



Ministry of Transportation, Ontario

**HIGHWAY 407 TRANSITWAY:
TRANSPORTATION STUDY FOR PROPOSED WOODBINE /
RODICK STATION**

FINAL REPORT

DECEMBER, 2010



TABLE OF CONTENTS

1.	INTRODUCTION	1
1.1	Report Outline	1
1.2	Key Issues.....	2
2.	THE PROPOSED DEVELOPMENT	3
2.1	Station Location	3
2.2	Site Plan	4
3.	STUDY SCOPE	6
3.1	Study Area	6
3.2	Guidelines and Standards	6
3.3	Horizon Years and Analysis Periods	8
3.4	Data Collection	8
	3.4.1 Turning Movement Counts.....	8
	3.4.2 Signal Timing and Intersection Configurations.....	8
3.5	Traffic Analysis Parameters	8
	3.5.1 Capacity and Level of Service	8
	3.5.2 Queue Lengths	9
4.	EXISTING CONDITION	10
4.1	Area Road Network	10
4.2	Lane Configurations	13
4.3	Transit Services and Operations	13
4.4	Existing Condition (2010) Traffic Volumes and Operations	13
	4.4.1 Capacity and Level of Service	13
	4.4.2 Queue Lengths	18
5.	FUTURE BACKGROUND CONDITION.....	19
5.1	Proposed Transit Services	19
5.2	Future Background Traffic Growth.....	19
5.3	Future Background Developments.....	19
5.4	Future Total Background Volumes.....	19
5.5	Future Background Condition (2031) Traffic Operations	21
	5.5.1 Capacity and Level of Service	21
	5.5.2 Queue Lengths.....	21
6.	WOODBINE / RODICK STATION RELATED TRAFFIC	24
6.1	Passenger Flow Projections	24

TABLE OF CONTENTS

6.2	Woodbine / Rodick Station Trip Generation	24
6.2.1	Assumptions	24
6.2.2	Generated Trips	24
6.3	Future Bus Transit Volumes.....	25
6.4	Trip Distribution	25
6.5	Trip Assignment.....	25
7.	FUTURE TOTAL CONDITION	27
7.1	Future Transit Services and Operations	27
7.2	Future Pedestrian / Bicycle Facilities and Operations.....	27
7.3	Site Access and Configurations	27
7.4	Future Traffic Control and Lane Configurations	28
7.5	Future Total Traffic Volumes.....	28
7.6	Future Total Condition (2031) Traffic Operations.....	28
7.6.1	Capacity and Level of Service	28
7.6.2	Queue Lengths	32
8.	SUMMARY AND CONCLUSIONS.....	34

TABLE OF CONTENTS (CONT'D)

APPENDICES

A. 2010 EXISTING CONDITION SYNCHRO SUMMARY OUTPUTS	A-1
B. 2031 BACKGROUND CONDITION SYNCHRO SUMMARY OUTPUTS.....	B-1
C. 2031 FUTURE CONDITION SYNCHRO SUMMARY OUTPUTS	C-1

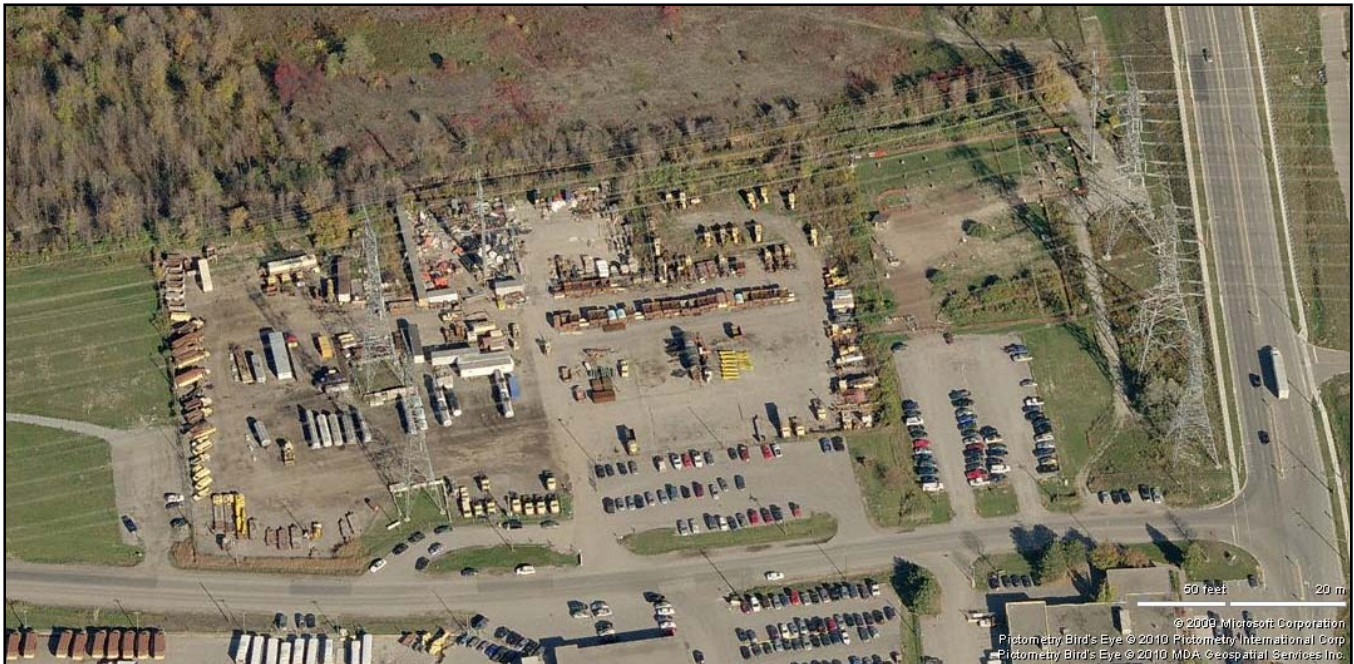
LIST OF EXHIBITS

Exhibit 1-1 Aerial View of Proposed Woodbine / Rodick Station Site	1
Exhibit 2-1: Proposed Woodbine / Rodick Station Site and Vacinity	3
Exhibit 2-2: Preferred Woodbine / Rodick Station Concept (June 2010)	5
Exhibit 3-1: List of Study Area Intersections	6
Exhibit 3-2: Study Area of Transportation Study.....	7
Exhibit 4-1: Existing Study Area Lane Configurations	14
Exhibit 4-2: Transit Services in the Study Area	15
Exhibit 4-3: 2010 Existing Condition Traffic Volumes.....	16
Exhibit 4-4: Existing Condition (2010) Intersection Operations.....	17
Exhibit 4-5: Existing Condition (2010) Turning Movement Queue Lengths.....	18
Exhibit 5-1: 2031 Background Condition Traffic Volumes.....	20
Exhibit 5-2: Background Condition (2031) Compared with Existing Condition (2010) Intersection Operations	22
Exhibit 5-3: Background Condition (2031) Compared with Existing Condition (2010) Turning Movement Queue Lengths	23
Exhibit 6-1: Trips Rates and Splits for Park-and-Ride with PPUDO Facility.....	24
Exhibit 6-2: Estimated Trip Generation for Woodbine / Rodick Station.....	24
Exhibit 6-3: Distribution of Park-and-Ride Traffic	25
Exhibit 6-4: 2031 Site Generated Traffic Volumes	26
Exhibit 7-1: Future Study Area Recommended Lane and Geometrical Configurations	29
Exhibit 7-2: 2031 Future Total Traffic Volumes.....	30
Exhibit 7-3: Future Total Condition (2031) Compared with Background Condition (2031) Intersection Operations	31
Exhibit 7-4: Future Total Condition (2031) Compared With Background Condition (2031) Intersection Operations.....	33

1. INTRODUCTION

This transportation study report presents the preliminary findings of traffic analysis of the proposed 407 Transitway Woodbine / Rodick Station. The station will be located on the north side of Miller Avenue between Woodbine Avenue and Rodick Road (**Exhibit 1-1**). The analysis assesses the ability of the preferred alternative geometric layouts to accommodate projected traffic volumes.

Exhibit 1-1 Aerial View of Proposed Woodbine / Rodick Station Site



1.1 Report Outline

The subsequent sections of this transportation study report are as follows:

- Section 2 – Summary of the Proposed Development;
- Section 3 – Scope for the Transportation Study;
- Section 4 – Existing Condition (2010) Analysis and Results;
- Section 5 – Future Background Condition (2031) Analysis and Results;
- Section 6 – Proposed Woodbine / Rodick Station Related Traffic;
- Section 7 – Future Total Condition (2031) Analysis and Results; and
- Section 8 – Summary and Conclusions.

1.2 Key Issues

Key issues addressed in this transportation study report include the following:

- The existing and background traffic conditions at Study Area intersections;
- The estimate of traffic generated by the proposed Woodbine / Rodick Station park-and-ride;
- The assignment and distribution of site generated traffic;
- The implications of site generated traffic on Study Area intersections, access driveways/roadways and the surrounding road network; and
- Potential site access geometric configurations and other measures to mitigate projected traffic impacts.

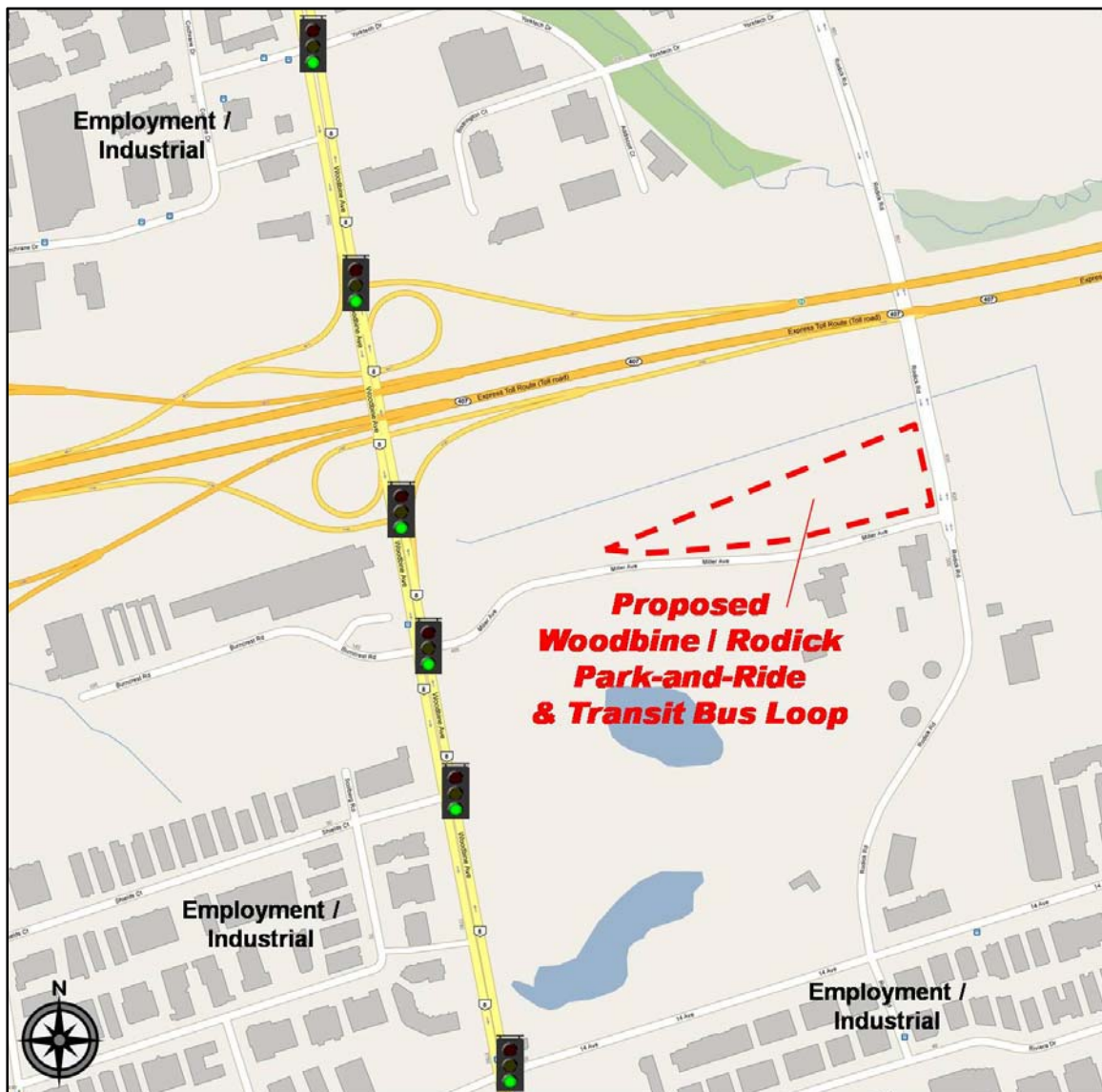
2. THE PROPOSED DEVELOPMENT

2.1 Station Location

The proposed 407 Transitway Woodbine / Rodick Station ("Proposed Station") will be located on a parcel of land ("Subject Site") on north side of Miller Avenue approximately 500 metres east of Woodbine Avenue. The Subject Site is located in the Town of Markham and is currently used as a parking area for industrial vehicles.

A map showing the location of Subject Site and Proposed Development is in **Exhibit 2-1**

Exhibit 2-1: Proposed Woodbine / Rodick Station Site and Vacinity

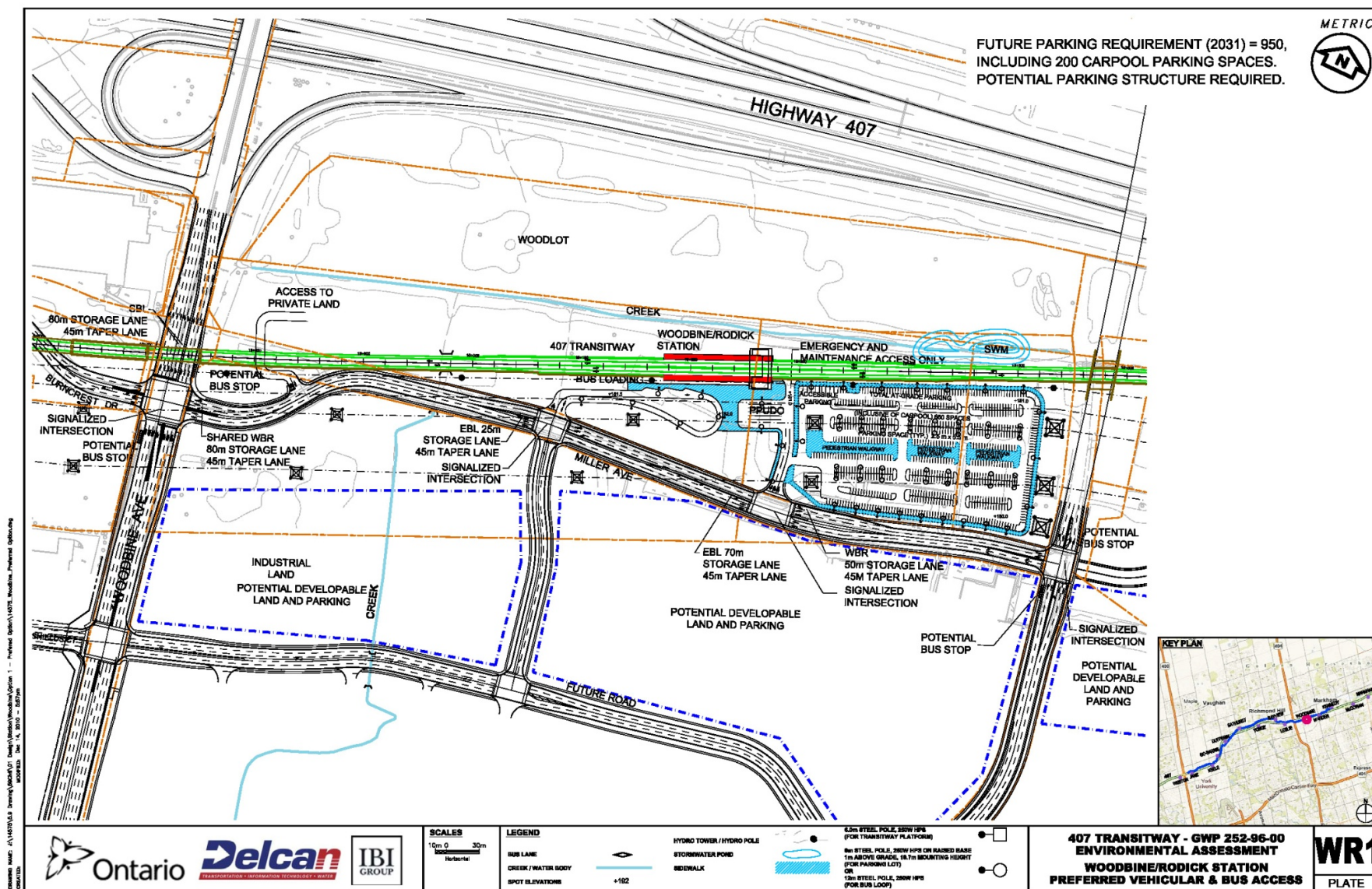


2.2 Site Plan

A site plan for the preferred option schematic concept is shown in **Exhibit 2-2**. The proposed Woodbine / Rodick Station will serve as a regional intermodal station for passengers transferring between the proposed 407 Transitway and other bus services including TTC and YRT. Located on the western parcel will be a transit bus loop and on the eastern parcel a passenger pick-up and drop-off (PPUDO) area, and two parking areas – one for 407 Transitway users (430 parking spaces) and for carpool users (200 parking spaces). The proposed Woodbine / Rodick Station will be located north of the transit bus loop. Two access roads are provided along Miller Avenue with the western access road being for transit vehicles only with direct access to the bus loop and the eastern access road being for general vehicles with direct access to the park-and-ride lot and PPUDO area.

Currently, a multi-use pathway is located just west of Woodbine Avenue. Pedestrian and bicycle access are planned to connect the proposed Woodbine / Rodick Station with existing pathways to establish connections between major road networks to the east and west side of the station area. Recommendations from the preliminary Markham Centre development plans include a pedestrian and bicycle link along Rodick Road corridor to connect areas on the north and south sides of Highway 407.

Exhibit 2-2: Preferred Woodbine / Rodick Station Concept (December 2010)



3. STUDY SCOPE

3.1 Study Area

The Study Area for the transportation study is generally bounded by Highway 407 to the north, Miller Avenue to the south, Woodbine Avenue to the east and Rodick Road to the west. A list of all Study Area intersections analyzed in this study is shown in **Exhibit 3-1** and a map of the Woodbine / Rodick Station Study Area is shown in **Exhibit 3-2**.

Exhibit 3-1: List of Study Area Intersections

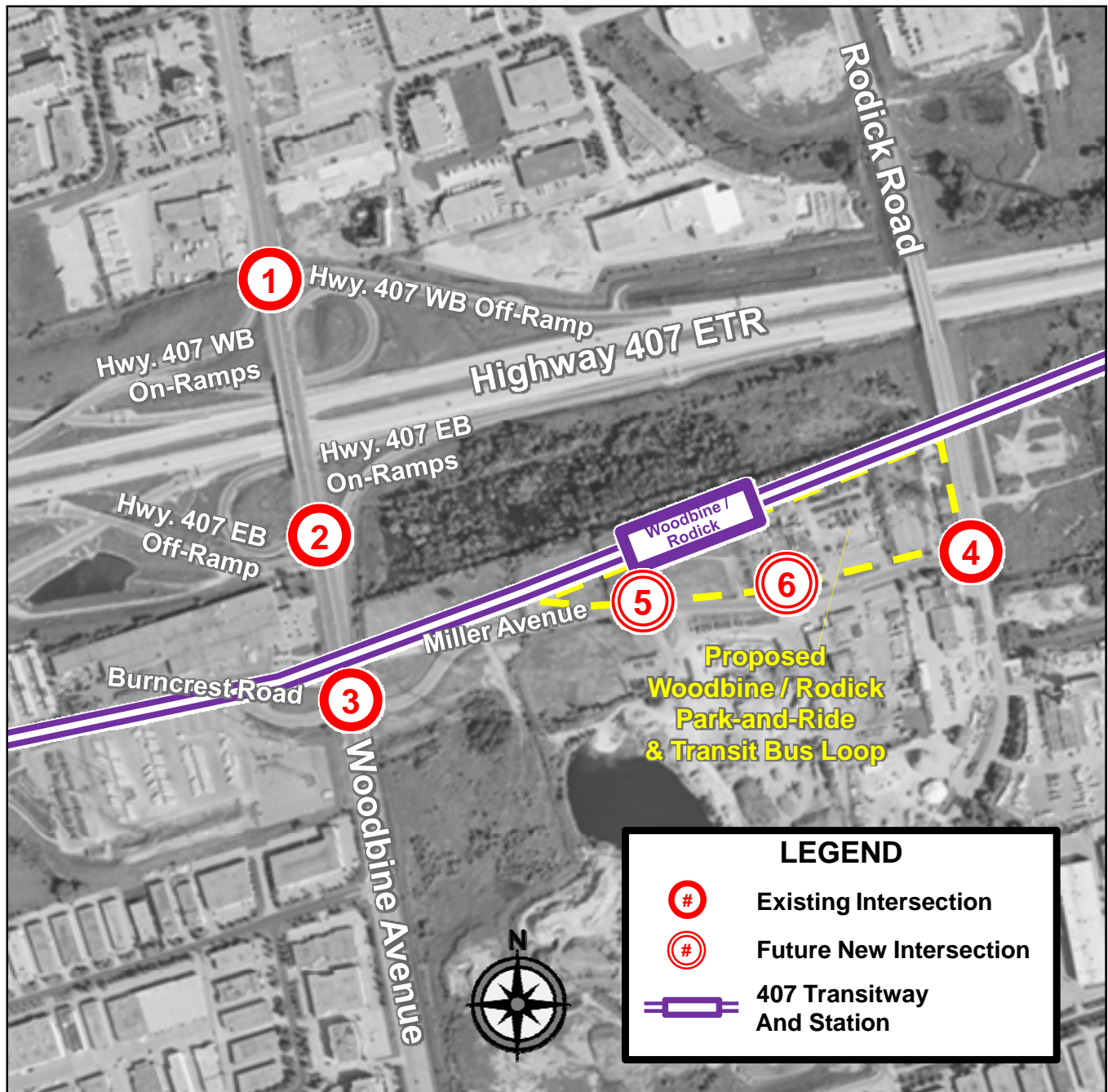
No.	East-West Street	North-South Street	Intersection Type
1	Highway 407 Westbound Off-Ramp	Woodbine Avenue	Signalized
2	Highway 407 Eastbound Off-Ramp	Woodbine Avenue	Signalized
3	Burncrest Road / Miller Avenue	Woodbine Avenue	Signalized
4	Miller Avenue	Rodick Road	Signalized
5	Miller Avenue	Transit Access Road	Signalized Transit Priority
6	Miller Avenue	Station Access Road	Signalized

3.2 Guidelines and Standards

Guidelines consulted for this study include the *York Region Transportation Impact Study (TIS) Guideline For Development Applications (August 2007)* and the *Ministry of Transportation, Ontario General Guidelines for the Preparation of Traffic Impact Studies (January 2008)*.

