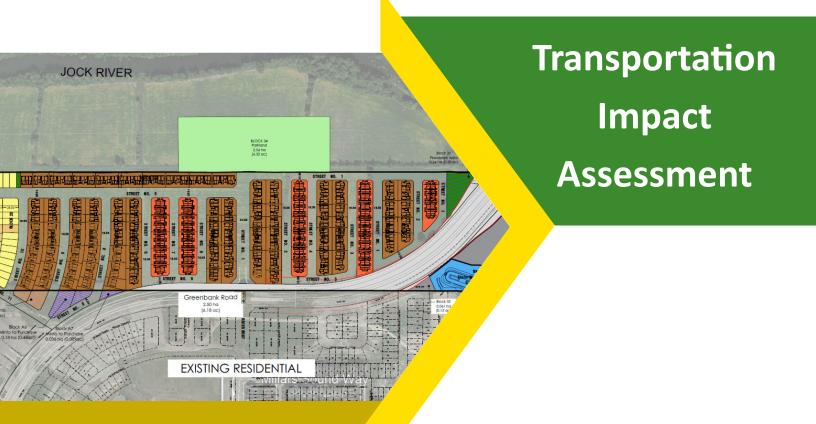
# Minto Communities Inc.

# 3432 Greenbank Road





# 3432 Greenbank Road

# **Transportation Impact Assessment**

Step 1 Screening Report Step 2 Scoping Report Step 3 Forecasting Report Step 4 Strategy Report

Prepared for:

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September 2021 PN: 2020-59

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## 1 Screening

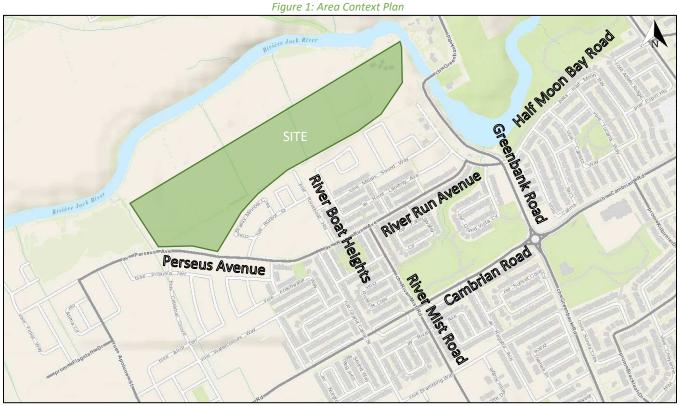
This study has been prepared according to the City of Ottawa's 2017 Transportation Impact Assessment (TIA) Guidelines. Accordingly, a Step 1 Screening Form has been prepared and is included as Appendix A, along with the Certification Form for TIA Study PM. As shown in the Screening Form, a TIA is required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

# 2 Existing and Planned Conditions

#### 2.1 Proposed Development

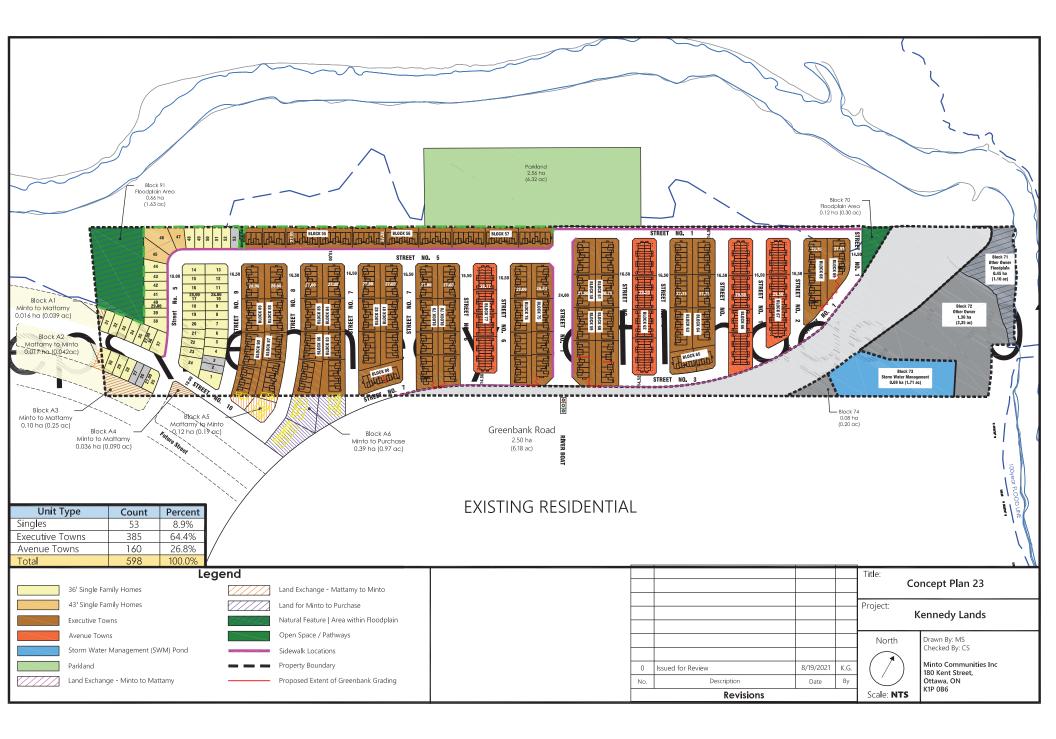
The subject property, located at 3432 Greenbank Road, is currently zoned as Development Reserve Zone [DR] and is undeveloped. The proposed development consists of 598 units, including 53 single family homes, 385 executive townhomes, and 160 avenue townhomes.

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.



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





#### 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

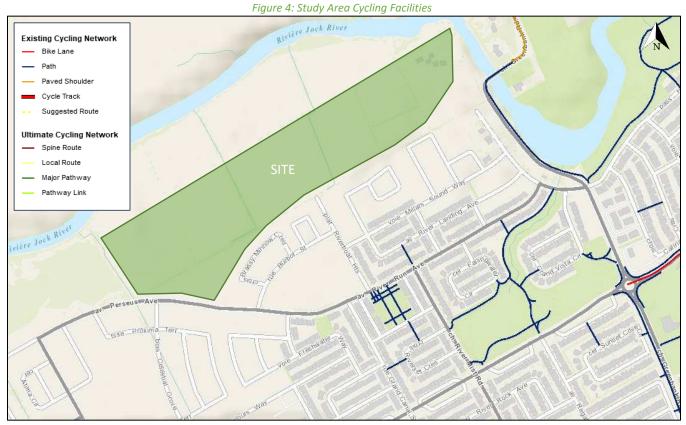
Pedestrian infrastructure is provided along one or both sides of developed communities in the vicinity of the proposed development. As the area builds out, it is expected that pedestrian connections will be provided through all of the neighboring communities, leading to arterial and collector roads. 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





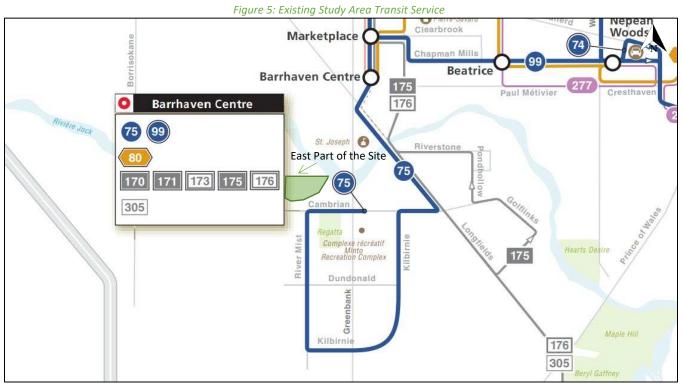
Source: http://maps.ottawa.ca/geoOttawa/ Accessed: July 28, 2021

#### 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:

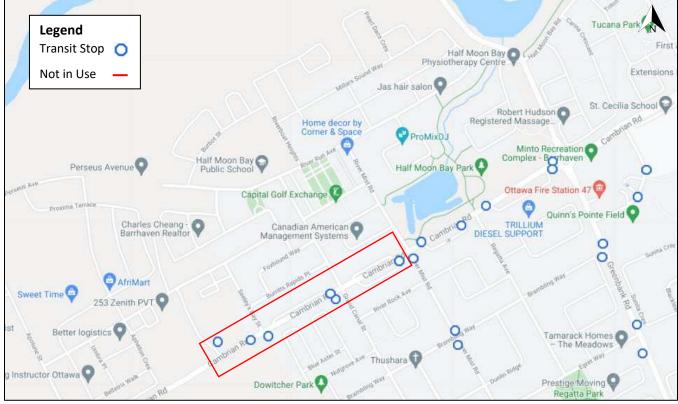
• Route # 75 – every 15 minutes during AM and PM weekday peak hours and every 30 during all other times.





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





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.

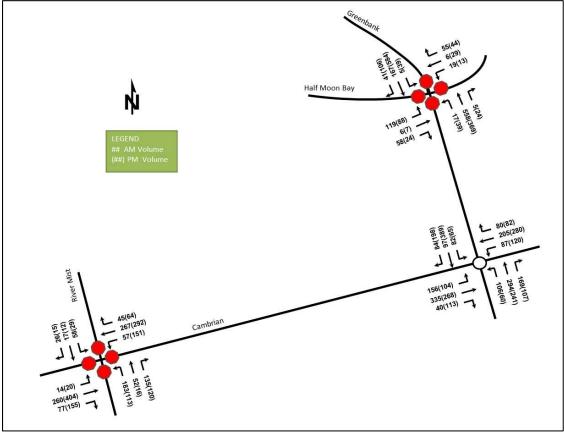
#### 2.2.7 Existing Peak Hour Travel Demand

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							

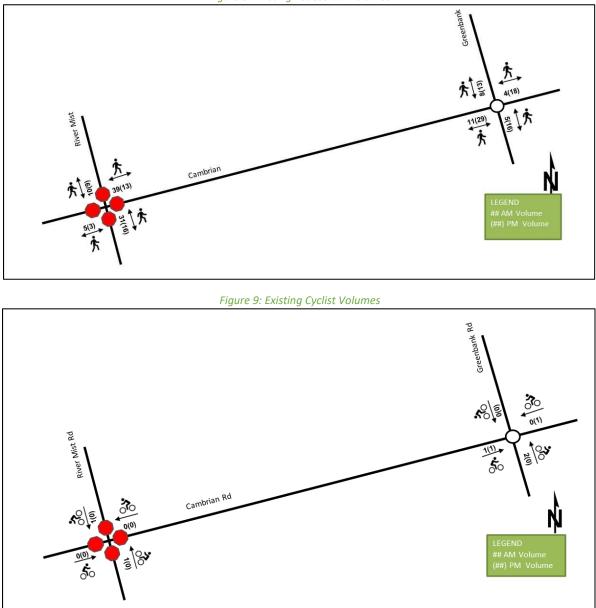
Figure 7 illustrates the 2021 existing horizon traffic volumes. To reflect a constant horizon, a 2% background growth rate has been used. This growth rate is consistent with surrounding development Traffic Impact Assessments such as 3285 Borrisokane Road Commercial Development Transportation Impact Study (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.







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.







#### 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.



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

rusic 2. summary of comsion Eccations								
Intersection / Segment	Number	%						
Intersection / Segment	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 2: Summary of Collision Locations



		Number	%
Total (	Collisions	18	100%
	Fatality	0	0%
Classification	Non-Fatal Injury	1	6%
	Property Damage Only	17	94%
	Approaching	0	0%
	Angle	5	28%
Initial Impact Type	Rear End	6	33%
	Sideswipe	0	0%
	Turning Movement	2	11%
	SMV Unattended Vehicle	0	0%
	SMV Other	5	28%
	Other	0	0%
	Dry	10	56%
	Wet	1	6%
	Loose Snow	2	11%
oad Surface Condition	Slush	3	17%
	Packed Snow	0	0%
	Ice	2	11%
	Loose Sand or Gravel	0	0%
Pedestria	an Involved	0	0%
Cyclists	Involved	0	0%

Table 3:Collision Summary

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.



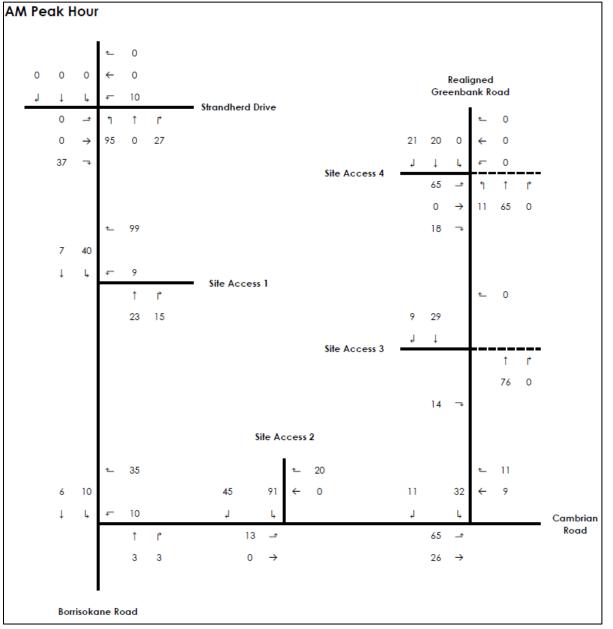
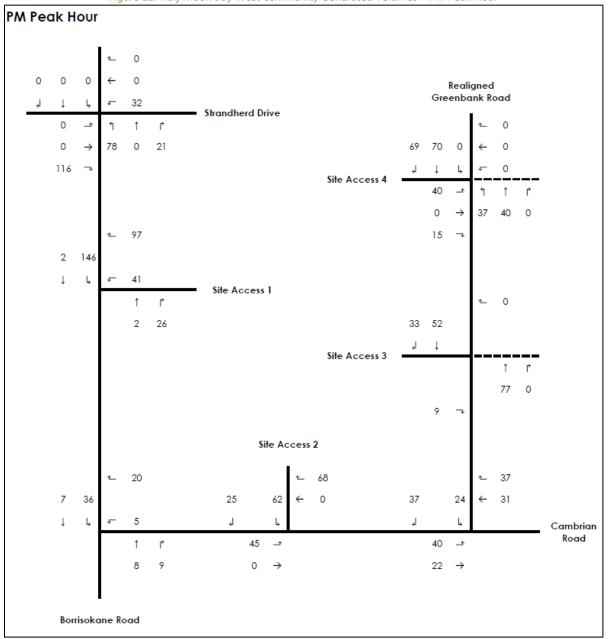


Figure 11: Half Moon Bay West Community Generated Volumes – AM Peak Hour

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





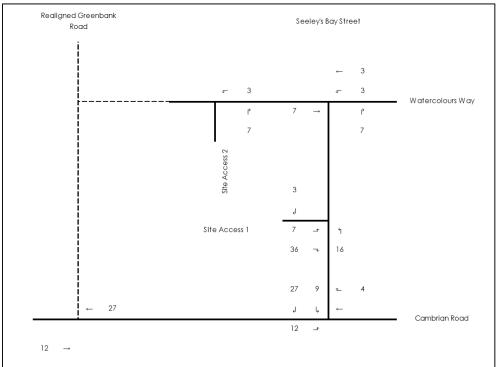


Source: Half Moon Bay West Community Transportation Study (Stantec, 2016)

#### 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.







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

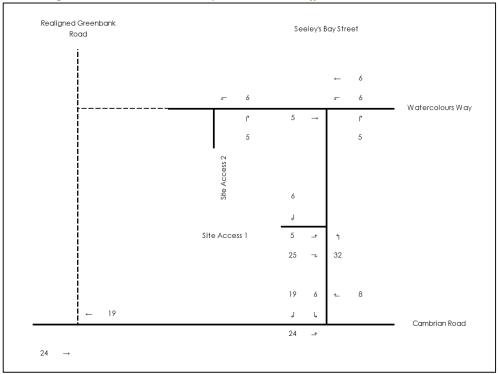


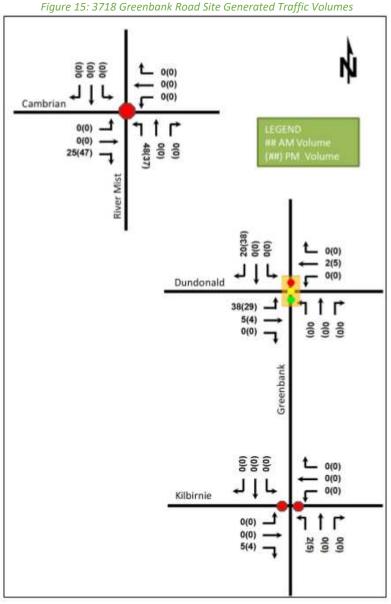
Figure 14: 2444 Watercolours Way Site Generated Traffic Volumes - PM Peak Hour

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.

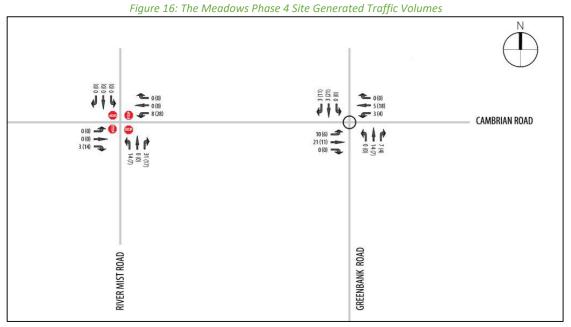


Source: 3718 Greenbank Road – Half Moon Bay South – Phase 5 Transportation Impact Assessment (CGH, 2019)



#### 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.

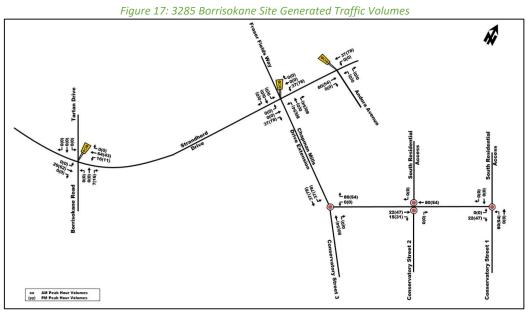


Source: The Meadows Phase 4 TIA Report (IBI, 2018)

#### 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.





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.

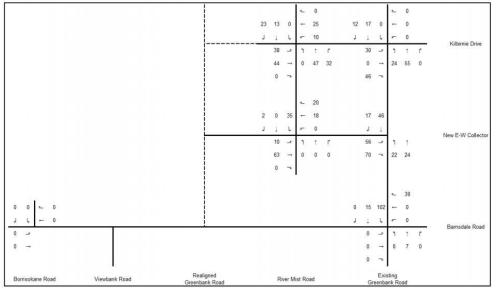


Figure 18: 3882 Barnsdale and 3960 Greenbank Road 2022 Site Generated Traffic Volumes – AM Peak Hour

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



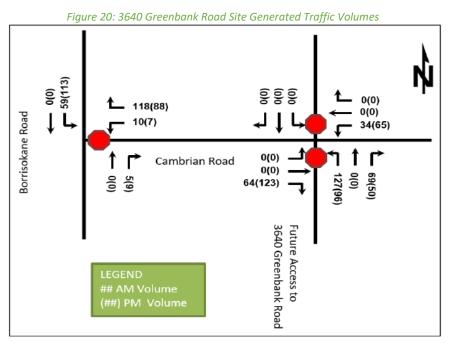
Borrisokane Road	Viewbank Road	Realigned Greenbank Road		Ri	ver Mi	st Ro	ad			Gr		sting ank Ri	oad		
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0 →										0		0	13	0	
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						-	0					*	0		

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.



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.

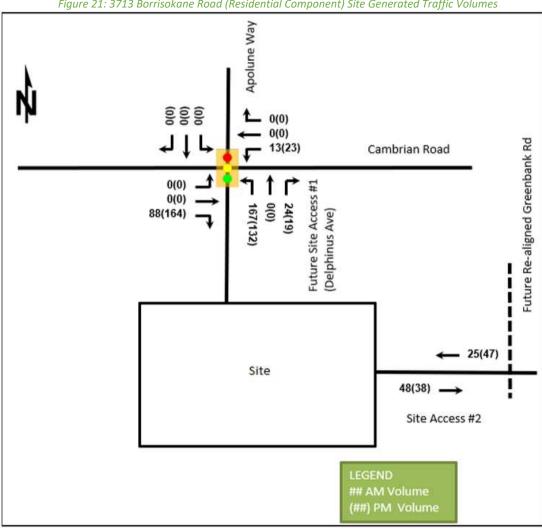


Figure 21: 3713 Borrisokane Road (Residential Component) Site Generated Traffic Volumes

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.



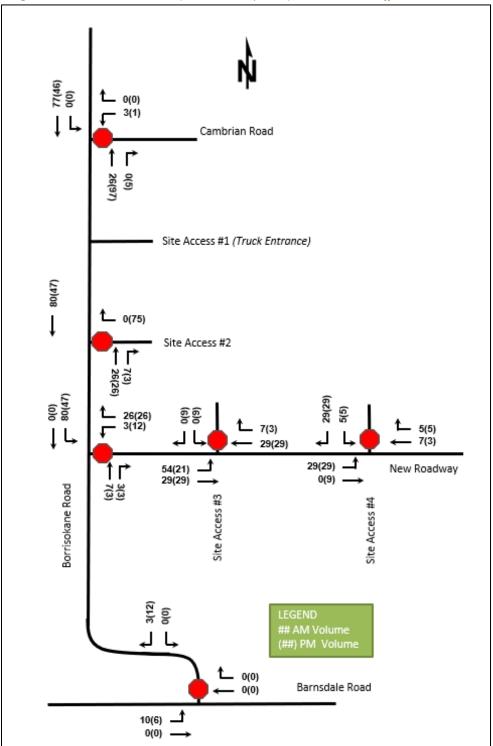
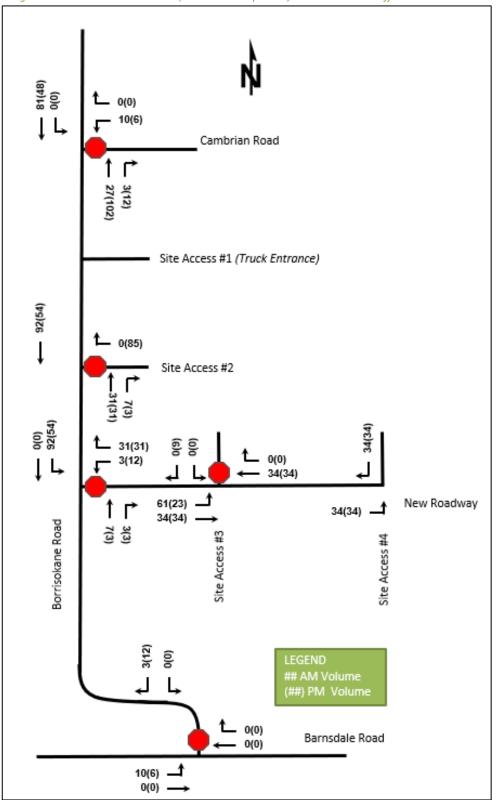


Figure 22: 3713 Borrisokane Road (Industrial Component) Site Generated Traffic Volumes – 2022

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





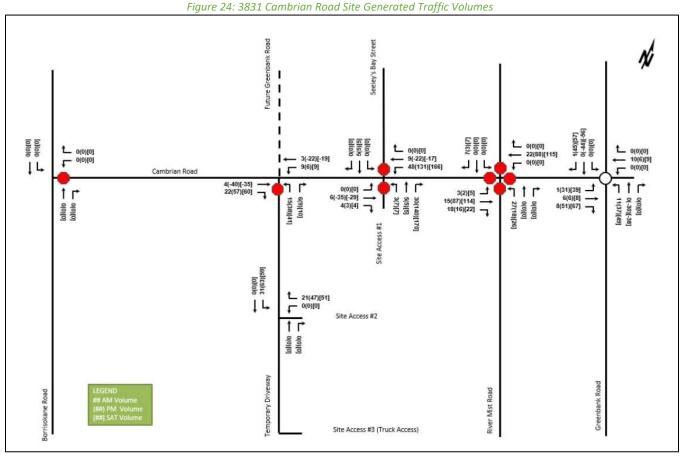


Source: 3713 Borrisokane Road – ABIC Manufacturing Facility Transportation Impact Assessment (CGH, 2020)



#### 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.



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				
<b>Design Review Compo</b>	nent						
4.1 Development	4.1.2 Circulation and Access	Only required for site plans	Exempt				
Design	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 Comp	onent						
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.

