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**CHARLESTON HOMES
RESIDENTIAL DEVELOPMENT
Town of Collingwood**

Traffic Impact Study

prepared by:

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Table of Contents

1	Introduction	1
2	Existing Conditions	2
2.1	Road Network	2
2.2	Existing Traffic Volumes	4
2.3	Existing Traffic Operations	5
3	Future Background Conditions	8
3.1	Road Network	8
3.2	Background Traffic Volumes	9
3.3	Background Traffic Operations	13
4	Proposed Development	19
4.1	Site Location	19
4.2	Proposed Land-use	19
4.3	Development Phasing	19
4.4	Site Access	19
4.5	Active Transportation	20
4.6	Site Traffic	20
5	Transportation Impacts	23
5.1	Future Traffic Volumes	23
5.2	Future Traffic Operations	23
5.3	Turn Lane Requirements	29
5.4	Sight Line Analysis	30
6	Summary	32

Appendices

Appendix A: Traffic Counts

Appendix B: Existing Operations

Appendix C: Future Background Operations

Appendix D: Future Total Operations

Appendix E: Traffic Signal Warrant

List of Tables

Table 1: Intersection Operations – 2015 Conditions	6
Table 2: Road Section Operations – 2015 Conditions	7
Table 3: Background Development – Trip Generation/Estimates	12
Table 4: Intersection Operations – 2020 Background Conditions	14
Table 5: Intersection Operations – 2025 Background Conditions	15
Table 6: Intersection Operations – 2030 Background Conditions	16
Table 7: Intersection Operations – 2035 Background Conditions	17
Table 8: Intersection Operations – 2035 Background (w/improvements)	17
Table 9: Road Section Operations – 2035 Background Conditions	18
Table 10: Trip Generation Rates	20
Table 11: Trip Estimates	21
Table 12: Intersection Operations – 2020 Total Conditions	24
Table 13: Intersection Operations – 2025 Total Conditions	25
Table 14: Intersection Operations – 2030 Total Conditions	26
Table 15: Intersection Operations – 2035 Total Conditions	27
Table 16: Road Section Operations – 2035 Total Conditions	28

List of Figures

Figure 1: Site Location	34
Figure 2: Area Road Network	35
Figure 3: 2015 Traffic Volumes	36
Figure 4: Background Development Traffic	37
Figure 5: 2020 Background Traffic Volumes	38
Figure 6: 2025 Background Traffic Volumes	39
Figure 7: 2030 Background Traffic Volumes	40
Figure 8: 2035 Background Traffic Volumes	41
Figure 9: Preliminary Draft Plan of Subdivision	42
Figure 10: Site Generated Traffic	43
Figure 11: 2020 Total Traffic Volumes	44
Figure 12: 2025 Total Traffic Volumes	45
Figure 13: 2030 Total Traffic Volumes	46
Figure 14: 2035 Total Traffic Volumes	47

1 Introduction

C.C. Tatham & Associates was retained by Charleston Homes to address the traffic impacts associated with the proposed residential development to be located at the northwest corner of Poplar Sideroad (County Road 32) and High Street in the Town of Collingwood. The location of the development site is illustrated in Figure 1.

The purpose of this study is to address the requirements of the Town of Collingwood and the County of Simcoe with respect to the potential transportation impacts of the development on the local road network. In particular, the following will be discussed:

- the operations of the road system through the study area prior to the proposed development;
- an estimation of the growth in the traffic volumes not otherwise attributed to the development (i.e. from overall growth in the area and/or other developments);
- an estimation of the number of new trips the proposed development is likely to generate;
- the operations of the study area road system upon completion of the development; and
- the resulting impacts and need for mitigating measures (if required) to ensure acceptable overall road operations.

Chapter 2 of this report addresses the existing conditions, detailing the road system and corresponding traffic operations. Chapter 3 addresses future conditions, prior to the completion of the proposed development, and will address the expected growth in the traffic levels and the resulting operating conditions. Chapters 4 and 5 address the proposed development, the ensuing vehicle trips that it will generate, and the associated impacts on the road system. Lastly, Chapter 6 summarizes the report and the key findings.

2 Existing Conditions

This chapter will describe the road network, traffic volumes and operations for the existing conditions.

2.1 Road Network

The road network to be addressed by this study consists of High Street, Poplar Sideroad (County Road 32), Campbell Street, Hurontario Street (County Road 124) and the following intersections:

- Campbell Street with High Street;
- High Street with Poplar Sideroad (roundabout); and
- Poplar Sideroad with Hurontario Street/County Road 124.

Photographs of the road system are provided in Figure 2.

2.1.1 Road Sections

High Street

As per the *Town of Collingwood Official Plan*, High Street is designated as an arterial road. The road is oriented north-south through the study area and has a 2-lane rural cross-section (i.e. 1 lane of travel per direction with gravel shoulders and open drainage ditches). The posted speed limit is 50 km/h and hence a design of 70 km/h has been assumed (posted speed limit + 20 km/h). As an arterial road, High Street has an assumed planning capacity of 900 vehicles per hour per lane (vphpl). The road maintains a straight and flat alignment through the study area. It is understood that across the development frontage, High Street has a 30 metre right-of-way that can accommodate a future 4-lane profile (as discussed in Section 3.1).

Poplar Sideroad

Poplar Sideroad, also known as County Road 32, is a primary arterial road under the jurisdiction of the County, as per the *County of Simcoe Official Plan*. The road is oriented east-west and has a 2-lane profile. Poplar Sideroad is urbanized (curb and gutter) from approximately 415 metres west of High Street through to Hurontario Street/County Road 124. The road has a posted speed limit of 60 km/h and an assumed design speed of 80 km/h. As a primary arterial road in the County road network, Poplar Sideroad has an assumed planning capacity in the order of 900 to 1,100 vphpl. The road is relatively flat and straight through the study area.

Campbell Street

Campbell Street is a 2-lane local road within the Town of Collingwood. It provides east-west service and has a rural cross-section with gravel shoulders and drainage ditches. The posted speed limit is 50 km/h. As a local road, Campbell Street has an assumed planning capacity of 400 vphpl.

County Road 124 / Hurontario Street

County Road 124 is a north-south primary arterial road under the jurisdiction of the County of Simcoe. The road has a 2-lane rural cross section and a posted speed limit of 70 km/h through the study area. As a primary arterial road, County Road 124 has an assumed planning capacity in the order of 900 to 1,100 vphpl.

North of Poplar Sideroad, County Road 124 is within the Town of Collingwood and thus under the jurisdiction of the Town and known locally as Hurontario Street. In the immediate area, the general characteristics remains consistent with those of County Road 124 (i.e. rural cross section with 1 travel lane per direction).

2.1.2 Key Intersections

Campbell Street & High Street

The intersection of Campbell Street with High Street is a 3-leg 'T' intersection with stop control on all approaches (i.e. 3-way stop). The north approach consists of a through lane and an exclusive left turn lane, whereas the south approach consists of a shared through/right turn lane. The east approach (Campbell Street) provides a shared left/right turn lane.

High Street & Poplar Sideroad

The intersection of High Street with Poplar Sideroad is a 3-leg roundabout. As a roundabout, each approach operates under yield control. The north leg (High Street) flares to a 2-lane approach in advance of the roundabout to accommodate an exclusive left turn lane and an exclusive right turn lane. The north leg has a single lane departure. The east and west legs each have a 2-lane approach (flared from 1-lane in advance of the roundabout) and a 2-lane departure configuration. The 2-lane departures to the east and west taper back down to a single lane to match the existing cross-section on Poplar Sideroad (i.e. two-lanes are carried through the roundabout in the east-west direction).

Poplar Sideroad & Hurontario Street/County Road 124

The intersection of Poplar Sideroad and Hurontario Street/County Road 124 is a signalized 4-leg intersection. The north and west approaches provide an exclusive left turn lane and a shared through/right turn lane, whereas the south and east approaches consist of an exclusive left turn lane,

an exclusive through lane and an exclusive right turn lane. The signal timing plans include an advance green for the northbound left turn movement.

2.2 Existing Traffic Volumes

To determine the existing traffic volumes on the study area road network, traffic counts were conducted at the intersection of High Street with Poplar Sideroad on Wednesday November 4, 2015 (7:00 to 10:00 and 16:00 to 18:00) and at the intersection of Campbell Street with High Street on Thursday November 12, 2015 (16:00 to 18:00) and Friday November 13, 2015 (7:00 to 9:30). For the intersection of Poplar Sideroad with Hurontario Street, data from a turning movement count conducted on Friday May 31, 2013 (6:00 to 9:00 and 15:00 to 18:00) was obtained from the County. In addition to the noted turning movement counts, automatic traffic recorder (ATR) data was obtained from the County for Poplar Sideroad (west of High Street) and County Road 124 (south of Poplar Sideroad). The traffic count details are provided in Appendix A.

The traffic volumes on High Street were established based on the volumes observed during the traffic counts at the intersections of High Street with Poplar Sideroad and Campbell Street. Upon review of the traffic count data, it was determined that the southbound volumes on High Street at Campbell Street were greater than the southbound volumes observed at Poplar Sideroad; conversely, the northbound volumes on High Street at Poplar Sideroad were greater than the northbound volumes observed at Campbell Street. Recognizing that there are no intersections along High Street between Poplar Sideroad and Campbell Street that would otherwise account for an imbalance in the traffic volumes along High Street, and in order to ensure a conservative approach, the southbound volumes observed at Campbell Street were carried through to Poplar Sideroad and the northbound volumes observed at Poplar Sideroad were carried through to Campbell Street (i.e. the volumes along High Street have been balanced between Poplar Sideroad and Campbell Street using the more conservative volumes observed during the traffic count). The southbound volumes (as observed at Campbell Street and carried through to Poplar Sideroad) were distributed to the east and west along Poplar Sideroad based on the traffic patterns observed at the roundabout during the 2015 traffic count.

The traffic volumes along Poplar Sideroad were established based on the volumes observed at the intersection of High Street with Poplar Sideroad (adjusted to reflect the more conservative southbound volumes on High Street as observed at Campbell Street and noted above). It is noted that fall 2015 ATR average peak hour volumes on Poplar Sideroad, west of High Street, are comparable to the 2015 adjusted turning movement count volumes on Poplar Sideroad west of High Street. The total average peak hour volume (AM+PM) observed by the ATR was 631 vehicles, whereas the peak hour turning movement count volumes (adjusted) are 653 vehicles. Between High Street and Hurontario Street, the 2015 volumes on Poplar Sideroad at High Street were found to be considerably higher than the 2013 volumes observed at Hurontario Street. While there is some development along this section of road that would account for some imbalance in the traffic volumes, the variance was considered too great to be solely attributed to this development. Therefore the volumes on Poplar Sideroad, as observed at

High Street, were carried to the east through the intersection with Hurontario Street. While this results in the volumes being balanced between High Street and Hurontario Street (which is not likely given the presence of Saunders Street and Clark Street and the existing residential development that these streets serve), the approach is considered conservative and is assumed to reflect the increased use of Poplar Sideroad and High Street as alternative travel routes to/from the Town.

The remaining volumes at the intersection of Poplar Sideroad with Hurontario Street/County Road 124 are based on the volumes observed during the 2013 traffic counts, adjusted by a growth rate of 1% per annum to account for background growth. Additional discussion on growth rates is provided in Section 3.2.

The 2015 ATR volumes (spring, summer and fall) provided for Poplar Sideroad and County Road 124 were reviewed to determine whether or not the traffic patterns experience any seasonal peaks. For Poplar Sideroad, the peak volumes were observed during the fall counts. Thus the volumes along Poplar Sideroad, which were observed during the fall season, are considered reflective of typical peak hour conditions. The 2015 spring, summer and fall ATR volumes on County Road 124 are all comparable with no discernible seasonal peak. Therefore no adjustments are considered necessary to account for peak seasonal conditions.

The 2015 traffic volumes are illustrated in Figure 3.

2.3 Existing Traffic Operations

2.3.1 Intersection Operations

The assessment of existing conditions provides the baseline from which the future traffic volumes and operations (both with and without the subject development) can be assessed. The capacity, and hence operations, of a road system is effectively dictated by its intersections. As such, the analysis focused on the operations of the noted key intersections. The analysis is based on the 2015 traffic volumes, the existing configuration and intersection control (including optimization of traffic signal timings and schemes) and procedures outlined in the *2000 Highway Capacity Manual*¹ (using Synchro v.8 software). For the signalized intersection, the analysis considers each approach and the overall intersection. For the unsignalized intersections, the review considers the average delay (measured in seconds), level of service (LOS) and volume to capacity (v/c) for the critical movements, namely the stop movements on the minor street or each approach to the roundabout. A summary of the analyses is provided in Table 1. Level of service A corresponds to the best operating condition with minimal delays whereas level of service F corresponds to poor operations resulting from high intersection delays. A v/c ratio of less than 1.0 indicates the intersection movement/approach is operating at less than capacity while v/c of 1.0 indicates capacity has been reached. Detailed operations worksheets for the existing traffic conditions are included in Appendix B.

¹ *Highway Capacity Manual*. Transportation Research Board, Washington DC, 2000.

Based on the existing volumes and configurations, the key intersections provide excellent overall levels of service (LOS A or B) with minimal delays during both peak hours. As such, no improvements are required to support the existing conditions.

Table 1: Intersection Operations – 2015 Conditions

Intersection and Movement		Control	Weekday AM Peak Hour			Weekday PM Peak Hour		
			delay	LOS	v/c	delay	LOS	v/c
High Street & Poplar Sideroad	EB	roundabout	5	A	0.10	5	A	0.12
	WB		5	A	0.24	5	A	0.22
	SB		5	A	0.21	7	A	0.34
	overall	roundabout	5	A	-	6	A	-
Poplar Sideroad & Hurontario Street	EB	signal	22	C	0.68	32	C	0.86
	WB		18	B	0.59	17	B	0.40
	NB		8	A	0.37	9	A	0.32
	SB		13	B	0.33	20	B	0.62
	overall	signal	15	B	0.50	20	B	0.68
Campbell Street & High Street	EB	stop	9	A	0.12	9	A	0.14
	NB		10	B	0.36	10	B	0.34
	SB		9	A	0.31	11	B	0.47
	overall	stop	9	A	-	10	B	-

2.3.2 Road Section Operations

As previously noted, the following lane capacities have been assumed for the adjacent road network (for the purpose of this study, and to ensure a conservative approach, the lower capacity threshold has been considered for those roads where a lane capacity range was provided):

- High Street – 900 vphpl (arterial);
- Poplar Sideroad – 900 vphpl (arterial);
- Campbell Street – 400 vphpl (local road); and
- County Road 124/Hurontario Street – 900 vphpl (arterial).

The existing road section operations are summarized in Table 2, reflective of the peak directional volumes during each of the noted peak hours. As indicated, the study area road network is operating at 64% of capacity or less (i.e. $v/c \leq 0.64$), thus indicating that the network has excess reserve capacity. No improvements are recommended to address capacity under existing conditions.

Table 2: Road Section Operations – 2015 Conditions

Road and Lanes per Direction		Capacity ¹		Traffic Volumes		Volume to Capacity	
		NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB
High Street	1	900	900	268	335	0.30	0.37
Poplar Sideroad (west of High St.)	1	900	900	186	150	0.21	0.17
Poplar Sideroad (east of High St.)	1	900	900	477	355	0.53	0.39
Campbell Street	1	400	400	91	93	0.23	0.23
Hurontario Street (north of Poplar S/R)	1	900	900	579	568	0.64	0.63
County Road 124 (south of Poplar S/R)	1	900	900	475	550	0.53	0.61

¹ Capacity is denoted as vehicles per hour per direction

3 Future Background Conditions

This chapter will describe the road network and background traffic volumes expected for the years 2020, 2025, 2030 and 2035. The 2020 horizon year is an interim horizon period and has been adopted to consider 50% build-out and occupancy of the development, whereas the 2025 horizon has been adopted to consider full build-out and occupancy. The 2030 and 2035 horizons will address the longer-term impacts (5 and 10 years beyond build-out) to the road network.

3.1 Road Network

3.1.1 High Street Improvements

In 2007, the Town of Collingwood completed the *High Street Schedule C Class Environmental Assessment*², which investigated the need for road improvements between Third Street and Poplar Sideroad. For the section of High Street from Poplar Sideroad to Campbell Street, the Class EA recommended that High Street be widened to a 4-lane urban cross-section (i.e. with curb and gutter). The timing for the proposed widening was noted as beyond 2010. It is noted no improvements have occurred to date for this section of High Street.

It is understood that the engineering design for the road widening has been undertaken, but not yet finalized or ready for implementation (which is subject to funding). For the purpose of this study, it has been assumed that the widening of High Street will be completed by 2025.

3.1.2 Campbell Street & High Street Intersection Improvements

It is further understood that the improvements to High Street will include the installation of traffic signals at the intersection of High Street with Campbell Street. In addition to the traffic signals, improvements to the approach configurations will also be implemented. Upon completion of the improvements, the intersection will have the following approach configurations:

- north approach – two exclusive through lanes and an exclusive left turn lane;
- south approach – an exclusive through lane and a shared through/right turn lane; and
- east approach – an exclusive left turn lane and an exclusive right turn lane.

For the purpose of this study and the analysis of the future background conditions, the intersection improvements at the Campbell Street and High Street intersection are assumed to be complete by 2025 (to be completed in conjunction with the High Street works).

² *High Street Schedule C, Class EA Environmental Study Report*. R.J. Burnside & Associates Ltd. (July 2007)

3.2 Background Traffic Volumes

Background traffic volumes expected for the 2020, 2025, 2030 and 2035 horizon years for the study area have been determined based on the existing traffic volumes, historical and projected growth, traffic data and growth estimates presented in the *Town of Collingwood Transportation Study*³ and additional increases in volumes due to other development within the immediate area (apart from the subject development).

3.2.1 Background Growth

Population Growth

The 2011 census⁴ results for the Town of Collingwood indicate that the population increased from 17,503 persons in 2006 to 19,241 in 2011, translating to an annual growth rate of 1.9%. Over the same period, employment increased at an annual growth rate of 1.3% from 8,140 to 8,715.

The *Town of Collingwood Official Plan*⁵, in considering permanent and recreational residents, projects an annual increase in population of 1.5% between 2011 and 2021. According to the *Growth Plan for the Greater Golden Horseshoe*⁶, which is intended to guide future development within the Greater Golden Horseshoe (and hence Simcoe County), the 2031 population for the Town of Collingwood has been forecasted at 33,400 persons. In consideration of the 2011 census population level of 19,243, this translates to an annual increase of 2.8% in population. The employment level is forecasted to increase from 8,715 (2011 census) to 13,500 in 2031, equating to an annual increase of 2.2%.

Historic Traffic Growth

The 2013 and 2015 turning movement counts were compared with traffic counts conducted in 2010 as part of the *Town of Collingwood Transportation Study* in order to establish the historic growth rates for the study area road network.

A review of the volumes observed at the intersection of High Street with Poplar Sideroad indicates that volumes on High Street have increased by 75% between 2010 and 2015, translating to an annual growth rate of 11.8%. On Poplar Sideroad, volumes have increased by 50% to the west of High Street and 84% to the east of High Street, translating to annual growth rates of 8.4% and 12.9% respectively. Based on a review of the 2010 and 2013 volumes at the intersection of Poplar Sideroad and Hurontario Street, the volumes on Poplar Sideroad increased by 44% (12.9% per annum) to the west of Hurontario Street and by 80% (21.7% per annum) to the east of Hurontario Street. The traffic on Hurontario Street/County Road 124 over the same period was much more reserved, with annual

³ *Town of Collingwood Transportation Study*, C.C. Tatham & Associates Ltd., July 2012

⁴ *Statistics Canada, 2012 Census Profile – Collingwood*. Statistics Canada, October 2012.

(<http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/index.cfm?Lang=E>) Accessed November 20, 2015

⁵ *Town of Collingwood Official Plan*. Town of Collingwood. Office consolidated, December 2014.

⁶ *Growth Plan for the Greater Golden Horseshoe, 2006*. Ministry of Infrastructure. Office consolidated, June 2013.

growth of only 3.3% to the north of Poplar Sideroad and 0% to the south. Increases of the magnitudes noted on Poplar Sideroad and High Street are not common; they are largely attributed to the improvements introduced in 2011 intended to promote Poplar Sideroad as an alternative route to Highway 26 through the Town.

A review of the historic Average Annual Daily Traffic (AADT) on County Road 124, south of Poplar Sideroad, for the period 2006 to 2012 indicates annual growth of 1.0%. The 2015 AADT indicates 0% growth from 2006 and an annual decrease of 2.4% over the 2012 AADT.

The Town of Collingwood Transportation Study

The *Town of Collingwood Transportation Study* applied a 0.5% background growth rate in establishing the future background traffic volumes. In addition to the 0.5% background growth, the study was also comprehensive in the explicit inclusion of background developments as part of the traffic forecasts (i.e. traffic volumes attributed to specific developments added to the road network in addition to the 0.5% background growth rate). In considering a 0.5% background growth rate and the traffic volumes associated with 36 planned developments within the Town, the effective annual growth rate on the study area road network from 2010 to 2030 was projected as follows:

- High Street (north of Poplar Sideroad): 4.6%;
- Poplar Sideroad (west of High Street): 3.6%;
- Poplar Sideroad (east of High Street): 4.1%;
- Hurontario Street (north of Poplar Sideroad): 3.2%; and
- County Road 124 (south of Poplar Sideroad): 2.8%

Overall Background Growth

The *Collingwood Transportation Study* projects annual growth in the order of 3.6% to 4.6% on Poplar Sideroad and High Street from 2010 to 2030. These projections assume uniform growth over a 20 year period. In reality, the growth from year to year will vary as developments realize partial or full build-out. While the *Collingwood Transportation Study* considers a 20 year horizon, some of the considered developments will have been completed within 5 or 10 year horizons. Thus the actual growth rate may be more pronounced within the first 5 or 10 years before lowering over the remaining horizon years. As indicated in the comparison of the 2010 and 2015 traffic volumes, the actual annual growth on the study area roads has been in the order of 8.5% to 13.0%. These growth rates are not indicative of normal growth moving forward but rather reflect the relatively high level of development realized in the Collingwood area in recent years and further reflect the improvements to Poplar Sideroad and completion of the new Highway 26. Traffic growth is expected to slow to a more realistic and sustainable level.

In considering the historic growth and the projected growth for the area, an annual background growth rate of 1% has been applied to the 2015 volumes. While a 1.0% growth rate appears low given the noted projected growth in population and traffic, it recognizes that substantial growth has occurred in recent years and that overall growth will slow as fewer developments come online. To apply a 4.0% background growth rate to the 2015 volumes would result in an overstatement in traffic growth over the study horizon.

3.2.2 Development Growth

In addition to the 1.0% background growth rate, consideration has also been given to several other developments planned for the study area. These developments are expected to reach full build-out by the 2035 horizon year. The background developments are discussed in detail below.

Mountaincroft Subdivision

The Mountaincroft subdivision is located on the northeast corner of the High Street and Poplar Sideroad intersection. Upon completion, it will consist of approximately 375 single family units and is expected to generate in the order of 280 to 380 new peak hour trips upon full build-out (as noted in the *High Street & Poplar Sideroad Residential Development Traffic Impact Study*⁷). Phases 1 and 2 are built-out and Phase 3 is nearing completion. The developer is preparing the launch of Phases 4 through 6, the final phases consisting of approximately 200 units. Full build-out of the Mountaincroft development is assumed by 2020. It is noted that Phase 6 will include the extension of Findlay Drive through to High Street. This connection has been considered in the intersection assessment of the future background conditions.

The Trails of Collingwood Subdivision

The Trails of Collingwood Subdivision site is located on the east side of High Street, approximately 300 metres north of Campbell Street. As per the *Trails of Collingwood Subdivision Traffic Impact Study*⁸, the proposed development is to consist of 62 single units, 78 townhouse units and 111 apartment units. There is currently no development activity on the site. As such, it has been assumed that the site will experience 50% build-out by 2025 and full build-out by 2030. The site generated traffic, as presented in the respective traffic impact study, has been carried through the study area road network and distributed through the intersections of Poplar Sideroad with High Street and Hurontario Street based on the traffic patterns observed during the 2013 and 2015 traffic counts.

7618 & 7624 Poplar Sideroad Commercial Development

The 7618 & 7624 Poplar Sideroad Commercial Development is located on the northwest corner of the intersection of Poplar Sideroad with Hurontario Road. The development will consist of a gas bar with a

⁷ *High Street & Poplar Sideroad Residential Development Traffic Impact Study*, Consult Tatham. November 2004.

⁸ *Trails of Collingwood Subdivision Traffic Impact Study*. R.J. Burnside & Associates Ltd. June 2007.

convenience store and car wash and a Tim Hortons restaurant with a drive-thru. The site is currently under construction will completion expected in late 2015/early 2016. The traffic volumes to be generated by the site have been assigned to the study area road network as per the 7618 & 7624 Poplar Sideroad Traffic Impact Study⁹.

High Street & Poplar Sideroad — Future Residential

The parcel of property abutting the Charleston Homes site to the southeast (located on the northwest corner of the intersection of High Street and Poplar Sideroad) is zoned for residential development. While there are no existing development plans for the site, the potential for residential development has been considered. In order to establish the potential trip generation for the site, the maximum residential density under current zoning has been assumed. As such, it has been assumed that the site will consist of 28 single units and 186 townhouse units (this is a conservative assumption and is not based on a site design, nor does it consider servicing constraints). A single access to High Street has also been assumed. The trip estimates for the site are based on the noted residential use assumptions and ITE trip generation rates for the *single family detached* (ITE code 210) and the *low-rise residential condo/townhouse* land uses. The trip rates and estimates are provided in Table 3.

Table 3: Background Development – Trip Generation/Estimates

Land Use/ Development	rate/ estimate	Unit/ Size	AM Peak Hour			PM Peak Hour		
			in	out	total	in	out	total
single family detached	rate	per unit	0.19	0.56	0.75	0.63	0.37	1.00
low-rise condo/town	rate	per unit	0.17	0.37	0.44	0.35	0.17	0.52
single family units	estimate	28 units	5	16	21	18	10	28
townhouse units	estimate	186 units	31	93	124	84	61	145
Total Trips			36	109	145	102	71	173

As noted, the site is expected to generate 145 new trips during the AM peak hour and 173 new trips during the PM peak hour. The site trips have been assigned to the study area road network based on traffic patterns and trip distribution for the area (additional details on trip distribution and assignment are provided in Section 4.6). It is noted that 50% build-out has been assumed for the 2030 horizon year with full build-out for 2035.

⁹ 7618 & 7624 Poplar Sideroad Traffic Impact Study. C.F. Crozier & Associates Inc. January 2014.

Overall Background Development Volumes

The traffic to be generated by the noted background developments is illustrated in Figure 4. The distribution and assignment reflects that which was provided in the respective traffic impact studies and/or considers traffic patterns observed at the key intersections and the overall distribution patterns for the study area.

3.2.3 Background Traffic Volumes

The resulting 2020, 2025, 2030 and 2035 background traffic volumes are illustrated in Figure 5 through Figure 8. The background volumes are based on the 2015 volumes, adjusted to reflect background growth and the additional traffic volumes associated with the noted background developments. In considering the resulting 2030 background traffic volumes, they reflect an overall annual growth rate in the order of 3.6% to 4.9% over the 2010 volumes noted in the *Collingwood Transportation Study* (comparable to the projected growth rates noted therein). With respect to the 2015 volumes, the 2035 background volumes reflect annual growth rates in the order of 1.6% to 2.1%.

3.3 Background Traffic Operations

3.3.1 Intersection Operations

The study area intersections were again analyzed for each horizon year given the projected background volumes. The results are summarized in Table 4 through Table 7 (detailed worksheets are provided in Appendix C). The analysis considers the widening of High Street in 2025 along with the improvements to the intersection of Campbell Street with High Street (as described in Section 3.1). Furthermore, with full build-out of the Mountaincroft development in 2020 (which includes the extension of Findlay Drive to High Street), the intersection of Findlay Drive with High Street has also been included in the analysis. The intersection will be stop controlled on the minor movement (Findlay Drive). For the signalized intersections, the signal timings have been optimized to ensure efficient operations.

As indicated, the roundabout and stop controlled intersections will provide excellent operating conditions (LOS A and B) with minimal delays through 2035. The signalized intersections will provide good overall operation (LOS C or better) with average delays through the considered horizon periods given the assumed background traffic volumes.

Despite the good operations at the intersection of Poplar Sideroad with Hurontario Street, it is noted that the eastbound movement will approach capacity ($v/c = 0.96$) in 2035. This is due to the relatively high volume of eastbound right turns occurring during the peak hours (180 to 225 vehicles). These volumes are comparable to the westbound right turn volumes on the east approach, which is provided with an exclusive right turn lane. In order to alleviate the capacity issues on the west approach, and to improve the overall operations of the intersection, implementation of an exclusive right turn lane to

serve the eastbound right turn movement is recommended. The intersection operations were reviewed again, the results of which are provided in Table 8. As noted, the implementation of the exclusive right turn lane improves the conditions for the eastbound movement and the overall intersection.

Other than the exclusive eastbound right turn lane at the intersection of Poplar Sideroad with Hurontario Street, no other improvements are required to accommodate the background conditions through 2035.

Table 4: Intersection Operations – 2020 Background Conditions

Intersection and Movement			Weekday AM Peak Hour			Weekday PM Peak Hour		
			delay	LOS	v/c	delay	LOS	v/c
High Street & Poplar Sideroad	EB	roundabout	5	A	0.13	6	A	0.15
	WB		6	A	0.29	5	A	0.25
	SB		6	A	0.25	8	A	0.38
	overall	roundabout	6	A	-	6	A	-
Poplar Sideroad & Hurontario Street	EB	signal	24	C	0.76	41	D	0.93
	WB		17	B	0.59	18	B	0.47
	NB		9	A	0.42	11	B	0.48
	SB		16	B	0.41	27	C	0.78
	overall	signal	16	B	0.58	25	C	0.80
Campbell Street & High Street	EB	stop	9	A	0.14	9	A	0.16
	NB		12	B	0.46	11	B	0.40
	SB		10	A	0.12	13	B	0.58
	overall	stop	11	B	0.38	12	B	-
Findlay Drive & High Street	WB	stop	11	B	0.05	11	B	0.04

Table 5: Intersection Operations – 2025 Background Conditions

Intersection and Movement			Weekday AM Peak Hour			Weekday PM Peak Hour		
			delay	LOS	v/c	delay	LOS	v/c
High Street & Poplar Sideroad	EB	roundabout	5	A	0.14	6	A	0.17
	WB		6	A	0.29	6	A	0.27
	SB		6	A	0.27	8	A	0.41
	overall	roundabout	6	A	-	7	A	-
Poplar Sideroad & Hurontario Street	EB	signal	25	C	0.78	39	D	0.91
	WB		18	B	0.60	19	B	0.59
	NB		10	A	0.44	13	B	0.54
	SB		16	B	0.43	30	C	0.79
	overall	signal	17	B	0.60	26	C	0.81
Campbell Street & High Street	EB	signal	17	B	0.12	17	B	0.12
	NB		4	A	0.17	4	A	0.15
	SB		4	A	0.14	4	A	0.20
	overall	signal	5	A	0.16	5	A	0.19
Findlay Drive & High Street	WB	stop	10	B	0.04	11	B	0.03

Table 6: Intersection Operations – 2030 Background Conditions

Intersection and Movement			Weekday AM Peak Hour			Weekday PM Peak Hour		
			delay	LOS	v/c	delay	LOS	v/c
High Street & Poplar Sideroad	EB	roundabout	6	A	0.14	6	A	0.18
	WB		6	A	0.32	6	A	0.30
	SB		7	A	0.30	9	A	0.44
	overall	roundabout	6	A	-	7	A	-
Poplar Sideroad & Hurontario Street	EB	signal	30	C	0.85	47	D	0.95
	WB		18	B	0.62	21	C	0.63
	NB		10	B	0.46	15	B	0.63
	SB		17	B	0.45	32	C	0.81
	overall	signal	19	B	0.64	30	C	0.85
Campbell Street & High Street	EB	signal	17	B	0.12	17	B	0.15
	NB		4	A	0.20	4	A	0.17
	SB		4	A	0.15	4	A	0.22
	overall	signal	5	A	0.19	5	A	0.21
Findlay Drive & High Street	WB	stop	11	B	0.06	12	B	0.05

Table 7: Intersection Operations – 2035 Background Conditions

Intersection and Movement		Control	Weekday AM Peak Hour			Weekday PM Peak Hour		
			delay	LOS	v/c	delay	LOS	v/c
High Street & Poplar Sideroad	EB	roundabout	6	A	0.16	7	A	0.19
	WB		6	A	0.34	6	A	0.33
	SB		7	A	0.33	9	A	0.47
	overall	roundabout	7	A	-	7	A	-
Poplar Sideroad & Hurontario Street	EB	signal	31	C	0.87	48	D	0.96
	WB		17	B	0.61	24	C	0.77
	NB		11	B	0.50	20	C	0.75
	SB		19	B	0.50	35	D	0.83
	overall	signal	19	B	0.69	33	C	0.88
Campbell Street & High Street	EB	signal	17	B	0.12	17	B	0.18
	NB		4	A	0.22	4	A	0.19
	SB		4	A	0.16	4	A	0.25
	overall	signal	5	A	0.21	5	A	0.24
Findlay Drive & High Street	WB	stop	11	B	0.06	12	B	0.05

Table 8: Intersection Operations – 2035 Background (w/improvements)

Intersection and Movement		Control	Weekday AM Peak Hour			Weekday PM Peak Hour		
			delay	LOS	v/c	delay	LOS	v/c
Poplar Sideroad & Hurontario Street	EB	signal	19	B	0.66	29	C	0.88
	WB		20	B	0.73	21	C	0.66
	NB		9	A	0.47	10	A	0.56
	SB		16	B	0.48	26	C	0.82
	overall	signal	16	B	0.60	22	C	0.80

3.3.2 Road Section Operations

The road section capacity operations have been reviewed for the 2035 horizon period (considered the critical horizon as volumes will be greatest) based on the projected background volumes and the existing road network with the noted improvements to High Street in 2025 (i.e. widening to 4-lanes). The results are summarized in Table 9.

