Riverfront Residential, City of Niagara Falls

Traffic Impact Study Update

Paradigm Transportation Solutions Limited

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Project Summary

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Riverfront Residential, City of Niagara Falls Traffic Impact Study Update

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Executive Summary

Content

Paradigm Transportation Solutions Limited (Paradigm) was retained to conduct this Traffic Impact Study (TIS) update for the proposed residential subdivision (Riverfront Residential) within the Riverfront Community Master Plan Area in the City of Niagara Falls, Niagara Region, Ontario. This update is in support of the Zoning By-law Amendment (ZBA) and Official Plan Amendment (OPA) applications.

In January 2019, Paradigm completed the report "*Riverfront Residential, Traffic Impact Study*" for the subject Riverfront Residential lands. Following the submission of the previous TIS, the draft plan of subdivision was revised. This submission addressed proposed changes to the development plans and confirmed where the conclusions in the January 2019 TIS were still appropriate.

This TIS update provides an assessment of the existing transportation networks, the development and analysis of future traffic forecasts, recommendations for future transportation requirements and/or considerations, if any, and a review of the proposed site accesses regarding auxiliary turn lanes and sight distance.

This study assesses the 2029 and 2034 horizon years, representing the anticipated full build-out year and five years beyond the full build-out, respectively.

The findings, conclusions, and recommendations of this study are summarized below and outlined in further detail in the body of the report.

Development Concept

The subject lands, which are currently vacant, are bounded by the Welland River to the south, Chippawa Parkway to the west, the Canadian Pacific (CP) Rail Montrose spur line to the north, and the proposed boundary to the east. The proposed subdivision is part of the overall Riverfront Community Master Plan area.

The property owners propose to construct a residential community comprised of single-detached houses, townhouses, a mid-rise block, neighbourhood parks, and the supporting transportation road network. The detailed development breakdown is as follows:

- 175 single-detached houses in Block 1 to 175;
- 209 street townhouse units in Blocks 176 to 214;
- 110 back-to-back townhouse units in Blocks 215 to 224;
- 138 mid-rise dwelling units in Block 225; and
- Neighbourhood parks in Block 226.

Vehicle access is proposed via Street A and Street C, providing full movement connections with Chippawa Parkway.

The proposed internal road network serving the subject residential subdivision includes Street A, Street B, Street C, Street D, Street E, Street F, Street G, Street H, Street I, and Street J.

It is anticipated full build-out and occupancy of the residential subdivision will occur by 2029.

Conclusions

Based on the investigations carried out, it is concluded that:

- **Base Year (2024) Conditions:** The intersection of Dorchester Road/Oldfield Road is operating at acceptable service levels and well within capacity during the weekday AM and PM peak hours. Similarly, the link volumes on Chippawa Parkway along the frontage of the subject lands are well within typical planning level capacities for arterial roads of this type;
- **Future Background Traffic Conditions** (without the proposed Riverfront Residential): The intersection operation of Dorchester Road/Oldfield Road is reported to be slightly worse than base year conditions. All traffic movements are forecast to continue operating at acceptable service levels and within capacity up to the 2034 horizon.

  The exceptions include the eastbound left-turn and southbound right-turn movements at Dorchester Road/Oldfield Road during the AM and/or PM peak hours under the 2029 and 2034 horizons. However, both movements are noted to operate within capacity.

  The link volumes on Chippawa Parkway would remain well within capacity;

- **Site-Generated Traffic:** With full development and occupancy of the Riverfront Residential, it is forecast to generate 295 and 380 automobile trips during the weekday AM and PM peak hours, respectively;
- **Future Total Traffic Conditions** (with the proposed Riverfront Residential): The operations at the study area intersections are slightly worse with the addition of the site-generated traffic compared to future background traffic conditions. All intersections and traffic movements are forecast to continue operating at acceptable service levels and within capacity up to the 2034 horizon.

  The exceptions include the previously identified critical movements under future background conditions; no additional critical movements have been identified. It is noted the eastbound left-turn movement at Dorchester Road/Oldfield Road is forecast to operate exceeding capacity during the PM peak hour under the 2029 and 2034 horizons;
- **Remedial Measures:** Even though a traffic control signal is not warranted at Dorchester Road/Oldfield Road from a volume perspective, the 2034 total traffic operational analysis indicates that a traffic control signal would resolve the identified critical movements at the intersection;
- **Auxiliary Turn Lanes:** An eastbound left-turn lane with 15 metres of storage is warranted along Chippawa Parkway at Street C and Street A. The turn lane should be designed following the TAC Guide.

  A westbound right-turn lane is not warranted on Chippawa Parkway from both traffic operation and traffic volume perspectives;
- **Sight Distance Review:** Street C is confirmed to meet and exceed the TAC Guide sight distance requirements (departure and approach) for a 70 km/h design speed. At the same time, Street A is identified with a sight distance deficiency due to the horizontal curve and existing vegetation on Chippawa Parkway. However, this is not considered a critical issue given the anticipated lower travel speed along Chippawa Parkway, and meeting the sight distance guideline is feasible through height restrictions incorporated within the landscape plan for the stormwater management pond;
- **Speed Limit Review:** As per the Transportation Association of Canada (TAC) Canadian Guidelines for Establishing Posted Speed Limits (CGEPSL), Dorchester Road (south of Oldfield Road) and Chippawa Parkway (west of Stanley Avenue) have a

total risk score of 60 and it is recommended that the current posted speed limit of 60 km/h be reduced to 50 km/h given the physical road conditions.

Recommendations

The recommendations of the study area are as follows:

- An eastbound left-turn lane with 15 metres of storage be implemented by the Applicant on Chippawa Parkway at the proposed site access intersections (Street A and Street C);
- The City of Niagara Falls and Niagara Region should monitor traffic growths and traffic patterns at Dorchester Road/Oldfield Road to determine whether the implementation of traffic control signal is required as necessary;
- To achieve sufficient sight distance east of Street A, it is recommended that the stormwater management pond's landscape plan implement height restrictions along the frontage to Chippawa Parkway;
- The posted speed limit on Dorchester Road and Chippawa Parkway be reduced from 60 km/h to 50 km/h once construction of the proposed residential subdivision is underway; and
- Niagara Falls Transit service be extended to the Riverfront Residential area.

Contents

Appendices

Figures

Tables

1 Introduction

1.1 Overview

Paradigm Transportation Solutions Limited (Paradigm) was retained to conduct this Traffic Impact Study (TIS) update for the proposed residential subdivision (Riverfront Residential) within the Riverfront Community Master Plan Area in the City of Niagara Falls, Niagara Region, Ontario, in support of the Zoning By-law Amendment (ZBA) and Official Plan Amendment (OPA) applications.

The Riverfront Community Master Plan Area is in the City of Niagara Falls, located generally south of Oldfield Road, west of the Thundering Waters Golf Course and Stanley Avenue Industrial Business Park, north of the Welland River, and east of the Ontario Power Generation (OPG) Canal.

Figure 1.1 illustrates the Riverfront Community Master Plan Area within the City of Niagara Falls and highlights the proposed Riverfront Residential subdivision area in the southerly portion of these lands.

In January 2019, Paradigm completed the report "*Riverfront Residential, Traffic Impact Study*" for the subject Riverfront Residential lands. Following the submission of the previous TIS, the draft plan of subdivision was revised. This submission addressed proposed changes to the development plans and confirmed where the conclusions in the January 2019 TIS were still appropriate.

This study determines the impacts of the additional traffic generated by the proposed residential subdivision on the surrounding road network, the remedial measures necessary to accommodate future traffic satisfactorily, and reviews the proposed site accesses. The scope of this study includes:

- Determine and assess the current study area traffic conditions;
- Forecast the additional traffic generated by the proposed residential subdivision;
- Analyze the impacts of the additional traffic on the study area intersections for the horizon years of anticipated full build-out year (2029) and five years beyond full build-out (2034);
- Recommend any necessary remedial measures to mitigate the traffic impacts; and
- Confirm that the proposed site access intersections on Chippawa Parkway are feasible in terms of sight lines.

The study has been carried out in general accordance with the Niagara Region *Transportation Impact Assessment Guidelines* (July 24, 2023)[1] and pre-study consultation correspondence that was exchanged with the City staff to refine the scope. **Appendix A** contains the pre-study consultation material for reference.

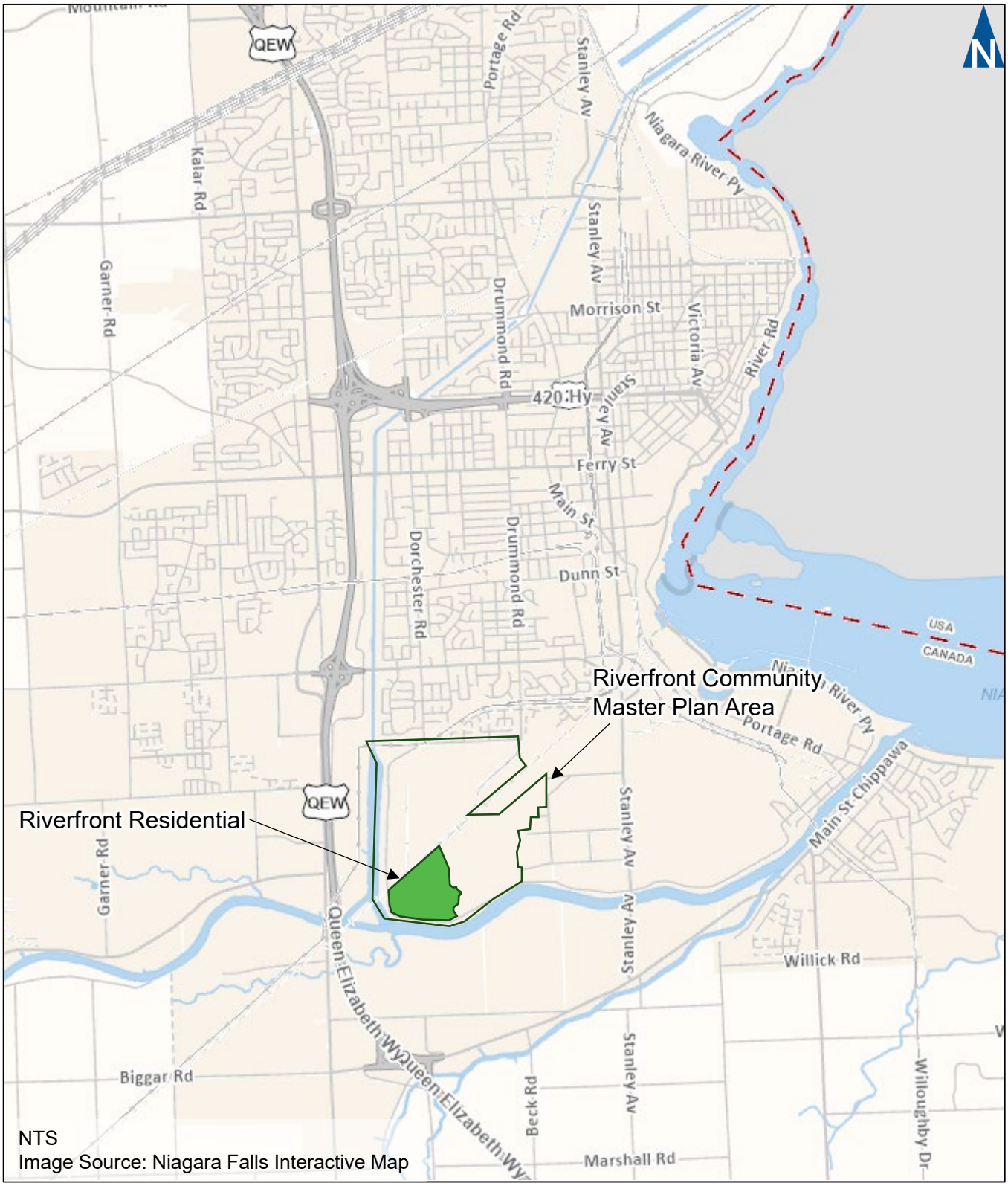
1.2 Study Area and Study Periods

The study area intersections assessed in this study include:

- Dorchester Road and Oldfield Road (unsignalized);
- Chippawa Parkway with Street A (proposed unsignalized); and
- Chippawa Parkway with Street C (proposed unsignalized).

The analysis periods include the weekday AM and PM peak hours, representing typical commuter periods.

[1] Niagara Region, *Transportation Impact Assessment Guidelines*, July 24, 2023.



Riverfront Community Master Plan Area and Subject Land Area

2 Development Concept

The subject lands, which are currently vacant, are bounded by the Welland River to the south, Chippawa Parkway to the west, the Canadian Pacific (CP) Rail Montrose spur line to the north, and the proposed boundary to the east. The proposed subdivision is part of the overall Riverfront Community Master Plan area.

The property owners propose to construct a residential community comprised of single-detached houses, townhouses, a mid-rise block, neighbourhood parks, and the supporting transportation road network.

Figure 2.1 illustrates the draft plan of subdivision and internal road network for the subject lands. The detailed development breakdown is as follows:

- 175 single-detached houses in Block 1 to 175;
- 209 street townhouse units in Blocks 176 to 214;
- 110 back-to-back townhouse units in Blocks 215 to 224;
- 138 mid-rise dwelling units in Block 225; and
- Neighbourhood parks in Block 226.

Vehicle access is proposed via Street A and Street C, providing full movement connections with Chippawa Parkway.

Compared to the previous submission (January 2019), the current draft plan of subdivision illustrates Street A and Street C connecting with Chippawa Parkway at different locations. Specifically, Street A is at the end of a horizontal curve, and Street C abuts the woodlot. The two streets are approximately 165 metres apart (measured centreline to centreline). The sight line/distance review for the relocated Street A and Street C is detailed in **Section 6.2**.

The proposed internal road network serving the subject residential subdivision includes Street A, Street B, Street C, Street D, Street E, Street F, Street G, Street H, Street I, and Street J.

It is anticipated full build-out and occupancy of the residential subdivision will occur by 2029.

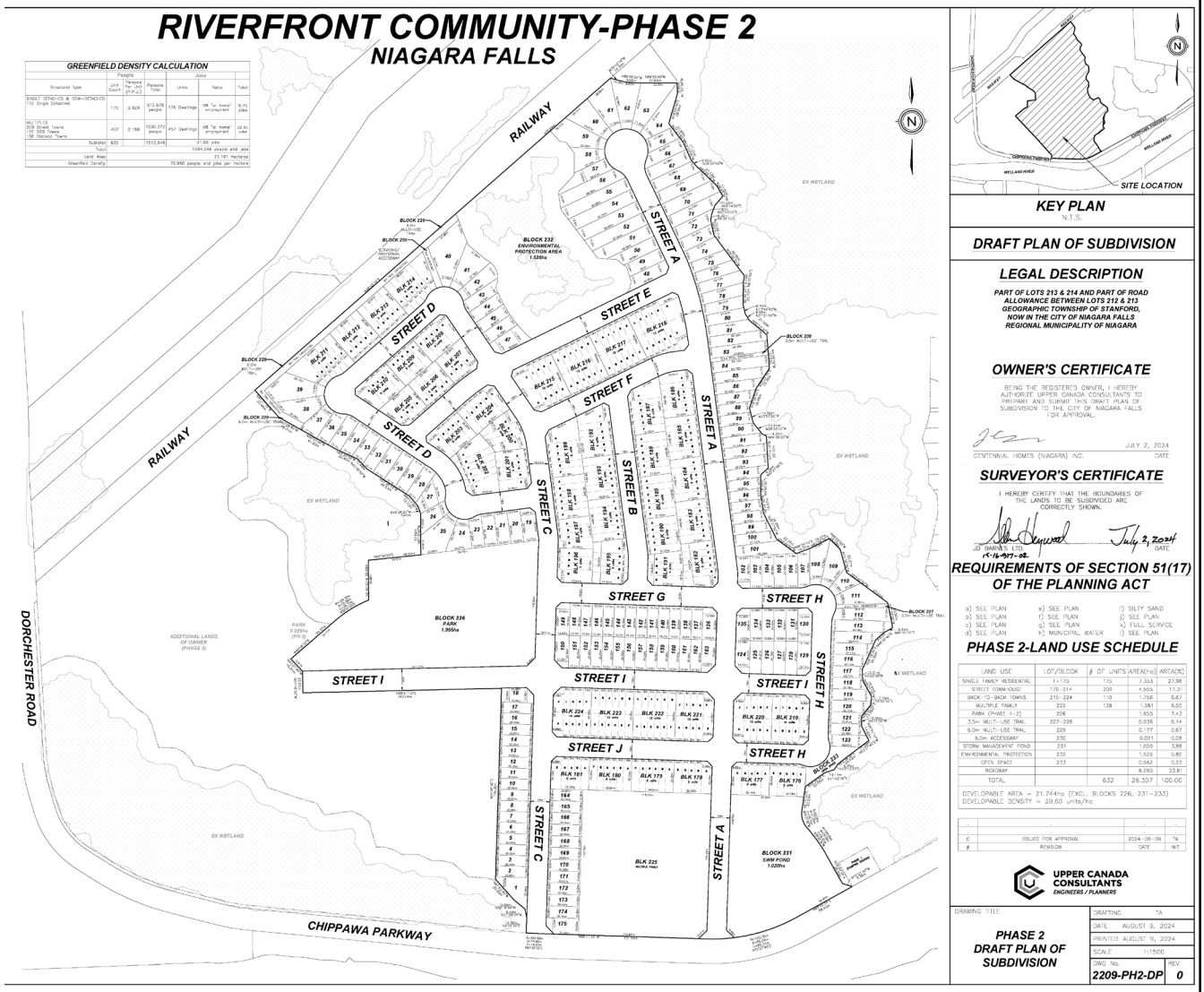


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Image Source: Site Plan by Upper Canada Consultants (August 9, 2024)

Draft Plan of Subdivision

3 Existing Conditions

3.1 Roads and Traffic Control

The characteristics of the roads in the vicinity of the subject lands are described below. Reference was made to the City of Niagara Falls *Official Plan, Schedule C – Major Roads Plan.*[2]

- **Dorchester Road** is a north-south, two-lane road under the jurisdiction of the City of Niagara Falls. The road is designated as an arterial in the City's Official Plan, except for the short segment between McLeod Road and Oldfield Road within the study area that is classified as a collector. Dorchester Road extends from the north limit of Niagara Falls into the study area, where it curves and connects to Chippawa Parkway. The posted speed limit on Dorchester Road is 50 km/h north of Oldfield Road and 60 km/h south of Oldfield Road. Curve ahead warning signs with an advisory speed of 40 km/h are posted at three locations, including one where Dorchester Road transitions into Chippawa Parkway and two between the CP Rail Montrose rail line and Oldfield Road;
- **Oldfield Road** is an east-west, two-lane road under the jurisdiction of the City of Niagara Falls and runs between Dorchester Road and Drummond Road. Oldfield Road is designated as an arterial in the City's Official Plan. The posted speed limit on Oldfield Road is 50 km/h; and
- **Chippawa Parkway** is an east-west, two-lane road under the jurisdiction of the City of Niagara Falls. The road is designated as an arterial in the City's Official Plan for the Dorchester Road and Stanley Avenue section. The posted speed limit is 60 km/h, and curve ahead warning signs with an advisory speed of 40 km/h are posted at three locations: one to the east of the subject lands, one along the site frontage, and one where Chippawa Parkway transitions into Dorchester Road.

  The CP Rail Montrose rail line crosses Chippawa Parkway west of the subject lands. Flashing red lights, gates, signage, and pavement markings are provided on the northbound and southbound approaches to the rail line crossing.

The intersection of Dorchester Road and Oldfield Road currently has a "Y" configuration, and it operates as a three-leg all-way stop control (AWSC) intersection. All intersection approaches are single lanes

[2] City of Niagara Falls, *Official Plan, Schedule C – Major Roads Plan*, December 2008.

providing for shared through and turning movements. It is noted that at the time of writing, the intersection is closed due to road reconstruction.

Figure 3.1 illustrates the existing lane configurations and traffic control within the study area.

3.2 Transit

Niagara Region Transit is the public transit operator for the City of Niagara Falls.

Currently, no public transit routes are running along the subject lands' Dorchester Road or Chippawa Parkway frontages. **Figure 3.2** illustrates the existing Niagara Region Transit service around the study area. The closest route to the subject lands is **Route 103**, which provides hourly transit service from 6:00 AM to 6:30 PM between Main/Ferry Hub and the Canadian Drive Hub via McLeod Road and Drummond Road, Monday to Saturday. During peak times (i.e., 7:30 AM – 10:30 AM and 3:30 PM – 6:30 PM), 30-minute service times are provided, Monday to Saturday. Route 103 operates as Route 203 with 30-minute headways during the evenings on Monday to Saturday as well as on Sundays and statutory holidays.

The closest bus stops are at the intersection of Dorchester Road and Jubilee Drive, approximately 1.8 kilometres north of the subject lands. These bus stops provide paved waiting pad areas without other amenities (e.g., shelter and seating).

Niagara Region Transit also provides the following transit services in the City:

- **OnDemand Transit**: provides a shared-ride service from an address in the service area to a zone-specific transfer hub via TransCab; and
- **Specialized Transit**: provides flexible and personalized service for customers who do not have the ability to use conventional transit service.

3.3 Active Transportation

With the subject lands being vacant, no sidewalks or dedicated cycling facilities are serving this area. The Millennium Trail runs north-south along the Hydro Canal to the west of the site and east-west along the Welland River to the south.

Various cycling facilities along several roads near the site's periphery provide opportunities for connections with the Riverfront Community as it develops.

3.4 Traffic Volumes

Turning movement counts (TMCs) are used to quantify the movement of vehicles, pedestrians, trucks, buses, and cyclists through an intersection to assess intersection operations. Existing traffic data at an intersection or on a road section forms the foundation for operational analysis. The counts are usually collected during peak periods to complete level of service (LOS) analysis under its “worst-case” operating conditions.

The intersection of Dorchester Road and Oldfield Road is closed due to road reconstruction. As a result, a May 2023 count was used and factored to 2024 volumes using a 1.0% per annum growth rate. This approach has been confirmed by City staff through pre-study consultation.

Additionally, a fall 2023 24-hour automatic traffic recorder (ATR) data along Chippawa Parkway between Dorchester Road and Stanley Avenue was obtained from the City. The data was used to estimate eastbound and westbound traffic volumes along Chippawa Parkway under the base year conditions.

Figure 3.3 illustrates the base year (2024) weekday AM and PM peak hour traffic volumes. **Appendix B** contains the original traffic data for reference.

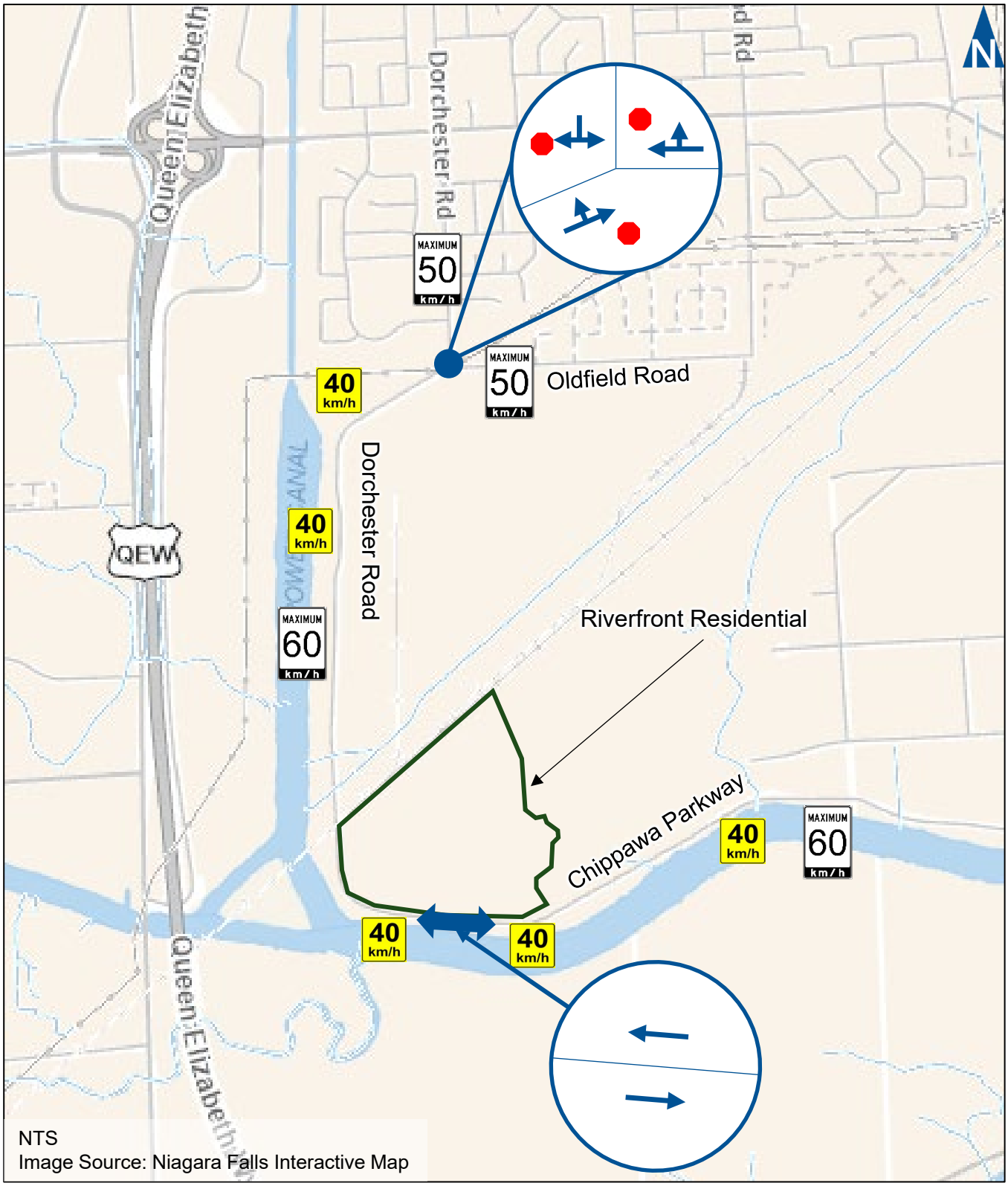

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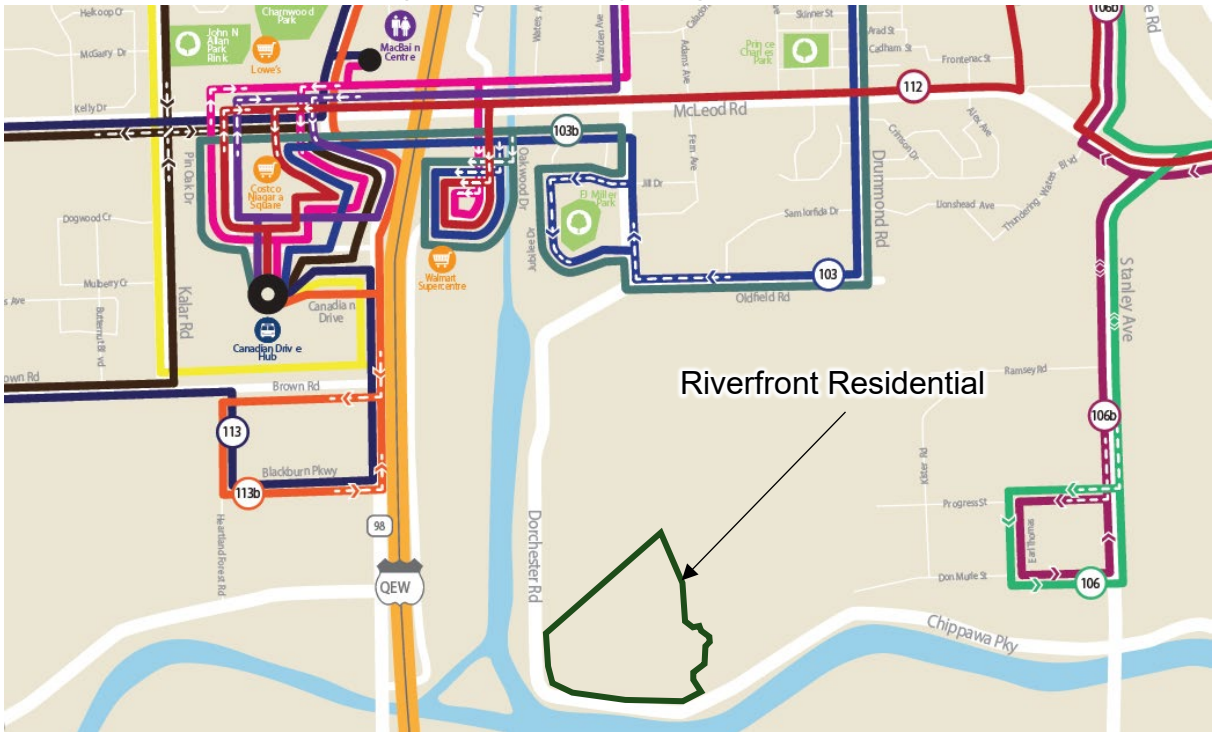
Image Source: Niagara Falls Interactive Map

