3809 Borrisokane Road Transportation Impact Assessment

Step 1 Screening Report

Step 2 Scoping Report

Step 3 Forecasting Report

Step 4 Strategy Report

Step 5 TIA Report - Revised

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July 2019

PN: 2018-05

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1 Screening

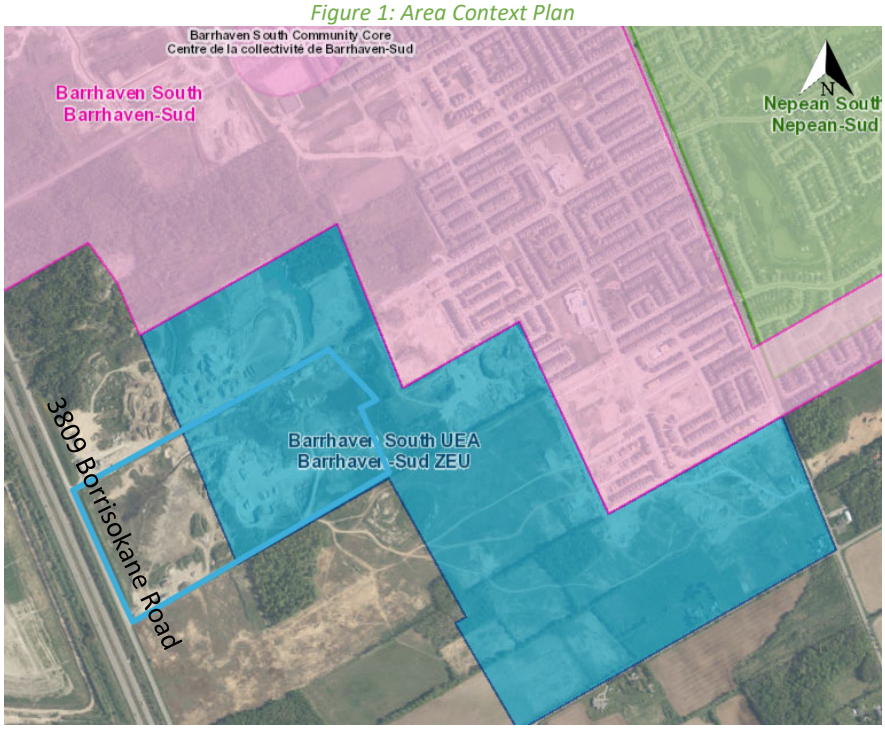
This study has been prepared according to the City of Ottawa's 2017 Transportation Impact Assessment (TIA) Guidelines. Accordingly, a Step 1 Screening Form has been prepared and is included as Appendix A, along with the Certification Form for TIA Study PM. As shown in the Screening Form, a TIA is required.

2 Existing and Planned Conditions

2.1 Proposed Development

The proposed development, located at 3809 Borrisokane Road, is currently a greenfield property within the Barrhaven South Urban Expansion Area (UEA). The site is in an area that is currently zoned ME Mineral Extraction Zone. The current zoning modification application would modify the zoning to allow for low-rise residential uses on the eastern portion of the property. Beyond the Urban Boundary the western portion of the land will remain the current zoning, however, a road connection is proposed through to Borrisokane Road, which will be the primary access for the development. The proposed residential development will consist of a mixture of detached homes and townhouses. The concept plan currently considers a total of approximately 590 units, split between townhouse and detached units. Access to the proposed development will be via a full movement access to Borrisokane Road, and ultimately will be accessed via New Greenbank Road. The New Greenbank Road access configuration will be determined once that road is completed. The development will also have connections to the adjacent developments to allow access to shared community services (i.e. parks, schools, etc.) through Block 52. A service road for the stormwater pond will be provided through Blcok 51. The development traffic will primarily use the main access (Borrisokane Road) to reach the transportation network, but an interim access through Half Moon Bay South will be provided, prior to the implementation of Re-Aligned Greenbank Road. The anticipated full build-out and occupancy horizon is 2025, with two interim phases. The exact phasing and timing of each phase has not been determined at this time. Figure 1 illustrates the Study Area Context. Figure 2 illustrates the proposed concept plan.

Figure 1: Area Context Plan



SUBJECT TO THE CONDITIONS, IF ANY, SET FORTH IN OUR LETTER DATED ...., THIS DRAFT PLAN IS APPROVED BY THE CITY OF OTTAWA UNDER SECTION 51 OF THE PLANNING ACT THIS .... DAY OF ...., 2019.

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

ADDITIONAL INFORMATION
As required under section 51(17) of the Planning Act R.S.O. 2001

(a)(b)(e)(f)(g)(j) and (l) - As shown on this Plan.
(c) - As shown on this Draft and Key Plan
(d) - Land to be used in accordance with the Schedule of Land Use.
(h)(k) - Full Municipal Services
(i) - Offshore Marine Deposits of clay, silty clay and silt, Bedrock Ottawa Formation, limestone

KEY PLAN (NOT TO SCALE)

DRAFT PLAN OF SUBDIVISION OF

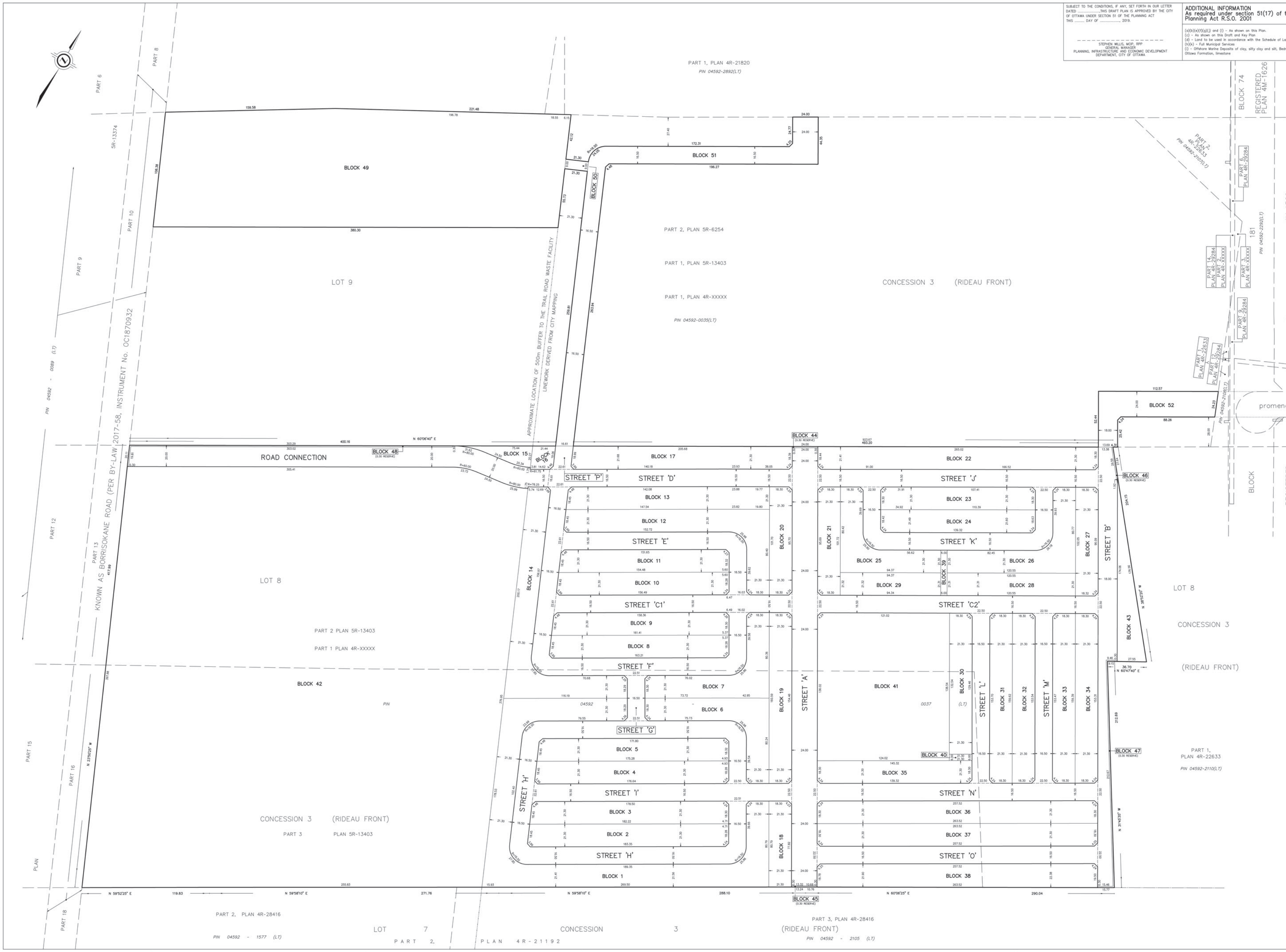
PART OF LOT 8 AND PART OF LOT 9 CONCESSION 3 (RIDEAU FRONT)

GEOGRAPHIC TOWNSHIP OF NEPEAN
NOW IN THE
CITY OF OTTAWA

SCALE 1 : 1000

J.D. BARNES LIMITED

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



OWNER'S CERTIFICATE

BARRHAVEN CONSERVANCY EAST INC., BEING THE REGISTERED OWNER OF THE SUBJECT LANDS HEREBY AUTHORIZES J. D. BARNES LIMITED TO PREPARE AND SUBMIT THIS DRAFT PLAN OF SUBDIVISION FOR APPROVAL.

DATE

FRANK CAIRO
PRESIDENT
(I HAVE THE AUTHORITY TO BIND THE CORPORATION)

SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED ARE CORRECTLY SHOWN.

DATE

C.M. FOX
ONTARIO LAND SURVEYOR

J.D.BARNES LIMITED
SURVEYING MAPPING GIS
LAND INFORMATION SPECIALISTS
2430 DON REID DRIVE, SUITE 204, OTTAWA, ON K1H 1E1
T: (613) 731-7244 F: (613) 731-8955 www.jdbarnes.com

DRAWN BY: NS	CHECKED BY: CF	REFERENCE NO.: 18-10-145-00 DRAFT
		DATED: 05/09/19

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PLOTTED: 7/31/2019

2.2 Existing Conditions

2.2.1 Area Road Network

Borrisokane Road

Borrisokane Road is a City of Ottawa collector road with a two-lane rural cross-section including gravel shoulders and an 80 km/h posted speed limit along the frontage of the site. North of Cambrian Road, Borrisokane Road becomes an Arterial Road, the cross section does not change. The Ottawa Official Plan reserves a 24 metre right of way along the 3908 Borrisokane Road frontage, north of Cambrian Road a 37.5 right of way is reserved.

Cambrian Road

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

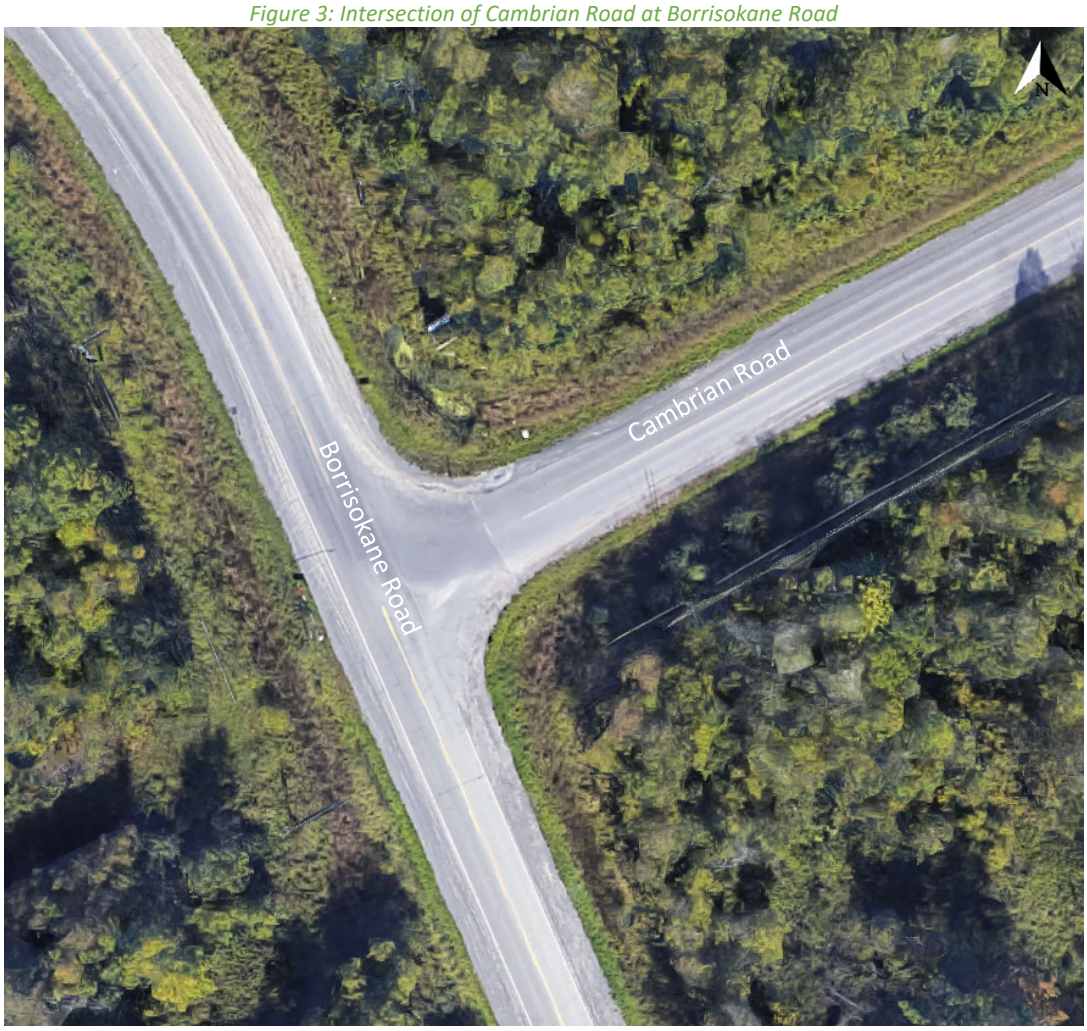
2.2.2 Existing Intersections

There are no existing intersections within one kilometre of the future reserved access onto Borrisokane Road. Just beyond one kilometre to the north and south are the intersections of Borrisokane Road at Cambrian Road and Borrisokane Road at Barnsdale Road, respectively. It is anticipated that, based on the location of this development, that nearly all the traffic will proceed north from the site and pass through the Cambrian Road at Borrisokane Road intersections. Conversely, almost no traffic will proceed south to the Barnsdale intersection (<20 two-way trips, estimated 5% of the traffic will be southbound). Therefore, the intersection of Cambrian Road at Borrisokane Road will be included in the TIA, whereas, the intersection of Barnsdale Road at Borrisokane Road will not be included.

