

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

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1 Screening

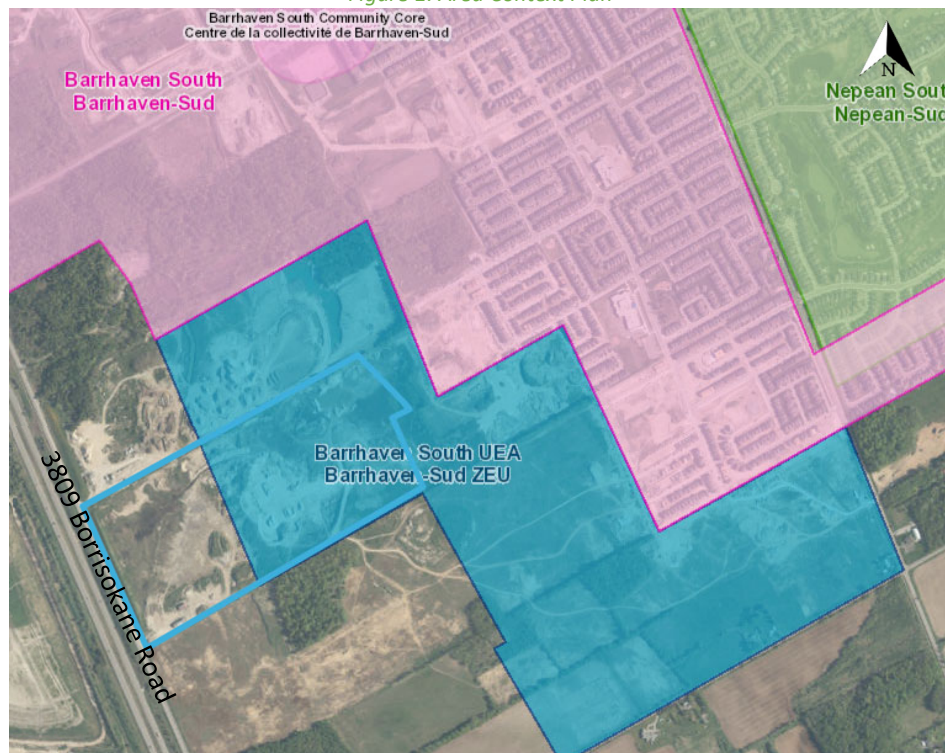
This study has been prepared according to the City of Ottawa's 2017 Transportation Impact Assessment (TIA) Guidelines. Accordingly, a Step 1 Screening Form has been prepared and is included as Appendix A, along with the Certification Form for TIA Study PM. As shown in the Screening Form, a TIA is required.

2 Existing and Planned Conditions

2.1 Proposed Development

The proposed development, located at 3809 Borriskane 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 Borriskane 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 500 units, split between townhouse and detached units. Access to the proposed development will be via a full movement access to Borriskane 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.). The development traffic will primarily use the main access (Borriskane 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 three 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





DRAFT

- All Units in Metric Unless Otherwise Noted.
- Base Information Obtained From Various Sources And Is Approximate.
- Schedule / Plan Information Is Conceptual And Requires Verification by Appropriate Agency.
- Aerial Photo: Google Earth, Approx. Fall 2016



CAIVAN DRUMMOND/BRAZEAU | Ottawa, Ontario
PRELIMINARY DEVELOPMENT CONCEPT



OCTOBER 30, 2018
 PROJECT 1807
 SCALE 1:4000

SK-05

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.

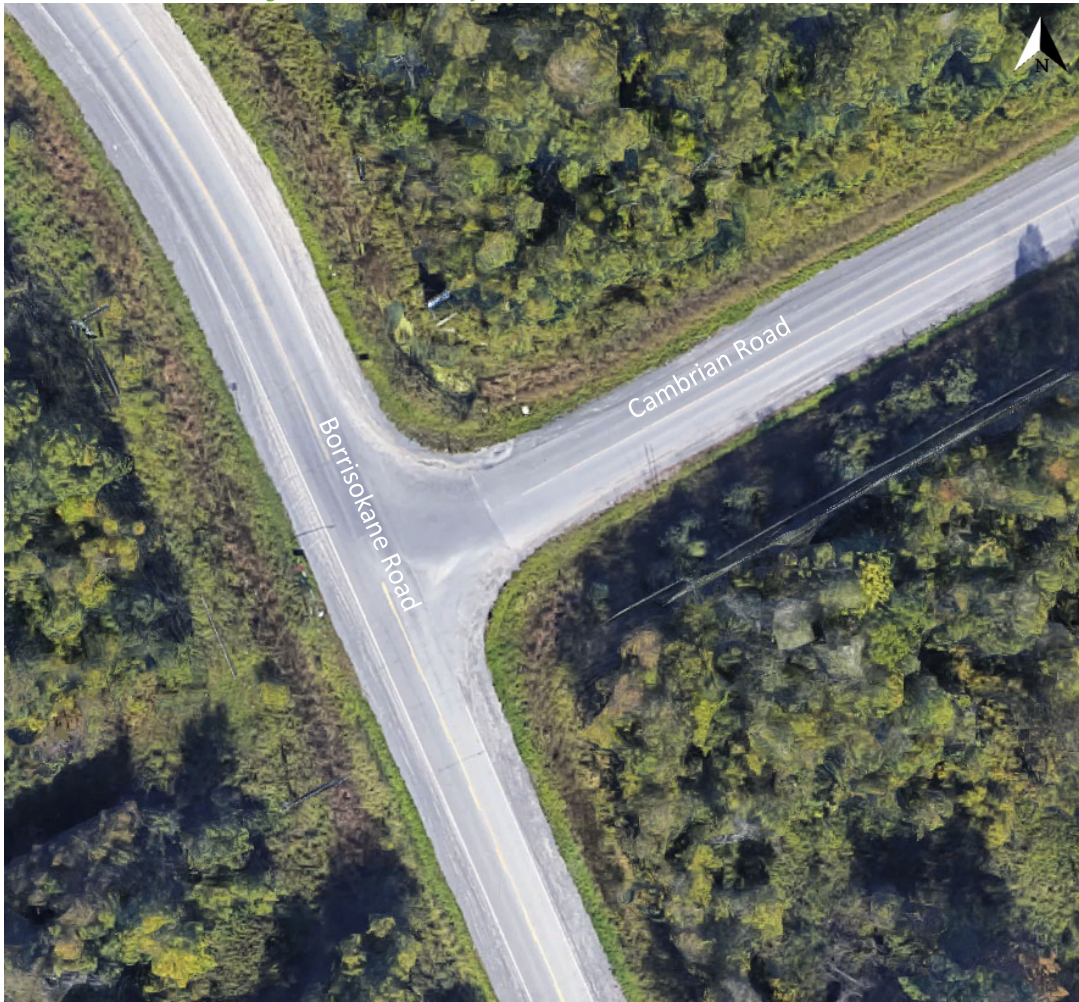
2.2.2 Existing Intersections

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 Borriskane 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 Borriskane 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 Borriskane 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 Borriskane Road. The access to the adjacent property is just north of the 3809 Borriskane 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 Borriskane Road, and no future cycling facilities are included in the Cycling Plan. Similarly, no existing or planned pedestrian facilities are shown on Borriskane 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.

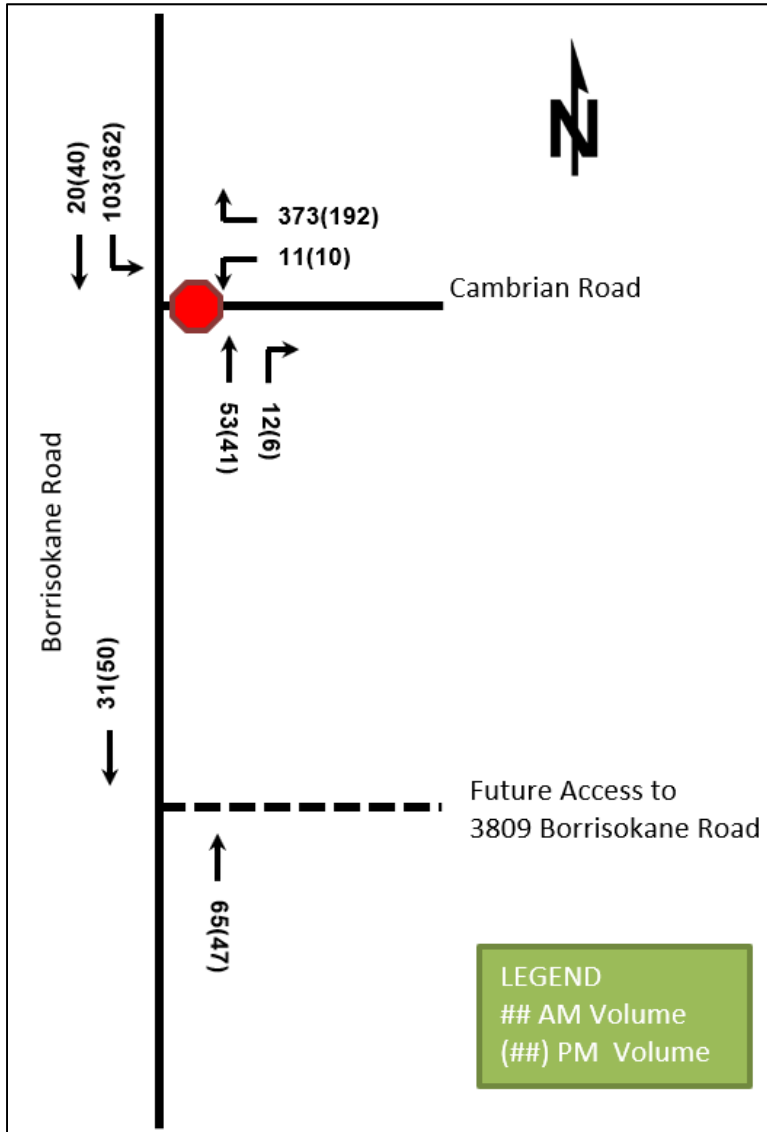
2.2.6 Existing Area Traffic Management Measures