This study was carried out according to the accepted documents for geometric design standards outlined in the *York Region Road Design Guidelines*. It also maintains consistency with recommendations described in the report *Highway 7 Corridor & Vaughan North-South Link Public Transit Improvements (August 2005)*. Allowances for traffic generated by the planned Markham Centre residential and commercial centre developments will be incorporated to reflect long-term growth and planned road network improvements in the vicinity of the proposed Woodbine /Rodick Station area.

Exhibit 3-2: Study Area of Transportation Study



3.3 Horizon Years and Analysis Periods

Based on these guidelines and proposed construction and operational dates for the 407 Transitway, the following existing and future horizon periods (conditions) were established as part of this study:

- 2010 (Existing Condition);
- 2031 (Background Condition);
- 2031 (Future Total Condition).

Performance of the road network was assessed during the weekday am peak hour and pm peak hour, which correspond to the peak hours for the proposed Woodbine / Rodick Station.

3.4 Data Collection

3.4.1 TURNING MOVEMENT COUNTS

Turning movement counts for all Study Area intersections were obtained from York Region's Transportation Service's Department.

3.4.2 SIGNAL TIMING AND INTERSECTION CONFIGURATIONS

Current signal phasing and splits for the signalized study intersections were obtained from York Region's Transportation Service's Department. Intersection configurations were obtained through field studies undertaken by IBI Group staff.

3.5 Traffic Analysis Parameters

A Synchro signalized intersection analysis was conducted at all Study Area intersections under the existing, future background and future total traffic conditions. The operational analyses were primarily based on procedures set out in the Highway Capacity Manual (2000) with the assistance of Synchro 6.0 and Highway Capacity Software 2000. Signal cycle lengths, timing, and phasing currently in effect were obtained from York Region. The critical movements are identified for each time period.

3.5.1 CAPACITY AND LEVEL OF SERVICE

An intersection's overall operating conditions are typically characterized by two standard measures: the volume to capacity ratio (V/C) and the level of service (LOS). Taken together, they provide an indication of delay and the number of vehicles that can be accommodated through an intersection.

The V/C ratio is an indication of the volume of traffic attempting to make a specific movement through an intersection (i.e., northbound left, westbound straight through), versus the theoretical capacity of that movement given the lane configurations, operating conditions and signal timings provided at the intersection. A V/C ratio of 1.0 represents a condition where the theoretical capacity for a particular movement is being fully used.

The level of service (LOS) of the overall intersection of a particular movement is a measure of the average vehicle delay experienced by the motorists attempting to travel through the intersection. LOS is measured from "A" to "F" with peak hour LOS in the "A" to "D" range being considered acceptable by most and a "LOS F" representing unacceptable delays.

York Region's *Transportation Impact Study (TIS) Guidelines Development Applications (August 2007)* and the Ministry of Transportation's *General Guidelines for the Preparation of Traffic Impact Studies (January 2008)* were consulted for the base parameters of this study.

Existing intersection capacity analyses were undertaken using the Highway Capacity Manual (HCM) methodology, and specifically the Synchro 6.0 Traffic Signal Coordination Software package by Trafficware. The analysis reflects the most recently available traffic volumes, current signal timings, and existing lane configurations. Peak hour factors (PHF) at each intersection were calculated using 15-minute and hourly count data.

Critical movements were identified as those operating with a volume-to-capacity (V/C) ratio of 0.85 or higher and/or the poorest level of service (LOS) among all movements.

3.5.2 QUEUE LENGTHS

A queue length for a turning movement that exceeds the length of the available storage bay or creates back-ups is a concern, particularly at a signalized intersection. These turning vehicles can potentially block through vehicles during a green light, which reduces the intersection efficiency.

The Synchro 6.0 Traffic Signal Coordination Software measures both the 50th percentile and 95th percentile maximum queue lengths. The 50th percentile queue (the median) is the maximum back of queue length during a typical traffic cycle. The 95th percentile queue is the maximum back of queue length during a typical traffic cycle with 95th percentile traffic volumes. The 95th percentile queue measures the queue length that 95 percent of the sample lies below.

95th percentile critical queue lengths were identified for movements where the queue surpassed the estimated length of the storage bay.

4. EXISTING CONDITION

4.1 Area Road Network

Major roadways in the Study Area include the following:

- Woodbine Avenue – Regional (Arterial) Road;
- Rodick Road – Urban (Local) Road;
- Highway 407 Westbound Off-Ramp – 400 Series Provincial Highway;
- Highway 407 Eastbound Off-Ramp – 400 Series Provincial Highway; and
- Miller Avenue – Urban (Local) Road.

These are described in further detail below.

Woodbine Avenue

is a six-lane arterial road under the jurisdiction of York Region, and is classified as a “Regional Primary Arterial” road. According to 2003 York Region ATR counts, Woodbine Avenue south of Highway 407 accommodates approximately 43,000 to 47,000 vehicles per day within the study area road network. Within the Study Area, the maximum posted speed is 60 km/h on Woodbine Avenue.



Street View of Woodbine Avenue Looking South

Rodick Road is an urban local north-south roadway that connects Rivera Drive in the south with Woodbine Avenue in the northwest, crossing Highway 407 and 16th Avenue. South of Miller Avenue, it consists of one northbound and one southbound travel lanes and north of Miller Avenue, it consists of two northbound and two southbound travel lanes.



Street View of Rodick Road Looking North

Highway 407 Westbound Off-Ramp allows westbound Highway 407 vehicles to exit to Woodbine Avenue. It consists of one westbound left-turn lane, one westbound right-turn lane and one shared westbound left/right-turn lane.



Street View of Highway 407 Westbound Off-Ramp Looking West

Highway 407 Eastbound Off-Ramp allows eastbound Highway 407 vehicles to exit to Woodbine Avenue. It consists of one eastbound left-turn lane, one eastbound right-turn lane and one shared eastbound left/right-turn lane.



Street View of Highway 407 Eastbound Off-Ramp Looking East

Miller Avenue is an urban local east-west roadway that connects Woodbine Avenue in the west with Rodick Road in the east. It consists of one eastbound and one westbound travel lanes.



Street View of Miller Avenue Looking East

4.2 Lane Configurations

A map shown existing Study Area roadway lane configurations is shown in **Exhibit 4-1**. Along Woodbine Avenue, there are three traffic signals between Burncrest Road and the Highway 407 Westbound Off-Ramp terminal. Through the Study Area, Woodbine Avenue consists of three northbound and three southbound travel lanes with dedicated left-turn lanes at key signalized intersections. Rodick Road consists of two northbound and two southbound travel lanes. The Highway 407 Westbound Off-Ramp has three westbound lanes: one left-turn, one right-turn and one shared left/right-turn lane. The Highway 407 Eastbound Off-Ramp has three eastbound lanes: one left-turn, one right-turn and one shared left/right-turn lane. Miller Avenue has one travel lane in each direction.

4.3 Transit Services and Operations

Exhibit 4-2 shows the existing transit routes in the Study Area. In the vicinity of the Subject Site, transit bus routes include two TTC bus routes on Woodbine Avenue: Route #24 and Route #224 and its variants. The peak hour headways for these bus routes range from 20 to 30 minutes. A total of approximately 10 buses in both directions pass through the Woodbine Avenue corridor during the weekday am and pm peak hours (one hour between 7:00 to 9:00 am and 4:00 to 6:00 pm).

4.4 Existing Condition (2010) Traffic Volumes and Operations

The 2010 Existing Condition traffic volumes, including the weekday am and pm peak hours, are shown in **Exhibit 4-3**. The 2010 Existing Condition intersection capacity analyses were undertaken using the methodology outlined in **Section 3.2**.

4.4.1 CAPACITY AND LEVEL OF SERVICE

The weekday am and pm peak hour existing condition traffic analysis results are included in **Exhibit 4-4**. Existing Condition Synchro traffic analysis reports are included in **Appendix A**.

Overall, the three existing signalized intersections in the Study Area operate at acceptable levels of service (LOS 'D' or better) under the existing weekday am and pm peak hour traffic demands, with the volume to capacity (V/C) ratio below 1.0. Overall V/C ratios range from 0.71 to 0.98 during the weekday am peak hour, and from 0.55 to 0.83 during the weekday pm peak hour.

South of Highway 407, the Woodbine Avenue corridor is fully built up with large commercial and industrial/manufacturing districts to the east and west, which generates a lot of truck traffic and causes congestion, heavy stop-and-go traffic and increases delay during weekday peak hours.

The southbound through movement at the Highway 407 Eastbound Off-Ramp @ Woodbine Avenue intersection operates well above capacity (1.10) during the am peak hour. The northbound through movement at the Burncrest Road / Miller Avenue @ Woodbine Avenue intersection operates at capacity (0.98) during the pm peak hour. These findings indicate that the Study Area signalized intersections are experiencing specific turning movement capacity deficiencies with the current operations and geometric configurations.

Exhibit 4-1: Existing Study Area Lane Configurations

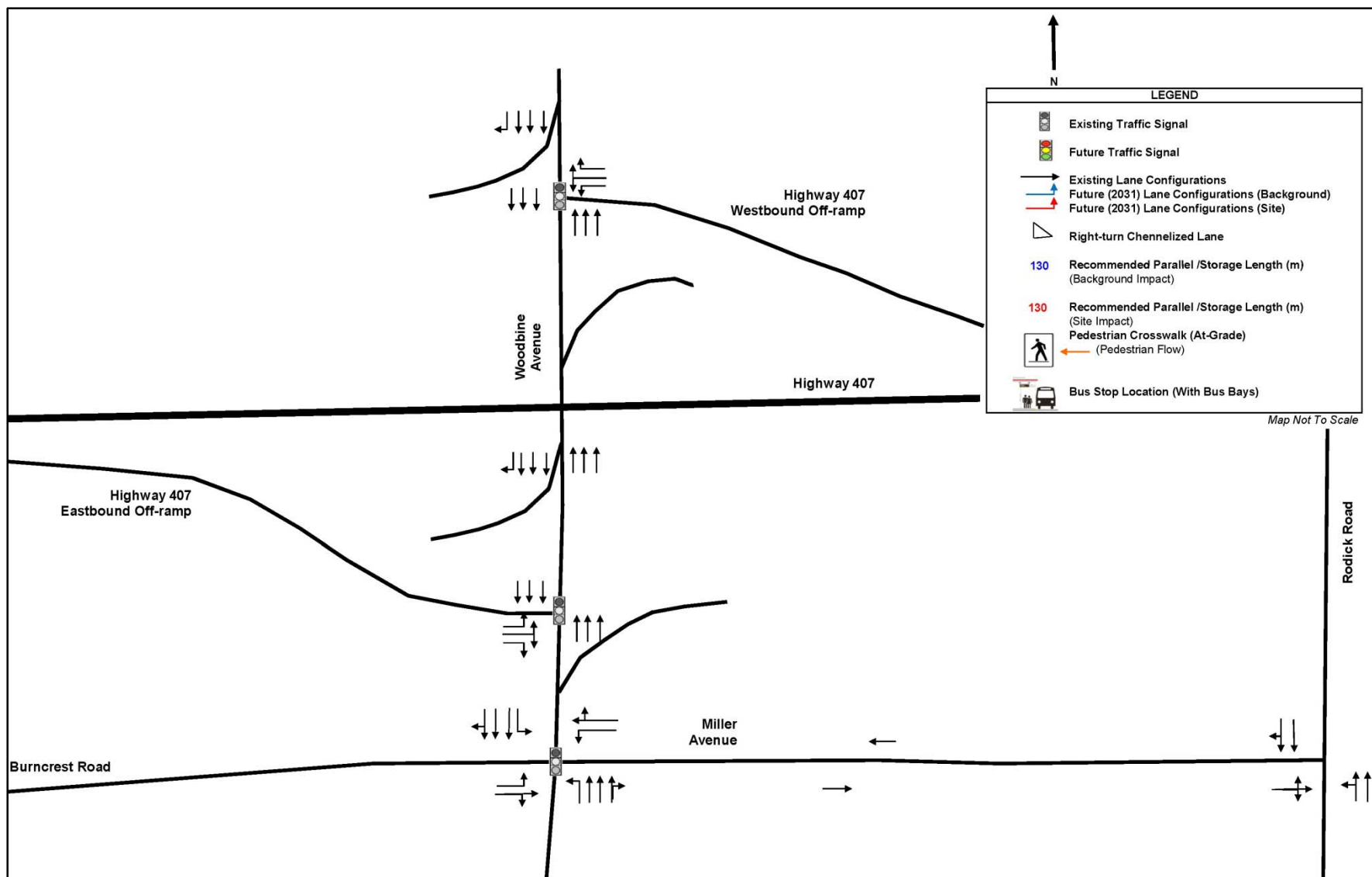


Exhibit 4-2: Transit Services in the Study Area

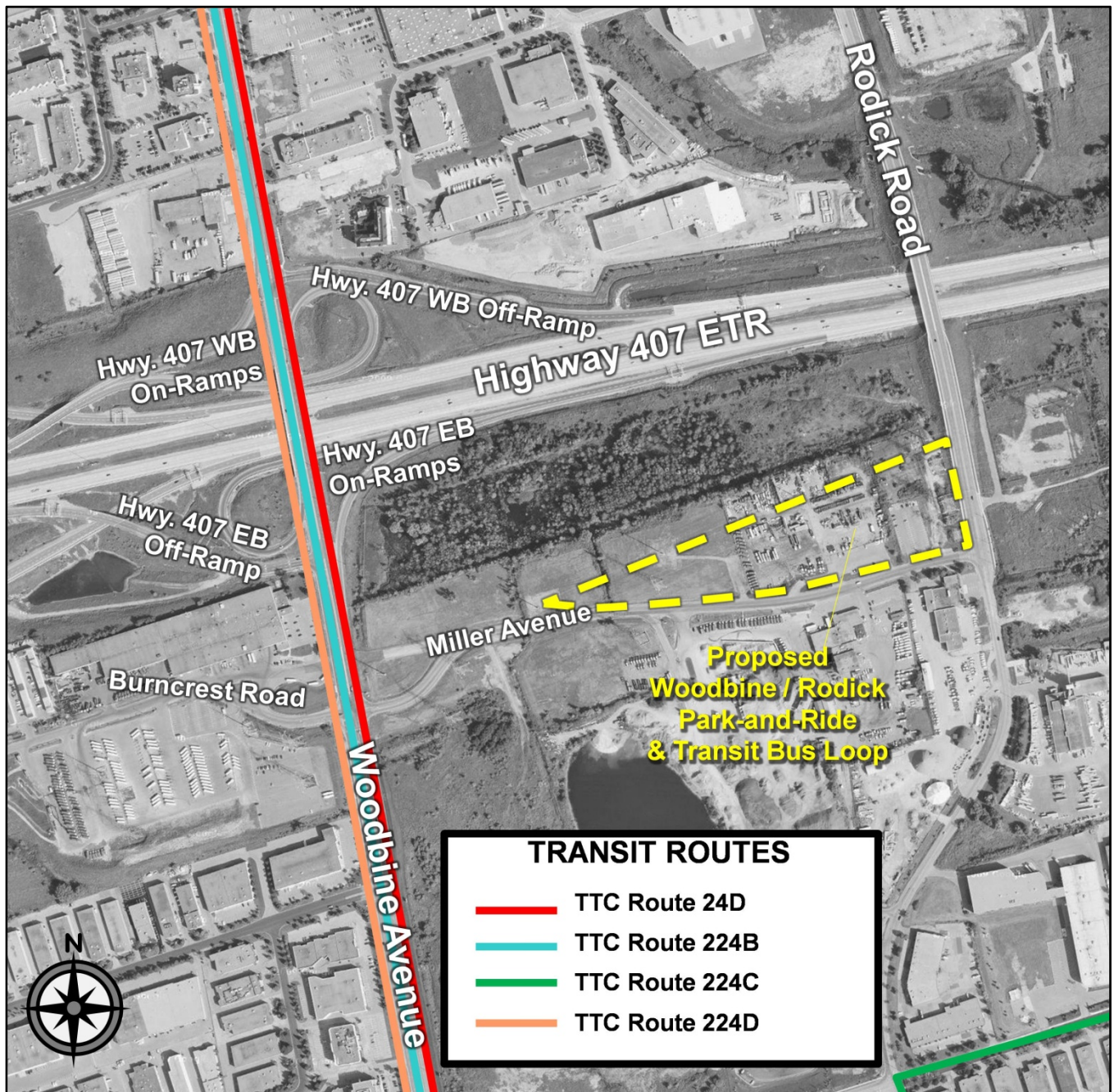


Exhibit 4-3: 2010 Existing Condition Traffic Volumes

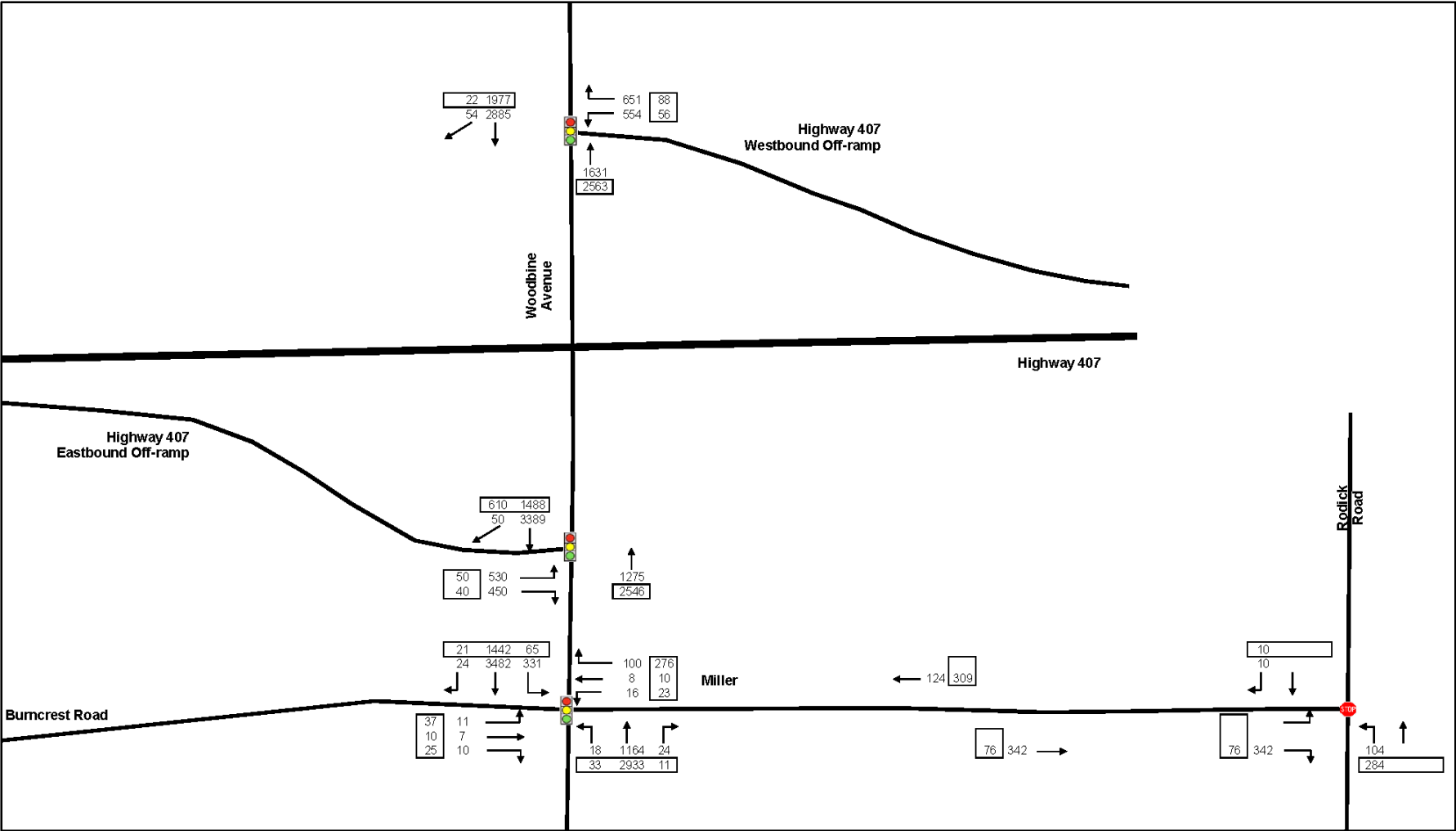


Exhibit 4-4: Existing Condition (2010) Intersection Operations

Intersection		Peak Hour	Movement	Existing Condition (2010)		
				V/C	Delay	LOS
Signalized Intersections						
1	Highway 407 Westbound Off-Ramp @ Woodbine Avenue	am	Overall	0.78	14	B
			SBT	0.79	13	B
		pm	Overall	0.55	11	B
			NBT	0.73	12	B
2	Highway 407 Eastbound Off-Ramp @ Woodbine Avenue	am	Overall	0.98	48	D
			SBT	1.10	69	E
		pm	Overall	0.63	4	A
3	Burncrest Road / Miller Avenue @ Woodbine Avenue	am	Overall	0.71	10	A
			SBL	0.72	14	B
			SBT	0.79	7	A
		pm	Overall	0.83	29	C
			NBT	0.98	38	D
5	Transit Access Road @ Miller Avenue	am	EBL	No Intersection Under Existing Conditions		
			SBLR			
		pm	EBL			
			SBLR			
6	Station Access Road @ Miller Avenue	am	EBL	No Intersection Under Existing Conditions		
			SBL			
		pm	EBL			
			SBL			
Unsignalized Intersections						
4	Miller Avenue @ Rodick Road	am	EBL	0.02	10	B
			NBLT	0.07	7	A
		pm	EBL	0.03	16	C
			NBLT	0.19	8	A

Notes:

Critical movement(s) defined as V/C > 0.85 and/or poorest LOS.

