION

NOTES

93.875 m - AVERAGE GRADE BASED ON EXISTING GRADE ELEVATIONS AT NORTH-WEST AND SOUTH-WEST CORNERS OF THE PROPERTY (SEE SITE PLAN)

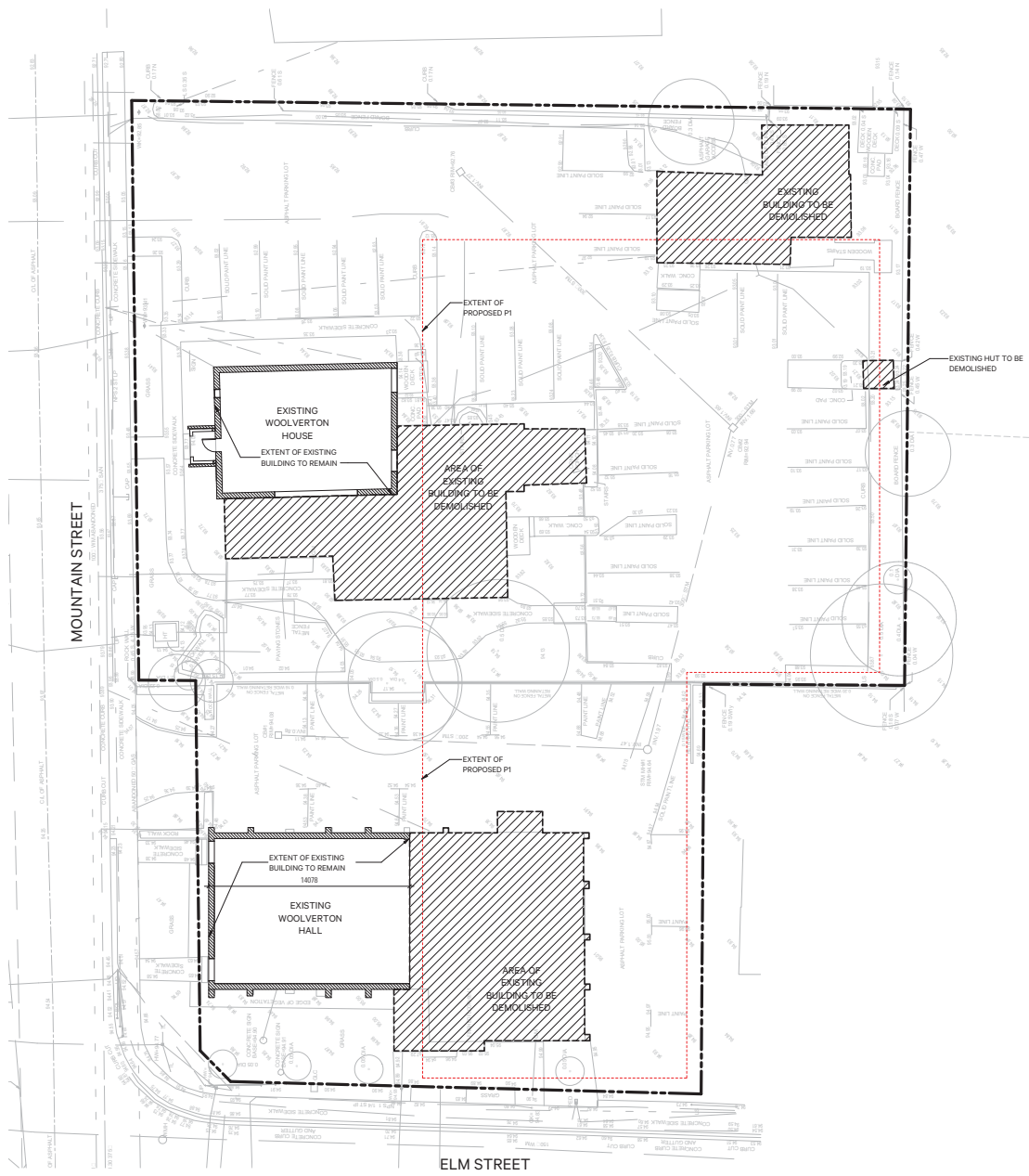


**THE WOOLVERTON**  
 13 MOUNTAIN STREET & 19 ELM STREET  
 Valentine Coleman 1 Inc.  
 Valentine Coleman 2 Inc.

SITE PLAN + STATISTICS

PROJECT	42881	DRAWN	LS
SCALE	1:200	CHECKED	AS
DATE	06/25/21	PLOTTED	5/28/2023 10:17:35 AM

**A010**



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NO.	DATE	DESCRIPTION/COMMENTS
1	2021-09-25	ISSUED FOR OPA/23A

**LEGEND**

**NOTES**



**THE WOOLVERTON**  
 13 MOUNTAIN STREET & 13 ELM STREET

Valentine Coleman 1 Inc.  
 Valentine Coleman 2 Inc.

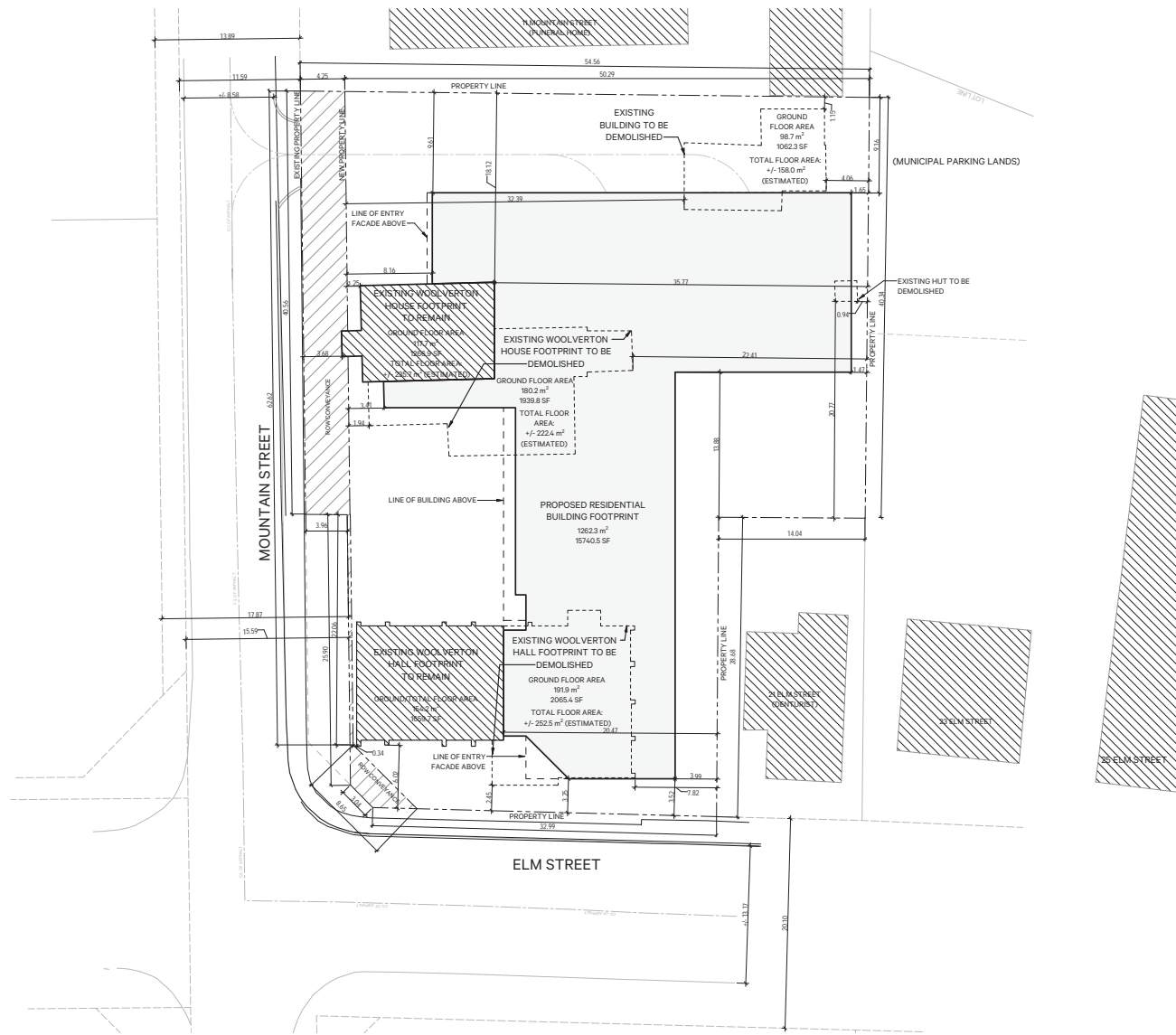
**EXISTING SITE LAYOUT AND DEMOLITION PLAN**



PROJECT	42081	DRAWN	LS
SCALE	1:50	CHECKED	AS
DATE	06/25/21	PLOTTED	11/25/2021 6:26:16 PM

1  
 A011 EXISTING SITE LAYOUT AND DEMOLITION PLAN  
 1 : 150

**A011**



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NO.	DATE	DESCRIPTION/COMMENTS
1	2021-09-25	ISSUED FOR OPA/23A

**LEGEND**

[Hatched Box] ROW CONVEYANCE

[Hatched Box] EXISTING BUILDING

**NOTES**  
 2 parking spaces on adjacent municipal lot owned by Valentine Coleman 1 and Valentine Coleman 2



**THE WOOLVERTON**  
 13 MOUNTAIN STREET & 13 ELM STREET  
 Valentine Coleman 1 Inc.  
 Valentine Coleman 2 Inc.

**ZONING PLAN**

PROJECT	42081	DRAWN	LS
SCALE	1:200	CHECKED	AS
DATE	06/25/21	PLOTTED	3/28/2023 1:56:02 PM

FLOOR 01 - ZONING PLAN  
 A012 1:200

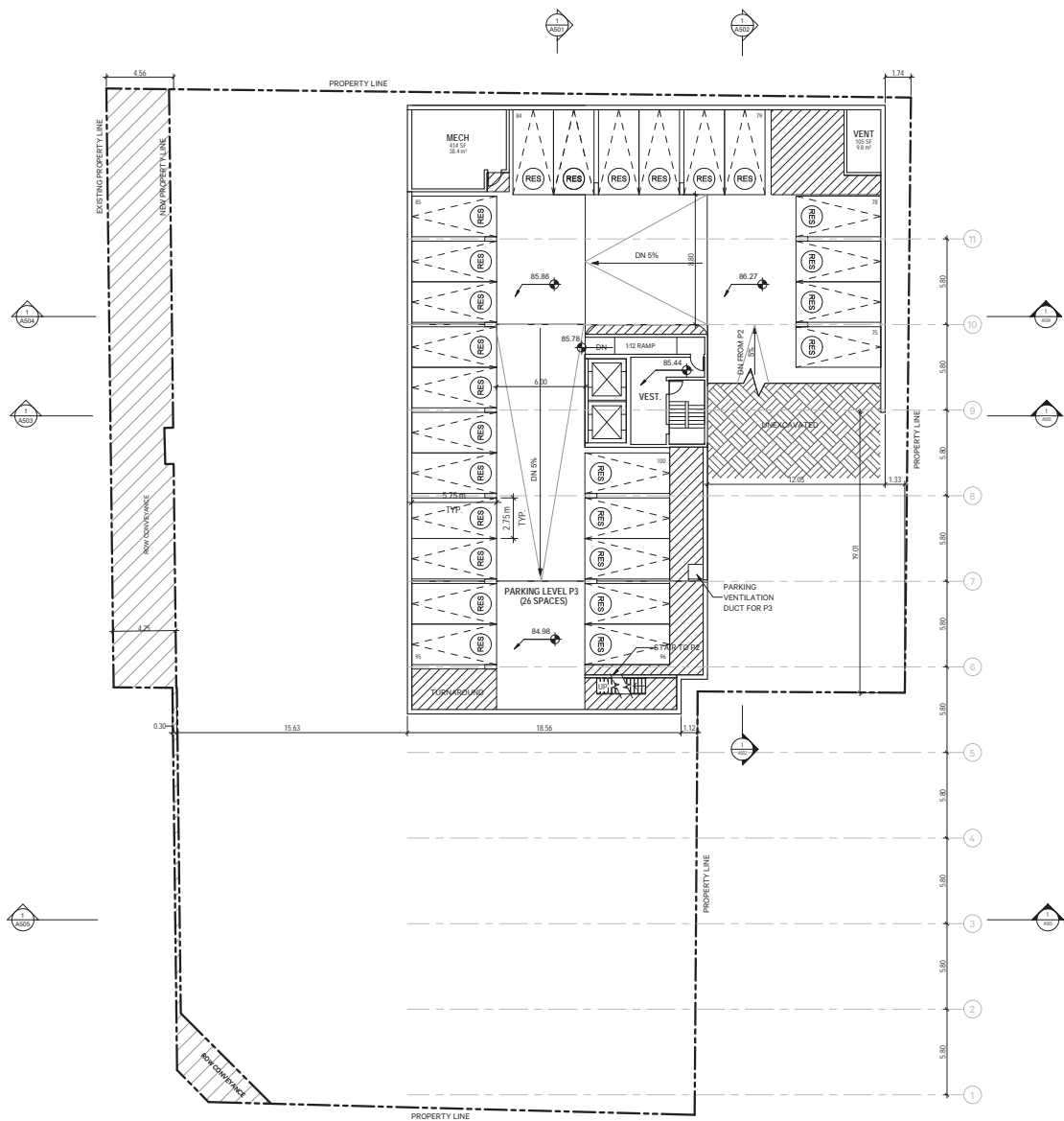
**A012**

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NO.	DATE	DESCRIPTION/COMMENTS
1	2021-09-25	ISSUED FOR OFA/23A



**LEGEND**

- ROW CONVEYANCE
- EXISTING BUILDING
- PRIMARY BUILDING ENTRANCE
- SECONDARY BUILDING ENTRANCE/EXIT
- PRIVATE RESIDENTIAL BUILDING ENTRANCE
- PARKING ENTRANCE

**NOTES**



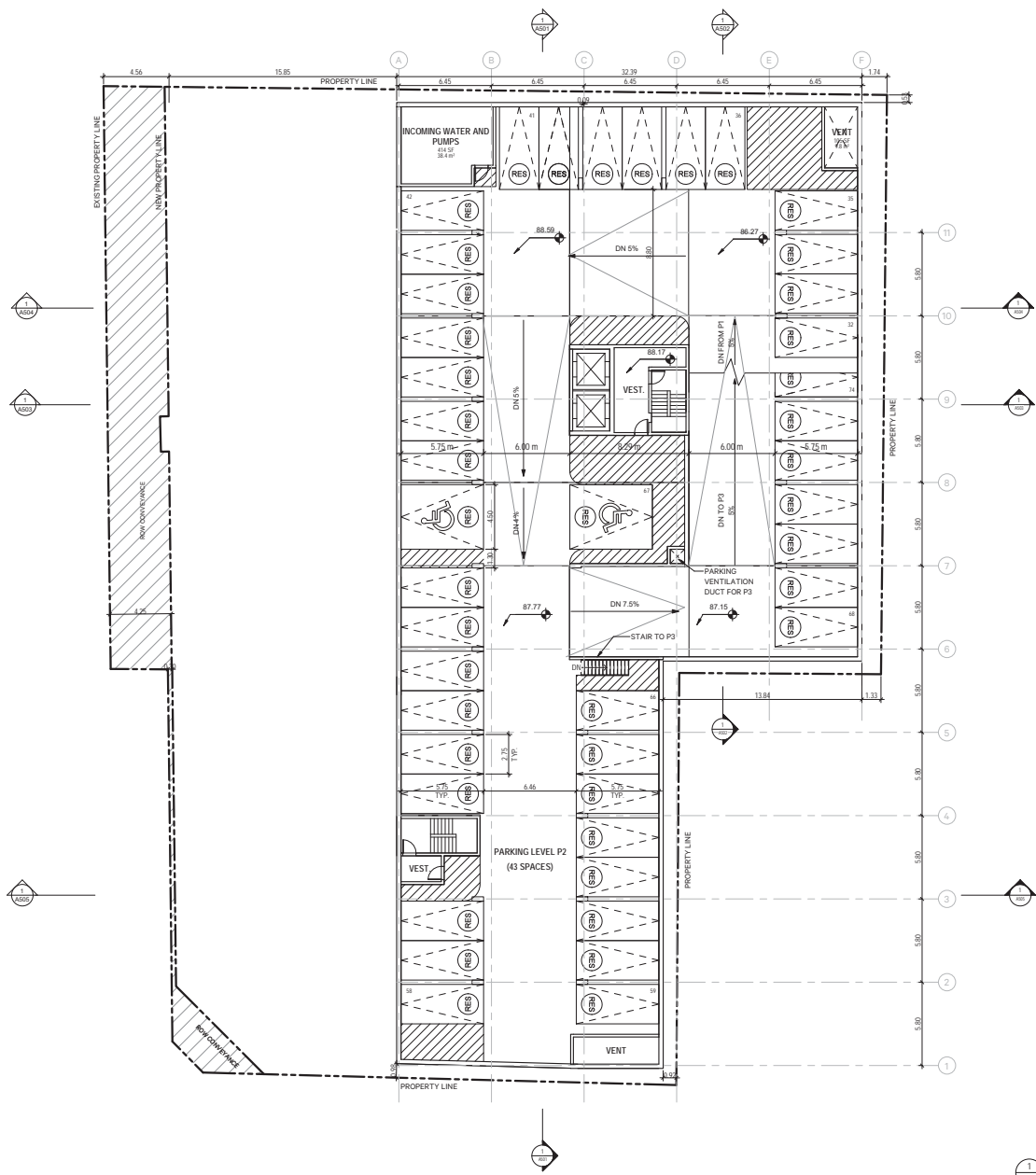
**THE WOOLVERTON**  
 13 MOUNTAIN STREET & 10 ELM STREET  
 Valentine Coleman 1 Inc.  
 Valentine Coleman 2 Inc.

