



141-149 Main Street East Town of Grimsby Transportation Impact Study

Paradigm Transportation Solutions Limited

May 2020

Project No. 200138



Project Summary



Project Number
200138

**141-149 Main Street East, Town of Grimsby
Transportation Impact Study**

May 2020

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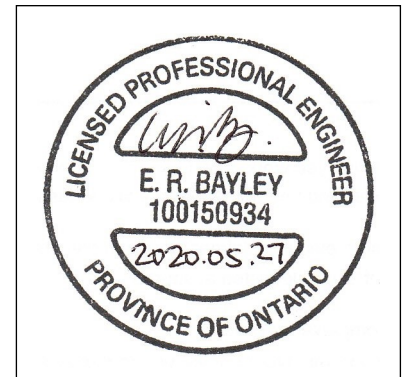
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Executive Summary

Content

Paradigm Transportation Solutions Limited (Paradigm) was retained to conduct this Transportation Impact Study for a proposed residential development at 141-149 Main Street East in the Town of Grimsby.

This Transportation Impact Study includes an assessment of existing traffic conditions, a description of the proposed development, traffic forecasts and analyses for a five-year planning horizon, with and without the development, and a review of on-site circulation. If applicable, this study identifies any mitigation measures required to accommodate the development.

Development Concept

The subject site is located on the northwest corner of Main Street East and Wentworth Drive and is currently occupied by a garden centre and nursery. Two existing all-moves driveway connections are provided to Main Street East. These existing land uses, and driveways will be removed to facilitate redevelopment.

The redevelopment of the site is proposed to comprise a seven-storey, 217-unit condominium building. Access is proposed via one new all-moves driveway connection to Wentworth Drive, located approximately 75 metres north of Main Street East (centreline to centreline). This driveway is aligned approximately opposite an existing driveway connection to the commercial plaza at 155 Main Street East.

Conclusions

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

- ▶ Under existing conditions, the study intersections are operating at acceptable levels of service and within capacity;
- ▶ The site is estimated to generate approximately 73 new trips in the AM peak hour and approximately 93 new trips in the PM peak hour;
- ▶ Under the Town's Zoning By-law, a total of 327 parking spaces (1.50 spaces per unit) are required to support the proposed development program. The site statistics indicate a vehicle parking supply of 252 spaces (1.16 spaces/unit).
- ▶ The site design does not suggest any safety concerns for the circulation of vehicles and is expected to operate acceptably for a private development;



- ▶ The location of the new site driveway connection provides sufficient, unobstructed visibility to the north and south along Wentworth Drive;
- ▶ Under background traffic conditions, the study intersections are forecast to operate at acceptable levels of service and within capacity; and
- ▶ Under total traffic conditions, the study intersections and the new proposed driveway connection are forecast to operate at acceptable levels of service and within capacity.
- ▶ Transportation Demand Management (TDM) measures can assist in further mitigating the site's transportation and parking impact on the adjacent road network. TDM measures to encourage and support walking and cycling should be integrated into the site plan.

Recommendations

Based on the findings of this study, it is recommended that:

- ▶ Upon redevelopment of the site, the Region remove the existing eastbound left-turn lane on Main Street East at the Tim Horton's restaurant (142 Main Street);
- ▶ The internal drop-off loop should be signed to function as one-way eastbound.
- ▶ The following TDM strategies be considered to further mitigate the site's transportation and parking impact:
 - Walking – Pedestrian amenities including benches, lighting and weather protection at primary and secondary building entrances should be considered.

The on-site pedestrian realm should be designed to provide a safe and attractive environment for residents and visitors to the site.

Define walking routes with sidewalks through the at grade parking area.

- Carpool/Rideshare – consider providing a weather protected waiting area within the drop-off loop.



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1 Introduction

1.1 Overview

Paradigm Transportation Solutions Limited (Paradigm) was retained by Losani Homes (1998) Limited to conduct this Transportation Impact Study for a proposed residential development at 141-149 Main Street East in the Town of Grimsby. The site is currently occupied by a garden centre and nursery with two all-moves driveway connections to Main Street East. **Figure 1.1** illustrates the location of the subject site.

This study has been carried out in general accordance with the Regional Municipality of Niagara Transportation Impact Study Guidelines¹ and comments received from Town and Region Transportation Planning staff via email in March 2020. **Appendix A** contains the pre-study correspondence and terms of reference established for this study.

1.2 Purpose and Scope

The purpose of this report is to determine the net impact of the proposed development on the surrounding road network and provide recommendations on any measures necessary to support the development from a transportation perspective.

The scope of the study includes:

- ▶ Determine and document existing traffic volumes and operations at the study intersections in the weekday AM and PM peak hours;
- ▶ Estimate future background traffic volumes at a horizon year five-years from the date of this study, including traffic generated by planned development near the site;
- ▶ Estimate the new site generated traffic and assign these trips to the study road network;
- ▶ Estimate future total traffic volumes through the summation of the background traffic and site generated traffic forecasts;
- ▶ Estimate future traffic operations at the forecast horizon year, under both future background and future total traffic conditions;
- ▶ Review the on-site circulation of vehicles through the site;
- ▶ Identify any remedial measures, if necessary, to support the development from a transportation perspective; and

¹ Regional Municipality of Niagara. *Guidelines for Transportation Impact Study*. May 2012.



- ▶ Review Transportation Demand Management (TDM) strategies.

1.3 Study Area

The intersections analyzed as part of this study, as confirmed during pre-study consultation with Town of Grimsby and Region of Niagara Transportation Planning staff, are as follows:

- ▶ Main Street East and Nelles Road;
- ▶ Main Street East and Wentworth Drive; and
- ▶ Wentworth Drive and Future Site Driveway.





Location of Subject Site

141-149 Main Street East TIS
200138

Figure 1.1

2 Proposed Development

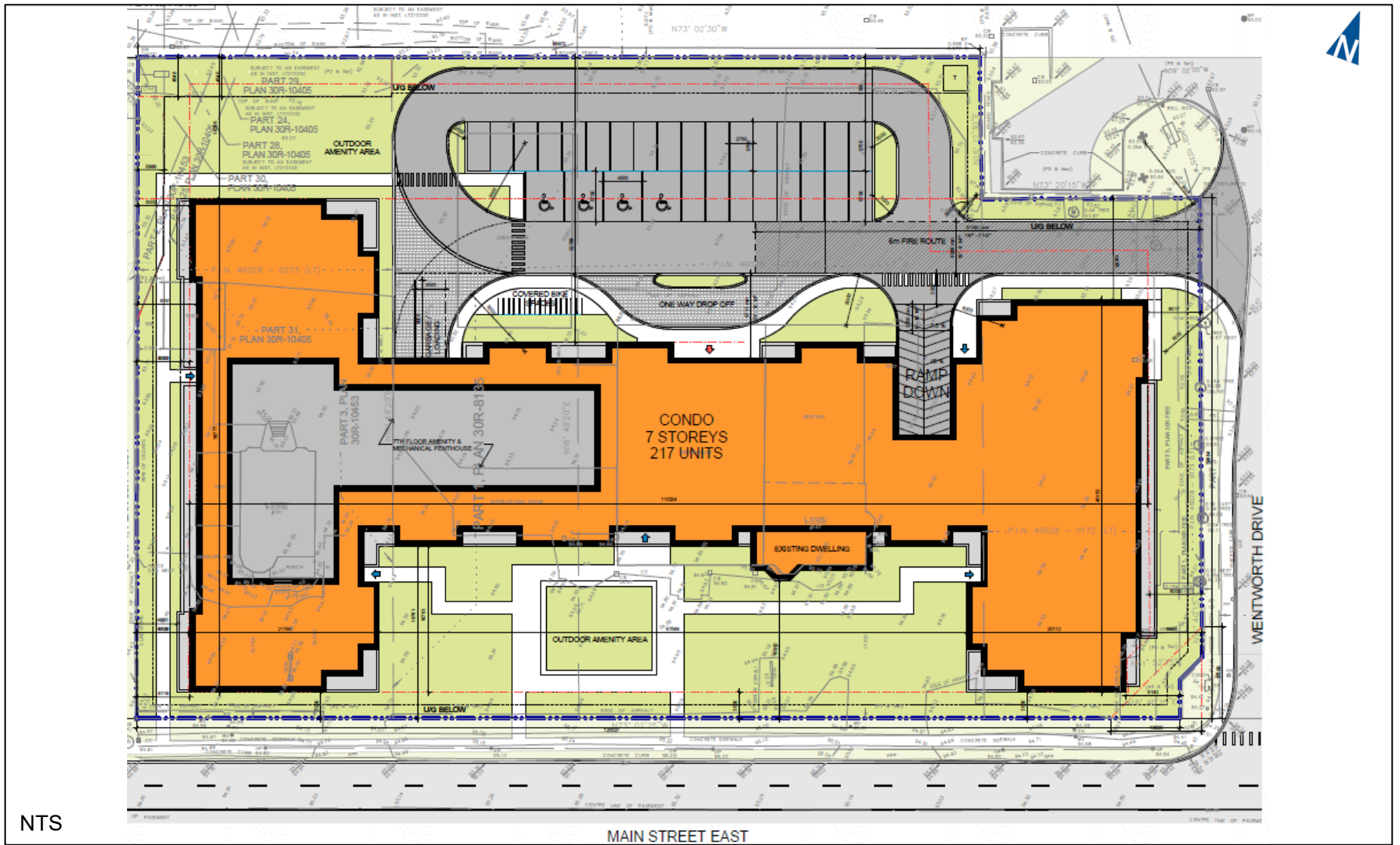
The subject site is located on the northwest corner of Main Street East and Wentworth Drive. The redevelopment of the site is proposed to comprise a seven-storey, 217-unit condominium building.

Vehicular access is proposed via one new all-moves driveway connection to Wentworth Drive, located approximately 75 metres north of Main Street East (centreline to centreline). This driveway is aligned approximately opposite an existing driveway connection to the commercial plaza at 155 Main Street East.

Direct sidewalk connections are proposed between the building's entrances and the existing sidewalk along Main Street East. A sidewalk is also illustrated along the site driveway approach to Wentworth Drive. A new municipal sidewalk is proposed along the west side of Wentworth Drive from Main Street East to the site driveway.

Figure 2.1 illustrates the preliminary site concept plan.





2.1 Parking

2.1.1 Proposed Parking Supply

The site's parking demand is proposed to be accommodated on site. The site's parking supply does not meet the zoning by-law.

The site statistics indicate a vehicle parking supply of 252 spaces (1.16 spaces/unit). 29 spaces are located at grade, and the remaining 223 spaces are contained in the underground parking structure.

2.1.2 Zoning By-Law Parking Requirements

The on-site parking requirements are governed by the minimum parking requirements set out in the Town of Grimsby's Zoning By-law 14-45². Parking rates are provided for residential dwelling units which include *dwelling units in a converted dwelling, townhouse dwelling, apartment building, secondary suite, or garden suite*. The By-law defines apartment buildings as *"a separate building containing five (5) or more dwelling units that have a common entrance from the street level, but does not include a boarding house"*.

Section 5.1 of the Zoning By-law outlines the minimum parking requirements for apartment buildings. The By-law requires 1.25 parking spaces per dwelling unit for residents and 0.25 parking spaces per dwelling unit for visitors. **Table 2.1** summarizes the minimum parking requirements for the site. It is noted that the Town's By-law requires the rounding up of partial parking space calculations to the nearest whole number.

TABLE 2.1: ZONING BY-LAW PARKING REQUIREMENTS

Parking Space Type	Units	Requirement	Parking Spaces
Apartment (Tenant)	217	1.25 spaces per unit	272
Apartment (Visitor)		0.25 spaces per unit	55
Total Parking Required			327
Total Parking Provided			252
Parking Deficit			-75

Under this by-law a total of 327 parking spaces would be required to service the site. Since the site is providing 252 parking spaces, this is a deficit of 75 spaces as compared to the Zoning By-law.

² The Corporation of the Town of Grimsby. *Zoning By-law 14-45, Section 5.1: Parking Space Requirements*. n.d.



2.2 Site Circulation Assessment

Heavy vehicle and site circulation have been assessed using AutoTURN swept path analysis software. Four design vehicles were used in the analysis:

- ▶ Fire Truck – NCHRP Report 659 Pumper Fire Truck;
- ▶ Delivery/Garbage Truck; and
 - Transportation Association of Canada (TAC) Heavy Single Unit (HSU)³;
 - TAC Medium Signal Unit (MSU).
- ▶ Passenger Car – TAC Passenger Vehicle (P).

Appendix G contains the AutoTURN swept path analysis and the following is noted:

- ▶ The site driveway right-turn curb radii can accommodate larger design vehicles (fire, delivery/garbage trucks) as well as typical passenger cars.
- ▶ All internal drive aisle measure at least 6.0 m in width and can accommodate two-way traffic;
- ▶ The circulatory movements within the underground parking structure are typical for a constrained environment. Vehicles travelling within the parking structure are expected to be traveling at a low speed. Driver attention is required to navigate and circulate within the structure as well while undertaking parking manoeuvres adjacent to structural columns or walls;
- ▶ Turning movements into and out of the site's loading zone for the HSU and MSU design vehicle can be completed without conflict. For vehicles to exit the loading zone, a three-point turn is required;
- ▶ The on-site fire route does not allow for a turn around space for a fire truck. Fire trucks would be expected to reverse to the street.
- ▶ The drop-off loop should be signed to function as one-way eastbound. For passenger cars to enter the loop, vehicles will have to circulate the site first to enter from the west.

³ 2.4 – *Design Vehicles*, Geometric Design Guide for Canadian Roads, Transportation Association of Canada, June 2017.



The site design does not suggest any safety concerns for the circulation of the design vehicles and is expected to operate acceptably for a private development.

As is typical with all underground parking structures, it is a constrained environment where all drivers must exercise an appropriate level of care while circulating within the parking structure. All residential occupants of the building will develop familiarity with the structure and how to circulate safely. As no visitor parking is provided or allowed underground there is no opportunity for conflicts or issues due to unfamiliar motorists.

2.3 Sight Distance Assessment

Pursuant to the terms of reference established for this study, the proposed driveway connection to Wentworth Drive has been reviewed to determine sight distance availability. The assessment has been carried out using the methodology for calculating sight distance outlined in the Transportation Association of Canada's *Geometric Design Guide for Canadian Roads*.⁴ The following object heights were used in the field measurements:

- ▶ Object Height (Vehicle tail or brake light) – 0.60 metres;
- ▶ Driver Eye Height – 1.08 metres; and
- ▶ Top of Car – 1.30 metres.

The main measurements for outbound traffic were taken five metres back from the existing edge of pavement for vehicles exiting the subject site, representing the position of a driver performing a turning movement. The main measurements for inbound traffic were taken from within the centre of either travel lane on the main road, assuming a vehicle position perpendicular to the proposed driveway connection.

The sight distance requirements for the driveway location on Wentworth Drive based on a design speed of 60 km/h (10 km/h above the default speed limit of 50 km/h) are as follows:

- ▶ Minimum stopping sight distance: 85 metres⁵
- ▶ Intersection sight distance (Left Turn from Stop): 130 metres⁶
- ▶ Intersection sight distance (Right Turn from Stop): 110 metres⁷

⁴ Transportation Association of Canada. *Geometric Design Guide for Canadian Roads*. June 2017.

⁵ Ibid. Table 2.5.2: Stopping Sight Distance on Level Roadways for Automobiles

⁶ Ibid. Table 9.9.4: Design intersection Sight Distance – Case B1, Left Turn from Stop

⁷ Ibid. Table 9.9.6: Design Intersection Sight Distance – Case B2, Right Turn from Stop



Table 2.2 summarizes the available sight distances measured during the site visit. During the site visit, it was observed that visibility is unobstructed to the north despite the minor horizontal curve on Wentworth Drive at the proposed driveway location. Visibility is also unobstructed to the south, through the intersection at Main Street.

Although three of the four sight distance measurements are unsatisfactory, the available distances are limited by roadway length as opposed to roadway geometry (i.e. horizontal or vertical curves).

The length of the roadway itself, limits sight distance to less than that required in TAC; however, the distances provided in TAC represent free-flow roadway segments, independent of limitations imposed by traffic control at intersections or roadway lengths less than the sight distance requirements.

TABLE 2.2: OBSERVED SIGHT DISTANCE MEASUREMENTS

Sight Distance	Measurement	Satisfactory
Minimum Stopping Sight Distance (Northbound)	60 metres	No
Minimum Stopping Sight Distance (Southbound)	85 metres	Yes
Intersection Sight Distance (Left Turn from Stop)	65 metres	No
Intersection Sight Distance (Right Turn from Stop)	90 metres	No

In conclusion, the location of the driveway connection provides adequate sight distance to the north and south, considering the limitations imposed by the existing roadway lengths. From the site driveway location, sightlines to south are unobstructed for approximately 75 metres to where Wentworth Drive intersects with Main Street East. Sightlines to the north are unobstructed for approximately 90 metres to where Wentworth Drive terminates.



3 Existing Conditions

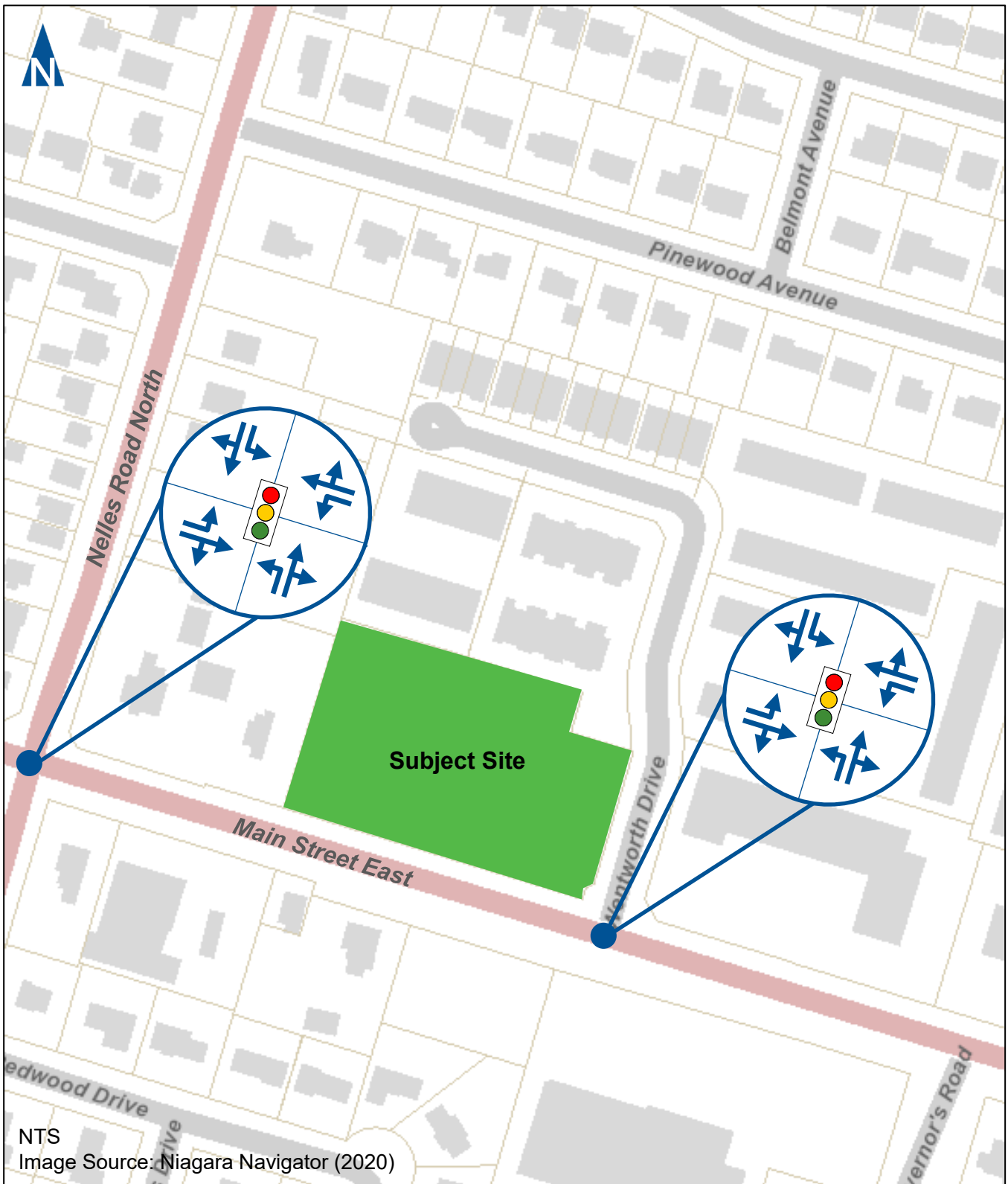
3.1 Road Network

The roadways of interest within the study area include:

- ▶ **Main Street East** is an east-west, three-lane, regional arterial that comprises one travel lane per direction with shared centre two-way, left-turn lane. The road operates under the jurisdiction of the Region of Niagara as Regional Road 81. Auxiliary left-turn lanes are provided at major intersections and driveways, including at Wentworth Drive. The maximum speed limit is not posted and is assumed to be 50 km/h. Parking is not permitted on either side of the road. Sidewalks are provided on both sides and include a landscaped buffer. Dedicated cycling facilities are not provided, requiring all road users to share the road space. The intersections with Wentworth Drive and Nelles Road are signalized.
- ▶ **Nelles Road** is a north-south, two-lane, collector road that comprises one travel lane per direction. The road operates under the jurisdiction of the Town of Grimsby. The maximum posted speed limit is not posted and is assumed to be 50 km/h. Sidewalks are provided on both sides and include a landscaped buffer. Dedicated cycling facilities are not provided, requiring all road users to share the road space. Parking is not permitted on Nelles Road, except for the west side, south of Main Street East on Sundays between 8 AM and 2 PM.
- ▶ **Wentworth Drive** is a north-south, two-lane, local road that comprises one travel lane per direction. The road operates under the jurisdiction of the Town of Grimsby. A dedicated left-turn lane is provided at Main Street East. The maximum speed limit is not posted and is assumed to be 50 km/h. Parking is not permitted on either side of the road. A sidewalk is provided on the east side of the road and includes a landscaped buffer. Dedicated cycling facilities are not provided requiring all road users to share the road space. The south leg of Wentworth Drive intersection functions as a private driveway to the existing commercial plaza at 150 Main Street East.

Figure 3.1 illustrates the existing lane configurations and traffic control.





3.2 Transit Services

Public transit services are not provided in the Town; however, regional services are provided by GO Transit, Greyhound Canada Transportation and Coach Canada.

GO Transit provides service via Route 12 (Niagara Falls/Toronto) with a combination of train and bus trips. Rail service is not provided in the Town of Grimsby and is supplemented by bus service at the Casablanca Boulevard and QEW Park & Ride. This bus service provides connections to rail service at Burlington GO Station. Service is provided seven days a week, with weekday headways of 30 to 60 minutes and weekend headways of 60 minutes.

Coach Canada provides services to Mississauga and Toronto via a bus stop on the northeast corner of Main Street and Christie Street. This stop is also served by Greyhound Canada Transportation.

3.3 Existing Traffic Volumes

Existing traffic volumes are typically obtained through the completion of turning movement counts at the study area intersections. These counts summarize the quantity, and type of traffic at an intersection, including cars, trucks, pedestrians, and cyclists. The counts are usually completed on a typical weekend to determine the peak traffic conditions for analyses.

At the time of writing, the Province of Ontario had instituted several restrictions on day-to-day activities in response to a global pandemic of COVID-19. The closure of all provincial elementary and secondary schools, universities/colleges, non-essential businesses, sit-down restaurants, and entertainment venues eliminated the possibility of collecting current traffic volumes since these counts would not be representative of normal travel patterns. Through consultation with the Region and Town, traffic data was obtained from historical counts conducted at the study intersections, which were then adjusted to a Year 2020 base year condition.

The turning movement counts used in this study were collected by the Region on Thursday 08 June 2017. A review of historical average annual daily traffic (AADT) volumes on Main Street East were extracted from the Region's OpenData website.⁸ However, a lack of data points limited the ability to determine clear indications of historical growth patterns in the study area.

⁸ Regional Municipality of Niagara. *NiagaraOpenData: Regional Road Traffic Volumes (AADT)*. Retrieved from: <https://niagaraopendata.ca/dataset/regional-road-traffic-volumes>



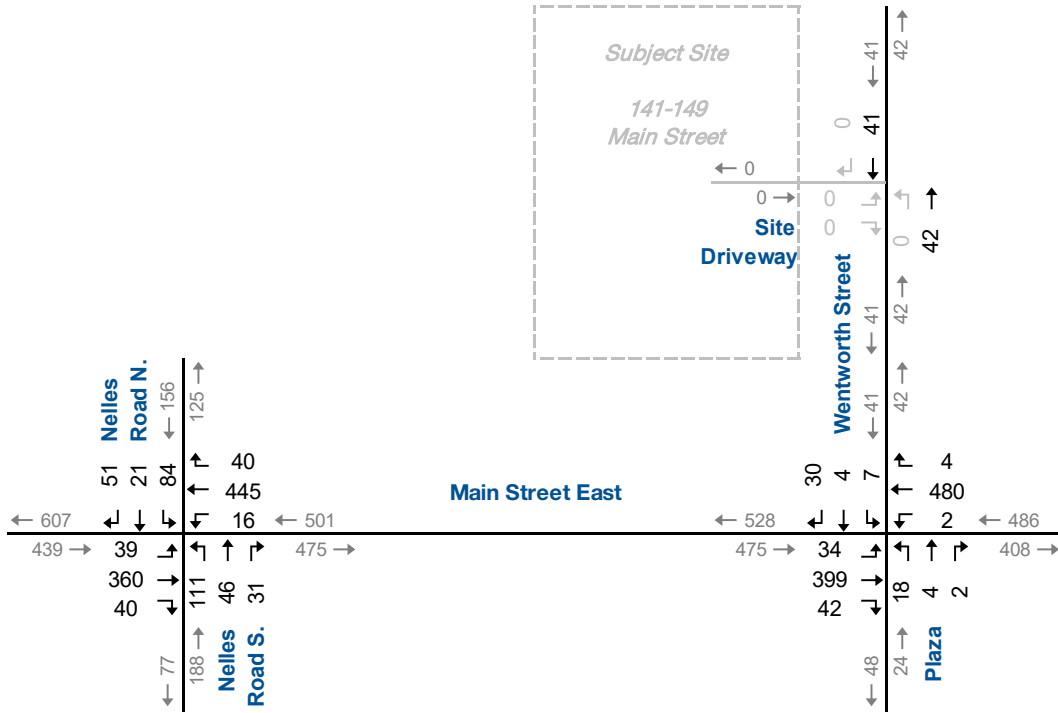
In consultation with the Region, the 2017 counts have been factored to the 2020 base year through the application of a 2% compounded per annum growth rate to all movements. This growth rate is consistent with the growth rate outlined in the Region's TIS Guidelines. Volumes on Main Street East have not been balanced due to existing driveways between Nelles Road and Wentworth Street, which services a Tim Horton's restaurant, Monk's Chocolate, a dentist office, and the existing uses on the subject site.

Appendix B contains the turning movement count data referenced in this study. **Figure 3.2** illustrates the adjusted base year traffic volumes.

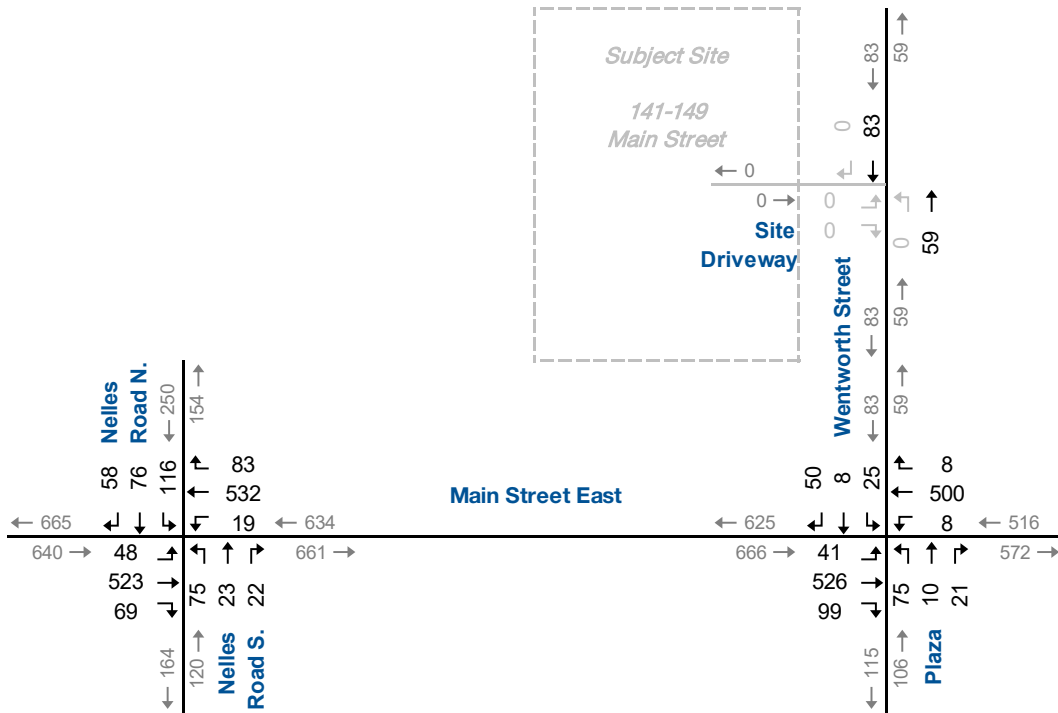




AM Peak Hour



PM Peak Hour



NTS



Base Year Traffic Volumes

3.4 Existing Traffic Operations

The quality of intersection operations at signalized and unsignalized intersections is evaluated in terms of level of service (LOS) and volume to capacity (v/c) as defined by the Highway Capacity Manual (HCM). LOS is evaluated based on the average control delay per vehicle and includes deceleration delay, queue move-up delay, stopped delay and final acceleration delay.

For signalized intersections, LOS ranges from LOS A (<10 seconds of average delay) to LOS F (>80 seconds of average delay). For unsignalized intersections, the LOS ranges from LOS A (<10 seconds of average delay) to LOS F (>50 seconds of average delay). Capacity is evaluated in terms of the ratio of demand flow to capacity with an at-capacity condition represented by a v/c ratio of 1.00 (i.e. volume demand equals capacity).

The Region's TIS Guidelines define critical movements as follows:

- ▶ At signalized intersections, through and/or through/right and/or right-turn movements with a v/c ratio greater than 0.85;
- ▶ At signalized intersections, dedicated left-turn movements with a v/c ratio greater than 0.90; and
- ▶ At unsignalized intersections, where movements operate at LOS D or worse, or where the estimated 95th percentile queue length for an individual movement exceeds the available queuing space.

The analysis of existing conditions was completed using Synchro. Queuing conditions have been estimated using SimTraffic, with a seeding interval of 15-minutes and five simulated runs. The key parameters used in the analysis include:

- ▶ Existing lane configurations;
- ▶ Ideal saturation flow of 1,750 vehicles per hour per lane (vphpl);
- ▶ Heavy vehicles percentages, pedestrian volumes and overall intersection peak hour factors as derived from the turning movement counts;
- ▶ Signal timing as provided by the Region; and
- ▶ Synchro default values for all other inputs.

Appendix B contains the signal timing plans referenced in this study.

Table 3.1 illustrates the existing traffic operations and indicates that the study area intersections are operating with acceptable levels of



service and within capacity for both the weekday AM and PM Peak hours. **Appendix C** contains the detailed Synchro and SimTraffic reports.



