

Minto Communities and 2559688 Ontario Inc

936 March Road

Transportation Impact Study



2018-04

December 2018



936 March Road Transportation Impact Assessment

Step 1 Screening Report

Step 2 Scoping Report

Step 3 Forecasting Report

Step 4 Analysis Report

Prepared for:

Minto Communities
2559688 Ontario Inc.
200-180 Kent Street
Ottawa, ON K1P 0B6

Prepared by:

CGH Transportation Inc.
13 Markham Avenue
Ottawa, ON K2G 3Z1

December 2018

PN: 2018-04

Table of Contents

- 1 Screening 1
- 2 Scoping 1
 - 2.1 Existing and Planned Conditions 1
 - 2.1.1 Proposed Development 1
 - 2.1.2 Existing Conditions 3
 - 2.1.3 Planned Conditions..... 7
 - 2.2 Study Area and Time Periods 7
 - 2.2.1 Study Area 7
 - 2.2.2 Time Periods 7
 - 2.2.3 Horizon Years..... 7
 - 2.3 Exemption Review 8
- 3 Forecasting 8
 - 3.1 Development-Generated Travel Demand 8
 - 3.1.1 Trip Generation and Mode Shares 8
 - 3.1.2 Trip Distribution..... 10
 - 3.1.3 Trip Assignment 10
 - 3.2 Background Network Travel Demands..... 13
 - 3.2.1 Transportation Network Plans 13
 - 3.2.2 Background Growth and Other Developments 13
 - 3.3 Demand Rationalization 15
- 4 Analysis..... 18
 - 4.1 Development Design 18
 - 4.1.1 Design for Sustainable Modes 18
 - 4.1.2 Circulation and Access 18
 - 4.1.3 New Street Networks 18
 - 4.2 Parking..... 18
 - 4.3 Boundary Street Design..... 18
 - 4.4 Access Intersections 20
 - 4.4.1 Location and Design of Access..... 20
 - 4.4.2 Intersection Control..... 20
 - 4.5 Transportation Demand Management..... 20
 - 4.6 Neighbourhood Traffic Management..... 20
 - 4.7 Transit..... 20
 - 4.8 Review of Network Concept..... 21
 - 4.9 Intersection Design..... 21
 - 4.9.1 Intersection Control..... 21
 - 4.9.2 Intersection Design..... 21
- 5 Conclusions..... 28

List of Figures

Figure 1: Area Context Plan	1
Figure 2: Concept Plan.....	2
Figure 3: Intersection of Maxwell Bridge Road/Halton Terrace at March Road	3
Figure 4: March Road Site Photo - August 8, 2018.....	4
Figure 5: Existing Transit Service	5
Figure 6: 2018 Adjusted Traffic Counts	6
Figure 7: Traffic Assignment (%).....	11
Figure 8: Assignment (Volumes).....	12
Figure 9: Kanata North CDP TMP Excerpt – 2026 Total Traffic Volumes	13
Figure 10: 2023 Future Background Traffic	14
Figure 11: 2028 Future Background Traffic Volumes	15
Figure 12: 2023 Future Total Traffic Volumes	16
Figure 13: 2028 Future Total Traffic Volumes	17
Figure 14: Transit Walking Distance	19

Table of Tables

Table 1: Intersection Count Date.....	5
Table 2: Collision Summary - March Road @ Halton Terrace / Maxwell Bridge Road.....	7
Table 3: Exemption Review	8
Table 4: ITE Trip Generation Person Trip Rates.....	9
Table 5: Total Person Trip Generation	9
Table 6: OD Survey Existing Mode Share – Kanata Stittsville.....	9
Table 7: Trip Generation by Mode	9
Table 8: OD Survey Existing Mode Share – Kanata/Stittsville	10
Table 9: Trip Generation by Transit Mode	20
Table 10: 2018 Existing Conditions Operational Analysis	21
Table 11: 2023 Future Background Conditions Operational Analysis	22
Table 12: 2028 Future Background Conditions Operational Analysis	22
Table 13: 2023 Total Future Conditions Operational Analysis	23
Table 14: 2028 Total Future Conditions Operational Analysis	24
Table 15: PETS I Score Halton Terrace/Maxwell Bridge Road at March Road	25
Table 16: PETS I Score Street 1 at March Road	25
Table 17: Bicycle LOS Criteria Halton Terrace/Maxwell Bridge Road at March Road.....	26
Table 18: Bicycle LOS Criteria Street 1 at March Road.....	26

List of Appendices

- Appendix A – TIA Screening Form and Certification Form
- Appendix B – Turning Movement Count Data
- Appendix C – Collision Data
- Appendix D – March Road Cross-Sections
- Appendix E – Traffic Signal Warrants

Appendix F – 2018 Existing Synchro

Appendix G – 2023 Future Background Synchro

Appendix H – 2028 Future Background Synchro

Appendix I – 2023 Total Future Synchro

Appendix J – 2028 Total Future Synchro

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 component and the Network Impact Component.

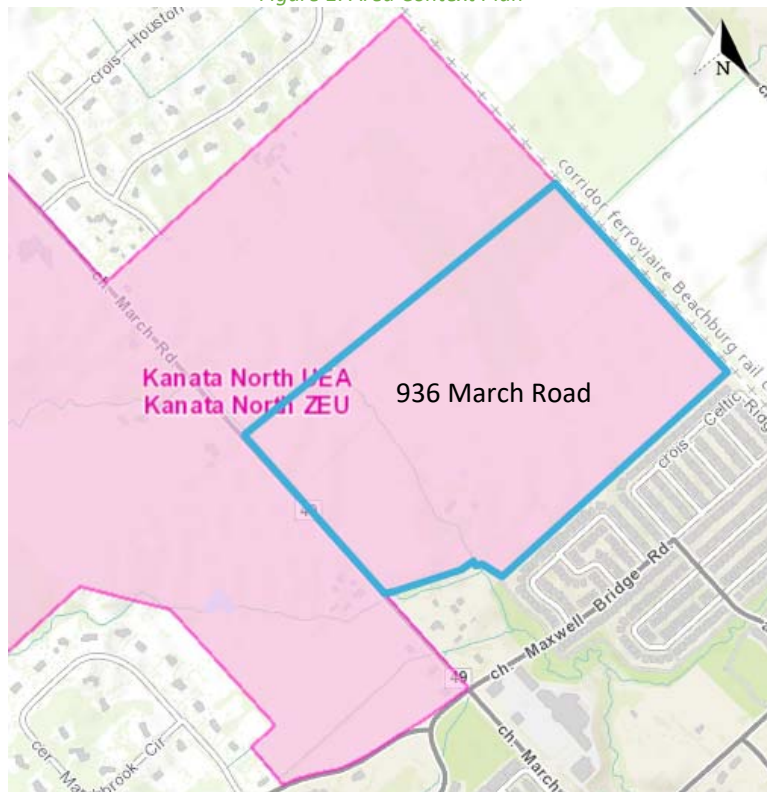
2 Scoping

2.1 Existing and Planned Conditions

2.1.1 Proposed Development

The proposed development, located at 936 March Road, is currently a greenfield property within the Kanata North Urban Expansion Area (UEA). The site is in an area that is currently zoned RU Rural Countryside Zone. The current development application would modify the zoning to allow for low-rise residential uses, with a future commercial area along the March Road frontage (commercial area owned by others). The commercial portion has been generally considered in this report, consistent with the Kanata North Community Design Plan, which assumed 300,000 square feet of commercial space. The proposed residential development with a mixture of detached homes and townhouses. The concept plan currently considers a total of approximately 800 units, split evenly between townhouse and detached units. Access to the proposed development will be via one full movements access, located approximately 600 metres north of the signalized intersection of Maxwell Bridge Road / Halton Terrace at March Road. Future accesses are provided to allow connections to the north and the east. These access points are consistent with the Kanata North Community Design Plan (CDP). To the north it is anticipated that this development would connect with the adjacent lands, and the future residential development on those lands. To the east, an access is provided, as per the CDP, however, this is shown as a dead-end connection at the CN Railway Corridor. The anticipated full build-out and occupancy horizon is 2023. No phasing is known at this time. Figure 1 illustrates the Study Area Context. Figure 2 illustrates the proposed concept plan.

Figure 1: Area Context Plan





scale | 1:5000

legend

- Single Detached
- Executive Townhomes
- Commercial
- School
- Storm Pond
- Park
- Open Space
- Woodlot
- Creek Buffer
- Creek

summary

Site Area	46.32Ha
Road Length	
26m Collector	881.67m
24m Collector	231.30m
16.5m Local	4967.97m
Frontage	
Single Detached	5329.70m
Townhomes	2879.05m



U:\Silvano\2018\18-142 - Minto - Kanata North\Design\2018-07-23_Community_Visioning(dwg)\2018-11-15_Kanata North_Concept Plan v4.1.dwg

2.1.2 Existing Conditions

2.1.2.1 Area Road Network

March Road

March Road is a City of Ottawa Arterial road with a two-lane rural cross-section including gravel shoulders and an 80 km/h posted speed limit along the frontage of the site. At Maxwell Bridge Road / Halton Terrace, March Road widens to four-lanes and has an urban cross-section including at-grade cycling lanes. The speed limit remains 80km/h. The Ottawa Official Plan reserves a 44.5 metre right of way along the March Road frontage.

2.1.2.2 Existing Intersections

Maxwell Bridge Road / Halton Terrace at March Road

The intersection of Maxwell Bridge Road / Halton Terrace at March Road is a signalized intersection with auxiliary left turn lanes on each approach. The northbound and southbound approaches each also have right turn lanes and at grade cycling lanes, between the through lane and the right turn lane. No turn restrictions were noted.

Figure 3: Intersection of Maxwell Bridge Road/Halton Terrace at March Road



2.1.2.3 Existing Driveways

The existing driveway to 936 March Road will remain after the construction of the proposed development. Additionally, just beyond 200 metres in each direction from the proposed access point there is a driveway to a private residence. It is assumed that as this area is built-out the need for those private driveways will be reduced or eliminated. None of the driveways would provide access to significant traffic generators and would therefore have no impact on this TIA.

2.1.2.4 Cycling and Pedestrian Facilities

The section of March Road along the frontage of the proposed development is noted on the City of Ottawa's Existing Cycling Network as a "Paved Shoulder". However, a review of Google Streetview (image dated August 2017) shows that there is a gravel shoulder along this section of March Road. Through a site visit, it has been determined that this is a paved shoulder, where the pavement is in very poor condition, not appropriate for cycling. No pedestrian facilities are noted along the frontage of 936 March Road. Figure 4 documents the condition of the shoulders of March Road along the site frontage.

Figure 4: March Road Site Photo - August 8, 2018

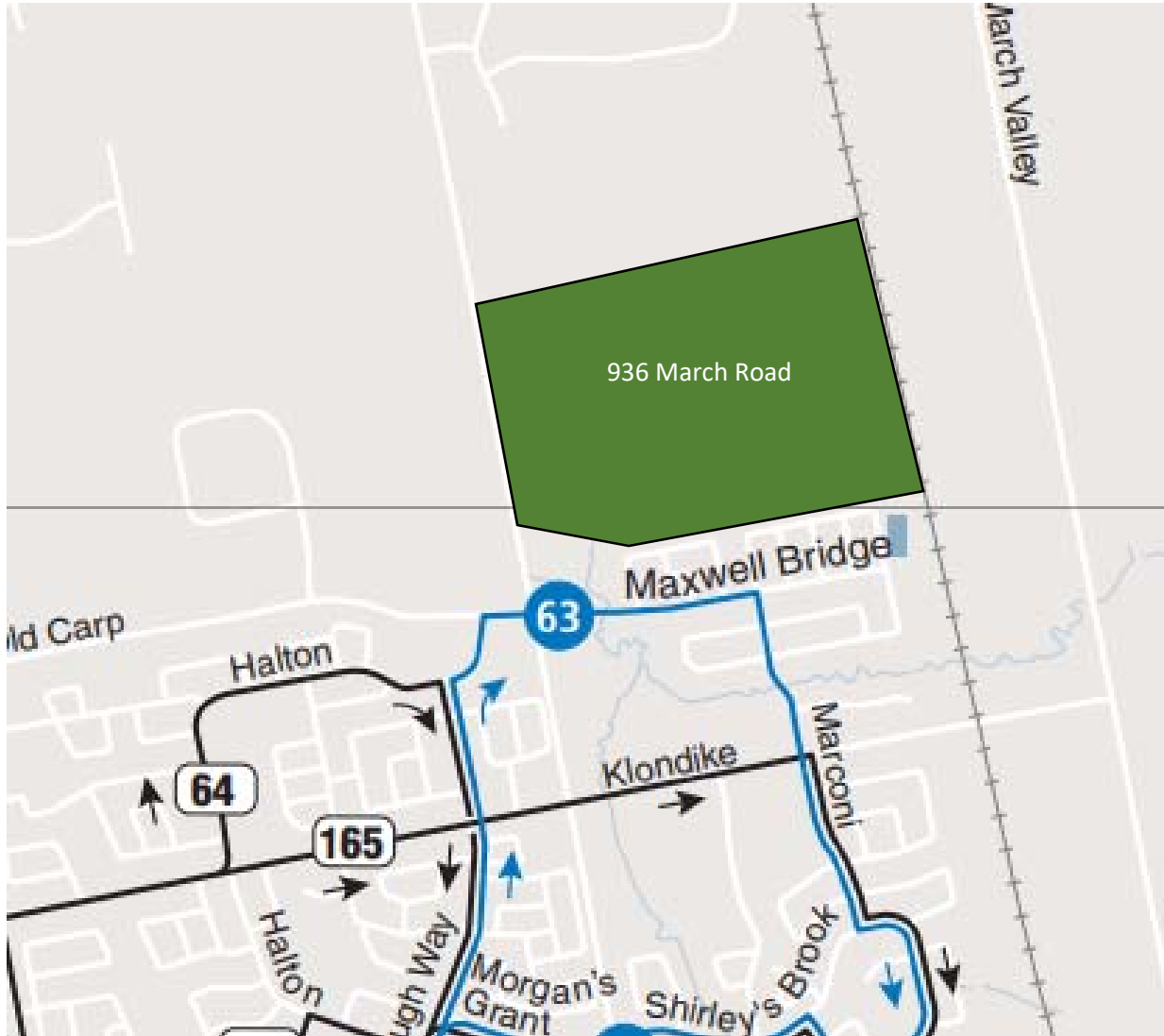


South of the site, March Road transitions to an urban cross-section with sidewalks and at-grade cycling lanes.

2.1.2.5 Existing Transit

There is no existing transit service along the boundary road that would serve the proposed development. South of the site, at the intersection of Maxwell Bridge/Halton Terrace at March Road, Route 63 travels east-west along Maxwell Bridge / Halton Terrace. No other existing routes currently exist.

Figure 5: Existing Transit Service



2.1.2.6 Existing Area Traffic Management Measures

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

2.1.2.7 Existing Peak Hour Travel Demand

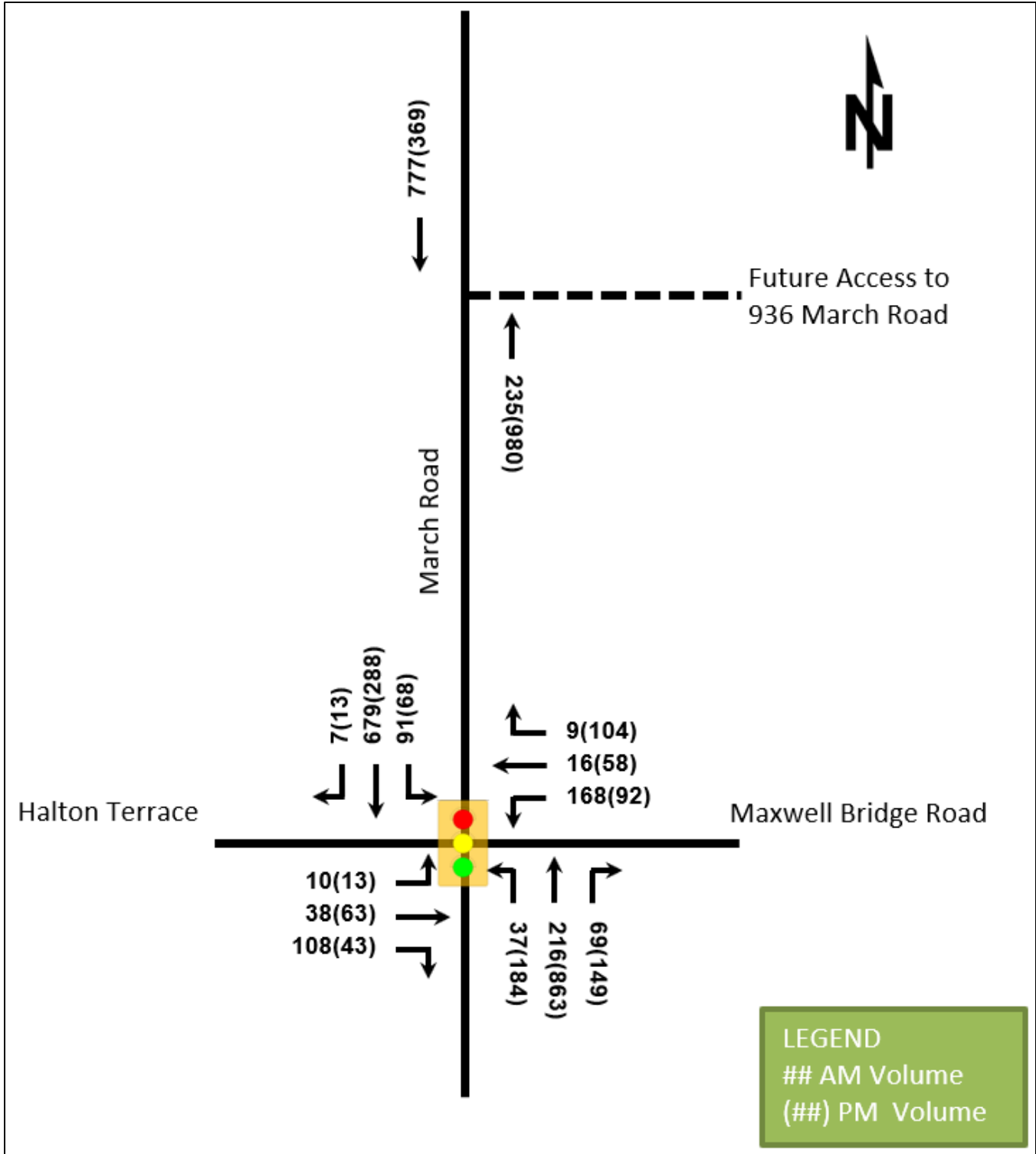
Existing turning movement counts were acquired from the City of Ottawa for the existing Study Area intersection. Table 1 summarizes the intersection count dates.

Table 1: Intersection Count Date

Intersection	Count Date
March Road @ Halton Terrace / Maxwell Bridge Road	Wednesday, August 10, 2016

As the intersection was counted two years prior to the study date, a 0.5%/ annum compound growth rate has been applied to estimate the 2018 adjusted traffic counts. This growth rate is consistent with the Kanata North CDP TMP. Figure 6 illustrates the 2018 adjusted traffic counts.

Figure 6: 2018 Adjusted Traffic Counts



Detailed turning movement count data is included in Appendix B.

2.1.2.8 Collision Analysis

Collision data has been acquired from the City of Ottawa for five years prior to the commencement of this TIA at each of the Study Area intersections. Table 2 summarizes the collisions at the intersection of March Road at Halton Terrace / Maxwell Bridge Road.

Table 2: Collision Summary - March Road @ Halton Terrace / Maxwell Bridge Road

		Number	%
Total Collisions		13	100%
Classification	Fatality	0	0%
	Non-Fatal Injury	5	38%
	Property Damage Only	8	62%
Initial Impact Type	Angle	2	15%
	Rear end	0	0%
	Sideswipe	2	15%
	Turning Movement	5	38%
	SMV Other	3	23%
	Other	1	8%
	Road Surface Condition	Dry	7
	Wet	3	23%
	Loose Snow	1	8%
	Slush	0	0%
	Packed Snow	0	0%
	Ice	2	15%
Pedestrian Involved		1	8%

Collisions at the intersection of March Road at Halton Terrace / Maxwell Bridge Road were primarily on the east and west legs, and 40% of the collisions involved a turning movement. It was also noted that 60% of the collisions only involved property damage, indicating low speed collisions, with no fatalities. Collision data is included in Appendix C.

2.1.3 Planned Conditions

2.1.3.1 Changes to the Area Transportation Network

The subject development is within the Kanata North CDP Urban Expansion Area. As such, it is subject to the planning policies outlined in the CDP. The CDP proposes that March Road would be an Arterial Road with a median Bus Rapid (BRT) facility, following the results of the Environmental Assessment (EA) completed for March Road. The widening of March Road, and the extension of a Bus Rapid Transit facility along the frontage of 936 March Road is considered in the City of Ottawa TMP Ultimate Network. Neither of these future transportation infrastructure upgrades are included in the 2031 Affordable Network. March Road is shown in the Ultimate Cycling Network as a Spine Route.

2.1.3.2 Other Study Area Developments

At the time of this report, no other development applications were available for the adjacent properties. However, the CDP Transportation Master Plan will be used to estimate the impact of adjacent developments.

2.2 Study Area and Time Periods

2.2.1 Study Area

The study area will include the intersection of Maxwell Bridge Road / Halton Terrace at March Road and the 936 March Road access intersection and will include examining March Road as a Boundary Road.

2.2.2 Time Periods

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

2.2.3 Horizon Years

The anticipated build-out year is 2023. As a result, the full build-out plus five years horizon year is 2028.

2.3 Exemption Review

Table 3 summarizes the exemptions for this TIA.

Table 3: Exemption Review

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

3 Forecasting

3.1 Development-Generated Travel Demand

3.1.1 Trip Generation and Mode Shares

This TIA has been written within the context of the council approved Kanata North Community Design Plan (CDP) and will reconfirm the findings of the Kanata North Transportation Master Plan that was conducted as part of the CDP. That study used Institute of Transportation Engineers (ITE) Trip Generation Manual trip generation rates. In order to re-confirm the previous work, ITE Trip Generation Manual (10th Edition) Rates will be used. While it is acknowledged that the City of Ottawa's preference is for the Trans Study Rates to be used, in this case those rates would be overly conservative and are not appropriate. This methodology has been discussed with and agreed upon by City Staff and therefore ITE Trip Generation Rates have been used in this report. As there is currently no plan for the commercial spaces the trip generation has been taken directly from the CDP with no modifications.

Vehicle trip rates have been determined using the ITE Trip Generation Manual. To estimate person trip generation a factor of 1.28 has been applied to the rates. Table 3 summarizes the person trip rates for the proposed land uses.

Table 4: ITE Trip Generation Person Trip Rates

Dwelling Type	ITE LUC	Peak Hour	Vehicle Trip Rate	Person Trip Rates
Single Detached	210	AM	0.72	0.92
		PM	0.96	1.23
Townhouse	220	AM	0.44	0.56
		PM	0.51	0.65

LUC – Land Use Code

Vehicle Trip Rates have been calculated using the fitted curve equations

Using the above Person Trip rates, the total person trip generation has been estimates. Table 5 below illustrates the total person trip generation by dwelling type.

Table 5: Total Person Trip Generation

Land Use	Units	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
Single Detached	455	105	314	419	353	207	560
Townhouse	401	52	173	225	164	97	261
Total Person Trips		157	487	644	517	304	821

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

Table 6: OD Survey Existing Mode Share – Kanata Stittsville

Travel Mode	Existing Mode Share
Auto Driver	65%
Auto Passenger	15%
Transit	10%
Non-Auto	10%
Total	100%

The CDP considers a bus rapid transit facility along the centreline of March Road, and the City of Ottawa TMP 2031 Network Concept contemplates a conceptual future transit corridor along the section of March Road adjacent to the proposed development. However, the 2031 Affordable Network does not include any higher order transit facilities along the subject section of March Road. Therefore, as a conservative estimate of the traffic the existing mode share for the Kanata/Stittsville traffic zone was used.

Using the above mode shares and person trip rates the person trips by mode have been projected. Table 7 summarizes the trip generation by mode.

Table 7: Trip Generation by Mode

Travel Mode	Mode Share	In	Out	Total	In	Out	Total
Auto Driver	65%	102	316	418	336	198	534
Auto Passenger	15%	24	73	97	78	46	123
Transit	10%	16	48	65	51	31	82
Non-Auto Modes	10%	16	48	65	51	31	82
Total	100%	157	487	644	517	304	821

As shown above, 390 AM and 781 PM peak hour two-way trips are projected as a result of the proposed development.

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

3.1.2 Trip Distribution

To understand the travel patterns of the subject development the OD Survey has been reviewed to determine the existing travel patterns. Table 8 below summarizes the distribution.

Table 8: OD Survey Existing Mode Share – Kanata/Stittsville

To/From	Percent of Trips
North	5%
South	60%
East	30%
West	5%
Total	100%

3.1.3 Trip Assignment

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

Figure 7: Traffic Assignment (%)

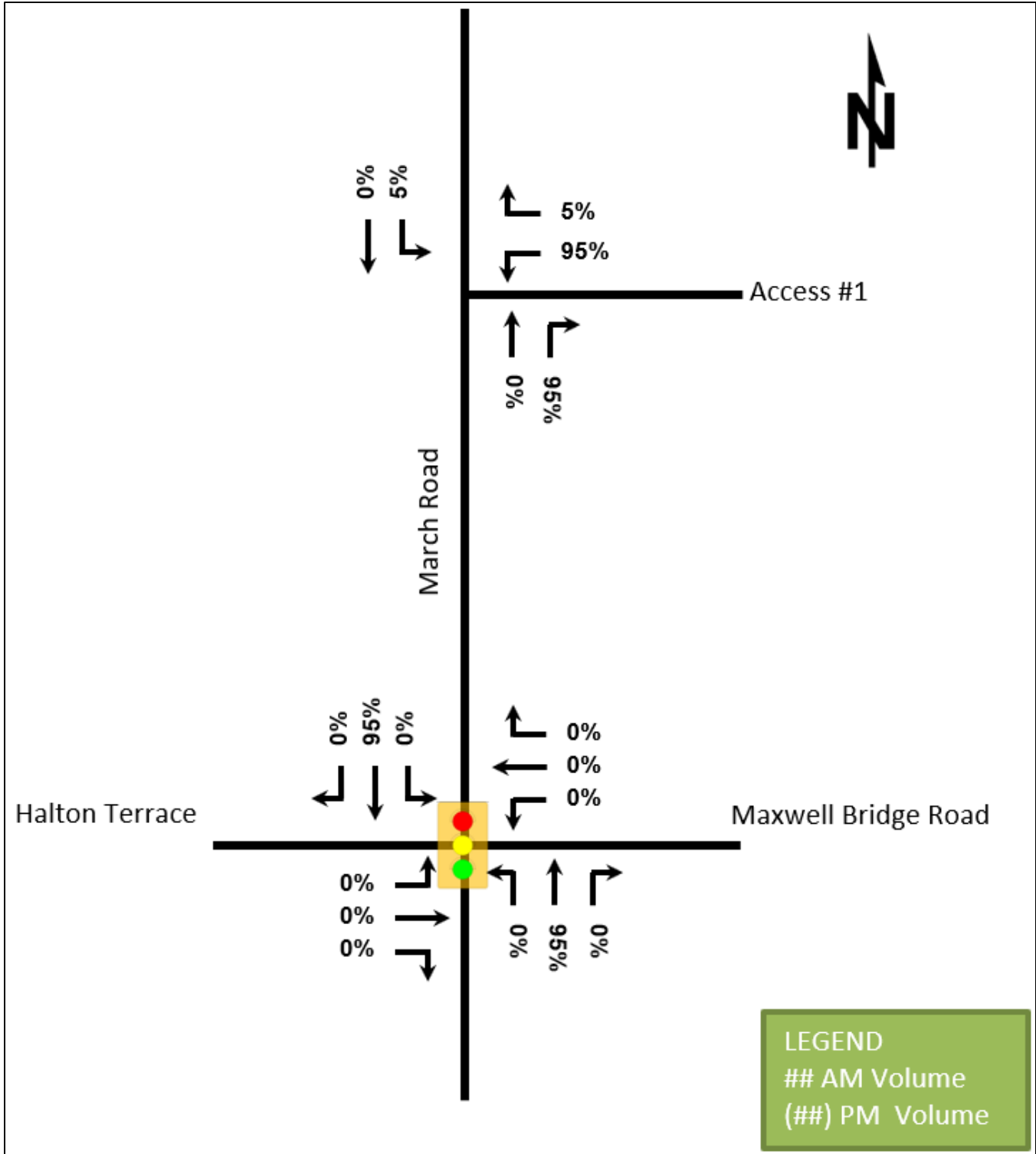
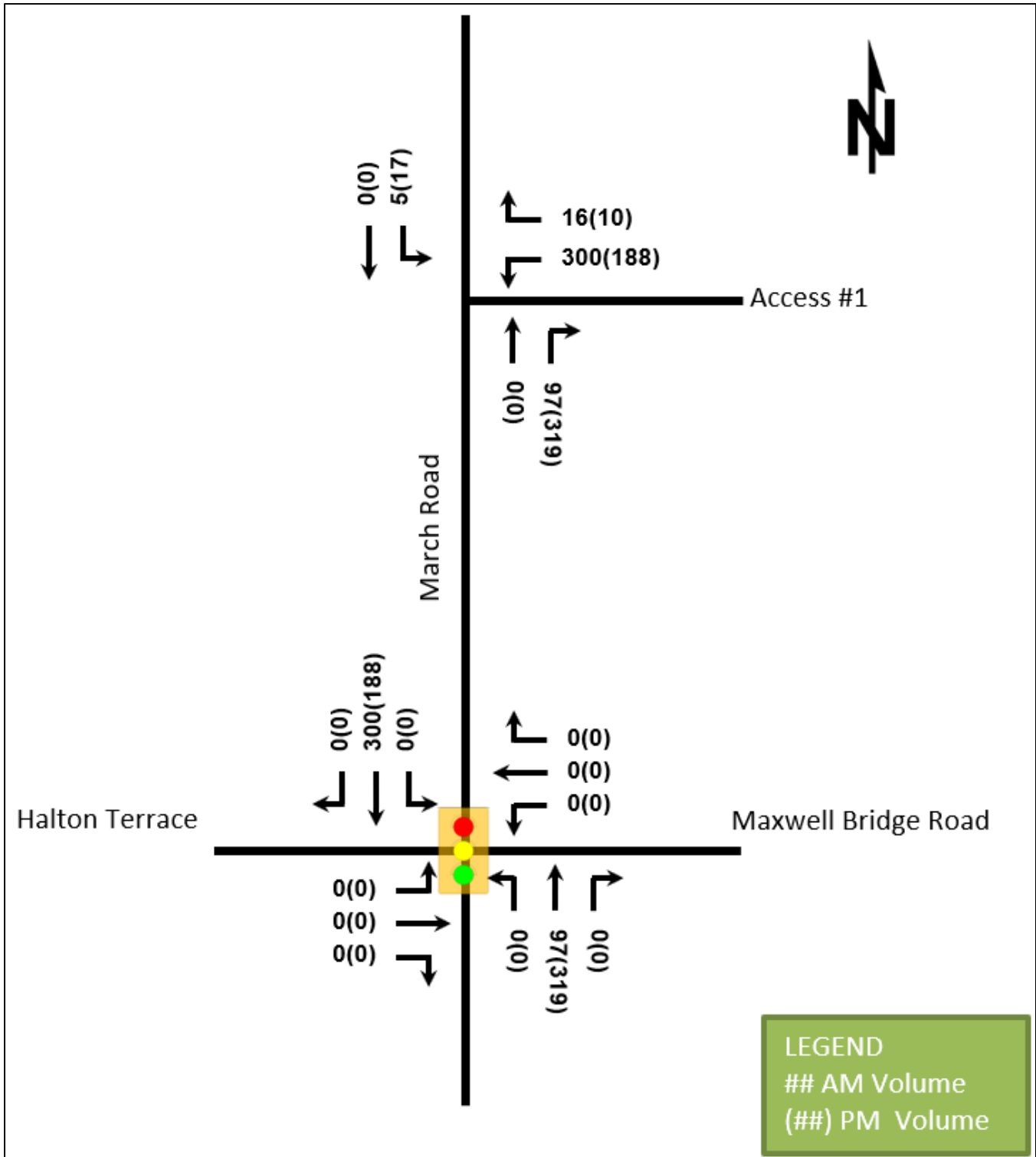


Figure 8: Assignment (Volumes)



3.2 Background Network Travel Demands

3.2.1 Transportation Network Plans

The Kanata North CDP has determined the required March Road interim and ultimate cross-sections. Both cross-sections include two traffic lanes, cycling lanes, and sidewalks, both northbound and southbound. The ultimate cross-section also includes a centreline bus rapid transitway. Appendix D includes the interim and ultimate cross-sections from the CDP.