**PLAN - PARKING LEVEL P3**

PROJECT	42081	DRAWN	LS
SCALE	1/8" = 1'-0"	CHECKED	AS
DATE	06/25/21	PLOTTED	8/25/2021 6:26:55 PM

**A100**

1 P3  
 A100 1:150



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NO.	DATE	DESCRIPTION/COMMENTS
1	2021-05-25	ISSUED FOR OPA/25A

**LEGEND**

- ROW CONVEYANCE
- EXISTING BUILDING
- PRIMARY BUILDING ENTRANCE
- SECONDARY BUILDING ENTRANCE/EXIT
- PRIVATE RESIDENTIAL BUILDING ENTRANCE
- PARKING ENTRANCE

**NOTES**



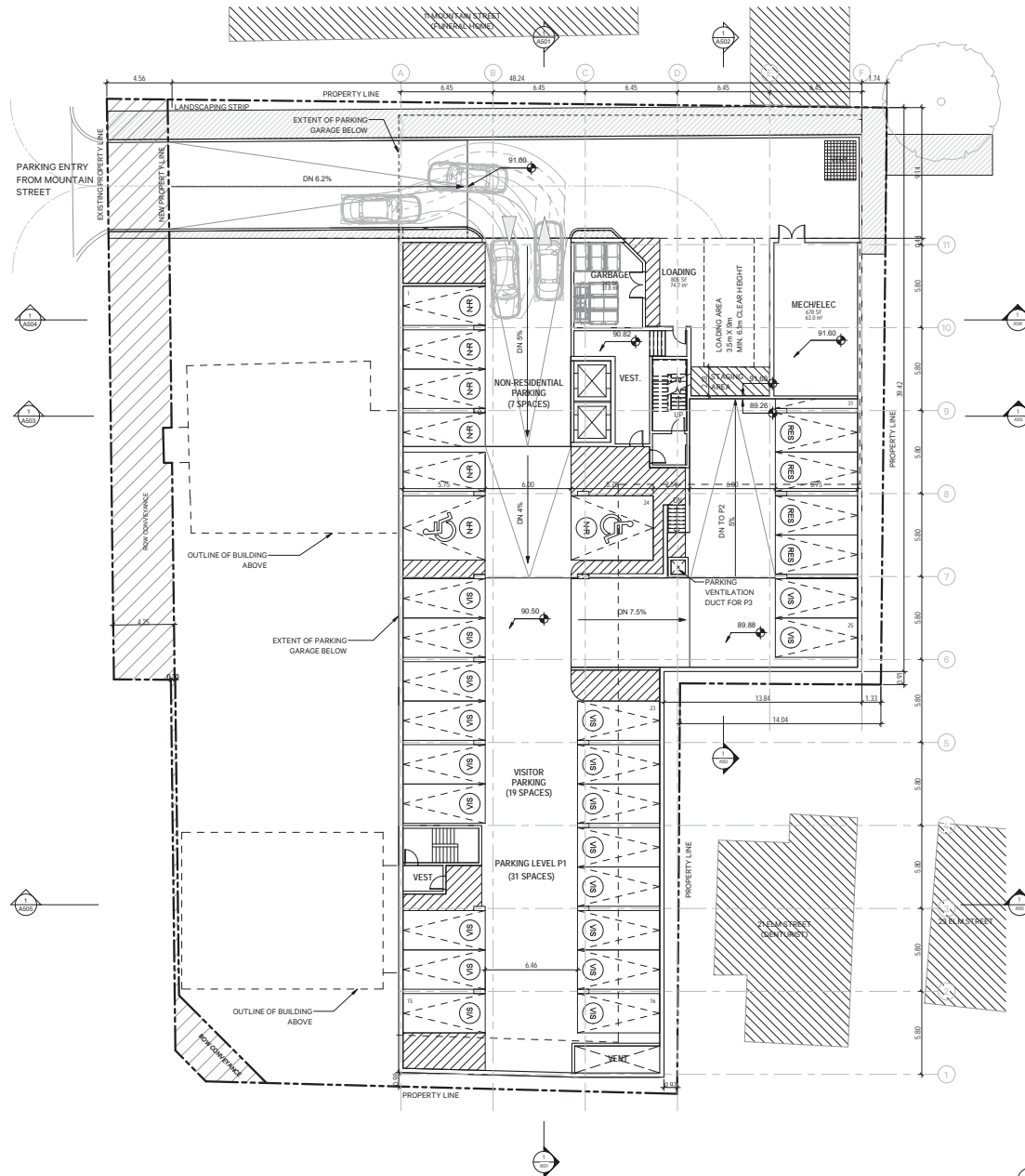
**THE WOOLVERTON**  
 13 MOUNTAIN STREET & 13 ELM STREET  
 Valentine Coleman 1 Inc.  
 Valentine Coleman 2 Inc.

**PLAN - PARKING LEVEL P2**

PROJECT	42081	DRAWN	LS
SCALE	1:50	CHECKED	48
DATE	06/25/21	PLOTTED	3/26/2021 6:36:16 PM

**A101**

1 P2  
 A101 1:150



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NO.	DATE	DESCRIPTION/COMMENTS
1	2021-09-25	ISSUED FOR OFA/23/A

**LEGEND**

- ROW CONVEYANCE
- EXISTING BUILDING
- PRIMARY BUILDING ENTRANCE
- SECONDARY BUILDING ENTRANCE/EXIT
- PRIVATE RESIDENTIAL BUILDING ENTRANCE
- PARKING ENTRANCE

**NOTES**



**THE WOOLVERTON**  
 13 MOUNTAIN STREET & 13 ELM STREET  
 Valentine Coleman 1 Inc.  
 Valentine Coleman 2 Inc.

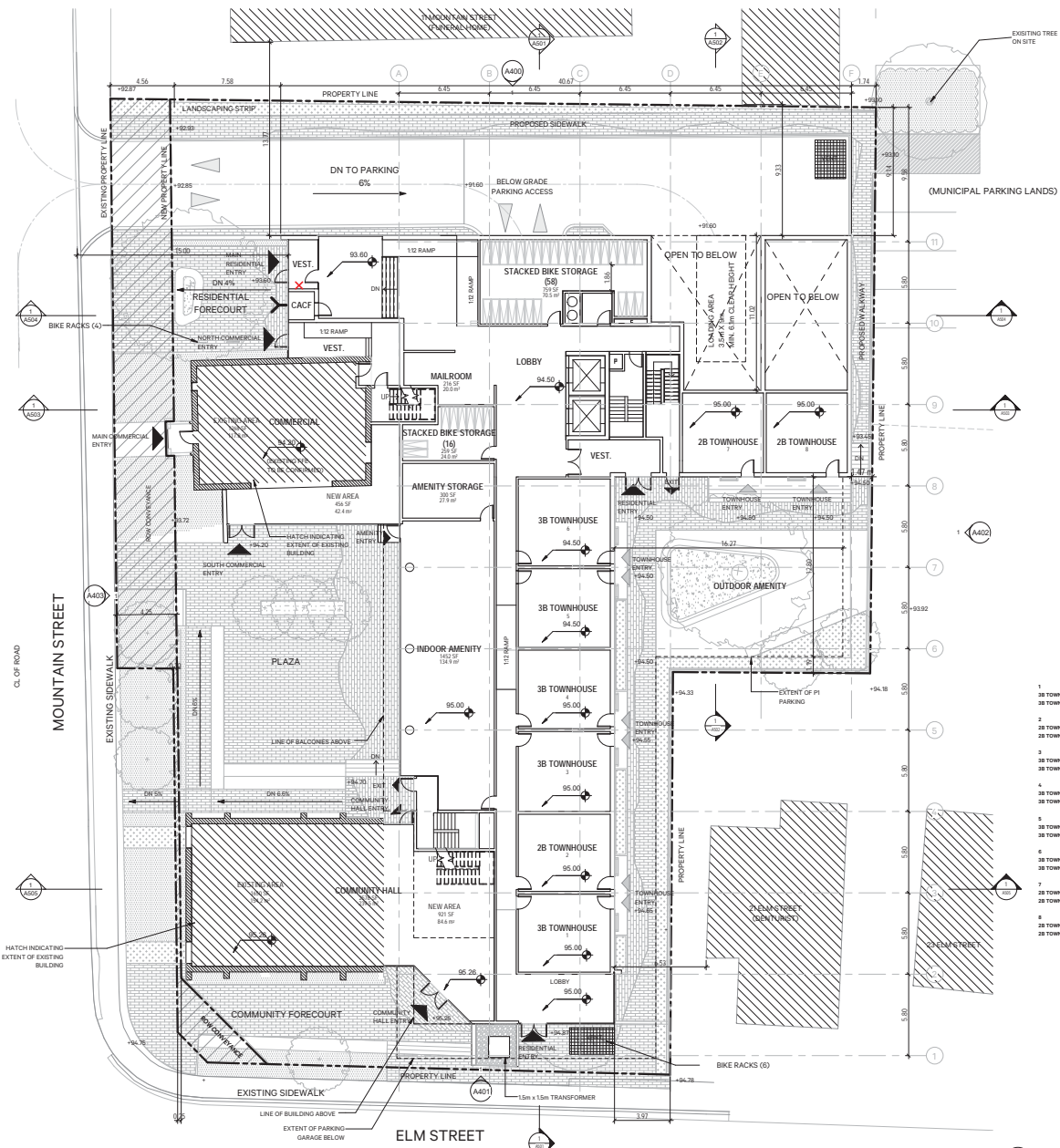
**PLAN - PARKING LEVEL P1**

PROJECT	42081	DRAWN	LS
SCALE	1:500	CHECKED	AK
DATE	06/25/21	PLOTTED	1/25/2021 6:26:16 PM

**A102**

1 P1  
 A102 1:150





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NO.	DATE	DESCRIPTION/COMMENTS
1	2021-05-25	ISSUED FOR OPA/25A

**LEGEND**

- ROW CONVEYANCE
- EXISTING BUILDING
- PRIMARY BUILDING ENTRANCE
- SECONDARY BUILDING ENTRANCE/EXIT
- PRIVATE RESIDENTIAL BUILDING ENTRANCE
- PARKING ENTRANCE
- FIRE DEPARTMENT CONNECTION
- FIRE ANNUNCIATOR PANEL
- FIRE HYDRANT LOCATION

**NOTES**

2 parking spaces on adjacent municipal lot owned by Valentine Coleman 1 and Valentine Coleman 2

**TOWNHOUSE UNIT AREAS**

UNIT TYPE	FLOOR	AREA	
		METRIC	IMPERIAL
1	FLOOR 01	45 m <sup>2</sup>	427 SF
	FLOOR 02	89 m <sup>2</sup>	854 SF
2	FLOOR 01	39 m <sup>2</sup>	422 SF
	FLOOR 02	43 m <sup>2</sup>	531 SF
3	FLOOR 01	41 m <sup>2</sup>	440 SF
	FLOOR 02	77 m <sup>2</sup>	830 SF
4	FLOOR 01	45 m <sup>2</sup>	432 SF
	FLOOR 02	77 m <sup>2</sup>	830 SF
5	FLOOR 01	45 m <sup>2</sup>	432 SF
	FLOOR 02	77 m <sup>2</sup>	830 SF
6	FLOOR 01	45 m <sup>2</sup>	432 SF
	FLOOR 02	77 m <sup>2</sup>	830 SF
7	FLOOR 01	36 m <sup>2</sup>	389 SF
	FLOOR 02	84 m <sup>2</sup>	905 SF
8	FLOOR 01	37 m <sup>2</sup>	402 SF
	FLOOR 02	40 m <sup>2</sup>	422 SF

1 FLOOR 01  
A200 1:150



**THE WOOLVERTON**  
13 MOUNTAIN STREET & 13 ELM STREET  
Valentine Coleman 1 Inc.  
Valentine Coleman 2 Inc.

PLAN - LEVEL 1

PROJECT	42081	DRAWN	LS
SCALE	1/80	CHECKED	AK
DATE	06/21/21	PLOTTED	5/26/2021 6:25:59 PM

**A200**

## **APPENDIX B: TTS Mode Split Data**



**AREA TRAVEL MODE SPLITS**

**INBOUND**

Tue May 18 2021 10:54:39 GMT-0400 (Eastern Daylight Time)

Frequency Distribution Query Form - Trip - 2016 v1.1

Field: Primary travel mode of trip - mode\_prime

Filters:

Start time of trip - start\_time In 1500-1759

and

Trip purpose of destination - purp\_

and

2006 GTA zone of destination - gta06\_dest In 6008,6009,6010,6014,6015,6016,6017

and

Type of dwelling unit - dwell\_type I

Table: Trip 2016

Row:,Count:,Expanded:	Count:	Expanded:
Auto driver,116,2514	116	2514
GO rail only,1,10	1	10
Joint GO rail and local transit,1,17	1	17
Auto passenger,24,474	24	474
School bus,12,287	12	287
Walk,7,140	7	140
Total:,161,3441	161	3441

**OUTBOUND**

Tue May 18 2021 10:56:11 GMT-0400 (Eastern Daylight Time)

Frequency Distribution Query Form - Trip - 2016 v1.1

Field: Primary travel mode of trip - mode\_prime

Filters:

Start time of trip - start\_time In 600-859

and

Trip purpose of origin - purp\_orig I

and

2006 GTA zone of origin - gta06\_orig In 6008,6009,6010,6014,6015,6016,6017

and

Type of dwelling unit - dwell\_type I

Table: Trip 2016

Row:,Count:,Expanded:	Count:	Expanded:
Cycle,1,10	1	10
Auto driver,102,2273	102	2273
Auto passenger,16,341	16	341
School bus,13,254	13	254
Walk,8,147	8	147
Total:,140,3025	140	3025

	INBOUND	OUTBOUND
Auto (Driver)	2514	2273
Auto (Passenger)	761	595
Transit	27	0
Cycle	0	10
Walk	140	147
Total	3442	3025

**Unrounded**

	INBOUND	OUTBOUND
Auto (Driver)	73.04%	75.14%
Auto (Passenger)	22.11%	19.67%
Transit	0.78%	0.00%
Cycle	0.00%	0.33%
Walk	4.07%	4.86%
Total	100%	100%

**Rounded**

	INBOUND	OUTBOUND
Auto (Driver)	73%	75%
Auto (Passenger)	22%	20%
Transit	1%	0%
Cycle	0%	0%
Walk	4%	5%
Total	100%	100%

	INBOUND	OUTBOUND
Auto (Driver)	2514	2273
Auto (Passenger)	761	595
Transit	27	0
Cycle	0	10
Walk	140	147
Total	3442	3025

	INBOUND	OUTBOUND
Auto (Driver)	73%	75%
Auto (Passenger)	22%	20%
Transit	1%	0%
Cycle	0%	0%
Walk	4%	5%
Total	100%	100%

### RESIDENTIAL SUMMARY

	Inbound	Outbound
North - Mountain Street	54%	57%
South - Mountain Street	4%	3%
East - Main Street W	0%	9%
West - Main Street W	13%	12%
East - Elm Street	20%	9%
West - Elm Street	10%	10%

### RETAIL SUMMARY

	Inbound	Outbound
North - Mountain Street	50%	32%
South - Mountain Street	5%	8%
East - Main Street W	0%	21%
West - Main Street W	10%	7%
East - Elm Street	28%	21%
West - Elm Street	8%	11%

**INBOUND**

Wed Mar 31 2021 16:43:32 GMT-0400 (Eastern Daylight Time) - Run Time: 2808ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Planning district of origin - pd\_orig  
 Column: 2006 GTA zone of destination - gta06\_dest

RowG:  
 ColG:(6008,6009,6010,6014,6015,6016,6017)  
 TblG:

Filters:  
 Start time of trip - start\_time In 1500-1759  
 and  
 Trip purpose of destination - purp\_dest In H,  
 and  
 Primary travel mode of trip - mode\_prime In D,U,M,P,T,S

Trip 2016

Table:

			North	South	East	West	East	West		North	South	East	West	East	West	
,1		1	Mountain	Mountain	Main	Main	Elm	Elm		Mountain	Mountain	Main	Main	Elm	Elm	
PD 1 of Toronto,29	PD 1 of Toronto	29	1%	90%		10%			100%	1%	0%	0%	0%	0%	0%	
PD 11 of Toronto,27	PD 11 of Toronto	27	1%	90%		10%			100%	1%	0%	0%	0%	0%	0%	
Richmond Hill,17	Richmond Hill	17	1%	90%		10%			100%	0%	0%	0%	0%	0%	0%	
Brampton,37	Brampton	37	1%	90%		10%			100%	1%	0%	0%	0%	0%	0%	
Mississauga,44	Mississauga	44	1%	90%		10%			100%	1%	0%	0%	0%	0%	0%	
Oakville,14	Oakville	14	0%	90%		10%			100%	0%	0%	0%	0%	0%	0%	
Burlington,98	Burlington	98	3%	90%		10%			100%	3%	0%	0%	0%	0%	0%	
Ancaster,17	Ancaster	17	1%	90%		10%			100%	0%	0%	0%	0%	0%	0%	
Stoney Creek,178	Stoney Creek	178	5%	60%		20%		20%	100%	3%	0%	0%	1%	0%	1%	
Hamilton,467	Hamilton	467	14%	90%		10%			100%	13%	0%	0%	1%	0%	0%	
Grimsby,1372	Grimsby									0%	0%	0%	0%	0%	0%	
6001,47	6001	47	1%	50%		50%			100%	1%	0%	0%	1%	0%	0%	
6002,98	6002	98	3%	50%		50%			100%	1%	0%	0%	1%	0%	0%	
6003,22	6003	22	1%	50%		50%			100%	0%	0%	0%	0%	0%	0%	
6004,38	6004	38	1%	30%		30%		40%	100%	0%	0%	0%	0%	0%	0%	
6005,46	6005	46	1%	10%		40%		50%	100%	0%	0%	0%	1%	0%	1%	
6008, 293	6008	293	9%		10%	20%		70%	100%	0%	1%	0%	2%	0%	6%	
6009, 272	6009	272	8%	10%		10%		60%	100%	1%	1%	0%	1%	5%	1%	
6010,96	6010	96	3%	30%		70%			100%	1%	0%	0%	2%	0%	0%	
6011,42	6011	42	1%	50%		50%			100%	1%	0%	0%	1%	0%	0%	
6012,40	6012	40	1%	70%		30%			100%	1%	0%	0%	0%	0%	0%	
6014,35	6014	35	1%	30%				70%	100%	0%	0%	0%	0%	1%	0%	
6015,45	6015	45	1%	40%		0%		60%	100%	1%	0%	0%	0%	1%	0%	
6016, 156	6016	156	5%		20%	0%		80%	100%	0%	1%	0%	0%	4%	0%	
6019,25	6019	25	1%	60%		0%		40%	100%	0%	0%	0%	0%	0%	0%	
6020, 116	6020	116	4%	10%		0%		80%	100%	0%	0%	0%	0%	3%	0%	
Lincoln,335	Lincoln	335	10%	60%		0%		40%	100%	6%	0%	0%	0%	4%	0%	
Niagara-on-the-Lake,119	Niagara-on-the-Lake	119	4%	90%		0%		10%	100%	3%	0%	0%	0%	0%	0%	
St. Catharines,258	St. Catharines	258	8%	90%		0%		10%	100%	7%	0%	0%	0%	1%	0%	
Thorold,31	Thorold	31	1%	40%		0%		60%	100%	0%	0%	0%	0%	1%	0%	
Niagara Falls,112	Niagara Falls	112	3%	90%		0%		10%	100%	3%	0%	0%	0%	0%	0%	
Welland,18	Welland	18	1%	90%		0%		10%	100%	0%	0%	0%	0%	0%	0%	
Fort Erie,31	Fort Erie	31	1%	90%		0%		10%	100%	1%	0%	0%	0%	0%	0%	
West Lincoln,12	West Lincoln	12	0%		50%	0%		30%	100%	0%	0%	0%	0%	0%	0%	
Puslinch,15	Puslinch	15	0%	90%		10%			100%	0%	0%	0%	0%	0%	0%	
Orangeville,24	Orangeville	24	1%	90%		10%			100%	1%	0%	0%	0%	0%	0%	
Haldimand-Norfolk,19	Haldimand-Norfolk	19	1%		50%			50%	100%	0%	0%	0%	0%	0%	0%	
	Total	3273	100%							54%	4%	0%	13%	20%	10%	100%