Travel Mode	Single-Detack	ned Dwellings	Multi-Unit (Low-Rise)			
Traver Mode	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%		

Table 5: TRANS Trip Generation Manual Recommended Mode Shares – South Nepear	Table 5: 1	RANS Trip G	Generation Mar	ual Recommende	ed Mode Shares ·	– South Nepean
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#### 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	210	AM	-	2.05
Dwellings	(TRANS)	PM	-	2.48
Multi-Unit (Low-Rise)	221 & 222	AM	-	1.35
Wulli-Offit (Low-Rise)	(TRANS)	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	AN	/I Peak Pe	eriod	PM Peak Period				
Land Ose	Units	In Out Total In					Total		
Single-Detached Dwellings	53	33	76	109	81	50	131		
Multi-Unit (Low-Rise)	545	221	515	736	482	379	861		

#### Table 7: Total De Trip Congration by Dack Daried

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.



Travel Mode			M Peak H		n by Would	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

Table 8: Trip Generation by Mode

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.

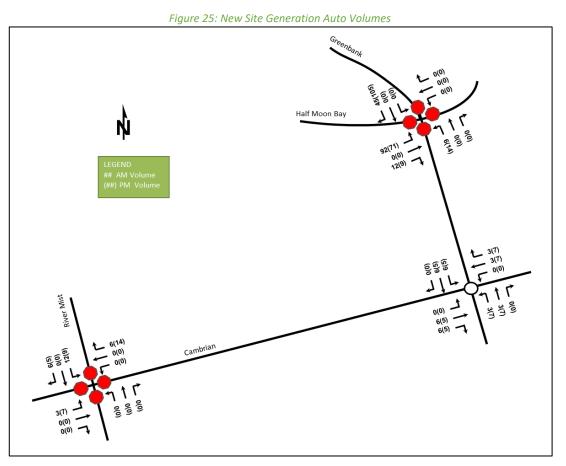
To/From	% of Trips
North	75%
South	10%
East	10%
West	5%
Total	100%

Table 0. OD Survey	Evicting	Directional	Split South	Nonoan
Table 9: OD Survey	EXISTING	Directional	Spiil South	Nepeun



### 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.



# 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.

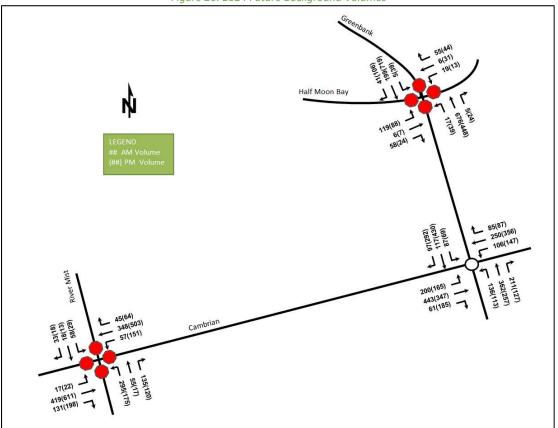
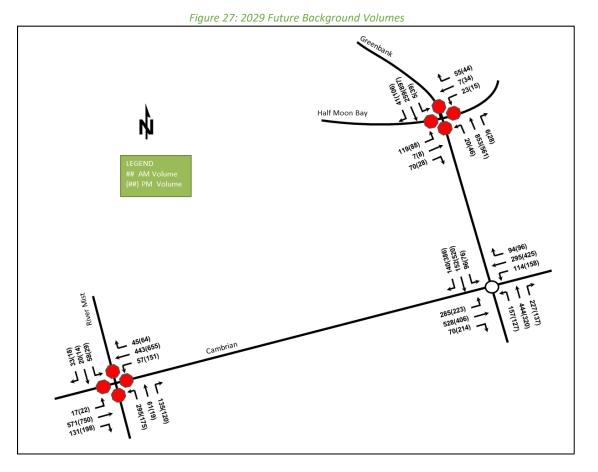


Figure 26: 2024 Future Background Volumes





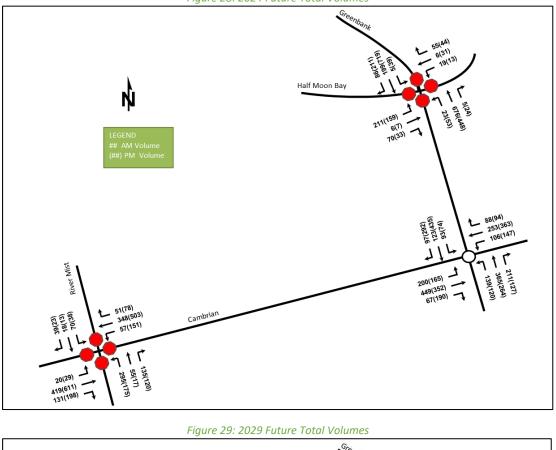
7 Demand Rationalization

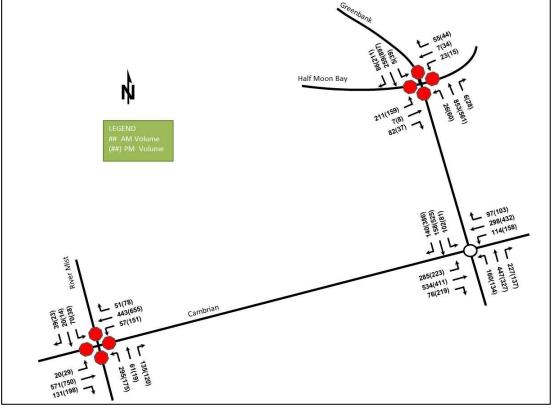
### 7.1 2024 Future Background Operations

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

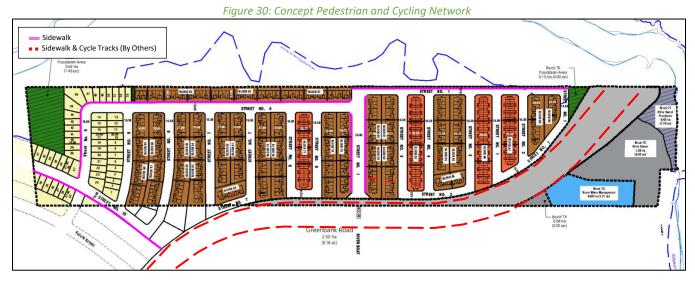




# 8 Development Design

### 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.



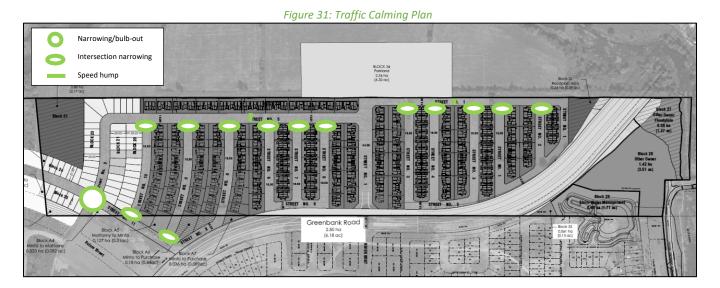
#### 8.2 New Street Networks

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.





#### 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.

West of Greenbank Road								
	PM Peak							
Development	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%				

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

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.

	North of C	Cambrian Road		
		PM F	Peak	
Development	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%

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				
Travel Mode		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 Inte	rsection Op	erations						
Intersection	Lane		AM Pe	ak Hour			PM Pe	ak Hour				
intersection	Lane	LOS	V/C	Delay	Q (95 <sup>th</sup> )	LOS	V/C	Delay	Q (95 <sup>th</sup> )			
	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	С	0.57	19.3	24.8			
	SBL/T/R	В	0.26	14.2	7.5	В	0.15	13.2	3.8			
River Mist	Overall	D	-	31.5	-	F	-	65.7	-			
Road &	Alternative Scenario: All-way Stop Control Replaced by a Two-way Stop Control on the Minor											
Cambrian				(north	/south) A	pproaches						
Road Unsignalized	EBL/T/R	А	0.02	8.5	0.0	А	0.02	8.2	0.8			
Unsignunzeu	WBL/T/R	А	0.06	8.5	1.5	А	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	-			
	EBL/T/R	В	0.36	13.1	12.0	В	0.28	13.4	7.5			
	WBL/T/R	В	0.16	10.8	4.5	В	0.20	12.3	5.3			
	NBL/T/R	Е	0.94	45.0	99.8	D	0.80	26.2	52.5			
Greenbank	SBL/T/R	В	0.38	12.4	13.5	F	1.22	137.2	219.8			
Road & Half	Overall	D	-	30.3	-	F	-	83.4	-			
Moon Bay		Alter	native Scena	ario: Signaliz	ation as p	er Justificatio	n 3 of OTM E	3ook 12				
Road	EBL/T/R	А	0.55	27.5	43.0	А	0.44	28.8	31.3			
Unsignalized	WBL/T/R	А	0.20	10.9	13.4	А	0.25	16.0	17.4			
	NBL/T/R	В	0.65	15.3	94.8	А	0.49	9.9	55.2			
	SBL/T/R	А	0.24	8.2	25.4	С	0.78	17.2	128.9			
	Overall	В	0.61	15.7	-	В	0.68	15.9	-			
Greenbank	EBL/T/R	С	0.72	19	76	E	0.89	40	103			
Road &	WBL/T/R	С	0.68	21	43	С	0.76	23	70			
Cambrian	NBL/T/R	F	1.08	88	248	С	0.66	18	45			
Road	SBL/T/R	В	0.42	11	15	F	1.09	86	303			
Roundabout	Overall	E	1.08	41	248	E	1.09	46	303			
Notes:	Saturation flow	w rate of 180	0 veh/h/lane			= metered queue						
	PHF = 0.90				# =	queue exceeds s	torage or mid-b	lock length				

Table 12: Existing Intersection Operatio



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. 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.



	1.000		AM Pe	ak Hour			PM Pe	ak Hour	
Intersection	Lane	LOS	V/C	Delay	Q (95 <sup>t</sup>	<sup>n</sup> ) LOS	V/C	Delay	Q (95 <sup>th</sup> )
	EBL	А	0.09	15.6	5.3	А	0.07	18.4	7.3
	EBT	D	0.83	35.7	82.0	E	0.91	46.2	#164.0
	EBR	А	0.24	4.2	9.2	A	0.29	3.9	12.5
<b>River Mist</b>	WBL	А	0.34	22.6	14.4	В	0.69	29.7	#29.1
Road &	WBT	В	0.68	26.9	63.9	A	0.57	19.4	90.4
Cambrian	WBR	А	0.10	5.3	5.5	A	0.09	3.4	5.9
Road	NBL	А	0.55	19.8	60.4	A	0.37	26.3	43.8
Signalized	NBT/R	А	0.27	6.0	17.0	A	0.23	6.8	14.6
	SBL	А	0.13	13.5	12.5	A	0.07	22.1	9.9
	SBT/R	А	0.08	7.2	7.6	А	0.05	13.1	7.6
	Overall	В	0.66	21.6	-	В	0.65	26.3	-
Greenbank	EBL/T/R	А	0.52	27.6	39.4	А	0.39	27.5	28.1
Road & Half	WBL/T/R	А	0.19	11.6	12.8	А	0.23	16.4	16.7
Moon Bay	NBL/T/R	В	0.68	15.3	102.7	' A	0.52	10.3	59.9
Road	SBL/T/R	А	0.24	7.7	25.1	D	0.83	19.9	#158.9
Signalized	Overall	В	0.62	15.4	-	В	0.70	17.2	-
Greenbank	EBL/T/R	D	0.88	31.2	160.1	. F	1.07	80.1	273.8
Road &	WBL/T/R	С	0.72	22.9	50.1	E	0.90	39.4	120.9
Cambrian	NBL/T/R	F	1.33	185.4	494.8	D	0.76	24.7	64.5
Road	SBL/T/R	В	0.44	11.5	17.1	F	1.33	178.8	548.8
Roundabout	Overall	F	1.33	77.5	494.8	B F	1.33	90.4	548.8
Notes:	Saturation flo	w rate of 180	0 veh/h/lane			n = metered queue			
	PHF = 1.0				#	= queue exceeds	storage or mid-b	lock length	

 Table 14: 2024 Future Background Intersection Operations

It has been noted that the 95<sup>th</sup> 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 95<sup>th</sup> 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 95<sup>th</sup> 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 95<sup>th</sup> 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.

Interception	Lana		AM Pe	ak Hour			PM Pe	ak Hour	
Intersection	Lane	LOS	V/C	Delay	Q (95 <sup>tl</sup>	') LOS	V/C	Delay	Q (95 <sup>th</sup> )
	EBL	А	0.09	15.4	5.4	A	0.10	19.1	7.6
	EBT	E	0.95	50.6	#142.4	4 F	1.03	70.2	#224.0
	EBR	А	0.21	3.8	9.2	A	0.27	3.7	12.5
<b>River Mist</b>	WBL	А	0.42	28.0	17.3	D	0.84	55.1	#48.3
Road &	WBT	С	0.73	27.7	87.9	С	0.71	23.1	133.4
Cambrian	WBR	А	0.09	5.1	5.5	А	0.08	3.3	5.9
Road	NBL	В	0.61	24.3	60.5	A	0.40	27.9	43.8
Signalized	NBT/R	А	0.31	6.8	17.8	A	0.24	7.0	14.9
	SBL	А	0.14	15.3	12.5	A	0.07	22.4	9.9
	SBT/R	А	0.09	7.8	7.9	A	0.06	13.3	7.9
	Overall	С	0.77	28.7	-	С	0.75	38.1	-
Greenbank	EBL/T/R	А	0.55	27.6	41.3	A	0.40	27.3	29.0
Road & Half	WBL/T/R	А	0.21	12.1	13.8	A	0.24	16.9	17.5
Moon Bay	NBL/T/R	D	0.86	24.2	#184.	2 B	0.66	13.4	88.2
Road	SBL/T/R	А	0.30	8.5	32.6	E	1.00	43.5	#236.6
Signalized	Overall	С	0.75	20.7	-	D	0.83	31.0	-
Greenbank	EBL/T/R	F	1.16	105.6	483.9	F	1.25	145.1	526.8
Road &	WBL/T/R	D	0.84	34.0	81.8	F	1.14	107.9	320.3
Cambrian	NBL/T/R	F	1.68	334.4	838.0	E	0.91	41.8	125.1
Road	SBL/T/R	С	0.59	16.0	33.0	F	1.69	335.3	1004.6
Roundabout	Overall	F	1.68	151.2	838.0	) <b>F</b>	1.69	177.9	1004.6
Notes:	Saturation flow	rate of 1800	veh/h/lane			= metered queue			
	PHF = 1.0				#	= queue exceeds st	orage or mid-b	lock length	

Table 15: 2029 Future Background Intersection Operations

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.

Interestion	Lana		AM Pe	ak Hour			PM Pe	ak Hour	
Intersection	Lane	LOS	V/C	Delay	Q (95 <sup>t</sup>	<sup>h</sup> ) LOS	V/C	Delay	Q (95 <sup>th</sup> )
	EBL	А	0.10	15.9	5.9	А	0.09	18.8	9.0
	EBT	D	0.83	35.7	82.0	E	0.91	46.2	#164.0
	EBR	А	0.24	4.2	9.2	A	0.29	3.9	12.5
<b>River Mist</b>	WBL	А	0.34	22.6	14.4	В	0.69	29.7	#29.1
Road &	WBT	В	0.68	26.9	63.9	A	0.57	19.4	90.4
Cambrian	WBR	А	0.11	5.1	5.9	A	0.10	3.2	6.5
Road	NBL	А	0.55	19.9	60.6	A	0.37	26.3	43.8
Signalized	NBT/R	А	0.27	6.0	17.0	A	0.23	6.8	14.6
	SBL	А	0.15	13.8	14.6	A	0.09	22.3	12.0
	SBT/R	А	0.09	6.8	7.9	A	0.06	12.1	8.2
	Overall	В	0.66	21.4	-	В	0.65	26.0	-
Greenbank	EBL/T/R	В	0.64	27.8	59.6	В	0.67	39.2	#53.4
Road & Half	WBL/T/R	А	0.15	8.8	11.1	A	0.23	16.4	16.7
Moon Bay	NBL/T/R	D	0.81	26.3	#149.	<b>4</b> A	0.57	11.4	65.9
Road	SBL/T/R	А	0.34	11.6	37.0	E	0.93	30.0	#211.0
Signalized	Overall	С	0.74	22.5	-	D	0.86	24.9	-
Greenbank	EBL/T/R	E	0.90	35.1	178.3	3 <b>F</b>	1.08	84.3	289.8
Road &	WBL/T/R	С	0.73	23.3	51.9	E	0.93	45.3	139.6
Cambrian	NBL/T/R	F	1.36	197.3	520.6	5 D	0.78	26.5	70.9
Road	SBL/T/R	В	0.46	11.9	18.8	F	1.36	194.2	586.6
Roundabout	Overall	F	1.36	82.3	520.6	5 F	1.36	97.6	586.6
Notes:	Saturation flow	rate of 1800	veh/h/lane			n = metered queue			
NULES.	PHF = 1.0				#	= queue exceeds s	torage or mid-b	lock length	

Table 16: 2024 Future Total Intersection Operations

It has been noted that the 95<sup>th</sup> 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 95<sup>th</sup> 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.

			AM Pe	ak Hour			PM Pea	ak Hour		
Intersection	Lane	LOS	V/C	Delay	Q (95 <sup>th</sup> )	LOS	V/C	Delay	Q (95 <sup>th</sup> )	
	EBL	А	0.10	15.7	6.0	А	0.13	19.7	9.4	
	EBT	E	0.95	50.6	#142.4	F	1.03	70.2	#224.0	
	EBR	А	0.21	3.8	9.2	А	0.27	3.7	12.5	
<b>River Mist</b>	WBL	А	0.42	28.0	17.3	D	0.84	55.1	#48.3	
Road &	WBT	С	0.73	27.7	87.9	С	0.71	23.1	133.4	
Cambrian	WBR	А	0.10	4.9	5.9	А	0.10	3.1	6.5	
Road	NBL	В	0.61	24.4	60.7	А	0.40	27.9	43.8	
Signalized	NBT/R	А	0.31	6.8	17.8	А	0.24	7.0	14.9	
	SBL	Α	0.17	15.7	14.6	А	0.10	22.8	12.0	
	SBT/R	Α	0.10	7.4	8.3	А	0.07	12.3	8.3	
	Overall	С	0.78	28.5	-	С	0.75	37.7	-	
	EBL/T/R	В	0.66	28.4	62.2	В	0.68	39.6	#54.8	
	WBL/T/R	Α	0.16	9.1	11.9	А	0.25	17.0	17.5	
	NBL/T/R	F	1.03	59.5	#213.8	С	0.71	15.3	98.4	
Greenbank	SBL/T/R	Α	0.41	13.0	47.3	F	1.10	76.6	#272.9	
Road & Half	Overall	D	0.87	41.0	-	E	0.99	51.4	-	
Moon Bay		Mitig	ation Measu	re: PM Pea	k Cycle Lengt	h Extension	from 80 s to	o 110 s		
Road	EBL/T/R	-	-	-	-	Е	0.95	95.0	#87.1	
Signalized	WBL/T/R	-	-	-	-	А	0.32	29.2	25.9	
	NBL/T/R	-	-	-	-	В	0.63	11.1	93.7	
	SBL/T/R	-	-	-	-	Е	0.96	33.1	#322.4	
	Overall	-	-	-	-	E	0.96	32.1	-	
Greenbank	EBL/T/R	F	1.19	117.6	521.6	F	1.26	150.2	546.1	
Road &	WBL/T/R	D	0.85	34.8	84.9	F	1.18	122.1	359.7	
Cambrian	NBL/T/R	F	1.68	334.8	845.0	E	0.93	46.0	140.3	
Road	SBL/T/R	С	0.61	16.8	35.8	F	1.70	341.2	1024.9	
Roundabout	Overall	F	1.68	155.0	845.0	F	1.70	184.5	1024.9	
Notes:	Saturation flo PHF = 1.0	ow rate of 18	300 veh/h/lan	e		m = metered queue # = queue exceeds storage or mid-block length				

Table 17: 2029 Future Total Intersection Operations

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.

Intersection	Horizon	Pedestrian LOS		Bicyc	Bicycle LOS		Transit LOS		Auto LOS	
Intersection	HOLIZON	PLOS	Target	BLOS	Target	TLOS	Target	ALOS	Target	
Greenbank	2024 FB							В		
Road & Half	2029 FB	D		D	D		_		С	
Moon Bay	2024 FT						D	В		
Road	2029 FT		с		D			С	D	
<b>•</b> • •	2024 FB		Ū					В		
Cambrian Road & River	2029 FB	E		F				D		
Mist Road	2024 FT	<u>د</u>		E E		D		D	_	
Wilst Noau	2029 FT							E		

Table 18: Study Area Intersection MMLOS Analysis—All Horizons

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 95<sup>th</sup> 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:

Reviewed By:

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



Mark Crockford, P. Eng. Senior Transportation Engineer



## Appendix A

TIA Screening Form and PM Certification Form



City of Ottawa 2017 TIA Guidelines Step 1 - Screening Form Date: Project Number: Project Reference: 20-Sep-21 2020-59 Minto Kennedy Lands

1.1 Description of Proposed Development	
Municipal Address	3432 Greenbank Road
	Located in Barrhaven South in the area bounded by
Description of Location	the Jock River, the realigned Greenbank Road, and
	the future Proxima Terrace
Land Use Classification	DR
Development Size	598 Units
Assesses	One access at Perseus Avenue and one access at
Accesses	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	No					
Bicycle Networks?						
Is the development in a Design Priority Area (DPA) or Transit-oriented	No					
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	Νο
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,	No
or within 150 m of intersection in urban/ suburban conditions)?	
Is the proposed driveway within auxiliary lanes of an intersection?	No
Does the proposed driveway make use of an existing median break that	No
serves an existing site?	NO
Is there is a documented history of traffic operations or safety concerns on	No
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<sup>1</sup> or registered<sup>2</sup> professional in good standing, whose field of expertise [check  $\sqrt{}$  appropriate field(s)] is either transportation engineering  $\sqrt{}$  or transportation planning  $\Box$ .

