# 825 Garrison Road, Fort Erie ON

Traffic Impact Brief

Stantec

Prepared for:
Upper Canada Planning & Engineering Ltd.

Prepared by:
Stantec Consulting Ltd.

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Stantec Consulting Ltd.

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Prepared by: Christine Del Rosario

Reviewed by: Ahmad Kamal

Approved by: Mark Bekkers P.Eng

# Table of Contents


**1 Introduction ..... 1**
1.1 Proposed Development ..... 1
1.2 Study Area ..... 1
1.3 Study Scenarios, Horizons, and Growth Rates ..... 2

**2 Existing Conditions ..... 3**
2.1 Traffic Volumes ..... 3

**3 Future Background Conditions ..... 4**
3.1 Background Developments ..... 4
3.2 Traffic Volumes ..... 5

**4 Site Trips ..... 6**
4.1 Trip Generation ..... 6
4.2 Trip Distribution and Assignment ..... 6

**5 Future Total Conditions ..... 7**
5.1 Traffic Volumes ..... 7
5.2 Methodology ..... 9
5.3 Traffic Operations Analysis ..... 9

**6 Access Management Analysis ..... 11**
6.1 Site Access Sightline Review ..... 11
6.2 Access Design Review ..... 15
6.3 Swept Path Analysis ..... 15

**7 Conclusions and Recommendations ..... 15**


### List of Tables


Table 1: Background Developments ..... 4
Table 2: Proposed Development Vehicular Trip Generation Results ..... 6
Table 3: Level of Service Criteria, Unsignalized Intersection ..... 9
Table 4: ICA results, Future Total Conditions 2027 ..... 9
Table 5: ICA Results, Future Total Conditions 2032 ..... 10
Table 6: ISD Calculation Results for Single-unit Trucks ..... 12
Table 7: Driveway Dimensions Review ..... 15


### List of Figures


Figure 1: Proposed Site Location and Study Area Intersection ..... 2
Figure 2: Existing Conditions (2025) Peak Hour Traffic Volumes ..... 3
Figure 3: Background Developments ..... 4
Figure 4: Future Background Conditions (2027) Peak Hour Traffic Volumes ..... 5
Figure 5: Future Background Conditions (2032) Peak Hour Traffic Volumes ..... 5
Figure 6: Site Trip Assignment ..... 7

Figure 7: Future Total Conditions (2027) Peak Hour Traffic Volumes....8
Figure 8: Future Total Conditions (2032) Peak Hour Volumes....8
Figure 9: Available Westbound Left-Turn Storage Length....11
Figure 10: Intersection Sight Distance Requirements for Left/Right Turns Out of the Site Access....13
Figure 11: Intersection Sight Distance Requirements for Left Turns into the Site Access....14

## List of Appendices

**Appendix A Site Plan**
**Appendix B Synchro Outputs**
**Appendix C AutoTURN Outputs**

# 1 Introduction

Stantec Consulting Ltd. has been retained by Upper Canada Planning and Engineering Ltd. to conduct a Traffic Impact Brief (TIB) for the proposed residential development located at 825 Garrison Road, Fort Erie, Ontario.

The purpose of this study is to examine the potential impacts of the proposed development on the surrounding transportation network.

The primary objectives of this TIB are to:

- Estimate the peak hour traffic generation from the proposed development;
- Analyze the intersection capacity for the study area intersection under future conditions;
- Recommend intersection improvements, where required, to maintain an acceptable level of service; and
- Evaluate the proposed site access location on Garrison Road based on applicable design guidelines

## 1.1 Proposed Development

The proposed 6-storey residential development will consist of 100 units with an approximate Gross Floor Area (GFA) of 2,060.59 square metres. It will have one full-moves access along Garrison Road and a proposed 150 parking spaces on-site. The proposed site plan is illustrated in **Appendix A**.

## 1.2 Study Area

The proposed study area is shown in **Figure 1** which comprises of the site access intersection with Garrison Road.

*Figure 1: Proposed Site Location and Study Area Intersection*

## 1.3 Study Scenarios, Horizons, and Growth Rates

Based on consultation and confirmation with Niagara Region and the Town of Fort Erie, this study investigated the following study horizons:

- Existing Conditions in 2025
- Future Horizon Year in 2027 – representing the approximate build-out year (2 years from the Existing Conditions year)
- Future Horizon Year in 2032 – representing 5 years post build-out year

For each of the future horizon years, two scenarios were analyzed:

- Projected background traffic without the proposed development
- Projected total traffic with the proposed development

Traffic volumes along Garrison Road were taken from the *Crescent Acres Traffic Impact Assessment* prepared by Stantec Consulting Ltd in 2024. The traffic volumes for the intersection of Garrison Road and Crescent Road were collected in 2023.

An annual growth rate of 1% was applied to the 2023 collected traffic volumes along Garrison Road, projecting them to Existing Conditions year 2025, and Future Horizon years 2027 and 2032, as agreed upon with Niagara Region.

# 2 Existing Conditions

## 2.1 Traffic Volumes

The traffic volume distribution for the weekday AM and PM peak hours in the existing conditions is illustrated in **Figure 2**.

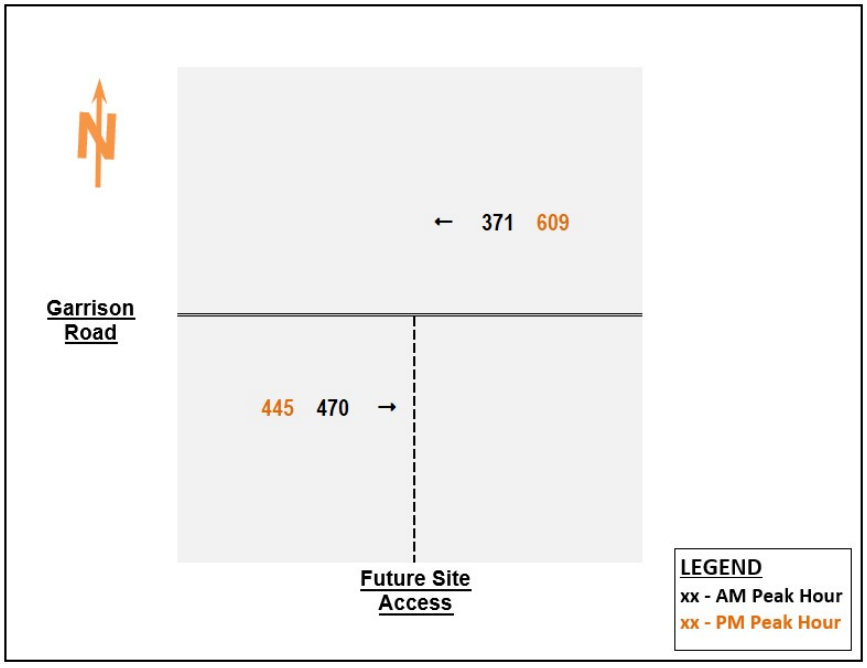



*Figure 2: Existing Conditions (2025) Peak Hour Traffic Volumes*

# 3 Future Background Conditions

## 3.1 Background Developments

A review of Fort Erie's list of Planning Department applications was conducted. The background developments identified in **Table 1** and shown in **Figure 3** were considered as part of the analysis.