Cambrian Road at Borrisokane Road

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

Figure 3: Intersection of Cambrian Road at Borrisokane Road



New Greenbank Road does not yet exist and therefore, no intersections along this road exists. A 41.5 metre right-of-way is protected for New Greenbank Road for in the Official Plan, north of the South Urban Community – south limit. The intersection of Borrisokane Road and Barnsdale Road is considered beyond the scope of this study and is currently a low volume intersection (as noted by existing volumes along Borrisokane Road in Section 2.2.7).

The adjacent street network has been prepared in concept but does not exist.

2.2.3 Existing Driveways

There are no existing driveways within 200 metres of the potential future access to Borrisokane Road. The access to the adjacent property is just north of the 3809 Borrisokane Road frontage (more than 200 metres north of the proposed access), accessing the adjacent aggregate area.

2.2.4 Cycling and Pedestrian Facilities

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

2.2.5 Existing Transit

There is no existing transit service along the boundary roads.

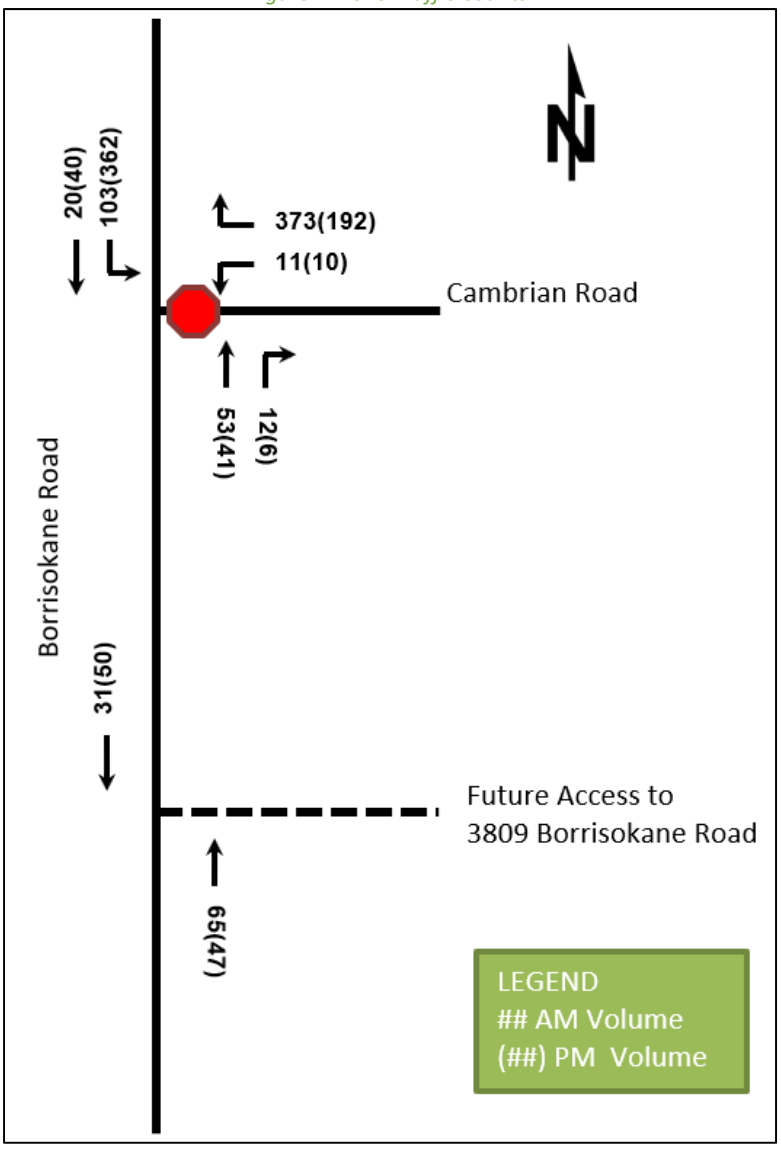
2.2.6 Existing Area Traffic Management Measures

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

2.2.7 Existing Peak Hour Travel Demand

AM and PM two-way traffic volumes along Borrisokane Road and at the intersection of Cambrian Road at Borrisokane Road have been documented in Figure 4 below. Appendix B includes excerpts from the Meadows Phase 5 TIA by others, detailing the turning movement counts.

Figure 4: 2018 Traffic Counts



2.2.8 Collision Analysis

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

Table 1: Collision Summary - Cambrian Road @ Borrisokane Road

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

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

2.3 Planned Conditions

2.3.1 Changes to the Area Transportation Network

The subject development is within the Barrhaven South CDP Urban Expansion Area, however, it was noted as predominantly active sand and gravel pits within the draft demonstration plan. Additionally, the CDP shows a transition / overlap at the boundary between the developed area of the CDP and the "Brazeau" property, indicating that it was anticipated that the gravel pit may eventually develop. As such, it is subject to the planning polices outlined in the ongoing CDP for the Barrhaven South Urban Expansion Area.

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

2.3.2 Other Study Area Developments

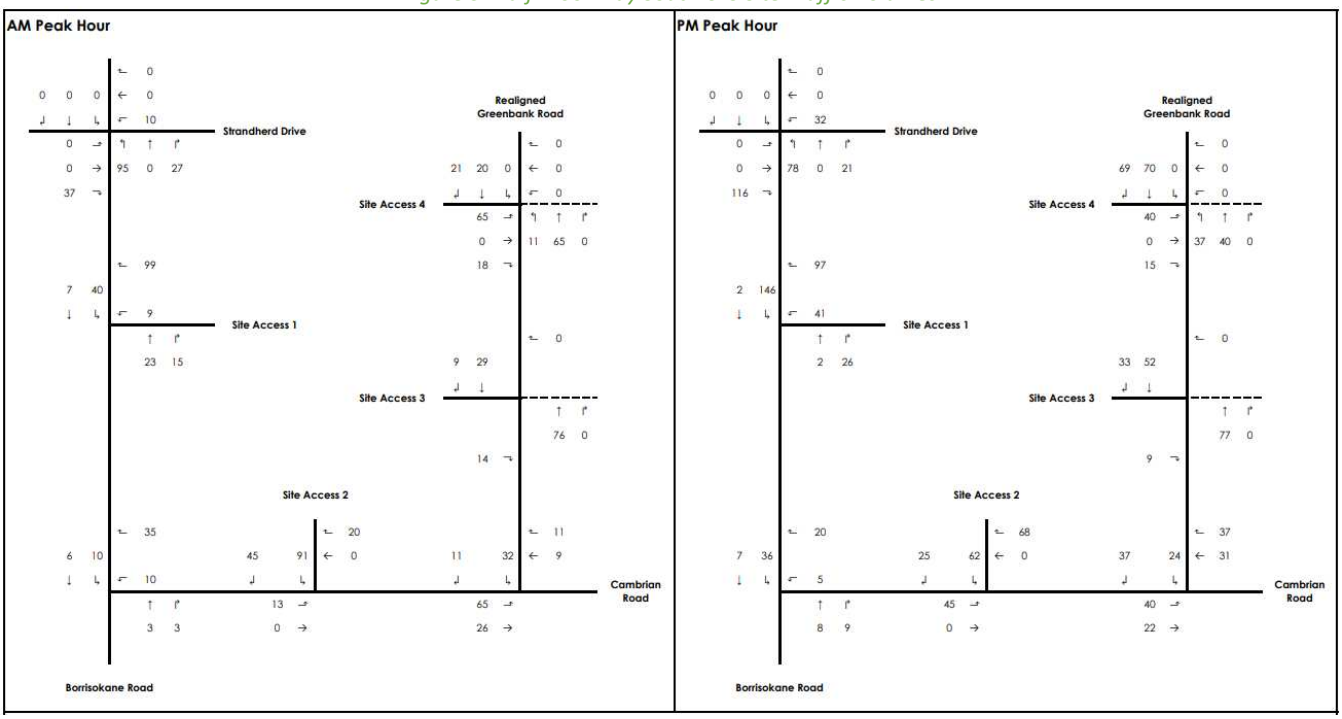
Half Moon Bay South

Immediately to the east of the proposed development is the Mattamy Development of Half Moon Bay South. This development is nearing completion and only the final phases remain. 3809 Borrisokane Road will include a connection to the Half Moon Bay South Development. However, this connection will be a secondary access, allowing connectivity to schools and traffic to pass back and forth between the developments. There is anticipated to be minimal traffic flow between the two developments and that each development will utilize the primary access constructed to support that development. As a result, any traffic that flows between the two developments will be minor and will not impact the access intersections for each development.

Half Moon Bay West

North of the proposed development is the Mattamy Development of Half Moon Bay West. Construction has not commenced on this subdivision. This development will not have shared accesses or traffic cross-over but will impact the Study Area intersections. The site trips generated by this site will be accounted for in the traffic projections. Figure 5 below is an excerpt from the Half Moon Bay West Community Transportation Study, illustrating the net new site traffic volumes.

Figure 5: Half Moon Bay South CTS Site Traffic Volumes



Excerpt from: Half Moon Bay South CTS, Stantec

Barrhaven South Expansion Lands (Quinn's Pointe 2)

To the southeast of the proposed development is the Minto Development of Quinn's Pointe 2. The first phase of this development has been constructed. This development will not have shared accesses or traffic cross-over and will not generate traffic that impacts the Study Area intersections.