Existing Lane Configurations and Traffic Control

Monday to Saturday Daytime Service



Monday to Saturday Evening, Sunday, and Statutory Holiday Service

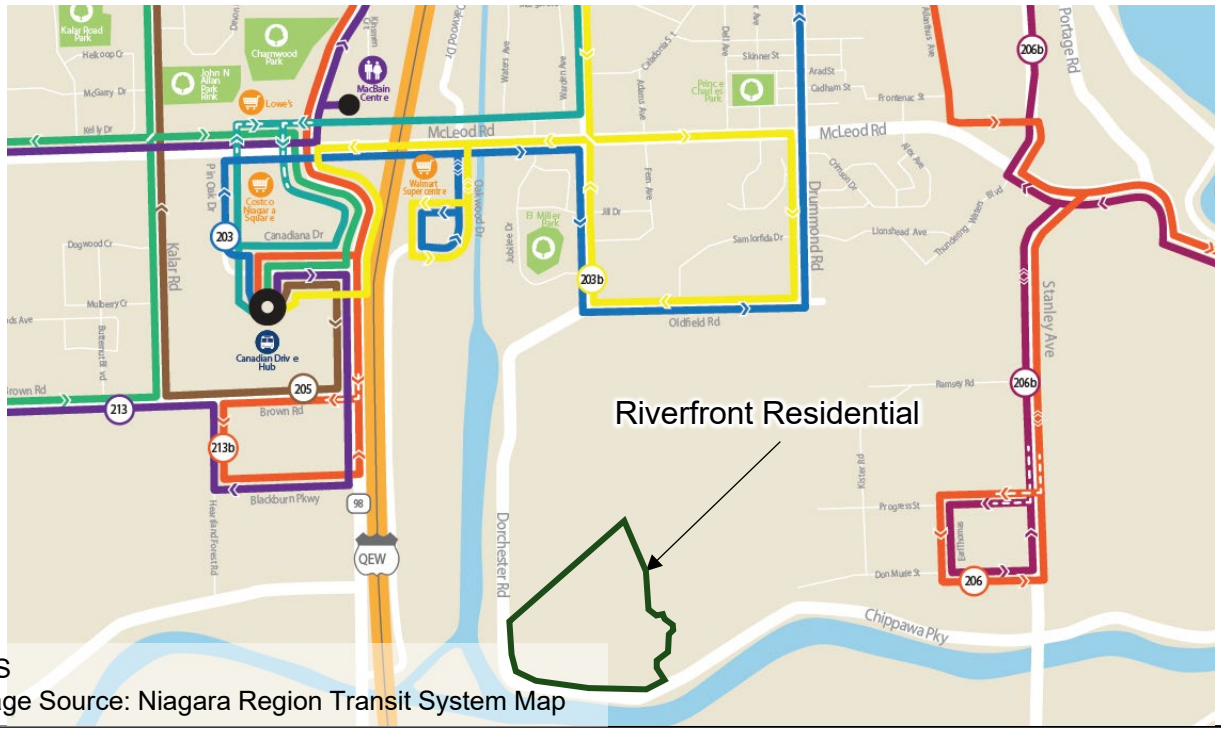


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Image Source: Niagara Region Transit System Map

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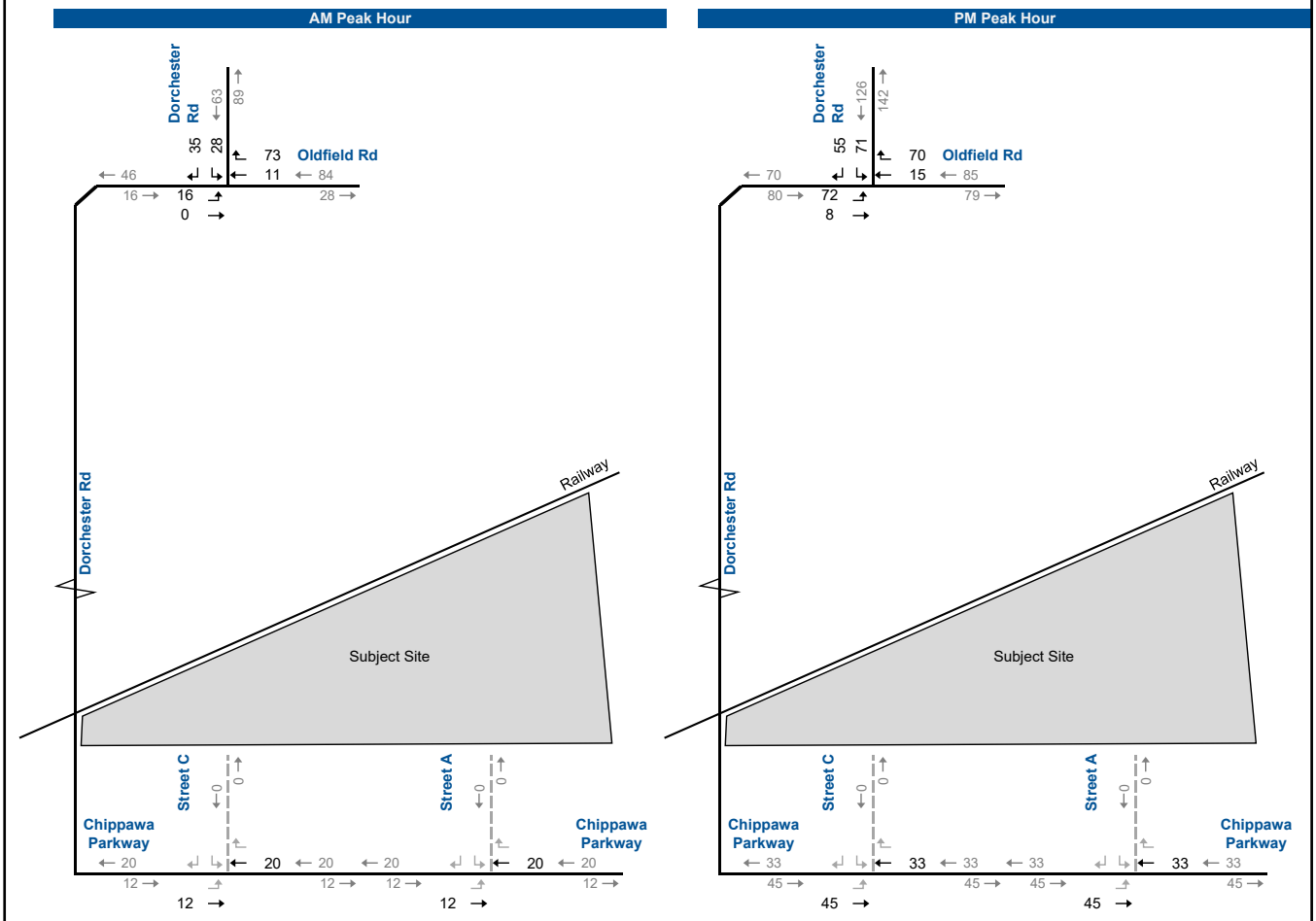
Existing Transit Service



Base Year (2024) Traffic Volumes

Riverfront Residential, Traffic Impact Study, City of Niagara Falls
240167

Figure 3.3

3.5 Traffic Operations

Intersection level of service (LOS) is a recognized method of quantifying the average delay experienced by drivers at intersections. It is based on the delay related to the number of vehicles desiring to make a through or turning movement, compared to the estimated capacity for that movement.

The capacity is based on several criteria, including but not limited to vehicle headways, intersection geometry, vehicle composition, opposing traffic flows, and signal timing for signalized intersections. Capacity is evaluated in terms of the ratio of demand flow to capacity with an at-capacity condition represented by a volume-to-capacity (v/c) ratio of 1.00 (i.e., volume demand equals capacity).

The highest possible rating is LOS A, in which the average total delay is equal or less than 10 seconds per vehicle. When the average delay exceeds 80 seconds for signalized intersections, 50 seconds for unsignalized intersections, the movement is classed as LOS F and improvements are usually implemented if they are feasible. LOS E is generally used as a guideline for the determination of road improvement needs on through lanes, while LOS F may be acceptable for left-turn movements at peak times, depending on capacity and safety considerations. It is also recognized that the guidelines for determining when improvements are necessary can vary in different municipalities.

The Niagara Region *Transportation Impact Assessment Guidelines* (July 24, 2023) identifies the following criteria for critical movements:[3]

- At signalized intersections, movements with a v/c ratio greater than 0.85 and/or LOS E or worse;
- At unsignalized intersections, movements expected to operate at LOS D or worse and/or where the estimated 95th percentile queue length for an individual movement exceeds the available queuing space;
- Any site accesses where entrances or egress is anticipated to be blocked by traffic queues from an upstream/downstream intersection;
- An exclusive turning movement in which the 95th percentile queue will exceed the available storage space; and

[3] Niagara Region, *Transportation Impact Assessment Guidelines*, July 24, 2023, p12.

- Exclusive left- and right-turn lanes that are inaccessible due to the length of queues in the adjacent through lanes.

To assess the base year peak hour automobile conditions, an operational analysis was conducted for the weekday AM and PM peak hour traffic volumes at the study area intersection using Synchro software, which implements the Highway Capacity Manual (HCM) methods. The key parameters used in the analysis include:

- Saturation flow rates as listed in Table 1 of the Region's Guidelines;[4]
- Existing lane configurations;
- Heavy vehicle percentages derived from existing traffic count data;
- Conflicting pedestrian volumes derived from existing traffic count data;
- Calculated intersection peak hour factors (PHF), which facilitates an assessment of the busiest 15-minute period within the peak hour;
- SimTraffic was utilized to output vehicle queues at the all-way stop-controlled intersection of Dorchester Road and Oldfield Road, with a 5-minute seeding interval and a 60-minute analysis period. The 95th percentile queues were generated via an average of five simulation runs; and
- Synchro default values for all other inputs.

Table 3.1 summarizes the operational analysis results, including the LOS, average delay in seconds, degree utilization, and 95th percentile queue lengths in metres for the weekday AM and PM peak hours. Any critical movements are highlighted in the results table. **Appendix C** contains the Synchro analysis outputs for reference.

The results indicate the intersection and traffic movements are currently operating at acceptable levels of service (LOS A) and well within capacity (degree utilization < 0.85). No critical movements are identified.

The link volumes on Dorchester Road-Chippawa Parkway carry less than 100 vehicles per direction per peak hour. This is well within the planning level capacity for arterial roads, typically 900 to 1,000 vehicles per lane in urban areas with regularly spaced signal control at intersections (interrupted flow conditions). Similar planning level

[4] Niagara Region, *Transportation Impact Assessment Guidelines*, July 24, 2023, p14.

capacities could be assumed for Dorchester Road-Chippawa Parkway for its current rural condition and less-than-ideal lane geometry (minimum lane and shoulder widths) since it operates under free-flow conditions.

TABLE 3.1: BASE YEAR (2024) TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																Overall
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	Dorchester Road and Oldfield Road	AWSC	LOS	<	A		**A**		A	>	**A**					A		>	**A**	
			Delay	<	8		**8**		7	>	**7**					8		>	**8**	
			D'Utl	<	0.02				0.10	>						0.08		>		
			Q	<	12				18	>						17		>		
PM Peak Hour	Dorchester Road and Oldfield Road	AWSC	LOS	<	A		**A**		A	>	**A**					A		>	**A**	
			Delay	<	8		**8**		7	>	**7**					8		>	**8**	
			D'Utl	<	0.12				0.11	>						0.17		>		
			Q	<	13				15	>						15		>		

MOE - Measure of Effectiveness
LOS - Level of Service
Delay - Average Delay per Vehicle in Seconds
V/C - Volume to Capacity Ratio
Q - 95th Percentile Queue Length (m)
AWSC - All-Way Stop Control
< / > - Shared with through movement
D'Utl - Degree Utilization

4 Forecasts

4.1 Horizon Years and Future Background Traffic

For assessment purposes, the horizon years of 2029 and 2034 have been analyzed to represent the anticipated full build-out year and five years beyond full build-out, respectively.

Future background traffic forecasts will include higher non-site traffic volumes due to applying a growth factor and traffic generated by other area developments, if any.

4.1.1 Generalized Background Growth

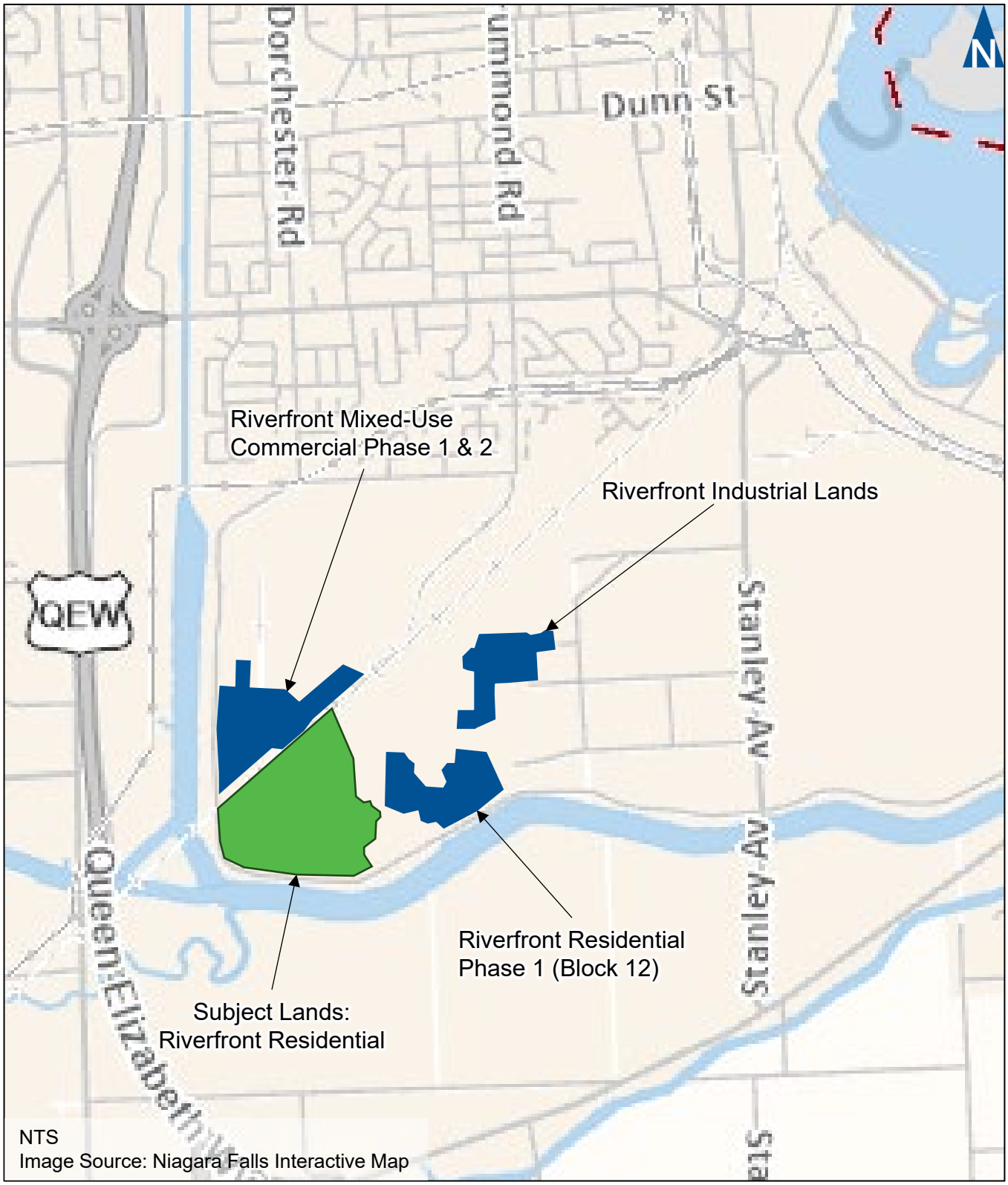
Based on the terms of reference established, a general growth rate of 1.0% was applied to the study area roadways to account for population and employment growth.

4.1.2 Other Area Developments

Traffic associated with other area developments planned or under construction was added to develop the background traffic projections. **Table 4.1** outlines the developments included in the background traffic projections. The projections for these sites have been taken from their respective studies completed. **Appendix D** contains the site traffic assignments from the other area developments. **Figure 4.1** illustrates the locations of the other development areas.

TABLE 4.1: OTHER AREA DEVELOPMENTS

Site Location/Name	Site Description	Source
Riverfront Mixed-Use Commercial Phases 1 & 2	Mixed-use subdivision, includes 656 residential units (330 condominium units, 66 townhouse units and 260 retirement units), a 330-room hotel and approximately 19,610 m^2 (211,080 square feet) of commercial space.	Transportation Assessment, Paradigm, April 2024
Riverfront Industrial Lands	Industrial development, includes seven industrial lots with 21,452 m^2 of building area.	Transportation Assessment, Paradigm, April 2024
Riverfront Residential Phase 1 (Block 12)	Residential development, includes 145 single detached homes and 68 townhouse units.	Traffic Impact Brief, Paradigm, March 2023



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Other Area Developments Locations

4.1.3 Future Background Traffic Forecasts

The future generalized background growth was combined with the site traffic generated by the other area developments to determine the background traffic volumes for the future horizon years.

Figure 4.2 illustrates the 2029 background traffic forecasts for the weekday AM and PM peak hours.

Figure 4.3 illustrates the 2034 background traffic forecasts for the weekday AM and PM peak hours.

4.2 Future Transportation Network Improvements

4.2.1 Road Network

The City recently reconstructed Dorchester Road between McLeod Road and Oldfield Road. It remains a two-lane cross-section with a bike lane in each direction.

Additionally, the intersection of Dorchester Road and Oldfield Road is undergoing a Municipal Class Environmental Assessment (EA) to evaluate road improvement options to address future travel demands.

This EA[5] recommends that the all-way stop control (AWSC) remain at the intersection of Dorchester Road and Oldfield Road with the addition of a dedicated eastbound left-turn lane and southbound right-turn lane. These improvements have been assumed for the future horizons in our study.

Regarding the proposed Street C and Street A site accesses with Chippawa Parkway, it was assumed the site access intersections would operate unsignalized, with Street C and Street A operating under stop control.

Figure 4.4 illustrates the future lane configurations and traffic control at the study area intersections.

4.2.2 Transit and Active Transportation

Through a review of the City of Niagara Falls Sustainable Transportation Master Plan (TMP) (October 2011) and Niagara Region TMP (October 2017), no future planned transit or active transportation improvements are identified around the study area.

[5] City of Niagara Falls, *Municipal Class Environmental Assessment, Dorchester Road and Oldfield Road Intersection Improvements*, October 2023.

It is noted that Dorchester Road-Chippawa Parkway is classified as an infill link on a municipal road or other corridor by the Strategic Cycling Network in the Region's TMP.

As the Riverfront lands develop, it is anticipated Niagara Region Transit, the City of Niagara Falls, Niagara Region, and other related parties will work together to develop and implement an appropriate transit system serving the needs of the Riverfront community.

Specifically, extending an existing Niagara Falls Transit route along Dorchester Road-Chippawa Parkway will be necessary. This would bring transit service to within approximately 400 metres of all residents of the Riverfront Residential subdivision. With Route 103 being closest to the subject lands, it would appear to be the most likely candidate to provide this service. To provide transit service within closer proximity to the proposed subdivision (i.e. within approximately 200 metres of all residents) would require the westerly extension of Street I to Dorchester Road, which would create the potential for a route that runs along Street I and Street A between Dorchester Road and Chippawa Parkway within the proposed residential subdivision.

The active transportation facilities within the proposed subdivision should complement and connect to existing facilities, such as the Millennium Trail, and future extensions of on- and off-road active transportation networks, which will be envisioned in transportation policy documents.

4.3 Site Trip Generation

The Institute of Transportation Engineers (ITE) publication, *Trip Generation Manual* (11th Edition),[6] was used to estimate the peak hour traffic volumes generated by the proposed residential subdivision. The following land use codes (LUC) data is referenced:

- **LUC 210 (Single-Family Detached Housing)**: includes any single-family detached home on an individual lot;
- **LUC 220 (Multifamily Housing – Low-Rise)**: includes apartments, townhouses, and condominiums located within the same building with at least three other dwelling units and that have two or three floors (levels); and
- **LUC 221 (Multifamily Housing – Mid-Rise)**: includes apartments and condominiums located in a building that has between four and ten floors of living space.

Table 4.2 summarizes the trip generation. The proposed residential subdivision is forecast to generate 295 vehicle trips during the AM peak hour and 380 vehicle trips during the PM peak hour.

A conservative approach has been taken by assuming no trip reduction for modal splits for the subject subdivision.

TABLE 4.2: SITE TRIP GENERATION

LUC	Units	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
210[1]	175	31	93	124	106	62	168
220[2]	319	29	93	122	99	59	158
221[3]	138	11	38	49	33	21	54
Total		***71***	***224***	***295***	***238***	***142***	***380***

1: AM peak hour: Ln(T) = 0.91 Ln(X) + 0.12 (25% in/75% out); PM peak hour: Ln(T) = 0.94 Ln(X) + 0.27 (63% in/37% out).
2: AM peak hour: T = 0.31 X + 22.85 (24% in/76% out); PM peak hour: T = 0.43 X + 20.55 (63% in/37% out).
3: AM peak hour: T = 0.44 X – 11.61 (23% in/77% out); PM peak hour: T = 0.39 X + 0.34 (61% in/39% out).

[6] Institute of Transportation Engineers, *Trip Generation Manual, 11th Edition*, 2021

4.4 Site Trip Distribution and Assignment

The directional distribution of traffic approaching and departing the subject lands is a function of several variables, including population density, existing travel patterns, and efficiency of the roadways leading to the site.

Table 4.3 summarizes the directional distribution for site trip assignment purposes, consistent with the distribution presented in the previous TIS report for the Riverfront Residential lands, namely, "*Riverfront Residential, Paradigm Transportation Solutions Limited, January 2019*".

TABLE 4.3: TRIP DISTRIBUTION

To/From via	Percentage
North via Dorchester Road	58%
East via Chippawa Parkway	42%
Total	***100%***

Development traffic was assigned to the adjacent road network using the trip generation data and the trip distribution. Trips inbound/outbound of the subject lands were assumed to be 40% via Street C and 60% via Street A.

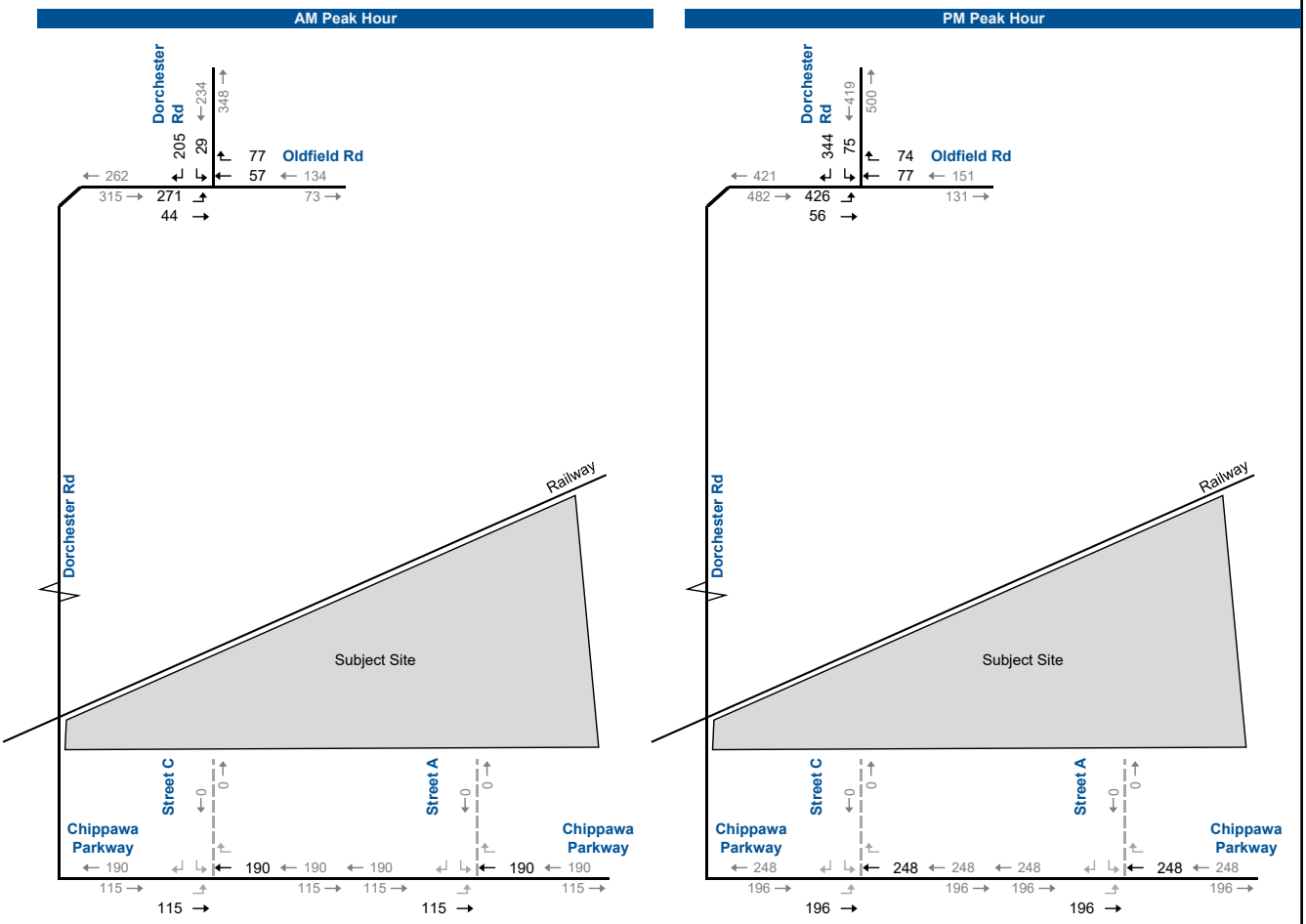
Figure 4.5 illustrates the site-generated traffic assignment during the weekday AM and PM peak hours.

4.5 Future Total Traffic

The weekday AM and PM peak hour background traffic forecasts were combined with the site traffic assignment to determine the total traffic forecasts for the 2029 and 2034 horizon years.

Figure 4.6 illustrates the 2029 total traffic forecasts for the weekday AM and PM peak hours.

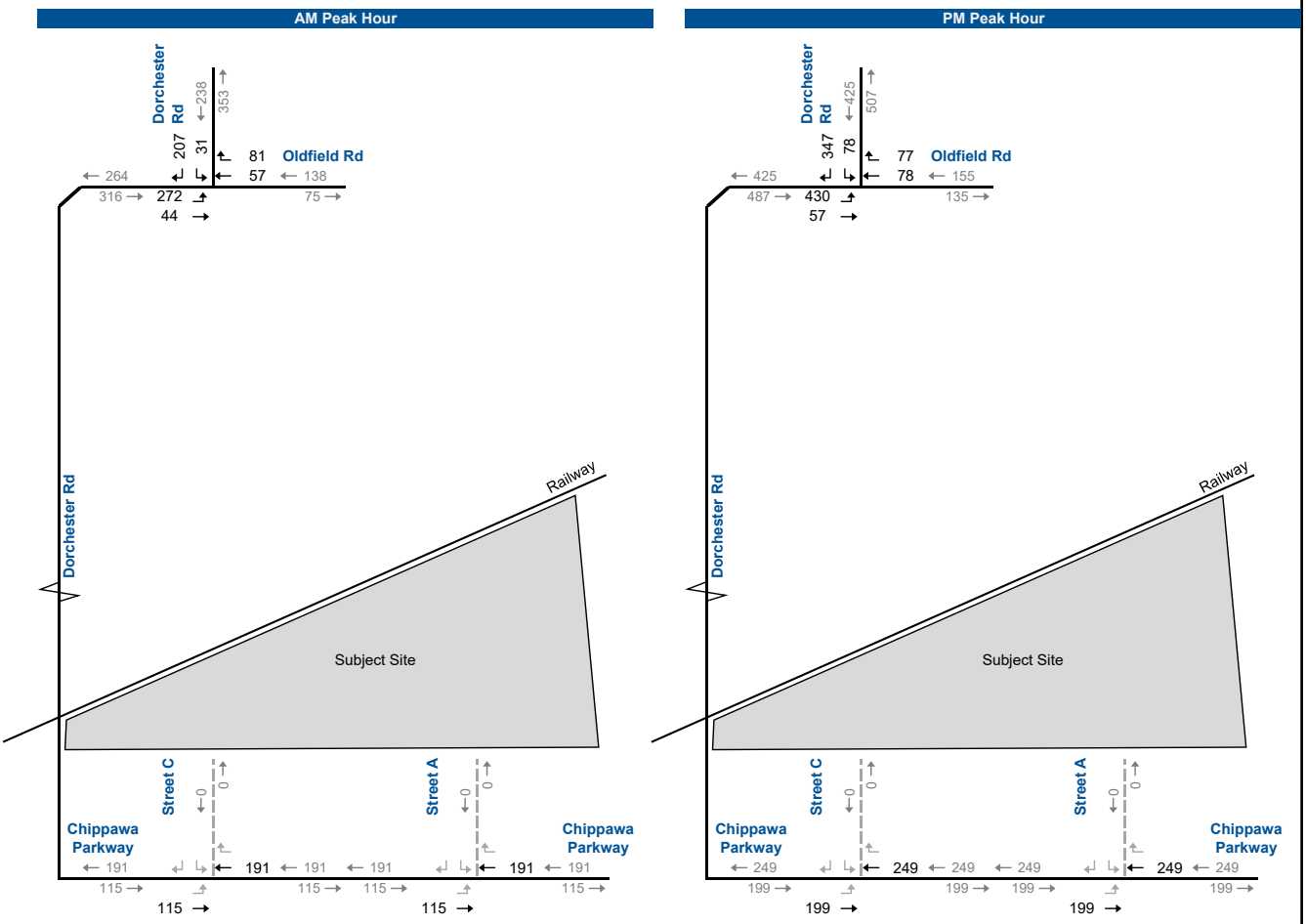
Figure 4.7 illustrates the 2034 total traffic forecasts for the weekday AM and PM peak hours.