*Table 1: Background Developments*

| No. | Background Development | Land Use | Proposed Units |
|---|---|---|---|
| 1 | Crescent Acres Subdivision | Residential | 85 single-family, 8 semi-detached, 145 townhouses |
| 2 | 1199, 1211, 1225 & 1237 Pettit Road | Residential | 15 single-detached, 8 semi-detached, 107 townhouses |
| 3 | 1127 Garrison Road | Residential | 90 stacked townhouses |

*Figure 3: Background Developments*

## 3.2 Traffic Volumes

The traffic volumes distribution for the weekday AM and PM peak hours in the future background conditions 2027 and 2032 are illustrated in **Figure 4** and **Figure 5** respectively.

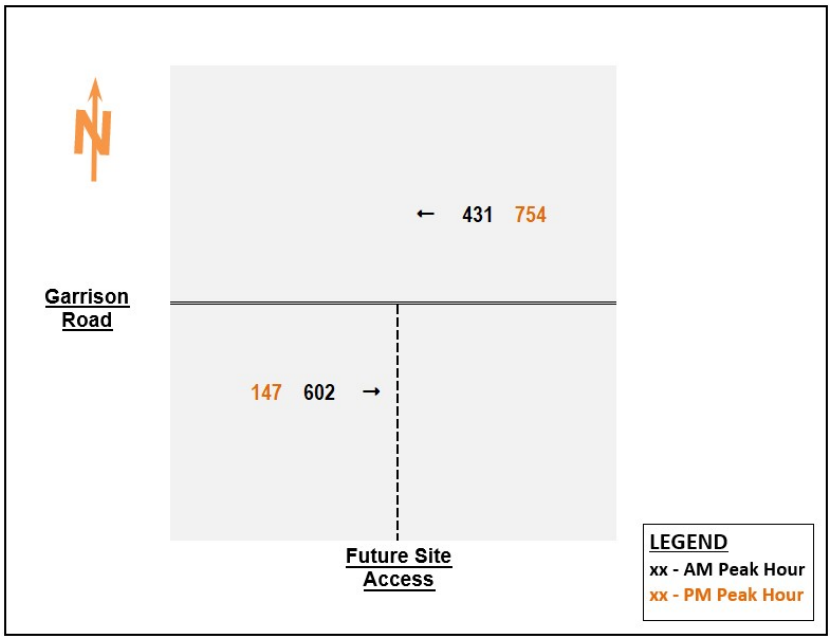



*Figure 4: Future Background Conditions (2027) Peak Hour Traffic Volumes*

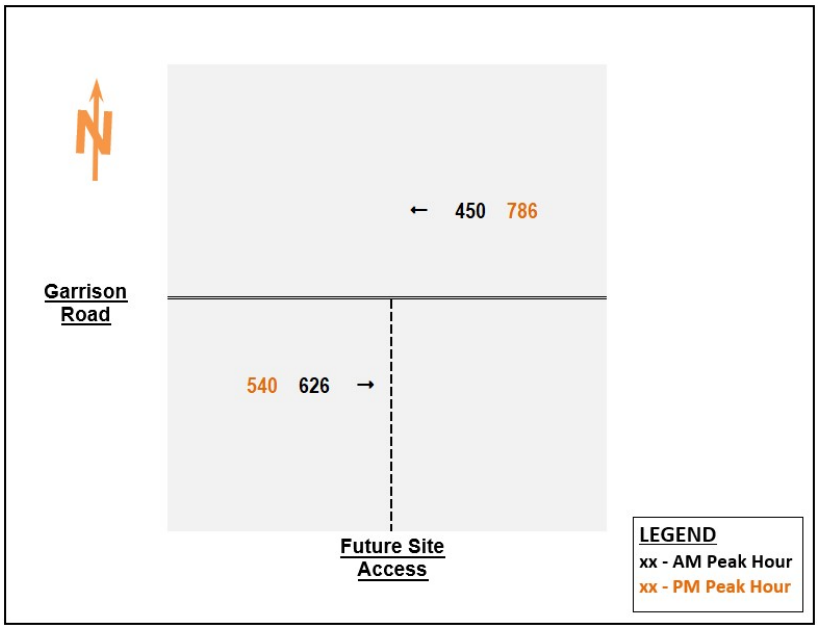



*Figure 5: Future Background Conditions (2032) Peak Hour Traffic Volumes*

# 4 Site Trips

## 4.1 Trip Generation

Vehicular trip generation for the proposed land use on the site was calculated using the Institute of Transportation Engineers' (ITE) Trip Generation Manual, 11th edition. The vehicular trip generation calculated for the proposed development is based on ITE Land Use Code (LUC) 221 – Multifamily Housing (Mid-Rise). This category is typically used for apartments and condominiums with four to 10 floors of living space.

The vehicular trip generation results for the proposed development are provided in **Table 2**. Both the fitted curve equation method and the average rate method were used to compute the trips generated by the site. To remain conservative, the method that produced the higher number of total trips were used in the study.

*Table 2: Proposed Development Vehicular Trip Generation Results*

| LUC | Variable | Units | Fitted Curve Equation | Average Rate | Total Trip Generation | IN | | OUT | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | % | # | % | # |
| ***AM Peak Hour*** | | | | | | | | | |
| 221 | GFA (1000 sqft) | 100 | T = 0.44(X)-11.61 | 0.37 | 37 | 23% | 9 | 77% | 28 |
| ***PM Peak Hour*** | | | | | | | | | |
| 221 | GFA (1000 sqft) | 100 | T = 0.39(X)+0.34 | 0.39 | 39 | 61% | 24 | 39% | 15 |

## 4.2 Trip Distribution and Assignment

The trips generated by the proposed development were distributed to the road network based on estimated travel patterns with respect to the surrounding area (e.g. Highway on and off ramps, commercial developments, etc.)

**Figure 6** shows the resulting AM and PM peak hour inbound and outbound site trip assignment.

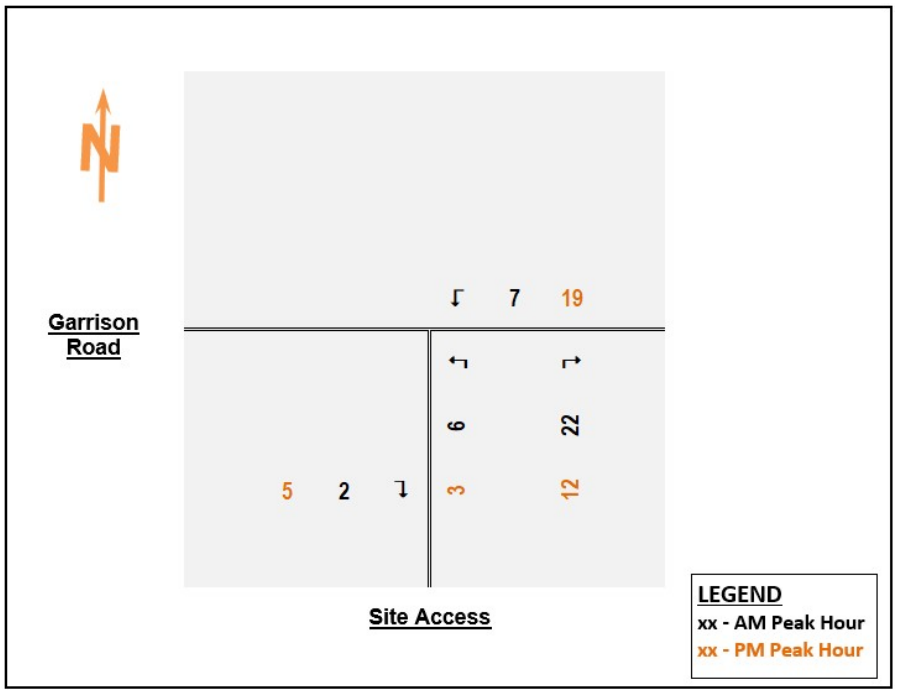



*Figure 6: Site Trip Assignment*

# 5 Future Total Conditions

In the future total traffic conditions, both the estimated future background traffic volumes in **Section 3.2** and the trips generated by the proposed development in **Section 4.2** are considered for the future horizon years of 2027 and 2032.

