3640 Greenbank Road Transportation Impact Assessment

Step 1 Screening Report

Step 2 Scoping Report

Step 3 Forecasting Report

Step 4 Analysis Report

Prepared for:

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Nepean, ON K2G 3Z1

December 2018

PN: 2018-05

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1 Screening

This study has been prepared according to the City of Ottawa's 2017 Transportation Impact Assessment (TIA) Guidelines. Accordingly, a Step 1 Screening Form has been prepared and is included as Appendix A, along with the Certification Form for TIA Study PM. As shown in the Screening Form, a TIA is required. Both the Design Review Component and the Network Impact Component will be completed.

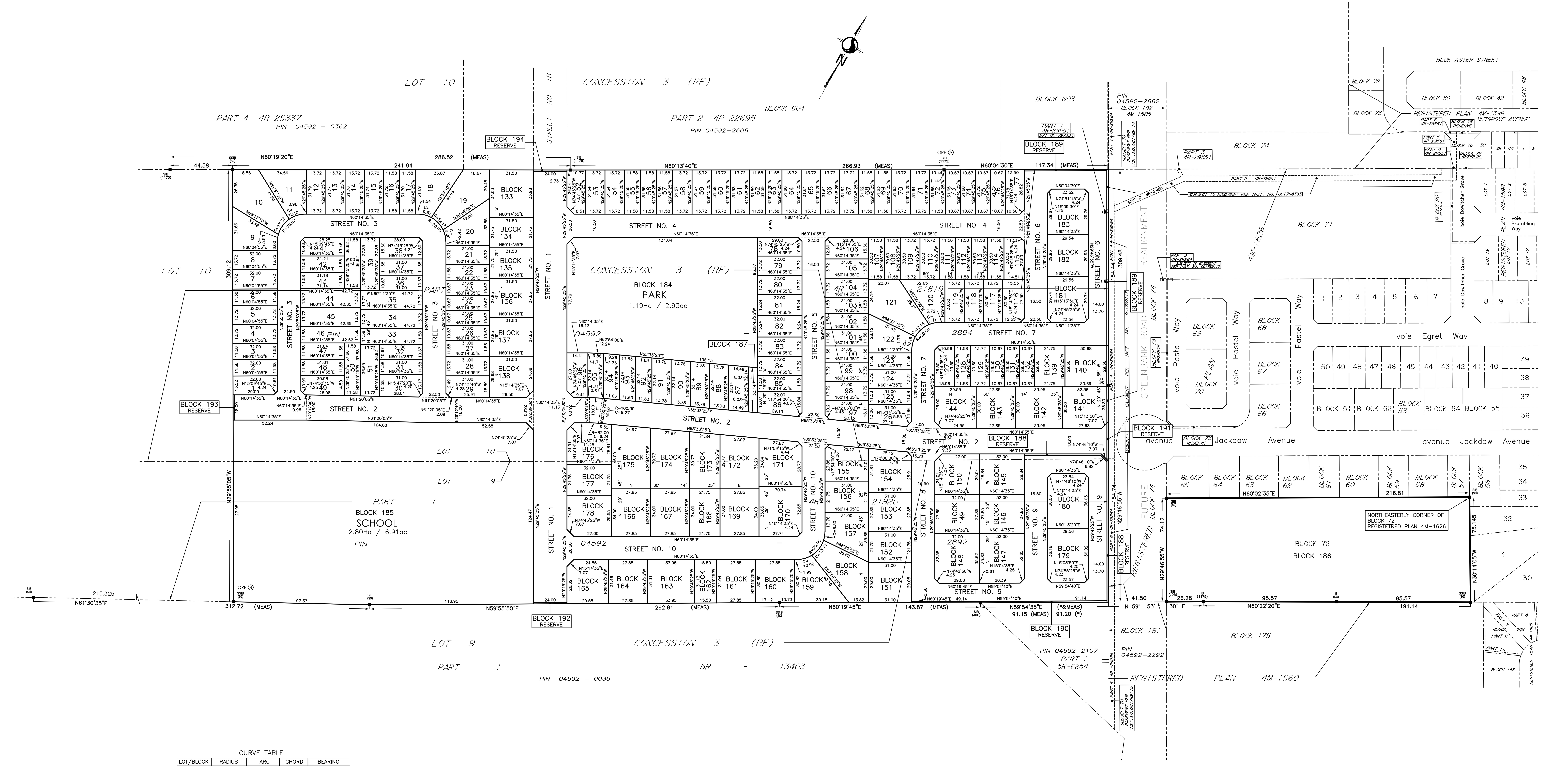
2 Scoping

2.1 Existing and Planned Conditions

2.1.1 Proposed Development

The proposed development, located at 3640 Greenbank Road, is currently a greenfield property within the Barrhaven South CDP Area. The site is in an area that is currently zoned DR Development Reserve Zone. The proposed residential development will consist of a mix of detached homes and townhouses. The concept plan considers a total of approximately 350 units, split between townhouse and detached units (221 townhouses and 125 detached homes). Access to the proposed development will be via the adjacent developments, and ultimately will be accessed via realigned Greenbank Road. The realigned Greenbank Road access configuration will be determined once that road is completed. The development will also have connections to the adjacent developments to allow access to shared community services (i.e. parks, schools, etc.). The development traffic will primarily use the main access (Street 1) to reach the transportation network. The anticipated full build-out and occupancy horizon is 2022, built in two phases, referred to herein as Phase 7 and Phase 8. Figure 1 illustrates the Study Area Context. Figure 2 illustrates the proposed concept plan.

Figure 1: Area Context Plan



APPROVED UNDER SECTION 51 OF THE PLANNING ACT BY THE CITY OF OTTAWA THIS ____ DAY OF __________________ ,20___

STEPHEN WILLIS, MCIP, RPP. GENERAL MANAGER
PLANNING, INFRASTRUCTURE AND ECONOMIC DEVELOPMENT DEPARTMENT, CITY OF OTTAWA

PLAN 4M-

I CERTIFY THAT THIS PLAN IS REGISTERED IN THE LAND REGISTRY OFFICE FOR THE LAND TITLES DIVISION OF OTTAWA-CARLETON No.4 AT_____ O'CLOCK ON THE______ DAY OF _____________, 2019 AND ENTERED IN THE PARCEL REGISTER FOR PROPERTY IDENTIFIER 04592-2486, 04592-2811, AND THE REQUIRED CONSENTS ARE REGISTERED AS PLAN DOCUMENT NUMBER OC-____________.

REPRESENTATIVE FOR LAND REGISTRAR

THIS PLAN COMPRISES OF PART OF PIN 04592-2486 AND PART OF PIN 04592-2811.

PART OF BLOCK 189 AND STREET 6 : SUBJECT TO EASEMENT OVER PART 4 ON PLAN 4R-29284 AS IN OC1769117 AND SUBJECT TO EASEMENT OVER PART 1 ON PLAN 4R-29551 AS IN OC1797333.

PLAN OF SUBDIVISION of

PART OF LOTS 9 AND 10 CONCESSION 3 (RIDEAU FRONT)

(GEOGRAPHIC TOWNSHIP OF NEPEAN)

AND BLOCK 72 REGISTERED PLAN 4M-1626 CITY OF OTTAWA

Scale 1:1250

20 0 20 40 60 80 METRES

METRIC CONVERSION

DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

GRID SCALE CONVERSION

DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.999933.

BEARING NOTE

BEARINGS ARE GRID, DERIVED FROM CAN-NET VRS NETWORK GPS OBSERVATIONS ON NCC HORIZONTAL CONTROL MONUMENTS 19773035 AND 19680191, CENTRAL MERIDIAN, 76° 30' WEST LONGITUDE MTM ZONE 9, NAD83 (ORIGINAL).

19773035 N:5006060.42 E:324888.04
19680191 N:5033564.26 E:388064.94

OBSERVED REFERENCE POINTS DERIVED FROM THE CAN-NET VRS NETWORK GPS OBSERVATIONS ON NCC HORIZONTAL CONTROL MONUMENTS 19773035 AND 19680191, CENTRAL MERIDIAN, 76° 30' WEST LONGITUDE MTM ZONE 9, NAD83 (ORIGINAL).
COORDINATES TO URBAN ACCURACY PER SEC 14(2) OF O.REG. 216/10

ORP ID	NORTHING	EASTING
Ⓐ	5012066.56	363839.78
Ⓑ	5011546.28	363552.10

COORDINATES CANNOT, IN THEMSELVES, BE USED TO RE-ESTABLISH CORNERS OR BOUNDARIES SHOWN ON THIS PLAN.

LEGEND

■	DENOTES	FOUND MONUMENTS
□	"	SET MONUMENTS (IB) UNLESS OTHERWISE STATED
IB	"	IRON BAR
IBø	"	ROUND IRON BAR
SIB	"	STANDARD IRON BAR
SSIB	"	SHORT STANDARD IRON BAR
CC	"	CUT CROSS
CP	"	CONCRETE PIN
WIT	"	WITNESS
PIN	"	PROPERTY IDENTIFICATION NUMBER
MEAS	"	MEASURED
PROP	"	PROPORTIONED
OU	"	ORIGIN UNKNOWN
SG	"	STANTEC GEOMATICS LTD.
ORP	"	OBSERVED REFERENCE POINT
*	"	*
*	"	*
*	"	*
*	"	*

OWNER'S CERTIFICATE PART OF PIN 04592-2486
PART OF PIN 04592-2811

THIS IS TO CERTIFY THAT :

1. LOTS 1 TO 132, BOTH INCLUSIVE, BLOCKS 133 TO 187, BOTH INCLUSIVE, THE STREETS, NAMELY 1 TO 10, AND RESERVES, NAMELY BLOCKS 188, 189, 190, 191, 192, 193 AND 194, HAVE BEEN LAID OUT IN ACCORDANCE WITH OUR INSTRUCTIONS.

2. THE STREETS ARE DEDICATED TO CITY OF OTTAWA AS PUBLIC HIGHWAYS.

DATE

CHRISTOPHER TAGGART
TAMARACK (NEPEAN) CORPORATION
I HAVE THE AUTHORITY TO BIND THE CORPORATION

SURVEYOR'S CERTIFICATE

I CERTIFY THAT :

1. THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT AND THE LAND TITLES ACT AND THE REGULATIONS MADE UNDER THEM.

THE SURVEY WAS COMPLETED ON THE DAY OF , 2019

DATE

BRIAN J. WEBSTER
ONTARIO LAND SURVEYOR

Stantec Geomatics Ltd.
CANADA LANDS SURVEYORS
ONTARIO LAND SURVEYORS
1331 CLYDE AVENUE, SUITE 400
OTTAWA, ONTARIO, K2C 3G4
TEL. 613.722.4420 FAX. 613.722.2799
stantec.com

DRAWN: CEC	CHECKED: *	PM: FP	FIELD: *	PROJECT No.: 161613817-132

CURVE TABLE

LOT/BLOCK	RADIUS	ARC	CHORD	BEARING
9	20.00	5.55	5.53	N21°58'10"W
10	20.00	13.63	13.37	N5°30'20"E
11	20.00	12.29	12.10	N42°38'15"E
18	20.00	9.97	9.87	N74°31'30"E
19	20.00	12.37	12.17	N73°28'50"W
20	20.00	9.08	9.00	N42°45'45"W
95	100.00	9.28	9.27	N62°54'00"E
120	20.00	7.76	7.71	N49°07'35"E
121	20.00	13.38	13.14	N18°50'15"E
122	20.00	10.27	10.16	N15°02'45"W
157	20.00	6.32	6.30	N20°42'00"W
158	20.00	13.99	13.71	N08°23'55"E
159	20.00	11.10	10.96	N44°20'25"E
176	82.00	6.25	6.24	N62°25'30"E

2.1.2 Existing Conditions

2.1.2.1 Area Road Network

Borrisokane Road

Borrisokane Road is a City of Ottawa collector road with a two-lane rural cross-section including gravel shoulders and an 80 km/h posted speed limit. North of Cambrian Road, Borrisokane Road becomes an Arterial Road, the cross section does not change. The Ottawa Official Plan reserves a 24-metre right-of-way (ROW) south of Cambrian Road, north of Cambrian Road a 37.5 ROW is reserved.

Cambrian Road

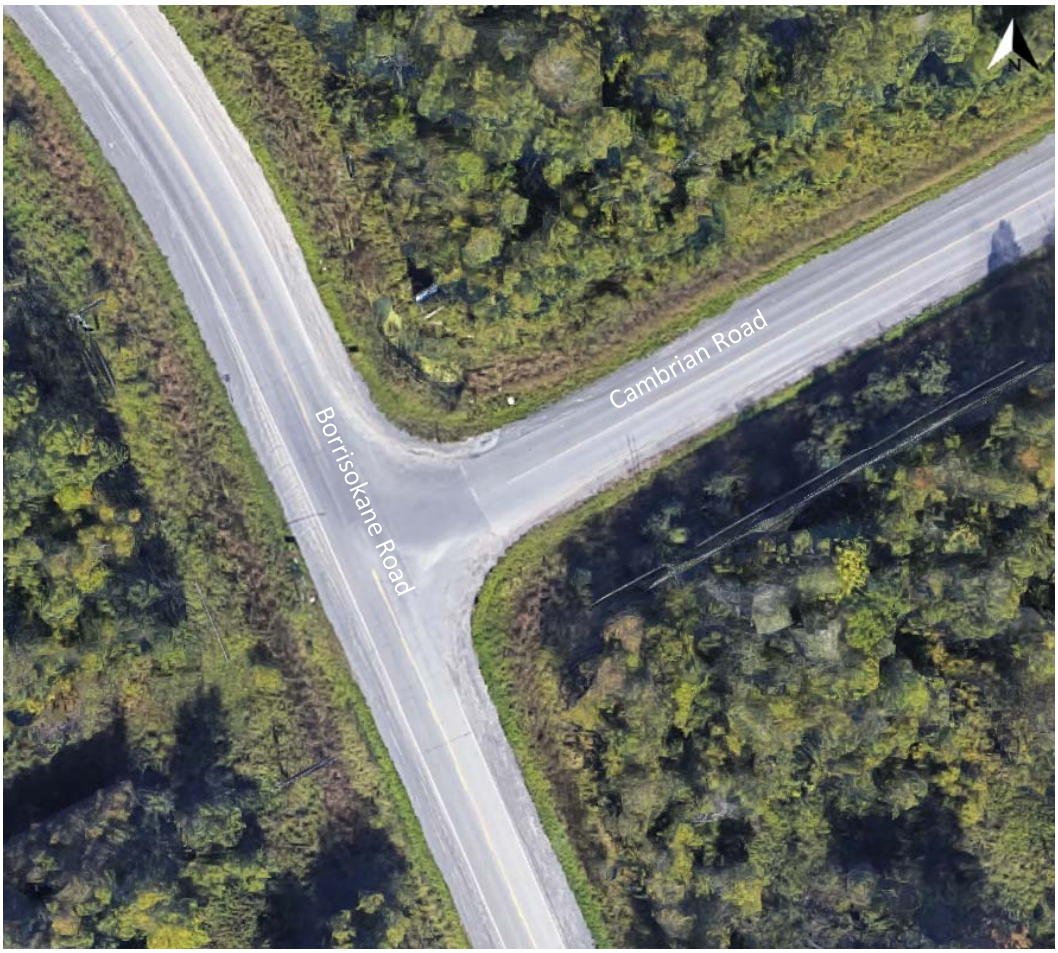
Cambrian Road is a City of Ottawa arterial road with a two-lane rural cross-section including gravel shoulders and a 70 km/h posted speed limit. The Ottawa Official Plan reserves a 37.5 metre ROW from Cedarview (now Borrisokane Road) to Jockvale Road.

2.1.2.2 Existing Intersections

Cambrian Road at Borrisokane Road

The intersection of Cambrian Road at Borrisokane Road is an unsignalized intersection with no auxiliary lanes. The intersection is stop controlled on the Cambrian Road (minor) leg of the road. No crosswalks are present, and none of the legs of the intersection have sidewalks. No cycling facilities are present on any of the legs of the intersection. No turn restrictions are present. Figure 3 illustrates the intersection of Cambrian Road at Borrisokane Road.

Figure 3: Intersection of Cambrian Road at Borrisokane Road



New Greenbank Road does not yet exist and therefore, no intersections along this road exists. A 41.5 metre ROW is protected for New Greenbank Road for in the Official Plan, north of the South Urban Community – south limit. The adjacent street network has been prepared in concept but does not exist.

2.1.2.3 Existing Driveways

There are no existing driveways within 200 metres of the potential future access.

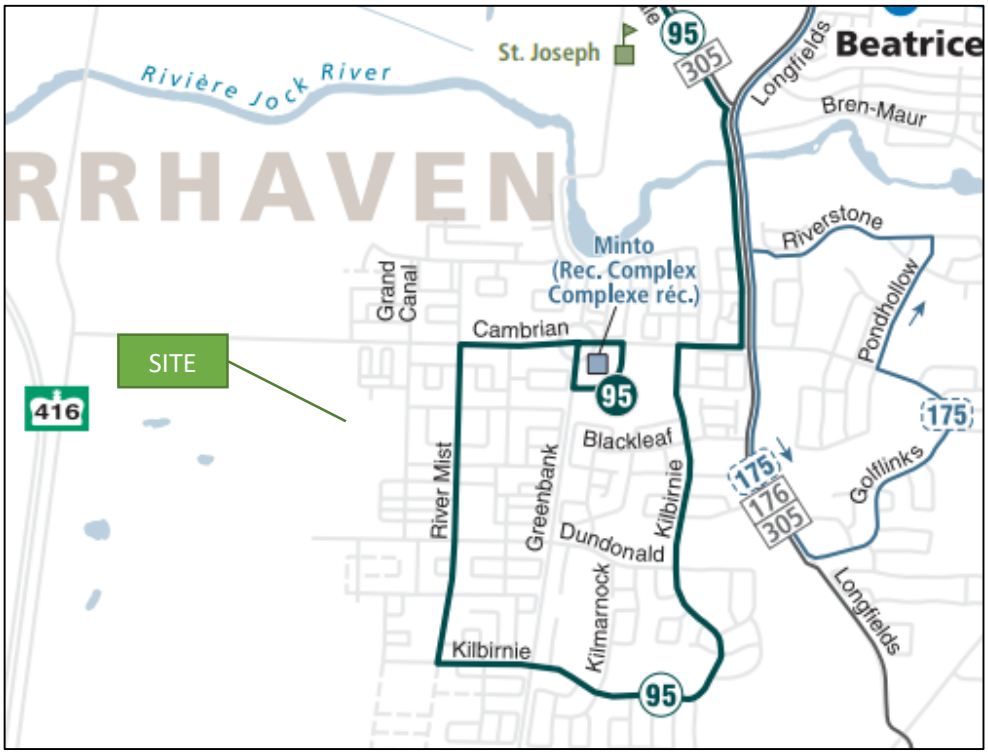
2.1.2.4 Cycling and Pedestrian Facilities

No cycling facilities currently exist along Borrisokane Road or Cambrian Road, and no future cycling facilities are included in the Cycling Plan. Similarly, no existing or planned pedestrian facilities are shown on Borrisokane Road. As New Greenbank Road has not yet been constructed, no cycling or pedestrian facilities currently exist. The future cross-section has not been determined for New Greenbank Road (South of the urban boundary limit), but it is assumed that it would include pedestrian and cycling facilities, like the cross-section contemplated within the Urban Boundary.

2.1.2.5 Existing Transit

There is no existing transit service along the boundary roads. East of the subject development on Cambrian Road Route 95 runs along River Mist Road and Cambrian Road. Figure 4 illustrates the existing transit service.

Figure 4: Existing Transit Service



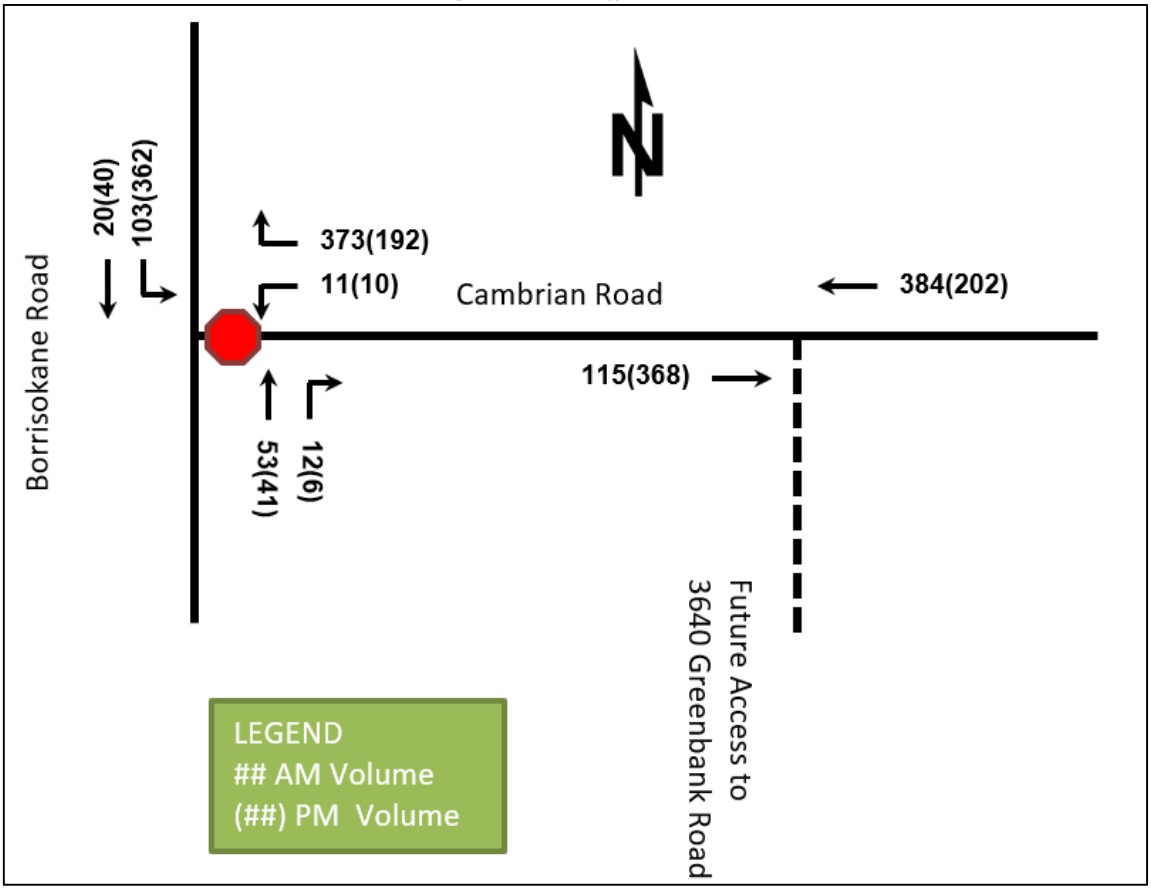
2.1.2.6 Existing Area Traffic Management Measures

There are no existing area traffic management measures within the Study Area.

