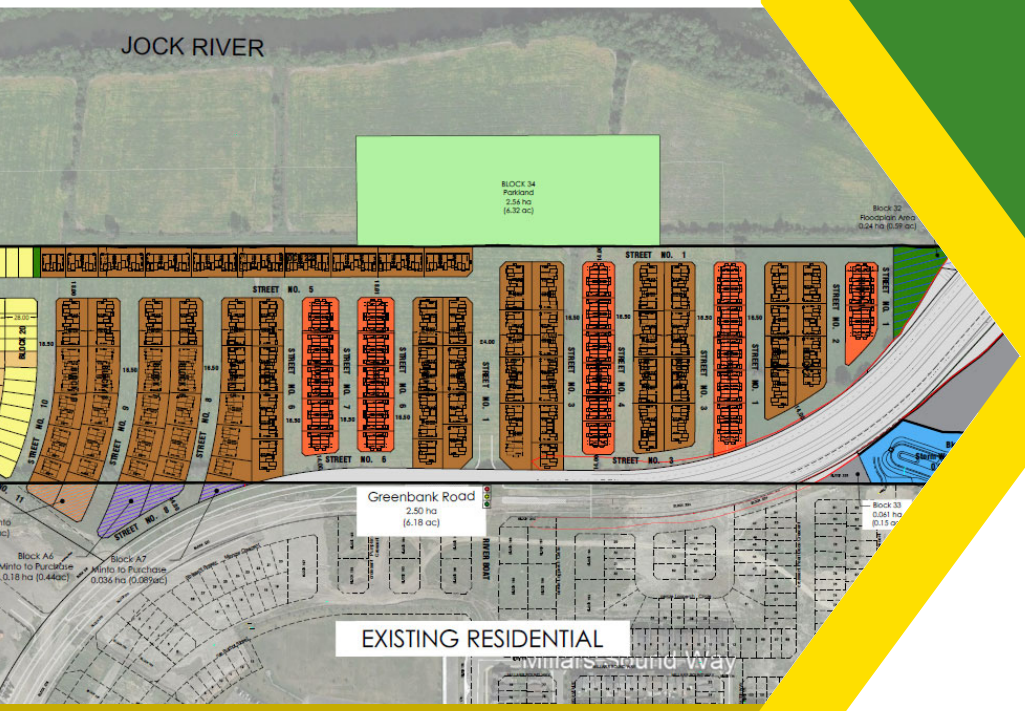
Minto Communities Inc.

3432 Greenbank Road

Transportation Impact Assessment



C|G|H
TRANSPORTATION

3432 Greenbank Road

Transportation Impact Assessment

Step 1 Screening Report

Step 2 Scoping Report

Step 3 Forecasting Report

Step 4 Strategy Report

Prepared for:

Minto Communities Inc.
200-180 Kent Street
Ottawa, ON, K1P 0B6

Prepared by:

CGH TRANSPORTATION

13 Markham Avenue
Ottawa, ON K2G 3Z1

September 2021

PN: 2020-59

Table of Contents

1 Screening 1
2 Existing and Planned Conditions 1
2.1 Proposed Development 1
2.2 Existing Conditions 3
2.2.1 Area Road Network 3
2.2.2 Existing Intersections 4
2.2.3 Existing Driveways 5
2.2.4 Cycling and Pedestrian Facilities 5
2.2.5 Existing Transit 6
2.2.6 Existing Area Traffic Management Measures 8
2.2.7 Existing Peak Hour Travel Demand 8
2.2.8 Collision Analysis 10
2.3 Planned Conditions 11
2.3.1 Changes to the Area Transportation Network 11
2.3.2 Other Study Area Developments 12
3 Study Area and Time Periods 24
3.1 Study Area 24
3.2 Time Periods 24
3.3 Horizon Years 24
4 Exemption Review 24
5 Development-Generated Travel Demand 25
5.1 Mode Shares 25
5.2 Trip Generation 25
5.3 Trip Distribution 26
5.4 Trip Assignment 27
6 Background Network Travel Demands 27
6.1 Transportation Network Plans 27
6.2 Background Growth and Other Developments 28
7 Demand Rationalization 29
7.1 2024 Future Background Operations 29
8 Development Design 31
8.1 Design for Sustainable Modes 31
8.2 New Street Networks 31
9 Boundary Street Design 32
10 Access Intersections Design 32
10.1 Location and Design of Access 32
10.2 Access Intersection Control 32
10.3 Access Intersection Design 32
11 Transportation Demand Management 32
11.1 Context for TDM 32
11.2 Need and Opportunity 33
11.3 TDM Program 33

12 Neighbourhood Traffic Management 33
12.1 Half Moon Bay Road 33
12.2 River Mist Road 34
13 Transit 34
13.1 Route Capacity 34
13.2 Transit Priority 34
14 Review of Network Concept 35
15 Network Intersection Design 35
15.1 Network Intersection Control 35
15.2 Network Intersection Design 35
15.2.1 Existing Conditions 36
15.2.2 2024 Future Background Operations 37
15.2.3 2029 Future Background Operations 39
15.2.4 2024 Future Total Operations 40
15.2.5 2029 Future Total Operations 41
15.2.6 Network Intersection MMLOS 42
16 Conclusions 43

List of Figures

Figure 1: Area Context Plan 1
Figure 2: Concept Plan 2
Figure 3: Study Area Pedestrian Facilities 5
Figure 4: Study Area Cycling Facilities 6
Figure 5: Existing Study Area Transit Service 7
Figure 6: Existing Study Area Transit Stops 7
Figure 7: 2021 Existing Horizon Traffic Volumes and Traffic Controls 8
Figure 8: Existing Pedestrian Volumes 9
Figure 9: Existing Cyclist Volumes 9
Figure 10: Study Area Representation of Collision Locations 10
Figure 11: Half Moon Bay West Community Generated Volumes – AM Peak Hour 13
Figure 12: Half Moon Bay West Community Generated Volumes – PM Peak Hour 14
Figure 13: 2444 Watercolours Way Site Generated Traffic Volumes – AM Peak Hour 15
Figure 14: 2444 Watercolours Way Site Generated Traffic Volumes - PM Peak Hour 15
Figure 15: 3718 Greenbank Road Site Generated Traffic Volumes 16
Figure 16: The Meadows Phase 4 Site Generated Traffic Volumes 17
Figure 17: 3285 Borrisokane Site Generated Traffic Volumes 18
Figure 18: 3882 Barnsdale and 3960 Greenbank Road 2022 Site Generated Traffic Volumes – AM Peak Hour 18
Figure 19: 3882 Barnsdale and 3960 Greenbank Road 2022 Site Generated Traffic Volumes – PM Peak Hour 19
Figure 20: 3640 Greenbank Road Site Generated Traffic Volumes 19
Figure 21: 3713 Borrisokane Road (Residential Component) Site Generated Traffic Volumes 20
Figure 22: 3713 Borrisokane Road (Industrial Component) Site Generated Traffic Volumes – 2022 21
Figure 23: 3713 Borrisokane Road (Industrial Component) Site Generated Traffic Volumes – 2027 22
Figure 24: 3831 Cambrian Road Site Generated Traffic Volumes 23

Figure 25: New Site Generation Auto Volumes 27
Figure 26: 2024 Future Background Volumes 28
Figure 27: 2029 Future Background Volumes 29
Figure 28: 2024 Future Total Volumes 30
Figure 29: 2029 Future Total Volumes 30
Figure 30: Concept Pedestrian and Cycling Network 31
Figure 31: Traffic Calming Plan 32

Table of Tables

Table 1: Intersection Count Date 8
Table 2: Summary of Collision Locations 10
Table 3:Collision Summary 11
Table 4: Exemption Review 24
Table 5: TRANS Trip Generation Manual Recommended Mode Shares – South Nepean 25
Table 6: Trip Generation Person Trip Rates by Peak Period 25
Table 7: Total Person Trip Generation by Peak Period 25
Table 8: Trip Generation by Mode 26
Table 9: OD Survey Existing Directional Split South Nepean 26
Table 10: Half Moon Bay Road / River Run Avenue Volumes - NTM Review 33
Table 11: River Mist Road Volumes - NTM Review 34
Table 12: Trip Generation by Transit Mode 34
Table 13: Existing Intersection Operations 36
Table 14: 2024 Future Background Intersection Operations 38
Table 15: 2029 Future Background Intersection Operations 39
Table 16: 2024 Future Total Intersection Operations 40
Table 17: 2029 Future Total Intersection Operations 41
Table 18: Study Area Intersection MMLOS Analysis—All Horizons 42

List of Appendices

Appendix A – TIA Screening Form and PM Certification Form
Appendix B – Traffic Data
Appendix C – Collision Data
Appendix D – Background Developments
Appendix E – TDM Checklist
Appendix F – Half Moon Bay Road and Greenbank Road Signalization – City Correspondence
Appendix G – Traffic Signal Warrants
Appendix H – Roundabout Screening Forms
Appendix I – HV% Calculations
Appendix J – Synchro Worksheets – 2021 Existing Conditions and Alternative Intersection Control Measures
Appendix K – Synchro Worksheets – 2024 Future Background Synchro Sheets
Appendix L – Synchro Worksheets – 2024 Future Total Synchro Sheets
Appendix M – Intersection MMLOS

1 Screening

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

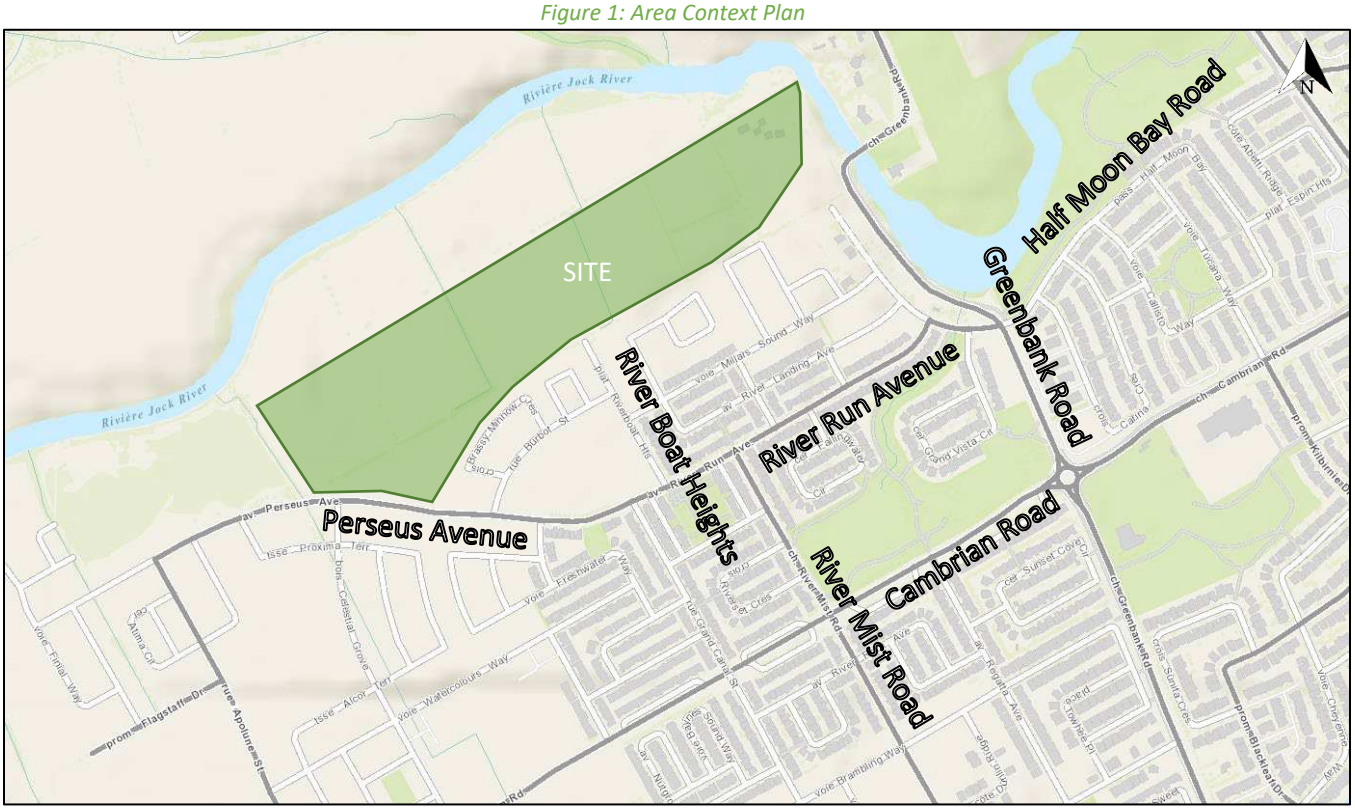
2 Existing and Planned Conditions

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 598 units, including 53 single family homes, 385 executive townhomes, and 160 avenue townhomes.

Access to the site will be accommodated via future Perseus Avenue/Riven Run Avenue (270 metres from Burbot Street) and Riverboat Heights, which will be extended north and cut through the Minto Subdivision. 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	53	8.9%
Executive Towns	385	64.4%
Avenue Towns	160	26.8%
Total	598	100.0%

Legend

- 36' Single Family Homes
- 43' Single Family Homes
- Executive Towns
- Avenue Towns
- Storm Water Management (SWM) Pond
- Parkland
- Land Exchange - Minto to Mattamy
- Land Exchange - Mattamy to Minto
- Land for Minto to Purchase
- 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	8/19/2021	K.G.

Revisions

Title: **Concept Plan 23**

Project: **Kennedy Lands**

North

Scale: **NTS**

Drawn By: MS
Checked By: CS

Minto Communities Inc
180 Kent Street,
Ottawa, ON
K1P 0B6

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 posted 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

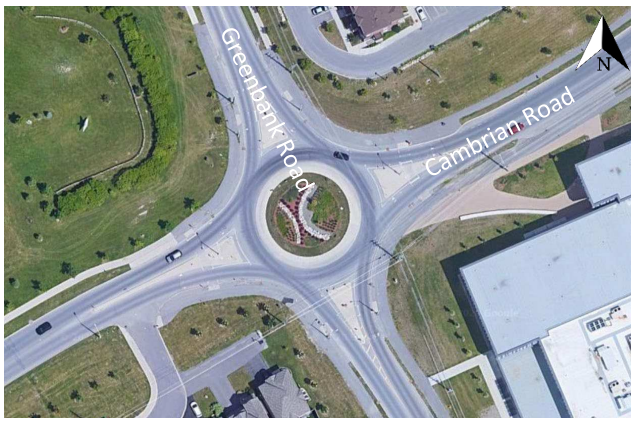
The intersection of River Mist Road and Cambrian Road is an all-way stop-controlled intersection with a shared left-turn / through / right-turn lane on all approaches. No turn restrictions were noted.

Half Moon Bay Road at Greenbank Road

The intersection of Half Moon Bay Road at Greenbank Road is an all-way stop-controlled intersection with a shared left-turn / through / right-turn lane on all approaches. No turn restrictions were noted.

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.

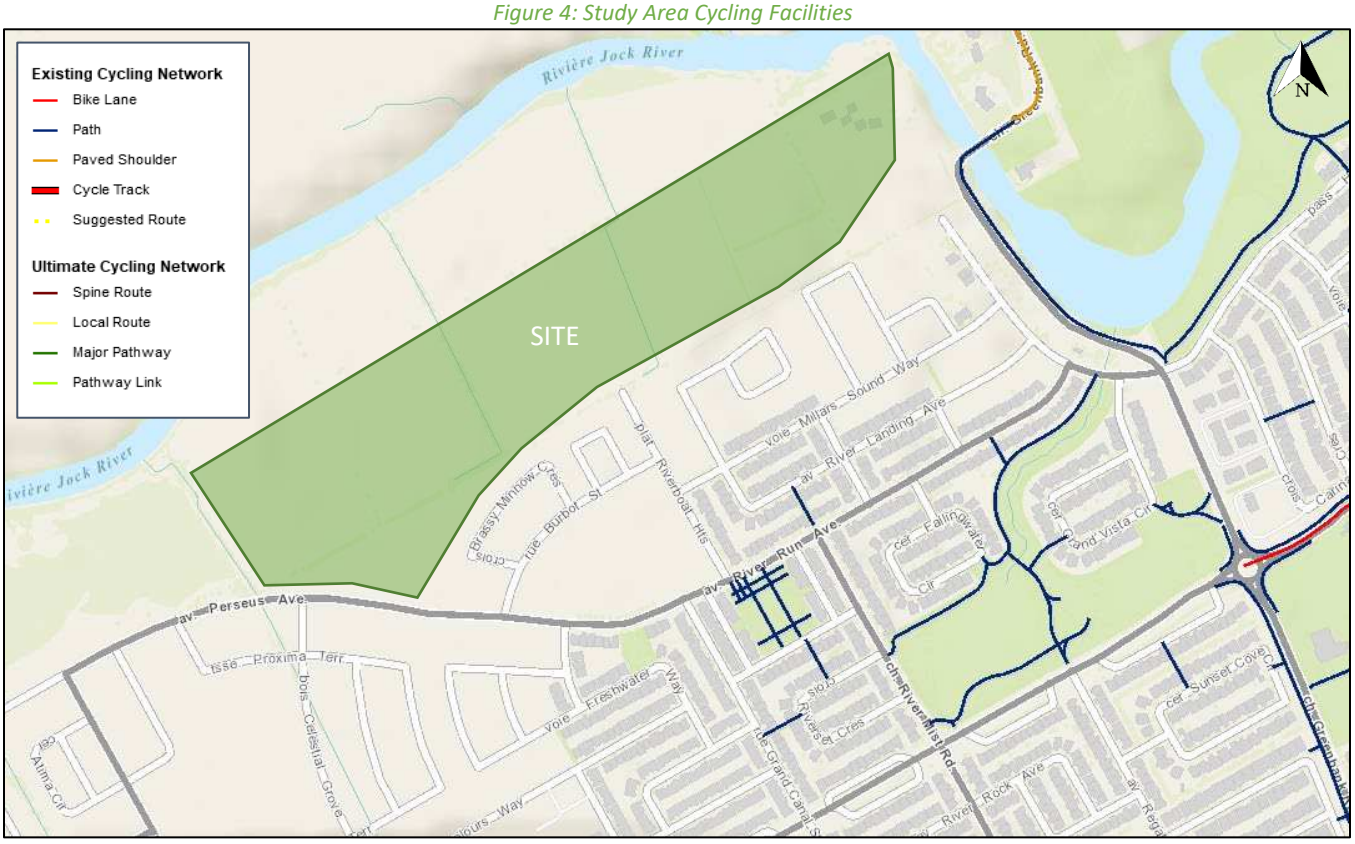
2.2.4 Cycling and Pedestrian Facilities

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 the Half Mon 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



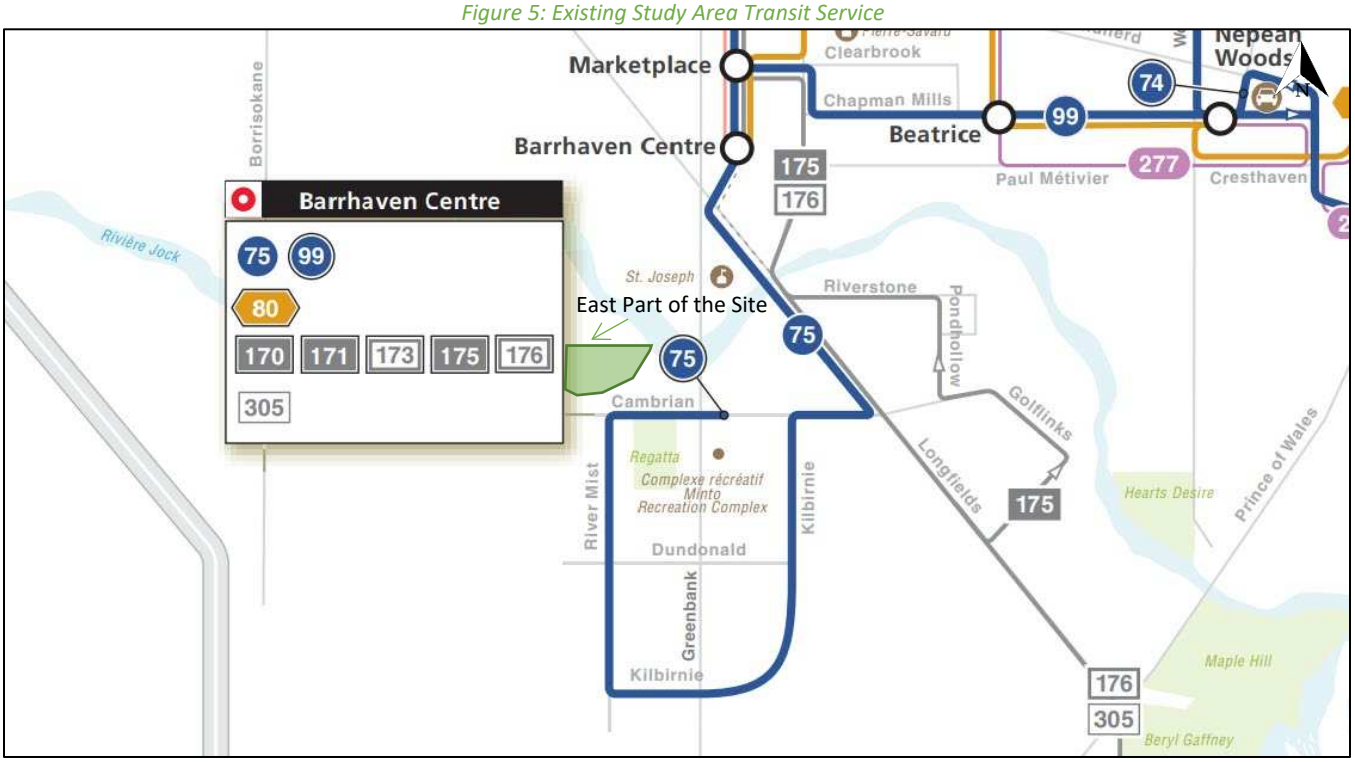
Source: http://maps.ottawa.ca/geoOttawa/ Accessed: July 28, 2021

2.2.5 Existing Transit

There is no existing transit service along the subject development boundary. South of the subject 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 can be seen 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:

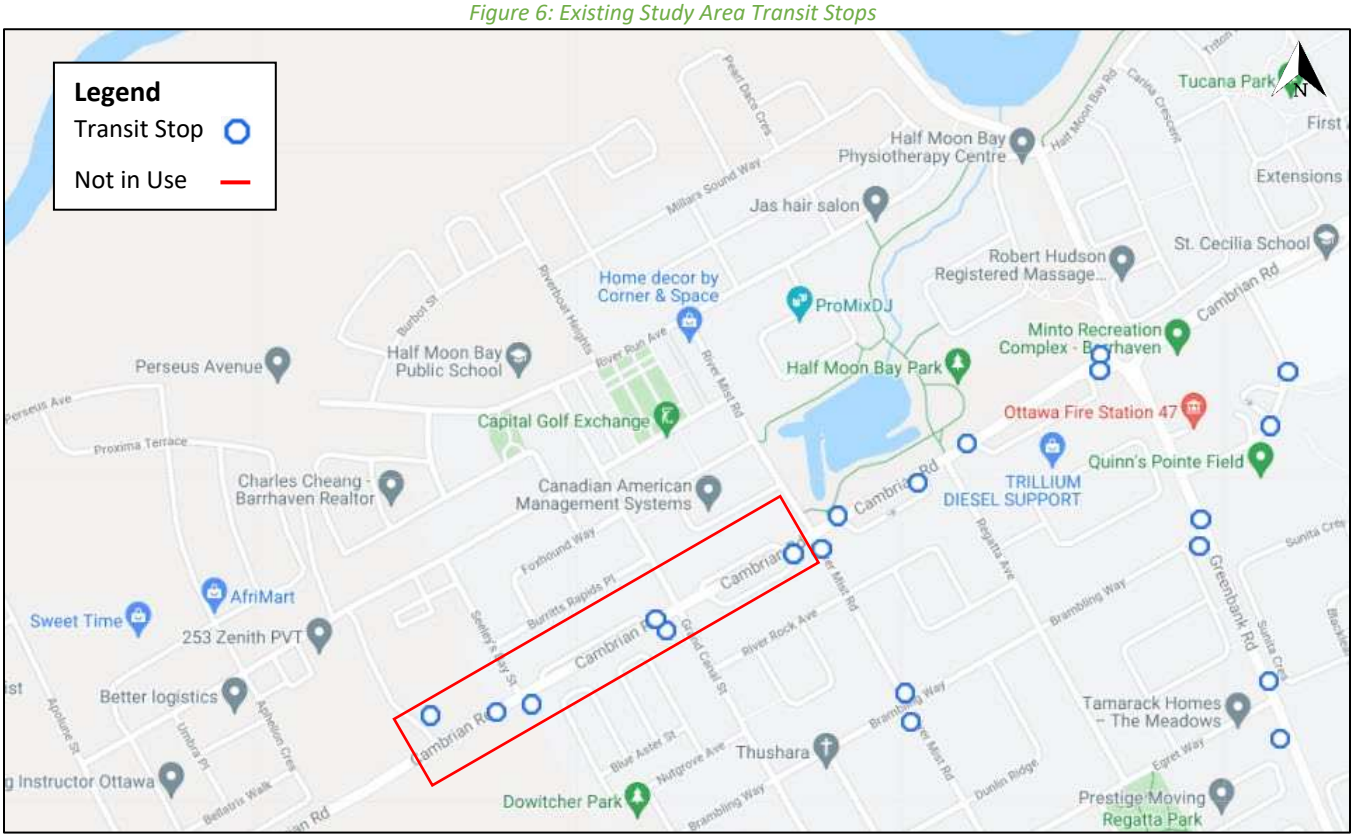
- Route # 75 – every 15 minutes during AM and PM weekday peak hours and every 30 during all other times.

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

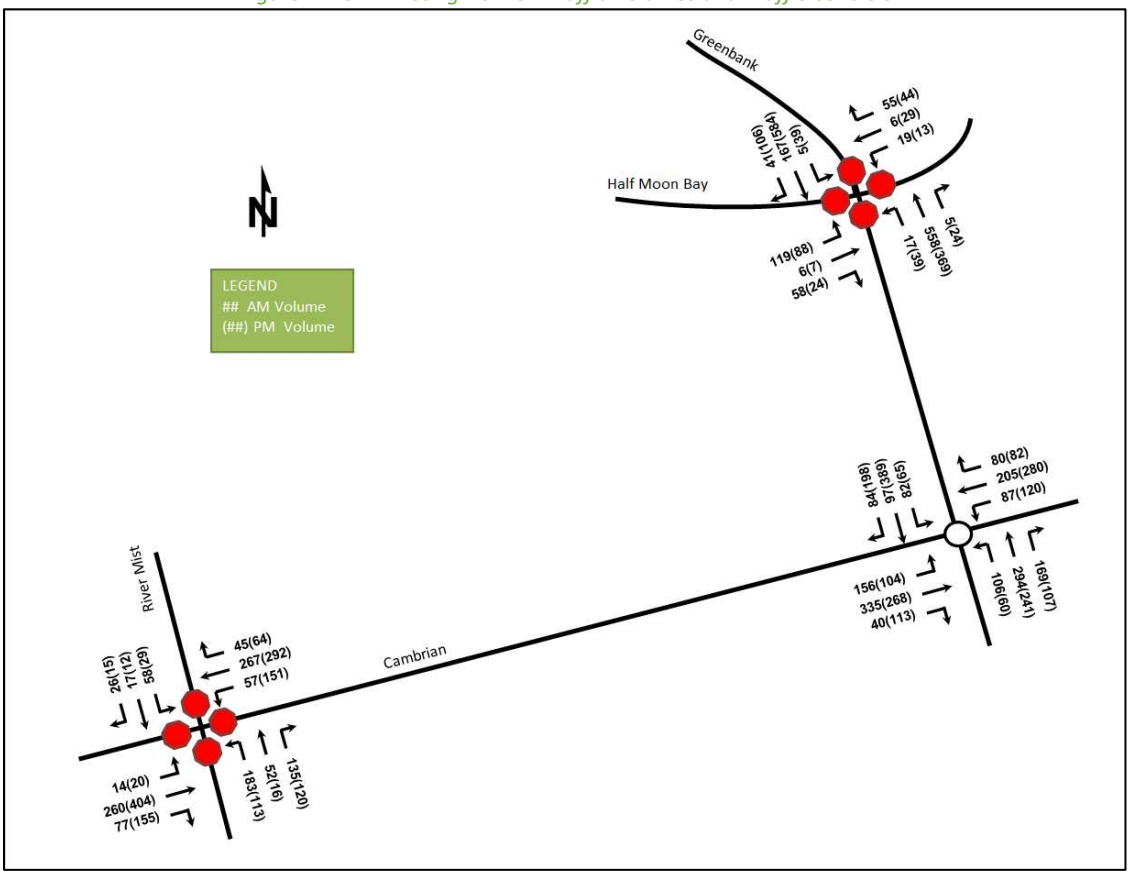
Existing turning movement counts were acquired from the City of Ottawa for the existing study area intersections. Table 1 summarizes the intersection count dates and data source.

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 B.