## 5.1 Traffic Volumes

The traffic volumes distribution for the weekday AM and PM peak hours in the future total conditions 2027 and 2032 are illustrated in **Figure 7** and **Figure 8**, respectively.

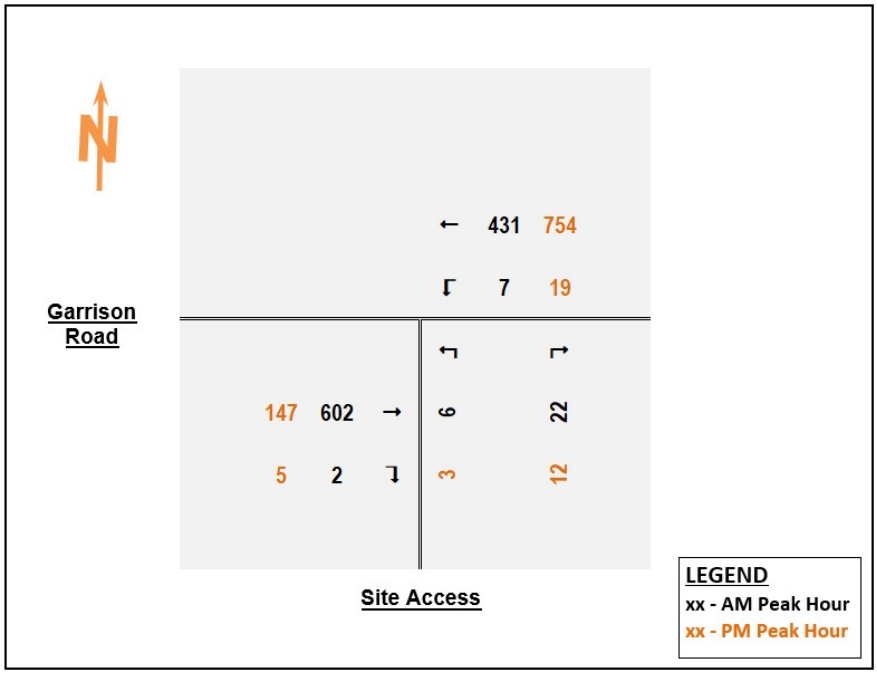



*Figure 7: Future Total Conditions (2027) Peak Hour Traffic Volumes*

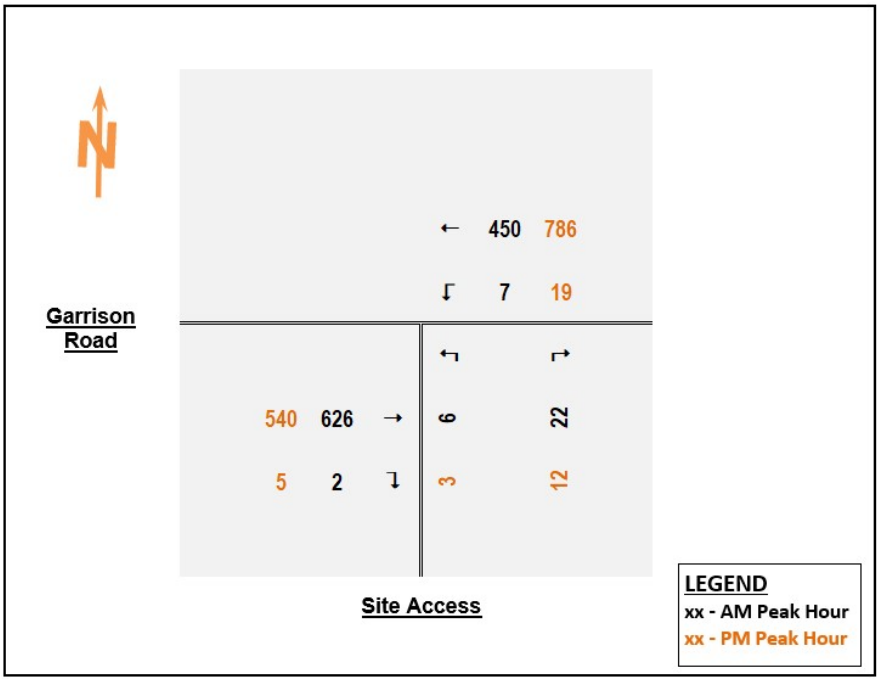



*Figure 8: Future Total Conditions (2032) Peak Hour Volumes*

## 5.2 Methodology

The traffic operations analysis for the study area intersection was conducted for typical weekday AM and PM peak hours, based on Niagara Region's *Transportation Impact Assessment Guidelines* (2023).

The operations of the study area intersection were evaluated in terms of level of service (LOS) and volume to capacity (v/c) as defined by the Highway Capacity Manual (HCM). The 95$^{th}$ percentile queue lengths at intersection movements were also be evaluated as compared to the available turning lane storage capacity.

LOS was evaluated based on the average control delay per vehicle and includes deceleration delay, queue move-up time, stopped delay, and final acceleration delay. Capacity was evaluated in terms of ratio of demand flow to capacity with an at-capacity condition represented by a v/c ratio of 1.00 (i.e. volume demand equals capacity). The LOS criteria are defined in **Table 3**.

*Table 3: Level of Service Criteria, Unsignalized Intersection*

| LOS | Delay (seconds/veh) |
|---|---|
| **A** | ≤10s |
| **B** | >10s and ≤15s |
| **C** | >15s and ≤25s |
| **D** | >25s and ≤35s |
| **E** | >35s and ≤50s |
| **F** | >50s |

## 5.3 Traffic Operations Analysis

The results of the HCM intersection capacity analysis (ICA) of the future total conditions for the study area intersection in the future horizon years of 2027 and 2032 is presented in **Table 4** and **Table 5** respectively. Synchro outputs for the future total conditions are included in **Appendix B**.

*Table 4: ICA results, Future Total Conditions 2027*

| Intersection | Intersection Delay (s) | Lane | Lane LOS | Lane Delay (s) | Lane V/C Ratio | 95th % Queue (m) |
|---|---|---|---|---|---|---|
| **AM Peak Hour** | | | | | | |
| Garrison Road at Site Access | 0.4 | WBL | A | 0.5 | 0.01 | 0 |
| | | NBL | B | 13.5 | 0.02 | 0 |
| | | NBR | B | 10.7 | 0.04 | 1 |

| Intersection | Intersection Delay (s) | Lane | Lane LOS | Lane Delay (s) | Lane V/C Ratio | 95th % Queue (m) |
|---|---|---|---|---|---|---|
| **PM Peak Hour** | | | | | | |
| Garrison Road at Site Access | 0.3 | WBL | A | 0.8 | 0.02 | 1 |
| | | NBL | B | 13.5 | 0.01 | 0 |
| | | NBR | B | 10.2 | 0.02 | 0 |

In the build out year, 2027, the proposed site access intersection at Garrison Road is expected to operate at LOS B or better during the AM and PM peak hours.