TABLE 3.1: EXISTING TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																Overall
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	Main Street East & Nelles Road	TCS	LOS Delay V/C Q Ex. Avail.	A 5 0.14 20 50 30	A 7 0.51 49 - -	> > > > > >	A 7	A 5 0.05 15 55 40	A 8 0.60 57 - -	> > > > > >	A 8	B 16 0.42 27 20 -7	B 14 0.15 28 - -	> > > > > >	B 15	B 15 0.31 22 20 -2	B 14 0.10 21 - -	> > > > > >	B 14	A 9 0.54
	Main Street East & Wentworth Drive	TCS	LOS Delay V/C Q Ex. Avail.	A 3 0.08 20 30 10	A 4 0.44 47 - -	> > > > > >	A 4	A 2 0.00 3 35 32	A 4 0.47 43 - -	> > > > > >	A 4	B 16 0.11 11 15 4	B 16 0.02 7 - -	> > > > > >	B 16	B 16 0.05 9 15 6	B 16 0.04 14 - -	> > > > > >	B 16	A 4 0.40
PM Peak Hour	Main Street East & Nelles Road	TCS	LOS Delay V/C Q Ex. Avail.	A 5 0.14 21 50 29	A 7 0.59 68 - -	> > > > > >	A 7	A 5 0.05 16 55 39	A 8 0.62 69 - -	> > > > > >	A 8	B 15 0.26 23 20 -3	B 14 0.07 21 - -	> > > > > >	B 15	B 16 0.37 28 20 -8	B 15 0.24 37 - -	> > > > > >	B 16	A 9 0.54
	Main Street East & Wentworth Drive	TCS	LOS Delay V/C Q Ex. Avail.	A 4 0.10 22 30 8	A 6 0.64 73 - -	> > > > > >	A 6	A 3 0.03 8 35 27	A 5 0.51 52 - -	> > > > > >	A 5	B 16 0.33 17 15 -2	B 15 0.05 12 - -	> > > > > >	B 16	B 15 0.11 13 15 2	B 15 0.07 17 - -	> > > > > >	B 15	A 7 0.56

MOE - Measure of Effectiveness

LOS - Level of Service

Delay - Average Delay per Vehicle in Seconds

Q - 95th Percentile Queue Length

Ex - Existing Available Storage

Avail. - Available Storage

TCS - Traffic Control Signal

TWSC - Two-Way Stop Control

AWSC - All-Way Stop Control



4 Future Conditions

4.1 Forecast Horizon Years

Consistent with the Region's TIS Guidelines and terms of reference, a horizon year of 2025 has been used for traffic forecasting and analysis purposes. This is five-years from the date of the study.

4.2 Future Roadway Improvements

During pre-study consultation, Town and Region staff confirmed there were no future roadway improvements in the study area, such as changes in traffic control or road widenings.

The analysis of future traffic conditions has assumed the existing roadway configurations and traffic control, subject to any changes in access imparted by redevelopment of the subject site.

4.3 Forecast Background Traffic Volumes

The future background traffic volumes in the study area are reasonably expected to comprise general background growth and traffic generated by nearby development applications. For the purposes of this report, and consistent with the Region's TIS Guidelines and pre-study consultation, a growth rate of two percent compounded per annum has been applied to the existing traffic volumes.

In addition to general background traffic growth, the Town's Development Application Map has been reviewed to identify potential development applications near the subject site. Based on this review one development has been noted near the subject site, at 133-137 Main Street East. This development is proposed to comprise a 148-unit, four-to-five storey apartment building, with 305 square metres (3,283 square feet) of commercial uses and 392 square metres (4,219 square feet) of office uses. The estimated traffic generated by this development has been extracted from the Traffic Impact Study⁹ completed for this site. **Appendix D** contains the traffic forecasts extracted from the TIS.

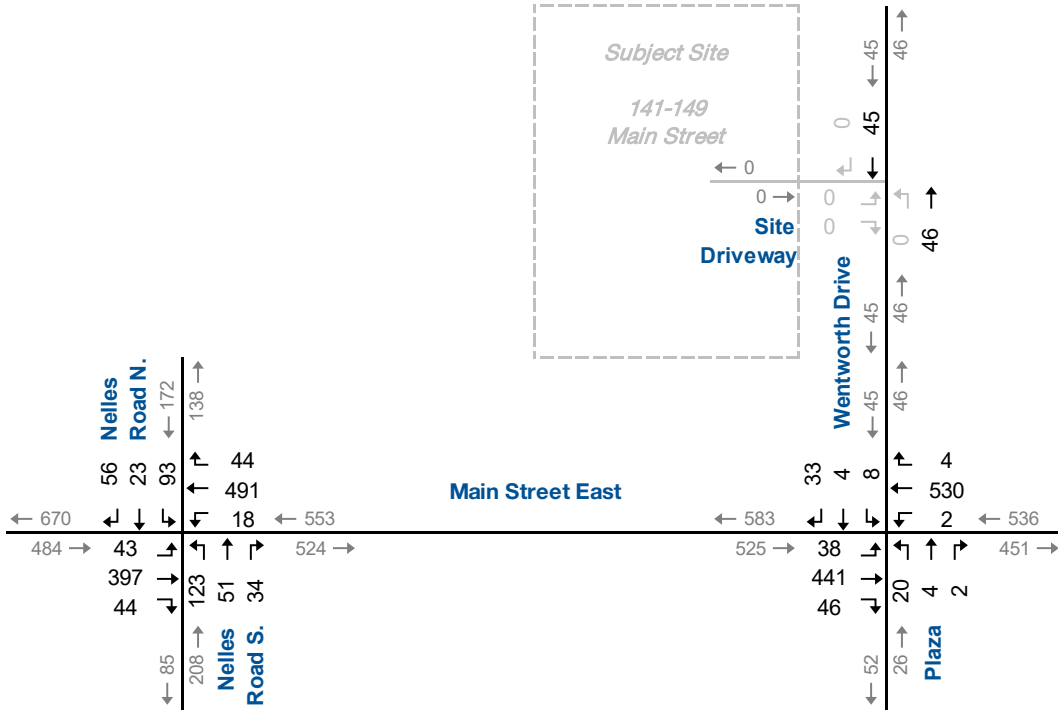
Figure 4.1 illustrates the future background traffic forecasts, including general growth and background developments, for the AM and PM peak hours.

⁹ Burgess Heritage Estates Inc. *133-137 Main Street East Traffic Impact Study*. Prepared by Crozier Consulting Engineers. August 2019.

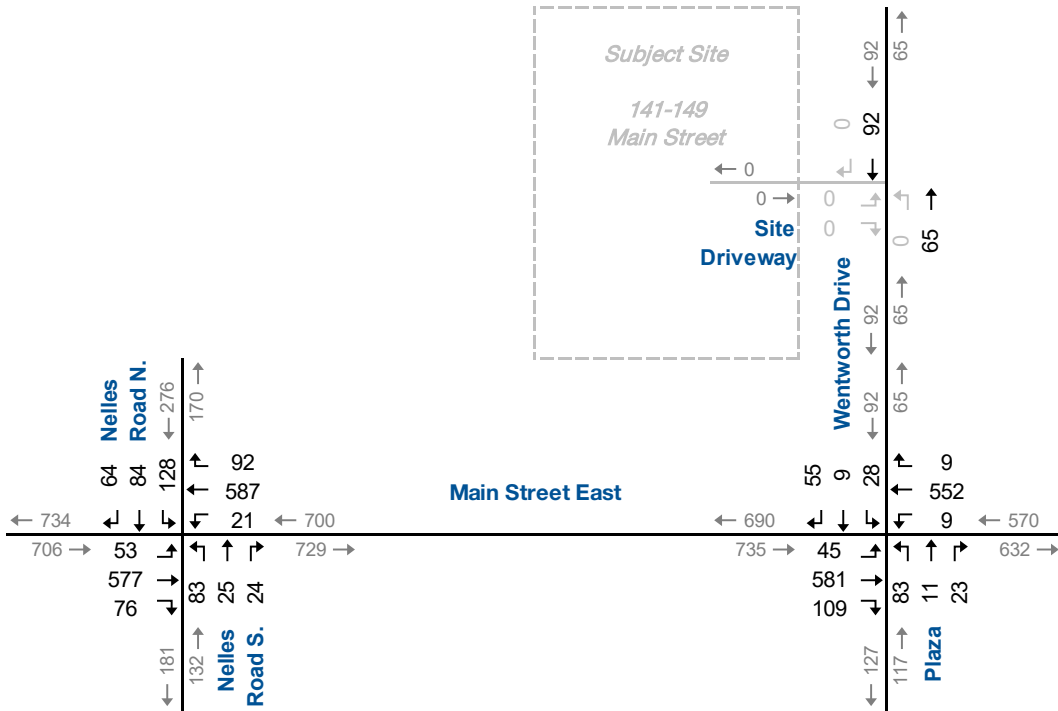




AM Peak Hour



PM Peak Hour



NTS



Forecast Background Traffic

4.4 Forecast Site Generated Traffic Volumes

The trips estimated to be generated by the site have been forecast using information contained in the Institute of Transportation Engineer's (ITE) Trip Generation Manual (10th Edition).¹⁰ Land Use Code 221 (Multifamily Housing (Mid-Rise)) has been referenced which is defined as "*apartments, townhouses and condominiums located within the same building with at least three other dwelling units and that have between three and ten floors.*"

The trip generation estimates have been calculated using the regression equations for each peak hour, in a general urban/suburban environment. **Table 4.1** summarizes the trip generation estimates and indicates the site is forecast to generate approximately 73 trips in the AM peak hour and approximately 93 trips in the PM peak hour. It is noted that these represent new trips beyond any vehicle trips the site is currently generating as a garden centre.

Due to the limited access to transit and alternate modes of transportation, no reductions have been applied to the trip generation estimates. It is also noted that the regression equations in the ITE Trip Generation Manual capture solely vehicular demand, which in and of itself, is affected by the proximity and access to alternate modes at each study site from which the trip rates were derived.

TABLE 4.1: ESTIMATED TRIP GENERATION

Land Use	Units	AM Peak Hour				PM Peak Hour			
		Source	In	Out	Total	Source	In	Out	Total
LUC 220	217	Eqn. ¹	19	54	73	Eqn. ²	57	36	93

¹ – $\ln(T) = 0.98\ln(X) - 0.98$

² – $\ln(T) = 0.96\ln(X) - 0.63$

The trip distribution for the study has been determined through a review of existing travel patterns as documented in the existing turning movement counts and broader travel characteristics as extracted from the 2016 Transportation Tomorrow Survey (TTS).

The 2016 TTS has been utilized to extract origin and destination trip information for all trips in and out of traffic analysis zone 6015 between 6:00 AM and 9:00 AM and 3:00 PM and 6:00 PM. **Appendix B** contains the detailed trip distribution assessment and TTS output.

¹⁰ Institute of Transportation Engineers. *Trip Generation Manual (10th Edition)*. Washington D.C. September 2017.



Table 4.2 summarizes the estimated distribution used in this study.

TABLE 4.2: ESTIMATED TRIP DISTRIBUTION

Origin/Destination	AM Peak Hour		PM Peak Hour	
	In	Out	In	Out
East via Main Street East	20%	42%	77%	76%
West via Main Street East	80%	58%	23%	24%
Total	100%	100%	100%	100%

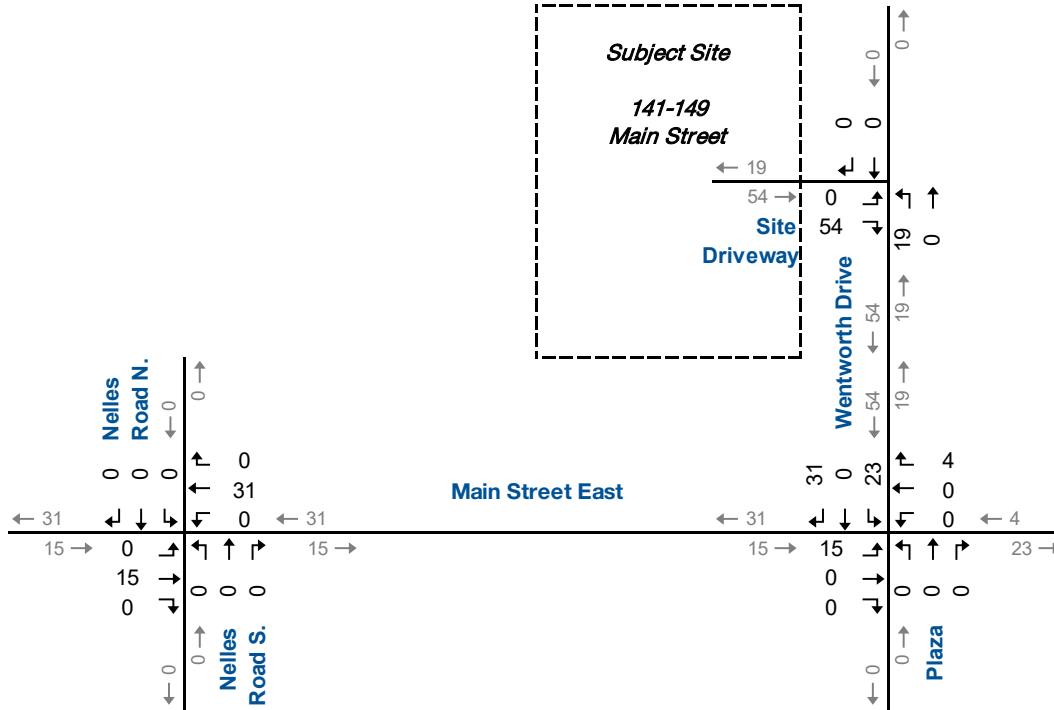
The estimated trip generation has been assigned to the study road network based on the distribution noted in **Table 4.2**. No traffic has been applied north via Wentworth Drive since the road terminates in a cul-de-sac.

Figure 4.2 illustrates the site generated traffic forecasts in the AM and PM peak hours.

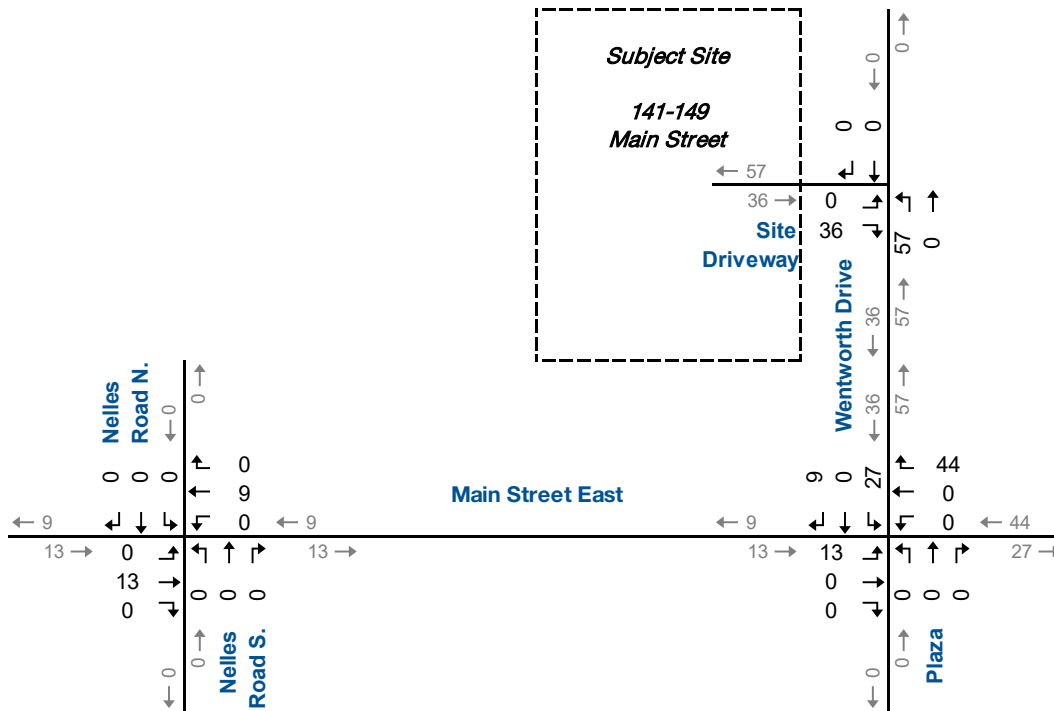




AM Peak Hour



PM Peak Hour



NTS



Forecast Site Generated Traffic

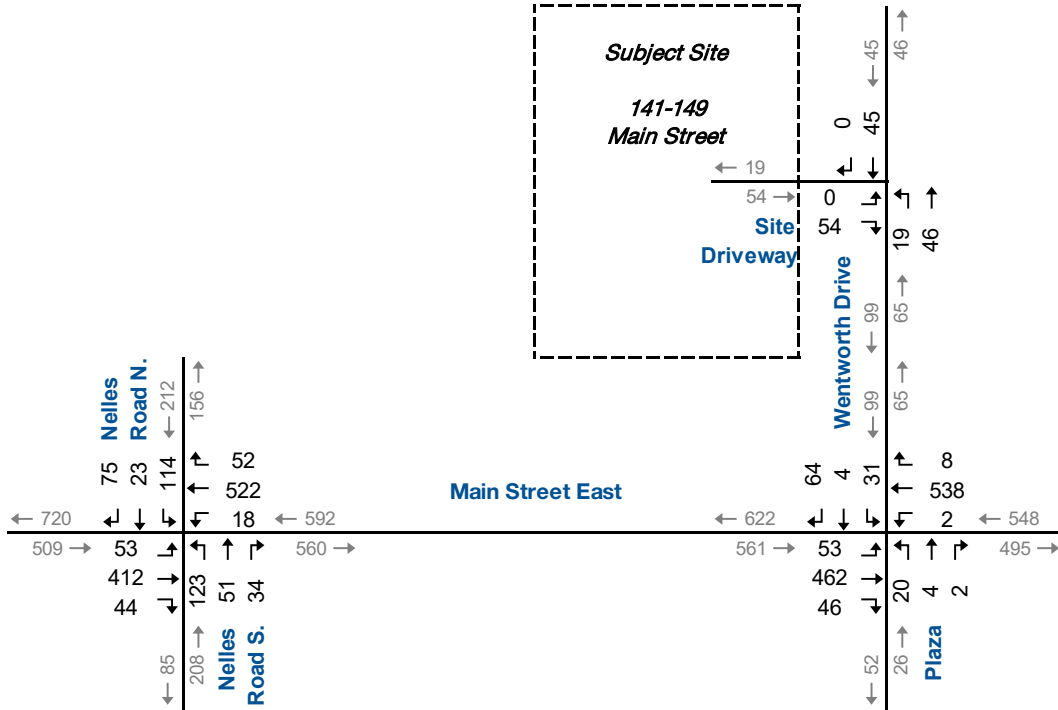
4.5 Forecast Total Traffic Volumes

The forecast total traffic volumes have been developed through the addition of the site generated traffic volumes and the forecast background traffic volumes. Traffic generated by the existing garden centre was captured in the existing traffic volumes. To remain conservative, and in lieu of detailed traffic volumes at the existing driveways to Main Street East, these volumes have not been removed from the forecast traffic volumes. **Figure 4.3** illustrates the forecast total traffic volumes in the AM and PM peak hours.

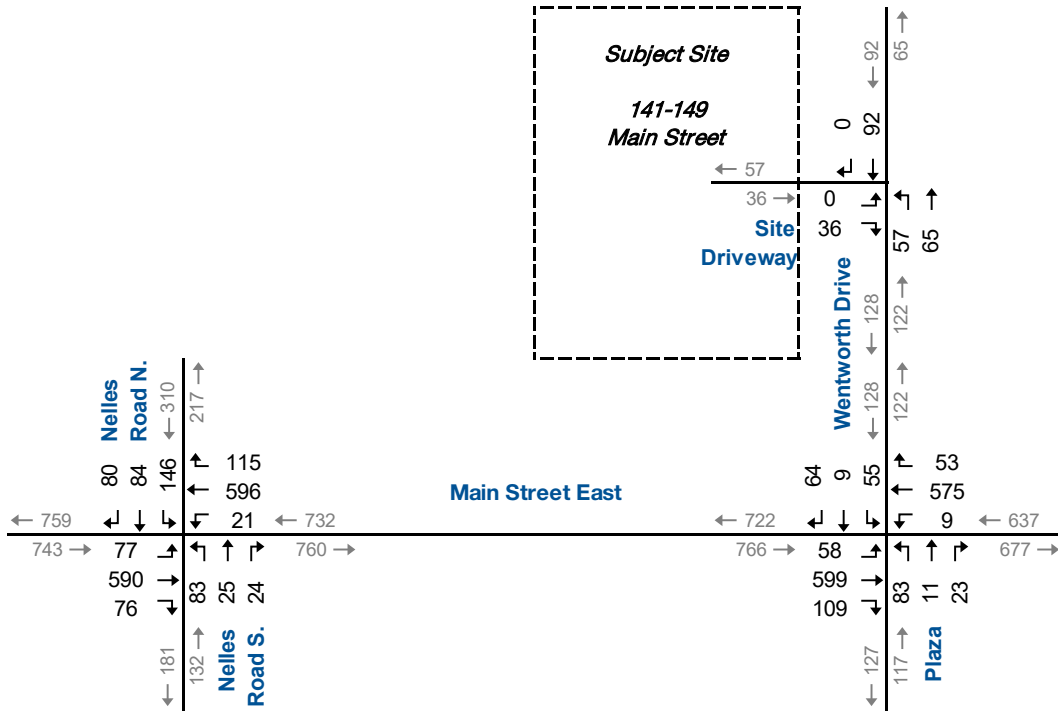




AM Peak Hour



PM Peak Hour



NTS



Forecast Total Traffic

5 Transportation Impact Assessment

5.1 Background Traffic Operations

The background traffic operations have been analyzed using the same methodology and parameters as used under existing conditions. Signal timing phasing and splits have not been modified or optimized.

Table 5.1 summarizes the background traffic operations and indicates that the study area intersections are expected to continue to operate with acceptable level of services during the weekday AM and PM peak hours. No remedial measures are necessary to support the forecast traffic volumes.

Appendix E contains the detailed Synchro and SimTraffic reports.



TABLE 5.1: BACKGROUND TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																Overall
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	Main Street East & Nelles Road	TCS	LOS Delay V/C Q Ex. Avail.	A 5 0.18 21 50 29	A 7 0.55 51 - -	> > > > > >	A 7	A 5 0.06 11 55 44	A 9 0.65 59 - -	> > > > > >	A 9	B 17 0.47 27 20 -7	B 15 0.17 33 - -	> > > > > >	B 16	B 16 0.35 23 20 -3	B 15 0.11 22 - -	> > > > > >	B 16	B 10 0.59
	Main Street East & Wentworth Drive	TCS	LOS Delay V/C Q Ex. Avail.	A 3 0.09 17 30 13	A 4 0.49 49 - -	> > > > > >	A 4	A 2 0.00 3 35 32	A 4 0.51 53 - -	> > > > > >	A 4	B 17 0.12 11 15 4	B 16 0.02 7 - -	> > > > > >	B 17	B 16 0.06 10 15 5	B 16 0.04 17 - -	> > > > > >	B 16	A 5 0.44
PM Peak Hour	Main Street East & Nelles Road	TCS	LOS Delay V/C Q Ex. Avail.	A 5 0.17 36 50 14	A 8 0.63 83 - -	> > > > > >	A 8	A 5 0.06 16 55 39	A 9 0.66 79 - -	> > > > > >	A 8	B 17 0.30 26 20 -6	B 16 0.08 24 - -	> > > > > >	B 17	B 18 0.42 30 20 -10	B 17 0.29 42 - -	> > > > > >	B 18	B 10 0.59
	Main Street East & Wentworth Drive	TCS	LOS Delay V/C Q Ex. Avail.	A 4 0.12 34 30 -4	A 8 0.70 116 - -	> > > > > >	A 7	A 3 0.03 8 35 27	A 5 0.55 63 - -	> > > > > >	A 5	B 17 0.36 19 15 -4	B 15 0.06 15 - -	> > > > > >	B 16	B 16 0.12 14 15 1	B 15 0.07 18 - -	> > > > > >	B 15	A 8 0.62

MOE - Measure of Effectiveness

LOS - Level of Service

Delay - Average Delay per Vehicle in Seconds

Q - 95th Percentile Queue Length

Ex - Existing Available Storage

Avail. - Available Storage

TCS - Traffic Control Signal

TWSC - Two-Way Stop Control

AWSC - All-Way Stop Control



5.2 Total Traffic Operations

The total traffic operations have been analyzed using the same methodology and parameters as used under existing and background conditions. Signal timing phasing and splits have not been modified.

Table 5.2 summarizes the total traffic operations and indicates that the study area intersections are expected to continue to operate with acceptable level of services during the weekday AM and PM peak hours. The queuing analyses forecast a maximum queue of 19 metres southbound on Wentworth Street, which is less than the distance between Main Street and the Site Driveway (75 metres) and Main Street and the 150 Main Street East driveway connection (25 metres). Neither of these driveways are forecast to be blocked by queued vehicles on Wentworth Street.

The operational analyses at the site driveway indicates that it is forecast to operate at an acceptable level of service (LOS A) in both peak hours and with low v/c ratios (0.05 or less). A maximum vehicle queue of 15 metres (approximately two to three vehicles) is forecast in the AM peak hour. The preliminary site plan indicates approximately 25 metres between the internal parking garage ramp and the driveway connection. Therefore, the forecast queue is not expected to block the ramp to the parking garage.

Appendix F contains the detailed Synchro and SimTraffic reports.

It is noted that Main Street East currently includes an eastbound left-turn lane at the westerly driveway connection to the existing garden centre. Once the site is redeveloped and this existing driveway connection is removed, it is recommended the Region remove this left-turn lane as it will be redundant.



TABLE 5.2: TOTAL TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																Overall							
				Eastbound				Westbound				Northbound				Southbound											
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach								
AM Peak Hour	Main Street East & Nelles Road	TCS	LOS	A	A	>	A	A	>	A	A	>	B	B	>	B	B	>	B	B	>	B	B	>			
			Delay	6	8	>	7	5	10	>	10	18	16	>	17	17	15	>	16	15	>	16	15	>	11	11	>
			V/C	0.24	0.56	>	0.06	0.69	>	0.49	0.17	>	0.43	0.13	>	0.27	0.32	>	0.20	0.32	>	0.20	0.32	>	0.62	0.62	>
	Q	22	59	>	20	66	>	28	31	>	27	32	>	27	32	>	20	32	>	20	32	>	16	16	>		
	Ex.	50	-	>	55	-	>	20	-	>	20	-	>	20	-	>	-	-	>	-	-	>	-	-	>		
	Avail.	28	-	>	35	-	>	-8	-	>	-7	-	>	-7	-	>	-	-	>	-	-	>	-	-	>		
AM Peak Hour	Main Street East & Wentworth Drive	TCS	LOS	A	A	>	A	A	>	A	A	>	B	B	>	B	B	>	B	B	>	B	B	>			
			Delay	3	4	>	4	3	4	>	4	15	15	>	15	15	>	15	15	>	15	15	>	15	15	>	
			V/C	0.14	0.52	>	0.00	0.55	>	0.11	0.02	>	0.21	0.07	>	0.21	0.07	>	0.21	0.07	>	0.21	0.07	>	0.15	0.15	>
	Q	24	57	>	7	57	>	13	8	>	19	19	>	19	19	>	15	19	>	15	19	>	15	19	>		
	Ex.	30	-	>	35	-	>	15	-	>	15	-	>	15	-	>	-	-	>	-	-	>	-	-	>		
	Avail.	6	-	>	29	-	>	2	-	>	-4	-	>	-4	-	>	-	-	>	-	-	>	-	-	>		
PM Peak Hour	Main Street East & Nelles Road	TCS	LOS	A	A	>	A	A	>	A	A	>	B	B	>	B	B	>	B	B	>	B	B	>			
			Delay	6	9	>	8	5	10	>	10	17	16	>	17	17	>	17	17	>	17	17	>	18	18	>	
			V/C	0.28	0.65	>	0.07	0.70	>	0.30	0.08	>	0.46	0.30	>	0.31	0.55	>	0.20	0.55	>	0.20	0.55	>	0.63	0.63	>
	Q	37	78	>	17	81	>	24	20	>	31	55	>	31	55	>	20	55	>	20	55	>	18	18	>		
	Ex.	50	-	>	55	-	>	20	-	>	20	-	>	20	-	>	-	-	>	-	-	>	-	-	>		
	Avail.	13	-	>	38	-	>	-4	-	>	-11	-	>	-11	-	>	-	-	>	-	-	>	-	-	>		
PM Peak Hour	Main Street East & Wentworth Drive	TCS	LOS	A	A	>	A	A	>	A	A	>	B	B	>	B	B	>	B	B	>	B	B	>			
			Delay	4	8	>	8	3	7	>	6	16	15	>	16	15	>	16	15	>	16	15	>	15	15	>	
			V/C	0.18	0.72	>	0.04	0.63	>	0.36	0.05	>	0.23	0.08	>	0.23	0.08	>	0.23	0.08	>	0.23	0.08	>	0.63	0.63	>
	Q	36	133	>	16	79	>	20	18	>	17	17	>	17	17	>	15	17	>	15	17	>	15	17	>		
	Ex.	30	-	>	35	-	>	15	-	>	15	-	>	15	-	>	-	-	>	-	-	>	-	-	>		
	Avail.	-6	-	>	19	-	>	-5	-	>	-2	-	>	-2	-	>	-	-	>	-	-	>	-	-	>		
PM Peak Hour	Wentworth Street & Site Driveway	TWSC	LOS	<	A	>	A																				
			Delay	<	9	>	9																				
			V/C	<	0.04	>	0.04																				
	Q	<	14	>	14																						
	Ex.	<	-	>	-																						
	Avail.	<	-	>	-																						

MOE - Measure of Effectiveness

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Ex. - Existing Available Storage

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TCS - Traffic Control Signal

TWSC - Two-Way Stop Control

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6 Transportation Demand Management

Transportation Demand Management (TDM) refers to strategies or programs that seek to manage or alter transportation demands rather than increase roadway capacity to meet existing demands. The preparation of a TDM Plan serves to identify pre-construction and post-construction initiatives, strategies or programs that can be implemented to attempt to change people's behavior. To be successful, they must rely on incentives or disincentives to make shifts in travel behaviour.

TDM strategies and measures can include financial incentives, time incentives, the provision of new or enhanced commuter services, dissemination of information, or marketing alternative services.

The following sections highlight potential opportunities to reduce single occupant vehicle traffic to and from the site and modify travel behaviour as part of the redevelopment of the site.

6.1 Proposed TDM Measures

The subject site's location on Main Street East provides connectivity to the existing municipal sidewalk network; however, the lack of nearby transit services and cycling infrastructure limits the potential for increased transit use among future residents.

The preliminary site plan indicates the provision of sidewalks around the building with direct connections to Main Street and Wentworth Street. Three sidewalk connections are proposed to Main Street, including one that surrounds the west frontage of the building. The connection to Wentworth Street is proposed alongside the driveway connection. The internal sidewalk system includes delineated crosswalk markings across internal driveways to the underground parking garage and the garbage and loading bay. Delineated crosswalks are also proposed across internal parking lot drive aisles, and connections points between the internal pathway network.

The site plan includes 16 weather-protected, short-term bicycle parking spaces, at-grade, near the main entrance to the building. An additional 50 long-term bicycle parking spaces are proposed within the underground garage within relative proximity of staircases and elevators.

6.2 Potential TDM Measures

To expand upon those TDM measures already included on the site plan, additional measures could be implemented pre and post



construction to encourage the uptake of alternate modes for some, if not most, trips.

6.2.1 Walking

Pedestrian amenities including benches, lighting and weather protection at primary and secondary building entrances should be considered for the site. The on-site pedestrian realm should be designed to provide a safe and attractive environment for residents and visitors to the site.

Consideration should also be given to providing additional sidewalk connections within the at-grade parking lot. This reduces the need for pedestrians to walk through the parking lot to their vehicles, and in winter months can provide a dedicated pathway, when sufficiently cleared of snow.

6.2.2 Cycling

In lieu of dedicated cycling facilities (bike lanes, cycle tracks, etc.) being provided on the study area roadways, the future development of a cycling network is a function of cyclists having safe, secure, and accessible parking at their origin and/or destination. This includes both short-term and long-term parking for residents and visitors.

The Town's Zoning By-law requires the provision of 0.3 bicycle parking spaces per unit for residents and visitors within a covered bicycle storage area.

Based on the proposed unit count of the site, a total of 65 bicycle parking spaces are required to meet the Zoning By-law requirements. As noted in **Section 6.1**, a total of 16 short-term and 50 long-term bicycle parking spaces are proposed on the site, which exceeds the Zoning By-law requirements.

6.2.3 Carpool/Ridesharing

Rideshare/carpooling involves two or more people sharing a vehicle for a trip. The costs of the journey (fuel, tolls, parking, etc.) can be split between the driver and passengers, resulting in savings for all concerned. This also reduces the number of vehicle trips and parking demands.

Although not related to one another, carpooling and ridesharing can share common elements. The site plan includes a dedicated pick-up/drop-off area adjacent to the main entrance on the north side of the building. This drop-off/pick-up area provides a visible area for passengers to wait for ridesharing services or a ride as part of a



carpool. The preliminary site plan illustrates some weather protection will be provided by residential balconies on the floors above this drop-off area. Consideration could be given to extend weather protection across the drop-off area.



