The Meadows Phase 5

TRANSPORTATION IMPACT ASSESSMENT (TIA) REPORT

Prepared for Tamarack Homes
by IBI Group

April 2018

IBI GROUP
400–333 Preston Street
Ottawa ON K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

April 11, 2018

Ms. Rosanna Baggs, CET
Project Manager
Infrastructure Approvals, Development Review
City of Ottawa
110 Laurier Avenue West
Ottawa, ON
K1P 1J1

Dear Ms. Baggs:

RE: TAMARACK HOMES – THE MEADOWS PHASE 5
TIA STEP 4 SUBMISSION

The enclosed submission for the Meadows Phase 5 in the City of Ottawa includes four (4) hardcopies of the Transportation Impact Assessment (TIA), as well as a USB stick containing an electronic copy of the TIA report, appendices and the Synchro files. The following TIA represents Steps 1 – 4, as defined in the City TIA Guidelines. The report has address/ incorporated the required technical comments received over the course of the submission process. We have also enclosed these comments with for your reference.

If you have any questions regarding the contents of this submission, please do not hesitate to contact the undersigned at 613-225-1311 ext. 564.

Sincerely,

Austin Shih, M.A.Sc, P.Eng.
Project Engineer

Ben Pascolo-Neveu

To:	'Baggs, Rosanna'
Cc:	Austin Shih
Subject:	RE: Meadows Ph 5 - TIA Study Area Requirements - Comments

---

From: Ben Pascolo-Neveu
Sent: Wednesday, April 11, 2018 10:49 AM
To: 'Baggs, Rosanna'
Cc: Austin Shih
Subject: RE: Meadows Ph 5 - TIA Study Area Requirements - Comments

Hi Rosanna,

Thank you for your comments. We are preparing to submit Step 4.

Regards,
Ben

Ben Pascolo-Neveu, EIT

IBI GROUP
Suite 400, 333 Preston Street
Ottawa ON K1S 5N4 Canada
tel +1 613 225 1311 ext 520 fax +1 613 225 9868

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From: Baggs, Rosanna [mailto:Rosanna.Baggs@ottawa.ca]
Sent: Monday, April 9, 2018 3:07 PM
To: Ben Pascolo-Neveu
Cc: Austin Shih
Subject: RE: Meadows Ph 5 - TIA Study Area Requirements - Comments

Hi Ben,

Please see the comments for the Traffic Impact Assessment Steps 1-3 submission:

Transportation Engineering Services

1) The City recommends using 2009 TRANS Trip Generation Study for residential rates. Acknowledged.

If the above can be incorporated into the next submission please proceed with Step 4. Otherwise please discuss responses prior to proceeding.

Regards,

Rosanna Baggs, C.E.T.
Project Manager, Infrastructure Approvals | GPRJ Approbation demandes infrastructure
Development Review West Branch | Dir Services d'exam des dem d'amgt
Tel |Tél. : 613-580- 2424 ext. | poste 26388

From: Ben Pascolo-Neveu <Ben.Pascolo-Neveu@ibigroup.com>
Sent: Friday, March 09, 2018 5:44 PM
To: Baggs, Rosanna <Rosanna.Baggs@ottawa.ca>
Cc: Austin Shih <austin.shih@IBIGroup.com>
Subject: RE: Meadows Ph 5 - TIA Study Area Requirments

Hi Rosanna,

Please find attached the Forecasting for The Meadows Phase 5.

Regards,
Ben

Ben Pascolo-Neveu, EIT

IBI GROUP
Suite 400, 333 Preston Street
Ottawa ON K1S 5N4 Canada
tel +1 613 225 1311 ext 520 fax +1 613 225 9868

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From: Austin Shih
Sent: Friday, March 9, 2018 2:47 PM
To: Baggs, Rosanna
Cc: Ben Pascolo-Neveu
Subject: RE: Meadows Ph 5 - TIA Study Area Requirments

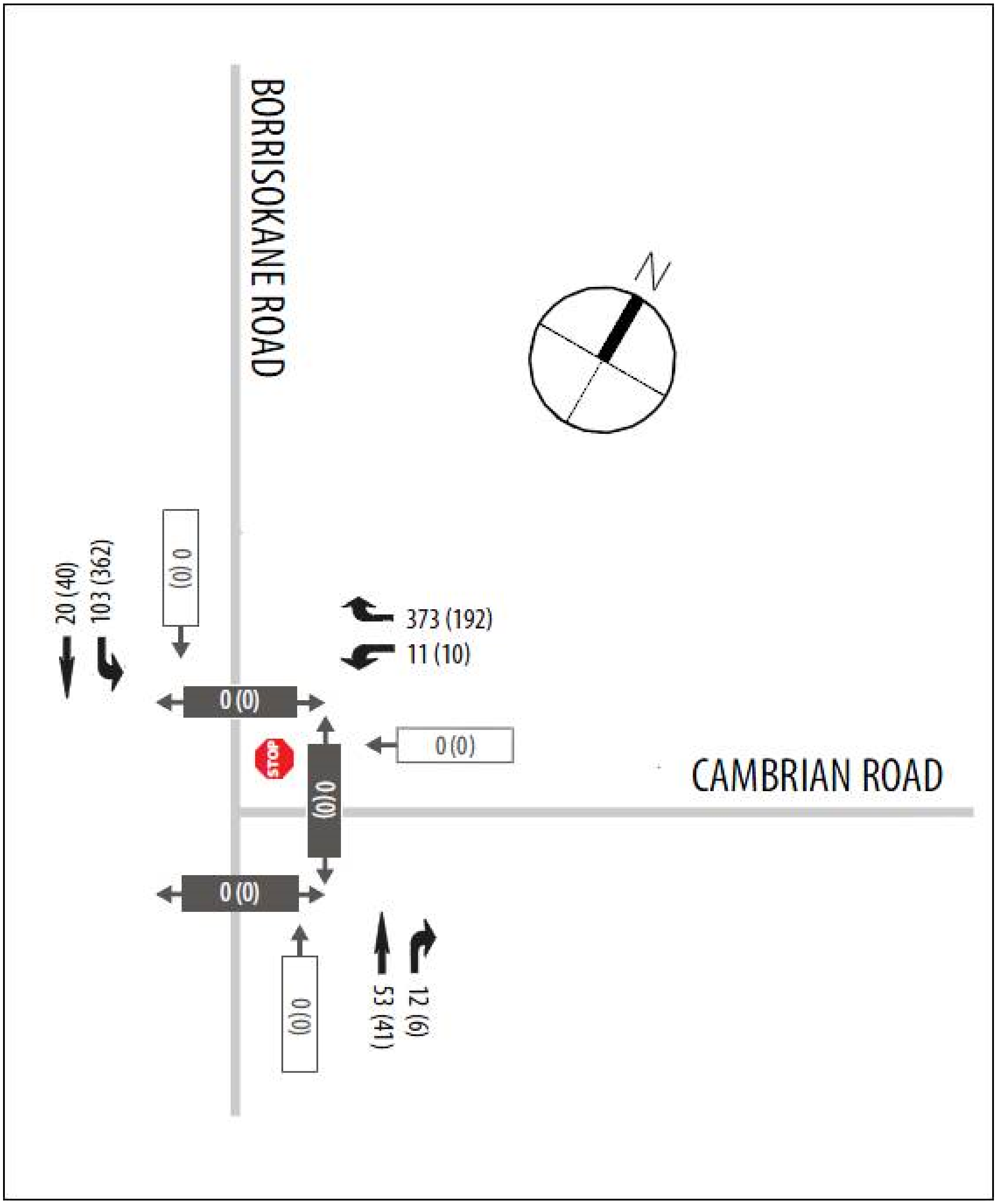
Hey Rosanna,
Thanks for the comments to Phase 4 – I'll have a response to comments soon.

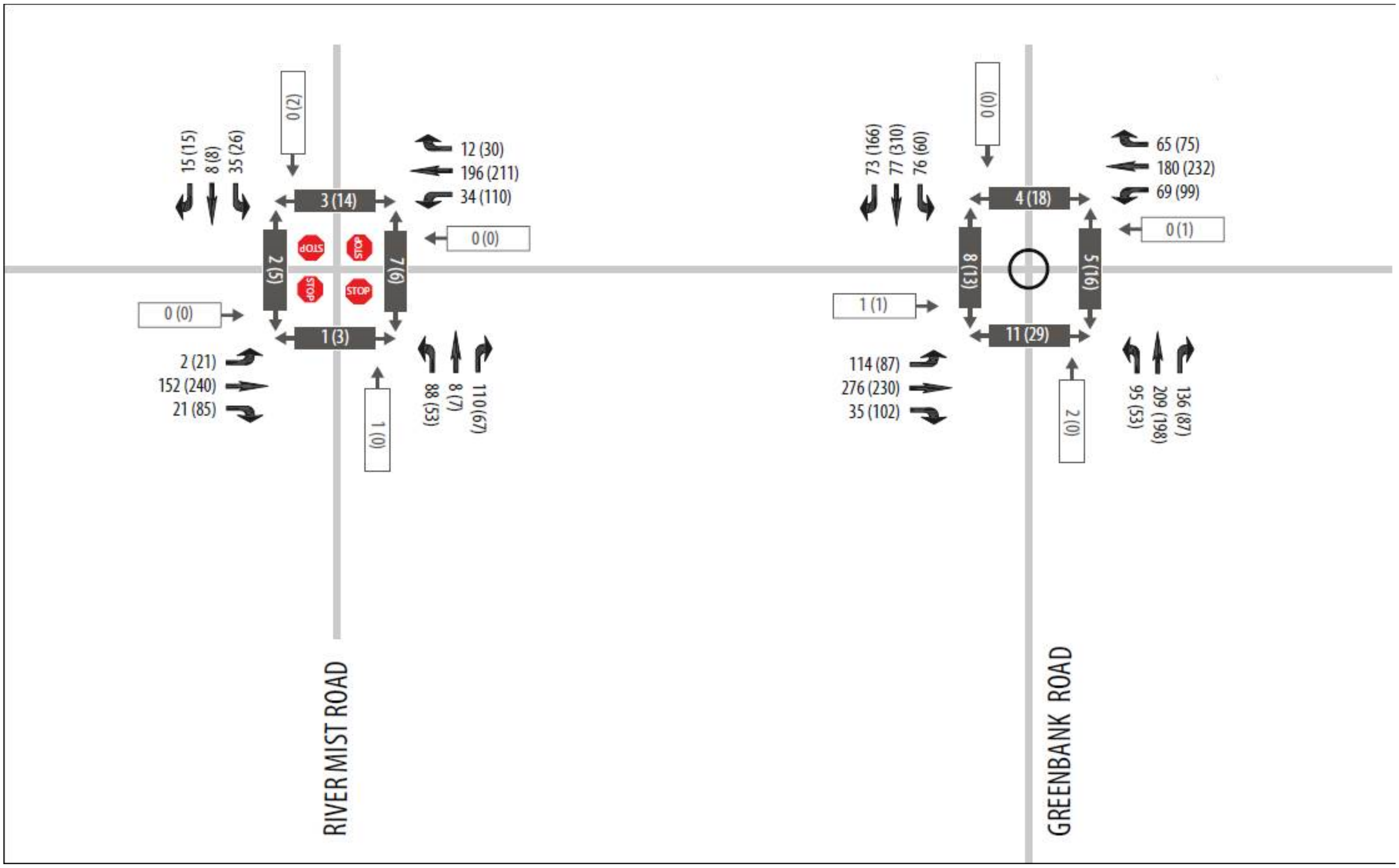
As for Phase 5 – the confirmation of access between Mattamy and Tamarack will come soon, so in the meantime we will send you the Forecasting report later this afternoon to send for review.

I wanted to clarify some points about the Grand Canal and Cambrian Road intersection. We do not expect it to be impacted by the Phase 5 development. Keep in mind that for Phase 4 – we directed all traffic to River Mist, with the majority of traffic to Greenbank to be conservative. Even still, it operated with City standards (0.81 v/c/ LOS D) at the ultimate 2024 horizon as an all way stop. If you look at the numbers below; IBI got manual counts last year at the intersections of River Mist and Borriskoane/ Cambrian. As you can see, there is more peak traffic going to and from Borriskoane than Greenbank. So I don't believe there would be significant impacts to Grand Canal by Phase 5 traffic. It would take longer for them to navigate within the local road network of Phase 4 than to simply continue on west Cambrian and turn left directly into their development. We also have to consider that if we direct traffic between Phases 4 and 5 and vice versa, in the end, the numbers themselves will likely balance out and have little to no effect on the operations of the intersection.

Feel free to call if you wish to discuss.

Thanks,
Austin





Austin Shih M.A.SC., P.ENG.

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From: Baggs, Rosanna [mailto:Rosanna.Baggs@ottawa.ca]
Sent: Friday, March 09, 2018 11:28 AM
To: Justin Date <jdate@IBIGroup.com>
Cc: Austin Shih <austin.shih@IBIGroup.com>; ''Taggart Michelle' (mtaggart@taggart.ca)' <mtaggart@taggart.ca>; Ben Pascolo-Neveu <Ben.Pascolo-Neveu@ibigroup.com>; Moore, Sean <Sean.Moore@ottawa.ca>
Subject: RE: Meadows Ph 5 - TIA Study Area Requirments

Hi Justin,

As per our discussion last night, the content of your Traffic Impact Assessment needs to reflect how you plan on connecting the development with the rest of the network.

The options discussed were as follows:

1) The Traffic Impact Assessment can demonstrate how the development will operate with the Street 23 extension connecting to Cambrian. I do not have any documentation from Mattamy as to their plan or timing to construct this section of the road on their property. As such, it would be in your client's best interest to secure/confirm a plan to have this extension built; this confirmation should be included and discussed in your Traffic Impact Assessment. If this is the route taken, it will be a condition of draft approval that Street 23 and its extension through the Mattamy lands is constructed prior to the rest of the development proceeding.

   a. If this direction is taken, please include the analysis of the intersection of Street 23 and Cambrian, and the intersection of Grand Canal and Cambrian in addition to the intersection already reviewed in the report.

2) If the above cannot be accomplished then the Traffic Impact Assessment will have to analyze how the development will impact the network by providing access through Phase 4. This will require the same analysis as Ph4 with the addition of the volumes from Ph5.

Please let me know if you have any questions or concerns.

Regards,

Rosanna Baggs, C.E.T.
Project Manager, Infrastructure Approvals | GPRJ Approbation demandes infrastructure
Development Review West Branch | Dir Services d'exam des dem d'amgt
Tel |Tél. : 613-580- 2424 ext. | poste 26388

From: Justin Date [mailto:jdate@IBIGroup.com]
Sent: Thursday, March 08, 2018 5:54 PM
To: Baggs, Rosanna <Rosanna.Baggs@ottawa.ca>
Cc: Austin Shih <austin.shih@IBIGroup.com>; 'Taggart Michelle' (mtaggart@taggart.ca) <mtaggart@taggart.ca>; Ben Pascolo-Neveu <Ben.Pascolo-Neveu@ibigroup.com>
Subject: RE: Meadows Ph 5 - Screening & Scoping

Hi Rosanna,

I hope you are well.

Ben mentioned that you had some concerns with how access would be provided to The Meadows Phase 5 development in the interim period before the realigned Greenbank Road is constructed.
The intention is for primary access to be provided from Cambrian Road via the new north-south collector road in the adjacent Mattamy lands, as indicated on the attached. This connection is required for servicing as well as for providing access for vehicles.

It is our understanding that the Mattamy application is at a more advanced stage than The Meadows Phase 5 application and that construction of the new collector road connection to Cambrian Road will precede construction of Phase 5.

Michelle, could you please confirm the above?

Many thanks,

Justin

Justin Date P.ENG.

Associate | Manager, Transportation Engineering

IBI GROUP
400-333 Preston Street
Ottawa ON K1S 5N4 Canada
tel +1 613 225 1311 ext 508 fax +1 613 225 9868

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From: Baggs, Rosanna [mailto:Rosanna.Baggs@ottawa.ca]
Sent: Thursday, March 8, 2018 1:56 PM
To: Ben Pascolo-Neveu
Cc: Austin Shih
Subject: RE: Meadows Ph 5 - Screening & Scoping

Hi Ben,

My comments for you Step 1-2 submission is as follows:

1) Section 2.3 and 2.5 – you will have to include the same study area as the Meadows Ph 4 as this will be how the traffic will access the site until the Re-aligned Greenbank is constructed or Street 23 is connected to Cambrian. As such I don't think the intersection of Cambrian and Borrisokane is relevant unless Street 23 will connect in the very near future.

If the above can be incorporated into the next submission please proceed with Step 2. Otherwise please discuss responses prior to proceeding.

Regards,

Rosanna Baggs, C.E.T.
Project Manager, Infrastructure Approvals | GPRJ Approbation demandes infrastructure
Development Review West Branch | Dir Services d'exam des dem d'amgt
Tel |Tél. : 613-580- 2424 ext. | poste 26388

From: Ben Pascolo-Neveu [mailto:Ben.Pascolo-Neveu@ibigroup.com]
Sent: Friday, March 02, 2018 11:19 AM
To: Baggs, Rosanna <Rosanna.Baggs@ottawa.ca>
Cc: Austin Shih <austin.shih@IBIGroup.com>
Subject: Meadows Ph 5 - Screening & Scoping

Hi Rosanna,

Please find attached the Screening and Scoping for The Meadows Phase 5 (Tamarack) for your review.

Have a good weekend!

Regards,
Ben

Ben Pascolo-Neveu, EIT
IBI GROUP

Ben Pascolo-Neveu

From:	Austin Shih
Sent:	Friday, March 16, 2018 10:37 AM
To:	Ben Pascolo-Neveu
Subject:	FW: Meadows Ph 5 - TIA Study Area Requirments

FYI

Austin Shih M.A.SC., P.ENG.

From: Michelle Taggart [mailto:mtaggart@taggart.ca]
Sent: Friday, March 16, 2018 9:28 AM
To: Austin Shih <austin.shih@IBIGroup.com>; Terry Brule <tbrule@IBIGroup.com>; Stephanie Morris <morris@fotenn.com>
Subject: FW: Meadows Ph 5 - TIA Study Area Requirments

FYI

From: Baggs, Rosanna <Rosanna.Baggs@ottawa.ca>
Sent: March-16-18 9:22 AM
To: Michelle Taggart <mtaggart@taggart.ca>
Subject: Re: Meadows Ph 5 - TIA Study Area Requirments

That works, thanks.

Regards,

Rosanna Baggs, C.E.T.

On Mar 16, 2018, at 9:16 AM, Michelle Taggart <mtaggart@taggart.ca> wrote:

> Rosanna,
> Is this enough for you?
>
> ---
>
> **From:** Melissa Pettem <Melissa.Pettem@mattamycorp.com>
> **Sent:** March-16-18 9:08 AM
> **To:** Michelle Taggart <mtaggart@taggart.ca>; Kevin Murphy <Kevin.Murphy@mattamycorp.com>
> **Subject:** RE: Meadows Ph 5 - TIA Study Area Requirments
>
> Hi Michelle,
>
> We don’t have any problems with you front ending the construction of the road.

<image001.jpg>

Melissa Pettem
Land Development Manager
T (613)831-3546 (direct). **C** (613)219-2065. **F** (613)831-9060.
melissa.pettem@mattamycorp.com
Ottawa Office: 50 Hines Road, Suite 100, Ottawa, ON K2K 2M5

From: Michelle Taggart [mailto:mtaggart@taggart.ca]
Sent: Thursday, March 15, 2018 3:55 PM
To: Melissa Pettem; Kevin Murphy
Subject: RE: Meadows Ph 5 - TIA Study Area Requirments

Hi Melissa and Kevin,
It looks like we will need that road ahead of you. Are you ok if we front-end it and you pay us back later?

From: Melissa Pettem <Melissa.Pettem@mattamycorp.com>
Sent: March-12-18 2:31 PM
To: Michelle Taggart <mtaggart@taggart.ca>; Kevin Murphy <Kevin.Murphy@mattamycorp.com>
Subject: RE: Meadows Ph 5 - TIA Study Area Requirments

Hi Michelle,

The street will be registered as part of our Phase 1 of development, however the timing for construction of the road is tied to the school block purchase. We currently do not have a timeline from the school board as to when they are looking to purchase the block. They have 7 years to enter into an agreement, in which case the road may not be constructed in time for when you would need it. I can keep you posted if I hear anything from them in the meantime.

Let me know if you have any questions.

Thanks,

<image001.jpg>

Melissa Pettem
Land Development Manager
T (613)831-3546 (direct). **C** (613)219-2065. **F** (613)831-9060.
melissa.pettem@mattamycorp.com
Ottawa Office: 50 Hines Road, Suite 100, Ottawa, ON K2K 2M5

Notice: This email is intended for use of the party to whom it is addressed and may contain confidential information. If you have received this email in error, please inform me and delete it. Thank you.

'

TIA Plan Reports - Certification

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 associate 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[1] professional in good standing, whose field of expertise [check √ appropriate field(s)] is either transportation engineering □ or transportation planning □.

[1] **License or 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.**

Dated at Ottawa this 11th day of April, 2018.
(City)

Name: Austin Shih, M.A.Sc., P.Eng.

Professional Title: Project Engineer

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

Office Contact Information (Please Print)
Address: 400-333 Preston Street
City / Postal Code: K1S 5N4
Telephone / Extension: 613-225-1311 ext. 564
E-Mail Address: austin.shih@ibigroup.com

Stamp

Document Control Page

CLIENT:	Tamarack Homes
PROJECT NAME:	The Meadows Phase 5 TIA
REPORT TITLE:	TIA Report
IBI REFERENCE:	115637
VERSION:	3.0
DIGITAL MASTER:	J:\115637_MeadowPh5TIA\5.2 Reports\5.2.4 Transportation\5.2.4.5 Traffic Impact_Submission
ORIGINATOR:	Ben Pascolo-Neveu, E.I.T.
REVIEWER:	Austin Shih, M.A.Sc, P.Eng.
AUTHORIZATION:	Justin Date, P.Eng.
CIRCULATION LIST:	Rosanna Baggs, C.E.T.
HISTORY:	1.0. Screening and Scoping Report to City of Ottawa – March 2018 2.0. Screening, Scoping & Forecasting to City of Ottawa – March 2018 3.0. Screening, Scoping, Forecasting & Analysis to City of Ottawa – April 2018

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1 Introduction

The Screening and Scoping has been prepared on behalf of Tamarack Homes in support of the Meadows Phase 5 (Meadows Ph5) draft plan of subdivision application. The format of the Screening and Scoping was based on the City of Ottawa's 2017 Transportation Impact Assessment (TIA) Guidelines. The purpose of the Screening and Scoping is to identify "the range of analyses required to understand how well the development proposal aligns with City of Ottawa policies and objectives, and if the transportation network requires modification to offset development impacts." [1]

2 Screening and Scoping

Section 2 is the initial stage of the TIA. The Screening Form (Section 2.1) establishes the need to complete the study. The remainder of Section 2 focuses on the Scoping, which involves establishing the existing/ planned conditions of the study, key parameters and a review of possible exemptions.

2.1 Screening Form

STEP 1 - City of Ottawa 2017 TIA Guidelines Screening Form

1. Description of Proposed Development

Municipal Address	Tamarack Homes - The Meadows Phase 5 – TIA Screening Letter
Description of Location	Barrhaven South Subject site is located east of the future realigned Greenbank Road, south of Cambrian Road and is bounded by undeveloped lands to the north, south and west
Land Use Classification	Residential
Development Size (units)	221 units (Townhomes/ Semi-detached Residential) 125 units (Single Family Homes)
Development Size (ha)	19 ha
Number of Accesses and Locations	There are two (2) accesses/ egresses proposed for this development: (1) Street 23 – connects with residential development to the north (2) Street 17 – connects with residential development to the east and to the future realigned Greenbank Road. The future re-aligned Greenbank Road will eventually be a boundary street on the east side of the development; however, the realignment is not expected to be complete until after the study horizon years considered in this traffic study
Phase of Development	Single Phase
Buildout Year	2022 (full buildout) 2027 (full buildout + 5 years)

[1] Ottawa Transportation Impact Assessment Guidelines (2017), p.19

2. Trip Generation Trigger

Considering the Development's Land Use type and Size (as filled out in the previous section), please refer to the Trip Generation Trigger checks below.

Land Use Type	Minimum Development Size
Single-family homes	40 units ✓
Townhomes or apartments	90 units ✓
Office	3,500 m^2
Industrial	5,000 m^2
Fast-food restaurant or coffee shop	100 m^2
Destination retail	1,000 m^2
Gas station or convenience market	75 m^2

** If the development has a land use type other than what is presented in the table above, estimates of person-trip generation may be made based on average trip generation characteristics represented in the current edition of the Institute of Transportation Engineers (ITE) Trip Generation Manual.*

If the proposed development size is greater than the sizes identified above, therefore the Trip Generation Trigger is satisfied.

3. Location Triggers

	Yes	No
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?		✓
Is the development in a Design Priority Area (DPA) or Transit-oriented Development (TOD) zone?*		✓

**DPA and TOD are identified in the City of Ottawa Official Plan (DPA in Section 2.5.1 and Schedules A and B; TOD in Annex 6). See Chapter 4 for a list of City of Ottawa Planning and Engineering documents that support the completion of TIA).*

If any of the above questions were answered with 'Yes,' the Location Trigger is satisfied.

4. Safety Triggers

	Yes	No
Are posted speed limits on a boundary street are 80 km/h or greater?		✓
Are there any horizontal/vertical curvatures on a boundary street limits sight lines at a proposed driveway?		✓
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)?		✓
Is the proposed driveway within auxiliary lanes of an intersection?		✓

Does the proposed driveway make use of an existing median break that serves an existing site?		✓
Is there is a documented history of traffic operations or safety concerns on the boundary streets within 500 m of the development?		✓
Does the development include a drive-thru facility?		✓

If any of the above questions were answered with 'Yes,' the Safety Trigger is satisfied.

5. Summary

	Yes	No
Does the development satisfy the Trip Generation Trigger?	✓	
Does the development satisfy the Location Trigger?		✓
Does the development satisfy the Safety Trigger?		✓

Overall, the subject development has been found to satisfy one of the triggers for a Transportation Impact Assessment (TIA).

2.2 Description of Proposed Development

2.2.1 Site Location

The proposed Meadows Phase 5, part of the lands municipally known as 3640 Greenbank Road, is shown in **Exhibit 1**. The portion of these lands that is proposed to be developed is approximately 19 hectares in total. The land abuts the proposed future alignment of Greenbank Road to the east, and is bounded by undeveloped lands to the north, south and west. Cambrian Road is located approximately 200m north of the subject property.

2.2.2 Land Use

The proposed draft plan for the subject site is shown in **Exhibit 2**. The land is currently undeveloped, and is zoned mostly for development reserve zone, with a small section designated as mineral aggregate reserve zone. The proposed development will contain a mix of low and medium density residential land uses, as summarized in **Table 1**.

For the purposes of this study, full occupancy of the proposed development was assumed by the 2022 horizon year. However, the assumed buildout horizon year is highly dependent on market forces. It is possible full occupancy won't be achieved by the buildout horizon year.

TABLE 1 – Land Use Statistics

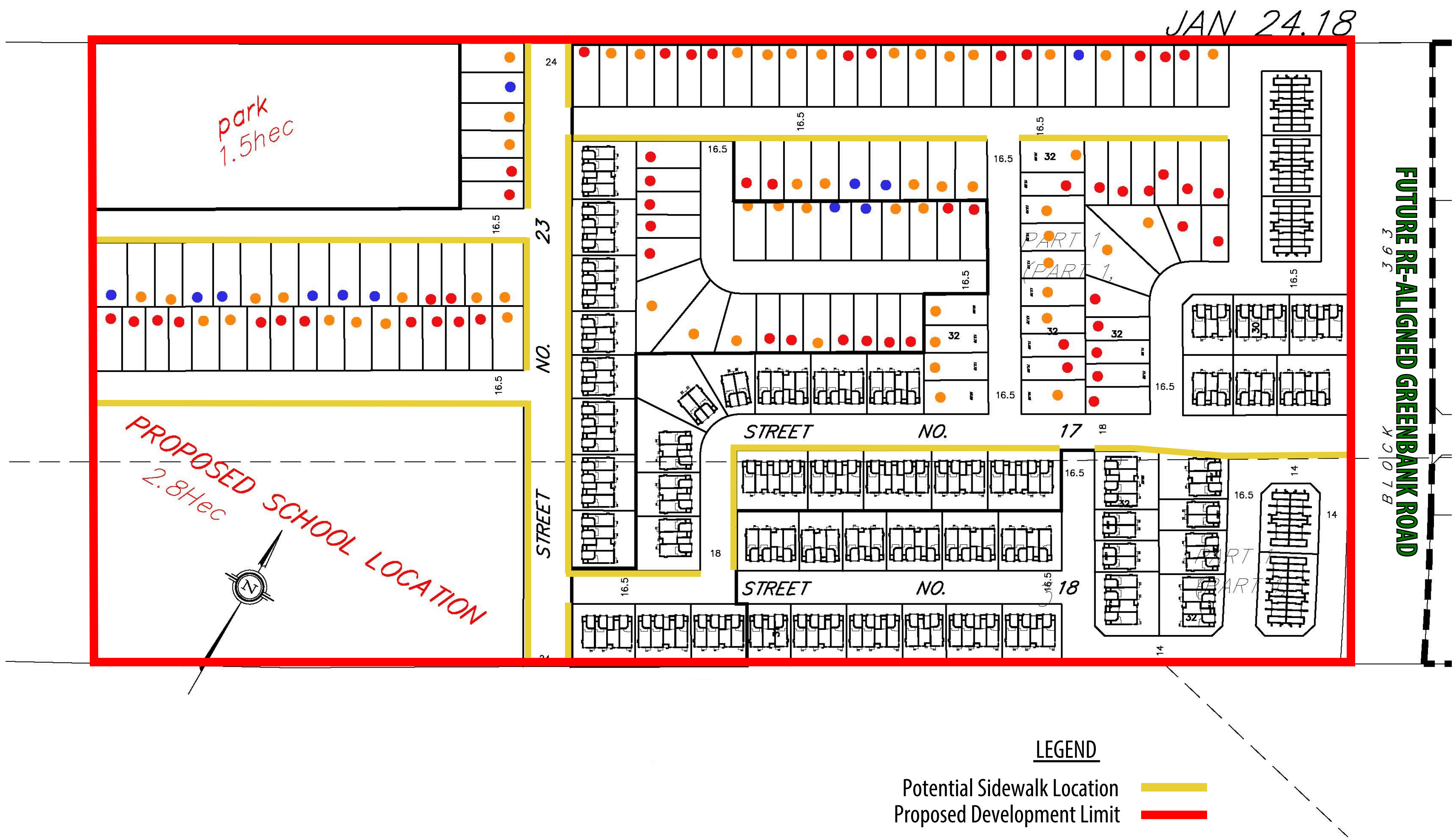
LAND USE	SIZE (# OF UNITS)
Townhome/ Semi-Detached Residential	221 units
Single Family Homes	125 units

IBI

The Meadows Phase 5
Transportation Impact Assessment

Exhibit 1
Site Location

PROJECT No. 115637
DATE: APRIL 2018
SCALE:
-50m 0 100m



IBI

The Meadows Phase 5
Transportation Impact Assessment

Exhibit 2
Proposed Development

PROJECT No. 115637
DATE: APRIL 2018
SCALE: -50m 0 100m

2.2.3 Site Layout

According to the plan of subdivision, the proposed development is expected to connect to the Meadows Phase 4 subdivision to the east via Street 17. Street 17 is proposed as an east-west local road with an 18m right-of-way, crossing the realigned Greenbank Road and terminating at Street 23 to the west. Street 23 is proposed as a north-south collector road with a 24m right-of-way (ROW) that will connect to Cambrian Road via the proposed Half Moon Bay West development access intersection to the north. Street 23 is approximately 300m in length, and will terminate at the southern edge of the development.

The remaining roads proposed within the development were proposed to have a 16.5m right-of-way (ROW) width for double-loaded streets, and 14m right-of-way (ROW) width for single-loaded streets.

2.2.4 Transit, Pedestrian and Cycling Facilities

The proposed development does not include any transit or cycling facilities. Sidewalks will be provided on select sections, as noted in **Exhibit 2**, to provide access to local amenities and adjacent developments.

2.3 Existing Conditions

2.3.1 Existing Road Network

2.3.1.1 Roadways

Cambrian Road is designated as an arterial road with a with a ROW width of 37.5 m that extends east-west from Longfields Drive (formerly Jockvale Road) to Borrisokane Road. Between Borrisokane Road and Seeley's Bay Street, Cambrian Road is a two-lane rural arterial road with a posted speed limit of 70km/h. East of Seeley's Bay Street, Cambrian Road transitions to a two-lane urban arterial road with a posted speed limit of 50km/h.

Borrisokane Road is a two-lane rural arterial road with a posted speed limit of 80km/h, and gravel shoulders along both sides of the roadway within the vicinity of the subject site.

2.3.1.2 Study Area Intersections

The following existing intersection will be evaluated in this report:

- Cambrian Road and Borrisokane Road

The Cambrian Road and Borrisokane Road intersection is stop-controlled on the westbound approach along Cambrian Road, and free-flow along Borrisokane Road in the northbound and southbound directions.

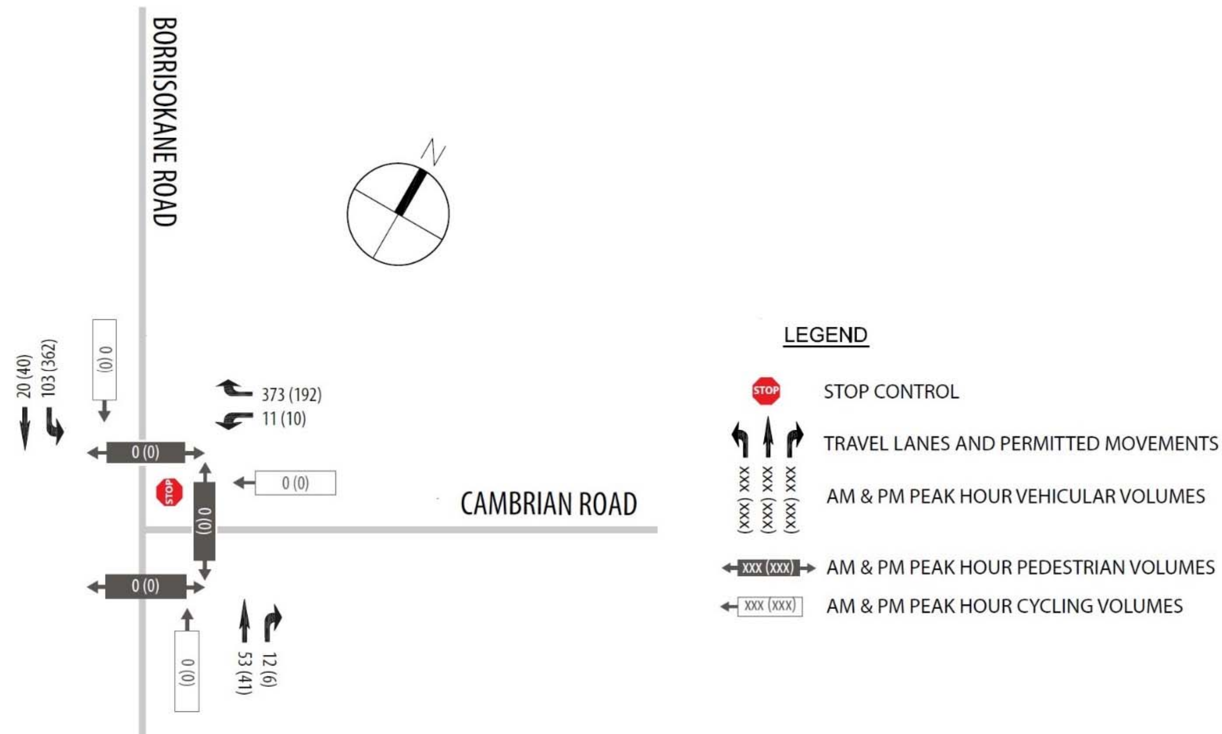
2.3.1.3 Traffic Management Measures

There are currently no existing traffic management or traffic calming measures on any of the boundary roads located within the study area.