*Table 5: ICA Results, Future Total Conditions 2032*

| Intersection | Intersection Delay (s) | Lane | Lane LOS | Lane Delay (s) | Lane V/C Ratio | 95th % Queue (m) |
|---|---|---|---|---|---|---|
| **AM Peak Hour** | | | | | | |
| Garrison Road at Site Access | 0.4 | WBL | A | 0.5 | 0.01 | 0 |
| | | NBL | B | 13.2 | 0.02 | 0 |
| | | NBR | B | 10.6 | 0.04 | 1 |
| **PM Peak Hour** | | | | | | |
| Garrison Road at Site Access | 0.3 | WBL | A | 0.7 | 0.01 | 0 |
| | | NBL | B | 11.4 | 0.01 | 0 |
| | | NBR | A | 8.8 | 0.01 | 0 |

Similarly, five years post build-out of the proposed development in 2032, the site access is expected to operate well below capacity with each movement performing at LOS B or better during the AM and PM peak hours.

In both horizon years, the queue generated by the westbound left-turning traffic into the site is not expected to be significant. As shown in **Figure 9** below, there is approximately 40 metres of queue storage space in the centre median along Garrison Road. This length can accommodate the anticipated westbound left-turning queue generated by the site in both the AM and PM peak hours.

*Figure 9: Available Westbound Left-Turn Storage Length*

# 6 Access Management Analysis

## 6.1 Site Access Sightline Review

A desktop review was performed by utilizing Google's aerial and street view imagery to identify sightline deficiencies in the vicinity of the proposed access locations. Using **Equation 9.9.1** of the Transportation Association of Canada's (TAC) *Geometric Design Guide for Canadian Roads, Chapter 9 – Intersections*, the following was used to calculate intersection sight distance (ISD):

$$ISD = 0.278\, V_{Major} t_g$$

Where:

***ISD*** is the required intersection sight distance in metres;

$V_{Major}$ is the major roadway's design speed in km/h; and

$t_g$ is the minor roadway time gap in seconds.

The intersection sight distance was calculated using the following parameters:

- 70 km/h design speed for Garrison Road for the purpose of evaluating sight distance at the proposed site access intersection;
- A time gap of 9.5s for left turns from a stop and 8.5s for right turns from a stop was utilized to represent a worst-case scenario of a single-unit truck attempting to perform a turning maneuver from the site access; and,
- A time gap of 6.5s for left turns from Garrison Road into the site access.

The calculations results are summarized in **Table 6**. Based on TAC Geometric Design Guide for Canadian Roads ("TAC") Section 9.9.2.3, the applicable cases are as follows:

- Case B1 – left turn movement from the minor road
- Case B2 – right turn movement from the minor road
- Case F – left turn movement from the major road

*Table 6: ISD Calculation Results for Single-unit Trucks*

| Intersection | Case | Design Speed (km/h) | Stopping Sight Distance (m) | Required Intersection Sight Distance (m) | Available Sight Distance |
|---|---|---|---|---|---|
| Garrison Road and Site Access (stop sign on the minor road) | B1 | 70 | 105 | 185 | >200m |
| | B2 | 70 | 105 | 165 | >200m |
| | F | 70 | 105 | 125 | >200m |

**Figure 10** illustrates the sight distance requirements for left and right turns out of the proposed site access and **Figure 11** illustrates the sight distance requirements for left turns into the site access.

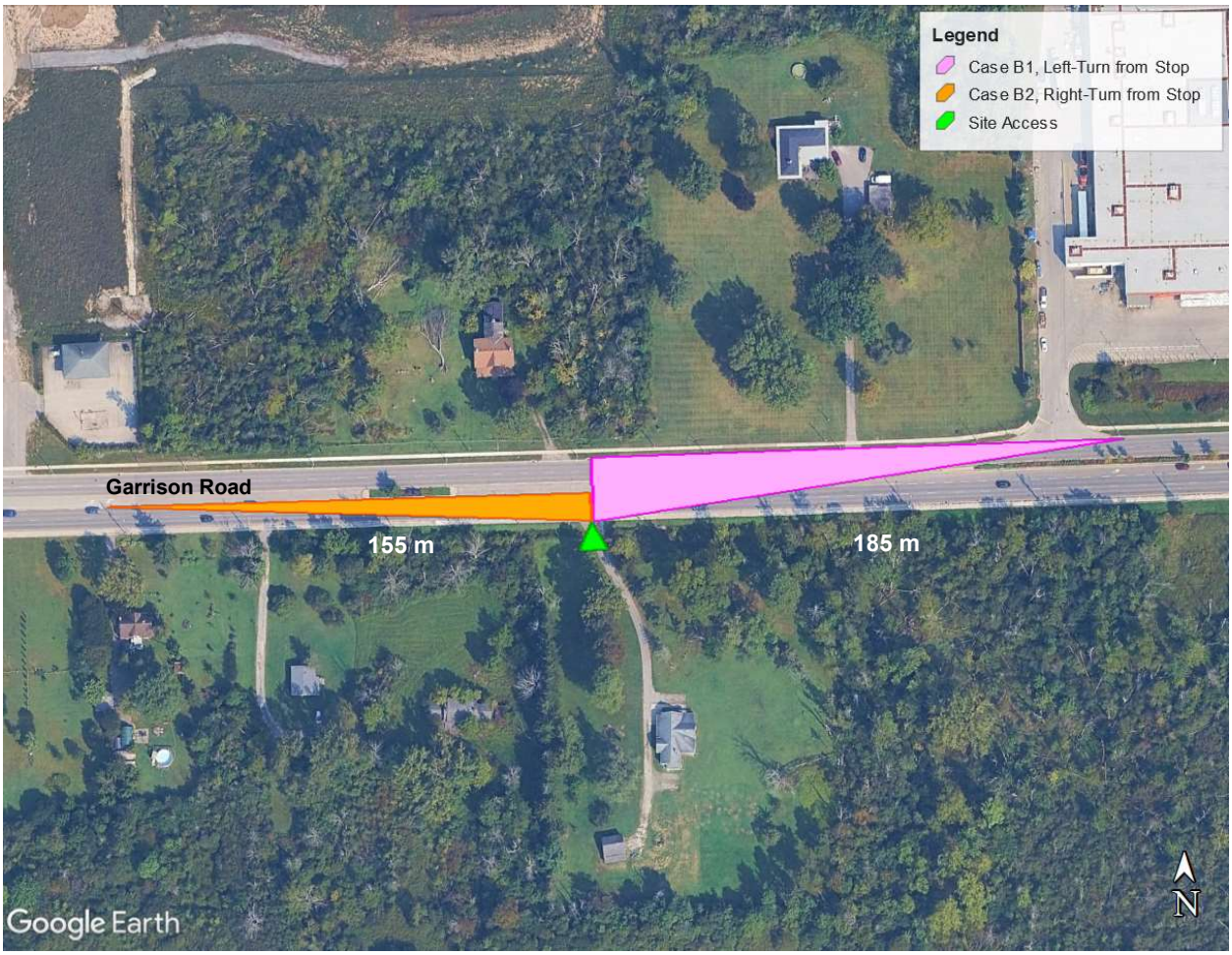



*Figure 10: Intersection Sight Distance Requirements for Left/Right Turns Out of the Site Access*