3.2.2 Background Growth and Other Developments

This TIA is being prepared within the context of the Kanata North CDP – Transportation Master Plan. As a result, the background traffic projections will include all the developments considered as part of that document. Figure 9 is an excerpt from the CDP TMP detailing the 2026 total traffic volumes. This TIA assumes that the subject development will build-out by 2023 and will be the first development to open. The 2028 horizon will include all the development accounted for in the CDP TMP. As per the CDP TMP a 0.5% / annum growth rate will be applied to adjust the existing counts to reflect each future horizon. Figure 10 and Figure 11 illustrate the 2023 and 2028 future background traffic volumes, respectively. The 2028 future background traffic volumes also include the traffic from developments other than 936 March Road that are considered in the CDP TMP.

Figure 9: Kanata North CDP TMP Excerpt – 2026 Total Traffic Volumes

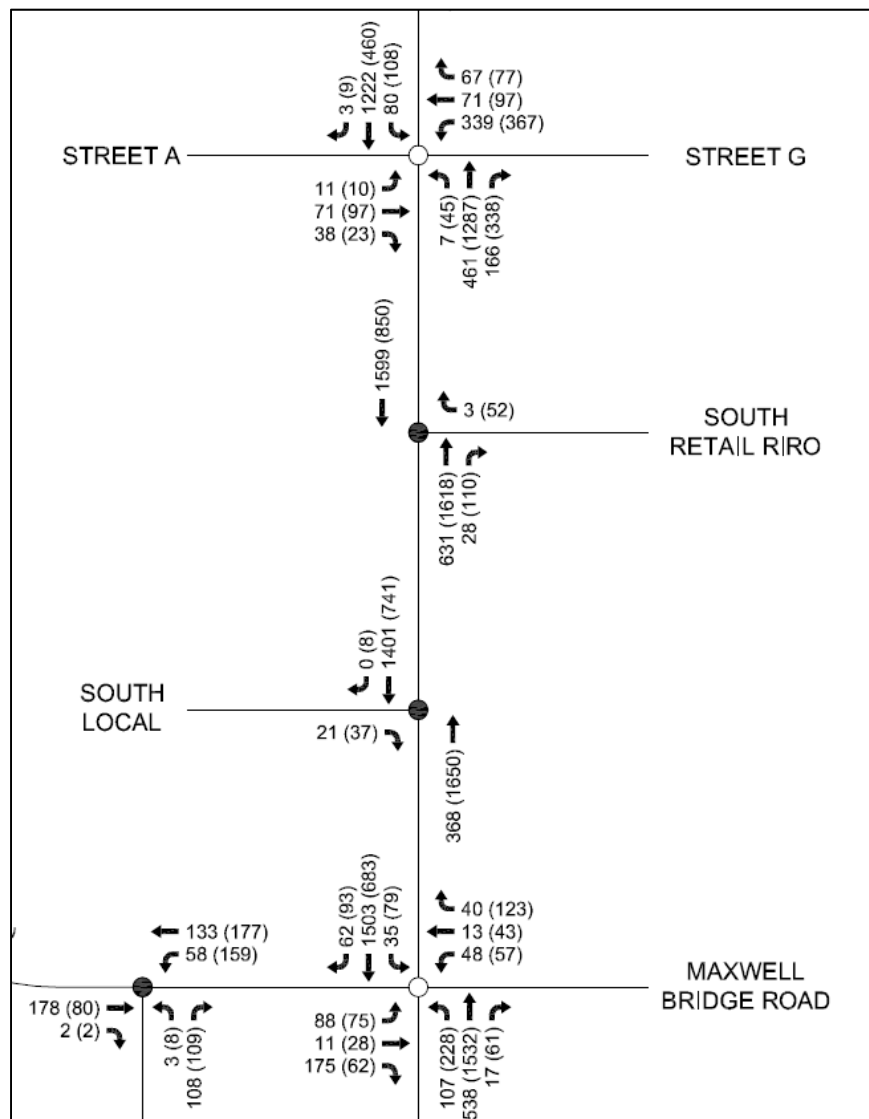


Figure 10: 2023 Future Background Traffic

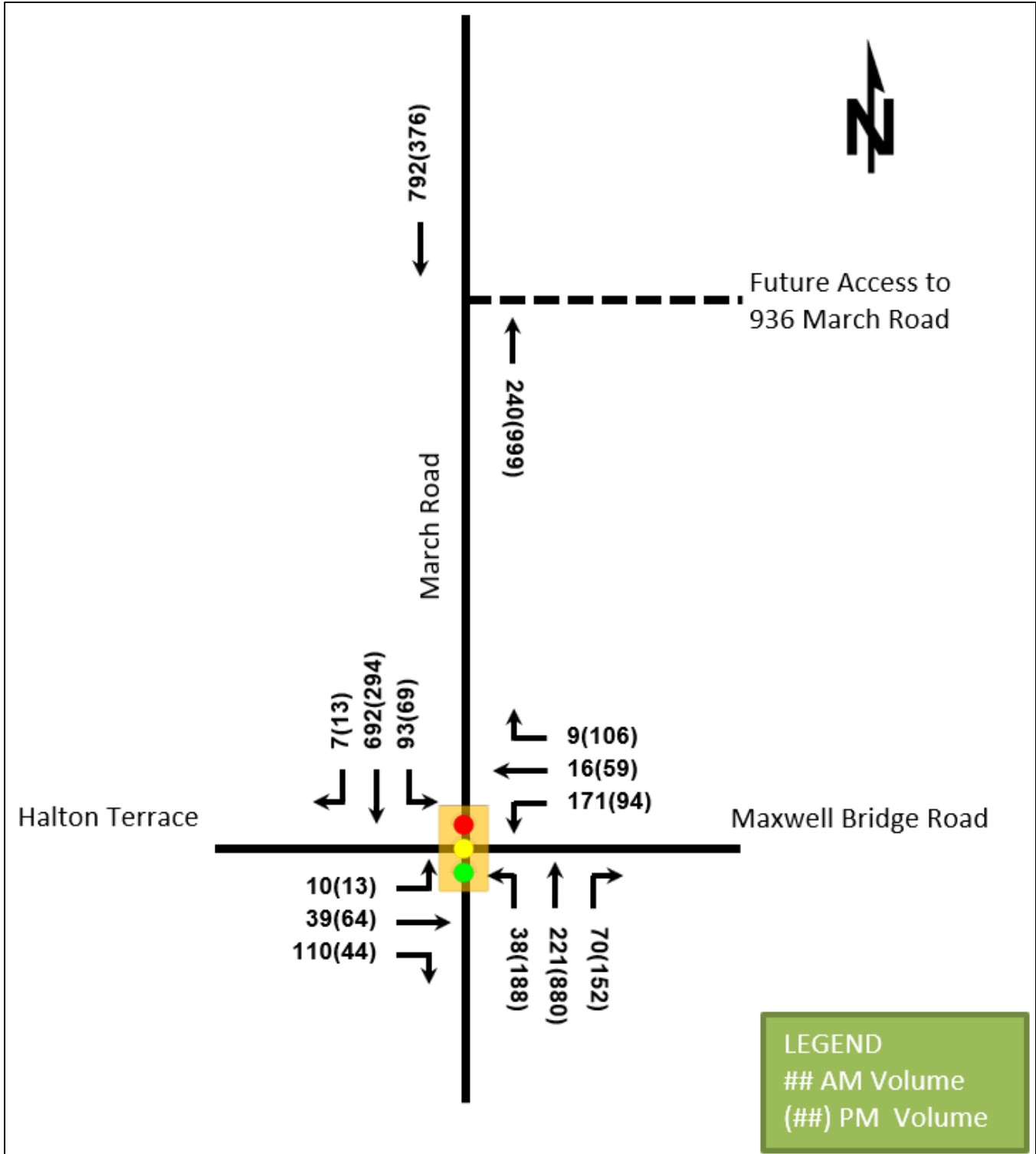
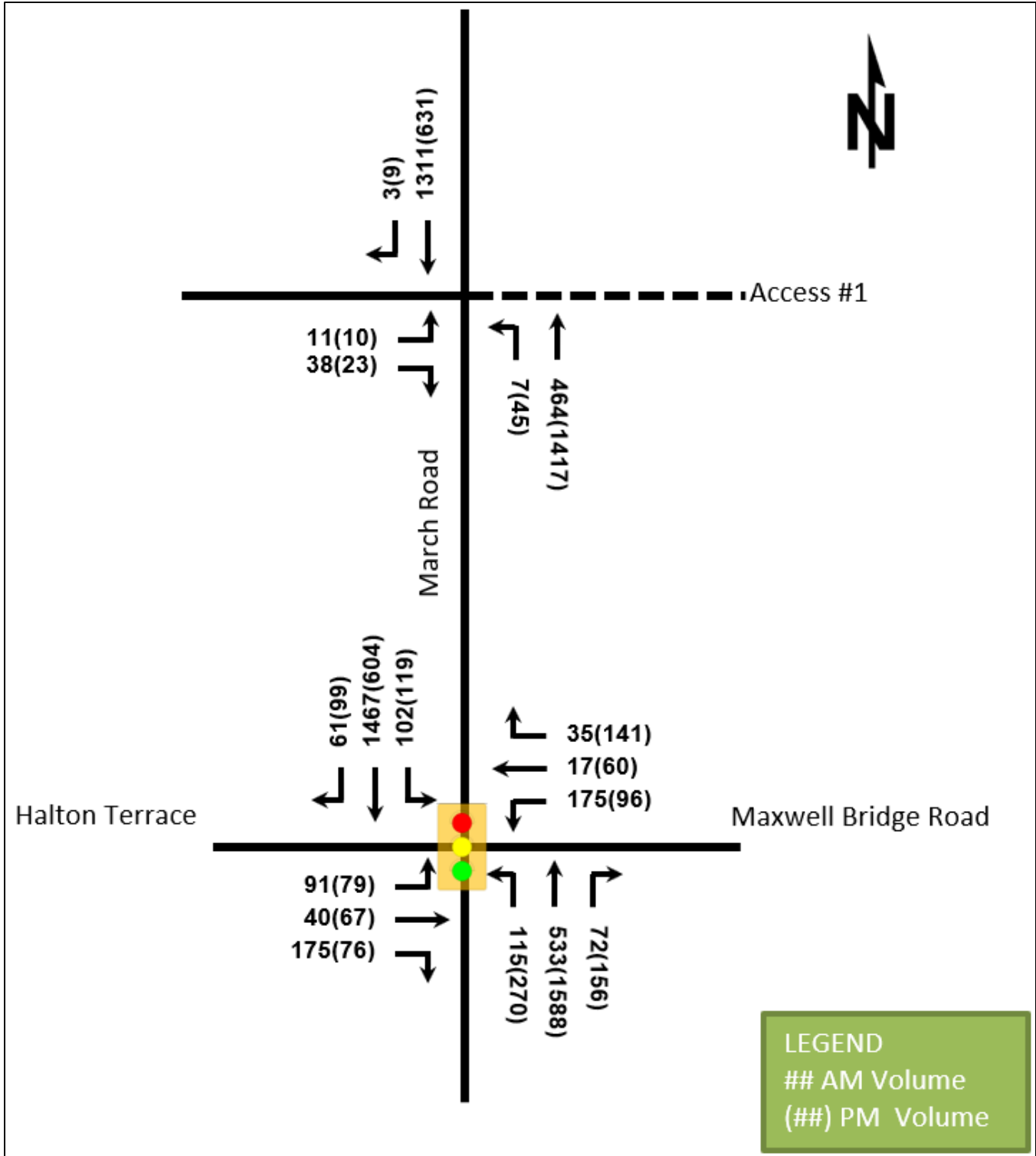


Figure 11: 2028 Future Background Traffic Volumes



3.3 Demand Rationalization

The Kanata CDP TMP examined the network capacity of the Kanata North CDP area. It was determined that the network could accommodate the projected demands. As this study is being written within the context of the council approved CDP, it is not anticipated that the demand will drastically change from what was considered in the CDP TMP. As no adjustments are being made as a result of the demand rationalization, the site generated

traffic documented in Section 3.1 has been added to the Future Background traffic volumes. Figure 12 and Figure 13 illustrate the 2023 and 2028 Future Total traffic volumes, respectively.

Figure 12: 2023 Future Total Traffic Volumes

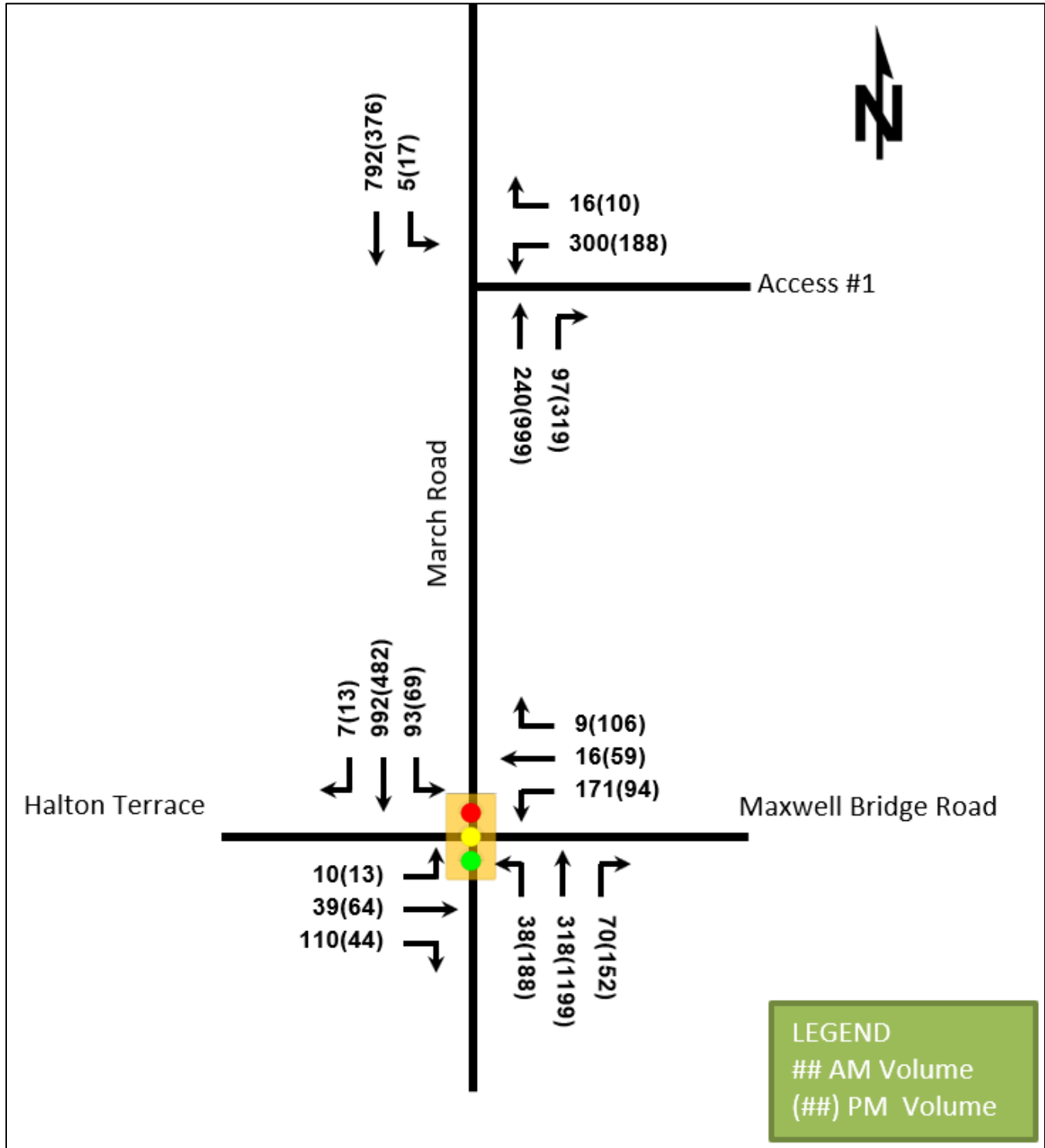
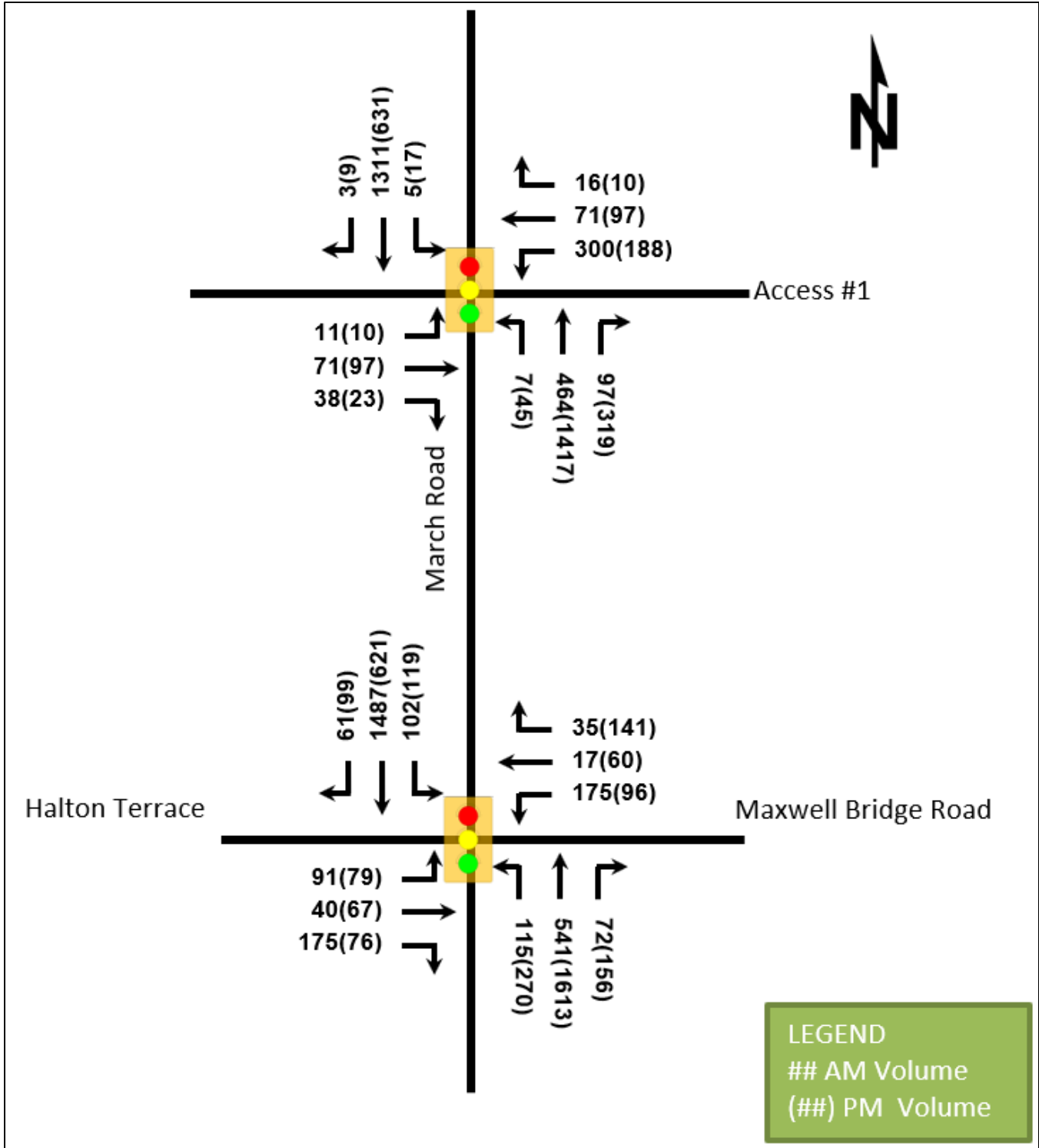


Figure 13: 2028 Future Total Traffic Volumes



4 Analysis

4.1 Development Design

4.1.1 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.

Initial sidewalk locations have been proposed based on the Kanata North CDP TMP. Sidewalks are included as needed to provide access to transit, local amenities, and the adjacent road network. Bus stops are proposed on the main east-west collector at two locations. By providing transit service in this manner 85% of the subject development would be within the 400-metre walking distance to a transit stop. The remaining 15% would be within 500-metre walking distance to a transit stop.

A multi-use pathway (MUP) is proposed in the Kanata North CDP TMP along the collector road. This will be included in the proposed development to provide cycling access to the adjacent arterial road network.

Figure 14 illustrates the transit walking distance, the sidewalk/MUP locations, and the transit stop locations.

4.1.2 Circulation and Access

This TIA is exempt from this element (see Table 3).

4.1.3 New Street Networks

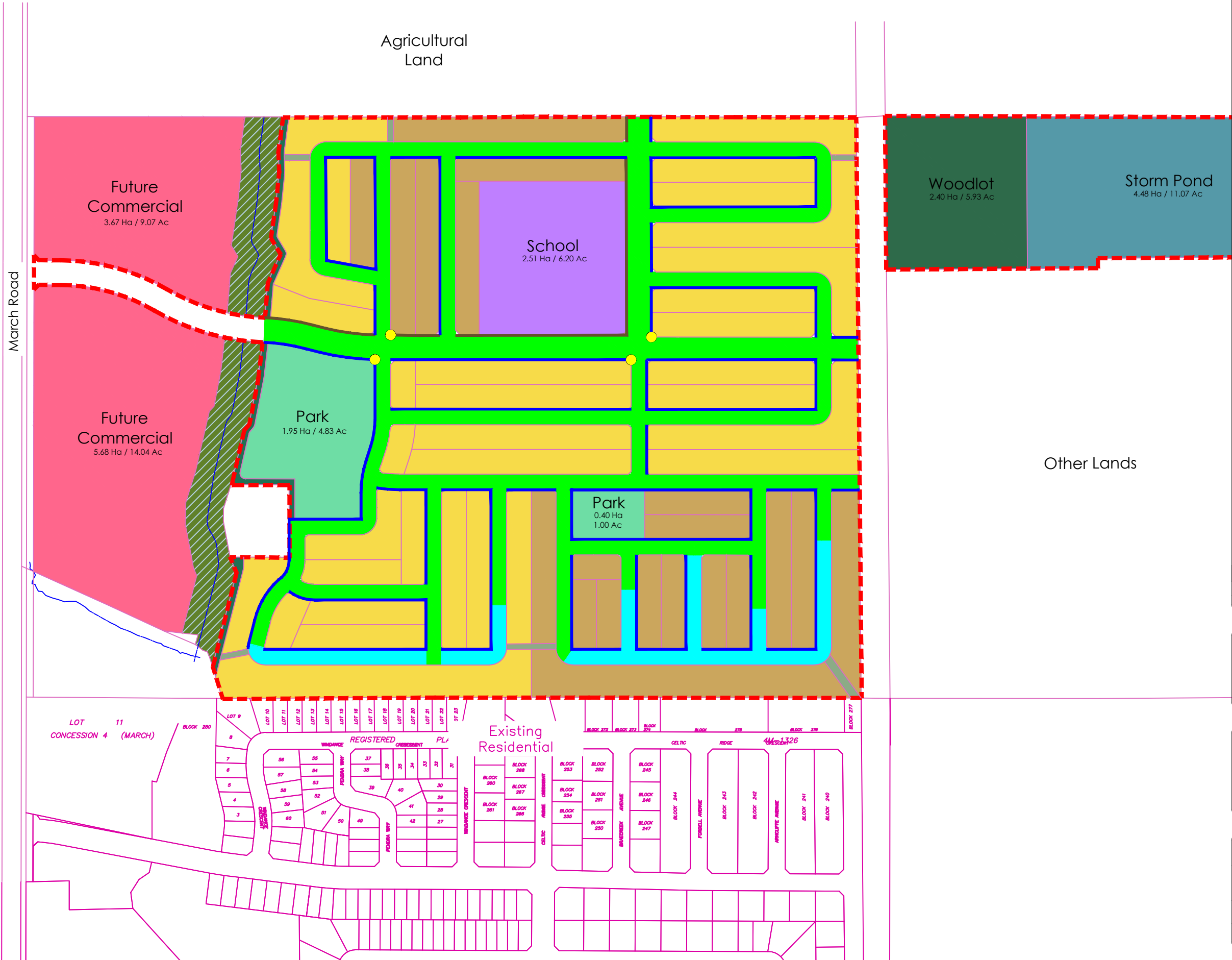
Primary access to the development will be via Street No. 1, a 26-metre right-of-way collector road. Secondary access will be provided through the development to the north, as intended in the Kanata North CDP. This northern link and secondary access will be an extension of Street No. 2 and continue to be a 26-metre cross-section. The street network is generally proposed as a grid with no cul-de-sacs and only one dead end, which is a stub road. All other local roads will serve lots on both sides and will have 16.5-metre ROWs.

4.2 Parking

This TIA is exempt from this Module (see Table 3).