2.3.1.4 Existing Traffic Volumes

Weekday morning and afternoon peak hour turning movement counts were conducted by IBI Group in February 2018 for the study area intersection of Cambrian Road and Borrisokane Road. The existing (2018) peak hour traffic volumes are shown in **Exhibit 3**. Traffic count data is provided in **Appendix A**.

EXHIBIT 3 – Existing (2018) Pedestrian, Cycling and Vehicular Volumes



2.3.2 Existing Bicycle and Pedestrian Facilities

East of Seeley's Bay Street, formal urban sidewalks are located on both sides of Cambrian Road. West of Seeley's Bay Street, Cambrian Road transitions to a two-lane rural road with gravel shoulders, and no formal pedestrian facilities.

No dedicated cycling facilities exist within the vicinity of the subject site.

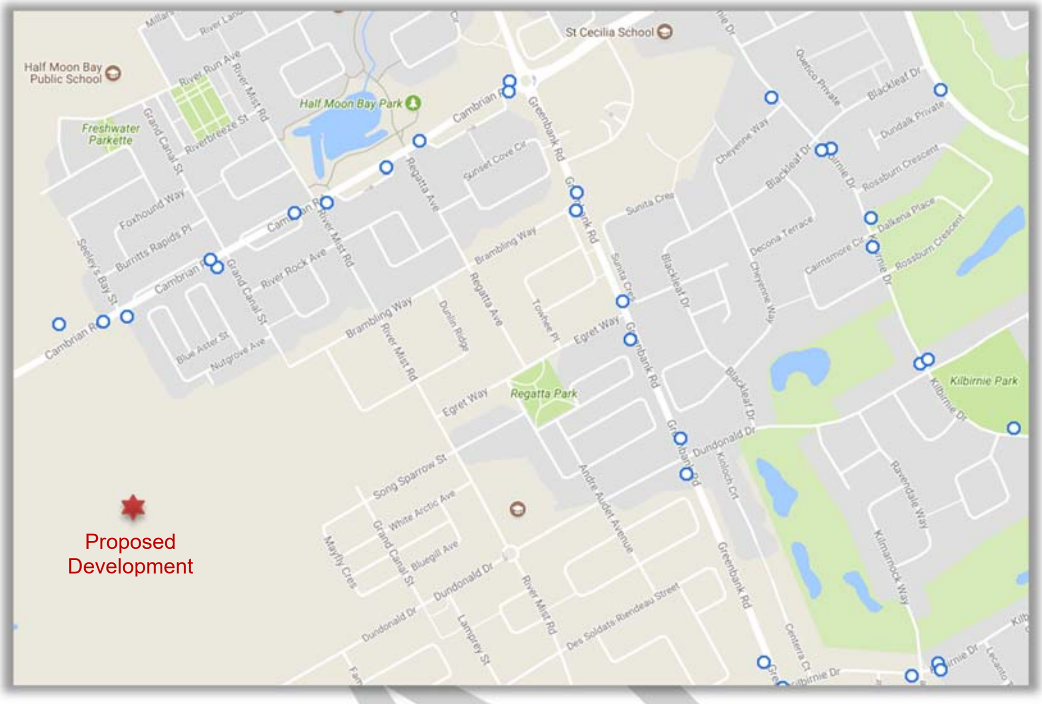
2.3.3 Existing Transit Facilities and Service

There is currently one OC Transpo service route that run through the study area.

- Route #177 is a regular/all-day service route with headways ranging from 15 to 30 minutes in the peak and off-peak hours. It operates between Barrhaven Centre and a loop just east of the study area on Cambrian Road. On weekends, transit service typically operates at 30-minute headways.

Exhibit 4 shows the existing transit stops in the study area. Transit data is provided in Appendix B.

EXHIBIT 4 – Existing Transit Stops



2.3.4 Collision Analysis

A review of historical collision data has been provided. The City requires a safety review if at least six collisions for any one movement or of a discernible pattern, over a five year period have occurred. Table 2 summarizes all reported collisions between January 1, 2011 and January 1, 2016.

TABLE 2 – Reported Collisions within Study Area

LOCATION	# OF REPORTED COLLISIONS
Cambrian Road and River Mist Road	1
Cambrian Road and Grand Canal Street	2
Cambrian Road, between Greenbank Road and Borrisokane Road	5
Cambrian Road, between Grand Canal Street and Seeley's Bay Street	1
Cambrian Road, between Grand Canal Street and Borrisokane Road	1

Upon review of all collision records, there were no discernible collision patterns noted. A copy of the City collision records is available in Appendix C.

2.4 Planned Conditions

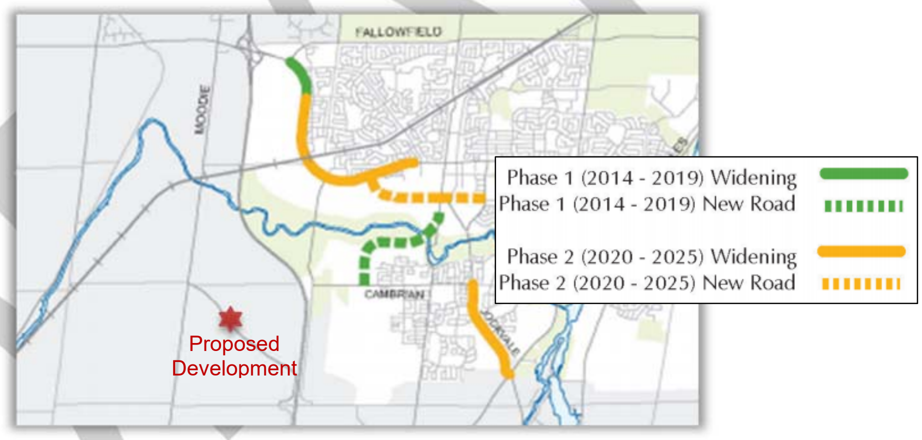
2.4.1 Changes to the Study Area Transportation Network

2.4.1.1 Future Road Network Projects (TMP)

The 2013 Transportation Master Plan (TMP) outlines future road network modifications required in the 2031 'Affordable Road Network,' as shown in **Exhibit 5**. The following projects were noted that may have an impact on study area traffic:

- Greenbank Road realignment – New 4-lane road between Cambrian Road and Jockvale Road (Phase 1: 2014-2019). The anticipated completion date has been pushed to Phase 3 (2026-2031), as indicated by City staff.
- Jockvale Road (now Longfields Drive) widening – Widen from two to four lanes between Cambrian Road and Prince of Wales Drive (Phase 2: 2020-2025). At the time of this study, the project was not anticipated prior to Phase 3 (2026-2031).
- Chapman Mills Drive extension – New 4-lane road between Strandherd Drive and Longfields Drive (Phase 2: 2020-2025), currently projected by 2024.
- Strandherd Drive widening – Widen from two to four lanes between Fallowfield Drive and Maravista Drive (Phase 1: 2014-2019) and widen from two to four lanes between Maravista Drive and Jockvale Road (Phase 2: 2020-2025).

EXHIBIT 5 – Future Road Network Projects



Phase 1 of the Strandherd Drive widening, between Fallowfield Drive and Maravista Drive has been completed. The Development Charges Amendment Background Study: Transit and Roads and Related Services (March 24, 2017) identified funds set aside for the Jockvale Road widening between 2024 and 2025, Strandherd Drive Phase 2 widening between 2020 and 2022, and Chapman Mills Drive extension between 2019 and 2020.

As noted above, the City indicated that the Greenbank Road re-alignment was postponed until Phase 3 (2026-2031) of the TMP. Addendum No. 1 of the Community Transportation Study (CTS) for Half Moon Bay West, completed in November 2017 (see Section 2.4.2), assumed that the re-alignment was not to be in place through to the ultimate planning horizon in 2029. This was meant to reflect the worst case scenario for traffic analysis purposes. At the time of this study, the Half Moon Bay West Addendum No. 1 CTS was pending approval, following resubmission to address minor comments. Similarly, for the Meadows Phase 5 Development, it was assumed that the Greenbank Road re-alignment would not be completed within the planning time horizons of this study. The planning horizons were further defined in Section 2.7.

2.4.1.2 Future Road Network Projects (Cambrian Road EA)

The Cambrian Road Widening Environmental Assessment (EA) was completed by Stantec in 2014, and proposes an ultimate four-lane cross-section along Cambrian Road from the future re-aligned Greenbank Road to Longfields Drive. Although this EA is not shown in the TMP's affordable network, it has been approved by Transportation Committee and City Council. Please refer to Appendix D for the Cambrian Road Widening EA Recommended 4-lane Functional Design.

The Barrhaven South Community Design Plan (CDP) outlined potential road widenings and rapid transit expansions in the study area. The CDP also highlighted a potential future interchange where Cambrian Road currently dead-ends at Highway 416. A map of the planned and potential transportation network and transit network changes as shown in the CDP are shown below in Exhibit 6.

EXHIBIT 6 – Barrhaven South Community Design Plan – Road Network

2.4.1.3 Future Transit Facilities and Services

The 2013 TMP outlines future rapid transit and transit priority (RTTP) network. The nearest project noted in the 'Affordable RTTP Network' was the Chapman Mills/ Strandherd / Earl Armstrong Transit Signal Priority and Queue Jump Lanes at select intersections between Barrhaven Centre Station to Bowesville Station. This project was not expected to impact study area traffic.

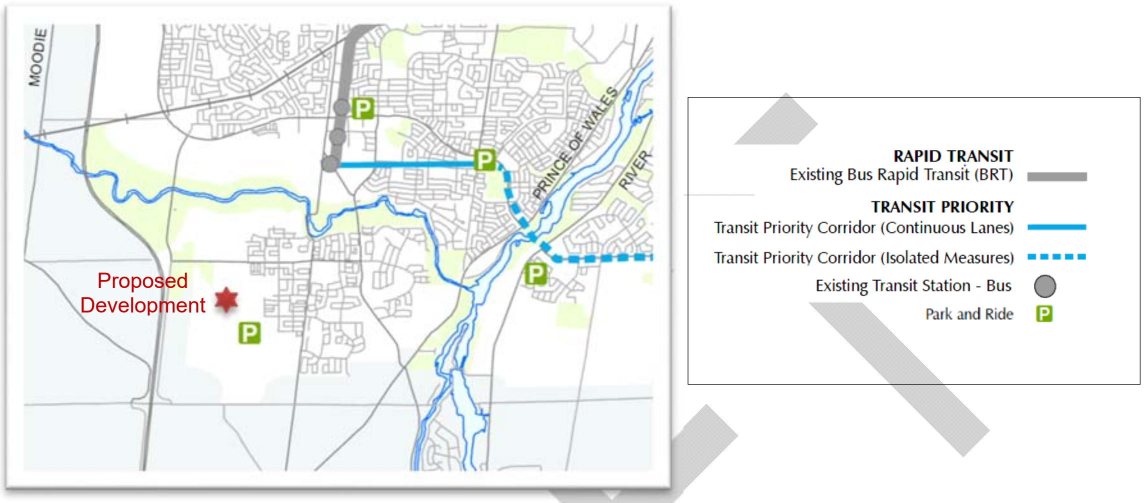
The following projects were noted in the '2031 Network Concept' that may have an impact on study area traffic:

- South Transitway Extension: At-Grade BRT corridor following the re-aligned Greenbank Road extension between Barrhaven Town Centre and Cambrian Road, with the possibility of a future extension to Barnsdale Road
- South Transitway: At-Grade BRT corridor between the Southwest Transitway and Riverside South Town Centre

Exhibit 7 shows the transit infrastructure projects in the vicinity of the study area that are part of the affordable plan.

In addition to the above-noted regional transit facilities outlined in the TMP, typical cross-sections presented in the Cambrian Road Environmental Assessment (EA) from 2014 demonstrates that this corridor will be able to accommodate mixed-use transit, as shown in Appendix D.

EXHIBIT 7 – Future 'Affordable RTTP Network Projects'



2.4.1.4 Future Cycling and Pedestrian Facilities

The Transportation Master Plan (TMP) designates Cambrian Road as "Local Route".

The Ottawa Cycling Plan (2013), a long term strategic plan to strengthen and support cycling in the City, does not note any future modifications to the area cycling network based on the 'Affordable Cycling Network Plan' recommendations. Exhibit 8 below shows the future cycling network in the vicinity of the proposed development.

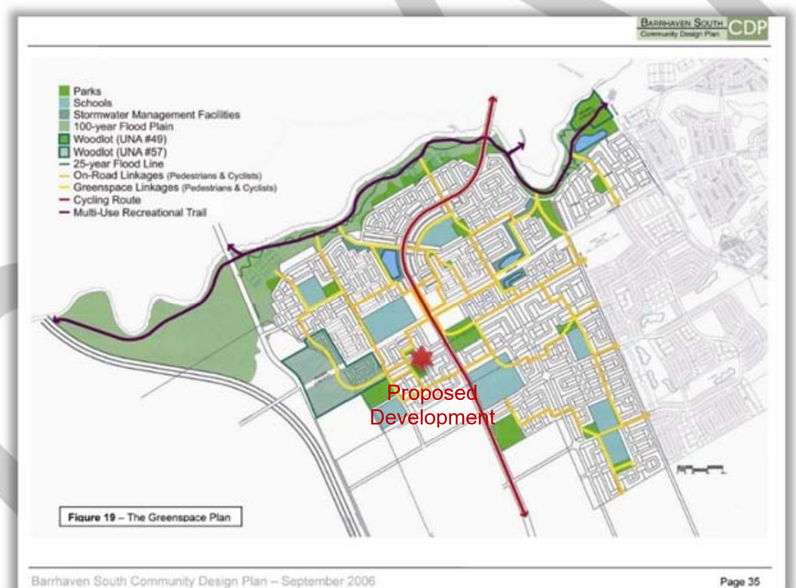
The Ottawa Pedestrian Plan (2013) does not propose any future modifications to the pedestrian network within the study area.

The Cambrian Road Environmental Assessment (EA) was completed in 2014, after the latest TMP update in 2013. This Environmental Assessment (EA) proposes a typical cross-section that features enhanced cycling and pedestrian facilities, as compared to the existing cross-section. Sharrows and dedicated cycling lanes will be utilized along the corridor to promote the use of active transportation methods, especially for inter-zonal commuting. In addition, 2.0m sidewalks separated by grassed boulevards and a multi-use pathway (MUP) is proposed on the south side of the roadway. Please refer to the Typical Cross-section in Appendix D.

EXHIBIT 8 – Future Cycling Connections

The Barrhaven South Community Design Plan (CDP) shows Cambrian Road immediately east and west of the proposed Greenbank Road re-alignment will provide "On-Road Linkages" for pedestrians and cyclists. The planned cycling and pedestrian network from the CDP are shown below in **Exhibit 9**.

EXHIBIT 9 – Riverside South Community Design Plan – Cycling and Pedestrian Network



2.4.2 Future Adjacent Developments

The City of Ottawa Transportation Impact Assessment (TIA) Guidelines specifies all significant developments within the study area which are likely to occur within the horizon year must be identified and recognized in all TIA reports. Since the traffic generated by these developments was not captured in the background traffic growth calculation, they must be added separately. Developments adjacent to the study area are shown in **Exhibit 10**.

IBI

The Meadows Phase 5
Transportation Impact Assessment

Exhibit 10
Future Adjacent Developments

PROJECT No. 115637
DATE: APRIL 2018
SCALE:

-100m 0 100m

Table 3 outlines future adjacent developments to the study area. The development of Half Moon Bay West was proposed immediately to the north of the subject site, and The Meadows Phase 4 was proposed to the east of the subject site, according to TIA reports prepared for these developments. As confirmed via Google Maps aerial imagery at the time of writing this TIA, no portions of either site have been builtout.

TABLE 3 – Developments Adjacent to Subject Development

DEVELOPMENT NAME	TIA PREPARED BY	SIZE/ NUMBER OF UNITS	EXPECTED BUILDOUT/ OCCUPANCY DATE	RECOMMENDED ROAD MODIFICATIONS
Half Moon Bay West (Mattamy Homes)	Stantec Consulting	518 singles	2024 (no occupancy in 2018)	Construction of auxiliary lanes and implementation of traffic signals at the following intersections: 1) Cambrian Road & Mattamy Site Access 2) Cambrian Road & Borrisokane Road
		427 townhome units		
		5.3 acres of commercial land		
		109 townhome units		
		360 townhomes/back-to-back homes		
The Meadows Phase 4 (Tamarack Homes)	IBI Group	50 singles	2019 (no occupancy in 2018)	No recommended modifications to intersections on roadways within study area.
		136 units townhomes/ Semi-detached		

2.4.3 Network Concept Screenline

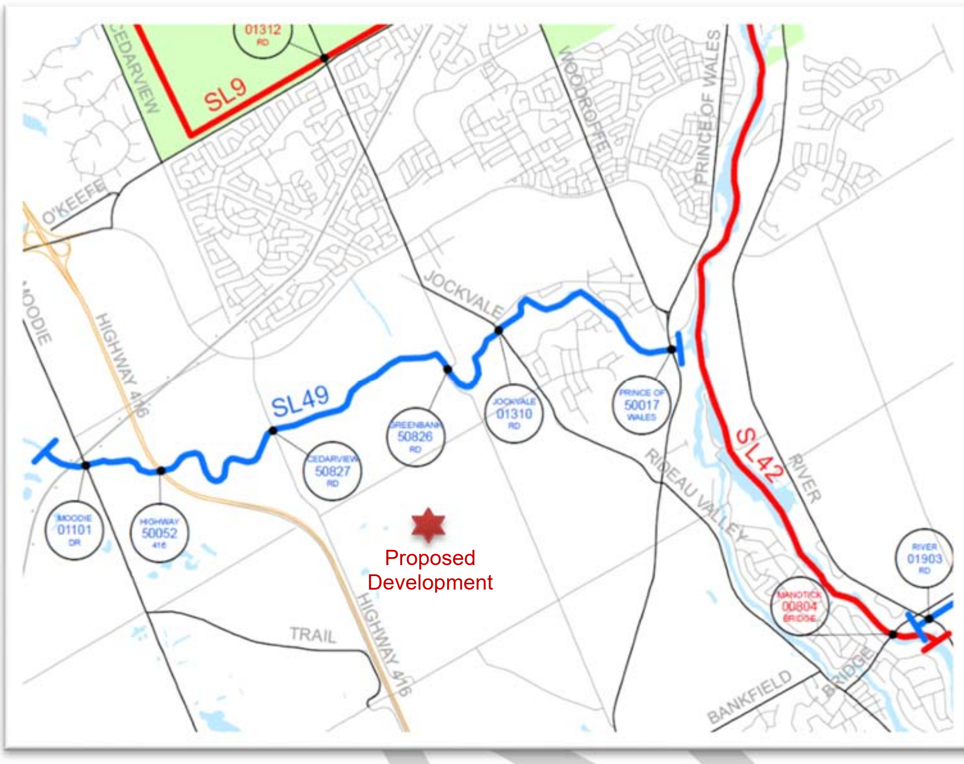
A screenline is an imaginary line made up of a number of stations to count east/west or north/south travel within a particular area. Screenlines are typically located along geographical barriers such as rivers, rail lines or within the greenbelt. To be truly representative of the flow, there is a station at each intersecting road crossing the screenline.

As specified in Module 4.8 of the 2017 TIA Guidelines, the latest Network Concept will be reviewed with to ensure that the nearest strategic planning screenlines adjacent to the development are considered in the screenline analysis.

- SL42 – Rideau River (Manotick) – This is the closest north/south screenline to the subject site, and it is located along the Rideau River from just south of Mitch Owens Road to just north of Leitrim Road. It has two (2) crossing points: the Vimy Memorial Bridge and the Manotick Bridge.
- SL49 – Jock River – This is the nearest east/west screenline to the subject site. It follows the Jock River from just west of Moodie Drive in the west to the Rideau River in the east. This screenline has six (6) crossing points over the Jock River, including: Moodie Drive, Highway 416, Cedarview Road (now called Borrisokane Road), Greenbank Road, Jockvale Road and Prince of Wales Drive.

SL42 and SL49 are shown in **Exhibit 11**, as determined from the City of Ottawa's Road Network Development Report (2013), a supporting document to the 2013 Transportation Master Plan (TMP).

EXHIBIT 11 – Nearest Screenlines



2.5 Study Area

Based on the review of the nearest screenlines, transit routes and active transportation facilities, the proposed study area will be defined by Cambrian Road to the north, Borrisokane Road to the west and undeveloped lands to the south and east.

The following existing intersection will be assessed as part of this TIA:

- Cambrian Road and Borrisokane Road

The following proposed intersection will be assessed as part of this TIA:

- Cambrian Road and Street 23/ Mattamy Site Access

Intersections along Cambrian Road east of Street 23 up to Greenbank Road were discussed and reviewed as part of the TIA prepared for the Meadows Phase 4, which is currently under review to address minor comments. As part of the Meadows Phase 4, the majority traffic was directed to River Mist Road and the existing Greenbank Road. Even with this conservative distribution, the River Mist Road and Cambrian Road intersection was shown to operate within City standards through to the ultimate 2024 planning horizon as stop-controlled intersection. Based on existing turning movement counts along Cambrian Road, the majority of traffic from the subject site is expected to utilize Street 23 and Borrisokane Road, as this a more direct route to Cambrian Road and the broader transportation network, rather than navigating through internal streets within the Meadows Phase 4 development. Since very little traffic is expected to bleed east through the development, existing intersections to the east of Street 23 along Cambrian Road were not considered as part of the study area.

As previously discussed in Section 2.4.1.1, this TIA will consider the worst case scenario, and rely on existing infrastructure to service the subject development. In this scenario, it was assumed that the Greenbank Road realignment to Cambrian Road would not be completed within the study horizons, and the existing Greenbank Road alignment remains through to the ultimate planning horizon. This approach provided a better evaluation of potential bottlenecks in the adjacent road network.

An agreement will be in place between the Mattamy Homes and Tamarack Homes as part of the conditions of approval, stating that the construction of Street 23 will be built from the subject lands and connect to Cambrian Road prior to the completion and occupancy of residential units within the subject development. Street 23 will be required for servicing, as well to provide vehicular access to the subject site.

2.6 Time Periods

Since this is a residential development, traffic generated during the morning and afternoon peak hour are expected to result in the most significant impact to traffic operations on the adjacent network in terms of development-generated and background traffic. These two (2) analysis periods will be used for operational analysis in the TIA.

2.7 Horizon Years

Two (2) future horizons are proposed for analysis in the Transportation Impact Analysis (TIA) Report:

- Year 2022 – Opening Day; Full occupancy
- Year 2027 – Opening Day plus 5 years

2.8 Exemptions Review

The TIA Guidelines provide exemption considerations for elements of the Design Review and Network Impact components. Table 4 identifies each element, and indicates whether or not it will be required in Step 4 – Analysis.

TABLE 4 – Exemptions Review

TIA MODULE	ELEMENT	EXEMPTION CONISDERATIONS	REQUIRED
Design Review Component			
4.1 Development Design	4.1.2 Circulation and Access	• Only required for site plans	✗
	4.1.3 New Street Networks	• Only required for plans of subdivision	✓
4.2 Parking	4.2.1 Parking Supply	• Only required for site plans	✗
	4.2.2 Spillover Parking	• Only required for site plans where parking supply is 15% below unconstrained demand	✗
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	✓
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	✓
4.8 Network Concept	n/a	• Only required when proposed development generates more than 200 person-trips during the peak hour in excess of the equivalent volume permitted by established zoning	✓

3 Forecasting

The purpose of the Forecasting section is to "generate the future transportation demand number required to analyze pre and post-development network performance to determine if a network modification is required to offset development impacts." [2]

3.1 Development Generated Traffic

3.1.1 Trip Generation Methodology

Peak hour development generated traffic volumes were developed using Institute of Transportation Engineers (ITE) Trip Generation Manual, 9th Edition, 2012. The Transportation Impact Assessment (TIA) Guidelines require ITE vehicle-trip rates to be adjusted to better reflect local travel patterns. The ITE trip generation rates are based on data collected from traffic surveys conducted across North America, but mostly in suburban areas of the United States where the level of transit use is traditionally very low (estimates show that ITE rates average approximately 96% auto mode split). This statistic is not representative of the City of Ottawa that has a well-established transit system and pedestrian/ cycling network.

The City recommends the ITE vehicle-trip rates be converted to person-trips split based on representative mode share proportions. This conversion factor was based on a recommended average vehicle occupancy of 1.15 and a 10% non-auto mode share. The person-trips were then split based on representative mode share percentages to determine the number of vehicle, transit, pedestrian, cycling and other trip types.

Local mode shares were based on the TRANS Committee: 2011 Origin-Destination (OD) Survey completed for the City of Ottawa. The OD Survey has mode share breakdowns for specific zones throughout the City; the South Nepean Zone contained the subject site and was applied in this analysis.

3.1.2 Trip Generation Results

3.1.2.1 ITE Vehicle Trip Generation

The peak hour vehicular traffic volumes from The Meadows Phase 5 development were determined using peak hour trip generation rates from the ITE Manual. A summary of the vehicular trip generation results for the proposed development has been summarized in Table 5.

The relevant extracts from the ITE Manual have been provided in Appendix E.

[2] Ottawa 2017 Transportation Impact Assessment Guidelines, p. 27

TABLE 5 – ITE Development Trip Generation Results

LAND USE (ITE CODE)	SIZE (DU)	PERIOD	GENERATED TRIPS (VPH)		
			IN	OUT	TOTAL
Single Detached Housing (210)	125	AM	24	73	97
		PM	81	48	56
Townhouse (230)	221	AM	17	81	98
		PM	77	38	115

Notes: DU = Dwelling Units
vph = vehicles per hour; DU = Dwelling Units   vph = vehicles per hour; DU = Dwelling Units
Formula Rate and Splits for Single Detached Homes   Formula Rate and Splits for Townhomes
AM T = 0.7(X) + 9.74   IN: 25%; OUT: 75%   AM T = e^(0.80*ln(X) + 0.26)   IN: 17%; OUT: 83%
PM T = e^(0.9*ln(X)+0.51)   IN: 63%; OUT: 37%   PM T = e^(0.82*ln(X)+0.51)   IN: 67%; OUT: 33%

3.1.2.2 Person Trip Generation

The ITE vehicle-trip to person-trip conversion factor of 1.28 based on an average vehicle occupancy of 1.15 and a default 10% non-auto mode share was applied to vehicle-trip results in Table 1. The results after applying this factor have been summarized in Table 6.

TABLE 6 – Development Person Trip Generation Results

LAND USE (ITE CODE)	FACTOR	PERIOD	GENERATED TRIPS (PPH)		
			IN	OUT	TOTAL
Single Detached Housing (210)	1.28	AM	24	73	97
		PM	80	47	127
Townhouse (230)		AM	16	81	97
		PM	76	37	113
Total		AM	40	154	194
		PM	156	84	240

Notes:
pph = persons per hour; DU = dwelling units

3.1.2.3 Mode Share Proportions

The total person trips generated by the proposed development were stratified by mode, based on mode share proportions in the 2011 Origin-Destination (OD) Survey for the South Nepean Traffic Assessment Zone (TAZ). The relevant extracts from the 2011 OD Survey has been provided in Appendix F.

No adjustments were made to active transportation modes such as walking or cycling for future planning horizons used for this traffic study. The existing and proposed mode share targets for the South Nepean TAZ for each of the analysis horizons are outlined in Table 7. Significant adjustments were made to the transit modal split to reduce it from 27% to 10% in the AM peak hour, and from 24% to 10% in the PM peak hour. The difference was shifted over to the auto-drive mode. This approach should be considered conservative.

TABLE 7 – Proposed Mode Shares for South Nepean (2011 OD Survey)

TRAVEL MODE	2011 OD SURVEY MODE SHARE		ADJUSTED MODE SHARE	
	AM	PM	AM	PM
Auto Driver	61%	63%	78%	77%
Transit	27%	24%	10%	10%
Auto Passenger	8%	11%	No Change	
Cycling	0%	0%		
Walking	0%	0%		
Other	4%	2%		
Total	100%	100%	100%	100%

3.1.2.4 Trip Generation by Mode

The mode share target in Table 7 were applied to person trips results from Table 6 to estimate the number of development generated trips by mode, as shown in Table 8.

TABLE 8 – Development Generated Traffic by Mode

TRAVEL MODE	PEAK PERIOD TRIPS BY MODE					
	AM			PM		
	IN	OUT	TOTAL	IN	OUT	TOTAL
Auto Driver	41	153	194	156	84	240
Transit	5	20	25	20	11	31
Auto Passenger	4	16	20	22	12	34
Cycling	0	0	0	0	0	0
Walking	0	0	0	0	0	0
Other	2	8	10	4	2	6

The proposed development is expected to generate approximately 194 morning and 240 afternoon peak hour vehicular trips at full buildout.

3.1.3 Trip Distribution and Assignment

A regional trip distribution was applied to the site generated traffic within the study area. The expected travel routes to and from the study area were as follows:

- East on Cambrian Road
- North and South on Borrisokane Road

It should be noted that since Cambrian Road terminates to the west at Borrisokane Road, any traffic heading west on Cambrian Road is captured in the north or south directions along Borrisokane Road. The estimated trip distributions were based on assumptions made in approved traffic studies completed within the study area.

A summary of trip distribution proportions applied to site generated trips is shown in Table 9.

TABLE 9 – Trip Distribution by Direction

LOCATION	TRIP DISTRIBUTION	
	IN	OUT
East on Cambrian Road	35%	35%
North on existing Borrisokane Road	60%	60%
South on existing Borrisokane Road	5%	5%

The intersection level trip distribution was based on existing turning movement counts. The resulting development generated morning and afternoon peak hour traffic volumes has been provided in Exhibit 12.

3.1 Background Network Traffic

3.1.1 Changes to the Background Transportation Network

To properly assess future traffic conditions, the City requires that all anticipated changes to the transportation network over time, particularly road and transit route components, are accounted for in the traffic analysis. These changes would then be reflected in the future background demand volumes to develop an appropriate foundation for the TIA.

As noted in the Scoping, the impact of the Greenbank Road realignment was not accounted for in the following TIA. This approach was meant to represent the worst case scenario for the transportation network and provide a better evaluation of potential bottlenecks in the adjacent road network.

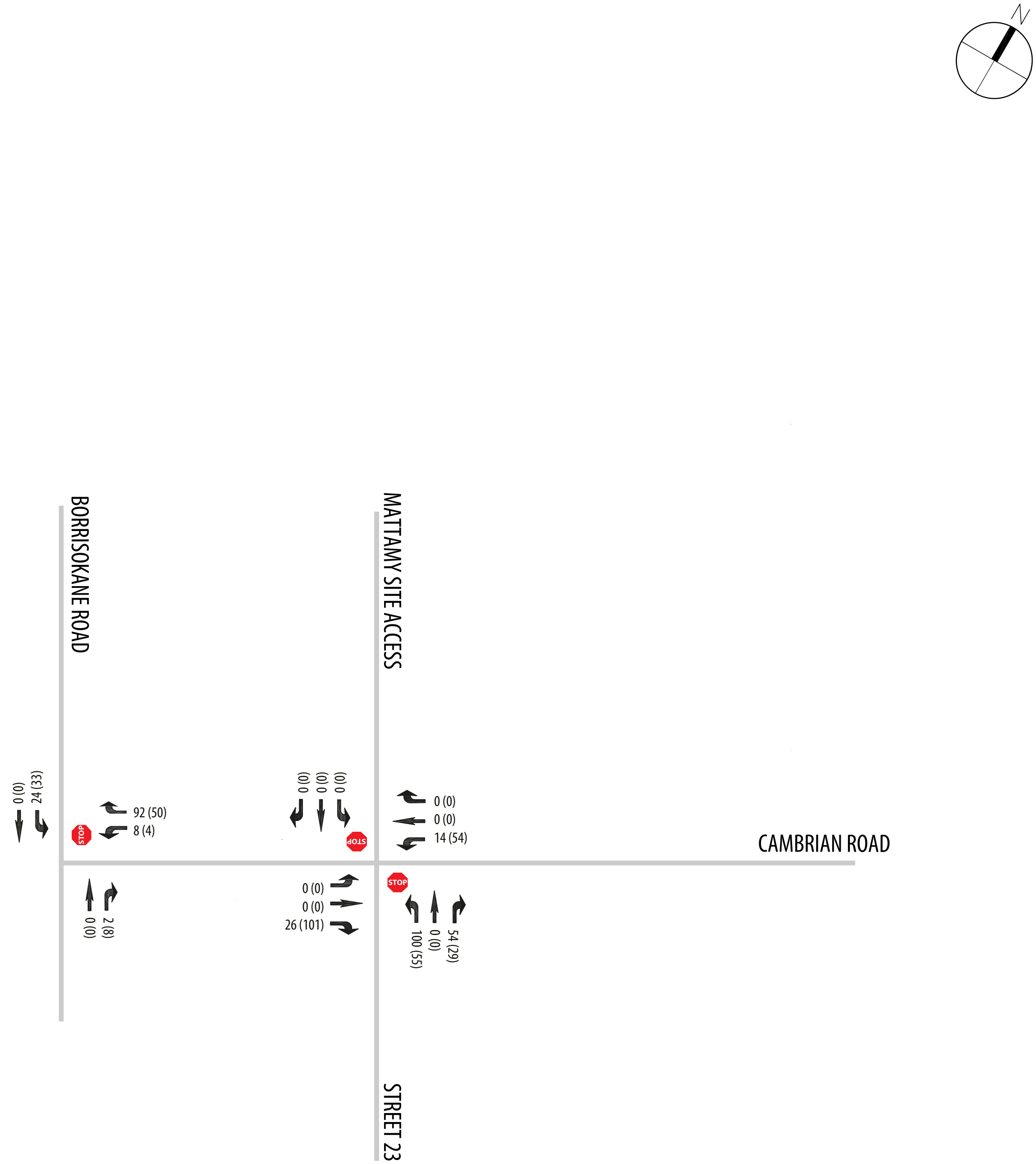
Recommended intersection modifications noted in the Half Moon Bay West Community Transportation Study (CTS): Addendum No. 1 dated November 2017, include adding traffic signals and auxiliary lanes at the intersections of Borrisokane Road and Cambrian Road, as well as at Street 23 and Cambrian Road. It is not anticipated that further modifications in addition to those recommended in the Half Moon Bay West CTS will be required to accommodate traffic generated from the subject development.