Table 9: Road Section Operations – 2035 Background Conditions

Road & Lanes per Direction		Capacity ¹		Traffic Volumes		Volume to Capacity	
		NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB
High Street	2	1,800	1,800	455	530	0.26	0.29
Poplar Sideroad (west of High St.)	1	900	900	270	225	0.30	0.25
Poplar Sideroad (east of High St.)	1	900	900	680	570	0.76	0.63
Campbell Street	1	400	400	115	120	0.29	0.30
Hurontario Street (north of Poplar S/R)	1	900	900	760	750	0.84	0.83
County Road 124 (south of Poplar S/R)	1	900	900	620	730	0.69	0.81

¹ Capacity is denoted as vehicles per hour per direction

As noted, the study area road network is expected to operate at 84% of capacity or less through the 2035 horizon period (i.e. $v/c \leq 0.84$) under background conditions. Thus no improvements are required to increase road section capacity given the projected background conditions. It is also noted that sufficient capacity will be provided on High Street should the assumed widening to 2 lanes per direction not occur.

4 Proposed Development

This section will provide additional details with respect to the proposed development, including its location, the projected site generated traffic volumes and the assignment of such to the adjacent road network.

4.1 Site Location

As illustrated in Figure 1, the proposed development is located on the northwest corner of the intersection of High Street with Poplar Sideroad within the Town of Collingwood.

4.2 Proposed Land-use

The proposed Charleston Homes residential development will consist of 281 single detached units and 86 townhouse units. A preliminary draft plan of subdivision is provided in Figure 9.

4.3 Development Phasing

Full build-out and occupancy is assumed by 2025 (i.e. a 10 year build). It is understood that the site will be constructed from east to west.

4.4 Site Access

The proposed development will be served by an access on High Street (located approximately 485 metres north of Poplar Sideroad) and an access on Poplar Sideroad (approximately 850 metres west of High Street). Both access points will be full-moves and provide one lane of travel per direction. The access on High Street will be located opposite the Findlay Drive extension, creating a 4-leg intersection with Findlay Drive and High Street.

As previously noted, the site will be developed from east to west, thus the access on High Street will be constructed first. The access to Poplar Sideroad will not be constructed until the operations at the High Street access dictate such need (i.e. when the High Street access begins to experience operational or capacity concern, the Poplar Sideroad access will be opened to alleviate the operations). For the purpose of this study, only the High Street access is considered in 2020 (interim horizon considering 50% build-out); whereas both access points are considered in 2025 (full build-out).

As per the draft plan, a temporary access to High Street (south of the main access at Findlay Drive) is proposed. This access will serve as a construction access during the initial stages of the development and will also serve as a secondary access for emergency vehicles. The access will be closed permanently upon construction of the Poplar Sideroad access. The temporary access will not be for use by general traffic (i.e. residents).

4.5 Active Transportation

The Charleston Home development, in recognizing the growing emphasis being placed on active transportation planning, will include facilities to encourage active transportation. The site will include a comprehensive sidewalk network with internal walkways which will provide additional connectivity within the site. The site will also be well connected to the Town's trail network, with direct connection to the existing trail on the west side of High Street via walkways and the internal sidewalk network. A walkway will also provide connection to Poplar Sideroad. The *Collingwood Official Plan* also identifies a future trail along the Black Ash Creek. The proposed plan provides walkways and park access to this area.

The proposed active transportation linkages are noted on the draft plan of subdivision provided in Figure 9.

4.6 Site Traffic

4.6.1 Trip Generation

The number of vehicle trips to be generated by the proposed development for the weekday AM and PM peak hours has been determined based on type of use, development size, and trip generation rates as per the *ITE Trip Generation Manual*¹⁰ 9th Edition. The *single family detached* (ITE code 210) and the *low-rise residential condo/townhouse* land uses have been applied to the single units and the townhouse units, respectively.

The associated trip rates and trip estimates are provided in Table 10 and Table 11. The rates represent the weekday AM and PM peak hour of the adjacent street. Overall, the proposed development is expected to generate 268 new trips during the weekday AM peak hour and 348 new trips during the weekday PM peak hour.

Table 10: Trip Generation Rates

Land Use	variable	Weekday AM Peak Hour			Weekday PM Peak Hour		
		in	out	total	in	out	total
single family detached	units	0.19	0.56	0.75	0.63	0.37	1.00
low-rise residential condo/townhouse	units	0.17	0.37	0.44	0.35	0.17	0.52

¹⁰ *ITE Trip Generation Manual, 9th Edition*. Institute of Transportation Engineers, 2012.

Table 11: Trip Estimates

Land Use	size	Weekday AM Peak Hour			Weekday PM Peak Hour		
		in	out	total	in	out	total
single family detached	281 units	53	158	211	177	104	281
low-rise residential condo/townhouse	86 units	14	43	57	39	28	67
Total		67	201	268	216	132	348

4.6.2 Trip Distribution & Assignment

The distribution of the site generated trips has been developed based on the results of the *Transportation Tomorrow Survey* (TTS) completed in 2011. The TTS is a telephone interview of a random sampling of 5% of the households in the Greater Toronto Area and surrounding area of Central Ontario, including the Town of Collingwood. Based on a review of the TTS data with respect to trips to/from the traffic zone within which the subject site is located, the following trip distribution was identified:

- to/from Toronto/Barrie/Springwater – 4%;
- to/from Clearview – 8%;
- to/from Grey County – 4%;
- to/from Wasaga Beach – 9%;
- to/from other locations outside of Collingwood – 5%; and
- to/from locations within Collingwood – 70%.

As indicated, 70% of the trips remain wholly within the Town of Collingwood whereas 30% originate from, or are destined to, areas outside of the Town. With respect to the trips that remain within Collingwood, a majority of these trips will be destined to/from the north/northeast given the location of the site in relation to the built-up area of Collingwood.

Overall, the following distribution was assumed:

- 50% to/from the north via High St.;
- 10% to/from the south via County Road 124;
- 5% to/from the east/south via Highway 26;
- 10% to/from the north/east via Campbell St.;
- 5% to/from the north/east via Findlay Dr.;
- 10% to/from the east via Poplar S/R; and
- 10% to/from the west via Poplar S/R.

With respect to the assignment of the site generated trips to the access points, the site traffic was assigned based on the location of the residential units with respect to the access points, the directness of the internal road system and the shortest path to the boundary roads, and the ultimate trip origin/destination.

The resulting site generated traffic assignment to the road network is illustrated in Figure 10. Overall, approximately 80% of the site traffic is expected to use the High Street access, whereas 20% will use the Poplar Sideroad access.

5 Transportation Impacts

This chapter will address the resulting impacts of the proposed development on the adjacent road system. The following areas are to be addressed:

- operations at the key intersections and site access points;
- road section operations;
- available sight lines along High Street and Poplar Sideroad at the proposed access points; and
- potential improvements to the study area road network, if necessary.

5.1 Future Traffic Volumes

To assess the impacts of the increased traffic volumes resulting from the proposed development, the site generated traffic was combined with the 2020, 2025, 2030 and 2035 background traffic volumes. The resulting total traffic volumes are presented in Figure 11 through Figure 14. The 2035 total volumes reflect overall annual growth rates in the order of 2.0% to 2.5% when compared to the 2015 volumes. When compared to the 2010 volumes noted in the *Collingwood Transportation Study*, the 2035 total volumes reflect annual growth rates in the order of 3.6% to 5.0%.

5.2 Future Traffic Operations

5.2.1 Intersection Operations

The operations of the study area intersections were again investigated considering the total traffic volumes for each horizon year. In addition to this, the operations of the proposed site access points have also been reviewed, assuming stop control upon exit. The High Street access, which creates a 4-leg intersection with Findlay Drive, is considered in 2020, whereas the Poplar Sideroad access is considered in 2025 (full build-out). The improvements to High Street and its intersection with Campbell Street have been maintained as previously noted. Furthermore, the exclusive eastbound right turn lane at the intersection of Poplar Sideroad with Hurontario Street recommended in 2035 under background conditions has also been considered.

The results of the operational review are provided in Table 12 through Table 15 (detailed worksheets are provided in Appendix D).

As indicated, the key intersections will continue to provide good overall operations (LOS C or better) with average delays through the 2035 horizon given the projected total volumes. The exception is the westbound movement at the intersection of Findlay Drive/Street A and High Street which experiences a LOS E during the PM peak hour in 2035. While still considered acceptable, a LOS E indicates that

poor operating conditions are likely to occur with additional growth (resulting from higher delays, despite the overall approach operating below capacity as evident by the v/c ratio of less than 1.0). It is noted, however, that the operational analysis does not consider the impact of the upstream traffic signals at Campbell Street and High Street. The traffic signals will create gaps in the traffic flow which in turn provide additional opportunity for traffic to exit the site, thus improving the operations at the intersection. Therefore, the actual operations in 2035 are expected to be somewhat better than reported given the impacts of the upstream traffic signal. It is noted that the total volumes in 2035 at the intersection of Findlay Drive and High Street do not satisfy the MTO warrant for the implementation of traffic signals (traffic signal warrant worksheets are provided in Appendix E).

In considering the projected total traffic volumes and the noted background improvements, no additional intersection improvements are recommended to accommodate the future total conditions.

Table 12: Intersection Operations – 2020 Total Conditions

Intersection and Movement			Weekday AM Peak Hour			Weekday PM Peak Hour		
			delay	LOS	v/c	delay	LOS	v/c
High Street & Poplar Sideroad	EB		5	A	0.13	6	A	0.17
	WB	roundabout	6	A	0.29	6	A	0.28
	SB		6	A	0.28	8	A	0.40
	overall	roundabout	6	A	-	7	A	-
Poplar Sideroad & Hurontario Street	EB		25	C	0.87	37	D	0.91
	WB	signal	17	B	0.61	18	B	0.50
	NB		10	A	0.50	13	B	0.55
	SB		16	B	0.50	30	C	0.80
	overall	signal	17	B	0.60	25	C	0.81
Campbell Street & High Street	EB		9	A	0.15	10	A	0.18
	NB	stopl	14	B	0.56	12	B	0.48
	SB		10	A	0.13	13	B	0.14
	overall	stop	12	B	-	12	B	0.24
Street A / Findlay Drive & High Street	EB	stop	17	C	0.30	22	C	0.27
	WB	stop	12	B	0.07	16	C	0.09

Table 13: Intersection Operations – 2025 Total Conditions

Intersection and Movement		Control	Weekday AM Peak Hour			Weekday PM Peak Hour		
			delay	LOS	v/c	delay	LOS	v/c
High Street & Poplar Sideroad	EB	roundabout	6	A	0.16	7	A	0.19
	WB		6	A	0.32	6	A	0.32
	SB		7	A	0.31	8	A	0.45
	overall	roundabout	6	A	-	7	A	-
Poplar Sideroad & Hurontario Street	EB	signal	30	C	0.86	40	D	0.92
	WB		17	B	0.58	20	B	0.62
	NB		10	B	0.45	16	B	0.67
	SB		17	B	0.44	33	C	0.81
	overall	signal	19	B	0.65	28	C	0.85
Campbell Street & High Street	EB	signal	17	B	0.19	17	B	0.27
	NB		4	A	0.24	4	A	0.20
	SB		4	A	0.16	4	A	0.20
	overall	signal	5	A	0.23	6	A	0.21
Street A / Findlay Drive & High Street	EB	stop	19	C	0.42	29	D	0.45
	WB	stop	12	C	0.06	18	C	0.12
Street B & Poplar Sideroad	WB	stop	11	B	0.01	11	B	0.06

Table 14: Intersection Operations – 2030 Total Conditions

Intersection and Movement		Control	Weekday AM Peak Hour			Weekday PM Peak Hour		
			delay	LOS	v/c	delay	LOS	v/c
High Street & Poplar Sideroad	EB	roundabout	6	A	0.17	7	A	0.20
	WB		6	A	0.34	6	A	0.35
	SB		7	A	0.35	9	A	0.48
	overall	roundabout	7	A	-	8	A	-
Poplar Sideroad & Hurontario Street	EB	signal	34	C	0.89	46	D	0.95
	WB		17	B	0.60	22	C	0.71
	NB		11	B	0.48	22	C	0.79
	SB		19	B	0.48	35	C	0.82
	overall	signal	20	C	0.69	32	C	0.89
Campbell Street & High Street	EB	signal	17	B	0.19	17	B	0.29
	NB		4	A	0.26	4	A	0.22
	SB		4	A	0.17	4	A	0.23
	overall	signal	5	A	0.25	6	A	0.23
Street A / Findlay Drive & High Street	EB	stop	22	C	0.46	35	D	0.51
	WB	stop	13	B	0.09	20	C	0.15
Street B & Poplar Sideroad	WB	stop	11	B	0.08	12	B	0.06

Table 15: Intersection Operations – 2035 Total Conditions

Intersection and Movement			Control	Weekday AM Peak Hour			Weekday PM Peak Hour		
				delay	LOS	v/c	delay	LOS	v/c
High Street & Poplar Sideroad	EB	roundabout	6	A	0.18	7	A	0.22	
	WB		7	A	0.36	7	A	0.38	
	SB		8	A	0.38	10	A	0.51	
	overall	roundabout	7	A	-	8	A	-	
Poplar Sideroad & Hurontario Street	EB	signal	21	C	0.72	33	C	0.92	
	WB		22	C	0.75	22	C	0.72	
	NB		9	A	0.46	11	B	0.63	
	SB		16	B	0.45	27	C	0.83	
	overall	signal	17	B	0.60	24	C	0.83	
Campbell Street & High Street	EB	signal	17	B	0.19	17	B	0.31	
	NB		4	A	0.29	4	A	0.24	
	SB		4	A	0.18	4	A	0.25	
	overall	signal	5	A	0.28	6	A	0.26	
Street A / Findlay Drive & High Street	EB	stop	25	C	0.50	44	E	0.58	
	WB	stop	14	B	0.10	23	C	0.17	
Street B & Poplar Sideroad	WB	stop	12	B	0.08	12	B	0.07	

5.2.2 Road Section Operations

The road section operations were reviewed again with consideration of the projected total traffic volumes for the 2035 horizon period. The results are provided in Table 16.

The study area road network is expected to operate at 84% of capacity or less through the 2035 horizon period (i.e. $v/c \leq 0.84$) under total conditions. As such, no improvements are recommended to accommodate the projected total volumes with respect to road capacity.

Table 16: Road Section Operations – 2035 Total Conditions

Road and Lanes per Direction		Capacity ¹		Traffic Volumes		Volume to Capacity	
		NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB
High Street	2	1,800	1,800	580	550	0.32	0.31
Poplar Sideroad (west of High St.)	1	900	900	295	250	0.33	0.28
Poplar Sideroad (east of High St.)	1	900	900	715	630	0.79	0.70
Campbell Street	1	400	400	130	145	0.33	0.36
Hurontario Street (north of Poplar S/R)	1	900	900	760	750	0.84	0.83
County Road 124 (south of Poplar S/R)	1	900	900	630	745	0.70	0.83

¹ Capacity is denoted as vehicles per hour per direction

5.2.3 Poplar Sideroad Access

At the time of full build-out, the High Street access, which will have approximately 80% of the total site trips assigned to it, will provide acceptable operations. In order to ensure that the operations at the High Street access remain acceptable throughout the construction phase, it is recommended that the Poplar Sideroad access be constructed by the time the development reaches 80% build-out (assuming construction generally occurs from east to west). Requiring the High Street access to accommodate more than 80% of the site traffic may result in poor operating conditions.

This also reflects the overall layout of the development and anticipated use of the respective access points by those closest residents (even if the Poplar Sideroad access were constructed earlier, it is unlikely to be used significantly utilized by other than those who reside adjacent to it, or the limited volume of residents destined to travel to/from Poplar Sideroad to the west).

5.2.4 High Street & Poplar Sideroad – Background Development

It is noted that this study has assumed that the parcel of land abutting the subject lands to the southeast would be developed with a direct access to High Street. In the event that direct access is

not provided, and the abutting developments are directed to provide internal connections to one another so as to direct all traffic through the Charleston Homes access points, the intersection of High Street with Findlay Avenue will experience poor operating conditions and will likely require traffic signals to address such conditions. However, recognizing that this is a hypothetical scenario, traffic signals are not recommended at this point in time, rather the need for signals at this intersection should be reviewed in conjunction with future development plans for the noted parcel.

5.3 Turn Lane Requirements

Despite the acceptable levels of service at the site access intersections, the need for left and right turn lanes to serve the Charleston Home development has been reviewed in consideration of MTO warrants for exclusive left and right turn lanes at unsignalized intersections on a two-lane highway (Poplar Sideroad) and on a four-lane undivided highway (High Street, considering the proposed 4-laning in 2025). The analysis considers the 2035 total volumes given that they reflect the most critical conditions.

MTO guidelines suggest that exclusive right turn lanes be considered where right turn volumes exceed 60 vehicles per hour and impede the operations of through traffic. Based on the estimated volume of right turning traffic entering at the Poplar Sideroad access (in the order of 10 to 30 vehicles per hour), an exclusive right turn lane is not warranted. At the High Street access there are 120 southbound right turning vehicles during the PM peak hour. While these volumes satisfy the MTO warrant threshold, an exclusive right turn lane is not considered necessary given the proposed 4-lane cross-section on High Street and the anticipated excess capacity. The additional through capacity will allow through vehicles to manoeuvre around right turning traffic with minimal impedance. As such, exclusive right turn lanes are not required to at the site access points.

With respect to left turn lanes on two-lane highways (Poplar Sideroad), the needs are based on the volume of left turn traffic, the volume of advancing and opposing traffic and the design speed (80 km/h). A review of the 2035 total volumes indicates that a left turn lane is not warranted on Poplar Sideroad at the site access.

On a four-lane undivided highway, the need for a left turn lane is based solely on left turning volumes and opposing volumes. In 2035, a left turn lane with 15 metres of storage is warranted at the High Street access based on the projected total volumes. However, the PM peak hour left turn volume is estimated at only 45 vehicles, which translates to less than 1 left turn a minute, or 3 left turns every 4 minutes (which is not considered significant). In considering the proposed four-laning of High Street and the resulting excess capacity, and the relatively low volume of left turns accessing the site under peak hour operations, the provision of an exclusive northbound left turn lane on High Street at the site access is not considered necessary. Furthermore, the provision of upstream traffic signals at the intersection of Campbell Street and High Street will provide additional gaps in the traffic flow to further facilitate the northbound left turn movement.

While exclusive right and left turn lanes are not considered necessary given the proposed 4-laning of High Street, further consideration was given to the need for such should the widening of High Street be delayed beyond the study horizon period or postponed indefinitely. In the absence of the proposed widening, the volumes at the High Street access will warrant a southbound exclusive right turn lane and a northbound exclusive left turn lane. In considering MTO geometric design standards, a right turn lane for a design speed of 70 km/h requires a 60 metre taper and a 45 metre parallel lane. However, when considering Town standards for right turn lanes (including at the adjacent Mountaincroft subdivision and along Highway 26), a right turn lane consisting solely of a 60 metre taper would be sufficient. With respect to the northbound left turn lane, the volumes on High Street warrant a 15 metre storage length, whereas the design standards for a 70 km/h design speed require a 115 metre taper and a 40 metre parallel lane. It is noted that a southbound left turn lane to serve Findlay Drive is also warranted based on the projected volumes and would nonetheless be recommended in order to ensure lane balance through the intersection. In consideration of the assumed development staging and progress (eg. 50% complete by 2020), both the northbound left turn lane and southbound right turn taper should be constructed by 2020, if the widening of High Street is not implemented.

5.4 Sight Line Analysis

Based on the County of Simcoe Entrance By-law, which regulates entrances onto County roads, the minimum sight distance for a road with a speed of 50 km/h is 135 metres, whereas for a road with a speed limit of 60 km/h the minimum sight distance is 170 metres. In comparison, the MTO guidelines dictate minimum stopping sight distances of 85, 110 and 135 metres for design speeds of 60, 70 and 80 km/h. The MTO requirements provide a sufficient distance for an approaching motorist to observe a stationary hazard in the road (i.e. a vehicle stopped on the adjacent road waiting to access the site) and bring their vehicle to a complete stop prior to the hazard. The County requirements provide additional sight distance to provide for manoeuvres other than stopping (i.e. simply reducing the approach speed to avoid a collision).

At the proposed access location on High Street, the sight lines to the north are in excess of 200 metres (the Campbell Street intersection is visible at 280 metres), whereas the sight lines to the south are in excess of 400 metres (the roundabout at Poplar Sideroad is visible at 475 metres). The available sight lines at the proposed High Street access satisfy both the County's and MTO minimum sight distance requirements. No improvements are required to address the sight lines at the High Street access.

At the proposed access on Poplar Sideroad, the sight lines to/from the east are in excess of 400 metres and thus satisfy the County's minimum sight distance. The sight lines to/from the west are approximately 90 metres, limited by a vertical sag curve. While the 90 metre sight line does not satisfy the County's minimum sight distance for a road with a posted speed limit of 60 km/h, it does satisfy the MTO minimum stopping distance for a design speed of approximately 65 km/h (following consideration for the reduction in stopping distance due to the 7% uphill grade). In this regard, motorists travelling at the posted speed limit will have sufficient space to bring their vehicle to a stop and avoid any conflicts.

While the sight lines to/from the west are restricted beyond 90 metres from the Poplar Sideroad access, vehicles entering/exiting the site are in fact visible from the 10th Line intersection, at a distance of approximately 400 metres. Proceeding eastbound, the sight line becomes restricted at 265 metres west of the access due to the vertical alignment, and then is re-established at 90 metres west of the access. No improvements are considered necessary to address sight lines.

6 Summary

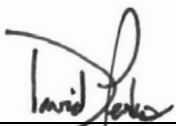
This study has addressed the transportation impacts associated with the proposed Charleston Homes residential development, to be located on the northwest corner of the intersection of High Street with Poplar Sideroad within the Town of Collingwood. The development will consist of 281 single family detached units and 86 townhouse units. Upon full build-out, the development is expected to generate 268 trips in the AM peak hour and 348 trips in the PM peak hour.

In addressing the study area operations, the key intersections were analysed under existing conditions (2015) and for the 2020, 2025, 2030 and 2035 horizon periods. The results of the operational analysis indicate that the intersections will provide acceptable overall conditions through 2035 under both future background and future total conditions. Despite the acceptable operations, an eastbound right turn lane at the intersection of Poplar Sideroad with Hurontario Street is recommended in 2035 under background conditions (i.e. prior to consideration for the subject development) given the high volume of right turning vehicles and elevated volume to capacity ratio. The capacity of the study area road network was also reviewed under both background and future traffic conditions. All road sections are expected to operate at 84% or less of their respective capacities ($v/c \leq 0.84$). As such, no improvements to the road network are considered necessary to accommodate the future background or total volumes (notwithstanding the planned improvements to High Street and its intersection with Campbell Street).

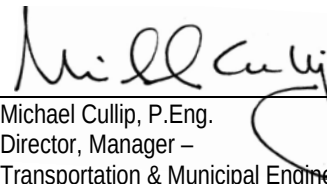
The need for exclusive right and left turn lanes at the site access points was reviewed in consideration of MTO warrants for exclusive left and right turn lanes. The volume of right turning and left turning vehicles entering the site at the Poplar Sideroad access do not warrant the provision of exclusive turn lanes. While the volumes at the High Street access do warrant exclusive turn lanes based on the MTO warrants, such are not considered necessary given the proposed widening of High Street to a 4-lane profile and the additional capacity that such improvements will provide. However, in the absence of the proposed widening, a 60 metre right turn taper and a northbound exclusive left turn lane with 15 metres of storage are recommended at the High Street access to accommodate the site volumes until such a time that High Street is widened to four lanes. These should be constructed for the year 2020.

Sight lines on High Street and Poplar Sideroad were reviewed at the proposed access locations. The available sight distances to the north and south on High Street satisfy the County of Simcoe and MTO minimum sight distance requirements in consideration of the 50 km/h posted speed (and associated 70 km/h design speed). As such, no improvements are required to address the sight lines at the High Street access. At the Poplar Sideroad access, sight lines to/from the east also satisfy the County of Simcoe and MTO requirements, reflective of the posted 60 km/h speed limit (and assumed 80 km/h design speed). However, sight distances to/from the west are limited to 90 metres by a vertical sag curve along the road. While this does not satisfy the County requirements, it is noted that they exceed the minimum requirements of the MTO. The minimum stopping sight distance for a 60 km/h design

speed (which corresponds to the posted speed limit) is 80 metres after consideration for the uphill grade through the vertical curve which assists with vehicle stopping. As the available sight distance exceeds this (it corresponds to a design speed of 65 km/h), vehicles travelling at the posted speed will be in a position to observe vehicles entering/exiting the site and react accordingly. No improvements are considered necessary to address sight lines.



Authorized by: David Perks
Transportation Planner

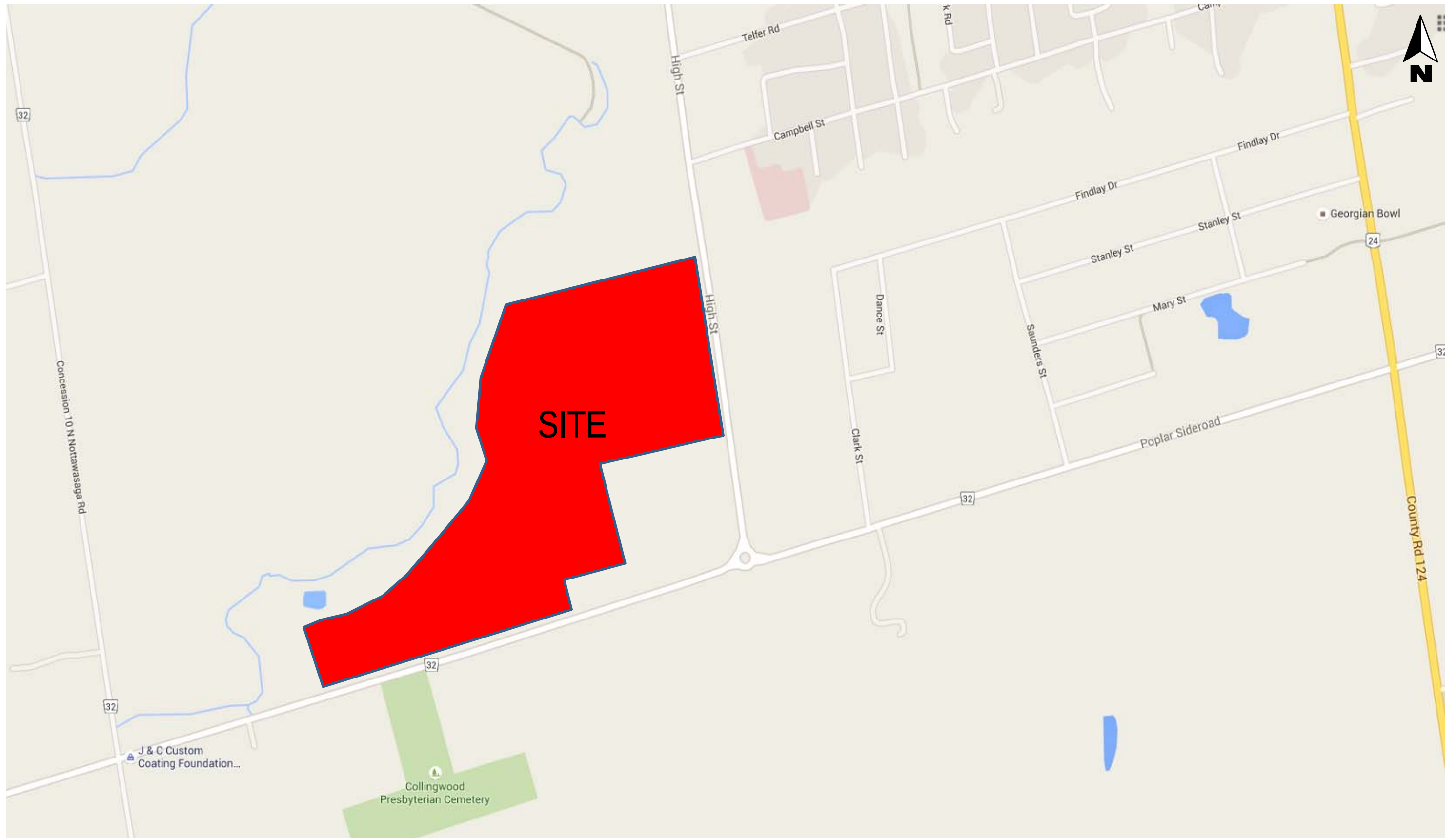


Reviewed by: Michael Cullip, P.Eng.
Director, Manager –
Transportation & Municipal Engineering

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Campbell Street & High Street - Aerial



Looking north along High Street from Campbell Street



Looking south along High Street from Campbell Street



Looking east along Campbell Street from High Street



Looking west towards High Street from Campbell Street



High Street & Poplar Sideroad – Aerial



Looking north along High Street from roundabout



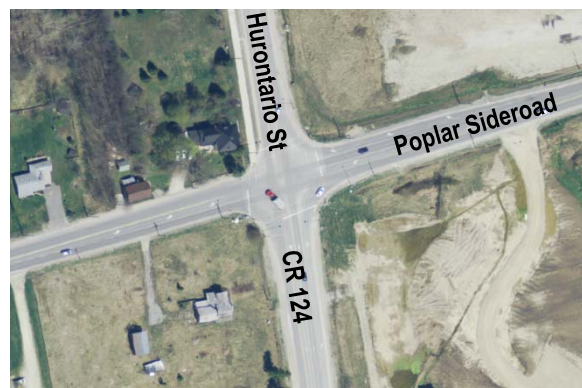
Looking south along High Street towards roundabout



Looking east along Poplar Sideroad towards roundabout



Looking west along Poplar Sideroad towards roundabout



Poplar Sideroad & Hurontario Street - Aerial



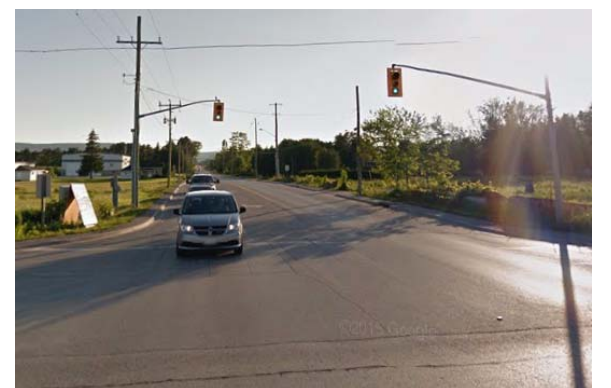
Looking north along Hurontario Street from Poplar Sideroad



Looking south along County Road 124 from Poplar Sideroad



Looking east along Poplar Sideroad from Hurontario Street



Looking west along Poplar Sideroad from Hurontario Street



Looking north along High Street from Street A /Findlay Drive



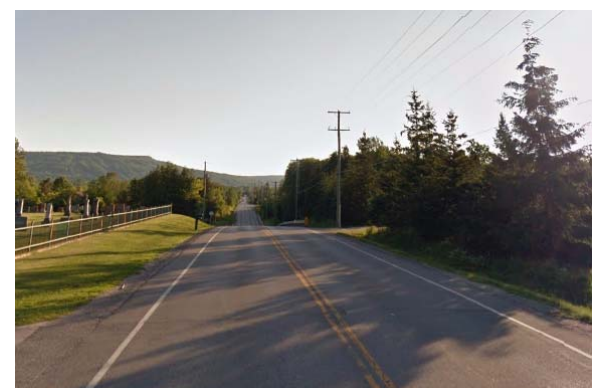
Looking south along High Street from Street A /Findlay Drive



Looking east towards future Findlay Dr. extension from High St.