2029 Background Traffic Forecasts

Riverfront Residential, Traffic Impact Study, City of Niagara Falls
240167

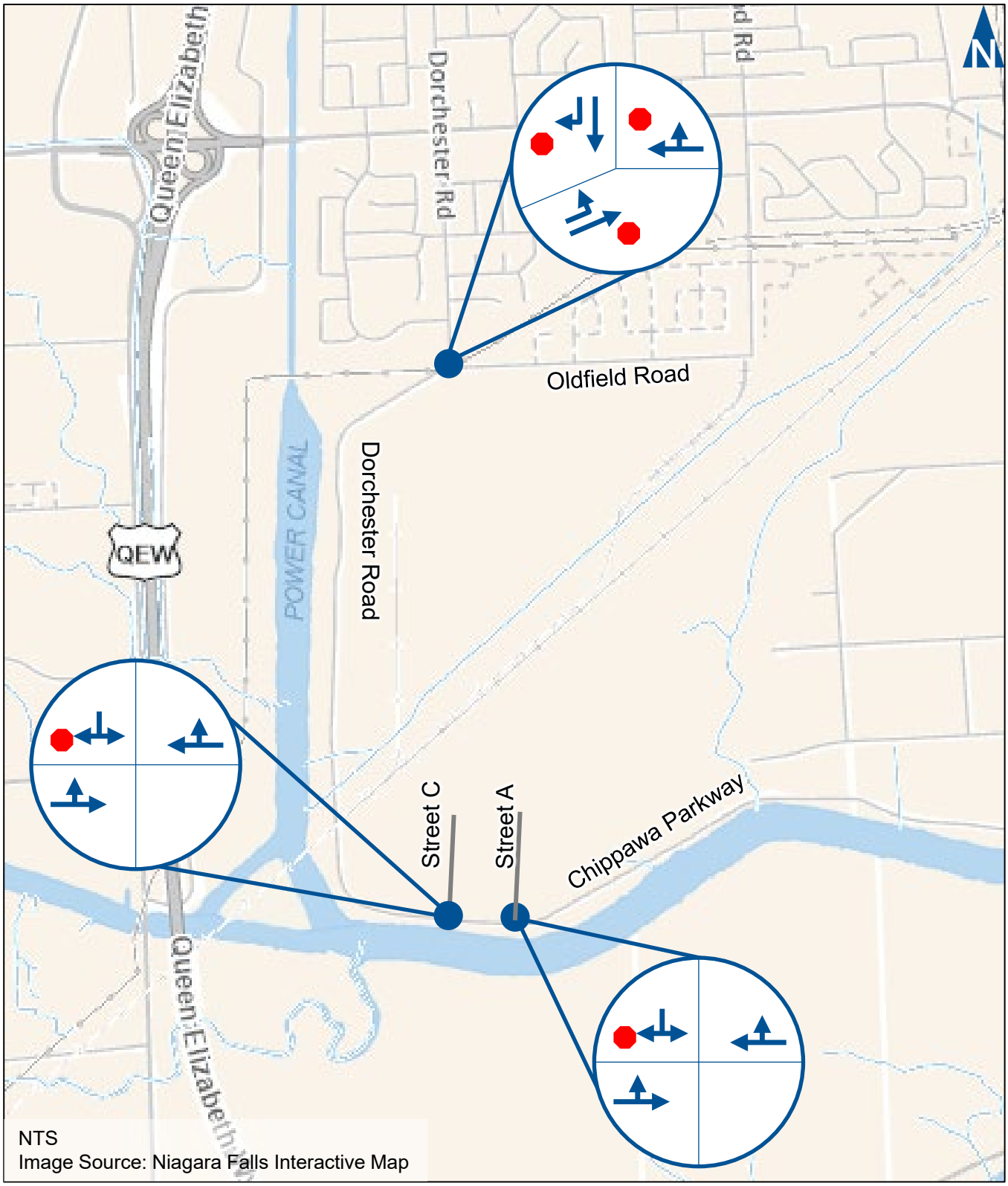
Figure 4.2



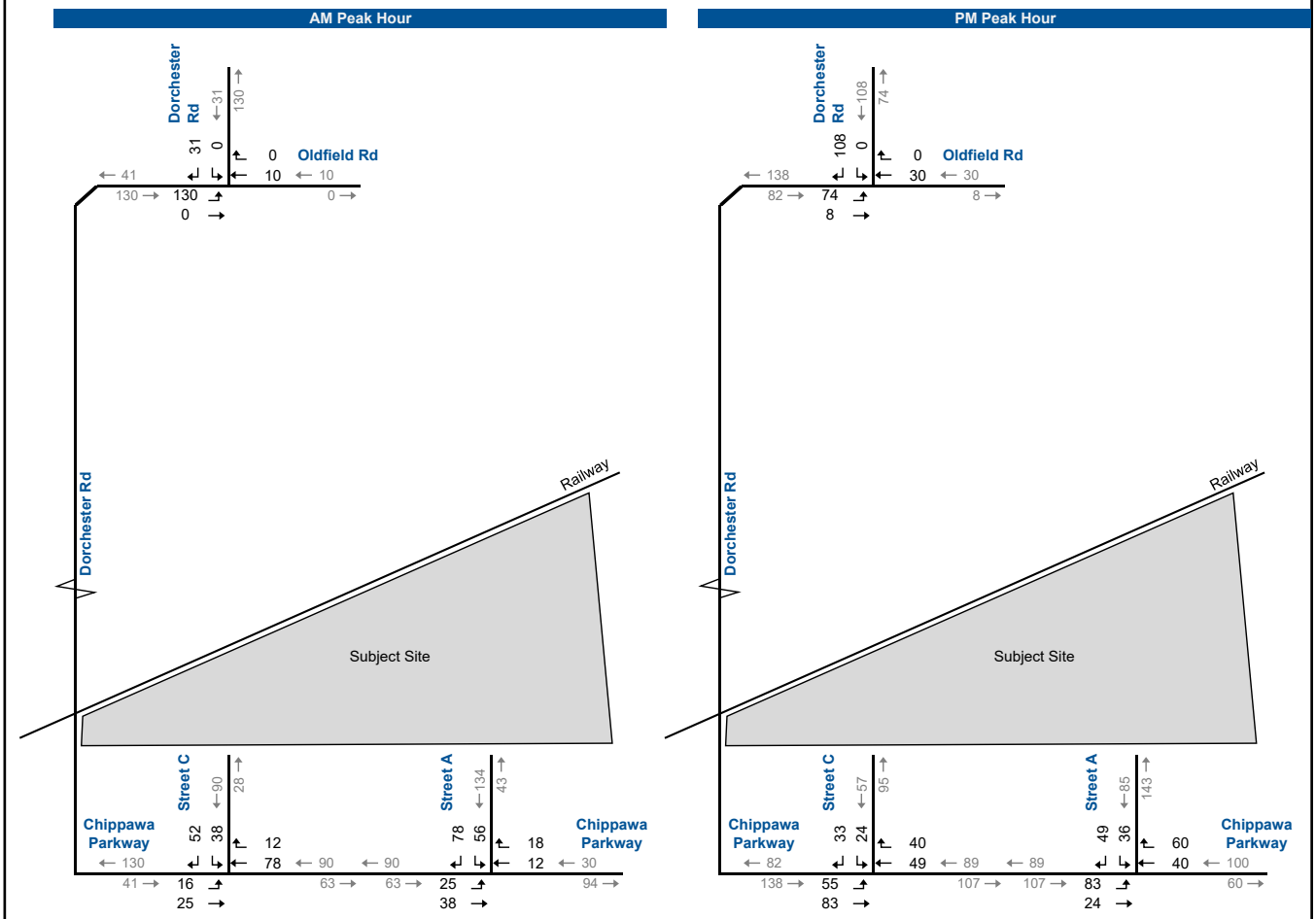
2034 Background Traffic Forecasts

Riverfront Residential, Traffic Impact Study, City of Niagara Falls
240167

Figure 4.3



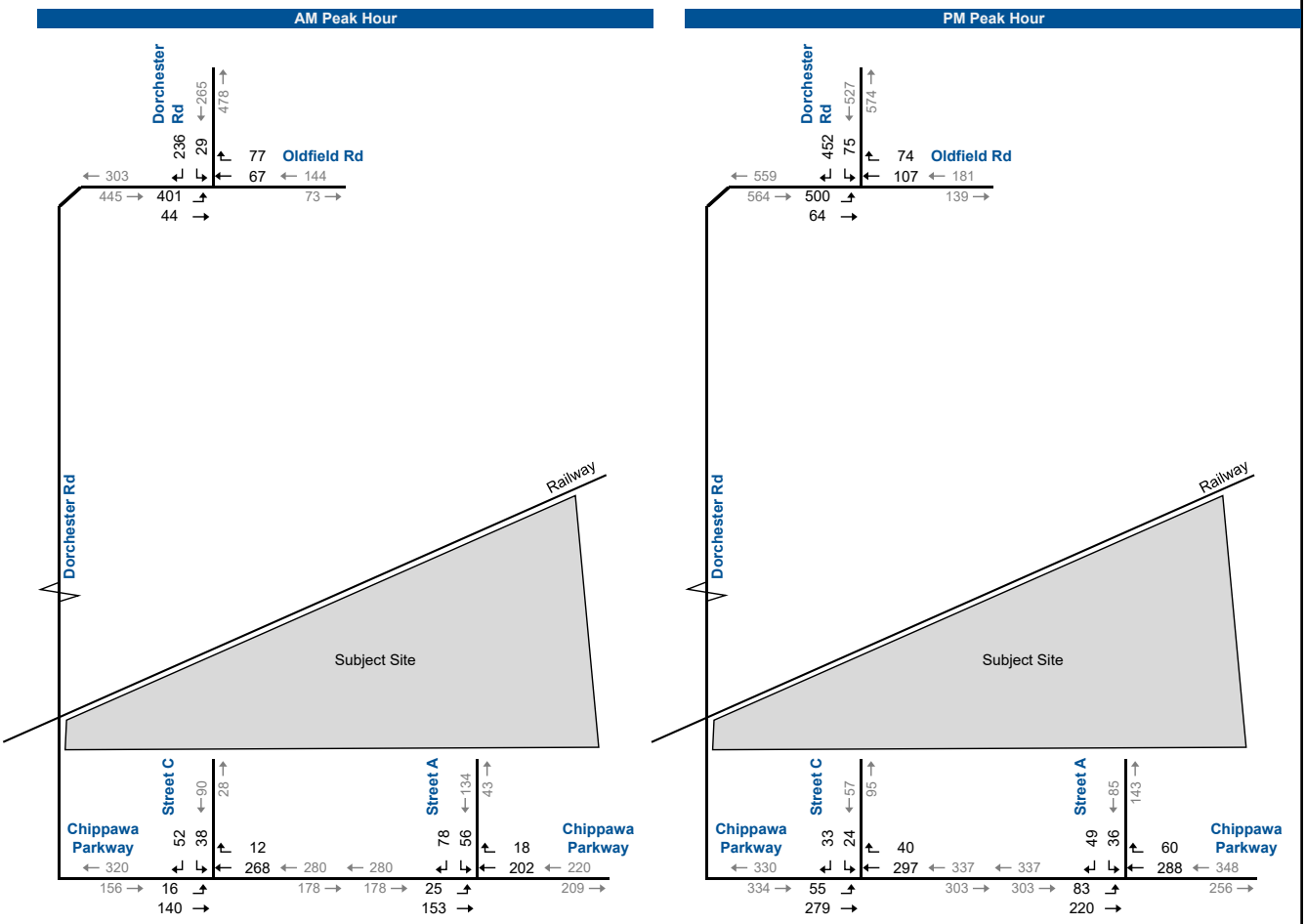
Future Lane Configurations and Traffic Control



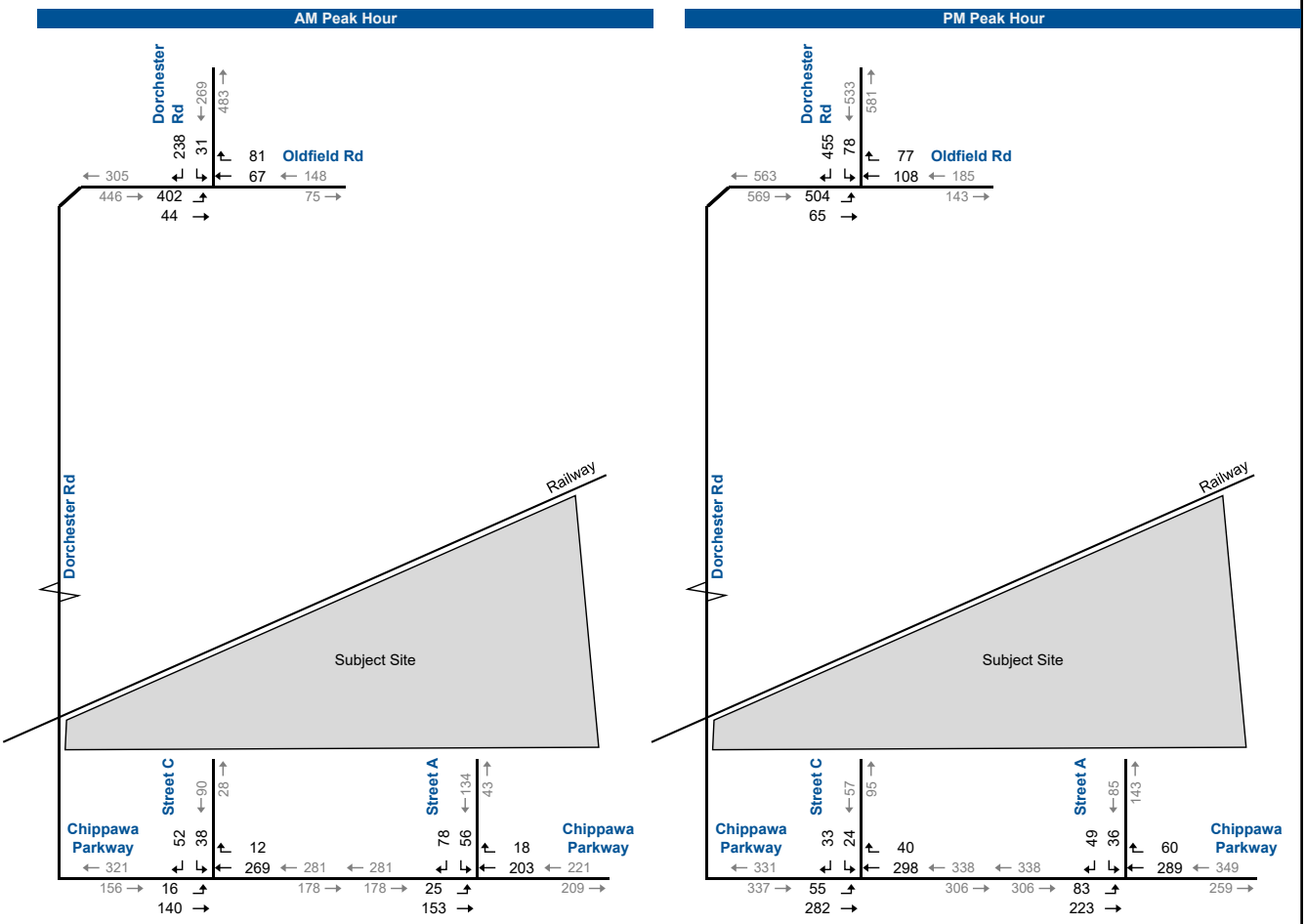
Site-Generated Traffic Forecasts

Riverfront Residential, Traffic Impact Study, City of Niagara Falls
240167

Figure 4.5



2029 Total Traffic Forecasts



2034 Total Traffic Forecasts

Riverfront Residential, Traffic Impact Study, City of Niagara Falls
240167

Figure 4.7

5 Traffic Impact Assessment

5.1 Future Background Traffic

To assess the automobile operating conditions for the weekday AM and PM peak hour background traffic forecasts, a level of service analysis was undertaken using the same methodology, parameters, lane arrangements, and traffic control devices as base year (2024) conditions, except the future lane configurations at Dorchester Road/Oldfield Road as discussed in **Section 4.2.1** are incorporated.

Table 5.1 and **Table 5.2** summarize the results of the operational analysis for the 2029 and 2034 background traffic conditions (without the proposed residential subdivision). Any movements identified as critical movements are highlighted within the results tables. **Appendix E** contains the Synchro analysis outputs for reference.

The results indicate that the intersection of Dorchester Road/Oldfield Road is forecast to operate at similar levels of service as noted under the base year (2024) conditions. Still, it is slightly exacerbated, accounting for background growth and traffic contributions related to the other area developments.

Under the 2029 and 2034 background conditions (without the proposed residential subdivision), the Dorchester Road/Oldfield Road intersection is forecast to continue operating at acceptable levels of service and within capacity. The exceptions include the following movements:

- The eastbound left-turn movement is forecast to operate with delays in the LOS E range under the 2029 horizon and LOS F range under the 2034 horizon during the PM peak hour. The movement is also noted to operate approaching capacity (degree of utilization > 0.90) during the PM peak hour under both horizons; and
- The 95th percentile queues for the eastbound left-turn and southbound right-turn movements are anticipated to exceed the available storage by up to seven metres during the AM and PM peak hours under the 2029 and 2034 horizons.

The results indicate that applicable mitigation measures need to be investigated and considered to address the anticipated poor levels of service due to general background growth and site traffic contributions by the other area developments.

Similar to base year conditions, the background traffic link volumes on Dorchester Road-Chippawa Parkway are less than 500 vehicles per direction per peak hour, which is well within the planning level capacity for this type of arterial road.

TABLE 5.1: 2029 BACKGROUND TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																Overall
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	Dorchester Road and Oldfield Road	AWSC	LOS	B	A		**B**		B	>	**B**					A		A	**A**	
			Delay	14	8		**13**		10	>	**10**					9		10	**10**	
			D'Utl	0.52	0.08				0.23	>						0.06		0.35		
			Q	22	17				21	>						18		21		
			Stor.	15	-				-	>						-		15		
			Avail.	-7	-				-	>						-		-6		
PM Peak Hour	Dorchester Road and Oldfield Road	AWSC	LOS	E	A		**E**		B	>	**B**					B		C	**C**	
			Delay	50	9		**45**		12	>	**12**					11		19	**18**	
			D'Utl	0.94	0.11				0.32	>						0.18		0.67		
			Q	22	21				20	>						22		22		
			Stor.	15	-				-	>						-		15		
			Avail.	-7	-				-	>						-		-7		

MOE - Measure of Effectiveness
LOS - Level of Service
Delay - Average Delay per Vehicle in Seconds
V/C - Volume to Capacity Ratio
Q - 95th Percentile Queue Length (m)
Stor. - Existing Storage (m)
Avail. - Available Storage (m)
AWSC - All-Way Stop Control
< / > - Shared with through movement
D'Utl - Degree Utilization

TABLE 5.2: 2034 BACKGROUND TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																Overall
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	Dorchester Road and Oldfield Road	AWSC	LOS	B	A		**B**		B	>	**B**					A		B	**A**	
			Delay	14	8		**14**		10	>	**10**					9		10	**10**	
			D'Utl	0.53	0.08				0.24	>						0.07		0.35		
			Q	22	17				21	>						18		21		
			Stor.	15	-				-	>						-		15		
			Avail.	-7	-				-	>						-		-6		
PM Peak Hour	Dorchester Road and Oldfield Road	AWSC	LOS	F	A		**E**		B	>	**B**					B		C	**C**	
			Delay	53	9		**48**		13	>	**13**					11		20	**18**	
			D'Utl	0.95	0.12				0.33	>						0.19		0.68		
			Q	22	21				21	>						22		22		
			Stor.	15	-				-	>						-		15		
			Avail.	-7	-				-	>						-		-7		

MOE - Measure of Effectiveness
LOS - Level of Service
Delay - Average Delay per Vehicle in Seconds
V/C - Volume to Capacity Ratio
Q - 95th Percentile Queue Length (m)
Stor. - Existing Storage (m)
Avail. - Available Storage (m)
AWSC - All-Way Stop Control
< / > - Shared with through movement
D'Utl - Degree Utilization

5.2 Future Total Traffic

To assess the automobile operating conditions for the weekday AM and PM peak hour total traffic forecasts, an operational analysis was undertaken using the same methodology, parameters, lane arrangements, and traffic control devices as in the analysis of background conditions. The assessment includes the proposed site access intersections with Chippawa Parkway.

Table 5.3 and **Table 5.4** present the results of the operational analysis for the 2029 and 2034 total traffic conditions (with the proposed residential subdivision). Any movements identified as critical movements are highlighted within the results tables. **Appendix F** contains the Synchro analysis outputs for reference.

With the addition of the site-generated traffic, it is forecasted that, under the 2029 and 2034 horizons, the study area intersections would operate similarly to background conditions, with delays generally increasing by less than 25 seconds due to the addition of site traffic.

The exception being a noticeable increase in delays for the eastbound left-turn movement at Dorchester Road/Oldfield Road under the PM peak hour total conditions. The eastbound left-turn movement is expected to function at a LOS F rating with a degree of utilization exceeding 1.00.

The site access intersections with Chippawa Parkway are forecast to operate at acceptable levels of service, and all movements are well within capacity during the AM and PM peak hours under the 2029 and 2034 horizons.

The previously identified critical movements under background conditions are further exacerbated under total traffic conditions. No additional critical movements are identified.

TABLE 5.3: 2029 TOTAL TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																Overall
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	Dorchester Road & Oldfield Road	AWSC	LOS	D	A		D		B	>	B					A		B	B	
			Delay	29	8		27		11	>	11					10		12	12	
			D'Utl	0.80	0.08				0.27	>						0.07		0.44		
			Q	24	26				24	>						18		21		
			Stor.	15	-				-	>						-		15		
			Avail.	-9	-				-	>						-		-6		
	Chippawa Parkway & Street C	TWSC	LOS	<	A		A		A	>	A					B		>	B	
			Delay	<	1		1		0	>	0					12		>	12	
			V/C	<	0.01				0.18	>						0.15		>		
			Q	<	0				0	>						4		>		
	Chippawa Parkway & Street A	TWSC	LOS	<	A		A		A	>	A					B		>	B	
			Delay	<	1		1		0	>	0					12		>	12	
			V/C	<	0.02				0.14	>						0.21		>		
			Q	<	0				0	>						6		>		
PM Peak Hour	Dorchester Road & Oldfield Road	AWSC	LOS	F	A		F		B	>	B					B		E	E	
			Delay	128	10		115		15	>	15					11		42	38	
			D'Utl	1.19	0.14				0.41	>						0.18		0.91		
			Q	24	35				20	>						31		24		
			Stor.	15	-				-	>						-		15		
			Avail.	-9	-				-	>						-		-9		
	Chippawa Parkway & Street C	TWSC	LOS	<	A		A		A	>	A					B		>	B	
			Delay	<	2		2		0	>	0					13		>	13	
			V/C	<	0.05				0.22	>						0.13		>		
			Q	<	1				0	>						3		>		
	Chippawa Parkway & Street A	TWSC	LOS	<	A		A		A	>	A					B		>	B	
			Delay	<	3		3		0	>	0					14		>	14	
			V/C	<	0.08				0.22	>						0.19		>		
			Q	<	2				0	>						6		>		

MOE - Measure of Effectiveness
LOS - Level of Service
Delay - Average Delay per Vehicle in Seconds
V/C - Volume to Capacity Ratio
Q - 95th Percentile Queue Length (m)
Stor. - Existing Storage (m)
Avail. - Available Storage (m)
TWSC - Two-Way Stop Control
AWSC - All-Way Stop Control
< / > - Shared with through movement
D'Utl - Degree Utilization

TABLE 5.4: 2034 TOTAL TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																Overall
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	Dorchester Road & Oldfield Road	AWSC	LOS	D	A		D		B	>	B					A		B	B	
			Delay	30	8		27		11	>	11					10		12	12	
			D'Utl	0.81	0.08				0.28	>						0.07		0.45		
			Q	24	27				24	>						18		21		
			Stor.	15	-				-	>						-		15		
			Avail.	-9	-				-	>						-		-6		
	Chippawa Parkway & Street C	TWSC	LOS	<	A		A		A	>	A					B		>	B	
			Delay	<	1		1		0	>	0					12		>	12	
			V/C	<	0.01				0.18	>						0.15		>		
			Q	<	0				0	>						4		>		
	Chippawa Parkway & Street A	TWSC	LOS	<	A		A		A	>	A					B		>	B	
			Delay	<	1		1		0	>	0					12		>	12	
			V/C	<	0.02				0.14	>						0.22		>		
			Q	<	0				0	>						6		>		
PM Peak Hour	Dorchester Road & Oldfield Road	AWSC	LOS	F	A		F		B	>	B					B		E	E	
			Delay	134	10		120		15	>	15					11		44	39	
			D'Utl	1.21	0.15				0.42	>						0.19		0.92		
			Q	24	38				20	>						30		25		
			Stor.	15	-				-	>						-		15		
			Avail.	-9	-				-	>						-		-10		
	Chippawa Parkway & Street C	TWSC	LOS	<	A		A		A	>	A					B		>	B	
			Delay	<	2		2		0	>	0					13		>	13	
			V/C	<	0.05				0.22	>						0.13		>		
			Q	<	1				0	>						3		>		
	Chippawa Parkway & Street A	TWSC	LOS	<	A		A		A	>	A					B		>	B	
			Delay	<	3		3		0	>	0					14		>	14	
			V/C	<	0.08				0.22	>						0.19		>		
			Q	<	2				0	>						6		>		

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LOS - Level of Service
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V/C - Volume to Capacity Ratio
Q - 95th Percentile Queue Length (m)
Stor. - Existing Storage (m)
Avail. - Available Storage (m)
TWSC - Two-Way Stop Control
AWSC - All-Way Stop Control
< / > - Shared with through movement
D'Utl - Degree Utilization

5.3 Remedial Measures

As noted in **Section 4.2.1**, the City is undergoing an EA for improvements to the intersection of Dorchester Road/Oldfield Road. It is understood that the all-way stop control was selected as the preferred improvement option, with a separate left-turn lane for the eastbound approach and a separate right-turn lane for the southbound approach. This preferred improvement has been accounted for in future traffic operational analyses.

Under the 2029 and 2034 total traffic conditions, critical movements are identified at the eastbound left-turn and southbound right-turn movements during the weekday AM and PM peak hours. It is noted that during the weekday PM peak hour, the eastbound left-turn lane will be heavily utilized, exceeding a degree of utilization of 1.00.

Signal warrant analyses were conducted to determine whether the total traffic forecasts for 2029 and 2034 warrant consideration of traffic control signals at Dorchester Road/Oldfield Road.

The warrant analyses were conducted in accordance with OTM Book 12 – Traffic Signals, using Justification 7, which is based on projected volumes (where the minimum requirements are increased to be met for 120% for projected volumes). **Appendix G** contains the signal warrant analysis for reference.

The results indicate that the traffic forecasts would not meet the justification thresholds to warrant consideration of traffic signals at Dorchester Road/Oldfield Road for 2029 or 2034 total traffic conditions. However, installing an unwarranted traffic control signal would improve operations, which has been further investigated in **Section 5.4**.

It is noted that a roundabout was also considered; however, as indicated in the EA, a roundabout at Dorchester Road/Oldfield Road would have greater impacts on utilities and property, and higher life cycle cost compared to the traffic control signal option (approximately $860,000 vs $720,000).[7] Therefore, a roundabout is considered less favourable than a traffic control signal and was not further investigated.

[7] City of Niagara Falls, *Municipal Class Environmental Assessment, Dorchester Road and Oldfield Road Intersection Improvements*, October 2023, p18.

5.4 Sensitivity Analysis

A sensitivity analysis has been undertaken to assess the proposed improvement (i.e., traffic control signal) at the Dorchester Road/Oldfield Road intersection for the 2034 total traffic conditions, representing the “worst-case” scenario.

It should be noted that Dorchester Road was assessed as a north-south road and Oldfield Road as an east-west road for this specific analysis. As illustrated in **Figure 4.7**, traffic forecasts along Dorchester Road are more balanced and higher than that of Oldfield Road. Keeping the Dorchester Road approaches in the same signal phase would help create a more efficient and better-utilized signalized intersection.

Table 5.5 summarizes the results of the sensitivity analysis. **Appendix H** contains the detailed Synchro reports.