Existing transit service routes will need to be adjusted to increase transit coverage within the proposed development, however, as transit accessibility within 400m will be limited until the future Greenbank realignment south of Cambrian Road is completed.

3.1.2 General Background Growth Rates

The background growth rate is meant to represent regional growth, outside the study area, along the adjacent road network. Approved transportation impact assessments completed within the study area applied growth rates of 2% at the intersection of Borrisokane Road and Cambrian Road. For this study, a linear growth rate of 2% per annum to existing traffic volumes was applied to all movements at the Borrisokane Road and Cambrian Road intersection, as well as through movements along Cambrian Road.

The above assumptions were considered conservative since other area developments have been captured separately in the TIA, as discussed in the following section.



LEGEND

STOP CONTROL

TRAFFIC CONTROL SIGNAL

TRAVEL LANES AND PERMITTED MOVEMENTS

xx (xxx) AM & PM PEAK HOUR VEHICULAR VOLUMES

IBI

The Meadows Phase 5
Transportation Impact Assessment

EXHIBIT 12
Site Generated AM & PM
Peak Hour Traffic Volumes

PROJECT No.: 115637
DATE: APRIL 2018
SCALE: NTS

3.1.3 Other Area Development

The City of Ottawa TIA Guidelines specifies all significant developments within the study area which are likely to occur within the horizon years must be identified and taken into consideration in all TIA reports. Since the traffic generated by these developments was not captured in the background traffic growth calculation, they must be added separately.

There are two (2) known developments expected to contribute traffic within the study area. These developments are currently in the development application approval process, and are both currently in the development review process. Construction has not begun on either development. Half Moon Bay West is located immediately to the north of the subject property, and the Meadows Phase 4 is located to the east of the subject property, on the other side of the future re-aligned Greenbank Road. The unit counts and characteristics for each development were based on traffic studies that supported the development application.

The adjacent developments have been summarized in **Table 10**, and their approximate locations in relation to subject site were shown in **Exhibit 10**.

TABLE 10 – Future Adjacent Developments

DEVELOPMENT NAME	TIA PREPARED BY	SIZE/ NUMBER OF UNITS	EXPECTED BUILDOUT/ OCCUPANCY DATE	RECOMMENDED ROAD MODIFICATIONS
Half Moon Bay West (Mattamy Homes)	Stantec Consulting	518 singles 427 townhome units 5.3 acres of commercial land 109 townhome units 360 townhomes/back-to-back homes	2024 (no occupancy in 2018)	Construction of auxiliary lanes and implementation of traffic signals at the following intersections: 1) Cambrian Road & Mattamy Site Access 2) Cambrian Road & Borrisokane Road
The Meadows Phase 4 (Tamarack Homes)	IBI Group	50 singles 136 units townhomes/ Semi-detached	2019 (no occupancy in 2018)	No recommended modifications to intersections on roadways within study area.

3.2 Demand Rationalization

The following section summarizes any adjustments made to future travel demands in the study area to account for capacity limitations of the transportation network.

3.2.1 Description of Capacity Issues

A review of previous TIAs in the area reveal no major capacity issues within the study area. The development generated traffic volumes were not expected to create significant capacity issues in the local network.

According to the Needs and Opportunities Report (2013), both the SL42 – River Road (Manotick) and SL49 – Jock River have sufficient capacity to accommodate future traffic demand, in even the Inbound 2031 Base Scenario, which does not include modifications from the City 2031 Network Concept.

The City planned realignment of Greenbank Road and the future widening of Longfields Drive is expected to create additional capacity in the road network to accommodate any deficiencies that may be triggered by future background or development generated traffic growth. As previously discussed, the realignment was assumed not to be completed in the future horizons, to represent the worst case scenario.

Therefore, there were no adjustments made to development generated or background network demand.

3.3 Traffic Volume Summary

3.3.1 Future Background Traffic Volumes

The existing (2018) peak hour traffic volumes from the Scoping Report has been provided in **Exhibit 13**. The future background traffic volumes developed in Section 3: Background Network Traffic for the 2022 and 2027 horizons have been provided in **Exhibits 14** and **15**, respectively.

EXHIBIT 13 – Existing (2018) Auto, Cycling and Pedestrian AM & PM Peak Hour Traffic Volumes

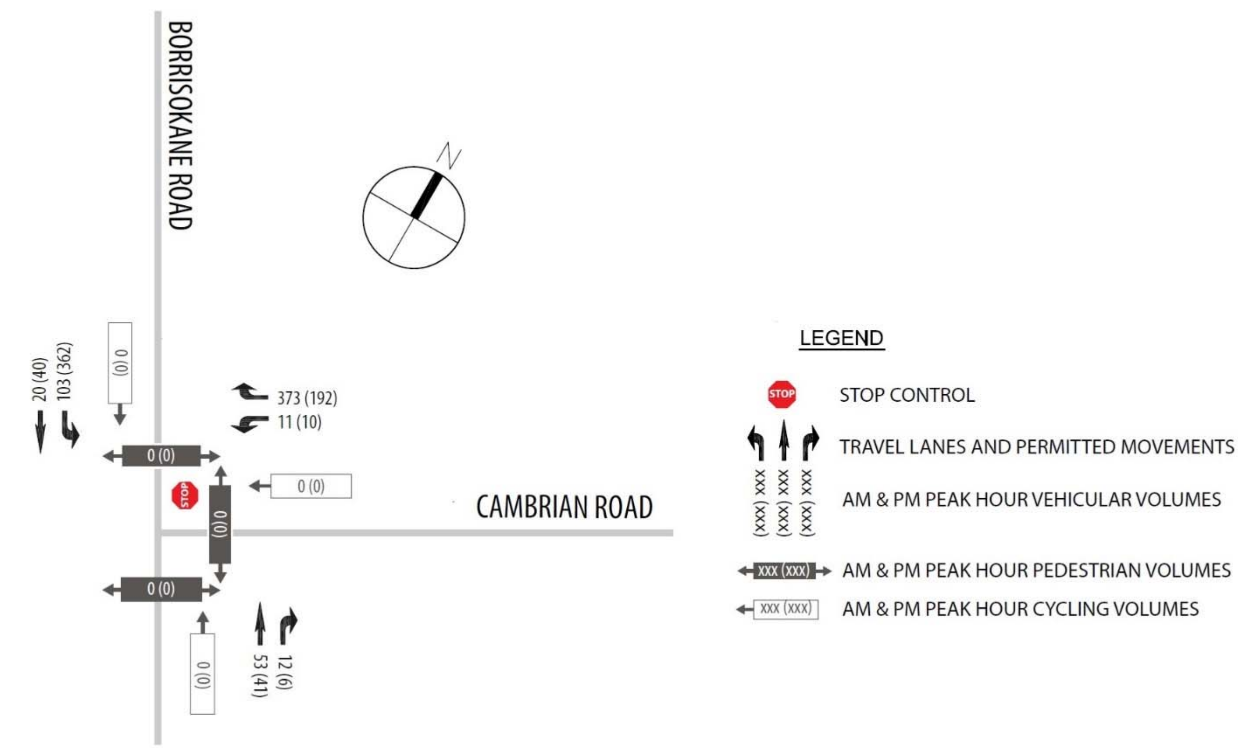


EXHIBIT 14 – Future (2022) Background AM & PM Peak Hour Traffic Volumes

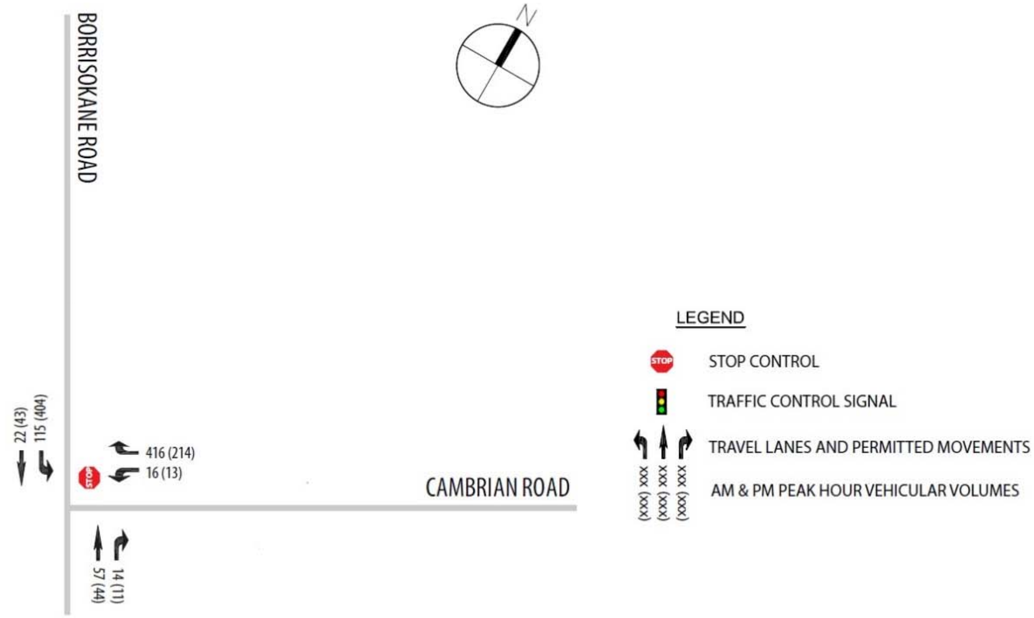
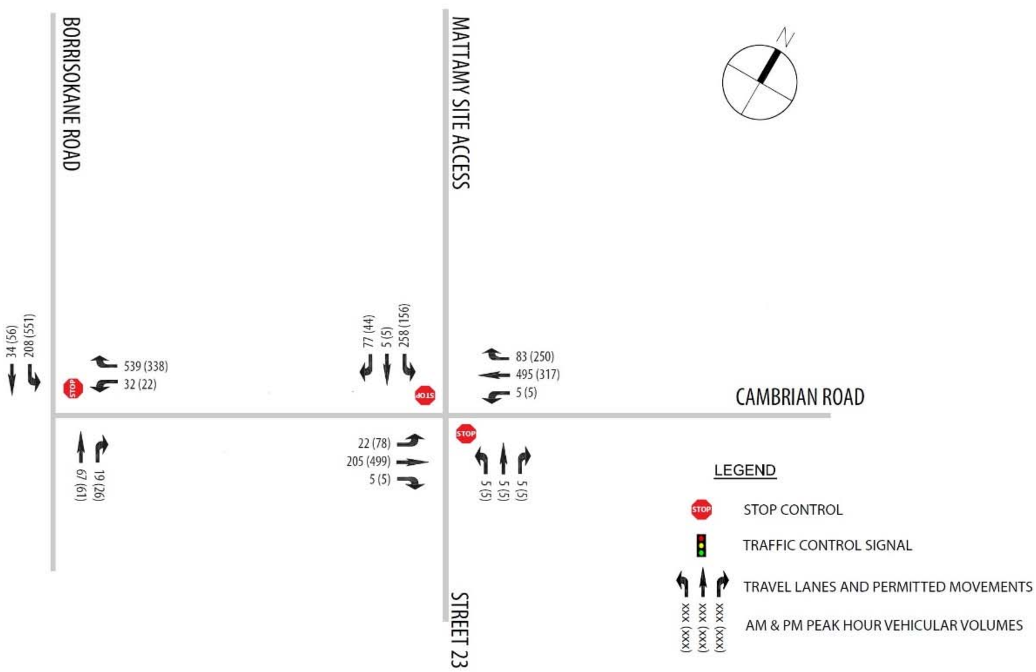


EXHIBIT 15 – Future (2027) Background AM & PM Peak Hour Traffic Volumes



3.3.1 Future Total Traffic Volumes

The site generated peak hour traffic volumes from Exhibit 12 were added to corresponding background traffic volumes to create background plus site generated or total peak hour traffic volumes for the 2022 and 2027 horizon years, as shown in Exhibits 16 and 17, respectively.

EXHIBIT 16 – Future (2022) Total AM & PM Peak Hour Traffic Volumes

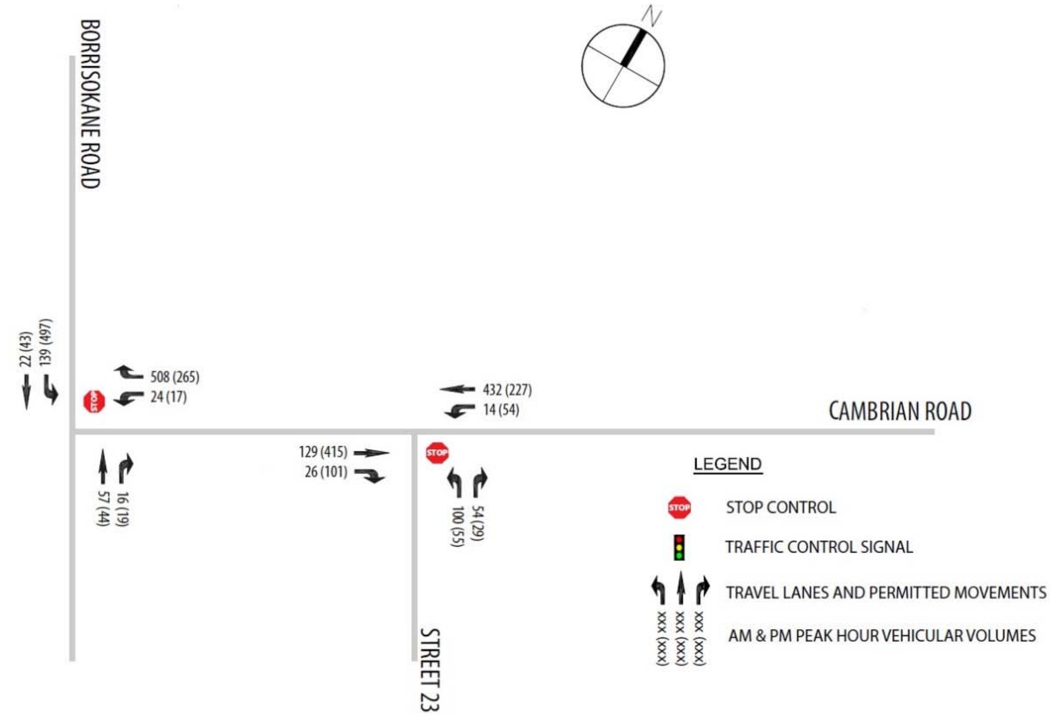
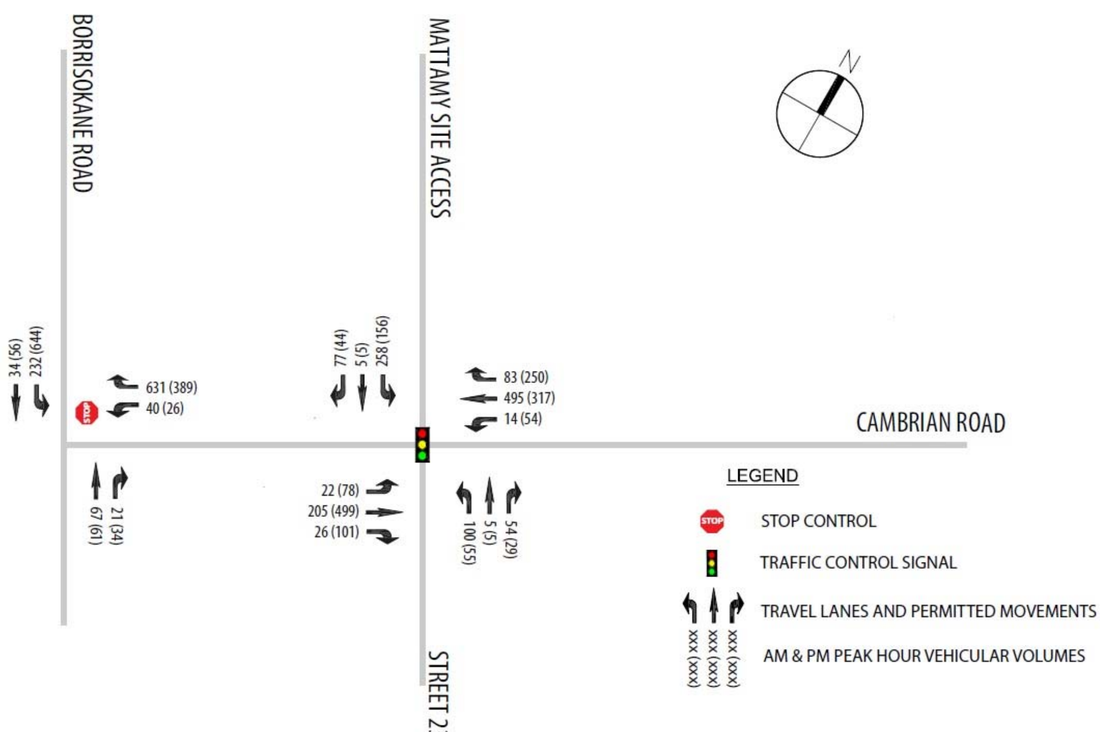


EXHIBIT 17 – Future (2027) Total AM & PM Peak Hour Traffic Volumes



4 Analysis

The purpose of the TIA Analysis is to "assess the alignment between the transportation elements of the proposed development and the City of Ottawa's city-building objectives and identify any opportunities to improve alignment. It also evaluates the post-development performance of the planned transportation network based on the City's established performance measures and targets and identifies potential mitigation measures to off-set development impacts." [3]

4.1 Development Design

4.1.1 Design for Sustainable Modes

The nearest bus stop to the Meadows Phase 5 development is located northeast of the subject site at Seeley's Bay Street and Cambrian Road, but it is beyond the 400m maximum walking distance to a transit stop as required by the City. Extending transit service west along Cambrian Road, south along the proposed Street 23 access and providing a turn-around area for buses at the southern edge of the subject site at Street 23, would put approximately 90% of residents within a 400m walking distance of a transit stop and approximately 100% of residents within a 500m walking distance of a transit stop. Proposed transit coverage is shown in Exhibit 18.

There are no cycling facilities planned within the proposed development. Sidewalks have been strategically placed to ensure adequate accessibility to the adjacent road network and local amenities, as shown in Exhibit 2.

4.1.2 Circulation and Access

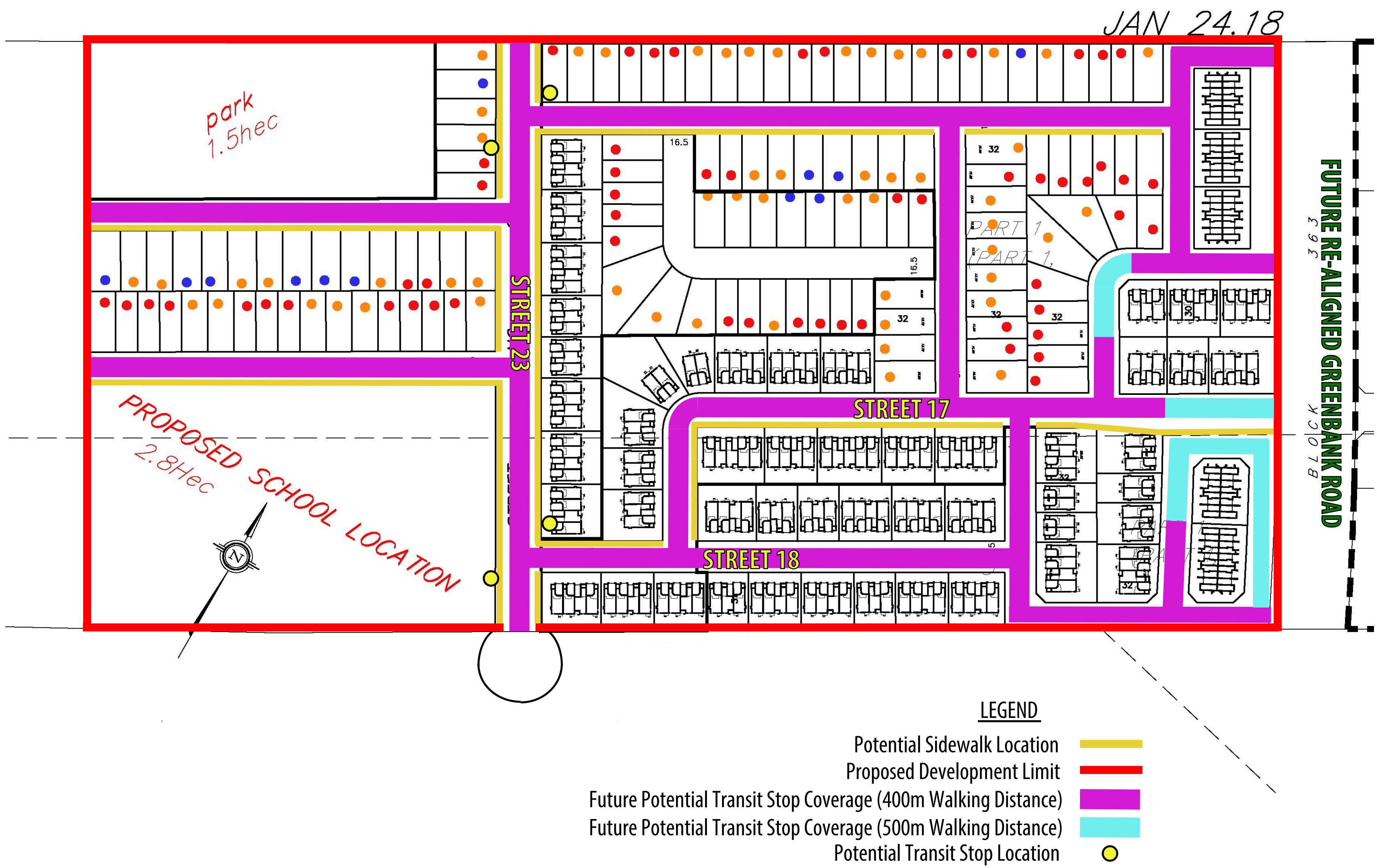
This element is only required for site plans. Therefore, it has been exempt from this TIA.

4.1.3 New Street Networks

According to the plan of subdivision, the proposed development is expected to connect to the Meadows Phase 4 subdivision to the east via Street 17. Street 17 is proposed as an east-west local road with an 18m right-of-way, crossing the realigned Greenbank Road and terminating at Street 23 to the west. Street 23 is proposed as a north-south collector road with a 24m right-of-way (ROW) that will connect to Cambrian Road via the proposed Half Moon Bay West development access intersection to the north. Street 23 is approximately 500m in length, and was proposed to connect from Cambrian Road and terminate in a cul-de-sac at the southern edge of the subject development.

The remaining roads proposed within the development were proposed to have a 16.5m right-of-way (ROW) width for double-loaded streets, and 14m right-of-way (ROW) width for single-loaded streets.

[3] Ottawa 2017 Transportation Impact Assessment (TIA) Guidelines, p. 35



IBI

The Meadows Phase 5
Transportation Impact Assessment

Exhibit 18
Proposed Transit Coverage

PROJECT No. 115637
DATE: APRIL 2018
SCALE: -50m 0 100m

4.2 Parking

4.2.1 Parking Supply

The Parking Supply element is exempt from this TIA, as indicated in Section 2.8: Exemptions Review. This element is only required for site plan applications.

4.2.2 Spillover Parking

The Spillover Parking element is exempt from this TIA, as indicated in Section 2.8: Exemptions Review. This element is only required for site plan applications.

4.3 Boundary Streets

Cambrian Road is considered the only boundary street to the subject development, and it is classified as an arterial road, running east-west approximately 200m to the north of the subject development.

In the future, the re-aligned Greenbank Road will be extended south of Cambrian Road and run along the west property line. Future design elements along this frontage will be reviewed by the City during the Environmental Assessment of the future extension.

The results of the Segment Multi-Modal Level of Service (MMLOS) of Cambrian Road within the vicinity of the study area is provided in Table 11. Detailed results are provided in Appendix G. The Segment MMLOS is based on the geometry of the roadway and not traffic volumes.

TABLE 11 – Segment MMLOS – Future Background and Total Results

INTERSECTION	SCENARIO	LEVEL OF SERVICE			
		PLOS	BLOS	TLOS	TKLOS
Cambrian Road (300m east of Borrisokane Road to Existing Bus Turn-around)	Existing (2018)	F [1]	F [2]	D	B
	2022 BG & BGSG	F [1]	F [2]	D	B
	2027 BG & BGSG	B	F [2]	D	B

Notes: [1] No formal sidewalks; rural cross-section on Cambrian Road with gravel shoulders
[2] The Segment BLOS of 'F' along Cambrian Road is attributed to the higher operating speed (>= 60 km/h) for vehicular traffic

The Community Transportation Study (CTS) for Half Moon Bay West: Addendum 1 (November 2017) indicated that there would be sidewalks provided along the approximately 500m section of Cambrian Road fronting the Half Moon Bay West development. Therefore, by 2027, it was assumed in this study that sidewalks would be provided along Cambrian Road from 300m east of Borrisokane Road to just west of the existing bus turn-around to coincide with the full buildout of the proposed Half Moon Bay West development.

4.4 Access Intersections

4.4.1 Location and Design of Access Intersections

The proposed primary vehicular access/ egress for the subject site was located to the north of the subject site via Street 23 and Cambrian Road. A secondary access/ egress was proposed via Street 17 to connect to the future Meadows Phase 4 development to the east.

Analysis is only shown for the Street 23 and Cambrian Road intersection, as the majority of traffic generated from the subject site is expected to access/ egress the site from the Street 23 access. This assumption, as a worst case scenario, was based on the majority of traffic heading west on Cambrian Road to Borrisokane Road, as indicated by existing traffic counts conducted for intersections located to the east of the study area. Utilizing Street 23 provides a more direct route to access the Cambrian Road, compared with navigating through the local road network of Meadows Phase 4 and utilizing Grand Canal Street or River Mist Road to access Cambrian Road.

For the Meadows Phase 4 traffic study, the majority of traffic was directed to River Mist Road and was assumed to head towards the existing Greenbank Road, as a worst case scenario. The Cambrian Road and River Mist Road intersection was shown to operate with a v/c ratio of 0.81 and an LOS of 'D' in the 2024 total traffic condition with the existing four-way stop control, which could accommodate some traffic from the subject site, if it were to bleed through the proposed Meadows Phase 4 development. The Meadows Phase 4 and Meadows Phase 5 developments have similar unit counts, and it is expected that if some traffic from Meadows Phase 4 bleeds west through Meadows Phase 5 and vice versa, the traffic volumes will likely balance out and have little or no effect on the operations of the access intersections.

4.4.2 Intersection Control

4.4.2.1 Traffic Signal Warrants

The use of traffic signals was investigated at the intersections of Cambrian Road and Borrisokane Road, as well as Cambrian Road and Street 23/ Mattamy Site Access. Traffic signal warrants specified in the Ontario Traffic Manual (OTM) Book 12 were completed for both intersections. The results of the analysis indicated that signalizing the intersection of Cambrian Road and Street 23/ Mattamy Site Access was warranted in the 2027 total traffic condition. Cambrian Road and Borrisokane Road did not trigger traffic signal warrants through to the 2027 total traffic condition.

The results of the traffic signal warrant analysis for the Street shown in Appendix H.

4.4.2.2 Roundabout Analysis

The Roundabout Screening Tool was used to determine the feasibility of a roundabout at the intersection of Cambrian Road and Street 23/ Mattamy Site Access, as this is proposed as a new City intersection, and traffic signals were warranted at this intersection in the 2027 traffic condition, as discussed in Section 4.4.2.1. There were no contra-indications to suggest that a roundabout would be 'problematic', and the suitability factors suggested that roundabout is technically feasible at this intersection. The results of the Roundabout Feasibility Screening Tool are provided in Appendix I.

A detailed roundabout capacity analysis was completed using SIDRA analysis software for a single-lane roundabout at the proposed intersection of Cambrian Road and Street 23/ Mattamy Site Access. The analysis results showed that the roundabout operated within City operational standards in the 2027 total traffic condition. SIDRA is an industry accepted program that uses similar delay-based methodology as the HCM 2010. Any movement with a v/c ratio greater than 1.0 triggers an LOS F for that movement. If the v/c ratio for any movement is equal to or less than 1.0, the delay criteria for unsignalized intersections, shown in Table 16, should be used.

4.4.3 Intersection Design (MMLOS)

The Multi-Modal Level of Service (MMLOS) Guidelines provide guidance on how to assess various LOS for the different modes of transportation and specify target levels of service for each mode, given the location and context of the transportation project. This all-in-one evaluation tool allows for comparison using similar performance metrics for each non-auto mode.

The MMLOS procedure is only applied to signalized intersections and the worst-performing approach at the intersection for any mode represents the overall intersection MMLOS for that mode. As indicated in Section 4.4.2.1, the proposed Cambrian Road and Street 23/ Mattamy Site Access intersection is expected to require signals by the 2027 background and total traffic conditions; therefore, analysis was completed for 2027 background and total traffic condition scenarios only. MMLOS was only completed for the proposed Cambrian Road and Street 23/ Mattamy Site Access intersection in the 2027 background and total traffic conditions.

The detailed MMLOS results are provided in Appendix G, and Intersection MMLOS results are provided in Table 12.

TABLE 12 – Intersection MMLOS – Future BG & Future BGSG Results

INTERSECTION	SCENARIO	LEVEL OF SERVICE			
		2027			
		P	B	T	TK
Cambrian Road and Street 23/ Mattamy Site Access	Future BG	C	F	D	F
	Future BGSG	C	F	D	F

Notes:
LOS = Level of Service; P = Pedestrian LOS; B = Bicycle LOS; T = Transit LOS; TK = Truck LOS
Future BG = Future Background Traffic; Future BGSG = Future Background and Site-Generated Traffic
No Intersection MMLOS results were produced for Cambrian Road and Borrisokane Road, as this intersection did not require signals for the 2021 Background or 2021 Background plus Site-generated planning horizons. MMLOS warrants only apply to signalized intersections.

4.4.3.1 Intersection Pedestrian Level of Service (PLOS)

The PLOS at intersections is based on several factors including the number of traffic lanes that pedestrians must cross, corner radii, and whether the crossing allows for permissive or protective right or left turns, among others. The City of Ottawa target for PLOS is C.

The proposed intersection of Cambrian Road and Street 23/ Mattamy Site Access was tested in the 2027 background and total traffic conditions. All of these scenarios met the City of Ottawa PLOS target of ‘C’.

4.4.3.2 Intersection Bicycle Level of Service (BLOS)

The BLOS at intersections is dependent on the number of lanes that the cyclist is required to cross to make a left-turn or on the presence of a dedicated right-turn lane on the approach, as well as the operating speed of each approach. The City target for BLOS is ‘C’.

The 2027 background and total traffic conditions were tested with traffic signals, and all resulted in a BLOS of ‘F’, due to the high operating speeds along the Cambrian Road (i.e. 60 km/h or greater), as well as the number of lanes that cyclists must cross to make a left-turn when left-turn lanes are added to an approach.

It should be noted that reducing the speed limit along Cambrian Road to 50km/h to match the urbanized section of the roadway to the east of Seeley’s Bay Street will significantly improve the BLOS.

4.4.3.3 Intersection Transit Level of Service (TLOS)

Intersection TLOS is based on the average signal delay experienced by transit vehicles at each intersection. The City Target TLOS is ‘C’.

The 2027 total traffic conditions result in a TLOS of ‘D’, which marginally exceeds the City’s TLOS target of ‘C’. The deterioration of the TLOS in the 2027 total traffic condition can be attributed to the approach delay experienced by vehicles exiting the Mattamy Site Access to the north in the morning peak period. All other approaches at this intersection experienced delays resulting in a TLOS of ‘C’.

4.4.3.4 Intersection Truck Level of Service (TKLOS)

The TKLOS is based on the right-turn radii, as well as the number of receiving lanes for vehicles making a right-turn from the traffic lane being analyzed. The City of Ottawa target for TKLOS is ‘D’.

The intersection of Cambrian Road and Street 23/ Mattamy Site Access has a TKLOS of ‘F’, which is attributed to the tighter turning radii and single-receiving lanes. The main purpose of this intersection is to provide access for local, residential traffic to the Half Moon Bay West and Meadows Phase 5 developments.

4.5 Transportation Demand Management

The City of Ottawa is committed to implementing Transportation Demand Management (TDM) measures on a City-wide basis in an effort to reduce the automobile dependence of Ottawa residents, particularly during the weekday peak travel periods. TDM initiatives are aimed at encouraging individuals to use non-auto modes of travel during the peak periods.

Mode shares used to estimate future development traffic were based on the 2011 TRANS OD Survey for the Traffic Assessment Zone where the proposed development is located. The non-auto transportation mode shares were left constant in the future, which was a conservative assumption. There are no employment uses proposed onsite. However, the development will still conform to the City’s TDM principles by providing direct connections to adjacent pedestrian, cycling and transit facilities where applicable.

4.6 Neighbourhood Traffic Management

4.6.1 Adjacent Neighbourhoods

The TIA Guidelines provide peak hour vehicular volume thresholds for local and collector roads that are located along significant access/ egress routes for the proposed development. For the subject site, Street 23 was proposed as the sole access for the subject development to connect directly with Cambrian Road to the north. To be conservative, it was assumed that 100% of development traffic utilized Street 23 to access/ egress the subject site. Street 17 provided a secondary site access/ egress location to the east; however, this is not a direct route to the arterial road network, and would force vehicles to navigate through the road network for the proposed Meadows Phase 4. As shown in Table 13, the proposed development is expected to generate less than 300 vehicles per hour per lane (vphpl) on Street 23, the threshold for a collector road.

The threshold of 120 vphpl for local roadways within the development is not expected to be exceeded, since traffic generated in the dominant direction by the entire development is expected to only marginally exceed the threshold for local roadways. Traffic utilizing the local roads to the east and west of Street 23, the collector road, will be further divided based on the resident’s location within the subject development.

TABLE 13 – Road Classification Capacity

STREET	SEGMENT	CAPACITY (VPHPL)	PEAK HOUR DEMAND IN PEAK DIRECTION (VPHPL)	
			AM	PM
Street 23	South of Cambrian Road	300	154	155

Notes: vphpl = vehicles per hour per lane

The results from **Table 13** show that the local roadways in the vicinity of the proposed development are expected to accommodate future traffic. The overall impact of congestion is not expected to adversely impact the role or function of the roadway.