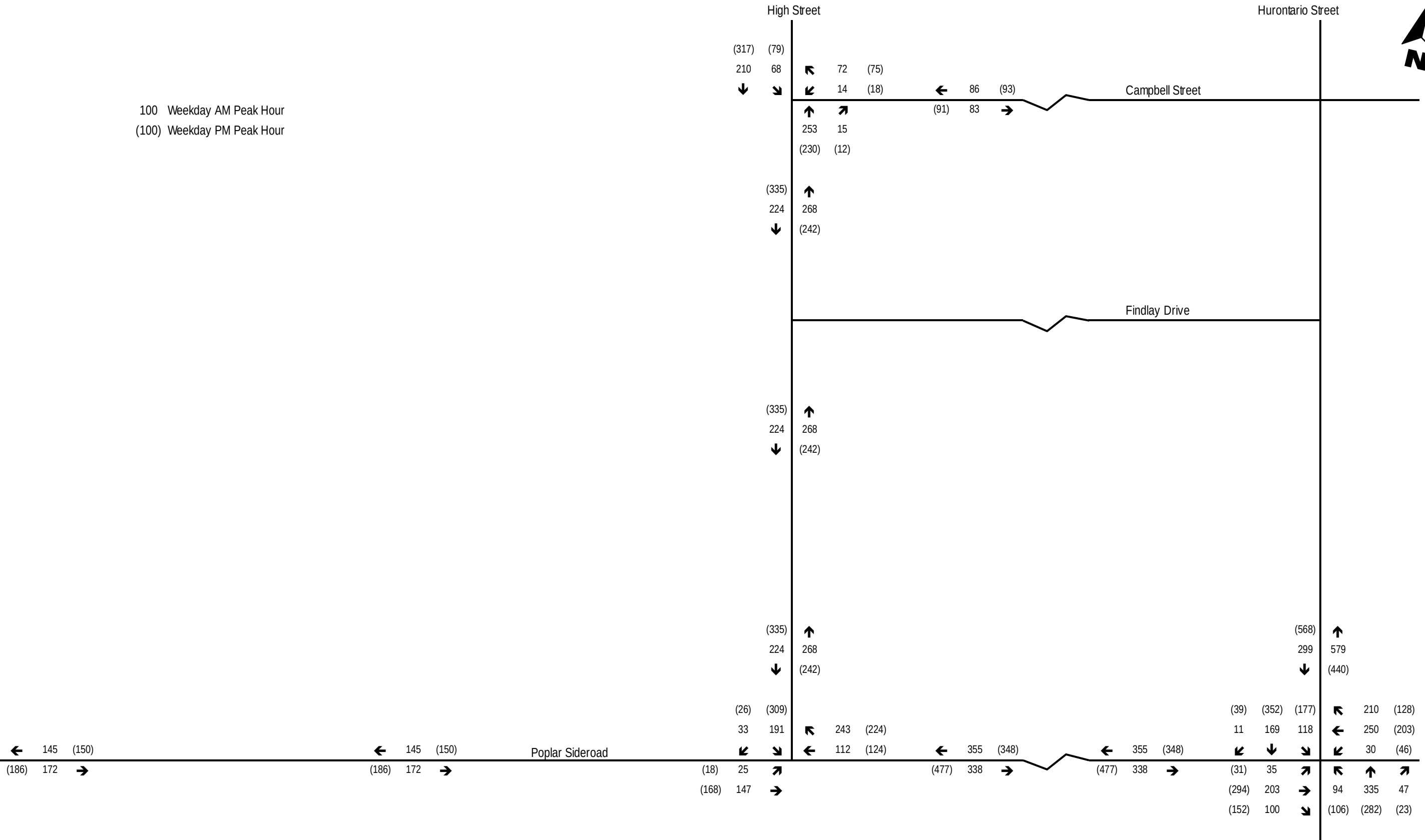


Looking east along Poplar Sideroad from Street B

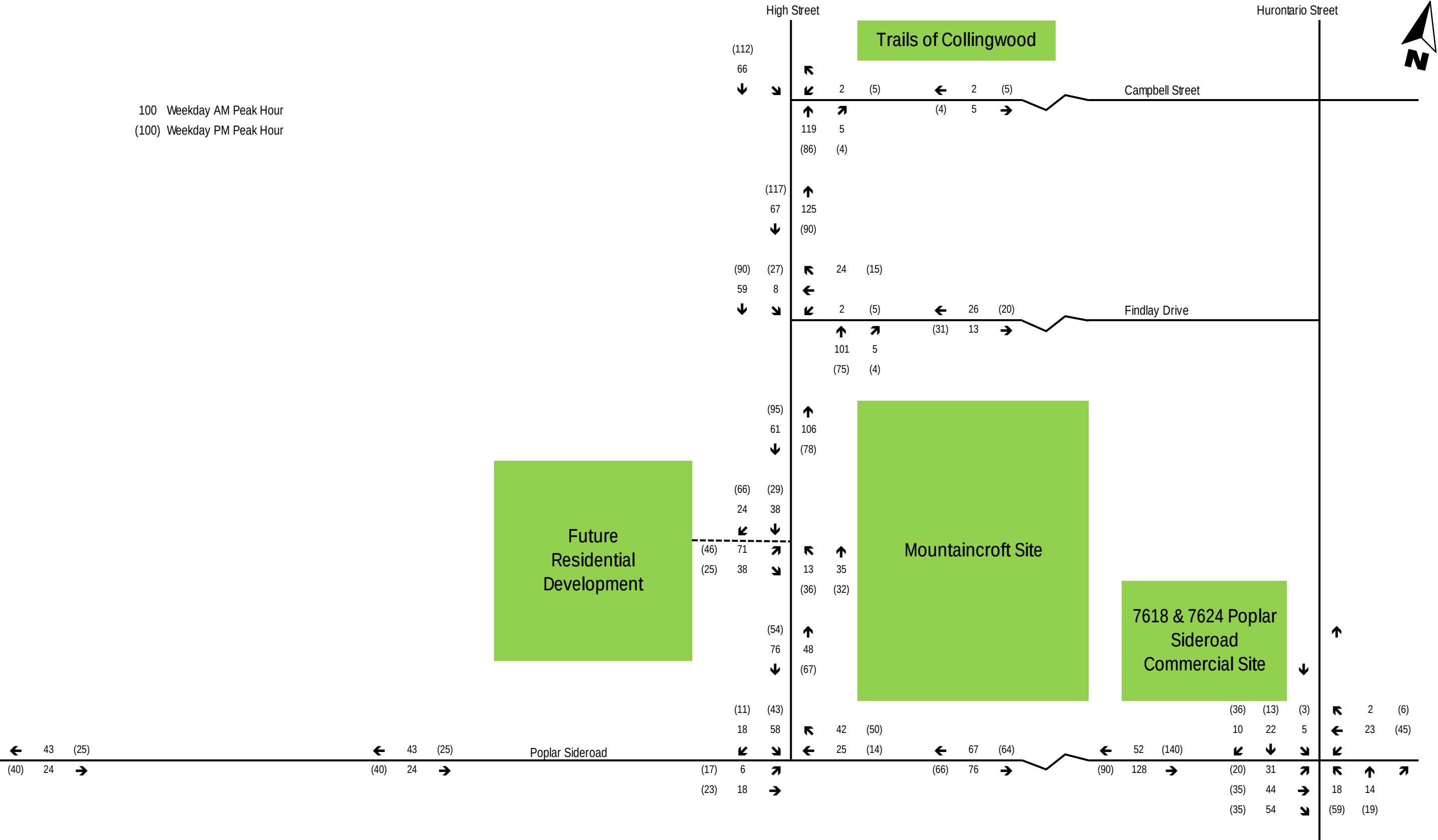


Looking west along Poplar Sideroad from Street B

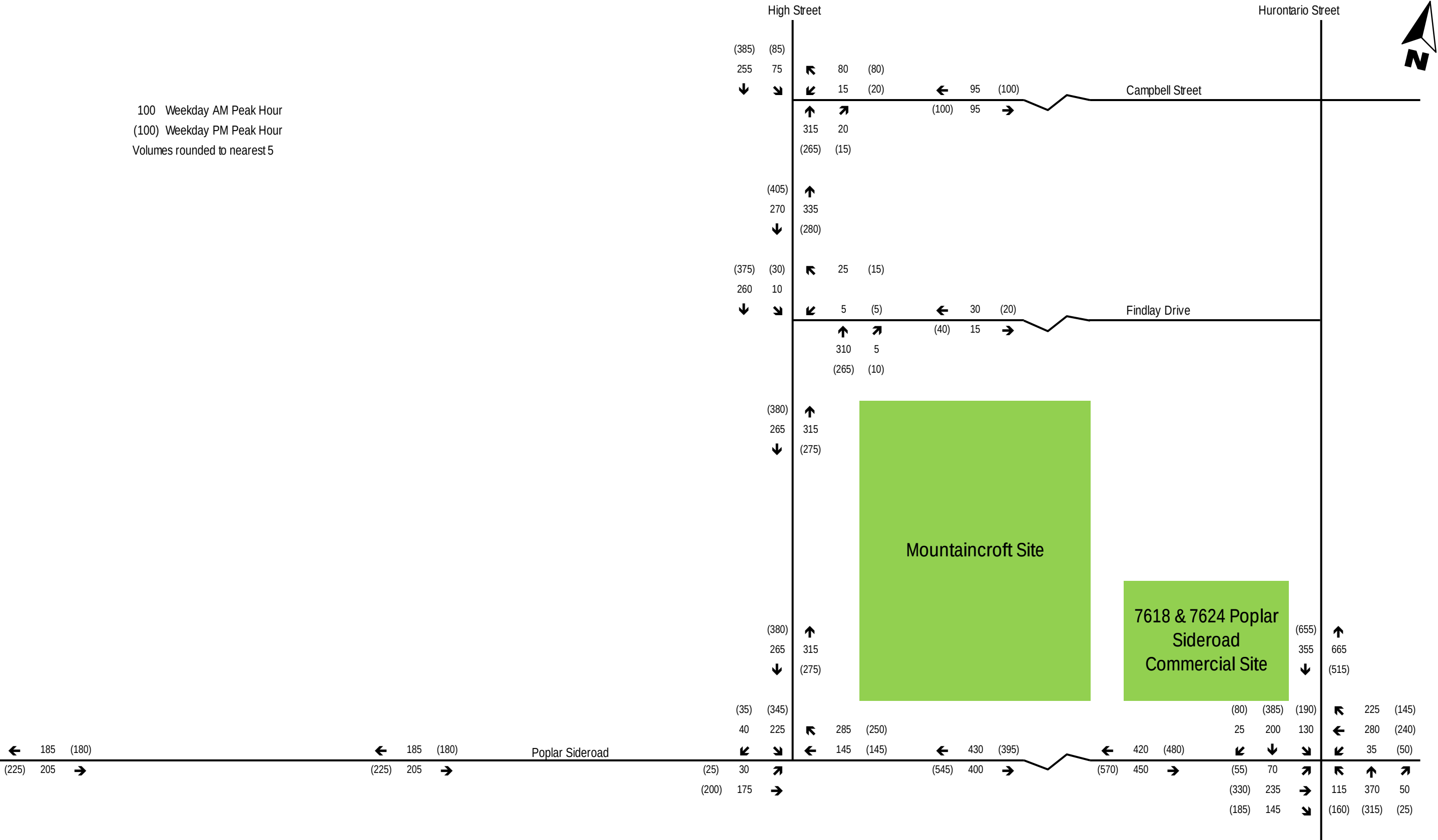
100 Weekday AM Peak Hour
(100) Weekday PM Peak Hour



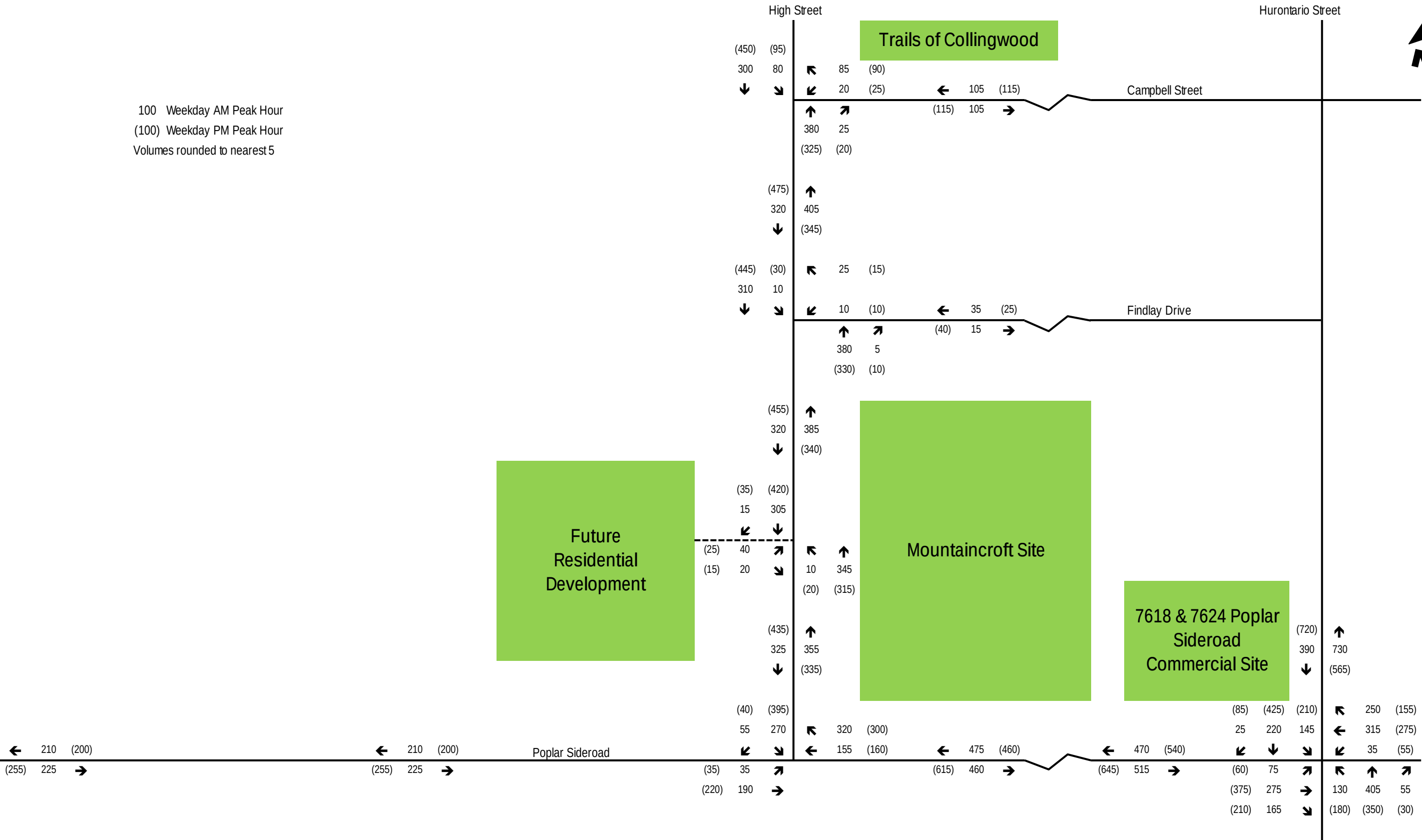
100 Weekday AM Peak Hour
(100) Weekday PM Peak Hour



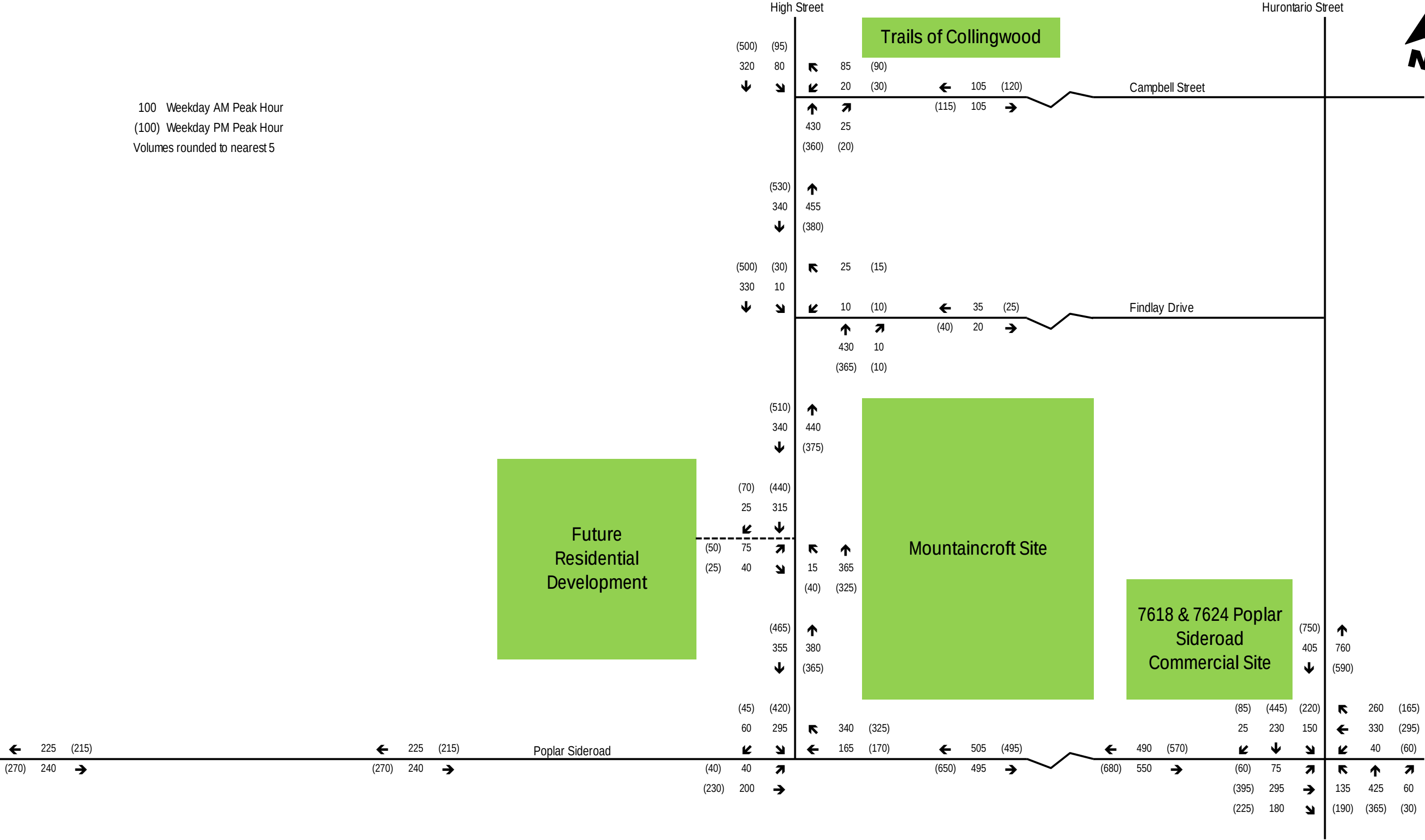
100 Weekday AM Peak Hour
(100) Weekday PM Peak Hour
Volumes rounded to nearest 5

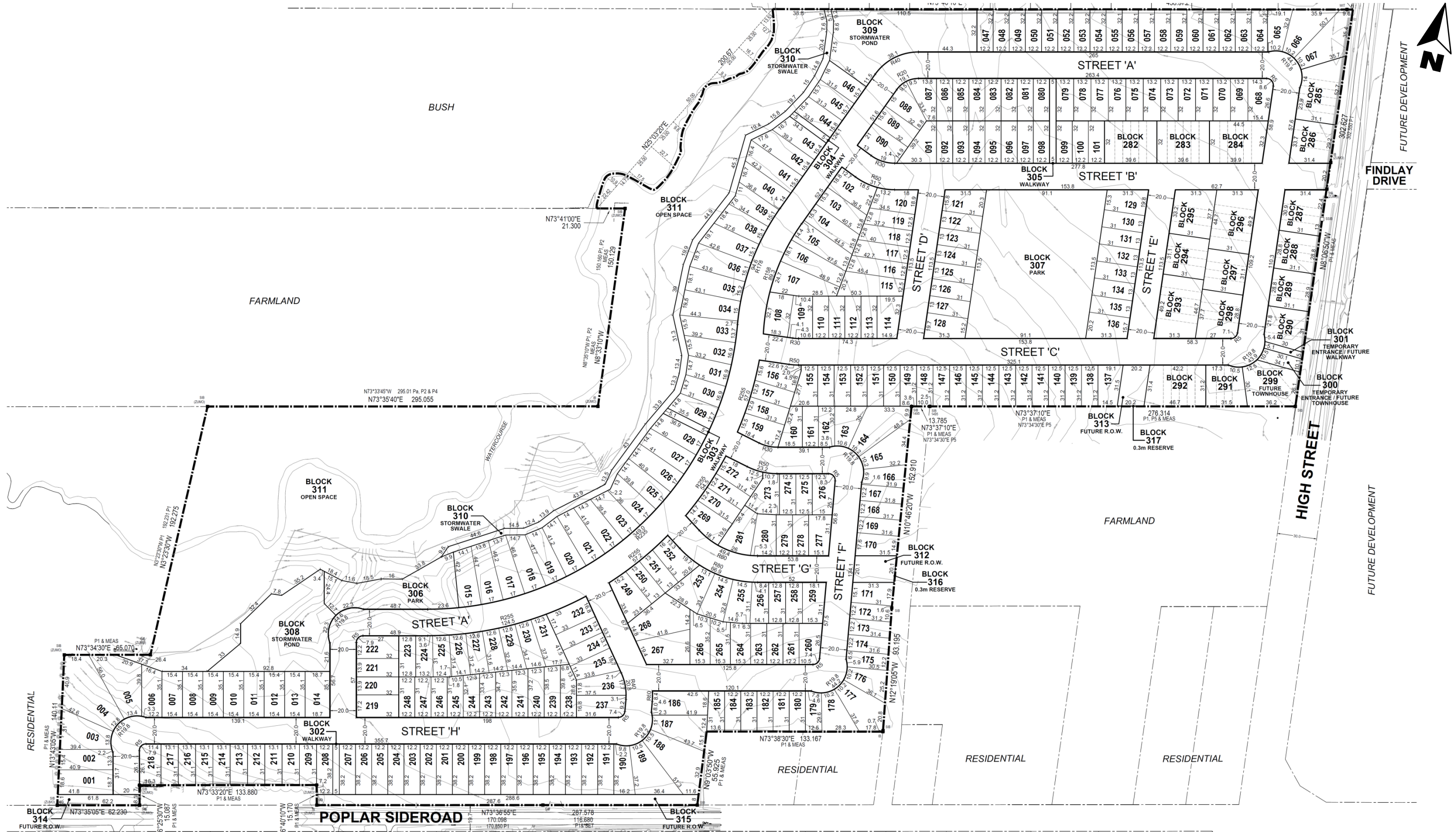


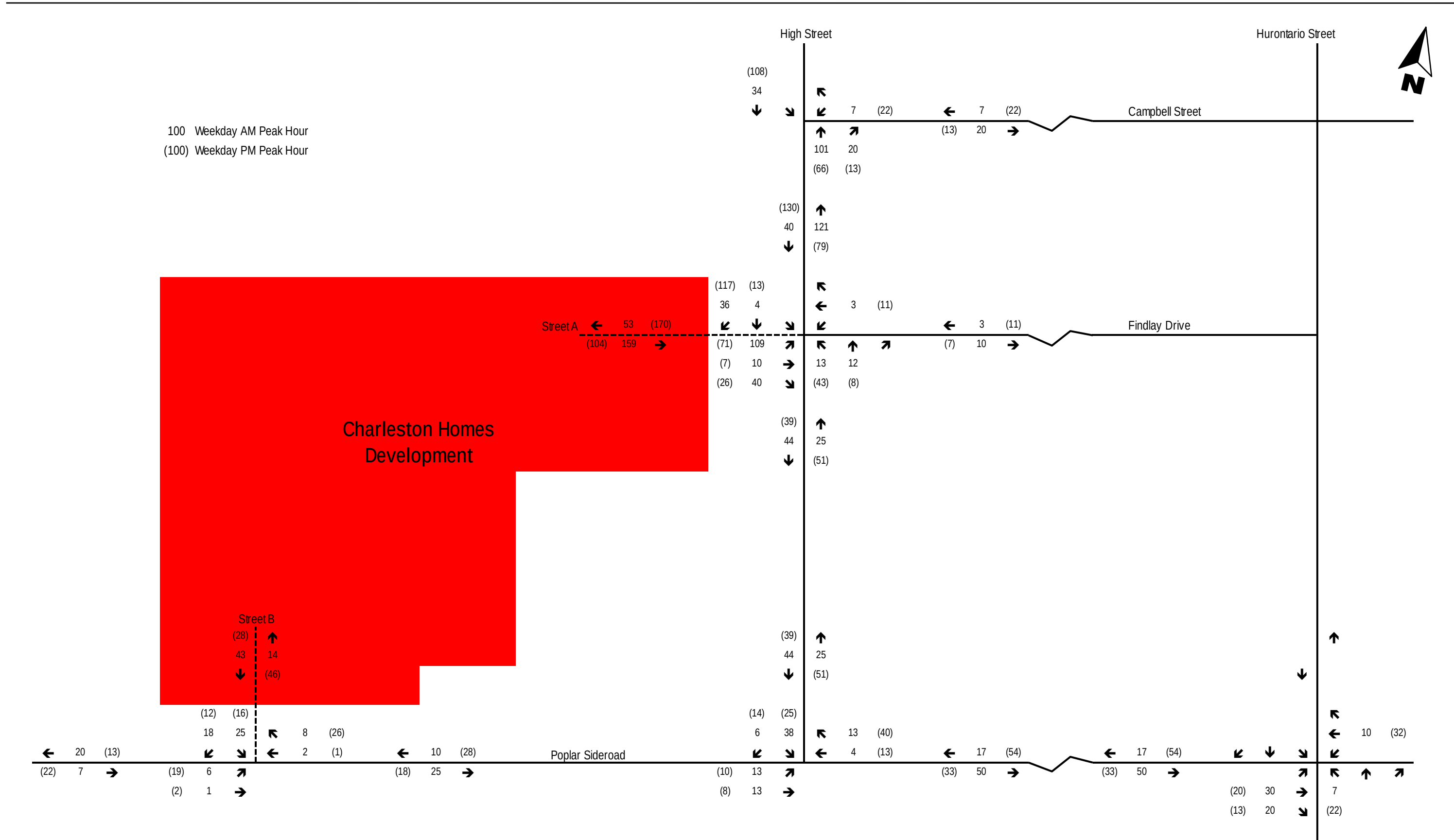
100 Weekday AM Peak Hour
(100) Weekday PM Peak Hour
Volumes rounded to nearest 5



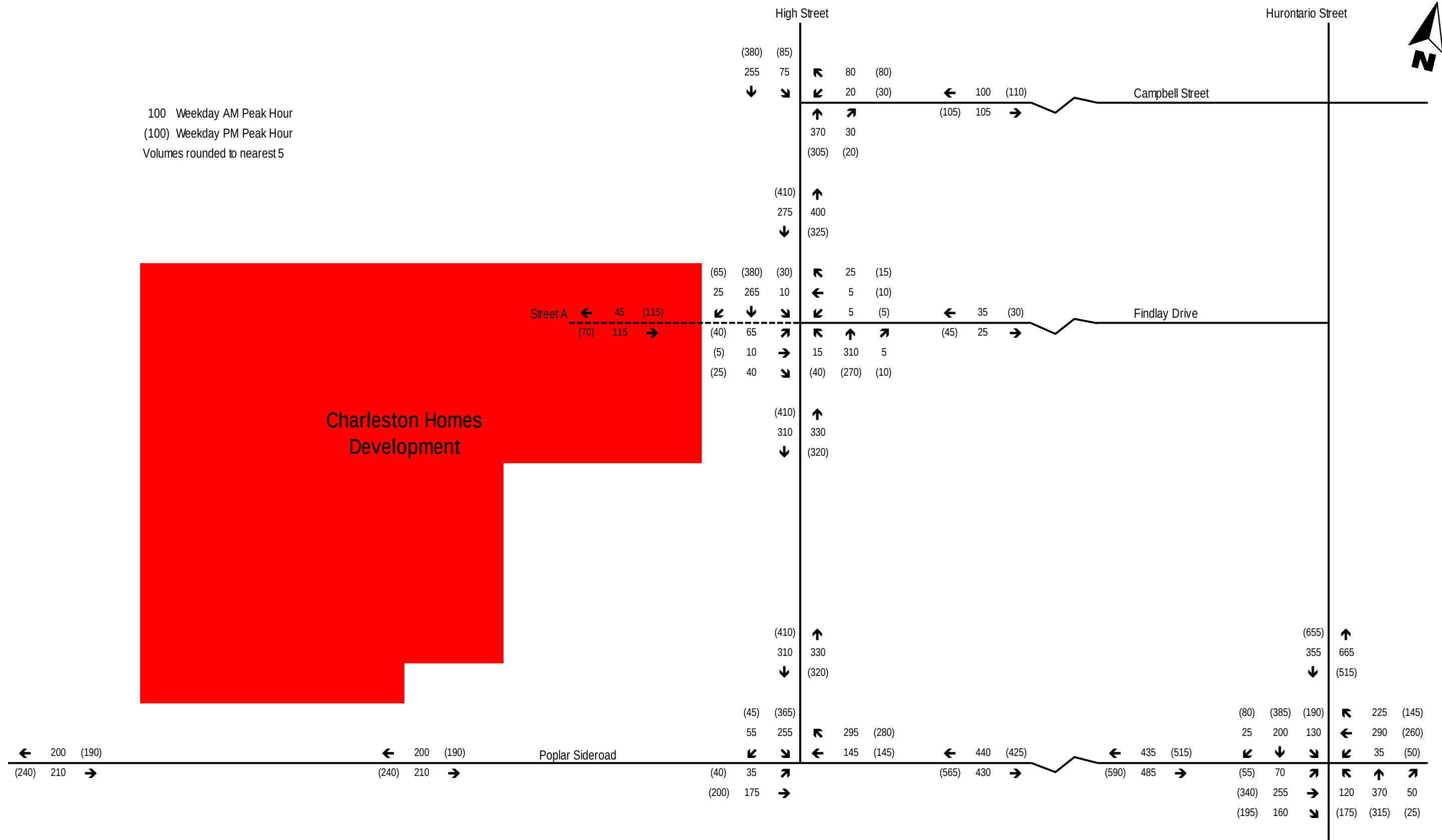
100 Weekday AM Peak Hour
(100) Weekday PM Peak Hour
Volumes rounded to nearest 5



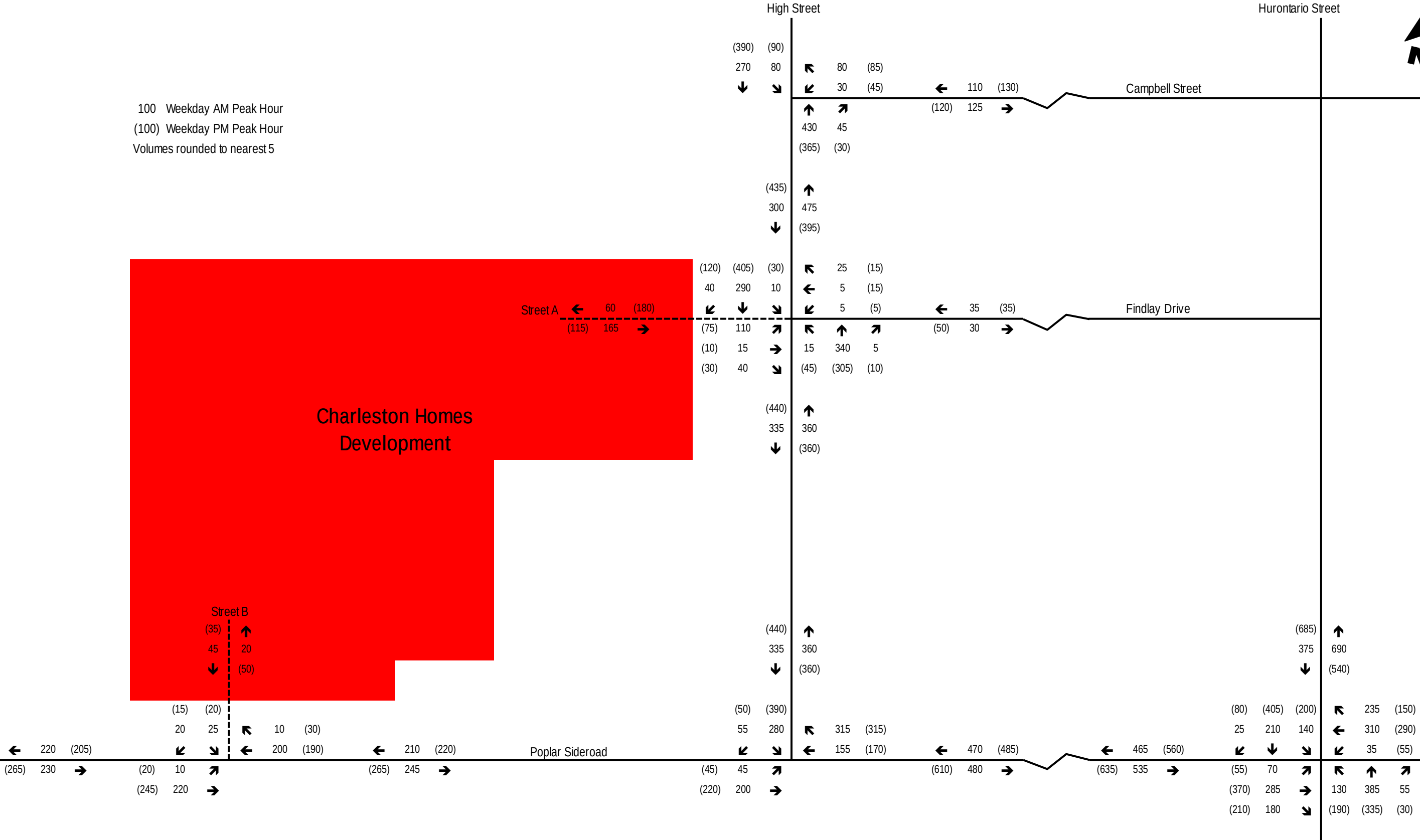




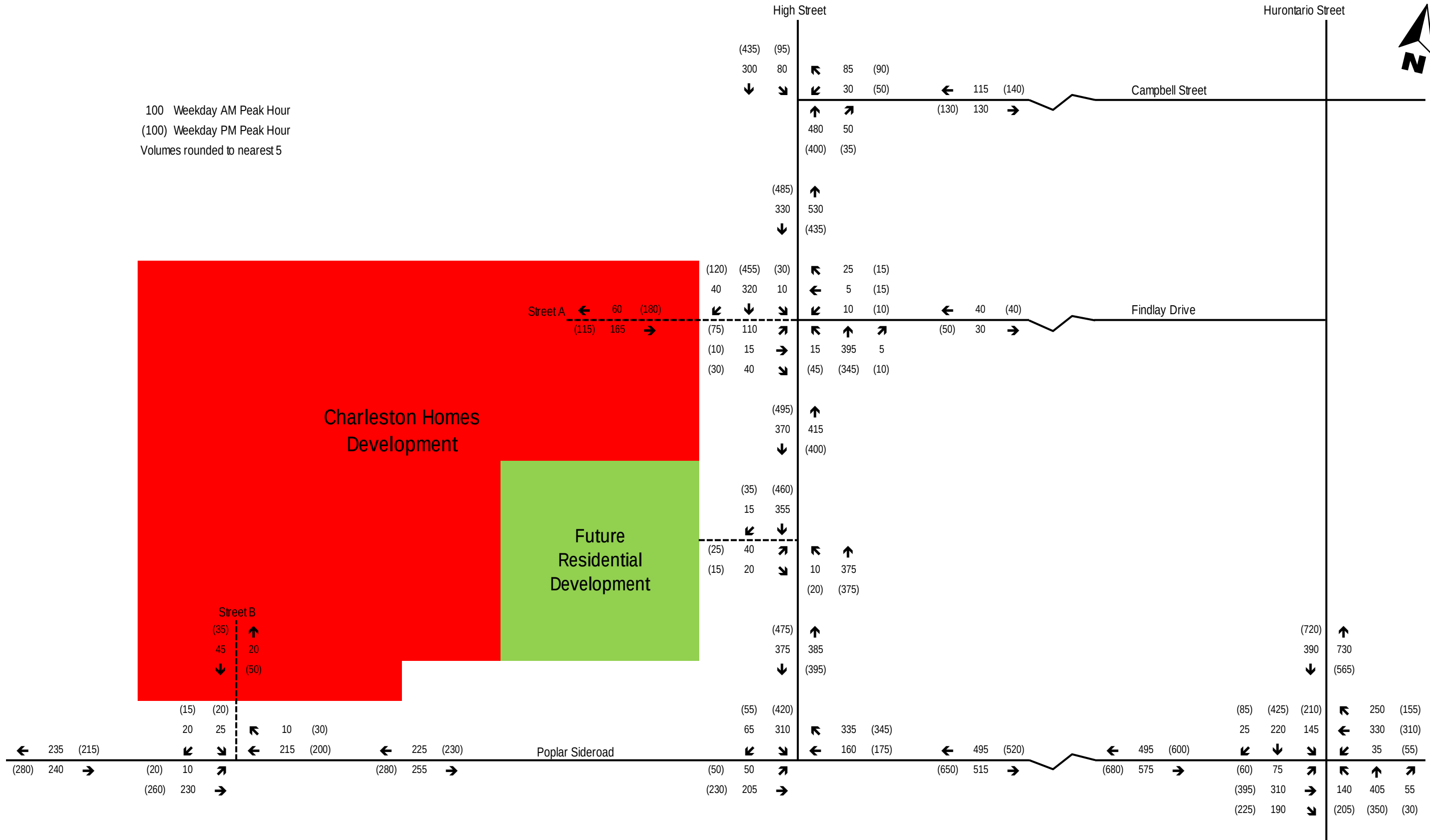
100 Weekday AM Peak Hour
(100) Weekday PM Peak Hour
Volumes rounded to nearest 5