7 Conclusions and Recommendations

7.1 Conclusions

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

- ▶ Under existing conditions, the study intersections are operating at acceptable levels of service and within capacity;
- ▶ The site is estimated to generate approximately 73 new trips in the AM peak hour and approximately 93 new trips in the PM peak hour;
- ▶ Under the Town's Zoning By-law, a total of 327 parking spaces (1.50 spaces per unit) are required to support the proposed development program. The site statistics indicate a vehicle parking supply of 252 spaces (1.16 spaces/unit).
- ▶ The site design does not suggest any safety concerns for the circulation of vehicles and is expected to operate acceptably for a private development;
- ▶ The location of the new site driveway connection provides sufficient, unobstructed visibility to the north and south along Wentworth Drive;
- ▶ Under background traffic conditions, the study intersections are forecast to operate at acceptable levels of service and within capacity; and
- ▶ Under total traffic conditions, the study intersections and the new proposed driveway connection are forecast to operate at acceptable levels of service and within capacity.
- ▶ Transportation Demand Management (TDM) measures can assist in further mitigating the site's transportation and parking impact on the adjacent road network. TDM measures to encourage and support walking and cycling should be integrated into the site plan.

7.2 Recommendations

Based on the findings of this study, it is recommended that:

- ▶ Upon redevelopment of the site, the Region remove the existing eastbound left-turn lane on Main Street East at the Tim Horton's restaurant (142 Main Street);
- ▶ The internal drop-off loop should be signed to function as one-way eastbound.



- ▶ The following TDM strategies be considered to further mitigate the site's transportation and parking impact:

- Walking – Pedestrian amenities including benches, lighting and weather protection at primary and secondary building entrances should be considered.

The on-site pedestrian realm should be designed to provide a safe and attractive environment for residents and visitors to the site.

Define walking routes with sidewalks through the at grade parking area.

- Carpool/Rideshare – consider providing a weather protected waiting area within the drop-off loop.



Appendix A

Pre-Study Consultation Notes



Andrew Steinsky

From: Dunsmore, Susan <Susan.Dunsmore@niagararegion.ca>
Sent: March 26, 2020 11:48 AM
To: Andrew Steinsky
Cc: Scott Catton; Ramundo, Matteo; mpalomba@grimsby.ca
Subject: RE: 200138 - 141-149 Main Street TIS - Scope of Work

Hi Andrew

Just use the 2% increase for the years and note that it is in accordance with Regional TIS guidelines.

Thanks
Susan

From: Andrew Steinsky <asteinsky@ptsl.com>
Sent: Wednesday, March 25, 2020 2:13 PM
To: Dunsmore, Susan <Susan.Dunsmore@niagararegion.ca>
Cc: Scott Catton <scatton@ptsl.com>; Ramundo, Matteo <Matteo.Ramundo@niagararegion.ca>; mpalomba@grimsby.ca
Subject: RE: 200138 - 141-149 Main Street TIS - Scope of Work

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Hi Susan,

Thank you for the comments. We pulled AADT volumes from the Region's OpenData website which shows AADT volumes on the Main Street segment in questions as follows:

Year	AADT	Year to Year Growth (%)	Growth (%/Year)
2011	13,700	-	-
2014	11,500	-16.06%	-5.35%
2016	11,500	0.00%	0.00%
2017	13,300	15.65%	15.65%

The limited dataset does not appear to indicate clear growth patterns, and the lack of available 2018 or 2019 data makes it difficult to gauge whether the growth seen from 2016 to 2017 (15.6% per annum) carried forward into 2018 and 2019. Therefore, we derived a regression equation for the four data points, which show a overall negative trend in traffic volumes along the corridor, on the order of approximately -1% per annum. We recognize volumes are likely increasing on Main Street, but we do not expect this growth to be on the order of 15.6%. Therefore, two percent was chosen on the basis of consistency with the Region's TIS Guidelines, and in recognition of an apparent positive growth trend between 2016 and 2017.

That being said, we've also looked back to our in-house turning movement counts for which we had counts at Main Street/Wentworth Street in 2007 and 2012. Once we receive the 2017 count data form the Region we will also have an additional data point. We also looked into the turning movement count included at Main

Street/Nelles Road as part of the TIS for 133 Main Street. The two-way PM peak hour volumes on Main Street between Nelles Road and Wentworth Drive are presented below. The growth rates below are **compared to 2007 volumes** due to lack of 2017 data affording year to year comparisons.

Year	Source	Main St between Wentworth & Nelles PM Peak Hour - Two-way Volume	Growth (%) (compared to 2007)	Growth (compared to 2007)
2007	PTSL TMC	1300	-	
2012	PTSL TMC	1125	-13.46%	
2017	Region TMC	Region TMC Data to be obtained	-	
2019	133 Main St TIS TMC at Nelles	1336	2.77%	

All in all, the corridor of the study area appears to be relatively stable, with the two-way volumes between 2007 and 2019 differing by 36 vehicles (approximately 2.8%). We'll defer to the Region on an appropriate factor.

Thank you for your patience and assistance in sorting this out.

Andrew Steinsky, EIT
Transportation Consultant



Paradigm Transportation Solutions Limited

5A-150 Pinebush Road, Cambridge ON N1R 8J8
 p: 416.479.9684 x507

In these very uncertain times, we want to take this opportunity to assure you that our unique “work at home” business model enables us to offer uninterrupted support to our clients, ensuring we can continue to offer the high-quality service and work product we always have. We are fully operational and our staff are diligently working on our assignments with you.

As social distancing is imperative to stop the spread of the COVID-19 virus, we will not be conducting in-person meetings until we are advised by the proper authorities that it is safe to do so. In the meantime, we have the technology to host on-line meetings in various forms and will be using it to communicate with you.

Let's stay safe and look out for each other. We will get through this together.

From: Dunsmore, Susan <Susan.Dunsmore@niagararegion.ca>
Sent: March 25, 2020 9:51 AM
To: Andrew Steinsky <asteinsky@ptsl.com>
Cc: Scott Catton <scatton@ptsl.com>; Ramundo, Matteo <Matteo.Ramundo@niagararegion.ca>; mpalomba@grimsby.ca
Subject: RE: 200138 - 141-149 Main Street TIS - Scope of Work

Hello Andrew,

For the driveways that is fine it would be more helpful if the streets were labelled, as well the north arrow seems to be a little off so we just wanted to make sure that our original comments were reiterated in case there is a change for access points to this property.

I have had our transportation group review your approach for growing the traffic and their comments are as follows:

- As for the approach for growing the 2017 traffic volumes to 2020 is suitable; however, they did not provide the percentage growth between the 2016 and 2017 traffic volumes (or what type of volumes were used in 2016 and 2017). There is limited growth potential within the Town of Grimsby along this corridor and 2% may be overly conservative. We would like to see the presented growth from 2016 to 2017 (and is it based on ATR or TMC data) and may suggest a growth rate of 0.5% of 1.0% per annum.

If you require anything further please contact me at your convenience.

Thank you

Susan M. Dunsmore, P. Eng.
Manager, Development Engineering
Planning and Development Services

Phone: (905) 980-6000 or 1-800-263-7215 ext 3661

Address: 1815 Sir Isaac Brock Way, Thorold ON, L2V4T7



From: Andrew Steinsky <asteinsky@ptsl.com>
Sent: Tuesday, March 24, 2020 4:25 PM
To: Dunsmore, Susan <Susan.Dunsmore@niagararegion.ca>
Cc: Scott Catton <scatton@ptsl.com>; Ramundo, Matteo <Matteo.Ramundo@niagararegion.ca>; mpalomba@grimsby.ca
Subject: RE: 200138 - 141-149 Main Street TIS - Scope of Work

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Hi Susan,

Thanks for the comments. To clarify, at this time, a driveway connection is not proposed onto Main Street, and the connection onto Wentworth Drive is at the north edge of the eastern property line, as far back from Main Street as appears feasible.

I'll note that through our consultation with the Town (Michael Palomba) we've been asked to also include the intersection of Main Street/Nelles Street. However, due to recent actions by the Federal and Provincial governments to combat COVID-19, including the suspension of schools, and closure of non-essential businesses, traffic demands and traffic patterns have been significantly impacted, and at this time, do not mimic typical traffic patterns. Therefore, we are not expecting current turning movement counts to provide

accurate data of traffic and travel patterns. As none of us knows how long this situation will last, and when traffic demands and travel patterns will return to pre-pandemic levels, we have a potential solution to estimate existing traffic volumes for the study intersections in the TIS, in lieu of collecting current traffic data.

We have been in contact with the Region and understand turning movement counts are available for Main Street/Wentworth Drive and Main Street/Nelles Street, both of which were counted on June 8, 2017. Based on the availability of this data, we propose to estimate base year (2020) traffic volumes by applying a growth factor to these 2017 counts. We have reviewed the AADT volumes on Main Street in the study area and they indicate a variation of -3% from 2011 to 2017, or approximately -0.5% per year, although more recent 2016 and 2017 data indicates an upward trend in volume data. Based on this information we propose to factor the 2017 volumes to 2020 with a growth rate of 2% compounded per annum. The use of 2% is considered conservative, but is also consistent with the Region's TIS Guidelines for background traffic estimates.

Seeing as the data for each intersection was collected on the same day, we believe this approach will provide for a reasonable estimate for us to complete the necessary traffic capacity analysis. We are open to additional methodologies; however, we would need to have direction provided to us as soon as possible so we not incur delay to our study.

I've copied Michael Palomba from the Town of Grimsby, so that we can attempt to all be on the same page and confirm this approach is acceptable, prior to undertaking significant work on the TIS.

If you have any questions, please let me know.

Thanks,

Andrew Steinsky, EIT
Transportation Consultant



Paradigm Transportation Solutions Limited

5A-150 Pinebush Road, Cambridge ON N1R 8J8
p: 416.479.9684 x507

In these very uncertain times, we want to take this opportunity to assure you that our unique "work at home" business model enables us to offer uninterrupted support to our clients, ensuring we can continue to offer the high-quality service and work product we always have. We are fully operational and our staff are diligently working on our assignments with you.

As social distancing is imperative to stop the spread of the COVID-19 virus, we will not be conducting in-person meetings until we are advised by the proper authorities that it is safe to do so. In the meantime, we have the technology to host on-line meetings in various forms and will be using it to communicate with you.

Let's stay safe and look out for each other. We will get through this together.

From: Dunsmore, Susan <Susan.Dunsmore@niagararegion.ca>

Sent: March 23, 2020 3:50 PM

To: Andrew Steinsky <asteinsky@ptsl.com>

Cc: Scott Catton <scatton@ptsl.com>; Ramundo, Matteo <Matteo.Ramundo@niagararegion.ca>

Subject: RE: 200138 - 141-149 Main Street TIS - Scope of Work

Hi Andrew,

I have had our transportation staff review the scope of work and we don't have any comments our original comments about the entrances still remain as follows:

- the driveway should line up with driveways on the South Side either Tim Hortons driveway or driveway to the west of Tim Hortons
- The driveway on Wentworth should be as far back from the intersection as possible.

If you require anything further please let me know.

Thank you

Susan M. Dunsmore, P. Eng.
Manager, Development Engineering
Planning and Development Services

Phone: (905) 980-6000 or 1-800-263-7215 ext 3661
Address: 1815 Sir Isaac Brock Way, Thorold ON, L2V4T7



From: Andrew Steinsky>
Sent: Tuesday, March 17, 2020 10:07 AM
To: Dunsmore, Susan <Susan.Dunsmore@niagararegion.ca>
Cc: Scott Catton <scatton@ptsl.com>
Subject: {Spam?} 200138 - 141-149 Main Street TIS - Scope of Work

CAUTION: This email originated from outside of the Niagara Region email system. Use caution when clicking links or opening attachments unless you recognize the sender and know the content is safe.

Hi Susan,

Paradigm Transportation Solutions Limited (Paradigm) has been retained to complete a Traffic Impact Study for a proposed residential development to be located at 141-149 Main Street in the Town of Grimsby. The site is currently occupied by a nursery and garden center, but is to be redeveloped into a seven-storey, 217-unit condominium. Access is proposed via one new driveway connection to Wentworth Drive, approximately opposite the existing service entrance to the commercial plaza at 155 Main Street East. The existing driveway connections to Main Street will not be retained. I have attached a current copy of site plan for your reference; however, I note this plan is preliminary in nature and may be subject to future revisions or changes.

Prior to undertaking significant work on this study, we would like to confirm our work plan with the Region. We kindly ask Region staff to review the work plan below and provide any comments no later than **Friday 27 March 2020**. Our work plan is as follows:

- We will complete the study in accordance with the Region's TIS Guidelines (May 2012);

- We will analyze the weekday AM and PM peak hours, under existing conditions and five-years from the date of the study;
- The study area will comprise the following intersections:
 - o Main Street East and Wentworth Drive; and
 - o Wentworth Drive and Future Site Driveway.
- We have requested from the Region the most recent turning movement count for the intersection of Main Street East and Wentworth Drive. If a TMC is not available, we will complete updated turning movement counts, including counts at the existing driveway connections to the nursery and the service driveway to the property at 155 Main Street East. However, given the ongoing impacts of COVID-19, including the extension of March Break at provincial schools, how should we go about collecting traffic at these intersections? Can we count the intersections and factor them up based on historical traffic growth patterns? Since the duration of these closures remain uncertain, including the possibility of them being extended, we would appreciate any assistance from the Region.
- We will complete a site visit to confirm existing lane configurations, transit, cycling and pedestrian facilities, and any other pertinent information for the study. We have requested the most up-to-date signal timing plan for the intersection of Main Street East and Wentworth Drive.
- We will estimate future background traffic volumes through the application of a growth rate to the existing traffic volumes, as well as the addition of traffic generated by approved or in-stream developments near the study area. Our preliminary review of the Town of Grimsby's Development Application Map identifies a proposed residential development at 133 Main Street East, for which a TIS is available. We will reference this TIS in our work, and account for general background traffic growth through a 2% compounded per annum growth rate.
- We will estimate the trip generation of the site based on information contained in the ITE Trip Generation Manual. We will assign the estimated trips to the road network based on existing travel patterns, 2016 TTS data and the most logical routes to and from the site.
- We will review and forecast traffic operations under existing, future background and future total traffic conditions using Synchro, including calibration guidelines set out in the Region's TIS Guidelines. We will comment on the adequacy of the study area to accommodate the estimated traffic (LOS, v/c ratios and queuing), and identify any traffic improvements in the study area, if needed.
- We will comment on potential TDM measures that could be applied, or are proposed by the site to encourage trips by alternate modes, including cycling, walking and transit.
- We will prepare a comprehensive report documenting our assumptions and findings, including appendices. The appendices will include, but are not limited to, the traffic data used in the study and copies of the output from the traffic analysis software.
- At this time, we are not completing a parking justification report. If required, it is our understanding this would be completed by others.

If you have any questions or require any additional information, please do not hesitate to contact me.

Thanks,

Andrew Steinsky, EIT
Transportation Consultant



Paradigm Transportation Solutions Limited

5A-150 Pinebush Road, Cambridge ON N1R 8J8

p: 416.479.9684 x507

e: asteinsky@ptsl.com

w: www.ptsl.com

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Andrew Steinsky

From: Michael Palomba <mpalomba@grimsby.ca>
Sent: March 23, 2020 11:05 AM
To: Andrew Steinsky
Cc: Scott Catton
Subject: RE: 200138 - 141-149 Main Street TIS - Scope of Work

Hi Andrew,

Sorry I have one additional comment that was not included in my previous email:

- The study area should include the following intersections:
 1. Wentworth Drive and the Proposed Site Access
 2. Wentworth Drive and Main Street East
 3. Main Street East and Nelles Road

Regards,

Michael Palomba C.E.T.

Transportation Engineering Technologist

Town of Grimsby, Public Works

160 Livingston Avenue, Grimsby, ON L3M 4G3

Office Phone: 905-945-9634 Ext.2104

Email: mpalomba@grimsby.ca



**Town of
Grimsby**

From: Michael Palomba
Sent: March 23, 2020 10:02 AM
To: 'Andrew Steinsky' <asteinsky@ptsl.com>
Cc: Scott Catton <scatton@ptsl.com>
Subject: RE: 200138 - 141-149 Main Street TIS - Scope of Work

Good afternoon Andrew,

We have reviewed your proposed work plan and are in agreement with the following comments:

- Analysis of traffic operations should be completed and reported using HCM methodology. Ensure that all intersection analyses account for pedestrian/cyclist conflicts with turning movements.
- When calibrating the model, peak hour factors should be calculated based on the 8-hour TMC collected instead of a uniform 0.92 value.
- Queuing analysis should be completed using SimTraffic with a 15 minute seeding interval and 5 simulated runs.
- Although a parking justification report is not required as part of the TIS, information regarding the proposed parking supply vs Town requirements is to be included in the report in order for Town staff to assess the need for further analysis of parking requirements.
- Complete a review of the preliminary site plan:

1. Site design, circulation and safety
2. Access spacing and sight distance requirements
3. Access design (design vehicle swept paths, etc.)

If you have any additional questions or concerns please do not hesitate to contact me.

Regards,

Michael Palomba C.E.T.

Transportation Engineering Technologist

Town of Grimsby, Public Works

160 Livingston Avenue, Grimsby, ON L3M 4G3

Office Phone: 905-945-9634 Ext.2104

Email: mpalomba@grimsby.ca



**Town of
Grimsby**

From: Andrew Steinsky <asteinsky@ptsl.com>
Sent: March 17, 2020 10:07 AM
To: Michael Palomba <mpalomba@grimsby.ca>
Cc: Scott Catton <scatton@ptsl.com>
Subject: 200138 - 141-149 Main Street TIS - Scope of Work

CAUTION: Email external to Grimsby!

Hi Michael,

Paradigm Transportation Solutions Limited (Paradigm) has been retained to complete a Traffic Impact Study for a proposed residential development to be located at 141-149 Main Street in the Town of Grimsby. The site is currently occupied by a nursery and garden center, but is to be redeveloped into a seven-storey, 217-unit condominium. Access is proposed via one new driveway connection to Wentworth Drive, approximately opposite the existing service entrance to the commercial plaza at 155 Main Street East. The existing driveway connections to Main Street will not be retained. I have attached a current copy of site plan for your reference; however, I note this plan is preliminary in nature and may be subject to future revisions or changes.

Prior to undertaking significant work on this study, we would like to confirm our work plan with the Town. We kindly ask Town staff to review the work plan below and provide any comments no later than **Friday 27 March 2020**. Our work plan is as follows:

- We will complete the study in accordance with the Region's TIS Guidelines (May 2012);
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- The study area will comprise the following intersections:
 - o Main Street East and Wentworth Drive; and

- Wentworth Drive and Future Site Driveway.
- We have requested from the Region the most recent turning movement count for the intersection of Main Street East and Wentworth Drive. If a TMC is not available, we will complete updated turning movement counts, including counts at the existing driveway connections to the nursery and the service driveway to the property at 155 Main Street East. However, given the ongoing impacts of COVID-19, including the extension of March Break at provincial schools, we are in discussions with the Region on how to best determine existing traffic volumes at the study intersections.
- We will complete a site visit to confirm existing lane configurations, transit, cycling and pedestrian facilities, and any other pertinent information for the study. We have requested the most up-to-date signal timing plan for the intersection of Main Street East and Wentworth Drive.
- We will estimate future background traffic volumes through the application of a growth rate to the existing traffic volumes, as well as the addition of traffic generated by approved or in-stream developments near the study area. Our preliminary review of the Town of Grimsby's Development Application Map identifies a proposed residential development at 133 Main Street East, for which a TIS is available. We will reference this TIS in our work, and account for general background traffic growth through a 2% compounded per annum growth rate.
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- We will comment on potential TDM measures that could be applied, or are proposed by the site to encourage trips by alternate modes, including cycling, walking and transit.
- We will prepare a comprehensive report documenting our assumptions and findings, including appendices. The appendices will include, but are not limited to, the traffic data used in the study and copies of the output from the traffic analysis software.
- At this time, we are not completing a parking justification report. If required, it is our understanding this would be completed by others.

If you have any questions or require any additional information, please do not hesitate to contact me.

Thanks,

Andrew Steinsky, EIT
Transportation Consultant



Paradigm Transportation Solutions Limited

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Appendix B

Existing Traffic Data and TTS Summaries



Location..... Main Street East @ Nelles Road North/Nelles Road South GeoID..... 01101
 Road South

Municipality. GRIMSBY

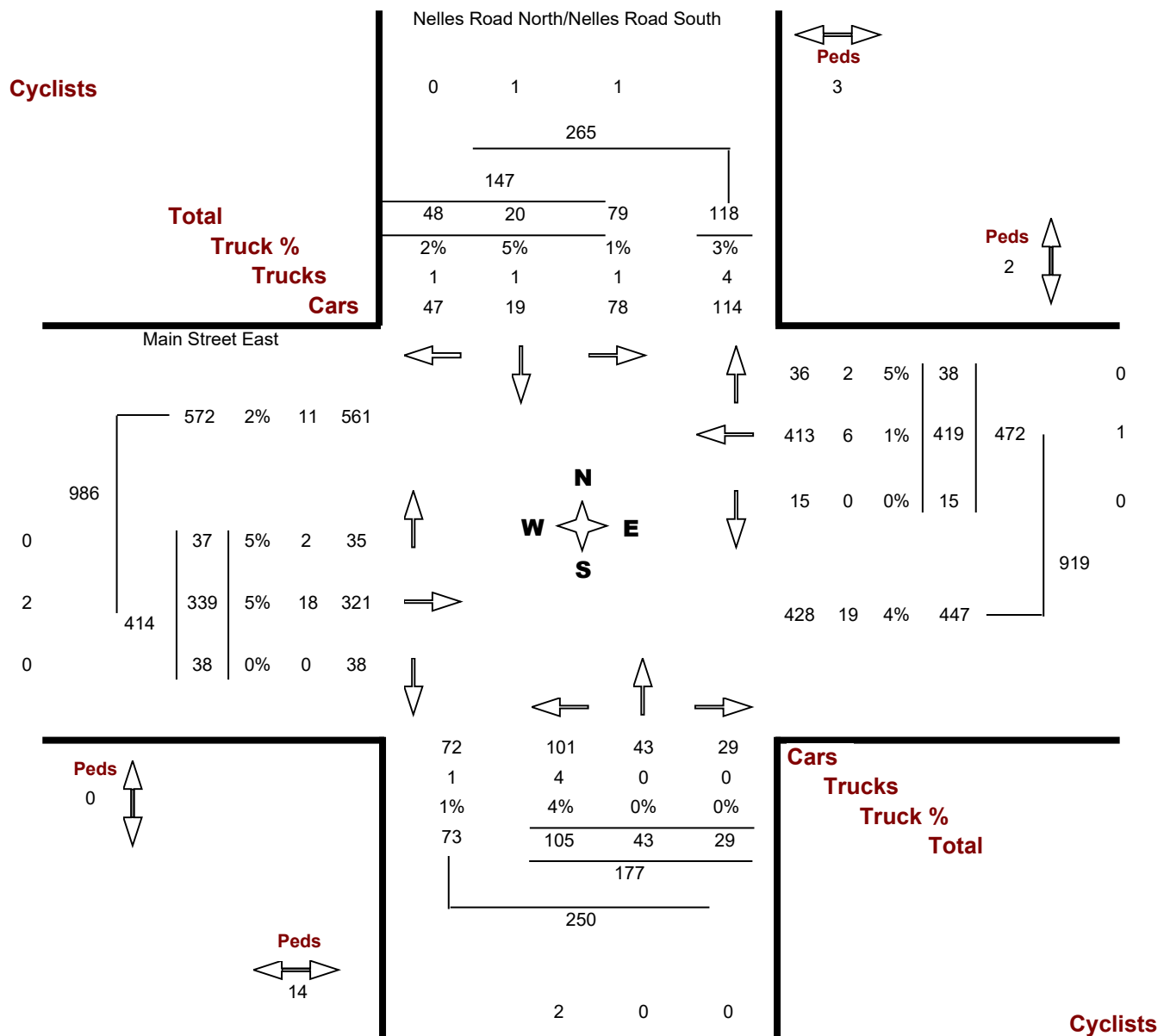
Count Date. Thursday, 08 June, 2017

Traffic Cont. Traffic signal

Count Time. 07:00 AM — 09:00 AM

Major Dir..... East west

Peak Hour.. 08:00 AM — 09:00 AM

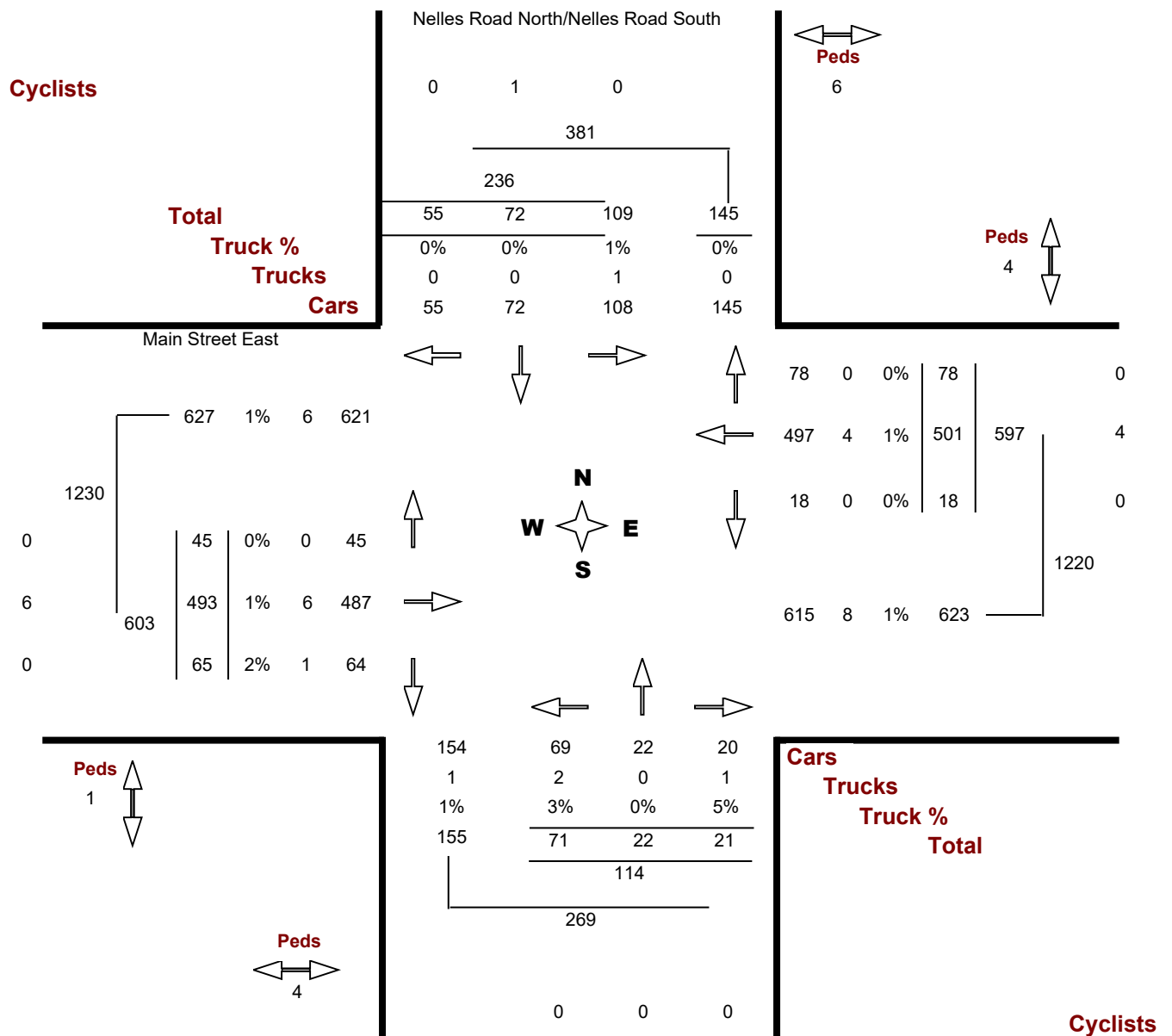


Location..... Main Street East @ Nelles Road North/Nelles Road South GeoID..... 01101
 Road South

Municipality. GRIMSBY Count Date. Thursday, 08 June, 2017

Traffic Cont. Traffic signal Count Time. 03:00 PM — 06:00 PM

Major Dir..... East west Peak Hour.. 04:30 PM — 05:30 PM

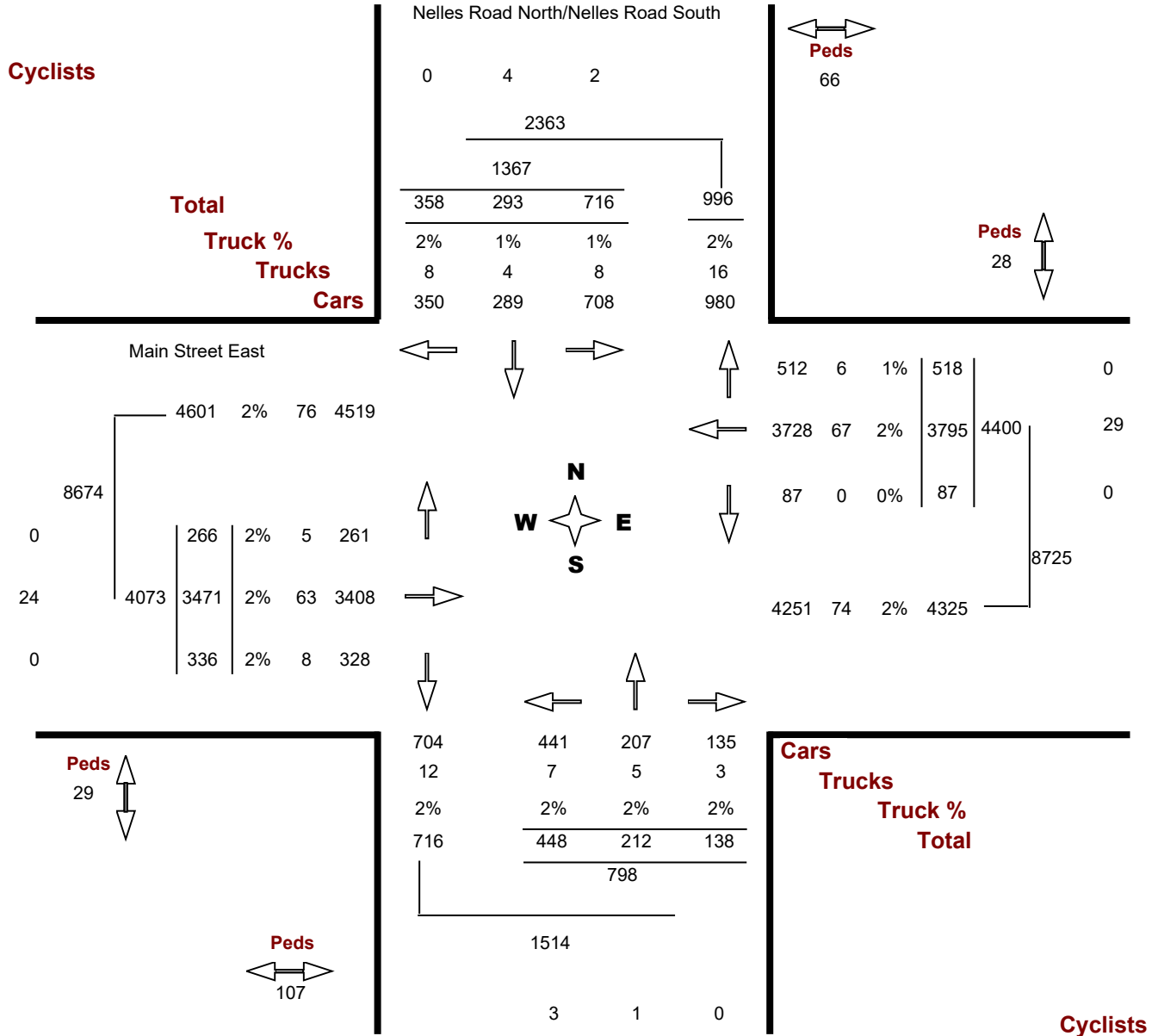


Location..... Main Street East @ Nelles Road North/Nelles Road South

Municipality..... GRIMSBY

GeoID..... 01101

Count Date..... Thursday, 08 June, 2017



Location..... Main Street East @ Nelles Road North/Nelles Road South

Municipality..... GRIMSBY

Count Date..... Thursday, June 08, 2017

Nelles Road North/Nelles Road South

Main Street East

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	8	1	4	0	13	6	6	5	0	17	2	76	11	0	89	2	30	2	0	34
07:15 07:30	13	1	3	0	17	11	14	7	0	32	2	65	5	0	72	6	51	2	0	59
07:30 07:45	8	3	11	0	22	19	7	1	0	27	0	96	10	0	106	1	52	1	0	54
07:45 08:00	13	4	14	0	31	18	8	5	0	31	3	107	5	0	115	7	85	4	0	96
Hourly Total	42	9	32	0	83	54	35	18	0	107	7	344	31	0	382	16	218	9	0	243
08:00 08:15	13	3	11	0	27	31	11	8	0	50	2	91	6	0	99	7	64	10	0	81
08:15 08:30	20	4	14	0	38	22	8	7	0	37	5	99	8	0	112	6	83	12	0	101
08:30 08:45	22	9	17	0	48	30	17	8	0	55	7	125	11	0	143	11	96	10	0	117
08:45 09:00	24	4	6	0	34	22	7	6	0	35	1	104	13	0	118	13	96	6	0	115
Hourly Total	79	20	48	0	147	105	43	29	0	177	15	419	38	0	472	37	339	38	0	414
11:00 11:15	18	5	16	0	39	8	1	6	0	15	5	115	18	0	138	2	132	10	0	144
11:15 11:30	18	2	10	0	30	11	4	1	0	16	3	127	9	0	139	11	112	9	0	132
11:30 11:45	19	4	10	0	33	4	5	3	0	12	3	132	17	0	152	3	116	9	0	128
11:45 12:00	16	8	13	0	37	10	5	2	0	17	1	118	19	0	138	10	148	10	0	168
Hourly Total	71	19	49	0	139	33	15	12	0	60	12	492	63	0	567	26	508	38	0	572
12:00 12:15	16	7	13	0	36	9	3	2	0	14	1	120	16	0	137	7	123	14	0	144
12:15 12:30	15	7	11	0	33	10	4	2	0	16	3	148	18	0	169	5	129	7	0	141
12:30 12:45	21	7	8	0	36	10	5	3	0	18	2	137	11	0	150	7	108	11	0	126
12:45 13:00	25	5	7	0	37	10	7	3	0	20	3	130	24	0	157	9	147	11	0	167
Hourly Total	77	26	39	0	142	39	19	10	0	68	9	535	69	0	613	28	507	43	0	578
13:00 13:15	31	2	10	0	43	4	3	2	0	9	1	125	14	0	140	4	129	6	0	139
13:15 13:30	24	5	6	0	35	6	4	2	0	12	5	126	15	0	146	8	108	5	0	121
13:30 13:45	21	6	10	0	37	6	4	6	0	16	2	143	18	0	163	12	98	12	0	122
13:45 14:00	26	6	8	0	40	7	2	2	0	11	1	136	18	0	155	2	113	4	0	119
Hourly Total	102	19	34	0	155	23	13	12	0	48	9	530	65	0	604	26	448	27	0	501
15:00 15:15	36	12	11	0	59	27	13	9	0	49	1	136	21	0	158	9	109	8	0	126
15:15 15:30	26	14	13	0	53	11	9	3	0	23	2	135	24	0	161	14	120	12	0	146
15:30 15:45	25	15	6	0	46	15	6	8	0	29	3	125	19	0	147	10	111	16	0	137
15:45 16:00	27	9	10	0	46	17	3	2	0	22	3	136	19	0	158	13	122	16	0	151
Hourly Total	114	50	40	0	204	70	31	22	0	123	9	532	83	0	624	46	462	52	0	560