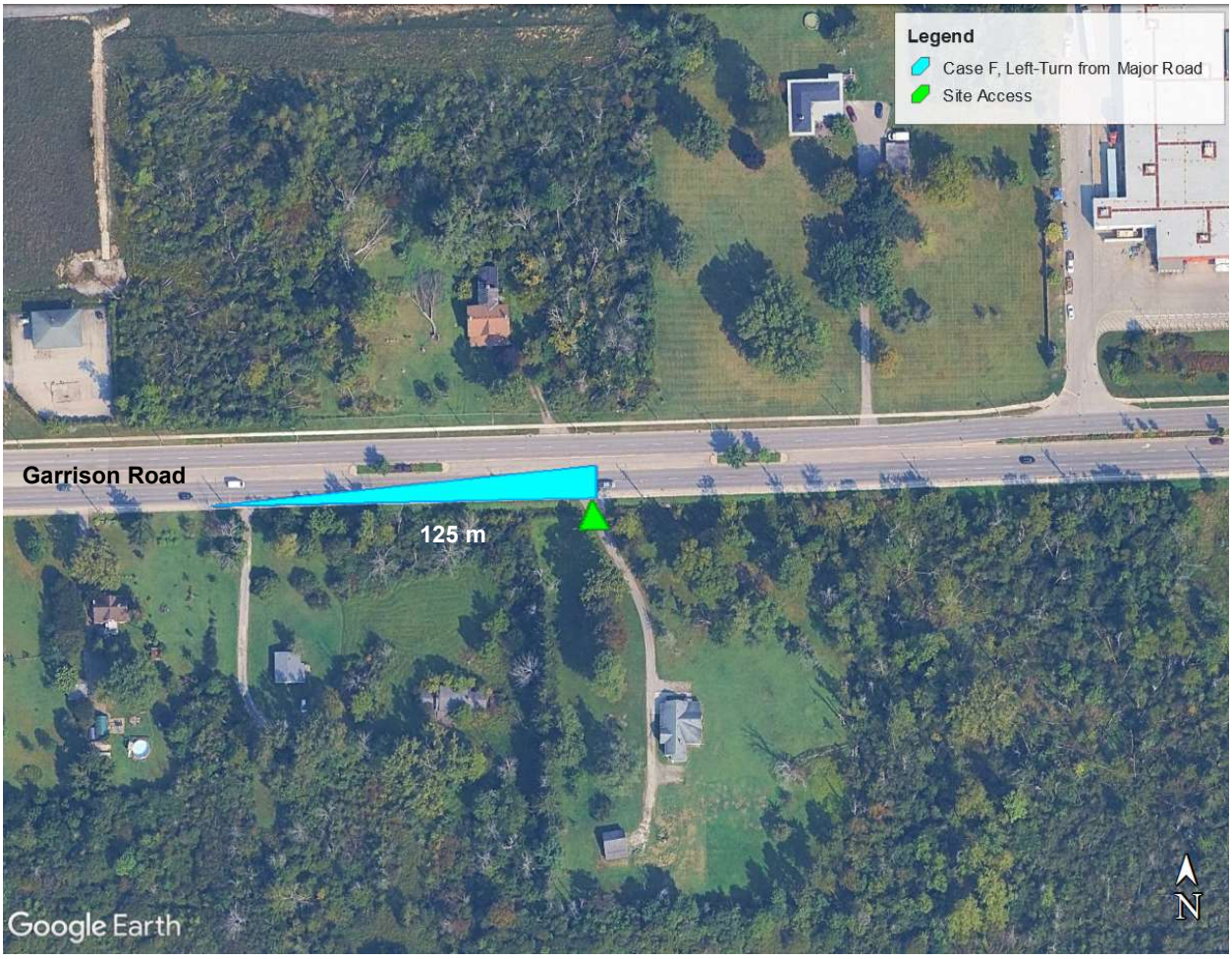



*Figure 11: Intersection Sight Distance Requirements for Left Turns into the Site Access*

According to the existing aerial map, the sight distances in the east and west directions from the proposed access at Garrison Road are expected to exceed the required distances. In addition, no vertical profile sight constraint was observed at the proposed site accesses. Therefore, the proposed site accesses are expected to have adequate sight distance.

In addition to intersection sight distance requirements, stopping sight distances were also evaluated to determine whether approaching vehicles along the major roadways have sufficient sight distance to perceive a conflict and decelerate to a stop in order to avoid a collision. Stopping sight distance is the sum of the distance travelled during the perception and reaction time, and the braking distance. To determine the minimum stopping sight distance relative to the design speed, TAC Table 2.5.2 was used. For a design speed of 70km/h, the safe stopping distance requirement is 105 metres which was determined to be available east and west of the proposed site access.

## 6.2 Access Design Review

Using Table 8.9.1 of TAC's *Geometric Design Guide for Canadian Roads, Chapter 8 – Access,* the access design for the proposed development was reviewed. **Table 7** below shows the typical driveway dimensions recommended by TAC compared to the driveway access dimensions shown in the proposed site plan found in **Appendix A**.

*Table 7: Driveway Dimensions Review*

| Driveway Dimension | TAC Guidelines Dimension | Proposed Site Plan Dimension |
|---|---|---|
| Width (two-way, commercial*) | 7.2 - 12.0 m | 7.5 m |
| Right turn radius | 4.5 - 12.0 m | 9 m |

**Note: TAC defines commercial as office, retail, institutional, or multiunit residential (5 or more dwelling units)*

As shown on the table above, the proposed dimensions for the site's driveway access meets the recommended dimensions as per TAC guidelines.

## 6.3 Swept Path Analysis

A vehicle swept path analysis was conducted using AutoTURN software to verify that a typical front-loading waste collection vehicle can access the designated loading area within the site plan. The result of this analysis is presented in **Appendix C**.

The findings indicate that the proposed loading area is functional, and the internal circulation network can adequately support loading operations and access.

# 7 Conclusions and Recommendations

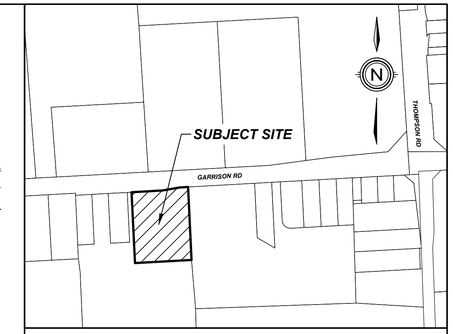
This Traffic Impact Brief for the proposed residential development located at 825 Garrison Road, Fort Erie, Ontario concludes:

- 9 inbound trips and 28 inbound trips in the AM peak hour, and 24 inbound trips and 15 outbound trips in the PM peak hour are expected to be generated by the proposed development based on the ITE Trip Generation Manual, 11$^{th}$ Edition
- The site access intersection at Garrison Road is expected to perform well below capacity with LOS B or better with the proposed development under the future horizon years of 2027 and 2032
- The sightlines for the proposed site access are adequate according to the TAC intersection sight distance and stopping sight distance guidelines
- The site's internal road network and access design can sufficiently accommodate the circulation of a typical front-loading waste collection vehicle