4.3 Boundary Street Design

The subject development is surrounded on four sides by existing and future development lands. For the purposes of this TIA, March Road will be examined as a boundary street as the development will have a direct connection to and will be primarily accessed via March Road. Through the Kanata North CDP an interim and ultimate cross-section for March Road have been created. These cross sections include cycle tracks and sidewalks on both sides of the road and the ultimate cross-section includes a centreline bus rapid transit facility. As per the TIA Guidelines, a complete street concept has already been prepared for the boundary street. Appendix D includes the March Road cross-sections from the CDP TMP.



Notes:

Legend

- Transit Coverage (400m)
- Transit Coverage (500m)
- Transit Stop Location (Approx)
- Sidewalk Location (Proposed)

A	description	by	xx/xx/xx
REV:	DESCRIPTION:	BY:	DATE:
STATUS:		status	

CGH Transportation
 13 Markham Ave
 Nepean, ON
 K2G 3Z1
 (343) 999-9117

CLIENT: Minto Communities - Canada
 200-180 Kent Street
 Ottawa, ON
 K1P 0B6

ARCHITECT:

SITE: 936 March Road

TITLE: SideTransit Stops, Sidewalks, and Transit Walking Distance

SCALE AT A3: NTS	DATE: 2018-11-28	DRAWN: MC	CHECKED:
PROJECT NO: 2018-04	DRAWING NO: 14	REVISION:	

4.4 Access Intersections

4.4.1 Location and Design of Access

The proposed main access to the site will be via an intersection onto March Road. An additional secondary access through the development to the north is also considered, but it is assumed that residents will primarily use the main access onto March Road. The operational analysis focuses on the intersection of Street 1 and March Road as it is anticipated that traffic generated by this site will use this intersection to access the arterial road network. It is assumed that the adjacent developments will use their own access and that the impact of any cross-over traffic will be minor and is not anticipated to have a significant impact on the proposed access intersection.

4.4.2 Intersection Control

Street 1 at March Road

The intersection of Street 1 at March Road has been examined using 2023 and 2028 traffic volumes to determine if signals are warranted. Ontario Traffic Manual (OTM) Book 12 traffic signal warrants have been used, specifically Justification #7. This warrant was shown to reach 161% of the criteria for 2023 volumes/intersection configuration and 194% for 2028 volumes/intersection configuration. When using the Justification 7 warrant for future new intersections, it is required to meet 150% to be considered justified. It is also noted that where the warrant meets 100%, the necessary underground provisions should be made as part of the road works. The warrant is met to 161% for the 2023 volumes and 194% for the 2028 volumes. Therefore, signals will be examined in both the 2023 and 2028 future total horizon. Appendix E contains the traffic signal warrant analysis sheets.

In addition to Traffic Signal Justification Warrants, the City of Ottawa's Roundabout Screening Tool has been used to determine the appropriate traffic control for the intersection of Street 1 at March Road. Using this tool, it was found that there were no contra-indications. It was found that there was only one suitability factor, that traffic signals are warranted. Additionally, the CDP considers a centreline BRT along March Road. This would preclude the use of a roundabout as a traffic control at this location. Therefore, a roundabout is not considered technically feasible at this location.

4.5 Transportation Demand Management

Transportation Demand Management measures are implemented to encourage the use of non-auto modes of travel. This is aimed at reducing the reliance on single occupant auto trips in the City of Ottawa. The proposed development adheres to the City's TDM principles by providing direct connections to adjacent pedestrian, cycling, and transit facilities. The existing mode share for Kanata/Stittsville has been used for all study horizons.

4.6 Neighbourhood Traffic Management

This TIA is exempt from this Module (see Table 3).

4.7 Transit

In Section 3.1 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 9 summarizes the transit trip generation.

Table 9: Trip Generation by Transit Mode

Travel Mode	Mode Share	In	Out	Total	In	Out	Total
Transit	10%	16	48	65	51	31	82

The anticipated increase in travel demand is anticipated to be reasonable. It is recommended that OC Transpo provide additional transit capacity only as needed once the development is completed. It is expected that once the March Road BRT is constructed, that the transit mode share, and therefore the transit trips generated by the

proposed development would increase. This change in transit mode share has not been examined herein as the BRT is not included in the City of Ottawa TMP 2031 Affordable Network.

4.8 Review of Network Concept

The Kanata North CDP TMP examined the adequacy of the network concept via a review of two screenlines, one to the north of the CDP area and one to the south. These screenlines were examined at 2026 and 2031 horizons. At the 2026 horizon, which aligns closely with the 2028 analysis horizon presented herein, the CDP TAI Screenline, south of the proposed development was shown to operate with no deficiencies, indicating that the southbound traffic will have adequate network capacity. North of the subject development the March Road Screenline was shown to exceed the peak direction capacity by approximately 114 vehicles per hour during the peak hour. This minor deficiency does not warrant the construction of additional corridor capacity, and the future BRT will improve this by providing additional person trip capacity, while maintaining the same level of vehicle capacity. Additionally, the 2028 total volume projected in this study would not exceed the screenline capacity (approximately 1400 peak hour vph demand vs approximately 1800 vph capacity).

Therefore, adequate screenline capacity is provided to support the proposed development.

4.9 Intersection Design

4.9.1 Intersection Control

As discussed in Section 4.4.2 signals will be analyzed at the intersection of Street 1 at March Road for the 2028 Future Total Horizon. As roundabouts have been screened out no roundabout analysis will be included.

4.9.2 Intersection Design

To understand the intersection design, an MMLOS analysis of existing, future background, and future total travel demands is required. The following sections will discuss the vehicle LOS at the Study Area intersections, followed by a discussion of the intersection MMLOS for other modes.

4.9.2.1 Existing Conditions

The existing intersection volumes have been analyzed to establish a baseline condition to compare all future horizons to and determine the impact of the subject development on the Study Area road network. Table 10 summarizes the operational analysis of 2018 existing conditions. Appendix F contains the 2018 Existing Conditions Synchro sheets.

Table 10: 2018 Existing Conditions Operational Analysis

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95 th)	LOS	Delay	V/C	Q (95 th)
Halton Terrace/Maxwell Bridge Road & March Road Signalized	EBL	A	33	0.04	7	A	46	0.14	9
	EBT/R	A	14	0.38	25	A	41	0.48	37
	WBL	D	77	0.85	67	B	70	0.67	42
	WBT/R	A	25	0.08	11	B	37	0.64	45
	NBL	A	9	0.10	9	A	6	0.27	24
	NBT	A	15	0.13	27	A	12	0.43	88
	NBR	A	3	0.09	7	A	2	0.16	9
	SBL	A	9	0.14	18	A	6	0.19	10
	SBT	A	16	0.38	83	A	11	0.15	29
	SBR	A	0	0.01	0	A	0	0.01	0
	Overall	C	22	-	-	B	19	-	-

The existing intersection has been shown to operate with good LOS, and no operational concerns. No mitigation measures are required or recommended.

4.9.2.2 2023 Future Background

The 2023 future background intersection volumes have been analyzed to allow a comparison between the future volumes with and without the proposed development. Table 11 summarizes the operational analysis of 2023 future background conditions.

Table 11: 2023 Future Background Conditions Operational Analysis

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95 th)	LOS	Delay	V/C	Q (95 th)
Halton Terrace/Maxwell Bridge Road & March Road Signalized	EBL	A	33	0.04	7	A	46	0.14	9
	EBT/R	A	13	0.38	25	A	41	0.48	38
	WBL	D	77	0.86	68	B	71	0.68	42
	WBT/R	A	24	0.08	10	B	38	0.65	47
	NBL	A	9	0.10	9	A	6	0.28	25
	NBT	A	15	0.13	28	A	12	0.44	91
	NBR	A	3	0.09	7	A	2	0.16	9
	SBL	A	9	0.15	19	A	6	0.20	10
	SBT	A	16	0.39	86	A	11	0.16	30
	SBR	A	0	0.01	0	A	0	0.01	0
Overall	C	23	-	-	-	B	19	-	-

With the addition of background growth to reflect the 2023 horizon, the existing intersection is anticipated to operate with similar operational characteristics to the existing conditions, and well within City of Ottawa operational thresholds. Appendix G contains the 2023 Future Background Synchro Sheets.

4.9.2.3 2028 Future Background

The 2028 future background intersection volumes have been analyzed to allow a comparison between the future volumes with and without the proposed development. Table 12 summarizes the operational analysis of 2028 future background conditions.

Table 12: 2028 Future Background Conditions Operational Analysis

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95 th)	LOS	Delay	V/C	Q (95 th)
March Road & West Access Unsignalized	EBL/R	D	30	0.28	1	E	37	0.25	1
	NBL/T	A	0	0.02	0	A	9	0.06	0
	SBT/R	-	-	-	-	-	-	-	-
Halton Terrace/Maxwell Bridge Road & March Road Signalized	EBL	A	37	0.32	32	F	169	1.07	49
	EBT/R	A	10	0.45	27	A	40	0.58	44
	WBL	E	92	0.94	72	C	88	0.80	44
	WBT/R	A	14	0.14	13	C	38	0.72	53
	NBL	A	24	0.57	32	A	8	0.45	39
	NBT	A	19	0.29	60	C	21	0.71	196
	NBR	A	4	0.10	8	A	5	0.18	18
	SBL	A	11	0.21	23	A	15	0.49	23
	SBT	C	31	0.78	230	A	14	0.24	50
	SBR	A	3	0.08	6	A	5	0.12	13
Overall	C	31	-	-	-	C	25	-	-

With the addition of background growth to reflect the 2028 horizon, including other areas of Kanata North. The west access, opposite the access to the proposed development, is anticipated to operate with LOS E, higher than the target LOS D. The signal warrant was found to be met for the full intersection including the access to the

proposed development. This will be examined further in the 2028 total future conditions. Appendix H contains the 2028 Future Background Synchro sheets.

4.9.2.4 2023 Total Future

The 2023 total future intersection volumes, including the site generated traffic, have been analyzed to understand the impact of the subject development on the Study Area intersections. Table 13 summarizes the operational analysis of 2023 total future conditions.

Table 13: 2023 Total Future Conditions Operational Analysis

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95 th)	LOS	Delay	V/C	Q (95 th)
Street 1 & March Road Signalized	WBL	C	43	0.79	82	B	47	0.69	58
	WBR	A	10	0.05	5	A	15	0.04	5
	NBT	A	9	0.25	38	D	26	0.91	300
	NBR	A	2	0.11	7	A	2	0.31	12
	SBL	A	8	0.01	2	A	10	0.15	5
	SBT	D	22	0.82	220	A	7	0.34	52
	Overall	B	19	-	-	B	16	-	-
Halton Terrace/Maxwell Bridge Road & March Road Signalized	EBL	A	33	0.04	7	A	43	0.13	9
	EBT/R	A	13	0.38	25	A	36	0.42	36
	WBL	D	77	0.86	68	B	66	0.66	42
	WBT/R	A	24	0.08	10	A	32	0.57	44
	NBL	A	10	0.15	9	A	6	0.32	24
	NBT	A	16	0.19	39	A	14	0.59	144
	NBR	A	3	0.09	7	A	3	0.16	13
	SBL	A	9	0.16	19	A	6	0.24	10
	SBT	A	19	0.56	137	A	11	0.25	47
	SBR	A	0	0.01	0	A	0	0.01	0
Overall	C	23	-	-	B	17	-	-	

With the addition of site generated traffic, the existing intersection of Halton Terrace/Maxwell Bridge Road & March Road is anticipated to operate with similar LOS and delay as 2023 future background conditions. The access intersection to 936 March Road is anticipated to operate with minimal delays and good LOS. Appendix I contains the 2023 Total Future Synchro sheets.

4.9.2.5 2028 Total Future

The 2028 total future intersection volumes, including the site generated traffic, have been analyzed to understand the impact of the subject development on the Study Area intersections.

Table 14: 2028 Total Future Conditions Operational Analysis

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95 th)	LOS	Delay	V/C	Q (95 th)
Street 1 & March Road Signalized	EBL	A	40	0.09	8	A	39	0.07	7
	EBT/R	A	45	0.58	38	A	50	0.60	44
	WBL	E	78	0.98	119	D	62	0.84	70
	WBT/R	A	26	0.21	27	A	33	0.30	36
	NBL	A	10	0.06	3	A	8	0.12	9
	NBT	A	9	0.25	35	C	14	0.71	143
	NBR	A	2	0.11	7	A	5	0.34	32
	SBL	A	8	0.01	2	A	11	0.15	6
	SBT/R	B	15	0.70	138	A	8	0.32	45
	Overall	C	26	-	-	B	17	-	-
Halton Terrace/Maxwell Bridge Road & March Road Signalized	EBL	A	37	0.32	32	F	169	1.07	49
	EBT/R	A	10	0.45	27	A	40	0.58	44
	WBL	E	92	0.94	72	C	88	0.80	44
	WBT/R	A	14	0.14	13	C	38	0.72	53
	NBL	B	39	0.66	39	A	9	0.54	39
	NBT	A	20	0.35	75	D	28	0.88	301
	NBR	A	4	0.10	8	A	6	0.18	22
	SBL	A	12	0.24	23	B	37	0.63	38
	SBT	E	47	0.98	321	A	15	0.35	73
	SBR	A	3	0.08	6	A	5	0.12	13
	Overall	D	51	-	-	C	32	-	-

While it is not included in the 2031 affordable network, for the analysis herein it has assumed the 2028 horizon will include the widening of March Road from two to four lanes.

With the addition of the site traffic and the future background traffic the study area intersections are anticipated to operate with reasonable LOS with a few exceptions. The westbound left at Street 1 and March Road is projected to operate with LOS E in the AM peak hour. While this is movement is anticipated to exceed the City of Ottawa's operational thresholds (LOS D) it is not uncommon for left turns from collector roads to arterial roads to experience poor LOS as the function of the arterial road dictates that the main street (March Road) would receive priority in the signal timing (i.e. more time allocated to it) over the side streets. Therefore, this minor deficiency is acceptable.

At the signalized intersection of Halton Terrace/Maxwell Bridge Road at March Road several deficiencies begin to arise in the 2028 horizon. During the AM peak hour, the westbound left and southbound through are approaching capacity. Like the intersection of Street 1 at March Road, it is not uncommon for a left turn onto an arterial road to operate at or approaching capacity during peak hours. Additionally, the southbound through is projected to approach capacity during the AM peak hour. To increase the southbound through capacity would require additional through lanes, which are not feasible. The future transit priority measures or bus rapid transit facility will provide additional transit capacity, reducing the number of vehicle trips. During the PM peak hour, the eastbound left turn lane is projected to operate at a LOS F. This, again, is a left turn from a collector road onto an arterial road, which, as discussed previously, often operate at or slightly over capacity as the arterial road traffic

is prioritized over the side streets. Additionally, the overall intersection LOS meets the City of Ottawa's vehicle LOS target, LOS D. Appendix J contains the 2028 Total Future Synchro sheets.

4.9.2.6 Intersection MMLOS

Intersection MMLOS is undertaken at signalized intersections. Pedestrian LOS (PLOS) is evaluated using the PETSU score methodology which evaluates various intersection geometry elements and assigns those values a score. The intersection of Halton Terrace/Maxwell Bridge Road at March Road has been evaluated using the existing geometry. The intersection of Street 1 at March Road will be evaluated using the assumed 2028 future geometry including a four-lane cross section on March Road and both sides of the intersection constructed. Table 15 summarizes the PETSU score evaluation for the proposed signalized intersection of Halton Terrace/Maxwell Bridge Road at March Road.

Table 15: PETSU Score Halton Terrace/Maxwell Bridge Road at March Road

Element	Crossing East West		Crossing North South		
	Condition	Points	Condition	Points	
Crossing Distance	6 Lanes – No Median	55	3 Lanes – No Median	105	
Island Refuge	No	-4	No	-4	
Signal Phasing / Timing					
Left Turn Type	Protected/Permissive	-8	Permissive	-8	
Right Turn Conflict	Permissive	-5	Permissive	-5	
Right Turn on Red	RTOR Allowed	-3	RTOR Allowed	-3	
Leading Ped. Interval	No	-2	No	-2	
Corner Radius	>10m to 15m	-6	>10m to 15m	-6	
Crosswalk	Standard Markings	-7	Standard Markings	-7	
PETSU LOS	Actual	20	F	70	C
	Target		C	Target	C

The north south pedestrian crossing meets the target PLOS C for a collector road in a development community. The east west pedestrian crossing does not meet the target PLOS C for an arterial road in a developing community. This existing intersection has a very long east-west crossing distance and would be very difficult to improve without removing lanes on March Road, which is not feasible. Therefore, in this case the LOS F should be tolerated as it is not reasonable to achieve the target PLOS.

Table 16 summarizes the PETSU score evaluation for the proposed signalized intersection of Street 1 at March Road.

Table 16: PETSU Score Street 1 at March Road

Element	Crossing East West		Crossing North South		
	Condition	Points	Condition	Points	
Crossing Distance	6 Lanes - Median	60	3 Lanes – No Median	105	
Island Refuge	No	-4	No	-4	
Signal Phasing / Timing					
Left Turn Type	Protected/Permissive	-8	Permissive	-8	
Right Turn Conflict	Permissive	-5	Permissive	-5	
Right Turn on Red	RTOR Allowed	-3	RTOR Allowed	-3	
Leading Ped. Interval	No	-2	No	-2	
Corner Radius	>10m to 15m	-6	>10m to 15m	-6	
Crosswalk	Standard Markings	-7	Standard Markings	-7	
PETSU LOS	Actual	25	F	70	C
	Target		C	Target	C

The north south pedestrian crossing meets the target PLOS C for a collector road in a development community. The east west pedestrian crossing does not meet the target PLOS C for an arterial road in a developing community. The proposed future cross-section of March Road (CDP cross-section) includes a 5-metre median and two lanes of travel in each direction. With this configuration it is very difficult to meet the target PLOS. By implementing no right turns on red on the east and west approaches, and a leading pedestrian interval a PLOS E could be achieved. By also adding a raised cross-walk (across March Road) and eliminating permissive left turns on the east and west approaches a PLOS D could be achieved. However, as March Road is an arterial road and is anticipated to have an 80 km/h posted speed limit it is not appropriate to implement raised crosswalks. Therefore, in this case a PLOS F should be tolerated as it is not feasible to achieve the target PLOS.

Bicycle LOS (BLOS) is evaluated by examining elements that impact the level of traffic stress (LTS). For the existing intersection of Halton Terrace/Maxwell Bridge Road at March Road the Pocket Bike Lanes on a Signalized Intersection Approach criteria has been applied along March Road. For the proposed intersection the Bike Lanes or higher order facility on a Signalized Intersection Approach criteria has been applied along March Road. Along the minor streets the Mixed Traffic on a Signalized Intersection Approach has been applied. Table 17 summarizes the BLOS for the intersection of Halton Terrace/Maxwell Bridge Road at March Road.

Table 17: Bicycle LOS Criteria Halton Terrace/Maxwell Bridge Road at March Road

	East-West		North-South	
Right-turn Lane and Turning Speed of Motorists	No Right Turn Lanes	N/A	Right-turn lane introduced to the right of the bike lane and > 50 m long, turning speed \leq 30 km/h (based on curb radii and angle of intersection)	D
Cyclist Making a Left-turn and Operating Speed of Motorists	1 lane crossed, 50 km/h	D	2 or more lanes crossed, \geq 50 km/h	F

The BLOS for the north-south approaches are governed by the number of lanes crossed and the operating speed on March Road. A bike box style left turn would have to be implemented to improve the LOS along with eliminating the right turn lanes. This is not considered feasible at this existing intersection. The east-west approaches are governed by the left turning bicycles. Neither approach meets the target BLOS of C for an arterial route in a Developing Community.

Table 18 summarizes the BLOS for the intersection of Street 1 at March Road.

Table 18: Bicycle LOS Criteria Street 1 at March Road

	East-West		North-South	
Right-turn Lane and Turning Speed of Motorists	No Right Turn Lanes	N/A	No Impact on LTS (Separated Facility)	N/A
Cyclist Making a Left-turn and Operating Speed of Motorists	See Note below		See Note below	

Note: the intersection design has not been completed, but in order to meet the target BLOS for this intersection, a two-stage, left-turn bike box should be provided. This should be confirmed at the time of a functional design and implemented if feasible.

Transit LOS (TLOS) is evaluated by examining the average signal delay and the relative attractiveness of transit compared to automobile trips. While local transit service is anticipated to be extended to the subject development, the TMP Ultimate Network and Affordable Network do not include higher order transit facilities or transit signal priority (TSP) measures. The CDP does include a centreline Bus Rapid Transit facility, however, as the timing of this facility is not known it cannot be assumed that it will be in place within the development horizons. Therefore, the TLOS for this intersection is F, until such time as TSP or BRT is implemented.

Truck LOS (TkLOS) is evaluated for Developing Communities only along Arterial and Collector Truck Routes. The Street 1 collector is not anticipated to be a Truck Route and therefore no TkLOS has been evaluated at the proposed signalized intersection.

4.9.2.7 Access Intersection Design

The signalized intersection of Street 1 at March Road has been evaluated using the MMLOS methodology, OTM Book 12 Traffic Warrants, and TAC Geometric Standards to determine the appropriate intersection configuration.

Auxiliary Right Turn Lanes

The TAC Geometric Standards suggest that a right turn lane is required where the right turn volume exceed 10% of the approach volume. At the subject intersection, the northbound right turn volume exceeds 10% of the approach volume in the 2023 and 2028 horizon. Therefore, a right turn lane should be provided for the 2023 and 2028 horizons.

Auxiliary Left Turn Lanes

The vehicle LOS has been completed assuming that left turn lanes are provided on all approaches of the signalized intersection. The left turn lanes into and out of the west leg will be further examined by others at the time of a development application for the development adjacent to 936 March Road. The southbound left turn lane and westbound left turn lane provide access into and out of the proposed development. The operational analysis of the proposed intersection has indicated that left-turn lane storage should be provided as follows:

- Westbound Left-turn storage lane 115m
- Southbound Left-turn storage lane 10m

These storage lengths would accommodate the anticipated queue lengths, but the actual storage length should be calculated using geometric design principles including applicable minimums, deceleration length, and taper lengths. The recommended auxiliary left-turn lane storage and taper lengths should be confirmed during the detailed design of the proposed intersection.

4.9.2.8 Design Context

This TIA has been prepared within the context of the Kanata North CDP and the associated TMP. It is understood that development applications are underway for adjacent properties to the north, west, and northwest. This TIA has assumed that the TMP has accurately forecast the growth of these adjacent developments. These forecasts will be refined through upcoming TIAs for those properties. Once those projections are available the design of the access intersection can be refined to ensure the appropriate lane geometry and signal timing is provided. In advance of that, this application should be allowed to proceed and be deemed complete, with the understanding that the developers of the adjacent properties in Kanata North have agreed to enter into cost sharing agreements to complete the construction of shared elements, such as the access intersection.

5 Conclusions

This Transportation Impact Assessment has documented the existing and future transportation conditions, for all travel modes, in the Study Area. The following conclusions can be offered based on the foregoing:

- A. The proposed development, located at 936 March Road, is a greenfield development that will include approximately 800 residential units with a mix of townhouses and detached homes (401 townhouses and 455 detached homes). Additionally, the western portion of the property will include a future commercial development (by others) that has been assumed to consist of 300,000 square feet of retail/commercial space.
- B. Access to the proposed development will be via Street 1, which will intersect with March Road at a signalized intersection.
- C. The existing development is not currently served by transit. However, Route 63 currently serves the adjacent developments to the south and could be easily re-routed / extended to also serve 936 March Road.
- D. The previous five years of collision history at the existing intersection of Halton Terrace/Maxwell Bridge Road & March Road has been reviewed. No patterns emerged that indicated that mitigation measures or further monitoring was required.
- E. Using ITE Trip Generation 10th Edition Trip Rates, the residential trip generation rates were calculated. The existing mode shares from the OD Survey were reviewed. Using these factors, the person trip by mode was calculated. It was found that the proposed development can be anticipated to generate 621 AM and 781 PM peak hour two-way person trips.
- F. By providing transit stops at appropriate locations along the collector road (Street 1) it was shown that 85% of the proposed development units would be within a 400m walking distance to transit, with the remaining 15% no more than 500m from transit. To get all units within 500m would require excess transit stops, located in awkward locations. Therefore, the transit stops, as proposed, will provide appropriate transit coverage for the proposed development.
- G. Traffic signal control warrants have been examined for the intersection of Street 1 at March Road. Using OTM Book 12 Justification 7, it was found that the 2023 and 2028 traffic volumes would meet the volume threshold, and traffic control signals are warranted.
- H. The Kanata North CDP TMP examined the network concept and it was shown that adequate screenline capacity will be provided by the road network to support the proposed development.
- I. An auxiliary right turn lane has been found to be warranted on the northbound approach of the Street 1 at March Road access intersection.
- J. Auxiliary left turn lanes are proposed on all four legs of the proposed signalized intersection of Street 1 at March Road.
- K. 936 March Road is one of several proposed developments that are being put forward in similar timelines. This development application is proceeding prior to TIAs being completed for the proposed development across March Road. While the Kanata North CDP TMP has prepared traffic projections for the adjacent developments, these projections will be refined through upcoming TIAs for those properties. Therefore, while the access intersection has been examined herein, the design of the intersection will have to be refined once traffic projections for the west leg of the intersection have been finalized. Proceeding with a functional design in advance of the availability of these projections will create unnecessary duplication of design efforts. It is recommended that this duplication be avoided by allowing the development application for 936 March Road to be deemed complete and all reports be circulated in advance of the preparation of an RMA or functional design for the subject intersection. Construction of this intersection will not proceed until such time as a functional design that satisfies City Staff is prepared and approved. Minto and CGH Transportation are committed to working with Brigil and their consultant, Stantec, to develop and appropriate RMA for the interim intersection configuration.

The proposed development, with the intersection control discussed herein, will function within the Study Area Road Network. It is recommended that, from a transportation perspective, the proposed development application proceed.

Prepared By:



Mark Crockford, P. Eng.
Director
905-251-4070
Mark.Crockford@CGHTransportation.com



Christopher Gordon, P. Eng.
Director
343-999-9117
Christopher.Gordon@CGHTransportation.com

Appendix A

TIA Screening Form and PM Certification Form



TIA Plan Reports

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

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

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

CERTIFICATION

1. I have reviewed and have a sound understanding of the objectives, needs and requirements of the City of Ottawa's Official Plan, Transportation Master Plan and the Transportation Impact Assessment (2017) Guidelines;
2. I have a sound knowledge of industry standard practice with respect to the preparation of transportation impact assessment reports, including multi modal level of service review;
3. I have substantial experience (more than 5 years) in undertaking and delivering transportation impact studies (analysis, reporting and geometric design) with strong background knowledge in transportation planning, engineering or traffic operations; and
4. I am either a licensed¹ or registered² professional in good standing, whose field of expertise [check appropriate field(s)] is either transportation engineering or transportation planning .

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

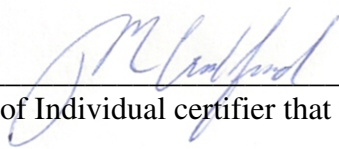
City Of Ottawa
Infrastructure Services and Community
Sustainability
Planning and Growth Management
110 Laurier Avenue West, 4th fl.
Ottawa, ON K1P 1J1
Tel. : 613-580-2424
Fax: 613-560-6006

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

Dated at Newmarket this 8 day of August, 2018.
(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



City of Ottawa 2017 TIA Guidelines
Step 1 - Screening FormDate: July 16, 2018
Project Number: 2018-04
Project Reference: Minto - 936 March Road

Module 1.1 Description of Proposed Development	
Municipal Address	936 March Road
Description of Location	MARCH CON 2 PT LOT 11
Land Use Classification	Residential
Development Size	~800 Units (Mix of Towns and Singles)
Accesses	1 Access on March Road, Connections to adjacent
Phase of Development	1 Phase
Buildout Year	~2023
TIA Requirement	Full TIA Required

Module 1.2 Trip Generation Trigger	
Land Use Type	Single-family homes
Development Size	800 G.F.A.
Trip Generation Trigger	Yes

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

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

Appendix B

Turning Movement Counts



Turning Movement Count - 15 Minute Summary Report

HALTON TERR/MAXWELL BRIDGE RD @ MARCH RD

Survey Date: Wednesday, August 10, 2016

Total Observed U-Turns

Northbound: 25 Southbound: 0
Eastbound: 2 Westbound: 0

MARCH RD

HALTON TERR/MAXWELL BRIDGE RD

Table with columns: Time Period, Northbound (LT, ST, RT, N TOT), Southbound (LT, ST, RT, S TOT, STR TOT), Eastbound (LT, ST, RT, E TOT), Westbound (LT, ST, RT, W TOT, STR TOT), Grand Total. Rows include 15-minute intervals from 07:00 to 17:45 and a final TOTAL row.

Note: U-Turns are included in Totals.