Nelles Road North/Nelles Road South

Main Street East

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
16:00 16:15	33	21	6	0	60	8	5	6	0	19	4	114	23	0	141	15	131	17	0	163
16:15 16:30	24	15	27	0	66	11	8	5	0	24	2	112	27	0	141	7	124	12	0	143
16:30 16:45	19	19	15	0	53	26	10	4	0	40	0	137	18	0	155	10	114	17	0	141
16:45 17:00	39	23	9	0	71	17	5	4	0	26	6	114	22	0	142	12	125	16	0	153
Hourly Total	115	78	57	0	250	62	28	19	0	109	12	477	90	0	579	44	494	62	0	600
17:00 17:15	22	18	17	0	57	11	2	8	0	21	4	131	24	0	159	10	133	11	0	154
17:15 17:30	29	12	14	0	55	17	5	5	0	27	8	119	14	0	141	13	121	21	0	155
17:30 17:45	36	21	13	0	70	18	7	3	0	28	2	100	24	0	126	8	128	21	0	157
17:45 18:00	29	21	15	0	65	16	14	0	0	30	0	116	17	0	133	12	113	14	0	139
Hourly Total	116	72	59	0	247	62	28	16	0	106	14	466	79	0	559	43	495	67	0	605
Grand Total	716	293	358	0	1367	448	212	138	0	798	87	3795	518	0	4400	266	3471	336	0	4073
Truck %	1%	1%	2%	0%	1%	2%	2%	2%	0%	2%	0%	2%	1%	0%	2%	2%	2%	2%	0%	2%

Location..... Main Street East @ Wentworth Drive

GeoID..... 01100

Municipality. GRIMSBY

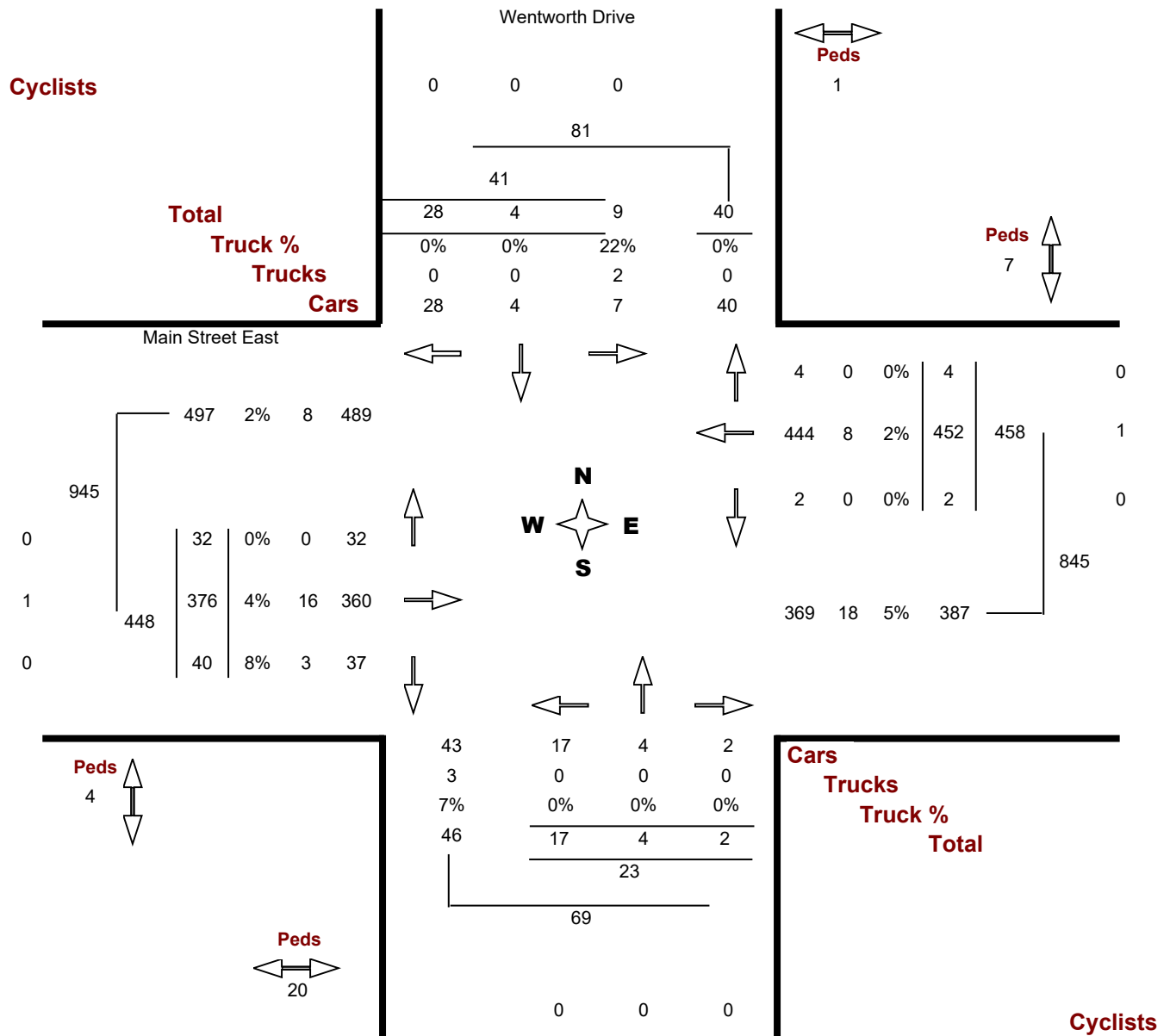
Count Date. Thursday, 08 June, 2017

Traffic Cont. Traffic signal

Count Time. 07:00 AM — 09:00 AM

Major Dir..... East west

Peak Hour.. 08:00 AM — 09:00 AM



Location..... Main Street East @ Wentworth Drive

GeoID..... 01100

Municipality. GRIMSBY

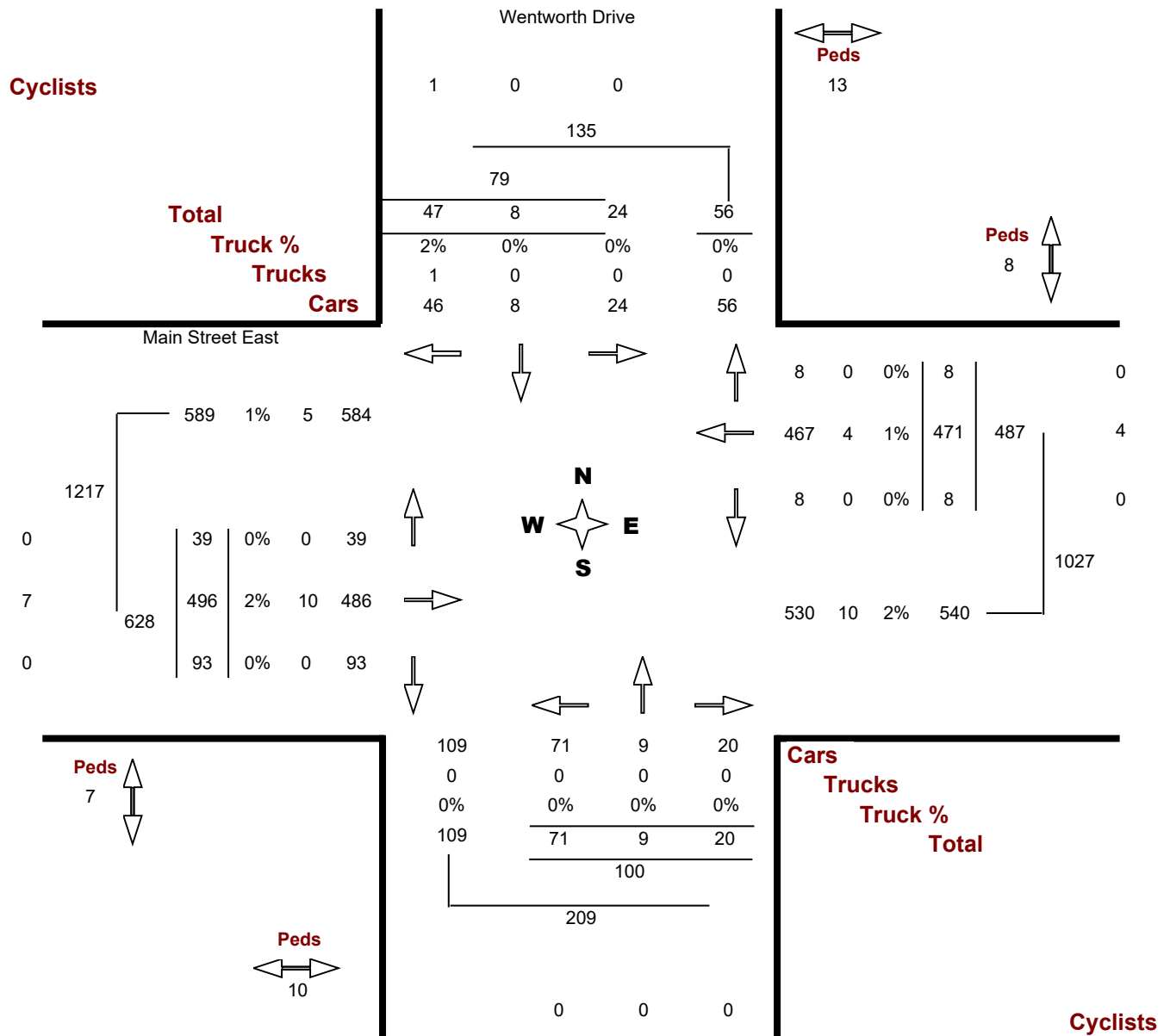
Count Date. Thursday, 08 June, 2017

Traffic Cont. Traffic signal

Count Time. 03:00 PM — 06:00 PM

Major Dir..... East west

Peak Hour.. 04:15 PM — 05:15 PM

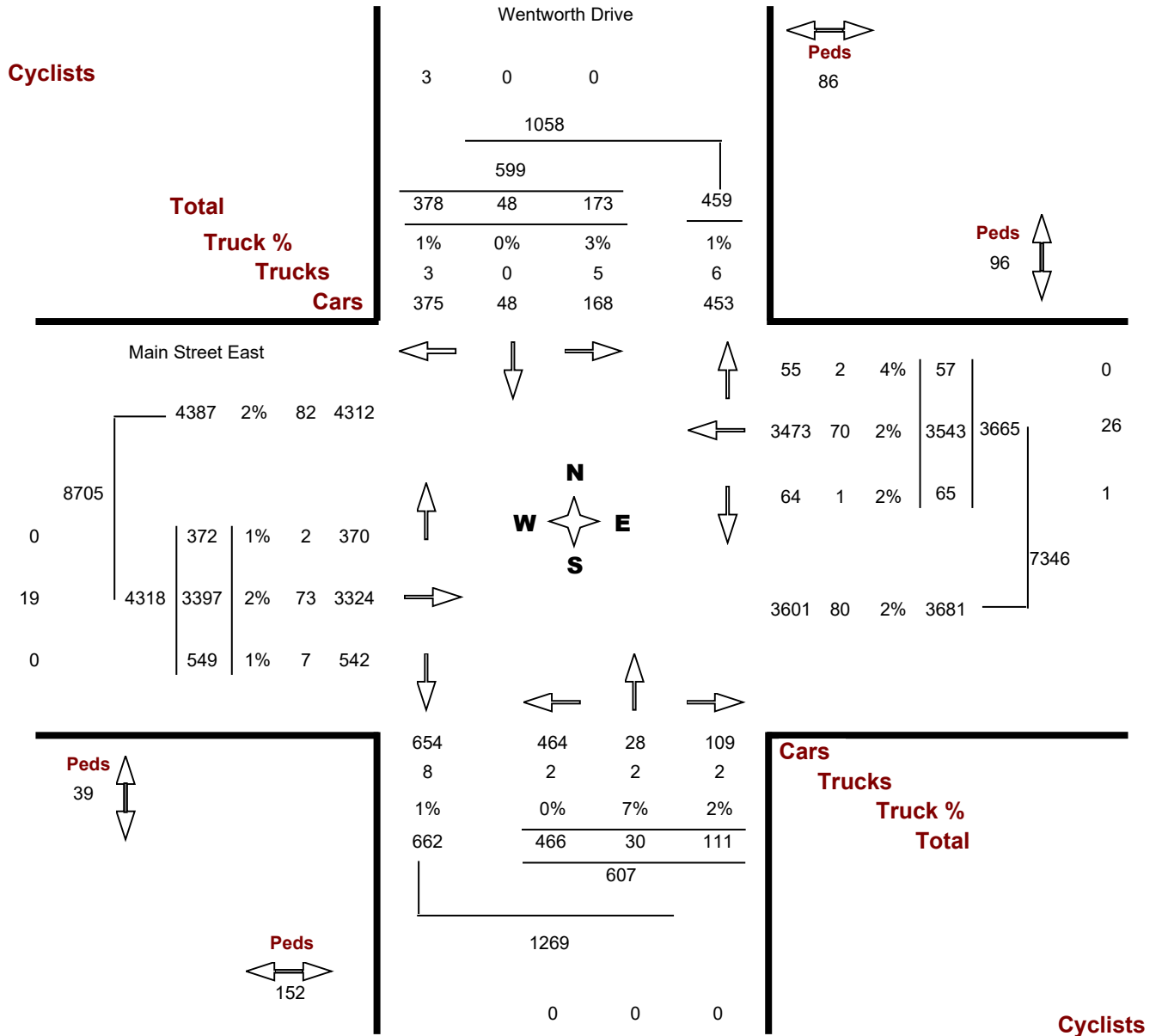


Location..... Main Street East @ Wentworth Drive

Municipality..... GRIMSBY

GeoID..... 01100

Count Date..... Thursday, 08 June, 2017



Turning Movement Count - Details Report (15 min)

Location..... Main Street East @ Wentworth Drive

Municipality..... GRIMSBY

Count Date..... Thursday, June 08, 2017

Wentworth Drive

Main Street East

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	0	5	0	5	0	0	0	0	0	0	76	1	0	77	1	37	1	0	39
07:15 07:30	1	0	1	0	2	1	0	1	0	2	1	64	1	0	66	4	49	2	0	55
07:30 07:45	0	0	6	0	6	2	0	2	0	4	1	104	2	0	107	4	53	8	0	65
07:45 08:00	1	0	3	0	4	1	0	0	0	1	0	116	0	0	116	2	88	3	0	93
Hourly Total	2	0	15	0	17	4	0	3	0	7	2	360	4	0	366	11	227	14	0	252
08:00 08:15	0	2	3	0	5	3	0	0	0	3	0	92	1	0	93	4	83	7	0	94
08:15 08:30	4	0	7	0	11	0	3	0	0	3	0	124	0	0	124	7	94	7	0	108
08:30 08:45	2	1	4	0	7	7	0	2	0	9	1	127	1	0	129	7	97	11	0	115
08:45 09:00	3	1	14	0	18	7	1	0	0	8	1	109	2	0	112	14	102	15	0	131
Hourly Total	9	4	28	0	41	17	4	2	0	23	2	452	4	0	458	32	376	40	0	448
11:00 11:15	6	1	19	0	26	21	2	4	0	27	1	94	2	0	97	15	113	30	0	158
11:15 11:30	9	1	19	0	29	22	3	4	0	29	2	106	3	0	111	13	110	23	0	146
11:30 11:45	3	2	19	0	24	15	2	8	0	25	1	117	3	0	121	11	114	17	0	142
11:45 12:00	9	4	14	0	27	23	1	2	0	26	4	96	0	0	100	15	121	27	0	163
Hourly Total	27	8	71	0	106	81	8	18	0	107	8	413	8	0	429	54	458	97	0	609
12:00 12:15	8	0	15	0	23	16	1	2	0	19	6	108	2	0	116	13	108	16	0	137
12:15 12:30	6	4	18	0	28	27	3	4	0	34	6	128	3	0	137	12	130	15	0	157
12:30 12:45	4	5	12	0	21	18	0	7	0	25	2	115	3	0	120	14	104	20	0	138
12:45 13:00	5	2	12	0	19	20	0	4	0	24	3	136	4	0	143	19	122	33	0	174
Hourly Total	23	11	57	0	91	81	4	17	0	102	17	487	12	0	516	58	464	84	0	606
13:00 13:15	9	1	9	0	19	18	0	3	0	21	4	96	3	0	103	17	125	30	0	172
13:15 13:30	6	4	24	0	34	28	1	3	0	32	2	108	0	0	110	15	99	25	0	139
13:30 13:45	7	3	19	0	29	15	0	2	0	17	3	123	3	0	129	13	101	18	0	132
13:45 14:00	8	1	14	0	23	21	0	3	0	24	1	128	1	0	130	20	86	16	0	122
Hourly Total	30	9	66	0	105	82	1	11	0	94	10	455	7	0	472	65	411	89	0	565
15:00 15:15	9	2	14	0	25	23	1	3	0	27	3	126	2	0	131	12	119	17	0	148
15:15 15:30	7	1	8	0	16	19	0	4	0	23	5	129	0	0	134	16	121	11	0	148
15:30 15:45	7	1	16	0	24	16	1	2	0	19	3	115	2	0	120	7	124	15	0	146
15:45 16:00	12	2	8	0	22	8	1	8	0	17	1	118	5	0	124	12	118	16	0	146
Hourly Total	35	6	46	0	87	66	3	17	0	86	12	488	9	0	509	47	482	59	0	588

Wentworth Drive

Main Street East

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
16:00 16:15	6	1	21	0	28	15	0	5	0	20	3	106	3	0	112	23	112	21	0	156
16:15 16:30	8	3	13	0	24	16	1	5	0	22	3	131	3	0	137	9	134	22	0	165
16:30 16:45	7	3	13	0	23	18	4	3	0	25	1	113	1	0	115	11	106	20	0	137
16:45 17:00	8	1	10	0	19	15	2	7	0	24	1	107	2	0	110	7	124	25	0	156
Hourly Total	29	8	57	0	94	64	7	20	0	91	8	457	9	0	474	50	476	88	0	614
17:00 17:15	1	1	11	0	13	22	2	5	0	29	3	120	2	0	125	12	132	26	0	170
17:15 17:30	5	0	9	0	14	15	0	7	0	22	1	102	0	0	103	18	123	14	0	155
17:30 17:45	4	1	11	0	16	18	0	5	0	23	1	96	1	0	98	12	138	15	0	165
17:45 18:00	8	0	7	0	15	16	1	6	0	23	1	113	1	0	115	13	110	23	0	146
Hourly Total	18	2	38	0	58	71	3	23	0	97	6	431	4	0	441	55	503	78	0	636
Grand Total	173	48	378	0	599	466	30	111	0	607	65	3543	57	0	3665	372	3397	549	0	4318
Truck %	3%	0%	1%	0%	1%	0%	7%	2%	0%	1%	2%	2%	4%	0%	2%	1%	2%	1%	0%	2%

AM Inbound
Thu Mar 26 2020 17:07:21 GMT-0400 (Eastern Daylight Time) - Run Time: 2666ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: 2006 GTA zone of destination - gta06_dest
Column: Planning district of origin - pd_orig

Filters:
(2006 GTA zone of destination - gta06_dest In 6015
and
Start time of trip - start_time In 0600-0900)

Trip 2016	ROW : gta06_dest	COLUMN : pd_orig	gta06_dest	pd_orig	total		
6015	40	26	Burlington	West	3.66%		
6015	41	32	Flamborough	West	4.51%		
6015	46	227	Hamilton	West	31.97%		
6015	51	238	Grimsby	West	33.52%		
6015	52	18	Lincoln	East	2.54%		
6015	55	34	St. Catharines	East	4.79%		
6015	57	57	Niagara Falls	East	8.03%		
6015	61	15	West Lincoln	East	2.11%		
6015	62	19	Wainfleet	East	2.68%		
6015	63	14	Waterloo	West	1.97%		
6015	103	30	Peterborough	West	4.23%		
		710					

PM Inbound
Thu Mar 26 2020 17:13:20 GMT-0400 (Eastern Daylight Time) - Run Time: 2583ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: 2006 GTA zone of destination - gta06_dest
Column: Planning district of origin - pd_orig

Filters:
(2006 GTA zone of destination - gta06_dest In 6015
and
Start time of trip - start_time In 1500-1800)

Trip 2016	ROW : gta06_dest	COLUMN : pd_orig	gta06_dest	pd_orig	total		
6015	8	21	Toronto	West	1.47%		
6015	11	27	Toronto	West	1.89%		
6015	39	14	Oakville	West	0.98%		
6015	40	24	Burlington	West	1.68%		
6015	45	28	Stoney Creek	West	1.96%		
6015	46	154	Hamilton	West	10.79%		
6015	51	657	Grimsby	East	46.04%		
6015	52	215	Lincoln	East	15.07%		
6015	54	90	NOTL	East	6.31%		
6015	55	107	St. Catharines	East	7.50%		
6015	58	18	Welland	East	1.26%		
6015	61	14	West Lincoln	East	0.98%		
6015	71	15	Puslinch	West	1.05%		
6015	80	24	Orangeville	West	1.68%		
6015	125	19	Haldimand and Norfolk County	West	1.33%		
		1427					

AM Outbound
Thu Mar 26 2020 17:09:29 GMT-0400 (Eastern Daylight Time) - Run Time: 2237ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: 2006 GTA zone of origin - gta06_orig
Column: Planning district of destination - pd_dest

Filters:
(2006 GTA zone of origin - gta06_orig In 6015
and
Start time of trip - start_time In 0600-0900)

Trip 2016	ROW : gta06_orig	COLUMN : pd_dest	gta06_orig	pd_dest	total		
6015	11	27	Toronto	West	1.91%		
6015	36	18	Mississauga	West	1.27%		
6015	38	35	Milton	West	2.48%		
6015	39	54	Oakville	West	3.82%		
6015	40	24	Burlington	West	1.70%		
6015	45	24	Stoney Creek	West	1.70%		
6015	46	154	Hamilton	East	10.89%		
6015	51	607	Grimsby	West	42.93%		
6015	52	172	Lincoln	East	12.16%		
6015	54	69	NOTL	East	4.88%		
6015	55	145	St. Catharines	East	10.25%		
6015	56	12	Thorold	East	0.85%		
6015	57	27	Niagara Falls	East	1.91%		
6015	58	18	Welland	East	1.27%		
6015	63	6	Waterloo	West	0.42%		
6015	998	22	External	West	1.56%		
		1414					

PM Outbound
Thu Mar 26 2020 17:10:17 GMT-0400 (Eastern Daylight Time) - Run Time: 2558ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: 2006 GTA zone of origin - gta06_orig
Column: Planning district of destination - pd_dest

Filters:
(2006 GTA zone of origin - gta06_orig In 6015
and
Start time of trip - start_time In 1500-1800)

Trip 2016	ROW : gta06_orig	COLUMN : pd_dest	gta06_orig	pd_dest	total		
6015	40	40	Burlington	West	3.89%		
6015	41	32	Flamborough	West	3.11%		
6015	45	20	Stoney Creek	West	1.95%		
6015	46	103	Hamilton	West	10.02%		
6015	51	433	Grimsby	East	42.12%		
6015	52	66	Lincoln	East	6.42%		
6015	55	128	St. Catharines	East	12.45%		
6015	57	106	Niagara Falls	East	10.31%		
6015	61	29	West Lincoln	East	2.82%		
6015	62	19	Wainfleet	East	1.85%		
6015	63	14	Waterloo	West	1.36%		
6015	125	38	Haldimand and Norfolk County	West	3.70%		
		1028					

	AM In	AM Out	PM In	PM Out
North	0%	0%	0%	0%
South	0%	0%	0%	0%
East	20%	42%	77%	76%
West	80%	58%	23%	24%
	100%	100%	100%	100%

Signal Code: 081NLL						
Intersection: RR81 (MAIN ST.) & NELLES RD.						
Municipality: grimsby						
Owner: Region						
Last Modified: 3/30/2020 10:47:08 AM						
Timing Parameters	EBD & WBD MAIN ST.	NBD & SBD NELLES	n/a	n/a	n/a	n/a
Min Green	10	8	0	0	0	0
Walk	10	8	0	0	0	0
Ped Clearance	16	11	0	0	0	0
Vehicle Ext.	2.5	2.5	0	0	0	0
Max Green	54	25	0	0	0	0
Yellow	4.1	4.1	0	0	0	0
All Red	2.6	2.1	0	0	0	0

	Offset
Minimum Cycle	30.9
Pedestrian Cycle	57.9
Maximum Cycle	91.9
Operation	FA

Installed On:

2/5/2000

Count Date:

8/6/2017

FA = Fully Actuated

SA = Semi Actuated

FT = Fixed Time

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

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Signal Code: 081WNT						
Intersection: RR81 (MAIN ST.) & WENTWORTH DR.						
Municipality: grimsby						
Owner: region						
Last Modified: 4/4/2018 2:55:08 PM						
Timing Parameters	EBD & WBD MAIN ST.	NBD & SBD WENTWORTH DR.	n/a	n/a	n/a	n/a
Min Green	10	8	0	0	0	0
Walk	8	8	0	0	0	0
Ped Clearance	12	12	0	0	0	0
Vehicle Ext.	2.5	2.5	0	0	0	0
Max Green	30	20	0	0	0	0
Yellow	4.1	4.1	0	0	0	0
All Red	2.1	2.1	0	0	0	0

		Offset
Minimum Cycle	30.4	0
Pedestrian Cycle	52.4	
Maximum Cycle	62.4	0
Operation	SA	

Installed On:

4/29/2011

Count Date:

6/8/2017

FA = Fully Actuated

SA = Semi Actuated

FT = Fixed Time

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

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Appendix C

Existing Traffic Operations Reports



Lanes, Volumes, Timings

Existing: AM Peak Hour

1: Nelles Road S/Nelles Road N & Main St E

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	39	360	40	16	445	40	111	46	31	84	21	51
Future Volume (vph)	39	360	40	16	445	40	111	46	31	84	21	51
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Storage Length (m)	50.0	0.0	55.0	0.0	20.0	0.0	20.0	0.0	20.0	0.0	20.0	0.0
Storage Lanes	1	0	1	0	1	0	1	0	1	0	1	0
Taper Length (m)	7.5		7.5		7.5		7.5		7.5		7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	1.00	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00
Frt	0.985		0.988		0.940		0.894					
Fit Protected	0.950		0.950		0.950		0.950		0.950		0.950	
Satd. Flow (prot)	1583	1643	0	1662	1703	0	1599	1629	0	1646	1521	0
Fit Permitted	0.345		0.422		0.701		0.697					
Satd. Flow (perm)	574	1643	0	731	1703	0	1180	1629	0	1203	1521	0
Right Turn on Red		Yes		Yes		Yes		Yes		Yes		Yes
Satd. Flow (RTOR)		14		11		37		61		50		50
Link Speed (k/h)		50		50		50		50		50		50
Link Distance (m)		106.6		231.4		118.5		110.9		110.9		110.9
Travel Time (s)		7.7		16.7		8.5		8.0		8.0		8.0
Confl. Peds. (#/hr)	3		14	14		3		2	2		2	2
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Heavy Vehicles (%)	5%	5%	0%	0%	1%	5%	4%	0%	0%	1%	5%	2%
Adj. Flow (vph)	47	434	48	19	536	48	134	55	37	101	25	61
Shared Lane Traffic (%)												
Lane Group Flow (vph)	47	482	0	19	584	0	134	92	0	101	86	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6		3.6		3.6		3.6		3.6		3.6
Link Offset(m)		0.0		0.0		0.0		0.0		0.0		0.0
Crosswalk Width(m)		4.8		4.8		4.8		4.8		4.8		4.8
Two way Left Turn Lane												
Headway Factor	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
Turning Speed (k/h)	25		15	25		15		25		15		25
Number of Detectors	1	2		1	2		1	2		1		2
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left		Thru
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0		10.0
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0		0.0
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0		0.0
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6		2.0		0.6
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex		Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0		0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0		0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0		0.0
Detector 2 Position(m)		9.4			9.4			9.4				9.4
Detector 2 Size(m)		0.6			0.6			0.6				0.6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0

Lanes, Volumes, Timings

Existing: AM Peak Hour

1: Nelles Road S/Nelles Road N & Main St E

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Detector Phase	2	2		2	2		4	4		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		8.0	8.0		8.0	8.0	
Minimum Split (s)	32.7	32.7		32.7	32.7		25.2	25.2		25.2	25.2	
Total Split (s)	54.0	54.0		54.0	54.0		25.2	25.2		25.2	25.2	
Total Split (%)	68.2%	68.2%		68.2%	68.2%		31.8%	31.8%		31.8%	31.8%	
Maximum Green (s)	47.3	47.3		47.3	47.3		19.0	19.0		19.0	19.0	
Yellow Time (s)	4.1	4.1		4.1	4.1		4.1	4.1		4.1	4.1	
All-Red Time (s)	2.6	2.6		2.6	2.6		2.1	2.1		2.1	2.1	
Lost Time Adjust (s)	-2.7	-2.7		-2.7	-2.7		-2.2	-2.2		-2.2	-2.2	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Walk Time (s)	10.0	10.0		10.0	10.0		8.0	8.0		8.0	8.0	
Flash Dont Walk (s)	16.0	16.0		16.0	16.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	28.4	28.4		28.4	28.4		13.5	13.5		13.5	13.5	
Actuated g/C Ratio	0.57	0.57		0.57	0.57		0.27	0.27		0.27	0.27	
v/c Ratio	0.15	0.52		0.05	0.60		0.42	0.20		0.31	0.19	
Control Delay	7.1	9.2		5.9	10.6		21.1	11.7		18.9	8.7	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	7.1	9.2		5.9	10.6		21.1	11.7		18.9	8.7	
LOS	A	A		A	B		C	B		B	A	
Approach Delay		9.0			10.5			17.3			14.2	
Approach LOS		A			B			B			B	
Intersection Summary												
Area Type:	Other											
Cycle Length:	79.2											
Actuated Cycle Length:	50.2											
Natural Cycle:	60											
Control Type:	Actuated-Uncoordinated											
Maximum v/c Ratio:	0.60											
Intersection Signal Delay:	11.4						Intersection LOS: B					
Intersection Capacity Utilization	55.4%						ICU Level of Service B					
Analysis Period (min)	15											
Splits and Phases:	1: Nelles Road S/Nelles Road N & Main St E											