# APPENDIX A

## Site Plan

# 825 GARRISON ROAD
## TOWN OF FORT ERIE




## KEY PLAN
N.T.S.

## CONCEPT PLAN

## LEGAL DESCRIPTION

***LOT #***
***MUNICIPALITY***
***REGION***

### ZONING MATRIX

| PROVISION | ZONING (RM2) | PROVIDED |
|---|---|---|
| PERMITTED USES: APARTMENT DWELLINGS | | |
| MIN LOT FRONTAGE | 30m | 100.81m |
| MIN LOT AREA | 115m² per dwelling unit | 95.14m² |
| MAX LOT COVERAGE | 40% | 21.64% |
| MIN FRONT YARD | 7.5m | 2.00m |
| MIN SIDE YARD | One-half of the building height or 4m, whichever is greater | 14.67m |
| MIN EXT. SIDE YARD | One-half of the building height or 6m, whichever is greater | NA |
| MIN REAR YARD | One-half of the building height or 7.5m, whichever is greater | 13.67m |
| MIN FLOOR AREA PER DWELLING UNIT | Bachelor Unit: 40m²<br>One-Bedroom Unit: 50m²<br>Two-Bedroom Unit: 60m²<br>Unit comprising three or more bedrooms: 79m² plus 7m² for each bedroom in excess of three | BACH. NA<br>1-BED 65.3m²<br>2-BED 94.1m²<br>3-BED 114.5m² |
| MAX BUILDING HEIGHT | 9 storeys or 26m whichever is greater | i)6 storeys<br>ii) 18.60m |
| MIN. LANDSCAPED AREA | 25% | 33.19% |
| PARKING AREA LOCATION ON LOT | All yards provided that no part of any parking area, other than a driveway, is located closer than 3m to any street line and any lot line | 5.29m to street<br>3.05m to lot line |

### SITE STATISTICS

| AREA | Ha. | % COVERAGE |
|---|---|---|
| BUILDING | 0.206 | 21.64 |
| ROAD/DRIVEWAY/PARKING | 0.430 | 45.17 |
| LANDSCAPING | 0.316 | 33.19 |
| TOTAL DEVELOPABLE | 0.952 | 100.00 |
| WETLAND & BUFFER | 0.325 | – |
| TOTAL | 1.277 | – |
| UNITS | | 100 |
| DEVELOPABLE AREA (LESS WETLAND) | | 0.952 Ha. |
| DENSITY (UNITS/DEVELOPABLE AREA) | | 105.04u/Ha. |

REQUIRED PARKING
1.5 Spaces/Residential Unit — 150 Spaces
TOTAL REQUIRED PARKING — 150 Spaces

REQUIRED ACCESSIBLE PARKING — 5 Spaces
(3 TYPE 'A', 2 TYPE 'B' included in required)

PROPOSED PARKING
SURFACE (includes 5 accessible) — 150 Spaces

| # | REVISION | DATE | INIT |
|---|---|---|---|
| . | . | . | . |
| . | . | . | . |
| 0 | ISSUED FOR | YYYY-MM-DD | . |


**UPPER CANADA CONSULTANTS**
*ENGINEERS / PLANNERS*


DRAWING TITLE
***CONCEPT PLAN***

| | |
|---|---|
| DRAFTING | MK |
| DATE | APRIL 9, 2025 |
| PRINTED | MAY 14, 2025 |
| SCALE | 1:300 |
| DWG No. | 24090-CP5 |
| REV | 0 |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# APPENDIX B

