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Warren Woods Commercial Block City of Niagara Falls Transportation Impact Study

Paradigm Transportation Solutions Limited

January 2024
230368



ptsl.com



Project Summary



Project Number
230368

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**Garner Niagara Development
GP Inc.**
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Executive Summary

Content

Garner Niagara Development GP Inc. retained Paradigm Transportation Solutions Limited (Paradigm) to conduct this Transportation Impact Study for a proposed retail and office development located on the northeast quadrant of Garner Road and Warren Woods Avenue in the City of Niagara Falls.

This study determines the impacts of the development traffic on the adjacent road network and identifies any modifications recommended to accommodate the site generated traffic.

Development Concept

The development concept includes two buildings with approximately 3,871 m² (41,667 sq. ft.) of office and retail space.

The ground floor retail measures approximately 2,610 m² (29,094 sq.ft.) and the second floor office space measures approximately 1,261 m² (13,573 sq.ft.).

Vehicle access is proposed by a private driveway to Garner Road located approximately 80 metres north of Warren Woods Avenue. An emergency connection is proposed to Dockweed Drive near the bend in the roadway. The emergency connection will provide an active transportation connection between the site and the adjacent community.

The site's parking demand is proposed to be accommodated on-site by approximately 125 spaces.

Build-out is expected to occur in one phase by Year 2025.

Conclusions

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

- ▶ **Study Area:** The intersections that form the study area include the Site Driveway with Garner Road.
- ▶ **Development Generated Traffic:** The subject site is forecast to generate approximately 87 AM peak hour trips and 194 PM peak hour trips.
- ▶ **Forecast Parking Demand:** The *ITE Parking Generation Manual* forecast's the site's parking demand to be



approximately 105 spaces. With a parking supply of 125 spaces, the site's parking demand is forecast to be less than the proposed supply.

- ▶ **Existing Traffic Conditions:** The intersection within the study area is currently operating with acceptable levels of service and well within capacity during the AM and PM peak hours.
- ▶ **Opening Date Operations:** The intersection within the study area is forecast to operate with acceptable levels of service and well within capacity during the AM and PM peak hours.

The site driveway approach is forecast to operate with delays in the LOS A range with a v/c ratio of less than 0.15. Minimal queuing is anticipated to occur on the site driveway approach to Garner Road.

- ▶ **Five-Year Horizon Operations:** The intersection within the study area is forecast to operate with acceptable levels of service and well within capacity during the AM and PM peak hours.

The site driveway approach is forecast to operate with delays in the LOS A range with a v/c ratio of less than 0.15. Minimal queuing is anticipated to occur on the site driveway approach to Garner Road.

- ▶ **Remedial Measures:** A southbound left-turn lane is not warranted at the proposed site driveway intersection with Garner Road. No changes to the existing lane configuration is recommended.

Stop control is an appropriate form of traffic control for the site driveway approach to Garner Road.

Recommendations

Based on the findings of this study, it is recommended the site driveway approach to Garner Road operate under stop control. An Ra-1 (STOP SIGN) be added to the site driveway approach.



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1 Introduction

1.1 Overview

Garner Niagara Development GP Inc. retained Paradigm Transportation Solutions Limited (Paradigm) to conduct this Transportation Impact Study for a proposed retail and office development located on the northeast quadrant of Garner Road and Warren Woods Avenue in the City of Niagara Falls. **Figure 1.1** illustrates the site location.

The scope of the study includes:

- ▶ Determine and assess the current study area traffic conditions;
- ▶ Forecast the additional traffic generated by the proposed development;
- ▶ Analyze the impacts of the additional traffic on the study area road network;
- ▶ Recommend remedial measures to mitigate any identified site traffic related impacts; and
- ▶ An assessment of vehicle circulation within the site.

Appendix A contains the pre-study consultation material and responses from the Niagara Region and the City of Niagara Falls. The study has been conducted in general accordance with the Region's¹ TIS Guidelines and the City's² TIS Guidelines³. The analysis periods assessed include weekday AM and PM peak hours.

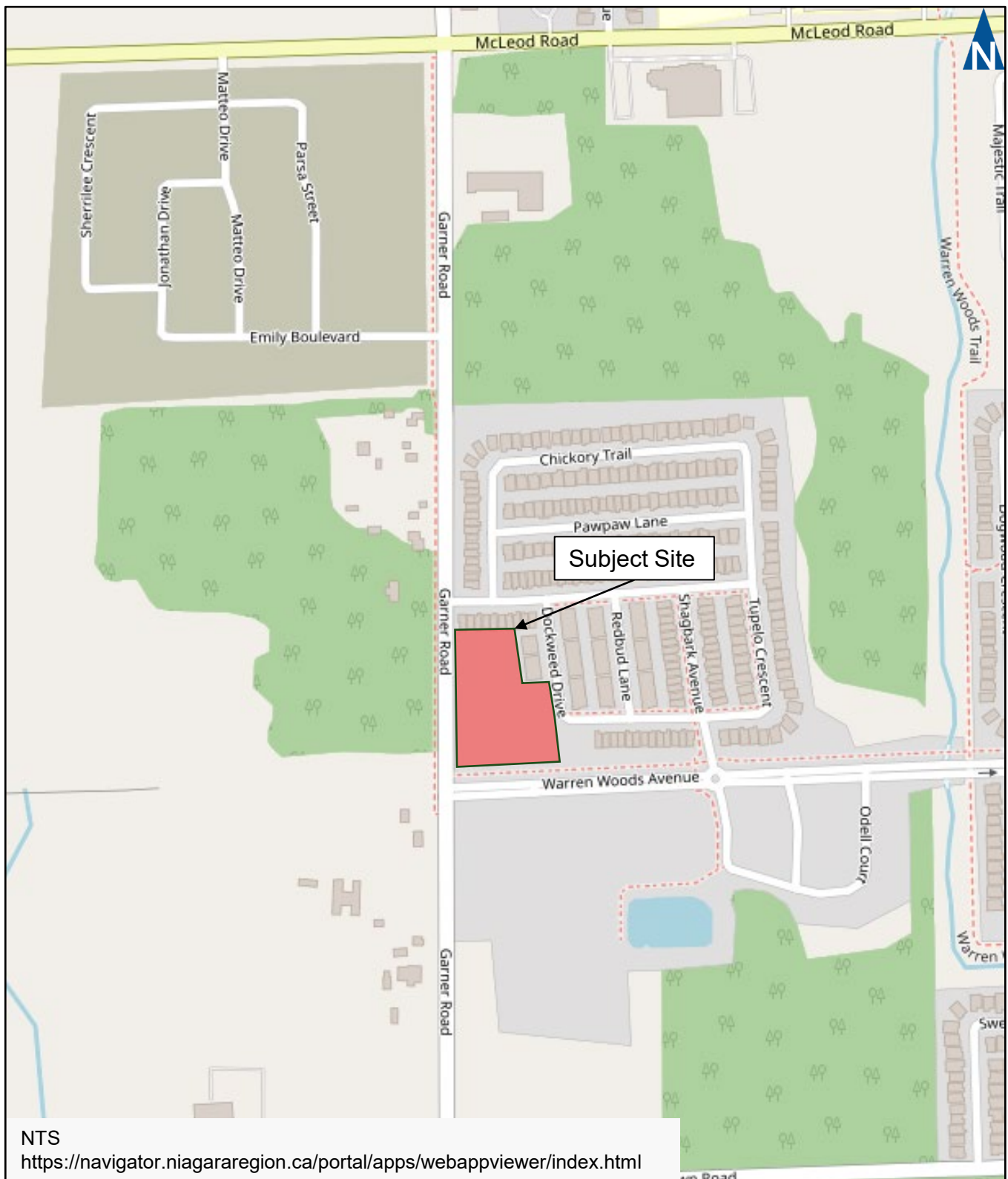
The only intersection included in the study area is Garner Road at the proposed site driveway.

¹ Niagara Region, Guidelines for Transportation Impact Studies, May 2012

² City of Niagara Falls, Guidelines for the Preparation of Transportation Impact Studies and Site Plan Review, November 2011

³ Guidelines for Transportation Impact Studies, Niagara Region, May 2012





2 Existing Conditions

2.1 Road Network

Garner Road is a north/south two-lane local road⁴ with an urban cross-section and posted speed limit of 60 km/h. At the proposed site driveway location, Garner Road is straight and flat with no apparent sight distance issues.

2.2 Pedestrian and Cycling Network

Sidewalks are provided on both sides of Garner Road within the study area and on-street bike lanes are also provided in both directions.

An asphalt multi-use trail currently exists on the southern property limit along Warren Woods Avenue. The trail runs from Garner Road towards the east where it terminates into Warren Woods Trail.

The Niagara Region Transportation Master Plan⁵ and the City of Niagara Falls Transportation Master Plan⁶ do not identify any additional active transportation facilities along Garner Road within the study area.

2.3 Transit Service

Niagara region transit operates the transit network within the City of Niagara Falls. There are two stops located within 500 m of the subject site. These routes provide connectivity to the larger City-Wide transit network. **Figure 2.1A-B** illustrates the existing transit network.

The closest existing northbound transit stop is located on the southeast corner of Garner Road and Sourgum Avenue (located north of the subject site). The walking distance to this stop is approximately 100 metres or less than 2 minutes. The closest existing southbound transit stop is adjacent to the northbound transit stop on the west side of Garner Road. The walking distance to the stop is approximately 115 metres or less than 2 minutes.

The transit routes that service these stops are:

- **Route 113/213:** services Department Canadian Drive Hub to Mt. Caramel Plaza via Montrose Road. Service is provided 7

⁴ (City of Niagara Falls). Niagara Falls Sustainable Transportation Master Plan. (Niagara Falls. October 2011).

⁵ (Niagara Region). Road Classification Map (Niagara Falls. October 2011).

⁶ (City of Niagara Falls). Niagara Falls Sustainable Transportation Master Plan. (Niagara Falls. October 2011).



days a week. Weekday and Saturday service is provided from 6:00 AM to 10:30 PM with headways in the order of 60 minutes. Sunday and Holiday service is provided from 7:00 AM to 7:30 PM with headways in the order of 60 minutes. Route 113 is designated as Route 213 on Sunday or after 7:15 PM Monday to Saturday. Route 213 continues along the same route as Route 113.

- ▶ **Route 105/205:** services Department Drive Hub to Mt. Caramel Plaza via Kala Road. Service is provided 7 days a week. Weekday and Saturday service is provided from 6:00 AM to 10:00 PM with headways in the order of 60 minutes. Sunday and Holiday service is provided from 7:00 AM to 8:00 PM with headways in the order of 60 minutes. Route 105 is designated as Route 205 on Sunday or after 7:15 PM Monday to Saturday. Route 213 continues along the same route as Route 113.