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
	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 policies 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

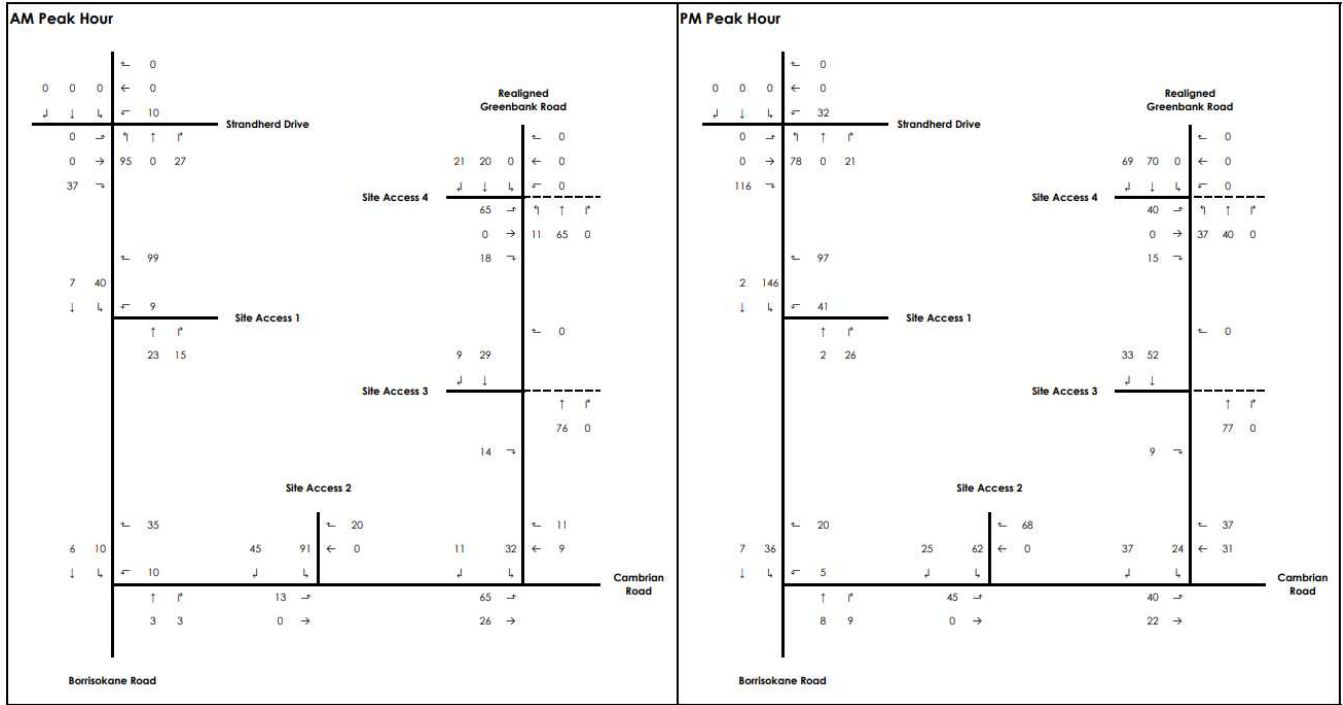
Immediately to the east of the proposed development is the Mattamy Development of Half Moon Bay South. This development is nearing completion and only the final phases remain. 3809 Borrisokane Road will include a connection to the Half Moon Bay South Development. However, this connection will be a secondary 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.

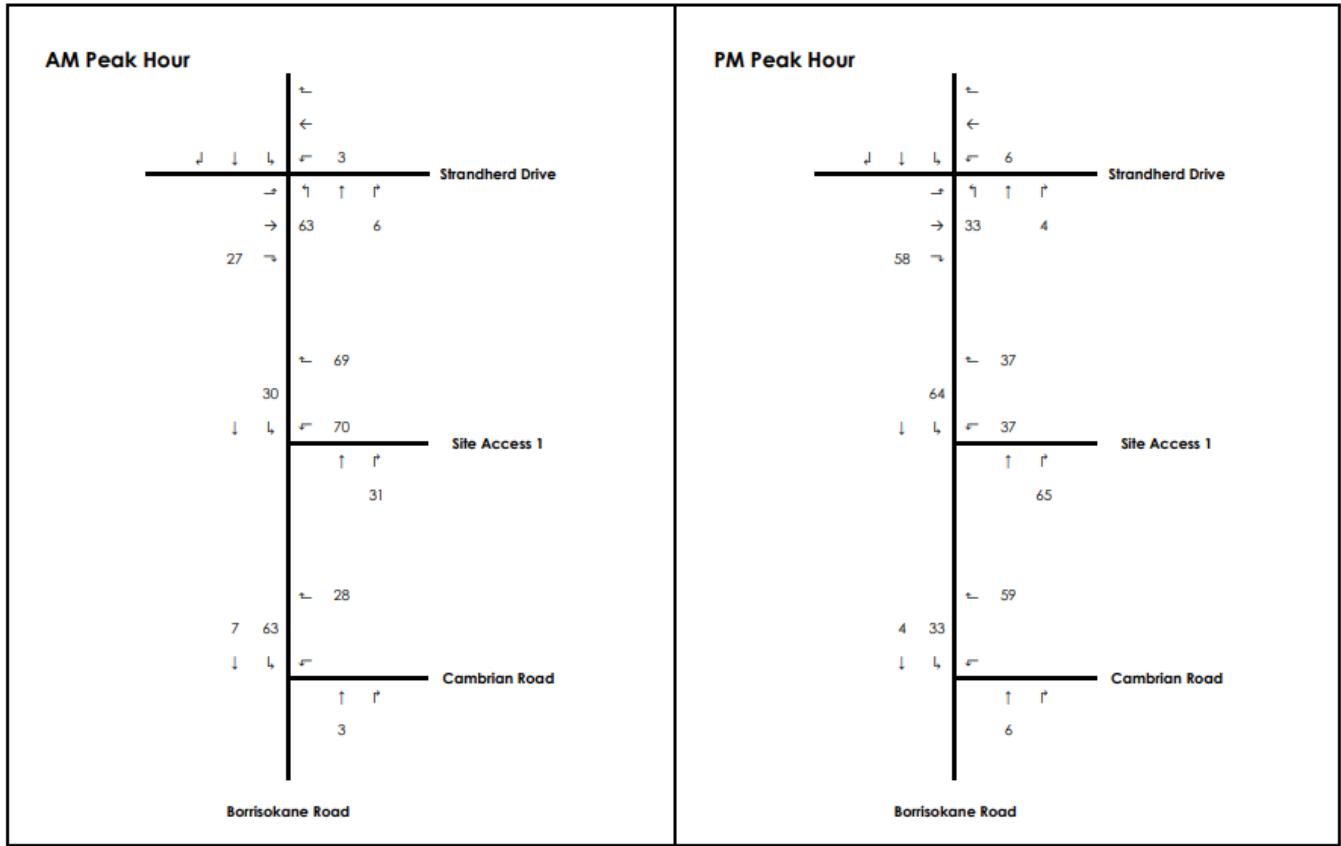
The Meadows Phase 5

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 Area 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 Borriskane Road Site Traffic Volumes



Excerpt from: 3387 Borriskane 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 Borriskane Road as a Boundary Road and will focus on the access intersection on Borriskane Road and the intersection of Borriskane Road at Cambrian Road. As discussed previously, the intersection of Barnsdale Road at Borriskane 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	315	116	284	400	271	173	444
Townhouse	185	67	114	181	114	101	215
Total Person Trips		183	398	581	385	274	659

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%	110	238	349	231	165	395
Auto Passenger	15%	27	60	87	58	41	99
Transit	15%	27	60	87	58	41	99
Non-Auto Modes	10%	19	39	58	38	27	66
Total	100%	183	398	581	385	274	659

As shown above, 581 AM and 659 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 (%)