<sup>1,2</sup> 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	<u>Newmarket</u>	this	<u>14th</u>	_ 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

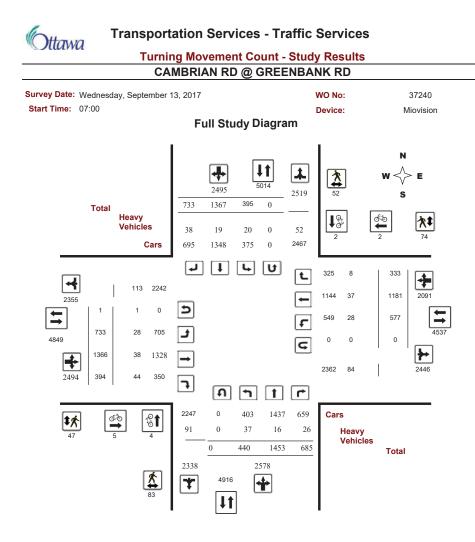
Telephone / Extension: (905) 251-4070

E-Mail Address: Mark.Crockford@CGHTransportation.com





Traffic Data





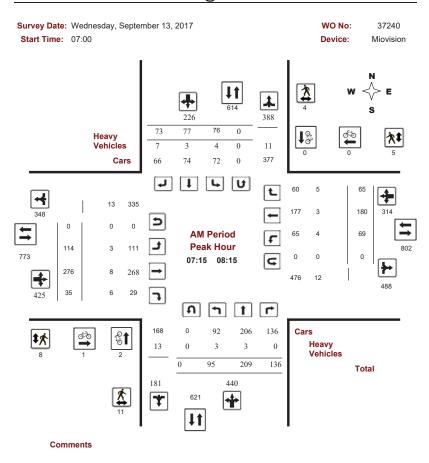
Turning Movement Count - Study Results CAMBRIAN RD @ GREENBANK RD

Survey Date: \ Start Time: (							WO No: Device:	37240 Miovision	
	Total	Heavy Vehicles Cars	Full S	<b>5</b> 39	<b>eak Hou</b> <b>900</b> 60 0 1 0 59 0	r Diag	18 18 0	N W ← E S 1 1	
451 451 870 870 419	0 87 230 102	4 447 0 0 2 85 4 226 4 98	ר ר ו		Study Hour: 18:00	L L U	76     0       232     0       99     0       0     0       371     6	76       232       407       99       0       784       377	
<b>\$</b>	ब्रैटे <b>1</b>		507	0	49     197       4     1       53     198	86 1 87	Cars Heavy Vehicl	es Total	
		29	514	852	338				

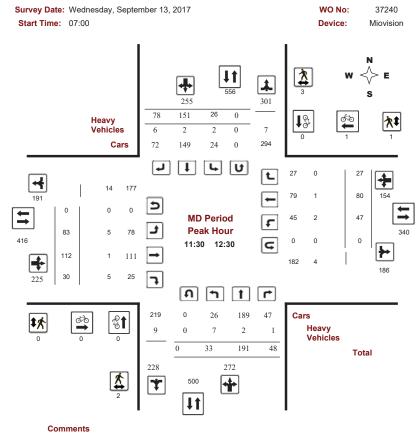


#### **Turning Movement Count - Peak Hour Diagram**

#### CAMBRIAN RD @ GREENBANK RD



# Transportation Services - Traffic Services Turning Movement Count - Peak Hour Diagram CAMBRIAN RD @ GREENBANK RD



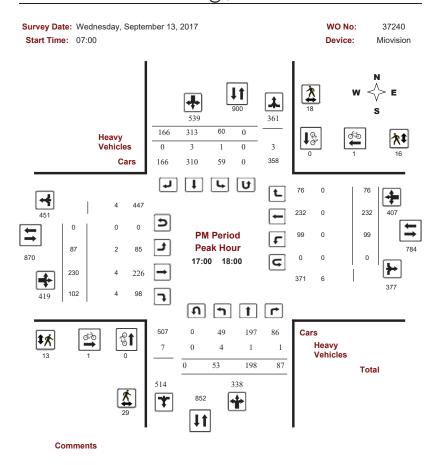
2020-Jul-14

2020-Jul-14



**Turning Movement Count - Peak Hour Diagram** 

#### CAMBRIAN RD @ GREENBANK RD



/	
(r	14-
Me	Ittawa

#### **Transportation Services - Traffic Services**

					CA	MBF	RIAN	RD	@ G	REE	ENB/	ANK	RD						
Survey D	ate:	Wedne	sday,	Septer	nber <sup>-</sup>	13, 20 <sup>-</sup>	17					wo	No:			37	240		
Start Tin	ne:	07:00										Devi	ce:	Miovision					
				F	ull	Stud	y Su	Imma	ary (8	B HF	R Sta	ndar	d)						
Survey Da	ate:	Wedne	esday	Septe	mber	13,		1	Fotal C	bser	ved U-						AAD	T Facto	or
		2017						lorthbou	0			nbound:	0				1.00		
							I	Eastbour	nd: 1		vves	tbound:	0				1.00		
	N	orthbou	ind		So	uthbou	und			E	Eastbou	Ind		V	/estboi	und			
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	Grar Tot
07:00 08:00	80	242	147	469	69	81	68	218	687	136	254	32	422	65	144	60	269	691	13
00:00 09:00	89	198	117	404	73	101	78	252	656	86	232	46	364	66	190	37	293	657	13
09:00 10:00	70	174	64	308	33	95	57	185	493	104	110	20	234	56	81	34	171	405	8
11:30 12:30	33	191	48	272	26	151	78	255	527	83	112	30	225	47	80	27	154	379	90
12:30 13:30	25	123	52	200	36	145	63	244	444	58	102	29	189	55	103	13	171	360	8
15:00 16:00	52	148	84	284	47	223	89	359	643	73	146	71	290	83	145	38	266	556	11
6:00 17:00	38	179	86	303	51	258	134	443	746	106	180	64	350	106	206	48	360	710	14
17:00 18:00	53	198	87	338	60	313	166	539	877	87	230	102	419	99	232	76	407	826	17
Sub Total	440	1453	685	2578	395	1367	733	2495	5073	733	1366	394	2493	577	1181	333	2091	4584	96
U Turns				0				0	0				1				0	1	
Total	440	1453	685	2578	395	1367	733	2495	5073	733	1366	394	2494	577	1181	333	2091	4585	96
EQ 12Hr lote: These v	612 alues/	2020 are calcu	952 Ilated b	3583 y multipl <sup>,</sup>	549 /ing the	1900 totals b	1019 by the ap	3468 opropriate	7051 e expans	1019 sion fac	1899 tor.	548	3467	802 1.39	1642	463	2906	6373	134
AVG 12Hr	576	1903	897	3377	517	1791	960	3268	7051	960	1789	516	3267	756	1547	436	2739	6373	134
lote: These v	/olume	s are cal	culated	by multi	olying t	he Equiv	alent 1	2 hr. tota	Is 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	165

Ottawa	Transportation Services - Traffic Services							
Juama	Turning Movement Co	ount - Study Results						
	CAMBRIAN RD @	GREENBANK RD						
Survey Date: Wed	nesday, September 13, 2017	WO No:	37240					
Start Time: 07:00	)	Device:	Miovision					
	Full Study 15 I	Vinute Increments						

		N	orthbo	und		Sc	outhbou	nd		Eastbound				We	estbour	nd				
Time I	Period	LT	ST	RT	N TOT	LT	ST	RT	S TOT	STR TOT	LT	ST	RT	Е ТОТ	LT	ST	RT	W тот	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
8:30 08:45	0	0	0	0	0	0	0
08:45 09:00	0	0	0	0	0	0	0
9:00 09:15	0	0	0	0	0	0	0
9:15 09:30	0	0	0	0	0	0	0
9:30 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
2:15 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
3:00 13:15	0	0	0	0	0	0	0
13:15 13:30	0	0	0	0	0	0	0
5:00 15:15	0	0	0	0	0	0	0
5:15 15:30	0	0	0	0	0	0	0
5:30 15:45	0	0	0	1	0	1	1
5:45 16:00	2	0	2	0	0	0	2
6:00 16:15	0	0	0	0	0	0	0
6:15 16:30	0	0	0	0	0	0	0
6:30 16:45	0	0	0	0	0	0	0
6:45 17:00	0	2	2	0	0	0	2
7:00 17:15	0	0	0	0	0	0	0
7:15 17:30	0	0	0	0	1	1	1
7:30 17:45	0	0	0	0	0	0	0
7:45 18:00	0	0	0	1	0	1	1
Total	4	2	6	5	2	7	13

Transportation Services - Traffic Services												
Juan	U	Turning	Movem	ent Count - S	Study Resul	ts						
		CAME	BRIAN F	RD @ GREE	NBANK RD							
Survey Date:	Wednesday	/, September 13, 2	2017		WO No:		37240					
Start Time:	07:00				Device:		Miovision					
		F	ull Stud	y Pedestriar	n Volume							
Time Period NB Approach SB Approach Total EB Approach WB Approach Total Grand Total (N or S Crossing) (N or S Crossing)												
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					
08:30 08:45	1	0	3	3	0	3	5 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 13:00 13:15	1	1	2	0	0	0	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					



#### 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	

		N	orthbo	und		So	outhbou	ind		Eastbound					Westbound					
Time I	Period	LT	ST	RT	N TOT	LT	ST	RT	S TOT	STR TOT	LT	ST	RT	Е ТОТ	LT	ST	RT	W тот	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

Ottawa	Transportation Services - Traffic Services						
Junna	Turning Movement Count - Study Results						
CAMBRIAN RD @ GREENBANK RD							
Survey Date: Wed	nesday, September 13, 2017	WO No:	37240				
Start Time: 07:00	)	Device:	Miovision				
	Full Study 15 M	Ainute U-Turn Total					

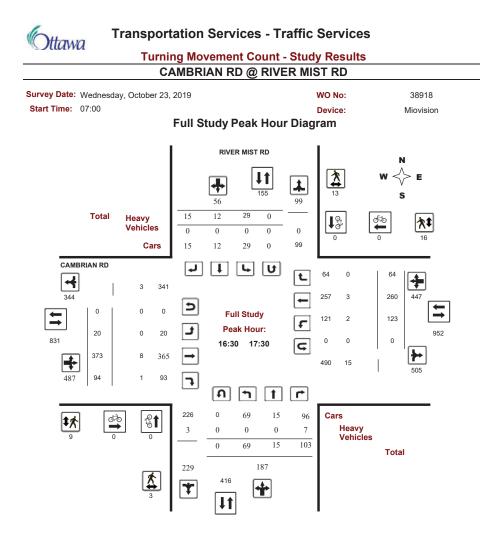
Full Study	y 15 Minute	U-Turn	l otal
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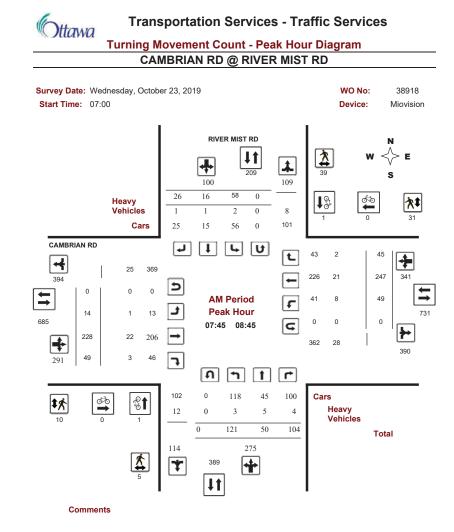
Time I	Period	Northbound U-Turn Total	Southbound U-Turn Total	Eastbound U-Turn Total	Westbound U-Turn Total	Total
07:00	07:15	0	0	0	0	0
07:15	07:30	0	0	0	0	0
07:30	07:45	0	0	0	0	0
07:45	08:00	0	0	0	0	0
08:00	08:15	0	0	0	0	0
08:15	08:30	0	0	0	0	0
08:30	08:45	0	0	0	0	0
08:45	09:00	0	0	1	0	1
09:00	09:15	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
Te	otal	0	0	1	0	1



Turning Movement Count - Study Results CAMBRIAN RD @ RIVER MIST RD

Survey Date: Wed		ay, Octob	oer 23,	2019					WO No:		38918	
Start Time: 07:0	0			Fι	ıll Stu	ıdy D	iagra		Device:	М	liovision	
						ER MIST						
										N A		
					495	1	030	535		w <>>	►E	
т	otal			146	88	261	0			s	_	
		Heavy Vehicle	s	5	3	8	0	21	18	<i>6</i> ™ <b>←</b>	<b>★</b>	
		c	ars	141	85	253	0	514	4	2	164	
	N RD			Ŀ	I	L.	U	L	282 8	290		
2316		112	2204						1521 91	1612	2460	
	0	0	0	5					519 39	558	<b></b>	
4682	115	7	108	E				F	0 0	0	5293	
<b>•</b>	1838	111	1727	→				ç		1 1	₩	
	413	18	395	<b>–</b>					2671 162		2833	
					٩	1	1					
<b>\$</b>	đ		81	1000	1	542	124	691	Cars			
92	2		6	60	0	16 558	6 130	43	Heavy Vehicle			
				1060			423	/ 34		Total		
			\$	*	2483	6						
		-	33		ļţ							





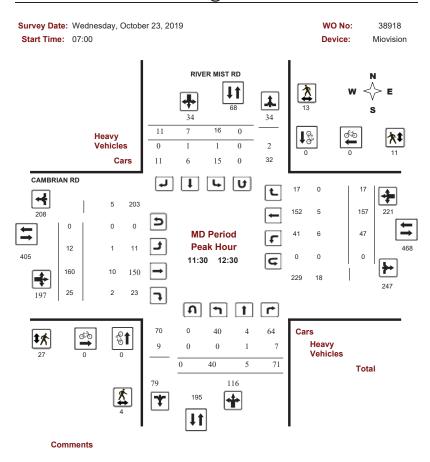
Page 2 of 8

2020-Jul-14



#### **Turning Movement Count - Peak Hour Diagram**

#### CAMBRIAN RD @ RIVER MIST RD



Ottawa **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 RIVER MIST RD Ν 13 ļţ <> E w ♣ \* 155 s 56 99 15 12 29 0 13 ক্⊅ • ☆‡ Heavy Vehicles 0 0 0 0 0 16 29 99 Cars 15 12 0 CAMBRIAN RD L. Ŧ L. U 64 0 Ł 64 4 4 3 341 260 447 257 3 344 |← 5 ţţ 0 0 0 ţţ 123 PM Period 121 2 F t Peak Hour 20 0 20 952 831 G 0 0 0 16:30 17:30 ₩ 373 8 -365 + 490 15 505 F 94 1 93 487 ค 1 1 1 226 69 15 96 Cars 0 ്ര **ന**്ത 81 **\$** Heavy 3 0 0 0 7 Vehicles 0

69

416

11

0

229

\*

15

187

4

103

2020-Jul-14

2020-Jul-14

Comments

Total

Wedne 07:00 Wedn Northbou	esday	Octobe <b>F</b>	CA er 23, 2 Full S	MBI 2019 Stud	RIAI	ment N RD				-	RD	lts		38	918		
07:00 Wedn	esday	<b>F</b> , Octob	er 23, 2 F <b>ull S</b>	2019 Stud			@ R	IVE	R MI					38	918		
07:00 Wedn	esday	<b>F</b> , Octob	ull S	Stud	y Sı	ımma				wo	No:			38	918		
Wedn	RIVE	, Octob			y Sı	ımma											
Northbo	RIVE	, Octob			y Sı	imma				Devi	ce:			Miov	vision		
Northbo	RIVE		er 23,	201			ary (8	B HR	t Sta	ndaı	rd)						
		R MIS				1	Total O	bserv	ved U-	Turns					AAD	Facto	or
		RMIS			Ν	lorthbour	nd: 1		South	bound:	0				.90		
		R MIS			I	Eastbour	nd: 0		West	bound:	0						
	und										1BRIA	N RD					
г st		NB	Soι	uthbou	nd	SB	STR		astbou		EB		/estboi	und	WB	STR	Gran
	RT	TOT	LT	ST	RT	TOT	TOT	LT	ST	RT	TOT	LT	ST	RT	тот	TOT	Tota
2 19	133	264	42	6	25	73	337	12	198	38	248	35	227	35	297	545	88
3 47	100	260	54	19	25	98	358	13	226	45	284	56	246	36	338	622	98
2 9	107	198	22	10	16	48	246	9	149	28	186	46	173	21	240	426	67
0 5	71	116	16	7	11	34	150	12	160	25	197	47	157	17	221	418	56
4 6	55	85	11	1	14	26	111	8	150	34	192	41	140	26	207	399	51
7 17	80	154	50	15	20	85	239	17	229	65	311	85	167	38	290	601	84
1 13	87	161	32	15	15	62	223	20	371	76	467	121	254	54	429	896	111
9 14	101	184	34	15	20	69	253	24	355	102	481	127	248	63	438	919	117:
8 130	734	1422	261	88	146	495	1917	115	1838	413	2366	558	1612	290	2460	4826	674
		1				0	1				0				0	0	1
8 130	734	1423	261	88	146	495	1918	115	1838	413	2366	558	1612	290	2460	4826	674
6 181 s are calc	1020 ulated b	1978 v multiply	363 vina the	122 totals b	203 v the a	688 ppropriate	2666 e expans	160 ion fact	2555	574	3289	776 1.39	2241	403	3419	6708	9374
			-							407	2700		1001	240	2000	6027	843
										407	2190	0.9	1901	342	2900	003/	043
2 201	1134	2198	403	136	225	765	2963	178	2839	638	3654	862	2490	448	3799	7453	1041
es are ca	lculated	by multip	olying th	ie Avera	ige Dai	y 12 hr. 1	totals by	12 to 24	4 expans	sion fact	or.	1.31					
	3         47           2         9           0         5           4         6           7         17           1         13           3         130	3         47         100           2         9         107           0         5         71           4         6         55           7         17         80           1         13         87           9         14         101           3         130         734           6         181         1020           6         are calculated b         3           3         153         865           es are calculated         201         1134	3         47         100         260           2         9         107         198           0         5         71         116           4         6         55         85           7         17         80         154           1         13         87         161           9         14         101         184           3         130         734         1422           1         130         87         161           3         130         734         1422           1         1020         1978           6         181         1020         1978           8         are calculated by multiply         3         153           3         153         865         1678           es are calculated by multiply         2         201         1134         2198           es are calculated by multiply         2         134         2198	3       47       100       260       54         2       9       107       198       22         0       5       71       116       16         4       6       55       85       11         7       17       80       154       50         1       13       87       161       32         9       14       101       184       34         3       130       734       1422       261         1       130       734       1423       261         5       181       1020       1978       363         6       153       865       1678       308         9       153       865       1678       308         9       153       865       1678       308         9       153       865       1678       308         9       153       865       1678       308         9       153       865       1678       308	3       47       100       260       54       19         2       9       107       198       22       10         0       5       71       116       16       7         4       6       55       85       11       1         7       17       80       154       50       15         1       13       87       161       32       15         3       130       734       1422       261       88         T         3       130       734       1423       261       88         6       1978       363       122         a real-culated by multiplying the totals b         3       153       865       1678       308       104         es are calculated by multiplying the Equiv         2       201       134       2198       403       136         es are calculated by multiplying the Avera	47         100         260         54         19         25           2         9         107         198         22         10         16           0         5         71         116         16         7         11           4         6         55         85         11         1         14           7         17         80         154         50         15         20           1         13         87         161         32         15         15           9         14         101         184         34         15         20           3         130         734         1422         261         88         146           5         181         1020         1978         363         122         203           3         130         734         1422         261         88         146           5         181         1020         1978         363         122         203           3         153         865         1678         308         104         172           es are calculated by multiplying the totals by the ap         3         153	3       47       100       260       54       19       25       98         2       9       107       198       22       10       16       48         0       5       71       116       16       7       11       34         4       6       55       85       11       1       14       26         7       17       80       154       50       15       20       85         1       13       87       161       32       15       15       62         9       14       101       184       34       15       20       69         3       130       734       1422       261       88       146       495         5       181       1020       1978       363       122       203       688         3       153       865       1678       308       104       172       584         es are calculated by multiplying the totals by the appropriate appr	3       47       100       260       54       19       25       98       358         2       9       107       198       22       10       16       48       246         0       5       71       116       16       7       11       34       150         4       6       55       85       11       1       14       26       111         7       17       80       154       50       15       20       85       239         1       13       87       161       32       15       15       62       223         9       14       101       184       34       15       20       69       253         3       130       734       1422       261       88       146       495       1917         7       7       10       17       9       363       122       203       688       2666         3       130       734       1423       261       88       146       495       1918         5       181       1020       1978       363       122       203       688       2666	3       47       100       260       54       19       25       98       358       13         2       9       107       198       22       10       16       48       246       9         0       5       71       116       16       7       11       34       150       12         4       6       55       85       11       1       14       26       111       8         7       17       80       154       50       15       20       85       239       17         1       13       87       161       32       15       15       62       223       20         9       14       101       184       34       15       20       69       253       24         3       130       734       1422       261       88       146       495       1917       115         5       181       1020       1978       363       122       203       688       2666       160         5       181       1020       1978       363       122       203       688       2666       160	3       47       100       260       54       19       25       98       358       13       226         2       9       107       198       22       10       16       48       246       9       149         0       5       71       116       16       7       11       34       150       12       160         4       6       55       85       11       1       14       26       111       8       150         7       17       80       154       50       15       20       85       239       17       229         1       13       87       161       32       15       15       62       223       20       371         9       14       101       184       34       15       20       69       253       24       355         3       130       734       1422       261       88       146       495       1917       115       1838         5       181       1020       1978       363       122       203       688       2666       160       2555         5       3130	3       47       100       260       54       19       25       98       358       13       226       45         2       9       107       198       22       10       16       48       246       9       149       28         0       5       71       116       16       7       11       34       150       12       160       25         4       6       55       85       11       1       14       26       111       8       150       34         7       17       80       154       50       15       20       85       239       17       229       65         1       13       87       161       32       15       15       62       223       20       371       76         9       14       101       184       34       15       20       69       253       24       355       102         3       130       734       1422       261       88       146       495       1917       115       1838       413         5       181       1020       1978       363       122 <t< td=""><td>3       47       100       260       54       19       25       98       358       13       226       45       284         2       9       107       198       22       10       16       48       246       9       149       28       186         0       5       71       116       16       7       11       34       150       12       160       25       197         4       6       55       85       11       1       14       26       111       8       150       34       192         7       17       80       154       50       15       20       85       239       17       229       65       311         1       13       87       161       32       15       15       62       223       20       371       76       467         9       14       101       184       34       15       20       69       253       24       355       102       481         3       130       734       1422       261       88       146       495       1917       115       1838       413       <td< td=""><td>3       47       100       260       54       19       25       98       358       13       226       45       284       56         2       9       107       198       22       10       16       48       246       9       149       28       186       46         0       5       71       116       16       7       11       34       150       12       160       25       197       47         4       6       55       85       11       1       14       26       111       8       150       34       192       41         7       17       80       154       50       15       20       85       239       17       229       65       311       85         1       13       87       161       32       15       15       62       223       20       371       76       467       121         9       14       101       184       34       15       20       69       253       24       355       102       481       127         3       130       734       1423       261       88</td></td<></td></t<> <td>3       47       100       260       54       19       25       98       358       13       226       45       284       56       246         2       9       107       198       22       10       16       48       246       9       149       28       186       46       173         0       5       71       116       16       7       11       34       150       12       160       25       197       47       157         4       6       55       85       11       1       14       26       111       8       150       34       192       41       140         7       77       80       154       50       15       20       85       239       17       229       65       311       85       167         1       13       87       161       32       15       15       62       223       20       371       76       467       121       254         9       14       101       184       34       15       20       69       253       24       355       102       481       127       248&lt;</td> <td>3       47       100       260       54       19       25       98       358       13       226       45       284       56       246       36         2       9       107       198       22       10       16       48       246       9       149       28       186       46       173       21         0       5       71       116       16       7       11       34       150       12       160       25       197       47       157       17         4       6       55       85       11       1       14       26       111       8       150       34       192       41       140       26         7       17       80       154       50       15       20       85       239       17       229       65       311       85       167       38         1       13       87       161       32       15       15       62       223       20       371       76       467       121       254       54         9       14       101       184       34       15       20       69       253</td> <td>3       47       100       260       54       19       25       98       358       13       226       45       284       56       246       36       338         2       9       107       198       22       10       16       48       246       9       149       28       186       46       173       21       240         0       5       71       116       16       7       11       34       150       12       160       25       197       47       157       17       221         4       6       55       85       11       1       144       26       111       8       150       34       192       41       140       26       207         7       17       80       154       50       15       20       85       239       17       229       65       311       85       167       38       290         1       13       87       161       32       15       15       62       223       20       371       76       467       121       254       54       429         9       14       101&lt;</td> <td>3       47       100       260       54       19       25       98       358       13       226       45       284       56       246       36       338       622         2       9       107       198       22       10       16       48       246       9       149       28       186       46       173       21       240       426         0       5       71       116       16       7       11       34       150       12       160       25       197       47       157       17       221       418         4       6       55       85       11       1       14       26       111       8       150       34       192       41       140       26       207       399         7       17       80       154       50       15       20       85       239       17       229       65       311       85       167       38       290       601         1       13       87       161       32       15       15       62       223       20       371       76       467       121       246       4</td>	3       47       100       260       54       19       25       98       358       13       226       45       284         2       9       107       198       22       10       16       48       246       9       149       28       186         0       5       71       116       16       7       11       34       150       12       160       25       197         4       6       55       85       11       1       14       26       111       8       150       34       192         7       17       80       154       50       15       20       85       239       17       229       65       311         1       13       87       161       32       15       15       62       223       20       371       76       467         9       14       101       184       34       15       20       69       253       24       355       102       481         3       130       734       1422       261       88       146       495       1917       115       1838       413 <td< td=""><td>3       47       100       260       54       19       25       98       358       13       226       45       284       56         2       9       107       198       22       10       16       48       246       9       149       28       186       46         0       5       71       116       16       7       11       34       150       12       160       25       197       47         4       6       55       85       11       1       14       26       111       8       150       34       192       41         7       17       80       154       50       15       20       85       239       17       229       65       311       85         1       13       87       161       32       15       15       62       223       20       371       76       467       121         9       14       101       184       34       15       20       69       253       24       355       102       481       127         3       130       734       1423       261       88</td></td<>	3       47       100       260       54       19       25       98       358       13       226       45       284       56         2       9       107       198       22       10       16       48       246       9       149       28       186       46         0       5       71       116       16       7       11       34       150       12       160       25       197       47         4       6       55       85       11       1       14       26       111       8       150       34       192       41         7       17       80       154       50       15       20       85       239       17       229       65       311       85         1       13       87       161       32       15       15       62       223       20       371       76       467       121         9       14       101       184       34       15       20       69       253       24       355       102       481       127         3       130       734       1423       261       88	3       47       100       260       54       19       25       98       358       13       226       45       284       56       246         2       9       107       198       22       10       16       48       246       9       149       28       186       46       173         0       5       71       116       16       7       11       34       150       12       160       25       197       47       157         4       6       55       85       11       1       14       26       111       8       150       34       192       41       140         7       77       80       154       50       15       20       85       239       17       229       65       311       85       167         1       13       87       161       32       15       15       62       223       20       371       76       467       121       254         9       14       101       184       34       15       20       69       253       24       355       102       481       127       248<	3       47       100       260       54       19       25       98       358       13       226       45       284       56       246       36         2       9       107       198       22       10       16       48       246       9       149       28       186       46       173       21         0       5       71       116       16       7       11       34       150       12       160       25       197       47       157       17         4       6       55       85       11       1       14       26       111       8       150       34       192       41       140       26         7       17       80       154       50       15       20       85       239       17       229       65       311       85       167       38         1       13       87       161       32       15       15       62       223       20       371       76       467       121       254       54         9       14       101       184       34       15       20       69       253	3       47       100       260       54       19       25       98       358       13       226       45       284       56       246       36       338         2       9       107       198       22       10       16       48       246       9       149       28       186       46       173       21       240         0       5       71       116       16       7       11       34       150       12       160       25       197       47       157       17       221         4       6       55       85       11       1       144       26       111       8       150       34       192       41       140       26       207         7       17       80       154       50       15       20       85       239       17       229       65       311       85       167       38       290         1       13       87       161       32       15       15       62       223       20       371       76       467       121       254       54       429         9       14       101<	3       47       100       260       54       19       25       98       358       13       226       45       284       56       246       36       338       622         2       9       107       198       22       10       16       48       246       9       149       28       186       46       173       21       240       426         0       5       71       116       16       7       11       34       150       12       160       25       197       47       157       17       221       418         4       6       55       85       11       1       14       26       111       8       150       34       192       41       140       26       207       399         7       17       80       154       50       15       20       85       239       17       229       65       311       85       167       38       290       601         1       13       87       161       32       15       15       62       223       20       371       76       467       121       246       4



