Minto Communities and 2559688 Ontario Inc

936 March Road

Transportation Impact Study

2018-04

April 2020

C|G|H TRANSPORTATION

936 March Road Transportation Impact Assessment

Step 1 Screening Report

Step 2 Scoping Report

Step 3 Forecasting Report

Step 4 Analysis Report

Prepared for:

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PN: 2018-04

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A. TIA Update Context

This report has been updated following the submission of the Step 4 Strategy Report. This update will include incorporating all comments that were previously addressed through comment responses. It will also incorporate an updated unit count and comparison of the trip generation based on the updated unit counts. Based on the small change in unit counts it is anticipated that the trip generation will not be significantly changed and therefore the analysis that was originally presented as part of this TIA will remain unchanged and therefore the conclusions of this TIA will remain unchanged. In the original TIA the development concept included 455 single detached units and 401 townhouse units. The updated concept plan includes 353 single detached units and 575 townhouse units. The resultant change in trip generation will be further discussed in Section 3.1. As a full TIA was triggered and has been completed the original screening form has been included with this updated TIA. For additional context, while most of the comments have been addressed herein, the comment response memo has been appended as requested by the City of Ottawa.

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.

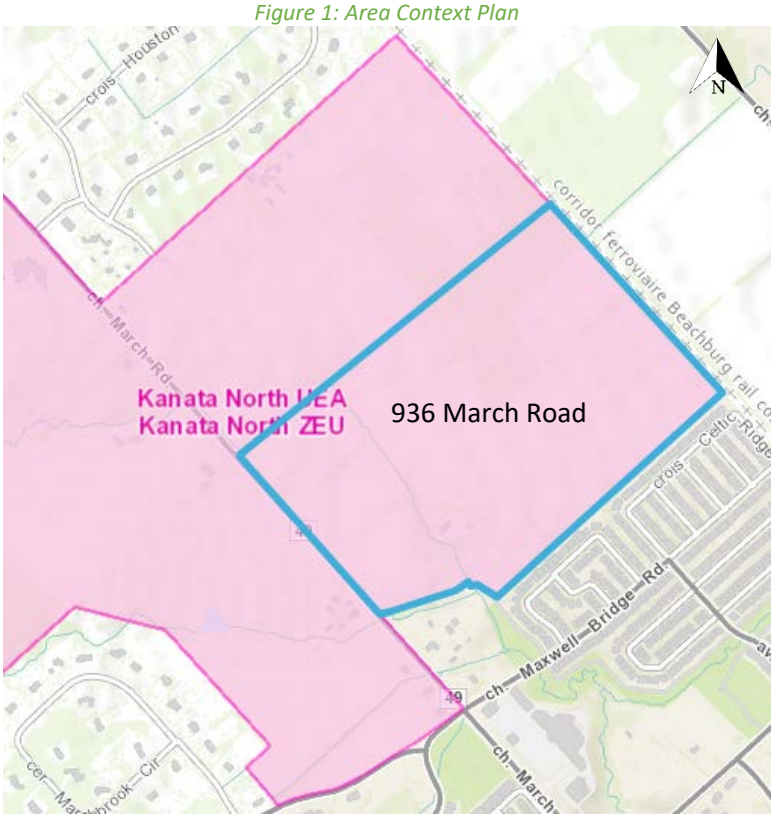
2 Scoping

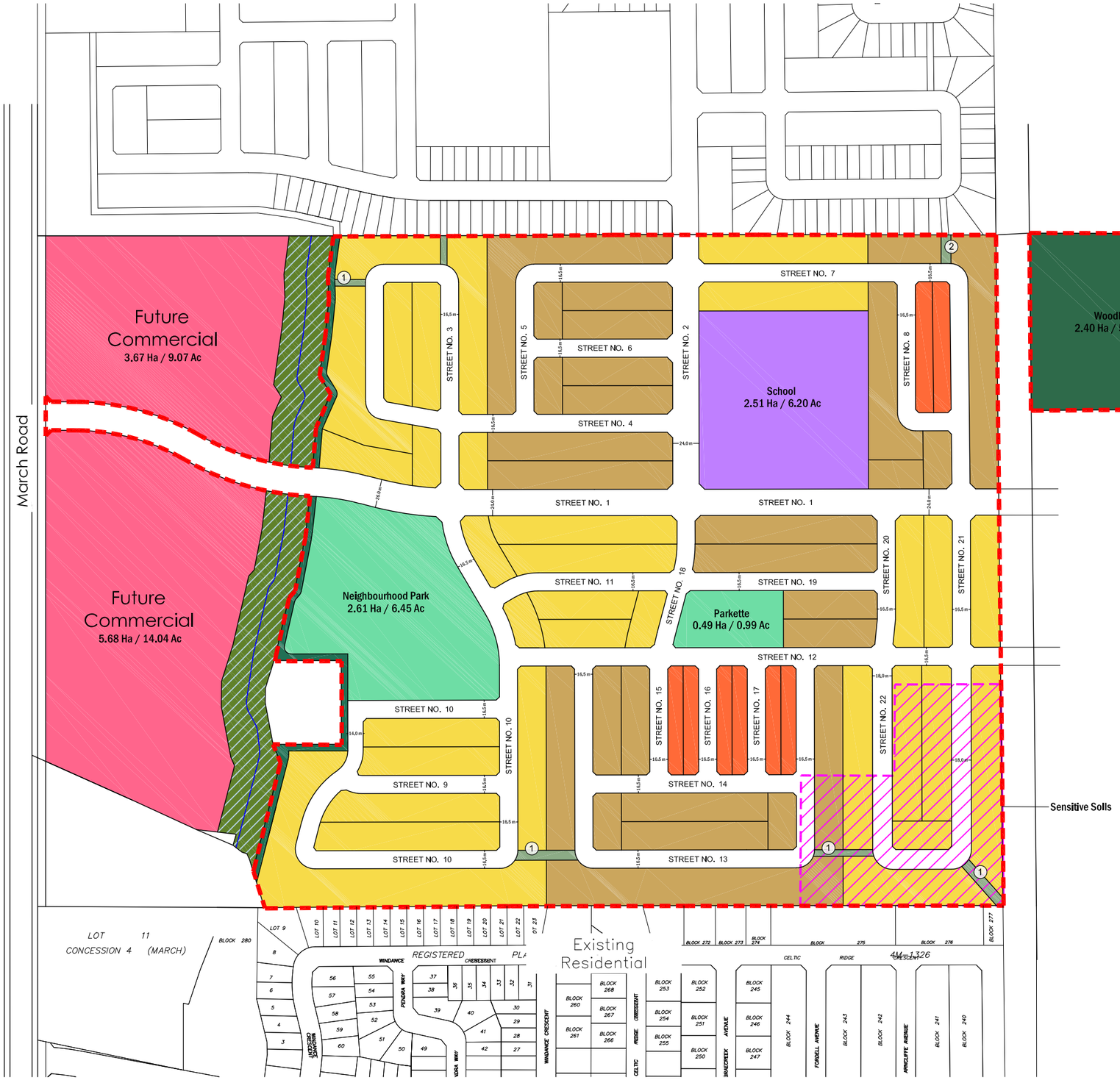
2.1 Existing and Planned Conditions

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 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





CONCEPT PLAN.

OTHER LANDS

minto Communities

Kanata North

LEGEND

- Single Detached
- Executive Townhomes
- Avenue Townhomes
- Commercial
- School
- Storm Pond
- Park
- Service Block
- Woodlot
- Creek Buffer
- Creek
- Sensitive Soils

NOTE

1. Service block may shift to create efficient lotting in the abutting residential blocks
2. Service block will need to align with the community to the north but may shift slightly to create efficient lotting in the abutting residential blocks

NORTH

421 RONCESVALLES AVENUE, TORONTO, ON M6R 2N1 CANADA
T 416.340.8700 F 416.340.7100 NAKDESIGNSTRATEGIES.COM

SCALE | 1:4000 (0, 20M, 40M, 60M)

DATE | 03.30.2020 **PROJECT |** 18-142

LU-11-1

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.

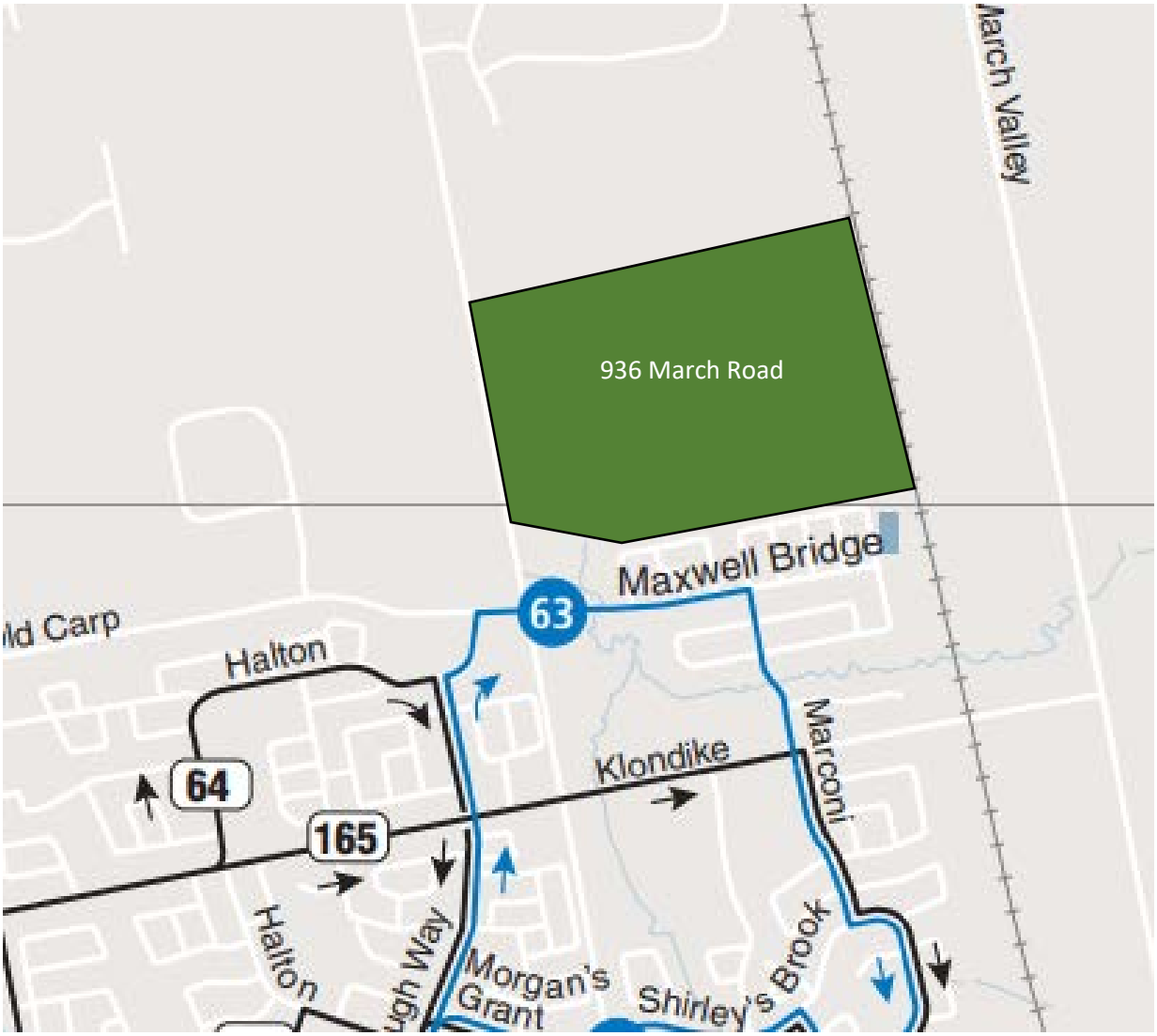
Figure 4: March Road Site Photo - August 8, 2018

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

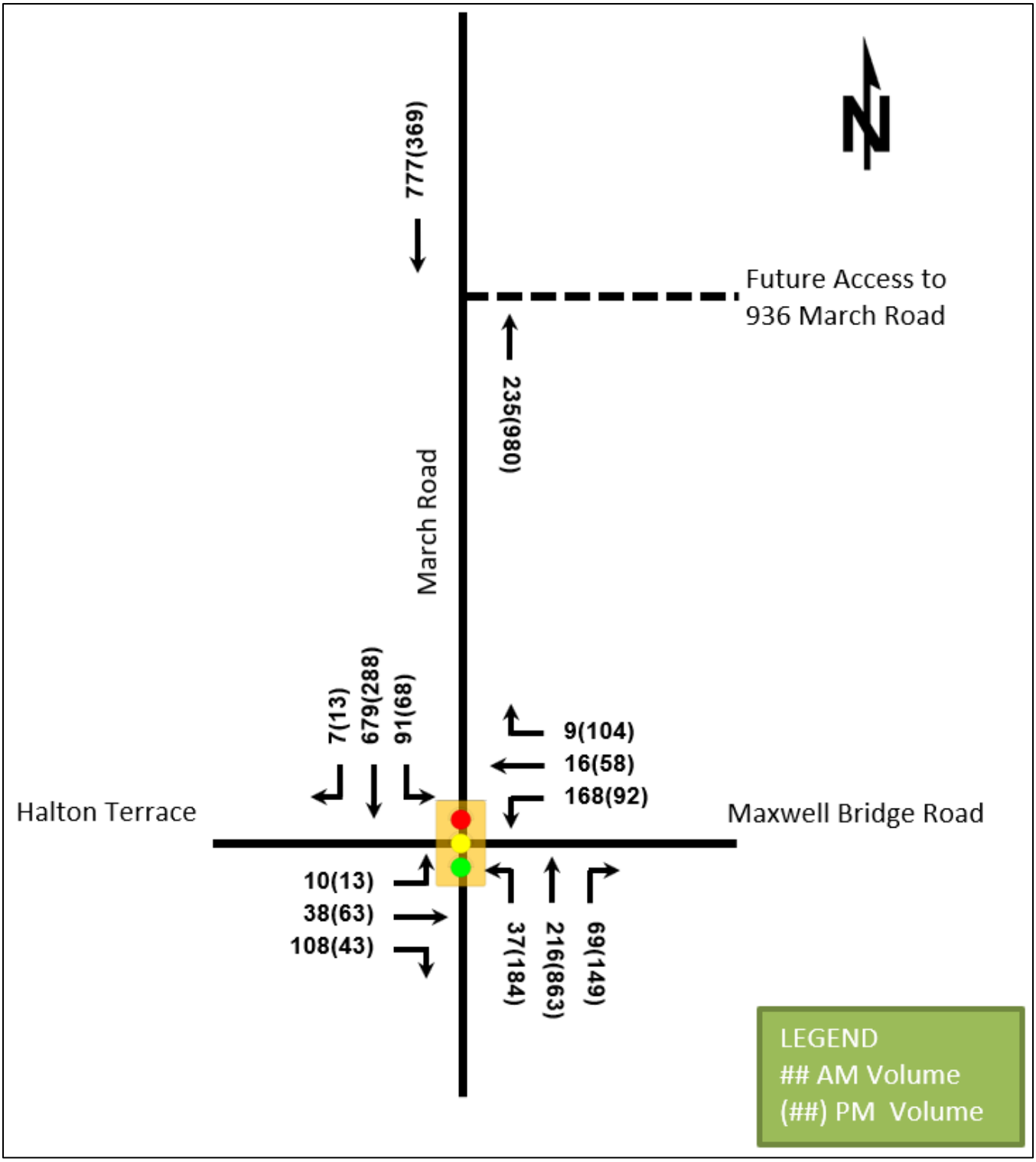
Existing turning movement counts were acquired from the City of Ottawa for the existing Study Area intersection. Table 1 summarizes the intersection count dates.

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	54%
	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 polices 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.

The ultimate and interim cross-section for March Road, considered in the CDP, include northbound and southbound cycling tracks. These will be carried through the intersection of March Road at Street 1.

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 4 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).

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 TIA Trip Generation Update and Comparison

As discussion in the pre-amble to this report, the unit count has changed based on updates to the plan of subdivision. The unit count changes are summarized in Table 8.

Table 8: Unit Change Comparison

Unit Type	Original Unit Count	Updated Unit Count	Change	Percent Change
Single-Detached Dwellings	455	353	-102	-22%
Townhouse Units	401	575	+174	+43%

The unit count has increased overall by 70 units, however, as the mix of unit types has changed, and therefore the trip generation has not necessarily increased. A comparison of the trip generation, using the same factors as Section 3.1.1, has been prepared and is summarized in Table 9

Table 9: Updated Total Person Trip Generation

Land Use	Units	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
Single Detached	353	81	244	325	276	162	438
Townhouse	575	74	248	322	228	134	362
Total Person Trips		**155**	**492**	**647**	**504**	**296**	**800**

The total updated person trip generation, presented in Table 9, have been compared to the total original person trip generation, presented in Table 10. This comparison is summarized in Table 10.

Table 10: Trip Generation Comparison

Land Use	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
Original Trip Gen	157	487	644	517	304	821
Updated Trip Gen	155	492	647	504	296	800
Change	**-2**	**5**	**3**	**-13**	**-8**	**-21**
Percent Change	**-1.3%**	**1.0%**	**0.5%**	**-2.5%**	**-2.6%**	**-2.6%**

As shown above, while the overall unit count has changed, due to the change in unit types, the trip generation is very similar to what was analyzed previously. Given the small change in trip generation, less than 3% and generally a reduction in trips, the change in units counts will not impact the results of the analysis presented in this report and therefore the analysis has been carried forward using the original unit count.

3.1.3 Trip Distribution

To understand the travel patterns of the subject development the OD Survey has been reviewed to determine the existing travel patterns. Table 11 below summarizes the distribution.

Table 11: OD Survey Existing Mode Share – Kanata/Stittsville

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

3.1.4 Trip Assignment

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

Figure 7: Traffic Assignment (%)

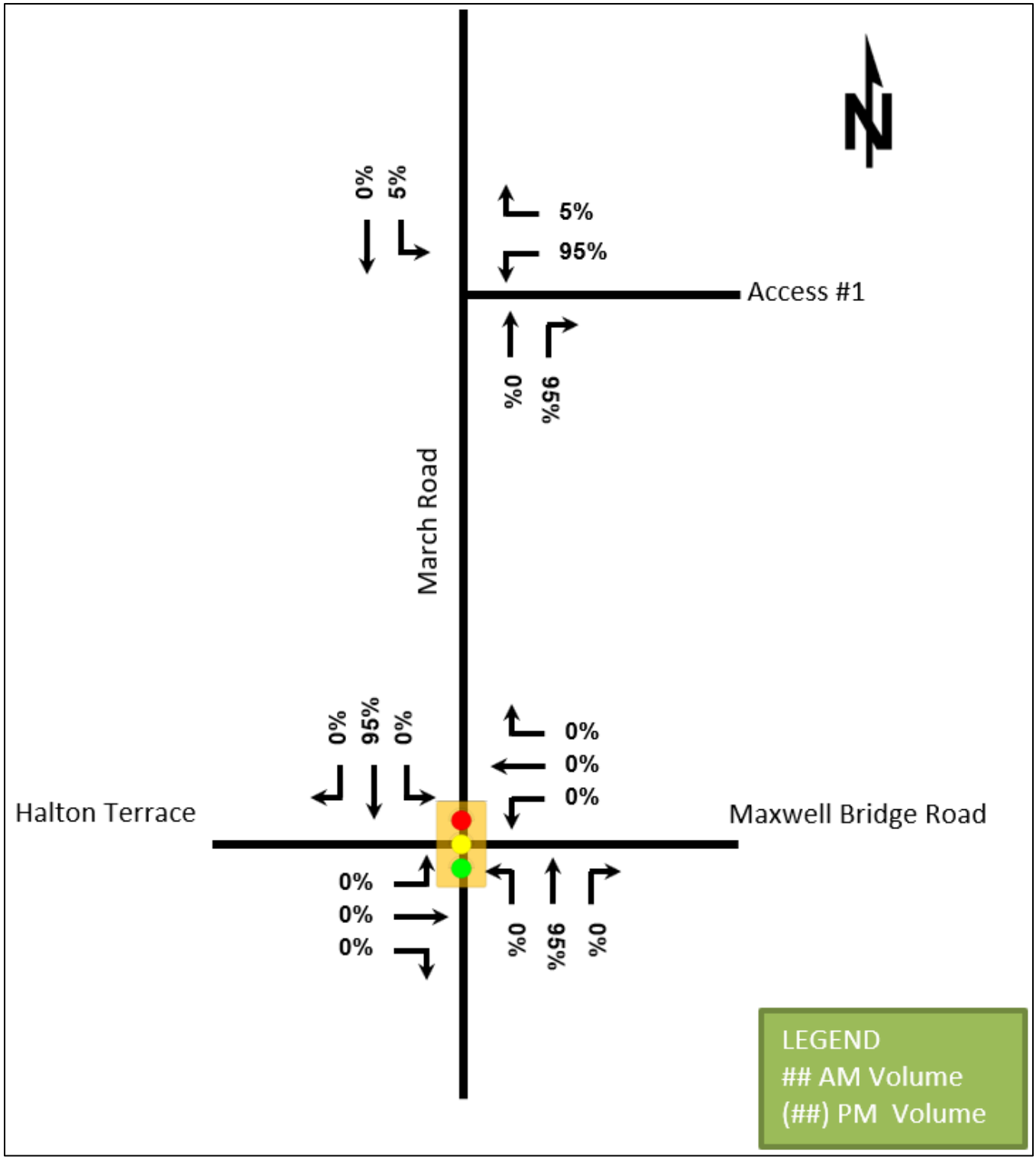
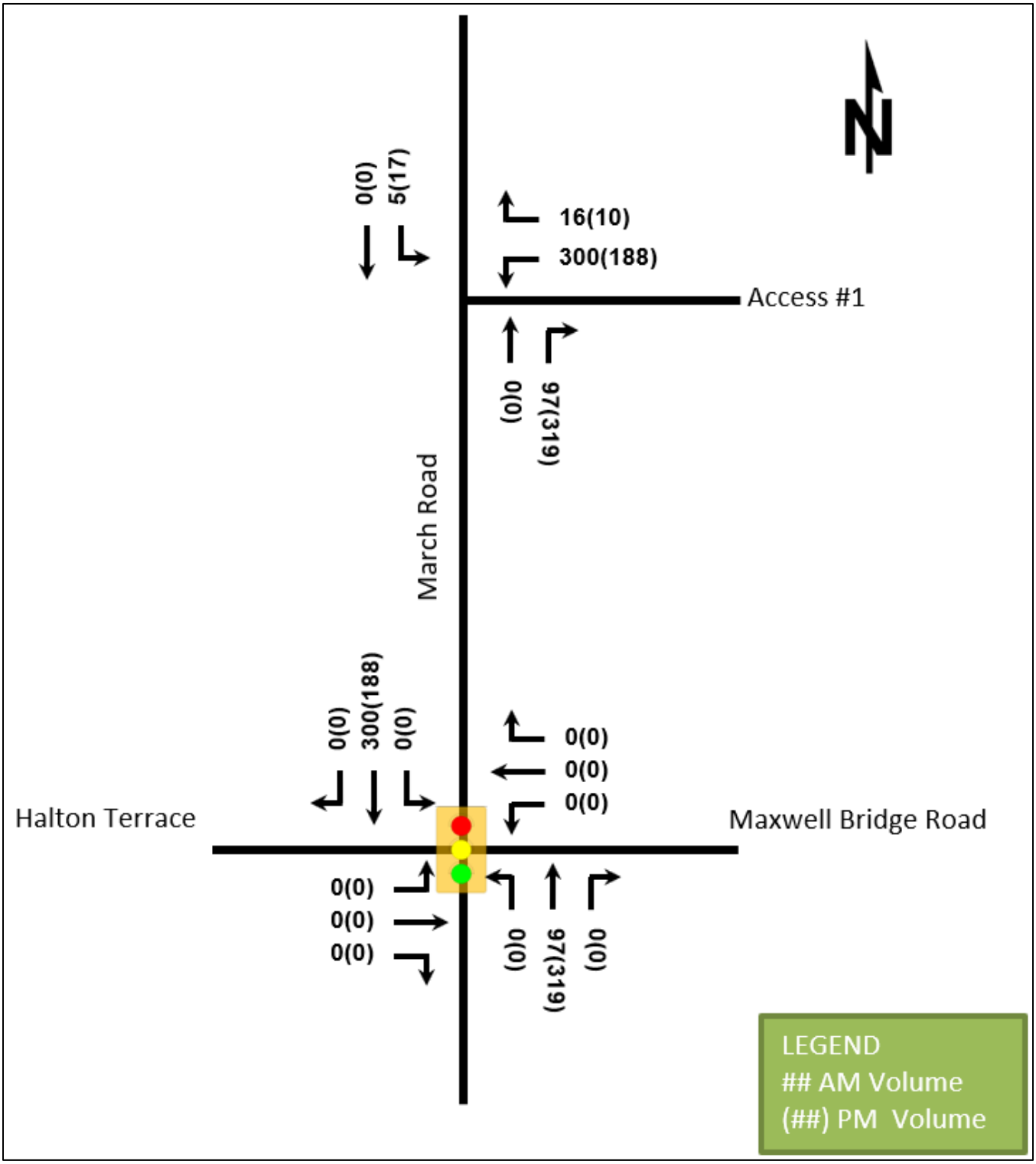


Figure 8: Assignment (Volumes)



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

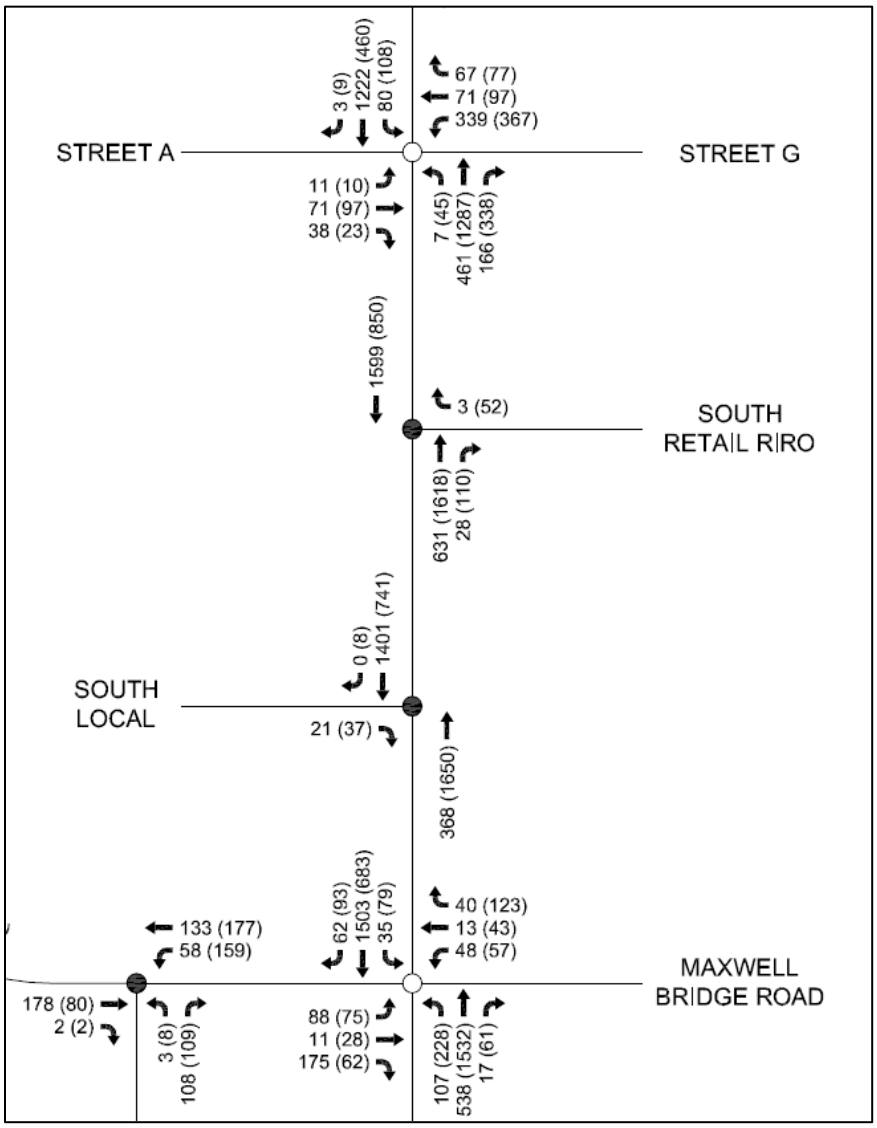


Figure 10: 2023 Future Background Traffic

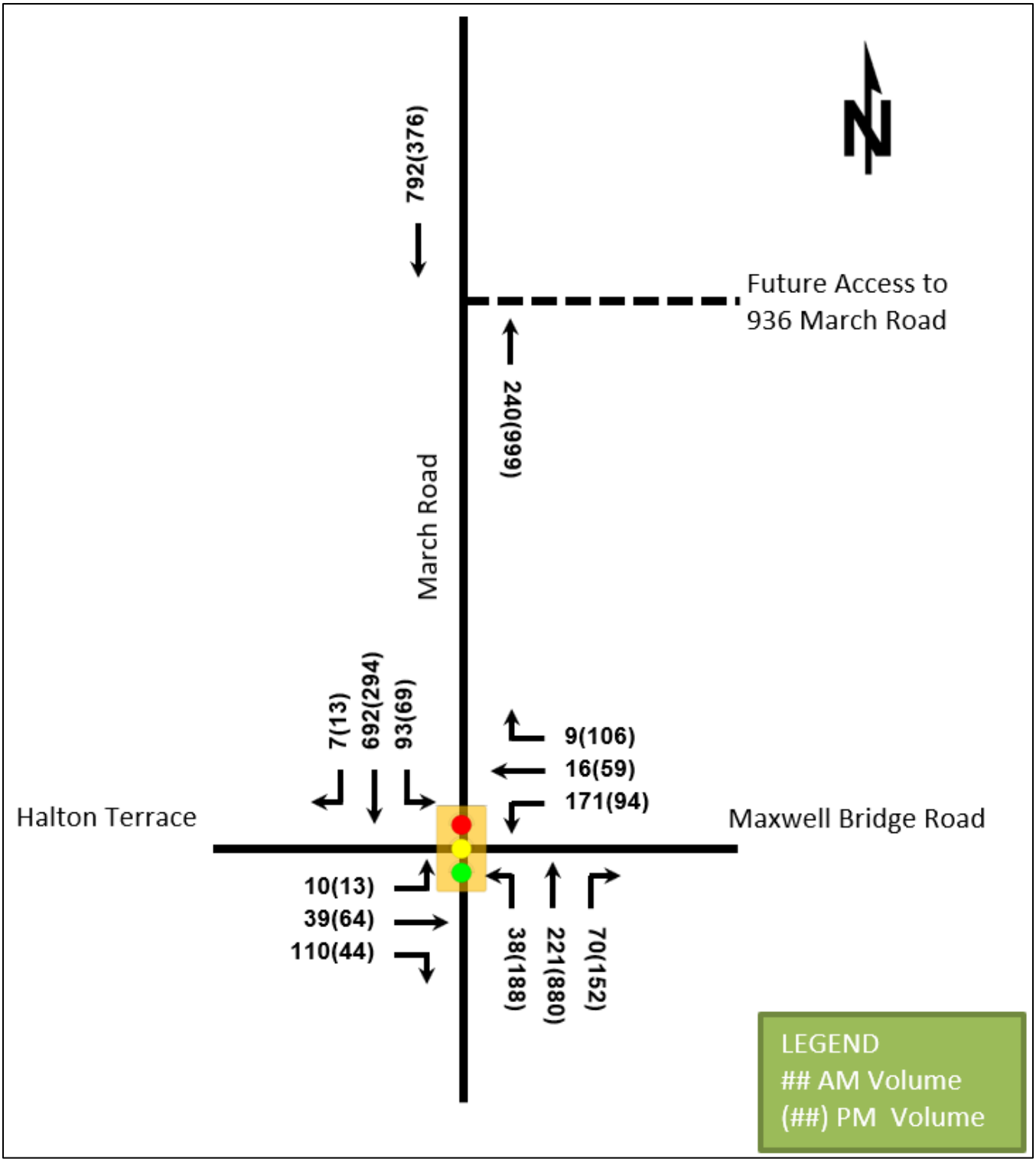
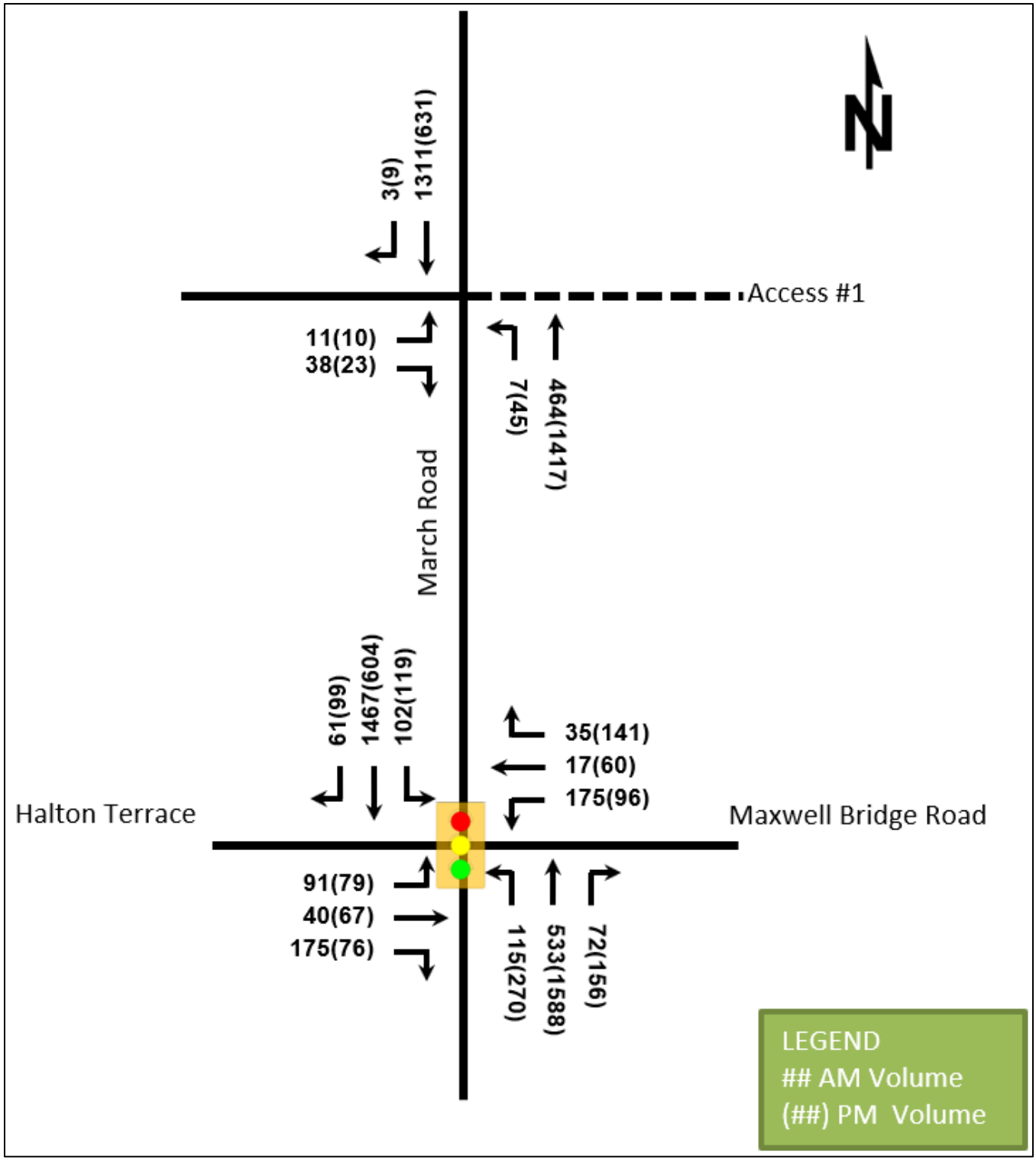


Figure 11: 2028 Future Background Traffic Volumes



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

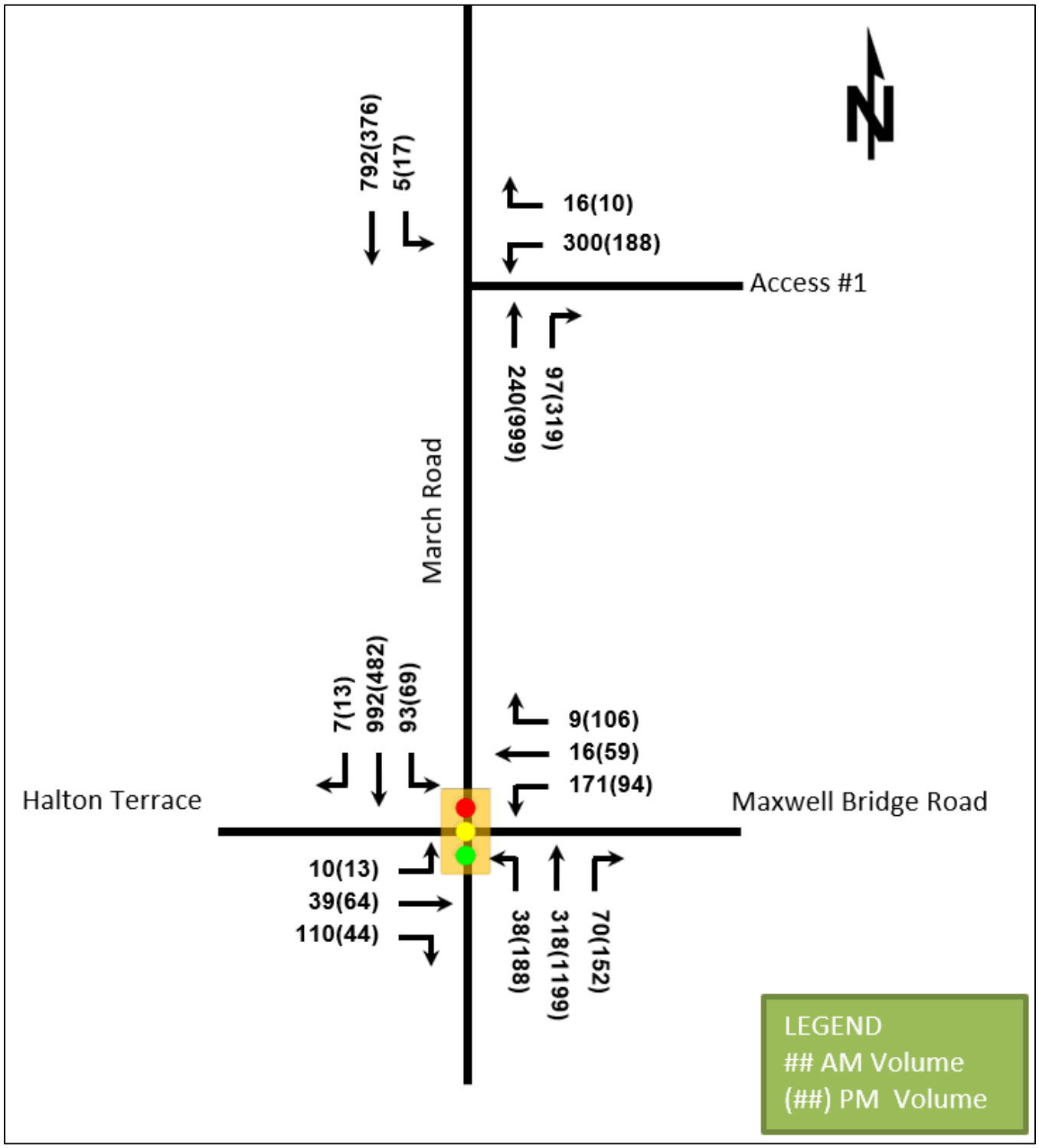
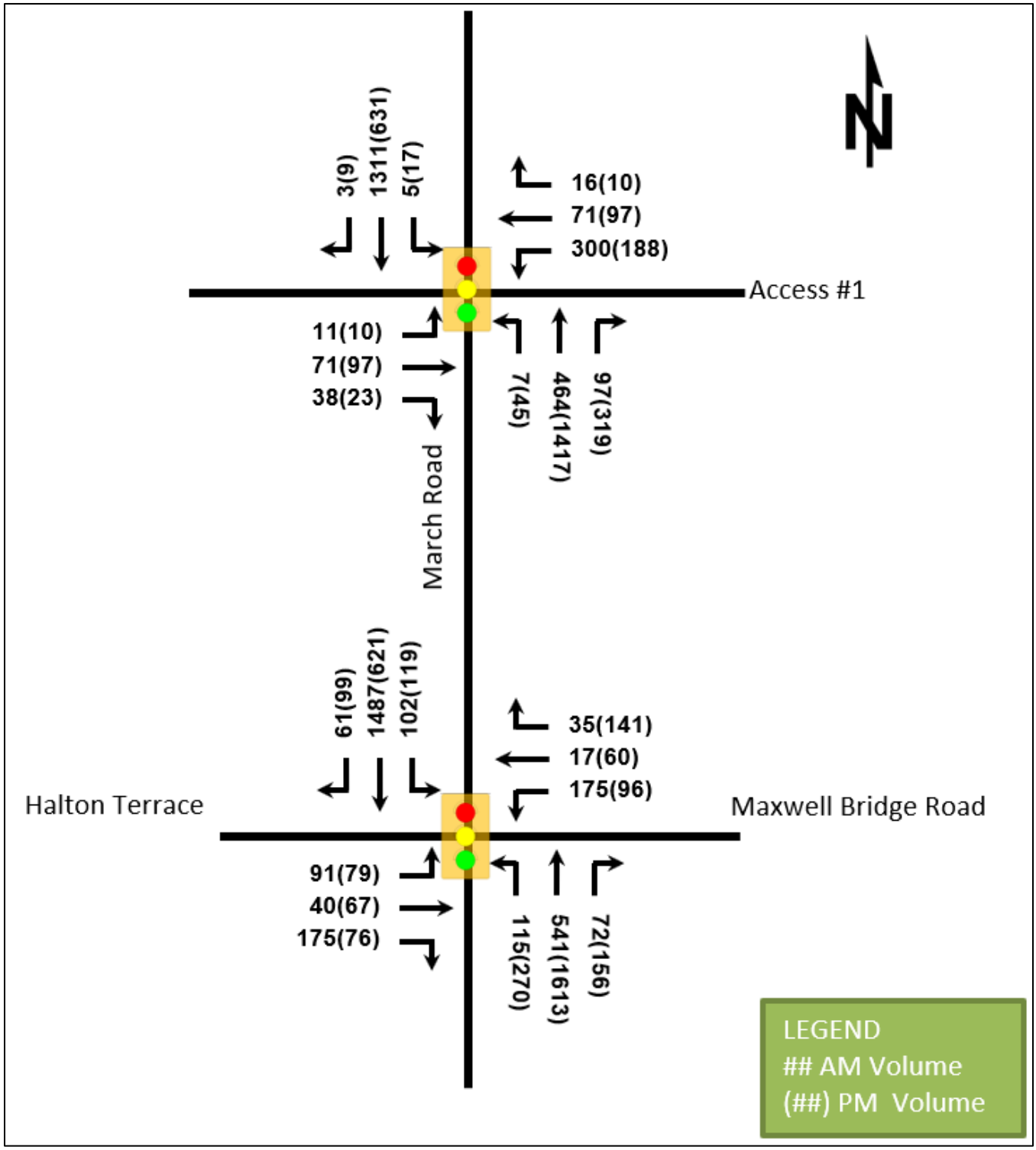


Figure 13: 2028 Future Total Traffic Volumes



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 80% of the subject development would be within the 400-metre walking distance to a transit stop. The remaining 20% would be within 500-metre walking distance to a transit stop. While ideally 100% of the units would be within a 400-metre walking distance, due to the subdivision layout, this is not possible as it would create a long loop for the buses that would not be efficient. In the fullness of time Street 1 will be extended to the east, allowing bus stops to be located such that most of the development would be within a 400-metre walking distance of the bus stops.

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 from March Road to the first local road intersection, where the ROW narrows to a 24 metre right-of-way. 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. most other local roads will serve lots on both sides and will have 16.5-metre ROWs. One section in the southeast corner will have 18 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 Stop Location (Approx.)
- Sidewalk Location (Proposed)
- MUP Location (Proposed)
- Areas Beyond Transit Coverage (400 m)

Future Commercial
3.67 Ha / 9.07 Ac

Future Commercial
5.68 Ha / 14.04 Ac

Neighbourhood Park
2.61 Ha / 6.45 Ac

School
2.51 Ha / 6.20 Ac

Parkette
0.49 Ha / 0.99 Ac

Existing Residential

March Road

STREET NO. 1
STREET NO. 2
STREET NO. 3
STREET NO. 4
STREET NO. 5
STREET NO. 6
STREET NO. 7
STREET NO. 8
STREET NO. 9
STREET NO. 10
STREET NO. 11
STREET NO. 12
STREET NO. 13
STREET NO. 14
STREET NO. 15
STREET NO. 16
STREET NO. 17
STREET NO. 18
STREET NO. 19
STREET NO. 20
STREET NO. 21
STREET NO. 22

REV:	DESCRIPTION:	BY:	DATE:
04	Revised Subdivision	JK	20/04/23

STATUS: Draft

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

CLIENT: Minto Communities

CIVIL ENGINEER: DSEL

SITE: 936 March Road

TITLE: Transit & Active Modes

SCALE AT A3:	DATE:	DRAWN:	CHECKED:
NTS	2020-04-23	JK	MC
PROJECT NO:	DRAWING NO:		REVISION:
2018-04	014		04

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.

A secondary interim access has been confirmed to the north of the proposed development. This will provide temporary secondary access along the road that will ultimately be the final secondary access. This will avoid an unnecessary additional crossing of the creek between the residential and commercial portions of the property.

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 12 summarizes the transit trip generation.

Table 12: 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 Transportation Area of Interest (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 13 summarizes the operational analysis of 2018 existing conditions. Appendix F contains the 2018 Existing Conditions Synchro sheets.

Table 13: 2018 Existing Conditions Operational Analysis

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95th)	LOS	Delay	V/C	Q (95th)
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 14 summarizes the operational analysis of 2023 future background conditions.

Table 14: 2023 Future Background Conditions Operational Analysis

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95th)	LOS	Delay	V/C	Q (95th)
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 15 summarizes the operational analysis of 2028 future background conditions

Table 15: 2028 Future Background Conditions Operational Analysis

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95th)	LOS	Delay	V/C	Q (95th)
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.

It was noted through comments from the City of Ottawa that the all-red time for the westbound left cannot equal zero. This would be a minor change and has not been incorporated as this change would not impact the conclusions or recommendations of this report.

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 16 summarizes the operational analysis of 2023 total future conditions.

Table 16: 2023 Total Future Conditions Operational Analysis

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95th)	LOS	Delay	V/C	Q (95th)
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 17 summarizes the operational analysis of 2023 total future conditions.

Table 17: 2028 Total Future Conditions Operational Analysis

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95th)	LOS	Delay	V/C	Q (95th)
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 PETSI 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 18 summarizes the PETSI score evaluation for the proposed signalized intersection of Halton Terrace/Maxwell Bridge Road at March Road.

Table 18: PETSI Score Halton Terrace/Maxwell Bridge Road at March Road

	Crossing East West			Crossing North South		
Element	**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	
PETSI LOS	Actual	20	F	Actual	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 19 summarizes the PETSI score evaluation for the proposed signalized intersection of Street 1 at March Road.

Table 19: PETSI Score Street 1 at March Road

	Crossing East West			Crossing North South		
Element	**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	
PETSI LOS	Actual	25	F	Actual	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 20 summarizes the BLOS for the intersection of Halton Terrace/Maxwell Bridge Road at March Road.

Table 20: 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 ≤ 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, ≥ 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 21 summarizes the BLOS for the intersection of Street 1 at March Road.

Table 21: 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.
    a. *This report has been updated based on an updated unit count, which includes 353 detached homes and 575 townhomes. The trip generation was recalculated based on the updated unit counts. It was found that the change in unit counts will result in a 1.0% increase in site trip generation in the AM peak hour and a 2.5% increase in site trip generation in the PM peak hour. Therefore, the unit count change does not impact the trip generation and the analysis, based on the original unit count, is an accurate representation of the impact of the proposed development.*
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.

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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 licensed[1] or registered[2] professional in good standing, whose field of expertise [check √ appropriate field(s)] is either transportation engineering √ or transportation planning □.

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

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Dated at ___Newmarket_____ this __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

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City of Ottawa 2017 TIA Guidelines
Step 1 - Screening Form

Date: 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

Transportation Services - Traffic Services

W.O. 36161

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									
		Northbound				Southbound					Eastbound				Westbound					
Time Period		LT	ST	RT	N TOT	LT	ST	RT	S TOT	STR TOT	LT	ST	RT	E TOT	LT	ST	RT	W TOT	STR TOT	Grand Total
07:00	07:15	3	31	10	**45**	15	153	0	**168**	**213**	4	5	16	**25**	35	1	0	**36**	**61**	**274**
07:15	07:30	6	41	12	**59**	14	196	0	**210**	**269**	0	6	12	**18**	25	0	0	**25**	**43**	**312**
07:30	07:45	5	31	9	**45**	13	168	1	**182**	**227**	0	5	19	**24**	38	0	0	**38**	**62**	**289**
07:45	08:00	8	43	7	**59**	25	192	0	**217**	**276**	0	10	15	**25**	41	1	2	**44**	**69**	**345**
08:00	08:15	6	55	18	**80**	20	173	3	**196**	**276**	1	6	28	**35**	36	0	4	**40**	**75**	**351**
08:15	08:30	10	46	18	**74**	22	172	0	**194**	**268**	2	12	26	**40**	43	4	1	**48**	**88**	**356**
08:30	08:45	10	61	17	**88**	26	160	0	**186**	**274**	2	12	23	**38**	34	6	1	**41**	**79**	**353**
08:45	09:00	11	52	15	**79**	22	167	4	**193**	**272**	4	8	30	**42**	53	6	3	**62**	**104**	**376**
09:00	09:15	7	71	14	**92**	13	132	1	**146**	**238**	3	3	17	**23**	29	4	4	**37**	**60**	**298**
09:15	09:30	4	52	8	**68**	17	129	1	**147**	**215**	1	8	24	**33**	25	3	6	**34**	**67**	**282**
09:30	09:45	6	62	25	**93**	19	141	0	**160**	**253**	0	4	18	**22**	22	6	5	**33**	**55**	**308**
09:45	10:00	9	63	8	**80**	14	110	2	**126**	**206**	1	8	12	**21**	26	3	6	**35**	**56**	**262**
11:30	11:45	10	83	30	**123**	10	84	7	**101**	**224**	5	7	5	**17**	22	7	10	**39**	**56**	**280**
11:45	12:00	18	93	27	**139**	15	82	1	**98**	**237**	1	6	15	**22**	32	4	11	**47**	**69**	**306**
12:00	12:15	18	94	40	**153**	18	72	5	**95**	**248**	1	5	11	**18**	33	9	11	**53**	**71**	**319**
12:15	12:30	21	94	31	**147**	19	88	4	**111**	**258**	1	7	5	**13**	23	6	12	**41**	**54**	**312**
12:30	12:45	12	78	40	**132**	20	80	0	**100**	**232**	1	7	7	**15**	34	7	12	**53**	**68**	**300**
12:45	13:00	17	94	26	**137**	13	87	2	**102**	**239**	0	7	11	**18**	37	2	16	**55**	**73**	**312**
13:00	13:15	24	98	20	**143**	19	85	4	**108**	**251**	0	8	18	**26**	24	9	23	**56**	**82**	**333**
13:15	13:30	9	72	24	**107**	14	77	2	**93**	**200**	0	12	12	**24**	29	3	22	**54**	**78**	**278**
15:00	15:15	12	113	28	**153**	11	74	3	**88**	**241**	1	10	9	**20**	16	3	20	**39**	**59**	**300**
15:15	15:30	20	139	25	**185**	14	87	1	**102**	**287**	1	9	11	**21**	17	14	15	**46**	**67**	**354**
15:30	15:45	27	192	31	**253**	17	73	1	**91**	**344**	4	8	9	**21**	25	9	32	**66**	**87**	**431**
15:45	16:00	20	163	25	**209**	19	85	2	**106**	**315**	3	7	7	**17**	11	16	27	**54**	**71**	**386**
16:00	16:15	25	179	27	**231**	20	75	3	**98**	**329**	6	10	11	**27**	25	12	21	**58**	**85**	**414**
16:15	16:30	31	231	29	**291**	10	77	5	**92**	**383**	5	12	4	**21**	25	12	23	**60**	**81**	**464**
16:30	16:45	34	185	29	**248**	15	59	2	**76**	**324**	3	7	14	**24**	22	15	26	**63**	**87**	**411**
16:45	17:00	47	217	40	**305**	22	65	5	**92**	**397**	1	9	9	**19**	22	12	24	**58**	**77**	**474**
17:00	17:15	49	218	34	**302**	18	56	3	**77**	**379**	2	16	11	**29**	30	13	22	**65**	**94**	**473**
17:15	17:30	48	235	41	**324**	17	80	3	**100**	**424**	4	17	12	**33**	22	14	30	**66**	**99**	**523**
17:30	17:45	35	184	33	**253**	10	84	2	**96**	**349**	6	20	11	**37**	17	18	27	**62**	**99**	**448**
17:45	18:00	34	190	29	**254**	15	62	0	**77**	**331**	1	14	12	**27**	26	10	25	**61**	**88**	**419**
TOTAL:		596	3560	770	**4951**	536	3425	67	**4028**	**8979**	64	285	444	**795**	899	229	441	**1569**	**2364**	**11343**

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

	MARCH RD			HALTON TERR/MAXWELL BRIDGE RD			
Time Period	Northbound	Southbound	**Street Total**	Eastbound	Westbound	**Street Total**	**Grand 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.

Transportation Services - Traffic Services

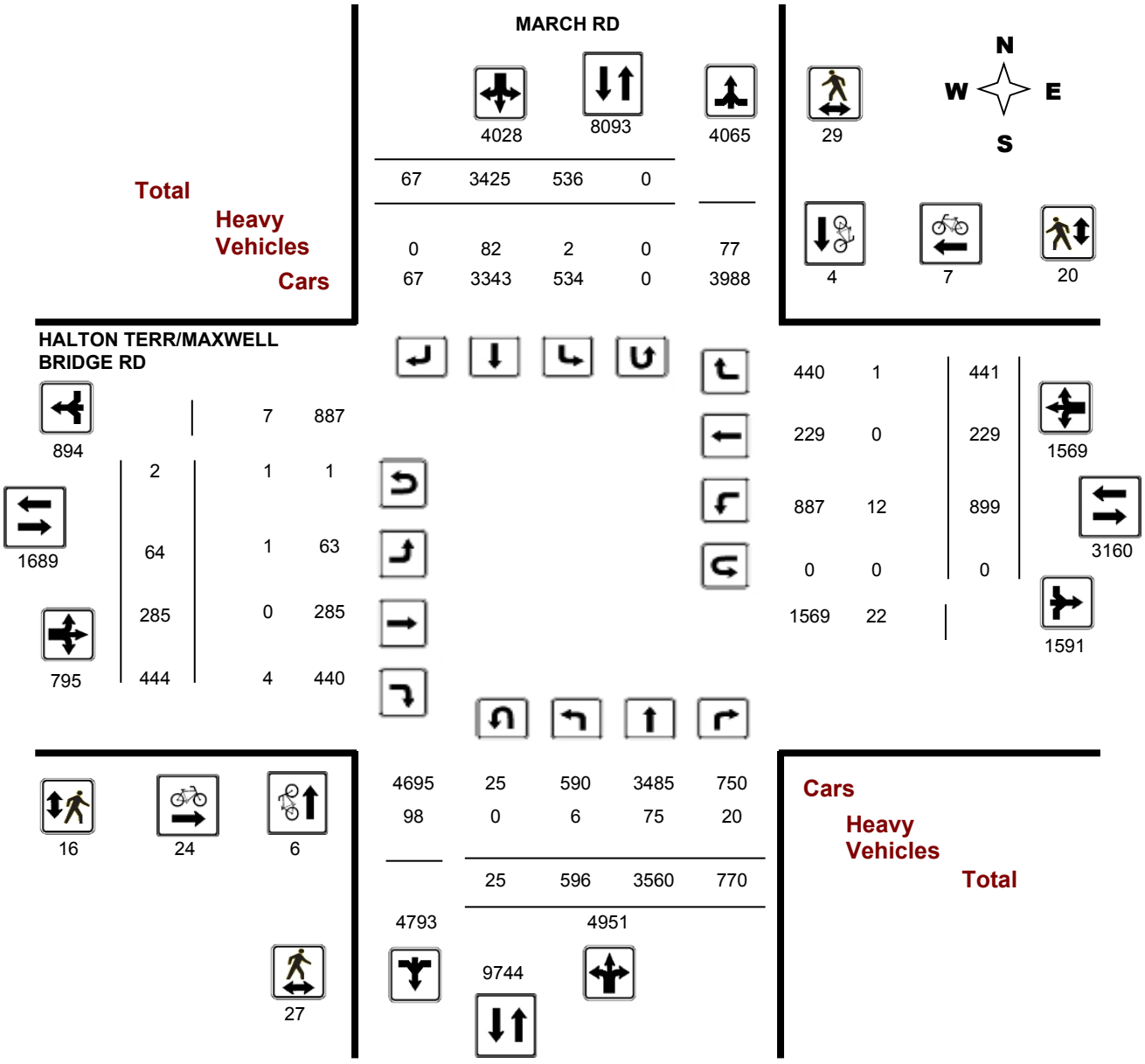
Turning Movement Count - Full Study Diagram

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

		MARCH RD									HALTON TERR/MAXWELL BRIDGE RD									
		Northbound				Southbound					Eastbound				Westbound					
Time Period		LT	ST	RT	N TOT	LT	ST	RT	S TOT	STR TOT	LT	ST	RT	E TOT	LT	ST	RT	W TOT	STR TOT	Grand Total
07:00	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:

Transportation Services - Traffic Services

Work Order 36161

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

	MARCH RD									HALTON TERR/MAXWELL BRIDGE RD									
	Northbound				Southbound					Eastbound				Westbound					
Period	LT	ST	RT	**NB TOT**	LT	ST	RT	**SB TOT**	**STR TOT**	LT	ST	RT	**EB TOT**	LT	ST	RT	**WB TOT**	**STR TOT**	**Grand Total**
07:00 08:00	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.

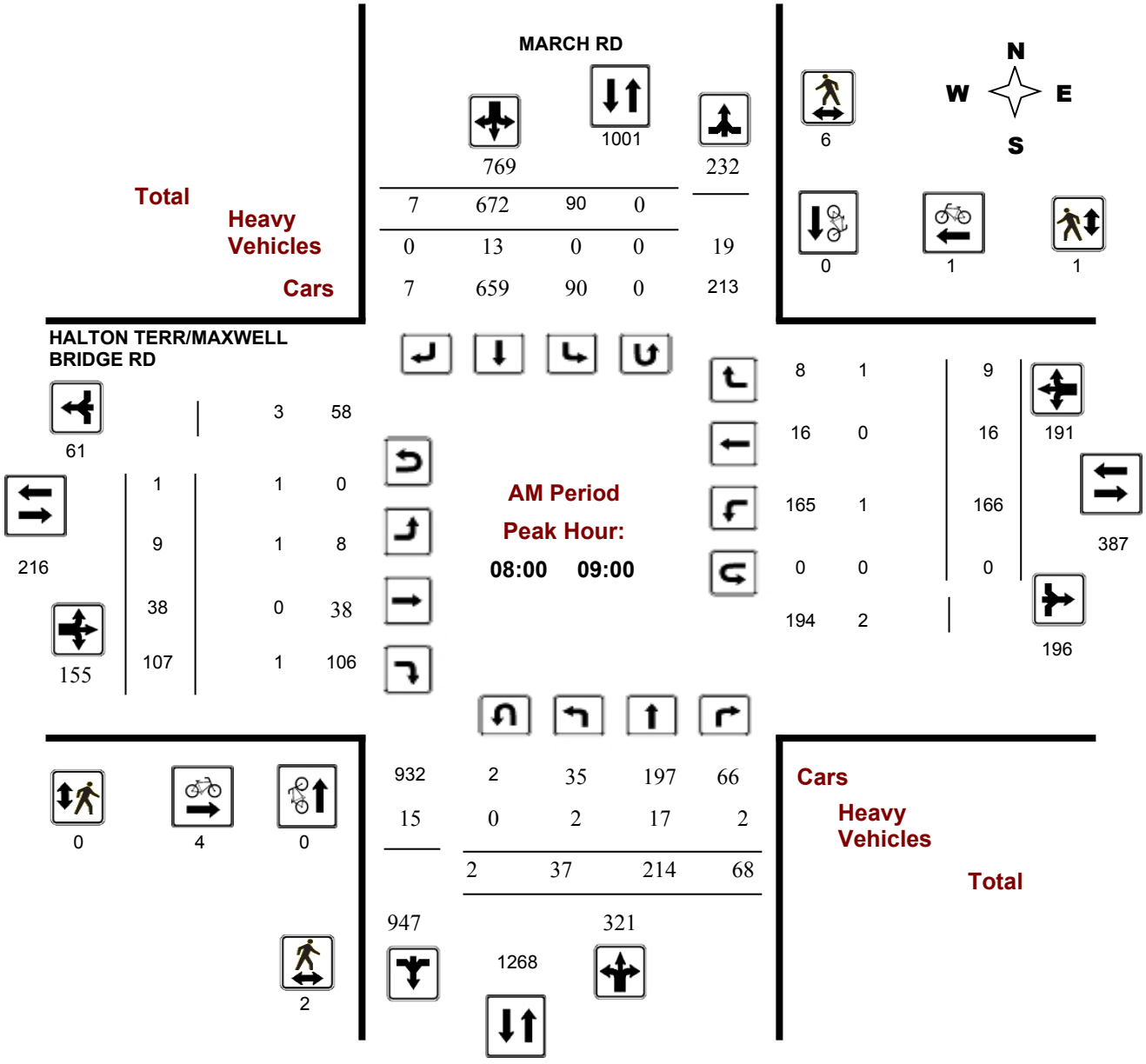
Transportation Services - Traffic Services

Turning Movement Count - Full Study Peak Hour Diagram

HALTON TERR/MAXWELL BRIDGE RD @ MARCH RD

Survey Date: Wednesday, August 10, 2016 **WO No:** 36161

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



Comments

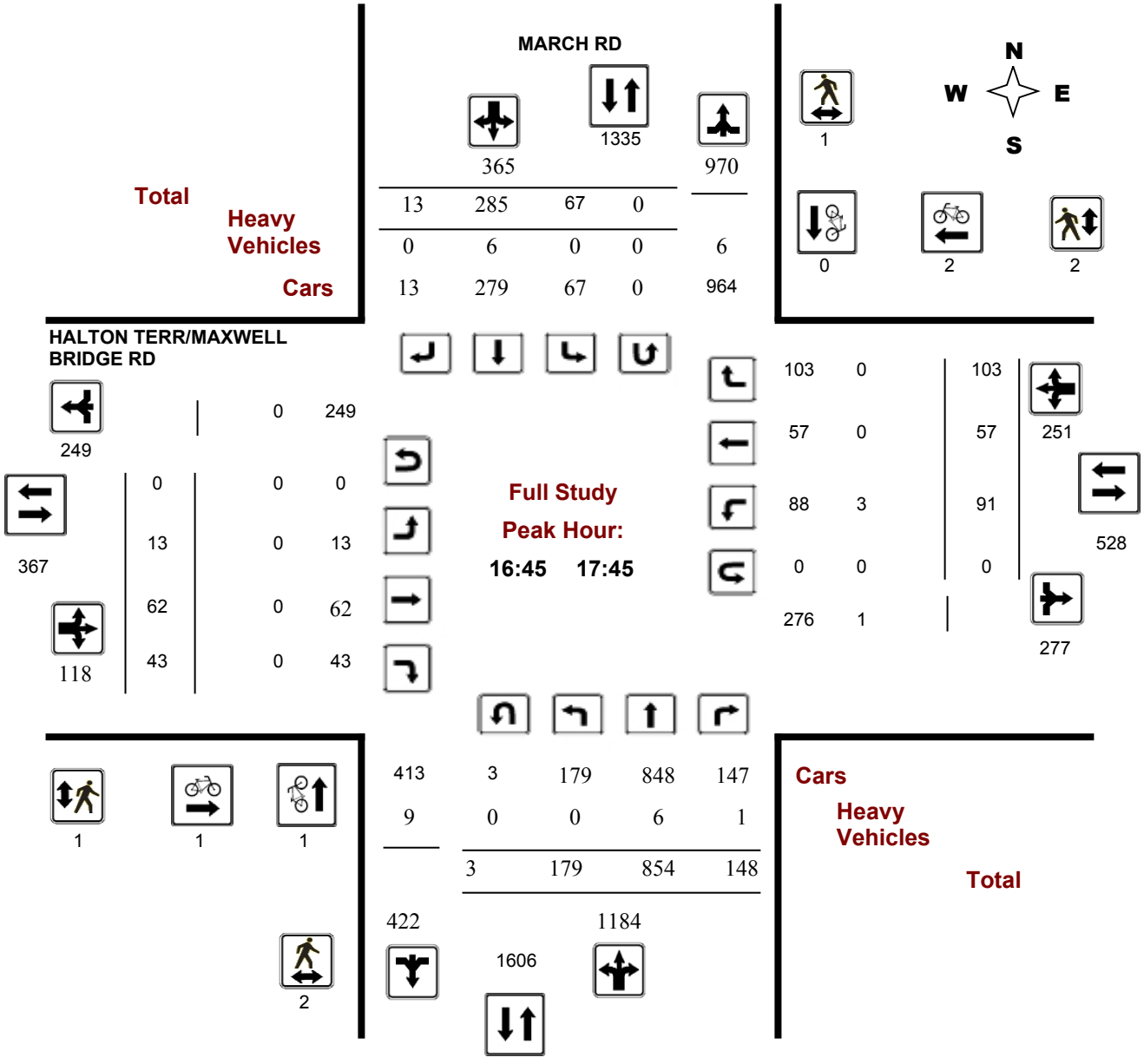
Transportation Services - Traffic Services

Turning Movement Count - Full Study Peak Hour Diagram

HALTON TERR/MAXWELL BRIDGE RD @ MARCH RD

Survey Date: Wednesday, August 10, 2016 **WO No:** 36161

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



Comments

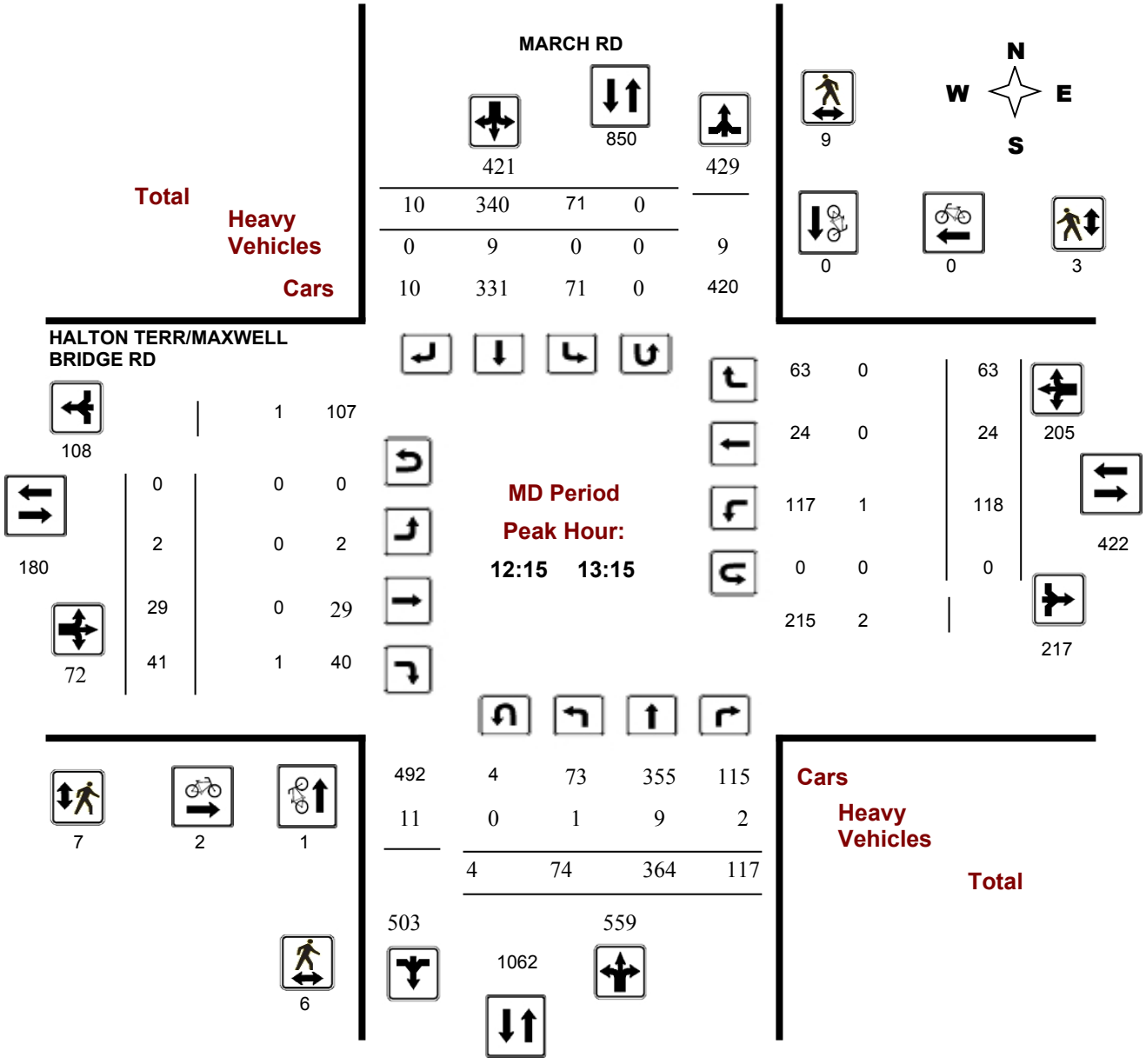
Transportation Services - Traffic Services

Turning Movement Count - Full Study Peak Hour Diagram

HALTON TERR/MAXWELL BRIDGE RD @ MARCH RD

Survey Date: Wednesday, August 10, 2016 **WO No:** 36161

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



Comments

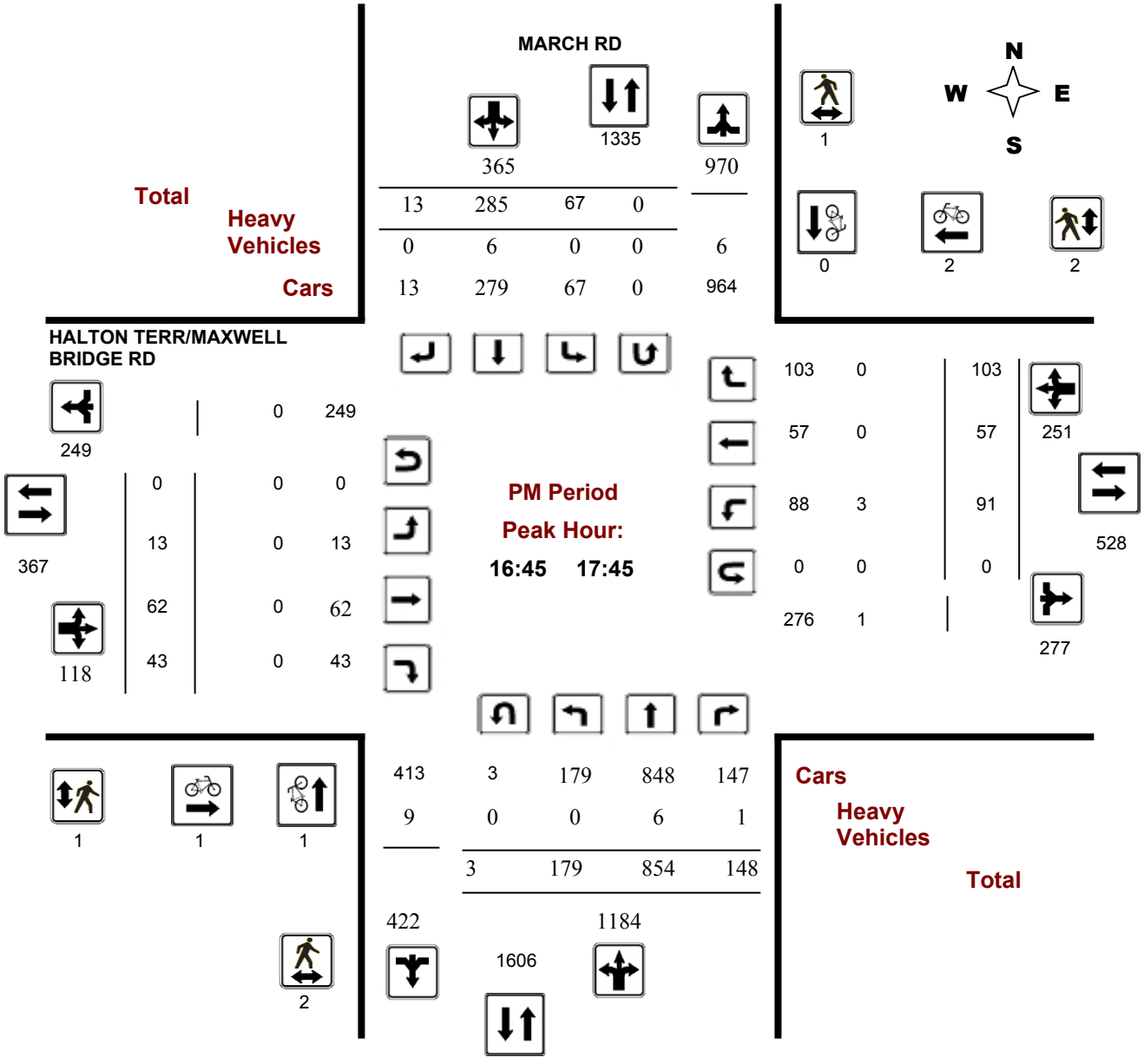
Transportation Services - Traffic Services

Turning Movement Count - Full Study Peak Hour Diagram

HALTON TERR/MAXWELL BRIDGE RD @ MARCH RD

Survey Date: Wednesday, August 10, 2016 **WO No:** 36161

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



Transportation Services - Traffic Services

Work Order
36161

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

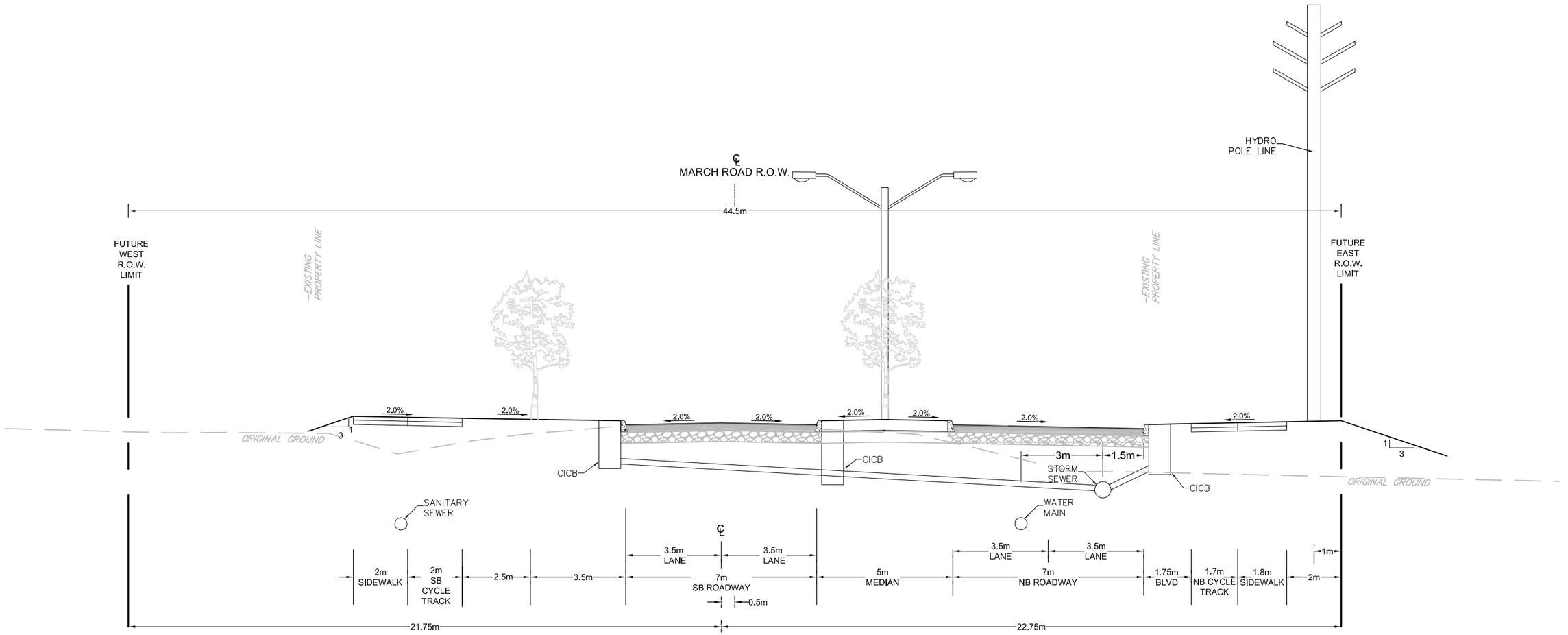
Total Collisions: 13

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	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



KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 24

MARCH ROAD - INTERIM
CROSS SECTION

DATE
JUN 2016

JOB
112117

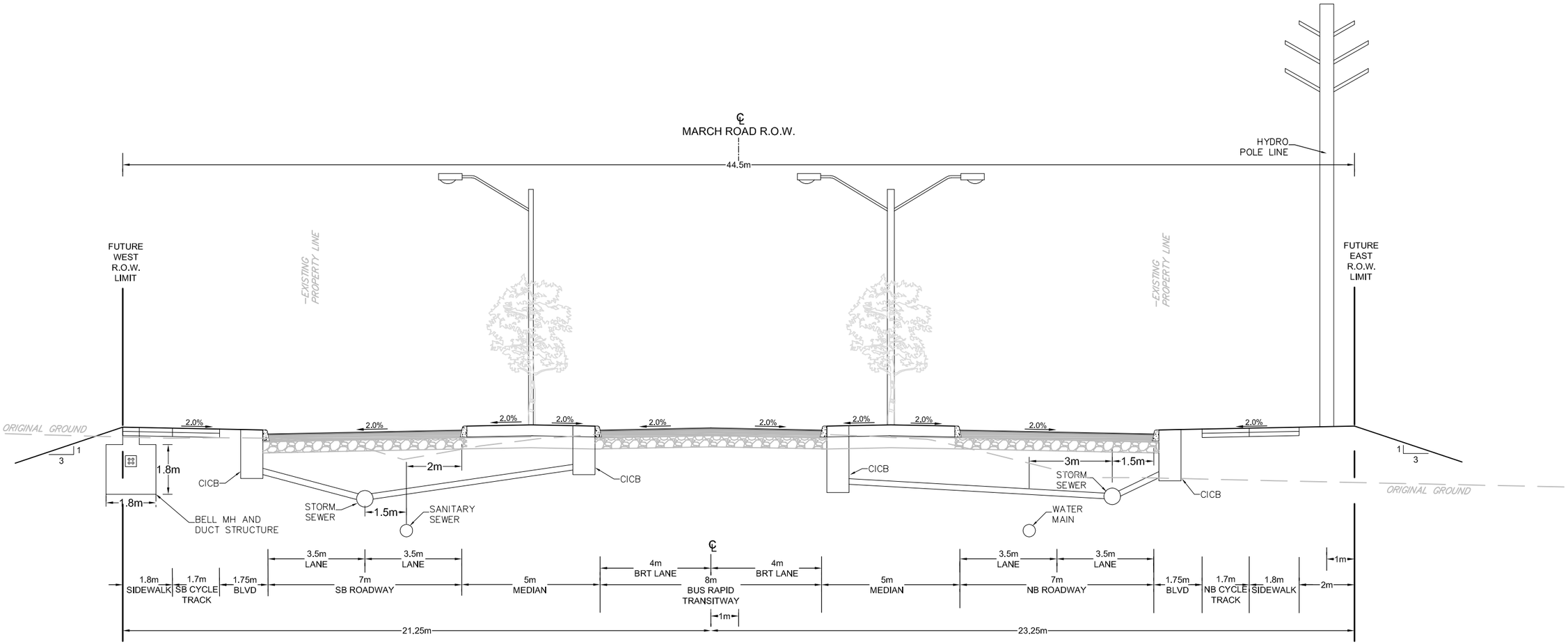
SCALE
1:150

0 1m 2m 4m

NOVATECH
Engineers, Planners & Landscape Architects

SHT11x17.DWG - 279mmx432mm

M:\2012\112117\CADDesign\Figures\Traffic\TMP\FINAL\112117 - March sections - 20160212.dwg, INTERIM (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

0 1m 2m 4m

NOVATECH
Engineers, Planners & Landscape Architects

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SHT11x17.DWG - 279mmx432mm

Appendix E

Traffic Signal Warrants

Future Collector @ March Road
2022 Future Total

Justification #7

Justification	Description	Minimum Requirement 1 Lane Highway		Minimum Requirement 2 or More Lanes		Compliance Sectional		Compliance Entire %	Signal
		Free Flow	Restr. Flow	Free Flow	Restr. Flow	Numerical	%		
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	480	720	600	900	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 estiamted from peak hour volumes, AHV = PM/2 or (AM + PM) / 4

Future Collector @ March Road
2027 Future Total

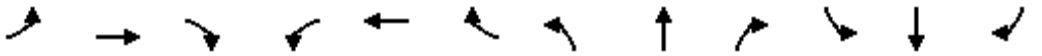
Justification #7

Justification	Description	Minimum Requirement 1 Lane Highway		Minimum Requirement 2 or More Lanes		Compliance Sectional		Compliance Entire %	Signal
		Free Flow	Restr. Flow	Free Flow	Restr. Flow	Numerical	%		
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	480	720	600	900	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%		

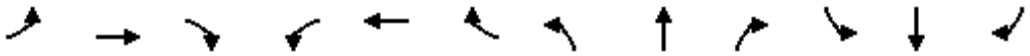
Notes
1. Refer to OTM Book 12, pg 88, Nov 2007
2. Lowest section percentage governs justification
3. Average hourly volumes estiamted from peak hour volumes, AHV = PM/2 or (AM + PM) / 4

Appendix F

2018 Existing Synchro



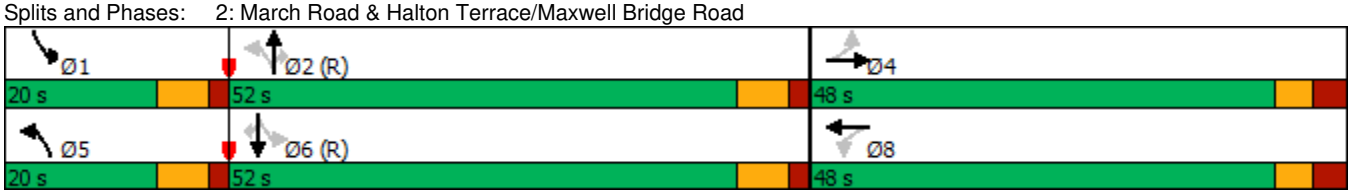
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	38	108	168	16	9	37	216	69	91	679	7
Future Volume (vph)	10	38	108	168	16	9	37	216	69	91	679	7
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (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
Frt		0.889			0.946				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1676	1569	0	1676	1669	0	1676	3353	1500	1676	3353	1500
Flt 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

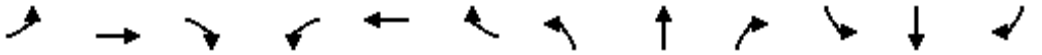


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4		8	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	38.6	38.6		38.6	38.6		11.4	34.6	34.6	11.4	34.6	34.6
Total Split (s)	48.0	48.0		48.0	48.0		20.0	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			

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





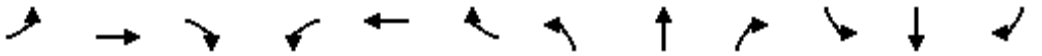
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	38	108	168	16	9	37	216	69	91	679	7
Future Volume (veh/h)	10	38	108	168	16	9	37	216	69	91	679	7
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	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(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	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

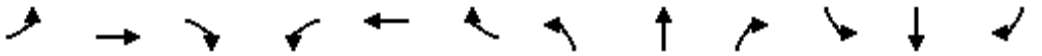
Intersection Summary	
HCM 2010 Ctrl Delay	22.2
HCM 2010 LOS	C

Notes

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



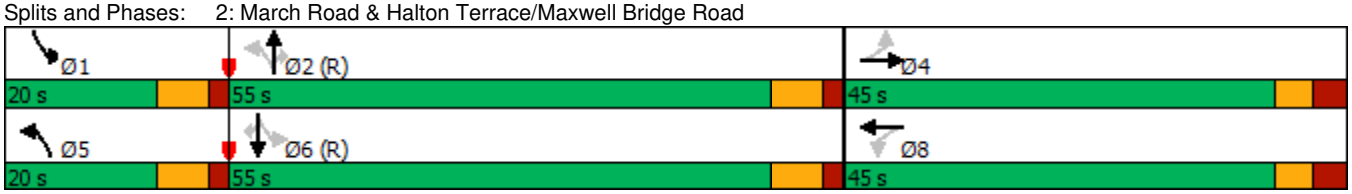
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	13	63	43	92	58	104	184	863	149	68	288	13
Future Volume (vph)	13	63	43	92	58	104	184	863	149	68	288	13
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage 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
Frt		0.939			0.903				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1676	1657	0	1676	1594	0	1676	3353	1500	1676	3353	1500
Flt 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



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			

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



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

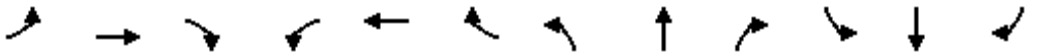
Intersection Summary	
HCM 2010 Ctrl Delay	18.6
HCM 2010 LOS	B

Notes

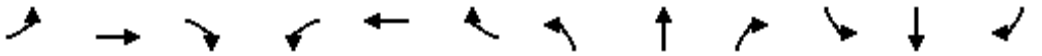
* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Appendix G

2023 Future Background Synchro



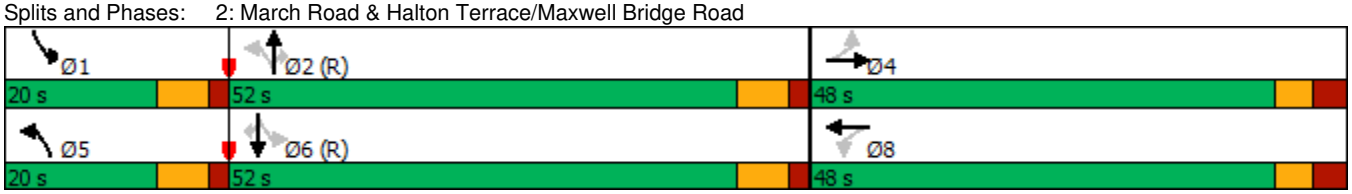
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	39	110	171	16	9	38	221	70	93	692	7
Future Volume (vph)	10	39	110	171	16	9	38	221	70	93	692	7
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (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
Frt		0.889			0.946				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1676	1569	0	1676	1669	0	1676	3353	1500	1676	3353	1500
Flt 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



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



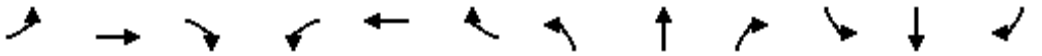
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	39	110	171	16	9	38	221	70	93	692	7
Future Volume (veh/h)	10	39	110	171	16	9	38	221	70	93	692	7
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	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(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	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

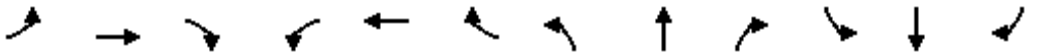
Intersection Summary	
HCM 2010 Ctrl Delay	22.5
HCM 2010 LOS	C

Notes

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



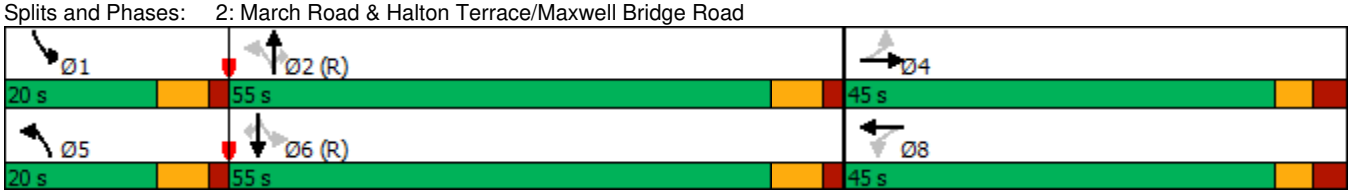
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	13	64	44	94	59	106	188	880	152	69	294	13
Future Volume (vph)	13	64	44	94	59	106	188	880	152	69	294	13
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage 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
Frt		0.939			0.904				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1676	1657	0	1676	1595	0	1676	3353	1500	1676	3353	1500
Flt 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



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



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(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	44.0	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

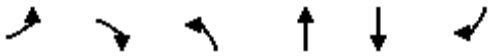
Intersection Summary	
HCM 2010 Ctrl Delay	18.8
HCM 2010 LOS	B

Notes

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

Appendix H

2028 Future Background Synchro



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			

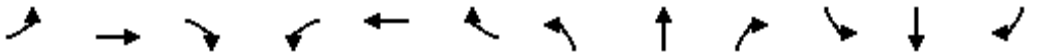
Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
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

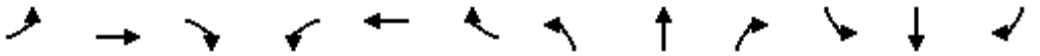
Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1733	730	1460	0	-	0
Stage 1	1459	-	-	-	-	-
Stage 2	274	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.14	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.22	-	-	-
Pot Cap-1 Maneuver	79	365	459	-	-	-
Stage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



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



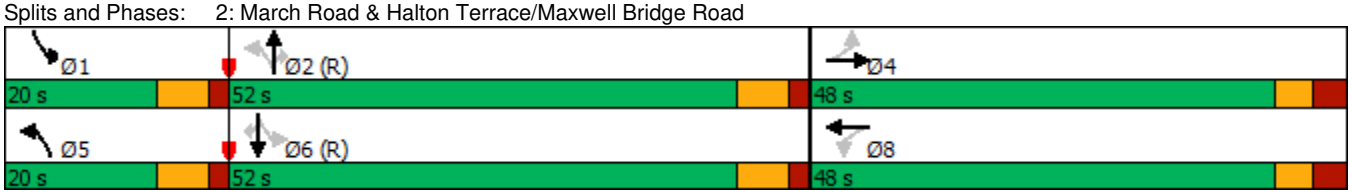
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4		8	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	38.6	38.6		38.6	38.6		11.4	34.6	34.6	11.4	34.6	34.6
Total Split (s)	48.0	48.0		48.0	48.0		20.0	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



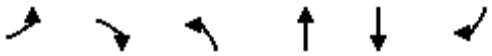
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	91	40	175	175	17	35	115	444	72	102	1187	61
Future Volume (veh/h)	91	40	175	175	17	35	115	444	72	102	1187	61
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike 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(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	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.



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
Frt	0.905				0.998	
Flt Protected	0.985			0.998		
Satd. Flow (prot)	1573	0	0	3346	3346	0
Flt 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			

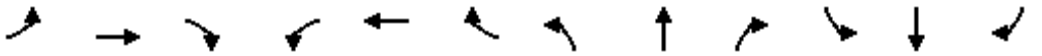
Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
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

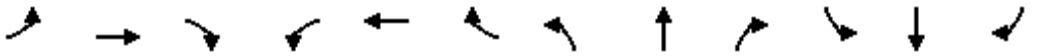
Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1593	356	711	0	-	0
Stage 1	706	-	-	-	-	-
Stage 2	887	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.14	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.22	-	-	-
Pot Cap-1 Maneuver	98	640	884	-	-	-
Stage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



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
Frt		0.920			0.895				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1676	1624	0	1676	1579	0	1676	3353	1500	1676	3353	1500
Flt 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



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	

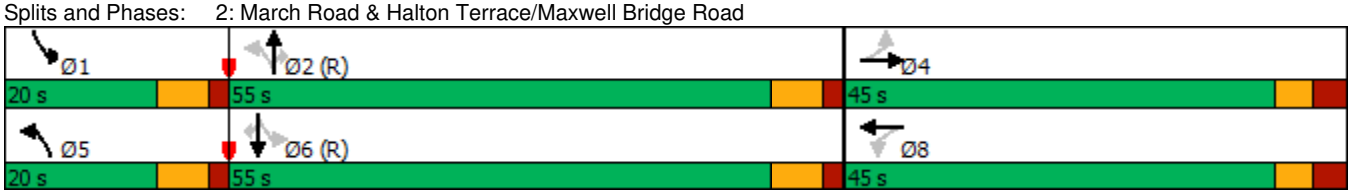
~ Volume exceeds capacity, queue is theoretically infinite.

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



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

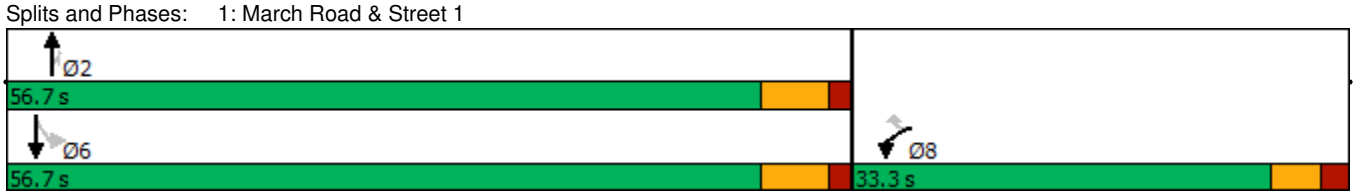
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	300	16	240	97	5	792
Future Volume (vph)	300	16	240	97	5	792
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850		0.850		
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1676	1500	1765	1500	1676	1765
Flt 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

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



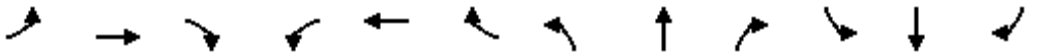
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	300	16	240	97	5	792
Future Volume (veh/h)	300	16	240	97	5	792
Number	3	18	2	12	1	6
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	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(I)	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

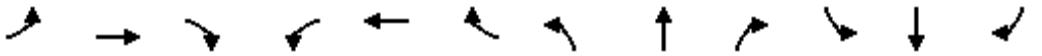
Intersection Summary	
HCM 2010 Ctrl Delay	19.1
HCM 2010 LOS	B

Notes

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



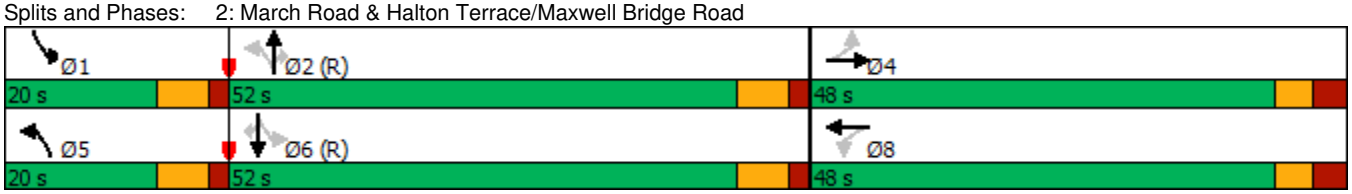
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	39	110	171	16	9	38	318	70	93	992	7
Future Volume (vph)	10	39	110	171	16	9	38	318	70	93	992	7
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (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
Frt		0.889			0.946				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1676	1569	0	1676	1669	0	1676	3353	1500	1676	3353	1500
Flt 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

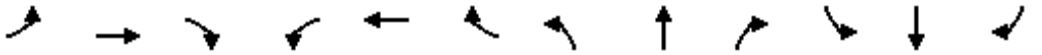


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4		8	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	38.6	38.6		38.6	38.6		11.4	34.6	34.6	11.4	34.6	34.6
Total Split (s)	48.0	48.0		48.0	48.0		20.0	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			

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

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
Frt		0.850		0.850		
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1676	1500	1765	1500	1676	1765
Flt 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

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

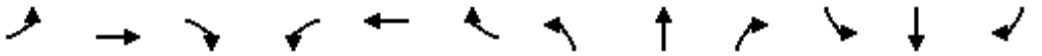
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	188	10	999	319	17	376
Future Volume (veh/h)	188	10	999	319	17	376
Number	3	18	2	12	1	6
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, 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.

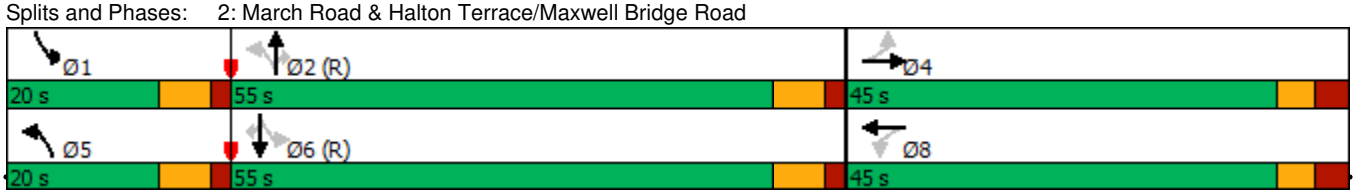


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	13	64	44	94	59	106	188	1199	152	69	482	13
Future Volume (vph)	13	64	44	94	59	106	188	1199	152	69	482	13
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage 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
Frt		0.939			0.904				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1676	1657	0	1676	1595	0	1676	3353	1500	1676	3353	1500
Flt 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

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
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)	-2.6	-2.6		-2.6	-2.6		-2.4	-2.6	-2.6	-2.4	-2.6	-2.6
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
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)	19.1	19.1		19.1	19.1		91.5	81.3	81.3	86.8	76.8	76.8
Actuated g/C Ratio	0.16	0.16		0.16	0.16		0.76	0.68	0.68	0.72	0.64	0.64
v/c Ratio	0.13	0.42		0.66	0.57		0.32	0.59	0.16	0.24	0.25	0.01
Control Delay	43.1	36.4		65.8	31.9		5.5	13.5	3.0	6.1	10.6	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	43.1	36.4		65.8	31.9		5.5	13.5	3.0	6.1	10.6	0.0
LOS	D	D		E	C		A	B	A	A	B	A
Approach Delay		37.1			44.1			11.5			9.8	
Approach LOS		D			D			B			A	
Queue Length 50th (m)	3.0	19.9		24.6	23.4		11.1	87.6	2.4	3.7	27.2	0.0
Queue Length 95th (m)	8.9	36.2		41.6	44.4		23.6	144.1	13.1	9.7	47.2	0.0
Internal Link Dist (m)		178.9			259.1			197.3			282.4	
Turn Bay Length (m)	30.0			30.0			60.0			60.0		15.0
Base Capacity (vph)	235	586		341	598		686	2272	1061	398	2146	993
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	0.20		0.30	0.31		0.30	0.59	0.16	0.19	0.25	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: 0.66			
Intersection Signal Delay: 15.8		Intersection LOS: B	
Intersection Capacity Utilization 61.3%		ICU Level of Service B	
Analysis Period (min) 15			

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

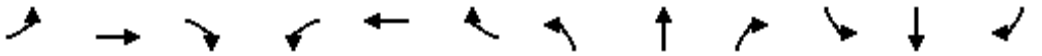
Intersection Summary	
HCM 2010 Ctrl Delay	17.2
HCM 2010 LOS	B

Notes

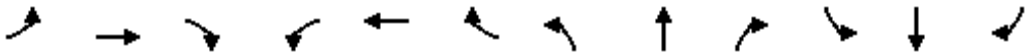
* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Appendix J

2028 Total Future Synchro



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		

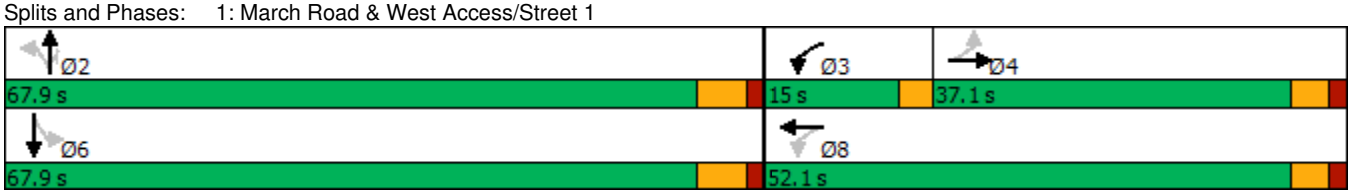


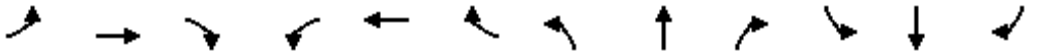
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4		3	8		2	2	2	6	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	37.1	37.1		10.0	37.1		34.2	34.2	34.2	34.2	34.2	
Total Split (s)	37.1	37.1		15.0	52.1		67.9	67.9	67.9	67.9	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	
Flash Dont Walk (s)	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	
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





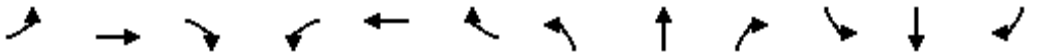
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	11	71	38	300	71	16	7	464	97	5	1311	3
Future Volume (veh/h)	11	71	38	300	71	16	7	464	97	5	1311	3
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	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

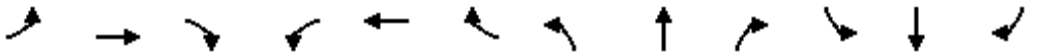
Intersection Summary	
HCM 2010 Ctrl Delay	26.4
HCM 2010 LOS	C

Notes

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



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
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			0.065			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



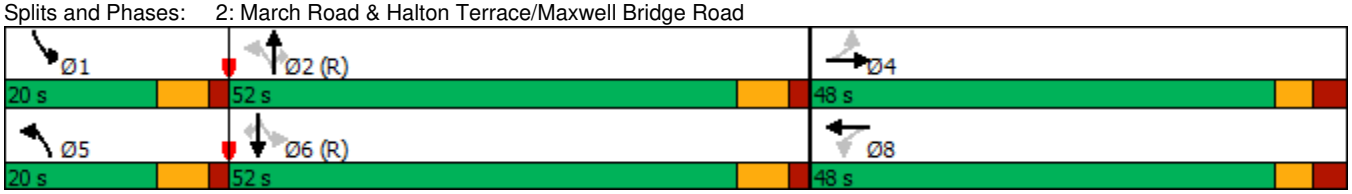
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4		8	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	38.6	38.6		38.6	38.6		11.4	34.6	34.6	11.4	34.6	34.6
Total Split (s)	48.0	48.0		48.0	48.0		20.0	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		0.66	0.35	0.10	0.24	0.98	0.08
Control Delay	36.8	10.0		91.8	13.9		39.1	20.1	3.9	11.7	47.2	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		39.1	20.1	3.9	11.7	47.2	2.7
LOS	D	B		F	B		D	C	A	B	D	A
Approach Delay		18.0			73.9			21.5			43.4	
Approach LOS		B			E			C			D	
Queue Length 50th (m)	20.4	8.4		47.1	3.6		15.3	45.1	0.0	10.1	202.2	0.0
Queue Length 95th (m)	32.4	26.7		#72.1	12.7		39.1	74.7	8.4	22.8	#320.7	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		248	1715	812	536	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		0.52	0.35	0.10	0.21	0.98	0.08

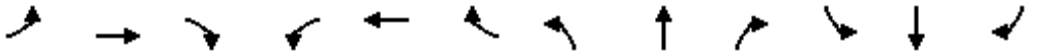
Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 120			
Offset: 99 (83%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green			
Natural Cycle: 115			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.98			
Intersection Signal Delay: 37.6		Intersection LOS: D	
Intersection Capacity Utilization 95.8%		ICU Level of Service F	
Analysis Period (min) 15			

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

Queue shown is maximum after two cycles.

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





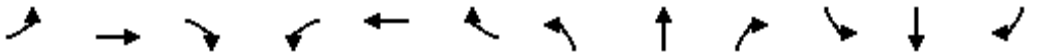
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	91	40	175	175	17	35	115	541	72	102	1487	61
Future Volume (veh/h)	91	40	175	175	17	35	115	541	72	102	1487	61
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike 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(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	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

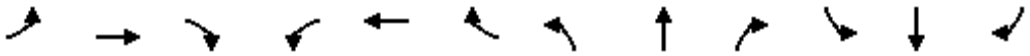
Intersection Summary	
HCM 2010 Ctrl Delay	50.6
HCM 2010 LOS	D

Notes

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



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
Frt		0.971			0.986				0.850		0.998	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1676	1714	0	1676	1740	0	1676	3353	1500	1676	3346	0
Flt 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		

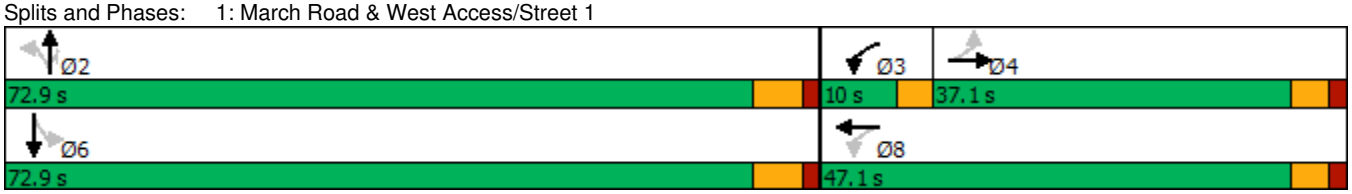


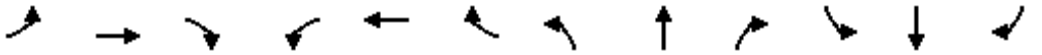
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4		3	8		2	2	2	6	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	37.1	37.1		10.0	37.1		35.0	35.0	35.0	34.2	34.2	
Total Split (s)	37.1	37.1		10.0	47.1		72.9	72.9	72.9	72.9	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	
Flash Dont Walk (s)	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	
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





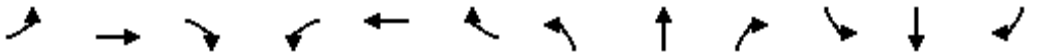
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	97	23	188	97	10	45	1417	319	17	631	9
Future Volume (veh/h)	10	97	23	188	97	10	45	1417	319	17	631	9
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike 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

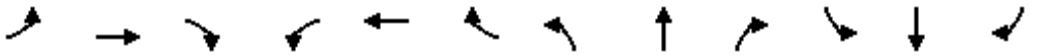
Intersection Summary	
HCM 2010 Ctrl Delay	17.2
HCM 2010 LOS	B

Notes

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



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
Frt		0.920			0.895				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1676	1624	0	1676	1579	0	1676	3353	1500	1676	3353	1500
Flt 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



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	

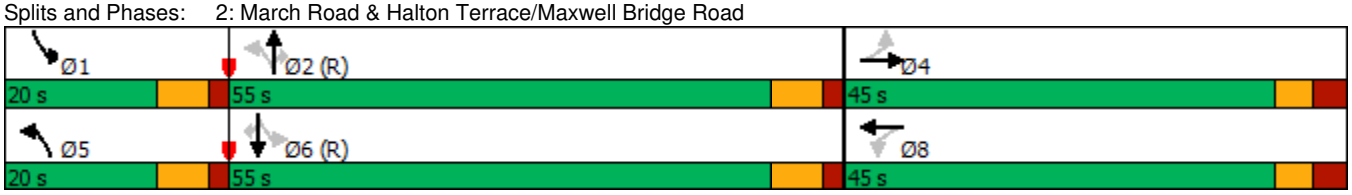
~ Volume exceeds capacity, queue is theoretically infinite.

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



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.

Appendix K

Comment Response Table

Technical Memorandum

To:	Rosanna Baggs, Project Manager – Transportation Approvals	Date:	July 31, 2019
Cc:	Mark Crockford, P.Eng., Christopher Gordon, P.Eng.		
From:	Andrew Harte, P.Eng.	Project Number:	2018-04

Re: 936 March Road – Consolidated Transportation Comments Response

The City of Ottawa provided comments on the planned residential subdivision development at 936 March Road in Kanata North, including Step 4 of the TIA process, on May 23, 2019. The following summarizes the comments and the response to the comments.

	Comment	Response
Traffic Signal Design		
77	Traffic Signal Design and Specification reserves the right to make future comments based on subsequent submissions.	Noted
Traffic Signal Operations		
78	The report indicates that the intersection of March Road and Street 1 will experience LOS F for the WBL (westbound left turn) movement. Given that this is the only access to this 800-unit neighbourhood, consideration is needed for emergency access until future connections are completed. Provide recommendations to mitigate this shortfall.	*A secondary interim access has been confirmed to the north of the proposed development. This will provide temporary secondary access along the road that will ultimately be the final secondary access. This will avoid an unnecessary additional crossing of the creek between the residential and commercial portions of the property.*
79	Indicate if cycling facilities will be included at March Road and Street 1 intersection. This may affect the intersection size, geometry, signal operation, vehicle phasing, and LOS.	*The ultimate and interim cross-section considered in the CDP include northbound and southbound cycling tracks. These will be carried through the intersection of March Road at Street 1.*
80	All-red time cannot equal zero for WBL 2028 AM and PM Peak Hour March Road and West Access/Street 1; this change will force an increase in WBL Minimum Split and affect various LOS.	*This minor change to the signal timing has a negligible impact on the operational characteristics of the proposed intersection and will not impact the conclusions or recommendations of the TIA.*
Transit Services		
81	Bus service through this project will service both Street No. 1 and Street No. 2. Stops identified at the intersection of Streets No. 1 and No. 4 as identified on page 19 are acceptable. Stops identified on the intersection of Streets No. 1 and No. 2 will need to be positioned to service this turn movement, otherwise suggested location is acceptable. This future route will service the	*Noted. Transit service will be located such that it provides service on Streets No. 1 and No.2*

	Comment	Response
	planned Park and Ride to be located along March Road north of Maxwell Bridge Road.	
82	Future service would require the following conditions: a. The applicant shall design and construct, at no cost to the City, Street No. 1 and Street No. 2 who are identified for potential transit service to Transportation Association of Canada standards. This includes right-of-way width, horizontal and vertical geometry, pavement structure and the construction of sidewalks on both sides of the streets.	*Noted.*
	b. For service to be provided within this development, a temporary turn-around at the north end of Street No. 2 would be required if subsequent development is not complete. This temporary turn-around will be provided prior to registration, to the satisfaction of the City to accommodate interim transit routes.	*Noted.*
	c. The Owner shall ensure that the staging of the subdivision, including dwellings, roadways, walkways, and paved passenger standing areas, or shelter pads and shelters, will be constructed in a sequence that permits the operation of an efficient, high quality transit service at all stages of development.	Noted.
	d. The Owner shall design and construct, at no cost to the City, paved passenger standing areas, concrete shelter pads and/or shelter at the locations identified as bus stops to the specification of Transit Services. Bus infrastructure shall be constructed to the specifications of standard drawings SC11 and SC12 of the City.	Noted. Minto will provide paved passenger standing area or concrete pads for the bus stop locations.
	e. The developer shall provide trees in the vicinity of proposed bus stops to improve customer experience while waiting for transit vehicles.	Noted.
	f. The Owner shall inform all prospective purchasers, through a clause in all agreements of Purchase and Sale and indicate on all plans used for marketing purposes, those streets identified for potential transit services, the location of the bus stops, paved passenger standing areas, or shelters pads and shelters, which may be located in front of or adjacent to the purchaser's lot at any time.	Noted.
	g. Wherever a bus stop must be located adjacent to a home the developer shall	Noted. Where possible, this will be explored although lotting restricts the ability to re-orient lots and access.

	Comment	Response
	reorient lots to ensure that bus stops are located adjacent to a side-lot.	
	h. No further comment regarding TIA content.	Noted.
Transportation Engineering Services		
83	Provide left turn lane warrant analysis for the proposed left turn lanes on March Street and Street 1.	*The intersection of March Road at Street 1 is a proposed signalized intersection. Left turn lane warrants are utilized to examine unsignalized intersections. Left turn lanes are provided at all signalized intersections (where feasible). As this is a greenfield development there is no reason to preclude left turn lanes on all legs of the proposed intersections.*
84	Confirm that site generated volumes for this development match the projected volumes provided in the Kanata North CDP transportation master plan.	*The CDP does not break down the traffic generation for each development. Overall, the operational performance of the main intersection, through which all the site traffic will pass, is similar or better than the results projected in the CDP TMP. Therefore, the site generated traffic volumes are similar to those considered in the CDP TMP.*
85	We support the recommendation that the RMA and functional design for the March Road/Street 1 intersection is not required to deem the application complete. However, an RMA will be required for the interim condition if the timing to coordinate the required intersection modifications for the complete intersection design cannot be finalized within the application period.	*Noted.*
86	Provide a subdivision plan showing cycling and pedestrian infrastructure needs in the Strategy Report. Consider possible connections to the future park and ride.	*Figure 14 illustrates the cycling and pedestrian infrastructure. As the plan has been updated, an updated plan will be created showing the cycling and pedestrian infrastructure.*
87	Both Street 1 and Street 2 (26m ROW) are fronting the school lot. This property will likely require bus lay by and student drop off layby along each of these streets. If possible, consider this requirement when designing the road cross sections.	*Noted. Street 2 right-of-way has been updated in the revised plan and the school block relocated.* *With respect to the lay-bys, The School Board would not provide an answer until they proceed with development of the site. Therefore, until such time as a school is committed to the site, those elements should not be constructed as they would have to be removed if the School Board does not utilize the site.*
88	The City is currently reviewing the approved collector road cross sections. All draft cross sections include cycle tracks on the 26m ROW. Signalized intersections are more challenging to design with a MUP as a cycling facility. Consider the new collector road cross section options when developing Street 1 and Street 2. This includes Street 1 east of Street 2.	*Noted. The right-of-way for Street 1 east of Street 2, and Street 2 north of Street 1, are planned to be 24 metre right of ways. The proposed cross-sections for these roads are consistent with the approved cross-sections within the CDP for this area.*

	Comment	Response
89	Consider ride share opportunities for the subdivision.	*Noted. OC Transpo has noted that service will be provided through the planned Park and Ride located along March Road north of Maxwell Bridge Road.*
90	The site is located within 300 m of Beachburg rail corridor. The City of Ottawa will not be responsible for any complaints or claims arising from use of such facilities and/or operations on, over or under the aforesaid rights-of-way.	*Noted.*
Development Review – Transportation Engineering Services		
91	As per the CDP, A 16.5m right-of-way may only be considered where soil conditions will permit planting of street trees within the reduced right-of-way.	*Noted.*
92	Confirm Development Charge By-law eligibility for intersection access needs with Ann Selfe at ann.selfe@ottawa.ca.	*Ann Selfe has been contacted and discussions are ongoing.*
93	Temporary cul-du-sacs will be required at the east end of Street 9, and north end of Street 2 (if the connection to the neighbouring development cannot be made prior to registration).	*Noted.*
94	Geometric Road Design (GRD) drawings will be required with the first submission of underground infrastructure and grading drawings. These drawings should include such items as, but is not limited to: a. Road Signage and Pavement Marking for the subdivision; b. Intersection control measure at new internal intersections; and c. Location of depressed curbs and TWSIs; d. More details can be provided upon request	*Noted these drawings will be provided along with engineering submission.*
95	A pedestrian and traffic calming plan will be required prior to the submission of the GRD, especially since draft plan is different from the CDP Proposed Plans.	*Noted.*
96	Sidewalks (and/or MUPS) are required along all street frontages for the park and school blocks.	*The previous plan provided this. The updated plan similarly accounts for this.*
97	The MUP in Block 59 will be required to connect to Celtic Ridge Cres.	*See Block 481 on the updated plan.*
98	Include traffic calming measures on roads within the limits of their subdivision to limit vehicular speed and improve pedestrian safety. Traffic calming measures shall reference best management practices from the Canadian Guide to Neighbourhood Traffic Calming, published by the Transportation Association of Canada, and/or Ontario Traffic Manual, and/or the City of Ottawa's Draft Traffic Calming Design Guidelines. These measures may include either vertical or horizontal	*Noted these drawings will be provided along with engineering submission.*

	Comment	Response
	features (such measures shall not interfere with stormwater management and overland flow routing), including but not limited to: a. intersection or mid block narrowings, chicanes, medians; b. speed humps, speed tables, raised intersections, raised pedestrian crossings; c. road surface alterations (for example, use of pavers or other alternate materials, provided these are consistent with the City's Official Plan polices related to Design Priority Areas); d. pavement markings/signage; and e. temporary/seasonal installations such as flexi posts or removable bollards. Refer to the CDP and supporting TMP for guidance on the above.	
99	Ensure to pair driveways where possible; consideration for fire hydrant placement should be included in this exercise.	*Noted.*
100	Cross sections will be required for Street 1 east of Street 2 to demonstrate the interim local road profile and how it will be upgraded to a collector road in the future. Cross section should encourage minimal throwaway and minimal infrastructure relocation requirement. An estimate of the cost associated with the upgrade is to be provided.	*The 24.0 metre right-of-way cross-section will be constructed. No interim road will be provided.*
101	v/c of less than 0.9 must be achieved as per TMP 2013.	*Noted. Optimizing intersection operation for all modes will be revisited during the RMA process.*
102	The CDP assumes dual Westbound left turn lanes at the intersection of March and Street A/G(1).	
	Since the operation of the WBL will remain protected-only from day-1 through 100% build-out scenario, it may be beneficial to utilize both WBL lanes to mitigate any failures.	*Noted. Optimizing intersection operation for all modes will be revisited during the RMA process.*
	Under all build-out scenarios (even with the dual WBL lanes in full operation), the potential will remain for WBL to spill out of its storage lane(s) as sufficient green time must be provided on March (downstream) to create capacity for WBL to exit.	*Noted. As part of the City's ongoing monitoring process of existing intersections, the operation of the March Road at Halton Terrace/Maxwell Bridge Road intersection will be adjusted to accommodate all of the growth in Kanata North.*
103	Please be advised street light design is a requirement for this development.	*Noted.*
104	Pertaining to the bi-directional bicycle facility (MUP) at the intersection of March Road and Street 1, additional ROW is likely required on Street 1 due to the requirement of installing fully protected left-turn phases and centre medians. Confirm that bicycle facilities will be provided on March Road as	*Bicycle facilities will be provided at the intersection of March Road and Street 1. The RMA will examine the need for additional ROW near the intersection of March Road at Street 1.*

	Comment	Response
	part of the intersection design. Details of the intersection design need to be considered now to address ROW needs.	
105	The widening of March Road is not currently part of the City's 2031 Affordable Road Network. Given that the March Road screen line will operate above capacity following build out, no viable solution has been proposed to address the expected road capacity deficiency in the absence of widening March Road which is not expected until sometime post-2031 as the Traffic Impact Assessment was written assuming the widening would occur. The City has already completed this task and has identified a preferred long term solution to widening March Road, yet this is unaffordable before 2031.The applicant should consider phasing implementation build-out to coincide with the timing of the March Road widening project or other solutions to address the expected capacity deficiency.	*Noted.*