With Dorchester Road/Oldfield Road being signalized, the intersection is reported to operate at acceptable levels of service (LOS C or better) and with all movements well within capacity (v/c < 0.85). All the previously identified critical movements under total traffic conditions would be resolved by installing signal control at the intersection.

TABLE 5.5: 2034 TOTAL TRAFFIC OPERATIONS WITH TCS

Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																Overall
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	Dorchester Road & Oldfield Road	TCS	LOS					C		>	**C**		A	A	**A**	A	A		**A**	**A**
			Delay					25		>	**25**		8	3	**8**	4	4		**4**	**10**
			V/C					0.53		>			0.61	0.06		0.09	0.3			**0.59**
			Q					20		>			74	4		5	28			
			Stor.					-		>			-	15		15	-			
			Avail.					-		>			-	11		10	-			
PM Peak Hour	Dorchester Road & Oldfield Road	TCS	LOS					C		>	**C**		B	A	**B**	A	A		**A**	**B**
			Delay					27		>	**27**		14	4	**12**	7	9		**9**	**13**
			V/C					0.65		>			0.79	0.09		0.28	0.59			**0.75**
			Q					31		>			111	6		13	65			
			Stor.					-		>			-	15		15	-			
			Avail.					-		>			-	9		2	-			

MOE - Measure of Effectiveness
LOS - Level of Service
Delay - Average Delay per Vehicle in Seconds
V/C - Volume to Capacity Ratio
Q - 95th Percentile Queue Length (m)
Stor. - Existing Storage (m)
Avail. - Available Storage (m)
TCS - Traffic Control Signal
< / > - Shared with through movement

5.5 Transportation Demand Management (TDM) and Monitoring

Transportation Demand Management (TDM) planning is intended to encourage the use of sustainable transportation modes and minimize single-occupant vehicle trips as part of an overall community transportation management strategy. The design of the subdivision concept plan will provide the framework for TDM and facilitate establishing a higher priority for sustainable modes of transportation over single-occupant vehicles where appropriate. This relates to the internal road system, which is being designed to create TDM-supportive opportunities for the placement of buildings and public amenity spaces along the streets and at their intersections, desirable locations for building entrances and vehicular access, and well-defined pedestrian circulation routes and safer road crossings.

For the proposed residential subdivision, a key TDM strategy will be the introduction of public transit to this area. As noted previously in **Section 4.2.2**, this will require extending a Niagara Falls Transit route along Dorchester Road-Chippawa Parkway and possibly within and through the subject lands following the completion of the internal road network.

In the longer term, the commercial development proposed for the northern part of the Riverfront Community is anticipated to provide shopping, entertainment, personal services, and employment opportunities. As such, these new land uses will provide additional TDM benefits associated with mixed or multi-use development. This form of development supports sustainability initiatives by promoting complementary land uses in close proximity.[8] The primary effect is to allow locally generated trips to be made by foot, bike, public transit (including privately operated shuttles, taxis, uber, etc.), or private vehicle (car) while only travelling on the internal sidewalk, path or road networks ("internal capture trips").[9] Since vehicle trips with local origins and destinations would not leave the Riverfront Community, the potential traffic impact on the surrounding arterial road network ("external trips") would be reduced.

Once the proposed residential subdivision reaches approximately 50% build-out/occupancy, there would be an opportunity to conduct monitoring surveys to determine the actual transportation characteristics related to peak hour trip generation, mode split,

[8] Centre for Urban Transportation Research, *Trip Internalization in Multi-Use Developments*, April 2014.

[9] Institute of Transportation Engineers, *Trip Generation Handbook* (3rd edition), August 2014.

directional travel patterns, the effects of TDM planning or specific strategies, and intersection operations. This information would be used to determine the potential need for implementing additional transportation system improvements and for planning subsequent phases of development.

6 Site Access Review

6.1 Auxiliary Turn Lanes

Pre-consultation commentary from the City noted the requirement for assessing an auxiliary eastbound left-turn lane and a westbound right-turn lane at the proposed site accesses with Chippawa Parkway.

6.1.1 Left-Turn Lane

The proposed new unsignalized intersections with Chippawa Parkway were assessed to determine if the future traffic volumes warrant the installation of a left-turn lane along Chippawa Parkway. The warrants for left-turn lanes follow the Ministry of Transportation's (MTO) Design Supplement to the Transportation Association of Canada (TAC) *Geometric Design Guide for Canadian Roads* (GDGCR)[10] requirements, which provides guidance on the assessment of and/or need for auxiliary left-turn lanes at unsignalized intersections. The warrant analysis to determine if a left-turn lane is needed is based on the following criteria:

- Design speed of the road (posted speed + 10 km/h);
- Advancing Volume;
- Opposing Volume; and
- Percent of advancing vehicles performing a left-turn maneuver.

The percentages of left-turning vehicles in the approaching volume were rounded to the nearest five percent, as warrant nomographs are only provided for five percent increments. **Table 6.1** summarizes the results of the left-turn lane warrant analysis. The results indicate an auxiliary left-turn lane with 15 metres of storage is warranted along Chippawa Parkway at Street C and Street A during the PM peak hour under the 2029 and 2034 horizons.

It is noted that the posted speed limit on Chippawa Parkway may be reduced from 60 km/h to 50 km/h (see detailed discussion in **Section 6.3**). Therefore, the left-turn lane warrant analysis was also conducted for a design speed of 60 km/h (posted speed + 10 km/h). The results indicate the same findings as a design speed of 70 km/h, where an auxiliary left-turn lane with 15 metres of storage is warranted at Street

[10] Transportation Association of Canada, *MTO Design Supplement for TAC Geometric Design Guide for Canadian Roads – Appendix 9A*, Ministry of Transportation of Ontario, 2023.

C and Street A during the PM peak hour under the 2029 and 2034 horizons.

TABLE 6.1: LEFT-TURN LANE WARRANT SUMMARY

	Chippawa Parkway at Street C		Chippawa Parkway at Street A	
Approach Direction	Eastbound		Eastbound	
Design Speed	70 km/h		70 km/h	
Horizon	2029 Total		2029 Total	
Peak Hour	AM	PM	AM	PM
Advancing Volume	156	334	178	303
Opposing Volumes	280	337	220	348
Left Turning Traffic	16	55	25	83
% of Left Turning Traffic	10.3%	16.5%	14.0%	27.4%
Figure Used*	EA-10 (10%)	EA-11 (15%)	EA-11 (15%)	EA-12 (25%)
Warranted	**No**	**Yes**	**No**	**Yes**
Storage Length Required	-	15	-	15
	Chippawa Parkway at Street C		Chippawa Parkway at Street A	
Approach Direction	Eastbound		Eastbound	
Design Speed	70 km/h		70 km/h	
Horizon	2034 Total		2034 Total	
Peak Hour	AM	PM	AM	PM
Advancing Volume	156	337	178	306
Opposing Volumes	281	338	221	349
Left Turning Traffic	16	55	25	83
% of Left Turning Traffic	10.3%	16.3%	14.0%	27.1%
Figure Used*	EA-10 (10%)	EA-11 (15%)	EA-11 (15%)	EA-12 (25%)
Warranted	**No**	**Yes**	**No**	**Yes**
Storage Length Required	-	15	-	15

Based on MTO Design Supplement for TAC Geometric Design Guide for Canadian Road - June 2017

6.1.2 Deceleration Right-Turn Lane

Right turn lanes are exclusive vehicle lanes allowing a right turn movement to occur outside the through lane. Deceleration lanes are advantageous on higher-speed roads because the driver of a vehicle leaving the highway has no choice but to slow down on the through-traffic lane if a deceleration lane is not provided. The failure to brake by the following drivers, because of a lack of alertness may result in rear-end collisions.

The Federal Highway Administration (FHWA) studied the safety impact of exclusive right turn lanes, and based on their review, collisions can be expected to decrease from 4% to 27%, depending on the circumstances.[11]

The proposed new roadways to Chippawa Parkway (Street C and Street A) were assessed to determine if the forecasted traffic volumes warrant installing a westbound right-turn lane along Chippawa Parkway.

TAC *GDGCR*[12] details the requirements for auxiliary right-turn lanes and recommends a right-turn taper and/or a right-turn lane at unsignalized intersections when "*the volume of decelerating or accelerating vehicles compared with the through traffic volume causes undue hazard*."

MTO guidelines (Geometric Design Standards for Ontario Highways)[13] note that right-turn lanes or tapers may be considered at channelized intersections where right-turn volumes exceed 60 vehicles per hour (vph) and where right-turning vehicles create a hazard or reduce capacity at the intersection. Although this guideline is noted for channelized intersections and the reference pertains to best practices at the time (1976), it provides a benchmark guideline for the volume of right-turning vehicles that may benefit from a right-turn lane.

The westbound right-turning volumes at Street C and Street A are less than 60 vehicles per peak hour under the 2034 total horizon, equivalent to approximately one vehicle every minute over a peak hour. This turning movement is considered insignificant, accounting for less than 20% of the approaching volumes. As a result, the westbound right-turn movements are anticipated not to cause undue hazard, and

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[11] Federal Highway Administration, Safety Effectiveness of Intersection Left-and Right-Turn Lanes.

[12] Transportation Association of Canada, *Geometric Design Guide for Canadian Roads*, 2017, p99.

[13] Geometric Design Standards for Ontario Highways, Ministry of Transportation, Surveys & Design Office, Chapter E7.2.

an auxiliary right-turn lane is not recommended along Chippawa Parkway with Streets A and C.

6.2 Sight Distance

6.2.1 Methodology

The proposed two site access connections with Chippawa Parkway have been reviewed to confirm sight distance and sight line availability and provisions.

The assessment has been carried out based on the methodology contained in the TAC GDGCR. Sight distance requirements are considered for vehicles departing from the site accesses (departure sight distance) and for vehicles approaching the site accesses (approach sight distance). The following object heights were utilized in obtaining field measurements:

- Driver eye height: 1.05 metres;
- Top of car: 1.30 metres (for departure sight distance, height of approaching vehicle); and
- Vehicle headlight or tail/brake light: 0.60 metres (for approach sight distance, height of vehicle/target object).

The main measurements for departing traffic were taken from 5.0 metres back from the existing pavement edge for vehicles exiting at the proposed site accesses, representing the position of a driver/vehicle performing a turning movement.

The main measurements for approaching traffic were taken from within the centre of either travel lane on Chippawa Parkway, assuming a vehicle position perpendicular to the proposed site accesses.

The sight distance requirements are based upon a design speed of 70 km/h (10 km/h above the posted speed limit of 60 km/h along Chippawa Parkway).

Table 6.2 summarizes the required sight distances for the design speed.

TABLE 6.2: REQUIRED SIGHT DISTANCE CRITERIA

Sight Distance Criteria	Sight Distance Requirement (metres)
	Design Speed 70 km/h
Minimum Departure (Left Turn) Sight Distance[1]	150.0
Minimum Departure (Right Turn) Sight Distance[2]	130.0
Minimum Stopping Sight Distance[3]	105.0

[1] TAC Guide. June 2017. Table 9.9.4: Design Intersection Sight Distance – Case B1, Left Turn from Stop
[2] TAC Guide. June 2017. Table 9.9.6: Design Intersection Sight Distance – Case B2, Right Turn from Stop
[3] TAC Guide. June 2017. Table 2.5.2: Stopping Sight Distance on Level Roadways for Automobiles

6.2.2 Departure Sight Distance

The departure sight distance represents the minimum distance required for a vehicle to safely enter the major roadway and complete a turning movement without significantly impeding traffic flow or providing the opportunity for conflict.

Table 6.3 summarizes the available and TAC recommended sight distances for a departing left-turn and right-turn movement across Chippawa Parkway for the Street A and Street C accesses. **Figure 6.1** illustrates the available and recommended departure sight distances.

TABLE 6.3: DEPARTURE SIGHT DISTANCE ANALYSIS SUMMARY

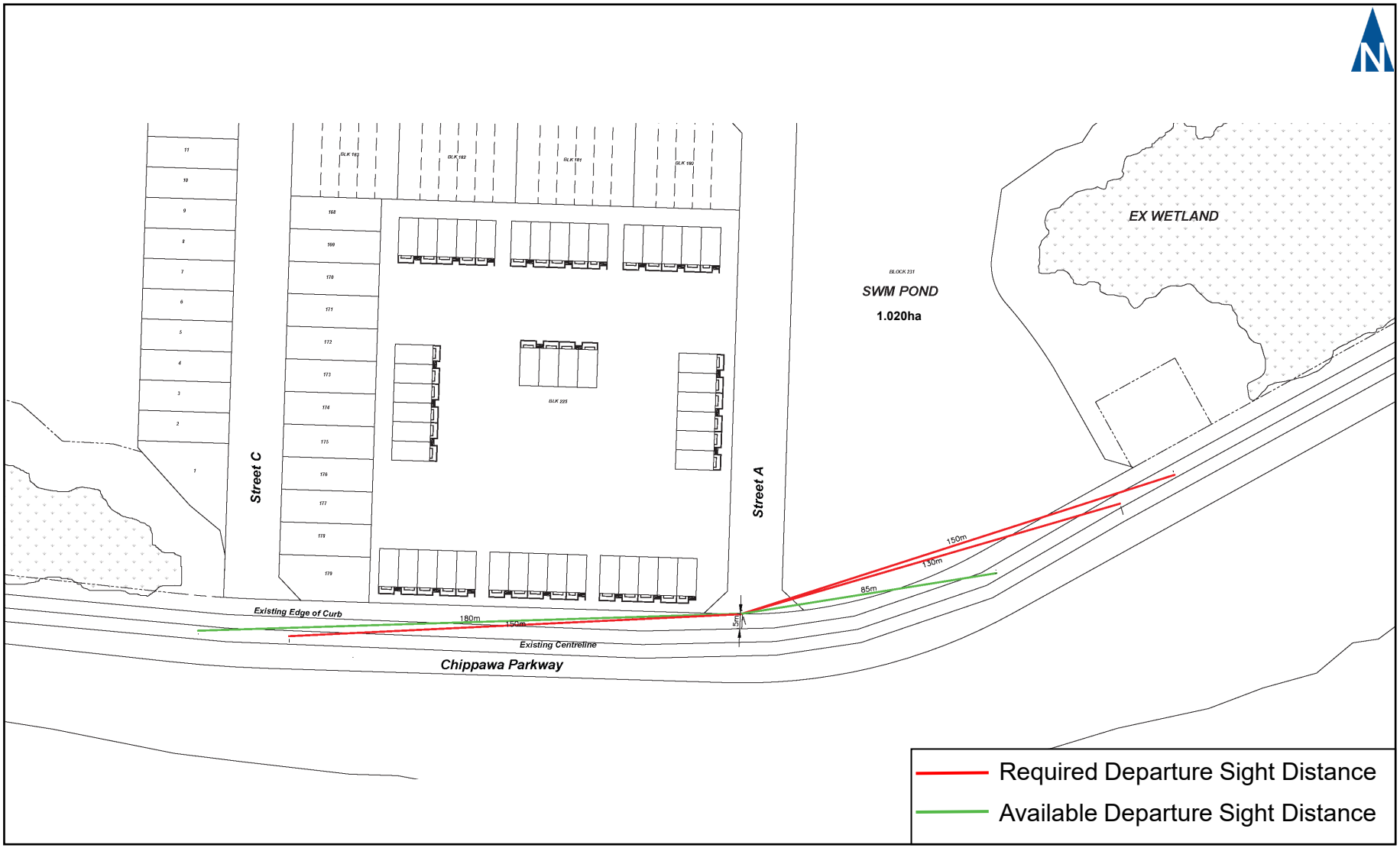
Departure Movement	Available Sight Distance (m)		TAC Sight Distance Requirement (m)	Requirements Met?
	Direction	Distance		
Departing from Street A				
Left-Turn	Looking right (west)	180	150.0	Yes
	Looking left (east)	85	150.0	No
Right-Turn	Looking left (east)	85	130.0	No
Departing from Street C				
Left-Turn	Looking right (west)	310	150.0	Yes
	Looking left (east)	205	150.0	Yes
Right-Turn	Looking left (east)	205	130.0	Yes

The required sight distances are met and satisfied for both left-turn and right-turn movements departing Street C.

At Street A, the required sight distance to the east is limited by the adjacent horizontal curve and vegetation along Chippawa Parkway. However, this is not considered a critical issue based upon the following rationale and proposed mitigation measures:

- Rationale
  - The available sight distance of 85 metres is equivalent to a travel speed of 40 km/h for a left turn, and 45 km/h for a right turn, meaning if vehicles are operating at speeds of 40 km/h or less, vehicles could make a left turn or a right turn at Street A without being overtaken or impeding approaching traffic from Chippawa Parkway.

    Curve ahead warning signs with advisory speeds of 40 km/h are posted for the westbound traffic on Chippawa Parkway prior to the horizontal curve. Motorists are likely to exercise caution, and exhibit advised travel speeds as they travel through the horizontal curve. Therefore, the available sight distance of 85 metres would be considered sufficient for a travel speed of 40 km/h.
- Mitigation
  - The sight triangle from Street A to the east would need to be located within parts of the stormwater management pond to achieve 150 metres. It is feasible to achieve the 150 metres subject to the area illustrated in **Figure 6.3C** to be cleared of obstructions between 0.38 to 2.50 metres in height (trunks and thin clusters of branches excluded). All vegetation proposed within this area will need to be pruned and/or trimmed (by others, as required) to meet this restriction.



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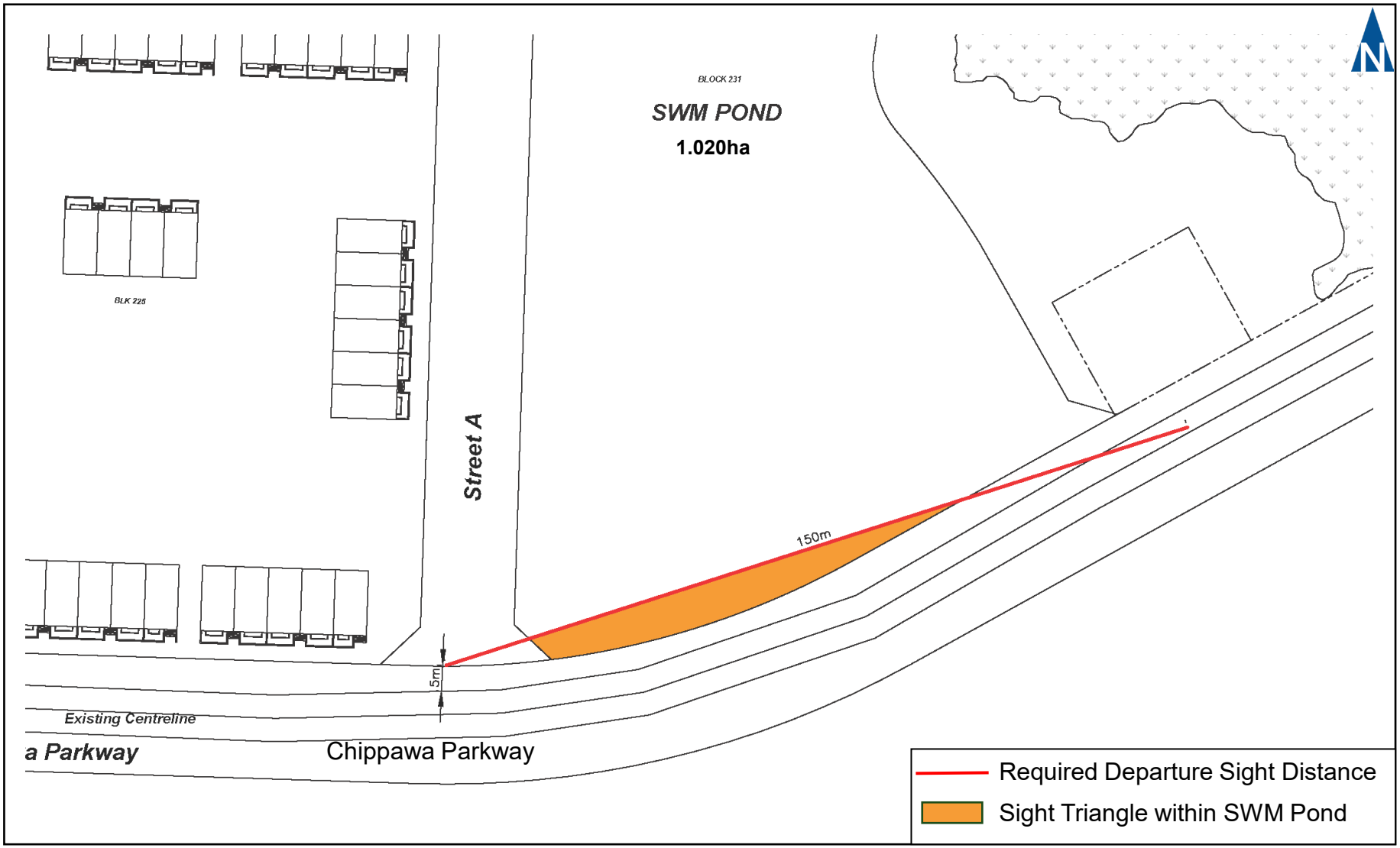
Departure Sight Distance Assessment (Street A)

Departure Sight Distance Assessment (Street C)



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Sight Triangle within SWM Pond

6.2.3 Approach Sight Distance

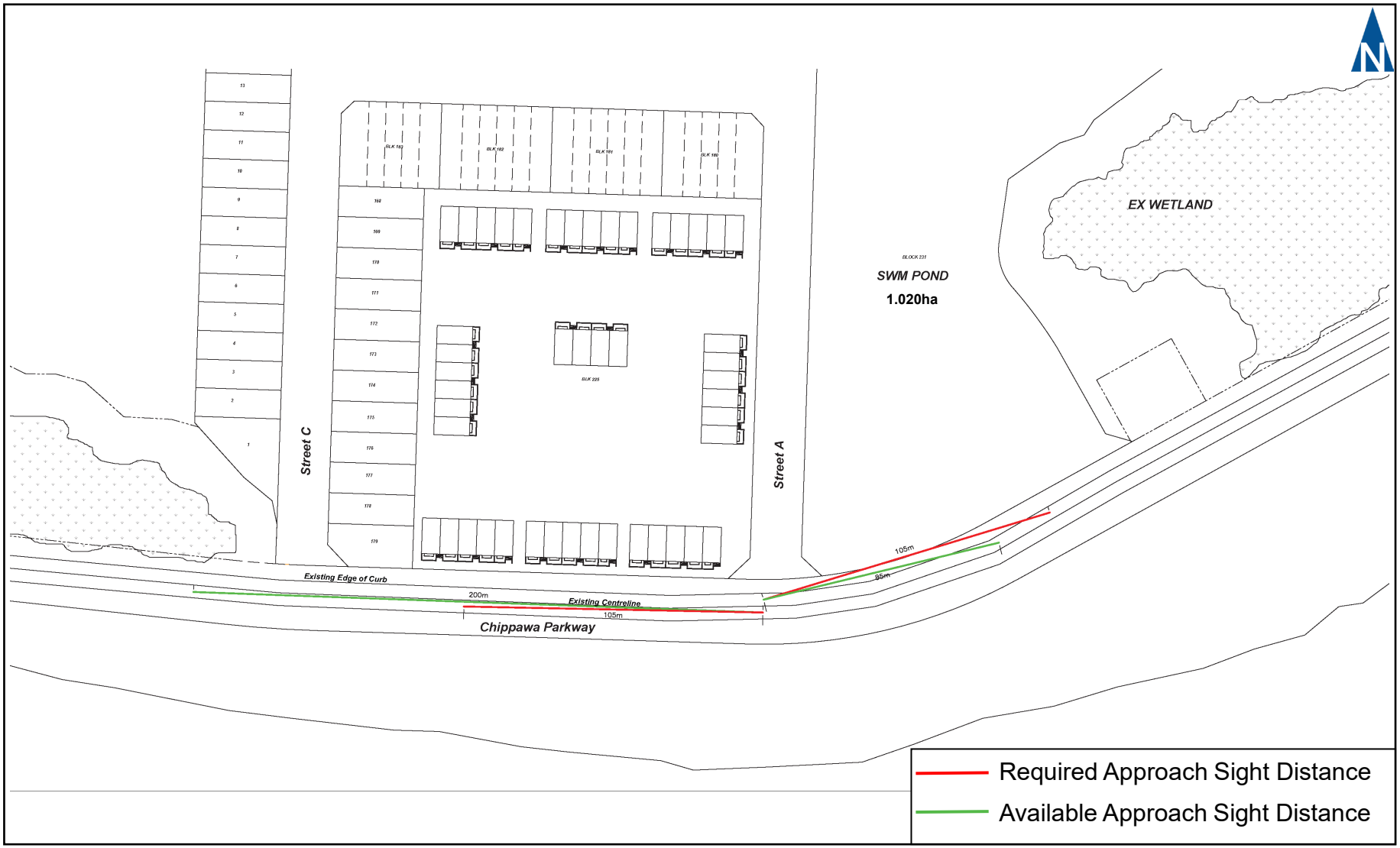
The minimum stopping sight distance for vehicles approaching the site accesses is the distance required for an approaching vehicle to stop safely and avoid a collision. Stopping sight distance is the sum of the distance travelled by a motorist during the perception and reaction time and the braking distance.

Table 6.4 summarizes the available and TAC recommended minimum approach sight distances along Chippawa Parkway for the Street A and Street C site accesses. **Figure 6.4** illustrates the available and recommended approach sight distances.

TABLE 6.1: APPROACH SIGHT DISTANCE ANALYSIS SUMMARY

Approach Direction	Available Sight Distance (m)	TAC Sight Distance Requirement (m)	Requirements Met?
Approaching Street A			
Eastbound	200	105.0	Yes
Westbound	85	105.0	No
Approaching Street C			
Eastbound	310	105.0	Yes
Westbound	190	105.0	Yes

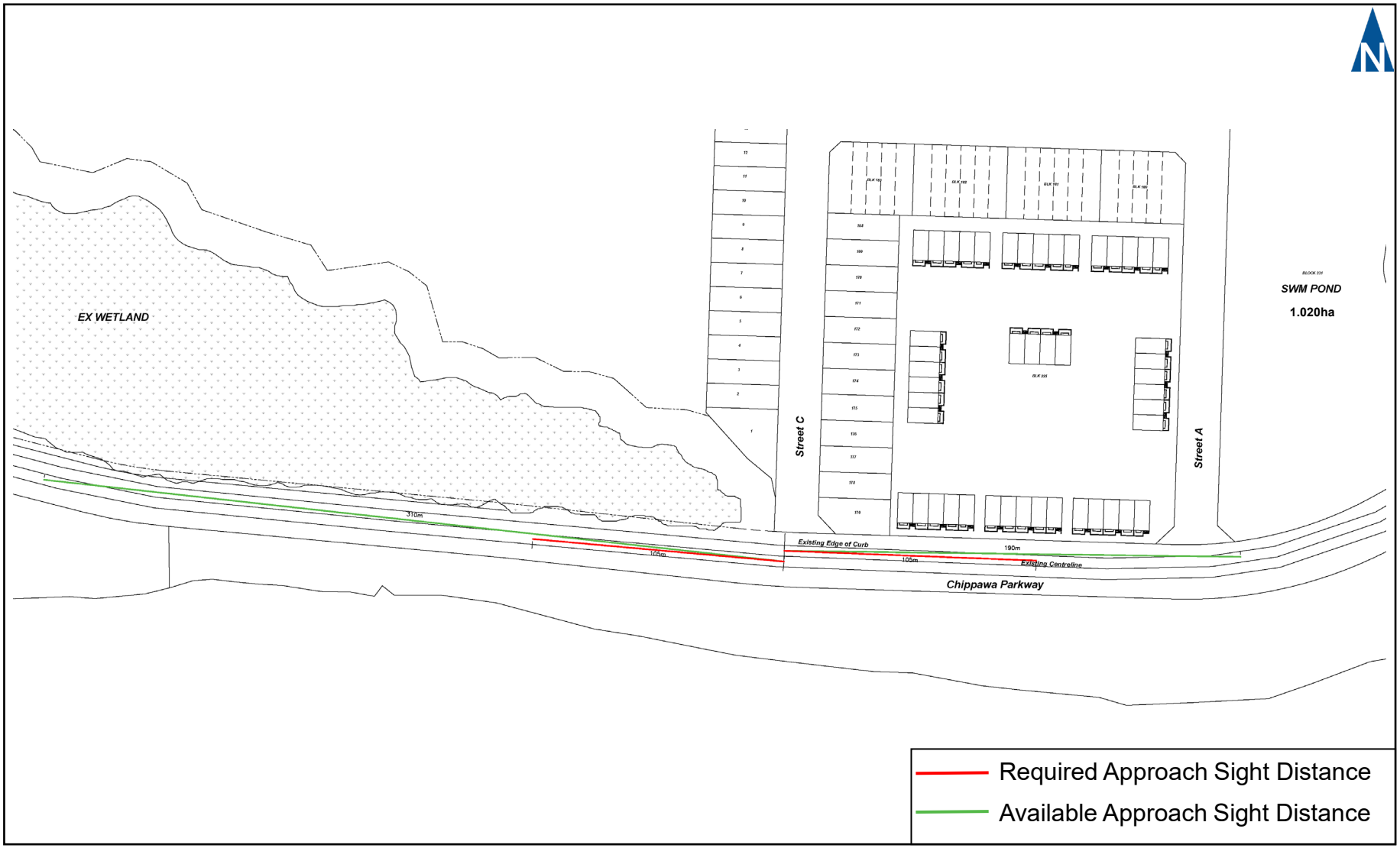
Approach sight distance requirements are generally met and satisfied for eastbound and westbound approaching vehicles to the site accesses on Chippawa Parkway. The exception is the westbound approaching vehicles for Street A. The adjacent horizontal curve and vegetation along Chippawa Parkway limit the available approach sight distance. However, this is not considered a critical issue based upon the rationale and mitigation provided in **Section 6.2.2**.