#### **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 LT ST RT S STR TOT TOT W STR TOT TOT LT ST RT E LT ST Grand RT Total 33 61 203 07:00 07:15 10 14 50 60 24 68 212 22 37 64 10 19 64 07.30 07:45 28 30 63 13 22 2 43 11 58 223 12 80 8 244 07.45 08:00 38 5 33 76 9 2 18 2 52 11 66 63 13 84 7 3 12 257 28 72 20 57 74 12 65 08:00 08:15 32 12 9 10 5 5 14 91 08:30 33 22 83 26 56 10 274 08:15 28 6 6 38 5 4 70 10 58 15 83 08:30 08:45 21 44 14 24 4 63 16 81 19 61 232 83 08:45 29 61 16 50 59 62 217 09.00 09:15 32 52 91 9 18 4 49 12 62 13 66 84 255 09:15 09:30 18 18 36 a 14 38 3 46 13 38 5 56 152 Ω 0 5 37 3 13 34 142 09:30 09:45 14 1 26 41 2 1 6 1 1 41 7 54 123 09:45 11 30 25 10 37 7 10:00 18 1 2 2 10 2 35 4 46 158 11:30 11.45 16 21 37 38 10 50 13 46 10 61 11:45 8 16 39 4 45 10 41 128 12:00 11 56 12:00 12:15 9 20 32 10 47 5 54 12 41 4 153 3 7 2 2 57 129 12.15 12:30 8 22 31 2 1 0 3 5 6 36 6 48 12 29 6 47 1 138 12:30 12:45 10 2 16 29 2 0 5 7 1 2 41 6 49 8 38 7 53 12:45 128 13:00 0 7 14 6 1 4 11 1 40 12 53 12 36 2 50 13:00 13:15 17 22 6 33 8 44 10 30 118 3 2 0 4 3 3 6 46 13:15 13:30 15 21 36 8 46 11 36 127 2 2 0 2 11 58 15:15 11 23 28 61 11 76 18 37 192 197 15:30 14 26 12 26 2 52 16 71 25 40 16 45 213 15:45 12 23 37 17 67 18 91 15.30 4 32 68 238 16:00 49 73 26 15.45 28 14 20 45 12 24 45 30 285 91 63 248 18 29 99 6:1 75 63 23 42 142 29 309 16:30 16:45 17 119 18 65 14 16:45 22 45 86 20 111 35 63 14 277 17:00 19 9 112 300 17.00 17.15 13 40 58 8 17 2 6 83 31 120 24 67 14 105 17:15 17:30 21 18 42 13 2 4 85 25 114 35 65 22 122 291 8 2 2 17:45 21 36 24 105 23 133 36 58 16 303 17:30 12 10 5 3 5 110 3 17:45 18:00 23 22 48 9 82 23 114 278 8 15 2 32 58 11 3 4 3 101 558 130 734 1423 261 88 146 495 81 115 1838 413 2366 558 1612 290 2460 81 6,744 Total: Note: U-Turns are included in Totals.

Ottawa
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#### **Turning Movement Count - Study Results**

CAMBRIAN RD	@ RIVER MIST RD
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Survey Dat	e: Wednesda	y, October 23, 2	019		WO No:		38918
Start Time	07:00				Device:		Viovision
			Full Study	Cyclist V	olumo		
		RIVER MIST RE		Oyenst V	CAMBRIAN RI	n	
Time Period	Northbound	Southbound	Street Total	Eastbound	Westbound	Street Total	Grand Total
07:00 07:15	0	0	O	0	westbound	1	Grand Total
07:00 07:15	0	0	0	0	0		0
07:15 07:30	1	0	1	1	0	0	2
07:45 08:00	0	0	0	0	0	0	0
07:45 08:00	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**

		CAM	BRIAN	RD @ RIVE	R MIST RD			
Survey Date	Wednesda	y, October 23, 201	9		WO No:		38918	
Start Time:	07:00				Device:		Miovision	
		-		ly Pedestria			NIIO VIOIOIT	
				iy Peuesilla				
		RIVER MIST RE	)		CAMBRIAN RD			
	NB Approach 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	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	

	ttav	m						•	001	VIC	es -	119	ITTIC	, Se	IVIC	,es				
					Т	urn	ing	Mov	eme	ent (	Cou	nt - 3	Stud	dy R	esu	lts				
						С	AM	BRI	AN I	RD (	@ R	VE	R M	ST	RD					
Survey Date: Wednesday, October 23, 2019 WO No: 38918																				
Start <sup>-</sup>	Time	: 07	<b>7</b> :00											Dev	ice:			Mie	ovisior	ı
							F	ull S	stud	у Не	avy	Veł	nicle	s						
				RIVE	r Mis	T RD							CAN	IBRIA	N RD					
		No	orthbo	und		So	outhbou	nd	s	OTD	E	astbour		-	We	estbour	nd	w	STR	Crowned
Time Pe	eriod	LT	ST	RT	N TOT	LT	ST	RT	тот	STR TOT	LT	ST	RT	Е ТОТ	LT	ST	RT	тот	TOT	Grand Total
07:00 0	_	0	0	1	1	0	0	0	0	1	1	2	1	4	3	4	0	7	11	12
	07:30 07:45	0	0	3	3	0	0	0	0	3	0	7	2	9 3	2	4	1	7	16 9	19 11
	07.45	2	0	0	2	0	0	0	0	2	1	7	2	10	2	4 5	0	7	9 17	19
08:00 0	08:15	0	3	1	4	0	0	1	1	5	0	3	1	4	2	4	1	7	11	16
	08:30	1	2	0	3	2	0	0	2	5	0	5	0	5	1	4	1	6	11	16
	08:45	0	0	3	3	0	1	0	1	4	0	7	0	7	3	8	0	11	18	22
	)9:00 )9:15	1	0	0	1	0	0	0	0	1	1	4	2	7	1	8	0	9 9	16 10	17
	)9:30	0	0	0	4	0	0	0	0	4	0	3	0	3	1	0	0	2	5	5
	)9:45	0	0	1	1	0	0	0	0	1	0	5	0	5	2	2	1	5	10	11
09:45 1	10:00	0	0	1	1	0	0	0	0	1	0	4	0	4	2	2	0	4	8	9
	11:45	0	0	2	2	1	0	0	1	3	0	6	1	7	2	1	0	3	10	13
	12:00	0	0	1	1	0	0	0	0	1	0	0	0	0	2	1	0	3	3	4
	12:15 12:30	0	0	1	1	0	0	0	0	1	1	3	1	5 1	1	1	0	2	7	8
	12:30	0	0	1	4	0	0	0	0	5 1	0	4	0	4	1	2	1	3	4	8
	13:00	0	0	0	0	0	0	1	1	1	1	4	1	6	1	2	1	4	10	11
13:00 1	13:15	0	0	2	2	0	0	1	1	3	0	4	1	5	1	0	0	1	6	9
13:15 1	13:30	1	0	1	2	0	0	0	0	2	1	5	0	6	1	4	0	5	11	13
	15:15	1	0	1	2	5	0	0	5	7	1	4	2	7	1	1	0	2	9	16
	15:30	0	0	1	1	0	0	1	1	2	0	2	1	3	1	2	0	3	6	8
	15:45 16:00	1	0	3	4	0	0	0	0	4	0	2	1	3	1	5 3	0	6 4	9 11	13 14
	16:15	1	0	1	2	0	0	0	0	2	0	6	0	6	1	3	1	5	11	14
	16:30	2	0	2	4	0	1	0	1	5	0	1	0	1	0	6	0	6	7	12
16:30 1	16:45	0	0	0	0	0	0	0	0	0	0	1	0	1	1	2	0	3	4	4
	17:00	0	0	3	3	0	0	0	0	3	0	2	1	3	0	0	0	0	3	6
	17:15	0	0	2	2	0	0	0	0	2	0	2	0	2	1	1	0	2	4	6
	17:30 17:45	0	0	2	2	0	0	0	0	2	0	3	0	3	0	0	0	0	3	5
	17:45	0	0	2	2	0	0	0	0	2	0	2	0	2	0	1	0	1	4	5
	None	16	6	43	65	8	3	5	16	81	7	111	18	136	39	91	8	138	274	355



#### Turning Movement Count - Study Results CAMBRIAN RD @ RIVER MIST RD

Date: Wedne	esday, Octol	per 23, 2019		wo	) No:	38918	
<b>Time:</b> 07:00				De	vice:	Miovision	
		Full S	tudy 15 Mir	ute U-Turn	Total		
		RIVER MIS			IBRIAN RD		
Time I	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	



#### Turning Movement Count - Full Study Diagram

#### GREENBANK RD @ HALF MOON BAY

Survey Date: Tuesday, June 19, Start Time: 07:00	2018	WO#: 37881 Device: Miovision
Peak Hour 17:00 18:00 Total Heavy Vehicles Cars	GREENBANK RD           Image: 2955         Image: 6358         Image: 3403           505         2281         169         0           8         47         3         0         48           497         2234         166         0         3355	$ \begin{array}{c} \mathbf{N} \\ \mathbf{N} \\ \mathbf{W} \\ \mathbf{E} \\ \mathbf{S} \\ \mathbf{E} \\ \mathbf{S} \\ \mathbf{V} \\ \mathbf{S} \\ \mathbf{V} \\ \mathbf{S} \\ \mathbf$
HALF MOON BAY           39         741           780         0         0           1716         650         10         640           49         5         44           936         237         34         203	J L U   D Full Study   J C   J C	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
	Image: Constraint of the second s	Cars Heavy Vehicles Total



#### Transportation Services - Traffic Services

**Work Order** 37881

#### Turning Movement Count - Full Study Summary Report

#### GREENBANK RD @ HALF MOON BAY

Survey Da	te:	Tuesda	ay, Ju	ne 19,	2018				Total C	Obser	ved U-	Turns					AAD	T Fact	or
								Northbou	ind: 0		South	hbound:	0				.90		
								Eastbou	nd: 0		West	tbound:	0						
								F	ull Stu	udy									
			GR	EENBA	NK R	D						HAL	F MO	ON BA	Y				
	1	Northbo	ound		ŝ	Southb	ound				Eastbo	ound		1	Westb	ound			
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	Gran Tota
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 v	alues a	re calcu	lated by	y multiply	ying the	totals b	y the a	opropriat	e expans	ion fact	tor.		1	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 v	olumes	are calo	culated	by multi	plying t	he Equiv	alent 1	2 hr. tota	Is 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 v	olumes	are calo	culated	by multi	plying t	he Avera	ige Dai	ly 12 hr. 1	totals by	12 to 2	4 expans	sion fact	tor.	1.31					

Comments:

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

2019-Feb-14

Comments :

Page 1 of 1

2019-Feb-14

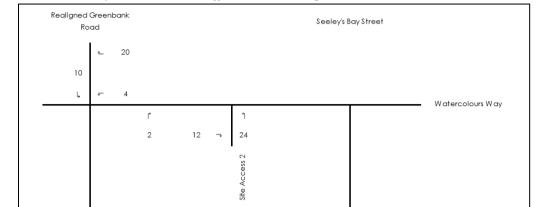


**Collision Data** 

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



Background Developments



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Cambrian Road

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Site Access 1

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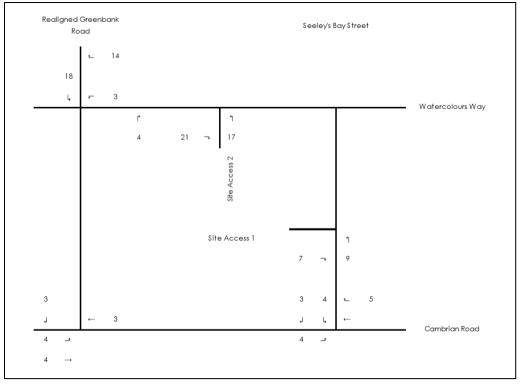
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← 4

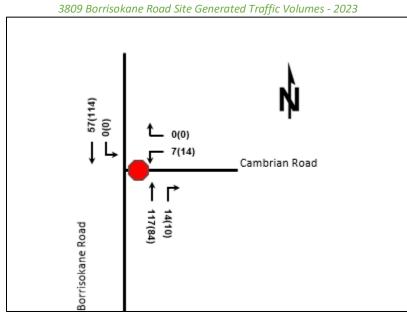
2444 Watercolours Way Site Generated Traffic Volumes, Realigned Greenbank Road Scenario, AM Peak Hour

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

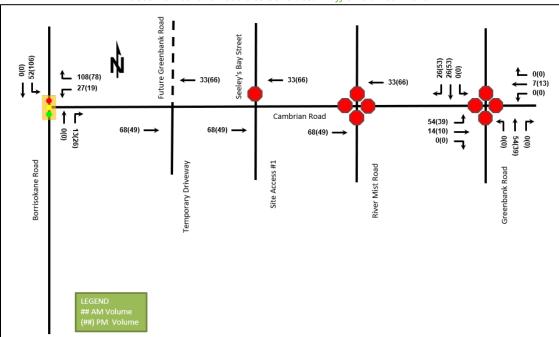
2444 Watercolours Way Site Generated Traffic Volumes, Realigned Greenbank Road Scenario, PM Peak Hour



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







3809 Borrisokane Road Site Generated Traffic Volumes - 2025

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

			45	50	39	-	26 72		60	274	20		107		
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						-	20								
			23	11	35	+	47			31	494				
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										15	~				
Borrisokane Road	Viewbank Road	Realigned Greenbank Road	igned River Mist Road							Gr					

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

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

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				93	-	0	2	4		83	~	148	544		
				0	~										
												1	448		
65 32 🛥 60									38	245	192		141		
J L ← 153									J	1	١.	÷	0		
39										43	-	٦	Ť	٢	Barnsdale Road
113 →										93	-	32	199	0	
										8	~				
Borrisokane Road	Viewbank Road	Realigned		P	ver M	ist P	ad				Exi	sting			
		Greenbank Road								Gr	eenba	ink R	oad		

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

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

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	0(33)[33]	0(0)[0]	[0](0)0	32/81/[81]	8(30)[30]	29/16\[16]	31/17\[17]	[0](0)0

3882 Barnsdale and 3960 Greenbank Road 2025 Site Generated Traffic Volumes

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]



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

**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.

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

## 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 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 nontransit 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

**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

also tends to eliminate security concerns.

**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.
- *Ridesharing*—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

C 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 & destin	ations
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 Checklist

Version 1.0 (30 June 2017)

	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 Checklist**

Version 1.0 (30 June 2017)

	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	
BETTER ★	710	Visitor travel Include multimodal travel option information in	
BETTER ★	1.1.2	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)

C 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 & des	tinations
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 ( <i>subdivision</i> )	
	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 ( <i>multi-family</i> )	
BETTER	4.1.2	Provide residents with bikeshare memberships, either free or subsidized <i>(multi-family)</i>	
	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)	

Version 1.0 (30 June 2017)

	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
То:	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,



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 <<u>christopher.gordon@cghtransportation.com</u>>
Sent: February 14, 2019 5:20 PM
To: Andrew Harte <<u>andrew.harte@cghtransportation.com</u>>; Mark Crockford <<u>mark.crockford@cghtransportation.com</u>>; 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.

С

Christopher Gordon, P.Eng. CGH Transportation Inc.



From: Cairns, Amy <<u>Amy.Cairns@ottawa.ca</u>>
Sent: February 14, 2019 2:12 PM
To: Christopher Gordon <<u>christopher.gordon@cghtransportation.com</u>>
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 <u>Amy.Cairns@ottawa.ca</u> Please sign up for Councillor Harder's <u>newsletter</u>

From: Selfe, Ann <<u>Ann.Selfe@ottawa.ca</u>> Sent: February 14, 2019 1:44 PM To: Cairns, Amy <<u>Amy.Cairns@ottawa.ca</u>> Cc: Simpson, Colin <<u>Colin.Simpson@ottawa.ca</u>> 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

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Traffic Signal Warrants

## Greenbank Road @ Half Moon Bay Road 2021 Existing Conditions

#### Justification #7

		Minimum Requirement 1 Lane Highway		Minimum Requirement 2 or More Lanes		Compliance			
Justification	Description					Sectional		Entire %	Signal
		Free Flow	Restr. Flow	Free Flow	Restr. Flow	Numerical	%	Entire %	
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%	0978	NU
	A. Vehicle volumes, major street (average hour)	480	720	600	900	489	68%		
2. Delay to Cross Traffic	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	75	50	75	69	91%	68%	No

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

## Greenbank Road @ Half Moon Bay Road 2023 Future Background

#### Justification #7

		Minimum Requirement		Minimum Requirement		Compliance			
Justification	Description	1 Lane Highway		2 or More Lanes		Sectional		Entire %	Signal
		Free Flow	Restr. Flow	Free Flow	Restr. Flow	Numerical	%	Entire %	
1. Minimum Vehicular	A. Vehicle volume, all approaches (average hour)	480	720	600	900	704	98%	69%	No
Volume	B. Vehicle volume, along minor streets (average hour)	120	170	120	170	117	69%		NO
	A. Vehicle volumes, major street (average hour)	480	720	600	900	587	81%	81%	
Traffic	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	75	50	75	69	92%		No

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

## Greenbank Road @ Half Moon Bay Road 2023 Future Total Conditions

#### Justification #7

		Minimum Requirement		Minimum Requirement		Compliance			
Justification	Description	1 Lane Highway		2 or More Lanes		Sectional		Entire %	Signal
		Free Flow	Restr. Flow	Free Flow	Restr. Flow	Numerical	%	Entire %	
1. Minimum Vehicular	A. Vehicle volume, all approaches (average hour)	480	720	600	900	869	121%	121%	Yes
Volume	B. Vehicle volume, along minor streets (average hour)	120	170	120	170	207	122%		Tes
	A. Vehicle volumes, major street (average hour)	480	720	600	900	662	92%	92%	
Traffic	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	75	50	75	148	197%		No

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

## River Mist Road @ Cambrian Road 2020 Existing Conditions

#### Justification #7

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

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

## River Mist Road @ Cambrian Road 2023 Future Background

#### Justification #7

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

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

## River Mist Road @ Cambrian Road 2023 Future Total Conditions

#### Justification #7

		Minimum Requirement		Minimum Requirement		Compliance			
Justification	Description	1 Lane Highway		2 or More Lanes		Sectional		Entire %	Signal
		Free Flow	Restr. Flow	Free Flow	Restr. Flow	Numerical	%	Entire %	
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%		Tes
	A. Vehicle volumes, major street (average hour)	480	720	600	900	701	97%	97%	
Traffic	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	75	50	75	168	223%		No

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



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, semiurban/suburban and urban intersections are listed in **Table 1**.

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

#### Table 1 Roundabout Evaluation Criteria

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.

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

#### Table 2 Roundabout Evaluation Matrix - Example Urban Intersection

#### 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 roundahout hair a	
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 1 injury 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



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 Intersection LOS

31.5

D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			\$			\$			÷	
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			В		

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
Сар	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	В
HCM 95th-tile Q	7.5	7.1	7.9	1

D

#### Intersection

Intersection Delay, s/veh Intersection LOS

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30.3
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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4			4			4	
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	В			В			E			В		

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
Сар	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	В	В	В
HCM 95th-tile Q	13.3	1.6	0.6	1.8

70.7

#### Intersection

Int Delay, s/veh

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		4			4			4			4		
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										
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	0.0						F			F		
Minor Lane/Major Mvm	nt	NBLn1	EBL	EBT	EBR	WBL	WBT	WRP	SBLn1			
Capacity (veh/h)	n	305	1037			1101	101		17/			

	NDEIT					WEIGELII
Capacity (veh/h)	305	1037	-	- 11(	1 -	- 174
HCM Lane V/C Ratio	1.348	0.015	-	- 0.05	- 8	- 0.645
HCM Control Delay (s)	210.4	8.5	0	- 8	5 0	- 57.1
HCM Lane LOS	F	А	А	-	A A	- F
HCM 95th %tile Q(veh)	20.7	0	-	- 0	2 -	- 3.7