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

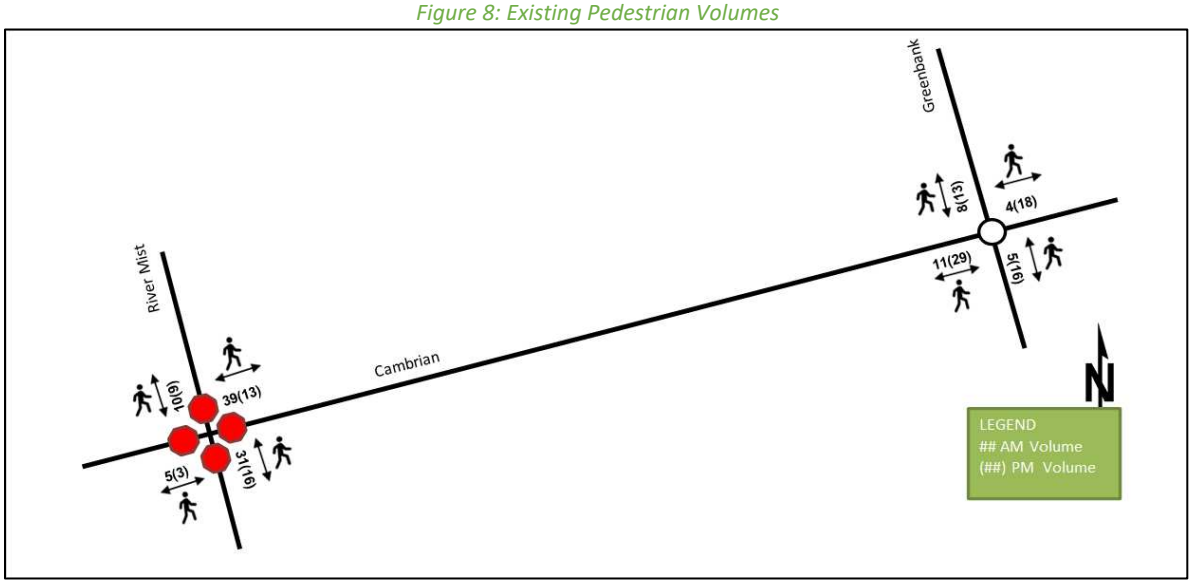
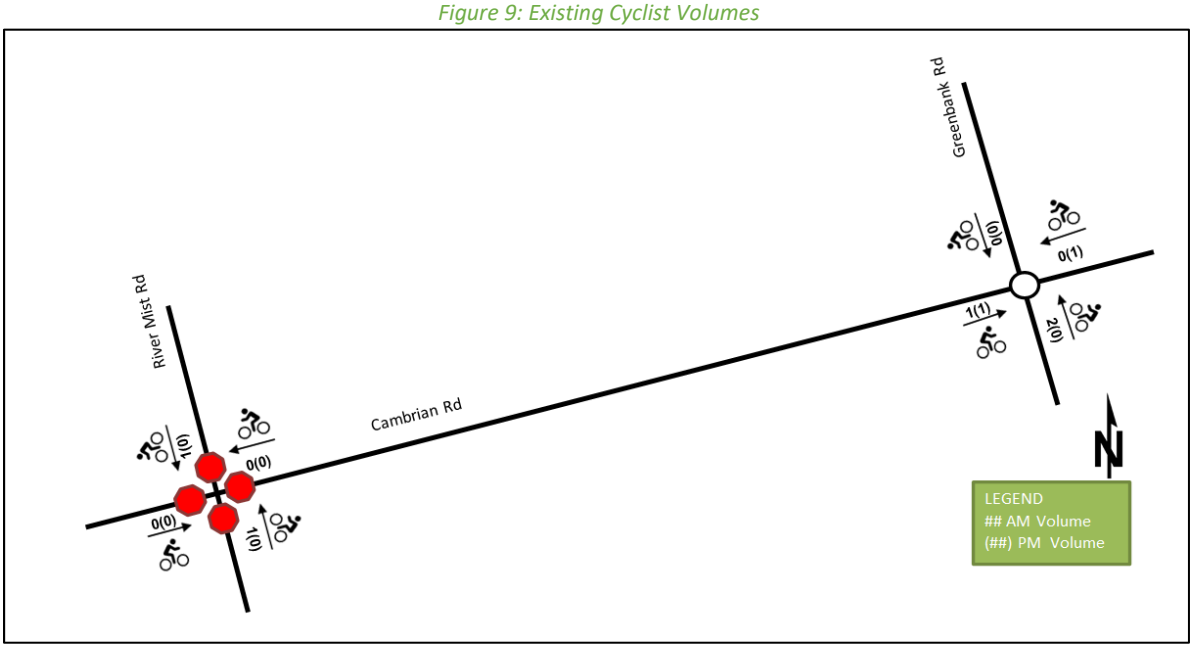


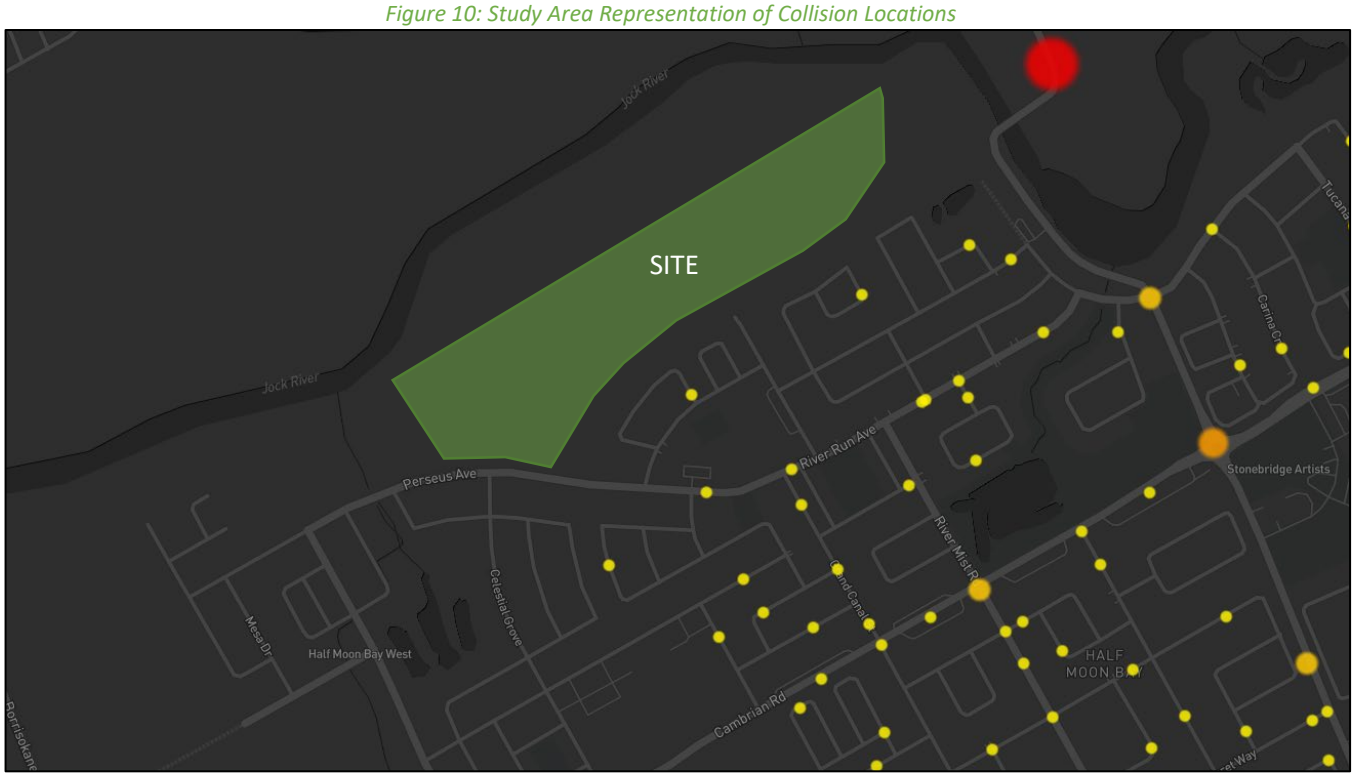
Figure 9: Existing Cyclist Volumes



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 are road network. Table 2 illustrates the collisions at the intersections and road segments within the study area, and Table 3 summarizes the collision types and conditions of the 10 collisions recorded in the study area. Collision data is included in Appendix C.

Figure 10: Study Area Representation of Collision Locations



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

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%

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	Approaching	0	0%
	Angle	5	28%
	Rear End	6	33%
	Sideswipe	0	0%
	Turning Movement	2	11%
	SMV Unattended Vehicle	0	0%
	SMV Other	5	28%
	Other	0	0%
Road Surface Condition	Dry	10	56%
	Wet	1	6%
	Loose Snow	2	11%
	Slush	3	17%
	Packed Snow	0	0%
	Ice	2	11%
	Loose Sand or Gravel	0	0%
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 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:

- Re-Aligned 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

Re-Aligned 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 Re-Aligned Greenbank Road will be completed to Cambrian Road by 2031. The proposed cross-section of Re-Aligned 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

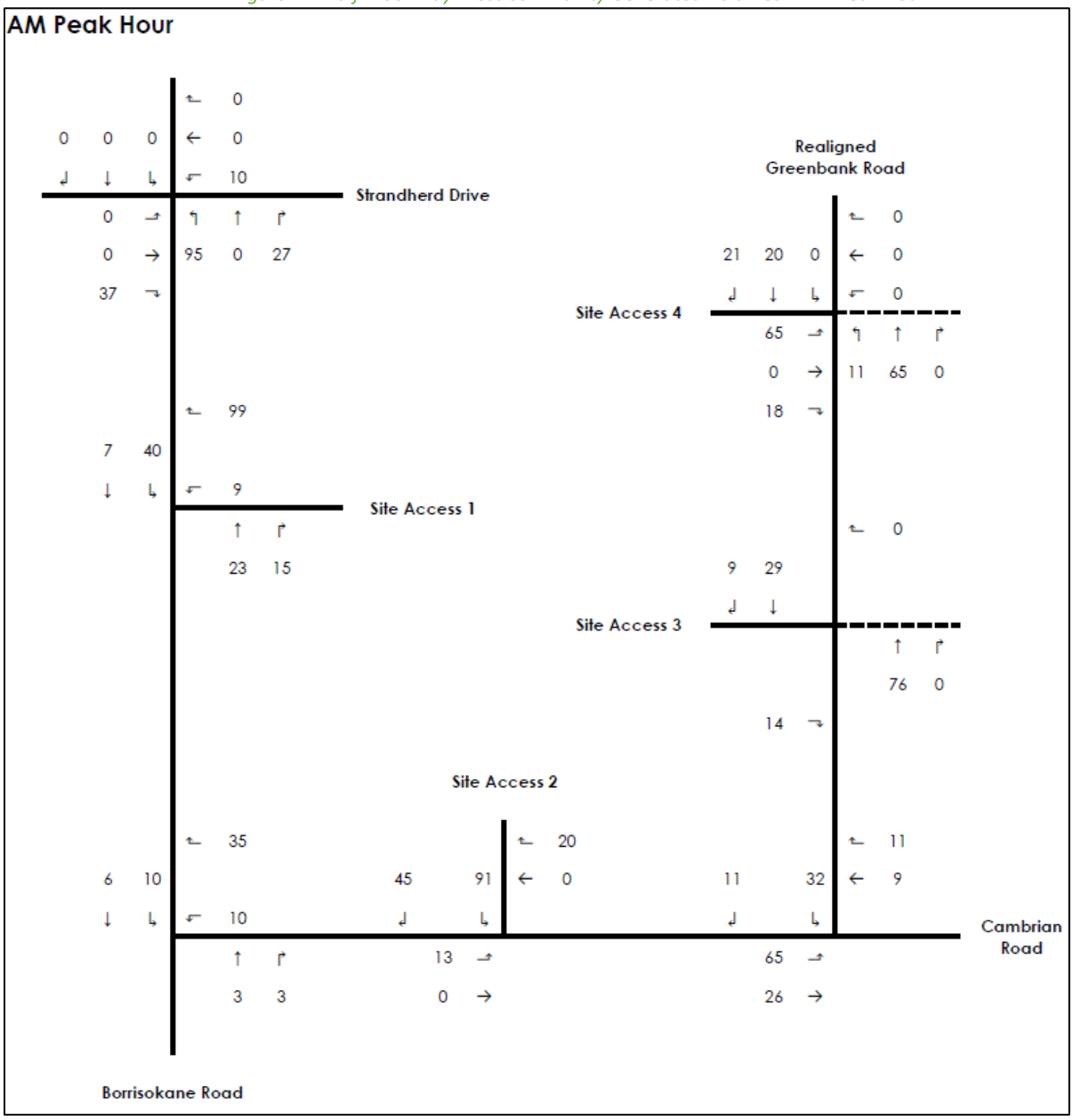
Several development applications were available for the adjacent properties as listed on the City's Development Application Search tool:

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.

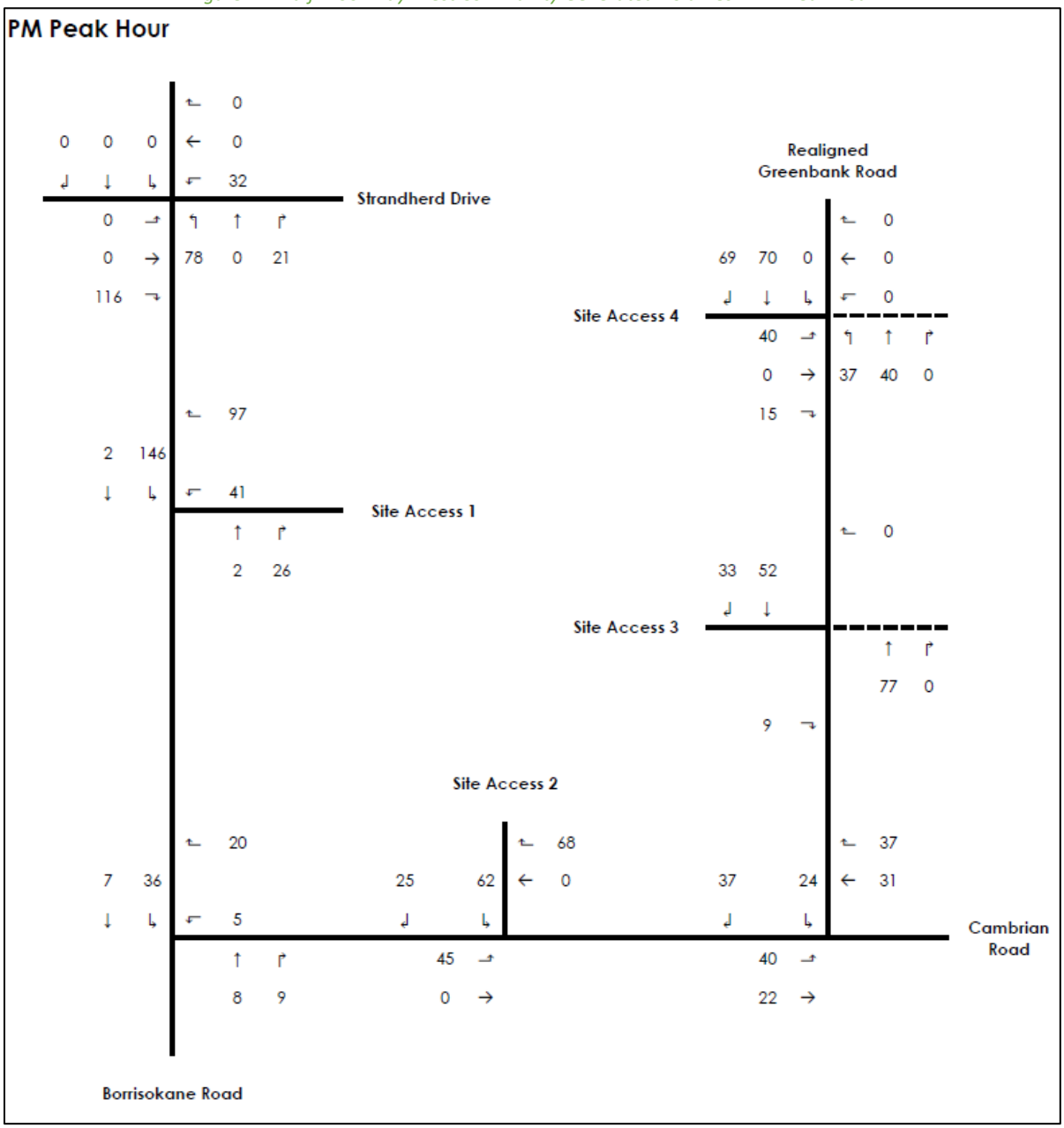
In the 2019 update, the plan was revised to include 154 back-to-back townhouse dwellings, 300 wide lot townhouse dwellings, 447 detached dwellings, and 72 apartment units. The anticipated trip generation from the new plan is 536 and 659 two-way auto trips during the AM and PM peak hours, respectively. 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

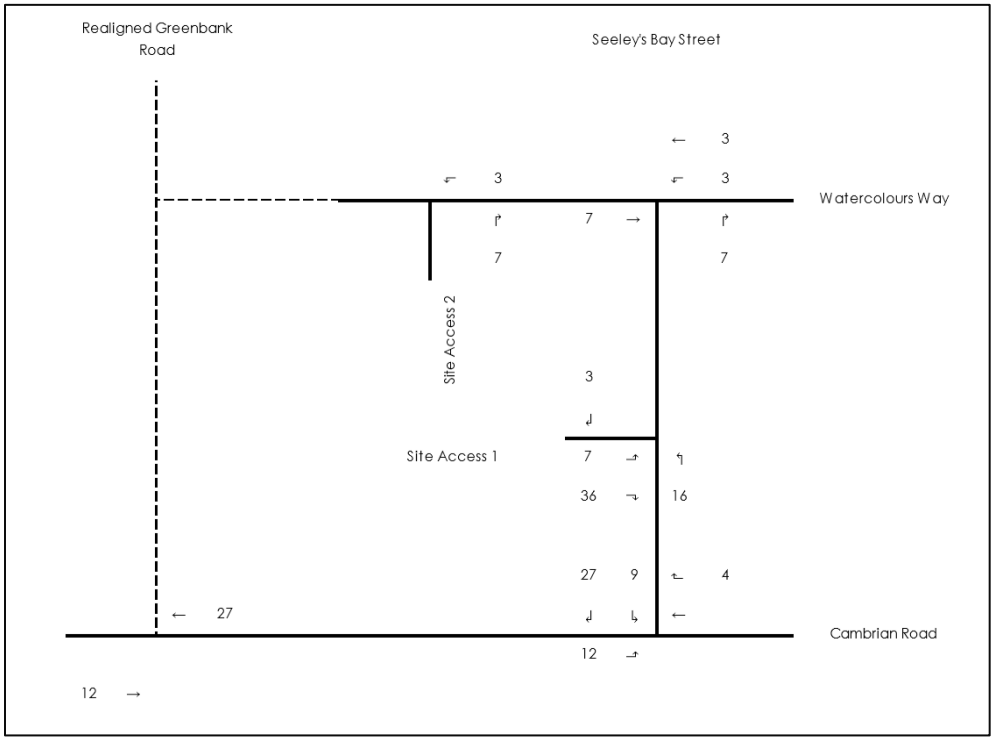


Source: Half Moon Bay West Community Transportation Study (Stantec, 2016)

2444 Watercolours Way

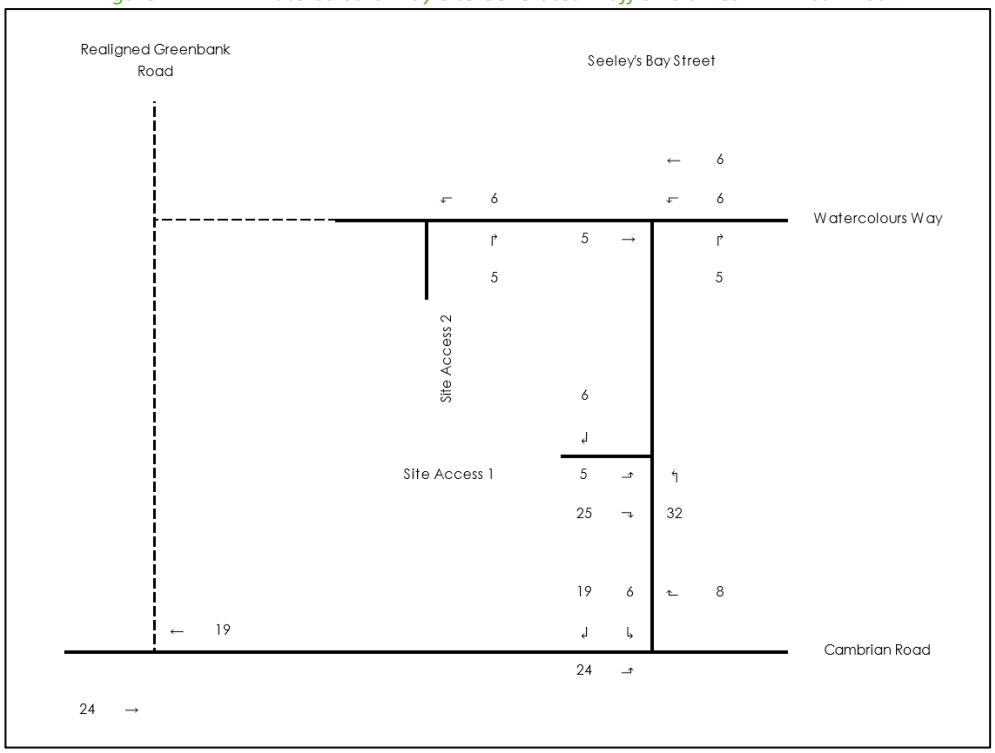
2444 Watercolours Way (Half Moon Bay North Phase 9) is a proposed residential development consisting of 60 stacked house units. This development was completed in 2019. However, this development is not captured in the available TMCs and therefore it has been accounted for explicitly herein. 2444 Watercolours 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

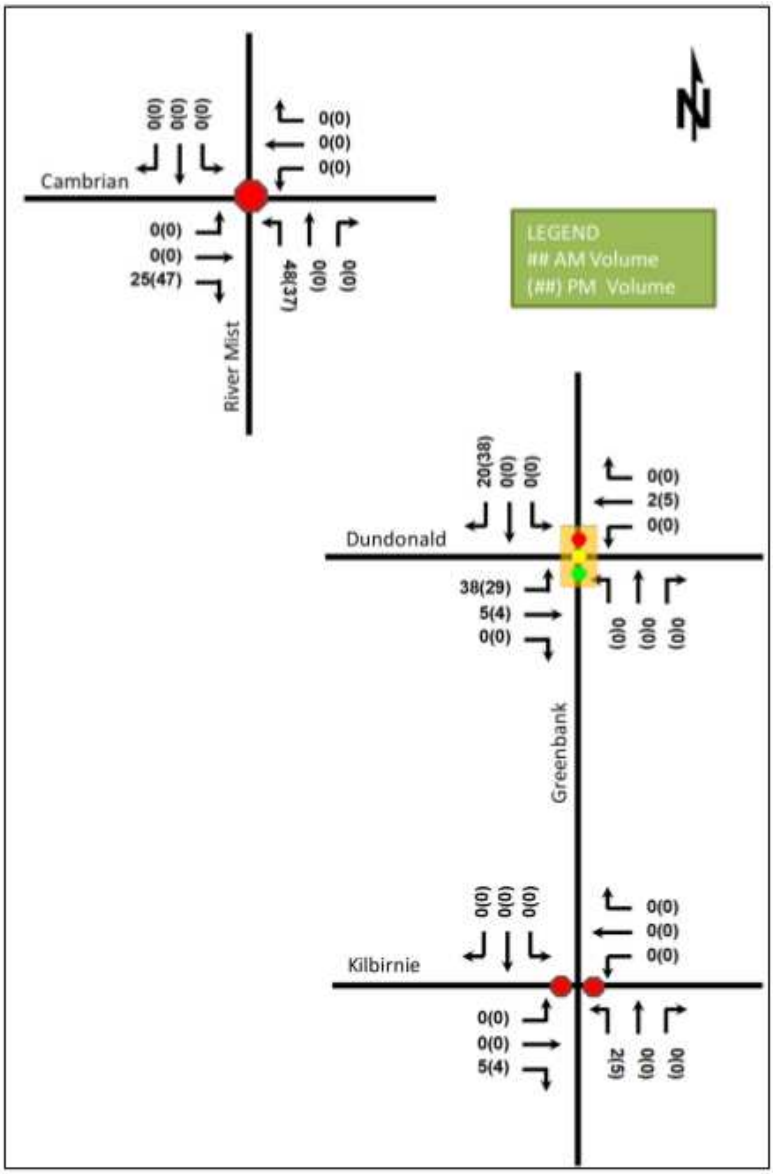


Source: Half Moon Bay North Apartment Block Transportation Impact Assessment (Stantec, 2018)

3718 Greenbank Road

3718 Greenbank Road is Phase 5 of Mattamy Half Moon Bay South, which is located south of the subject site and is expected to be built-out in 2020. 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

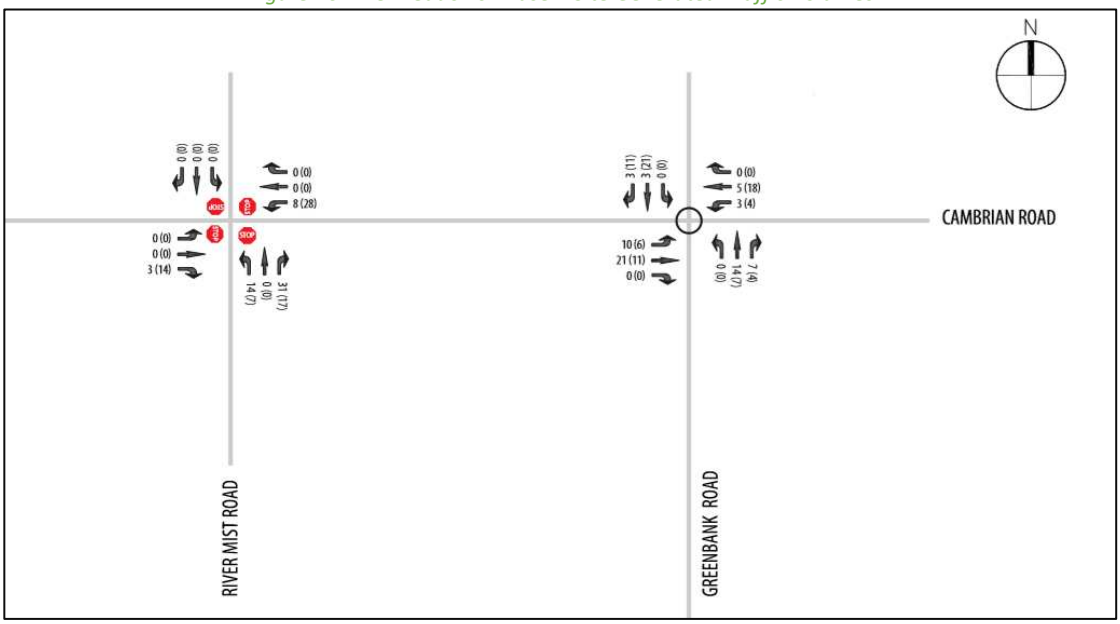


Source: 3718 Greenbank Road – Half Moon Bay South – Phase 5 Transportation Impact Assessment (CGH, 2019)

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

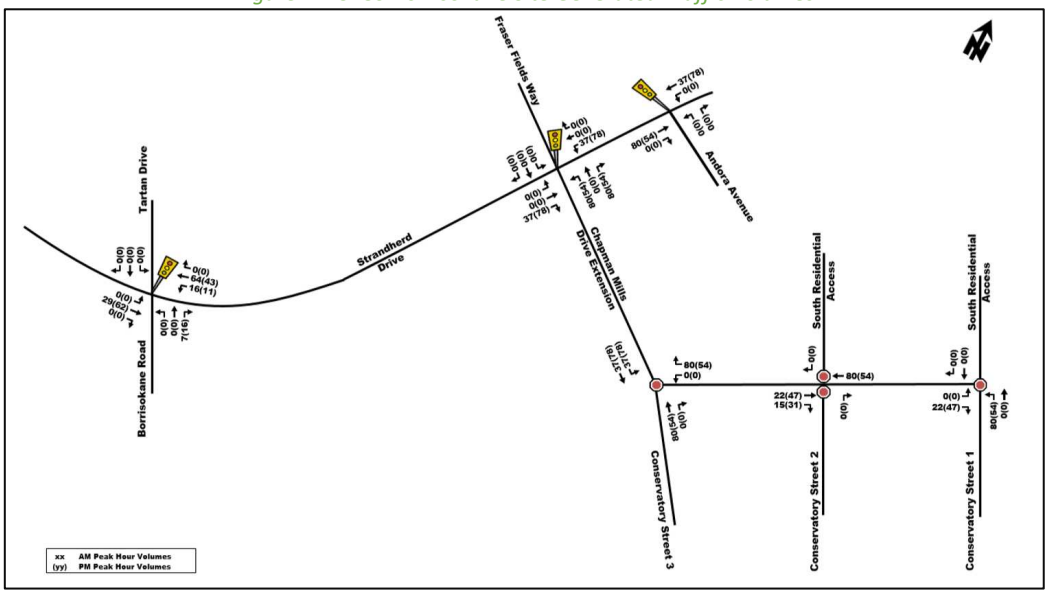


Source: The Meadows Phase 4 TIA Report (IBI, 2018)

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

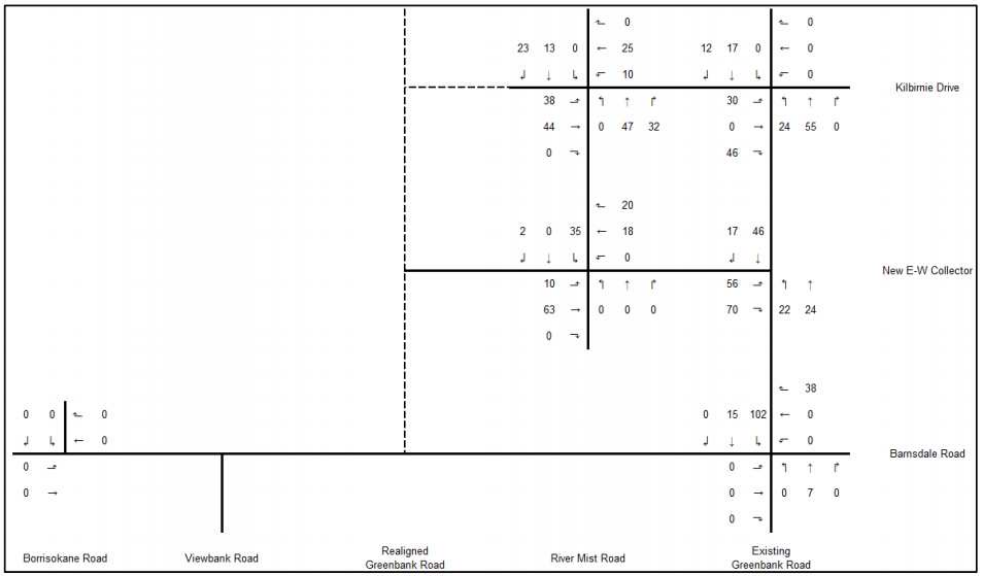


Source: 3285 Borrisokane Road Phase 1 Transportation Impact Study (Parsons, 2018)

3882 Barnsdale Road and 3960 Greenbank Road

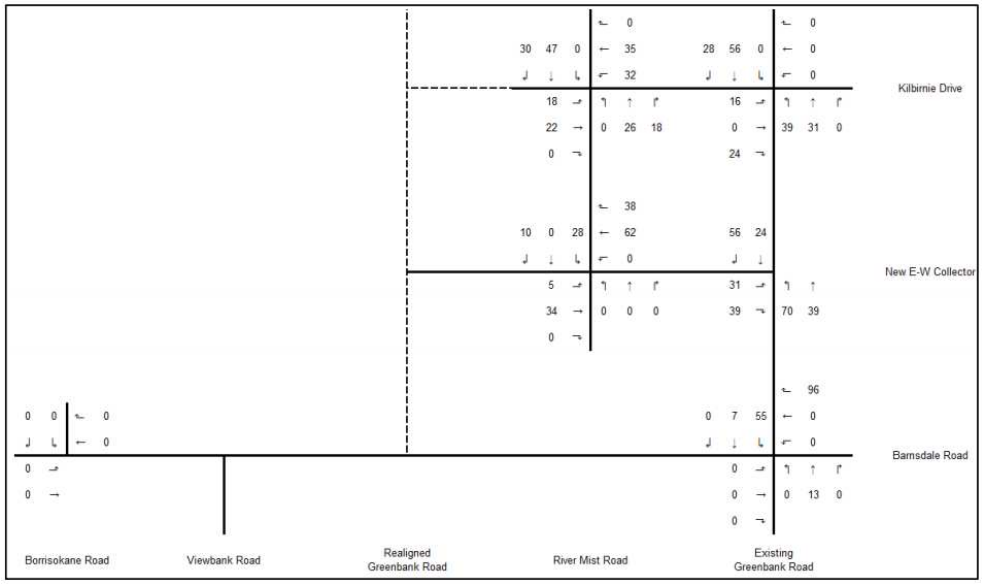
3882 Barnsdale Road and 3960 Greenbank Road (Quinn's Pointe 2) is a proposed two-phase residential development that will include 536 single-family dwelling units, 493 townhomes, 100 apartment units, and two elementary schools. A total of 749 two-way AM peak period auto trips and 813 two-way PM peak period 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

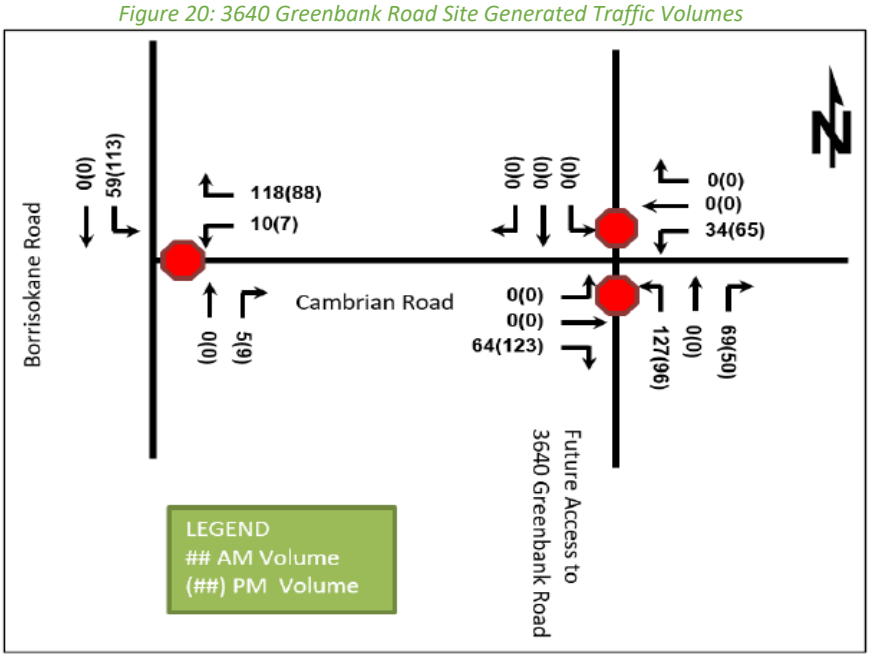


Source: 3718 Greenbank Road – Half Moon Bay South – Phase 5 Transportation Impact Assessment (CGH, 2019)