Comment:



Transportation Services - Traffic Services

Turning Movement Count - Cyclist Volume Report

Work Order
36161

HALTON TERR/MAXWELL BRIDGE RD @ MARCH RD

Count Date: Wednesday, August 10, 2016

Start Time: 07:00

Time Period	MARCH RD			HALTON TERR/MAXWELL BRIDGE RD			Grand Total
	Northbound	Southbound	Street Total	Eastbound	Westbound	Street Total	
07:00 08:00	0	0	0	1	1	2	2
08:00 09:00	0	0	0	4	1	5	5
09:00 10:00	0	0	0	0	1	1	1
11:30 12:30	1	4	5	7	1	8	13
12:30 13:30	2	0	2	1	0	1	3
15:00 16:00	0	0	0	5	1	6	6
16:00 17:00	2	0	2	4	0	4	6
17:00 18:00	1	0	1	2	2	4	5
Total	6	4	10	24	7	31	41

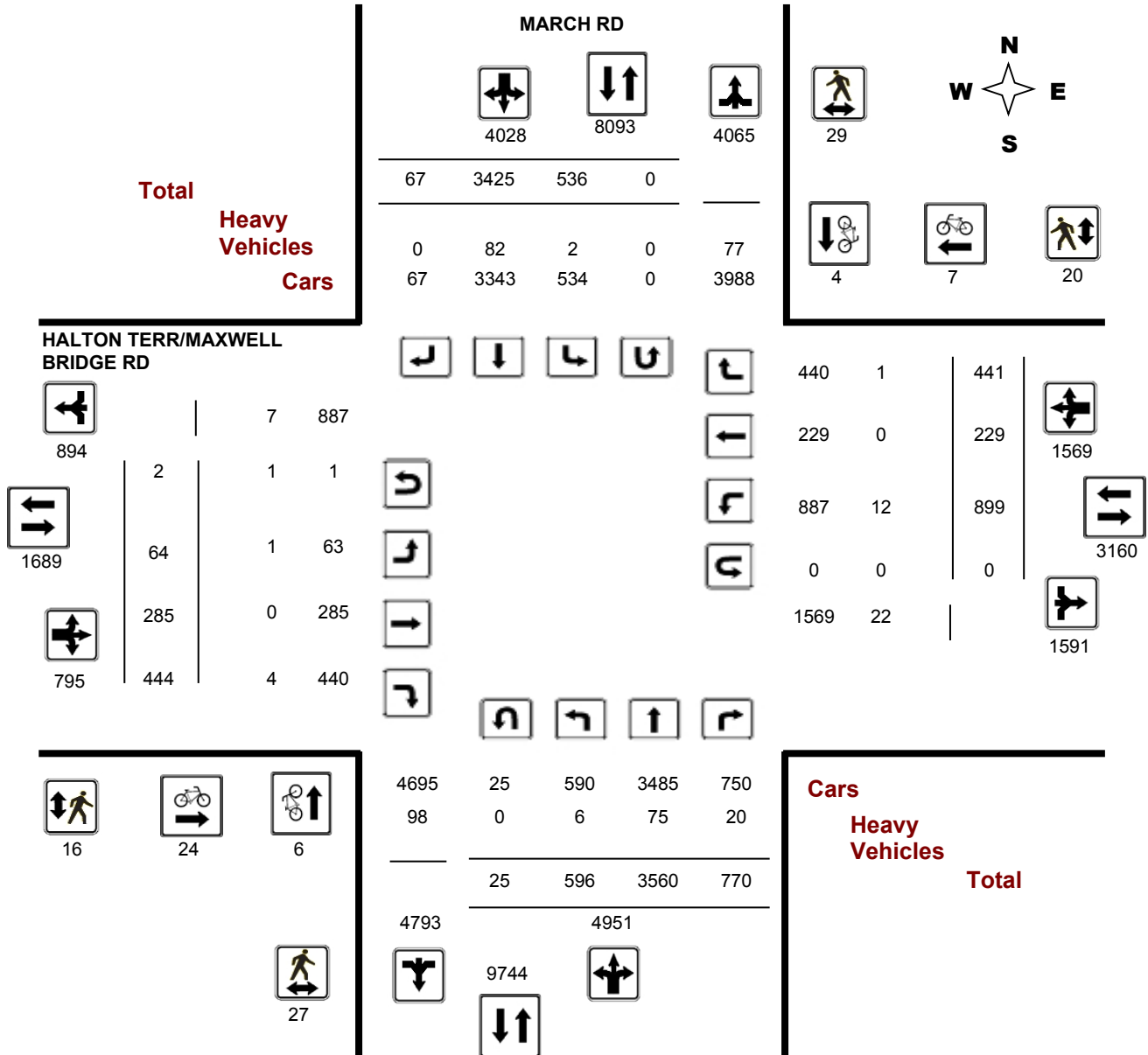
Comment:

Note: These volumes consists of bicycles only (no mopeds or motorcycles) and ARE NOT included in the Turning Movement Count Summary.

HALTON TERR/MAXWELL BRIDGE RD @ MARCH RD

Survey Date: Wednesday, August 10, 2016

WO#: 36161
Device: Miovision



Comments



Transportation Services - Traffic Services

W.O.
36161

Turning Movement Count - Heavy Vehicle Report

HALTON TERR/MAXWELL BRIDGE RD @ MARCH RD

Survey Date: Wednesday, August 10, 2016

Time Period	MARCH RD								HALTON TERR/MAXWELL BRIDGE RD											Grand Total
	Northbound				Southbound				Eastbound						Westbound					
	LT	ST	RT	N TOT	LT	ST	RT	S TOT	STR TOT	LT	ST	RT	E TOT	LT	ST	RT	W TOT	STR TOT		
07:00 08:00	3	12	4	19	0	14	0	14	33	0	0	0	0	0	0	0	0	0	33	
08:00 09:00	2	17	2	21	0	13	0	13	34	1	0	1	3	1	0	1	2	5	39	
09:00 10:00	0	11	0	11	0	11	0	11	22	0	0	2	2	0	0	0	0	2	24	
11:30 12:30	1	5	6	12	1	11	0	12	24	0	0	0	0	2	0	0	2	2	26	
12:30 13:30	0	7	2	9	0	11	0	11	20	0	0	1	1	0	0	0	0	1	21	
15:00 16:00	0	8	4	12	1	9	0	10	22	0	0	0	0	3	0	0	3	3	25	
16:00 17:00	0	11	1	12	0	8	0	8	20	0	0	0	0	3	0	0	3	3	23	
17:00 18:00	0	4	1	5	0	5	0	5	10	0	0	0	0	3	0	0	3	3	13	
Sub Total	6	75	20	101	2	82	0	84	185	1	0	4	6	12	0	1	13	19	204	
U-Turns (Heavy Vehicles)				0				0	0				1				0	1	1	
Total	6	75	20	0	2	82	0	84	185	1	0	4	7	12	0	1	13	20	205	

Heavy Vehicles include Buses, Single-Unit Trucks and Articulated Trucks. Further, they ARE included in the Turning Movement Count Summary.



Transportation Services - Traffic Services

Work Order

36161

Turning Movement Count - Pedestrian Volume Report

HALTON TERR/MAXWELL BRIDGE RD @ MARCH RD

Count Date: Wednesday, August 10, 2016

Start Time: 07:00

Time Period	NB Approach (E or W Crossing)	SB Approach (E or W Crossing)	Total	EB Approach (N or S Crossing)	WB Approach (N or S Crossing)	Total	Grand Total
07:00 07:15	2	0	2	0	2	2	4
07:15 07:30	0	0	0	0	0	0	0
07:30 07:45	1	0	1	0	1	1	2
07:45 08:00	1	0	1	0	0	0	1
07:00 08:00	4	0	4	0	3	3	7
08:00 08:15	0	2	2	0	1	1	3
08:15 08:30	1	3	4	0	0	0	4
08:30 08:45	0	1	1	0	0	0	1
08:45 09:00	1	0	1	0	0	0	1
08:00 09:00	2	6	8	0	1	1	9
09:00 09:15	1	2	3	3	2	5	8
09:15 09:30	3	1	4	0	2	2	6
09:30 09:45	0	0	0	1	3	4	4
09:45 10:00	4	1	5	1	0	1	6
09:00 10:00	8	4	12	5	7	12	24
11:30 11:45	2	1	3	2	0	2	5
11:45 12:00	0	1	1	0	1	1	2
12:00 12:15	0	1	1	0	0	0	1
12:15 12:30	1	2	3	2	0	2	5
11:30 12:30	3	5	8	4	1	5	13
12:30 12:45	0	0	0	0	1	1	1
12:45 13:00	2	6	8	5	2	7	15
13:00 13:15	3	1	4	0	0	0	4
13:15 13:30	0	1	1	0	1	1	2
12:30 13:30	5	8	13	5	4	9	22
15:00 15:15	0	0	0	0	0	0	0
15:15 15:30	0	0	0	0	0	0	0
15:30 15:45	0	0	0	0	0	0	0
15:45 16:00	1	0	1	0	0	0	1
15:00 16:00	1	0	1	0	0	0	1
16:00 16:15	0	3	3	0	0	0	3
16:15 16:30	0	1	1	1	0	1	2
16:30 16:45	0	1	1	0	1	1	2
16:45 17:00	0	0	0	0	1	1	1
16:00 17:00	0	5	5	1	2	3	8
17:00 17:15	0	0	0	0	0	0	0
17:15 17:30	0	0	0	0	1	1	1
17:30 17:45	2	1	3	1	0	1	4
17:45 18:00	2	0	2	0	1	1	3
17:00 18:00	4	1	5	1	2	3	8
Total	27	29	56	16	20	36	92

Comment:



Turning Movement Count - Full Study Summary Report

HALTON TERR/MAXWELL BRIDGE RD @ MARCH RD

Survey Date: Wednesday, August 10, 2016

Total Observed U-Turns

Northbound: 25 Southbound: 0
Eastbound: 2 Westbound: 0

AADT Factor

.90

Full Study

Period	MARCH RD									HALTON TERR/MAXWELL BRIDGE RD										Grand Total
	Northbound				Southbound					Eastbound					Westbound					
	LT	ST	RT	NB TOT	LT	ST	RT	SB TOT	STR TOT	LT	ST	RT	EB TOT	LT	ST	RT	WB TOT	STR TOT		
07:00 08:00	22	146	38	206	67	709	1	777	983	4	26	62	92	139	2	2	143	235	1218	
08:00 09:00	37	214	68	319	90	672	7	769	1088	9	38	107	154	166	16	9	191	345	1433	
09:00 10:00	26	248	55	329	63	512	4	579	908	5	23	71	99	102	16	21	139	238	1146	
11:30 12:30	67	364	128	559	62	326	17	405	964	8	25	36	69	110	26	44	180	249	1213	
12:30 13:30	62	342	110	514	66	329	8	403	917	1	34	48	83	124	21	73	218	301	1218	
15:00 16:00	79	607	109	795	61	319	7	387	1182	9	34	36	79	69	42	94	205	284	1466	
16:00 17:00	137	812	125	1074	67	276	15	358	1432	15	38	38	91	94	51	94	239	330	1762	
17:00 18:00	166	827	137	1130	60	282	8	350	1480	13	67	46	126	95	55	104	254	380	1860	
Sub Total	596	3560	770	4926	536	3425	67	4028	8954	64	285	444	793	899	229	441	1569	2362	11316	
U Turns				25				0	25				2				0	2	27	
Total	596	3560	770	4951	536	3425	67	4028	8979	64	285	444	795	899	229	441	1569	2364	11343	
EQ 12Hr	828	4948	1070	6882	745	4761	93	5599	12481	89	396	617	1105	1250	318	613	2181	3286	15767	
Note: These values are calculated by multiplying the totals by the appropriate expansion factor.													1.39							
AVG 12Hr	746	4454	963	6194	671	4285	84	5039	11233	80	357	555	995	1125	286	552	1963	2958	14191	
Note: These volumes are calculated by multiplying the Equivalent 12 hr. totals by the AADT factor.													.90							
AVG 24Hr	977	5834	1262	8114	878	5613	110	6601	14715	105	467	728	1303	1473	375	723	2571	3874	18589	
Note: These volumes are calculated by multiplying the Average Daily 12 hr. totals by 12 to 24 expansion factor.													1.31							

Comments:

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



Transportation Services - Traffic Services

Turning Movement Count - Full Study Peak Hour Diagram

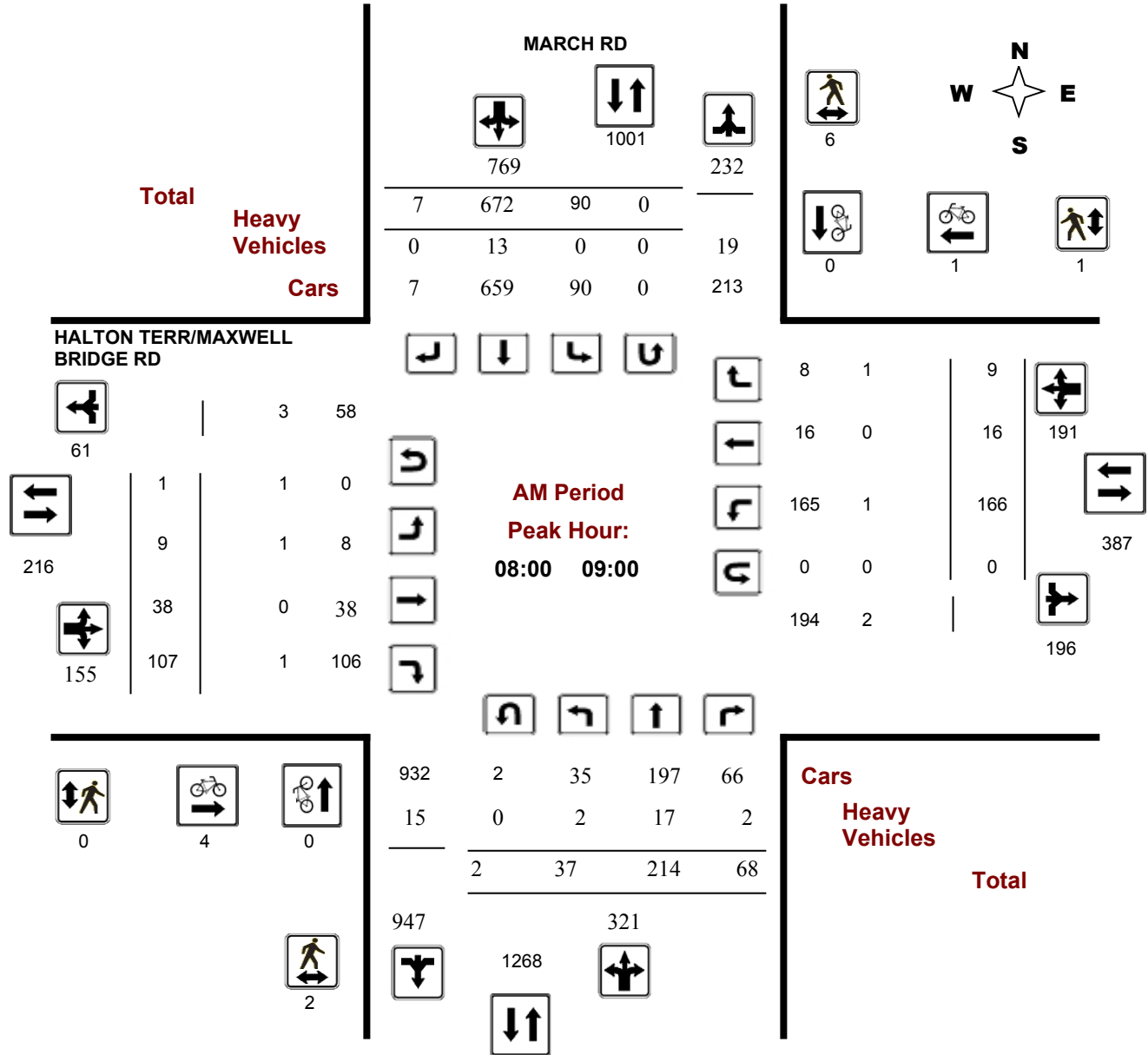
HALTON TERR/MAXWELL BRIDGE RD @ MARCH RD

Survey Date: Wednesday, August 10, 2016

Start Time: 07:00

WO No: 36161

Device: Miovision



Turning Movement Count - Full Study Peak Hour Diagram

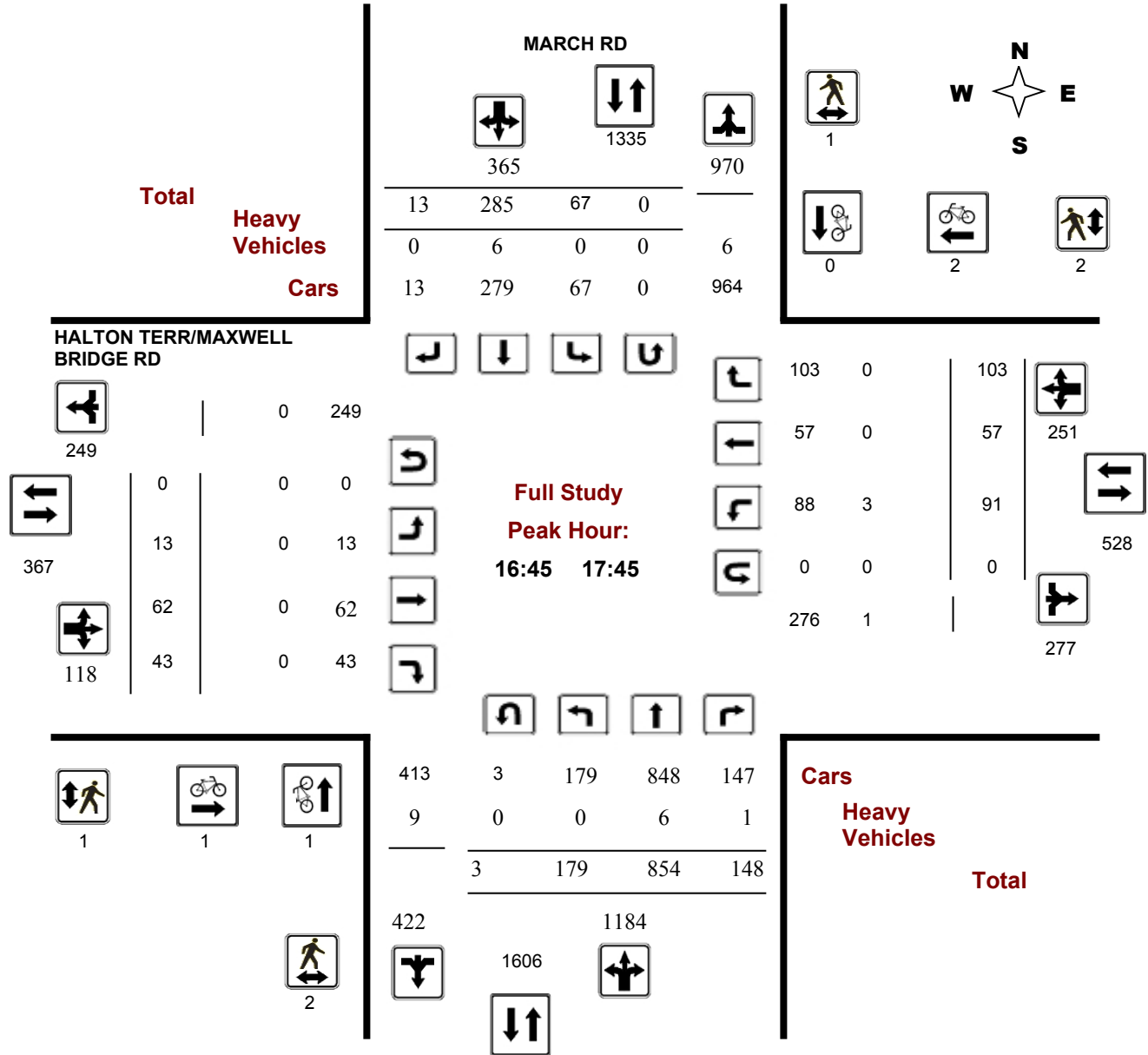
HALTON TERR/MAXWELL BRIDGE RD @ MARCH RD

Survey Date: Wednesday, August 10, 2016

Start Time: 07:00

WO No: 36161

Device: Miovision



Comments

Turning Movement Count - Full Study Peak Hour Diagram

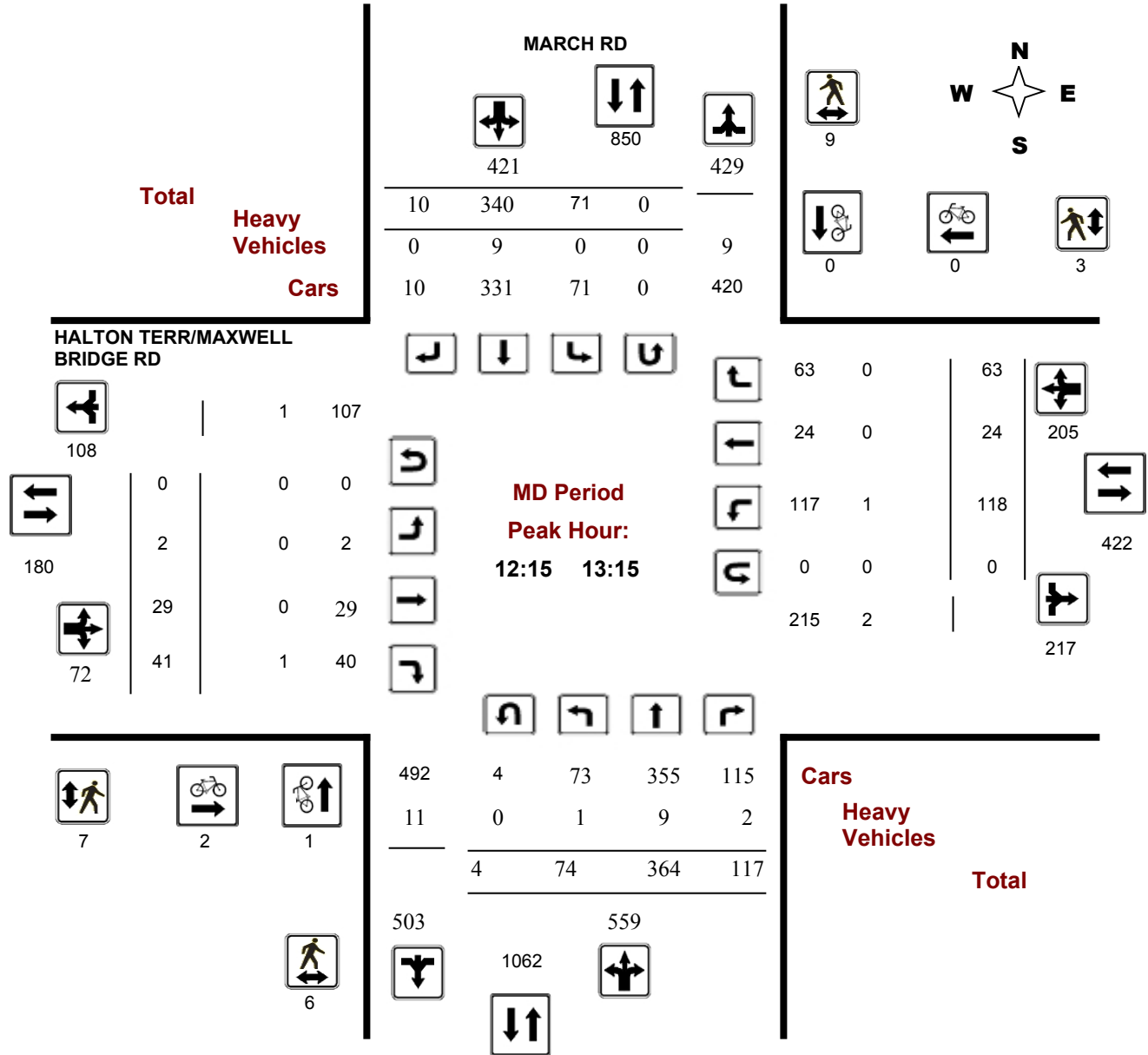
HALTON TERR/MAXWELL BRIDGE RD @ MARCH RD

Survey Date: Wednesday, August 10, 2016

Start Time: 07:00

WO No: 36161

Device: Miovision





Transportation Services - Traffic Services

Turning Movement Count - Full Study Peak Hour Diagram

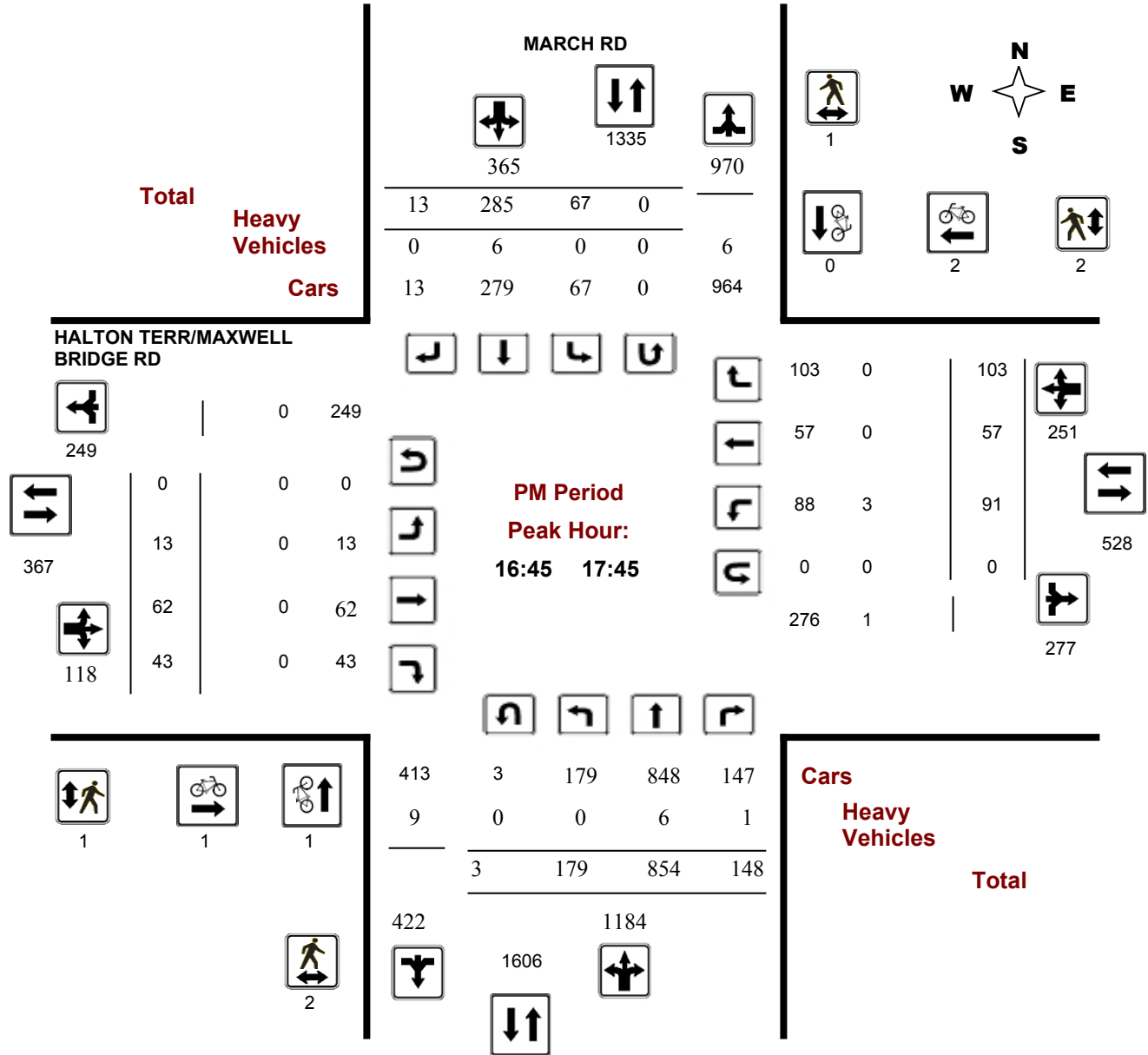
HALTON TERR/MAXWELL BRIDGE RD @ MARCH RD

Survey Date: Wednesday, August 10, 2016

Start Time: 07:00

WO No: 36161

Device: Miovision



Turning Movement Count - 15 Min U-Turn Total Report

HALTON TERR/MAXWELL BRIDGE RD @ MARCH RD

Survey Date: Wednesday, August 10, 2016

Time Period		Northbound U-Turn Total	Southbound U-Turn Total	Eastbound U-Turn Total	Westbound U-Turn Total	Total
07:00	07:15	1	0	0	0	1
07:15	07:30	0	0	0	0	0
07:30	07:45	0	0	0	0	0
07:45	08:00	1	0	0	0	1
08:00	08:15	1	0	0	0	1
08:15	08:30	0	0	0	0	0
08:30	08:45	0	0	1	0	1
08:45	09:00	1	0	0	0	1
09:00	09:15	0	0	0	0	0
09:15	09:30	4	0	0	0	4
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	1	0	0	0	1
12:00	12:15	1	0	1	0	2
12:15	12:30	1	0	0	0	1
12:30	12:45	2	0	0	0	2
12:45	13:00	0	0	0	0	0
13:00	13:15	1	0	0	0	1
13:15	13:30	2	0	0	0	2
15:00	15:15	0	0	0	0	0
15:15	15:30	1	0	0	0	1
15:30	15:45	3	0	0	0	3
15:45	16:00	1	0	0	0	1
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	1	0	0	0	1
17:00	17:15	1	0	0	0	1
17:15	17:30	0	0	0	0	0
17:30	17:45	1	0	0	0	1
17:45	18:00	1	0	0	0	1
Total		25	0	2	0	27