### Lanes, Volumes, Timings <u>2: Greenbank Road & Half Moon Bay Road</u>

09/17/2021
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Lane Configurations         Image of the state of t		٦	-	$\mathbf{F}$	4	+	•	1	Ť	1	1	Ļ	~
Traffic Volume (vph)       119       6       58       19       6       55       17       558       5       5       167       4         Satd, Flow (prot)       0       1618       0       0       1564       0       0       1742       0       0       1689       0         FI Permitted       0.750       0.904       0.969       0.968       0       534       Flow (Prot)       23       0       1431       0       0       1724       0       0       1676       0       0       238       0       0       645       0       0       238       0       0       645       0       0       238       0       0       645       0       0       238       0       0       1645       0       0       238       0       0       1645       0       0       238       0       0       1645       0       0       238       0       0       1618       518	Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Volume (vph)       119       6       58       19       6       55       17       558       5       5       167       4         Satd, Flow (prot)       0       1618       0       0       1564       0       0       1742       0       0       1689       0         FI Permitted       0.750       0.904       0.969       0.968       0       534       Flow (Prot)       23       0       1431       0       0       1724       0       0       1676       0       0       238       0       0       645       0       0       238       0       0       645       0       0       238       0       0       645       0       0       238       0       0       1645       0       0       238       0       0       1645       0       0       238       0       0       1645       0       0       238       0       0       1618       518	Lane Configurations		\$			\$			\$			\$	
Satid Flow (prot)       0       0       1618       0       0       1564       0       0       1742       0       0       1698       0         FIt Permitted       0.750       0.904       0.986       0.986       0<	Traffic Volume (vph)	119		58	19		55	17		5	5		41
FI Permitted       0.750       0.904       0.986       0.986         Satd. Flow (perm)       0       1253       0       0       1724       0       0       1676       0         Satd. Flow (pth)       0       203       0       88       0       0       645       0       0       238         Tum Type       Perm       NA       Permitedition       Na       Sata       Sata <td>Future Volume (vph)</td> <td>119</td> <td>6</td> <td>58</td> <td>19</td> <td>6</td> <td>55</td> <td>17</td> <td>558</td> <td>5</td> <td>5</td> <td>167</td> <td>41</td>	Future Volume (vph)	119	6	58	19	6	55	17	558	5	5	167	41
FIP Permitted       0.750       0.904       0.988       0.986         Statl. Flow (perm)       0       1253       0       0       1431       0       0       1724       0       0       1676       0         Statl. Flow (rPOR)       29       61       1       25       0       0       233       0       0       89       0       0       645       0       0       233         Tum Type       Perm< NA	( 1 )	0	1618	0	0	1564	0	0	1742	0	0	1698	0
Satid. Flow (perm)         0         1253         0         0         1431         0         0         1774         0         0         1676         0           Satid. Flow (RTOR)         29         61         1         25         0         238         0           Lane Group Flow (ph)         0         203         0         0         89         0         6         6           Protected Phases         4         8         2         6           Permitted Phases         4         8         2         6           Minimum Split (s)         23.9         23.9         23.9         37.7         37.7         23.7         23.7           Total Split (s)         3.3 </td <td>, , , , , , , , , , , , , , , , , , ,</td> <td></td> <td>0.750</td> <td></td> <td></td> <td>0.904</td> <td></td> <td></td> <td>0.989</td> <td></td> <td></td> <td>0.986</td> <td></td>	, , , , , , , , , , , , , , , , , , ,		0.750			0.904			0.989			0.986	
Satic Flow (RTOR)         29         61         1         25           Lane Group Flow (vph)         0         0         0         0         645         0         0         0         23         0           Tum Type         Perm         NA         Static Sta	Satd. Flow (perm)	0		0	0		0	0		0	0		0
Lane Group Flow (vph) 0 203 0 0 89 0 0 645 0 0 238 0 Tum Type Perm NA PAR PAR PAR PAR PAR PAR PAR PA	. ,												
Turn Type         Perm         NA         Perm         NA         Perm         NA         Perm         NA           Protected Phases         4         8         2         6           Minimum Split (s)         23.9         23.9         23.9         37.7         37.7         23.7         23.7           Total Split (s)         23.2         28.2         28.2         28.2         51.8         61.8         51.7         5.7         LeadLag         LeadLag		0		0	0		0	0	645	0	0		0
Protected Phases         4         8         2         6           Permitted Phases         4         8         2         6           Minimum Split (s)         23.9         23.9         23.7         73.7         73.7         23.7         23.7           Total Split (s)         28.2         28.2         28.2         51.8 </td <td></td> <td>Perm</td> <td></td> <td></td> <td>Perm</td> <td></td> <td></td> <td>Perm</td> <td></td> <td></td> <td>Perm</td> <td></td> <td></td>		Perm			Perm			Perm			Perm		
Permitted Phases         4         8         2         6           Minimum Split (s)         23.9         23.9         23.9         37.7         37.7         23.7         23.7           Total Split (s)         28.2         28.2         28.2         51.8         51.9         52.0         52.0         52.0         52.													
Minimum Split (s)       23.9       23.9       23.9       23.7       37.7       37.7       23.7       23.7         Total Split (%)       35.3%       35.3%       35.3%       35.3%       35.3%       64.8% <td></td> <td>4</td> <td></td> <td></td> <td>8</td> <td></td> <td></td> <td>2</td> <td></td> <td></td> <td>6</td> <td>-</td> <td></td>		4			8			2			6	-	
Total Split (s)       28.2       28.2       28.2       51.8			23.9			23.9			37.7			23.7	
Total Split (%)         35.3%         35.3%         35.3%         35.3%         64.8%         64.8%         64.8%         64.8%           Yellow Time (s)         3.3	• • • • •												
Yellow Time (s)       3.3													
All-Red Time (s)       2.6       2.6       2.6       2.6       2.4 <td>• • •</td> <td></td>	• • •												
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         0.58           Vic 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         0.0         10.0           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         LOS         C         B         B         A           Queue Length S0th (m)         22.2         3.1         60.7         14.4         Queue Length S0th (m)         22.6.5         242.1         157.6         402.9           Tum Bay Length (m)         Base Capacity (vph)         370         442         993         976         Starvation Cap Reductn         0 </td <td></td>													
Total Lost Time (s)         5.9         5.9         5.7         5.7           Lead/Lag Optimize?	. ,	2.0			2.0			2.7			2.7		
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 LOS C B B A 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 Tum Bay Length (m) Base Capacity (vph) 370 442 993 976 Starvation Cap Reductn 0 0 0 0 Spillback Cap Reductn 0 0 0 0 Spillback 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 Actuated													
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         vic 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         LOS       C       B       B       A         Approach LOS       C       B       B       A         Queue Length 50th (m)       23.0       13.4       94.8       25.4         Internal Link Dist (m)       226.5       242.1       157.6       402.9         Turn Bay Length (m)       370       442       993       976         Starvation Cap Reductn       0       0       0       0         Starvation Cap Reductn       0       0       0       0         Starvation Cap Reductn       0       0       0			0.0			0.0			0.1			0.1	
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         LOS       C       B       B       A         Approach LOS       C       B       B       A         Queue Length S0th (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)       370       442       993       976         Starvation Cap Reductn       0       0       0       0         Spillback Cap Reductn       0       0       0       0         Offs													
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           LOS         C         B         B         A           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)         370         442         993         976           Starvation Cap Reductn         0         0         0         0           Starvation Cap Reductn         0         0.20         0.65         0.24 <tr< td=""><td></td><td></td><td>22.3</td><td></td><td></td><td><b>22 3</b></td><td></td><td></td><td>46.1</td><td></td><td></td><td>46.1</td><td></td></tr<>			22.3			<b>22 3</b>			46.1			46.1	
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         LOS       C       B       B       A         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         Internat Link Dist (m)       22.6.5       242.1       157.6       402.9         Turn Bay Length (m)       370       442       993       976         Starvation Cap Reductn       0       0       0       0         Starvation 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       Actuated Cycle Length: 80 <td></td>													
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 50th (m)         226.5         242.1         157.6         402.9           Turn Bay Length (m)         226.5         242.1         157.6         402.9           Base Capacity (vph)         370         442         993         976           Starvation Cap Reductn         0         0         0         0           Spliback Cap Reductn         0         0         0         0           Stary action Cap Reductn         0         0         0         0           Stary action Cap Reductn         0         0         0         0         0           Stary action Cap Reductn         0         0.55         0.20													
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           LOS         C         B         B         A           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         4442         993         976           Starvation Cap Reductn         0         0         0         0         0         0           Staryation Cap Reductn         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         0         0           Spillback Cap Reductn         0													
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         0         0           Starvation Cap Reductn         0         0         0         0         0         0           Starvation Cap Reductn         0         0         0         0         0         0           Starvation Cap Reductn         0         0.55         0.20         0.65         0.24         0           Reduced v/c Ratio         0.55         0.20         0.65         0.24         0         0         0         0         0         0         0         0         0         1         0	,												
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         0         0           Spillback Cap Reductn         0 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>													
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         0         0           Starvation Cap Reductn         0<													
Diverse         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)         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           Storage Cap Reductn         0         0         0         0           Reduced v/c Ratio         0.55         0.20         0.65         0.24           Intersection Summary         Cycle Length: 80         0         0         0           Actuated Cycle Length: 80         0         0         0         0           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 LOS: B         Intersection Signal Delay: 15.7         Intersection LOS: B           Intersection Capacity Utilization 67.3%         ICU Level of Service C         UCU Level of Service C	,												
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         0         0           Spillback Cap Reductn         0         10         0         12         12         12         12         12         12         12 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>													
Internal Link Dist (m)         226.5         242.1         157.6         402.9           Turn Bay Length (m)         Base Capacity (vph)         370         442         993         976           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	<b>3</b> ( )												
Turn Bay Length (m)         Base Capacity (vph)       370       442       993       976         Starvation Cap Reductn       0       0       0       0         Starvation Cap Reductn       0       0       0       0         Spillback Cap Reductn       0       0       0       0         Storage 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 LOS: B         Intersection Signal Delay: 15.7       Intersection LOS: B       Intersection Capacity Utilization 67.3%													
Base Capacity (vph)         370         442         993         976           Starvation Cap Reductn         0			220.5			242.1			157.0			402.9	
Starvation Cap Reductn         0         0         0         0           Spillback Cap Reductn         0			070			440			000			070	_
Spillback Cap Reductin0000Storage Cap Reductin0000Reduced v/c Ratio0.550.200.650.24Intersection SummaryCycle Length: 80Actuated Cycle Length: 80Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of GreenNatural Cycle: 65Control Type: PretimedMaximum v/c Ratio: 0.650.65Intersection Signal Delay: 15.7Intersection LOS: BIntersection Capacity Utilization 67.3%ICU Level of Service C													
Storage Cap Reductn0000Reduced v/c Ratio0.550.200.650.24Intersection SummaryCycle Length: 80Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of GreenNatural Cycle: 65Control Type: PretimedMaximum v/c Ratio: 0.650.65Intersection Signal Delay: 15.7Intersection LOS: BIntersection Capacity Utilization 67.3%ICU Level of Service C			-			· ·						-	_
Reduced v/c Ratio0.550.200.650.24Intersection SummaryCycle Length: 80Actuated Cycle Length: 80Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of GreenNatural Cycle: 65Control Type: PretimedMaximum v/c Ratio: 0.65Intersection Signal Delay: 15.7Intersection LOS: BIntersection Capacity Utilization 67.3%													
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			-			-			-			-	_
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	Reduced V/C Ratio		0.55			0.20			0.65			0.24	
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 Capacity Utilization 67.3%													
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 Capacity Utilization 67.3%         ICU Level of Service C													
Control Type: Pretimed         Maximum v/c Ratio: 0.65         Intersection Signal Delay: 15.7         Intersection Capacity Utilization 67.3%         ICU Level of Service C	, ,	to phase 2	:NBTL and	d 6:SBTL	., Start of	Green							
Maximum v/c Ratio: 0.65         Intersection Signal Delay: 15.7         Intersection Capacity Utilization 67.3%         ICU Level of Service C	Natural Cycle: 65												
Maximum v/c Ratio: 0.65         Intersection Signal Delay: 15.7         Intersection Capacity Utilization 67.3%         ICU Level of Service C	Control Type: Pretimed												
Intersection Signal Delay: 15.7       Intersection LOS: B         Intersection Capacity Utilization 67.3%       ICU Level of Service C													
Intersection Capacity Utilization 67.3% ICU Level of Service C	Intersection Signal Delay: 1	5.7			Ir	ntersection	n LOS: B						
			)					ЭC					
• • • •	Analysis Period (min) 15												

Scenario 1 3432 Greenbank Road 2:52 pm 11/02/2020 2021 Existing - AM Alternative Scenario

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

Ø2 (R)	 ⊉	
51.8 s	28.2 s	
● ● Ø6 (R)	<b>↓</b> Ø8	
51.8 s	28.2 s	

#### Intersection Intersection Delay, s/veh Intersection LOS 65.7

F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4			4			4	
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			С			В		

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
Сар	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	С	F	F	В
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	В			В			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
Сар	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	В	В	F
HCM 95th-tile Q	7	1	0.7	29.3

75.4

#### Intersection

Int Delay, s/veh

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		4			4			4			4		
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										
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		Ν	Major2		1	Minor1		I	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			
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 Mvn	nt N	VBLn1	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	-						
HCM Lane LOS		F	A	A	-	A	A	-	F					
HCM 95th %tile Q(veh	I)	19.6	0.1	-	-	0.6	-	-	3.2					
Notes														
~: Volume exceeds ca	pacity	\$: De	lay exc	eeds 30	)0s -	+: Com	putatio	n Not D	efined	*: All	major	volume i	in platoon	

Scenario 1 3432 Greenbank Road 2:52 pm 11/02/2020 2021 Existing - PM Alternative Scenario

### Lanes, Volumes, Timings <u>2: Greenbank Road & Half Moon Bay Road</u>

09/17/2021	17/2021
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	٦	-	$\mathbf{F}$	4	-	*	1	1	1	1	Ļ	~
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		0.0						•			•	
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)		220.0			212.1			107.0			102.0	
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	d 6:SBTL	., Start of	Green							
Natural Cycle: 70												
Control Type: Pretimed												
Maximum v/c Ratio: 0.78												
Intersection Signal Delay: 1	5.9			Ir	ntersectior	1 LOS: B						
Intersection Capacity Utiliza		)			CU Level		e C					
Analysis Period (min) 15												

Scenario 1 3432 Greenbank Road 2:52 pm 11/02/2020 2021 Existing - PM Alternative Scenario

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

Ø2 (R)	<u>⊿</u>	
56.1 s	23.9 s	
Ø6 (R)	<b>↓</b> Ø8	
56.1s	23.9 s	

## Appendix K

Synchro Worksheets – 2024 Future Background Synchro Sheets

## Lanes, Volumes, Timings <u>1: River Mist Road & Cambrian Road</u>

09/16/2021

	٭	-	$\mathbf{\hat{z}}$	4	+	•	•	1	1	1	Ŧ	~
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBF
Lane Configurations	1	<b>†</b>	1	٦	•	1	۲	ef 🔰		۲.	el 🗧	
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	(
Flt Permitted	0.440			0.351			0.724			0.638		
Satd. Flow (perm)	566	1456	1300	483	1470	1215	1125	1296	0	963	1353	(
Satd. Flow (RTOR)			131			45		135			33	
Lane Group Flow (vph)	17	419	131	57	348	45	295	190	0	58	51	(
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	В	D	А	C	С	A	В	A		В	А	
Approach Delay		27.9			24.2			14.4			10.6	
Approach LOS		С			С			В			В	
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	0.00			0.20				•.=.			0.00	
,												
Cycle Length: 80	2											
Actuated Cycle Length: 71.	3											
Natural Cycle: 80	v - l											
Control Type: Semi Act-Uno	coord											
Maximum v/c Ratio: 0.83												

Scenario 1 3432 Greenbank Road 2:52 pm 11/02/2020 2024 Future Background - AM Peak Hour

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



## Lanes, Volumes, Timings 2: Greenbank Road & Half Moon Bay Road

Lane Configurations         4.         4.         4.         4.         4.         4.           Trafic Volume (vph)         119         6         58         19         6         55         17         676         5         5         199         41           Volume (vph)         0         1618         0         0         1564         0         0         1742         0         1703         0           Sated, Flow (prot)         0         1618         0         0         1564         0         0         1742         0         1703         0           Sated, Flow (prot)         0         183         0         0         1486         0         1728         0         1686         0           Sated, Flow (prot)         0         183         0         0         80         0         0         245         0           Turn Type         Perm NA         Perm< NA         Perm         NA         Perm         NA         Perm         NA         Perm NA         Perm NA         Perm NA         Perm NA         Perm NA         Perm NA         Perm NA         Perm NA         S3.2         53.2         53.2         53.2         53.2         53.2<		٦	-	$\mathbf{F}$	4	+	•	•	t	1	1	Ļ	~
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         Stadt, Flow (prot)       0       1618       0       1564       0       0       1742       0       0       1768       0       1782       0       0       1686       0       0       283       55       1       22       28       0       0       0       245       0       0       1883       0       0       688       0       0       245       0       0       1984       0       1984       0       1984       0       10       1245       0       11994       10       1243       10       10       1245       116       153       11       22       6       10       1149       116       153       133       33       33       33       33       33       33       33       33       33       33       33       33       33       33       33       33       33       33	Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Volume (vph)       119       6       58       19       6       55       17       676       5       5       199       44         Satd, Flow (prot)       0       1618       0       0       1564       0       0       1742       0       0       1703       0.989         Satd, Flow (prot)       0       1261       0       1436       0       0       1728       0       0       1686       0       383       180       0       0       1630       0       0       1630       0       1830       0       0       1686       0       0       245       0       0       1686       0       0       245       0       0       1686       0       0       245       0       0       1686       0       0       245       0       0       1686       0       0       245       0       0       1618       0       0       333       33	Lane Configurations		\$			\$			\$			\$	
Satid Flow (prod)       0       1618       0       0       1742       0       0       1703       0         File Permitted       0.755       0.907       0.991       0.989       0       0       989       0       0       989       0       0       989       0       0       989       0       0       1886       0       0       1886       0       0       188       0       0       0       0       0       0       0       22       0       0       1886       0       0       22       0       0       188       0       0       0       0       22       0       0       0       22       0       0       0       22       0       0       0       0       23 <td>Traffic Volume (vph)</td> <td>119</td> <td></td> <td>58</td> <td>19</td> <td></td> <td>55</td> <td>17</td> <td>676</td> <td>5</td> <td>5</td> <td>199</td> <td>41</td>	Traffic Volume (vph)	119		58	19		55	17	676	5	5	199	41
FIP Permitted       0.755       0.907       0.991       0.993         Satd. Flow (perm)       0       1261       0       0       1436       0       0       1728       0       0       1686       0         Satd. Flow (PR)       28       55       1       22       22       23       25       1       22       245       0       0       698       0       0       245       0       0       797       0.917       0.917       0.937       0.237       23.7       23	Future Volume (vph)	119	6	58	19	6	55	17	676	5	5	199	41
Satid, Flow (nerm)       0       1261       0       0       1426       0       0       1728       0       0       1686       0         Satid, Flow (nerm)       28       55       1       22       22       22       22       22       22       0       22       0       22       0       22       0       22       0       22       0       22       0       22       0       22       0       22       0       22       0       22       0       22       0       22       0       22       0       22       0       0       0       245       0       245       0       245       0       245       0       245       0       245       0       245       0       245       0       245       0       245       0       245       26       26       26       26       26       26       26       26       24	Satd. Flow (prot)	0	1618	0	0	1564	0	0	1742	0	0	1703	0
Satid, Flow (nerm)       0       1261       0       0       1426       0       0       1728       0       0       1686       0         Satid, Flow (nerm)       28       55       1       22       22       22       22       22       22       0       22       0       22       0       22       0       22       0       22       0       22       0       22       0       22       0       22       0       22       0       22       0       22       0       22       0       22       0       22       0       0       0       245       0       245       0       245       0       245       0       245       0       245       0       245       0       245       0       245       0       245       0       245       26       26       26       26       26       26       26       26       24	Flt Permitted		0.755			0.907			0.991			0.989	
Satd. Flow (RTOR)       28       55       1       22         Lane Group Flow (vph)       0       183       0       0       60       698       0       0       245       0         Tum Type       Perm       NA       Stats	Satd. Flow (perm)	0	1261	0	0	1436	0	0	1728	0	0	1686	0
Lane Group Flow (vph) 0 183 0 0 80 0 0 689 0 0 245 0 Tum Type Perm NA PA POR NA PA PARA PARA PARA PARA PARA PARA PA			28			55			1			22	
Turn Type         Perm         NA         Perm         NA         Perm         NA           Protected Phases         4         8         2         6           Minimum Split (s)         23.9         23.9         23.9         23.7         23.6         24         24         24         24         24         24         24         24         24         24		0	183	0	0	80	0	0	698	0	0	245	0
Protecied Phases 4 6 2 6 Permitted Phases 4 6 2 6 Minimum Split (s) 23.9 23.9 23.9 23.9 23.7 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% 66.5% 66.5% 66.5% 66.5% Lost Time (s) 3.3 3.3 3.3 3.3 3.3 3.3 3.3 3.3 3.3 3.	Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Minimum Split (s)       23.9       23.9       23.7       23	Protected Phases		4			8			2			6	
Total Split (s)       26.8       26.8       26.8       53.2	Permitted Phases	4			8			2			6		
Total Split (s)         26.8         26.8         26.8         53.2         53.2         53.2         53.2           Total Split (%)         33.5%         33.5%         33.5%         66.5%         66.5%         66.5%         66.5%           Vellow Time (s)         3.3	Minimum Split (s)	23.9	23.9		23.9	23.9		23.7	23.7		23.7	23.7	
Total Split (%)         33.5%         33.5%         33.5%         33.5%         33.5%         66.5%         67.5%         67.5%         67.5%	,												
Yellow Time (s)       3.3													
All-Red Time (s)       2.6       2.6       2.6       2.6       2.4 <td></td>													
Lost Time Adjust (s) 0.0 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 vic 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 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 Approach Delay 27.6 11.6 15.3 7.7 Approach LOS C B A A Approach Delay 27.6 11.6 15.3 7.7 Approach LOS C C B C B C A C B C C C C C C C C C C C													
Total Lost Time (s)       5.9       5.9       5.7       5.7         Lead-Lag Optimize?													
Lead-Lag Optimize? Act Effct Green (s) 20.9 20.9 47.5 47.5 Act affct 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 A Approach Delay 27.6 11.6 15.3 7.7 Approach Delay 27.6 11.6 15.3 7.7 I OS C B A B A A Approach Delay 27.6 11.6 15.3 7.7 Approach LOS C B A B A 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 Turm Bay Length (m) Base Capacity (vph) 350 415 1026 1010 Starvation Cap Reductn 0 0 0 0 Spillback Cap Reductn 0 0 0 0 Spillback Cap Reductn 0 0 0 Reduced v/c Ratio 0.52 0.19 0.68 0.24 Intersection Summary Cycle Length: 80 Actuated Cycle Length: 80 Intersection Signal Delay: 15.4 Intersection LOS: B Intersection Capacity Ulitzation 74.3% ICU Level of Service D	,												
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         Vic 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         Queue Delay       0.0       0.0       0.0       0.0         Total Delay       27.6       11.6       15.3       7.7         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         Turm Bay Length (m)       350       415       1026       1010         Starvation Cap Reductn       0       0       0       0         Storage Cap Reductn       0<	( )		0.0			0.0			•			•	
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 50th (m)       29.6       242.1       157.6       402.9         Turn Bay Length (m)       350       415       102.6       1010         Starvation Cap Reductn       0       0       0       0       0 <td></td>													
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           LOS         C         B         B         A           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)         350         415         1026         1010           Starvation Cap Reducth         0         0         0         0           Storage Cap Reducth         0         0         0         0			20.9			20.9			47.5			47.5	
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         Queue Delay       27.6       11.6       15.3       7.7         LOS       C       B       B       A         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         Intermal Link Dist (m)       226.5       242.1       157.6       402.9         Turm Bay Length (m)       350       415       1026       1010         Starvation Cap Reductn       0       0       0       0         Sprilback Cap Reductn       0       0       0       0       0         Strayation Cap Reductn       0       0       0       0       0       0         Sprilback Cap Reductn       0       0       0       0       0       0       0         Strayet Cap Reductn													
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 50th (m)         226.5         242.1         157.6         402.9           Turn Bay Length (m)         226.5         242.1         157.6         402.9           Turn Bay Length (m)         350         415         1026         1010           Starvation Cap Reductn         0         0         0         0           Spliback Cap Reductn         0         0         0         0         0           Storage Cap Reductn         0         0.19         0.68         0.24         0           Intersection Summary         C         0.19         0.68         0.24         0         0         0         0         0													
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           LOS         C         B         B         A           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         0         0           Spillback Cap Reductn         0         0         0         0         0         0         0           Storage Cap Reductn         0         0         0         0         0         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           Tum Bay Length (m)         Base Capacity (vph)         350         415         1026         1010           Starvation Cap Reductn         0         0         0         0         0         0           Spillback Cap Reductn         0													
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           Tum Bay Length (m)         Base Capacity (vph)         350         415         1026         1010           Starvation Cap Reductn         0         0         0         0         0         0           Spillback Cap Reductn         0	,												
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         0         0           Spillback Cap Reductn         0													
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)         350         415         1026         1010           Starvation Cap Reductn         0         0         0         0           Spillback Cap Reductn         0         0         0         0           Starvation Cap Reductn         0         0         0         0           Spillback Cap Reductn         0         0         0         0         0           Staryation Cap Reductn         0													
Display         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)         350         415         1026         1010           Starvation Cap Reductn         0         0         0         0           Spillback Cap Reductn         0         0         0         0           Spillback Cap Reductn         0         0         0         0           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         E         E         E         E           Cycle Length: 80         Actuated Cycle Length: 80         O         O         E         E           Natural Cycle: 60         E         O         E         E         E         E         E         E         E         E <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>													
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           Base Capacity (vph)         350         415         1026         1010         10         0         0         0         0         0         0         0         0         0         <													
Internal Link Dist (m)         226.5         242.1         157.6         402.9           Turn Bay Length (m)         Base Capacity (vph)         350         415         1026         1010           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         0.24         0         0           Actuated Cycle Length: 80         Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green         Vatural Cycle: 60         Vatural Cycle: 10.68         Vatural Cycle: 10.63	• • • •												
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         0           Spillback Cap Reductn         0         <													
Base Capacity (vph)         350         415         1026         1010           Starvation Cap Reductn         0 <t< td=""><td>( )</td><td></td><td>220.5</td><td></td><td></td><td>272.1</td><td></td><td></td><td>157.0</td><td></td><td></td><td>402.3</td><td></td></t<>	( )		220.5			272.1			157.0			402.3	
Starvation Cap Reductn0000Spillback Cap Reductn0000Storage Cap Reductn0000Reduced v/c Ratio0.520.190.680.24Intersection SummaryCycle Length: 80Actuated Cycle Length: 80Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of GreenNatural Cycle: 60Control Type: PretimedMaximum v/c Ratio: 0.68Intersection Signal Delay: 15.4Intersection LOS: BIntersection Capacity Utilization 74.3%			350			115			1026			1010	
Spillback Cap Reductn000Storage Cap Reductn000Reduced v/c Ratio0.520.190.680.24Intersection SummaryCycle Length: 80Actuated Cycle Length: 80Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of GreenNatural Cycle: 60Control Type: PretimedMaximum v/c Ratio: 0.68Intersection Signal Delay: 15.4Intersection LOS: BIntersection Capacity Utilization 74.3%												-	
Storage Cap Reductn0000Reduced v/c Ratio0.520.190.680.24Intersection SummaryCycle Length: 80Actuated Cycle Length: 80Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of GreenNatural Cycle: 60Control Type: PretimedMaximum v/c Ratio: 0.68Intersection LOS: BIntersection Signal Delay: 15.4Intersection LOS: BIntersection Capacity Utilization 74.3%ICU Level of Service D			-			-			· ·				
Reduced v/c Ratio0.520.190.680.24Intersection SummaryCycle Length: 80Actuated Cycle Length: 80Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of GreenNatural Cycle: 60Control Type: PretimedMaximum v/c Ratio: 0.68Intersection Signal Delay: 15.4Intersection LOS: BIntersection Capacity Utilization 74.3%	•												
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			-			-			-			-	
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 Capacity Utilization 74.3%	Intersection Summary		0.02			0.10			0.00			0.24	
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	, ,												
Control Type: Pretimed         Maximum v/c Ratio: 0.68         Intersection Signal Delay: 15.4         Intersection Capacity Utilization 74.3%         ICU Level of Service D		to phase 2	:NBTL and	d 6:SBTL	., Start of	Green							
Maximum v/c Ratio: 0.68         Intersection Signal Delay: 15.4         Intersection Capacity Utilization 74.3%         ICU Level of Service D	Natural Cycle: 60												
Maximum v/c Ratio: 0.68         Intersection Signal Delay: 15.4         Intersection Capacity Utilization 74.3%         ICU Level of Service D	Control Type: Pretimed												
Intersection Signal Delay: 15.4       Intersection LOS: B         Intersection Capacity Utilization 74.3%       ICU Level of Service D	Maximum v/c Ratio: 0.68												
Intersection Capacity Utilization 74.3% ICU Level of Service D	Intersection Signal Delay: 1	5.4			Ir	ntersection	1 LOS: B						
	<b>.</b> .		þ					) D					
	Analysis Period (min) 15												