2.1.2.7 Existing Peak Hour Travel Demand

AM and PM two-way traffic volumes at the intersection of Cambrian Road at Borrisokane Road have been documented in Figure 5 below. Appendix B includes excerpts from the Meadows Phase 5 TIA by others, detailing the turning movement counts.

Figure 5: 2018 Traffic Counts



2.1.2.8 Collision Analysis

Collision data has been acquired from the City of Ottawa for five years prior to the commencement of this TIA at each of the Study Area intersections. Table 1 summarizes the collisions at the intersection of Cambrian Road at Borrisokane Road.

Table 1:Collision Summary - Cambrian Road @ Borrisokane Road

		Number	%
Total Collisions		**9**	**100%**
Classification	Fatality	0	0%
	Non-Fatal Injury	2	22%
	Property Damage Only	7	78%
Initial Impact Type	Angle	0	0%
	Rear end	4	44%
	Sideswipe	0	0%
	Turning Movement	0	0%
	SMV Other	5	56%
	Other	0	0%
Road Surface Condition	Dry	6	67%
	Wet	1	11%
	Loose Snow	0	0%
	Slush	0	0%
	Packed Snow	0	0%
	Ice	2	22%
Pedestrian Involved		0	0%

Collisions at the intersection of Cambrian Road at Borrisokane Road were primarily on the westbound leg. The collisions were only single motor vehicle and rear end type collisions. It was also noted that 80% of the collisions only involved property damage, indicating low speed collisions, with no fatalities. Collision data is included in Appendix C.

2.1.3 Planned Conditions

2.1.3.1 Changes to the Area Transportation Network

Greenbank Road

The future New Greenbank Road extension, south of Cambrian Road, will pass just east of the proposed development, providing Arterial Road connectivity. However, the timing of this extension is unknown as it is not included in the City of Ottawa's Transportation Master Plan 2031 Affordable Road Network.

Cambrian Road

The Cambrian Road Widening Environmental Assessment includes a four-lane cross-section along Cambrian Road from Longfields Drive to the future Realigned Greenbank Road. This EA has been approved by Transportation Committee and City Council, but the widening is not considered in the City of Ottawa's Transportation Master Plan 2031 Affordable Road Network and therefore the timing of this widening is unknown.

2.1.3.2 Other Study Area Developments

Half Moon Bay West

North of the proposed development is the Mattamy Development of Half Moon Bay West. This development will include 518 detached homes and 427 townhouses. Construction has not commenced on this subdivision. The site trips generated by this site will be accounted for in the traffic projections.

Half Moon Bay South

Southeast of the proposed development is the Mattamy Development of Half Moon Bay South. This development is nearing completion and only the final phases remain. It is assumed that any traffic generated by this development is either captured in the existing count or would be so minimal at the Study Area intersections that it would have a negligible impact on the operational analysis. Therefore, no additional traffic has been added to the network to account for this development.

The Meadows Phase 4

East of the proposed development is the Tamarack Development of the Meadows. Phase 4 has a current development application. This development will not have shared accesses or traffic cross-over but will impact the Study Area intersections. This development will include 50 detached homes and 136 townhouses. The site trips generated by this site will be accounted for in the traffic projections.

2.2 Study Area and Time Periods

2.2.1 Study Area

The Study Area will include examining Borrisokane Road as a Boundary Road and will focus on the access intersection on Cambrian Road and the intersection of Borrisokane Road at Cambrian Road.

2.2.2 Time Periods

As the proposed development is composed entirely of residential units the AM and PM peak hours will be examined.

2.2.3 Horizon Years

The anticipated build-out year is 2022. As a result, the full build-out plus five years horizon year is 2027.

2.3 Exemption Review

Table 2 summarizes the exemptions for this TIA.

Table 2: Exemption Review

Module	Element	Explanation	Exempt/Required
Design Review Component			
4.1 Development Design	4.1.2 Circulation and Access	Only required for site plans	Exempt
	4.2.3 New Street Networks	Only required for plans of subdivision	Required
4.2 Parking	4.2.1 Parking Supply	Only required for site plans	Exempt
	4.2.2 Spillover Parking	Only required for site plans where parking supply is 15% below unconstrained demand	Exempt
Network Impact Component			
4.5 Transportation Demand Management	All Elements	Not required for site plans expected to have fewer than 60 employees and/or students on location at any given time	Required
4.6 Neighbourhood Traffic Management	4.6.1 Adjacent Neighbourhoods	Only required when the development relies on local or collector streets for access and total volumes exceed ATM capacity thresholds	Required
4.8 Network Concept		Only required when proposed development generates more than 200 person-trips during the peak hour in excess of equivalent volume permitted by established zoning	Required

3 Forecasting

3.1 Development-Generated Travel Demand

3.1.1 Trip Generation and Mode Shares

The 2009 TRANS Trip Generation Study (TRANS Study) has been reviewed to determine the appropriate residential trip generation rates. Both single detached and townhouse style dwellings are proposed within the subject development. Vehicle trip rates have been determined using Table 6.3 of the TRANS Study. The initial mode share associated with these trips has been determined using Table 3.13 of the TRANS Study. Using this information, the person trip rate has been calculated. Table 3 below summarizes the vehicle trip rates, initial mode shares, and person trip rates, for each land use this study will consider.

Table 3: TRANS Trip Generation Person Trip Rates

Dwelling Type	ITE LUC	Peak Hour	Vehicle Trip Rate	Mode Share			Person Trip Rates
				Vehicle	Transit	Non-Motorized	
Single Detached	210	AM	0.70	55%	25%	9%	1.27
		PM	0.90	64%	19%	6%	1.41
Townhouse	220	AM	0.54	55%	27%	8%	0.98
		PM	0.71	61%	22%	6%	1.16

LUC – Land Use Code

Using the above Person Trip rates, the total person trip generation has been estimates. Table 4 below illustrates the total person trip generation by dwelling type.

Table 4: Total Person Trip Generation

Land Use	Units	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
Single Detached	125	47	113	160	108	69	177
Townhouse	221	78	138	216	136	121	257
Total Person Trips		**125**	**251**	**376**	**244**	**190**	**434**

Using the most recent National Capital Region Origin-Destination survey (OD Survey), the existing mode shares for South Nepean have been determined. Table 5 summarizes the existing mode share.

Table 5: OD Survey Existing Mode Share - South Nepean

Travel Mode	AM Mode Share	PM Mode Share
Auto Driver	61%	63%
Auto Passenger	8%	11%
Transit	27%	24%
Non-Auto	4%	2%
Total	**100%**	**100%**

As per the direction from the City of Ottawa the Transit mode share has been adjusted to lower the transit share for this development. Table 6 summarizes the adjusted mode shares.

Table 6: OD Survey Existing Mode Share - Adjusted

Travel Mode	AM Mode Share	PM Mode Share
Auto Driver	78%	77%
Auto Passenger	8%	11%
Transit	10%	10%
Non-Auto	4%	2%
Total	**100%**	**100%**

Using the above mode shares and person trip rates the person trips by mode have been projected. Table 7 summarizes the trip generation by mode.

Table 7: Trip Generation by Mode

Travel Mode	Mode Share	In	Out	Total	Mode Share	In	Out	Total
Auto Driver	78%	98	196	294	77%	188	146	334
Auto Passenger	8%	10	20	30	11%	27	21	48
Transit	10%	13	25	38	10%	24	19	43
Non-Auto Modes	4%	5	10	15	2%	5	4	9
Total	100%	**125**	**251**	**376**	100%	**244**	**190**	**434**

As shown above, 294 AM and 334 PM peak hour two-way vehicle trips are projected as a result of the proposed development.

No trip reductions factors (i.e. synergy, pass-by, etc.) have been applied as the subject development is composed entirely of residential units.

3.1.2 Trip Distribution

To understand the travel patterns of the subject development the OD Survey has been reviewed to determine the existing travel patterns. Table 8 below summarizes the distribution.

Table 8: OD Survey Existing Mode Share - South Nepean

To/From	Percent of Trips
North	60%
South	5%
East	35%
West	0%
Total	100%

3.1.3 Trip Assignment

Using the distribution outlined above, turning movement splits, and access to major transportation infrastructure, the trips generated by the site have been assigned to the Study Area road network. Figure 6 illustrates the percent traffic assignment. Figure 7 illustrates the volume traffic assignment.

Figure 6: Traffic Assignment (%)

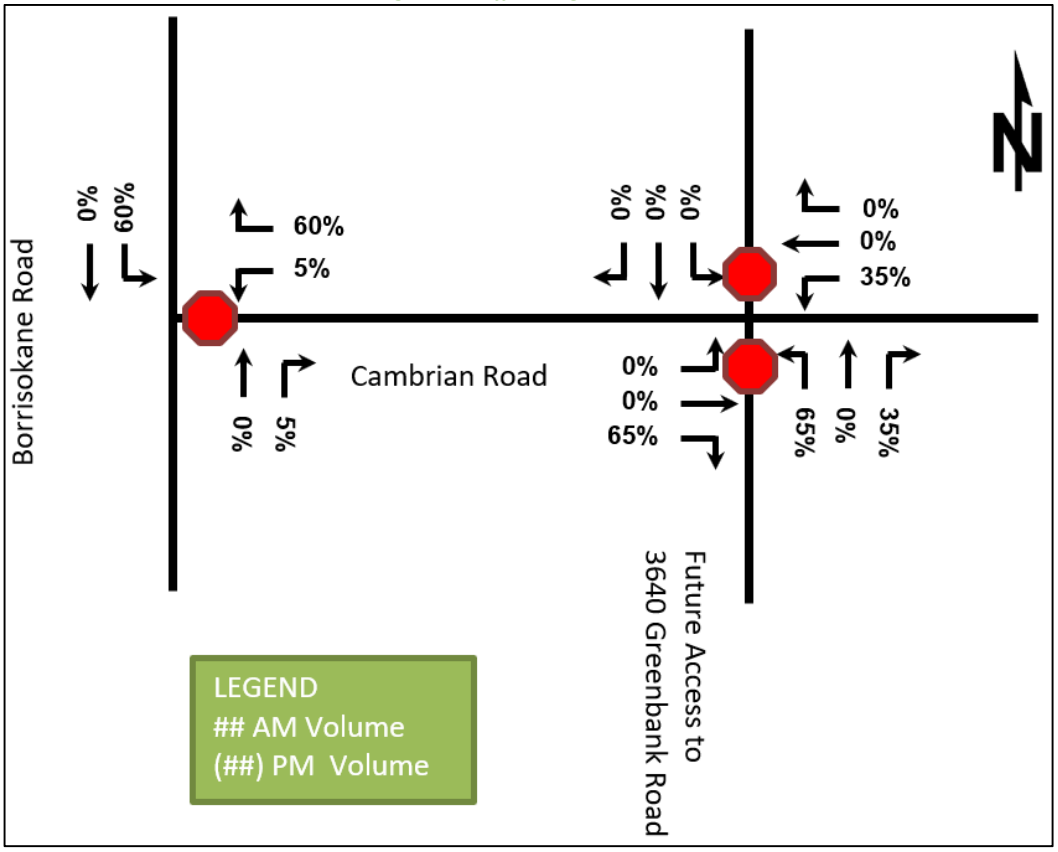
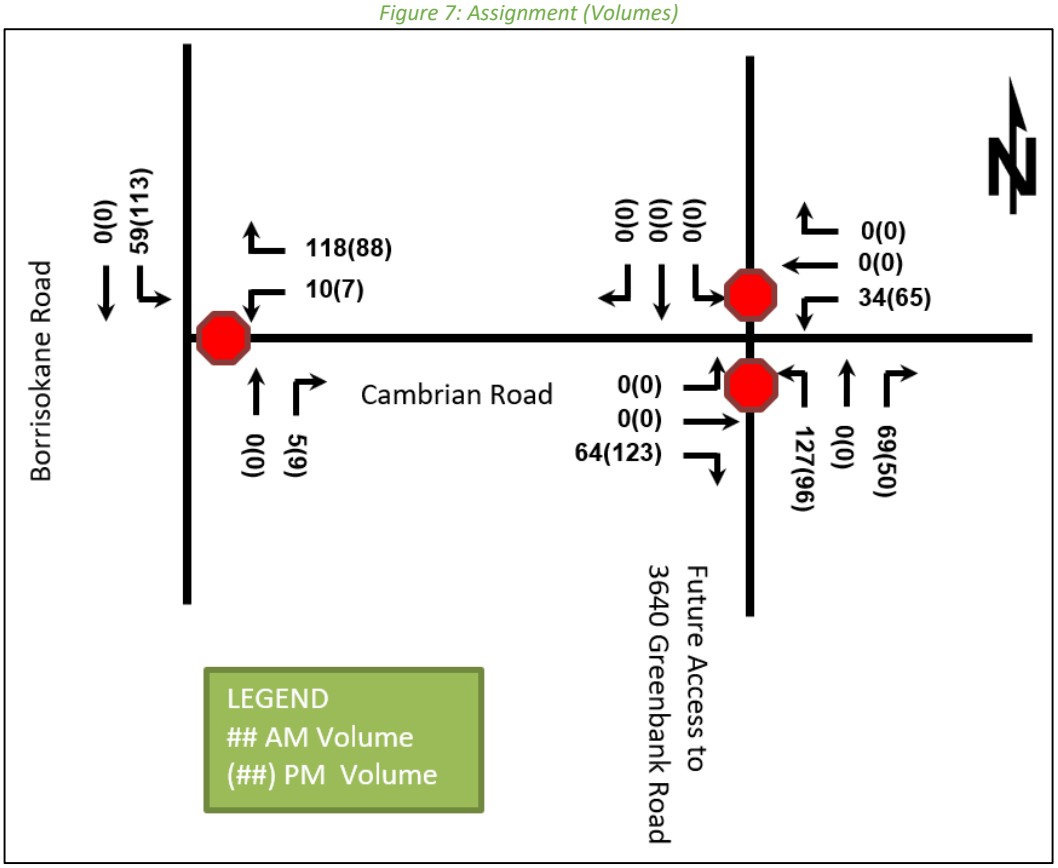


Figure 7: Assignment (Volumes)



3.2 Background Network Travel Demands

3.2.1 Transportation Network Plans

There are no planned changes to the Study Area Transportation Network within the Study Horizons that would influence the Study Area.

3.2.2 Background Growth

A large amount of background traffic has been accounted for through the other developments that have been documented in Section 2.1.3.2. To account for background growth along this corridor a 2%/annum background growth rate has been applied along Cambrian Road and Borrisokane Road.

3.2.3 Other Developments

As detailed in Section 2.1.3.2, the following developments have been included in the background traffic forecasts:

- Half Moon Bay West
- The Meadows Phase 4

Figure 8 illustrates the 2022 future background traffic volumes. Figure 9 illustrates the 2027 future background traffic volumes. Figure 10 illustrates 2022 total future traffic, including the site generated traffic. Figure 11 illustrates the 2027 total future traffic, including the site generated traffic.