The Meadows Phase 5

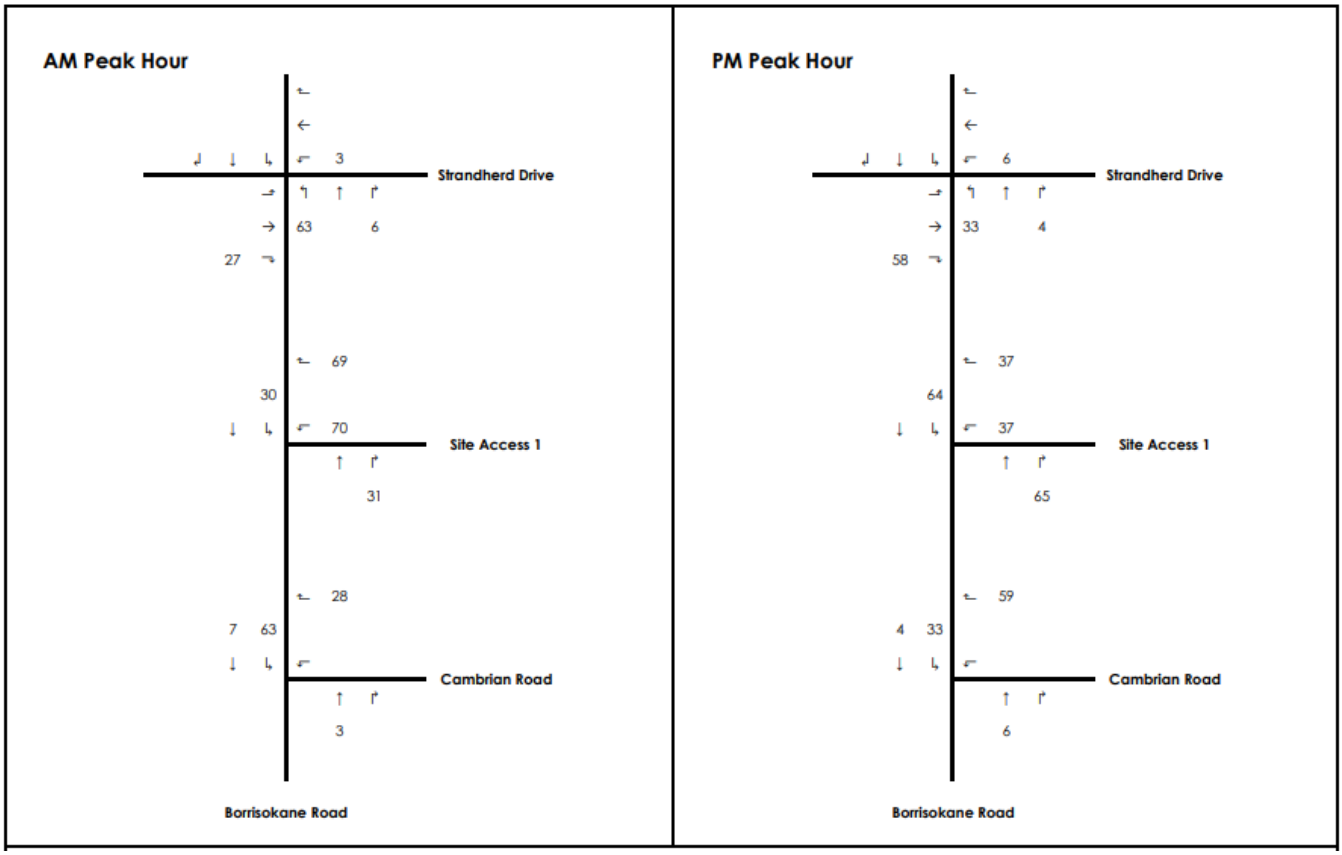
North of the proposed development is the Tamarack Development of the Meadows. Phase 5 has a current development application. This development will not have shared accesses or traffic cross-over but will impact the Study Are intersections. The site trips generated by this site will be accounted for in the traffic projections. However, it is understood that while this application is on the City of Ottawa's Development Applications site, the TIA has not been approved, and the traffic projections are not finalized. Once those projections are finalized they will be included in the projections prior to submitting Step 4.

3387 Borrisokane Road

North of the proposed development is the Glenview Development of 3387 Borrisokane Road. Construction has not commenced on this subdivision. This development will not have shared accesses or traffic cross-over but will impact the Study Area intersections. The site trips generated by this site will be accounted for in the traffic

projections. Figure 6 below is an excerpt from the 3387 Borrisokane Road Community Transportation Study / Transportation Impact Study Addendum 1, illustrating the net new site traffic volumes.

Figure 6: 3387 Borrisokane Road Site Traffic Volumes



Excerpt from: 3387 Borrisokane Road TIS, Stantec

Other Developments

While an adjacent development is anticipated to the north of the subject development, there is currently no plan or application associated with this development. As this development may occur beyond the development horizon of the subject application, no traffic from this development will be considered.

3 Study Area and Time Periods

3.1 Study Area

The study area will include examining Borrisokane Road as a Boundary Road and will focus on the access intersection on Borrisokane Road and the intersection of Borrisokane Road at Cambrian Road. As discussed previously, the intersection of Barnsdale Road at Borrisokane Road has not been included as the existing intersection has very low volumes and the proposed development is anticipated to have a negligible impact on that intersection.

3.2 Time Periods

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

3.3 Horizon Years

The anticipated build-out year is 2025. As a result, the full build-out plus five years horizon year is 2030.

4 Exemption Review

Table 2 summarizes the exemptions for this TIA.

Table 2: Exemption Review

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

5 Development-Generated Travel Demand

5.1 Trip Generation and Mode Shares

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

Table 3: TRANS Trip Generation Person Trip Rates

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

LUC – Land Use Code

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

Table 4: Total Person Trip Generation

Land Use	Units	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
Single Detached	311	115	280	395	268	171	439
Townhouse	279	101	172	273	172	152	324
Total Person Trips		**216**	**452**	**668**	**440**	**323**	**763**

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

Table 5: OD Survey Existing Mode Share - South Nepean

Travel Mode	Existing Mode Share
Auto Driver	60%
Auto Passenger	15%
Transit	15%
Non-Auto	10%
Total	100%

There are no major transit upgrades (i.e. BRT, transit priority measures, etc.) within the Study Area that are planned to be in place by the study horizons that will be examined in this study. Therefore, the existing mode shares will be carried forward.

Using the above mode shares and person trip rates the person trips by mode have been projected. Table 6 summarizes the trip generation by mode.

Table 6: Trip Generation by Mode

Travel Mode	Mode Share	In	Out	Total	In	Out	Total
Auto Driver	60%	130	271	401	264	194	457
Auto Passenger	15%	32	68	100	66	49	115
Transit	15%	32	68	100	66	49	115
Non-Auto Modes	10%	22	45	67	44	32	76
Total	**100%**	**216**	**452**	**668**	**440**	**323**	**763**

As shown above, 668 AM and 763 PM peak hour two-way trips are projected as a result of the proposed development.

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

5.2 Trip Distribution

To understand the travel patterns of the subject development the OD Survey has been reviewed to determine the existing travel patterns. Table 7 below summarizes the distribution.

Table 7: OD Survey Existing Mode Share - South Nepean

To/From	Percent of Trips
North	80%
South	5%
East	10%
West	5%
Total	100%

5.3 Trip Assignment

Using the distribution outlined above, turning movement splits, and access to major transportation infrastructure, the trips generated by the site have been assigned to the Study Area road network.

Figure 7: Site Traffic Assignment (%)

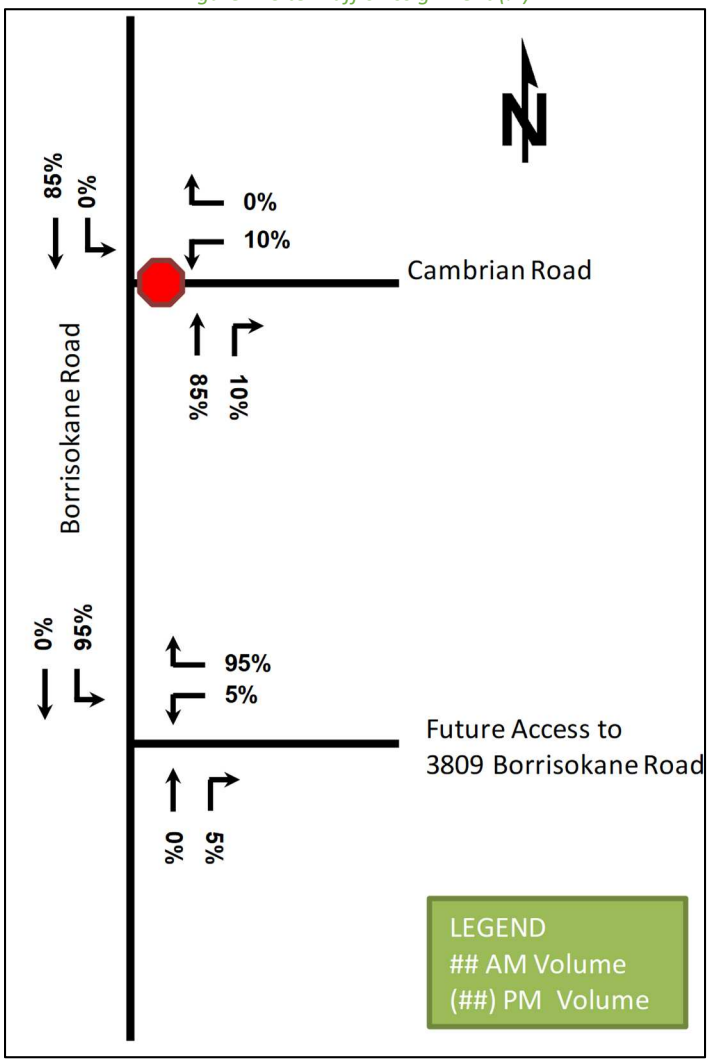
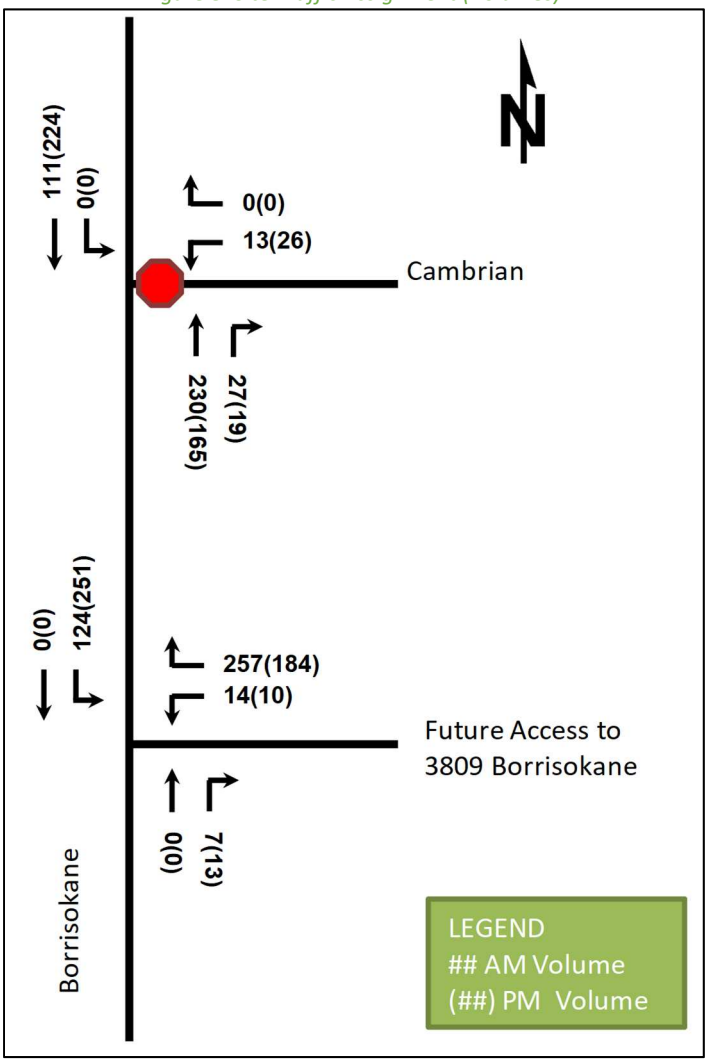


Figure 8: Site Traffic Assignment (Volumes)



6 Background Network Travel Demands

6.1 Transportation Network Plans

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

6.2 Background Growth

A large amount of background traffic has been accounted for through the other developments that have been documented in Section 2.3.2. This is particularly important along Cambrian Road, where most of the developments have been built or planned. Therefore, no additional background growth has been accounted for along Cambrian Road. Along Borrisokane Road there is less known about the future of the development along this corridor. To account for background growth along this corridor a 3%/annum background growth rate has been applied.

6.3 Other Developments

As detailed in Section 2.3.2, the following developments have been included in the background traffic forecasts:

- Half Moon Bay South

- Half Moon Bay West
- Barrhaven South Expansion Lands (Quinn's Pointe 2)
- The Meadows Phase 5 (to be added once available)
- 3387 Borrisokane Road

Figure 9 illustrates the 2025 future background traffic volumes. Figure 10 illustrates the 2030 future background traffic volumes.