Approach Sight Distance Assessment (Street A)

Riverfront Residential, Traffic Impact Study, City of Niagara Falls
240167

Figure 6.2A



Approach Sight Distance Assessment (Street C)

6.3 Speed Limit Review

This section assesses the current posted speed limit (60 km/h) on Dorchester Road-Chippawa Parkway following the TAC Guidelines and provides recommendations if needed.

6.3.1 Overview

Speed limits aid motorists in selecting safe operating speeds for the prevailing conditions, which will vary as the roadway geometry, traffic demands, and road environment change. The selection of a posted speed limit must consider legislative regulations per the Highway Traffic Act (HTA), public recognition and understanding, ease of implementation, and adherence to recognized engineering standards and practices.

The TAC Canadian Guidelines for Establishing Posted Speed Limits (CGEPSL)[14] provides guidance to provide a consistent evaluation of posted limits. This process considers the risks associated with the physical design of the road, its setting, and the expected traffic conditions. It also provides an evaluation tool for selecting appropriate posted speed limits based primarily on a roadway's classification, function, and physical characteristics.

The evaluation method begins with identifying the ideal speed according to the surrounding land use (urban or rural), cross-section, median separation, and classification. For municipal roads, the ideal speed is based on the typical functions of these roads and public expectations under minimal risk conditions. A high degree of risk associated with the physical conditions of the road can warrant a lower posted speed limit. A systematic evaluation of the risks related to geometry and traffic criteria is then carried out considering the following characteristics:

- Horizontal geometry
- Vertical geometry
- Average lane width
- Roadside hazards
- Pedestrian exposure
- Cyclists' exposure
- Pavement surface
- Intersection density
- Access density
- Interchange density
- On-street parking

[14] Transportation Association of Canada. Canadian Guidelines for Establishing Posted Speed Limits, (Ottawa: TAC, 2009).

The TAC Guidelines outline the risk factors (low, medium, high) associated with each criterion considered within the methodology. For example, roadways with more frequent horizontal curves represent a higher risk of loss of control, which is accounted for in the methodology by a higher risk score. A similar risk assessment is conducted for the vertical geometry of the road, the lane widths of the roadways, the presence of roadway hazards, vulnerable user exposure, and the pavement condition.

The TAC Guidelines also account for risk scores associated with intersecting public roadways and private driveways where conflicts with other vehicles may occur. A larger number of intersections and/or driveways is correlated with an increased risk of conflict, increasing the total risk score associated with the segment under review.

Lastly, the TAC Guidelines account for the existence of on-street parking on the roadway segment under review. More frequent parked cars, or cars maneuvering to/from a parked position, require increased driver attention to avoid a collision. Higher risk scores are associated with roadways in which there is higher roadside parking activity.

It should also be noted that the TAC methodology is limited in its application as it does not account for collision history, available sight distances, truck speed limits, or time of day speed limits. As such, a suggested speed limit obtained using the TAC methodology should be considered as a suggestion. Additional reviews of operating speeds, sight distances and collision history should be undertaken by the City.

6.3.2 Chippawa Parkway

The segment of Chippawa Parkway between Stanley Avenue and the CN Railroad Crossing was assessed to determine if the current road conditions warrant a speed reduction from the posted speed limit of 60 km/h. **Appendix I** contains the guidelines spreadsheet used to determine the recommended posted speed, derived from the magnitude of risks associated with the present physical road characteristics.

Based on the analysis, Chippawa Parkway exhibits a total risk score of 60, and suggests the speed limit should be reduced by 10 km/h to 50 km/h. The lower recommended speed limit is primarily due to the road serving minor arterial functions as opposed to major arterial road functions along with the setting of the roadway (i.e. rural and settlement areas).

6.3.3 Dorchester Road

The segment of Dorchester Road between Oldfield Road and the CN Railroad Crossing was also assessed. **Appendix I** contains the guidelines spreadsheet used to determine the recommended posted speed.

The results indicate that Dorchester Road exhibits a total risk score of 60 which suggests a speed limit of 50 km/h. This is consistent with the recommended speed limit on Chippawa Parkway between Stanley Avenue and the CN Railroad Crossing. Additionally, Dorchester Road north of Oldfield Road is currently posted at 50 km/h. Reducing the speed limit on Dorchester Road south of Oldfield Road to 50km/h will maintain a consistent speed limit along Dorchester Road-Chippawa Parkway and require less of an adjustment in operating speed along the roadway.

7 Conclusions and Recommendations

7.1 Conclusions

Based on the investigations carried out, it is concluded that:

- **Base Year (2024) Conditions**: The intersection of Dorchester Road/Oldfield Road is operating at acceptable service levels and well within capacity during the weekday AM and PM peak hours. Similarly, the link volumes on Chippawa Parkway along the frontage of the subject lands are well within typical planning level capacities for arterial roads of this type;
- **Future Background Traffic Conditions** (without the proposed Riverfront Residential): The intersection operation of Dorchester Road/Oldfield Road is reported to be slightly worse than base year conditions. All traffic movements are forecast to continue operating at acceptable service levels and within capacity up to the 2034 horizon.

  The exceptions include the eastbound left-turn and southbound right-turn movements at Dorchester Road/Oldfield Road during the AM and/or PM peak hours under the 2029 and 2034 horizons. However, both movements are noted to operate within capacity.

  The link volumes on Chippawa Parkway would remain well within capacity;
- **Site-Generated Traffic:** With full development and occupancy of the Riverfront Residential, it is forecast to generate 295 and 380 automobile trips during the weekday AM and PM peak hours, respectively;
- **Future Total Traffic Conditions** (with the proposed Riverfront Residential): The operations at the study area intersections are slightly worse with the addition of the site-generated traffic compared to future background traffic conditions. All intersections and traffic movements are forecast to continue operating at acceptable service levels and within capacity up to the 2034 horizon.

  The exceptions include the previously identified critical movements under future background conditions, and no additional critical movements have been identified. It is noted the eastbound left-turn movement at Dorchester Road/Oldfield Road is forecast to operate exceeding capacity during the PM peak hour under the 2029 and 2034 horizons;

- **Remedial Measures:** Even though a traffic control signal is not warranted at Dorchester Road/Oldfield Road from a volume perspective, the 2034 total traffic operational analysis indicates that a traffic control signal would resolve the identified critical movements at the intersection;
- **Auxiliary Turn Lanes**: An eastbound left-turn lane with 15 metres of storage is warranted along Chippawa Parkway at Street C and Street A. The turn lane should be designed following the TAC Guide.

  A westbound right-turn lane is not warranted on Chippawa Parkway from both traffic operation and traffic volume perspectives;
- **Sight Distance Review**: Street C is confirmed to meet and exceed the TAC Guide sight distance requirements (departure and approach) for a 70 km/h design speed. At the same time, Street A is identified with a sight distance deficiency due to the horizontal curve and existing vegetation on Chippawa Parkway. However, this is not considered a critical issue given the anticipated lower travel speed along Chippawa Parkway, and meeting the sight distance guideline is feasible through height restrictions incorporated within the landscape plan for the stormwater management pond;
- **Speed Limit Review**: As per the TAC CGEPSL, Dorchester Road (south of Oldfield Road) and Chippawa Parkway (west of Stanley Avenue) have a total risk score of 60 and it is recommended that the current posted speed limit of 60 km/h be reduced to 50 km/h given the physical road conditions.

7.2 Recommendations

The recommendations of the study area are as follows:

- An eastbound left-turn lane with 15 metres of storage be implemented by the Applicant on Chippawa Parkway at the proposed site access intersections (Street A and Street C);
- The City of Niagara Falls and Niagara Region should monitor traffic growths and traffic patterns at Dorchester Road/Oldfield Road to determine whether the implementation of traffic control signal is required as necessary;
- To achieve sufficient sight distance east of Street A, it is recommended that the stormwater management pond's landscape plan implement height restrictions along the frontage to Chippawa Parkway;
- The posted speed limit on Dorchester Road and Chippawa Parkway be reduced from 60 km/h to 50 km/h once construction of the proposed residential subdivision is underway;
- Niagara Falls Transit service be extended to the Riverfront Residential area;

Appendix A

Pre-Study Consultation

From:	Adam Makarewicz
To:	Wenting Li
Subject:	FW: [EXTERNAL]-240167: Riverfront Residential Phase 2 - TIS - Scope of Work
Date:	April 10, 2024 12:20:56 PM
Attachments:	image001.png

Hi Wenting,

Just received comments back from the City.

Looks like we will need to include two horizons (Build-out, plus five years after build-out). I would assume Build-out is 2029 and fiver years after is 2034.

Can you obtain the 2023 ATR from the City along Chippawa. This will help provide the existing volumes adjacent to the two new intersections proposed?

Adam J. Makarewicz
Senior Project Manager, Associate

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5A-150 Pinebush Road, Cambridge ON, N1R 8J8
p: 905.381.2229 x303
e: amakarewicz@ptsl.com
w: www.ptsl.com

From: John Grubich <jgrubich@niagarafalls.ca>
Sent: Wednesday, April 10, 2024 11:55 AM
To: Adam Makarewicz <amakarewicz@ptsl.com>
Subject: RE: [EXTERNAL]-240167: Riverfront Residential Phase 2 - TIS - Scope of Work

Adam;

Thank you for submitting your work plan for the modification of the approved draft plan for Riverfront Phase 2. I have some comments below. Feel free to call/e-mail if you have any questions.

John Grubich, C.E.T. | Traffic Planning Supervisor | Municipal Works - Transportation Services | City of Niagara Falls
8208 Heartland Forest Road | Niagara Falls, ON L2H 0L7 | (905) 356-7521 ext 5214 | Fax 905-356-5576 | jgrubich@niagarafalls.ca

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From: Adam Makarewicz <amakarewicz@ptsl.com>
Sent: Tuesday, April 9, 2024 1:46 PM

To: John Grubich <jgrubich@niagarafalls.ca>
Subject: [EXTERNAL]-240167: Riverfront Residential Phase 2 - TIS - Scope of Work

Hi John,

We've been retained to complete an update to the traffic study completed in 2019 for "Riverfront Residential".

The Applicant is seeking modification to the Riverfront Draft Plan of Subdivision to facilitate the development of 556 dwelling units, a park, open space, a stormwater management pond, and a block for future development. An Official Plan and Zoning By-law Amendment are proposed to facilitate the proposed block/lot fabric. The two roads intersecting with Chippawa Parkway are at different locations than originally approved. We understand the City has requested an updated traffic impact study to assesses the latest unit count as well review the two intersections with Chippawa Parkway from a sight line perspective as the western road abuts the woodlot while the eastern road is at the end of a horizontal curve.

Would the following work plan be acceptable to the City to satisfy the traffic study requirements?

Be advised that the City has recently adopted Niagara Region's Traffic Impact study guidelines, dated July 2023 -> https://niagarafalls.ca/city-hall/transportation-services/traffic/traffic-impact-study-guidelines.aspx.

- Study Area **OK**
  - Oldfield Road at Dorchester Road (unsignalized); and
  - Two New Intersections to Chippawa Parkway (unsignalized).

- Existing Data **OK**
  - As Dorchester Road is currently closed due to road reconstruction, we have a May 2023 traffic count at Dorchester Road and Old Filed Road that we will utilize.

    The City has a September 2023 ATR data (24 hrs only) on Chippawa Parkway, between Dorchester Road and Stanley Avenue if you wish to purchase. The peak hour volumes are similar to the 2016 data you used in the 2019 report.

- Peak Hours **OK**
  - Weekday AM
  - Weekday PM

- Horizon Years **OK**
  - Existing Year (2024)
  - ~~10-Years from the date of the study (2034)~~
    - **Projected full buildout (20xx)**
    - **5 years after full buildout (20xx +5)**

- Analysis **OK**
    - Synchro 11.
    - HCM 2000

- Background Traffic
    - Generalized growth rate of 1% per annum. **OK**
    - Background Traffic from
        - Riverfront Commercial
        - Riverfront Industrial
            - **As the subject lands already have existing approvals, only use these future phases to assess if turn lanes are warranted on Chippawa Parkway, if the warrants are not met for Phases 1 & 2**
        - Riverfront Residential Phase 1 **(yes, assuming this is the condominium block to the east)**

- Site Traffic Estimates **OK**
    - ITE Trip Generation Data 11th Edition
    - No modal split reductions

- Site Traffic Distribution **OK**
    - Distribution as contained in the 2019 TIS (58% North-Dorchester, 42% East-Chippawa)

- **Assess turn lane requirements on Chippawa Parkway and intersection traffic control.**

- **Intersection locations and sight lines – as you noted above, please review the two intersections with Chippawa Parkway from a sight line perspective (stopping sight, intersection/departure sight) as the western road abuts the woodlot while the eastern road is at the end of a horizontal curve.**

Thanks,

Adam J. Makarewicz
Senior Project Manager, Associate

paradigm TRANSPORTATION SOLUTIONS LIMITED

Great Place To Work. Certified NOV 2023 - NOV 2024 CANADA

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

Traffic Data

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Dorchester Road & Oldfield Road
Site Code: 220542
Start Date: 05/04/2023

Turning Movement Data

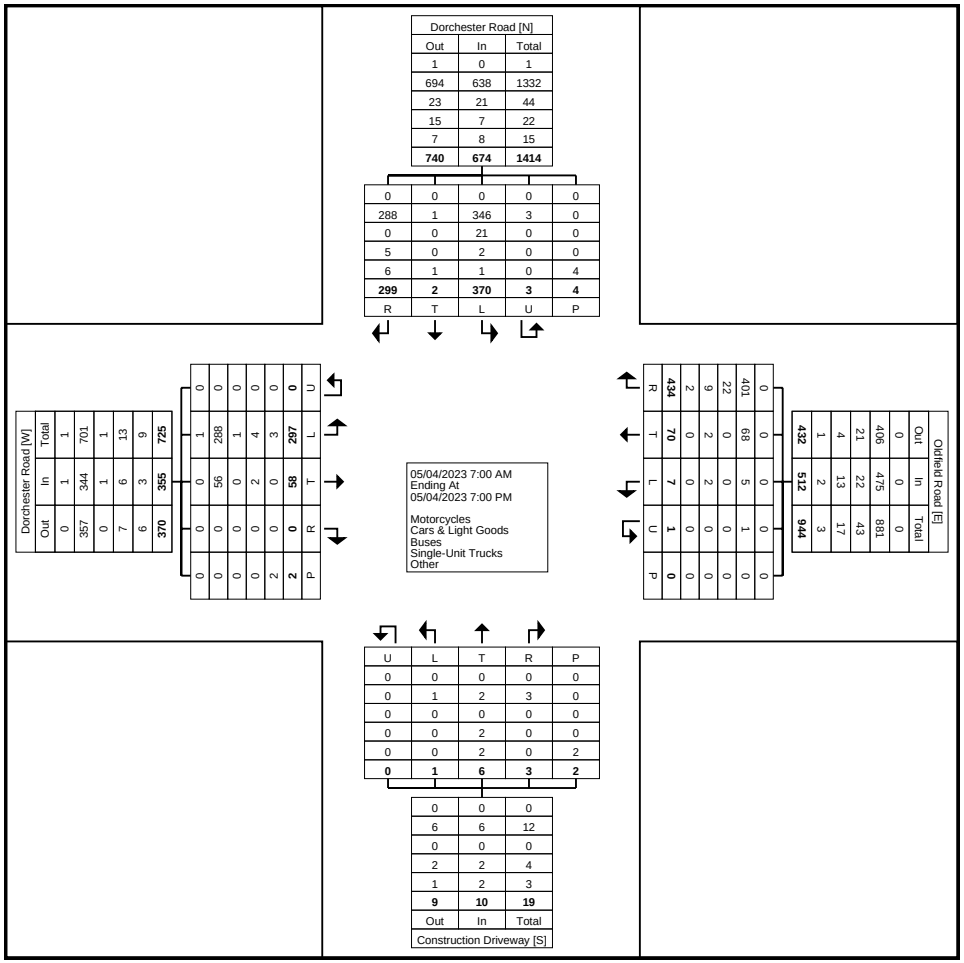
Start Time	Dorchester Road Eastbound						Oldfield Road Westbound						Construction Driveway Northbound						Dorchester Road Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
7:00 AM	1	0	0	0	0	1	0	2	10	0	0	12	0	0	0	0	0	0	5	0	5	0	1	10	23
7:15 AM	2	0	0	0	0	2	0	2	19	0	0	21	0	0	0	0	0	0	9	0	3	0	0	12	35
7:30 AM	7	0	0	0	0	7	1	0	21	0	0	22	0	0	0	0	0	0	7	0	11	0	0	18	47
7:45 AM	3	0	0	0	0	3	2	3	12	0	0	17	0	1	0	0	0	1	4	0	11	0	0	15	36
Hourly Total	13	0	0	0	0	13	3	7	62	0	0	72	0	1	0	0	0	1	25	0	30	0	1	55	141
8:00 AM	4	0	0	0	0	4	1	2	20	0	0	23	0	0	0	0	0	0	7	1	10	0	0	18	45
8:15 AM	5	1	0	0	0	6	0	3	11	0	0	14	0	1	0	0	0	1	5	0	4	0	0	9	30
8:30 AM	5	0	0	0	0	5	0	2	17	0	0	19	0	0	1	0	0	1	7	1	9	0	0	17	42
8:45 AM	1	1	0	0	0	2	0	0	20	0	0	20	0	0	0	0	0	0	8	0	7	0	0	15	37
Hourly Total	15	2	0	0	0	17	1	7	68	0	0	76	0	1	1	0	0	2	27	2	30	0	0	59	154
9:00 AM	4	3	0	0	0	7	1	0	11	0	0	12	0	0	0	0	0	0	11	0	6	0	2	17	36
9:15 AM	1	2	0	0	0	3	0	1	8	0	0	9	0	0	0	0	0	0	5	0	6	0	0	11	23
9:30 AM	1	0	0	0	0	1	0	1	14	0	0	15	0	2	1	0	0	3	12	0	8	0	0	20	39
9:45 AM	7	1	0	0	0	8	0	4	12	0	0	16	0	0	0	0	0	0	7	0	5	0	0	12	36
Hourly Total	13	6	0	0	0	19	1	6	45	0	0	52	0	2	1	0	0	3	35	0	25	0	2	60	134
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11:30 AM	6	1	0	0	1	7	0	3	9	0	0	12	0	0	0	0	1	0	5	0	13	0	0	18	37
11:45 AM	15	4	0	0	0	19	0	3	14	0	0	17	0	0	0	0	0	0	7	0	18	0	0	25	61
Hourly Total	21	5	0	0	1	26	0	6	23	0	0	29	0	0	0	0	1	0	12	0	31	0	0	43	98
12:00 PM	17	9	0	0	0	26	2	2	5	0	0	9	0	1	0	0	0	1	3	0	6	0	0	9	45
12:15 PM	9	3	0	0	0	12	0	6	10	1	0	17	1	1	1	0	0	3	6	0	7	0	0	13	45
12:30 PM	8	2	0	0	0	10	0	3	6	0	0	9	0	0	0	0	0	0	5	0	8	0	0	13	32
12:45 PM	4	0	0	0	0	4	0	2	9	0	0	11	0	0	0	0	0	0	11	0	14	0	0	25	40
Hourly Total	38	14	0	0	0	52	2	13	30	1	0	46	1	2	1	0	0	4	25	0	35	0	0	60	162
1:00 PM	9	2	0	0	0	11	0	2	5	0	0	7	0	0	0	0	0	0	13	0	6	0	0	19	37
1:15 PM	9	3	0	0	0	12	0	1	12	0	0	13	0	0	0	0	0	0	9	0	5	0	0	14	39
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	18	5	0	0	0	23	0	3	17	0	0	20	0	0	0	0	0	0	22	0	11	0	0	33	76
4:00 PM	19	5	0	0	0	24	0	3	20	0	0	23	0	0	0	0	0	0	20	0	15	1	0	36	83
4:15 PM	13	2	0	0	0	15	0	3	13	0	0	16	0	0	0	0	0	0	17	0	14	0	0	31	62
4:30 PM	19	1	0	0	0	20	0	3	19	0	0	22	0	0	0	0	0	0	18	0	13	1	0	32	74
4:45 PM	18	3	0	0	1	21	0	2	12	0	0	14	0	0	0	0	0	0	20	0	12	0	1	32	67
Hourly Total	69	11	0	0	1	80	0	11	64	0	0	75	0	0	0	0	0	0	75	0	54	2	1	131	286
5:00 PM	24	4	0	0	0	28	0	4	17	0	0	21	0	0	0	0	0	0	17	0	13	0	0	30	79
5:15 PM	6	1	0	0	0	7	0	3	21	0	0	24	0	0	0	0	0	0	12	0	9	0	0	21	52

5:30 PM	22	1	0	0	0	23	0	4	22	0	0	26	0	0	0	0	1	0	19	0	15	0	0	34	83
5:45 PM	19	2	0	0	0	21	0	4	9	0	0	13	0	0	0	0	0	0	22	0	17	0	0	39	73
Hourly Total	71	8	0	0	0	79	0	15	69	0	0	84	0	0	0	0	1	0	70	0	54	0	0	124	287
6:00 PM	16	2	0	0	0	18	0	1	17	0	0	18	0	0	0	0	0	0	18	0	7	0	0	25	61
6:15 PM	7	1	0	0	0	8	0	0	12	0	0	12	0	0	0	0	0	0	27	0	2	1	0	30	50
6:30 PM	4	2	0	0	0	6	0	0	16	0	0	16	0	0	0	0	0	0	22	0	10	0	0	32	54
6:45 PM	12	2	0	0	0	14	0	1	11	0	0	12	0	0	0	0	0	0	12	0	10	0	0	22	48
Hourly Total	39	7	0	0	0	46	0	2	56	0	0	58	0	0	0	0	0	0	79	0	29	1	0	109	213
Grand Total	297	58	0	0	2	355	7	70	434	1	0	512	1	6	3	0	2	10	370	2	299	3	4	674	1551
Approach %	83.7	16.3	0.0	0.0	-	-	1.4	13.7	84.8	0.2	-	-	10.0	60.0	30.0	0.0	-	-	54.9	0.3	44.4	0.4	-	-	-
Total %	19.1	3.7	0.0	0.0	-	22.9	0.5	4.5	28.0	0.1	-	33.0	0.1	0.4	0.2	0.0	-	0.6	23.9	0.1	19.3	0.2	-	43.5	-
Motorcycles	1	0	0	0	-	1	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	1
% Motorcycles	0.3	0.0	-	-	-	0.3	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	0.0	-	0.0	0.1
Cars & Light Goods	288	56	0	0	-	344	5	68	401	1	-	475	1	2	3	0	-	6	346	1	288	3	-	638	1463
% Cars & Light Goods	97.0	96.6	-	-	-	96.9	71.4	97.1	92.4	100.0	-	92.8	100.0	33.3	100.0	-	-	60.0	93.5	50.0	96.3	100.0	-	94.7	94.3
Buses	1	0	0	0	-	1	0	0	22	0	-	22	0	0	0	0	-	0	21	0	0	0	-	21	44
% Buses	0.3	0.0	-	-	-	0.3	0.0	0.0	5.1	0.0	-	4.3	0.0	0.0	0.0	-	-	0.0	5.7	0.0	0.0	0.0	-	3.1	2.8
Single-Unit Trucks	4	2	0	0	-	6	2	2	9	0	-	13	0	2	0	0	-	2	2	0	5	0	-	7	28
% Single-Unit Trucks	1.3	3.4	-	-	-	1.7	28.6	2.9	2.1	0.0	-	2.5	0.0	33.3	0.0	-	-	20.0	0.5	0.0	1.7	0.0	-	1.0	1.8
Articulated Trucks	2	0	0	0	-	2	0	0	0	0	-	0	0	2	0	0	-	2	1	1	3	0	-	5	9
% Articulated Trucks	0.7	0.0	-	-	-	0.6	0.0	0.0	0.0	0.0	-	0.0	0.0	33.3	0.0	-	-	20.0	0.3	50.0	1.0	0.0	-	0.7	0.6
Bicycles on Road	1	0	0	0	-	1	0	0	2	0	-	2	0	0	0	0	-	0	0	0	3	0	-	3	6
% Bicycles on Road	0.3	0.0	-	-	-	0.3	0.0	0.0	0.5	0.0	-	0.4	0.0	0.0	0.0	-	-	0.0	0.0	0.0	1.0	0.0	-	0.4	0.4
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	2	-	-	-	-	-	0	-	-	-	-	-	2	-	-	-	-	-	4	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Dorchester Road & Oldfield Road
Site Code: 220542
Start Date: 05/04/2023



Turning Movement Data Plot

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Dorchester Road & Oldfield Road
Site Code: 220542
Start Date: 05/04/2023

Turning Movement Peak Hour Data (7:15 AM)

Start Time	Dorchester Road Eastbound						Oldfield Road Westbound						Construction Driveway Northbound						Dorchester Road Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
7:15 AM	2	0	0	0	0	2	0	2	19	0	0	21	0	0	0	0	0	0	9	0	3	0	0	12	35
7:30 AM	7	0	0	0	0	7	1	0	21	0	0	22	0	0	0	0	0	0	7	0	11	0	0	18	47
7:45 AM	3	0	0	0	0	3	2	3	12	0	0	17	0	1	0	0	0	1	4	0	11	0	0	15	36
8:00 AM	4	0	0	0	0	4	1	2	20	0	0	23	0	0	0	0	0	0	7	1	10	0	0	18	45
Total	16	0	0	0	0	16	4	7	72	0	0	83	0	1	0	0	0	1	27	1	35	0	0	63	163
Approach %	100.0	0.0	0.0	0.0	-	-	4.8	8.4	86.7	0.0	-	-	0.0	100.0	0.0	0.0	-	-	42.9	1.6	55.6	0.0	-	-	-
Total %	9.8	0.0	0.0	0.0	-	9.8	2.5	4.3	44.2	0.0	-	50.9	0.0	0.6	0.0	0.0	-	0.6	16.6	0.6	21.5	0.0	-	38.7	-
PHF	0.571	0.000	0.000	0.000	-	0.571	0.500	0.583	0.857	0.000	-	0.902	0.000	0.250	0.000	0.000	-	0.250	0.750	0.250	0.795	0.000	-	0.875	0.867
Motorcycles	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Motorcycles	0.0	-	-	-	-	0.0	0.0	0.0	0.0	-	-	0.0	-	0.0	-	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Cars & Light Goods	15	0	0	0	-	15	3	6	65	0	-	74	0	1	0	0	-	1	22	1	33	0	-	56	146
% Cars & Light Goods	93.8	-	-	-	-	93.8	75.0	85.7	90.3	-	-	89.2	-	100.0	-	-	-	100.0	81.5	100.0	94.3	-	-	88.9	89.6
Buses	1	0	0	0	-	1	0	0	7	0	-	7	0	0	0	0	-	0	4	0	0	0	-	4	12
% Buses	6.3	-	-	-	-	6.3	0.0	0.0	9.7	-	-	8.4	-	0.0	-	-	-	0.0	14.8	0.0	0.0	-	-	6.3	7.4
Single-Unit Trucks	0	0	0	0	-	0	1	1	0	0	-	2	0	0	0	0	-	0	1	0	0	0	-	1	3
% Single-Unit Trucks	0.0	-	-	-	-	0.0	25.0	14.3	0.0	-	-	2.4	-	0.0	-	-	-	0.0	3.7	0.0	0.0	-	-	1.6	1.8
Articulated Trucks	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	2	0	-	2	2
% Articulated Trucks	0.0	-	-	-	-	0.0	0.0	0.0	0.0	-	-	0.0	-	0.0	-	-	-	0.0	0.0	0.0	5.7	-	-	3.2	1.2
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	0.0	-	-	-	-	0.0	0.0	0.0	0.0	-	-	0.0	-	0.0	-	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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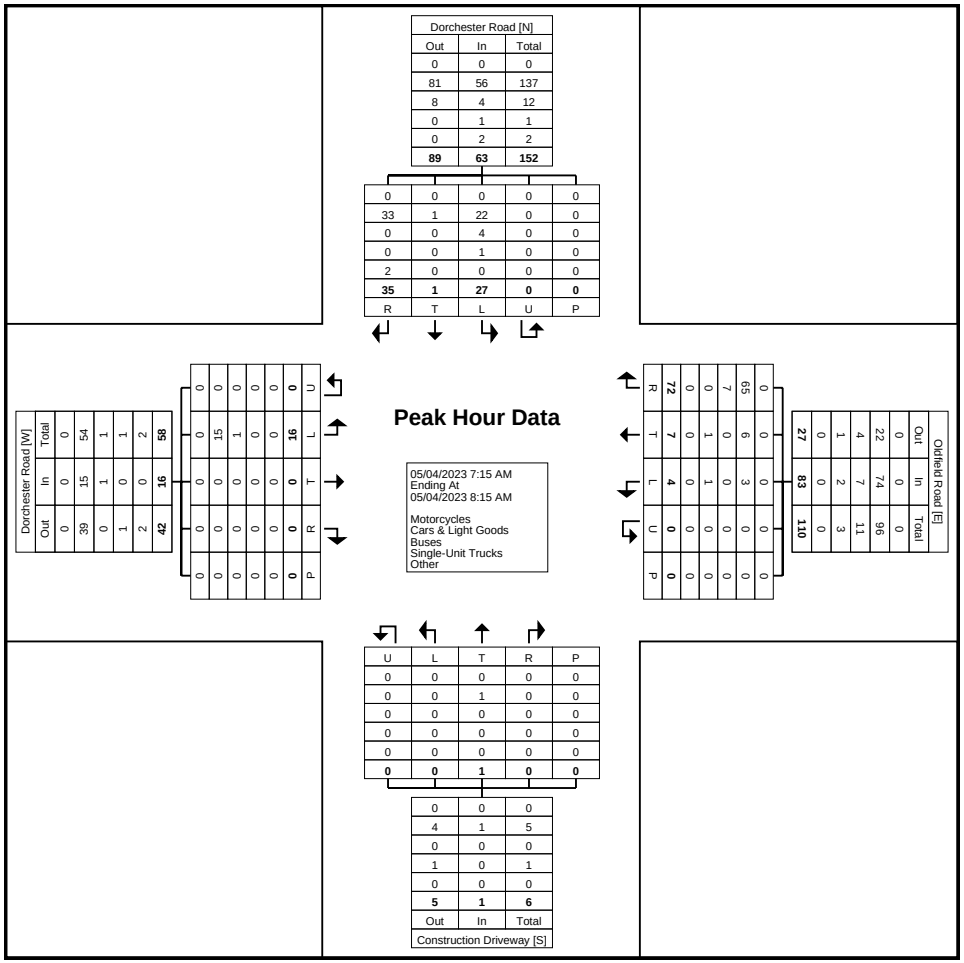
Start Date: 05/04/2023