Figure 8: 2022 Future Background Traffic Volumes

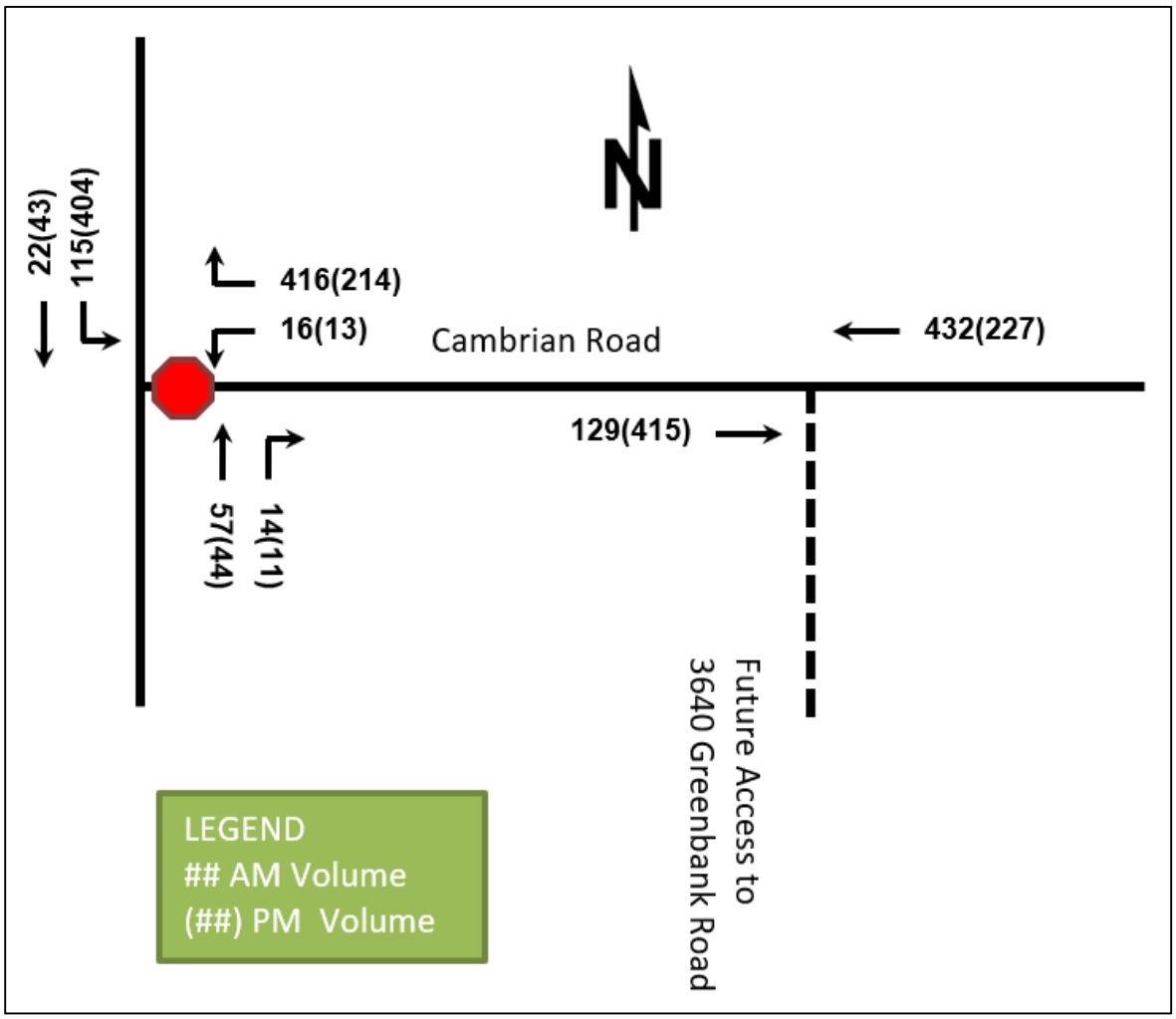


Figure 9: 2027 Future Background Traffic Volumes

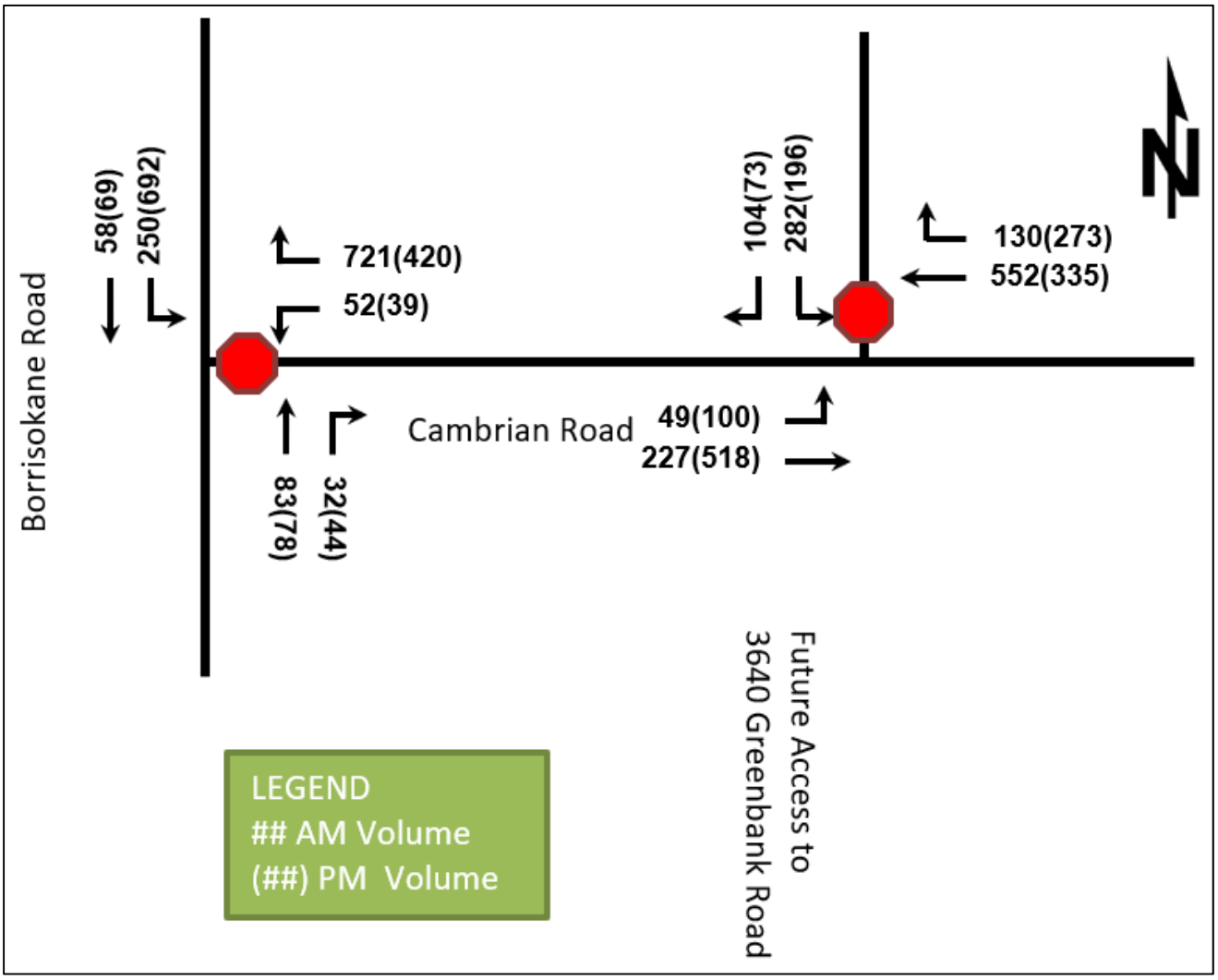


Figure 10: 2022 Future Total Traffic Volumes

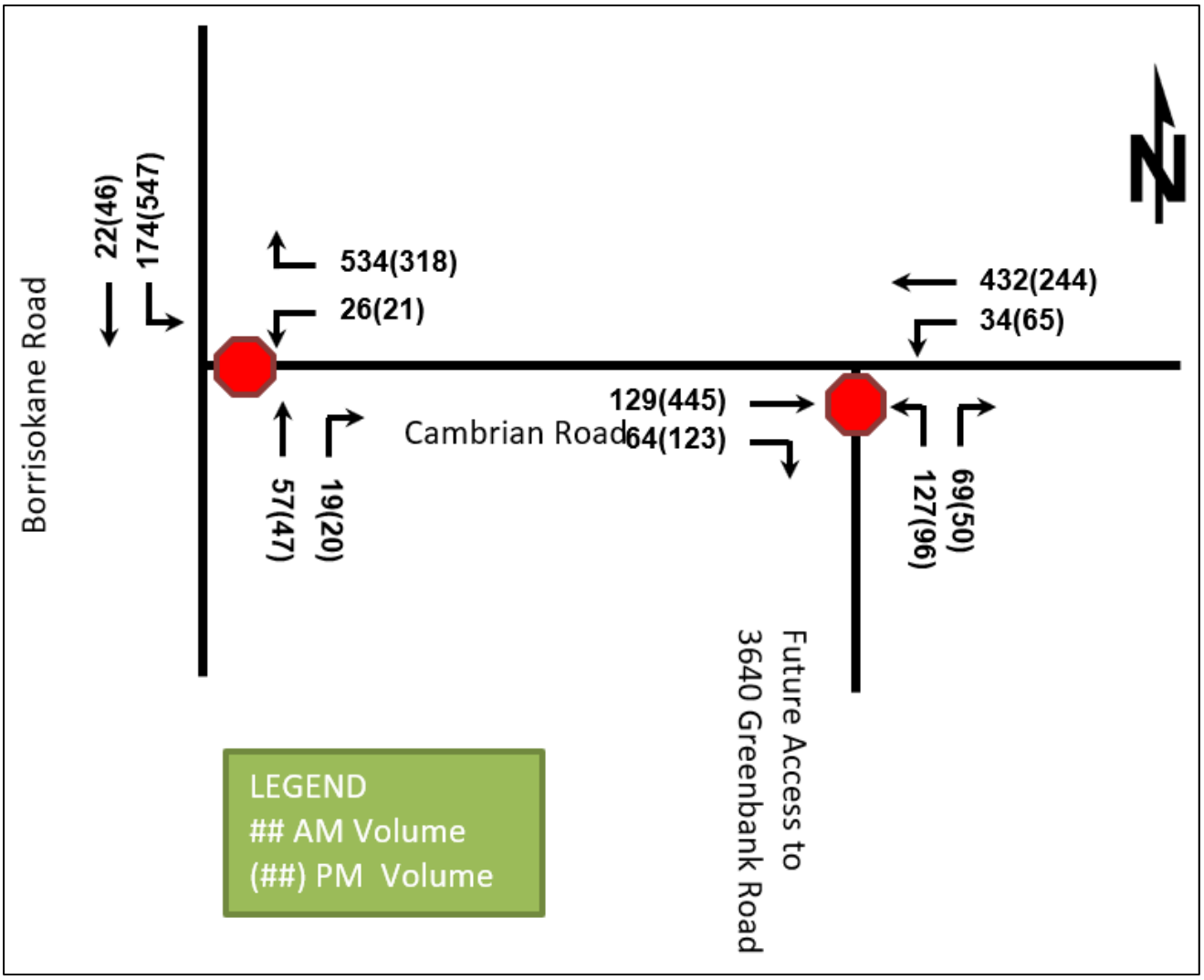
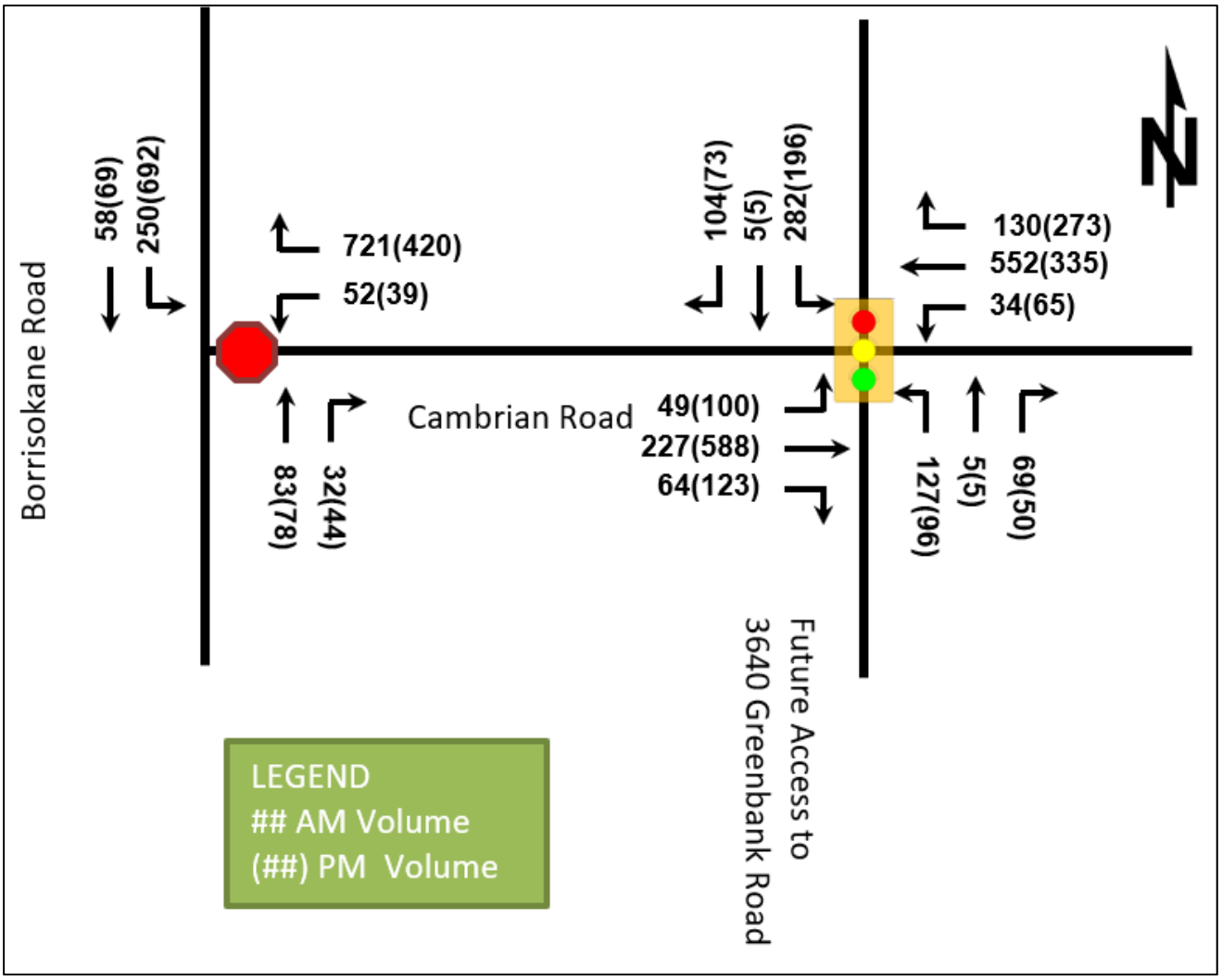


Figure 11: 2027 Future Total Traffic Volumes



3.3 Demand Rationalization

No major capacity issues were noted in the TIAs for nearby developments and the development generated traffic volumes are of a magnitude that is not anticipated to create capacity issues at the Study Area intersections. Therefore, no adjustments have been made to the development generated traffic.

4 Analysis

4.1 Development Design

4.1.1 Design for Sustainable Modes

An existing bus stop is currently located at the intersection of Seeley's Bay Street and Cambrian Road. This bus stop would be beyond the 400-metre maximum walking distance to a transit stop prescribed by the City of Ottawa. It is recommended that transit service be extended west to the proposed Street 1 access, including a turn-around area at the southern edge of the subject site. By providing transit service in this manner 85% of the subject development would be within the 400-metre walking distance to a transit stop. The remaining 15% would be within 500-metre walking distance to a transit stop. This calculation assumes that Realigned Greenbank Road has not been constructed. Upon completion of Realigned Greenbank Road, it is assumed that transit service would be

extended along the corridor (as per the TMP) and would put all areas of the subject development within 400 metres walking distance to transit.

Bike lanes are to be provided along Street No. 1, the main collector road serving the proposed development.

Sidewalks are included as needed to provide access to transit, local amenities, and the adjacent road network.

Figure 12 illustrates the transit walking distance and the sidewalk locations.

4.1.2 Circulation and Access

This TIA is exempt from this element (see Table 2).

4.1.3 New Street Networks

The proposed development is anticipated to connect to both the Meadows Phase 4 (to the east) and the Half Moon Bay West development (to the north). Street 2 will connect to the east and is a local collector road with an 18-metre ROW. This road starts at Street 1 (north-south collector) and continues east to the future Realigned Greenbank Road Corridor. Prior to the construction of that facility Street 2 will connect directly to the development to the east (Meadows Phase 4). Street 1 will be a north-south collector with a 24-metre ROW. This street will connect through the development to the north (Half Moon Bay West) to Cambrian Road, forming the primary access to the proposed development. All other roads serving lots on both sides will have a 16.5-metre ROW. Roads serving lots on a single side will have a 14.5-metre ROW.

With the proposed cycling lanes Street 1 would have a BLOS A. Figure 13 illustrates the proposed 24 metre collector road cross-section.

4.2 Parking

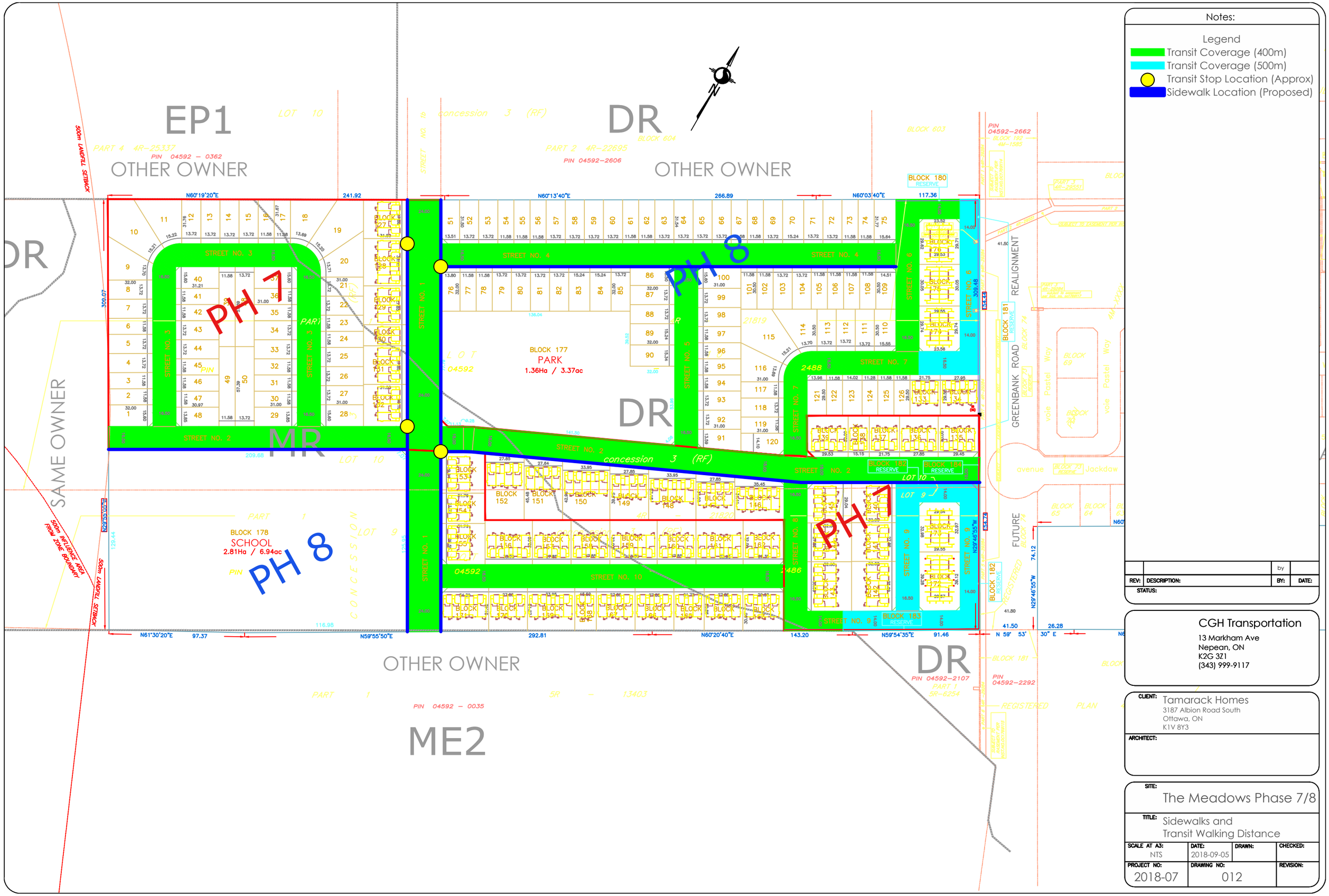
This TIA is exempt from this Module (see Table 2).

4.3 Boundary Street Design

The subject development is surrounded on three sides by future development lands. On the east side is the future corridor for Realigned Greenbank Road. As the timing of this section of Realigned Greenbank Road is unknown, and the section along the frontage of the site will be constructed beyond the development horizon for The Meadows Phase 7 and Phase 8, it has been assumed that the City will determine the appropriate design elements through a future Environmental Assessment and the cross section will be similar to that proposed in the Cambrian Road EA completed for the section between New Greenbank Road and Longfields (formerly Jockvale). For the purposes of this TIA Cambrian Road will be considered as a boundary street and the Segment Multi-Modal Level of Service (MMLOS) will be recorded.

Road Segment	**Horizon**	**MMLOS**			
		PLOS	BLOS	TLOS	TkLOS
Cambrian Road	Existing & 2022	F	F	D	B
	2027	B	F	D	B

It has been assumed that by the 2027 that a sidewalk would be built along Cambrian Road along the Half Moon Bay West frontage. This will improve the pedestrian level of service from a PLOS F to a PLOS B. The BLOS is primarily limited by the posted speed. If the speed limit on Cambrian Road were lowered to 50 km/h the BLOS would improve to a BLOS D. East of the subject section Cambrian Road widens to four-lanes and includes an at grade cycling facility on each side. Carrying this cross-section east through the subject section could increase the BLOS to a BLOS B or better.



Notes:

Legend

- Transit Coverage (400m)
- Transit Coverage (500m)
- Transit Stop Location (Approx)
- Sidewalk Location (Proposed)

REV:	DESCRIPTION:	BY:	DATE:
		by	

STATUS:

CGH Transportation
13 Markham Ave
Nepean, ON
K2G 3Z1
(343) 999-9117

CLIENT: Tamarack Homes
3187 Albion Road South
Ottawa, ON
K1V 8Y3

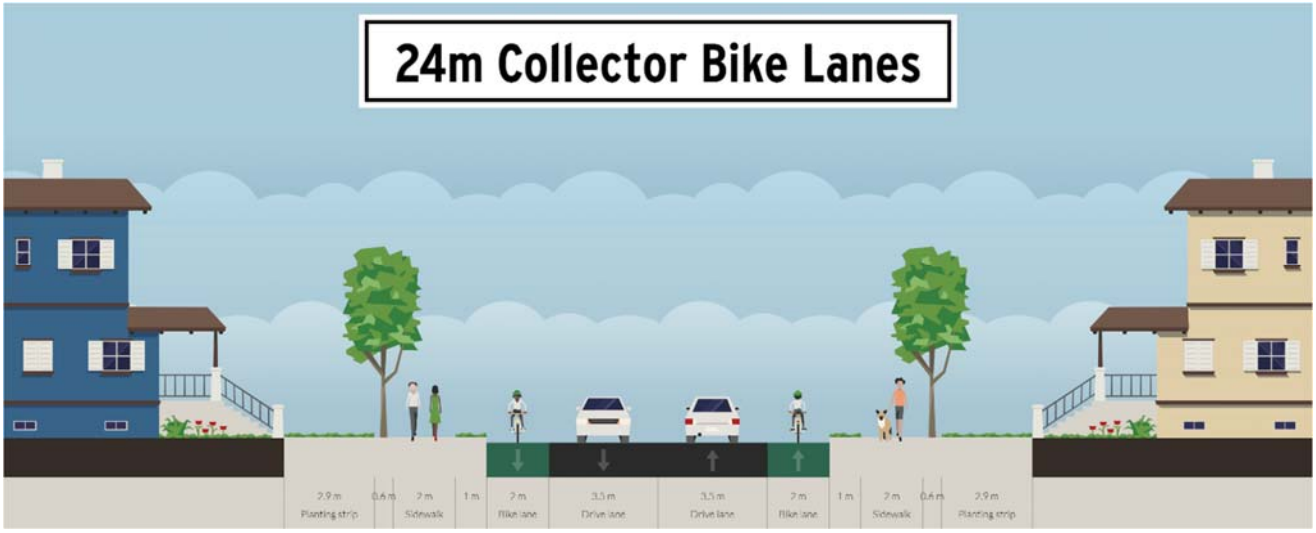
ARCHITECT:

SITE: The Meadows Phase 7/8

TITLE: Sidewalks and Transit Walking Distance

SCALE AT A3:	DATE:	DRAWN:	CHECKED:
NTS	2018-09-05		
PROJECT NO:	DRAWING NO:		REVISION:
2018-07	012		

Figure 13: Proposed Collector Road Cross-section



4.4 Access Intersections

4.4.1 Location and Design of Access

The proposed main access to the site will be through the adjacent Half Moon Bay West development (to the north) and onto Cambrian Road via Street 1. An additional, secondary access is proposed through the adjacent Meadows Phase 4 to the west via Street 2. The operational analysis focuses on the intersection of Street 1 and Cambrian Road as it is anticipated that traffic generated by this site will primarily use this intersection to access the arterial road network. Given the size and unit type of the adjacent Meadows Phase 4 development, it is anticipated that any cross-traffic between the developments would be minor and likely balance out, and therefore have no impact on the operational analysis.

4.4.2 Intersection Control

Street 1 / HMBW Access at Cambrian Road

The intersection of Cambrian Road at Street 1 / HMBW Access has been examined using 2022 and 2027 traffic volumes to determine if signals are warranted. Ontario Traffic Manual (OTM) Book 12 traffic signal warrants have been used, specifically Justification #7. This warrant was shown to reach 107% of the criteria for 2022 volumes and 151% for 2027 volumes. However, when using the Justification 7 warrant for future new intersections, it is required to meet 150% to be considered justified. It is also noted that where the warrant meets 100%, the necessary underground provisions should be made as part of the road works. The warrant is met for the 2027 total future traffic conditions and therefore, signals will be examined in the 2027 future total horizon. Appendix D contains the traffic signal warrant analysis sheets.

In addition to Traffic Signal Justification Warrants, the City of Ottawa's Roundabout Screening Tool has been used to determine the appropriate traffic control for the intersection of Cambrian Road at Street 1 / HMBW Access. Using this tool, it was found that there were no contra-indications. It was found that there was only one suitability factor, that traffic signals are warranted. Therefore, a roundabout is not considered technically feasible at this location.

Borrisokane Road at Cambrian Road

The intersection of Cambrian Road at Borrisokane Road has been examined using 2022 and 2027 traffic volumes to determine if signals are warranted. Ontario Traffic Manual (OTM) Book 12 traffic signals warrants have been

used, specifically Justification #7. This warrant was shown to reach 119% of the criteria for 2022 volumes and 110% for 2027 volumes. However, when using the Justification 7 warrant for future volumes at existing intersections, it is required to meet 120% to be considered justified. It is also noted that where the warrant meets 100%, the necessary underground provisions should be made during construction of the intersection. Therefore, signals will not be considered in the operational analysis. However, if this intersection is reconstructed underground provisions for signals should be included. Appendix D contains the traffic signal warrant analysis sheets.