Wed Mar 31 2021 16:55:24 GMT-0400 (Eastern Daylight Time) - Run Time: 2551ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: 2006 GTA zone of origin - gta06\_orig  
 Column: 2006 GTA zone of destination - gta06\_dest

RowG:  
 ColG:(6008,6009,6010,6014,6015,6016,6017)  
 TblG:

Filters:  
 Start time of trip - start\_time In 1500-1759  
 and  
 Trip purpose of destination - purp\_dest In H,  
 and  
 Primary travel mode of trip - mode\_prime In D,U,M,P,T,S  
 and  
 Planning district of origin - pd\_orig In 51,

Trip 2016

Table:

,1
6001,47
6002,98
6003,22
6004,38
6005,46
6008, 293
6009, 272
6010,96
6011,42
6012,40
6014,35
6015,45
6016, 156
6019,25
6020, 116

OUTBOUND

Wed Mar 31 2021 16:50:23 GMT-0400 (Eastern Daylight Time) - Run Time: 2834ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Planning district of destination - pd\_dest
Column: 2006 GTA zone of origin - gta06\_orig

RowG:
ColG:(6008,6009,6010,6014,6015,6016,6017)
TblG:

Filters:
Start time of trip - start\_time In 600-859
and
Trip purpose of origin - purp\_orig In H,
and
Primary travel mode of trip - mode\_prime In D,U,M,P,T,S

Trip 2016

Table:

Table with 16 columns: ,1, PD 1 of Toronto, PD 2 of Toronto, PD 11 of Toronto, Richmond Hill, Brampton, Mississauga, Milton, Oakville, Burlington, Flamborough, Ancaster, Stoney Creek, Hamilton, Grimsby, 6001,15, 6002, 113, 6003,12, 6004,83, 6005,46, 6008, 308, 6009,35, 6010,80, 6011,42, 6014,17, 6015,68, 6016, 186, 6017,18, 6019,46, 6020,83, Lincoln,257, Niagara-on-the-Lake,100, St. Catharines,319, Thorold,43, Niagara Falls,139, Welland,18, Fort Erie,45, West Lincoln,25, City of Guelph,20, External,22, Total. Columns include counts, percentages, and regional breakdowns (North Mountain, South Mountain, East Main, West Main, East Elm, West Elm).

Wed Mar 31 2021 16:56:54 GMT-0400 (Eastern Daylight Time) - Run Time: 2525ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: 2006 GTA zone of destination - gta06\_dest
Column: 2006 GTA zone of origin - gta06\_orig

RowG:
ColG:(6008,6009,6010,6014,6015,6016,6017)
TblG:

Filters:
Start time of trip - start\_time In 600-859
and
Trip purpose of origin - purp\_orig In H,
and
Primary travel mode of trip - mode\_prime In D,U,M,P,T,S
and
Planning district of destination - pd\_dest In 51,

Trip 2016

Table:

- ,1
6001,15
6002, 113
6003,12
6004,83
6005,46
6008, 308
6009,35
6010,80
6011,42
6014,17
6015,68
6016, 186
6017,18
6019,46
6020,83

**INBOUND**

Thu Apr 01 2021 11:07:54 GMT-0400 (Eastern Daylight Time) - Run Time: 2582ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Planning district of origin - pd\_orig  
 Column: 2006 GTA zone of destination - gta06\_dest

RowG:  
 ColG:(6008,6009,6010,6014,6015,6016,6017)  
 TblG:

Filters:  
 Start time of trip - start\_time In 1500-1759  
 and  
 Trip purpose of destination - purp\_dest In M,  
 and  
 Primary travel mode of trip - mode\_prime In D,U,M,P,T,S

Trip 2016

Table:

			North	South	East	West	East	West		North	South	East	West	East	West	
			Mountain	Mountain	Main	Main	Elm	Elm		Mountain	Mountain	Main	Main	Elm	Elm	
,1		1														
Burlington,28	Burlington	28	4%	90%		10%			100%	4%	0%	0%	0%	0%	0%	
Hamilton,9	Hamilton	9	1%	90%		10%			100%	1%	0%	0%	0%	0%	0%	
Grimsby,455	Grimsby									0%	0%	0%	0%	0%	0%	
6003,11	6003	11	2%	50%		50%			100%	1%	0%	0%	1%	0%	0%	
6004,52	6004	52	8%	30%		30%		40%	100%	2%	0%	0%	2%	0%	3%	
6005,7	6005	7	1%	10%		40%		50%	100%	0%	0%	0%	0%	0%	1%	
6008,28	6008	28	4%		10%	20%		70%	100%	0%	0%	0%	1%	0%	3%	
6009,55	6009	55	8%	10%	10%	0%	10%	60%	100%	1%	1%	0%	1%	5%	1%	
6012,93	6012	93	14%	70%		30%			100%	10%	0%	0%	4%	0%	0%	
6015,48	6015	48	7%	40%			60%		100%	3%	0%	0%	0%	4%	0%	
6016,80	6016	80	12%		20%	0%		80%	100%	0%	2%	0%	0%	9%	0%	
6018,35	6018	35	5%	90%		0%		10%	100%	5%	0%	0%	0%	1%	0%	
6019,48	6019	48	7%	90%		0%		10%	100%	6%	0%	0%	0%	1%	0%	
Lincoln,117	Lincoln	117	17%	60%		0%		40%	100%	10%	0%	0%	0%	7%	0%	
St. Catharines,52	St. Catharines	52	8%	90%		0%		10%	100%	7%	0%	0%	0%	1%	0%	
West Lincoln,14	West Lincoln	14	2%		50%	0%		30%	100%	0%	1%	0%	0%	1%	0%	
Total		677	100%							50%	5%	0%	10%	28%	8%	100%

Thu Apr 01 2021 11:09:55 GMT-0400 (Eastern Daylight Time) - Run Time: 2330ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: 2006 GTA zone of origin - gta06\_orig  
 Column: 2006 GTA zone of destination - gta06\_dest

RowG:  
 ColG:(6008,6009,6010,6014,6015,6016,6017)  
 TblG:

Filters:  
 Start time of trip - start\_time In 1500-1759  
 and  
 Trip purpose of destination - purp\_dest In M,  
 and  
 Primary travel mode of trip - mode\_prime In D,U,M,P,T,S  
 and  
 Planning district of origin - pd\_orig In 51,

Trip 2016

Table:

- ,1
- 6003,11
- 6004,52
- 6005,7
- 6008,28
- 6009,55
- 6012,93
- 6015,48
- 6016,80
- 6018,35
- 6019,48

**OUTBOUND**

Thu Apr 01 2021 11:14:31 GMT-0400 (Eastern Daylight Time) - Run Time: 2390ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Planning district of destination - pd\_dest  
 Column: 2006 GTA zone of origin - gta06\_orig

RowG:  
 ColG:(6008,6009,6010,6014,6015,6016,6017)  
 TblG:

Filters:  
 Start time of trip - start\_time In 1500-1759  
 and  
 Trip purpose of origin - purp\_orig In M,  
 and  
 Primary travel mode of trip - mode\_prime In D,U,M,P,T,S

Trip 2016

Table:

				North	South	East	West	East	West		North	South	East	West	East	West
				Mountain	Mountain	Main	Main	Elm	Elm		Mountain	Mountain	Main	Main	Elm	Elm
,1		1														
Stoney Creek,10	Stoney Creek	10	2%	60%			20%			100%	1%	0%	0%	0%	0%	0%
Grimsby,468	Grimsby										0%	0%	0%	0%	0%	0%
6001,12	6001	12	2%	50%			50%			100%	1%	0%	0%	1%	0%	0%
6002,11	6002	11	2%	50%			50%			100%	1%	0%	0%	1%	0%	0%
6004,14	6004	14	2%	30%			30%		40%	100%	1%	0%	0%	1%	0%	1%
6005,7	6005	7	1%	10%			40%		50%	100%	0%	0%	0%	0%	0%	1%
6006,11	6006	11	2%	30%					70%	100%	1%	0%	0%	0%	0%	1%
6008,48	6008	48	8%		10%		20%		70%	100%	0%	1%	0%	2%	0%	6%
6009,40	6009	40	7%	10%	10%	30%	10%	30%	10%	100%	1%	1%	2%	1%	2%	1%
6012,13	6012	13	2%	70%			30%			100%	2%	0%	0%	1%	0%	0%
6015,59	6015	59	10%	40%		30%		30%		100%	4%	0%	3%	0%	3%	0%
6016, 113	6016	113	20%		20%	40%		40%		100%	0%	4%	8%	0%	8%	0%
6018,55	6018	55	10%	60%		20%		20%		100%	6%	0%	2%	0%	2%	0%
6019,60	6019	60	10%	60%		20%		20%		100%	6%	0%	2%	0%	2%	0%
6020,25	6020	25	4%	10%	10%	40%		40%		100%	0%	0%	2%	0%	2%	0%
Lincoln,43	Lincoln	43	7%	60%		20%		20%		100%	4%	0%	1%	0%	1%	0%
St. Catharines,28	St. Catharines	28	5%	90%		5%		5%		100%	4%	0%	0%	0%	0%	0%
West Lincoln,29	West Lincoln	29	5%		50%	15%		15%	20%	100%	0%	3%	1%	0%	1%	1%
	Total	578	100%								32%	8%	21%	7%	21%	11%

Thu Apr 01 2021 11:16:05 GMT-0400 (Eastern Daylight Time) - Run Time: 2362ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: 2006 GTA zone of destination - gta06\_dest  
 Column: 2006 GTA zone of origin - gta06\_orig

RowG:  
 ColG:(6008,6009,6010,6014,6015,6016,6017)  
 TblG:

Filters:  
 Start time of trip - start\_time In 1500-1759  
 and  
 Trip purpose of origin - purp\_orig In M,  
 and  
 Primary travel mode of trip - mode\_prime In D,U,M,P,T,S  
 and  
 Planning district of destination - pd\_dest In 51,

Trip 2016

Table:

,1
6001,12
6002,11
6004,14
6005,7
6006,11
6008,48
6009,40
6012,13
6015,59
6016, 113
6018,55
6019,60
6020,25



## **APPENDIX C: Turning Movement Counts**



Location..... Christie Street/Mountain Street @ Main Street GeoID..... 01115

Municipality. GRIMSBY

Count Date. Tuesday, 09 April, 2019

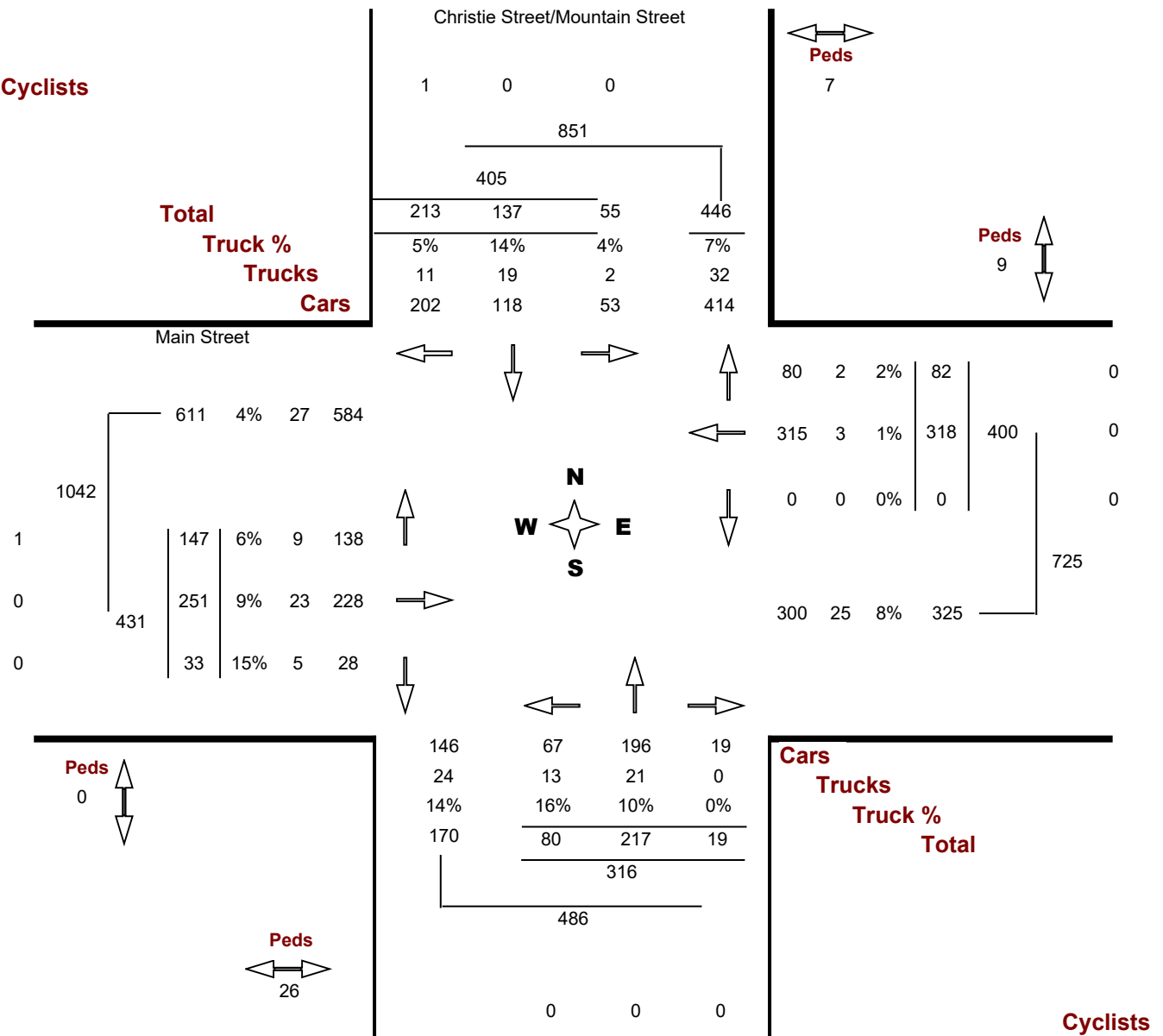
Traffic Cont.

Count Time. 07:00 AM — 09:00 AM

Major Dir..... East west

Peak Hour.. 08:00 AM — 09:00 AM

**Cyclists**



Location..... Christie Street/Mountain Street @ Main Street GeoID..... 01115

Municipality. GRIMSBY

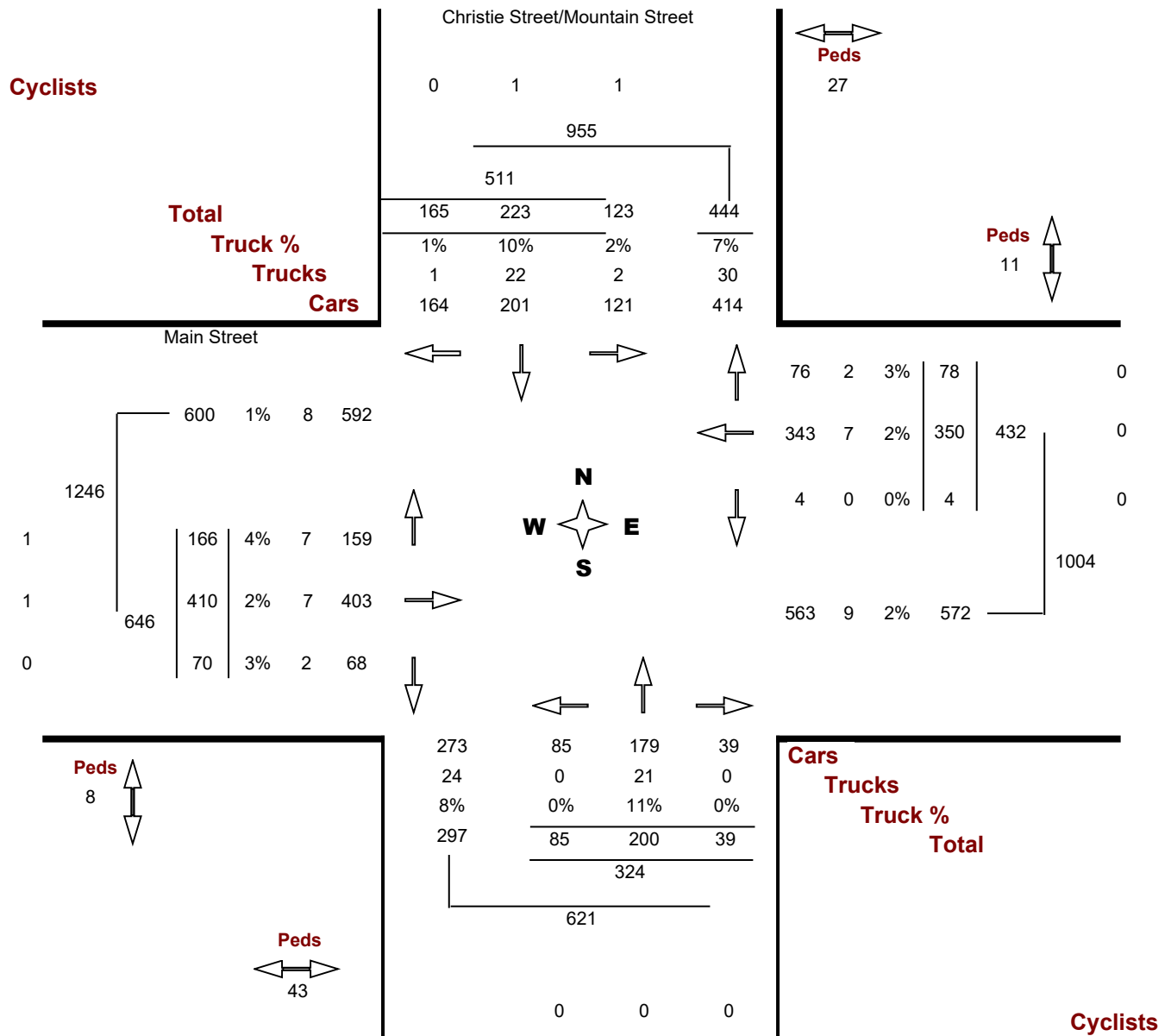
Count Date. Tuesday, 09 April, 2019

Traffic Cont.