Scenario 1 3432 Greenbank Road 2:52 pm 11/02/2020 2024 Future Background - AM Peak Hour

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

Ø2 (R)	<u>→</u> <sub>Ø4</sub>
53.2 s	26.8 s
● ● Ø6 (R)	<b>€</b> Ø8
53.2 s	26.8 s

## Lanes, Volumes, Timings <u>1: River Mist Road & Cambrian Road</u>

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	1	•	1	ľ	•	1	<u>ک</u>	el el		<u>ک</u>	el el	
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	C
Flt Permitted	0.463			0.136			0.737			0.669		
Satd. Flow (perm)	800	1745	1447	237	1745	1422	1270	1397	0	1143	1563	C
Satd. Flow (RTOR)			198			64		120			18	
Lane Group Flow (vph)	22	611	198	151	503	64	175	137	0	29	31	C
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	0.1	0.1	0.0	0.0		0.0	0.0	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes								
Recall Mode	None	None	None	None	None	None	Max	Max		Max	Max	
	36.7	36.7	36.7	49.4	47.8	47.8	35.2	35.2		35.2	35.2	
Act Effct Green (s)	0.39	0.39	0.39	49.4 0.52	0.50	0.50	0.37	0.37		0.37	0.37	
Actuated g/C Ratio v/c Ratio	0.39	0.39	0.39	0.52	0.50	0.50	0.37	0.37		0.37	0.37	
	18.4	46.2	3.9	29.7	19.4	3.4	26.3	0.23 6.8		22.1	13.1	
Control Delay	0.0	40.2	5.9 0.0	29.7	0.0	0.0	20.3	0.0			0.0	
Queue Delay		46.2	0.0 3.9	29.7	19.4	3.4	26.3	6.8		0.0	13.1	
Total Delay	18.4									22.1		
LOS	В	D	А	С	B	Α	С	A		С	B	
Approach Delay		35.4			20.1			17.7			17.4	
Approach LOS	0.5	D	0.0	40.0	C	0.0	04.0	B		0.0	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)	<u> </u>	136.7	05.0	00.0	171.5	<u> </u>	400.0	225.4		<u> </u>	236.2	
Turn Bay Length (m)	60.0	770	85.0	80.0	075	60.0	100.0	<b>F</b> 04		60.0	<b>F00</b>	
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-Unco	oord											
Maximum v/c Ratio: 0.91												

Scenario 1 3432 Greenbank Road 2:52 pm 11/02/2020 2024 Future Background - PM Peak Hour

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

# 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

<b>↑</b> <sub>Ø2</sub>	Ø3	<b>→</b> Ø4
41 s	11s 48	8 s
Ø6	Ø8	
41 s	59 s	

## Lanes, Volumes, Timings 2: Greenbank Road & Half Moon Bay Road

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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		0.0			0.0			0.1			0.1	
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			0.22			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			В	
Approach Delay		27.5			16.4			10.3			19.9	
Approach LOS		27.5 C			ю.4 В			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)		220.5			272.1			157.0			402.5	
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		0.00			0.20			0.02			0.00	
Cycle Length: 80 Actuated Cycle Length: 80												
Offset: 0 (0%), Referenced Natural Cycle: 70	to phase 2	:NBTL and	d 6:SBTL	., Start of	Green							
Control Type: Pretimed												
Maximum v/c Ratio: 0.83												
Intersection Signal Delay: 1	72				ntersectior							
Intersection Signal Delay. I					CU Level							
Analysis Period (min) 15	1011 00.9%	)		I	JU Level (		; U					

Scenario 1 3432 Greenbank Road 2:52 pm 11/02/2020 2024 Future Background - PM Peak Hour

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



## Appendix L

Synchro Worksheets – 2029 Future Background Synchro Sheets

## Lanes, Volumes, Timings <u>1: River Mist Road & Cambrian Road</u>

09/16/2021

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	۲	<b>†</b>	1	5	•	1	<u>۲</u>	eî.		<u> </u>	¢Î	
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	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0		0.0	0.0	
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	В	D	A	C	C	A	C	A		B	A	
Approach Delay	2	41.2	7.	Ű	25.8	7.	Ű	17.3		2	11.7	
Approach LOS		D			20.0 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)	0.4	136.7	0.2	17.0	171.5	0.0	00.0	225.4		12.0	236.2	
Turn Bay Length (m)	60.0	100.1	85.0	80.0	17 1.0	60.0	100.0	220.1		60.0	200.2	
Base Capacity (vph)	203	627	635	141	633	549	485	639		413	606	
Starvation Cap Reductn	0	0	000	0	000	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	0.00	0.01	0.21	0.10	0110	0.00	0.01	0.01		0.11	0.00	
Cycle Length: 80												
Actuated Cycle Length: 78.7	7											
Natural Cycle: 80												
Control Type: Semi Act-Unc	coord											
Maximum v/c Ratio: 0.95												

Scenario 1 3432 Greenbank Road 2:52 pm 11/02/2020 2029 Future Background - AM Peak Hour

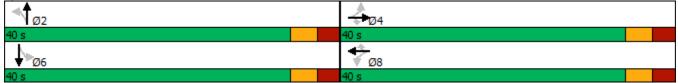
#### Intersection Signal Delay: 28.7 Intersection Capacity Utilization 111.2%

Intersection LOS: C 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



## Lanes, Volumes, Timings 2: Greenbank Road & Half Moon Bay Road

	٦	-	$\mathbf{F}$	4	+	•	1	Ť	1	1	Ļ	~
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)	2.0	0.0		2.0	0.0		2.7	0.0		2.7	0.0	
Total Lost Time (s)		5.9			5.9			5.7			5.7	
Lead/Lag		0.0			0.0			0.1			0.1	
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		0.20			0.20			0.39			0.30	
Control Delay		27.6			12.1			24.2			8.5	
Queue Delay		0.0			0.0			0.0			0.0	
,		27.6			12.1			24.2			8.5	
Total Delay LOS		27.0 C			IZ.I B			24.2 C				
		27.6			ь 12.1			24.2			A 8.5	
Approach Delay		27.0 C			IZ.I B			24.2 C				
Approach LOS Queue Length 50th (m)		21.0			ы 3.4			100.2			A 19.4	
<b>3</b> ( )												
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)		257			440			1005			1010	
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	d 6:SBTL	., Start of	Green							
Natural Cycle: 70												
Control Type: Pretimed												
Maximum v/c Ratio: 0.86												
Intersection Signal Delay: 2					ntersectior							
Intersection Capacity Utiliza	ation 87.5%	)		10	CU Level of	of Service	θE					
Analysis Period (min) 15												

Scenario 1 3432 Greenbank Road 2:52 pm 11/02/2020 2029 Future Background - AM Peak Hour

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



## Lanes, Volumes, Timings <u>1: River Mist Road & Cambrian Road</u>

		_	•	- <b></b>	•	$\sim$			- ^	*	÷	-
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBF
Lane Configurations	5	•	1	ľ	•	1	<u>ک</u>	¢Î		1	el el	
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	(
Flt Permitted	0.318			0.086			0.736			0.668		
Satd. Flow (perm)	550	1745	1447	150	1745	1422	1268	1402	0	1142	1569	(
Satd. Flow (RTOR)			198			64		120			18	
Lane Group Flow (vph)	22	750	198	151	655	64	175	139	0	29	32	(
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	0.1	0.1	0.0	0.0		0.0	0.0	
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	0.42	1.03	0.42	0.84	0.55	0.03	0.35	0.33		0.07	0.05	
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	19.1 B	70.2 E	3.7 A	55.1 E	23.1 C	3.3 A	27.9 C	7.0 A		22.4 C	13.3 B	
Approach Delay	D	⊑ 55.5	A	E	27.2	A	U	18.6		U	ь 17.7	
		55.5 E			27.2 C			10.0 B			н. В	
Approach LOS	0 E		0.0	110		0.0	0E 0			27		
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)	<u> </u>	136.7	05.0	00.0	171.5	<u> </u>	100.0	225.4		<u> </u>	236.2	
Turn Bay Length (m)	60.0	704	85.0	80.0	000	60.0	100.0	500		60.0	560	
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-Unco	bord											
Maximum v/c Ratio: 1.03												

Scenario 1 3432 Greenbank Road 2:52 pm 11/02/2020 2029 Future Background - PM Peak Hour

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 lo	nger.

Queue shown is maximum after two cycles.

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

1 ø2	✓ Ø3
41 s	11 s 48 s
<b>↓</b> ø <sub>6</sub>	◆ ▼ Ø8
41 s	59 s

## Lanes, Volumes, Timings 2: Greenbank Road & Half Moon Bay Road

	٦	-	$\mathbf{F}$	4	←	*	1	1	۲	1	Ļ	~
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)	2.0	0.0		2.0	0.0		2.1	0.0		2.1	0.0	
Total Lost Time (s)		5.9			5.9			5.7			5.7	
Lead/Lag		0.0			0.0			0.1			0.1	
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		0.22			0.22			0.66			1.00	
Control Delay		27.3			16.9			13.4			43.5	
Queue Delay		0.0			0.0			0.0			43.5	
		27.3			16.9			13.4			43.5	
Total Delay LOS		27.3 C			10.9 B			13.4 B			43.5 D	
		27.3			16.9			13.4			43.5	
Approach Delay		27.3 C			10.9 B			13.4 B			43.5 D	
Approach LOS		13.8			Б 6.0			Б 53.6			138.0	
Queue Length 50th (m)		29.0			17.5			53.6 88.2			#236.6	
Queue Length 95th (m)								00.2 157.6				
Internal Link Dist (m)		226.5			242.1			157.0			402.9	
Turn Bay Length (m)		207			200			000			4047	
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 t	to phase 2	:NBTL and	d 6:SBTL	., Start of	Green							
Natural Cycle: 90												
Control Type: Pretimed												
Maximum v/c Ratio: 1.00												
Intersection Signal Delay: 3					ntersection							
Intersection Capacity Utiliza	tion 91.3%	)		10	CU Level	of Service	e F					
Analysis Period (min) 15												

Scenario 1 3432 Greenbank Road 2:52 pm 11/02/2020 2029 Future Background - PM Peak Hour

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



## Appendix M

Synchro Worksheets – 2024 Future Total Synchro Sheets

## Lanes, Volumes, Timings <u>1: River Mist Road & Cambrian Road</u>

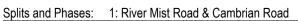
09/16/2021

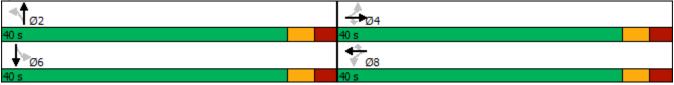
Lane Group Lane Configurations Traffic Volume (vph)	EBL	EBT										
	×		EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBF
Traffic Volume (vph)		•	1	ľ	•	1	۲ ۲	¢Î		1	el el	
	20	419	131	57	348	51	295	55	135	70	18	39
Future Volume (vph)	20	419	131	57	348	51	295	55	135	70	18	39
Satd. Flow (prot)	1258	1456	1335	1312	1470	1309	1492	1296	0	1478	1343	(
Flt Permitted	0.440			0.351			0.720			0.638		
Satd. Flow (perm)	566	1456	1300	483	1470	1215	1119	1296	0	963	1343	(
Satd. Flow (RTOR)			131			51		135			39	
Lane Group Flow (vph)	20	419	131	57	348	51	295	190	0	70	57	(
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	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0		0.0	0.0	
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	0.35	0.33	0.33	0.33	0.55	0.33	0.40	0.40		0.40	0.48	
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	4.Z 0.0	0.0	20.9	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	15.9 B	55.7 D	4.2 A	22.0 C	20.9 C	5.1 A	19.9 B	0.0 A		13.0 B	0.0 A	
	D	27.8	A	U	23.9	A	D	14.5		D	10.7	
Approach Delay		27.0 C										
Approach LOS	1.0		0.0	E E	C	0.0	06.4	B		ΕO	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)	<u> </u>	136.7	05.0	00.0	171.5	<u> </u>	100.0	225.4		<u> </u>	236.2	
Turn Bay Length (m)	60.0	000	85.0	80.0	705	60.0	100.0	600		60.0	600	
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	5											
Natural Cycle: 80												
Control Type: Semi Act-Unc	oord											
Maximum v/c Ratio: 0.83												

Scenario 1 3432 Greenbank Road 2:52 pm 11/02/2020 2024 Future Total - AM Peak Hour

Intersection Signal Delay: 21.4	Intersection LOS: C
Intersection Capacity Utilization 101.9%	ICU Level of Service G

Analysis Period (min) 15





## Lanes, Volumes, Timings 2: Greenbank Road & Half Moon Bay Road

Traffic Oxlume (vph)       211       6       70       19       6       55       23       676       5       5       199       66         Sadt, Flow (rot)       0       1628       0       1564       0       0       1740       0       0       1674       0         Sadt, Flow (prot)       0       1232       0.888       0.994       0.990       0         Sadt, Flow (prot)       0       1235       0       1421       0       0       1740       0       0       1659       0         Sadt, Flow (prot)       0       222       55       1       38       1689       0       0       704       0       0       290       0         Tum Type       Perm< NA       Perm< NA       Perm< NA       Perm< NA       Perm< NA       Perm       NA       Perm< NA       Perm       NA       S3       33       33 <td< th=""><th></th><th>٦</th><th>-</th><th><math>\mathbf{F}</math></th><th>4</th><th>+</th><th>•</th><th>•</th><th>Ť</th><th>1</th><th>1</th><th>Ļ</th><th>~</th></td<>		٦	-	$\mathbf{F}$	4	+	•	•	Ť	1	1	Ļ	~
Traffic Volume (vph)       211       6       70       19       6       55       23       676       5       5       199       66         Future Volume (vph)       211       6       70       19       6       55       23       676       5       5       199       66         Satd, Flow (prot)       0       1628       0       0       1674       0       0       1674       0       0       1674       0       0       1674       0       0       1674       0       0       1679       0       0       1679       0       0       1679       0       0       1679       0       0       1679       0       0       1679       0       0       0       1679       0       0       0       1689       0       0       0       1740       0       0       1689       0       0       0       0       1689       0       0       0       1899       0       1740       0       0       1673       1893       1403       1403       1403       1403       1403       1403       1403       1403       1403       1403       1403       1403       1403       1403	Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Volume (vph)       211       6       70       19       6       55       23       676       5       5       199       66         Satd, Flow (prot)       0       1628       0       0       1564       0       0       1740       0       0       1674       0       0       1674       0       0       1674       0       0       1674       0       0       1674       0       0       1674       0       0       1674       0       0       1674       0       0       1674       0       0       1674       0       0       1674       0       0       1674       0       0       1674       0       0       1674       0       0       1674       0       0       1674       0       0       1674       0       0       1674       0       0       1689       0       1614       0       1414	Lane Configurations		\$			÷			\$			\$	
Satid Flow (prod)       0       1628       0       0       1574       0       0       1674       0         File Permitted       0.732       0.898       0.984       0.990       0       1674       0         Satid. Flow (perm)       0       1235       0       0       1421       0       0       1715       0       0       1659       0         Lane Group Flow (ph)       0       22       55       1       38       38       1       38         Lane Group Flow (ph)       0       27       0       0       0       704       0       0       290       0         Turn Type       Perm       NA       Permitted Phases       4       8       2       6       C       10       10       0       0       0       10       11       11       11       11       11       11       11       11       11       11       11       11       11       11       11       11       11 </td <td>Traffic Volume (vph)</td> <td>211</td> <td></td> <td>70</td> <td>19</td> <td></td> <td>55</td> <td>23</td> <td>676</td> <td>5</td> <td>5</td> <td>199</td> <td>86</td>	Traffic Volume (vph)	211		70	19		55	23	676	5	5	199	86
Fit Permitted       0.732       0.898       0.984       0.990       0         Satd. Flow (perm)       0       1235       0       0       1421       0       0       1715       0       0       1659       0         Satd. Flow (PtOR)       22       55       1       38	Future Volume (vph)	211	6	70	19	6	55	23	676	5	5	199	86
Fit 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 (RDR)       22       55       1       38	Satd. Flow (prot)	0	1628	0	0	1564	0	0	1740	0	0	1674	0
Satil. Flow (FROR)       22       55       1       38         Lane Group Flow (vph)       0       287       0       0       80       0       0       704       0       0       290       0         Um Type       Perm <na< td="">       Perm<na< td="">       Perm NA       Perm NA</na<></na<></na<></na<></na<></na<></na<></na<></na<></na<></na<></na<>	Flt Permitted		0.732			0.898			0.984			0.990	
Lane Group Flow (vph) 0 287 0 0 80 0 0 704 0 0 290 0 Tum Type Perm NA Perm NA Perm NA Perm NA Perm NA Permited Phases 4 8 2 6 Minimum Split (s) 23.9 23.9 23.9 23.9 23.7 23.7 23.7 23.7 1013 Split (s) 23.9 23.9 23.9 23.9 23.9 23.7 23.7 23.7 23.7 1013 Split (s) 23.40 34.0 34.0 34.0 46.0 46.0 46.0 46.0 46.0 1014 Split (s) 23.9 23.9 23.9 23.9 23.9 23.9 5.7 5.7 5.5 57.5 57.5 57.5 57.5 57.5	Satd. Flow (perm)	0	1235	0	0	1421	0	0	1715	0	0	1659	0
Lane Group Flow (vph) 0 287 0 0 80 0 0 704 0 0 290 0 Tum Type Perm NA Perm NA Perm NA Perm NA Perm NA Perm NA Permited Phases 4 8 2 6 Minimum Split (s) 23.9 23.9 23.9 23.7 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 46.0 Total Split (s) 42.5% 42.5% 42.5% 57	Satd. Flow (RTOR)		22			55			1			38	
Turn Type         Perm         NA         Perm         NA         Perm         NA         Perm         NA           Protected Phases         4         8         2         6           Minimum Split (s)         23.9         23.9         23.9         23.7	( )	0	287	0	0	80	0	0	704	0	0	290	0
Protegride Phases 4 8 2 6 Permitted Phases 4 8 2 6 Minimum Split (s) 23.9 23.9 23.9 23.7 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 46.0 Total Split (s) 42.5% 42.5% 42.5% 57.5% 57.5% 57.5% 57.5% 57.5% Vellow 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 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 Kore and the adjust (s) 0.0 0.0 0.0 Total Lost Time (s) 5.9 5.9 5.7 Act Effet Green (s) 28.1 28.1 40.3 40.3 Actuated g/C Ratio 0.35 0.35 0.50 0.50 Ver Ratio 0.64 0.15 0.81 0.34 Control Delay 27.8 8.8 26.3 11.6 Approach Delay 3.1 2.5 85.0 21.2 C A C B Queue Length S0th (m) 33.1 2.5 85.0 21.2 Cueue Length S0th (m) 59.6 11.1 #149.4 37.0 Internal Link Dist (m) 22.65 242.1 157.6 400.9 Tum Bay Length (m) 59.6 11.1 #149.4 37.0 Internal Link Dist (m) 22.65 242.1 157.6 400.9 Tum Bay Length (m) 59.6 11.1 #149.4 37.0 Internal Link Dist (m) 22.65 242.1 157.6 400.9 Tum Bay Length (m) 59.6 11.1 #149.4 37.0 Internal Link Dist (m) 22.65 242.1 157.6 400.9 Tum Bay Length (m) 59.6 11.1 #149.4 37.0 Internal Link Dist (m) 22.65 242.1 157.6 400.9 Tum Bay Length (m) 59.6 11.1 #149.4 37.0 Could Delay 2.7 8 0.8 10.3 Distribut (m) 22.6 5 242.1 157.6 400.9 Tum Bay Length (m) 59.6 11.1 #149.4 37.0 Intersection Concol 0 0 Solvage Cap Reductn 0 0 0 Solvage Cap Reductn 0 Solvage Ca	Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Minimum Split (s)       23.9       23.9       23.7       23	Protected Phases		4			8			2			6	
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%       57.5%	Permitted Phases	4			8			2			6		
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%       57.5%	Minimum Split (s)	23.9	23.9		23.9	23.9		23.7	23.7		23.7	23.7	
Total Split (%)       42.5%       42.5%       42.5%       57.5%       57.5%       57.5%       57.5%         Yellow Time (s)       3.3       3	• • • • •								46.0				
Yellow Time (s)       3.3 <td></td> <td></td> <td></td> <td></td> <td></td> <td>42.5%</td> <td></td> <td></td> <td>57.5%</td> <td></td> <td>57.5%</td> <td>57.5%</td> <td></td>						42.5%			57.5%		57.5%	57.5%	
All-Red Time (s)       2.6       2.6       2.6       2.6       2.4       2.4       2.4       2.4       2.4       2.4       2.4       2.4       1.4       Lost Time Adjust (s)       0.0       Act Effct Green (s)       28.1       28.1       40.3       40.3       Actatated gC Ratio       0.35       0.50       0.50       v/c Ratio       0.35       0.50       0.50       v/c Ratio       0.34       0.34       Control Delay       27.8       8.8       26.3       11.6       1.6       Approach Delay       27.8       8.8       26.3       11.6       Approach Delay       27.8													
Lost Time Adjust (s) 0.0 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 Ve 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 LOS C A C B Approach Delay 27.8 8.8 26.3 11.6 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 Storage Cap Reductn 0 0 0 Storage Cap Reductn 0 0 Storage Cap Reductn 0 0 Storage Cap Reductn 0 0 Storage Cap Reductn 0 0 Control Type: Pretimed Maximum Vc Ratio: 0.61 Intersection Signal Delay: 22.5 Intersection LOS: C Intersection Capacity (Utization 84.5% ICU Level of Service E													
Total Lost Time (s)         5.9         5.9         5.7         5.7           Lead/Lag Optimize?													
Lead-Lag Optimize? 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 LOS C A C B Approach Delay 27.8 8.8 26.3 11.6 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 Turm Bay Length (m) Base Capacity (vph) 448 534 864 854 Starvation Cap Reductn 0 0 0 0 Spillback Cap Reductn 0 0 0 Spillback Cap Reductn 0 0 0 Reduced v/c Ratio 0.64 0.15 0.81 0.34 Intersection Summary Cycle Length : 80 Actuated Cycle Length : 80 Actuated Cy	,												
Lead-Lag Optimize?         Act Effet Green (s)       28.1       28.1       40.3       40.3         Actuated g/C Ratio       0.35       0.35       0.50       0.50         Vic 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         LOS       C       A       C       B         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         Turm Bay Length (m)       Base Capacity (vph)       448       534       864       854         Starvation Cap Reductn       0       0       0       0       0         Storage Cap Reductn </td <td>( )</td> <td></td> <td>-</td> <td></td>	( )											-	
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         LOS       C       A       C       B         Approach Delay       27.8       8.8       26.3       11.6         LOS       C       A       C       B         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 (wph)       0       0       0       0													
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           LOS         C         A         C         B           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 Reducth         0         0         0         0         0           Storage Cap Reducth         0         0.5			28.1			28.1			40.3			40.3	
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         LOS       C       A       C       B         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         Tum Bay Length (m)       226.5       242.1       157.6       402.9         Starvation Cap Reductn       0       0       0       0         Starvation Cap Reductn       0       0       0       0         Starvation Cap Reductn       0       0       0       0         Reduced v/c Ratio       0.64       0.15       0.81       0.34         Inte													
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           Approach LOS         C         A         C         B           Queue Length 50th (m)         33.1         2.5         85.0         21.2           Queue Length 95th (m)         29.6         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         0           Starvation Cap Reductn         0         0         0         0         0           Starvation Cap Reductn         0         0         0         0         0           Reduced v/c Ratio         <													
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           LOS         C         A         C         B           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         0           Starvation Cap Reductn         0         0         0         0         0           Starvation Cap Reductn         0         0         0         0         0         0         0         0         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           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           Tum Bay Length (m)         Base Capacity (vph)         448         534         864         854           Starvation Cap Reductn         0         0         0         0         Storage Cap Reductn         0         0         0           Storage Cap Reductn         0         0         0         0         0         O         Storage Cap Reductn         0         0         0         0         0         O         Storage Cap Reductn         0         0         0         O         0         Colassic Case Case Cap Reductn         0         0         0													
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           Tum Bay Length (m)         Base Capacity (vph)         448         534         864         854           Starvation Cap Reductn         0         0         0         0         0           Spillback Cap Reductn         0         0         0         0         0           Starvation Cap Reductn         0         0         0         0         0           Starvation Cap Reductn         0         0         0         0         0         0           Starvation Cap Reductn         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         1         1	,												
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         0         0           Spillback Cap Reductn         0													
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         0           Spillback Cap Reductn         0         0         0         0         0           Storage Cap Reductn         0         0         0         0         0         0           Reduced v/c Ratio         0.64         0.15         0.81         0.34         0.34         0.34           Intersection Summary         Cycle Length: 80 </td <td></td>													
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         0           Spillback Cap Reductn         0         0         0         0         0           Starvation Cap Reductn         0													
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         0           Spillback Cap Reductn         0         0         0         0         0           Starvation Cap Reductn         0         0         0         0         0           Starvation Cap Reductn         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         0           Spillback Cap Reductn         0         0         0         0         0         0           Storage Cap Reductn         0<	• • • •												
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         Storage Cap Reductn       0       0       0       0         Reduced v/c Ratio       0.64       0.15       0.81       0.34         Intersection Summary													
Base Capacity (vph)         448         534         864         854           Starvation Cap Reductn         0	( )												
Starvation Cap Reductn         0         0         0         0           Spillback Cap Reductn         0			448			534			864			854	
Spillback Cap Reductn0000Storage Cap Reductn0000Reduced v/c Ratio0.640.150.810.34Intersection SummaryCycle Length: 80Actuated Cycle Length: 80Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of GreenNatural Cycle: 60Control Type: PretimedMaximum v/c Ratio: 0.81Intersection Signal Delay: 22.5Intersection LOS: CIntersection Capacity Utilization 84.5%									-				
Storage Cap Reductn0000Reduced v/c Ratio0.640.150.810.34Intersection SummaryCycle Length: 80Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of GreenNatural Cycle: 60Control Type: PretimedMaximum v/c Ratio: 0.81Intersection Signal Delay: 22.5Intersection LOS: CIntersection Capacity Utilization 84.5%ICU Level of Service E			0			0			0			0	
Reduced v/c Ratio0.640.150.810.34Intersection SummaryCycle Length: 80Actuated Cycle Length: 80Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of GreenNatural Cycle: 60Control Type: PretimedMaximum v/c Ratio: 0.81Intersection Signal Delay: 22.5Intersection LOS: CIntersection Capacity Utilization 84.5%	•												
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	Reduced v/c Ratio		0.64			0.15			0.81			0.34	
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 Capacity Utilization 84.5%	Intersection Summary												
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 Capacity Utilization 84.5%	Cycle Length: 80												
Natural Cycle: 60         Control Type: Pretimed         Maximum v/c Ratio: 0.81         Intersection Signal Delay: 22.5         Intersection Capacity Utilization 84.5%         ICU Level of Service E	, ,	to nhase 2	·NRTL and	16.SBTI	Start of	Green							
Control Type: Pretimed         Maximum v/c Ratio: 0.81         Intersection Signal Delay: 22.5         Intersection Capacity Utilization 84.5%         ICU Level of Service E				. 0.001	., otart of	0.001							
Maximum v/c Ratio: 0.81         Intersection Signal Delay: 22.5         Intersection Capacity Utilization 84.5%         ICU Level of Service E													
Intersection Signal Delay: 22.5       Intersection LOS: C         Intersection Capacity Utilization 84.5%       ICU Level of Service E	51												
Intersection Capacity Utilization 84.5% ICU Level of Service E		2.5			h	ntersection	LOS C						
	<b>.</b> .		'n					÷Ε					
	Analysis Period (min) 15												