Appendix C

Collision Data



City Operations - Transportation Services

Collision Details Report - Public Version

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

Location: HALTON TERR/MAXWELL BRIDGE RD @ MARCH RD

Traffic Control: Traffic signal

Total Collisions: 13

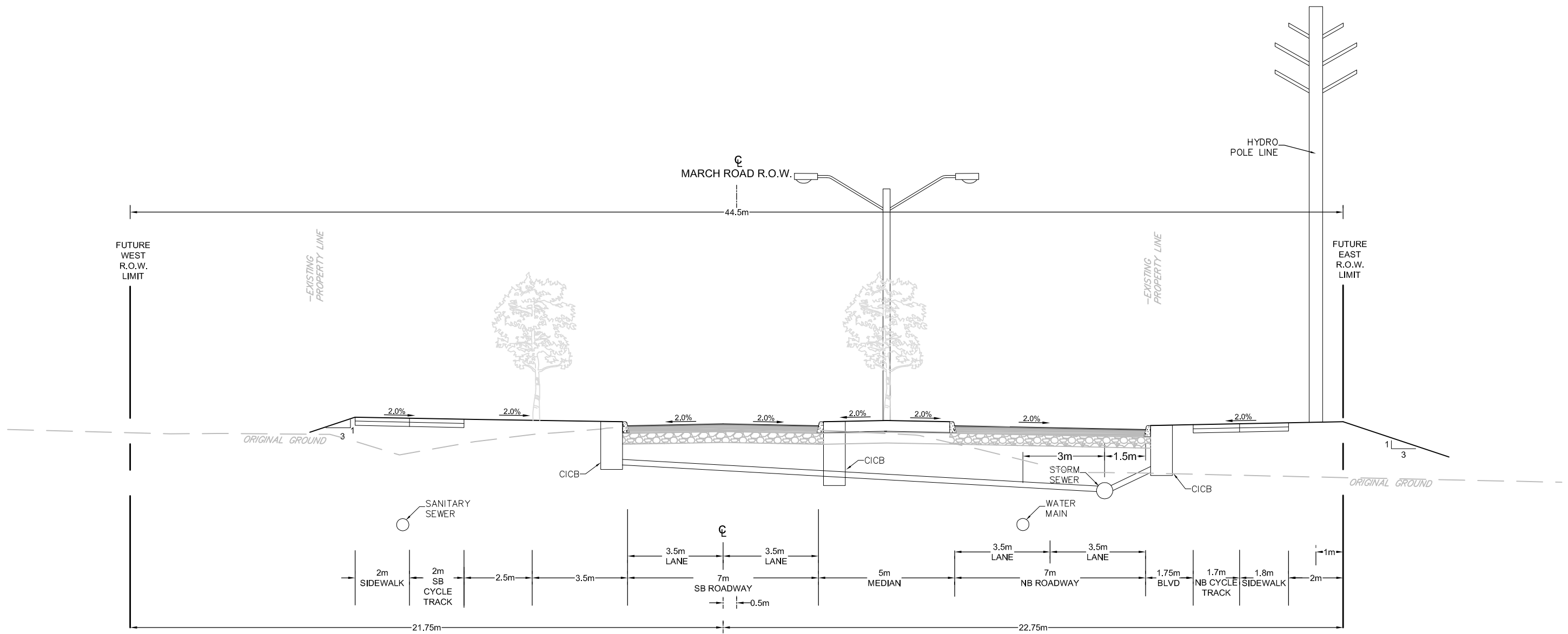
Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuvre	Vehicle type	First Event	No. Ped
2013-Apr-10, Wed,15:45	Clear	Angle	P.D. only	Dry	East	Turning right	Automobile, station wagon	Other motor vehicle	
					North	Going ahead	Pick-up truck	Other motor vehicle	
2013-Aug-11, Sun,03:45	Clear	SMV other	P.D. only	Dry	North	Changing lanes	Unknown	Skidding/sliding	
2013-Oct-01, Tue,07:47	Clear	Turning movement	Non-fatal injury	Dry	South	Going ahead	Automobile, station wagon	Other motor vehicle	
					North	Turning left	Automobile, station wagon	Other motor vehicle	
2014-Jul-29, Tue,19:40	Clear	SMV other	P.D. only	Dry	South	Going ahead	Automobile, station wagon	Skidding/sliding	
2015-Dec-13, Sun,17:23	Clear	Sideswipe	P.D. only	Dry	North	Changing lanes	Passenger van	Other motor vehicle	
					North	Going ahead	Passenger van	Other motor vehicle	
2016-Feb-28, Sun,19:57	Freezing Rain	Turning movement	P.D. only	Ice	West	Turning left	Pick-up truck	Other motor vehicle	
					East	Going ahead	Automobile, station wagon	Other motor vehicle	

2016-Sep-30, Fri,19:32	Clear	Turning movement	Non-fatal injury	Dry	South	Turning left	Automobile, station wagon	Other motor vehicle	
					North	Going ahead	Pick-up truck	Other motor vehicle	
2016-Nov-24, Thu,06:47	Snow	Turning movement	Non-fatal injury	Ice	South	Turning left	Pick-up truck	Other motor vehicle	
					North	Going ahead	Automobile, station wagon	Other motor vehicle	
2016-Dec-05, Mon,08:23	Snow	Sideswipe	P.D. only	Loose snow	West	Changing lanes	Pick-up truck	Other motor vehicle	
					West	Going ahead	Automobile, station wagon	Other motor vehicle	
2016-Dec-23, Fri,10:59	Clear	Turning movement	P.D. only	Wet	South	Turning left	Automobile, station wagon	Other motor vehicle	
					North	Going ahead	Pick-up truck	Other motor vehicle	
2017-Apr-19, Wed,14:14	Rain	Angle	Non-fatal injury	Wet	North	Going ahead	Automobile, station wagon	Other motor vehicle	
					West	Stopped	Pick-up truck	Other motor vehicle	
2017-Jun-22, Thu,10:59	Clear	Other	P.D. only	Dry	West	Reversing	Automobile, station wagon	Other motor vehicle	
					East	Stopped	Automobile, station wagon	Other motor vehicle	
2017-Nov-28, Tue,22:03	Rain	SMV other	Non-fatal injury	Wet	South	Turning left	Automobile, station wagon	Pedestrian	1

Appendix D

March Road Cross-Sections

M:\2012\112117\CAD\Design\Figures\Traffic\TMP\FINAL\112117 - March sections - 20160212.dwg, INTERIM (TMP), Apr 05, 2016 - 9:09am, tbrooks



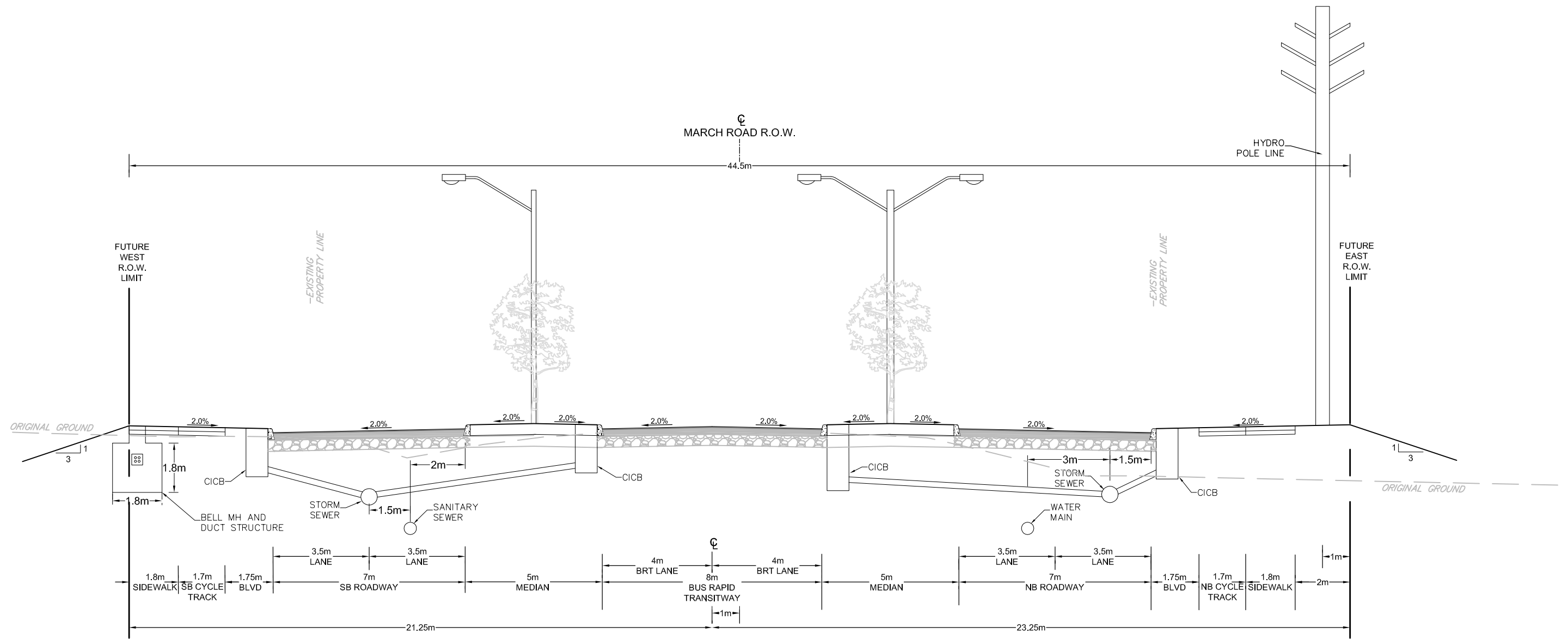
KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 24
MARCH ROAD - INTERIM
CROSS SECTION

DATE JUN 2016 JOB 112117
SCALE 1:150



M:\2012\112117\CAD\Design\Figures\Traffic\TMP\FINAL\112117 - March sections - 20160212.dwg, UTMATE (TMP), Apr 05, 2016 - 9:09am, tbrooks

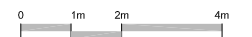


KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 25
MARCH ROAD - ULTIMATE
CROSS SECTION

DATE JUN 2016 JOB 112117

SCALE 1:150



Engineers, Planners & Landscape Architects

Appendix E

Traffic Signal Warrants

Future Collector @ March Road
 2022 Future Total

Justification #7

Justification	Description	Minimum Requirement		Minimum Requirement		Compliance		Entire %	Signal
		1 Lane Highway		2 or More Lanes		Sectional			
		Free Flow	Restr. Flow	Free Flow	Restr. Flow	Numerical	%		
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	480	720	600	900	891	186%	154%	Yes
	B. Vehicle volume, along minor streets (average hour)	120	170	120	170	185	154%		
2. Delay to Cross Traffic	A. Vehicle volumes, major street (average hour)	480	420	600	900	706	147%	147%	No
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	75	120	170	117	235%		

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 $(AM + PM) / 4$

Future Collector @ March Road
2027 Future Total

Justification #7

Justification	Description	Minimum Requirement		Minimum Requirement		Compliance		Entire %	Signal
		1 Lane Highway		2 or More Lanes		Sectional			
		Free Flow	Restr. Flow	Free Flow	Restr. Flow	Numerical	%		
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	480	720	600	900	1304	217%	190%	Yes
	B. Vehicle volume, along minor streets (average hour)	120	170	120	170	228	190%		
2. Delay to Cross Traffic	A. Vehicle volumes, major street (average hour)	480	420	600	900	1076	179%	179%	Yes
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	75	120	170	165	329%		

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 $(AM + PM) / 4$

Appendix F

2018 Existing Synchro

Lanes, Volumes, Timings
2: March Road & Halton Terrace/Maxwell Bridge Road

2018 Existing
AM Peak Hour



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	38	108	168	16	9	37	216	69	91	679	7
Future Volume (vph)	10	38	108	168	16	9	37	216	69	91	679	7
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	30.0		0.0	30.0		0.0	60.0		0.0	60.0		15.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	60.0			60.0			70.0			70.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Fr _t		0.889			0.946				0.850			0.850
Fl _t Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1676	1569	0	1676	1669	0	1676	3353	1500	1676	3353	1500
Fl _t Permitted	0.739			0.584			0.338			0.579		
Satd. Flow (perm)	1304	1569	0	1031	1669	0	596	3353	1500	1022	3353	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		120			10				91			91
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		202.9			283.1			221.3			1399.3	
Travel Time (s)		14.6			20.4			15.9			100.7	
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
Adj. Flow (vph)	11	42	120	187	18	10	41	240	77	101	754	8
Shared Lane Traffic (%)												
Lane Group Flow (vph)	11	162	0	187	28	0	41	240	77	101	754	8
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2		2	6		6

Lanes, Volumes, Timings
 2: March Road & Halton Terrace/Maxwell Bridge Road

2018 Existing
 AM Peak Hour



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4		8	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	38.6	38.6		38.6	38.6		11.4	34.6	34.6	11.4	34.6	34.6
Total Split (s)	48.0	48.0		48.0	48.0		20.0	52.0	52.0	20.0	52.0	52.0
Total Split (%)	40.0%	40.0%		40.0%	40.0%		16.7%	43.3%	43.3%	16.7%	43.3%	43.3%
Maximum Green (s)	41.4	41.4		41.4	41.4		13.6	45.4	45.4	13.6	45.4	45.4
Yellow Time (s)	3.3	3.3		3.3	3.3		4.6	4.6	4.6	4.6	4.6	4.6
All-Red Time (s)	3.3	3.3		3.3	3.3		1.8	2.0	2.0	1.8	2.0	2.0
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)	6.6	6.6		6.6	6.6		6.4	6.6	6.6	6.4	6.6	6.6
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max	C-Max	None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0	7.0		7.0	7.0
Flash Dont Walk (s)	25.0	25.0		25.0	25.0			21.0	21.0		21.0	21.0
Pedestrian Calls (#/hr)	0	0		0	0			0	0		0	0
Act Effct Green (s)	25.5	25.5		25.5	25.5		73.5	66.7	66.7	77.8	70.7	70.7
Actuated g/C Ratio	0.21	0.21		0.21	0.21		0.61	0.56	0.56	0.65	0.59	0.59
v/c Ratio	0.04	0.38		0.85	0.08		0.10	0.13	0.09	0.14	0.38	0.01
Control Delay	33.2	13.5		76.6	24.7		9.1	14.7	3.0	8.6	15.8	0.0
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.2	13.5		76.6	24.7		9.1	14.7	3.0	8.6	15.8	0.0
LOS	C	B		E	C		A	B	A	A	B	A
Approach Delay		14.8			69.9			11.6			14.8	
Approach LOS		B			E			B			B	
Queue Length 50th (m)	2.2	8.5		44.9	3.6		3.1	14.2	0.0	7.8	51.8	0.0
Queue Length 95th (m)	6.6	24.8		66.6	10.5		8.9	26.8	6.8	18.3	82.6	0.0
Internal Link Dist (m)		178.9			259.1			197.3			1375.3	
Turn Bay Length (m)	30.0			30.0			60.0			60.0		15.0
Base Capacity (vph)	449	619		355	582		520	1863	873	766	1974	920
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	0.02	0.26		0.53	0.05		0.08	0.13	0.09	0.13	0.38	0.01

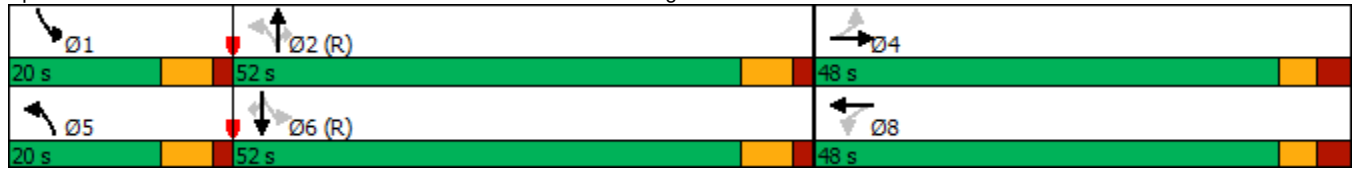
Intersection Summary

Area Type:	Other
Cycle Length:	120
Actuated Cycle Length:	120
Offset:	99 (83%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle:	85
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.85
Intersection Signal Delay:	21.5
Intersection LOS:	C
Intersection Capacity Utilization:	64.8%
ICU Level of Service:	C
Analysis Period (min):	15

Lanes, Volumes, Timings
 2: March Road & Halton Terrace/Maxwell Bridge Road























2018 Existing
 AM Peak Hour

Splits and Phases: 2: March Road & Halton Terrace/Maxwell Bridge Road



HCM 2010 Signalized Intersection Summary
 2: March Road & Halton Terrace/Maxwell Bridge Road

2018 Existing
 AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	38	108	168	16	9	37	216	69	91	679	7
Future Volume (veh/h)	10	38	108	168	16	9	37	216	69	91	679	7
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1765	1765	1765	1765	1765	1765
Adj Flow Rate, veh/h	11	42	120	187	18	10	41	240	77	101	754	8
Adj No. of Lanes	1	1	0	1	1	0	1	2	1	1	2	1
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	399	105	299	271	276	153	403	1791	801	661	1833	820
Arrive On Green	0.26	0.26	0.26	0.26	0.26	0.26	0.03	0.53	0.53	0.04	0.55	0.55
Sat Flow, veh/h	1377	405	1156	1219	1067	593	1681	3353	1500	1681	3353	1500
Grp Volume(v), veh/h	11	0	162	187	0	28	41	240	77	101	754	8
Grp Sat Flow(s),veh/h/ln	1377	0	1561	1219	0	1660	1681	1676	1500	1681	1676	1500
Q Serve(g_s), s	0.7	0.0	10.3	18.0	0.0	1.5	1.3	4.3	3.0	3.2	15.8	0.3
Cycle Q Clear(g_c), s	2.3	0.0	10.3	28.3	0.0	1.5	1.3	4.3	3.0	3.2	15.8	0.3
Prop In Lane	1.00		0.74	1.00		0.36	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	399	0	404	271	0	430	403	1791	801	661	1833	820
V/C Ratio(X)	0.03	0.00	0.40	0.69	0.00	0.07	0.10	0.13	0.10	0.15	0.41	0.01
Avail Cap(c_a), veh/h	517	0	538	376	0	573	542	1791	801	778	1833	820
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(l)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	34.4	0.0	36.8	48.5	0.0	33.5	12.5	14.0	13.7	11.5	15.9	12.4
Incr Delay (d2), s/veh	0.0	0.0	0.6	3.1	0.0	0.1	0.1	0.2	0.2	0.1	0.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	4.5	6.3	0.0	0.7	0.6	2.0	1.3	1.5	7.4	0.1
LnGrp Delay(d),s/veh	34.4	0.0	37.4	51.6	0.0	33.6	12.6	14.2	14.0	11.6	16.6	12.4
LnGrp LOS	C		D	D		C	B	B	B	B	B	B
Approach Vol, veh/h		173			215			358			863	
Approach Delay, s/veh		37.2			49.3			14.0			16.0	
Approach LOS		D			D			B			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	11.6	70.7		37.7	10.1	72.2		37.7				
Change Period (Y+Rc), s	* 6.4	6.6		6.6	* 6.4	6.6		6.6				
Max Green Setting (Gmax), s	* 14	45.4		41.4	* 14	45.4		41.4				
Max Q Clear Time (g_c+I1), s	5.2	6.3		12.3	3.3	17.8		30.3				
Green Ext Time (p_c), s	0.2	2.4		1.2	0.1	6.9		0.8				
Intersection Summary												
HCM 2010 Ctrl Delay	22.2											
HCM 2010 LOS	C											
Notes												

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Lanes, Volumes, Timings
 2: March Road & Halton Terrace/Maxwell Bridge Road

2018 Existing
 PM Peak Hour



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	13	63	43	92	58	104	184	863	149	68	288	13
Future Volume (vph)	13	63	43	92	58	104	184	863	149	68	288	13
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	30.0		0.0	30.0		0.0	60.0		0.0	60.0		15.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	60.0			60.0			70.0			70.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Fr _t		0.939			0.903				0.850			0.850
Fl _t Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1676	1657	0	1676	1594	0	1676	3353	1500	1676	3353	1500
Fl _t Permitted	0.443			0.651			0.530			0.277		
Satd. Flow (perm)	782	1657	0	1149	1594	0	935	3353	1500	489	3353	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		30			80				166			91
Link Speed (k/h)		50			50			50				50
Link Distance (m)		202.9			283.1			221.3				1399.3
Travel Time (s)		14.6			20.4			15.9				100.7
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
Adj. Flow (vph)	14	70	48	102	64	116	204	959	166	76	320	14
Shared Lane Traffic (%)												
Lane Group Flow (vph)	14	118	0	102	180	0	204	959	166	76	320	14
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6				3.6
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4				9.4
Detector 2 Size(m)		0.6			0.6			0.6				0.6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1		6
Permitted Phases	4			8			2		2	6		6

Lanes, Volumes, Timings
 2: March Road & Halton Terrace/Maxwell Bridge Road

2018 Existing
 PM Peak Hour



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4		8	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	38.6	38.6		38.6	38.6		11.4	34.6	34.6	11.4	34.6	34.6
Total Split (s)	45.0	45.0		45.0	45.0		20.0	55.0	55.0	20.0	55.0	55.0
Total Split (%)	37.5%	37.5%		37.5%	37.5%		16.7%	45.8%	45.8%	16.7%	45.8%	45.8%
Maximum Green (s)	38.4	38.4		38.4	38.4		13.6	48.4	48.4	13.6	48.4	48.4
Yellow Time (s)	3.3	3.3		3.3	3.3		4.6	4.6	4.6	4.6	4.6	4.6
All-Red Time (s)	3.3	3.3		3.3	3.3		1.8	2.0	2.0	1.8	2.0	2.0
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)	6.6	6.6		6.6	6.6		6.4	6.6	6.6	6.4	6.6	6.6
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max	C-Max	None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0	7.0		7.0	7.0
Flash Dont Walk (s)	25.0	25.0		25.0	25.0			21.0	21.0		21.0	21.0
Pedestrian Calls (#/hr)	0	0		0	0			0	0		0	0
Act Effct Green (s)	15.9	15.9		15.9	15.9		88.5	79.9	79.9	81.9	74.7	74.7
Actuated g/C Ratio	0.13	0.13		0.13	0.13		0.74	0.67	0.67	0.68	0.62	0.62
v/c Ratio	0.14	0.48		0.67	0.64		0.27	0.43	0.16	0.19	0.15	0.01
Control Delay	46.1	41.1		69.7	36.9		5.5	11.5	2.0	6.0	10.7	0.0
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.1	41.1		69.7	36.9		5.5	11.5	2.0	6.0	10.7	0.0
LOS	D	D		E	D		A	B	A	A	B	A
Approach Delay		41.6			48.8			9.4			9.5	
Approach LOS		D			D			A			A	
Queue Length 50th (m)	3.1	20.3		24.5	23.5		11.7	56.5	0.0	4.0	16.0	0.0
Queue Length 95th (m)	9.2	37.2		41.6	45.4		24.2	87.8	9.4	10.1	28.9	0.0
Internal Link Dist (m)		178.9			259.1			197.3			1375.3	
Turn Bay Length (m)	30.0			30.0			60.0			60.0		15.0
Base Capacity (vph)	250	550		367	564		791	2232	1054	495	2087	968
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	0.21		0.28	0.32		0.26	0.43	0.16	0.15	0.15	0.01

Intersection Summary

Area Type:	Other
Cycle Length:	120
Actuated Cycle Length:	120
Offset:	50 (42%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle:	85
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.67
Intersection Signal Delay:	16.5
Intersection LOS:	B
Intersection Capacity Utilization:	57.7%
ICU Level of Service:	B
Analysis Period (min):	15

Lanes, Volumes, Timings
 2: March Road & Halton Terrace/Maxwell Bridge Road























2018 Existing
 PM Peak Hour

Splits and Phases: 2: March Road & Halton Terrace/Maxwell Bridge Road



HCM 2010 Signalized Intersection Summary
 2: March Road & Halton Terrace/Maxwell Bridge Road

2018 Existing
 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	13	63	43	92	58	104	184	863	149	68	288	13
Future Volume (veh/h)	13	63	43	92	58	104	184	863	149	68	288	13
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1765	1765	1765	1765	1765	1765
Adj Flow Rate, veh/h	14	70	48	102	64	116	204	959	166	76	320	14
Adj No. of Lanes	1	1	0	1	1	0	1	2	1	1	2	1
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	139	168	115	198	97	176	750	2099	939	362	2005	897
Arrive On Green	0.17	0.17	0.17	0.17	0.17	0.17	0.07	0.63	0.63	0.04	0.60	0.60
Sat Flow, veh/h	1199	977	670	1269	563	1021	1681	3353	1500	1681	3353	1500
Grp Volume(v), veh/h	14	0	118	102	0	180	204	959	166	76	320	14
Grp Sat Flow(s),veh/h/ln	1199	0	1647	1269	0	1585	1681	1676	1500	1681	1676	1500
Q Serve(g_s), s	1.3	0.0	7.7	9.4	0.0	12.7	5.6	18.0	5.6	2.1	5.1	0.5
Cycle Q Clear(g_c), s	14.1	0.0	7.7	17.0	0.0	12.7	5.6	18.0	5.6	2.1	5.1	0.5
Prop In Lane	1.00		0.41	1.00		0.64	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	139	0	284	198	0	273	750	2099	939	362	2005	897
V/C Ratio(X)	0.10	0.00	0.42	0.52	0.00	0.66	0.27	0.46	0.18	0.21	0.16	0.02
Avail Cap(c_a), veh/h	317	0	527	385	0	507	829	2099	939	488	2005	897
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	52.9	0.0	44.3	51.9	0.0	46.4	7.8	11.8	9.4	9.4	10.7	9.8
Incr Delay (d2), s/veh	0.3	0.0	1.0	2.1	0.0	2.7	0.2	0.7	0.4	0.3	0.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	0.0	3.6	3.4	0.0	5.8	2.6	8.5	2.4	1.0	2.4	0.2
LnGrp Delay(d),s/veh	53.2	0.0	45.2	53.9	0.0	49.1	8.0	12.5	9.9	9.6	10.9	9.8
LnGrp LOS	D		D	D		D	A	B	A	A	B	A
Approach Vol, veh/h		132			282			1329			410	
Approach Delay, s/veh		46.1			50.8			11.5			10.6	
Approach LOS		D			D			B			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	11.0	81.7		27.3	14.4	78.4		27.3				
Change Period (Y+Rc), s	* 6.4	6.6		6.6	* 6.4	6.6		6.6				
Max Green Setting (Gmax), s	* 14	48.4		38.4	* 14	48.4		38.4				
Max Q Clear Time (g_c+I1), s	4.1	20.0		16.1	7.6	7.1		19.0				
Green Ext Time (p_c), s	0.1	10.5		0.8	0.4	2.8		1.7				
Intersection Summary												
HCM 2010 Ctrl Delay			18.6									
HCM 2010 LOS			B									
Notes												

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Appendix G

2023 Future Background Synchro

Lanes, Volumes, Timings
2: March Road & Halton Terrace/Maxwell Bridge Road

2023 Future Background

936 March Road



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	39	110	171	16	9	38	221	70	93	692	7
Future Volume (vph)	10	39	110	171	16	9	38	221	70	93	692	7
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	30.0		0.0	30.0		0.0	60.0		0.0	60.0		15.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	60.0			60.0			70.0			70.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Fr _t		0.889			0.946				0.850			0.850
Fl _t Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1676	1569	0	1676	1669	0	1676	3353	1500	1676	3353	1500
Fl _t Permitted	0.739			0.580			0.331			0.575		
Satd. Flow (perm)	1304	1569	0	1024	1669	0	584	3353	1500	1015	3353	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		122			10				91			91
Link Speed (k/h)		50			50			50				50
Link Distance (m)		202.9			283.1			221.3			1399.3	
Travel Time (s)		14.6			20.4			15.9			100.7	
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
Adj. Flow (vph)	11	43	122	190	18	10	42	246	78	103	769	8
Shared Lane Traffic (%)												
Lane Group Flow (vph)	11	165	0	190	28	0	42	246	78	103	769	8
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2		2	6		6