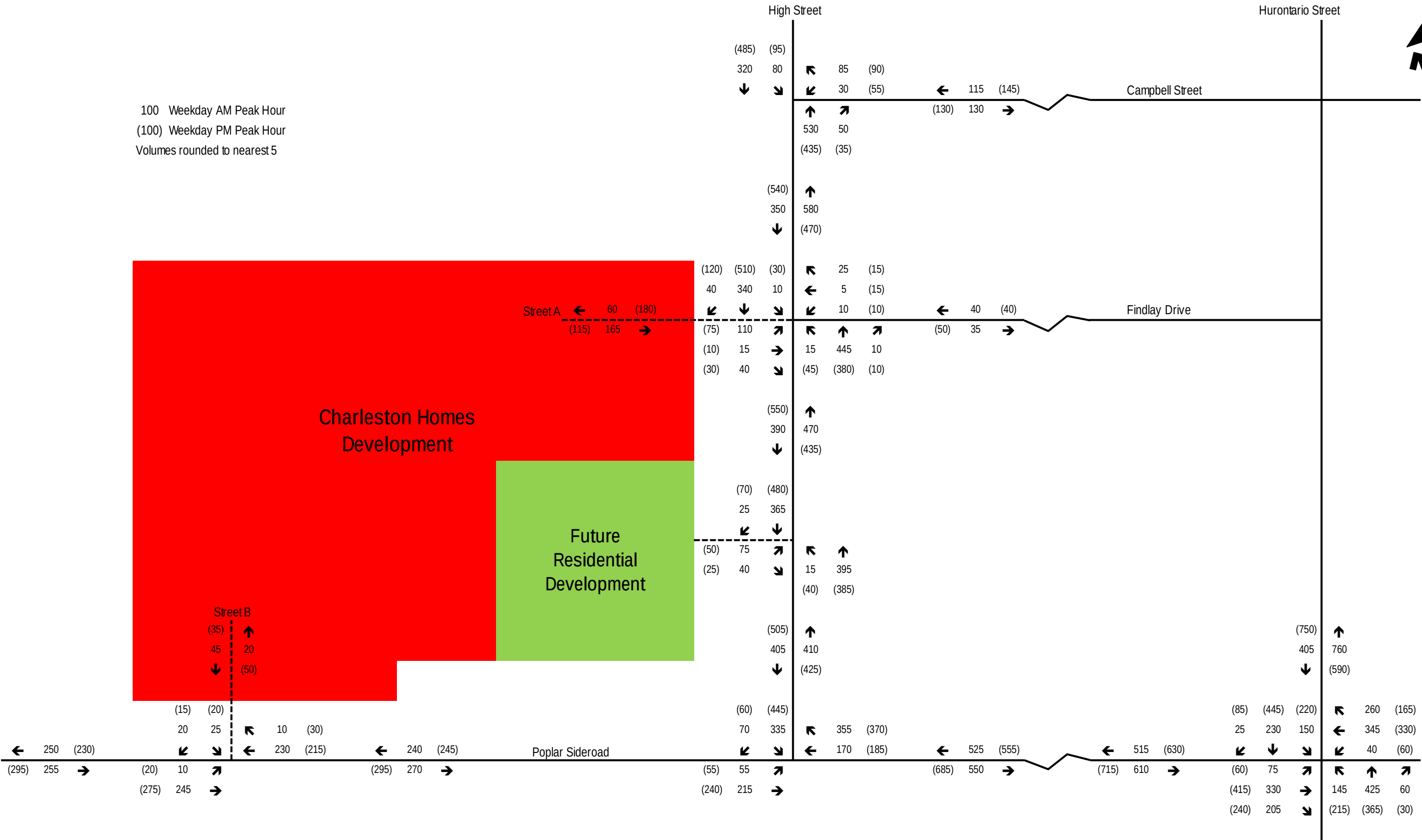
100 Weekday AM Peak Hour
(100) Weekday PM Peak Hour
Volumes rounded to nearest 5



100 Weekday AM Peak Hour
(100) Weekday PM Peak Hour
Volumes rounded to nearest 5



100 Weekday AM Peak Hour
(100) Weekday PM Peak Hour
Volumes rounded to nearest 5



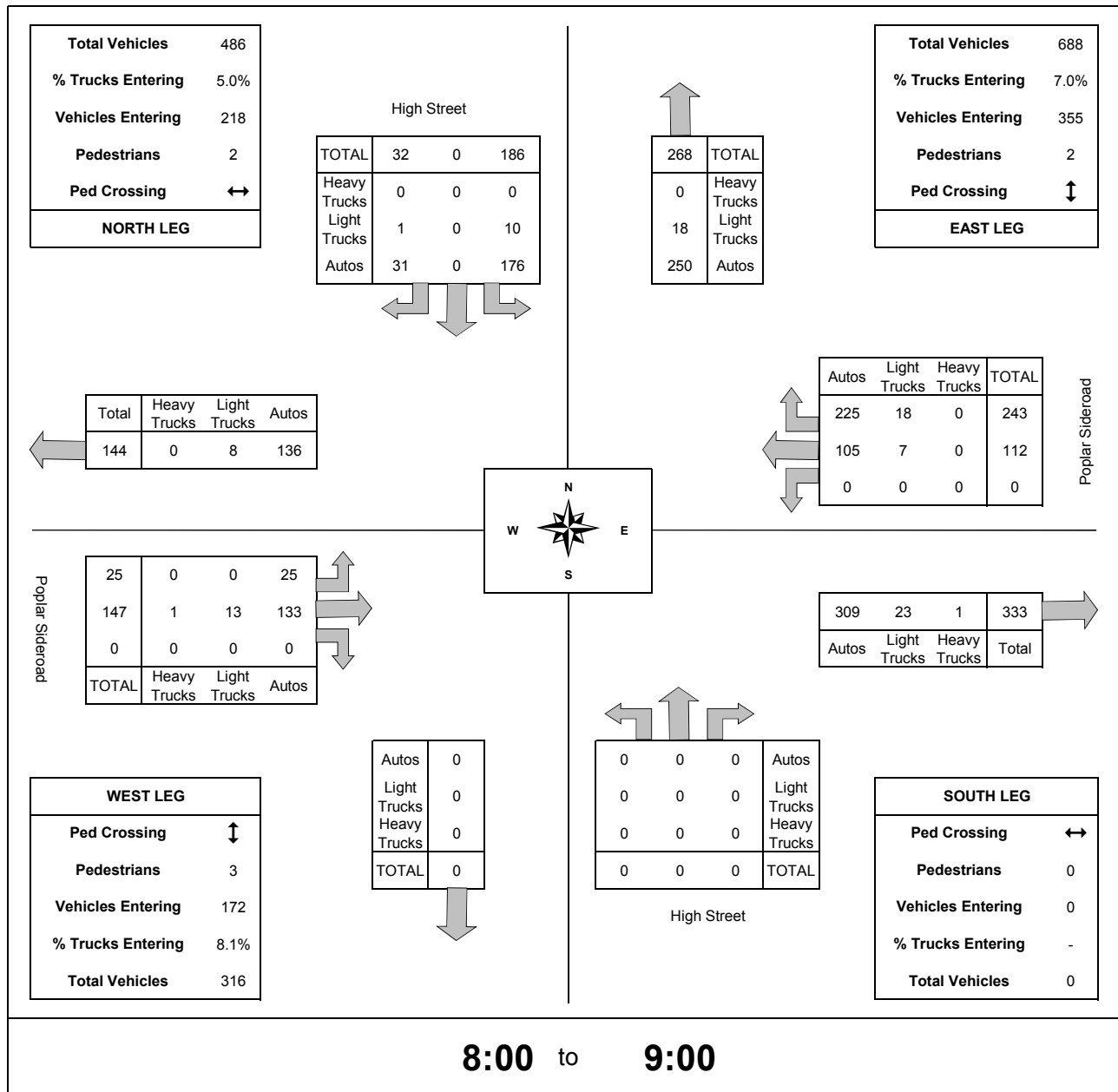
APPENDIX A: TRAFFIC COUNTS

INTERSECTION COUNT AM PEAK HOUR

GENERAL INFORMATION

Surveyor Name	Grant Beeler	Jurisdiction/Date	Town of Collingwood 4-Nov-2015
Weather Conditions	Sunny, +11C	Major Street	Poplar Sideroad E-W
Project Name	Charleston Homes	Minor Street	High Street N-S
Project Number	114056	Intersection Control	roundabout / traffic circle

Additional Comments

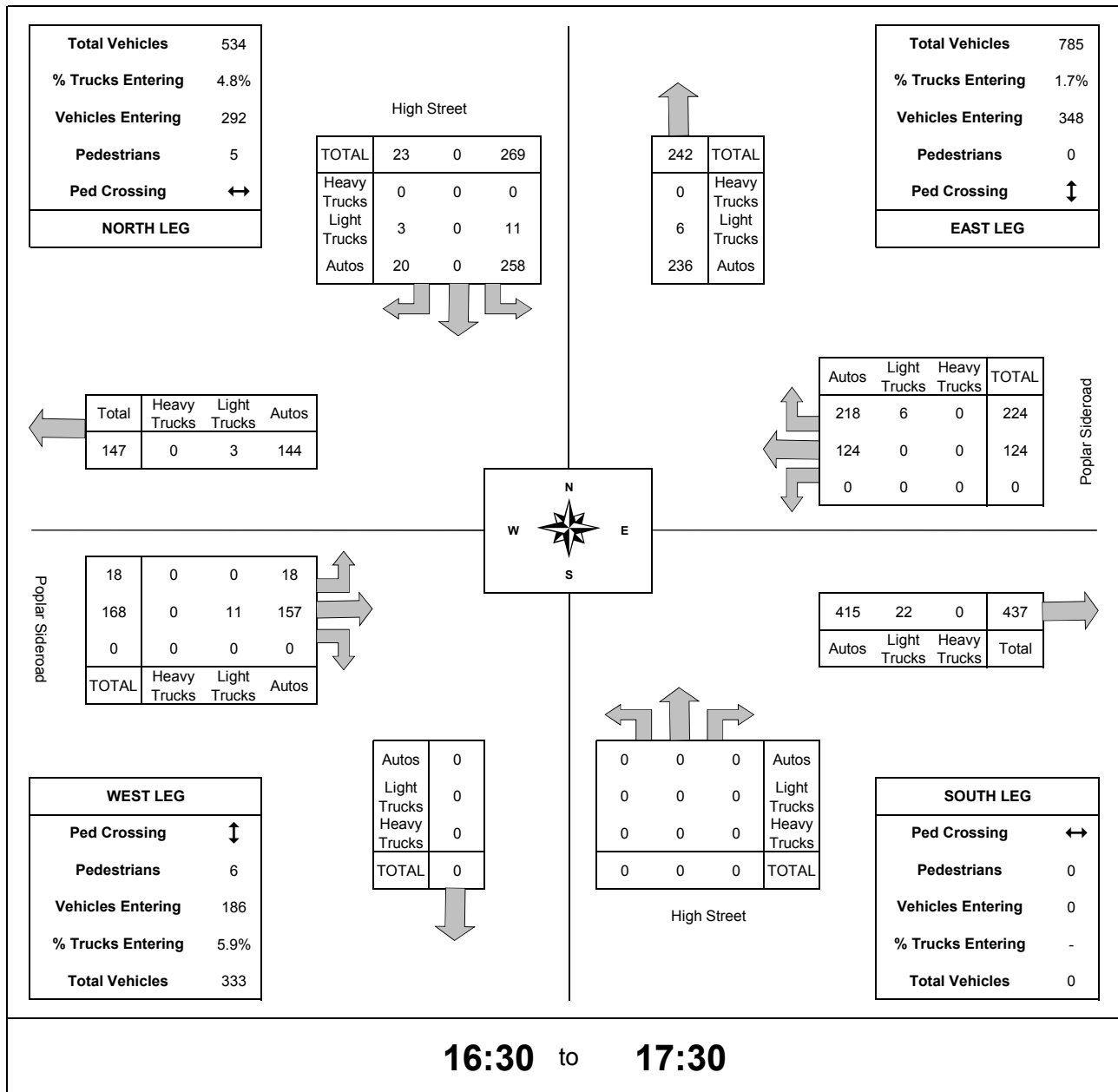


INTERSECTION COUNT PM PEAK HOUR

GENERAL INFORMATION

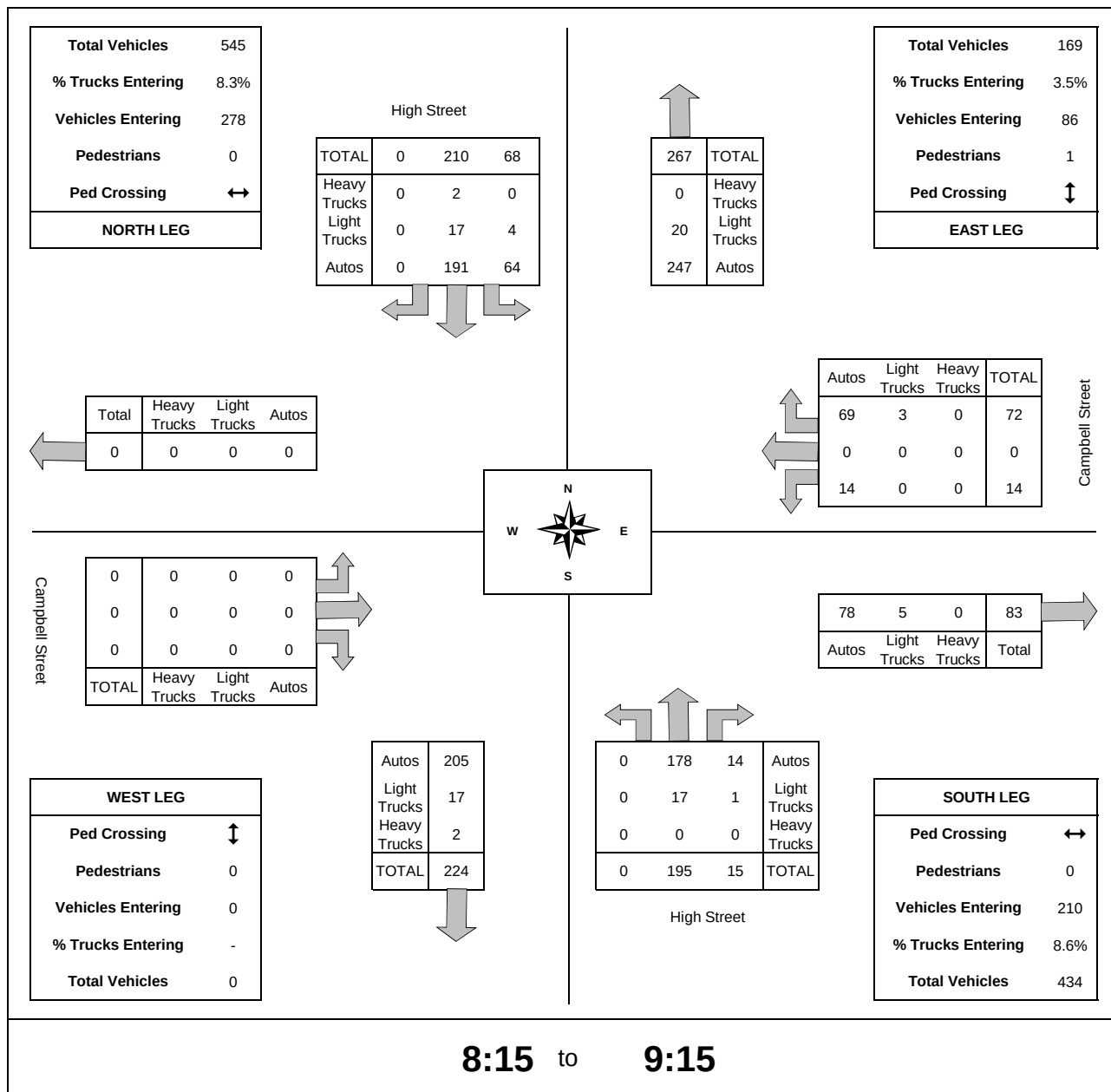
Surveyor Name	Grant Beeler	Jurisdiction/Date	Town of Collingwood 4-Nov-2015
Weather Conditions	Sunny, +11C	Major Street	Poplar Sideroad E-W
Project Name	Charleston Homes	Minor Street	High Street N-S
Project Number	114056	Intersection Control	roundabout / traffic circle

Additional Comments



INTERSECTION COUNT AM PEAK HOUR

GENERAL INFORMATION			
Surveyor Name	<u>Grant Beeler</u>	Jurisdiction/Date	<u>Town of Collingwood 13-Nov-2015</u>
Weather Conditions	<u>Rainy, +8C</u>	Major Street	<u>High Street N-S</u>
Project Name	<u>Charleston Homes</u>	Minor Street	<u>Campbell Street E-W</u>
Project Number	<u>114056</u>	Intersection Control	<u>other (specify) 3-way stop control</u>
Additional Comments			





C.C. Tatham & Associates Ltd.
Consulting Engineers

INTERSECTION COUNT PM PEAK HOUR

GENERAL INFORMATION

Surveyor Name	Grant Beeler	Jurisdiction/Date	Town of Collingwood	12-Nov-2015
Weather Conditions	Rainy, +8C	Major Street	High Street	N-S
Project Name	Charleston Homes	Minor Street	Campbell Street	E-W
Project Number	114056	Intersection Control	other (specify)	3-way stop control

Additional Comments

Total Vehicles	705
% Trucks Entering	2.9%
Vehicles Entering	408
Pedestrians	0
Ped Crossing	↔
NORTH LEG	

High Street				
TOTAL	0	325	83	
Heavy Trucks	0	1	0	
Light Trucks	0	7	4	
Autos	0	317	79	

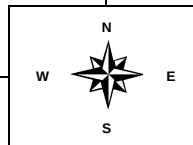
297	TOTAL
0	Heavy Trucks
6	Light Trucks
291	Autos

Total Vehicles	188
% Trucks Entering	1.1%
Vehicles Entering	93
Pedestrians	0
Ped Crossing	↑↓
EAST LEG	

Total	Heavy Trucks	Light Trucks	Autos
0	0	0	0

Autos	Light Trucks	Heavy Trucks	TOTAL
74	1	0	75
0	0	0	0
18	0	0	18

Campbell Street



0	0	0	0
0	0	0	0
0	0	0	0
TOTAL	Heavy Trucks	Light Trucks	Autos

Campbell Street

91	4	0	95
Autos	Light Trucks	Heavy Trucks	Total

WEST LEG	
Ped Crossing	↑↓
Pedestrians	0
Vehicles Entering	0
% Trucks Entering	-
Total Vehicles	0

Autos	335
Light Trucks	7
Heavy Trucks	1
TOTAL	343

0	217	12	Autos
0	5	0	Light Trucks
0	0	0	Heavy Trucks
0	222	12	TOTAL

High Street

SOUTH LEG	
Ped Crossing	↔
Pedestrians	0
Vehicles Entering	234
% Trucks Entering	2.1%
Total Vehicles	577

16:30 to 17:30

Ontario Traffic Inc.

Morning Peak Diagram

Specified Period

From: 6:00:00

To: 9:00:00

One Hour Peak

From: 8:00:00

To: 9:00:00

Municipality: Collingwood
Site #: 1301800048
Intersection: CR 124 & Poplar Side Rd
TFR File #: 9
Count date: 31-May-13

Weather conditions:

Person(s) who counted:

**** Signalized Intersection ****

Major Road: CR 124 runs N/S

North Leg Total: 861

North Entering: 293

North Peds: 0

Peds Cross: 0

Heavys	Trucks	Cars	Totals
0	1	10	11
0	7	159	166
0	15	101	116
0	23	270	



Heavys	Trucks	Cars	Totals
0	45	523	568

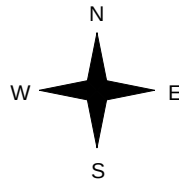
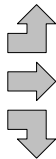
East Leg Total: 626
 East Entering: 342
 East Peds: 3
 Peds Cross: 0

Heavys	Trucks	Cars	Totals
0	19	191	210



Poplar Side Rd

Heavys	Trucks	Cars	Totals
0	3	31	34
0	11	111	122
0	7	91	98
0	21	233	



CR 124



Cars	Trucks	Heavys	Totals
187	19	0	206
99	8	0	107
21	8	0	29
307	35	0	



Poplar Side Rd



Cars	Trucks	Heavys	Totals
248	36	0	284

Peds Cross: 0
 West Peds: 3
 West Entering: 254
 West Leg Total: 464

Cars	Trucks	Heavys	Totals
271	22	0	293



Cars	Trucks	Heavys	Totals
82	10	0	92
305	23	0	328
36	10	0	46
423	43	0	

Peds Cross: 0
 South Peds: 0
 South Entering: 466
 South Leg Total: 759

Comments

Ontario Traffic Inc.

Mid-day Peak Diagram

Specified Period

From: 11:00:00

To: 13:00:00

One Hour Peak

From: 12:00:00

To: 13:00:00

Municipality: Collingwood
Site #: 1301800048
Intersection: CR 124 & Poplar Side Rd
TFR File #: 9
Count date: 31-May-13

Weather conditions:

Person(s) who counted:

**** Signalized Intersection ****

Major Road: CR 124 runs N/S

North Leg Total: 713
 North Entering: 333
 North Peds: 2
 Peds Cross: $\bowtie$

	Heavys	Trucks	Cars	Totals
North	0	0	0	0
East	1	9	4	14
South	23	218	78	319
West	24	227	82	



	Heavys	Trucks	Cars	Totals
North	0	11	369	380

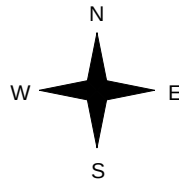
East Leg Total: 440
 East Entering: 211
 East Peds: 0
 Peds Cross: $\bowtie$

Heavys	Trucks	Cars	Totals
0	20	178	198



Poplar Side Rd

Heavys	Trucks	Cars	Totals
0	1	31	32
0	11	106	117
0	2	100	102
0	14	237	



CR 124

CR 124

Cars	Trucks	Heavys	Totals
95	4	0	99
78	12	0	90
21	1	0	22
194	17	0	

Poplar Side Rd



Cars	Trucks	Heavys	Totals
211	18	0	229

Peds Cross: $\bowtie$
 West Peds: 1
 West Entering: 251
 West Leg Total: 449

	Cars	Trucks	Heavys	Totals
West	339	12	0	351



	Cars	Trucks	Heavys	Totals
West	77	7	0	84
East	243	6	0	249
South	27	3	0	30
North	347	16	0	

Peds Cross: $\bowtie$
 South Peds: 0
 South Entering: 363
 South Leg Total: 714

Comments

Ontario Traffic Inc.

Afternoon Peak Diagram

Specified Period

From: 15:00:00

To: 18:00:00

One Hour Peak

From: 15:00:00

To: 16:00:00

Municipality: Collingwood

Site #: 1301800048

Intersection: CR 124 & Poplar Side Rd

TFR File #: 9

Count date: 31-May-13

Weather conditions:

Person(s) who counted:

**** Signalized Intersection ****

Major Road: CR 124 runs N/S

North Leg Total: 988

North Entering: 557

North Peds: 0

Peds Cross: $\nlessgtr$

Heavys	0	0	0	0
Trucks	3	23	17	43
Cars	35	322	157	514
Totals	38	345	174	



Heavys	0
Trucks	11
Cars	420
Totals	431

East Leg Total: 629

East Entering: 306

East Peds: 0

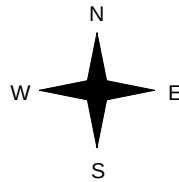
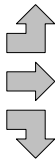
Peds Cross: $\nlessgtr$

Heavys	Trucks	Cars	Totals
0	16	262	278



Poplar Side Rd

Heavys	Trucks	Cars	Totals
0	1	29	30
0	6	120	126
0	10	139	149
0	17	288	



CR 124



Cars	Trucks	Heavys	Totals
120	5	0	125
133	3	0	136
40	5	0	45
293	13	0	



Poplar Side Rd



Cars	Trucks	Heavys	Totals
300	23	0	323

Peds Cross: $\nlessgtr$

West Peds: 4

West Entering: 305

West Leg Total: 583

Cars	501	Cars	94	271	23	388
Trucks	38	Trucks	10	5	0	15
Heavys	0	Heavys	0	0	0	0
Totals	539	Totals	104	276	23	



Peds Cross: $\nlessgtr$

South Peds: 0

South Entering: 403

South Leg Total: 942

Comments

Ontario Traffic Inc.

Total Count Diagram

Municipality: Collingwood
Site #: 1301800048
Intersection: CR 124 & Poplar Side Rd
TFR File #: 9
Count date: 31-May-13

Weather conditions:
Person(s) who counted:

**** Signalized Intersection ****

Major Road: CR 124 runs N/S

North Leg Total: 5458
 North Entering: 2681
 North Peds: 6
 Peds Cross: $\bowtie$

	Heavys	Trucks	Cars	Totals
North	0	0	0	0
East	5	55	54	114
South	139	1701	727	2567
West	144	1756	781	

Heavys 0
 Trucks 101
 Cars 2676
 Totals 2777

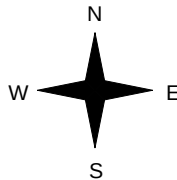
East Leg Total: 3847
 East Entering: 1939
 East Peds: 5
 Peds Cross: $\bowtie$

Heavys	Trucks	Cars	Totals
0	108	1606	1714



Poplar Side Rd

Heavys	Trucks	Cars	Totals
0	7	170	177
0	44	829	873
0	53	701	754
0	104	1700	



CR 124

Cars	Trucks	Heavys	Totals
804	45	0	849
815	47	0	862
202	26	0	228
1821	118	0	

Poplar Side Rd



Cars	Trucks	Heavys	Totals
1780	128	0	1908

Peds Cross: $\bowtie$
 West Peds: 13
 West Entering: 1804
 West Leg Total: 3518

Cars	Trucks	Heavys	Totals
2604	134	0	2738



Cars	Trucks	Heavys	Totals
652	56	0	708
1702	49	0	1751
224	30	0	254
2578	135	0	

Peds Cross: $\bowtie$
 South Peds: 5
 South Entering: 2713
 South Leg Total: 5451

Comments

County of Simcoe

County Road 32 - Spring 2015
Poplar Sideroad to
County Road 124

Transportation and Engineering Department
Midhurst, Ontario
(705)-726-9300

Site Code: 032 03

Poplar Sideroad
County Road 124

Start Time	11-May-15		Tue		Wed		Thu		Fri		Sat		Sun		Week Average	
	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
12:00 AM	4	2	0	2	3	7	4	4	*	*	*	*	*	*	3	4
01:00	3	2	1	4	1	1	1	2	*	*	*	*	*	*	2	2
02:00	1	1	4	1	2	2	3	3	*	*	*	*	*	*	2	2
03:00	0	1	1	1	1	0	0	0	*	*	*	*	*	*	0	0
04:00	1	1	0	2	0	3	1	1	*	*	*	*	*	*	0	2
05:00	8	2	8	7	10	4	5	6	*	*	*	*	*	*	8	5
06:00	20	25	13	27	19	29	24	31	*	*	*	*	*	*	19	28
07:00	42	66	41	71	42	74	45	66	*	*	*	*	*	*	42	69
08:00	134	101	127	109	132	91	127	103	*	*	*	*	*	*	130	101
09:00	93	107	69	86	83	92	79	94	*	*	*	*	*	*	81	95
10:00	83	96	74	74	75	85	72	78	*	*	*	*	*	*	76	83
11:00	67	70	66	70	65	61	71	79	*	*	*	*	*	*	67	70
12:00 PM	70	78	58	71	66	79	66	88	*	*	*	*	*	*	65	79
01:00	77	81	79	80	73	91	85	102	*	*	*	*	*	*	78	88
02:00	82	85	81	82	66	95	99	96	*	*	*	*	*	*	82	90
03:00	104	84	90	78	93	111	100	95	*	*	*	*	*	*	97	92
04:00	105	94	102	98	98	109	100	94	*	*	*	*	*	*	101	99
05:00	111	100	100	104	111	114	127	110	*	*	*	*	*	*	112	107
06:00	57	71	66	80	82	69	58	81	*	*	*	*	*	*	66	75
07:00	37	45	48	46	43	50	58	68	*	*	*	*	*	*	46	52
08:00	33	27	25	24	40	40	46	65	*	*	*	*	*	*	36	39
09:00	15	26	20	32	25	37	44	48	*	*	*	*	*	*	26	36
10:00	10	16	9	20	14	19	18	21	*	*	*	*	*	*	13	19
11:00	8	11	5	11	8	10	13	15	*	*	*	*	*	*	8	12
Lane	1165	1192	1087	1180	1152	1273	1246	1350	0	0	0	0	0	0	1160	1249
Day	2357		2267		2425		2596		0		0		0		2409	
AM Peak	08:00	09:00	08:00	08:00	08:00	09:00	08:00	08:00	-	-	-	-	-	-	08:00	08:00
Vol.	134	107	127	109	132	92	127	103	-	-	-	-	-	-	130	101
PM Peak	17:00	17:00	16:00	17:00	17:00	17:00	17:00	17:00	-	-	-	-	-	-	17:00	17:00
Vol.	111	100	102	104	111	114	127	110	-	-	-	-	-	-	112	107

Comb. Total	2357	2267	2425	2596	0	0	0	2409
ADT	ADT 2,411	AADT 2,411						

County of Simcoe

County Road 32 - Summer 2015
Poplar Sideroad to
County Road 124

Transportation and Engineering Department
Midhurst, Ontario
(705)-726-9300

Site Code: 032 03

Poplar Sideroad
County Road 124

Start Time	20-Jul-15		Tue		Wed		Thu		Fri		Sat		Sun		Week Average	
	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
12:00 AM	12	14	4	3	5	5	6	8	*	*	*	*	*	*	7	8
01:00	2	7	3	2	2	4	1	3	*	*	*	*	*	*	2	4
02:00	0	8	1	2	0	0	2	2	*	*	*	*	*	*	1	3
03:00	2	0	1	1	1	0	2	1	*	*	*	*	*	*	2	0
04:00	5	4	3	1	1	0	1	1	*	*	*	*	*	*	2	2
05:00	10	5	7	7	3	6	5	6	*	*	*	*	*	*	6	6
06:00	15	22	27	31	15	33	21	28	*	*	*	*	*	*	20	28
07:00	51	64	44	76	53	62	57	70	*	*	*	*	*	*	51	68
08:00	87	122	101	122	122	113	109	119	*	*	*	*	*	*	105	119
09:00	107	109	122	102	109	111	121	97	*	*	*	*	*	*	115	105
10:00	87	111	91	99	80	102	94	123	*	*	*	*	*	*	88	109
11:00	101	119	100	121	95	118	107	117	*	*	*	*	*	*	101	119
12:00 PM	112	131	107	134	108	138	121	120	*	*	*	*	*	*	112	131
01:00	93	94	122	104	98	114	112	102	*	*	*	*	*	*	106	104
02:00	90	107	109	119	107	113	102	145	*	*	*	*	*	*	102	121
03:00	100	106	99	103	108	113	134	122	*	*	*	*	*	*	110	111
04:00	132	128	164	131	141	137	138	125	*	*	*	*	*	*	144	130
05:00	139	103	160	141	158	133	168	165	*	*	*	*	*	*	156	136
06:00	95	113	100	102	88	95	113	106	*	*	*	*	*	*	99	104
07:00	73	78	73	84	66	70	67	79	*	*	*	*	*	*	70	78
08:00	83	45	66	49	54	65	53	49	*	*	*	*	*	*	64	52
09:00	38	37	47	39	54	40	54	46	*	*	*	*	*	*	48	40
10:00	21	32	31	16	27	32	36	31	*	*	*	*	*	*	29	28
11:00	8	15	14	16	29	19	22	36	*	*	*	*	*	*	18	22
Lane	1463	1574	1596	1605	1524	1623	1646	1701	0	0	0	0	0	0	1558	1628
Day	3037		3201		3147		3347		0	0	0	0	0	0	3186	
AM Peak	09:00	08:00	09:00	08:00	08:00	11:00	09:00	10:00	-	-	-	-	-	-	09:00	08:00
Vol.	107	122	122	122	122	118	121	123	-	-	-	-	-	-	115	119
PM Peak	17:00	12:00	16:00	17:00	17:00	12:00	17:00	17:00	-	-	-	-	-	-	17:00	17:00
Vol.	139	131	164	141	158	138	168	165	-	-	-	-	-	-	156	136