4.6.2 Local Intersection Requirements

Local road intersections within the subject development are expected to be signalized (stop-controlled) on the side street movement. These requirements will be reviewed and confirmed at detailed design. All pavement marking and signage requirements are expected to follow City standards.

4.7 Transit

4.7.1 Route Capacity

The estimated future 2027 total transit passenger demand within the study area was provided in Section 3.1.2.4: Trip Generation by Mode. The results have been summarized in **Table 14**.

TABLE 14 – Development-Generated Transit Demand

PERIOD	PEAK PERIOD DEMAND	
	IN	OUT
AM	5	20
PM	20	11

The proposed development will generate a marginal amount of transit demand. Additional capacity and service improvements via transit priority measures were not deemed necessary.

When the realigned Greenbank Road is extended south of Cambrian Road, there will be opportunities for OC-Transpo to provide improved transit coverage for this development.

4.8 Review of Network Concept

Section 2.4.3 outlined nearby screenlines to the subject site, SL 42 – Rideau River (Manotick); and SL49 – Jock River, shown in **Exhibit 19**. A summary of 2031 Base and 2031 Network Concept demand and capacity scenarios have been provided in **Table 15**. The results of the 2031 Network Concept reflect the increase in roadway capacity associated with planned capital projects noted in the Transportation Master Plan (TMP), as compared with the 2031 Base scenario.

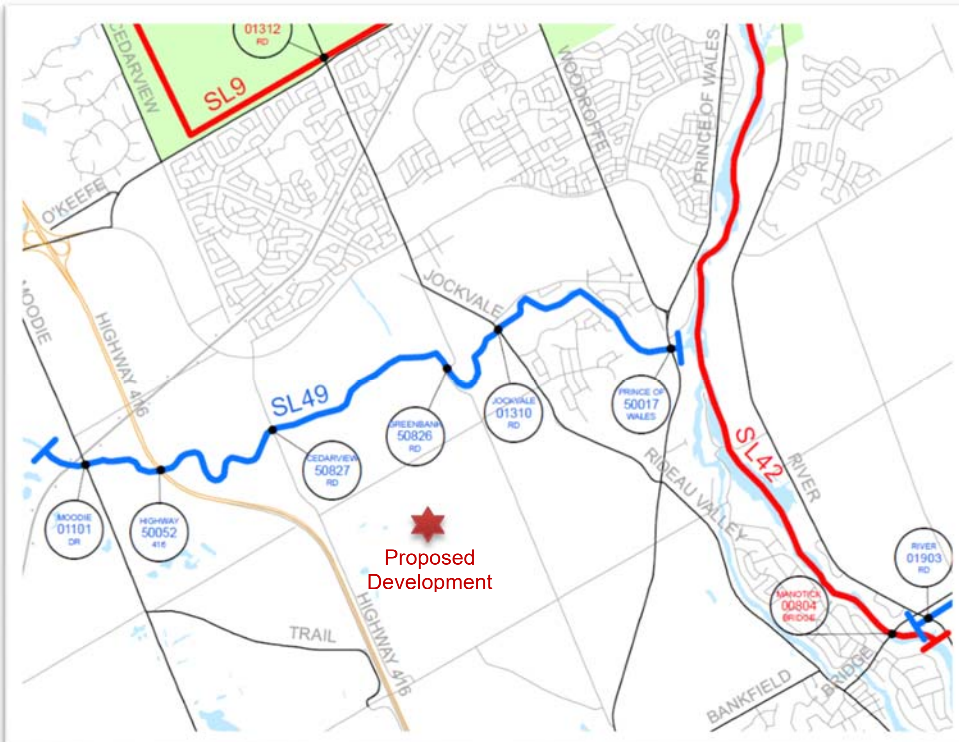
TABLE 15 – 2031 Development Generated Transit Demand

SCREENLINE	AM 2031 INBOUND (BASE)			AM 2031 INBOUND (NETWORK CONCEPT)		
	DEMAND	CAPACITY	V/C RATIO	DEMAND	CAPACITY	V/C RATIO
SL42 Rideau River (Manotick)	2,928	3,800	0.77	2,596	3,800	0.68
SL49 Jock River	6,405	10,200	0.63	6,642	13,200	0.50

Notes:
Table results from TMP – Final Report: Road Network Development Report

Proposed development traffic does not trigger any capacity deficiencies along nearby screenlines in either the 2031 Base Scenario or 2031 Network Concept. However, future road projects such as the widening of Cambrian Road, the realignment of Greenbank Road and widening of Strandherd Drive should be completed on schedule to reduce or spread traffic demand along nearby screenlines and help mitigate local traffic bottlenecks.

EXHIBIT 19 – Nearest Screenlines



4.9 Intersection Design

The study area intersections were evaluated in the morning and afternoon peak hour traffic conditions at the following horizons:

- Existing Traffic (2018)
- Future (2022) Background Traffic
- Future (2027) Background Traffic
- Future (2022) Total Traffic
- Future (2027) Total Traffic

The following intersection was included in this analysis:

- Cambrian Road and Borrisokane Road

4.9.1 Base Road Network

There were no future roadway modifications noted in the Transportation Master Plan (TMP) "Affordable Network," DC Background Study or Capital Budget Forecasts within the study area.

Roundabouts were only considered at unsignalized intersections if shown to be operating below City standards. Further discussion on the geometric requirements for auxiliary turn lanes and storage lengths at proposed access intersections has been provided in Section 4.10.1: Auxiliary Lane Analysis.

4.9.2 Intersection Analysis Criteria

4.9.2.1 Signalized Intersections

In qualitative terms, the Level-of-Service (LOS) defines operational conditions within a traffic stream and their perception by motorists. A LOS definition generally describes these conditions in terms of such factors as delay, speed and travel time, freedom to manoeuvre, traffic interruptions, safety, comfort and convenience. LOS can also be related to the ratio of the volume to capacity (v/c) which is simply the relationship of the traffic volume (either measured or forecast) to the capability of the intersection or road section to accommodate a given traffic volume. This capability varies depending on the factors described above. LOS are given letter designations from A to F. LOS “A” represents the best operating conditions and LOS “E” represents the level at which the intersection or an approach to the intersection is carrying the maximum traffic volume that can, practicably, be accommodated. LOS F indicates that the intersection is operating beyond its theoretical capacity.

The City of Ottawa has developed criteria as part of the Transportation Impact Assessment Guidelines, which directly relate the volume to capacity (v/c) ratio of a signalized intersection to a LOS designation. These criteria are shown in Table 16.

TABLE 16 – LOS Criteria for Signalized Intersections

LOS	VOLUME TO CAPACITY RATIO (v/c)
A	0 to 0.60
B	0.61 to 0.70
C	0.71 to 0.80
D	0.81 to 0.90
E	0.91 to 1.00
F	> 1.00

The intersection capacity analysis technique provides an indication of the LOS for each movement at the intersection under consideration and for the intersection as a whole. The overall v/c ratio for an intersection is defined as the sum of equivalent volumes for all critical movements at the intersection divided by the sum of capacities for all critical movements.

4.9.2.2 Unsignalized Intersections

The capacity of an unsignalized intersection can also be expressed in terms of the LOS it provides. For an un-signalized intersection, the Level of Service is defined in terms of the average movement delays at the intersection. This is defined as the total elapsed time from when a vehicle stops at the end of the queue until the vehicle departs from the stop line; this includes the time required for a vehicle to travel from the last-in-queue position to the first-in-queue position. The average delay for any particular minor movement at the un-signalized intersection is a function of the capacity of the approach and the degree of saturation.

The Highway Capacity Manual 2010 (HCM), prepared by the Transportation Research Board, includes the following Levels of Service criteria for un-signalized intersections, related to average movement delays at the intersection, as indicated in Table 17.

TABLE 17 – LOS Criteria for Unsignalized Intersections

LOS	DELAY (seconds)
A	<10
B	>10 and <15
C	>15 and <25
D	>25 and <35
E	>35 and <50
F	>50

The unsignalized intersection capacity analysis technique included in the HCM and used in the current study provides an indication of the Level of Service for each movement of the intersection under consideration. By this technique, the performance of the unsignalized intersection can be compared under varying traffic conditions, using the Level of Service concept in a qualitative sense. One unsignalized intersection can be compared with another unsignalized intersection using this concept. Level of Service 'E' represents the capacity of the movement under consideration and generally, in large urban areas, Level of Service 'D' is considered to represent an acceptable operating condition (Level of Service 'E' is considered an acceptable operating condition for planning purposes for intersections located within Ottawa's Urban Core— the downtown and its vicinity). Level of Service 'F' indicates that the movement is operating beyond its design capacity.

4.9.2.3 Roundabout Analysis

The Roundabout Feasibility Screening Tool was not completed for the intersection of Cambrian Road and Borrisokane Road, as this intersection does not satisfy any of the following conditions that require a roundabout to be considered:

(1) It is not a new City intersection
(2) Traffic signals are not warranted at this intersection through to the 2027 total traffic condition
(3) There were no capacity or safety problems are experienced through to the 2027 total traffic condition

The Roundabout Feasibility Screening Tool was completed for the proposed intersection of Cambrian Road and Street 23/ Mattamy Site Access, as discussed in Section 4.4.2.2.

4.9.3 Intersection Control

4.9.3.1 Traffic Signal Warrant Methodology

Traffic control signal warrants were completed for all unsignalized stop or yield controlled intersections. The warrant procedures for both existing and future conditions were based on the established methodology outlined in the Ontario Traffic Manual, Book 12, Ministry of Transportation Ontario (MTO), 2012.

Traffic signals are warranted at the intersection of

For future traffic conditions, an Average Hourly Volume (AHV) for each intersection approach is estimated using the following equation and applied to the warrant procedure:

$$\text{Average Hourly Volume} = \frac{\text{AM Peak Hour Volume + PM Peak Hour Volume}}{4}$$

4.9.3.2 Traffic Signal Warrants

The traffic signal warrants were not triggered in the 2027 total traffic condition at the Cambrian Road and Borrisokane Road intersection. Details of the traffic signal warrants analyses described above are included in Appendix H.

4.9.4 Intersection Design (Operations)

4.9.4.1 Intersection Analysis Methodology

Using the established intersection capacity analysis criteria described above, the existing and future conditions were analyzed during the weekday peak hour traffic volumes derived in the previous sections of this report.

The worst/ critical observed LOS movement at each study area intersection was recorded; if the LOS was E or lower, it was compared to the intersection LOS. If the intersection LOS was also indicated to be below City standards, potential roadway modifications or measures were considered and the intersection was re-evaluated. Any recommended modifications would be carried forward to the following horizon.

The following section presents the results of the intersection capacity analysis and roundabout capacity analysis. All tables summarize study area intersection LOS results during the morning and afternoon peak hour periods. The Synchro and SIDRA analysis output files have been provided in Appendix J.

4.9.4.2 Existing (2018) Traffic Results

The existing (2018) intersection capacity analysis was based on morning and afternoon peak hour traffic volumes. A summary of the results has been provided in Table 18.

TABLE 18 – Intersection Capacity Analysis: Existing (2018) Traffic

INTERSECTION	CONTROL	PEAK HOUR	V/C RATIO		LEVEL OF SERVICE	
			CRITICAL MOVEMENT	INTERSECTION	CRITICAL MOVEMENT	INTERSECTION
Cambrian Road and Borrisokane Road	WB Stop	AM	0.44	-	B	-
		PM	0.26	-	B	-

Notes: EB = eastbound; WB = westbound; NB = northbound; SB = southbound

4.9.4.3 2022 Background Traffic Results

The 2022 background traffic condition intersection capacity analysis for total background traffic was completed using morning and afternoon peak hour traffic volumes. A summary of the results has been provided in Table 19.

TABLE 19 – Intersection Capacity Analysis: Future (2022) Background Traffic

INTERSECTION	CONTROL	PEAK HOUR	V/C RATIO		LEVEL OF SERVICE	
			CRITICAL MOVEMENT	INTERSECTION	CRITICAL MOVEMENT	INTERSECTION
Cambrian Road and Borrisokane Road	WB Stop	AM	0.44	-	B	-
		PM	0.27	-	B	-

Notes: EB = eastbound; WB = westbound; NB = northbound; SB = southbound

4.9.4.4 2027 Background Traffic Results

The 2027 background traffic condition intersection capacity for total background traffic analysis was completed using morning and afternoon peak hour traffic volumes. All recommended modifications from the 2022 background traffic condition have been carried forward to this horizon. A summary of the results has been provided in Table 20.

TABLE 20 – Intersection Capacity Analysis: Future (2027) Background Traffic

INTERSECTION	CONTROL	PEAK HOUR	V/C RATIO		LEVEL OF SERVICE	
			CRITICAL MOVEMENT	INTERSECTION	CRITICAL MOVEMENT	INTERSECTION
Cambrian Road & Borrisokane Road	WB Stop	AM	0.62	-	C	-
		PM	0.52	-	C	-
Cambrian Road and Street 23/ Mattamy Site Access	NB/ SB Stop	AM	0.99	-	F	-
		PM	0.96	-	F	-
	Traffic Signals [a]	AM	0.78	-	C	-
		PM	0.64	-	B	-
	Roundabout [b]	AM	0.55	-	B	B
		PM	0.63	-	B	B

Notes: EB = eastbound; WB = westbound; NB = northbound; SB = southbound
Summary of Modifications:
1 - Cambrian Road and Street 23/ Mattamy Site Access intersection
  a. Traffic Signals
    i. Construct north leg (Mattamy Site Access) with 70m SBL storage lane
    ii. Construct south leg (Street 23) with 20m NBL storage lane
    iii. Construct 40m EBL storage lane
    iv. Construct 15m WBL storage lane and 15m WBR storage lane
  b. Single-lane roundabout
    i. Construct north and south legs of intersection with shared-turning lanes on all approaches

4.9.4.5 2022 Total Traffic Results

The 2022 total traffic condition intersection capacity analysis was completed using morning and afternoon peak hour traffic volumes. A summary of the results has been provided in Table 21.

TABLE 21 – Intersection Capacity Analysis: Future (2022) Total Traffic

INTERSECTION	CONTROL	PEAK HOUR	V/C RATIO		LEVEL OF SERVICE	
			CRITICAL MOVEMENT	INTERSECTION	CRITICAL MOVEMENT	INTERSECTION
Cambrian Road & Borrisokane Road	WB Stop	AM	0.69	-	C	-
		PM	0.63	-	C	-
Cambrian Road & Street 23	NB Stop [1]	AM	0.31	-	C	-
		PM	0.25	-	C	-

Notes: EB = eastbound; WB = westbound; NB = northbound; SB = southbound
Summary of Modifications:
1 - Cambrian Road and Street 23
  a. Construct NB stop-controlled access with shared-through turning lane
  b. Construct 15m WBL storage lane
  c. Construct provisional EBL left-turn lane to ensure symmetry between eastbound and westbound through lanes

4.9.4.6 2027 Total Traffic Results

The 2027 total traffic condition intersection capacity analysis was completed using morning and afternoon peak hour traffic volumes. All recommended modifications from the 2022 total traffic condition have been carried forward to this horizon. A summary of the results has been provided in Table 22.

TABLE 22 – Intersection Capacity Analysis: Future (2027) Total Traffic

INTERSECTION	CONTROL	PEAK HOUR	V/C RATIO		LEVEL OF SERVICE	
			CRITICAL MOVEMENT	INTERSECTION	CRITICAL MOVEMENT	INTERSECTION
Cambrian Road & Borrisokane Road	WB Stop	AM	0.74	-	C	-
		PM	0.71	-	C	-
Cambrian Road & Street 23/ Mattamy Site Access	NB/ SB Stop [a]	AM	1.16	-	F	-
		PM	1.41	-	F	-
	Traffic Signals [b]	AM	0.80	-	C	-
		PM	0.77	-	C	-
	Roundabout [c]	AM	0.61	-	C	B
		PM	0.77	-	C	C

Notes: EB = eastbound; WB = westbound; NB = northbound; SB = southbound
Summary of Modifications:
1 - Cambrian Road and Street 23/ Mattamy Site Access intersection
   a. NB/ SB stop-controlled intersection
      i. Construct north leg (Mattamy Site Access) with shared through-turning lane
   b. Traffic Signals
      i. Construct north leg (Mattamy Site Access) with 70m SBL storage lane
      ii. Construct 40m EBL storage lane, 20m NBL storage and 15m WBR storage lane
   c. Single-lane roundabout
      i. Construct north leg of intersection (Mattamy Site Access)
      ii. Shared turning lanes on all approaches

4.9.5 Intersection Design (MMLOS)

The MMLOS Guidelines provide guidance on how to assess the various LOS for the different modes of transportation and what the specific target service levels for each mode should be given the location and context of the transportation project. This all-in-one evaluation tool will allow comparisons using similar performance metrics for each non-auto mode. The MMLOS procedure is only applied to signalized intersections and the worst performing approach at the intersection for any mode represents the overall intersection MMLOS for that mode, as per the MMLOS Guidelines.

MMLOS was only completed for the proposed Cambrian Road and Street 23/ Mattamy Site Access intersection in the 2027 background and total traffic conditions. No MMLOS results were produced for Cambrian Road and Borrisokane Road, as this intersection did not require signals through to the 2027 total traffic condition.

Refer to Section 4.4.3 for results of the MMLOS for Cambrian Road and Street 23/ Mattamy Site Access. The detailed MMLOS results are provided in Appendix G.

4.10 Geometric Review

The following section reviews all geometric requirements for the study area intersections. All relevant excerpts from referenced technical standards have been provided in Appendix K.

4.10.1 Auxiliary Lane Analysis

Auxiliary turning lane lengths for all study area intersections were evaluated for unsignalized intersections.

4.10.1.1 Unsignalized Auxiliary Left-Turn Lane Requirements

The MTO Geometric Design Standards for Ontario Highways left-turn warrant was applied to main-street approaches at all unsignalized intersections using the highest left-turn volume from either the morning or afternoon peak hour.

The results have been summarized below in **Table 23.**

TABLE 23 – Auxiliary Left-Turn Lane Analysis at Unsignalized Intersections

INTERSECTION	MOVEMENT	POSTED SPEED (KM/H)	DESIGN SPEED (KM/H)	LEFT-TURN VOLUME (VPH)	APPROACH VOLUME (VPH)	OPPOSING VOLUME (VPH)	LEFT-TURN STORAGE (M)
Cambrian Road & Street 23	WBL	70	80	54	282	516	15 [1,2,3]
Borrisokane Road and Cambrian Road	SBL	80	90	644	700	96	120 [1,2]

Notes: WBL = westbound left-turn; SBL = southbound left-turn

[1] Left-turn lanes requirements will be reviewed during detailed design stage

[2] Recommended storage lengths do not include deceleration lane and taper lengths. Units rounded to nearest 5m.

[3] The City requires a minimum 35m storage length for left-turn lanes along arterial roads. Recommended left-turns storage lengths were based on the 95th percentile queue lengths from Synchro, and did not consider parallel deceleration or taper length requirements from TAC. Left-turn lane requirements will be reviewed and confirmed during detailed design.

Cambrian Road and Street 23

Auxiliary left-turn lane analysis was completed under 2022 total traffic conditions for the Cambrian Road and Street 23 intersection, triggering a 15m westbound left-turn storage lane. This intersection is expected to require traffic signals with the construction of the north leg for the Mattamy Site Access, as part of the Half Moon Bay West development in 2027. Signalized auxiliary left-turn lane analysis for this intersection will be verified in Section 4.10.1.2 under the 2027 total traffic condition.

In order to ensure symmetry of the eastbound and westbound through lanes at the Cambrian Road and Street 23 intersection, provisions for an eastbound left-turn lane are recommended to be constructed to oppose the proposed westbound left-turn in the 2022 total traffic condition. Street 23 should be constructed with an 11m pavement width to ensure that there is sufficient width to accommodate a left-turn lane, if one is required in the future.

Cambrian Road and Borrisokane Road

The storage length requirements for the southbound approach of the Cambrian Road and Borrisokane Road intersection could not be properly assessed using the MTO left-turn warrant, due to the high number of southbound left-turning vehicles in all planning horizons through to the 2027 total traffic condition. The proportion of southbound left-turning vehicles was approximately 90% of the overall southbound approach volumes. Graphs provided for left-turn warrant analysis only allow for the assessment of left-turns up to 40% of the total approach volume, which yielded a storage length of 30m. To determine the southbound left-turn storage length required in the worst-case scenario, the Cambrian Road and Borrisokane Road intersection was tested as an all-way stop in Synchro. This provided a very conservative 95th percentile queue length of 140m for the southbound left-turn. In the Half Moon Bay West Community Transportation Study (CTS), a 120m southbound left-turn storage length was shown to accommodate vehicular traffic through to the ultimate planning horizon with traffic signals at Cambrian Road and Borrisokane Road. Therefore, in this

TIA, it was reasonable to assume that a maximum southbound left-turn storage length of 120m would provide sufficient storage through to the ultimate planning horizon with the existing free-flow traffic condition along Borrisokane Road.

The recommended left-turn storage lanes for both intersections should be reviewed and confirmed during detailed design.

4.10.1.2 Signalized Auxiliary Left-Turn Lane Requirements

A review of auxiliary left-turn lane storage requirements was completed at the intersection of Cambrian Road and Street 23/ Mattamy Site Access, the only intersection within the study area expected to require signalization in the 2027 total traffic condition. The review compared the projected 95th percentile queue lengths from Synchro operational results, and the City of Ottawa queue length calculation based on the following equation:

$$Storage\ Length, S = \frac{NL}{C} \times 1.5$$

Where:
N = number of vehicles per hour
L = Length occupied by a vehicle in the queue = 7 m
C= number of traffic signal cycles per hour (3600 seconds per hour/cycle length)

The results of the auxiliary left-turn lane analysis storage lengths are summarized below in Table 24.

TABLE 24 – Recommended Auxiliary Left-Turn Storage Lengths at Signalized Intersections

INTERSECTION	APPROACH	95TH %ILE QUEUE LENGTH (M)	CITY QUEUE LENGTH (M)	EXISTING STORAGE LENGTH (M)	RECOMMENDED ADDITIONAL STORAGE LENGTH (M)
Cambrian Road and Street 23/ Mattamy Site Access	NB	<10	20	-	20
	WB	10	15	-	15 [1]

Recommended storage lengths do not include deceleration lane and taper lengths. Units rounded to nearest 5m.
- Synchro extrapolated queue lengths at congested intersections. From Synchro 9 User Guide, "In practice, 95th percentile queue lengths will rarely be exceeded and the queues shown with the # footnote are acceptable in the design of storage bays."
1 The City requires a minimum 35m storage length for left-turn lanes along arterial roads. Recommended left-turns storage lengths were based on the 95th percentile queue lengths from Synchro, and did not consider parallel deceleration or taper length requirements from TAC. Left-turn lane requirements will be reviewed and confirmed during detailed design.

The following auxiliary storage lanes were recommended at the intersection of Cambrian Road and Street 23/ Mattamy Site Access in the Half Moon Bay West Community Transportation Study (CTS) – Addendum No. 1:

- A 40m eastbound left-turn storage lane
- A 70m southbound left-turn storage lane

As previously recommended in Section 4.10.1.1, Street 23 should be constructed with an 11m pavement width to meet the current standards width for a collector road. This will ensure that there is sufficient roadway width to accommodate a northbound left-turn lane at the Cambrian and Street 23/ Mattamy Site Access. The results of this traffic study indicated that a 20m northbound left-turn lane was required in the 2027 background and total traffic conditions, as per the City queue length calculation.

A 15m westbound left-turn storage lane was able to accommodate traffic in the 2027 total traffic condition, according to the 95th percentile Synchro results and the City of Ottawa queue length calculation.

The recommended left-turn storage lengths should be reviewed and confirmed during detailed design.

4.10.1.3 Unsignalized Auxiliary Right-Turn Lane Requirements

There is currently no formal City or MTO warrant procedure governing the application of auxiliary right-turn lanes at unsignalized intersections. Referring to TAC standards, Section 9.14.2 suggests an auxiliary right-turn lane be considered "when the volume of decelerating or accelerating vehicles compared with the through traffic volume causes undue hazard." Field observations did not note any undue hazard; auxiliary right-turn lanes were not recommended at the Borrisokane Road and Cambrian Road intersection.

At the time of this study, there were no right-turn lanes provided at the intersection of Borrisokane Road and Cambrian Road. A westbound right-turn lane may be warranted under 2027 total traffic condition, due to the high number of right-turning vehicles anticipated in the morning peak period, which exceeded 600 vehicles per hour.

Right-turn lane requirements should be reviewed and confirmed during detailed design.

4.10.1.4 Signalized Auxiliary Right-Turn Lane Requirements

Signalized auxiliary right-turn lane requirements were verified using the worst AM or PM peak hour volumes in the 2027 total traffic condition. Section 9.14 of TAC recommends implementing a right-turn lane when more than 20% of vehicles on an approach are turning right, and generally when the peak hour demand exceeds 60 vehicles per hour. The results of the auxiliary right-turn lane analysis are summarized below in Table 25.

A westbound right-turn lane is warranted at the intersection of Cambrian Road and Street 23/ Mattamy Site Access. The requirements for a westbound right-turn lane are triggered in the 2027 background and total traffic conditions, and a westbound right-turn was recommended in the Half Moon Bay West Community Transportation Study (CTS) – Addendum No. 1 at this intersection.

Even though the peak hour volume requirement of 60 right-turning vehicles was met on the southbound and eastbound approaches of the Cambrian Road and Street 23/ Mattamy Site Access intersection under the 2027 total traffic conditions, Synchro results indicated that right-turn lanes on the eastbound and southbound approaches were not necessary for the intersection to operate within City standards. The southbound approach was anticipated to have very few vehicles travelling southbound through, so it was assumed that right-turn lane may be able to remain as a shared through-right turning lane, and the eastbound approach did not exceed the 20% threshold for right-turning vehicles.

Right-turn lane requirements should be reviewed and confirmed during detailed design.

TABLE 25 – Recommended Auxiliary Right-Turn Storage Lengths at Signalized Intersections

INTERSECTION	APPROACH	RIGHT TURN VOLUME	APPROACH VEHICLES TURNING RIGHT (%)	95TH %ILE QUEUE LENGTH (M)	EXISTING STORAGE LENGTH (M)	RECOMMENDED ADDITIONAL STORAGE LENGTH (M)
Cambrian Road and Street 23/ Mattamy Site Access	EB	101	15%	<10	-	Not warranted at this time [1]
	WB	250	40%	15	-	15 [1,2,3]
	NB	54	35%	<10	-	Not warranted at this time [1]
	SB	77	23%	<10	-	Not warranted at this time [1]

[1] Right-turn lanes requirements will be reviewed during detailed design stage

[2] Recommended storage lengths do not include deceleration lane and taper lengths. Units rounded to nearest 5m.

[3] The City requires a minimum 35m storage length for right-turn lanes along arterial roads. Recommended right-turns storage lengths were based on the 95th percentile queue lengths from Synchro, and did not consider parallel deceleration or taper length requirements from TAC. Right-turn lane requirements will be reviewed and confirmed during detailed design.

4.11 Summary of Improvements Indicated and Modification Options

4.11.1 Cambrian Road and Borrisokane Road

The Cambrian Road and Borrisokane Road intersection was shown to operate within City standards through to the 2027 total traffic condition with the existing lane configurations and stop-controlled westbound approach.

A westbound right-turn lane and a 120m westbound left-turn storage lane may be required to accommodate traffic from the Half Moon Bay West Development. Auxiliary lane requirements should be reviewed and confirmed during detailed design.

4.11.2 Cambrian Road and Street 23/ Mattamy Site Access

Under the 2022 total traffic condition, the proposed intersection of Cambrian Road and Street 23 was proposed as an unsignalized T-intersection with a northbound stop-controlled approach. The intersection was shown to operate within City standards in the 2022 planning horizon with shared-through lanes on all approaches.

MTO left-turn lane requirements triggered a 15m westbound left-turn storage lane with the 2022 total traffic demand. According to TAC Section 9.1.2.3, provisions should also be provided for the construction of an eastbound left-turn lane to ensure symmetry between eastbound and westbound approach and departure lanes, which will mitigate the risk of potential collisions between left-turns and opposing through traffic, once the north leg of the intersection is constructed.

By 2027, the Mattamy Site Access was assumed to be constructed to provide access to the Half Moon Bay West development to the north of Cambrian Road. The intersection did not conform to City operational standards with northbound and southbound stop-controlled approaches, and signal warrants were triggered under 2027 total traffic conditions. Based on the results of the OTM signal warrants and the Roundabout Feasibility Screening Tool, it was recommended to either implement traffic signals or a single-lane roundabout at this intersection. Both are considered acceptable solutions to accommodate the traffic demand in the 2027 total traffic condition.

Synchro results indicated that if the Cambrian Road and Street 23/ Mattamy Site Access intersection was signalized, a 15m westbound left-turn storage lane and 15m westbound right-turn storage lane would be sufficient to accommodate total traffic demand in 2027. According to the Community Transportation Study (CTS) for Half Moon Bay West – Addendum No. 1 (November 2017), a 70m southbound left-turn storage lane and a 40m eastbound left-turn storage lane were required at the intersection. In order to maintain the alignment of the northbound and southbound through lanes, a northbound left-turn with a storage length of 20m should be provided at the intersection to oppose the southbound left-turn lane.

4.11.3 Summary of Conclusions and Recommendations

The key conclusions from the TIA Analysis Report are as follows:

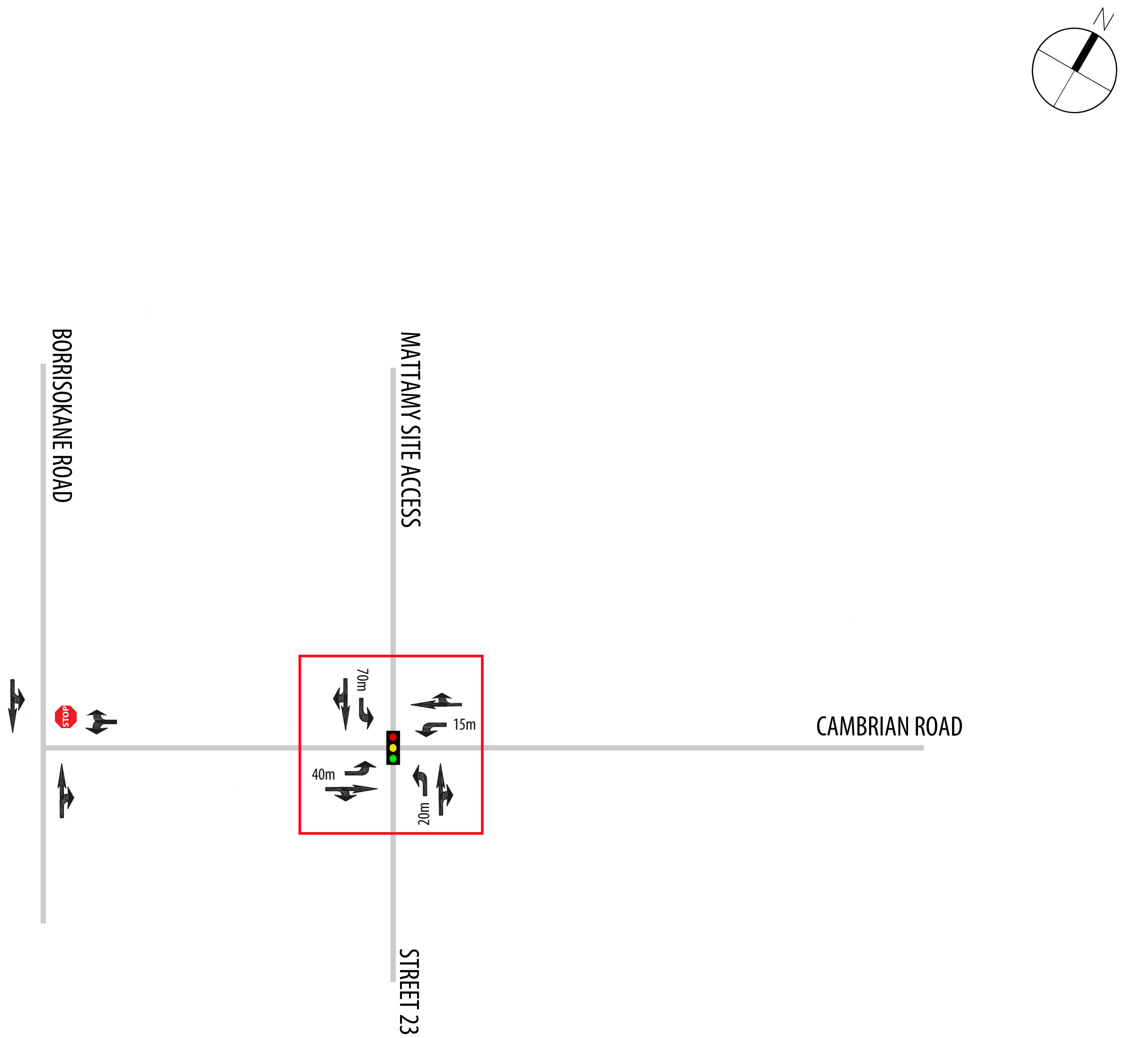
- The study area transportation network is expected to accommodate site-generated traffic volumes through to the 2027 horizon year. Tamarack Homes shall be responsible for constructing all required access intersections and internal transportation facilities as dictated by the proposed draft plan.
- There is a requirement for an RMA to construct Street 23 from the subject lands, crossing through Mattamy's lands, and connecting with Cambrian Road to the north. Street 23 is proposed as a north-south collector road, and is required to provide vehicular access to the subject site. Mattamy Homes shall be responsible for constructing further roadway modifications at the intersection of Cambrian Road and Street 23 to accommodate traffic generated from the future Half Moon Bay West Development.

- There is no requirement for a monitoring plan.

A summary of all recommendations has been provided in **Table 26**. The recommended design for all off-site roadway modifications in the 2027 total traffic condition has been provided in **Exhibit 20**.