Scenario 1 3432 Greenbank Road 2:52 pm 11/02/2020 2024 Future Total - AM Peak Hour

# 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



## Lanes, Volumes, Timings <u>1: River Mist Road & Cambrian Road</u>

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	1	•	1	ľ	•	1	<u>ک</u>	el el		۲ ۲	¢Î	
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	C
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	C
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	В	D	А	С	В	А	С	А		С	В	
Approach Delay		35.3			19.8			17.8			17.4	
Approach LOS		D			В			В			В	
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-Unc	oord											
Maximum v/c Ratio: 0.91												

Scenario 1 3432 Greenbank Road 2:52 pm 11/02/2020 2024 Future Total - PM Peak Hour

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

# 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

<b>↑</b> <sub>Ø2</sub>	✓ Ø3
41 s	11 s 48 s
<b>↓</b> Ø6	₩ Ø8
41 s	59 s

## Lanes, Volumes, Timings 2: Greenbank Road & Half Moon Bay Road

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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)	2.0	0.0		2.0	0.0		2.1	0.0		2.1	0.0	
Total Lost Time (s)		5.9			5.9			5.7			5.7	
Lead/Lag		0.0			0.0			0.1			0.1	
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		0.22			0.22			0.05			0.03	
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		59.2 D			10.4 B			н.4 В			30.0 C	
Approach Delay		39.2			ь 16.4			ы 11.4			30.0	
,		59.2 D			10.4 B			11.4 B			30.0 C	
Approach LOS Queue Length 50th (m)		26.0			5.4			40.1			113.4	
<b>3</b> ( )		#53.4			16.7			40.1 65.9			#211.0	
Queue Length 95th (m) Internal Link Dist (m)		#55.4 226.5			242.1			157.6			402.9	
· · · · · · · · · · · · · · · · · · ·		220.0			242.1			157.0			402.9	
Turn Bay Length (m)		200			277			000			1042	
Base Capacity (vph)		298			377			928			1043	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn Reduced v/c Ratio		0.67			0.23			0.57			0.93	
Intersection Summary		0.07			0.23			0.57			0.95	
Cycle Length: 80												
Actuated Cycle Length: 80												
Offset: 0 (0%), Referenced	to phace 2	·NRTL on		Start of	Green							
Natural Cycle: 80	to phase 2	INDIE all	10.001	., Start Of	GIGGII							
Control Type: Pretimed												
Maximum v/c Ratio: 0.93												
Intersection Signal Delay: 2	10			I.	ntersection							
Intersection Signal Delay: 2 Intersection Capacity Utiliza					CU Level							
Analysis Period (min) 15	mon 90.0%	J		K	JO LEVEL		<u>,</u> L					

Scenario 1 3432 Greenbank Road 2:52 pm 11/02/2020 2024 Future Total - PM Peak Hour

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



## Appendix N

Synchro Worksheets – 2029 Future Total Synchro Sheets

## Lanes, Volumes, Timings <u>1: River Mist Road & Cambrian Road</u>

09/16/2021

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	<u>۲</u>	1	1	5	<b>†</b>	1	<u>۲</u>	eî.		<u>۲</u>	¢Î	
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	В	D	А	С	С	А	С	А		В	А	
Approach Delay		41.1			25.6			17.4			11.9	
Approach LOS		D			С			В			В	
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-Unco	oord											
Maximum v/c Ratio: 0.95												

Scenario 1 3432 Greenbank Road 2:52 pm 11/02/2020 2029 Future Total - AM Peak Hour

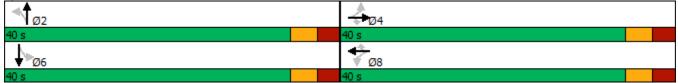
### Intersection Signal Delay: 28.5 Intersection Capacity Utilization 111.2%

Intersection LOS: C 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



## Lanes, Volumes, Timings 2: Greenbank Road & Half Moon Bay Road

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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)	2.0	0.0		2.0	0.0		2.7	0.0		2.7	0.0	
Total Lost Time (s)		5.9			5.9			5.7			5.7	
Lead/Lag		0.0			0.5			0.7			0.1	
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		0.55			0.35			1.03			0.30	
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		20.4 C			9.1 A			59.5 E			13.0 B	
Approach Delay		28.4			9.1			59.5			13.0	
Approach LOS		20.4 C			9.1 A			59.5 E			13.0 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)		220.5			242.1			157.0			402.9	
		150			506			060			955	
Base Capacity (vph) Starvation Cap Reductn		452 0			526 0			863 0			855 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		0.00			0.10			1.05			0.41	
Cycle Length: 80												
Actuated Cycle Length: 80												
Offset: 0 (0%), Referenced t	o phase 2	:NBTL and	d 6:SBTL	., Start of	Green							
Natural Cycle: 90												
Control Type: Pretimed												
Maximum v/c Ratio: 1.03												
Intersection Signal Delay: 47	1.0			Ir	ntersectior	ו LOS: D						
Intersection Capacity Utilization	tion 97.8%	)		10	CU Level o	of Service	ə F					
Analysis Period (min) 15												

Scenario 1 3432 Greenbank Road 2:52 pm 11/02/2020 2029 Future Total - AM Peak Hour

- $\sim$   $\;$  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

Ø2 (R)	<u>→</u> <sub>Ø4</sub>
46 s	34 s
Ø6 (R)	<b>₩</b> Ø8
46 s	34 s

## Lanes, Volumes, Timings <u>1: River Mist Road & Cambrian Road</u>

09/16/2021

	٦	-	$\mathbf{r}$	•	-	•	1	1	1	1	Ļ	~
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	1	•	*	ľ	•	1	<u>ک</u>	el el		۲ ۲	¢Î	
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	0.1	0.1	0.0	0.0		0.0	0.0	
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	. <u>2.</u> в	
Approach Delay	D	55.3	7.		26.8	7.	Ū	18.7		Ũ	17.6	
Approach LOS		E			20.0 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)	0.4	136.7	12.0	//+0.0	171.5	0.0	40.0	225.4		12.0	236.2	
Turn Bay Length (m)	60.0	100.7	85.0	80.0	17 1.0	60.0	100.0	220.4		60.0	200.2	
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	
	0.10	1.00	0.21	0.04	0.71	0.10	0.70	0.27		0.10	0.01	
Intersection Summary												
Cycle Length: 100												
Actuated Cycle Length: 100												
Natural Cycle: 100												
Control Type: Semi Act-Unco	ord											
Maximum v/c Ratio: 1.03												

Scenario 1 3432 Greenbank Road 2:52 pm 11/02/2020 2029 Future Total - PM Peak Hour

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 I	longer.
Queue shown is maximum after two cycles.	

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

	44	
<↑ø₂	<b>√</b> Ø3	₩04
41 s	11 s	48 s
▼Ø6	<b>₽</b> Ø8	
41 s	59 s	

## Lanes, Volumes, Timings 2: Greenbank Road & Half Moon Bay Road

Lane Group         EBL         EBL         EBR         WBL         WBR         NBL         NBT         NBR         SBL         SBR         SBR           Lane Condyurations		۶	-	$\mathbf{F}$	4	+	*	•	Ť	1	1	Ļ	~
Traffic 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       1688       0       0       1620       0       1726       0       0       1682       0       1642       0       1642       0       1642       0       1642       0       1642       0       1642       0       1642       0       1642       0       1642       0       0       1641       0       1642       0       1642       0       0       1641       0       1642       0       0       1641       0       1642       0       1642       0       1641       0       1642       0       1641       0       1641	Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic 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       1688       0       0       1620       0       1726       0       0       1682       0       1642       0       1642       0       1642       0       1642       0       1642       0       1642       0       1642       0       1642       0       1642       0       0       1641       0       1642       0       1642       0       0       1641       0       1642       0       0       1641       0       1642       0       1642       0       1641       0       1642       0       1641       0       1641	Lane Configurations		\$			\$			\$			\$	
Satal Flow (prof.)       0       1638       0       0       1726       0       0       1726       0       0       1698       0         FIL Permitted       0.760       0.934       0.834       0.965       0       1447       0       0       1642       0         Satd. Flow (perm)       0       1244       0       0       1526       0       0       1447       0       0       1642       0         Lane Group Flow (ph)       0       0       0       0       0       649       0       0       1147       0         Turn Type       Perm       NA       S3.3       3.3       3.3       3.3       3.3       3.3	Traffic Volume (vph)	159		37	15		44	60		28	39		211
FIP Permitted       0.760       0.934       0.834       0.834       0.965         Satd, Flow (perm)       0       1294       0       0       1526       0       0       1447       0       0       1622       0         Lane Group Flow (vph)       0       204       0       0       93       0       649       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       0       1147       0       0       0       1147       0       0       0       1147       0       0       0       1147       0       0       0       1147       0	Future Volume (vph)	159	8	37	15	34	44	60	561	28	39	897	211
FIP Permitted       0.760       0.934       0.834       0.836         Satd, Flow (perm)       0       1294       0       0       1526       0       0       1447       0       0       1622       0         Satd, Flow (ROR)       13       44       5       27       27         Lane Group Flow (vph)       0       204       0       93       0       649       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       1141       116       1141       1141       1141       1141       1141       1141       1141       1141       1141       1141       1141       1141       1141       1141       1141       1141       1141       1141       1141       <	( 1 )	0	1638	0	0	1620	0	0	1726	0	0	1698	0
Satid Flow (perm)         0         1294         0         0         1526         0         0         1447         0         0         1642         0           Satid, Flow (RTOR)         13         444         5         27         27           Lane Group Flow (vph)         0         0         93         0         649         0         0         1147         0           Tum Type         Perm         NA         Para         Para         Para         Para         Para <td>, , , , , , , , , , , , , , , , , , ,</td> <td></td> <td>0.760</td> <td></td> <td></td> <td>0.934</td> <td></td> <td></td> <td>0.834</td> <td></td> <td></td> <td>0.965</td> <td></td>	, , , , , , , , , , , , , , , , , , ,		0.760			0.934			0.834			0.965	
Sati. Flow (FTOR)       13       44       5       27         Lane Group Flow (vph)       0       0       0       0       649       0       0       1147       0         Tum Type       Perm       NA       Par       P	Satd. Flow (perm)	0	1294	0	0	1526	0	0	1447	0	0	1642	0
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 Perm NA Protected Phases 4 8 2 6 Minimum Split (s) 239 239 239 237 237 237 237 237 237 Total Split (s) 239 239 239 239 56.1 56.1 56.1 56.1 56.1 Total Split (s) 299% 299% 70.1% 70.1% 70.1% 70.1% Pellow Time (s) 3.3 3.3 3.3 3.3 3.3 3.3 3.3 3.3 3.3 3.			13			44			5			27	
Turn Type         Perm         NA         Perm         NA         Perm         NA           Protected Phases         4         8         2         6           Minimum Split (s)         23.9         23.9         23.9         23.7         23.8         3.3		0		0	0	93	0	0	649	0	0	1147	0
Protected Phases         4         8         2         6           Permited Phases         4         8         2         6           Minimum Split (s)         23.9         23.9         23.7         23.7         23.7         23.7         23.7         7         7		Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Minimum Split (s)       23.9       23.9       23.9       23.7       23			4			8						6	
Minimum Split (s)       23.9       23.9       23.7       23		4			8			2			6		
Total Split (s)       23.9       23.9       23.9       23.9       56.1       56.1       56.1       56.1       56.1       56.1       56.1       56.1       56.1       56.1       56.1       56.1       56.1       56.1       56.1       56.1       56.1       70.1%	Minimum Split (s)		23.9		23.9	23.9		23.7	23.7		23.7	23.7	
Total Split (%)         29.9%         29.9%         29.9%         70.1%	• • • • •								56.1		56.1	56.1	
Yellow Time (s)       3.3       3.4       3.4       3.5       3.6													
All-Red Time (s) 2.6 2.6 2.6 2.6 2.6 2.4 2.4 2.4 2.4 2.4 Lost Time Adjust (s) 0.0 0.0 0.0 0.0 0.0 0.0 Total Lost Time Adjust (s) 0.0 5.9 5.7 5.7 Lead/Lag Use the set of the set	• • •												
Lost Time Adjušt (s)         0.0         0.0         0.0         0.0           Total Lost Time (s)         5.9         5.7         5.7           Lead/Lag         Lead-Lag Optimize?													
Total Lost Time (s)         5.9         5.9         5.7         5.7           Lead-Lag Optimize?	.,												
Lead-Lag Optimize? Act Effct Green (s) 18.0 18.0 50.4 50.4 Act Effct Green (s) 18.0 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 B E Approach Delay 39.6 17.0 15.3 76.6 Approach Delay 39.6 17.0 15.3 76.6 Approach Delay 39.6 17.0 15.3 76.6 Approach Delay 39.6 17.0 15.3 76.6 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 Turm Bay Length (m) Base Capacity (vph) 301 377 913 1044 Starvation Cap Reductn 0 0 0 0 Spillback 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 (Itilization 101.1% ICU Level of Service G													
Lead-Lag Optimize?         Act EftG Green (s)       18.0       18.0       50.4       50.4         Actuated g/C Ratio       0.22       0.22       0.63       0.63         vic 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       100         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         LOS       D       B       B       E       E         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       0         Storage Cap Reductn       0												•	
Act Effct Green (s)       18.0       18.0       50.4       50.4         Actuated g/C Ratio       0.22       0.22       0.63       0.63         vic 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         LOS       D       B       B       E       2         Approach Delay       39.6       17.0       15.3       76.6         LOS       D       B       B       E       2         Queue Length Soft (m)       26.6       6.0       58.1       ~199.8         Queue Length Soft (m)       226.5       242.1       157.6       402.9         Turn Bay Length (m)       Base       Capacity (wph)       301       377       913       1044         Starvation Cap Reductn       0       0       0       0       0       0       0         Stor													
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           LOS         D         B         B         E           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           Turm Bay Length (m)         301         377         913         1044           Starvation Cap Reducth         0         0         0         0           Spillback Cap Reducth         0         0.25         0.71         1.10	• •		18.0			18.0			50 4			50 4	
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 Delay       39.6       17.0       15.3       76.6         Approach LOS       D       B       B       E         Queue Length Sth (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)       301       377       913       1044         Starvation Cap Reductn       0       0       0       0         SpliBack Cap Reductn       0       0       0       0       0         Reduced v/c Ratio       0.68       0.25       0.71       1.10       1.10         Intersection Summary       Cycle Length: 80       O.25													
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 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           Tum Bay Length (m)         301         377         913         1044           Starvation Cap Reductn         0         0         0         0           SpliBack Cap Reductn         0         0         0         0           Staryation Cap Reductn         0.68         0.25         0.71         1.10           Intersection Summary         E         C         C         C													
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           LOS         D         B         B         E           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           Tum Bay Length (m)         Base Capacity (vph)         301         377         913         1044           Starvation Cap Reductn         0         0         0         0         Storage Cap Reductn         0         0         0           Storage Cap Reductn         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           Tum Bay Length (m)         Base Capacity (vph)         301         377         913         1044           Starvation Cap Reductn         0         0         0         0         Storage Cap Reductn         0         0         0           Storage Cap Reductn         0         0         0         0         0         O         0         O         0         O         0													
LOS         D         B         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         0           Spillback Cap Reductn         0         0         0         0         0           Starvation Cap Reductn         0         0         0         0         0           Starvation Cap Reductn         0         0         0         0         0         0           Starvation Cap Reductn         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         10         110 <td< td=""><td>,</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>	,												
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         0           Spillback Cap Reductn         0         0         0         0         0           Starge Cap Reductn         0         0         0         0         0           Reduced v/c Ratio         0.68         0.25         0.71         1.10           Intersection Summary         Versection Summary         Versection Summary         Versection Summary         Versection Summary           Cycle Length: 80         O         O         O         O         O         O         O         O         O         O         O         O         O         O         O         O													
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         0           Starvation Cap Reductn         0													
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         0           Spillback Cap Reductn         0         0         0         0         0           Starvation Cap Reductn         0         0         0         0         0         0           Spillback Cap Reductn         0 <td></td>													
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         0           Spillback Cap Reductn         0         0         0         0         0           Storage Cap Reductn         0         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         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 LOS: D         Intersection Signal Delay: 51.4         Intersection LOS: D         Intersection Cospacity Utilization 101.1%         ICU Level of Service G													
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         0           Spillback Cap Reductn         0         0         0         0         0         0           Storage Cap Reductn         0         1.10         0         1.10         0         1.10         1         1         0         1         0	<b>3</b> ( )												
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         Storage Cap Reductn       0       0       0       0         Reduced v/c Ratio       0.68       0.25       0.71       1.10         Intersection Summary													
Base Capacity (vph)         301         377         913         1044           Starvation Cap Reductn         0 <td< td=""><td>· · · · · · · · · · · · · · · · · · ·</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>	· · · · · · · · · · · · · · · · · · ·												
Starvation Cap Reductn         0         0         0         0           Spillback Cap Reductn         0			301			377			913			1044	
Spillback Cap Reductin0000Storage Cap Reductin0000Reduced v/c Ratio0.680.250.711.10Intersection SummaryCycle Length: 80Actuated Cycle Length: 80Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of GreenNatural Cycle: 100Control Type: PretimedMaximum v/c Ratio: 1.10Intersection Signal Delay: 51.4Intersection LOS: DIntersection Capacity Utilization 101.1%													
Storage Cap Reductn0000Reduced v/c Ratio0.680.250.711.10Intersection SummaryCycle Length: 80Actuated Cycle Length: 80Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of GreenNatural Cycle: 100Control Type: PretimedMaximum v/c Ratio: 1.10Intersection Signal Delay: 51.4Intersection LOS: DIntersection Capacity Utilization 101.1%			-						-				
Reduced v/c Ratio0.680.250.711.10Intersection SummaryCycle Length: 80Actuated Cycle Length: 80Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of GreenNatural Cycle: 100Control Type: PretimedMaximum v/c Ratio: 1.10Intersection Signal Delay: 51.4Intersection LOS: DIntersection Capacity Utilization 101.1%ICU Level of Service G						0			0			0	
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			0.68			0.25			0.71			1.10	
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 Capacity Utilization 101.1%         ICU Level of Service G	Intersection Summary												
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 Capacity Utilization 101.1%         ICU Level of Service G													
Natural Cycle: 100         Control Type: Pretimed         Maximum v/c Ratio: 1.10         Intersection Signal Delay: 51.4         Intersection Capacity Utilization 101.1%         ICU Level of Service G	, ,	to phase 2	:NBTL and	16:SBTI	. Start of	Green							
Control Type: Pretimed         Maximum v/c Ratio: 1.10         Intersection Signal Delay: 51.4         Intersection Capacity Utilization 101.1%         ICU Level of Service G					,								
Maximum v/c Ratio: 1.10         Intersection Signal Delay: 51.4         Intersection Capacity Utilization 101.1%         ICU Level of Service G													
Intersection Signal Delay: 51.4         Intersection LOS: D           Intersection Capacity Utilization 101.1%         ICU Level of Service G													
Intersection Capacity Utilization 101.1% ICU Level of Service G		1.4			Ir	ntersection	LOS: D						
			%					G					
								-					

Scenario 1 3432 Greenbank Road 2:52 pm 11/02/2020 2029 Future Total - PM Peak Hour

- ~ 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

∫ ≪	<u>⊿</u> Ø4	
56.1 s	23.9 s	
Ø6 (R)	<b>↓</b> Ø8	
56.1s	23.9 s	

## Lanes, Volumes, Timings <u>1: River Mist Road & Cambrian Road</u>

09/23/2021

	≯	+	*	4	+	•	•	1	1	1	Ļ	~
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	ľ	•	1	ľ	•	1	ľ	el el		۲ ۲	¢Î	
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	•	•	0.0	0.0		0.0	0.0	
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	В	E	A	E	С	A	С	A		С	В	
Approach Delay		55.3			26.8			18.7			17.6	
Approach LOS		E			С			В			В	
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-Unco	oord											
Maximum v/c Ratio: 1.03												

Scenario 1 3432 Greenbank Road 2:52 pm 11/02/2020 2029 Future Total - PM Peak Hour Mitigation

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

<b>▲</b> ¶ <sub>Ø2</sub>	✓ Ø3 → Ø4
41 s	11 s 48 s
Ø6	
41 s	59 s

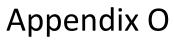
## Lanes, Volumes, Timings 2: Greenbank Road & Half Moon Bay Road