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

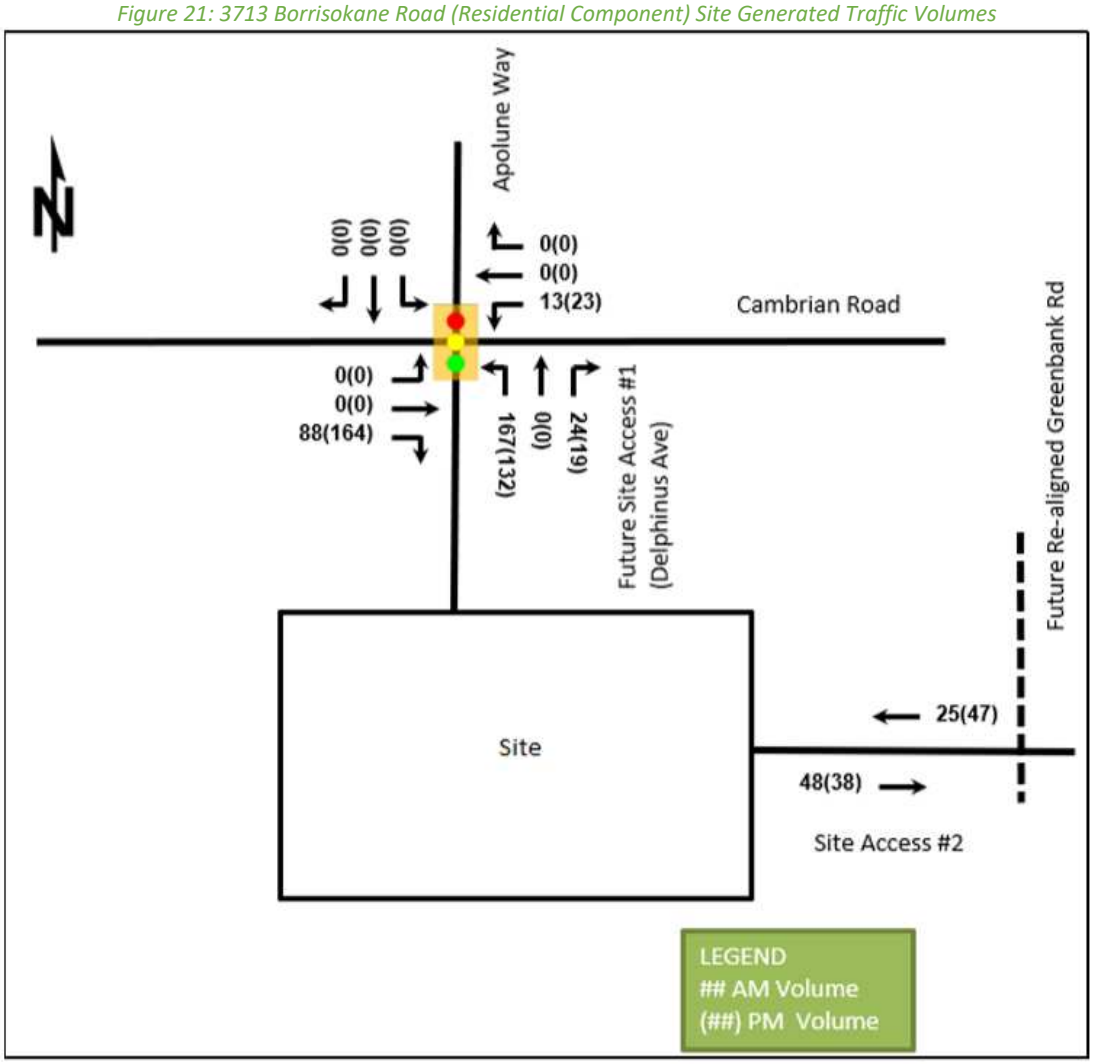


Source: 3640 Greenbank Road Transportation Impact Assessment (CGH, 2018)

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

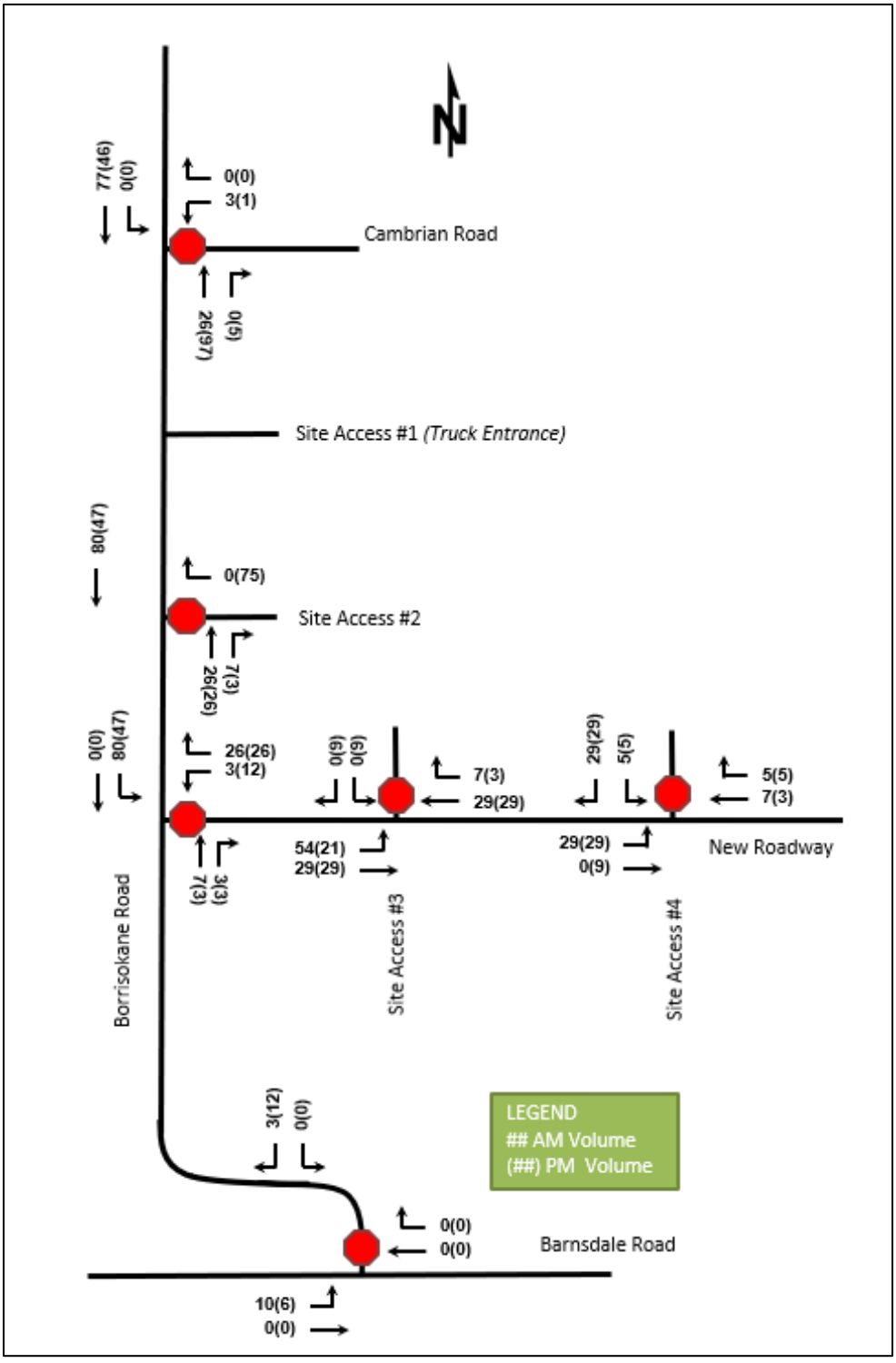


Source: 3713 Borrisokane Road Transportation Impact Assessment (CGH, 2020)

3713 Borrisokane Road-Industrial Component

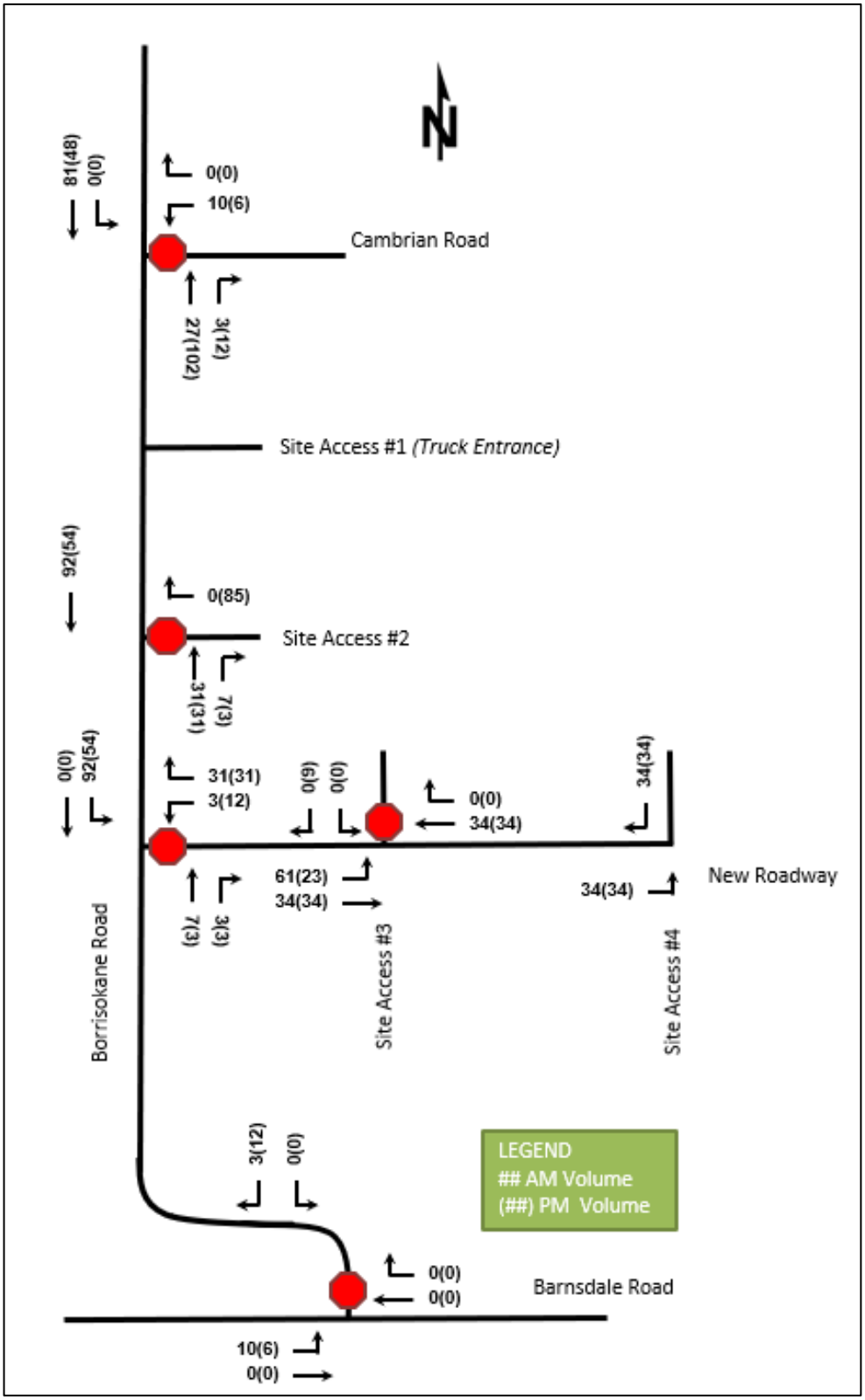
The industrial component of 3713 Borrisokane Road will be built-out in 2 phases, Phase 1 in 2022 and Phase 2 in 2027. The development will include approximately 3,250 square metres of general office space and 9,385 square metres of industrial buildings. This development is expected to produce 112 two-way 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

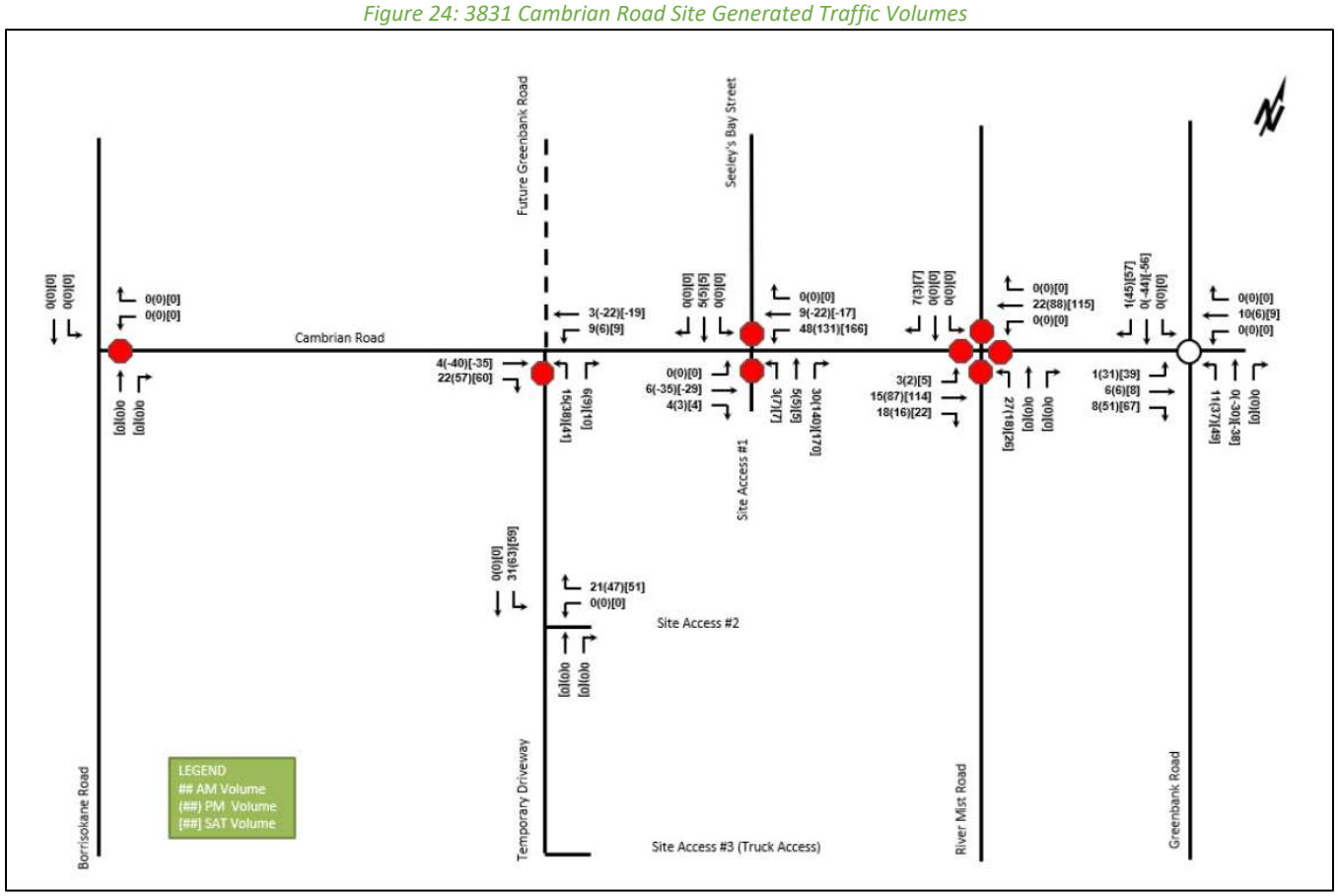


Source: 3713 Borrisokane Road – ABIC Manufacturing Facility Transportation Impact Assessment (CGH, 2020)

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 the Appendix D.

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

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 Alta Vista have been summarized in in Table 5.

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%	49%	49%
Auto Passenger	14%	19%	13%	13%
Transit	25%	18%	26%	24%
Cycling	1%	1%	2%	2%
Walking	9%	10%	9%	12%
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	Vehicle Trip Rate	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	53	33	76	109	81	50	131
Multi-Unit (Low-Rise)	545	221	515	736	482	379	861

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%**	8	19	27	**53%**	19	11	30
	Auto Passenger	**14%**	2	5	7	**19%**	7	4	11
	Transit	**25%**	4	10	14	**18%**	7	3	10
	Cycling	**1%**	0	0	0	**1%**	0	0	0
	Walking	**9%**	2	4	6	**10%**	4	3	7
	Total	**100%**	**16**	**39**	**55**	**100%**	**37**	**21**	**58**
Multi-Unit (Low-Rise)	Auto Driver	**49%**	52	121	173	**49%**	104	82	186
	Auto Passenger	**13%**	14	32	46	**13%**	28	21	49
	Transit	**26%**	31	74	105	**24%**	54	43	97
	Cycling	**2%**	2	6	8	**2%**	4	4	8
	Walking	**9%**	12	26	38	**12%**	30	23	53
	Total	**100%**	**111**	**259**	**368**	**100%**	**212**	**167**	**379**
Total	Auto Driver	-	60	140	200	-	123	93	216
	Auto Passenger	-	16	37	53	-	35	25	60
	Transit	-	35	84	119	-	61	46	107
	Cycling	-	2	6	8	-	4	4	8
	Walking	-	14	30	44	-	34	26	61
	Total	-	**127**	**297**	**424**	-	**248**	**189**	**437**

As shown above, 200 AM and 216 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.

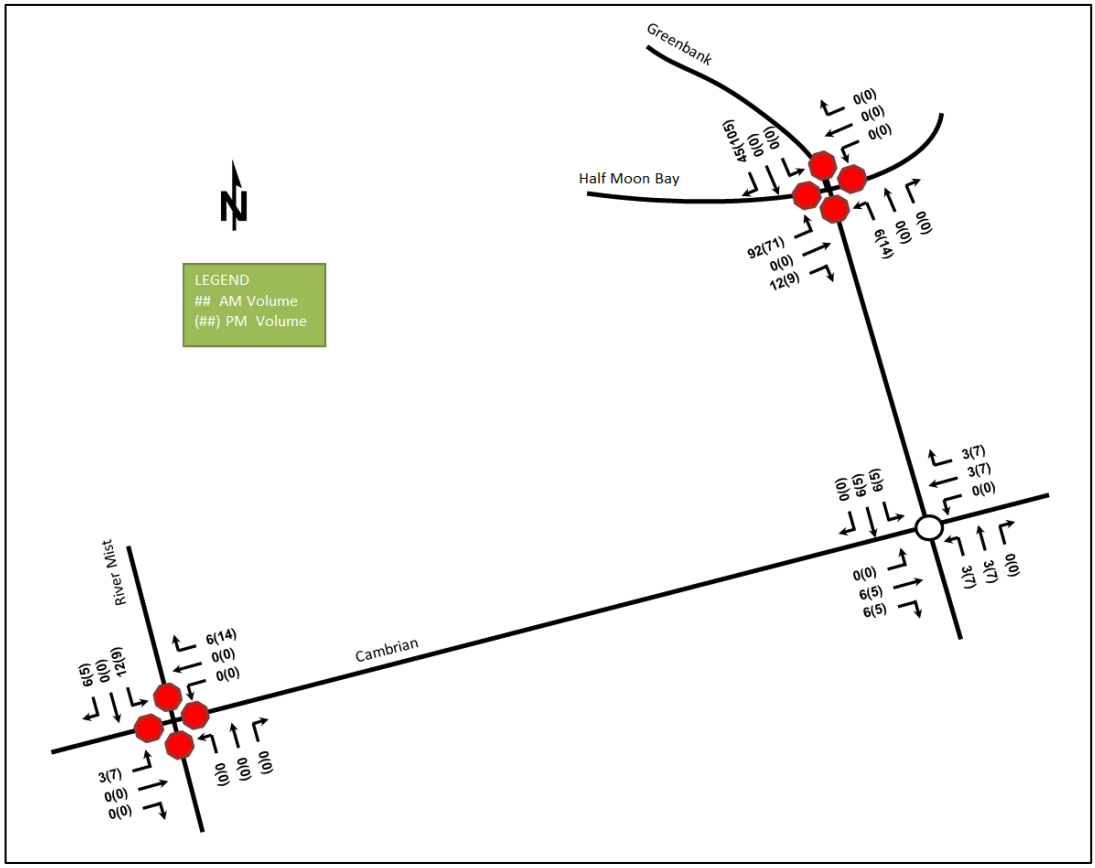
Table 9: OD Survey Existing Directional Split South Nepean

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. Figure 25 illustrates the new site generated volumes.

Figure 25: New Site Generation 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. As such, the 2024 Synchro model of the study area will be based on the existing roadway configuration.

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 26 illustrates the 2024 future background volumes, and Figure 27 illustrates the 2029 future background volumes.

Figure 26: 2024 Future Background Volumes

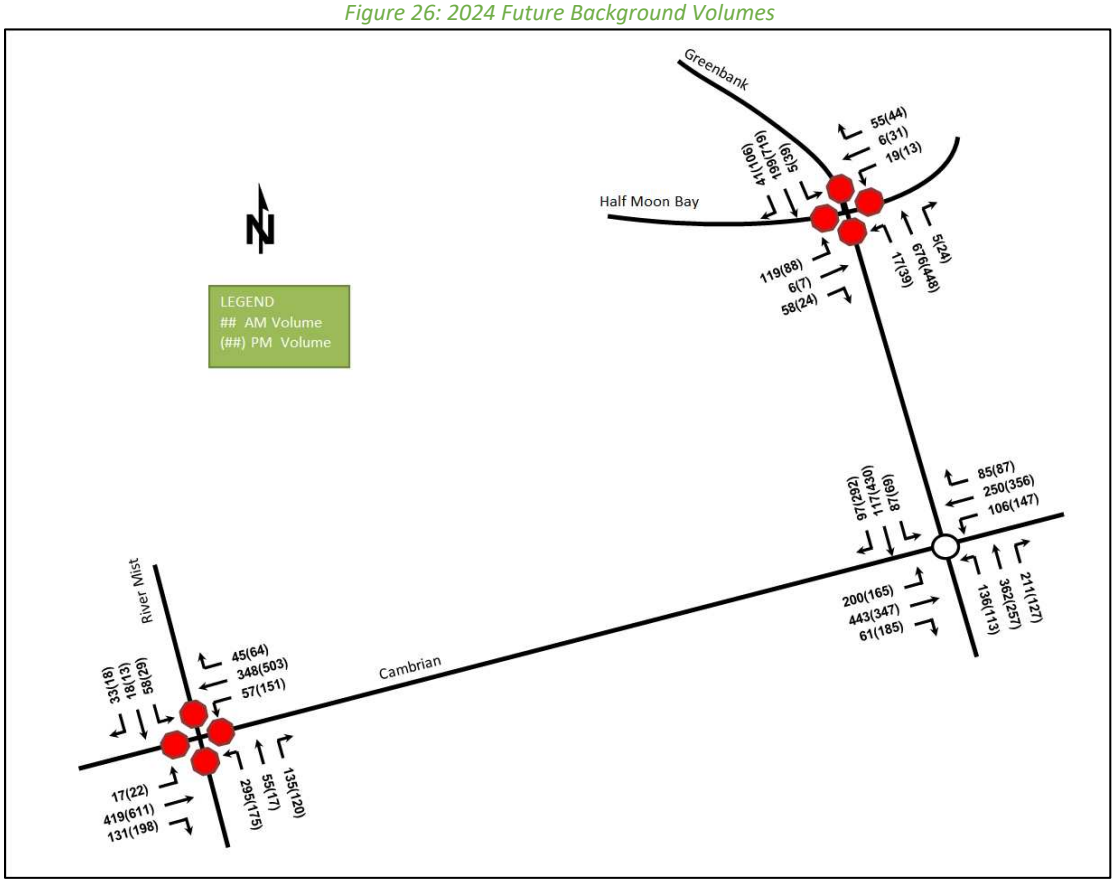
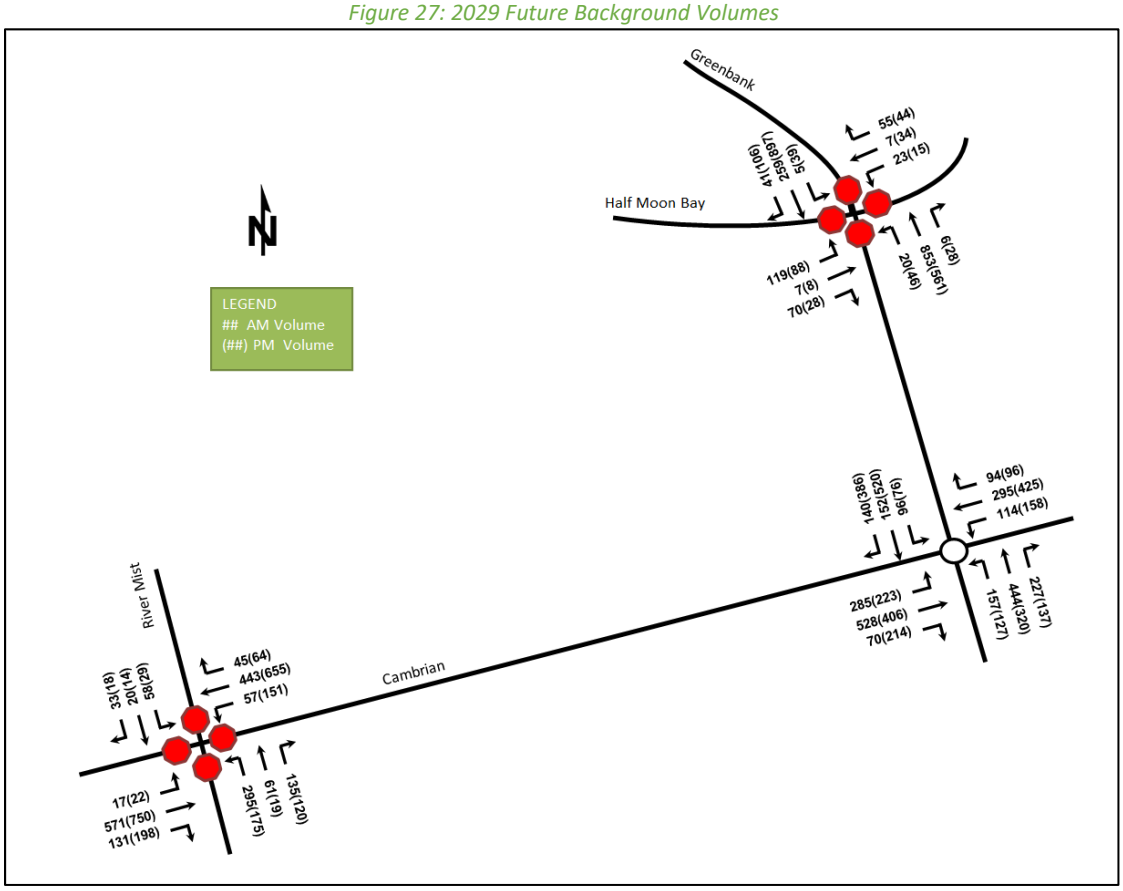


Figure 27: 2029 Future Background Volumes



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 28, and future total 2029 volumes are illustrated in Figure 29.

Figure 28: 2024 Future Total Volumes

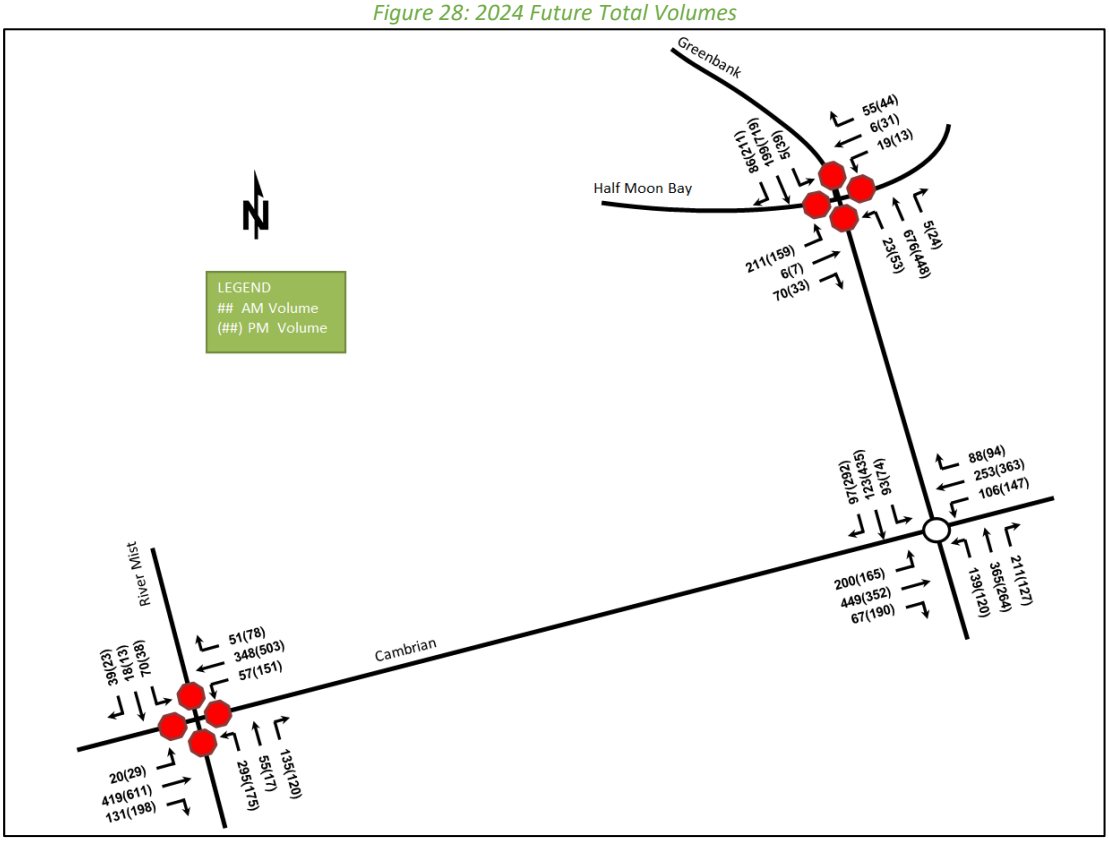
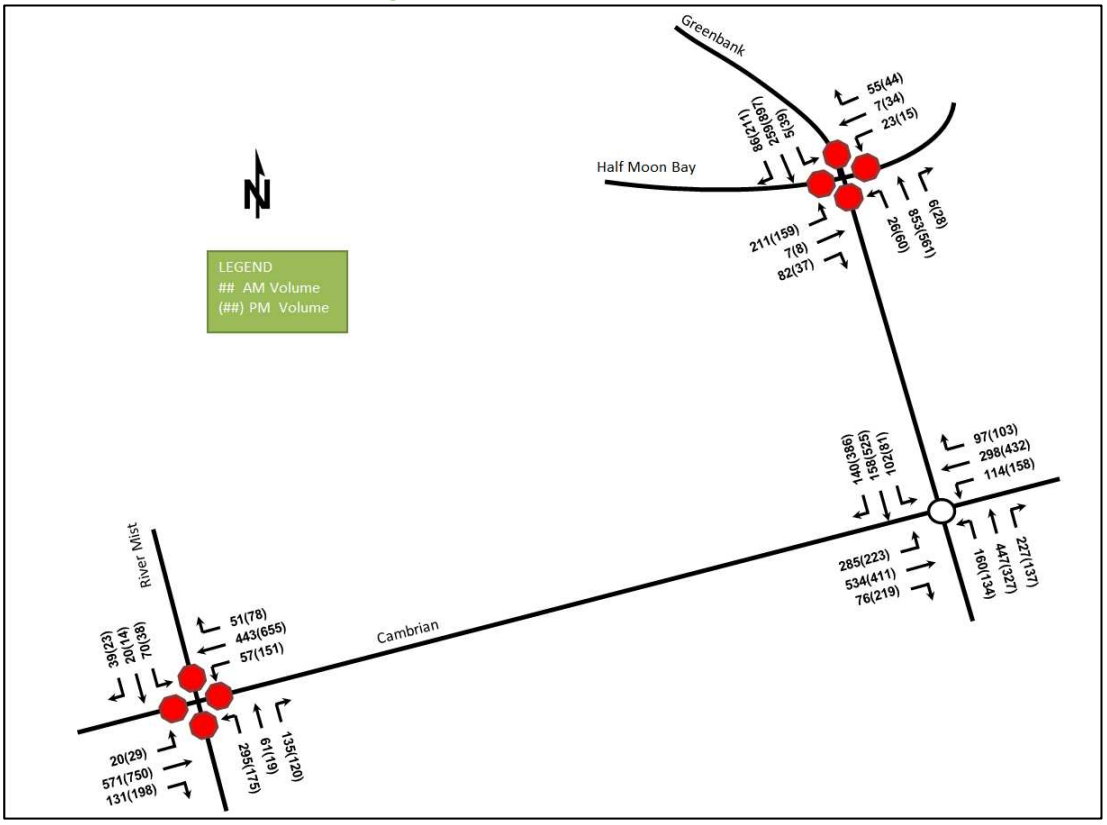


Figure 29: 2029 Future Total Volumes



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 30 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.