2.4 Existing Traffic Volumes

On Wednesday 12 July 2023, Paradigm conducted an 8-hour turning movement count at the intersection of Garner Road and Warren Woods Avenue to capture the volumes on Garner Road at the new driveway location.

Figure 2.2 illustrates the existing AM and PM peak hour traffic volumes at the study area intersection. **Appendix B** contains the existing count data.

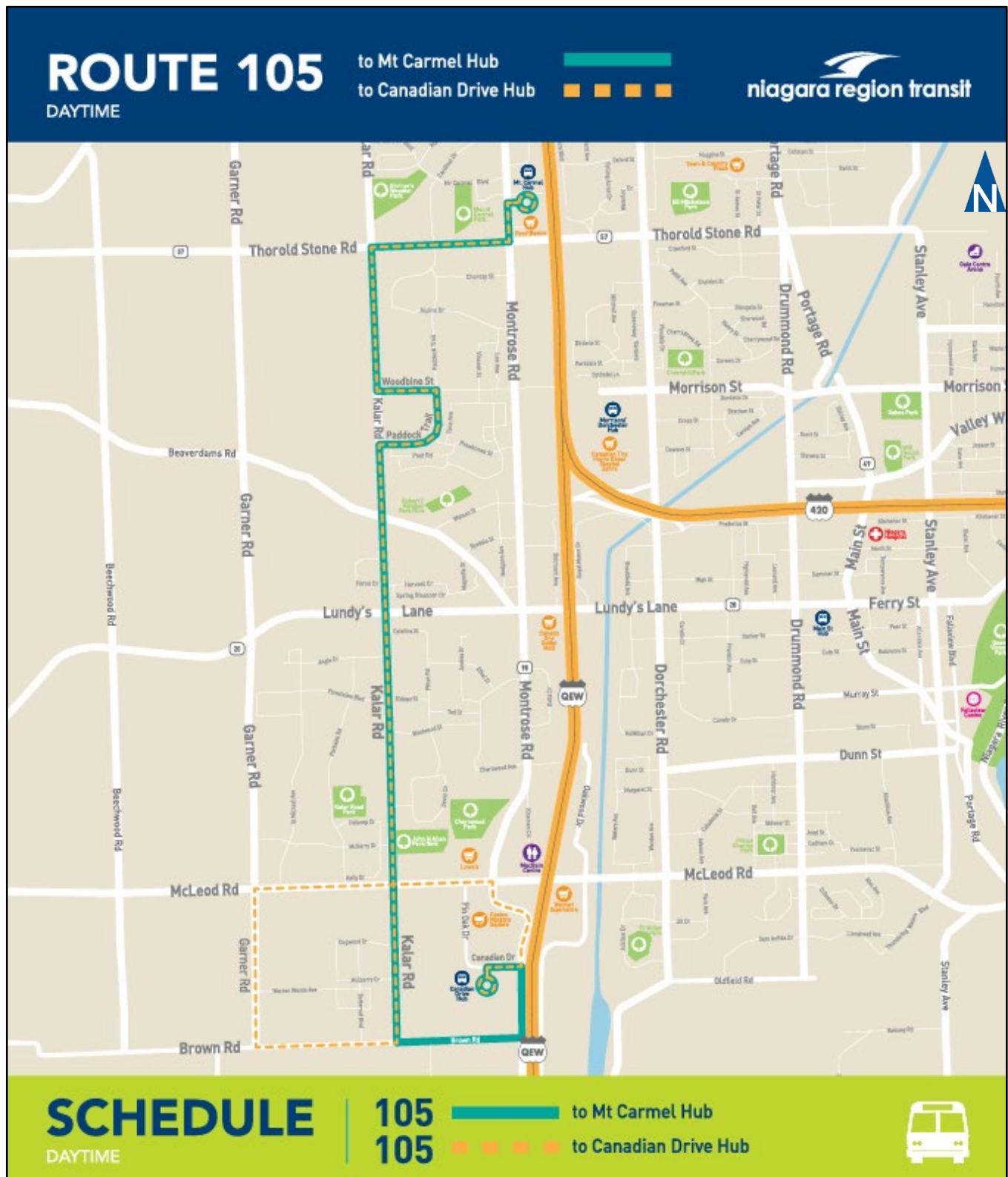


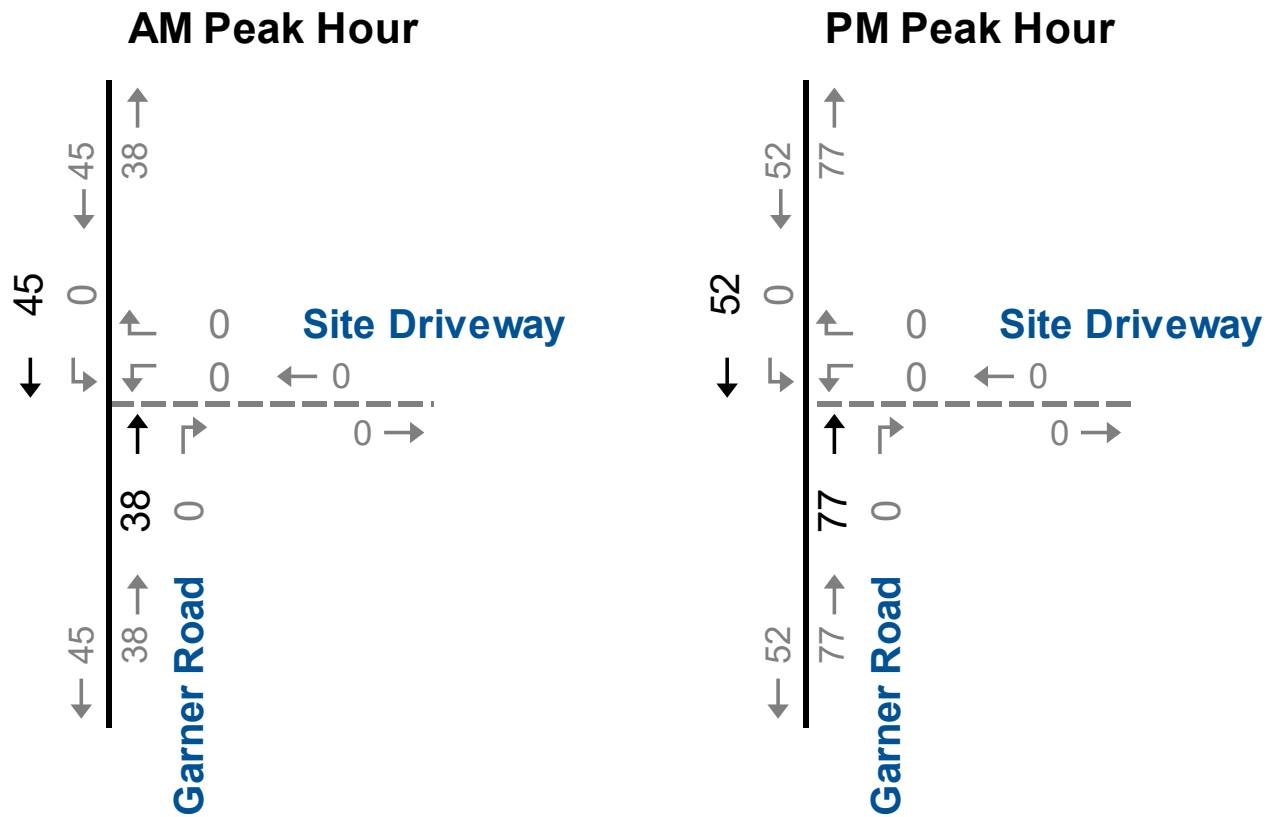


Existing Transit Service Route 113/213

Warren Woods Commercial Block
230368

Figure 2.1A





3 Development Concept

3.1 Description

The development concept includes two buildings with approximately 3,871 m² (41,667 sq. ft.) of office and retail space.

The ground floor retail measures approximately 2,610 m² (28,094sq.ft.) and the second floor office space measures approximately 1,261 m² (13,573 sq.ft.).

Vehicle access is proposed by a private driveway to Garner Road located approximately 80 metres north of Warren Woods Avenue. The driveway approach is assumed to operate with one inbound and one outbound lane with the outbound lane operating under stop control.

An emergency connection is proposed to Dockweed Drive near the bend in the roadway. The emergency connection will provide an active transportation connection between the site and the adjacent community.

The site's parking demand is proposed to be accommodated on-site by approximately 125 spaces.

Build-out is expected to occur in one phase by Year 2025.



3.2 Parking

3.2.1 Proposed Supply

The proposed parking supply consists of 125 parking spaces and includes four accessible parking spaces.

The accessible parking spaces will be signed and marked according to the City's by-law requirements.

Each building is also designed with two 9 metre x 3 metre loading zones.

3.2.2 Zoning By-law Parking Requirements

The City of Niagara Falls Zoning By-law 79-200 parking requirements for the subject site is 136 spaces. The proposed parking supply is reduced compared to the City's Zoning By-law requirements.

The number of accessible parking spaces and loading zones meets the City's Zoning By-law requirements.

3.2.3 Forecast Parking Demand

The Institute of Transportation Engineers (ITE) Parking Generation manual⁷ provides data on surveys across the USA and Canada of peak parking demand of different land uses.

The parking demand for the subject site has been estimated using the average rates for General Office Building (710) and Strip Retail Plaza (< 40k) (822).

Table 3.3 summarizes the ITE parking generation estimate. The site's parking demand is forecast to be 105 spaces. With a parking supply of 125 spaces, the site's parking demand is forecast to be less than the proposed supply.

⁷ Institute of Transportation Engineers, *Parking Generation*, 5th ed., (Washington, DC: ITE, 2019).



TABLE 3.1: ITE PARKING GENERATION

Land Use	GFA	Parking Generation
General Office Building (710)	1,261 m ²	26 spaces
Strip Retail Plaza (< 40k) (822)	2,610 m ²	79 spaces
Total		105 spaces
Proposed Supply		125 spaces
Surplus/Deficit		+20 spaces

3.3 Vehicle Circulation

Heavy vehicle circulation has been assessed using AutoTURN swept path analysis software. Six design vehicles were used in the analysis:

- ▶ Transportation Association of Canada (TAC)⁸ Light Single Unit (LSU).
- ▶ TAC Medium Single Unit (MSU);
- ▶ TAC Heavy Single Unit (HSU);
- ▶ Niagara Region Garbage Truck;
- ▶ Wayne Titan (garbage truck); and
- ▶ NCHRP Report 659 Pumper Fire Truck.