In addition to Traffic Signal Justification Warrants, the City of Ottawa's Roundabout Screening Tool has been used to determine the appropriate traffic control for the intersection of Cambrian Road at Street 1 / HMBW Access. Using this tool, it was found that there were no contra-indications. It was found that there were no suitability factors.

4.5 Transportation Demand Management

Transportation Demand Management measures are implemented to encourage the use of non-auto modes of travel. This is aimed at reducing the reliance on single occupant auto trips in the City of Ottawa. The proposed development adheres to the City's TDM principles by providing direct connections to adjacent pedestrian, cycling, and transit facilities. The existing mode share for South Nepean has been used for all study horizons. The TDM Measures Checklist has been included in Appendix E. Note that this has been completed at a conceptual level and is subject to change.

4.6 Neighbourhood Traffic Management

The significant access routes to the development include Street 1, through the adjacent development to the north to Cambrian Road. It is assumed that 100% of the site traffic will utilize this route to access the Arterial Road Network. Additional access is provided through the adjacent development to the west via Street 2, however, as this route forces vehicles to travel along a circuitous route to get to Cambrian Road it is assumed that a negligible amount of traffic will use this route.

Local roads within the development are not expected to exceed the 120 vehicle per hour threshold as the local roads will feed the collector road (Street 1), which experiences approximately 200 peak hour peak direction trips. The traffic volumes on all roads are anticipated to be within the volume thresholds outlined in the City of Ottawa TIA Guidelines.

At the intersection of Street No. 1 and Street No. 2 it is recommended that appropriately designed bulb-outs be used on Street No. 2 to calm traffic along Street No. 1.

4.7 Transit

In Section 3.1 the trip generation by mode was estimated, including an estimate of the number of transit trips that will be generated by the proposed development. Table 9 summarizes the transit trip generation.

Table 9: Trip Generation by Transit Mode

Travel Mode	Mode Share	In	Out	Total	Mode Share	In	Out	Total
Transit	10%	13	25	38	10%	24	19	43

The anticipated increase in travel demand is anticipated to be minimal. It is recommended that OC Transpo provide additional transit capacity only as needed once the development is completed. It is expected that once realigned Greenbank Road is constructed, including an upgraded transit facility, that the transit mode share, and therefore the transit trips generated by the proposed development would increase.

4.8 Review of Network Concept

A screenline is a tool used to evaluate the adequacy of traffic capacity at a broad network level. To develop a screenline, an imaginary line is drawn, generally along a relevant geographic feature (i.e. major roadway, river, greenbelt, etc.). Each road that crosses this imaginary line forms a station within that screenline. The traffic volumes and traffic capacity at each of the stations is tabulated. The NCR Trans Committee maintains a database of traffic data for various established screenlines across the City of Ottawa. Two screenlines have been examined to determine if the network can accommodate the proposed development, SL 42 Rideau River and SL 49 Jock River. The 2031 Base scenario and 2031 Network Concept have been summarized in Table 10.

Table 10: 2031 Screenline Capacity

Screenline	AM 2031 Inbound (Base)			AM 2031 Inbound (Network Concept)		
	Demand	Capacity	V/C Ratio	Demand	Capacity	V/C Ratio
SL 42 Rideau River (Manotick)	2928	3800	0.77	2596	3800	0.68
SL 49 Jock River	6405	10200	0.63	6642	13200	0.50

The proposed development does not generate enough traffic to impact the V/C ratio of the above screenlines. Future road projects should proceed on schedule to prevent local traffic issues. These projects include the Cambrian Road widening, Strandherd Drive (currently in the design stage), and realigned Greenbank Road.

4.9 Intersection Design

4.9.1 Intersection Control

As discussed in Section 4.4.2 signals will be analyzed at the intersection of Street 1 at Cambrian Road for the 2027 Future Total Horizon. As roundabouts have been screened out no roundabout analysis will be included.

4.9.2 Intersection Design

To understand the intersection design, an MMLOS analysis of existing, future background, and future total travel demands is required. The existing and future segment MMLOS has been discussed in Section 4.3. The following sections will discuss the vehicle LOS at the Study Area intersections, followed by a discussion of the intersection MMLOS for other modes.

4.9.2.1 Existing Conditions

The existing intersection volumes have been analyzed to establish a baseline condition to compare all future horizons to and determine the impact of the subject development on the Study Area road network. Table 11 summarizes the operational analysis of 2018 existing conditions. Appendix F contains the 2018 Existing Conditions Synchro sheets.

Table 11: 2018 Existing Conditions Operational Analysis

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95th)	LOS	Delay	V/C	Q (95th)
Borrisokane Road & Cambrian Road *Unsignalized*	WBL/R	B	12	0.44	2	B	11	0.26	1
	NBT/R	-	-	-	-	-	-	-	-
	SBL/T	A	6	0.08	0	A	7	0.26	1

The existing intersection has been shown to operate with good LOS, and no operational concerns. No mitigation measures are required or recommended.

4.9.2.2 2022 Future Background

The 2022 future background intersection volumes have been analyzed to allow a comparison between the future volumes with and without the proposed development. Table 12 summarizes the operational analysis of 2022 future background conditions.

Table 12: 2022 Future Background Conditions Operational Analysis

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95th)	LOS	Delay	V/C	Q (95th)
Borrisokane Road & Cambrian Road *Unsignalized*	WBL/R	B	12	0.44	2	B	11	0.27	1
	NBT/R	-	-	-	-	-	-	-	-
	SBL/T	A	8	0.08	0	A	8	0.26	1

With the addition of background growth to reflect the 2022 horizon, the existing intersection is anticipated to operate with similar operational characteristics to the existing conditions, and well within City of Ottawa operational thresholds. Appendix G contains the 2022 Future Background Synchro Sheets.

4.9.2.3 2027 Future Background

The 2027 future background intersection volumes have been analyzed to allow a comparison between the future volumes with and without the proposed development. Table 13 summarizes the operational analysis of 2027 future background conditions

Table 13: 2027 Future Background Conditions Operational Analysis

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95th)	LOS	Delay	V/C	Q (95th)
Borrisokane Road & Cambrian Road *Unsignalized*	WBL/R	D	34	0.9	13	F	87	1.05	15
	NBT/R	-	-	-	-	-	-	-	-
	SBL/T	A	6	0.17	1	A	9	0.47	3
Half Moon Bay West Access & Cambrian Road *Unsignalized*	EBT/R	A	2	0.05	0	A	9	0.10	0
	WBL/T	-	-	-	-	-	-	-	-
	SBL/R	F	168	1.24	18	F	181	1.23	14

With the addition of background growth to reflect the 2027 horizon, including Half Moon Bay North, the existing intersection is anticipated to operate with poor LOS in the PM peak hour. The new access to Half Moon Bay West is anticipated to operate with high delays and poor LOS in the AM and PM peak hour. The signal warrant was found to be met for the full intersection including the access to Meadows Phase 7 and 8. This will be examined further in the 2027 total future conditions. Appendix H contains the 2027 Future Background Synchro sheets.

4.9.2.4 2022 Total Future

The 2022 total future intersection volumes, including the site generated traffic, have been analyzed to understand the impact of the subject development on the Study Area intersections. Table 14 summarizes the operational analysis of 2022 total future conditions.

Table 14: 2022 Total Future Conditions Operational Analysis

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95th)	LOS	Delay	V/C	Q (95th)
Borrisokane Road & Cambrian Road *Unsignalized*	WBL/R	B	14	0.59	4	B	14	0.43	2
	NBT/R	-	-	-	-		-	-	-
	SBL/T	A	7	0.11	0	A	8	0.34	2
Meadows Phase 7 and 8 Access & Cambrian Road *Unsignalized*	EBL/T	A	0	-	-	A	0	0.39	2
	WBT/R	A	1	0.03	0	A	2	-	-
	NBL/R	B	16	0.38	2	C	21	0.06	0

With the addition of site generated traffic, the existing intersection of Borrisokane Road at Cambrian Road is anticipated to operate with similar LOS and delay as 2022 future background conditions. The access intersection to Meadows Phase 7 and 8 is anticipated to operate with minimal delays as a stop-controlled intersection. Appendix I contains the 2022 Total Future Synchro sheets.

4.9.2.5 2027 Total Future

The 2027 total future intersection volumes, including the site generated traffic, have been analyzed to understand the impact of the subject development on the Study Area intersections.

Table 15: 2027 Total Future Conditions Operational Analysis

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95th)	LOS	Delay	V/C	Q (95th)
Borrisokane Road & Cambrian Road *Unsignalized*	WBL/R	D	34	0.9	13	F	87	1.05	15
	NBT/R	-	-	-	-	-	-	-	-
	SBL/T	A	6	0.17	1	A	9	0.47	3
Meadows Phase 7 and 8 Access/Half Moon Bay West & Cambrian Road *Unsignalized*	EBL/T/R	A	1	0.05	0	A	1	0.10	0
	WBL/T/R	A	0	0.03	0	A	1	0.07	0
	NBL/T/R	F	129	1.05	9	F	588	2.07	17
	SBL/T/R	F	501	1.99	29	F	1071	3.15	27
Meadows Phase 7 and 8 Access/Half Moon Bay West & Cambrian Road *Signalized*	EBL	A	12	0.18	9	A	10	0.18	13
	EBT	A	11	0.24	25	A	16	0.55	75
	EBR	A	3	0.08	4	A	5	0.13	9
	WBL	A	9	0.06	6	A	12	0.21	11
	WBT	A	18	0.59	70	A	11	0.31	36
	WBR	A	6	0.16	11	A	6	0.28	18
	NBL	A	15	0.32	17	A	14	0.24	15
	NBT/R	A	8	0.08	9	A	10	0.07	8
	SBL	A	21	0.58	36	A	17	0.46	28
	SBT/R	A	8	0.11	11	A	9	0.09	10

By 2027 The unsignalized intersection of Borrisokane Road and Cambrian Road is projected to operate at or slightly above the theoretical capacity of a stop-controlled intersection. However, as shown in Section 4.4.2, this intersection does not meet the warrant for traffic control signals for future volumes at an existing intersection. Given the projected capacity deficiencies the City of Ottawa should monitor this intersection in the future to ensure that, at the time when the eight-hour traffic count volumes meet the traffic signal warrant, signals are implemented.

It is anticipated that by 2027 both Meadows Phase 7/8 and Half Moon Bay North will be complete. As shown in Section 4.4.2, the future intersection of the proposed access intersection on Cambrian Road will meet the warrant for signalization. The signalized intersection operates with good LOS, low delays, and no movements over capacity. Appendix J contains the 2027 Total Future Synchro sheets.

4.9.2.6 Intersection MMLOS

Intersection MMLOS is only undertaken at signalized intersections. There is only one signalized intersection considered in this study, the future intersection of Meadows Phase 7/8 and Half Moon Bay North onto Cambrian Road.

Pedestrian LOS (PLOS) is evaluated using the PETSI score methodology which evaluates various intersection geometry elements and assigns those values a score. Table 16 summarizes the PETSI score evaluation for the proposed signalized intersection of Street 1 at Cambrian Road.

Table 16: PETSI Score

	Crossing East West			Crossing North South		
Element	**Condition**	**Points**		**Condition**	**Points**	
Crossing Distance	3 Lanes No Median	105		4 Lanes No Median	88	
Island Refuge	No	-4		No	-4	
Signal Phasing / Timing						
Left Turn Type	Protected / Permissive	-8		Permissive	-8	
Right Turn Conflict	Permissive	-5		Permissive	-5	
Right Turn on Red	Allowed	-3		Allowed	-3	
Leading Ped. Interval	No	-2		No	-2	
Corner Radius	10m to 15m	-6		10m to 15m	-6	
Crosswalk	Standard Transverse	-7		Standard Transverse	-7	
PETSI LOS	Actual	70	C	Actual	53	D
	Target		C	Target		C

The east-west pedestrian crossing meets the target PLOS C for a collector road in a development community. The north-south pedestrian crossing does not meet the target PLOS C for an arterial road in a developing community. To improve the PLOS, the signal timing could be adjusted to only allow protected left turns. Alternatively, the right turn lanes on the eastbound and westbound lanes could be removed to reduce the crossing distance. Removing the permissive left turn phase on the eastbound and westbound approaches will reduce the vehicle LOS and create an awkward signal timing for motorists. Removing the right turn lanes is not recommended as this can increase the number of rear-end collisions at a signalized intersection. Therefore, in this case the LOS D should be tolerated as it is not reasonable to achieve the target PLOS.

Bicycle LOS (BLOS) is evaluated by examining elements that impact the level of traffic stress (LTS). For the proposed intersection it has been assumed that the "Mixed Traffic on a Signalized Intersection Approach" would apply. Table 17 summarizes the elements that impact the BLOS, the worst of these is taken as the intersection BLOS.

Table 17: Bicycle LOS Criteria

	East-West		North-South	
Right-turn Lane and Turning Speed of Motorists	Right-turn lane 25 to 50 m long, turning speed ≤ 25 km/h (based on curb radii and angle of intersection)	D	No Right Turn Lanes	N/A
Cyclist Making a Left-turn and Operating Speed of Motorists	No lane crossed, ≤ 50 km/h	B	No lane crossed, ≤ 50 km/h	B

The BLOS for the east-west approaches is governed by the right turn lanes on the eastbound and westbound approaches would operate at a BLOS D. This would not meet the target BLOS for the east-west approaches. The north south approaches of the intersection would operate at a BLOS B, meeting the target for this Local Route in a Development Community. As discussed previously in Section 4.3, the segment BLOS is not anticipated to meet the target for the north-south collector (Street 1).

Transit LOS (TLOS) is evaluated by examining the average signal delay and the relative attractiveness of transit compared to automobile trips. While local transit service is anticipated to be extended to the subject development, the TMP Ultimate Network does not include higher order transit facilities or transit signal priority (TSP) measures. Therefore, the TLOS for this intersection is F. Based on the definition of TLOS there are no improvements, aside from adding TSP along the corridor, which is not recommended as Cambrian Road is an arterial road serving developments and only extends from Borrisokane Road to Longfields Drive (2.75km), making it a poor candidate for a rapid transit facility.

Truck LOS (TkLOS) is evaluated for Developing Communities only along Arterial and Collector Truck Routes. The Street 1 collector is not anticipated to be a Truck Route and therefore no TkLOS has been evaluated at the proposed signalized intersection.

4.9.2.7 Access Intersection Design

The signalized intersection of Street 1 at Cambrian Road has been evaluated using the MMLOS methodology, OTM Book 12 Traffic Warrants, and TAC Geometric Standards to determine the appropriate intersection configuration.

Auxiliary Right Turn Lanes

The vehicle LOS has been completed assuming that eastbound and westbound right turn lanes are provided. However, the BLOS at the intersection of Street 1 and Cambrian Road is governed by the presence of these auxiliary lanes. Based on the traffic volumes the vehicle LOS would not be significantly impacted by not including right turn lanes at the subject intersection. As it will improve the BLOS consideration should be given to not including right turn lanes. This should be balanced against the potential increase in rear-end collisions due to the high volume of right turning vehicles in a shared through-right-turn lane configuration. If they are included the eastbound right turn lane (accessing the Meadows Phase 7/8) does not require significant storage space, the 95th percentile queue is projected to be less than 10 metres in either peak hour. Therefore, minimum geometry requirements will dictate the intersection configuration.

Auxiliary Left Turn Lanes

The vehicle LOS has been completed assuming that left turn lanes are provided on all approaches. The left turn lanes into and out of the north leg have been assumed to be consistent with the Half Moon Bay West Community Transportation Study Addendum No. 1, as follows:

- Eastbound Left-turn storage lane 40m
- Southbound Left-turn storage lane 70m

These have been included to show a fulsome description of the intersection and have not been reconfirmed through the analysis herein. The westbound left-turn lane and northbound left-turn lane provide access into and out of the proposed development. The operational analysis of the proposed intersection has indicated that left-turn lane storage should be provided as follows:

- Westbound Left-turn storage lane 15m
- Northbound Left-turn storage lane 20m

These storage lengths would accommodate the anticipated queue lengths, but the actual storage length should be calculated using geometric design principles including applicable minimums, deceleration length, and taper lengths. The recommended auxiliary left-turn lane storage and taper lengths should be confirmed during the detailed design of the proposed intersection.

4.9.2.8 Design Context

It is understood that development applications are underway for adjacent properties to the north. This TIA has included the traffic forecasts to reflect the growth associated with these adjacent developments. These forecasts will be refined through upcoming TIAs for those properties. Once those projections are available the design of the access intersection can be refined to ensure the appropriate lane geometry and signal timing is provided. In advance of that, this application should be allowed to proceed and be deemed complete, with the understanding that the developers of the adjacent properties have agreed to enter into cost sharing agreements to complete the construction of shared elements, such as the access intersection.

5 Conclusions

This Transportation Impact Assessment has documented the existing and future transportation conditions, for all travel modes, in the Study Area. The following conclusions can be offered based on the foregoing:

A. The proposed development, located at 3640 Greenbank Road, is a greenfield development that will include approximately 350 residential units with a mix of townhouses and detached homes (221 townhouses and 125 detached homes).
B. Access to the proposed development will be via the future realigned Greenbank Road once opened. Prior to that, and for the foreseeable future, the development will access Cambrian Road through the adjacent development to the north. Connections will be provided to the development to the east (Meadows Phase 4) but this is not anticipated to be the primary route for access to the development.
C. The existing development is not currently served by transit. However, Route 95 currently serves the adjacent developments to the west and could be easily re-routed / extended to also serve Meadows Phase 7/8.
D. The previous five years of collision history at the existing intersection of Borrisokane Road at Cambrian Road has been reviewed. No patterns emerged that indicated that mitigation measures or further monitoring was required.
E. Using the TRANS Study the residential trip generation rates were calculated. The existing mode shares from the OD Survey were reviewed. City of Ottawa Staff indicated that the mode share should be adjusted to reflect a lower initial transit share for the proposed development. Using these factors, the person trip by mode was calculated. It was found that the proposed development can be anticipated to generate 376 AM and 434 PM peak hour two-way person trips.
F. By providing transit stops at appropriate locations along Street 1 it was shown that 85% of the proposed development units would be within a 400m walking distance to transit, with the remaining 15% no more than 500m from transit. While it is typically desired that all residents would be within 400m of transit, in this case the units beyond 400m walking distance would be serviced by very close transit once realigned Greenbank Road is constructed.
G. It was found that the road segment of Cambrian Road closest to the subject development would meet nearly all of the target MMLOS levels. The major exception is the BLOS, which was found to be BLOS F, whereas the target BLOS is B along Cambrian Road. East of the subject section of Cambrian Road, the road widens to four lanes and includes an at-grade cycling facility. Extending this cross-section along the subject section would increase the BLOS to B, meeting the target for this corridor.
H. The proposed collector road cross-section would provide cycling lanes along each side, which would provide a BLOS A along Street No. 1.

I. Traffic signal control warrants have been examined for the intersection of Street 1 / Half Moon Bay West Access at Cambrian Road. Using OTM Book 12 Justification 7, it was found that the 2027 traffic volumes would meet the volume threshold, and traffic control signals are warranted.

J. Traffic signal control warrants have been examined for the intersection of Borrisokane Road at Cambrian Road. Using OTM Book 12 Justification 7, signals were not warranted. However, it was found that the volumes would warrant the inclusion of underground provisions for signals if the intersection is reconstructed.

K. A review of screenline volumes indicated that there exists adequate network capacity to support the proposed development.

L. Auxiliary right turn lanes have been examined on both the eastbound and westbound approaches of the intersection of Street 1 / HMBW Access at Cambrian Road. It was found that both approaches exceed the 10% of approach volume and are therefore warranted. However, consideration should be given to excluding these lanes as the BLOS at the intersection is reduced to below the minimum desirable MMLOS. The operational analysis projected that the signalized intersection will operate very well, with LOS A on all approaches, and therefore the right turn lanes are not required to address vehicle LOS constraints. As a result, it is recommended that these lanes be excluded from the intersection configuration.

M. Given the low through volumes on the northbound and southbound approaches of the Street 1 / HMBW Access at Cambrian Road intersection, and confirmed through the operational analysis, the shared through-right-turn lane will provide adequate capacity to serve both approaches and no auxiliary right turn lanes are needed northbound or southbound.

N. Auxiliary left turn lanes are proposed on all four legs of the proposed signalized intersection of Street 1 / HMBW Access at Cambrian Road. The geometry of these lanes should be confirmed as part of the functional design process.

O. 3640 Greenbank Road Road is one of several proposed developments that are being put forward in similar timelines. This development application is proceeding prior to TIAs being completed for the proposed development across Cambrian Road. While the traffic projections for the adjacent developments have been included herein, these projections will be refined through upcoming TIAs for those properties. Therefore, while the access intersection has been examined herein, the design of the intersection will have to be refined once traffic projections for the north leg of the intersection have been finalized. Proceeding with a functional design in advance of the availability of these projections will create unnecessary duplication of design efforts. It is recommended that this duplication be avoided by allowing the development application for 3640 Greenbank Road to be deemed complete and all reports be circulated in advance of the preparation of an RMA or functional design for the subject intersection. Construction of this intersection will not proceed until such time as a functional design that satisfies City Staff is prepared and approved. Tamarack and CGH Transportation are committed to working with Mattamy and their consultant, Stantec, to develop an appropriate RMA for the intersection configuration.

The proposed development, with the proposed intersection control, will function within the Study Area Road Network. It is recommended that, from a transportation perspective, the proposed development application proceed.

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Appendix A

TIA Screening Form and PM Certification Form

CGH TRANSPORTATION INC.