Figure 30: Concept Pedestrian and Cycling Network

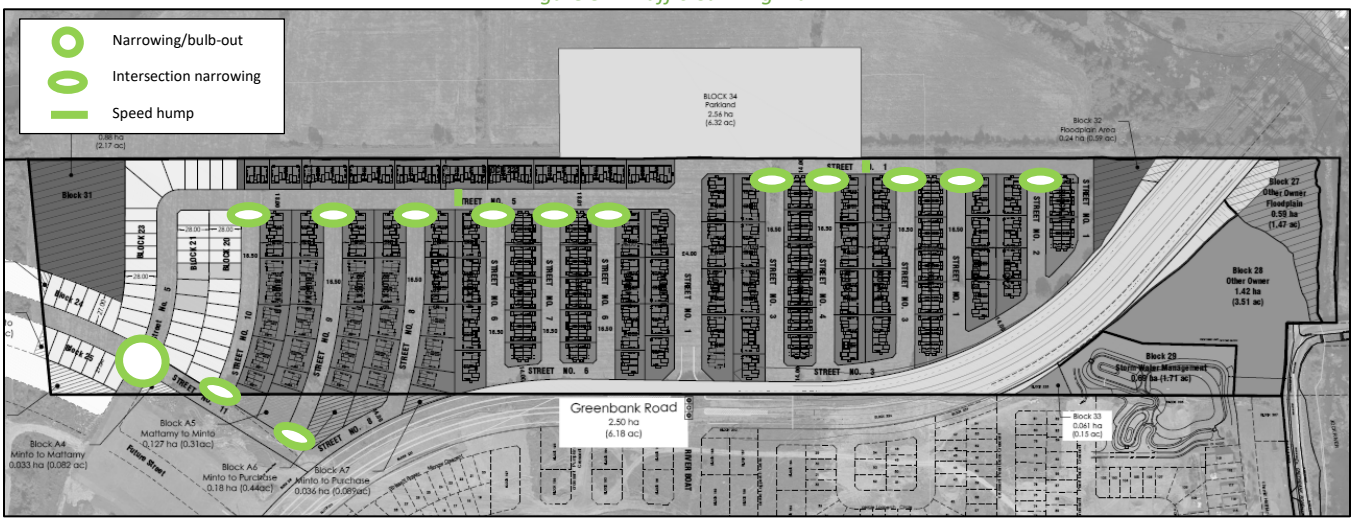
8.2 New Street Networks

The planned street network will include 14.0 metre window roads, 16.5 metre laneways, 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 31 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 31: Traffic Calming Plan



9 Boundary Street Design

The Re-Aligned 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 future Perseus Avenue/Riven Run Avenue (270 metres from Burbot Street) and Riverboat Heights, which will be extended north and cut through the Minto Subdivision.

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

As the Greenbank corridor is not expected to be re-aligned within the future horizons considered in this study, the MMLOS and capacity analysis will be completed as part of the detailed design of the corridor and is beyond the scope of this study. This design is currently underway by the City.

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 Re-Aligned 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. As a result, no TDM measures are recommended at this time beyond providing a multimodal travel option information package to new residents. The TDM Checklist has been provided in Appendix E.

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 outline a collector road threshold of 2,500 vehicles per day (AADT), or 300 vehicles in a given peak hour for Neighbourhood Traffic Management review. This will give an indication of whether Half Moon Bay Road / River Run Avenue and River Mist Road meet or exceed the theoretical thresholds. The implications of the anticipated traffic within the context of the existing/planned road network and any required mitigation measures are discussed in the following subsections.

12.1 Half Moon Bay Road

Table 10 summarizes the AADT in both directions on the collector road of Half Moon Bay Road / River Run Avenue in the PM peak period.

Table 10: Half Moon Bay Road / River Run Avenue Volumes - NTM Review

West of Greenbank Road				
Development	**PM Peak**			
	Eastbound	**% Theoretical Threshold**	**Westbound**	**% Theoretical Threshold**
3434 Greenbank Road	164 (1640 AADT)	66%	193 (1930 AADT)	77%
2024 Future Background Volumes	119 (1190 AADT)	48%	176 (1760 AADT)	70%
Total	**283 (2830 AADT)**	**113%**	**369 (3690 AADT)**	**148%**

Note:
1. AADT approximated using 10:1 ratio of PM peak hour traffic
   AADT calculated as one-way peak direction volumes

As shown above, the proposed site trip generation is expected to use 77% of the theoretical TIA AADT threshold of Half Moon Bay Road / River Run Avenue. When combined with traffic from background developments, the westbound AADT along Half Moon Bay Road / River Run Avenue, west of Greenbank Road is 3690 vehicles, which is 148% of the daily theoretical threshold for a collector road. However, the volume generated by the proposed development along Half Moon Bay Road / River Run Avenue is temporary and will be redirected once the future Re-Aligned Greenbank Road is built beyond this study's horizons.

12.2 River Mist Road

Table 11 summarizes the AADT in both directions on the River Mist Road collector in the PM peak period.

Table 11: River Mist Road Volumes - NTM Review

North of Cambrian Road				
Development	**PM Peak**			
	Northbound	**% Theoretical Threshold**	**Southbound**	**% Theoretical Threshold**
3434 Greenbank Road	34 (340 AADT)	14%	29 (290 AADT)	12%
2024 Future Background Volumes	103 (1030 AADT)	41%	60 (600 AADT)	24%
Total	**137 (1370 AADT)**	**55%**	**89 (890 AADT)**	**36%**

Note:
1. AADT approximated using 10:1 ratio of PM peak hour development-generated traffic
AADT calculated as one-way peak direction volumes

The proposed development generates 34 PM peak hour trips in the peak direction along River Mist Road. As illustrated above, this does not exceed the City's ADDT threshold. No mitigation measures are proposed along this road.

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 12 summarizes the transit trip generation.

Table 12: Trip Generation by Transit Mode

Travel Mode	**Mode Share**	**AM**			**PM**		
		In	Out	Total	In	Out	Total
Transit	Varies	35	84	119	61	46	107

The proposed development is anticipated to generate an additional 119 AM peak hour transit trips and 107 PM peak hour transit trips. Of these trips, 84 outbound AM trips and 61 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 63 trips to the north, eight each to the south and east, and four trips to the west. Site-generated inbound PM trips break down to 34 trips from the north, five 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, Re-Aligned 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 Re-Aligned Greenbank Road, from Chapman Mills Drive to Cambrian Road
- Re-Aligned Greenbank Road extension south of Cambrian Road
- Widening of Cambrian Road from the Re-Aligned 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

A signal warrant analysis was performed for the intersection of Cambrian Road and River Mist Road as well as Greenbank Road at Half Moon Bay Road for the 2024 future background and future total horizons using the OTM Book 12 Justification 7 criteria. 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. It was also found that signals are warranted at the Greenbank Road and Half Moon Bay Road intersection during the 2024 future total horizon. The City of Ottawa has also conducted signal warrants in 2020 using Justification 3 criteria of OTM Book 12 and it was determined that signals are justified under existing conditions. Therefore, the operations of Greenbank Road at Half Moon Bay Road will be analysed under both All-Way Stop Control and signalized operations in the existing horizon, and as a signalized intersection in future horizons. The email confirming that signals are warranted at Greenbank Road and Half Moon Bay Road using Justification 3 of OTM Book 12 is included in Appendix F. 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.

15.2 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 I. All parameters have been coded using the City of Ottawa's TIA Guidelines and default parameters.

15.2.1 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 13 summarizes the operational analysis of the 2021 existing conditions. Appendix J contains the 2021 Existing Conditions Synchro and Sidra sheets.

Table 13: 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*	EBL/T/R	D	0.78	31.7	53.3	**F**	**1.10**	**97.2**	**151.5**
	WBL/T/R	D	0.81	34.9	59.3	**F**	**1.01**	**58.2**	**100.5**
	NBL/T/R	D	0.79	32.5	56.3	C	0.57	19.3	24.8
	SBL/T/R	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								
	EBL/T/R	A	0.02	8.5	0.0	A	0.02	8.2	0.8
	WBL/T/R	A	0.06	8.5	1.5	A	0.18	9.6	4.5
	NBL/T/R	**F**	**1.35**	**210.4**	**155.3**	**F**	**1.71**	**392.5**	**147.0**
	SBL/T/R	**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 *Unsignalized*	EBL/T/R	B	0.36	13.1	12.0	B	0.28	13.4	7.5
	WBL/T/R	B	0.16	10.8	4.5	B	0.20	12.3	5.3
	NBL/T/R	E	0.94	45.0	99.8	D	0.80	26.2	52.5
	SBL/T/R	B	0.38	12.4	13.5	**F**	**1.22**	**137.2**	**219.8**
	Overall	**D**	-	**30.3**	-	**F**	-	**83.4**	-
	Alternative Scenario: Signalization as per Justification 3 of OTM Book 12								
	EBL/T/R	A	0.55	27.5	43.0	A	0.44	28.8	31.3
	WBL/T/R	A	0.20	10.9	13.4	A	0.25	16.0	17.4
	NBL/T/R	B	0.65	15.3	94.8	A	0.49	9.9	55.2
	SBL/T/R	A	0.24	8.2	25.4	C	0.78	17.2	128.9
	Overall	**B**	**0.61**	**15.7**	-	**B**	**0.68**	**15.9**	-
Greenbank Road & Cambrian Road *Roundabout*	EBL/T/R	C	0.72	19	76	E	0.89	40	103
	WBL/T/R	C	0.68	21	43	C	0.76	23	70
	NBL/T/R	**F**	**1.08**	**88**	**248**	C	0.66	18	45
	SBL/T/R	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					m = metered queue			
	PHF = 0.90					# = queue exceeds storage or mid-block length			

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 G. 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 J.

Similar operational performance is observed at Greenbank Road and Half Moon Bay Road intersection, with poor level of service at southbound approach. As the City has indicated that signals are warranted at this intersection using 2020 volumes and Justification 3 of OTM Book 12, this intersection has also been analysed under signalized operations. The results of the analysis show that the intersection performance improves as a result of signalization with LOS ranging between A and C.

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 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.

15.2.2 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. This improvement as well as signalization of Greenbank Road at Half Moon Bay Road were applied to the Synchro model in the 2024 future background horizon and are discussed below. Table 14 summarizes the operational analysis of 2024 future background conditions. Appendix K contains the 2024 future background Synchro sheets.

Table 14: 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 *Signalized*	EBL/T/R	A	0.52	27.6	39.4	A	0.39	27.5	28.1
	WBL/T/R	A	0.19	11.6	12.8	A	0.23	16.4	16.7
	NBL/T/R	B	0.68	15.3	102.7	A	0.52	10.3	59.9
	SBL/T/R	A	0.24	7.7	25.1	D	0.83	19.9	#158.9
	Overall	**B**	**0.62**	**15.4**	-	**B**	**0.70**	**17.2**	-
Greenbank Road & Cambrian Road *Roundabout*	EBL/T/R	D	0.88	31.2	160.1	**F**	**1.07**	**80.1**	**273.8**
	WBL/T/R	C	0.72	22.9	50.1	E	0.90	39.4	120.9
	NBL/T/R	**F**	**1.33**	**185.4**	**494.8**	D	0.76	24.7	64.5
	SBL/T/R	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				m = metered queue				
	PHF = 1.0				# = queue exceeds storage or mid-block length				

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 as well as at the northbound approach of Half Moon Bay Road and Greenbank Road intersection during the PM peak period. However, as 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 operations of Greenbank Road and Half Moon Bay Road remain predominantly unchanged with majority of movements at LOS A or B. The southbound approach V/C ratio increases from 0.78 to 0.83, and the 95th percentile queues extend beyond the intersection capacity, however, as the V/C ratio of this movement is less than 1.0 it can be assumed that the 95th percentile queue will rarely be exceeded.

The eastbound approach at Greenbank Road and Cambrian Road roundabout has fails 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.

15.2.3 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 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. This improvement as well as signalization of Greenbank Road at Half Moon Bay Road were applied to the Synchro model in the 2029 future background horizon and are discussed below. Table 15 summarizes the operational analysis of 2029 future background conditions. Appendix L contains the 2029 future background Synchro sheets.

Table 15: 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	0.10	19.1	7.6
	EBT	E	0.95	50.6	#142.4	F	1.03	70.2	#224.0
	EBR	A	0.21	3.8	9.2	A	0.27	3.7	12.5
	WBL	A	0.42	28.0	17.3	D	0.84	55.1	#48.3
	WBT	C	0.73	27.7	87.9	C	0.71	23.1	133.4
	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	27.9	43.8
	NBT/R	A	0.31	6.8	17.8	A	0.24	7.0	14.9
	SBL	A	0.14	15.3	12.5	A	0.07	22.4	9.9
	SBT/R	A	0.09	7.8	7.9	A	0.06	13.3	7.9
	Overall	**C**	**0.77**	**28.7**	-	**C**	**0.75**	**38.1**	-
Greenbank Road & Half Moon Bay Road *Signalized*	EBL/T/R	A	0.55	27.6	41.3	A	0.40	27.3	29.0
	WBL/T/R	A	0.21	12.1	13.8	A	0.24	16.9	17.5
	NBL/T/R	D	0.86	24.2	#184.2	B	0.66	13.4	88.2
	SBL/T/R	A	0.30	8.5	32.6	E	1.00	43.5	#236.6
	Overall	**C**	**0.75**	**20.7**	-	**D**	**0.83**	**31.0**	-
Greenbank Road & Cambrian Road *Roundabout*	EBL/T/R	F	1.16	105.6	483.9	F	1.25	145.1	526.8
	WBL/T/R	D	0.84	34.0	81.8	F	1.14	107.9	320.3
	NBL/T/R	F	1.68	334.4	838.0	E	0.91	41.8	125.1
	SBL/T/R	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**	**177.9**	**1004.6**
Notes:	Saturation flow rate of 1800 veh/h/lane				m = metered queue				
	PHF = 1.0				# = queue exceeds storage or mid-block length				

The intersections at the 2029 future background horizon are 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 Half Moon Bay Road may exhibit extended queuing on the northbound movement during AM peak hour and southbound movement during PM peak hour.

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

15.2.4 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 16 summarizes the operational analysis of the 2024 total future conditions. Appendix M contains the 2024 future total Synchro Sheets.

Table 16: 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	0.10	15.9	5.9	A	0.09	18.8	9.0
	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	6.5
	NBL	A	0.55	19.9	60.6	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	0.15	13.8	14.6	A	0.09	22.3	12.0
	SBT/R	A	0.09	6.8	7.9	A	0.06	12.1	8.2
	Overall	**B**	**0.66**	**21.4**	-	**B**	**0.65**	**26.0**	-
Greenbank Road & Half Moon Bay Road *Signalized*	EBL/T/R	B	0.64	27.8	59.6	B	0.67	39.2	#53.4
	WBL/T/R	A	0.15	8.8	11.1	A	0.23	16.4	16.7
	NBL/T/R	D	0.81	26.3	#149.4	A	0.57	11.4	65.9
	SBL/T/R	A	0.34	11.6	37.0	E	0.93	30.0	#211.0
	Overall	**C**	**0.74**	**22.5**	-	**D**	**0.86**	**24.9**	-
Greenbank Road & Cambrian Road *Roundabout*	EBL/T/R	E	0.90	35.1	178.3	F	1.08	84.3	289.8
	WBL/T/R	C	0.73	23.3	51.9	E	0.93	45.3	139.6
	NBL/T/R	F	1.36	197.3	520.6	D	0.78	26.5	70.9
	SBL/T/R	B	0.46	11.9	18.8	F	1.36	194.2	586.6
	Overall	**F**	**1.36**	**82.3**	**520.6**	**F**	**1.36**	**97.6**	**586.6**
Notes:	Saturation flow rate of 1800 veh/h/lane				m = metered queue				
	PHF = 1.0				# = queue exceeds storage or mid-block length				

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 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 intersection of River Mist Road and Cambrian Road operates similarly to 2024 future background horizon.

The intersection of the Half Moon Bay at Greenbank Road may be subject to extended queues on the northbound movements during AM peak hour and eastbound and southbound movements during PM peak hour.

The operations of Greenbank Road at Cambrian Road further deteriorate. This is because in 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.

15.2.5 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 17 summarizes the operational analysis of the 2029 total future conditions. Appendix N contains the 2029 future total Synchro Sheets.

Table 17: 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	15.7	6.0	A	0.13	19.7	9.4
	EBT	E	0.95	50.6	**#142.4**	F	1.03	70.2	**#224.0**
	EBR	A	0.21	3.8	9.2	A	0.27	3.7	12.5
	WBL	A	0.42	28.0	17.3	D	0.84	55.1	**#48.3**
	WBT	C	0.73	27.7	87.9	C	0.71	23.1	133.4
	WBR	A	0.10	4.9	5.9	A	0.10	3.1	6.5
	NBL	B	0.61	24.4	60.7	A	0.40	27.9	43.8
	NBT/R	A	0.31	6.8	17.8	A	0.24	7.0	14.9
	SBL	A	0.17	15.7	14.6	A	0.10	22.8	12.0
	SBT/R	A	0.10	7.4	8.3	A	0.07	12.3	8.3
	Overall	**C**	**0.78**	**28.5**	**-**	**C**	**0.75**	**37.7**	**-**
Greenbank Road & Half Moon Bay Road *Signalized*	EBL/T/R	B	0.66	28.4	62.2	B	0.68	39.6	**#54.8**
	WBL/T/R	A	0.16	9.1	11.9	A	0.25	17.0	17.5
	NBL/T/R	F	1.03	59.5	**#213.8**	C	0.71	15.3	98.4
	SBL/T/R	A	0.41	13.0	47.3	F	1.10	76.6	**#272.9**
	Overall	**D**	**0.87**	**41.0**	**-**	**E**	**0.99**	**51.4**	**-**
	Mitigation Measure: PM Peak Cycle Length Extension from 80 s to 110 s								
	EBL/T/R	-	-	-	-	E	0.95	95.0	**#87.1**
	WBL/T/R	-	-	-	-	A	0.32	29.2	25.9
	NBL/T/R	-	-	-	-	B	0.63	11.1	93.7
	SBL/T/R	-	-	-	-	E	0.96	33.1	**#322.4**
	Overall	-	-	-	-	**E**	**0.96**	**32.1**	**-**
Greenbank Road & Cambrian Road *Roundabout*	EBL/T/R	**F**	**1.19**	**117.6**	**521.6**	**F**	**1.26**	**150.2**	**546.1**
	WBL/T/R	D	0.85	34.8	84.9	**F**	**1.18**	**122.1**	**359.7**
	NBL/T/R	**F**	**1.68**	**334.8**	**845.0**	E	0.93	46.0	140.3
	SBL/T/R	C	0.61	16.8	35.8	**F**	**1.70**	**341.2**	**1024.9**
	Overall	**F**	**1.68**	**155.0**	**845.0**	**F**	**1.70**	**184.5**	**1024.9**
Notes:	Saturation flow rate of 1800 veh/h/lane				m = metered queue				
	PHF = 1.0				# = queue exceeds storage or mid-block length				

The intersections at the 2029 future total horizon are anticipated to operate similarly to the 2029 future background conditions.

At the intersection of Half Moon Bay and Greenbank Road the V/C ratio of the northbound approach increases from 0.84 in the future background horizon to 1.01 during the PM peak hour. Cycle length extension has been proposed at this intersection to provide longer green times to movements with heavier flows and as a result all movements at this intersection operate with a V/C ratio below 1.0.

15.2.6 Network Intersection MMLOS

Intersection MMLOS is only undertaken at signalized intersections. The two signalized intersections considered in this study are Greenbank Road at Half Moon Bay Road, and Cambrian Road at River Mist Road. These intersections are currently stop-controlled and have 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 O. Table 18 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 18: Study Area Intersection MMLOS Analysis—All Horizons

Intersection	Horizon	Pedestrian LOS		Bicycle LOS		Transit LOS		Auto LOS	
		PLOS	Target	BLOS	Target	TLOS	Target	ALOS	Target
Greenbank Road & Half Moon Bay Road	2024 FB	**D**	C	D	D	-	D	B	D
	2029 FB							C	
	2024 FT							B	
	2029 FT							C	
Cambrian Road & River Mist Road	2024 FB	**E**		**F**		D		B	
	2029 FB							D	
	2024 FT							D	
	2029 FT							**E**	

Based on the new intersection configuration assumptions, the pedestrian LOS target is not met at Greenbank Road at Half Moon Bay Road as a result of the future effective walk time at north and south legs, and it is not met at Cambrian Road and River Mist Road intersection as a result of the future crossing distances at east and west legs of the intersection.

The bicycle LOS is also not met at this intersection as a result of auxiliary turn lanes introduced in future horizon.

The Auto LOS is also not met at this intersection of Cambrian Road and River Mist Road in 2029 future total horizon.

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 Greenbank Road at Half Moon Bay Road as well as Cambrian Road and River Mist Road intersections 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 3434 Greenbank Road, is a proposed subdivision consisting of 53 single family houses, 387 executive townhomes, and 160 avenue townhouses.
B. Access to the subdivision will be accommodated via intersections of Cambrian Road at River Mist Road and Greenbank Road at Half Moon Bay Road. Beyond this study's horizon, access to the proposed development will be accommodated via future realigned Greenbank Road.
C. The existing study area is currently served by bus route #75.
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 Report (2009). 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 200 AM, and 216 PM net new peak hour two-way vehicle trips.
G. Both signalization warrants and left-turn lane warrants were evaluated at Cambrian Road and River Mist Road as well as Greenbank Road at Half Moon Bay Road. Signals were warranted at Cambrian Road and River Mist Road in 2024 future background and 2029 future background horizon. Additionally, at the intersection of Greenbank Road and Half Moon Bay Road, northbound and southbound left turn lanes were found to be warranted in 2024 future background horizon and 2029 future background horizon. As both the signalization and the auxiliary left-turns were warranted in a background horizon, these roadway improvements were coded in Synchro for operational analysis purposes only and are required to be designed by others.
H. In the existing conditions operational analysis, major approaches at the All-Way Stop Controlled intersections of River Mist Road at Cambrian Road, and Greenbank Road at Half Moon Bay Road operate at LOS F. During this horizon traffic signals are not warranted at River Mist Road and Cambrian Road. For comparison, a scenario with Two-Way Stop Controls at these intersections has been modeled. This improved the operations of major approaches; however, the operations of minor movements have deteriorated as a result. In contrast, traffic signals are warranted at the Greenbank Road and Half Moon Bay Road intersection. Analysis under signalized operations at this intersection resulted in performance improvements with LOS ranging between A and C.
I. The north and southbound approaches at the intersection of Greenbank Road and Cambrian Road are also experiencing LOS F during the AM and PM peak hour, respectively. 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.
J. 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 2021 Existing horizon. The operations of Greenbank Road and Half Moon Bay Road remain predominantly unchanged with majority of movements at LOS A or B. Although the 95th percentile queues at this intersection extend beyond intersection capacity, the V/C ratio is less than 1 and it can be assumed that these queues would rarely be exceeded. 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.

K. With the addition of the site generated traffic, the intersection of River Mist Road and Cambrian Road operates similarly to 2029 future background horizon. A cycle length extension has been proposed as a mitigation measure at the intersection of Greenbank Road at Half Moon Bay, which results in all movements operating below capacity. 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.

L. The PLOS, BLOS, TLOS, and TkLOS were evaluated at two signalized Study Area intersections. No intersection alterations or mitigation measures are suggested as it is expected that general urban area MMLOS targets will inform the design of Greenbank Road at Half Moon Bay Road and Cambrian Road at River Mist Road.

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

Prepared By:

Michelle Chen

Michelle Chen, E.I.T.
Transportation Engineer in Training

Reviewed By:

Mark Crockford, P. Eng. Senior
Transportation Engineer

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.

City Of Ottawa
Infrastructure Services and Community Sustainability
Planning and Growth Management
110 Laurier Avenue West, 4th fl.
Ottawa, ON K1P 1J1
Tel. : 613-580-2424
Fax: 613-560-6006

Ville d'Ottawa
Services d 'infrastructure et Viabilité des collectivités
Urbanisme et Gestion de la croissance
110, avenue Laurier Ouest
Ottawa (Ontario) K1P 1J1
Tél. : 613-580-2424
Télécopieur: 613-560-6006

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

Traffic Data

Transportation Services - Traffic Services

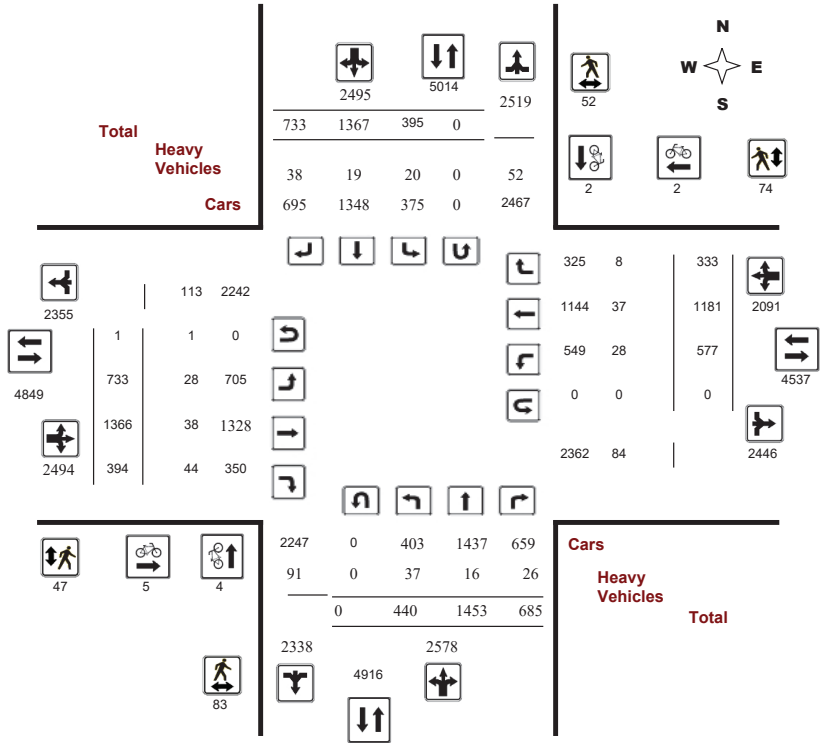
Turning Movement Count - Study Results

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

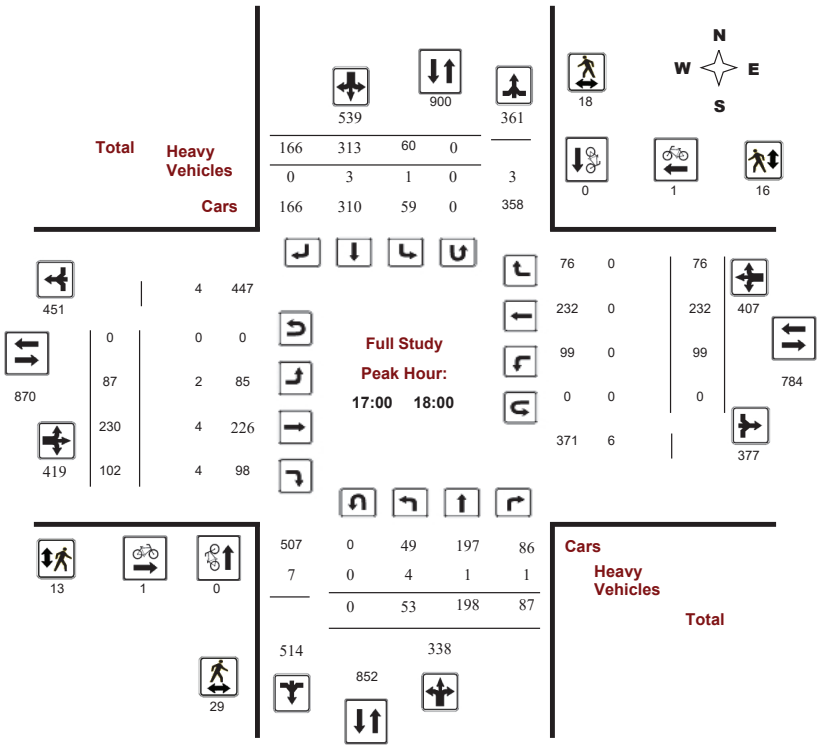
Turning Movement Count - Study Results

CAMBRIAN RD @ GREENBANK RD

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

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

Full Study Peak Hour Diagram



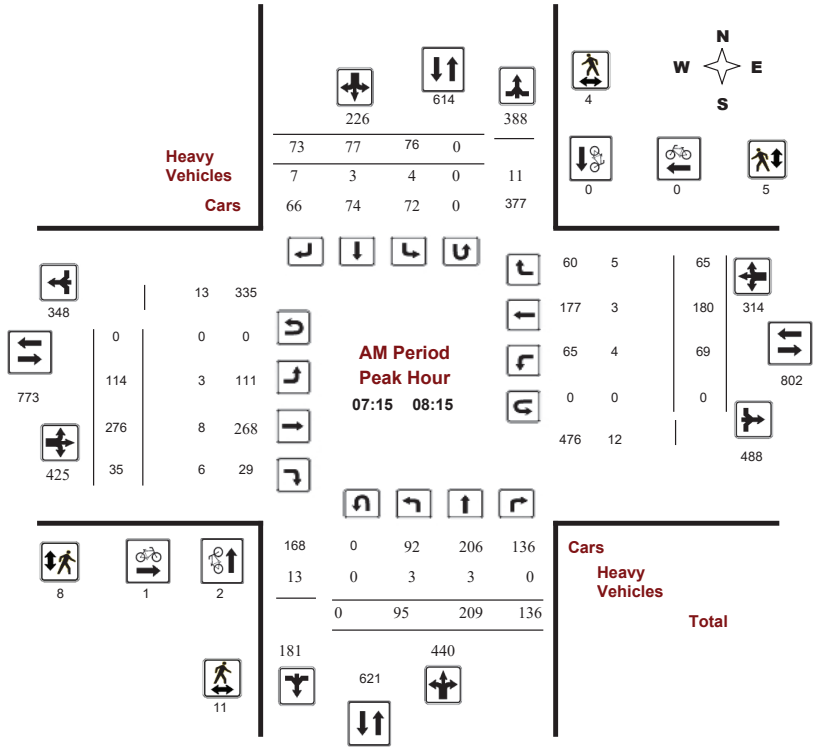
Transportation Services - Traffic Services