Appendix C contains the AutoTURN swept path analysis.

No conflicts with the proposed on-site geometry is noted.

⁸ (Transportation Association of Canada). Geometric Design Guide for Canadian Roads, Chapter 2.4 – Design Vehicles. (Washington, June 2017).



4 Traffic Forecast

4.1 Site Generated Traffic

The Institute of Transportation Engineers (ITE) Trip Generation Manual⁹ was used to estimate the peak hour vehicular traffic generated by the proposed development. The regression equations were used. The following land use codes were used to estimate the site's trip generation:

- ▶ General Office Building (LUC 710); and
- ▶ Shopping Plaza (<44k) (LUC 822).

Table 4.1 summarizes the estimated trip generation.

To remain conservative, no modal split adjustments have been applied to the trip generation estimate to account for active transportation or transit-oriented trips.

The subject site is estimated to generate approximately 87 AM peak hour trips and 194 PM peak hour trips.

TABLE 4.1: SITE GENERATED TRAFFIC

Land Use	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
Shopping Plaza (<44k) (LUC 822) ¹ 28,094 sq.ft.	34	23	57	81	81	162
General Office Building (LUC 710) ² 13,573 sq.ft.	26	4	30	5	27	32
Total Generation	60	27	87	86	108	194

¹AM Peak Hour - $\ln(T) = 0.66 \ln(X) + 1.84$, PM Peak Hour - $\ln(T) = 0.71 \ln(X) + 2.72$

²AM Peak Hour - $\ln(T) = 0.86 \ln(X) + 1.16$, PM Peak Hour - $\ln(T) = 0.83 \ln(X) + 1.29$

⁹(Institute of Transportation Engineers). Trip Generation Manual 11th Edition. (Washington DC, September 2021).



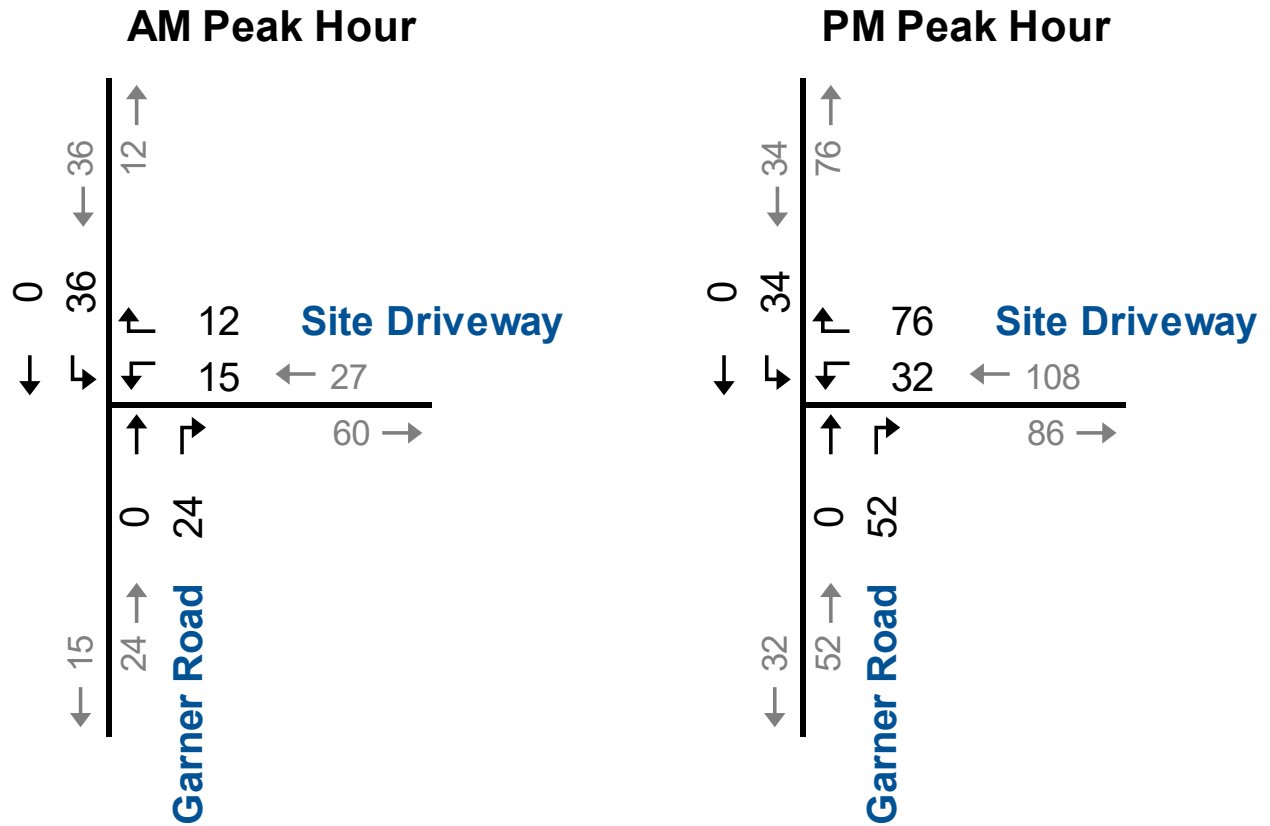
Table 4.2 summarizes the estimated trip distribution. The distribution was developed using existing traffic volumes in the study area as confirmed in pre-consultation with the City of Niagara Falls.

Figure 4.1 illustrates the site generated traffic.

TABLE 4.2: ESTIMATED TRIP ASSIGNMENT

Origin/Destination	AM Peak Hour		PM Peak Hour	
	In	Out	In	Out
North via Garner Road	60%	45%	40%	70%
South via Garner Road	40%	55%	60%	30%
Total	100%	100%	100%	100%





4.2 Future Traffic

Two horizon years are assessed in this study. The opening date of the development (Year 2025) and five-year from opening date (Year 2030). The future traffic volumes near the subject site are estimated to consist of:

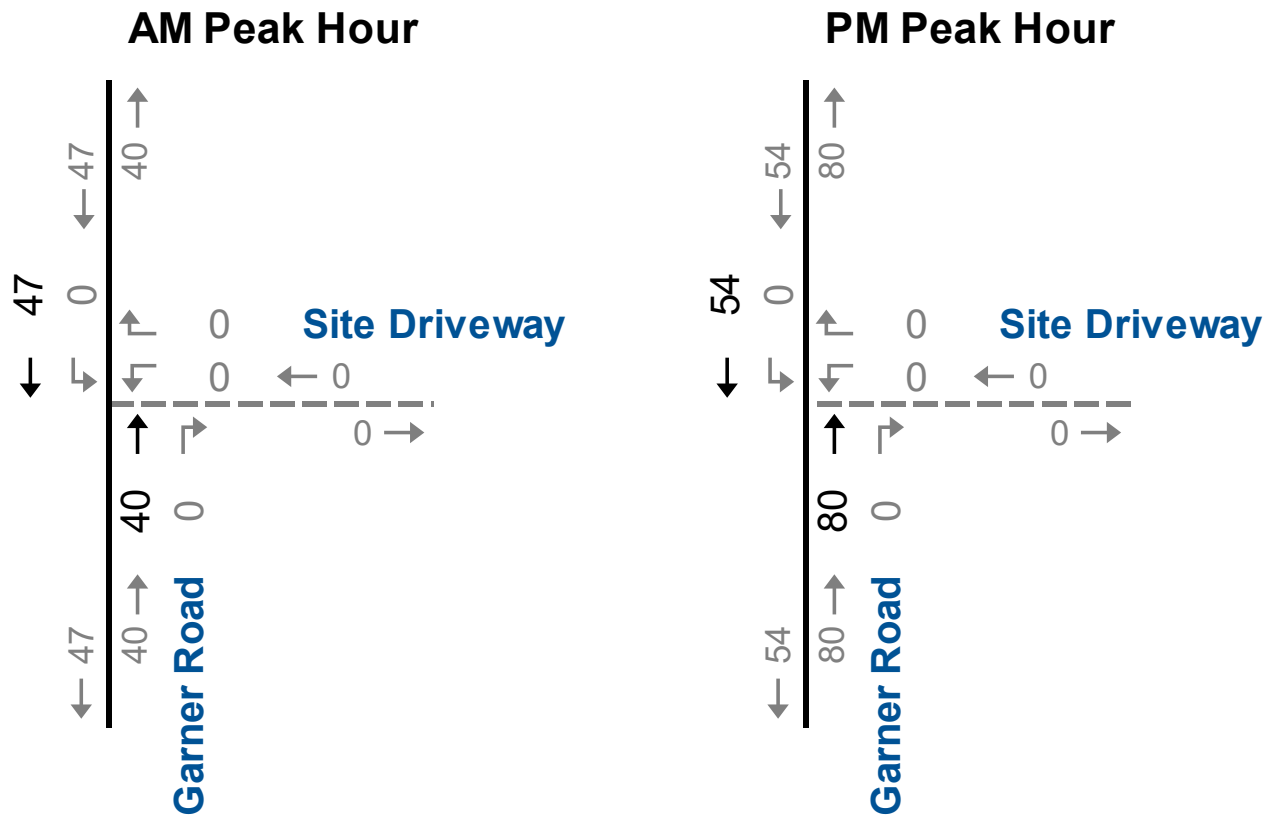
- ▶ Increased non-site traffic (generalized background traffic growth); and
- ▶ Traffic generated by the proposed development.