13 Markham Avenue
Nepean ON K2G 3Z1

City of Ottawa 2017 TIA Guidelines
Step 1 - Screening Form

Date: 29-Aug-18
Project Number: Jul-18
Project Reference: Meadows Phase 7/8

1.1 Description of Proposed Development	
Municipal Address	3640 Greenbank Road
Description of Location	Greenfield Development
Land Use Classification	Residential
Development Size	125 Detached / 221 Townhomes
Accesses	Two accesses through adjacent developments
Phase of Development	Single Phase
Buildout Year	2022
TIA Requirement	Full TIA Required

1.2 Trip Generation Trigger		
Land Use Type	Townhomes or apartments	
Development Size	221	Units
Trip Generation Trigger	Yes	

1.3 Location Triggers	
Does the development propose a new driveway to a boundary street that is designated as part of the City's Transit Priority, Rapid Transit or Spine Bicycle Networks?	No
Is the development in a Design Priority Area (DPA) or Transit-oriented Development (TOD) zone?	No
Location Trigger	No

1.4. Safety Triggers	
Are posted speed limits on a boundary street are 80 km/hr or greater?	No
Are there any horizontal/vertical curvatures on a boundary street limits sight lines at a proposed driveway?	No
Is the proposed driveway within the area of influence of an adjacent traffic signal or roundabout (i.e. within 300 m of intersection in rural conditions, or within 150 m of intersection in urban/ suburban conditions)?	No
Is the proposed driveway within auxiliary lanes of an intersection?	No
Does the proposed driveway make use of an existing median break that serves an existing site?	No
Is there is a documented history of traffic operations or safety concerns on the boundary streets within 500 m of the development?	No
Does the development include a drive-thru facility?	No
Safety Trigger	No

TIA Plan Reports

On 14 June 2017, the Council of the City of Ottawa adopted new Transportation Impact Assessment (TIA) Guidelines. In adopting the guidelines, Council established a requirement for those preparing and delivering transportation impact assessments and reports to sign a letter of certification.

Individuals submitting TIA reports will be responsible for all aspects of development-related transportation assessment and reporting, and undertaking such work, in accordance and compliance with the City of Ottawa's Official Plan, the Transportation Master Plan and the Transportation Impact Assessment (2017) Guidelines.

By submitting the attached TIA report (and any associated documents) and signing this document, the individual acknowledges that s/he meets the four criteria listed below.

CERTIFICATION

1. I have reviewed and have a sound understanding of the objectives, needs and requirements of the City of Ottawa's Official Plan, Transportation Master Plan and the Transportation Impact Assessment (2017) Guidelines;
2. I have a sound knowledge of industry standard practice with respect to the preparation of transportation impact assessment reports, including multi modal level of service review;
3. I have substantial experience (more than 5 years) in undertaking and delivering transportation impact studies (analysis, reporting and geometric design) with strong background knowledge in transportation planning, engineering or traffic operations; and
4. I am either a licensed[1] or registered[2] professional in good standing, whose field of expertise [check √ appropriate field(s)] is either transportation engineering √ or transportation planning □.

[1,2] License of registration body that oversees the profession is required to have a code of conduct and ethics guidelines that will ensure appropriate conduct and representation for transportation planning and/or transportation engineering works.

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Dated at ___Newmarket_____ this __27__ day of _____August_____, 2018.
(City)

Name: _____Mark Crockford_____
(Please Print)

Professional Title: _____Professional Engineer_____

_____
Signature of Individual certifier that s/he meets the above four criteria

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October 11, 2018

Appendix B

Turning Movement Counts

Survey Date: Tuesday February 15 2018
Weather: Cloudy

TURNING MOVEMENT COUNT SUMMARY - ALL MODES

AM Peak Hour: 7:30 AM to 8:30 AM
MD Peak Hour: 11:30 AM to 12:30 PM
PM Peak Hour: 4:45 PM to 5:45 PM

AADT FACTOR: 1.0

Turning Movement Count - Full Study Summary Report (Vehicles)

Time Period		Borrisokane Road Northbound					Borrisokane Road Southbound					N/S STREET TOTAL	0 Eastbound					Cambrian Road Westbound					E/W STREET TOTAL	Grand TOTAL
		LT	ST	RT	U-Turns	NB TOTAL	LT	ST	RT	U-Turns	SB TOTAL		LT	ST	RT	U-Turns	EB TOTAL	LT	ST	RT	U-Turns	WB TOTAL		
7:00	8:00	0	28	10	0	**38**	72	15	0	0	**87**	**125**	0	0	0	0	**0**	8	0	350	0	**358**	**358**	**483**
8:00	9:00	0	48	13	0	**61**	123	22	0	0	**145**	**206**	0	0	0	0	**0**	5	0	346	0	**351**	**351**	**557**
9:00	10:00	0	24	1	0	**25**	60	22	0	0	**82**	**107**	0	0	0	0	**0**	1	0	209	0	**210**	**210**	**317**
AVG AM Pk HR		0	33	8	0	**41**	85	20	0	0	**105**	**146**	0	0	0	0	**0**	5	0	302	0	**306**	**306**	**452**
11:30	12:30	0	54	9	0	**63**	105	26	0	0	**131**	**194**	0	0	0	0	**0**	4	0	139	0	**143**	**143**	**337**
12:30	13:30	0	48	6	0	**54**	87	23	0	0	**110**	**164**	0	0	0	0	**0**	2	0	117	0	**119**	**119**	**283**
AVG MD Pk HR		0	51	8	0	**59**	96	25	0	0	**121**	**179**	0	0	0	0	**0**	3	0	128	0	**131**	**131**	**310**
15:00	16:00	0	40	1	0	**41**	58	51	0	0	**109**	**150**	0	0	0	0	**0**	13	0	159	0	**172**	**172**	**322**
16:00	17:00	0	25	0	0	**25**	344	43	0	0	**387**	**412**	0	0	0	0	**0**	11	0	162	0	**173**	**173**	**585**
17:00	18:00	0	22	0	0	**22**	352	36	0	0	**388**	**410**	0	0	0	0	**0**	14	0	198	0	**212**	**212**	**622**
AVG PM Pk HR		0	29	0	0	**29**	251	43	0	0	**295**	**324**	0	0	0	0	**0**	13	0	173	0	**186**	**186**	**510**
TOTAL		0	373	56	0	**429**	1,382	282	0	0	**1,664**	**2,093**	0	0	0	0	**0**	66	0	2,110	0	**2,175**	**2,175**	**4,268**
EQ 12Hr		0	519	77	0	596	1921	392	0	0	2313	2909	0	0	0	0	0	91	0	2932	0	3024	3024	5933
Note: These volumes are calculated by multiplying the totals by the appropriate expansion factor.											1.39													
AVG 12Hr		0	519	77	0	596	1921	392	0	0	2313	2909	0	0	0	0	0	91	0	2932	0	3024	3024	5933
Note: These volumes are calculated by multiplying the Equivalent 12 hr. totals by the AADT factor.											1.0													
AVG 24Hr		0	680	101	0	781	2516	514	0	0	3030	3811	0	0	0	0	0	120	0	3841	0	3961	3961	7772
Note: These volumes are calculated by multiplying the Average Daily 12hr. totals by the 12 to 24 expansion factor.													1.31											

Turning Movement Count - Full Study Summary Report (Pedestrians)

Time Period		Borrisokane Road NB Approach (East or West Crossing)	Borrisokane Road SB Approach (East or West Crossing)	N/S STREET TOTAL	0 EB Approach (North or South Crossing)	Cambrian Road WB Approach (North or South Crossing)	E/W STREET TOTAL	Grand TOTAL
7:00	8:00	0	0	**0**	0	0	**0**	**0**
8:00	9:00	0	0	**0**	0	0	**0**	**0**
9:00	10:00	0	0	**0**	0	1	**1**	**1**
11:30	12:30	0	0	**0**	0	0	**0**	**0**
12:30	13:30	0	0	**0**	0	0	**0**	**0**
15:00	16:00	0	0	**0**	0	0	**0**	**0**
16:00	17:00	0	228	**228**	0	0	**0**	**228**
17:00	18:00	0	0	**0**	0	0	**0**	**0**
TOTAL:		0	228	**228**	0	1	**1**	**229**

Turning Movement Count - Full Study Summary Report (Cyclists)

Time Period		Borrisokane Road Northbound	Borrisokane Road Southbound	N/S STREET TOTAL	0 Eastbound	Cambrian Road Westbound	E/W STREET TOTAL	Grand TOTAL
7:00	8:00	0	0	**0**	0	0	**0**	**0**
8:00	9:00	0	0	**0**	0	0	**0**	**0**
9:00	10:00	0	0	**0**	0	0	**0**	**0**
11:30	12:30	0	0	**0**	0	0	**0**	**0**
12:30	13:30	0	0	**0**	0	0	**0**	**0**
15:00	16:00	0	0	**0**	0	0	**0**	**0**
16:00	17:00	0	0	**0**	0	0	**0**	**0**
17:00	18:00	0	0	**0**	0	0	**0**	**0**
TOTAL:		0	0	**0**	0	0	**0**	**0**

Turning Movement Count - Full Study Summary Report (Heavy Vehicles)

Time Period		Borrisokane Road Northbound					Borrisokane Road Southbound					N/S STREET TOTAL	0 Eastbound					Cambrian Road Westbound					E/W STREET TOTAL	Grand TOTAL
		LT	ST	RT	U-Turns	NB TOTAL	LT	ST	RT	U-Turns	SB TOTAL		LT	ST	RT	U-Turns	EB TOTAL	LT	ST	RT	U-Turns	WB TOTAL		
7:00	8:00	0	9	0	0	**9**	16	8	0	0	**24**	**33**	0	0	0	0	**0**	0	0	5	0	**5**	**5**	**38**
8:00	9:00	0	10	2	0	**12**	4	10	0	0	**14**	**26**	0	0	0	0	**0**	2	0	16	0	**18**	**18**	**44**
9:00	10:00	0	12	0	0	**12**	7	13	0	0	**20**	**32**	0	0	0	0	**0**	0	0	10	0	**10**	**10**	**42**
11:30	12:30	0	11	1	0	**12**	2	11	0	0	**13**	**25**	0	0	0	0	**0**	1	0	5	0	**6**	**6**	**31**
12:30	13:30	0	10	3	0	**13**	2	11	0	0	**13**	**26**	0	0	0	0	**0**	0	0	5	0	**5**	**5**	**31**
15:00	16:00	0	2	0	0	**2**	10	2	0	0	**12**	**14**	0	0	0	0	**0**	1	0	11	0	**12**	**12**	**26**
16:00	17:00	0	1	5	0	**6**	6	2	0	0	**8**	**14**	0	0	0	0	**0**	4	0	17	0	**21**	**21**	**35**
17:00	18:00	0	2	1	0	**3**	1	1	0	0	**2**	**5**	0	0	0	0	**0**	2	0	5	0	**7**	**7**	**12**
TOTAL:		0	57	12	0	**69**	48	58	0	0	**106**	**175**	0	0	0	0	**0**	10	0	74	0	**84**	**84**	**259**

Appendix C

Collision Data

City Operations - Transportation Services

Collision Details Report - Public Version

From: January 1, 2014 **To:** January 1, 2016

Location: CAMBRIAN RD @ GREENBANK RD

Traffic Control: Yield sign **Total Collisions:** 2

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2014-Jul-02, Wed,20:45	Clear	Rear end	Non-fatal injury	Dry	West	Slowing or stopping	Automobile, station wagon	Other motor vehicle	
					West	Slowing or stopping	Passenger van	Other motor vehicle	
2014-Aug-30, Sat,12:58	Clear	Sideswipe	Non-fatal injury	Dry	East	Going ahead	Automobile, station wagon	Cyclist	
					East	Going ahead	Bicycle	Other motor vehicle	

Location: CAMBRIAN RD @ REGATTA AVE

Traffic Control: Stop sign **Total Collisions:** 2

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2015-Jul-05, Sun,13:15	Clear	Turning movement	P.D. only	Dry	West	Turning left	Passenger van	Other motor vehicle	
					West	Overtaking	Automobile, station wagon	Other motor vehicle	
2015-Aug-11, Tue,22:06	Clear	Angle	P.D. only	Dry	West	Turning left	Pick-up truck	Other motor vehicle	
					North	Stopped	Pick-up truck	Other motor vehicle	

Location: CAMBRIAN RD @ RIVER MIST RD

Traffic Control: Stop sign

Total Collisions: 1

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2015-Sep-04, Fri,07:15	Clear	Angle	P.D. only	Dry	East	Going ahead	Automobile, station wagon	Other motor vehicle	
					North	Turning right	Automobile, station wagon	Other motor vehicle	

Location: CAMBRIAN RD btwn BORRISOKANE RD & GRAND CANAL ST

Traffic Control: No control

Total Collisions: 1

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2015-Oct-09, Fri,00:00	Clear	SMV unattended vehicle	P.D. only	Dry	West	Unknown	Unknown	Unattended vehicle	

City Operations - Transportation Services

Collision Details Report - Public Version

From: January 1, 2014 **To:** January 1, 2016

Location: CAMBRIAN RD @ GREENBANK RD

Traffic Control: Yield sign **Total Collisions:** 2

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2014-Jul-02, Wed,20:45	Clear	Rear end	Non-fatal injury	Dry	West	Slowing or stopping	Automobile, station wagon	Other motor vehicle	
					West	Slowing or stopping	Passenger van	Other motor vehicle	
2014-Aug-30, Sat,12:58	Clear	Sideswipe	Non-fatal injury	Dry	East	Going ahead	Automobile, station wagon	Cyclist	
					East	Going ahead	Bicycle	Other motor vehicle	

Location: DUNDONALD DR @ GREENBANK RD

Traffic Control: Stop sign **Total Collisions:** 6

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2014-Jun-24, Tue,13:00	Rain	Turning movement	P.D. only	Wet	South	Going ahead	Pick-up truck	Other motor vehicle	
					North	Turning left	Automobile, station wagon	Other motor vehicle	
2014-Nov-05, Wed,18:20	Clear	Angle	P.D. only	Dry	East	Turning left	Automobile, station wagon	Other motor vehicle	
					South	Going ahead	Automobile, station wagon	Other motor vehicle	
2014-Sep-25, Thu,16:02	Clear	SMV other	Non-fatal injury	Dry	North	Turning left	Automobile, station wagon	Pedestrian	1

2014-Jul-24, Thu,16:07	Clear	Turning movement	Non-fatal injury	Dry	North	Turning left	Automobile, station wagon	Other motor vehicle
					South	Going ahead	Pick-up truck	Other motor vehicle
2014-May-19, Mon,15:42	Clear	Angle	P.D. only	Dry	West	Going ahead	Pick-up truck	Other motor vehicle
					South	Going ahead	Automobile, station wagon	Other motor vehicle
2015-Oct-09, Fri,14:10	Clear	Angle	P.D. only	Dry	West	Going ahead	Automobile, station wagon	Other motor vehicle
					North	Going ahead	Automobile, station wagon	Other motor vehicle

Location: EGRET WAY @ GREENBANK RD

Traffic Control: Stop sign

Total Collisions: 1

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2015-Feb-27, Fri,07:32	Clear	Angle	P.D. only	Dry	South	Turning right	Pick-up truck	Other motor vehicle	
					East	Stopped	Automobile, station wagon	Other motor vehicle	

Location: GREENBANK RD btwn CAMBRIAN RD & DUNDONALD DR

Traffic Control: No control

Total Collisions: 2

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2015-Jan-10, Sat,10:40	Clear	Approaching	P.D. only	Wet	South	Going ahead	Unknown	Other motor vehicle	
					North	Going ahead	Pick-up truck	Other motor vehicle	
2015-Jan-30, Fri,06:09	Drifting Snow	SMV other	P.D. only	Ice	North	Going ahead	Pick-up truck	Ran off road	

City Operations - Transportation Services

Collision Details Report - Public Version

From: January 1, 2014 **To:** January 1, 2016

Location: CAMBRIAN RD @ RIVER MIST RD

Traffic Control: Stop sign **Total Collisions:** 1

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2015-Sep-04, Fri,07:15	Clear	Angle	P.D. only	Dry	East	Going ahead	Automobile, station wagon	Other motor vehicle	
					North	Turning right	Automobile, station wagon	Other motor vehicle	

Location: RIVER MIST RD btwn BRAMBLING WAY & RIVER ROCK AVE

Traffic Control: No control **Total Collisions:** 1

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2015-Jun-24, Wed,11:06	Clear	SMV unattended vehicle	P.D. only	Dry	East	Reversing	Automobile, station wagon	Unattended vehicle	

Collision Main Detail Summary

OnTRAC Reporting System

FROM: 2011-01-01 TO: 2014-01-01

CAMBRIAN RD, CEDARVIEW RD to GREENBANK RD

Former Municipality: **Nepean** Traffic Control: **No control** Number of Collisions: **5**

	DATE	DAY	TIME	ENV	LIGHT	IMPACT TYPE	CLASS	DIR	SURFACE COND'N	VEHICLE MANOEUVRE	VEHICLE TYPE	FIRST EVENT	No. PED
1	2011-05-16	Mo	16:00	Rain	Daylight	Rear end	P.D. only	V1 E	Wet	Going ahead	Automobile, station	Other motor vehicle	0
								V2 E	Wet	Stopped	School bus	Other motor vehicle	
2	2012-03-05	Mo	21:00	Clear	Dark	Single vehicle	P.D. only	V1 U	Dry	Unknown	Automobile, station	Unattended vehicle	0
3	2012-10-20	Sat	04:35	Clear	Dark	Single vehicle	P.D. only	V1 E	Wet	Going ahead	Automobile, station	Ran off road	0
4	2013-02-22	Fri	07:00	Unknow	Dawn	Single vehicle	P.D. only	V1 W	Slush	Going ahead	Unknown	Unattended vehicle	0
5	2013-11-14	Thu	07:34	Clear	Daylight	Single vehicle	P.D. only	V1 W	Dry	Going ahead	Automobile, station	Animal - wild	0

CAMBRIAN RD & GREENBANK RD

Former Municipality: **Nepean** Traffic Control: **Stop sign** Number of Collisions: **4**

	DATE	DAY	TIME	ENV	LIGHT	IMPACT TYPE	CLASS	DIR	SURFACE COND'N	VEHICLE MANOEUVRE	VEHICLE TYPE	FIRST EVENT	No. PED
6	2012-03-01	Thu	12:07	Snow	Daylight	Rear end	P.D. only	V1 S	Packed snow	Going ahead	Automobile, station	Skidding/Sliding	0
								V2 S	Packed snow	Going ahead	Automobile, station	Skidding/Sliding	
7	2013-02-14	Thu	16:20	Clear	Daylight	Single vehicle	Non-fatal	V1 N	Mud	Going ahead	School bus	Skidding/Sliding	0
8	2013-09-09	Mo	07:40	Clear	Daylight	Sideswipe	P.D. only	V1 S	Dry	Changing lanes	Automobile, station	Other motor vehicle	0
								V2 S	Dry	Going ahead	Passenger van	Other motor vehicle	
9	2013-12-13	Fri	23:41	Clear	Dark	Single vehicle	P.D. only	V1 N	Dry	Going ahead	Automobile, station	Pole (sign, parking	0

CAMBRIAN RD & GRAND CANAL ST

Former Municipality: **Nepean** Traffic Control: **Stop sign** Number of Collisions: **2**

	DATE	DAY	TIME	ENV	LIGHT	IMPACT TYPE	CLASS	DIR	SURFACE COND'N	VEHICLE MANOEUVRE	VEHICLE TYPE	FIRST EVENT	No. PED
10	2012-12-21	Fri	07:36	Snow	Dawn	Angle	P.D. only	V1 W	Wet	Slowing or	Automobile, station	Other motor vehicle	0
								V2 S	Wet	Turning left	Automobile, station	Other motor vehicle	
11	2013-11-03	Sun	12:41	Clear	Daylight	Turning	Non-fatal	V1 E	Dry	Going ahead	Automobile, station	Other motor vehicle	0
								V2 W	Dry	Turning left	Automobile, station	Other motor vehicle	

(Note: Time of Day = "00:00" represents unknown collision time

GREENBANK RD, BARNSDALE RD to CAMBRIAN RD

Former Municipality: **Nepean** Traffic Control: **No control** Number of Collisions: **3**

	DATE	DAY	TIME	ENV	LIGHT	IMPACT TYPE	CLASS	DIR	SURFACE COND'N	VEHICLE MANOEUVRE	VEHICLE TYPE	FIRST EVENT	No. PED
12	2011-02-10	Thu	07:48	Clear	Daylight	Other	P.D. only	V1 S	Wet	Going ahead	Pick-up truck	Other Moveable	0
								V2 N	Loose snow	Going ahead	Automobile, station	Debris falling off	
13	2011-09-25	Sun	20:50	Clear	Dark	Single vehicle	P.D. only	V1 N	Loose sand or	Going ahead	Automobile, station	Debris on road	0

CAMBRIAN RD, SEELEY'S BAY ST to GRAND CANAL ST

Former Municipality: **Nepean** Traffic Control: **No control** Number of Collisions: **7**

	DATE	DAY	TIME	ENV	LIGHT	IMPACT TYPE	CLASS	DIR	SURFACE COND'N	VEHICLE MANOEUVRE	VEHICLE TYPE	FIRST EVENT	No. PED
14	2011-07-12	Tue	16:30	Clear	Daylight	Single vehicle	P.D. only	V1 W	Dry	Reversing	Farm tractor	Unattended vehicle	0

CAMBRIAN RD & REGATTA AVE

Former Municipality: **Nepean** Traffic Control: **Stop sign** Number of Collisions: **8**

	DATE	DAY	TIME	ENV	LIGHT	IMPACT TYPE	CLASS	DIR	SURFACE COND'N	VEHICLE MANOEUVRE	VEHICLE TYPE	FIRST EVENT	No. PED
15	2011-11-17	Thu	17:09	Rain	Dark	Turning	P.D. only	V1 W	Wet	Turning left	Automobile, station	Other motor vehicle	0
								V2 E	Wet	Going ahead	Pick-up truck	Other motor vehicle	

DUNDONALD DR & GREENBANK RD

Former Municipality: **Nepean** Traffic Control: **Stop sign** Number of Collisions: **2**

	DATE	DAY	TIME	ENV	LIGHT	IMPACT TYPE	CLASS	DIR	SURFACE COND'N	VEHICLE MANOEUVRE	VEHICLE TYPE	FIRST EVENT	No. PED
16	2012-07-13	Fri	21:00	Clear	Dusk	Rear end	P.D. only	V1 W	Dry	Going ahead	Automobile, station	Other motor vehicle	0
								V2 W	Dry	Stopped	Automobile, station	Other motor vehicle	
17	2012-12-13	Thu	09:42	Clear	Daylight	Angle	P.D. only	V1 E	Wet	Going ahead	Pick-up truck	Other motor vehicle	0
								V2 N	Wet	Going ahead	Passenger van	Other motor vehicle	

(Note: Time of Day = "00:00" represents unknown collision time

Appendix D

Traffic Signal Warrant Sheet

Street 1 @ Cambrian Road
2022 Total Future

Justification #7

Justification	Description	Minimum Requirement 1 Lane Highway		Minimum Requirement 2 or More Lanes		Compliance Sectional		Compliance Entire %	Signal
		Free Flow	Restr. Flow	Free Flow	Restr. Flow	Numerical	%		
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	480	720	600	900	512	107%	107%	No
	B. Vehicle volume, along minor streets (average hour)	120	170	120	170	128	107%		
2. Delay to Cross Traffic	A. Vehicle volumes, major street (average hour)	480	420	600	900	384	80%	80%	No
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	75	120	170	56	112%		

Notes
1. Refer to OTM Book 12, pg 88, Nov 2007
2. Lowest section percentage governs justification
3. Average hourly volumes estiamted from peak hour volumes, AHV = PM/2 or (AM + PM) / 4
4. Due to the increased uncertainty of volume projections for proposed new developments, an increased justification threshold is used in those cases. Justification 1 and Justification 2 are used only and the justification is required to be met to 120% in the case of an existing intersection and 150% in the case of a new intersection for traffic signals to be considered.