Comb. Total	3037	3201	3147	3347	0	0	0	3186
ADT	ADT 3,183	AADT 3,183						

County of Simcoe

Transporation and Engineering Department
Midhurst, Ontario
(705) 726-9300

County Road 32 - Fall 2015
10 Concession to
County Road 124

Site Code: 032 03

Date Start: 22-Sep-15

Date End: 24-Sep-15

Start Time	21-Sep-15		Tue		Wed		Thu		Fri		Sat		Sun		Week Average	
	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
12:00 AM	*	*	4	7	7	8	4	13	*	*	*	*	*	*	5	9
01:00	*	*	4	2	3	5	2	3	*	*	*	*	*	*	3	3
02:00	*	*	3	3	1	1	2	2	*	*	*	*	*	*	2	2
03:00	*	*	1	2	2	0	2	3	*	*	*	*	*	*	2	2
04:00	*	*	4	2	1	0	0	0	*	*	*	*	*	*	2	1
05:00	*	*	2	1	4	1	2	3	*	*	*	*	*	*	3	2
06:00	*	*	14	12	12	11	15	11	*	*	*	*	*	*	14	11
07:00	*	*	36	51	32	48	36	47	*	*	*	*	*	*	35	49
08:00	*	*	81	93	67	127	74	97	*	*	*	*	*	*	74	106
09:00	*	*	168	159	188	151	169	133	*	*	*	*	*	*	175	148
10:00	*	*	72	99	95	110	114	111	*	*	*	*	*	*	94	107
11:00	*	*	93	108	107	108	78	85	*	*	*	*	*	*	93	100
12:00 PM	*	*	79	100	84	125	84	114	*	*	*	*	*	*	82	113
01:00	*	*	96	124	89	120	93	98	*	*	*	*	*	*	93	114
02:00	*	*	119	106	121	127	97	99	*	*	*	*	*	*	112	111
03:00	*	*	107	82	113	100	118	102	*	*	*	*	*	*	113	95
04:00	*	*	134	144	170	165	121	156	*	*	*	*	*	*	142	155
05:00	*	*	148	133	155	124	146	132	*	*	*	*	*	*	150	130
06:00	*	*	145	166	153	144	160	137	*	*	*	*	*	*	153	149
07:00	*	*	93	76	98	73	78	93	*	*	*	*	*	*	90	81
08:00	*	*	50	46	67	75	75	61	*	*	*	*	*	*	64	61
09:00	*	*	27	42	38	45	27	43	*	*	*	*	*	*	31	43
10:00	*	*	14	28	18	31	21	30	*	*	*	*	*	*	18	30
11:00	*	*	13	15	24	19	22	16	*	*	*	*	*	*	20	17
Lane	0	0	1507	1601	1649	1718	1540	1589	0	0	0	0	0	0	1570	1639
Day	0		3108		3367		3129		0		0		0		3209	
AM Peak	-	-	09:00	09:00	09:00	09:00	09:00	09:00	-	-	-	-	-	-	09:00	09:00
Vol.	-	-	168	159	188	151	169	133	-	-	-	-	-	-	175	148
PM Peak	-	-	17:00	18:00	16:00	16:00	18:00	16:00	-	-	-	-	-	-	18:00	16:00
Vol.	-	-	148	166	170	165	160	156	-	-	-	-	-	-	153	155

Comb. Total	0	3108	3367	3129	0	0	0	3209
ADT	ADT 3,201	AADT 3,201						

County of Simcoe

County Road 124 - Spring 2015
33/34 SR Nottawasaga to
Poplar SR / Collingwood Limit

Transportation and Engineering Department
Midhurst, Ontario
(705)-726-9300

Site Code: 124 06

33/34 SR Nottawasaga
Poplar SR / Collingwood Limit

Start Time	18-May-15		Tue		Wed		Thu		Fri		Sat		Sun		Week Average	
	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB
12:00 AM	*	*	9	12	26	7	10	15	*	*	*	*	*	*	15	11
01:00	*	*	7	6	6	5	8	5	*	*	*	*	*	*	7	5
02:00	*	*	3	3	4	2	3	9	*	*	*	*	*	*	3	5
03:00	*	*	3	4	5	4	6	4	*	*	*	*	*	*	5	4
04:00	*	*	9	4	7	5	6	6	*	*	*	*	*	*	7	5
05:00	*	*	31	32	23	16	28	23	*	*	*	*	*	*	27	24
06:00	*	*	53	96	59	96	57	100	*	*	*	*	*	*	56	97
07:00	*	*	139	193	155	215	149	217	*	*	*	*	*	*	148	208
08:00	*	*	235	373	214	394	222	356	*	*	*	*	*	*	224	374
09:00	*	*	250	346	265	363	227	329	*	*	*	*	*	*	247	346
10:00	*	*	224	316	243	282	200	223	*	*	*	*	*	*	222	274
11:00	*	*	252	299	242	249	251	237	*	*	*	*	*	*	248	262
12:00 PM	*	*	316	271	293	252	253	264	*	*	*	*	*	*	287	262
01:00	*	*	269	287	282	306	255	267	*	*	*	*	*	*	269	287
02:00	*	*	274	282	276	268	271	295	*	*	*	*	*	*	274	282
03:00	*	*	362	286	369	299	360	306	*	*	*	*	*	*	364	297
04:00	*	*	403	287	345	281	371	299	*	*	*	*	*	*	373	289
05:00	*	*	425	292	418	347	393	344	*	*	*	*	*	*	412	328
06:00	*	*	263	229	289	251	304	274	*	*	*	*	*	*	285	251
07:00	*	*	175	171	194	187	191	186	*	*	*	*	*	*	187	181
08:00	*	*	145	92	175	131	178	147	*	*	*	*	*	*	166	123
09:00	*	*	143	83	154	97	158	126	*	*	*	*	*	*	152	102
10:00	*	*	73	63	73	64	77	63	*	*	*	*	*	*	74	63
11:00	*	*	23	29	32	24	43	29	*	*	*	*	*	*	33	27
Lane	0	0	4086	4056	4149	4145	4021	4124	0	0	0	0	0	0	4085	4107
Day	0		8142		8294		8145		0		0		0		8192	
AM Peak	-	-	11:00	08:00	09:00	08:00	11:00	08:00	-	-	-	-	-	-	11:00	08:00
Vol.	-	-	252	373	265	394	251	356	-	-	-	-	-	-	248	374
PM Peak	-	-	17:00	17:00	17:00	17:00	17:00	17:00	-	-	-	-	-	-	17:00	17:00
Vol.	-	-	425	292	418	347	393	344	-	-	-	-	-	-	412	328

Comb. Total	0	8142	8294	8145	0	0	0	8192
ADT	ADT 8,194	AADT 8,194						

County of Simcoe

County Road 124 - Summer 2015
33/34 Sideroad Nottawasaga to
Poplar Sideroad/ Collingwood Limit

Transportation and Engineering Department
Midhurst, Ontario
(705)-726-9300

Site Code: 124 06

33/34 Sideroad Nottawasaga
Poplar Sideroad/ Collingwood Limit

Start Time	17-Aug-15		Tue		Wed		Thu		Fri		Sat		Sun		Week Average	
	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB
12:00 AM	31	23	20	18	26	18	20	9	*	*	*	*	*	*	24	17
01:00	10	9	8	6	13	4	7	9	*	*	*	*	*	*	10	7
02:00	11	11	4	8	6	8	5	3	*	*	*	*	*	*	6	8
03:00	2	3	3	5	3	4	6	1	*	*	*	*	*	*	4	3
04:00	11	7	5	2	5	5	3	5	*	*	*	*	*	*	6	5
05:00	13	23	21	23	18	22	26	26	*	*	*	*	*	*	20	24
06:00	54	64	58	76	49	76	64	83	*	*	*	*	*	*	56	75
07:00	98	166	103	178	101	183	110	161	*	*	*	*	*	*	103	172
08:00	141	288	168	263	180	267	185	275	*	*	*	*	*	*	168	273
09:00	228	254	158	281	213	267	217	296	*	*	*	*	*	*	204	274
10:00	237	270	203	240	226	246	226	283	*	*	*	*	*	*	223	260
11:00	281	288	267	256	239	288	285	302	*	*	*	*	*	*	268	284
12:00 PM	292	308	296	256	301	316	301	286	*	*	*	*	*	*	298	292
01:00	295	298	298	254	282	280	291	320	*	*	*	*	*	*	292	288
02:00	264	289	250	253	299	257	297	281	*	*	*	*	*	*	278	270
03:00	276	280	294	226	317	268	295	301	*	*	*	*	*	*	296	269
04:00	329	238	319	256	283	247	373	307	*	*	*	*	*	*	326	262
05:00	381	254	386	287	374	251	387	302	*	*	*	*	*	*	382	274
06:00	291	212	309	224	273	260	303	252	*	*	*	*	*	*	294	237
07:00	209	173	191	176	188	182	193	192	*	*	*	*	*	*	195	181
08:00	157	110	136	133	188	133	164	176	*	*	*	*	*	*	161	138
09:00	147	104	132	88	145	78	120	115	*	*	*	*	*	*	136	96
10:00	82	59	85	66	100	71	91	78	*	*	*	*	*	*	90	68
11:00	38	29	47	41	35	45	46	57	*	*	*	*	*	*	42	43
Lane	3878	3760	3761	3616	3864	3776	4015	4120	0	0	0	0	0	0	3882	3820
Day	7638		7377		7640		8135		0		0		0		7702	
AM Peak	11:00	08:00	11:00	09:00	11:00	11:00	11:00	11:00	-	-	-	-	-	-	11:00	11:00
Vol.	281	288	267	281	239	288	285	302	-	-	-	-	-	-	268	284
PM Peak	17:00	12:00	17:00	17:00	17:00	12:00	17:00	13:00	-	-	-	-	-	-	17:00	12:00
Vol.	381	308	386	287	374	316	387	320	-	-	-	-	-	-	382	292

Comb. Total	7638	7377	7640	8135	0	0	0	7702
ADT	ADT 7,698	AADT 7,698						

County of Simcoe

Transporation and Engineering Department
Midhurst, Ontario
(705) 726-9300

County Road 124 - Fall 2015
33/34 Sidreoad Nottawasaga to
Poplar Side Road / County Road 32

Site Code: 124 06

Date Start: 15-Sep-15

Date End: 17-Sep-15

Start Time	14-Sep-15		Tue		Wed		Thu		Fri		Sat		Sun		Week Average	
	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB
12:00 AM	*	*	11	10	14	14	13	16	*	*	*	*	*	*	13	13
01:00	*	*	5	7	6	7	6	11	*	*	*	*	*	*	6	8
02:00	*	*	4	3	5	4	3	7	*	*	*	*	*	*	4	5
03:00	*	*	4	3	3	1	3	1	*	*	*	*	*	*	3	2
04:00	*	*	8	3	9	5	3	3	*	*	*	*	*	*	7	4
05:00	*	*	15	17	11	14	16	18	*	*	*	*	*	*	14	16
06:00	*	*	45	77	54	65	45	76	*	*	*	*	*	*	48	73
07:00	*	*	119	181	126	184	134	166	*	*	*	*	*	*	126	177
08:00	*	*	198	316	186	334	194	330	*	*	*	*	*	*	193	327
09:00	*	*	270	368	250	367	270	358	*	*	*	*	*	*	263	364
10:00	*	*	222	263	229	247	212	247	*	*	*	*	*	*	221	252
11:00	*	*	224	264	239	251	243	256	*	*	*	*	*	*	235	257
12:00 PM	*	*	280	292	278	276	259	265	*	*	*	*	*	*	272	278
01:00	*	*	257	278	279	275	275	257	*	*	*	*	*	*	270	270
02:00	*	*	262	232	281	238	261	262	*	*	*	*	*	*	268	244
03:00	*	*	351	285	361	271	316	273	*	*	*	*	*	*	343	276
04:00	*	*	384	319	392	328	377	310	*	*	*	*	*	*	384	319
05:00	*	*	397	320	397	322	415	333	*	*	*	*	*	*	403	325
06:00	*	*	287	283	305	254	290	266	*	*	*	*	*	*	294	268
07:00	*	*	217	201	219	216	209	228	*	*	*	*	*	*	215	215
08:00	*	*	179	136	191	131	186	127	*	*	*	*	*	*	185	131
09:00	*	*	135	70	116	87	134	101	*	*	*	*	*	*	128	86
10:00	*	*	71	41	69	64	91	82	*	*	*	*	*	*	77	62
11:00	*	*	37	26	47	30	43	36	*	*	*	*	*	*	42	31
Lane	0	0	3982	3995	4067	3985	3998	4029	0	0	0	0	0	0	4014	4003
Day	0		7977		8052		8027		0		0		0		8017	
AM Peak	-	-	09:00	09:00	09:00	09:00	09:00	09:00	-	-	-	-	-	-	09:00	09:00
Vol.	-	-	270	368	250	367	270	358	-	-	-	-	-	-	263	364
PM Peak	-	-	17:00	17:00	17:00	16:00	17:00	17:00	-	-	-	-	-	-	17:00	17:00
Vol.	-	-	397	320	397	328	415	333	-	-	-	-	-	-	403	325

Comb. Total	0	7977	8052	8027	0	0	0	8017
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ADT	ADT 8,019	AADT 8,019
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APPENDIX B: EXISTING OPERATIONS

Intersection						
Intersection Delay, s/veh	5.2					
Intersection LOS	A					
Approach	EB		WB		SB	
Entry Lanes	2		2		2	
Conflicting Circle Lanes	2		2		2	
Adj Approach Flow, veh/h	181		374		236	
Demand Flow Rate, veh/h	190		393		248	
Vehicles Circulating, veh/h	211		27		124	
Vehicles Exiting, veh/h	161		374		296	
Follow-Up Headway, s	3.186		3.186		3.186	
Ped Vol Crossing Leg, #/h	0		0		0	
Ped Cap Adj	1.000		1.000		1.000	
Approach Delay, s/veh	4.8		5.3		5.4	
Approach LOS	A		A		A	
Lane	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	L	TR
Assumed Moves	LT	TR	LT	R	L	TR
RT Channelized						
Lane Util	0.468	0.532	0.316	0.684	0.851	0.149
Critical Headway, s	4.293	4.113	4.293	4.113	4.293	4.113
Entry Flow, veh/h	89	101	124	269	211	37
Cap Entry Lane, veh/h	965	975	1107	1109	1030	1036
Entry HV Adj Factor	0.957	0.951	0.952	0.952	0.953	0.946
Flow Entry, veh/h	85	96	118	256	201	35
Cap Entry, veh/h	923	927	1055	1055	981	980
V/C Ratio	0.092	0.104	0.112	0.243	0.205	0.036
Control Delay, s/veh	4.8	4.8	4.4	5.7	5.6	4.0
LOS	A	A	A	A	A	A
95th %tile Queue, veh	0	0	0	1	1	0

HCM Signalized Intersection Capacity Analysis

5: Hurontario St. & Poplar S/R

2015 Existing Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	203	100	30	250	210	94	335	47	118	169	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1738	1739		1738	1830	1555	1738	1830	1555	1738	1812	
Flt Permitted	0.56	1.00		0.45	1.00	1.00	0.55	1.00	1.00	0.55	1.00	
Satd. Flow (perm)	1024	1739		829	1830	1555	1012	1830	1555	1006	1812	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	37	214	105	32	263	221	99	353	49	124	178	12
RTOR Reduction (vph)	0	34	0	0	0	167	0	0	23	0	4	0
Lane Group Flow (vph)	37	285	0	32	263	54	99	353	26	124	186	0
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	
Protected Phases		4			8		5	2				6
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)	12.7	12.7		12.7	12.7	12.7	27.7	27.7	27.7	19.5	19.5	
Effective Green, g (s)	12.7	12.7		12.7	12.7	12.7	27.7	27.7	27.7	19.5	19.5	
Actuated g/C Ratio	0.24	0.24		0.24	0.24	0.24	0.53	0.53	0.53	0.37	0.37	
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	248	421		200	443	376	607	967	822	374	674	
v/s Ratio Prot		c0.16			0.14		0.02	c0.19			0.10	
v/s Ratio Perm	0.04			0.04		0.03	0.07		0.02	0.12		
v/c Ratio	0.15	0.68		0.16	0.59	0.14	0.16	0.37	0.03	0.33	0.28	
Uniform Delay, d1	15.6	18.0		15.6	17.6	15.6	6.3	7.2	5.9	11.8	11.5	
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	0.3	4.3		0.4	2.1	0.2	0.1	1.1	0.1	2.4	1.0	
Delay (s)	15.9	22.3		16.0	19.7	15.8	6.4	8.3	6.0	14.2	12.5	
Level of Service	B	C		B	B	B	A	A	A	B	B	
Approach Delay (s)		21.6			17.8			7.7			13.2	
Approach LOS		C			B			A			B	
Intersection Summary												
HCM 2000 Control Delay			14.7				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.50									
Actuated Cycle Length (s)			52.4				Sum of lost time (s)			15.0		
Intersection Capacity Utilization			64.3%				ICU Level of Service			C		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis 11: High St. & Campbell St.

2015 Existing Conditions
AM Peak Hour

								
Movement	WBL	WBR	NBT	NBR	SBL	SBT		
Lane Configurations								
Sign Control	Stop		Stop		Stop	Stop		
Volume (vph)	14	72	253	15	68	210		
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95		
Hourly flow rate (vph)	15	76	266	16	72	221		
Direction, Lane #	WB 1	NB 1	SB 1	SB 2				
Volume Total (vph)	91	282	72	221				
Volume Left (vph)	15	0	72	0				
Volume Right (vph)	76	16	0	0				
Hadj (s)	-0.38	0.05	0.58	0.08				
Departure Headway (s)	4.8	4.6	5.5	5.0				
Degree Utilization, x	0.12	0.36	0.11	0.31				
Capacity (veh/h)	673	759	629	695				
Control Delay (s)	8.5	10.2	8.0	9.1				
Approach Delay (s)	8.5	10.2	8.8					
Approach LOS	A	B	A					
Intersection Summary								
Delay			9.4					
Level of Service			A					
Intersection Capacity Utilization			33.2%	ICU Level of Service	A			
Analysis Period (min)			15					

Intersection						
Intersection Delay, s/veh	5.9					
Intersection LOS	A					
Approach	EB		WB		SB	
Entry Lanes	2		2		2	
Conflicting Circle Lanes	2		2		2	
Adj Approach Flow, veh/h	196		367		352	
Demand Flow Rate, veh/h	206		386		369	
Vehicles Circulating, veh/h	341		20		138	
Vehicles Exiting, veh/h	166		527		268	
Follow-Up Headway, s	3.186		3.186		3.186	
Ped Vol Crossing Leg, #/h	0		0		0	
Ped Cap Adj	1.000		1.000		1.000	
Approach Delay, s/veh	5.4		5.1		7.0	
Approach LOS	A		A		A	
Lane	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	L	TR
Assumed Moves	LT	TR	LT	R	L	TR
RT Channelized						
Lane Util	0.471	0.529	0.358	0.642	0.924	0.076
Critical Headway, s	4.293	4.113	4.293	4.113	4.293	4.113
Entry Flow, veh/h	97	109	138	248	341	28
Cap Entry Lane, veh/h	875	890	1113	1114	1019	1026
Entry HV Adj Factor	0.950	0.954	0.952	0.952	0.953	0.964
Flow Entry, veh/h	92	104	131	236	325	27
Cap Entry, veh/h	832	849	1060	1060	971	989
V/C Ratio	0.111	0.122	0.124	0.223	0.335	0.027
Control Delay, s/veh	5.4	5.4	4.5	5.5	7.2	3.9
LOS	A	A	A	A	A	A
95th %tile Queue, veh	0	0	0	1	1	0

HCM Signalized Intersection Capacity Analysis

5: Hurontario St. & Poplar S/R

2015 Existing Conditions

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	31	294	152	46	203	128	106	282	23	177	352	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1738	1736		1738	1830	1555	1738	1830	1555	1738	1802	
Flt Permitted	0.62	1.00		0.25	1.00	1.00	0.35	1.00	1.00	0.58	1.00	
Satd. Flow (perm)	1142	1736		450	1830	1555	632	1830	1555	1059	1802	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	33	309	160	48	214	135	112	297	24	186	371	41
RTOR Reduction (vph)	0	32	0	0	0	95	0	0	12	0	6	0
Lane Group Flow (vph)	33	437	0	48	214	40	112	297	12	186	406	0
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)	17.3	17.3		17.3	17.3	17.3	29.7	29.7	29.7	21.3	21.3	
Effective Green, g (s)	17.3	17.3		17.3	17.3	17.3	29.7	29.7	29.7	21.3	21.3	
Actuated g/C Ratio	0.29	0.29		0.29	0.29	0.29	0.50	0.50	0.50	0.36	0.36	
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	334	509		131	536	455	419	921	782	382	650	
v/s Ratio Prot		c0.25			0.12		0.02	c0.16			c0.23	
v/s Ratio Perm	0.03			0.11		0.03	0.11		0.01	0.18		
v/c Ratio	0.10	0.86		0.37	0.40	0.09	0.27	0.32	0.02	0.49	0.62	
Uniform Delay, d1	15.2	19.7		16.5	16.7	15.1	8.4	8.7	7.3	14.6	15.5	
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	13.5		1.7	0.5	0.1	0.3	0.9	0.0	4.4	4.5	
Delay (s)	15.3	33.2		18.2	17.2	15.2	8.8	9.6	7.4	19.0	20.0	
Level of Service	B	C		B	B	B	A	A	A	B	C	
Approach Delay (s)		32.0			16.6			9.3			19.7	
Approach LOS		C			B			A			B	
Intersection Summary												
HCM 2000 Control Delay			19.9	HCM 2000 Level of Service					B			
HCM 2000 Volume to Capacity ratio			0.68									
Actuated Cycle Length (s)			59.0	Sum of lost time (s)					15.0			
Intersection Capacity Utilization			73.2%	ICU Level of Service					D			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

11: High St. & Campbell St.

2015 Existing Conditions

PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Stop		Stop	Stop
Volume (vph)	18	75	230	12	79	317
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	19	79	242	13	83	334
Direction, Lane #	WB 1	NB 1	SB 1	SB 2		
Volume Total (vph)	98	255	83	334		
Volume Left (vph)	19	0	83	0		
Volume Right (vph)	79	13	0	0		
Hadj (s)	-0.36	0.06	0.58	0.08		
Departure Headway (s)	5.1	4.8	5.6	5.1		
Degree Utilization, x	0.14	0.34	0.13	0.47		
Capacity (veh/h)	638	730	629	696		
Control Delay (s)	8.9	10.2	8.2	11.3		
Approach Delay (s)	8.9	10.2	10.7			
Approach LOS	A	B	B			
Intersection Summary						
Delay			10.3			
Level of Service			B			
Intersection Capacity Utilization			32.8%	ICU Level of Service	A	
Analysis Period (min)			15			

APPENDIX C: FUTURE BACKGROUND OPERATIONS

Intersection						
Intersection Delay, s/veh	5.7					
Intersection LOS	A					
Approach	EB		WB		SB	
Entry Lanes	2		2		2	
Conflicting Circle Lanes	2		2		2	
Adj Approach Flow, veh/h	216		453		279	
Demand Flow Rate, veh/h	227		476		293	
Vehicles Circulating, veh/h	249		34		161	
Vehicles Exiting, veh/h	205		442		349	
Follow-Up Headway, s	3.186		3.186		3.186	
Ped Vol Crossing Leg, #/h	0		0		0	
Ped Cap Adj	1.000		1.000		1.000	
Approach Delay, s/veh	5.2		5.7		5.9	
Approach LOS	A		A		A	
Lane	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	L	TR
Assumed Moves	LT	TR	LT	R	L	TR
RT Channelized						
Lane Util	0.471	0.529	0.338	0.662	0.850	0.150
Critical Headway, s	4.293	4.113	4.293	4.113	4.293	4.113
Entry Flow, veh/h	107	120	161	315	249	44
Cap Entry Lane, veh/h	937	949	1101	1103	1001	1010
Entry HV Adj Factor	0.948	0.953	0.952	0.952	0.952	0.955
Flow Entry, veh/h	101	114	153	300	237	42
Cap Entry, veh/h	889	905	1049	1051	953	964
V/C Ratio	0.114	0.126	0.146	0.285	0.249	0.044
Control Delay, s/veh	5.1	5.2	4.7	6.2	6.3	4.1
LOS	A	A	A	A	A	A
95th %tile Queue, veh	0	0	1	1	1	0

HCM Signalized Intersection Capacity Analysis

2020 Background Conditions

5: Hurontario St. & Poplar S/R

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	70	235	145	35	280	225	115	370	50	130	200	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.94		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1738	1725		1738	1830	1555	1738	1830	1555	1738	1800	
Flt Permitted	0.52	1.00		0.34	1.00	1.00	0.53	1.00	1.00	0.53	1.00	
Satd. Flow (perm)	944	1725		625	1830	1555	962	1830	1555	973	1800	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	74	247	153	37	295	237	121	389	53	137	211	26
RTOR Reduction (vph)	0	43	0	0	0	173	0	0	26	0	7	0
Lane Group Flow (vph)	74	357	0	37	295	64	121	389	27	137	230	0
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)	14.4	14.4		14.4	14.4	14.4	26.7	26.7	26.7	18.4	18.4	
Effective Green, g (s)	14.4	14.4		14.4	14.4	14.4	26.7	26.7	26.7	18.4	18.4	
Actuated g/C Ratio	0.27	0.27		0.27	0.27	0.27	0.50	0.50	0.50	0.35	0.35	
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	256	467		169	496	421	561	920	781	337	623	
v/s Ratio Prot		c0.21			0.16		0.02	c0.21			0.13	
v/s Ratio Perm	0.08			0.06		0.04	0.09		0.02	0.14		
v/c Ratio	0.29	0.76		0.22	0.59	0.15	0.22	0.42	0.03	0.41	0.37	
Uniform Delay, d1	15.3	17.8		15.0	16.8	14.7	7.1	8.3	6.7	13.2	13.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.6	7.3		0.7	1.9	0.2	0.2	1.4	0.1	3.6	1.7	
Delay (s)	15.9	25.1		15.6	18.7	14.9	7.3	9.8	6.8	16.8	14.7	
Level of Service	B	C		B	B	B	A	A	A	B	B	
Approach Delay (s)		23.7			16.9			9.0			15.5	
Approach LOS		C			B			A			B	
Intersection Summary												
HCM 2000 Control Delay			16.0		HCM 2000 Level of Service				B			
HCM 2000 Volume to Capacity ratio			0.58									
Actuated Cycle Length (s)			53.1		Sum of lost time (s)				15.0			
Intersection Capacity Utilization			71.2%		ICU Level of Service				C			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

8: High St. & Findlay Dr.

2020 Background Conditions
AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	5	25	310	5	10	260
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	5	26	326	5	11	274
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	624	329			332	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	624	329			332	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	96			99	
cM capacity (veh/h)	441	706			1211	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	32	332	284			
Volume Left	5	0	11			
Volume Right	26	5	0			
cSH	641	1700	1211			
Volume to Capacity	0.05	0.20	0.01			
Queue Length 95th (m)	1.2	0.0	0.2			
Control Delay (s)	10.9	0.0	0.4			
Lane LOS	B		A			
Approach Delay (s)	10.9	0.0	0.4			
Approach LOS	B					
Intersection Summary						
Average Delay		0.7				
Intersection Capacity Utilization		31.8%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

2020 Background Conditions

11: High St. & Campbell St.

AM Peak Hour

								
Movement	WBL	WBR	NBT	NBR	SBL	SBT		
Lane Configurations								
Sign Control	Stop		Stop		Stop	Stop		
Volume (vph)	15	80	315	20	75	255		
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95		
Hourly flow rate (vph)	16	84	332	21	79	268		
Direction, Lane #	WB 1	NB 1	SB 1	SB 2				
Volume Total (vph)	100	353	79	268				
Volume Left (vph)	16	0	79	0				
Volume Right (vph)	84	21	0	0				
Hadj (s)	-0.39	0.05	0.58	0.09				
Departure Headway (s)	5.1	4.7	5.7	5.2				
Degree Utilization, x	0.14	0.46	0.12	0.38				
Capacity (veh/h)	629	744	617	680				
Control Delay (s)	8.9	11.7	8.3	10.1				
Approach Delay (s)	8.9	11.7	9.7					
Approach LOS	A	B	A					
Intersection Summary								
Delay			10.5					
Level of Service			B					
Intersection Capacity Utilization			37.7%	ICU Level of Service	A			
Analysis Period (min)			15					

Intersection						
Intersection Delay, s/veh	6.3					
Intersection LOS	A					
Approach	EB		WB		SB	
Entry Lanes	2		2		2	
Conflicting Circle Lanes	2		2		2	
Adj Approach Flow, veh/h	237		416		400	
Demand Flow Rate, veh/h	249		437		420	
Vehicles Circulating, veh/h	381		27		161	
Vehicles Exiting, veh/h	200		603		303	
Follow-Up Headway, s	3.186		3.186		3.186	
Ped Vol Crossing Leg, #/h	0		0		0	
Ped Cap Adj	1.000		1.000		1.000	
Approach Delay, s/veh	5.9		5.4		7.6	
Approach LOS	A		A		A	
Lane	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	L	TR
Assumed Moves	LT	TR	LT	R	L	TR
RT Channelized						
Lane Util	0.470	0.530	0.368	0.632	0.907	0.093
Critical Headway, s	4.293	4.113	4.293	4.113	4.293	4.113
Entry Flow, veh/h	117	132	161	276	381	39
Cap Entry Lane, veh/h	849	865	1107	1109	1001	1010
Entry HV Adj Factor	0.954	0.953	0.952	0.953	0.953	0.949
Flow Entry, veh/h	112	126	153	263	363	37
Cap Entry, veh/h	810	825	1055	1057	954	958
V/C Ratio	0.138	0.153	0.145	0.249	0.380	0.039
Control Delay, s/veh	5.8	5.9	4.7	5.8	8.0	4.1
LOS	A	A	A	A	A	A
95th %tile Queue, veh	0	1	1	1	2	0

HCM Signalized Intersection Capacity Analysis

5: Hurontario St. & Poplar S/R

2020 Background Conditions

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	55	330	185	50	240	145	160	315	25	190	385	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1738	1731		1738	1830	1555	1738	1830	1555	1738	1782	
Flt Permitted	0.57	1.00		0.20	1.00	1.00	0.24	1.00	1.00	0.56	1.00	
Satd. Flow (perm)	1038	1731		357	1830	1555	437	1830	1555	1025	1782	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	58	347	195	53	253	153	168	332	26	200	405	84
RTOR Reduction (vph)	0	31	0	0	0	104	0	0	13	0	11	0
Lane Group Flow (vph)	58	511	0	53	253	49	168	332	13	200	478	0
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)	20.5	20.5		20.5	20.5	20.5	32.0	32.0	32.0	22.2	22.2	
Effective Green, g (s)	20.5	20.5		20.5	20.5	20.5	32.0	32.0	32.0	22.2	22.2	
Actuated g/C Ratio	0.32	0.32		0.32	0.32	0.32	0.50	0.50	0.50	0.34	0.34	
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	329	550		113	581	494	353	907	771	352	613	
v/s Ratio Prot		c0.30			0.14		c0.05	0.18			c0.27	
v/s Ratio Perm	0.06			0.15		0.03	0.19		0.01	0.20		
v/c Ratio	0.18	0.93		0.47	0.44	0.10	0.48	0.37	0.02	0.57	0.78	
Uniform Delay, d1	15.9	21.3		17.6	17.4	15.5	10.6	10.0	8.3	17.2	19.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.3	22.0		3.1	0.5	0.1	1.0	1.1	0.0	6.5	9.5	
Delay (s)	16.2	43.3		20.7	17.9	15.6	11.6	11.1	8.3	23.8	28.4	
Level of Service	B	D		C	B	B	B	B	A	C	C	
Approach Delay (s)		40.7			17.5			11.2			27.1	
Approach LOS		D			B			B			C	
Intersection Summary												
HCM 2000 Control Delay			25.0									HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio			0.80									
Actuated Cycle Length (s)			64.5									Sum of lost time (s) 15.0
Intersection Capacity Utilization			84.3%									ICU Level of Service E
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

8: High St. & Findlay Dr.

2020 Background Conditions
PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	5	15	265	10	30	375
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	5	16	279	11	32	395
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	742	284			289	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	742	284			289	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	98			97	
cM capacity (veh/h)	369	748			1255	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	21	289	426			
Volume Left	5	0	32			
Volume Right	16	11	0			
cSH	595	1700	1255			
Volume to Capacity	0.04	0.17	0.03			
Queue Length 95th (m)	0.8	0.0	0.6			
Control Delay (s)	11.3	0.0	0.8			
Lane LOS	B		A			
Approach Delay (s)	11.3	0.0	0.8			
Approach LOS	B					
Intersection Summary						
Average Delay		0.8				
Intersection Capacity Utilization		49.3%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis 11: High St. & Campbell St.