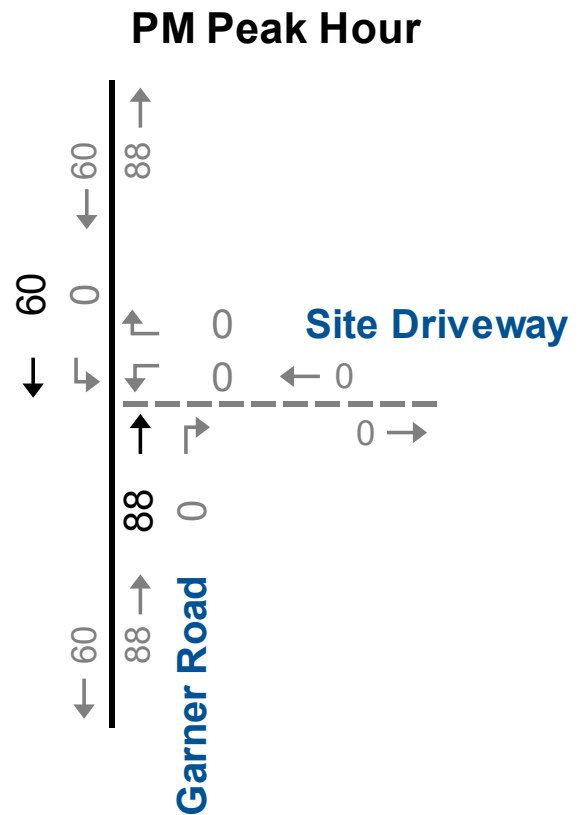
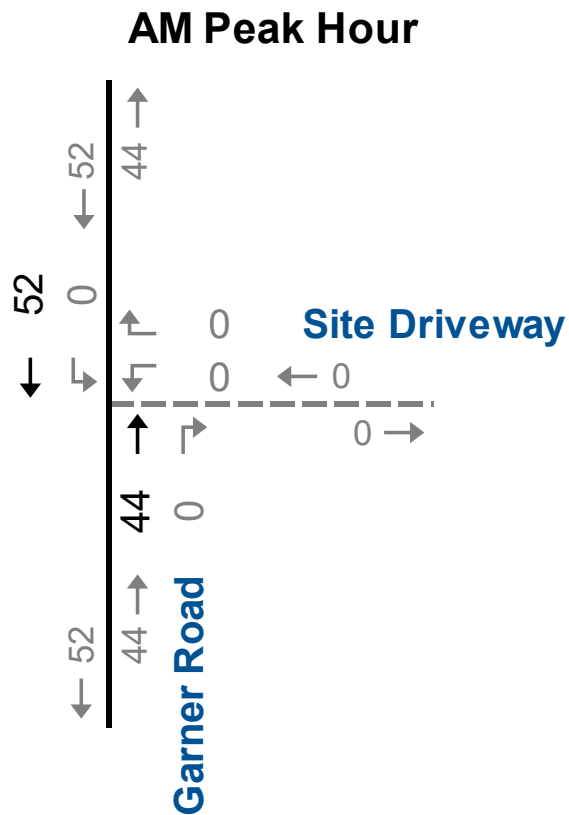
During pre-study consultations, City staff confirmed the use of a 2% per annum growth rate for estimating the future non-site increases in traffic in the study area.

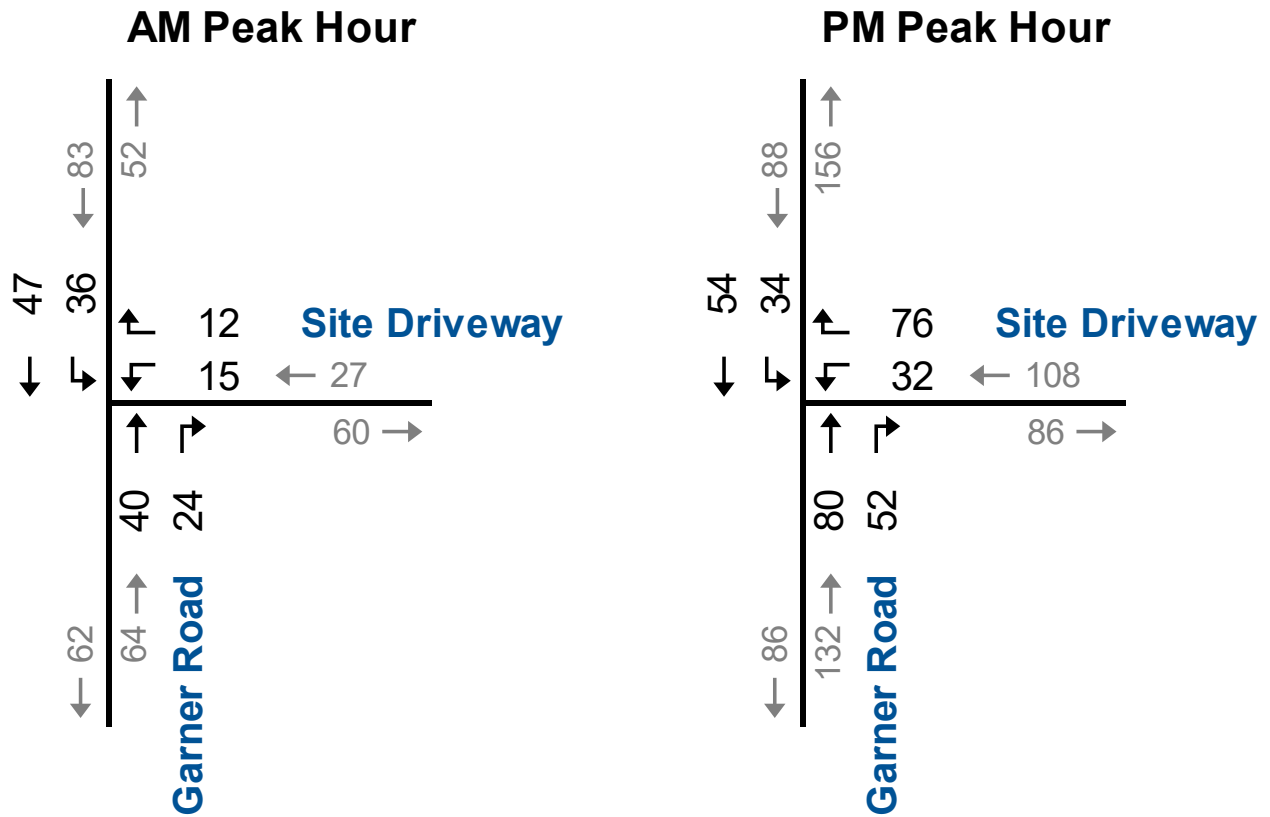
Figure 4.2 illustrates the forecast opening date background traffic volumes. **Figure 4.3** illustrates the forecast five-year background traffic volumes.

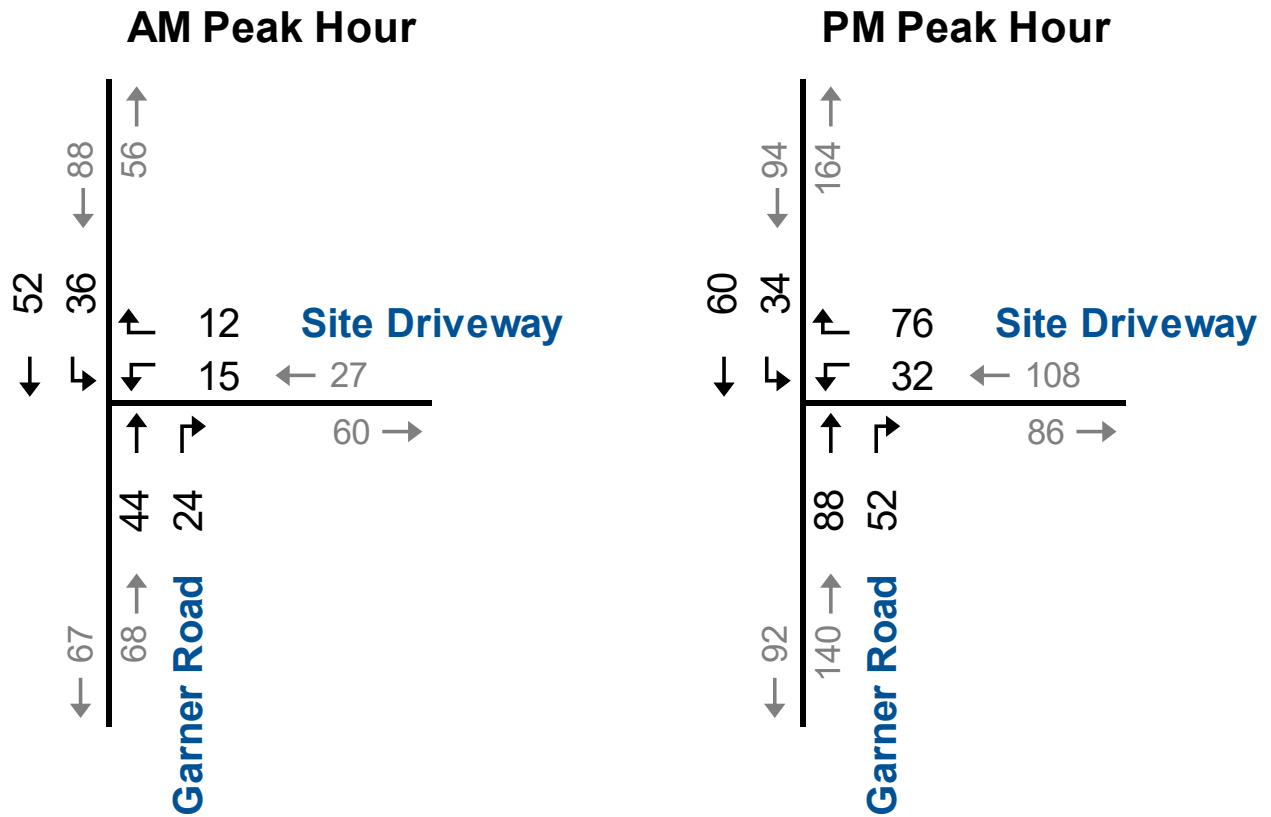
Figure 4.4 illustrates the forecast opening date total traffic volumes (background + site traffic). **Figure 4.5** illustrates the forecast five-year total traffic volumes (background + site traffic).











4 Traffic Operations

Intersection level of service (LOS) is a recognized method of quantifying the efficiency of traffic flow at intersections. It is based on the delay experienced by individual vehicles executing the various movements. The delay is related to the number of vehicles desiring to make a movement, compared to the estimated capacity for that movement. The capacity is based on several criteria related to the opposing traffic flows. The highest possible rating is LOS A, under which the average total delay is equal or less than 10.0 seconds per vehicle. When the average delay exceeds 80 seconds at signalized intersections (50 seconds at unsignalized), the movement is considered to have a LOS F and remedial measures are usually implemented if they are feasible.

The operations of the study area intersections were evaluated using Synchro 11 and HCM 2000 procedures. The intersection analysis considered the following measures of performance:

- ▶ The LOS for each turning movement. LOS is based on the average control delay per vehicle;
- ▶ The volume to capacity ratio (v/c) for each intersection; and
- ▶ 95th percentile queue length (metres).

Under the City's¹⁰ TIS Guidelines, the following criteria indicate critical conditions and signify that mitigation measures may need to be considered:

- ▶ At unsignalized intersections,
 - LOS, based on average delay per vehicle, on individual movements meets or exceeds LOS "E;" or
 - Queues for an individual movement are projected to exceed turning lane storage.

¹⁰ City of Niagara Falls, Guidelines for the Preparation of Transportation Impact Studies and Site Plan Review, November 2011



4.1 Opening Date Operations

Table 2.1 summarizes the level of service conditions for the existing traffic forecast, opening date background traffic forecast, and opening date total traffic forecast. There are no critical movements noted.