Street 1 @ Cambrian Road
2027 Total Future

Justification #7

Justification	Description	Minimum Requirement 1 Lane Highway		Minimum Requirement 2 or More Lanes		Compliance Sectional		Compliance Entire %	Signal
		Free Flow	Restr. Flow	Free Flow	Restr. Flow	Numerical	%		
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	480	720	600	900	889	124%	124%	No
	B. Vehicle volume, along minor streets (average hour)	120	170	120	170	254	150%		
2. Delay to Cross Traffic	A. Vehicle volumes, major street (average hour)	480	420	600	900	635	151%	151%	Yes
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	75	120	170	178	237%		

Notes
1. Refer to OTM Book 12, pg 88, Nov 2007
2. Lowest section percentage governs justification
3. Average hourly volumes estiamted from peak hour volumes, AHV = PM/2 or (AM + PM) / 4
4. Due to the increased uncertainty of volume projections for proposed new developments, an increased justification threshold is used in those cases. Justification 1 and Justification 2 are used only and the justification is required to be met to 120% in the case of an existing intersection and 150% in the case of a new intersection for traffic signals to be considered.

Borrisokane Road @ Cambrian Road
2022 Total Future

Justification #7

Justification	Description	Minimum Requirement 1 Lane Highway		Minimum Requirement 2 or More Lanes		Compliance Sectional		Compliance Entire %	Signal
		Free Flow	Restr. Flow	Free Flow	Restr. Flow	Numerical	%		
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	480	720	600	900	570	119%	119%	No
	B. Vehicle volume, along minor streets (average hour)	120	170	120	170	337	281%		
2. Delay to Cross Traffic	A. Vehicle volumes, major street (average hour)	480	420	600	900	233	49%	49%	No
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	75	120	170	102	204%		

Notes
1. Refer to OTM Book 12, pg 88, Nov 2007
2. Lowest section percentage governs justification
3. Average hourly volumes estiamted from peak hour volumes, AHV = PM/2 or (AM + PM) / 4
4. Due to the increased uncertainty of volume projections for proposed new developments, an increased justification threshold is used in those cases. Justification 1 and Justification 2 are used only and the justification is required to be met to 120% in the case of an existing intersection and 150% in the case of a new intersection for traffic signals to be considered.

Borrisokane Road @ Cambrian Road
2027 Total Future

Justification #7

Justification	Description	Minimum Requirement 1 Lane Highway		Minimum Requirement 2 or More Lanes		Compliance Sectional		Compliance Entire %	Signal
		Free Flow	Restr. Flow	Free Flow	Restr. Flow	Numerical	%		
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	480	720	600	900	789	110%	110%	No
	B. Vehicle volume, along minor streets (average hour)	120	170	120	170	462	272%		
2. Delay to Cross Traffic	A. Vehicle volumes, major street (average hour)	480	420	600	900	327	78%	78%	No
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	75	120	170	141	187%		

Notes
1. Refer to OTM Book 12, pg 88, Nov 2007
2. Lowest section percentage governs justification
3. Average hourly volumes estiamted from peak hour volumes, AHV = PM/2 or (AM + PM) / 4
4. Due to the increased uncertainty of volume projections for proposed new developments, an increased justification threshold is used in those cases. Justification 1 and Justification 2 are used only and the justification is required to be met to 120% in the case of an existing intersection and 150% in the case of a new intersection for traffic signals to be considered.

Appendix E

TDM Measures Checklist

TDM Measures Checklist:
Residential Developments (multi-family, condominium or subdivision)

Legend

BASIC — The measure is generally feasible and effective, and in most cases would benefit the development and its users

BETTER — The measure could maximize support for users of sustainable modes, and optimize development performance

★ — The measure is one of the most dependably effective tools to encourage the use of sustainable modes

		TDM measures: *Residential developments*	Check if proposed & add descriptions
	1.	**TDM PROGRAM MANAGEMENT**	
	1.1	**Program coordinator**	
BASIC ★	1.1.1	Designate an internal coordinator, or contract with an external coordinator	☐
	1.2	**Travel surveys**	
BETTER	1.2.1	Conduct periodic surveys to identify travel-related behaviours, attitudes, challenges and solutions, and to track progress	☐
	2.	**WALKING AND CYCLING**	
	2.1	**Information on walking/cycling routes & destinations**	
BASIC	2.1.1	Display local area maps with walking/cycling access routes and key destinations at major entrances *(multi-family, condominium)*	☐
	2.2	**Bicycle skills training**	
BETTER	2.2.1	Offer on-site cycling courses for residents, or subsidize off-site courses	☐

		TDM measures: *Residential developments*	Check if proposed & add descriptions
		3. TRANSIT	
		3.1 Transit information	
BASIC		3.1.1 Display relevant transit schedules and route maps at entrances *(multi-family, condominium)*	☐
BETTER		3.1.2 Provide real-time arrival information display at entrances *(multi-family, condominium)*	☐
		3.2 Transit fare incentives	
BASIC	★	3.2.1 Offer PRESTO cards preloaded with one monthly transit pass on residence purchase/move-in, to encourage residents to use transit	☐
BETTER		3.2.2 Offer at least one year of free monthly transit passes on residence purchase/move-in	☐
		3.3 Enhanced public transit service	
BETTER	★	3.3.1 Contract with OC Transpo to provide early transit services until regular services are warranted by occupancy levels *(subdivision)*	☒ Transit service will likely be warranted soon after occupancy begins.
		3.4 Private transit service	
BETTER		3.4.1 Provide shuttle service for seniors homes or lifestyle communities (e.g. scheduled mall or supermarket runs)	☐
		4. CARSHARING & BIKESHARING	
		4.1 Bikeshare stations & memberships	
BETTER		4.1.1 Contract with provider to install on-site bikeshare station (*multi-family)*	☐
BETTER		4.1.2 Provide residents with bikeshare memberships, either free or subsidized *(multi-family)*	☐
		4.2 Carshare vehicles & memberships	
BETTER		4.2.1 Contract with provider to install on-site carshare vehicles and promote their use by residents	☐
BETTER		4.2.2 Provide residents with carshare memberships, either free or subsidized	☐
		5. PARKING	
		5.1 Priced parking	
BASIC	★	5.1.1 Unbundle parking cost from purchase price *(condominium)*	☐
BASIC	★	5.1.2 Unbundle parking cost from monthly rent *(multi-family)*	☐

TDM measures: *Residential developments*				Check if proposed & add descriptions
		6.	**TDM MARKETING & COMMUNICATIONS**	
		6.1	**Multimodal travel information**	
BASIC	★	6.1.1	Provide a multimodal travel option information package to new residents	☐
		6.2	**Personalized trip planning**	
BETTER	★	6.2.1	Offer personalized trip planning to new residents	☐

Appendix F

2018 Existing Synchro

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	11	373	53	12	103	20
Future Volume (vph)	11	373	53	12	103	20
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.869		0.976			
Flt Protected	0.999					0.960
Satd. Flow (prot)	1549	0	1741	0	0	1713
Flt Permitted	0.999					0.960
Satd. Flow (perm)	1549	0	1741	0	0	1713
Link Speed (k/h)	70		80			80
Link Distance (m)	399.0		269.7			282.6
Travel Time (s)	20.5		12.1			12.7
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	12	414	59	13	114	22
Shared Lane Traffic (%)						
Lane Group Flow (vph)	426	0	72	0	0	136
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 45.5%		ICU Level of Service A	
Analysis Period (min) 15			

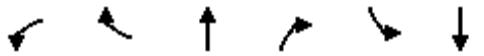
Intersection	
Int Delay, s/veh	9.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	11	373	53	12	103	20
Future Vol, veh/h	11	373	53	12	103	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	12	414	59	13	114	22

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	316	66	0	0	72	0
Stage 1	66	-	-	-	-	-
Stage 2	250	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	677	998	-	-	1528	-
Stage 1	957	-	-	-	-	-
Stage 2	792	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	626	998	-	-	1528	-
Mov Cap-2 Maneuver	626	-	-	-	-	-
Stage 1	884	-	-	-	-	-
Stage 2	792	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.5	0	6.3
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	981	1528	-
HCM Lane V/C Ratio	-	-	0.435	0.075	-
HCM Control Delay (s)	-	-	11.5	7.5	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	2.2	0.2	-



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	10	192	41	6	362	40
Future Volume (vph)	10	192	41	6	362	40
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.872		0.982			
Flt Protected	0.998					0.957
Satd. Flow (prot)	1536	0	1733	0	0	1689
Flt Permitted	0.998					0.957
Satd. Flow (perm)	1536	0	1733	0	0	1689
Link Speed (mph)	43		50			50
Link Distance (ft)	1309		885			927
Travel Time (s)	20.8		12.1			12.6
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	11	213	46	7	402	44
Shared Lane Traffic (%)						
Lane Group Flow (vph)	224	0	53	0	0	446
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 49.8%		ICU Level of Service A	
Analysis Period (min) 15			

Intersection	
Int Delay, s/veh	7.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	10	192	41	6	362	40
Future Vol, veh/h	10	192	41	6	362	40
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	213	46	7	402	44

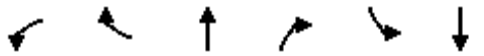
Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	898	50	0	0	53	0
Stage 1	50	-	-	-	-	-
Stage 2	848	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	310	1018	-	-	1553	-
Stage 1	972	-	-	-	-	-
Stage 2	420	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	228	1018	-	-	1553	-
Mov Cap-2 Maneuver	228	-	-	-	-	-
Stage 1	714	-	-	-	-	-
Stage 2	420	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.6	0	7.3
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	869	1553	-
HCM Lane V/C Ratio	-	-	0.258	0.259	-
HCM Control Delay (s)	-	-	10.6	8.1	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	1	1	-

Appendix G

2022 Future Background Synchro



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	16	416	57	14	115	22
Future Volume (vph)	16	416	57	14	115	22
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.870		0.973			
Flt Protected	0.998					0.960
Satd. Flow (prot)	1549	0	1736	0	0	1713
Flt Permitted	0.998					0.960
Satd. Flow (perm)	1549	0	1736	0	0	1713
Link Speed (k/h)	70		80			80
Link Distance (m)	509.6		269.7			282.6
Travel Time (s)	26.2		12.1			12.7
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	16	416	57	14	115	22
Shared Lane Traffic (%)						
Lane Group Flow (vph)	432	0	71	0	0	137
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 49.4%		ICU Level of Service A	
Analysis Period (min) 15			

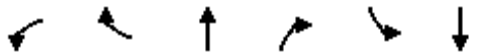
Intersection	
Int Delay, s/veh	9.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	16	416	57	14	115	22
Future Vol, veh/h	16	416	57	14	115	22
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	16	416	57	14	115	22

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	316	64	0	0	71	0
Stage 1	64	-	-	-	-	-
Stage 2	252	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	677	1000	-	-	1529	-
Stage 1	959	-	-	-	-	-
Stage 2	790	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	626	1000	-	-	1529	-
Mov Cap-2 Maneuver	626	-	-	-	-	-
Stage 1	886	-	-	-	-	-
Stage 2	790	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.6	0	6.3
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	978	1529	-
HCM Lane V/C Ratio	-	-	0.442	0.075	-
HCM Control Delay (s)	-	-	11.6	7.5	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	2.3	0.2	-



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	13	214	44	11	404	43
Future Volume (vph)	13	214	44	11	404	43
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.873		0.973			
Flt Protected	0.997					0.957
Satd. Flow (prot)	1553	0	1736	0	0	1708
Flt Permitted	0.997					0.957
Satd. Flow (perm)	1553	0	1736	0	0	1708
Link Speed (k/h)	70		80			80
Link Distance (m)	509.6		269.7			282.6
Travel Time (s)	26.2		12.1			12.7
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	13	214	44	11	404	43
Shared Lane Traffic (%)						
Lane Group Flow (vph)	227	0	55	0	0	447
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 54.1%		ICU Level of Service A	
Analysis Period (min) 15			

Intersection	
Int Delay, s/veh	7.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	13	214	44	11	404	43
Future Vol, veh/h	13	214	44	11	404	43
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	13	214	44	11	404	43

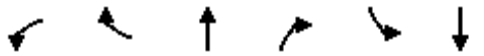
Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	901	50	0	0	55	0
Stage 1	50	-	-	-	-	-
Stage 2	851	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	309	1018	-	-	1550	-
Stage 1	972	-	-	-	-	-
Stage 2	419	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	226	1018	-	-	1550	-
Mov Cap-2 Maneuver	226	-	-	-	-	-
Stage 1	712	-	-	-	-	-
Stage 2	419	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.8	0	7.4
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	848	1550	-
HCM Lane V/C Ratio	-	-	0.268	0.261	-
HCM Control Delay (s)	-	-	10.8	8.1	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	1.1	1.1	-

Appendix H

2027 Future Background Synchro



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	52	721	83	32	250	58
Future Volume (vph)	52	721	83	32	250	58
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.874		0.962			
Flt Protected	0.997					0.961
Satd. Flow (prot)	1555	0	1717	0	0	1715
Flt Permitted	0.997					0.961
Satd. Flow (perm)	1555	0	1717	0	0	1715
Link Speed (k/h)	70		80			80
Link Distance (m)	509.6		269.7			282.6
Travel Time (s)	26.2		12.1			12.7
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	52	721	83	32	250	58
Shared Lane Traffic (%)						
Lane Group Flow (vph)	773	0	115	0	0	308
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 81.3%		ICU Level of Service D	
Analysis Period (min) 15			

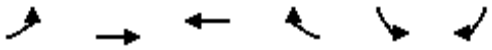
Intersection	
Int Delay, s/veh	23.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	52	721	83	32	250	58
Future Vol, veh/h	52	721	83	32	250	58
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	52	721	83	32	250	58

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	657	99	0	0	115	0
Stage 1	99	-	-	-	-	-
Stage 2	558	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	430	957	-	-	1474	-
Stage 1	925	-	-	-	-	-
Stage 2	573	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	355	957	-	-	1474	-
Mov Cap-2 Maneuver	355	-	-	-	-	-
Stage 1	763	-	-	-	-	-
Stage 2	573	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	33.6	0	6.4
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	859	1474	-
HCM Lane V/C Ratio	-	-	0.9	0.17	-
HCM Control Delay (s)	-	-	33.6	7.9	0
HCM Lane LOS	-	-	D	A	A
HCM 95th %tile Q(veh)	-	-	12.5	0.6	-



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	49	227	552	130	282	104
Future Volume (vph)	49	227	552	130	282	104
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.974		0.964	
Flt Protected		0.991			0.965	
Satd. Flow (prot)	0	1768	1738	0	1660	0
Flt Permitted		0.991			0.965	
Satd. Flow (perm)	0	1768	1738	0	1660	0
Link Speed (k/h)		70	70		50	
Link Distance (m)		509.6	247.9		283.1	
Travel Time (s)		26.2	12.7		20.4	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	49	227	552	130	282	104
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	276	682	0	386	0
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 86.8%		ICU Level of Service E	
Analysis Period (min) 15			

Intersection	
Int Delay, s/veh	48.5

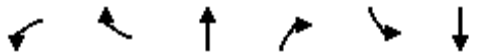
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	49	227	552	130	282	104
Future Vol, veh/h	49	227	552	130	282	104
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	49	227	552	130	282	104

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	682	0	-	0	942	617
Stage 1	-	-	-	-	617	-
Stage 2	-	-	-	-	325	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	911	-	-	-	292	490
Stage 1	-	-	-	-	538	-
Stage 2	-	-	-	-	732	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	911	-	-	-	~ 274	490
Mov Cap-2 Maneuver	-	-	-	-	~ 274	-
Stage 1	-	-	-	-	505	-
Stage 2	-	-	-	-	732	-

Approach	EB	WB	SB
HCM Control Delay, s	1.6	0	167.8
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	911	-	-	-	311
HCM Lane V/C Ratio	0.054	-	-	-	1.241
HCM Control Delay (s)	9.2	0	-	-	167.8
HCM Lane LOS	A	A	-	-	F
HCM 95th %tile Q(veh)	0.2	-	-	-	17.6

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	39	420	78	44	692	69
Future Volume (vph)	39	420	78	44	692	69
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.876		0.951			
Flt Protected	0.996					0.957
Satd. Flow (prot)	1557	0	1697	0	0	1708
Flt Permitted	0.996					0.957
Satd. Flow (perm)	1557	0	1697	0	0	1708
Link Speed (k/h)	71		80			80
Link Distance (m)	509.6		269.7			282.6
Travel Time (s)	25.8		12.1			12.7
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	39	420	78	44	692	69
Shared Lane Traffic (%)						
Lane Group Flow (vph)	459	0	122	0	0	761
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 91.1%		ICU Level of Service F	
Analysis Period (min) 15			

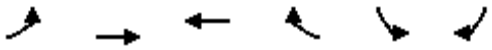
Intersection	
Int Delay, s/veh	34.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	39	420	78	44	692	69
Future Vol, veh/h	39	420	78	44	692	69
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	39	420	78	44	692	69

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1553	100	0	0	122	0
Stage 1	100	-	-	-	-	-
Stage 2	1453	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	125	956	-	-	1465	-
Stage 1	924	-	-	-	-	-
Stage 2	215	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	64	956	-	-	1465	-
Mov Cap-2 Maneuver	64	-	-	-	-	-
Stage 1	470	-	-	-	-	-
Stage 2	215	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	87.2	0	8.8
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	438	1465	-
HCM Lane V/C Ratio	-	-	1.048	0.472	-
HCM Control Delay (s)	-	-	87.2	9.6	0
HCM Lane LOS	-	-	F	A	A
HCM 95th %tile Q(veh)	-	-	14.5	2.6	-



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	100	518	335	273	196	73
Future Volume (vph)	100	518	335	273	196	73
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.939		0.963	
Flt Protected		0.992			0.965	
Satd. Flow (prot)	0	1770	1675	0	1658	0
Flt Permitted		0.992			0.965	
Satd. Flow (perm)	0	1770	1675	0	1658	0
Link Speed (k/h)		48	71		48	
Link Distance (m)		509.6	247.9		283.1	
Travel Time (s)		38.2	12.6		21.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	100	518	335	273	196	73
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	618	608	0	269	0
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 97.0%		ICU Level of Service F	
Analysis Period (min) 15			

Intersection	
Int Delay, s/veh	33.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	100	518	335	273	196	73
Future Vol, veh/h	100	518	335	273	196	73
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	100	518	335	273	196	73

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	608	0	-	0	1190	472
Stage 1	-	-	-	-	472	-
Stage 2	-	-	-	-	718	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	970	-	-	-	207	592
Stage 1	-	-	-	-	628	-
Stage 2	-	-	-	-	483	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	970	-	-	-	~ 177	592
Mov Cap-2 Maneuver	-	-	-	-	~ 177	-
Stage 1	-	-	-	-	537	-
Stage 2	-	-	-	-	483	-

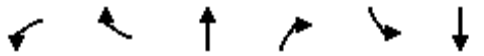
Approach	EB	WB	SB
HCM Control Delay, s	1.5	0	181.1
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	970	-	-	-	219
HCM Lane V/C Ratio	0.103	-	-	-	1.228
HCM Control Delay (s)	9.1	0	-	-	181.1
HCM Lane LOS	A	A	-	-	F
HCM 95th %tile Q(veh)	0.3	-	-	-	13.6

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Appendix I

2022 Total Future Synchro



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	26	534	57	19	174	22
Future Volume (vph)	26	534	57	19	174	22
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.871		0.966			
Flt Protected	0.998					0.957
Satd. Flow (prot)	1551	0	1724	0	0	1708
Flt Permitted	0.998					0.957
Satd. Flow (perm)	1551	0	1724	0	0	1708
Link Speed (k/h)	70		80			80
Link Distance (m)	509.6		269.7			282.6
Travel Time (s)	26.2		12.1			12.7
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	26	534	57	19	174	22
Shared Lane Traffic (%)						
Lane Group Flow (vph)	560	0	76	0	0	196
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 61.1%		ICU Level of Service B	
Analysis Period (min) 15			

Intersection	
Int Delay, s/veh	11

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	26	534	57	19	174	22
Future Vol, veh/h	26	534	57	19	174	22
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	26	534	57	19	174	22