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

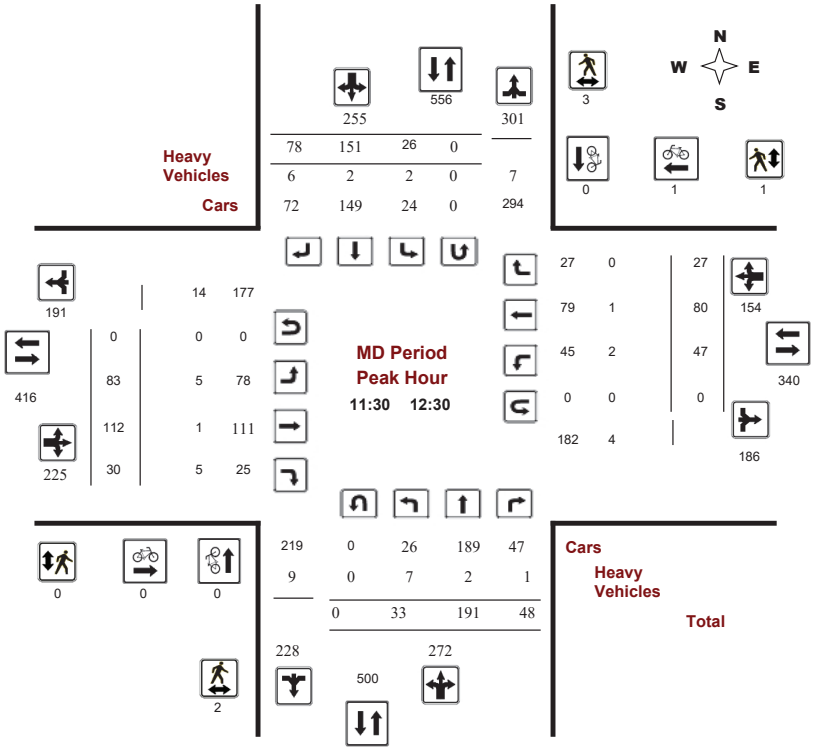
Transportation Services - Traffic Services

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

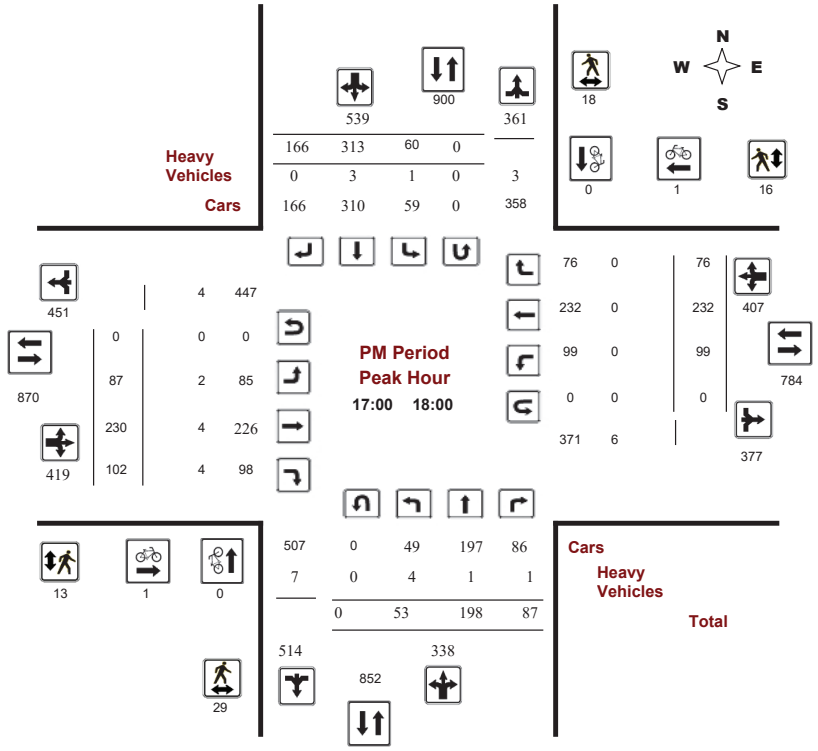
Transportation Services - Traffic Services

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

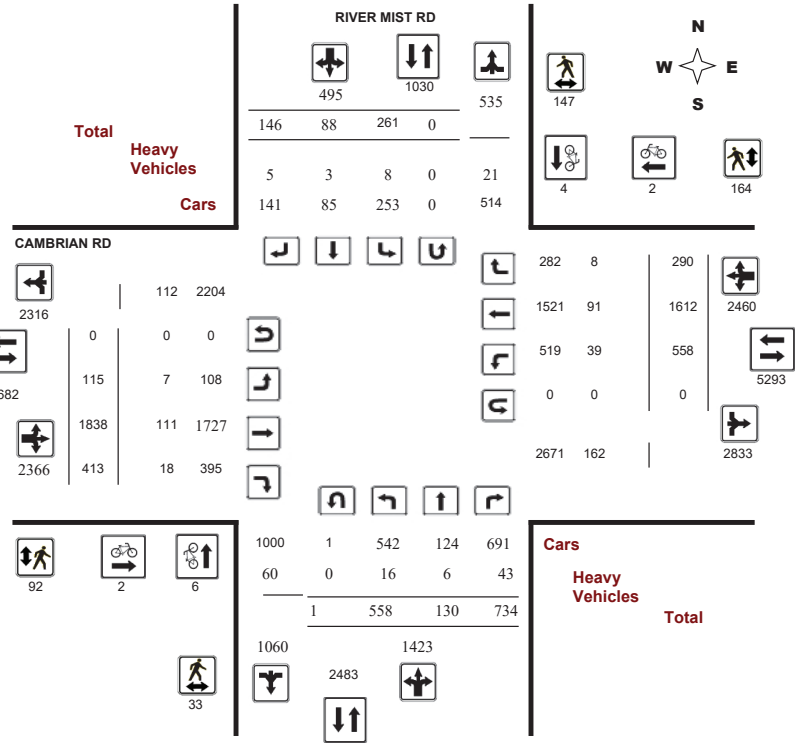
Turning Movement Count - Study Results

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

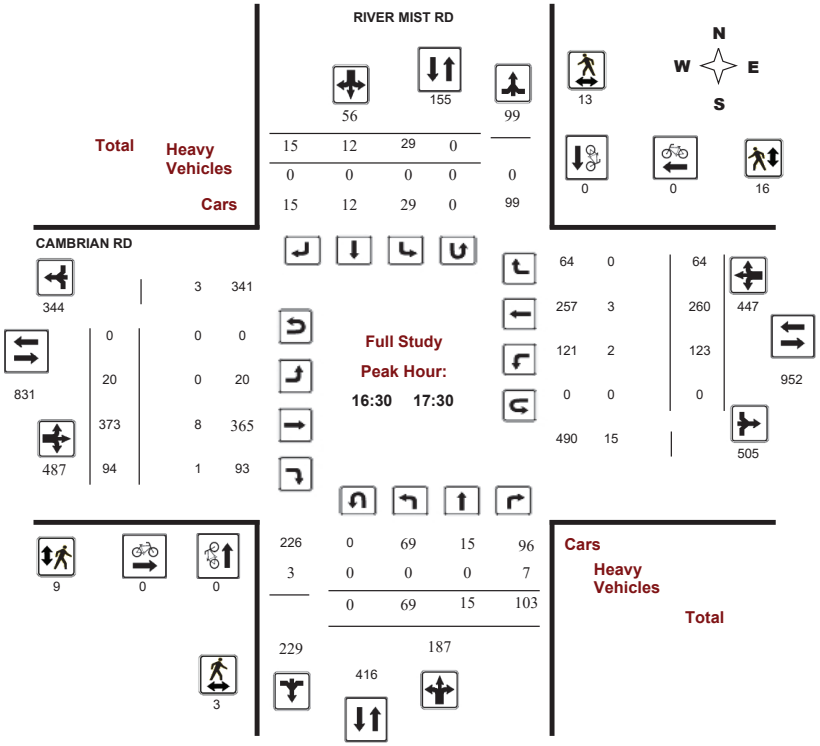
Turning Movement Count - Study Results

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



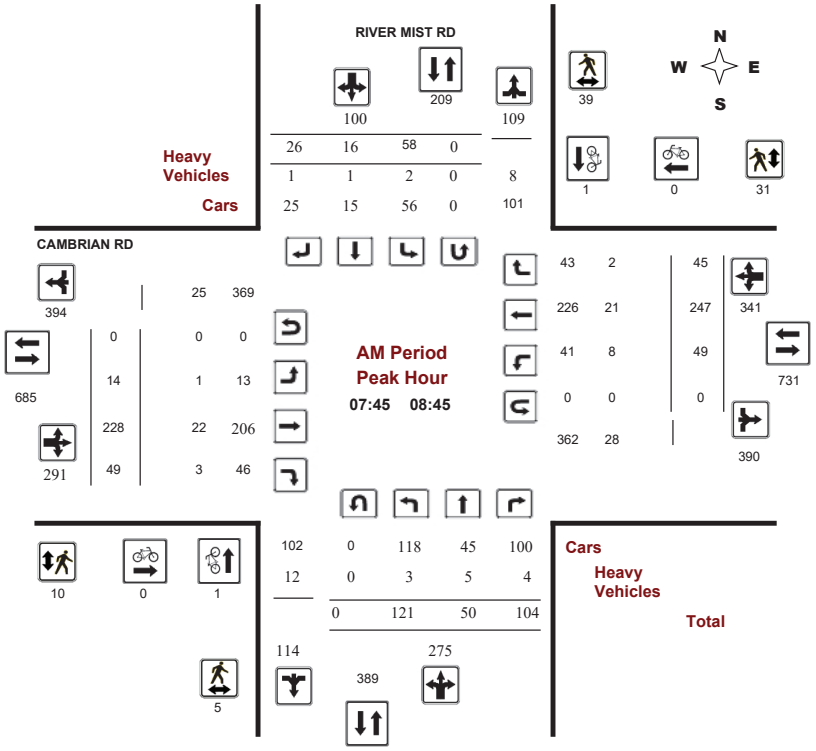
Transportation Services - Traffic Services

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

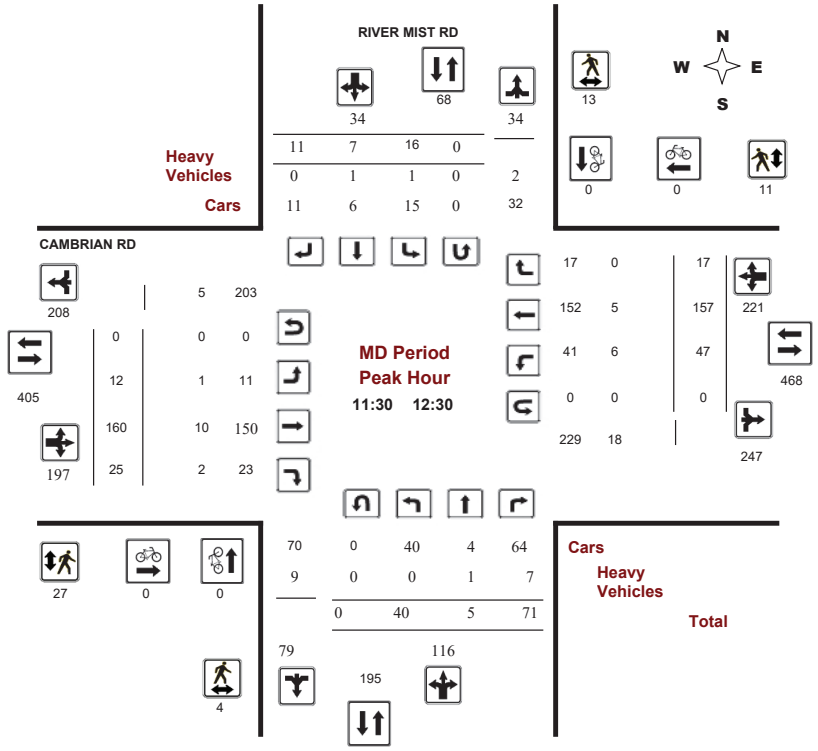
Transportation Services - Traffic Services

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

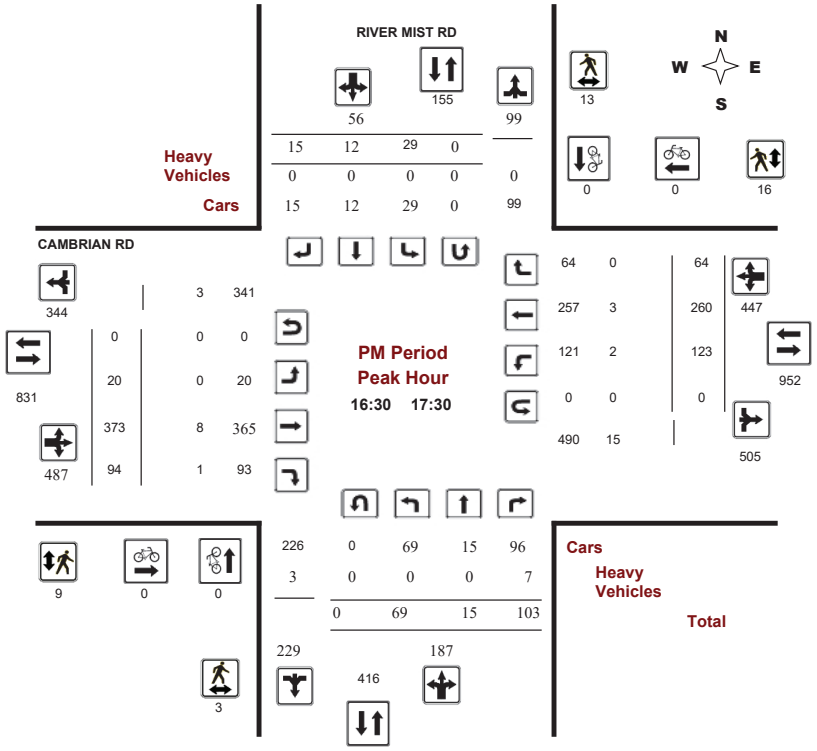
Transportation Services - Traffic Services

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

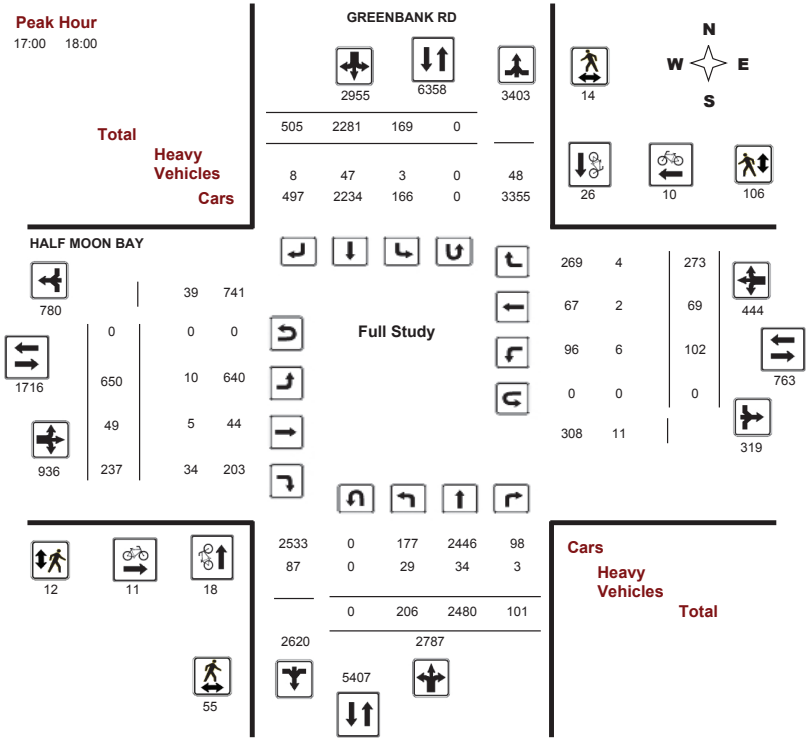
Transportation Services - Traffic Services

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.

Appendix C

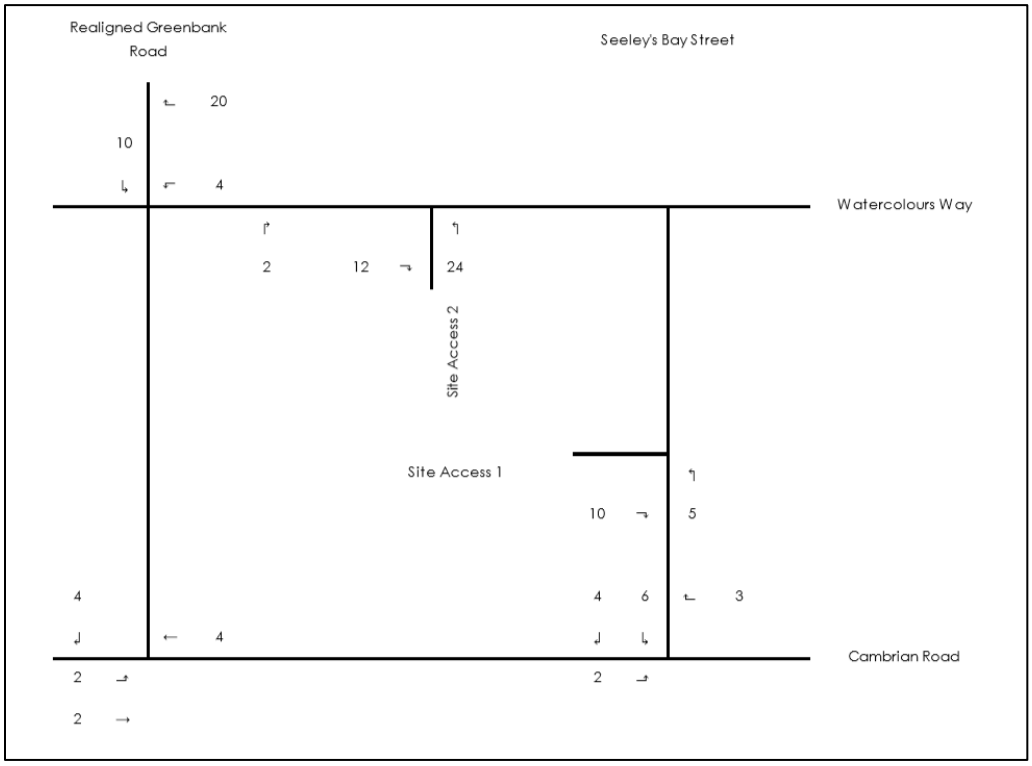
Collision Data

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 D

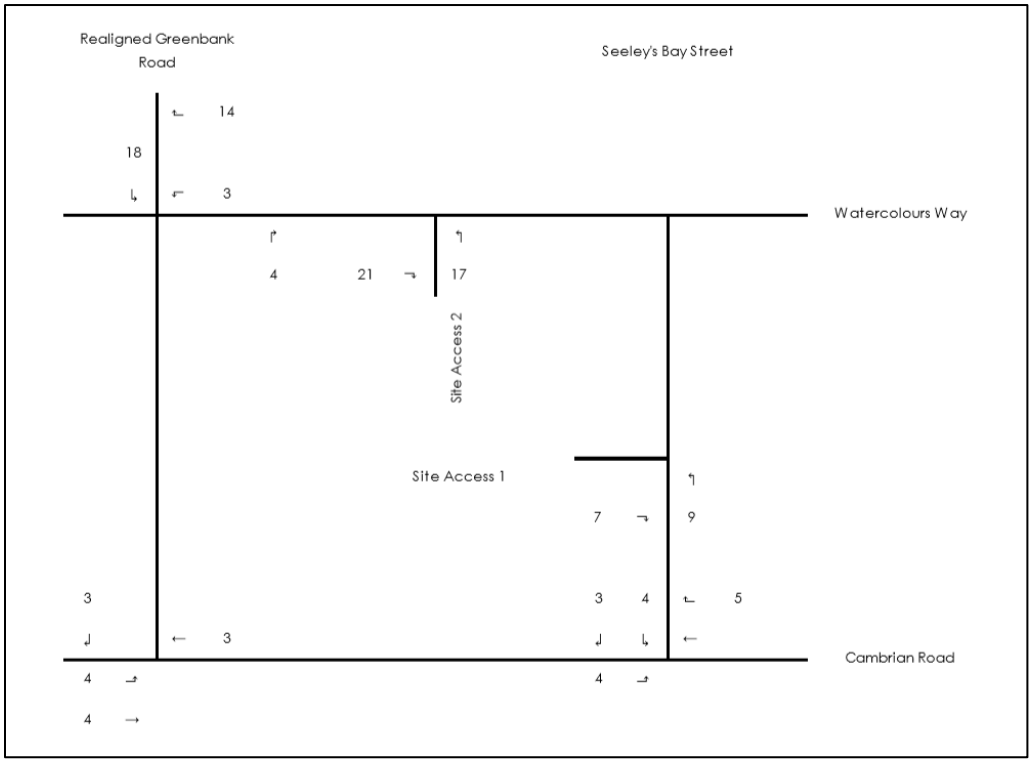
Background Developments

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



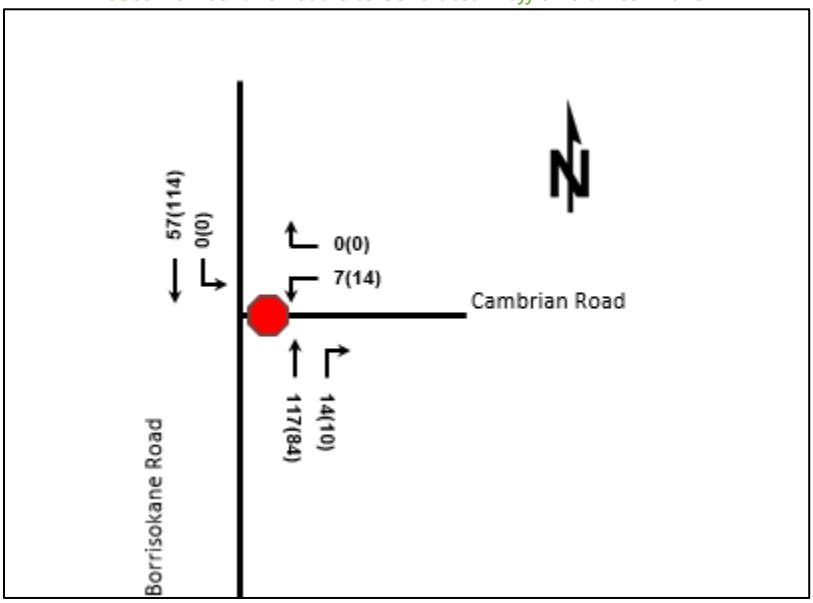
Source: Half Moon Bay North Apartment Block Transportation Impact Assessment (Stantec, 2018)

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



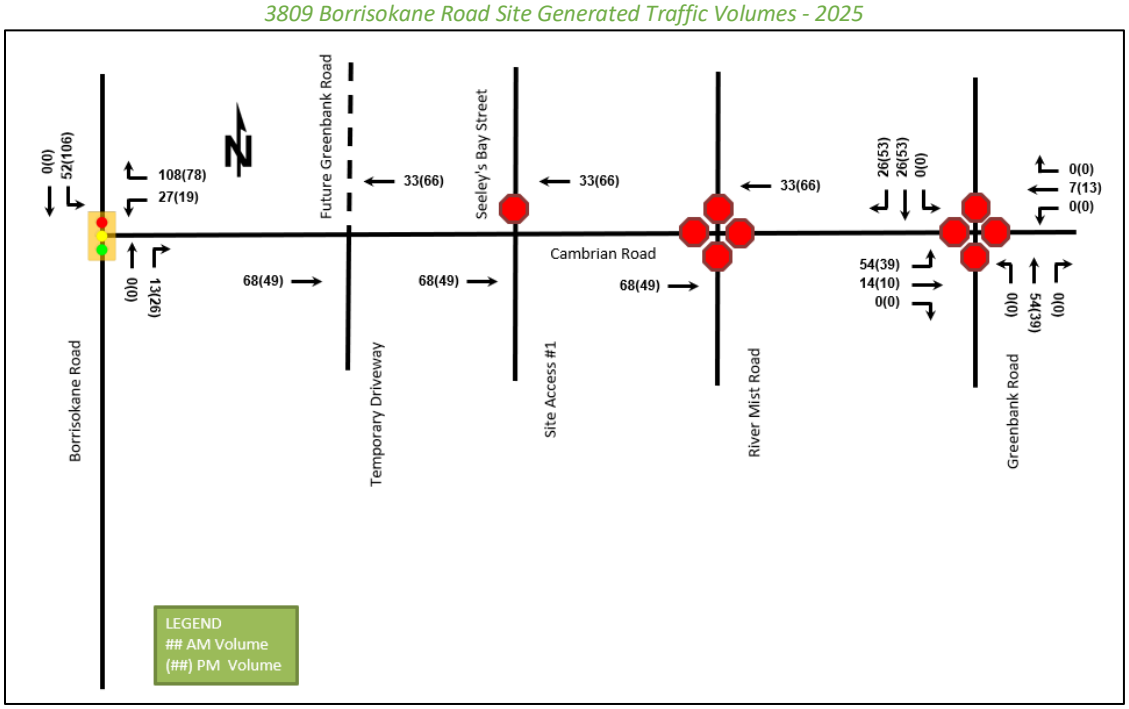
Source: Half Moon Bay North Apartment Block Transportation Impact Assessment (Stantec, 2018)

3809 Borrisokane Road Site Generated Traffic Volumes - 2023



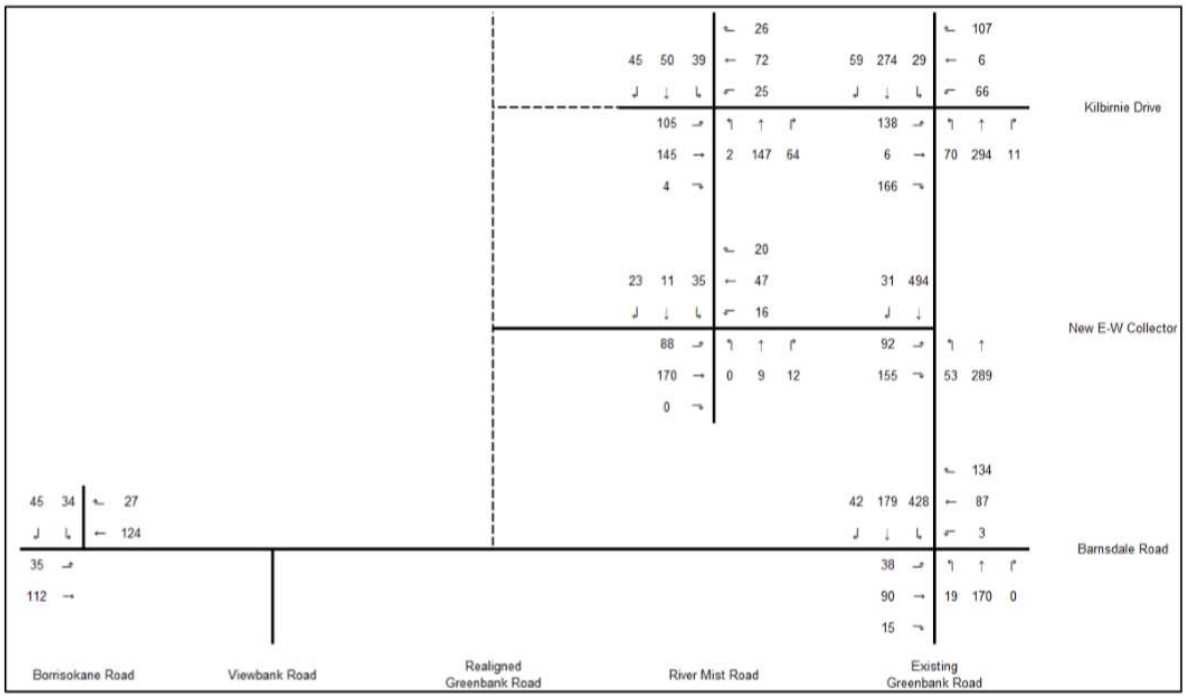
Source: 3809 Borrisokane Road Transportation Impact Assessment (CGH, 2020)

3809 Borrisokane Road Site Generated Traffic Volumes - 2025



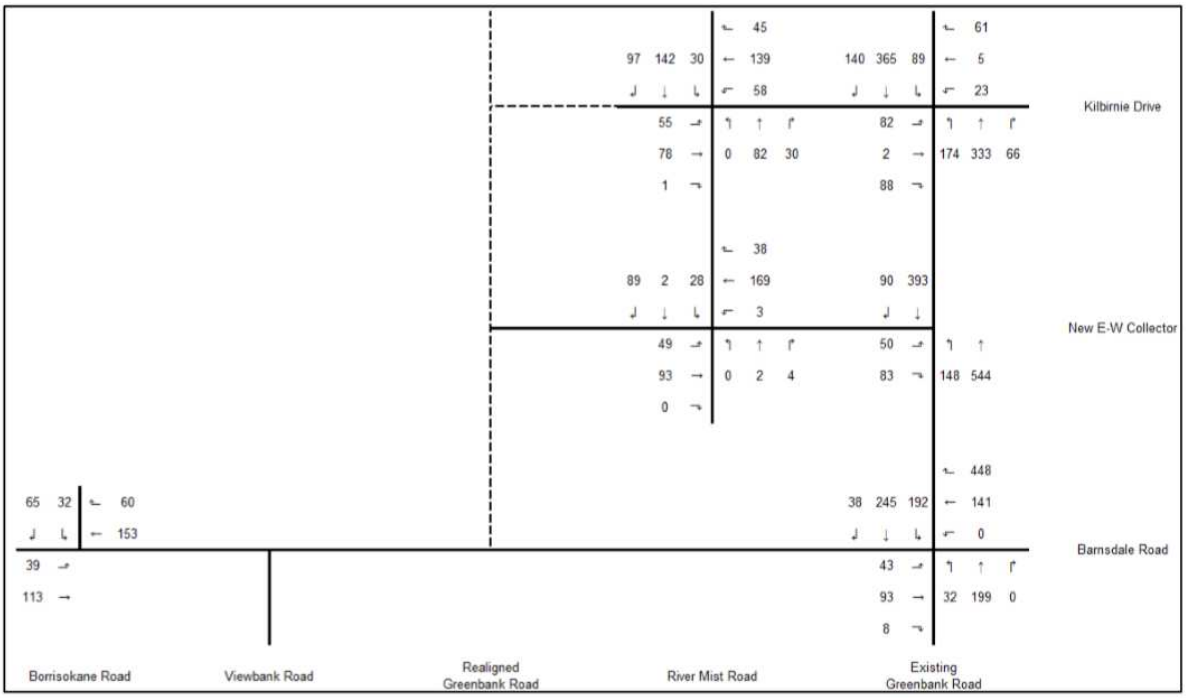
Source: 3809 Borrisokane Road Transportation Impact Assessment (CGH, 2020)

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 E

TDM Checklist

Introduction

The City of Ottawa's *Transportation Impact Assessment (TIA) Guidelines* (specifically Module 4.3—Transportation Demand Management) requires proponents of qualifying developments to assess the context, need and opportunity for transportation demand management (TDM) measures at their development. The guidelines require that proponents complete the City's **TDM Measures Checklist**, at a minimum, to identify any TDM measures being proposed.