The site driveway approach is forecast to operate with delays in the LOS A range with v/c ratios of less than 0.15 with minimal queuing on the driveway approach. Site traffic is also forecast to have negligible impact to the mainline traffic operations of Garner Road. Volume to capacity ratios for northbound and southbound approaches are forecast to increase by 0.03.

Appendix E contains the detailed Synchro reports for the forecast opening date horizon.



TABLE 2.1: EXISTING AND OPENING DATE HORIZON OPERATIONS

Analysis Period	Traffic Condition	Intersection	Control Type	MOE	Direction / Movement / Approach								
					Westbound			Northbound			Southbound		
					Left	Right	Approach	Through	Right	Approach	Left	Through	Approach
AM Peak Hour	Existing	Garner Road and Site Driveway	TWSC	LOS Delay V/C 95th				A 0 0.02 0	> > > >	A 0 0 0	< < < <	A 0 0.00 0	A 0 0 0
	Background	Garner Road and Site Driveway	TWSC	LOS Delay V/C 95th				A 0 0.03 0	> > > >	A 0 0 0	< < < <	A 0 0.00 0	A 0 0 0
	Total	Garner Road and Site Driveway	TWSC	LOS Delay V/C 95th	A 9 0.03 1	> > > >	A 9 0 0	A 0 0.04 0	> > > >	A 0 0 0	< < < <	A 3 0.03 1	A 3 0 0
PM Peak Hour	Existing	Garner Road and Site Driveway	TWSC	LOS Delay V/C 95th				A 0 0.05 0	> > > >	A 0 0 0	< < < <	A 0 0.00 0	A 0 0 0
	Background	Garner Road and Site Driveway	TWSC	LOS Delay V/C 95th				A 0 0.05 0	> > > >	A 0 0 0	< < < <	A 0 0.00 0	A 0 0 0
	Total	Garner Road and Site Driveway	TWSC	LOS Delay V/C 95th	A 10 0.14 4	> > > >	A 10 0 0	A 0 0.08 0	> > > >	A 0 0 0	< < < <	A 3 0.03 1	A 3 0 0

MOE - Measure of Effectiveness

TWSC - Two-Way Stop Control

LOS - Level of Service

V/C - Volume to Capacity Ratio

95th - 95th Percentile Queue Length

> - Shared Right-Turn Lane

< - Shared Left-Turn Lane



4.2 Total Traffic Operations

The study area intersection operations followed the same methodology used for the opening date traffic conditions.

Table 4.1 summarizes the level of service conditions for the existing traffic volumes, forecast five-year background traffic volumes, and forecast five-year traffic volumes. There are no critical movements noted.

The site driveway approach is forecast to operate with delays in the LOS A range with v/c ratios of less than 0.15 with minimal queuing on the driveway approach. Site traffic is also forecast to have negligible impact to the mainline traffic operations of Garner Road. Volume to capacity ratios for northbound and southbound approaches are forecast to increase by 0.04.

Appendix F contains the detailed Synchro reports for the forecast five-year horizon.



TABLE 2.1: EXISTING AND FORECAST FIVE-YEAR TRAFFIC OPERATIONS

Analysis Period	Traffic Condition	Intersection	Control Type	MOE	Direction / Movement / Approach								
					Westbound			Northbound			Southbound		
					Left	Right	Approach	Through	Right	Approach	Left	Through	Approach
AM Peak Hour	Existing	Garner Road and Site Driveway	TWSC	LOS Delay V/C 95th				A 0 0.02 0	> > > >	A 0 0 0	< < < <	A 0 0.00 0	A 0 0 0
	Background	Garner Road and Site Driveway	TWSC	LOS Delay V/C 95th				A 0 0.03 0	> > > >	A 0 0 0	< < < <	A 0 0.00 0	A 0 0 0
	Total	Garner Road and Site Driveway	TWSC	LOS Delay V/C 95th	A 9 0.03 1	> > > >	A 9 0 0	A 0 0.04 0	> > > >	A 0 0 0	< < < <	A 3 0.03 1	A 3 0 0
PM Peak Hour	Existing	Garner Road and Site Driveway	TWSC	LOS Delay V/C 95th				A 0 0.05 0	> > > >	A 0 0 0	< < < <	A 0 0.00 0	A 0 0 0
	Background	Garner Road and Site Driveway	TWSC	LOS Delay V/C 95th				A 0 0.06 0	> > > >	A 0 0 0	< < < <	A 0 0.00 0	A 0 0 0
	Total	Garner Road and Site Driveway	TWSC	LOS Delay V/C 95th	A 10 0.14 4	> > > >	A 10 0 0	A 0 0.09 0	> > > >	A 0 0 0	< < < <	A 3 0.03 1	A 3 0 0

MOE - Measure of Effectiveness

TWSC - Two-Way Stop Control

LOS - Level of Service

V/C - Volume to Capacity Ratio

95th - 95th Percentile Queue Length

> - Shared Right-Turn Lane

< - Shared Left-Turn Lane



5 Remedial Measures

5.1 Left-Turn Lane Warrants

The Ministry of Transportation's Design Supplement to the Transportation Association of Canada (TAC) Guide for Canadian Roads¹¹ provides guidance on the assessment of and/or need for auxiliary left-turn lanes at intersections. **Appendix G** contains the left-turn lane warrant nomographs.

Based on the warrant analysis a southbound left-turn lane is not warranted at the site driveway intersection with Garner Road. No changes to the existing lane configuration at the site driveway are recommended.

5.2 Traffic Control

The site driveway intersection with Garner Road was assessed using the Ontario Traffic Manual (OTM Book 12 – Justification 7) signal warrant procedures for total traffic conditions. **Appendix H** contains the warrant analysis.

Based on the warrant analysis, a traffic control signal is not warranted at the site driveway intersection with Garner Road. Stop control is an appropriate form of traffic control for the site driveway approach.

¹¹ Transportation Association of Canada, *MTO Design Supplement for TAC Geometric Design Guide for Canadian Roads – Appendix 9A*, Ministry of Transportation of Ontario, 2017.



6 Conclusions and Recommendations

6.1 Conclusions

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

- ▶ **Study Area:** The intersections that form the study area include the Site Driveway with Garner Road.
- ▶ **Development Generated Traffic:** The subject site is forecast to generate approximately 87 AM peak hour trips and 194 PM peak hour trips.
- ▶ **Forecast Parking Demand:** The *ITE Parking Generation Manual* forecast's the site's parking demand to be approximately 105 spaces. With a parking supply of 125 spaces, the site's parking demand is forecast to be less than the proposed supply.
- ▶ **Existing Traffic Conditions:** The intersection within the study area is currently operating with acceptable levels of service and well within capacity during the AM and PM peak hours.
- ▶ **Opening Date Operations:** The intersection within the study area is forecast to operate with acceptable levels of service and well within capacity during the AM and PM peak hours.

The site driveway approach is forecast to operate with delays in the LOS A range with a v/c ratio of less than 0.15. Minimal queuing is anticipated to occur on the site driveway approach to Garner Road.

- ▶ **Five-Year Horizon Operations:** The intersection within the study area is forecast to operate with acceptable levels of service and well within capacity during the AM and PM peak hours.

The site driveway approach is forecast to operate with delays in the LOS A range with a v/c ratio of less than 0.15. Minimal queuing is anticipated to occur on the site driveway approach to Garner Road.

- ▶ **Remedial Measures:** A southbound left-turn lane is not warranted at the proposed site driveway intersection with Garner Road. No changes to the existing lane configuration is recommended.

Stop control is an appropriate form of traffic control for the site driveway approach to Garner Road.



6.2 Recommendations

Based on the findings of this study, it is recommended the site driveway approach to Garner Road operate under stop control. An Ra-1 (STOP SIGN) be added to the site driveway approach.



Appendix A

Pre-Study Consultation



Creighton Chartier

From: Creighton Chartier
Sent: June 14, 2023 11:01 AM
To: John Grubich
Cc: Scott Catton
Subject: RE: [EXTERNAL]-Scope of Work - TIS - Garner Road and Warren Woods Avenue Commercial Block (Block 302 of Plan 59M-463)

Thank you for the response John.

Regards,

Creighton Chartier

Transportation Consultant, Associate
(he/him)

Paradigm Transportation Solutions Limited

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m: 905.242.2420
w: www.ptsl.com



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From: John Grubich <jgrubich@niagarafalls.ca>
Sent: Wednesday, June 14, 2023 10:31 AM
To: Creighton Chartier <cchartier@ptsl.com>
Cc: Scott Catton <scatton@ptsl.com>
Subject: RE: [EXTERNAL]-Scope of Work - TIS - Garner Road and Warren Woods Avenue Commercial Block (Block 302 of Plan 59M-463)

Creighton;

Thank you for forwarding your terms of reference for this project.

I made some notes within your e-mail.

Please let me know 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

From: Creighton Chartier <cchartier@ptsl.com>
Sent: Tuesday, June 13, 2023 10:51 AM

To: John Grubich <jgrubich@niagarafalls.ca>; Dunsmore, Susan <Susan.Dunsmore@niagararegion.ca>

Cc: Scott Catton <scatton@ptsl.com>

Subject: [EXTERNAL]-Scope of Work - TIS - Garner Road and Warren Woods Avenue Commercial Block (Block 302 of Plan 59M-463)

Hello All,

Paradigm has been retained to prepare a Transportation Impact Study for the proposed development of Block 302 of Plan 59M-463 in the City of Niagara Falls. The subject site is located on the northeast corner of Warren Woods Avenue and Garner Road. The conceptual site plan is attached.

The property owner is proposing a retail plaza with second storey office space. The proposed development is comprised of two buildings; building one contains 1,014 m² of retail space while building two contains 1,286 m² of retail space with 1,286 m² of office space on the second level. Vehicle access is proposed by a private driveway to Garner Road located approximately 95 metres north of Warren Woods Avenue (Centreline to Centreline). A pedestrian/emergency connection is proposed to Dockweed Drive. This connection will be closed to regular traffic through use of bollards. A total parking supply of 131 spaces is proposed. The build-out date is TBD.

Proposed Terms of Reference (Transportation Impact Study)

Study Guidelines:

- Generally follow the City of Niagara Falls Guidelines for the Preparation of Transportation Impact Studies and Site Plan Review.

Study Area Intersections:

- ~~Garner Road at Warren Woods Avenue (unsignalized); and~~ **remove**
- Garner Road at the proposed site driveway.