Turning Movement Peak Hour Data Plot (7:15 AM)

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Dorchester Road & Oldfield Road
Site Code: 220542
Start Date: 05/04/2023

Turning Movement Peak Hour Data (11:30 AM)

Start Time	Dorchester Road Eastbound						Oldfield Road Westbound						Construction Driveway Northbound						Dorchester Road Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
11:30 AM	6	1	0	0	1	7	0	3	9	0	0	12	0	0	0	0	1	0	5	0	13	0	0	18	37
11:45 AM	15	4	0	0	0	19	0	3	14	0	0	17	0	0	0	0	0	0	7	0	18	0	0	25	61
12:00 PM	17	9	0	0	0	26	2	2	5	0	0	9	0	1	0	0	0	1	3	0	6	0	0	9	45
12:15 PM	9	3	0	0	0	12	0	6	10	1	0	17	1	1	1	0	0	3	6	0	7	0	0	13	45
Total	47	17	0	0	1	64	2	14	38	1	0	55	1	2	1	0	1	4	21	0	44	0	0	65	188
Approach %	73.4	26.6	0.0	0.0	-	-	3.6	25.5	69.1	1.8	-	-	25.0	50.0	25.0	0.0	-	-	32.3	0.0	67.7	0.0	-	-	-
Total %	25.0	9.0	0.0	0.0	-	34.0	1.1	7.4	20.2	0.5	-	29.3	0.5	1.1	0.5	0.0	-	2.1	11.2	0.0	23.4	0.0	-	34.6	-
PHF	0.691	0.472	0.000	0.000	-	0.615	0.250	0.583	0.679	0.250	-	0.809	0.250	0.500	0.250	0.000	-	0.333	0.750	0.000	0.611	0.000	-	0.650	0.770
Motorcycles	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Motorcycles	0.0	0.0	-	-	-	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	0.0
Cars & Light Goods	46	17	0	0	-	63	2	14	37	1	-	54	1	0	1	0	-	2	19	0	44	0	-	63	182
% Cars & Light Goods	97.9	100.0	-	-	-	98.4	100.0	100.0	97.4	100.0	-	98.2	100.0	0.0	100.0	-	-	50.0	90.5	-	100.0	-	-	96.9	96.8
Buses	0	0	0	0	-	0	0	0	1	0	-	1	0	0	0	0	-	0	1	0	0	0	-	1	2
% Buses	0.0	0.0	-	-	-	0.0	0.0	0.0	2.6	0.0	-	1.8	0.0	0.0	0.0	-	-	0.0	4.8	-	0.0	-	-	1.5	1.1
Single-Unit Trucks	1	0	0	0	-	1	0	0	0	0	-	0	0	1	0	0	-	1	0	0	0	0	-	0	2
% Single-Unit Trucks	2.1	0.0	-	-	-	1.6	0.0	0.0	0.0	0.0	-	0.0	0.0	50.0	0.0	-	-	25.0	0.0	-	0.0	-	-	0.0	1.1
Articulated Trucks	0	0	0	0	-	0	0	0	0	0	-	0	0	1	0	0	-	1	1	0	0	0	-	1	2
% Articulated Trucks	0.0	0.0	-	-	-	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	50.0	0.0	-	-	25.0	4.8	-	0.0	-	-	1.5	1.1
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	0.0	0.0	-	-	-	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	0.0
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-	-	-	-	-	-
Pedestrians	-	-	-	-	1	-	-	-	-	-	0	-	-	-	-	-	1	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-	-	-	-	-	-	-

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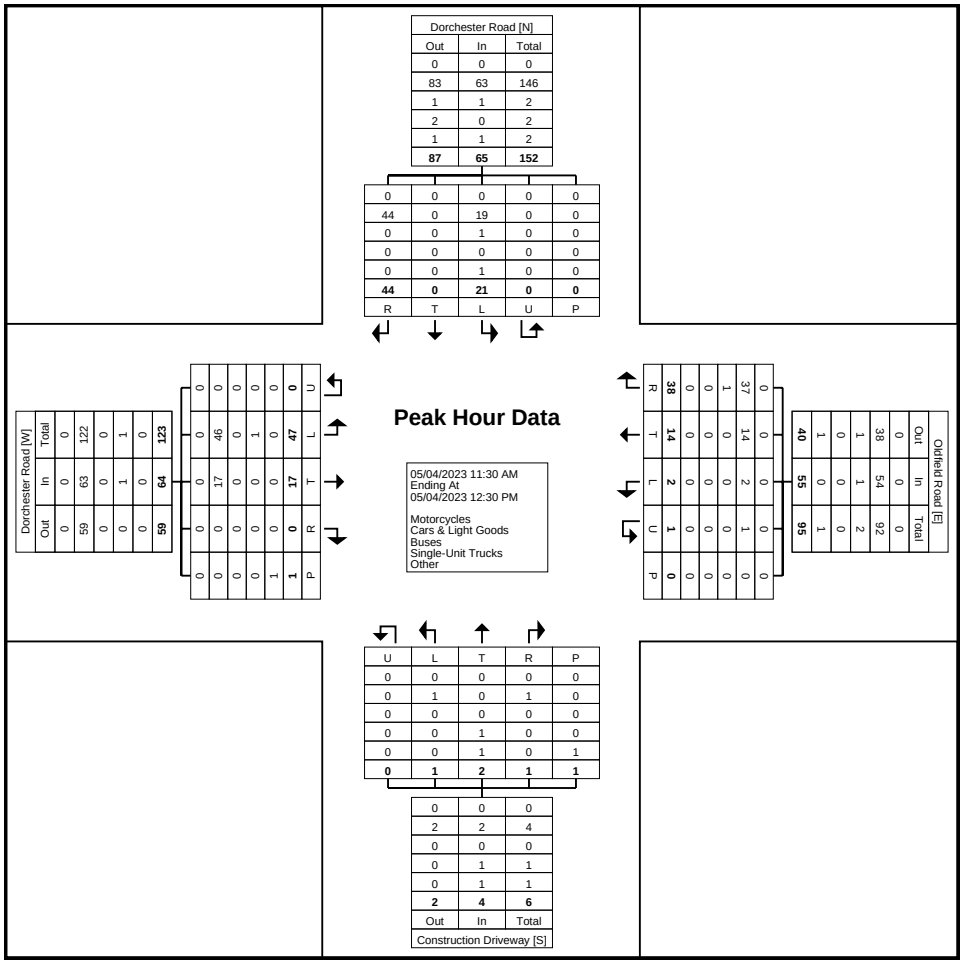
Start Date: 05/04/2023



Turning Movement Peak Hour Data Plot (11:30 AM)

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Dorchester Road & Oldfield Road
Site Code: 220542
Start Date: 05/04/2023

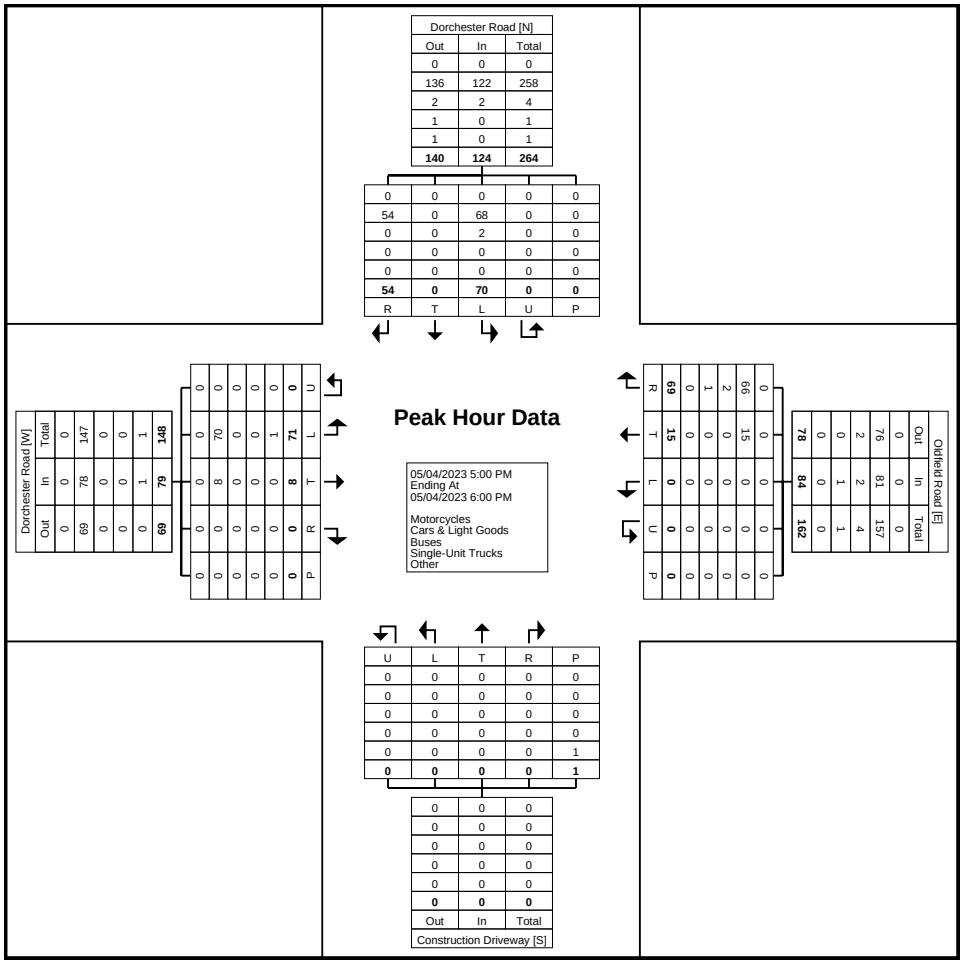
Turning Movement Peak Hour Data (5:00 PM)

Start Time	Dorchester Road Eastbound						Oldfield Road Westbound						Construction Driveway Northbound						Dorchester Road Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
5:00 PM	24	4	0	0	0	28	0	4	17	0	0	21	0	0	0	0	0	0	17	0	13	0	0	30	79
5:15 PM	6	1	0	0	0	7	0	3	21	0	0	24	0	0	0	0	0	0	12	0	9	0	0	21	52
5:30 PM	22	1	0	0	0	23	0	4	22	0	0	26	0	0	0	0	1	0	19	0	15	0	0	34	83
5:45 PM	19	2	0	0	0	21	0	4	9	0	0	13	0	0	0	0	0	0	22	0	17	0	0	39	73
Total	71	8	0	0	0	79	0	15	69	0	0	84	0	0	0	0	1	0	70	0	54	0	0	124	287
Approach %	89.9	10.1	0.0	0.0	-	-	0.0	17.9	82.1	0.0	-	-	0.0	0.0	0.0	0.0	-	-	56.5	0.0	43.5	0.0	-	-	-
Total %	24.7	2.8	0.0	0.0	-	27.5	0.0	5.2	24.0	0.0	-	29.3	0.0	0.0	0.0	0.0	-	0.0	24.4	0.0	18.8	0.0	-	43.2	-
PHF	0.740	0.500	0.000	0.000	-	0.705	0.000	0.938	0.784	0.000	-	0.808	0.000	0.000	0.000	0.000	-	0.000	0.795	0.000	0.794	0.000	-	0.795	0.864
Motorcycles	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Motorcycles	0.0	0.0	-	-	-	0.0	-	0.0	0.0	-	-	0.0	-	-	-	-	-	-	0.0	-	0.0	-	-	0.0	0.0
Cars & Light Goods	70	8	0	0	-	78	0	15	66	0	-	81	0	0	0	0	-	0	68	0	54	0	-	122	281
% Cars & Light Goods	98.6	100.0	-	-	-	98.7	-	100.0	95.7	-	-	96.4	-	-	-	-	-	-	97.1	-	100.0	-	-	98.4	97.9
Buses	0	0	0	0	-	0	0	0	2	0	-	2	0	0	0	0	-	0	2	0	0	0	-	2	4
% Buses	0.0	0.0	-	-	-	0.0	-	0.0	2.9	-	-	2.4	-	-	-	-	-	-	2.9	-	0.0	-	-	1.6	1.4
Single-Unit Trucks	0	0	0	0	-	0	0	0	1	0	-	1	0	0	0	0	-	0	0	0	0	0	-	0	1
% Single-Unit Trucks	0.0	0.0	-	-	-	0.0	-	0.0	1.4	-	-	1.2	-	-	-	-	-	-	0.0	-	0.0	-	-	0.0	0.3
Articulated Trucks	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Articulated Trucks	0.0	0.0	-	-	-	0.0	-	0.0	0.0	-	-	0.0	-	-	-	-	-	-	0.0	-	0.0	-	-	0.0	0.0
Bicycles on Road	1	0	0	0	-	1	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	1
% Bicycles on Road	1.4	0.0	-	-	-	1.3	-	0.0	0.0	-	-	0.0	-	-	-	-	-	-	0.0	-	0.0	-	-	0.0	0.3
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-	-	-	-	-	-
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	1	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Dorchester Road & Oldfield Road
Site Code: 220542
Start Date: 05/04/2023



Turning Movement Peak Hour Data Plot (5:00 PM)

Appendix C

Base Year (2024) Traffic Synchro Outputs

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	16	0	11	73	28	35
Future Volume (vph)	16	0	11	73	28	35
Ideal Flow (vphpl)	1178	1178	1338	1338	1433	1433
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.883		0.925	
Flt Protected		0.950			0.978	
Satd. Flow (prot)	0	1056	1069	0	1160	0
Flt Permitted		0.950			0.978	
Satd. Flow (perm)	0	1056	1069	0	1160	0
Link Speed (k/h)		50	50		50	
Link Distance (m)		271.0	295.7		242.0	
Travel Time (s)		19.5	21.3		17.4	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Heavy Vehicles (%)	6%	0%	14%	10%	19%	6%
Adj. Flow (vph)	18	0	13	84	32	40
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	18	97	0	72	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		0.0	0.0		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.80	1.80	1.55	1.55	1.42	1.42
Turning Speed (k/h)	25			15	25	15
Sign Control		Stop	Stop		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	19.7%	ICU Level of Service	A
Analysis Period (min)	15		

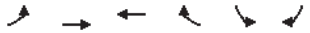
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Traffic Volume (vph)	16	0	11	73	28	35
Future Volume (vph)	16	0	11	73	28	35
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	18	0	13	84	32	40

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total (vph)	18	97	72
Volume Left (vph)	18	0	32
Volume Right (vph)	0	84	40
Hadj (s)	0.30	-0.34	-0.04
Departure Headway (s)	4.4	3.7	4.1
Degree Utilization, x	0.02	0.10	0.08
Capacity (veh/h)	788	941	848
Control Delay (s)	7.5	7.2	7.5
Approach Delay (s)	7.5	7.2	7.5
Approach LOS	A	A	A

Intersection Summary			
Delay	7.3		
Level of Service	A		
Intersection Capacity Utilization	19.7%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection: 1: Dorchester Road & Oldfield Road

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (m)	12.6	21.4	19.6
Average Queue (m)	4.0	10.2	9.1
95th Queue (m)	12.2	18.1	17.3
Link Distance (m)	266.1	285.4	233.4
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	72	8	15	70	71	55
Future Volume (vph)	72	8	15	70	71	55
Ideal Flow (vphpl)	1178	1178	1338	1338	1433	1433
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.888		0.941	
Flt Protected		0.957			0.973	
Satd. Flow (prot)	0	1127	1150	0	1290	0
Flt Permitted		0.957			0.973	
Satd. Flow (perm)	0	1127	1150	0	1290	0
Link Speed (k/h)		50	50		50	
Link Distance (m)		271.0	295.7		242.0	
Travel Time (s)		19.5	21.3		17.4	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	0%	0%	0%	4%	3%	0%
Adj. Flow (vph)	84	9	17	81	83	64
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	93	98	0	147	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		0.0	0.0		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.80	1.80	1.55	1.55	1.42	1.42
Turning Speed (k/h)	100			15	25	100
Sign Control		Stop	Stop		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	30.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Traffic Volume (vph)	72	8	15	70	71	55
Future Volume (vph)	72	8	15	70	71	55
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	84	9	17	81	83	64

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total (vph)	93	98	147
Volume Left (vph)	84	0	83
Volume Right (vph)	0	81	64
Hadj (s)	0.18	-0.44	-0.12
Departure Headway (s)	4.5	3.9	4.2
Degree Utilization, x	0.12	0.11	0.17
Capacity (veh/h)	769	884	818
Control Delay (s)	8.1	7.4	8.1
Approach Delay (s)	8.1	7.4	8.1
Approach LOS	A	A	A

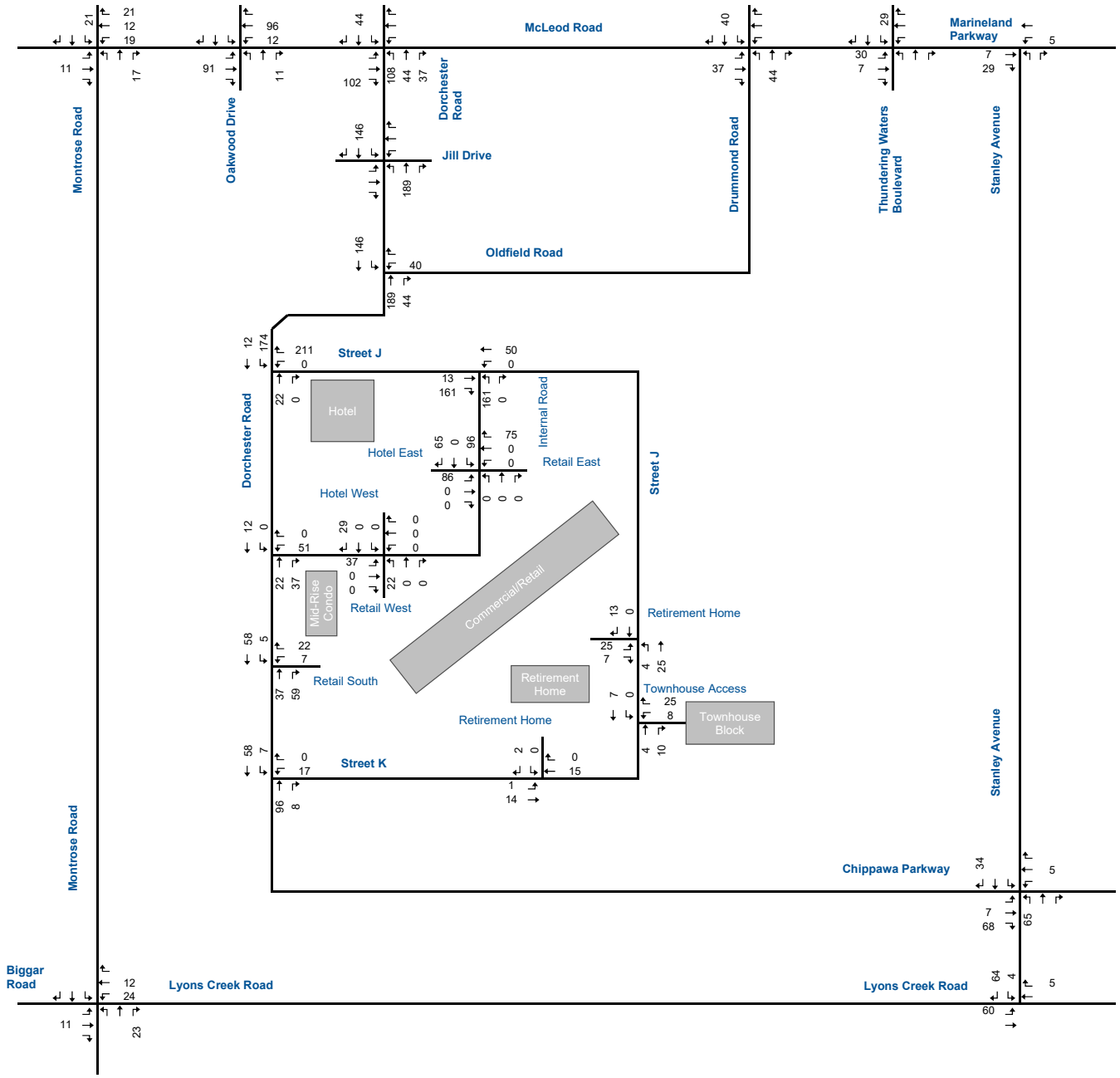
Intersection Summary				
Delay		7.9		
Level of Service		A		
Intersection Capacity Utilization		30.1%	ICU Level of Service	A
Analysis Period (min)		15		

Intersection: 1: Dorchester Road & Oldfield Road

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (m)	13.3	20.7	17.6
Average Queue (m)	8.6	9.6	9.8
95th Queue (m)	12.9	15.4	14.8
Link Distance (m)	266.1	285.4	233.4
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Appendix D