HCM Signalized Intersection Capacity Analysis
 1: Nelles Road S/Nelles Road N & Main St E

Existing: AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	39	360	40	16	445	40	111	46	31	84	21	51
Future Volume (vph)	39	360	40	16	445	40	111	46	31	84	21	51
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		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	0.99		1.00	1.00	
Ftpb, ped/bikes	1.00	1.00		0.99	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.99		1.00	0.94		1.00	0.89	
Fit Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1582	1644		1652	1703		1599	1630		1642	1520	
Fit Permitted	0.35	1.00		0.42	1.00		0.70	1.00		0.70	1.00	
Satd. Flow (perm)	575	1644		734	1703		1180	1630		1206	1520	
Peak-hour factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Adj. Flow (vph)	47	434	48	19	536	48	134	55	37	101	25	61
RTOR Reduction (vph)	0	6	0	0	5	0	0	27	0	0	45	0
Lane Group Flow (vph)	47	476	0	19	579	0	134	65	0	101	41	0
Confl. Peds. (#/hr)	3		14	14		3			2	2		
Heavy Vehicles (%)	5%	5%	0%	0%	1%	5%	4%	0%	0%	1%	5%	2%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Actuated Green, G (s)	25.5	25.5		25.5	25.5		11.2	11.2		11.2	11.2	
Effective Green, g (s)	28.2	28.2		28.2	28.2		13.4	13.4		13.4	13.4	
Actuated g/C Ratio	0.57	0.57		0.57	0.57		0.27	0.27		0.27	0.27	
Clearance Time (s)	6.7	6.7		6.7	6.7		6.2	6.2		6.2	6.2	
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	326	934		417	968		318	440		325	410	
v/s Ratio Prot		0.29			c0.34			0.04			0.03	
v/s Ratio Perm	0.08			0.03			c0.11			0.08		
v/c Ratio	0.14	0.51		0.05	0.60		0.42	0.15		0.31	0.10	
Uniform Delay, d1	5.0	6.5		4.7	7.0		14.9	13.8		14.4	13.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.3		0.0	0.8		0.7	0.1		0.4	0.1	
Delay (s)	5.2	6.8		4.8	7.8		15.6	13.9		14.8	13.7	
Level of Service	A	A		A	A		B	B		B	B	
Approach Delay (s)		6.7			7.7			14.9			14.3	
Approach LOS		A			A			B			B	
Intersection Summary												
HCM 2000 Control Delay	9.2		HCM 2000 Level of Service				A					
HCM 2000 Volume to Capacity ratio	0.54											
Actuated Cycle Length (s)	49.6				Sum of lost time (s)				8.0			
Intersection Capacity Utilization	55.4%		ICU Level of Service				B					
Analysis Period (min)	15											
c Critical Lane Group												

Lanes, Volumes, Timings
 2: Wentworth Dr & Main St E

Existing: AM Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	34	399	42	2	480	4	18	4	2	7	4	30
Future Volume (vph)	34	399	42	2	480	4	18	4	2	7	4	30
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Storage Length (m)	30.0	0.0	35.0	0.0	15.0	0.0	15.0	0.0	15.0	0.0	15.0	0.0
Storage Lanes	1	0	1	0	1	0	1	0	1	0	1	0
Taper Length (m)	7.5		7.5		7.5		7.5		7.5		7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	1.00	1.00		0.99	1.00		0.99	0.99		0.99	0.98	
Frt		0.986			0.999			0.950			0.866	
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1662	1645	0	1662	1714	0	1662	1646	0	1289	1481	0
Fit Permitted	0.429			0.461			0.733			0.754		
Satd. Flow (perm)	750	1645	0	797	1714	0	1276	1646	0	1013	1481	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		13			1			2			33	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		231.4			112.0			56.9			70.1	
Travel Time (s)		16.7			8.1			4.1			5.0	
Confl. Peds. (#/hr)	1		20	20		1	4		7	7		4
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	0%	4%	8%	0%	2%	0%	0%	0%	0%	29%	0%	0%
Adj. Flow (vph)	38	443	47	2	533	4	20	4	2	8	4	33
Shared Lane Traffic (%)												
Lane Group Flow (vph)	38	490	0	2	537	0	20	6	0	8	37	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	

Lanes, Volumes, Timings
2: Wentworth Dr & Main St E

Existing: AM Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	2		2		2		4		4		4	
Permitted Phases	2			2			4			4		
Detector Phase	2	2		2	2		4	4		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		8.0	8.0		8.0	8.0	
Minimum Split (s)	26.2	26.2		26.2	26.2		26.2	26.2		26.2	26.2	
Total Split (s)	30.0	30.0		30.0	30.0		26.2	26.2		26.2	26.2	
Total Split (%)	53.4%	53.4%		53.4%	53.4%		46.6%	46.6%		46.6%	46.6%	
Maximum Green (s)	23.8	23.8		23.8	23.8		20.0	20.0		20.0	20.0	
Yellow Time (s)	4.1	4.1		4.1	4.1		4.1	4.1		4.1	4.1	
All-Red Time (s)	2.1	2.1		2.1	2.1		2.1	2.1		2.1	2.1	
Lost Time Adjust (s)	-2.2	-2.2		-2.2	-2.2		-2.2	-2.2		-2.2	-2.2	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Walk Time (s)	8.0	8.0		8.0	8.0		8.0	8.0		8.0	8.0	
Flash Dont Walk (s)	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	30.5	30.5		30.5	30.5		10.6	10.6		10.6	10.6	
Actuated g/C Ratio	0.76	0.76		0.76	0.76		0.26	0.26		0.26	0.26	
v/c Ratio	0.07	0.39		0.00	0.41		0.06	0.01		0.03	0.09	
Control Delay	4.3	5.3		4.0	5.6		14.2	12.0		13.9	7.3	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	4.3	5.3		4.0	5.6		14.2	12.0		13.9	7.3	
LOS	A	A		A	A		B	B		B	A	
Approach Delay	5.2		5.5		13.7		8.5					
Approach LOS	A		A		B		A					

Intersection Summary

Area Type: Other
 Cycle Length: 56.2
 Actuated Cycle Length: 40.1
 Natural Cycle: 55
 Control Type: Semi Act-Uncoord
 Maximum v/c Ratio: 0.41
 Intersection Signal Delay: 5.7
 Intersection Capacity Utilization 46.9%
 Analysis Period (min) 15
 Intersection LOS: A
 ICU Level of Service A

Splits and Phases: 2: Wentworth Dr & Main St E



HCM Signalized Intersection Capacity Analysis
2: Wentworth Dr & Main St E

Existing: AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	34	399	42	2	480	4	18	4	2	7	4	30
Future Volume (vph)	34	399	42	2	480	4	18	4	2	7	4	30
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		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	0.99		1.00	0.98	
Flpb, ped/bikes	1.00	1.00		0.99	1.00		1.00	1.00		0.99	1.00	
Frt	1.00	0.99		1.00	1.00		1.00	0.95		1.00	0.87	
Fit Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1662	1646		1645	1714		1656	1647		1279	1483	
Fit Permitted	0.43	1.00		0.46	1.00		0.73	1.00		0.75	1.00	
Satd. Flow (perm)	751	1646		798	1714		1277	1647		1015	1483	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	38	443	47	2	533	4	20	4	2	8	4	33
RTOR Reduction (vph)	0	4	0	0	0	0	0	2	0	0	28	0
Lane Group Flow (vph)	38	486	0	2	537	0	20	4	0	8	9	0
Confl. Peds. (#/hr)	1		20	20		1	4		7	7		4
Heavy Vehicles (%)	0%	4%	8%	0%	2%	0%	0%	0%	0%	29%	0%	0%
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	2		2		4		4		4		4	
Permitted Phases	2			2			4			4		
Actuated Green, G (s)	26.2	26.2		26.2	26.2		4.2	4.2		4.2	4.2	
Effective Green, g (s)	28.4	28.4		28.4	28.4		6.4	6.4		6.4	6.4	
Actuated g/C Ratio	0.66	0.66		0.66	0.66		0.15	0.15		0.15	0.15	
Clearance Time (s)	6.2	6.2		6.2	6.2		6.2	6.2		6.2	6.2	
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	498	1092		529	1137		190	246		151	221	
v/s Ratio Prot	0.30		c0.31		0.00		0.00				0.01	
v/s Ratio Perm	0.05		0.00		c0.02		0.01				0.05	
v/c Ratio	0.08	0.44		0.00	0.47		0.11	0.02		0.05	0.04	
Uniform Delay, d1	2.6	3.4		2.4	3.5		15.7	15.5		15.6	15.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.0	0.2		0.0	0.2		0.2	0.0		0.1	0.1	
Delay (s)	2.6	3.6		2.4	3.8		15.9	15.5		15.7	15.6	
Level of Service	A	A		A	A		B	B		B	B	
Approach Delay (s)	3.6		3.7		15.8		15.6					
Approach LOS	A		A		B		B					

Intersection Summary

HCM 2000 Control Delay 4.4
 HCM 2000 Volume to Capacity ratio 0.40
 Actuated Cycle Length (s) 42.8
 Intersection Capacity Utilization 46.9%
 Analysis Period (min) 15
 HCM 2000 Level of Service A
 Sum of lost time (s) 8.0
 ICU Level of Service A

c Critical Lane Group

Queuing and Blocking Report

Existing: AM Peak Hour

Intersection: 1: Nelles Road S/Nelles Road N & Main St E

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	28.3	66.2	25.0	73.2	27.1	40.5	24.2	27.6
Average Queue (m)	8.0	26.4	3.8	31.9	15.4	12.5	11.4	10.2
95th Queue (m)	20.2	49.2	14.7	57.1	26.5	28.3	21.7	20.8
Link Distance (m)		96.3		210.5		108.2		100.5
Upstream Blk Time (%)	0							
Queuing Penalty (veh)	0							
Storage Bay Dist (m)	50.0		55.0		20.0		20.0	
Storage Blk Time (%)	0		0	1	6	1	2	0
Queuing Penalty (veh)	0		0	5	1	1	1	0

Intersection: 2: Wentworth Dr & Main St E

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	33.0	60.6	7.1	51.4	11.0	9.0	17.1	15.8
Average Queue (m)	6.3	21.1	0.3	21.2	3.9	1.5	1.9	6.2
95th Queue (m)	20.2	47.0	2.9	42.9	11.2	6.8	9.4	14.2
Link Distance (m)		210.5		101.4		46.3		
Upstream Blk Time (%)	0							
Queuing Penalty (veh)	0							
Storage Bay Dist (m)	30.0		35.0		15.0		15.0	
Storage Blk Time (%)	0	3		2	0		1	0
Queuing Penalty (veh)	0	1		0	0		0	0

Zone Summary

Zone wide Queuing Penalty: 9

Lanes, Volumes, Timings

Existing: PM Peak Hour

1: Nelles Road S/Nelles Road N & Main St E

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	48	523	69	19	532	83	75	23	22	116	76	58
Future Volume (vph)	48	523	69	19	532	83	75	23	22	116	76	58
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Storage Length (m)	50.0		0.0	55.0		0.0	20.0		0.0	20.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		7.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	1.00	1.00		1.00	1.00		1.00	0.99		0.99	0.99	0.99
Frt	0.982				0.980		0.927				0.935	
Fit Protected	0.950				0.950		0.950				0.950	
Satd. Flow (prot)	1662		1694		0		1662		1694		0	
Fit Permitted	0.328				0.345		0.670				0.728	
Satd. Flow (perm)	572		1694		0		602		1694		0	
Right Turn on Red			Yes				Yes				Yes	
Satd. Flow (RTOR)			16				19				22	
Link Speed (k/h)			50				50				50	
Link Distance (m)			106.6				231.4				118.5	
Travel Time (s)			7.7				16.7				8.5	
Conf. Peds. (#/hr)	6		4		4		6		1		4	
Peak Hour Factor	0.99		0.99		0.99		0.99		0.99		0.99	
Heavy Vehicles (%)	0%		1%		2%		0%		1%		0%	
Adj. Flow (vph)	48		528		70		19		537		84	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	48	598	0	19	621	0	76	45	0	117	136	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)	3.6				3.6				3.6		3.6	
Link Offset(m)	0.0				0.0				0.0		0.0	
Crosswalk Width(m)	4.8				4.8				4.8		4.8	
Two way Left Turn Lane												
Headway Factor	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
Turning Speed (k/h)	25		15		25		15		25		15	
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)	9.4				9.4				9.4		9.4	
Detector 2 Size(m)	0.6				0.6				0.6		0.6	
Detector 2 Type	Cl+Ex				Cl+Ex				Cl+Ex		Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)	0.0				0.0				0.0		0.0	

Lanes, Volumes, Timings

Existing: PM Peak Hour

1: Nelles Road S/Nelles Road N & Main St E

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	2		2		2		4		4		4	
Permitted Phases	2		2		4		4		4		4	
Detector Phase	2	2	2	2	4	4	4	4	4	4	4	4
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Minimum Split (s)	32.7	32.7	32.7	32.7	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2
Total Split (s)	54.0	54.0	54.0	54.0	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2
Total Split (%)	68.2%	68.2%	68.2%	68.2%	31.8%	31.8%	31.8%	31.8%	31.8%	31.8%	31.8%	31.8%
Maximum Green (s)	47.3	47.3	47.3	47.3	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	2.6	2.6	2.6	2.6	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
Lost Time Adjust (s)	-2.7	-2.7	-2.7	-2.7	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Recall Mode	Min	Min	Min	Min	None	None	None	None	None	None	None	None
Walk Time (s)	10.0	10.0	10.0	10.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Flash Dont Walk (s)	16.0	16.0	16.0	16.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Act Effct Green (s)	29.7	29.7	29.7	29.7	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9
Actuated g/C Ratio	0.58	0.58	0.58	0.58	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
v/c Ratio	0.14	0.60	0.05	0.62	0.26	0.11	0.37	0.31	0.37	0.31	0.37	0.31
Control Delay	6.5	9.9	5.5	10.3	19.7	12.2	21.0	13.8	19.7	12.2	21.0	13.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	6.5	9.9	5.5	10.3	19.7	12.2	21.0	13.8	19.7	12.2	21.0	13.8
LOS	A	A	A	B	B	B	C	B	B	B	C	B
Approach Delay	9.6		10.1		16.9		17.2		17.2		17.2	
Approach LOS	A		B		B		B		B		B	

Intersection Summary

Area Type: Other
 Cycle Length: 79.2
 Actuated Cycle Length: 50.9
 Natural Cycle: 60
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.62
 Intersection Signal Delay: 11.5
 Intersection LOS: B
 Intersection Capacity Utilization 68.5%
 ICU Level of Service C
 Analysis Period (min) 15

Splits and Phases: 1: Nelles Road S/Nelles Road N & Main St E



HCM Signalized Intersection Capacity Analysis

Existing: PM Peak Hour

1: Nelles Road S/Nelles Road N & Main St E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔		↔		↔		↔		↔		↔	
Traffic Volume (vph)	48	523	69	19	532	83	75	23	22	116	76	58
Future Volume (vph)	48	523	69	19	532	83	75	23	22	116	76	58
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.0		4.0		4.0		4.0		4.0		4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frbp, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	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	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98	1.00	0.98	1.00	0.93	1.00	0.93	1.00	0.93	1.00	0.93
Fit Protected	0.95	1.00	0.95	1.00	0.95	1.00	0.95	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1659	1696	1660	1694	1612	1563	1638	1621	1638	1621	1638	1621
Fit Permitted	0.33	1.00	0.34	1.00	0.67	1.00	0.73	1.00	0.73	1.00	0.73	1.00
Satd. Flow (perm)	574	1696	602	1694	1137	1563	1255	1621	1255	1621	1255	1621
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	48	528	70	19	537	84	76	23	22	117	77	59
RTOR Reduction (vph)	0	7	0	0	8	0	0	16	0	0	36	0
Lane Group Flow (vph)	48	591	0	19	613	0	76	29	0	117	100	0
Conf. Peds. (#/hr)	6	4	4	4	6	1	4	4	4	4	4	1
Heavy Vehicles (%)	0%	1%	2%	0%	1%	0%	3%	0%	5%	1%	0%	0%
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	2		2		4		4		4		4	
Permitted Phases	2		2		4		4		4		4	
Actuated Green, G (s)	26.9	26.9	26.9	26.9	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6
Effective Green, g (s)	29.6	29.6	29.6	29.6	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8
Actuated g/C Ratio	0.59	0.59	0.59	0.59	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Clearance Time (s)	6.7	6.7	6.7	6.7	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2
Vehicle Extension (s)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Lane Grp Cap (vph)	337	996	353	994	288	396	318	411	318	411	318	411
v/s Ratio Prot	0.35		c0.36		0.02		0.06		0.06		0.06	
v/s Ratio Perm	0.08		0.03		0.07		c0.09		0.07		c0.09	
v/c Ratio	0.14	0.59	0.05	0.62	0.26	0.07	0.37	0.24	0.26	0.07	0.37	0.24
Uniform Delay, d1	4.7	6.6	4.4	6.7	15.0	14.3	15.5	15.0	15.0	14.3	15.5	15.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.8	0.0	1.0	0.4	0.1	0.5	0.2	0.4	0.1	0.5	0.2
Delay (s)	4.8	7.4	4.5	7.7	15.4	14.3	16.0	15.2	15.4	14.3	16.0	15.2
Level of Service	A	A	A	A	B	B	B	B	B	B	B	B
Approach Delay (s)	7.2		7.6		15.0		15.6		15.6		15.6	
Approach LOS	A		A		B		B		B		B	

Intersection Summary

HCM 2000 Control Delay 9.2
 HCM 2000 Volume to Capacity ratio 0.54
 Actuated Cycle Length (s) 50.4
 Sum of lost time (s) 8.0
 Intersection Capacity Utilization 68.5%
 ICU Level of Service C
 Analysis Period (min) 15
 c Critical Lane Group

Lanes, Volumes, Timings
2: Wentworth Dr & Main St E

Existing: PM Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	41	526	99	8	500	8	75	10	21	25	8	50
Future Volume (vph)	41	526	99	8	500	8	75	10	21	25	8	50
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Storage Length (m)	30.0		0.0	35.0		0.0	15.0		0.0	15.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.99	0.99		1.00		1.00	0.99	0.98		0.99	0.97	
Frt	0.976			0.998			0.899			0.871		
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1662	1671	0	1662	1728	0	1662	1540	0	1662	1460	0
Fit Permitted	0.404			0.321			0.716			0.735		
Satd. Flow (perm)	702	1671	0	560	1728	0	1242	1540	0	1272	1460	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		22			2			23				54
Link Speed (k/h)		50			50			50				50
Link Distance (m)		231.4			112.0			56.9				70.1
Travel Time (s)		16.7			8.1			4.1				5.0
Confl. Peds. (#/hr)	13		10	10		13	7		8	8		7
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	0%	2%	0%	0%	1%	0%	0%	0%	0%	0%	0%	2%
Adj. Flow (vph)	44	566	106	9	538	9	81	11	23	27	9	54
Shared Lane Traffic (%)												
Lane Group Flow (vph)	44	672	0	9	547	0	81	34	0	27	63	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6				3.6
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane				Yes								
Headway Factor	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	

Lanes, Volumes, Timings
2: Wentworth Dr & Main St E

Existing: PM Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Detector Phase	2	2		2	2		4	4		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		8.0	8.0		8.0	8.0	
Minimum Split (s)	26.2	26.2		26.2	26.2		26.2	26.2		26.2	26.2	
Total Split (s)	30.0	30.0		30.0	30.0		26.2	26.2		26.2	26.2	
Total Split (%)	53.4%	53.4%		53.4%	53.4%		46.6%	46.6%		46.6%	46.6%	
Maximum Green (s)	23.8	23.8		23.8	23.8		20.0	20.0		20.0	20.0	
Yellow Time (s)	4.1	4.1		4.1	4.1		4.1	4.1		4.1	4.1	
All-Red Time (s)	2.1	2.1		2.1	2.1		2.1	2.1		2.1	2.1	
Lost Time Adjust (s)	-2.2	-2.2		-2.2	-2.2		-2.2	-2.2		-2.2	-2.2	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Walk Time (s)	8.0	8.0		8.0	8.0		8.0	8.0		8.0	8.0	
Flash Dont Walk (s)	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	29.6	29.6		29.6	29.6		11.3	11.3		11.3	11.3	
Actuated g/C Ratio	0.67	0.67		0.67	0.67		0.26	0.26		0.26	0.26	
v/c Ratio	0.09	0.59		0.02	0.47		0.25	0.08		0.08	0.15	
Control Delay	5.4	9.6		4.9	7.4		16.4	8.3		13.8	6.6	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	5.4	9.6		4.9	7.4		16.4	8.3		13.8	6.6	
LOS	A	A		A	A		B	A		B	A	
Approach Delay		9.3			7.4			14.0			8.8	
Approach LOS		A			A			B			A	
Intersection Summary												
Area Type:	Other											
Cycle Length:	56.2											
Actuated Cycle Length:	44											
Natural Cycle:	60											
Control Type:	Semi Act-Uncoord											
Maximum v/c Ratio:	0.59											
Intersection Signal Delay:	8.9						Intersection LOS: A					
Intersection Capacity Utilization	56.1%						ICU Level of Service B					
Analysis Period (min)	15											
Splits and Phases:	2: Wentworth Dr & Main St E											

HCM Signalized Intersection Capacity Analysis
2: Wentworth Dr & Main St E

Existing: PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	41	526	99	8	500	8	75	10	21	25	8	50
Future Volume (vph)	41	526	99	8	500	8	75	10	21	25	8	50
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		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	0.98		1.00	0.98	
Flpb, ped/bikes	0.99	1.00		1.00	1.00		0.99	1.00		0.99	1.00	
Frt	1.00	0.98		1.00	1.00		1.00	0.90		1.00	0.87	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1652	1672		1656	1728		1650	1542		1648	1464	
Flt Permitted	0.40	1.00		0.32	1.00		0.72	1.00		0.73	1.00	
Satd. Flow (perm)	703	1672		560	1728		1244	1542		1275	1464	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	44	566	106	9	538	9	81	11	23	27	9	54
RTOR Reduction (vph)	0	8	0	0	1	0	0	18	0	0	43	0
Lane Group Flow (vph)	44	664	0	9	546	0	81	16	0	27	20	0
Confl. Peds. (#/hr)	13		10	10		13	7		8	8		7
Heavy Vehicles (%)	0%	2%	0%	0%	1%	0%	0%	0%	0%	0%	0%	2%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Actuated Green, G (s)	26.2	26.2		26.2	26.2		6.8	6.8		6.8	6.8	
Effective Green, g (s)	28.4	28.4		28.4	28.4		9.0	9.0		9.0	9.0	
Actuated g/C Ratio	0.63	0.63		0.63	0.63		0.20	0.20		0.20	0.20	
Clearance Time (s)	6.2	6.2		6.2	6.2		6.2	6.2		6.2	6.2	
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	439	1045		350	1080		246	305		252	290	
v/s Ratio Prot		c0.40			0.32			0.01			0.01	
v/s Ratio Perm	0.06			0.02			c0.07			0.02		
v/c Ratio	0.10	0.64		0.03	0.51		0.33	0.05		0.11	0.07	
Uniform Delay, d1	3.4	5.3		3.2	4.7		15.6	14.7		14.9	14.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	1.1		0.0	0.3		0.6	0.1		0.1	0.1	
Delay (s)	3.5	6.4		3.3	4.9		16.2	14.8		15.0	14.9	
Level of Service	A	A		A	A		B	B		B	B	
Approach Delay (s)		6.2			4.9			15.8			14.9	
Approach LOS		A			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	7.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	45.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.1%	ICU Level of Service	B
Analysis Period (min)	15		
c	Critical Lane Group		

Queuing and Blocking Report

Existing: PM Peak Hour

Intersection: 1: Nelles Road S/Nelles Road N & Main St E

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	33.0	80.7	25.3	75.3	24.8	32.0	27.1	49.9
Average Queue (m)	8.8	39.8	4.5	41.4	13.2	7.8	17.3	19.2
95th Queue (m)	21.4	67.7	15.8	69.2	22.6	20.9	27.7	36.7
Link Distance (m)		96.3		210.5		108.2		100.5
Upstream Blk Time (%)	0							
Queuing Penalty (veh)	0							
Storage Bay Dist (m)	50.0		55.0		20.0		20.0	
Storage Blk Time (%)		3		2	4	0	7	6
Queuing Penalty (veh)		1		0	2	0	10	7

Intersection: 2: Wentworth Dr & Main St E

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	32.4	92.0	10.1	61.8	18.3	13.1	15.5	20.1
Average Queue (m)	8.6	42.6	2.0	30.4	9.3	4.8	5.0	8.7
95th Queue (m)	22.0	72.9	8.1	51.9	17.2	12.3	13.4	17.3
Link Distance (m)		210.5		101.4		46.3		
Upstream Blk Time (%)	0							
Queuing Penalty (veh)	0							
Storage Bay Dist (m)	30.0		35.0		15.0		15.0	
Storage Blk Time (%)	0	13		4	4	0	1	2
Queuing Penalty (veh)	0	5		0	1	0	0	0

Zone Summary

Zone wide Queuing Penalty: 28

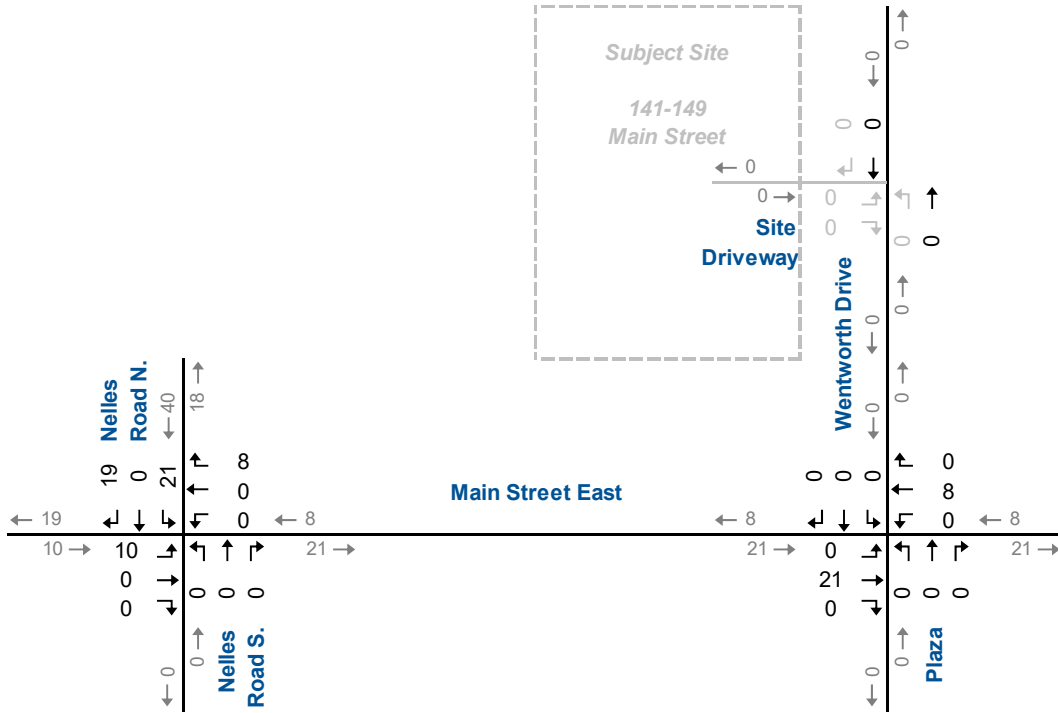
Appendix D

Background Development Traffic Forecasts

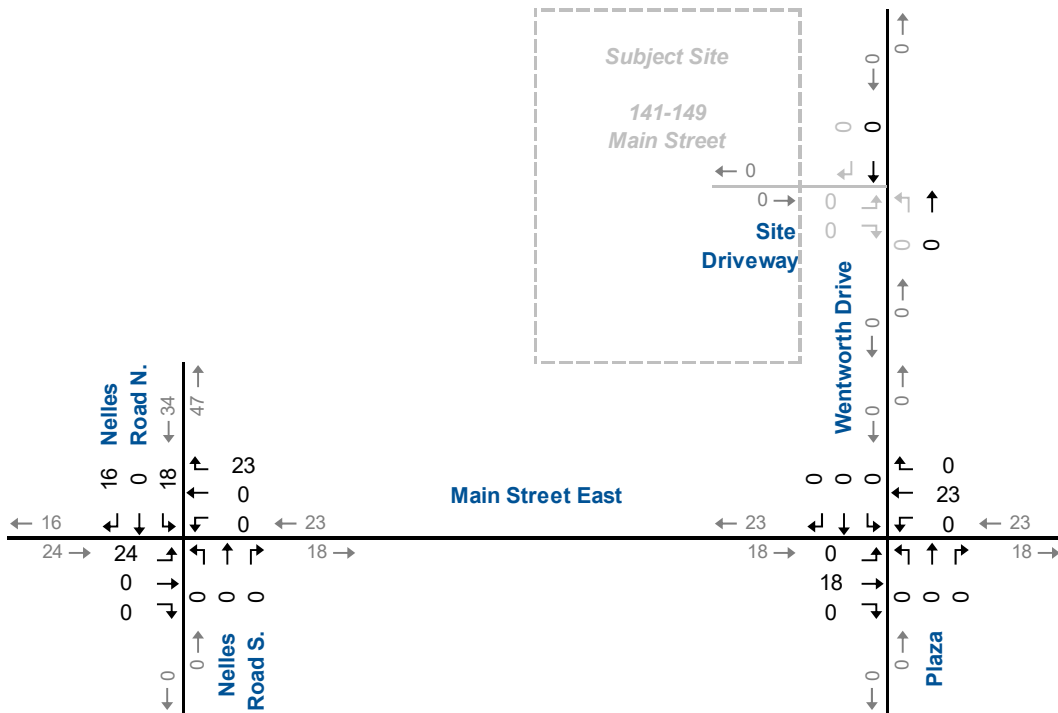




AM Peak Hour



PM Peak Hour



NTS



Forecast Background Development Traffic

Appendix E

Background Traffic Operations Reports



Lanes, Volumes, Timings

Background: AM Peak Hour

1: Nelles Road S/Nelles Road N & Main St E

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	43	397	44	18	491	44	123	51	34	93	23	56
Future Volume (vph)	43	397	44	18	491	44	123	51	34	93	23	56
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Storage Length (m)	50.0		0.0	55.0		0.0	20.0		0.0	20.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	1.00	1.00		0.99	1.00		0.99	1.00		1.00		
Frt		0.985			0.988			0.940			0.894	
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1583	1643	0	1662	1703	0	1599	1629	0	1646	1521	0
Fit Permitted	0.306			0.387			0.695			0.691		
Satd. Flow (perm)	509	1643	0	671	1703	0	1169	1629	0	1193	1521	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		14			11			41				67
Link Speed (k/h)		50			50			50				50
Link Distance (m)		106.6			231.4			118.5				110.9
Travel Time (s)		7.7			16.7			8.5				8.0
Confl. Peds. (#/hr)	3		14	14		3		2	2			
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Heavy Vehicles (%)	5%	5%	0%	0%	1%	5%	4%	0%	0%	1%	5%	2%
Adj. Flow (vph)	52	478	53	22	592	53	148	61	41	112	28	67
Shared Lane Traffic (%)												
Lane Group Flow (vph)	52	531	0	22	645	0	148	102	0	112	95	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6				3.6
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	