Analysis Periods:

- Weekday AM peak hour
- Weekday PM peak hour

Existing Data:

- Collect new TMC data for the above noted intersections. **Collect Traffic volumes on Garner Road north of Warren Woods Avenue by the proposed plaza only**

Horizon Year:

- Existing conditions
Opening Day/year
- Five-years from ~~the date the study~~ **opening day/year**

Analysis:

- Synchro 11 with HCM 2000 analysis

Site Circulation:

- AutoTURN Analysis for the following design vehicles:
 - Garbage Truck
 - TAC MSU
 - TAC P
 - Fire Truck (on-site fire route(s) only)

Traffic Forecast:

- Background traffic annual growth rate of 2% per annum.

- Other approved developments to include in background. **Please identify if any specific development applications should be included. No other developments to include as background traffic**

Trip Generation:

- ITE Trip Generation Data 11th Edition
 - Strip Retail Plaza (LUC 822)
 - General Office Building (LUC 710)
- Preliminary trip generation
 - AM Peak Hour – 83 total (58 in and 25 out)
 - PM Peak Hour – 180 total (79 in and 101 out)
- No modal split reductions.

Trip Distribution:

- Existing Traffic Patterns

Future Road Improvements:

- **None, unless identified - none for the immediate area**

Remedial Measures:

- OTM Traffic Control signal warrants
- Left-Turn lane warrants

Report:

- Report documenting the study methodologies, findings and conclusions.

Regards,

Creighton Chartier

Transportation Consultant, Associate
(he/him)

Paradigm Transportation Solutions Limited

5A-150 Pinebush Road, Cambridge ON N1R 8J8
p: 905.381.2229 x504
m: 905.242.2420
w: www.ptsl.com



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Creighton Chartier

From: Dunsmore, Susan <Susan.Dunsmore@niagararegion.ca>
Sent: June 13, 2023 3:22 PM
To: Creighton Chartier; John Grubich
Cc: Scott Catton
Subject: RE: Scope of Work - TIS - Garner Road and Warren Woods Avenue Commercial Block (Block 302 of Plan 59M-463)

Hello

Thank you for circulating us on this terms of reference, the Region did not require a TIS for this development, therefore we have no comments on the scope if you require anything further please contact me at your convenience.

Thank you



Susan M. Dunsmore, P.Eng.

MANAGER, DEVELOPMENT ENGINEERING

Niagara Region, 1815 Sir Isaac Brock Way, Thorold, ON, L2V 4T7

P : (905) 980 - 6000 ext. 3661

W : www.niagararegion.ca

E : susan.dunsmore@niagararegion.ca



From: Creighton Chartier <cchartier@ptsl.com>
Sent: Tuesday, June 13, 2023 10:51 AM
To: John Grubich <jgrubich@niagarafalls.ca>; Dunsmore, Susan <Susan.Dunsmore@niagararegion.ca>
Cc: Scott Catton <scatton@ptsl.com>
Subject: Scope of Work - TIS - Garner Road and Warren Woods Avenue Commercial Block (Block 302 of Plan 59M-463)

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- Garner Road at Warren Woods Avenue (unsignalized); and
- Garner Road at the proposed site driveway.

Analysis Periods:

- Weekday AM peak hour
- Weekday PM peak hour

Existing Data:

- Collect new TMC data for the above noted intersections.

Horizon Year:

- Existing conditions
- Five-years from the date the study

Analysis:

- Synchro 11 with HCM 2000 analysis

Site Circulation:

- AutoTURN Analysis for the following design vehicles:
 - Garbage Truck
 - TAC MSU
 - TAC P
 - Fire Truck (on-site fire route(s) only)

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 - Strip Retail Plaza (LUC 822)
 - General Office Building (LUC 710)
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- No modal split reductions.

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- Existing Traffic Patterns

Future Road Improvements:

- **None, unless identified**

Remedial Measures:

- OTM Traffic Control signal warrants
- Left-Turn lane warrants

Report:

- Report documenting the study methodologies, findings and conclusions.

Regards,

Creighton Chartier

Transportation Consultant, Associate
(he/him)

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Appendix B

Existing Data



Garner Rd @ Warren Woods Ave

Morning Peak Diagram

Specified Period

From: 7:00:00

To: 9:00:00

One Hour Peak

From: 7:45:00

To: 8:45:00

Municipality: Niagara Falls

Site #: 0000000001

Intersection: Garner Rd & Warren Woods Ave

TFR File #: 1

Count date: 12-Jul-2023

Weather conditions:

Clear/Dry

Person(s) who counted:

Cam

** Non-Signalized Intersection **

Major Road: Garner Rd runs N/S

North Leg Total: 83

North Entering: 45

North Peds: 0

Peds Cross: ∇

Heavys	2	0	2
Trucks	0	0	0
Cars	39	4	43
Totals	41	4	

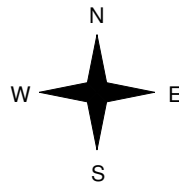
Heavys	1
Trucks	0
Cars	37
Totals	38

East Leg Total: 14

East Entering: 9

East Peds: 1

Peds Cross: ∇



Cars	Trucks	Heavys	Totals
6	0	0	6
2	1	0	3
8	1	0	

Warren Woods Ave



Garner Rd

Cars	41	Cars	31	0	31
Trucks	1	Trucks	0	1	1
Heavys	2	Heavys	1	0	1
Totals	44	Totals	32	1	

Peds Cross: ∇

South Peds: 0

South Entering: 33

South Leg Total: 77

Comments

Garner Rd @ Warren Woods Ave

Afternoon Peak Diagram

Specified Period

From: 15:00:00

To: 18:00:00

One Hour Peak

From: 16:15:00

To: 17:15:00

Municipality: Niagara Falls

Site #: 0000000001

Intersection: Garner Rd & Warren Woods Ave

TFR File #: 1

Count date: 12-Jul-2023

Weather conditions:

Clear/Dry

Person(s) who counted:

Cam

** Non-Signalized Intersection **

Major Road: Garner Rd runs N/S

North Leg Total: 129

North Entering: 52

North Peds: 2

Peds Cross: \times

Heavys	3	0	3
Trucks	0	0	0
Cars	32	17	49
Totals	35	17	

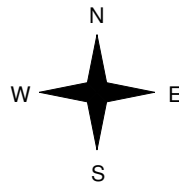
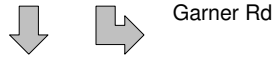
Heavys	1
Trucks	1
Cars	75
Totals	77

East Leg Total: 44

East Entering: 17

East Peds: 0

Peds Cross: \times



Cars	Trucks	Heavys	Totals
16	0	0	16
1	0	0	1
17	0	0	

Warren Woods Ave



Garner Rd

Cars	33	Cars	59	10	69
Trucks	0	Trucks	1	0	1
Heavys	3	Heavys	1	0	1
Totals	36	Totals	61	10	

Peds Cross: \times

South Peds: 0

South Entering: 71

South Leg Total: 107

Comments

Garner Rd @ Warren Woods Ave

Total Count Diagram

Municipality: Niagara Falls

Site #: 0000000001

Intersection: Garner Rd & Warren Woods Ave

TFR File #: 1

Count date: 12-Jul-2023

Weather conditions:

Clear/Dry

Person(s) who counted:

Cam

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

Major Road: Garner Rd runs N/S

North Leg Total: 475

North Entering: 234

North Peds: 2

Peds Cross: ∇

Heavys	9	1	10
Trucks	0	0	0
Cars	165	59	224
Totals	174	60	

Heavys	5
Trucks	2
Cars	234
Totals	241

East Leg Total: 132

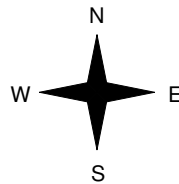
East Entering: 56

East Peds: 1

Peds Cross: ∇



Garner Rd



Cars	Trucks	Heavys	Totals
49	0	0	49
6	1	0	7
55	1	0	



Warren Woods Ave



Garner Rd



Cars	171
Trucks	1
Heavys	9
Totals	181



Cars	185	14	199
Trucks	2	1	3
Heavys	5	1	6
Totals	192	16	

Peds Cross: ∇

South Peds: 1

South Entering: 208

South Leg Total: 389

Comments

Appendix C

AutoTURN Swept Path Analysis

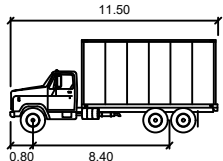




THIS AUTOTURN SWEEP PATH ANALYSIS HAS BEEN PREPARED USING BASE PLANS PROVIDED BY OTHERS. THE PRACTITIONER HAS NOT INSPECTED THE ACCURACY AND/OR THE COMPLETENESS OF THESE BASE PLANS AND SHALL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH MAY BE INCORPORATED HEREIN AS A RESULT.

NO.	DATE	INITIAL	REVISION DETAIL

DESIGN VEHICLE:



HSU

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

AUTOTURN ASSESSMENT GARNER ROAD & WARREN WOODS NIAGARA FALLS, ON



PROJECT NO.: 230368

DATE: DECEMBER 2023

SCALE: 1:550

DRAWING NO.:

DRAWN: LC

DESIGN: LC

CHECK: SC

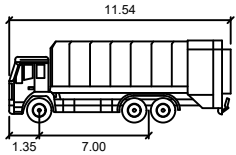
03



THIS AUTOTURN SWEEP PATH ANALYSIS HAS BEEN PREPARED USING BASE PLANS PROVIDED BY OTHERS. THE PRACTITIONER HAS NOT INSPECTED THE ACCURACY AND/OR THE COMPLETENESS OF THESE BASE PLANS AND SHALL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH MAY BE INCORPORATED HEREIN AS A RESULT.