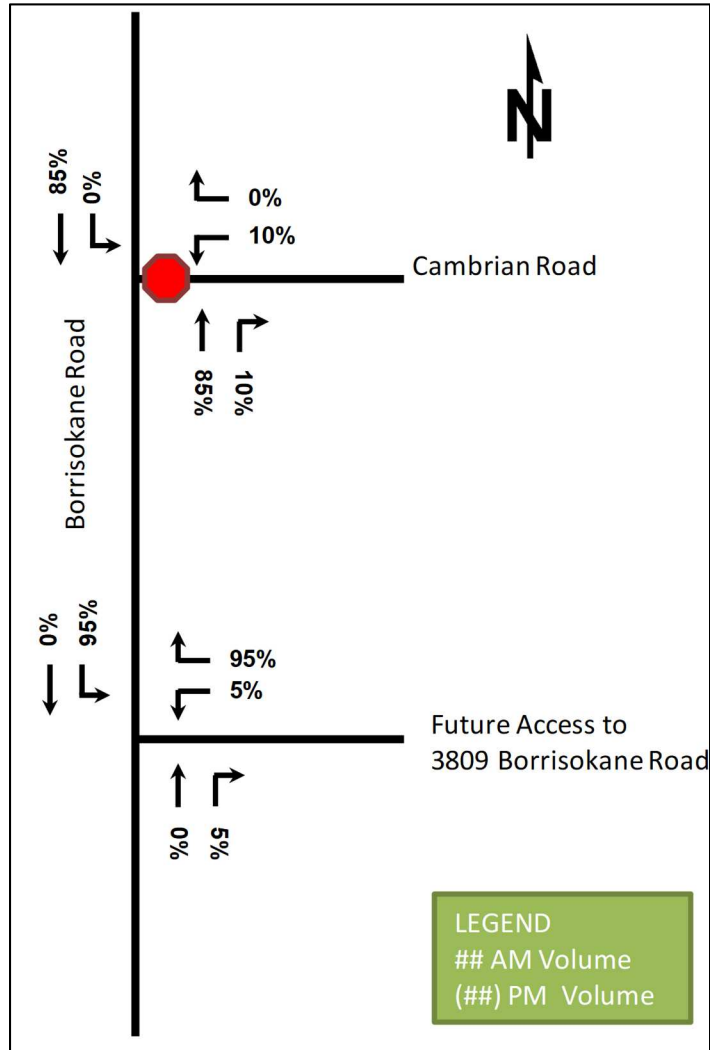
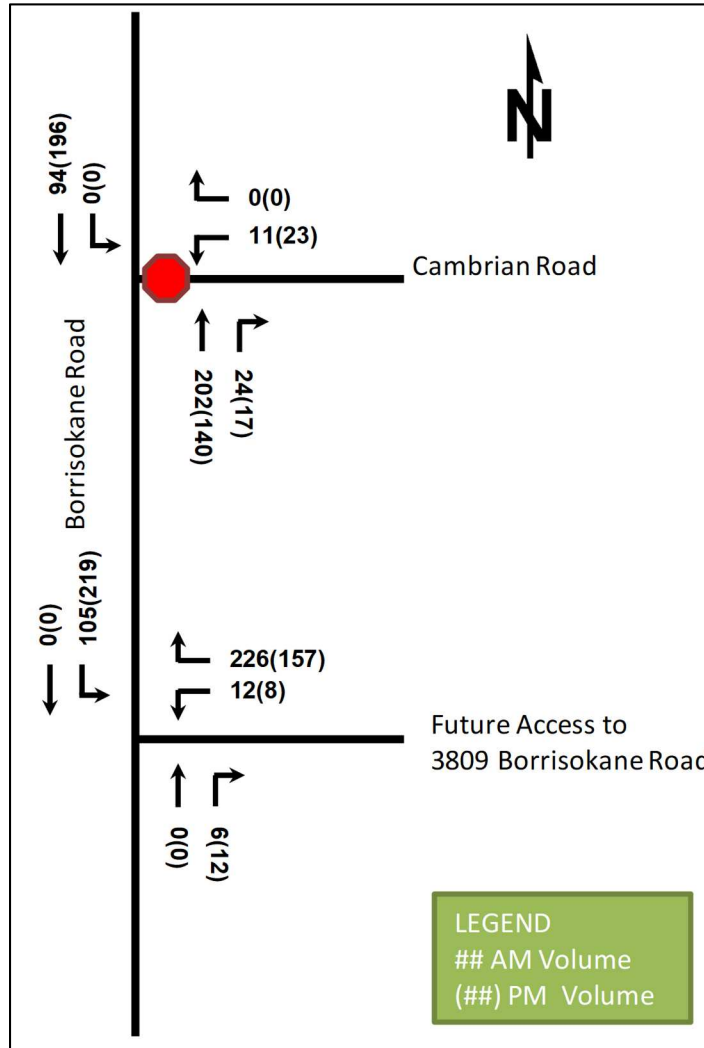


Figure 8: Site Traffic Assignment (Volumes)



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 Borrissokane 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 Borriskane 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

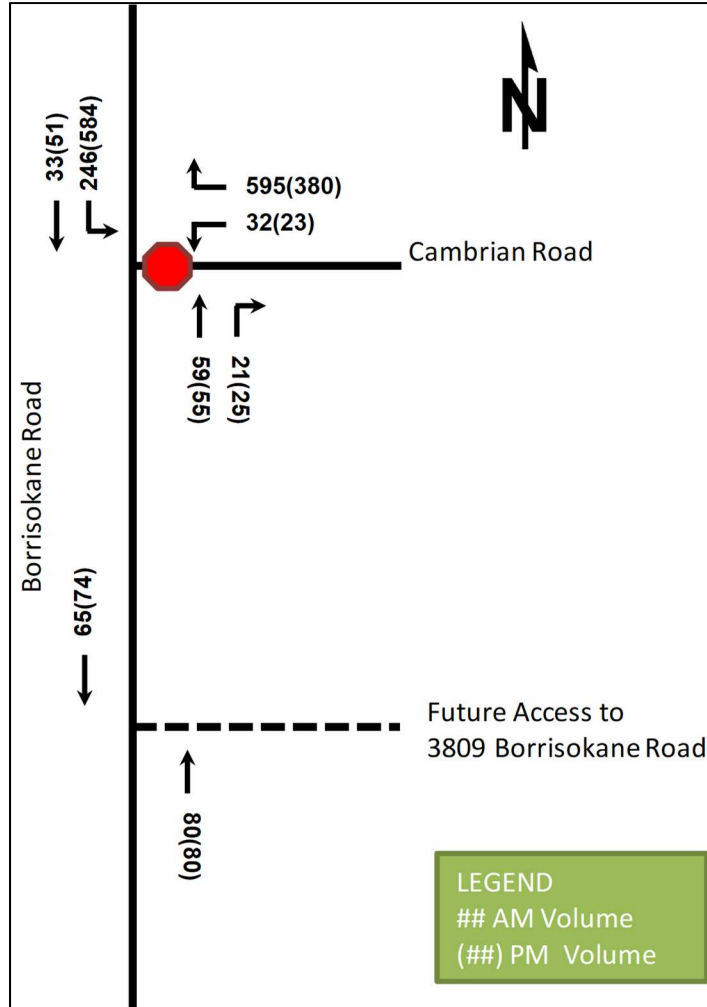
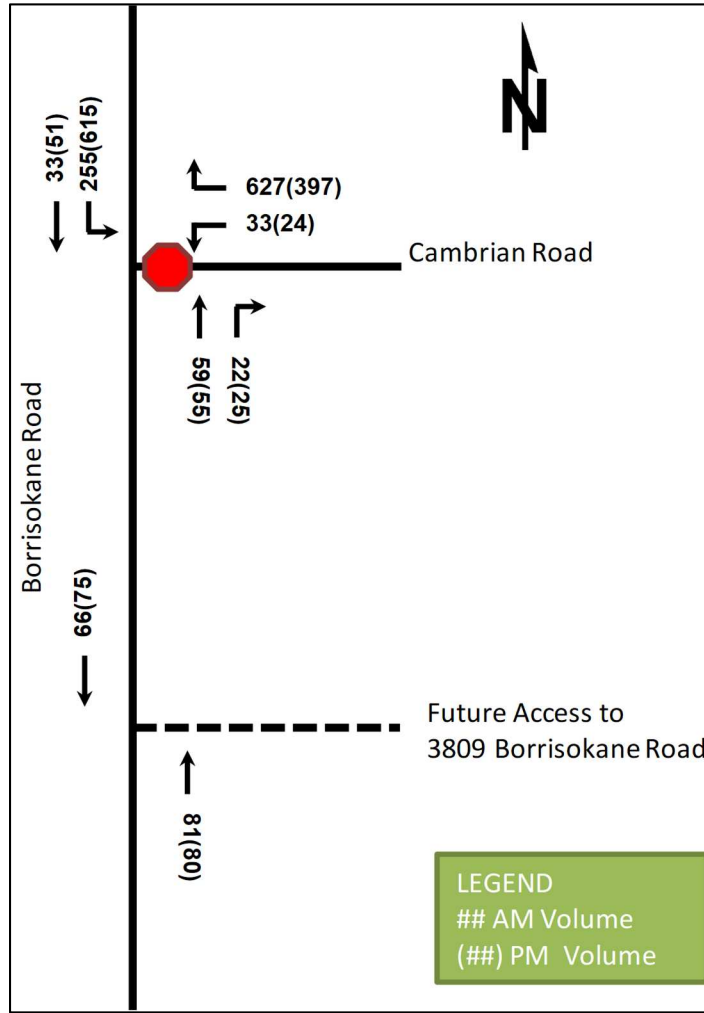


