



1 North Front Street

**Transportation Impact
Assessment, Parking Study
and Site Circulation
Analysis**

Paradigm Transportation Solutions Limited

2026-03
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Project Summary

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Client:

Alexander Wilson Architect Inc.
103-20 Gore Street
Kingston, ON K7L 2L1

Client Contact:

Patrick Roulstone
B.Comm, MAES

Consultant Project Team

Joshua de Boer, Executive Principal,
Finance and Strategy
Abanoub Gaber, Transportation
Consultant

**Paradigm Transportation
Solutions Limited**

5A-150 Pinebush Road
Cambridge ON N1R 8J8

p: 519.896.3163
905.381.2229
416.479.9684

www.ptsl.com

1 North Front Street Transportation Impact Assessment, Parking Study and Site Circulation Analysis

<< Original Signed By >>
Joshua de Boer, P.Eng.

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Executive Summary

Content

Alexander Wilson Architect Inc., on behalf of Summers and Co., retained Paradigm Transportation Solutions Limited (Paradigm) to prepare this Transportation Impact Assessment (TIA), Parking Study and Site Circulation Analysis for a proposed residential development located at 1 North Front Street in the City of Belleville.

The purpose of this report is to identify and assess potential transportation impacts, if any, resulting from the development.

Development Concept

The subject site is located at 1 North Front Street in the City of Belleville. The site currently consists of a surface parking lot and a three-storey building. The existing building accommodates ground floor commercial space (currently vacant) and 38 residential units across its upper storeys. The residential space is known as Sagonaska Place.

The property owner is proposing to construct a nine storey (mid-rise) multi-unit dwelling, accommodating 53 residential units and 335 m² of amenity space on the footprint of the existing parking lot. The property owner is also proposing to convert the ground floor commercial space of the existing building into six residential units, which is included in the total 53 new units.

Vehicle access is proposed via a single all-moves private driveway connection to North Front Street and single all-moves private parking garage along Moira Street. A single vehicle access at North Front Street already exists at the site and a parking garage access already exists along Moira Street. The North Front Street access will connect to Parking Level One on site, while the Moira Street access will lead to the Lower-level Parking. The two parking levels are not connected. There are a total 65 parking spaces currently available in the two parking levels. The existing surface parking lot is proposed to be removed from the site.

Conclusions

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

- **Existing Traffic Conditions:** All the study area intersections are operating at acceptable levels of service and well within capacity during both AM and PM peak hours.



- ▶ **Development Trip Generation:** Development of the site is forecast to generate 14 trips in the AM peak hour and 22 trips in the PM peak hour.
- ▶ **Background Traffic Conditions:** Under 2032 background traffic conditions, the study area intersections are forecast to operate at acceptable levels of service and well within capacity. No critical movements are forecast.
- ▶ **Total Traffic Conditions:** Under 2032 total traffic conditions, the study area intersections are forecast to operate at acceptable levels of service and well within capacity. No critical movements are forecast.
- ▶ **Remedial Measures:** All study area intersections are forecast to operate at acceptable levels of service and well within capacity. No off-site modifications, such as geometric road or intersection improvements, are required to support the subject development.
- ▶ **Vehicle Parking:** Development plans include 65 vehicle parking spaces for the total 91 residential units. This supply meets City of Belleville by-law parking requirements with a surplus of two spaces. Development plans also include four accessible vehicle parking spaces, which also meets City by-law requirements.
- ▶ **Bicycle Parking:** Development plans include 27 bicycle parking spaces for the 91 residential units. This supply is intended for the 53 new units and meets City by-law requirements for the new units. As the existing units and related building components are not being renovated, no changes to existing bicycle parking are proposed for these existing units.
- ▶ **Vehicle Site Circulation:** An analysis of site circulation indicates that vehicles can enter, exit, and navigate the site without conflict.

Recommendations

Based on the study results, it is recommended that the conclusions of this report be recognized.



Contents

1	Introduction	1
1.1	Overview	1
1.2	Purpose and Scope	1
2	Current Conditions	4
2.1	Roads	4
2.2	Transit Network	7
2.3	Active Transportation	9
2.3.1	Walking.....	9
2.3.2	Cycling.....	9
2.4	Traffic Volumes	9
2.5	Traffic Operations	12
3	Development Concept.....	16
3.1	Development Description	16
3.2	Site Trip Forecasts	18
3.2.1	Trip Generation	18
3.2.2	Modal Split.....	18
3.2.3	Trip Distribution and Assignment.....	19
4	Future Conditions.....	22
4.1	Horizon Years	22
4.2	Future Road Improvements.....	22
4.3	Background Traffic Forecasts.....	22
4.3.1	General Background Growth	22
4.4	Forecast Total Traffic.....	25
4.5	Future Background Traffic Operations.....	28
4.6	Future Total Traffic Operations.....	31
4.7	Transit and Active Transportation Impacts.....	34
4.7.1	Transit	34
4.7.2	Walking.....	34
4.7.3	Cycling.....	34
5	Parking Study	36
5.1	City of Belleville Zoning By-law Requirements	36
5.1.1	Vehicle Parking	36
5.1.2	Bicycle Parking.....	37
5.2	Conclusions.....	38
6	Site Circulation Analysis.....	39
7	Conclusions and Recommendations	40
7.1	Conclusions.....	40
7.2	Recommendations	41



Appendices

Appendix A	Pre-Study Consultation Notes
Appendix B	Turning Movement Count Data and Signal Timings
Appendix C	Existing Traffic Operations Reports
Appendix D	Background Traffic Operations Reports
Appendix E	Total Traffic Operations Reports
Appendix F	AutoTURN Site Circulation Review

Figures

Figure 1.1:	Subject Site Location	3
Figure 2.1:	Existing Lane Configurations and Traffic Control	6
Figure 2.2:	Belleville Transit Services	8
Figure 2.3:	Existing Traffic Volumes – AM Peak Hour	10
Figure 2.4:	Existing Traffic Volumes – PM Peak Hour	11
Figure 3.1:	Draft Site Plan	17
Figure 3.2:	Site Generated Traffic in AM Peak Hour	20
Figure 3.3:	Site Generated Traffic in PM Peak Hour	21
Figure 4.1:	2032 Background Traffic – AM Peak Hour	23
Figure 4.2:	2032 Background Traffic – PM Peak Hour	24
Figure 4.3:	2032 Total Traffic – AM Peak Hour	26
Figure 4.4:	2032 Total Traffic – PM Peak Hour	27
Figure 4.5:	Proposed Cycling Network	35

Tables

Table 2.1:	Existing Transit Services	7
Table 2.2:	AM Existing Traffic Operations	14
Table 2.3:	PM Existing Traffic Operations	15
Table 3.1:	Trip Generation Estimates – Vehicle Trips	18
Table 3.2:	Modal Split	19
Table 3.3:	Trip Distribution	19
Table 4.1:	2032 AM Background Traffic Operations	29
Table 4.2:	2032 PM Background Traffic Operations	30
Table 4.3:	2032 AM Total Traffic Operations	32
Table 4.4:	2032 PM Total Traffic Operations	33
Table 5.1:	Existing Vehicle Parking Requirements (By-Law)	37
Table 5.2:	Future Vehicle Parking Requirements (By-Law)	37
Table 5.5:	Existing bicycle Parking Requirements	38
Table 5.6:	Future bicycle Parking Requirements	38



1 Introduction

1.1 Overview

Alexander Wilson Architect Inc., on behalf of Summers and Co., retained Paradigm Transportation Solutions Limited (Paradigm) to prepare this Transportation Impact Assessment (TIA) for a proposed residential development located at 1 North Front Street in the City of Belleville.

The property owner is proposing to construct a nine storey (mid-rise) multi-unit dwelling, with 53 new residential units and 335 m² of amenity space on the footprint of the existing parking lot. The property owner is also proposing to convert the ground floor commercial space of the existing building into six residential units. These six unit conversions are included in the total 53 new residential units.

Figure 1.1 illustrates the location of the subject site.

1.2 Purpose and Scope

The purpose of this study is to identify and assess the potential traffic impacts, if any resulting from the development.

The scope of this study has been developed in consultation with the City of Belleville (the City). The scope of this study includes:

- ▶ An assessment of current transportation conditions within the study area, including the following intersections:
 - North Front Street and Harriett Street/Grove Street (signalized)
 - North Front Street and Moira Street (signalized)
 - Pinnacle Street and Moira Street (signalized)
 - Pinnacle Street and Grove Street (signalized)
 - One site driveway along North Front Street (unsignalized)
 - One site driveway along Moira Street (unsignalized)
- ▶ Estimates of background traffic growth for the build-out year of the development and five years after build-out;
- ▶ Estimates of vehicle trips generated by the proposed development;
- ▶ Analysis of future transportation impacts on the road network;



- ▶ Identification of off-site road improvements, if required, to mitigate impacts from site generated trips in a satisfactory manner;
- ▶ A Parking Study to estimate the parking demand generated by the proposed development and establish the number of on-site parking spaces that should be provided, recognizing site constraints and local conditions; and
- ▶ A Site Circulation Analysis to ensure that all vehicle types projected to use the site can appropriately circulate and comply with review agency requirements and applicable industry guidelines.

This study has been completed in accordance with the City of Belleville *Transportation Impact Assessment Guidelines* and direction provided by the review agencies during pre-study consultation.¹

Appendix A contains the pre-study consultation material and responses provided by the City.

¹ City of Belleville, *Transportation Impact Assessment Guidelines (Working Version 1)*, 2021.





2 Current Conditions

2.1 Roads

The main roads in the study area comprise North Front Street, Harriett Street, Grove Street, Pinnacle Street and Moira Street.² Within the study area, all roads operate under the jurisdiction of the City of Belleville.