NO.	DATE	INITIAL	REVISION DETAIL

DESIGN VEHICLE:



Niagara Region Grbg

meters

Width : 2.98
Track : 2.98
Lock to Lock Time : 3.0
Steering Angle : 37.2

AUTOTURN ASSESSMENT
GARNER ROAD & WARREN WOODS
NIAGARA FALLS, ON



PROJECT NO.: 230368

DATE: DECEMBER 2023

SCALE: 1:550

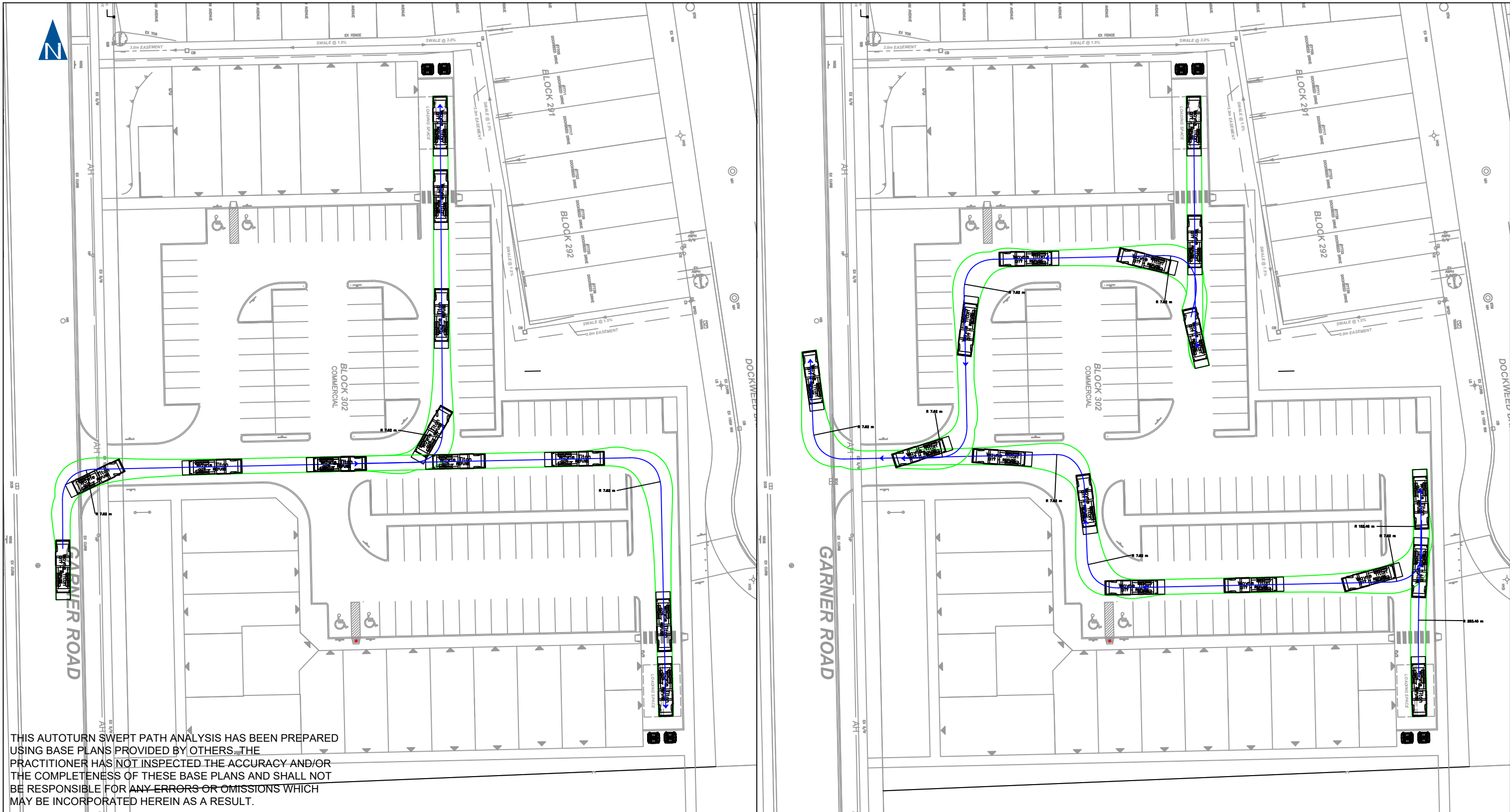
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DRAWN: LC

DESIGN: LC

CHECK: SC

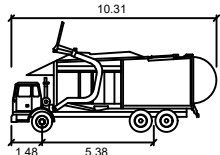
04



THIS AUTOTURN SWEEP PATH ANALYSIS HAS BEEN PREPARED USING BASE PLANS PROVIDED BY OTHERS. THE PRACTITIONER HAS NOT INSPECTED THE ACCURACY AND/OR THE COMPLETENESS OF THESE BASE PLANS AND SHALL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH MAY BE INCORPORATED HEREIN AS A RESULT.

NO.	DATE	INITIAL	REVISION DETAIL

DESIGN VEHICLE:



Wayne Titan

Width : 2.58
Track : 2.44
Lock to Lock Time : 6.0
Steering Angle : 45.0

AUTOTURN ASSESSMENT
GARNER ROAD & WARREN WOODS
NIAGARA FALLS, ON



PROJECT NO.: 230368

DATE: DECEMBER 2023

SCALE: 1:550

DRAWING NO.:

DRAWN: LC

DESIGN: LC

CHECK: SC

05

Appendix D










Existing Year Traffic Operations Reports



HCM Unsignalized Intersection Capacity Analysis

101: Garner Road & Site Driveway










AM - Existing Traffic
(230368) Warran Woods Commercial Block

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	0	38	0	0	45
Future Volume (Veh/h)	0	0	38	0	0	45
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	41	0	0	49
Pedestrians	1					
Lane Width (m)	3.6					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	91	42			42	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	91	42			42	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	909	1028			1566	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	0	41	49			
Volume Left	0	0	0			
Volume Right	0	0	0			
cSH	1700	1700	1566			
Volume to Capacity	0.00	0.02	0.00			
Queue Length 95th (m)	0.0	0.0	0.0			
Control Delay (s)	0.0	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	0.0	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utilization			7.0%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

101: Garner Road & Site Driveway

AM - Existing Traffic
(230368) Warran Woods Commercial Block

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	0	77	0	0	52
Future Volume (Veh/h)	0	0	77	0	0	52
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	84	0	0	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	141	84			84	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	141	84			84	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	852	975			1513	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	0	84	57			
Volume Left	0	0	0			
Volume Right	0	0	0			
cSH	1700	1700	1513			
Volume to Capacity	0.03	0.05	0.00			
Queue Length 95th (m)	0.0	0.0	0.0			
Control Delay (s)	0.0	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	0.0	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utilization			7.7%	ICU Level of Service	A	
Analysis Period (min)			15			

Appendix E










Opening Year Traffic Operations Reports



HCM Unsignalized Intersection Capacity Analysis

101: Garner Road & Site Driveway










AM - Opening Year Traffic
(230368) Warran Woods Commercial Block

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	15	12	40	24	36	47
Future Volume (Veh/h)	15	12	40	24	36	47
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	13	43	26	39	51
Pedestrians	1					
Lane Width (m)	3.6					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	186	57			70	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	186	57			70	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	99			97	
cM capacity (veh/h)	782	1008			1529	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	29	69	90			
Volume Left	16	0	39			
Volume Right	13	26	0			
cSH	870	1700	1529			
Volume to Capacity	0.03	0.04	0.03			
Queue Length 95th (m)	0.8	0.0	0.6			
Control Delay (s)	9.3	0.0	3.3			
Lane LOS	A		A			
Approach Delay (s)	9.3	0.0	3.3			
Approach LOS	A					
Intersection Summary						
Average Delay			3.0			
Intersection Capacity Utilization			21.5%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

101: Garner Road & Site Driveway










AM - Opening Year Traffic
(230368) Warran Woods Commercial Block

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	32	76	80	52	34	54
Future Volume (Veh/h)	32	76	80	52	34	54
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	35	83	87	57	37	59
Pedestrians	1					
Lane Width (m)	3.6					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	250	116			145	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	250	116			145	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	95	91			97	
cM capacity (veh/h)	719	935			1436	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	118	144	96			
Volume Left	35	0	37			
Volume Right	83	57	0			
cSH	859	1700	1436			
Volume to Capacity	0.14	0.08	0.03			
Queue Length 95th (m)	3.8	0.0	0.6			
Control Delay (s)	9.9	0.0	3.0			
Lane LOS	A		A			
Approach Delay (s)	9.9	0.0	3.0			
Approach LOS	A					
Intersection Summary						
Average Delay			4.1			
Intersection Capacity Utilization			30.4%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis










101: Garner Road & Site Driveway

AM - Opening Year Background Traffic
(230368) Warran Woods Commercial Block

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	0	40	0	0	47
Future Volume (Veh/h)	0	0	40	0	0	47
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	43	0	0	51
Pedestrians	1					
Lane Width (m)	3.6					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	95	44			44	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	95	44			44	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	904	1025			1563	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	0	43	51			
Volume Left	0	0	0			
Volume Right	0	0	0			
cSH	1700	1700	1563			
Volume to Capacity	0.03	0.03	0.00			
Queue Length 95th (m)	0.0	0.0	0.0			
Control Delay (s)	0.0	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	0.0	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utilization			7.0%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis 101: Garner Road & Site Driveway

PM - Opening Year Background Traffic
(230368) Garner Road & Warren Woods

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	0	80	0	0	54
Future Volume (Veh/h)	0	0	80	0	0	54
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	87	0	0	59
Pedestrians	1					
Lane Width (m)	3.6					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	147	88			88	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	147	88			88	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	845	969			1506	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	0	87	59			
Volume Left	0	0	0			
Volume Right	0	0	0			
cSH	1700	1700	1506			
Volume to Capacity	0.13	0.05	0.00			
Queue Length 95th (m)	0.0	0.0	0.0			
Control Delay (s)	0.0	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	0.0	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utilization			8.2%	ICU Level of Service		A
Analysis Period (min)			15			

Appendix F










Total Traffic Operations Reports



HCM Unsignalized Intersection Capacity Analysis

101: Garner Road & Site Driveway










AM Peak Period - Total Traffic
(230368) Warran Woods Commercial Block

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	15	12	44	24	36	52
Future Volume (Veh/h)	15	12	44	24	36	52
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	13	48	26	39	57
Pedestrians	1					
Lane Width (m)	3.6					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	197	62			75	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	197	62			75	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	99			97	
cM capacity (veh/h)	771	1002			1523	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	29	74	96			
Volume Left	16	0	39			
Volume Right	13	26	0			
cSH	860	1700	1523			
Volume to Capacity	0.03	0.04	0.03			
Queue Length 95th (m)	0.8	0.0	0.6			
Control Delay (s)	9.3	0.0	3.1			
Lane LOS	A		A			
Approach Delay (s)	9.3	0.0	3.1			
Approach LOS	A					
Intersection Summary						
Average Delay			2.9			
Intersection Capacity Utilization			21.8%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

101: Garner Road & Site Driveway










PM - Total Traffic
(230368) Warran Woods Commercial Block

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	32	76	88	52	34	60
Future Volume (Veh/h)	32	76	88	52	34	60
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	35	83	96	57	37	65
Pedestrians	1					
Lane Width (m)	3.6					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	264	126			154	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	264	126			154	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	95	91			97	
cM capacity (veh/h)	705	924			1425	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	118	153	102			
Volume Left	35	0	37			
Volume Right	83	57	0			
cSH	846	1700	1425			
Volume to Capacity	0.14	0.09	0.03			
Queue Length 95th (m)	3.9	0.0	0.6			
Control Delay (s)	9.9	0.0	2.9			
Lane LOS	A		A			
Approach Delay (s)	9.9	0.0	2.9			
Approach LOS	A					
Intersection Summary						
Average Delay			3.9			
Intersection Capacity Utilization			31.1%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis AM Peak Period - Total Background Traffic