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	437	67	0	0	76	0
Stage 1	67	-	-	-	-	-
Stage 2	370	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	577	997	-	-	1523	-
Stage 1	956	-	-	-	-	-
Stage 2	699	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	510	997	-	-	1523	-
Mov Cap-2 Maneuver	510	-	-	-	-	-
Stage 1	845	-	-	-	-	-
Stage 2	699	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	14	0	6.8
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	955	1523	-
HCM Lane V/C Ratio	-	-	0.586	0.114	-
HCM Control Delay (s)	-	-	14	7.7	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	3.9	0.4	-

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	129	64	34	432	127	69
Future Volume (vph)	129	64	34	432	127	69
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)		0.0	15.0		0.0	0.0
Storage Lanes		0	1		1	0
Taper Length (m)			7.6		7.6	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.955				0.952	
Flt Protected			0.950		0.969	
Satd. Flow (prot)	1704	0	1695	1784	1646	0
Flt Permitted			0.950		0.969	
Satd. Flow (perm)	1704	0	1695	1784	1646	0
Link Speed (k/h)	70			70	50	
Link Distance (m)	509.6			247.9	230.8	
Travel Time (s)	26.2			12.7	16.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	129	64	34	432	127	69
Shared Lane Traffic (%)						
Lane Group Flow (vph)	193	0	34	432	196	0
Sign Control	Free			Free	Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 42.5%		ICU Level of Service A	
Analysis Period (min) 15			

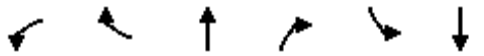
Intersection	
Int Delay, s/veh	4.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	129	64	34	432	127	69
Future Vol, veh/h	129	64	34	432	127	69
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	150	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	129	64	34	432	127	69

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	193	0	661	161
Stage 1	-	-	-	-	161	-
Stage 2	-	-	-	-	500	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1380	-	427	884
Stage 1	-	-	-	-	868	-
Stage 2	-	-	-	-	609	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1380	-	416	884
Mov Cap-2 Maneuver	-	-	-	-	416	-
Stage 1	-	-	-	-	846	-
Stage 2	-	-	-	-	609	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.6	16.4
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	511	-	-	1380	-
HCM Lane V/C Ratio	0.384	-	-	0.025	-
HCM Control Delay (s)	16.4	-	-	7.7	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	1.8	-	-	0.1	-



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	20	302	44	20	517	43
Future Volume (vph)	20	302	44	20	517	43
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.873		0.958			
Flt Protected	0.997					0.956
Satd. Flow (prot)	1553	0	1709	0	0	1706
Flt Permitted	0.997					0.956
Satd. Flow (perm)	1553	0	1709	0	0	1706
Link Speed (k/h)	70		80			80
Link Distance (m)	509.6		269.7			282.6
Travel Time (s)	26.2		12.1			12.7
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	20	302	44	20	517	43
Shared Lane Traffic (%)						
Lane Group Flow (vph)	322	0	64	0	0	560
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 66.8%		ICU Level of Service C	
Analysis Period (min) 15			

Intersection	
Int Delay, s/veh	9.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	20	302	44	20	517	43
Future Vol, veh/h	20	302	44	20	517	43
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	20	302	44	20	517	43

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1131	54	0	0	64	0
Stage 1	54	-	-	-	-	-
Stage 2	1077	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	225	1013	-	-	1538	-
Stage 1	969	-	-	-	-	-
Stage 2	327	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	148	1013	-	-	1538	-
Mov Cap-2 Maneuver	148	-	-	-	-	-
Stage 1	636	-	-	-	-	-
Stage 2	327	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	13.5	0	7.9
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	743	1538	-
HCM Lane V/C Ratio	-	-	0.433	0.336	-
HCM Control Delay (s)	-	-	13.5	8.5	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	2.2	1.5	-

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	415	123	65	227	96	50
Future Volume (vph)	415	123	65	227	96	50
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)		0.0	15.0		0.0	0.0
Storage Lanes		0	1		1	0
Taper Length (m)			7.6		7.6	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.969				0.954	
Flt Protected			0.950		0.968	
Satd. Flow (prot)	1729	0	1695	1784	1648	0
Flt Permitted			0.950		0.968	
Satd. Flow (perm)	1729	0	1695	1784	1648	0
Link Speed (k/h)	70			70	50	
Link Distance (m)	509.6			247.9	230.8	
Travel Time (s)	26.2			12.7	16.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	415	123	65	227	96	50
Shared Lane Traffic (%)						
Lane Group Flow (vph)	538	0	65	227	146	0
Sign Control	Free			Free	Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 53.6%		ICU Level of Service A	
Analysis Period (min) 15			

Intersection	
Int Delay, s/veh	3.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	415	123	65	227	96	50
Future Vol, veh/h	415	123	65	227	96	50
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	150	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	415	123	65	227	96	50

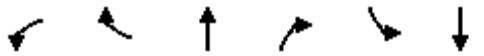
Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	538	0	834	477
Stage 1	-	-	-	-	477	-
Stage 2	-	-	-	-	357	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1030	-	338	588
Stage 1	-	-	-	-	624	-
Stage 2	-	-	-	-	708	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1030	-	317	588
Mov Cap-2 Maneuver	-	-	-	-	317	-
Stage 1	-	-	-	-	585	-
Stage 2	-	-	-	-	708	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.9	20.5
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	376	-	-	1030	-
HCM Lane V/C Ratio	0.388	-	-	0.063	-
HCM Control Delay (s)	20.5	-	-	8.7	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	1.8	-	-	0.2	-

Appendix J

2027 Total Future Synchro



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	52	721	83	32	250	58
Future Volume (vph)	52	721	83	32	250	58
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.874		0.962			
Flt Protected	0.997					0.961
Satd. Flow (prot)	1555	0	1717	0	0	1715
Flt Permitted	0.997					0.961
Satd. Flow (perm)	1555	0	1717	0	0	1715
Link Speed (k/h)	69		80			80
Link Distance (m)	509.6		269.7			282.6
Travel Time (s)	26.6		12.1			12.7
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	52	721	83	32	250	58
Shared Lane Traffic (%)						
Lane Group Flow (vph)	773	0	115	0	0	308
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 81.3%		ICU Level of Service D	
Analysis Period (min) 15			

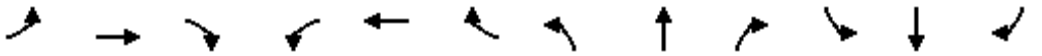
Intersection	
Int Delay, s/veh	23.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	52	721	83	32	250	58
Future Vol, veh/h	52	721	83	32	250	58
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	52	721	83	32	250	58

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	657	99	0	0	115	0
Stage 1	99	-	-	-	-	-
Stage 2	558	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	430	957	-	-	1474	-
Stage 1	925	-	-	-	-	-
Stage 2	573	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	355	957	-	-	1474	-
Mov Cap-2 Maneuver	355	-	-	-	-	-
Stage 1	763	-	-	-	-	-
Stage 2	573	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	33.6	0	6.4
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	859	1474	-
HCM Lane V/C Ratio	-	-	0.9	0.17	-
HCM Control Delay (s)	-	-	33.6	7.9	0
HCM Lane LOS	-	-	D	A	A
HCM 95th %tile Q(veh)	-	-	12.5	0.6	-



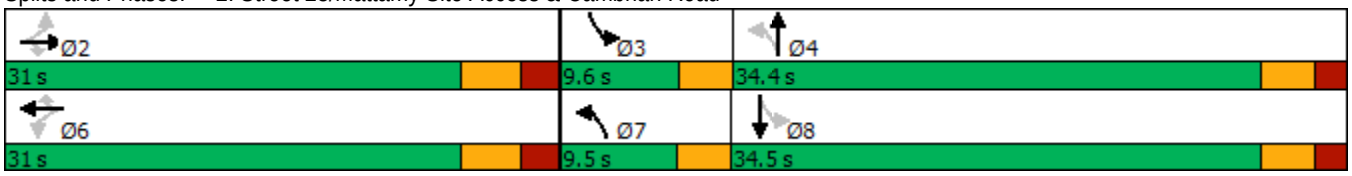
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	49	227	64	34	552	130	127	5	69	282	5	104
Future Volume (vph)	49	227	64	34	552	130	127	5	69	282	5	104
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	40.0		10.0	15.0		10.0	20.0		0.0	70.0		0.0
Storage Lanes	1		1	1		1	1		0	1		0
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.860			0.857	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1695	1784	1517	1695	1784	1517	1695	1535	0	1695	1529	0
Flt Permitted	0.296			0.617			0.727			0.471		
Satd. Flow (perm)	528	1784	1517	1101	1784	1517	1297	1535	0	840	1529	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			71			71		69			104	
Link Speed (k/h)		69			69			50			50	
Link Distance (m)		509.6			247.9			230.8			283.1	
Travel Time (s)		26.6			12.9			16.6			20.4	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	49	227	64	34	552	130	127	5	69	282	5	104
Shared Lane Traffic (%)												
Lane Group Flow (vph)	49	227	64	34	552	130	127	74	0	282	109	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases		2			6		7	4		3	8	
Permitted Phases	2		2	6		6	4			8		
Detector Phase	2	2	2	6	6	6	7	4		3	8	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	5.0	10.0		5.0	10.0	
Minimum Split (s)	30.8	30.8	30.8	30.8	30.8	30.8	9.5	34.4		9.5	34.4	
Total Split (s)	31.0	31.0	31.0	31.0	31.0	31.0	9.5	34.4		9.6	34.5	
Total Split (%)	41.3%	41.3%	41.3%	41.3%	41.3%	41.3%	12.7%	45.9%		12.8%	46.0%	
Maximum Green (s)	25.5	25.5	25.5	25.5	25.5	25.5	6.5	29.5		6.6	29.6	
Yellow Time (s)	3.3	3.3	3.3	3.3	3.3	3.3	3.0	3.0		3.0	3.0	
All-Red Time (s)	2.2	2.2	2.2	2.2	2.2	2.2	0.0	1.9		0.0	1.9	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	3.0	4.9		3.0	4.9	
Lead/Lag							Lead	Lag		Lead	Lag	
Lead-Lag Optimize?							Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	Min	Min	Min	Min	Min	Min	None	None		None	None	
Walk Time (s)	7.0	7.0	7.0	7.0	7.0	7.0		7.0			7.0	
Flash Dont Walk (s)	18.0	18.0	18.0	18.0	18.0	18.0		21.0			21.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0		0			0	
Act Effct Green (s)	22.2	22.2	22.2	22.2	22.2	22.2	13.1	10.3		17.8	10.4	
Actuated g/C Ratio	0.44	0.44	0.44	0.44	0.44	0.44	0.26	0.20		0.35	0.21	
v/c Ratio	0.21	0.29	0.09	0.07	0.70	0.18	0.33	0.20		0.58	0.27	
Control Delay	11.9	10.6	2.8	9.0	17.6	5.5	15.1	8.4		20.5	7.8	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	11.9	10.6	2.8	9.0	17.6	5.5	15.1	8.4		20.5	7.8	

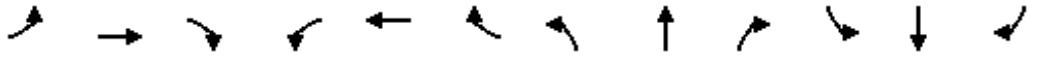
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	B	B	A	A	B	A	B	A		C	A	
Approach Delay		9.3			15.0			12.6			17.0	
Approach LOS		A			B			B			B	
Queue Length 50th (m)	2.7	13.2	0.0	1.8	40.5	3.1	7.9	0.4		19.6	0.4	
Queue Length 95th (m)	8.6	24.9	4.4	5.6	69.8	10.5	17.2	8.9		#36.3	10.6	
Internal Link Dist (m)		485.6			223.9			206.8			259.1	
Turn Bay Length (m)	40.0		10.0	15.0		10.0	20.0			70.0		
Base Capacity (vph)	275	932	826	575	932	826	393	955		487	968	
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Reduced v/c Ratio	0.18	0.24	0.08	0.06	0.59	0.16	0.32	0.08		0.58	0.11	

Intersection Summary			
Area Type:	Other		
Cycle Length: 75			
Actuated Cycle Length: 50.4			
Natural Cycle: 75			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.70			
Intersection Signal Delay: 14.0		Intersection LOS: B	
Intersection Capacity Utilization 74.8%		ICU Level of Service D	
Analysis Period (min) 15			

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

Splits and Phases: 2: Street 23/Mattamy Site Access & Cambrian Road





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	49	227	64	34	552	130	127	5	69	282	5	104
Future Volume (veh/h)	49	227	64	34	552	130	127	5	69	282	5	104
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q, veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj (A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1765	1765	1765	1765	1765	1765	1800	1765	1765	1800
Adj Flow Rate, veh/h	49	227	64	34	552	130	127	5	69	282	5	104
Adj No. of Lanes	1	1	1	1	1	1	1	1	0	1	1	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Opposing Right Turn Influence	Yes			Yes			Yes			Yes		
Cap, veh/h	254	734	624	498	734	624	511	20	273	558	17	344
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Prop Arrive On Green	0.42	0.42	0.42	0.42	0.42	0.42	0.08	0.19	0.19	0.13	0.24	0.24
Ln Grp Delay, s/veh	20.1	10.3	9.2	11.9	15.7	9.7	14.7	0.0	17.9	14.0	0.0	16.4
Ln Grp LOS	C	B	A	B	B	A	B		B	B		B
Approach Vol, veh/h		340			716			201			391	
Approach Delay, s/veh		11.5			14.4			15.9			14.7	
Approach LOS		B			B			B			B	

Timer:	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Case No		5.0	1.1	4.0		5.0	1.1	4.0
Phs Duration (G+Y+Rc), s		26.8	9.6	14.8		26.8	7.3	17.1
Change Period (Y+Rc), s		5.5	3.0	* 4.9		5.5	3.0	* 4.9
Max Green (Gmax), s		25.5	6.6	* 30		25.5	6.5	* 30
Max Allow Headway (MAH), s		7.8	5.2	9.2		7.9	5.2	9.2
Max Q Clear (g_c+I1), s		18.6	8.6	4.1		15.6	5.0	5.0
Green Ext Time (g_e), s		1.9	0.0	1.0		5.7	0.1	1.5
Prob of Phs Call (p_c)		1.00	0.98	0.99		1.00	0.84	1.00
Prob of Max Out (p_x)		1.00	1.00	0.00		0.88	1.00	0.01

Left-Turn Movement Data								
Assigned Mvmt		5	3			1	7	
Mvmt Sat Flow, veh/h		756	1681			1084	1681	

Through Movement Data								
Assigned Mvmt		2		4		6		8
Mvmt Sat Flow, veh/h		1765		102		1765		69

Right-Turn Movement Data								
Assigned Mvmt		12		14		16		18
Mvmt Sat Flow, veh/h		1500		1413		1500		1441

Left Lane Group Data								
Assigned Mvmt	0	5	3	0	0	1	7	0
Lane Assignment			(Pr/Pm)				(Pr/Pm)	

Lanes in Grp	0	1	1	0	0	1	1	0
Grp Vol (v), veh/h	0	49	282	0	0	34	127	0
Grp Sat Flow (s), veh/h/ln	0	756	1681	0	0	1084	1681	0
Q Serve Time (g_s), s	0.0	3.0	6.6	0.0	0.0	1.1	3.0	0.0
Cycle Q Clear Time (g_c), s	0.0	16.6	6.6	0.0	0.0	5.5	3.0	0.0
Perm LT Sat Flow (s_l), veh/h/ln	0	756	1320	0	0	1084	1279	0
Shared LT Sat Flow (s_sh), veh/h/ln	0	0	0	0	0	0	0	0
Perm LT Eff Green (g_p), s	0.0	21.3	11.2	0.0	0.0	21.3	9.9	0.0
Perm LT Serve Time (g_u), s	0.0	7.7	7.8	0.0	0.0	16.9	9.2	0.0
Perm LT Q Serve Time (g_ps), s	0.0	3.0	1.1	0.0	0.0	1.1	0.1	0.0
Time to First Blk (g_f), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Serve Time pre Blk (g_fs), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prop LT Inside Lane (P_L)	0.00	1.00	1.00	0.00	0.00	1.00	1.00	0.00
Lane Grp Cap (c), veh/h	0	254	558	0	0	498	511	0
V/C Ratio (X)	0.00	0.19	0.51	0.00	0.00	0.07	0.25	0.00
Avail Cap (c_a), veh/h	0	317	558	0	0	588	584	0
Upstream Filter (I)	0.00	1.00	1.00	0.00	0.00	1.00	1.00	0.00
Uniform Delay (d1), s/veh	0.0	19.8	13.2	0.0	0.0	11.9	14.5	0.0
Incr Delay (d2), s/veh	0.0	0.4	0.7	0.0	0.0	0.1	0.3	0.0
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	0.0	20.1	14.0	0.0	0.0	11.9	14.7	0.0
1st-Term Q (Q1), veh/ln	0.0	0.6	3.0	0.0	0.0	0.3	1.4	0.0
2nd-Term Q (Q2), veh/ln	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
3rd-Term Q (Q3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q Factor (f_B%)	0.00	1.00	1.00	0.00	0.00	1.00	1.00	0.00
%ile Back of Q (50%), veh/ln	0.0	0.7	3.1	0.0	0.0	0.3	1.4	0.0
%ile Storage Ratio (RQ%)	0.00	3.60	10.38	0.00	0.00	5.23	15.57	0.00
Initial Q (Qb), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final (Residual) Q (Qe), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Delay (ds), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Q (Qs), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Cap (cs), veh/h	0	0	0	0	0	0	0	0
Initial Q Clear Time (tc), h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Middle Lane Group Data								
Assigned Mvmt	0	2	0	4	0	6	0	8
Lane Assignment		T				T		
Lanes in Grp	0	1	0	0	0	1	0	0
Grp Vol (v), veh/h	0	227	0	0	0	552	0	0
Grp Sat Flow (s), veh/h/ln	0	1765	0	0	0	1765	0	0
Q Serve Time (g_s), s	0.0	4.4	0.0	0.0	0.0	13.6	0.0	0.0
Cycle Q Clear Time (g_c), s	0.0	4.4	0.0	0.0	0.0	13.6	0.0	0.0
Lane Grp Cap (c), veh/h	0	734	0	0	0	734	0	0
V/C Ratio (X)	0.00	0.31	0.00	0.00	0.00	0.75	0.00	0.00
Avail Cap (c_a), veh/h	0	880	0	0	0	880	0	0
Upstream Filter (I)	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d1), s/veh	0.0	10.0	0.0	0.0	0.0	12.7	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.2	0.0	0.0	0.0	3.0	0.0	0.0
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	0.0	10.3	0.0	0.0	0.0	15.7	0.0	0.0
1st-Term Q (Q1), veh/ln	0.0	2.1	0.0	0.0	0.0	6.6	0.0	0.0

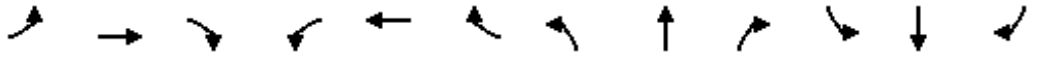
2nd-Term Q (Q2), veh/ln	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0
3rd-Term Q (Q3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q Factor (f_B%)	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00
%ile Back of Q (50%), veh/ln	0.0	2.2	0.0	0.0	0.0	7.2	0.0	0.0
%ile Storage Ratio (RQ%)	0.00	1.05	0.00	0.00	0.00	7.14	0.00	0.00
Initial Q (Qb), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final (Residual) Q (Qe), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Delay (ds), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Q (Qs), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Cap (cs), veh/h	0	0	0	0	0	0	0	0
Initial Q Clear Time (tc), h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Right Lane Group Data								
Assigned Mvmt	0	12	0	14	0	16	0	18
Lane Assignment		R		T+R		R		T+R
Lanes in Grp	0	1	0	1	0	1	0	1
Grp Vol (v), veh/h	0	64	0	74	0	130	0	109
Grp Sat Flow (s), veh/h/ln	0	1500	0	1515	0	1500	0	1510
Q Serve Time (g_s), s	0.0	1.3	0.0	2.1	0.0	2.8	0.0	3.0
Cycle Q Clear Time (g_c), s	0.0	1.3	0.0	2.1	0.0	2.8	0.0	3.0
Prot RT Sat Flow (s_R), veh/h/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prot RT Eff Green (g_R), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prop RT Outside Lane (P_R)	0.00	1.00	0.00	0.93	0.00	1.00	0.00	0.95
Lane Grp Cap (c), veh/h	0	624	0	293	0	624	0	361
V/C Ratio (X)	0.00	0.10	0.00	0.25	0.00	0.21	0.00	0.30
Avail Cap (c_a), veh/h	0	748	0	874	0	748	0	874
Upstream Filter (I)	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d1), s/veh	0.0	9.1	0.0	17.5	0.0	9.6	0.0	16.0
Incr Delay (d2), s/veh	0.0	0.1	0.0	0.4	0.0	0.2	0.0	0.5
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	0.0	9.2	0.0	17.9	0.0	9.7	0.0	16.4
1st-Term Q (Q1), veh/ln	0.0	0.6	0.0	0.9	0.0	1.2	0.0	1.2
2nd-Term Q (Q2), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3rd-Term Q (Q3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q Factor (f_B%)	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00
%ile Back of Q (50%), veh/ln	0.0	0.6	0.0	0.9	0.0	1.2	0.0	1.3
%ile Storage Ratio (RQ%)	0.00	10.87	0.00	1.00	0.00	22.85	0.00	1.12
Initial Q (Qb), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final (Residual) Q (Qe), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Delay (ds), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Q (Qs), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Cap (cs), veh/h	0	0	0	0	0	0	0	0
Initial Q Clear Time (tc), h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	14.1
HCM 2010 LOS	B