2020 Background Conditions
PM Peak Hour

								
Movement	WBL	WBR	NBT	NBR	SBL	SBT		
Lane Configurations								
Sign Control	Stop		Stop		Stop	Stop		
Volume (vph)	20	80	265	15	85	385		
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95		
Hourly flow rate (vph)	21	84	279	16	89	405		
Direction, Lane #	WB 1	NB 1	SB 1	SB 2				
Volume Total (vph)	105	295	89	405				
Volume Left (vph)	21	0	89	0				
Volume Right (vph)	84	16	0	0				
Hadj (s)	-0.35	0.05	0.58	0.09				
Departure Headway (s)	5.3	4.9	5.6	5.1				
Degree Utilization, x	0.16	0.40	0.14	0.58				
Capacity (veh/h)	603	712	621	688				
Control Delay (s)	9.3	11.2	8.4	13.8				
Approach Delay (s)	9.3	11.2	12.8					
Approach LOS	A	B	B					
Intersection Summary								
Delay			11.9					
Level of Service			B					
Intersection Capacity Utilization			35.6%	ICU Level of Service	A			
Analysis Period (min)			15					

Intersection						
Intersection Delay, s/veh	5.8					
Intersection LOS	A					
Approach	EB		WB		SB	
Entry Lanes	2		2		2	
Conflicting Circle Lanes	2		2		2	
Adj Approach Flow, veh/h	227		474		300	
Demand Flow Rate, veh/h	239		498		315	
Vehicles Circulating, veh/h	266		34		166	
Vehicles Exiting, veh/h	215		471		366	
Follow-Up Headway, s	3.186		3.186		3.186	
Ped Vol Crossing Leg, #/h	0		0		0	
Ped Cap Adj	1.000		1.000		1.000	
Approach Delay, s/veh	5.3		5.9		6.1	
Approach LOS	A		A		A	
Lane	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	L	TR
Assumed Moves	LT	TR	LT	R	L	TR
RT Channelized						
Lane Util	0.469	0.531	0.333	0.667	0.844	0.156
Critical Headway, s	4.293	4.113	4.293	4.113	4.293	4.113
Entry Flow, veh/h	112	127	166	332	266	49
Cap Entry Lane, veh/h	926	938	1101	1103	998	1006
Entry HV Adj Factor	0.954	0.948	0.952	0.952	0.951	0.959
Flow Entry, veh/h	107	120	158	316	253	47
Cap Entry, veh/h	883	889	1049	1050	949	965
V/C Ratio	0.121	0.135	0.151	0.301	0.267	0.049
Control Delay, s/veh	5.2	5.4	4.8	6.4	6.5	4.2
LOS	A	A	A	A	A	A
95th %tile Queue, veh	0	0	1	1	1	0

HCM Signalized Intersection Capacity Analysis

5: Hurontario St. & Poplar S/R

2025 Background Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	70	250	155	35	295	235	120	385	55	140	210	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.94		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1738	1725		1738	1830	1555	1738	1830	1555	1738	1801	
Flt Permitted	0.48	1.00		0.30	1.00	1.00	0.53	1.00	1.00	0.52	1.00	
Satd. Flow (perm)	883	1725		557	1830	1555	966	1830	1555	959	1801	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	74	263	163	37	311	247	126	405	58	147	221	26
RTOR Reduction (vph)	0	40	0	0	0	176	0	0	29	0	6	0
Lane Group Flow (vph)	74	386	0	37	311	71	126	405	29	147	241	0
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)	16.3	16.3		16.3	16.3	16.3	28.8	28.8	28.8	20.4	20.4	
Effective Green, g (s)	16.3	16.3		16.3	16.3	16.3	28.8	28.8	28.8	20.4	20.4	
Actuated g/C Ratio	0.29	0.29		0.29	0.29	0.29	0.50	0.50	0.50	0.36	0.36	
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	252	492		159	522	443	560	923	784	342	643	
v/s Ratio Prot		c0.22			0.17		0.02	c0.22			0.13	
v/s Ratio Perm	0.08			0.07		0.05	0.09		0.02	0.15		
v/c Ratio	0.29	0.78		0.23	0.60	0.16	0.23	0.44	0.04	0.43	0.37	
Uniform Delay, d1	15.9	18.8		15.6	17.6	15.3	7.7	9.0	7.1	13.9	13.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.7	8.0		0.8	1.8	0.2	0.2	1.5	0.1	3.9	1.7	
Delay (s)	16.6	26.8		16.4	19.4	15.4	7.9	10.5	7.2	17.8	15.3	
Level of Service	B	C		B	B	B	A	B	A	B	B	
Approach Delay (s)		25.3			17.6			9.6			16.2	
Approach LOS		C			B			A			B	
Intersection Summary												
HCM 2000 Control Delay		16.9			HCM 2000 Level of Service			B				
HCM 2000 Volume to Capacity ratio		0.60										
Actuated Cycle Length (s)		57.1			Sum of lost time (s)			15.0				
Intersection Capacity Utilization		74.0%			ICU Level of Service			D				
Analysis Period (min)		15										
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis 8: High St. & Findlay Dr.

2025 Background Conditions
AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	5	25	325	5	10	280
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	5	26	342	5	11	295
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)						286
pX, platoon unblocked						
vC, conflicting volume	513	174			347	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	513	174			347	
tC, single (s)	6.9	7.0			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	97			99	
cM capacity (veh/h)	479	830			1187	
Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	32	228	119	109	196	
Volume Left	5	0	0	11	0	
Volume Right	26	0	5	0	0	
cSH	740	1700	1700	1187	1700	
Volume to Capacity	0.04	0.13	0.07	0.01	0.12	
Queue Length 95th (m)	1.0	0.0	0.0	0.2	0.0	
Control Delay (s)	10.1	0.0	0.0	0.8	0.0	
Lane LOS	B			A		
Approach Delay (s)	10.1	0.0		0.3		
Approach LOS	B					
Intersection Summary						
Average Delay			0.6			
Intersection Capacity Utilization			25.0%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

11: High St. & Campbell St.

2025 Background Conditions

AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	20	80	330	20	80	270
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1738	1555	3447		1738	3476
Flt Permitted	0.95	1.00	1.00		0.53	1.00
Satd. Flow (perm)	1738	1555	3447		975	3476
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	21	84	347	21	84	284
RTOR Reduction (vph)	0	76	6	0	0	0
Lane Group Flow (vph)	21	8	362	0	84	284
Turn Type	Prot	Perm	NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	4.1	4.1	25.8		25.8	25.8
Effective Green, g (s)	4.1	4.1	25.8		25.8	25.8
Actuated g/C Ratio	0.10	0.10	0.62		0.62	0.62
Clearance Time (s)	6.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	170	152	2122		600	2140
v/s Ratio Prot	c0.01		c0.10			0.08
v/s Ratio Perm		0.01			0.09	
v/c Ratio	0.12	0.05	0.17		0.14	0.13
Uniform Delay, d1	17.3	17.1	3.5		3.4	3.4
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.3	0.1	0.2		0.5	0.1
Delay (s)	17.6	17.3	3.6		3.9	3.5
Level of Service	B	B	A		A	A
Approach Delay (s)	17.3		3.6			3.6
Approach LOS	B		A			A
Intersection Summary						
HCM 2000 Control Delay			5.3		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.16			
Actuated Cycle Length (s)			41.9		Sum of lost time (s)	12.0
Intersection Capacity Utilization			32.5%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

Intersection						
Intersection Delay, s/veh	6.6					
Intersection LOS	A					
Approach	EB		WB		SB	
Entry Lanes	2		2		2	
Conflicting Circle Lanes	2		2		2	
Adj Approach Flow, veh/h	253		447		421	
Demand Flow Rate, veh/h	266		469		442	
Vehicles Circulating, veh/h	403		34		171	
Vehicles Exiting, veh/h	210		635		332	
Follow-Up Headway, s	3.186		3.186		3.186	
Ped Vol Crossing Leg, #/h	0		0		0	
Ped Cap Adj	1.000		1.000		1.000	
Approach Delay, s/veh	6.1		5.6		8.0	
Approach LOS	A		A		A	
Lane	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	L	TR
Assumed Moves	LT	TR	LT	R	L	TR
RT Channelized						
Lane Util	0.470	0.530	0.365	0.635	0.912	0.088
Critical Headway, s	4.293	4.113	4.293	4.113	4.293	4.113
Entry Flow, veh/h	125	141	171	298	403	39
Cap Entry Lane, veh/h	835	852	1101	1103	994	1002
Entry HV Adj Factor	0.951	0.951	0.952	0.953	0.953	0.949
Flow Entry, veh/h	119	134	163	284	384	37
Cap Entry, veh/h	794	810	1049	1052	947	951
V/C Ratio	0.150	0.165	0.155	0.270	0.405	0.039
Control Delay, s/veh	6.1	6.1	4.8	6.0	8.4	4.1
LOS	A	A	A	A	A	A
95th %tile Queue, veh	1	1	1	1	2	0

HCM Signalized Intersection Capacity Analysis

2025 Background Conditions

5: Hurontario St. & Poplar S/R

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	55	350	195	55	255	150	165	335	30	200	405	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1738	1731		1738	1830	1555	1738	1830	1555	1738	1784	
Flt Permitted	0.54	1.00		0.16	1.00	1.00	0.22	1.00	1.00	0.55	1.00	
Satd. Flow (perm)	984	1731		289	1830	1555	402	1830	1555	1006	1784	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	58	368	205	58	268	158	174	353	32	211	426	84
RTOR Reduction (vph)	0	27	0	0	0	103	0	0	16	0	9	0
Lane Group Flow (vph)	58	546	0	58	268	55	174	353	16	211	501	0
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)	25.4	25.4		25.4	25.4	25.4	36.1	36.1	36.1	26.2	26.2	
Effective Green, g (s)	25.4	25.4		25.4	25.4	25.4	36.1	36.1	36.1	26.2	26.2	
Actuated g/C Ratio	0.35	0.35		0.35	0.35	0.35	0.49	0.49	0.49	0.36	0.36	
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	340	598		99	632	537	322	898	763	358	635	
v/s Ratio Prot		c0.32			0.15		c0.05	0.19			c0.28	
v/s Ratio Perm	0.06			0.20		0.04	0.21		0.01	0.21		
v/c Ratio	0.17	0.91		0.59	0.42	0.10	0.54	0.39	0.02	0.59	0.79	
Uniform Delay, d1	16.7	23.0		19.7	18.4	16.3	12.7	11.8	9.6	19.3	21.2	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.2	18.3		8.6	0.5	0.1	1.8	1.3	0.0	7.0	9.6	
Delay (s)	17.0	41.3		28.3	18.9	16.4	14.5	13.1	9.7	26.2	30.8	
Level of Service	B	D		C	B	B	B	B	A	C	C	
Approach Delay (s)		39.0			19.2			13.3			29.5	
Approach LOS		D			B			B			C	
Intersection Summary												
HCM 2000 Control Delay			26.2									HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio			0.81									
Actuated Cycle Length (s)			73.5									Sum of lost time (s) 15.0
Intersection Capacity Utilization			87.3%									ICU Level of Service E
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis 8: High St. & Findlay Dr.

2025 Background Conditions
PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (veh/h)	5	15	290	10	30	395
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	5	16	305	11	32	416
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)						286
pX, platoon unblocked						
vC, conflicting volume	582	158			316	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	582	158			316	
tC, single (s)	6.9	7.0			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	98			97	
cM capacity (veh/h)	426	850			1220	
Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	21	204	112	170	277	
Volume Left	5	0	0	32	0	
Volume Right	16	0	11	0	0	
cSH	681	1700	1700	1220	1700	
Volume to Capacity	0.03	0.12	0.07	0.03	0.16	
Queue Length 95th (m)	0.7	0.0	0.0	0.6	0.0	
Control Delay (s)	10.5	0.0	0.0	1.7	0.0	
Lane LOS	B			A		
Approach Delay (s)	10.5	0.0		0.6		
Approach LOS	B					
Intersection Summary						
Average Delay			0.6			
Intersection Capacity Utilization			33.5%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

2025 Background Conditions

11: High St. & Campbell St.

PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	20	85	290	15	90	405
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1738	1555	3450		1738	3476
Flt Permitted	0.95	1.00	1.00		0.56	1.00
Satd. Flow (perm)	1738	1555	3450		1020	3476
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	21	89	305	16	95	426
RTOR Reduction (vph)	0	80	5	0	0	0
Lane Group Flow (vph)	21	9	316	0	95	426
Turn Type	Prot	Perm	NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	4.1	4.1	25.5		25.5	25.5
Effective Green, g (s)	4.1	4.1	25.5		25.5	25.5
Actuated g/C Ratio	0.10	0.10	0.61		0.61	0.61
Clearance Time (s)	6.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	171	153	2114		625	2130
v/s Ratio Prot	c0.01		0.09			c0.12
v/s Ratio Perm		0.01			0.09	
v/c Ratio	0.12	0.06	0.15		0.15	0.20
Uniform Delay, d1	17.1	17.0	3.4		3.4	3.6
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.3	0.2	0.1		0.5	0.2
Delay (s)	17.4	17.2	3.6		4.0	3.8
Level of Service	B	B	A		A	A
Approach Delay (s)	17.2		3.6			3.8
Approach LOS	B		A			A
Intersection Summary						
HCM 2000 Control Delay			5.3		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.19			
Actuated Cycle Length (s)			41.6		Sum of lost time (s)	12.0
Intersection Capacity Utilization			31.8%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

Intersection						
Intersection Delay, s/veh	6.1					
Intersection LOS	A					
Approach	EB		WB		SB	
Entry Lanes	2		2		2	
Conflicting Circle Lanes	2		2		2	
Adj Approach Flow, veh/h	237		500		342	
Demand Flow Rate, veh/h	249		525		359	
Vehicles Circulating, veh/h	298		39		171	
Vehicles Exiting, veh/h	232		508		393	
Follow-Up Headway, s	3.186		3.186		3.186	
Ped Vol Crossing Leg, #/h	0		0		0	
Ped Cap Adj	1.000		1.000		1.000	
Approach Delay, s/veh	5.5		6.1		6.5	
Approach LOS	A		A		A	
Lane	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	L	TR
Assumed Moves	LT	TR	LT	R	L	TR
RT Channelized						
Lane Util	0.470	0.530	0.326	0.674	0.830	0.170
Critical Headway, s	4.293	4.113	4.293	4.113	4.293	4.113
Entry Flow, veh/h	117	132	171	354	298	61
Cap Entry Lane, veh/h	904	917	1097	1100	994	1002
Entry HV Adj Factor	0.952	0.952	0.952	0.952	0.953	0.951
Flow Entry, veh/h	111	126	163	337	284	58
Cap Entry, veh/h	860	873	1045	1047	947	953
V/C Ratio	0.129	0.144	0.156	0.322	0.300	0.061
Control Delay, s/veh	5.5	5.5	4.9	6.7	6.9	4.3
LOS	A	A	A	A	A	A
95th %tile Queue, veh	0	1	1	1	1	0

HCM Signalized Intersection Capacity Analysis

2030 Background Conditions

5: Hurontario St. & Poplar S/R

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	75	275	165	35	315	250	130	405	55	145	220	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Flt Protected	1.00	0.94		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1738	1726		1738	1830	1555	1738	1830	1555	1738	1802	
Satd. Flow (perm)	820	1726		460	1830	1555	949	1830	1555	941	1802	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	79	289	174	37	332	263	137	426	58	153	232	26
RTOR Reduction (vph)	0	38	0	0	0	187	0	0	29	0	6	0
Lane Group Flow (vph)	79	425	0	37	332	76	137	426	29	153	252	0
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)	17.1	17.1		17.1	17.1	17.1	29.7	29.7	29.7	21.3	21.3	
Effective Green, g (s)	17.1	17.1		17.1	17.1	17.1	29.7	29.7	29.7	21.3	21.3	
Actuated g/C Ratio	0.29	0.29		0.29	0.29	0.29	0.51	0.51	0.51	0.36	0.36	
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	238	501		133	532	452	551	924	785	340	652	
v/s Ratio Prot		c0.25			0.18		0.02	c0.23			0.14	
v/s Ratio Perm	0.10			0.08		0.05	0.10		0.02	0.16		
v/c Ratio	0.33	0.85		0.28	0.62	0.17	0.25	0.46	0.04	0.45	0.39	
Uniform Delay, d1	16.4	19.6		16.1	18.1	15.6	7.9	9.4	7.3	14.3	13.9	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.8	12.7		1.1	2.3	0.2	0.2	1.7	0.1	4.3	1.7	
Delay (s)	17.2	32.3		17.2	20.3	15.7	8.2	11.0	7.4	18.5	15.6	
Level of Service	B	C		B	C	B	A	B	A	B	B	
Approach Delay (s)		30.1			18.2			10.1			16.7	
Approach LOS		C			B			B			B	
Intersection Summary												
HCM 2000 Control Delay			18.6									HCM 2000 Level of Service B
HCM 2000 Volume to Capacity ratio			0.64									
Actuated Cycle Length (s)			58.8									Sum of lost time (s) 15.0
Intersection Capacity Utilization			77.2%									ICU Level of Service D
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis 8: High St. & Findlay Dr.

2030 Background Conditions
AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	10	25	380	5	10	310
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	11	26	400	5	11	326
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)						286
pX, platoon unblocked						
vC, conflicting volume	587	203			405	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	587	203			405	
tC, single (s)	6.9	7.0			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	97			99	
cM capacity (veh/h)	430	795			1129	
Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	37	267	139	119	218	
Volume Left	11	0	0	11	0	
Volume Right	26	0	5	0	0	
cSH	640	1700	1700	1129	1700	
Volume to Capacity	0.06	0.16	0.08	0.01	0.13	
Queue Length 95th (m)	1.4	0.0	0.0	0.2	0.0	
Control Delay (s)	11.0	0.0	0.0	0.8	0.0	
Lane LOS	B			A		
Approach Delay (s)	11.0	0.0		0.3		
Approach LOS	B					
Intersection Summary						
Average Delay			0.6			
Intersection Capacity Utilization			25.8%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

2030 Background Conditions

11: High St. & Campbell St.

AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	20	85	380	25	80	300
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1738	1555	3444		1738	3476
Flt Permitted	0.95	1.00	1.00		0.50	1.00
Satd. Flow (perm)	1738	1555	3444		921	3476
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	21	89	400	26	84	316
RTOR Reduction (vph)	0	80	7	0	0	0
Lane Group Flow (vph)	21	9	419	0	84	316
Turn Type	Prot	Perm	NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	4.1	4.1	25.5		25.5	25.5
Effective Green, g (s)	4.1	4.1	25.5		25.5	25.5
Actuated g/C Ratio	0.10	0.10	0.61		0.61	0.61
Clearance Time (s)	6.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	171	153	2111		564	2130
v/s Ratio Prot	c0.01		c0.12			0.09
v/s Ratio Perm		0.01			0.09	
v/c Ratio	0.12	0.06	0.20		0.15	0.15
Uniform Delay, d1	17.1	17.0	3.5		3.4	3.4
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.3	0.2	0.2		0.6	0.1
Delay (s)	17.4	17.2	3.8		4.0	3.6
Level of Service	B	B	A		A	A
Approach Delay (s)	17.2		3.8			3.7
Approach LOS	B		A			A
Intersection Summary						
HCM 2000 Control Delay			5.3		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.19			
Actuated Cycle Length (s)			41.6		Sum of lost time (s)	12.0
Intersection Capacity Utilization			34.1%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

Intersection						
Intersection Delay, s/veh	7.0					
Intersection LOS	A					
Approach	EB		WB		SB	
Entry Lanes	2		2		2	
Conflicting Circle Lanes	2		2		2	
Adj Approach Flow, veh/h	269		484		458	
Demand Flow Rate, veh/h	283		508		481	
Vehicles Circulating, veh/h	437		39		176	
Vehicles Exiting, veh/h	220		681		371	
Follow-Up Headway, s	3.186		3.186		3.186	
Ped Vol Crossing Leg, #/h	0		0		0	
Ped Cap Adj	1.000		1.000		1.000	
Approach Delay, s/veh	6.4		5.9		8.6	
Approach LOS	A		A		A	
Lane	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	L	TR
Assumed Moves	LT	TR	LT	R	L	TR
RT Channelized						
Lane Util	0.470	0.530	0.346	0.654	0.909	0.091
Critical Headway, s	4.293	4.113	4.293	4.113	4.293	4.113
Entry Flow, veh/h	133	150	176	332	437	44
Cap Entry Lane, veh/h	814	832	1097	1100	990	999
Entry HV Adj Factor	0.952	0.952	0.952	0.952	0.952	0.955
Flow Entry, veh/h	127	143	168	316	416	42
Cap Entry, veh/h	775	792	1045	1047	943	954
V/C Ratio	0.163	0.180	0.160	0.302	0.441	0.044
Control Delay, s/veh	6.4	6.4	4.9	6.4	9.0	4.2
LOS	A	A	A	A	A	A
95th %tile Queue, veh	1	1	1	1	2	0

HCM Signalized Intersection Capacity Analysis

5: Hurontario St. & Poplar S/R

2030 Background Conditions

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	375	210	55	275	155	180	350	30	210	425	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Flt	1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1738	1731		1738	1830	1555	1738	1830	1555	1738	1784	
Flt Permitted	0.51	1.00		0.14	1.00	1.00	0.20	1.00	1.00	0.54	1.00	
Satd. Flow (perm)	925	1731		258	1830	1555	362	1830	1555	992	1784	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	63	395	221	58	289	163	189	368	32	221	447	89
RTOR Reduction (vph)	0	25	0	0	0	105	0	0	16	0	9	0
Lane Group Flow (vph)	63	591	0	58	289	58	189	368	16	221	527	0
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)	28.4	28.4		28.4	28.4	28.4	39.0	39.0	39.0	29.0	29.0	
Effective Green, g (s)	28.4	28.4		28.4	28.4	28.4	39.0	39.0	39.0	29.0	29.0	
Actuated g/C Ratio	0.36	0.36		0.36	0.36	0.36	0.49	0.49	0.49	0.37	0.37	
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	330	619		92	654	556	299	898	763	362	651	
v/s Ratio Prot		c0.34			0.16		c0.06	0.20			c0.30	
v/s Ratio Perm	0.07			0.23		0.04	0.25		0.01	0.22		
v/c Ratio	0.19	0.95		0.63	0.44	0.10	0.63	0.41	0.02	0.61	0.81	
Uniform Delay, d1	17.6	24.9		21.1	19.5	17.0	14.3	12.9	10.4	20.6	22.7	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.3	25.2		13.2	0.5	0.1	4.3	1.4	0.0	7.5	10.5	
Delay (s)	17.9	50.1		34.4	19.9	17.1	18.6	14.3	10.4	28.1	33.2	
Level of Service	B	D		C	B	B	B	B	B	C	C	
Approach Delay (s)		47.1			20.7			15.4			31.7	
Approach LOS		D			C			B			C	
Intersection Summary												
HCM 2000 Control Delay			29.8				HCM 2000 Level of Service			C		
HCM 2000 Volume to Capacity ratio			0.85									
Actuated Cycle Length (s)			79.4				Sum of lost time (s)			15.0		
Intersection Capacity Utilization			91.7%				ICU Level of Service			F		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

8: High St. & Findlay Dr.

2030 Background Conditions
PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	10	15	330	10	30	445
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	11	16	347	11	32	468
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)						286
pX, platoon unblocked						
vC, conflicting volume	650	179			358	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	650	179			358	
tC, single (s)	6.9	7.0			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	97	98			97	
cM capacity (veh/h)	385	824			1176	
Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	26	232	126	188	312	
Volume Left	11	0	0	32	0	
Volume Right	16	0	11	0	0	
cSH	565	1700	1700	1176	1700	
Volume to Capacity	0.05	0.14	0.07	0.03	0.18	
Queue Length 95th (m)	1.1	0.0	0.0	0.6	0.0	
Control Delay (s)	11.7	0.0	0.0	1.6	0.0	
Lane LOS	B			A		
Approach Delay (s)	11.7	0.0		0.6		
Approach LOS	B					
Intersection Summary						
Average Delay			0.7			
Intersection Capacity Utilization			35.9%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

2030 Background Conditions

11: High St. & Campbell St.

PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	25	90	325	20	95	450
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1738	1555	3446		1738	3476
Flt Permitted	0.95	1.00	1.00		0.54	1.00
Satd. Flow (perm)	1738	1555	3446		979	3476
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	26	95	342	21	100	474
RTOR Reduction (vph)	0	85	6	0	0	0
Lane Group Flow (vph)	26	10	357	0	100	474
Turn Type	Prot	Perm	NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	4.1	4.1	24.8		24.8	24.8
Effective Green, g (s)	4.1	4.1	24.8		24.8	24.8
Actuated g/C Ratio	0.10	0.10	0.61		0.61	0.61
Clearance Time (s)	6.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	174	155	2089		593	2107
v/s Ratio Prot	c0.01		0.10			c0.14
v/s Ratio Perm		0.01			0.10	
v/c Ratio	0.15	0.06	0.17		0.17	0.22
Uniform Delay, d1	16.8	16.7	3.5		3.5	3.7
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.4	0.2	0.2		0.6	0.2
Delay (s)	17.2	16.8	3.7		4.1	3.9
Level of Service	B	B	A		A	A
Approach Delay (s)	16.9		3.7			4.0
Approach LOS	B		A			A
Intersection Summary						
HCM 2000 Control Delay			5.4		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.21			
Actuated Cycle Length (s)			40.9		Sum of lost time (s)	12.0
Intersection Capacity Utilization			33.2%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

Intersection						
Intersection Delay, s/veh	6.4					
Intersection LOS	A					
Approach	EB		WB		SB	
Entry Lanes	2		2		2	
Conflicting Circle Lanes	2		2		2	
Adj Approach Flow, veh/h	253		532		374	
Demand Flow Rate, veh/h	266		559		393	
Vehicles Circulating, veh/h	327		44		183	
Vehicles Exiting, veh/h	249		549		420	
Follow-Up Headway, s	3.186		3.186		3.186	
Ped Vol Crossing Leg, #/h	0		0		0	
Ped Cap Adj	1.000		1.000		1.000	
Approach Delay, s/veh	5.7		6.3		6.9	
Approach LOS	A		A		A	
Lane	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	L	TR
Assumed Moves	LT	TR	LT	R	L	TR
RT Channelized						
Lane Util	0.470	0.530	0.327	0.673	0.832	0.168
Critical Headway, s	4.293	4.113	4.293	4.113	4.293	4.113
Entry Flow, veh/h	125	141	183	376	327	66
Cap Entry Lane, veh/h	884	899	1093	1096	985	994
Entry HV Adj Factor	0.953	0.953	0.952	0.952	0.951	0.955
Flow Entry, veh/h	119	134	174	358	311	63
Cap Entry, veh/h	843	856	1041	1043	937	949
V/C Ratio	0.141	0.157	0.167	0.343	0.332	0.066
Control Delay, s/veh	5.7	5.8	5.0	7.0	7.4	4.4
LOS	A	A	A	A	A	A
95th %tile Queue, veh	0	1	1	2	1	0

HCM Signalized Intersection Capacity Analysis

5: Hurontario St. & Poplar S/R

2035 Background Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	75	295	180	40	330	260	135	425	60	150	230	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.94		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1738	1726		1738	1830	1555	1738	1830	1555	1738	1803	
Flt Permitted	0.44	1.00		0.23	1.00	1.00	0.50	1.00	1.00	0.50	1.00	
Satd. Flow (perm)	805	1726		413	1830	1555	910	1830	1555	923	1803	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	79	311	189	42	347	274	142	447	63	158	242	26
RTOR Reduction (vph)	0	38	0	0	0	189	0	0	32	0	6	0
Lane Group Flow (vph)	79	462	0	42	347	85	142	447	31	158	262	0
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)	18.2	18.2		18.2	18.2	18.2	28.7	28.7	28.7	20.2	20.2	
Effective Green, g (s)	18.2	18.2		18.2	18.2	18.2	28.7	28.7	28.7	20.2	20.2	
Actuated g/C Ratio	0.31	0.31		0.31	0.31	0.31	0.49	0.49	0.49	0.34	0.34	
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	248	533		127	565	480	520	891	757	316	618	
v/s Ratio Prot		c0.27			0.19		0.03	c0.24			0.15	
v/s Ratio Perm	0.10			0.10		0.05	0.11		0.02	0.17		
v/c Ratio	0.32	0.87		0.33	0.61	0.18	0.27	0.50	0.04	0.50	0.42	
Uniform Delay, d1	15.6	19.2		15.7	17.4	14.9	8.6	10.2	7.9	15.3	14.9	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.7	13.9		1.5	2.0	0.2	0.3	2.0	0.1	5.6	2.1	
Delay (s)	16.3	33.1		17.2	19.3	15.0	8.9	12.3	8.0	20.9	17.0	
Level of Service	B	C		B	B	B	A	B	A	C	B	
Approach Delay (s)		30.8			17.4			11.1			18.5	
Approach LOS		C			B			B			B	
Intersection Summary												
HCM 2000 Control Delay			19.2		HCM 2000 Level of Service				B			
HCM 2000 Volume to Capacity ratio			0.69									
Actuated Cycle Length (s)			58.9		Sum of lost time (s)				15.0			
Intersection Capacity Utilization			80.5%		ICU Level of Service				D			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis 8: High St. & Findlay Dr.

2035 Background Conditions
AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	10	25	430	10	10	330
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	11	26	453	11	11	347
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)						286
pX, platoon unblocked						
vC, conflicting volume	653	232			463	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	653	232			463	
tC, single (s)	6.9	7.0			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	97	97			99	
cM capacity (veh/h)	390	761			1073	
Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	37	302	161	126	232	
Volume Left	11	0	0	11	0	
Volume Right	26	0	11	0	0	
cSH	598	1700	1700	1073	1700	
Volume to Capacity	0.06	0.18	0.09	0.01	0.14	
Queue Length 95th (m)	1.5	0.0	0.0	0.2	0.0	
Control Delay (s)	11.4	0.0	0.0	0.8	0.0	
Lane LOS	B			A		
Approach Delay (s)	11.4	0.0		0.3		
Approach LOS	B					
Intersection Summary						
Average Delay			0.6			
Intersection Capacity Utilization			26.3%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

2035 Background Conditions

11: High St. & Campbell St.

AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	20	85	430	25	80	320
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1738	1555	3448		1738	3476
Flt Permitted	0.95	1.00	1.00		0.48	1.00
Satd. Flow (perm)	1738	1555	3448		875	3476
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	21	89	453	26	84	337
RTOR Reduction (vph)	0	80	6	0	0	0
Lane Group Flow (vph)	21	9	473	0	84	337
Turn Type	Prot	Perm	NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	4.1	4.1	25.5		25.5	25.5
Effective Green, g (s)	4.1	4.1	25.5		25.5	25.5
Actuated g/C Ratio	0.10	0.10	0.61		0.61	0.61
Clearance Time (s)	6.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	171	153	2113		536	2130
v/s Ratio Prot	c0.01		c0.14			0.10
v/s Ratio Perm		0.01			0.10	
v/c Ratio	0.12	0.06	0.22		0.16	0.16
Uniform Delay, d1	17.1	17.0	3.6		3.4	3.5
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.3	0.2	0.2		0.6	0.2
Delay (s)	17.4	17.2	3.9		4.1	3.6
Level of Service	B	B	A		A	A
Approach Delay (s)	17.2		3.9			3.7
Approach LOS	B		A			A
Intersection Summary						
HCM 2000 Control Delay			5.2		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.21			
Actuated Cycle Length (s)			41.6		Sum of lost time (s)	12.0
Intersection Capacity Utilization			35.4%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

Intersection						
Intersection Delay, s/veh	7.4					
Intersection LOS	A					
Approach	EB		WB		SB	
Entry Lanes	2		2		2	
Conflicting Circle Lanes	2		2		2	
Adj Approach Flow, veh/h	284		521		489	
Demand Flow Rate, veh/h	298		547		513	
Vehicles Circulating, veh/h	464		44		188	
Vehicles Exiting, veh/h	237		718		403	
Follow-Up Headway, s	3.186		3.186		3.186	
Ped Vol Crossing Leg, #/h	0		0		0	
Ped Cap Adj	1.000		1.000		1.000	
Approach Delay, s/veh	6.7		6.2		9.1	
Approach LOS	A		A		A	
Lane	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	L	TR
Assumed Moves	LT	TR	LT	R	L	TR
RT Channelized						
Lane Util	0.470	0.530	0.344	0.656	0.904	0.096
Critical Headway, s	4.293	4.113	4.293	4.113	4.293	4.113
Entry Flow, veh/h	140	158	188	359	464	49
Cap Entry Lane, veh/h	798	817	1093	1096	981	991
Entry HV Adj Factor	0.953	0.952	0.952	0.953	0.953	0.959
Flow Entry, veh/h	133	150	179	342	442	47
Cap Entry, veh/h	760	778	1041	1044	935	950
V/C Ratio	0.175	0.193	0.172	0.328	0.473	0.049
Control Delay, s/veh	6.6	6.7	5.0	6.8	9.6	4.2
LOS	A	A	A	A	A	A
95th %tile Queue, veh	1	1	1	1	3	0

HCM Signalized Intersection Capacity Analysis

2035 Background Conditions

5: Hurontario St. & Poplar S/R

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	395	225	60	295	165	190	365	30	220	445	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1738	1730		1738	1830	1555	1738	1830	1555	1738	1786	
Flt Permitted	0.48	1.00		0.12	1.00	1.00	0.18	1.00	1.00	0.53	1.00	
Satd. Flow (perm)	876	1730		216	1830	1555	323	1830	1555	978	1786	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	63	416	237	63	311	174	200	384	32	232	468	89
RTOR Reduction (vph)	0	23	0	0	0	108	0	0	17	0	8	0
Lane Group Flow (vph)	63	630	0	63	311	66	200	384	15	232	549	0
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)	33.9	33.9		33.9	33.9	33.9	43.0	43.0	43.0	33.0	33.0	
Effective Green, g (s)	33.9	33.9		33.9	33.9	33.9	43.0	43.0	43.0	33.0	33.0	
Actuated g/C Ratio	0.38	0.38		0.38	0.38	0.38	0.48	0.48	0.48	0.37	0.37	
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	334	659		82	697	592	267	885	752	363	662	
v/s Ratio Prot		c0.36			0.17		c0.06	0.21			c0.31	
v/s Ratio Perm	0.07			0.29		0.04	0.30		0.01	0.24		
v/c Ratio	0.19	0.96		0.77	0.45	0.11	0.75	0.43	0.02	0.64	0.83	
Uniform Delay, d1	18.3	26.8		24.1	20.5	17.8	17.0	15.0	12.0	23.0	25.4	
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	0.3	24.5		34.2	0.5	0.1	10.9	1.5	0.1	8.4	11.5	
Delay (s)	18.6	51.2		58.3	21.0	17.9	27.9	16.5	12.0	31.4	36.9	
Level of Service	B	D		E	C	B	C	B	B	C	D	
Approach Delay (s)		48.4			24.3			20.0			35.3	
Approach LOS		D			C			C			D	
Intersection Summary												
HCM 2000 Control Delay			33.0		HCM 2000 Level of Service					C		
HCM 2000 Volume to Capacity ratio			0.88									
Actuated Cycle Length (s)			88.9		Sum of lost time (s)					15.0		
Intersection Capacity Utilization			95.3%		ICU Level of Service					F		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis 8: High St. & Findlay Dr.

2035 Background Conditions
PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	10	15	365	10	30	500
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	11	16	384	11	32	526
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)						286
pX, platoon unblocked						
vC, conflicting volume	716	197			395	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	716	197			395	
tC, single (s)	6.9	7.0			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	97	98			97	
cM capacity (veh/h)	349	801			1139	
Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	26	256	139	207	351	
Volume Left	11	0	0	32	0	
Volume Right	16	0	11	0	0	
cSH	527	1700	1700	1139	1700	
Volume to Capacity	0.05	0.15	0.08	0.03	0.21	
Queue Length 95th (m)	1.2	0.0	0.0	0.6	0.0	
Control Delay (s)	12.2	0.0	0.0	1.5	0.0	
Lane LOS	B			A		
Approach Delay (s)	12.2	0.0		0.5		
Approach LOS	B					
Intersection Summary						
Average Delay			0.6			
Intersection Capacity Utilization			38.4%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

2035 Background Conditions

11: High St. & Campbell St.

PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	30	90	360	20	95	500
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1738	1555	3449		1738	3476
Flt Permitted	0.95	1.00	1.00		0.52	1.00
Satd. Flow (perm)	1738	1555	3449		945	3476
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	95	379	21	100	526
RTOR Reduction (vph)	0	85	6	0	0	0
Lane Group Flow (vph)	32	10	394	0	100	526
Turn Type	Prot	Perm	NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	4.2	4.2	24.5		24.5	24.5
Effective Green, g (s)	4.2	4.2	24.5		24.5	24.5
Actuated g/C Ratio	0.10	0.10	0.60		0.60	0.60
Clearance Time (s)	6.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	179	160	2076		568	2092
v/s Ratio Prot	c0.02		0.11			c0.15
v/s Ratio Perm		0.01			0.11	
v/c Ratio	0.18	0.06	0.19		0.18	0.25
Uniform Delay, d1	16.7	16.5	3.6		3.6	3.8
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.5	0.2	0.2		0.7	0.3
Delay (s)	17.2	16.6	3.8		4.3	4.1
Level of Service	B	B	A		A	A
Approach Delay (s)	16.8		3.8			4.1
Approach LOS	B		A			A
Intersection Summary						
HCM 2000 Control Delay			5.4		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.24			
Actuated Cycle Length (s)			40.7		Sum of lost time (s)	12.0
Intersection Capacity Utilization			34.2%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

2035 BG (w/improvement)

5: Hurontario St. & Poplar S/R

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	75	295	180	40	330	260	135	425	60	150	230	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1738	1830	1555	1738	1830	1555	1738	1830	1555	1738	1803	
Flt Permitted	0.41	1.00	1.00	0.48	1.00	1.00	0.51	1.00	1.00	0.50	1.00	
Satd. Flow (perm)	758	1830	1555	873	1830	1555	941	1830	1555	923	1803	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	79	311	189	42	347	274	142	447	63	158	242	26
RTOR Reduction (vph)	0	0	140	0	0	203	0	0	30	0	6	0
Lane Group Flow (vph)	79	311	49	42	347	71	142	447	33	158	262	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		
Actuated Green, G (s)	13.9	13.9	13.9	13.9	13.9	13.9	27.7	27.7	27.7	19.3	19.3	
Effective Green, g (s)	13.9	13.9	13.9	13.9	13.9	13.9	27.7	27.7	27.7	19.3	19.3	
Actuated g/C Ratio	0.26	0.26	0.26	0.26	0.26	0.26	0.52	0.52	0.52	0.36	0.36	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	196	474	403	226	474	403	566	945	803	332	649	
v/s Ratio Prot		0.17			c0.19		0.03	c0.24			0.15	
v/s Ratio Perm	0.10		0.03	0.05		0.05	0.10		0.02	0.17		
v/c Ratio	0.40	0.66	0.12	0.19	0.73	0.18	0.25	0.47	0.04	0.48	0.40	
Uniform Delay, d1	16.4	17.7	15.2	15.4	18.1	15.4	6.9	8.3	6.4	13.2	12.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.4	3.3	0.1	0.4	5.8	0.2	0.2	1.7	0.1	4.8	1.9	
Delay (s)	17.8	21.0	15.3	15.8	23.9	15.6	7.1	10.0	6.5	18.1	14.7	
Level of Service	B	C	B	B	C	B	A	A	A	B	B	
Approach Delay (s)		18.7			20.0			9.0			15.9	
Approach LOS		B			B			A			B	
Intersection Summary												
HCM 2000 Control Delay			15.8				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.60									
Actuated Cycle Length (s)			53.6				Sum of lost time (s)			15.0		
Intersection Capacity Utilization			72.2%				ICU Level of Service			C		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

2035 BG (w/improvement)

5: Hurontario St. & Poplar S/R

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	395	225	60	295	165	190	365	30	220	445	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1738	1830	1555	1738	1830	1555	1738	1830	1555	1738	1786	
Flt Permitted	0.45	1.00	1.00	0.28	1.00	1.00	0.21	1.00	1.00	0.53	1.00	
Satd. Flow (perm)	829	1830	1555	504	1830	1555	381	1830	1555	978	1786	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	63	416	237	63	311	174	200	384	32	232	468	89
RTOR Reduction (vph)	0	0	176	0	0	129	0	0	15	0	11	0
Lane Group Flow (vph)	63	416	61	63	311	45	200	384	17	232	546	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		
Actuated Green, G (s)	15.4	15.4	15.4	15.4	15.4	15.4	32.0	32.0	32.0	22.2	22.2	
Effective Green, g (s)	15.4	15.4	15.4	15.4	15.4	15.4	32.0	32.0	32.0	22.2	22.2	
Actuated g/C Ratio	0.26	0.26	0.26	0.26	0.26	0.26	0.54	0.54	0.54	0.37	0.37	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	214	474	403	130	474	403	360	985	837	365	667	
v/s Ratio Prot		c0.23			0.17		c0.06	0.21			c0.31	
v/s Ratio Perm	0.08		0.04	0.13		0.03	0.24		0.01	0.24		
v/c Ratio	0.29	0.88	0.15	0.48	0.66	0.11	0.56	0.39	0.02	0.64	0.82	
Uniform Delay, d1	17.6	21.1	17.0	18.6	19.6	16.8	9.2	8.0	6.4	15.3	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	
Incremental Delay, d2	0.8	16.6	0.2	2.8	3.3	0.1	1.9	1.2	0.0	8.2	10.7	
Delay (s)	18.4	37.7	17.1	21.5	22.9	16.9	11.1	9.2	6.4	23.5	27.5	
Level of Service	B	D	B	C	C	B	B	A	A	C	C	
Approach Delay (s)		29.2			20.8			9.6			26.3	
Approach LOS		C			C			A			C	
Intersection Summary												
HCM 2000 Control Delay			22.1				HCM 2000 Level of Service			C		
HCM 2000 Volume to Capacity ratio			0.80									
Actuated Cycle Length (s)			59.4				Sum of lost time (s)			15.0		
Intersection Capacity Utilization			81.6%				ICU Level of Service			D		
Analysis Period (min)			15									
c Critical Lane Group												

APPENDIX D:
FUTURE TOTAL OPERATIONS

HCM 2010 Roundabout
3: Poplar S/R & High St.

11/19/2015

Intersection						
Intersection Delay, s/veh	5.9					
Intersection LOS	A					
Approach	EB		WB		SB	
Entry Lanes	2		2		2	
Conflicting Circle Lanes	2		2		2	
Adj Approach Flow, veh/h	221		464		326	
Demand Flow Rate, veh/h	232		488		342	
Vehicles Circulating, veh/h	281		39		161	
Vehicles Exiting, veh/h	222		474		366	
Follow-Up Headway, s	3.186		3.186		3.186	
Ped Vol Crossing Leg, #/h	0		0		0	
Ped Cap Adj	1.000		1.000		1.000	
Approach Delay, s/veh	5.3		5.8		6.2	
Approach LOS	A		A		A	
Lane	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	L	TR
Assumed Moves	LT	TR	LT	R	L	TR
RT Channelized						
Lane Util	0.470	0.530	0.330	0.670	0.822	0.178
Critical Headway, s	4.293	4.113	4.293	4.113	4.293	4.113
Entry Flow, veh/h	109	123	161	327	281	61
Cap Entry Lane, veh/h	915	928	1097	1100	1001	1010
Entry HV Adj Factor	0.952	0.951	0.952	0.951	0.954	0.951
Flow Entry, veh/h	104	117	153	311	268	58
Cap Entry, veh/h	871	883	1045	1046	955	960
V/C Ratio	0.119	0.133	0.147	0.297	0.281	0.060
Control Delay, s/veh	5.3	5.4	4.8	6.4	6.6	4.3
LOS	A	A	A	A	A	A
95th %tile Queue, veh	0	0	1	1	1	0

HCM Signalized Intersection Capacity Analysis

5: Hurontario St. & Poplar S/R

11/19/2015

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	70	255	160	35	290	225	120	370	50	130	200	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.94		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1738	1724		1738	1830	1555	1738	1830	1555	1738	1800	
Flt Permitted	0.50	1.00		0.30	1.00	1.00	0.53	1.00	1.00	0.53	1.00	
Satd. Flow (perm)	915	1724		553	1830	1555	969	1830	1555	973	1800	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	74	268	168	37	305	237	126	389	53	137	211	26
RTOR Reduction (vph)	0	41	0	0	0	167	0	0	27	0	7	0
Lane Group Flow (vph)	74	395	0	37	305	70	126	389	26	137	230	0
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)	16.6	16.6		16.6	16.6	16.6	27.9	27.9	27.9	19.5	19.5	
Effective Green, g (s)	16.6	16.6		16.6	16.6	16.6	27.9	27.9	27.9	19.5	19.5	
Actuated g/C Ratio	0.29	0.29		0.29	0.29	0.29	0.49	0.49	0.49	0.35	0.35	
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	268	506		162	537	456	551	903	767	335	621	
v/s Ratio Prot		c0.23			0.17		0.02	c0.21			0.13	
v/s Ratio Perm	0.08			0.07		0.04	0.09		0.02	0.14		
v/c Ratio	0.28	0.78		0.23	0.57	0.15	0.23	0.43	0.03	0.41	0.37	
Uniform Delay, d1	15.3	18.3		15.1	16.9	14.8	7.9	9.2	7.4	14.1	13.9	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.6	7.7		0.7	1.4	0.2	0.2	1.5	0.1	3.7	1.7	
Delay (s)	15.9	25.9		15.8	18.3	14.9	8.1	10.7	7.4	17.8	15.6	
Level of Service	B	C		B	B	B	A	B	A	B	B	
Approach Delay (s)		24.5			16.7			9.8			16.4	
Approach LOS		C			B			A			B	
Intersection Summary												
HCM 2000 Control Delay			16.7				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.60									
Actuated Cycle Length (s)			56.5				Sum of lost time (s)			15.0		
Intersection Capacity Utilization			73.2%				ICU Level of Service			D		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

8: High St. & Street A/Findlay Dr.

11/19/2015

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	65	10	40	5	5	25	15	310	5	10	265	25
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	68	11	42	5	5	26	16	326	5	11	279	26
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	703	676	292	721	687	329	305			332		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	703	676	292	721	687	329	305			332		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	79	97	94	98	99	96	99			99		
cM capacity (veh/h)	326	363	740	307	358	706	1239			1211		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	121	37	347	316								
Volume Left	68	5	16	11								
Volume Right	42	26	5	26								
cSH	410	533	1239	1211								
Volume to Capacity	0.30	0.07	0.01	0.01								
Queue Length 95th (m)	9.1	1.7	0.3	0.2								
Control Delay (s)	17.4	12.3	0.5	0.3								
Lane LOS	C	B	A	A								
Approach Delay (s)	17.4	12.3	0.5	0.3								
Approach LOS	C	B										
Intersection Summary												
Average Delay			3.5									
Intersection Capacity Utilization			42.8%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

11: High St. & Campbell St.

11/19/2015

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Stop		Stop	Stop
Volume (vph)	20	80	370	30	75	255
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	21	84	389	32	79	268
Direction, Lane #	WB 1	NB 1	SB 1	SB 2		
Volume Total (vph)	105	421	79	268		
Volume Left (vph)	21	0	79	0		
Volume Right (vph)	84	32	0	0		
Hadj (s)	-0.35	0.04	0.58	0.09		
Departure Headway (s)	5.3	4.7	5.7	5.2		
Degree Utilization, x	0.15	0.56	0.13	0.39		
Capacity (veh/h)	603	742	606	667		
Control Delay (s)	9.3	13.5	8.4	10.4		
Approach Delay (s)	9.3	13.5	9.9			
Approach LOS	A	B	A			
Intersection Summary						
Delay			11.6			
Level of Service			B			
Intersection Capacity Utilization			41.5%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM 2010 Roundabout
3: Poplar S/R & High St.

11/19/2015

Intersection						
Intersection Delay, s/veh	6.6					
Intersection LOS	A					
Approach	EB		WB		SB	
Entry Lanes	2		2		2	
Conflicting Circle Lanes	2		2		2	
Adj Approach Flow, veh/h	253		448		431	
Demand Flow Rate, veh/h	266		471		452	
Vehicles Circulating, veh/h	403		44		161	
Vehicles Exiting, veh/h	210		625		354	
Follow-Up Headway, s	3.186		3.186		3.186	
Ped Vol Crossing Leg, #/h	0		0		0	
Ped Cap Adj	1.000		1.000		1.000	
Approach Delay, s/veh	6.1		5.7		7.8	
Approach LOS	A		A		A	
Lane	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	L	TR
Assumed Moves	LT	TR	LT	R	L	TR
RT Channelized						
Lane Util	0.470	0.530	0.342	0.658	0.892	0.108
Critical Headway, s	4.293	4.113	4.293	4.113	4.293	4.113
Entry Flow, veh/h	125	141	161	310	403	49
Cap Entry Lane, veh/h	835	852	1093	1096	1001	1010
Entry HV Adj Factor	0.953	0.953	0.952	0.952	0.953	0.959
Flow Entry, veh/h	119	134	153	295	384	47
Cap Entry, veh/h	796	812	1041	1043	954	968
V/C Ratio	0.150	0.165	0.147	0.283	0.402	0.049
Control Delay, s/veh	6.1	6.1	4.8	6.2	8.3	4.2
LOS	A	A	A	A	A	A
95th %tile Queue, veh	1	1	1	1	2	0

HCM Signalized Intersection Capacity Analysis

5: Hurontario St. & Poplar S/R

11/19/2015

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	55	345	195	50	260	145	175	315	25	190	385	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1738	1731		1738	1830	1555	1738	1830	1555	1738	1782	
Flt Permitted	0.54	1.00		0.17	1.00	1.00	0.23	1.00	1.00	0.56	1.00	
Satd. Flow (perm)	985	1731		310	1830	1555	414	1830	1555	1025	1782	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	58	363	205	53	274	153	184	332	26	200	405	84
RTOR Reduction (vph)	0	30	0	0	0	100	0	0	13	0	11	0
Lane Group Flow (vph)	58	538	0	53	274	53	184	332	13	200	478	0
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)	23.6	23.6		23.6	23.6	23.6	33.1	33.1	33.1	23.2	23.2	
Effective Green, g (s)	23.6	23.6		23.6	23.6	23.6	33.1	33.1	33.1	23.2	23.2	
Actuated g/C Ratio	0.34	0.34		0.34	0.34	0.34	0.48	0.48	0.48	0.34	0.34	
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	338	594		106	628	534	332	881	749	346	601	
v/s Ratio Prot		c0.31			0.15		c0.06	0.18			c0.27	
v/s Ratio Perm	0.06			0.17		0.03	0.21		0.01	0.20		
v/c Ratio	0.17	0.91		0.50	0.44	0.10	0.55	0.38	0.02	0.58	0.80	
Uniform Delay, d1	15.7	21.5		17.9	17.4	15.3	12.1	11.3	9.3	18.7	20.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.2	17.4		3.7	0.5	0.1	2.0	1.2	0.0	6.9	10.5	
Delay (s)	16.0	38.9		21.5	17.9	15.4	14.1	12.5	9.3	25.6	31.1	
Level of Service	B	D		C	B	B	B	B	A	C	C	
Approach Delay (s)		36.8			17.5			12.9			29.5	
Approach LOS		D			B			B			C	
Intersection Summary												
HCM 2000 Control Delay			25.1									HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio			0.81									
Actuated Cycle Length (s)			68.7									Sum of lost time (s) 15.0
Intersection Capacity Utilization			86.5%									ICU Level of Service E
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

8: High St. & Street A/Findlay Dr.

11/19/2015

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	45	5	25	5	10	15	40	270	10	30	380	70
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	47	5	26	5	11	16	42	284	11	32	400	74
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	895	879	437	903	911	289	474			295		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	895	879	437	903	911	289	474			295		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	80	98	96	98	96	98	96			97		
cM capacity (veh/h)	233	265	613	229	254	743	1073			1250		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	79	32	337	505								
Volume Left	47	5	42	32								
Volume Right	26	16	11	74								
cSH	297	368	1073	1250								
Volume to Capacity	0.27	0.09	0.04	0.03								
Queue Length 95th (m)	7.9	2.1	0.9	0.6								
Control Delay (s)	21.5	15.7	1.4	0.8								
Lane LOS	C	C	A	A								
Approach Delay (s)	21.5	15.7	1.4	0.8								
Approach LOS	C	C										
Intersection Summary												
Average Delay			3.2									
Intersection Capacity Utilization			47.4%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

11: High St. & Campbell St.

11/19/2015

								
Movement	WBL	WBR	NBT	NBR	SBL	SBT		
Lane Configurations								
Sign Control	Stop		Stop		Stop	Stop		
Volume (vph)	30	80	310	20	85	380		
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95		
Hourly flow rate (vph)	32	84	326	21	89	400		
Direction, Lane #	WB 1	NB 1	SB 1	SB 2				
Volume Total (vph)	116	347	89	400				
Volume Left (vph)	32	0	89	0				
Volume Right (vph)	84	21	0	0				
Hadj (s)	-0.30	0.05	0.58	0.09				
Departure Headway (s)	5.5	5.0	5.7	5.2				
Degree Utilization, x	0.18	0.48	0.14	0.58				
Capacity (veh/h)	582	707	610	673				
Control Delay (s)	9.7	12.4	8.5	14.1				
Approach Delay (s)	9.7	12.4	13.1					
Approach LOS	A	B	B					
Intersection Summary								
Delay			12.4					
Level of Service			B					
Intersection Capacity Utilization			38.8%	ICU Level of Service	A			
Analysis Period (min)			15					

Intersection						
Intersection Delay, s/veh	6.2					
Intersection LOS	A					
Approach	EB		WB		SB	
Entry Lanes	2		2		2	
Conflicting Circle Lanes	2		2		2	
Adj Approach Flow, veh/h	258		495		353	
Demand Flow Rate, veh/h	271		520		371	
Vehicles Circulating, veh/h	310		49		171	
Vehicles Exiting, veh/h	232		532		398	
Follow-Up Headway, s	3.186		3.186		3.186	
Ped Vol Crossing Leg, #/h	0		0		0	
Ped Cap Adj	1.000		1.000		1.000	
Approach Delay, s/veh	5.7		6.1		6.6	
Approach LOS	A		A		A	
Lane	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	L	TR
Assumed Moves	LT	TR	LT	R	L	TR
RT Channelized						
Lane Util	0.469	0.531	0.329	0.671	0.836	0.164
Critical Headway, s	4.293	4.113	4.293	4.113	4.293	4.113
Entry Flow, veh/h	127	144	171	349	310	61
Cap Entry Lane, veh/h	896	910	1089	1092	994	1002
Entry HV Adj Factor	0.956	0.951	0.952	0.951	0.952	0.951
Flow Entry, veh/h	121	137	163	332	295	58
Cap Entry, veh/h	856	865	1037	1039	946	953
V/C Ratio	0.142	0.158	0.157	0.320	0.312	0.061
Control Delay, s/veh	5.6	5.7	4.9	6.7	7.1	4.3
LOS	A	A	A	A	A	A
95th %tile Queue, veh	0	1	1	1	1	0

HCM Signalized Intersection Capacity Analysis

5: Hurontario St. & Poplar S/R

2025 Total Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	70	285	180	35	310	235	130	385	55	140	210	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.94		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1738	1724		1738	1830	1555	1738	1830	1555	1738	1801	
Flt Permitted	0.47	1.00		0.24	1.00	1.00	0.52	1.00	1.00	0.52	1.00	
Satd. Flow (perm)	857	1724		430	1830	1555	960	1830	1555	959	1801	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	74	300	189	37	326	247	137	405	58	147	221	26
RTOR Reduction (vph)	0	40	0	0	0	172	0	0	30	0	7	0
Lane Group Flow (vph)	74	449	0	37	326	75	137	405	28	147	240	0
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)	17.9	17.9		17.9	17.9	17.9	28.8	28.8	28.8	20.3	20.3	
Effective Green, g (s)	17.9	17.9		17.9	17.9	17.9	28.8	28.8	28.8	20.3	20.3	
Actuated g/C Ratio	0.30	0.30		0.30	0.30	0.30	0.49	0.49	0.49	0.35	0.35	
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	261	525		131	558	474	543	897	762	331	622	
v/s Ratio Prot		c0.26			0.18		0.02	c0.22			0.13	
v/s Ratio Perm	0.09			0.09		0.05	0.10		0.02	0.15		
v/c Ratio	0.28	0.86		0.28	0.58	0.16	0.25	0.45	0.04	0.44	0.39	
Uniform Delay, d1	15.5	19.2		15.5	17.3	14.9	8.4	9.8	7.8	14.8	14.5	
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	0.6	12.9		1.2	1.6	0.2	0.2	1.6	0.1	4.3	1.8	
Delay (s)	16.1	32.1		16.7	18.8	15.1	8.6	11.4	7.8	19.1	16.3	
Level of Service	B	C		B	B	B	A	B	A	B	B	
Approach Delay (s)		30.0			17.2			10.4			17.4	
Approach LOS		C			B			B			B	
Intersection Summary												
HCM 2000 Control Delay			18.7		HCM 2000 Level of Service					B		
HCM 2000 Volume to Capacity ratio			0.65									
Actuated Cycle Length (s)			58.7		Sum of lost time (s)					15.0		
Intersection Capacity Utilization			77.3%		ICU Level of Service					D		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

8: High St. & Street A/Findlay Dr.

2025 Total Conditions
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	110	15	45	5	5	25	15	340	5	10	285	40
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	116	16	47	5	5	26	16	358	5	11	300	42
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh												
Upstream signal (m)											286	
pX, platoon unblocked												
vC, conflicting volume	582	737	171	618	755	182	342			363		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	582	737	171	618	755	182	342			363		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	68	95	94	98	98	97	99			99		
cM capacity (veh/h)	367	331	834	328	323	821	1192			1171		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	179	37	195	184	161	192						
Volume Left	116	5	16	0	11	0						
Volume Right	47	26	0	5	0	42						
cSH	426	572	1192	1700	1171	1700						
Volume to Capacity	0.42	0.06	0.01	0.11	0.01	0.11						
Queue Length 95th (m)	15.3	1.5	0.3	0.0	0.2	0.0						
Control Delay (s)	19.4	11.7	0.8	0.0	0.6	0.0						
Lane LOS	C	B	A		A							
Approach Delay (s)	19.4	11.7	0.4		0.3							
Approach LOS	C	B										
Intersection Summary												
Average Delay			4.4									
Intersection Capacity Utilization			43.6%		ICU Level of Service		A					
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

11: High St. & Campbell St.

2025 Total Conditions

AM Peak Hour

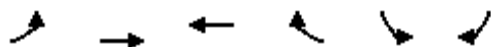
						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	30	80	430	45	80	265
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1738	1555	3427		1738	3476
Flt Permitted	0.95	1.00	1.00		0.47	1.00
Satd. Flow (perm)	1738	1555	3427		857	3476
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	84	453	47	84	279
RTOR Reduction (vph)	0	76	11	0	0	0
Lane Group Flow (vph)	32	8	489	0	84	279
Turn Type	Prot	Perm	NA		Perm	NA
Protected Phases	3		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	4.0	4.0	24.5		24.5	24.5
Effective Green, g (s)	4.0	4.0	24.5		24.5	24.5
Actuated g/C Ratio	0.10	0.10	0.60		0.60	0.60
Clearance Time (s)	6.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	171	153	2073		518	2102
v/s Ratio Prot	c0.02		c0.14			0.08
v/s Ratio Perm		0.01			0.10	
v/c Ratio	0.19	0.05	0.24		0.16	0.13
Uniform Delay, d1	16.8	16.5	3.7		3.5	3.4
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.5	0.1	0.3		0.7	0.1
Delay (s)	17.3	16.7	4.0		4.2	3.6
Level of Service	B	B	A		A	A
Approach Delay (s)	16.9		4.0			3.7
Approach LOS	B		A			A
Intersection Summary						
HCM 2000 Control Delay			5.4		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.23			
Actuated Cycle Length (s)			40.5		Sum of lost time (s)	12.0
Intersection Capacity Utilization			36.1%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis

16: Poplar S/R & Street B

2025 Total Conditions

AM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	10	220	200	10	25	20
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	11	232	211	11	26	21
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	221				468	216
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	221				468	216
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				95	97
cM capacity (veh/h)	1330				543	817
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	242	221	47			
Volume Left	11	0	26			
Volume Right	0	11	21			
cSH	1330	1700	638			
Volume to Capacity	0.01	0.13	0.07			
Queue Length 95th (m)	0.2	0.0	1.8			
Control Delay (s)	0.4	0.0	11.1			
Lane LOS	A		B			
Approach Delay (s)	0.4	0.0	11.1			
Approach LOS			B			
Intersection Summary						
Average Delay			1.2			
Intersection Capacity Utilization			29.7%	ICU Level of Service		A
Analysis Period (min)			15			

Intersection						
Intersection Delay, s/veh	7.1					
Intersection LOS	A					
Approach	EB		WB		SB	
Entry Lanes	2		2		2	
Conflicting Circle Lanes	2		2		2	
Adj Approach Flow, veh/h	279		511		469	
Demand Flow Rate, veh/h	293		537		493	
Vehicles Circulating, veh/h	437		49		188	
Vehicles Exiting, veh/h	244		681		398	
Follow-Up Headway, s	3.186		3.186		3.186	
Ped Vol Crossing Leg, #/h	0		0		0	
Ped Cap Adj	1.000		1.000		1.000	
Approach Delay, s/veh	6.5		6.1		8.6	
Approach LOS	A		A		A	
Lane	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	L	TR
Assumed Moves	LT	TR	LT	R	L	TR
RT Channelized						
Lane Util	0.471	0.529	0.350	0.650	0.886	0.114
Critical Headway, s	4.293	4.113	4.293	4.113	4.293	4.113
Entry Flow, veh/h	138	155	188	349	437	56
Cap Entry Lane, veh/h	814	832	1089	1092	981	991
Entry HV Adj Factor	0.952	0.955	0.952	0.951	0.952	0.946
Flow Entry, veh/h	131	148	179	332	416	53
Cap Entry, veh/h	775	795	1037	1039	934	938
V/C Ratio	0.169	0.186	0.173	0.320	0.445	0.057
Control Delay, s/veh	6.4	6.5	5.1	6.7	9.1	4.4
LOS	A	A	A	A	A	A
95th %tile Queue, veh	1	1	1	1	2	0

HCM Signalized Intersection Capacity Analysis

5: Hurontario St. & Poplar S/R

2025 Total Conditions

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	55	375	210	55	290	150	190	335	30	200	405	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1738	1731		1738	1830	1555	1738	1830	1555	1738	1784	
Flt Permitted	0.49	1.00		0.14	1.00	1.00	0.21	1.00	1.00	0.55	1.00	
Satd. Flow (perm)	905	1731		255	1830	1555	375	1830	1555	1006	1784	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	58	395	221	58	305	158	200	353	32	211	426	84
RTOR Reduction (vph)	0	26	0	0	0	99	0	0	17	0	8	0
Lane Group Flow (vph)	58	590	0	58	305	59	200	353	15	211	502	0
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)	28.9	28.9		28.9	28.9	28.9	37.1	37.1	37.1	27.1	27.1	
Effective Green, g (s)	28.9	28.9		28.9	28.9	28.9	37.1	37.1	37.1	27.1	27.1	
Actuated g/C Ratio	0.37	0.37		0.37	0.37	0.37	0.48	0.48	0.48	0.35	0.35	
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	335	641		94	678	576	300	870	739	349	619	
v/s Ratio Prot		c0.34			0.17		c0.06	0.19			c0.28	
v/s Ratio Perm	0.06			0.23		0.04	0.26		0.01	0.21		
v/c Ratio	0.17	0.92		0.62	0.45	0.10	0.67	0.41	0.02	0.60	0.81	
Uniform Delay, d1	16.5	23.5		20.0	18.5	16.1	14.6	13.3	10.8	21.0	23.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.2	18.7		11.5	0.5	0.1	5.5	1.4	0.1	7.6	11.0	
Delay (s)	16.8	42.1		31.5	19.0	16.1	20.1	14.7	10.9	28.6	34.1	
Level of Service	B	D		C	B	B	C	B	B	C	C	
Approach Delay (s)		39.9			19.5			16.3			32.5	
Approach LOS		D			B			B			C	
Intersection Summary												
HCM 2000 Control Delay			28.0		HCM 2000 Level of Service					C		
HCM 2000 Volume to Capacity ratio			0.85									
Actuated Cycle Length (s)			78.0		Sum of lost time (s)					15.0		
Intersection Capacity Utilization			90.9%		ICU Level of Service					E		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

8: High St. & Street A/Findlay Dr.

2025 Total Conditions

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	75	10	30	5	15	15	45	305	10	30	410	120
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	79	11	32	5	16	16	47	321	11	32	432	126
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh												
Upstream signal (m)											286	
pX, platoon unblocked												
vC, conflicting volume	837	984	279	737	1042	166	558			332		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	837	984	279	737	1042	166	558			332		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	64	95	96	98	92	98	95			97		
cM capacity (veh/h)	222	224	709	262	207	840	988			1203		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	121	37	208	171	247	342						
Volume Left	79	5	47	0	32	0						
Volume Right	32	16	0	11	0	126						
cSH	271	320	988	1700	1203	1700						
Volume to Capacity	0.45	0.12	0.05	0.10	0.03	0.20						
Queue Length 95th (m)	16.3	2.9	1.1	0.0	0.6	0.0						
Control Delay (s)	28.6	17.7	2.4	0.0	1.2	0.0						
Lane LOS	D	C	A		A							
Approach Delay (s)	28.6	17.7	1.3		0.5							
Approach LOS	D	C										
Intersection Summary												
Average Delay			4.4									
Intersection Capacity Utilization			49.3%	ICU Level of Service					A			
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

11: High St. & Campbell St.

2025 Total Conditions

PM Peak Hour

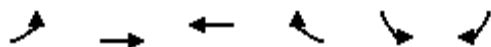
						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	45	85	365	30	90	395
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1738	1555	3436		1738	3476
Flt Permitted	0.95	1.00	1.00		0.51	1.00
Satd. Flow (perm)	1738	1555	3436		930	3476
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	47	89	384	32	95	416
RTOR Reduction (vph)	0	80	9	0	0	0
Lane Group Flow (vph)	47	9	407	0	95	416
Turn Type	Prot	Perm	NA		Perm	NA
Protected Phases	3		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	4.0	4.0	23.7		23.7	23.7
Effective Green, g (s)	4.0	4.0	23.7		23.7	23.7
Actuated g/C Ratio	0.10	0.10	0.60		0.60	0.60
Clearance Time (s)	6.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	175	156	2051		555	2075
v/s Ratio Prot	c0.03		0.12			c0.12
v/s Ratio Perm		0.01			0.10	
v/c Ratio	0.27	0.06	0.20		0.17	0.20
Uniform Delay, d1	16.5	16.1	3.7		3.6	3.7
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.8	0.2	0.2		0.7	0.2
Delay (s)	17.3	16.3	3.9		4.3	3.9
Level of Service	B	B	A		A	A
Approach Delay (s)	16.7		3.9			4.0
Approach LOS	B		A			A
Intersection Summary						
HCM 2000 Control Delay			5.5		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.21			
Actuated Cycle Length (s)			39.7		Sum of lost time (s)	12.0
Intersection Capacity Utilization			34.4%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis

16: Poplar S/R & Street B

2025 Total Conditions

PM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	20	245	190	30	20	15
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	21	258	200	32	21	16
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	232				516	216
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	232				516	216
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				96	98
cM capacity (veh/h)	1319				506	817
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	279	232	37			
Volume Left	21	0	21			
Volume Right	0	32	16			
cSH	1319	1700	604			
Volume to Capacity	0.02	0.14	0.06			
Queue Length 95th (m)	0.4	0.0	1.5			
Control Delay (s)	0.7	0.0	11.3			
Lane LOS	A		B			
Approach Delay (s)	0.7	0.0	11.3			
Approach LOS			B			
Intersection Summary						
Average Delay			1.1			
Intersection Capacity Utilization			39.2%	ICU Level of Service	A	
Analysis Period (min)			15			

Intersection						
Intersection Delay, s/veh	6.5					
Intersection LOS	A					
Approach	EB		WB		SB	
Entry Lanes	2		2		2	
Conflicting Circle Lanes	2		2		2	
Adj Approach Flow, veh/h	269		521		394	
Demand Flow Rate, veh/h	283		547		413	
Vehicles Circulating, veh/h	342		56		176	
Vehicles Exiting, veh/h	247		569		427	
Follow-Up Headway, s	3.186		3.186		3.186	
Ped Vol Crossing Leg, #/h	0		0		0	
Ped Cap Adj	1.000		1.000		1.000	
Approach Delay, s/veh	5.9		6.3		7.0	
Approach LOS	A		A		A	
Lane	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	L	TR
Assumed Moves	LT	TR	LT	R	L	TR
RT Channelized						
Lane Util	0.470	0.530	0.322	0.678	0.828	0.172
Critical Headway, s	4.293	4.113	4.293	4.113	4.293	4.113
Entry Flow, veh/h	133	150	176	371	342	71
Cap Entry Lane, veh/h	874	889	1083	1087	990	999
Entry HV Adj Factor	0.951	0.951	0.952	0.951	0.953	0.958
Flow Entry, veh/h	127	143	168	353	326	68
Cap Entry, veh/h	832	846	1032	1034	944	957
V/C Ratio	0.152	0.169	0.162	0.341	0.345	0.071
Control Delay, s/veh	5.9	6.0	5.0	7.0	7.5	4.4
LOS	A	A	A	A	A	A
95th %tile Queue, veh	1	1	1	2	2	0

HCM Signalized Intersection Capacity Analysis

5: Hurontario St. & Poplar S/R

2030 Total Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	75	310	190	35	330	250	140	405	55	145	220	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Flt	1.00	0.94		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1738	1725		1738	1830	1555	1738	1830	1555	1738	1802	
Flt Permitted	0.44	1.00		0.21	1.00	1.00	0.51	1.00	1.00	0.51	1.00	
Satd. Flow (perm)	812	1725		387	1830	1555	927	1830	1555	941	1802	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	79	326	200	37	347	263	147	426	58	153	232	26
RTOR Reduction (vph)	0	38	0	0	0	180	0	0	30	0	7	0
Lane Group Flow (vph)	79	488	0	37	347	83	147	426	28	153	251	0
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)	18.9	18.9		18.9	18.9	18.9	28.7	28.7	28.7	20.2	20.2	
Effective Green, g (s)	18.9	18.9		18.9	18.9	18.9	28.7	28.7	28.7	20.2	20.2	
Actuated g/C Ratio	0.32	0.32		0.32	0.32	0.32	0.48	0.48	0.48	0.34	0.34	
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	257	547		122	580	493	521	881	748	318	610	
v/s Ratio Prot		c0.28			0.19		0.03	c0.23			0.14	
v/s Ratio Perm	0.10			0.10		0.05	0.11		0.02	0.16		
v/c Ratio	0.31	0.89		0.30	0.60	0.17	0.28	0.48	0.04	0.48	0.41	
Uniform Delay, d1	15.4	19.4		15.4	17.2	14.7	8.9	10.4	8.2	15.6	15.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.7	16.8		1.4	1.7	0.2	0.3	1.9	0.1	5.1	2.1	
Delay (s)	16.1	36.2		16.8	18.8	14.8	9.2	12.3	8.3	20.7	17.2	
Level of Service	B	D		B	B	B	A	B	A	C	B	
Approach Delay (s)		33.5			17.1			11.2			18.5	
Approach LOS		C			B			B			B	
Intersection Summary												
HCM 2000 Control Delay			20.1									HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio			0.69									
Actuated Cycle Length (s)			59.6									Sum of lost time (s) 15.0
Intersection Capacity Utilization			80.6%									ICU Level of Service D
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

8: High St. & Street A/Findlay Dr.