## Synchro Outputs

| Lane Group | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 602 | 2 | 7 | 431 | 6 | 22 |
| Future Volume (vph) | 602 | 2 | 7 | 431 | 6 | 22 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Util. Factor | 0.95 | 0.95 | 0.95 | 0.95 | 1.00 | 1.00 |
| Frt | | | | | | 0.850 |
| Flt Protected | | | | 0.999 | 0.950 | |
| Satd. Flow (prot) | 3477 | 0 | 0 | 3610 | 1789 | 1601 |
| Flt Permitted | | | | 0.999 | 0.950 | |
| Satd. Flow (perm) | 3477 | 0 | 0 | 3610 | 1789 | 1601 |
| Link Speed (k/h) | 60 | | | 60 | 60 | |
| Link Distance (m) | 295.1 | | | 440.1 | 121.0 | |
| Travel Time (s) | 17.7 | | | 26.4 | 7.3 | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 5% | 2% | 2% | 1% | 2% | 2% |
| Adj. Flow (vph) | 654 | 2 | 8 | 468 | 7 | 24 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 656 | 0 | 0 | 476 | 7 | 24 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.7 | | | 3.7 | 3.7 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.9 | | | 4.9 | 4.9 | |
| Two way Left Turn Lane | Yes | | | Yes | | |
| Headway Factor | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 |
| Turning Speed (k/h) | | 14 | 24 | | 24 | 14 |
| Sign Control | Free | | | Free | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization 26.9% | | ICU Level of Service A | |
| Analysis Period (min) 15 | | | |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 602 | 2 | 7 | 431 | 6 | 22 |
| Future Volume (Veh/h) | 602 | 2 | 7 | 431 | 6 | 22 |
| 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) | 654 | 2 | 8 | 468 | 7 | 24 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | TWLTL | | | TWLTL | | |
| Median storage veh) | 2 | | | 2 | | |
| Upstream signal (m) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | | | 656 | | 905 | 328 |
| vC1, stage 1 conf vol | | | | | 655 | |
| vC2, stage 2 conf vol | | | | | 250 | |
| vCu, unblocked vol | | | 656 | | 905 | 328 |
| tC, single (s) | | | 4.1 | | 6.8 | 6.9 |
| tC, 2 stage (s) | | | | | 5.8 | |
| tF (s) | | | 2.2 | | 3.5 | 3.3 |
| p0 queue free % | | | 99 | | 98 | 96 |
| cM capacity (veh/h) | | | 927 | | 445 | 668 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | NB 1 | NB 2 |
|---|---|---|---|---|---|---|
| Volume Total | 436 | 220 | 164 | 312 | 7 | 24 |
| Volume Left | 0 | 0 | 8 | 0 | 7 | 0 |
| Volume Right | 0 | 2 | 0 | 0 | 0 | 24 |
| cSH | 1700 | 1700 | 927 | 1700 | 445 | 668 |
| Volume to Capacity | 0.26 | 0.13 | 0.01 | 0.18 | 0.02 | 0.04 |
| Queue Length 95th (m) | 0.0 | 0.0 | 0.2 | 0.0 | 0.4 | 0.8 |
| Control Delay (s/veh) | 0.0 | 0.0 | 0.5 | 0.0 | 13.2 | 10.6 |
| Lane LOS | | | A | | B | B |
| Approach Delay (s/veh) | 0.0 | | 0.2 | | 11.2 | |
| Approach LOS | | | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.4 | | |
| Intersection Capacity Utilization | 26.9% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Lane Group | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 147 | 5 | 19 | 754 | 3 | 12 |
| Future Volume (vph) | 147 | 5 | 19 | 754 | 3 | 12 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Util. Factor | 0.95 | 0.95 | 0.95 | 0.95 | 1.00 | 1.00 |
| Frt | 0.995 | | | | | 0.850 |
| Flt Protected | | | | 0.999 | 0.950 | |
| Satd. Flow (prot) | 3462 | 0 | 0 | 3575 | 1789 | 1601 |
| Flt Permitted | | | | 0.999 | 0.950 | |
| Satd. Flow (perm) | 3462 | 0 | 0 | 3575 | 1789 | 1601 |
| Link Speed (k/h) | 60 | | | 60 | 60 | |
| Link Distance (m) | 295.1 | | | 440.1 | 121.0 | |
| Travel Time (s) | 17.7 | | | 26.4 | 7.3 | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 5% | 2% | 2% | 2% | 2% | 2% |
| Adj. Flow (vph) | 160 | 5 | 21 | 820 | 3 | 13 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 165 | 0 | 0 | 841 | 3 | 13 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.7 | | | 3.7 | 3.7 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.9 | | | 4.9 | 4.9 | |
| Two way Left Turn Lane | Yes | | | Yes | | |
| Headway Factor | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 |
| Turning Speed (k/h) | | 14 | 24 | | 24 | 14 |
| Sign Control | Free | | | Free | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization 38.9% | | ICU Level of Service A | |
| Analysis Period (min) 15 | | | |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 147 | 5 | 19 | 754 | 3 | 12 |
| Future Volume (Veh/h) | 147 | 5 | 19 | 754 | 3 | 12 |
| 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) | 160 | 5 | 21 | 820 | 3 | 13 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | TWLTL | | | TWLTL | | |
| Median storage veh) | 2 | | | 2 | | |
| Upstream signal (m) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | | | 165 | | 615 | 83 |
| vC1, stage 1 conf vol | | | | | 163 | |
| vC2, stage 2 conf vol | | | | | 452 | |
| vCu, unblocked vol | | | 165 | | 615 | 83 |
| tC, single (s) | | | 4.1 | | 6.8 | 6.9 |
| tC, 2 stage (s) | | | | | 5.8 | |
| tF (s) | | | 2.2 | | 3.5 | 3.3 |
| p0 queue free % | | | 99 | | 99 | 99 |
| cM capacity (veh/h) | | | 1411 | | 565 | 961 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | NB 1 | NB 2 |
|---|---|---|---|---|---|---|
| Volume Total | 107 | 58 | 294 | 547 | 3 | 13 |
| Volume Left | 0 | 0 | 21 | 0 | 3 | 0 |
| Volume Right | 0 | 5 | 0 | 0 | 0 | 13 |
| cSH | 1700 | 1700 | 1411 | 1700 | 565 | 961 |
| Volume to Capacity | 0.06 | 0.03 | 0.01 | 0.32 | 0.01 | 0.01 |
| Queue Length 95th (m) | 0.0 | 0.0 | 0.3 | 0.0 | 0.1 | 0.3 |
| Control Delay (s/veh) | 0.0 | 0.0 | 0.7 | 0.0 | 11.4 | 8.8 |
| Lane LOS | | | A | | B | A |
| Approach Delay (s/veh) | 0.0 | | 0.2 | | 9.3 | |
| Approach LOS | | | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.3 | | |
| Intersection Capacity Utilization | 38.9% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Lane Group | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 626 | 2 | 7 | 450 | 6 | 22 |
| Future Volume (vph) | 626 | 2 | 7 | 450 | 6 | 22 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Util. Factor | 0.95 | 0.95 | 0.95 | 0.95 | 1.00 | 1.00 |
| Frt | | | | | | 0.850 |
| Flt Protected | | | | 0.999 | 0.950 | |
| Satd. Flow (prot) | 3477 | 0 | 0 | 3610 | 1789 | 1601 |
| Flt Permitted | | | | 0.999 | 0.950 | |
| Satd. Flow (perm) | 3477 | 0 | 0 | 3610 | 1789 | 1601 |
| Link Speed (k/h) | 60 | | | 60 | 60 | |
| Link Distance (m) | 295.1 | | | 440.1 | 121.0 | |
| Travel Time (s) | 17.7 | | | 26.4 | 7.3 | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 5% | 2% | 2% | 1% | 2% | 2% |
| Adj. Flow (vph) | 680 | 2 | 8 | 489 | 7 | 24 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 682 | 0 | 0 | 497 | 7 | 24 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.7 | | | 3.7 | 3.7 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.9 | | | 4.9 | 4.9 | |
| Two way Left Turn Lane | Yes | | | Yes | | |
| Headway Factor | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 |
| Turning Speed (k/h) | | 14 | 24 | | 24 | 14 |
| Sign Control | Free | | | Free | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization 27.4% | | ICU Level of Service A | |
| Analysis Period (min) 15 | | | |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 626 | 2 | 7 | 450 | 6 | 22 |
| Future Volume (Veh/h) | 626 | 2 | 7 | 450 | 6 | 22 |
| 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) | 680 | 2 | 8 | 489 | 7 | 24 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | TWLTL | | | TWLTL | | |
| Median storage veh) | 2 | | | 2 | | |
| Upstream signal (m) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | | | 682 | | 942 | 341 |
| vC1, stage 1 conf vol | | | | | 681 | |
| vC2, stage 2 conf vol | | | | | 261 | |
| vCu, unblocked vol | | | 682 | | 942 | 341 |
| tC, single (s) | | | 4.1 | | 6.8 | 6.9 |
| tC, 2 stage (s) | | | | | 5.8 | |
| tF (s) | | | 2.2 | | 3.5 | 3.3 |
| p0 queue free % | | | 99 | | 98 | 96 |
| cM capacity (veh/h) | | | 907 | | 431 | 655 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | NB 1 | NB 2 |
|---|---|---|---|---|---|---|
| Volume Total | 453 | 229 | 171 | 326 | 7 | 24 |
| Volume Left | 0 | 0 | 8 | 0 | 7 | 0 |
| Volume Right | 0 | 2 | 0 | 0 | 0 | 24 |
| cSH | 1700 | 1700 | 907 | 1700 | 431 | 655 |
| Volume to Capacity | 0.27 | 0.13 | 0.01 | 0.19 | 0.02 | 0.04 |
| Queue Length 95th (m) | 0.0 | 0.0 | 0.2 | 0.0 | 0.4 | 0.9 |
| Control Delay (s/veh) | 0.0 | 0.0 | 0.5 | 0.0 | 13.5 | 10.7 |
| Lane LOS | | | A | | B | B |
| Approach Delay (s/veh) | 0.0 | | 0.2 | | 11.3 | |
| Approach LOS | | | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.4 | | |
| Intersection Capacity Utilization | 27.4% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Lane Group | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 540 | 5 | 19 | 786 | 3 | 12 |
| Future Volume (vph) | 540 | 5 | 19 | 786 | 3 | 12 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Util. Factor | 0.95 | 0.95 | 0.95 | 0.95 | 1.00 | 1.00 |
| Frt | 0.999 | | | | | 0.850 |
| Flt Protected | | | | 0.999 | 0.950 | |
| Satd. Flow (prot) | 3474 | 0 | 0 | 3575 | 1789 | 1601 |
| Flt Permitted | | | | 0.999 | 0.950 | |
| Satd. Flow (perm) | 3474 | 0 | 0 | 3575 | 1789 | 1601 |
| Link Speed (k/h) | 60 | | | 60 | 60 | |
| Link Distance (m) | 295.1 | | | 440.1 | 121.0 | |
| Travel Time (s) | 17.7 | | | 26.4 | 7.3 | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 5% | 2% | 2% | 2% | 2% | 2% |
| Adj. Flow (vph) | 587 | 5 | 21 | 854 | 3 | 13 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 592 | 0 | 0 | 875 | 3 | 13 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.7 | | | 3.7 | 3.7 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.9 | | | 4.9 | 4.9 | |
| Two way Left Turn Lane | Yes | | | Yes | | |
| Headway Factor | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 |
| Turning Speed (k/h) | | 14 | 24 | | 24 | 14 |
| Sign Control | Free | | | Free | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization 45.3% | | ICU Level of Service A | |
| Analysis Period (min) 15 | | | |