Count Time. 03:00 PM — 06:00 PM

Major Dir..... East west

Peak Hour.. 03:15 PM — 04:15 PM



# Turning Movement Count - Details Report (15 min)

**Location**..... Christie Street/Mountain Street @ Main Street

**Municipality**..... GRIMSBY

**Count Date**..... Tuesday, April 09, 2019

Christie Street/Mountain Street

Main Street

North Approach

South Approach

East Approach

West Approach

Time Period	LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT
07:00 07:15	5	23	18	0	46	16	52	2	0	70	0	37	38	0	75	12	19	6	0	37
07:15 07:30	7	28	23	0	58	12	53	0	0	65	0	28	29	0	57	25	32	8	0	65
07:30 07:45	9	19	23	0	51	17	51	4	0	72	0	62	32	0	94	23	33	10	0	66
07:45 08:00	14	36	41	0	91	32	46	1	0	79	0	85	31	0	116	34	65	17	0	116
<b>Hourly Total</b>	<b>35</b>	<b>106</b>	<b>105</b>	<b>0</b>	<b>246</b>	<b>77</b>	<b>202</b>	<b>7</b>	<b>0</b>	<b>286</b>	<b>0</b>	<b>212</b>	<b>130</b>	<b>0</b>	<b>342</b>	<b>94</b>	<b>149</b>	<b>41</b>	<b>0</b>	<b>284</b>
08:00 08:15	12	31	43	0	86	13	55	5	0	73	0	66	27	0	93	35	60	7	0	102
08:15 08:30	8	29	46	0	83	19	56	5	0	80	0	78	22	0	100	29	60	4	0	93
08:30 08:45	16	34	49	0	99	25	53	3	0	81	0	70	17	0	87	33	50	13	0	96
08:45 09:00	19	43	75	0	137	23	53	6	0	82	0	104	16	0	120	50	81	9	0	140
<b>Hourly Total</b>	<b>55</b>	<b>137</b>	<b>213</b>	<b>0</b>	<b>405</b>	<b>80</b>	<b>217</b>	<b>19</b>	<b>0</b>	<b>316</b>	<b>0</b>	<b>318</b>	<b>82</b>	<b>0</b>	<b>400</b>	<b>147</b>	<b>251</b>	<b>33</b>	<b>0</b>	<b>431</b>
11:00 11:15	18	46	33	0	97	27	46	5	0	78	0	69	21	0	90	28	70	8	0	106
11:15 11:30	21	34	33	0	88	16	33	9	0	58	0	89	17	0	106	32	69	16	0	117
11:30 11:45	23	32	33	0	88	11	39	7	0	57	2	63	21	0	86	30	68	12	0	110
11:45 12:00	19	28	41	0	88	25	39	6	0	70	0	96	21	0	117	31	72	12	0	115
<b>Hourly Total</b>	<b>81</b>	<b>140</b>	<b>140</b>	<b>0</b>	<b>361</b>	<b>79</b>	<b>157</b>	<b>27</b>	<b>0</b>	<b>263</b>	<b>2</b>	<b>317</b>	<b>80</b>	<b>0</b>	<b>399</b>	<b>121</b>	<b>279</b>	<b>48</b>	<b>0</b>	<b>448</b>
12:00 12:15	25	34	47	0	106	17	41	11	0	69	1	80	19	0	100	31	91	12	0	134
12:15 12:30	30	38	31	0	99	18	44	13	0	75	1	92	24	0	117	38	70	16	0	124
12:30 12:45	23	33	35	0	91	12	39	8	0	59	0	82	21	0	103	24	91	17	0	132
12:45 13:00	26	34	39	0	99	15	37	8	0	60	0	82	33	0	115	26	67	12	0	105
<b>Hourly Total</b>	<b>104</b>	<b>139</b>	<b>152</b>	<b>0</b>	<b>395</b>	<b>62</b>	<b>161</b>	<b>40</b>	<b>0</b>	<b>263</b>	<b>2</b>	<b>336</b>	<b>97</b>	<b>0</b>	<b>435</b>	<b>119</b>	<b>319</b>	<b>57</b>	<b>0</b>	<b>495</b>
13:00 13:15	21	33	42	0	96	23	30	12	0	65	0	95	24	0	119	23	62	14	0	99
13:15 13:30	24	37	35	0	96	20	44	9	0	73	0	83	17	0	100	36	67	17	0	120
13:30 13:45	27	36	29	0	92	17	33	10	0	60	2	83	19	0	104	23	73	23	0	119
13:45 14:00	23	42	41	0	106	23	46	9	0	78	1	90	23	0	114	25	74	16	0	115
<b>Hourly Total</b>	<b>95</b>	<b>148</b>	<b>147</b>	<b>0</b>	<b>390</b>	<b>83</b>	<b>153</b>	<b>40</b>	<b>0</b>	<b>276</b>	<b>3</b>	<b>351</b>	<b>83</b>	<b>0</b>	<b>437</b>	<b>107</b>	<b>276</b>	<b>70</b>	<b>0</b>	<b>453</b>
15:00 15:15	25	56	42	0	123	19	48	10	0	77	0	91	16	0	107	39	77	19	0	135
15:15 15:30	34	57	45	0	136	19	35	8	0	62	0	97	11	0	108	42	117	17	0	176
15:30 15:45	25	51	34	0	110	24	35	13	0	72	1	85	28	0	114	48	106	22	0	176
15:45 16:00	25	57	41	0	123	25	50	9	0	84	1	78	14	0	93	37	96	12	0	145
<b>Hourly Total</b>	<b>109</b>	<b>221</b>	<b>162</b>	<b>0</b>	<b>492</b>	<b>87</b>	<b>168</b>	<b>40</b>	<b>0</b>	<b>295</b>	<b>2</b>	<b>351</b>	<b>69</b>	<b>0</b>	<b>422</b>	<b>166</b>	<b>396</b>	<b>70</b>	<b>0</b>	<b>632</b>
16:00 16:15	39	58	45	0	142	17	80	9	0	106	2	90	25	0	117	39	91	19	0	149

## Christie Street/Mountain Street

## Main Street

Time Period	North Approach					South Approach					East Approach					West Approach				
	LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT
16:15 16:30	20	57	43	0	120	9	48	8	0	65	1	94	21	0	116	35	89	22	0	146
16:30 16:45	28	65	35	0	128	20	46	9	0	75	0	89	22	0	111	38	121	20	0	179
16:45 17:00	24	53	34	0	111	11	48	7	0	66	1	92	16	0	109	45	88	20	0	153
Hourly Total	111	233	157	0	501	57	222	33	0	312	4	365	84	0	453	157	389	81	0	627
17:00 17:15	26	71	36	0	133	14	41	11	0	66	0	90	23	0	113	45	90	18	0	153
17:15 17:30	25	66	40	0	131	14	39	9	0	62	0	78	22	0	100	38	75	18	0	131
17:30 17:45	29	55	34	0	118	8	49	13	0	70	1	64	17	0	82	41	76	13	0	130
17:45 18:00	24	46	29	0	99	10	44	4	0	58	0	77	17	0	94	36	72	14	0	122
Hourly Total	104	238	139	0	481	46	173	37	0	256	1	309	79	0	389	160	313	63	0	536
Grand Total	694	1362	1215	0	3271	571	1453	243	0	2267	14	2559	704	0	3277	1071	2372	463	0	3906
Truck %	3%	9%	3%	0%	5%	5%	10%	1%	0%	8%	7%	2%	3%	0%	2%	3%	3%	4%	0%	3%

Location..... Elm Street @ Mountain Street

GeoID..... 01112

Municipality. GRIMSBY

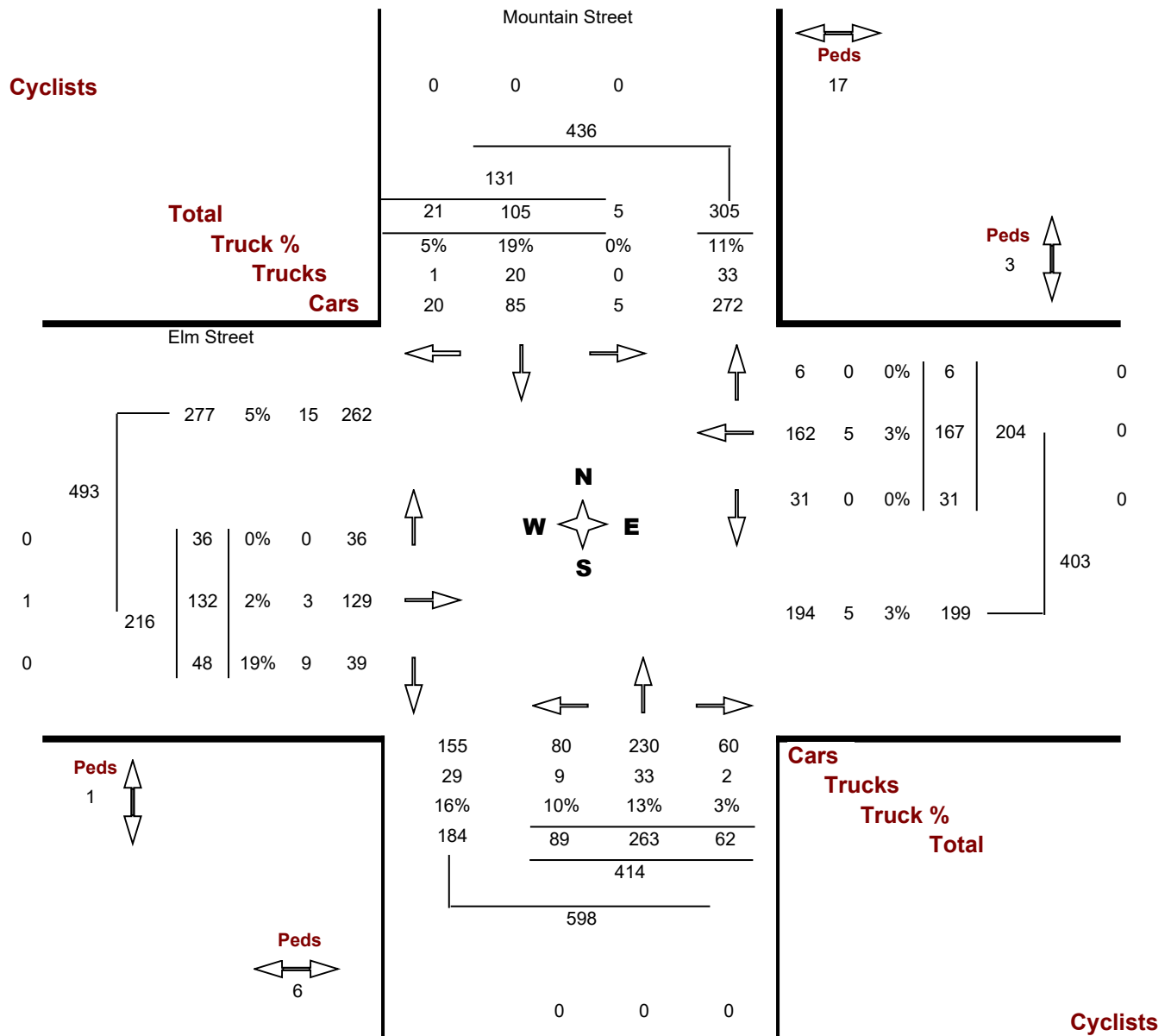
Count Date. Tuesday, 09 April, 2019

Traffic Cont.

Count Time. 07:00 AM — 09:00 AM

Major Dir..... North south

Peak Hour.. 08:00 AM — 09:00 AM



Location..... Elm Street @ Mountain Street

GeoID..... 01112

Municipality. GRIMSBY

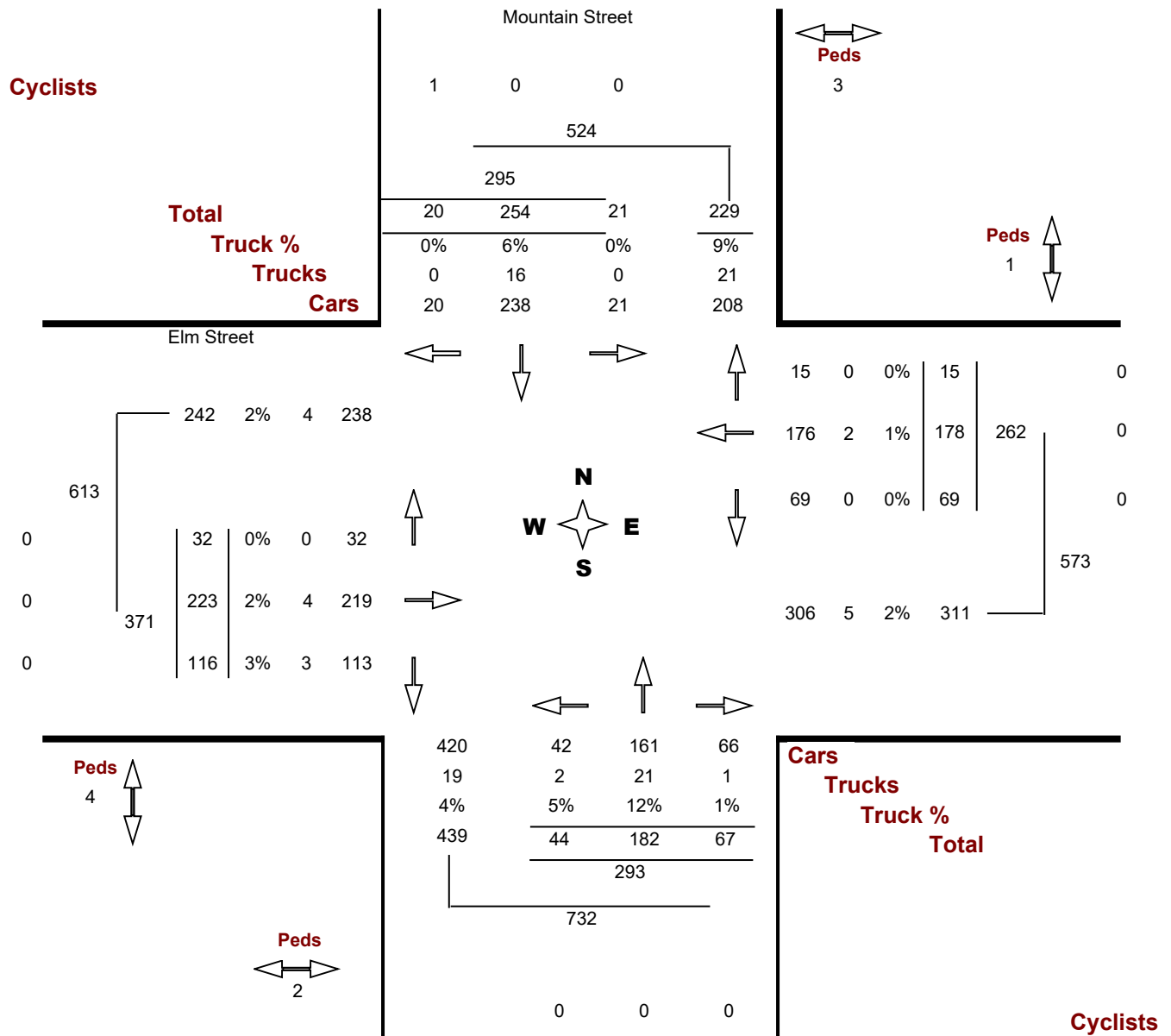
Count Date. Tuesday, 09 April, 2019

Traffic Cont.