The remaining sections of this document are:

- Using the Checklist
- Glossary
- TDM Measures Checklist: Non-Residential Developments
- TDM Measures Checklist: Residential developments

Readers are encouraged to contact the City of Ottawa's TDM Officer for any guidance and assistance they require to complete this checklist.

Using the Checklist

The City's *TIA Guidelines* are designed so that *Module 3.1—Development-Generated Travel Demand*, *Module 4.1—Development Design*, and *Module 4.2—Parking* are complete before a proponent begins *Module 4.3—Transportation Demand Management*.

Within Module 4.3, *Element 4.3.1—Context for TDM* and *Element 4.3.2—Need and Opportunity* are intended to create an understanding of the need for any TDM measures, and of the results they are expected to achieve or support. Once those two elements are complete, proponents begin *Element 4.3.3—TDM Program* that requires proponents to identify proposed TDM measures using the **TDM Measures Checklist**, at a minimum. The *TIA Guidelines* note that the City may require additional analysis for large or complex development proposals, or those that represent a higher degree of performance risk; as well, proponents proposing TDM measures for a new development must also propose an implementation plan that addresses planning and coordination, funding and human resources, timelines for action, performance targets and monitoring requirements.

This **TDM Measures Checklist** document includes two actual checklists, one for non-residential developments (office, institutional, retail or industrial) and one for residential developments (multi-family, condominium or subdivision). Readers may download the applicable checklist in electronic format and complete it electronically, or print it out and complete it by hand. As an alternative, they may create a freestanding document that lists the TDM measures being proposed and provides additional detail on them, including an implementation plan as required by the City's *TIA Guidelines*.

Each measure in the checklist is numbered for easy reference. Each measure is also flagged as:

- 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.

Glossary

This glossary defines and describes the following measures that are identified in the **TDM Measures Checklist**:

TDM program management
- Program coordinator
- Travel surveys

Parking
- Priced parking

Walking & cycling
- Information on walking/cycling routes & destinations
- Bicycle skills training
- Valet bike parking

Transit
- Transit information
- Transit fare incentives
- Enhanced public transit service
- Private transit service

Ridesharing
- Ridematching service
- Carpool parking price incentives
- Vanpool service

Carsharing & bikesharing
- Bikeshare stations & memberships
- Carshare vehicles & memberships

TDM marketing & communications
- Multimodal travel information
- Personalized trip planning
- Promotions

Other incentives & amenities
- Emergency ride home
- Alternative work arrangements
- Local business travel options
- Commuter incentives
- On-site amenities

For further information on selecting and implementing TDM measures (particularly as they apply to non-residential developments, with a focus on workplaces), readers may find it helpful to consult Transport Canada's *Workplace Travel Plans: Guidance for Canadian Employers*, which can be downloaded in English and French from the ACT Canada website at www.actcanada.com/resources/act-resources.

▶ *TDM program management*

While some TDM measures can be implemented with a minimum of effort through routine channels (e.g. parking or human resources), more complex measures or a larger development site may warrant assigning responsibility for TDM program coordination to a designated person either inside or outside the implementing organization. Similarly, some TDM measures are more effective if they are targeted or customized for specific audiences, and would benefit from the collection of related information.

Program coordinator. This person is charged with day-to-day TDM program development and implementation. Only in very large employers with thousands of workers is this likely to be a full-time, dedicated position. Usually, it is added to an existing role in parking, real estate, human resources or environmental management. In practice, this role may be called TDM coordinator, commute trip reduction coordinator or employee transportation coordinator. The City of Ottawa can identify external resources (e.g. non-profit organizations or consultants) that could provide these services.

Travel surveys. Travel surveys are most commonly conducted at workplaces, but can be helpful in other settings. They identify how and why people travel the way they do, and what barriers and opportunities exist for different behaviours. They usually capture the following information:

- *Personal data* including home address or postal code, destination, job type or function, employment status (full-time, part-time and/or teleworker), gender, age and hours of work
- *Commute information* including distance or time for the trip between home and work, usual methods of commuting, and reasons for choosing them
- *Barriers and opportunities* including why other commuting methods are unattractive, willingness to consider other options, and what improvements to other options could make them more attractive

▶ *Parking*

Priced parking. Charging for parking is typically among the most effective ways of getting drivers to consider other travel options. While drivers may not support parking fees, they can be more accepting if the revenues are used to improve other travel options (e.g. new showers and change rooms, improved bicycle parking or subsidized transit passes). At workplaces or daytime destinations, parking discounts (e.g. early bird specials, daily passes that cost significantly less than the equivalent hourly charge, monthly passes that cost significantly less than the equivalent daily charge) encourage long-term parking and discourage the use of other travel options. For residential uses, unbundling parking costs from dwelling purchase, lease or rental costs provides an incentive for residents to own fewer cars, and can reduce car use and the costs of parking provision.

▶ *Walking & cycling*

Active transportation options like cycling and walking are particularly attractive for short trips (typically up to 5 km and 2 km, respectively). Other supportive factors include an active, health-conscious audience, and development proximity to high-quality walking and cycling networks. Common challenges to active transportation include rain, darkness, snowy or icy conditions, personal safety concerns, the potential for bicycle theft, and a lack of shower and change facilities for those making longer trips.

Information on walking/cycling routes & destinations. Ottawa, Gatineau and the National Capital Commission all publish maps to help people identify the most convenient and comfortable walking or cycling routes.

Bicycle skills training. Potential cyclists can be intimidated by the need to ride on roads shared with motor vehicles. This barrier can be reduced or eliminated by offering cycling skills training to interested cyclists (e.g. CAN-BIKE certification courses).

Valet bike parking. For large events, temporary “valet parking” areas can be easily set up to maximize convenience and security for cyclists. Experienced local non-profit groups can help.

▶ *Transit*

Transit information. Difficulty in finding or understanding basic information on transit fares, routes and schedules can prevent people from trying transit. Employers can help by providing online links to OC Transpo and STO websites. Transit users also appreciate visible maps and schedules of transit routes that serve the site; even better, a screen that shows real-time transit arrival information is particularly useful at sites with many transit users and an adjacent transit stop or station.

Transit fare incentives. Free or subsidized transit fares are an attractive incentive for non-transit riders to try transit. Many non-users are unsure of how to pay a fare, and providing tickets or a preloaded PRESTO card (or, for special events, pre-arranging with OC Transpo that transit fares are included with event tickets) overcome that barrier.

Enhanced public transit service. OC Transpo may adjust transit routes, stop locations, service hours or frequencies for an agreed fee under contract, or at no cost where warranted by the potential ridership increase. Information provided by a survey of people who travel to a given development can support these decisions.

Private transit service. At remote suburban or rural workplaces, a poor transit connection to the nearest rapid transit station can be an obstacle for potential transit users, and an employer in this situation could initiate a private shuttle service to make transit use more feasible or attractive. Other circumstances where a shuttle makes sense include large special events, or a residential development for people with limited independent mobility who still require regular access to shops and services.

▶ *Ridesharing*

Ridesharing's potential is greatest in situations where transit ridership is low, where parking costs are high, and/or where large numbers of car commuters (e.g. employees or full-time students) live reasonably far from the workplace.

Ridematching service. Potential carpoolers in Ottawa are served by www.OttawaRideMatch.com, an online service to help people find carpool partners. Employers can arrange for a dedicated portal where their employees can search for potential carpool partners only among their colleagues, if they desire. Some very large employers may establish internal ridematching services, to maximize employee uptake and corporate control. Ridematching service providers typically include a waiver to relieve employers of liability when their employees start carpooling through a ridematching service. Ridesharing with co-workers also tends to eliminate security concerns.

Carpool parking price incentives. Discounted parking fees for carpools can be an extra incentive to rideshare.

Vanpool service. Vanpools operate in the Toronto and Vancouver metropolitan areas, where vans that carry up to about ten occupants are driven by one of the vanpool members. Vanpools tend to operate on a cost-recovery basis, and are most practical for long-distance commutes where transit is not an option. Current legislation in Ontario does not permit third-party (i.e. private or non-profit) vanpool services, but does permit employers to operate internal vanpools.

▶ *Carsharing & bikesharing*

Bikeshare station & memberships. VeloGO Bike Share and Right Bike both operate bikesharing services in Ottawa. Developments that would benefit from having a bikeshare station installed at or near their development may negotiate directly with either service provider.

Carshare vehicles & memberships. VRTUCAR and Zipcar both operate carsharing services in Ottawa, for use by the general public or by businesses as an alternative to corporate fleets. Carsharing services offer 24-hour access, self-serve reservation systems, itemized monthly billings, and outsourcing of all financing, insurance, maintenance and administrative responsibilities.

▶ *TDM marketing & communications*

Multimodal travel information. Aside from mode-specific information discussed elsewhere in this document, multimodal information that identifies and explains the full range of travel options available to people can be very influential—especially when provided at times and locations where individuals are actively choosing among those options. Examples include: employees when their employer is relocating, or when they are joining a new employer; students when they are starting a program at a new institution; visitors or customers travelling to an unfamiliar destination, or when faced with new options (e.g. shuttle services or parking restrictions); and residents when they purchase or occupy a residence that is new to them.

Personalized trip planning. As an extension to the simple provision of information, this technique (also known as *individualized marketing*) is effective in helping people make more sustainable travel choices. The approach involves identifying who is most likely to change their travel choices (notably relocating employees, students or residents) giving them customized information, training and incentives to support them in making that change. It may be conducted with assistance from an external service provider with the necessary skills, and delivered in a variety of settings including workplaces and homes.

Promotions. Special events and incentives can raise awareness and encourage individuals to examine and try new travel options.

- *Special events* can help attract attention, build participation and celebrate successes. Events that have been held in Ottawa include Earth Day (in April) Bike to Work Month (in May), Environment Week (early June), International Car Free Day (September 22), and Canadian Ridesharing Week (October). At workplaces or educational institutions, similarly effective internal events could include workshops, lunch-and-learns, inter-departmental challenges, pancake breakfasts, and so on.
- *Incentives* can encourage trial of sustainable modes, and might include loyalty rewards for duration or consistency of activity (e.g. 1,000 km commuted by bicycle), participation prizes (e.g. for completing a survey or joining a special event), or personal recognition that highlights individual accomplishments.

▶ ***Other incentives & amenities***

Emergency ride home. This measure assures non-driving commuters that they will be able to get home quickly and conveniently in case of family emergency (or in some workplaces, in case of unexpected overtime, severe weather conditions, or the early departure of a carpool driver) by offering a chit or reimbursement for taxi, carshare or rental car usage. Limits on annual usage or cost per employee may be set, although across North America the actual rates of usage are typically very low.

Alternative work arrangements. A number of alternatives to the standard 9-to-5, Monday-to-Friday workweek can support sustainable commuting (and work-life balance) at workplaces:

- *Flexible working hours* allow transit commuters to take advantage of the fastest and most convenient transit services, and allow potential carpoolers to include people who work slightly different schedules in their search for carpool partners. They also allow active commuters to travel at least one direction in daylight, either in the morning or the afternoon, during the winter.
- *Compressed workweeks* allow employees to work their required hours over fewer days (e.g. five days in four, or ten days in nine), eliminating the need to commute on certain days. For employees, this can promote work-life balance and gives flexibility for appointments. For employers, this can permit extended service hours as well as reduced parking demands if employees stagger their days off.
- *Telework* is a normal part of many workplaces. It helps reduce commuting activity, and can lead to significant cost savings through workspace sharing. Telework initiatives involve many stakeholders, and may face as much resistance as support within an organization. Consultation, education and training are helpful.

Local business travel options. A common obstacle for people who might prefer to not drive to work is that their employer requires them to bring a car to work so they can make business trips during the day. Giving employees convenient alternatives to private cars for local business travel during the workday makes walking, cycling, transit or carpooling in someone else's car more practical.

- *Walking and cycling*—Active transportation can be a convenient and enjoyable way to make short business trips. They can also reduce employer expenses, although they may require extra travel time. Providing a fleet of shared bikes, or reimbursing cyclists for the kilometres they ride, are inexpensive ways to validate their choice.
- *Public transit*—Transit can be convenient and inexpensive compared to driving. OC Transpo's PRESTO cards are transferable among employees and automatically reloadable, making them the perfect tool for enabling transit use during the day.
- *Ridesharin*g—When multiple employees attend the same off-site meeting or event, they can be reminded to carpool whenever possible.
- *Taxis or ride-hailing*—Taxis and ride-hailing can eliminate parking costs, save time and eliminate collision liability concerns. Taxi chits eliminate cash transactions and minimize paperwork.
    - *Fleet vehicles or carsharing*—Fleet vehicles can be cost-effective for high travel volumes, while carsharing is a great option for less frequent trips.
    - *Interoffice shuttles*—Employers with multiple worksites in the region could use a shuttle service to move people as well as mail or supplies.
    - *Videoconferencing*—New technologies mean that staying in the office to hold meetings electronically is more viable, affordable and productive than ever.

Commuter incentives. Financial incentives can help create a level playing field and support commuting by sustainable modes. A "commuting allowance" given to all employees as a taxable benefit is one such incentive; employees who choose to drive could then be charged for parking, while other employees could use the allowance for transit fares or cycling equipment, or for spending or saving. (Note that in the United States this practice is known as "parking cash-out," and is popular because commuting allowances are not taxable up to a certain limit). Alternatively, a monthly commuting allowance for non-driving employees would give drivers an incentive to choose a different commuting mode. Another practical incentive for active commuters or transit users is to offer them discounted "rainy day" parking passes for a small number of days each month.

On-site amenities. Developments that offer services to limit employees' need for a car during their commute (e.g. to drop off clothing at the dry cleaners) or during their workday (e.g. to buy lunch) can free employees to make the commuting decision that otherwise works best for them.

TDM Measures Checklist:
Non-Residential Developments (office, institutional, retail or industrial)

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: *Non-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	☐
		2.2 Bicycle skills training	
		Commuter travel	
BETTER	★ 2.2.1	Offer on-site cycling courses for commuters, or subsidize off-site courses	☐
		2.3 Valet bike parking	
		Visitor travel	
BETTER	2.3.1	Offer secure valet bike parking during public events when demand exceeds fixed supply (e.g. for festivals, concerts, games)	☐

			TDM measures: *Non-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	☐
BASIC		3.1.2	Provide online links to OC Transpo and STO information	☐
BETTER		3.1.3	Provide real-time arrival information display at entrances	☐
		3.2	**Transit fare incentives**	
			Commuter travel	
BETTER		3.2.1	Offer preloaded PRESTO cards to encourage commuters to use transit	☐
BETTER	★	3.2.2	Subsidize or reimburse monthly transit pass purchases by employees	☐
			Visitor travel	
BETTER		3.2.3	Arrange inclusion of same-day transit fare in price of tickets (e.g. for festivals, concerts, games)	☐
		3.3	**Enhanced public transit service**	
			Commuter travel	
BETTER		3.3.1	Contract with OC Transpo to provide enhanced transit services (e.g. for shift changes, weekends)	☐
			Visitor travel	
BETTER		3.3.2	Contract with OC Transpo to provide enhanced transit services (e.g. for festivals, concerts, games)	☐
		3.4	**Private transit service**	
			Commuter travel	
BETTER		3.4.1	Provide shuttle service when OC Transpo cannot offer sufficient quality or capacity to serve demand (e.g. for shift changes, weekends)	☐
			Visitor travel	
BETTER		3.4.2	Provide shuttle service when OC Transpo cannot offer sufficient quality or capacity to serve demand (e.g. for festivals, concerts, games)	☐

			TDM measures: *Non-residential developments*	Check if proposed & add descriptions
		4.	**RIDESHARING**	
		4.1	**Ridematching service**	
			Commuter travel	
BASIC	★	4.1.1	Provide a dedicated ridematching portal at OttawaRideMatch.com	☐
		4.2	**Carpool parking price incentives**	
			Commuter travel	
BETTER		4.2.1	Provide discounts on parking costs for registered carpools	☐
		4.3	**Vanpool service**	
			Commuter travel	
BETTER		4.3.1	Provide a vanpooling service for long-distance commuters	☐
		5.	**CARSHARING & BIKESHARING**	
		5.1	**Bikeshare stations & memberships**	
BETTER		5.1.1	Contract with provider to install on-site bikeshare station for use by commuters and visitors	☐
			Commuter travel	
BETTER		5.1.2	Provide employees with bikeshare memberships for local business travel	☐
		5.2	**Carshare vehicles & memberships**	
			Commuter travel	
BETTER		5.2.1	Contract with provider to install on-site carshare vehicles and promote their use by tenants	☐
BETTER		5.2.2	Provide employees with carshare memberships for local business travel	☐
		6.	**PARKING**	
		6.1	**Priced parking**	
			Commuter travel	
BASIC	★	6.1.1	Charge for long-term parking (daily, weekly, monthly)	☐
BASIC		6.1.2	Unbundle parking cost from lease rates at multi-tenant sites	☐
			Visitor travel	
BETTER		6.1.3	Charge for short-term parking (hourly)	☐

			TDM measures: *Non-residential developments*	Check if proposed & add descriptions
		7.	**TDM MARKETING & COMMUNICATIONS**	
		7.1	**Multimodal travel information**	
			Commuter travel	
BASIC	★	7.1.1	Provide a multimodal travel option information package to new/relocating employees and students	☐
			Visitor travel	
BETTER	★	7.1.2	Include multimodal travel option information in invitations or advertising that attract visitors or customers (e.g. for festivals, concerts, games)	☐
		7.2	**Personalized trip planning**	
			Commuter travel	
BETTER	★	7.2.1	Offer personalized trip planning to new/relocating employees	☐
		7.3	**Promotions**	
			Commuter travel	
BETTER		7.3.1	Deliver promotions and incentives to maintain awareness, build understanding, and encourage trial of sustainable modes	☐
		8.	**OTHER INCENTIVES & AMENITIES**	
		8.1	**Emergency ride home**	
			Commuter travel	
BETTER	★	8.1.1	Provide emergency ride home service to non-driving commuters	☐
		8.2	**Alternative work arrangements**	
			Commuter travel	
BASIC	★	8.2.1	Encourage flexible work hours	☐
BETTER		8.2.2	Encourage compressed workweeks	☐
BETTER	★	8.2.3	Encourage telework	☐
		8.3	**Local business travel options**	
			Commuter travel	
BASIC	★	8.3.1	Provide local business travel options that minimize the need for employees to bring a personal car to work	☐
		8.4	**Commuter incentives**	
			Commuter travel	
BETTER		8.4.1	Offer employees a taxable, mode-neutral commuting allowance	☐
		8.5	**On-site amenities**	
			Commuter travel	
BETTER		8.5.1	Provide on-site amenities/services to minimize mid-day or mid-commute errands	☐

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 F

Half Moon Bay Road and Greenbank Road Signalization – City Correspondence

Viktoriya Zaytseva

From: Andrew Harte
Sent: July 30, 2021 10:04 AM
To: Viktoriya Zaytseva
Subject: FW: Half Moon Bay and Greenbank
Attachments: Greenbank Rd at Half Moon Bay - Full Study Diagram.pdf; Greenbank Rd at Half Moon Bay - Full Study Summary.pdf

Regards,

Andrew Harte, P.Eng.
CGH Transportation Inc.
P:613-697-3797
E:Andrew.Harte@CGHTransportation.com

From: Andrew Harte
Sent: November 3, 2020 11:49 AM
To: Viktoriya Zaytseva <viktoriya.zaytseva@cghtransportation.com>
Subject: FW: Half Moon Bay and Greenbank

Regards,

Andrew Harte, P.Eng.
CGH Transportation Inc.
P:613-697-3797
E:Andrew.Harte@CGHTransportation.com

From: Christopher Gordon <christopher.gordon@cghtransportation.com>
Sent: February 14, 2019 5:20 PM
To: Andrew Harte <andrew.harte@cghtransportation.com>; Mark Crockford <mark.crockford@cghtransportation.com>
Subject: FW: Half Moon Bay and Greenbank

Hey guys.

Check out how busy Greenbank Road and Half Moon Bay Way is. Lots of cut through traffic is a result.

Ann Selfe is looking for $ in 2019 to build signals, but I'm going to try and use this to promote new Greenbank. Signals is a band-aid solution.

C

Christopher Gordon, P.Eng.
CGH Transportation Inc.

P: 343-999-9117
E: Christopher.Gordon@CGHTransportation.com

From: Cairns, Amy <Amy.Cairns@ottawa.ca>
Sent: February 14, 2019 2:12 PM
To: Christopher Gordon <christopher.gordon@cghtransportation.com>
Subject: Re: Half Moon Bay and Greenbank

Is this what you were looking for?

If not let me know!

Thanks!

Amy Cairns
Assistant to Councillor Harder
Barrhaven, Ward 3
613-580-2424 ext 30320
Amy.Cairns@ottawa.ca
Please sign up for Councillor Harder's newsletter

From: Selfe, Ann <Ann.Selfe@ottawa.ca>
Sent: February 14, 2019 1:44 PM
To: Cairns, Amy <Amy.Cairns@ottawa.ca>
Cc: Simpson, Colin <Colin.Simpson@ottawa.ca>
Subject: FW: Half Moon Bay and Greenbank

Hello Amy,

As per your request please find attached the most recent count for that intersection from June 19, 2018 and traffic signals are warranted at that intersection as per Justification 3 from the Ontario Traffic Manual Book 12.

If you require further information please do not hesitate to contact me,

Ann Selfe, P.Eng.
Senior Project Manager, Transportation Engineering Services
Transportation Services Department |Direction generale des transports
City of Ottawa I Ville d'Ottawa
110 Laurier Ave. West | 110, avenue Laurier Ouest
Ottawa K1P 1J1
* ann.selfe@ottawa.ca
(613.580.2424 ext./poste 13185

'

'

Appendix G

Traffic Signal Warrants

Greenbank Road @ Half Moon Bay 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	606	84%	69%	No
	B. Vehicle volume, along minor streets (average hour)	120	170	120	170	117	69%		
2. Delay to Cross Traffic	A. Vehicle volumes, major street (average hour)	480	720	600	900	489	68%	68%	No
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	75	50	75	69	91%		

Notes
1. Refer to OTM Book 12, pg 88, Nov 2007
2. Lowest section percentage governs justification
3. Average hourly volumes estimated from peak hour volumes, AHV = PM/2 or (AM + PM) / 4
4. T-intersection factor corrected, applies only to 1B

Greenbank Road @ Half Moon Bay Road
2023 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	704	98%	69%	No
	B. Vehicle volume, along minor streets (average hour)	120	170	120	170	117	69%		
2. Delay to Cross Traffic	A. Vehicle volumes, major street (average hour)	480	720	600	900	587	81%	81%	No
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	75	50	75	69	92%		

Notes
1. Refer to OTM Book 12, pg 88, Nov 2007
2. Lowest section percentage governs justification
3. Average hourly volumes estimated from peak hour volumes, AHV = PM/2 or (AM + PM) / 4
4. T-intersection factor corrected, applies only to 1B

Greenbank Road @ Half Moon Bay Road
2023 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	869	121%	121%	Yes
	B. Vehicle volume, along minor streets (average hour)	120	170	120	170	207	122%		
2. Delay to Cross Traffic	A. Vehicle volumes, major street (average hour)	480	720	600	900	662	92%	92%	No
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	75	50	75	148	197%		

Notes
1. Refer to OTM Book 12, pg 88, Nov 2007
2. Lowest section percentage governs justification
3. Average hourly volumes estimated from peak hour volumes, AHV = PM/2 or (AM + PM) / 4
4. T-intersection factor corrected, applies only to 1B

River Mist Road @ Cambrian Road
2020 Existing Conditions

Justification #7

Justification	Description	Minimum Requirement		Minimum Requirement		Compliance			Signal
		1 Lane Highway		2 or More Lanes		Sectional		Entire %	
		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 88, Nov 2007
2. Lowest section percentage governs justification
3. Average hourly volumes estimated from peak hour volumes, AHV = PM/2 or (AM + PM) / 4
4. T-intersection factor corrected, applies only to 1B

River Mist Road @ Cambrian Road
2023 Future Background

Justification #7

Justification	Description	Minimum Requirement		Minimum Requirement		Compliance			Signal
		1 Lane Highway		2 or More Lanes		Sectional		Entire %	
		Free Flow	Restr. Flow	Free Flow	Restr. Flow	Numerical	%		
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	480	720	600	900	929	129%	129%	Yes
	B. Vehicle volume, along minor streets (average hour)	120	170	120	170	241	142%		
2. Delay to Cross Traffic	A. Vehicle volumes, major street (average hour)	480	720	600	900	688	95%	95%	No
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	75	50	75	157	209%		

Notes
1. Refer to OTM Book 12, pg 88, Nov 2007
2. Lowest section percentage governs justification
3. Average hourly volumes estimated from peak hour volumes, AHV = PM/2 or (AM + PM) / 4
4. T-intersection factor corrected, applies only to 1B

River Mist Road @ Cambrian Road
2023 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	958	133%	133%	Yes
	B. Vehicle volume, along minor streets (average hour)	120	170	120	170	257	151%		
2. Delay to Cross Traffic	A. Vehicle volumes, major street (average hour)	480	720	600	900	701	97%	97%	No
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	75	50	75	168	223%		

Notes
1. Refer to OTM Book 12, pg 88, Nov 2007
2. Lowest section percentage governs justification
3. Average hourly volumes estimated from peak hour volumes, AHV = PM/2 or (AM + PM) / 4
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

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 J

Synchro 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	
Intersection Delay, s/veh	30.3
Intersection LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	119	6	58	19	6	55	17	558	5	5	167	41
Future Vol, veh/h	119	6	58	19	6	55	17	558	5	5	167	41
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	2	2	2	2
Mvmt Flow	132	7	64	21	7	61	19	620	6	6	186	46
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	13.1	10.8	45	12.4
HCM LOS	B	B	E	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	3%	65%	24%	2%
Vol Thru, %	96%	3%	7%	78%
Vol Right, %	1%	32%	69%	19%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	580	183	80	213
LT Vol	17	119	19	5
Through Vol	558	6	6	167
RT Vol	5	58	55	41
Lane Flow Rate	644	203	89	237
Geometry Grp	1	1	1	1
Degree of Util (X)	0.944	0.362	0.161	0.379
Departure Headway (Hd)	5.276	6.407	6.54	5.767
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	683	557	552	618
Service Time	3.343	4.502	4.54	3.861
HCM Lane V/C Ratio	0.943	0.364	0.161	0.383
HCM Control Delay	45	13.1	10.8	12.4
HCM Lane LOS	E	B	B	B
HCM 95th-tile Q	13.3	1.6	0.6	1.8

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	-

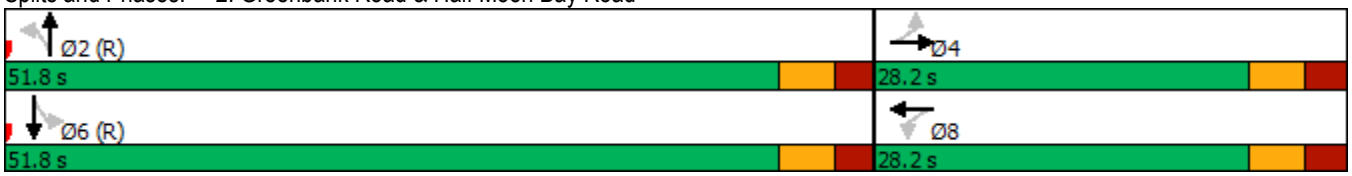
Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	1.3	210.4	57.1
HCM LOS			F	F

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

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	119	6	58	19	6	55	17	558	5	5	167	41
Future Volume (vph)	119	6	58	19	6	55	17	558	5	5	167	41
Satd. Flow (prot)	0	1618	0	0	1564	0	0	1742	0	0	1698	0
Flt Permitted		0.750			0.904			0.989			0.986	
Satd. Flow (perm)	0	1253	0	0	1431	0	0	1724	0	0	1676	0
Satd. Flow (RTOR)		29			61			1			25	
Lane Group Flow (vph)	0	203	0	0	89	0	0	645	0	0	238	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Minimum Split (s)	23.9	23.9		23.9	23.9		37.7	37.7		23.7	23.7	
Total Split (s)	28.2	28.2		28.2	28.2		51.8	51.8		51.8	51.8	
Total Split (%)	35.3%	35.3%		35.3%	35.3%		64.8%	64.8%		64.8%	64.8%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.6	2.6		2.6	2.6		2.4	2.4		2.4	2.4	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		5.9			5.9			5.7			5.7	
Lead/Lag												
Lead-Lag Optimize?												
Act Effct Green (s)		22.3			22.3			46.1			46.1	
Actuated g/C Ratio		0.28			0.28			0.58			0.58	
v/c Ratio		0.55			0.20			0.65			0.24	
Control Delay		27.5			10.9			15.3			8.2	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		27.5			10.9			15.3			8.2	
LOS		C			B			B			A	
Approach Delay		27.5			10.9			15.3			8.2	
Approach LOS		C			B			B			A	
Queue Length 50th (m)		22.2			3.1			60.7			14.4	
Queue Length 95th (m)		43.0			13.4			94.8			25.4	
Internal Link Dist (m)		226.5			242.1			157.6			402.9	
Turn Bay Length (m)												
Base Capacity (vph)		370			442			993			976	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.55			0.20			0.65			0.24	

Intersection Summary	
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 65	
Control Type: Pretimed	
Maximum v/c Ratio: 0.65	
Intersection Signal Delay: 15.7	Intersection LOS: B
Intersection Capacity Utilization 67.3%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 2: Greenbank Road & Half Moon Bay Road



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	
Intersection Delay, s/veh	83.4
Intersection LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	88	7	24	13	29	44	39	369	24	39	584	106
Future Vol, veh/h	88	7	24	13	29	44	39	369	24	39	584	106
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	2	2	2	2
Mvmt Flow	98	8	27	14	32	49	43	410	27	43	649	118
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	13.4	12.3	26.2	137.2
HCM LOS	B	B	D	F

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	9%	74%	15%	5%
Vol Thru, %	85%	6%	34%	80%
Vol Right, %	6%	20%	51%	15%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	432	119	86	729
LT Vol	39	88	13	39
Through Vol	369	7	29	584
RT Vol	24	24	44	106
Lane Flow Rate	480	132	96	810
Geometry Grp	1	1	1	1
Degree of Util (X)	0.765	0.263	0.187	1.233
Departure Headway (Hd)	6.094	7.716	7.599	5.481
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	600	468	475	664
Service Time	4.094	5.716	5.599	3.528
HCM Lane V/C Ratio	0.8	0.282	0.202	1.22
HCM Control Delay	26.2	13.4	12.3	137.2
HCM Lane LOS	D	B	B	F
HCM 95th-tile Q	7	1	0.7	29.3

Intersection	
Int Delay, s/veh	75.4

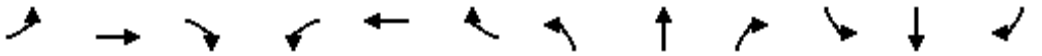
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	20	404	155	151	292	64	113	16	120	29	12	15
Future Vol, veh/h	20	404	155	151	292	64	113	16	120	29	12	15
Conflicting Peds, #/hr	13	0	3	3	0	13	9	0	16	16	0	9
Sign Control	Free	Free	Free	Free	Free	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