TABLE 26 – Summary of Recommended Actions/ Modifications

HORIZON	RECOMMENDED ACTIONS/ MODIFICATIONS
Existing (2018)	Cambrian Road and Borrisokane Road • Meets City operational guidelines
Future (2022) Background – No Meadows Phase 5 Traffic	Assume all modifications from the Existing (2018) traffic conditions remain. No further recommendations. Cambrian Road and Borrisokane Road • Meets City operational guidelines
Future (2022) Total – With Meadows Phase 5 Traffic	Assume all modifications from the Existing (2018) traffic conditions remain. No further recommendations. Cambrian Road and Borrisokane Road • Meets City operational guidelines Cambrian Road and Street 23 • Unsignalized Intersection – Tamarack Homes ➢ Construct south leg (Street 23) with shared lane ➢ Northbound stop-controlled ➢ Construct 15m westbound left-turn storage lane and provision for an eastbound left-turn lane
Future (2027) Background – No Meadows Phase 5 Traffic	Assume all modifications from the Future (2022) Background traffic conditions remain. Cambrian Road and Borrisokane Road • Meets City operational guidelines • City of Ottawa – construct 120m southbound left-turn storage lane • City of Ottawa – construct westbound right-turn lane Cambrian Road and Street 23/ Mattamy Site Access • Traffic Signals – Mattamy Homes ➢ Construct north leg (Mattamy Site Access) with 70m southbound left-turn storage lane ➢ Construct south leg (Street 23) with 20m northbound left-turn storage lane ➢ Construct 40m eastbound left-turn storage lane ➢ Construct 15m westbound left-turn storage lane and 15m westbound right-turn storage lane OR • Single-lane roundabout – Mattamy Homes ➢ Construct north leg (Mattamy Site Access) with shared through-turning lane ➢ Construct south leg (Street 23) with shared through-turning lane
Future (2027) Total – With Meadows Phase 5 Traffic	Assume all modifications from the Future (2022) Total traffic conditions remain. No further recommendations. Cambrian Road and Borrisokane Road • Meets City operational guidelines • City of Ottawa – Construct 120m southbound left-turn storage lane • City of Ottawa – Construct westbound right-turn lane Cambrian Road and Street 23/ Mattamy Site Access • Traffic Signals – Mattamy Homes ➢ Construct north leg (Mattamy Site Access) with 70m southbound left-turn storage lane ➢ Construct 20m northbound left-turn storage lane ➢ Construct 40m eastbound left-turn storage lane ➢ Construct 15m westbound right-turn storage lane OR • Single-lane roundabout – Mattamy Homes ➢ Construct north leg (Mattamy Site Access) with shared through-turning lane ➢ Construct south leg (Street 23) with shared through-turning lane



LEGEND

STOP CONTROL

TRAFFIC CONTROL SIGNAL

TRAVEL LANES AND PERMITTED MOVEMENTS

XXm AUXILIARY STORAGE LENGTHS (METRES) DOES NOT INCLUDE TAPER

RECOMMENDED MODIFICATION

IBI

The Meadows Phase 5
Transportation Impact Assessment

EXHIBIT 20
Future (2027) Lane Configurations and Intersection Control

PROJECT No.: 115637
DATE: APRIL 2018
SCALE: NTS

TAMARACK

The Meadows Phase 5

Transportation Impact Assessment Report

Appendix A: Traffic Data

April 2018

IBI

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	Borrisokane Road	N/S STREET TOTAL	0	Cambrian Road	E/W STREET TOTAL	Grand TOTAL
		Northbound	Southbound		Eastbound	Westbound		
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					Borrisokane Road					N/S STREET TOTAL	0					Cambrian Road					E/W STREET TOTAL	Grand TOTAL
		Northbound					Southbound						Eastbound					Westbound						
		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**

TAMARACK

The Meadows Phase 5

Transportation Impact Assessment Report

Appendix B: OC Transpo Maps

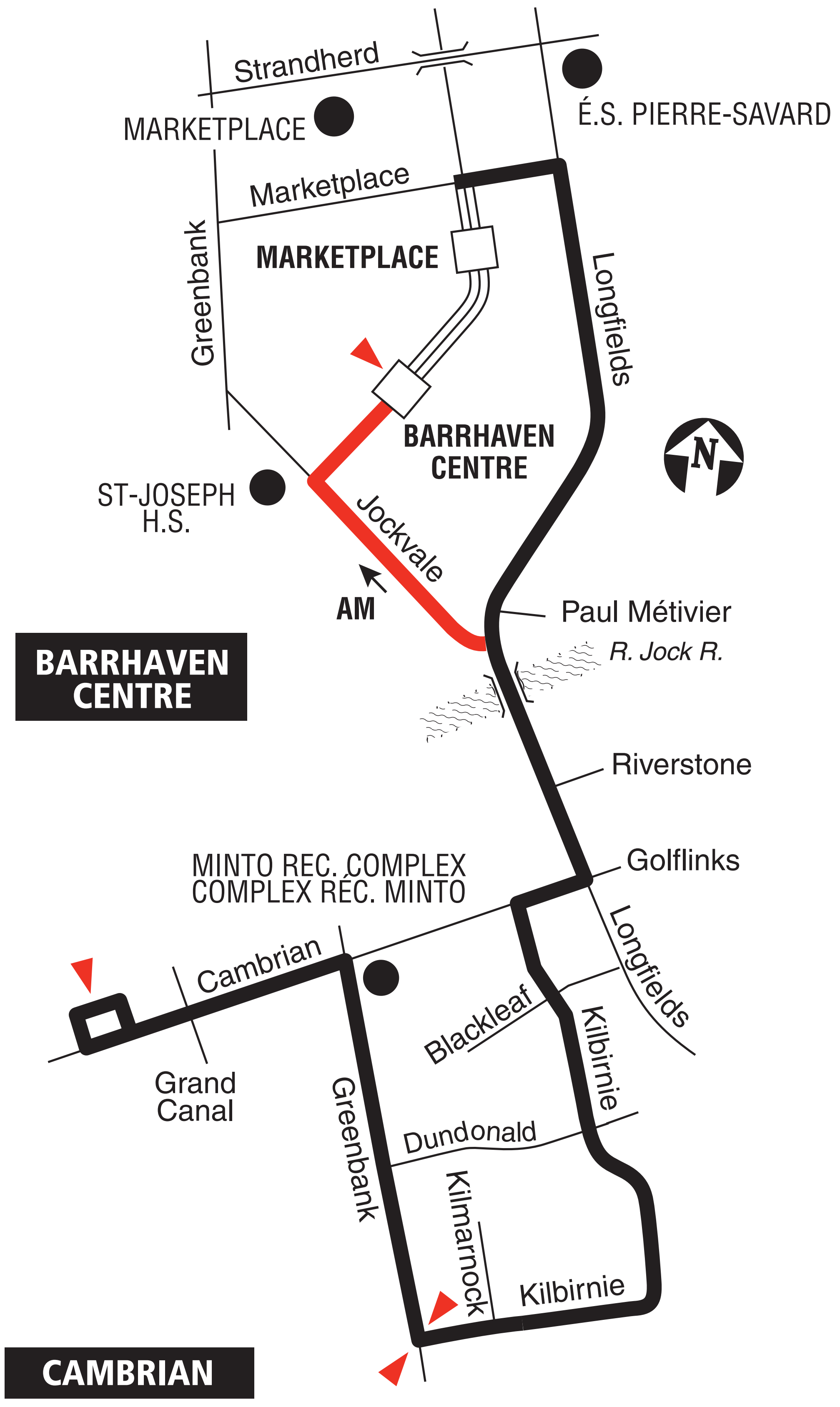
April 2018

IBI

177 BARRHAVEN CENTRE / CAMBRIAN

Local

7 days a week / 7 jours par semaine
No Sunday evening service
Aucun service de soirée le dimanche



Legend • *Légende*

- Transitway & Station / *Transitway & station*
- Peak Periods only / *Périodes de pointe seulement*
- Park & Ride / *Parc-o-bus*
- Timepoint / *Heures de passage*

2017.01

Schedule / Horaire....... 613-560-1000
Text / Texto 560560
plus your four digit bus stop number / *plus* votre numéro d'arrêt à quatre chiffres

Customer Relations
Service à la clientèle **613-842-3600**
Lost and Found / Objets perdus...... **613-563-4011**
Security / Sécurité..................... **613-741-2478**

Effective September 6, 2015
En vigueur 6 septembre 2015

OC Transpo **INFO 613-741-4390**
octranspo.com

The Meadows Phase 5

Transportation Impact Assessment Report

Appendix C: Collision Data

April 2018

IBI

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	

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

TAMARACK

The Meadows Phase 5

Transportation Impact Assessment Report

Appendix D: Cambrian Road Widening EA

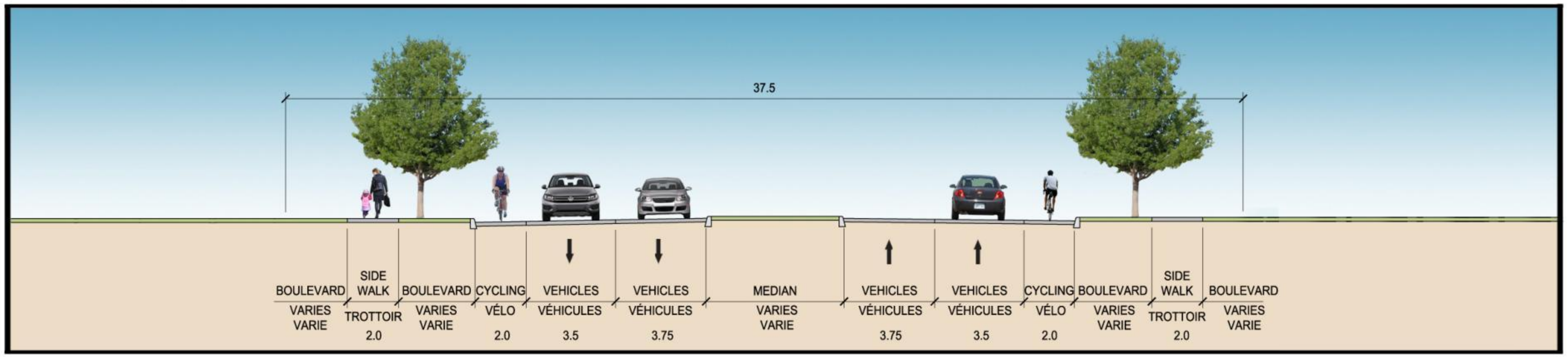
April 2018

IBI

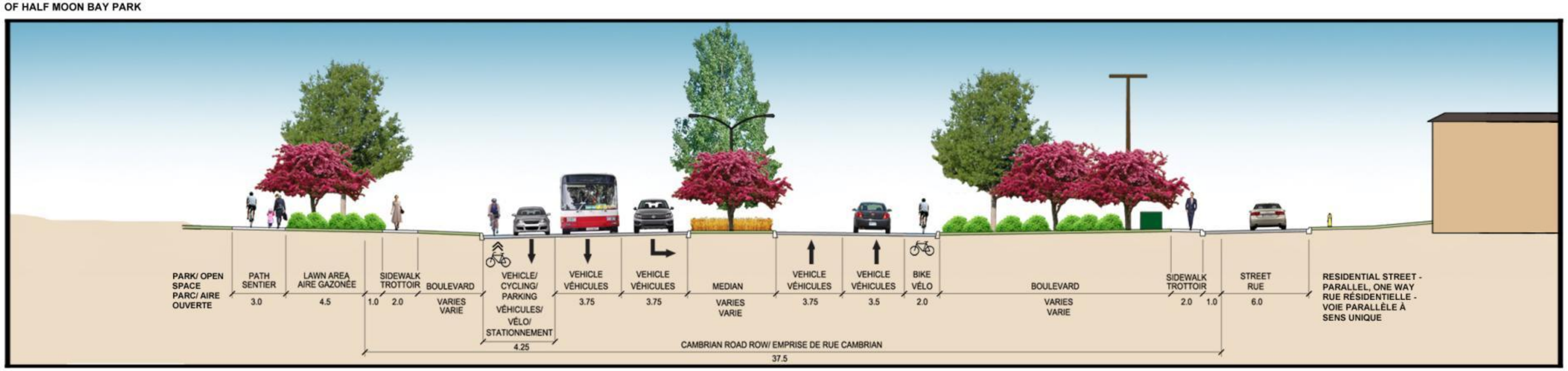
Document 3 - Illustrative Plan of the Recommended Ultimate Four-Lane Design

Cross-Section illustrations of the Ultimate Four-Lane Design and modifications in the vicinity of Half-Moon Bay Park

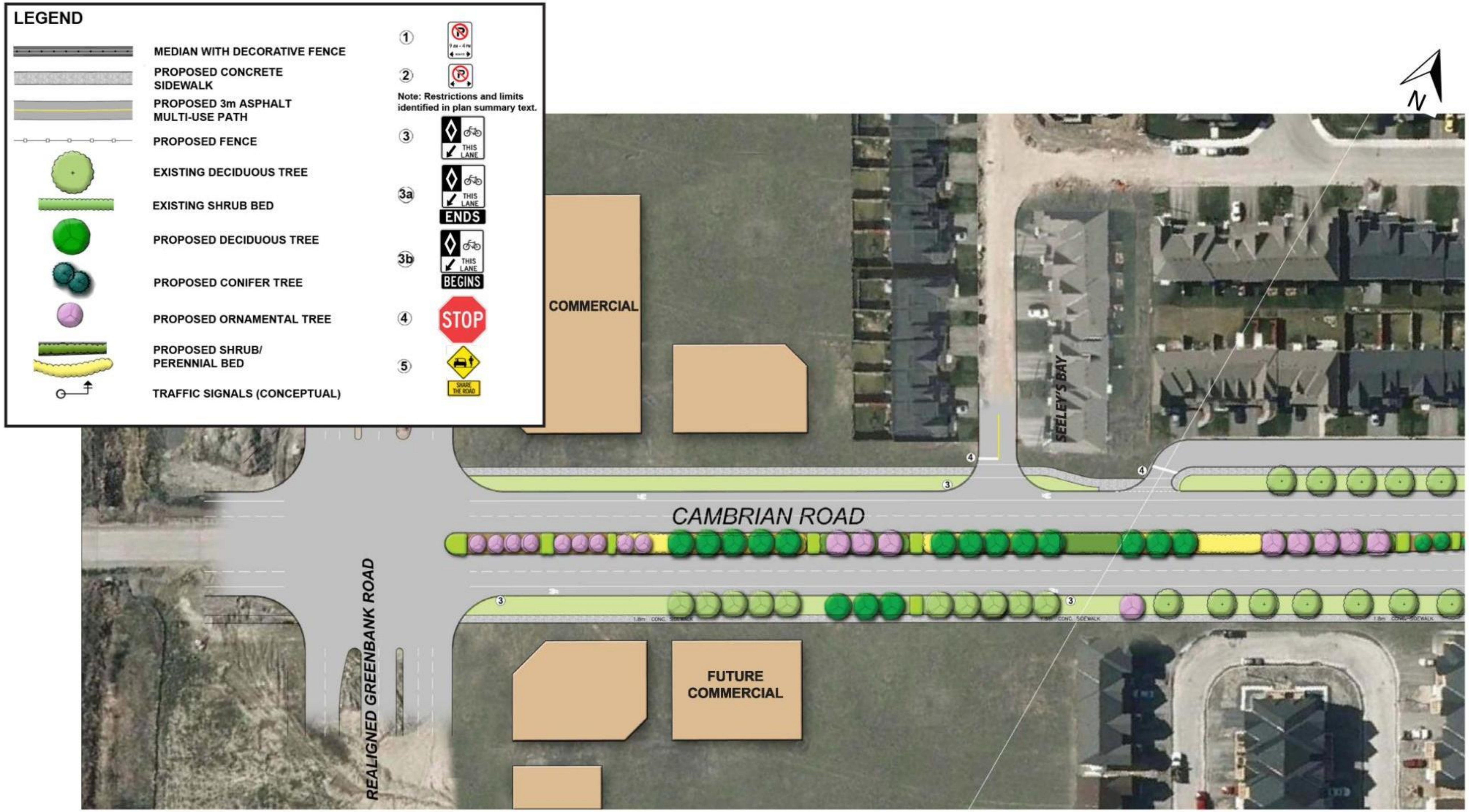
ULTIMATE TYPICAL CROSS SECTION



ULTIMATE CROSS SECTION IN VICINITY
OF HALF MOON BAY PARK



Recommended Ultimate Design for Four-Lane Deign for Cambrian Road



RECOMMENDED PLAN 4-LANE DESIGN
REALIGNED GREENBANK ROAD TO SEELEY'S BAY

RECOMMENDED PLAN 4-LANE DESIGN
SEELEY'S BAY TO RIVER MIST ROAD

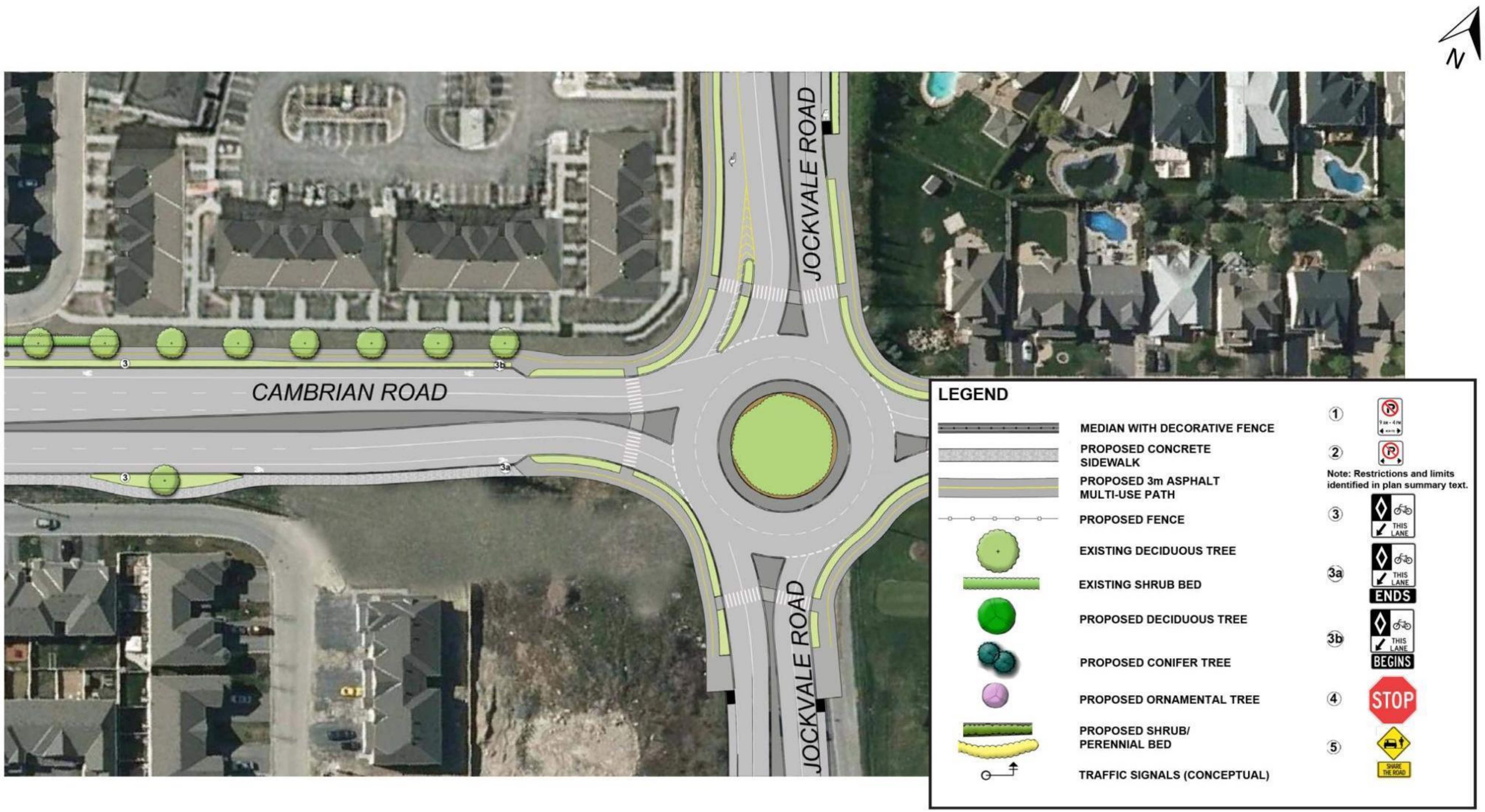
RECOMMENDED PLAN 4-LANE DESIGN
RIVER MIST ROAD TO REGATTA AVENUE

RECOMMENDED PLAN 4-LANE DESIGN

GREENBANK ROAD TO ST. CECILIA ELEMENTARY SCHOOL

RECOMMENDED PLAN 4-LANE DESIGN

ST. CECILIA ELEMENTARY SCHOOL TO TUSCANA WAY/KILBIRNIE DRIVE



RECOMMENDED PLAN 4-LANE DESIGN

TUSCANA WAY/KILBIRNIE DRIVE TO JOCKVALE ROAD

The Meadows Phase 5

Transportation Impact Assessment Report

Appendix E: ITE Trip Generation Data

April 2018

Single-Family Detached Housing
(210)

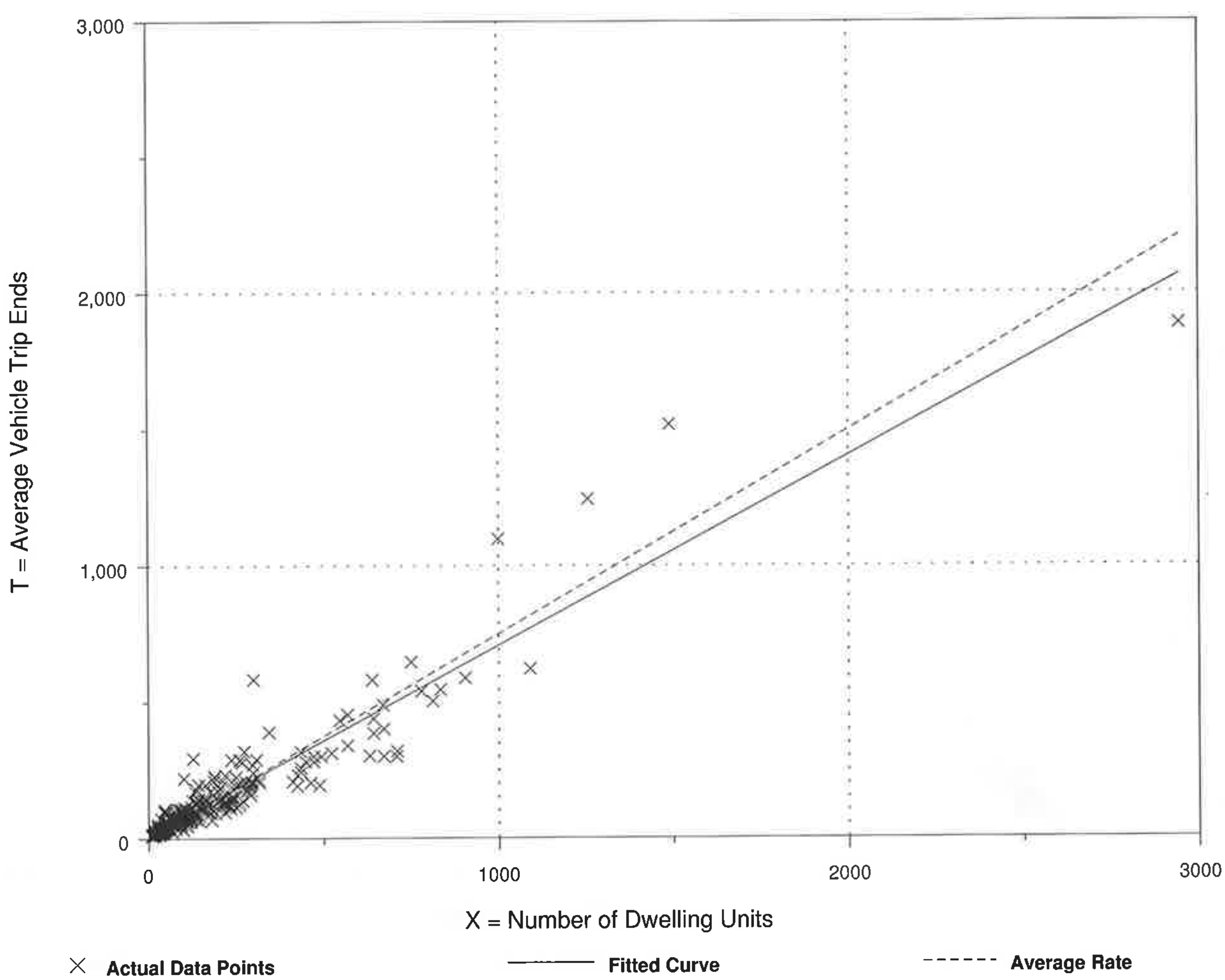
Average Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday,** **Peak Hour of Adjacent Street Traffic,** **One Hour Between 7 and 9 a.m.**

Number of Studies:	292
Avg. Number of Dwelling Units:	194
Directional Distribution:	25% entering, 75% exiting

Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.75	0.33 - 2.27	0.90

Data Plot and Equation



Fitted Curve Equation: T = 0.70(X) + 9.74 **R^2 = 0.89**

Single-Family Detached Housing
(210)

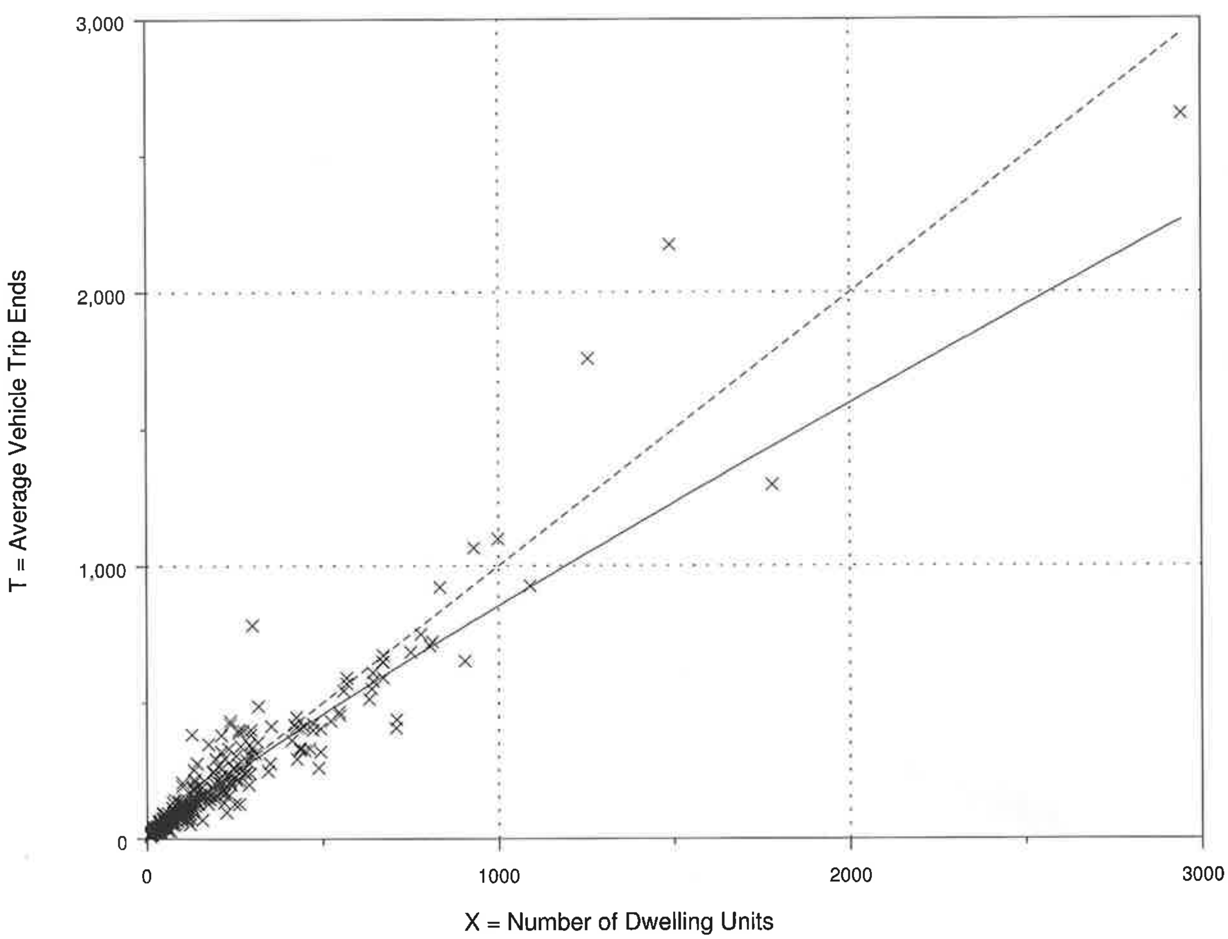
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

Number of Studies: 321
Avg. Number of Dwelling Units: 207
Directional Distribution: 63% entering, 37% exiting

Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
1.00	0.42 - 2.98	1.05

Data Plot and Equation



Fitted Curve Equation: $Ln(T) = 0.90\ Ln(X) + 0.51$ **$R^2 = 0.91$**

Residential Condominium/Townhouse
(230)

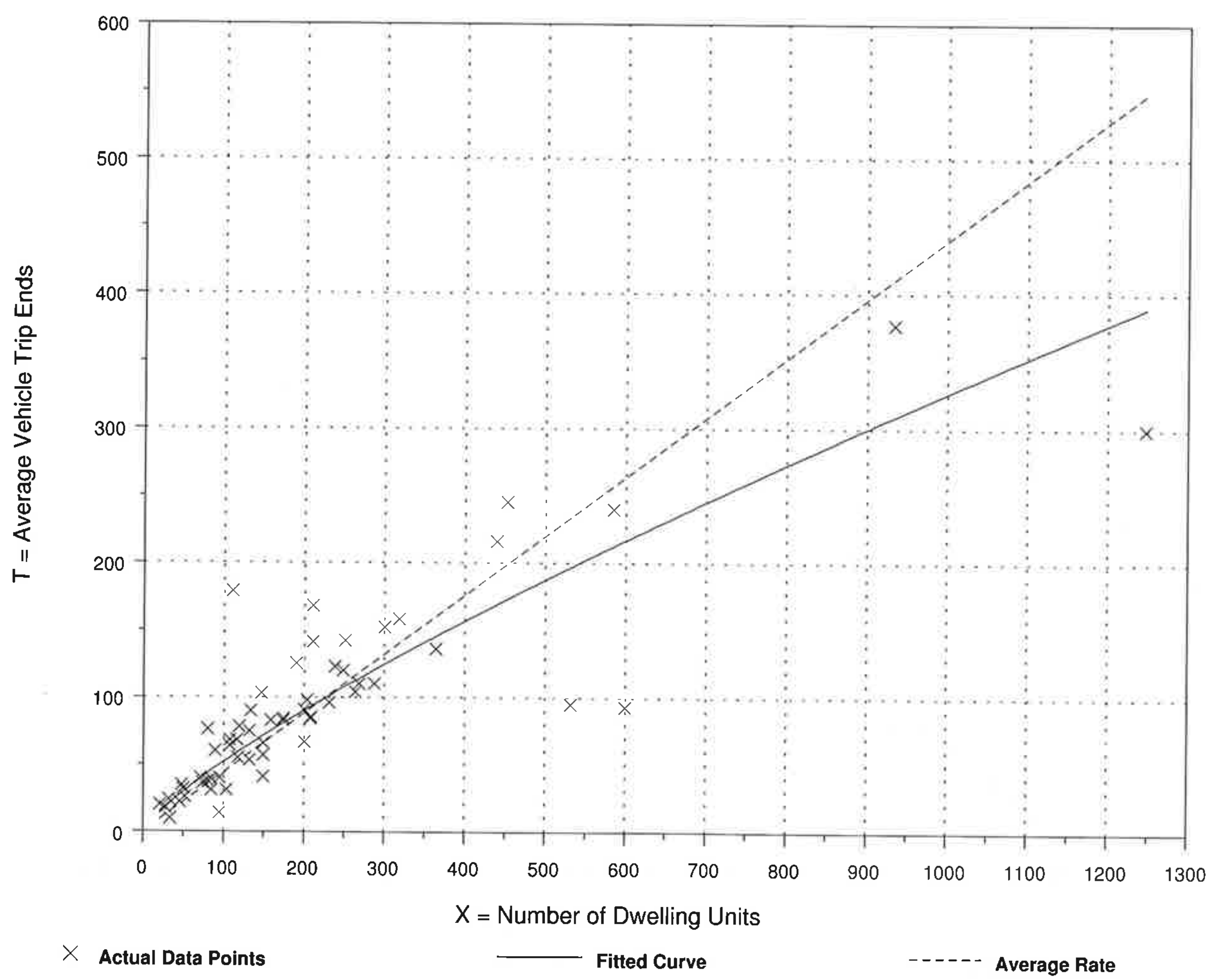
Average Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 7 and 9 a.m.**

Number of Studies:	59
Avg. Number of Dwelling Units:	213
Directional Distribution:	17% entering, 83% exiting

Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.44	0.15 - 1.61	0.69

Data Plot and Equation



Fitted Curve Equation: $Ln(T) = 0.80\ Ln(X) + 0.26$ $R^2 = 0.76$

Residential Condominium/Townhouse
(230)

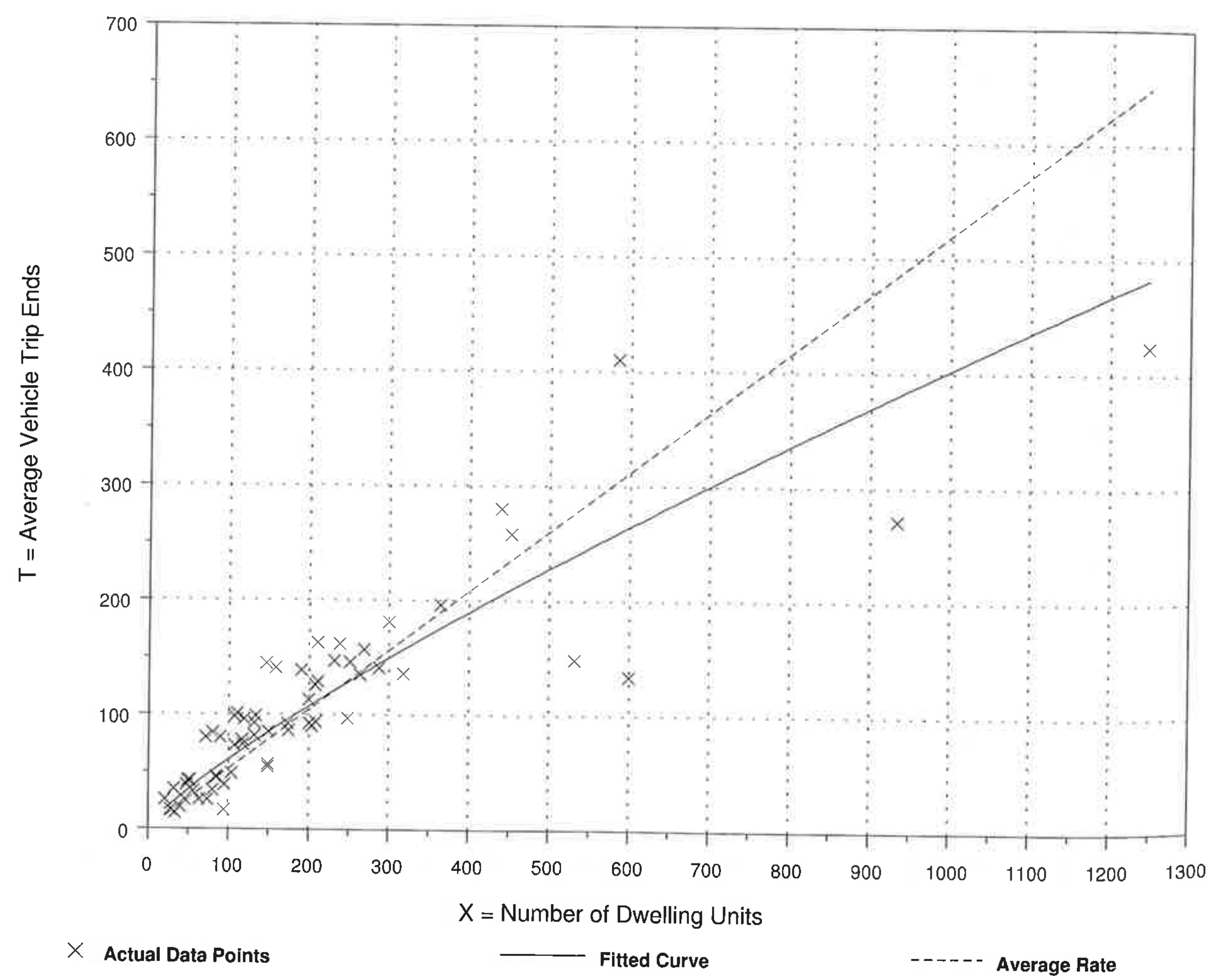
Average Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 4 and 6 p.m.**