Lane Configurations         Image: height and text of tex of text of text of text of text of tex of text of te		٦	-	$\mathbf{F}$	4	-	*	1	1	1	1	Ļ	~
Traffic Volume (vph)       159       8       37       15       34       44       60       561       28       39       897       211         Future Volume (vph)       159       8       37       15       34       444       60       561       28       39       897       211         Satd, Flow (prot)       0       1638       0       1620       0       1726       0       0       1639       0         Satd, Flow (prot)       0       1218       0       1542       0       1415       0       0       1639       0       1639       0       1639       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       1147       0       1147       0       1147       0       1147       0       1147       0       1147       0       1147       0       1148       1161       1141       1141       1141       1141       1141       1141       11	Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic 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       1689       0       1610       0       1638       0       1612       0       1726       0       0       1639       0       0       1639       0       0       1639       0       0       1639       0       0       1639       0       0       1147       0       0       1639       0       0       1147       0       0       1639       0       0       1147       0       0       1639       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       1147       0       1147       0       1147       0       1147       0       1147       0       1147       0       1147       10       1147       10       1147       10       1147       10       1147       10       1147       10       1141       1141       1141       1141       1143	Lane Configurations		4			\$			÷			\$	
Satid Flow (prof.)         0         1638         0         0         1620         0         0         1726         0         0         1698         0           Fit Parmitted         0.715         0.944         0.816         0.963         0         1693         0           Satid. Flow (perm)         0         1542         0         0         1415         0         0         1639         0           Satid. Flow (perm)         0         0         93         0         649         0         0         1147         0           Turn Type         Perm         NA         S1         S1         S1         S1         S1         S1         S1         S1	Traffic Volume (vph)	159		37	15		44	60	561	28	39	897	211
FIP Permitted       0.715       0.944       0.816       0.963         Satd, Flow (perm)       0       1218       0       0       1415       0       0       1639       0         Lane Group Flow (vph)       0       204       0       0       933       0       649       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       1147       0       0       11415       0       1147       0       0       11415       0       0       11415       0       0       11415       0       0       11415       0       0       11415       0       11415       0       0       11415       0       0       0       0       0       0       0	Future Volume (vph)	159	8	37	15	34	44	60	561	28	39	897	211
Sate:         Inversion         0         1218         0         0         1542         0         0         1415         0         0         1639         0           Sate:         Flow (RTOR)         9         35         5         27         27           Lane Group Flow (pht)         0         0         930         0         6         649         0         0         1147         0           Tum Type         Perm         NA         Perm         NA         Perm         NA         Perm         NA           Protected Phases         4         8         2         6         24         64         24.6         24.6         24.6         24.6         24.6         24.6         24.6         24.6         24.6         24.6         24.6         24.6         24.6         24.6         24.6         24.4         24	Satd. Flow (prot)	0	1638	0	0	1620	0	0	1726	0	0	1698	0
Sati. Flow (RTOR)         9         35         5         27           Lane Group Flow (vph)         0         0         0         0         649         0         0         0         147         0           Tum Type         Perm         NA         SA         SA         SA <td< td=""><td>Flt Permitted</td><td></td><td>0.715</td><td></td><td></td><td>0.944</td><td></td><td></td><td>0.816</td><td></td><td></td><td>0.963</td><td></td></td<>	Flt Permitted		0.715			0.944			0.816			0.963	
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 Perm NA Protected Phases 4 8 2 6 Minimum Split (s) 23.9 23.9 23.9 23.7 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 (s) 22.4% 22.4% 22.4% 77.6%	Satd. Flow (perm)	0	1218	0	0	1542	0	0	1415	0	0	1639	0
Turn Type         Perm         NA         Perm         NA         Perm         NA           Protected Phases         4         8         2         6           Minimum Split (s)         23.9         23.9         23.9         23.7         13.7         13.7         13.7         13.7         13.7         13.7         13.8         13.3         3.3         3.3         3.3         3.3         3.3         3.3         3.3         3.3         3.3         3.3         3.3         3.3         13.8         12.4         12.4<	Satd. Flow (RTOR)		9			35			5			27	
Protected Phases         4         8         2         6           Permited Phases         4         8         2         6           Permited Phases         23.9         23.7         23.7         23.7         23.7         23.7         23.7         7         23.7         7 <td< td=""><td>Lane Group Flow (vph)</td><td>0</td><td>204</td><td>0</td><td>0</td><td>93</td><td>0</td><td>0</td><td>649</td><td>0</td><td>0</td><td>1147</td><td>0</td></td<>	Lane Group Flow (vph)	0	204	0	0	93	0	0	649	0	0	1147	0
Permitted Phases         4         8         2         6           Minimum Split (s)         23.9         23.9         23.7	Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Minimum Split (s)       23.9       23.9       23.7       23	Protected Phases		4			8			2			6	
Total Split (s)       24.6       24.6       24.6       85.4	Permitted Phases	4			8			2			6		
Total Split (%)         22.4%         22.4%         22.4%         77.6%	Minimum Split (s)	23.9	23.9		23.9	23.9		23.7	23.7		23.7	23.7	
Total Split (%)       22.4%       22.4%       22.4%       77.6%       70.72	Total Split (s)	24.6	24.6		24.6	24.6		85.4	85.4		85.4	85.4	
Yellow Time (s)       3.3		22.4%	22.4%		22.4%	22.4%		77.6%	77.6%		77.6%	77.6%	
All-Red Time (s) 2.6 2.6 2.6 2.6 2.6 2.4 2.4 2.4 2.4 2.4 Lost Time Adjust (s) 0.0 0.0 0.0 0.0 0.0 0.0 Log Unitizet (s) 5.9 5.9 5.7 5.7 Lead/Lag Optimize? Lead/Lag Optimize? Act Effct Green (s) 18.7 18.7 79.7 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 0.0 Total Delay 95.0 29.2 11.1 33.1 LOS F C B C B C Approach Delay 95.0 29.2 11.1 33.1 Approach LOS F C B C B C Queue Length 50th (m) 42.1 10.9 61.0 190.7 Queue Length 50th (m) 42.1 10.9 61.0 190.7 Queue Length 50th (m) 42.1 157.6 402.9 Turn Bay Length (m) Ease Capacity (vph) 214 291 1026 1194 Starvation Cap Reducth 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0													
Lost Time Adjust (s) 0.0 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 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 0.0 Total Delay 95.0 29.2 11.1 33.1 LOS F C B C B C Approach Delay 95.0 29.2 11.1 33.1 LOS F C B C B C Queue Length 50th (m) 42.1 10.9 61.0 190.7 Queue Length 50th (m) 42.1 10.9 61.0 190.7 Queue Length 95th (m) 226.5 242.1 157.6 402.9 Turm Bay Length (m) Base Capacity (vph) 214 291 1026 1194 Starvation Cap Reducth 0 0 0 0 0 0 0 Storage Cap Reducth 0 0 0 0 0 0 Storage Cap Reducth 0 0 0 0 0 0 0 Storage Cap Reducth 0 0 0 0 0 0 Co													
Total Lost Time (s)         5.9         5.9         5.7         5.7           Lead-Lag Optimize?													
Lead/Lag Optimize? Act Effct Green (s) 18.7 18.7 79.7 79.7 Act Effct Green (s) 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 LOS F C B C Queue Length 50th (m) 42.1 10.9 61.0 190.7 Queue Length 50th (m) 42.1 10.9 61.0 190.7 Queue Length 50th (m) 42.1 10.9 61.0 190.7 Queue Length 50th (m) 47.1 25.9 93.7 #322.4 Internal Link Dist (m) 22.6.5 242.1 157.6 402.9 Turm Bay Length (m) Base Capacity (vph) 214 291 1026 1194 Starvation Cap Reductn 0 0 0 0 Spillback Cap Reductn 0 0 0 0 Spillback Cap Reductn 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 Capacity (Jilization 101.1% ICU Level of Service G	,												
Lead-Lag Optimize?         Act EftG Green (s)       18.7       18.7       79.7       79.7         Actuated g/C Ratio       0.17       0.17       0.72       0.72         vic 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         Queue 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)       47.1       25.9       93.7       #322.4         Internal Link Dist (m)       226.5       242.1       157.6       402.9         Turn Bay Length (m)       214       291       1026       1194         Starvation Cap Reductn       0       0       0       0         Starvation Cap Reductn       0       0       0       0       0         Starage Cap Reductn       0	· · · ·											•••	
Act Effct Green (s)       18.7       18.7       79.7       79.7         Actuated g/C Ratio       0.17       0.17       0.72       0.72         vic 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 Delay       95.0       29.2       11.1       33.1         Approach LOS       F       C       B       C         Queue Length S0th (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       24.1       157.6       402.9         Turn Bay Length (m)       E       1       190.7       0       0         Starvation Cap Reductn       0       0       0       0       0       0         Storage Cap Reductn       0 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>													
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         LOS       F       C       B       C         Approach LOS       F       C       B       C         Queue Length 50th (m)       42.1       10.9       61.0       190.7         Queue Length 50th (m)       #87.1       25.9       93.7       #322.4         Internal Link Dist (m)       226.5       242.1       157.6       402.9         Turm Bay Length (m)       E       76       0       0       0         Starvation Cap Reducth       0       0       0       0       0         Starvation Cap Reducth       0       0       0       0       0         Storage Cap Reducth       0       0.32       0.63			18.7			18.7			79.7			79.7	
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         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         LOS       F       C       B       C         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)       214       291       1026       1194         Starvation Cap Reductn       0       0       0       0         Staryation Cap Reductn       0       0       0       0         Staryation Cap Reductn       0       0       0       0         Reduced v/c Ratio       0.95       0.32       0.63       0.96         Intersection Summary </td <td></td>													
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 Delay         95.0         29.2         11.1         33.1           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 50th (m)         242.1         157.6         402.9           Tum Bay Length (m)         226.5         242.1         157.6         402.9           Tum Bay Length (m)         214         291         1026         1194           Starvation Cap Reductn         0         0         0         0           Staryation Cap Reductn         0         0         0         0           Staryation Cap Reductn         0         0.32         0.63         0.96													
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           LOS         F         C         B         C           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           Tum Bay Length (m)         Base Capacity (vph)         214         291         1026         1194           Starvation Cap Reductn         0         0         0         0         0         0           Staryation Cap Reductn         0 </td <td></td>													
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)         214         291         1026         1194           Starvation Cap Reductn         0         0         0         0           Spillback Cap Reductn         0         0         0         0         0           Starvation Cap Reductn         0													
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         0           Spillback Cap Reductn         0         0         0         0         0           Starvation Cap Reductn         0         0         0         0         0           Starvation Cap Reductn         0         0         0         0         0         0           Starvation Cap Reductn         0         0.32         0.63         0.96         0           Intersection Summary         E         E         E         E         E         E         E         E         E         E	,												
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         0           Spillback Cap Reductn         0         0         0         0         0           Storage Cap Reductn         0         0         0         0         0           Reduced v/c Ratio         0.95         0.32         0.63         0.96           Intersection Summary         Vertex East of Green         Vertex East of Green         Vertex East of Green           Natural Cycle: 100         Control Type: Pretimed         Vertex East of Green         Vertex East of Signal Delay: 32.1         Intersection LOS: C           Intersection Signal Delay: 32.1         Intersection LOS: C         Intersection Capacity Utilization 101.1%         <													
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         0           Starvation Cap Reductn         0         0         0         0         0           Storage Cap Reductn         0         0         0         0         0         0           Reduced v/c Ratio         0.95         0.32         0.63         0.96         1           Intersection Summary         Vice Length: 110         Vice Length: 110         Vice Length: 110         Vice 100         Vice 10													
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         0           Spillback Cap Reductn         0         0         0         0         0           Starvation Cap Reductn         0         0         0         0         0           Starvation Cap Reductn         0         10         10													
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         0           Spillback Cap Reductn         0         0         0         0         0           Storage Cap Reductn         0         0         0         0         0           Reduced V/c Ratio         0.95         0.32         0.63         0.96           Intersection Summary         Cycle Length: 110         0         0         0         0           Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green         Natural Cycle: 100         Control Type: Pretimed         Visition 100         Visition 100<													
Internal Link Dist (m)         226.5         242.1         157.6         402.9           Turn Bay Length (m)         Base Capacity (vph)         214         291         1026         1194           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	<b>č</b> ( )												
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         Storage Cap Reductn       0       0       0       0         Reduced v/c Ratio       0.95       0.32       0.63       0.96         Intersection Summary													
Base Capacity (vph)         214         291         1026         1194           Starvation Cap Reductn         0 <t< td=""><td>( )</td><td></td><td>220.0</td><td></td><td></td><td>212.1</td><td></td><td></td><td>107.0</td><td></td><td></td><td>102.0</td><td></td></t<>	( )		220.0			212.1			107.0			102.0	
Starvation Cap Reductn         0         0         0         0           Spillback Cap Reductn         0			214			291			1026			1194	
Spillback Cap Reductin0000Storage Cap Reductin00000Reduced v/c Ratio0.950.320.630.96Intersection SummaryCycle Length: 110Cycle Length: 110Actuated Cycle Length: 110Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of GreenVision 100Natural Cycle: 100Control Type: PretimedVision 100Control Type: PretimedIntersection LOS: CIntersection LOS: CIntersection Signal Delay: 32.1Intersection LOS: CIntersection Capacity Utilization 101.1%ICU Level of Service G													
Storage Cap Reductn0000Reduced v/c Ratio0.950.320.630.96Intersection SummaryCycle Length: 110Actuated Cycle Length: 110Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of GreenNatural Cycle: 100Control Type: PretimedMaximum v/c Ratio: 0.96Intersection Signal Delay: 32.1Intersection LOS: CIntersection Capacity Utilization 101.1%ICU Level of Service G			-						-				
Reduced v/c Ratio0.950.320.630.96Intersection SummaryCycle Length: 110Actuated Cycle Length: 110Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of GreenNatural Cycle: 100Control Type: PretimedMaximum v/c Ratio: 0.96Intersection Signal Delay: 32.1Intersection LOS: CIntersection Capacity Utilization 101.1%ICU Level of Service G													
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			-			-			-			-	
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 Capacity Utilization 101.1%	Intersection Summary												
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 Capacity Utilization 101.1%         ICU Level of Service G	, ,												
Control Type: Pretimed         Maximum v/c Ratio: 0.96         Intersection Signal Delay: 32.1         Intersection Capacity Utilization 101.1%         ICU Level of Service G	, ,		:NBTL and	d 6:SBTL	., Start of	Green							
Maximum v/c Ratio: 0.96         Intersection Signal Delay: 32.1         Intersection Capacity Utilization 101.1%         ICU Level of Service G	Natural Cycle: 100												
Intersection Signal Delay: 32.1         Intersection LOS: C           Intersection Capacity Utilization 101.1%         ICU Level of Service G	Control Type: Pretimed												
Intersection Capacity Utilization 101.1% ICU Level of Service G													
Intersection Capacity Utilization 101.1% ICU Level of Service G		32.1			Ir	ntersectior	LOS: C						
	• •		%					G					

Scenario 1 3432 Greenbank Road 2:52 pm 11/02/2020 2029 Future Total - PM Peak Hour Mitigation

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

Ø2 (R)	A 04	
85.4 s	24.6 s	
Ø6 (R)	<b>₩</b> Ø8	
85.4s	24.6 s	



Intersection MMLOS

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

IN	NTERSECTIONS	Gr	eenbank Road a	at Half Moon Bay	Road (AM)	Greenbank Road at Half Moon Bay Road (PM )			F	River Mist Rd & C	Cambrian Rd (Al	Л)	River Mist Rd & Cambrian Rd (PM)				
	Crossing Side	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST
	Lanes Median	0-2	0 - 2	0-2	0-2	0-2	0-2	0-2	0-2	3	3	4	4	3	3	4	4
			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 Protected/	No Median - 2.4 m			No Median - 2.4 m Protected/		No Median - 2.4 m
C. C	Conflicting Left Turns	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	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
5	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
5	Ped Signal Leading Interval?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
a g	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
stri	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
Pedestrian	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
ă.	PETSI Score	85	85	85	85	85	85	85	85	70	70	53	53	70	70	53	53
	Ped. Exposure to Traffic LoS	В	в	В	В	В	в	в	В	с	с	D	D	с	С	D	D
	Cycle Length	80	80	80	80	80	80	80	80	80	80	80	80	100	100	100	100
8	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	В	В	D	D	В	В	D	D	D	D	с	D	E	E
		D	D	В	В	D	D	В	В	D	D	D	D	С	D	E	E
	Level of Service			D				D			1	D			1	E	
	Approach From	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST
Ε	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
F	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
ω	Cyclist relative to RT motorists	D	D	D	D	D	D	D	D	D	D	F	F	D	D	F	F
ycl	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	
-	Left Turning Cyclist	В	B	В	В	В	В	В	В	В	В	В	В	В	В	В	В
	Level of Service	D	D	D	D	D	D	D	D	D	D	F	F	D	D	F	F
				D				D				F				F	
÷,	Average Signal Delay										≤ 10 sec	≤ 30 sec			≤ 10 sec	≤ 30 sec	
Transit	Level of Service		-		-	-	-		-	-	В	D	-	-	В	D	
Ë.	Level of Service			-				-			I	D			1	D	
8	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
ž	Number of Receiving Lanes on Departure from Intersection	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Truck		E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
	Level of Service			E				E			I	E			1	E	
o	Volume to Capacity Ratio	0.61 - 0.70			0.61 - 0.70			0.61 - 0.70			0.61 - 0.70						
Auto	Level of Service			в				в			E	в				В	

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

Mark         Auto         Auto        Auto        Auto        Au		INTERSECTIONS	Gr	reenbank Road a	at Half Moon Bay	Road (AM)	Gre	enbank Road a	t Half Moon Bay I	Road (PM )	F	River Mist Rd & C	ambrian Rd (AM	A)	River Mist Rd & Cambrian Rd (PM)			
Math         Math <th< th=""><th></th><th>Crossing Side</th><th>NORTH</th><th>SOUTH</th><th>EAST</th><th>WEST</th><th>NORTH</th><th>SOUTH</th><th>EAST</th><th>WEST</th><th>NORTH</th><th>SOUTH</th><th>EAST</th><th>WEST</th><th>NORTH</th><th>SOUTH</th><th>EAST</th><th>WEST</th></th<>		Crossing Side	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST
Image: state in the s																		
Image and mark         Partial mar		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
Model         Model <th< td=""><td></td><td>Conflicting Left Turns</td><td>Permissive</td><td>Permissive</td><td>Permissive</td><td>Permissive</td><td>Permissive</td><td>Permissive</td><td>Permissive</td><td>Permissive</td><td>Permissive</td><td></td><td>Permissive</td><td>Permissive</td><td>Permissive</td><td></td><td>Permissive</td><td>Permissive</td></th<>		Conflicting Left Turns	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive		Permissive	Permissive	Permissive		Permissive	Permissive
Propulsion         No         No       <		Conflicting Right Turns				Permissive or yield control				Permissive or yield control								Permissive or yield control
proprime         space         space        <		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
HET Signer         HS         HS       <		Ped Signal Leading Interval?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
PECT Score         Ref	ian	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
PET Store         ns         sto         st	str	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
PECT Score         Ref	Pede	Crosswalk Type				Std transverse markings				Std transverse markings								Std transverse markings
Optilizing         Optiliing         Optiling         Optilizing		PETSI Score	85	85	85	85	85	85	85	85	70	70	53	53	70	70	53	53
Ender         10         10         17         27         7         20         20         11         10         0         0         13         14         14         14           Anage destina belay Los         00         0		Ped. Exposure to Traffic LoS					-			The second s								
<table-container>Average Pedestria Data Pedestria Data Pedestria Data Pedestria Data Pedestria Data Pedestria Data111<!--</td--><td></td><td></td><td></td><td></td><td></td><td></td><td>80</td><td>80</td><td></td><td></td><td></td><td></td><td></td><td>80</td><td></td><td></td><td></td><td></td></table-container>							80	80						80				
Production boly Los         D         D         B         D         D         B         D													-				-	
$ \begin{array}{ c c c c c c } \hline \begin begin b$																		
$ \begin{array}{                                    $		Pedestrian Delay LoS			· · · · · · · · · · · · · · · · · · ·													
Image: second			D	D	В	В	D	D	В	В	D	D	D	D	С	D	E	E
Bigle Lane Arrangement on Agrouch         Meed Tatile         Meed Tatile <thm< td=""><td></td><td>Level of Service</td><td></td><td></td><td>D</td><td></td><td></td><td></td><td>D</td><td></td><td></td><td></td><td>)</td><td></td><td></td><td>1</td><td>E</td><td></td></thm<>		Level of Service			D				D				)			1	E	
$ \begin{array}{ c c c c } \hline Part Part Part Part Part Part Part Part$		Approach From	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST
$ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$		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
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		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
Separated or Mixed Traffic																		≤ 25 km/h
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	O						5						<u> </u>		-			
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	ycl	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
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Bic																	No lane crossed
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$																		> 40 to ≤ 50 km/h
Level of Service       Image: Signal Delay       Image: Signal Delay <thimage: delay<="" signal="" th="">       Image: Signal Delay       Image: Signal Delay<td></td><td>Left Turning Cyclist</td><td>-</td><td></td><td></td><td></td><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-</td></thimage:>		Left Turning Cyclist	-				-											-
$ \begin{array}{ c c c c c c } \hline \begin{tabular}{ c c c c c } \hline \begin{tabular}{ c c c c c c c } \hline \begin{tabular}{ c c c c c c c c } \hline \begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		Loval of Sanvisa	D	D	D	D	D	D	D	D	D	D	F	F	D	D	F	F
$ \frac{1}{1} + 1$					D				D									
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	#	Average Signal Delay																
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	sui		-				-	-	-	-	-	В	D	-		В	D	-
Mumber of Receiving Lanse on Departure from Intersection         1	<u> </u>	Level of Service			-				-				)			1	c	
$\frac{1}{1} = \frac{1}{1} = \frac{1}$		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
Level of Service         E         E         E	ż		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	E
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         D		Level of Service			E		E			E			E					
e Level of Service C. C. D.	0	Volume to Capacity Ratio	0.71 - 0.80			0.71 - 0.80			0.71 - 0.80			0.81 - 0.90						
	Auto	Level of Service			С				С			(	;			1	<b>D</b>	

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
<u> </u>	PETSI Score	85	85	85	85	85	85	85	85	70	70	53	53	70	70	53	53
	Ped. Exposure to Traffic LoS	в	в	в	в	в	в	в	в	с	С	D	D	с	с	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	с	с	В	В	D	D	В	В	D	D	D	D	с	D	E	E
	Level of Service	С	С	В	В	D	D	В	В	D	D	D	D	С	D	E	E
				С				D				5				Ē	
	Approach From	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST
	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
٥	Cyclist relative to RT motorists	D	D	D	D	D	D	D	D	D	D	F	F	D	D	F	F
2 Z	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
Bicycle	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 $\leq$ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to $\leq$ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to $\leq$ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h
	Left Turning Cyclist	В	В	В	В	В	В	В	В	В	В	В	В	В	В	В	В
	Level of Service	D	D	D	D	D	D	D	D	D	D	F	F	D	D	F	F
				D				D			1	-			l	F	
	Average Signal Delay										≤ 10 sec	≤ 30 sec			≤ 10 sec	≤ 30 sec	
Transit	Level of Service	-	-	-	-	-	-	-	-	-	В	D	-	-	В	D	-
Tra				-				-			I	)			1	D	
	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
Truck	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			1	=				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					В				2				D		

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
	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	В	В	В	В	В	В	В	В	с	с	D	D	с	с	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	с	с	В	В	E	E	A	A	D	D	D	D	с	D	E	E
	Level of Service	С	С	В	В	E	E	В	В	D	D	D	D	С	D	E	E
				С				E				)			E	1	
	Approach From	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST
	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
ø	Cyclist relative to RT motorists	D	D	D	D	D	D	D	D	D	D	F	F	D	D	F	F
ycl	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
Bicycle	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
	Left Turning Cyclist	В	В	В	В	В	В	В	В	В	В	В	В	В	В	В	В
	Level of Service	D	D	D	D	D	D	D	D	D	D	F	F	D	D	F	F
				D				D			- F	-			F	-	
=	Average Signal Delay										≤ 10 sec	≤ 30 sec			≤ 10 sec	≤ 30 sec	
Transit		-				-					В	D			В	D	
Tra	Level of Service			-				-			[	)			[	)	
	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
Truck	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	1			1	1	
Auto	Volume to Capacity Ratio	0.71 - 0.80					0.71 - 0.80		1	0.81 ·	0.90			0.91	0.91 - 1.00		
	Level of Service	С						С				)		0.91 - 1.00 E			