Figure 9: 2025 Future Background Traffic Volumes

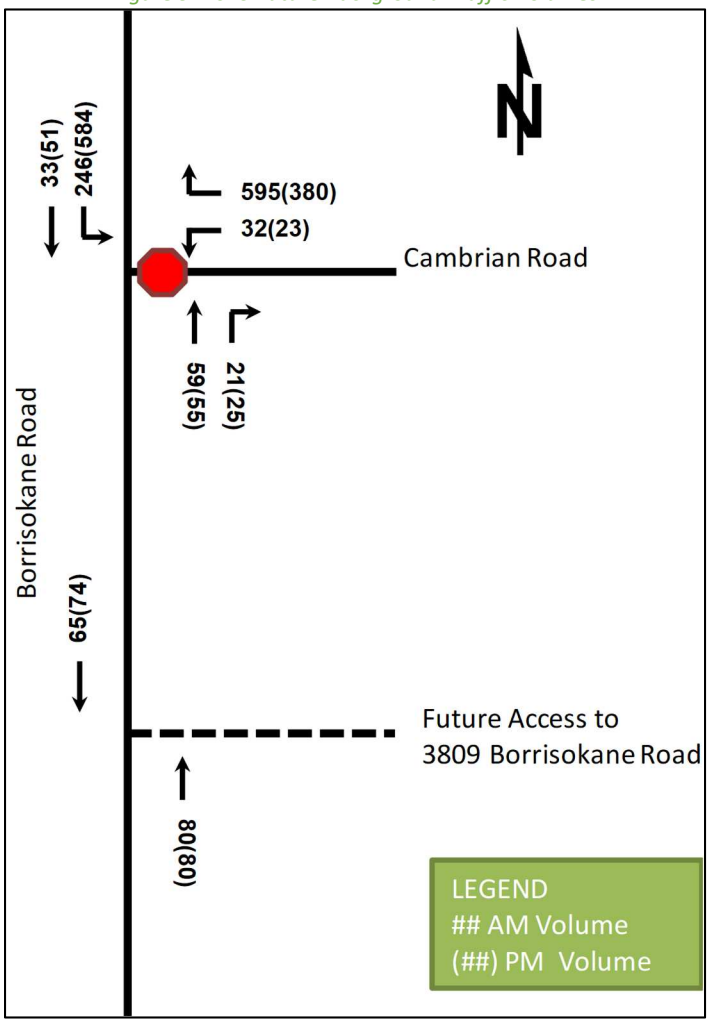
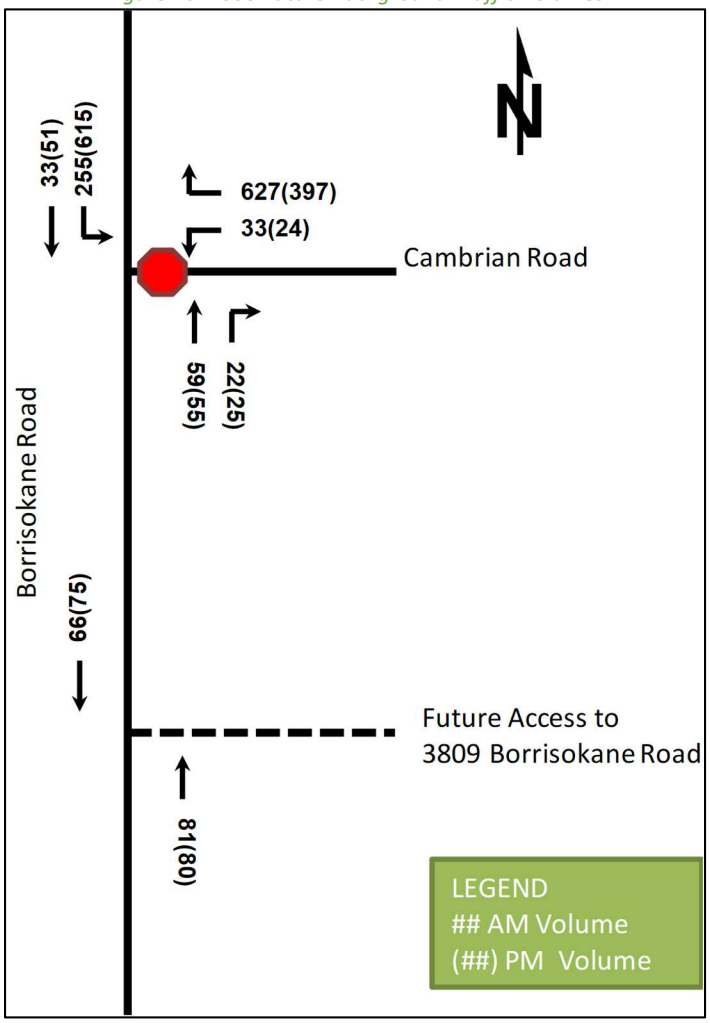


Figure 10: 2030 Future Background Traffic Volumes



7 Demand Rationalization

Figure 9 illustrates the 2025 future background traffic volumes and Figure 10 illustrates the 2030 future background traffic volumes. Table 8 summarizes the 2025 forecasted intersection operations and Table 9 summarizes the 2030 forecasted intersection operations. The level of service is based on the HCM criteria for average delay at signalized intersections. The synchro worksheets have been provided in Appendix D and Appendix E.

Table 8: 2025 Future Background Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95th)	LOS	Delay	V/C	Q (95th)
Cambrian Road & Borrisokane Road	WBL/R	C	16.8	0.68	5.6	C	17.7	0.59	3.9
	NBT/R	A	0.0	0.00	0.0	A	0.0	0.00	0.0
	SBL/T	A	6.9	0.16	0.6	A	8.1	0.39	1.8
	Overall	**B**	**12.6**	-	-	**B**	**11.0**	-	-

The future 2025 background conditions are forecasted to operate well during the peak hours as a minor stop-controlled intersection. While both the southbound left-turn and westbound right-turn volumes are significant in both peaks, no operational issues are noted, and no auxiliary turn lanes are recommended.

Table 9: 2030 Future Background Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95th)	LOS	Delay	V/C	Q (95th)
Cambrian Road & Borrisokane Road	WBL/R	C	18.3	0.72	6.4	C	20.1	0.65	4.7
	NBT/R	A	0.0	0.00	0.0	A	0.0	0.00	0.0
	SBL/T	A	7.0	0.17	0.6	A	8.3	0.41	2.0
	Overall	**B**	**13.7**	-	-	**B**	**12.0**	-	-

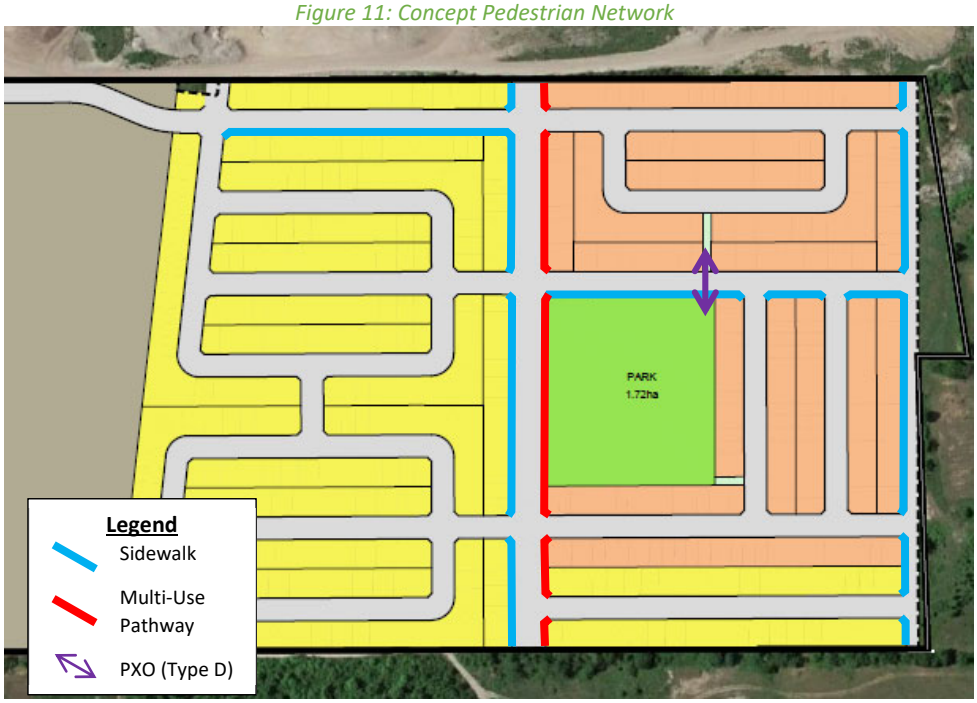
The future 2030 background conditions are forecasted to operate similar to the 2025 background operations. As noted in 2025, no auxiliary turn lanes are recommended.

8 Development Design

8.1 Design for Sustainable Modes

The proposed development is a residential subdivision and therefore auto and bicycle parking areas will be within each resident's home. Figure 11 illustrates the concept active mode network. The plan incorporates the adjacent developments, planned routes on geoOttawa, and the extension of the Barrhaven South Urban Expansion Study Area CDP networks.

Figure 11: Concept Pedestrian Network

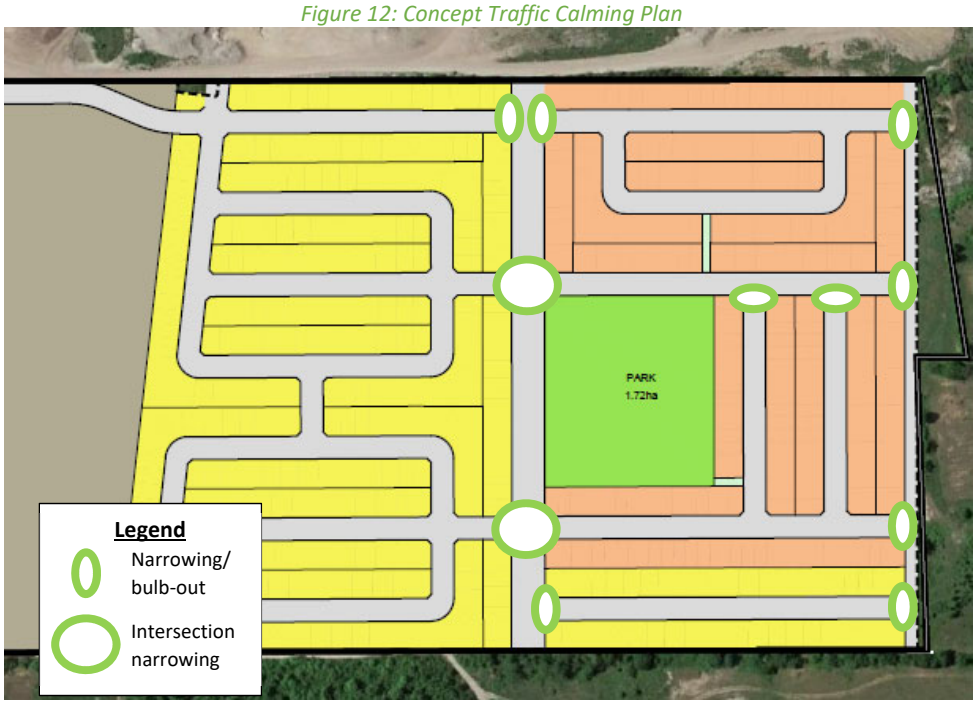


8.2 New Street Networks

The planned street network will include 16.5 and 18.0 metre local roadways and a single north-south 24.0 metre collector road. The local and collector roads will provide parking on one-side of the roadway and are proposed to be posted as 40 km/h. The pedestrian and cycling network are provided in Section 8.1.

To support the pedestrian and cycling connectivity within the subdivision, Figure 12 illustrates the concept traffic calming plan. The plan reduces crossing distances for the pedestrian and cycling network, as well as limits the speed of vehicles entering and exiting the local roads from the collector road.

Figure 12: Concept Traffic Calming Plan



The internal road intersections are recommended to be stop-controlled on the minor approaches of all intersections.

9 Boundary Street Design

Table 10 summarizes the MMLOS analysis for the boundary road of Borrisokane Road. The existing and future conditions are the same and have been provided as a single line. The MMLOS worksheet has been provided in Appendix F.

Table 10: Boundary Street MMLOS Analysis

Segment	Pedestrian LOS		Bicycle LOS		Transit LOS		Truck LOS	
	PLOS	Target	BLOS	Target	TLOS	Target	TrLOS	Target
Borrisokane Road	F	N/A	**F**	D	D	N/A	C	N/A

The only target level of service applicable to Borrisokane Road, as a general rural area collector road, is the target B for the local cycling route. Cyclist are required to operate in mixed traffic and would require paved shoulders to increase the BLOS to E. The operating speeds would need to be reduced to below 60 km/h or a fully separated facility would be required to meet/exceed the BLOS target. For even a minimal addition of paved shoulders along Borrisokane Road, it would require paving the gravel shoulders from the site access to Strandherd Drive, almost 3km distance. Therefore, no mitigation measures are recommended as part of this development and the active mode network provided by development to the north and east will ultimately provide the connectivity to support this development.

10 Access Intersections Design

10.1 Location and Design of Access

The proposed access to the subdivision is through a temporary access road to Borrisokane Road. The road access is proposed as a full movement access approximately 850 metres south of Cambrian Road, or 1.2km north of Barnsdale Road. This access would be used until such time that Re-Aligned Greenbank Road is constructed, and the adjacent development is completed to connect Dundonald Drive and Kilbirnie Drive to Re-Aligned Greenbank Road. This connection does not trigger the removal of the temporary access road but can be re-evaluated at this time.

10.2 Access Intersection Control

Based on the projected volumes, a minor stop-controlled intersection is recommended at the temporary site access intersection. No further traffic control or turn lanes are warranted to address operational issues.

10.3 Access Intersection Design

10.3.1 2025 Total Future Conditions

Figure 13 illustrates the 2025 future background traffic volumes and Table 11 summarizes the 2025 forecasted intersection operations. The level of service is based on the HCM criteria for average delay at unsignalized intersections. The synchro worksheets have been provided in Appendix G.

Left-turn lane warrants do not trigger the need for auxiliary lanes due to the low through volumes along Borrisokane Road. Should the mainline volumes increase as a result of other area developments, it is likely that these new developments would trigger the need for left-turn lanes. The left-turn lane warrant has been provided in Appendix H.