Lanes, Volumes, Timings
2: March Road & Halton Terrace/Maxwell Bridge Road

2023 Future Background

936 March Road

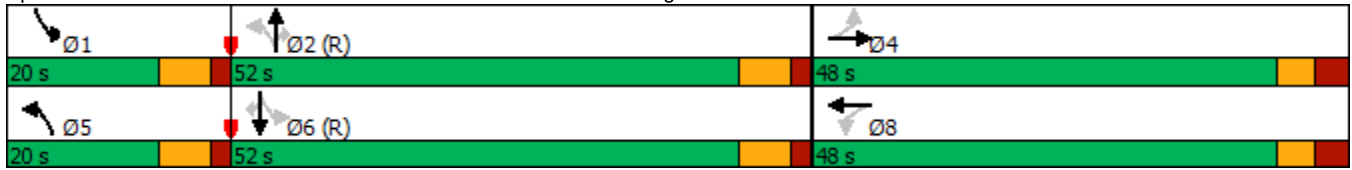


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4		8	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	38.6	38.6		38.6	38.6		11.4	34.6	34.6	11.4	34.6	34.6
Total Split (s)	48.0	48.0		48.0	48.0		20.0	52.0	52.0	20.0	52.0	52.0
Total Split (%)	40.0%	40.0%		40.0%	40.0%		16.7%	43.3%	43.3%	16.7%	43.3%	43.3%
Maximum Green (s)	41.4	41.4		41.4	41.4		13.6	45.4	45.4	13.6	45.4	45.4
Yellow Time (s)	3.3	3.3		3.3	3.3		4.6	4.6	4.6	4.6	4.6	4.6
All-Red Time (s)	3.3	3.3		3.3	3.3		1.8	2.0	2.0	1.8	2.0	2.0
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)	6.6	6.6		6.6	6.6		6.4	6.6	6.6	6.4	6.6	6.6
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max	C-Max	None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0	7.0		7.0	7.0
Flash Dont Walk (s)	25.0	25.0		25.0	25.0			21.0	21.0		21.0	21.0
Pedestrian Calls (#/hr)	0	0		0	0			0	0		0	0
Act Effct Green (s)	26.0	26.0		26.0	26.0		73.0	66.1	66.1	77.5	70.2	70.2
Actuated g/C Ratio	0.22	0.22		0.22	0.22		0.61	0.55	0.55	0.65	0.58	0.58
v/c Ratio	0.04	0.38		0.86	0.08		0.10	0.13	0.09	0.15	0.39	0.01
Control Delay	32.8	13.4		76.7	24.4		9.4	15.1	3.1	8.8	16.3	0.0
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.8	13.4		76.7	24.4		9.4	15.1	3.1	8.8	16.3	0.0
LOS	C	B		E	C		A	B	A	A	B	A
Approach Delay		14.6			70.0			11.9			15.3	
Approach LOS		B			E			B			B	
Queue Length 50th (m)	2.2	8.6		45.6	3.6		3.2	14.7	0.0	8.1	53.9	0.0
Queue Length 95th (m)	6.6	25.1		67.5	10.4		9.2	27.7	7.2	18.8	85.8	0.0
Internal Link Dist (m)		178.9			259.1			197.3			1375.3	
Turn Bay Length (m)	30.0			30.0			60.0			60.0		15.0
Base Capacity (vph)	449	621		353	582		511	1847	867	758	1960	914
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	0.02	0.27		0.54	0.05		0.08	0.13	0.09	0.14	0.39	0.01

Intersection Summary

Area Type:	Other
Cycle Length:	120
Actuated Cycle Length:	120
Offset:	99 (83%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle:	85
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.86
Intersection Signal Delay:	21.7
Intersection LOS:	C
Intersection Capacity Utilization:	65.5%
ICU Level of Service:	C
Analysis Period (min):	15























Splits and Phases: 2: March Road & Halton Terrace/Maxwell Bridge Road



HCM 2010 Signalized Intersection Summary
 2: March Road & Halton Terrace/Maxwell Bridge Road

2023 Future Background

936 March Road

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	39	110	171	16	9	38	221	70	93	692	7
Future Volume (veh/h)	10	39	110	171	16	9	38	221	70	93	692	7
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1765	1765	1765	1765	1765	1765
Adj Flow Rate, veh/h	11	43	122	190	18	10	42	246	78	103	769	8
Adj No. of Lanes	1	1	0	1	1	0	1	2	1	1	2	1
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	404	107	303	274	281	156	394	1774	794	652	1819	814
Arrive On Green	0.26	0.26	0.26	0.26	0.26	0.26	0.03	0.53	0.53	0.04	0.54	0.54
Sat Flow, veh/h	1377	407	1154	1216	1067	593	1681	3353	1500	1681	3353	1500
Grp Volume(v), veh/h	11	0	165	190	0	28	42	246	78	103	769	8
Grp Sat Flow(s),veh/h/ln	1377	0	1561	1216	0	1660	1681	1676	1500	1681	1676	1500
Q Serve(g_s), s	0.7	0.0	10.5	18.3	0.0	1.5	1.4	4.5	3.1	3.3	16.3	0.3
Cycle Q Clear(g_c), s	2.2	0.0	10.5	28.8	0.0	1.5	1.4	4.5	3.1	3.3	16.3	0.3
Prop In Lane	1.00		0.74	1.00		0.36	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	404	0	410	274	0	436	394	1774	794	652	1819	814
V/C Ratio(X)	0.03	0.00	0.40	0.69	0.00	0.06	0.11	0.14	0.10	0.16	0.42	0.01
Avail Cap(c_a), veh/h	517	0	539	374	0	573	531	1774	794	768	1819	814
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(l)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	34.0	0.0	36.5	48.3	0.0	33.2	12.8	14.4	14.0	11.7	16.3	12.6
Incr Delay (d2), s/veh	0.0	0.0	0.6	3.4	0.0	0.1	0.1	0.2	0.2	0.1	0.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	4.6	6.4	0.0	0.7	0.6	2.1	1.3	1.5	7.8	0.1
LnGrp Delay(d),s/veh	34.0	0.0	37.1	51.7	0.0	33.2	13.0	14.5	14.3	11.8	17.0	12.7
LnGrp LOS	C		D	D		C	B	B	B	B	B	B
Approach Vol, veh/h		176			218			366			880	
Approach Delay, s/veh		36.9			49.3			14.3			16.4	
Approach LOS		D			D			B			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	11.8	70.1		38.1	10.2	71.7		38.1				
Change Period (Y+Rc), s	* 6.4	6.6		6.6	* 6.4	6.6		6.6				
Max Green Setting (Gmax), s	* 14	45.4		41.4	* 14	45.4		41.4				
Max Q Clear Time (g_c+I1), s	5.3	6.5		12.5	3.4	18.3		30.8				
Green Ext Time (p_c), s	0.2	2.5		1.3	0.1	7.1		0.8				
Intersection Summary												
HCM 2010 Ctrl Delay			22.5									
HCM 2010 LOS			C									
Notes												

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Lanes, Volumes, Timings
2: March Road & Halton Terrace/Maxwell Bridge Road

2023 Future Background

936 March Road



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	13	64	44	94	59	106	188	880	152	69	294	13
Future Volume (vph)	13	64	44	94	59	106	188	880	152	69	294	13
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	30.0		0.0	30.0		0.0	60.0		0.0	60.0		15.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	60.0			60.0			70.0			70.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Fr _t		0.939			0.904				0.850			0.850
Fl _t Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1676	1657	0	1676	1595	0	1676	3353	1500	1676	3353	1500
Fl _t Permitted	0.433			0.645			0.526			0.269		
Satd. Flow (perm)	764	1657	0	1138	1595	0	928	3353	1500	475	3353	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		30			79				169			91
Link Speed (k/h)		50			50			50				50
Link Distance (m)		202.9			283.1			221.3				1399.3
Travel Time (s)		14.6			20.4			15.9				100.7
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
Adj. Flow (vph)	14	71	49	104	66	118	209	978	169	77	327	14
Shared Lane Traffic (%)												
Lane Group Flow (vph)	14	120	0	104	184	0	209	978	169	77	327	14
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6				3.6
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4				9.4
Detector 2 Size(m)		0.6			0.6			0.6				0.6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1		6
Permitted Phases	4			8			2		2	6		6

Lanes, Volumes, Timings
2: March Road & Halton Terrace/Maxwell Bridge Road

2023 Future Background

936 March Road



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4		8	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	38.6	38.6		38.6	38.6		11.4	34.6	34.6	11.4	34.6	34.6
Total Split (s)	45.0	45.0		45.0	45.0		20.0	55.0	55.0	20.0	55.0	55.0
Total Split (%)	37.5%	37.5%		37.5%	37.5%		16.7%	45.8%	45.8%	16.7%	45.8%	45.8%
Maximum Green (s)	38.4	38.4		38.4	38.4		13.6	48.4	48.4	13.6	48.4	48.4
Yellow Time (s)	3.3	3.3		3.3	3.3		4.6	4.6	4.6	4.6	4.6	4.6
All-Red Time (s)	3.3	3.3		3.3	3.3		1.8	2.0	2.0	1.8	2.0	2.0
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)	6.6	6.6		6.6	6.6		6.4	6.6	6.6	6.4	6.6	6.6
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max	C-Max	None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0	7.0		7.0	7.0
Flash Dont Walk (s)	25.0	25.0		25.0	25.0			21.0	21.0		21.0	21.0
Pedestrian Calls (#/hr)	0	0		0	0			0	0		0	0
Act Effct Green (s)	16.1	16.1		16.1	16.1		88.4	79.7	79.7	81.6	74.4	74.4
Actuated g/C Ratio	0.13	0.13		0.13	0.13		0.74	0.66	0.66	0.68	0.62	0.62
v/c Ratio	0.14	0.48		0.68	0.65		0.28	0.44	0.16	0.20	0.16	0.01
Control Delay	46.0	41.2		70.7	38.1		5.7	11.7	2.0	6.2	10.9	0.0
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.0	41.2		70.7	38.1		5.7	11.7	2.0	6.2	10.9	0.0
LOS	D	D		E	D		A	B	A	A	B	A
Approach Delay		41.7			49.8			9.6			9.7	
Approach LOS		D			D			A			A	
Queue Length 50th (m)	3.1	20.8		25.0	24.7		12.1	58.5	0.0	4.1	16.5	0.0
Queue Length 95th (m)	9.2	37.8		42.1	46.6		25.0	91.0	9.4	10.2	29.9	0.0
Internal Link Dist (m)		178.9			259.1			197.3			1375.3	
Turn Bay Length (m)	30.0			30.0			60.0			60.0		15.0
Base Capacity (vph)	244	550		364	564		785	2227	1053	485	2078	964
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	0.22		0.29	0.33		0.27	0.44	0.16	0.16	0.16	0.01

Intersection Summary























Area Type:	Other
Cycle Length:	120
Actuated Cycle Length:	120
Offset:	50 (42%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle:	85
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.68
Intersection Signal Delay:	16.8
Intersection LOS:	B
Intersection Capacity Utilization:	58.3%
ICU Level of Service:	B
Analysis Period (min):	15

Splits and Phases: 2: March Road & Halton Terrace/Maxwell Bridge Road



HCM 2010 Signalized Intersection Summary
 2: March Road & Halton Terrace/Maxwell Bridge Road

2023 Future Background
 936 March Road

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	13	64	44	94	59	106	188	880	152	69	294	13
Future Volume (veh/h)	13	64	44	94	59	106	188	880	152	69	294	13
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1765	1765	1765	1765	1765	1765
Adj Flow Rate, veh/h	14	71	49	104	66	118	209	978	169	77	327	14
Adj No. of Lanes	1	1	0	1	1	0	1	2	1	1	2	1
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	140	171	118	200	100	178	743	2089	934	353	1990	890
Arrive On Green	0.18	0.18	0.18	0.18	0.18	0.18	0.07	0.62	0.62	0.04	0.59	0.59
Sat Flow, veh/h	1195	974	672	1266	569	1017	1681	3353	1500	1681	3353	1500
Grp Volume(v), veh/h	14	0	120	104	0	184	209	978	169	77	327	14
Grp Sat Flow(s),veh/h/ln	1195	0	1646	1266	0	1585	1681	1676	1500	1681	1676	1500
Q Serve(g_s), s	1.3	0.0	7.8	9.6	0.0	13.0	5.8	18.6	5.7	2.1	5.3	0.5
Cycle Q Clear(g_c), s	14.3	0.0	7.8	17.3	0.0	13.0	5.8	18.6	5.7	2.1	5.3	0.5
Prop In Lane	1.00		0.41	1.00		0.64	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	140	0	288	200	0	278	743	2089	934	353	1990	890
V/C Ratio(X)	0.10	0.00	0.42	0.52	0.00	0.66	0.28	0.47	0.18	0.22	0.16	0.02
Avail Cap(c_a), veh/h	313	0	527	383	0	507	819	2089	934	479	1990	890
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(l)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	52.9	0.0	44.0	51.7	0.0	46.2	8.0	12.0	9.6	9.6	11.0	10.0
Incr Delay (d2), s/veh	0.3	0.0	1.0	2.1	0.0	2.7	0.2	0.8	0.4	0.3	0.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	0.0	3.6	3.5	0.0	5.9	2.7	8.8	2.5	1.0	2.5	0.2
LnGrp Delay(d),s/veh	53.2	0.0	45.0	53.8	0.0	48.9	8.2	12.8	10.0	10.0	11.2	10.0
LnGrp LOS	D		D	D		D	A	B	B	A	B	B
Approach Vol, veh/h		134			288			1356			418	
Approach Delay, s/veh		45.8			50.7			11.7			10.9	
Approach LOS		D			D			B			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	11.0	81.4		27.6	14.6	77.8		27.6				
Change Period (Y+Rc), s	* 6.4	6.6		6.6	* 6.4	6.6		6.6				
Max Green Setting (Gmax), s	* 14	48.4		38.4	* 14	48.4		38.4				
Max Q Clear Time (g_c+I1), s	4.1	20.6		16.3	7.8	7.3		19.3				
Green Ext Time (p_c), s	0.1	10.6		0.8	0.4	2.9		1.7				
Intersection Summary												
HCM 2010 Ctrl Delay			18.8									
HCM 2010 LOS			B									
Notes												

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Appendix H

2028 Future Background Synchro

Lanes, Volumes, Timings
1: March Road & West Access



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	11	38	7	464	1311	3
Future Volume (vph)	11	38	7	464	1311	3
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Util. Factor	1.00	1.00	0.95	0.95	0.95	0.95
Frt	0.895					
Flt Protected	0.989			0.999		
Satd. Flow (prot)	1562	0	0	3350	3353	0
Flt Permitted	0.989			0.999		
Satd. Flow (perm)	1562	0	0	3350	3353	0
Link Speed (k/h)	50			50	50	
Link Distance (m)	280.3			684.3	305.5	
Travel Time (s)	20.2			49.3	22.0	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	12	42	8	516	1457	3
Shared Lane Traffic (%)						
Lane Group Flow (vph)	54	0	0	524	1460	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.6			3.6	3.6	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (k/h)	25	15	25			15
Sign Control	Stop			Free	Free	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	48.4%
ICU Level of Service	A
Analysis Period (min)	15

Intersection						
Int Delay, s/veh	0.9					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	T			T		
Traffic Vol, veh/h	11	38	7	464	1311	3
Future Vol, veh/h	11	38	7	464	1311	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	12	42	8	516	1457	3

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	1733	730	1460	0	-	0
Stage 1	1459	-	-	-	-	-
Stage 2	274	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.14	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.22	-	-	-
Pot Cap-1 Maneuver	79	365	459	-	-	-
Stage 1	180	-	-	-	-	-
Stage 2	747	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	77	365	459	-	-	-
Mov Cap-2 Maneuver	77	-	-	-	-	-
Stage 1	176	-	-	-	-	-
Stage 2	747	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	29.9	0.4	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	459	-	198	-	-
HCM Lane V/C Ratio	0.017	-	0.275	-	-
HCM Control Delay (s)	13	0.2	29.9	-	-
HCM Lane LOS	B	A	D	-	-
HCM 95th %tile Q(veh)	0.1	-	1.1	-	-

Lanes, Volumes, Timings
2: March Road & Halton Terrace/Maxwell Bridge Road

2028 Future Background

936 March Road



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	91	40	175	175	17	35	115	444	72	102	1187	61
Future Volume (vph)	91	40	175	175	17	35	115	444	72	102	1187	61
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	30.0		0.0	30.0		0.0	60.0		0.0	60.0		15.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	60.0			60.0			70.0			70.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		0.878			0.899				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1676	1549	0	1676	1586	0	1676	3353	1500	1676	3353	1500
Flt Permitted	0.719			0.467			0.101			0.453		
Satd. Flow (perm)	1269	1549	0	824	1586	0	178	3353	1500	799	3353	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		194			39				91			91
Link Speed (k/h)		50			50			50				50
Link Distance (m)		202.9			283.1			221.3				684.3
Travel Time (s)		14.6			20.4			15.9				49.3
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
Adj. Flow (vph)	101	44	194	194	19	39	128	493	80	113	1319	68
Shared Lane Traffic (%)												
Lane Group Flow (vph)	101	238	0	194	58	0	128	493	80	113	1319	68
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6				3.6
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4				9.4
Detector 2 Size(m)		0.6			0.6			0.6				0.6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1		6
Permitted Phases	4			8			2		2	6		6

Lanes, Volumes, Timings
2: March Road & Halton Terrace/Maxwell Bridge Road

2028 Future Background

936 March Road



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4		8	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	38.6	38.6		38.6	38.6		11.4	34.6	34.6	11.4	34.6	34.6
Total Split (s)	48.0	48.0		48.0	48.0		20.0	52.0	52.0	20.0	52.0	52.0
Total Split (%)	40.0%	40.0%		40.0%	40.0%		16.7%	43.3%	43.3%	16.7%	43.3%	43.3%
Maximum Green (s)	41.4	41.4		41.4	41.4		13.6	45.4	45.4	13.6	45.4	45.4
Yellow Time (s)	3.3	3.3		3.3	3.3		4.6	4.6	4.6	4.6	4.6	4.6
All-Red Time (s)	3.3	3.3		3.3	3.3		1.8	2.0	2.0	1.8	2.0	2.0
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)	6.6	6.6		6.6	6.6		6.4	6.6	6.6	6.4	6.6	6.6
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max	C-Max	None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0	7.0		7.0	7.0
Flash Dont Walk (s)	25.0	25.0		25.0	25.0			21.0	21.0		21.0	21.0
Pedestrian Calls (#/hr)	0	0		0	0			0	0		0	0
Act Effct Green (s)	30.1	30.1		30.1	30.1		71.3	61.4	61.4	69.8	60.7	60.7
Actuated g/C Ratio	0.25	0.25		0.25	0.25		0.59	0.51	0.51	0.58	0.51	0.51
v/c Ratio	0.32	0.45		0.94	0.14		0.57	0.29	0.10	0.21	0.78	0.08
Control Delay	36.8	10.0		91.8	13.9		23.7	19.3	3.9	11.4	30.5	2.7
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.8	10.0		91.8	13.9		23.7	19.3	3.9	11.4	30.5	2.7
LOS	D	B		F	B		C	B	A	B	C	A
Approach Delay		18.0			73.9			18.4			27.8	
Approach LOS		B			E			B			C	
Queue Length 50th (m)	20.4	8.4		47.1	3.6		11.5	35.6	0.0	10.1	135.2	0.0
Queue Length 95th (m)	32.4	26.7		#72.1	12.7		31.6	60.3	8.4	22.8	#229.8	5.8
Internal Link Dist (m)		178.9			259.1			197.3			660.3	
Turn Bay Length (m)	30.0			30.0			60.0			60.0		15.0
Base Capacity (vph)	437	661		284	572		281	1715	812	594	1694	803
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	0.23	0.36		0.68	0.10		0.46	0.29	0.10	0.19	0.78	0.08

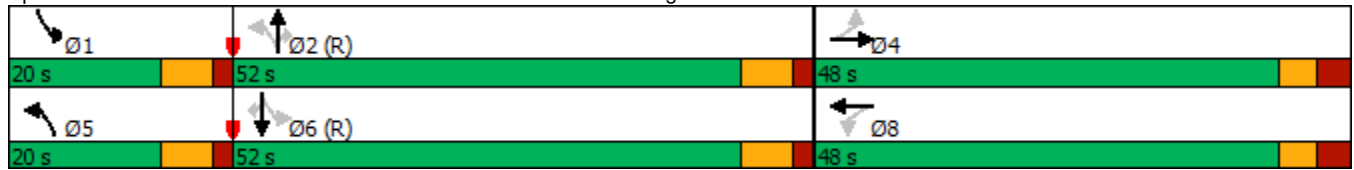
Intersection Summary

Area Type: Other
 Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 99 (83%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 85
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.94
 Intersection Signal Delay: 28.4 Intersection LOS: C
 Intersection Capacity Utilization 87.0% ICU Level of Service E
 Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.























Queue shown is maximum after two cycles.

Splits and Phases: 2: March Road & Halton Terrace/Maxwell Bridge Road



HCM 2010 Signalized Intersection Summary
 2: March Road & Halton Terrace/Maxwell Bridge Road

2028 Future Background
 936 March Road

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	91	40	175	175	17	35	115	444	72	102	1187	61
Future Volume (veh/h)	91	40	175	175	17	35	115	444	72	102	1187	61
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1765	1765	1765	1765	1765	1765
Adj Flow Rate, veh/h	101	44	194	194	19	39	128	493	80	113	1319	68
Adj No. of Lanes	1	1	0	1	1	0	1	2	1	1	2	1
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	445	89	394	274	162	332	203	1581	707	465	1564	700
Arrive On Green	0.31	0.31	0.31	0.31	0.31	0.31	0.06	0.47	0.47	0.05	0.47	0.47
Sat Flow, veh/h	1340	285	1258	1138	517	1061	1681	3353	1500	1681	3353	1500
Grp Volume(v), veh/h	101	0	238	194	0	58	128	493	80	113	1319	68
Grp Sat Flow(s),veh/h/ln	1340	0	1543	1138	0	1578	1681	1676	1500	1681	1676	1500
Q Serve(g_s), s	7.0	0.0	15.0	20.0	0.0	3.1	4.7	10.9	3.6	4.2	41.5	3.0
Cycle Q Clear(g_c), s	10.1	0.0	15.0	35.1	0.0	3.1	4.7	10.9	3.6	4.2	41.5	3.0
Prop In Lane	1.00		0.82	1.00		0.67	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	445	0	483	274	0	494	203	1581	707	465	1564	700
V/C Ratio(X)	0.23	0.00	0.49	0.71	0.00	0.12	0.63	0.31	0.11	0.24	0.84	0.10
Avail Cap(c_a), veh/h	487	0	532	310	0	544	297	1581	707	569	1564	700
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(l)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	33.0	0.0	33.5	47.7	0.0	29.4	25.2	19.6	17.7	15.4	28.2	17.9
Incr Delay (d2), s/veh	0.3	0.0	0.8	6.3	0.0	0.1	3.2	0.5	0.3	0.3	5.7	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.6	0.0	6.5	6.8	0.0	1.4	2.3	5.2	1.6	1.9	20.5	1.3
LnGrp Delay(d),s/veh	33.2	0.0	34.2	54.0	0.0	29.5	28.4	20.2	18.0	15.7	33.9	18.2
LnGrp LOS	C		C	D		C	C	C	B	B	C	B
Approach Vol, veh/h		339			252			701			1500	
Approach Delay, s/veh		33.9			48.4			21.4			31.8	
Approach LOS		C			D			C			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	12.6	63.2		44.2	13.2	62.6		44.2				
Change Period (Y+Rc), s	* 6.4	6.6		6.6	* 6.4	6.6		6.6				
Max Green Setting (Gmax), s	* 14	45.4		41.4	* 14	45.4		41.4				
Max Q Clear Time (g_c+I1), s	6.2	12.9		17.0	6.7	43.5		37.1				
Green Ext Time (p_c), s	0.2	4.8		2.3	0.2	1.5		0.5				
Intersection Summary												
HCM 2010 Ctrl Delay			31.0									
HCM 2010 LOS			C									
Notes												

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Lanes, Volumes, Timings
1: March Road & West Access

2028 Future Background

936 March Road



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	10	23	45	1417	631	9
Future Volume (vph)	10	23	45	1417	631	9
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Util. Factor	1.00	1.00	0.95	0.95	0.95	0.95
Fr _t	0.905			0.998		
Fl _t Protected	0.985			0.998		
Satd. Flow (prot)	1573	0	0	3346	3346	0
Fl _t Permitted	0.985			0.998		
Satd. Flow (perm)	1573	0	0	3346	3346	0
Link Speed (k/h)	50			50	50	
Link Distance (m)	256.5			684.3	375.4	
Travel Time (s)	18.5			49.3	27.0	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	11	26	50	1574	701	10
Shared Lane Traffic (%)						
Lane Group Flow (vph)	37	0	0	1624	711	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.6			3.6	3.6	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (k/h)	25	15	25			15
Sign Control	Stop			Free	Free	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	74.8%
ICU Level of Service	D
Analysis Period (min)	15

Intersection						
Int Delay, s/veh	2.1					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	T			T		
Traffic Vol, veh/h	10	23	45	1417	631	9
Future Vol, veh/h	10	23	45	1417	631	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	26	50	1574	701	10

Major/Minor	Minor2	Major1		Major2	
Conflicting Flow All	1593	356	711	0	0
Stage 1	706	-	-	-	-
Stage 2	887	-	-	-	-
Critical Hdwy	6.84	6.94	4.14	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.22	-	-
Pot Cap-1 Maneuver	98	640	884	-	-
Stage 1	450	-	-	-	-
Stage 2	363	-	-	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	54	640	884	-	-
Mov Cap-2 Maneuver	54	-	-	-	-
Stage 1	247	-	-	-	-
Stage 2	363	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	36.9	2.2	0
HCM LOS	E		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	884	-	149	-	-
HCM Lane V/C Ratio	0.057	-	0.246	-	-
HCM Control Delay (s)	9.3	2	36.9	-	-
HCM Lane LOS	A	A	E	-	-
HCM 95th %tile Q(veh)	0.2	-	0.9	-	-

Lanes, Volumes, Timings
2: March Road & Halton Terrace/Maxwell Bridge Road

2028 Future Background

936 March Road



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	79	67	76	96	60	141	270	1294	156	119	433	99
Future Volume (vph)	79	67	76	96	60	141	270	1294	156	119	433	99
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	30.0		0.0	30.0		0.0	60.0		0.0	60.0		15.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	60.0			60.0			70.0			70.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Fr _t		0.920			0.895				0.850			0.850
Fl _t Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1676	1624	0	1676	1579	0	1676	3353	1500	1676	3353	1500
Fl _t Permitted	0.328			0.530			0.456			0.117		
Satd. Flow (perm)	579	1624	0	935	1579	0	805	3353	1500	206	3353	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		50			103				126			91
Link Speed (k/h)		50			50			50				50
Link Distance (m)		202.9			283.1			221.3				684.3
Travel Time (s)		14.6			20.4			15.9				49.3
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
Adj. Flow (vph)	88	74	84	107	67	157	300	1438	173	132	481	110
Shared Lane Traffic (%)												
Lane Group Flow (vph)	88	158	0	107	224	0	300	1438	173	132	481	110
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6				3.6
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4				9.4
Detector 2 Size(m)		0.6			0.6			0.6				0.6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1		6
Permitted Phases	4			8			2		2	6		6

Lanes, Volumes, Timings
2: March Road & Halton Terrace/Maxwell Bridge Road

2028 Future Background

936 March Road



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4		8	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	38.6	38.6		38.6	38.6		11.4	34.6	34.6	11.4	34.6	34.6
Total Split (s)	45.0	45.0		45.0	45.0		20.0	55.0	55.0	20.0	55.0	55.0
Total Split (%)	37.5%	37.5%		37.5%	37.5%		16.7%	45.8%	45.8%	16.7%	45.8%	45.8%
Maximum Green (s)	38.4	38.4		38.4	38.4		13.6	48.4	48.4	13.6	48.4	48.4
Yellow Time (s)	3.3	3.3		3.3	3.3		4.6	4.6	4.6	4.6	4.6	4.6
All-Red Time (s)	3.3	3.3		3.3	3.3		1.8	2.0	2.0	1.8	2.0	2.0
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)	6.6	6.6		6.6	6.6		6.4	6.6	6.6	6.4	6.6	6.6
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max	C-Max	None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0	7.0		7.0	7.0
Flash Dont Walk (s)	25.0	25.0		25.0	25.0			21.0	21.0		21.0	21.0
Pedestrian Calls (#/hr)	0	0		0	0			0	0		0	0
Act Effct Green (s)	17.1	17.1		17.1	17.1		85.3	72.5	72.5	81.7	70.7	70.7
Actuated g/C Ratio	0.14	0.14		0.14	0.14		0.71	0.60	0.60	0.68	0.59	0.59
v/c Ratio	1.07	0.58		0.80	0.72		0.45	0.71	0.18	0.49	0.24	0.12
Control Delay	168.6	39.9		88.0	38.3		7.8	20.8	4.9	14.5	13.6	4.7
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	168.6	39.9		88.0	38.3		7.8	20.8	4.9	14.5	13.6	4.7
LOS	F	D		F	D		A	C	A	B	B	A
Approach Delay		85.9			54.4			17.3			12.4	
Approach LOS		F			D			B			B	
Queue Length 50th (m)	~24.4	25.1		26.1	28.9		19.4	120.6	4.4	7.6	27.9	1.8
Queue Length 95th (m)	#49.4	44.4		44.1	53.0		38.7	196.1	18.3	22.7	49.6	12.5
Internal Link Dist (m)		178.9			259.1			197.3			660.3	
Turn Bay Length (m)	30.0			30.0			60.0			60.0		15.0
Base Capacity (vph)	185	553		299	575		691	2026	956	318	1976	921
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	0.48	0.29		0.36	0.39		0.43	0.71	0.18	0.42	0.24	0.12

Intersection Summary

Area Type:	Other
Cycle Length:	120
Actuated Cycle Length:	120
Offset:	50 (42%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle:	95
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	1.07
Intersection Signal Delay:	25.3
Intersection LOS:	C
Intersection Capacity Utilization:	87.4%
ICU Level of Service:	E
Analysis Period (min):	15

~ Volume exceeds capacity, queue is theoretically infinite.

Lanes, Volumes, Timings
 2: March Road & Halton Terrace/Maxwell Bridge Road

2028 Future Background

936 March Road

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: March Road & Halton Terrace/Maxwell Bridge Road



HCM 2010 Signalized Intersection Summary
 2: March Road & Halton Terrace/Maxwell Bridge Road

2028 Future Background
 936 March Road

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	79	67	76	96	60	141	270	1294	156	119	433	99
Future Volume (veh/h)	79	67	76	96	60	141	270	1294	156	119	433	99
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1765	1765	1765	1765	1765	1765
Adj Flow Rate, veh/h	88	74	84	107	67	157	300	1438	173	132	481	110
Adj No. of Lanes	1	1	0	1	1	0	1	2	1	1	2	1
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	176	173	196	238	108	252	579	1852	829	221	1697	759
Arrive On Green	0.23	0.23	0.23	0.23	0.23	0.23	0.10	0.55	0.55	0.06	0.51	0.51
Sat Flow, veh/h	1152	756	858	1223	470	1101	1681	3353	1500	1681	3353	1500
Grp Volume(v), veh/h	88	0	158	107	0	224	300	1438	173	132	481	110
Grp Sat Flow(s),veh/h/ln	1152	0	1613	1223	0	1570	1681	1676	1500	1681	1676	1500
Q Serve(g_s), s	8.9	0.0	10.0	9.8	0.0	15.4	10.0	40.3	7.0	4.5	9.9	4.7
Cycle Q Clear(g_c), s	24.3	0.0	10.0	19.9	0.0	15.4	10.0	40.3	7.0	4.5	9.9	4.7
Prop In Lane	1.00		0.53	1.00		0.70	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	176	0	369	238	0	360	579	1852	829	221	1697	759
V/C Ratio(X)	0.50	0.00	0.43	0.45	0.00	0.62	0.52	0.78	0.21	0.60	0.28	0.14
Avail Cap(c_a), veh/h	281	0	516	349	0	503	599	1852	829	318	1697	759
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	52.5	0.0	39.5	48.0	0.0	41.6	11.5	21.1	13.6	21.2	17.1	15.8
Incr Delay (d2), s/veh	2.2	0.0	0.8	1.3	0.0	1.8	0.7	3.3	0.6	2.6	0.4	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.9	0.0	4.6	3.4	0.0	6.8	4.7	19.4	3.0	2.3	4.7	2.0
LnGrp Delay(d),s/veh	54.7	0.0	40.3	49.4	0.0	43.4	12.2	24.3	14.2	23.8	17.5	16.2
LnGrp LOS	D		D	D		D	B	C	B	C	B	B
Approach Vol, veh/h		246			331			1911			723	
Approach Delay, s/veh		45.5			45.3			21.5			18.5	
Approach LOS		D			D			C			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	13.0	72.9		34.1	18.6	67.3		34.1				
Change Period (Y+Rc), s	* 6.4	6.6		6.6	* 6.4	6.6		6.6				
Max Green Setting (Gmax), s	* 14	48.4		38.4	* 14	48.4		38.4				
Max Q Clear Time (g_c+I1), s	6.5	42.3		26.3	12.0	11.9		21.9				
Green Ext Time (p_c), s	0.2	4.9		1.2	0.2	4.9		1.9				
Intersection Summary												
HCM 2010 Ctrl Delay	25.1											
HCM 2010 LOS	C											
Notes												

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Appendix I

2023 Total Future Synchro

Lanes, Volumes, Timings
1: March Road & Street 1

2023 Total Future
AM Peak Hour



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	300	16	240	97	5	792
Future Volume (vph)	300	16	240	97	5	792
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr _t		0.850		0.850		
Fl _t Protected	0.950				0.950	
Satd. Flow (prot)	1676	1500	1765	1500	1676	1765
Fl _t Permitted	0.950				0.595	
Satd. Flow (perm)	1676	1500	1765	1500	1050	1765
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		18		108		
Link Speed (k/h)	50		50			50
Link Distance (m)	145.2		387.2			760.6
Travel Time (s)	10.5		27.9			54.8
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	333	18	267	108	6	880
Shared Lane Traffic (%)						
Lane Group Flow (vph)	333	18	267	108	6	880
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		3.6			3.6
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (k/h)	25	15		15	25	
Number of Detectors	1	1	2	1	1	2
Detector Template	Left	Right	Thru	Right	Left	Thru
Leading Detector (m)	2.0	2.0	10.0	2.0	2.0	10.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	2.0	0.6	2.0	2.0	0.6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)			9.4			9.4
Detector 2 Size(m)			0.6			0.6
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type	Prot	Perm	NA	Perm	Perm	NA
Protected Phases	8		2			6
Permitted Phases		8		2	6	
Detector Phase	8	8	2	2	6	6
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0

Lanes, Volumes, Timings
1: March Road & Street 1

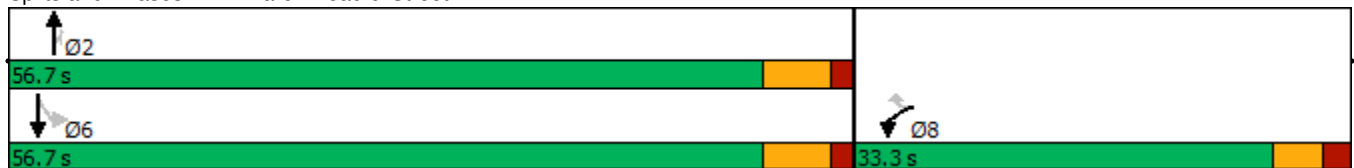
2023 Total Future
AM Peak Hour



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Minimum Split (s)	33.3	33.3	38.2	38.2	38.2	38.2
Total Split (s)	33.3	33.3	56.7	56.7	56.7	56.7
Total Split (%)	37.0%	37.0%	63.0%	63.0%	63.0%	63.0%
Maximum Green (s)	28.0	28.0	50.5	50.5	50.5	50.5
Yellow Time (s)	3.3	3.3	4.6	4.6	4.6	4.6
All-Red Time (s)	2.0	2.0	1.6	1.6	1.6	1.6
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.3	5.3	6.2	6.2	6.2	6.2
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Max	Max	Max	Max
Walk Time (s)	7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	21.0	21.0	25.0	25.0	25.0	25.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effct Green (s)	21.0	21.0	50.9	50.9	50.9	50.9
Actuated g/C Ratio	0.25	0.25	0.61	0.61	0.61	0.61
v/c Ratio	0.79	0.05	0.25	0.11	0.01	0.82
Control Delay	43.1	10.2	9.2	2.2	8.2	22.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.1	10.2	9.2	2.2	8.2	22.3
LOS	D	B	A	A	A	C
Approach Delay	41.4		7.2			22.2
Approach LOS	D		A			C
Queue Length 50th (m)	51.7	0.0	18.8	0.0	0.4	105.1
Queue Length 95th (m)	81.6	4.9	37.7	6.8	2.2	#219.8
Internal Link Dist (m)	121.2		363.2			736.6
Turn Bay Length (m)						
Base Capacity (vph)	564	517	1076	956	640	1076
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.59	0.03	0.25	0.11	0.01	0.82













Intersection Summary
 Area Type: Other
 Cycle Length: 90
 Actuated Cycle Length: 83.4
 Natural Cycle: 90
 Control Type: Semi Act-Uncoord
 Maximum v/c Ratio: 0.82
 Intersection Signal Delay: 22.9
 Intersection LOS: C
 Intersection Capacity Utilization 71.1%
 ICU Level of Service C
 Analysis Period (min) 15
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 1: March Road & Street 1



HCM 2010 Signalized Intersection Summary
 1: March Road & Street 1

2023 Total Future
 AM Peak Hour

								
Movement	WBL	WBR	NBT	NBR	SBL	SBT		
Lane Configurations								
Traffic Volume (veh/h)	300	16	240	97	5	792		
Future Volume (veh/h)	300	16	240	97	5	792		
Number	3	18	2	12	1	6		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1765	1765	1765	1765	1765	1765		
Adj Flow Rate, veh/h	333	18	267	108	6	880		
Adj No. of Lanes	1	1	1	1	1	1		
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Percent Heavy Veh, %	2	2	2	2	2	2		
Cap, veh/h	386	345	1107	941	652	1107		
Arrive On Green	0.23	0.23	0.63	0.63	0.63	0.63		
Sat Flow, veh/h	1681	1500	1765	1500	1003	1765		
Grp Volume(v), veh/h	333	18	267	108	6	880		
Grp Sat Flow(s),veh/h/ln	1681	1500	1765	1500	1003	1765		
Q Serve(g_s), s	15.3	0.8	5.3	2.3	0.2	29.8		
Cycle Q Clear(g_c), s	15.3	0.8	5.3	2.3	5.6	29.8		
Prop In Lane	1.00	1.00		1.00	1.00			
Lane Grp Cap(c), veh/h	386	345	1107	941	652	1107		
V/C Ratio(X)	0.86	0.05	0.24	0.11	0.01	0.79		
Avail Cap(c_a), veh/h	585	522	1107	941	652	1107		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(l)	1.00	1.00	1.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	29.8	24.2	6.6	6.0	7.8	11.2		
Incr Delay (d2), s/veh	8.4	0.1	0.5	0.2	0.0	5.9		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	8.0	0.3	2.8	1.0	0.1	16.2		
LnGrp Delay(d),s/veh	38.1	24.2	7.1	6.3	7.8	17.1		
LnGrp LOS	D	C	A	A	A	B		
Approach Vol, veh/h	351		375			886		
Approach Delay, s/veh	37.4		6.9			17.0		
Approach LOS	D		A			B		
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		56.7				56.7		23.8
Change Period (Y+Rc), s		* 6.2				* 6.2		5.3
Max Green Setting (Gmax), s		* 51				* 51		28.0
Max Q Clear Time (g_c+I1), s		7.3				31.8		17.3
Green Ext Time (p_c), s		2.7				7.8		1.2
Intersection Summary								
HCM 2010 Ctrl Delay			19.1					
HCM 2010 LOS			B					
Notes								

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Lanes, Volumes, Timings
2: March Road & Halton Terrace/Maxwell Bridge Road

2023 Total Future
AM Peak Hour



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	39	110	171	16	9	38	318	70	93	992	7
Future Volume (vph)	10	39	110	171	16	9	38	318	70	93	992	7
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	30.0		0.0	30.0		0.0	60.0		0.0	60.0		15.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	60.0			60.0			70.0			70.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Fr _t		0.889			0.946				0.850			0.850
Fl _t Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1676	1569	0	1676	1669	0	1676	3353	1500	1676	3353	1500
Fl _t Permitted	0.739			0.580			0.201			0.518		
Satd. Flow (perm)	1304	1569	0	1024	1669	0	355	3353	1500	914	3353	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		122			10				91			91
Link Speed (k/h)		50			50			50				50
Link Distance (m)		202.9			283.1			221.3				297.1
Travel Time (s)		14.6			20.4			15.9				21.4
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
Adj. Flow (vph)	11	43	122	190	18	10	42	353	78	103	1102	8
Shared Lane Traffic (%)												
Lane Group Flow (vph)	11	165	0	190	28	0	42	353	78	103	1102	8
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6				3.6
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4				9.4
Detector 2 Size(m)		0.6			0.6			0.6				0.6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1		6
Permitted Phases	4			8			2		2	6		6

Lanes, Volumes, Timings
 2: March Road & Halton Terrace/Maxwell Bridge Road

2023 Total Future
 AM Peak Hour



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4		8	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	38.6	38.6		38.6	38.6		11.4	34.6	34.6	11.4	34.6	34.6
Total Split (s)	48.0	48.0		48.0	48.0		20.0	52.0	52.0	20.0	52.0	52.0
Total Split (%)	40.0%	40.0%		40.0%	40.0%		16.7%	43.3%	43.3%	16.7%	43.3%	43.3%
Maximum Green (s)	41.4	41.4		41.4	41.4		13.6	45.4	45.4	13.6	45.4	45.4
Yellow Time (s)	3.3	3.3		3.3	3.3		4.6	4.6	4.6	4.6	4.6	4.6
All-Red Time (s)	3.3	3.3		3.3	3.3		1.8	2.0	2.0	1.8	2.0	2.0
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)	6.6	6.6		6.6	6.6		6.4	6.6	6.6	6.4	6.6	6.6
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max	C-Max	None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0	7.0		7.0	7.0
Flash Dont Walk (s)	25.0	25.0		25.0	25.0			21.0	21.0		21.0	21.0
Pedestrian Calls (#/hr)	0	0		0	0			0	0		0	0
Act Effct Green (s)	26.0	26.0		26.0	26.0		73.0	66.1	66.1	77.5	70.2	70.2
Actuated g/C Ratio	0.22	0.22		0.22	0.22		0.61	0.55	0.55	0.65	0.58	0.58
v/c Ratio	0.04	0.38		0.86	0.08		0.15	0.19	0.09	0.16	0.56	0.01
Control Delay	32.8	13.4		76.7	24.4		10.0	15.5	3.1	8.9	19.2	0.0
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.8	13.4		76.7	24.4		10.0	15.5	3.1	8.9	19.2	0.0
LOS	C	B		E	C		A	B	A	A	B	A
Approach Delay		14.6			70.0			13.0			18.2	
Approach LOS		B			E			B			B	
Queue Length 50th (m)	2.2	8.6		45.6	3.6		3.2	22.0	0.0	8.1	88.7	0.0
Queue Length 95th (m)	6.6	25.1		67.5	10.4		9.2	39.0	7.2	18.8	137.3	0.0
Internal Link Dist (m)		178.9			259.1			197.3			273.1	
Turn Bay Length (m)	30.0			30.0			60.0			60.0		15.0
Base Capacity (vph)	449	621		353	582		385	1847	867	702	1960	914
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	0.02	0.27		0.54	0.05		0.11	0.19	0.09	0.15	0.56	0.01

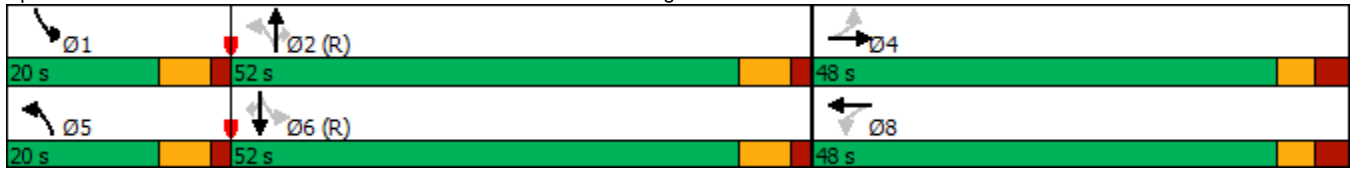
Intersection Summary

Area Type:	Other
Cycle Length:	120
Actuated Cycle Length:	120
Offset:	99 (83%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle:	85
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.86
Intersection Signal Delay:	22.1
Intersection LOS:	C
Intersection Capacity Utilization:	74.3%
ICU Level of Service:	D
Analysis Period (min):	15

Lanes, Volumes, Timings
 2: March Road & Halton Terrace/Maxwell Bridge Road























2023 Total Future
 AM Peak Hour

Splits and Phases: 2: March Road & Halton Terrace/Maxwell Bridge Road



HCM 2010 Signalized Intersection Summary
 2: March Road & Halton Terrace/Maxwell Bridge Road

2023 Total Future
 AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	39	110	171	16	9	38	318	70	93	992	7
Future Volume (veh/h)	10	39	110	171	16	9	38	318	70	93	992	7
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1765	1765	1765	1765	1765	1765
Adj Flow Rate, veh/h	11	43	122	190	18	10	42	353	78	103	1102	8
Adj No. of Lanes	1	1	0	1	1	0	1	2	1	1	2	1
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	404	107	303	274	281	156	274	1774	794	587	1819	814
Arrive On Green	0.26	0.26	0.26	0.26	0.26	0.26	0.03	0.53	0.53	0.04	0.54	0.54
Sat Flow, veh/h	1377	407	1154	1216	1067	593	1681	3353	1500	1681	3353	1500
Grp Volume(v), veh/h	11	0	165	190	0	28	42	353	78	103	1102	8
Grp Sat Flow(s),veh/h/ln	1377	0	1561	1216	0	1660	1681	1676	1500	1681	1676	1500
Q Serve(g_s), s	0.7	0.0	10.5	18.3	0.0	1.5	1.4	6.6	3.1	3.3	26.9	0.3
Cycle Q Clear(g_c), s	2.2	0.0	10.5	28.8	0.0	1.5	1.4	6.6	3.1	3.3	26.9	0.3
Prop In Lane	1.00		0.74	1.00		0.36	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	404	0	410	274	0	436	274	1774	794	587	1819	814
V/C Ratio(X)	0.03	0.00	0.40	0.69	0.00	0.06	0.15	0.20	0.10	0.18	0.61	0.01
Avail Cap(c_a), veh/h	517	0	539	374	0	573	411	1774	794	702	1819	814
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(l)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	34.0	0.0	36.5	48.3	0.0	33.2	14.8	14.9	14.0	11.8	18.7	12.6
Incr Delay (d2), s/veh	0.0	0.0	0.6	3.4	0.0	0.1	0.3	0.3	0.2	0.1	1.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	4.6	6.4	0.0	0.7	0.6	3.2	1.3	1.5	12.8	0.1
LnGrp Delay(d),s/veh	34.0	0.0	37.1	51.7	0.0	33.2	15.0	15.1	14.3	12.0	20.2	12.7
LnGrp LOS	C		D	D		C	B	B	B	B	C	B
Approach Vol, veh/h		176			218			473			1213	
Approach Delay, s/veh		36.9			49.3			15.0			19.5	
Approach LOS		D			D			B			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	11.8	70.1		38.1	10.2	71.7		38.1				
Change Period (Y+Rc), s	* 6.4	6.6		6.6	* 6.4	6.6		6.6				
Max Green Setting (Gmax), s	* 14	45.4		41.4	* 14	45.4		41.4				
Max Q Clear Time (g_c+I1), s	5.3	8.6		12.5	3.4	28.9		30.8				
Green Ext Time (p_c), s	0.2	3.4		1.3	0.1	8.4		0.8				
Intersection Summary												
HCM 2010 Ctrl Delay			23.0									
HCM 2010 LOS			C									
Notes												

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Lanes, Volumes, Timings
1: March Road & Street 1

2023 Total Future
PM Peak Hour



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	188	10	999	319	17	376
Future Volume (vph)	188	10	999	319	17	376
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr _t		0.850		0.850		
Fl _t Protected	0.950				0.950	
Satd. Flow (prot)	1676	1500	1765	1500	1676	1765
Fl _t Permitted	0.950				0.106	
Satd. Flow (perm)	1676	1500	1765	1500	187	1765
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		11		320		
Link Speed (k/h)	50		50		50	
Link Distance (m)	297.2		377.9		733.5	
Travel Time (s)	21.4		27.2		52.8	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	209	11	1110	354	19	418
Shared Lane Traffic (%)						
Lane Group Flow (vph)	209	11	1110	354	19	418
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		3.6		3.6	
Link Offset(m)	0.0		0.0		0.0	
Crosswalk Width(m)	4.8		4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (k/h)	25	15		15	25	
Number of Detectors	1	1	1	1	1	1
Detector Template	Left	Right	Thru	Right	Left	Thru
Leading Detector (m)	2.0	2.0	10.0	2.0	2.0	10.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	2.0	10.0	2.0	2.0	10.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Turn Type	Prot	Perm	NA	Perm	Perm	NA
Protected Phases	8		2			6
Permitted Phases		8		2	6	
Detector Phase	8	8	2	2	6	6
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	33.3	33.3	38.2	38.2	38.2	38.2
Total Split (s)	33.3	33.3	66.7	66.7	66.7	66.7
Total Split (%)	33.3%	33.3%	66.7%	66.7%	66.7%	66.7%
Maximum Green (s)	28.0	28.0	60.5	60.5	60.5	60.5
Yellow Time (s)	3.3	3.3	4.6	4.6	4.6	4.6

Lanes, Volumes, Timings
1: March Road & Street 1

2023 Total Future
PM Peak Hour



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
All-Red Time (s)	2.0	2.0	1.6	1.6	1.6	1.6
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.3	5.3	6.2	6.2	6.2	6.2
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Max	Max	Max	Max
Walk Time (s)	7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	21.0	21.0	25.0	25.0	25.0	25.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effct Green (s)	16.5	16.5	63.6	63.6	63.6	63.6
Actuated g/C Ratio	0.18	0.18	0.69	0.69	0.69	0.69
v/c Ratio	0.69	0.04	0.91	0.31	0.15	0.34
Control Delay	46.8	15.1	25.7	1.9	9.5	7.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.8	15.1	25.7	1.9	9.5	7.2
LOS	D	B	C	A	A	A
Approach Delay	45.2		19.9			7.3
Approach LOS	D		B			A
Queue Length 50th (m)	35.0	0.0	143.7	1.7	1.0	26.4
Queue Length 95th (m)	58.0	4.5	#299.5	12.3	5.2	52.4
Internal Link Dist (m)	273.2		353.9			709.5
Turn Bay Length (m)						
Base Capacity (vph)	512	466	1225	1139	129	1225
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.41	0.02	0.91	0.31	0.15	0.34

Intersection Summary













Area Type: Other
 Cycle Length: 100
 Actuated Cycle Length: 91.6
 Natural Cycle: 100
 Control Type: Semi Act-Uncoord
 Maximum v/c Ratio: 0.91
 Intersection Signal Delay: 19.9
 Intersection LOS: B
 Intersection Capacity Utilization 76.1%
 ICU Level of Service D
 Analysis Period (min) 15
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 1: March Road & Street 1



HCM 2010 Signalized Intersection Summary
 1: March Road & Street 1

2023 Total Future
 PM Peak Hour

								
Movement	WBL	WBR	NBT	NBR	SBL	SBT		
Lane Configurations								
Traffic Volume (veh/h)	188	10	999	319	17	376		
Future Volume (veh/h)	188	10	999	319	17	376		
Number	3	18	2	12	1	6		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1765	1765	1765	1765	1765	1765		
Adj Flow Rate, veh/h	209	11	1110	354	19	418		
Adj No. of Lanes	1	1	1	1	1	1		
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Percent Heavy Veh, %	2	2	2	2	2	2		
Cap, veh/h	256	229	1257	1068	166	1257		
Arrive On Green	0.15	0.15	0.71	0.71	0.71	0.71		
Sat Flow, veh/h	1681	1500	1765	1500	361	1765		
Grp Volume(v), veh/h	209	11	1110	354	19	418		
Grp Sat Flow(s),veh/h/ln	1681	1500	1765	1500	361	1765		
Q Serve(g_s), s	10.2	0.5	41.5	7.6	3.7	7.6		
Cycle Q Clear(g_c), s	10.2	0.5	41.5	7.6	45.1	7.6		
Prop In Lane	1.00	1.00		1.00	1.00			
Lane Grp Cap(c), veh/h	256	229	1257	1068	166	1257		
V/C Ratio(X)	0.82	0.05	0.88	0.33	0.11	0.33		
Avail Cap(c_a), veh/h	554	494	1257	1068	166	1257		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	34.8	30.7	9.5	4.6	27.0	4.6		
Incr Delay (d2), s/veh	6.2	0.1	9.2	0.8	1.4	0.7		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	5.2	0.2	23.0	3.3	0.4	3.8		
LnGrp Delay(d),s/veh	41.1	30.8	18.7	5.4	28.4	5.3		
LnGrp LOS	D	C	B	A	C	A		
Approach Vol, veh/h	220		1464			437		
Approach Delay, s/veh	40.6		15.5			6.3		
Approach LOS	D		B			A		
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		66.7				66.7		18.3
Change Period (Y+Rc), s		* 6.2				* 6.2		5.3
Max Green Setting (Gmax), s		* 61				* 61		28.0
Max Q Clear Time (g_c+I1), s		43.5				47.1		12.2
Green Ext Time (p_c), s		11.6				2.8		0.8
Intersection Summary								
HCM 2010 Ctrl Delay			16.2					
HCM 2010 LOS			B					
Notes								

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Lanes, Volumes, Timings
2: March Road & Halton Terrace/Maxwell Bridge Road























2023 Total Future
PM Peak Hour



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	13	64	44	94	59	106	188	1199	152	69	482	13
Future Volume (vph)	13	64	44	94	59	106	188	1199	152	69	482	13
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	30.0		0.0	30.0		0.0	60.0		0.0	60.0		15.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Fr _t		0.939			0.904				0.850			0.850
Fl _t Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1676	1657	0	1676	1595	0	1676	3353	1500	1676	3353	1500
Fl _t Permitted	0.390			0.566			0.411			0.157		
Satd. Flow (perm)	688	1657	0	999	1595	0	725	3353	1500	277	3353	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		31			81				138			91
Link Speed (k/h)		50			50			50				50
Link Distance (m)		202.9			283.1			221.3				306.4
Travel Time (s)		14.6			20.4			15.9				22.1
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
Adj. Flow (vph)	14	71	49	104	66	118	209	1332	169	77	536	14
Shared Lane Traffic (%)												
Lane Group Flow (vph)	14	120	0	104	184	0	209	1332	169	77	536	14
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6				3.6
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	1		1	1		1	1	1	1	1	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	10.0		2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2		2	6		6
Detector Phase	4	4		8	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	38.6	38.6		38.6	38.6		11.4	34.6	34.6	11.4	34.6	34.6
Total Split (s)	45.0	45.0		45.0	45.0		20.0	55.0	55.0	20.0	55.0	55.0

HCM 2010 Signalized Intersection Summary
 2: March Road & Halton Terrace/Maxwell Bridge Road

2023 Total Future
 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	13	64	44	94	59	106	188	1199	152	69	482	13
Future Volume (veh/h)	13	64	44	94	59	106	188	1199	152	69	482	13
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1765	1765	1765	1765	1765	1765
Adj Flow Rate, veh/h	14	71	49	104	66	118	209	1332	169	77	536	14
Adj No. of Lanes	1	1	0	1	1	0	1	2	1	1	2	1
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	165	189	131	225	110	197	668	2171	971	302	2093	937
Arrive On Green	0.19	0.19	0.17	0.19	0.19	0.17	0.08	0.65	0.65	0.06	0.62	0.62
Sat Flow, veh/h	1195	974	672	1266	569	1017	1681	3353	1500	1681	3353	1500
Grp Volume(v), veh/h	14	0	120	104	0	184	209	1332	169	77	536	14
Grp Sat Flow(s),veh/h/ln	1195	0	1646	1266	0	1585	1681	1676	1500	1681	1676	1500
Q Serve(g_s), s	1.3	0.0	7.7	9.3	0.0	12.8	4.9	27.9	5.4	1.8	8.6	0.4
Cycle Q Clear(g_c), s	14.1	0.0	7.7	17.0	0.0	12.8	4.9	27.9	5.4	1.8	8.6	0.4
Prop In Lane	1.00		0.41	1.00		0.64	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	165	0	320	225	0	308	668	2171	971	302	2093	937
V/C Ratio(X)	0.09	0.00	0.38	0.46	0.00	0.60	0.31	0.61	0.17	0.25	0.26	0.01
Avail Cap(c_a), veh/h	341	0	562	412	0	542	755	2171	971	428	2093	937
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(l)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	50.5	0.0	42.5	49.4	0.0	44.9	6.2	12.4	8.4	9.8	10.1	8.5
Incr Delay (d2), s/veh	0.2	0.0	0.7	1.5	0.0	1.9	0.3	1.3	0.4	0.4	0.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	3.6	3.4	0.0	5.8	2.3	13.2	2.3	0.9	4.0	0.2
LnGrp Delay(d),s/veh	50.8	0.0	43.2	50.9	0.0	46.7	6.5	13.7	8.8	10.2	10.4	8.6
LnGrp LOS	D		D	D		D	A	B	A	B	B	A
Approach Vol, veh/h		134			288			1710			627	
Approach Delay, s/veh		44.0			48.2			12.3			10.3	
Approach LOS		D			D			B			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	11.0	81.7		27.3	13.8	78.9		27.3				
Change Period (Y+Rc), s	* 6.4	6.6		6.6	* 6.4	6.6		6.6				
Max Green Setting (Gmax), s	* 14	48.4		38.4	* 14	48.4		38.4				
Max Q Clear Time (g_c+I1), s	3.8	29.9		16.1	6.9	10.6		19.0				
Green Ext Time (p_c), s	0.1	11.7		0.8	0.4	5.0		1.7				
Intersection Summary												
HCM 2010 Ctrl Delay			17.2									
HCM 2010 LOS			B									
Notes												

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Appendix J

2028 Total Future Synchro

Lanes, Volumes, Timings
1: March Road & West Access/Street 1

2028 Total Future
AM Peak Hour



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	11	71	38	300	71	16	7	464	97	5	1311	3
Future Volume (vph)	11	71	38	300	71	16	7	464	97	5	1311	3
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	35.0		0.0	90.0		0.0	35.0		35.0	35.0		0.0
Storage Lanes	1		0	1		0	1		1	1		0
Taper Length (m)	35.0			35.0			35.0			35.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Frt		0.948			0.972				0.850			
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1676	1673	0	1676	1715	0	1676	3353	1500	1676	3353	0
Flt Permitted	0.694			0.476			0.117			0.458		
Satd. Flow (perm)	1225	1673	0	840	1715	0	206	3353	1500	808	3353	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		22			11				108			
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		280.3			196.5			684.3			305.5	
Travel Time (s)		20.2			14.1			49.3			22.0	
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
Adj. Flow (vph)	12	79	42	333	79	18	8	516	108	6	1457	3
Shared Lane Traffic (%)												
Lane Group Flow (vph)	12	121	0	333	97	0	8	516	108	6	1460	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4		3	8			2			6	
Permitted Phases	4			8			2		2	6		

Lanes, Volumes, Timings
1: March Road & West Access/Street 1

2028 Total Future
AM Peak Hour



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4		3	8		2	2	2	6	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	37.1	37.1		10.0	37.1		34.2	34.2	34.2	34.2	34.2	
Total Split (s)	37.1	37.1		15.0	52.1		67.9	67.9	67.9	67.9	67.9	
Total Split (%)	30.9%	30.9%		12.5%	43.4%		56.6%	56.6%	56.6%	56.6%	56.6%	
Maximum Green (s)	32.0	32.0		12.0	47.0		61.7	61.7	61.7	61.7	61.7	
Yellow Time (s)	3.3	3.3		3.0	3.3		4.6	4.6	4.6	4.6	4.6	
All-Red Time (s)	1.8	1.8		0.0	1.8		1.6	1.6	1.6	1.6	1.6	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.1	5.1		3.0	5.1		6.2	6.2	6.2	6.2	6.2	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None		None	None		Max	Max	Max	Max	Max	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0	7.0	7.0	7.0	
Flash Dont Walk (s)	25.0	25.0		25.0	25.0		21.0	21.0	21.0	21.0	21.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0	0	0	0	
Act Effct Green (s)	11.2	11.2		28.3	26.2		61.8	61.8	61.8	61.8	61.8	
Actuated g/C Ratio	0.11	0.11		0.28	0.26		0.62	0.62	0.62	0.62	0.62	
v/c Ratio	0.09	0.58		0.98	0.21		0.06	0.25	0.11	0.01	0.70	
Control Delay	40.0	45.3		78.1	26.0		10.1	9.1	2.1	8.4	15.4	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	40.0	45.3		78.1	26.0		10.1	9.1	2.1	8.4	15.4	
LOS	D	D		E	C		B	A	A	A	B	
Approach Delay		44.8			66.4			7.9			15.4	
Approach LOS		D			E			A			B	
Queue Length 50th (m)	2.2	19.2		60.0	13.5		0.6	22.4	0.0	0.4	95.3	
Queue Length 95th (m)	7.7	37.5		#118.5	26.7		3.1	35.2	6.8	2.3	138.1	
Internal Link Dist (m)		256.3			172.5			660.3			281.5	
Turn Bay Length (m)	35.0			90.0			35.0		35.0	35.0		
Base Capacity (vph)	395	554		340	818		128	2085	973	502	2085	
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	
Reduced v/c Ratio	0.03	0.22		0.98	0.12		0.06	0.25	0.11	0.01	0.70	

Intersection Summary























Area Type:	Other
Cycle Length:	120
Actuated Cycle Length:	99.3
Natural Cycle:	95
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.98
Intersection Signal Delay:	23.3
Intersection LOS:	C
Intersection Capacity Utilization:	72.0%
ICU Level of Service:	C
Analysis Period (min):	15
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	

Splits and Phases: 1: March Road & West Access/Street 1

 Ø2	 Ø3	 Ø4
67.9 s	15 s	37.1 s
 Ø6	 Ø8	
67.9 s	52.1 s	

HCM 2010 Signalized Intersection Summary
 1: March Road & West Access/Street 1

2028 Total Future
 AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	11	71	38	300	71	16	7	464	97	5	1311	3
Future Volume (veh/h)	11	71	38	300	71	16	7	464	97	5	1311	3
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1765	1765	1765	1765	1765	1800
Adj Flow Rate, veh/h	12	79	42	333	79	18	8	516	108	6	1457	3
Adj No. of Lanes	1	1	0	1	1	0	1	2	1	1	2	0
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	202	108	57	316	352	80	204	2118	948	524	2169	4
Arrive On Green	0.10	0.10	0.10	0.12	0.25	0.25	0.63	0.63	0.63	0.63	0.63	0.63
Sat Flow, veh/h	1293	1086	577	1681	1392	317	362	3353	1500	797	3433	7
Grp Volume(v), veh/h	12	0	121	333	0	97	8	516	108	6	711	749
Grp Sat Flow(s),veh/h/ln	1293	0	1663	1681	0	1709	362	1676	1500	797	1676	1763
Q Serve(g_s), s	0.8	0.0	6.9	12.0	0.0	4.4	1.4	6.5	2.8	0.3	26.5	26.5
Cycle Q Clear(g_c), s	0.8	0.0	6.9	12.0	0.0	4.4	27.9	6.5	2.8	6.9	26.5	26.5
Prop In Lane	1.00		0.35	1.00		0.19	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	202	0	165	316	0	432	204	2118	948	524	1059	1114
V/C Ratio(X)	0.06	0.00	0.73	1.05	0.00	0.22	0.04	0.24	0.11	0.01	0.67	0.67
Avail Cap(c_a), veh/h	497	0	545	316	0	822	204	2118	948	524	1059	1114
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	40.0	0.0	42.8	37.1	0.0	28.9	20.5	7.8	7.1	9.3	11.5	11.5
Incr Delay (d2), s/veh	0.1	0.0	6.2	65.4	0.0	0.3	0.4	0.3	0.2	0.0	3.4	3.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	3.4	13.2	0.0	2.1	0.2	3.1	1.2	0.1	13.1	13.7
LnGrp Delay(d),s/veh	40.1	0.0	49.0	102.5	0.0	29.2	20.8	8.1	7.4	9.4	14.9	14.7
LnGrp LOS	D		D	F		C	C	A	A	A	B	B
Approach Vol, veh/h		133			430			632			1466	
Approach Delay, s/veh		48.2			86.0			8.1			14.8	
Approach LOS		D			F			A			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2	3	4		6		8				
Phs Duration (G+Y+Rc), s		67.9	15.0	14.8		67.9		29.8				
Change Period (Y+Rc), s		* 6.2	3.0	5.1		* 6.2		5.1				
Max Green Setting (Gmax), s		* 62	12.0	32.0		* 62		47.0				
Max Q Clear Time (g_c+I1), s		29.9	14.0	8.9		28.5		6.4				
Green Ext Time (p_c), s		5.4	0.0	0.8		16.5		0.7				
Intersection Summary												
HCM 2010 Ctrl Delay			26.4									
HCM 2010 LOS			C									
Notes												

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Lanes, Volumes, Timings
2: March Road & Halton Terrace/Maxwell Bridge Road

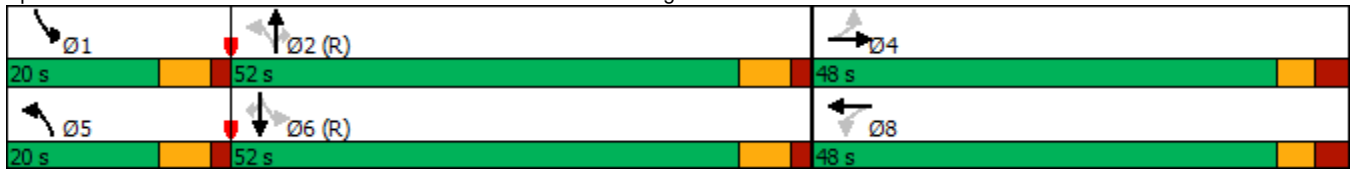
2028 Total Future
AM Peak Hour



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	91	40	175	175	17	35	115	541	72	102	1487	61
Future Volume (vph)	91	40	175	175	17	35	115	541	72	102	1487	61
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	30.0		0.0	30.0		0.0	60.0		0.0	60.0		15.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	60.0			60.0			70.0			70.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Fr _t		0.878			0.899				0.850			0.850
Fl _t Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1676	1549	0	1676	1586	0	1676	3353	1500	1676	3353	1500
Fl _t Permitted	0.719			0.467			0.065			0.389		
Satd. Flow (perm)	1269	1549	0	824	1586	0	115	3353	1500	686	3353	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		194			39				91			91
Link Speed (k/h)		50			50			50				50
Link Distance (m)		202.9			283.1			221.3				684.3
Travel Time (s)		14.6			20.4			15.9				49.3
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
Adj. Flow (vph)	101	44	194	194	19	39	128	601	80	113	1652	68
Shared Lane Traffic (%)												
Lane Group Flow (vph)	101	238	0	194	58	0	128	601	80	113	1652	68
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6				3.6
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4				9.4
Detector 2 Size(m)		0.6			0.6			0.6				0.6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1		6
Permitted Phases	4			8			2		2	6		6























Queue shown is maximum after two cycles.

Splits and Phases: 2: March Road & Halton Terrace/Maxwell Bridge Road



HCM 2010 Signalized Intersection Summary
 2: March Road & Halton Terrace/Maxwell Bridge Road

2028 Total Future
 AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	91	40	175	175	17	35	115	541	72	102	1487	61
Future Volume (veh/h)	91	40	175	175	17	35	115	541	72	102	1487	61
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1765	1765	1765	1765	1765	1765
Adj Flow Rate, veh/h	101	44	194	194	19	39	128	601	80	113	1652	68
Adj No. of Lanes	1	1	0	1	1	0	1	2	1	1	2	1
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	445	89	394	274	162	332	156	1581	707	417	1564	700
Arrive On Green	0.31	0.31	0.31	0.31	0.31	0.31	0.06	0.47	0.47	0.05	0.47	0.47
Sat Flow, veh/h	1340	285	1258	1138	517	1061	1681	3353	1500	1681	3353	1500
Grp Volume(v), veh/h	101	0	238	194	0	58	128	601	80	113	1652	68
Grp Sat Flow(s),veh/h/ln	1340	0	1543	1138	0	1578	1681	1676	1500	1681	1676	1500
Q Serve(g_s), s	7.0	0.0	15.0	20.0	0.0	3.1	4.7	13.8	3.6	4.2	56.0	3.0
Cycle Q Clear(g_c), s	10.1	0.0	15.0	35.1	0.0	3.1	4.7	13.8	3.6	4.2	56.0	3.0
Prop In Lane	1.00		0.82	1.00		0.67	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	445	0	483	274	0	494	156	1581	707	417	1564	700
V/C Ratio(X)	0.23	0.00	0.49	0.71	0.00	0.12	0.82	0.38	0.11	0.27	1.06	0.10
Avail Cap(c_a), veh/h	487	0	532	310	0	544	250	1581	707	520	1564	700
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(l)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	33.0	0.0	33.5	47.7	0.0	29.4	27.8	20.4	17.7	15.8	32.0	17.9
Incr Delay (d2), s/veh	0.3	0.0	0.8	6.3	0.0	0.1	10.9	0.7	0.3	0.3	39.3	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.6	0.0	6.5	6.8	0.0	1.4	2.6	6.6	1.6	1.9	34.4	1.3
LnGrp Delay(d),s/veh	33.2	0.0	34.2	54.0	0.0	29.5	38.7	21.1	18.0	16.1	71.4	18.2
LnGrp LOS	C		C	D		C	D	C	B	B	F	B
Approach Vol, veh/h		339			252			809			1833	
Approach Delay, s/veh		33.9			48.4			23.6			66.0	
Approach LOS		C			D			C			E	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	12.6	63.2		44.2	13.2	62.6		44.2				
Change Period (Y+Rc), s	* 6.4	6.6		6.6	* 6.4	6.6		6.6				
Max Green Setting (Gmax), s	* 14	45.4		41.4	* 14	45.4		41.4				
Max Q Clear Time (g_c+I1), s	6.2	15.8		17.0	6.7	58.0		37.1				
Green Ext Time (p_c), s	0.2	5.8		2.3	0.2	0.0		0.5				
Intersection Summary												
HCM 2010 Ctrl Delay			50.6									
HCM 2010 LOS			D									
Notes												

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Lanes, Volumes, Timings
1: March Road & West Access/Street 1

2028 Future Background

PM Peak Hour



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	97	23	188	97	10	45	1417	319	17	631	9
Future Volume (vph)	10	97	23	188	97	10	45	1417	319	17	631	9
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	35.0		0.0	90.0		0.0	35.0		35.0	35.0		0.0
Storage Lanes	1		0	1		0	1		1	1		0
Taper Length (m)	35.0			35.0			35.0			35.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Fr _t		0.971			0.986				0.850		0.998	
Fl _t Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1676	1714	0	1676	1740	0	1676	3353	1500	1676	3346	0
Fl _t Permitted	0.681			0.448			0.366			0.106		
Satd. Flow (perm)	1202	1714	0	791	1740	0	646	3353	1500	187	3346	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		10			5				155			2
Link Speed (k/h)		50			50			50				50
Link Distance (m)		256.5			190.9			684.3				375.4
Travel Time (s)		18.5			13.7			49.3				27.0
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
Adj. Flow (vph)	11	108	26	209	108	11	50	1574	354	19	701	10
Shared Lane Traffic (%)												
Lane Group Flow (vph)	11	134	0	209	119	0	50	1574	354	19	711	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6				3.6
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2	1	1		2
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0	2.0	2.0		10.0
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0		0.0
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0		0.0
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6	2.0	2.0		0.6
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0		0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0		0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0		0.0
Detector 2 Position(m)		9.4			9.4			9.4				9.4
Detector 2 Size(m)		0.6			0.6			0.6				0.6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	Perm	Perm		NA
Protected Phases		4		3	8			2				6
Permitted Phases	4			8			2		2	6		

Lanes, Volumes, Timings
1: March Road & West Access/Street 1

2028 Future Background
PM Peak Hour

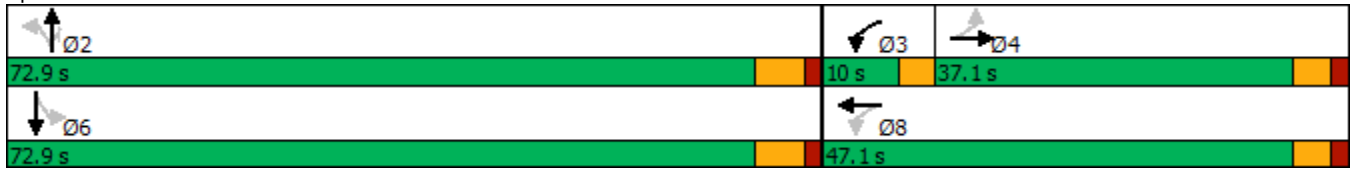


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4		3	8		2	2	2	6	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	37.1	37.1		10.0	37.1		35.0	35.0	35.0	34.2	34.2	
Total Split (s)	37.1	37.1		10.0	47.1		72.9	72.9	72.9	72.9	72.9	
Total Split (%)	30.9%	30.9%		8.3%	39.3%		60.8%	60.8%	60.8%	60.8%	60.8%	
Maximum Green (s)	32.0	32.0		6.7	42.0		66.7	66.7	66.7	66.7	66.7	
Yellow Time (s)	3.3	3.3		3.3	3.3		4.6	4.6	4.6	4.6	4.6	
All-Red Time (s)	1.8	1.8		0.0	1.8		1.6	1.6	1.6	1.6	1.6	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.1	5.1		3.3	5.1		6.2	6.2	6.2	6.2	6.2	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None		None	None		Max	Max	Max	Max	Max	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0	7.0	7.0	7.0	
Flash Dont Walk (s)	25.0	25.0		25.0	25.0		21.0	21.0	21.0	21.0	21.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0	0	0	0	
Act Effct Green (s)	12.6	12.6		24.4	22.6		66.8	66.8	66.8	66.8	66.8	
Actuated g/C Ratio	0.13	0.13		0.24	0.22		0.66	0.66	0.66	0.66	0.66	
v/c Ratio	0.07	0.60		0.84	0.30		0.12	0.71	0.34	0.15	0.32	
Control Delay	39.1	50.0		62.3	33.0		7.9	13.5	5.2	11.1	8.1	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	39.1	50.0		62.3	33.0		7.9	13.5	5.2	11.1	8.1	
LOS	D	D		E	C		A	B	A	B	A	
Approach Delay		49.2			51.7			11.9				8.1
Approach LOS		D			D			B				A
Queue Length 50th (m)	2.0	24.4		37.3	19.5		3.4	96.9	14.2	1.3	29.4	
Queue Length 95th (m)	7.4	44.0		#69.5	35.6		9.3	143.3	32.4	5.7	45.4	
Internal Link Dist (m)		232.5			166.9			660.3				351.4
Turn Bay Length (m)	35.0			90.0			35.0		35.0	35.0		
Base Capacity (vph)	382	552		250	729		428	2223	1046	123	2220	
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	
Reduced v/c Ratio	0.03	0.24		0.84	0.16		0.12	0.71	0.34	0.15	0.32	

Intersection Summary























Area Type:	Other
Cycle Length:	120
Actuated Cycle Length:	100.7
Natural Cycle:	95
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.84
Intersection Signal Delay:	16.8
Intersection LOS:	B
Intersection Capacity Utilization:	68.4%
ICU Level of Service:	C
Analysis Period (min):	15
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	

Splits and Phases: 1: March Road & West Access/Street 1



HCM 2010 Signalized Intersection Summary
 1: March Road & West Access/Street 1

2028 Future Background
 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	97	23	188	97	10	45	1417	319	17	631	9
Future Volume (veh/h)	10	97	23	188	97	10	45	1417	319	17	631	9
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1765	1765	1765	1765	1765	1800
Adj Flow Rate, veh/h	11	108	26	209	108	11	50	1574	354	19	701	10
Adj No. of Lanes	1	1	0	1	1	0	1	2	1	1	2	0
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	207	145	35	224	326	33	510	2274	1017	164	2295	33
Arrive On Green	0.11	0.11	0.11	0.07	0.21	0.21	0.68	0.68	0.68	0.68	0.68	0.68
Sat Flow, veh/h	1268	1375	331	1681	1576	161	736	3353	1500	230	3384	48
Grp Volume(v), veh/h	11	0	134	209	0	119	50	1574	354	19	347	364
Grp Sat Flow(s),veh/h/ln	1268	0	1706	1681	0	1736	736	1676	1500	230	1676	1756
Q Serve(g_s), s	0.8	0.0	7.5	6.7	0.0	5.7	2.9	28.0	9.8	5.4	8.3	8.3
Cycle Q Clear(g_c), s	0.8	0.0	7.5	6.7	0.0	5.7	11.2	28.0	9.8	33.4	8.3	8.3
Prop In Lane	1.00		0.19	1.00		0.09	1.00		1.00	1.00		0.03
Lane Grp Cap(c), veh/h	207	0	180	224	0	359	510	2274	1017	164	1137	1191
V/C Ratio(X)	0.05	0.00	0.75	0.93	0.00	0.33	0.10	0.69	0.35	0.12	0.31	0.31
Avail Cap(c_a), veh/h	486	0	555	224	0	742	510	2274	1017	164	1137	1191
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	39.7	0.0	42.7	40.3	0.0	33.2	8.7	9.6	6.7	19.7	6.4	6.4
Incr Delay (d2), s/veh	0.1	0.0	6.0	42.0	0.0	0.5	0.4	1.8	0.9	1.4	0.7	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	3.8	7.5	0.0	2.8	0.6	13.2	4.3	0.4	4.0	4.2
LnGrp Delay(d),s/veh	39.8	0.0	48.8	82.3	0.0	33.7	9.1	11.4	7.6	21.2	7.1	7.1
LnGrp LOS	D		D	F		C	A	B	A	C	A	A
Approach Vol, veh/h		145			328			1978			730	
Approach Delay, s/veh		48.1			64.7			10.6			7.5	
Approach LOS		D			E			B			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2	3	4		6		8				
Phs Duration (G+Y+Rc), s		72.9	10.0	15.5		72.9		25.5				
Change Period (Y+Rc), s		* 6.2	3.3	5.1		* 6.2		5.1				
Max Green Setting (Gmax), s		* 67	6.7	32.0		* 67		42.0				
Max Q Clear Time (g_c+I1), s		30.0	8.7	9.5		35.4		7.7				
Green Ext Time (p_c), s		23.9	0.0	0.9		6.8		0.8				
Intersection Summary												
HCM 2010 Ctrl Delay			17.2									
HCM 2010 LOS			B									
Notes												

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Lanes, Volumes, Timings
2: March Road & Halton Terrace/Maxwell Bridge Road

2028 Future Background

PM Peak Hour



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	79	67	76	96	60	141	270	1597	156	119	612	99
Future Volume (vph)	79	67	76	96	60	141	270	1597	156	119	612	99
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	30.0		0.0	30.0		0.0	60.0		0.0	60.0		15.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	60.0			60.0			70.0			70.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Fr _t		0.920			0.895				0.850			0.850
Fl _t Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1676	1624	0	1676	1579	0	1676	3353	1500	1676	3353	1500
Fl _t Permitted	0.328			0.530			0.351			0.057		
Satd. Flow (perm)	579	1624	0	935	1579	0	619	3353	1500	101	3353	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		50			103				102			91
Link Speed (k/h)		50			50			50				50
Link Distance (m)		202.9			283.1			221.3				684.3
Travel Time (s)		14.6			20.4			15.9				49.3
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
Adj. Flow (vph)	88	74	84	107	67	157	300	1774	173	132	680	110
Shared Lane Traffic (%)												
Lane Group Flow (vph)	88	158	0	107	224	0	300	1774	173	132	680	110
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6				3.6
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4				9.4
Detector 2 Size(m)		0.6			0.6			0.6				0.6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1		6
Permitted Phases	4			8			2		2	6		6

Lanes, Volumes, Timings
2: March Road & Halton Terrace/Maxwell Bridge Road

2028 Future Background

PM Peak Hour



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4		8	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	38.6	38.6		38.6	38.6		11.4	34.6	34.6	11.4	34.6	34.6
Total Split (s)	45.0	45.0		45.0	45.0		20.0	55.0	55.0	20.0	55.0	55.0
Total Split (%)	37.5%	37.5%		37.5%	37.5%		16.7%	45.8%	45.8%	16.7%	45.8%	45.8%
Maximum Green (s)	38.4	38.4		38.4	38.4		13.6	48.4	48.4	13.6	48.4	48.4
Yellow Time (s)	3.3	3.3		3.3	3.3		4.6	4.6	4.6	4.6	4.6	4.6
All-Red Time (s)	3.3	3.3		3.3	3.3		1.8	2.0	2.0	1.8	2.0	2.0
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)	6.6	6.6		6.6	6.6		6.4	6.6	6.6	6.4	6.6	6.6
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max	C-Max	None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0	7.0		7.0	7.0
Flash Dont Walk (s)	25.0	25.0		25.0	25.0			21.0	21.0		21.0	21.0
Pedestrian Calls (#/hr)	0	0		0	0			0	0		0	0
Act Effct Green (s)	17.1	17.1		17.1	17.1		85.6	72.5	72.5	81.4	70.5	70.5
Actuated g/C Ratio	0.14	0.14		0.14	0.14		0.71	0.60	0.60	0.68	0.59	0.59
v/c Ratio	1.07	0.58		0.80	0.72		0.54	0.88	0.18	0.63	0.35	0.12
Control Delay	168.6	39.9		88.0	38.3		9.3	27.9	6.3	37.4	14.9	4.7
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	168.6	39.9		88.0	38.3		9.3	27.9	6.3	37.4	14.9	4.7
LOS	F	D		F	D		A	C	A	D	B	A
Approach Delay		85.9			54.4			23.7			16.9	
Approach LOS		F			D			C			B	
Queue Length 50th (m)	~24.4	25.1		26.1	28.9		19.4	180.8	6.8	15.6	42.7	1.9
Queue Length 95th (m)	#49.4	44.4		44.1	53.0		38.7	#300.8	22.0	38.1	72.6	12.5
Internal Link Dist (m)		178.9			259.1			197.3			660.3	
Turn Bay Length (m)	30.0			30.0			60.0			60.0		15.0
Base Capacity (vph)	185	553		299	575		579	2026	947	256	1968	918
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	0.48	0.29		0.36	0.39		0.52	0.88	0.18	0.52	0.35	0.12

Intersection Summary

Area Type:	Other
Cycle Length:	120
Actuated Cycle Length:	120
Offset:	50 (42%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle:	125
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	1.07
Intersection Signal Delay:	28.8
Intersection LOS:	C
Intersection Capacity Utilization:	96.2%
ICU Level of Service:	F
Analysis Period (min):	15

~ Volume exceeds capacity, queue is theoretically infinite.

Lanes, Volumes, Timings
 2: March Road & Halton Terrace/Maxwell Bridge Road

2028 Future Background

PM Peak Hour

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: March Road & Halton Terrace/Maxwell Bridge Road



HCM 2010 Signalized Intersection Summary
 2: March Road & Halton Terrace/Maxwell Bridge Road

2028 Future Background
 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	79	67	76	96	60	141	270	1597	156	119	612	99
Future Volume (veh/h)	79	67	76	96	60	141	270	1597	156	119	612	99
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1765	1765	1765	1765	1765	1765
Adj Flow Rate, veh/h	88	74	84	107	67	157	300	1774	173	132	680	110
Adj No. of Lanes	1	1	0	1	1	0	1	2	1	1	2	1
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	176	173	196	238	108	252	491	1852	829	164	1697	759
Arrive On Green	0.23	0.23	0.23	0.23	0.23	0.23	0.10	0.55	0.55	0.06	0.51	0.51
Sat Flow, veh/h	1152	756	858	1223	470	1101	1681	3353	1500	1681	3353	1500
Grp Volume(v), veh/h	88	0	158	107	0	224	300	1774	173	132	680	110
Grp Sat Flow(s),veh/h/ln	1152	0	1613	1223	0	1570	1681	1676	1500	1681	1676	1500
Q Serve(g_s), s	8.9	0.0	10.0	9.8	0.0	15.4	10.0	60.4	7.0	4.5	15.1	4.7
Cycle Q Clear(g_c), s	24.3	0.0	10.0	19.9	0.0	15.4	10.0	60.4	7.0	4.5	15.1	4.7
Prop In Lane	1.00		0.53	1.00		0.70	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	176	0	369	238	0	360	491	1852	829	164	1697	759
V/C Ratio(X)	0.50	0.00	0.43	0.45	0.00	0.62	0.61	0.96	0.21	0.80	0.40	0.14
Avail Cap(c_a), veh/h	281	0	516	349	0	503	510	1852	829	262	1697	759
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	52.5	0.0	39.5	48.0	0.0	41.6	12.7	25.5	13.6	27.6	18.4	15.8
Incr Delay (d2), s/veh	2.2	0.0	0.8	1.3	0.0	1.8	2.0	13.1	0.6	9.1	0.7	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.9	0.0	4.6	3.4	0.0	6.8	4.9	31.2	3.0	2.6	7.2	2.0
LnGrp Delay(d),s/veh	54.7	0.0	40.3	49.4	0.0	43.4	14.7	38.6	14.2	36.7	19.1	16.2
LnGrp LOS	D		D	D		D	B	D	B	D	B	B
Approach Vol, veh/h		246			331			2247			922	
Approach Delay, s/veh		45.5			45.3			33.5			21.3	
Approach LOS		D			D			C			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	13.0	72.9		34.1	18.6	67.3		34.1				
Change Period (Y+Rc), s	* 6.4	6.6		6.6	* 6.4	6.6		6.6				
Max Green Setting (Gmax), s	* 14	48.4		38.4	* 14	48.4		38.4				
Max Q Clear Time (g_c+I1), s	6.5	62.4		26.3	12.0	17.1		21.9				
Green Ext Time (p_c), s	0.2	0.0		1.2	0.2	7.0		1.9				
Intersection Summary												
HCM 2010 Ctrl Delay			32.3									
HCM 2010 LOS			C									
Notes												

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.