Lanes, Volumes, Timings

Background: AM Peak Hour

1: Nelles Road S/Nelles Road N & Main St E

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Detector Phase	2	2		2	2		4	4		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		8.0	8.0		8.0	8.0	
Minimum Split (s)	32.7	32.7		32.7	32.7		25.2	25.2		25.2	25.2	
Total Split (s)	54.0	54.0		54.0	54.0		25.2	25.2		25.2	25.2	
Total Split (%)	68.2%	68.2%		68.2%	68.2%		31.8%	31.8%		31.8%	31.8%	
Maximum Green (s)	47.3	47.3		47.3	47.3		19.0	19.0		19.0	19.0	
Yellow Time (s)	4.1	4.1		4.1	4.1		4.1	4.1		4.1	4.1	
All-Red Time (s)	2.6	2.6		2.6	2.6		2.1	2.1		2.1	2.1	
Lost Time Adjust (s)	-2.7	-2.7		-2.7	-2.7		-2.2	-2.2		-2.2	-2.2	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Walk Time (s)	10.0	10.0		10.0	10.0		8.0	8.0		8.0	8.0	
Flash Dont Walk (s)	16.0	16.0		16.0	16.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	31.1	31.1		31.1	31.1		14.3	14.3		14.3	14.3	
Actuated g/C Ratio	0.58	0.58		0.58	0.58		0.27	0.27		0.27	0.27	
v/c Ratio	0.18	0.56		0.06	0.65		0.48	0.22		0.35	0.21	
Control Delay	7.6	9.8		5.9	11.6		24.7	13.3		21.9	9.7	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	7.6	9.8		5.9	11.6		24.7	13.3		21.9	9.7	
LOS	A	A		A	B		C	B		C	A	
Approach Delay		9.6			11.4			20.0			16.3	
Approach LOS		A			B			C			B	

Intersection Summary

Area Type:	Other
Cycle Length:	79.2
Actuated Cycle Length:	53.9
Natural Cycle:	60
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.65
Intersection Signal Delay:	12.6
Intersection LOS:	B
Intersection Capacity Utilization:	59.6%
ICU Level of Service:	B
Analysis Period (min):	15

Splits and Phases: 1: Nelles Road S/Nelles Road N & Main St E



HCM Signalized Intersection Capacity Analysis
1: Nelles Road S/Nelles Road N & Main St E

Background: AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	↔	↗	↘	↔	↗	↘	↔	↗	↘	↔	↗	↘	
Traffic Volume (vph)	43	397	44	18	491	44	123	51	34	93	23	56	
Future Volume (vph)	43	397	44	18	491	44	123	51	34	93	23	56	
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0		
Lane Util. Factor	1.00	1.00		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	0.99		1.00	1.00		
Ftpb, ped/bikes	1.00	1.00		0.99	1.00		1.00	1.00		1.00	1.00		
Frt	1.00	0.99		1.00	0.99		1.00	0.94		1.00	0.89		
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00		
Satd. Flow (prot)	1582	1644		1652	1703		1599	1629		1642	1521		
Flt Permitted	0.31	1.00		0.39	1.00		0.70	1.00		0.69	1.00		
Satd. Flow (perm)	510	1644		673	1703		1170	1629		1195	1521		
Peak-hour factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	
Adj. Flow (vph)	52	478	53	22	592	53	148	61	41	112	28	67	
RTOR Reduction (vph)	0	6	0	0	5	0	0	30	0	0	49	0	
Lane Group Flow (vph)	52	525	0	22	640	0	148	72	0	112	46	0	
Confl. Peds. (#/hr)	3		14	14		3		2		2			
Heavy Vehicles (%)	5%	5%	0%	0%	1%	5%	4%	0%	0%	1%	5%	2%	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA		
Protected Phases		2			2			4			4		
Permitted Phases	2			2			4			4			
Actuated Green, G (s)	28.3	28.3		28.3	28.3		12.0	12.0		12.0	12.0		
Effective Green, g (s)	31.0	31.0		31.0	31.0		14.2	14.2		14.2	14.2		
Actuated g/C Ratio	0.58	0.58		0.58	0.58		0.27	0.27		0.27	0.27		
Clearance Time (s)	6.7	6.7		6.7	6.7		6.2	6.2		6.2	6.2		
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5		
Lane Grp Cap (vph)	297	957		392	992		312	434		318	405		
v/s Ratio Prot		0.32			c0.38			0.04			0.03		
v/s Ratio Perm	0.10			0.03			c0.13			0.09			
v/c Ratio	0.18	0.55		0.06	0.65		0.47	0.17		0.35	0.11		
Uniform Delay, d1	5.2	6.8		4.8	7.4		16.4	15.0		15.8	14.7		
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00		
Incremental Delay, d2	0.2	0.5		0.0	1.3		0.8	0.1		0.5	0.1		
Delay (s)	5.4	7.3		4.8	8.7		17.2	15.1		16.3	14.8		
Level of Service	A	A		A	A		B	B		B	B		
Approach Delay (s)		7.1			8.6			16.3			15.6		
Approach LOS		A			A			B			B		
Intersection Summary													
HCM 2000 Control Delay	10.1		HCM 2000 Level of Service					B					
HCM 2000 Volume to Capacity ratio	0.59												
Actuated Cycle Length (s)	53.2												
Sum of lost time (s)	8.0												
Intersection Capacity Utilization	59.6%		ICU Level of Service					B					
Analysis Period (min)	15												
c Critical Lane Group													

Lanes, Volumes, Timings
2: Wentworth Dr & Main St E

Background: AM Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↗	↘	↔	↗	↘	↔	↗	↘	↔	↗	↘
Traffic Volume (vph)	38	441	46	2	530	4	20	4	2	8	4	33
Future Volume (vph)	38	441	46	2	530	4	20	4	2	8	4	33
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Storage Length (m)	30.0	0.0	35.0	0.0	15.0	0.0	15.0	0.0	15.0	0.0	15.0	0.0
Storage Lanes	1	0	1	0	1	0	1	0	1	0	1	0
Taper Length (m)	7.5		7.5		7.5		7.5		7.5		7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	1.00	1.00		0.99	1.00		0.99	0.99		0.99	0.98	
Frt	0.986			0.999			0.950			0.865		
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1662	1646	0	1662	1714	0	1662	1646	0	1289	1479	0
Flt Permitted	0.395			0.428			0.730			0.754		
Satd. Flow (perm)	691	1646	0	741	1714	0	1271	1646	0	1013	1479	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		12			1			2			37	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		231.4			112.0			56.9			70.1	
Travel Time (s)		16.7			8.1			4.1			5.0	
Confl. Peds. (#/hr)	1		20	20		1	4		7	7		4
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	0%	4%	8%	0%	2%	0%	0%	0%	0%	29%	0%	0%
Adj. Flow (vph)	42	490	51	2	589	4	22	4	2	9	4	37
Shared Lane Traffic (%)												
Lane Group Flow (vph)	42	541	0	2	593	0	22	6	0	9	41	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane					Yes							
Headway Factor	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	

Lanes, Volumes, Timings
2: Wentworth Dr & Main St E

Background: AM Peak Hour

	↖	→	↗	↖	←	↙	↘	↗	↖	↘	↙	↘	↖	↘
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA		Perm	NA
Protected Phases		2			2			4			4			4
Permitted Phases	2			2			4			4			4	
Detector Phase	2	2		2	2		4	4		4	4		4	4
Switch Phase														
Minimum Initial (s)	10.0	10.0		10.0	10.0		8.0	8.0		8.0	8.0		8.0	8.0
Minimum Split (s)	26.2	26.2		26.2	26.2		26.2	26.2		26.2	26.2		26.2	26.2
Total Split (s)	30.0	30.0		30.0	30.0		26.2	26.2		26.2	26.2		26.2	26.2
Total Split (%)	53.4%	53.4%		53.4%	53.4%		46.6%	46.6%		46.6%	46.6%		46.6%	46.6%
Maximum Green (s)	23.8	23.8		23.8	23.8		20.0	20.0		20.0	20.0		20.0	20.0
Yellow Time (s)	4.1	4.1		4.1	4.1		4.1	4.1		4.1	4.1		4.1	4.1
All-Red Time (s)	2.1	2.1		2.1	2.1		2.1	2.1		2.1	2.1		2.1	2.1
Lost Time Adjust (s)	-2.2	-2.2		-2.2	-2.2		-2.2	-2.2		-2.2	-2.2		-2.2	-2.2
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0
Lead/Lag														
Lead-Lag Optimize?														
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5
Recall Mode	Min	Min		Min	Min		None	None		None	None		None	None
Walk Time (s)	8.0	8.0		8.0	8.0		8.0	8.0		8.0	8.0		8.0	8.0
Flash Dont Walk (s)	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0		0	0
Act Effct Green (s)	31.8	31.8		31.8	31.8		10.7	10.7		10.7	10.7		10.7	10.7
Actuated g/C Ratio	0.77	0.77		0.77	0.77		0.26	0.26		0.26	0.26		0.26	0.26
v/c Ratio	0.08	0.43		0.00	0.45		0.07	0.01		0.03	0.10		0.03	0.10
Control Delay	4.3	5.6		4.0	5.8		14.9	12.4		14.4	7.3		14.4	7.3
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0
Total Delay	4.3	5.6		4.0	5.8		14.9	12.4		14.4	7.3		14.4	7.3
LOS	A	A		A	A		B	B		B	A		B	A
Approach Delay		5.5			5.8			14.4			8.6			8.6
Approach LOS		A			A			B			A			A

Intersection Summary

Area Type:	Other
Cycle Length:	56.2
Actuated Cycle Length:	41.3
Natural Cycle:	60
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.45
Intersection Signal Delay:	6.0
Intersection LOS:	A
Intersection Capacity Utilization:	50.7%
ICU Level of Service:	A
Analysis Period (min):	15

Splits and Phases: 2: Wentworth Dr & Main St E



HCM Signalized Intersection Capacity Analysis
2: Wentworth Dr & Main St E

Background: AM Peak Hour

	↖	→	↗	↖	←	↙	↘	↗	↖	↘	↙	↘	↖	↘
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT
Lane Configurations	↖	↗	↘	↖	↗	↘	↖	↗	↘	↖	↗	↘	↖	↗
Traffic Volume (vph)	38	441	46	2	530	4	20	4	2	8	4	33	38	441
Future Volume (vph)	38	441	46	2	530	4	20	4	2	8	4	33	38	441
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00
Frbp, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99		1.00	0.99		1.00	0.98
Flpb, ped/bikes	1.00	1.00		0.99	1.00		1.00	1.00		1.00	1.00		0.99	1.00
Frt	1.00	0.99		1.00	1.00		1.00	0.95		1.00	0.86		1.00	0.86
Fit Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00
Satd. Flow (prot)	1662	1646		1646	1714		1656	1647		1279	1480		1279	1480
Fit Permitted	0.39	1.00		0.43	1.00		0.73	1.00		0.75	1.00		0.75	1.00
Satd. Flow (perm)	691	1646		742	1714		1273	1647		1015	1480		1015	1480
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	42	490	51	2	589	4	22	4	2	9	4	37	42	490
RTOR Reduction (vph)	0	4	0	0	0	0	0	2	0	0	32	0	0	4
Lane Group Flow (vph)	42	537	0	2	593	0	22	4	0	9	9	0	42	537
Conf. Peds. (#/hr)	1		20	20		1	4		7	7		4	1	
Heavy Vehicles (%)	0%	4%	8%	0%	2%	0%	0%	0%	0%	29%	0%	0%	0%	4%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA		Perm	NA
Protected Phases		2			2			4			4			4
Permitted Phases	2			2			4			4			4	
Actuated Green, G (s)	27.4	27.4		27.4	27.4		4.2	4.2		4.2	4.2		4.2	4.2
Effective Green, g (s)	29.6	29.6		29.6	29.6		6.4	6.4		6.4	6.4		6.4	6.4
Actuated g/C Ratio	0.67	0.67		0.67	0.67		0.15	0.15		0.15	0.15		0.15	0.15
Clearance Time (s)	6.2	6.2		6.2	6.2		6.2	6.2		6.2	6.2		6.2	6.2
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5
Lane Grp Cap (vph)	464	1107		499	1153		185	239		147	215		464	1107
v/s Ratio Prot		0.33			c0.35			0.00			0.01			0.01
v/s Ratio Perm	0.06			0.00			c0.02			0.01			0.06	
v/c Ratio	0.09	0.49		0.00	0.51		0.12	0.02		0.06	0.04		0.09	0.44
Uniform Delay, d1	2.5	3.5		2.4	3.6		16.3	16.1		16.2	16.2		2.5	3.5
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	0.1	0.2		0.0	0.3		0.2	0.0		0.1	0.1		0.1	0.1
Delay (s)	2.6	3.7		2.4	3.9		16.6	16.1		16.3	16.2		2.6	3.7
Level of Service	A	A		A	A		B	B		B	B		A	A
Approach Delay (s)		3.7			3.9			16.5			16.2			3.7
Approach LOS		A			A			B			B			A

Intersection Summary

HCM 2000 Control Delay	4.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	44.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	50.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Queuing and Blocking Report

Background: AM Peak Hour

Intersection: 1: Nelles Road S/Nelles Road N & Main St E

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	29.7	64.1	15.6	68.9	26.7	48.1	24.1	29.6
Average Queue (m)	9.0	29.6	3.2	34.2	16.0	13.5	13.7	10.8
95th Queue (m)	20.7	51.3	10.9	59.3	26.5	32.8	22.6	21.9
Link Distance (m)	96.3		210.5		108.2		100.5	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)	50.0	55.0		20.0		20.0		
Storage Blk Time (%)	1		1		7	2	3	1
Queuing Penalty (veh)	0		0		6	2	2	1

Intersection: 2: Wentworth Dr & Main St E

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	25.6	67.6	5.4	71.5	13.0	8.9	15.5	23.1
Average Queue (m)	6.0	22.8	0.4	25.1	3.5	1.6	2.1	7.3
95th Queue (m)	16.6	49.3	3.3	52.9	11.0	7.1	9.7	17.3
Link Distance (m)	210.5		101.4		46.3			
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)	30.0	35.0		15.0		15.0		
Storage Blk Time (%)	4		2		0	1	1	
Queuing Penalty (veh)	1		0		0	0	0	0


Zone Summary

Zone wide Queuing Penalty: 13

Lanes, Volumes, Timings

Background: PM Peak Hour

1: Nelles Road S/Nelles Road N & Main St E



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	53	577	76	21	587	92	83	25	24	128	84	64
Future Volume (vph)	53	577	76	21	587	92	83	25	24	128	84	64
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Storage Length (m)	50.0	0.0	55.0	0.0	20.0	0.0	20.0	0.0	20.0	0.0	20.0	0.0
Storage Lanes	1	0	1	0	1	0	1	0	1	0	1	0
Taper Length (m)	7.5		7.5		7.5		7.5		7.5		7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99	0.99	0.99	0.99	0.99
Frt	0.982				0.980		0.927				0.935	
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1662	1694	0	1662	1694	0	1614	1562	0	1646	1621	0
Fit Permitted	0.292			0.309			0.662			0.725		
Satd. Flow (perm)	510	1694	0	540	1694	0	1123	1562	0	1246	1621	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			16			19			24			47
Link Speed (k/h)			50			50			50			50
Link Distance (m)			106.6			231.4			118.5			110.9
Travel Time (s)			7.7			16.7			8.5			8.0
Conf. Peds. (#/hr)	6			4			4			6		
Peak Hour Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Heavy Vehicles (%)	0%	1%	2%	0%	1%	0%	3%	0%	5%	1%	0%	0%
Adj. Flow (vph)	54	583	77	21	593	93	84	25	24	129	85	65
Shared Lane Traffic (%)												
Lane Group Flow (vph)	54	660	0	21	686	0	84	49	0	129	150	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)			3.6			3.6			3.6			3.6
Link Offset(m)			0.0			0.0			0.0			0.0
Crosswalk Width(m)			4.8			4.8			4.8			4.8
Two way Left Turn Lane												
Headway Factor	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
Turning Speed (k/h)	25			15	25			15	25			15
Number of Detectors	1	2			1	2			1	2		
Detector Template	Left	Thru			Left	Thru			Left	Thru		
Leading Detector (m)	2.0	10.0			2.0	10.0			2.0	10.0		
Trailing Detector (m)	0.0	0.0			0.0	0.0			0.0	0.0		
Detector 1 Position(m)	0.0	0.0			0.0	0.0			0.0	0.0		
Detector 1 Size(m)	2.0	0.6			2.0	0.6			2.0	0.6		
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex	Cl+Ex			Cl+Ex	Cl+Ex		
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0	0.0			0.0	0.0		
Detector 1 Queue (s)	0.0	0.0			0.0	0.0			0.0	0.0		
Detector 1 Delay (s)	0.0	0.0			0.0	0.0			0.0	0.0		
Detector 2 Position(m)			9.4			9.4			9.4			9.4
Detector 2 Size(m)			0.6			0.6			0.6			0.6
Detector 2 Type			Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)			0.0			0.0			0.0			0.0

Lanes, Volumes, Timings

Background: PM Peak Hour

1: Nelles Road S/Nelles Road N & Main St E

	←		→		←		→		←		→	
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	2		2		2		2		2		2	
Permitted Phases	2		2		4		4		4		4	
Detector Phase	2	2	2	2	4	4	4	4	4	4	4	4
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Minimum Split (s)	32.7	32.7	32.7	32.7	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2
Total Split (s)	54.0	54.0	54.0	54.0	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2
Total Split (%)	68.2%	68.2%	68.2%	68.2%	31.8%	31.8%	31.8%	31.8%	31.8%	31.8%	31.8%	31.8%
Maximum Green (s)	47.3	47.3	47.3	47.3	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	2.6	2.6	2.6	2.6	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
Lost Time Adjust (s)	-2.7	-2.7	-2.7	-2.7	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Recall Mode	Min	Min	Min	Min	None	None	None	None	None	None	None	None
Walk Time (s)	10.0	10.0	10.0	10.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Flash Dont Walk (s)	16.0	16.0	16.0	16.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Act Effct Green (s)	33.7	33.7	33.7	33.7	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8
Actuated g/C Ratio	0.60	0.60	0.60	0.60	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
v/c Ratio	0.18	0.64	0.06	0.67	0.30	0.12	0.42	0.34	0.42	0.34	0.42	0.34
Control Delay	7.1	10.8	5.8	11.3	22.5	13.3	24.3	16.1	24.3	16.1	24.3	16.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.1	10.8	5.8	11.3	22.5	13.3	24.3	16.1	24.3	16.1	24.3	16.1
LOS	A	B	A	B	C	B	C	B	C	B	C	B
Approach Delay	10.5		11.2		19.1		19.9		19.1		19.9	
Approach LOS	B		B		B		B		B		B	

Intersection Summary

Area Type:	Other
Cycle Length:	79.2
Actuated Cycle Length:	55.9
Natural Cycle:	60
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.67
Intersection Signal Delay:	12.8
Intersection LOS:	B
Intersection Capacity Utilization:	73.8%
ICU Level of Service:	D
Analysis Period (min):	15

Splits and Phases: 1: Nelles Road S/Nelles Road N & Main St E



HCM Signalized Intersection Capacity Analysis

Background: PM Peak Hour

1: Nelles Road S/Nelles Road N & Main St E

	←		→		←		→		←		→	
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔		↔	↔		↔	↔	↔
Traffic Volume (vph)	53	577	76	21	587	92	83	25	24	128	84	64
Future Volume (vph)	53	577	76	21	587	92	83	25	24	128	84	64
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frbp, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	0.99	1.00	0.99
Ftbp, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00
Frt	1.00	0.98	1.00	0.98	1.00	0.93	1.00	0.93	1.00	0.94	1.00	0.94
Fit Protected	0.95	1.00	0.95	1.00	0.95	1.00	0.95	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1659	1696	1660	1694	1612	1563	1637	1621	1637	1621	1637	1621
Fit Permitted	0.29	1.00	0.31	1.00	0.66	1.00	0.73	1.00	0.73	1.00	0.73	1.00
Satd. Flow (perm)	509	1696	539	1694	1123	1563	1249	1621	1249	1621	1249	1621
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	54	583	77	21	593	93	84	25	24	129	85	65
RTOR Reduction (vph)	0	6	0	0	7	0	0	18	0	0	35	0
Lane Group Flow (vph)	54	654	0	21	679	0	84	31	0	129	115	0
Conf. Peds. (#/hr)	6		4	4		6	1		4	4		1
Heavy Vehicles (%)	0%	1%	2%	0%	1%	0%	3%	0%	5%	1%	0%	0%
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	2		2		4		4		4		4	
Permitted Phases	2		2		4		4		4		4	
Actuated Green, G (s)	30.9	30.9	30.9	30.9	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5
Effective Green, g (s)	33.6	33.6	33.6	33.6	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7
Actuated g/C Ratio	0.61	0.61	0.61	0.61	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Clearance Time (s)	6.7	6.7	6.7	6.7	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2
Vehicle Extension (s)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Lane Grp Cap (vph)	309	1030	327	1029	278	387	309	401	309	401	309	401
v/s Ratio Prot	0.39		c0.40		0.02		0.07		c0.10		0.07	
v/s Ratio Perm	0.11		0.04		0.07		0.30		0.08		0.42	
v/c Ratio	0.17	0.63	0.06	0.66	0.30	0.08	0.42	0.29	0.42	0.29	0.42	0.29
Uniform Delay, d1	4.8	6.9	4.4	7.1	16.9	16.0	17.5	16.8	16.9	16.0	17.5	16.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	1.1	0.1	1.4	0.4	0.1	0.7	0.3	0.4	0.1	0.7	0.3
Delay (s)	5.0	8.1	4.5	8.5	17.4	16.0	18.1	17.1	17.4	16.0	18.1	17.1
Level of Service	A	A	A	A	B	B	B	B	B	B	B	B
Approach Delay (s)	7.8		8.4		16.9		17.6		7.8		17.6	
Approach LOS	A		A		B		B		A		B	

Intersection Summary

HCM 2000 Control Delay	10.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	55.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	73.8%	ICU Level of Service	D
Analysis Period (min)	15		
c	Critical Lane Group		

Lanes, Volumes, Timings
2: Wentworth Dr & Main St E

Background: PM Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	45	581	109	9	552	9	83	11	23	28	9	55
Future Volume (vph)	45	581	109	9	552	9	83	11	23	28	9	55
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Storage Length (m)	30.0	0.0	35.0	0.0	15.0	0.0	15.0	0.0	15.0	0.0	15.0	0.0
Storage Lanes	1	0	1	0	1	0	1	0	1	0	1	0
Taper Length (m)	7.5		7.5		7.5		7.5		7.5		7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.99	0.99	1.00	1.00	0.99	0.98	0.99	0.98	0.99	0.97		
Frt	0.976			0.998			0.899			0.872		
Fit Protected	0.950		0.950		0.950		0.950		0.950			
Satd. Flow (prot)	1662	1671	0	1662	1728	0	1662	1540	0	1662	1462	0
Fit Permitted	0.366		0.277		0.712		0.733		0.733			
Satd. Flow (perm)	637	1671	0	483	1728	0	1235	1540	0	1269	1462	0
Right Turn on Red		Yes		Yes		Yes		Yes		Yes		Yes
Satd. Flow (RTOR)	22			2			25			59		
Link Speed (k/h)	50			50			50			50		
Link Distance (m)	231.4			112.0			56.9			70.1		
Travel Time (s)	16.7			8.1			4.1			5.0		
Confl. Peds. (#/hr)	13	10	10	13	7	8	8	8	8	7		
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	0%	2%	0%	0%	1%	0%	0%	0%	0%	0%	0%	2%
Adj. Flow (vph)	48	625	117	10	594	10	89	12	25	30	10	59
Shared Lane Traffic (%)												
Lane Group Flow (vph)	48	742	0	10	604	0	89	37	0	30	69	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)	3.6			3.6			3.6			3.6		
Link Offset(m)	0.0			0.0			0.0			0.0		
Crosswalk Width(m)	4.8			4.8			4.8			4.8		
Two way Left Turn Lane				Yes								
Headway Factor	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)	9.4			9.4			9.4			9.4		
Detector 2 Size(m)	0.6			0.6			0.6			0.6		
Detector 2 Type	Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex		
Detector 2 Channel												
Detector 2 Extend (s)	0.0			0.0			0.0			0.0		

Lanes, Volumes, Timings
2: Wentworth Dr & Main St E

Background: PM Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4		4		4
Permitted Phases	2			2			4			4		
Detector Phase	2	2		2	2		4	4		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		8.0	8.0		8.0	8.0	
Minimum Split (s)	26.2	26.2		26.2	26.2		26.2	26.2		26.2	26.2	
Total Split (s)	30.0	30.0		30.0	30.0		26.2	26.2		26.2	26.2	
Total Split (%)	53.4%	53.4%		53.4%	53.4%		46.6%	46.6%		46.6%	46.6%	
Maximum Green (s)	23.8	23.8		23.8	23.8		20.0	20.0		20.0	20.0	
Yellow Time (s)	4.1	4.1		4.1	4.1		4.1	4.1		4.1	4.1	
All-Red Time (s)	2.1	2.1		2.1	2.1		2.1	2.1		2.1	2.1	
Lost Time Adjust (s)	-2.2	-2.2		-2.2	-2.2		-2.2	-2.2		-2.2	-2.2	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Walk Time (s)	8.0	8.0		8.0	8.0		8.0	8.0		8.0	8.0	
Flash Dont Walk (s)	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	30.4	30.4		30.4	30.4		11.3	11.3		11.3	11.3	
Actuated g/C Ratio	0.67	0.67		0.67	0.67		0.25	0.25		0.25	0.25	
v/c Ratio	0.11	0.66		0.03	0.52		0.29	0.09		0.09	0.17	
Control Delay	5.8	11.9		5.1	8.3		16.9	8.2		13.9	6.5	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	5.8	11.9		5.1	8.3		16.9	8.2		13.9	6.5	
LOS	A	B		A	A		B	A		B	A	
Approach Delay		11.5			8.2			14.4			8.8	
Approach LOS		B			A			B			A	
Intersection Summary												
Area Type:	Other											
Cycle Length:	56.2											
Actuated Cycle Length:	45.4											
Natural Cycle:	60											
Control Type:	Semi Act-Uncoord											
Maximum v/c Ratio:	0.66											
Intersection Signal Delay:	10.3						Intersection LOS: B					
Intersection Capacity Utilization	60.1%						ICU Level of Service B					
Analysis Period (min)	15											
Splits and Phases: 2: Wentworth Dr & Main St E												

HCM Signalized Intersection Capacity Analysis
2: Wentworth Dr & Main St E

Background: PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	45	581	109	9	552	9	83	11	23	28	9	55
Future Volume (vph)	45	581	109	9	552	9	83	11	23	28	9	55
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		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	0.98		1.00	0.98	
Flpb, ped/bikes	0.99	1.00		1.00	1.00		0.99	1.00		0.99	1.00	
Frt	1.00	0.98		1.00	1.00		1.00	0.90		1.00	0.87	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1653	1672		1657	1728		1650	1542		1648	1464	
Flt Permitted	0.37	1.00		0.28	1.00		0.71	1.00		0.73	1.00	
Satd. Flow (perm)	637	1672		484	1728		1237	1542		1271	1464	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	48	625	117	10	594	10	89	12	25	30	10	59
RTOR Reduction (vph)	0	8	0	0	1	0	0	20	0	0	47	0
Lane Group Flow (vph)	48	734	0	10	603	0	89	17	0	30	22	0
Confl. Peds. (#/hr)	13		10	10		13	7		8	8		7
Heavy Vehicles (%)	0%	2%	0%	0%	1%	0%	0%	0%	0%	0%	0%	2%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Actuated Green, G (s)	27.2	27.2		27.2	27.2		7.1	7.1		7.1	7.1	
Effective Green, g (s)	29.4	29.4		29.4	29.4		9.3	9.3		9.3	9.3	
Actuated g/C Ratio	0.63	0.63		0.63	0.63		0.20	0.20		0.20	0.20	
Clearance Time (s)	6.2	6.2		6.2	6.2		6.2	6.2		6.2	6.2	
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	401	1052		304	1087		246	307		253	291	
v/s Ratio Prot		c0.44			0.35			0.01			0.01	
v/s Ratio Perm	0.08			0.02			c0.07			0.02		
v/c Ratio	0.12	0.70		0.03	0.55		0.36	0.06		0.12	0.07	
Uniform Delay, d1	3.5	5.7		3.3	4.9		16.1	15.1		15.3	15.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	1.9		0.0	0.5		0.7	0.1		0.2	0.1	
Delay (s)	3.6	7.6		3.3	5.4		16.8	15.2		15.5	15.3	
Level of Service	A	A		A	A		B	B		B	B	
Approach Delay (s)		7.3			5.4			16.3			15.3	
Approach LOS		A			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	7.8	HCM 2000 Level of Service	
HCM 2000 Volume to Capacity ratio	0.62	A	
Actuated Cycle Length (s)	46.7	Sum of lost time (s)	
Intersection Capacity Utilization	60.1%	8.0	
Analysis Period (min)	15	ICU Level of Service	
		B	
c Critical Lane Group			

Queuing and Blocking Report

Background: PM Peak Hour

Intersection: 1: Nelles Road S/Nelles Road N & Main St E

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	51.3	98.5	23.5	88.5	26.6	38.2	27.3	49.4
Average Queue (m)	13.9	46.6	5.0	47.2	13.8	9.4	19.9	22.9
95th Queue (m)	35.6	83.2	16.0	79.1	25.8	24.1	30.2	42.3
Link Distance (m)		96.3		210.5		108.2		100.5
Upstream Blk Time (%)	1							
Queuing Penalty (veh)	0							
Storage Bay Dist (m)	50.0		55.0		20.0		20.0	
Storage Blk Time (%)		4		4	6	1	11	10
Queuing Penalty (veh)		2		1	3	1	17	12

Intersection: 2: Wentworth Dr & Main St E

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	37.3	150.4	10.2	77.2	20.2	17.3	16.2	23.2
Average Queue (m)	13.8	63.0	2.0	37.1	10.8	6.1	5.5	8.7
95th Queue (m)	34.0	116.2	8.1	63.3	19.0	14.9	13.8	18.3
Link Distance (m)		210.5		101.4		46.3		
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)	30.0		35.0		15.0		15.0	
Storage Blk Time (%)	0	22		6	6	1	1	1
Queuing Penalty (veh)	0	10		1	2	1	1	0

Zone Summary

Zone wide Queuing Penalty: 51

Appendix F

Total Traffic Operations Reports



Lanes, Volumes, Timings

Total: AM Peak Hour

1: Nelles Road S/Nelles Road N & Main St E

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	53	412	44	18	522	52	123	51	34	114	23	75
Future Volume (vph)	53	412	44	18	522	52	123	51	34	114	23	75
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Storage Length (m)	50.0		0.0	55.0		0.0	20.0		0.0	20.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	1.00	1.00		0.99	1.00		0.99	1.00		1.00		
Frt	0.986			0.986			0.940			0.886		
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1583	1644	0	1662	1698	0	1599	1629	0	1646	1510	0
Fit Permitted	0.275			0.374			0.681			0.691		
Satd. Flow (perm)	458	1644	0	649	1698	0	1146	1629	0	1193	1510	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		13			12			41				90
Link Speed (k/h)		50			50			50				50
Link Distance (m)		106.6			231.4			118.5				110.9
Travel Time (s)		7.7			16.7			8.5				8.0
Confl. Peds. (#/hr)	3		14	14		3		2	2			
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Heavy Vehicles (%)	5%	5%	0%	0%	1%	5%	4%	0%	0%	1%	5%	2%
Adj. Flow (vph)	64	496	53	22	629	63	148	61	41	137	28	90
Shared Lane Traffic (%)												
Lane Group Flow (vph)	64	549	0	22	692	0	148	102	0	137	118	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6				3.6
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	