101: Garner Road & Site Driveway

(230368) Garner Road & Warren Woods

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	0	44	0	0	52
Future Volume (Veh/h)	0	0	44	0	0	52
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	48	0	0	57
Pedestrians	1					
Lane Width (m)	3.6					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	106	49			49	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	106	49			49	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	891	1019			1557	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	0	48	57			
Volume Left	0	0	0			
Volume Right	0	0	0			
cSH	1700	1700	1557			
Volume to Capacity	0.03	0.03	0.00			
Queue Length 95th (m)	0.0	0.0	0.0			
Control Delay (s)	0.0	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	0.0	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utilization			7.0%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis 101: Garner Road & Site Driveway

PM - Total Background Traffic
(230368) Warran Woods Commercial Block

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	0	88	0	0	60
Future Volume (Veh/h)	0	0	88	0	0	60
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	96	0	0	65
Pedestrians	1					
Lane Width (m)	3.6					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	162	97			97	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	162	97			97	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	828	958			1495	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	0	96	65			
Volume Left	0	0	0			
Volume Right	0	0	0			
cSH	1700	1700	1495			
Volume to Capacity	0.13	0.06	0.00			
Queue Length 95th (m)	0.0	0.0	0.0			
Control Delay (s)	0.0	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	0.0	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utilization			8.6%	ICU Level of Service	A	
Analysis Period (min)			15			

Appendix G

Left Turn Lane Warrant Nomograph



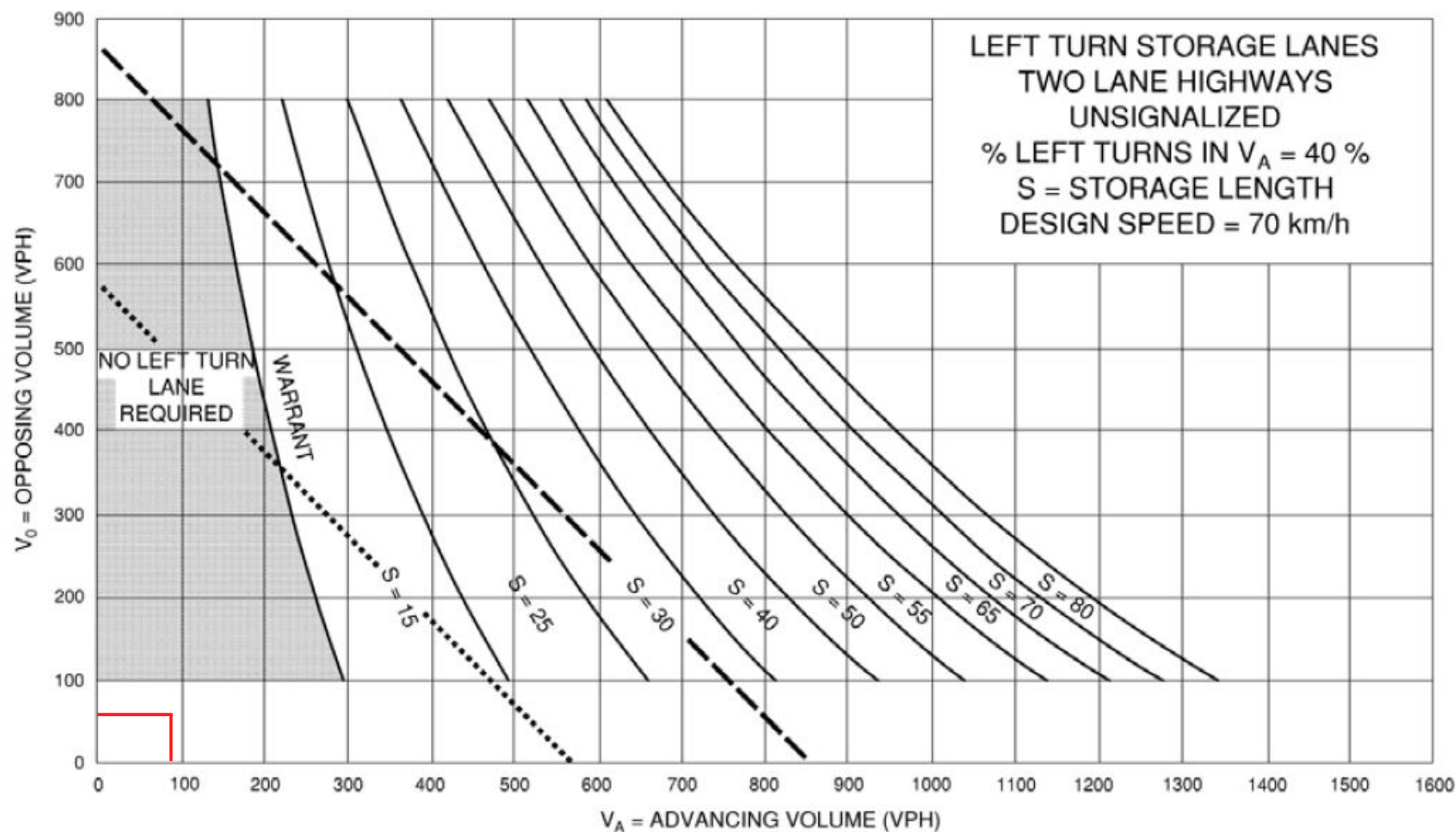
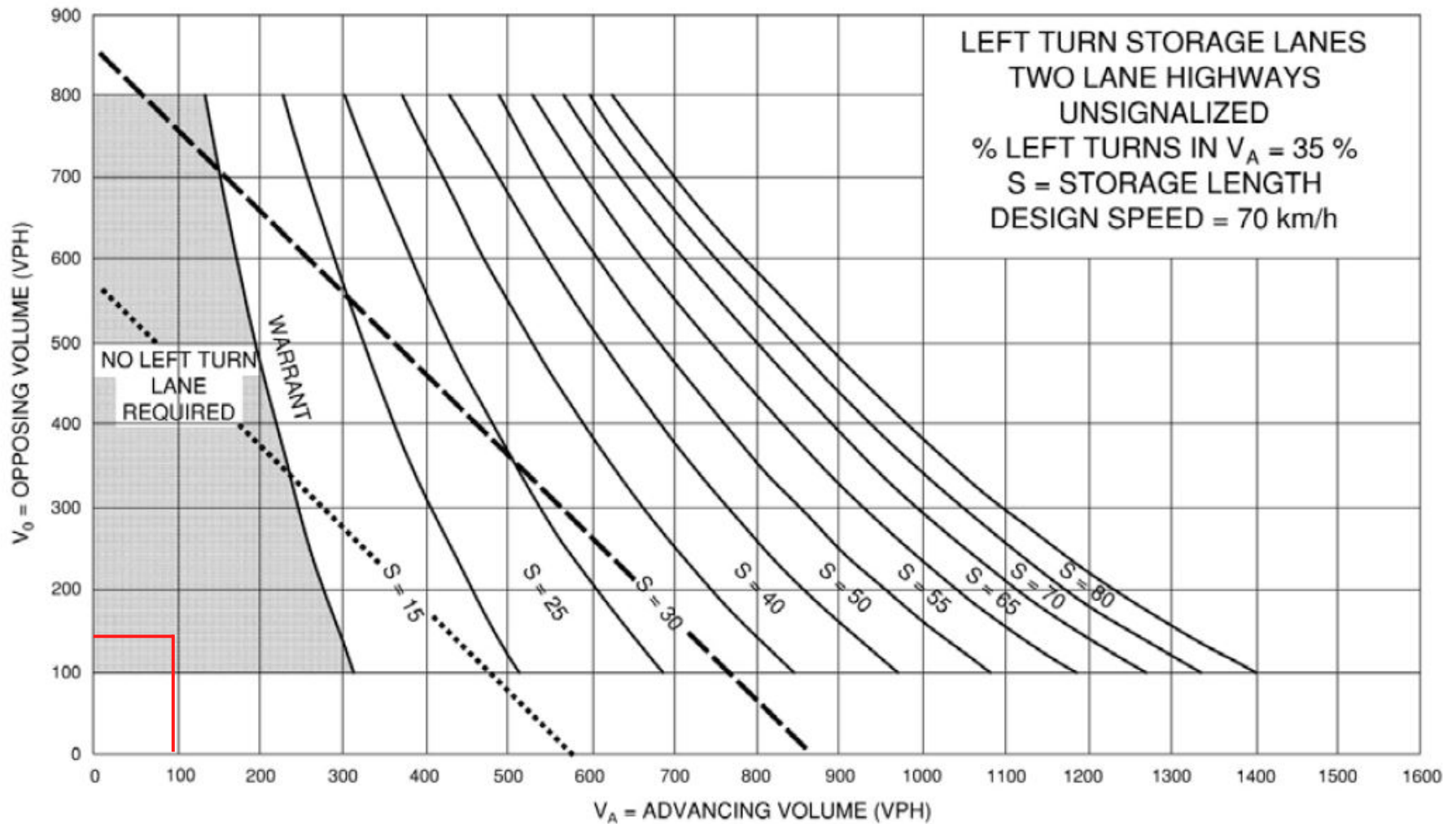


Exhibit 9A-13



Appendix H

OTM Book 12 – Justification 7 Signal Warrant



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



Horizon Year: _____ Total Traffic _____
Region/City/Township: City of Niagara Falls

Major Street: Garner Road North/South: Y
Minor Street: Site Driveway

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

Time Period	Major Street						Minor Street						Peds Crossing Main Road
	Garner Road						Site Driveway						
	Northbound			Southbound			Eastbound			Westbound			
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
AM Peak Hour		44	24	36	52					15		12	0
PM Peak Hour		88	52	34	60					32		76	0
Average Hourly Volume	0	33	19	18	28	0	0	0	0	12	0	22	0

Warrant 1 - Minimum Vehicular Volume

1A	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
	X					
	All Approaches	480	720	600	900	
% Fulfilled						27.3%

1B	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
	X					
	Minor Street Approaches	180	255	180	255	
% Fulfilled						18.8%

Warrant	AHV
1A - All	131
1B - Mino	34
2A - Majo	98
2B - Cros	12

Warrant 2 - Delay To Cross Traffic

2A	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
	X					
	Major Street Approaches	480	720	600	900	
% Fulfilled						20.3%

2B	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
	X					
	Traffic Crossing Major Street	50	75	50	75	
% Fulfilled						23.5%