Count Time. 03:00 PM — 06:00 PM

Major Dir..... North south

Peak Hour.. 04:00 PM — 05:00 PM



**Location**..... Elm Street @ Mountain Street

**Municipality**..... GRIMSBY

**Count Date**..... Tuesday, April 09, 2019

		Mountain Street										Elm Street									
		North Approach					South Approach					East Approach					West Approach				
Time Period		LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT
07:00	07:15	0	25	1	0	26	11	66	6	0	83	3	15	0	0	18	1	11	3	0	15
07:15	07:30	0	28	2	0	30	13	56	4	0	73	6	18	1	0	25	2	16	8	0	26
07:30	07:45	2	19	4	0	25	14	76	9	0	99	4	16	1	0	21	4	11	7	0	22
07:45	08:00	1	46	1	0	48	36	72	11	0	119	13	19	2	0	34	3	24	9	0	36
<b>Hourly Total</b>		<b>3</b>	<b>118</b>	<b>8</b>	<b>0</b>	<b>129</b>	<b>74</b>	<b>270</b>	<b>30</b>	<b>0</b>	<b>374</b>	<b>26</b>	<b>68</b>	<b>4</b>	<b>0</b>	<b>98</b>	<b>10</b>	<b>62</b>	<b>27</b>	<b>0</b>	<b>99</b>
08:00	08:15	2	21	5	0	28	21	59	10	0	90	7	29	0	0	36	3	21	14	0	38
08:15	08:30	0	29	3	0	32	19	72	15	0	106	5	36	0	0	41	8	31	8	0	47
08:30	08:45	2	27	8	0	37	22	69	14	0	105	13	39	1	0	53	11	38	12	0	61
08:45	09:00	1	28	5	0	34	27	63	23	0	113	6	63	5	0	74	14	42	14	0	70
<b>Hourly Total</b>		<b>5</b>	<b>105</b>	<b>21</b>	<b>0</b>	<b>131</b>	<b>89</b>	<b>263</b>	<b>62</b>	<b>0</b>	<b>414</b>	<b>31</b>	<b>167</b>	<b>6</b>	<b>0</b>	<b>204</b>	<b>36</b>	<b>132</b>	<b>48</b>	<b>0</b>	<b>216</b>
11:00	11:15	5	29	2	0	36	9	42	11	0	62	14	34	6	0	54	6	35	11	0	52
11:15	11:30	4	27	3	0	34	14	32	7	0	53	9	39	8	0	56	7	39	18	0	64
11:30	11:45	9	40	9	0	58	10	47	14	0	71	5	45	2	0	52	11	39	16	0	66
11:45	12:00	6	25	4	0	35	10	37	7	0	54	11	39	11	0	61	8	43	13	0	64
<b>Hourly Total</b>		<b>24</b>	<b>121</b>	<b>18</b>	<b>0</b>	<b>163</b>	<b>43</b>	<b>158</b>	<b>39</b>	<b>0</b>	<b>240</b>	<b>39</b>	<b>157</b>	<b>27</b>	<b>0</b>	<b>223</b>	<b>32</b>	<b>156</b>	<b>58</b>	<b>0</b>	<b>246</b>
12:00	12:15	6	21	2	0	29	12	49	5	0	66	9	28	5	0	42	5	36	14	0	55
12:15	12:30	6	38	7	0	51	7	35	9	0	51	14	39	5	0	58	7	38	22	0	67
12:30	12:45	6	42	4	0	52	11	40	7	0	58	10	40	3	0	53	6	49	23	0	78
12:45	13:00	6	50	4	0	60	13	39	14	0	66	10	43	4	0	57	8	35	21	0	64
<b>Hourly Total</b>		<b>24</b>	<b>151</b>	<b>17</b>	<b>0</b>	<b>192</b>	<b>43</b>	<b>163</b>	<b>35</b>	<b>0</b>	<b>241</b>	<b>43</b>	<b>150</b>	<b>17</b>	<b>0</b>	<b>210</b>	<b>26</b>	<b>158</b>	<b>80</b>	<b>0</b>	<b>264</b>
13:00	13:15	4	32	7	0	43	9	31	7	0	47	4	42	8	0	54	7	43	14	0	64
13:15	13:30	6	49	10	0	65	10	44	11	0	65	10	30	7	0	47	5	35	11	0	51
13:30	13:45	3	30	3	0	36	13	45	12	0	70	14	36	4	0	54	5	56	6	0	67
13:45	14:00	6	32	2	0	40	14	43	19	0	76	18	34	6	0	58	3	45	18	0	66
<b>Hourly Total</b>		<b>19</b>	<b>143</b>	<b>22</b>	<b>0</b>	<b>184</b>	<b>46</b>	<b>163</b>	<b>49</b>	<b>0</b>	<b>258</b>	<b>46</b>	<b>142</b>	<b>25</b>	<b>0</b>	<b>213</b>	<b>20</b>	<b>179</b>	<b>49</b>	<b>0</b>	<b>248</b>
15:00	15:15	4	56	4	0	64	18	56	11	0	85	14	57	5	0	76	16	57	27	0	100
15:15	15:30	7	65	6	0	78	12	43	7	0	62	10	30	5	0	45	14	68	52	0	134
15:30	15:45	10	55	6	0	71	9	37	8	0	54	15	42	5	0	62	9	52	29	0	90
15:45	16:00	5	48	3	0	56	4	46	18	0	68	17	46	2	0	65	11	67	25	0	103
<b>Hourly Total</b>		<b>26</b>	<b>224</b>	<b>19</b>	<b>0</b>	<b>269</b>	<b>43</b>	<b>182</b>	<b>44</b>	<b>0</b>	<b>269</b>	<b>56</b>	<b>175</b>	<b>17</b>	<b>0</b>	<b>248</b>	<b>50</b>	<b>244</b>	<b>133</b>	<b>0</b>	<b>427</b>
16:00	16:15	7	63	9	0	79	7	46	13	0	66	19	44	5	0	68	10	64	28	0	102



Mountain Street

Elm Street

North Approach

South Approach

East Approach

West Approach

Time Period	LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT
16:15 16:30	5	63	2	0	70	15	48	20	0	83	21	39	5	0	65	8	57	27	0	92
16:30 16:45	3	64	6	0	73	11	44	17	0	72	15	45	1	0	61	5	53	35	0	93
16:45 17:00	6	64	3	0	73	11	44	17	0	72	14	50	4	0	68	9	49	26	0	84
Hourly Total	21	254	20	0	295	44	182	67	0	293	69	178	15	0	262	32	223	116	0	371
17:00 17:15	4	71	2	0	77	15	38	11	0	64	16	41	2	0	59	7	44	30	0	81
17:15 17:30	3	62	4	0	69	11	48	14	0	73	13	31	2	0	46	12	43	21	0	76
17:30 17:45	2	70	3	0	75	7	33	15	0	55	16	33	1	0	50	5	39	31	0	75
17:45 18:00	4	50	3	0	57	18	33	16	0	67	11	25	0	0	36	9	34	19	0	62
Hourly Total	13	253	12	0	278	51	152	56	0	259	56	130	5	0	191	33	160	101	0	294
Grand Total	135	1369	137	0	1641	433	1533	382	0	2348	366	1167	116	0	1649	239	1314	612	0	2165
Truck %	1%	14%	3%	0%	12%	10%	13%	2%	0%	11%	2%	2%	3%	0%	2%	3%	2%	10%	0%	4%

## **APPENDIX D: Existing Signal Timing Plans**



**Signal Code: 012081**  
**Intersection: RR12(Mountain St.) & RR81(Main St.)**  
**Municipality: grimsby**  
**Owner: region**  
**Last Modified: 5/3/2021 1:16:53 PM**

Timing Parameters	EBD MAIN ST. ADVANCE	WBD & EBD MAIN THRU	SBD & NBD CHRISTIE ADVANCE	NBD & SBD CHRISTIE THRU	n/a	n/a
Min Green	6	10	6	10	0	0
Walk	0	15	0	18	0	0
Ped Clearance	0	18	0	20	0	0
Vehicle Ext.	2.6	2.5	2.6	2.5	0	0
Max Green	20	50	10	50	0	0
Yellow	3	4.1	3	4.1	0	0
All Red	0	2.4	0	3.1	0	0

		Offset
Minimum Cycle	33.7	0
Pedestrian Cycle	84.7	
Maximum Cycle	149.7	0
Operation	FA	

**Installed On:**

**7/28/2011**

**Count Date:**

**10/7/2009**

**FA = Fully Actuated**

**SA = Semi Actuated**

**FT = Fixed Time**

Close Window    Print Entry\*    Refresh Entry

**\*Note: you need to change the paper orientation from Portrait to Landscape**

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<b>Signal Code: 012ELM</b>						
<b>Intersection: RR12 (MOUNTAIN STREET) &amp; ELM STREET</b>						
<b>Municipality: grimsby</b>						
<b>Owner: region</b>						
<b>Last Modified: 5/29/2018 11:44:59 AM</b>						
Timing Parameters	NBD & SBD MOUNTAIN	EBD & WBD ELM	n/a	n/a	n/a	n/a
Min Green	<b>8</b>	<b>8</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Walk	<b>8</b>	<b>8</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Ped Clearance	<b>9</b>	<b>9</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Vehicle Ext.	<b>2.5</b>	<b>2.5</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Max Green	<b>23</b>	<b>25</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Yellow	<b>4.1</b>	<b>4.1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
All Red	<b>2</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

		Offset
Minimum Cycle	<b>28.2</b>	<b>0</b>
Pedestrian Cycle	<b>46.2</b>	
Maximum Cycle	<b>60.2</b>	<b>0</b>
Operation	<b>FA</b>	

**Installed On:**

**5/4/2018**

**Count Date:**

**9/30/2016**

**FA = Fully Actuated**

**SA = Semi Actuated**

**FT = Fixed Time**

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**\*Note: you need to change the paper orientation from Portrait to Landscape**

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## **APPENDIX E: Intersection Analysis Worksheets**



HCM Signalized Intersection Capacity Analysis  
1: Mountain Street & Main Street W

Existing (AM)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	147	251	33	0	318	82	80	217	19	55	137	213
Future Volume (vph)	147	251	33	0	318	82	80	217	19	55	137	213
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.0	6.5			6.5		3.0	7.2		3.0	7.2	
Lane Util. Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Frbp, ped/bikes	1.00	0.99			0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		0.99	1.00	
Frt	1.00	0.98			0.97		1.00	0.99		1.00	0.91	
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1567	1553			1669		1433	1578		1591	1465	
Flt Permitted	0.24	1.00			1.00		0.33	1.00		0.49	1.00	
Satd. Flow (perm)	392	1553			1669		492	1578		816	1465	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	160	273	36	0	346	89	87	236	21	60	149	232
RTOR Reduction (vph)	0	3	0	0	6	0	0	2	0	0	37	0
Lane Group Flow (vph)	160	306	0	0	429	0	87	255	0	60	344	0
Confl. Peds. (#/hr)	7		26	26		7			9	9		
Heavy Vehicles (%)	6%	9%	15%	0%	1%	2%	16%	10%	0%	4%	14%	5%
Turn Type	pm+pt	NA			NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases	4						2			6		
Actuated Green, G (s)	73.0	73.0			50.0		60.0	50.0		60.0	50.0	
Effective Green, g (s)	73.0	73.0			50.0		60.0	50.0		60.0	50.0	
Actuated g/C Ratio	0.49	0.49			0.33		0.40	0.33		0.40	0.33	
Clearance Time (s)	3.0	6.5			6.5		3.0	7.2		3.0	7.2	
Lane Grp Cap (vph)	348	757			557		260	527		378	489	
v/s Ratio Prot	c0.06	0.20			c0.26		c0.02	0.16		0.01	c0.23	
v/s Ratio Perm	0.16						0.11			0.05		
v/c Ratio	0.46	0.40			0.77		0.33	0.48		0.16	0.70	
Uniform Delay, d1	25.2	24.5			44.7		30.0	39.6		28.2	43.4	
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.3	1.6			9.9		3.4	3.2		0.9	8.2	
Delay (s)	29.5	26.1			54.6		33.5	42.8		29.1	51.6	
Level of Service	C	C			D		C	D		C	D	
Approach Delay (s)		27.2			54.6			40.4			48.5	
Approach LOS		C			D			D			D	

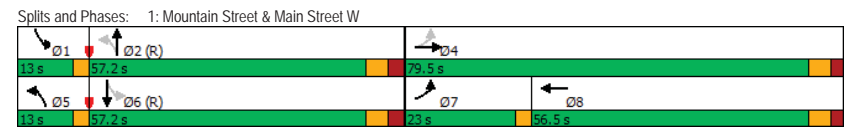
Intersection Summary			
HCM 2000 Control Delay	42.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	149.7	Sum of lost time (s)	19.7
Intersection Capacity Utilization	91.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Queues  
1: Mountain Street & Main Street W

Existing (AM)

Lane Group	EBL	EBT	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	147	251	318	80	217	55	137
Future Volume (vph)	147	251	318	80	217	55	137
Lane Group Flow (vph)	160	309	435	87	257	60	381
Turn Type	pm+pt	NA	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	8	5	2	1	6
Permitted Phases	4			2		6	
Detector Phase	7	4	8	5	2	1	6
Switch Phase							
Minimum Initial (s)	6.0	10.0	10.0	6.0	10.0	6.0	10.0
Minimum Split (s)	9.5	39.5	39.5	9.5	45.2	9.5	45.2
Total Split (s)	23.0	79.5	56.5	13.0	57.2	13.0	57.2
Total Split (%)	15.4%	53.1%	37.7%	8.7%	38.2%	8.7%	38.2%
Yellow Time (s)	3.0	4.1	4.1	3.0	4.1	3.0	4.1
All-Red Time (s)	0.0	2.4	2.4	0.0	3.1	0.0	3.1
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.5	6.5	3.0	7.2	3.0	7.2
Lead/Lag	Lead		Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes		Yes	Yes	Yes	Yes	Yes
Recall Mode	Max	Max	Max	Max	Max	Max	Max
v/c Ratio	0.45	0.41	0.77	0.32	0.49	0.15	0.72
Control Delay	24.2	26.0	54.5	27.6	42.9	24.7	46.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.2	26.0	54.5	27.6	42.9	24.7	46.2
Queue Length 50th (m)	26.6	59.3	119.9	15.8	63.2	10.6	90.4
Queue Length 95th (m)	41.5	85.0	164.6	27.6	91.8	20.1	132.0
Internal Link Dist (m)		87.2	97.9		105.0		107.9
Turn Bay Length (m)	20.0			45.0			
Base Capacity (vph)	357	760	563	273	529	400	526
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	0.45	0.41	0.77	0.32	0.49	0.15	0.72

Intersection Summary	
Cycle Length:	149.7
Actuated Cycle Length:	149.7
Offset:	54.5 (36%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle:	105
Control Type:	Pretimed



Queues  
3: Mountain Street & Elm Street

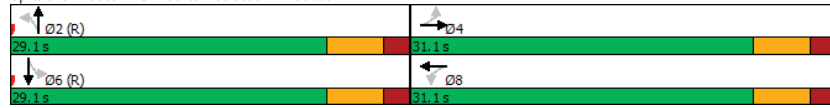
Existing (AM)

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖	↗	↖	↗	↖	↗	↖	↗
Traffic Volume (vph)	36	132	31	167	89	263	5	105
Future Volume (vph)	36	132	31	167	89	263	5	105
Lane Group Flow (vph)	39	195	34	189	0	461	0	142
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Minimum Split (s)	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1
Total Split (s)	31.1	31.1	31.1	31.1	29.1	29.1	29.1	29.1
Total Split (%)	51.7%	51.7%	51.7%	51.7%	48.3%	48.3%	48.3%	48.3%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max
v/c Ratio	0.09	0.29	0.07	0.27		0.86		0.25
Control Delay	11.4	10.8	11.3	12.6		35.6		12.4
Queue Delay	0.0	0.0	0.0	0.0		0.0		0.0
Total Delay	11.4	10.8	11.3	12.6		35.6		12.4
Queue Length 50th (m)	2.6	11.4	2.3	13.5		45.6		9.3
Queue Length 95th (m)	7.6	24.1	6.9	26.0		#97.6		20.6
Internal Link Dist (m)		56.0		63.6		77.7		48.5
Turn Bay Length (m)	140.0		45.0					
Base Capacity (vph)	453	671	457	703		536		563
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	0.09	0.29	0.07	0.27		0.86		0.25

Intersection Summary

Cycle Length: 60.2  
 Actuated Cycle Length: 60.2  
 Offset: 0 (0%), Referenced to phase 2-NBTL and 6-SBTL, Start of Green  
 Natural Cycle: 60  
 Control Type: Pretimed  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 3: Mountain Street & Elm Street



HCM Unsignalized Intersection Capacity Analysis  
2: Mountain Street & Site Driveway

Existing (AM)

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖	↗	↖	↗	↖	↗
Traffic Volume (veh/h)	0	0	305	0	0	131
Future Volume (Veh/h)	0	0	305	0	0	131
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	332	0	0	142
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)			73			129
pX, platoon unblocked						
vC, conflicting volume	474	332			332	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	474	332			332	
IC, single (s)	6.4	6.2			4.1	
IC, 2 stage (s)						
IF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	549	710			1227	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	0	332	142			
Volume Left	0	0	0			
Volume Right	0	0	0			
eSH	1700	1700	1227			
Volume to Capacity	0.00	0.20	0.00			
Queue Length 95th (m)	0.0	0.0	0.0			
Control Delay (s)	0.0	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	0.0	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay		0.0				
Intersection Capacity Utilization		20.8%		ICU Level of Service		A
Analysis Period (min)		15				

Queues

1: Mountain Street & Main Street W

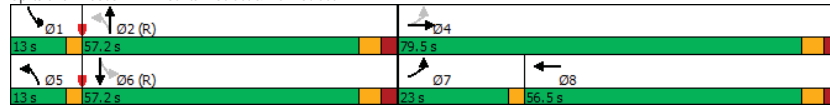
Existing (PM)

	↖	→	←	↙	↑	↘	↓
Lane Group	EBL	EBT	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖	↖	↖	↖	↖	↖	↖
Traffic Volume (vph)	166	410	354	85	200	123	223
Future Volume (vph)	166	410	354	85	200	123	223
Lane Group Flow (vph)	180	522	470	92	259	134	421
Turn Type	pm+pt	NA	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	8	5	2	1	6
Permitted Phases	4			2			6
Detector Phase	7	4	8	5	2	1	6
Switch Phase							
Minimum Initial (s)	6.0	10.0	10.0	6.0	10.0	6.0	10.0
Minimum Split (s)	9.5	39.5	39.5	9.5	45.2	9.5	45.2
Total Split (s)	23.0	79.5	56.5	13.0	57.2	13.0	57.2
Total Split (%)	15.4%	53.1%	37.7%	8.7%	38.2%	8.7%	38.2%
Yellow Time (s)	3.0	4.1	4.1	3.0	4.1	3.0	4.1
All-Red Time (s)	0.0	2.4	2.4	0.0	3.1	0.0	3.1
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.5	6.5	3.0	7.2	3.0	7.2
Lead/Lag	Lead		Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes		Yes	Yes	Yes	Yes	Yes
Recall Mode	Max	Max	Max	Max	Max	Max	Max
v/c Ratio	0.53	0.65	0.85	0.32	0.50	0.33	0.80
Control Delay	26.4	32.9	60.8	27.4	42.6	27.4	55.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.4	32.9	60.8	27.4	42.6	27.4	55.3
Queue Length 50th (m)	30.3	118.1	134.5	16.6	62.9	24.8	113.0
Queue Length 95th (m)	46.1	160.3	#194.9	28.5	92.1	39.7	#160.5
Internal Link Dist (m)		87.2	97.9		105.0		107.9
Turn Bay Length (m)	20.0			45.0			
Base Capacity (vph)	337	807	555	284	523	406	525
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	0.53	0.65	0.85	0.32	0.50	0.33	0.80

Intersection Summary

Cycle Length: 149.7  
 Actuated Cycle Length: 149.7  
 Offset: 54.5 (36%), Referenced to phase 2:NBT and 6:SBT, Start of Green  
 Natural Cycle: 105  
 Control Type: Pre timed  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 1: Mountain Street & Main Street W



HCM Signalized Intersection Capacity Analysis

3: Mountain Street & Elm Street

Existing (AM)

	↖	→	↘	↙	←	↘	↙	↑	↘	↙	↓	↘
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↖		↖	↖		↖	↖	↖	↖	↖	↖
Traffic Volume (vph)	36	132	48	31	167	6	89	263	72	5	105	21
Future Volume (vph)	36	132	48	31	167	6	89	263	72	5	105	21
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	6.1	6.1		6.1	6.1		6.1	6.1	6.1	6.1	6.1	6.1
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	0.98	1.00		0.99	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.96		1.00	0.99		1.00	0.98	1.00	1.00	0.98	1.00
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.99	1.00	1.00	0.99	1.00
Satd. Flow (prot)	1624	1564		1649	1688		1522	1467	1467	1467	1467	1467
Flt Permitted	0.64	1.00		0.64	1.00		0.89	0.98	0.98	0.98	0.98	0.98
Satd. Flow (perm)	1092	1564		1102	1688		1374	1444	1444	1444	1444	1444
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	39	143	52	34	182	7	97	286	78	5	114	23
RTOR Reduction (vph)	0	22	0	0	2	0	0	12	0	0	12	0
Lane Group Flow (vph)	39	173	0	34	187	0	0	449	0	0	130	0
Confl. Peds. (#/hr)	17		6	6		17	1		3	3		1
Heavy Vehicles (%)	0%	2%	19%	0%	3%	0%	10%	13%	3%	0%	19%	5%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	NA	Perm	NA
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		6			
Actuated Green, G (s)	25.0	25.0		25.0	25.0		23.0		23.0		23.0	
Effective Green, g (s)	25.0	25.0		25.0	25.0		23.0		23.0		23.0	
Actuated g/C Ratio	0.42	0.42		0.42	0.42		0.38		0.38		0.38	
Clearance Time (s)	6.1	6.1		6.1	6.1		6.1		6.1		6.1	
Lane Grp Cap (vph)	453	649		457	700		524		551		551	
v/s Ratio Prot		c0.11			0.11							
v/s Ratio Perm	0.04			0.03			c0.33		0.09		0.09	
v/c Ratio	0.09	0.27		0.07	0.27		0.86		0.24		0.24	
Uniform Delay, d1	10.7	11.6		10.6	11.6		17.1		12.6		12.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00		1.00		1.00	
Incremental Delay, d2	0.4	1.0		0.3	0.9		16.3		1.0		1.0	
Delay (s)	11.0	12.6		10.9	12.5		33.4		13.6		13.6	
Level of Service	B	B		B	B		C		B		B	
Approach Delay (s)		12.3			12.3		33.4		13.6		13.6	
Approach LOS		B			B		C		B		B	

Intersection Summary

HCM 2000 Control Delay: 21.7  
 HCM 2000 Volume to Capacity ratio: 0.55  
 Actuated Cycle Length (s): 60.2  
 Intersection Capacity Utilization: 80.5%  
 Analysis Period (min): 15  
 HCM 2000 Level of Service: C  
 Sum of lost time (s): 12.2  
 ICU Level of Service: D  
 Critical Lane Group



HCM Unsignalized Intersection Capacity Analysis  
2: Mountain Street & Site Driveway

Existing (PM)

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔		↔			↔
Traffic Volume (veh/h)	0	0	229	0	0	295
Future Volume (Veh/h)	0	0	229	0	0	295
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	249	0	0	321
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None		None	
Median storage (veh)						
Upstream signal (m)			73			129
pX, platoon unblocked						
vC, conflicting volume	570	249			249	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	570	249			249	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	483	790			1317	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	0	249	321			
Volume Left	0	0	0			
Volume Right	0	0	0			
cSH	1700	1700	1317			
Volume to Capacity	0.00	0.15	0.00			
Queue Length 95th (m)	0.0	0.0	0.0			
Control Delay (s)	0.0	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	0.0	0.0	0.0			
Approach LOS	A					
<b>Intersection Summary</b>						
Average Delay			0.0			
Intersection Capacity Utilization			20.2%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis  
1: Mountain Street & Main Street W

Existing (PM)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔		↔	↔		↔	↔	↔
Traffic Volume (vph)	166	410	70	0	354	78	85	200	39	123	223	165
Future Volume (vph)	166	410	70	0	354	78	85	200	39	123	223	165
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.0	6.5			6.5		3.0	7.2		3.0	7.2	
Lane Util. Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Frbp, ped/bikes	1.00	0.98			0.99		1.00	0.99		1.00	0.98	
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		0.99	1.00	
Frt	1.00	0.98			0.98		1.00	0.98		1.00	0.94	
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1594	1648			1647		1660	1553		1620	1520	
Flt Permitted	0.20	1.00			1.00		0.28	1.00		0.48	1.00	
Satd. Flow (perm)	332	1648			1647		483	1553		826	1520	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	180	446	76	0	385	85	92	217	42	134	242	179
RTOR Reduction (vph)	0	4	0	0	5	0	0	5	0	0	18	0
Lane Group Flow (vph)	180	518	0	0	465	0	92	254	0	134	403	0
Confl. Peds. (#/hr)	27		43	43		27	8		11	11		8
Heavy Vehicles (%)	4%	2%	3%	0%	2%	3%	0%	11%	0%	2%	10%	1%
Turn Type	pm+pt	NA			NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases	4						2			6		
Actuated Green, G (s)	73.0	73.0			50.0		60.0	50.0		60.0	50.0	
Effective Green, g (s)	73.0	73.0			50.0		60.0	50.0		60.0	50.0	
Actuated g/C Ratio	0.49	0.49			0.33		0.40	0.33		0.40	0.33	
Clearance Time (s)	3.0	6.5			6.5		3.0	7.2		3.0	7.2	
Lane Grp Cap (vph)	330	803			550		272	518		384	507	
v/s Ratio Prot	0.07	c0.31			c0.28		0.02	0.16		c0.02	c0.27	
v/s Ratio Perm	0.19						0.11			0.12		
v/c Ratio	0.55	0.64			0.84		0.34	0.49		0.35	0.79	
Uniform Delay, d1	26.4	28.7			46.3		30.5	39.7		29.6	45.2	
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	6.3	4.0			14.7		3.3	3.3		2.5	12.2	
Delay (s)	32.8	32.6			61.0		33.8	43.0		32.1	57.4	
Level of Service	C	C			E		C	D		C	E	
Approach Delay (s)		32.7			61.0			40.6			51.3	
Approach LOS		C			E			D			D	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			45.4									D
HCM 2000 Volume to Capacity ratio			0.76									
Actuated Cycle Length (s)			149.7			Sum of lost time (s)				19.7		
Intersection Capacity Utilization			94.6%			ICU Level of Service				F		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
3: Mountain Street & Elm Street

Existing (PM)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	[Diagrammatic Lane Configurations]											
Traffic Volume (vph)	32	223	116	69	178	15	44	182	67	21	254	20
Future Volume (vph)	32	223	116	69	178	15	44	182	67	21	254	20
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	6.1											
Lane Util. Factor	1.00											
Frbp, ped/bikes	1.00											
Flpb, ped/bikes	1.00											
Frt	1.00											
Flt Protected	0.95											
Satd. Flow (prot)	1656											
Flt Permitted	0.63											
Satd. Flow (perm)	1093											
Peak-hour factor, PHF	0.92											
Adj. Flow (vph)	35											
RTOR Reduction (vph)	0											
Lane Group Flow (vph)	35											
Confl. Peds. (#/hr)	3											
Heavy Vehicles (%)	0%											
Turn Type	Perm											
Protected Phases	4											
Permitted Phases	4											
Actuated Green, G (s)	25.0											
Effective Green, g (s)	25.0											
Actuated g/C Ratio	0.42											
Clearance Time (s)	6.1											
Lane Grp Cap (vph)	453											
v/s Ratio Prot	c0.21											
v/s Ratio Perm	0.03											
v/c Ratio	0.08											
Uniform Delay, d1	10.6											
Progression Factor	1.00											
Incremental Delay, d2	0.3											
Delay (s)	11.0											
Level of Service	B											
Approach Delay (s)	15.3											
Approach LOS	B											
<b>Intersection Summary</b>												
HCM 2000 Control Delay	16.2		HCM 2000 Level of Service				B					
HCM 2000 Volume to Capacity ratio	0.53											
Actuated Cycle Length (s)	60.2		Sum of lost time (s)				12.2					
Intersection Capacity Utilization	72.0%		ICU Level of Service				C					
Analysis Period (min)	15											
c Critical Lane Group												

Queues  
3: Mountain Street & Elm Street

Existing (PM)

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	[Diagrammatic Lane Configurations]							
Traffic Volume (vph)	32	223	69	178	44	182	21	254
Future Volume (vph)	32	223	69	178	44	182	21	254
Lane Group Flow (vph)	35	368	75	209	0	319	0	321
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	4							
Permitted Phases	4							
Detector Phase	4							
Switch Phase								
Minimum Initial (s)	8.0							
Minimum Split (s)	25.1							
Total Split (s)	31.1							
Total Split (%)	51.7%							
Yellow Time (s)	4.1							
All-Red Time (s)	2.0							
Lost Time Adjust (s)	0.0							
Total Lost Time (s)	6.1							
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	Max							
v/c Ratio	0.08							
Control Delay	11.3							
Queue Delay	0.0							
Total Delay	11.3							
Queue Length 50th (m)	2.4							
Queue Length 95th (m)	7.1							
Internal Link Dist (m)	56.0							
Turn Bay Length (m)	140.0							
Base Capacity (vph)	453							
Starvation Cap Reductn	0							
Spillback Cap Reductn	0							
Storage Cap Reductn	0							
Reduced v/c Ratio	0.08							
<b>Intersection Summary</b>								
Cycle Length: 60.2								
Actuated Cycle Length: 60.2								
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green								
Natural Cycle: 55								
Control Type: Pretimed								
Splints and Phases: 3: Mountain Street & Elm Street								
[Queue Diagram: Shows lane groups and their respective queue lengths and delays]								

HCM Signalized Intersection Capacity Analysis  
1: Mountain Street & Main Street W

Future Background (AM)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↘		↖	↗	↖	↗	↘	↖	↗	↘
Traffic Volume (vph)	147	277	33	0	351	82	80	240	19	55	151	213
Future Volume (vph)	147	277	33	0	351	82	80	240	19	55	151	213
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.0	6.5			6.5		3.0	7.2		3.0	7.2	
Lane Util. Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Frbp, ped/bikes	1.00	0.99			0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98			0.97		1.00	0.99		1.00	0.91	
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1567	1557			1674		1433	1579		1592	1468	
Flt Permitted	0.20	1.00			1.00		0.31	1.00		0.45	1.00	
Satd. Flow (perm)	325	1557			1674		464	1579		760	1468	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	160	301	36	0	382	89	87	261	21	60	164	232
RTOR Reduction (vph)	0	3	0	0	5	0	0	2	0	0	34	0
Lane Group Flow (vph)	160	334	0	0	466	0	87	280	0	60	362	0
Confl. Peds. (#/hr)	7		26	26		7			9		9	
Heavy Vehicles (%)	6%	9%	15%	0%	1%	2%	16%	10%	0%	4%	14%	5%
Turn Type	pm+pt	NA			NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases	4						2			6		
Actuated Green, G (s)	73.0	73.0			50.0		60.0	50.0		60.0	50.0	
Effective Green, g (s)	73.0	73.0			50.0		60.0	50.0		60.0	50.0	
Actuated g/C Ratio	0.49	0.49			0.33		0.40	0.33		0.40	0.33	
Clearance Time (s)	3.0	6.5			6.5		3.0	7.2		3.0	7.2	
Lane Grp Cap (vph)	324	759			559		250	527		360	490	
v/s Ratio Prot	c0.07	0.21			c0.28		c0.02	0.18		0.01	c0.25	
v/s Ratio Perm	0.17						0.12			0.06		
v/c Ratio	0.49	0.44			0.83		0.35	0.53		0.17	0.74	
Uniform Delay, d1	26.1	25.0			46.0		30.3	40.4		28.4	44.1	
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	5.3	1.8			13.6		3.8	3.8		1.0	9.6	
Delay (s)	31.4	26.9			59.6		34.0	44.2		29.4	53.7	
Level of Service	C	C			E		C	D		C	D	
Approach Delay (s)		28.3			59.6			41.8			50.5	
Approach LOS		C			E			D			D	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		44.9									D	
HCM 2000 Volume to Capacity ratio		0.71										
Actuated Cycle Length (s)		149.7			Sum of lost time (s)			19.7				
Intersection Capacity Utilization		91.1%			ICU Level of Service			F				
Analysis Period (min)		15										
c Critical Lane Group												

Queues

Future Background (AM)

1: Mountain Street & Main Street W

Lane Group	EBL	EBT	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖	↗	↖	↖	↗	↖	↗
Traffic Volume (vph)	147	277	351	80	240	55	151
Future Volume (vph)	147	277	351	80	240	55	151
Lane Group Flow (vph)	160	337	471	87	282	60	396
Turn Type	pm+pt	NA	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	8	5	2	1	6
Permitted Phases	4			2		6	
Detector Phase	7	4	8	5	2	1	6
<b>Switch Phase</b>							
Minimum Initial (s)	6.0	10.0	10.0	6.0	10.0	6.0	10.0
Minimum Split (s)	9.5	39.5	39.5	9.5	45.2	9.5	45.2
Total Split (s)	23.0	79.5	56.5	13.0	57.2	13.0	57.2
Total Split (%)	15.4%	53.1%	37.7%	8.7%	38.2%	8.7%	38.2%
Yellow Time (s)	3.0	4.1	4.1	3.0	4.1	3.0	4.1
All-Red Time (s)	0.0	2.4	2.4	0.0	3.1	0.0	3.1
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.5	6.5	3.0	7.2	3.0	7.2
Lead/Lag	Lead		Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes		Yes	Yes	Yes	Yes	Yes
Recall Mode	Max	Max	Max	Max	Max	Max	Max
v/c Ratio	0.48	0.44	0.84	0.33	0.53	0.16	0.76
Control Delay	25.2	26.9	59.5	27.9	44.4	24.8	49.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.2	26.9	59.5	27.9	44.4	24.8	49.0
Queue Length 50th (m)	26.6	66.3	134.1	15.8	70.7	10.6	97.4
Queue Length 95th (m)	41.5	94.0	#192.0	27.6	101.6	20.1	141.2
Internal Link Dist (m)		87.2	97.9		105.0		107.9
Turn Bay Length (m)	20.0			45.0			
Base Capacity (vph)	331	762	564	263	529	380	524
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	0.48	0.44	0.84	0.33	0.53	0.16	0.76
<b>Intersection Summary</b>							
Cycle Length: 149.7							
Actuated Cycle Length: 149.7							
Offset: 54.5 (36%), Referenced to phase 2:NBT and 6:SBTL, Start of Green							
Natural Cycle: 105							
Control Type: Pretimed							
# 95th percentile volume exceeds capacity, queue may be longer.							
Queue shown is maximum after two cycles.							
<b>Splits and Phases: 1: Mountain Street &amp; Main Street W</b>							
↖	↗	↖	↖	↗	↖	↗	
13 s	57.2 s			79.5 s			
↖	↗	↖	↖	↗	↖	↗	
13 s	57.2 s			79.5 s		56.5 s	

Queues  
3: Mountain Street & Elm Street

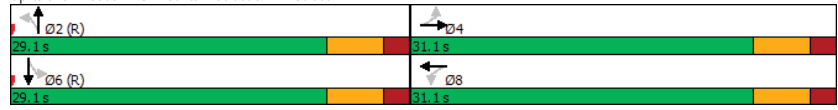
Future Background (AM)

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	36	146	31	184	89	286	5	119
Future Volume (vph)	36	146	31	184	89	286	5	119
Lane Group Flow (vph)	39	211	34	207	0	486	0	157
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	4		8		2		6	
Permitted Phases	4		8		2		6	
Detector Phase	4		8		2		6	
Switch Phase	8.0		8.0		8.0		8.0	
Minimum Initial (s)	8.0		8.0		8.0		8.0	
Minimum Split (s)	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1
Total Split (s)	31.1	31.1	31.1	31.1	29.1	29.1	29.1	29.1
Total Split (%)	51.7%	51.7%	51.7%	51.7%	48.3%	48.3%	48.3%	48.3%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max
v/c Ratio	0.09	0.31	0.08	0.29		0.91		0.28
Control Delay	11.4	11.5	11.3	12.9		41.6		13.1
Queue Delay	0.0	0.0	0.0	0.0		0.0		0.0
Total Delay	11.4	11.5	11.3	12.9		41.6		13.1
Queue Length 50th (m)	2.6	13.1	2.3	15.0		49.8		10.8
Queue Length 95th (m)	7.7	26.6	6.9	28.4		#104.9		22.8
Internal Link Dist (m)		56.0		63.6		77.7		48.5
Turn Bay Length (m)	140.0		45.0					
Base Capacity (vph)	446	673	451	703		537		562
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	0.09	0.31	0.08	0.29		0.91		0.28

Intersection Summary

Cycle Length: 60.2  
 Actuated Cycle Length: 60.2  
 Offset: 0 (0%), Referenced to phase 2-NBTL and 6-SBTL, Start of Green  
 Natural Cycle: 60  
 Control Type: Pretimed  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 3: Mountain Street & Elm Street



HCM Unsignalized Intersection Capacity Analysis  
2: Mountain Street & Site Driveway

Future Background (AM)

	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔
Traffic Volume (veh/h)	0	0	328	0	0	145
Future Volume (Veh/h)	0	0	328	0	0	145
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	357	0	0	158
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None		None	
Median storage (veh)						
Upstream signal (m)			73		129	
pX, platoon unblocked						
vC, conflicting volume	515	357			357	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	515	357			357	
IC, single (s)	6.4	6.2			4.1	
IC, 2 stage (s)						
IF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	520	687			1202	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	0	357	158
Volume Left	0	0	0
Volume Right	0	0	0
sSH	1700	1700	1202
Volume to Capacity	0.00	0.21	0.00
Queue Length 95th (m)	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0
Lane LOS	A		
Approach Delay (s)	0.0	0.0	0.0
Approach LOS	A		

Intersection Summary

Average Delay: 0.0  
 Intersection Capacity Utilization: 22.1%  
 Analysis Period (min): 15  
 ICU Level of Service: A

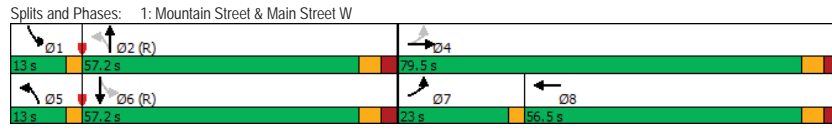
Queues

1: Mountain Street & Main Street W

Future Background (PM)

	↖	→	←	↙	↑	↘	↓
Lane Group	EBL	EBT	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖	↘	↘	↖	↘	↖	↘
Traffic Volume (vph)	166	453	391	85	221	123	246
Future Volume (vph)	166	453	391	85	221	123	246
Lane Group Flow (vph)	180	568	510	92	282	134	446
Turn Type	pm+pt	NA	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	8	5	2	1	6
Permitted Phases	4			2			6
Detector Phase	7	4	8	5	2	1	6
Switch Phase							
Minimum Initial (s)	6.0	10.0	10.0	6.0	10.0	6.0	10.0
Minimum Split (s)	9.5	39.5	39.5	9.5	45.2	9.5	45.2
Total Split (s)	23.0	79.5	56.5	13.0	57.2	13.0	57.2
Total Split (%)	15.4%	53.1%	37.7%	8.7%	38.2%	8.7%	38.2%
Yellow Time (s)	3.0	4.1	4.1	3.0	4.1	3.0	4.1
All-Red Time (s)	0.0	2.4	2.4	0.0	3.1	0.0	3.1
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.5	6.5	3.0	7.2	3.0	7.2
Lead/Lag	Lead		Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes		Yes	Yes	Yes	Yes	Yes
Recall Mode	Max	Max	Max	Max	Max	Max	Max
v/c Ratio	0.58	0.70	0.92	0.35	0.54	0.35	0.85
Control Delay	28.8	35.3	69.8	28.0	44.2	27.7	60.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.8	35.3	69.8	28.0	44.2	27.7	60.1
Queue Length 50th (m)	30.3	134.2	151.4	16.6	70.2	24.8	123.8
Queue Length 95th (m)	47.1	181.3	#222.5	28.5	101.1	39.7	#183.8
Internal Link Dist (m)		87.2	97.9		105.0		107.9
Turn Bay Length (m)	20.0			45.0			
Base Capacity (vph)	309	809	556	265	523	387	525
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	0.58	0.70	0.92	0.35	0.54	0.35	0.85

**Intersection Summary**  
 Cycle Length: 149.7  
 Actuated Cycle Length: 149.7  
 Offset: 54.5 (36%), Referenced to phase 2:NBT and 6:SBTL, Start of Green  
 Natural Cycle: 105  
 Control Type: Pre timed  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.



HCM Signalized Intersection Capacity Analysis

3: Mountain Street & Elm Street

Future Background (AM)

	↖	→	↘	↙	←	↘	↙	↑	↘	↙	↓	↘
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↘		↖	↘			↕		↖	↘	↘
Traffic Volume (vph)	36	146	48	31	184	6	89	286	72	5	119	21
Future Volume (vph)	36	146	48	31	184	6	89	286	72	5	119	21
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	6.1	6.1		6.1	6.1			6.1			6.1	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Frpb, ped/bikes	1.00	0.99		1.00	1.00			1.00			1.00	
Flpb, ped/bikes	0.98	1.00		0.99	1.00			1.00			1.00	
Frt	1.00	0.96		1.00	0.99			0.98			0.98	
Flt Protected	0.95	1.00		0.95	1.00			0.99			1.00	
Satd. Flow (prot)	1625	1575		1649	1689			1523			1467	
Flt Permitted	0.63	1.00		0.63	1.00			0.89			0.98	
Satd. Flow (perm)	1074	1575		1087	1689			1376			1445	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	39	159	52	34	200	7	97	311	78	5	129	23
RTOR Reduction (vph)	0	19	0	0	2	0	0	12	0	0	11	0
Lane Group Flow (vph)	39	192	0	34	205	0	0	474	0	0	146	0
Confl. Peds. (#/hr)	17		6	6		17	1		3	3		1
Heavy Vehicles (%)	0%	2%	19%	0%	3%	0%	10%	13%	3%	0%	19%	5%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	25.0	25.0		25.0	25.0			23.0			23.0	
Effective Green, g (s)	25.0	25.0		25.0	25.0			23.0			23.0	
Actuated g/C Ratio	0.42	0.42		0.42	0.42			0.38			0.38	
Clearance Time (s)	6.1	6.1		6.1	6.1			6.1			6.1	
Lane Grp Cap (vph)	446	654		451	701			525			552	
v/s Ratio Prot		c0.12			0.12							
v/s Ratio Perm	0.04			0.03				c0.34			0.10	
v/c Ratio	0.09	0.29		0.08	0.29			0.90			0.27	
Uniform Delay, d1	10.7	11.7		10.6	11.7			17.6			12.8	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	0.4	1.1		0.3	1.1			21.5			1.2	
Delay (s)	11.1	12.9		10.9	12.8			39.0			14.0	
Level of Service	B	B		B	B			D			B	
Approach Delay (s)		12.6			12.5			39.0			14.0	
Approach LOS		B			B			D			B	

**Intersection Summary**  
 HCM 2000 Control Delay: 24.1  
 HCM 2000 Volume to Capacity ratio: 0.58  
 Actuated Cycle Length (s): 60.2  
 Intersection Capacity Utilization: 81.8%  
 Analysis Period (min): 15  
 HCM 2000 Level of Service: C  
 Sum of lost time (s): 12.2  
 ICU Level of Service: D  
 Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis  
2: Mountain Street & Site Driveway

Future Background (PM)

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔		↔			↔
Traffic Volume (veh/h)	0	0	250	0	0	318
Future Volume (Veh/h)	0	0	250	0	0	318
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	272	0	0	346
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None		None	
Median storage (veh)						
Upstream signal (m)			73			129
pX, platoon unblocked						
vC, conflicting volume	618	272			272	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	618	272			272	
IC, single (s)	6.4	6.2			4.1	
IC, 2 stage (s)						
IF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	453	767			1291	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	0	272	346			
Volume Left	0	0	0			
Volume Right	0	0	0			
cSH	1700	1700	1291			
Volume to Capacity	0.00	0.16	0.00			
Queue Length 95th (m)	0.0	0.0	0.0			
Control Delay (s)	0.0	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	0.0	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utilization			21.5%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis  
1: Mountain Street & Main Street W

Future Background (PM)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔		↔	↔		↔	↔	↔
Traffic Volume (vph)	166	453	70	0	391	78	85	221	39	123	246	165
Future Volume (vph)	166	453	70	0	391	78	85	221	39	123	246	165
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.0	6.5			6.5		3.0	7.2		3.0	7.2	
Lane Util. Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Frbp, ped/bikes	1.00	0.98			0.99		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		0.99	1.00	
Frt	1.00	0.98			0.98		1.00	0.98		1.00	0.94	
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1599	1653			1652		1661	1555		1621	1524	
Flt Permitted	0.15	1.00			1.00		0.25	1.00		0.45	1.00	
Satd. Flow (perm)	258	1653			1652		430	1555		774	1524	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	180	492	76	0	425	85	92	240	42	134	267	179
RTOR Reduction (vph)	0	4	0	0	5	0	0	4	0	0	16	0
Lane Group Flow (vph)	180	564	0	0	505	0	92	278	0	134	430	0
Confl. Peds. (#/hr)	27		43	43		27	8		11	11		8
Heavy Vehicles (%)	4%	2%	3%	0%	2%	3%	0%	11%	0%	2%	10%	1%
Turn Type	pm+pt	NA			NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases	4						2			6		
Actuated Green, G (s)	73.0	73.0			50.0		60.0	50.0		60.0	50.0	
Effective Green, g (s)	73.0	73.0			50.0		60.0	50.0		60.0	50.0	
Actuated g/C Ratio	0.49	0.49			0.33		0.40	0.33		0.40	0.33	
Clearance Time (s)	3.0	6.5			6.5		3.0	7.2		3.0	7.2	
Lane Grp Cap (vph)	304	806			551		254	519		366	509	
v/s Ratio Prot	0.08	c0.34			c0.31		0.02	0.18		c0.02	c0.28	
v/s Ratio Perm	0.21						0.12			0.12		
v/c Ratio	0.59	0.70			0.92		0.36	0.54		0.37	0.84	
Uniform Delay, d1	27.7	29.8			47.9		30.9	40.4		29.8	46.3	
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	8.2	5.0			22.5		4.0	3.9		2.8	15.7	
Delay (s)	35.9	34.9			70.4		34.9	44.4		32.6	62.0	
Level of Service	D	C			E		C	D		C	E	
Approach Delay (s)		35.1			70.4			42.0			55.2	
Approach LOS		D			E			D			E	
Intersection Summary												
HCM 2000 Control Delay			49.7								D	
HCM 2000 Volume to Capacity ratio			0.82									
Actuated Cycle Length (s)			149.7			Sum of lost time (s)				19.7		
Intersection Capacity Utilization			95.0%								F	
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
3: Mountain Street & Elm Street

Future Background (PM)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔		↔		↔		↕		↔		↔	
Traffic Volume (vph)	32	246	116	69	197	15	44	203	67	21	277	20
Future Volume (vph)	32	246	116	69	197	15	44	203	67	21	277	20
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	6.1		6.1		6.1		6.1		6.1		6.1	
Lane Util. Factor	1.00		1.00		1.00		1.00		1.00		1.00	
Frbp, ped/bikes	1.00		1.00		1.00		1.00		1.00		1.00	
Flpb, ped/bikes	1.00		1.00		1.00		1.00		1.00		1.00	
Frt	1.00		0.95		1.00		0.99		0.97		0.99	
Flt Protected	0.95		1.00		0.95		1.00		0.99		1.00	
Satd. Flow (prot)	1656		1616		1659		1713		1545		1641	
Flt Permitted	0.62		1.00		0.45		1.00		0.91		0.96	
Satd. Flow (perm)	1072		1616		787		1713		1415		1582	
Peak-hour factor, PHF	0.92		0.92		0.92		0.92		0.92		0.92	
Adj. Flow (vph)	35		267		126		75		214		16	
RTOR Reduction (vph)	0		28		0		0		5		0	
Lane Group Flow (vph)	35		365		0		75		225		0	
Confl. Peds. (#/hr)	3		2		2		3		4		1	
Heavy Vehicles (%)	0%		2%		3%		0%		1%		0%	
Turn Type	Perm		NA		Perm		NA		Perm		NA	
Protected Phases	4		8		8		2		6		6	
Permitted Phases	4		8		2		6		6		6	
Actuated Green, G (s)	25.0		25.0		25.0		23.0		23.0		23.0	
Effective Green, g (s)	25.0		25.0		25.0		23.0		23.0		23.0	
Actuated g/C Ratio	0.42		0.42		0.42		0.38		0.38		0.38	
Clearance Time (s)	6.1		6.1		6.1		6.1		6.1		6.1	
Lane Grp Cap (vph)	445		671		326		711		540		604	
v/s Ratio Prot	c0.23		0.13		c0.23		0.22		0.60		0.57	
v/s Ratio Perm	0.03		0.10		0.60		0.57		14.9		14.7	
v/c Ratio	0.08		0.54		0.23		0.32		1.00		1.00	
Uniform Delay, d1	10.6		13.3		11.4		11.9		4.9		3.8	
Progression Factor	1.00		1.00		1.00		1.00		19.9		18.5	
Incremental Delay, d2	0.3		3.2		1.6		1.2		B		B	
Delay (s)	11.0		16.4		13.0		13.0		19.9		18.5	
Level of Service	B		B		B		B		B		B	
Approach Delay (s)	16.0		13.0		B		B		19.9		18.5	
Approach LOS	B		B		B		B		B		B	

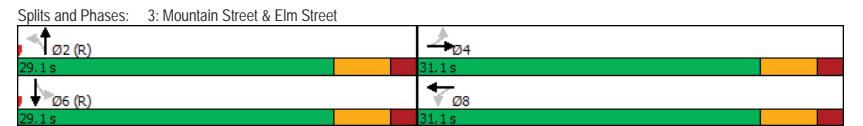
Intersection Summary			
HCM 2000 Control Delay	16.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	60.2	Sum of lost time (s)	12.2
Intersection Capacity Utilization	75.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Queues  
3: Mountain Street & Elm Street

Future Background (PM)

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↔		↔		↕		↔	
Traffic Volume (vph)	32	246	69	197	44	203	21	277
Future Volume (vph)	32	246	69	197	44	203	21	277
Lane Group Flow (vph)	35	393	75	230	0	342	0	346
Turn Type	Perm		NA		Perm		NA	
Protected Phases	4		8		2		6	
Permitted Phases	4		8		2		6	
Detector Phase	4		4		8		8	
Switch Phase	4		8		2		6	
Minimum Initial (s)	8.0		8.0		8.0		8.0	
Minimum Split (s)	25.1		25.1		25.1		25.1	
Total Split (s)	31.1		31.1		29.1		29.1	
Total Split (%)	51.7%		51.7%		48.3%		48.3%	
Yellow Time (s)	4.1		4.1		4.1		4.1	
All-Red Time (s)	2.0		2.0		2.0		2.0	
Lost Time Adjust (s)	0.0		0.0		0.0		0.0	
Total Lost Time (s)	6.1		6.1		6.1		6.1	
Lead/Lag	4		8		2		6	
Lead-Lag Optimize?	Max		Max		Max		Max	
v/c Ratio	0.08		0.56		0.23		0.32	
Control Delay	11.3		15.5		13.8		13.0	
Queue Delay	0.0		0.0		0.0		0.0	
Total Delay	11.3		15.5		13.8		13.0	
Queue Length 50th (m)	2.4		28.8		5.4		16.6	
Queue Length 95th (m)	7.1		53.1		13.7		31.0	
Internal Link Dist (m)	56.0		63.6		77.7		48.5	
Turn Bay Length (m)	140.0		45.0		556		608	
Base Capacity (vph)	445		699		327		716	
Starvation Cap Reductn	0		0		0		0	
Spillback Cap Reductn	0		0		0		0	
Storage Cap Reductn	0		0		0		0	
Reduced v/c Ratio	0.08		0.56		0.23		0.32	

Intersection Summary	
Cycle Length:	60.2
Actuated Cycle Length:	60.2
Offset:	0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle:	55
Control Type:	Pretimed



HCM Signalized Intersection Capacity Analysis  
1: Mountain Street & Main Street W

Future Total (AM)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	↖	↗	↘	↖	↗	↘	↖	↗	↘	↖	↗	↘	
Traffic Volume (vph)	147	277	34	0	351	82	83	251	21	55	155	213	
Future Volume (vph)	147	277	34	0	351	82	83	251	21	55	155	213	
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	
Total Lost time (s)	3.0	6.5			6.5		3.0	7.2		3.0	7.2		
Lane Util. Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00		
Frbp, ped/bikes	1.00	0.99			0.99		1.00	1.00		1.00	1.00		
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00	1.00		
Frt	1.00	0.98			0.97		1.00	0.99		1.00	0.91		
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95	1.00		
Satd. Flow (prot)	1567	1556			1674		1433	1579		1592	1469		
Flt Permitted	0.20	1.00			1.00		0.30	1.00		0.44	1.00		
Satd. Flow (perm)	325	1556			1674		456	1579		730	1469		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	160	301	37	0	382	89	90	273	23	60	168	232	
RTOR Reduction (vph)	0	3	0	0	5	0	0	2	0	0	33	0	
Lane Group Flow (vph)	160	335	0	0	466	0	90	294	0	60	367	0	
Confl. Peds. (#/hr)	7		26	26		7			9	9			
Heavy Vehicles (%)	6%	9%	15%	0%	1%	2%	16%	10%	0%	4%	14%	5%	
Turn Type	pm+pt	NA			NA		pm+pt	NA		pm+pt	NA		
Protected Phases	7	4			8		5	2		1	6		
Permitted Phases	4						2			6			
Actuated Green, G (s)	73.0	73.0			50.0		60.0	50.0		60.0	50.0		
Effective Green, g (s)	73.0	73.0			50.0		60.0	50.0		60.0	50.0		
Actuated g/C Ratio	0.49	0.49			0.33		0.40	0.33		0.40	0.33		
Clearance Time (s)	3.0	6.5			6.5		3.0	7.2		3.0	7.2		
Lane Grp Cap (vph)	324	758			559		248	527		350	490		
v/s Ratio Prot	c0.07	0.22			c0.28		c0.02	0.19		0.01	c0.25		
v/s Ratio Perm	0.17						0.12			0.06			
v/c Ratio	0.49	0.44			0.83		0.36	0.56		0.17	0.75		
Uniform Delay, d1	26.1	25.0			46.0		30.4	40.8		28.5	44.3		
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00		
Incremental Delay, d2	5.3	1.9			13.6		4.1	4.2		1.1	10.0		
Delay (s)	31.4	26.9			59.6		34.5	45.0		29.5	54.3		
Level of Service	C	C			E		C	D		C	D		
Approach Delay (s)		28.4			59.6			42.6			51.1		
Approach LOS		C			E			D			D		
<b>Intersection Summary</b>													
HCM 2000 Control Delay	45.2			HCM 2000 Level of Service				D					
HCM 2000 Volume to Capacity ratio	0.71												
Actuated Cycle Length (s)	149.7			Sum of lost time (s)				19.7					
Intersection Capacity Utilization	91.1%			ICU Level of Service				F					
Analysis Period (min)	15												
c Critical Lane Group													

Queues  
1: Mountain Street & Main Street W

Future Total (AM)

Lane Group	EBL	EBT	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖	↗	↖	↖	↗	↖	↗
Traffic Volume (vph)	147	277	351	83	251	55	155
Future Volume (vph)	147	277	351	83	251	55	155
Lane Group Flow (vph)	160	338	471	90	296	60	400
Turn Type	pm+pt	NA	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	8	5	2	1	6
Permitted Phases	4			2		6	
Detector Phase	7	4	8	5	2	1	6
<b>Switch Phase</b>							
Minimum Initial (s)	6.0	10.0	10.0	6.0	10.0	6.0	10.0
Minimum Split (s)	9.5	39.5	39.5	9.5	45.2	9.5	45.2
Total Split (s)	23.0	79.5	56.5	13.0	57.2	13.0	57.2
Total Split (%)	15.4%	53.1%	37.7%	8.7%	38.2%	8.7%	38.2%
Yellow Time (s)	3.0	4.1	4.1	3.0	4.1	3.0	4.1
All-Red Time (s)	0.0	2.4	2.4	0.0	3.1	0.0	3.1
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.5	6.5	3.0	7.2	3.0	7.2
Lead/Lag	Lead		Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes		Yes	Yes	Yes	Yes	Yes
Recall Mode	Max	Max	Max	Max	Max	Max	Max
v/c Ratio	0.48	0.44	0.84	0.35	0.56	0.16	0.76
Control Delay	25.2	26.9	59.5	28.3	45.3	24.9	49.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.2	26.9	59.5	28.3	45.3	24.9	49.8
Queue Length 50th (m)	26.6	66.5	134.1	16.3	75.0	10.6	99.3
Queue Length 95th (m)	41.5	94.1	#192.0	28.5	107.8	20.1	143.4
Internal Link Dist (m)		87.2	97.9		105.0		107.9
Turn Bay Length (m)	20.0		45.0				
Base Capacity (vph)	331	762	564	260	529	369	523
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	0.48	0.44	0.84	0.35	0.56	0.16	0.76
<b>Intersection Summary</b>							
Cycle Length: 149.7							
Actuated Cycle Length: 149.7							
Offset: 54.5 (36%), Referenced to phase 2:NBT and 6:SBTL, Start of Green							
Natural Cycle: 105							
Control Type: Pretimed							
# 95th percentile volume exceeds capacity, queue may be longer.							
Queue shown is maximum after two cycles.							
<b>Splits and Phases: 1: Mountain Street &amp; Main Street W</b>							



Queues  
3: Mountain Street & Elm Street

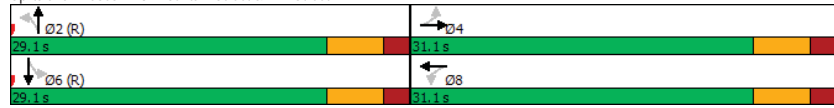
Future Total (AM)

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖	↗	↖	↗	↖	↗	↖	↗
Traffic Volume (vph)	37	146	31	184	89	286	7	119
Future Volume (vph)	37	146	31	184	89	286	7	119
Lane Group Flow (vph)	40	211	34	208	0	486	0	162
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Minimum Split (s)	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1
Total Split (s)	31.1	31.1	31.1	31.1	29.1	29.1	29.1	29.1
Total Split (%)	51.7%	51.7%	51.7%	51.7%	48.3%	48.3%	48.3%	48.3%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max
v/c Ratio	0.09	0.31	0.08	0.30		0.91		0.29
Control Delay	11.5	11.5	11.3	13.0		41.9		13.2
Queue Delay	0.0	0.0	0.0	0.0		0.0		0.0
Total Delay	11.5	11.5	11.3	13.0		41.9		13.2
Queue Length 50th (m)	2.7	13.1	2.3	15.1		49.8		11.1
Queue Length 95th (m)	7.8	26.6	6.9	28.4		#105.0		23.6
Internal Link Dist (m)		56.0		63.6		77.7		48.5
Turn Bay Length (m)	140.0		45.0					
Base Capacity (vph)	446	673	451	703		536		558
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	0.09	0.31	0.08	0.30		0.91		0.29

Intersection Summary

Cycle Length: 60.2  
 Actuated Cycle Length: 60.2  
 Offset: 0 (0%), Referenced to phase 2-NBTL and 6-SBTL, Start of Green  
 Natural Cycle: 60  
 Control Type: Pretimed  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 3: Mountain Street & Elm Street



HCM Unsignalized Intersection Capacity Analysis  
2: Mountain Street & Site Driveway

Future Total (AM)

	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖	↗	↖	↗	↖	↗
Traffic Volume (veh/h)	4	16	328	2	5	145
Future Volume (Veh/h)	4	16	328	2	5	145
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	17	357	2	5	158
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)			73			129
pX, platoon unblocked						
vC, conflicting volume	526	358			359	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	526	358			359	
IC, single (s)	6.4	6.2			4.1	
IC, 2 stage (s)						
IF (s)	3.5	3.3			2.2	
p0 queue free %	99	98			100	
cM capacity (veh/h)	510	686			1200	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	21	359	163			
Volume Left	4	0	5			
Volume Right	17	2	0			
cSH	644	1700	1200			
Volume to Capacity	0.03	0.21	0.00			
Queue Length 95th (m)	0.8	0.0	0.1			
Control Delay (s)	10.8	0.0	0.3			
Lane LOS	B		A			
Approach Delay (s)	10.8	0.0	0.3			
Approach LOS	B					
Intersection Summary						
Average Delay			0.5			
Intersection Capacity Utilization			28.9%		ICU Level of Service	A
Analysis Period (min)			15			

Queues

Future Total (PM)

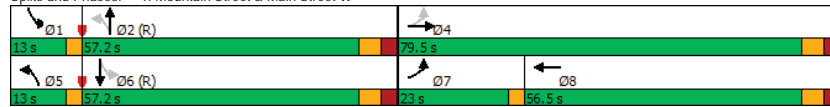
1: Mountain Street & Main Street W

	↖	→	←	↙	↑	↘	↓
Lane Group	EBL	EBT	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖	↘	↘	↖	↖	↖	↘
Traffic Volume (vph)	166	453	391	88	231	123	262
Future Volume (vph)	166	453	391	88	231	123	262
Lane Group Flow (vph)	180	571	510	96	297	134	464
Turn Type	pm+pt	NA	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	8	5	2	1	6
Permitted Phases	4			2			6
Detector Phase	7	4	8	5	2	1	6
Switch Phase							
Minimum Initial (s)	6.0	10.0	10.0	6.0	10.0	6.0	10.0
Minimum Split (s)	9.5	39.5	39.5	9.5	45.2	9.5	45.2
Total Split (s)	23.0	79.5	56.5	13.0	57.2	13.0	57.2
Total Split (%)	15.4%	53.1%	37.7%	8.7%	38.2%	8.7%	38.2%
Yellow Time (s)	3.0	4.1	4.1	3.0	4.1	3.0	4.1
All-Red Time (s)	0.0	2.4	2.4	0.0	3.1	0.0	3.1
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.5	6.5	3.0	7.2	3.0	7.2
Lead/Lag	Lead		Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes		Yes	Yes	Yes	Yes	Yes
Recall Mode	Max	Max	Max	Max	Max	Max	Max
v/c Ratio	0.58	0.71	0.92	0.38	0.57	0.36	0.88
Control Delay	28.5	35.4	69.8	28.8	45.0	27.9	64.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.5	35.4	69.8	28.8	45.0	27.9	64.2
Queue Length 50th (m)	30.3	135.1	151.4	17.3	74.6	24.8	131.6
Queue Length 95th (m)	46.4	183.1	#222.5	29.7	107.1	39.7	#197.1
Internal Link Dist (m)		87.2	97.9		105.0		107.9
Turn Bay Length (m)	20.0			45.0			
Base Capacity (vph)	310	809	556	252	523	375	525
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	0.58	0.71	0.92	0.38	0.57	0.36	0.88

Intersection Summary

Cycle Length: 149.7  
 Actuated Cycle Length: 149.7  
 Offset: 54.5 (36%), Referenced to phase 2:NBT and 6:SBTL, Start of Green  
 Natural Cycle: 105  
 Control Type: Pretimed  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 1: Mountain Street & Main Street W



HCM Signalized Intersection Capacity Analysis

Future Total (AM)

3: Mountain Street & Elm Street

	↖	→	↘	↙	←	↘	↙	↑	↘	↙	↓	↘
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↘	↘	↖	↖	↖	↖	↖	↖	↖	↖	↘
Traffic Volume (vph)	37	146	48	31	184	7	89	286	72	7	119	23
Future Volume (vph)	37	146	48	31	184	7	89	286	72	7	119	23
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	6.1	6.1		6.1	6.1		6.1	6.1		6.1	6.1	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.98	1.00		0.99	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.99		1.00	0.98		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.99	0.99		1.00	1.00	
Satd. Flow (prot)	1625	1575		1649	1688		1523	1470		1470	1470	
Flt Permitted	0.63	1.00		0.63	1.00		0.89	0.97		0.97	0.97	
Satd. Flow (perm)	1074	1575		1087	1688		1374	1432		1432	1432	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	40	159	52	34	200	8	97	311	78	8	129	25
RTOR Reduction (vph)	0	19	0	0	2	0	0	12	0	0	11	0
Lane Group Flow (vph)	40	192	0	34	206	0	0	474	0	0	151	0
Confl. Peds. (#/hr)	17		6	6		17	1		3	3		1
Heavy Vehicles (%)	0%	2%	19%	0%	3%	0%	10%	13%	3%	0%	19%	5%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	25.0	25.0		25.0	25.0		23.0	23.0		23.0	23.0	
Effective Green, g (s)	25.0	25.0		25.0	25.0		23.0	23.0		23.0	23.0	
Actuated g/C Ratio	0.42	0.42		0.42	0.42		0.38	0.38		0.38	0.38	
Clearance Time (s)	6.1	6.1		6.1	6.1		6.1	6.1		6.1	6.1	
Lane Grp Cap (vph)	446	654		451	700		524	547		547	547	
v/s Ratio Prot		0.12			c0.12							
v/s Ratio Perm	0.04			0.03			c0.35			0.11		
v/c Ratio	0.09	0.29		0.08	0.29		0.91	0.28		0.28	0.28	
Uniform Delay, d1	10.7	11.7		10.6	11.7		17.6	12.8		12.8	12.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.4	1.1		0.3	1.1		21.7	1.2		1.2	1.2	
Delay (s)	11.1	12.9		10.9	12.8		39.3	14.1		14.1	14.1	
Level of Service	B	B		B	B		D	B		B	B	
Approach Delay (s)	12.6			12.5			39.3	14.1		14.1		
Approach LOS	B			B			D	B		B		

Intersection Summary

HCM 2000 Control Delay: 24.2  
 HCM 2000 Volume to Capacity ratio: 0.59  
 Actuated Cycle Length (s): 60.2  
 Intersection Capacity Utilization: 81.8%  
 Analysis Period (min): 15  
 HCM 2000 Level of Service: C  
 Sum of lost time (s): 12.2  
 ICU Level of Service: D  
 Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis  
2: Mountain Street & Site Driveway

Future Total (PM)

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔	↔	↕	↕	↔	↔
Traffic Volume (veh/h)	7	16	250	11	19	318
Future Volume (Veh/h)	7	16	250	11	19	318
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	8	17	272	12	21	346
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None		None	
Median storage (veh)						
Upstream signal (m)			73		129	
pX, platoon unblocked						
vC, conflicting volume	666	278			284	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	666	278			284	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	98			98	
cM capacity (veh/h)	418	761			1278	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	25	284	367			
Volume Left	8	0	21			
Volume Right	17	12	0			
cSH	602	1700	1278			
Volume to Capacity	0.04	0.17	0.02			
Queue Length 95th (m)	1.0	0.0	0.4			
Control Delay (s)	11.2	0.0	0.6			
Lane LOS	B		A			
Approach Delay (s)	11.2	0.0	0.6			
Approach LOS	B		A			
Intersection Summary						
Average Delay			0.7			
Intersection Capacity Utilization			45.0%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis  
1: Mountain Street & Main Street W

Future Total (PM)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	166	453	73	0	391	78	88	231	42	123	262	165
Future Volume (vph)	166	453	73	0	391	78	88	231	42	123	262	165
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.0	6.5			6.5		3.0	7.2		3.0	7.2	
Lane Util. Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.98			0.99		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
FrT	1.00	0.98			0.98		1.00	0.98		1.00	0.94	
FlT Protected	0.95	1.00			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1599	1651			1652		1661	1554		1622	1527	
FlT Permitted	0.15	1.00			1.00		0.22	1.00		0.43	1.00	
Satd. Flow (perm)	258	1651			1652		392	1554		741	1527	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	180	492	79	0	425	85	96	251	46	134	285	179
RTOR Reduction (vph)	0	4	0	0	5	0	0	5	0	0	15	0
Lane Group Flow (vph)	180	567	0	0	505	0	96	292	0	134	449	0
Confl. Peds. (#/hr)	27		43	43		27	8		11	11		8
Heavy Vehicles (%)	4%	2%	3%	0%	2%	3%	0%	11%	0%	2%	10%	1%
Turn Type	pm+pt	NA			NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases	4						2			6		
Actuated Green, G (s)	73.0	73.0			50.0		60.0	50.0		60.0	50.0	
Effective Green, g (s)	73.0	73.0			50.0		60.0	50.0		60.0	50.0	
Actuated g/C Ratio	0.49	0.49			0.33		0.40	0.33		0.40	0.33	
Clearance Time (s)	3.0	6.5			6.5		3.0	7.2		3.0	7.2	
Lane Grp Cap (vph)	304	805			551		241	519		355	510	
v/s Ratio Prot	0.08	c0.34			c0.31		c0.03	0.19		0.03	c0.29	
v/s Ratio Perm	0.21						0.13			0.13		
v/c Ratio	0.59	0.70			0.92		0.40	0.56		0.38	0.88	
Uniform Delay, d1	27.7	29.9			47.9		31.3	40.9		29.9	47.0	
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	8.2	5.1			22.5		4.9	4.4		3.0	19.1	
Delay (s)	35.9	35.1			70.4		36.2	45.3		32.9	66.1	
Level of Service	D	D			E		D	D		C	E	
Approach Delay (s)		35.3			70.4			43.1			58.7	
Approach LOS		D			E			D			E	
Intersection Summary												
HCM 2000 Control Delay			50.8								D	
HCM 2000 Volume to Capacity ratio			0.83									
Actuated Cycle Length (s)			149.7			Sum of lost time (s)				19.7		
Intersection Capacity Utilization			95.0%								F	
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
3: Mountain Street & Elm Street

Future Total (PM)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	
Traffic Volume (vph)	35	246	116	69	197	22	44	204	67	24	279	22	
Future Volume (vph)	35	246	116	69	197	22	44	204	67	24	279	22	
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	
Total Lost time (s)	6.1	6.1		6.1	6.1			6.1			6.1		
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00		
Frbp, ped/bikes	1.00	0.99		1.00	1.00			1.00			1.00		
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			1.00		
Frt	1.00	0.95		1.00	0.98			0.97			0.99		
Flt Protected	0.95	1.00		0.95	1.00			0.99			1.00		
Satd. Flow (prot)	1656	1616		1659	1704			1545			1640		
Flt Permitted	0.61	1.00		0.45	1.00			0.91			0.96		
Satd. Flow (perm)	1065	1616		787	1704			1416			1573		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	38	267	126	75	214	24	48	222	73	26	303	24	
RTOR Reduction (vph)	0	28	0	0	6	0	0	16	0	0	4	0	
Lane Group Flow (vph)	38	365	0	75	232	0	0	327	0	0	349	0	
Confl. Peds. (#/hr)	3		2	2		3	4		1	1		4	
Heavy Vehicles (%)	0%	2%	3%	0%	1%	0%	5%	12%	1%	0%	6%	0%	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA		
Protected Phases		4			8			2			6		
Permitted Phases	4			8			2			6			
Actuated Green, G (s)	25.0	25.0		25.0	25.0			23.0			23.0		
Effective Green, g (s)	25.0	25.0		25.0	25.0			23.0			23.0		
Actuated g/C Ratio	0.42	0.42		0.42	0.42			0.38			0.38		
Clearance Time (s)	6.1	6.1		6.1	6.1			6.1			6.1		
Lane Grp Cap (vph)	442	671		326	707			540			600		
v/s Ratio Prot		c0.23			0.14								
v/s Ratio Perm	0.04			0.10				c0.23			0.22		
v/c Ratio	0.09	0.54		0.23	0.33			0.61			0.58		
Uniform Delay, d1	10.7	13.3		11.4	11.9			15.0			14.8		
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00		
Incremental Delay, d2	0.4	3.2		1.6	1.2			5.0			4.1		
Delay (s)	11.1	16.4		13.0	13.1			19.9			18.8		
Level of Service	B	B		B	B			B			B		
Approach Delay (s)		16.0			13.1			19.9			18.8		
Approach LOS		B			B			B			B		
<b>Intersection Summary</b>													
HCM 2000 Control Delay	17.0			HCM 2000 Level of Service				B					
HCM 2000 Volume to Capacity ratio	0.57												
Actuated Cycle Length (s)	60.2			Sum of lost time (s)				12.2					
Intersection Capacity Utilization	74.0%			ICU Level of Service				D					
Analysis Period (min)	15												
c Critical Lane Group													

Queues  
3: Mountain Street & Elm Street

Future Total (PM)

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	35	246	69	197	44	204	24	279
Future Volume (vph)	35	246	69	197	44	204	24	279
Lane Group Flow (vph)	38	393	75	238	0	343	0	353
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Minimum Split (s)	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1
Total Split (s)	31.1	31.1	31.1	31.1	29.1	29.1	29.1	29.1
Total Split (%)	51.7%	51.7%	51.7%	51.7%	48.3%	48.3%	48.3%	48.3%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.1	6.1	6.1	6.1		6.1		6.1
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max
v/c Ratio	0.09	0.56	0.23	0.33		0.62		0.58
Control Delay	11.4	15.5	13.8	13.0		19.6		19.3
Queue Delay	0.0	0.0	0.0	0.0		0.0		0.0
Total Delay	11.4	15.5	13.8	13.0		19.6		19.3
Queue Length 50th (m)	2.6	28.8	5.4	17.0		28.5		30.8
Queue Length 95th (m)	7.5	53.1	13.7	31.9		53.7		55.0
Internal Link Dist (m)		56.0		63.6		77.7		48.5
Turn Bay Length (m)	140.0		45.0					
Base Capacity (vph)	442	699	327	714		557		605
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	0.09	0.56	0.23	0.33		0.62		0.58

**Intersection Summary**  
 Cycle Length: 60.2  
 Actuated Cycle Length: 60.2  
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green  
 Natural Cycle: 55  
 Control Type: Pretimed