Number of Studies:	62
Avg. Number of Dwelling Units:	205
Directional Distribution:	67% entering, 33% exiting

Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.52	0.18 - 1.24	0.75

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.82 Ln(X) + 0.32 **R^2 = 0.80**

The Meadows Phase 5

Transportation Impact Assessment Report

Appendix F: 2011 OD Survey Data – South Nepean

April 2018

South Nepean

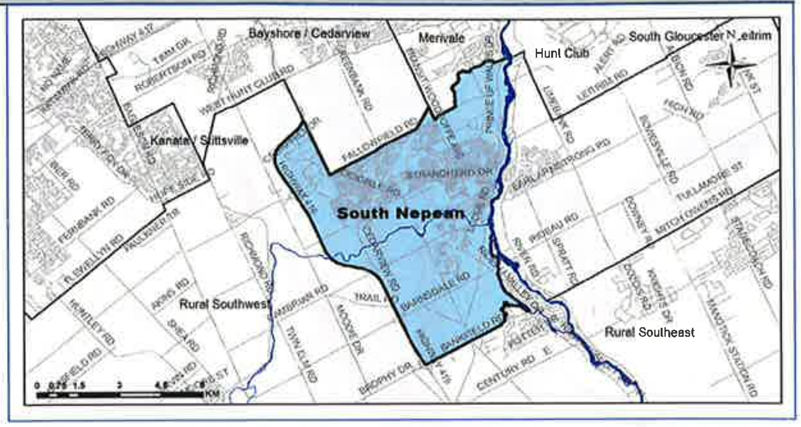
Demographic Characteristics

Population	72,750	Actively Travelled	57,830
Employed Population	35,540	Number of Vehicles	44,130
Households	26,260	Area (km^2)	54.8

Occupation Status (age 5+)	Male	Female	Total
Full Time Employed	17,630	14,730	32,350
Part Time Employed	620	2,570	3,190
Student	9,910	9,420	19,340
Retiree	3,420	4,200	7,620
Unemployed	720	500	1,220
Homemaker	180	2,390	2,570
Other	270	540	810
Total:	32,750	34,350	67,100

Traveller Characteristics	Male	Female	Total
Transit Pass Holders	5,590	6,100	11,700
Licensed Drivers	24,480	25,260	49,740
Telecommuters	60	310	370
Trips made by residents	88,180	97,380	185,550

Selected Indicators	
Daily Trips per Person (age 5+)	2.77
Vehicles per Person	0.61
Number of Persons per Household	2.77
Daily Trips per Household	7.07
Vehicles per Household	1.68
Workers per Household	1.35
Population Density (Pop/km2)	1330

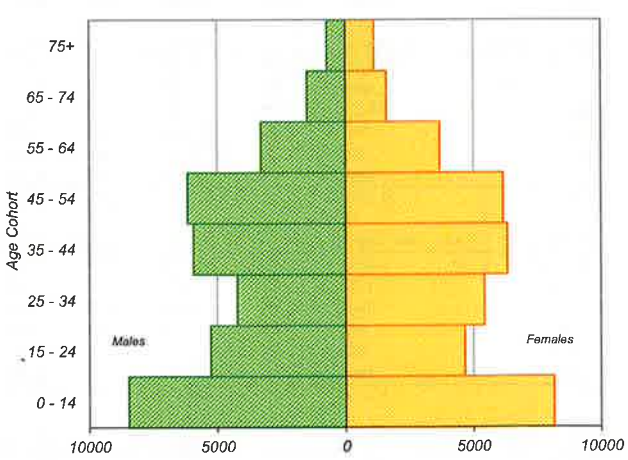


Household Size		
1 person	3,560	14%
2 persons	7,300	28%
3 persons	5,500	21%
4 persons	6,320	24%
5+ persons	3,590	14%
Total:	26,260	100%

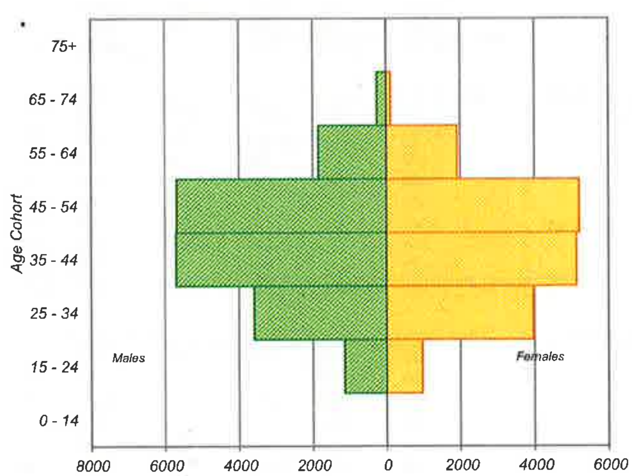
Households by Vehicle Availability		
0 vehicles	810	3%
1 vehicle	9,500	36%
2 vehicles	13,800	53%
3 vehicles	1,730	7%
4+ vehicles	410	2%
Total:	26,260	100%

Households by Dwelling Type		
Single-detached	14,530	55%
Semi-detached	3,090	12%
Townhouse	7,770	30%
Apartment/Condo	870	3%
Total:	26,260	100%

Population



Employed Population



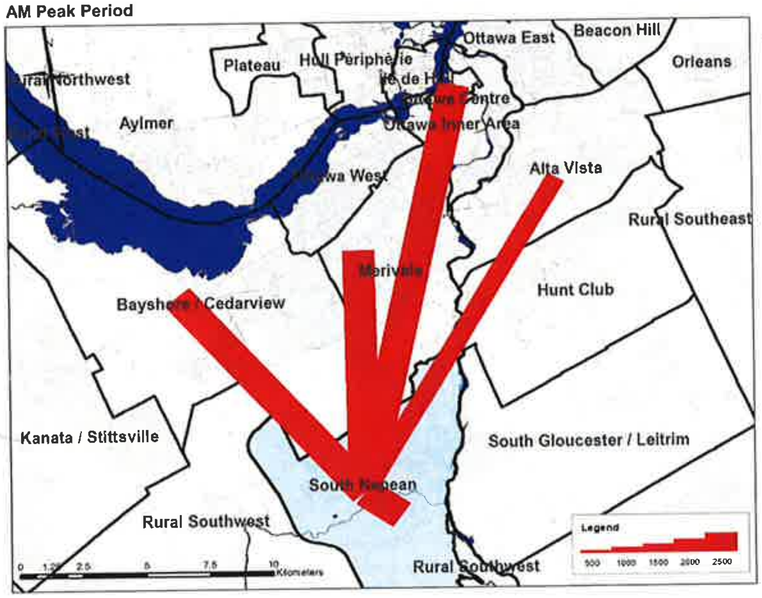
* In 2005 data was only collected for household members aged 11+ therefore these results cannot be compared to the 2011 data.

malatest Program Evaluation & Market Research

Travel Patterns

Top Five Destinations of Trips from South Nepean

AM Peak Period



Summary of Trips to and from South Nepean

AM Peak Period (6:30 - 8:59) Districts	Destinations of Trips From District	% Total	Origins of Trips To District	% Total
Ottawa Centre	3,820	9%	30	0%
Ottawa Inner Area	2,270	5%	340	1%
Ottawa East	630	2%	50	0%
Beacon Hill	370	1%	50	0%
Alta Vista	2,360	6%	460	2%
Hunt Club	920	2%	440	2%
Merivale	4,310	10%	790	3%
Ottawa West	1,830	4%	160	1%
Bayshore / Cedarview	3,230	8%	700	3%
Orléans	330	1%	200	1%
Rural East	20	0%	60	0%
Rural Southeast	250	1%	580	2%
South Gloucester / Leitrim	100	0%	310	1%
South Nepean	17,260	42%	17,260	74%
Rural Southwest	580	1%	970	4%
Kanata / Stittsvile	1,800	4%	690	3%
Rural West	80	0%	30	0%
Île de Hull	840	2%	50	0%
Hull Périphérie	260	1%	40	0%
Plateau	0	0%	40	0%
Aylmer	60	0%	40	0%
Rural Northwest	40	0%	40	0%
Pointe Gatineau	0	0%	0	0%
Gatineau Est	0	0%	20	0%
Rural Northeast	10	0%	20	0%
Buckingham / Masson-Angers	20	0%	0	0%
Ontario Sub-Total:	40,160	97%	23,120	99%
Québec Sub-Total:	1,230	3%	250	1%
Total:	41,390	100%	23,370	100%

Trips by Trip Purpose

24 Hours	From District		To District		Within District	
Work or related	25,640	41%	5,290	8%	4,680	6%
School	5,310	8%	1,430	2%	10,610	13%
Shopping	4,940	8%	4,220	7%	12,840	16%
Leisure	6,960	11%	4,020	6%	5,760	7%
Medical	1,720	3%	900	1%	840	1%
Pick-up / drive passenger	4,040	6%	3,920	6%	7,530	9%
Return Home	11,460	18%	40,960	65%	34,630	43%
Other	2,640	4%	2,090	3%	3,020	4%
Total:	62,710	100%	62,830	100%	79,910	100%

AM Peak (06:30 - 08:59)	From District		To District		Within District	
Work or related	18,160	75%	2,890	47%	2,120	12%
School	3,280	14%	1,170	19%	9,180	53%
Shopping	180	1%	70	1%	720	4%
Leisure	350	1%	230	4%	220	1%
Medical	400	2%	60	1%	100	1%
Pick-up / drive passenger	1,060	4%	770	13%	2,860	17%
Return Home	210	1%	640	10%	1,070	6%
Other	520	2%	290	5%	990	6%
Total:	24,160	100%	6,120	100%	17,260	100%

PM Peak (15:30 - 17:59)	From District		To District		Within District	
Work or related	410	5%	290	1%	410	2%
School	250	3%	0	0%	50	0%
Shopping	900	11%	1,090	5%	2,090	11%
Leisure	1,420	17%	790	3%	1,840	10%
Medical	190	2%	230	1%	90	0%
Pick-up / drive passenger	820	10%	1,700	7%	1,610	9%
Return Home	3,800	47%	18,990	81%	11,810	64%
Other	360	4%	490	2%	540	3%
Total:	8,150	100%	23,580	100%	18,440	100%

Peak Period (%)	Total:	% of 24 Hours	Within District (%)
24 Hours	205,450		39%
AM Peak Period	47,540	23%	36%
PM Peak Period	50,170	24%	37%

Trips by Primary Travel Mode

24 Hours	From District		To District		Within District	
Auto Driver	41,340	66%	41,280	66%	39,110	49%
Auto Passenger	9,400	15%	10,030	16%	15,320	19%
Transit	9,990	16%	9,520	15%	2,260	3%
Bicycle	310	0%	320	1%	960	1%
Walk	80	0%	170	0%	13,060	16%
Other	1,600	3%	1,520	2%	9,210	12%
Total:	62,720	100%	62,840	100%	79,920	100%

AM Peak (06:30 - 08:59)	From District		To District		Within District	
Auto Driver	14,570	60%	4,360	71%	5,800	34%
Auto Passenger	1,930	8%	780	13%	3,210	19%
Transit	6,610	27%	330	5%	730	4%
Bicycle	80	0%	50	1%	320	2%
Walk	20	0%	10	0%	3,000	17%
Other	930	4%	590	10%	4,200	24%
Total:	24,140	100%	6,120	100%	17,260	100%

PM Peak (15:30 - 17:59)	From District		To District		Within District	
Auto Driver	5,840	72%	14,640	62%	8,420	46%
Auto Passenger	1,730	21%	2,680	11%	3,930	21%
Transit	350	4%	5,770	24%	650	4%
Bicycle	80	1%	110	0%	150	1%
Walk	30	0%	0	0%	3,680	20%
Other	100	1%	380	2%	1,590	9%
Total:	8,130	100%	23,580	100%	18,420	100%

Avg Vehicle Occupancy	From District	To District	Within District
24 Hours	1.23	1.24	1.39
AM Peak Period	1.13	1.18	1.55
PM Peak Period	1.30	1.18	1.47

Transit Modal Split	From District	To District	Within District
24 Hours	16%	16%	4%
AM Peak Period	29%	6%	7%
PM Peak Period	4%	25%	5%

The Meadows Phase 5

Transportation Impact Assessment Report

Appendix G: MMLOS Results

April 2018

Multi-Modal Level of Service **March 14, 2018**

The Meadows Phase 5 - Transportation Impact Assessment (TIA)

Existing (2018) - Base

IBI

INTERSECTIONS		Cambrian Rd & Borrisokane Rd [1]					
		NORTH leg	SOUTH leg	EAST leg	WEST leg		
Pedestrian	Lanes (do NOT include lanes protected by bulb-outs)						
	Median						
	Island Refuge						
	Conflicting Left Turns (from street to right)						
	Conflicting Right Turns (from street to left)						
	RTOR? (from street to left)						
	Ped Leading Interval? (on cross street)						
	Corner Radius						
	Right Turn Channel						
	Crosswalk Type						
	LOS (PETSI)						
	Cycle Length (sec)						
	Pedestrian Walk Time (solid white symbol) (sec)						
	LOS (Delay,seconds)						
	Overall Level of Service						
Cyclist	Type of Bikeway						
	Turning Speed (based on corner radius & angle)						
	Right Turn Storage Length						
	Dual Right Turn?						
	Shared Through-Right?						
	Bike Box?						
	Number of Lanes Crossed for Left Turns						
	Operating Speed on Approach						
	Dual Left Turn Lanes?						
	Level of Service						
Transit	Average Signal Delay						
	Level of Service						
Truck	Turning Radius (Right Turn)						
	Number of Receiving Lanes						
Auto	**Level of Service**	B (AM) / B (PM)					

SEGMENTS		Borrisokane Road & Cambrian Road	Section 1	Section 2	Section 3	Cambrian Road & Seeley's Bay Street			
Pedestrian	Sidewalk Width		No Sidewalk	No Sidewalk	No Sidewalk				
	Boulevard Width		N/A	N/A	N/A				
	AADT		> 3000	> 3000	> 3000				
	On-Street Parking		N/A	N/A	N/A				
	Operating Speed		51 to 60 km/h	51 to 60 km/h	51 to 60 km/h				
	Level of Service		F	F	F				
			F [2]						
Cyclist	Type of Bikeway		Mixed Traffic						
	Number of Travel Lanes (per direction)		1 Travel Lane Per Direction						
	Raised Median?		No						
	Bike Lane Width		N/A						
	Operating Speed		≥ 70 km/h						
	Bike Lane Blockages (Commercial Areas)		Rare						
	Median Refuge		No Median Refuge						
	Number of Travel Lanes on Sidestreet		2 Lanes Crossed						
	Sidestreet Operating Speed		50 km/h						
	Level of Service		F						
Transit	Facility Type		Mixed Traffic						
	Friction		Limited parking/driveway friction						
	Level of Service		D						
Truck	Curb Lane Width		>3.7	>3.7	>3.7				
	Number of Travel Lanes		2	2	2				
			B	B	B				
			B						

[1] Multi-Modal Level of Service does not apply to unsignalized intersections.

[2] Rural road with no formal sidewalk facilities

Multi-Modal Level of Service **March 13, 2018**

The Meadows Phase 5 - Transportation Impact Assessment (TIA)

Future (2022) - Background Traffic

INTERSECTIONS		Cambrian Rd & Borrisokane Rd [1]					
		NORTH leg	SOUTH leg	EAST leg	WEST leg		
Pedestrian	Lanes (do NOT include lanes protected by bulb-outs)						
	Median						
	Island Refuge						
	Conflicting Left Turns (from street to right)						
	Conflicting Right Turns (from street to left)						
	RTOR? (from street to left)						
	Ped Leading Interval? (on cross street)						
	Corner Radius						
	Right Turn Channel						
	Crosswalk Type						
	LOS (PETSI)						
	Cycle Length (sec)						
	Pedestrian Walk Time (solid white symbol) (sec)						
	LOS (Delay,seconds)						
	Overall Level of Service						
Cyclist	Type of Bikeway						
	Turning Speed (based on corner radius & angle)						
	Right Turn Storage Length						
	Dual Right Turn?						
	Shared Through-Right?						
	Bike Box?						
	Number of Lanes Crossed for Left Turns						
	Operating Speed on Approach						
	Dual Left Turn Lanes?						
	Level of Service						
Transit	Average Signal Delay						
	Level of Service						
Truck	Turning Radius (Right Turn)						
	Number of Receiving Lanes						
Auto	**Level of Service**	**B (AM) / B (PM)**					

SEGMENTS		300m East of Borrisokane & Cambrian	Section 1	Section 2	Section 3	Street 23 & Cambrian Road	Section 1	Section 2	Section 3	Cambrian Road & Existing Bus Turn-around	
Pedestrian	Sidewalk Width		No Sidewalk	No Sidewalk	No Sidewalk		No Sidewalk	No Sidewalk	No Sidewalk		
	Boulevard Width		N/A	N/A	N/A		N/A	N/A	N/A		
	AADT		N/A	N/A	N/A		N/A	N/A	N/A		
	On-Street Parking		N/A	N/A	N/A		N/A	N/A	N/A		
	Operating Speed		51 to 60 km/h	51 to 60 km/h	51 to 60 km/h		51 to 60 km/h	51 to 60 km/h	51 to 60 km/h		
	Level of Service		F	F	F		F	F	F		
				F [2]				F [2]			
Cyclist	Type of Bikeway			Mixed Traffic				Mixed Traffic			
	Number of Travel Lanes (per direction)			1 Travel Lane Per Direction				1 Travel Lane Per Direction			
	Raised Median?			No				No			
	Bike Lane Width			N/A				N/A			
	Operating Speed			≥ 70 km/h				≥ 70 km/h			
	Bike Lane Blockages (Commercial Areas)			Rare				Rare			
	Median Refuge			No Median Refuge				No Median Refuge			
	Number of Travel Lanes on Sidestreet			2 Lanes Crossed				2 Lanes Crossed			
	Sidestreet Operating Speed			50 km/h				50 km/h			
	Level of Service			F				F			
Transit	Facility Type			Mixed Traffic				Mixed Traffic			
	Friction			Limited parking/driveway friction				Limited parking/driveway friction			
	Level of Service			D				D			
Truck	Curb Lane Width		>3.7	>3.7	>3.7		>3.7	>3.7	>3.7		
	Number of Travel Lanes		2	2	2		2	2	2		
			B	B	B		B	B	B		
				B				**B**			

[1] Multi-Modal Level of Service does not apply to unsignalized intersections.

[2] No formal pedestrian facilities provided along Cambrian Road.

Multi-Modal Level of Service

The Meadows Phase 5 - Transportation Impact Assessment (TIA)

Future (2027) - Background Traffic

March 13, 2018

IBI

INTERSECTIONS		Cambrian Rd & Borrisokane Rd [1]				Cambrian Rd & Street 23/ Mattamy Site Access			
		NORTH leg	SOUTH leg	EAST leg	WEST leg	NORTH leg	SOUTH leg	EAST leg	WEST leg
Pedestrian	Lanes (do NOT include lanes protected by bulb-outs)					2	2	2	2
	Median					No Median	No Median	No Median	No Median
	Island Refuge								
	Conflicting Left Turns (from street to right)					Permissive	Permissive	Permissive	Permissive
	Conflicting Right Turns (from street to left)					Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control
	RTOR? (from street to left)					RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed
	Ped Leading Interval? (on cross street)					No	No	No	No
	Corner Radius					> 5m to 10m	> 5m to 10m	> 5m to 10m	> 5m to 10m
	Right Turn Channel					No right turn channel	No right turn channel	No right turn channel	No right turn channel
	Crosswalk Type					Standard transverse markings	Standard transverse markings	Standard transverse markings	Standard transverse markings
	LOS (PETSI)					86 B	86 B	86 B	86 B
	Cycle Length (sec)					70	70	70	70
	Pedestrian Walk Time (solid white symbol) (sec)					7	7	7	7
	LOS (Delay,seconds)					28.4 C	28.4 C	28.4 C	28.4 C
	Overall Level of Service					C			
Cyclist	Type of Bikeway					Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic
	Turning Speed (based on corner radius & angle)					Slow	Slow	Slow	Slow
	Right Turn Storage Length								
	Dual Right Turn?					No	No	No	No
	Shared Through-Right?					Yes	Yes	Yes	Yes
	Bike Box?					No	No	No	No
	Number of Lanes Crossed for Left Turns					No Lanes Crossed	1 Lane Crossed	No Lanes Crossed	No Lanes Crossed
	Operating Speed on Approach					50km/h	50km/h	50km/h	50km/h
	Dual Left Turn Lanes?					No	No	No	No
	Level of Service					D	F	D	D
						F			
Transit	Average Signal Delay					≤30 sec	≤10 sec	≤20 sec	≤20 sec
	Level of Service					D	B	C	C
						D			
Truck	Turning Radius (Right Turn)					< 10m	< 10m	< 10m	< 10m
	Number of Receiving Lanes					1	1	1	1
						F	F	F	F
						F			
Auto	**Level of Service**	C (AM) / C (PM)				C (AM) / C (PM)			

SEGMENTS		300m East of Borrisokane & Cambrian	Section			Street 23 & Cambrian Road	Section			Cambrian Road & Existing Bus Turn-around
			1	2	3		1	2	3	
Pedestrian	Sidewalk Width		2.0 or more	2.0 or more	2.0 or more		2.0 or more	2.0 or more	2.0 or more	
	Boulevard Width		> 2	> 2	> 2		> 2	> 2	> 2	
	AADT		> 3000	> 3000	> 3000		> 3000	> 3000	> 3000	
	On-Street Parking		Yes	Yes	Yes		Yes	Yes	Yes	
	Operating Speed		51 to 60 km/h	51 to 60 km/h	51 to 60 km/h		51 to 60 km/h	51 to 60 km/h	51 to 60 km/h	
	Level of Service		B	B	B		B	B	B	
			B				B			
Cyclist	Type of Bikeway		Mixed Traffic				Mixed Traffic			
	Number of Travel Lanes (per direction)		1 Travel Lane Per Direction				1 Travel Lane Per Direction			
	Raised Median?		No				No			
	Bike Lane Width		N/A				N/A			
	Operating Speed		≥ 70 km/h				≥ 70 km/h			
	Bike Lane Blockages (Commercial Areas)		Rare				Rare			
	Median Refuge		No Median Refuge				No Median Refuge			
	Number of Travel Lanes on Sidestreet		2 Lanes Crossed				2 Lanes Crossed			
	Sidestreet Operating Speed		50 km/h				50 km/h			
	Level of Service		F				F			
Transit	Facility Type		Mixed Traffic				Mixed Traffic			
	Friction		Limited parking/driveway friction				Limited parking/driveway friction			
	Level of Service		D				D			
Truck	Curb Lane Width		>3.7	>3.7	>3.7		>3.7	>3.7	>3.7	
	Number of Travel Lanes		2	2	2		2	2	2	
			B	B	B		B	B	B	
			B				B			

[1] Multi-Modal Level of Service does not apply to unsignalized intersections.

Multi-Modal Level of Service

The Meadows Phase 5 - Transportation Impact Assessment (TIA)

Future (2022) - Background Plus Site-Generated Traffic

March 13, 2018

IBI

INTERSECTIONS		Cambrian Rd & Borrisokane Rd [1]				Cambrian Rd & Street 23 [1]				
		NORTH leg	SOUTH leg	EAST leg	WEST leg	NORTH leg	SOUTH leg	EAST leg	WEST leg	
Pedestrian	Lanes (do NOT include lanes protected by bulb-outs)									
	Median									
	Island Refuge									
	Conflicting Left Turns (from street to right)									
	Conflicting Right Turns (from street to left)									
	RTOR? (from street to left)									
	Ped Leading Interval? (on cross street)									
	Corner Radius									
	Right Turn Channel									
	Crosswalk Type									
	LOS (PETSI)									
	Cycle Length (sec)									
	Pedestrian Walk Time (solid white symbol) (sec)									
	LOS (Delay,seconds)									
	Overall Level of Service									
Cyclist	Type of Bikeway									
	Turning Speed (based on corner radius & angle)									
	Right Turn Storage Length									
	Dual Right Turn?									
	Shared Through-Right?									
	Bike Box?									
	Number of Lanes Crossed for Left Turns									
	Operating Speed on Approach									
	Dual Left Turn Lanes?									
	Level of Service									
Transit	Average Signal Delay									
	Level of Service									
Truck	Turning Radius (Right Turn)									
	Number of Receiving Lanes									
Auto	Level of Service	C (AM) / C (PM)				C (AM) / C (PM)				

SEGMENTS		300m East of Borrisokane & Cambrian	Section 1	Section 2	Section 3	Street 23 & Cambrian Road	Section 1	Section 2	Section 3	Cambrian Road & Existing Bus Turn-around	
Pedestrian	Sidewalk Width		No Sidewalk	No Sidewalk	No Sidewalk		No Sidewalk	No Sidewalk	No Sidewalk		
	Boulevard Width		N/A	N/A	N/A		N/A	N/A	N/A		
	AADT		N/A	N/A	N/A		N/A	N/A	N/A		
	On-Street Parking		N/A	N/A	N/A		N/A	N/A	N/A		
	Operating Speed		51 to 60 km/h	51 to 60 km/h	51 to 60 km/h		51 to 60 km/h	51 to 60 km/h	51 to 60 km/h		
	Level of Service		F	F	F		F	F	F		
			F [2]				F [2]				
Cyclist	Type of Bikeway		Mixed Traffic				Mixed Traffic				
	Number of Travel Lanes (per direction)		1 Travel Lane Per Direction				1 Travel Lane Per Direction				
	Raised Median?		No				No				
	Bike Lane Width		N/A				N/A				
	Operating Speed		≥ 70 km/h				≥ 70 km/h				
	Bike Lane Blockages (Commercial Areas)		Rare				Rare				
	Median Refuge		No Median Refuge				No Median Refuge				
	Number of Travel Lanes on Sidestreet		2 Lanes Crossed				2 Lanes Crossed				
	Sidestreet Operating Speed		50 km/h				50 km/h				
	Level of Service		F				F				
Transit	Facility Type		Mixed Traffic				Mixed Traffic				
	Friction		Limited parking/driveway friction				Limited parking/driveway friction				
	Level of Service		D				D				
Truck	Curb Lane Width		>3.7	>3.7	>3.7		>3.7	>3.7	>3.7		
	Number of Travel Lanes		2	2	2		2	2	2		
			B	B	B		B	B	B		
			B				B				

[1] Multi-Modal Level of Service does not apply to unsignalized intersections.

[2] No formal pedestrian facilities provided along Cambrian Road.

Multi-Modal Level of Service

The Meadows Phase 5 - Transportation Impact Assessment (TIA)

Future (2027) - Background plus Site-Generated

March 13, 2018

IBI

INTERSECTIONS		Cambrian Rd & Borrisokane Rd [1]				Cambrian Rd & Street 23/ Mattamy Site Access			
		NORTH leg	SOUTH leg	EAST leg	WEST leg	NORTH leg	SOUTH leg	EAST leg	WEST leg
Pedestrian	Lanes (do NOT include lanes protected by bulb-outs)					2	2	3	3
	Median					No Median	No Median	No Median	No Median
	Island Refuge								
	Conflicting Left Turns (from street to right)					Permissive	Permissive	Permissive	Permissive
	Conflicting Right Turns (from street to left)					Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control
	RTOR? (from street to left)					RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed
	Ped Leading Interval? (on cross street)					No	No	No	No
	Corner Radius					> 5m to 10m	> 5m to 10m	> 5m to 10m	> 5m to 10m
	Right Turn Channel					No right turn channel	No right turn channel	No right turn channel	No right turn channel
	Crosswalk Type					Standard transverse markings	Standard transverse markings	Standard transverse markings	Standard transverse markings
	LOS (PETSI)					86 B	86 B	71 C	71 C
	Cycle Length (sec)					70	70	70	70
	Pedestrian Walk Time (solid white symbol) (sec)					7	7	7	7
	LOS (Delay,seconds)					28.4 C	28.4 C	28.4 C	28.4 C
	Overall Level of Service					C			
Cyclist	Type of Bikeway					Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic
	Turning Speed (based on corner radius & angle)					Slow	Slow	Slow	Slow
	Right Turn Storage Length								
	Dual Right Turn?					No	No	No	No
	Shared Through-Right?					Yes	Yes	Yes	Yes
	Bike Box?					No	No	No	No
	Number of Lanes Crossed for Left Turns					No Lanes Crossed	1 Lane Crossed	No Lanes Crossed	No Lanes Crossed
	Operating Speed on Approach					50km/h	50km/h	50km/h	50km/h
	Dual Left Turn Lanes?					No	No	No	No
	Level of Service					D	F	D	D
						F			
Transit	Average Signal Delay					≤30 sec	≤20 sec	≤20 sec	≤20 sec
	Level of Service					D	C	C	C
						D			
Truck	Turning Radius (Right Turn)					< 10m	< 10m	< 10m	< 10m
	Number of Receiving Lanes					1	1	1	1
						F	F	F	F
						F			
Auto	**Level of Service**	C (AM) / C (PM)				C (AM) / C (PM)			

SEGMENTS		300m East of Borrisokane & Cambrian	Section 1	Section 2	Section 3	Street 23 & Cambrian Road	Section 1	Section 2	Section 3	Cambrian Road & Existing Bus Turn-around
Pedestrian	Sidewalk Width		2.0 or more	2.0 or more	2.0 or more		2.0 or more	2.0 or more	2.0 or more	
	Boulevard Width		> 2	> 2	> 2		> 2	> 2	> 2	
	AADT		> 3000	> 3000	> 3000		> 3000	> 3000	> 3000	
	On-Street Parking		Yes	Yes	Yes		Yes	Yes	Yes	
	Operating Speed		51 to 60 km/h	51 to 60 km/h	51 to 60 km/h		51 to 60 km/h	51 to 60 km/h	51 to 60 km/h	
	Level of Service		B	B	B		B	B	B	
			B				B			
Cyclist	Type of Bikeway		Mixed Traffic				Mixed Traffic			
	Number of Travel Lanes (per direction)		1 Travel Lane Per Direction				1 Travel Lane Per Direction			
	Raised Median?		No				No			
	Bike Lane Width		N/A				N/A			
	Operating Speed		≥ 70 km/h				≥ 70 km/h			
	Bike Lane Blockages (Commercial Areas)		Rare				Rare			
	Median Refuge		No Median Refuge				No Median Refuge			
	Number of Travel Lanes on Sidestreet		2 Lanes Crossed				2 Lanes Crossed			
	Sidestreet Operating Speed		50 km/h				50 km/h			
	Level of Service		F				F			
Transit	Facility Type		Mixed Traffic				Mixed Traffic			
	Friction		Limited parking/driveway friction				Limited parking/driveway friction			
	Level of Service		D				D			
Truck	Curb Lane Width		>3.7	>3.7	>3.7		>3.7	>3.7	>3.7	
	Number of Travel Lanes		2	2	2		2	2	2	
			B	B	B		B	B	B	
			B				B			

[1] Multi-Modal Level of Service does not apply to unsignalized intersections.

The Meadows Phase 5

Transportation Impact Assessment Report

Appendix H: Traffic Signal Warrants

April 2018

Input Data Sheet

Analysis Sheet | Results Sheet | Proposed Collision

GO TO Justification:

What are the intersecting roadways? Borrisokane Road & Cambrian Road

What is the direction of the Main Road street? North-South

When was the data collected? Tuesday, February 15, 2018

Justification 1 - 4: Volume Warrants

a.- Number of lanes on the Main Road? 1

b.- Number of lanes on the Minor Road? 1

c.- How many approaches? 3

d.- What is the operating environment? Rural — Population < 10,000 AND Speed >= 70 km/hr

e.- What is the eight hour vehicle volume at the intersection? (Please fill in table below)

Hour Ending	Main Northbound Approach			Minor Eastbound Approach			Main Southbound Approach			Minor Westbound Approach			Pedestrians Crossing Main Road
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	
8:00	0	28	10	0	0	0	8	0	350	72	15	0	0
9:00	0	48	6	0	0	0	5	0	346	123	22	0	0
10:00	0	8	1	0	0	0	1	0	209	60	22	0	0
12:30	0	30	1	0	0	0	4	0	139	30	1	0	0
13:30	0	33	5	0	0	0	2	0	117	33	5	0	0
16:00	0	27	4	0	0	0	13	0	159	27	4	0	0
17:00	0	29	9	0	0	0	11	0	162	29	9	0	0
18:00	0	37	4	0	0	0	14	0	198	37	4	0	0
Total	**0**	**240**	**40**	**0**	**0**	**0**	**58**	**0**	**1,680**	**411**	**82**	**0**	**0**

Justification 5: Collision Experience

Preceding Months	Number of Collisions*
1-12	0
13-24	0
25-36	0

* Include only collisions that are susceptable to correction through the installation of traffic signal control

Justification 6: Pedestrian Volume

a.- Please fill in table below summarizing total pedestrians crossing major roadway at the intersection or in proximity to the intersection (zones). Please reference Section 4.8 of the Manual for further explanation and graphical representation.

	Zone 1		Zone 2		Zone 3 (if needed)		Zone 4 (if needed)		Total
	Assisted	Unassisted	Assisted	Unassisted	Assisted	Unassisted	Assisted	Unassisted	
Total 8 hour pedestrian volume	5	5	5	5	0	0	0	0	
Factored 8 hour pedestrian volume	15		15		0		0		
% Assigned to crossing rate	100%		50%		0%		0%		
Net 8 Hour Pedestrian Volume at Crossing									23
Net 8 Hour Vehicular Volume on Street Being Crossed									0

b.- Please fill in table below summarizing delay to pedestrians crossing major roadway at the intersection or in proximity to the intersection (zones). Please reference Section 4.8 of the Manual for further explanation and graphical representation.