2030 Total Conditions
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	110	15	45	10	5	25	15	395	5	10	315	40
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	116	16	47	11	5	26	16	416	5	11	332	42
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh												
Upstream signal (m)											286	
pX, platoon unblocked												
vC, conflicting volume	642	826	187	692	845	211	374			421		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	642	826	187	692	845	211	374			421		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	65	95	94	96	98	97	99			99		
cM capacity (veh/h)	330	293	814	288	286	786	1160			1113		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	179	42	224	213	176	208						
Volume Left	116	11	16	0	11	0						
Volume Right	47	26	0	5	0	42						
cSH	387	476	1160	1700	1113	1700						
Volume to Capacity	0.46	0.09	0.01	0.13	0.01	0.12						
Queue Length 95th (m)	17.7	2.2	0.3	0.0	0.2	0.0						
Control Delay (s)	22.1	13.3	0.7	0.0	0.6	0.0						
Lane LOS	C	B	A		A							
Approach Delay (s)	22.1	13.3	0.4		0.3							
Approach LOS	C	B										
Intersection Summary												
Average Delay			4.6									
Intersection Capacity Utilization			45.0%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

11: High St. & Campbell St.

2030 Total Conditions

AM Peak Hour

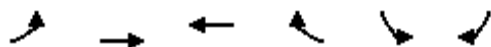
						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	30	85	480	50	80	295
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1738	1555	3427		1738	3476
Flt Permitted	0.95	1.00	1.00		0.44	1.00
Satd. Flow (perm)	1738	1555	3427		810	3476
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	89	505	53	84	311
RTOR Reduction (vph)	0	80	11	0	0	0
Lane Group Flow (vph)	32	9	547	0	84	311
Turn Type	Prot	Perm	NA		Perm	NA
Protected Phases	3		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	4.0	4.0	24.3		24.3	24.3
Effective Green, g (s)	4.0	4.0	24.3		24.3	24.3
Actuated g/C Ratio	0.10	0.10	0.60		0.60	0.60
Clearance Time (s)	6.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	172	154	2066		488	2095
v/s Ratio Prot	c0.02		c0.16			0.09
v/s Ratio Perm		0.01			0.10	
v/c Ratio	0.19	0.06	0.26		0.17	0.15
Uniform Delay, d1	16.7	16.4	3.8		3.5	3.5
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.5	0.2	0.3		0.8	0.1
Delay (s)	17.2	16.6	4.1		4.3	3.6
Level of Service	B	B	A		A	A
Approach Delay (s)	16.8		4.1			3.8
Approach LOS	B		A			A
Intersection Summary						
HCM 2000 Control Delay			5.4		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.25			
Actuated Cycle Length (s)			40.3		Sum of lost time (s)	12.0
Intersection Capacity Utilization			37.6%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis

16: Poplar S/R & Street B

2030 Total Conditions

AM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	10	230	215	10	25	20
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	11	242	226	11	26	21
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	237				495	232
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	237				495	232
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				95	97
cM capacity (veh/h)	1313				524	800
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	253	237	47			
Volume Left	11	0	26			
Volume Right	0	11	21			
cSH	1313	1700	619			
Volume to Capacity	0.01	0.14	0.08			
Queue Length 95th (m)	0.2	0.0	1.9			
Control Delay (s)	0.4	0.0	11.3			
Lane LOS	A		B			
Approach Delay (s)	0.4	0.0	11.3			
Approach LOS			B			
Intersection Summary						
Average Delay			1.2			
Intersection Capacity Utilization			30.2%	ICU Level of Service	A	
Analysis Period (min)			15			

Intersection						
Intersection Delay, s/veh	7.5					
Intersection LOS	A					
Approach	EB		WB		SB	
Entry Lanes	2		2		2	
Conflicting Circle Lanes	2		2		2	
Adj Approach Flow, veh/h	295		547		505	
Demand Flow Rate, veh/h	310		574		530	
Vehicles Circulating, veh/h	469		56		193	
Vehicles Exiting, veh/h	254		723		437	
Follow-Up Headway, s	3.186		3.186		3.186	
Ped Vol Crossing Leg, #/h	0		0		0	
Ped Cap Adj	1.000		1.000		1.000	
Approach Delay, s/veh	6.8		6.4		9.2	
Approach LOS	A		A		A	
Lane	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	L	TR
Assumed Moves	LT	TR	LT	R	L	TR
RT Channelized						
Lane Util	0.471	0.529	0.336	0.664	0.885	0.115
Critical Headway, s	4.293	4.113	4.293	4.113	4.293	4.113
Entry Flow, veh/h	146	164	193	381	469	61
Cap Entry Lane, veh/h	795	814	1083	1087	978	987
Entry HV Adj Factor	0.949	0.953	0.952	0.953	0.953	0.951
Flow Entry, veh/h	139	156	184	363	447	58
Cap Entry, veh/h	755	776	1032	1035	932	939
V/C Ratio	0.184	0.202	0.178	0.351	0.480	0.062
Control Delay, s/veh	6.8	6.8	5.1	7.1	9.8	4.4
LOS	A	A	A	A	A	A
95th %tile Queue, veh	1	1	1	2	3	0

HCM Signalized Intersection Capacity Analysis

5: Hurontario St. & Poplar S/R

2030 Total Conditions

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	400	225	55	310	155	205	350	30	210	425	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Flt	1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1738	1731		1738	1830	1555	1738	1830	1555	1738	1784	
Flt Permitted	0.47	1.00		0.12	1.00	1.00	0.19	1.00	1.00	0.54	1.00	
Satd. Flow (perm)	852	1731		213	1830	1555	344	1830	1555	992	1784	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	63	421	237	58	326	163	216	368	32	221	447	89
RTOR Reduction (vph)	0	23	0	0	0	100	0	0	17	0	8	0
Lane Group Flow (vph)	63	635	0	58	326	63	216	368	15	221	528	0
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)	34.3	34.3		34.3	34.3	34.3	42.1	42.1	42.1	32.1	32.1	
Effective Green, g (s)	34.3	34.3		34.3	34.3	34.3	42.1	42.1	42.1	32.1	32.1	
Actuated g/C Ratio	0.39	0.39		0.39	0.39	0.39	0.48	0.48	0.48	0.36	0.36	
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	330	671		82	710	603	274	871	740	360	647	
v/s Ratio Prot		c0.37			0.18		c0.06	0.20			0.30	
v/s Ratio Perm	0.07			0.27		0.04	c0.31		0.01	0.22		
v/c Ratio	0.19	0.95		0.71	0.46	0.10	0.79	0.42	0.02	0.61	0.82	
Uniform Delay, d1	17.9	26.2		22.8	20.1	17.3	17.1	15.2	12.2	23.1	25.5	
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	0.3	22.2		24.2	0.5	0.1	13.9	1.5	0.1	7.6	10.9	
Delay (s)	18.2	48.3		47.0	20.6	17.3	31.1	16.7	12.3	30.7	36.4	
Level of Service	B	D		D	C	B	C	B	B	C	D	
Approach Delay (s)		45.7			22.4			21.5			34.7	
Approach LOS		D			C			C			C	
Intersection Summary												
HCM 2000 Control Delay			32.1				HCM 2000 Level of Service			C		
HCM 2000 Volume to Capacity ratio			0.89									
Actuated Cycle Length (s)			88.4				Sum of lost time (s)			15.0		
Intersection Capacity Utilization			95.3%				ICU Level of Service			F		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

8: High St. & Street A/Findlay Dr.

2030 Total Conditions
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	75	10	30	10	15	15	45	345	10	30	460	120
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	79	11	32	11	16	16	47	363	11	32	484	126
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh												
Upstream signal (m)											286	
pX, platoon unblocked												
vC, conflicting volume	911	1079	305	805	1137	187	611			374		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	911	1079	305	805	1137	187	611			374		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	59	95	95	95	91	98	95			97		
cM capacity (veh/h)	194	196	682	231	181	814	944			1160		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	121	42	229	192	274	368						
Volume Left	79	11	47	0	32	0						
Volume Right	32	16	0	11	0	126						
cSH	239	277	944	1700	1160	1700						
Volume to Capacity	0.51	0.15	0.05	0.11	0.03	0.22						
Queue Length 95th (m)	19.6	4.0	1.2	0.0	0.6	0.0						
Control Delay (s)	34.6	20.3	2.3	0.0	1.2	0.0						
Lane LOS	D	C	A		A							
Approach Delay (s)	34.6	20.3	1.2		0.5							
Approach LOS	D	C										
Intersection Summary												
Average Delay			4.8									
Intersection Capacity Utilization			51.8%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

11: High St. & Campbell St.

2030 Total Conditions

PM Peak Hour

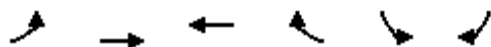
						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	50	90	400	35	95	440
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1738	1555	3434		1738	3476
Flt Permitted	0.95	1.00	1.00		0.49	1.00
Satd. Flow (perm)	1738	1555	3434		893	3476
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	53	95	421	37	100	463
RTOR Reduction (vph)	0	85	9	0	0	0
Lane Group Flow (vph)	53	10	449	0	100	463
Turn Type	Prot	Perm	NA		Perm	NA
Protected Phases	3		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	4.2	4.2	23.4		23.4	23.4
Effective Green, g (s)	4.2	4.2	23.4		23.4	23.4
Actuated g/C Ratio	0.11	0.11	0.59		0.59	0.59
Clearance Time (s)	6.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	184	164	2029		527	2054
v/s Ratio Prot	c0.03		0.13			c0.13
v/s Ratio Perm		0.01			0.11	
v/c Ratio	0.29	0.06	0.22		0.19	0.23
Uniform Delay, d1	16.3	15.9	3.8		3.7	3.8
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.9	0.2	0.3		0.8	0.3
Delay (s)	17.2	16.1	4.1		4.5	4.1
Level of Service	B	B	A		A	A
Approach Delay (s)	16.5		4.1			4.2
Approach LOS	B		A			A
Intersection Summary						
HCM 2000 Control Delay			5.7		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.23			
Actuated Cycle Length (s)			39.6		Sum of lost time (s)	12.0
Intersection Capacity Utilization			35.8%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis

16: Poplar S/R & Street B

2030 Total Conditions

PM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	20	260	200	30	20	15
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	21	274	211	32	21	16
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	242				542	226
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	242				542	226
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				96	98
cM capacity (veh/h)	1307				488	806
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	295	242	37			
Volume Left	21	0	21			
Volume Right	0	32	16			
cSH	1307	1700	587			
Volume to Capacity	0.02	0.14	0.06			
Queue Length 95th (m)	0.4	0.0	1.5			
Control Delay (s)	0.7	0.0	11.5			
Lane LOS	A		B			
Approach Delay (s)	0.7	0.0	11.5			
Approach LOS			B			
Intersection Summary						
Average Delay			1.1			
Intersection Capacity Utilization			40.2%	ICU Level of Service	A	
Analysis Period (min)			15			

Intersection						
Intersection Delay, s/veh	6.8					
Intersection LOS	A					
Approach	EB		WB		SB	
Entry Lanes	2		2		2	
Conflicting Circle Lanes	2		2		2	
Adj Approach Flow, veh/h	284		553		427	
Demand Flow Rate, veh/h	298		581		449	
Vehicles Circulating, veh/h	371		61		188	
Vehicles Exiting, veh/h	266		608		454	
Follow-Up Headway, s	3.186		3.186		3.186	
Ped Vol Crossing Leg, #/h	0		0		0	
Ped Cap Adj	1.000		1.000		1.000	
Approach Delay, s/veh	6.2		6.6		7.5	
Approach LOS	A		A		A	
Lane	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	L	TR
Assumed Moves	LT	TR	LT	R	L	TR
RT Channelized						
Lane Util	0.470	0.530	0.324	0.676	0.826	0.174
Critical Headway, s	4.293	4.113	4.293	4.113	4.293	4.113
Entry Flow, veh/h	140	158	188	393	371	78
Cap Entry Lane, veh/h	855	872	1079	1083	981	991
Entry HV Adj Factor	0.952	0.952	0.952	0.952	0.951	0.949
Flow Entry, veh/h	133	150	179	374	353	74
Cap Entry, veh/h	815	829	1028	1030	934	940
V/C Ratio	0.164	0.181	0.174	0.363	0.378	0.079
Control Delay, s/veh	6.1	6.2	5.1	7.3	8.1	4.6
LOS	A	A	A	A	A	A
95th %tile Queue, veh	1	1	1	2	2	0

HCM Signalized Intersection Capacity Analysis

5: Hurontario St. & Poplar S/R

2035 Total Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	75	330	205	40	345	260	145	425	60	150	230	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Fr _t	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Fl _t Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1738	1830	1555	1738	1830	1555	1738	1830	1555	1738	1803	
Fl _t Permitted	0.37	1.00	1.00	0.40	1.00	1.00	0.52	1.00	1.00	0.50	1.00	
Satd. Flow (perm)	685	1830	1555	734	1830	1555	946	1830	1555	923	1803	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	79	347	216	42	363	274	153	447	63	158	242	26
RTOR Reduction (vph)	0	0	159	0	0	201	0	0	30	0	6	0
Lane Group Flow (vph)	79	347	57	42	363	73	153	447	33	158	262	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		
Actuated Green, G (s)	15.4	15.4	15.4	15.4	15.4	15.4	30.8	30.8	30.8	22.3	22.3	
Effective Green, g (s)	15.4	15.4	15.4	15.4	15.4	15.4	30.8	30.8	30.8	22.3	22.3	
Actuated g/C Ratio	0.26	0.26	0.26	0.26	0.26	0.26	0.53	0.53	0.53	0.38	0.38	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	181	484	411	194	484	411	575	968	822	353	690	
v/s Ratio Prot		0.19			c0.20		0.03	c0.24			0.15	
v/s Ratio Perm	0.12		0.04	0.06		0.05	0.12		0.02	0.17		
v/c Ratio	0.44	0.72	0.14	0.22	0.75	0.18	0.27	0.46	0.04	0.45	0.38	
Uniform Delay, d ₁	17.8	19.4	16.3	16.7	19.6	16.5	7.2	8.5	6.6	13.4	13.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d ₂	1.7	5.0	0.2	0.6	6.4	0.2	0.2	1.6	0.1	4.1	1.6	
Delay (s)	19.5	24.4	16.5	17.3	26.1	16.7	7.4	10.1	6.7	17.4	14.5	
Level of Service	B	C	B	B	C	B	A	B	A	B	B	
Approach Delay (s)		21.2			21.8			9.2			15.6	
Approach LOS		C			C			A			B	
Intersection Summary												
HCM 2000 Control Delay			17.0				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.60									
Actuated Cycle Length (s)			58.2				Sum of lost time (s)			15.0		
Intersection Capacity Utilization			73.0%				ICU Level of Service			C		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

8: High St. & Street A/Findlay Dr.

2035 Total Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	110	15	45	10	5	25	15	445	10	10	335	40
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	116	16	47	11	5	26	16	468	11	11	353	42
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh												
Upstream signal (m)											286	
pX, platoon unblocked												
vC, conflicting volume	689	905	197	758	921	239	395			479		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	689	905	197	758	921	239	395			479		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	62	94	94	96	98	97	99			99		
cM capacity (veh/h)	304	263	801	256	258	753	1139			1059		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	179	42	250	245	187	218						
Volume Left	116	11	16	0	11	0						
Volume Right	47	26	0	11	0	42						
cSH	358	436	1139	1700	1059	1700						
Volume to Capacity	0.50	0.10	0.01	0.14	0.01	0.13						
Queue Length 95th (m)	20.1	2.4	0.3	0.0	0.2	0.0						
Control Delay (s)	24.7	14.1	0.6	0.0	0.6	0.0						
Lane LOS	C	B	A		A							
Approach Delay (s)	24.7	14.1	0.3		0.3							
Approach LOS	C	B										
Intersection Summary												
Average Delay			4.7									
Intersection Capacity Utilization			46.5%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

11: High St. & Campbell St.

2035 Total Conditions

AM Peak Hour

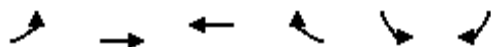
						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	30	85	530	50	80	315
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1738	1555	3431		1738	3476
Flt Permitted	0.95	1.00	1.00		0.42	1.00
Satd. Flow (perm)	1738	1555	3431		769	3476
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	89	558	53	84	332
RTOR Reduction (vph)	0	80	10	0	0	0
Lane Group Flow (vph)	32	9	601	0	84	332
Turn Type	Prot	Perm	NA		Perm	NA
Protected Phases	3		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	4.0	4.0	24.3		24.3	24.3
Effective Green, g (s)	4.0	4.0	24.3		24.3	24.3
Actuated g/C Ratio	0.10	0.10	0.60		0.60	0.60
Clearance Time (s)	6.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	172	154	2068		463	2095
v/s Ratio Prot	c0.02		c0.18			0.10
v/s Ratio Perm		0.01			0.11	
v/c Ratio	0.19	0.06	0.29		0.18	0.16
Uniform Delay, d1	16.7	16.4	3.9		3.6	3.5
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.5	0.2	0.4		0.9	0.2
Delay (s)	17.2	16.6	4.2		4.4	3.7
Level of Service	B	B	A		A	A
Approach Delay (s)	16.8		4.2			3.8
Approach LOS	B		A			A
Intersection Summary						
HCM 2000 Control Delay			5.4		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.28			
Actuated Cycle Length (s)			40.3		Sum of lost time (s)	12.0
Intersection Capacity Utilization			39.0%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis

16: Poplar S/R & Street B

2035 Total Conditions

AM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	10	245	230	10	25	20
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	11	258	242	11	26	21
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	253				526	247
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	253				526	247
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				95	97
cM capacity (veh/h)	1295				503	784
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	268	253	47			
Volume Left	11	0	26			
Volume Right	0	11	21			
cSH	1295	1700	598			
Volume to Capacity	0.01	0.15	0.08			
Queue Length 95th (m)	0.2	0.0	1.9			
Control Delay (s)	0.4	0.0	11.5			
Lane LOS	A		B			
Approach Delay (s)	0.4	0.0	11.5			
Approach LOS			B			
Intersection Summary						
Average Delay			1.1			
Intersection Capacity Utilization			31.0%	ICU Level of Service	A	
Analysis Period (min)			15			

Intersection						
Intersection Delay, s/veh	8.0					
Intersection LOS	A					
Approach	EB		WB		SB	
Entry Lanes	2		2		2	
Conflicting Circle Lanes	2		2		2	
Adj Approach Flow, veh/h	311		584		537	
Demand Flow Rate, veh/h	327		613		564	
Vehicles Circulating, veh/h	498		61		205	
Vehicles Exiting, veh/h	271		764		469	
Follow-Up Headway, s	3.186		3.186		3.186	
Ped Vol Crossing Leg, #/h	0		0		0	
Ped Cap Adj	1.000		1.000		1.000	
Approach Delay, s/veh	7.1		6.7		9.8	
Approach LOS	A		A		A	
Lane	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	L	TR
Assumed Moves	LT	TR	LT	R	L	TR
RT Channelized						
Lane Util	0.471	0.529	0.334	0.666	0.883	0.117
Critical Headway, s	4.293	4.113	4.293	4.113	4.293	4.113
Entry Flow, veh/h	154	173	205	408	498	66
Cap Entry Lane, veh/h	778	797	1079	1083	969	979
Entry HV Adj Factor	0.950	0.954	0.952	0.953	0.952	0.955
Flow Entry, veh/h	146	165	195	389	474	63
Cap Entry, veh/h	739	761	1028	1032	922	934
V/C Ratio	0.198	0.217	0.190	0.377	0.514	0.067
Control Delay, s/veh	7.1	7.1	5.3	7.5	10.5	4.5
LOS	A	A	A	A	B	A
95th %tile Queue, veh	1	1	1	2	3	0

HCM Signalized Intersection Capacity Analysis

5: Hurontario St. & Poplar S/R

2035 Total Conditions

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	420	240	60	330	165	215	365	30	220	445	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1738	1830	1555	1738	1830	1555	1738	1830	1555	1738	1786	
Flt Permitted	0.40	1.00	1.00	0.25	1.00	1.00	0.20	1.00	1.00	0.53	1.00	
Satd. Flow (perm)	723	1830	1555	463	1830	1555	372	1830	1555	978	1786	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	63	442	253	63	347	174	226	384	32	232	468	89
RTOR Reduction (vph)	0	0	186	0	0	128	0	0	15	0	11	0
Lane Group Flow (vph)	63	442	67	63	347	46	226	384	17	232	546	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		
Actuated Green, G (s)	15.8	15.8	15.8	15.8	15.8	15.8	32.0	32.0	32.0	22.1	22.1	
Effective Green, g (s)	15.8	15.8	15.8	15.8	15.8	15.8	32.0	32.0	32.0	22.1	22.1	
Actuated g/C Ratio	0.26	0.26	0.26	0.26	0.26	0.26	0.54	0.54	0.54	0.37	0.37	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	191	483	410	122	483	410	356	979	832	361	660	
v/s Ratio Prot		c0.24			0.19		c0.07	0.21			c0.31	
v/s Ratio Perm	0.09		0.04	0.14		0.03	0.27		0.01	0.24		
v/c Ratio	0.33	0.92	0.16	0.52	0.72	0.11	0.63	0.39	0.02	0.64	0.83	
Uniform Delay, d1	17.7	21.3	16.9	18.7	20.0	16.7	9.6	8.2	6.5	15.6	17.1	
Progression Factor	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	1.0	21.9	0.2	3.7	5.1	0.1	3.7	1.2	0.0	8.5	11.4	
Delay (s)	18.7	43.2	17.1	22.4	25.0	16.8	13.3	9.4	6.6	24.1	28.5	
Level of Service	B	D	B	C	C	B	B	A	A	C	C	
Approach Delay (s)		32.5			22.3			10.6			27.2	
Approach LOS		C			C			B			C	
Intersection Summary												
HCM 2000 Control Delay			23.8				HCM 2000 Level of Service			C		
HCM 2000 Volume to Capacity ratio			0.83									
Actuated Cycle Length (s)			59.8				Sum of lost time (s)			15.0		
Intersection Capacity Utilization			84.3%				ICU Level of Service			E		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis 8: High St. & Street A/Findlay Dr.

2035 Total Conditions
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	75	10	30	10	15	15	45	380	10	30	515	120
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	79	11	32	11	16	16	47	400	11	32	542	126
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh												
Upstream signal (m)											286	
pX, platoon unblocked												
vC, conflicting volume	987	1174	334	871	1232	205	668			411		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	987	1174	334	871	1232	205	668			411		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	53	94	95	95	90	98	95			97		
cM capacity (veh/h)	168	171	653	205	158	792	897			1124		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	121	42	247	211	303	397						
Volume Left	79	11	47	0	32	0						
Volume Right	32	16	0	11	0	126						
cSH	209	246	897	1700	1124	1700						
Volume to Capacity	0.58	0.17	0.05	0.12	0.03	0.23						
Queue Length 95th (m)	24.0	4.5	1.3	0.0	0.7	0.0						
Control Delay (s)	43.6	22.6	2.2	0.0	1.1	0.0						
Lane LOS	E	C	A		A							
Approach Delay (s)	43.6	22.6	1.2		0.5							
Approach LOS	E	C										
Intersection Summary												
Average Delay			5.4									
Intersection Capacity Utilization			54.2%	ICU Level of Service					A			
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

11: High St. & Campbell St.

2035 Total Conditions

PM Peak Hour

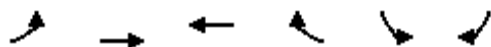
						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	55	90	435	35	95	490
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1738	1555	3437		1738	3476
Flt Permitted	0.95	1.00	1.00		0.47	1.00
Satd. Flow (perm)	1738	1555	3437		862	3476
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	58	95	458	37	100	516
RTOR Reduction (vph)	0	85	9	0	0	0
Lane Group Flow (vph)	58	10	486	0	100	516
Turn Type	Prot	Perm	NA		Perm	NA
Protected Phases	3		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	4.3	4.3	23.3		23.3	23.3
Effective Green, g (s)	4.3	4.3	23.3		23.3	23.3
Actuated g/C Ratio	0.11	0.11	0.59		0.59	0.59
Clearance Time (s)	6.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	188	168	2022		507	2045
v/s Ratio Prot	c0.03		0.14			c0.15
v/s Ratio Perm		0.01			0.12	
v/c Ratio	0.31	0.06	0.24		0.20	0.25
Uniform Delay, d1	16.3	15.8	3.9		3.8	3.9
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.9	0.2	0.3		0.9	0.3
Delay (s)	17.2	16.0	4.2		4.7	4.2
Level of Service	B	B	A		A	A
Approach Delay (s)	16.5		4.2			4.3
Approach LOS	B		A			A
Intersection Summary						
HCM 2000 Control Delay			5.7		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.26			
Actuated Cycle Length (s)			39.6		Sum of lost time (s)	12.0
Intersection Capacity Utilization			36.7%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis

16: Poplar S/R & Street B

2035 Total Conditions

PM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	20	275	215	30	20	15
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	21	289	226	32	21	16
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	258				574	242
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	258				574	242
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				95	98
cM capacity (veh/h)	1290				468	789
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	311	258	37			
Volume Left	21	0	21			
Volume Right	0	32	16			
cSH	1290	1700	567			
Volume to Capacity	0.02	0.15	0.07			
Queue Length 95th (m)	0.4	0.0	1.6			
Control Delay (s)	0.7	0.0	11.8			
Lane LOS	A		B			
Approach Delay (s)	0.7	0.0	11.8			
Approach LOS			B			
Intersection Summary						
Average Delay			1.1			
Intersection Capacity Utilization			40.9%	ICU Level of Service	A	
Analysis Period (min)			15			

APPENDIX E:
TRAFFIC SIGNAL WARRANT



8-HOUR TRAFFIC SIGNAL WARRANT

Project & No.: Charleston Homes

114056

GENERAL INFORMATION

Analyst	David Perks	Jurisdiction/Area	Collingwood	Date	17 Nov 2015
Agency or Company	CC Tatham & Associates Ltd.	East-West Street	Findlay Drive		
Analysis Period	2035 Total Conditions	North-South Street	High Street		
Flow Conditions	Restricted flow (urban)	Major Street	North-South		
T Intersection	No	Approach Lanes per Direction	2		
		Hours of Traffic Volume Data	AM & PM peaks only		
Additional Comments	future total conditions with developments				

TRAFFIC & PEDESTRIAN VOLUMES

Hour of Data Hour Ending	AM Peak hr ending							PM Peak hr ending	AM + PM 4
MAJOR STREET									
Northbound	right	10						10	5
	thru	445						380	206
	left	15						45	15
Southbound	right	40						120	40
	thru	335						515	213
	left	10						30	10
MINOR STREET									
Eastbound	right	45						30	19
	thru	15						10	6
	left	115						75	48
Westbound	right	25						15	10
	thru	5						15	5
	left	10						10	5
PEDESTRIANS									
crossing MAJOR street		0						0	0
crossing MINOR street		0						0	0
APPROACH VOLUMES									
major		855						1100	489
minor		215						155	93
TOTAL		1070						1255	581
CROSSING VOLUMES									
TOTAL		140						100	60
note 1		125						85	
note 2		15						15	
note 3		0						0	
3a		no						no	
3b		no						no	
note 4		0						0	

NOTES

Traffic crossing MAJOR street defined as:

note 1: Left turns from both minor street approaches

note 2: The heaviest through volume from the minor street

note 3: 50% of the heavier left turn movement from the major street when both of the following are met:

3a: the left turn volume > 120

3b: the left turn volume + opposing volume > 720

note 4: Pedestrians crossing the major street

ACCIDENT HISTORY

Reportable accidents over the past 36 months susceptible to correction by a traffic signal.	months 1 to 12	-
	months 13 to 24	-
	months 25 to 36	-



8-HOUR TRAFFIC SIGNAL WARRANT

Project & No.: Charleston Homes

114056

GENERAL INFORMATION													
Analyst	David Perks				Jurisdiction/Area		Collingwood		Date		17 Nov 2015		
Agency or Company	CC Tatham & Associates Ltd.				East-West Street		Findlay Drive						
Analysis Period	2035 Total Conditions				North-South Street		High Street						
Flow Conditions	Restricted flow (urban)				Major Street		High Street						
T Intersection	No				Approach Lanes per Direction		2						
Additional Comments	future total conditions with developments				Hours of Traffic Volume Data		AM & PM peaks only						
JUSTIFICATION 1 - MINIMUM VEHICLE VOLUME													
JUSTIFICATION	GUIDANCE	HOUR ENDING								No. of hours with compliance			
		AM Peak	Hour 2	Hour 3	Hour 4	Hour 5	Hour 6	Hour 7	PM Peak				
1A	TOTAL TRAFFIC VOLUME ENTERING INTERSECTION (vph) (2 way Total)	1070	581	581	581	581	581	581	581	1255	100%	80%+	Average Compliance
	COMPLIANCE % $\frac{VOL \times 100}{720}$ OR $\frac{VOL \times 100}{900}$ (1 lane approach on main road) (2 or more lane approach on main road)	100%	65%	65%	65%	65%	65%	65%	65%	100%	2	2	73%
1B	TRAFFIC VOLUME ON MINOR STREET (vph) (2 way Total)	215	93	93	93	93	93	93	93	155	100%	80%+	Average Compliance
	COMPLIANCE % $\frac{VOL \times 100}{170}$ OR $\frac{VOL \times 100}{255}$ (full intersection) (tee intersection)	100%	54%	54%	54%	54%	54%	54%	54%	91%	1	2	65%
(RESTRICTED FLOW)		BOTH 1A AND 1B 100% FULFILLED EACH OF 8 HOURS										NO	
SIGNAL JUSTIFICATION 1:		LESSER OF 1A OR 1B AT LEAST 80% FULFILLED EACH OF 8 HOURS										NO	
JUSTIFICATION 2 - DELAY TO CROSS TRAFFIC													
JUSTIFICATION	GUIDANCE	HOUR ENDING								No. of hours with compliance			
		Hour 1	Hour 2	Hour 3	Hour 4	Hour 5	Hour 6	Hour 7	Hour 8				
2A	MAIN ROAD TRAFFIC VOLUME (vph) (2 way Total)	855	489	489	489	489	489	489	489	1100	100%	80%+	Average Compliance
	COMPLIANCE % $\frac{VOL \times 100}{720}$ OR $\frac{VOL \times 100}{900}$ (1 lane approach on main road) (2 or more lane approach on main road)	95%	54%	54%	54%	54%	54%	54%	54%	100%	1	2	65%
2B	CROSSING TRAFFIC VOLUME (vph) (2 way Total)	140	60	60	60	60	60	60	60	100	100%	80%+	Average Compliance
	COMPLIANCE % $\frac{VOL \times 100}{75}$	100%	80%	80%	80%	80%	80%	80%	80%	100%	2	8	85%
(RESTRICTED FLOW)		BOTH 2A AND 2B 100% FULFILLED EACH OF 8 HOURS										NO	
SIGNAL JUSTIFICATION 2:		LESSER OF 2A OR 2B AT LEAST 80% FULFILLED EACH OF 8 HOURS										NO	
JUSTIFICATION 3 - COLLISION EXPERIENCE													
A. Number of reportable collisions susceptible to prevention by a traffic signal.								Preceding Months		Number of Collisions		% Fulfillment	
								1 - 12		-		-	
								13 - 24		-		-	
								25 - 36		-		-	
								annual average		-		-	
B. Adequate trial of less restrictive remedies has failed to reduce collision frequency.								☐ YES		☐ NO		n/a	
C. Either Justification 1 (Minimum Vehicular Volume) or Justification 2 (Delay to Cross Traffic) satisfied to 80% or more.								☐ YES		☐ NO		n/a	
SIGNAL JUSTIFICATION 3:								ALL OF 3A, 3B & 3C FULFILLED TO 100%?				NO	
JUSTIFICATION 4 - COMBINATION JUSTIFICATION													
JUSTIFICATION SATISFIED 80% OR MORE								Two Justifications Satisfied 80% or more					
Justification 1	-	Minimum Vehicle Volume	NO					NO					
Justification 2	-	Delay to Cross Traffic	NO										
Justification 3	-	Collision Experience	-										
JUSTIFICATION SUMMARY													
ARE TRAFFIC SIGNALS JUSTIFIED FOR THE INTERSECTION IN QUESTION?								NO					