4.4.2 QUEUE LENGTHS

The weekday am and pm peak hour existing condition queue length analysis results are included in **Exhibit 4-5**. Existing Condition Synchro traffic analysis reports are included in **Appendix A**.

Exhibit 4-5: Existing Condition (2010) Turning Movement Queue Lengths

Intersection		Peak Hour	Movement	Parallel Lane Storage Length (m)	Existing Condition (2010) Synchro Queues (m)	
					50th Percentile	95th Percentile
Signalized Intersections						
1	Highway 407 Westbound Off-Ramp @ Woodbine Avenue	am	WBL	WBL = 625;	62	79
		pm	WBL		6	11
2	Highway 407 Eastbound Off-Ramp @ Woodbine Avenue	am	EBL	WBL = 550;	58	75
		pm	EBL		6	11
3	Burncrest Road / Miller Avenue @ Woodbine Avenue	am	WBL	WBL = 55; SBL = 110;	4	10
			WBR		0	0
			SBL		16	48
		pm	WBL		5	12
			WBR		0	0
			SBL		6	11
5	Transit Access Road @ Miller Avenue	am	EBL	.	No Intersection Under Existing Conditions	
			SBL			
		pm	EBL			
			SBL			
6	Station Access Road @ Miller Avenue	am	EBL	.	No Intersection Under Existing Conditions	
			SBL			
		pm	EBL			
			SBL			
Unsignalized Intersections						
4	Miller Avenue @ Rodick Road	am	EBL	.	0	1
			NBLT		0	2
		pm	EBL		0	1
			NBLT		0	5

There are no queuing issues at Study Area intersection turning movements. However, long through traffic movement queuing spillbacks occur in the southbound direction during the am peak hour and in the northbound direction during the pm peak period.

5. FUTURE BACKGROUND CONDITION

5.1 Proposed Transit Services

A potential new YRT bus route is recommended along the Rodick Road corridor following the completion of Rodick Road connection with Miller Avenue. Consequently, this study will incorporate the impacts of new transit route on the proposed Woodbine / Rodick Station.

5.2 Future Background Traffic Growth

Future background traffic volumes account for general corridor growth on the Study Area road network. This growth was estimated based on the forecasts obtained from the York Region Travel Demand Forecasting Model. For the purposes of this study, existing traffic volumes were factored up by 1.245, representing a compound growth rate of 1% per annum over 21 years, to develop the 2031 base background traffic volumes. These factors were applied to all movements along the Woodbine and Miller Avenue corridor.

5.3 Future Background Developments

The *Markham Centre Development Plan* (referred to as “Markham Centre” in this study) is a series of large mixed used development blocks planned for an area northeast of the proposed Woodbine / Rodick Station – generally bounded by Woodbine Avenue to the west, Kennedy Road to the east, Highway 7 to the north and Highway 407 to the south. Major developments under construction or planned for Markham Centre include multi-unit residential buildings and single family townhouses, office developments, commercial and retail developments and community/institutional uses such as churches, schools, and parks. By 2031, under a 60% intensification growth scenario, it is forecasted that Markham Centre will be home to 28,600 people and 21,700 jobs. Under a full build-out scenario, it is forecast that the population and employment numbers be approximately 39,300 and 39,400, respectively.

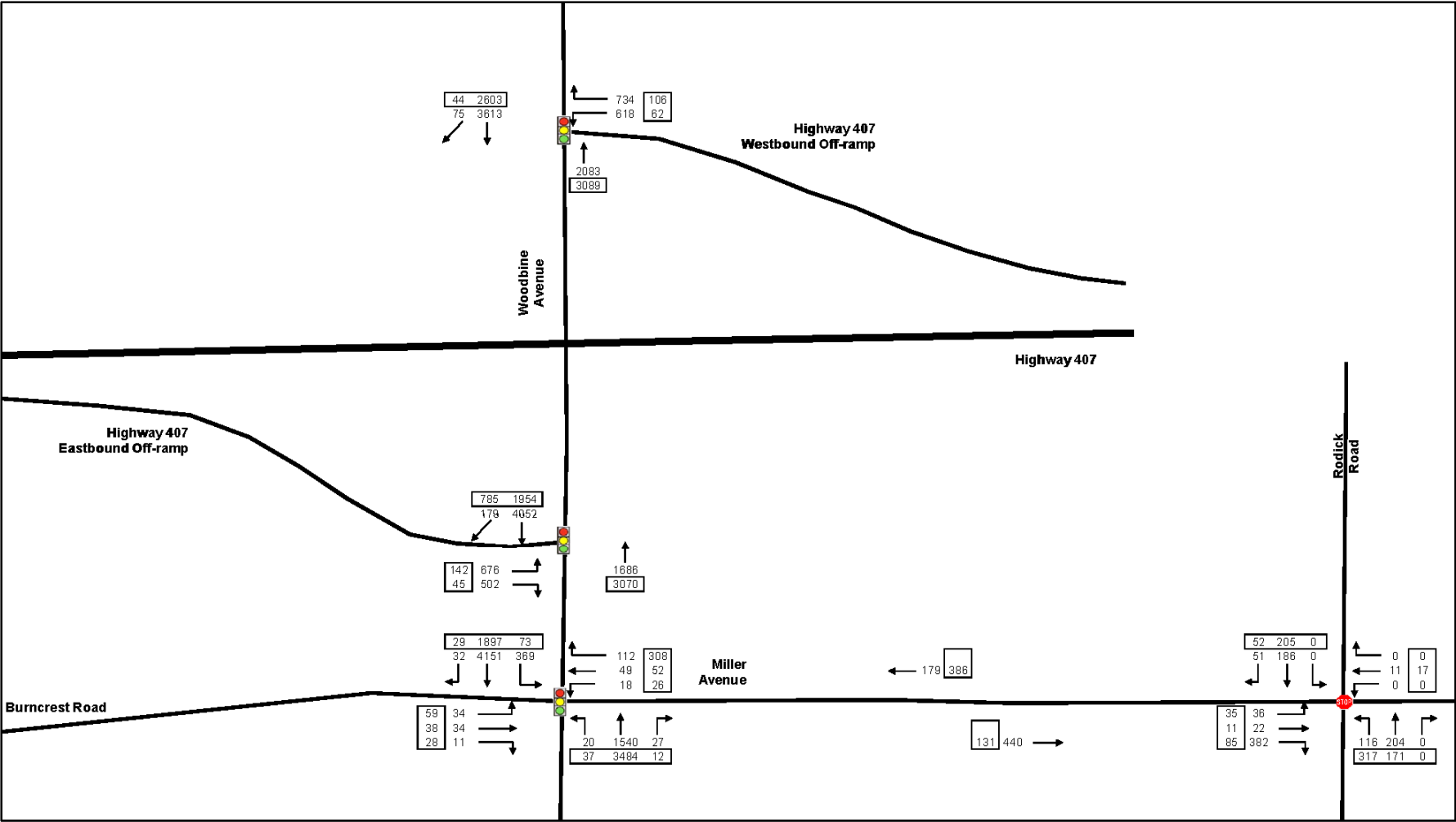
A transportation plan for the Markham Centre development investigates strategies and techniques that make more efficient use of current roadway infrastructure, primarily shifting travel demand from single-occupancy vehicle to bus rapid transit. Relevant transit and traffic operational changes from this transportation plan have been taken into account in this study. Through the Study Area, Markham Centre is projected to generate several hundred inbound and outbound auto trips during both the am and pm peak hours. These auto trips will use the Woodbine Avenue and Rodick Road north-south corridors but are not projected to use the Miller Avenue east-west corridor.

Several transit oriented developments are also planned for areas south of Miller Avenue. However, at this time, no concrete land use plans or development statistics are available for these developments, and thus they excluded from this study.

5.4 Future Total Background Volumes

The future (2031) background traffic volumes comprise existing (2010) base traffic volumes shown in **Exhibit 4-3** plus corridor growth traffic to the area surrounding the Subject Site and projected traffic generated by future background developments. The resultant future background traffic volumes are illustrated in **Exhibit 5-1** for the weekday am and pm peak hours, respectively.

Exhibit 5-1: 2031 Background Condition Traffic Volumes



5.5 Future Background Condition (2031) Traffic Operations

The 2031 Background Condition intersection capacity analyses were undertaken using the methodology outlined in **Section 3.2**.

5.5.1 CAPACITY AND LEVEL OF SERVICE

The weekday am and pm peak hour background condition traffic analysis results are included in **Exhibit 5-2**. Full analysis summaries are included in **Appendix B**.

The future total background traffic analysis results indicate that there is considerable deterioration in traffic operations at key intersections along the Woodbine Avenue corridor. The projected impact of background traffic increases are in the range of 2% to 15% in overall V/C ratios at Study Area intersections during weekday peak hours.

Future background growth and the background traffic associated with the Markham Centre development are projected to impact the signalized intersections along the Woodbine Avenue corridor. Delays at northbound and southbound through movements are projected to increase and create conflicts for left-turn and right-turn movements from of Miller Avenue and Highway 407 Off-Ramps. The congested through movements must compete with opposing turning movements for a proportion of green time. As a result, northbound and southbound approaches are projected to experience delays of 60 seconds per vehicle during weekday peak hours.

While a portion of turning traffic volumes can be readily accommodated through diversions to future new parallel road connections such as Rodick Road and Birchmount Road, future traffic condition sensitivity tests project that overall level-of-service at Woodbine Avenue corridor signalized intersection would remain 'D' (or better).

To address identified deficiencies, physical road improvements are recommended to mitigate the impacts of increased background, particularly along the Woodbine Avenue corridor. These include the following:

- An exclusive westbound right-turn lane at the Burncrest Road / Miller Avenue @ Woodbine intersection;
- A channelized eastbound right-turn lane combined with a shorter receiving lane at the Highway 407 Eastbound Off-Ramp @ Woodbine Avenue intersection to alleviate right-turn traffic congestion during the am peak hour; and
- Signalize the Miller Avenue @ Rodick Road intersection to accommodate Markham Centre development traffic.

5.5.2 QUEUE LENGTHS

The weekday am and pm peak hour existing condition queue length analysis results are included in **Exhibit 5-3**. Full analysis summaries are included in **Appendix B**.

**Exhibit 5-2: Background Condition (2031) Compared with Existing Condition (2010)
Intersection Operations**

Intersection		Peak Hour	Movement	Existing Condition (2010)			Background Condition (2031)		
				V/C	Delay	LOS	V/C	Delay	LOS
Signalized Intersections									
1	Highway 407 Westbound Off-Ramp @ Woodbine Avenue	am	Overall	0.78	14	B	0.90	19	B
			SBT	0.79	13	B	0.94	21	C
		pm	Overall	0.55	11	B	0.60	12	B
			NBT	0.73	12	B	0.53	9	A
2	Highway 407 Eastbound Off-Ramp @ Woodbine Avenue	am	Overall	0.98	48	D	1.00	50	D
			SBT	1.10	69	E	1.11	74	E
		pm	Overall	0.63	4	A	0.72	8	A
3	Burncrest Road / Miller Avenue @ Woodbine Avenue	am	Overall	0.71	10	A	0.85	68	E
			SBL	0.72	14	B	0.87	31	C
			SBT	0.79	7	A	1.15	91	F
		pm	Overall	0.83	29	C	0.92	44	D
			NBT	0.98	38	D	1.07	62	E
5	Transit Access Road @ Miller Avenue	am	EBL	No Intersection Under Existing and Background Conditions					
			SBLR						
		pm	EBL						
			SBLR						
6	Station Access Road @ Miller Avenue	am	EBL	No Intersection Under Existing and Background Conditions					
			SBL						
		pm	EBL						
			SBL						
Unsignalized Intersections									
4	Miller Avenue @ Rodick Road	am	EBL	0.02	10	B	0.09	16	C
			NBL	0.07	7	A	0.09	8	A
		pm	EBL	0.03	16	C	0.42	43	E
			NBL	0.19	8	A	0.24	6.7	A

Notes:

Critical movement(s) defined as V/C > 0.85 and/or poorest LOS.

Exhibit 5-3: Background Condition (2031) Compared with Existing Condition (2010) Turning Movement Queue Lengths

Intersection		Peak Hour	Movement	Parallel Lane Storage Length (m)	Existing Condition (2010) Synchro Queues (m)		Background Condition (2031) Synchro Queues (m)	
					50th Percen.	95th Percen.	50th Percen.	95th Percen.
Signalized Intersections								
1	Highway 407 Westbound Off-Ramp @ Woodbine Ave	am	WBL	WBL = 625;	62	79	64	82
		pm	WBL		6	11	6	11
2	Highway 407 Eastbound Off-Ramp @ Woodbine Ave	am	EBL	WBL = 550;	58	75	67	85
		pm	EBL		6	11	15	23
3	Burncrest Road / Miller Avenue @ Woodbine Avenue	am	WBL	WBL = 55; SBL= 110;	4	10	3	9
			WBR		0	0	0	13
			SBL		16	48	32	63
		pm	WBL		5	12	5	12
			WBR		0	0	43	73
			SBL		6	11	6	11
5	Transit Access Road @ Miller Avenue	am	EBL	.	No Intersection Under Existing and Background Conditions			
			SBL					
		pm	EBL					
			SBL					
6	Station Access Road @ Miller Avenue	am	EBL	.	No Intersection Under Existing and Background Conditions			
			SBL					
		pm	EBL					
			SBL					
Unsignalized Intersections								
4	Miller Avenue @ Rodick Road	am	EBL	.	0	1	0	3
			NBLT		0	2	0	2
		pm	EBL		0	1	0	14
			NBLT		0	5	0	7

There are no queuing issues projected at Study Area intersection turning movements. However, long through traffic movement queuing spillbacks are projected to get worse along the Woodbine Avenue corridor in the southbound direction (approximately 225-375 metres) during the am peak hour and in the northbound direction approximately (150-300 metres) during the pm peak period.

6. WOODBINE / RODICK STATION RELATED TRAFFIC

6.1 Passenger Flow Projections

The preferred station concept shown in **Exhibit 2-2** indicates that the park-and-ride facility will include 430 parking spaces for 407 Transitway users and 200 spaces for carpoolers by the year 2031. Vehicle access to and from the parking lot will be through a single access point from Miller Avenue with a separate access point for transit vehicles only.

6.2 Woodbine / Rodick Station Trip Generation

6.2.1 ASSUMPTIONS

The following assumptions were used to establish the increase in site related traffic. The trip generation rates for the subject park-and-ride development were extracted from the *Institute of Transportation Engineers (ITE) Trip Generation Manual, 8th Edition*. The selected trip rates were taken from Land Use Code 090: Park-and-Ride Lot with Bus Service and are summarized in **Exhibit 6-1**.

Exhibit 6-1: Trips Rates and Splits for Park-and-Ride with PPUDO Facility

Site Users	No. of Parking Spaces	Am Split		Pm Split		Trip Rates					
						Am Peak Hour			Pm Peak Hour		
		In	Out	In	Out	In	Out	Total	In	Out	Total
407 Transitway	430	81%	19%	23%	77%	0.58	0.14	0.72	0.14	0.48	0.62
Carpool	200	81%	19%	23%	77%	0.58	0.14	0.72	0.14	0.48	0.62

6.2.2 GENERATED TRIPS

The estimated trip generation for the proposed Woodbine / Rodick Station is summarized in **Exhibit 6-2**. The park-and-ride facility will generate approximately 450 and nearly 400 two-way trips during the am and pm peak hours, respectively.

Exhibit 6-2: Estimated Trip Generation for Woodbine / Rodick Station

Site Users	No. of Parking Spaces	Am Split		Pm Split		Trip Rates					
						Am Peak Hour			Pm Peak Hour		
		In	Out	In	Out	In	Out	Total	In	Out	Total
407 Transitway	430	81%	19%	23%	77%	251	59	310	61	205	267
Carpool	200	81%	19%	23%	77%	117	27	144	29	95	124
Total Trips						367	86	454	90	301	391

6.3 Future Bus Transit Volumes

In terms of bus traffic accessing the proposed Woodbine / Rodick Station, it was assumed that a new YRT local feeder bus service will be introduced to capture the benefits of new road connections from the proposed Markham Centre developments such as the planned extensions of Enterprise Boulevard and Rodick Road. Therefore, a total of 8 buses (4 in each direction) will enter the station in both directions during the weekday am and pm peak hours. While the existing bus services operated on Woodbine Avenue would not access the Woodbine/ Rodick Station with doubled frequencies. As a result, a total of 20 buses (10 per direction) will pass through the Woodbine Avenue Corridor during peak hours. Based on data from *Canadian Capacity Guide for Signalized Intersection, 3rd Edition (February 2008)*, each bus is assumed to be equivalent to two passenger cars in this study.

6.4 Trip Distribution

Site generated traffic was assigned to the road network based on the indicated trip generation, trip distribution, and proposed site access parameters. **Exhibit 6-3** summarizes the trip distribution parameters used for this study.