Figure 13: 2025 Future Total Traffic Volumes

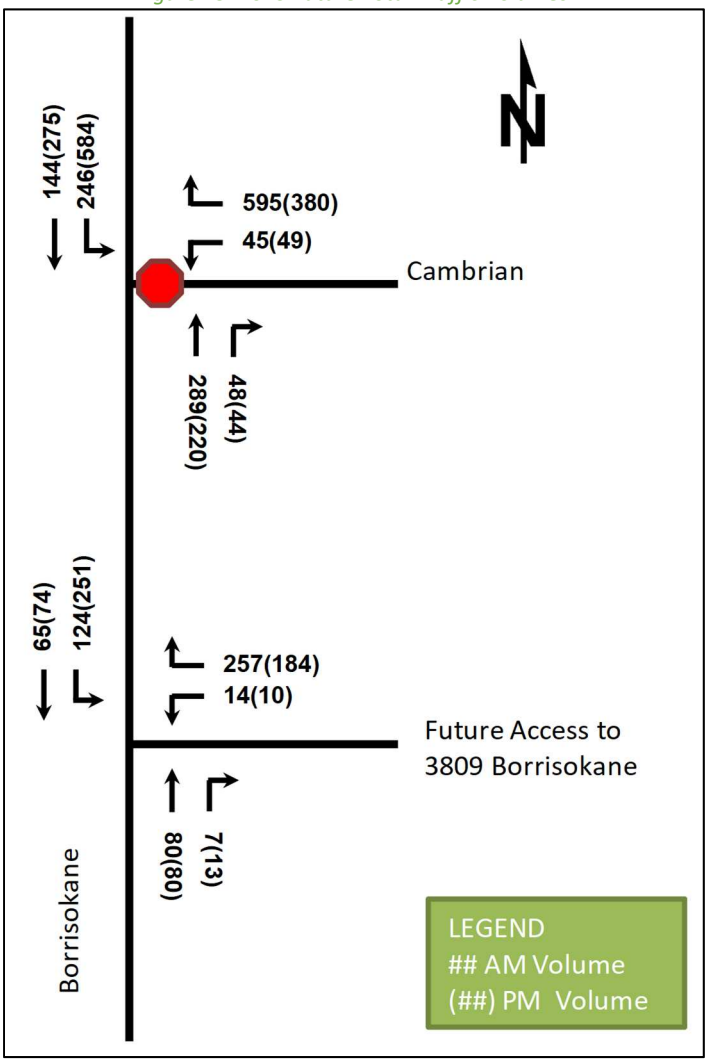


Table 11: 2025 Future Total Access Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95th)	LOS	Delay	V/C	Q (95th)
Temp Site Access & Borrisokane Road	WBL/R	B	10.4	0.29	1.2	B	10.2	0.22	0.8
	NBT/R	-	-	-	-	-	-	-	-
	SBL/T	A	5.0	0.08	0.3	A	6.1	0.17	0.6
	Overall	**A**	**6.9**	**-**	**-**	**A**	**6.5**	**-**	**-**

The temporary access road and Borrisokane Road intersection is anticipated to operate with high levels of service during both peak periods in the 2025 horizon.

10.3.2 2030 Total Future Conditions

Figure 14 illustrates the 2025 future background traffic volumes and Table 12 summarizes the 2025 forecasted intersection operations. The level of service is based on the HCM criteria for average delay at unsignalized intersections. The synchro worksheets have been provided in Appendix I.

Left-turn lane warrants do not trigger the need for auxiliary lanes due to the low through volumes along Borrisokane Road. Should the mainline volumes increase as a result of other area developments, it is likely that

these new developments would trigger the need for left-turn lanes. The left-turn lane warrant has been provided in Appendix H.

Figure 14: 2030 Future Total Traffic Volumes

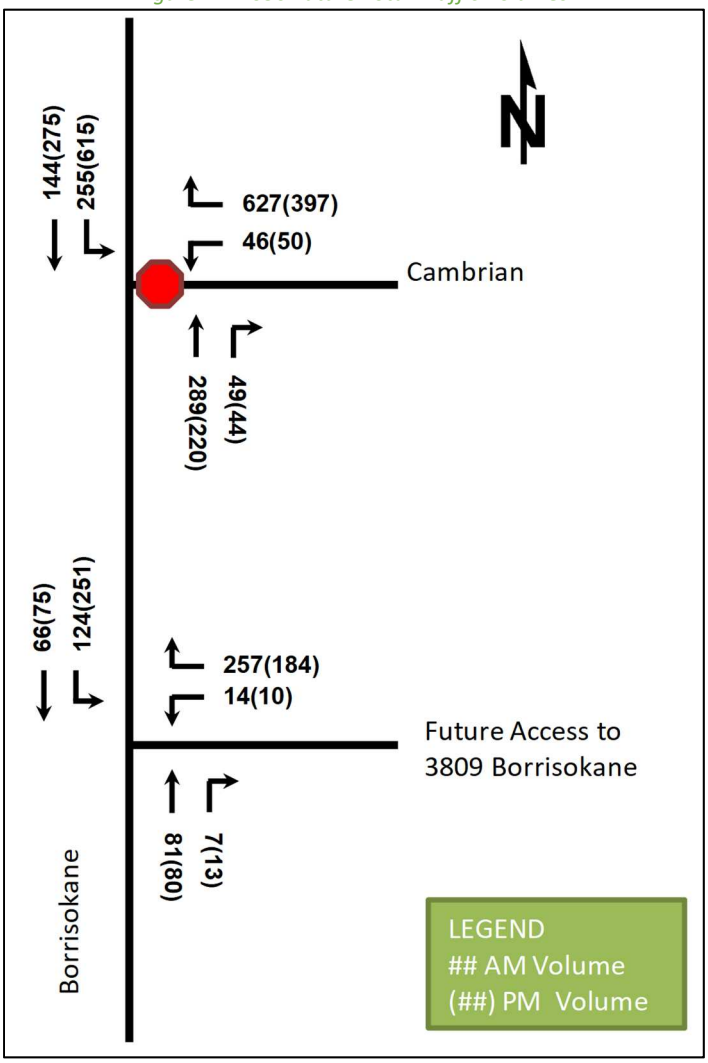


Table 12: 2030 Future Total Access Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95th)	LOS	Delay	V/C	Q (95th)
Temp Site Access & Borrisokane Road	WBL/R	B	10.4	0.29	1.2	B	10.2	0.22	0.8
	NBT/R	-	-	-	-	-	-	-	-
	SBL/T	A	5.0	0.08	0.3	A	6.1	0.17	0.6
	Overall	**A**	**6.9**	**-**	**-**	**A**	**6.5**	**-**	**-**

The temporary access road and Borrisokane Road intersection is anticipated to operate with high levels of service during both peak periods in the 2030 horizon.

11 Transportation Demand Management

11.1 Context for TDM

The mode shares used within the TIA represent this area of the City and have not been altered. Should these mode shares not be reached, the subject site accesses Borrisokane Road directly and will not impact any adjacent residential, recreational or natural land uses.

The subject site is not within a design priority or transit-oriented design area.

Total bedrooms within the development is subject to owner purchasing preferences. No age restrictions are noted.

11.2 Need and Opportunity

The subject site has been assumed to rely predominantly on auto travel and those assumptions have been carried through the analysis. A decrease in the low transit or non-auto mode shares will result in higher volumes along Borrisokane Road. The Cambrian Road intersection is anticipated to have residual capacity and will not significantly impact its operations should the auto mode share increase. Little opportunity is available to shift these modes until major infrastructure projects are completed to increase the transit and active mode network connectivity from South Barrhaven to the rest of the City.

11.3 TDM Program

As discussed above, any “suite of post-occupancy TDM measures” are limited in their applicability. It is anticipated that this development will rely predominantly on auto travel and those assumptions have been carried through the analysis.

12 Transit

12.1 Route Capacity

Overall, the forecasted new transit trips would result in approximately two additional bus (single bus, 55-person capacity) being required in the peak direction to accommodate the additional transit trips from the subject site.

As no transit routes are currently routed along the boundary roads, this would require additional service or alterations to existing transit routes to service this development.

12.2 Transit Priority

No transit priority is required/considered for the study area.

13 Review of Network Concept

The background and forecasted site trips do not exceed the anticipated lane capacities on the boundary road network. Beyond the TIA horizons, additional road and transit service via Re-Aligned Greenbank Road, will add additional capacity and promote higher transit use south of the Jock River.

14 Network Intersection Design

14.1 Network Intersection Control

The study area intersection of Borrisokane Road and Cambrian Road warrants signalization for the build-out horizon of 2025, as per the TAC signal warrant for the City of Ottawa. The intersection has been considered as a signalized intersection for the future total horizons of 2025 and 2030.

The signal warrant is provided in Appendix J.

14.2 Network Intersection Design

14.2.1 2025 Future Total Intersection Operations

The 2025 future total intersection volumes are illustrated above in Figure 13 and the operations are summarized below in Table 13. The signal timing has been optimized for the horizon. The synchro worksheets have been provided in Appendix G.

Table 13: 2025 Future Total Study Area Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95th)	LOS	Delay	V/C	Q (95th)
Cambrian Road & Borrisokane Road *Signalized*	WBL	B	14.0	0.12	8.3	C	28.6	0.20	14.3
	WBR	B	16.5	0.85	39.0	B	10.8	0.70	21.3
	NBT/R	A	9.8	0.38	41.1	A	4.6	0.23	22.8
	SBL	B	14.0	0.49	40.0	C	22.3	0.83	#138.7
	SBT	A	8.7	0.16	18.3	A	5.1	0.23	25.7
	Overall	**B**	**13.5**	-	-	**B**	**13.7**	-	-

The 2025 future conditions are forecasted to operate acceptably during the peak hours as signalized intersections. No volume-to-capacity issues are noted at the intersection.

Using the TIA Guidelines, the southbound left-turn lane storage length would need to be approximately 153 metres and the westbound left-turn lane storage length would need to be meet the City minimum of 38 metres. TAC (eqn. 9.14.1 would produce a southbound left storage length of 192-256 metres.

14.2.2 2030 Future Total Intersection Operations

The 2030 future total intersection volumes are illustrated above in Figure 14 and the operations are summarized below in Table 14. The signal timing has been optimized for the horizon. The synchro worksheets have been provided in Appendix I.

Table 14: 2030 Future Total Study Area Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95th)	LOS	Delay	V/C	Q (95th)
Cambrian Road & Borrisokane Road *Signalized*	WBL	B	12.2	0.10	7.9	D	35.6	0.27	16.5
	WBR	B	16.5	0.84	#63.8	B	14.2	0.76	24.5
	NBT/R	B	11.3	0.42	39.2	A	3.8	0.21	22.7
	SBL	B	18.1	0.57	#47.3	B	19.2	0.81	#158.7
	SBT	A	9.7	0.18	17.5	A	4.2	0.22	25.6
	Overall	**B**	**14.7**	-	-	**B**	**13.4**	-	-

The 2030 future total conditions are forecasted to operate similarly to the 2025 future total conditions. No volume-to-capacity issues are noted at the intersection.

Using the TIA Guidelines, the southbound left-turn lane storage length would need to be approximately 161 metres and the westbound left-turn lane storage length would need to be meet the City minimum of 38 metres. TAC (eqn. 9.14.1 would produce a southbound left storage length of 203-270 metres.

14.2.3 Network Intersection MMLOS

The warranted signal at the Borrisokane Road and Cambrian Road intersection has been assessed under the assumed auxiliary lane configuration and that the paved shoulders will transition into bike lanes at the intersection. Table 15 summarizes the MMMLOS analysis for the future study area intersection. No existing

MMLOS analysis has been provided as the intersection is currently a minor stop-controlled intersection. The MMLOS worksheet has been provided in Appendix F.

Table 15: 2030 Future Signal MMLOS Analysis

Intersection	Pedestrian LOS		Bicycle LOS		Transit LOS		Truck LOS		Auto LOS	
	PLOS	Target	BLOS	Target	TLOS	Target	TrLOS	Target	ALOS	Target
Cambrian Road & Borrisokane Road	B	C	E	B	D	-	E	-	C	D

The target level of service for arterial roads in a developing community would be met by a typical signalized intersection with the exception of the bike level of service. Due to the operating speed and need to cross a lane to turn left would require a left-turn box for bikes on the southbound and westbound approaches to meet the level of service target B.