	Zone 1		Zone 2		Zone 3 (if needed)		Zone 4 (if needed)		Total
	Assisted	Unassisted	Assisted	Unassisted	Assisted	Unassisted	Assisted	Unassisted	
Total 8 hour pedestrian volume	5	5	5	5	0	0	0	0	
Total 8 hour pedestrians delayed greater than 10 seconds	0	0	0	0	0	0	0	0	
Factored volume of total pedestrians	15		15		0		0		
Factored volume of delayed pedestrians	0		0		0		0		
% Assigned to Crossing Rate	100%		50%		0%		0%		
Net 8 Hour Volume of Total Pedestrians									23
Net 8 Hour Volume of Delayed Pedestrians									0

Results Sheet

Input Sheet | Analysis Sheet | Proposed Collision

GO TO Justification:

Intersection: Borrisokane Road & Cambrian Road

Count Date: Tuesday, February 15, 2018

Summary Results

Justification			Compliance		Signal Justified? YES	Signal Justified? NO
1. Minimum Vehicular Volume	A	Total Volume	44	%	☐	☑
	B	Crossing Volume	24	%		
2. Delay to Cross Traffic	A	Main Road	53	%	☐	☑
	B	Crossing Road	82	%		
3. Combination	A	Justificaton 1	24	%	☐	☑
	B	Justification 2	53	%		
4. 4-Hr Volume			24	%	☐	☑

5. Collision Experience	0	%	☐	☑

6. Pedestrians	A	Volume	Justification not met	☐	☑
	B	Delay	Justification not met		

MINIMUM WARRANTS FOR INSTALLATION OF TRAFFIC SIGNALS USING PROJECTED VOLUMES*

Project: Meadows Phase 5 **Date:** 2018-03-14

Project # 115637

Location: Borrisokane Road (Roadway) at Cambrian Road (Intersecting Roadway)

Municipality: Barrhaven Projected Volume: Background and Site-Generated 2027

Peak Hour: AM & PM

WARRANT	DESCRIPTION	MINIMUM REQUIREMENT FOR 2 LANE HIGHWAYS				COMPLIANCE		
		FREE FLOW	RESTRICTED FLOW	ADJUSTED FREE FLOW	ADJUSTED RESTRICTED FLOW	SECTIONAL		ENTIRE %
						Number	%	
1. VEHICULAR VOLUME	A. Vehicle volumes, all approaches (Average Hour)	480	720	576	864	559	97%	97%
	B. Vehicle volume along minor roads (Average Hour)	120	170	216	306	272	126%	
2. DELAY TO CROSS TRAFFIC	A. Vehicle volumes, along artery (Average Hour)	480	720	576	864	288	50%	36%
	B. Combined vehicle and pedestrian volume crossing artery from minor roads (Average Hour)	50	75	60	90	22	36%	

Projected Traffic Volumes:

Approach Volume Input (vph)			
Artery V1	Artery V2	Minor V3	Minor V4
241.75	46	271.5	

Average Hourly Volume (AHV) = PHV/2 or (amPHV + pmPHV)/4
PHV = Either AM or PM Peak Hour Volume

Notes and Adjustment Factors:

Note	Input	Adj. Factors
1. Vehicle volume warrants (1A) and (2A) for intersections of roadways having two or more moving lanes in one direction should be 25% higher than the values given above.	No	1
2. Warrant values for free flow apply when the 85th percentile speed of artery traffic equals or exceeds 70 km/h or when the intersection lies within the built-up area of an isolated community having a population of less than 10,000.	Yes	
3. Warrant values for restricted flow apply to large urban communities when the 85th percentile speed of artery traffic does not exceed 70 km/h.	Yes	
4. The lowest sectional percentage governs the entire warrant.		
5. For "T" intersections the warrant values for the minor road should be increased by 50% (Warrant 1B only).	Yes	1.5
6. All flow values for Warrant 1 and Warrant 2 are to be increased by 20% for existing intersections and by 50% in the case of new intersections.	Existing	1.2
7. The crossing volumes are defined as:		
(a) Left-turns from both minor road approaches.	16.5 0	
(b) The heaviest through volume from the minor road.	0	
© 50% of the heavier left turn movement from major road when both of the following are met:		0
(i) the left-turn volume >120 vph	Yes	
(ii) the left-turn volume plus the opposing volume >720 vph	No	
(d) Pedestrians crossing the main road.	5	

CONCLUSION: The intersection does NOT meet the minimum warrants for traffic control signals.

* "Ontario Traffic Manual, Book 12", Ontario Ministry of Transportation.

IBI GROUP

MINIMUM WARRANTS FOR INSTALLATION OF TRAFFIC SIGNALS USING PROJECTED VOLUMES*

Project: Meadows Phase 5 **Date:** 2018-03-14

Project # 115637

Location: Cambrian Road (Roadway) at Street 23/Half Moon Bay West Access 2 (Intersecting Roadway)

Municipality: Barrhaven Projected Volume: Background and Site-Generated 2027

Peak Hour: AM & PM

WARRANT	DESCRIPTION	MINIMUM REQUIREMENT FOR 2 LANE HIGHWAYS				COMPLIANCE		
		FREE FLOW	RESTRICTED FLOW	ADJUSTED FREE FLOW	ADJUSTED RESTRICTED FLOW	SECTIONAL Number	SECTIONAL %	ENTIRE %
1. VEHICULAR VOLUME	A. Vehicle volumes, all approaches (Average Hour)	480	720	576	864	730	127%	127%
	B. Vehicle volume along minor roads (Average Hour)	120	170	144	204	193	134%	
2. DELAY TO CROSS TRAFFIC	A. Vehicle volumes, along artery (Average Hour)	480	720	576	864	537	93%	93%
	B. Combined vehicle and pedestrian volume crossing artery from minor roads (Average Hour)	50	75	60	90	147	245%	

Projected Traffic Volumes:

Approach Volume Input (vph)			
Artery V1	Artery V2	Minor V3	Minor V4
303.5	233.25	59.5	133.75

Average Hourly Volume (AHV) = PHV/2 or (amPHV + pmPHV)/4
PHV = Either AM or PM Peak Hour Volume

Notes and Adjustment Factors:

Note	Input	Adj. Factors
1. Vehicle volume warrants (1A) and (2A) for intersections of roadways having two or more moving lanes in one direction should be 25% higher than the values given above.	No	1
2. Warrant values for free flow apply when the 85th percentile speed of artery traffic equals or exceeds 70 km/h or when the intersection lies within the built-up area of an isolated community having a population of less than 10,000.	Yes	
3. Warrant values for restricted flow apply to large urban communities when the 85th percentile speed of artery traffic does not exceed 70 km/h.	Yes	
4. The lowest sectional percentage governs the entire warrant.		
5. For "T" intersections the warrant values for the minor road should be increased by 50% (Warrant 1B only).	No	1
6. All flow values for Warrant 1 and Warrant 2 are to be increased by 20% for existing intersections and by 50% in the case of new intersections.	Existing	1.2
7. The crossing volumes are defined as:		
(a) Left-turns from both minor road approaches.	103.5 38.75	
(b) The heaviest through volume from the minor road.	0	
© 50% of the heavier left turn movement from major road when both of the following are met:		0
(i) the left-turn volume >120 vph	No	
(ii) the left-turn volume plus the opposing volume >720 vph	No	
(d) Pedestrians crossing the main road.	5	

CONCLUSION: The intersection meets the minimum warrants for traffic control signals.

* "Ontario Traffic Manual, Book 12", Ontario Ministry of Transportation.

TAMARACK

The Meadows Phase 5

Transportation Impact Assessment Report

Appendix I: Roundabout Feasibility Screening Tool

April 2018

IBI

Ottawa

City of Ottawa
Roundabout Initial Feasibility Screening Tool

The intent of this screening tool is to provide a relatively quick assessment of the feasibility of a roundabout at a particular intersection in comparison to other appropriate forms of traffic control or road modifications including all-way stop control, traffic signals, auxiliary lanes, etc. The intended outcome of this tool is to provide enough information to assist staff in deciding whether or not to proceed with an Intersection Control Study to investigate the feasibility of a roundabout in more detail.

1 Project Name:

Meadows Phase 5

2 Intersection:

Street 23 + Cambrian Road

3 Location and Description of Intersection:
Lane configuration, total or approach AADT, distance to nearby intersection(s), etc. Attach or sketch a diagram and include existing and/or horizon-year turning movements. If an existing intersection then indicate type of control.

Proposed 4-legged intersection to be located approximately 590m east of Borrisokane Road.

AADT (AM & PM)
NB approach - 1185 vehs
SB approach - 2675 vehs
EB approach - 4665 vehs
WB approach - 6670 vehs

4 What traditional modifications are proposed?
All-way stop control, traffic signals, auxiliary lanes, etc. Attach or sketch a diagram if necessary.

- SB and NB stop controls
- Auxiliary southbound lefttwn lane along Cambria Road proposed (71m storage)

5 What size of roundabout is being considered?
Describe, and attach a Roundabout Traffic Flow Worksheet.

Single-lane roundabout

6 Why is a roundabout being considered?

This is a "new city intersection"

7 Are there contra-indications for a roundabout?

If "Yes" is indicated for one or more of the contra-indications then a roundabout may be problematic at the subject intersection. That is not to say that a roundabout is not possible, just that there may be difficulties or high costs.

No.	Contra-Indication	Outcome
1	Is there insufficient property at the intersection (i.e. less than 44 metres diameter if considering a single-lane roundabout, and less than 60 metres if considering a two-lane roundabout) or property constraints that would require demolition of adjacent structures?	Yes ☐ No ☒
2	Are there any instances where stopping sight distance (SSD) of a roundabout yield line may not be attainable (i.e. the intersection is on a crest vertical curve)?	Yes ☐ No ☒
3	Is there an existing uncontrolled approach with a grade in excess of 4 percent?	Yes ☐ No ☒
4	Is the intersection located within a coordinated signal system?	Yes ☐ No ☒
5	Is there a closely-spaced traffic signal or railway crossing that could not be controlled with a nearby roundabout?	Yes ☐ No ☒
6	Are significant differences in directional flows or any situations of sudden high demand expected?	Yes ☐ No ☒
7	Are there known visually-impaired pedestrians that cross this intersection?	Yes ☐ No ☒

8 Are there suitability factors for a roundabout?

If "Yes" is indicated for two or more of the suitability factors then a roundabout should be technically feasible at the subject intersection.

No.	Suitability Factor	Outcome	
1	Does the intersection currently experience an average collision frequency of more than 1.5 injury crashes per year, or a collision rate in excess of 1injury crash per 1 million vehicles entering (MVE)?	Yes ☐ No ☒	Intersection does not exist.
2	Has there been a fatal crash at the intersection in the last 10 years?	Yes ☐ No ☒	Intersection does not exis
3	Are capacity problems currently being experienced, or expected in the future?	Yes ☐ No ☒	
4	Are traffic signals warranted, or expected to be warranted in the future?	Yes ☒ No ☐	
5	Does the intersection have more than 4 legs, or unusual geometry?	Yes ☐ No ☒	
6	Will planned modifications to the intersection require that nearby structures be widened (i.e. to accommodate left-turn lanes)?	Yes ☐ No ☒	
7	Is the intersection located at a transition between rural and urban environments (i.e. an urban boundary) such that a roundabout could act as a means of speed transition?	Yes ☒ No ☐	

9	Conclusions/recommendation whether to proceed with an Intersection Control Study:	The overall conclusion of the roundabout screening form for the proposed intersection of Cambrian Road and Street 23 is that a roundabout meets the requirements based on the suitability factors.

Project No.: 115637 **Horizon Year:** 2027

Intersection: Cambrian Road at Street 23/Half Moon Bay West Access 2 **Time Period:** AM Peak

Entering+Circulating 944

eet 23/Half Moon Bay West Access 2

335

77	0	258	0

105

% Trucks 2%

Single-Lane V/C 0.39

Double-Lane V/C 0.17

PHF 1.00

Single-Lane V/C 0.52

Double-Lane V/C 0.26

% Trucks 2%

672

Entering+Circulating 525

Cambrian Road W

253

22
205
26

609

272

122

485

83

495

14

592

Cambrian Road E

714 **Entering+Circulating**

517

% Trucks 2%

Single-Lane V/C 0.24

Double-Lane V/C 0.11

40

0	100	0	54

154

eet 23/Half Moon Bay West Access 2

Entering+Circulating 639

Single-Lane V/C 0.16

Double-Lane V/C 0.08

% Trucks 2%

- Input Field

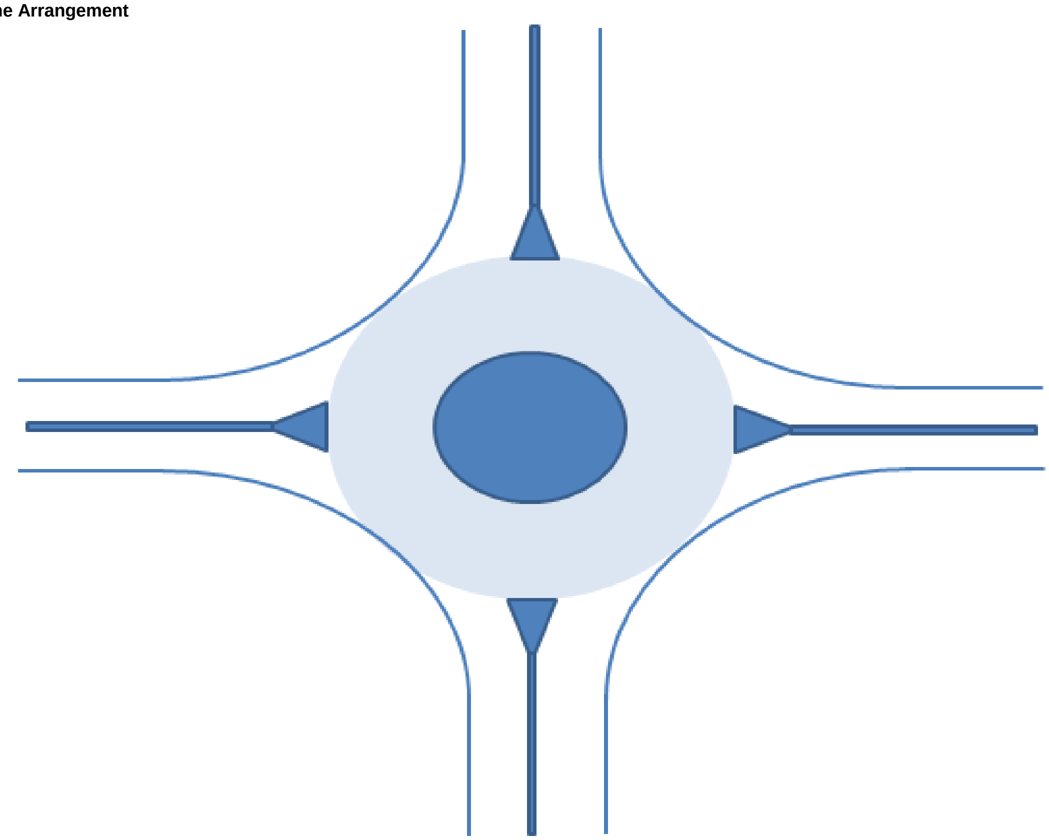
- Formula Field

Capacity Guidelines for Single-Lane Roundabouts

1. Single-lane service volumes < 900 vph - 1200 vph
2. Exit flow < 900 vph - 1200 vph
3. Entry flow + circulating flow < 1400 vph - 1800 vph
4. Circulating flow downstream of any entry 1400 vph - 1800 vph
5. V/C > 0.85

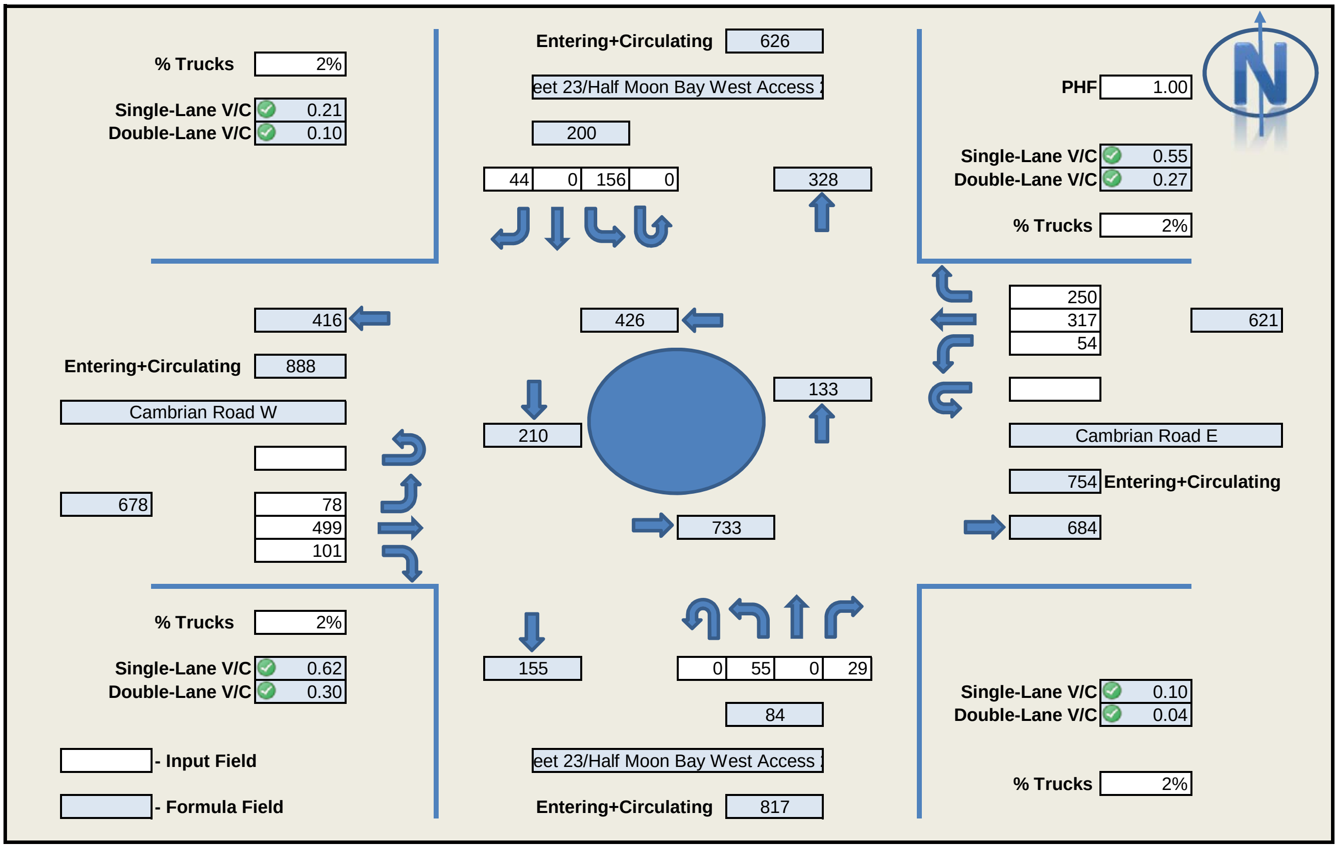
RODEL Inputs					
Leg	PCU	1st Exit	2nd Exit	3rd Exit	U-Turn
/Half Moon Bay West Ac	1.02	77	0	258	0
Cambrian Road W	1.02	26	205	22	0
/Half Moon Bay West Ac	1.02	54	0	100	0
Cambrian Road E	1.02	83	495	14	0

Proposed Lane Arrangement



Project No.: 115637 **Horizon Year:** 2027

Intersection: Cambrian Road at Street 23/Half Moon Bay West Access 2 **Time Period:** PM Peak

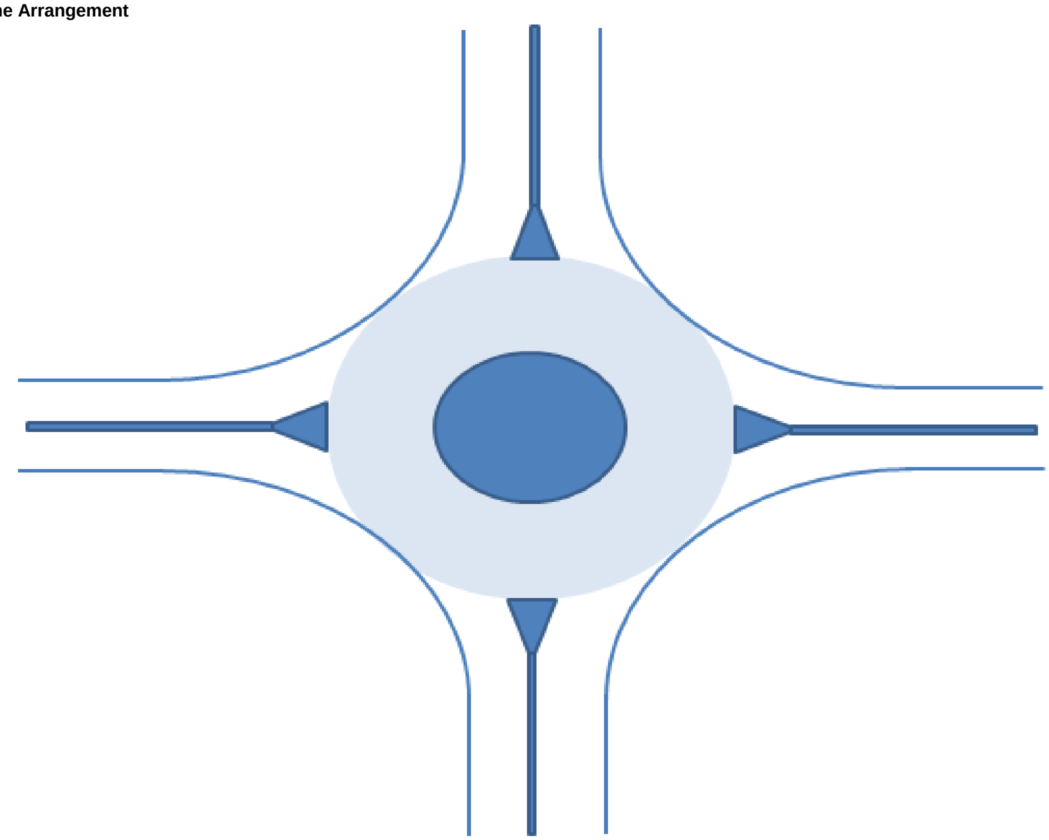


Capacity Guidelines for Single-Lane Roundabouts

1. Single-lane service volumes < 900 vph - 1200 vph
2. Exit flow < 900 vph - 1200 vph
3. Entry flow + circulating flow < 1400 vph - 1800 vph
4. Circulating flow downstream of any entry 1400 vph - 1800 vph
5. V/C > 0.85

RODEL Inputs					
Leg	PCU	1st Exit	2nd Exit	3rd Exit	U-Turn
/Half Moon Bay West Ac	1.02	44	0	156	0
Cambrian Road W	1.02	101	499	78	0
/Half Moon Bay West Ac	1.02	29	0	55	0
Cambrian Road E	1.02	250	317	54	0

Proposed Lane Arrangement



The Meadows Phase 5

Transportation Impact Assessment Report

Appendix J: Synchro and SIDRA Results

April 2018

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	317	66	0	0	72	0
Stage 1	66	-	-	-	-	-
Stage 2	251	-	-	-	-	-
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	676	998	-	-	1528	-
Stage 1	957	-	-	-	-	-
Stage 2	791	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	625	998	-	-	1528	-
Mov Cap-2 Maneuver	625	-	-	-	-	-
Stage 1	957	-	-	-	-	-
Stage 2	731	-	-	-	-	-

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	-

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	49	0	0	52	0
Stage 1	49	-	-	-	-	-
Stage 2	849	-	-	-	-	-
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	1020	-	-	1554	-
Stage 1	973	-	-	-	-	-
Stage 2	419	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	228	1020	-	-	1554	-
Mov Cap-2 Maneuver	228	-	-	-	-	-
Stage 1	973	-	-	-	-	-
Stage 2	308	-	-	-	-	-

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)	-	-	870	1554	-
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	-

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	959	-	-	-	-	-
Stage 2	730	-	-	-	-	-

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	-

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	972	-	-	-	-	-
Stage 2	307	-	-	-	-	-

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	-

Intersection	
Int Delay, s/veh	13

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	39	594	61	20	222	32
Future Vol, veh/h	39	594	61	20	222	32
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	594	61	20	222	32

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	547	71	0	0	81	0
Stage 1	71	-	-	-	-	-
Stage 2	476	-	-	-	-	-
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	498	991	-	-	1517	-
Stage 1	952	-	-	-	-	-
Stage 2	625	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	424	991	-	-	1517	-
Mov Cap-2 Maneuver	424	-	-	-	-	-
Stage 1	952	-	-	-	-	-
Stage 2	532	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	17.2	0	6.8
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	916	1517	-
HCM Lane V/C Ratio	-	-	0.691	0.146	-
HCM Control Delay (s)	-	-	17.2	7.8	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	5.8	0.5	-

Intersection	
Int Delay, s/veh	11.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	25	370	57	34	608	52
Future Vol, veh/h	25	370	57	34	608	52
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	25	370	57	34	608	52

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1342	74	0	0	91	0
Stage 1	74	-	-	-	-	-
Stage 2	1268	-	-	-	-	-
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	168	988	-	-	1504	-
Stage 1	949	-	-	-	-	-
Stage 2	265	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	98	988	-	-	1504	-
Mov Cap-2 Maneuver	98	-	-	-	-	-
Stage 1	949	-	-	-	-	-
Stage 2	155	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	20	0	8.3
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	627	1504	-
HCM Lane V/C Ratio	-	-	0.63	0.404	-
HCM Control Delay (s)	-	-	20	9	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	4.4	2	-

Intersection	
Int Delay, s/veh	2.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	194	26	14	456	100	54
Future Vol, veh/h	194	26	14	456	100	54
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	194	26	14	456	100	54

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	220	0	691	207
Stage 1	-	-	-	-	207	-
Stage 2	-	-	-	-	484	-
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	-	-	1349	-	410	833
Stage 1	-	-	-	-	828	-
Stage 2	-	-	-	-	620	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1349	-	406	833
Mov Cap-2 Maneuver	-	-	-	-	406	-
Stage 1	-	-	-	-	828	-
Stage 2	-	-	-	-	614	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	15.5
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	495	-	-	1349	-
HCM Lane V/C Ratio	0.311	-	-	0.01	-
HCM Control Delay (s)	15.5	-	-	7.7	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	1.3	-	-	0	-

Intersection	
Int Delay, s/veh	2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	463	101	54	297	55	29
Future Vol, veh/h	463	101	54	297	55	29
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	463	101	54	297	55	29

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	564	0	919	514
Stage 1	-	-	-	-	514	-
Stage 2	-	-	-	-	405	-
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	-	-	1008	-	301	560
Stage 1	-	-	-	-	600	-
Stage 2	-	-	-	-	673	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1008	-	285	560
Mov Cap-2 Maneuver	-	-	-	-	285	-
Stage 1	-	-	-	-	600	-
Stage 2	-	-	-	-	637	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.3	18.9
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	343	-	-	1008	-
HCM Lane V/C Ratio	0.245	-	-	0.054	-
HCM Control Delay (s)	18.9	-	-	8.8	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	0.9	-	-	0.2	-

Intersection	
Int Delay, s/veh	11.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	32	539	67	19	208	34
Future Vol, veh/h	32	539	67	19	208	34
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	32	539	67	19	208	34

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	527	77	0	0	86	0
Stage 1	77	-	-	-	-	-
Stage 2	450	-	-	-	-	-
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	512	984	-	-	1510	-
Stage 1	946	-	-	-	-	-
Stage 2	642	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	440	984	-	-	1510	-
Mov Cap-2 Maneuver	440	-	-	-	-	-
Stage 1	946	-	-	-	-	-
Stage 2	552	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	15.1	0	6.7
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	920	1510	-
HCM Lane V/C Ratio	-	-	0.621	0.138	-
HCM Control Delay (s)	-	-	15.1	7.8	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	4.5	0.5	-

Intersection							
Int Delay, s/veh	9.9						

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	22	338	61	26	551	56
Future Vol, veh/h	22	338	61	26	551	56
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	22	338	61	26	551	56

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1232	74	0	0	87	0
Stage 1	74	-	-	-	-	-
Stage 2	1158	-	-	-	-	-
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	196	988	-	-	1509	-
Stage 1	949	-	-	-	-	-
Stage 2	299	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	122	988	-	-	1509	-
Mov Cap-2 Maneuver	122	-	-	-	-	-
Stage 1	949	-	-	-	-	-
Stage 2	186	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	15.8	0	7.9
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	689	1509	-
HCM Lane V/C Ratio	-	-	0.522	0.365	-
HCM Control Delay (s)	-	-	15.8	8.8	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	3.1	1.7	-

Intersection	
Int Delay, s/veh	24.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	22	205	0	0	495	83	0	0	0	258	0	77
Future Vol, veh/h	22	205	0	0	495	83	0	0	0	258	0	77
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	22	205	0	0	495	83	0	0	0	258	0	77

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	578	0	0	205	0	0	824	827	205	786	786	537
Stage 1	-	-	-	-	-	-	249	249	-	537	537	-
Stage 2	-	-	-	-	-	-	575	578	-	249	249	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	996	-	-	1366	-	-	292	307	836	310	324	544
Stage 1	-	-	-	-	-	-	755	701	-	528	523	-
Stage 2	-	-	-	-	-	-	503	501	-	755	701	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	996	-	-	1366	-	-	246	299	836	304	316	544
Mov Cap-2 Maneuver	-	-	-	-	-	-	246	299	-	304	316	-
Stage 1	-	-	-	-	-	-	736	683	-	515	523	-
Stage 2	-	-	-	-	-	-	432	501	-	736	683	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.8	0	0	82.6
HCM LOS			A	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	-	996	-	-	1366	-	-	338
HCM Lane V/C Ratio	-	0.022	-	-	-	-	-	0.991
HCM Control Delay (s)	0	8.7	0	-	0	-	-	82.6
HCM Lane LOS	A	A	A	-	A	-	-	F
HCM 95th %tile Q(veh)	-	0.1	-	-	0	-	-	11

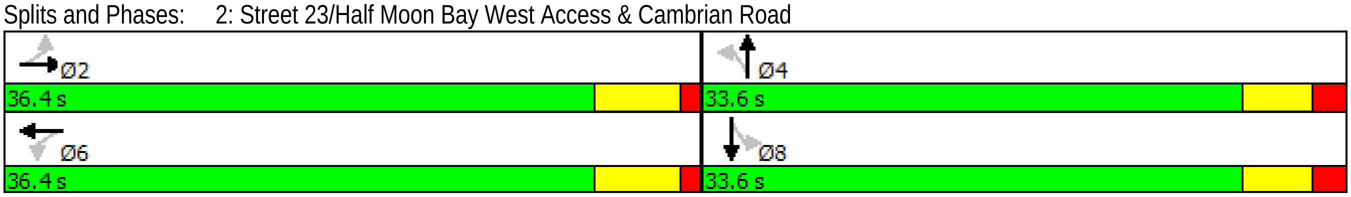
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	22	205	0	0	495	83	0	0	0	258	0	77
Future Volume (vph)	22	205	0	0	495	83	0	0	0	258	0	77
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	15.0		0.0	15.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	1		0	0		0	0		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					0.978						0.969	
Flt Protected	0.950										0.963	
Satd. Flow (prot)	1695	1784	0	1784	1745	0	0	1784	0	0	1665	0
Flt Permitted	0.282										0.775	
Satd. Flow (perm)	503	1784	0	1784	1745	0	0	1784	0	0	1340	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					15						42	
Link Speed (k/h)		70			70			50			50	
Link Distance (m)		509.6			247.9			230.8			283.1	
Travel Time (s)		26.2			12.7			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)	22	205	0	0	495	83	0	0	0	258	0	77
Shared Lane Traffic (%)												
Lane Group Flow (vph)	22	205	0	0	578	0	0	0	0	0	335	0
Turn Type	Perm	NA		Perm	NA					Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2			6			4			8		
Detector Phase	2	2		6	6		4	4		8	8	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	30.7	30.7		30.7	30.7		33.5	33.5		33.5	33.5	
Total Split (s)	36.4	36.4		36.4	36.4		33.6	33.6		33.6	33.6	
Total Split (%)	52.0%	52.0%		52.0%	52.0%		48.0%	48.0%		48.0%	48.0%	
Maximum Green (s)	30.7	30.7		30.7	30.7		28.1	28.1		28.1	28.1	
Yellow Time (s)	4.5	4.5		4.5	4.5		3.6	3.6		3.6	3.6	
All-Red Time (s)	1.2	1.2		1.2	1.2		1.9	1.9		1.9	1.9	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	
Total Lost Time (s)	5.7	5.7		5.7	5.7			5.5			5.5	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	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		21.0	21.0		21.0	21.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	21.6	21.6			21.6						17.7	
Actuated g/C Ratio	0.42	0.42			0.42						0.34	
v/c Ratio	0.10	0.27			0.78						0.69	
Control Delay	12.0	11.7			22.0						21.7	
Queue Delay	0.0	0.0			0.0						0.0	
Total Delay	12.0	11.7			22.0						21.7	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	B	B			C						C	
Approach Delay		11.7			22.0						21.7	
Approach LOS		B			C						C	
Queue Length 50th (m)	1.1	11.0			39.8						22.0	
Queue Length 95th (m)	5.6	29.2			#96.8						53.8	
Internal Link Dist (m)		485.6			223.9			206.8			259.1	
Turn Bay Length (m)	15.0											
Base Capacity (vph)	324	1150			1130						807	
Starvation Cap Reductn	0	0			0						0	
Spillback Cap Reductn	0	0			0						0	
Storage Cap Reductn	0	0			0						0	
Reduced v/c Ratio	0.07	0.18			0.51						0.42	

Intersection Summary

Area Type: Other
Cycle Length: 70
Actuated Cycle Length: 51.4
Natural Cycle: 65
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 19.8 Intersection LOS: B
Intersection Capacity Utilization 62.2% ICU Level of Service B
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/Half Moon Bay West Access & Cambrian Road