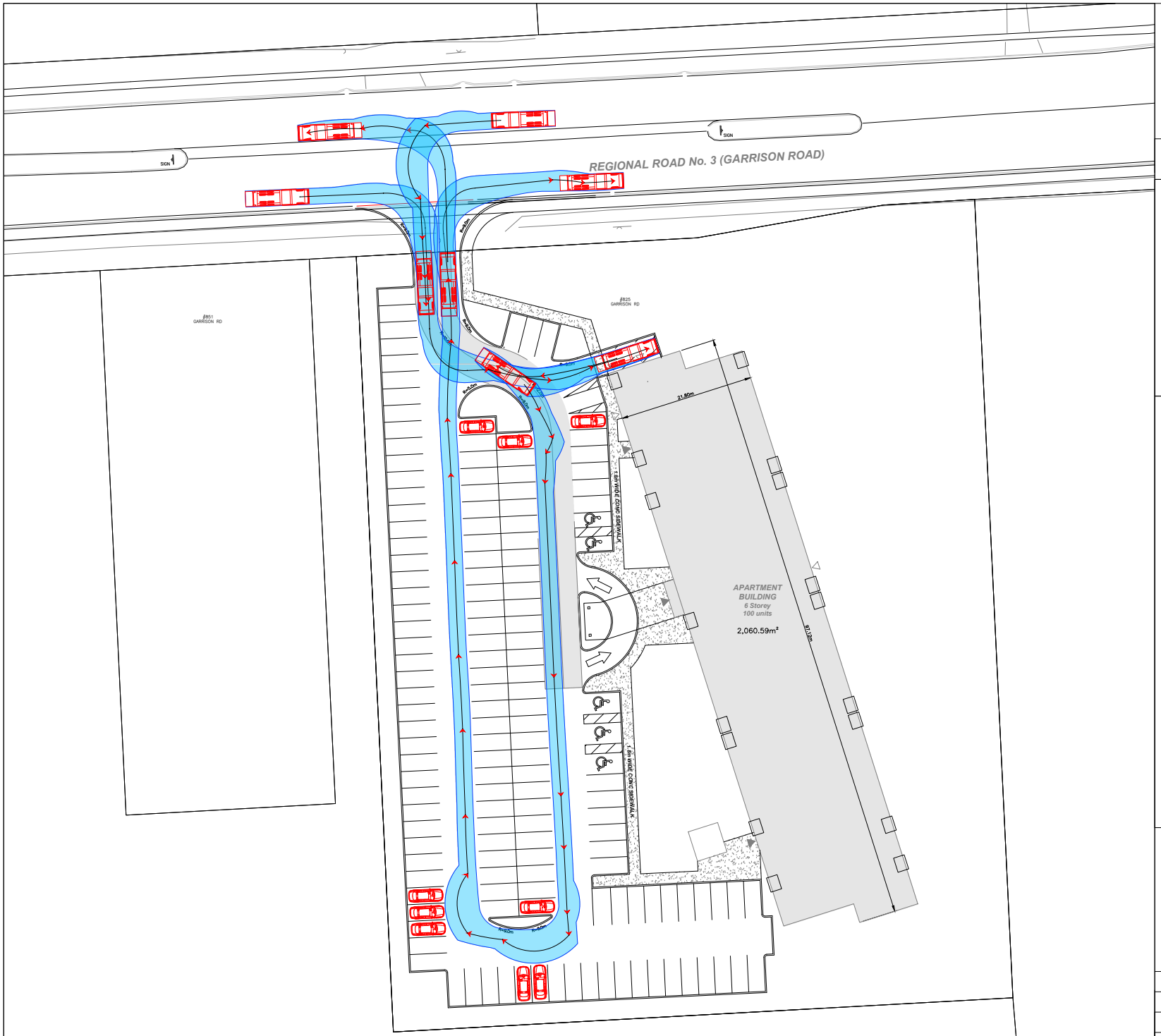
| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 540 | 5 | 19 | 786 | 3 | 12 |
| Future Volume (Veh/h) | 540 | 5 | 19 | 786 | 3 | 12 |
| Sign Control | Free | | | Free | Stop | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 587 | 5 | 21 | 854 | 3 | 13 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | TWLTL | | | TWLTL | | |
| Median storage veh) | 2 | | | 2 | | |
| Upstream signal (m) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | | | 592 | | 1059 | 296 |
| vC1, stage 1 conf vol | | | | | 590 | |
| vC2, stage 2 conf vol | | | | | 469 | |
| vCu, unblocked vol | | | 592 | | 1059 | 296 |
| tC, single (s) | | | 4.1 | | 6.8 | 6.9 |
| tC, 2 stage (s) | | | | | 5.8 | |
| tF (s) | | | 2.2 | | 3.5 | 3.3 |
| p0 queue free % | | | 98 | | 99 | 98 |
| cM capacity (veh/h) | | | 980 | | 425 | 700 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | NB 1 | NB 2 |
|---|---|---|---|---|---|---|
| Volume Total | 391 | 201 | 306 | 569 | 3 | 13 |
| Volume Left | 0 | 0 | 21 | 0 | 3 | 0 |
| Volume Right | 0 | 5 | 0 | 0 | 0 | 13 |
| cSH | 1700 | 1700 | 980 | 1700 | 425 | 700 |
| Volume to Capacity | 0.23 | 0.12 | 0.02 | 0.33 | 0.01 | 0.02 |
| Queue Length 95th (m) | 0.0 | 0.0 | 0.5 | 0.0 | 0.2 | 0.4 |
| Control Delay (s/veh) | 0.0 | 0.0 | 0.8 | 0.0 | 13.5 | 10.2 |
| Lane LOS | | | A | | B | B |
| Approach Delay (s/veh) | 0.0 | | 0.3 | | 10.9 | |
| Approach LOS | | | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.3 | | |
| Intersection Capacity Utilization | 45.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

# APPENDIX C

## AutoTURN Outputs

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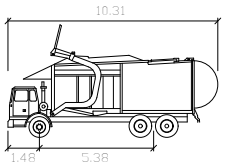
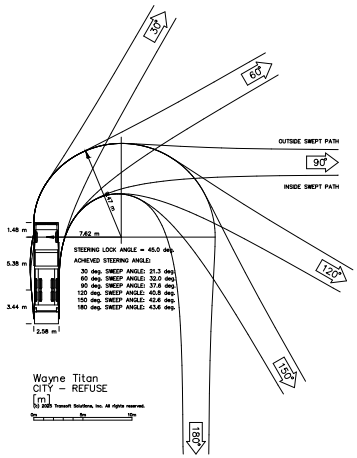
N




Wayne Titan

meters

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




# 825 GARRISON ROAD
# TURNING TEMPLATE

| | |
|---|---|
| DRAWN | CD |
| CHECKED | MB |
| SCALE | N.T.S. |
| DATE | JUNE 2025 |
| PROJECT NUMBER | 132601036 |