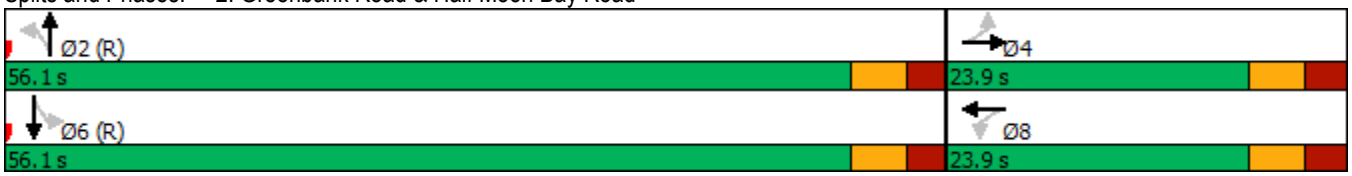
Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	88	7	24	13	29	44	39	369	24	39	584	106
Future Volume (vph)	88	7	24	13	29	44	39	369	24	39	584	106
Satd. Flow (prot)	0	1637	0	0	1612	0	0	1724	0	0	1705	0
Flt Permitted		0.768			0.947			0.892			0.958	
Satd. Flow (perm)	0	1304	0	0	1537	0	0	1544	0	0	1638	0
Satd. Flow (RTOR)		15			49			7			21	
Lane Group Flow (vph)	0	133	0	0	95	0	0	480	0	0	810	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Minimum Split (s)	23.9	23.9		23.9	23.9		23.7	23.7		23.7	23.7	
Total Split (s)	23.9	23.9		23.9	23.9		56.1	56.1		56.1	56.1	
Total Split (%)	29.9%	29.9%		29.9%	29.9%		70.1%	70.1%		70.1%	70.1%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.6	2.6		2.6	2.6		2.4	2.4		2.4	2.4	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		5.9			5.9			5.7			5.7	
Lead/Lag												
Lead-Lag Optimize?												
Act Effct Green (s)		18.0			18.0			50.4			50.4	
Actuated g/C Ratio		0.22			0.22			0.63			0.63	
v/c Ratio		0.44			0.25			0.49			0.78	
Control Delay		28.8			16.0			9.9			17.2	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		28.8			16.0			9.9			17.2	
LOS		C			B			A			B	
Approach Delay		28.8			16.0			9.9			17.2	
Approach LOS		C			B			A			B	
Queue Length 50th (m)		15.3			5.6			34.1			77.4	
Queue Length 95th (m)		31.3			17.4			55.2			128.9	
Internal Link Dist (m)		226.5			242.1			157.6			402.9	
Turn Bay Length (m)												
Base Capacity (vph)		305			383			975			1039	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.44			0.25			0.49			0.78	

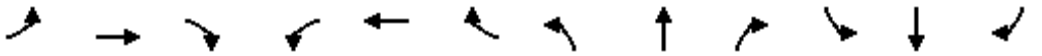
Intersection Summary		
Cycle Length: 80		
Actuated Cycle Length: 80		
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green		
Natural Cycle: 70		
Control Type: Pretimed		
Maximum v/c Ratio: 0.78		
Intersection Signal Delay: 15.9	Intersection LOS: B	
Intersection Capacity Utilization 72.3%	ICU Level of Service C	
Analysis Period (min) 15		

Splits and Phases: 2: Greenbank Road & Half Moon Bay Road



Appendix K

Synchro Worksheets – 2024 Future Background Synchro Sheets

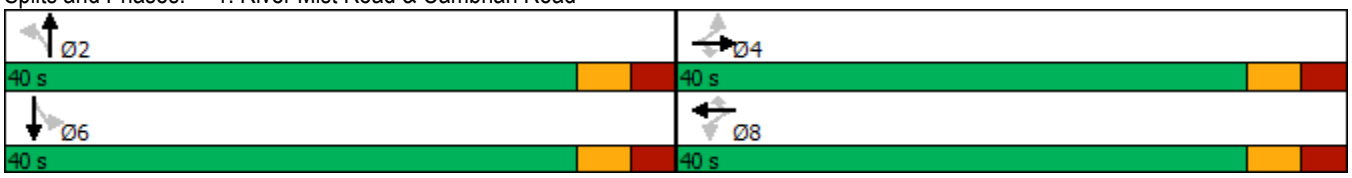


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	17	419	131	57	348	45	295	55	135	58	18	33
Future Volume (vph)	17	419	131	57	348	45	295	55	135	58	18	33
Satd. Flow (prot)	1258	1456	1335	1312	1470	1309	1492	1296	0	1478	1353	0
Flt Permitted	0.440			0.351			0.724			0.638		
Satd. Flow (perm)	566	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		4			8			2			6	
Permitted Phases	4		4	8		8	2			6		
Detector Phase	4	4	4	8	8	8	2	2		6	6	
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	

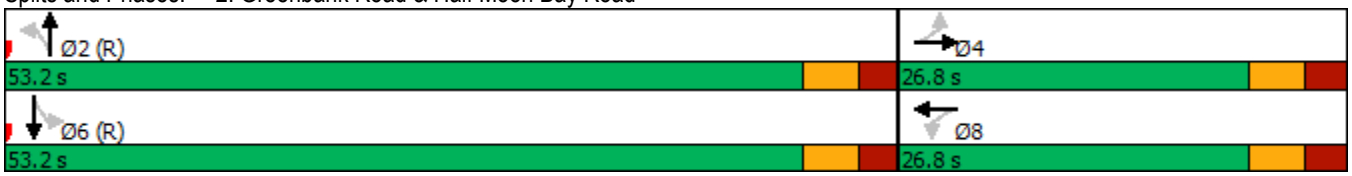
Splits and Phases: 1: River Mist Road & Cambrian Road

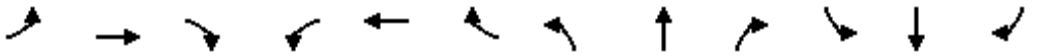


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	119	6	58	19	6	55	17	676	5	5	199	41
Future Volume (vph)	119	6	58	19	6	55	17	676	5	5	199	41
Satd. Flow (prot)	0	1618	0	0	1564	0	0	1742	0	0	1703	0
Flt Permitted		0.755			0.907			0.991			0.989	
Satd. Flow (perm)	0	1261	0	0	1436	0	0	1728	0	0	1686	0
Satd. Flow (RTOR)		28			55			1			22	
Lane Group Flow (vph)	0	183	0	0	80	0	0	698	0	0	245	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Minimum Split (s)	23.9	23.9		23.9	23.9		23.7	23.7		23.7	23.7	
Total Split (s)	26.8	26.8		26.8	26.8		53.2	53.2		53.2	53.2	
Total Split (%)	33.5%	33.5%		33.5%	33.5%		66.5%	66.5%		66.5%	66.5%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.6	2.6		2.6	2.6		2.4	2.4		2.4	2.4	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		5.9			5.9			5.7			5.7	
Lead/Lag												
Lead-Lag Optimize?												
Act Effct Green (s)		20.9			20.9			47.5			47.5	
Actuated g/C Ratio		0.26			0.26			0.59			0.59	
v/c Ratio		0.52			0.19			0.68			0.24	
Control Delay		27.6			11.6			15.3			7.7	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		27.6			11.6			15.3			7.7	
LOS		C			B			B			A	
Approach Delay		27.6			11.6			15.3			7.7	
Approach LOS		C			B			B			A	
Queue Length 50th (m)		19.9			2.9			65.4			14.4	
Queue Length 95th (m)		39.4			12.8			102.7			25.1	
Internal Link Dist (m)		226.5			242.1			157.6			402.9	
Turn Bay Length (m)												
Base Capacity (vph)		350			415			1026			1010	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.52			0.19			0.68			0.24	

Intersection Summary	
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 60	
Control Type: Pretimed	
Maximum v/c Ratio: 0.68	
Intersection Signal Delay: 15.4	Intersection LOS: B
Intersection Capacity Utilization 74.3%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 2: Greenbank Road & Half Moon Bay Road





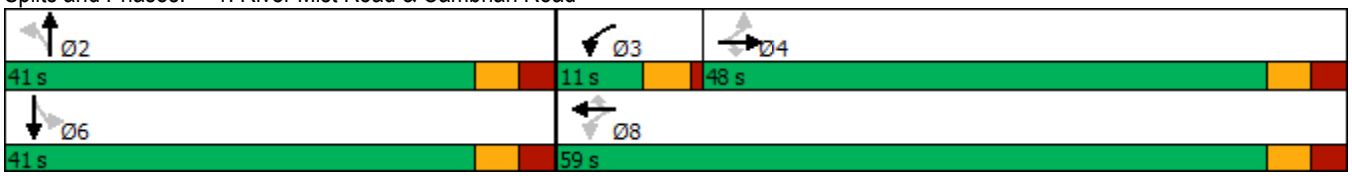
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	22	611	198	151	503	64	175	17	120	29	13	18
Future Volume (vph)	22	611	198	151	503	64	175	17	120	29	13	18
Satd. Flow (prot)	1658	1745	1483	1658	1745	1483	1658	1397	0	1658	1563	0
Flt Permitted	0.463			0.136			0.737			0.669		
Satd. Flow (perm)	800	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)	354	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	

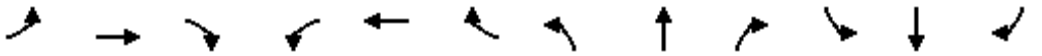
Intersection Summary
Cycle Length: 100
Actuated Cycle Length: 95.1
Natural Cycle: 90
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.91

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



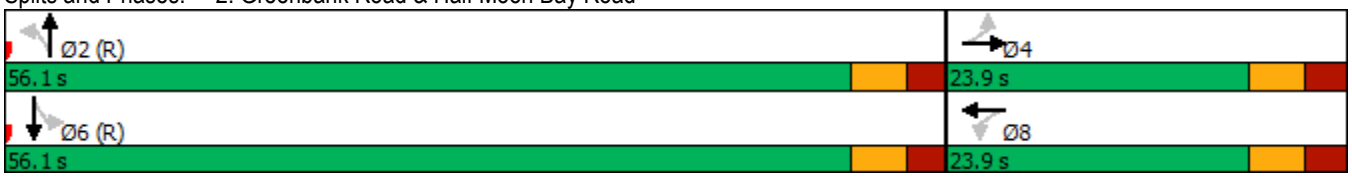


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	88	7	24	13	31	44	39	448	24	39	719	106
Future Volume (vph)	88	7	24	13	31	44	39	448	24	39	719	106
Satd. Flow (prot)	0	1637	0	0	1615	0	0	1728	0	0	1712	0
Flt Permitted		0.762			0.950			0.903			0.963	
Satd. Flow (perm)	0	1294	0	0	1545	0	0	1566	0	0	1652	0
Satd. Flow (RTOR)		15			44			6			17	
Lane Group Flow (vph)	0	119	0	0	88	0	0	511	0	0	864	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Minimum Split (s)	23.9	23.9		23.9	23.9		23.7	23.7		23.7	23.7	
Total Split (s)	23.9	23.9		23.9	23.9		56.1	56.1		56.1	56.1	
Total Split (%)	29.9%	29.9%		29.9%	29.9%		70.1%	70.1%		70.1%	70.1%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.6	2.6		2.6	2.6		2.4	2.4		2.4	2.4	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		5.9			5.9			5.7			5.7	
Lead/Lag												
Lead-Lag Optimize?												
Act Effct Green (s)		18.0			18.0			50.4			50.4	
Actuated g/C Ratio		0.22			0.22			0.63			0.63	
v/c Ratio		0.39			0.23			0.52			0.83	
Control Delay		27.5			16.4			10.3			19.9	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		27.5			16.4			10.3			19.9	
LOS		C			B			B			B	
Approach Delay		27.5			16.4			10.3			19.9	
Approach LOS		C			B			B			B	
Queue Length 50th (m)		13.4			5.4			37.2			88.2	
Queue Length 95th (m)		28.1			16.7			59.9			#158.9	
Internal Link Dist (m)		226.5			242.1			157.6			402.9	
Turn Bay Length (m)												
Base Capacity (vph)		302			381			988			1047	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.39			0.23			0.52			0.83	

Intersection Summary			
Cycle Length: 80			
Actuated Cycle Length: 80			
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green			
Natural Cycle: 70			
Control Type: Pretimed			
Maximum v/c Ratio: 0.83			
Intersection Signal Delay: 17.2		Intersection LOS: B	
Intersection Capacity Utilization 80.9%		ICU Level of Service D	
Analysis Period (min) 15			

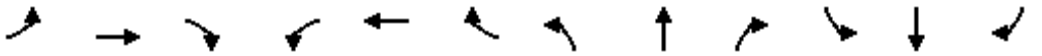
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 2: Greenbank Road & Half Moon Bay Road



Appendix L

Synchro Worksheets – 2029 Future Background Synchro Sheets



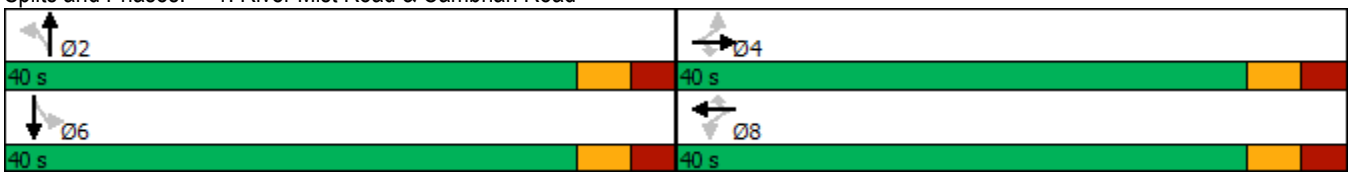
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	17	571	131	57	443	45	295	61	135	58	20	33
Future Volume (vph)	17	571	131	57	443	45	295	61	135	58	20	33
Satd. Flow (prot)	1258	1456	1335	1312	1470	1309	1492	1302	0	1478	1359	0
Flt Permitted	0.367			0.238			0.722			0.634		
Satd. Flow (perm)	472	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		4			8			2			6	
Permitted Phases	4		4	8		8	2			6		
Detector Phase	4	4	4	8	8	8	2	2		6	6	
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)		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)	203	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

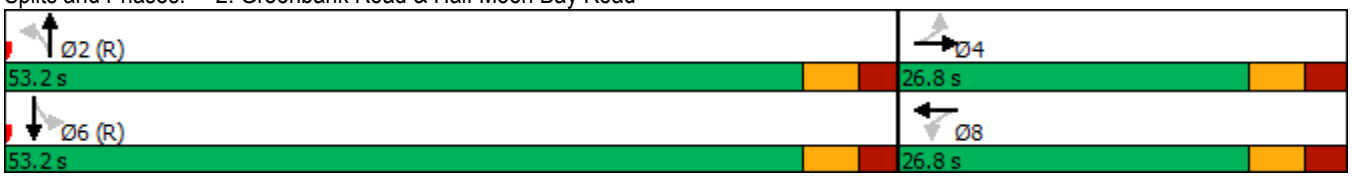


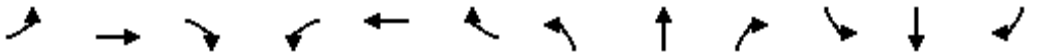
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	119	7	70	23	7	55	20	853	6	5	259	41
Future Volume (vph)	119	7	70	23	7	55	20	853	6	5	259	41
Satd. Flow (prot)	0	1613	0	0	1573	0	0	1742	0	0	1712	0
Flt Permitted		0.765			0.888			0.990			0.988	
Satd. Flow (perm)	0	1271	0	0	1415	0	0	1726	0	0	1693	0
Satd. Flow (RTOR)		34			55			1			17	
Lane Group Flow (vph)	0	196	0	0	85	0	0	879	0	0	305	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Minimum Split (s)	23.9	23.9		23.9	23.9		23.7	23.7		23.7	23.7	
Total Split (s)	26.8	26.8		26.8	26.8		53.2	53.2		53.2	53.2	
Total Split (%)	33.5%	33.5%		33.5%	33.5%		66.5%	66.5%		66.5%	66.5%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.6	2.6		2.6	2.6		2.4	2.4		2.4	2.4	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		5.9			5.9			5.7			5.7	
Lead/Lag												
Lead-Lag Optimize?												
Act Effct Green (s)		20.9			20.9			47.5			47.5	
Actuated g/C Ratio		0.26			0.26			0.59			0.59	
v/c Ratio		0.55			0.21			0.86			0.30	
Control Delay		27.6			12.1			24.2			8.5	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		27.6			12.1			24.2			8.5	
LOS		C			B			C			A	
Approach Delay		27.6			12.1			24.2			8.5	
Approach LOS		C			B			C			A	
Queue Length 50th (m)		21.0			3.4			100.2			19.4	
Queue Length 95th (m)		41.3			13.8			#184.2			32.6	
Internal Link Dist (m)		226.5			242.1			157.6			402.9	
Turn Bay Length (m)												
Base Capacity (vph)		357			410			1025			1012	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.55			0.21			0.86			0.30	

Intersection Summary	
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 70	
Control Type: Pretimed	
Maximum v/c Ratio: 0.86	
Intersection Signal Delay: 20.7	Intersection LOS: C
Intersection Capacity Utilization 87.5%	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: 2: Greenbank Road & Half Moon Bay Road





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	0.318			0.086			0.736			0.668		
Satd. Flow (perm)	550	1745	1447	150	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		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)	41.9	41.9	41.9	54.5	52.9	52.9	35.0	35.0		35.0	35.0	
Actuated g/C Ratio	0.42	0.42	0.42	0.54	0.53	0.53	0.35	0.35		0.35	0.35	
v/c Ratio	0.10	1.03	0.27	0.84	0.71	0.08	0.40	0.24		0.07	0.06	
Control Delay	19.1	70.2	3.7	55.1	23.1	3.3	27.9	7.0		22.4	13.3	
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	70.2	3.7	55.1	23.1	3.3	27.9	7.0		22.4	13.3	
LOS	B	E	A	E	C	A	C	A		C	B	
Approach Delay		55.5			27.2			18.6			17.7	
Approach LOS		E			C			B			B	
Queue Length 50th (m)	2.5	~155.9	0.0	14.0	91.1	0.0	25.3	2.4		3.7	1.8	
Queue Length 95th (m)	7.6	#224.0	12.5	#48.3	133.4	5.9	43.8	14.9		9.9	7.9	
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)	230	731	721	179	923	782	443	568		399	560	
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	1.03	0.27	0.84	0.71	0.08	0.40	0.24		0.07	0.06	

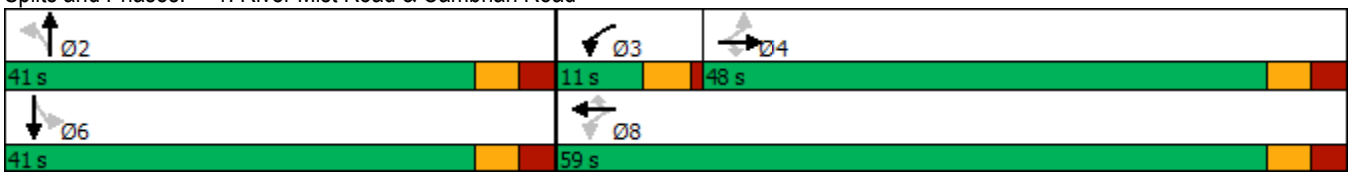
Intersection Summary
Cycle Length: 100
Actuated Cycle Length: 100
Natural Cycle: 100
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 1.03

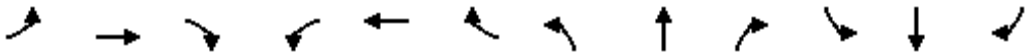
Intersection Signal Delay: 38.1	Intersection LOS: D
Intersection Capacity Utilization 92.7%	ICU Level of Service F
Analysis Period (min) 15	

~ 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



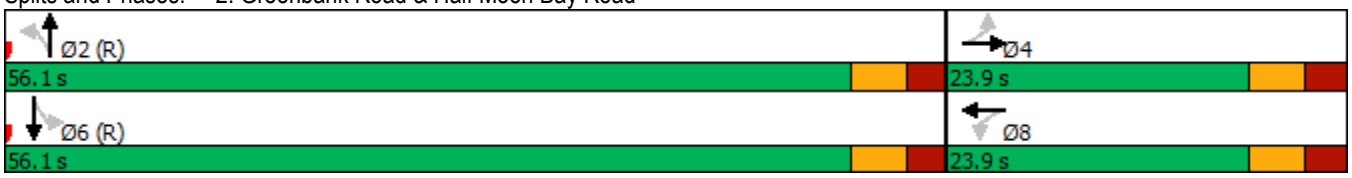


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	88	8	28	15	34	44	46	561	28	39	897	106
Future Volume (vph)	88	8	28	15	34	44	46	561	28	39	897	106
Satd. Flow (prot)	0	1635	0	0	1620	0	0	1728	0	0	1717	0
Flt Permitted		0.772			0.943			0.880			0.962	
Satd. Flow (perm)	0	1307	0	0	1540	0	0	1526	0	0	1655	0
Satd. Flow (RTOR)		17			44			6			14	
Lane Group Flow (vph)	0	124	0	0	93	0	0	635	0	0	1042	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Minimum Split (s)	23.9	23.9		23.9	23.9		23.7	23.7		23.7	23.7	
Total Split (s)	23.9	23.9		23.9	23.9		56.1	56.1		56.1	56.1	
Total Split (%)	29.9%	29.9%		29.9%	29.9%		70.1%	70.1%		70.1%	70.1%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.6	2.6		2.6	2.6		2.4	2.4		2.4	2.4	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		5.9			5.9			5.7			5.7	
Lead/Lag												
Lead-Lag Optimize?												
Act Effct Green (s)		18.0			18.0			50.4			50.4	
Actuated g/C Ratio		0.22			0.22			0.63			0.63	
v/c Ratio		0.40			0.24			0.66			1.00	
Control Delay		27.3			16.9			13.4			43.5	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		27.3			16.9			13.4			43.5	
LOS		C			B			B			D	
Approach Delay		27.3			16.9			13.4			43.5	
Approach LOS		C			B			B			D	
Queue Length 50th (m)		13.8			6.0			53.6			138.0	
Queue Length 95th (m)		29.0			17.5			88.2			#236.6	
Internal Link Dist (m)		226.5			242.1			157.6			402.9	
Turn Bay Length (m)												
Base Capacity (vph)		307			380			963			1047	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.40			0.24			0.66			1.00	

Intersection Summary	
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 90	
Control Type: Pretimed	
Maximum v/c Ratio: 1.00	
Intersection Signal Delay: 31.0	Intersection LOS: C
Intersection Capacity Utilization 91.3%	ICU Level of Service F
Analysis Period (min) 15	

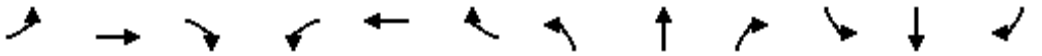
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 2: Greenbank Road & Half Moon Bay Road



Appendix M

Synchro Worksheets – 2024 Future Total Synchro Sheets

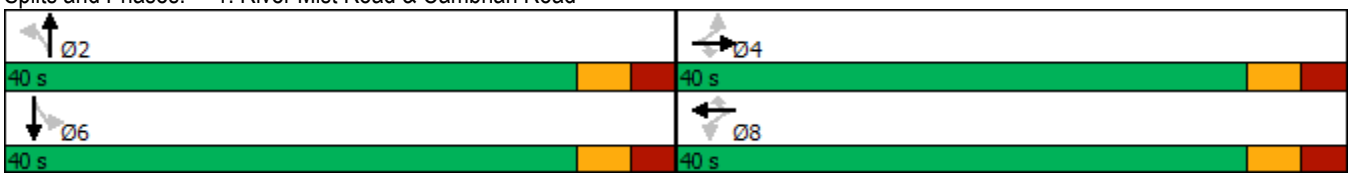


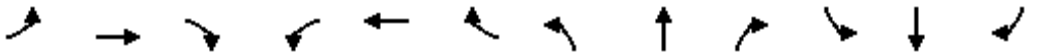
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	419	131	57	348	51	295	55	135	70	18	39
Future Volume (vph)	20	419	131	57	348	51	295	55	135	70	18	39
Satd. Flow (prot)	1258	1456	1335	1312	1470	1309	1492	1296	0	1478	1343	0
Flt Permitted	0.440			0.351			0.720			0.638		
Satd. Flow (perm)	566	1456	1300	483	1470	1215	1119	1296	0	963	1343	0
Satd. Flow (RTOR)			131			51		135			39	
Lane Group Flow (vph)	20	419	131	57	348	51	295	190	0	70	57	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8		8	2			6		
Detector Phase	4	4	4	8	8	8	2	2		6	6	
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	0.10	0.83	0.24	0.34	0.68	0.11	0.55	0.27		0.15	0.09	
Control Delay	15.9	35.7	4.2	22.6	26.9	5.1	19.9	6.0		13.8	6.8	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	15.9	35.7	4.2	22.6	26.9	5.1	19.9	6.0		13.8	6.8	
LOS	B	D	A	C	C	A	B	A		B	A	
Approach Delay		27.8			23.9			14.5			10.7	
Approach LOS		C			C			B			B	
Queue Length 50th (m)	1.8	49.9	0.0	5.5	38.6	0.0	26.4	3.8		5.0	1.2	
Queue Length 95th (m)	5.9	82.0	9.2	14.4	63.9	5.9	60.6	17.0		14.6	7.9	
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	609	538	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	0.07	0.60	0.19	0.25	0.49	0.08	0.55	0.27		0.15	0.09	

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



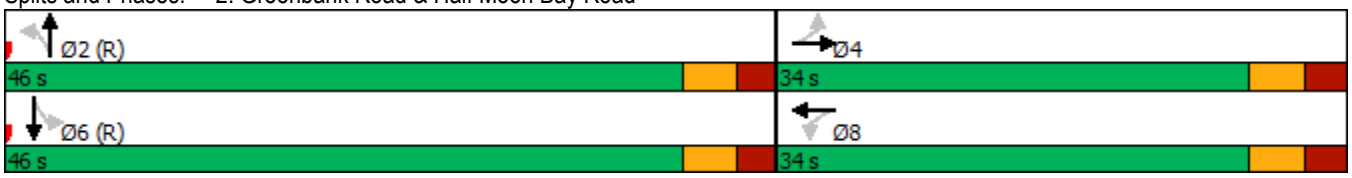


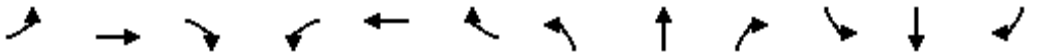
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	211	6	70	19	6	55	23	676	5	5	199	86
Future Volume (vph)	211	6	70	19	6	55	23	676	5	5	199	86
Satd. Flow (prot)	0	1628	0	0	1564	0	0	1740	0	0	1674	0
Flt Permitted		0.732			0.898			0.984			0.990	
Satd. Flow (perm)	0	1235	0	0	1421	0	0	1715	0	0	1659	0
Satd. Flow (RTOR)		22			55			1			38	
Lane Group Flow (vph)	0	287	0	0	80	0	0	704	0	0	290	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Minimum Split (s)	23.9	23.9		23.9	23.9		23.7	23.7		23.7	23.7	
Total Split (s)	34.0	34.0		34.0	34.0		46.0	46.0		46.0	46.0	
Total Split (%)	42.5%	42.5%		42.5%	42.5%		57.5%	57.5%		57.5%	57.5%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.6	2.6		2.6	2.6		2.4	2.4		2.4	2.4	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		5.9			5.9			5.7			5.7	
Lead/Lag												
Lead-Lag Optimize?												
Act Effct Green (s)		28.1			28.1			40.3			40.3	
Actuated g/C Ratio		0.35			0.35			0.50			0.50	
v/c Ratio		0.64			0.15			0.81			0.34	
Control Delay		27.8			8.8			26.3			11.6	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		27.8			8.8			26.3			11.6	
LOS		C			A			C			B	
Approach Delay		27.8			8.8			26.3			11.6	
Approach LOS		C			A			C			B	
Queue Length 50th (m)		33.1			2.5			85.0			21.2	
Queue Length 95th (m)		59.6			11.1			#149.4			37.0	
Internal Link Dist (m)		226.5			242.1			157.6			402.9	
Turn Bay Length (m)												
Base Capacity (vph)		448			534			864			854	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.64			0.15			0.81			0.34	

Intersection Summary	
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 60	
Control Type: Pretimed	
Maximum v/c Ratio: 0.81	
Intersection Signal Delay: 22.5	Intersection LOS: C
Intersection Capacity Utilization 84.5%	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: 2: Greenbank Road & Half Moon Bay Road





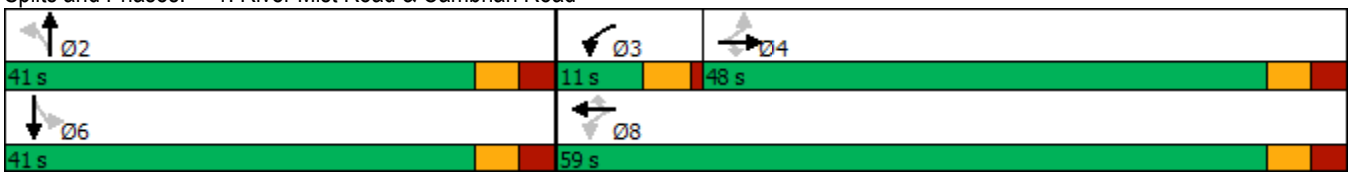
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	29	611	198	151	503	78	175	17	120	38	13	23
Future Volume (vph)	29	611	198	151	503	78	175	17	120	38	13	23
Satd. Flow (prot)	1658	1745	1483	1658	1745	1483	1658	1397	0	1658	1544	0
Flt Permitted	0.463			0.136			0.734			0.669		
Satd. Flow (perm)	800	1745	1447	237	1745	1422	1265	1397	0	1143	1544	0
Satd. Flow (RTOR)			198			78		120			23	
Lane Group Flow (vph)	29	611	198	151	503	78	175	137	0	38	36	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	0.09	0.91	0.29	0.69	0.57	0.10	0.37	0.23		0.09	0.06	
Control Delay	18.8	46.2	3.9	29.7	19.4	3.2	26.3	6.8		22.3	12.1	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	18.8	46.2	3.9	29.7	19.4	3.2	26.3	6.8		22.3	12.1	
LOS	B	D	A	C	B	A	C	A		C	B	
Approach Delay		35.3			19.8			17.8			17.4	
Approach LOS		D			B			B			B	
Queue Length 50th (m)	3.3	103.5	0.0	13.9	61.3	0.0	24.8	2.1		4.8	1.6	
Queue Length 95th (m)	9.0	#164.0	12.5	#29.1	90.4	6.5	43.8	14.6		12.0	8.2	
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)	354	772	751	220	975	828	467	591		422	585	
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	0.79	0.26	0.69	0.52	0.09	0.37	0.23		0.09	0.06	

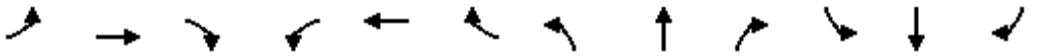
Intersection Summary
Cycle Length: 100
Actuated Cycle Length: 95.1
Natural Cycle: 90
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.91

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



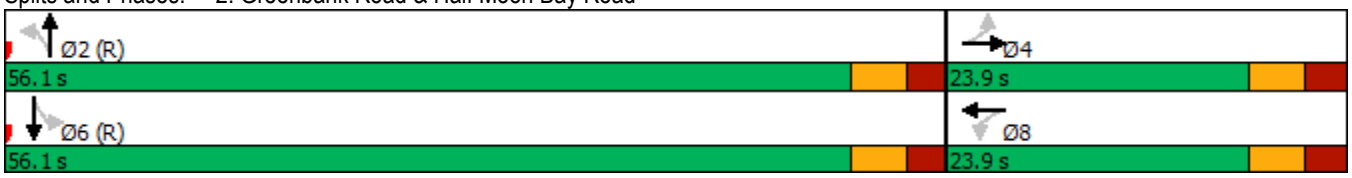


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	159	7	33	13	31	44	53	448	24	39	719	211
Future Volume (vph)	159	7	33	13	31	44	53	448	24	39	719	211
Satd. Flow (prot)	0	1642	0	0	1615	0	0	1726	0	0	1691	0
Flt Permitted		0.754			0.939			0.848			0.966	
Satd. Flow (perm)	0	1287	0	0	1527	0	0	1471	0	0	1637	0
Satd. Flow (RTOR)		12			44			6			34	
Lane Group Flow (vph)	0	199	0	0	88	0	0	525	0	0	969	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Minimum Split (s)	23.9	23.9		23.9	23.9		23.7	23.7		23.7	23.7	
Total Split (s)	23.9	23.9		23.9	23.9		56.1	56.1		56.1	56.1	
Total Split (%)	29.9%	29.9%		29.9%	29.9%		70.1%	70.1%		70.1%	70.1%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.6	2.6		2.6	2.6		2.4	2.4		2.4	2.4	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		5.9			5.9			5.7			5.7	
Lead/Lag												
Lead-Lag Optimize?												
Act Effct Green (s)		18.0			18.0			50.4			50.4	
Actuated g/C Ratio		0.22			0.22			0.63			0.63	
v/c Ratio		0.67			0.23			0.57			0.93	
Control Delay		39.2			16.4			11.4			30.0	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		39.2			16.4			11.4			30.0	
LOS		D			B			B			C	
Approach Delay		39.2			16.4			11.4			30.0	
Approach LOS		D			B			B			C	
Queue Length 50th (m)		26.0			5.4			40.1			113.4	
Queue Length 95th (m)		#53.4			16.7			65.9			#211.0	
Internal Link Dist (m)		226.5			242.1			157.6			402.9	
Turn Bay Length (m)												
Base Capacity (vph)		298			377			928			1043	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.67			0.23			0.57			0.93	