14.2.4 Network Intersection Recommended Design Elements

The study area intersection of Borrisokane Road and Cambrian Road will require signalization due to the heavy turning movements at the intersection and anticipated increase of the northbound and southbound through volumes from the subject development. As such, the conceptual design elements for this intersection would include:

- Lane arrangement to include:
  - Southbound left-turn lane with storage in the range of 161 metres
  - Westbound left-turn lane with City minimum storage of 38 metres
- Pedestrian crossings on all legs
- Bike lanes provide through the intersection and transition areas
- Left-turn bike boxes on the southbound and westbound approaches

15 Summary of Improvements Indicated and Modifications Options

The following summarizes the analysis and results presented in this TIA report:

Proposed Site and Screening

- The proposed site includes 590 units, split approximately between 311 single detached homes and 279 townhomes
- An access road will be provided from the development to Borrisokane Road, until such time that additional access is provided to Re-Aligned Greenbank Road (once constructed) through adjacent developments
- The access road is proposed as a full movement access
- The development is proposed to be completed as a single phase by 2025
- The Trip Generation, Location, and Safety triggers were all met for the TIA Screening

Existing Conditions

- Borrisokane Road is an 80km/h two-lane rural collector road with gravel shoulders
- No pedestrian, cycling, and transit facilities are provided adjacent to the proposed development
- No collision issues were noted in the study area

Development Generated Travel Demand

- The proposed development is forecasted to generate 668 people two-way trips during the AM peak and 763 people two-way trips during the PM peak

- Based on the study area travel patterns, a total of 401 two-way vehicle trips will be generated during the AM peak and 457 two-way vehicles trips during the PM peak
- 95% of the traffic is estimated to travel north of the site (ultimately 80% north, 10% east, and 5% west) and 5% to the south of the site

Background Conditions

- The background developments of Half Moon Bay South, Half Moon Bay West, Barrhaven South Expansion Lands (Quinn's Pointe 2), The Meadows Phase 5 (to be added once available), and 3387 Borrisokane Road were included within the background conditions, including a 1.5% background growth
- No operational issues are noted in the background horizons of 2025 and 2030 for the Borrisokane Road and Cambrian Road intersection
- The southbound left-turn and westbound right-turn volumes are the primary movements at this intersection

Development Design

- The collector road is provided in the north-south direction within the development with a 24.0 metre right-of-way and the remaining development roads are 16.5 and 18.0 metre local roads
- A multi-use pathway and sidewalk are proposed along the north-south collector road, and sidewalk connections are proposed in the vicinity of the park and other primary connections, including a Type D pedestrian crossover to the park
- The internal road intersections are recommended to be minor stop-controlled
- Traffic calming measures are recommended to reduce pedestrian crossing distances where sidewalks are provided and the reduce turning speeds from the collector road to local roads

Boundary Street Design

- The existing and future Borrisokane Road will not meet the cycling targets for MMLOS
- No improvements are recommended as the rural road is outside the urban boundary and any local improvements (e.g. paved shoulders) would still have a connectivity gap of over 2.5km

Access Intersections Design

- The Site Access Road will be provided from the development to Borrisokane Road
- Once Re-Aligned Greenbank Road is constructed and development extends to the proposed development (beyond 2030), the Temporary Site Access Road may be removed if necessary
- The Temporary Site Access Road is anticipated to operate at a high level of service during the peak hours at the study horizons
- The intersection is recommended to be a stop-control on the minor approach and no auxiliary lanes are required
- It is noted that the southbound left-turn lane is close to being warranted and other area developments may trigger the need to implement a turn-lane if the mainline volumes Borrisokane Road

TDM

- The lack of supporting infrastructure limits the potential for TDM measures to reduce the auto reliance anticipated for the proposed development

- Beyond the study horizons, the transit network along Re-Aligned Greenbank Road and the associated cycling and pedestrian networks will begin to produce the connectivity required to see a mode shift from the proposed development

Transit

- No transit service is provided on the boundary road network, nor future route plans include the proposed development at this time
- To meet minimum area transit use, two single bus trips, or equivalent capacity, would be required to support the proposed development during the AM and PM peak hours

Network Intersection Design

- The intersection of Cambrian Road and Borrisokane Road will require signalization as the volumes increase along Borrisokane Road from the proposed development due to the very high southbound left-turn volumes
- In addition, based on the volumes and MMLOS analysis, the following design elements should be considered for the future signalized intersection at Cambrian Road and Borrisokane Road:
    - Southbound left-turn lane with storage in the range of 161 metres
    - Westbound left-turn lane with City minimum storage of 38 metres
    - Pedestrian crossings on all legs
    - Bike lanes provide through the intersection and transition areas
    - Left-turn bike boxes on the southbound and westbound approaches

16 Conclusion

The proposed development at 3809 Borrisokane Road is recommended to proceed from a transportation perspective.

Prepared By:

Andrew Harte, P.Eng.
Senior Transportation Engineer

Reviewed By:

Christopher Gordon, P.Eng.
Senior Transportation Engineer

Appendix A

TIA Screening Form and PM Certification Form

TIA Plan Reports

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

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

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

CERTIFICATION

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

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

City Of Ottawa
Infrastructure Services and Community Sustainability
Planning and Growth Management
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Télécopieur: 613-560-6006

Dated at ___Ottawa_____ this __20__ day of _____September_____, 2018.
(City)

Name: _____Andrew Harte_____
(Please Print)

Professional Title: _____Professional Engineer_____

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

Office Contact Information (Please Print)
Address: 13 Markham Avenue
City / Postal Code: Ottawa / K2G 3Z1
Telephone / Extension: (613) 697-3797
E-Mail Address: Andrew.Harte@CGHTransportation.com

CGH TRANSPORTATION INC.

13 Markham Avenue
Ottawa, ON K2G 3Z1

City of Ottawa 2017 TIA Guidelines
Step 1 - Screening Form

Date: 26-Jul-18
Project Number: 2018-05
Project Reference: Caivan Brazeau

1. Description of Proposed Development	
Municipal Address	3809 Borrisokane Road
Description of Location	CON 3 RF W PT LOT 8;RP5R-13403 PARTS 2 AND 3;LESS RP 5R-13374 PARTS 15 &;16
Land Use Classification	Residential / Commercial
Development Size	500 Units with a mix of Single and Townhouse units 33% TH / 67% Singles
Accesses	1 Access to Borrisokane + Adjacent Prop. + future access to New Greenbank Road
Phase of Development	N/A
Buildout Year	2025
TIA Requirement	Full TIA Required

2. Trip Generation Trigger		
Land Use Type	Single-family homes	
Development Size	335	Units
Trip Generation Trigger	Yes	

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

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

Appendix B

Turning Movement Counts

Survey Date: Tuesday February 15 2018
Weather: Cloudy

TURNING MOVEMENT COUNT SUMMARY - ALL MODES

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

AADT FACTOR: 1.0

Turning Movement Count - Full Study Summary Report (Vehicles)

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

Turning Movement Count - Full Study Summary Report (Pedestrians)

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

Turning Movement Count - Full Study Summary Report (Cyclists)

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

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

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

Appendix C

Collision Data

City Operations - Transportation Services

Collision Details Report - Public Version

From: January 1, 2013 **To:** December 31, 2017

Location: CAMBRIAN RD @ CEDARVIEW RD

Traffic Control: Stop sign

Total Collisions: 9

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2014-Aug-08, Fri,15:30	Clear	SMV other	Non-fatal injury	Dry	West	Going ahead	Automobile, station wagon	Ran off road	
2015-Jan-25, Sun,16:43	Clear	SMV other	P.D. only	Ice	West	Slowing or stopping	Automobile, station wagon	Skidding/sliding	
2015-Jul-10, Fri,08:58	Clear	Rear end	P.D. only	Dry	West	Turning left	Automobile, station wagon	Other motor vehicle	
					West	Turning left	Automobile, station wagon	Other motor vehicle	
2016-Jun-23, Thu,17:10	Clear	Rear end	Non-fatal injury	Dry	South	Going ahead	Pick-up truck	Other motor vehicle	
					South	Turning left	Automobile, station wagon	Other motor vehicle	
2016-Jul-22, Fri,20:56	Rain	SMV other	P.D. only	Wet	West	Slowing or stopping	Automobile, station wagon	Skidding/sliding	
2016-Jul-29, Fri,03:27	Fog, mist, smoke, dust	Rear end	P.D. only	Dry	West	Going ahead	Unknown	Other motor vehicle	
					West	Slowing or stopping	Pick-up truck	Other motor vehicle	
2016-Dec-11, Sun,09:30	Clear	SMV other	P.D. only	Ice	West	Slowing or stopping	Automobile, station wagon	Ditch	

2017-Aug-29, Tue,13:57	Clear	Rear end	P.D. only	Dry	West	Turning right	Automobile, station wagon	Other motor vehicle
					West	Turning right	Pick-up truck	Other motor vehicle
2017-Dec-17, Sun,08:33	Clear	SMV other	P.D. only	Dry	North	Turning right	Automobile, station wagon	Ditch

Appendix D

2025 Future Background Synchro Worksheets

Intersection	
Int Delay, s/veh	12.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	32	595	59	21	246	33
Future Vol, veh/h	32	595	59	21	246	33
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	595	59	21	246	33

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	595	70	0	0	80	0
Stage 1	70	-	-	-	-	-
Stage 2	525	-	-	-	-	-
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	467	993	-	-	1518	-
Stage 1	953	-	-	-	-	-
Stage 2	593	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	390	993	-	-	1518	-
Mov Cap-2 Maneuver	390	-	-	-	-	-
Stage 1	953	-	-	-	-	-
Stage 2	495	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.8	0	6.9
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	920	1518	-
HCM Lane V/C Ratio	-	-	0.682	0.162	-
HCM Control Delay (s)	-	-	16.8	7.8	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	5.6	0.6	-

Intersection	
Int Delay, s/veh	11

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	23	380	55	25	584	51
Future Vol, veh/h	23	380	55	25	584	51
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	23	380	55	25	584	51

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1287	68	0	0	80	0
Stage 1	68	-	-	-	-	-
Stage 2	1219	-	-	-	-	-
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	181	995	-	-	1518	-
Stage 1	955	-	-	-	-	-
Stage 2	279	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	109	995	-	-	1518	-
Mov Cap-2 Maneuver	109	-	-	-	-	-
Stage 1	955	-	-	-	-	-
Stage 2	169	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	17.7	0	8.1
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	680	1518	-
HCM Lane V/C Ratio	-	-	0.593	0.385	-
HCM Control Delay (s)	-	-	17.7	8.8	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	3.9	1.8	-

Appendix E

2030 Future Background Synchro Worksheets

Intersection	
Int Delay, s/veh	13.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	33	627	59	22	255	33
Future Vol, veh/h	33	627	59	22	255	33
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	33	627	59	22	255	33

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	613	70	0	0	81	0
Stage 1	70	-	-	-	-	-
Stage 2	543	-	-	-	-	-
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	456	993	-	-	1517	-
Stage 1	953	-	-	-	-	-
Stage 2	582	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	378	993	-	-	1517	-
Mov Cap-2 Maneuver	378	-	-	-	-	-
Stage 1	953	-	-	-	-	-
Stage 2	482	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	18.3	0	7
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	918	1517	-
HCM Lane V/C Ratio	-	-	0.719	0.168	-
HCM Control Delay (s)	-	-	18.3	7.9	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	6.4	0.6	-

HCM 2010 TWSC
1: Borrisokane Road & Cambrian Road 11-07-2018

Intersection	
Int Delay, s/veh	12

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	24	397	55	25	615	51
Future Vol, veh/h	24	397	55	25	615	51
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	24	397	55	25	615	51

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1349	68	0	0	80	0
Stage 1	68	-	-	-	-	-
Stage 2	1281	-	-	-	-	-
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	166	995	-	-	1518	-
Stage 1	955	-	-	-	-	-
Stage 2	261	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	97	995	-	-	1518	-
Mov Cap-2 Maneuver	97	-	-	-	-	-
Stage 1	955	-	-	-	-	-
Stage 2	152	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	20.1	0	8.3
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	651	1518	-
HCM Lane V/C Ratio	-	-	0.647	0.405	-
HCM Control Delay (s)	-	-	20.1	9	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	4.7	2	-

Appendix F

MMLOS Analysis

Multi-Modal Level of Service - Intersections Form

Consultant	**CGH Transportation**	**Project**	**Caivan Brazeau**
Scenario	**All**	**Date**	**2018-10-31**
Comments			