Lanes, Volumes, Timings

Total: AM Peak Hour

1: Nelles Road S/Nelles Road N & Main St E

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Detector Phase	2	2		2	2		4	4		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		8.0	8.0		8.0	8.0	
Minimum Split (s)	32.7	32.7		32.7	32.7		25.2	25.2		25.2	25.2	
Total Split (s)	54.0	54.0		54.0	54.0		25.2	25.2		25.2	25.2	
Total Split (%)	68.2%	68.2%		68.2%	68.2%		31.8%	31.8%		31.8%	31.8%	
Maximum Green (s)	47.3	47.3		47.3	47.3		19.0	19.0		19.0	19.0	
Yellow Time (s)	4.1	4.1		4.1	4.1		4.1	4.1		4.1	4.1	
All-Red Time (s)	2.6	2.6		2.6	2.6		2.1	2.1		2.1	2.1	
Lost Time Adjust (s)	-2.7	-2.7		-2.7	-2.7		-2.2	-2.2		-2.2	-2.2	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Walk Time (s)	10.0	10.0		10.0	10.0		8.0	8.0		8.0	8.0	
Flash Dont Walk (s)	16.0	16.0		16.0	16.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	32.3	32.3		32.3	32.3		14.7	14.7		14.7	14.7	
Actuated g/C Ratio	0.58	0.58		0.58	0.58		0.26	0.26		0.26	0.26	
v/c Ratio	0.24	0.57		0.06	0.70		0.49	0.22		0.43	0.25	
Control Delay	8.7	10.0		5.9	12.6		26.4	14.1		24.8	9.4	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	8.7	10.0		5.9	12.6		26.4	14.1		24.8	9.4	
LOS	A	A		A	B		C	B		C	A	
Approach Delay		9.8			12.4			21.4			17.7	
Approach LOS		A			B			C			B	
Intersection Summary												
Area Type:	Other											
Cycle Length:	79.2											
Actuated Cycle Length:	55.5											
Natural Cycle:	60											
Control Type:	Actuated-Uncoordinated											
Maximum v/c Ratio:	0.70											
Intersection Signal Delay:	13.5						Intersection LOS: B					
Intersection Capacity Utilization:	65.8%						ICU Level of Service C					
Analysis Period (min):	15											
Splits and Phases:	1: Nelles Road S/Nelles Road N & Main St E											

HCM Signalized Intersection Capacity Analysis
 1: Nelles Road S/Nelles Road N & Main St E

Total: AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	53	412	44	18	522	52	123	51	34	114	23	75
Future Volume (vph)	53	412	44	18	522	52	123	51	34	114	23	75
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		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	0.99		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		0.99	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.99		1.00	0.94		1.00	0.89	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1582	1645		1652	1699		1599	1629		1642	1509	
Flt Permitted	0.28	1.00		0.37	1.00		0.68	1.00		0.69	1.00	
Satd. Flow (perm)	458	1645		651	1699		1146	1629		1194	1509	
Peak-hour factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Adj. Flow (vph)	64	496	53	22	629	63	148	61	41	137	28	90
RTOR Reduction (vph)	0	5	0	0	5	0	0	30	0	0	66	0
Lane Group Flow (vph)	64	544	0	22	687	0	148	72	0	137	52	0
Confl. Peds. (#/hr)	3		14	14		3		2		2		
Heavy Vehicles (%)	5%	5%	0%	0%	1%	5%	4%	0%	0%	1%	5%	2%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Actuated Green, G (s)	29.4	29.4		29.4	29.4		12.4	12.4		12.4	12.4	
Effective Green, g (s)	32.1	32.1		32.1	32.1		14.6	14.6		14.6	14.6	
Actuated g/C Ratio	0.59	0.59		0.59	0.59		0.27	0.27		0.27	0.27	
Clearance Time (s)	6.7	6.7		6.7	6.7		6.2	6.2		6.2	6.2	
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	268	965		382	997		305	434		318	402	
v/s Ratio Prot		0.33			c0.40			0.04			0.03	
v/s Ratio Perm	0.14			0.03			c0.13			0.11		
v/c Ratio	0.24	0.56		0.06	0.69		0.49	0.17		0.43	0.13	
Uniform Delay, d1	5.4	7.0		4.8	7.8		16.9	15.4		16.6	15.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	0.6		0.0	1.8		0.9	0.1		0.7	0.1	
Delay (s)	5.8	7.6		4.9	9.7		17.8	15.5		17.3	15.3	
Level of Service	A	A		A	A		B	B		B	B	
Approach Delay (s)		7.4			9.5			16.8			16.4	
Approach LOS		A			A			B			B	
Intersection Summary												
HCM 2000 Control Delay		10.8					HCM 2000 Level of Service				B	
HCM 2000 Volume to Capacity ratio		0.62										
Actuated Cycle Length (s)		54.7					Sum of lost time (s)				8.0	
Intersection Capacity Utilization		65.8%					ICU Level of Service				C	
Analysis Period (min)		15										
c Critical Lane Group												

Lanes, Volumes, Timings
 2: Wentworth Dr & Main St E

Total: AM Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	53	462	46	2	538	8	20	4	2	31	4	64
Future Volume (vph)	53	462	46	2	538	8	20	4	2	31	4	64
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Storage Length (m)	30.0		0.0	35.0		0.0	15.0		0.0	15.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	1.00	1.00		0.99	1.00		0.99	0.99		0.99	0.98	
Frt		0.986			0.998			0.950			0.858	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1662	1646	0	1662	1712	0	1662	1646	0	1289	1465	0
Flt Permitted	0.380			0.408			0.708			0.754		
Satd. Flow (perm)	665	1646	0	707	1712	0	1233	1646	0	1013	1465	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		12			2			2			71	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		231.4			112.0			56.9			70.1	
Travel Time (s)		16.7			8.1			4.1			5.0	
Confl. Peds. (#/hr)	1		20	20		1	4		7	7		4
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	0%	4%	8%	0%	2%	0%	0%	0%	0%	29%	0%	0%
Adj. Flow (vph)	59	513	51	2	598	9	22	4	2	34	4	71
Shared Lane Traffic (%)												
Lane Group Flow (vph)	59	564	0	2	607	0	22	6	0	34	75	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)												
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	

Lanes, Volumes, Timings
2: Wentworth Dr & Main St E

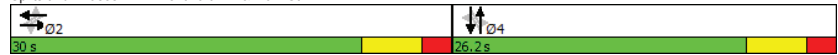
Total: AM Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA	Perm	NA	Perm	NA	
Protected Phases	2		2		2		4		4		4		
Permitted Phases	2		2		4		4		4		4		
Detector Phase	2	2	2	2	4	4	4	4	4	4	4	4	
Switch Phase													
Minimum Initial (s)	10.0	10.0	10.0	10.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	
Minimum Split (s)	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	
Total Split (s)	30.0	30.0	30.0	30.0	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	
Total Split (%)	53.4%	53.4%	53.4%	53.4%	46.6%	46.6%	46.6%	46.6%	46.6%	46.6%	46.6%	46.6%	
Maximum Green (s)	23.8	23.8	23.8	23.8	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	
All-Red Time (s)	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	
Lost Time Adjust (s)	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lead/Lag													
Lead-Lag Optimize?													
Vehicle Extension (s)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	
Recall Mode	Min	Min	Min	Min	None	None	None	None	None	None	None	None	
Walk Time (s)	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	
Flash Dont Walk (s)	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0	
Act Effct Green (s)	29.0	29.0	29.0	29.0	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	
Actuated g/C Ratio	0.75	0.75	0.75	0.75	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	
v/c Ratio	0.12	0.46	0.00	0.47	0.07	0.01	0.12	0.17	0.12	0.17	0.12	0.17	
Control Delay	4.9	6.3	4.0	6.5	13.8	11.8	14.6	6.0	13.8	11.8	14.6	6.0	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	4.9	6.3	4.0	6.5	13.8	11.8	14.6	6.0	13.8	11.8	14.6	6.0	
LOS	A	A	A	A	B	B	B	A	B	B	B	A	
Approach Delay	6.2		6.5		13.4				8.7				
Approach LOS	A		A		B				A				

Intersection Summary

Area Type: Other
 Cycle Length: 56.2
 Actuated Cycle Length: 38.9
 Natural Cycle: 60
 Control Type: Semi Act-Uncoord
 Maximum v/c Ratio: 0.47
 Intersection Signal Delay: 6.7
 Intersection LOS: A
 Intersection Capacity Utilization 59.3%
 ICU Level of Service B
 Analysis Period (min) 15

Splits and Phases: 2: Wentworth Dr & Main St E



HCM Signalized Intersection Capacity Analysis
2: Wentworth Dr & Main St E

Total: AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	
Traffic Volume (vph)	53	462	46	2	538	8	20	4	2	31	4	64	
Future Volume (vph)	53	462	46	2	538	8	20	4	2	31	4	64	
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frbp, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	0.98	1.00	0.98	
Ftbp, ped/bikes	1.00	1.00	0.99	1.00	1.00	1.00	1.00	1.00	0.99	1.00	0.99	1.00	
Frt	1.00	0.99	1.00	1.00	1.00	1.00	1.00	0.95	1.00	0.86	1.00	0.86	
Fit Protected	0.95	1.00	0.95	1.00	0.95	1.00	0.95	1.00	0.95	1.00	0.95	1.00	
Satd. Flow (prot)	1662	1648	1648	1712	1656	1647	1279	1467	1279	1467	1279	1467	
Fit Permitted	0.38	1.00	0.41	1.00	0.71	1.00	0.75	1.00	0.75	1.00	0.75	1.00	
Satd. Flow (perm)	664	1648	708	1712	1235	1647	1015	1467	1015	1467	1015	1467	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	
Adj. Flow (vph)	59	513	51	2	598	9	22	4	2	34	4	71	
RTOR Reduction (vph)	0	4	0	0	1	0	0	2	0	0	60	0	
Lane Group Flow (vph)	59	560	0	2	606	0	22	4	0	34	15	0	
Confl. Peds. (#/hr)	1	20	20	1	4	7	7	7	7	7	7	4	
Heavy Vehicles (%)	0%	4%	8%	0%	2%	0%	0%	0%	0%	29%	0%	0%	
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA	Perm	NA	Perm	NA	
Protected Phases	2		2		4		4		4		4		
Permitted Phases	2		2		4		4		4		4		
Actuated Green, G (s)	24.8	24.8	24.8	24.8	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	
Effective Green, g (s)	27.0	27.0	27.0	27.0	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	
Actuated g/C Ratio	0.65	0.65	0.65	0.65	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	
Clearance Time (s)	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	
Vehicle Extension (s)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	
Lane Grp Cap (vph)	430	1069	459	1111	195	261	161	232	161	232	161	232	
v/s Ratio Prot	0.34		c0.35		0.00		0.01		0.01		0.01		
v/s Ratio Perm	0.09		0.00		0.02		c0.03		0.02		c0.03		
v/c Ratio	0.14	0.52	0.00	0.55	0.11	0.02	0.21	0.07	0.11	0.02	0.21	0.07	
Uniform Delay, d1	2.8	3.9	2.6	4.0	15.0	14.8	15.2	14.9	15.0	14.8	15.2	14.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	0.4	0.0	0.4	0.2	0.0	0.5	0.1	0.2	0.0	0.5	0.1	
Delay (s)	2.9	4.2	2.6	4.4	15.2	14.8	15.7	15.0	15.2	14.8	15.7	15.0	
Level of Service	A	A	A	A	B	B	B	B	B	B	B	B	
Approach Delay (s)	4.1		4.4		15.1				15.2				
Approach LOS	A		A		B				B				

Intersection Summary

HCM 2000 Control Delay 5.3
 HCM 2000 Volume to Capacity ratio 0.48
 Actuated Cycle Length (s) 41.6
 Intersection Capacity Utilization 59.3%
 Analysis Period (min) 15
 HCM 2000 Level of Service A
 Sum of lost time (s) 8.0
 ICU Level of Service B
 Critical Lane Group

Lanes, Volumes, Timings
3: Wentworth Dr & Site Driveway

Total: AM Peak Hour

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	54	19	46	45	0
Future Volume (vph)	0	54	19	46	45	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.865					
Fit Protected				0.985		
Satd. Flow (prot)	1611	0	0	1835	1863	0
Fit Permitted				0.985		
Satd. Flow (perm)	1611	0	0	1835	1863	0
Link Speed (k/h)	50			50	50	
Link Distance (m)	39.1			70.1	91.6	
Travel Time (s)	2.8			5.0	6.6	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	59	21	50	49	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	59	0	0	71	49	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.6			3.6	3.6	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25	15	25			15
Sign Control	Stop			Free	Free	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	20.1%
Analysis Period (min)	15
	ICU Level of Service A

HCM Unsignalized Intersection Capacity Analysis
3: Wentworth Dr & Site Driveway

Total: AM Peak Hour

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	54	19	46	45	0
Future Volume (Veh/h)	0	54	19	46	45	0
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	59	21	50	49	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)				70		
pX, platoon unblocked						
vC, conflicting volume	141	49	49			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	141	49	49			
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	94	99			
cM capacity (veh/h)	840	1020	1558			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	59	71	49
Volume Left	0	21	0
Volume Right	59	0	0
cSH	1020	1558	1700
Volume to Capacity	0.06	0.01	0.03
Queue Length 95th (m)	1.5	0.3	0.0
Control Delay (s)	8.7	2.2	0.0
Lane LOS	A	A	
Approach Delay (s)	8.7	2.2	0.0
Approach LOS	A		

Intersection Summary

Average Delay		3.8	
Intersection Capacity Utilization	20.1%	ICU Level of Service	A
Analysis Period (min)	15		

Queuing and Blocking Report

Total: AM Peak Hour

Intersection: 1: Nelles Road S/Nelles Road N & Main St E

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	32.6	77.8	30.9	78.2	27.0	46.4	27.0	43.2
Average Queue (m)	9.8	31.9	5.3	37.7	17.2	14.2	16.0	14.4
95th Queue (m)	21.7	58.8	20.4	66.3	27.7	31.3	26.6	31.6
Link Distance (m)	96.3		210.5		108.2		100.5	
Upstream Blk Time (%)	0							
Queuing Penalty (veh)	0							
Storage Bay Dist (m)	50.0		55.0		20.0		20.0	
Storage Blk Time (%)	1		2		8		2	
Queuing Penalty (veh)	1		0		7		2	

Intersection: 2: Wentworth Dr & Main St E

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	31.1	66.8	13.4	72.3	12.8	11.7	21.9	25.2
Average Queue (m)	10.1	29.5	0.5	30.9	5.0	1.7	7.0	9.6
95th Queue (m)	24.2	57.0	6.5	56.5	12.6	8.0	18.5	19.4
Link Distance (m)	210.5		101.4		46.3		52.8	
Upstream Blk Time (%)	0							
Queuing Penalty (veh)	0							
Storage Bay Dist (m)	30.0		35.0		15.0		15.0	
Storage Blk Time (%)	5		4		1		0	
Queuing Penalty (veh)	3		0		0		2	

Intersection: 3: Wentworth Dr & Site Driveway

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (m)	14.0	6.3
Average Queue (m)	7.6	0.2
95th Queue (m)	14.1	3.4
Link Distance (m)	27.5	52.8
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	0	
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		


Network Summary

Network wide Queuing Penalty: 24

Lanes, Volumes, Timings

Total: PM Peak Hour

1: Nelles Road S/Nelles Road N & Main St E



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	77	590	76	21	596	115	83	25	24	146	84	80
Future Volume (vph)	77	590	76	21	596	115	83	25	24	146	84	80
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Storage Length (m)	50.0	0.0	55.0	0.0	20.0	0.0	20.0	0.0	20.0	0.0	20.0	0.0
Storage Lanes	1	0	1	0	1	0	1	0	1	0	1	0
Taper Length (m)	7.5		7.5		7.5		7.5		7.5		7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	1.00	1.00		1.00	1.00		1.00	0.99		0.99	0.99	0.99
Fr	0.983				0.976		0.927				0.927	
Fit Protected	0.950				0.950		0.950				0.950	
Satd. Flow (prot)	1662		1696		0		1662		1686		0	
Fit Permitted	0.267				0.296		0.641				0.725	
Satd. Flow (perm)	466		1696		0		517		1686		0	
Right Turn on Red			Yes				Yes				Yes	
Satd. Flow (RTOR)			16				24				59	
Link Speed (k/h)	50				50				50			
Link Distance (m)	106.6				231.4				118.5		110.9	
Travel Time (s)	7.7				16.7				8.5		8.0	
Conf. Peds. (#/hr)	6		4		4		6		1		4	
Peak Hour Factor	0.99		0.99		0.99		0.99		0.99		0.99	
Heavy Vehicles (%)	0%		1%		2%		0%		1%		0%	
Adj. Flow (vph)	78		596		77		21		602		116	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	78		673		0		21		718		0	
Enter Blocked Intersection	No		No		No		No		No		No	
Lane Alignment	Left		Left		Right		Left		Left		Right	
Median Width(m)	3.6				3.6				3.6		3.6	
Link Offset(m)	0.0				0.0				0.0		0.0	
Crosswalk Width(m)	4.8				4.8				4.8		4.8	
Two way Left Turn Lane												
Headway Factor	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)	9.4				9.4				9.4		9.4	
Detector 2 Size(m)	0.6				0.6				0.6		0.6	
Detector 2 Type	Cl+Ex				Cl+Ex				Cl+Ex		Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)	0.0				0.0				0.0		0.0	

Lanes, Volumes, Timings

Total: PM Peak Hour

1: Nelles Road S/Nelles Road N & Main St E

	↖		→		↗		↖		←		↗		↖		↑		↗		↖		↓		↖	
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA		Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2						4												4				
Permitted Phases	2			2			4			4			2			2			4			4		
Detector Phase	2	2		2	2		4	4		4	4		2	2		2	2		4	4		4	4	
Switch Phase																								
Minimum Initial (s)	10.0	10.0		10.0	10.0		8.0	8.0		8.0	8.0		10.0	10.0		10.0	10.0		8.0	8.0		8.0	8.0	
Minimum Split (s)	32.7	32.7		32.7	32.7		25.2	25.2		25.2	25.2		32.7	32.7		32.7	32.7		25.2	25.2		25.2	25.2	
Total Split (s)	54.0	54.0		54.0	54.0		25.2	25.2		25.2	25.2		54.0	54.0		54.0	54.0		25.2	25.2		25.2	25.2	
Total Split (%)	68.2%	68.2%		68.2%	68.2%		31.8%	31.8%		31.8%	31.8%		68.2%	68.2%		68.2%	68.2%		31.8%	31.8%		31.8%	31.8%	
Maximum Green (s)	47.3	47.3		47.3	47.3		19.0	19.0		19.0	19.0		47.3	47.3		47.3	47.3		19.0	19.0		19.0	19.0	
Yellow Time (s)	4.1	4.1		4.1	4.1		4.1	4.1		4.1	4.1		4.1	4.1		4.1	4.1		4.1	4.1		4.1	4.1	
All-Red Time (s)	2.6	2.6		2.6	2.6		2.1	2.1		2.1	2.1		2.6	2.6		2.6	2.6		2.1	2.1		2.1	2.1	
Lost Time Adjust (s)	-2.7	-2.7		-2.7	-2.7		-2.2	-2.2		-2.2	-2.2		-2.7	-2.7		-2.7	-2.7		-2.2	-2.2		-2.2	-2.2	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag																								
Lead-Lag Optimize?																								
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	
Recall Mode	Min	Min		Min	Min		None	None		None	None		Min	Min		Min	Min		None	None		None	None	
Walk Time (s)	10.0	10.0		10.0	10.0		8.0	8.0		8.0	8.0		10.0	10.0		10.0	10.0		8.0	8.0		8.0	8.0	
Flash Dont Walk (s)	16.0	16.0		16.0	16.0		11.0	11.0		11.0	11.0		16.0	16.0		16.0	16.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0	
Act Effct Green (s)	33.9	33.9		33.9	33.9		14.5	14.5		14.5	14.5		33.9	33.9		33.9	33.9		14.5	14.5		14.5	14.5	
Actuated g/C Ratio	0.60	0.60		0.60	0.60		0.26	0.26		0.26	0.26		0.60	0.60		0.60	0.60		0.26	0.26		0.26	0.26	
v/c Ratio	0.28	0.66		0.07	0.71		0.30	0.12		0.46	0.37		0.28	0.66		0.07	0.71		0.30	0.12		0.46	0.37	
Control Delay	9.1	11.4		6.0	12.6		23.2	13.6		25.8	16.1		9.1	11.4		6.0	12.6		23.2	13.6		25.8	16.1	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	9.1	11.4		6.0	12.6		23.2	13.6		25.8	16.1		9.1	11.4		6.0	12.6		23.2	13.6		25.8	16.1	
LOS	A	B		A	B		C	B		C	B		A	B		A	B		C	B		C	B	
Approach Delay		11.2			12.4			19.7			20.6													
Approach LOS		B			B			B			C													

Intersection Summary

Area Type: Other
 Cycle Length: 79.2
 Actuated Cycle Length: 56.8
 Natural Cycle: 60
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.71
 Intersection Signal Delay: 13.8
 Intersection LOS: B
 Intersection Capacity Utilization 80.4%
 ICU Level of Service D
 Analysis Period (min) 15

Splits and Phases: 1: Nelles Road S/Nelles Road N & Main St E



HCM Signalized Intersection Capacity Analysis

Total: PM Peak Hour

1: Nelles Road S/Nelles Road N & Main St E

	↖		→		↗		↖		←		↗		↖		↑		↗		↖		↓		↖	
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↖		↖	↖		↖	↖		↖	↖		↖	↖		↖	↖		↖	↖		↖	↖	
Traffic Volume (vph)	77	590	76	21	596	115	83	25	24	146	84	80	77	590	76	21	596	115	83	25	24	146	84	80
Future Volume (vph)	77	590	76	21	596	115	83	25	24	146	84	80	77	590	76	21	596	115	83	25	24	146	84	80
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frbp, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Ftbp, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.98		1.00	0.93		1.00	0.93		1.00	0.98		1.00	0.98		1.00	0.93		1.00	0.93	
Fit Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1659	1696		1660	1686		1612	1563		1637	1605		1659	1696		1660	1686		1612	1563		1637	1605	
Fit Permitted	0.27	1.00		0.30	1.00		0.64	1.00		0.73	1.00		0.27	1.00		0.30	1.00		0.64	1.00		0.73	1.00	
Satd. Flow (perm)	466	1696		518	1686		1087	1563		1249	1605		466	1696		518	1686		1087	1563		1249	1605	
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	78	596	77	21	602	116	84	25	24	147	85	81	78	596	77	21	602	116	84	25	24	147	85	81
RTOR Reduction (vph)	0	6	0	0	10	0	0	18	0	0	44	0	0	6	0	0	10	0	0	18	0	0	44	0
Lane Group Flow (vph)	78	667	0	21	708	0	84	31	0	147	122	0	78	667	0	21	708	0	84	31	0	147	122	0
Conf. Peds. (#/hr)	6		4	4		6	1		4	4		1	6		4	4		6	1		4	4		1
Heavy Vehicles (%)	0%	1%	2%	0%	1%	0%	3%	0%	5%	1%	0%	0%	0%	1%	2%	0%	1%	0%	3%	0%	5%	1%	0%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA		Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2						4												4				
Permitted Phases	2			2			4			4			2			2			4			4		
Actuated Green, G (s)	31.1	31.1		31.1	31.1		12.1	12.1		12.1	12.1		31.1	31.1		31.1	31.1		12.1	12.1		12.1	12.1	
Effective Green, g (s)	33.8	33.8		33.8	33.8		14.3	14.3		14.3	14.3		33.8	33.8		33.8	33.8		14.3	14.3		14.3	14.3	
Actuated g/C Ratio	0.60	0.60		0.60	0.60		0.25	0.25		0.25	0.25		0.60	0.60		0.60	0.60		0.25	0.25		0.25	0.25	
Clearance Time (s)	6.7	6.7		6.7	6.7		6.2	6.2		6.2	6.2													

Lanes, Volumes, Timings
2: Wentworth Dr & Main St E

Total: PM Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	58	599	109	9	575	53	83	11	23	55	9	64
Future Volume (vph)	58	599	109	9	575	53	83	11	23	55	9	64
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Storage Length (m)	30.0		0.0	35.0		0.0	15.0		0.0	15.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	1.00	0.99		1.00	1.00		0.99	0.98		0.99	0.97	
Frt		0.977			0.987			0.899				0.869
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1662	1673	0	1662	1706	0	1662	1540	0	1662	1456	0
Flt Permitted	0.317			0.262			0.706			0.733		
Satd. Flow (perm)	552	1673	0	457	1706	0	1225	1540	0	1269	1456	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		22			11			25			69	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		231.4			112.0			56.9			70.1	
Travel Time (s)		16.7			8.1			4.1			5.0	
Confl. Peds. (#/hr)	13		10	10		13	7		8	8		7
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	0%	2%	0%	0%	1%	0%	0%	0%	0%	0%	0%	2%
Adj. Flow (vph)	62	644	117	10	618	57	89	12	25	59	10	69
Shared Lane Traffic (%)												
Lane Group Flow (vph)	62	761	0	10	675	0	89	37	0	59	79	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane					Yes							
Headway Factor	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	

Lanes, Volumes, Timings
2: Wentworth Dr & Main St E

Total: PM Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Detector Phase	2	2		2	2		4	4		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		8.0	8.0		8.0	8.0	
Minimum Split (s)	26.2	26.2		26.2	26.2		26.2	26.2		26.2	26.2	
Total Split (s)	30.0	30.0		30.0	30.0		26.2	26.2		26.2	26.2	
Total Split (%)	53.4%	53.4%		53.4%	53.4%		46.6%	46.6%		46.6%	46.6%	
Maximum Green (s)	23.8	23.8		23.8	23.8		20.0	20.0		20.0	20.0	
Yellow Time (s)	4.1	4.1		4.1	4.1		4.1	4.1		4.1	4.1	
All-Red Time (s)	2.1	2.1		2.1	2.1		2.1	2.1		2.1	2.1	
Lost Time Adjust (s)	-2.2	-2.2		-2.2	-2.2		-2.2	-2.2		-2.2	-2.2	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Walk Time (s)	8.0	8.0		8.0	8.0		8.0	8.0		8.0	8.0	
Flash Dont Walk (s)	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	29.7	29.7		29.7	29.7		11.3	11.3		11.3	11.3	
Actuated g/C Ratio	0.66	0.66		0.66	0.66		0.25	0.25		0.25	0.25	
v/c Ratio	0.17	0.68		0.03	0.60		0.29	0.09		0.19	0.19	
Control Delay	6.7	12.7		5.2	9.8		16.7	8.3		15.0	6.4	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	6.7	12.7		5.2	9.8		16.7	8.3		15.0	6.4	
LOS	A	B		A	A		B	A		B	A	
Approach Delay		12.2			9.8			14.2			10.0	
Approach LOS		B			A			B			B	
Intersection Summary												
Area Type:	Other											
Cycle Length:	56.2											
Actuated Cycle Length:	44.9											
Natural Cycle:	65											
Control Type:	Semi Act-Uncoord											
Maximum v/c Ratio:	0.68											
Intersection Signal Delay:	11.2						Intersection LOS: B					
Intersection Capacity Utilization	71.8%						ICU Level of Service C					
Analysis Period (min)	15											
Splits and Phases: 2: Wentworth Dr & Main St E												

HCM Signalized Intersection Capacity Analysis
2: Wentworth Dr & Main St E

Total: PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔		↔	↔		↔	↔	
Traffic Volume (vph)	58	599	109	9	575	53	83	11	23	55	9	64
Future Volume (vph)	58	599	109	9	575	53	83	11	23	55	9	64
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		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	0.98		1.00	0.98	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.99	1.00		0.99	1.00	
Frt	1.00	0.98		1.00	0.99		1.00	0.90		1.00	0.87	
Fit Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1654	1673		1657	1707		1650	1542		1648	1458	
Fit Permitted	0.32	1.00		0.26	1.00		0.71	1.00		0.73	1.00	
Satd. Flow (perm)	552	1673		458	1707		1226	1542		1271	1458	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	62	644	117	10	618	57	89	12	25	59	10	69
RTOR Reduction (vph)	0	8	0	0	4	0	0	20	0	0	55	0
Lane Group Flow (vph)	62	753	0	10	671	0	89	17	0	59	24	0
Confl. Peds. (#/hr)	13		10	10		13	7		8	8		7
Heavy Vehicles (%)	0%	2%	0%	0%	1%	0%	0%	0%	0%	0%	0%	2%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Actuated Green, G (s)	26.6	26.6		26.6	26.6		7.2	7.2		7.2	7.2	
Effective Green, g (s)	28.8	28.8		28.8	28.8		9.4	9.4		9.4	9.4	
Actuated g/C Ratio	0.62	0.62		0.62	0.62		0.20	0.20		0.20	0.20	
Clearance Time (s)	6.2	6.2		6.2	6.2		6.2	6.2		6.2	6.2	
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	344	1042		285	1064		249	313		258	296	
v/s Ratio Prot		c0.45			0.39			0.01			0.02	
v/s Ratio Perm	0.11			0.02			c0.07			0.05		
v/c Ratio	0.18	0.72		0.04	0.63		0.36	0.05		0.23	0.08	
Uniform Delay, d1	3.7	6.0		3.3	5.4		15.8	14.8		15.4	14.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	2.3		0.0	1.1		0.6	0.1		0.3	0.1	
Delay (s)	3.9	8.3		3.4	6.5		16.4	14.9		15.7	15.0	
Level of Service	A	A		A	A		B	B		B	B	
Approach Delay (s)		8.0			6.4			16.0			15.3	
Approach LOS		A			A			B			B	
Intersection Summary												
HCM 2000 Control Delay		8.5			HCM 2000 Level of Service			A				
HCM 2000 Volume to Capacity ratio		0.63										
Actuated Cycle Length (s)		46.2			Sum of lost time (s)		8.0					
Intersection Capacity Utilization		71.8%			ICU Level of Service		C					
Analysis Period (min)		15										
c	Critical Lane Group											

Lanes, Volumes, Timings
3: Wentworth Dr & Site Driveway

Total: PM Peak Hour

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔			↔	↔	
Traffic Volume (vph)	0	36	57	65	92	0
Future Volume (vph)	0	36	57	65	92	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.865					
Fit Protected				0.977		
Satd. Flow (prot)	1611	0	0	1820	1863	0
Fit Permitted				0.977		
Satd. Flow (perm)	1611	0	0	1820	1863	0
Link Speed (k/h)	50			50	50	
Link Distance (m)	39.1			70.1	91.6	
Travel Time (s)	2.8			5.0	6.6	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	39	62	71	100	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	39	0	0	133	100	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.6			3.6	3.6	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25	15	25			15
Sign Control	Stop			Free	Free	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	23.2%			ICU Level of Service A		
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis
3: Wentworth Dr & Site Driveway

Total: PM Peak Hour

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔			↑	↑	
Traffic Volume (veh/h)	0	36	57	65	92	0
Future Volume (Veh/h)	0	36	57	65	92	0
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	39	62	71	100	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None	None		
Median storage (veh)						
Upstream signal (m)	70					
pX, platoon unblocked						
vC, conflicting volume	295	100	100			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	295	100	100			
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	96	96			
cM capacity (veh/h)	667	956	1493			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	39	133	100			
Volume Left	0	62	0			
Volume Right	39	0	0			
cSH	956	1493	1700			
Volume to Capacity	0.04	0.04	0.06			
Queue Length 95th (m)	1.0	1.0	0.0			
Control Delay (s)	8.9	3.7	0.0			
Lane LOS	A	A				
Approach Delay (s)	8.9	3.7	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			3.1			
Intersection Capacity Utilization			23.2%	ICU Level of Service	A	
Analysis Period (min)			15			

Queuing and Blocking Report

Total: PM Peak Hour

Intersection: 1: Nelles Road S/Nelles Road N & Main St E

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	49.2	88.0	27.4	90.3	25.2	27.5	27.3	66.0
Average Queue (m)	16.7	45.4	5.2	50.6	13.2	8.9	21.2	28.9
95th Queue (m)	37.2	77.7	17.4	80.8	24.4	20.2	31.4	54.7
Link Distance (m)	96.3		210.5		108.2		100.5	
Upstream Blk Time (%)	1							
Queuing Penalty (veh)	0							
Storage Bay Dist (m)	50.0	55.0		20.0		20.0		
Storage Blk Time (%)	4		5		6		1	
Queuing Penalty (veh)	3		1		3		1	

Intersection: 2: Wentworth Dr & Main St E

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	37.4	166.3	30.1	94.5	21.4	29.4	17.8	18.1
Average Queue (m)	15.7	70.7	3.3	43.8	11.0	6.9	8.8	8.7
95th Queue (m)	36.3	133.3	15.6	79.3	19.8	18.3	17.1	16.6
Link Distance (m)	210.5		101.4		46.3		52.8	
Upstream Blk Time (%)	0							
Queuing Penalty (veh)	0							
Storage Bay Dist (m)	30.0	35.0		15.0		15.0		
Storage Blk Time (%)	0	26	11		7	1	3	2
Queuing Penalty (veh)	1	15	1		2	1	2	1

Intersection: 3: Wentworth Dr & Site Driveway

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (m)	15.8	9.2
Average Queue (m)	6.3	1.5
95th Queue (m)	13.7	7.0
Link Distance (m)	27.5	52.8
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	0	
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