Intersection Summary	
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 80	
Control Type: Pretimed	
Maximum v/c Ratio: 0.93	
Intersection Signal Delay: 24.9	Intersection LOS: C
Intersection Capacity Utilization 90.5%	ICU Level of Service E
Analysis Period (min) 15	

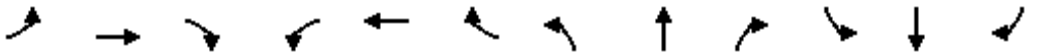
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 2: Greenbank Road & Half Moon Bay Road



Appendix N

Synchro Worksheets – 2029 Future Total Synchro Sheets



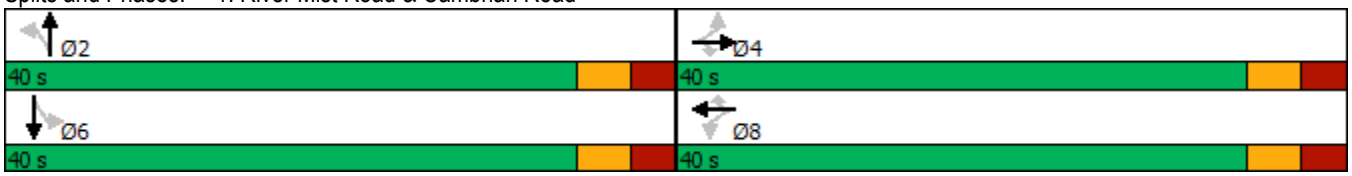
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	571	131	57	443	51	295	61	135	70	20	39
Future Volume (vph)	20	571	131	57	443	51	295	61	135	70	20	39
Satd. Flow (prot)	1258	1456	1335	1312	1470	1309	1492	1302	0	1478	1349	0
Flt Permitted	0.367			0.238			0.719			0.634		
Satd. Flow (perm)	472	1456	1300	328	1470	1215	1117	1302	0	957	1349	0
Satd. Flow (RTOR)			131			51		135			39	
Lane Group Flow (vph)	20	571	131	57	443	51	295	196	0	70	59	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8		8	2			6		
Detector Phase	4	4	4	8	8	8	2	2		6	6	
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	0.10	0.95	0.21	0.42	0.73	0.10	0.61	0.31		0.17	0.10	
Control Delay	15.7	50.6	3.8	28.0	27.7	4.9	24.4	6.8		15.7	7.4	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	15.7	50.6	3.8	28.0	27.7	4.9	24.4	6.8		15.7	7.4	
LOS	B	D	A	C	C	A	C	A		B	A	
Approach Delay		41.1			25.6			17.4			11.9	
Approach LOS		D			C			B			B	
Queue Length 50th (m)	1.8	79.6	0.0	5.9	53.7	0.0	33.9	5.4		6.4	1.7	
Queue Length 95th (m)	6.0	#142.4	9.2	17.3	87.9	5.9	60.7	17.8		14.6	8.3	
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)	203	627	635	141	633	553	482	639		413	605	
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	0.91	0.21	0.40	0.70	0.09	0.61	0.31		0.17	0.10	

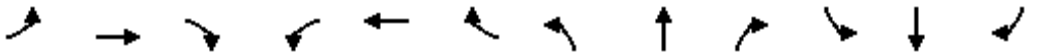
Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 78.7
Natural Cycle: 80
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.95

Intersection Signal Delay: 28.5	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



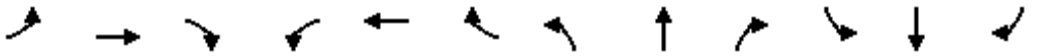


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	211	7	82	23	7	55	26	853	6	5	259	86
Future Volume (vph)	211	7	82	23	7	55	26	853	6	5	259	86
Satd. Flow (prot)	0	1623	0	0	1573	0	0	1742	0	0	1686	0
Flt Permitted		0.738			0.877			0.983			0.989	
Satd. Flow (perm)	0	1240	0	0	1397	0	0	1714	0	0	1669	0
Satd. Flow (RTOR)		26			55			1			30	
Lane Group Flow (vph)	0	300	0	0	85	0	0	885	0	0	350	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Minimum Split (s)	23.9	23.9		23.9	23.9		23.7	23.7		23.7	23.7	
Total Split (s)	34.0	34.0		34.0	34.0		46.0	46.0		46.0	46.0	
Total Split (%)	42.5%	42.5%		42.5%	42.5%		57.5%	57.5%		57.5%	57.5%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.6	2.6		2.6	2.6		2.4	2.4		2.4	2.4	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		5.9			5.9			5.7			5.7	
Lead/Lag												
Lead-Lag Optimize?												
Act Effct Green (s)		28.1			28.1			40.3			40.3	
Actuated g/C Ratio		0.35			0.35			0.50			0.50	
v/c Ratio		0.66			0.16			1.03			0.41	
Control Delay		28.4			9.1			59.5			13.0	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		28.4			9.1			59.5			13.0	
LOS		C			A			E			B	
Approach Delay		28.4			9.1			59.5			13.0	
Approach LOS		C			A			E			B	
Queue Length 50th (m)		34.6			3.0			~137.5			28.3	
Queue Length 95th (m)		62.2			11.9			#213.8			47.3	
Internal Link Dist (m)		226.5			242.1			157.6			402.9	
Turn Bay Length (m)												
Base Capacity (vph)		452			526			863			855	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.66			0.16			1.03			0.41	

Intersection Summary	
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 90	
Control Type: Pretimed	
Maximum v/c Ratio: 1.03	
Intersection Signal Delay: 41.0	Intersection LOS: D
Intersection Capacity Utilization 97.8%	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: 2: Greenbank Road & Half Moon Bay Road



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	29	750	198	151	655	78	175	19	120	38	14	23
Future Volume (vph)	29	750	198	151	655	78	175	19	120	38	14	23
Satd. Flow (prot)	1658	1745	1483	1658	1745	1483	1658	1402	0	1658	1550	0
Flt Permitted	0.318			0.086			0.733			0.668		
Satd. Flow (perm)	550	1745	1447	150	1745	1422	1263	1402	0	1142	1550	0
Satd. Flow (RTOR)			198			78		120			23	
Lane Group Flow (vph)	29	750	198	151	655	78	175	139	0	38	37	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)	41.9	41.9	41.9	54.5	52.9	52.9	35.0	35.0		35.0	35.0	
Actuated g/C Ratio	0.42	0.42	0.42	0.54	0.53	0.53	0.35	0.35		0.35	0.35	
v/c Ratio	0.13	1.03	0.27	0.84	0.71	0.10	0.40	0.24		0.10	0.07	
Control Delay	19.7	70.2	3.7	55.1	23.1	3.1	27.9	7.0		22.8	12.3	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	19.7	70.2	3.7	55.1	23.1	3.1	27.9	7.0		22.8	12.3	
LOS	B	E	A	E	C	A	C	A		C	B	
Approach Delay		55.3			26.8			18.7			17.6	
Approach LOS		E			C			B			B	
Queue Length 50th (m)	3.4	~155.9	0.0	14.0	91.1	0.0	25.3	2.4		4.9	1.8	
Queue Length 95th (m)	9.4	#224.0	12.5	#48.3	133.4	6.5	43.8	14.9		12.0	8.3	
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)	230	731	721	179	923	788	442	568		399	557	
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	1.03	0.27	0.84	0.71	0.10	0.40	0.24		0.10	0.07	

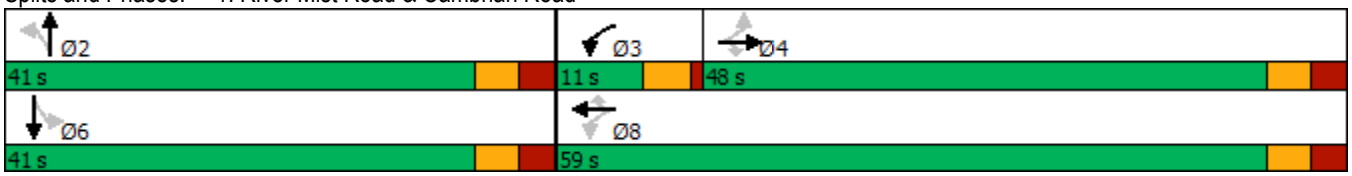
Intersection Summary
Cycle Length: 100
Actuated Cycle Length: 100
Natural Cycle: 100
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 1.03

Intersection Signal Delay: 37.7	Intersection LOS: D
Intersection Capacity Utilization 97.7%	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

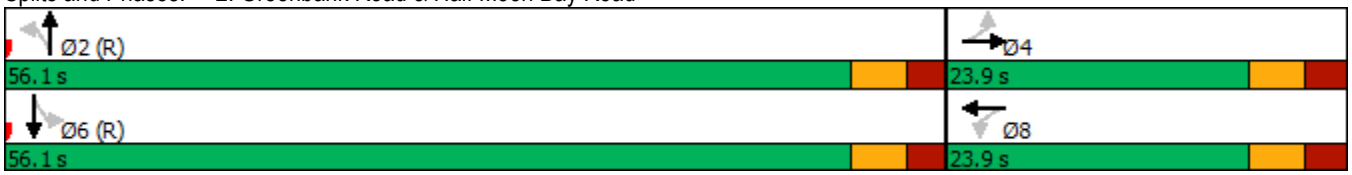


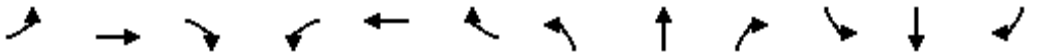
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	159	8	37	15	34	44	60	561	28	39	897	211
Future Volume (vph)	159	8	37	15	34	44	60	561	28	39	897	211
Satd. Flow (prot)	0	1638	0	0	1620	0	0	1726	0	0	1698	0
Flt Permitted		0.760			0.934			0.834			0.965	
Satd. Flow (perm)	0	1294	0	0	1526	0	0	1447	0	0	1642	0
Satd. Flow (RTOR)		13			44			5			27	
Lane Group Flow (vph)	0	204	0	0	93	0	0	649	0	0	1147	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Minimum Split (s)	23.9	23.9		23.9	23.9		23.7	23.7		23.7	23.7	
Total Split (s)	23.9	23.9		23.9	23.9		56.1	56.1		56.1	56.1	
Total Split (%)	29.9%	29.9%		29.9%	29.9%		70.1%	70.1%		70.1%	70.1%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.6	2.6		2.6	2.6		2.4	2.4		2.4	2.4	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		5.9			5.9			5.7			5.7	
Lead/Lag												
Lead-Lag Optimize?												
Act Effct Green (s)		18.0			18.0			50.4			50.4	
Actuated g/C Ratio		0.22			0.22			0.63			0.63	
v/c Ratio		0.68			0.25			0.71			1.10	
Control Delay		39.6			17.0			15.3			76.6	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		39.6			17.0			15.3			76.6	
LOS		D			B			B			E	
Approach Delay		39.6			17.0			15.3			76.6	
Approach LOS		D			B			B			E	
Queue Length 50th (m)		26.6			6.0			58.1			~199.8	
Queue Length 95th (m)		#54.8			17.5			98.4			#272.9	
Internal Link Dist (m)		226.5			242.1			157.6			402.9	
Turn Bay Length (m)												
Base Capacity (vph)		301			377			913			1044	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.68			0.25			0.71			1.10	

Intersection Summary	
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 100	
Control Type: Pretimed	
Maximum v/c Ratio: 1.10	
Intersection Signal Delay: 51.4	Intersection LOS: D
Intersection Capacity Utilization 101.1%	ICU Level of Service G
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: 2: Greenbank Road & Half Moon Bay Road





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	29	750	198	151	655	78	175	19	120	38	14	23
Future Volume (vph)	29	750	198	151	655	78	175	19	120	38	14	23
Satd. Flow (prot)	1658	1745	1483	1658	1745	1483	1658	1402	0	1658	1550	0
Flt Permitted	0.318			0.086			0.733			0.668		
Satd. Flow (perm)	551	1745	1447	150	1745	1422	1263	1402	0	1142	1550	0
Satd. Flow (RTOR)			198			78		120			23	
Lane Group Flow (vph)	29	750	198	151	655	78	175	139	0	38	37	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)	41.9	41.9	41.9	54.5	52.9	52.9	35.0	35.0		35.0	35.0	
Actuated g/C Ratio	0.42	0.42	0.42	0.54	0.53	0.53	0.35	0.35		0.35	0.35	
v/c Ratio	0.13	1.03	0.27	0.84	0.71	0.10	0.40	0.24		0.10	0.07	
Control Delay	19.7	70.2	3.7	55.1	23.1	3.1	27.9	7.0		22.8	12.3	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	19.7	70.2	3.7	55.1	23.1	3.1	27.9	7.0		22.8	12.3	
LOS	B	E	A	E	C	A	C	A		C	B	
Approach Delay		55.3			26.8			18.7			17.6	
Approach LOS		E			C			B			B	
Queue Length 50th (m)	3.4	~155.9	0.0	14.0	91.1	0.0	25.3	2.4		4.9	1.8	
Queue Length 95th (m)	9.4	#224.0	12.5	#48.3	133.4	6.5	43.8	14.9		12.0	8.3	
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)	230	731	721	179	923	788	442	568		399	557	
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	1.03	0.27	0.84	0.71	0.10	0.40	0.24		0.10	0.07	

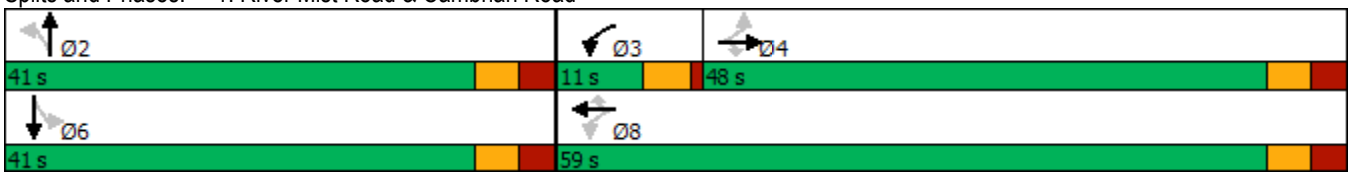
Intersection Summary
Cycle Length: 100
Actuated Cycle Length: 100
Natural Cycle: 100
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 1.03

Intersection Signal Delay: 37.7	Intersection LOS: D
Intersection Capacity Utilization 97.7%	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

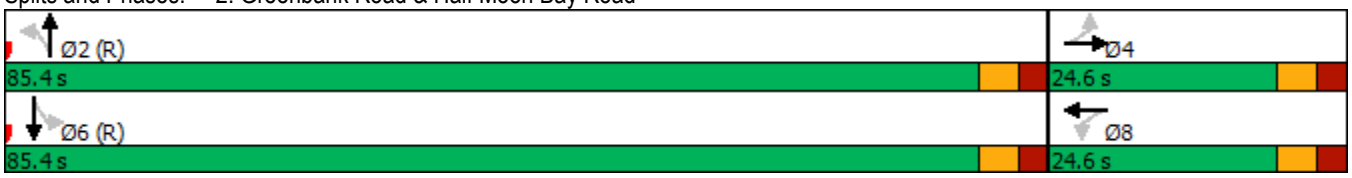


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	159	8	37	15	34	44	60	561	28	39	897	211
Future Volume (vph)	159	8	37	15	34	44	60	561	28	39	897	211
Satd. Flow (prot)	0	1638	0	0	1620	0	0	1726	0	0	1698	0
Flt Permitted		0.715			0.944			0.816			0.963	
Satd. Flow (perm)	0	1218	0	0	1542	0	0	1415	0	0	1639	0
Satd. Flow (RTOR)		9			35			5			27	
Lane Group Flow (vph)	0	204	0	0	93	0	0	649	0	0	1147	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Minimum Split (s)	23.9	23.9		23.9	23.9		23.7	23.7		23.7	23.7	
Total Split (s)	24.6	24.6		24.6	24.6		85.4	85.4		85.4	85.4	
Total Split (%)	22.4%	22.4%		22.4%	22.4%		77.6%	77.6%		77.6%	77.6%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.6	2.6		2.6	2.6		2.4	2.4		2.4	2.4	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		5.9			5.9			5.7			5.7	
Lead/Lag												
Lead-Lag Optimize?												
Act Effct Green (s)		18.7			18.7			79.7			79.7	
Actuated g/C Ratio		0.17			0.17			0.72			0.72	
v/c Ratio		0.95			0.32			0.63			0.96	
Control Delay		95.0			29.2			11.1			33.1	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		95.0			29.2			11.1			33.1	
LOS		F			C			B			C	
Approach Delay		95.0			29.2			11.1			33.1	
Approach LOS		F			C			B			C	
Queue Length 50th (m)		42.1			10.9			61.0			190.7	
Queue Length 95th (m)		#87.1			25.9			93.7			#322.4	
Internal Link Dist (m)		226.5			242.1			157.6			402.9	
Turn Bay Length (m)												
Base Capacity (vph)		214			291			1026			1194	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.95			0.32			0.63			0.96	

Intersection Summary	
Cycle Length: 110	
Actuated Cycle Length: 110	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 100	
Control Type: Pretimed	
Maximum v/c Ratio: 0.96	
Intersection Signal Delay: 32.1	Intersection LOS: C
Intersection Capacity Utilization 101.1%	ICU Level of Service G
Analysis Period (min) 15	

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

Splits and Phases: 2: Greenbank Road & Half Moon Bay Road



Appendix O

Intersection MMLOS

Multi-Modal Level of Service - Intersections Form

Consultant	**CGH Transportation**	**Project**	**2020-59**
Scenario	**2024 Future Background**	**Date**	**9/22/2021**
Comments			

INTERSECTIONS		Greenbank Road at Half Moon Bay Road (AM)				Greenbank Road at Half Moon Bay Road (PM)				River Mist Rd & Cambrian Rd (AM)				River Mist Rd & Cambrian Rd (PM)			
	Crossing Side	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST
Pedestrian	Lanes	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	3	3	4	4	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	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m
	Conflicting Left Turns	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Protected/ Permissive	Permissive	Permissive	Permissive	Protected/ Permissive	Permissive	Permissive
	Conflicting Right Turns	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	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	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed
	Ped Signal Leading Interval?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
	Right Turn Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel
	Corner Radius	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m
	Crosswalk Type	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings
	PETSI Score	**85**	**85**	**85**	**85**	**85**	**85**	**85**	**85**	**70**	**70**	**53**	**53**	**70**	**70**	**53**	**53**
	Ped. Exposure to Traffic LoS	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**C**	**C**	**D**	**D**	**C**	**C**	**D**	**D**
	Cycle Length	80	80	80	80	80	80	80	80	80	80	80	80	100	100	100	100
	Effective Walk Time	10	10	39	39	7	7	39	39	11	10	9	7	30	18	8	10
	Average Pedestrian Delay	**31**	**31**	**11**	**11**	**33**	**33**	**11**	**11**	**30**	**31**	**32**	**33**	**25**	**34**	**42**	**41**
	Pedestrian Delay LoS	**D**	**D**	**B**	**B**	**D**	**D**	**B**	**B**	**D**	**D**	**D**	**D**	**C**	**D**	**E**	**E**
	Level of Service	**D**	**D**	**B**	**B**	**D**	**D**	**B**	**B**	**D**	**D**	**D**	**D**	**C**	**D**	**E**	**E**
		D				**D**				**D**				**E**			
	Approach From	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST
Bicycle	Bicycle Lane Arrangement on Approach	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic
	Right Turn Lane Configuration	≤ 50 m	≤ 50 m	≤ 50 m	≤ 50 m	≤ 50 m	≤ 50 m	≤ 50 m	≤ 50 m	≤ 50 m	≤ 50 m	> 50 m	> 50 m	≤ 50 m	≤ 50 m	> 50 m	> 50 m
	Right Turning Speed	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h
	Cyclist relative to RT motorists	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**F**	**F**	**D**	**D**	**F**	**F**
	Separated or Mixed Traffic	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**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	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	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	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 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**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**
	Level of Service	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**F**	**F**	**D**	**D**	**F**	**F**
		D				**D**				**F**				**F**			
Transit	Average Signal Delay										≤ 10 sec	≤ 30 sec			≤ 10 sec	≤ 30 sec	
	Level of Service	-	-	-	-	-	-	-	-	-	**B**	**D**	-	-	**B**	**D**	-
		-				-				**D**				**D**			
Truck	Effective Corner Radius	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m
	Number of Receiving Lanes on Departure from Intersection	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Level of Service	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**
		E				**E**				**E**				**E**			
Auto	Volume to Capacity Ratio	0.61 - 0.70				0.61 - 0.70				0.61 - 0.70				0.61 - 0.70			
	Level of Service	**B**				**B**				**B**				**B**			

Multi-Modal Level of Service - Intersections Form

Consultant	**CGH Transportation**	**Project**	**2020-59**
Scenario	**2029 Future Background**	**Date**	**9/22/2021**
Comments			

INTERSECTIONS		Greenbank Road at Half Moon Bay Road (AM)				Greenbank Road at Half Moon Bay Road (PM)				River Mist Rd & Cambrian Rd (AM)				River Mist Rd & Cambrian Rd (PM)			
	Crossing Side	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST
Pedestrian	Lanes	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	3	3	4	4	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	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m
	Conflicting Left Turns	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Protected/ Permissive	Permissive	Permissive	Permissive	Protected/ Permissive	Permissive	Permissive
	Conflicting Right Turns	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	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	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed
	Ped Signal Leading Interval?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
	Right Turn Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel
	Corner Radius	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m
	Crosswalk Type	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings
	PETSI Score	**85**	**85**	**85**	**85**	**85**	**85**	**85**	**85**	**70**	**70**	**53**	**53**	**70**	**70**	**53**	**53**
	Ped. Exposure to Traffic LoS	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**C**	**C**	**D**	**D**	**C**	**C**	**D**	**D**
	Cycle Length	80	80	80	80	80	80	80	80	80	80	80	80	100	100	100	100
	Effective Walk Time	10	10	37	37	7	7	39	39	11	10	9	7	30	18	8	10
	Average Pedestrian Delay	**31**	**31**	**12**	**12**	**33**	**33**	**11**	**11**	**30**	**31**	**32**	**33**	**25**	**34**	**42**	**41**
	Pedestrian Delay LoS	**D**	**D**	**B**	**B**	**D**	**D**	**B**	**B**	**D**	**D**	**D**	**D**	**C**	**D**	**E**	**E**
	Level of Service	**D**	**D**	**B**	**B**	**D**	**D**	**B**	**B**	**D**	**D**	**D**	**D**	**C**	**D**	**E**	**E**
		D				**D**				**D**				**E**			
	Approach From	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST
Bicycle	Bicycle Lane Arrangement on Approach	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic
	Right Turn Lane Configuration	≤ 50 m	≤ 50 m	≤ 50 m	≤ 50 m	≤ 50 m	≤ 50 m	≤ 50 m	≤ 50 m	≤ 50 m	≤ 50 m	> 50 m	> 50 m	≤ 50 m	≤ 50 m	> 50 m	> 50 m
	Right Turning Speed	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h
	Cyclist relative to RT motorists	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**F**	**F**	**D**	**D**	**F**	**F**
	Separated or Mixed Traffic	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**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	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	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	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 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**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**
	Level of Service	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**F**	**F**	**D**	**D**	**F**	**F**
		D				**D**				**F**				**F**			
Transit	Average Signal Delay										≤ 10 sec	≤ 30 sec			≤ 10 sec	≤ 30 sec	
	Level of Service	-	-	-	-	-	-	-	-	-	**B**	**D**	-	-	**B**	**D**	-
		-				-				**D**				**D**			
Truck	Effective Corner Radius	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m
	Number of Receiving Lanes on Departure from Intersection	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Level of Service	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**
		E				**E**				**E**				**E**			
Auto	Volume to Capacity Ratio	0.71 - 0.80				0.71 - 0.80				0.71 - 0.80				0.81 - 0.90			
	Level of Service	**C**				**C**				**C**				**D**			

Multi-Modal Level of Service - Intersections Form

Consultant	**CGH Transportation**	**Project**	**2020-59**
Scenario	**2024 Future Total**	**Date**	**9/22/2021**
Comments			

INTERSECTIONS		Greenbank Road at Half Moon Bay Road (AM)				Greenbank Road at Half Moon Bay Road (PM)				River Mist Rd & Cambrian Rd (AM)				River Mist Rd & Cambrian Rd (PM)			
	Crossing Side	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST
Pedestrian	Lanes	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	3	3	4	4	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	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m
	Conflicting Left Turns	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Protected/ Permissive	Permissive	Permissive	Permissive	Protected/ Permissive	Permissive	Permissive
	Conflicting Right Turns	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	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	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed
	Ped Signal Leading Interval?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
	Right Turn Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel
	Corner Radius	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m
	Crosswalk Type	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings
	PETSI Score	**85**	**85**	**85**	**85**	**85**	**85**	**85**	**85**	**70**	**70**	**53**	**53**	**70**	**70**	**53**	**53**
	Ped. Exposure to Traffic LoS	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**C**	**C**	**D**	**D**	**C**	**C**	**D**	**D**
	Cycle Length	80	80	80	80	80	80	80	80	80	80	80	80	100	100	100	100
	Effective Walk Time	17	17	29	29	7	7	39	39	11	10	9	7	30	18	8	10
	Average Pedestrian Delay	**25**	**25**	**16**	**16**	**33**	**33**	**11**	**11**	**30**	**31**	**32**	**33**	**25**	**34**	**42**	**41**
	Pedestrian Delay LoS	**C**	**C**	**B**	**B**	**D**	**D**	**B**	**B**	**D**	**D**	**D**	**D**	**C**	**D**	**E**	**E**
	Level of Service	**C**	**C**	**B**	**B**	**D**	**D**	**B**	**B**	**D**	**D**	**D**	**D**	**C**	**D**	**E**	**E**
		C				**D**				**D**				**E**			
	Approach From	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST
Bicycle	Bicycle Lane Arrangement on Approach	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic
	Right Turn Lane Configuration	≤ 50 m	≤ 50 m	≤ 50 m	≤ 50 m	≤ 50 m	≤ 50 m	≤ 50 m	≤ 50 m	≤ 50 m	≤ 50 m	> 50 m	> 50 m	≤ 50 m	≤ 50 m	> 50 m	> 50 m
	Right Turning Speed	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h
	Cyclist relative to RT motorists	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**F**	**F**	**D**	**D**	**F**	**F**
	Separated or Mixed Traffic	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**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	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	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	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 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**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**
	Level of Service	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**F**	**F**	**D**	**D**	**F**	**F**
		D				**D**				**F**				**F**			
Transit	Average Signal Delay										≤ 10 sec	≤ 30 sec			≤ 10 sec	≤ 30 sec	
	Level of Service	-	-	-	-	-	-	-	-	-	**B**	**D**	-	-	**B**	**D**	-
		-				-				**D**				**D**			
Truck	Effective Corner Radius	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m
	Number of Receiving Lanes on Departure from Intersection	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Level of Service	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**
		E				**E**				**E**				**E**			
Auto	Volume to Capacity Ratio	0.61 - 0.70				0.61 - 0.70				0.71 - 0.80				0.81 - 0.90			
	Level of Service	**B**				**B**				**C**				**D**			

Multi-Modal Level of Service - Intersections Form

Consultant	**CGH Transportation**	**Project**	**2020-59**
Scenario	**2029 Future Total**	**Date**	**9/22/2021**
Comments			

	INTERSECTIONS	Greenbank Road at Half Moon Bay Road (AM)				Greenbank Road at Half Moon Bay Road (PM)				River Mist Rd & Cambrian Rd (AM)				River Mist Rd & Cambrian Rd (PM)			
	Crossing Side	**NORTH**	**SOUTH**	**EAST**	**WEST**	**NORTH**	**SOUTH**	**EAST**	**WEST**	**NORTH**	**SOUTH**	**EAST**	**WEST**	**NORTH**	**SOUTH**	**EAST**	**WEST**
Pedestrian	Lanes	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	3	3	4	4	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	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m
	Conflicting Left Turns	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Protected/ Permissive	Permissive	Permissive	Permissive	Protected/ Permissive	Permissive	Permissive
	Conflicting Right Turns	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	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	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed
	Ped Signal Leading Interval?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
	Right Turn Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel
	Corner Radius	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m
	Crosswalk Type	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings
	PETSI Score	**85**	**85**	**85**	**85**	**85**	**85**	**85**	**85**	**70**	**70**	**53**	**53**	**70**	**70**	**53**	**53**
	Ped. Exposure to Traffic LoS	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**C**	**C**	**D**	**D**	**C**	**C**	**D**	**D**
	Cycle Length	80	80	80	80	110	110	110	110	80	80	80	80	100	100	100	100
	Effective Walk Time	17	17	29	29	8	8	69	69	11	10	9	7	30	18	8	10
	Average Pedestrian Delay	**25**	**25**	**16**	**16**	**47**	**47**	**8**	**8**	**30**	**31**	**32**	**33**	**25**	**34**	**42**	**41**
	Pedestrian Delay LoS	**C**	**C**	**B**	**B**	**E**	**E**	**A**	**A**	**D**	**D**	**D**	**D**	**C**	**D**	**E**	**E**
	Level of Service	**C**	**C**	**B**	**B**	**E**	**E**	**B**	**B**	**D**	**D**	**D**	**D**	**C**	**D**	**E**	**E**
		C				**E**				**D**				**E**			
	Approach From	**NORTH**	**SOUTH**	**EAST**	**WEST**	**NORTH**	**SOUTH**	**EAST**	**WEST**	**NORTH**	**SOUTH**	**EAST**	**WEST**	**NORTH**	**SOUTH**	**EAST**	**WEST**
Bicycle	Bicycle Lane Arrangement on Approach	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic
	Right Turn Lane Configuration	≤ 50 m	≤ 50 m	≤ 50 m	≤ 50 m	≤ 50 m	≤ 50 m	≤ 50 m	≤ 50 m	≤ 50 m	≤ 50 m	> 50 m	> 50 m	≤ 50 m	≤ 50 m	> 50 m	> 50 m
	Right Turning Speed	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h
	Cyclist relative to RT motorists	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**F**	**F**	**D**	**D**	**F**	**F**
	Separated or Mixed Traffic	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**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	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	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	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 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**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**
	Level of Service	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**F**	**F**	**D**	**D**	**F**	**F**
		D				**D**				**F**				**F**			
Transit	Average Signal Delay										≤ 10 sec	≤ 30 sec			≤ 10 sec	≤ 30 sec	
	Level of Service	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**B**	**D**	**-**	**-**	**B**	**D**	**-**
		-				**-**				**D**				**D**			
Truck	Effective Corner Radius	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m
	Number of Receiving Lanes on Departure from Intersection	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Level of Service	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**
		E				**E**				**E**				**E**			
Auto	Volume to Capacity Ratio	0.71 - 0.80				0.71 - 0.80				0.81 - 0.90				0.91 - 1.00			
	Level of Service	**C**				**C**				**D**				**E**			