- ▶ **North Front Street** is a north-south local road with one southbound travel lane north of Grove Street. South of Grove Street there are two travel lanes (one lane per direction). Posted speed limit signage is not observed along the road, so it is therefore assumed that the statutory limit of 50 kilometres per hour governs. Sidewalks are provided on both sides of the road. There are no dedicated cycling facilities along the road, requiring all cyclists to share the travelled roadway with vehicles.
- ▶ **Pinnacle Street** is a north-south arterial road with four travel lanes (two lanes per direction). Posted speed limit signage is not observed along the road, so it is therefore assumed that the statutory limit of 50 kilometres per hour governs. Sidewalks are provided on both sides of the road. There are no dedicated cycling facilities along the road, requiring all cyclists to share the travelled roadway with vehicles. Northbound and southbound left turns are prohibited at the Moira Street intersection and southbound left turns are prohibited at Grove Street intersection.
- ▶ **Moira Street** is an east-west collector road with two travel lanes (one lane per direction). Posted speed limit signage is not observed along the road, so it is therefore assumed that the statutory limit of 50 kilometres per hour governs. Sidewalks are provided on both sides of the road. There are no dedicated cycling facilities along the road, requiring all cyclists to share the travelled roadway with vehicles. Parking is not permitted on the south side of the roadway.
- ▶ **Grove Street** is an east-west local road with two travel lanes (one lane per direction). Posted speed limit signage is not observed along the road, so it is therefore assumed that the statutory limit of 50 kilometres per hour governs. Sidewalks are provided on both sides of the road. There are no dedicated cycling facilities along the road, requiring all cyclists to share the travelled roadway with vehicles. Parking is not permitted on both

² City of Belleville, *Belleville GIS Hub - Road Network*, 2024. Available at: <https://opendata-bellevillegis.hub.arcgis.com>

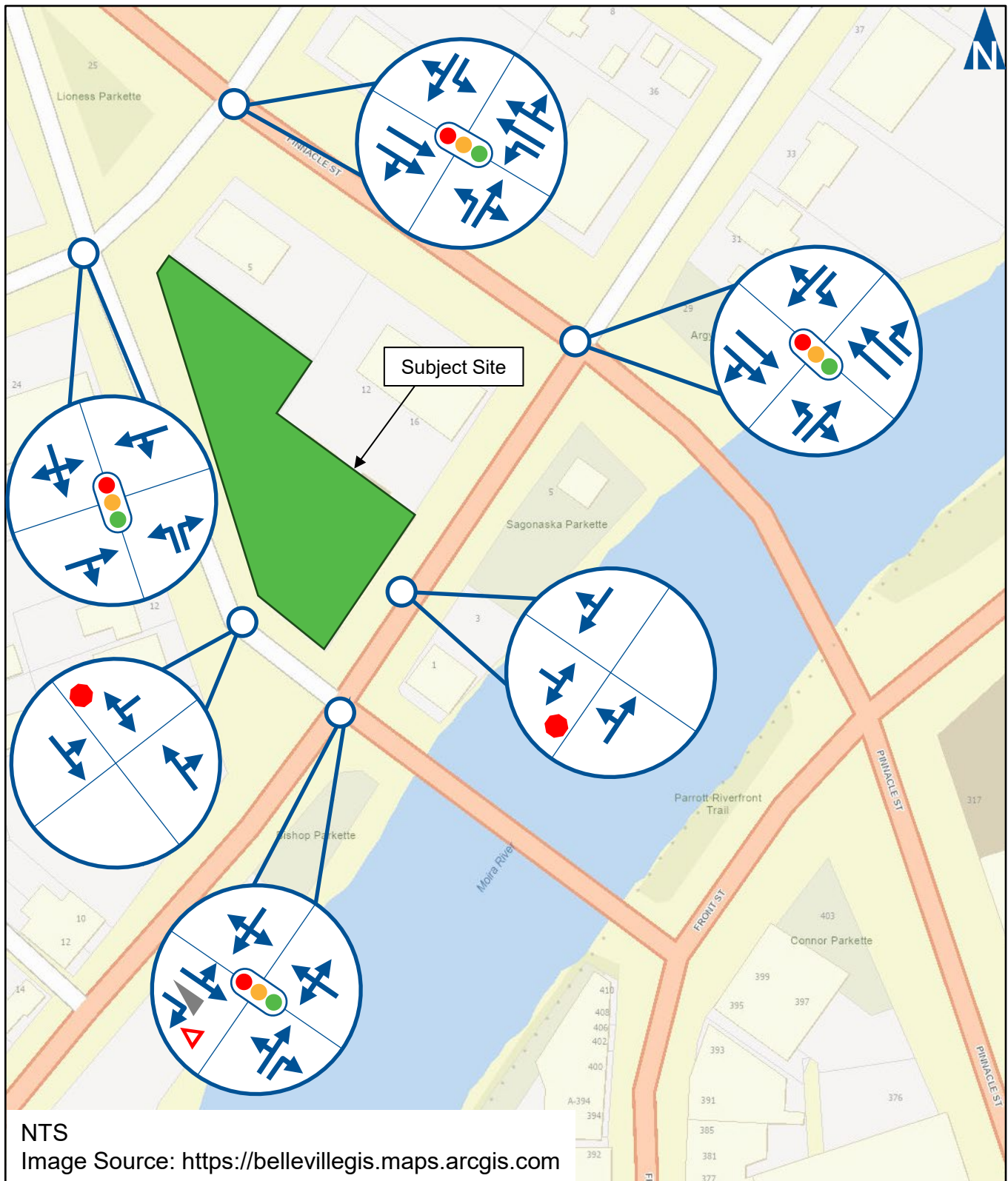


sides of the roadway from 9:00 AM-12:00 PM and 1:00 PM to 3:00 PM Monday to Friday.

- ▶ **Harriett Street** is an east-west local road with two travel lanes (one lane per direction). Posted speed limit signage is not observed along the road, so it is therefore assumed that the statutory limit of 50 kilometres per hour governs. Sidewalks are provided on both sides of the road. There are no dedicated cycling facilities along the road, requiring all cyclists to share the travelled roadway with vehicles. Parking is not permitted on the south side of the roadway from 9:00 AM-12:00 PM and 1:00 PM to 3:00 PM Monday to Friday.

Figure 2.1 illustrates the existing lane configurations and traffic control at the study area intersections.





2.2 Transit Network

Belleville Transit operates a bus route within the vicinity of the subject site. Route 1 operates along North Front Street from Terminal to Quinte Mall.³ The nearest transit stop is at the intersection of Pinnacle Street and Moira Street, approximately 140 metres east of the subject site, and serves Route 1. There is another bus stop located at the intersection of Pinnacle Street and Grove Street, approximately 160 metres east of the subject site, and serves and Route 1.

Table 2.1 summarizes the current schedules for Belleville Transit Route 1.

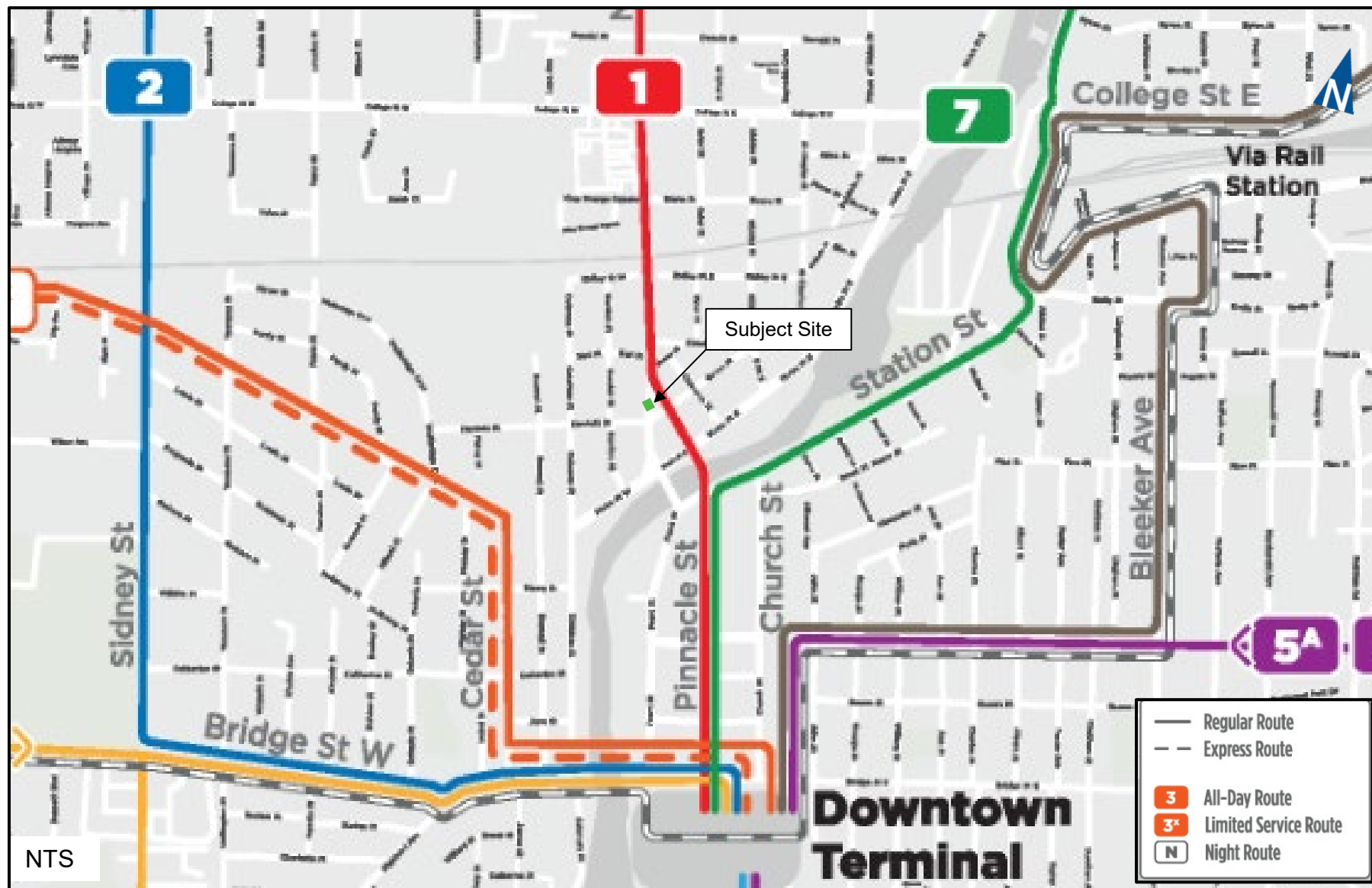
Figure 2.2 illustrates the existing transit services provided by Belleville Transit.

TABLE 2.1: EXISTING TRANSIT SERVICES

Route	Day(s) of Week	Service Hours	Approximate Headway
Route 1: Terminal- North Front- Quinte Mall	Monday to Friday	6:00 AM – 11:30 PM	30 Minutes
	Saturday	6:00 AM – 10:35 PM	1 Hour
	Sunday	7:00 AM – 10:30 PM	1 Hour

³ <https://www.belleville.ca/en/walk-ride-and-drive/route-2.aspx>





2.3 Active Transportation

2.3.1 Walking

All study roads have sidewalks on both sides of the road. All signalized intersections have delineated crosswalk pavement markings and pedestrian signal heads at crossings. There are curb depressions at the pedestrian crossings to allow for accessibility for individuals with mobility challenges.

Tactile plates and accessible pedestrian signals (APS) have not been identified at the intersections. As the study area traffic signals operate under pre-timed (fixed) control and there is no APS, pedestrian pushbuttons are not provided.

2.3.2 Cycling

The City of Belleville *Transportation Master Plan* identifies an existing off-road cycling facility outside of the study area on Moira Street, east of St Charles Street.⁴ On Moira Street, west of St Charles Street, an on-street cycling facility is proposed, but not yet installed. As such, there are no dedicated cycling facilities on any study area roads, and cyclists and motorists are required share road space.

2.4 Traffic Volumes

Analysis of intersection operations relies on turning movement counts (TMCs), which quantify the movement of vehicles through an intersection. These volumes form the foundation for operational analyses. The counts are usually conducted during the peak periods at a study area intersection to complete the level of service analysis under its worst-case operating condition(s).

Paradigm conducted eight-hour turning movements at the three study area intersections. The counts were conducted on Wednesday March 4, 2024, from 7:00 AM to 10:00 AM, 11:30 AM to 1:30 PM, and 3:30 PM to 6:30 PM.

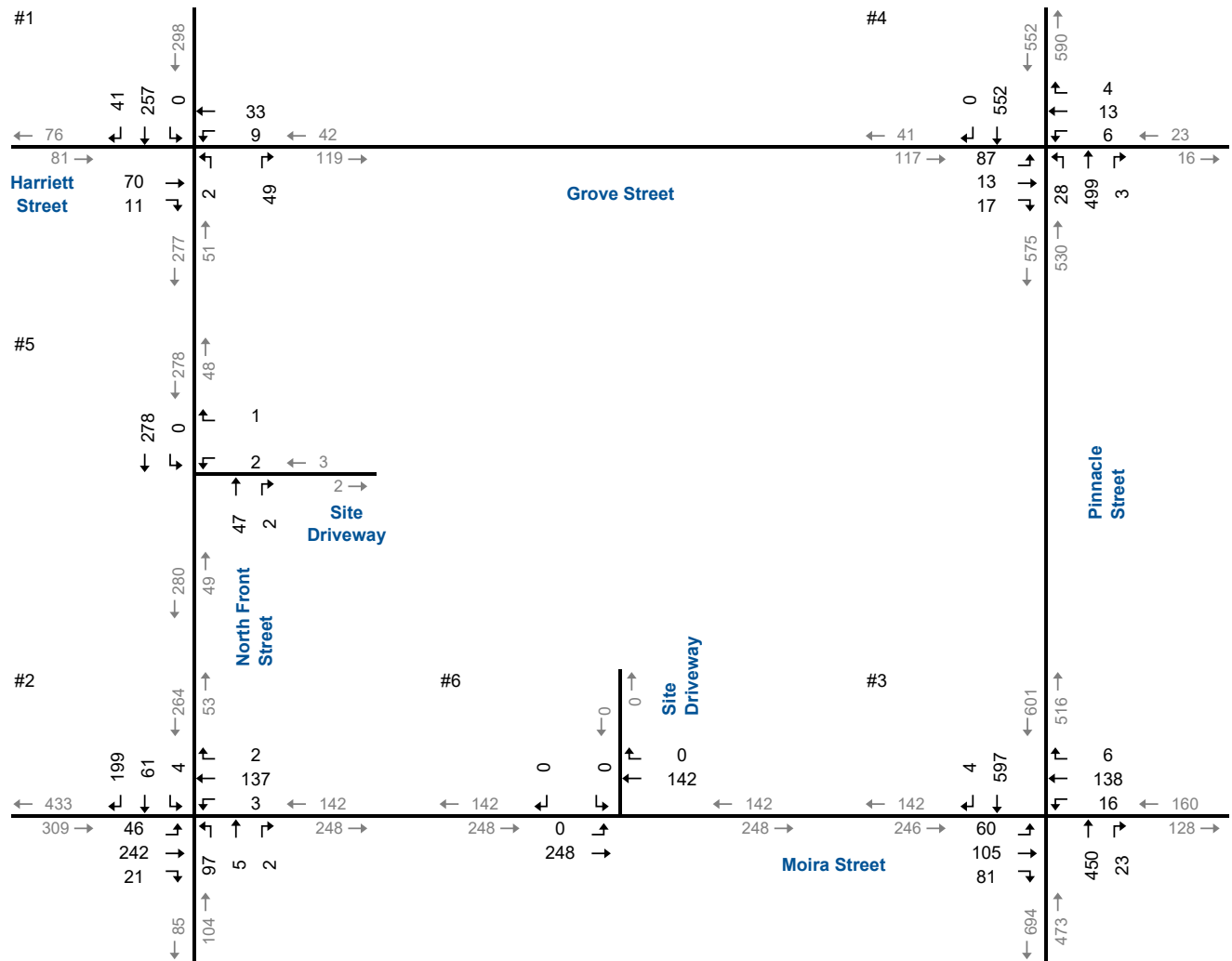
Figure 2.3 and **Figure 2.4** illustrate the existing traffic volumes in the AM and PM peak hours respectively.

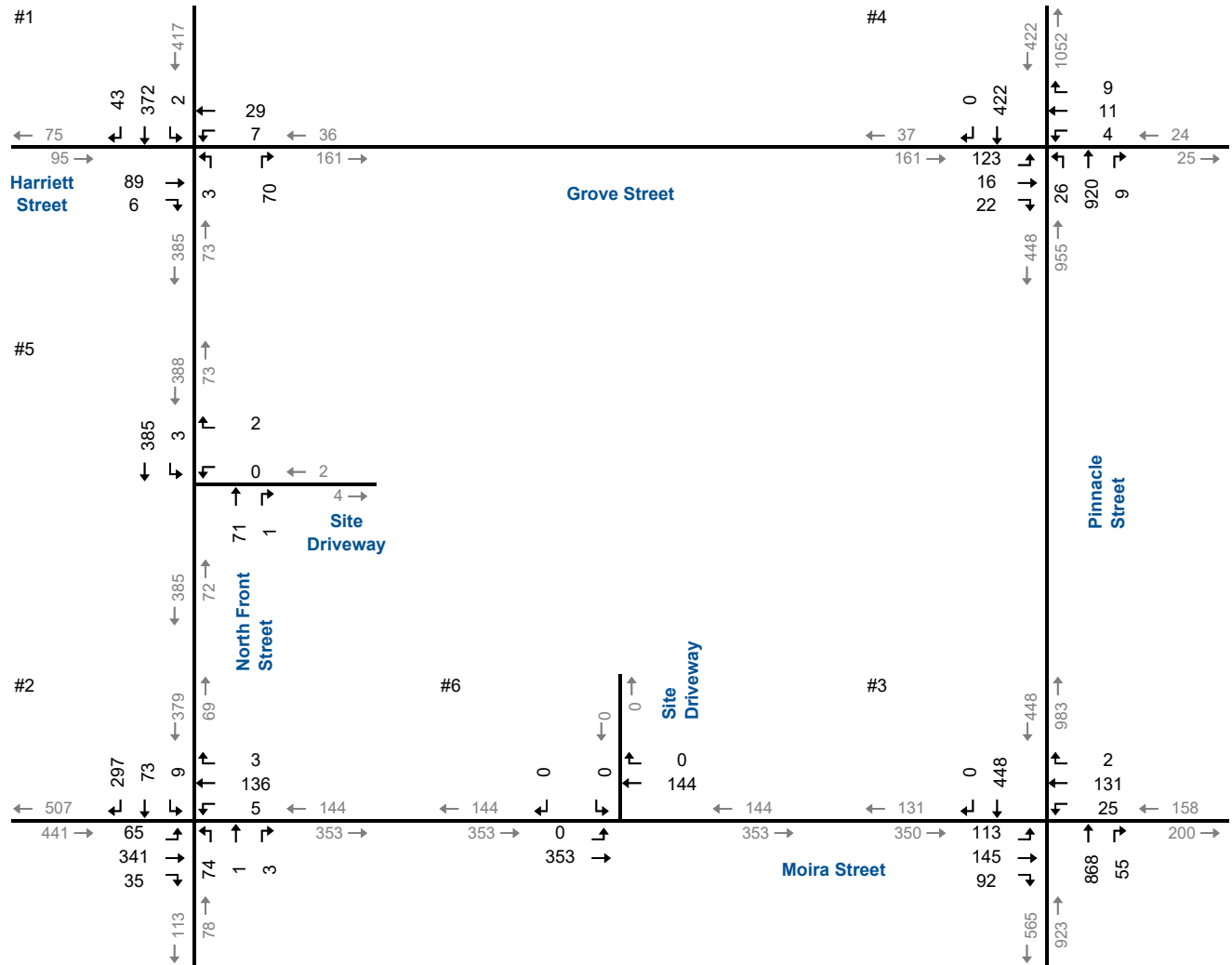
Appendix B contains the raw TMC data.

⁴ City of Belleville. *Transportation Master Plan, Figure 14 - Recommended Cycle Network*. 2014.



AM PEAK HOUR





2.5 Traffic Operations

Intersection level of service (LOS) is a recognized method of quantifying the average delay experienced by drivers at intersections. It is based on the delay experienced by individual vehicles executing the various movements. The delay is related to the number of vehicles intending to make a particular movement, compared to the estimated capacity for that movement. The capacity is based on several criteria related to opposing traffic flows, intersection geometry, and at signalized intersections, signal timing.

The highest possible rating is LOS A, under which the average total delay is equal or less than 10 seconds per vehicle. When the average delay exceeds 80 seconds for signalized intersections, 50 seconds for unsignalized intersections or when the volume to capacity ratio is greater than 1.00, the movement is classed as LOS F, and remedial measures are usually implemented if they are feasible.

Traffic operations at the study area intersections have been analyzed in *Synchro 12*, which implements the methodologies of the *Highway Capacity Manual (HCM)*.

The analysis reflects existing lane configurations, traffic control, estimated base year traffic volumes, and existing signal timing as provided by the City of Belleville.

Appendix B contains the signal timing plans for reference.

The analysis follows the City of Belleville TIA Guidelines and considers three measures of effectiveness⁵:

- ▶ The volume-to-capacity (v/c) ratio;
- ▶ The Level of Service (LOS); and
- ▶ The 95th percentile queue lengths, estimated using Synchro.

The City of Belleville TIA Guidelines require mitigation for specific movements and intersections where:

- ▶ V/C ratios surpass 0.85;
- ▶ The obtained LOS value is E or F; and/or
- ▶ The lane storage is smaller than the queue length.

⁵ City of Belleville Transportation Impact Assessment Guidelines Working Version 1. July 2021.



Table 2.2 and **Table 2.3** summarizes the existing level of service conditions for AM and PM peak hours respectively.

All traffic movements at the study area intersections are found to operate at acceptable levels of service. No critical movements are identified during the AM or PM peak hours.

Appendix C contains the detailed Synchro 12 reports.



TABLE 2.2: AM EXISTING TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																
				Eastbound				Westbound				Northbound				Southbound				Overall
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	North Front Street & Harriett Street/Grove Street	TCS	LOS Delay V/C Stor. Avail.		B 19 0.12 21 -	> > > >	B 19	< < < <	B 13 0.07 8 -	> > > >	B 13	B 12 0.00 0 31 31		D 51 0.03 7 -	D 50	< < < <	C 34 0.59 84 -	> > > >	C 34	C 31
	Moira Street & North Front Street	TCS	LOS Delay V/C Stor. Avail.	< < < <	B 15 0.48 38 -	B 10 0.01 1 20 19	B 15	< < < <	B 15 0.22 39 -	> > > >	B 15	< < < <	B 12 0.27 15 -	B 12	< < < <	B 18 0.09 22 -	A 0 0.13 0 20 20	> > > >	A 4	B 11
	Pinnacle Street & Moira Street	TCS	LOS Delay V/C Stor. Avail.	B 13 0.12 18	B 13 0.24 38	> > >	B 13	B 16 0.04 6	B 18 0.20 31	> > >	B 18		B 19 0.33 45	B 16 0.02 4	B 19		A 6 0.43 12	> > >	A 6	B 13
	Pinnacle Street & Grove Street	TCS	LOS Delay V/C Stor. Avail.	C 28 0.17 30 -	C 35 0.03 12 -	> > >	C 30	B 16 0.01 4 20 16	B 16 0.02 6 -	> > >	B 16	A 8 0.11 3 50 47	A 8 0.37 15 -	> > >	A 8		B 20 0.39 55 -	> > >	B 20	B 16
	North Front Street & Site Driveway	TWSC	LOS Delay V/C Stor. Avail.					A 10 0.00* 0.1		> > >	A 10		A 0 0.03 0	> > >	A 0		< < <	A 0 0.00 0		A 0

MOE - Measure of Effectiveness

LOS - Level of Service

Delay - Average Delay per Vehicle in Seconds

V/C - Volume to Capacity Ratio

Q - 95th Percentile Queue Length (m)

Stor. - Existing Storage (m)

Avail. - Available Storage (m)

TCS - Traffic Control Signal

TWSC - Two-Way Stop Control

AWSC - All-Way Stop Control

< / > - Shared with through movement

* - Value less than 0.01.



TABLE 2.3: PM EXISTING TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																
				Eastbound				Westbound				Northbound				Southbound				Overall
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
PM Peak Hour	North Front Street & Harriett Street/Grove Street	TCS	LOS Delay V/C Stor. Avail.		B 19 0.13 22 - -	> > > > > >	B 19	< < < < < <	B 12	B 12 0.05 6 - -	> > > > > >	A 7 0 31 31		A 2 0 0 - -	A 2	< < < < < <	D 39 0.75 111 - -	> > > > > >	D 39	C 30
	Moira Street & North Front Street	TCS	LOS Delay V/C Stor. Avail.	< < < < < <	C 23	C 23	B 16 0.03 6 20 14	> > > > > >	A 6	A 6 0.18 6 - -	> > > > > >	< < < < < <	B 17	B 17 0.14 19 - -	> > > > > >	< < < < < <	B 17 0.11 22 - 20	A 4	B 13	
	Pinnacle Street & Moira Street	TCS	LOS Delay V/C Stor. Avail.	A 6 0.22 5	A 4 0.31 2	> > > > > >	A 5	B 16 0.06 8	B 17 0.17 28	> > > > > >	B 17		C 22	C 22	C 22		A 6 0.31 8	> > > > > >	A 6	B 15
	Pinnacle Street & Grove Street	TCS	LOS Delay V/C Stor. Avail.	C 25 0.23 30 - -	C 29 0.04 10 - -	> > > > > >	C 26	B 16 0.01 3 20 17	B 16 0.02 6 - -	> > > > > >	B 16	A 7 2 50 48	A 9 26 - -	> > > > > >	A 9		B 19 0.30 41 - -	> > > > > >	B 19	B 13
	North Front Street & Site Driveway	TWSC	LOS Delay V/C Stor. Avail.					A 9 0.00* 0.0		> > > > > >	A 9		A 0 0.04 0	> > > > > >	A 0		< < < < < <	A 0 0.00* 0.0		A 0

MOE - Measure of Effectiveness

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TCS - Traffic Control Signal

TWSC - Two-Way Stop Control

AWSC - All-Way Stop Control

< / > - Shared with through movement

* - Value less than 0.01.



3 Development Concept

3.1 Development Description

The subject site is located at 1 North Front Street in the City of Belleville. The site currently consists of a surface parking lot and a three-storey building. The existing building accommodates ground floor commercial space (currently vacant) and 38 residential units across its upper storeys. The residential space is known as Sagonaska Place.

The property owner is proposing to construct a nine storey (mid-rise) multi-unit dwelling, accommodating 53 residential units and 335 m² of amenity space on the footprint of the existing parking lot. The property owner is also proposing to convert the ground floor commercial space of the existing building into six residential units, which are included in the 53 total new units.

Vehicle access is proposed via a single all-moves private driveway connection to North Front Street and single all-moves private parking garage along Moira Street. A single vehicle access at North Front Street already exists at the site and a parking garage access already exists along Moira Street. The North Front Street access will connect to Parking Level One on site, while the Moira Street access will lead to the Lower-level Parking. The two parking levels are not connected. There are a total 65 parking spaces currently available in the two parking levels. The existing surface parking lot is proposed to be removed from the site.

Full build-out of the development site is anticipated by 2027.

Figure 3.1 illustrates the site plan prepared by Alexander Wilson Architect Inc., dated September 2025.



3.2 Site Trip Forecasts

3.2.1 Trip Generation

The site trip generation is based on rates and equations for various land uses contained in the ITE *Trip Generation Manual (12th Edition)*.⁶ In this case, the site trip generation forecasts have relied on land use code (LUC) 221 (Multifamily Housing) in a general urban/suburban context.

TMCs were conducted at the existing North Front Street site access. This captured the existing trips that are coming in and out of the subject site for the existing 38 residential units. Therefore, the trip generation is only calculated for the new 53 residential units that are being proposed. The remainder of the site is not operational, so no existing trips are attributable to this component.

Table 3.1 summarizes the trip generation calculations.

TABLE 3.1: TRIP GENERATION ESTIMATES – VEHICLE TRIPS

Land Use	Units	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
Multifamily Housing (Mid-Rise) - Not Close to Rail Transit - (LUC 221)	53	3	11	14	14	8	22

The subject site is estimated to generate 14 and 22 vehicle trips in the AM and PM peak hours, respectively.

3.2.2 Modal Split

Data from the ITE Trip Generation Manual can be used to estimate trip data for all modes of travel. The trip generation included in **Table 3.1** already accounts for this modal split and provides the vehicle trips that are expected to enter and exit the site.

The data indicates that the majority of the projected trips for the subject site will be vehicle-based trips. Significant trip rates from other modes of travel are not anticipated.

Table 3.2 summarizes the ITE modal split data calculations.

⁶ ITE. *Trip Generation Manual (12th Edition)*. Washington, D.C. August 2025.



TABLE 3.2: MODAL SPLIT

Land Use	Trip	Units	AM Peak Hour			PM Peak Hour		
			In	Out	Total	In	Out	Total
Multifamily Housing (Mid-Rise) - Not Close to Rail Transit - (LUC 221)	Vehicle	53	3	11	14	14	8	22
	Walk, Transit, and Bicycle		2	1	3	3	3	6
Total			5	12	17	17	11	28

3.2.3 Trip Distribution and Assignment

Trip distribution is based on a review of existing traffic patterns found in the collected TMCs. Site trips are assigned to the study area roads based on logical route choice.

Table 3.3 summarizes the estimated trip distribution.

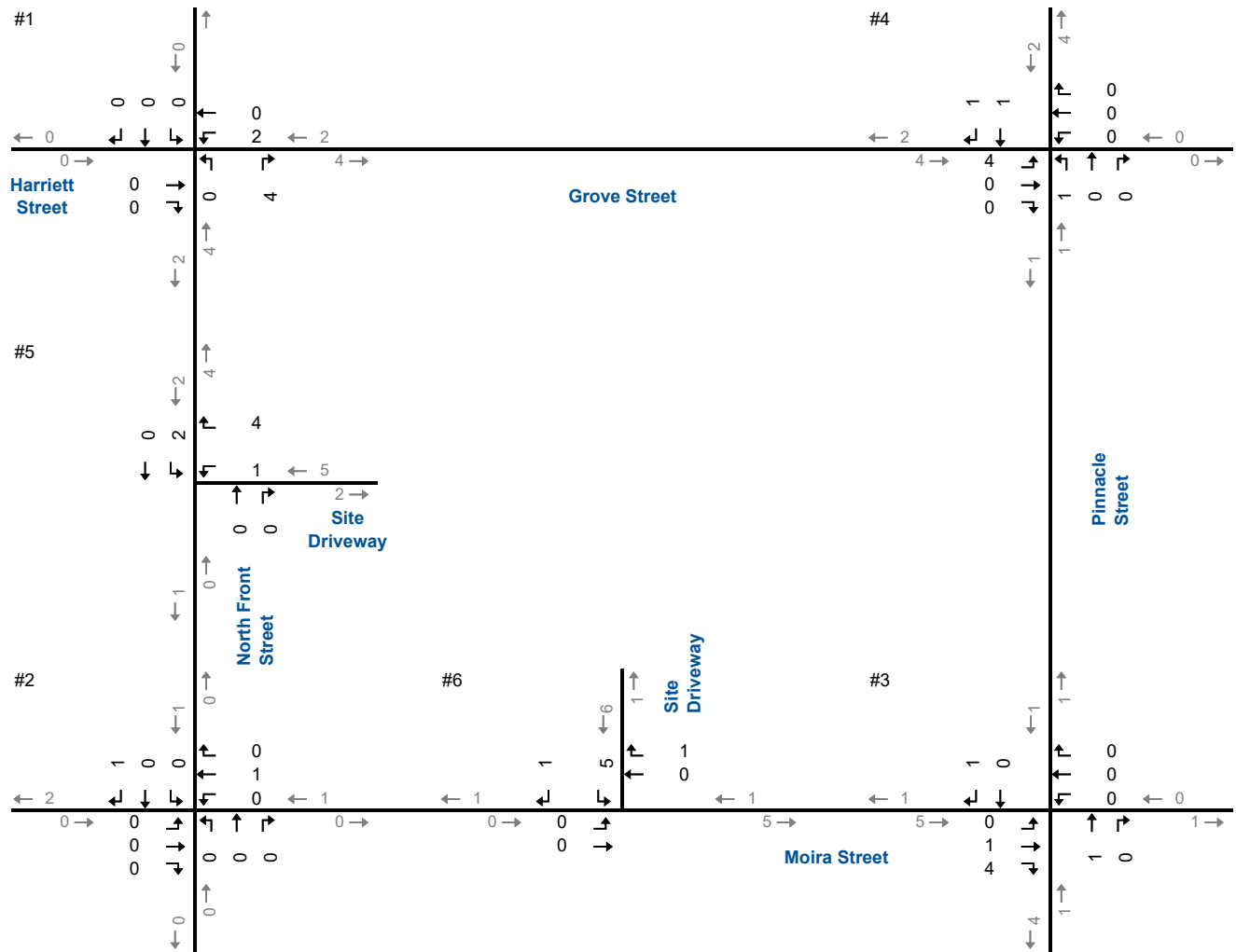
Figure 3.2 and **Figure 3.3** illustrate the site generated traffic for the weekday AM and PM peak hours, respectively.

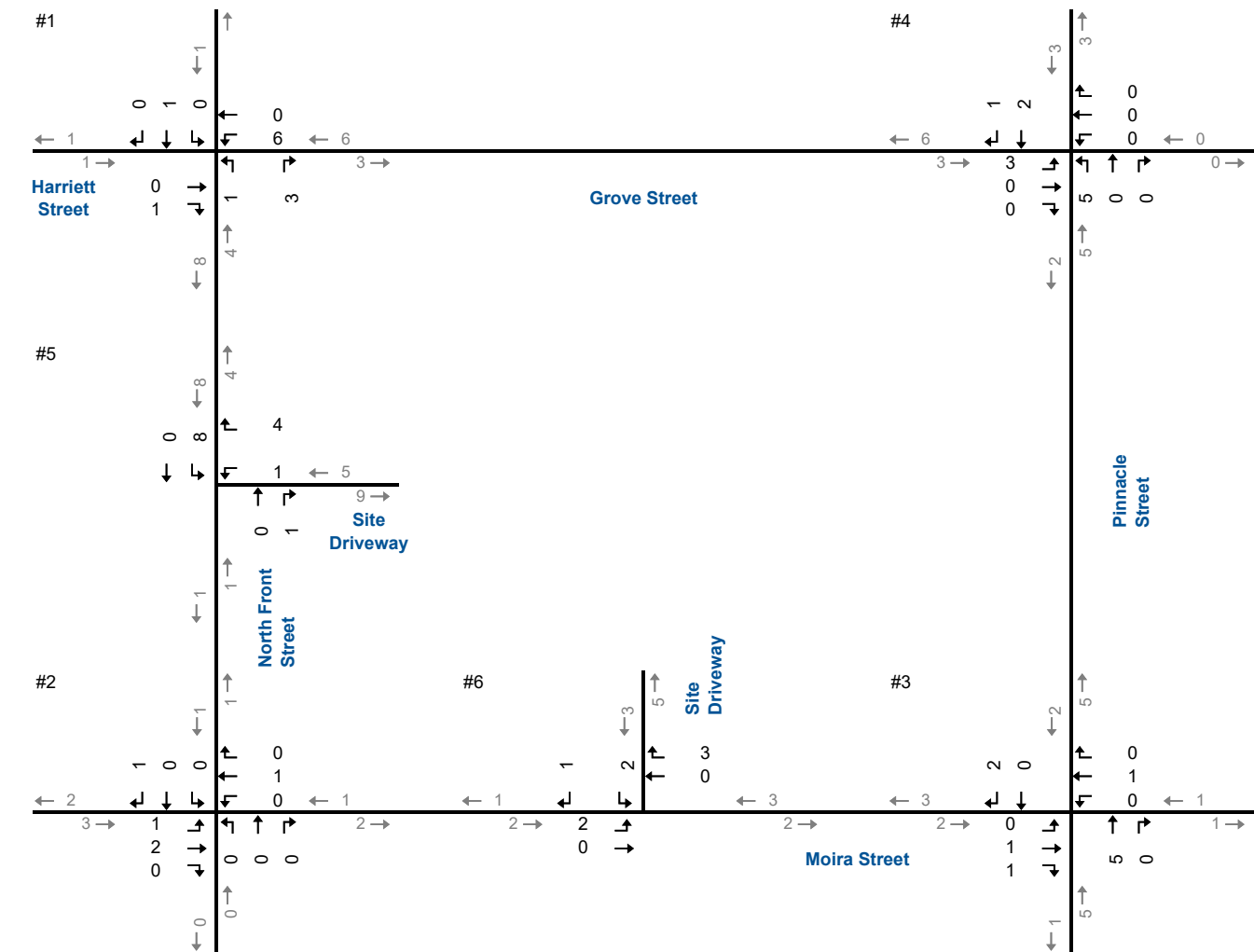
TABLE 3.3: TRIP DISTRIBUTION

Origin/Destination	AM Peak Hour		PM Peak Hour	
	In	Out	In	Out
North of North Front Street	15%	0%	16%	0%
South of North Front Street	5%	4%	3%	5%
East of Grove Street	1%	1%	1%	1%
West of Harriett Street	4%	4%	4%	3%
North of Pinnacle Street	28%	29%	17%	41%
South of Pinnacle Street	24%	34%	36%	22%
East of Moira Street	8%	6%	6%	8%
West of Moira Street	15%	22%	17%	20%
Total	100%	100%	100%	100%



AM PEAK HOUR





4 Future Conditions

4.1 Horizon Years

Consistent with the City of Belleville Traffic Impact Assessment Guidelines and pre-study consultation, Paradigm has analyzed the following horizon years:

- ▶ 2027: Estimated Opening Year; and
- ▶ 2032: Five-Years from the Opening Year.

4.2 Future Road Improvements

During pre-study consultation, City staff confirmed there are no road network improvements planned within the study area for the horizon years. Therefore, the existing road network and intersection lane configurations are applied to all future traffic operational analyses.

4.3 Background Traffic Forecasts

The future background traffic volumes in the study area are expected to comprise general background growth.

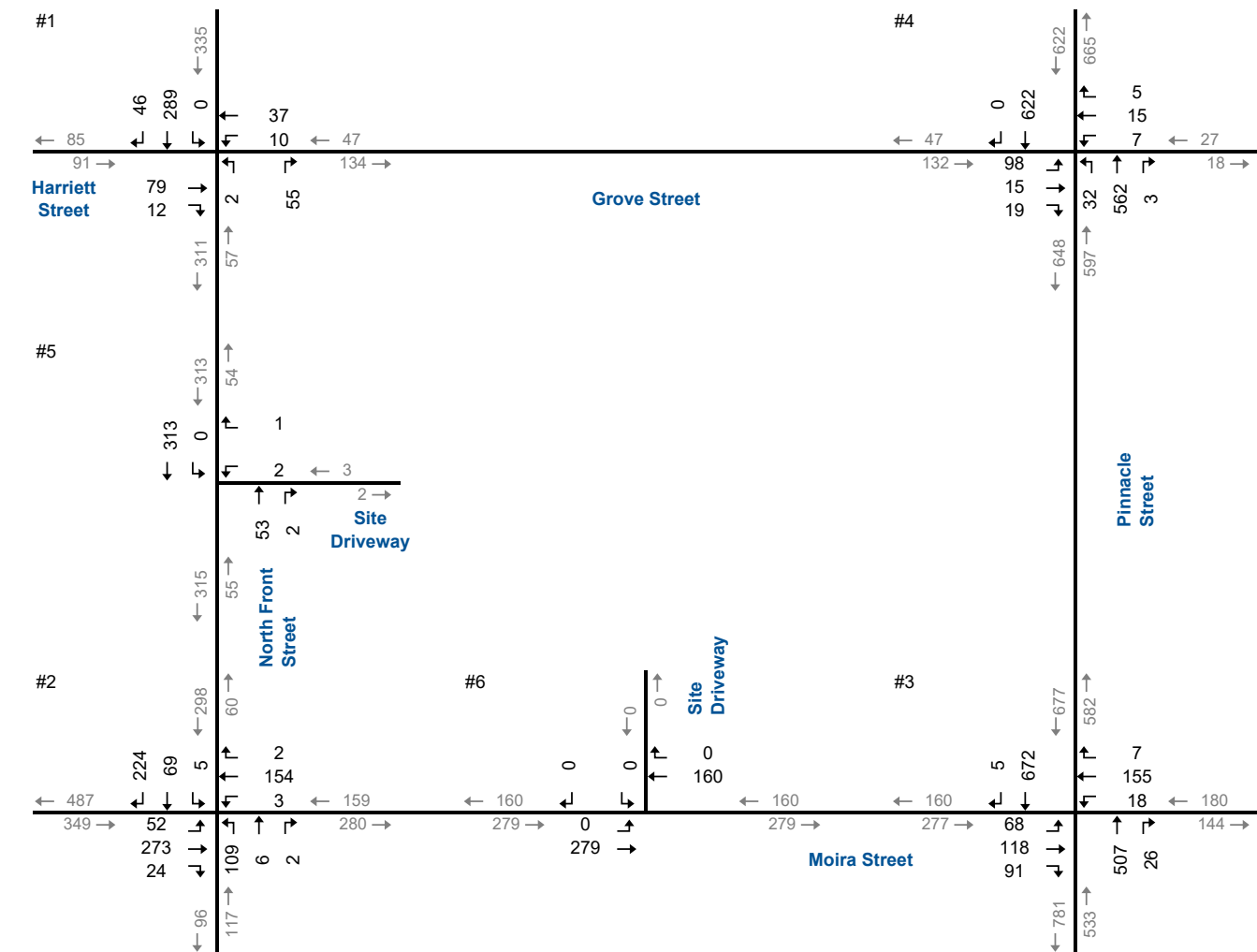
4.3.1 General Background Growth

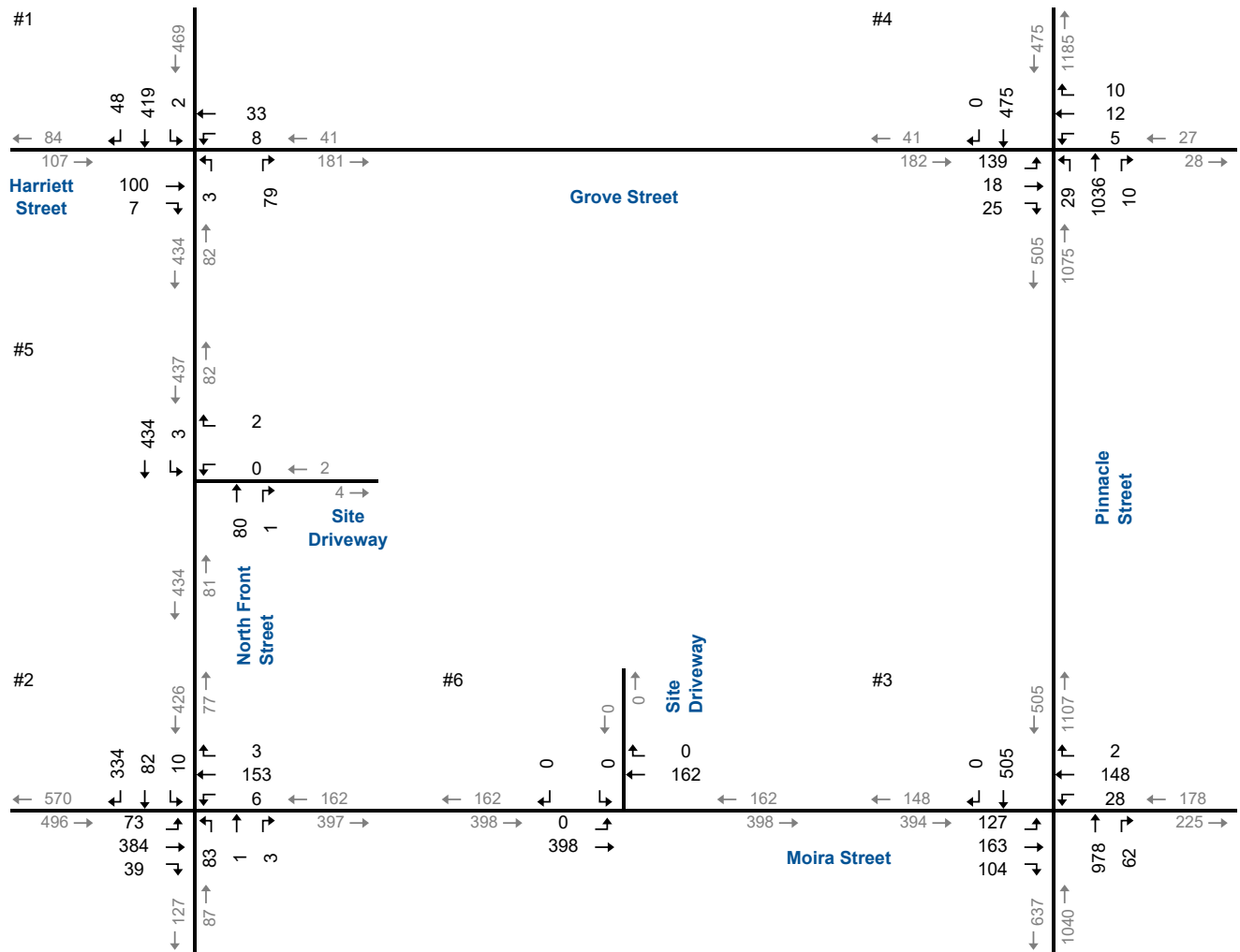
General background traffic reflects increases in traffic unrelated to any specific development plans. This background traffic growth is estimated using a compounded per annum growth rate of 2.0%. This growth rate has been confirmed with City staff during pre-study consultation (see **Appendix A**).

City staff confirmed that there are no planned developments that will generate transportation impacts for the study area.

Figure 4.1 and **Figure 4.2** illustrate the 2032 forecast background traffic volumes during the AM and PM peak hours, respectively.







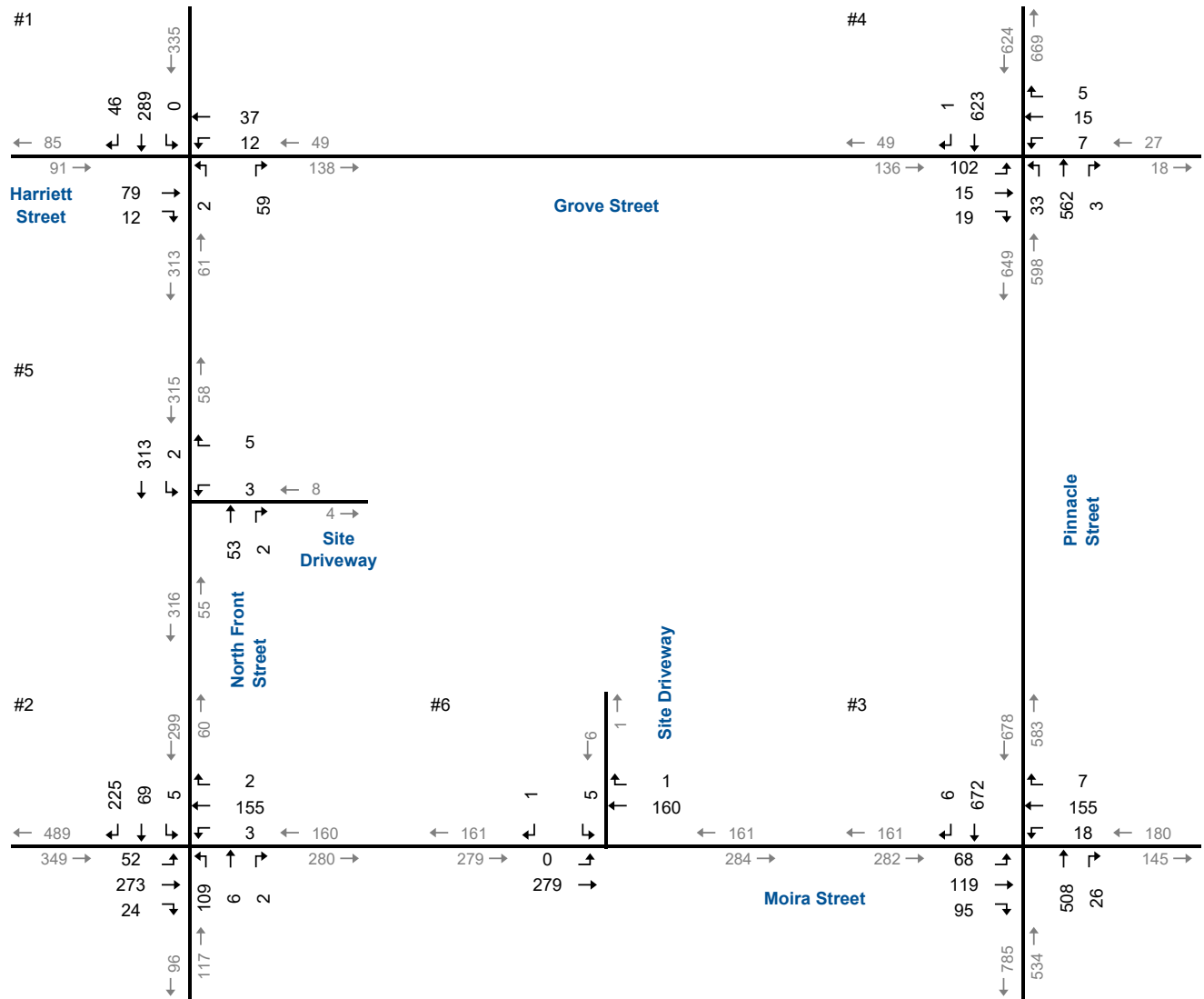
4.4 Forecast Total Traffic

Forecast total traffic volumes are estimated as the summation of the forecast site generated traffic volumes and the forecast background traffic volumes.

Figure 4.3 and **Figure 4.4** illustrate the 2032 forecast total traffic volumes during the AM and PM peak hours, respectively.

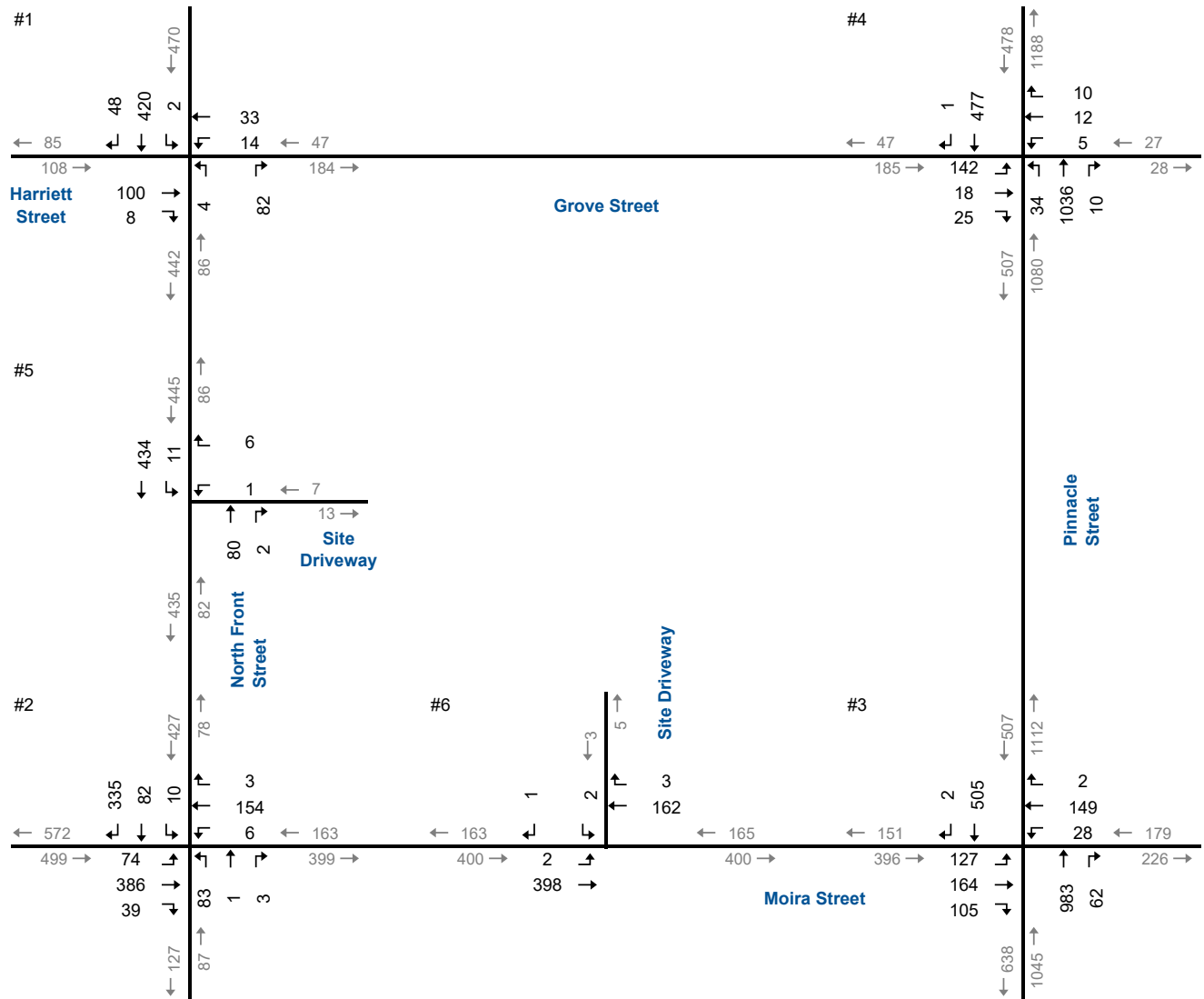


AM PEAK HOUR



2032 Total Traffic AM Peak Hour

PM PEAK HOUR



2032 Total Traffic PM Peak Hour

4.5 Future Background Traffic Operations

The 2032 background traffic volumes are analyzed using the same methodologies as existing traffic conditions.

All traffic movements are forecast to operate at acceptable levels of service. No critical movements are identified at the study area intersections during the AM or PM peak hours.

Table 4.1 and **Table 4.2** summarize the respective AM and PM level of service conditions.

Appendix D contains the detailed Synchro 12 reports.



TABLE 4.1: 2032 AM BACKGROUND TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																
				Eastbound				Westbound				Northbound				Southbound				Overall
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	North Front Street & Harriett Street/Grove Street	TCS	LOS Delay V/C Q Stor. Avail.		B	>	B 19	<	B	>	B 13	B		D	D 41	<	D	>	D 36	C 32
					19	>	<	13	0.08	0	42	<	36	>						
					0.14	>	<	0	0.04	7	<	0.67	>							
					23	>	<	9			96	>								
	Moira Street & North Front Street	TCS	LOS Delay V/C Q Stor. Avail.	<	B	B	B 16	<	B	>	B 15	<	B	>	B 12	<	B	A	A 4	B 12
16					10	<	15	>	<	12	>	<	17	0						
0.54					0.02	<	0.25	>	<	0.31	>	<	0.10	0.15						
43					1	<	42	>	<	17	>	<	22	0						
AM Peak Hour	Pinnacle Street & Moira Street	TCS	LOS Delay V/C Q	B	B	>	B 14	B	>	B 18		B	B	B 19		A	>	A 7	B 13	
					14	14	>	16	18	>	20	16	>	7	>					
					0.14	0.27	>	0.04	0.22	>	0.37	0.02	>	0.49	>					
					21	45	>	6	35	>	52	5	>	13	>					
	Pinnacle Street & Grove Street	TCS	LOS Delay V/C Q Stor. Avail.	C	D	>	C 31	B	>	B 16	A	A	>	A 8		C	>	C 20	B 16	
29					35	>	16	16	>	8	8	>	20	>						
0.19					0.04	>	0.02	0.03	>	0.14	0.42	>	0.44	>						
33					13	>	4	6	>	3	17	>	63	>						
AM Peak Hour	North Front Street & Site Driveway	TWSC	LOS Delay V/C Q					A	>	A 10		A	>	A 0	<	A		A 0	A 0	
								10			0	>	<	0						
								0.00*			0.04	>	<	0.00						
								0.1			0	>	<	0			0.27			

MOE - Measure of Effectiveness

LOS - Level of Service

Delay - Average Delay per Vehicle in Seconds

V/C - Volume to Capacity Ratio

Q - 95th Percentile Queue Length (m)

Stor. - Existing Storage (m)

Avail. - Available Storage (m)

TCS - Traffic Control Signal

TWSC - Two-Way Stop Control

AWSC - All-Way Stop Control

< / > - Shared with through movement

* - Value less than 0.01.



TABLE 4.2: 2032 PM BACKGROUND TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																
				Eastbound				Westbound				Northbound				Southbound				Overall
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
PM Peak Hour	North Front Street & Harriett Street/Grove Street	TCS	LOS Delay V/C Stor. Avail.		B 20 0.15 24 - -	> > > > >	B 20	< < < < <	B 13 0.06 7 - -	> > > > >	B 13	A 6 0.01 0 31 31	> > > > >	A 2 0.05 0 - -	< < < < <	D 46 0.84 141 - -	> > > > >	D 46	C 35	
	Moira Street & North Front Street	TCS	LOS Delay V/C Stor. Avail.	< < < < <	C 26 0.63 105 - -	B 16 0.03 7 20 13	C 25	< < < < <	A 6 0.21 6 - -	> > > > >	A 6	< < < < <	B 18 0.16 20 - -	> > > > >	B 18	< < < < <	B 17 0.12 21 - 20	A 0 0.22 0 20	A 4	B 14
	Pinnacle Street & Moira Street	TCS	LOS Delay V/C Stor. Avail.	A 6 0.25 5	A 5 0.35 3	> > > > >	A 5	B 16 0.07 9	B 18 0.19 32	> > > > >	B 18		C 24 0.67 107	B 16 0.04 7	C 24		A 6 0.35 10	> > > > >	A 6	B 16
	Pinnacle Street & Grove Street	TCS	LOS Delay V/C Stor. Avail.	C 26 0.26 34 - -	C 30 0.04 11 - -	> > > > >	C 27	B 16 0.01 3 20 17	B 16 0.03 6 - -	> > > > >	B 16	A 7 0.10 2 50 48	A 10 0.75 29 - -	> > > > >	A 9		B 19 0.34 47 - -	> > > > >	B 19	B 14
	North Front Street & Site Driveway	TWSC	LOS Delay V/C Stor. Avail.					A 9 0.00* 0.0			> > > > >	A 9		A 0 0.05 0	> > > > >	A 0		A 0 0.00* 0.0		A 0

MOE - Measure of Effectiveness

LOS - Level of Service

Delay - Average Delay per Vehicle in Seconds

V/C - Volume to Capacity Ratio

Q - 95th Percentile Queue Length (m)

Stor. - Existing Storage (m)

Avail. - Available Storage (m)

TCS - Traffic Control Signal

TWSC - Two-Way Stop Control

AWSC - All-Way Stop Control

< / > - Shared with through movement

* - Value less than 0.01.



4.6 Future Total Traffic Operations

The 2032 total traffic volumes are analyzed using the same methodologies as existing traffic conditions.

Overall, traffic operations remain relatively similar to background traffic conditions with the addition of site-generated traffic, indicating very minor impacts generated by development of the subject site. The proposed development does not significantly impact forecasted v/c ratios or the vehicle delay times in comparison to background traffic conditions. It is determined the site accesses operate at acceptable levels of service (LOS A) and well within capacity.

No intersection geometric improvements are identified nor required. No changes are recommended to the current intersection configurations. Traffic operations are expected to remain largely consistent between existing, forecast background, and total traffic conditions.

Table 4.3 and **Table 4.4** summarize the level of service conditions during the AM and PM peak hours, respectively.

Appendix E contains the detailed Synchro 12 reports.



TABLE 4.3: 2032 AM TOTAL TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																
				Eastbound				Westbound				Northbound				Southbound				Overall
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	North Front Street & Harriett Street/Grove Street	TCS	LOS Delay V/C Q Stor. Avail.		B 19 0.14 23 - -	> > > > >	B 19	< < < < <	B 13 0.09 9 - -	> > > > >	B 13	B 13 0.00 0 31 31		D 36 0.04 7 - -	D 36	< < < < <	D 36 0.67 96 - -	> > > > >	D 36	C 31
	Moira Street & North Front Street	TCS	LOS Delay V/C Q Stor. Avail.	< < < < <	B 16 0.54 43 - -	B 10 0.02 1 20 19	B 16	< < < < <	B 15 0.25 42 - -	> > > > >	B 15	< < < < <	B 12 0.31 17 - -	B 12	< < < < <	B 17 0.10 22 - -	A 0 0.15 0 20 20	A 4	B 12	
	Pinnacle Street & Moira Street	TCS	LOS Delay V/C Q	B 14 0.14 21	B 14 0.28 45	> > >	B 14	B 16 0.04 6	B 18 0.22 35	> > >	B 18		B 20 0.37 52	B 16 0.02 5	B 19		A 7 0.49 13	> > >	A 7	B 13
	Pinnacle Street & Grove Street	TCS	LOS Delay V/C Q Stor. Avail.	C 29 0.20 34 - -	C 35 0.04 13 - -	> > > > >	C 30	B 16 0.02 4 20 16	B 16 0.03 6 - -	> > > > >	B 16	A 8 0.15 4 50 46	A 8 0.42 17 - -	> > > > >	A 8		C 20 0.45 63 - -	> > > > >	C 20	B 16
	North Front Street & Site Driveway	TWSC	LOS Delay V/C Q					A 9 0.01 0		> > >	A 9		A 0 0.04 0	> > >	A 0		A 0 0.00* 0.0		A 0	A 0 0.28
	Moira Street & Site Driveway	TWSC	LOS Delay V/C Q	< < <	A 0 0.00 0		A 0		A 0 0.10 0	> > >	A 0					B 10 0.00* 0.2		> > >	B 10	A 0 0.18

MOE - Measure of Effectiveness

LOS - Level of Service

Delay - Average Delay per Vehicle in Seconds

V/C - Volume to Capacity Ratio

Q - 95th Percentile Queue Length (m)

Stor. - Existing Storage (m)

Avail. - Available Storage (m)

TCS - Traffic Control Signal

TWSC - Two-Way Stop Control

AWSC - All-Way Stop Control

< / > - Shared with through movement

* - Value less than 0.01.



TABLE 4.4: 2032 PM TOTAL TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																	
				Eastbound				Westbound				Northbound				Southbound				Overall	
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach		
PM Peak Hour	North Front Street & Harriett Street/Grove Street	TCS	LOS Delay		B 19	>	B 19	<	B 12	>	B 12	A 7		A 2	<	A 2	<	D 39	>	D 39	C 30
			V/C	0.13	>	<	0.05		0.05									0.75	>		
			Q	22	>	<	6		0		0							111	>		
			Stor. Avail.	-	>	<	-		31		31							-	>		
	Moira Street & North Front Street	TCS	LOS Delay	<	C 24	B 16	<	A 6	>	A 6	<	B 17	>	B 17	<	B 17	<	B 17	A 0	A 4	B 13
			V/C	<	0.56	0.03	<	0.18	>	<	0.14	>	<	0.11	0.19	<	0.11	>	0		
Q			<	90	6	<	7	>	<	19	>	<	22	0	<	22	>	0			
Stor. Avail.			<	-	20	<	-	>	<	-	>	<	-	20	<	-	>	-	20		
Pinnacle Street & Moira Street	TCS	LOS Delay	A 6	A 5	>	A 5	B 16	B 17	>	B 17		C 23	B 16	C 22		A 6	>	A 6	B 15		
		V/C	0.22	0.31	>	0.06	0.17	>	0.59	0.04		0.59	0.04		0.31	>					
		Q	5	2	>	8	28	>	91	7		7			8	>					
		Stor. Avail.	-	-	>	-	-	>	-	-	>	-	-	>	-	>	-	>			
Pinnacle Street & Grove Street	TCS	LOS Delay	C 25	C 29	>	C 26	B 16	B 16	>	B 16	A 7	A 9	>	A 9		B 19	>	B 19	B 13		
		V/C	0.23	0.04	>	0.01	0.02	>	0.08	0.66	>		0.30	>		0.30	>				
		Q	30	10	>	3	6	>	2	26	>		41	>		41	>				
		Stor. Avail.	-	-	>	20	-	>	50	-	>	48	-	>	-	>	-	>			
North Front Street & Site Driveway	TWSC	LOS Delay					A 9		>	A 9		A 0	>	A 0	<	A 0		A 0	A 0		
		V/C				0.00*		>			0.04	>		<		0.00*			0.33		
		Q				0.0		>			0	>		<		0.0					
		Stor. Avail.	-	-	>	-	-	>	-	-	>	-	-	>	-	>	-	>			
Moira Street & Site Driveway	TWSC	LOS Delay	<	A 0		A 0		A 0	>	A 0		A 0	>	A 0	<	A 0	>	A 0	A 0		
		V/C	<	0.00			0.09	>				0.00	>		<				0.13		
		Q	<	0			0	>					>		<						
		Stor. Avail.	-	-	>	-	-	>	-	-	>	-	-	>	-	>	-	>			

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< / > - Shared with through movement

* - Value less than 0.01.



4.7 Transit and Active Transportation Impacts

4.7.1 Transit

Currently, there are no available plans for changes or upgrades to existing transit service near the development site. The nearest transit stop is at the intersection of Pinnacle Street and Moira Street, approximately 140 metres east of the subject site. The close proximity to bus stops will continue to attract public transit trips to and from the site.

No changes to the public transit are anticipated as a result of the development.

4.7.2 Walking

The City of Belleville Transportation Master Plan provides a strategic long-term plan intended to encourage and promote sustainable transportation in the City.

There are plans for the Upper Front Street bridge, which is located south of the subject site, to be rehabilitated. Plans include maintaining vehicular and pedestrian access across the bridge.

No changes to off-site pedestrian infrastructure are anticipated as a result of the development.

4.7.3 Cycling

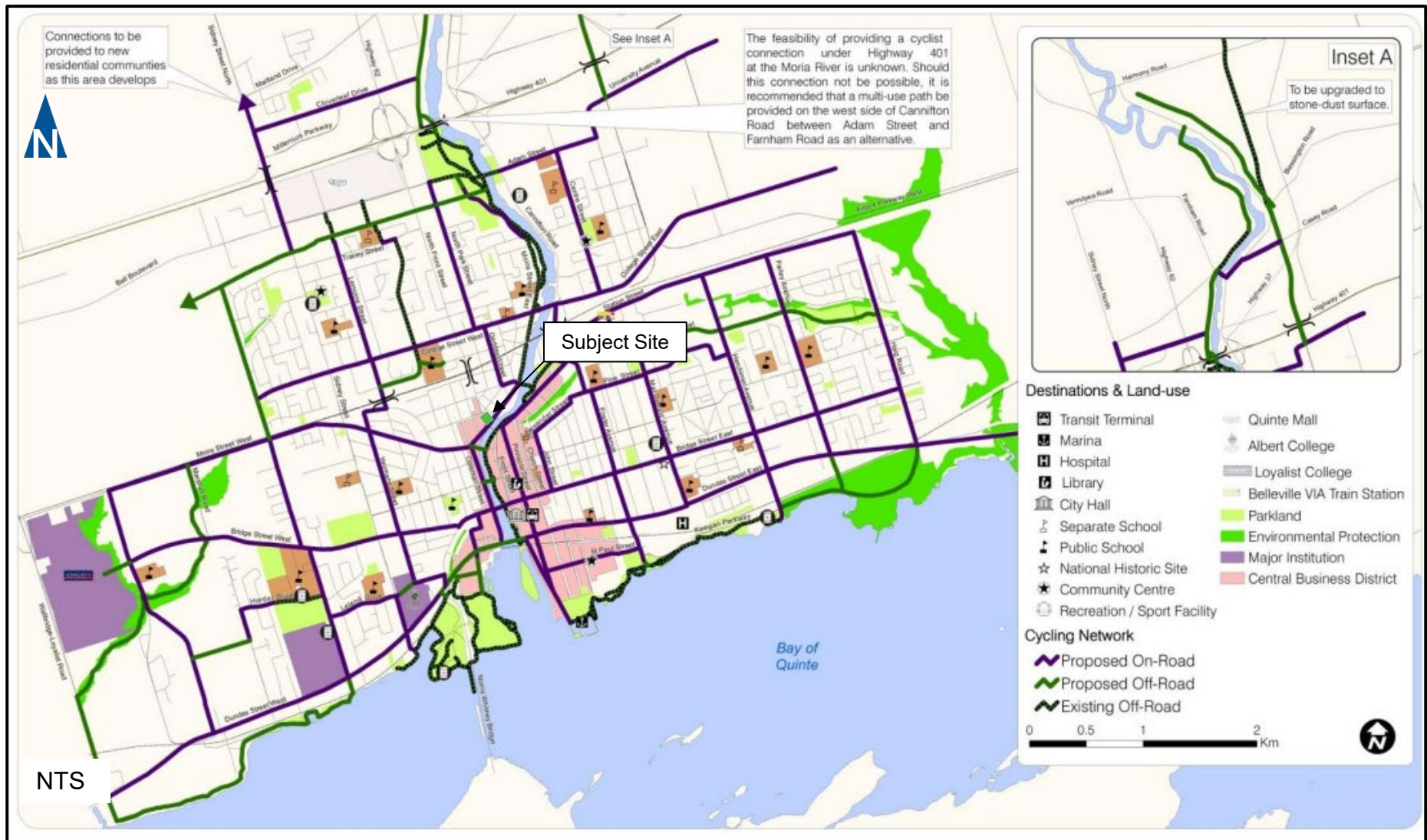
The City of Belleville Transportation Master Plan identifies plans to introduce dedicated on-road cycling lanes along Moira Street. This will help bolster active transportation in the subject area.

The City has a commitment to enhancing active transportation and is dedicated to creating a community that prioritizes accessible and health-conscious recreational options. The planned cycling lanes will enhance east-west connectivity and improve access for cyclists to and from the site. This initiative will also support efforts for the study area to become more accessible for cyclists.

No changes to the cycling lane plans are anticipated as a result of the subject development.

Figure 4.5 shows the proposed cycle network from the City of Belleville Transportation Master Plan.





5 Parking Study

5.1 City of Belleville Zoning By-law Requirements

5.1.1 Vehicle Parking

A total of 65 vehicle parking spaces are currently provided on the site to serve the existing 38 units and the proposed 53 units. Through the development plans, the existing vehicle parking supply is planned to be jointly shared between the existing residents and residents of the new development. Given the shared nature of the on-site vehicle parking facilities, this review considers the vehicle parking needs for all units of the building.

Off-street vehicle parking requirements are provided in the City of Belleville *Zoning By-law 2024-100*⁷. The subject site is located in mixed-use zone 1.

According to the *Table 18-1: Residential Off-Street Parking Requirements in the by-law*, “...the minimum required parking spaces in MX1 & MX2 Zones is 0.5 per unit; plus 0.2 parking spaces for visitors per unit (excluding the first 6 units).” In total, this results in a requirement of 0.7 spaces per residential unit and a total of 63 vehicle parking spaces for the site.

Section 18.4 of the by-law states that “...where the number of parking spaces in Table 18-1 or 18-2 is between 13 and 100 parking spaces, 5% of the number of parking spaces in must be accessible spaces.” In total, this results in a requirement of four accessible vehicle parking spaces needed for the proposed site.

Table 5.1 summarizes vehicle parking by-law requirements for the existing site.

⁷ City of Belleville. *Zoning By-law 2024-100, Table 18-1 Residential Off-Street Parking Requirements*. March 2024. Accessed from: <https://forms.belleville.ca/PDFs/By-law-2024-100>



TABLE 5.1: EXISTING VEHICLE PARKING REQUIREMENTS (BY-LAW)

Requirement Type	Rate	Units	Required Spaces
Dwelling Unit (Resident)	0.5 per unit	38	19
Dwelling Unit (Visitor)	0.2 per unit (excluding the first 6 units)	38	6
Total Required Vehicle Parking			25
Proposed Vehicle Parking Supply			65
Vehicle Parking Surplus (Deficit)			40

Table 5.2 summarizes vehicle parking by-law requirements for the proposed site.

TABLE 5.2: FUTURE VEHICLE PARKING REQUIREMENTS (BY-LAW)

Requirement Type	Rate	Units	Required Spaces
Dwelling unit (resident)	0.5 per unit	91	46
Dwelling unit (visitor)	0.2 per unit (excluding the first 6 units)	91	17
Total Required Vehicle Parking			63
Proposed Vehicle Parking Supply			65
Vehicle Parking Surplus (Deficit)			2

The existing vehicle parking supply meets by-law requirements with a surplus of 40 spaces. For the proposed site, City by-law requires 63 vehicle parking spaces. The proposed site plans include 65 vehicle parking spaces. Therefore, the future vehicle parking supply also meets by-law requirements, with a surplus of two spaces. The proposed accessible vehicle parking supply of four spaces meets the by-law requirement of four spaces as well.

5.1.2 Bicycle Parking

According to, *Table 18-5 Bicycle Parking Requirements* of the City zoning by-law, the site requires 0.5 bicycle spaces per residential unit.



Table 5.5 summarizes bicycle parking by-law requirements for the existing site.

TABLE 5.3: EXISTING BICYCLE PARKING REQUIREMENTS

Requirement Type	Rate	Units	Required Spaces
Dwelling unit	0.5 per unit	38	19
Bicycle Parking Supply			27
Bicycle Parking Surplus (Deficit)			8

Table 5.6 summarizes bicycle parking by-law requirements for the proposed site.

TABLE 5.4: FUTURE BICYCLE PARKING REQUIREMENTS

Requirement Type	Rate	Units	Required Spaces
Dwelling unit	0.5 per unit	91	46
Proposed Bicycle Parking Supply			27
Bicycle Parking Surplus (Deficit)			(-19)

The existing bicycle parking supply meets by-law requirements with a surplus of eight spaces. For the new units on the site, City by-law requires 27 bicycle parking spaces for the site. The proposed site plans include 27 bicycle parking spaces for these new units, and therefore meets by-law requirements. It is anticipated that residents from the existing units will continue to use the bicycle facilities already on site, as no changes are proposed to these units or their related cycling infrastructure.

5.2 Conclusions

The proposed development is projected to meet vehicle and bicycle parking by-law requirements. Occupants of the new residential units may have the option to obtain a parking space that is already in use on site. By limited any increases in vehicle parking on site, increased single-occupant vehicle (SOV) demand is discouraged. This initiative will help reduce demand on the City's road network and encourage more sustainable modes of travel, while still following City by-law.



6 Site Circulation Analysis

Vehicle access is proposed via a single all-moves private driveway connection to North Front Street and single all-moves private parking garage along Moira Street. A single vehicle access at North Front Street already exists at the site and a parking garage access already exists along Moira Street. The North Front Street access will connect to Parking Level One on site, while the Moira Street access will lead to the Lower-level Parking. The two parking levels are not connected. Aside from upgrades to support structural needs, no changes to the parking lots are proposed that would change vehicle circulation.

There are currently no loading spaces on site, and the development proposal does include any changes in this regard. Waste collection will occur at the Moira Street access. In case of an emergency, fire trucks are to be stationed on the surrounding road network, close to the site accesses.

Vehicle circulation is assessed using AutoTURN swept path analysis software.

Based on the site information, vehicle maneuvering diagrams are prepared for the following design vehicle:

- ▶ Transportation Association of Canada (TAC) passenger (P) vehicle

Results of the analysis indicate that there are no conflicts with the proposed on-site geometry. As no significant changes to the building parking lots are proposed, some aisle widths and parking spaces do not meet current municipal standards. Despite this, passenger vehicles are still able to circulate the site consistent with existing site conditions.

Appendix F contains the detailed AutoTURN vehicle manoeuvring diagrams.



7 Conclusions and Recommendations

7.1 Conclusions

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

- ▶ **Existing Traffic Conditions:** All the study area intersections are operating at acceptable levels of service and well within capacity during both AM and PM peak hours.
- ▶ **Development Trip Generation:** Development of the site is forecast to generate 14 trips in the AM peak hour and 22 trips in the PM peak hour.
- ▶ **Background Traffic Conditions:** Under 2032 background traffic conditions, the study area intersections are forecast to operate at acceptable levels of service and well within capacity. No critical movements are forecast.
- ▶ **Total Traffic Conditions:** Under 2032 total traffic conditions, the study area intersections are forecast to operate at acceptable levels of service and well within capacity. No critical movements are forecast.
- ▶ **Remedial Measures:** All study area intersections are forecast to operate at acceptable levels of service and well within capacity. No off-site modifications, such as geometric road or intersection improvements, are required to support the subject development.
- ▶ **Vehicle Parking:** Development plans include 65 vehicle parking spaces for the total 91 residential units. This supply meets City of Belleville by-law parking requirements with a surplus of two spaces. Development plans also include four accessible vehicle parking spaces, which also meets City by-law requirements.
- ▶ **Bicycle Parking:** Development plans include 27 bicycle parking spaces for the 91 residential units. This supply is intended for the 53 new units and meets City by-law requirements for the new units. As the existing units and related building components are not being renovated, no changes to existing bicycle parking are proposed for these existing units.
- ▶ **Vehicle Site Circulation:** An analysis of site circulation indicates that vehicles can enter, exit, and navigate the site without conflict.



7.2 Recommendations

Based on the study results, it is recommended that the conclusions of this report be recognized.



Appendix A

Pre-Study Consultation Notes

Appendix B

Turning Movement Count Data and Signal Timings

Appendix C

Existing Traffic Operations Reports

Appendix D

Background Traffic Operations Reports

Appendix E

Total Traffic Operations Reports

Appendix F

AutoTURN Site Circulation Review