LANE SUMMARY

Site: Cambrian Rd & Street 23/ Mattamy Site Access - 2027 BG AM

AM Peak Hour
Roundabout

Lane Use and Performance	Demand Flows Total veh/h	Demand Flows HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Street 23													
Lane 1[d]	15	3.0	666	0.023	100	5.6	LOS A	0.1	0.6	Full	500	0.0	0.0
Approach	15	3.0		0.023		5.6	LOS A	0.1	0.6				
East: Cambrian Raod													
Lane 1[d]	583	3.0	1062	0.549	100	10.2	LOS B	3.7	28.9	Full	500	0.0	0.0
Approach	583	3.0		0.549		10.2	LOS B	3.7	28.9				
North: Mattamy Site Access													
Lane 1[d]	340	3.0	652	0.521	100	14.0	LOS B	2.7	21.3	Full	500	0.0	0.0
Approach	340	3.0		0.521		14.0	LOS B	2.7	21.3				
West: Cambrian Road													
Lane 1[d]	232	3.0	832	0.279	100	7.4	LOS A	1.1	8.8	Full	500	0.0	0.0
Approach	232	3.0		0.279		7.4	LOS A	1.1	8.8				
Intersection	1170	3.0		0.549		10.7	LOS B	3.7	28.9				

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

Intersection	
Int Delay, s/veh	15.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	78	499	0	0	317	250	0	0	0	156	0	44
Future Vol, veh/h	78	499	0	0	317	250	0	0	0	156	0	44
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	78	499	0	0	317	250	0	0	0	156	0	44

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	567	0	0	499	0	0	1119	1222	499	1097	1097	442
Stage 1	-	-	-	-	-	-	655	655	-	442	442	-
Stage 2	-	-	-	-	-	-	464	567	-	655	655	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1005	-	-	1065	-	-	184	180	572	191	213	615
Stage 1	-	-	-	-	-	-	455	463	-	594	576	-
Stage 2	-	-	-	-	-	-	578	507	-	455	463	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1005	-	-	1065	-	-	157	161	572	175	190	615
Mov Cap-2 Maneuver	-	-	-	-	-	-	157	161	-	175	190	-
Stage 1	-	-	-	-	-	-	406	413	-	530	576	-
Stage 2	-	-	-	-	-	-	537	507	-	406	413	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.2	0	0	100.6
HCM LOS			A	F

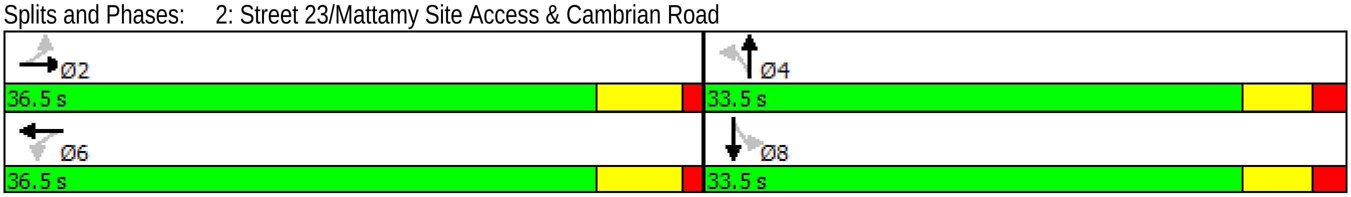
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	-	1005	-	-	1065	-	-	208
HCM Lane V/C Ratio	-	0.078	-	-	-	-	-	0.962
HCM Control Delay (s)	0	8.9	0	-	0	-	-	100.6
HCM Lane LOS	A	A	A	-	A	-	-	F
HCM 95th %tile Q(veh)	-	0.3	-	-	0	-	-	8.2

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	78	499	0	0	317	250	0	0	0	156	0	44
Future Volume (vph)	78	499	0	0	317	250	0	0	0	156	0	44
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	15.0		0.0	15.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	1		0	0		0	0		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					0.934						0.970	
Flt Protected	0.950										0.962	
Satd. Flow (prot)	1695	1784	0	1784	1667	0	0	1784	0	0	1665	0
Flt Permitted	0.343										0.773	
Satd. Flow (perm)	612	1784	0	1784	1667	0	0	1784	0	0	1338	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					72						42	
Link Speed (k/h)		70			70			50			50	
Link Distance (m)		509.6			247.9			230.8			283.1	
Travel Time (s)		26.2			12.7			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)	78	499	0	0	317	250	0	0	0	156	0	44
Shared Lane Traffic (%)												
Lane Group Flow (vph)	78	499	0	0	567	0	0	0	0	0	200	0
Turn Type	Perm	NA		Perm	NA					Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2			6			4			8		
Detector Phase	2	2		6	6		4	4		8	8	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	30.7	30.7		30.7	30.7		33.5	33.5		33.5	33.5	
Total Split (s)	36.5	36.5		36.5	36.5		33.5	33.5		33.5	33.5	
Total Split (%)	52.1%	52.1%		52.1%	52.1%		47.9%	47.9%		47.9%	47.9%	
Maximum Green (s)	30.8	30.8		30.8	30.8		28.0	28.0		28.0	28.0	
Yellow Time (s)	4.5	4.5		4.5	4.5		3.6	3.6		3.6	3.6	
All-Red Time (s)	1.2	1.2		1.2	1.2		1.9	1.9		1.9	1.9	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	
Total Lost Time (s)	5.7	5.7		5.7	5.7			5.5			5.5	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	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		21.0	21.0		21.0	21.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	21.8	21.8			21.8						12.6	
Actuated g/C Ratio	0.47	0.47			0.47						0.27	
v/c Ratio	0.27	0.59			0.68						0.51	
Control Delay	10.8	12.6			13.5						16.5	
Queue Delay	0.0	0.0			0.0						0.0	
Total Delay	10.8	12.6			13.5						16.5	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	B	B			B						B	
Approach Delay		12.3			13.5						16.5	
Approach LOS		B			B						B	
Queue Length 50th (m)	3.0	23.6			24.1						8.8	
Queue Length 95th (m)	11.7	57.7			64.6						30.0	
Internal Link Dist (m)		485.6			223.9			206.8			259.1	
Turn Bay Length (m)	15.0											
Base Capacity (vph)	423	1234			1176						857	
Starvation Cap Reductn	0	0			0						0	
Spillback Cap Reductn	0	0			0						0	
Storage Cap Reductn	0	0			0						0	
Reduced v/c Ratio	0.18	0.40			0.48						0.23	

Intersection Summary	
Area Type: Other	
Cycle Length: 70	
Actuated Cycle Length: 46	
Natural Cycle: 65	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.68	
Intersection Signal Delay: 13.4	Intersection LOS: B
Intersection Capacity Utilization 68.1%	ICU Level of Service C
Analysis Period (min) 15	

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



LANE SUMMARY

Site: Cambrian Rd & Street 23/ Mattamy Site Access - 2027 BG PM

PM Peak Hour
Roundabout

Lane Use and Performance

	Demand Flows Total veh/h	Demand Flows HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Street 23													
Lane 1[d]	15	3.0	516	0.029	100	7.3	LOS A	0.1	0.7	Full	500	0.0	0.0
Approach	15	3.0		0.029		7.3	LOS A	0.1	0.7				
East: Cambrian Raod													
Lane 1[d]	572	3.0	1002	0.571	100	11.1	LOS B	3.8	29.3	Full	500	0.0	0.0
Approach	572	3.0		0.571		11.1	LOS B	3.8	29.3				
North: Mattamy Site Access													
Lane 1[d]	205	3.0	783	0.262	100	7.5	LOS A	1.0	8.0	Full	500	0.0	0.0
Approach	205	3.0		0.262		7.5	LOS A	1.0	8.0				
West: Cambrian Road													
Lane 1[d]	582	3.0	925	0.629	100	13.4	LOS B	4.4	34.5	Full	500	0.0	0.0
Approach	582	3.0		0.629		13.4	LOS B	4.4	34.5				
Intersection	1374	3.0		0.629		11.5	LOS B	4.4	34.5				

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

Intersection	
Int Delay, s/veh	14.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	40	631	67	21	232	34
Future Vol, veh/h	40	631	67	21	232	34
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	40	631	67	21	232	34

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	576	78	0	0	88	0
Stage 1	78	-	-	-	-	-
Stage 2	498	-	-	-	-	-
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	479	983	-	-	1508	-
Stage 1	945	-	-	-	-	-
Stage 2	611	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	404	983	-	-	1508	-
Mov Cap-2 Maneuver	404	-	-	-	-	-
Stage 1	945	-	-	-	-	-
Stage 2	515	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	19.4	0	6.8
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	906	1508	-
HCM Lane V/C Ratio	-	-	0.741	0.154	-
HCM Control Delay (s)	-	-	19.4	7.8	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	6.9	0.5	-

Intersection	
Int Delay, s/veh	13.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	26	389	61	34	644	56
Future Vol, veh/h	26	389	61	34	644	56
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	389	61	34	644	56

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1422	78	0	0	95	0
Stage 1	78	-	-	-	-	-
Stage 2	1344	-	-	-	-	-
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	150	983	-	-	1499	-
Stage 1	945	-	-	-	-	-
Stage 2	243	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	84	983	-	-	1499	-
Mov Cap-2 Maneuver	84	-	-	-	-	-
Stage 1	945	-	-	-	-	-
Stage 2	135	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	24.5	0	8.5
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	588	1499	-
HCM Lane V/C Ratio	-	-	0.706	0.43	-
HCM Control Delay (s)	-	-	24.5	9.2	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	5.7	2.2	-

Intersection	
Int Delay, s/veh	39.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	22	205	26	14	495	83	100	0	54	258	0	77
Future Vol, veh/h	22	205	26	14	495	83	100	0	54	258	0	77
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	22	205	26	14	495	83	100	0	54	258	0	77

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	578	0	0	231	0	0	865	868	218	854	840	537
Stage 1	-	-	-	-	-	-	262	262	-	565	565	-
Stage 2	-	-	-	-	-	-	603	606	-	289	275	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	996	-	-	1337	-	-	274	290	822	279	302	544
Stage 1	-	-	-	-	-	-	743	691	-	510	508	-
Stage 2	-	-	-	-	-	-	486	487	-	719	683	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	996	-	-	1337	-	-	228	278	822	~ 253	290	544
Mov Cap-2 Maneuver	-	-	-	-	-	-	228	278	-	~ 253	290	-
Stage 1	-	-	-	-	-	-	724	674	-	497	500	-
Stage 2	-	-	-	-	-	-	411	479	-	655	666	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.8	0.2	28.3	143.1
HCM LOS			D	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	305	996	-	-	1337	-	-	288
HCM Lane V/C Ratio	0.505	0.022	-	-	0.01	-	-	1.163
HCM Control Delay (s)	28.3	8.7	0	-	7.7	0	-	143.1
HCM Lane LOS	D	A	A	-	A	A	-	F
HCM 95th %tile Q(veh)	2.7	0.1	-	-	0	-	-	14.5

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

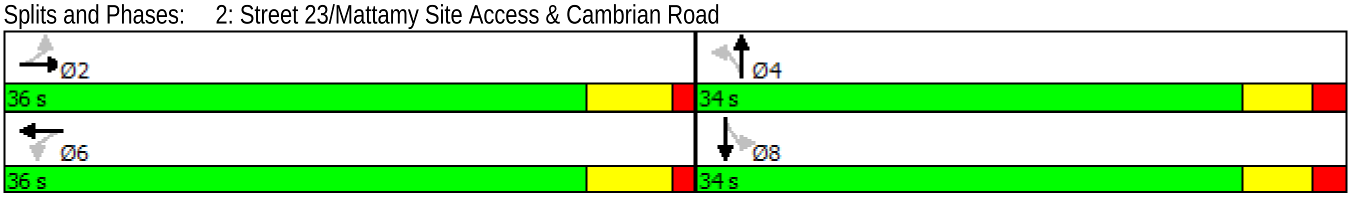
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	22	205	26	14	495	83	100	0	54	258	0	77
Future Volume (vph)	22	205	26	14	495	83	100	0	54	258	0	77
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	15.0		0.0	15.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	1		0	0		0	0		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		0.983			0.978			0.953			0.969	
Flt Protected	0.950			0.950				0.969			0.963	
Satd. Flow (prot)	1695	1754	0	1695	1745	0	0	1648	0	0	1665	0
Flt Permitted	0.275			0.615				0.688			0.698	
Satd. Flow (perm)	491	1754	0	1097	1745	0	0	1170	0	0	1207	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		12			15			47			42	
Link Speed (k/h)		70			70			50			50	
Link Distance (m)		509.6			247.9			230.8			283.1	
Travel Time (s)		26.2			12.7			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)	22	205	26	14	495	83	100	0	54	258	0	77
Shared Lane Traffic (%)												
Lane Group Flow (vph)	22	231	0	14	578	0	0	154	0	0	335	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2			6			4			8		
Detector Phase	2	2		6	6		4	4		8	8	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	30.7	30.7		30.7	30.7		33.5	33.5		33.5	33.5	
Total Split (s)	36.0	36.0		36.0	36.0		34.0	34.0		34.0	34.0	
Total Split (%)	51.4%	51.4%		51.4%	51.4%		48.6%	48.6%		48.6%	48.6%	
Maximum Green (s)	30.3	30.3		30.3	30.3		28.5	28.5		28.5	28.5	
Yellow Time (s)	4.5	4.5		4.5	4.5		3.6	3.6		3.6	3.6	
All-Red Time (s)	1.2	1.2		1.2	1.2		1.9	1.9		1.9	1.9	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	
Total Lost Time (s)	5.7	5.7		5.7	5.7			5.5			5.5	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	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		21.0	21.0		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			18.8			18.8	
Actuated g/C Ratio	0.42	0.42		0.42	0.42			0.35			0.35	
v/c Ratio	0.11	0.31		0.03	0.78			0.35			0.74	
Control Delay	12.6	12.0		10.9	23.0			12.5			24.9	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	12.6	12.0		10.9	23.0			12.5			24.9	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	B	B		B	C			B			C	
Approach Delay		12.0			22.7			12.5			24.9	
Approach LOS		B			C			B			C	
Queue Length 50th (m)	1.2	12.8		0.7	43.0			7.1			23.6	
Queue Length 95th (m)	5.7	32.0		3.9	#100.6			20.9			56.9	
Internal Link Dist (m)		485.6			223.9			206.8			259.1	
Turn Bay Length (m)	15.0			15.0								
Base Capacity (vph)	303	1088		678	1084			699			719	
Starvation Cap Reductn	0	0		0	0			0			0	
Spillback Cap Reductn	0	0		0	0			0			0	
Storage Cap Reductn	0	0		0	0			0			0	
Reduced v/c Ratio	0.07	0.21		0.02	0.53			0.22			0.47	

Intersection Summary

Area Type: Other
Cycle Length: 70
Actuated Cycle Length: 53.1
Natural Cycle: 65
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 20.0 Intersection LOS: C
Intersection Capacity Utilization 67.2% ICU Level of Service C
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



LANE SUMMARY

Site: Cambrian Rd & Street 23/ Mattamy Site Access - 2027 BGSG AM

AM Peak Hour
Roundabout

Lane Use and Performance

	Demand Flows Total veh/h	Demand Flows HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Street 23													
Lane 1[d]	155	3.0	666	0.233	100	8.2	LOS A	0.8	6.6	Full	500	0.0	0.0
Approach	155	3.0		0.233		8.2	LOS A	0.8	6.6				
East: Cambrian Raod													
Lane 1[d]	592	3.0	967	0.612	100	12.5	LOS B	4.2	32.5	Full	500	0.0	0.0
Approach	592	3.0		0.612		12.5	LOS B	4.2	32.5				
North: Mattamy Site Access													
Lane 1[d]	336	3.0	586	0.573	100	16.9	LOS C	3.1	24.2	Full	500	0.0	0.0
Approach	336	3.0		0.573		16.9	LOS C	3.1	24.2				
West: Cambrian Road													
Lane 1[d]	253	3.0	828	0.305	100	7.8	LOS A	1.3	9.8	Full	500	0.0	0.0
Approach	253	3.0		0.305		7.8	LOS A	1.3	9.8				
Intersection	1336	3.0		0.612		12.2	LOS B	4.2	32.5				

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

Intersection	
Int Delay, s/veh	38.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	78	499	101	54	317	250	55	0	29	156	0	44
Future Vol, veh/h	78	499	101	54	317	250	55	0	29	156	0	44
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	78	499	101	54	317	250	55	0	29	156	0	44

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	567	0	0	600	0	0	1278	1381	550	1270	1306	442
Stage 1	-	-	-	-	-	-	706	706	-	550	550	-
Stage 2	-	-	-	-	-	-	572	675	-	720	756	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1005	-	-	977	-	-	143	144	535	~ 145	160	615
Stage 1	-	-	-	-	-	-	427	439	-	519	516	-
Stage 2	-	-	-	-	-	-	505	453	-	419	416	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1005	-	-	977	-	-	113	116	535	~ 117	129	615
Mov Cap-2 Maneuver	-	-	-	-	-	-	113	116	-	~ 117	129	-
Stage 1	-	-	-	-	-	-	377	387	-	458	473	-
Stage 2	-	-	-	-	-	-	429	415	-	350	367	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1	0.8	52.8	278.8
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	155	1005	-	-	977	-	-	142
HCM Lane V/C Ratio	0.542	0.078	-	-	0.055	-	-	1.408
HCM Control Delay (s)	52.8	8.9	0	-	8.9	0	-	278.8
HCM Lane LOS	F	A	A	-	A	A	-	F
HCM 95th %tile Q(veh)	2.7	0.3	-	-	0.2	-	-	13

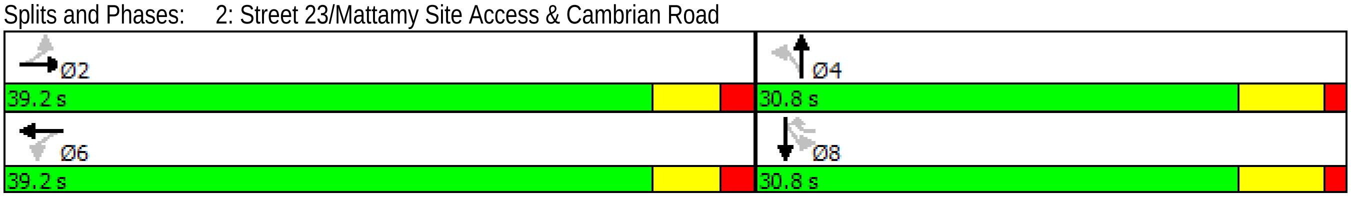
Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	78	499	101	54	317	250	55	0	29	156	0	44
Future Volume (vph)	78	499	101	54	317	250	55	0	29	156	0	44
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	40.0		0.0	15.0		10.0	20.0		0.0	70.0		0.0
Storage Lanes	1		0	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		0.975				0.850		0.850			0.850	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1695	1740	0	1695	1784	1517	1695	1517	0	1695	1517	0
Flt Permitted	0.568			0.300			0.728			0.738		
Satd. Flow (perm)	1013	1740	0	535	1784	1517	1299	1517	0	1317	1517	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		20				146		283			467	
Link Speed (k/h)		70			70			50			50	
Link Distance (m)		509.6			247.9			230.8			283.1	
Travel Time (s)		26.2			12.7			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)	78	499	101	54	317	250	55	0	29	156	0	44
Shared Lane Traffic (%)												
Lane Group Flow (vph)	78	600	0	54	317	250	55	29	0	156	44	0
Turn Type	Perm	NA		Perm	NA	custom	Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2			6		8	4			8		
Detector Phase	2	2		6	6	8	4	4		8	8	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0		10.0	10.0	
Minimum Split (s)	33.5	33.5		33.5	33.5	30.7	30.7	30.7		30.7	30.7	
Total Split (s)	39.2	39.2		39.2	39.2	30.8	30.8	30.8		30.8	30.8	
Total Split (%)	56.0%	56.0%		56.0%	56.0%	44.0%	44.0%	44.0%		44.0%	44.0%	
Maximum Green (s)	33.7	33.7		33.7	33.7	25.1	25.1	25.1		25.1	25.1	
Yellow Time (s)	3.6	3.6		3.6	3.6	4.5	4.5	4.5		4.5	4.5	
All-Red Time (s)	1.9	1.9		1.9	1.9	1.2	1.2	1.2		1.2	1.2	
Lost Time Adjust (s)	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	5.7	5.7	5.7		5.7	5.7	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	Min	Min		Min	Min	None	None	None		None	None	
Walk Time (s)	7.0	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	18.0	18.0	18.0		18.0	18.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0		0	0	
Act Effct Green (s)	20.9	20.9		20.9	20.9	13.0	13.0	13.0		13.0	13.0	
Actuated g/C Ratio	0.46	0.46		0.46	0.46	0.28	0.28	0.28		0.28	0.28	
v/c Ratio	0.17	0.74		0.22	0.39	0.47	0.15	0.05		0.42	0.06	
Control Delay	8.4	16.4		10.3	9.8	10.5	15.7	0.1		19.4	0.1	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	8.4	16.4		10.3	9.8	10.5	15.7	0.1		19.4	0.1	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	A	B		B	A	B	B	A		B	A	
Approach Delay		15.5			10.1			10.3			15.1	
Approach LOS		B			B			B			B	
Queue Length 50th (m)	2.9	29.5		2.0	13.0	5.8	3.0	0.0		9.2	0.0	
Queue Length 95th (m)	10.5	77.5		9.0	34.8	25.9	12.0	0.0		29.0	0.0	
Internal Link Dist (m)		485.6			223.9			206.8			259.1	
Turn Bay Length (m)	40.0			15.0		10.0	20.0			70.0		
Base Capacity (vph)	789	1360		417	1390	941	753	999		764	1076	
Starvation Cap Reductn	0	0		0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0		0	0	
Storage Cap Reductn	0	0		0	0	0	0	0		0	0	
Reduced v/c Ratio	0.10	0.44		0.13	0.23	0.27	0.07	0.03		0.20	0.04	

Intersection Summary	
Area Type: Other	
Cycle Length: 70	
Actuated Cycle Length: 45.7	
Natural Cycle: 65	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.74	
Intersection Signal Delay: 13.1	Intersection LOS: B
Intersection Capacity Utilization 72.2%	ICU Level of Service C
Analysis Period (min) 15	

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



LANE SUMMARY

Site: Cambrian Rd & Street 23/ Mattamy Site Access - 2027 BGSG PM

PM Peak Hour
Roundabout

Lane Use and Performance

	Demand Flows Total veh/h	Demand Flows HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Street 23													
Lane 1[d]	85	3.0	516	0.165	100	9.2	LOS A	0.5	4.3	Full	500	0.0	0.0
Approach	85	3.0		0.165		9.2	LOS A	0.5	4.3				
East: Cambrian Raod													
Lane 1[d]	621	3.0	956	0.650	100	13.7	LOS B	4.7	36.5	Full	500	0.0	0.0
Approach	621	3.0		0.650		13.7	LOS B	4.7	36.5				
North: Mattamy Site Access													
Lane 1[d]	201	3.0	707	0.284	100	8.5	LOS A	1.1	8.5	Full	500	0.0	0.0
Approach	201	3.0		0.284		8.5	LOS A	1.1	8.5				
West: Cambrian Road													
Lane 1[d]	678	3.0	883	0.768	100	20.0	LOS C	8.2	63.6	Full	500	0.0	0.0
Approach	678	3.0		0.768		20.0	LOS C	8.2	63.6				
Intersection	1585	3.0		0.768		15.5	LOS C	8.2	63.6				

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

TAMARACK

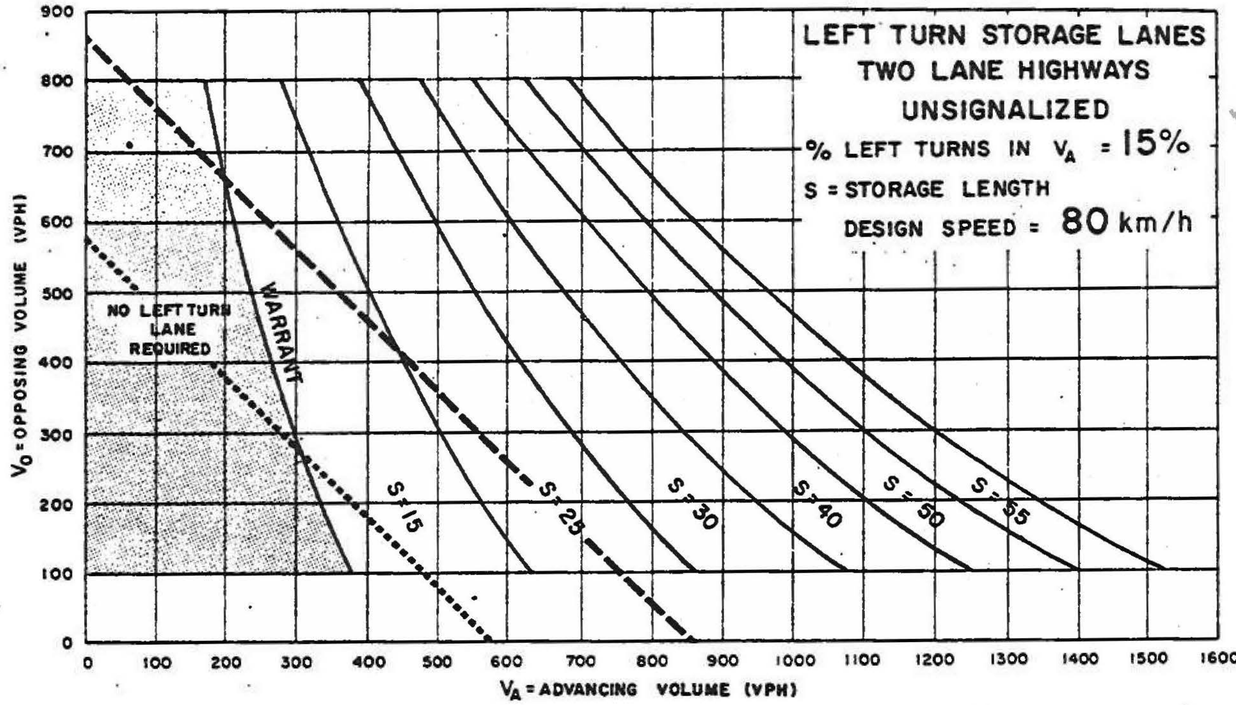
The Meadows Phase 5

Transportation Impact Assessment Report

Appendix K: Technical Standards

April 2018

IBI



TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW

TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

Cambrian Rd & Street 23 - 2022 Total Traffic Condition
Westbound Left-turn

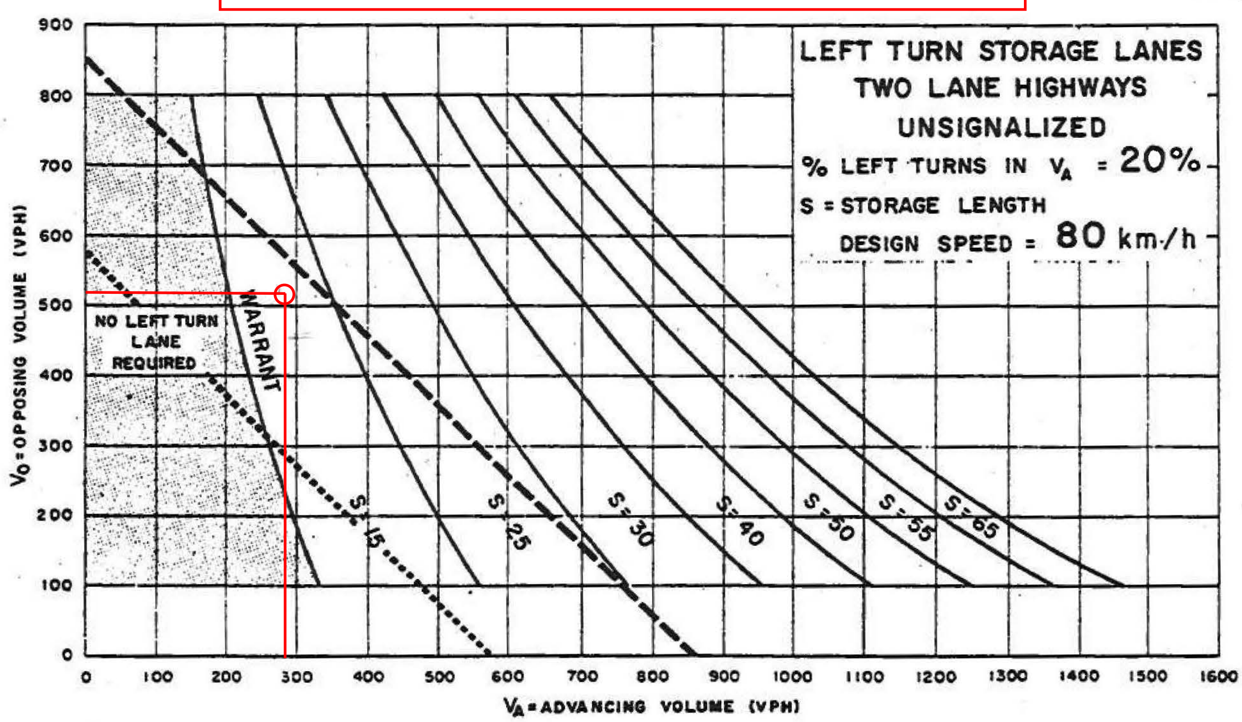
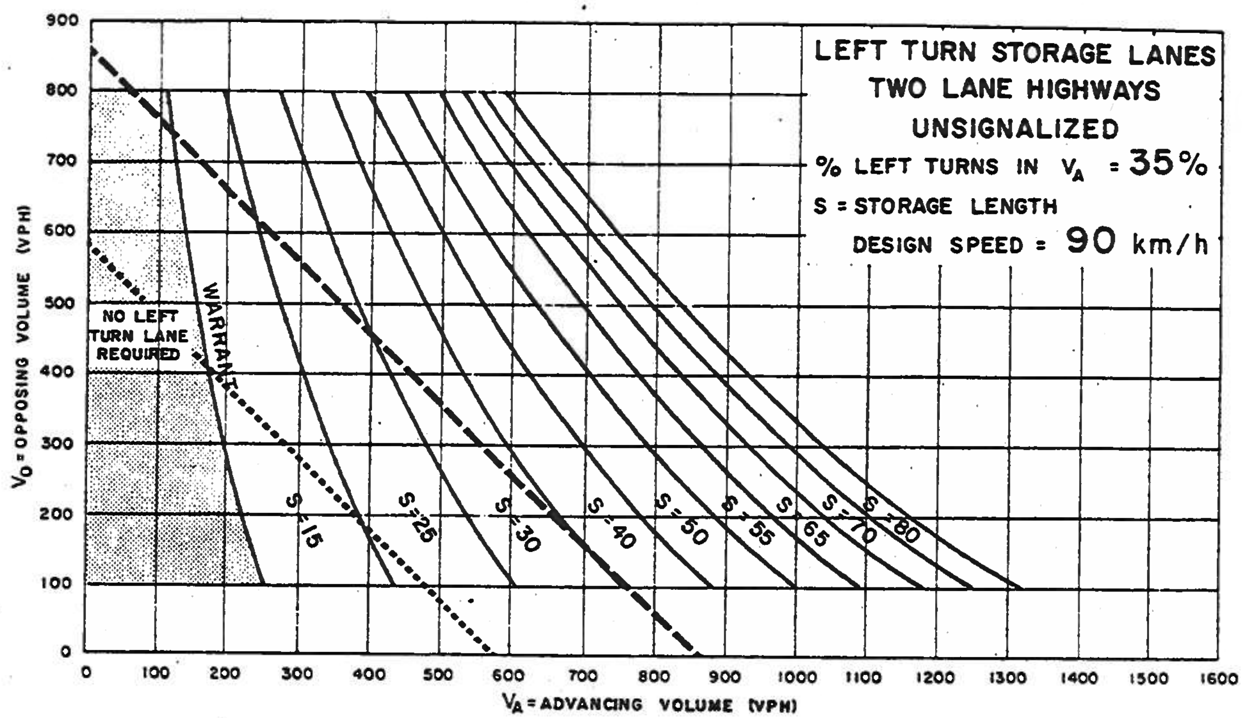


Figure EA-15



TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW

TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

Cambrian Road and Borrisokane Road SBL - 2027 Total Traffic
Southbound Left-turn

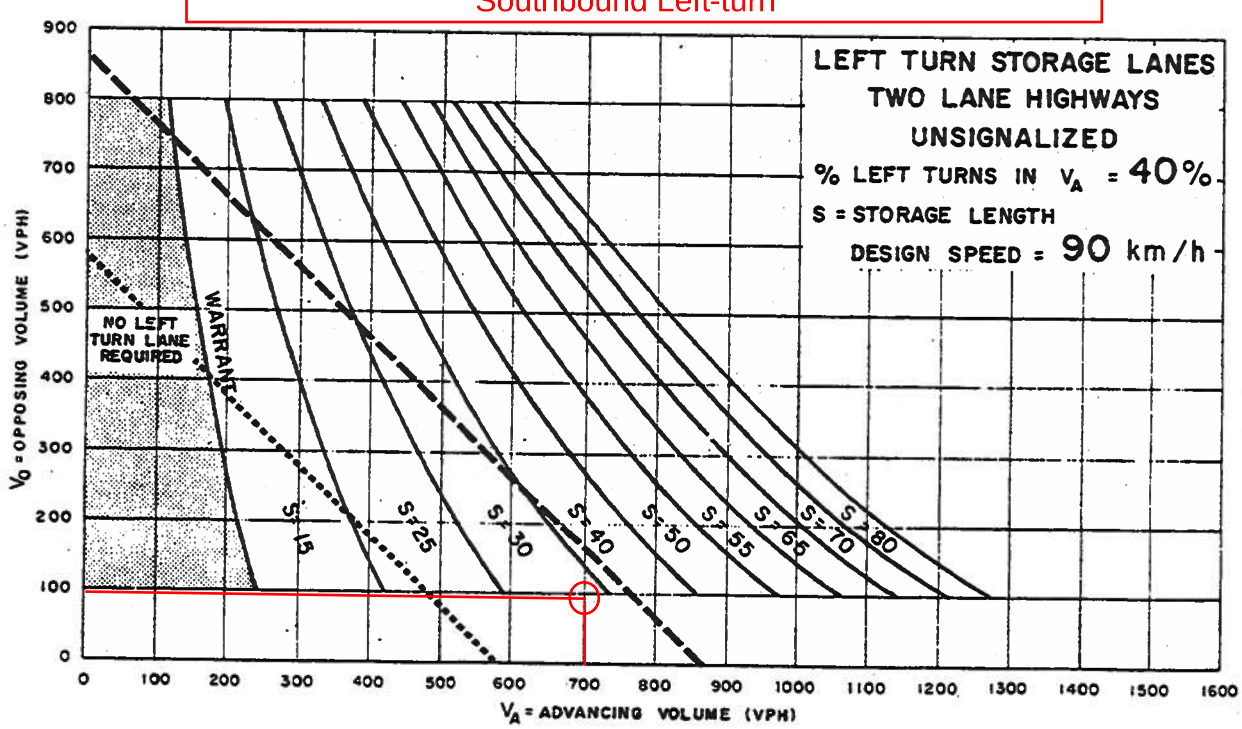


Figure EA-21