Exhibit 6-3: Distribution of Park-and-Ride Traffic

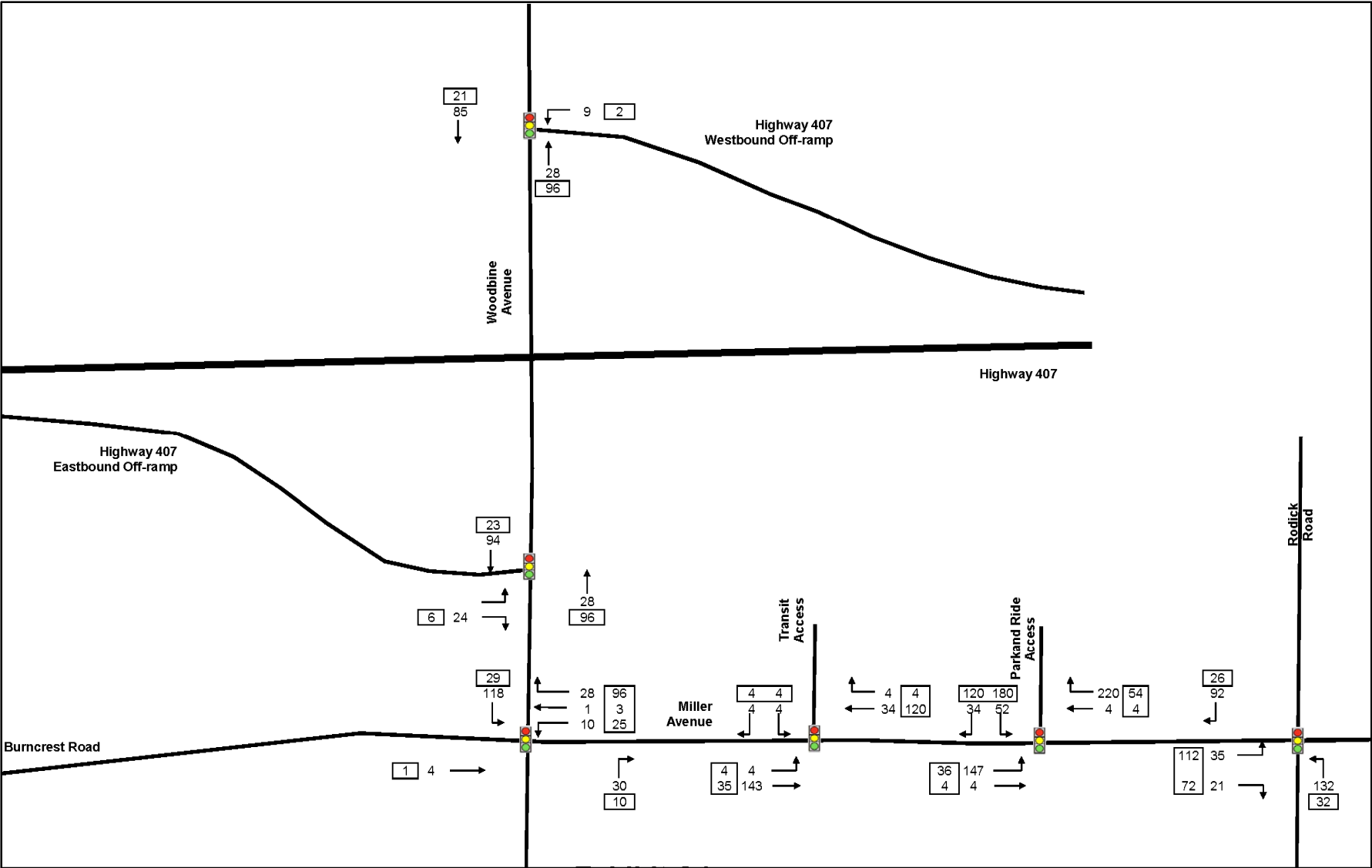
To / From	Am Peak Hour		Pm Peak Hour	
	IN	OUT	IN	OUT
Woodbine Avenue (North)	23%	32%	23%	32%
Woodbine Avenue (South)	7%	7%	7%	7%
Highway 407 (West)	9%	-	9%	-
Miller Avenue (East)	60%	60%	60%	60%
Burncrest Road (West)	1%	1%	1%	1%
Total	100%	100%	100%	100%

The source of the trip distribution is associated with Transportation Tomorrow Survey (TTS) data. It is expected that during weekday peak hours, approximately 60% of all inbound and outbound vehicles originate from and are destined to the Miller Avenue east approach. Although Miller Avenue currently ends at Rodick Road, it is proposed to be extended eastward to Birchmount Road. This study assumes that traffic from the proposed Markham Centre development and residential neighbourhoods south of Highway 407 will use the proposed Miller Avenue extension under the long-term horizon period. In the near future, motorists will still use Rodick Road to access Miller Avenue. Minor differences in inbound and outbound trip patterns reflect the relative convenience of alternative trip routings afforded by the regional road network.

6.5 Trip Assignment

The site generated trips were assigned to the street network based on the trip distribution percentages discussed above, taking into account the directionality of the trips (inbound vs. outbound). The site generated traffic volumes for the weekday am and pm peak hour are illustrated in **Exhibit 6-4**.

Exhibit 6-4: 2031 Site Generated Traffic Volumes



7. FUTURE TOTAL CONDITION

7.1 Future Transit Services and Operations

Based on the existing transit route configuration, the physical configuration of the future transit operations were evaluated to achieve optimum geometric configurations for the road network surrounding the proposed Woodbine / Rodick Station. The following can be concluded for future transit operations:

- A dedicated new signal-controlled Transit Access Road located 300 metres east of Woodbine Avenue. An exclusive eastbound left-turn lane will improve traffic flows on Miller Avenue; and
- A bus loop road with a dedicated bus unloading and loading area that is separated from the park-and-ride area.

7.2 Future Pedestrian / Bicycle Facilities and Operations

In order to ensure the Subject Site is a complete and sustainable community, it is proposed that walking and cycling infrastructure be built into the site from the outset (See **Exhibit 7-1**). Key features include:

- An at-grade crosswalk is recommended at the Shields Court @ Woodbine Avenue intersection to facilitate pedestrian crossings between both sides of Woodbine Avenue;
- A pedestrian and bicycle connection to the west Woodbine Avenue and north of Highway 407 is planned to provide access to residential neighbourhoods from the proposed Woodbine / Rodick Station;
- A circumferential walking path is recommended along Miller Avenue to provide access to the proposed Woodbine / Rodick Station from Woodbine Avenue; and
- As the site plan and station facilities details are refined, other opportunities to promote walking and cycling will be pursued, including options for bicycle parking, pedestrian amenities (e.g. benches), and further traffic calming measures.

7.3 Site Access and Configurations

Supplemental improvements beyond those planned will be required along the Miller Avenue corridor and at the Station Access Road and Transit Access Road intersections. These assumed improvements include:

- The signalization of the new Station Access Road intersection;
- The signalization of the new signal-controlled Transit Access Road intersection (west of the Station Access Road intersection);
- The introduction of eastbound left-turn and southbound right-turn lanes along Miller Avenue at the new signalized Station Access Road intersection (i.e. two inbound lanes);
- The addition of two outgoing lanes for the southbound approach of the new signalized Station Access Road intersection; and

- The introduction of an eastbound left-turn lane at the signal-controlled Transit Access Road intersection future inbound transit vehicles to access YRT bus loop.

The total signalized intersection spacing on Miller Avenue, Woodbine Avenue and Rodick Road, is approximately 810 metres. For the park-and-ride lot, a new signalized intersection would be installed approximately 180 meters west of Rodick Road. This is an acceptable distance from Rodick Road and will reduce interference with the eastbound left-turn lane at the Miller Avenue @ Rodick Road intersection.

The provision of a secondary transit only access on Miller approximately 300 meters west of the Station Access Road will also be feasible. In order to accommodate eastbound inbound transit vehicles during future transit operations, a left-turn turn lane with a minimum length of 25 metres is recommended. With the signal control, the Miller Avenue @ Transit Access Road intersection is projected to operate with satisfactory level of service during weekday peak hours.

7.4 Future Traffic Control and Lane Configurations

Currently, Miller Avenue and Rodick Road are two-lane minor collector roads under the jurisdiction of the Town of Markham. However, according to the *Markham Centre Capital Investment Plan*, both roads will be widened to four-lane roadways and be reclassified as major collector roads. This study incorporates all planned and under construction road improvements to reflect realistic future traffic conditions on Miller Avenue and Rodick Road.

A map shown future Study Area roadway lane configurations is shown in **Exhibit 7-1** with recommended future background and site lane configurations and storage lengths shown in blue and red. Other geometrical improvements including pedestrian crossings and pathways are also shown.

7.5 Future Total Traffic Volumes

Site traffic volumes were added to future background traffic volumes to obtain the corresponding future total traffic volumes at the study area intersections. The 2031 future total traffic volumes are shown in **Exhibit 7-2**.

7.6 Future Total Condition (2031) Traffic Operations

7.6.1 CAPACITY AND LEVEL OF SERVICE

The weekday am and pm peak hour traffic analysis results are included in **Exhibit 7-3**. Full analysis summaries are included in **Appendix C**.

Exhibit 7-1: Future Study Area Recommended Lane and Geometrical Configurations

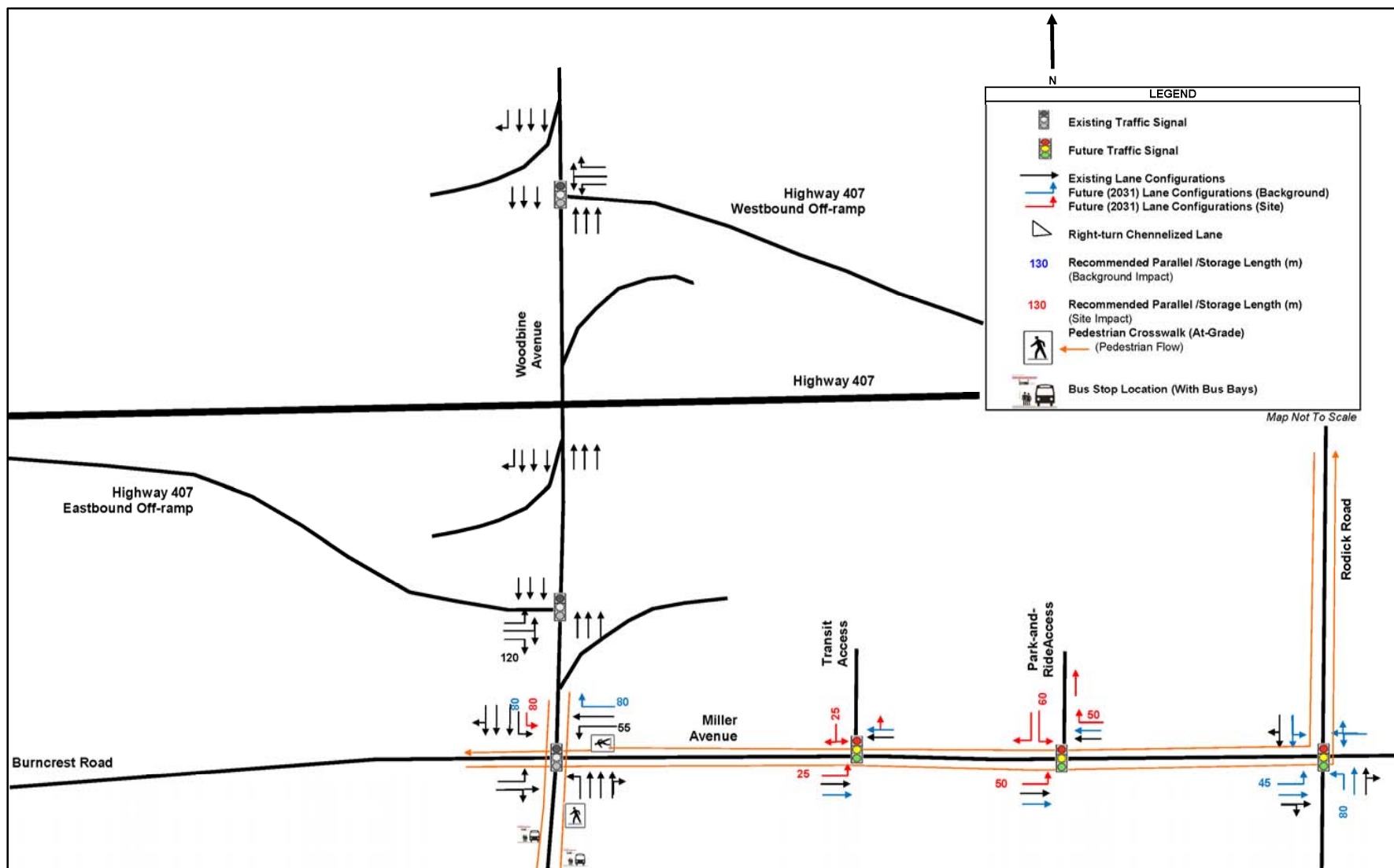
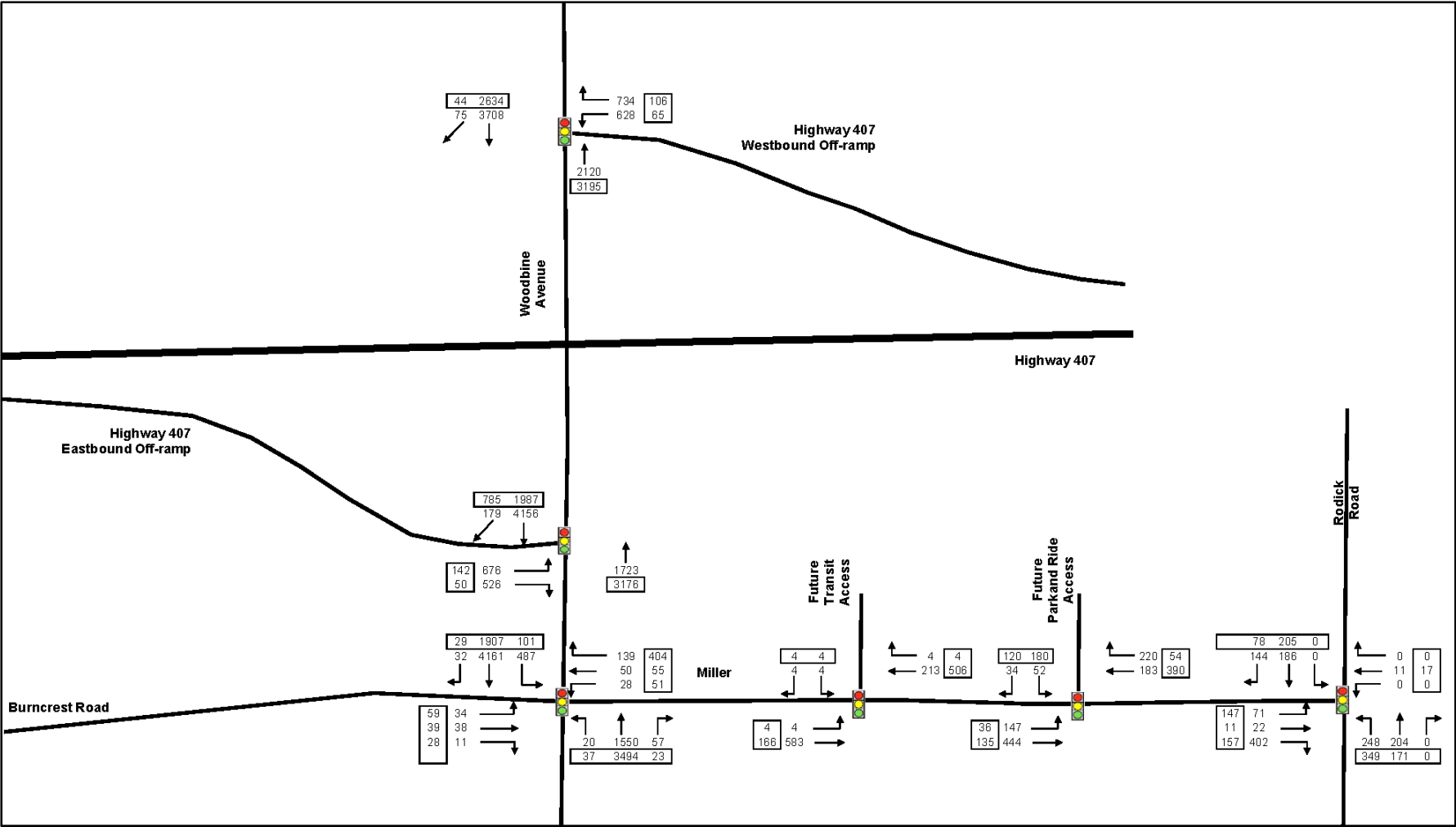


Exhibit 7-2: 2031 Future Total Traffic Volumes



**Exhibit 7-3: Future Total Condition (2031) Compared with Background Condition (2031)
Intersection Operations**

Intersection		Peak Hour	Movement	Background Condition (2031)			Future Total Condition (2031)		
				V/C	Delay	LOS	V/C	Delay	LOS
Signalized Intersections									
1	Highway 407 Westbound Off-Ramp @ Woodbine Avenue	am	Overall	0.90	19	B	0.92	20	C
			SBT	0.94	21	C	0.97	25	C
		pm	Overall	0.60	12	B	0.62	13	B
			NBT	0.53	9	A	0.82	14	B
2	Highway 407 Eastbound Off-Ramp @ Woodbine Avenue	am	Overall	1.00	50	D	1.02	57	E
			SBT	1.11	74	E	1.14	86	F
		pm	Overall	0.72	8	A	0.75	8	A
3	Burncrest Road / Miller Avenue @ Woodbine Avenue	am	Overall	0.85	68	E	0.86	66	E
			SBL	0.87	31.1	C	0.61	14	B
			SBT	1.15	90.5	F	1.15	92	F
		pm	Overall	0.92	44	D	1.01	52	D
			NBT	1.07	62	E	1.10	74	E
4	Miller Avenue @ Rodick Road	am	Overall	-	-	-	0.32	96	F
			EBL	0.09	16	C	0.29	63	E
			NBL	0.09	8	A	0.32	4	A
		pm	Overall	-	-	-	0.48	11	B
			EBL	0.42	43	E	0.63	35	C
			NBL	0.24	6.7	A	0.45	7	A
5	Transit Access Road @ Miller Avenue	am	EBL	No Intersection Under Background Conditions			0.00	8	A
			SBLR				0.02	14	B
		pm	EBL				0.02	11	B
			SBLR				0.02	14	B
6	Station Access Road @ Miller Avenue	am	EBL	No Intersection Under Background Conditions			0.60	36	D
			SBL				0.04	4	A
		pm	EBL				0.28	32	C
			SBL				0.14	4	A

Notes:

Critical movement(s) defined as V/C > 0.85 and/or poorest LOS.

The addition of site traffic will moderately affect future traffic operations at Study Area signalized intersections. Changes to the overall V/C ratio are in the range of 2% to 9% during the weekday peak hours. Only the Highway 407 Westbound Off-Ramp @ Woodbine Avenue is projected to operate with a satisfactory level-of-service (LOS 'D' or better). All other signalized intersections are projected to operate at LOS 'E' or worse.

The addition of site traffic to the Burncrest Road / Miller Avenue @ Woodbine Avenue intersection is projected to increase the southbound left-turn movement V/C ratio significantly and create over-capacity condition during the am peak hour. This impact combined with background traffic increases will warrant the installation of dual southbound left-turn lanes to accommodate the future project traffic volumes. The additional of a second southbound left-turn lane will improve the LOS.

7.6.2 QUEUE LENGTHS

The weekday am and pm peak hour existing condition queue length analysis results are included in **Exhibit 7-4**. Full analysis summaries are included in **Appendix C**.

With geometrical improvements, there are no queuing issues projected at Study Area intersection turning movements. However, long through traffic movement queuing spillbacks are projected to continue along the Woodbine Avenue corridor in the southbound direction (approximately 250-375 metres) during the am peak hour and in the northbound direction approximately (150-300 metres) during the pm peak period.

**Exhibit 7-4: Future Total Condition (2031) Compared With Background Condition (2031)
Intersection Operations**

Intersection		Peak Hour	Movement	Parallel Lane Storage Length (m)	Background Condition (2031) Synchro Queues (m)		Future Total Condition (2031) Synchro Queues (m)	
					50th Percen.	95th Percen.	50th Percen.	95th Percen.
Signalized Intersections								
1	Highway 407 Westbound Off-Ramp @ Woodbine Ave	am	WBL	WBL = 625; WBL = 550;	64	82	65	83
		pm	WBL		6	11	6	11
2	Highway 407 Eastbound Off-Ramp @ Woodbine Ave	am	EBL	WBL = 550; SBL = 110;	67	85	67	85
		pm	EBL		15	23	15	23
3	Burncrest Road / Miller Avenue @ Woodbine Avenue	am	WBL	WBL = 55; SBL = 110;	3	9	5	12
			WBR		0	13	0	15
			SBL		32	63	20	26
		pm	WBL		5	12	9	20
			WBR		43	73	68	121
			SBL		6	11	4	9
4	Miller Avenue @ Rodick Road	am	EBL	.	0	1	13	21
			NBL		0	2	8	25
		pm	EBL		0	1	17	36
			NBL		0	5	20	42
5	Transit Access Road @ Miller Avenue	am	EBL	.	No Intersection Under Background Conditions		0	1
			SBL				0	1
		pm	EBL				0	1
			SBL				0	1
6	Station Access Road @ Miller Avenue	am	EBL	.	No Intersection Under Background Conditions		22	36
			SBL				2	7
		pm	EBL				5	13
			SBL				8	15

8. SUMMARY AND CONCLUSIONS

Based on the analysis presented above, the following have been concluded / recommended:

- The preferred transit scenario for the proposed Woodbine / Rodick Station has separate site accesses to accommodate the site generated parking related traffic and local transit traffic;
- In order to avoid potential interference with the traffic operation on Rodick Road, the new signalized Station Access Road for the park-and-ride traffic should be installed at least 180 meters west of Rodick Road;
- The provision of the separate Transit Access Road is also feasible and should be located approximately 300 meters west of the park-and-ride access point;
- Several turning lanes are considered to accommodate the park-and-ride and transit traffic operation at the site access intersections. Transit operations will experience relatively acceptable delays at the new signalized transit priority Transit Access Road @ Miller Avenue intersection;
- Preliminary traffic analysis shows that key intersections on Woodbine Avenue will operate with relatively higher delays but at acceptable levels of service under the existing and future background conditions; This is primarily due to the substantial projected background growth and traffic from major background developments such as Markham Centre;
- A circumferential walking path is recommended along Miller Avenue and Rodick Road to provide pedestrian and cycling access to the proposed Woodbine /Rodick Station; and
- Further investigation on sight-line requirement of new signalized intersection is recommended to achieve satisfactory intersection sight triangle.

APPENDIX A

2010 EXISTING CONDITION SYNCHRO SUMMARY OUTPUTS



Lane Group	WBL	WBR	NBT	SBT
Lane Configurations	WY	Y	TTT	TTT
Volume (vph)	554	651	1631	2885
Lane Group Flow (vph)	602	708	1717	3037
Turn Type	Free			
Protected Phases	8		2	6
Permitted Phases	Free			
Detector Phases	8		2	6
Minimum Initial (s)	10.0		15.0	15.0
Minimum Split (s)	26.0		26.0	26.0
Total Split (s)	31.0	0.0	89.0	89.0
Total Split (%)	25.8%	0.0%	74.2%	74.2%
Yellow Time (s)	5.0		5.0	5.0
All-Red Time (s)	2.0		2.0	2.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max		Max	Max
v/c Ratio	0.75	0.49	0.51	0.79
Control Delay	50.0	1.2	8.6	13.6
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	50.0	1.2	8.6	13.6
Queue Length 50th (m)	61.2	0.0	55.5	130.0
Queue Length 95th (m)	79.0	0.0	64.3	145.0
Internal Link Dist (m)	614.1		112.6	59.1
Turn Bay Length (m)	130.0			
Base Capacity (vph)	805	1439	3364	3839
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.75	0.49	0.51	0.79

Intersection Summary

Cycle Length: 120

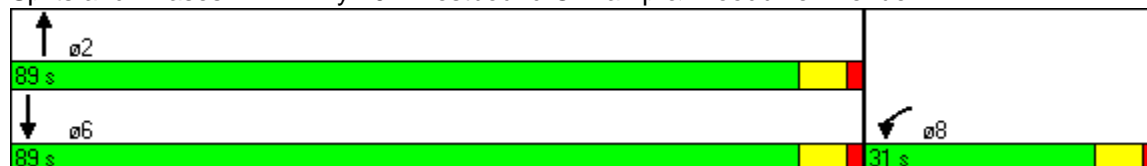
Actuated Cycle Length: 120

Offset: 115 (96%), Referenced to phase 8:WBL, Start of Green

Natural Cycle: 75

Control Type: Actuated-Coordinated

Splits and Phases: 1: Hwy 407 Westbound Off-ramp & Woodbine Avenue





Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W	W	W	W	W	W
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0			4.0
Lane Util. Factor	*1.00	0.91	0.91			*1.00
Frt	1.00	0.85	1.00			1.00
Flt Protected	1.00	1.00	1.00			1.00
Satd. Flow (prot)	3579	1439	4749			5420
Flt Permitted	1.00	1.00	1.00			1.00
Satd. Flow (perm)	3579	1439	4749			5420
Volume (vph)	554	651	1631	0	0	2885
Peak-hour factor, PHF	0.92	0.92	0.95	0.92	0.92	0.95
Adj. Flow (vph)	602	708	1717	0	0	3037
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	602	708	1717	0	0	3037
Heavy Vehicles (%)	5%	1%	8%	2%	2%	4%
Turn Type	Free					
Protected Phases	8		2			6
Permitted Phases	Free					
Actuated Green, G (s)	24.0	120.0	82.0			82.0
Effective Green, g (s)	27.0	120.0	85.0			85.0
Actuated g/C Ratio	0.22	1.00	0.71			0.71
Clearance Time (s)	7.0		7.0			7.0
Vehicle Extension (s)	3.0		6.0			6.0
Lane Grp Cap (vph)	805	1439	3364			3839
v/s Ratio Prot	c0.17		0.36			c0.56
v/s Ratio Perm		0.49				
v/c Ratio	0.75	0.49	0.51			0.79
Uniform Delay, d1	43.3	0.0	8.0			11.6
Progression Factor	1.00	1.00	1.00			1.00
Incremental Delay, d2	6.3	1.2	0.6			1.7
Delay (s)	49.6	1.2	8.6			13.4
Level of Service	D	A	A			B
Approach Delay (s)	23.4		8.6			13.4
Approach LOS	C		A			B
Intersection Summary						
HCM Average Control Delay			14.2		HCM Level of Service	B
HCM Volume to Capacity ratio			0.78			
Actuated Cycle Length (s)			120.0		Sum of lost time (s)	8.0
Intersection Capacity Utilization			85.0%		ICU Level of Service	E
Analysis Period (min)			15			
c Critical Lane Group						



Lane Group	EBL	EBR	NBT	SBT
Lane Configurations	YY	Y	YYY	YYY
Volume (vph)	530	450	1275	3389
Lane Group Flow (vph)	576	489	1386	3684
Turn Type	Free			
Protected Phases	4		2	6
Permitted Phases	Free			
Detector Phases	4		2	6
Minimum Initial (s)	10.0		15.0	15.0
Minimum Split (s)	26.0		26.0	26.0
Total Split (s)	36.0	0.0	84.0	84.0
Total Split (%)	30.0%	0.0%	70.0%	70.0%
Yellow Time (s)	5.0		5.0	5.0
All-Red Time (s)	2.0		2.0	2.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	None		C-Max	C-Max
v/c Ratio	0.68	0.35	0.42	1.10
Control Delay	44.6	0.7	9.3	70.4
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	44.6	0.7	9.3	70.4
Queue Length 50th (m)	57.1	0.0	47.0	~337.2
Queue Length 95th (m)	74.3	0.0	55.2	#357.7
Internal Link Dist (m)	638.1		55.3	98.5
Turn Bay Length (m)	150.0			
Base Capacity (vph)	897	1411	3291	3355
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.64	0.35	0.42	1.10

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 16 (13%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 110

Control Type: Actuated-Coordinated

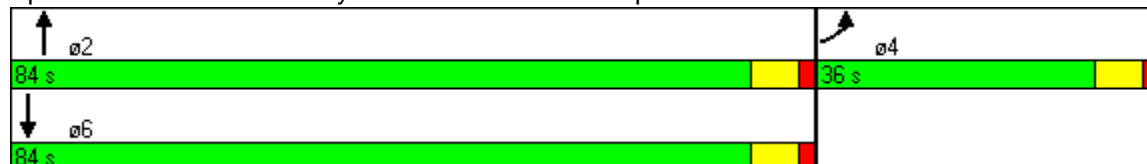
~ Volume exceeds capacity, queue is theoretically infinite.

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: Hwy 407 Eastbound Off-ramp & Woodbine Avenue





Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	←←←	←		↑↑↑	↑↑↑	←
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97	0.91		0.91	0.91	
Frt	1.00	0.85		1.00	1.00	
Flt Protected	0.95	1.00		1.00	1.00	
Satd. Flow (prot)	3362	1411		4839	4932	
Flt Permitted	0.95	1.00		1.00	1.00	
Satd. Flow (perm)	3362	1411		4839	4932	
Volume (vph)	530	450	0	1275	3389	0
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	576	489	0	1386	3684	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	576	489	0	1386	3684	0
Heavy Vehicles (%)	3%	3%	2%	6%	4%	2%
Turn Type	Free					
Protected Phases	4			2	6	
Permitted Phases	Free					
Actuated Green, G (s)	27.4	120.0		78.6	78.6	
Effective Green, g (s)	30.4	120.0		81.6	81.6	
Actuated g/C Ratio	0.25	1.00		0.68	0.68	
Clearance Time (s)	7.0			7.0	7.0	
Vehicle Extension (s)	6.0			6.0	3.0	
Lane Grp Cap (vph)	852	1411		3291	3354	
v/s Ratio Prot	c0.17			0.29	c0.75	
v/s Ratio Perm		0.35				
v/c Ratio	0.68	0.35		0.42	1.10	
Uniform Delay, d1	40.4	0.0		8.6	19.2	
Progression Factor	1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.3	0.7		0.4	49.6	
Delay (s)	43.7	0.7		9.0	68.8	
Level of Service	D	A		A	E	
Approach Delay (s)	23.9			9.0	68.8	
Approach LOS	C			A	E	

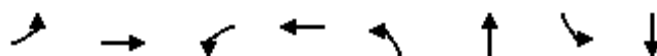
Intersection Summary

HCM Average Control Delay	47.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	92.0%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

2010 Existing - Weekday AM Peak Hour
3: Burncrest Road & Woodbine Avenue

Queues
Highway 407 Transitway: Woodbine / Rodick Station



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	11	7	16	8	18	1164	331	3482
Lane Group Flow (vph)	12	19	18	120	20	1252	348	3509
Turn Type	Perm		Perm		Perm		pm+pt	
Protected Phases	4		8		2		1	6
Permitted Phases	4		8		2		6	
Detector Phases	4	4	8	8	2	2	1	6
Minimum Initial (s)	10.0	10.0	10.0	10.0	30.0	30.0	7.0	30.0
Minimum Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	11.0	37.0
Total Split (s)	37.0	37.0	37.0	37.0	65.0	65.0	18.0	83.0
Total Split (%)	30.8%	30.8%	30.8%	30.8%	54.2%	54.2%	15.0%	69.2%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	3.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	1.0	2.0
Lead/Lag					Lag	Lag	Lead	
Lead-Lag Optimize?					Yes	Yes	Yes	
Recall Mode	None	None	None	None	C-Max	C-Max	None	C-Max
v/c Ratio	0.10	0.11	0.17	0.51	0.30	0.40	0.72	0.79
Control Delay	48.8	46.6	51.4	18.6	28.6	12.2	17.3	7.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	48.8	46.6	51.4	18.6	28.6	12.2	17.3	7.4
Queue Length 50th (m)	2.4	3.6	3.6	1.8	1.8	41.7	15.3	95.6
Queue Length 95th (m)	7.6	10.0	10.0	17.9	10.7	67.4	47.5	136.6
Internal Link Dist (m)	121.6		787.2		138.5		29.5	
Turn Bay Length (m)	50.0		60.0				100.0	
Base Capacity (vph)	278	401	247	405	67	3111	484	4468
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.04	0.05	0.07	0.30	0.30	0.40	0.72	0.79

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 41 (34%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 105























Control Type: Actuated-Coordinated

Splits and Phases: 3: Burncrest Road & Woodbine Avenue

ø1	ø2		ø4	
18 s	65 s		37 s	
ø6			ø8	
83 s			37 s	


















2010 Existing - Weekday AM Peak Hour
3: Burncrest Road & Woodbine Avenue

HCM Signalized Intersection Capacity Analysis
Highway 407 Transitway: Woodbine / Rodick Station

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	*0.95		1.00	*1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.91		1.00	0.86		1.00	1.00		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		1.00	1.00	
Satd. Flow (prot)	1513	1454		1144	1181		1526	4925		1678	5461	
Flt Permitted	0.50	1.00		0.75	1.00		0.05	1.00		0.20	1.00	
Satd. Flow (perm)	804	1454		897	1181		85	4925		336	5461	
Volume (vph)	11	7	10	16	8	100	18	1164	24	331	3482	24
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.95	0.90	0.95	1.00	0.90
Adj. Flow (vph)	12	8	11	18	9	111	20	1225	27	348	3482	27
RTOR Reduction (vph)	0	1	0	0	98	0	0	1	0	0	0	0
Lane Group Flow (vph)	12	18	0	18	22	0	20	1251	0	348	3509	0
Confl. Peds. (#/hr)							3					3
Heavy Vehicles (%)	18%	29%	10%	56%	13%	39%	17%	8%	25%	12%	3%	13%
Turn Type	Perm			Perm			Perm			pm+pt		
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	10.9	10.9		10.9	10.9		72.7	72.7		95.1	95.1	
Effective Green, g (s)	13.9	13.9		13.9	13.9		75.7	75.7		98.1	98.1	
Actuated g/C Ratio	0.12	0.12		0.12	0.12		0.63	0.63		0.82	0.82	
Clearance Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		4.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	93	168		104	137		54	3107		480	4464	
v/s Ratio Prot		0.01			0.02			0.25		0.11	c0.64	
v/s Ratio Perm	0.01			c0.02			0.24			0.48		
v/c Ratio	0.13	0.11		0.17	0.16		0.37	0.40		0.72	0.79	
Uniform Delay, d1	47.6	47.5		47.9	47.8		10.7	11.0		8.7	5.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.6	0.3		0.8	0.5		18.4	0.4		5.4	1.5	
Delay (s)	48.2	47.8		48.7	48.3		29.1	11.3		14.1	7.0	
Level of Service	D	D		D	D		C	B		B	A	
Approach Delay (s)		48.0			48.4			11.6			7.7	
Approach LOS		D			D			B			A	
Intersection Summary												
HCM Average Control Delay			9.9			HCM Level of Service				A		
HCM Volume to Capacity ratio			0.71									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)			8.0			
Intersection Capacity Utilization			111.1%			ICU Level of Service			H			
Analysis Period (min)			15									
c Critical Lane Group												

2010 Existing - Weekday AM Peak Hour
4: Miller Avenue & Rodick Road

HCM Unsignalized Intersection Capacity Analysis
Highway 407 Transitway: Woodbine / Rodick Station

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop				Stop				Free		Free	
Grade	0%				0%				0%		0%	
Volume (veh/h)	10	0	352	0	0	0	104	0	0	0	0	10
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	0	383	0	0	0	113	0	0	0	0	11
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None						None					
Median storage veh												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	232	232	5	614	237	0	11				0	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	232	232	5	614	237	0	11				0	
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
p0 queue free %	98	100	64	100	100	100	93				100	
cM capacity (veh/h)	684	622	1078	247	617	1085	1608				1623	
Direction, Lane #	EB 1	EB 2	NB 1	SB 1								
Volume Total	11	383	113	11								
Volume Left	11	0	113	0								
Volume Right	0	383	0	11								
cSH	684	1078	1608	1700								
Volume to Capacity	0.02	0.36	0.07	0.01								
Queue Length 95th (m)	0.3	11.4	1.6	0.0								
Control Delay (s)	10.3	10.2	7.4	0.0								
Lane LOS	B	B	A									
Approach Delay (s)	10.2		7.4	0.0								
Approach LOS	B											
Intersection Summary												
Average Delay			9.4									
Intersection Capacity Utilization			40.9%	ICU Level of Service				A				
Analysis Period (min)			15									



Lane Group	WBL	WBR	NBT	SBT
Lane Configurations	WY	Y	YYY	YYY
Volume (vph)	56	88	2563	1977
Lane Group Flow (vph)	61	96	2698	2081
Turn Type	Free			
Protected Phases	8		2	6
Permitted Phases	Free			
Detector Phases	8		2	6
Minimum Initial (s)	10.0		15.0	15.0
Minimum Split (s)	26.0		26.0	26.0
Total Split (s)	31.0	0.0	89.0	89.0
Total Split (%)	25.8%	0.0%	74.2%	74.2%
Yellow Time (s)	5.0		5.0	5.0
All-Red Time (s)	2.0		2.0	2.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max		Max	Max
v/c Ratio	0.07	0.07	0.73	0.59
Control Delay	37.0	0.1	12.0	9.6
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	37.0	0.1	12.0	9.6
Queue Length 50th (m)	5.2	0.0	110.1	73.8
Queue Length 95th (m)	10.3	0.0	123.5	84.2
Internal Link Dist (m)	614.1		112.6	59.1
Turn Bay Length (m)	130.0			
Base Capacity (vph)	846	1333	3719	3528
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.07	0.07	0.73	0.59

Intersection Summary

Cycle Length: 120

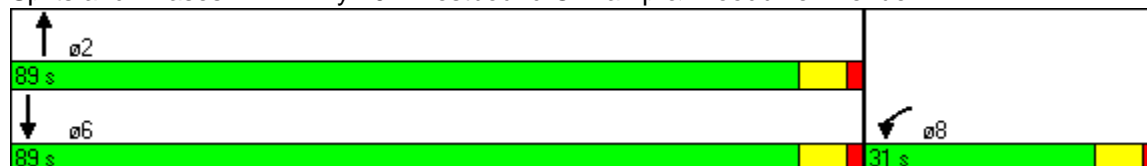
Actuated Cycle Length: 120

Offset: 27 (23%), Referenced to phase 8:WBL, Start of Green

Natural Cycle: 65

Control Type: Actuated-Coordinated

Splits and Phases: 1: Hwy 407 Westbound Off-ramp & Woodbine Avenue





Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔↔↔	↔	↔↔↔			↔↔↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0			4.0
Lane Util. Factor	*1.00	0.91	*0.95			0.91
Frt	1.00	0.85	1.00			1.00
Flt Protected	1.00	1.00	1.00			1.00
Satd. Flow (prot)	3758	1333	5250			4980
Flt Permitted	1.00	1.00	1.00			1.00
Satd. Flow (perm)	3758	1333	5250			4980
Volume (vph)	56	88	2563	0	0	1977
Peak-hour factor, PHF	0.92	0.92	0.95	0.92	0.92	0.95
Adj. Flow (vph)	61	96	2698	0	0	2081
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	61	96	2698	0	0	2081
Heavy Vehicles (%)	0%	9%	2%	0%	0%	3%
Turn Type	Free					
Protected Phases	8		2			6
Permitted Phases	Free					
Actuated Green, G (s)	24.0	120.0	82.0			82.0
Effective Green, g (s)	27.0	120.0	85.0			85.0
Actuated g/C Ratio	0.22	1.00	0.71			0.71
Clearance Time (s)	7.0		7.0			7.0
Vehicle Extension (s)	3.0		6.0			6.0
Lane Grp Cap (vph)	846	1333	3719			3528
v/s Ratio Prot	0.02		c0.51			0.42
v/s Ratio Perm	c0.07					
v/c Ratio	0.07	0.07	0.73			0.59
Uniform Delay, d1	36.6	0.0	10.5			8.8
Progression Factor	1.00	1.00	1.00			1.00
Incremental Delay, d2	0.2	0.1	1.3			0.7
Delay (s)	36.8	0.1	11.8			9.5
Level of Service	D	A	B			A
Approach Delay (s)	14.4		11.8			9.5
Approach LOS	B		B			A
Intersection Summary						
HCM Average Control Delay			10.9	HCM Level of Service		B
HCM Volume to Capacity ratio			0.55			
Actuated Cycle Length (s)			120.0	Sum of lost time (s)		4.0
Intersection Capacity Utilization			64.5%	ICU Level of Service		C
Analysis Period (min)			15			

c Critical Lane Group



Lane Group	EBL	EBR	NBT	SBT
Lane Configurations	←←←	→	↑↑↑	↑↑↑
Volume (vph)	50	40	2546	1488
Lane Group Flow (vph)	54	43	2767	1617
Turn Type	Free			
Protected Phases	4		2	6
Permitted Phases	Free			
Detector Phases	4		2	6
Minimum Initial (s)	10.0		15.0	15.0
Minimum Split (s)	26.0		26.0	26.0
Total Split (s)	36.0	0.0	84.0	84.0
Total Split (%)	30.0%	0.0%	70.0%	70.0%
Yellow Time (s)	5.0		5.0	5.0
All-Red Time (s)	2.0		2.0	2.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	None		C-Max	C-Max
v/c Ratio	0.14	0.03	0.67	0.38
Control Delay	48.7	0.1	4.9	2.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	48.7	0.1	4.9	2.8
Queue Length 50th (m)	5.5	0.0	69.6	25.8
Queue Length 95th (m)	11.0	0.0	87.9	33.2
Internal Link Dist (m)	638.1		55.3	98.5
Turn Bay Length (m)	150.0			
Base Capacity (vph)	897	1411	4140	4219
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.06	0.03	0.67	0.38

Intersection Summary

Cycle Length: 120

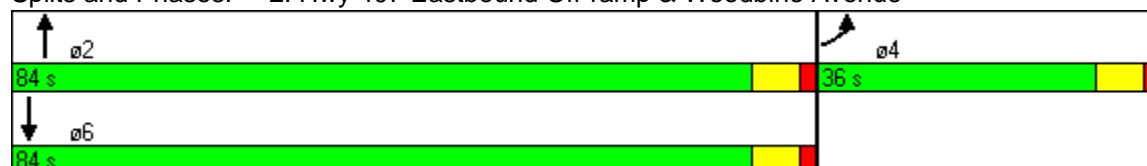
Actuated Cycle Length: 120

Offset: 102 (85%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 75

Control Type: Actuated-Coordinated

Splits and Phases: 2: Hwy 407 Eastbound Off-ramp & Woodbine Avenue





Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	←←←	→		↑↑↑	↑↑↑	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97	0.91		0.91	0.91	
Frt	1.00	0.85		1.00	1.00	
Flt Protected	0.95	1.00		1.00	1.00	
Satd. Flow (prot)	3362	1411		4839	4932	
Flt Permitted	0.95	1.00		1.00	1.00	
Satd. Flow (perm)	3362	1411		4839	4932	
Volume (vph)	50	40	0	2546	1488	0
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	43	0	2767	1617	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	54	43	0	2767	1617	0
Heavy Vehicles (%)	3%	3%	2%	6%	4%	2%
Turn Type	Free					
Protected Phases	4			2	6	
Permitted Phases	Free					
Actuated Green, G (s)	8.5	120.0		97.5	97.5	
Effective Green, g (s)	11.5	120.0		100.5	100.5	
Actuated g/C Ratio	0.10	1.00		0.84	0.84	
Clearance Time (s)	7.0			7.0	7.0	
Vehicle Extension (s)	6.0			6.0	3.0	
Lane Grp Cap (vph)	322	1411		4053	4131	
v/s Ratio Prot	c0.02			c0.57	0.33	
v/s Ratio Perm		0.03				
v/c Ratio	0.17	0.03		0.68	0.39	
Uniform Delay, d1	49.9	0.0		3.7	2.4	
Progression Factor	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.7	0.0		0.9	0.3	
Delay (s)	50.5	0.0		4.6	2.6	
Level of Service	D	A		A	A	
Approach Delay (s)	28.2			4.6	2.6	
Approach LOS	C			A	A	

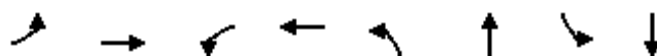
Intersection Summary

HCM Average Control Delay	4.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	64.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

2010 Existing - Weekday PM Peak Hour
3: Burncrest Road & Woodbine Avenue

Queues
Highway 407 Transitway: Woodbine / Rodick Station



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	37	10	23	10	33	2933	65	1442
Lane Group Flow (vph)	41	39	26	318	37	2945	72	1541
Turn Type	Perm		Perm		Perm		pm+pt	
Protected Phases	4		8		2		1	6
Permitted Phases	4		8		2		6	
Detector Phases	4	4	8	8	2	2	1	6
Minimum Initial (s)	30.0	30.0	30.0	30.0	10.0	10.0	7.0	10.0
Minimum Split (s)	37.0	37.0	37.0	37.0	35.0	35.0	11.0	35.0
Total Split (s)	37.0	37.0	37.0	37.0	71.0	71.0	12.0	83.0
Total Split (%)	30.8%	30.8%	30.8%	30.8%	59.2%	59.2%	10.0%	69.2%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	3.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	1.0	2.0
Lead/Lag					Lag	Lag	Lead	
Lead-Lag Optimize?					Yes	Yes	Yes	
Recall Mode	None	None	None	None	C-Max	C-Max	None	C-Max
v/c Ratio	0.25	0.10	0.14	0.66	0.20	0.97	0.46	0.43
Control Delay	39.1	15.9	35.3	30.8	16.8	36.0	16.7	10.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.1	15.9	35.3	30.8	16.8	36.0	16.7	10.2
Queue Length 50th (m)	6.9	1.8	4.3	37.9	3.8	~219.4	5.2	48.8
Queue Length 95th (m)	16.5	9.6	11.3	67.7	10.3	#258.6	10.3	56.5
Internal Link Dist (m)	121.6		787.2		138.5		29.5	
Turn Bay Length (m)	50.0		60.0				100.0	
Base Capacity (vph)	162	405	189	481	184	3034	162	3551
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.10	0.14	0.66	0.20	0.97	0.44	0.43

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 89 (74%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 115

Control Type: Actuated-Coordinated

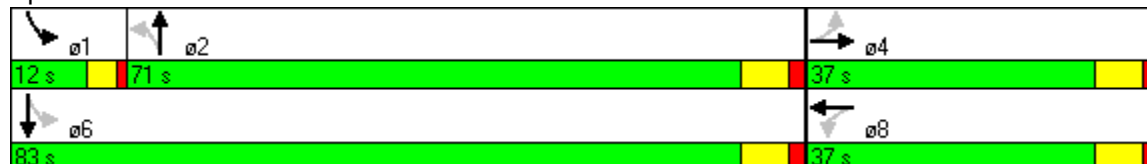
~ Volume exceeds capacity, queue is theoretically infinite.

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: 3: Burncrest Road & Woodbine Avenue



















2010 Existing - Weekday PM Peak Hour
3: Burncrest Road & Woodbine Avenue

HCM Signalized Intersection Capacity Analysis
Highway 407 Transitway: Woodbine / Rodick Station

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								  			  	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	*0.95		1.00	*1.00	
Frpb, ped/bikes	1.00	1.00		1.00	0.98		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.89		1.00	0.86		1.00	1.00		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1779	1400		892	1427		1683	5233		1257	5390	
Flt Permitted	0.32	1.00		0.73	1.00		0.17	1.00		0.10	1.00	
Satd. Flow (perm)	590	1400		687	1427		309	5233		132	5390	
Volume (vph)	37	10	25	23	10	276	33	2933	11	65	1442	21
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	1.00	0.90	0.90	0.95	0.90
Adj. Flow (vph)	41	11	28	26	11	307	37	2933	12	72	1518	23
RTOR Reduction (vph)	0	20	0	0	88	0	0	0	0	0	1	0
Lane Group Flow (vph)	41	19	0	26	230	0	37	2945	0	72	1540	0
Confl. Peds. (#/hr)	6					6	2		1	1		2
Heavy Vehicles (%)	0%	60%	4%	100%	80%	8%	6%	2%	64%	42%	4%	24%
Turn Type	Perm			Perm			Perm			pm+pt		
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	30.0	30.0		30.0	30.0		65.8	65.8		76.0	76.0	
Effective Green, g (s)	33.0	33.0		33.0	33.0		68.8	68.8		79.0	79.0	
Actuated g/C Ratio	0.28	0.28		0.28	0.28		0.57	0.57		0.66	0.66	
Clearance Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		4.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	162	385		189	392		177	3000		145	3548	
v/s Ratio Prot		0.01			c0.16			c0.56		0.03	c0.29	
v/s Ratio Perm	0.07			0.04			0.12			0.30		
v/c Ratio	0.25	0.05		0.14	0.59		0.21	0.98		0.50	0.43	
Uniform Delay, d1	33.9	32.0		32.8	37.6		12.4	25.0		27.9	9.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.8	0.1		0.3	2.2		2.7	12.6		2.7	0.4	
Delay (s)	34.7	32.0		33.1	39.8		15.1	37.6		30.5	10.2	
Level of Service	C	C		C	D		B	D		C	B	
Approach Delay (s)		33.4			39.3			37.3			11.1	
Approach LOS		C			D			D			B	
Intersection Summary												
HCM Average Control Delay		29.0					HCM Level of Service		C			
HCM Volume to Capacity ratio		0.83										
Actuated Cycle Length (s)		120.0					Sum of lost time (s)		12.0			
Intersection Capacity Utilization		94.3%					ICU Level of Service		F			
Analysis Period (min)		15										
c Critical Lane Group												

2010 Existing - Weekday PM Peak Hour
4: Burncrest Road & Rodick Road

HCM Unsignalized Intersection Capacity Analysis
Highway 407 Transitway: Woodbine / Rodick Station

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop				Stop			Free			Free	
Grade	0%				0%			0%			0%	
Volume (veh/h)	10	0	76	0	0	0	284	0	0	0	0	10
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	0	83	0	0	0	309	0	0	0	0	11
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage veh												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	623	623	5	705	628	0	11			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	623	623	5	705	628	0	11			0		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	97	100	92	100	100	100	81			100		
cM capacity (veh/h)	340	325	1078	276	323	1085	1608			1623		
Direction, Lane #	EB 1	EB 2	NB 1	SB 1								
Volume Total	11	83	309	11								
Volume Left	11	0	309	0								
Volume Right	0	83	0	11								
cSH	340	1078	1608	1700								
Volume to Capacity	0.03	0.08	0.19	0.01								
Queue Length 95th (m)	0.7	1.7	5.0	0.0								
Control Delay (s)	15.9	8.6	7.8	0.0								
Lane LOS	C	A	A									
Approach Delay (s)	9.5		7.8	0.0								
Approach LOS	A											
Intersection Summary												
Average Delay				7.9								
Intersection Capacity Utilization				33.8%	ICU Level of Service			A				
Analysis Period (min)				15								

APPENDIX B

2031 BACKGROUND CONDITION SYNCHRO SUMMARY OUTPUTS



Lane Group	WBL	WBR	NBT	SBT
Lane Configurations	WY	Y	AAA	AAA
Volume (vph)	618	734	2083	3613
Lane Group Flow (vph)	618	734	2083	3613
Turn Type	Free			
Protected Phases	8		2	6
Permitted Phases	Free			
Detector Phases	8		2	6
Minimum Initial (s)	10.0		15.0	15.0
Minimum Split (s)	26.0		26.0	26.0
Total Split (s)	31.0	0.0	89.0	89.0
Total Split (%)	25.8%	0.0%	74.2%	74.2%
Yellow Time (s)	5.0		5.0	5.0
All-Red Time (s)	2.0		2.0	2.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max		Max	Max
v/c Ratio	0.77	0.51	0.62	0.94
Control Delay	50.9	1.3	10.1	21.9
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	50.9	1.3	10.1	21.9
Queue Length 50th (m)	63.2	0.0	76.7	204.1
Queue Length 95th (m)	81.3	0.0	88.0	227.2
Internal Link Dist (m)	614.1		112.6	59.1
Turn Bay Length (m)	130.0			
Base Capacity (vph)	805	1439	3364	3839
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.77	0.51	0.62	0.94

Intersection Summary

Cycle Length: 120

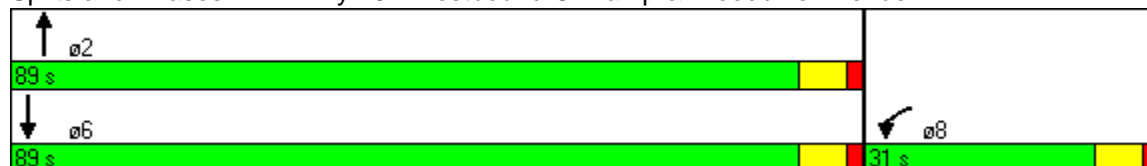
Actuated Cycle Length: 120

Offset: 0 (0%), Referenced to phase 8:WBL, Start of Green











Natural Cycle: 90

Control Type: Actuated-Coordinated

Splits and Phases: 1: Hwy 407 Westbound Off-ramp & Woodbine Avenue



2031 Background - Weekday AM Peak Hour HCM Signalized Intersection Capacity Analysis
 1: Hwy 407 Westbound Off-ramp & Woodbine Avenue Highway 407 Transitway: Woodbine / Rodick Station

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0			4.0
Lane Util. Factor	*1.00	0.91	0.91			*1.00
Frt	1.00	0.85	1.00			1.00
Flt Protected	1.00	1.00	1.00			1.00
Satd. Flow (prot)	3579	1439	4749			5420
Flt Permitted	1.00	1.00	1.00			1.00
Satd. Flow (perm)	3579	1439	4749			5420
Volume (vph)	618	734	2083	0	0	3613
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	618	734	2083	0	0	3613
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	618	734	2083	0	0	3613
Heavy Vehicles (%)	5%	1%	8%	2%	2%	4%
Turn Type	Free					
Protected Phases	8		2			6
Permitted Phases	Free					
Actuated Green, G (s)	24.0	120.0	82.0			82.0
Effective Green, g (s)	27.0	120.0	85.0			85.0
Actuated g/C Ratio	0.22	1.00	0.71			0.71
Clearance Time (s)	7.0		7.0			7.0
Vehicle Extension (s)	3.0		6.0			6.0
Lane Grp Cap (vph)	805	1439	3364			3839
v/s Ratio Prot	c0.17		0.44			c0.67
v/s Ratio Perm		0.51				
v/c Ratio	0.77	0.51	0.62			0.94
Uniform Delay, d1	43.6	0.0	9.1			15.3
Progression Factor	1.00	1.00	1.00			1.00
Incremental Delay, d2	6.9	1.3	0.9			6.1
Delay (s)	50.5	1.3	10.0			21.4
Level of Service	D	A	A			C
Approach Delay (s)	23.8		10.0			21.4
Approach LOS	C		A			C
Intersection Summary						
HCM Average Control Delay			18.5		HCM Level of Service	B
HCM Volume to Capacity ratio			0.90			
Actuated Cycle Length (s)			120.0		Sum of lost time (s)	8.0
Intersection Capacity Utilization		101.8%			ICU Level of Service	G
Analysis Period (min)			15			
c Critical Lane Group						



Lane Group	EBL	EBR	NBT	SBT
Lane Configurations	YY	Y	AAA	AAA
Volume (vph)	676	502	1686	4052
Lane Group Flow (vph)	676	502	1686	4052
Turn Type	Free			
Protected Phases	4		2	6
Permitted Phases	Free			
Detector Phases	4		2	6
Minimum Initial (s)	10.0		15.0	15.0
Minimum Split (s)	26.0		26.0	26.0
Total Split (s)	36.0	0.0	84.0	84.0
Total Split (%)	30.0%	0.0%	70.0%	70.0%
Yellow Time (s)	5.0		5.0	5.0
All-Red Time (s)	2.0		2.0	2.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	None		C-Max	C-Max
v/c Ratio	0.71	0.36	0.50	1.11
Control Delay	45.0	0.7	10.3	75.7
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	45.0	0.7	10.3	75.7
Queue Length 50th (m)	66.1	0.0	58.7	~337.7
Queue Length 95th (m)	84.2	0.0	67.8	#354.4
Internal Link Dist (m)	638.1		23.4	98.5
Turn Bay Length (m)	150.0			
Base Capacity (vph)	973	1411	3401	3648
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.69	0.36	0.50	1.11

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 120

Control Type: Actuated-Coordinated

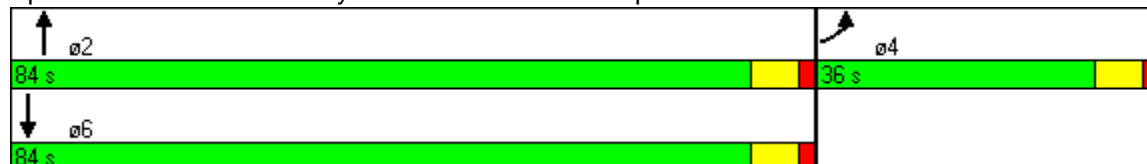
~ Volume exceeds capacity, queue is theoretically infinite.

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: Hwy 407 Eastbound Off-ramp & Woodbine Avenue



2031 Background - Weekday AM Peak Hour HCM Signalized Intersection Capacity Analysis
 2: Hwy 407 Eastbound Off-ramp & Woodbine Avenue Highway 407 Transitway: Woodbine / Rodick Station

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	
Lane Util. Factor	*1.00	0.91		*0.95	*1.00	
Frt	1.00	0.85		1.00	1.00	
Flt Protected	1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3648	1411		5052	5420	
Flt Permitted	1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3648	1411		5052	5420	
Volume (vph)	676	502	0	1686	4052	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	676	502	0	1686	4052	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	676	502	0	1686	4052	0
Heavy Vehicles (%)	3%	3%	2%	6%	4%	2%
Turn Type	Free					
Protected Phases	4			2	6	
Permitted Phases	Free					
Actuated Green, G (s)	28.2	120.0		77.8	77.8	
Effective Green, g (s)	31.2	120.0		80.8	80.8	
Actuated g/C Ratio	0.26	1.00		0.67	0.67	
Clearance Time (s)	7.0			7.0	7.0	
Vehicle Extension (s)	6.0			6.0	3.0	
Lane Grp Cap (vph)	948	1411		3402	3649	
v/s Ratio Prot	c0.19			0.33	c0.75	
v/s Ratio Perm		0.36				
v/c Ratio	0.71	0.36		0.50	1.11	
Uniform Delay, d1	40.3	0.0		9.6	19.6	
Progression Factor	1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.7	0.7		0.5	54.2	
Delay (s)	44.0	0.7		10.1	73.8	
Level of Service	D	A		B	E	
Approach Delay (s)	25.6			10.1	73.8	
Approach LOS	C			B	E	
Intersection Summary						
HCM Average Control Delay	50.1		HCM Level of Service		D	
HCM Volume to Capacity ratio	1.00					
Actuated Cycle Length (s)	120.0		Sum of lost time (s)		8.0	
Intersection Capacity Utilization	109.5%		ICU Level of Service		H	
Analysis Period (min)	15					
c Critical Lane Group						



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations	↰	↱	↰	↱	↰	↰	↱↱↱	↰	↱↱↱
Volume (vph)	34	34	18	49	112	20	1540	369	4151
Lane Group Flow (vph)	34	45	18	49	112	20	1567	369	4183
Turn Type	Perm		Perm		Perm	Perm		pm+pt	
Protected Phases		4		8			2	1	6
Permitted Phases	4		8		8	2		6	
Detector Phases	4	4	8	8	8	2	2	1	6
Minimum Initial (s)	30.0	30.0	30.0	30.0	30.0	10.0	10.0	7.0	10.0
Minimum Split (s)	37.0	37.0	37.0	37.0	37.0	35.0	35.0	11.0	35.0
Total Split (s)	36.0	36.0	36.0	36.0	36.0	66.0	66.0	18.0	84.0
Total Split (%)	30.0%	30.0%	30.0%	30.0%	30.0%	55.0%	55.0%	15.0%	70.0%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	3.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.0	2.0
Lead/Lag						Lag	Lag	Lead	
Lead-Lag Optimize?						Yes	Yes	Yes	
Recall Mode	None	None	None	None	None	C-Max	C-Max	None	C-Max
v/c Ratio	0.11	0.12	0.08	0.11	0.29	0.37	0.61	0.87	1.15
Control Delay	34.6	34.4	34.2	34.2	8.2	41.2	21.8	31.5	92.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.6	34.4	34.2	34.2	8.2	41.2	21.8	31.5	92.4
Queue Length 50th (m)	5.6	7.4	2.9	8.0	0.0	2.5	81.2	31.3	~356.6
Queue Length 95th (m)	13.3	16.2	8.5	17.1	12.6	#11.5	94.5	#62.8	#372.8
Internal Link Dist (m)		121.6		787.2			138.5		61.4
Turn Bay Length (m)	50.0		60.0					100.0	
Base Capacity (vph)	308	388	234	443	389	54	2549	426	3642
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	0.11	0.12	0.08	0.11	0.29	0.37	0.61	0.87	1.15

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 145

Control Type: Actuated-Coordinated

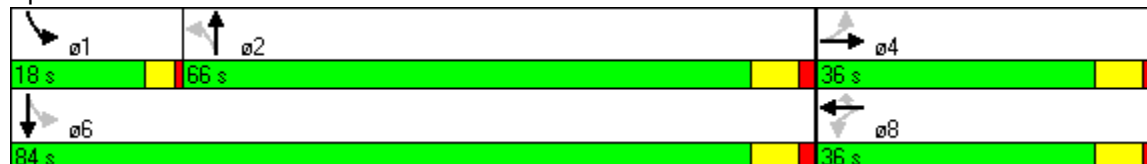
~ Volume exceeds capacity, queue is theoretically infinite.

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: 3: Burncrest Road & Woodbine Avenue





















2031 Background - Weekday AM Peak Hour
3: Burncrest Road & Woodbine Avenue

HCM Signalized Intersection Capacity Analysis
Highway 407 Transitway: Woodbine / Rodick Station

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								  			  	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	*0.95		1.00	*1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	1.00	0.85	1.00	1.00		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		1.00	1.00	
Satd. Flow (prot)	1513	1456		1144	1663	1149	1526	4932		1678	5461	
Flt Permitted	0.73	1.00		0.73	1.00	1.00	0.06	1.00		0.25	1.00	
Satd. Flow (perm)	1155	1456		876	1663	1149	104	4932		419	5461	
Volume (vph)	34	34	11	18	49	112	20	1540	27	369	4151	32
Peak-hour factor, PHF	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. Flow (vph)	34	34	11	18	49	112	20	1540	27	369	4151	32
RTOR Reduction (vph)	0	0	0	0	0	82	0	1	0	0	1	0
Lane Group Flow (vph)	34	45	0	18	49	30	20	1566	0	369	4182	0
Confl. Peds. (#/hr)							3					3
Heavy Vehicles (%)	18%	29%	10%	56%	13%	39%	17%	8%	25%	12%	3%	13%
Turn Type	Perm			Perm			Perm	Perm		pm+pt		
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)	29.0	29.0		29.0	29.0	29.0	59.0	59.0		77.0	77.0	
Effective Green, g (s)	32.0	32.0		32.0	32.0	32.0	62.0	62.0		80.0	80.0	
Actuated g/C Ratio	0.27	0.27		0.27	0.27	0.27	0.52	0.52		0.67	0.67	
Clearance Time (s)	7.0	7.0		7.0	7.0	7.0	7.0	7.0		4.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	308	388		234	443	306	54	2548		426	3641	
v/s Ratio Prot		c0.03			0.03			0.32		0.10	c0.77	
v/s Ratio Perm	0.03			0.02		0.03	0.19			0.48		
v/c Ratio	0.11	0.12		0.08	0.11	0.10	0.37	0.61		0.87	1.15	
Uniform Delay, d1	33.2	33.3		32.9	33.2	33.1	17.3	20.5		14.4	20.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	0.1		0.1	0.1	0.1	18.4	1.1		16.6	70.5	
Delay (s)	33.4	33.4		33.1	33.4	33.3	35.7	21.7		31.1	90.5	
Level of Service	C	C		C	C	C	D	C		C	F	
Approach Delay (s)		33.4			33.3			21.8			85.7	
Approach LOS		C			C			C			F	
Intersection Summary												
HCM Average Control Delay			67.7				HCM Level of Service			E		
HCM Volume to Capacity ratio			0.85									
Actuated Cycle Length (s)			120.0				Sum of lost time (s)			8.0		
Intersection Capacity Utilization			124.3%				ICU Level of Service			H		
Analysis Period (min)			15									
c Critical Lane Group												

2031 Background - Weekday AM Peak Hour HCM Unsignalized Intersection Capacity Analysis
 4: Miller Avenue & Rodick Road Highway 407 Transitway: Woodbine / Rodick Station

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	36	22	382	0	11	0	116	204	0	0	186	51
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	36	22	382	0	11	0	116	204	0	0	186	51
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage veh												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	551	648	118	922	673	102	237			204		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	551	648	118	922	673	102	237			204		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	91	94	58	100	97	100	91			100		
cM capacity (veh/h)	380	354	911	116	342	933	1327			1365		
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2				
Volume Total	36	404	11	116	136	68	93	144				
Volume Left	36	0	0	116	0	0	0	0				
Volume Right	0	382	0	0	0	0	0	51				
cSH	380	839	342	1327	1700	1700	1365	1700				
Volume to Capacity	0.09	0.48	0.03	0.09	0.08	0.04	0.00	0.08				
Queue Length 95th (m)	2.2	18.6	0.7	2.0	0.0	0.0	0.0	0.0				
Control Delay (s)	15.5	13.2	15.9	8.0	0.0	0.0	0.0	0.0				
Lane LOS	C	B	C	A								
Approach Delay (s)	13.4		15.9	2.9				0.0				
Approach LOS	B		C									
Intersection Summary												
Average Delay	6.9											
Intersection Capacity Utilization	48.0%			ICU Level of Service					A			
Analysis Period (min)	15											



Lane Group	WBL	WBR	NBT	SBT
Lane Configurations	WY	Y	YYY	YYY
Volume (vph)	62	108	2083	3089
Lane Group Flow (vph)	62	108	2083	3089
Turn Type	Free			
Protected Phases	8		2	6
Permitted Phases	Free			
Detector Phases	8		2	6
Minimum Initial (s)	10.0		15.0	15.0
Minimum Split (s)	26.0		26.0	26.0
Total Split (s)	31.0	0.0	89.0	89.0
Total Split (%)	25.8%	0.0%	74.2%	74.2%
Yellow Time (s)	5.0		5.0	5.0
All-Red Time (s)	2.0		2.0	2.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max		Max	Max
v/c Ratio	0.07	0.08	0.53	0.80
Control Delay	37.0	0.1	8.8	13.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	37.0	0.1	8.8	13.8
Queue Length 50th (m)	5.3	0.0	62.8	133.4
Queue Length 95th (m)	10.5	0.0	71.2	148.6
Internal Link Dist (m)	614.1		112.6	59.1
Turn Bay Length (m)	130.0			
Base Capacity (vph)	846	1333	3914	3876
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.07	0.08	0.53	0.80

Intersection Summary

Cycle Length: 120

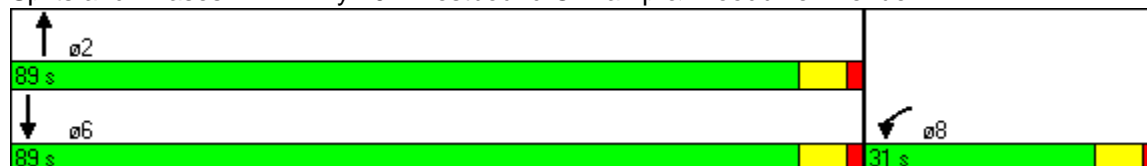
Actuated Cycle Length: 120

Offset: 0 (0%), Referenced to phase 8:WBL, Start of Green











Natural Cycle: 75

Control Type: Actuated-Coordinated

Splits and Phases: 1: Hwy 407 Westbound Off-ramp & Woodbine Avenue



2031 Background - Weekday PM Peak Hour HCM Signalized Intersection Capacity Analysis
 1: Hwy 407 Westbound Off-ramp & Woodbine Avenue Highway 407 Transitway: Woodbine / Rodick Station

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0			4.0
Lane Util. Factor	*1.00	0.91	*1.00			*1.00
Frt	1.00	0.85	1.00			1.00
Flt Protected	1.00	1.00	1.00			1.00
Satd. Flow (prot)	3758	1333	5526			5472
Flt Permitted	1.00	1.00	1.00			1.00
Satd. Flow (perm)	3758	1333	5526			5472
Volume (vph)	62	108	2083	0	0	3089
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	62	108	2083	0	0	3089
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	62	108	2083	0	0	3089
Heavy Vehicles (%)	0%	9%	2%	0%	0%	3%
Turn Type	Free					
Protected Phases	8		2			6
Permitted Phases	Free					
Actuated Green, G (s)	24.0	120.0	82.0			82.0
Effective Green, g (s)	27.0	120.0	85.0			85.0
Actuated g/C Ratio	0.22	1.00	0.71			0.71
Clearance Time (s)	7.0		7.0			7.0
Vehicle Extension (s)	3.0		6.0			6.0
Lane Grp Cap (vph)	846	1333	3914			3876
v/s Ratio Prot	0.02		0.38			c0.56
v/s Ratio Perm	c0.08					
v/c Ratio	0.07	0.08	0.53			0.80
Uniform Delay, d1	36.6	0.0	8.2			11.7
Progression Factor	1.00	1.00	1.00			1.00
Incremental Delay, d2	0.2	0.1	0.5			1.8
Delay (s)	36.8	0.1	8.7			13.5
Level of Service	D	A	A			B
Approach Delay (s)	13.5		8.7			13.5
Approach LOS	B		A			B
Intersection Summary						
HCM Average Control Delay			11.6		HCM Level of Service	B
HCM Volume to Capacity ratio			0.61			
Actuated Cycle Length (s)			120.0		Sum of lost time (s)	4.0
Intersection Capacity Utilization			74.7%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						



Lane Group	EBL	EBR	NBT	SBT
Lane Configurations	WY	Y	AAA	AAA
Volume (vph)	142	45	3070	2171
Lane Group Flow (vph)	142	45	3070	2171
Turn Type	Free			
Protected Phases	4		2	6
Permitted Phases	Free			
Detector Phases	4		2	6
Minimum Initial (s)	10.0		15.0	15.0
Minimum Split (s)	26.0		26.0	26.0
Total Split (s)	36.0	0.0	84.0	84.0
Total Split (%)	30.0%	0.0%	70.0%	70.0%
Yellow Time (s)	5.0		5.0	5.0
All-Red Time (s)	2.0		2.0	2.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	None		C-Max	C-Max
v/c Ratio	0.32	0.03	0.79	0.55
Control Delay	48.6	0.0	8.8	5.0
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	48.6	0.0	8.8	5.0
Queue Length 50th (m)	14.5	0.0	107.4	49.4
Queue Length 95th (m)	22.9	0.0	141.2	65.3
Internal Link Dist (m)	638.1		55.3	98.5
Turn Bay Length (m)	150.0			
Base Capacity (vph)	897	1411	3874	3948
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.16	0.03	0.79	0.55

Intersection Summary

Cycle Length: 120

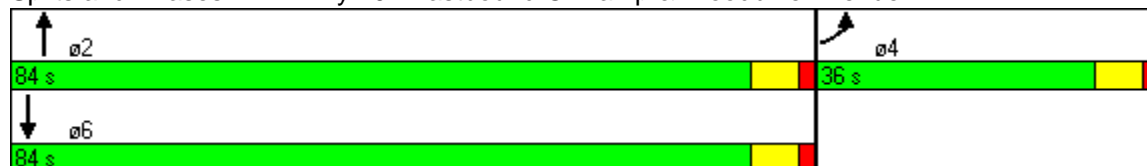
Actuated Cycle Length: 120

Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green











Natural Cycle: 90

Control Type: Actuated-Coordinated

Splits and Phases: 2: Hwy 407 Eastbound Off-ramp & Woodbine Avenue



2031 Background - Weekday PM Peak Hour HCM Signalized Intersection Capacity Analysis
 2: Hwy 407 Eastbound Off-ramp & Woodbine Avenue Highway 407 Transitway: Woodbine / Rodick Station

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97	0.91		0.91	0.91	
Frt	1.00	0.85		1.00	1.00	
Flt Protected	0.95	1.00		1.00	1.00	
Satd. Flow (prot)	3362	1411		4839	4932	
Flt Permitted	0.95	1.00		1.00	1.00	
Satd. Flow (perm)	3362	1411		4839	4932	
Volume (vph)	142	45	0	3070	2171	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	142	45	0	3070	2171	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	142	45	0	3070	2171	0
Heavy Vehicles (%)	3%	3%	2%	6%	4%	2%
Turn Type	Free					
Protected Phases	4			2	6	
Permitted Phases	Free					
Actuated Green, G (s)	12.9	120.0		93.1	93.1	
Effective Green, g (s)	15.9	120.0		96.1	96.1	
Actuated g/C Ratio	0.13	1.00		0.80	0.80	
Clearance Time (s)	7.0			7.0	7.0	
Vehicle Extension (s)	6.0			6.0	3.0	
Lane Grp Cap (vph)	445	1411		3875	3950	
v/s Ratio Prot	c0.04			c0.63	0.44	
v/s Ratio Perm		0.03				
v/c Ratio	0.32	0.03		0.79	0.55	
Uniform Delay, d1	47.1	0.0		6.5	4.3	
Progression Factor	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.2	0.0		1.7	0.6	
Delay (s)	48.3	0.0		8.3	4.8	
Level of Service	D	A		A	A	
Approach Delay (s)	36.7			8.3	4.8	
Approach LOS	D			A	A	
Intersection Summary						
HCM Average Control Delay			7.9		HCM Level of Service	A
HCM Volume to Capacity ratio			0.72			
Actuated Cycle Length (s)			120.0		Sum of lost time (s)	8.0
Intersection Capacity Utilization			74.3%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	59	38	26	52	308	37	3484	73	1897
Lane Group Flow (vph)	59	66	26	52	308	37	3496	73	1926
Turn Type	Perm		Perm		Perm	Perm		pm+pt	
Protected Phases		4		8			2	1	6
Permitted Phases	4		8		8	2		6	
Detector Phases	4	4	8	8	8	2	2	1	6
Minimum Initial (s)	30.0	30.0	30.0	30.0	30.0	10.0	10.0	7.0	10.0
Minimum Split (s)	37.0	37.0	37.0	37.0	37.0	35.0	35.0	11.0	35.0
Total Split (s)	36.0	36.0	36.0	36.0	36.0	74.0	74.0	10.0	84.0
Total Split (%)	30.0%	30.0%	30.0%	30.0%	30.0%	61.7%	61.7%	8.3%	70.0%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	3.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.0	2.0
Lead/Lag						Lag	Lag	Lead	
Lead-Lag Optimize?						Yes	Yes	Yes	
Recall Mode	None	None	None	None	None	C-Max	C-Max	None	C-Max
v/c Ratio	0.60	0.18	0.15	0.19	0.68	0.32	1.06	0.51	0.54
Control Delay	65.3	24.9	36.3	36.3	36.1	22.3	58.5	19.5	11.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	65.3	24.9	36.3	36.3	36.1	22.3	58.5	19.5	11.0
Queue Length 50th (m)	11.2	7.1	4.3	8.7	42.8	3.9	~284.8	5.1	65.8
Queue Length 95th (m)	#29.5	17.7	11.5	18.6	72.3	12.5	#304.7	10.5	75.1
Internal Link Dist (m)		121.6		787.2			138.5		29.5
Turn Bay Length (m)	50.0		60.0					100.0	
Base Capacity (vph)	99	361	179	278	453	116	3306	144	3595
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	0.60	0.18	0.15	0.19	0.68	0.32	1.06	0.51	0.54

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 135

Control Type: Actuated-Coordinated

~ 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: 3: Burncrest Road & Woodbine Avenue




















	ø1		ø2		ø4
10 s		74 s		36 s	
	ø6				ø8
84 s				36 s	

2031 Background - Weekday PM Peak Hour
3: Burncrest Road & Woodbine Avenue

HCM Signalized Intersection Capacity Analysis
Highway 407 Transitway: Woodbine / Rodick Station

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	*1.00		1.00	*1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.94		1.00	1.00	0.85	1.00	1.00		1.00	1.00	
Flt Protected	1.00	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1866	1291		892	1044	1450	1683	5512		1257	5390	
Flt Permitted	0.20	1.00		0.71	1.00	1.00	0.11	1.00		0.10	1.00	
Satd. Flow (perm)	373	1291		671	1044	1450	190	5512		132	5390	
Volume (vph)	59	38	28	26	52	308	37	3484	12	73	1897	29
Peak-hour factor, PHF	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. Flow (vph)	59	38	28	26	52	308	37	3484	12	73	1897	29
RTOR Reduction (vph)	0	17	0	0	0	66	0	0	0	0	1	0
Lane Group Flow (vph)	59	49	0	26	52	242	37	3496	0	73	1925	0
Confl. Peds. (#/hr)	6					6	2		1	1		2
Heavy Vehicles (%)	0%	60%	4%	100%	80%	8%	6%	2%	64%	42%	4%	24%
Turn Type	Perm			Perm			Perm	Perm		pm+pt		
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)	29.0	29.0		29.0	29.0	29.0	68.2	68.2		77.0	77.0	
Effective Green, g (s)	32.0	32.0		32.0	32.0	32.0	71.2	71.2		80.0	80.0	
Actuated g/C Ratio	0.27	0.27		0.27	0.27	0.27	0.59	0.59		0.67	0.67	
Clearance Time (s)	7.0	7.0		7.0	7.0	7.0	7.0	7.0		4.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	99	344		179	278	387	113	3270		133	3593	
v/s Ratio Prot		0.04			0.05			c0.63		0.02	c0.36	
v/s Ratio Perm	0.16			0.04		c0.17	0.19			0.34		
v/c Ratio	0.60	0.14		0.15	0.19	0.63	0.33	1.07		0.55	0.54	
Uniform Delay, d1	38.4	33.5		33.6	34.0	38.7	12.3	24.4		30.6	10.4	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	9.3	0.2		0.4	0.3	3.1	7.6	38.0		4.6	0.6	
Delay (s)	47.7	33.7		33.9	34.3	41.9	19.9	62.4		35.2	10.9	
Level of Service	D	C		C	C	D	B	E		D	B	
Approach Delay (s)		40.3			40.3			62.0			11.8	
Approach LOS		D			D			E			B	
Intersection Summary												
HCM Average Control Delay		43.6					HCM Level of Service		D			
HCM Volume to Capacity ratio		0.92										
Actuated Cycle Length (s)		120.0					Sum of lost time (s)		12.0			
Intersection Capacity Utilization		127.6%					ICU Level of Service		H			
Analysis Period (min)		15										
c Critical Lane Group												

2031 Background - Weekday PM Peak Hour HCM Unsignalized Intersection Capacity Analysis
 4: Miller Avenue & Rodick Road Highway 407 Transitway: Woodbine / Rodick Station

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	67	11	85	0	17	0	317	171	0	0	205	52
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	67	11	85	0	17	0	317	171	0	0	205	52
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage veh												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	959	1036	128	998	1062	86	257			171		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	959	1036	128	998	1062	86	257			171		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	58	94	91	100	90	100	76			100		
cM capacity (veh/h)	159	174	898	139	168	956	1305			1404		
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2				
Volume Total	67	96	17	317	114	57	102	154				
Volume Left	67	0	0	317	0	0	0	0				
Volume Right	0	85	0	0	0	0	0	52				
cSH	159	608	168	1305	1700	1700	1404	1700				
Volume to Capacity	0.42	0.16	0.10	0.24	0.07	0.03	0.00	0.09				
Queue Length 95th (m)	13.1	3.9	2.3	6.7	0.0	0.0	0.0	0.0				
Control Delay (s)	43.2	12.0	28.8	8.6	0.0	0.0	0.0	0.0				
Lane LOS	E	B	D	A								
Approach Delay (s)	24.8		28.8	5.6				0.0				
Approach LOS	C		D									
Intersection Summary												
Average Delay	7.9											
Intersection Capacity Utilization	45.3%			ICU Level of Service			A					
Analysis Period (min)	15											

APPENDIX C

2031 FUTURE CONDITION SYNCHRO SUMMARY OUTPUTS



Lane Group	WBL	WBR	NBT	SBT
Lane Configurations	WY	Y	YYY	YYY
Volume (vph)	628	734	2120	3708
Lane Group Flow (vph)	628	734	2120	3708
Turn Type	Free			
Protected Phases	8		2	6
Permitted Phases	Free			
Detector Phases	8		2	6
Minimum Initial (s)	10.0		15.0	15.0
Minimum Split (s)	26.0		26.0	26.0
Total Split (s)	31.0	0.0	89.0	89.0
Total Split (%)	25.8%	0.0%	74.2%	74.2%
Yellow Time (s)	5.0		5.0	5.0
All-Red Time (s)	2.0		2.0	2.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max		Max	Max
v/c Ratio	0.78	0.51	0.63	0.97
Control Delay	51.5	1.3	10.3	25.2
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	51.5	1.3	10.3	25.2
Queue Length 50th (m)	64.4	0.0	79.1	221.2
Queue Length 95th (m)	82.9	0.0	90.7	246.2
Internal Link Dist (m)	614.1		112.6	59.1
Turn Bay Length (m)	130.0			
Base Capacity (vph)	805	1439	3364	3839
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.78	0.51	0.63	0.97

Intersection Summary

Cycle Length: 120

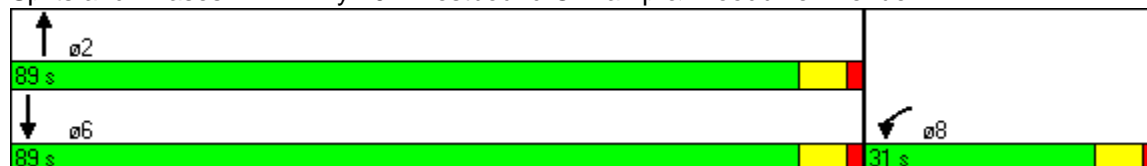
Actuated Cycle Length: 120

Offset: 0 (0%), Referenced to phase 8:WBL, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Splits and Phases: 1: Hwy 407 Westbound Off-ramp & Woodbine Avenue





Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	←←←	←	←←←			←←←
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0			4.0
Lane Util. Factor	*1.00	0.91	0.91			*1.00
Frt	1.00	0.85	1.00			1.00
Flt Protected	1.00	1.00	1.00			1.00
Satd. Flow (prot)	3579	1439	4749			5420
Flt Permitted	1.00	1.00	1.00			1.00
Satd. Flow (perm)	3579	1439	4749			5420
Volume (vph)	628	734	2120	0	0	3708
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	628	734	2120	0	0	3708
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	628	734	2120	0	0	3708
Heavy Vehicles (%)	5%	1%	8%	2%	2%	4%
Turn Type	Free					
Protected Phases	8		2			6
Permitted Phases	Free					
Actuated Green, G (s)	24.0	120.0	82.0			82.0
Effective Green, g (s)	27.0	120.0	85.0			85.0
Actuated g/C Ratio	0.22	1.00	0.71			0.71
Clearance Time (s)	7.0		7.0			7.0
Vehicle Extension (s)	3.0		6.0			6.0
Lane Grp Cap (vph)	805	1439	3364			3839
v/s Ratio Prot	c0.18		0.45			c0.68
v/s Ratio Perm		0.51				
v/c Ratio	0.78	0.51	0.63			0.97
Uniform Delay, d1	43.7	0.0	9.2			16.2
Progression Factor	1.00	1.00	1.00			1.00
Incremental Delay, d2	7.4	1.3	0.9			8.5
Delay (s)	51.1	1.3	10.1			24.7
Level of Service	D	A	B			C
Approach Delay (s)	24.3		10.1			24.7
Approach LOS	C		B			C
Intersection Summary						
HCM Average Control Delay			20.3		HCM Level of Service	C
HCM Volume to Capacity ratio			0.92			
Actuated Cycle Length (s)			120.0		Sum of lost time (s)	8.0
Intersection Capacity Utilization			103.9%		ICU Level of Service	G
Analysis Period (min)			15			

c Critical Lane Group



Lane Group	EBL	EBR	NBT	SBT
Lane Configurations	YY	Y	AAA	AAA
Volume (vph)	676	526	1723	4156
Lane Group Flow (vph)	676	526	1723	4156
Turn Type	Free			
Protected Phases	4		2	6
Permitted Phases	Free			
Detector Phases	4		2	6
Minimum Initial (s)	10.0		15.0	15.0
Minimum Split (s)	26.0		26.0	26.0
Total Split (s)	36.0	0.0	84.0	84.0
Total Split (%)	30.0%	0.0%	70.0%	70.0%
Yellow Time (s)	5.0		5.0	5.0
All-Red Time (s)	2.0		2.0	2.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	None		C-Max	C-Max
v/c Ratio	0.71	0.37	0.51	1.14
Control Delay	45.0	0.8	10.5	88.0
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	45.0	0.8	10.5	88.0
Queue Length 50th (m)	66.1	0.0	60.7	~353.4
Queue Length 95th (m)	84.2	0.0	69.8	#369.5
Internal Link Dist (m)	638.1		23.4	98.5
Turn Bay Length (m)	150.0			
Base Capacity (vph)	973	1411	3401	3648
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.69	0.37	0.51	1.14

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 140

Control Type: Actuated-Coordinated

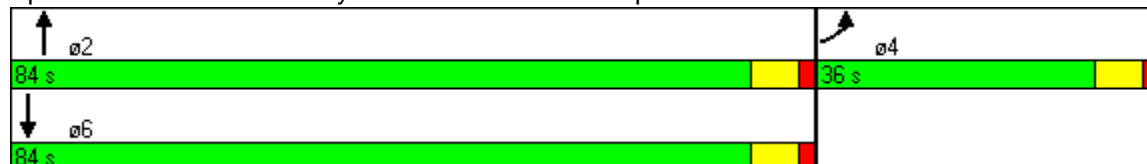
~ Volume exceeds capacity, queue is theoretically infinite.