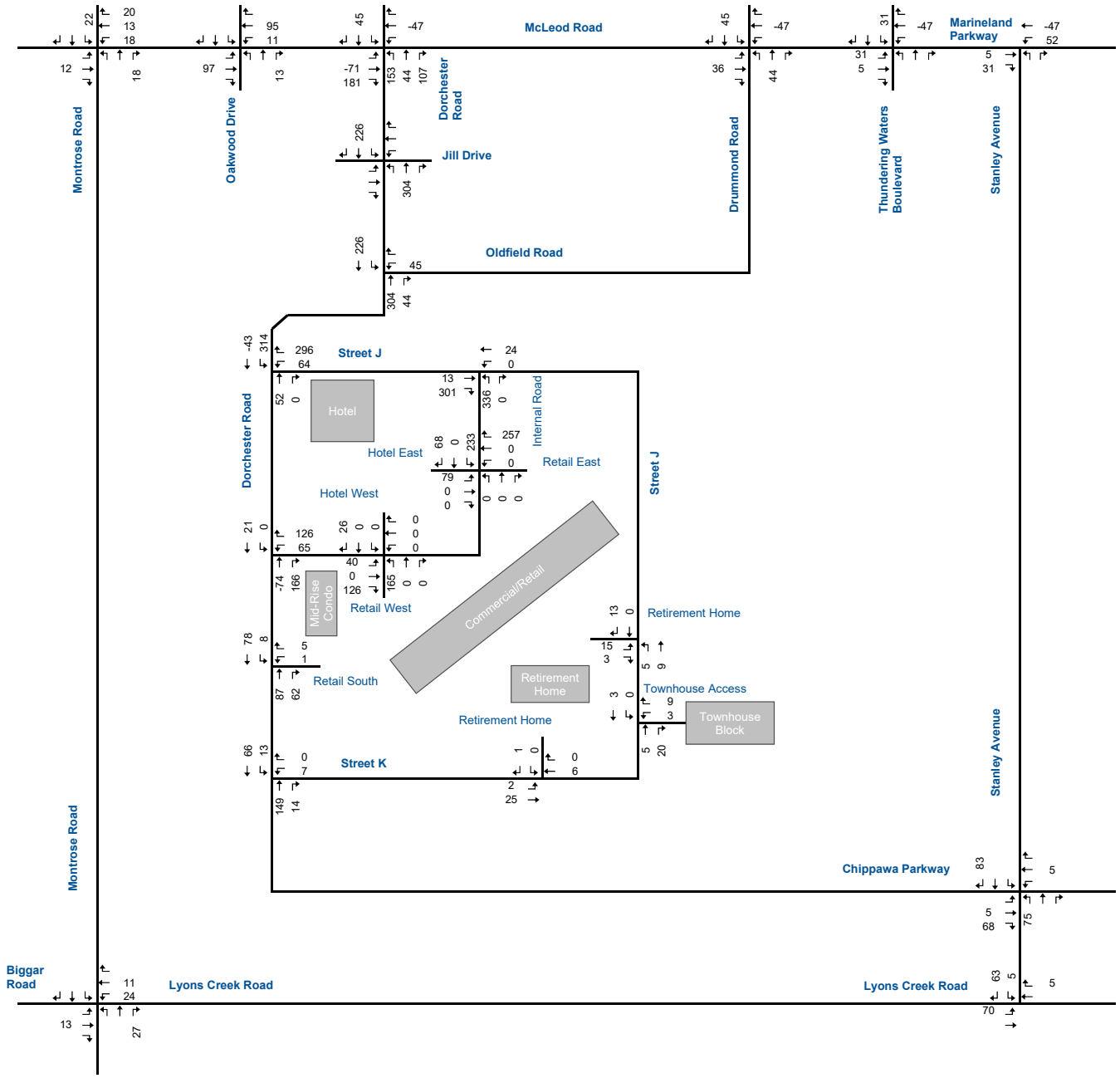
Other Area Developments Site Traffic



Site Generated Traffic Volumes
Weekday AM Peak Hour

Riverfront Community Phase 2, Niagara Falls
220542

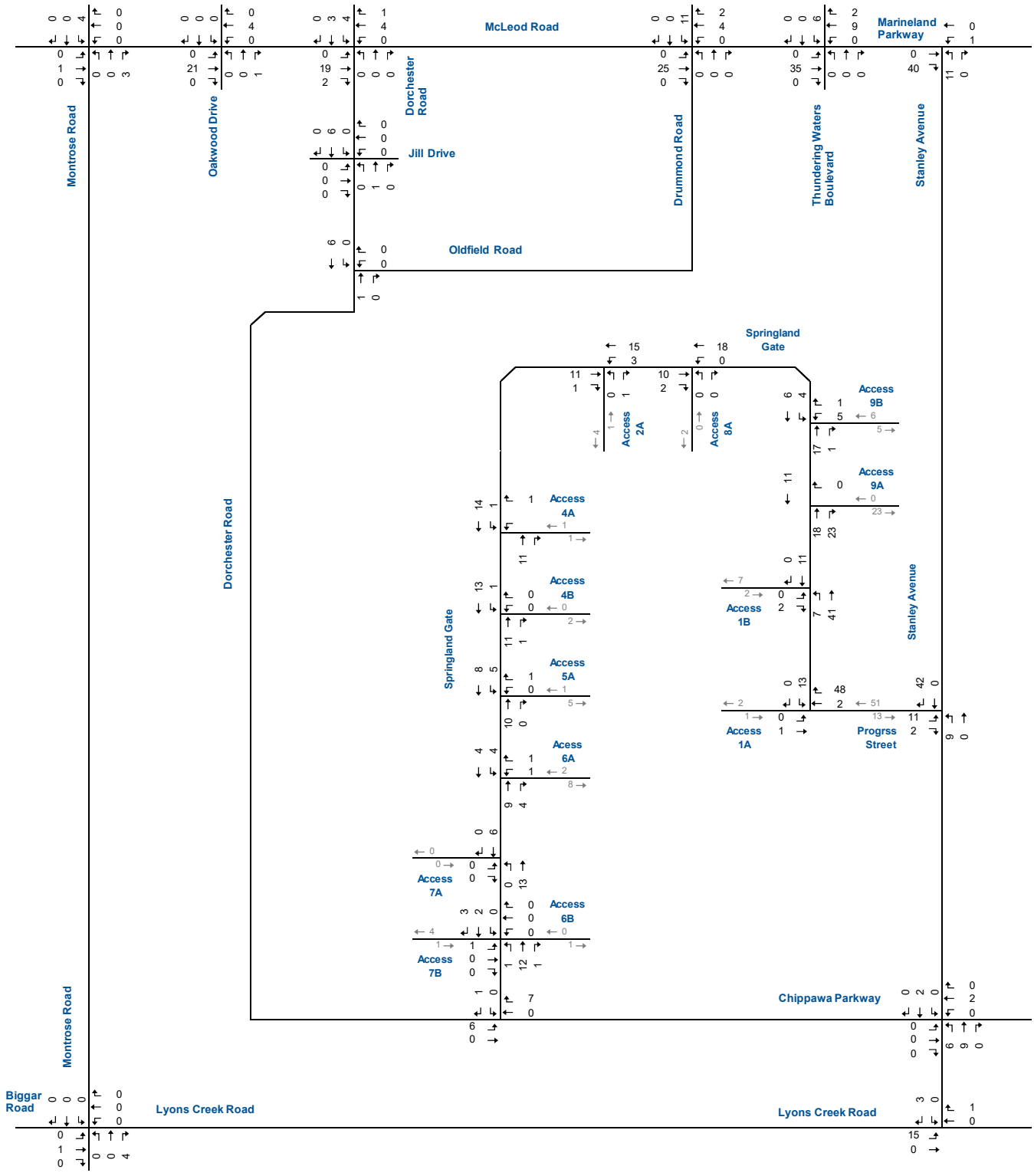
Figure 3.2A



Site Generated Traffic Volumes
Weekday PM Peak Hour

Riverfront Community Phase 2, Niagara Falls
220542

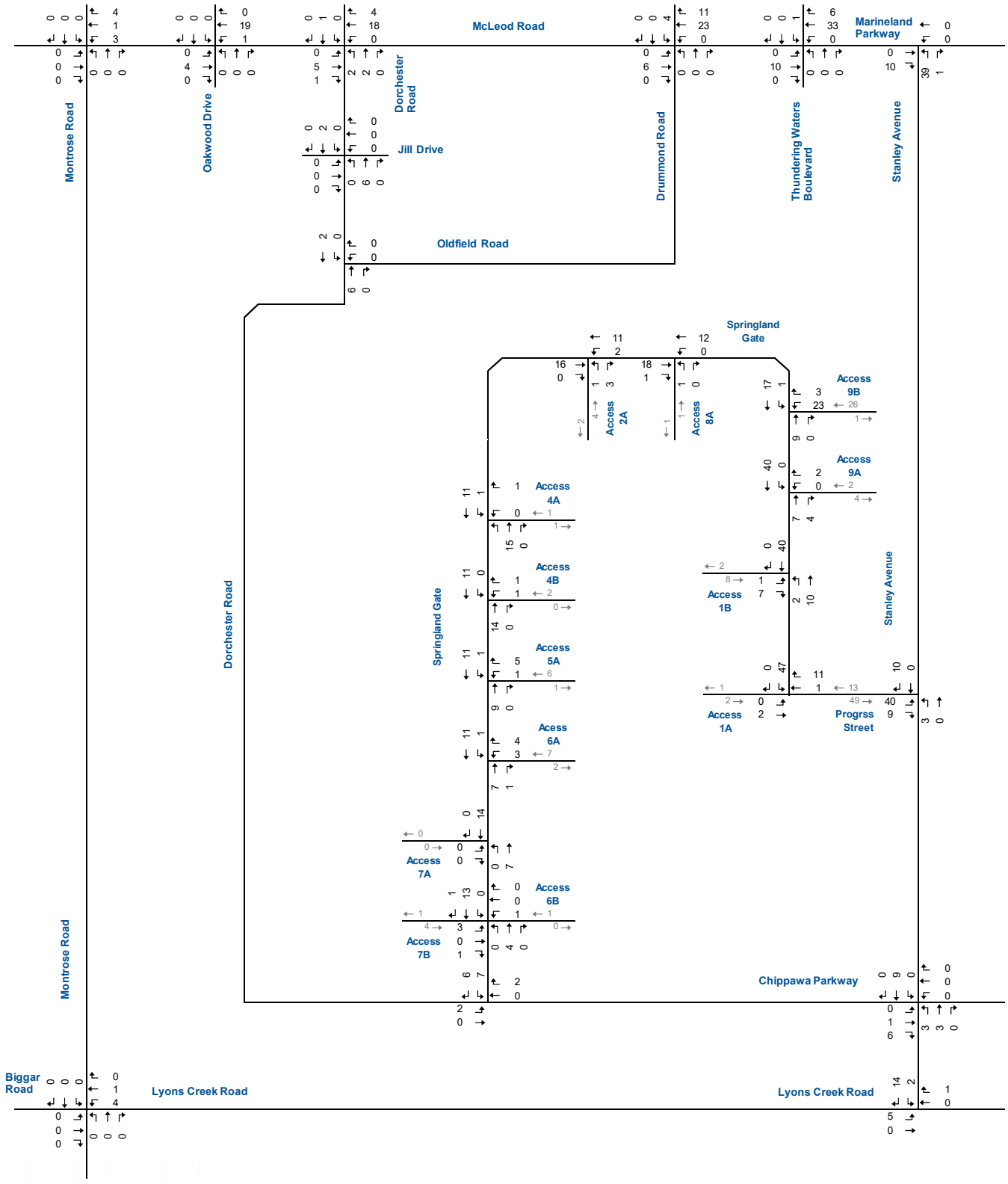
Figure 3.2B



Site Generated Traffic Volumes
Weekday AM Peak Hour

Riverfront Industrial Lands, Niagara Falls
220542

Figure 3.2A

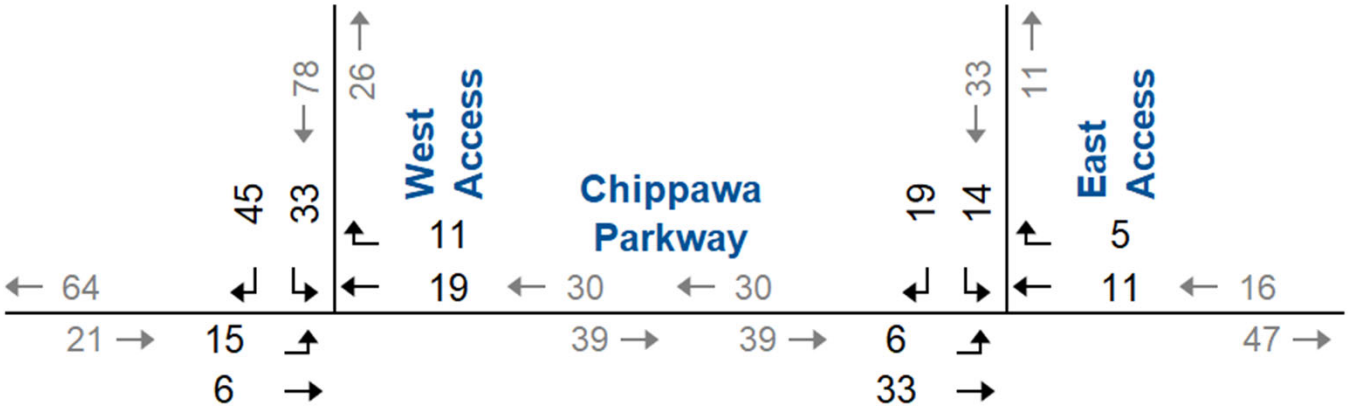


Site Generated Traffic Volumes
Weekday PM Peak Hour

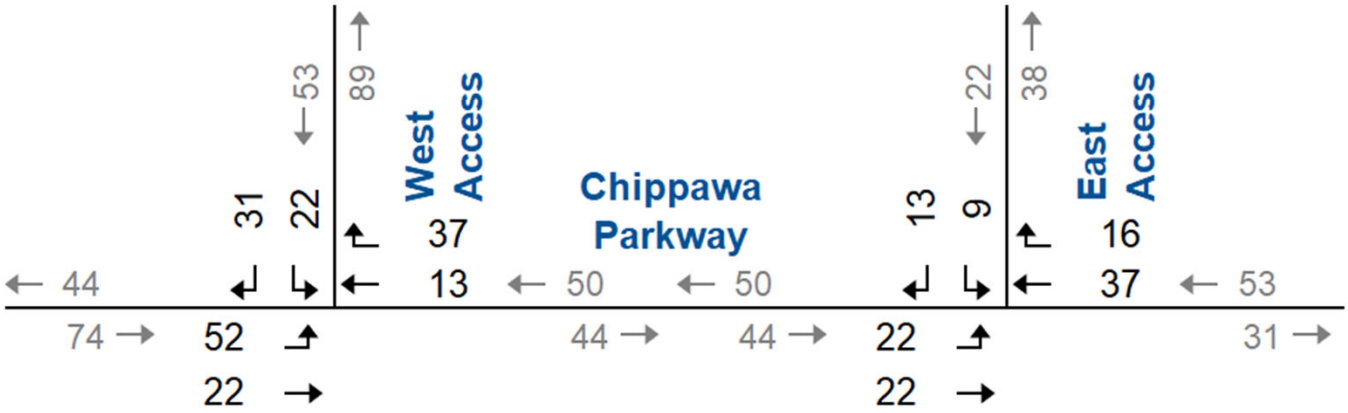
Riverfront Industrial Lands, Niagara Falls
220542

Figure 3.2B

AM PEAK HOUR



PM PEAK HOUR



Forecast Site Generated Traffic

Riverfront Residential Phase 1 (Block 12), Niagara Falls
240035

Figure 4

Appendix E

Future Background Traffic Synchro Outputs

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	271	44	57	77	29	205
Future Volume (vph)	271	44	57	77	29	205
Ideal Flow (vphpl)	1178	1178	1338	1338	1433	1433
Storage Length (m)	15.0			0.0	0.0	15.0
Storage Lanes	1			0	1	1
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.922			0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1056	1178	1104	0	1144	1149
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1056	1178	1104	0	1144	1149
Link Speed (k/h)		50	50		50	
Link Distance (m)		271.0	295.7		242.0	
Travel Time (s)		19.5	21.3		17.4	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Heavy Vehicles (%)	6%	0%	14%	10%	19%	6%
Adj. Flow (vph)	311	51	66	89	33	236
Shared Lane Traffic (%)						
Lane Group Flow (vph)	311	51	155	0	33	236
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.80	1.80	1.55	1.55	1.42	1.42
Turning Speed (k/h)	25			15	25	15
Sign Control		Stop	Stop		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	48.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Traffic Volume (vph)	271	44	57	77	29	205
Future Volume (vph)	271	44	57	77	29	205
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	311	51	66	89	33	236

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total (vph)	311	51	155	33	236
Volume Left (vph)	311	0	0	33	0
Volume Right (vph)	0	0	89	0	236
Hadj (s)	0.60	0.00	-0.15	0.82	-0.60
Departure Headway (s)	6.1	5.5	5.5	6.8	5.3
Degree Utilization, x	0.52	0.08	0.23	0.06	0.35
Capacity (veh/h)	575	632	625	503	636
Control Delay (s)	14.3	7.7	10.1	9.0	10.0
Approach Delay (s)	13.4		10.1	9.9	
Approach LOS	B		B	A	

Intersection Summary			
Delay	11.5		
Level of Service	B		
Intersection Capacity Utilization	48.5%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection: 1: Dorchester Road & Oldfield Road

Movement	EB	EB	WB	SB	SB
Directions Served	L	T	TR	L	R
Maximum Queue (m)	22.6	19.6	24.4	22.5	22.4
Average Queue (m)	15.0	8.4	12.6	7.1	11.9
95th Queue (m)	22.0	16.5	20.8	18.1	20.7
Link Distance (m)		262.9	285.4	231.7	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (m)	15.0				15.0
Storage Blk Time (%)	4	0		0	2
Queuing Penalty (veh)	2	0		1	0

Network Summary

Network wide Queuing Penalty: 3

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	426	56	77	74	75	344
Future Volume (vph)	426	56	77	74	75	344
Ideal Flow (vphpl)	1178	1178	1338	1338	1433	1433
Storage Length (m)	15.0			0.0	0.0	15.0
Storage Lanes	1			0	1	1
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.934			0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1119	1178	1226	0	1322	1218
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1119	1178	1226	0	1322	1218
Link Speed (k/h)		50	50		50	
Link Distance (m)		271.0	295.7		242.0	
Travel Time (s)		19.5	21.3		17.4	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	0%	0%	0%	4%	3%	0%
Adj. Flow (vph)	495	65	90	86	87	400
Shared Lane Traffic (%)						
Lane Group Flow (vph)	495	65	176	0	87	400
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.80	1.80	1.55	1.55	1.42	1.42
Turning Speed (k/h)	100			15	25	100
Sign Control		Stop	Stop		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 65.8%		ICU Level of Service C	
Analysis Period (min) 15			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Traffic Volume (vph)	426	56	77	74	75	344
Future Volume (vph)	426	56	77	74	75	344
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	495	65	90	86	87	400

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total (vph)	495	65	176	87	400
Volume Left (vph)	495	0	0	87	0
Volume Right (vph)	0	0	86	0	400
Hadj (s)	0.50	0.00	-0.26	0.55	-0.70
Departure Headway (s)	6.8	6.3	6.5	7.3	6.0
Degree Utilization, x	0.94	0.11	0.32	0.18	0.67
Capacity (veh/h)	495	549	534	481	574
Control Delay (s)	49.5	8.9	12.5	10.7	19.2
Approach Delay (s)	44.8		12.5	17.7	
Approach LOS	E		B	C	

Intersection Summary			
Delay	29.4		
Level of Service	D		
Intersection Capacity Utilization	65.8%	ICU Level of Service	C
Analysis Period (min)	15		

Intersection: 1: Dorchester Road & Oldfield Road

Movement	EB	EB	WB	SB	SB
Directions Served	L	T	TR	L	R
Maximum Queue (m)	21.8	31.2	26.9	28.8	22.0
Average Queue (m)	15.8	9.2	12.3	11.2	13.6
95th Queue (m)	22.1	20.5	20.3	22.0	21.7
Link Distance (m)		262.9	285.4	231.7	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (m)	15.0				15.0
Storage Blk Time (%)	9	0		1	4
Queuing Penalty (veh)	5	1		2	3

Network Summary

Network wide Queuing Penalty: 11

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	272	44	57	81	31	207
Future Volume (vph)	272	44	57	81	31	207
Ideal Flow (vphpl)	1178	1178	1338	1338	1433	1433
Storage Length (m)	15.0			0.0	0.0	15.0
Storage Lanes	1			0	1	1
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.921			0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1056	1178	1104	0	1144	1149
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1056	1178	1104	0	1144	1149
Link Speed (k/h)		50	50		50	
Link Distance (m)		271.0	295.7		242.0	
Travel Time (s)		19.5	21.3		17.4	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Heavy Vehicles (%)	6%	0%	14%	10%	19%	6%
Adj. Flow (vph)	313	51	66	93	36	238
Shared Lane Traffic (%)						
Lane Group Flow (vph)	313	51	159	0	36	238
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.80	1.80	1.55	1.55	1.42	1.42
Turning Speed (k/h)	25			15	25	15
Sign Control		Stop	Stop		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	48.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Traffic Volume (vph)	272	44	57	81	31	207
Future Volume (vph)	272	44	57	81	31	207
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	313	51	66	93	36	238

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total (vph)	313	51	159	36	238
Volume Left (vph)	313	0	0	36	0
Volume Right (vph)	0	0	93	0	238
Hadj (s)	0.60	0.00	-0.15	0.82	-0.60
Departure Headway (s)	6.1	5.5	5.5	6.8	5.4
Degree Utilization, x	0.53	0.08	0.24	0.07	0.35
Capacity (veh/h)	573	629	623	501	634
Control Delay (s)	14.5	7.7	10.2	9.1	10.1
Approach Delay (s)	13.6		10.2	9.9	
Approach LOS	B		B	A	

Intersection Summary				
Delay	11.6			
Level of Service	B			
Intersection Capacity Utilization	48.9%	ICU Level of Service		A
Analysis Period (min)	15			

Intersection: 1: Dorchester Road & Oldfield Road

Movement	EB	EB	WB	SB	SB
Directions Served	L	T	TR	L	R
Maximum Queue (m)	22.6	19.6	24.4	22.5	22.4
Average Queue (m)	14.9	8.4	12.7	7.2	11.9
95th Queue (m)	22.0	16.5	21.0	18.1	20.7
Link Distance (m)		262.9	285.4	231.7	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (m)	15.0				15.0
Storage Blk Time (%)	4	0		0	2
Queuing Penalty (veh)	2	0		1	0

Network Summary

Network wide Queuing Penalty: 3

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	430	57	78	77	78	347
Future Volume (vph)	430	57	78	77	78	347
Ideal Flow (vphpl)	1178	1178	1338	1338	1433	1433
Storage Length (m)	15.0			0.0	0.0	15.0
Storage Lanes	1			0	1	1
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.933			0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1119	1178	1224	0	1322	1218
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1119	1178	1224	0	1322	1218
Link Speed (k/h)		50	50		50	
Link Distance (m)		271.0	295.7		242.0	
Travel Time (s)		19.5	21.3		17.4	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	0%	0%	0%	4%	3%	0%
Adj. Flow (vph)	500	66	91	90	91	403
Shared Lane Traffic (%)						
Lane Group Flow (vph)	500	66	181	0	91	403
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.80	1.80	1.55	1.55	1.42	1.42
Turning Speed (k/h)	100			15	25	100
Sign Control		Stop	Stop		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 66.7%		ICU Level of Service C	
Analysis Period (min) 15			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Traffic Volume (vph)	430	57	78	77	78	347
Future Volume (vph)	430	57	78	77	78	347
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	500	66	91	90	91	403

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total (vph)	500	66	181	91	403
Volume Left (vph)	500	0	0	91	0
Volume Right (vph)	0	0	90	0	403
Hadj (s)	0.50	0.00	-0.26	0.55	-0.70
Departure Headway (s)	6.8	6.3	6.5	7.3	6.1
Degree Utilization, x	0.95	0.12	0.33	0.19	0.68
Capacity (veh/h)	517	548	533	480	574
Control Delay (s)	52.7	9.0	12.7	10.8	19.8
Approach Delay (s)	47.6		12.7	18.1	
Approach LOS	E		B	C	

Intersection Summary			
Delay	30.8		
Level of Service	D		
Intersection Capacity Utilization	66.7%	ICU Level of Service	C
Analysis Period (min)	15		

Intersection: 1: Dorchester Road & Oldfield Road

Movement	EB	EB	WB	SB	SB
Directions Served	L	T	TR	L	R
Maximum Queue (m)	21.8	31.2	26.8	28.2	22.0
Average Queue (m)	16.0	9.4	12.6	10.8	13.5
95th Queue (m)	22.2	20.6	20.7	21.6	21.7
Link Distance (m)		262.9	285.4	231.7	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (m)	15.0				15.0
Storage Blk Time (%)	9	0		1	4
Queuing Penalty (veh)	5	1		3	3

Network Summary

Network wide Queuing Penalty: 12

Appendix F

Future Total Traffic Synchro Outputs

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	401	44	67	77	29	236
Future Volume (vph)	401	44	67	77	29	236
Ideal Flow (vphpl)	1178	1178	1338	1338	1433	1433
Storage Length (m)	15.0			0.0	0.0	15.0
Storage Lanes	1			0	1	1
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.928			0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1056	1178	1110	0	1144	1149
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1056	1178	1110	0	1144	1149
Link Speed (k/h)		50	50		50	
Link Distance (m)		271.0	295.7		242.0	
Travel Time (s)		19.5	21.3		17.4	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Heavy Vehicles (%)	6%	0%	14%	10%	19%	6%
Adj. Flow (vph)	461	51	77	89	33	271
Shared Lane Traffic (%)						
Lane Group Flow (vph)	461	51	166	0	33	271
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.80	1.80	1.55	1.55	1.42	1.42
Turning Speed (k/h)	25			15	25	15
Sign Control		Stop	Stop		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	60.9%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Traffic Volume (vph)	401	44	67	77	29	236
Future Volume (vph)	401	44	67	77	29	236
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	461	51	77	89	33	271

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total (vph)	461	51	166	33	271
Volume Left (vph)	461	0	0	33	0
Volume Right (vph)	0	0	89	0	271
Hadj (s)	0.60	0.00	-0.12	0.82	-0.60
Departure Headway (s)	6.3	5.7	5.9	7.3	5.9
Degree Utilization, x	0.80	0.08	0.27	0.07	0.44
Capacity (veh/h)	564	611	572	465	578
Control Delay (s)	28.9	8.0	11.2	9.6	12.2
Approach Delay (s)	26.8		11.2	11.9	
Approach LOS	D		B	B	

Intersection Summary			
Delay	19.6		
Level of Service	C		
Intersection Capacity Utilization	60.9%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	16	140	268	12	38	52
Future Volume (vph)	16	140	268	12	38	52
Ideal Flow (vphpl)	1178	1178	1338	1338	1433	1433
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.994		0.921	
Flt Protected		0.995			0.980	
Satd. Flow (prot)	0	1149	1304	0	1268	0
Flt Permitted		0.995			0.980	
Satd. Flow (perm)	0	1149	1304	0	1268	0
Link Speed (k/h)		50	50		50	
Link Distance (m)		285.7	149.4		152.5	
Travel Time (s)		20.6	10.8		11.0	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	17	152	291	13	41	57
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	169	304	0	98	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		0.0	0.0		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.80	1.80	1.55	1.55	1.42	1.42
Turning Speed (k/h)	25			15	25	15
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	47.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	16	140	268	12	38	52
Future Volume (Veh/h)	16	140	268	12	38	52
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	17	152	291	13	41	57
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	304				484	298
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	304				484	298
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				92	92
cM capacity (veh/h)	1257				535	742

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	169	304	98
Volume Left	17	0	41
Volume Right	0	13	57
cSH	1257	1700	638
Volume to Capacity	0.01	0.18	0.15
Queue Length 95th (m)	0.3	0.0	4.3
Control Delay (s)	0.9	0.0	11.7
Lane LOS	A		B
Approach Delay (s)	0.9	0.0	11.7
Approach LOS			B

Intersection Summary				
Average Delay		2.3		
Intersection Capacity Utilization		47.1%	ICU Level of Service	A
Analysis Period (min)		15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	25	153	202	18	56	78
Future Volume (vph)	25	153	202	18	56	78
Ideal Flow (vphpl)	1178	1178	1338	1338	1433	1433
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.989		0.921	
Flt Protected		0.993			0.980	
Satd. Flow (prot)	0	1147	1297	0	1268	0
Flt Permitted		0.993			0.980	
Satd. Flow (perm)	0	1147	1297	0	1268	0
Link Speed (k/h)		50	50		50	
Link Distance (m)		149.4	87.8		78.1	
Travel Time (s)		10.8	6.3		5.6	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	166	220	20	61	85
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	193	240	0	146	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		0.0	0.0		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.80	1.80	1.55	1.55	1.42	1.42
Turning Speed (k/h)	25			15	25	15
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	52.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	25	153	202	18	56	78
Future Volume (Veh/h)	25	153	202	18	56	78
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	166	220	20	61	85
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	240				450	230
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	240				450	230
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				89	89
cM capacity (veh/h)	1327				555	809

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	193	240	146
Volume Left	27	0	61
Volume Right	0	20	85
cSH	1327	1700	679
Volume to Capacity	0.02	0.14	0.21
Queue Length 95th (m)	0.5	0.0	6.5
Control Delay (s)	1.2	0.0	11.7
Lane LOS	A		B
Approach Delay (s)	1.2	0.0	11.7
Approach LOS			B

Intersection Summary			
Average Delay	3.4		
Intersection Capacity Utilization	52.3%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection: 1: Dorchester Road & Oldfield Road

Movement	EB	EB	WB	SB	SB
Directions Served	L	T	TR	L	R
Maximum Queue (m)	23.4	41.1	31.3	21.6	21.6
Average Queue (m)	16.7	10.6	14.4	7.1	12.0
95th Queue (m)	23.7	25.5	24.4	18.3	20.6
Link Distance (m)		262.9	285.4	231.7	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (m)	15.0				15.0
Storage Blk Time (%)	9	0		1	2
Queuing Penalty (veh)	4	1		2	0

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	500	64	107	74	75	452
Future Volume (vph)	500	64	107	74	75	452
Ideal Flow (vphpl)	1178	1178	1338	1338	1433	1433
Storage Length (m)	15.0			0.0	0.0	15.0
Storage Lanes	1			0	1	1
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.945			0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1119	1178	1244	0	1322	1218
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1119	1178	1244	0	1322	1218
Link Speed (k/h)		50	50		50	
Link Distance (m)		271.0	295.7		242.0	
Travel Time (s)		19.5	21.3		17.4	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	0%	0%	0%	4%	3%	0%
Adj. Flow (vph)	581	74	124	86	87	526
Shared Lane Traffic (%)						
Lane Group Flow (vph)	581	74	210	0	87	526
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.80	1.80	1.55	1.55	1.42	1.42
Turning Speed (k/h)	100			15	25	100
Sign Control		Stop	Stop		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 74.6%		ICU Level of Service D	
Analysis Period (min) 15			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Traffic Volume (vph)	500	64	107	74	75	452
Future Volume (vph)	500	64	107	74	75	452
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	581	74	124	86	87	526

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total (vph)	581	74	210	87	526
Volume Left (vph)	581	0	0	87	0
Volume Right (vph)	0	0	86	0	526
Hadj (s)	0.50	0.00	-0.22	0.55	-0.70
Departure Headway (s)	7.4	6.9	7.0	7.5	6.2
Degree Utilization, x	1.19	0.14	0.41	0.18	0.91
Capacity (veh/h)	491	507	501	475	574
Control Delay (s)	128.5	9.8	14.7	10.9	42.1
Approach Delay (s)	115.1		14.7	37.7	
Approach LOS	F		B	E	

Intersection Summary			
Delay		68.7	
Level of Service		F	
Intersection Capacity Utilization		74.6%	ICU Level of Service D
Analysis Period (min)		15	

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	55	279	297	40	24	33
Future Volume (vph)	55	279	297	40	24	33
Ideal Flow (vphpl)	1178	1178	1338	1338	1433	1433
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.984		0.922	
Flt Protected		0.992			0.979	
Satd. Flow (prot)	0	1146	1291	0	1268	0
Flt Permitted		0.992			0.979	
Satd. Flow (perm)	0	1146	1291	0	1268	0
Link Speed (k/h)		50	50		50	
Link Distance (m)		285.7	149.4		152.5	
Travel Time (s)		20.6	10.8		11.0	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	60	303	323	43	26	36
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	363	366	0	62	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		0.0	0.0		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.80	1.80	1.55	1.55	1.42	1.42
Turning Speed (k/h)	100			100	100	100
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 68.7%			ICU Level of Service C
Analysis Period (min) 15			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	55	279	297	40	24	33
Future Volume (Veh/h)	55	279	297	40	24	33
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	60	303	323	43	26	36
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	366				768	344
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	366				768	344
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				93	95
cM capacity (veh/h)	1193				351	698

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	363	366	62
Volume Left	60	0	26
Volume Right	0	43	36
cSH	1193	1700	494
Volume to Capacity	0.05	0.22	0.13
Queue Length 95th (m)	1.3	0.0	3.4
Control Delay (s)	1.8	0.0	13.3
Lane LOS	A		B
Approach Delay (s)	1.8	0.0	13.3
Approach LOS			B

Intersection Summary				
Average Delay			1.9	
Intersection Capacity Utilization			68.7%	ICU Level of Service C
Analysis Period (min)			15	

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	83	220	288	60	36	49
Future Volume (vph)	83	220	288	60	36	49
Ideal Flow (vphpl)	1178	1178	1338	1338	1433	1433
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.977		0.922	
Flt Protected		0.987			0.979	
Satd. Flow (prot)	0	1140	1282	0	1268	0
Flt Permitted		0.987			0.979	
Satd. Flow (perm)	0	1140	1282	0	1268	0
Link Speed (k/h)		50	50		50	
Link Distance (m)		149.4	87.8		78.1	
Travel Time (s)		10.8	6.3		5.6	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	90	239	313	65	39	53
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	329	378	0	92	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		0.0	0.0		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.80	1.80	1.55	1.55	1.42	1.42
Turning Speed (k/h)	100			100	100	100
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 69.4%		ICU Level of Service C	
Analysis Period (min) 15			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	83	220	288	60	36	49
Future Volume (Veh/h)	83	220	288	60	36	49
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	90	239	313	65	39	53
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	378				764	346
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	378				764	346
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	92				89	92
cM capacity (veh/h)	1180				343	697

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	329	378	92
Volume Left	90	0	39
Volume Right	0	65	53
cSH	1180	1700	485
Volume to Capacity	0.08	0.22	0.19
Queue Length 95th (m)	2.0	0.0	5.5
Control Delay (s)	2.8	0.0	14.1
Lane LOS	A		B
Approach Delay (s)	2.8	0.0	14.1
Approach LOS			B

Intersection Summary			
Average Delay		2.8	
Intersection Capacity Utilization		69.4%	ICU Level of Service
Analysis Period (min)		15	

Intersection: 1: Dorchester Road & Oldfield Road

Movement	EB	EB	WB	SB	SB
Directions Served	L	T	TR	L	R
Maximum Queue (m)	22.3	45.9	23.5	45.4	22.5
Average Queue (m)	18.3	14.0	12.7	13.8	16.3
95th Queue (m)	23.5	35.1	19.6	30.5	24.2
Link Distance (m)		262.9	285.4	231.7	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (m)	15.0				15.0
Storage Blk Time (%)	19	0		1	11
Queuing Penalty (veh)	12	1		3	8