Figure 10: 2030 Future Background Traffic Volumes



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 (95 th)	LOS	Delay	V/C	Q (95 th)
Cambrian Road & Borriskane 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 (95 th)	LOS	Delay	V/C	Q (95 th)
Cambrian Road & Borriskane 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	-	-

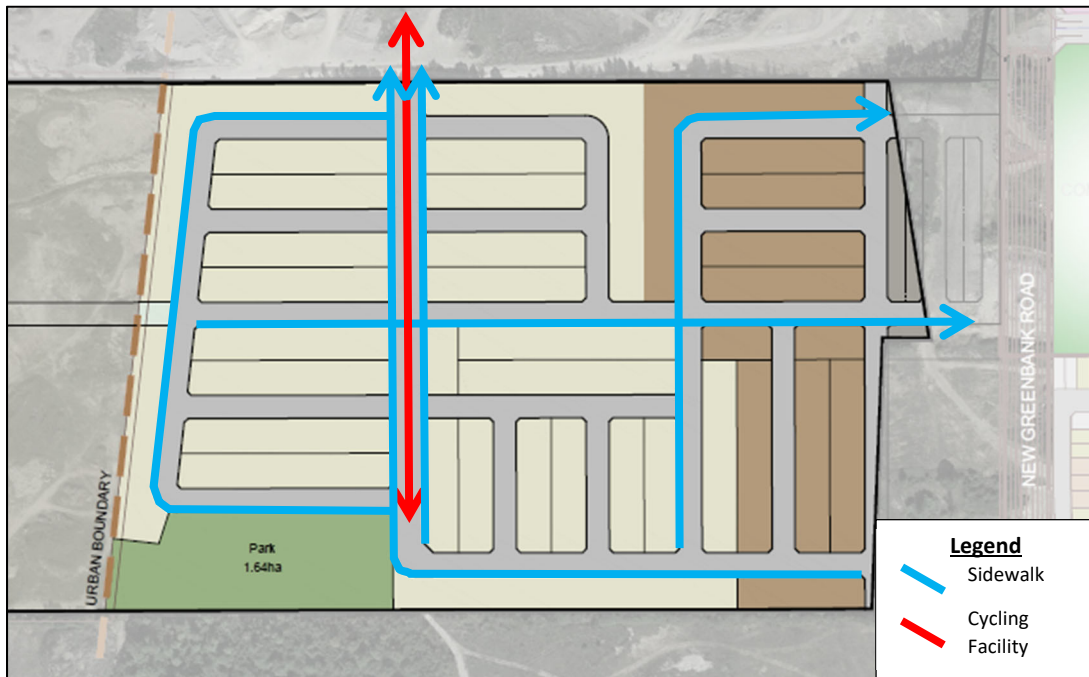
The future 2030 background conditions are forecasted to operate similar to the 2025 background operations. As noted in 2025, no auxiliary turn lanes are recommended.

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



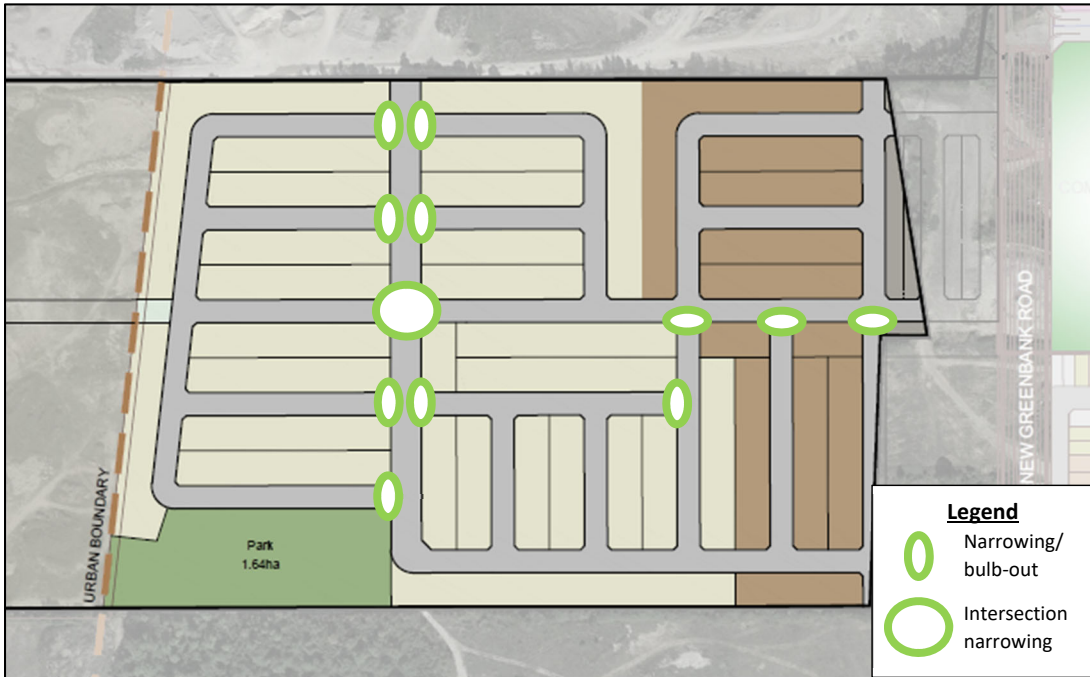
8.2 New Street Networks

The planned street network will include 18.0 metre local roadways and a single north-south 24.0 metre collector road. The local roads may include a sidewalk on one side, and the collector road should include sidewalks and cycle tracks on both sides, and parking on one side. It is noted that a multi-use pathway may be substituted to allow for utility spacing required or transit stops along the collector.

The cross-sections from the Barrhaven South Urban Expansion Study Area CDP have been provided in Appendix F for reference.

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 and an all-way stop is recommended at narrowed intersection of the collector road and east-west local road near the center of the subdivision.

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 1.05km south of Cambrian Road. This access would be used

until such time that Re-Aligned Greenbank Road is constructed, and the adjacent development is completed to connect the subject site 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 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 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 signalized 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 Borriskane 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 warrants have been provided in Appendix H.

Figure 13: 2025 Future Total Traffic Volumes

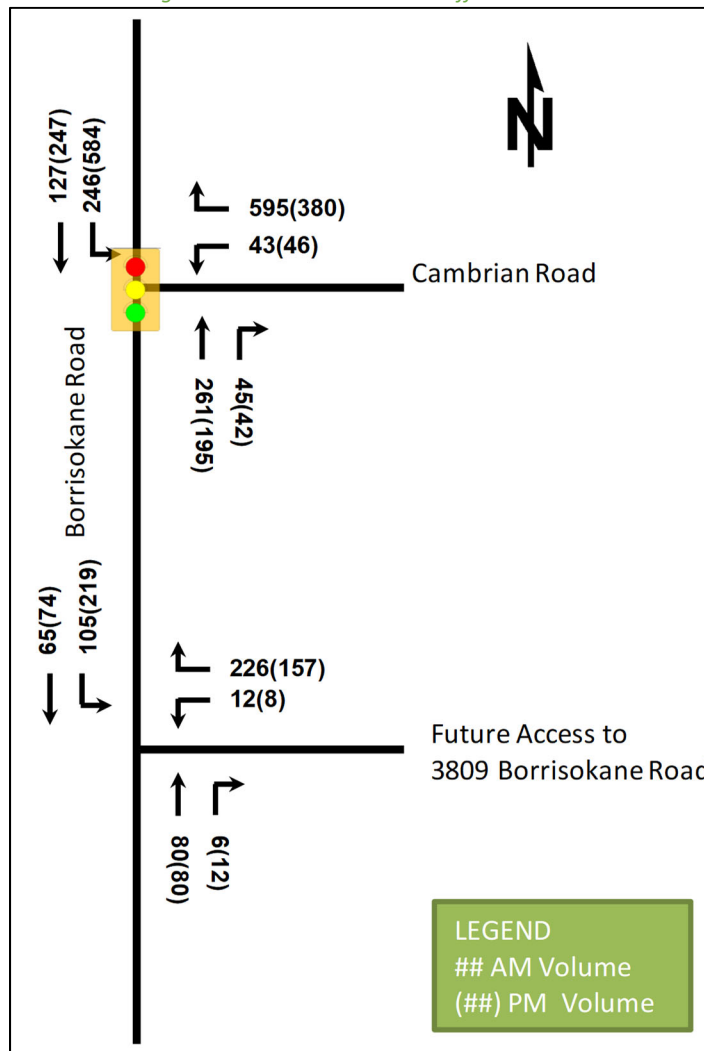


Table 11: 2025 Future Total Access Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95 th)	LOS	Delay	V/C	Q (95 th)
Temp Site Access & Borrissokane Road	WBL/R	B	10.1	0.25	1.0	A	9.8	0.18	0.7
	NBT/R	A	0.0	0.00	0.0	A	0.0	0.00	0.0
	SBL/T	A	4.7	0.07	0.2	A	5.8	0.15	0.5
	Overall	A	6.5	-	-	A	6.0	-	-

The temporary access road and Borrissokane 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 signalized 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 Borrissokane 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 warrants have been provided in Appendix H.

Figure 14: 2030 Future Total Traffic Volumes

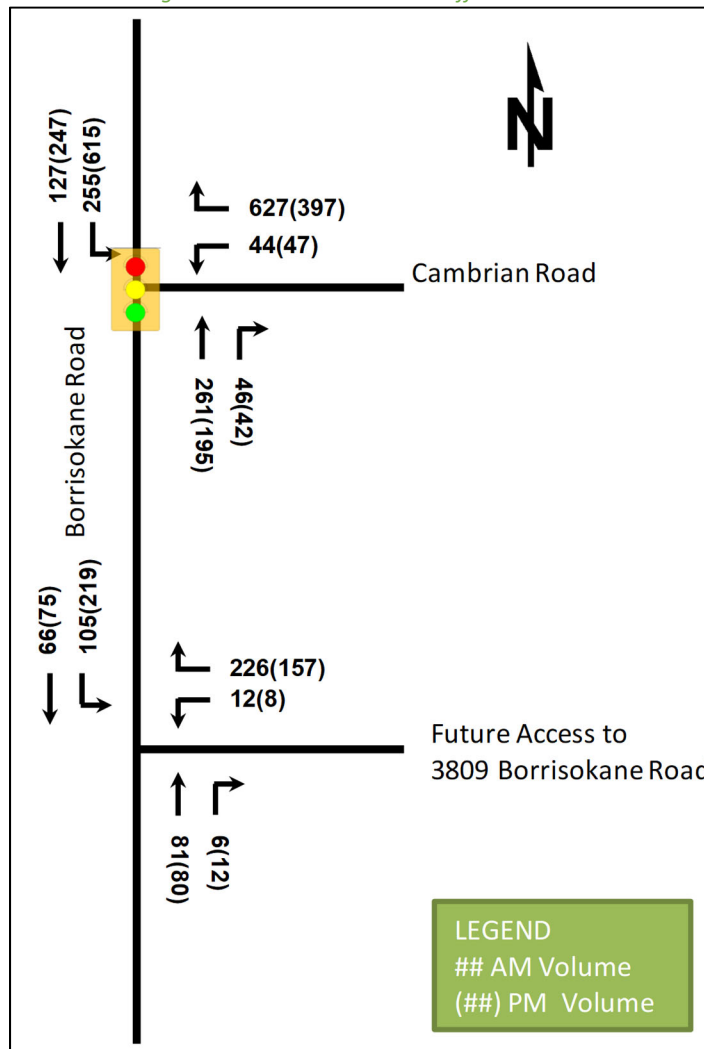


Table 12: 2030 Future Total Access Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95 th)	LOS	Delay	V/C	Q (95 th)
Temp Site Access & Borrisokane Road	WBL/R	B	10.1	0.25	1.0	A	9.8	0.18	0.7
	NBT/R	A	0.0	0.00	0.0	A	0.0	0.00	0.0
	SBL/T	A	4.6	0.07	0.2	A	5.8	0.15	0.5
	Overall	A	6.4	-	-	A	6.0	-	-

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 an 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 Intersection Design

14.1 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 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 (95 th)	LOS	Delay	V/C	Q (95 th)
Cambrian Road & Borrisokane Road <i>Signalized</i>	WBL	B	14.3	0.12	8.1	C	28.4	0.16	13.6
	WBR	B	14.2	0.83	31.8	B	10.8	0.16	21.3
	NBT/R	A	8.9	0.33	36.7	A	4.4	0.69	20.2
	SBL	B	12.9	0.46	39.2	C	20.6	0.69	#136.2
	SBT	A	8.1	0.14	16.5	A	5.0	0.69	23.0
	Overall	B	12.1	-	-	-	B	13.2	-

The 2025 future conditions are forecasted to operate acceptably during the peak hours as signalized intersections. 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 (95 th)	LOS	Delay	V/C	Q (95 th)
Cambrian Road & Borrisokane Road <i>Signalized</i>	WBL	B	12.4	0.09	7.6	D	35.3	0.25	15.6
	WBR	B	13.8	0.82	#43.2	B	14.3	0.77	24.5
	NBT/R	B	10.4	0.38	34.9	A	3.6	0.19	19.9
	SBL	B	16.2	0.54	#40.9	B	17.7	0.79	#155.6
	SBT	A	9.2	0.15	15.6	A	4.1	0.20	23.8
	Overall	B	13.0	-	-	-	B	13.0	-

The 2030 future total conditions are forecasted to operate similarly to the 2025 future total conditions. 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 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 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 500 units, split approximately between 315 single detached homes and 185 townhomes
- A temporary 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 temporary 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 580 people two-way trips during the AM peak and 660 people two-way trips during the PM peak

- Based on the study area travel patterns, a total of 350 two-way vehicle trips will be generated during the AM peak and 395 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 18.0 metre local roads
- The Barrhaven South Urban Expansion Study Area CDP road cross-sections are recommended for use in the development and would include:
 - A cycle track and sidewalk on both sides of the collector road with one lane of parking
 - No sidewalks or a single sidewalk on the local roads
 - Should utility or cross-sectional constraints be identified on the collector road, a MUP may be substituted for the cycle track and sidewalk
- The internal road intersections are recommended to be minor stop-controlled, with an all-way stop-control located at the collector and east-west local road in the center of the development
- 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

- A Temporary 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, a single bus, 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:

Reviewed By:



Andrew Harte, P.Eng.
Senior Transportation Engineer



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 licensed¹ or registered² professional in good standing, whose field of expertise [check appropriate field(s)] is either transportation engineering or transportation planning .

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


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Infrastructure Services and Community
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Planning and Growth Management
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Urbanisme et Gestion de la croissance
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Ottawa (Ontario) K1P 1J1
Tél. : 613-580-2424
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



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

Turning Movement Count - Full Study Summary Report (Cyclists)

Time Period	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	0	
8:00 9:00	0	0	0	0	0	0	0	0	
9:00 10:00	0	0	0	0	0	0	0	0	
11:30 12:30	0	0	0	0	0	0	0	0	
12:30 13:30	0	0	0	0	0	0	0	0	
15:00 16:00	0	0	0	0	0	0	0	0	
16:00 17:00	0	0	0	0	0	0	0	0	
17:00 18:00	0	0	0	0	0	0	0	0	
TOTAL:	0	0	0	0	0	0	0	0	

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

Time Period	Borrisokane Road					N/S STREET TOTAL	0					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	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 Manoeuvre	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
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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	NBRWBLn1	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	NBRWBLn1	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	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	918	1517
HCM Lane V/C Ratio	-	-	0.719	0.168
HCM Control Delay (s)	-	-	18.3	7.9
HCM Lane LOS	-	-	C	A
HCM 95th %tile Q(veh)	-	-	6.4	0.6

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	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	651	1518
HCM Lane V/C Ratio	-	-	0.647	0.405
HCM Control Delay (s)	-	-	20.1	9
HCM Lane LOS	-	-	C	A
HCM 95th %tile Q(veh)	-	-	4.7	2

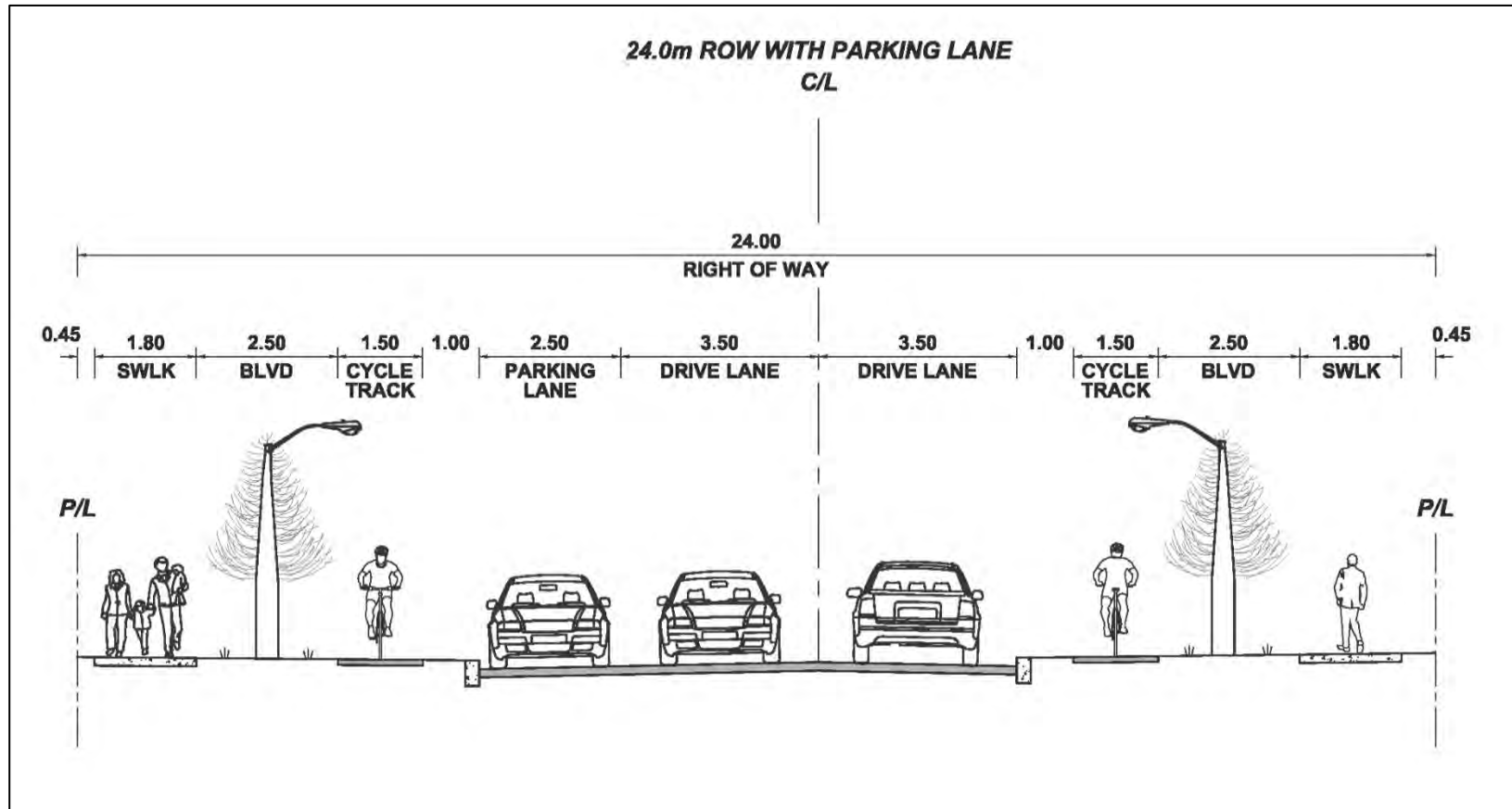
Appendix F

Barrhaven South Urban Expansion Study Area Road Cross-Sections

BARRHAVEN SOUTH URBAN EXPANSION STUDY AREA COMMUNITY DESIGN PLAN
FINAL TRANSPORTATION MASTER STUDY

Transportation Improvements and Design Elements
May 7, 2018

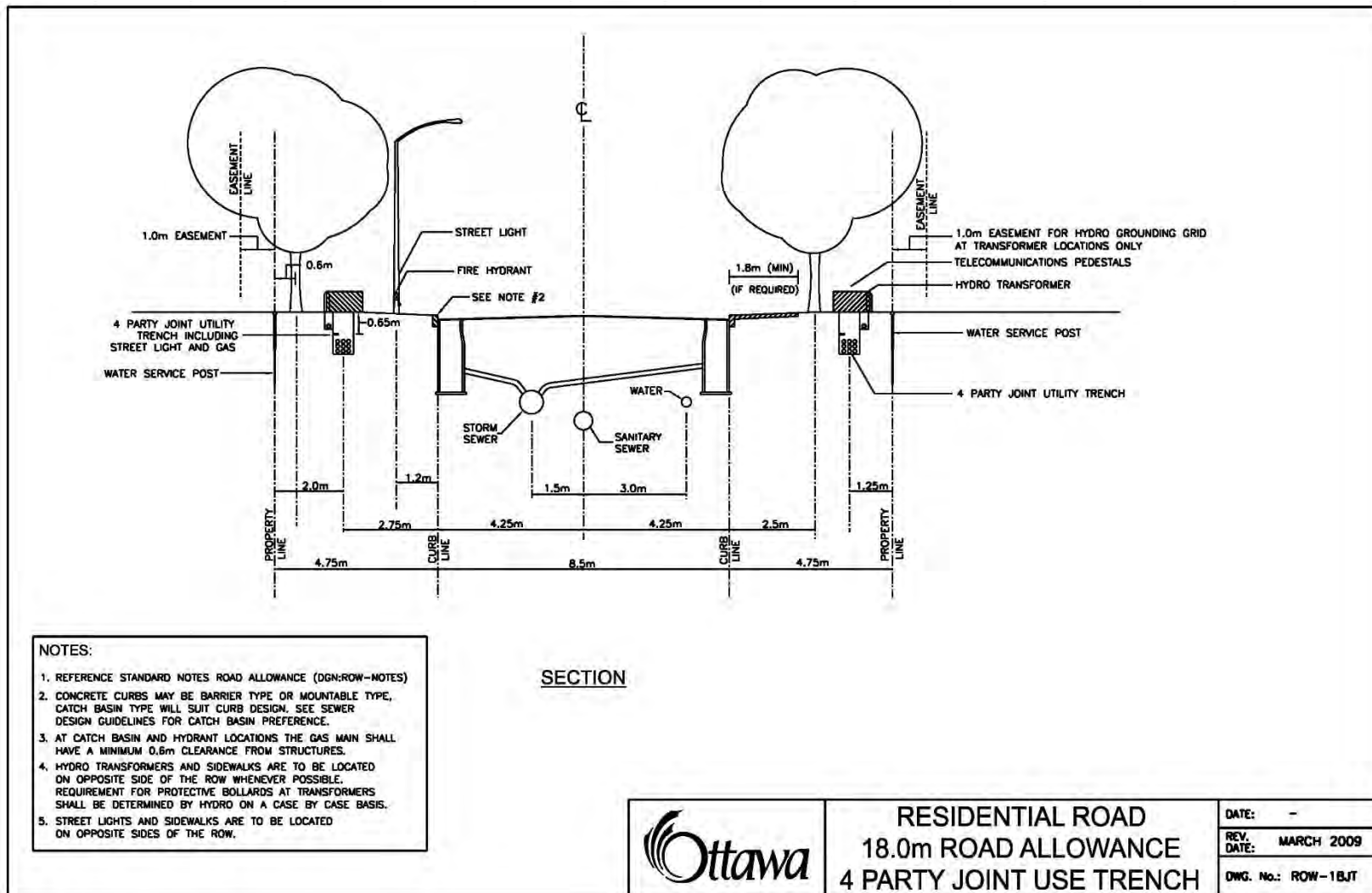
Figure 35 East - West Collector Proposed Cross-Section (mid-block with Parking on one side)



BARRHAVEN SOUTH URBAN EXPANSION STUDY AREA COMMUNITY DESIGN PLAN
 FINAL TRANSPORTATION MASTER STUDY

Transportation Improvements and Design Elements
 May 7, 2018

Figure 36 Local Road Proposed Cross-Section – Sidewalks on One (or both) Sides



Appendix G

MMLOS Analysis

Multi-Modal Level of Service - Intersections Form

Consultant
Scenario
Comments

CGH Transportation
All

Project
Date

Caivan Brazeau
2018-10-31

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	
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	-	
Level of Service		E			
Transit	Average Signal Delay	≤ 20 sec	≤ 10 sec	≤ 30 sec	
	Level of Service	C	B	D	-
Level of Service		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	-
Level of Service		E			
Auto	Volume to Capacity Ratio	0.71 - 0.80			
	Level of Service	C			

Multi-Modal Level of Service - Segments Form

Consultant	CGH Transportation
Scenario	All
Comments	

Project	Caivan Brazeau
Date	2018-10-31

SEGMENTS		Street A	Borrisokane 1	Section 2	Section 3
Pedestrian	Sidewalk Width	F	no sidewalk		
	Boulevard Width		n/a		
	Avg Daily Curb Lane Traffic Volume		> 3000		
	Operating Speed		> 60 km/h		
	On-Street Parking		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 H

2025 Future Total Synchro Worksheets

HCM 2010 TWSC

1: Borrisokane Road & Cambrian Road

10-31-2018

Intersection						
Int Delay, s/veh	18.2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔
Traffic Vol, veh/h	33	560	262	42	236	121
Future Vol, veh/h	33	560	262	42	236	121
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	560	262	42	236	121
Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	876	283	0	0	304	0
Stage 1	283	-	-	-	-	-
Stage 2	593	-	-	-	-	-
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	319	756	-	-	1257	-
Stage 1	765	-	-	-	-	-
Stage 2	552	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	255	756	-	-	1257	-
Mov Cap-2 Maneuver	255	-	-	-	-	-
Stage 1	765	-	-	-	-	-
Stage 2	441	-	-	-	-	-
Approach	WB	NB	SB			
HCM Control Delay, s	35.2	0	5.6			
HCM LOS	E					
Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT		
Capacity (veh/h)	-	-	681	1257		
HCM Lane V/C Ratio	-	-	0.871	0.188		
HCM Control Delay (s)	-	-	35.2	8.5	0	
HCM Lane LOS	-	-	E	A	A	
HCM 95th %tile Q(veh)	-	-	10.4	0.7		