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

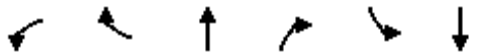


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	49	227	64	34	552	130	127	5	69	282	5	104
Future Volume (veh/h)	49	227	64	34	552	130	127	5	69	282	5	104
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1765	1765	1765	1765	1765	1765	1800	1765	1765	1800
Adj Flow Rate, veh/h	49	227	64	34	552	130	127	5	69	282	5	104
Adj No. of Lanes	1	1	1	1	1	1	1	1	0	1	1	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	254	734	624	498	734	624	511	20	273	558	17	344
Arrive On Green	0.42	0.42	0.42	0.42	0.42	0.42	0.08	0.19	0.19	0.13	0.24	0.24
Sat Flow, veh/h	756	1765	1500	1084	1765	1500	1681	102	1413	1681	69	1441
Grp Volume(v), veh/h	49	227	64	34	552	130	127	0	74	282	0	109
Grp Sat Flow(s),veh/h/ln	756	1765	1500	1084	1765	1500	1681	0	1515	1681	0	1510
Q Serve(g_s), s	3.0	4.4	1.3	1.1	13.6	2.8	3.0	0.0	2.1	6.6	0.0	3.0
Cycle Q Clear(g_c), s	16.6	4.4	1.3	5.5	13.6	2.8	3.0	0.0	2.1	6.6	0.0	3.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.93	1.00		0.95
Lane Grp Cap(c), veh/h	254	734	624	498	734	624	511	0	293	558	0	361
V/C Ratio(X)	0.19	0.31	0.10	0.07	0.75	0.21	0.25	0.00	0.25	0.51	0.00	0.30
Avail Cap(c_a), veh/h	317	880	748	588	880	748	584	0	874	558	0	874
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	19.8	10.0	9.1	11.9	12.7	9.6	14.5	0.0	17.5	13.2	0.0	16.0
Incr Delay (d2), s/veh	0.4	0.2	0.1	0.1	3.0	0.2	0.3	0.0	0.4	0.7	0.0	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	2.2	0.6	0.3	7.2	1.2	1.4	0.0	0.9	3.1	0.0	1.3
LnGrp Delay(d),s/veh	20.1	10.3	9.2	11.9	15.7	9.7	14.7	0.0	17.9	14.0	0.0	16.4
LnGrp LOS	C	B	A	B	B	A	B		B	B		B
Approach Vol, veh/h		340			716			201			391	
Approach Delay, s/veh		11.5			14.4			15.9			14.7	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		26.8	9.6	14.8		26.8	7.3	17.1
Change Period (Y+Rc), s		5.5	3.0	* 4.9		5.5	3.0	* 4.9
Max Green Setting (Gmax), s		25.5	6.6	* 30		25.5	6.5	* 30
Max Q Clear Time (g_c+I1), s		18.6	8.6	4.1		15.6	5.0	5.0
Green Ext Time (p_c), s		1.9	0.0	1.0		5.7	0.1	1.5

Intersection Summary	
HCM 2010 Ctrl Delay	14.1
HCM 2010 LOS	B

Notes



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	39	420	78	44	692	69
Future Volume (vph)	39	420	78	44	692	69
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.876		0.951			
Flt Protected	0.996					0.957
Satd. Flow (prot)	1557	0	1697	0	0	1708
Flt Permitted	0.996					0.957
Satd. Flow (perm)	1557	0	1697	0	0	1708
Link Speed (k/h)	69		80			80
Link Distance (m)	509.6		269.7			282.6
Travel Time (s)	26.6		12.1			12.7
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	39	420	78	44	692	69
Shared Lane Traffic (%)						
Lane Group Flow (vph)	459	0	122	0	0	761
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 91.1%		ICU Level of Service F	
Analysis Period (min) 15			

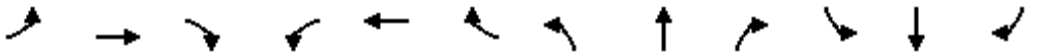
Intersection	
Int Delay, s/veh	34.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	39	420	78	44	692	69
Future Vol, veh/h	39	420	78	44	692	69
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	39	420	78	44	692	69

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1553	100	0	0	122	0
Stage 1	100	-	-	-	-	-
Stage 2	1453	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	125	956	-	-	1465	-
Stage 1	924	-	-	-	-	-
Stage 2	215	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	64	956	-	-	1465	-
Mov Cap-2 Maneuver	64	-	-	-	-	-
Stage 1	470	-	-	-	-	-
Stage 2	215	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	87.2	0	8.8
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	438	1465	-
HCM Lane V/C Ratio	-	-	1.048	0.472	-
HCM Control Delay (s)	-	-	87.2	9.6	0
HCM Lane LOS	-	-	F	A	A
HCM 95th %tile Q(veh)	-	-	14.5	2.6	-

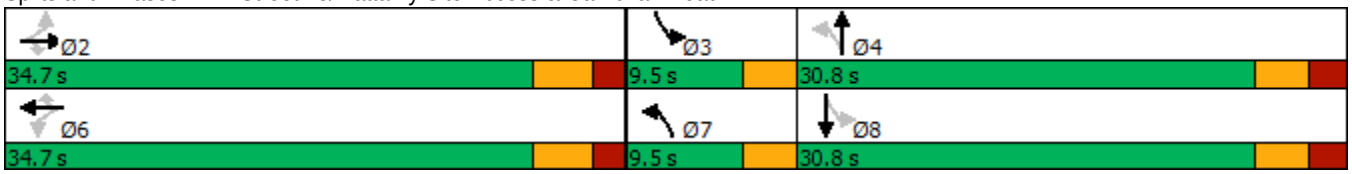


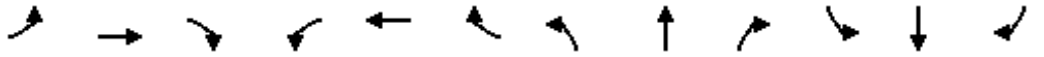
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	100	588	123	65	335	273	96	5	50	196	5	73
Future Volume (vph)	100	588	123	65	335	273	96	5	50	196	5	73
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	40.0		10.0	15.0		10.0	20.0		0.0	70.0		0.0
Storage Lanes	1		1	1		1	1		0	1		0
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.864			0.860	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1695	1784	1517	1695	1784	1517	1695	1542	0	1695	1535	0
Flt Permitted	0.531			0.292			0.755			0.482		
Satd. Flow (perm)	947	1784	1517	521	1784	1517	1347	1542	0	860	1535	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			76			149		50			73	
Link Speed (k/h)		69			69			50			50	
Link Distance (m)		509.6			247.9			230.8			283.1	
Travel Time (s)		26.6			12.9			16.6			20.4	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	100	588	123	65	335	273	96	5	50	196	5	73
Shared Lane Traffic (%)												
Lane Group Flow (vph)	100	588	123	65	335	273	96	55	0	196	78	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases		2			6		7	4		3	8	
Permitted Phases	2		2	6		6	4			8		
Detector Phase	2	2	2	6	6	6	7	4		3	8	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	5.0	10.0		5.0	10.0	
Minimum Split (s)	34.4	34.4	34.4	34.4	34.4	34.4	9.5	30.8		9.5	30.8	
Total Split (s)	34.7	34.7	34.7	34.7	34.7	34.7	9.5	30.8		9.5	30.8	
Total Split (%)	46.3%	46.3%	46.3%	46.3%	46.3%	46.3%	12.7%	41.1%		12.7%	41.1%	
Maximum Green (s)	29.5	29.5	29.5	29.5	29.5	29.5	6.5	25.6		6.5	25.6	
Yellow Time (s)	3.3	3.3	3.3	3.3	3.3	3.3	3.0	3.0		3.0	3.0	
All-Red Time (s)	1.9	1.9	1.9	1.9	1.9	1.9	0.0	2.2		0.0	2.2	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.2	5.2	5.2	5.2	5.2	5.2	3.0	5.2		3.0	5.2	
Lead/Lag							Lead	Lag		Lead	Lag	
Lead-Lag Optimize?							Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	Min	Min	Min	Min	Min	Min	None	None		None	None	
Walk Time (s)	7.0	7.0	7.0	7.0	7.0	7.0		7.0			7.0	
Flash Dont Walk (s)	21.0	21.0	21.0	21.0	21.0	21.0		18.0			18.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0		0			0	
Act Effct Green (s)	25.1	25.1	25.1	25.1	25.1	25.1	13.1	10.4		16.2	10.4	
Actuated g/C Ratio	0.49	0.49	0.49	0.49	0.49	0.49	0.25	0.20		0.32	0.20	
v/c Ratio	0.22	0.68	0.16	0.26	0.38	0.33	0.25	0.16		0.46	0.21	
Control Delay	10.0	15.5	4.6	12.0	10.5	5.5	14.2	9.8		17.1	8.9	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	10.0	15.5	4.6	12.0	10.5	5.5	14.2	9.8		17.1	8.9	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	A	B	A	B	B	A	B	A		B	A	
Approach Delay		13.1			8.6			12.6			14.8	
Approach LOS		B			A			B			B	
Queue Length 50th (m)	5.7	44.3	2.5	3.8	20.8	6.8	5.9	0.4		12.7	0.4	
Queue Length 95th (m)	13.2	74.9	9.2	10.8	36.3	18.0	15.1	8.3		28.3	9.7	
Internal Link Dist (m)		485.6			223.9			206.8			259.1	
Turn Bay Length (m)	40.0		10.0	15.0		10.0	20.0			70.0		
Base Capacity (vph)	565	1064	936	310	1064	965	393	822		427	830	
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Reduced v/c Ratio	0.18	0.55	0.13	0.21	0.31	0.28	0.24	0.07		0.46	0.09	

Intersection Summary			
Area Type:	Other		
Cycle Length: 75			
Actuated Cycle Length: 51.4			
Natural Cycle: 75			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.68			
Intersection Signal Delay: 11.7		Intersection LOS: B	
Intersection Capacity Utilization 72.1%		ICU Level of Service C	
Analysis Period (min) 15			

Splits and Phases: 2: Street 23/Mattamy Site Access & Cambrian Road





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	100	588	123	65	335	273	96	5	50	196	5	73
Future Volume (veh/h)	100	588	123	65	335	273	96	5	50	196	5	73
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q, veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj (A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1765	1765	1765	1765	1765	1765	1800	1765	1765	1800
Adj Flow Rate, veh/h	100	588	123	65	335	273	96	5	50	196	5	73
Adj No. of Lanes	1	1	1	1	1	1	1	1	0	1	1	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Opposing Right Turn Influence	Yes			Yes			Yes			Yes		
Cap, veh/h	401	811	689	271	811	689	482	24	245	528	22	320
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Prop Arrive On Green	0.46	0.46	0.46	0.46	0.46	0.46	0.07	0.18	0.18	0.12	0.23	0.23
Ln Grp Delay, s/veh	14.2	14.3	8.8	20.2	10.2	10.1	16.6	0.0	19.6	14.6	0.0	17.6
Ln Grp LOS	B	B	A	C	B	B	B		B	B		B
Approach Vol, veh/h		811			673			151			274	
Approach Delay, s/veh		13.5			11.2			17.7			15.5	
Approach LOS		B			B			B			B	

Timer:	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Case No		5.0	1.1	4.0		5.0	1.1	4.0
Phs Duration (G+Y+Rc), s		30.3	9.5	14.9		30.3	6.8	17.6
Change Period (Y+Rc), s		* 5.2	3.0	* 5.2		* 5.2	3.0	* 5.2
Max Green (Gmax), s		* 30	6.5	* 26		* 30	6.5	* 26
Max Allow Headway (MAH), s		8.0	5.2	9.2		7.2	5.2	9.2
Max Q Clear (g_c+l1), s		16.8	6.9	3.7		21.1	4.5	4.3
Green Ext Time (g_e), s		7.6	0.0	0.6		4.1	0.1	0.9
Prob of Phs Call (p_c)		1.00	0.95	0.97		1.00	0.77	0.99
Prob of Max Out (p_x)		0.78	1.00	0.00		0.89	1.00	0.01

Left-Turn Movement Data								
Assigned Mvmt		5	3			1	7	
Mvmt Sat Flow, veh/h		809	1681			736	1681	

Through Movement Data								
Assigned Mvmt		2		4		6		8
Mvmt Sat Flow, veh/h		1765		138		1765		97

Right-Turn Movement Data								
Assigned Mvmt		12		14		16		18
Mvmt Sat Flow, veh/h		1500		1382		1500		1417

Left Lane Group Data								
Assigned Mvmt	0	5	3	0	0	1	7	0
Lane Assignment			(Pr/Pm)				(Pr/Pm)	

Lanes in Grp	0	1	1	0	0	1	1	0
Grp Vol (v), veh/h	0	100	196	0	0	65	96	0
Grp Sat Flow (s), veh/h/ln	0	809	1681	0	0	736	1681	0
Q Serve Time (g_s), s	0.0	5.1	4.9	0.0	0.0	4.3	2.5	0.0
Cycle Q Clear Time (g_c), s	0.0	12.1	4.9	0.0	0.0	19.1	2.5	0.0
Perm LT Sat Flow (s_l), veh/h/ln	0	809	1343	0	0	736	1316	0
Shared LT Sat Flow (s_sh), veh/h/ln	0	0	0	0	0	0	0	0
Perm LT Eff Green (g_p), s	0.0	25.1	11.4	0.0	0.0	25.1	9.7	0.0
Perm LT Serve Time (g_u), s	0.0	18.2	8.0	0.0	0.0	10.4	9.7	0.0
Perm LT Q Serve Time (g_ps), s	0.0	5.1	0.6	0.0	0.0	4.3	0.0	0.0
Time to First Blk (g_f), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Serve Time pre Blk (g_fs), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prop LT Inside Lane (P_L)	0.00	1.00	1.00	0.00	0.00	1.00	1.00	0.00
Lane Grp Cap (c), veh/h	0	401	528	0	0	271	482	0
V/C Ratio (X)	0.00	0.25	0.37	0.00	0.00	0.24	0.20	0.00
Avail Cap (c_a), veh/h	0	465	528	0	0	329	564	0
Upstream Filter (I)	0.00	1.00	1.00	0.00	0.00	1.00	1.00	0.00
Uniform Delay (d1), s/veh	0.0	13.9	14.2	0.0	0.0	19.7	16.4	0.0
Incr Delay (d2), s/veh	0.0	0.3	0.4	0.0	0.0	0.5	0.2	0.0
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	0.0	14.2	14.6	0.0	0.0	20.2	16.6	0.0
1st-Term Q (Q1), veh/ln	0.0	1.1	2.2	0.0	0.0	0.9	1.1	0.0
2nd-Term Q (Q2), veh/ln	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
3rd-Term Q (Q3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q Factor (f_B%)	0.00	1.00	1.00	0.00	0.00	1.00	1.00	0.00
%ile Back of Q (50%), veh/ln	0.0	1.2	2.3	0.0	0.0	0.9	1.2	0.0
%ile Storage Ratio (RQ%)	0.00	6.48	7.71	0.00	0.00	13.91	12.94	0.00
Initial Q (Qb), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final (Residual) Q (Qe), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Delay (ds), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Q (Qs), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Cap (cs), veh/h	0	0	0	0	0	0	0	0
Initial Q Clear Time (tc), h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Middle Lane Group Data								
Assigned Mvmt	0	2	0	4	0	6	0	8
Lane Assignment		T				T		
Lanes in Grp	0	1	0	0	0	1	0	0
Grp Vol (v), veh/h	0	588	0	0	0	335	0	0
Grp Sat Flow (s), veh/h/ln	0	1765	0	0	0	1765	0	0
Q Serve Time (g_s), s	0.0	14.8	0.0	0.0	0.0	6.9	0.0	0.0
Cycle Q Clear Time (g_c), s	0.0	14.8	0.0	0.0	0.0	6.9	0.0	0.0
Lane Grp Cap (c), veh/h	0	811	0	0	0	811	0	0
V/C Ratio (X)	0.00	0.73	0.00	0.00	0.00	0.41	0.00	0.00
Avail Cap (c_a), veh/h	0	951	0	0	0	951	0	0
Upstream Filter (I)	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d1), s/veh	0.0	12.0	0.0	0.0	0.0	9.9	0.0	0.0
Incr Delay (d2), s/veh	0.0	2.3	0.0	0.0	0.0	0.3	0.0	0.0
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	0.0	14.3	0.0	0.0	0.0	10.2	0.0	0.0
1st-Term Q (Q1), veh/ln	0.0	7.0	0.0	0.0	0.0	3.3	0.0	0.0

2nd-Term Q (Q2), veh/ln	0.0	0.5	0.0	0.0	0.0	0.1	0.0	0.0
3rd-Term Q (Q3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q Factor (f_B%)	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00
%ile Back of Q (50%), veh/ln	0.0	7.5	0.0	0.0	0.0	3.4	0.0	0.0
%ile Storage Ratio (RQ%)	0.00	3.62	0.00	0.00	0.00	3.39	0.00	0.00
Initial Q (Qb), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final (Residual) Q (Qe), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Delay (ds), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Q (Qs), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Cap (cs), veh/h	0	0	0	0	0	0	0	0
Initial Q Clear Time (tc), h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Right Lane Group Data								
Assigned Mvmt	0	12	0	14	0	16	0	18
Lane Assignment		R		T+R		R		T+R
Lanes in Grp	0	1	0	1	0	1	0	1
Grp Vol (v), veh/h	0	123	0	55	0	273	0	78
Grp Sat Flow (s), veh/h/ln	0	1500	0	1521	0	1500	0	1515
Q Serve Time (g_s), s	0.0	2.6	0.0	1.7	0.0	6.6	0.0	2.3
Cycle Q Clear Time (g_c), s	0.0	2.6	0.0	1.7	0.0	6.6	0.0	2.3
Prot RT Sat Flow (s_R), veh/h/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prot RT Eff Green (g_R), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prop RT Outside Lane (P_R)	0.00	1.00	0.00	0.91	0.00	1.00	0.00	0.94
Lane Grp Cap (c), veh/h	0	689	0	269	0	689	0	342
V/C Ratio (X)	0.00	0.18	0.00	0.20	0.00	0.40	0.00	0.23
Avail Cap (c_a), veh/h	0	808	0	711	0	808	0	708
Upstream Filter (I)	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d1), s/veh	0.0	8.7	0.0	19.2	0.0	9.8	0.0	17.3
Incr Delay (d2), s/veh	0.0	0.1	0.0	0.4	0.0	0.4	0.0	0.3
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	0.0	8.8	0.0	19.6	0.0	10.1	0.0	17.6
1st-Term Q (Q1), veh/ln	0.0	1.1	0.0	0.7	0.0	2.7	0.0	1.0
2nd-Term Q (Q2), veh/ln	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
3rd-Term Q (Q3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q Factor (f_B%)	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00
%ile Back of Q (50%), veh/ln	0.0	1.1	0.0	0.7	0.0	2.7	0.0	1.0
%ile Storage Ratio (RQ%)	0.00	21.55	0.00	0.79	0.00	52.59	0.00	0.85
Initial Q (Qb), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final (Residual) Q (Qe), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Delay (ds), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Q (Qs), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Cap (cs), veh/h	0	0	0	0	0	0	0	0
Initial Q Clear Time (tc), h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	13.3
HCM 2010 LOS	B

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	100	588	123	65	335	273	96	5	50	196	5	73
Future Volume (veh/h)	100	588	123	65	335	273	96	5	50	196	5	73
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1765	1765	1765	1765	1765	1765	1800	1765	1765	1800
Adj Flow Rate, veh/h	100	588	123	65	335	273	96	5	50	196	5	73
Adj No. of Lanes	1	1	1	1	1	1	1	1	0	1	1	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	401	811	689	271	811	689	482	24	245	528	22	320
Arrive On Green	0.46	0.46	0.46	0.46	0.46	0.46	0.07	0.18	0.18	0.12	0.23	0.23
Sat Flow, veh/h	809	1765	1500	736	1765	1500	1681	138	1382	1681	97	1417
Grp Volume(v), veh/h	100	588	123	65	335	273	96	0	55	196	0	78
Grp Sat Flow(s),veh/h/ln	809	1765	1500	736	1765	1500	1681	0	1521	1681	0	1515
Q Serve(g_s), s	5.1	14.8	2.6	4.3	6.9	6.6	2.5	0.0	1.7	4.9	0.0	2.3
Cycle Q Clear(g_c), s	12.1	14.8	2.6	19.1	6.9	6.6	2.5	0.0	1.7	4.9	0.0	2.3
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.91	1.00		0.94
Lane Grp Cap(c), veh/h	401	811	689	271	811	689	482	0	269	528	0	342
V/C Ratio(X)	0.25	0.73	0.18	0.24	0.41	0.40	0.20	0.00	0.20	0.37	0.00	0.23
Avail Cap(c_a), veh/h	465	951	808	329	951	808	564	0	711	528	0	708
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	13.9	12.0	8.7	19.7	9.9	9.8	16.4	0.0	19.2	14.2	0.0	17.3
Incr Delay (d2), s/veh	0.3	2.3	0.1	0.5	0.3	0.4	0.2	0.0	0.4	0.4	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	7.5	1.1	0.9	3.4	2.8	1.2	0.0	0.7	2.3	0.0	1.0
LnGrp Delay(d),s/veh	14.2	14.3	8.8	20.2	10.2	10.1	16.6	0.0	19.6	14.6	0.0	17.6
LnGrp LOS	B	B	A	C	B	B	B		B	B		B
Approach Vol, veh/h		811			673			151			274	
Approach Delay, s/veh		13.5			11.2			17.7			15.5	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		30.3	9.5	14.9		30.3	6.8	17.6
Change Period (Y+Rc), s		* 5.2	3.0	* 5.2		* 5.2	3.0	* 5.2
Max Green Setting (Gmax), s		* 30	6.5	* 26		* 30	6.5	* 26
Max Q Clear Time (g_c+I1), s		16.8	6.9	3.7		21.1	4.5	4.3
Green Ext Time (p_c), s		7.6	0.0	0.6		4.1	0.1	0.9

Intersection Summary	
HCM 2010 Ctrl Delay	13.3
HCM 2010 LOS	B

Notes