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	402	44	67	81	31	238
Future Volume (vph)	402	44	67	81	31	238
Ideal Flow (vphpl)	1178	1178	1338	1338	1433	1433
Storage Length (m)	15.0			0.0	0.0	15.0
Storage Lanes	1			0	1	1
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.926			0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1056	1178	1108	0	1144	1149
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1056	1178	1108	0	1144	1149
Link Speed (k/h)		50	50		50	
Link Distance (m)		271.0	295.7		242.0	
Travel Time (s)		19.5	21.3		17.4	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Heavy Vehicles (%)	6%	0%	14%	10%	19%	6%
Adj. Flow (vph)	462	51	77	93	36	274
Shared Lane Traffic (%)						
Lane Group Flow (vph)	462	51	170	0	36	274
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.80	1.80	1.55	1.55	1.42	1.42
Turning Speed (k/h)	25			15	25	15
Sign Control		Stop	Stop		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	61.3%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Traffic Volume (vph)	402	44	67	81	31	238
Future Volume (vph)	402	44	67	81	31	238
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	462	51	77	93	36	274

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total (vph)	462	51	170	36	274
Volume Left (vph)	462	0	0	36	0
Volume Right (vph)	0	0	93	0	274
Hadj (s)	0.60	0.00	-0.13	0.82	-0.60
Departure Headway (s)	6.3	5.7	6.0	7.3	5.9
Degree Utilization, x	0.81	0.08	0.28	0.07	0.45
Capacity (veh/h)	561	608	571	464	577
Control Delay (s)	29.5	8.0	11.3	9.7	12.3
Approach Delay (s)	27.4		11.3	12.0	
Approach LOS	D		B	B	

Intersection Summary			
Delay	19.8		
Level of Service	C		
Intersection Capacity Utilization	61.3%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	16	140	269	12	38	52
Future Volume (vph)	16	140	269	12	38	52
Ideal Flow (vphpl)	1178	1178	1338	1338	1433	1433
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.994		0.921	
Flt Protected		0.995			0.980	
Satd. Flow (prot)	0	1149	1304	0	1268	0
Flt Permitted		0.995			0.980	
Satd. Flow (perm)	0	1149	1304	0	1268	0
Link Speed (k/h)		50	50		50	
Link Distance (m)		285.7	149.4		152.5	
Travel Time (s)		20.6	10.8		11.0	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	17	152	292	13	41	57
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	169	305	0	98	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		0.0	0.0		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.80	1.80	1.55	1.55	1.42	1.42
Turning Speed (k/h)	100			100	100	100
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	47.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	16	140	269	12	38	52
Future Volume (Veh/h)	16	140	269	12	38	52
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	17	152	292	13	41	57
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	305				484	298
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	305				484	298
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				92	92
cM capacity (veh/h)	1256				534	741

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	169	305	98
Volume Left	17	0	41
Volume Right	0	13	57
cSH	1256	1700	638
Volume to Capacity	0.01	0.18	0.15
Queue Length 95th (m)	0.3	0.0	4.3
Control Delay (s)	0.9	0.0	11.7
Lane LOS	A		B
Approach Delay (s)	0.9	0.0	11.7
Approach LOS			B

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	47.1%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	25	153	203	18	56	78
Future Volume (vph)	25	153	203	18	56	78
Ideal Flow (vphpl)	1178	1178	1338	1338	1433	1433
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.989		0.921	
Flt Protected		0.993			0.980	
Satd. Flow (prot)	0	1147	1297	0	1268	0
Flt Permitted		0.993			0.980	
Satd. Flow (perm)	0	1147	1297	0	1268	0
Link Speed (k/h)		50	50		50	
Link Distance (m)		149.4	87.8		78.1	
Travel Time (s)		10.8	6.3		5.6	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	166	221	20	61	85
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	193	241	0	146	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		0.0	0.0		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.80	1.80	1.55	1.55	1.42	1.42
Turning Speed (k/h)	100			100	100	100
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	52.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	25	153	203	18	56	78
Future Volume (Veh/h)	25	153	203	18	56	78
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	166	221	20	61	85
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	241				451	231
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	241				451	231
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				89	89
cM capacity (veh/h)	1326				555	808

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	193	241	146
Volume Left	27	0	61
Volume Right	0	20	85
cSH	1326	1700	679
Volume to Capacity	0.02	0.14	0.22
Queue Length 95th (m)	0.5	0.0	6.5
Control Delay (s)	1.2	0.0	11.8
Lane LOS	A		B
Approach Delay (s)	1.2	0.0	11.8
Approach LOS			B

Intersection Summary				
Average Delay		3.4		
Intersection Capacity Utilization		52.4%	ICU Level of Service	A
Analysis Period (min)		15		

Intersection: 1: Dorchester Road & Oldfield Road

Movement	EB	EB	WB	SB	SB
Directions Served	L	T	TR	L	R
Maximum Queue (m)	23.4	47.5	31.3	21.6	21.7
Average Queue (m)	16.9	10.9	14.7	6.9	12.2
95th Queue (m)	23.6	26.8	24.3	17.6	20.8
Link Distance (m)		262.9	285.4	231.7	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (m)	15.0				15.0
Storage Blk Time (%)	9	0		1	2
Queuing Penalty (veh)	4	1		1	1

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	504	65	108	77	78	455
Future Volume (vph)	504	65	108	77	78	455
Ideal Flow (vphpl)	1178	1178	1338	1338	1433	1433
Storage Length (m)	15.0			0.0	0.0	15.0
Storage Lanes	1			0	1	1
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.944			0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1119	1178	1242	0	1322	1218
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1119	1178	1242	0	1322	1218
Link Speed (k/h)		50	50		50	
Link Distance (m)		271.0	295.7		242.0	
Travel Time (s)		19.5	21.3		17.4	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	0%	0%	0%	4%	3%	0%
Adj. Flow (vph)	586	76	126	90	91	529
Shared Lane Traffic (%)						
Lane Group Flow (vph)	586	76	216	0	91	529
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.80	1.80	1.55	1.55	1.42	1.42
Turning Speed (k/h)	100			15	25	100
Sign Control		Stop	Stop		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 75.5%		ICU Level of Service D	
Analysis Period (min) 15			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Traffic Volume (vph)	504	65	108	77	78	455
Future Volume (vph)	504	65	108	77	78	455
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	586	76	126	90	91	529

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total (vph)	586	76	216	91	529
Volume Left (vph)	586	0	0	91	0
Volume Right (vph)	0	0	90	0	529
Hadj (s)	0.50	0.00	-0.22	0.55	-0.70
Departure Headway (s)	7.4	6.9	7.0	7.5	6.2
Degree Utilization, x	1.21	0.15	0.42	0.19	0.92
Capacity (veh/h)	490	505	501	474	564
Control Delay (s)	134.5	9.9	14.9	11.0	43.5
Approach Delay (s)	120.2		14.9	38.7	
Approach LOS	F		B	E	

Intersection Summary			
Delay	71.3		
Level of Service	F		
Intersection Capacity Utilization	75.5%	ICU Level of Service	D
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	55	282	298	40	24	33
Future Volume (vph)	55	282	298	40	24	33
Ideal Flow (vphpl)	1178	1178	1338	1338	1433	1433
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.984		0.922	
Flt Protected		0.992			0.979	
Satd. Flow (prot)	0	1146	1291	0	1268	0
Flt Permitted		0.992			0.979	
Satd. Flow (perm)	0	1146	1291	0	1268	0
Link Speed (k/h)		50	50		50	
Link Distance (m)		285.7	149.4		152.5	
Travel Time (s)		20.6	10.8		11.0	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	60	307	324	43	26	36
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	367	367	0	62	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		0.0	0.0		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.80	1.80	1.55	1.55	1.42	1.42
Turning Speed (k/h)	100			100	100	100
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	69.0%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	55	282	298	40	24	33
Future Volume (Veh/h)	55	282	298	40	24	33
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	60	307	324	43	26	36
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	367				772	346
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	367				772	346
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				93	95
cM capacity (veh/h)	1192				349	697

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	367	367	62
Volume Left	60	0	26
Volume Right	0	43	36
cSH	1192	1700	492
Volume to Capacity	0.05	0.22	0.13
Queue Length 95th (m)	1.3	0.0	3.4
Control Delay (s)	1.8	0.0	13.4
Lane LOS	A		B
Approach Delay (s)	1.8	0.0	13.4
Approach LOS			B

Intersection Summary			
Average Delay		1.9	
Intersection Capacity Utilization		69.0%	ICU Level of Service C
Analysis Period (min)		15	

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	83	223	289	60	36	49
Future Volume (vph)	83	223	289	60	36	49
Ideal Flow (vphpl)	1178	1178	1338	1338	1433	1433
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.977		0.922	
Flt Protected		0.987			0.979	
Satd. Flow (prot)	0	1140	1282	0	1268	0
Flt Permitted		0.987			0.979	
Satd. Flow (perm)	0	1140	1282	0	1268	0
Link Speed (k/h)		50	50		50	
Link Distance (m)		149.4	87.8		78.1	
Travel Time (s)		10.8	6.3		5.6	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	90	242	314	65	39	53
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	332	379	0	92	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		0.0	0.0		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.80	1.80	1.55	1.55	1.42	1.42
Turning Speed (k/h)	100			100	100	100
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 69.7%			ICU Level of Service C
Analysis Period (min) 15			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	83	223	289	60	36	49
Future Volume (Veh/h)	83	223	289	60	36	49
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	90	242	314	65	39	53
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	379				768	346
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	379				768	346
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	92				89	92
cM capacity (veh/h)	1179				341	697

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	332	379	92
Volume Left	90	0	39
Volume Right	0	65	53
cSH	1179	1700	483
Volume to Capacity	0.08	0.22	0.19
Queue Length 95th (m)	2.0	0.0	5.6
Control Delay (s)	2.8	0.0	14.2
Lane LOS	A		B
Approach Delay (s)	2.8	0.0	14.2
Approach LOS			B

Intersection Summary			
Average Delay		2.8	
Intersection Capacity Utilization		69.7%	ICU Level of Service
Analysis Period (min)		15	

Intersection: 1: Dorchester Road & Oldfield Road

Movement	EB	EB	WB	SB	SB
Directions Served	L	T	TR	L	R
Maximum Queue (m)	22.4	53.1	23.6	42.2	22.5
Average Queue (m)	18.5	14.6	12.9	14.0	16.3
95th Queue (m)	23.8	38.0	20.2	29.9	24.5
Link Distance (m)		262.9	285.4	231.7	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (m)	15.0				15.0
Storage Blk Time (%)	21	0		1	12
Queuing Penalty (veh)	14	2		4	9

Appendix G

Traffic Signal Warrant Analysis

Signal Justification Calculation for Forecast Volumes
(OTM Book 12 - Justification 7)

Horizon Year: 2029 Total
Region/City/Township: City of Niagara Falls

Major Street: Dorchester Road
Minor Street: Oldfield Road
North/South?: Y

Number of Approach Lanes: 1
Tee Intersection? Y
Flow Conditions: Free

PM Forecast Only? N

Warrant Results		
150% Satisfied	No	Justification for new intersections with forecast traffic
120% Satisfied	No	Justification for existing intersections with forecast traffic

	Major Street Dorchester Road						Minor Street Oldfield Road						
	Northbound			Southbound			Eastbound			Westbound			Peds
Time Period	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	Crossing
AM Peak Hour		401	44	29	236					67		77	
PM Peak Hour		500	64	75	452					107		74	
verage Hourly Volum	0	225	27	26	172	0	0	0	0	44	0	38	0

Warrant	AHV
1A - All	532
1B - Minor	81
2A - Major	450
2B - Cross	44

Warrant 1 - Minimum Vehicular Volume

	Approach Lanes	1		2 or more		Average Hourly Volume
1A	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	All Approaches	480	720	600	900	532
					% Fulfilled	110.7%

	Approach Lanes	1		2 or more		Average Hourly Volume
1B	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Minor Street Approaches	180	255	180	255	81
					% Fulfilled	45.1%

Warrant 2 - Delay To Cross Traffic

	Approach Lanes	1		2 or more		Average Hourly Volume
2A	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Major Street Approaches	480	720	600	900	450
					% Fulfilled	93.8%

	Approach Lanes	1		2 or more		Average Hourly Volume
2B	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Traffic Crossing Major Street	50	75	50	75	44
					% Fulfilled	87.0%

Signal Justification Calculation for Forecast Volumes
(OTM Book 12 - Justification 7)

Horizon Year: 2034 Total
Region/City/Township: City of Niagara Falls

Major Street: Dorchester Road
Minor Street: Oldfield Road
North/South?: Y

Number of Approach Lanes: 1
Tee Intersection? Y
Flow Conditions: Free

PM Forecast Only? N

Warrant Results		
150% Satisfied	No	Justification for new intersections with forecast traffic
120% Satisfied	No	Justification for existing intersections with forecast traffic

	Major Street						Minor Street						
	Dorchester Road						Oldfield Road						
	Northbound			Southbound			Eastbound			Westbound			Peds
Time Period	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	Crossing
AM Peak Hour		402	44	31	238					67		81	
PM Peak Hour		504	65	78	455					108		77	
verage Hourly Volun	0	227	27	27	173	0	0	0	0	44	0	40	0

Warrant	AHV
1A - All	538
1B - Minor	83
2A - Major	454
2B - Cross	44

Warrant 1 - Minimum Vehicular Volume

	Approach Lanes	1		2 or more		Average Hourly Volume
1A	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	All Approaches	480	720	600	900	538
					% Fulfilled	112.0%

	Approach Lanes	1		2 or more		Average Hourly Volume
1B	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Minor Street Approaches	180	255	180	255	83
					% Fulfilled	46.3%

Warrant 2 - Delay To Cross Traffic

	Approach Lanes	1		2 or more		Average Hourly Volume
2A	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Major Street Approaches	480	720	600	900	454
					% Fulfilled	94.6%

	Approach Lanes	1		2 or more		Average Hourly Volume
2B	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Traffic Crossing Major Street	50	75	50	75	44
					% Fulfilled	87.5%

Appendix H

2034 Total Traffic Synchro Outputs with Remedial Measures

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	67	81	402	44	31	238
Future Volume (vph)	67	81	402	44	31	238
Ideal Flow (vphpl)	1338	1338	1178	1178	1433	1433
Storage Length (m)	0.0	0.0		15.0	15.0	
Storage Lanes	1	0		1	1	
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.926			0.850		
Flt Protected	0.978				0.950	
Satd. Flow (prot)	1084	0	1111	1001	1144	1352
Flt Permitted	0.978				0.475	
Satd. Flow (perm)	1084	0	1111	1001	572	1352
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)	93			42		
Link Speed (k/h)	50		50			50
Link Distance (m)	295.7		271.0			242.0
Travel Time (s)	21.3		19.5			17.4
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Heavy Vehicles (%)	14%	10%	6%	0%	19%	6%
Adj. Flow (vph)	77	93	462	51	36	274
Shared Lane Traffic (%)						
Lane Group Flow (vph)	170	0	462	51	36	274
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		3.6			3.6
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	1.55	1.55	1.80	1.80	1.42	1.42
Turning Speed (k/h)	25	15		15	25	
Number of Detectors	1		2	1	1	2
Detector Template	Left		Thru	Right	Left	Thru
Leading Detector (m)	2.0		10.0	2.0	2.0	10.0
Trailing Detector (m)	0.0		0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0		0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0		0.6	2.0	2.0	0.6
Detector 1 Type	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0		0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0		0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0		0.0	0.0	0.0	0.0
Detector 2 Position(m)			9.4			9.4
Detector 2 Size(m)			0.6			0.6
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type	Prot		NA	Perm	Perm	NA
Protected Phases	8		2			6

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Permitted Phases				2	6	
Detector Phase	8		2	2	6	6
Switch Phase						
Minimum Initial (s)	5.0		5.0	5.0	5.0	5.0
Minimum Split (s)	22.5		22.5	22.5	22.5	22.5
Total Split (s)	22.5		37.5	37.5	37.5	37.5
Total Split (%)	37.5%		62.5%	62.5%	62.5%	62.5%
Maximum Green (s)	18.0		33.0	33.0	33.0	33.0
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5
All-Red Time (s)	1.0		1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5		4.5	4.5	4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Recall Mode	None		Max	Max	Max	Max
Walk Time (s)	7.0		7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0		11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0		0	0	0	0
Act Effct Green (s)	10.1		39.6	39.6	39.6	39.6
Actuated g/C Ratio	0.18		0.71	0.71	0.71	0.71
v/c Ratio	0.62		0.58	0.07	0.09	0.28
Control Delay	20.3		11.7	2.7	5.8	6.1
Queue Delay	0.0		0.0	0.0	0.0	0.0
Total Delay	20.3		11.7	2.7	5.8	6.1
LOS	C		B	A	A	A
Approach Delay	20.3		10.8			6.0
Approach LOS	C		B			A

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 55.7
Natural Cycle: 60
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.62
Intersection Signal Delay: 11.0 Intersection LOS: B
Intersection Capacity Utilization 54.0% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 1: Dorchester Road & Oldfield Road

Lane Group	WBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	170	462	51	36	274
v/c Ratio	0.62	0.58	0.07	0.09	0.28
Control Delay	20.3	11.7	2.7	5.8	6.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	20.3	11.7	2.7	5.8	6.1
Queue Length 50th (m)	7.2	22.0	0.3	1.1	9.6
Queue Length 95th (m)	20.3	#73.8	4.0	5.3	27.7
Internal Link Dist (m)	271.7	247.0			218.0
Turn Bay Length (m)			15.0	15.0	
Base Capacity (vph)	413	790	724	407	962
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.41	0.58	0.07	0.09	0.28

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	67	81	402	44	31	238
Future Volume (vph)	67	81	402	44	31	238
Ideal Flow (vphpl)	1338	1338	1178	1178	1433	1433
Total Lost time (s)	4.5		4.5	4.5	4.5	4.5
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00
Frt	0.93		1.00	0.85	1.00	1.00
Flt Protected	0.98		1.00	1.00	0.95	1.00
Satd. Flow (prot)	1084		1111	1001	1144	1352
Flt Permitted	0.98		1.00	1.00	0.48	1.00
Satd. Flow (perm)	1084		1111	1001	572	1352
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	77	93	462	51	36	274
RTOR Reduction (vph)	78	0	0	13	0	0
Lane Group Flow (vph)	92	0	462	38	36	274
Heavy Vehicles (%)	14%	10%	6%	0%	19%	6%
Turn Type	Prot		NA	Perm	Perm	NA
Protected Phases	8		2			6
Permitted Phases				2	6	
Actuated Green, G (s)	9.0		38.7	38.7	38.7	38.7
Effective Green, g (s)	9.0		38.7	38.7	38.7	38.7
Actuated g/C Ratio	0.16		0.68	0.68	0.68	0.68
Clearance Time (s)	4.5		4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	172		758	683	390	922
v/s Ratio Prot	c0.08		c0.42			0.20
v/s Ratio Perm				0.04	0.06	
v/c Ratio	0.53		0.61	0.06	0.09	0.30
Uniform Delay, d1	21.9		4.9	3.0	3.0	3.6
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	3.2		3.6	0.2	0.5	0.8
Delay (s)	25.1		8.5	3.1	3.5	4.4
Level of Service	C		A	A	A	A
Approach Delay (s)	25.1		8.0			4.3
Approach LOS	C		A			A

Intersection Summary

HCM 2000 Control Delay	9.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	56.7	Sum of lost time (s)	9.0
Intersection Capacity Utilization	54.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	108	77	504	65	78	455
Future Volume (vph)	108	77	504	65	78	455
Ideal Flow (vphpl)	1338	1338	1178	1178	1433	1433
Storage Length (m)	0.0	0.0		15.0	15.0	
Storage Lanes	1	0		1	1	
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.944			0.850		
Flt Protected	0.972				0.950	
Satd. Flow (prot)	1208	0	1178	1001	1322	1433
Flt Permitted	0.972				0.373	
Satd. Flow (perm)	1208	0	1178	1001	519	1433
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)	61			50		
Link Speed (k/h)	50		50			50
Link Distance (m)	295.7		271.0			242.0
Travel Time (s)	21.3		19.5			17.4
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	0%	4%	0%	0%	3%	0%
Adj. Flow (vph)	126	90	586	76	91	529
Shared Lane Traffic (%)						
Lane Group Flow (vph)	216	0	586	76	91	529
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		3.6			3.6
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	1.55	1.55	1.80	1.80	1.42	1.42
Turning Speed (k/h)	25	15		15	25	
Number of Detectors	1		2	1	1	2
Detector Template	Left		Thru	Right	Left	Thru
Leading Detector (m)	2.0		10.0	2.0	2.0	10.0
Trailing Detector (m)	0.0		0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0		0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0		0.6	2.0	2.0	0.6
Detector 1 Type	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0		0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0		0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0		0.0	0.0	0.0	0.0
Detector 2 Position(m)			9.4			9.4
Detector 2 Size(m)			0.6			0.6
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type	Prot		NA	Perm	Perm	NA
Protected Phases	8		2			6

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Permitted Phases				2	6	
Detector Phase	8		2	2	6	6
Switch Phase						
Minimum Initial (s)	5.0		5.0	5.0	5.0	5.0
Minimum Split (s)	22.5		22.5	22.5	22.5	22.5
Total Split (s)	22.5		37.5	37.5	37.5	37.5
Total Split (%)	37.5%		62.5%	62.5%	62.5%	62.5%
Maximum Green (s)	18.0		33.0	33.0	33.0	33.0
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5
All-Red Time (s)	1.0		1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5		4.5	4.5	4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Recall Mode	None		None	None	Max	Max
Walk Time (s)	7.0		7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0		11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0		0	0	0	0
Act Effct Green (s)	12.5		36.7	36.7	36.7	36.7
Actuated g/C Ratio	0.21		0.63	0.63	0.63	0.63
v/c Ratio	0.71		0.79	0.12	0.28	0.59
Control Delay	26.9		20.9	3.6	9.4	11.0
Queue Delay	0.0		0.0	0.0	0.0	0.0
Total Delay	26.9		20.9	3.6	9.4	11.0
LOS	C		C	A	A	B
Approach Delay	26.9		18.9			10.7
Approach LOS	C		B			B

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 58.2
Natural Cycle: 65
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.79
Intersection Signal Delay: 16.7 Intersection LOS: B
Intersection Capacity Utilization 75.0% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 1: Dorchester Road & Oldfield Road

Lane Group	WBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	216	586	76	91	529
v/c Ratio	0.71	0.79	0.12	0.28	0.59
Control Delay	26.9	20.9	3.6	9.4	11.0
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	26.9	20.9	3.6	9.4	11.0
Queue Length 50th (m)	14.3	40.1	0.9	3.8	28.8
Queue Length 95th (m)	31.0	#110.9	5.8	13.2	65.3
Internal Link Dist (m)	271.7	247.0			218.0
Turn Bay Length (m)			15.0	15.0	
Base Capacity (vph)	416	743	650	327	904
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.52	0.79	0.12	0.28	0.59

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	108	77	504	65	78	455
Future Volume (vph)	108	77	504	65	78	455
Ideal Flow (vphpl)	1338	1338	1178	1178	1433	1433
Total Lost time (s)	4.5		4.5	4.5	4.5	4.5
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00
Frt	0.94		1.00	0.85	1.00	1.00
Flt Protected	0.97		1.00	1.00	0.95	1.00
Satd. Flow (prot)	1207		1178	1001	1322	1433
Flt Permitted	0.97		1.00	1.00	0.37	1.00
Satd. Flow (perm)	1207		1178	1001	518	1433
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	126	90	586	76	91	529
RTOR Reduction (vph)	48	0	0	18	0	0
Lane Group Flow (vph)	168	0	586	58	91	529
Heavy Vehicles (%)	0%	4%	0%	0%	3%	0%
Turn Type	Prot		NA	Perm	Perm	NA
Protected Phases	8		2			6
Permitted Phases				2	6	
Actuated Green, G (s)	12.5		36.8	36.8	36.8	36.8
Effective Green, g (s)	12.5		36.8	36.8	36.8	36.8
Actuated g/C Ratio	0.21		0.63	0.63	0.63	0.63
Clearance Time (s)	4.5		4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	258		743	631	326	904
v/s Ratio Prot	c0.14		c0.50			0.37
v/s Ratio Perm				0.06	0.18	
v/c Ratio	0.65		0.79	0.09	0.28	0.59
Uniform Delay, d1	20.9		7.9	4.2	4.8	6.3
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	5.8		5.6	0.1	2.1	2.8
Delay (s)	26.7		13.5	4.3	6.9	9.1
Level of Service	C		B	A	A	A
Approach Delay (s)	26.7		12.4			8.7
Approach LOS	C		B			A

Intersection Summary

HCM 2000 Control Delay	13.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	58.3	Sum of lost time (s)	9.0
Intersection Capacity Utilization	75.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Appendix I

Automated Speed Limit Guidelines

Automated Speed Limit Guidelines

FORM A - Automated Speed Limit Guidelines Spreadsheet

Version: 10-Apr-09

Name of Corridor:	Chippawa Parkway				
Segment Evaluated:	CN Railroad Crossing	to	Stanley Avenue		
Geographic Region:	Ontario				
Road Agency:	City of Niagara Falls				
Road Classification:	Arterial	Length of Corridor:	2,950	m	
Urban / Rural:	Rural	Design Speed: (Required for Freeway, Expressway, Highway)	80	km/h	
Divided / Undivided:	Undivided	Current Posted Speed: (For information only)	60	km/h	
Major / Minor:	Minor	Prevailing Speed: (85th Percentile - for information only)		km/h	
# Through Lanes Per Direction:	1 lane	Policy: (Maximum Posted Speed)	No policy		

		RISK	Score
A1	GEOMETRY (Horizontal)	Higher	9
A2	GEOMETRY (Vertical)	Lower	3
A3	AVERAGE LANE WIDTH	Higher	9
B	ROADSIDE HAZARDS	Higher	9
C1	PEDESTRIAN EXPOSURE	Higher	6
C2	CYCLIST EXPOSURE	Higher	9
D	PAVEMENT SURFACE	Medium	6
E1	NUMBER OF INTERSECTIONS WITH PUBLIC ROADS	*Number of Occurrences*	6
	STOP controlled intersection	0	
	Signalized intersection	0	
	Roundabout or traffic circle	0	
	Crosswalk	0	
	Active, at-grade railroad crossing	1	
	Sidestreet STOP-controlled or lane	9	
E2	NUMBER OF INTERSECTIONS WITH PRIVATE ACCESS DRIVEWAYS	*Number of Occurrences*	2
	Left turn movements permitted	9	
	Right-in / Right-out only	0	
E3	NUMBER OF INTERCHANGES	*Number of Occurrences*	0
	Number of interchanges along corridor	0	
F	ON-STREET PARKING	Lower	1

Total Risk Score:

60

Recommended Posted Speed Limit (km/h):

As determined by road characteristics

50

As determined by policy

No policy

The recommended posted speed limit may be checked against the prevailing speeds of the roadway and the road's safety performance.

Comments:

Automated Speed Limit Guidelines

FORM A - Automated Speed Limit Guidelines Spreadsheet

Version: 10-Apr-09

Name of Corridor:	Dorchester Road				
Segment Evaluated:	Oldfield Road	to	CN Railroad Crossing		
Geographic Region:	Ontario				
Road Agency:	City of Niagara Falls				
Road Classification:	Arterial	Length of Corridor:	1,780	m	
Urban / Rural:	Rural	Design Speed: (Required for Freeway, Expressway, Highway)	80	km/h	
Divided / Undivided:	Undivided	Current Posted Speed: (For information only)	60	km/h	
Major / Minor:	Minor	Prevailing Speed: (85th Percentile - for information only)		km/h	
# Through Lanes Per Direction:	1 lane	Policy: (Maximum Posted Speed)	No policy		

		RISK	Score
A1	**GEOMETRY (Horizontal)**	Medium	6
A2	**GEOMETRY (Vertical)**	Lower	3
A3	**AVERAGE LANE WIDTH**	Higher	9
B	**ROADSIDE HAZARDS**	Higher	9
C1	**PEDESTRIAN EXPOSURE**	Higher	6
C2	**CYCLIST EXPOSURE**	Higher	9
D	**PAVEMENT SURFACE**	Medium	6
E1	**NUMBER OF INTERSECTIONS WITH PUBLIC ROADS**	*Number of Occurrences*	15
	STOP controlled intersection	1	
	Signalized intersection	0	
	Roundabout or traffic circle	0	
	Crosswalk	0	
	Active, at-grade railroad crossing	1	
	Sidestreet STOP-controlled or lane	11	
E2	**NUMBER OF INTERSECTIONS WITH PRIVATE ACCESS DRIVEWAYS**	*Number of Occurrences*	4
	Left turn movements permitted	11	
	Right-in / Right-out only	0	
E3	**NUMBER OF INTERCHANGES**	*Number of Occurrences*	0
	Number of interchanges along corridor	0	
F	**ON-STREET PARKING**	Lower	1

Total Risk Score:

68

Recommended Posted Speed Limit (km/h):

As determined by road characteristics

50

As determined by policy

No policy

The recommended posted speed limit may be checked against the prevailing speeds of the roadway and the road's safety performance.

Comments: