3432 Greenbank Road

Transportation Impact Assessment

Step 1 Screening Report

Step 2 Scoping Report

Step 3 Forecasting Report

Step 4 Strategy Report

Prepared for:

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April 2022

PN: 2020-59

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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 in Appendix A, along with the Certification Form for TIA Study PM. As shown in the Screening Form, a TIA is required including the Design Review and Network Impact Component.

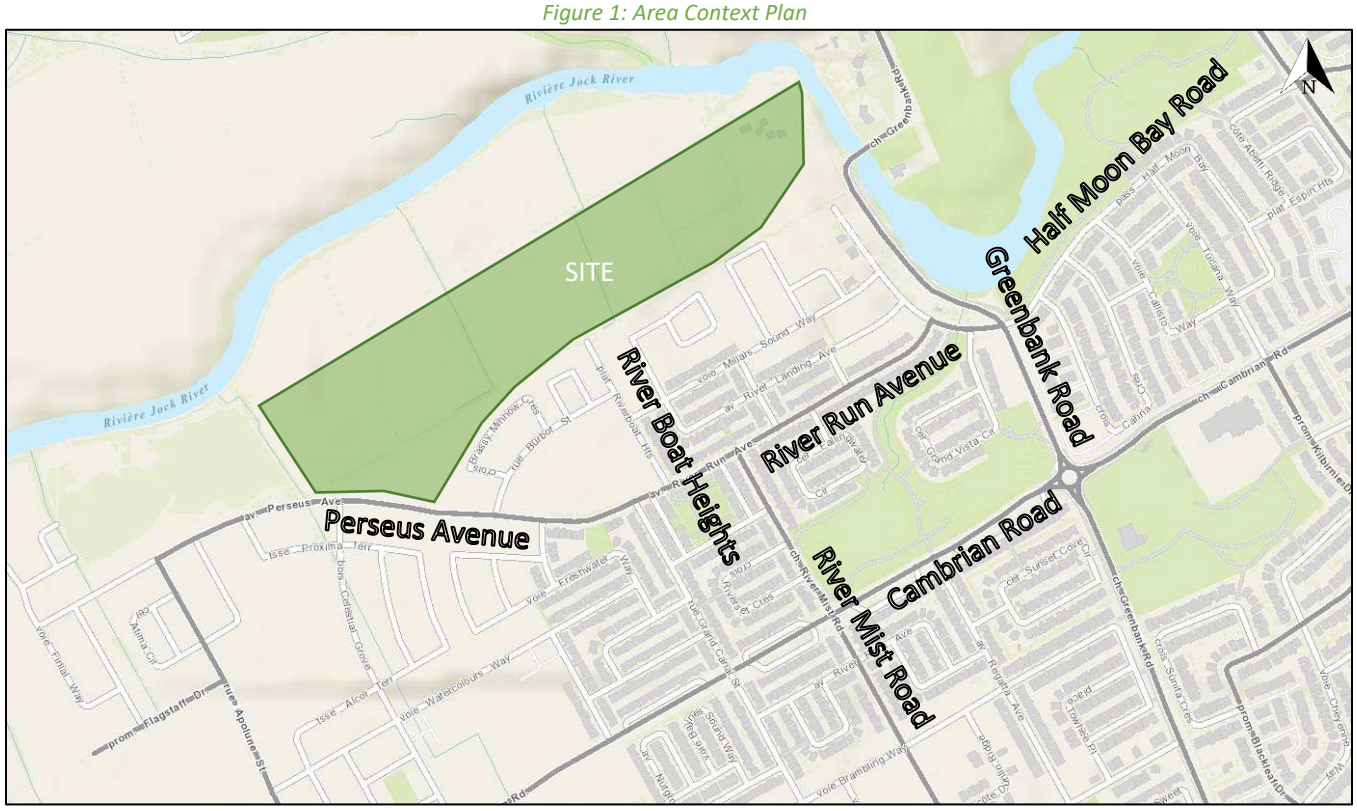
2 Existing and Planned Conditions

2.1 Proposed Development

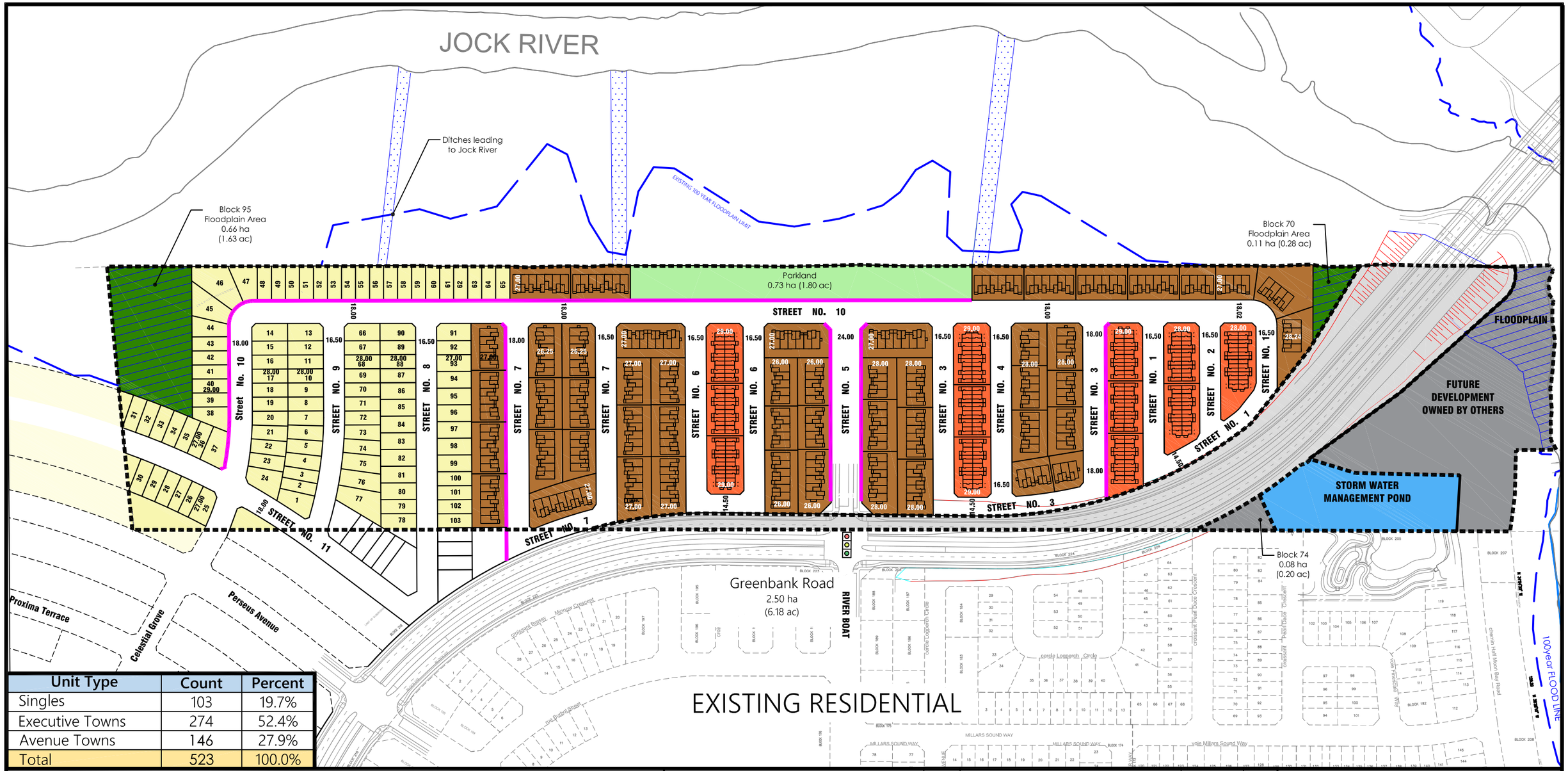
The subject property, located at 3432 Greenbank Road, is currently zoned as Development Reserve Zone [DR] and is undeveloped. The proposed development consists of 523 units, including 103 single family homes, 274 executive townhomes, and 146 avenue townhomes.

Access to the site will primarily be accommodated via River Boat Heights. A secondary access will be provided via Perseus Avenue at Celestial Grove, which will be extended north through the adjacent landowners property. The anticipated full build-out and occupancy horizon is 2024. Figure 1 illustrates the study area context. Figure 2 illustrates the proposed concept plan.

Figure 1: Area Context Plan



Source: http://maps.ottawa.ca/geoOttawa/ Accessed: July 28, 2021



Unit Type	Count	Percent
Singles	103	19.7%
Executive Towns	274	52.4%
Avenue Towns	146	27.9%
Total	523	100.0%

Legend

- Single Detached Homes
- Executive Towns
- Avenue Towns
- Storm Water Management (SWM) Pond
- Parkland
- Land Owned by Others
- Area within Floodplain
- Natural Feature | Area within Floodplain
- Open Space / Pathways
- Sidewalk Locations
- Property Boundary
- Proposed Extent of Greenbank Grading

No.	Description	Date	By
0	Issued for Review	2/25/2022	K.G.

Revisions

Title: **Concept Plan 26**

Project: **Kennedy Lands**

North

Scale: **NTS**

Drawn By: K.G.
Checked By: CS

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2.2 Existing Conditions

2.2.1 Area Road Network

Cambrian Road

Cambrian Road is a City of Ottawa arterial road with a two-lane cross-section and a posted speed limit of 50 km/h. Curbs, gutters, parking lanes, and boulevard separated sidewalks are present on both sides of the road. The Ottawa Official Plan reserves a 37.5 metre right-of-way for this road.

River Mist Road

River Mist Road is a City of Ottawa collector road with a two-lane urban cross-section including gutters, parking lanes and sidewalks on both sides of the road. The unposted speed limit is assumed to be 50 km/h. The measured right-of-way is approximately 24 metres.

Greenbank Road

Greenbank Road is a City of Ottawa arterial road with a two-lane cross-section and a suggested speed limit of 30 km/h in the vicinity of the subject development. South of Half Moon Bay Road, curbs and boulevard-separated sidewalks are present on both sides of the road. North of Half Moon Bay Road, paved shoulders are present on the west-side of the road and a sidewalk separated by a curb and bollards with reflective stripes is present on the east side of the road. The measured right-of-way is approximately 24 metres.

Perseus Avenue / River Run Avenue

Perseus Avenue / River Run Avenue is a City of Ottawa collector road with a two-lane cross-section including curbs and gutters. Sidewalks are present on both sides of the road. Perseus Avenue / River Run Avenue has an unposted speed limit of 50 km/h to the east of King's Creek Lane, and 40 km/h west of King's Creek Lane. West of King's Creek Lane, the road is part of a school zone. The measured right-of-way is approximately 24 metres.

Half Moon Bay Road

Half Moon Bay is a City of Ottawa local road west of River Run Avenue and east of Greenbank Road and is a collector road between River Run Avenue and Greenbank Road. Half Moon Bay has a two-lane cross-section including curbs, gutters and a sidewalk on the south side of the road. A cycling path is present on the north side of the road, east of Greenbank Road. The unposted speed limit is assumed to be 50 km/h. The measured right-of-way is approximately 14.5 metres.

River Boat Heights

River Boat Heights is a City of Ottawa local road with a two-lane cross-section including curbs and gutters. Sidewalks are present on both sides of the road. The unposted speed limit is assumed to be 40 km/h given its proximity to Half Moon Bay Public School. School drop-off areas are located on the west side of the road, south of Millars Sound Way. The measured right-of-way is approximately 24 metres.

2.2.2 Existing Intersections

A description and accompanying aerial photograph of the existing intersections within the study area can be found below.

River Mist Road at Cambrian Road

The intersection of River Mist Road and Cambrian Road is an all-way stop-controlled intersection with a shared left-turn / through / right-turn lane on all approaches. No turn restrictions were noted.

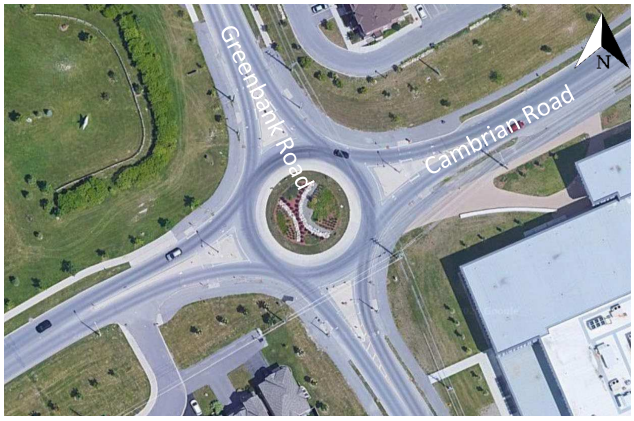
Half Moon Bay Road at Greenbank Road

The intersection of Half Moon Bay Road at Greenbank Road is a single-lane roundabout intersection. Each roundabout approach consists of a single lane.

Aerial Photo is unavailable. Photos of the roundabout is provided in Appendix B.

Greenbank Road at Cambrian Road

Greenbank Road at Cambrian Road is a single-lane roundabout intersection. Each roundabout approach consists of a single lane.



2.2.3 Existing Driveways

There are no existing driveways within 200 metres of the proposed site accesses.

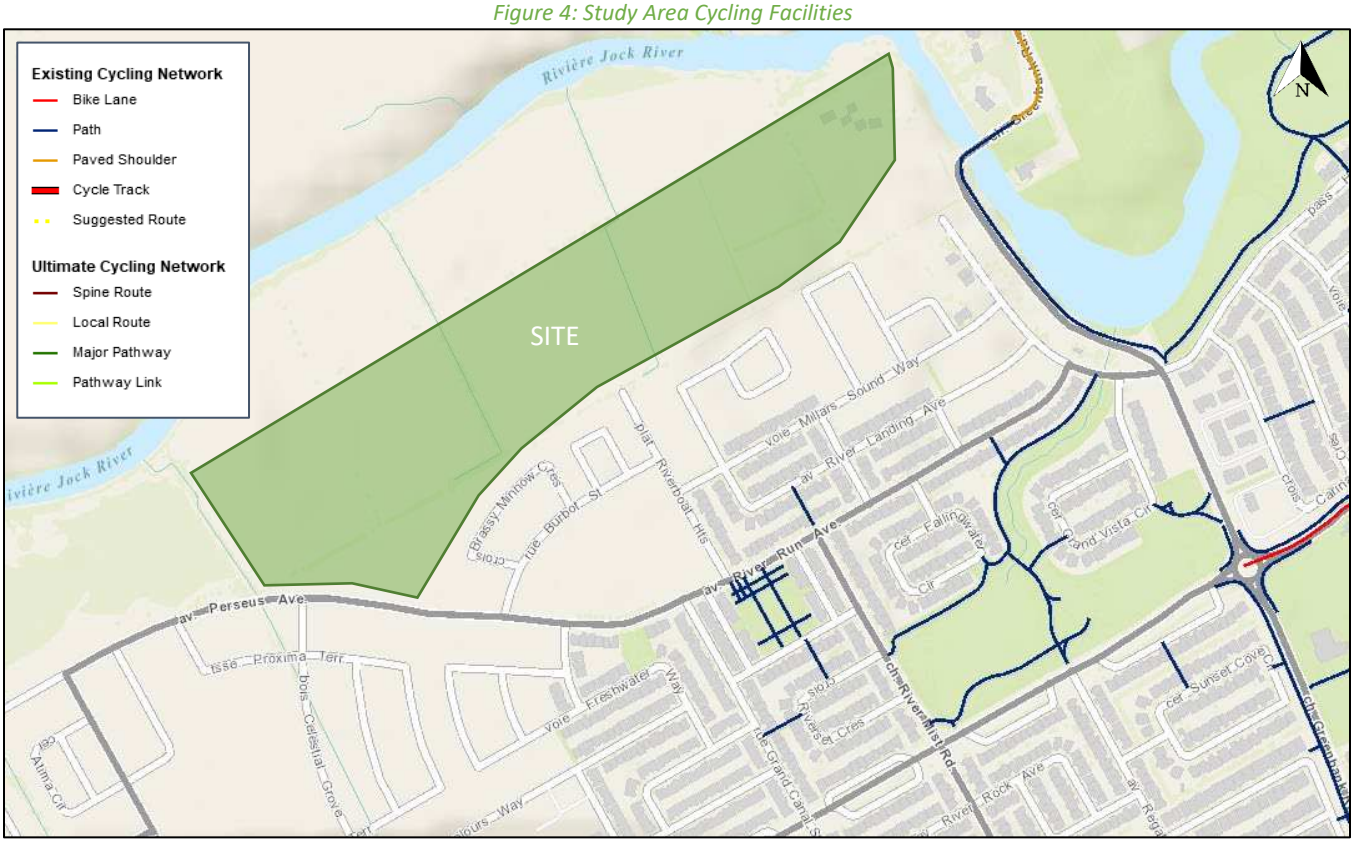
2.2.4 Cycling and Pedestrian Facilities

Pedestrian infrastructure is provided along one or both sides of developed communities in the vicinity of the proposed development. As the area builds out, it is expected that pedestrian connections will be provided through all of the neighboring communities, leading to arterial and collector roads. The cycling network consists of bike paths in Half Moon Bay Park and along Jock River near Greenbank Road. Figure 3 illustrates the pedestrian facilities in the study area and Figure 4 illustrates the cycling facilities.

Figure 3: Study Area Pedestrian Facilities

Source: http://maps.ottawa.ca/geoOttawa/ Accessed: July 28, 2021

Figure 4: Study Area Cycling Facilities



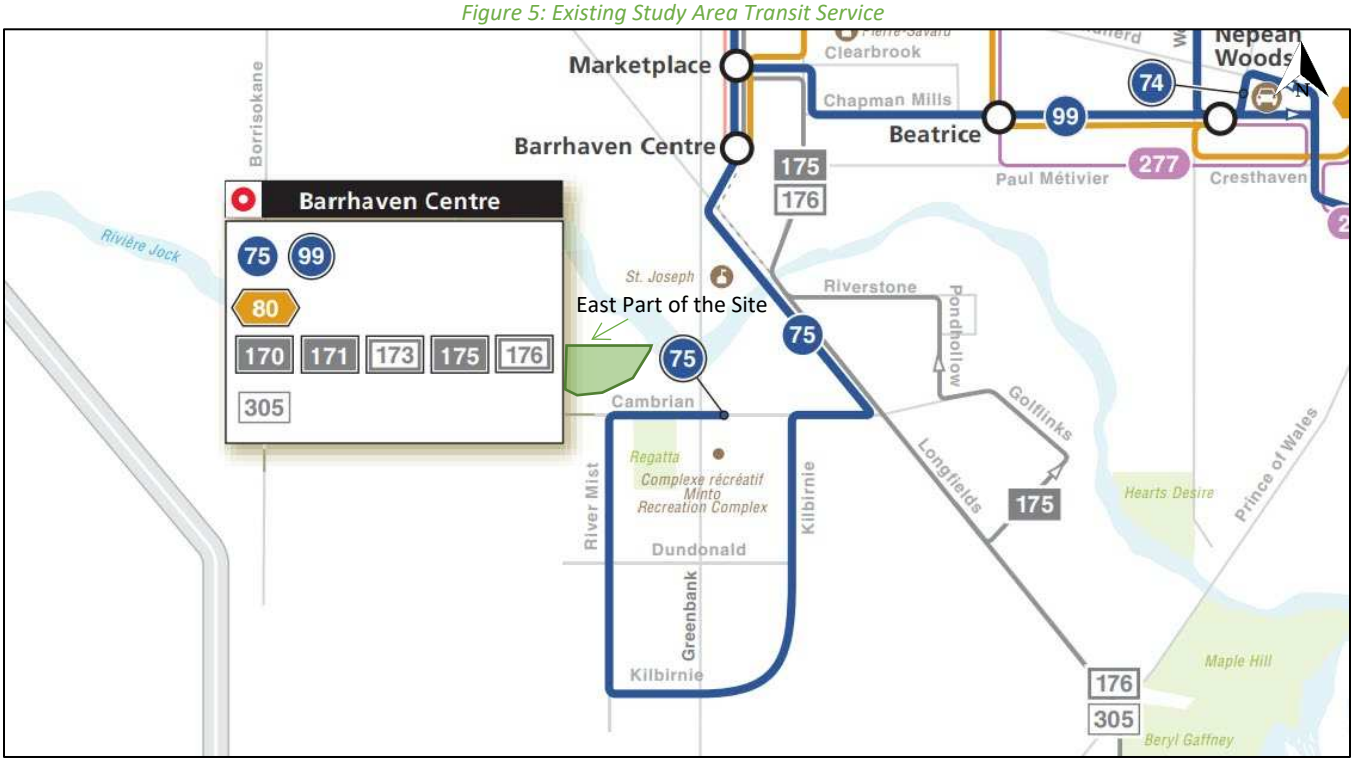
Source: http://maps.ottawa.ca/geoOttawa/ Accessed: July 28, 2021

2.2.5 Existing Transit

There is no existing transit service along the subject development boundary, and no transit service within 400 metres of the proposed development. South of the subject site, approximately 600 metres from the site, Route 75 runs along Cambrian Road. The existing study area transit service is presented in Figure 5. In this Figure, the map legend partially covers the location of the subject development. The transit stops in the study area are approximately 750 metres walking distance from the edge of the subject development (representing the shortest walking distance) to the transit stop, as shown in Figure 6. While all transit stops in the area are shown, the highlighted stops appear to not be in use. Both figures are excerpts from the OC Transpo Network Map. The frequency of Route 75 within proximity of the proposed site currently is:

- Route # 75 – every 15 minutes during AM and PM weekday peak hours and every 30 during all other times.

Figure 5: Existing Study Area Transit Service



Source: http://www.octranspo.com/ Accessed: July 28, 2021

Figure 6: Existing Study Area Transit Stops

Source: http://plan.octranspo.com/plan Accessed: July 28, 2021

2.2.6 Existing Area Traffic Management Measures

Within the study area, traffic management measures are present on River Mist Road, River Run Avenue and Greenbank Road. On River Mist Road, there is a radar feedback sign indicating drivers traveling north to slow down and reduced speed limit applies on River Run Avenue and Greenbank Road.

2.2.7 Existing Peak Hour Travel Demand

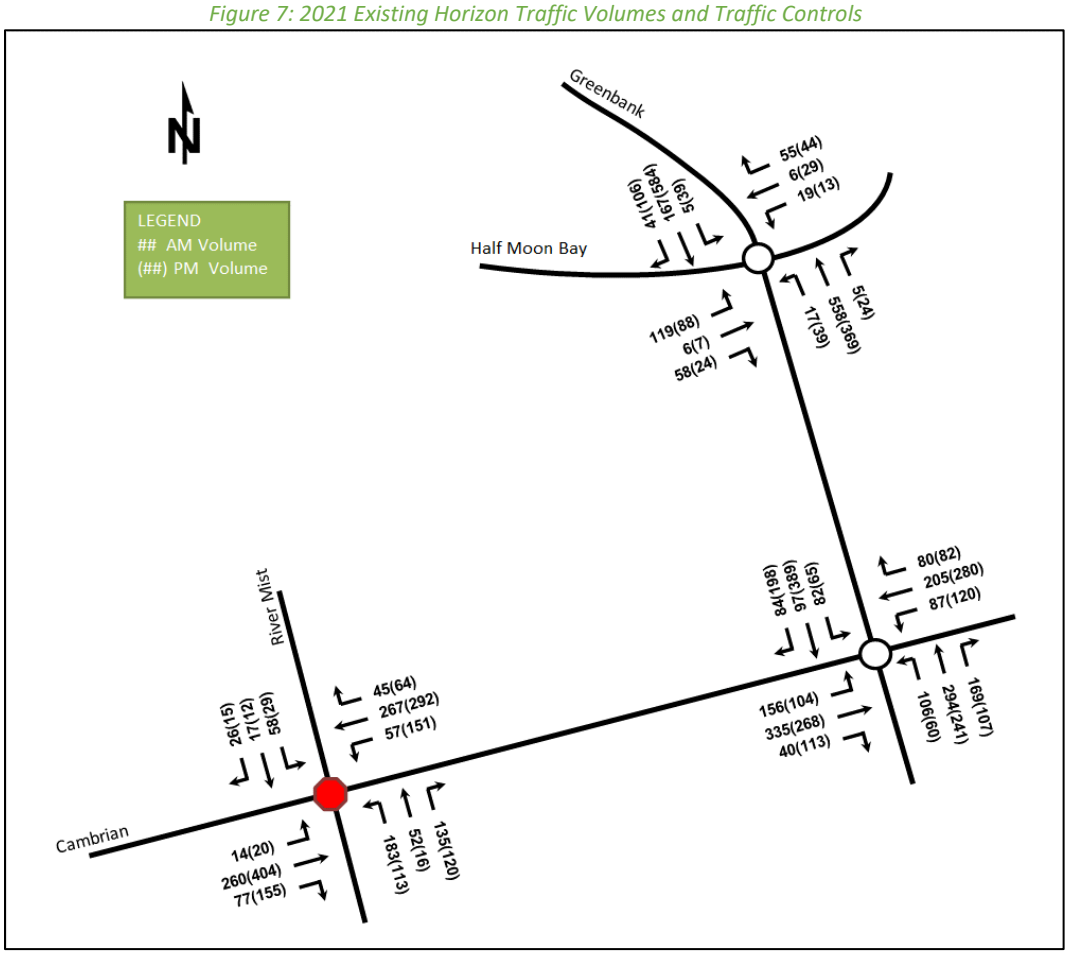
Existing turning movement counts were acquired from the City of Ottawa for the existing study area intersections. Table 1 summarizes the intersection count dates and data source.

Table 1: Intersection Count Date

Intersection	Count Date
River Mist Road at Cambrian Road	Wednesday, October 23, 2019
Greenbank Road at Half Moon Bay Road	Tuesday, June 19, 2018
Greenbank Road at Cambrian Road	Wednesday, September 13, 2017

Figure 7 illustrates the 2021 existing horizon traffic volumes. To reflect a constant horizon, a 2% background growth rate has been used. This growth rate is consistent with surrounding development Traffic Impact Assessments such as *3285 Borrisokane Road Commercial Development Transportation Impact Study (Parsons, 2018), 3640 Greenbank Road Transportation Impact Assessment (CGH Transportation, 2018 Half Moon Bay North Apartment Block Transportation Impact Assessment (Stantec, 2018), The Meadows Phase 5 Transportation Impact Assessment Report (IBI Group 2018),* and *Quinn's Pointe 2 Transportation Impact Assessment (Stantec, 2018).* Detailed turning movement count data is included in Appendix C.

Figure 7: 2021 Existing Horizon Traffic Volumes and Traffic Controls



Additionally, the collected intersection counts also provided existing pedestrian and cyclist demands at the Cambrian Road and River Mist Road intersection, as well as Cambrian Road and Greenbank Road intersection for both AM and PM peak periods. The pedestrian and cyclist peak hour volumes at Greenbank Road and Half Moon Bay Road are not available. Figure 8 illustrates the existing pedestrian volumes and Figure 9 illustrates the existing cyclist volumes at Cambrian Road and River Mist Road intersection.

Figure 8: Existing Pedestrian Volumes

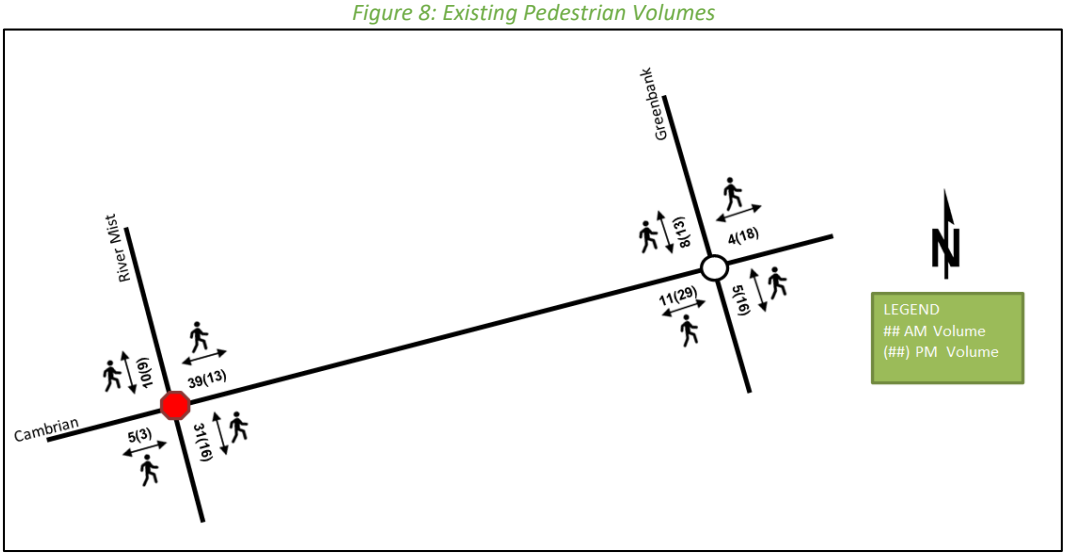
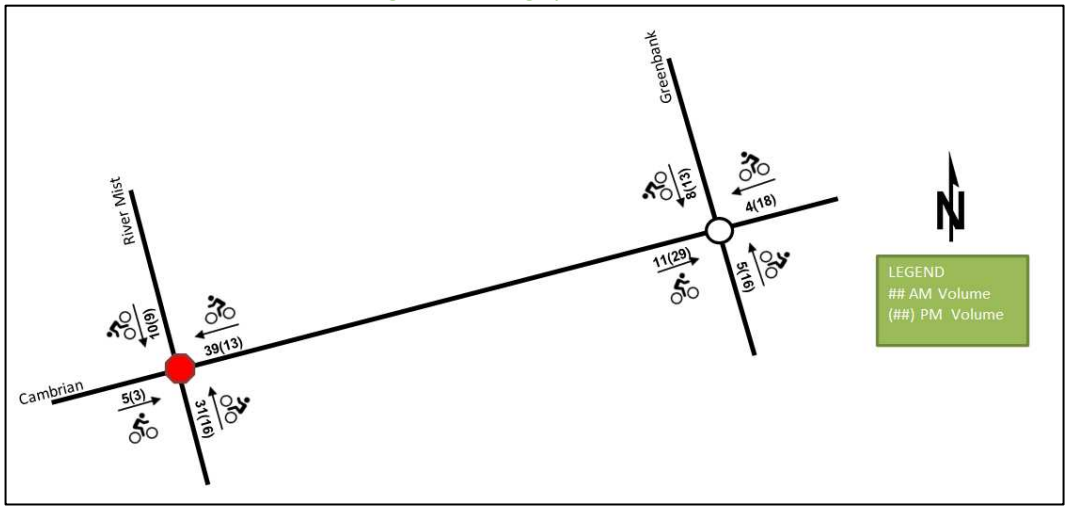


Figure 9: Existing Cyclist Volumes



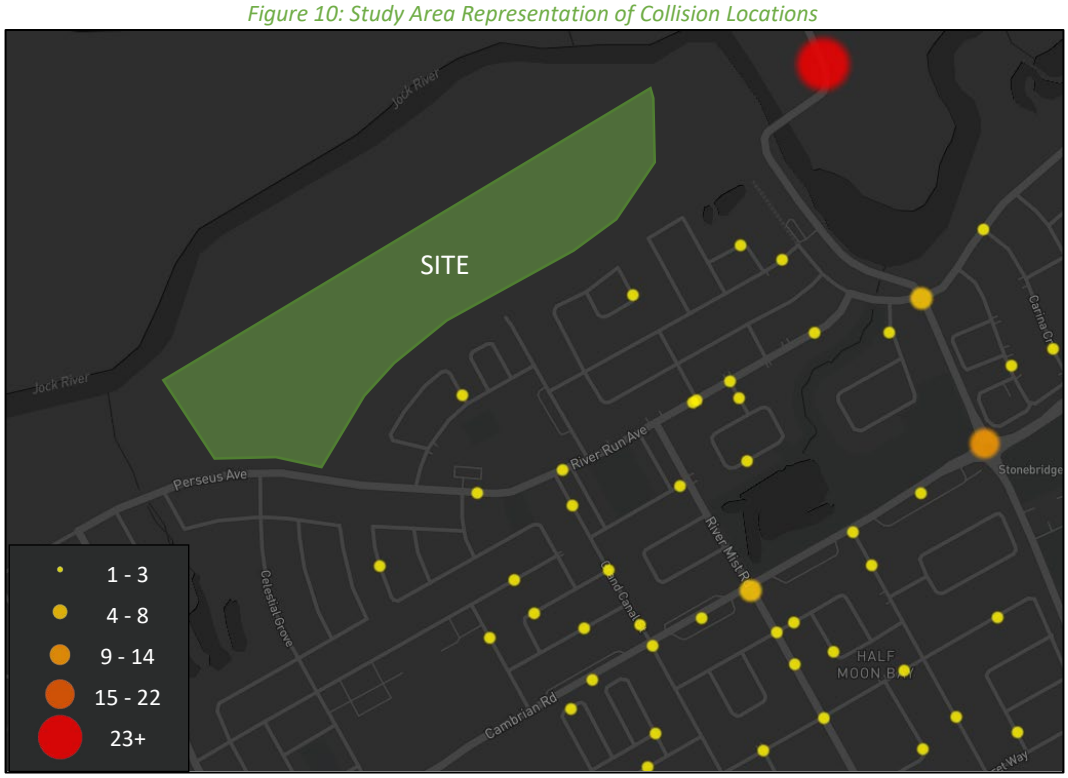
2.2.8 Collision Analysis

Collision data have been acquired from the City of Ottawa open data website (data.ottawa.ca) for five years prior to the commencement of this TIA for the surrounding study area road network. Table 2 illustrates the collisions at the intersections and road segments within the study area, Figure 10 illustrates the intersections and segments analyzed, and Table 3 summarizes the collision types and conditions of the 18 collisions recorded in the study area. Collision data is included in Appendix D.

Table 2: Summary of Collision Locations

Intersection / Segment	Number	%
	18	**100%**
Cambrian Road at River Mist Road	2	11%
Greenbank Road at Half Moon Bay Road	6	33%
Cambrian Road at Greenbank Road	10	56%

Figure 10: Study Area Representation of Collision Locations



Source: https://maps.bikeottawa.ca/collisions/ Accessed: September 16, 2021

Table 3: Collision Summary

		Number	%
Total Collisions		**18**	**100%**
Classification	**Fatality**	0	0%
	Non-Fatal Injury	1	6%
	Property Damage Only	17	94%
Initial Impact Type	**Angle**	5	28%
	Rear end	6	33%
	Turning Movement	2	11%
	SMV Other	5	28%
Road Surface Condition	**Dry**	10	56%
	Wet	1	6%
	Loose Snow	2	11%
	Slush	3	17%
	Loose Sand or Gravel	2	11%
Pedestrian Involved		0	0%
Cyclists Involved		0	0%

The study area intersections had a total of 18 collisions during the 2015-2019 time period, with 17 involving property damage only and one having non-fatal injuries. The collision types are most represented by the rear end with six collisions and angled with five collisions. Weather/road conditions are a contributing factor for 44% of the collisions in this area. There were no cyclist collisions and pedestrian collisions in the study area. Currently, no intersection has been noted to require an in-depth collision analysis.

2.3 Planned Conditions

2.3.1 Changes to the Area Transportation Network

The subject development is within the Barrhaven South Community Design Plan (CDP) Area. As such, it is subject to the planning polices outlined in the CDP. The CDP provides target population and employment densities in the four Sub-Planning Areas along with the plans for infrastructure to support the community growth. As part of this plan, the right-of-way along the following roads has been protected to accommodate an expansion to a four-lane arterial:

- Realigned Greenbank Road rapid transit corridor north and south of Cambrian Road with a protected right-of-way of 41.5 metres
- Cambrian Road between Borrisokane Road and Jockvale Road with a protected right-of-way of 37.5 metres. As part of this project, the intersection of Cambrian Road and River Mist Road will be signalized

Realigned Greenbank Road will be located on the south side of the proposed development. While listed within the Transportation Master Plan Affordable Network, it is unknown if Realigned Greenbank Road will be completed to Cambrian Road by 2031. It is assumed that the temporary connection of Realigned Greenbank Road between River Boat Heights and Cambrian Road will be completed by 2029 and will be included in 2029 future horizons. The proposed cross-section of Realigned Greenbank Road is a divided 4-lane cross-section including sidewalks, cycletracks, and centre median bus lanes.

Further, as the adjacent communities build out in the next five years, the local road network will expand and provide vehicular, and pedestrian connections to nearby communities, collector roads, and arterial roads. The City of Ottawa Ultimate Cycling Network also indicates that Perseus Avenue and Riverboat Heights are a proposed pathway link, and a local cycling route, respectively. These routes will provide cyclist connections to arterial roads and communities to the south, as well as connect to a proposed major cycling pathway along Jock River to the north beyond this study horizon.

2.3.2 Other Study Area Developments

Several development applications were available for the adjacent properties as listed on the City's Development Application Search tool:

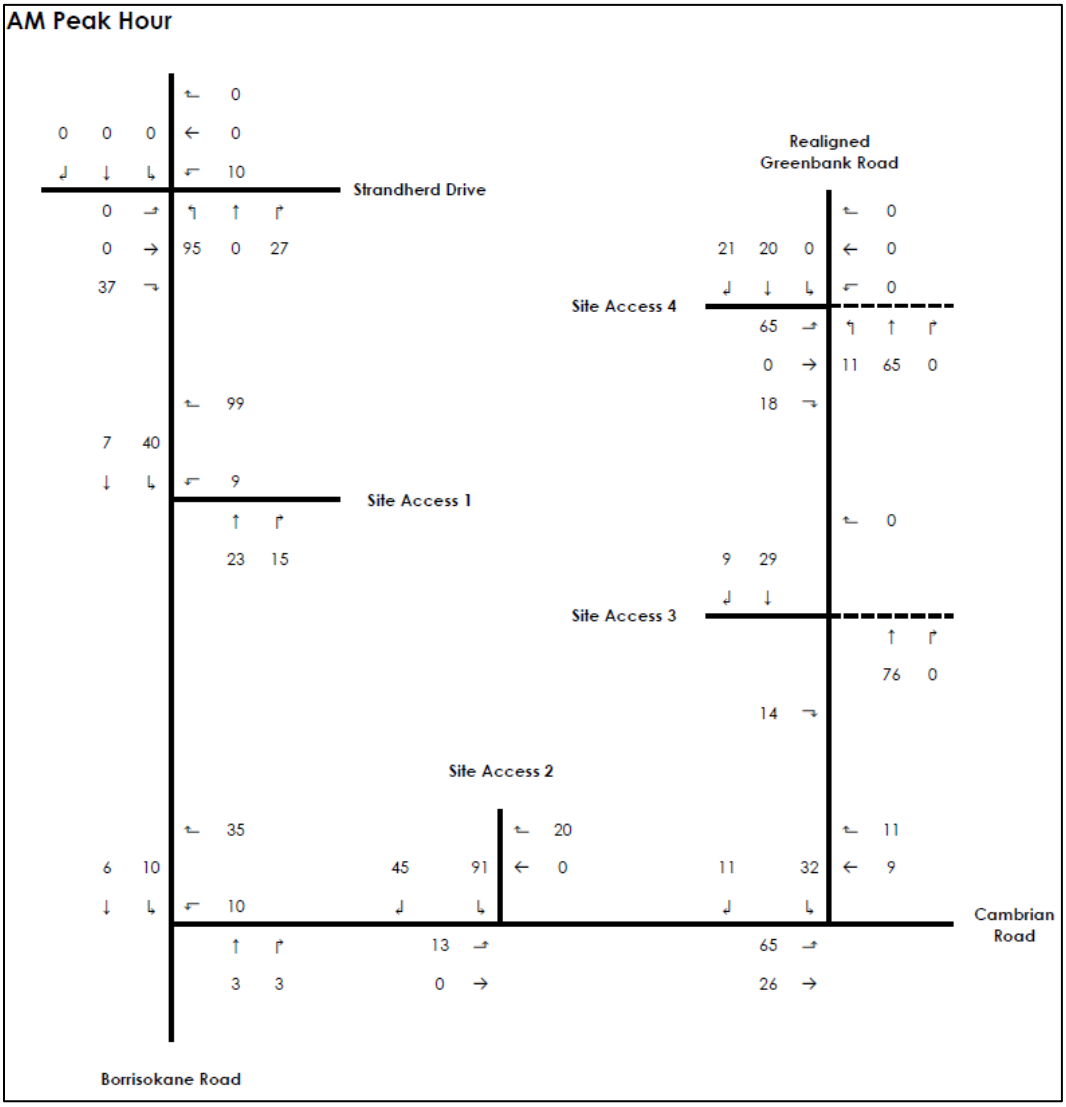
Half Moon Bay West Community

Half Moon Bay West Community is a proposed five-phase residential development located on a 57.4-hectare area west of the subject site. According to the 2016 Community Transportation Study (CTS), this site was planned to include 552 single family homes, 464 townhouses and a 5.3-acre commercial land. The projected trip generation is 589 and 725 two-way auto trips during the AM and PM peak hours, respectively. The community full build-out year is 2024.

In the 2019 update, the plan was revised to include 154 back-to-back townhouse dwellings, 300 wide lot townhouse dwellings, 447 detached dwellings, and 72 apartment units. The anticipated trip generation from the new plan is 536 and 659 two-way auto trips during the AM and PM peak hours, respectively. The revised plan does not include traffic distribution, however, since the updated plan results in a decrease in community-generated

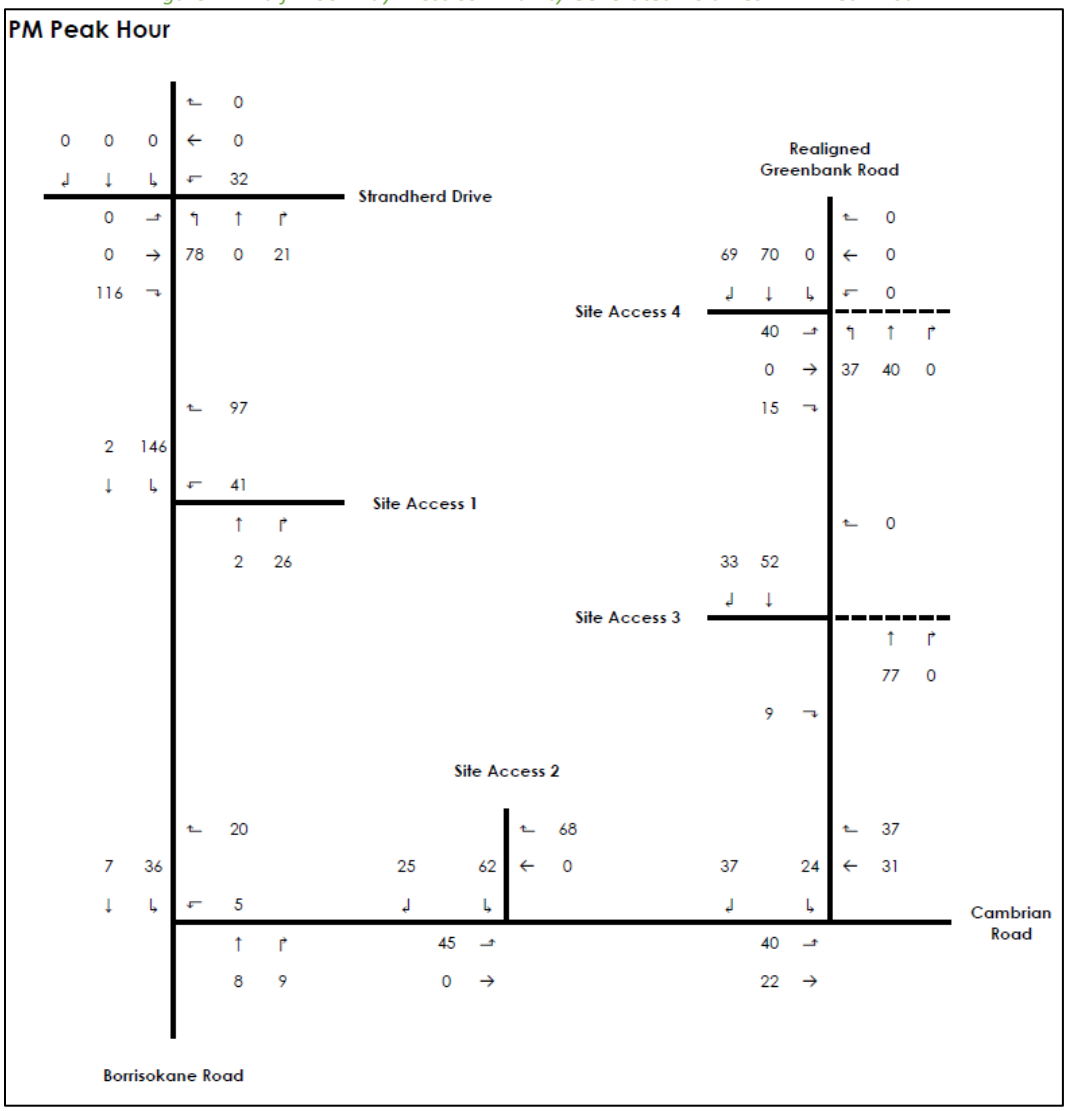
traffic volume, the original site traffic volume diagrams will be used. This will create a conservative estimate of the future background traffic volumes. The generated traffic volume from this community for AM and PM peak periods can be seen in Figure 11 and Figure 12 respectively and are excerpt from the Half Moon Bay West Community Transportation Study by Stantec.

Figure 11: Half Moon Bay West Community Generated Volumes – AM Peak Hour



Source: Half Moon Bay West Community Transportation Study (Stantec, 2016)

Figure 12: Half Moon Bay West Community Generated Volumes – PM Peak Hour

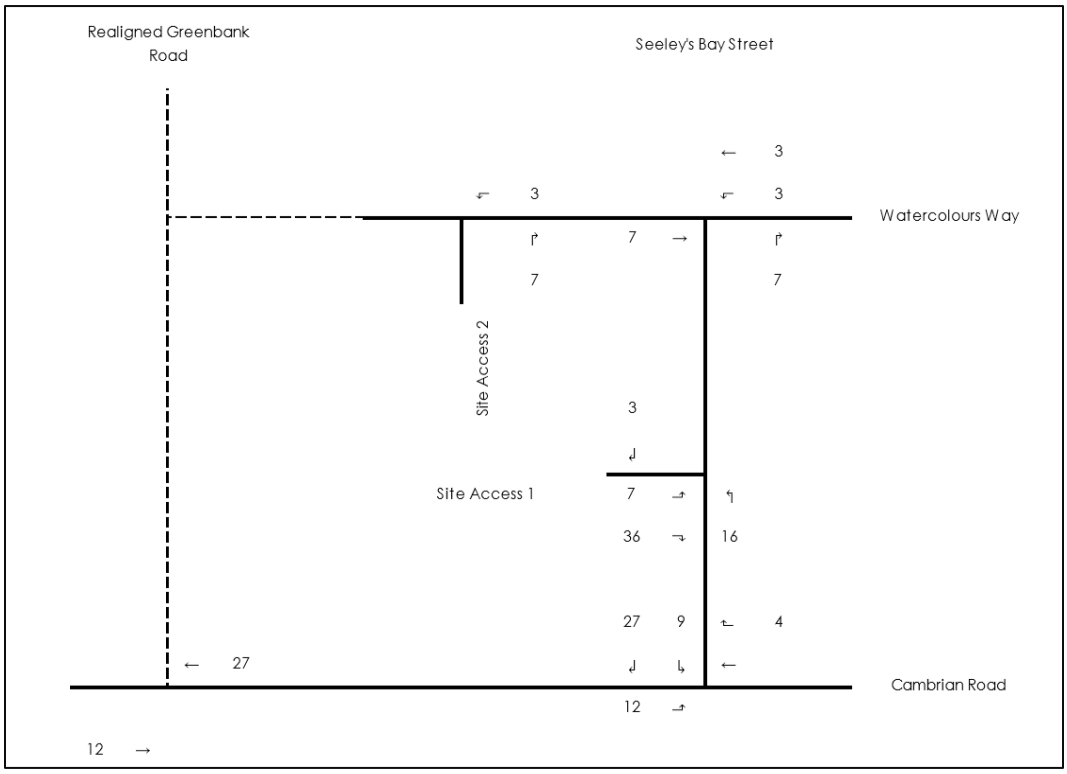


Source: Half Moon Bay West Community Transportation Study (Stantec, 2016)

2444 Watercolours Way

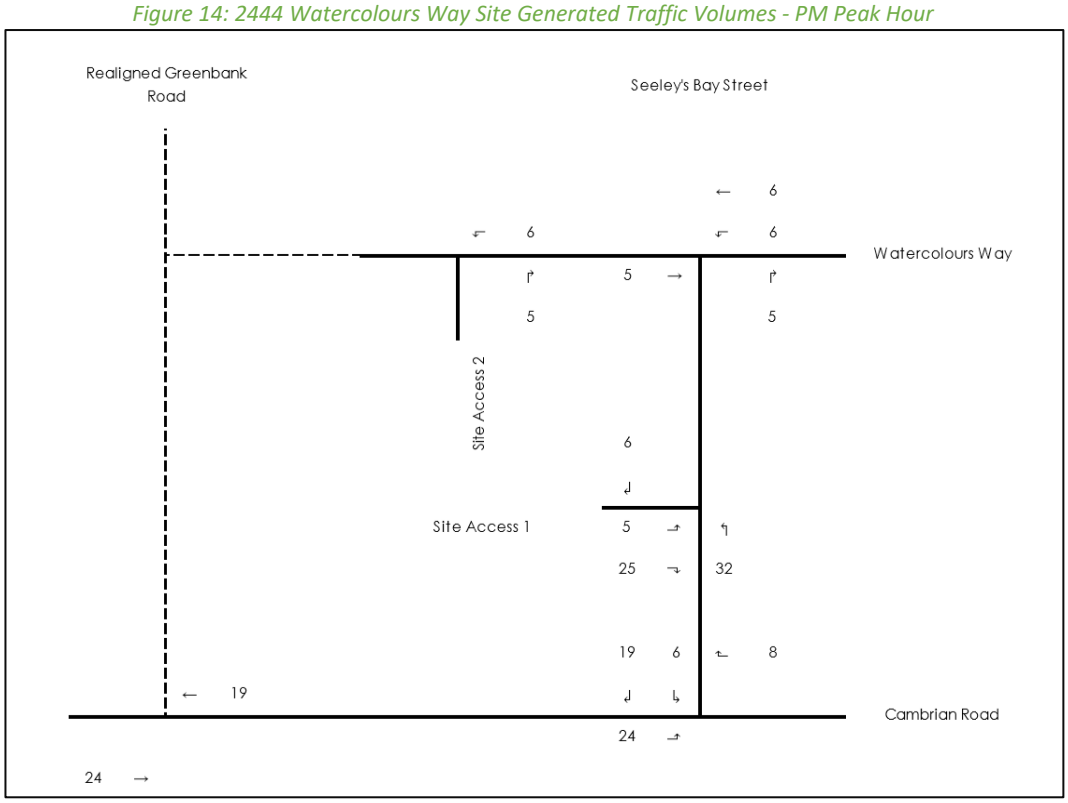
2444 Watercolours Way (Half Moon Bay North Phase 9) is a proposed residential development consisting of 60 stacked house units. This development was completed in 2019. However, this development is not captured in the available TMCs and therefore it has been accounted for explicitly herein. 2444 Watercolours Way is located south of the subject site and is expected to generate 74 and 80 two-way auto trips during the AM and PM peak hours, respectively. The anticipated trip generation from this site can be seen in Figure 13 and Figure 14 respectively and are excerpt from the Half Moon Bay North Apartment Block Transportation Impact Assessment by Stantec.

Figure 13: 2444 Watercolours Way Site Generated Traffic Volumes – AM Peak Hour



Source: Half Moon Bay North Apartment Block Transportation Impact Assessment (Stantec, 2018)

Figure 14: 2444 Watercolours Way Site Generated Traffic Volumes - PM Peak Hour

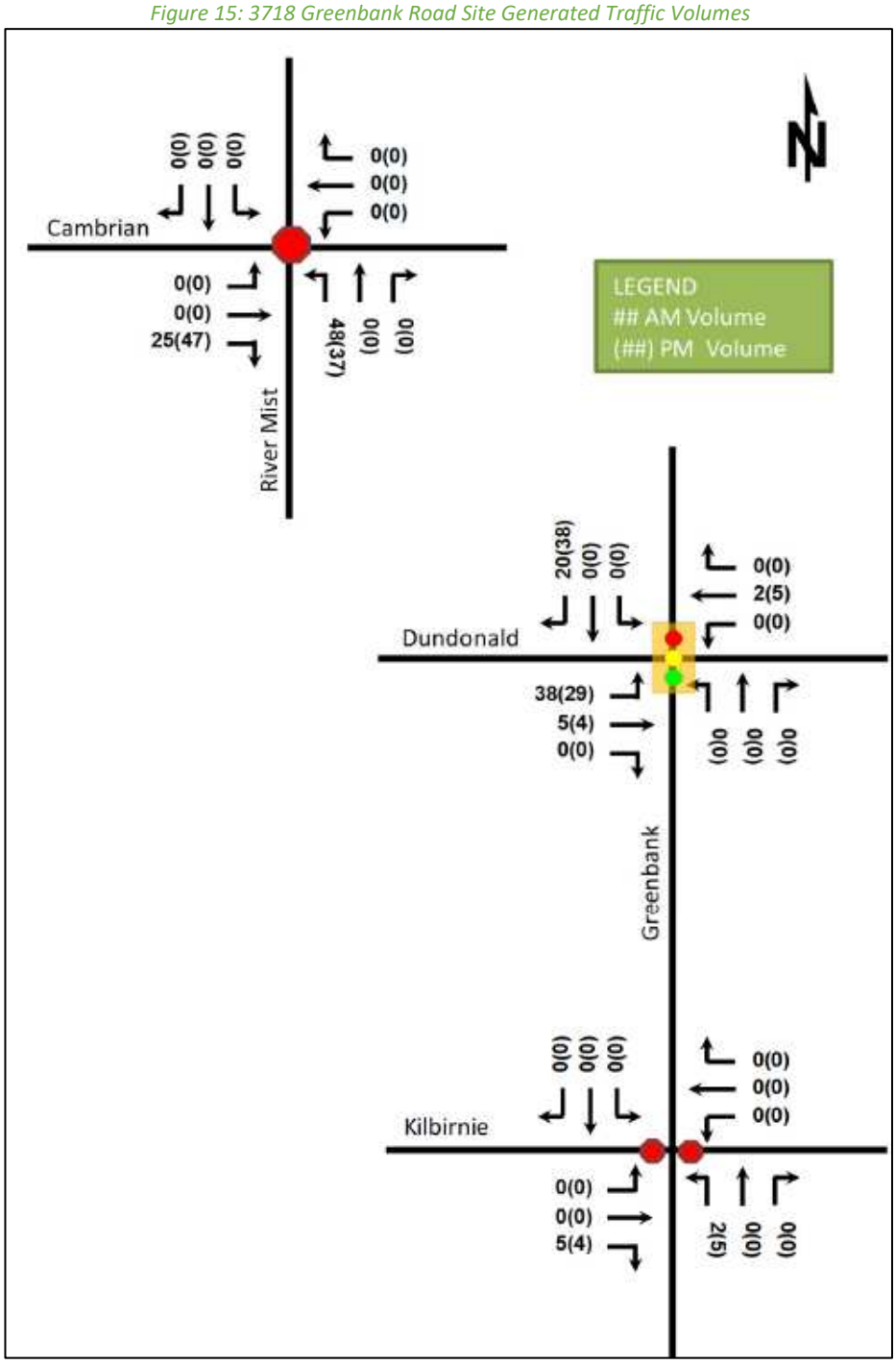


Source: Half Moon Bay North Apartment Block Transportation Impact Assessment (Stantec, 2018)

3718 Greenbank Road

3718 Greenbank Road is Phase 5 of Mattamy Half Moon Bay South, and it is located south of the subject site. The development will consist of 67 single detached home units and 97 townhouse units. This development is expected to produce 144 two-way AM peak period auto trips and 165 two-way PM peak period auto trips. The anticipated trip generation from this site can be seen Figure 15 and is an excerpt from the 3718 Greenbank Road – Half Moon Bay South – Phase 5 Transportation Impact Assessment by CGH Transportation.

Figure 15: 3718 Greenbank Road Site Generated Traffic Volumes

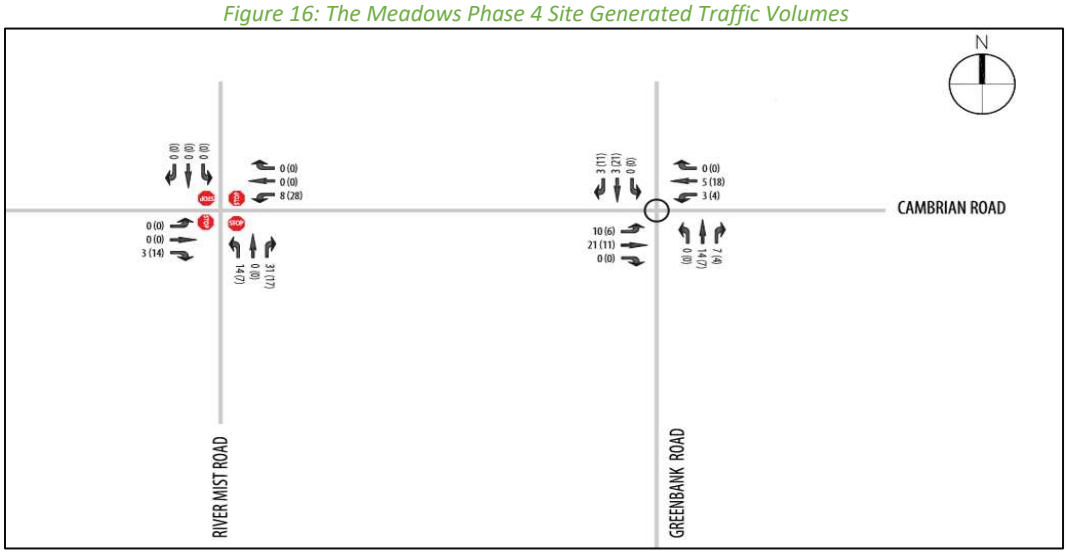


Source: 3718 Greenbank Road – Half Moon Bay South – Phase 5 Transportation Impact Assessment (CGH, 2019)

The Meadows Phase 4

The Meadows Phase 4 is a residential development located south of the subject site and was built out in 2019. This development includes 136 townhouse units and 50 single family units. This development is expected to produce 86 two-way AM peak period auto trips and 107 two-way PM peak period auto trips. The anticipated trip generation from this site can be seen Figure 16 and is excerpt from the Meadows Phase 4 TIA Report by IBI.

Figure 16: The Meadows Phase 4 Site Generated Traffic Volumes

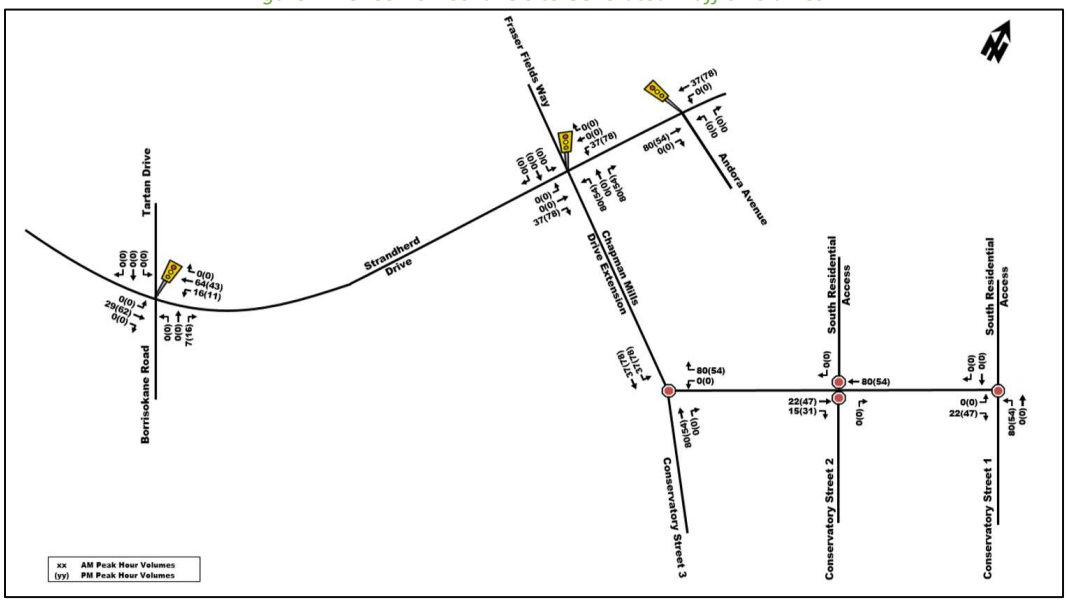


Source: The Meadows Phase 4 TIA Report (IBI, 2018)

3285 Borrisokane Road

3285 Borrisokane Road is a proposed residential development located northwest of the subject site and is expected to be built-out in 2020. This development will include 125 single family homes and 75 townhouses. This development is expected to produce 129 two-way AM peak period auto trips and 146 two-way PM peak period auto trips. The anticipated trip generation from this site can be seen Figure 17 and is an excerpt from the 3285 Borrisokane Road Phase 1 Transportation Impact Study by Parsons.

Figure 17: 3285 Borrisokane Site Generated Traffic Volumes

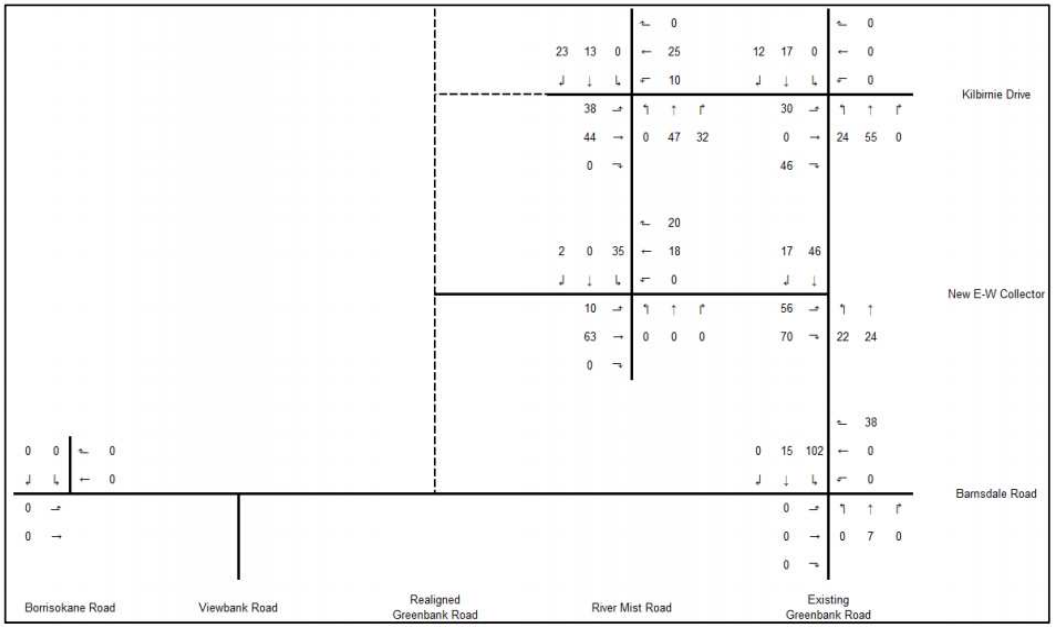


Source: 3285 Borrisokane Road Phase 1 Transportation Impact Study (Parsons, 2018)

3882 Barnsdale Road and 3960 Greenbank Road

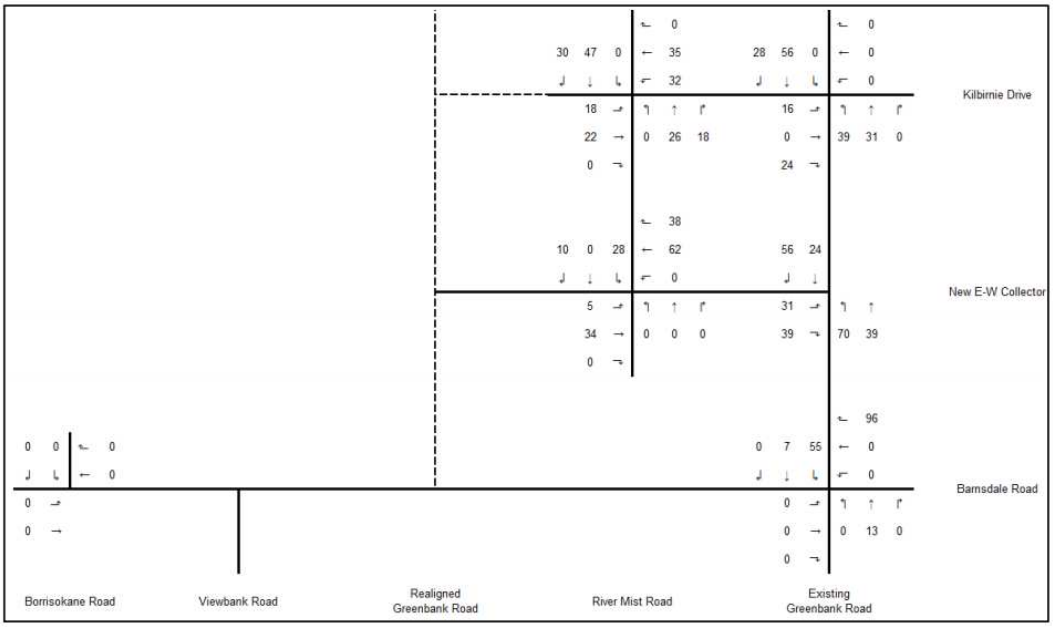
3882 Barnsdale Road and 3960 Greenbank Road (Quinn's Pointe 2) is a proposed two-phase residential development that will include 536 single-family dwelling units, 493 townhomes, 100 apartment units, and two elementary schools. A total of 749 two-way AM peak period auto trips and 813 two-way PM peak period auto trips are expected from this development upon full build-out. The anticipated trip generation from this site for Phase 1 (2022) can be seen in Figure 18 and Figure 19 are excerpts from Quinn's Pointe 2 Transportation Impact Assessment prepared by Stantec.

Figure 18: 3882 Barnsdale and 3960 Greenbank Road 2022 Site Generated Traffic Volumes – AM Peak Hour



Source: Quinn's Pointe 2 Transportation Impact Assessment (Stantec, 2018)

Figure 19: 3882 Barnsdale and 3960 Greenbank Road 2022 Site Generated Traffic Volumes – PM Peak Hour

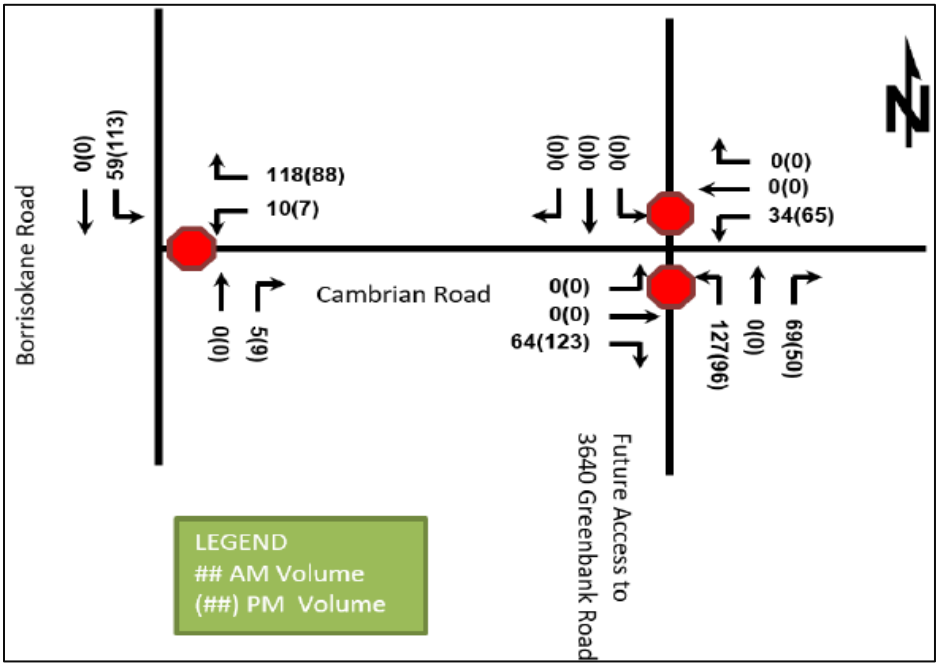


Source: 3718 Greenbank Road – Half Moon Bay South – Phase 5 Transportation Impact Assessment (CGH, 2019)

3640 Greenbank Road

3640 Greenbank Road (Meadow's Phase 5) is a proposed two-phase residential development located southwest of the subject site. The concept plan considers a total of approximately 350 units, split between townhouse and detached units (221 townhouses and 125 detached homes). The anticipated full build-out and occupancy horizon is 2022. The development is anticipated to produce 294 two-way AM peak period auto trips and 334 two-way PM peak period auto trips. The anticipated trip generation from this site can be seen in Figure 20 and is an excerpt from the 3640 Greenbank Road Transportation Impact Assessment by CGH Transportation.

Figure 20: 3640 Greenbank Road Site Generated Traffic Volumes

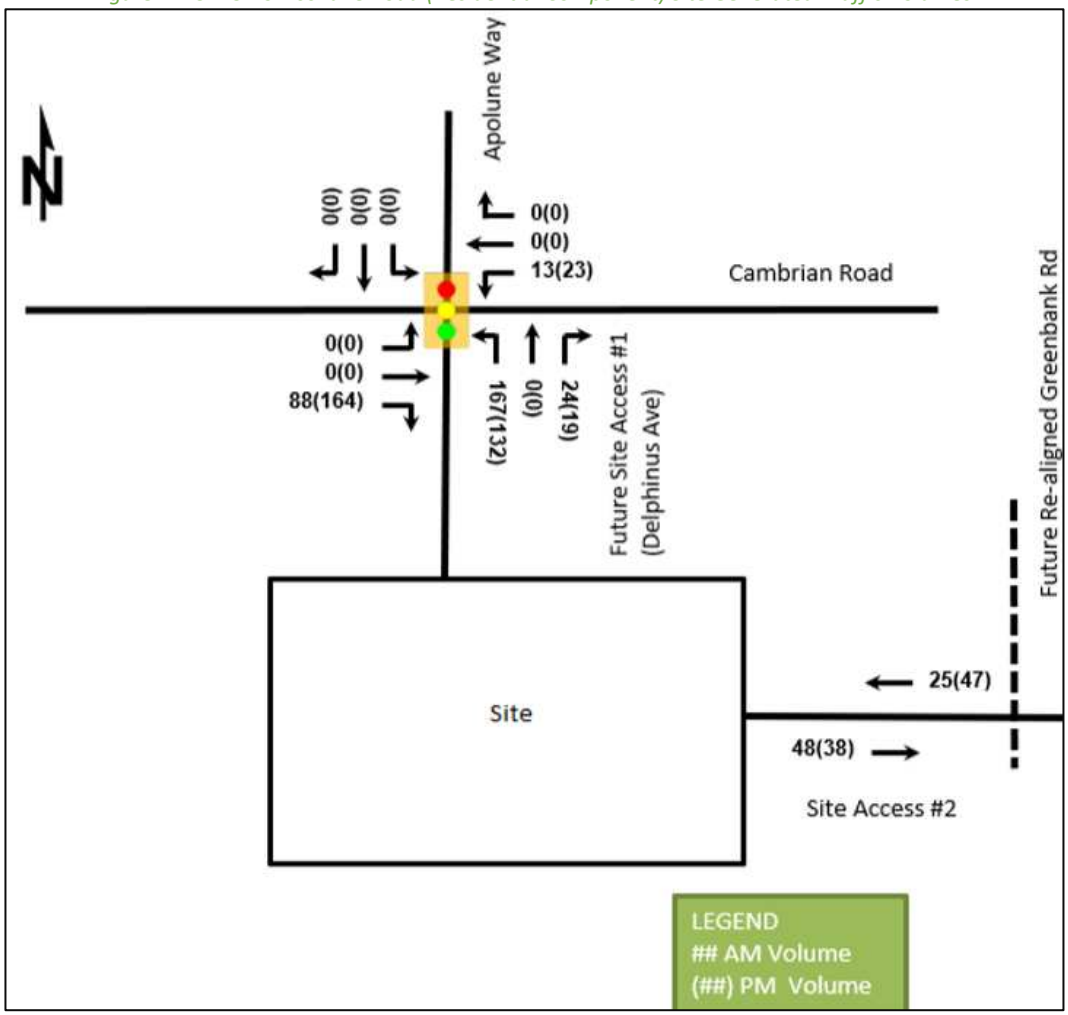


Source: 3640 Greenbank Road Transportation Impact Assessment (CGH, 2018)

3713 Borrisokane Road – Residential Component

3713 Borrisokane Road is a proposed residential development located southwest of the subject site and is expected to be built-out during 2024. This development will include 141 detached homes and 439 townhouses. 3713 Borrisokane Road will include a connection to 3809 Borrisokane Road and both developments will share an access to Borrisokane Road. This development is expected to produce 364 two-way AM peak period auto trips and 423 two-way PM peak period auto trips. The anticipated trip generation from this site can be seen in Figure 21 and is an excerpt from the 3713 Borrisokane Road Transportation Impact Assessment by CGH Transportation.

Figure 21: 3713 Borrisokane Road (Residential Component) Site Generated Traffic Volumes

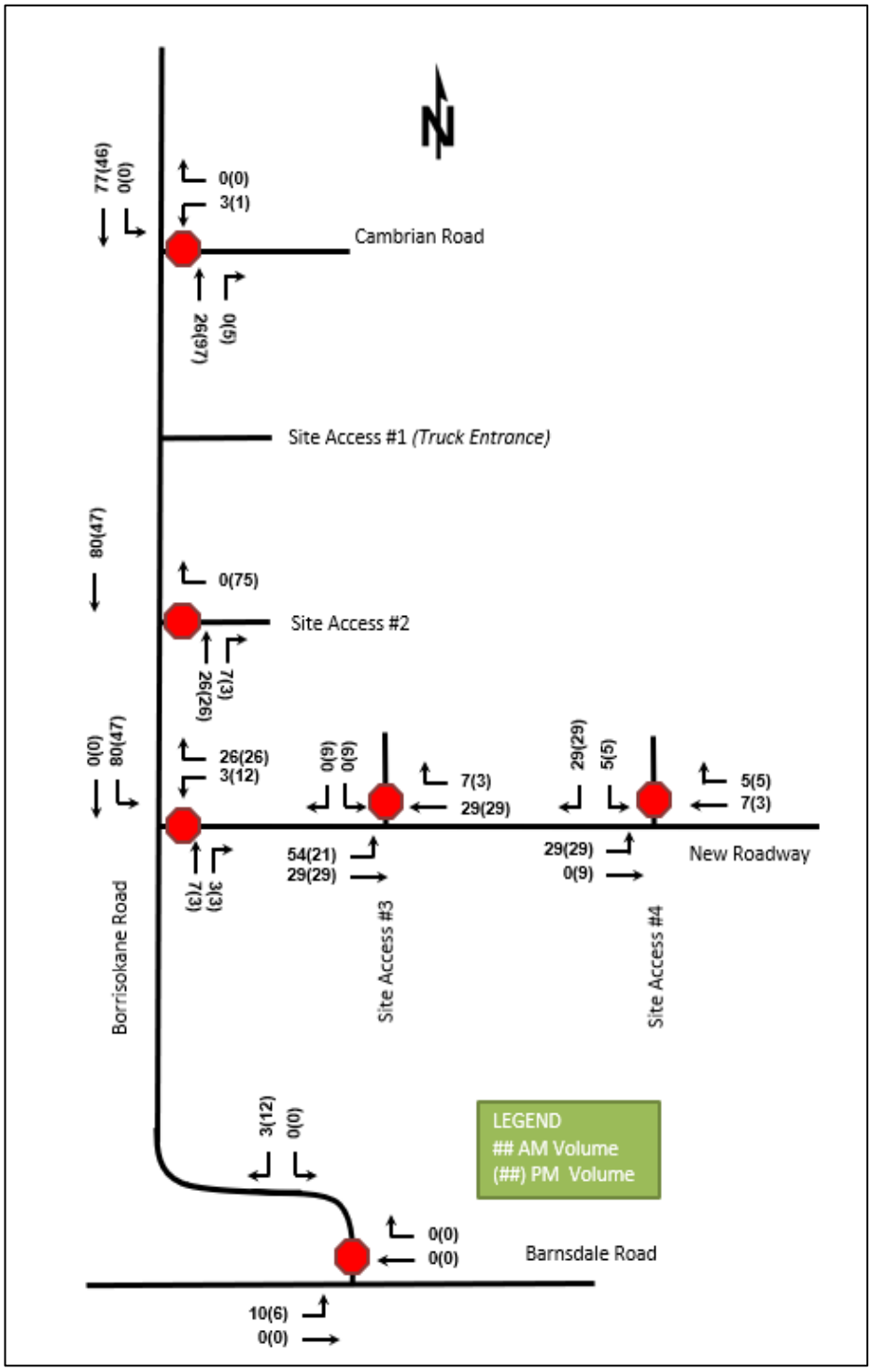


Source: 3713 Borrisokane Road Transportation Impact Assessment (CGH, 2020)

3713 Borrisokane Road-Industrial Component

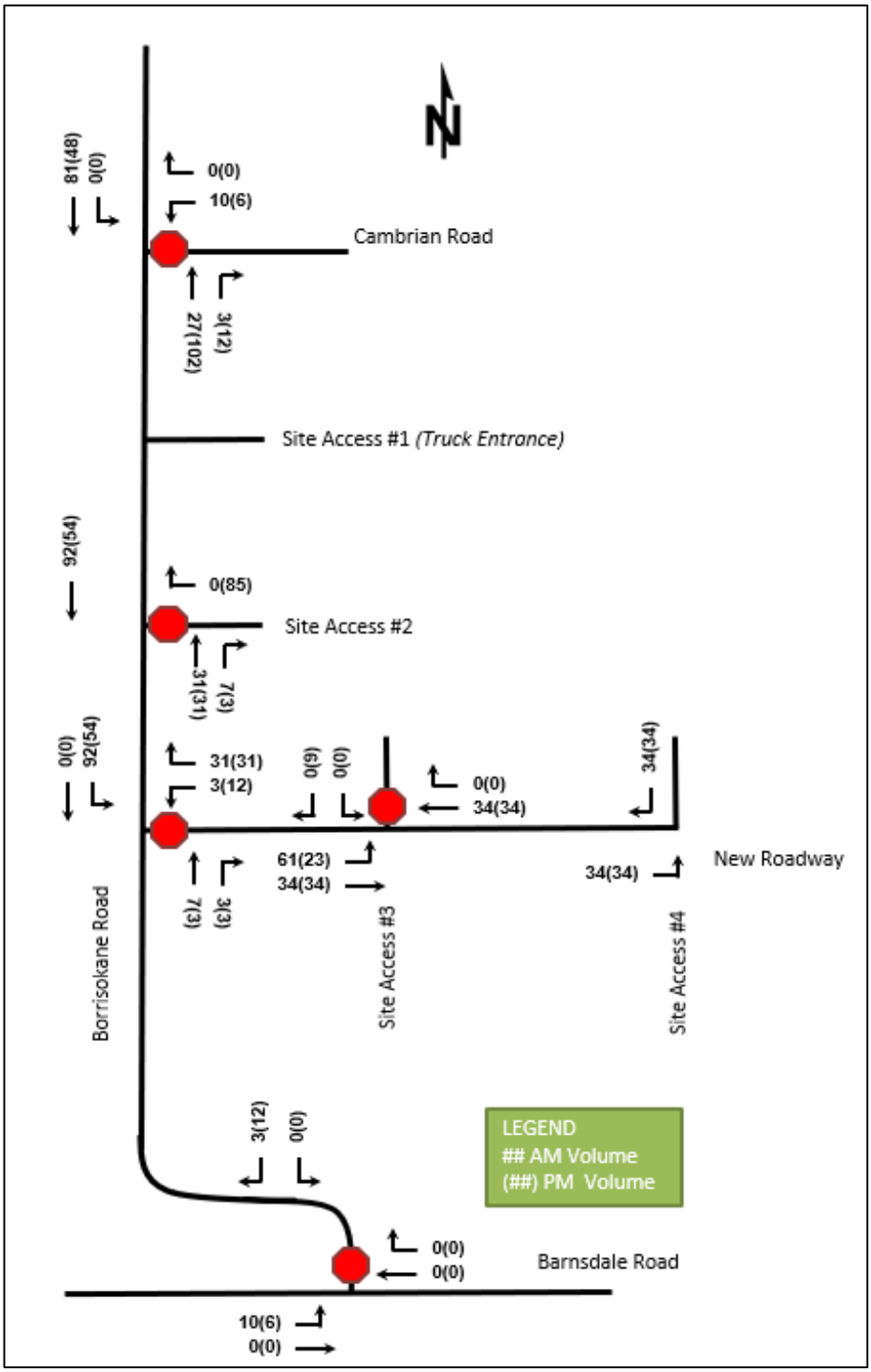
The industrial component of 3713 Borrisokane Road will be built-out in 2 phases, Phase 1 in 2022 and Phase 2 in 2027. The development will include approximately 3,250 square metres of general office space and 9,385 square metres of industrial buildings. This development is expected to produce 112 two-way AM peak period auto trips and-117 two-way PM peak period auto trips. The anticipated trip generation from this site after the completion of Phase 1 and Phase 2 can be seen in Figure 22 and Figure 23 respectively and are excerpts from the 3713 Borrisokane Road – ABIC Manufacturing Facility Transportation Impact Assessment by CGH Transportation.

Figure 22: 3713 Borrisokane Road (Industrial Component) Site Generated Traffic Volumes – 2022



Source: 3713 Borrisokane Road – ABIC Manufacturing Facility Transportation Impact Assessment (CGH, 2020)

Figure 23: 3713 Borrisokane Road (Industrial Component) Site Generated Traffic Volumes – 2027

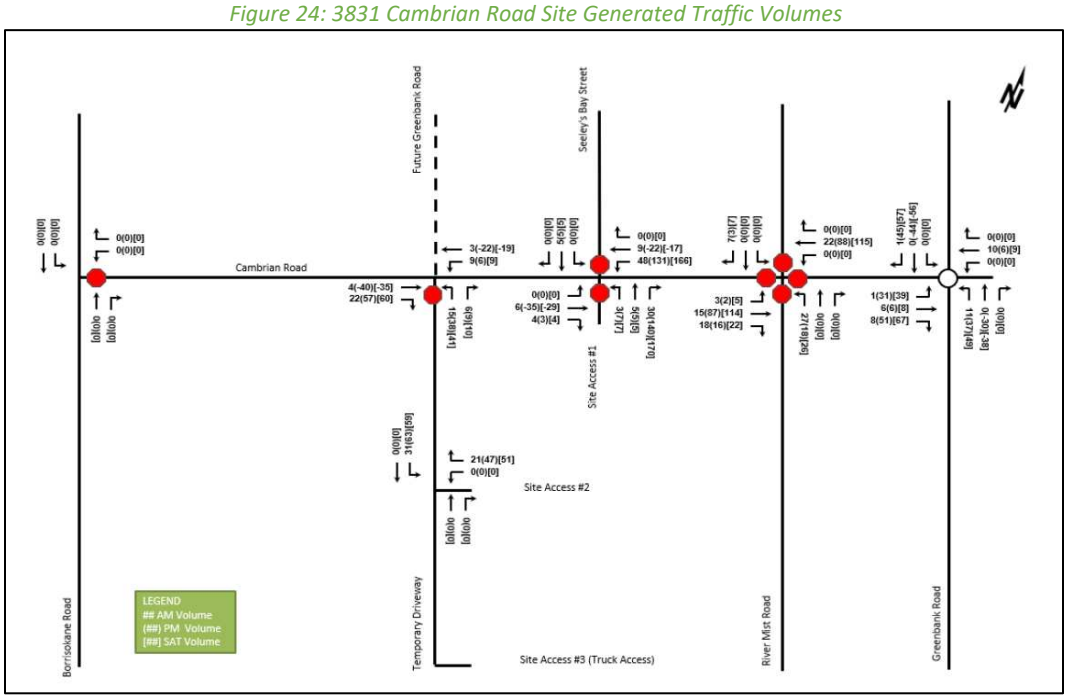


Source: 3713 Borrisokane Road – ABIC Manufacturing Facility Transportation Impact Assessment (CGH, 2020)

3831 Cambrian Road

The proposed development at 3831 Cambrian Road consists of a 4,024 square metre supermarket and an attached 929 square metre retail store. This development is anticipated to be built-out in 2023 and generate 134 new two-way AM peak hour, 88 new two-way PM peak hour, and 119 Saturday peak hour auto trips. The anticipated trip generation from this site can be seen in Figure 24 and is an excerpt from the 3831 Cambrian Road Transportation Impact Assessment by CGH Transportation.

Figure 24: 3831 Cambrian Road Site Generated Traffic Volumes



Source: 3831 Cambrian Road Transportation Impact Assessment (CGH, 2021)

3809 Borrisokane Road

3809 Borrisokane Road is a proposed residential development, which is located southwest of the subject site and is expected to be built-out in 2025. This development will include approximately 590 residential units, split between townhouse units and detached home units. The eastern parcel of 3713 Borrisokane Road will include a connection to 3809 Borrisokane Road and both developments will share an access to Borrisokane Road as part of an interim phase only. Approximately 300 units will use this connection prior to the full build-out in 2025 at which time the connection to Borrisokane Road will be closed. This development is expected to produce 401 two-way AM peak period auto trips and 457 two-way PM peak period auto trips. Based on the City of Ottawa comments, the TIA report for this devilment is being revised and is currently underway. The most recent update to the 2023 and 2025 3809 Borrisokane Road generated volumes is included in Appendix E.

3 Study Area and Time Periods

3.1 Study Area

The study area will include the following intersections:

- River Mist Road at Cambrian Road
- Greenbank Road at Cambrian Road
- Half Moon Bay Road at Greenbank Road
- Realigned Greenbank at Cambrian Road (2029 Future horizons)

3.2 Time Periods

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

3.3 Horizon Years

The anticipated build-out year is 2024. As a result, the full build-out plus five years horizon year is 2029.

4 Exemption Review

Table 4 summarizes the exemptions for this TIA.

Table 4: 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
	4.1.3 New Street Networks	Only required for plans of subdivision	Required
4.2 Parking	4.2.1 Parking Supply	Only required for site plans	Exempt
	4.2.2 Spillover Parking	Only required for site plans where parking supply is 15% below unconstrained demand	Exempt
Network Impact Component			
4.5 Transportation Demand Management	All Elements	Not required for site plans expected to have fewer than 60 employees and/or students on location at any given time	Required
4.6 Neighbourhood Traffic Management	4.6.1 Adjacent Neighbourhoods	Only required when the development relies on local or collector streets for access and total volumes exceed ATM capacity thresholds	Required
4.8 Network Concept		Only required when proposed development generates more than 200 person-trips during the peak hour in excess of equivalent volume permitted by established zoning	Exempt

5 Development-Generated Travel Demand

5.1 Mode Shares

Examining the mode shares presented in the TRANS Trip Generation Manual (2020) for the district derived from the most recent National Capital Region Origin-Destination survey (OD Survey), the existing mode shares by land use and peak period for South Nepean have been summarized in.

Table 5: TRANS Trip Generation Manual Recommended Mode Shares – South Nepean

Travel Mode	Single-Detached Dwellings		Multi-Unit (Low-Rise)	
	AM	PM	AM	PM
Auto Driver	51%	53%	51%	53%
Auto Passenger	14%	19%	14%	19%
Transit	25%	18%	25%	18%
Cycling	1%	1%	1%	1%
Walking	9%	10%	9%	10%
Total	**100%**	**100%**	**100%**	**100%**

5.2 Trip Generation

This TIA has been prepared using the vehicle and person trip rates for the residential dwellings using the TRANS Trip Generation Manual (2020). Table 6 summarizes the person trip rates for the proposed residential land uses for each peak period.

Table 6: Trip Generation Person Trip Rates by Peak Period

Land Use	Land Use Code	Peak Period	Person Trip Rates
Single-Detached Dwellings	210 (TRANS)	AM	2.05
		PM	2.48
Multi-Unit (Low-Rise)	221 & 222 (TRANS)	AM	1.35
		PM	1.58

Using the above person trip rates, the total person trip generation has been estimated. Table 7 summarizes the total person trip generation for the residential land uses.

Table 7: Total Person Trip Generation by Peak Period

Land Use	Units	AM Peak Period			PM Peak Period		
		In	Out	Total	In	Out	Total
Single-Detached Dwellings	103	63	148	211	158	97	255
Multi-Unit (Low-Rise)	420	170	397	567	372	292	664

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 the person trip rates, the person trips by mode have been projected. Table 8 summarizes the trip generation by mode and peak hour using the residential peak hour adjustment factor.

Table 8: Trip Generation by Mode

Travel Mode		AM Peak Hour				PM Peak Hour			
		Mode Share	In	Out	Total	Mode Share	In	Out	Total
Single-Detached Dwellings	Auto Driver	**51%**	15	36	51	**53%**	37	22	59
	Auto Passenger	**14%**	4	10	14	**19%**	13	8	21
	Transit	**25%**	9	20	29	**18%**	13	8	21
	Cycling	**1%**	0	1	1	**1%**	1	0	1
	Walking	**9%**	3	8	11	**10%**	8	5	14
	Total	**100%**	**32**	**74**	**106**	**100%**	**70**	**43**	**112**
Multi-Unit (Low-Rise)	Auto Driver	**49%**	40	93	133	**49%**	80	63	143
	Auto Passenger	**13%**	11	25	36	**13%**	21	17	38
	Transit	**26%**	24	57	81	**24%**	42	33	75
	Cycling	**2%**	2	4	6	**2%**	3	3	6
	Walking	**9%**	9	21	30	**12%**	23	18	42
	Total	**100%**	**85**	**199**	**284**	**100%**	**164**	**128**	**292**
Total	Auto Driver	-	55	129	184	-	117	85	202
	Auto Passenger	-	15	35	50	-	34	25	59
	Transit	-	33	77	110	-	55	41	96
	Cycling	-	2	5	7	-	4	3	7
	Walking	-	12	29	41	-	31	23	56
	Total	-	**117**	**273**	**390**	-	**234**	**171**	**404**

As shown above, 184 AM and 202 PM new peak hour two-way vehicle trips are projected as a result of the proposed development.

5.3 Trip Distribution

To understand the travel patterns of the subject development, the OD survey has been reviewed to determine the existing travel patterns that will be applied to the new vehicle trips. Table 9 below summarizes the distribution for South Nepean.

Table 9: OD Survey Existing Directional Split South Nepean

To/From	% of Trips
North	75%
South	10%
East	10%
West	5%
Total	100%

5.4 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. The 2029 new site generation auto volumes have been re-assigned due to the network changes associated with the temporary connection of Realigned Greenbank Road. Figure 25 and Figure 26 illustrate the 2024 and 2029 new site generated volumes, respectively.

Figure 25: 2024 New Site Generated Auto Volumes

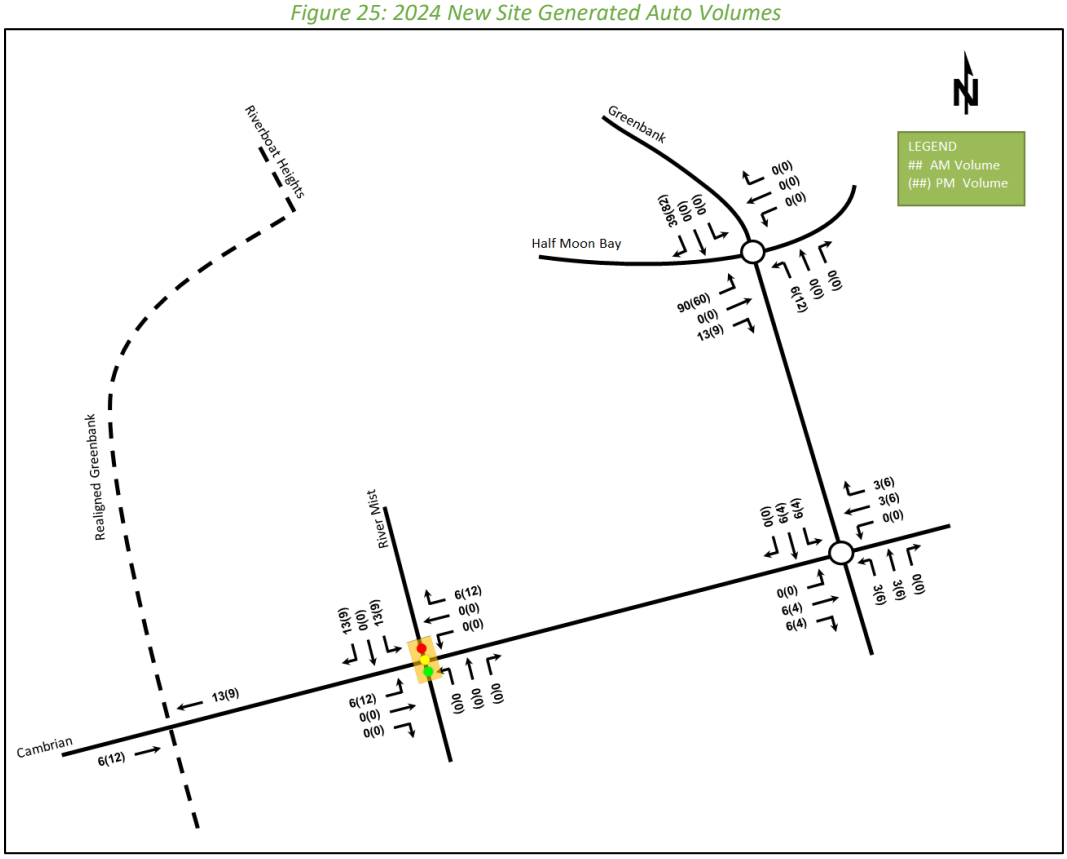
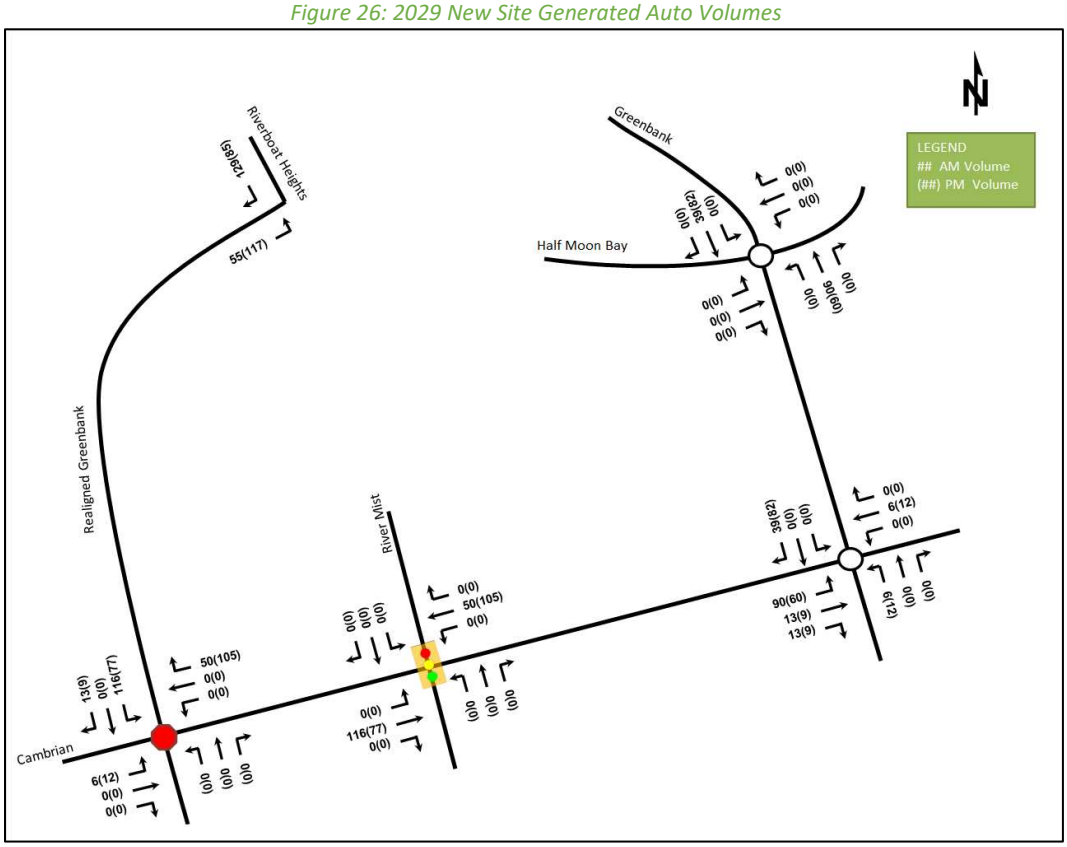


Figure 26: 2029 New Site Generated Auto Volumes



6 Background Network Travel Demands

6.1 Transportation Network Plans

The transportation network plans were discussed in Section 2.3.1. The additional capacity provided by these plans will improve the level of service in the study area road network, but these changes are not part of the 10-year affordable network. To support the proposed development and minimize the impact on the adjacent developments to the east, a temporary connection from the site access at River Boat Heights will be extended down to Cambrian Road. This road connection will be built along the Realigned Greenbank Road corridor. No access from the east side would be provided in order to prevent traffic from the proposed development cutting through the existing developments. This work should be coordinated with the ongoing Realigned Greenbank Road detail design to minimize throwaway. The 2029 Future background volume at the intersection of realigned Greenbank Road and Cambrian Road were acquired from the adjacent Half Moon Bay West Community development TIA (Stantec, 2016).

6.2 Background Growth and Other Developments

Surrounding development Traffic Impact Assessments have used a 2% traffic growth within the study area of this report. As such, an annual background growth of 2% will be used in order to remain consistent with these studies.

The background developments explicitly considered in the background conditions include:

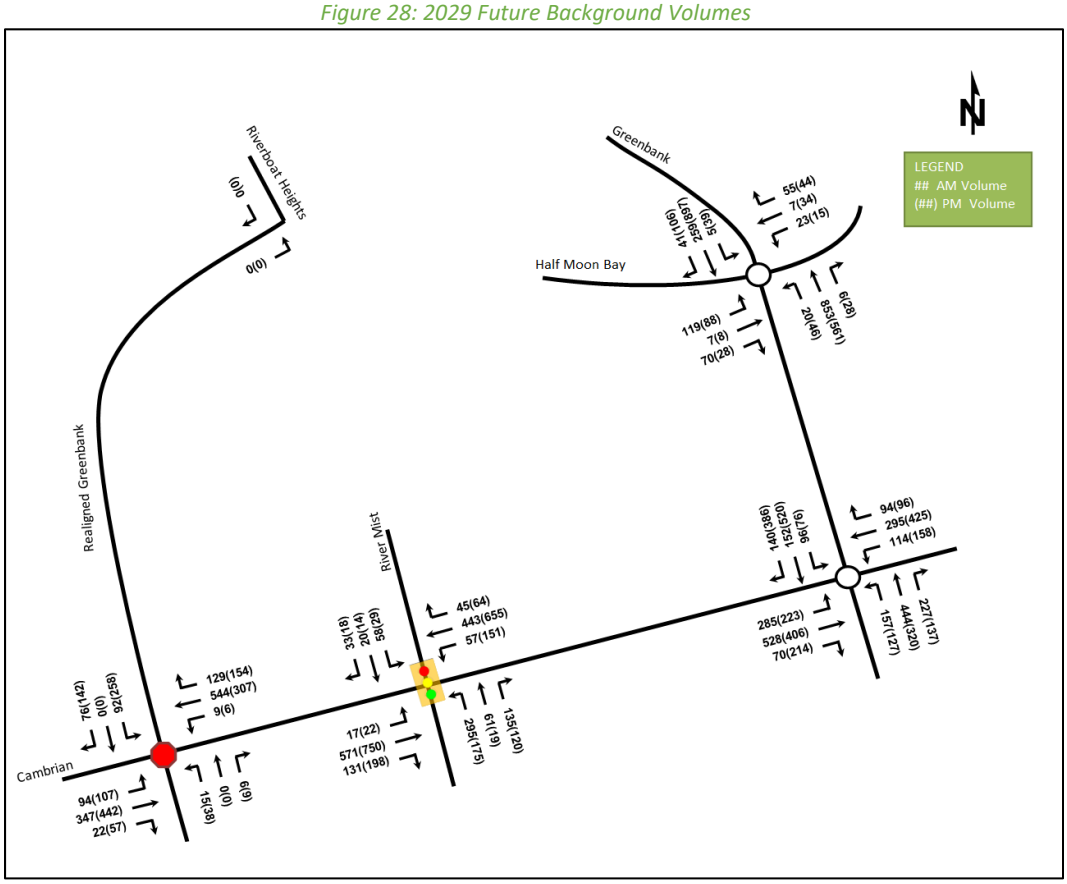
- Half Moon Bay West Community
- 2444 Watercolours Way
- 3831 Cambrian Road

- 3718 Greenbank Road
- The Meadows Phase 4
- 3882 Barnsdale Road and 3960 Greenbank Road
- 3285 Borrisokane Road
- 3640 Greenbank Road
- 3713 Borrisokane Road Residential Component
- 3713 Borrisokane Road Industrial Component
- 3809 Borrisokane Road

All of these developments are discussed in Section 2.3.2. Figure 27 and Figure 28 illustrate the 2024 and 2029 future background volumes, respectively.

Figure 27: 2024 Future Background Volumes

Figure 28: 2029 Future Background Volumes



7 Demand Rationalization

7.1 2024 Future Background Operations

Based on the Synchro and Sidra analysis in Section 2.2.7 and the CGH's experience with other nearby developments, Greenbank Road at Cambrian Road intersection is anticipated to experience capacity constraints in the near future. It has also been noted that River Mist Road at Cambrian Road intersection is experiencing capacity constraints and high delays. As multiple residential communities are anticipated to be built in the study area within next three years, the demand generated by these developments will outgrow the capacity that the current road configuration can provide. Taking into account this, the existing poor LOS, and a lack of alternative routes, the demand determined in the previous sections of this report should be carried forward into the next step of this TIA to highlight the need for the infrastructure upgrades outlined in the city's Transportation Master Plan. The future total 2024 volumes are illustrated in Figure 29, and future total 2029 volumes are illustrated in Figure 30.

Figure 29: 2024 Future Total Volumes

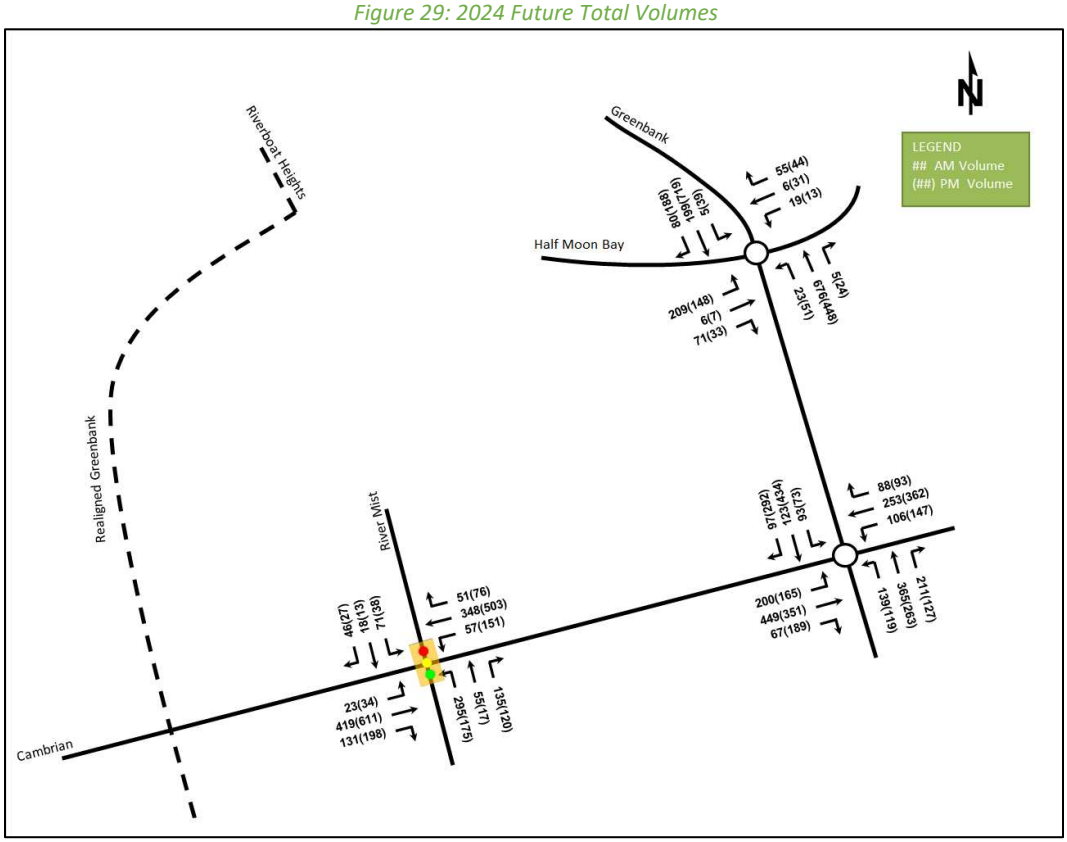
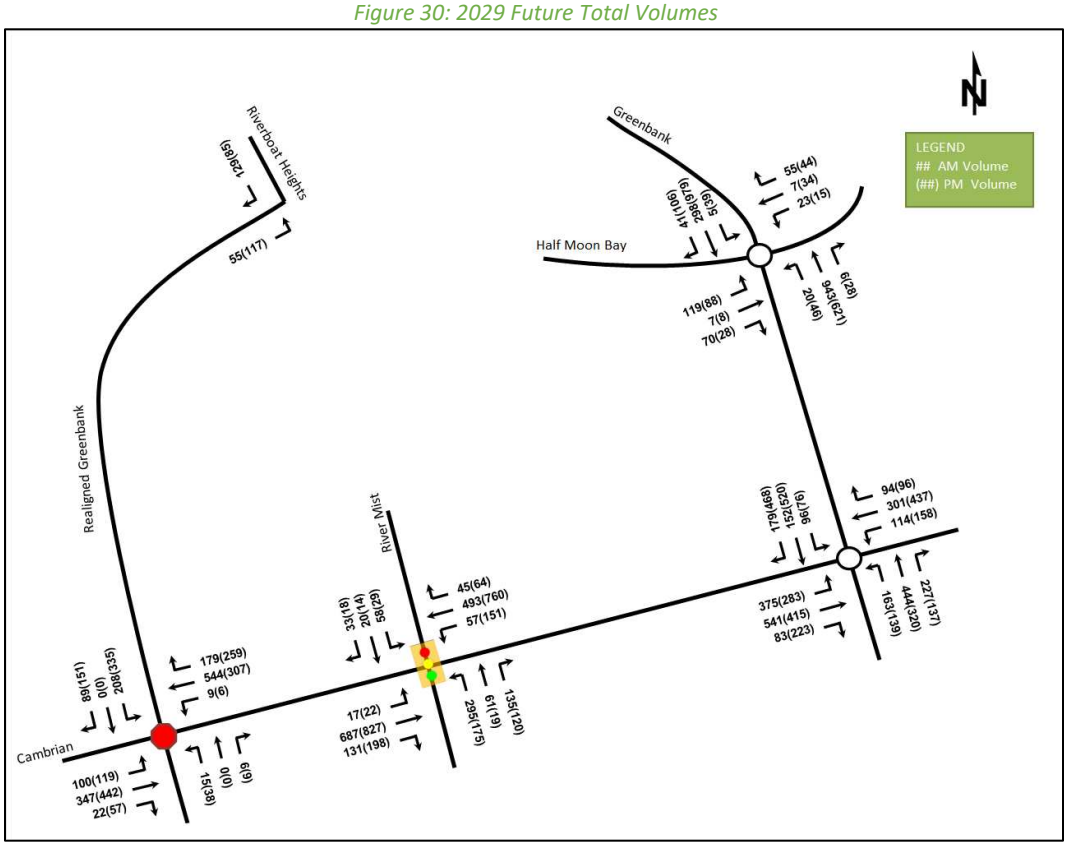


Figure 30: 2029 Future Total Volumes

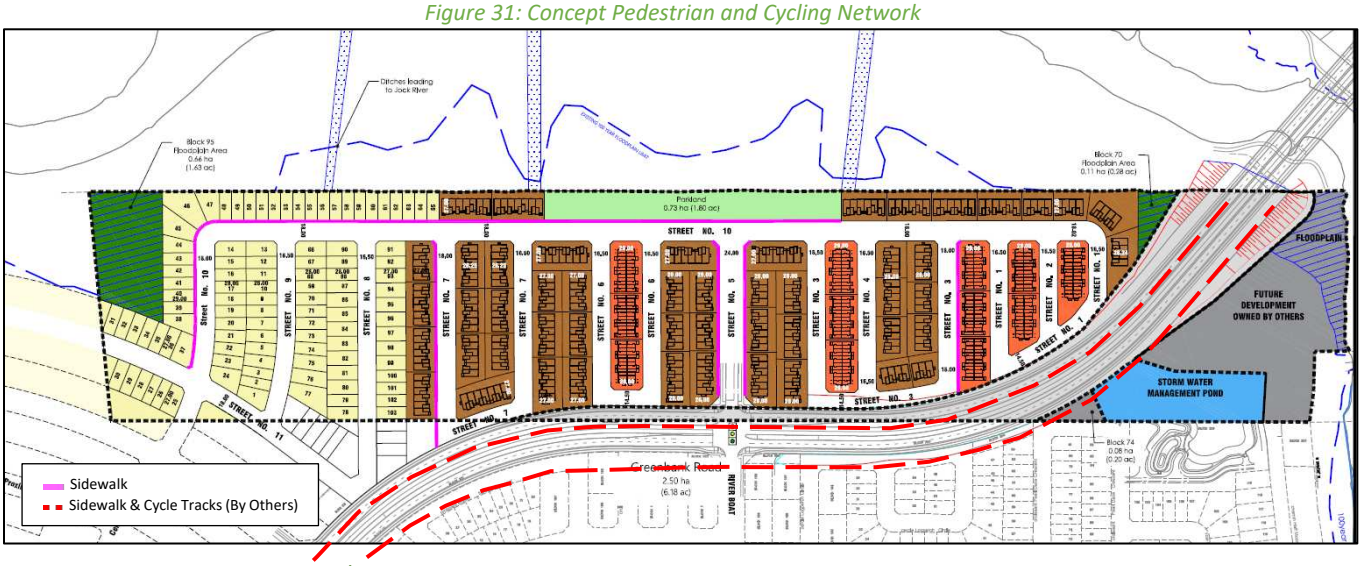


8 Development Design

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 31 illustrates the concept active mode network. The plan incorporates the adjacent developments, and planned routes on geoOttawa. Additionally, pedestrian connection will be provided between window streets and the future realigned Greenbank Road. The existing transit service does not meet the council approved 400 metre minimum walking distance to transit. Therefore, as the study area builds out, and houses in this area become occupied, it is anticipated that OC Transpo will re-evaluate demand and ensure that more transit routes will be provided closer to the site. Additionally, beyond this study's horizons the proposed Greenbank Road BRT will run along the southern frontage of this site, providing excellent transit service to this community in the fullness of time.

Figure 31: Concept Pedestrian and Cycling Network



8.2 New Street Networks

The planned street network will include 14.5 metre window roads, 16.5 metre local roads, 18 metre local roadways, and 24.0 metre collector roadways. The local and collector roads will provide parking on one side of the roadway. The local roads are proposed to be posted as 30 km/h and the collector roads are proposed to be posted as 50 km/h. The pedestrian and cycling network are provided in Section 8.1.

To support the pedestrian and cycling connectivity within the subdivision, Figure 32 illustrates the concept traffic calming plan. The plan reduces crossing distances for the pedestrian and cyclists, as well as limits the speed of vehicles entering and exiting the local roads from the collector roads. The location of speed humps is subject to minor changes and will need to be refined as part of the detailed engineering submission once the locations of driveway, stormwater flows, surface ponding, and servicing elements, such as utilities and fire hydrants, have been established.

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

Figure 32: Traffic Calming Plan

9 Boundary Street Design

The Realigned Greenbank Road corridor will be a future boundary road to the proposed development however its construction is anticipated to occur outside of the future horizons of this TIA. Any MMLOS analysis will be completed as part of the detailed design of the corridor and is beyond the scope of this study.

10 Access Intersections Design

10.1 Location and Design of Access

Access to the development lands will be accommodated via River Boat Heights and Perseus Avenue at Celestial Grove, which will be extended north through the adjacent landowners property.

The intersections of River Mist Road and Cambrian Road, Half Moon Bay and Greenbank Road, and Greenbank Road and Cambrian Road, and future Realigned Greenbank Road at Cambrian Road are considered as study area intersections and are not the access intersections.

10.2 Access Intersection Control

No intersections are currently located at the site boundaries and access is provided through collector roadways. Assessment of the network intersections is provided in Section 15.

10.3 Access Intersection Design

No access intersections are considered in this TIA.

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. The subject site is within 200 metres of a future Rapid Transit Station along the proposed Greenbank Road BRT corridor. However, as the timing of this improvement is unknown, and to remain conservative, the existing transit mode share was carried forward in the analysis.

11.2 Need and Opportunity

The subject site has been assumed to rely predominately on auto travel and those assumptions have been carried through the analysis. If the low transit or non-auto mode shares are further reduced, this will result in higher volumes along Cambrian Road. Little opportunity is available to shift these modes until major infrastructure projects, such as the Realigned Greenbank Road corridor, are complete to increase the transit connectivity between South Barrhaven and 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. The TDM Checklist has been provided in Appendix F. The key TDM measures recommended include:

- Provide a multimodal travel option information package to new residents
- Inclusion of a 1-year Presto card for first time new townhome purchase, with a set time frame for this offer (e.g. 6-months) from the initial opening of the site.

12 Neighbourhood Traffic Management

In this section, the Neighborhood Traffic Management along Half Moon Bay Road / River Run Avenue and River Mist Road will be discussed. The TIA Guidelines propose a threshold of 2,500 vehicles per day (AADT), or 300 vehicles per peak hour for the classification of collector roads, equivalent to five cars per minute, which per City guidance is to be interpreted as two-way volumes.

The existing volumes on Half Moon Bay Road west of Greenbank Road are 247 two-way vehicles in the AM peak hour and 293 two-way vehicles in the PM peak hour. The site is anticipated to add approximately 148 and 163 two-way vehicle trips during the AM and PM peak hours in 2024 horizon, respectively, and it is anticipated to add no vehicle trips during both peak hours in 2029 horizon, due to the proposed temporary road along the Realigned Greenbank Road corridor.

The site traffic will account for approximately 35-38% of the total traffic on Half Moon Bay Road west of Greenbank Road in 2024 horizon. While over the prescribed theoretical local road capacity, it is expected that no trips to or from the proposed development would travel along Half Moon Bay Road / River Run Avenue in 2029 horizon. Additionally, site traffic will be redirected once the future Realigned Greenbank Road is built beyond this study's horizons.

The existing volumes on River Mist Road North of Cambrian Road are 212 two-way vehicles in the AM peak hour and 156 two-way vehicles in the PM peak hour. The site is anticipated to add approximately 38 and 42 two-way vehicle trips during the AM and PM peak hours in 2024 horizon, respectively, and it is anticipated to add no vehicle trip during both peak hours in 2029 horizon. These volumes are below the threshold of 300 vehicles per peak hour for the classification of collector roads from the TIA guidelines.

13 Transit

13.1 Route Capacity

In Section 5.1, the trip generation by mode was estimated, including an estimate of the number of transit trips that will be generated by the proposed development. Table 10 summarizes the transit trip generation.

Table 10: Trip Generation by Transit Mode

Travel Mode	Mode Share	AM			PM		
		In	Out	Total	In	Out	Total
Transit	Varies	33	77	110	55	41	96

The proposed development is anticipated to generate an additional 110 AM peak hour transit trips and 96 PM peak hour transit trips. Of these trips, 77 outbound AM trips and 55 inbound PM trips are anticipated.

From the trip distribution found in Section 5.3, these values can be further broken down. Site-generated outbound AM trips break down to 58 trips to the north, eight each to the south and east, and three trips to the west. Site-generated inbound PM trips break down to 41 trips from the north, six trips each from the south and east, and two trips from the west.

Overall, the forecasted new transit trips would result in approximately one bus capacity equivalent (single bus, 55-person capacity) in the peak direction to accommodate the transit trips generated from the subject site. As the study area builds out, it is anticipated that OC Transpo will re-evaluate demand and ensure that adequate capacity is provided on Transit Route 75. Beyond this study's horizon, the transit trips generated by the subject site will be serviced by the proposed Greenbank Road BRT.

13.2 Transit Priority

The site-generated volumes at River Mist Road and Cambrian Road intersection do not impact the westbound left and the northbound right movements of transit route #75. Additionally, the operations of River Mist Road and Cambrian Road improve with signalization which is warranted in 2024 future background horizon. Therefore, no transit priority measures are required in the study area.

14 Review of Network Concept

Cambrian Road may potentially approach or exceed a single lane capacity in the peak direction by the 2024 background and total future conditions. For example, in the PM peak period the west approach volume at Cambrian Road and River Mist Road intersection is 579 during Existing horizon, and 831 in the 2024 future background horizon. These volume projections are a result of surrounding development growth being realized, Realigned Greenbank Road being constructed beyond this study's horizon, and on growth proceeding at the same rate. The likely impact of the interim condition is extended queues along Cambrian Road, between Borrisokane Road and Greenbank Road.

The network concept, as identified within the City of Ottawa's Transportation Master Plan Map 10, illustrates extensive improvements within Barrhaven South:

- New Realigned Greenbank Road, from Chapman Mills Drive to Cambrian Road
- Realigned Greenbank Road extension south of Cambrian Road
- Widening of Cambrian Road from the Realigned Greenbank Road to the existing Greenbank Road

These planned improvements are expected to address the high volumes experienced along Cambrian Road, and the existing Greenbank Road therefore no changes to the network concept are required.

15 Network Intersection Design

15.1 Network Intersection Control

Signal warrant analysis were performed for the intersection of Cambrian Road and River Mist Road for the 2024 and 2029 future background and future total horizons and Realigned Greenbank Road at Cambrian Road for the 2029 future background and future total horizons using the OTM Book 12 Justification 7 criteria and estimated average hourly volumes (AHV). Using these criteria, it was found that a signal is warranted at the Cambrian Road and River Mist Road intersection during the 2024 future background horizon. This is in line within the Cambrian Road Widening EA, where signals are the proposed intersection control method at the subject intersection. Appendix G includes the signal warrant calculation sheets.

The intersection of Cambrian Road at River Mist Road was also evaluated using the roundabout feasibility screening tool and the results indicate that a roundabout is not feasible at this location due to spatial limitations. Appendix H includes the roundabout screening forms.

The intersection method of control for Cambrian Road at Greenbank Road will remain consistent with existing methods of control at all future horizons.

Since the intersection of Realigned Greenbank Road at Cambrian Road is not warranted, it is assumed to be an All-Way stop controlled intersection.

15.2 Auxiliary Turn Lane Warrants

The Ministry of Transportation Ontario (MTO) Geometric Design Standards for Ontario Highways (GDSOH) has been reviewed to determine the need for left turns at the unsignalized intersection of Realigned Greenbank Road at Cambrian Road. Using the GDSOH methodology and appropriate design speeds, it was found that left-turn lane will be warranted on the eastbound and westbound legs in the 2029 background and future horizons.

Left turn lane warrant analysis sheets have been included in Appendix I. Required storage lengths for the eastbound and westbound left-turn lane were calculated using the Geometric Design Guide for Canadian Roads (TAC, 2017) equation 9.14.1. Table 11 summarizes the storage length calculations for each horizon and peak hour.

Table 11: Storage Length Requirements for Turn Lanes

Intersection	Movement	Storage Length Required			
		2029 Future Background		2029 Future Total	
		AM	PM	AM	PM
Realigned Greenbank Road at Cambrian Road	Eastbound Left	21.9 m	25.0 m	23.3 m	27.8 m
	Westbound Left	2.1 m	1.4 m	2.1 m	1.4 m

As summarized above, a storage length of 30.0 metres on the eastbound left-turn movement will be modeled in 2029 future horizons. And a storage length of 15.0 metres, which is the minimum recommended storage per section 9.17.4.3 of the Geometric Design Guide for Canadian Roads (TAC, 2017), will be modeled on the westbound left-turn movement in 2029 future horizons.

15.3 Network Intersection Design

To understand the intersection design, an MMLOS analysis of existing, 2024 future background, 2029 future background, 2024 future total, and 2029 future total horizon demands is required. The following sections will discuss the vehicle LOS at study area intersections which is based on the HCM criteria for average delay at unsignalized intersections and roundabouts. At signalized intersections, the level of service is based on the V/C ratio as required by the City of Ottawa. This will be followed by a discussion of the intersection MMLOS for other modes.

Synchro (Version 11) and Sidra (Version 8.0) were used to model the study area intersections. The Heavy Vehicle percentage (HV %) has been calculated for each turning movement at the study area intersection. All Heavy Vehicle percentages calculated to be less than 2% were entered into the Synchro model as 2% in order to produce a conservative analysis. These calculations are shown in Appendix J. All parameters have been coded using the City of Ottawa's TIA Guidelines and default parameters.

15.3.1 Existing Conditions

The existing intersection volumes have been analyzed to establish a baseline condition and determine the impact of the subject development as well as the surrounding background developments on the study area road network. Table 12 summarizes the operational analysis of the 2021 existing conditions. Appendix K contains the 2021 Existing Conditions Synchro and Sidra sheets.

Table 12: Existing Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	V/C	Delay	Q (95th)	LOS	V/C	Delay	Q (95th)
River Mist Road & Cambrian Road *Unsignalized*	EB	D	0.78	31.7	53.3	**F**	**1.10**	**97.2**	**151.5**
	WB	D	0.81	34.9	59.3	**F**	**1.01**	**58.2**	**100.5**
	NB	D	0.79	32.5	56.3	C	0.57	19.3	24.8
	SB	B	0.26	14.2	7.5	B	0.15	13.2	3.8
	Overall	**D**	-	**31.5**	-	**F**	-	**65.7**	-
	Alternative Scenario: All-way Stop Control Replaced by a Two-way Stop Control on the Minor (north/south) Approaches								
	EB	A	0.02	8.5	0.0	A	0.02	8.2	0.8
	WB	A	0.06	8.5	1.5	A	0.18	9.6	4.5
	NB	**F**	**1.35**	**210.4**	**155.3**	**F**	**1.71**	**392.5**	**147.0**
	SB	**F**	**0.65**	**57.1**	**27.8**	**F**	**0.66**	**98.4**	**24.0**
	Overall	**E**	-	**70.7**	-	**F**	-	**75.4**	-
Greenbank Road & Half Moon Bay Road *Roundabout*	EB	A	0.20	5.9	7.7	A	0.21	10.0	9.1
	WB	A	0.15	9.1	6.4	A	0.13	6.6	5.1
	NB	A	0.55	4.9	33.4	A	0.42	5.0	22.3
	SB	A	0.18	3.9	7.6	A	0.62	4.6	44.4
	Overall	**A**	**0.55**	**5.2**	**33.4**	**A**	**0.62**	**5.3**	**44.4**
Greenbank Road & Cambrian Road *Roundabout*	EB	C	0.72	19	76	E	0.89	40	103
	WB	C	0.68	21	43	C	0.76	23	70
	NB	**F**	**1.08**	**88**	**248**	C	0.66	18	45
	SB	B	0.42	11	15	**F**	**1.09**	**86**	**303**
	Overall	**E**	**1.08**	**41**	**248**	**E**	**1.09**	**46**	**303**

Notes:
Saturation flow rate of 1800 veh/h/lane
Queue is measured in metres
Peak Hour Factor = 0.90
m = metered queue
# = volume for the 95th %ile cycle exceeds capacity

As a result of high eastbound and westbound volumes at the intersection of River Mist Road and Cambrian Road, the east and west approaches are performing at LOS F during the PM peak hour. Using the OTM Book 5 methodology, the warrant for an all-way stop-controlled intersection (AWSC) has been reviewed. It has been found that an AWSC is not warranted, using existing volumes. The traffic signal warrant is also not met using the existing traffic volumes according to OTM Book 12 Justification 7 and is shown in Appendix H. Traffic signals are included in the Cambrian Road widening EA plan, however Cambrian Road widening is not part of the Transportation Master Plan 2031 Affordable Network. Synchro scenario with two-way stop control at River Mist Road and Cambrian Road intersection has been modeled for comparison. A two-way stop control improves the operational performance of heavier movements but decreases the LOS of the southbound and northbound

approaches. The summary of this analysis can be seen in Table 2 and the complete calculations are shown in Appendix K.

The northbound and southbound approaches at the intersection of Greenbank Road and Cambrian Road are also experiencing poor LOS, with the northbound and southbound approaches performing at LOS F during the AM and PM peak hour, respectively. The low performance of this intersection in the north and south directions is expected and can be explained by the location of the Ottawa CBD relative to the study area. The vehicle trips originating in the study area are directed towards the CBD (north) during the AM peak hour and back towards the residential communities in the study area (south) during the PM peak hour. However, the future realigned Greenbank Road will relieve the pressures from the current Greenbank Road and improve the north and southbound LOS at the intersection of Greenbank Road at Cambrian Road.

15.3.2 2024 Future Background Operations

The 2024 future background intersection volumes and other development traffic have been analyzed to allow a comparison between the future volumes with and without the proposed development. As previously mentioned, a signal warrant was met at Cambrian Road and River Mist Road intersection in 2024 future background horizon. The TIA for 3831 Cambrian Road prepared by CGH Transportation in 2021 has also illustrated Cambrian Road and River Mist Road intersection as signalized in 2024 future background horizon. Thus, the same intersection configuration assumptions as in 3831 Cambrian Road TIA have been used to model Cambrian Road and River Mist Road intersection within this study. Table 13 summarizes the operational analysis of 2024 future background conditions. Appendix L contains the 2024 future background Synchro sheets.

Table 13: 2024 Future Background Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	V/C	Delay	Q (95th)	LOS	V/C	Delay	Q (95th)
River Mist Road & Cambrian Road *Signalized*	EBL	A	0.09	15.6	5.3	A	0.07	18.4	7.3
	EBT	D	0.83	35.7	82.0	E	0.91	46.2	**#164.0**
	EBR	A	0.24	4.2	9.2	A	0.29	3.9	12.5
	WBL	A	0.34	22.6	14.4	B	0.69	29.7	**#29.1**
	WBT	B	0.68	26.9	63.9	A	0.57	19.4	90.4
	WBR	A	0.10	5.3	5.5	A	0.09	3.4	5.9
	NBL	A	0.55	19.8	60.4	A	0.37	26.3	43.8
	NBT/R	A	0.27	6.0	17.0	A	0.23	6.8	14.6
	SBL	A	0.13	13.5	12.5	A	0.07	22.1	9.9
	SBT/R	A	0.08	7.2	7.6	A	0.05	13.1	7.6
	Overall	**B**	**0.66**	**21.6**	**-**	**B**	**0.65**	**26.3**	**-**
Greenbank Road & Half Moon Bay Road *Roundabout*	EB	A	0.18	5.9	6.9	A	0.20	10.7	8.9
	WB	A	0.14	9.6	6.1	A	0.12	6.8	4.8
	NB	A	0.58	4.8	37.4	A	0.44	4.8	23.9
	SB	A	0.19	3.9	7.9	A	0.65	4.6	50.0
	Overall	**A**	**0.58**	**5.1**	**37.4**	**A**	**0.65**	**5.2**	**50.0**

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	V/C	Delay	Q (95th)	LOS	V/C	Delay	Q (95th)
Greenbank Road & Cambrian Road *Roundabout*	EB	D	0.88	31.2	160.1	**F**	**1.07**	**80.1**	**273.8**
	WB	C	0.72	22.9	50.1	E	0.90	39.4	120.9
	NB	**F**	**1.33**	**185.4**	**494.8**	D	0.76	24.7	64.5
	SB	B	0.44	11.5	17.1	**F**	**1.33**	**178.8**	**548.8**
	Overall	**F**	**1.33**	**77.5**	**494.8**	**F**	**1.33**	**90.4**	**548.8**

Notes: Saturation flow rate of 1800 veh/h/lane; Queue is measured in metres; Peak Hour Factor = 1.00; m = metered queue; # = volume for the 95th %ile cycle exceeds capacity

It has been noted that the 95th percentile cycle exceeds capacity at several approaches and time periods at Cambrian Road and River Mist Road intersection during the PM peak period. However, as the V/C ratio for these movements is less than one, it can be assumed that the 95th percentile queue will rarely be exceeded.

Cambrian Road and River Mist Road was signalized as traffic signals were found to be warranted at this intersection in 2024 future background horizon. As a result, the operations of this intersection improve when compared to the Existing 2021 horizon. All movements operate predominantly well, with eastbound through lane having the highest V/C ratio during both AM and PM peak periods, which is expected due to high volume demands along this road.

The eastbound approach at Greenbank Road and Cambrian Road roundabout has failed during the PM peak hour as a result of background growth and future developments. The southbound and northbound approaches have remained at LOS F during the PM and AM peak hours, respectively. As high north-south volumes at this roundabout are primarily driven by the location of Ottawa CBD relative to the study area, the LOS at these approaches will improve when the realigned Greenbank Road is built. The eastbound and westbound LOS at this roundabout will improve beyond our study horizon as a result of Cambrian Road widening.

15.3.3 2029 Future Background Operations

The 2029 future background intersection volumes and other development traffic have been analyzed to allow a comparison between the future volumes with and without the proposed development. As previously mentioned, a signal warrant was met at the Cambrian Road and River Mist Road intersection in the 2029 future background horizon. The TIA for 3831 Cambrian Road prepared by CGH Transportation in 2021 has also illustrated Cambrian Road and River Mist Road intersection as signalized in 2029 future background horizon. Thus, the same intersection configuration assumptions as in 3831 Cambrian Road TIA have been used to model Cambrian Road and River Mist Road intersection within this study. Also, the TIA for Half Moon Bay West Community by Stantec in 2016 has illustrated the volumes at realigned Greenbank Road and Cambrian Road intersection in 2029 Future horizon. The same volumes are assumed and used to model Greenbank Road and Cambrian Road intersection within this study. Table 14 summarizes the operational analysis of 2029 future background conditions. Appendix M contains the 2029 future background Synchro sheets.

Table 14: 2029 Future Background Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	V/C	Delay	Q (95th)	LOS	V/C	Delay	Q (95th)
River Mist Road & Cambrian Road ***Signalized***	EBL	A	0.09	15.4	5.4	A	0.09	18.5	7.4
	EBT	E	0.95	50.6	**#142.4**	E	1.00	63.4	**#220.5**
	EBR	A	0.21	3.8	9.2	A	0.27	3.6	12.2
	WBL	A	0.42	28.0	17.3	D	0.89	65.5	**#50.4**
	WBT	C	0.73	27.7	87.9	B	0.70	22.6	132.2
	WBR	A	0.09	5.1	5.5	A	0.08	3.3	5.9
	NBL	B	0.61	24.3	60.5	A	0.40	28.2	44.0
	NBT/R	A	0.31	6.8	17.8	A	0.25	7.1	15.0
	SBL	A	0.14	15.3	12.5	A	0.07	22.7	9.9
	SBT/R	A	0.09	7.8	7.9	A	0.06	13.5	8.0
	Overall	**C**	**0.77**	**28.7**	-	**C**	**0.75**	**36.4**	-
Greenbank Road & Half Moon Bay Road ***Roundabout***	EB	A	0.21	6.2	8.0	B	0.20	10.7	8.9
	WB	B	0.20	12.7	9.4	A	0.12	6.8	4.8
	NB	A	0.72	5.2	60.2	A	0.44	4.8	23.9
	SB	A	0.23	3.9	10.5	A	0.65	4.6	50.0
	Overall	**A**	**0.72**	**5.5**	**60.2**	**A**	**0.65**	**5.2**	**50.0**
Greenbank Road & Cambrian Road ***Roundabout***	EB	**F**	**1.16**	**105.6**	**483.9**	**F**	**1.25**	**145.1**	**526.8**
	WB	D	0.84	34.0	81.8	**F**	**1.14**	**107.9**	**320.3**
	NB	**F**	**1.68**	**334.4**	**117.5**	E	0.91	41.8	125.1
	SB	C	0.59	16.0	33.0	**F**	**1.69**	**335.3**	**1004.6**
	Overall	**F**	**1.68**	**151.2**	**838.0**	**F**	**1.69**	**145.1**	**526.8**
Realigned Greenbank Road & Cambrian Road ***Unsignalized***	EBL	B	0.17	10.6	4.5	B	0.24	13.1	6.8
	EBT/R	C	0.61	17.4	30.0	**F**	**1.01**	**73.2**	**107.3**
	WBL	A	0.02	9.1	0.0	B	0.01	11.0	0.0
	WBT/R	**F**	**1.05**	**75.7**	**138.0**	**F**	**0.94**	**52.5**	**83.3**
	NB	B	0.04	10.8	0.8	B	0.12	13.5	3.0
	SB	B	0.31	12.7	9.8	D	0.80	33.5	56.3
	Overall	**E**	-	**45.6**	-	**F**	-	**50.2**	-

Notes:
Saturation flow rate of 1800 veh/h/lane
Queue is measured in metres
Peak Hour Factor = 1.00
m = metered queue
# = volume for the 95th %ile cycle exceeds capacity

The intersection of Greenbank Road and Half Moon Bay Road at the 2029 future background horizon is anticipated to operate similarly to the 2024 future background conditions.

At the intersection of River Mist Road and Cambrian Road, eastbound through movement during AM peak hour and westbound left movement during PM peak hour may exhibit extended queuing. During PM peak hour, the eastbound through movement is over theoretical capacity and may be subject to high delays and extended queues and capacity issues.

The intersection of Greenbank Road and Cambrian Road eastbound and northbound movements during AM peak hour and eastbound, westbound, and southbound movements during PM peak hour are over theoretical capacity and may be subject to high delays and extended queues capacity issues.

The intersection of Realigned Greenbank Road and Cambrian Road westbound shared through/right-turn movements during AM peak hour and eastbound and westbound shared through/right-turn movements during PM peak hour are over theoretical capacity and may be subject to high delays and extended queues.

15.3.4 2024 Future Total Operations

The 2024 total future intersection volumes, including the site generated traffic and other development traffic, have been analyzed to understand the impact of the subject development on the study area intersections. Table 15 summarizes the operational analysis of the 2024 total future conditions. Appendix N contains the 2024 future total Synchro Sheets.

Table 15: 2024 Future Total Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	V/C	Delay	Q (95th)	LOS	V/C	Delay	Q (95th)
River Mist Road & Cambrian Road *Signalized*	EBL	A	0.12	16.3	6.6	A	0.11	19.1	10.2
	EBT	D	0.83	35.7	82.0	E	0.91	46.2	#164.0
	EBR	A	0.24	4.2	9.2	A	0.29	3.9	12.5
	WBL	A	0.34	22.6	14.4	B	0.69	29.7	#29.1
	WBT	B	0.68	26.9	63.9	A	0.57	19.4	90.4
	WBR	A	0.11	5.1	5.9	A	0.10	3.2	6.4
	NBL	A	0.55	20.1	60.9	A	0.38	26.4	43.8
	NBT/R	A	0.27	6.0	17.0	A	0.23	6.8	14.6
	SBL	A	0.15	13.9	14.8	A	0.09	22.3	12.0
	SBT/R	A	0.10	6.5	8.3	A	0.07	11.5	8.5
	Overall	**B**	**0.67**	**21.4**	-	**B**	**0.65**	**26.0**	-
Greenbank Road & Half Moon Bay Road *Roundabout*	EB	A	0.28	6.3	11.7	B	0.34	11.3	15.8
	WB	B	0.17	11.0	7.5	A	0.13	7.4	5.4
	NB	A	0.66	6.4	47.7	A	0.49	5.5	27.9
	SB	A	0.22	3.9	9.4	A	0.72	4.9	63.2
	Overall	**A**	**0.66**	**6.1**	**47.7**	**A**	**0.72**	**5.9**	**63.2**
Greenbank Road & Cambrian Road *Roundabout*	EB	E	0.90	35.1	178.3	**F**	**1.08**	**83.3**	**286.3**
	WB	C	0.73	23.3	51.9	E	0.93	44.4	136.8
	NB	**F**	**1.36**	**197.3**	**520.6**	D	0.78	26.2	70.0
	SB	B	0.46	11.9	2.5	**F**	**1.36**	**191.6**	**579.9**
	Overall	**F**	**1.36**	**82.3**	**520.6**	**F**	**1.36**	**96.3**	**579.9**

Notes:
Saturation flow rate of 1800 veh/h/lane
Queue is measured in metres
Peak Hour Factor = 1.00
m = metered queue
# = volume for the 95th %ile cycle exceeds capacity

It has been noted that the 95th percentile cycle exceeds capacity at several approaches and time periods at Cambrian Road and River Mist Road intersection. However, as the V/C ratio for these movements is less than one, it can be assumed that the 95th percentile queue will rarely be exceeded.

With the addition of the site generated traffic, the intersections of River Mist Road and Cambrian Road and Greenbank Road and Half Moon Bay Road operate similarly to the 2024 future background horizon.

The operations of Greenbank Road at Cambrian Road further deteriorate. This is because in the previous horizon many movements of this intersection operate at a V/C ratio above 1.0 and no residual capacity is available for any additional traffic being introduced into the road network. However, the poor operational performance at this intersection is expected to be temporary as the traffic demands along this road will be significantly reduced once the realigned Greenbank Road is constructed beyond this study's horizons.

15.3.5 2029 Future Total Operations

The 2029 total future intersection volumes, including the site generated traffic and other development traffic, have been analyzed to understand the impact of the subject development on the study area intersections. Table

16 summarizes the operational analysis of the 2029 total future conditions. Appendix O contains the 2029 future total Synchro Sheets.

Table 16: 2029 Future Total Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	V/C	Delay	Q (95th)	LOS	V/C	Delay	Q (95th)
River Mist Road & Cambrian Road *Signalized*	EBL	A	0.10	15.8	5.5	A	0.13	20.0	7.8
	EBT	**F**	**1.12**	**97.4**	**#182.9**	**F**	**1.11**	**94.8**	**#253.8**
	EBR	A	0.21	3.8	9.2	A	0.27	4.4	14.0
	WBL	C	0.71	69.3	**#27.5**	D	0.89	65.5	**#50.4**
	WBT	C	0.79	31.5	**#113.2**	D	0.82	28.3	170.7
	WBR	A	0.08	5.1	5.5	A	0.08	3.9	6.4
	NBL	B	0.62	24.9	60.5	A	0.40	28.2	44.0
	NBT/R	A	0.31	7.6	19.3	A	0.25	7.1	15.0
	SBL	A	0.14	15.3	12.5	A	0.07	22.7	9.9
	SBT/R	A	0.09	7.8	7.9	A	0.06	13.5	8.0
	Overall	**D**	**0.87**	**48.0**	**-**	**D**	**0.81**	**49.4**	**-**
Greenbank Road & Half Moon Bay Road *Roundabout*	EB	A	0.21	6.5	8.3	B	0.35	15.6	18.1
	WB	B	0.25	14.8	11.9	A	0.16	8.6	6.8
	NB	A	0.79	5.5	77.2	A	0.59	5.0	40.4
	SB	A	0.26	3.9	12.3	A	0.85	5.4	107.7
	Overall	**A**	**0.79**	**5.8**	**77.2**	**A**	**0.85**	**6.1**	**107.7**
Greenbank Road & Cambrian Road *Roundabout*	EB	**F**	**1.31**	**166.1**	**729.9**	**F**	**1.32**	**173.4**	**656.0**
	WB	E	0.88	40.9	95.2	**F**	**1.22**	**137.6**	**389.9**
	NB	**F**	**1.69**	**340.3**	**852.5**	E	0.95	49.7	147.5
	SB	C	0.66	18.6	**42.7**	**F**	**1.82**	**391.2**	**1182.0**
	Overall	**F**	**1.69**	**172.8**	**852.5**	**F**	**1.82**	**214.1**	**1182.0**
Realigned Greenbank Road & Cambrian Road *Unsignalized*	EBL	B	0.21	12.0	5.3	B	0.29	14.9	8.3
	EBT/R	C	0.70	22.5	36.8	**F**	**1.12**	**94.6**	**117.8**
	WBL	A	0.02	9.8	0.8	B	0.01	11.5	0.0
	WBT/R	**F**	**1.25**	**152.5**	**211.5**	**F**	**1.20**	**132.7**	**157.5**
	NB	B	0.05	12.0	0.8	B	0.14	15.0	3.0
	SB	C	0.60	18.9	24.8	**F**	**1.04**	**65.1**	**93.8**
	Overall	**F**	**-**	**82.8**	**-**	**F**	**-**	**90.8**	**-**

Notes:
Saturation flow rate of 1800 veh/h/lane
Queue is measured in metres
Peak Hour Factor = 1.00
m = metered queue
# = volume for the 95th %ile cycle exceeds capacity

At the River Mist Road and Cambrian Road intersection, the eastbound through movements are over the theoretical capacity during peak hours and may be subject to high delays and extended queues. Extended queues are projected on the westbound left-turn and through movements during AM peak hour and westbound left-turn movement during PM peak hour.

Similar to 2029 future background conditions, the roundabout intersection of Half Moon Bay Way at Greenbank Road is projected to operate with a good level of service on all approaches.

The roundabout intersection of Greenbank Road and Cambrian Road is projected to operate with similar constraints to those projected in the 2029 Future Background conditions, though some movements experience worse LOS and higher delays due to the addition of site traffic from the proposed development. Beyond this study's horizons the City plans to realign Greenbank Road, reducing the traffic volumes at this roundabout and improving the LOS.

Based on the signal, left-turn warrants, and storage length requirements, Realigned Greenbank Road and Cambrian Road is assumed to be All-Way stop control with auxiliary left-turn lanes on westbound and eastbound movements. However, it is noted that the westbound movements during peak hours and eastbound and westbound shared through/right-turn movements and southbound movements during PM peak hour are over theoretical capacity and may be subject to high delays and extended queues in 2029 future total horizon. Beyond the study horizon years, and after the completion of Realigned Greenbank Road, this intersection will become a signalized intersection, accommodating vehicular and bus traffic. The design of the temporary intersection should be coordinated with the Realigned Greenbank Road detail design team to minimize throwaway and ensure coordination between the future construction and the interim temporary road.

15.3.6 Network Intersection MMLOS

Intersection MMLOS is only undertaken at signalized intersections. The two signalized intersections considered in this study are Cambrian Road at River Mist Road and future Realigned Greenbank Road at Cambrian Road. The intersection of Cambrian Road at River Mist Road is currently stop-controlled and has been signalized in 2024 and 2029 future background and future total Synchro analyses. As such, several conservative assumptions about the intersection configuration were made to evaluate the intersection MMLOS and can be seen in MMLOS worksheets in Appendix P. Table 17 summarizes the MMLOS analysis for these intersections in the Study Area for the future background condition and future total horizons. The analysis is based on the general urban area targets.

Table 17: Study Area Intersection MMLOS Analysis

Intersection	Horizon	Pedestrian LOS		Bicycle LOS		Transit LOS		Truck LOS		Auto LOS	
		PLOS	Target	BLOS	Target	TLOS	Target	TrLOS	Target	ALOS	Target
Cambrian Road & River Mist Road	2024 FB	**D**	C	D	D	N/A	N/A	N/A	N/A	B	D
	2029 FB									C	
	2024 FT									B	
	2029 FT									D	

Based on the new intersection configuration assumptions, the pedestrian LOS target is not met at Cambrian Road and River Mist Road intersection as a result of the future crossing distances at the east and west legs of the intersection.

As City of Ottawa's MMLOS Guidelines do not provide Transit LOS targets for roadways that are not a Rapid Transit Corridor or a Transit Priority Corridor, a target LOS for Transit Priority Corridor with isolated measures was used as a conservative target for Cambrian Road. This target is met in all background horizons.

General urban area targets should inform the future design process for Cambrian Road and River Mist Road intersection to ensure that these intersections operate safely and efficiently for various types of travel modes in the future.

16 Conclusions

A. The proposed development, located at 3432 Greenbank Road, is a proposed subdivision consisting of 103 single family houses, 274 executive townhomes, and 146 avenue townhouses.
B. Access to the site will be accommodated via River Boat heights and Perseus Avenue at Celestial Grove, which will be extended north through the adjacent landowner's property.

C. The development area is not currently served by transit as the nearest bus stop is approximately 750 metres walking distance from the subject development, greater than the council approved minimum of 400 metres. Therefore, it is recommended that OC Transpo look at future transit route adjustments to better serve the proposed development. Beyond this study's horizons the subject development would be served by the future Realigned Greenbank BRT.
D. The previous five years of collision history at the existing study area intersections has been reviewed. No patterns emerged that indicated that mitigation measures or further monitoring was required.
E. The trip generation rates were identified using TRANS Trip Generation Manual (2020). The South Nepean mode shares were used to determine the trip generation by mode.
F. It was found that the proposed development can be anticipated to generate 184 new AM and 202 new PM peak hour two-way vehicle trips.
G. In the existing conditions operational analysis, major approaches at the All-Way Stop Controlled intersections of River Mist Road at Cambrian Road operate at LOS F. During this horizon traffic signals were not found to be warranted. For comparison, a scenario with Two-Way Stop Controls at the intersection has been modeled. This improved the operations of major approaches; however, the operations of minor movements have deteriorated as a result.
H. Signals were projected to be warranted at Cambrian Road and River Mist Road in the 2024 future background and 2029 future background horizon.
I. Realigned Greenbank Road at Cambrian Road will be included in the 2029 future background and future total horizons, and it is assumed to be All-Way stop control with auxiliary left-turn lanes on westbound and eastbound movements based on the requirements and warrants.
J. The north and southbound approaches at the intersection of Greenbank Road and Cambrian Road are also experiencing LOS F during the peak hours. This can be explained by the location of Ottawa Centre relative to the study area with originating traffic directed towards the downtown core (north) in the AM peak hour and back towards the residential communities (south) in the PM peak hour. However, the future realigned Greenbank Road will relieve the pressures from the current Greenbank Road and improve the north and southbound LOS at the intersection of Greenbank Road at Cambrian Road.
K. In the 2024 future background horizon, traffic signals were warranted at River Mist Road and Cambrian Road intersection, which improved operations of this intersection relative to the 2021 Existing horizon. At Greenbank Road and Cambrian Road intersection, the eastbound approach fails in the PM peak hour during the 2024 future background horizon. The operational performance of the previously failing northbound and southbound movements further deteriorates, which is expected as no residual capacity is available at these movement starting from the Existing 2021 horizon.
L. With the addition of the site generated traffic, the intersection of River Mist Road and Cambrian Road and Greenbank Road and Half Moon Bay Road operate similarly to the 2029 future background horizon. The operations of Greenbank Road at Cambrian Road further deteriorate, however, the poor operational performance at this intersection is expected to be temporary as the traffic demands along this road will be significantly reduced once the realigned Greenbank Road is constructed, beyond this study's horizons.
M. The PLOS, BLOS, TLOS, and TkLOS were evaluated at Cambrian Road and River Mist Road intersection. No intersection alterations or mitigation measures are suggested as it is expected that general urban area MMLOS targets will inform the design of Cambrian Road at River Mist Road.

From a transportation perspective this development is recommended to proceed for rezoning and draft plan submission.

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Appendix A

TIA Screening Form and PM Certification Form

13 Markham Avenue
Ottawa ON K2G 3Z1

City of Ottawa 2017 TIA Guidelines
Step 1 - Screening Form

Date: 20-Sep-21
Project Number: 2020-59
Project Reference: Minto Kennedy Lands

1.1 Description of Proposed Development	
Municipal Address	3432 Greenbank Road
Description of Location	Located in Barrhaven South in the area bounded by the Jock River, the realigned Greenbank Road, and the future Proxima Terrace
Land Use Classification	DR
Development Size	598 Units
Accesses	One access at Perseus Avenue and one access at Riverboat Heights
Phase of Development	Assumed 1 Phase for TIA
Buildout Year	~2024
TIA Requirement	Full TIA Required

1.2 Trip Generation Trigger		
Land Use Type	Townhomes or apartments	
Development Size	598	Units
Trip Generation Trigger	Yes	

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

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

TIA Plan Reports

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

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

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

CERTIFICATION

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

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

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Dated at ___Newmarket_____ this __14th__ day of _____July_____, 2020.
(City)

Name: _____Mark Crockford_____
(Please Print)

Professional Title: _____Professional Engineer_____

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

Office Contact Information (Please Print)
Address: 628 Haines Road
City / Postal Code: Newmarket / L3Y 6V5
Telephone / Extension: (905) 251-4070
E-Mail Address: Mark.Crockford@CGHTransportation.com

Appendix B

Photos of Half Moon Bay Road at Greenbank Road Roundabout

From the North

From the South

From the East

From the West

Appendix C

Traffic Data

Transportation Services - Traffic Services

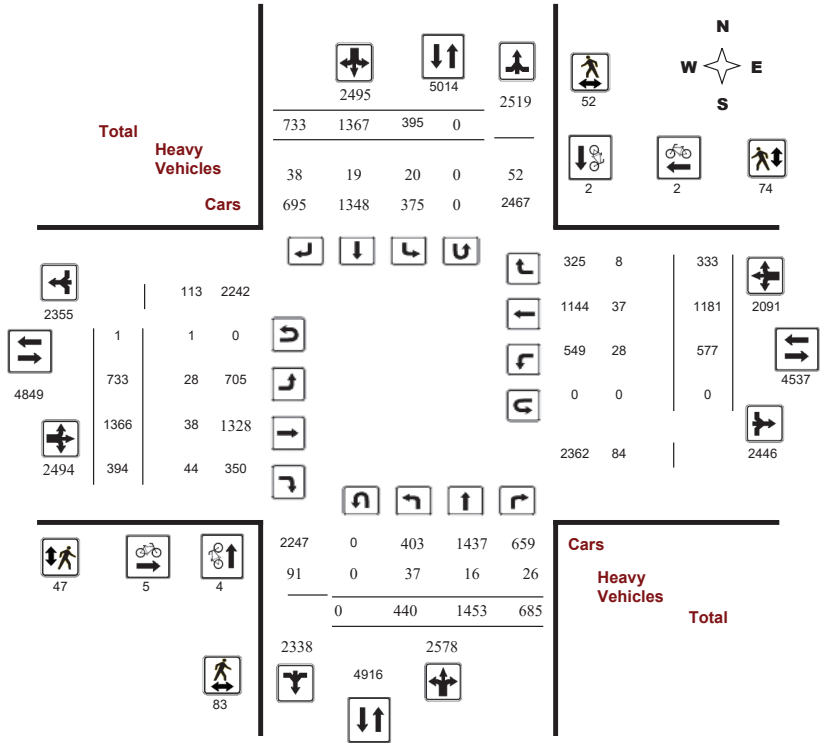
Turning Movement Count - Study Results

CAMBRIAN RD @ GREENBANK RD

Survey Date: Wednesday, September 13, 2017 **WO No:** 37240

Start Time: 07:00 **Device:** Miovision

Full Study Diagram



Transportation Services - Traffic Services

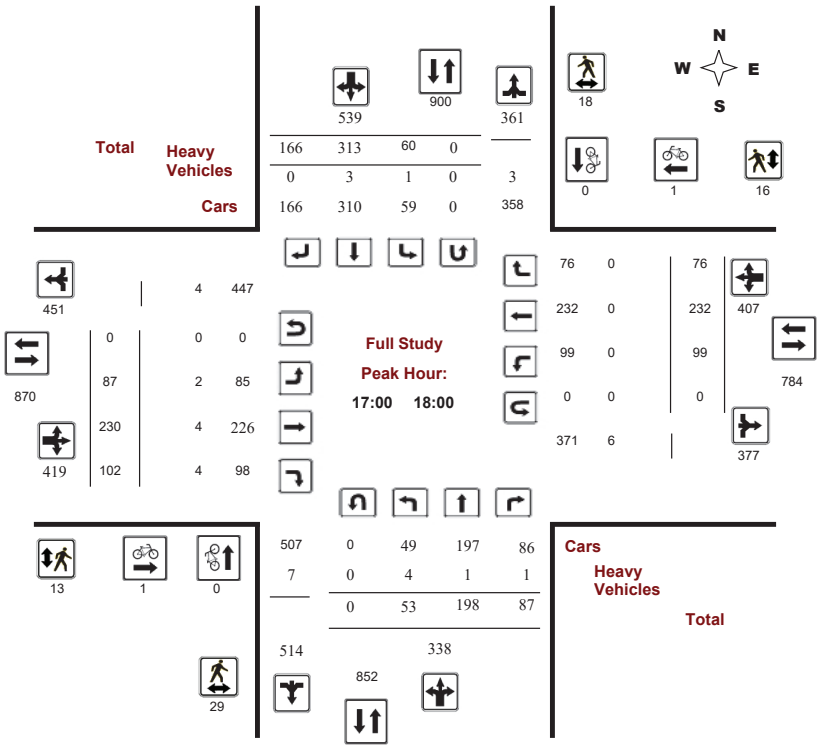
Turning Movement Count - Study Results

CAMBRIAN RD @ GREENBANK RD

Survey Date: Wednesday, September 13, 2017 **WO No:** 37240

Start Time: 07:00 **Device:** Miovision

Full Study Peak Hour Diagram



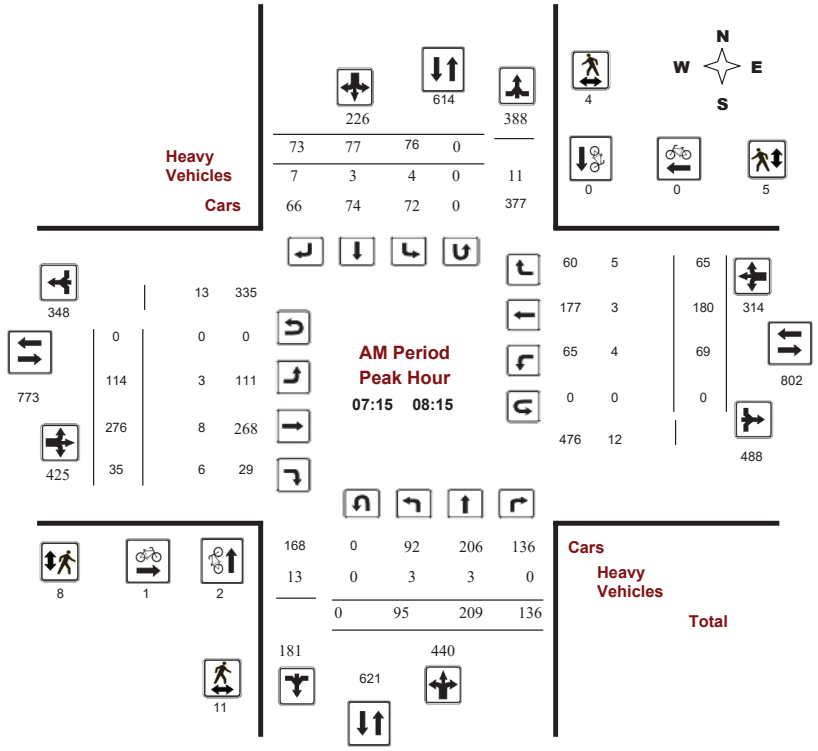
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

CAMBRIAN RD @ GREENBANK RD

Survey Date: Wednesday, September 13, 2017 **WO No:** 37240

Start Time: 07:00 **Device:** Miovision



Comments

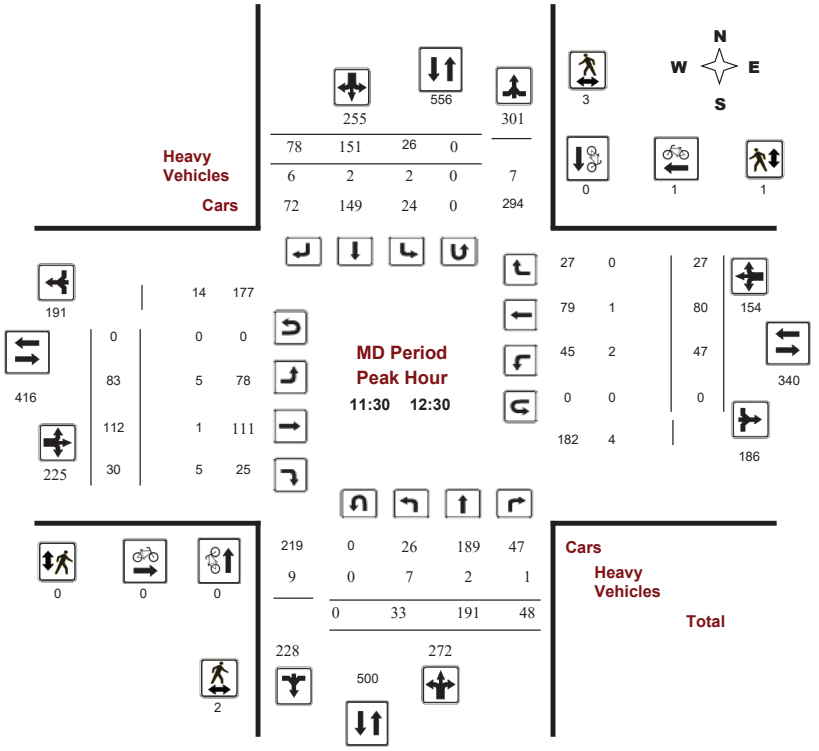
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

CAMBRIAN RD @ GREENBANK RD

Survey Date: Wednesday, September 13, 2017 **WO No:** 37240

Start Time: 07:00 **Device:** Miovision



Comments

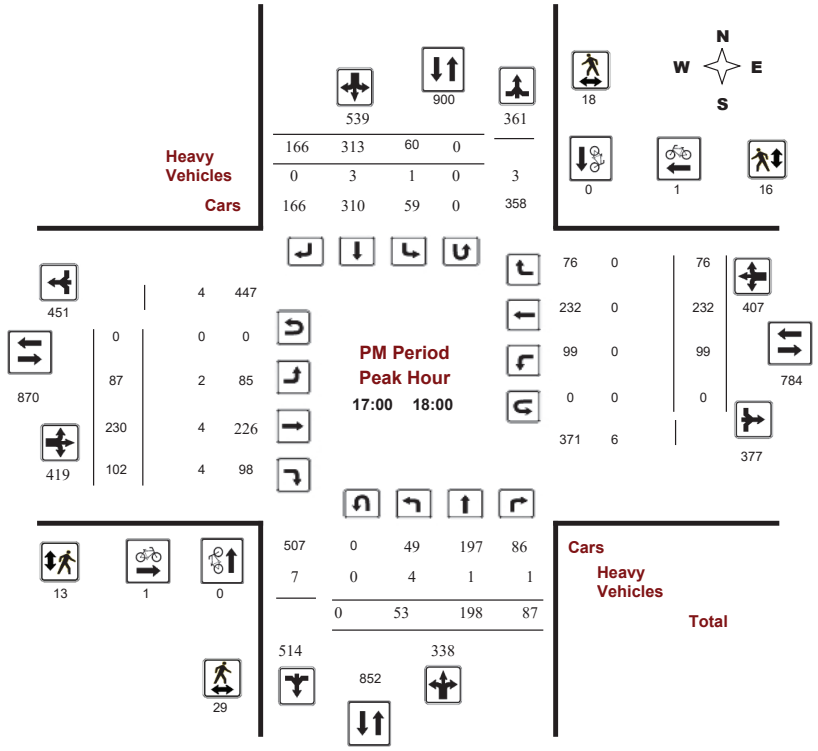
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

CAMBRIAN RD @ GREENBANK RD

Survey Date: Wednesday, September 13, 2017 **WO No:** 37240

Start Time: 07:00 **Device:** Miovision



Comments

Transportation Services - Traffic Services

Turning Movement Count - Study Results

CAMBRIAN RD @ GREENBANK RD

Survey Date: Wednesday, September 13, 2017 **WO No:** 37240

Start Time: 07:00 **Device:** Miovision

Full Study Summary (8 HR Standard)

Survey Date: Wednesday, September 13, 2017

Total Observed U-Turns

Northbound: 0 Southbound: 0

Eastbound: 1 Westbound: 0

AADT Factor

1.00

	Northbound				Southbound				Eastbound				Westbound						
Period	LT	ST	RT	NB TOT	LT	ST	RT	SB TOT	STR TOT	LT	ST	RT	EB TOT	LT	ST	RT	WB TOT	STR TOT	Grand Total
07:00 08:00	80	242	147	**469**	69	81	68	**218**	**687**	136	254	32	**422**	65	144	60	**269**	**691**	**1378**
08:00 09:00	89	198	117	**404**	73	101	78	**252**	**656**	86	232	46	**364**	66	190	37	**293**	**657**	**1313**
09:00 10:00	70	174	64	**308**	33	95	57	**185**	**493**	104	110	20	**234**	56	81	34	**171**	**405**	**898**
11:30 12:30	33	191	48	**272**	26	151	78	**255**	**527**	83	112	30	**225**	47	80	27	**154**	**379**	**906**
12:30 13:30	25	123	52	**200**	36	145	63	**244**	**444**	58	102	29	**189**	55	103	13	**171**	**360**	**804**
15:00 16:00	52	148	84	**284**	47	223	89	**359**	**643**	73	146	71	**290**	83	145	38	**266**	**556**	**1199**
16:00 17:00	38	179	86	**303**	51	258	134	**443**	**746**	106	180	64	**350**	106	206	48	**360**	**710**	**1456**
17:00 18:00	53	198	87	**338**	60	313	166	**539**	**877**	87	230	102	**419**	99	232	76	**407**	**826**	**1703**
Sub Total	440	1453	685	**2578**	395	1367	733	**2495**	**5073**	733	1366	394	**2493**	577	1181	333	**2091**	**4584**	**9657**
U Turns				**0**				**0**	**0**				**1**				**0**	**1**	**1**
Total	440	1453	685	**2578**	395	1367	733	**2495**	**5073**	733	1366	394	**2494**	577	1181	333	**2091**	**4585**	**9658**
EQ 12Hr	612	2020	952	**3583**	549	1900	1019	**3468**	**7051**	1019	1899	548	**3467**	802	1642	463	**2906**	**6373**	**13425**
Note: These values are calculated by multiplying the totals by the appropriate expansion factor.														**1.39**					
AVG 12Hr	576	1903	897	**3377**	517	1791	960	**3268**	**7051**	960	1789	516	**3267**	756	1547	436	**2739**	**6373**	**13425**
Note: These volumes are calculated by multiplying the Equivalent 12 hr. totals by the AADT factor.														**1**					
AVG 24Hr	755	2493	1176	**4424**	678	2346	1258	**4282**	**8706**	1258	2344	676	**4280**	990	2027	571	**3588**	**7868**	**16574**

Note: These volumes are calculated by multiplying the Average Daily 12 hr. totals by 12 to 24 expansion factor. **1.31**

Note: U-Turns provided for approach totals. Refer to 'U-Turn' Report for specific breakdown.

Transportation Services - Traffic Services

Turning Movement Count - Study Results

CAMBRIAN RD @ GREENBANK RD

Survey Date: Wednesday, September 13, 2017 **WO No:** 37240

Start Time: 07:00 **Device:** Miovision

Full Study 15 Minute Increments

		Northbound				Southbound					Eastbound				Westbound					
Time Period		LT	ST	RT	N TOT	LT	ST	RT	S TOT	STR TOT	LT	ST	RT	E TOT	LT	ST	RT	W TOT	STR TOT	Grand Total
07:00	07:15	11	75	41	127	11	30	13	54	2	35	49	8	92	18	16	8	42	2	315
07:15	07:30	24	71	38	133	26	12	12	50	6	43	64	6	113	17	33	9	59	6	355
07:30	07:45	25	49	35	109	19	17	20	56	8	30	70	11	111	17	41	24	82	8	358
07:45	08:00	20	47	33	100	13	22	23	58	5	28	71	7	106	13	54	19	86	5	350
08:00	08:15	26	42	30	98	18	26	18	62	1	13	71	11	95	22	52	13	87	1	342
08:15	08:30	30	53	30	113	19	23	18	60	10	28	62	9	99	18	52	8	78	10	350
08:30	08:45	17	45	31	93	18	21	24	63	11	21	55	13	89	11	42	9	62	11	307
08:45	09:00	16	58	26	100	18	31	18	67	10	24	44	13	82	15	44	7	66	10	315
09:00	09:15	22	41	15	78	7	29	14	50	2	43	30	3	76	12	21	14	47	2	251
09:15	09:30	22	38	14	74	8	24	18	50	2	32	28	5	65	15	18	12	45	2	234
09:30	09:45	17	55	18	90	9	20	5	34	4	13	29	5	47	15	17	3	35	4	206
09:45	10:00	9	40	17	66	9	22	20	51	2	16	23	7	46	14	25	5	44	2	207
11:30	11:45	12	36	20	68	5	45	18	68	3	16	23	8	47	12	18	8	38	3	221
11:45	12:00	7	49	13	69	3	31	16	50	4	25	26	8	59	17	19	6	42	4	220
12:00	12:15	9	55	7	71	11	42	21	74	5	25	32	9	66	6	16	6	28	5	239
12:15	12:30	5	51	8	64	7	33	23	63	8	17	31	5	53	12	27	7	46	8	226
12:30	12:45	10	30	12	52	14	37	21	72	4	21	22	5	48	18	23	4	45	4	217
12:45	13:00	3	32	10	45	13	42	18	73	9	12	23	9	44	11	28	2	41	9	203
13:00	13:15	6	35	13	54	6	33	13	52	5	10	26	8	44	17	29	2	48	5	198
13:15	13:30	6	26	17	49	3	33	11	47	5	15	31	7	53	9	23	5	37	5	186
15:00	15:15	9	27	22	58	8	41	16	65	5	18	35	19	72	24	32	8	64	5	259
15:15	15:30	11	39	25	75	13	47	25	85	10	14	37	19	70	21	39	8	68	10	298
15:30	15:45	17	36	16	69	15	77	24	116	5	17	35	16	68	14	41	12	67	5	320
15:45	16:00	15	46	21	82	11	58	24	93	6	24	39	17	80	24	33	10	67	6	322
16:00	16:15	12	37	22	71	11	59	32	102	6	28	42	12	82	32	47	11	90	6	345
16:15	16:30	7	41	18	66	13	71	29	113	4	22	47	16	85	28	60	18	106	4	370
16:30	16:45	10	52	20	82	17	57	27	101	1	30	37	24	91	16	54	6	76	1	350
16:45	17:00	9	49	26	84	10	71	46	127	3	26	54	12	92	30	45	13	88	3	391
17:00	17:15	13	40	20	73	14	72	38	124	5	23	63	26	112	31	64	19	114	5	423
17:15	17:30	14	56	24	94	14	73	45	132	1	19	62	27	108	29	58	16	103	1	437
17:30	17:45	11	46	24	81	15	97	38	150	2	24	48	23	95	17	62	21	100	2	426
17:45	18:00	15	56	19	90	17	71	45	133	2	21	57	26	104	22	48	20	90	2	417
Total:		440	1453	685	2578	395	1367	733	2495	156	733	1366	394	2494	577	1181	333	2091	156	9,658

Note: U-Turns are included in Totals.

Transportation Services - Traffic Services

Turning Movement Count - Study Results

CAMBRIAN RD @ GREENBANK RD

Survey Date: Wednesday, September 13, 2017 WO No: 37240

Start Time: 07:00 Device: Miovision

Full Study Cyclist Volume

Time Period		Northbound	Southbound	Street Total	Eastbound	Westbound	Street Total	Grand Total
07:00	07:15	0	0	0	0	0	0	0
07:15	07:30	1	0	1	0	0	0	1
07:30	07:45	1	0	1	0	0	0	1
07:45	08:00	0	0	0	0	0	0	0
08:00	08:15	0	0	0	1	0	1	1
08:15	08:30	0	0	0	0	0	0	0
08:30	08:45	0	0	0	0	0	0	0
08:45	09:00	0	0	0	0	0	0	0
09:00	09:15	0	0	0	0	0	0	0
09:15	09:30	0	0	0	0	0	0	0
09:30	09:45	0	0	0	0	0	0	0
09:45	10:00	0	0	0	0	0	0	0
11:30	11:45	0	0	0	0	0	0	0
11:45	12:00	0	0	0	0	0	0	0
12:00	12:15	0	0	0	0	0	0	0
12:15	12:30	0	0	0	0	1	1	1
12:30	12:45	0	0	0	2	0	2	2
12:45	13:00	0	0	0	0	0	0	0
13:00	13:15	0	0	0	0	0	0	0
13:15	13:30	0	0	0	0	0	0	0
15:00	15:15	0	0	0	0	0	0	0
15:15	15:30	0	0	0	0	0	0	0
15:30	15:45	0	0	0	1	0	1	1
15:45	16:00	2	0	2	0	0	0	2
16:00	16:15	0	0	0	0	0	0	0
16:15	16:30	0	0	0	0	0	0	0
16:30	16:45	0	0	0	0	0	0	0
16:45	17:00	0	2	2	0	0	0	2
17:00	17:15	0	0	0	0	0	0	0
17:15	17:30	0	0	0	0	1	1	1
17:30	17:45	0	0	0	0	0	0	0
17:45	18:00	0	0	0	1	0	1	1
Total		4	2	**6**	5	2	7	13

Transportation Services - Traffic Services

Turning Movement Count - Study Results

CAMBRIAN RD @ GREENBANK RD

Survey Date: Wednesday, September 13, 2017 **WO No:** 37240

Start Time: 07:00 **Device:** Miovision

Full Study Pedestrian Volume

Time Period	NB Approach (E or W Crossing)	SB Approach (E or W Crossing)	Total	EB Approach (N or S Crossing)	WB Approach (N or S Crossing)	Total	Grand Total
07:00 07:15	0	0	**0**	0	0	**0**	**0**
07:15 07:30	7	0	**7**	1	0	**1**	**8**
07:30 07:45	3	1	**4**	1	2	**3**	**7**
07:45 08:00	1	3	**4**	1	3	**4**	**8**
08:00 08:15	0	0	**0**	5	0	**5**	**5**
08:15 08:30	2	1	**3**	2	0	**2**	**5**
08:30 08:45	1	0	**1**	3	0	**3**	**4**
08:45 09:00	9	2	**11**	4	5	**9**	**20**
09:00 09:15	4	0	**4**	1	12	**13**	**17**
09:15 09:30	0	1	**1**	0	6	**6**	**7**
09:30 09:45	1	1	**2**	2	1	**3**	**5**
09:45 10:00	0	0	**0**	2	1	**3**	**3**
11:30 11:45	2	1	**3**	0	1	**1**	**4**
11:45 12:00	0	0	**0**	0	0	**0**	**0**
12:00 12:15	0	1	**1**	0	0	**0**	**1**
12:15 12:30	0	1	**1**	0	0	**0**	**1**
12:30 12:45	1	0	**1**	0	2	**2**	**3**
12:45 13:00	1	1	**2**	0	0	**0**	**2**
13:00 13:15	0	1	**1**	0	1	**1**	**2**
13:15 13:30	1	0	**1**	0	0	**0**	**1**
15:00 15:15	0	0	**0**	0	3	**3**	**3**
15:15 15:30	0	4	**4**	4	3	**7**	**11**
15:30 15:45	0	5	**5**	4	6	**10**	**15**
15:45 16:00	7	0	**7**	4	1	**5**	**12**
16:00 16:15	3	2	**5**	0	1	**1**	**6**
16:15 16:30	2	4	**6**	0	2	**2**	**8**
16:30 16:45	5	3	**8**	0	8	**8**	**16**
16:45 17:00	4	2	**6**	0	0	**0**	**6**
17:00 17:15	16	11	**27**	4	7	**11**	**38**
17:15 17:30	1	2	**3**	3	5	**8**	**11**
17:30 17:45	2	1	**3**	0	4	**4**	**7**
17:45 18:00	10	4	**14**	6	0	**6**	**20**
Total	83	52	**135**	47	74	**121**	**256**

Transportation Services - Traffic Services

Turning Movement Count - Study Results

CAMBRIAN RD @ GREENBANK RD

Survey Date: Wednesday, September 13, 2017 **WO No:** 37240

Start Time: 07:00 **Device:** Miovision

Full Study Heavy Vehicles

		Northbound				Southbound					Eastbound				Westbound					
Time Period		LT	ST	RT	N TOT	LT	ST	RT	S TOT	STR TOT	LT	ST	RT	E TOT	LT	ST	RT	W TOT	STR TOT	Grand Total
07:00	07:15	0	0	0	**0**	1	0	1	**2**	**2**	0	3	5	**8**	1	0	0	**1**	**9**	**11**
07:15	07:30	2	2	0	**4**	0	1	1	**2**	**6**	3	1	1	**5**	2	0	1	**3**	**8**	**14**
07:30	07:45	0	1	0	**1**	3	2	2	**7**	**8**	0	2	1	**3**	0	1	1	**2**	**5**	**13**
07:45	08:00	1	0	0	**1**	1	0	3	**4**	**5**	0	2	2	**4**	2	0	1	**3**	**7**	**12**
08:00	08:15	0	0	0	**0**	0	0	1	**1**	**1**	0	3	2	**5**	0	2	2	**4**	**9**	**10**
08:15	08:30	4	0	2	**6**	1	1	2	**4**	**10**	1	2	1	**4**	3	3	0	**6**	**10**	**20**
08:30	08:45	0	1	2	**3**	2	1	5	**8**	**11**	2	2	1	**5**	1	1	0	**2**	**7**	**18**
08:45	09:00	2	0	4	**6**	1	2	1	**4**	**10**	2	4	1	**8**	3	3	0	**6**	**14**	**24**
09:00	09:15	1	0	1	**2**	0	0	0	**0**	**2**	4	0	0	**4**	1	1	2	**4**	**8**	**10**
09:15	09:30	1	0	0	**1**	0	0	1	**1**	**2**	0	0	1	**1**	2	1	0	**3**	**4**	**6**
09:30	09:45	0	0	1	**1**	2	1	0	**3**	**4**	1	0	0	**1**	0	0	0	**0**	**1**	**5**
09:45	10:00	1	1	0	**2**	0	0	0	**0**	**2**	1	1	2	**4**	2	1	0	**3**	**7**	**9**
11:30	11:45	1	1	0	**2**	0	1	0	**1**	**3**	1	0	1	**2**	0	0	0	**0**	**2**	**5**
11:45	12:00	2	0	0	**2**	0	0	2	**2**	**4**	0	0	2	**2**	1	0	0	**1**	**3**	**7**
12:00	12:15	3	0	0	**3**	0	0	2	**2**	**5**	3	0	1	**4**	1	0	0	**1**	**5**	**10**
12:15	12:30	1	1	1	**3**	2	1	2	**5**	**8**	1	1	1	**3**	0	1	0	**1**	**4**	**12**
12:30	12:45	1	0	0	**1**	0	1	2	**3**	**4**	1	0	1	**2**	1	1	0	**2**	**4**	**8**
12:45	13:00	1	2	1	**4**	1	0	4	**5**	**9**	0	1	2	**3**	0	4	0	**4**	**7**	**16**
13:00	13:15	1	1	1	**3**	0	0	2	**2**	**5**	1	1	2	**4**	1	2	0	**3**	**7**	**12**
13:15	13:30	1	1	2	**4**	0	1	0	**1**	**5**	2	1	1	**4**	2	1	0	**3**	**7**	**12**
15:00	15:15	2	0	2	**4**	0	0	1	**1**	**5**	0	2	3	**5**	0	2	0	**2**	**7**	**12**
15:15	15:30	4	1	3	**8**	1	1	0	**2**	**10**	0	3	1	**4**	1	1	0	**2**	**6**	**16**
15:30	15:45	0	3	0	**3**	1	0	1	**2**	**5**	0	0	0	**0**	1	2	0	**3**	**3**	**8**
15:45	16:00	1	0	1	**2**	2	1	1	**4**	**6**	1	0	4	**5**	1	3	0	**4**	**9**	**15**
16:00	16:15	1	0	1	**2**	1	0	3	**4**	**6**	1	2	1	**4**	0	1	1	**2**	**6**	**12**
16:15	16:30	1	0	1	**2**	0	1	1	**2**	**4**	1	2	0	**3**	0	4	0	**4**	**7**	**11**
16:30	16:45	0	0	1	**1**	0	0	0	**0**	**1**	0	1	2	**3**	1	1	0	**2**	**5**	**6**
16:45	17:00	1	0	1	**2**	0	1	0	**1**	**3**	0	0	1	**1**	1	1	0	**2**	**3**	**6**
17:00	17:15	1	1	1	**3**	1	1	0	**2**	**5**	1	2	1	**4**	0	0	0	**0**	**4**	**9**
17:15	17:30	1	0	0	**1**	0	0	0	**0**	**1**	0	0	1	**1**	0	0	0	**0**	**1**	**2**
17:30	17:45	1	0	0	**1**	0	1	0	**1**	**2**	1	1	1	**3**	0	0	0	**0**	**3**	**5**
17:45	18:00	1	0	0	**1**	0	1	0	**1**	**2**	0	1	1	**2**	0	0	0	**0**	**2**	**4**
Total:	None	37	16	26	**79**	20	19	38	**77**	**156**	28	38	44	**111**	28	37	8	**73**	**184**	**340**

Transportation Services - Traffic Services

Turning Movement Count - Study Results

CAMBRIAN RD @ GREENBANK RD

Survey Date: Wednesday, September 13, 2017 **WO No:** 37240

Start Time: 07:00 **Device:** Miovision

Full Study 15 Minute U-Turn Total

Time Period		Northbound U-Turn Total	Southbound U-Turn Total	Eastbound U-Turn Total	Westbound U-Turn Total	Total
07:00	07:15	0	0	0	0	0
07:15	07:30	0	0	0	0	0
07:30	07:45	0	0	0	0	0
07:45	08:00	0	0	0	0	0
08:00	08:15	0	0	0	0	0
08:15	08:30	0	0	0	0	0
08:30	08:45	0	0	0	0	0
08:45	09:00	0	0	1	0	1
09:00	09:15	0	0	0	0	0
09:15	09:30	0	0	0	0	0
09:30	09:45	0	0	0	0	0
09:45	10:00	0	0	0	0	0
11:30	11:45	0	0	0	0	0
11:45	12:00	0	0	0	0	0
12:00	12:15	0	0	0	0	0
12:15	12:30	0	0	0	0	0
12:30	12:45	0	0	0	0	0
12:45	13:00	0	0	0	0	0
13:00	13:15	0	0	0	0	0
13:15	13:30	0	0	0	0	0
15:00	15:15	0	0	0	0	0
15:15	15:30	0	0	0	0	0
15:30	15:45	0	0	0	0	0
15:45	16:00	0	0	0	0	0
16:00	16:15	0	0	0	0	0
16:15	16:30	0	0	0	0	0
16:30	16:45	0	0	0	0	0
16:45	17:00	0	0	0	0	0
17:00	17:15	0	0	0	0	0
17:15	17:30	0	0	0	0	0
17:30	17:45	0	0	0	0	0
17:45	18:00	0	0	0	0	0
Total		0	0	1	0	1

Transportation Services - Traffic Services

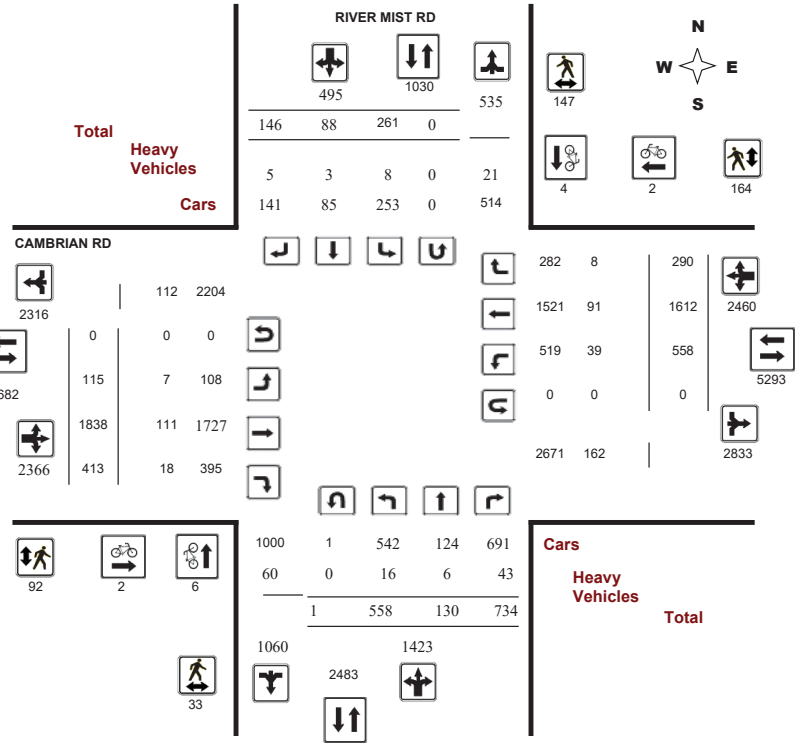
Turning Movement Count - Study Results

CAMBRIAN RD @ RIVER MIST RD

Survey Date: Wednesday, October 23, 2019 **WO No:** 38918

Start Time: 07:00 **Device:** Miovision

Full Study Diagram



Transportation Services - Traffic Services

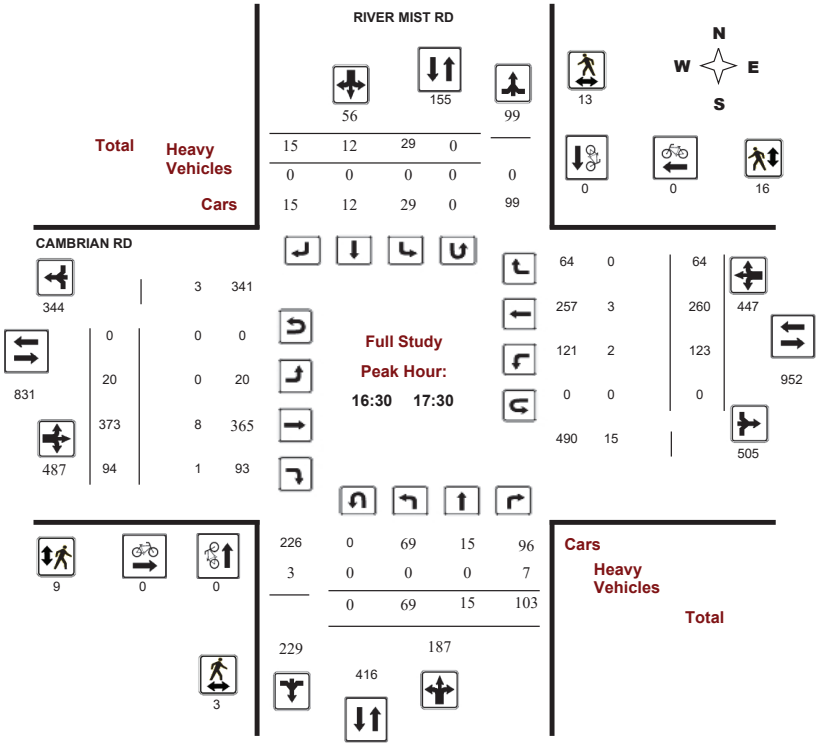
Turning Movement Count - Study Results

CAMBRIAN RD @ RIVER MIST RD

Survey Date: Wednesday, October 23, 2019 **WO No:** 38918

Start Time: 07:00 **Device:** Miovision

Full Study Peak Hour Diagram



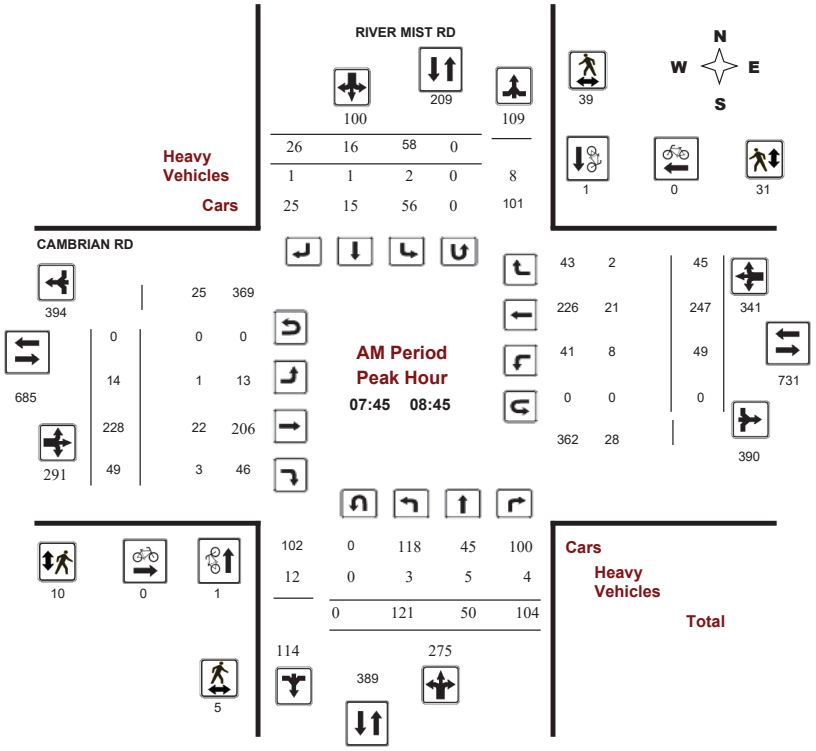
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

CAMBRIAN RD @ RIVER MIST RD

Survey Date: Wednesday, October 23, 2019 **WO No:** 38918

Start Time: 07:00 **Device:** Miovision



Comments

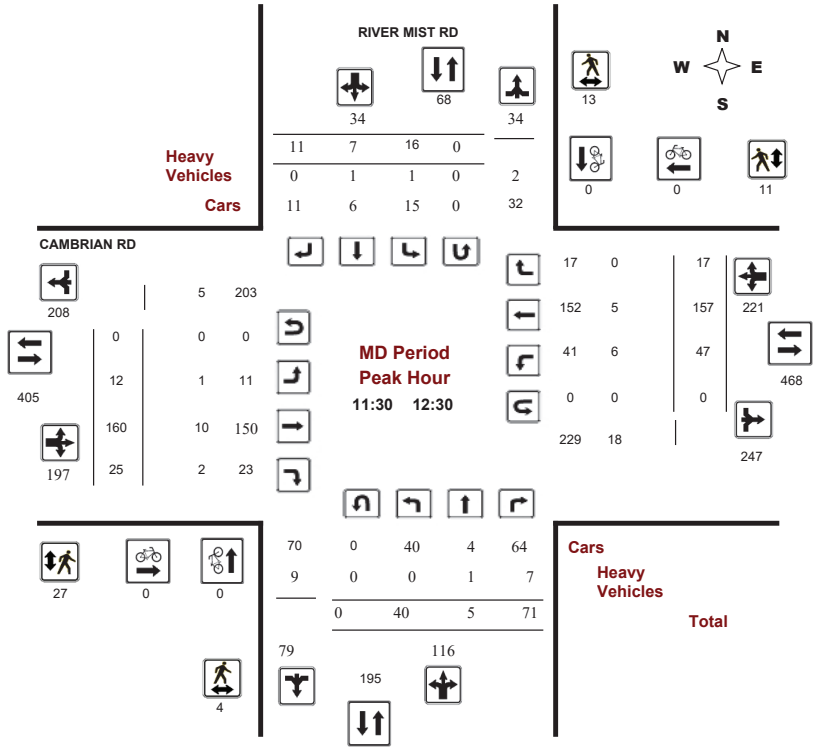
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

CAMBRIAN RD @ RIVER MIST RD

Survey Date: Wednesday, October 23, 2019 **WO No:** 38918

Start Time: 07:00 **Device:** Miovision



Comments

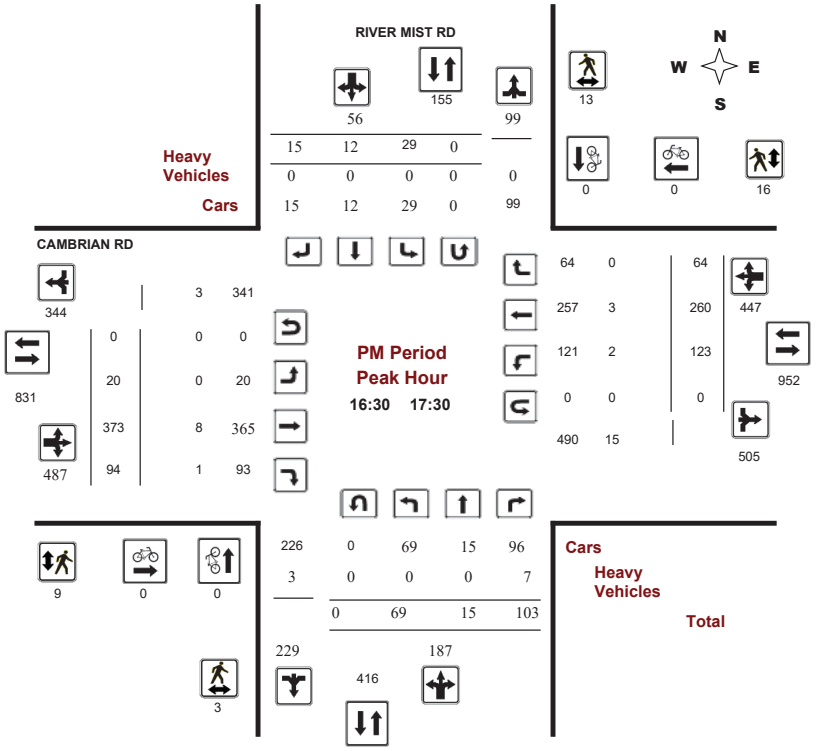
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

CAMBRIAN RD @ RIVER MIST RD

Survey Date: Wednesday, October 23, 2019 **WO No:** 38918

Start Time: 07:00 **Device:** Miovision



Comments

Transportation Services - Traffic Services

Turning Movement Count - Study Results

CAMBRIAN RD @ RIVER MIST RD

Survey Date: Wednesday, October 23, 2019 **WO No:** 38918

Start Time: 07:00 **Device:** Miovision

Full Study Summary (8 HR Standard)

Survey Date: Wednesday, October 23, 201

Total Observed U-Turns

Northbound: 1 Southbound: 0

Eastbound: 0 Westbound: 0

AADT Factor .90

	RIVER MIST RD								CAMBRIAN RD									
	Northbound				Southbound				Eastbound				Westbound					
Period	LT	ST	RT	NB TOT	LT	ST	RT	SB TOT	STR TOT	LT	ST	RT	EB TOT	LT	ST	RT	WB TOT	STR TOT	Grand Total
07:00 08:00	112	19	133	**264**	42	6	25	**73**	**337**	12	198	38	**248**	35	227	35	**297**	**545**	**882**
08:00 09:00	113	47	100	**260**	54	19	25	**98**	**358**	13	226	45	**284**	56	246	36	**338**	**622**	**980**
09:00 10:00	82	9	107	**198**	22	10	16	**48**	**246**	9	149	28	**186**	46	173	21	**240**	**426**	**672**
11:30 12:30	40	5	71	**116**	16	7	11	**34**	**150**	12	160	25	**197**	47	157	17	**221**	**418**	**568**
12:30 13:30	24	6	55	**85**	11	1	14	**26**	**111**	8	150	34	**192**	41	140	26	**207**	**399**	**510**
15:00 16:00	57	17	80	**154**	50	15	20	**85**	**239**	17	229	65	**311**	85	167	38	**290**	**601**	**840**
16:00 17:00	61	13	87	**161**	32	15	15	**62**	**223**	20	371	76	**467**	121	254	54	**429**	**896**	**1119**
17:00 18:00	69	14	101	**184**	34	15	20	**69**	**253**	24	355	102	**481**	127	248	63	**438**	**919**	**1172**
Sub Total	558	130	734	**1422**	261	88	146	**495**	**1917**	115	1838	413	**2366**	558	1612	290	**2460**	**4826**	**6743**
U Turns				**1**				**0**	**1**				**0**				**0**	**0**	**1**
Total	558	130	734	**1423**	261	88	146	**495**	**1918**	115	1838	413	**2366**	558	1612	290	**2460**	**4826**	**6744**
EQ 12Hr	776	181	1020	**1978**	363	122	203	**688**	**2666**	160	2555	574	**3289**	776	2241	403	**3419**	**6708**	**9374**
Note: These values are calculated by multiplying the totals by the appropriate expansion factor.														**1.39**					
AVG 12Hr	658	153	865	**1678**	308	104	172	**584**	**2399**	136	2167	487	**2790**	658	1901	342	**2900**	**6037**	**8437**
Note: These volumes are calculated by multiplying the Equivalent 12 hr. totals by the AADT factor.														**0.9**					
AVG 24Hr	862	201	1134	**2198**	403	136	225	**765**	**2963**	178	2839	638	**3654**	862	2490	448	**3799**	**7453**	**10416**
Note: These volumes are calculated by multiplying the Average Daily 12 hr. totals by 12 to 24 expansion factor.														**1.31**					

Note: U-Turns provided for approach totals. Refer to 'U-Turn' Report for specific breakdown.

Transportation Services - Traffic Services

Turning Movement Count - Study Results

CAMBRIAN RD @ RIVER MIST RD

Survey Date: Wednesday, October 23, 2019 **WO No:** 38918

Start Time: 07:00 **Device:** Miovision

Full Study 15 Minute Increments

		RIVER MIST RD									CAMBRIAN RD									
		Northbound				Southbound					Eastbound				Westbound					
Time Period		LT	ST	RT	N TOT	LT	ST	RT	S TOT	STR TOT	LT	ST	RT	E TOT	LT	ST	RT	W TOT	STR TOT	Grand Total
07:00	07:15	24	4	33	61	10	0	4	14	1	3	50	7	60	9	57	2	68	1	203
07:15	07:30	22	5	37	64	10	2	7	19	3	2	53	9	64	11	46	8	65	3	212
07:30	07:45	28	5	30	63	13	2	7	22	2	4	43	11	58	7	61	12	80	2	223
07:45	08:00	38	5	33	76	9	2	7	18	2	3	52	11	66	8	63	13	84	2	244
08:00	08:15	32	12	28	72	9	1	10	20	5	5	57	12	74	12	65	14	91	5	257
08:15	08:30	33	28	22	83	26	6	6	38	5	4	56	10	70	10	58	15	83	5	274
08:30	08:45	18	5	21	44	14	7	3	24	4	2	63	16	81	19	61	3	83	4	232
08:45	09:00	30	2	29	61	5	5	6	16	1	2	50	7	59	15	62	4	81	1	217
09:00	09:15	32	7	52	91	9	5	4	18	4	1	49	12	62	13	66	5	84	4	255
09:15	09:30	18	0	18	36	9	2	3	14	0	5	38	3	46	13	38	5	56	0	152
09:30	09:45	14	1	26	41	2	1	3	6	1	1	37	3	41	13	34	7	54	1	142
09:45	10:00	18	1	11	30	2	2	6	10	1	2	25	10	37	7	35	4	46	1	123
11:30	11:45	16	0	21	37	2	3	5	10	3	2	38	10	50	13	46	2	61	3	158
11:45	12:00	7	1	8	16	5	1	5	11	1	2	39	4	45	10	41	5	56	1	128
12:00	12:15	9	3	20	32	7	2	1	10	1	2	47	5	54	12	41	4	57	1	153
12:15	12:30	8	1	22	31	2	1	0	3	5	6	36	6	48	12	29	6	47	5	129
12:30	12:45	10	2	16	29	2	0	5	7	1	2	41	6	49	8	38	7	53	1	138
12:45	13:00	7	0	7	14	6	1	4	11	1	1	40	12	53	12	36	2	50	1	128
13:00	13:15	2	3	17	22	2	0	4	6	3	3	33	8	44	10	30	6	46	3	118
13:15	13:30	5	1	15	21	1	0	1	2	2	2	36	8	46	11	36	11	58	2	127
15:00	15:15	10	2	11	23	21	3	4	28	7	4	61	11	76	18	37	10	65	7	192
15:15	15:30	7	5	14	26	12	4	10	26	2	3	52	16	71	25	40	9	74	2	197
15:30	15:45	12	2	23	37	8	7	2	17	4	6	67	18	91	16	45	7	68	4	213
15:45	16:00	28	8	32	68	9	1	4	14	3	4	49	20	73	26	45	12	83	3	238
16:00	16:15	18	3	24	45	11	4	3	18	2	7	91	17	115	30	63	14	107	2	285
16:15	16:30	8	3	18	29	8	5	5	18	5	3	75	21	99	27	63	12	102	5	248
16:30	16:45	16	3	23	42	7	5	5	17	0	5	119	18	142	29	65	14	108	0	309
16:45	17:00	19	4	22	45	6	1	2	9	3	5	86	20	111	35	63	14	112	3	277
17:00	17:15	13	5	40	58	8	4	5	17	2	6	83	31	120	24	67	14	105	2	300
17:15	17:30	21	3	18	42	8	2	3	13	2	4	85	25	114	35	65	22	122	2	291
17:30	17:45	12	3	21	36	10	5	9	24	3	5	105	23	133	36	58	16	110	3	303
17:45	18:00	23	3	22	48	8	4	3	15	2	9	82	23	114	32	58	11	101	2	278
Total:		558	130	734	1423	261	88	146	495	81	115	1838	413	2366	558	1612	290	2460	81	6,744

Note: U-Turns are included in Totals.

Transportation Services - Traffic Services

Turning Movement Count - Study Results

CAMBRIAN RD @ RIVER MIST RD

Survey Date: Wednesday, October 23, 2019 **WO No:** 38918

Start Time: 07:00 **Device:** Miovision

Full Study Cyclist Volume

Time Period		RIVER MIST RD Northbound	RIVER MIST RD Southbound	RIVER MIST RD Street Total	CAMBRIAN RD Eastbound	CAMBRIAN RD Westbound	CAMBRIAN RD Street Total	Grand Total
07:00	07:15	0	0	0	0	1	1	1
07:15	07:30	0	0	0	0	0	0	0
07:30	07:45	1	0	1	1	0	1	2
07:45	08:00	0	0	0	0	0	0	0
08:00	08:15	0	1	1	0	0	0	1
08:15	08:30	1	0	1	0	0	0	1
08:30	08:45	0	0	0	0	0	0	0
08:45	09:00	0	0	0	1	0	1	1
09:00	09:15	0	0	0	0	0	0	0
09:15	09:30	0	0	0	0	1	1	1
09:30	09:45	1	0	1	0	0	0	1
09:45	10:00	0	0	0	0	0	0	0
11:30	11:45	0	0	0	0	0	0	0
11:45	12:00	0	0	0	0	0	0	0
12:00	12:15	0	0	0	0	0	0	0
12:15	12:30	0	0	0	0	0	0	0
12:30	12:45	0	0	0	0	0	0	0
12:45	13:00	0	0	0	0	0	0	0
13:00	13:15	0	0	0	0	0	0	0
13:15	13:30	0	0	0	0	0	0	0
15:00	15:15	0	2	2	0	0	0	2
15:15	15:30	1	0	1	0	0	0	1
15:30	15:45	0	0	0	0	0	0	0
15:45	16:00	2	0	2	0	0	0	2
16:00	16:15	0	1	1	0	0	0	1
16:15	16:30	0	0	0	0	0	0	0
16:30	16:45	0	0	0	0	0	0	0
16:45	17:00	0	0	0	0	0	0	0
17:00	17:15	0	0	0	0	0	0	0
17:15	17:30	0	0	0	0	0	0	0
17:30	17:45	0	0	0	0	0	0	0
17:45	18:00	0	0	0	0	0	0	0
Total		6	4	**10**	2	2	4	14

Transportation Services - Traffic Services

Turning Movement Count - Study Results

CAMBRIAN RD @ RIVER MIST RD

Survey Date: Wednesday, October 23, 2019 **WO No:** 38918

Start Time: 07:00 **Device:** Miovision

Full Study Pedestrian Volume

Time Period		RIVER MIST RD NB Approach (E or W Crossing)	RIVER MIST RD SB Approach (E or W Crossing)	RIVER MIST RD Total	CAMBRIAN RD EB Approach (N or S Crossing)	CAMBRIAN RD WB Approach (N or S Crossing)	CAMBRIAN RD Total	Grand Total
07:00	07:15	1	2	**3**	1	4	**5**	**8**
07:15	07:30	0	3	**3**	7	1	**8**	**11**
07:30	07:45	0	5	**5**	1	4	**5**	**10**
07:45	08:00	0	6	**6**	0	0	**0**	**6**
08:00	08:15	1	19	**20**	3	11	**14**	**34**
08:15	08:30	0	8	**8**	0	13	**13**	**21**
08:30	08:45	4	6	**10**	7	7	**14**	**24**
08:45	09:00	4	8	**12**	2	8	**10**	**22**
09:00	09:15	0	0	**0**	0	1	**1**	**1**
09:15	09:30	0	1	**1**	0	3	**3**	**4**
09:30	09:45	0	1	**1**	0	2	**2**	**3**
09:45	10:00	1	1	**2**	0	3	**3**	**5**
11:30	11:45	2	2	**4**	23	4	**27**	**31**
11:45	12:00	0	2	**2**	0	0	**0**	**2**
12:00	12:15	2	5	**7**	2	4	**6**	**13**
12:15	12:30	0	4	**4**	2	3	**5**	**9**
12:30	12:45	1	1	**2**	0	1	**1**	**3**
12:45	13:00	2	2	**4**	1	3	**4**	**8**
13:00	13:15	0	4	**4**	4	3	**7**	**11**
13:15	13:30	0	1	**1**	0	0	**0**	**1**
15:00	15:15	3	9	**12**	6	30	**36**	**48**
15:15	15:30	0	3	**3**	8	5	**13**	**16**
15:30	15:45	2	8	**10**	0	8	**8**	**18**
15:45	16:00	1	12	**13**	8	3	**11**	**24**
16:00	16:15	3	6	**9**	3	6	**9**	**18**
16:15	16:30	2	7	**9**	1	4	**5**	**14**
16:30	16:45	1	2	**3**	4	0	**4**	**7**
16:45	17:00	1	9	**10**	4	4	**8**	**18**
17:00	17:15	1	2	**3**	1	6	**7**	**10**
17:15	17:30	0	0	**0**	0	6	**6**	**6**
17:30	17:45	1	6	**7**	3	10	**13**	**20**
17:45	18:00	0	2	**2**	1	7	**8**	**10**
Total	.....	33	147	**180**	92	164	**256**	**436**

Transportation Services - Traffic Services

Turning Movement Count - Study Results

CAMBRIAN RD @ RIVER MIST RD

Survey Date: Wednesday, October 23, 2019 **WO No:** 38918

Start Time: 07:00 **Device:** Miovision

Full Study Heavy Vehicles

		RIVER MIST RD									CAMBRIAN RD									
		Northbound				Southbound					Eastbound				Westbound					
Time Period		LT	ST	RT	N TOT	LT	ST	RT	S TOT	STR TOT	LT	ST	RT	E TOT	LT	ST	RT	W TOT	STR TOT	Grand Total
07:00	07:15	0	0	1	**1**	0	0	0	**0**	**1**	1	2	1	**4**	3	4	0	**7**	**11**	**12**
07:15	07:30	0	0	3	**3**	0	0	0	**0**	**3**	0	7	2	**9**	2	4	1	**7**	**16**	**19**
07:30	07:45	1	0	1	**2**	0	0	0	**0**	**2**	0	3	0	**3**	1	4	1	**6**	**9**	**11**
07:45	08:00	2	0	0	**2**	0	0	0	**0**	**2**	1	7	2	**10**	2	5	0	**7**	**17**	**19**
08:00	08:15	0	3	1	**4**	0	0	1	**1**	**5**	0	3	1	**4**	2	4	1	**7**	**11**	**16**
08:15	08:30	1	2	0	**3**	2	0	0	**2**	**5**	0	5	0	**5**	1	4	1	**6**	**11**	**16**
08:30	08:45	0	0	3	**3**	0	1	0	**1**	**4**	0	7	0	**7**	3	8	0	**11**	**18**	**22**
08:45	09:00	1	0	0	**1**	0	0	0	**0**	**1**	1	4	2	**7**	1	8	0	**9**	**16**	**17**
09:00	09:15	3	0	1	**4**	0	0	0	**0**	**4**	0	0	1	**1**	1	8	0	**9**	**10**	**14**
09:15	09:30	0	0	0	**0**	0	0	0	**0**	**0**	0	3	0	**3**	1	1	0	**2**	**5**	**5**
09:30	09:45	0	0	1	**1**	0	0	0	**0**	**1**	0	5	0	**5**	2	2	1	**5**	**10**	**11**
09:45	10:00	0	0	1	**1**	0	0	0	**0**	**1**	0	4	0	**4**	2	2	0	**4**	**8**	**9**
11:30	11:45	0	0	2	**2**	1	0	0	**1**	**3**	0	6	1	**7**	2	1	0	**3**	**10**	**13**
11:45	12:00	0	0	1	**1**	0	0	0	**0**	**1**	0	0	0	**0**	2	1	0	**3**	**3**	**4**
12:00	12:15	0	0	1	**1**	0	0	0	**0**	**1**	1	3	1	**5**	1	1	0	**2**	**7**	**8**
12:15	12:30	0	1	3	**4**	0	1	0	**1**	**5**	0	1	0	**1**	1	2	0	**3**	**4**	**9**
12:30	12:45	0	0	1	**1**	0	0	0	**0**	**1**	0	4	0	**4**	1	1	1	**3**	**7**	**8**
12:45	13:00	0	0	0	**0**	0	0	1	**1**	**1**	1	4	1	**6**	1	2	1	**4**	**10**	**11**
13:00	13:15	0	0	2	**2**	0	0	1	**1**	**3**	0	4	1	**5**	1	0	0	**1**	**6**	**9**
13:15	13:30	1	0	1	**2**	0	0	0	**0**	**2**	1	5	0	**6**	1	4	0	**5**	**11**	**13**
15:00	15:15	1	0	1	**2**	5	0	0	**5**	**7**	1	4	2	**7**	1	1	0	**2**	**9**	**16**
15:15	15:30	0	0	1	**1**	0	0	1	**1**	**2**	0	2	1	**3**	1	2	0	**3**	**6**	**8**
15:30	15:45	1	0	3	**4**	0	0	0	**0**	**4**	0	2	1	**3**	1	5	0	**6**	**9**	**13**
15:45	16:00	1	0	1	**2**	0	0	1	**1**	**3**	0	7	0	**7**	1	3	0	**4**	**11**	**14**
16:00	16:15	1	0	1	**2**	0	0	0	**0**	**2**	0	6	0	**6**	1	3	1	**5**	**11**	**13**
16:15	16:30	2	0	2	**4**	0	1	0	**1**	**5**	0	1	0	**1**	0	6	0	**6**	**7**	**12**
16:30	16:45	0	0	0	**0**	0	0	0	**0**	**0**	0	1	0	**1**	1	2	0	**3**	**4**	**4**
16:45	17:00	0	0	3	**3**	0	0	0	**0**	**3**	0	2	1	**3**	0	0	0	**0**	**3**	**6**
17:00	17:15	0	0	2	**2**	0	0	0	**0**	**2**	0	2	0	**2**	1	1	0	**2**	**4**	**6**
17:15	17:30	0	0	2	**2**	0	0	0	**0**	**2**	0	3	0	**3**	0	0	0	**0**	**3**	**5**
17:30	17:45	1	0	2	**3**	0	0	0	**0**	**3**	0	2	0	**2**	1	1	0	**2**	**4**	**7**
17:45	18:00	0	0	2	**2**	0	0	0	**0**	**2**	0	2	0	**2**	0	1	0	**1**	**3**	**5**
Total:	None	16	6	43	**65**	8	3	5	**16**	**81**	7	111	18	**136**	39	91	8	**138**	**274**	**355**

Transportation Services - Traffic Services

Turning Movement Count - Study Results

CAMBRIAN RD @ RIVER MIST RD

Survey Date: Wednesday, October 23, 2019 **WO No:** 38918

Start Time: 07:00 **Device:** Miovision

Full Study 15 Minute U-Turn Total

		RIVER MIST RD		CAMBRIAN RD		
Time Period		Northbound U-Turn Total	Southbound U-Turn Total	Eastbound U-Turn Total	Westbound U-Turn Total	Total
07:00	07:15	0	0	0	0	0
07:15	07:30	0	0	0	0	0
07:30	07:45	0	0	0	0	0
07:45	08:00	0	0	0	0	0
08:00	08:15	0	0	0	0	0
08:15	08:30	0	0	0	0	0
08:30	08:45	0	0	0	0	0
08:45	09:00	0	0	0	0	0
09:00	09:15	0	0	0	0	0
09:15	09:30	0	0	0	0	0
09:30	09:45	0	0	0	0	0
09:45	10:00	0	0	0	0	0
11:30	11:45	0	0	0	0	0
11:45	12:00	0	0	0	0	0
12:00	12:15	0	0	0	0	0
12:15	12:30	0	0	0	0	0
12:30	12:45	1	0	0	0	1
12:45	13:00	0	0	0	0	0
13:00	13:15	0	0	0	0	0
13:15	13:30	0	0	0	0	0
15:00	15:15	0	0	0	0	0
15:15	15:30	0	0	0	0	0
15:30	15:45	0	0	0	0	0
15:45	16:00	0	0	0	0	0
16:00	16:15	0	0	0	0	0
16:15	16:30	0	0	0	0	0
16:30	16:45	0	0	0	0	0
16:45	17:00	0	0	0	0	0
17:00	17:15	0	0	0	0	0
17:15	17:30	0	0	0	0	0
17:30	17:45	0	0	0	0	0
17:45	18:00	0	0	0	0	0
Total		1	0	0	0	1

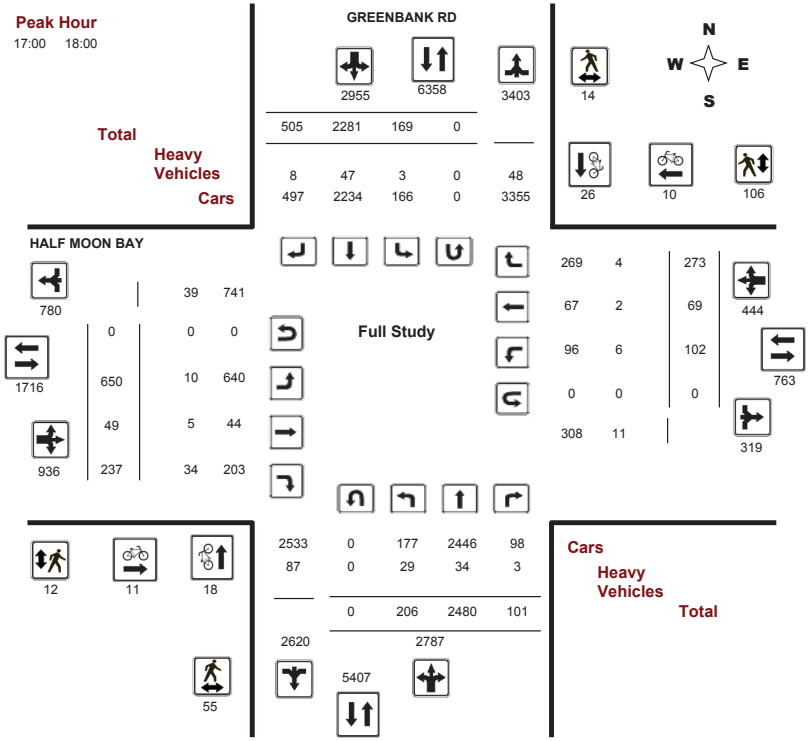
Transportation Services - Traffic Services

Turning Movement Count - Full Study Diagram

GREENBANK RD @ HALF MOON BAY

Survey Date: Tuesday, June 19, 2018 **WO#:** 37881

Start Time: 07:00 **Device:** Miovision



Comments :

Transportation Services - Traffic Services

Work Order 37881

Turning Movement Count - Full Study Summary Report

GREENBANK RD @ HALF MOON BAY

Survey Date: Tuesday, June 19, 2018

Total Observed U-Turns

Northbound: 0 Southbound: 0

Eastbound: 0 Westbound: 0

AADT Factor .90

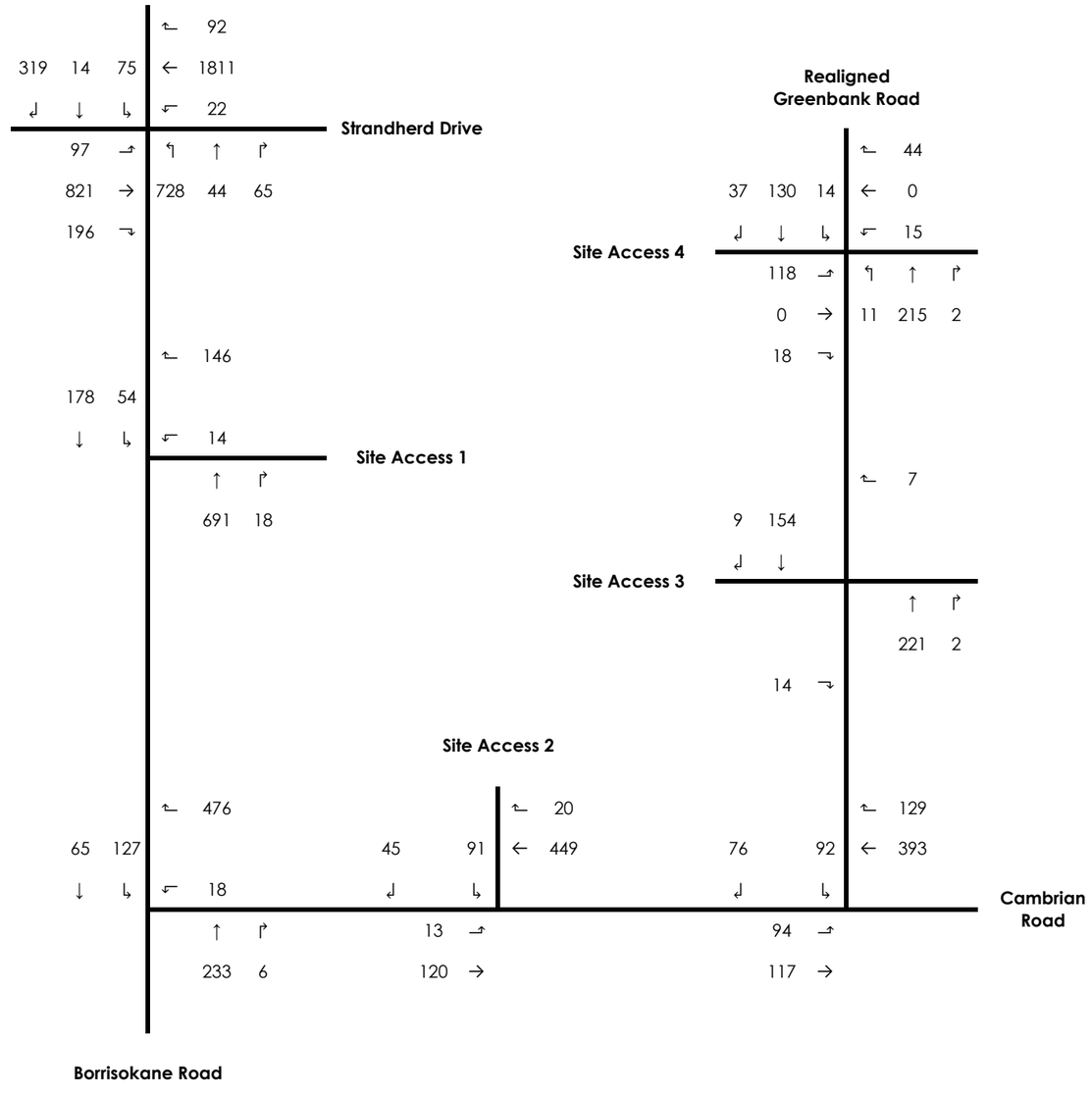
Full Study

	GREENBANK RD									HALF MOON BAY									
	Northbound				Southbound					Eastbound				Westbound					
Period	LT	ST	RT	NB TOT	LT	ST	RT	SB TOT	STR TOT	LT	ST	RT	EB TOT	LT	ST	RT	WB TOT	STR TOT	Grand Total
07:00 08:00	17	483	5	**505**	5	110	41	**156**	**661**	119	6	46	**171**	15	6	55	**76**	**247**	**908**
08:00 09:00	42	355	8	**405**	12	163	39	**214**	**619**	108	14	54	**176**	24	9	51	**84**	**260**	**879**
09:00 10:00	14	315	7	**336**	17	175	40	**232**	**568**	78	6	22	**106**	11	7	29	**47**	**153**	**721**
11:30 12:30	16	256	8	**280**	16	263	64	**343**	**623**	63	4	18	**85**	9	5	21	**35**	**120**	**743**
12:30 13:30	16	214	6	**236**	15	278	56	**349**	**585**	52	2	13	**67**	5	1	27	**33**	**100**	**685**
15:00 16:00	24	247	18	**289**	27	370	77	**474**	**763**	59	4	26	**89**	9	10	23	**42**	**131**	**894**
16:00 17:00	38	294	25	**357**	38	436	82	**556**	**913**	83	6	34	**123**	16	14	23	**53**	**176**	**1089**
17:00 18:00	39	316	24	**379**	39	486	106	**631**	**1010**	88	7	24	**119**	13	17	44	**74**	**193**	**1203**
Sub Total	206	2480	101	**2787**	169	2281	505	**2955**	**5742**	650	49	237	**936**	102	69	273	**444**	**1380**	**7122**
U Turns				**0**				**0**	**0**				**0**				**0**	**0**	**0**
Total	206	2480	101	**2787**	169	2281	505	**2955**	**5742**	650	49	237	**936**	102	69	273	**444**	**1380**	**7122**
EQ 12Hr	286	3447	140	**3874**	235	3171	702	**4107**	**7981**	903	68	329	**1301**	142	96	379	**617**	**1918**	**9899**
Note: These values are calculated by multiplying the totals by the appropriate expansion factor. **1.39**																			
AVG 12Hr	258	3102	126	**3487**	211	2854	632	**3697**	**7184**	813	61	296	**1171**	128	86	342	**555**	**1726**	**8910**
Note: These volumes are calculated by multiplying the Equivalent 12 hr. totals by the AADT factor. **.90**																			
AVG 24Hr	338	4064	166	**4567**	277	3738	828	**4843**	**9410**	1065	80	388	**1534**	167	113	447	**728**	**2262**	**11672**
Note: These volumes are calculated by multiplying the Average Daily 12 hr. totals by 12 to 24 expansion factor. **1.31**																			

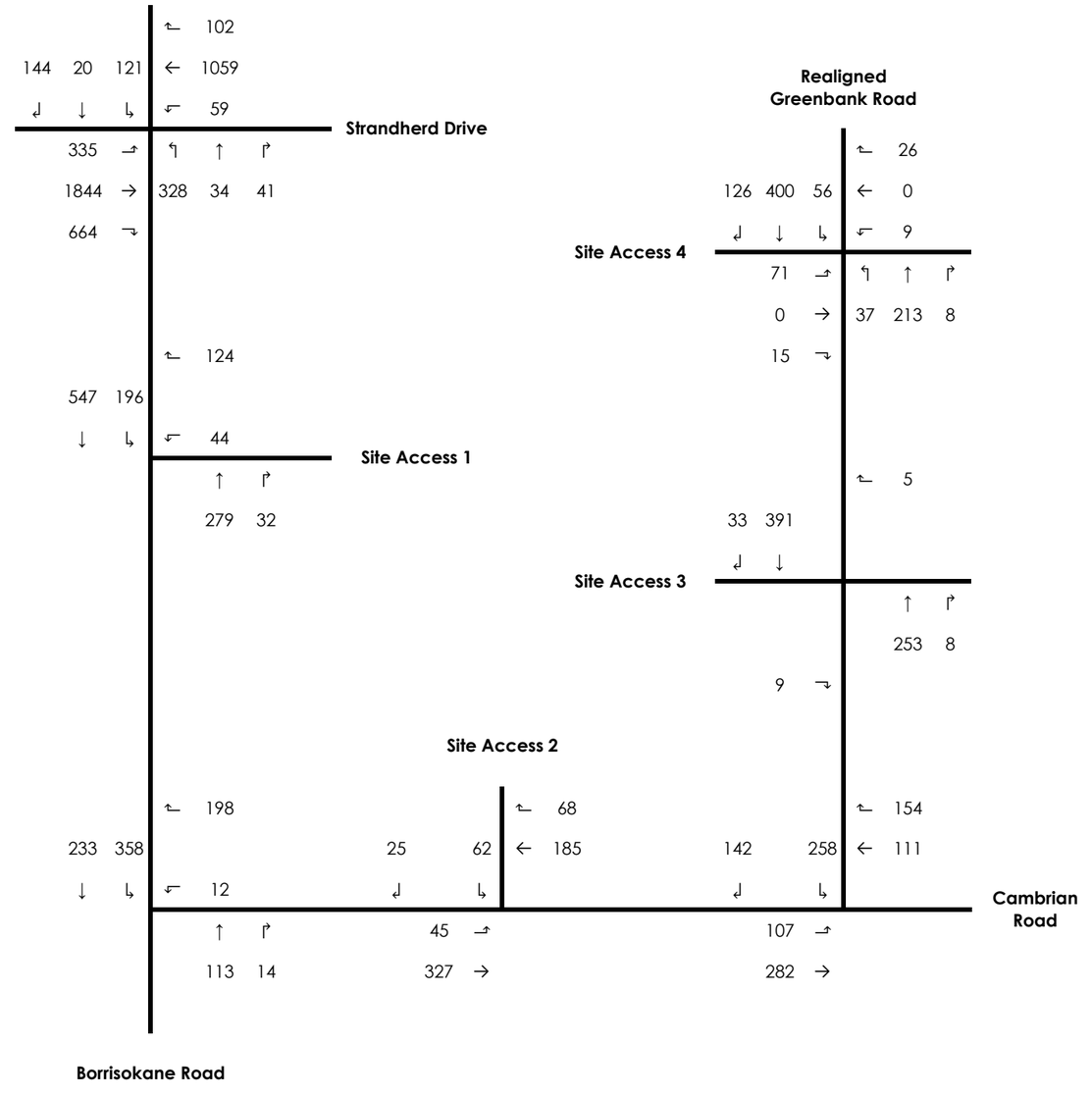
Comments:

Note: U-Turns provided for approach totals. Refer to 'U-Turn' Report for specific breakdown.

AM Peak Hour



PM Peak Hour



Stantec

Mattamy Homes

Half Moon Bay West

Figure 11: 2029 Ultimate Traffic Volumes

Appendix D

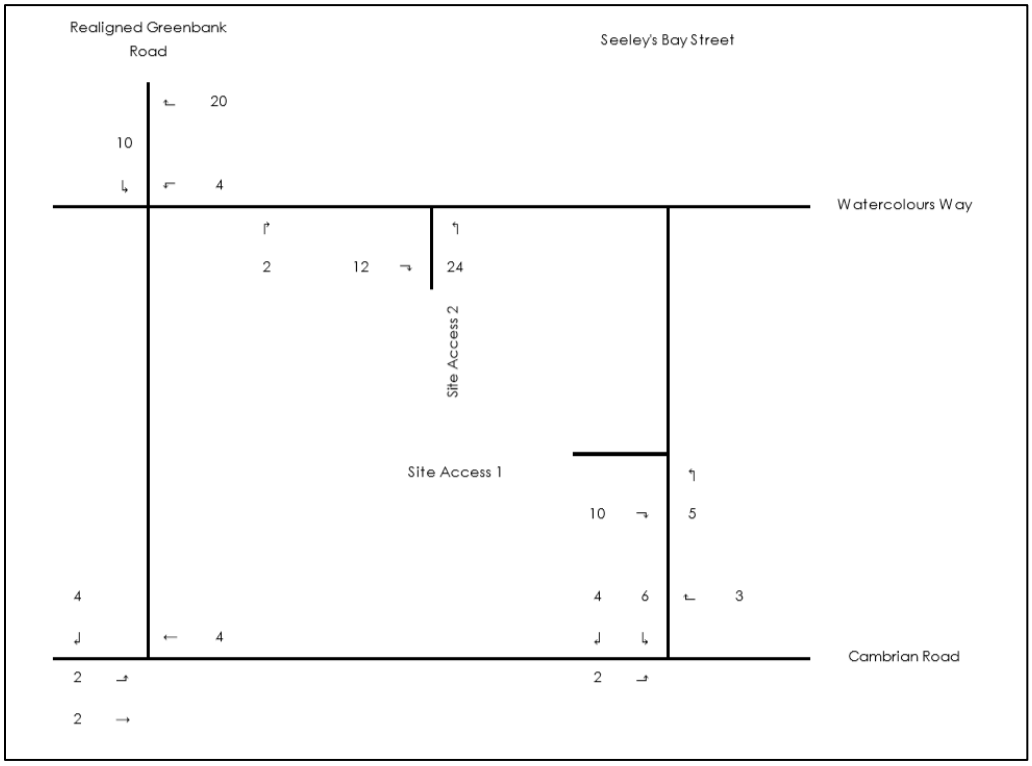
Collision Data

Accident Date	Accident Year	Accident Time	Location	Environment Condition	Light	Traffic Control	Traffic Control Condition	Classification Of Accident	Initial Impact Type	Road Surface Condition
9/4/2015	2015	7:15	CAMBRIAN RD @ RIVER MIST RD	01 - Clear	01 - Daylight	02 - Stop sign		03 - P.D. only	02 - Angle	01 - Dry
1/5/2017	2017	7:34	CAMBRIAN RD @ RIVER MIST RD	01 - Clear	03 - Dawn	02 - Stop sign		03 - P.D. only	02 - Angle	06 - Ice
8/31/2016	2016	9:40	GREENBANK RD @ HALF MOON BAY	01 - Clear	01 - Daylight	02 - Stop sign		02 - Non-fatal injury	03 - Rear end	01 - Dry
8/30/2017	2017	19:16	GREENBANK RD @ HALF MOON BAY	01 - Clear	01 - Daylight	02 - Stop sign		03 - P.D. only	05 - Turning movement	01 - Dry
7/23/2017	2017	10:20	GREENBANK RD @ HALF MOON BAY	01 - Clear	01 - Daylight	02 - Stop sign		03 - P.D. only	07 - SMV other	01 - Dry
1/5/2017	2017	8:42	GREENBANK RD @ HALF MOON BAY	04 - Freezing Rain	01 - Daylight	02 - Stop sign		03 - P.D. only	02 - Angle	06 - Ice
12/22/2017	2017	12:34	GREENBANK RD @ HALF MOON BAY	03 - Snow	01 - Daylight	02 - Stop sign		03 - P.D. only	07 - SMV other	03 - Loose snow
3/5/2019	2019	20:14	GREENBANK RD @ HALF MOON BAY (0014465)	03 - Snow	07 - Dark	02 - Stop sign		03 - P.D. only	05 - Turning movement	02 - Wet
2/12/2016	2016	18:18	CAMBRIAN RD @ GREENBANK RD	03 - Snow	07 - Dark	11 - Roundabout		03 - P.D. only	07 - SMV other	04 - Slush
3/13/2016	2016	15:45	CAMBRIAN RD @ GREENBANK RD	01 - Clear	01 - Daylight	11 - Roundabout		03 - P.D. only	03 - Rear end	01 - Dry
4/5/2016	2016	8:27	CAMBRIAN RD @ GREENBANK RD	01 - Clear	01 - Daylight	11 - Roundabout		03 - P.D. only	03 - Rear end	01 - Dry
12/28/2016	2016	17:35	CAMBRIAN RD @ GREENBANK RD	03 - Snow	07 - Dark	11 - Roundabout		03 - P.D. only	02 - Angle	04 - Slush
5/17/2017	2017	7:15	CAMBRIAN RD @ GREENBANK RD	01 - Clear	01 - Daylight	11 - Roundabout		03 - P.D. only	07 - SMV other	01 - Dry
12/12/2017	2017	13:17	CAMBRIAN RD @ GREENBANK RD	03 - Snow	01 - Daylight	11 - Roundabout		03 - P.D. only	02 - Angle	04 - Slush
5/29/2018	2018	22:16	CAMBRIAN RD @ GREENBANK RD (0001095)	01 - Clear	07 - Dark	11 - Roundabout		03 - P.D. only	07 - SMV other	01 - Dry
10/11/2018	2018	16:40	CAMBRIAN RD @ GREENBANK RD (0001095)	01 - Clear	01 - Daylight	11 - Roundabout		03 - P.D. only	03 - Rear end	01 - Dry
10/14/2018	2018	14:35	CAMBRIAN RD @ GREENBANK RD (0001095)	01 - Clear	01 - Daylight	11 - Roundabout		03 - P.D. only	03 - Rear end	01 - Dry
1/21/2019	2019	7:54	CAMBRIAN RD @ GREENBANK RD (0001095)	03 - Snow	03 - Dawn	11 - Roundabout		03 - P.D. only	03 - Rear end	03 - Loose snow

Appendix E

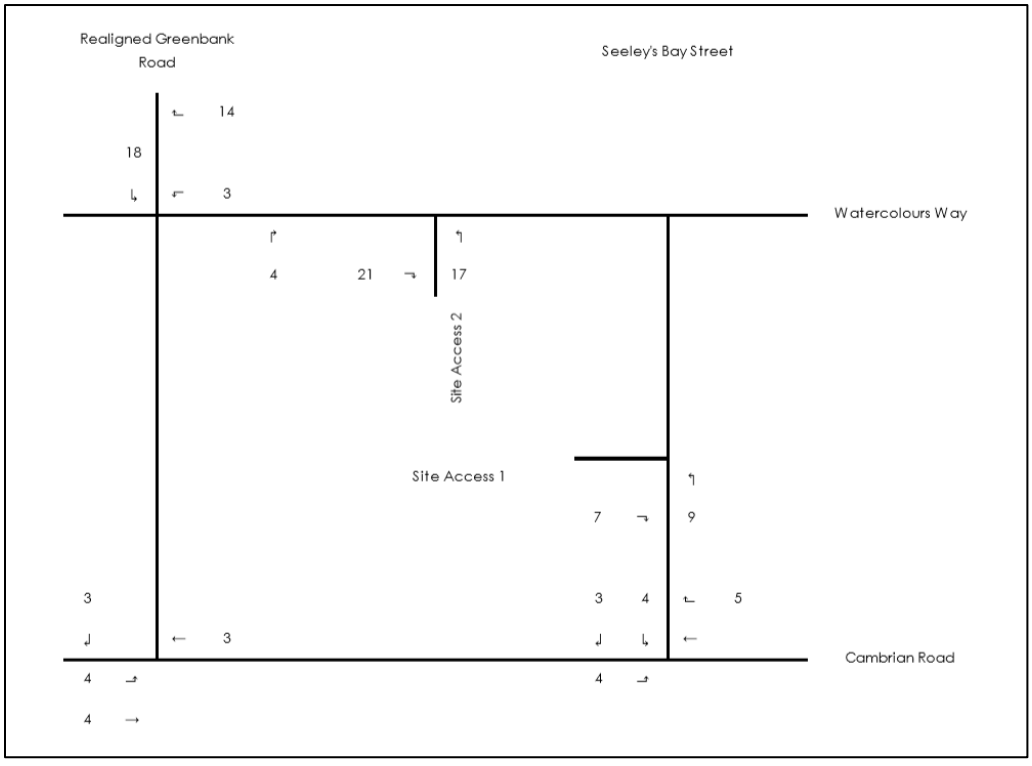
Background Developments

2444 Watercolours Way Site Generated Traffic Volumes, Realigned Greenbank Road Scenario, AM Peak Hour



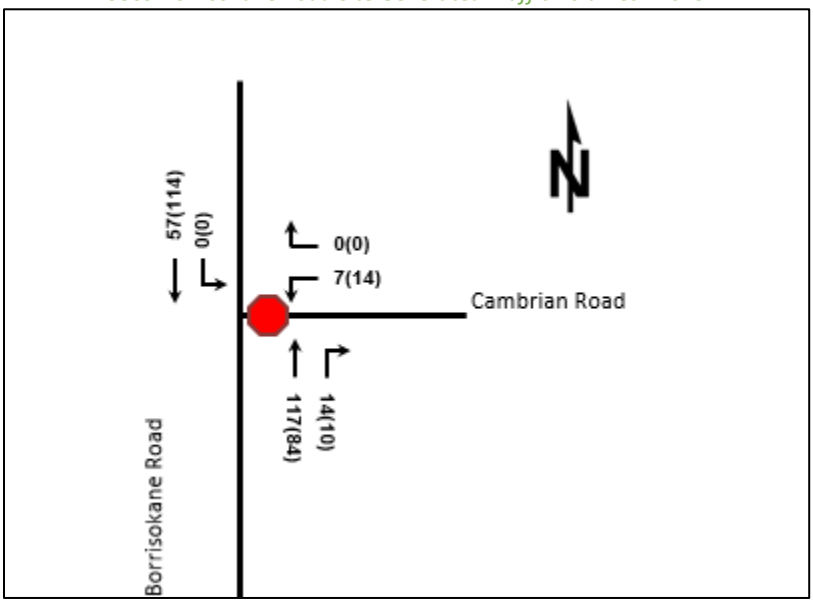
Source: Half Moon Bay North Apartment Block Transportation Impact Assessment (Stantec, 2018)

2444 Watercolours Way Site Generated Traffic Volumes, Realigned Greenbank Road Scenario, PM Peak Hour



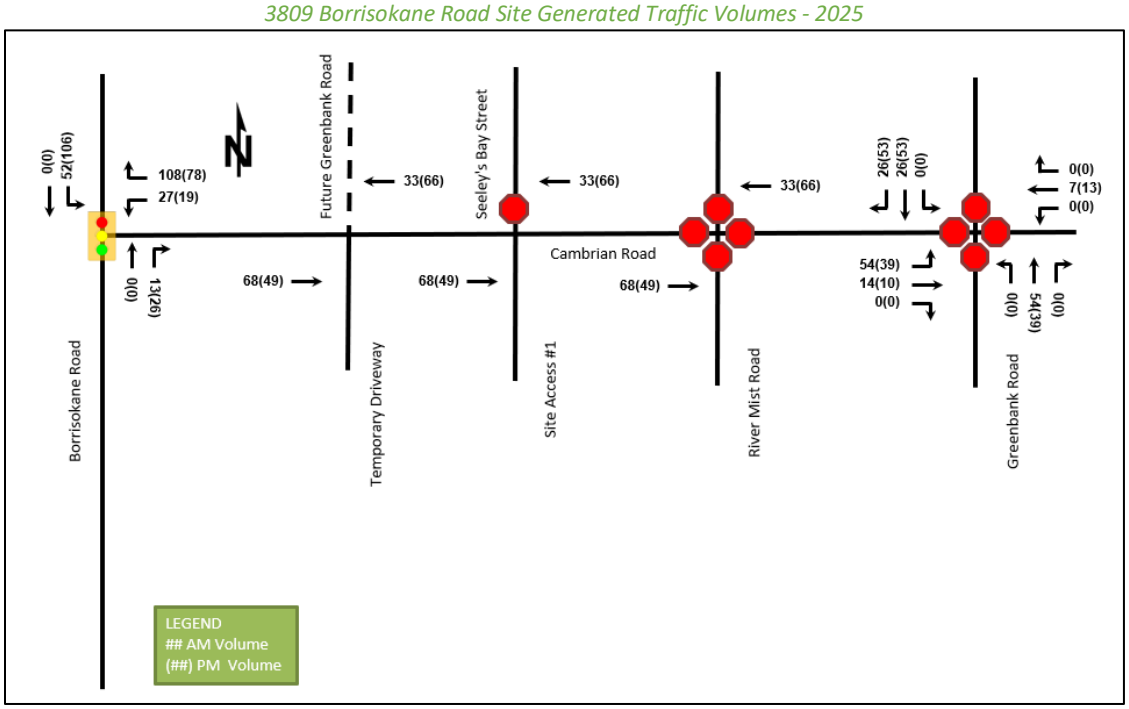
Source: Half Moon Bay North Apartment Block Transportation Impact Assessment (Stantec, 2018)

3809 Borrisokane Road Site Generated Traffic Volumes - 2023



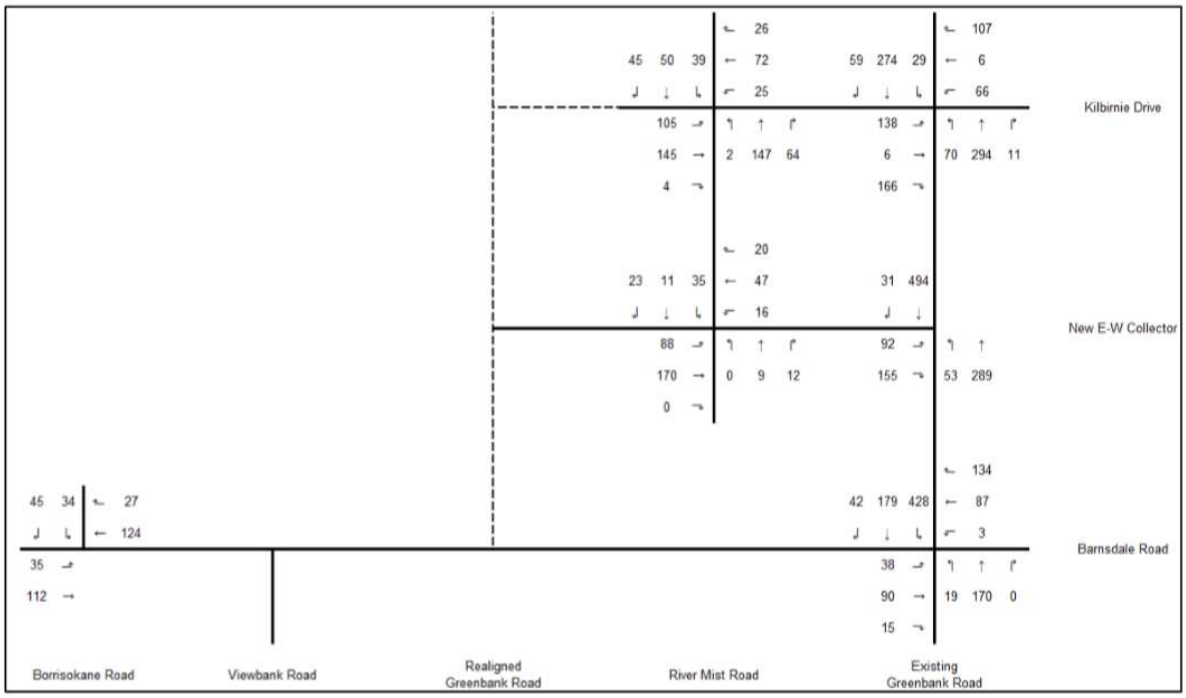
Source: 3809 Borrisokane Road Transportation Impact Assessment (CGH, 2020)

3809 Borrisokane Road Site Generated Traffic Volumes - 2025



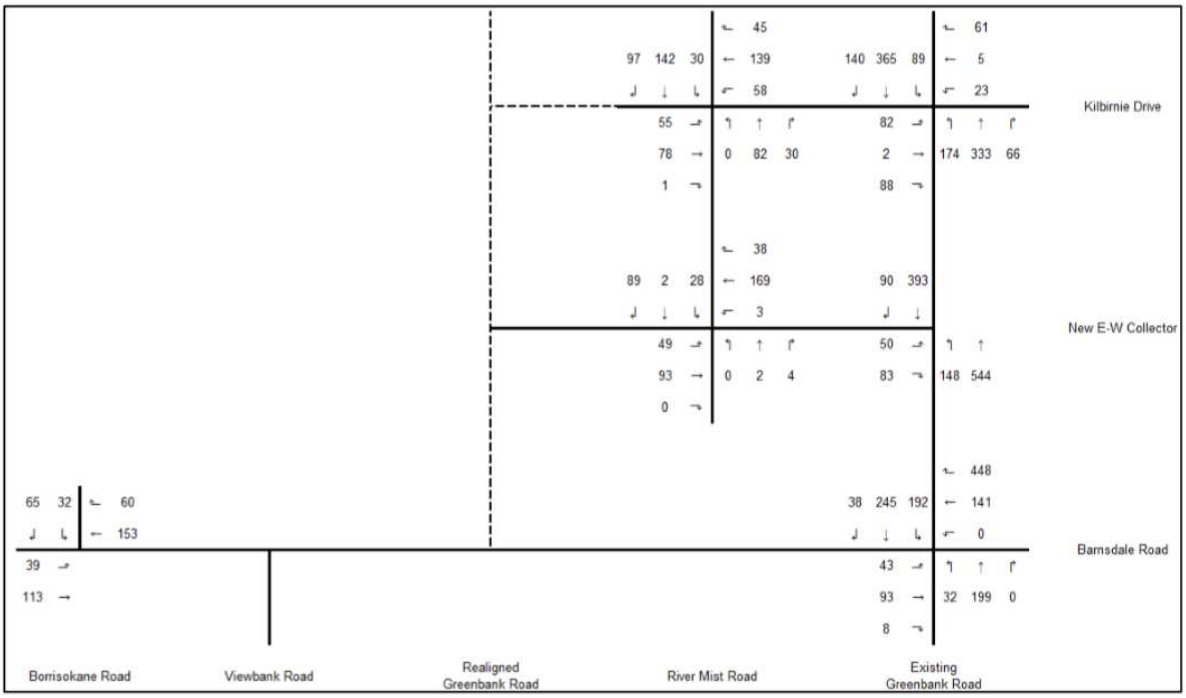
Source: 3809 Borrisokane Road Transportation Impact Assessment (CGH, 2020)

3882 Barnsdale and 3960 Greenbank Road 2025 Total Future Traffic Volumes – AM Peak Hour



Source: Quinn's Pointe 2 Transportation Impact Assessment (Stantec, 2018)

3882 Barnsdale and 3960 Greenbank Road 2025 Total Future Traffic Volumes – PM Peak Hour



Source: Quinn's Pointe 2 Transportation Impact Assessment (Stantec, 2018)

3882 Barnsdale and 3960 Greenbank Road 2025 Site Generated Traffic Volumes

Kilbirne/River Mist	NBL	NBT	NBR	WBL	WBT	WBR	SBL	SBT	SBR	EBL	EBT	EBR
AM	0	87	0	0	9	0	0	32	8	29	31	0
PM	0	46	0	0	33	0	0	81	30	16	17	0
SAT	0	46	0	0	33	0	0	81	30	16	17	0
	0(0)[0]	87(46)[46]	0(0)[0]	0(0)[0]	9(33)[33]	0(0)[0]	0(0)[0]	32(81)[81]	8(30)[30]	29(16)[16]	31(17)[17]	0(0)[0]

Kilbirne/Greenbank	NBL	NBT	NBR	WBL	WBT	WBR	SBL	SBT	SBR	EBL	EBT	EBR
AM	7	36	0	0	0	0	0	14	2	7	0	25
PM	26	19	0	0	0	0	0	34	8	4	0	14
SAT	26	19	0	0	0	0	0	34	8	4	0	14
	7(26)[26]	36(19)[19]	0(0)[0]	0(0)[0]	0(0)[0]	0(0)[0]	0(0)[0]	14(34)[34]	2(8)[8]	7(4)[4]	0(0)[0]	5(14)[14]

Appendix F

TDM Checklist

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

Legend

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

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

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

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

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

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

Appendix G

Traffic Signal Warrants

River Mist Road @ Cambrian Road
2021 Existing Conditions

Justification #7

Justification	Description	Minimum Requirement 1 Lane Highway		Minimum Requirement 2 or More Lanes		Compliance Sectional		Compliance Entire %	Signal
		Free Flow	Restr. Flow	Free Flow	Restr. Flow	Numerical	%		
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	480	720	600	900	646	90%	90%	No
	B. Vehicle volume, along minor streets (average hour)	120	170	120	170	194	114%		
2. Delay to Cross Traffic	A. Vehicle volumes, major street (average hour)	480	720	600	900	452	63%	63%	No
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	75	50	75	113	150%		

Notes
1. Refer to OTM Book 12, pg 92, Mar 2012
2. Lowest section percentage governs justification
3. Average hourly volumes estimated from peak hour volumes, AHV = PM/2 or (AM + PM) / 4, including amplifcation factors
4. T-intersection factor corrected, applies only to 1B

River Mist Road @ Cambrian Road
2024 Future Background

Justification #7

Justification	Description	Minimum Requirement 1 Lane Highway		Minimum Requirement 2 or More Lanes		Compliance Sectional		Compliance Entire %	Signal
		Free Flow	Restr. Flow	Free Flow	Restr. Flow	Numerical	%		
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	480	720	600	900	883	123%	123%	Yes
	B. Vehicle volume, along minor streets (average hour)	120	170	120	170	242	142%		
2. Delay to Cross Traffic	A. Vehicle volumes, major street (average hour)	480	720	600	900	642	89%	89%	No
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	75	50	75	157	210%		

Notes
1. Refer to OTM Book 12, pg 92, Mar 2012
2. Lowest section percentage governs justification
3. Average hourly volumes estimated from peak hour volumes, AHV = PM/2 or (AM + PM) / 4, including amplifcation factors
4. T-intersection factor corrected, applies only to 1B

River Mist Road @ Cambrian Road
2029 Future Background

Justification #7

Justification	Description	Minimum Requirement 1 Lane Highway		Minimum Requirement 2 or More Lanes		Compliance Sectional		Compliance Entire %	Signal
		Free Flow	Restr. Flow	Free Flow	Restr. Flow	Numerical	%		
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	480	720	600	900	1020	142%	142%	Yes
	B. Vehicle volume, along minor streets (average hour)	120	170	120	170	244	144%		
2. Delay to Cross Traffic	A. Vehicle volumes, major street (average hour)	480	720	600	900	776	108%	108%	No
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	75	50	75	159	212%		

Notes
1. Refer to OTM Book 12, pg 92, Mar 2012
2. Lowest section percentage governs justification
3. Average hourly volumes estimated from peak hour volumes, AHV = PM/2 or (AM + PM) / 4, including amplifcation factors
4. T-intersection factor corrected, applies only to 1B

River Mist Road @ Cambrian Road
2024 Future Total Conditions

Justification #7

Justification	Description	Minimum Requirement 1 Lane Highway		Minimum Requirement 2 or More Lanes		Compliance Sectional		Compliance Entire %	Signal
		Free Flow	Restr. Flow	Free Flow	Restr. Flow	Numerical	%		
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	480	720	600	900	903	125%	125%	Yes
	B. Vehicle volume, along minor streets (average hour)	120	170	120	170	253	149%		
2. Delay to Cross Traffic	A. Vehicle volumes, major street (average hour)	480	720	600	900	651	90%	90%	No
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	75	50	75	163	217%		

Notes
1. Refer to OTM Book 12, pg 92, Mar 2012
2. Lowest section percentage governs justification
3. Average hourly volumes estimated from peak hour volumes, AHV = PM/2 or (AM + PM) / 4, including amplifcation factors
4. T-intersection factor corrected, applies only to 1B

River Mist Road @ Cambrian Road
2029 Future Total Conditions

Justification #7

Justification	Description	Minimum Requirement 1 Lane Highway		Minimum Requirement 2 or More Lanes		Compliance Sectional		Compliance Entire %	Signal
		Free Flow	Restr. Flow	Free Flow	Restr. Flow	Numerical	%		
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	480	720	600	900	1107	154%	144%	Yes
	B. Vehicle volume, along minor streets (average hour)	120	170	120	170	244	144%		
2. Delay to Cross Traffic	A. Vehicle volumes, major street (average hour)	480	720	600	900	863	120%	120%	No
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	75	50	75	159	212%		

Notes
1. Refer to OTM Book 12, pg 92, Mar 2012
2. Lowest section percentage governs justification
3. Average hourly volumes estimated from peak hour volumes, AHV = PM/2 or (AM + PM) / 4, including amplifcation factors
4. T-intersection factor corrected, applies only to 1B

Realigned Greenbank Road @ Cambrian Road
2029 Future Background

Justification #7

Justification	Description	Minimum Requirement 1 Lane Highway		Minimum Requirement 2 or More Lanes		Compliance Sectional		Compliance Entire %	Signal
		Free Flow	Restr. Flow	Free Flow	Restr. Flow	Numerical	%		
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	480	720	600	900	714	99%	94%	No
	B. Vehicle volume, along minor streets (average hour)	120	170	120	170	159	94%		
2. Delay to Cross Traffic	A. Vehicle volumes, major street (average hour)	480	720	600	900	555	77%	77%	No
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	75	50	75	101	134%		

Notes
1. Refer to OTM Book 12, pg 92, Mar 2012
2. Lowest section percentage governs justification
3. Average hourly volumes estimated from peak hour volumes, AHV = PM/2 or (AM + PM) / 4, including amplifcation factors
4. T-intersection factor corrected, applies only to 1B

Realigned Greenbank Road @ Cambrian Road
2029 Future Total

Justification #7

Justification	Description	Minimum Requirement 1 Lane Highway		Minimum Requirement 2 or More Lanes		Compliance Sectional		Compliance Entire %	Signal
		Free Flow	Restr. Flow	Free Flow	Restr. Flow	Numerical	%		
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	480	720	600	900	811	113%	113%	No
	B. Vehicle volume, along minor streets (average hour)	120	170	120	170	213	125%		
2. Delay to Cross Traffic	A. Vehicle volumes, major street (average hour)	480	720	600	900	598	83%	83%	No
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	75	50	75	149	199%		

Notes
1. Refer to OTM Book 12, pg 92, Mar 2012
2. Lowest section percentage governs justification
3. Average hourly volumes estimated from peak hour volumes, AHV = PM/2 or (AM + PM) / 4, including amplifcation factors
4. T-intersection factor corrected, applies only to 1B

Appendix H

Roundabout Screening Forms

3. Roundabout Implementation Policy

The following sections describe a roundabout implementation policy developed for the City of Ottawa, in consultation with a Project Working Group, that is consistent with existing Ottawa City Council policy.

3.1 Background

There are a number of roundabout implementation policies in place in certain Canadian provinces, U.S. states, and other jurisdictions. The most common type is a policy that simply states a roundabout should be "considered" when a new road or highway is built or an existing facility is widening or reconstructed. It is usually left to the service provider to determine in what manner a roundabout is considered.

Another is a "roundabouts first" policy, where a roundabout is deemed preferred unless it can be demonstrated that another alternative is preferred because it will operate better or be significantly less costly. This type of policy is in place in the provinces of British Columbia and Alberta, and in several U.S. states.

Another type is a policy that has been approved by Council in the Region of Waterloo, where roundabouts are considered under the following conditions:

- At any new Regional Road intersection.
- Where traffic signals are warranted.
- Where capacity or safety problems are being experienced.

If one or more of the conditions is met then the location is subjected to an initial screening. Should a roundabout pass the initial screening then an Intersection Control Study (ICS) is undertaken that compares a roundabout and one or more alternatives in terms of several economic and non-economic criteria. The economic criteria comprise construction costs and study period costs (which include maintenance costs and the human capital costs of motor vehicle collisions). The non-economic criteria may include peak hour traffic operations, speed control, access management, conditions for pedestrians and cyclists, impacts to transit services, environmental benefits, etc. After comparing the economic and non-economic evaluation the technically preferred alternative is recommended for implementation.

Similar Intersection Control Studies have been undertaken elsewhere, although they may not necessarily be a requirement of the road authority.

In consultation with the Project Working Group it was decided that a roundabout policy similar to the one in the Region of Waterloo would be most appropriate for the City of Ottawa.

3.2 The Roundabout Screening Tool

Similar to the Region of Waterloo, an initial screening tool was developed for the City. The intent of the tool is to provide a relatively quick assessment of the feasibility of a roundabout at a particular intersection in comparison to other appropriate forms of traffic control or road modifications. The intended outcome is to provide enough information to assist City staff in deciding whether or not to proceed with an ICS to investigate the feasibility of a roundabout in more detail.

The Roundabout Initial Feasibility Screening Tool asks some questions about the intersection, what traditional modifications are being proposed (i.e. installation of traffic signals, addition of auxiliary lanes, etc.), the type of roundabout that would be implemented, and why a roundabout is being considered. It then asks a series of questions related to suitability factors and contra-indications for roundabouts to aid in the decision-making process.

The suitability factor questions are:

- Does the intersection currently experience an average collision frequency of more than 1.5 injury crashes per year, or a collision rate in excess of 1 injury crash per 1 million vehicles entering (MVE)?
- Has there been a fatal crash at the intersection in the last 10 years?
- Are capacity problems currently being experienced, or expected in the future?
- Are traffic signals warranted, or expected to be warranted in the future?
- Does the intersection have more than 4 legs, or unusual geometry?
- Will planned modifications to the intersection require that nearby structures be widened (i.e. to accommodate left-turn lanes)?
- Is the intersection located at a transition between rural and urban environments (i.e. an urban boundary) such that a roundabout could act as a means of speed transition?

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

The contra-indication questions are:

- Is there insufficient property at the intersection (i.e. less than 44 metres diameter if considering a single-lane roundabout, and less than 60 metres if considering a two-lane roundabout) or property constraints that would require demolition of adjacent structures?
- Are there any instances where stopping sight distance (SSD) of a roundabout yield line may not be attainable (i.e. the intersection is on a crest vertical curve)?
- Is there an existing uncontrolled approach with a grade in excess of 4 percent?
- Is the intersection located within a coordinated signal system?
- Is there a closely-spaced traffic signal or railway crossing that could not be controlled with a nearby roundabout?
- Are significant differences in directional flows or any situations of sudden high demand expected?
- Are there known visually-impaired pedestrians that cross this intersection?

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

At its conclusion the tool asks for a recommendation whether to proceed with an ICS. An example of the City of Ottawa Roundabout Initial Feasibility Screening Tool, as of May 14, 2013, is provided in **Appendix A**.

3.3 Intersection Control Studies

3.3.1 The Decision Matrix

The means of conducting an Intersection Control Study in the City of Ottawa was discussed with the Project Working Group. It was decided to go with a matrix style approach that would compare economic and non-economic criteria, and be responsive to the needs of individual locations. The rationale for this was brought forward in a memo dated May 16, 2013, which is included in **Appendix B**.

The criteria to be examined should be relevant to the general environment, although additional criteria relevant to the specific location could be incorporated. The base criteria for rural, semi-urban/suburban and urban intersections are listed in **Table 1**.

Table 1 Roundabout Evaluation Criteria

Rural Intersections	Semi-Urban/Suburban Intersections	Urban Intersections
Construction Cost	Construction Cost	Construction Cost
Safety	Safety	Safety
Capacity	Capacity	Capacity
	Pedestrians and Cyclists	Pedestrians and Cyclists
	Environmental	Environmental
	Property Impacts	Access Management
		Transit
		Property Impacts

It was decided that each criteria would be assigned a weight from 1 to 4 based on its subjective importance to the particular location (with 1 being “important enough that the criteria must be considered”, and 4 being “very important for intersection control selection”). The weights would be established by a project team at the start of the ICS. Then, during the course of the ICS each criteria would be assigned a score from 1 to 5, such that the score for both alternatives would have to add to 6.

An example of this evaluation for an urban intersection is seen in **Table 2**.

Table 2 Roundabout Evaluation Matrix – Example Urban Intersection

Criteria	Weight	Signalized Intersection	Roundabout
Construction Cost	2	5	1
Safety	4	3	3
Capacity	3	2	4
Pedestrians and Cyclists	4	4	2
Environmental	1	2	4
Access Management	2	2	4
Transit	2	4	2
Property Impacts	4	5	1
Total		**78**	**54**

3.3.2 Evaluating the Criteria

Some of the criteria, namely Construction Cost, Property Impacts and Capacity, can be evaluated objectively using cost estimation techniques and intersection capacity analysis software.

The Safety criterion should be evaluated using models to predict the frequency and severity of collisions that would occur at the intersection during a specified study period following implementation of the alternatives. A score between 1 and 5 would be assigned based on their performance relative to each other. It is suggested that the scores be based on "fatal+injury" collisions only, or be weighted to account for injury severity. The collision predictions could be further weighted by assigning human capital costs to motor vehicle collisions, as is done by the MTO and some other agencies.

The Environmental criterion could be evaluated subjectively, although reasons for assigning collective scores for components of the criterion (such as vehicle noise, fuel consumption and emissions, quantity of impermeable pavement, and area available for landscaping) should be documented.

The Pedestrians & Cyclists criterion would also need to be evaluated subjectively. Collisions involving pedestrians and cyclists are infrequent, as is information regarding statistical levels of safety at roundabouts. Perceived level of safety would be difficult to incorporate into a comparison. Therefore this criterion should be scored based on the "quality" of the facilities for pedestrians and cyclists proposed for each alternative. Quality should be considered a combination of convenience and accessibility. Again, reasons for assigning scores should be documented.

In urban locations the criteria of Access Management and Transit could be evaluated subjectively based on locations of existing or proposed driveways, corridor operating speeds, the type and frequency of transit service, locations for bus stops, and whether there is or are plans for transit priority.

3.3.3 The Roundabout Implementation Process

Similar to the Region of Waterloo, a roundabout should be considered in the City of Ottawa under the following conditions:

- At any new City intersection.
- Where traffic signals are warranted.
- At intersections where capacity or safety problems are being experienced.

If any of these conditions are met then screening for the possibility of a roundabout should be undertaken using the Roundabout Initial Feasibility Screening Tool. If the tool indicates that the feasibility of a roundabout should be investigated in more detail, City staff should proceed with an Intersection Control Study (ICS) to determine whether a roundabout or another alternative is preferred at the subject intersection.

City of Ottawa
Roundabout Initial Feasibility Screening Tool

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

1	Project Name:	2020-59 Minto Kennedy Lands
2	Intersection:	Cambrian Road at River Mist Road
3	Location and Description of Intersection: Lane configuration, total or approach AADT, distance to nearby intersection(s), etc. Attach or sketch a diagram and include existing and/or horizon-year turning movements. If an existing intersection then indicate type of control.	The intersection of Cambrian Road and River Mist Road is an all-way stop-controlled intersection with shared movement lanes on all approaches. No turn restrictions were noted.
4	What traditional modifications are proposed? All-way stop control, traffic signals, auxiliary lanes, etc. Attach or sketch a diagram if necessary.	Traffic signals (refer to Cambrian Road Widening EA in Appendix J)
5	What size of roundabout is being considered? Describe, and attach a Roundabout Traffic Flow Worksheet.	While a proponent isn't considering a roundabout for this intersection, conceptually, 2 two-lane roundabout would ultimately need to be considered to align with the planned Cambrian Road widening
6	Why is a roundabout being considered?	This intersection is being considered as signalized in the future and the roundabout screening form is completed as per TIA requirements

7 Are there contra-indications for a roundabout?

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

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

8 Are there suitability factors for a roundabout?

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

No.	Suitability Factor	Outcome
1	Does the intersection currently experience an average collision frequency of more than 1.5 injury crashes per year, or a collision rate in excess of 1injury crash per 1 million vehicles entering (MVE)?	Yes ☐ No ☑
2	Has there been a fatal crash at the intersection in the last 10 years?	Yes ☐ No ☑
3	Are capacity problems currently being experienced, or expected in the future?	Yes ☑ No ☐
4	Are traffic signals warranted, or expected to be warranted in the future?	Yes ☑ No ☐
5	Does the intersection have more than 4 legs, or unusual geometry?	Yes ☐ No ☑
6	Will planned modifications to the intersection require that nearby structures be widened (i.e. to accommodate left-turn lanes)?	Yes ☐ No ☑
7	Is the intersection located at a transition between rural and urban environments (i.e. an urban boundary) such that a roundabout could act as a means of speed transition?	Yes ☐ No ☑

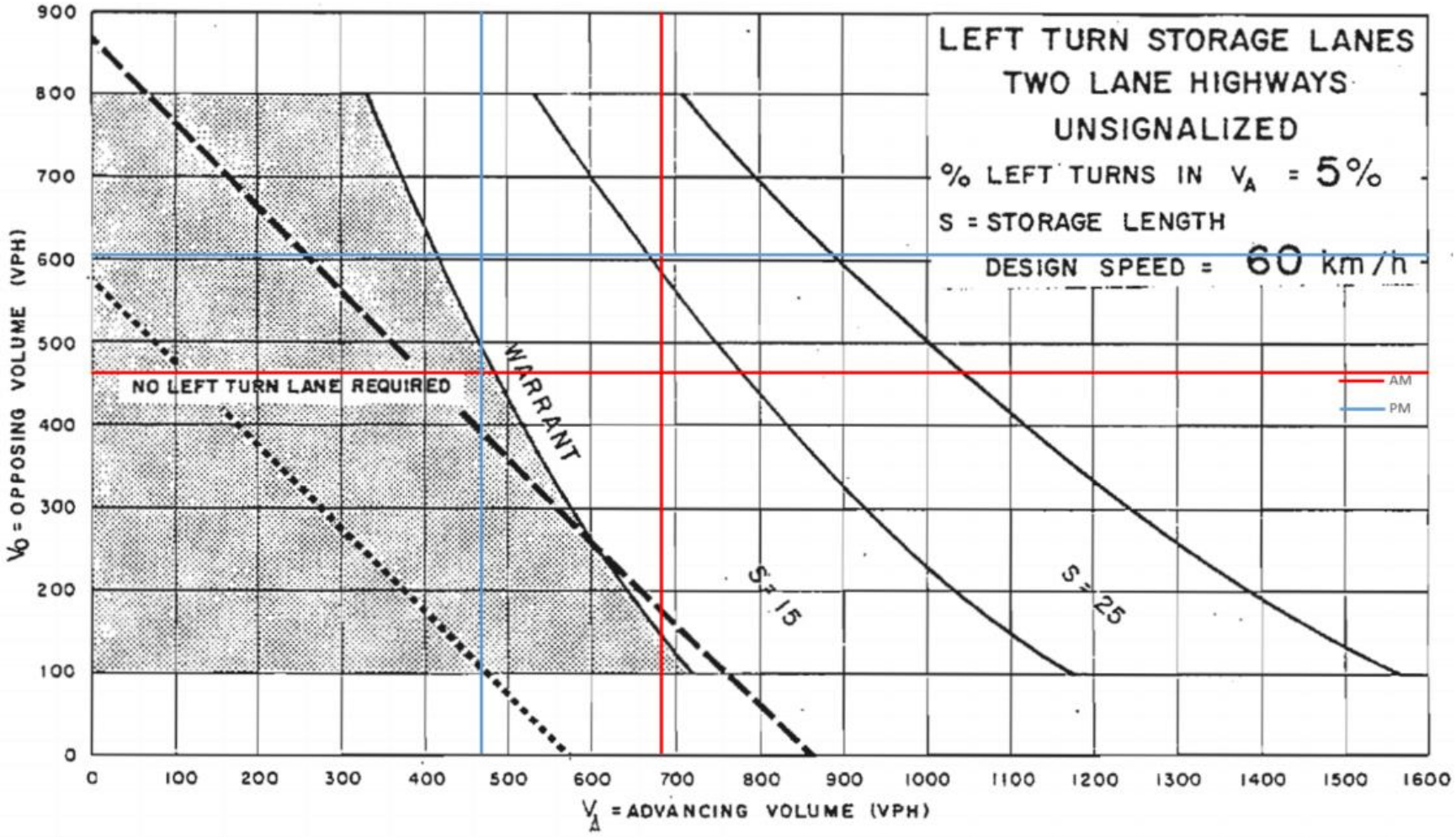
9	Conclusions/recommendation whether to proceed with an Intersection Control Study:	Due to spatial limitations, which prevent a roundabout from accommodating a future four-lane configuration of Cambrian Road, and per Cambrian Road widening EA, signalization of the subject intersection is recommended

Appendix I

Left Turn Lane Warrant

Cambrian Rd @ Realigned
Greenbank Road
FB2029

Design Speed	Westbound Left				Yes														
60 km/h		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	%Left Turn	Volume Advancing	Volume Opposing			
	AM	94	347	22	9	544	129	15	0	6	92	0	76	1.3%	682	463			
	PM	107	442	57	6	307	154	38	0	9	258	0	142	1.3%	467	606			
Design Speed	Southbound Left										Yes								
60 km/h		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	%Left Turn	Volume Advancing	Volume Opposing			
	AM	94	347	22	9	544	129	15	0	6	92	0	76	54.8%	168	21			
	PM	107	442	57	6	307	154	38	0	9	258	0	142	64.5%	400	47			
Design Speed	Eastbound Left	Yes																	
60 km/h		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	%Left Turn	Volume Advancing	Volume Opposing			
	AM	94	347	22	9	544	129	15	0	6	92	0	76	20.3%	463	682			
	PM	107	442	57	6	307	154	38	0	9	258	0	142	17.7%	606	467			
Design Speed	Northbound Left							Yes											
60 km/h		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	%Left Turn	Volume Advancing	Volume Opposing			
	AM	94	347	22	9	544	129	15	0	6	92	0	76	71.4%	21	168			
	PM	107	442	57	6	307	154	38	0	9	258	0	142	80.9%	47	400			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TWO LANE HIGHWAYS
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NO LEFT TURN LANE REQUIRED
WARRANT
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S=25
AM
PM
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V_A = ADVANCING VOLUME (VPH)
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300
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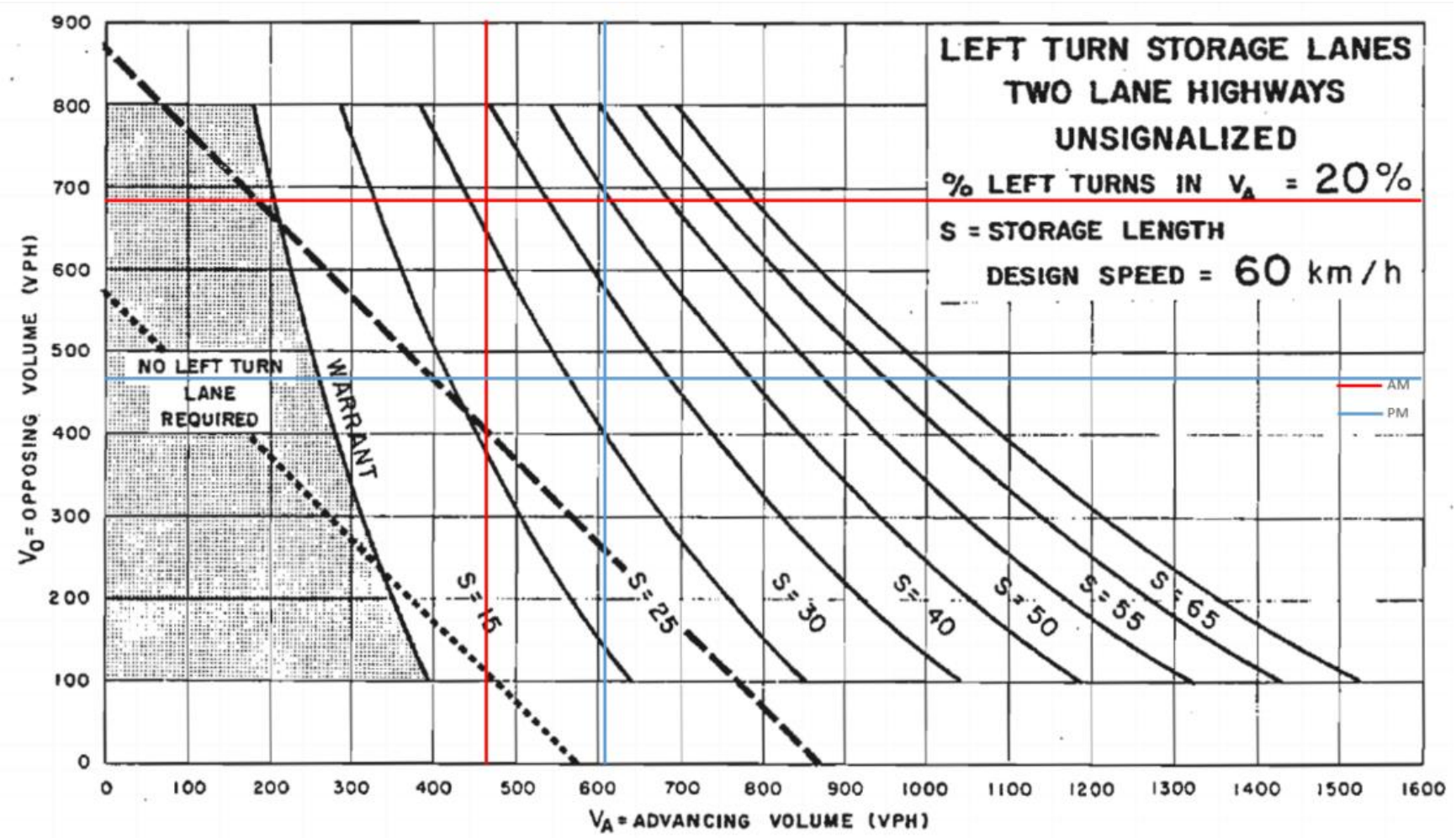
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600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UNSIGNALIZED
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S=25
S=30
S=40
S=50
S=55
S=65
AM
PM
V_O = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)
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1400
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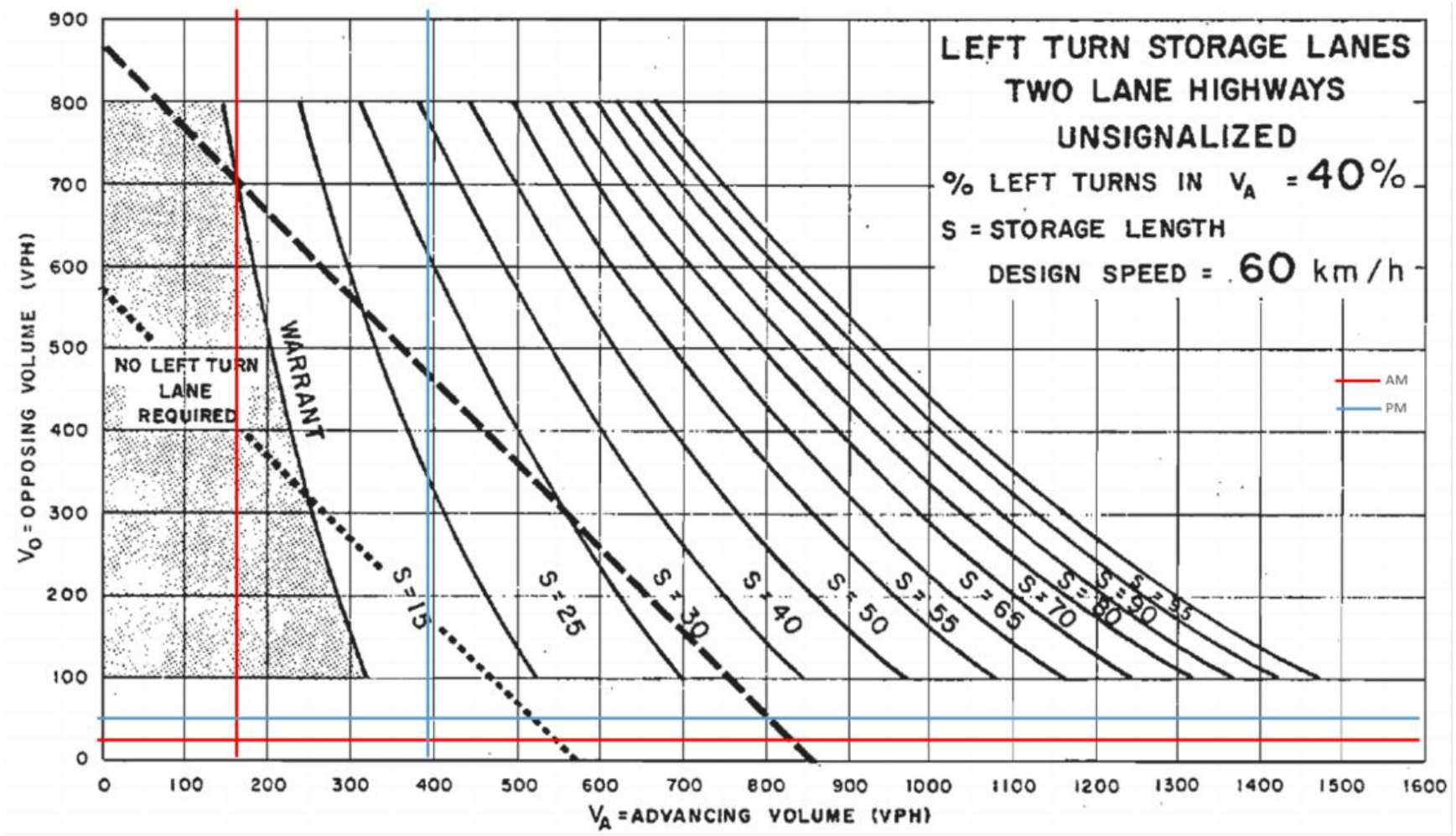
1600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S=55
S=65
S=70
S=80
S=90
S=95
AM
PM
V_O = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)
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400
500
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700
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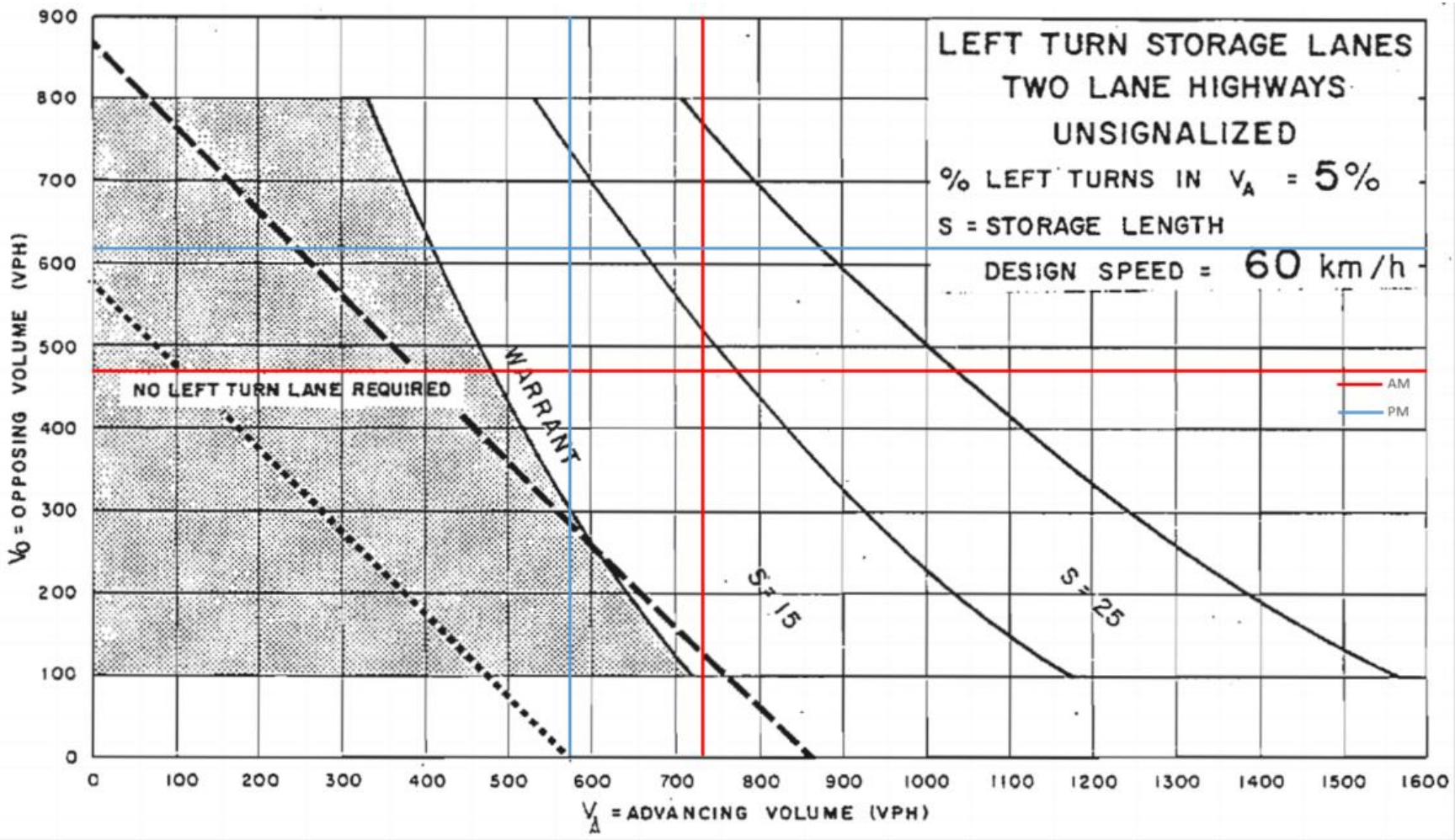
900
1000
1100
1200
1300
1400
1500
1600

Cambrian Rd @ Realigned
Greenbank Road
FT2029

Design Speed	Westbound Left				Yes														
60 km/h		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	%Left Turn	Volume Advancing	Volume Opposing			
	AM	100	347	22	9	544	179	15	0	6	208	0	89	0.0122951	732	469			
	PM	119	442	57	6	307	259	38	0	9	335	0	151	0.0104895	572	618			
Design Speed	Southbound Left										Yes								
60 km/h		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	%Left Turn	Volume Advancing	Volume Opposing			
	AM	100	347	22	9	544	179	15	0	6	208	0	89	0.7003367	297	21			
	PM	119	442	57	6	307	259	38	0	9	335	0	151	0.6893004	486	47			
Design Speed	Eastbound Left	Yes																	
60 km/h		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	%Left Turn	Volume Advancing	Volume Opposing			
	AM	100	347	22	9	544	179	15	0	6	208	0	89	0.2132196	469	732			
	PM	119	442	57	6	307	259	38	0	9	335	0	151	0.1925566	618	572			
Design Speed	Northbound Left							Yes											
60 km/h		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	%Left Turn	Volume Advancing	Volume Opposing			
	AM	100	347	22	9	544	179	15	0	6	208	0	89	0.7142857	21	297			
	PM	119	442	57	6	307	259	38	0	9	335	0	151	0.8085106	47	486			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DESIGN SPEED = 60 km/h
NO LEFT TURN LANE REQUIRED
WARRANT
S = 15
S = 25
AM
PM
V_O = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)
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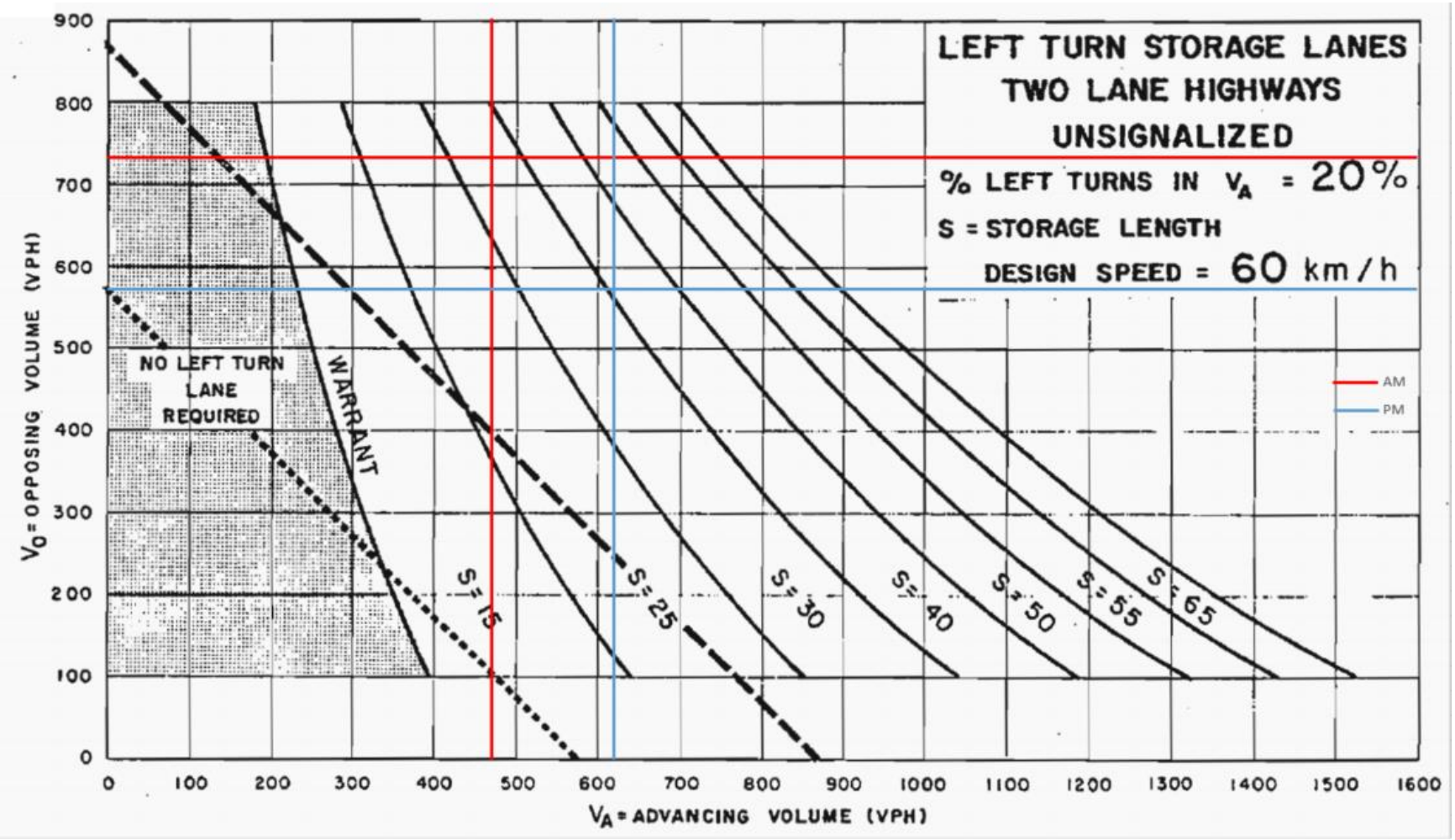
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UNSIGNALIZED
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DESIGN SPEED = 60 km/h
AM
PM
NO LEFT TURN LANE REQUIRED
WARRANT
S=15
S=25
S=30
S=40
S=50
S=55
S=65
V_O = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)
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800
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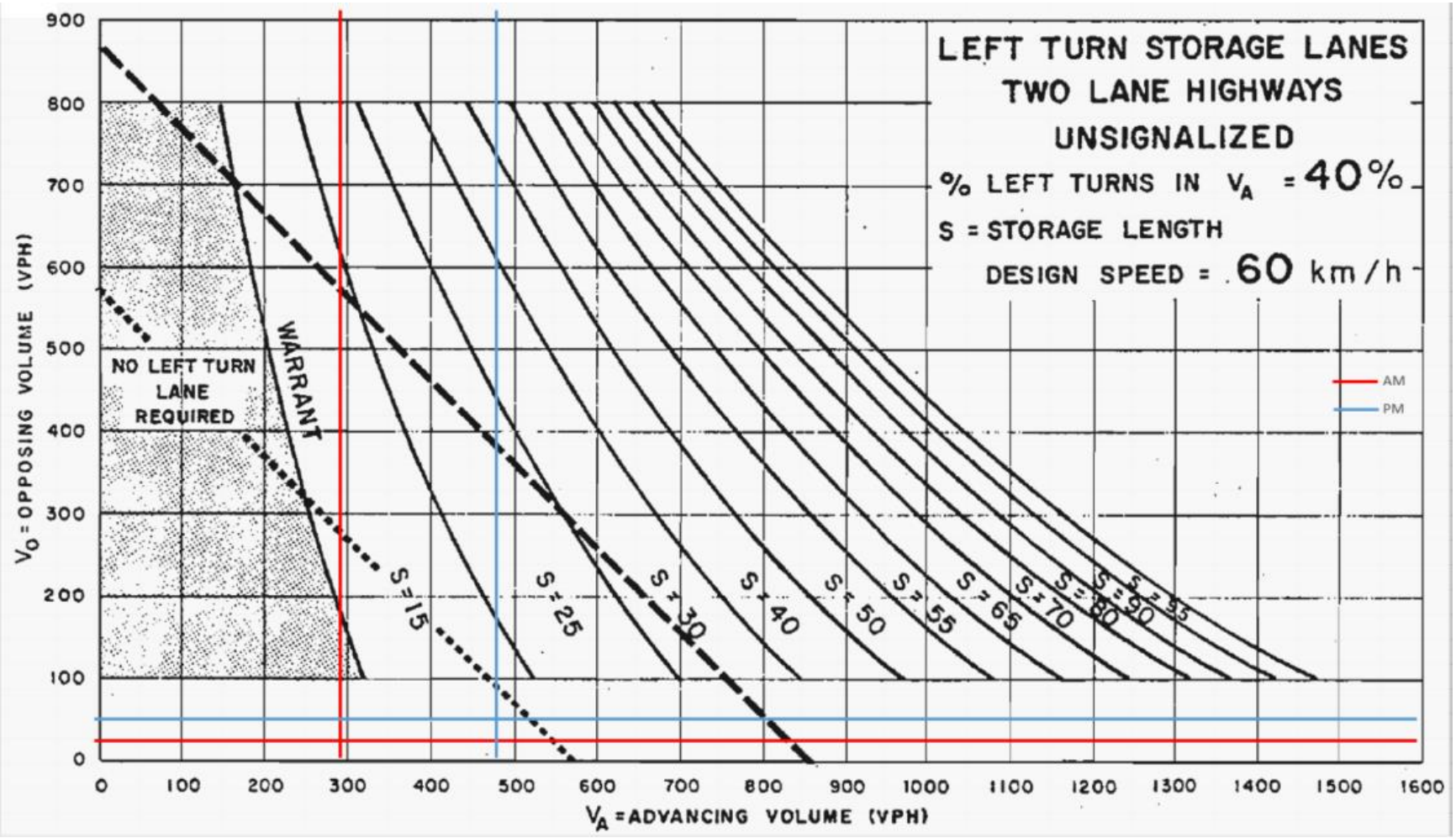
1200
1300
1400
1500
1600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UNSIGNALIZED
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DESIGN SPEED = 60 km/h
NO LEFT TURN LANE REQUIRED
WARRANT
S=15
S=25
S=30
S=40
S=50
S=55
S=65
S=70
S=80
S=90
S=95
AM
PM
V_O = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)
0
100
200
300
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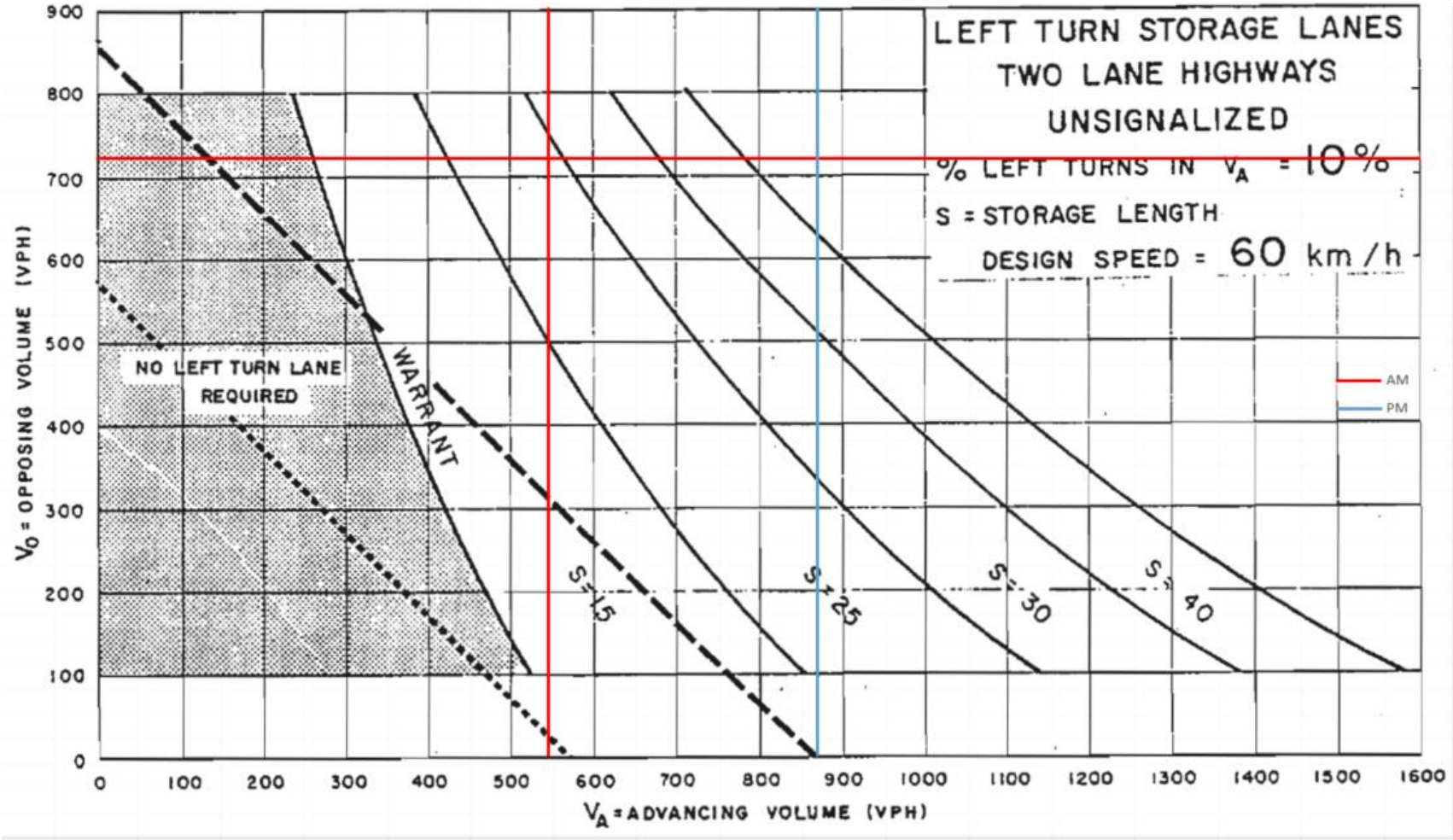
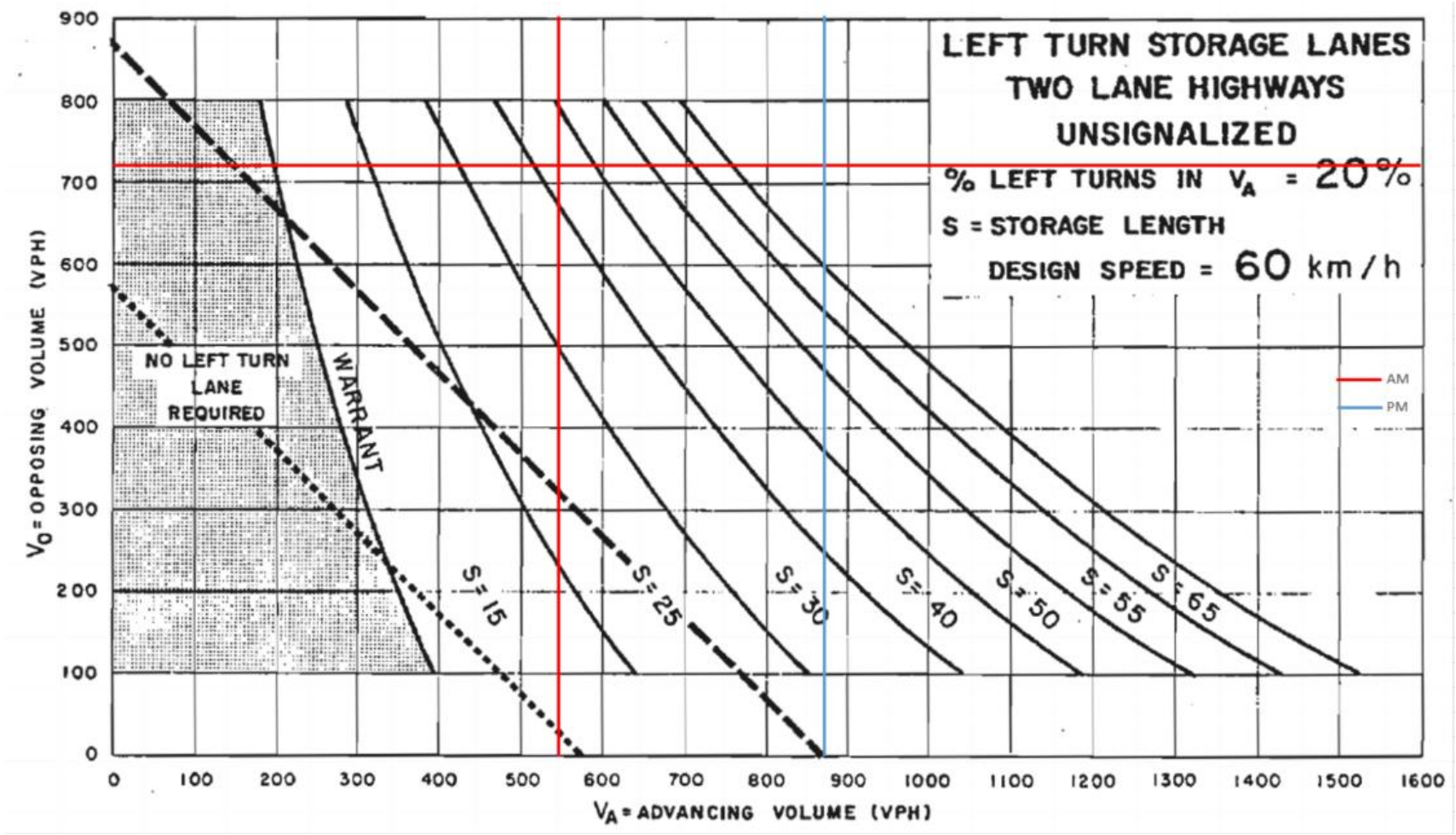
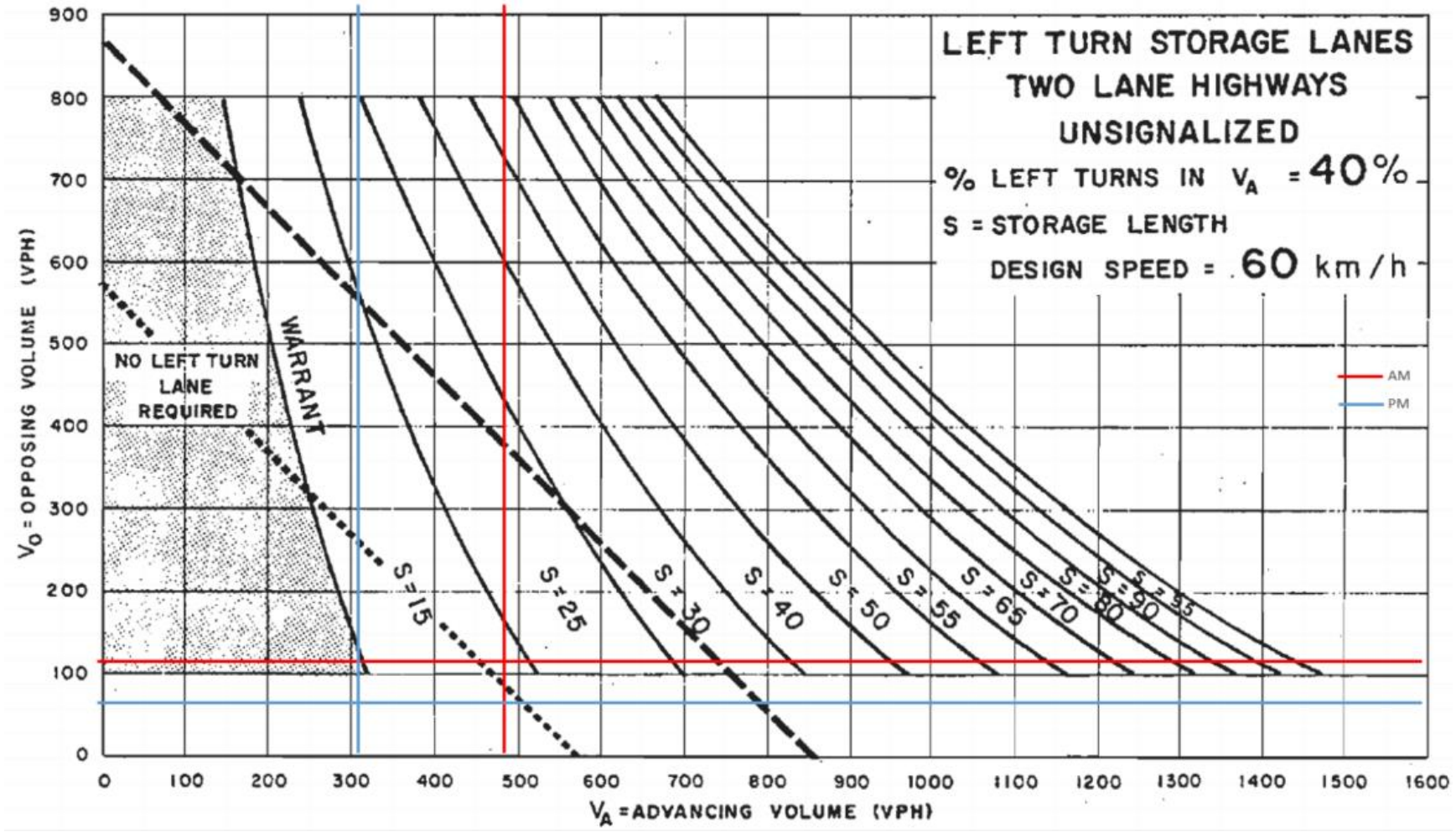
1000
1100
1200
1300
1400
1500
1600

Cambrian Rd @ River Mist Rd

FB2029	Design Speed	Westbound Left					Yes													
	60 km/h		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	%Left Turn	Volume Advancing	Volume Opposing			
		AM	17	571	131	57	443	45	295	61	135	58	20	33	10.5%	545	719			
		PM	22	750	198	151	655	64	175	19	120	29	14	18	17.4%	870	970			
	Design Speed	Southbound Left										Yes								
	60 km/h		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	%Left Turn	Volume Advancing	Volume Opposing			
		AM	17	571	131	57	443	45	295	61	135	58	20	33	52.3%	111	491			
		PM	22	750	198	151	655	64	175	19	120	29	14	18	47.5%	61	314			
	Design Speed	Eastbound Left	Yes																	
	60 km/h		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	%Left Turn	Volume Advancing	Volume Opposing			
		AM	17	571	131	57	443	45	295	61	135	58	20	33	2.4%	719	545			
		PM	22	750	198	151	655	64	175	19	120	29	14	18	2.3%	970	870			
	Design Speed	Northbound Left							Yes											
	60 km/h		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	%Left Turn	Volume Advancing	Volume Opposing			
		AM	17	571	131	57	443	45	295	61	135	58	20	33	60.1%	491	111			
		PM	22	750	198	151	655	64	175	19	120	29	14	18	55.7%	314	61			


LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 10%
S = STORAGE LENGTH
DESIGN SPEED = 60 km/h
NO LEFT TURN LANE REQUIRED
WARRANT
S=15
S=25
S=30
S=40
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


LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 20%
S = STORAGE LENGTH
DESIGN SPEED = 60 km/h
AM
PM
NO LEFT TURN LANE REQUIRED
WARRANT
S=15
S=25
S=30
S=40
S=50
S=55
S=65
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


LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 40%
S = STORAGE LENGTH
DESIGN SPEED = 60 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
S=90
S=95
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 J

HV% Calculations

[1]River Mist Road / Cambrian Road												
AM												
	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
HV Volume	3	5	4	2	1	1	3	22	1	8	21	2
Total Volume	121	50	104	58	16	26	14	228	49	49	247	45
HV%	2%	10%	4%	3%	6%	4%	21%	10%	2%	16%	9%	4%
PM												
	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
HV Volume	0	0	7	0	0	0	0	8	1	2	3	0
Total Volume	69	15	103	29	12	15	20	373	94	123	260	64
HV%	0%	0%	7%	0%	0%	0%	0%	2%	1%	2%	1%	0%

[3] Greenbank Road / Cambrian Road												
AM												
	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
HV Volume	3	3	0	4	3	7	3	8	6	4	3	5
Total Volume	95	209	136	76	77	73	114	276	35	69	180	65
HV%	3%	1%	0%	5%	4%	10%	3%	3%	17%	6%	2%	8%
PM												
	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
HV Volume	4	1	1	1	3	0	2	4	4	0	0	0
Total Volume	53	198	87	60	313	166	87	230	102	99	232	76
HV%	8%	1%	1%	2%	1%	0%	2%	2%	4%	0%	0%	0%

Appendix K

Synchro & Sidra Worksheets – 2021 Existing Conditions and Alternative Intersection Control Measures

Intersection	
Intersection Delay, s/veh	31.5
Intersection LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	14	260	77	57	267	45	183	52	135	58	17	26
Future Vol, veh/h	14	260	77	57	267	45	183	52	135	58	17	26
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	21	10	2	16	9	4	2	10	4	3	6	4
Mvmt Flow	16	289	86	63	297	50	203	58	150	64	19	29
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	31.7	34.9	32.5	14.2
HCM LOS	D	D	D	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	49%	4%	15%	57%
Vol Thru, %	14%	74%	72%	17%
Vol Right, %	36%	22%	12%	26%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	370	351	369	101
LT Vol	183	14	57	58
Through Vol	52	260	267	17
RT Vol	135	77	45	26
Lane Flow Rate	411	390	410	112
Geometry Grp	1	1	1	1
Degree of Util (X)	0.799	0.782	0.816	0.256
Departure Headway (Hd)	6.993	7.219	7.165	8.22
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	518	499	504	434
Service Time	5.051	5.282	5.228	6.314
HCM Lane V/C Ratio	0.793	0.782	0.813	0.258
HCM Control Delay	32.5	31.7	34.9	14.2
HCM Lane LOS	D	D	D	B
HCM 95th-tile Q	7.5	7.1	7.9	1

Intersection	
Int Delay, s/veh	70.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		⇕			⇕			⇕			⇕	
Traffic Vol, veh/h	14	260	77	57	267	45	183	52	135	58	17	26
Future Vol, veh/h	14	260	77	57	267	45	183	52	135	58	17	26
Conflicting Peds, #/hr	39	0	5	5	0	39	10	0	31	31	0	10
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	21	10	2	16	9	4	2	10	4	3	6	4
Mvmt Flow	16	289	86	63	297	50	203	58	150	64	19	29

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	386	0	0	380	0	0	851	881	368	986	899	371
Stage 1	-	-	-	-	-	-	369	369	-	487	487	-
Stage 2	-	-	-	-	-	-	482	512	-	499	412	-
Critical Hdwy	4.31	-	-	4.26	-	-	7.12	6.6	6.24	7.13	6.56	6.24
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.6	-	6.13	5.56	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.6	-	6.13	5.56	-
Follow-up Hdwy	2.389	-	-	2.344	-	-	3.518	4.09	3.336	3.527	4.054	3.336
Pot Cap-1 Maneuver	1076	-	-	1106	-	-	280	277	673	226	274	670
Stage 1	-	-	-	-	-	-	651	607	-	560	544	-
Stage 2	-	-	-	-	-	-	565	523	-	552	587	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1037	-	-	1101	-	-	231	242	651	124	239	640
Mov Cap-2 Maneuver	-	-	-	-	-	-	231	242	-	124	239	-
Stage 1	-	-	-	-	-	-	635	592	-	529	487	-
Stage 2	-	-	-	-	-	-	477	469	-	365	572	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	1.3	210.4	57.1
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	305	1037	-	-	1101	-	-	174
HCM Lane V/C Ratio	1.348	0.015	-	-	0.058	-	-	0.645
HCM Control Delay (s)	210.4	8.5	0	-	8.5	0	-	57.1
HCM Lane LOS	F	A	A	-	A	A	-	F
HCM 95th %tile Q(veh)	20.7	0	-	-	0.2	-	-	3.7

MOVEMENT SUMMARY

Site: 101 [Existing - AM Peak]

3432 Greenbank
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Greenbank												
1	L2	19	2.0	0.548	8.0	LOS A	4.7	33.4	0.52	0.54	0.52	40.2
2	T1	620	2.0	0.548	4.8	LOS A	4.7	33.4	0.52	0.54	0.52	44.6
3	R2	6	2.0	0.548	5.2	LOS A	4.7	33.4	0.52	0.54	0.52	39.5
Approach		644	2.0	0.548	4.9	LOS A	4.7	33.4	0.52	0.54	0.52	44.4
East: Half Moon Bay												
4	L2	21	2.0	0.151	11.2	LOS B	0.9	6.4	0.77	0.79	0.77	37.3
5	T1	7	2.0	0.151	8.0	LOS A	0.9	6.4	0.77	0.79	0.77	35.2
6	R2	61	2.0	0.151	8.6	LOS A	0.9	6.4	0.77	0.79	0.77	38.4
Approach		89	2.0	0.151	9.1	LOS A	0.9	6.4	0.77	0.79	0.77	37.9
North: Greenbank												
7	L2	6	2.0	0.181	7.0	LOS A	1.1	7.6	0.20	0.44	0.20	42.3
8	T1	186	2.0	0.181	3.8	LOS A	1.1	7.6	0.20	0.44	0.20	45.8
9	R2	46	2.0	0.181	4.1	LOS A	1.1	7.6	0.20	0.44	0.20	42.0
Approach		237	2.0	0.181	3.9	LOS A	1.1	7.6	0.20	0.44	0.20	44.9
West: Half Moon Bay												
10	L2	132	2.0	0.200	6.8	LOS A	1.1	7.7	0.42	0.59	0.42	40.6
11	T1	7	2.0	0.200	3.6	LOS A	1.1	7.7	0.42	0.59	0.42	36.9
12	R2	64	2.0	0.200	4.2	LOS A	1.1	7.7	0.42	0.59	0.42	38.4
Approach		203	2.0	0.200	5.9	LOS A	1.1	7.7	0.42	0.59	0.42	39.8
All Vehicles		1173	2.0	0.548	5.2	LOS A	4.7	33.4	0.46	0.55	0.46	43.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Cambrian and Greenbank 2021 Existing AM]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Greenbank Road												
1	L2	116	3.0	1.063	80.9	LOS F	32.6	232.5	1.00	2.41	5.31	14.1
2	T1	327	2.0	1.063	80.9	LOS F	32.6	232.5	1.00	2.41	5.31	14.7
3	R2	188	2.0	1.063	80.9	LOS F	32.6	232.5	1.00	2.41	5.31	11.6
Approach		630	2.2	1.063	80.9	LOS F	32.6	232.5	1.00	2.41	5.31	13.7
East: Cambrian Road												
4	L2	97	6.0	0.675	20.7	LOS C	5.8	41.9	0.78	1.07	1.53	27.5
5	T1	224	2.0	0.675	20.6	LOS C	5.8	41.9	0.78	1.07	1.53	29.8
6	R2	89	8.0	0.675	20.8	LOS C	5.8	41.9	0.78	1.07	1.53	29.8
Approach		410	4.2	0.675	20.7	LOS C	5.8	41.9	0.78	1.07	1.53	29.3
North: Greenbank Road												
7	L2	91	5.0	0.412	10.6	LOS B	2.0	14.9	0.58	0.63	0.70	39.1
8	T1	108	4.0	0.412	10.6	LOS B	2.0	14.9	0.58	0.63	0.70	39.2
9	R2	92	10.0	0.412	10.8	LOS B	2.0	14.9	0.58	0.63	0.70	38.4
Approach		291	6.2	0.412	10.7	LOS B	2.0	14.9	0.58	0.63	0.70	38.9
West: Cambrian Road												
10	L2	169	3.0	0.703	17.6	LOS C	9.6	69.4	0.74	1.00	1.37	35.2
11	T1	362	3.0	0.703	17.6	LOS C	9.6	69.4	0.74	1.00	1.37	31.5
12	R2	43	17.0	0.703	17.9	LOS C	9.6	69.4	0.74	1.00	1.37	30.1
Approach		574	4.1	0.703	17.6	LOS C	9.6	69.4	0.74	1.00	1.37	32.6
All Vehicles		1906	3.8	1.063	38.1	LOS E	32.6	232.5	0.81	1.43	2.60	22.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Intersection	
Intersection Delay, s/veh	65.7
Intersection LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	20	404	155	151	292	64	113	16	120	29	12	15
Future Vol, veh/h	20	404	155	151	292	64	113	16	120	29	12	15
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	7	2	2	2
Mvmt Flow	22	449	172	168	324	71	126	18	133	32	13	17
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	97.2	58.2	19.3	13.2
HCM LOS	F	F	C	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	45%	3%	30%	52%
Vol Thru, %	6%	70%	58%	21%
Vol Right, %	48%	27%	13%	27%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	249	579	507	56
LT Vol	113	20	151	29
Through Vol	16	404	292	12
RT Vol	120	155	64	15
Lane Flow Rate	277	643	563	62
Geometry Grp	1	1	1	1
Degree of Util (X)	0.551	1.116	0.976	0.144
Departure Headway (Hd)	7.48	6.243	6.579	8.76
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	484	585	558	412
Service Time	5.48	4.268	4.579	6.76
HCM Lane V/C Ratio	0.572	1.099	1.009	0.15
HCM Control Delay	19.3	97.2	58.2	13.2
HCM Lane LOS	C	F	F	B
HCM 95th-tile Q	3.3	20.2	13.4	0.5

Intersection	
Int Delay, s/veh	75.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		⇕			⇕			⇕			⇕	
Traffic Vol, veh/h	20	404	155	151	292	64	113	16	120	29	12	15
Future Vol, veh/h	20	404	155	151	292	64	113	16	120	29	12	15
Conflicting Peds, #/hr	13	0	3	3	0	13	9	0	16	16	0	9
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	7	2	2	2
Mvmt Flow	22	449	172	168	324	71	126	18	133	32	13	17

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	408	0	0	624	0	0	1302	1326	554	1380	1377	382
Stage 1	-	-	-	-	-	-	582	582	-	709	709	-
Stage 2	-	-	-	-	-	-	720	744	-	671	668	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.27	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.363	3.518	4.018	3.318
Pot Cap-1 Maneuver	1151	-	-	957	-	-	138	156	522	122	145	665
Stage 1	-	-	-	-	-	-	499	499	-	425	437	-
Stage 2	-	-	-	-	-	-	419	421	-	446	456	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1137	-	-	954	-	-	~ 97	115	513	63	107	651
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 97	115	-	63	107	-
Stage 1	-	-	-	-	-	-	483	483	-	407	333	-
Stage 2	-	-	-	-	-	-	300	321	-	304	441	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	2.9	$ 392.5	98.4
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	162	1137	-	-	954	-	-	94
HCM Lane V/C Ratio	1.708	0.02	-	-	0.176	-	-	0.662
HCM Control Delay (s)	$ 392.5	8.2	0	-	9.6	0	-	98.4
HCM Lane LOS	F	A	A	-	A	A	-	F
HCM 95th %tile Q(veh)	19.6	0.1	-	-	0.6	-	-	3.2

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

MOVEMENT SUMMARY

Site: 101 [Existing - PM Peak]

3432 Greenbank
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Greenbank												
1	L2	43	2.0	0.422	7.9	LOS A	3.1	22.3	0.47	0.54	0.47	40.3
2	T1	410	2.0	0.422	4.7	LOS A	3.1	22.3	0.47	0.54	0.47	44.7
3	R2	27	2.0	0.422	5.0	LOS A	3.1	22.3	0.47	0.54	0.47	39.6
Approach		480	2.0	0.422	5.0	LOS A	3.1	22.3	0.47	0.54	0.47	44.0
East: Half Moon Bay												
4	L2	14	2.0	0.129	9.0	LOS A	0.7	5.1	0.64	0.68	0.64	38.7
5	T1	32	2.0	0.129	5.8	LOS A	0.7	5.1	0.64	0.68	0.64	36.6
6	R2	49	2.0	0.129	6.4	LOS A	0.7	5.1	0.64	0.68	0.64	39.7
Approach		96	2.0	0.129	6.6	LOS A	0.7	5.1	0.64	0.68	0.64	38.6
North: Greenbank												
7	L2	43	2.0	0.622	7.6	LOS A	6.2	44.4	0.46	0.49	0.46	41.5
8	T1	649	2.0	0.622	4.4	LOS A	6.2	44.4	0.46	0.49	0.46	44.8
9	R2	118	2.0	0.622	4.8	LOS A	6.2	44.4	0.46	0.49	0.46	41.1
Approach		810	2.0	0.622	4.6	LOS A	6.2	44.4	0.46	0.49	0.46	44.0
West: Half Moon Bay												
10	L2	98	2.0	0.211	10.7	LOS B	1.3	9.1	0.76	0.82	0.76	38.0
11	T1	8	2.0	0.211	7.5	LOS A	1.3	9.1	0.76	0.82	0.76	34.8
12	R2	27	2.0	0.211	8.1	LOS A	1.3	9.1	0.76	0.82	0.76	35.6
Approach		132	2.0	0.211	10.0	LOS A	1.3	9.1	0.76	0.82	0.76	37.4
All Vehicles		1518	2.0	0.622	5.3	LOS A	6.2	44.4	0.50	0.55	0.50	43.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Cambrian and Greenbank 2021 Existing PM]

New Site
Site Category: (None)
Roundabout

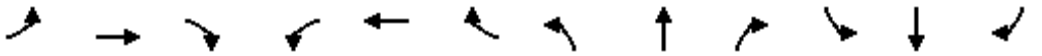
Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Greenbank Road												
1	L2	64	8.0	0.657	18.1	LOS C	6.2	44.2	0.75	0.99	1.40	32.7
2	T1	268	2.0	0.657	17.9	LOS C	6.2	44.2	0.75	0.99	1.40	34.0
3	R2	119	2.0	0.657	17.9	LOS C	6.2	44.2	0.75	0.99	1.40	28.2
Approach		451	2.9	0.657	18.0	LOS C	6.2	44.2	0.75	0.99	1.40	32.4
East: Cambrian Road												
4	L2	133	2.0	0.743	21.9	LOS C	9.3	66.3	0.83	1.21	1.73	27.0
5	T1	303	2.0	0.743	21.9	LOS C	9.3	66.3	0.83	1.21	1.73	29.0
6	R2	91	2.0	0.743	21.9	LOS C	9.3	66.3	0.83	1.21	1.73	29.5
Approach		528	2.0	0.743	21.9	LOS C	9.3	66.3	0.83	1.21	1.73	28.7
North: Greenbank Road												
7	L2	72	2.0	1.073	80.1	LOS F	40.3	286.8	1.00	2.53	5.31	14.8
8	T1	432	2.0	1.073	80.1	LOS F	40.3	286.8	1.00	2.53	5.31	14.8
9	R2	216	2.0	1.073	80.1	LOS F	40.3	286.8	1.00	2.53	5.31	16.2
Approach		720	2.0	1.073	80.1	LOS F	40.3	286.8	1.00	2.53	5.31	15.2
West: Cambrian Road												
10	L2	113	2.0	0.881	39.2	LOS E	13.7	97.8	0.94	1.64	2.75	25.4
11	T1	292	2.0	0.881	39.2	LOS E	13.7	97.8	0.94	1.64	2.75	22.0
12	R2	123	4.0	0.881	39.2	LOS E	13.7	97.8	0.94	1.64	2.75	21.6
Approach		529	2.5	0.881	39.2	LOS E	13.7	97.8	0.94	1.64	2.75	22.7
All Vehicles		2228	2.3	1.073	44.0	LOS E	40.3	286.8	0.89	1.69	3.06	21.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix L

Synchro & Sidra Worksheets – 2024 Future Background Synchro Sheets

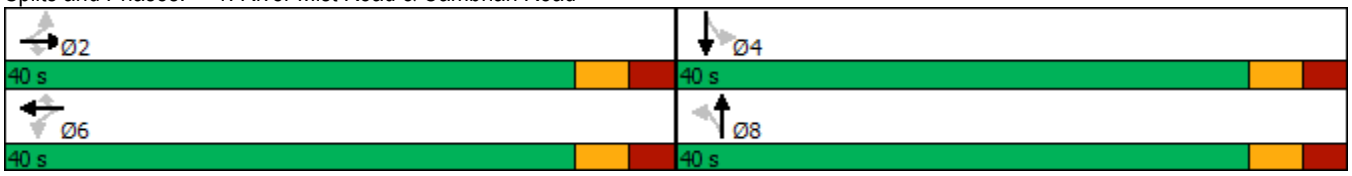


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	17	419	131	57	348	45	295	55	135	58	18	33
Future Volume (vph)	17	419	131	57	348	45	295	55	135	58	18	33
Satd. Flow (prot)	1258	1456	1335	1312	1470	1309	1492	1296	0	1478	1353	0
Flt Permitted	0.440			0.351			0.724			0.638		
Satd. Flow (perm)	565	1456	1300	483	1470	1215	1125	1296	0	963	1353	0
Satd. Flow (RTOR)			131			45		135			33	
Lane Group Flow (vph)	17	419	131	57	348	45	295	190	0	58	51	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6		6	8			4		
Detector Phase	2	2	2	6	6	6	8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0		10.0	10.0	
Minimum Split (s)	36.6	36.6	36.6	35.6	35.6	35.6	38.0	38.0		40.0	40.0	
Total Split (s)	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0		40.0	40.0	
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%		50.0%	50.0%	
Yellow Time (s)	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3		3.3	3.3	
All-Red Time (s)	2.8	2.8	2.8	2.8	2.8	2.8	2.7	2.7		2.7	2.7	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.1	6.1	6.1	6.1	6.1	6.1	6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	Max	Max		Max	Max	
Act Effct Green (s)	24.8	24.8	24.8	24.8	24.8	24.8	34.3	34.3		34.3	34.3	
Actuated g/C Ratio	0.35	0.35	0.35	0.35	0.35	0.35	0.48	0.48		0.48	0.48	
v/c Ratio	0.09	0.83	0.24	0.34	0.68	0.10	0.55	0.27		0.13	0.08	
Control Delay	15.6	35.7	4.2	22.6	26.9	5.3	19.8	6.0		13.5	7.2	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	15.6	35.7	4.2	22.6	26.9	5.3	19.8	6.0		13.5	7.2	
LOS	B	D	A	C	C	A	B	A		B	A	
Approach Delay		27.9			24.2			14.4			10.6	
Approach LOS		C			C			B			B	
Queue Length 50th (m)	1.5	49.9	0.0	5.5	38.6	0.0	26.4	3.8		4.1	1.2	
Queue Length 95th (m)	5.3	82.0	9.2	14.4	63.9	5.5	60.4	17.0		12.5	7.6	
Internal Link Dist (m)		136.7			171.5			225.4			236.2	
Turn Bay Length (m)	60.0		85.0	80.0		60.0	100.0			60.0		
Base Capacity (vph)	271	698	691	231	705	606	541	693		463	668	
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Reduced v/c Ratio	0.06	0.60	0.19	0.25	0.49	0.07	0.55	0.27		0.13	0.08	

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 71.3
Natural Cycle: 80
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.83

Intersection Signal Delay: 21.6	Intersection LOS: C
Intersection Capacity Utilization 101.9%	ICU Level of Service G
Analysis Period (min) 15	

Splits and Phases: 1: River Mist Road & Cambrian Road



MOVEMENT SUMMARY

Site: 101 [FB2024 - AM Peak]

3432 Greenbank
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Greenbank												
1	L2	17	2.0	0.578	7.9	LOS A	5.2	37.4	0.52	0.52	0.52	40.2
2	T1	676	2.0	0.578	4.7	LOS A	5.2	37.4	0.52	0.52	0.52	44.6
3	R2	5	2.0	0.578	5.1	LOS A	5.2	37.4	0.52	0.52	0.52	39.5
Approach		698	2.0	0.578	4.8	LOS A	5.2	37.4	0.52	0.52	0.52	44.5
East: Half Moon Bay												
4	L2	19	2.0	0.143	11.6	LOS B	0.9	6.1	0.78	0.80	0.78	37.0
5	T1	6	2.0	0.143	8.5	LOS A	0.9	6.1	0.78	0.80	0.78	34.9
6	R2	55	2.0	0.143	9.0	LOS A	0.9	6.1	0.78	0.80	0.78	38.2
Approach		80	2.0	0.143	9.6	LOS A	0.9	6.1	0.78	0.80	0.78	37.7
North: Greenbank												
7	L2	5	2.0	0.185	6.9	LOS A	1.1	7.9	0.19	0.43	0.19	42.3
8	T1	199	2.0	0.185	3.7	LOS A	1.1	7.9	0.19	0.43	0.19	45.8
9	R2	41	2.0	0.185	4.1	LOS A	1.1	7.9	0.19	0.43	0.19	42.0
Approach		245	2.0	0.185	3.9	LOS A	1.1	7.9	0.19	0.43	0.19	45.1
West: Half Moon Bay												
10	L2	119	2.0	0.182	6.8	LOS A	1.0	6.9	0.43	0.60	0.43	40.6
11	T1	6	2.0	0.182	3.7	LOS A	1.0	6.9	0.43	0.60	0.43	36.9
12	R2	58	2.0	0.182	4.2	LOS A	1.0	6.9	0.43	0.60	0.43	38.3
Approach		183	2.0	0.182	5.9	LOS A	1.0	6.9	0.43	0.60	0.43	39.8
All Vehicles		1206	2.0	0.578	5.1	LOS A	5.2	37.4	0.46	0.54	0.46	43.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

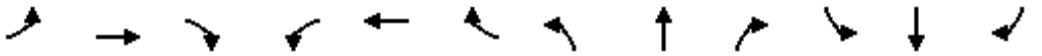
Site: 101 [Cambrian and Greenbank 2024 FB AM]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Greenbank Road												
1	L2	136	3.0	1.334	185.5	LOS F	69.4	494.8	1.00	3.89	10.28	7.2
2	T1	362	2.0	1.334	185.4	LOS F	69.4	494.8	1.00	3.89	10.28	7.5
3	R2	211	2.0	1.334	185.4	LOS F	69.4	494.8	1.00	3.89	10.28	5.9
Approach		709	2.2	1.334	185.4	LOS F	69.4	494.8	1.00	3.89	10.28	7.0
East: Cambrian Road												
4	L2	106	6.0	0.718	22.9	LOS C	6.9	50.1	0.81	1.15	1.69	26.3
5	T1	250	2.0	0.718	22.8	LOS C	6.9	50.1	0.81	1.15	1.69	28.6
6	R2	85	8.0	0.718	23.0	LOS C	6.9	50.1	0.81	1.15	1.69	28.7
Approach		441	4.1	0.718	22.9	LOS C	6.9	50.1	0.81	1.15	1.69	28.1
North: Greenbank Road												
7	L2	87	5.0	0.439	11.4	LOS B	2.3	17.1	0.61	0.68	0.80	38.5
8	T1	117	4.0	0.439	11.4	LOS B	2.3	17.1	0.61	0.68	0.80	38.6
9	R2	97	10.0	0.439	11.6	LOS B	2.3	17.1	0.61	0.68	0.80	37.8
Approach		301	6.2	0.439	11.5	LOS B	2.3	17.1	0.61	0.68	0.80	38.3
West: Cambrian Road												
10	L2	200	3.0	0.875	31.2	LOS D	22.1	160.1	0.99	1.69	2.48	28.3
11	T1	443	3.0	0.875	31.2	LOS D	22.1	160.1	0.99	1.69	2.48	24.8
12	R2	61	17.0	0.875	31.5	LOS D	22.1	160.1	0.99	1.69	2.48	23.9
Approach		704	4.2	0.875	31.2	LOS D	22.1	160.1	0.99	1.69	2.48	25.8
All Vehicles		2155	3.8	1.334	77.5	LOS F	69.4	494.8	0.90	2.16	4.65	14.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.



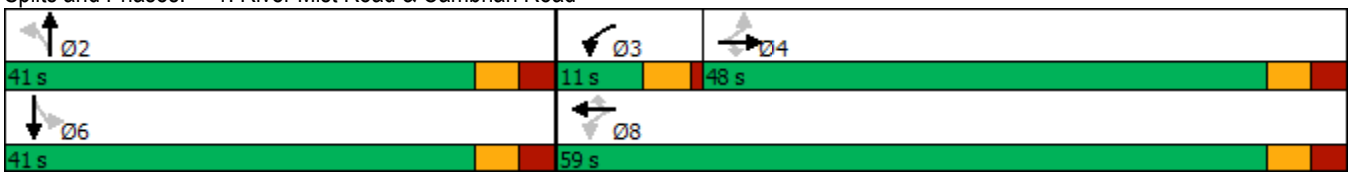
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	22	611	198	151	503	64	175	17	120	29	13	18
Future Volume (vph)	22	611	198	151	503	64	175	17	120	29	13	18
Satd. Flow (prot)	1658	1745	1483	1658	1745	1483	1658	1397	0	1658	1563	0
Flt Permitted	0.463			0.136			0.737			0.669		
Satd. Flow (perm)	799	1745	1447	237	1745	1422	1270	1397	0	1143	1563	0
Satd. Flow (RTOR)			198			64		120			18	
Lane Group Flow (vph)	22	611	198	151	503	64	175	137	0	29	31	0
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4		3	8			2			6	
Permitted Phases	4		4	8		8	2			6		
Detector Phase	4	4	4	3	8	8	2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	5.0	10.0	10.0	10.0	10.0		10.0	10.0	
Minimum Split (s)	36.6	36.6	36.6	9.5	35.6	35.6	38.0	38.0		40.0	40.0	
Total Split (s)	48.0	48.0	48.0	11.0	59.0	59.0	41.0	41.0		41.0	41.0	
Total Split (%)	48.0%	48.0%	48.0%	11.0%	59.0%	59.0%	41.0%	41.0%		41.0%	41.0%	
Yellow Time (s)	3.3	3.3	3.3	3.5	3.3	3.3	3.3	3.3		3.3	3.3	
All-Red Time (s)	2.8	2.8	2.8	1.0	2.8	2.8	2.7	2.7		2.7	2.7	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.1	6.1	6.1	4.5	6.1	6.1	6.0	6.0		6.0	6.0	
Lead/Lag	Lag	Lag	Lag	Lead								
Lead-Lag Optimize?	Yes	Yes	Yes	Yes								
Recall Mode	None	None	None	None	None	None	Max	Max		Max	Max	
Act Effct Green (s)	36.7	36.7	36.7	49.4	47.8	47.8	35.2	35.2		35.2	35.2	
Actuated g/C Ratio	0.39	0.39	0.39	0.52	0.50	0.50	0.37	0.37		0.37	0.37	
v/c Ratio	0.07	0.91	0.29	0.69	0.57	0.09	0.37	0.23		0.07	0.05	
Control Delay	18.4	46.2	3.9	29.7	19.4	3.4	26.3	6.8		22.1	13.1	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	18.4	46.2	3.9	29.7	19.4	3.4	26.3	6.8		22.1	13.1	
LOS	B	D	A	C	B	A	C	A		C	B	
Approach Delay		35.4			20.1			17.7			17.4	
Approach LOS		D			C			B			B	
Queue Length 50th (m)	2.5	103.5	0.0	13.9	61.3	0.0	24.8	2.1		3.6	1.6	
Queue Length 95th (m)	7.3	#164.0	12.5	#29.1	90.4	5.9	43.8	14.6		9.9	7.6	
Internal Link Dist (m)		136.7			171.5			225.4			236.2	
Turn Bay Length (m)	60.0		85.0	80.0		60.0	100.0			60.0		
Base Capacity (vph)	353	772	751	220	975	822	469	591		422	588	
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Reduced v/c Ratio	0.06	0.79	0.26	0.69	0.52	0.08	0.37	0.23		0.07	0.05	

Intersection Summary
Cycle Length: 100
Actuated Cycle Length: 95.1
Natural Cycle: 90
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.91

Intersection Signal Delay: 26.3	Intersection LOS: C
Intersection Capacity Utilization 84.9%	ICU Level of Service E
Analysis Period (min) 15	

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

Splits and Phases: 1: River Mist Road & Cambrian Road



MOVEMENT SUMMARY

Site: 101 [FB2024 - PM Peak]

3432 Greenbank
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Greenbank												
1	L2	39	2.0	0.438	7.8	LOS A	3.4	23.9	0.46	0.52	0.46	40.4
2	T1	448	2.0	0.438	4.6	LOS A	3.4	23.9	0.46	0.52	0.46	44.8
3	R2	24	2.0	0.438	4.9	LOS A	3.4	23.9	0.46	0.52	0.46	39.6
Approach		511	2.0	0.438	4.8	LOS A	3.4	23.9	0.46	0.52	0.46	44.2
East: Half Moon Bay												
4	L2	13	2.0	0.121	9.2	LOS A	0.7	4.8	0.65	0.69	0.65	38.6
5	T1	31	2.0	0.121	6.0	LOS A	0.7	4.8	0.65	0.69	0.65	36.5
6	R2	44	2.0	0.121	6.6	LOS A	0.7	4.8	0.65	0.69	0.65	39.6
Approach		88	2.0	0.121	6.8	LOS A	0.7	4.8	0.65	0.69	0.65	38.5
North: Greenbank												
7	L2	39	2.0	0.652	7.6	LOS A	7.0	50.0	0.47	0.48	0.47	41.5
8	T1	719	2.0	0.652	4.4	LOS A	7.0	50.0	0.47	0.48	0.47	44.8
9	R2	106	2.0	0.652	4.8	LOS A	7.0	50.0	0.47	0.48	0.47	41.1
Approach		864	2.0	0.652	4.6	LOS A	7.0	50.0	0.47	0.48	0.47	44.1
West: Half Moon Bay												
10	L2	88	2.0	0.204	11.4	LOS B	1.2	8.9	0.79	0.84	0.79	37.6
11	T1	7	2.0	0.204	8.2	LOS A	1.2	8.9	0.79	0.84	0.79	34.5
12	R2	24	2.0	0.204	8.8	LOS A	1.2	8.9	0.79	0.84	0.79	35.1
Approach		119	2.0	0.204	10.7	LOS B	1.2	8.9	0.79	0.84	0.79	37.0
All Vehicles		1582	2.0	0.652	5.2	LOS A	7.0	50.0	0.50	0.53	0.50	43.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Cambrian and Greenbank 2024 FB PM]

New Site
Site Category: (None)
Roundabout

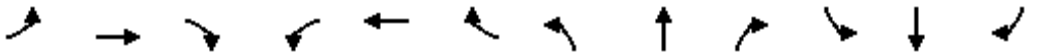
Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Greenbank Road												
1	L2	113	8.0	0.762	24.9	LOS C	9.0	64.5	0.85	1.21	1.88	28.5
2	T1	257	2.0	0.762	24.7	LOS C	9.0	64.5	0.85	1.21	1.88	29.6
3	R2	127	2.0	0.762	24.7	LOS C	9.0	64.5	0.85	1.21	1.88	24.3
Approach		497	3.4	0.762	24.7	LOS C	9.0	64.5	0.85	1.21	1.88	28.1
East: Cambrian Road												
4	L2	147	2.0	0.898	39.4	LOS E	17.0	120.9	0.99	1.76	2.91	19.7
5	T1	356	2.0	0.898	39.4	LOS E	17.0	120.9	0.99	1.76	2.91	22.0
6	R2	87	2.0	0.898	39.4	LOS E	17.0	120.9	0.99	1.76	2.91	22.5
Approach		590	2.0	0.898	39.4	LOS E	17.0	120.9	0.99	1.76	2.91	21.5
North: Greenbank Road												
7	L2	69	2.0	1.325	178.8	LOS F	77.1	548.8	1.00	3.97	10.02	7.7
8	T1	430	2.0	1.325	178.8	LOS F	77.1	548.8	1.00	3.97	10.02	7.7
9	R2	292	2.0	1.325	178.8	LOS F	77.1	548.8	1.00	3.97	10.02	8.8
Approach		791	2.0	1.325	178.8	LOS F	77.1	548.8	1.00	3.97	10.02	8.2
West: Cambrian Road												
10	L2	165	2.0	1.070	80.1	LOS F	38.3	273.8	1.00	2.74	5.31	16.5
11	T1	347	2.0	1.070	80.1	LOS F	38.3	273.8	1.00	2.74	5.31	13.9
12	R2	185	4.0	1.070	80.1	LOS F	38.3	273.8	1.00	2.74	5.31	13.8
Approach		697	2.5	1.070	80.1	LOS F	38.3	273.8	1.00	2.74	5.31	14.5
All Vehicles		2575	2.4	1.325	90.4	LOS F	77.1	548.8	0.97	2.60	5.54	13.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix M

Synchro & Sidra Worksheets – 2029 Future Background Synchro Sheets



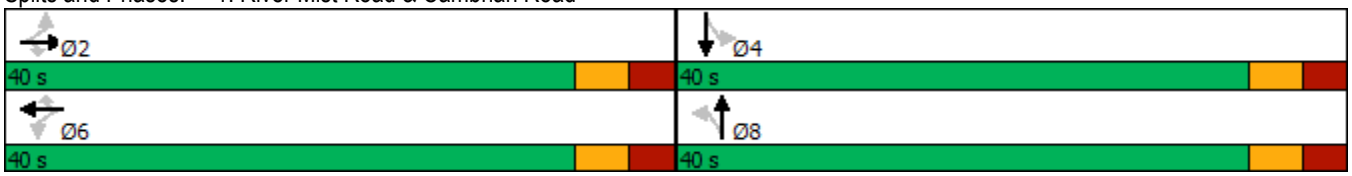
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	17	571	131	57	443	45	295	61	135	58	20	33
Future Volume (vph)	17	571	131	57	443	45	295	61	135	58	20	33
Satd. Flow (prot)	1258	1456	1335	1312	1470	1309	1492	1302	0	1478	1359	0
Flt Permitted	0.367			0.238			0.722			0.634		
Satd. Flow (perm)	474	1456	1300	328	1470	1215	1122	1302	0	957	1359	0
Satd. Flow (RTOR)			131			45		135			33	
Lane Group Flow (vph)	17	571	131	57	443	45	295	196	0	58	53	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6		6	8			4		
Detector Phase	2	2	2	6	6	6	8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0		10.0	10.0	
Minimum Split (s)	36.6	36.6	36.6	35.6	35.6	35.6	38.0	38.0		40.0	40.0	
Total Split (s)	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0		40.0	40.0	
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%		50.0%	50.0%	
Yellow Time (s)	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3		3.3	3.3	
All-Red Time (s)	2.8	2.8	2.8	2.8	2.8	2.8	2.7	2.7		2.7	2.7	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.1	6.1	6.1	6.1	6.1	6.1	6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	Max	Max		Max	Max	
Act Effct Green (s)	32.5	32.5	32.5	32.5	32.5	32.5	34.0	34.0		34.0	34.0	
Actuated g/C Ratio	0.41	0.41	0.41	0.41	0.41	0.41	0.43	0.43		0.43	0.43	
v/c Ratio	0.09	0.95	0.21	0.42	0.73	0.09	0.61	0.31		0.14	0.09	
Control Delay	15.4	50.6	3.8	28.0	27.7	5.1	24.3	6.8		15.3	7.8	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	15.4	50.6	3.8	28.0	27.7	5.1	24.3	6.8		15.3	7.8	
LOS	B	D	A	C	C	A	C	A		B	A	
Approach Delay		41.2			25.8			17.3			11.7	
Approach LOS		D			C			B			B	
Queue Length 50th (m)	1.5	79.6	0.0	5.9	53.7	0.0	33.9	5.4		5.2	1.7	
Queue Length 95th (m)	5.4	#142.4	9.2	17.3	87.9	5.5	60.5	17.8		12.5	7.9	
Internal Link Dist (m)		481.5			171.5			225.4			236.2	
Turn Bay Length (m)	60.0		85.0	80.0		60.0	100.0			60.0		
Base Capacity (vph)	204	627	635	141	633	549	485	639		413	606	
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Reduced v/c Ratio	0.08	0.91	0.21	0.40	0.70	0.08	0.61	0.31		0.14	0.09	

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 78.7
Natural Cycle: 80
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.95

Intersection Signal Delay: 28.7	Intersection LOS: C
Intersection Capacity Utilization 111.2%	ICU Level of Service H
Analysis Period (min) 15	

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

Splits and Phases: 1: River Mist Road & Cambrian Road



MOVEMENT SUMMARY

Site: 101 [FB2029 - AM Peak]

3432 Greenbank
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Greenbank												
1	L2	20	2.0	0.720	8.3	LOS A	8.5	60.2	0.67	0.56	0.67	39.7
2	T1	853	2.0	0.720	5.1	LOS A	8.5	60.2	0.67	0.56	0.67	44.1
3	R2	6	2.0	0.720	5.5	LOS A	8.5	60.2	0.67	0.56	0.67	39.1
Approach		879	2.0	0.720	5.2	LOS A	8.5	60.2	0.67	0.56	0.67	44.0
East: Half Moon Bay												
4	L2	23	2.0	0.202	14.6	LOS B	1.3	9.4	0.89	0.91	0.89	35.4
5	T1	7	2.0	0.202	11.5	LOS B	1.3	9.4	0.89	0.91	0.89	33.4
6	R2	55	2.0	0.202	12.0	LOS B	1.3	9.4	0.89	0.91	0.89	36.7
Approach		85	2.0	0.202	12.7	LOS B	1.3	9.4	0.89	0.91	0.89	36.1
North: Greenbank												
7	L2	5	2.0	0.232	7.0	LOS A	1.5	10.5	0.22	0.43	0.22	42.2
8	T1	259	2.0	0.232	3.8	LOS A	1.5	10.5	0.22	0.43	0.22	45.7
9	R2	41	2.0	0.232	4.2	LOS A	1.5	10.5	0.22	0.43	0.22	42.0
Approach		305	2.0	0.232	3.9	LOS A	1.5	10.5	0.22	0.43	0.22	45.1
West: Half Moon Bay												
10	L2	119	2.0	0.206	7.3	LOS A	1.1	8.0	0.49	0.63	0.49	40.4
11	T1	7	2.0	0.206	4.1	LOS A	1.1	8.0	0.49	0.63	0.49	36.8
12	R2	70	2.0	0.206	4.7	LOS A	1.1	8.0	0.49	0.63	0.49	38.1
Approach		196	2.0	0.206	6.2	LOS A	1.1	8.0	0.49	0.63	0.49	39.5
All Vehicles		1465	2.0	0.720	5.5	LOS A	8.5	60.2	0.56	0.56	0.56	43.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Cambrian and Greenbank 2029 FB AM]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Greenbank Road												
1	L2	157	3.0	1.678	334.4	LOS F	117.5	838.0	1.00	5.21	14.93	4.3
2	T1	444	2.0	1.678	334.4	LOS F	117.5	838.0	1.00	5.21	14.93	4.5
3	R2	227	2.0	1.678	334.4	LOS F	117.5	838.0	1.00	5.21	14.93	3.5
Approach		828	2.2	1.678	334.4	LOS F	117.5	838.0	1.00	5.21	14.93	4.2
East: Cambrian Road												
4	L2	114	6.0	0.841	34.1	LOS D	11.3	81.8	0.90	1.49	2.41	21.4
5	T1	295	2.0	0.841	34.0	LOS D	11.3	81.8	0.90	1.49	2.41	23.8
6	R2	94	8.0	0.841	34.1	LOS D	11.3	81.8	0.90	1.49	2.41	24.0
Approach		503	4.0	0.841	34.0	LOS D	11.3	81.8	0.90	1.49	2.41	23.3
North: Greenbank Road												
7	L2	96	5.0	0.590	16.0	LOS C	4.5	33.0	0.71	0.89	1.22	34.9
8	T1	152	4.0	0.590	15.9	LOS C	4.5	33.0	0.71	0.89	1.22	35.0
9	R2	140	10.0	0.590	16.1	LOS C	4.5	33.0	0.71	0.89	1.22	34.9
Approach		388	6.4	0.590	16.0	LOS C	4.5	33.0	0.71	0.89	1.22	34.9
West: Cambrian Road												
10	L2	285	3.0	1.156	105.6	LOS F	66.8	483.9	1.00	3.41	6.22	13.7
11	T1	528	3.0	1.156	105.6	LOS F	66.8	483.9	1.00	3.41	6.22	11.5
12	R2	70	17.0	1.156	105.9	LOS F	66.8	483.9	1.00	3.41	6.22	11.3
Approach		883	4.1	1.156	105.6	LOS F	66.8	483.9	1.00	3.41	6.22	12.2
All Vehicles		2602	3.8	1.678	151.2	LOS F	117.5	838.0	0.94	3.24	7.51	8.8

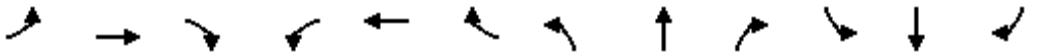
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Intersection	
Intersection Delay, s/veh	45.6
Intersection LOS	E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	94	347	22	9	544	129	15	0	6	92	0	76
Future Vol, veh/h	94	347	22	9	544	129	15	0	6	92	0	76
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	94	347	22	9	544	129	15	0	6	92	0	76
Number of Lanes	1	1	0	1	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	2	2
HCM Control Delay	16	74.8	10.8	12.7
HCM LOS	C	F	B	B

Lane	NBLn1	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1
Vol Left, %	71%	100%	0%	100%	0%	55%
Vol Thru, %	0%	0%	94%	0%	81%	0%
Vol Right, %	29%	0%	6%	0%	19%	45%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	21	94	369	9	673	168
LT Vol	15	94	0	9	0	92
Through Vol	0	0	347	0	544	0
RT Vol	6	0	22	0	129	76
Lane Flow Rate	21	94	369	9	673	168
Geometry Grp	2	7	7	7	7	2
Degree of Util (X)	0.042	0.168	0.603	0.016	1.06	0.306
Departure Headway (Hd)	7.48	6.575	6.024	6.313	5.671	6.736
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	482	549	601	568	639	538
Service Time	5.48	4.275	3.724	4.039	3.396	4.736
HCM Lane V/C Ratio	0.044	0.171	0.614	0.016	1.053	0.312
HCM Control Delay	10.8	10.6	17.4	9.1	75.7	12.7
HCM Lane LOS	B	B	C	A	F	B
HCM 95th-tile Q	0.1	0.6	4	0	18.4	1.3



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	22	750	198	151	655	64	175	19	120	29	14	18
Future Volume (vph)	22	750	198	151	655	64	175	19	120	29	14	18
Satd. Flow (prot)	1658	1745	1483	1658	1745	1483	1658	1402	0	1658	1569	0
Flt Permitted	0.317			0.084			0.736			0.668		
Satd. Flow (perm)	549	1745	1447	147	1745	1422	1268	1402	0	1142	1569	0
Satd. Flow (RTOR)			198			64		120			18	
Lane Group Flow (vph)	22	750	198	151	655	64	175	139	0	29	32	0
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2		2	6		6	8			4		
Detector Phase	2	2	2	1	6	6	8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	5.0	10.0	10.0	10.0	10.0		10.0	10.0	
Minimum Split (s)	36.6	36.6	36.6	9.5	35.6	35.6	38.0	38.0		40.0	40.0	
Total Split (s)	49.0	49.0	49.0	10.4	59.4	59.4	40.6	40.6		40.6	40.6	
Total Split (%)	49.0%	49.0%	49.0%	10.4%	59.4%	59.4%	40.6%	40.6%		40.6%	40.6%	
Yellow Time (s)	3.3	3.3	3.3	3.5	3.3	3.3	3.3	3.3		3.3	3.3	
All-Red Time (s)	2.8	2.8	2.8	1.0	2.8	2.8	2.7	2.7		2.7	2.7	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.1	6.1	6.1	4.5	6.1	6.1	6.0	6.0		6.0	6.0	
Lead/Lag	Lag	Lag	Lag	Lead								
Lead-Lag Optimize?	Yes	Yes	Yes	Yes								
Recall Mode	None	None	None	None	None	None	Max	Max		Max	Max	
Act Effct Green (s)	42.9	42.9	42.9	54.9	53.3	53.3	34.6	34.6		34.6	34.6	
Actuated g/C Ratio	0.43	0.43	0.43	0.55	0.53	0.53	0.35	0.35		0.35	0.35	
v/c Ratio	0.09	1.00	0.27	0.89	0.70	0.08	0.40	0.25		0.07	0.06	
Control Delay	18.5	63.4	3.6	65.5	22.6	3.3	28.2	7.1		22.7	13.5	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	18.5	63.4	3.6	65.5	22.6	3.3	28.2	7.1		22.7	13.5	
LOS	B	E	A	E	C	A	C	A		C	B	
Approach Delay		50.2			28.7			18.9			17.9	
Approach LOS		D			C			B			B	
Queue Length 50th (m)	2.5	~142.5	0.0	14.2	90.2	0.0	25.5	2.4		3.7	1.8	
Queue Length 95th (m)	7.4	#220.5	12.2	#50.4	132.2	5.9	44.0	15.0		9.9	8.0	
Internal Link Dist (m)		487.3			171.5			225.4			236.2	
Turn Bay Length (m)	60.0		85.0	80.0		60.0	100.0			60.0		
Base Capacity (vph)	235	748	733	169	930	787	438	563		395	554	
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Reduced v/c Ratio	0.09	1.00	0.27	0.89	0.70	0.08	0.40	0.25		0.07	0.06	

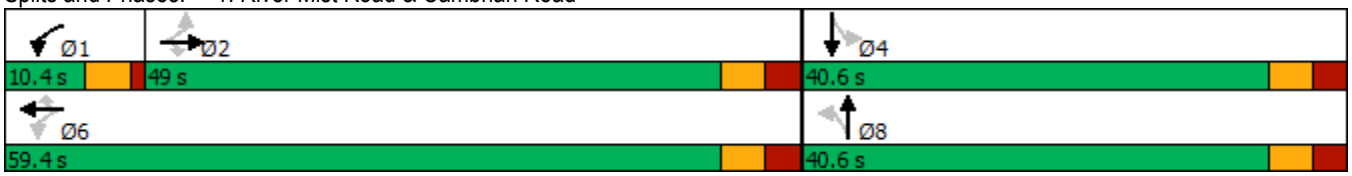
Intersection Summary
Cycle Length: 100
Actuated Cycle Length: 100
Natural Cycle: 100
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 1.00

Intersection Signal Delay: 36.4	Intersection LOS: D
Intersection Capacity Utilization 92.7%	ICU Level of Service F
Analysis Period (min) 15	

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

Splits and Phases: 1: River Mist Road & Cambrian Road



MOVEMENT SUMMARY

Site: 101 [FB2029 - PM Peak]

3432 Greenbank
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Greenbank												
1	L2	46	2.0	0.539	7.9	LOS A	4.8	34.2	0.53	0.54	0.53	40.1
2	T1	561	2.0	0.539	4.7	LOS A	4.8	34.2	0.53	0.54	0.53	44.5
3	R2	28	2.0	0.539	5.1	LOS A	4.8	34.2	0.53	0.54	0.53	39.4
Approach		635	2.0	0.539	5.0	LOS A	4.8	34.2	0.53	0.54	0.53	44.0
East: Half Moon Bay												
4	L2	15	2.0	0.147	10.3	LOS B	0.9	6.1	0.73	0.75	0.73	37.9
5	T1	34	2.0	0.147	7.2	LOS A	0.9	6.1	0.73	0.75	0.73	35.8
6	R2	44	2.0	0.147	7.7	LOS A	0.9	6.1	0.73	0.75	0.73	39.0
Approach		93	2.0	0.147	8.0	LOS A	0.9	6.1	0.73	0.75	0.73	37.7
North: Greenbank												
7	L2	39	2.0	0.795	8.2	LOS A	11.7	83.4	0.69	0.52	0.69	41.0
8	T1	897	2.0	0.795	5.0	LOS A	11.7	83.4	0.69	0.52	0.69	44.0
9	R2	106	2.0	0.795	5.3	LOS A	11.7	83.4	0.69	0.52	0.69	40.5
Approach		1042	2.0	0.795	5.1	LOS A	11.7	83.4	0.69	0.52	0.69	43.5
West: Half Moon Bay												
10	L2	88	2.0	0.292	14.2	LOS B	2.0	14.0	0.92	0.95	0.92	36.1
11	T1	8	2.0	0.292	11.0	LOS B	2.0	14.0	0.92	0.95	0.92	33.2
12	R2	28	2.0	0.292	11.6	LOS B	2.0	14.0	0.92	0.95	0.92	33.5
Approach		124	2.0	0.292	13.4	LOS B	2.0	14.0	0.92	0.95	0.92	35.4
All Vehicles		1894	2.0	0.795	5.7	LOS A	11.7	83.4	0.65	0.56	0.65	42.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Cambrian and Greenbank 2029 FB PM]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Greenbank Road												
1	L2	127	8.0	0.909	42.0	LOS E	17.4	125.1	0.99	1.70	3.04	21.7
2	T1	320	2.0	0.909	41.8	LOS E	17.4	125.1	0.99	1.70	3.04	22.6
3	R2	137	2.0	0.909	41.8	LOS E	17.4	125.1	0.99	1.70	3.04	18.3
Approach		584	3.3	0.909	41.8	LOS E	17.4	125.1	0.99	1.70	3.04	21.5
East: Cambrian Road												
4	L2	158	2.0	1.143	107.9	LOS F	45.0	320.3	1.00	3.20	6.80	9.5
5	T1	425	2.0	1.143	107.9	LOS F	45.0	320.3	1.00	3.20	6.80	11.2
6	R2	96	2.0	1.143	107.9	LOS F	45.0	320.3	1.00	3.20	6.80	11.6
Approach		679	2.0	1.143	107.9	LOS F	45.0	320.3	1.00	3.20	6.80	10.9
North: Greenbank Road												
7	L2	76	2.0	1.688	335.3	LOS F	141.1	1004.6	1.00	5.54	14.95	4.4
8	T1	520	2.0	1.688	335.3	LOS F	141.1	1004.6	1.00	5.54	14.95	4.4
9	R2	386	2.0	1.688	335.3	LOS F	141.1	1004.6	1.00	5.54	14.95	5.1
Approach		982	2.0	1.688	335.3	LOS F	141.1	1004.6	1.00	5.54	14.95	4.7
West: Cambrian Road												
10	L2	223	2.0	1.250	145.1	LOS F	73.7	526.8	1.00	4.04	8.36	10.6
11	T1	406	2.0	1.250	145.1	LOS F	73.7	526.8	1.00	4.04	8.36	8.8
12	R2	214	4.0	1.250	145.2	LOS F	73.7	526.8	1.00	4.04	8.36	8.8
Approach		843	2.5	1.250	145.1	LOS F	73.7	526.8	1.00	4.04	8.36	9.3
All Vehicles		3088	2.4	1.688	177.9	LOS F	141.1	1004.6	1.00	3.89	9.11	7.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Intersection	
Intersection Delay, s/veh	50.2
Intersection LOS	F

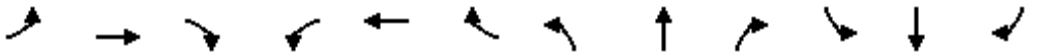
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	107	442	57	6	307	154	38	0	9	258	0	142
Future Vol, veh/h	107	442	57	6	307	154	38	0	9	258	0	142
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	107	442	57	6	307	154	38	0	9	258	0	142
Number of Lanes	1	1	0	1	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	2	2
HCM Control Delay	62.6	52	13.5	33.5
HCM LOS	F	F	B	D

Lane	NBLn1	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1
Vol Left, %	81%	100%	0%	100%	0%	65%
Vol Thru, %	0%	0%	89%	0%	67%	0%
Vol Right, %	19%	0%	11%	0%	33%	35%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	47	107	499	6	461	400
LT Vol	38	107	0	6	0	258
Through Vol	0	0	442	0	307	0
RT Vol	9	0	57	0	154	142
Lane Flow Rate	47	107	499	6	461	400
Geometry Grp	2	7	7	7	7	2
Degree of Util (X)	0.118	0.237	1.021	0.013	0.932	0.8
Departure Headway (Hd)	9.23	7.964	7.365	8.149	7.391	7.304
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	391	454	494	442	493	500
Service Time	7.23	5.664	5.065	5.849	5.091	5.304
HCM Lane V/C Ratio	0.12	0.236	1.01	0.014	0.935	0.8
HCM Control Delay	13.5	13.1	73.2	11	52.5	33.5
HCM Lane LOS	B	B	F	B	F	D
HCM 95th-tile Q	0.4	0.9	14.3	0	11.1	7.5

Appendix N

Synchro & Sidra Worksheets – 2024 Future Total Synchro Sheets

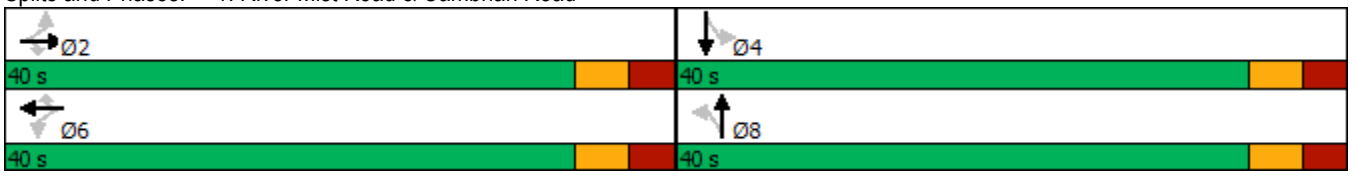


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	23	419	131	57	348	51	295	55	135	71	18	46
Future Volume (vph)	23	419	131	57	348	51	295	55	135	71	18	46
Satd. Flow (prot)	1258	1456	1335	1312	1470	1309	1492	1296	0	1478	1335	0
Flt Permitted	0.440			0.351			0.715			0.638		
Satd. Flow (perm)	565	1456	1300	483	1470	1215	1111	1296	0	963	1335	0
Satd. Flow (RTOR)			131			51		135			46	
Lane Group Flow (vph)	23	419	131	57	348	51	295	190	0	71	64	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6		6	8			4		
Detector Phase	2	2	2	6	6	6	8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0		10.0	10.0	
Minimum Split (s)	36.6	36.6	36.6	35.6	35.6	35.6	38.0	38.0		40.0	40.0	
Total Split (s)	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0		40.0	40.0	
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%		50.0%	50.0%	
Yellow Time (s)	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3		3.3	3.3	
All-Red Time (s)	2.8	2.8	2.8	2.8	2.8	2.8	2.7	2.7		2.7	2.7	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.1	6.1	6.1	6.1	6.1	6.1	6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	Max	Max		Max	Max	
Act Effct Green (s)	24.8	24.8	24.8	24.8	24.8	24.8	34.3	34.3		34.3	34.3	
Actuated g/C Ratio	0.35	0.35	0.35	0.35	0.35	0.35	0.48	0.48		0.48	0.48	
v/c Ratio	0.12	0.83	0.24	0.34	0.68	0.11	0.55	0.27		0.15	0.10	
Control Delay	16.3	35.7	4.2	22.6	26.9	5.1	20.1	6.0		13.9	6.5	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	16.3	35.7	4.2	22.6	26.9	5.1	20.1	6.0		13.9	6.5	
LOS	B	D	A	C	C	A	C	A		B	A	
Approach Delay		27.8			23.9			14.6			10.4	
Approach LOS		C			C			B			B	
Queue Length 50th (m)	2.0	49.9	0.0	5.5	38.6	0.0	26.4	3.8		5.1	1.2	
Queue Length 95th (m)	6.6	82.0	9.2	14.4	63.9	5.9	60.9	17.0		14.8	8.3	
Internal Link Dist (m)		239.8			171.5			225.4			236.2	
Turn Bay Length (m)	60.0		85.0	80.0		60.0	100.0			60.0		
Base Capacity (vph)	271	698	691	231	705	609	534	693		463	666	
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Reduced v/c Ratio	0.08	0.60	0.19	0.25	0.49	0.08	0.55	0.27		0.15	0.10	

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 71.3
Natural Cycle: 80
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.83

Intersection Signal Delay: 21.4	Intersection LOS: C
Intersection Capacity Utilization 101.9%	ICU Level of Service G
Analysis Period (min) 15	

Splits and Phases: 1: River Mist Road & Cambrian Road



MOVEMENT SUMMARY

Site: 101 [FT2024 - AM Peak]

3432 Greenbank
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Greenbank												
1	L2	23	2.0	0.660	9.5	LOS A	6.7	47.7	0.72	0.67	0.75	39.5
2	T1	676	2.0	0.660	6.3	LOS A	6.7	47.7	0.72	0.67	0.75	43.9
3	R2	5	2.0	0.660	6.7	LOS A	6.7	47.7	0.72	0.67	0.75	38.9
Approach		704	2.0	0.660	6.4	LOS A	6.7	47.7	0.72	0.67	0.75	43.7
East: Half Moon Bay												
4	L2	19	2.0	0.167	13.0	LOS B	1.1	7.5	0.85	0.86	0.85	36.2
5	T1	6	2.0	0.167	9.9	LOS A	1.1	7.5	0.85	0.86	0.85	34.2
6	R2	55	2.0	0.167	10.4	LOS B	1.1	7.5	0.85	0.86	0.85	37.5
Approach		80	2.0	0.167	11.0	LOS B	1.1	7.5	0.85	0.86	0.85	37.0
North: Greenbank												
7	L2	5	2.0	0.216	7.0	LOS A	1.3	9.4	0.21	0.44	0.21	42.2
8	T1	199	2.0	0.216	3.8	LOS A	1.3	9.4	0.21	0.44	0.21	45.8
9	R2	80	2.0	0.216	4.1	LOS A	1.3	9.4	0.21	0.44	0.21	42.0
Approach		284	2.0	0.216	3.9	LOS A	1.3	9.4	0.21	0.44	0.21	44.6
West: Half Moon Bay												
10	L2	209	2.0	0.282	7.0	LOS A	1.6	11.7	0.46	0.62	0.46	40.3
11	T1	6	2.0	0.282	3.8	LOS A	1.6	11.7	0.46	0.62	0.46	36.7
12	R2	71	2.0	0.282	4.4	LOS A	1.6	11.7	0.46	0.62	0.46	38.1
Approach		286	2.0	0.282	6.3	LOS A	1.6	11.7	0.46	0.62	0.46	39.8
All Vehicles		1354	2.0	0.660	6.1	LOS A	6.7	47.7	0.56	0.62	0.58	42.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

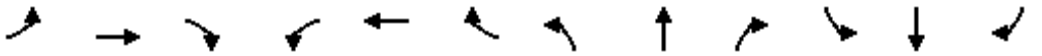
Site: 101 [Cambrian and Greenbank 2024 FT AM]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Greenbank Road												
1	L2	139	3.0	1.362	197.3	LOS F	73.0	520.6	1.00	4.02	10.73	6.9
2	T1	365	2.0	1.362	197.3	LOS F	73.0	520.6	1.00	4.02	10.73	7.2
3	R2	211	2.0	1.362	197.3	LOS F	73.0	520.6	1.00	4.02	10.73	5.6
Approach		715	2.2	1.362	197.3	LOS F	73.0	520.6	1.00	4.02	10.73	6.6
East: Cambrian Road												
4	L2	106	6.0	0.725	23.4	LOS C	7.2	51.9	0.81	1.17	1.72	26.1
5	T1	253	2.0	0.725	23.2	LOS C	7.2	51.9	0.81	1.17	1.72	28.4
6	R2	88	8.0	0.725	23.4	LOS C	7.2	51.9	0.81	1.17	1.72	28.4
Approach		447	4.1	0.725	23.3	LOS C	7.2	51.9	0.81	1.17	1.72	27.9
North: Greenbank Road												
7	L2	93	5.0	0.457	11.9	LOS B	2.5	18.8	0.62	0.70	0.84	38.1
8	T1	123	4.0	0.457	11.8	LOS B	2.5	18.8	0.62	0.70	0.84	38.2
9	R2	97	10.0	0.457	12.0	LOS B	2.5	18.8	0.62	0.70	0.84	37.5
Approach		313	6.2	0.457	11.9	LOS B	2.5	18.8	0.62	0.70	0.84	37.9
West: Cambrian Road												
10	L2	200	3.0	0.901	35.1	LOS E	24.6	178.3	1.00	1.82	2.73	26.8
11	T1	449	3.0	0.901	35.1	LOS E	24.6	178.3	1.00	1.82	2.73	23.4
12	R2	67	17.0	0.901	35.4	LOS E	24.6	178.3	1.00	1.82	2.73	22.6
Approach		716	4.3	0.901	35.1	LOS E	24.6	178.3	1.00	1.82	2.73	24.3
All Vehicles		2191	3.8	1.362	82.3	LOS F	73.0	520.6	0.91	2.24	4.87	14.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	34	611	198	151	503	76	175	17	120	38	13	27
Future Volume (vph)	34	611	198	151	503	76	175	17	120	38	13	27
Satd. Flow (prot)	1658	1745	1483	1658	1745	1483	1658	1397	0	1658	1534	0
Flt Permitted	0.463			0.136			0.731			0.669		
Satd. Flow (perm)	799	1745	1447	237	1745	1422	1260	1397	0	1143	1534	0
Satd. Flow (RTOR)			198			76		120			27	
Lane Group Flow (vph)	34	611	198	151	503	76	175	137	0	38	40	0
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2		2	6		6	8			4		
Detector Phase	2	2	2	1	6	6	8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	5.0	10.0	10.0	10.0	10.0		10.0	10.0	
Minimum Split (s)	36.6	36.6	36.6	9.5	35.6	35.6	38.0	38.0		40.0	40.0	
Total Split (s)	48.0	48.0	48.0	11.0	59.0	59.0	41.0	41.0		41.0	41.0	
Total Split (%)	48.0%	48.0%	48.0%	11.0%	59.0%	59.0%	41.0%	41.0%		41.0%	41.0%	
Yellow Time (s)	3.3	3.3	3.3	3.5	3.3	3.3	3.3	3.3		3.3	3.3	
All-Red Time (s)	2.8	2.8	2.8	1.0	2.8	2.8	2.7	2.7		2.7	2.7	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.1	6.1	6.1	4.5	6.1	6.1	6.0	6.0		6.0	6.0	
Lead/Lag	Lag	Lag	Lag	Lead								
Lead-Lag Optimize?	Yes	Yes	Yes	Yes								
Recall Mode	None	None	None	None	None	None	Max	Max		Max	Max	
Act Effct Green (s)	36.7	36.7	36.7	49.4	47.8	47.8	35.2	35.2		35.2	35.2	
Actuated g/C Ratio	0.39	0.39	0.39	0.52	0.50	0.50	0.37	0.37		0.37	0.37	
v/c Ratio	0.11	0.91	0.29	0.69	0.57	0.10	0.38	0.23		0.09	0.07	
Control Delay	19.1	46.2	3.9	29.7	19.4	3.2	26.4	6.8		22.3	11.5	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	19.1	46.2	3.9	29.7	19.4	3.2	26.4	6.8		22.3	11.5	
LOS	B	D	A	C	B	A	C	A		C	B	
Approach Delay		35.2			19.8			17.8			16.8	
Approach LOS		D			B			B			B	
Queue Length 50th (m)	3.9	103.5	0.0	13.9	61.3	0.0	24.8	2.1		4.8	1.6	
Queue Length 95th (m)	10.2	#164.0	12.5	#29.1	90.4	6.4	43.8	14.6		12.0	8.5	
Internal Link Dist (m)		136.7			171.5			225.4			236.2	
Turn Bay Length (m)	60.0		85.0	80.0		60.0	100.0			60.0		
Base Capacity (vph)	353	772	751	220	975	828	466	591		422	584	
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Reduced v/c Ratio	0.10	0.79	0.26	0.69	0.52	0.09	0.38	0.23		0.09	0.07	

Intersection Summary
Cycle Length: 100
Actuated Cycle Length: 95.1
Natural Cycle: 90
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.91

Intersection Signal Delay: 26.0	Intersection LOS: C
Intersection Capacity Utilization 89.9%	ICU Level of Service E
Analysis Period (min) 15	

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

Splits and Phases: 1: River Mist Road & Cambrian Road

MOVEMENT SUMMARY

Site: 101 [FT2024 - PM Peak]

3432 Greenbank
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Greenbank												
1	L2	51	2.0	0.490	8.4	LOS A	3.9	27.9	0.58	0.59	0.58	39.9
2	T1	448	2.0	0.490	5.1	LOS A	3.9	27.9	0.58	0.59	0.58	44.3
3	R2	24	2.0	0.490	5.5	LOS A	3.9	27.9	0.58	0.59	0.58	39.2
Approach		523	2.0	0.490	5.5	LOS A	3.9	27.9	0.58	0.59	0.58	43.6
East: Half Moon Bay												
4	L2	13	2.0	0.132	9.8	LOS A	0.8	5.4	0.70	0.72	0.70	38.2
5	T1	31	2.0	0.132	6.7	LOS A	0.8	5.4	0.70	0.72	0.70	36.1
6	R2	44	2.0	0.132	7.2	LOS A	0.8	5.4	0.70	0.72	0.70	39.3
Approach		88	2.0	0.132	7.4	LOS A	0.8	5.4	0.70	0.72	0.70	38.1
North: Greenbank												
7	L2	39	2.0	0.724	7.9	LOS A	8.9	63.2	0.58	0.51	0.58	41.3
8	T1	719	2.0	0.724	4.7	LOS A	8.9	63.2	0.58	0.51	0.58	44.4
9	R2	188	2.0	0.724	5.1	LOS A	8.9	63.2	0.58	0.51	0.58	40.8
Approach		946	2.0	0.724	4.9	LOS A	8.9	63.2	0.58	0.51	0.58	43.5
West: Half Moon Bay												
10	L2	148	3.0	0.336	11.9	LOS B	2.2	15.8	0.84	0.91	0.84	37.2
11	T1	7	3.0	0.336	8.7	LOS A	2.2	15.8	0.84	0.91	0.84	34.2
12	R2	33	3.0	0.336	9.3	LOS A	2.2	15.8	0.84	0.91	0.84	34.8
Approach		188	3.0	0.336	11.3	LOS B	2.2	15.8	0.84	0.91	0.84	36.7
All Vehicles		1745	2.1	0.724	5.9	LOS A	8.9	63.2	0.61	0.59	0.61	42.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Cambrian and Greenbank 2024 FT PM]

New Site
Site Category: (None)
Roundabout

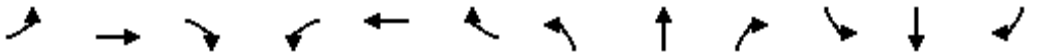
Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Greenbank Road												
1	L2	119	8.0	0.781	26.3	LOS D	9.7	70.0	0.86	1.25	1.98	27.7
2	T1	263	2.0	0.781	26.2	LOS D	9.7	70.0	0.86	1.25	1.98	28.8
3	R2	127	2.0	0.781	26.2	LOS D	9.7	70.0	0.86	1.25	1.98	23.7
Approach		509	3.4	0.781	26.2	LOS D	9.7	70.0	0.86	1.25	1.98	27.3
East: Cambrian Road												
4	L2	147	2.0	0.926	44.4	LOS E	19.2	136.8	1.00	1.89	3.21	18.3
5	T1	362	2.0	0.926	44.4	LOS E	19.2	136.8	1.00	1.89	3.21	20.6
6	R2	93	2.0	0.926	44.4	LOS E	19.2	136.8	1.00	1.89	3.21	21.1
Approach		602	2.0	0.926	44.4	LOS E	19.2	136.8	1.00	1.89	3.21	20.1
North: Greenbank Road												
7	L2	73	2.0	1.355	191.6	LOS F	81.4	579.9	1.00	4.12	10.52	7.3
8	T1	434	2.0	1.355	191.6	LOS F	81.4	579.9	1.00	4.12	10.52	7.3
9	R2	292	2.0	1.355	191.6	LOS F	81.4	579.9	1.00	4.12	10.52	8.3
Approach		799	2.0	1.355	191.6	LOS F	81.4	579.9	1.00	4.12	10.52	7.7
West: Cambrian Road												
10	L2	165	2.0	1.080	83.3	LOS F	40.0	286.3	1.00	2.82	5.48	16.1
11	T1	351	2.0	1.080	83.3	LOS F	40.0	286.3	1.00	2.82	5.48	13.6
12	R2	189	4.0	1.080	83.3	LOS F	40.0	286.3	1.00	2.82	5.48	13.4
Approach		705	2.5	1.080	83.3	LOS F	40.0	286.3	1.00	2.82	5.48	14.1
All Vehicles		2615	2.4	1.355	96.3	LOS F	81.4	579.9	0.97	2.69	5.82	12.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix O

Synchro & Sidra Worksheets – 2029 Future Total Synchro Sheets



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	17	687	131	57	493	45	295	61	135	58	20	33
Future Volume (vph)	17	687	131	57	493	45	295	61	135	58	20	33
Satd. Flow (prot)	1258	1456	1335	1312	1470	1309	1492	1302	0	1478	1359	0
Flt Permitted	0.322			0.138			0.722			0.634		
Satd. Flow (perm)	417	1456	1300	190	1470	1215	1122	1302	0	957	1359	0
Satd. Flow (RTOR)			131			45		124			33	
Lane Group Flow (vph)	17	687	131	57	493	45	295	196	0	58	53	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6		6	8			4		
Detector Phase	2	2	2	6	6	6	8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0		10.0	10.0	
Minimum Split (s)	36.6	36.6	36.6	35.6	35.6	35.6	38.0	38.0		40.0	40.0	
Total Split (s)	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0		40.0	40.0	
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%		50.0%	50.0%	
Yellow Time (s)	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3		3.3	3.3	
All-Red Time (s)	2.8	2.8	2.8	2.8	2.8	2.8	2.7	2.7		2.7	2.7	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.1	6.1	6.1	6.1	6.1	6.1	6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	Max	Max		Max	Max	
Act Effct Green (s)	33.9	33.9	33.9	33.9	33.9	33.9	34.0	34.0		34.0	34.0	
Actuated g/C Ratio	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42		0.42	0.42	
v/c Ratio	0.10	1.12	0.21	0.71	0.79	0.08	0.62	0.31		0.14	0.09	
Control Delay	15.8	97.4	3.8	69.3	31.5	5.1	24.9	7.6		15.3	7.8	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	15.8	97.4	3.8	69.3	31.5	5.1	24.9	7.6		15.3	7.8	
LOS	B	F	A	E	C	A	C	A		B	A	
Approach Delay		81.1			33.1			18.0			11.7	
Approach LOS		F			C			B			B	
Queue Length 50th (m)	1.5	~121.5	0.0	6.9	62.8	0.0	33.9	6.4		5.2	1.7	
Queue Length 95th (m)	5.5	#182.9	9.2	#27.5	#113.2	5.5	60.5	19.3		12.5	7.9	
Internal Link Dist (m)		481.5			171.5			225.4			236.2	
Turn Bay Length (m)	60.0		85.0	80.0		60.0	100.0			60.0		
Base Capacity (vph)	176	616	626	80	622	540	476	624		406	596	
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Reduced v/c Ratio	0.10	1.12	0.21	0.71	0.79	0.08	0.62	0.31		0.14	0.09	

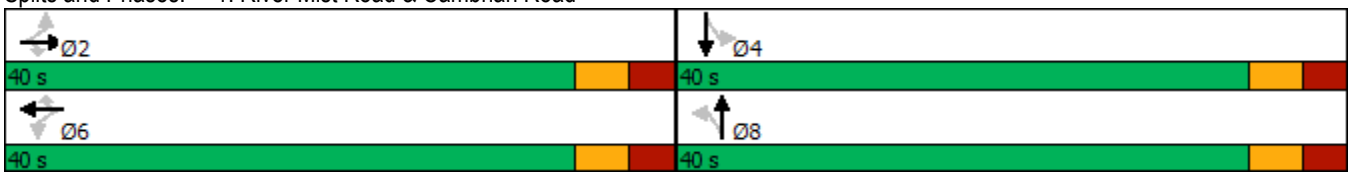
Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Natural Cycle: 90
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 1.12

Intersection Signal Delay: 48.0	Intersection LOS: D
Intersection Capacity Utilization 118.1%	ICU Level of Service H
Analysis Period (min) 15	

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

Splits and Phases: 1: River Mist Road & Cambrian Road



MOVEMENT SUMMARY

Site: 101 [FT2029 - AM Peak]

3432 Greenbank
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Greenbank												
1	L2	20	2.0	0.790	8.6	LOS A	10.8	77.2	0.77	0.58	0.77	39.3
2	T1	943	2.0	0.790	5.4	LOS A	10.8	77.2	0.77	0.58	0.77	43.7
3	R2	6	2.0	0.790	5.8	LOS A	10.8	77.2	0.77	0.58	0.77	38.8
Approach		969	2.0	0.790	5.5	LOS A	10.8	77.2	0.77	0.58	0.77	43.6
East: Half Moon Bay												
4	L2	23	2.0	0.246	16.7	LOS B	1.7	11.9	0.95	0.96	0.95	34.4
5	T1	7	2.0	0.246	13.6	LOS B	1.7	11.9	0.95	0.96	0.95	32.5
6	R2	55	2.0	0.246	14.1	LOS B	1.7	11.9	0.95	0.96	0.95	35.8
Approach		85	2.0	0.246	14.8	LOS B	1.7	11.9	0.95	0.96	0.95	35.2
North: Greenbank												
7	L2	5	2.0	0.260	7.0	LOS A	1.7	12.3	0.23	0.43	0.23	42.2
8	T1	298	2.0	0.260	3.8	LOS A	1.7	12.3	0.23	0.43	0.23	45.7
9	R2	41	2.0	0.260	4.2	LOS A	1.7	12.3	0.23	0.43	0.23	41.9
Approach		344	2.0	0.260	3.9	LOS A	1.7	12.3	0.23	0.43	0.23	45.2
West: Half Moon Bay												
10	L2	119	2.0	0.213	7.6	LOS A	1.2	8.3	0.52	0.65	0.52	40.2
11	T1	7	2.0	0.213	4.4	LOS A	1.2	8.3	0.52	0.65	0.52	36.6
12	R2	70	2.0	0.213	5.0	LOS A	1.2	8.3	0.52	0.65	0.52	37.9
Approach		196	2.0	0.213	6.5	LOS A	1.2	8.3	0.52	0.65	0.52	39.3
All Vehicles		1594	2.0	0.790	5.8	LOS A	10.8	77.2	0.63	0.58	0.63	42.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Cambrian and Greenbank 2029 FT AM]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Greenbank Road												
1	L2	163	3.0	1.691	340.3	LOS F	119.5	852.5	1.00	5.26	15.08	4.2
2	T1	444	2.0	1.691	340.3	LOS F	119.5	852.5	1.00	5.26	15.08	4.4
3	R2	227	2.0	1.691	340.3	LOS F	119.5	852.5	1.00	5.26	15.08	3.4
Approach		834	2.2	1.691	340.3	LOS F	119.5	852.5	1.00	5.26	15.08	4.1
East: Cambrian Road												
4	L2	114	6.0	0.884	40.9	LOS E	13.1	95.2	0.94	1.64	2.79	19.1
5	T1	301	2.0	0.884	40.8	LOS E	13.1	95.2	0.94	1.64	2.79	21.6
6	R2	94	8.0	0.884	41.0	LOS E	13.1	95.2	0.94	1.64	2.79	21.8
Approach		509	4.0	0.884	40.9	LOS E	13.1	95.2	0.94	1.64	2.79	21.1
North: Greenbank Road												
7	L2	96	5.0	0.655	18.6	LOS C	5.8	42.7	0.75	0.99	1.42	33.0
8	T1	152	4.0	0.655	18.6	LOS C	5.8	42.7	0.75	0.99	1.42	33.1
9	R2	179	10.0	0.655	18.7	LOS C	5.8	42.7	0.75	0.99	1.42	33.3
Approach		427	6.7	0.655	18.6	LOS C	5.8	42.7	0.75	0.99	1.42	33.2
West: Cambrian Road												
10	L2	375	3.0	1.308	166.1	LOS F	100.7	729.9	1.00	4.44	8.46	9.6
11	T1	541	3.0	1.308	166.1	LOS F	100.7	729.9	1.00	4.44	8.46	8.0
12	R2	83	17.0	1.308	166.4	LOS F	100.7	729.9	1.00	4.44	8.46	7.9
Approach		999	4.2	1.308	166.1	LOS F	100.7	729.9	1.00	4.44	8.46	8.6
All Vehicles		2769	3.9	1.691	172.8	LOS F	119.5	852.5	0.95	3.64	8.33	7.9

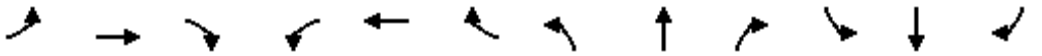
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Intersection	
Intersection Delay, s/veh	82.8
Intersection LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	100	347	22	9	544	179	15	0	6	208	0	89
Future Vol, veh/h	100	347	22	9	544	179	15	0	6	208	0	89
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	100	347	22	9	544	179	15	0	6	208	0	89
Number of Lanes	1	1	0	1	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	2	2
HCM Control Delay	20.3	150.7	12	18.9
HCM LOS	C	F	B	C

Lane	NBLn1	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1
Vol Left, %	71%	100%	0%	100%	0%	70%
Vol Thru, %	0%	0%	94%	0%	75%	0%
Vol Right, %	29%	0%	6%	0%	25%	30%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	21	100	369	9	723	297
LT Vol	15	100	0	9	0	208
Through Vol	0	0	347	0	544	0
RT Vol	6	0	22	0	179	89
Lane Flow Rate	21	100	369	9	723	297
Geometry Grp	2	7	7	7	7	2
Degree of Util (X)	0.046	0.196	0.669	0.017	1.263	0.555
Departure Headway (Hd)	8.605	7.475	6.918	6.974	6.287	7.259
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	419	483	528	513	578	499
Service Time	6.605	5.175	4.618	4.723	4.036	5.259
HCM Lane V/C Ratio	0.05	0.207	0.699	0.018	1.251	0.595
HCM Control Delay	12	12	22.5	9.8	152.5	18.9
HCM Lane LOS	B	B	C	A	F	C
HCM 95th-tile Q	0.1	0.7	4.9	0.1	28.2	3.3



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	22	827	198	151	760	64	175	19	120	29	14	18
Future Volume (vph)	22	827	198	151	760	64	175	19	120	29	14	18
Satd. Flow (prot)	1658	1745	1483	1658	1745	1483	1658	1402	0	1658	1569	0
Flt Permitted	0.222			0.084			0.736			0.668		
Satd. Flow (perm)	385	1745	1447	147	1745	1422	1268	1402	0	1142	1569	0
Satd. Flow (RTOR)			184			58		120			18	
Lane Group Flow (vph)	22	827	198	151	760	64	175	139	0	29	32	0
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2		2	6		6	8			4		
Detector Phase	2	2	2	1	6	6	8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	5.0	10.0	10.0	10.0	10.0		10.0	10.0	
Minimum Split (s)	36.6	36.6	36.6	9.5	35.6	35.6	38.0	38.0		40.0	40.0	
Total Split (s)	49.0	49.0	49.0	10.4	59.4	59.4	40.6	40.6		40.6	40.6	
Total Split (%)	49.0%	49.0%	49.0%	10.4%	59.4%	59.4%	40.6%	40.6%		40.6%	40.6%	
Yellow Time (s)	3.3	3.3	3.3	3.5	3.3	3.3	3.3	3.3		3.3	3.3	
All-Red Time (s)	2.8	2.8	2.8	1.0	2.8	2.8	2.7	2.7		2.7	2.7	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.1	6.1	6.1	4.5	6.1	6.1	6.0	6.0		6.0	6.0	
Lead/Lag	Lag	Lag	Lag	Lead								
Lead-Lag Optimize?	Yes	Yes	Yes	Yes								
Recall Mode	None	None	None	None	None	None	Max	Max		Max	Max	
Act Effct Green (s)	42.9	42.9	42.9	54.9	53.3	53.3	34.6	34.6		34.6	34.6	
Actuated g/C Ratio	0.43	0.43	0.43	0.55	0.53	0.53	0.35	0.35		0.35	0.35	
v/c Ratio	0.13	1.11	0.27	0.89	0.82	0.08	0.40	0.25		0.07	0.06	
Control Delay	20.0	94.8	4.4	65.5	28.3	3.9	28.2	7.1		22.7	13.5	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	20.0	94.8	4.4	65.5	28.3	3.9	28.2	7.1		22.7	13.5	
LOS	C	F	A	E	C	A	C	A		C	B	
Approach Delay		76.1			32.5			18.9			17.9	
Approach LOS		E			C			B			B	
Queue Length 50th (m)	2.5	~183.6	1.5	14.2	115.8	0.5	25.5	2.4		3.7	1.8	
Queue Length 95th (m)	7.8	#253.8	14.0	#50.4	170.7	6.4	44.0	15.0		9.9	8.0	
Internal Link Dist (m)		487.3			171.5			225.4			236.2	
Turn Bay Length (m)	60.0		85.0	80.0		60.0	100.0			60.0		
Base Capacity (vph)	165	748	725	169	930	785	438	563		395	554	
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Reduced v/c Ratio	0.13	1.11	0.27	0.89	0.82	0.08	0.40	0.25		0.07	0.06	

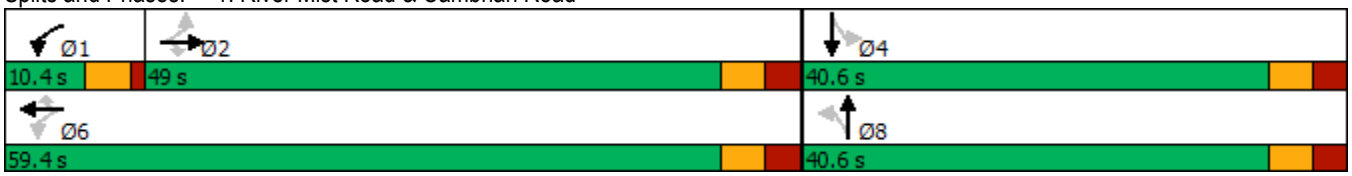
Intersection Summary
Cycle Length: 100
Actuated Cycle Length: 100
Natural Cycle: 110
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 1.11

Intersection Signal Delay: 49.4	Intersection LOS: D
Intersection Capacity Utilization 96.9%	ICU Level of Service F
Analysis Period (min) 15	

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

Splits and Phases: 1: River Mist Road & Cambrian Road



MOVEMENT SUMMARY

Site: 101 [FT2029 - PM Peak]

3432 Greenbank
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Greenbank												
1	L2	46	2.0	0.588	8.0	LOS A	5.7	40.4	0.57	0.54	0.57	40.0
2	T1	621	2.0	0.588	4.8	LOS A	5.7	40.4	0.57	0.54	0.57	44.4
3	R2	28	2.0	0.588	5.2	LOS A	5.7	40.4	0.57	0.54	0.57	39.3
Approach		695	2.0	0.588	5.0	LOS A	5.7	40.4	0.57	0.54	0.57	43.9
East: Half Moon Bay												
4	L2	15	2.0	0.159	11.0	LOS B	1.0	6.8	0.77	0.79	0.77	37.6
5	T1	34	2.0	0.159	7.9	LOS A	1.0	6.8	0.77	0.79	0.77	35.5
6	R2	44	2.0	0.159	8.4	LOS A	1.0	6.8	0.77	0.79	0.77	38.7
Approach		93	2.0	0.159	8.6	LOS A	1.0	6.8	0.77	0.79	0.77	37.4
North: Greenbank												
7	L2	39	2.0	0.853	8.5	LOS A	15.1	107.7	0.82	0.53	0.82	40.6
8	T1	979	2.0	0.853	5.3	LOS A	15.1	107.7	0.82	0.53	0.82	43.6
9	R2	106	2.0	0.853	5.6	LOS A	15.1	107.7	0.82	0.53	0.82	40.1
Approach		1124	2.0	0.853	5.4	LOS A	15.1	107.7	0.82	0.53	0.82	43.1
West: Half Moon Bay												
10	L2	88	2.0	0.354	16.3	LOS B	2.5	18.1	0.97	1.00	1.00	35.0
11	T1	8	2.0	0.354	13.2	LOS B	2.5	18.1	0.97	1.00	1.00	32.2
12	R2	28	2.0	0.354	13.7	LOS B	2.5	18.1	0.97	1.00	1.00	32.3
Approach		124	2.0	0.354	15.6	LOS B	2.5	18.1	0.97	1.00	1.00	34.2
All Vehicles		2036	2.0	0.853	6.1	LOS A	15.1	107.7	0.74	0.58	0.74	42.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Cambrian and Greenbank 2029 FT PM]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Greenbank Road												
1	L2	139	8.0	0.949	49.8	LOS E	20.5	147.5	1.00	1.85	3.50	19.6
2	T1	320	2.0	0.949	49.7	LOS E	20.5	147.5	1.00	1.85	3.50	20.4
3	R2	137	2.0	0.949	49.7	LOS E	20.5	147.5	1.00	1.85	3.50	16.4
Approach		596	3.4	0.949	49.7	LOS E	20.5	147.5	1.00	1.85	3.50	19.3
East: Cambrian Road												
4	L2	158	2.0	1.219	137.6	LOS F	54.8	389.9	1.00	3.68	8.25	7.8
5	T1	437	2.0	1.219	137.6	LOS F	54.8	389.9	1.00	3.68	8.25	9.3
6	R2	96	2.0	1.219	137.6	LOS F	54.8	389.9	1.00	3.68	8.25	9.6
Approach		691	2.0	1.219	137.6	LOS F	54.8	389.9	1.00	3.68	8.25	9.0
North: Greenbank Road												
7	L2	76	2.0	1.815	391.2	LOS F	166.0	1182.0	1.00	5.98	16.22	3.8
8	T1	520	2.0	1.815	391.2	LOS F	166.0	1182.0	1.00	5.98	16.22	3.8
9	R2	468	2.0	1.815	391.2	LOS F	166.0	1182.0	1.00	5.98	16.22	4.4
Approach		1064	2.0	1.815	391.2	LOS F	166.0	1182.0	1.00	5.98	16.22	4.1
West: Cambrian Road												
10	L2	283	2.0	1.321	173.3	LOS F	91.8	656.0	1.00	4.52	9.31	9.2
11	T1	415	2.0	1.321	173.3	LOS F	91.8	656.0	1.00	4.52	9.31	7.6
12	R2	223	4.0	1.321	173.4	LOS F	91.8	656.0	1.00	4.52	9.31	7.6
Approach		921	2.5	1.321	173.4	LOS F	91.8	656.0	1.00	4.52	9.31	8.1
All Vehicles		3272	2.4	1.815	214.1	LOS F	166.0	1182.0	1.00	4.33	10.28	6.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Intersection	
Intersection Delay, s/veh	90.8
Intersection LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	119	442	57	6	307	259	38	0	9	335	0	151
Future Vol, veh/h	119	442	57	6	307	259	38	0	9	335	0	151
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	119	442	57	6	307	259	38	0	9	335	0	151
Number of Lanes	1	1	0	1	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	2	2
HCM Control Delay	79.3	131.4	15	65.1
HCM LOS	F	F	B	F

Lane	NBLn1	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1
Vol Left, %	81%	100%	0%	100%	0%	69%
Vol Thru, %	0%	0%	89%	0%	54%	0%
Vol Right, %	19%	0%	11%	0%	46%	31%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	47	119	499	6	566	486
LT Vol	38	119	0	6	0	335
Through Vol	0	0	442	0	307	0
RT Vol	9	0	57	0	259	151
Lane Flow Rate	47	119	499	6	566	486
Geometry Grp	2	7	7	7	7	2
Degree of Util (X)	0.126	0.277	1.08	0.014	1.195	0.98
Departure Headway (Hd)	10.51	8.817	8.213	8.684	7.831	7.801
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	343	411	444	415	470	467
Service Time	8.51	6.517	5.913	6.384	5.531	5.801
HCM Lane V/C Ratio	0.137	0.29	1.124	0.014	1.204	1.041
HCM Control Delay	15	14.9	94.6	11.5	132.7	65.1
HCM Lane LOS	B	B	F	B	F	F
HCM 95th-tile Q	0.4	1.1	15.7	0	21	12.5

Appendix P

Intersection MMLOS

Multi-Modal Level of Service - Intersections Form

Consultant	**CGH Transportation**	**Project**	**2020-59**
Scenario	**Future**	**Date**	**4/5/2022**
Comments			

INTERSECTIONS		River Mist Road & Cambrian Road			
	Crossing Side	NORTH	SOUTH	EAST	WEST
Pedestrian	Lanes	3	3	4	4
	Median	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m
	Conflicting Left Turns	Permissive	Protected/ Permissive	Permissive	Permissive
	Conflicting Right Turns	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control
	Right Turns on Red (RToR) ?	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed
	Ped Signal Leading Interval?	No	No	No	No
	Right Turn Channel	No Channel	No Channel	No Channel	No Channel
	Corner Radius	10-15m	10-15m	10-15m	10-15m
	Crosswalk Type	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings
	PETSI Score	**70**	**70**	**53**	**53**
	Ped. Exposure to Traffic LoS	**C**	**C**	**D**	**D**
	Cycle Length	100	100	100	100
	Effective Walk Time	30	18	8	10
	Average Pedestrian Delay	**25**	**34**	**42**	**41**
	Pedestrian Delay LoS	**C**	**D**	**E**	**E**
	Level of Service	**C**	**D**	**E**	**E**
		E			
	Approach From	NORTH	SOUTH	EAST	WEST
Bicycle	Bicycle Lane Arrangement on Approach	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic
	Right Turn Lane Configuration	≤ 50 m	≤ 50 m	> 50 m	> 50 m
	Right Turning Speed	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h
	Cyclist relative to RT motorists	**D**	**D**	**F**	**F**
	Separated or Mixed Traffic	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**
	Left Turn Approach	No lane crossed	No lane crossed	No lane crossed	No lane crossed
	Operating Speed	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h
	Left Turning Cyclist	**B**	**B**	**B**	**B**
	Level of Service	**D**	**D**	**F**	**F**
		F			
Transit	Average Signal Delay		≤ 10 sec	≤ 30 sec	
	Level of Service	**-**	**B**	**D**	**-**
		D			
Truck	Effective Corner Radius	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m
	Number of Receiving Lanes on Departure from Intersection	1	1	1	1
	Level of Service	**E**	**E**	**E**	**E**
		E			
Auto	Volume to Capacity Ratio	0.81 - 0.90			
	Level of Service	**D**			