Timings

1: Borrisokane Road & Cambrian Road

01-17-2019

	↖	↗	↑	↘	↙	↓
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖	↗	↖	↗	↖	↗
Traffic Volume (vph)	43	595	261	45	246	127
Future Volume (vph)	43	595	261	45	246	127
Satd. Flow (prot)	1621	1450	1672	0	1621	1706
Fit Permitted	0.950				0.574	
Satd. Flow (perm)	1621	1450	1672	0	979	1706
Satd. Flow (RTOR)		507	18			
Lane Group Flow (vph)	43	595	306	0	246	127
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)	11.1	11.1	26.7		26.7	26.7
Actuated g/C Ratio	0.23	0.23	0.54		0.54	0.54
v/c Ratio	0.12	0.83	0.33		0.46	0.14
Control Delay	14.3	14.2	8.9		12.9	8.1
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	14.3	14.2	8.9		12.9	8.1
LOS	B	B	A		B	A
Approach Delay	14.2		8.9			11.3
Approach LOS	B		A			B
Queue Length 50th (m)	2.9	6.2	10.7		10.1	4.2
Queue Length 95th (m)	8.1	31.8	36.7		39.2	16.5
Internal Link Dist (m)	517.3		1008.4			1050.1
Turn Bay Length (m)	38.0				153.0	
Base Capacity (vph)	752	944	915		531	925
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	0.63	0.33		0.46	0.14

Intersection Summary

Cycle Length: 60
 Actuated Cycle Length: 49.2
 Natural Cycle: 60
 Control Type: Semi Act-Uncoord
 Maximum v/c Ratio: 0.83

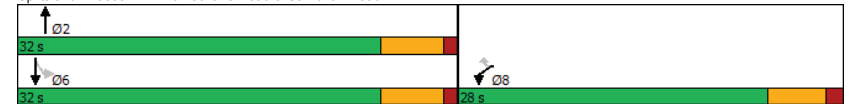
Timings

1: Borrisokane Road & Cambrian Road

01-17-2019

Intersection Signal Delay: 12.1	Intersection LOS: B
Intersection Capacity Utilization 65.6%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 1: Borrisokane Road & Cambrian Road



Intersection						
Int Delay, s/veh	6.5					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔	↔	↕	↕	↔	↔
Traffic Vol, veh/h	12	226	80	6	105	65
Future Vol, veh/h	12	226	80	6	105	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	12	226	80	6	105	65
Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	358	83	0	0	86	0
Stage 1	83	-	-	-	-	-
Stage 2	275	-	-	-	-	-
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	640	976	-	-	1510	-
Stage 1	940	-	-	-	-	-
Stage 2	771	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	594	976	-	-	1510	-
Mov Cap-2 Maneuver	594	-	-	-	-	-
Stage 1	940	-	-	-	-	-
Stage 2	715	-	-	-	-	-
Approach	WB	NB	SB			
HCM Control Delay, s	10.1	0	4.7			
HCM LOS	B					
Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT		
Capacity (veh/h)	-	-	945	1510		
HCM Lane V/C Ratio	-	-	0.252	0.07		
HCM Control Delay (s)	-	-	10.1	7.6	0	
HCM Lane LOS	-	-	B	A	A	
HCM 95th %tile Q(veh)	-	-	1	0.2		

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔	↔	↕	↕	↔	↔
Traffic Volume (vph)	46	380	195	42	584	247
Future Volume (vph)	46	380	195	42	584	247
Satd. Flow (prot)	1621	1450	1665	0	1621	1706
Fit Permitted	0.950			0.611		
Satd. Flow (perm)	1621	1450	1665	0	1042	1706
Satd. Flow (RTOR)	380			26		
Lane Group Flow (vph)	46	380	237	0	584	247
Turn Type	Prot	Perm	NA		Perm	NA
Protected Phases	8			2		
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	0.18	0.70	0.20		0.81	0.21
Control Delay	28.4	10.8	4.4		20.6	5.0
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	28.4	10.8	4.4		20.6	5.0
LOS	C	B	A		C	A
Approach Delay	12.7		4.4			15.9
Approach LOS	B		A			B
Queue Length 50th (m)	5.5	0.0	7.7		42.2	9.1
Queue Length 95th (m)	13.6	21.3	20.2		#136.2	23.0
Internal Link Dist (m)	517.3		1024.6			1050.1
Turn Bay Length (m)	38.0				153.0	
Base Capacity (vph)	400	644	1159		720	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	0.20		0.81	0.21
Intersection Summary						
Cycle Length: 80						
Actuated Cycle Length: 73.4						
Natural Cycle: 80						
Control Type: Semi Act-Uncoord						
Maximum v/c Ratio: 0.81						

Timings

1: Borrisokane Road & Cambrian Road

01-17-2019

Intersection Signal Delay: 13.2	Intersection LOS: B
Intersection Capacity Utilization 70.1%	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

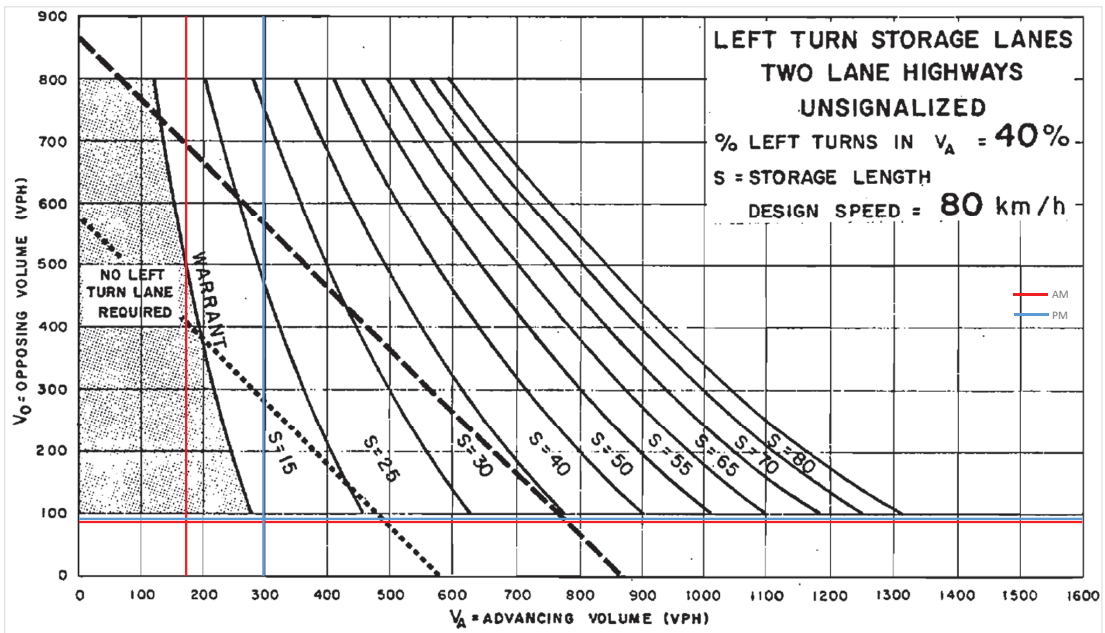
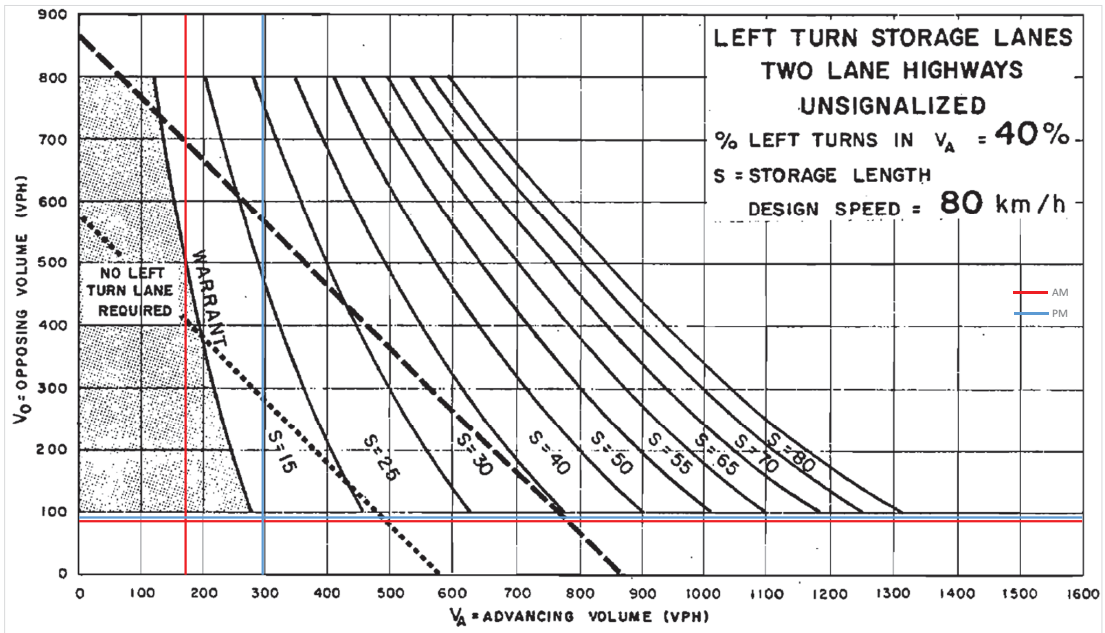
2: Borrisokane Road & Temp Site Access