INTERSECTIONS		Borrisokane-Cambrian (Future)			
	Crossing Side	**NORTH**	**SOUTH**	**EAST**	**WEST**
Pedestrian	Lanes	0 - 2	0 - 2		0 - 2
	Median	No Median - 2.4 m	No Median - 2.4 m		No Median - 2.4 m
	Conflicting Left Turns	No left turn / Prohib.	Permissive		Permissive
	Conflicting Right Turns	Permissive or yield control	No right turn		Permissive or yield control
	Right Turns on Red (RToR) ?	RTOR prohibited	RTOR allowed		RTOR allowed
	Ped Signal Leading Interval?	No	No		No
	Right Turn Channel	No Right Turn	No Channel		No Channel
	Corner Radius	No Right Turn	10-15m		10-15m
	Crosswalk Type	Std transverse markings	Std transverse markings		Std transverse markings
	PETSI Score	**106**	**90**		**85**
	Ped. Exposure to Traffic LoS	**A**	**A**	**-**	**B**
	Cycle Length				
	Effective Walk Time				
	Average Pedestrian Delay				
	Pedestrian Delay LoS	-	-	-	-
	Level of Service	**A**	**A**	**-**	**B**
		B			
	Approach From	**NORTH**	**SOUTH**	**EAST**	**WEST**
Bicycle	Bicycle Lane Arrangement on Approach	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP	
	Right Turn Lane Configuration				
	Right Turning Speed				
	Cyclist relative to RT motorists	**Not Applicable**	**Not Applicable**	**Not Applicable**	**-**
	Separated or Mixed Traffic	**Separated**	**Separated**	**Separated**	**-**
	Left Turn Approach	1 lane crossed		1 lane crossed	
	Operating Speed	≥ 60 km/h		≥ 60 km/h	
	Left Turning Cyclist	**E**	**-**	**E**	**-**
	Level of Service	**E**	**-**	**E**	**-**
		E			
Transit	Average Signal Delay	≤ 20 sec	≤ 10 sec	≤ 30 sec	
	Level of Service	**C**	**B**	**D**	**-**
		D			
Truck	Effective Corner Radius		10 - 15 m	10 - 15 m	
	Number of Receiving Lanes on Departure from Intersection		1	1	
	Level of Service	**-**	**E**	**E**	**-**
		E			
Auto	Volume to Capacity Ratio	0.71 - 0.80			
	Level of Service	**C**			

Multi-Modal Level of Service - Segments Form

Consultant	**CGH Transportation**	**Project**	**Caivan Brazeau**
Scenario	**All**	**Date**	**2018-10-31**
Comments			

SEGMENTS		Street A	Borrisokane 1	Section 2	Section 3
Pedestrian	Sidewalk Width Boulevard Width	F	no sidewalk n/a		
	Avg Daily Curb Lane Traffic Volume		> 3000		
	Operating Speed On-Street Parking		> 60 km/h no		
	Exposure to Traffic PLoS		**F**	-	-
	Effective Sidewalk Width		1.5 m		
	Pedestrian Volume		250 ped/hr		
	Crowding PLoS		**B**	-	-
	Level of Service		**F**	-	-
Bicycle	Type of Cycling Facility	F	Mixed Traffic		
	Number of Travel Lanes		≤ 2 (no centreline)		
	Operating Speed		≥ 60 km/h		
	# of Lanes & Operating Speed LoS		**F**	-	-
	Bike Lane (+ Parking Lane) Width				
	Bike Lane Width LoS		-	-	-
	Bike Lane Blockages				
	Blockage LoS		-	-	-
	Median Refuge Width (no median = < 1.8 m)		< 1.8 m refuge		
	No. of Lanes at Unsignalized Crossing		≤ 3 lanes		
	Sidestreet Operating Speed		>40 to 50 km/h		
	Unsignalized Crossing - Lowest LoS		**B**	-	-
	Level of Service		**F**	-	-
Transit	Facility Type	D	Mixed Traffic		
	Friction or Ratio Transit:Posted Speed		Vt/Vp ≥ 0.8		
	Level of Service		**D**	-	-
Truck	Truck Lane Width	C	≤ 3.5 m		
	Travel Lanes per Direction		1		
	Level of Service		**C**	-	-

Appendix G

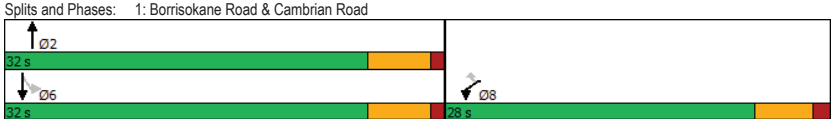
2025 Future Total Synchro Worksheets

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	45	595	289	48	246	144
Future Volume (vph)	45	595	289	48	246	144
Satd. Flow (prot)	1621	1450	1673	0	1621	1706
Flt Permitted	0.950				0.558	
Satd. Flow (perm)	1621	1450	1673	0	952	1706
Satd. Flow (RTOR)		467	18			
Lane Group Flow (vph)	45	595	337	0	246	144
Turn Type	Prot	Perm	NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases		8			6	
Detector Phase	8	8	2		6	6
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0		5.0	5.0
Minimum Split (s)	23.5	23.5	23.7		23.7	23.7
Total Split (s)	28.0	28.0	32.0		32.0	32.0
Total Split (%)	46.7%	46.7%	53.3%		53.3%	53.3%
Yellow Time (s)	4.2	4.2	4.6		4.6	4.6
All-Red Time (s)	1.3	1.3	1.1		1.1	1.1
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	5.5	5.5	5.7		5.7	5.7
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Max		Max	Max
Act Effct Green (s)	12.1	12.1	26.7		26.7	26.7
Actuated g/C Ratio	0.24	0.24	0.53		0.53	0.53
v/c Ratio	0.12	0.85	0.38		0.49	0.16
Control Delay	14.0	16.5	9.8		14.0	8.7
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	14.0	16.5	9.8		14.0	8.7
LOS	B	B	A		B	A
Approach Delay	16.3		9.8			12.0
Approach LOS	B		A			B
Queue Length 50th (m)	3.0	9.3	13.7		11.6	5.5
Queue Length 95th (m)	8.3	39.0	41.1		40.0	18.3
Internal Link Dist (m)	517.3		1008.4			1050.1
Turn Bay Length (m)	38.0				153.0	
Base Capacity (vph)	737	914	898		506	907
Starvation Cap Reductn	0	0	0		0	0
Spillback Cap Reductn	0	0	0		0	0
Storage Cap Reductn	0	0	0		0	0
Reduced v/c Ratio	0.06	0.65	0.38		0.49	0.16

Intersection Summary
Cycle Length: 60
Actuated Cycle Length: 50.2
Natural Cycle: 60
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.85

Intersection Signal Delay: 13.5 Intersection LOS: B
Intersection Capacity Utilization 67.4% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 1: Borrisokane Road & Cambrian Road



HCM 2010 TWSC
2: Borrisokane Road & Temp Site Access 07-24-2019

Intersection	
Int Delay, s/veh	6.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	14	257	80	7	124	65
Future Vol, veh/h	14	257	80	7	124	65
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	14	257	80	7	124	65

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	397	84	0	0	87	0
Stage 1	84	-	-	-	-	-
Stage 2	313	-	-	-	-	-
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	608	975	-	-	1509	-
Stage 1	939	-	-	-	-	-
Stage 2	741	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	556	975	-	-	1509	-
Mov Cap-2 Maneuver	556	-	-	-	-	-
Stage 1	939	-	-	-	-	-
Stage 2	678	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.4	0	5
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	- 938	1509	-
HCM Lane V/C Ratio	-	- 0.289	0.082	-
HCM Control Delay (s)	-	- 10.4	7.6	0
HCM Lane LOS	-	- B	A	A
HCM 95th %tile Q(veh)	-	- 1.2	0.3	-

Timings
1: Borrisokane Road & Cambrian Road 07-24-2019

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	49	380	220	44	584	275
Future Volume (vph)	49	380	220	44	584	275
Satd. Flow (prot)	1621	1450	1667	0	1621	1706
Flt Permitted	0.950				0.596	
Satd. Flow (perm)	1621	1450	1667	0	1017	1706
Satd. Flow (RTOR)		380	25			
Lane Group Flow (vph)	49	380	264	0	584	275
Turn Type	Prot	Perm	NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases		8			6	
Detector Phase	8	8	2		6	6
Switch Phase						
Minimum Initial (s)	10.0	10.0	10.0		10.0	10.0
Minimum Split (s)	23.5	23.5	23.7		23.7	23.7
Total Split (s)	23.6	23.6	56.4		56.4	56.4
Total Split (%)	29.5%	29.5%	70.5%		70.5%	70.5%
Yellow Time (s)	4.2	4.2	4.6		4.6	4.6
All-Red Time (s)	1.3	1.3	1.1		1.1	1.1
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	5.5	5.5	5.7		5.7	5.7
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Max		Max	Max
Act Effct Green (s)	11.4	11.4	50.8		50.8	50.8
Actuated g/C Ratio	0.16	0.16	0.69		0.69	0.69
v/c Ratio	0.20	0.70	0.23		0.83	0.23
Control Delay	28.6	10.8	4.6		22.3	5.1
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	28.6	10.8	4.6		22.3	5.1
LOS	C	B	A		C	A
Approach Delay	12.9		4.6			16.8
Approach LOS	B		A			B
Queue Length 50th (m)	5.9	0.0	8.8		43.4	10.4
Queue Length 95th (m)	14.3	21.3	22.8		#138.7	25.7
Internal Link Dist (m)	517.3		1024.6			1050.1
Turn Bay Length (m)	38.0				153.0	
Base Capacity (vph)	400	644	1160		704	1180
Starvation Cap Reductn	0	0	0		0	0
Spillback Cap Reductn	0	0	0		0	0
Storage Cap Reductn	0	0	0		0	0
Reduced v/c Ratio	0.12	0.59	0.23		0.83	0.23

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 73.4
Natural Cycle: 90
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.83

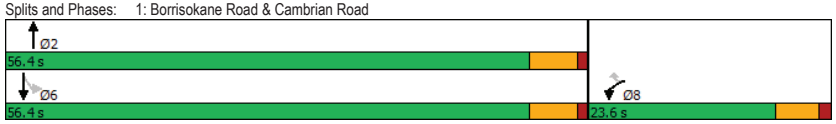
Timings
1: Borrisokane Road & Cambrian Road

07-24-2019

Intersection Signal Delay: 13.7	Intersection LOS: B
Intersection Capacity Utilization 71.6%	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: 1: Borrisokane Road & Cambrian Road



HCM 2010 TWSC
2: Borrisokane Road & Temp Site Access

07-24-2019

Intersection	
Int Delay, s/veh	6.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	10	184	80	13	251	74
Future Vol, veh/h	10	184	80	13	251	74
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	10	184	80	13	251	74

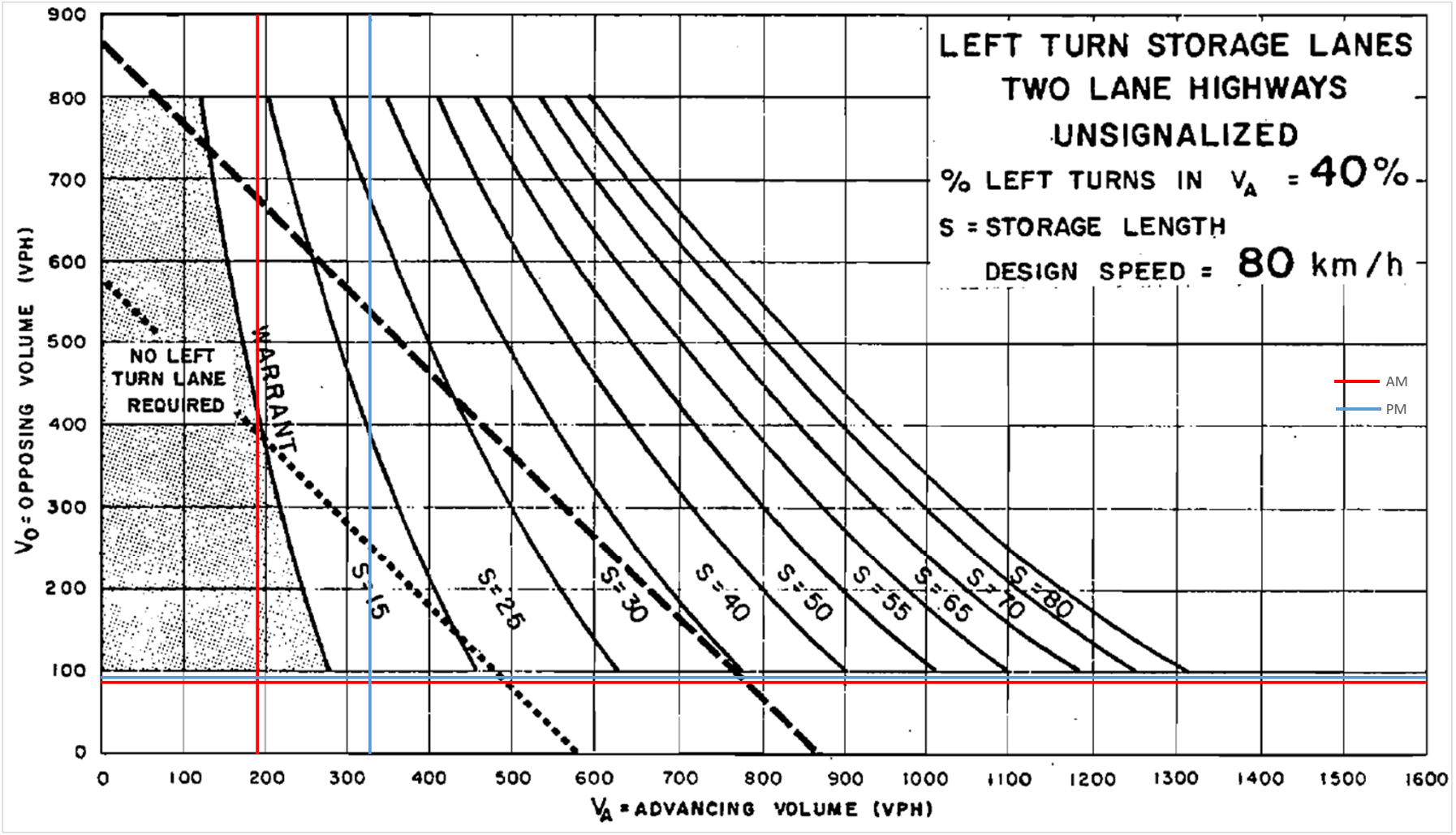
Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	663	87	0	0	93	0
Stage 1	87	-	-	-	-	-
Stage 2	576	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	426	971	-	-	1501	-
Stage 1	936	-	-	-	-	-
Stage 2	562	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	352	971	-	-	1501	-
Mov Cap-2 Maneuver	352	-	-	-	-	-
Stage 1	936	-	-	-	-	-
Stage 2	464	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.2	0	6.1
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	890	1501	-
HCM Lane V/C Ratio	-	-	0.218	0.167	-
HCM Control Delay (s)	-	-	10.2	7.9	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.8	0.6	-