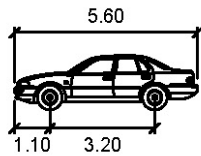
Network Summary

Network wide Queuing Penalty: 71

Appendix G

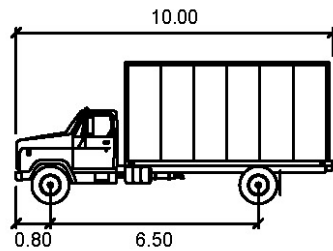
AutoTURN Analysis





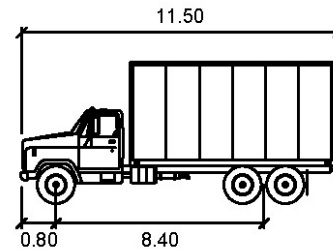
P

	meters
Width	: 2.00
Track	: 2.00
Lock to Lock Time	: 6.0
Steering Angle	: 35.9



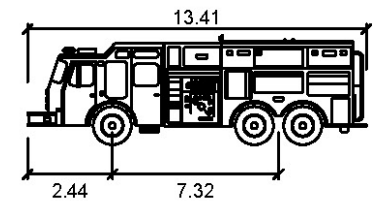
MSU

	meters
Width	: 2.60
Track	: 2.60
Lock to Lock Time	: 6.0
Steering Angle	: 40.2



HSU

	meters
Width	: 2.60
Track	: 2.60
Lock to Lock Time	: 6.0
Steering Angle	: 40.0

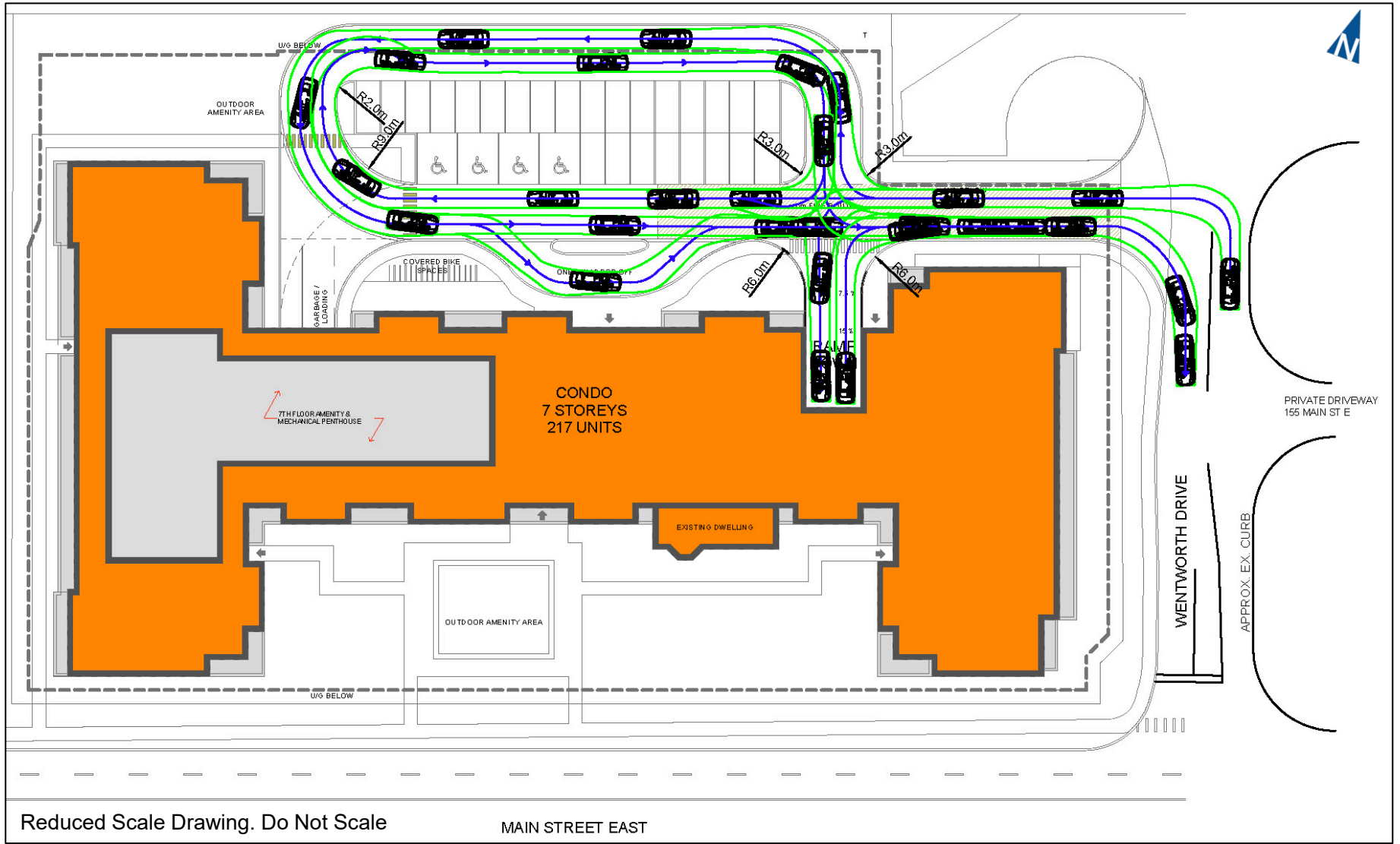


Pumper Fire Truck

	meters
Width	: 2.59
Track	: 2.59
Lock to Lock Time	: 6.0
Steering Angle	: 37.8

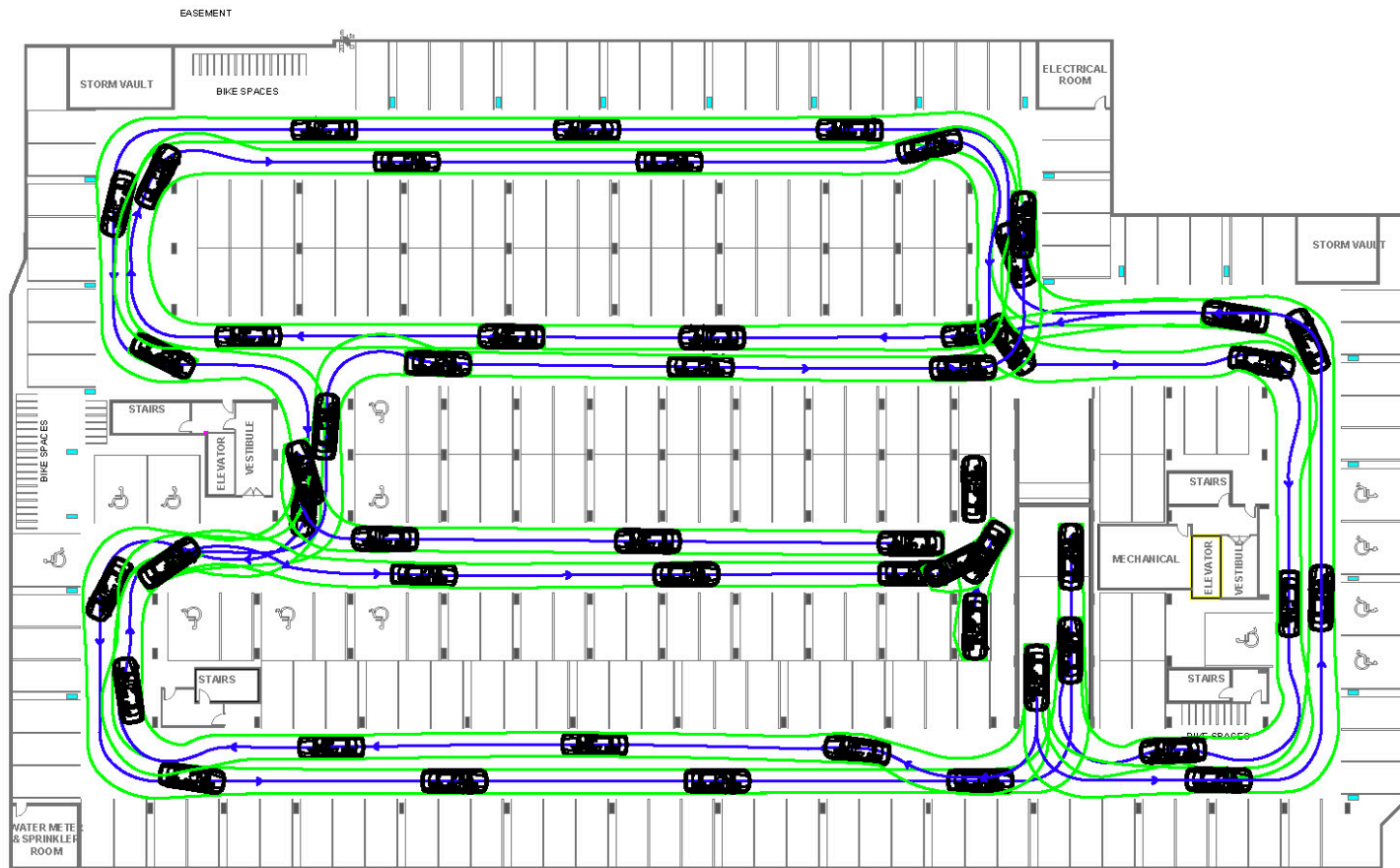
Reduced Scale Drawing. Do Not Scale





TAC Passenger Car At Grade Circulation

Appendix G – Figure 2

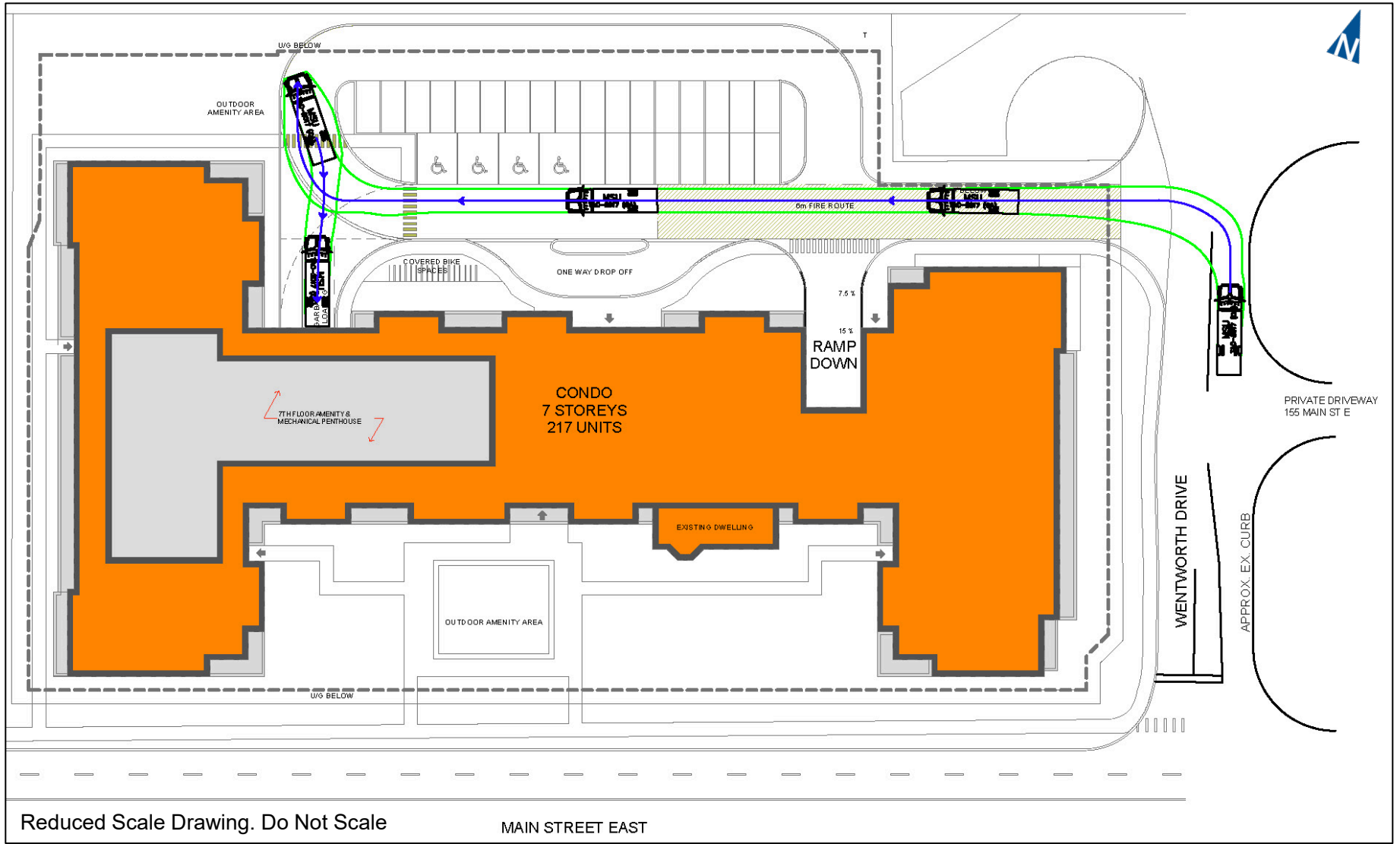


Reduced Scale Drawing. Do Not Scale



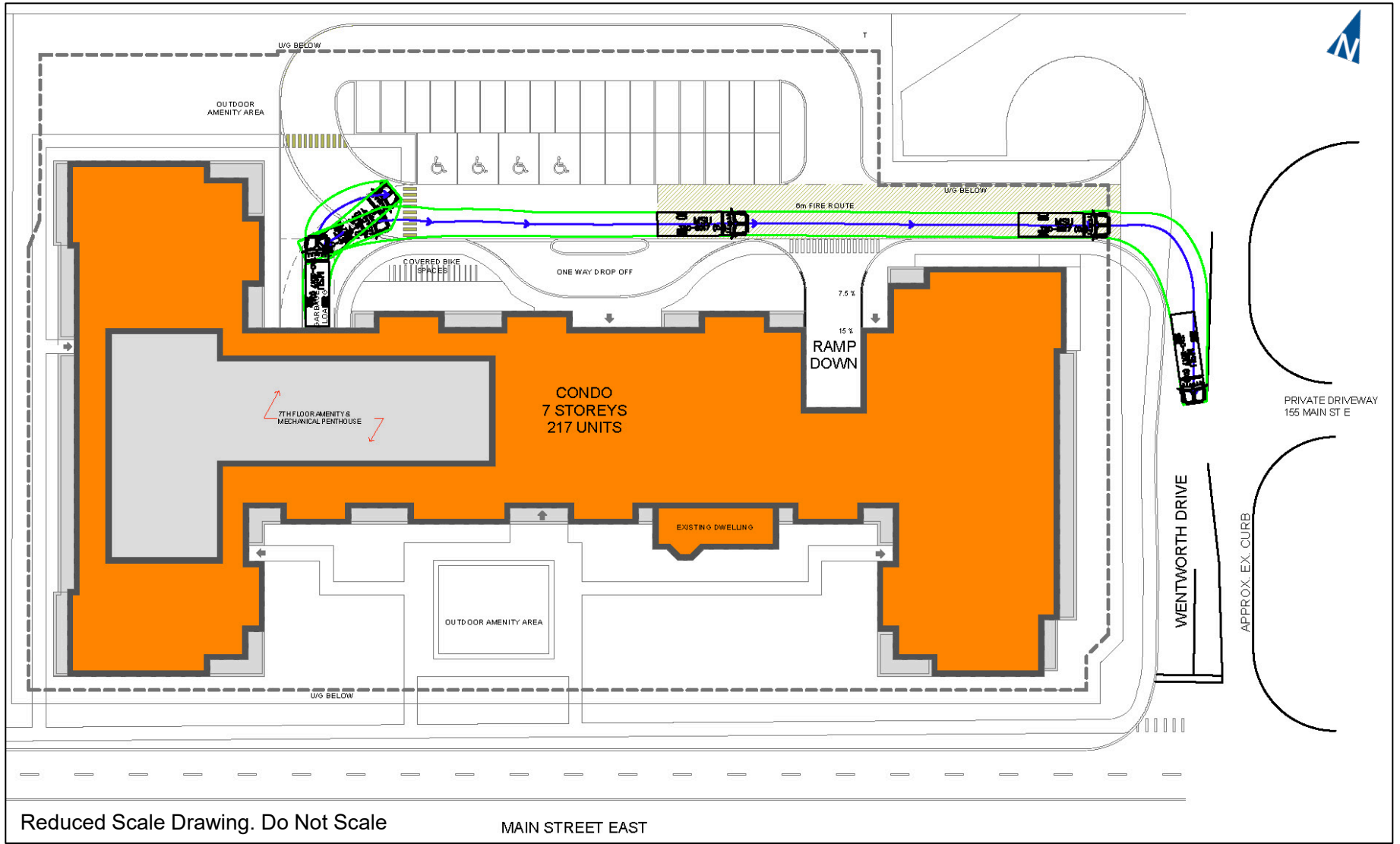
TAC Passenger Car Parking Structure Circulation

Appendix G – Figure 3



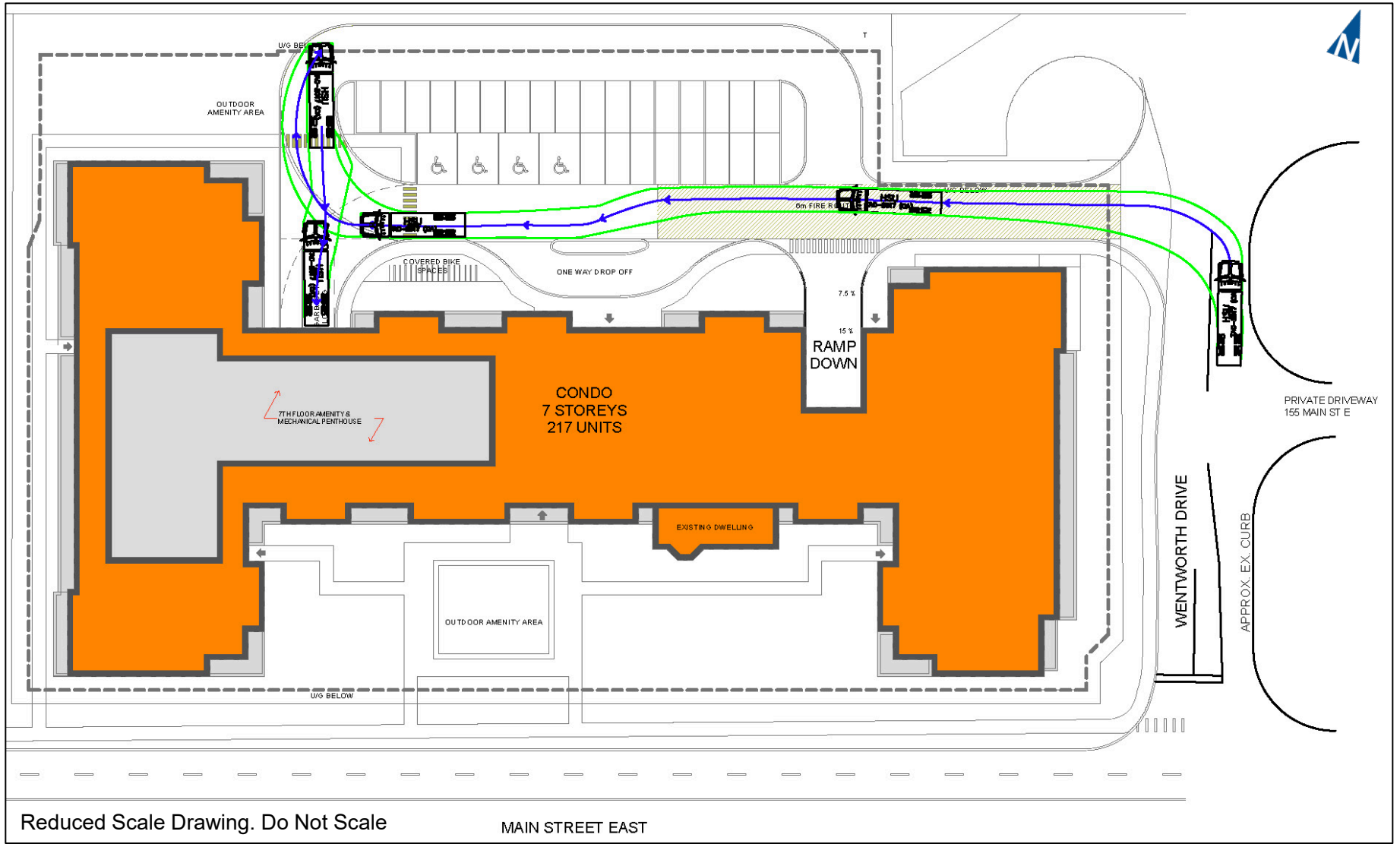
TAC Medium Single Unit (MSU) Inbound Movement to Loading Zone

Appendix G – Figure 4



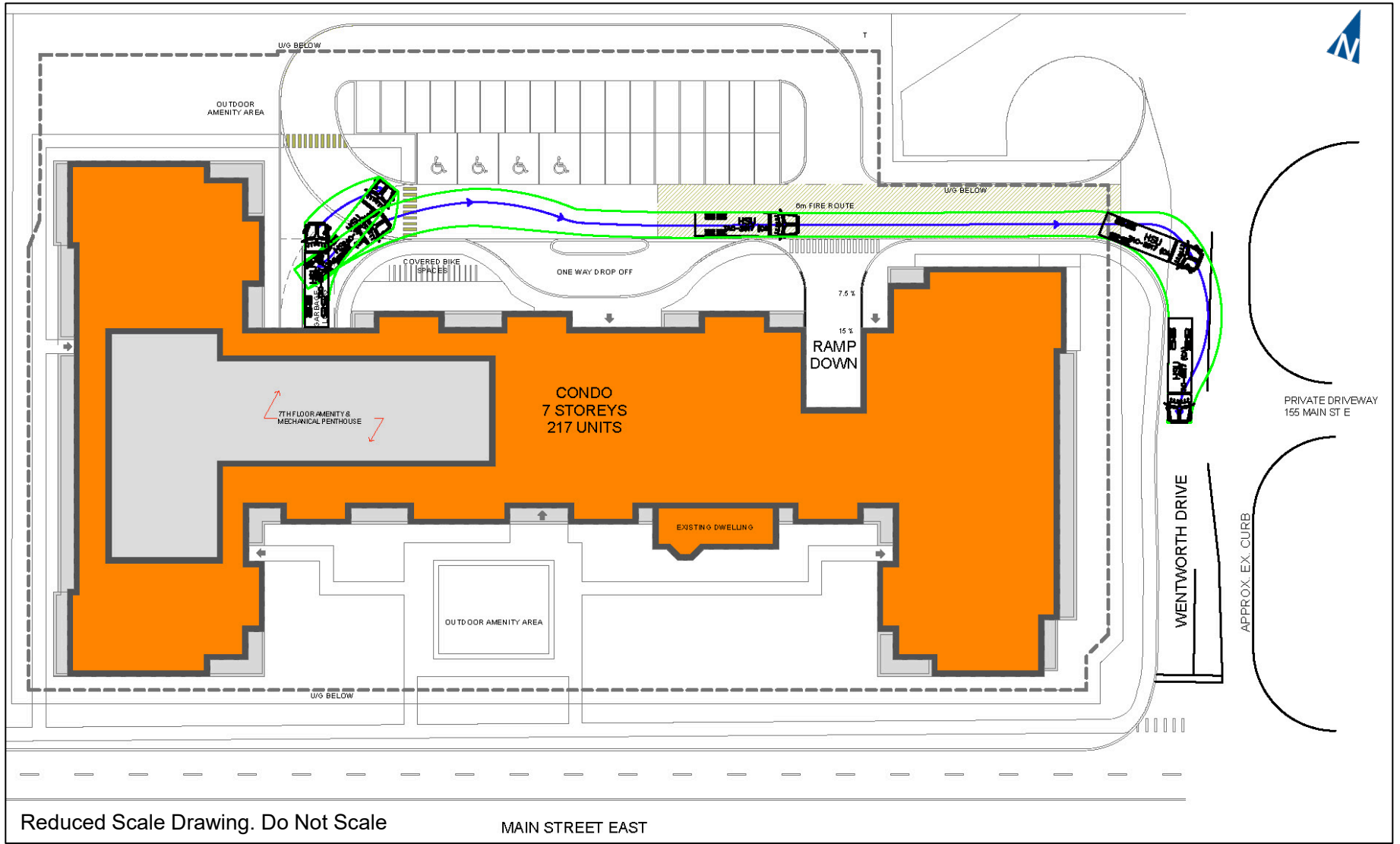
TAC Medium Single Unit (MSU) Outbound Movement from Loading Zone

Appendix G – Figure 5



TAC Heavy Single Unit (HSU) Inbound Movement to Loading Zone

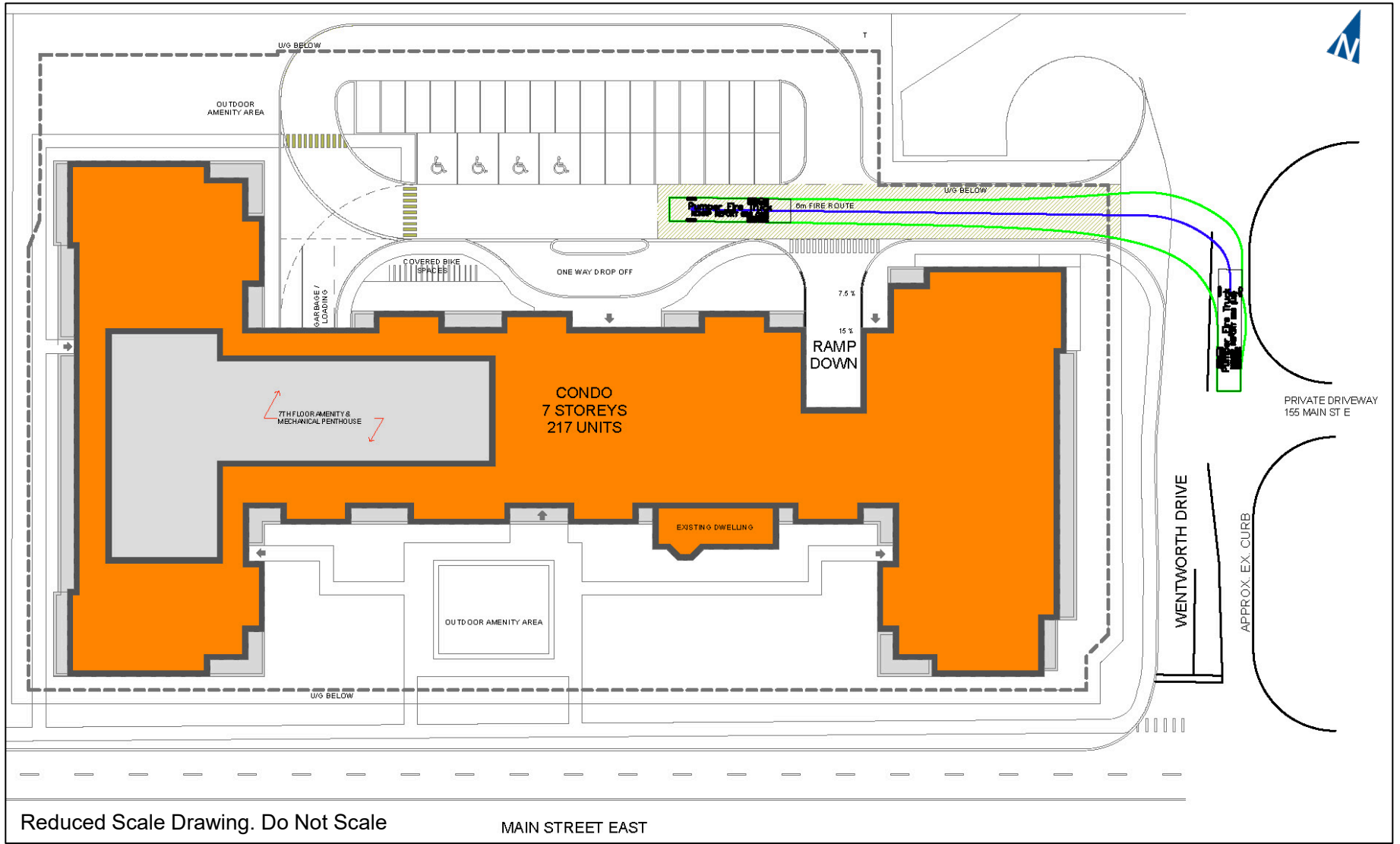
Appendix G – Figure 6



141-149 Main Street East TIS
200138

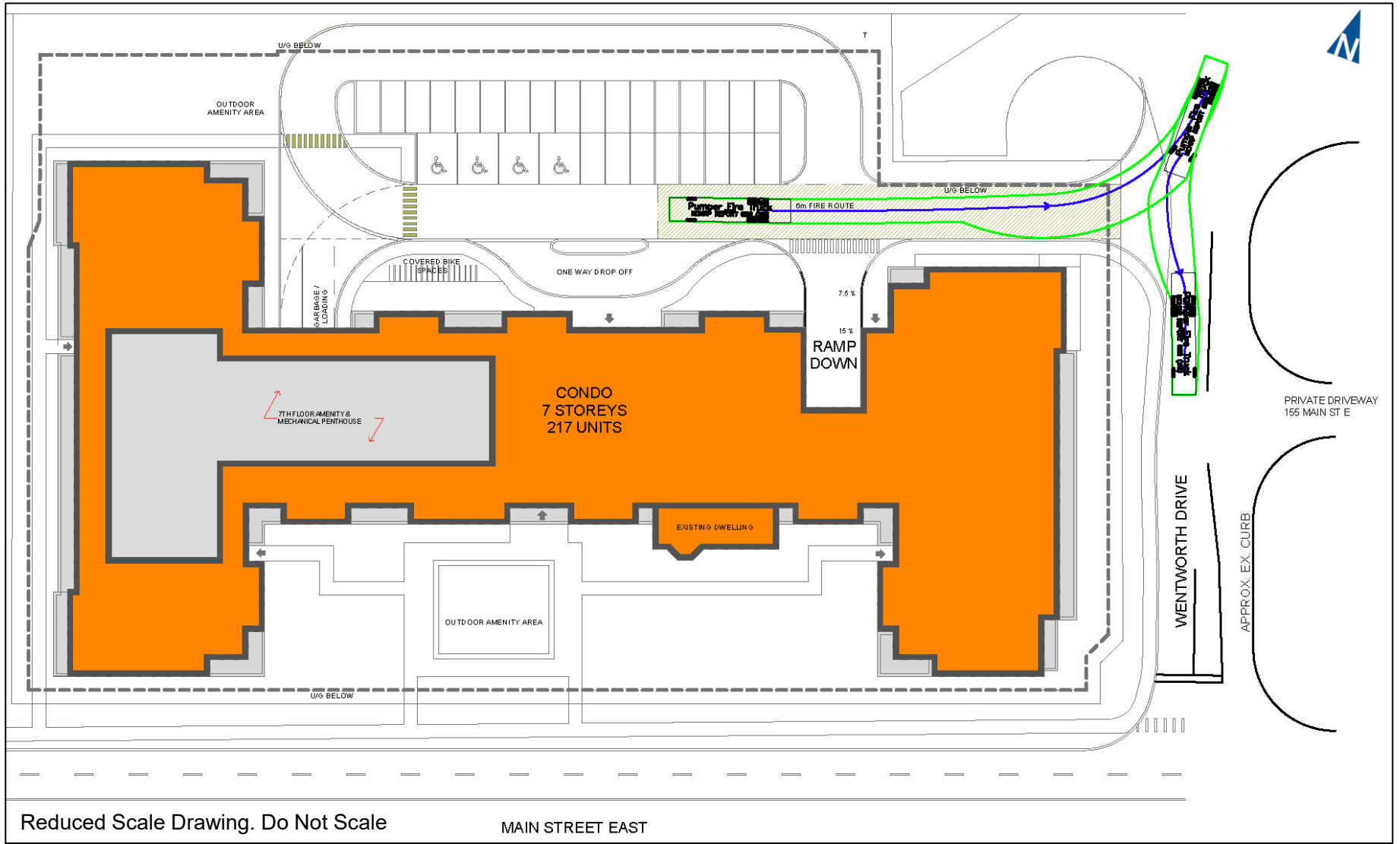
TAC Heavy Single Unit (HSU) Outbound Movement from Loading Zone

Appendix G – Figure 7



NCHRP Report 659 Fire Truck - Pumper Inbound Movement

Appendix G – Figure 8



NCHRP Report 659 Fire Truck - Pumper Outbound Movement

Appendix G – Figure 9

141-149 Main Street East TIS
200138