01-17-2019

Intersection						
Int Delay, s/veh	6					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔
Traffic Vol, veh/h	8	157	80	12	219	74
Future Vol, veh/h	8	157	80	12	219	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	8	157	80	12	219	74
Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	598	86	0	0	92	0
Stage 1	86	-	-	-	-	-
Stage 2	512	-	-	-	-	-
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	465	973	-	-	1503	-
Stage 1	937	-	-	-	-	-
Stage 2	602	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	394	973	-	-	1503	-
Mov Cap-2 Maneuver	394	-	-	-	-	-
Stage 1	937	-	-	-	-	-
Stage 2	510	-	-	-	-	-
Approach	WB	NB	SB			
HCM Control Delay, s	9.8	0	5.8			
HCM LOS	A					
Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT		
Capacity (veh/h)	-	-	908	1503		
HCM Lane V/C Ratio	-	-	0.182	0.146		
HCM Control Delay (s)	-	-	9.8	7.8	0	
HCM Lane LOS	-	-	A	A	A	
HCM 95th %tile Q(veh)	-	-	0.7	0.5		

Appendix I

Left-Turn Lane Warrants



Appendix J

2030 Future Total Synchro Worksheets

Timings

1: Borrisokane Road & Cambrian Road

01-17-2019

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖	↗	↖	↗	↖	↗
Traffic Volume (vph)	44	627	261	46	255	127
Future Volume (vph)	44	627	261	46	255	127
Satd. Flow (prot)	1621	1450	1672	0	1621	1706
Fit Permitted	0.950				0.573	
Satd. Flow (perm)	1621	1450	1672	0	977	1706
Satd. Flow (RTOR)		494	20			
Lane Group Flow (vph)	44	627	307	0	255	127
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)	14.1	14.1	23.5		23.5	23.5
Actuated g/C Ratio	0.29	0.29	0.48		0.48	0.48
v/c Ratio	0.09	0.82	0.38		0.54	0.15
Control Delay	12.4	13.8	10.4		16.2	9.2
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	12.4	13.8	10.4		16.2	9.2
LOS	B	B	B		B	A
Approach Delay	13.7		10.4			13.9
Approach LOS	B		B			B
Queue Length 50th (m)	2.7	8.7	12.4		12.4	4.9
Queue Length 95th (m)	7.6	#43.2	34.9		#40.9	15.6
Internal Link Dist (m)	517.3		1048.8			1050.1
Turn Bay Length (m)	38.0				161.0	
Base Capacity (vph)	685	898	813		469	820
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	0.70	0.38		0.54	0.15

Intersection Summary	
Cycle Length:	55
Actuated Cycle Length:	48.9
Natural Cycle:	55
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.82

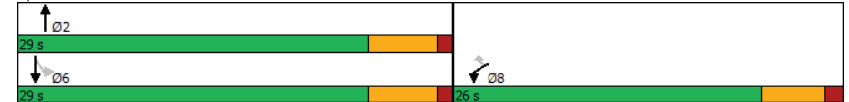
Timings

1: Borrisokane Road & Cambrian Road

01-17-2019

Intersection Signal Delay: 13.0	Intersection LOS: B
Intersection Capacity Utilization 67.8%	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



Intersection						
Int Delay, s/veh	6.4					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔	↔	↕	↕	↔	↔
Traffic Vol, veh/h	12	226	81	6	105	66
Future Vol, veh/h	12	226	81	6	105	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	12	226	81	6	105	66
Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	360	84	0	0	87	0
Stage 1	84	-	-	-	-	-
Stage 2	276	-	-	-	-	-
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	639	975	-	-	1509	-
Stage 1	939	-	-	-	-	-
Stage 2	771	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	593	975	-	-	1509	-
Mov Cap-2 Maneuver	593	-	-	-	-	-
Stage 1	939	-	-	-	-	-
Stage 2	715	-	-	-	-	-
Approach	WB	NB	SB			
HCM Control Delay, s	10.1	0	4.6			
HCM LOS	B					
Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT		
Capacity (veh/h)	-	-	944	1509		
HCM Lane V/C Ratio	-	-	0.252	0.07		
HCM Control Delay (s)	-	-	10.1	7.6	0	
HCM Lane LOS	-	-	B	A	A	
HCM 95th %tile Q(veh)	-	-	1	0.2		

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔	↔	↕	↕	↔	↔
Traffic Volume (vph)	47	397	195	42	615	257
Future Volume (vph)	47	397	195	42	615	257
Satd. Flow (prot)	1621	1450	1665	0	1621	1706
Fit Permitted	0.950			0.611		
Satd. Flow (perm)	1621	1450	1665	0	1042	1706
Satd. Flow (RTOR)	397			27		
Lane Group Flow (vph)	47	397	237	0	615	257
Turn Type	Prot	Perm	NA		Perm	NA
Protected Phases	8			2		
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	0.25	0.77	0.19		0.79	0.20
Control Delay	35.3	14.3	3.6		17.7	4.1
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	35.3	14.3	3.6		17.7	4.1
LOS	D	B	A		B	A
Approach Delay	16.5		3.6			13.7
Approach LOS	B		A			B
Queue Length 50th (m)	6.7	0.0	6.4		40.2	8.1
Queue Length 95th (m)	15.6	24.5	19.9		#155.6	23.8
Internal Link Dist (m)	517.3		1033.5			1050.1
Turn Bay Length (m)	38.0				161.0	
Base Capacity (vph)	360	631	1251		778	1275
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	0.13	0.63	0.19		0.79	0.20
Intersection Summary						
Cycle Length: 90						
Actuated Cycle Length: 81.6						
Natural Cycle: 90						
Control Type: Semi Act-Uncoord						
Maximum v/c Ratio: 0.79						

Timings

1: Borrisokane Road & Cambrian Road

01-17-2019

Intersection Signal Delay: 13.0	Intersection LOS: B
Intersection Capacity Utilization 66.8%	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

01-17-2019

Intersection						
Int Delay, s/veh	6					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔
Traffic Vol, veh/h	8	157	80	12	219	75
Future Vol, veh/h	8	157	80	12	219	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	8	157	80	12	219	75
Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	599	86	0	0	92	0
Stage 1	86	-	-	-	-	-
Stage 2	513	-	-	-	-	-
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	465	973	-	-	1503	-
Stage 1	937	-	-	-	-	-
Stage 2	601	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	394	973	-	-	1503	-
Mov Cap-2 Maneuver	394	-	-	-	-	-
Stage 1	937	-	-	-	-	-
Stage 2	510	-	-	-	-	-
Approach	WB	NB	SB			
HCM Control Delay, s	9.8	0	5.8			
HCM LOS	A					
Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT		
Capacity (veh/h)	-	-	908	1503		
HCM Lane V/C Ratio	-	-	0.182	0.146		
HCM Control Delay (s)	-	-	9.8	7.8		
HCM Lane LOS	-	-	A	A		
HCM 95th %tile Q(veh)	-	-	0.7	0.5		

Appendix K

TAC Signal Warrant

City of Ottawa Canadian Matrix Traffic Signal Warrant Analysis

Main Street (name)	Borrisokane	Direction (EW or NS)	NS
Side Street (name)	Cambrian	Direction (EW or NS)	EW
Quadrant / Int #	1	Comments	Enter Comments about the analysis here.
CHECK SHEET			

for Warrant Calculation Results, please hit 'Page Down'

Road Authority:	City of Ottawa
City:	Ottawa
Analysis Date:	2018 Oct 31, Wed
Count Date:	2025 Jan 01, Wed
Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl 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	

Traffic Input	Set Peak Hours												Ped1	Ped2	Ped3	Ped4
	NB			SB			WB			EB			NS	NS	EW	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		227	36	204	105		29		485				0	0	0	0
		262	42	236	121		33		560				0	0	0	0
		159	25	143	73		20		339				0	0	0	0
		85	15	249	111		19		164				0	0	0	0
		175	30	515	229		39		339				0	0	0	0
		186	32	548	243		41		360				0	0	0	0
Total (6-hour peak)	0	1,094	180	1,895	882	0	181	0	2,247	0	0	0	0	0	0	0
Average (6-hour peak)	0	182	30	316	147	0	30	0	375	0	0	0	0	0	0	0

Average 6-hour Peak Turning Movements

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