Appendix H

Left-Turn Lane Warrants


LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 40%
S = STORAGE LENGTH
DESIGN SPEED = 80 km/h
NO LEFT TURN LANE REQUIRED
WARRANT
S=15
S=25
S=30
S=40
S=50
S=55
S=65
S=70
S=80
AM
PM
V_O = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600

Appendix I

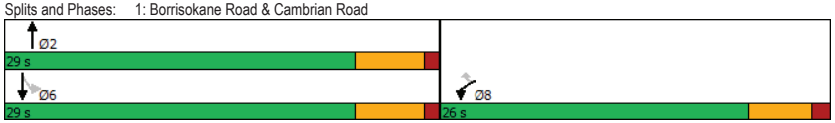
2030 Future Total Synchro Worksheets

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	46	627	289	49	255	144
Future Volume (vph)	46	627	289	49	255	144
Satd. Flow (prot)	1621	1450	1672	0	1621	1706
Flt Permitted	0.950				0.550	
Satd. Flow (perm)	1621	1450	1672	0	938	1706
Satd. Flow (RTOR)		453	19			
Lane Group Flow (vph)	46	627	338	0	255	144
Turn Type	Prot	Perm	NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases		8			6	
Detector Phase	8	8	2		6	6
Switch Phase						
Minimum Initial (s)	10.0	10.0	10.0		10.0	10.0
Minimum Split (s)	23.5	23.5	23.7		23.7	23.7
Total Split (s)	26.0	26.0	29.0		29.0	29.0
Total Split (%)	47.3%	47.3%	52.7%		52.7%	52.7%
Yellow Time (s)	4.2	4.2	4.6		4.6	4.6
All-Red Time (s)	1.3	1.3	1.1		1.1	1.1
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	5.5	5.5	5.7		5.7	5.7
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Max		Max	Max
Act Effct Green (s)	14.8	14.8	23.5		23.5	23.5
Actuated g/C Ratio	0.30	0.30	0.47		0.47	0.47
v/c Ratio	0.10	0.84	0.42		0.57	0.18
Control Delay	12.2	16.5	11.3		18.1	9.7
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	12.2	16.5	11.3		18.1	9.7
LOS	B	B	B		B	A
Approach Delay	16.2		11.3			15.1
Approach LOS	B		B			B
Queue Length 50th (m)	2.8	11.8	16.0		14.3	6.4
Queue Length 95th (m)	7.9	#63.8	39.2		#47.3	17.5
Internal Link Dist (m)	517.3		1048.8			1050.1
Turn Bay Length (m)	38.0				161.0	
Base Capacity (vph)	676	869	803		445	809
Starvation Cap Reductn	0	0	0		0	0
Spillback Cap Reductn	0	0	0		0	0
Storage Cap Reductn	0	0	0		0	0
Reduced v/c Ratio	0.07	0.72	0.42		0.57	0.18

Intersection Summary
Cycle Length: 55
Actuated Cycle Length: 49.6
Natural Cycle: 60
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.84

Intersection Signal Delay: 14.7 Intersection LOS: B
Intersection Capacity Utilization 69.5% 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: 1: Borrisokane Road & Cambrian Road



HCM 2010 TWSC
2: Borrisokane Road & Temp Site Access 07-24-2019

Intersection	
Int Delay, s/veh	6.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	14	257	81	7	124	66
Future Vol, veh/h	14	257	81	7	124	66
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	14	257	81	7	124	66

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	399	85	0	0	88	0
Stage 1	85	-	-	-	-	-
Stage 2	314	-	-	-	-	-
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	607	974	-	-	1508	-
Stage 1	938	-	-	-	-	-
Stage 2	741	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	555	974	-	-	1508	-
Mov Cap-2 Maneuver	555	-	-	-	-	-
Stage 1	938	-	-	-	-	-
Stage 2	678	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.4	0	5
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	- 937	1508	-
HCM Lane V/C Ratio	-	- 0.289	0.082	-
HCM Control Delay (s)	-	- 10.4	7.6	0
HCM Lane LOS	-	- B	A	A
HCM 95th %tile Q(veh)	-	- 1.2	0.3	-

Timings
1: Borrisokane Road & Cambrian Road 07-24-2019

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	50	397	220	44	615	275
Future Volume (vph)	50	397	220	44	615	275
Satd. Flow (prot)	1621	1450	1667	0	1621	1706
Flt Permitted	0.950				0.596	
Satd. Flow (perm)	1621	1450	1667	0	1017	1706
Satd. Flow (RTOR)		397	25			
Lane Group Flow (vph)	50	397	264	0	615	275
Turn Type	Prot	Perm	NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases		8			6	
Detector Phase	8	8	2		6	6
Switch Phase						
Minimum Initial (s)	1.0	1.0	10.0		10.0	10.0
Minimum Split (s)	23.4	23.4	23.8		23.8	23.8
Total Split (s)	23.5	23.5	66.5		66.5	66.5
Total Split (%)	26.1%	26.1%	73.9%		73.9%	73.9%
Yellow Time (s)	4.2	4.2	4.6		4.6	4.6
All-Red Time (s)	1.2	1.2	1.1		1.1	1.1
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	5.4	5.4	5.7		5.7	5.7
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Max		Max	Max
Act Effct Green (s)	9.5	9.5	61.0		61.0	61.0
Actuated g/C Ratio	0.12	0.12	0.75		0.75	0.75
v/c Ratio	0.27	0.76	0.21		0.81	0.22
Control Delay	35.6	14.2	3.8		19.2	4.2
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	35.6	14.2	3.8		19.2	4.2
LOS	D	B	A		B	A
Approach Delay	16.6		3.8			14.6
Approach LOS	B		A			B
Queue Length 50th (m)	7.1	0.0	7.5		42.1	8.9
Queue Length 95th (m)	16.5	24.5	22.7		#158.7	25.6
Internal Link Dist (m)	517.3		1033.5			1050.1
Turn Bay Length (m)	38.0				161.0	
Base Capacity (vph)	360	631	1252		759	1274
Starvation Cap Reductn	0	0	0		0	0
Spillback Cap Reductn	0	0	0		0	0
Storage Cap Reductn	0	0	0		0	0
Reduced v/c Ratio	0.14	0.63	0.21		0.81	0.22

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 81.6
Natural Cycle: 90
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.81

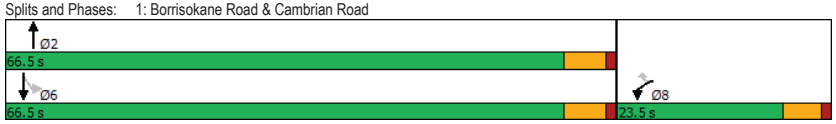
Timings
1: Borrisokane Road & Cambrian Road

07-24-2019

Intersection Signal Delay: 13.4	Intersection LOS: B
Intersection Capacity Utilization 68.3%	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: 1: Borrisokane Road & Cambrian Road



HCM 2010 TWSC
2: Borrisokane Road & Temp Site Access

07-24-2019

Intersection	
Int Delay, s/veh	6.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	10	184	80	13	251	75
Future Vol, veh/h	10	184	80	13	251	75
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	10	184	80	13	251	75

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	664	87	0	0	93	0
Stage 1	87	-	-	-	-	-
Stage 2	577	-	-	-	-	-
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	426	971	-	-	1501	-
Stage 1	936	-	-	-	-	-
Stage 2	562	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	352	971	-	-	1501	-
Mov Cap-2 Maneuver	352	-	-	-	-	-
Stage 1	936	-	-	-	-	-
Stage 2	464	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.2	0	6.1
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	890	1501	-
HCM Lane V/C Ratio	-	-	0.218	0.167	-
HCM Control Delay (s)	-	-	10.2	7.9	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.8	0.6	-

Appendix J

TAC Signal Warrant

City of Ottawa Canadian Matrix Traffic Signal Warrant Analysis

Main Street (name)	Borrisokane	Direction (EW or NS)	NS	Road Authority:	City of Ottawa
Side Street (name)	Cambrian	Direction (EW or NS)	EW	City:	Ottawa
Quadrant / Int #	1	Comments	Enter Comments about the analysis here.	Analysis Date:	2019 Jul 24, Wed
for Warrant Calculation Results, please hit 'Page Down'	CHECK SHEET			Count Date:	2025 Jan 01, Wed
				Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Exd LT	Th & LT	Through	Th+RT+LT	Th & RT	Exd RT	UpStream Signal (m)	# of Thru Lanes
Borrisokane	NB					1		1,900	1
Borrisokane	SB		1					2,000	1
Cambrian	WB				1				
Cambrian	EB								

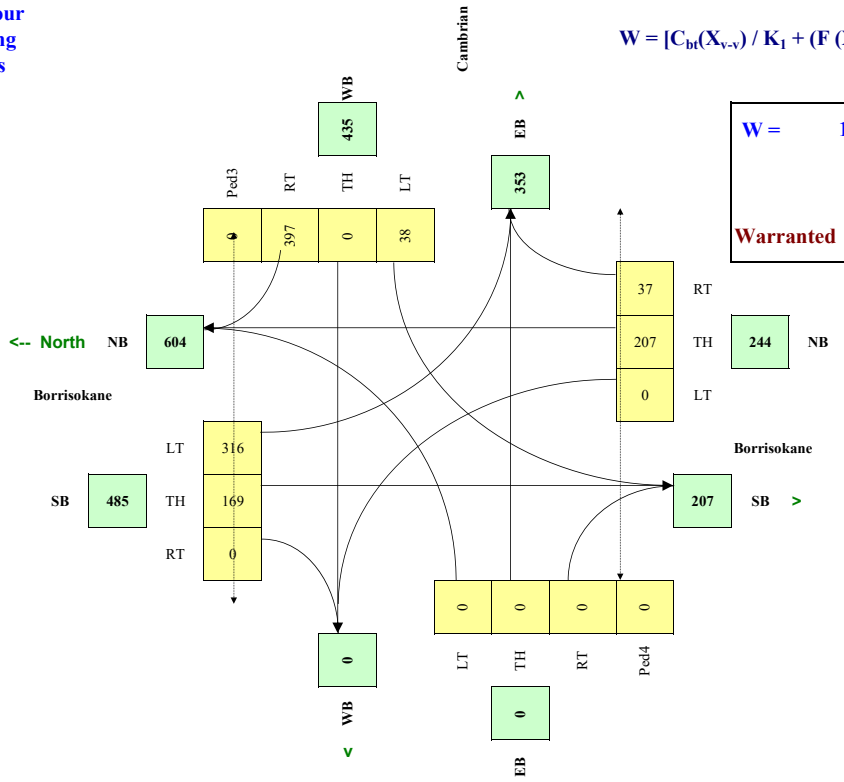
Demographics		
Elem. School/Mobility Impaired	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	1
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Borrisokane	NS	80	2.0%	n	0.0
Cambrian	EW		2.0%	n	

Set Peak Hours

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
press 'Set Peak Hours' Button to set the peak hour periods	0	250	42	204	125	0	39	0	515	0	0	0	0	0	0	0
	0	289	48	236	144	0	45	0	595	0	0	0	0	0	0	0
	0	175	29	143	87	0	27	0	360	0	0	0	0	0	0	0
	0	100	20	249	125	0	22	0	173	0	0	0	0	0	0	0
	0	207	41	515	259	0	46	0	357	0	0	0	0	0	0	0
	0	220	44	548	275	0	49	0	380	0	0	0	0	0	0	0
Total (6-hour peak)	**0**	**1,241**	**224**	**1,895**	**1,015**	**0**	**228**	**0**	**2,380**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**0**	**207**	**37**	**316**	**169**	**0**	**38**	**0**	**397**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Average 6-hour Peak Turning Movements



$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F(X_{v\text{-}p}) L) / K_2] \times C_i$$

W =	146	146	0
		Veh	*Ped*

Warranted

RESET SHEET