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: Hwy 407 Eastbound Off-ramp & Woodbine Avenue























Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	
Lane Util. Factor	*1.00	0.91		*0.95	*1.00	
Frt	1.00	0.85		1.00	1.00	
Flt Protected	1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3648	1411		5052	5420	
Flt Permitted	1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3648	1411		5052	5420	
Volume (vph)	676	526	0	1723	4156	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	676	526	0	1723	4156	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	676	526	0	1723	4156	0
Heavy Vehicles (%)	3%	3%	2%	6%	4%	2%
Turn Type	Free					
Protected Phases	4			2	6	
Permitted Phases	Free					
Actuated Green, G (s)	28.2	120.0		77.8	77.8	
Effective Green, g (s)	31.2	120.0		80.8	80.8	
Actuated g/C Ratio	0.26	1.00		0.67	0.67	
Clearance Time (s)	7.0			7.0	7.0	
Vehicle Extension (s)	6.0			6.0	3.0	
Lane Grp Cap (vph)	948	1411		3402	3649	
v/s Ratio Prot	c0.19			0.34	c0.77	
v/s Ratio Perm		0.37				
v/c Ratio	0.71	0.37		0.51	1.14	
Uniform Delay, d1	40.3	0.0		9.7	19.6	
Progression Factor	1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.7	0.8		0.5	66.3	
Delay (s)	44.0	0.8		10.3	85.9	
Level of Service	D	A		B	F	
Approach Delay (s)	25.1			10.3	85.9	
Approach LOS	C			B	F	
Intersection Summary						
HCM Average Control Delay			57.2		HCM Level of Service	E
HCM Volume to Capacity ratio			1.02			
Actuated Cycle Length (s)			120.0		Sum of lost time (s)	8.0
Intersection Capacity Utilization		111.8%			ICU Level of Service	H
Analysis Period (min)			15			

c Critical Lane Group

2031 Future - Weekday AM Peak Hour
3: Burncrest Road & Woodbine Avenue

Queues
Highway 407 Transitway: Woodbine / Rodick Station

									
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	34	38	28	50	139	20	1550	487	4161
Lane Group Flow (vph)	34	49	28	50	139	20	1607	487	4193
Turn Type	Perm		Perm		Perm	Perm	pm+pt		
Protected Phases	4		8		8		2	1	6
Permitted Phases	4	8		8		2	6		
Detector Phases	4	4	8	8	8	2	2	1	6
Minimum Initial (s)	30.0	30.0	30.0	30.0	30.0	10.0	10.0	7.0	10.0
Minimum Split (s)	37.0	37.0	37.0	37.0	37.0	35.0	35.0	11.0	35.0
Total Split (s)	36.0	36.0	36.0	36.0	36.0	66.0	66.0	18.0	84.0
Total Split (%)	30.0%	30.0%	30.0%	30.0%	30.0%	55.0%	55.0%	15.0%	70.0%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	3.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.0	2.0
Lead/Lag						Lag	Lag	Lead	
Lead-Lag Optimize?						Yes	Yes	Yes	
Recall Mode	None	None	None	None	None	C-Max	C-Max	None	C-Max
v/c Ratio	0.11	0.13	0.12	0.11	0.34	0.36	0.62	0.61	1.15
Control Delay	34.6	34.6	35.1	34.3	8.1	40.0	21.0	11.5	93.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.6	34.6	35.1	34.3	8.1	40.0	21.0	11.5	93.6
Queue Length 50th (m)	5.6	8.1	4.6	8.2	0.0	2.4	82.0	19.5	~358.2
Queue Length 95th (m)	13.3	17.3	11.8	17.5	14.2	#11.5	98.0	25.9	#374.2
Internal Link Dist (m)	121.6		227.1				138.5	61.4	
Turn Bay Length (m)	50.0	60.0						120.0	
Base Capacity (vph)	307	388	233	443	408	55	2607	827	3642
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	0.11	0.13	0.12	0.11	0.34	0.36	0.62	0.59	1.15

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 145

Control Type: Actuated-Coordinated






~ 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: 3: Burncrest Road & Woodbine Avenue

		
18 s	66 s	36 s
		
84 s		36 s

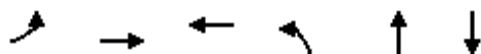
2031 Future - Weekday AM Peak Hour
3: Burncrest Road & Woodbine Avenue







HCM Signalized Intersection Capacity Analysis
Highway 407 Transitway: Woodbine / Rodick Station

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	*0.95		0.97	*1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	0.99		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		1.00	1.00	
Satd. Flow (prot)	1513	1456		1144	1663	1149	1526	4904		3255	5461	
Flt Permitted	0.72	1.00		0.73	1.00	1.00	0.06	1.00		0.25	1.00	
Satd. Flow (perm)	1153	1456		873	1663	1149	101	4904		814	5461	
Volume (vph)	34	38	11	28	50	139	20	1550	57	487	4161	32
Peak-hour factor, PHF	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. Flow (vph)	34	38	11	28	50	139	20	1550	57	487	4161	32
RTOR Reduction (vph)	0	0	0	0	0	102	0	3	0	0	1	0
Lane Group Flow (vph)	34	49	0	28	50	37	20	1604	0	487	4192	0
Confl. Peds. (#/hr)							3					3
Heavy Vehicles (%)	18%	29%	10%	56%	13%	39%	17%	8%	25%	12%	3%	13%
Turn Type	Perm			Perm			Perm	Perm		pm+pt		
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)	29.0	29.0		29.0	29.0	29.0	60.7	60.7		77.0	77.0	
Effective Green, g (s)	32.0	32.0		32.0	32.0	32.0	63.7	63.7		80.0	80.0	
Actuated g/C Ratio	0.27	0.27		0.27	0.27	0.27	0.53	0.53		0.67	0.67	
Clearance Time (s)	7.0	7.0		7.0	7.0	7.0	7.0	7.0		4.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	307	388		233	443	306	54	2603		793	3641	
v/s Ratio Prot		c0.03			0.03			0.33		0.06	c0.77	
v/s Ratio Perm	0.03			0.03		0.03	0.20			0.35		
v/c Ratio	0.11	0.13		0.12	0.11	0.12	0.37	0.62		0.61	1.15	
Uniform Delay, d1	33.2	33.4		33.3	33.3	33.3	16.4	19.6		12.2	20.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	0.1		0.2	0.1	0.2	18.4	1.1		1.4	71.7	
Delay (s)	33.4	33.5		33.6	33.4	33.5	34.9	20.7		13.6	91.7	
Level of Service	C	C		C	C	C	C	C		B	F	
Approach Delay (s)		33.5			33.5			20.9			83.6	
Approach LOS		C			C			C			F	
Intersection Summary												
HCM Average Control Delay		65.9					HCM Level of Service		E			
HCM Volume to Capacity ratio		0.86										
Actuated Cycle Length (s)		120.0					Sum of lost time (s)		8.0			
Intersection Capacity Utilization		124.4%					ICU Level of Service		H			
Analysis Period (min)		15										
c Critical Lane Group												

2031 Future - Weekday AM Peak Hour
4: Miller Avenue & Rodick Road

Queues
Highway 407 Transitway: Woodbine / Rodick Station



Lane Group	EBL	EBT	WBT	NBL	NBT	SBT
Lane Configurations						
Volume (vph)	71	22	11	248	204	186
Lane Group Flow (vph)	71	424	11	248	204	330
Turn Type	Perm		pm+pt			
Protected Phases		4	8	5	2	6
Permitted Phases	4			2		
Detector Phases	4	4	8	5	2	6
Minimum Initial (s)	10.0	10.0	10.0	4.0	15.0	15.0
Minimum Split (s)	25.0	25.0	25.0	8.0	25.0	25.0
Total Split (s)	34.0	34.0	34.0	8.0	56.0	48.0
Total Split (%)	37.8%	37.8%	37.8%	8.9%	62.2%	53.3%
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	1.0	2.0	2.0
Lead/Lag				Lead	Lag	
Lead-Lag Optimize?				Yes	Yes	
Recall Mode	None	None	None	None	C-Min	C-Min
v/c Ratio	0.29	0.70	0.03	0.32	0.08	0.17
Control Delay	61.2	40.1	27.4	5.7	4.1	6.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	61.2	40.1	27.4	5.7	4.1	6.3
Queue Length 50th (m)	12.3	60.4	1.6	7.9	3.1	5.4
Queue Length 95th (m)	m20.6	76.2	4.8	24.4	9.5	16.5
Internal Link Dist (m)	275.3		220.8	155.3		
Turn Bay Length (m)				70.0		
Base Capacity (vph)	461	795	614	764	2575	2001
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	0.15	0.53	0.02	0.32	0.08	0.16

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated



















m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Miller Avenue & Rodick Road



2031 Future - Weekday AM Peak Hour
4: Miller Avenue & Rodick Road

HCM Signalized Intersection Capacity Analysis
Highway 407 Transitway: Woodbine / Rodick Station

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0			4.0	
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95			0.95	
Frt	1.00	0.86			1.00		1.00	1.00			0.93	
Flt Protected	0.95	1.00			1.00		0.95	1.00			1.00	
Satd. Flow (prot)	1750	1580			1842		1750	3500			3271	
Flt Permitted	0.75	1.00			1.00		0.51	1.00			1.00	
Satd. Flow (perm)	1382	1580			1842		945	3500			3271	
Volume (vph)	71	22	402	0	11	0	248	204	0	0	186	144
Peak-hour factor, PHF	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. Flow (vph)	71	22	402	0	11	0	248	204	0	0	186	144
RTOR Reduction (vph)	0	331	0	0	0	0	0	0	0	0	60	0
Lane Group Flow (vph)	71	93	0	0	11	0	248	204	0	0	270	0
Turn Type	Perm			Perm			pm+pt			Perm		
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	13.8	13.8			13.8		64.2	64.2			50.4	
Effective Green, g (s)	15.8	15.8			15.8		66.2	66.2			52.4	
Actuated g/C Ratio	0.18	0.18			0.18		0.74	0.74			0.58	
Clearance Time (s)	6.0	6.0			6.0		4.0	6.0			6.0	
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)	243	277			323		783	2574			1904	
v/s Ratio Prot		c0.06			0.01		c0.03	0.06			0.08	
v/s Ratio Perm	0.05						c0.20					
v/c Ratio	0.29	0.33			0.03		0.32	0.08			0.14	
Uniform Delay, d1	32.2	32.5			30.8		3.8	3.3			8.6	
Progression Factor	1.92	8.25			1.00		1.00	1.00			1.00	
Incremental Delay, d2	0.6	0.6			0.0		0.2	0.1			0.2	
Delay (s)	62.4	268.6			30.8		4.0	3.4			8.7	
Level of Service	E	F			C		A	A			A	
Approach Delay (s)		239.0			30.8			3.7			8.7	
Approach LOS		F			C			A			A	
Intersection Summary												
HCM Average Control Delay			95.7				HCM Level of Service				F	
HCM Volume to Capacity ratio			0.32									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			8.0		
Intersection Capacity Utilization			62.3%				ICU Level of Service			B		
Analysis Period (min)			15									
c Critical Lane Group												

2031 Future - Weekday AM Peak Hour
5: Miller Avenue & Transit Access

HCM Unsignalized Intersection Capacity Analysis
Highway 407 Transitway: Woodbine / Rodick Station



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	4	583	213	4	4	4
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	4	583	213	4	4	4
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (m)		251	260			
pX, platoon unblocked					0.99	
vC, conflicting volume	217				514	108
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	217				498	108
tC, single (s)	4.3				8.8	8.9
tC, 2 stage (s)						
tF (s)	2.3				4.5	4.3
p0 queue free %	100				99	99
cM capacity (veh/h)	1293				314	683
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	4	292	292	142	75	8
Volume Left	4	0	0	0	0	4
Volume Right	0	0	0	0	4	4
cSH	1293	1700	1700	1700	1700	430
Volume to Capacity	0.00	0.17	0.17	0.08	0.04	0.02
Queue Length 95th (m)	0.1	0.0	0.0	0.0	0.0	0.4
Control Delay (s)	7.8	0.0	0.0	0.0	0.0	13.5
Lane LOS	A					B
Approach Delay (s)	0.1			0.0		13.5
Approach LOS						B
Intersection Summary						
Average Delay			0.2			
Intersection Capacity Utilization			26.1%		ICU Level of Service	A
Analysis Period (min)			15			

2031 Future - Weekday AM Peak Hour
6: Miller Avenue & P&R Access

Queues
Highway 407 Transitway: Woodbine / Rodick Station



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	147	444	183	220	52	34
Lane Group Flow (vph)	147	444	183	220	52	34
Turn Type	Perm			pm+ov		Perm
Protected Phases		4	8	6	6	
Permitted Phases	4			8		6
Detector Phases	4	4	8	6	6	6
Minimum Initial (s)	15.0	15.0	15.0	10.0	10.0	10.0
Minimum Split (s)	25.0	25.0	25.0	25.0	25.0	25.0
Total Split (s)	58.0	58.0	58.0	32.0	32.0	32.0
Total Split (%)	64.4%	64.4%	64.4%	35.6%	35.6%	35.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	None	C-Min	C-Min	C-Min
v/c Ratio	0.59	0.60	0.26	0.14	0.04	0.03
Control Delay	41.9	35.3	28.9	0.2	5.0	2.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.9	35.3	28.9	0.2	5.0	2.1
Queue Length 50th (m)	21.9	34.8	13.3	0.0	2.0	0.0
Queue Length 95th (m)	36.0	43.7	22.6	0.0	6.3	2.8
Internal Link Dist (m)		235.7	275.3		100.9	
Turn Bay Length (m)	50.0			40.0		
Base Capacity (vph)	703	2100	2002	1566	1224	1105
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	0.21	0.21	0.09	0.14	0.04	0.03

Intersection Summary

Cycle Length: 90

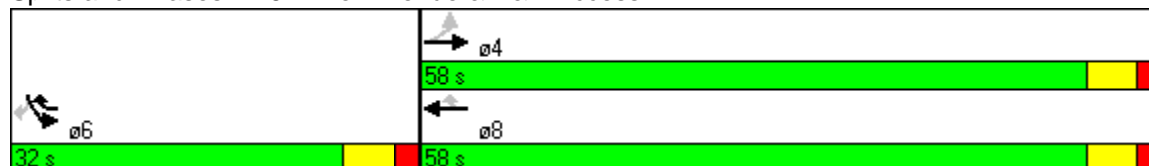
Actuated Cycle Length: 90

Offset: 0 (0%), Referenced to phase 2: and 6:SBL, Start of Green

Natural Cycle: 50

Control Type: Actuated-Coordinated

Splits and Phases: 6: Miller Avenue & P&R Access



2031 Future - Weekday AM Peak Hour
6: Miller Avenue & P&R Access

HCM Signalized Intersection Capacity Analysis
Highway 407 Transitway: Woodbine / Rodick Station



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1750	3500	3336	1566	1750	1566
Flt Permitted	0.64	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1172	3500	3336	1566	1750	1566
Volume (vph)	147	444	183	220	52	34
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	147	444	183	220	52	34
RTOR Reduction (vph)	0	0	0	0	0	10
Lane Group Flow (vph)	147	444	183	220	52	24
Heavy Vehicles (%)	2%	2%	7%	2%	2%	2%
Turn Type	Perm		pm+ov		Perm	
Protected Phases		4	8	6	6	
Permitted Phases	4		8		6	
Actuated Green, G (s)	17.1	17.1	17.1	78.0	60.9	60.9
Effective Green, g (s)	19.1	19.1	19.1	82.0	62.9	62.9
Actuated g/C Ratio	0.21	0.21	0.21	0.91	0.70	0.70
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	249	743	708	1566	1223	1094
v/s Ratio Prot		c0.13	0.05	c0.10	0.03	
v/s Ratio Perm	0.13			0.04		0.02
v/c Ratio	0.59	0.60	0.26	0.14	0.04	0.02
Uniform Delay, d1	31.9	32.0	29.5	0.4	4.2	4.1
Progression Factor	1.00	1.00	0.96	1.00	1.00	1.00
Incremental Delay, d2	3.7	1.3	0.2	0.0	0.1	0.0
Delay (s)	35.6	33.3	28.7	0.4	4.3	4.2
Level of Service	D	C	C	A	A	A
Approach Delay (s)		33.9	13.3		4.2	
Approach LOS		C	B		A	
Intersection Summary						
HCM Average Control Delay			23.8		HCM Level of Service	C
HCM Volume to Capacity ratio			0.24			
Actuated Cycle Length (s)			90.0		Sum of lost time (s)	4.0
Intersection Capacity Utilization			43.3%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

2031 Future - Weekday PM Peak Hour
 1: Hwy 407 Westbound Off-ramp & Woodbine Avenue

Queues
 407 Transitway: Woodbine / Rodick Station

Lane Group	WBL	WBR	NBT	SBT
Lane Configurations	WY	Y	YYY	YYY
Volume (vph)	65	106	3195	2634
Lane Group Flow (vph)	65	106	3195	2634
Turn Type	Free			
Protected Phases	8		2	6
Permitted Phases	Free			
Detector Phases	8		2	6
Minimum Initial (s)	10.0		15.0	15.0
Minimum Split (s)	26.0		26.0	26.0
Total Split (s)	31.0	0.0	89.0	89.0
Total Split (%)	25.8%	0.0%	74.2%	74.2%
Yellow Time (s)	5.0		5.0	5.0
All-Red Time (s)	2.0		2.0	2.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max		Max	Max
v/c Ratio	0.08	0.08	0.82	0.68
Control Delay	37.1	0.1	14.4	11.0
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	37.1	0.1	14.4	11.0
Queue Length 50th (m)	5.6	0.0	142.5	95.5
Queue Length 95th (m)	10.8	0.0	158.3	107.0
Internal Link Dist (m)	614.1		112.6	59.1
Turn Bay Length (m)	130.0			
Base Capacity (vph)	846	1333	3914	3876
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.08	0.08	0.82	0.68

Intersection Summary

Cycle Length: 120

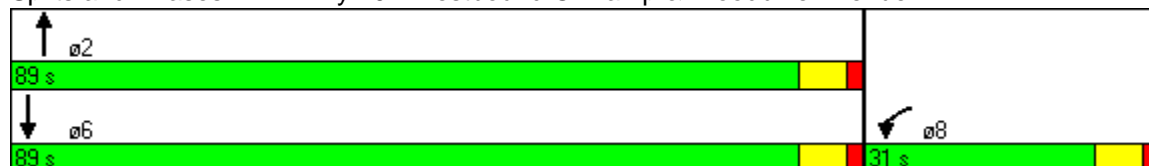
Actuated Cycle Length: 120

Offset: 0 (0%), Referenced to phase 8:WBL, Start of Green

Natural Cycle: 75

Control Type: Actuated-Coordinated

Splits and Phases: 1: Hwy 407 Westbound Off-ramp & Woodbine Avenue





Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	←←←	←→	←←←	←→	←→	←←←
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0			4.0
Lane Util. Factor	*1.00	0.91	*1.00			*1.00
Frt	1.00	0.85	1.00			1.00
Flt Protected	1.00	1.00	1.00			1.00
Satd. Flow (prot)	3758	1333	5526			5472
Flt Permitted	1.00	1.00	1.00			1.00
Satd. Flow (perm)	3758	1333	5526			5472
Volume (vph)	65	106	3195	0	0	2634
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	65	106	3195	0	0	2634
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	65	106	3195	0	0	2634
Heavy Vehicles (%)	0%	9%	2%	0%	0%	3%
Turn Type	Free					
Protected Phases	8		2			6
Permitted Phases	Free					
Actuated Green, G (s)	24.0	120.0	82.0			82.0
Effective Green, g (s)	27.0	120.0	85.0			85.0
Actuated g/C Ratio	0.22	1.00	0.71			0.71
Clearance Time (s)	7.0		7.0			7.0
Vehicle Extension (s)	3.0		6.0			6.0
Lane Grp Cap (vph)	846	1333	3914			3876
v/s Ratio Prot	0.02		c0.58			0.48
v/s Ratio Perm		c0.08				
v/c Ratio	0.08	0.08	0.82			0.68
Uniform Delay, d1	36.7	0.0	12.1			9.8
Progression Factor	1.00	1.00	1.00			1.00
Incremental Delay, d2	0.2	0.1	2.0			1.0
Delay (s)	36.8	0.1	14.1			10.8
Level of Service	D	A	B			B
Approach Delay (s)	14.1		14.1			10.8
Approach LOS	B		B			B
Intersection Summary						
HCM Average Control Delay			12.7		HCM Level of Service	B
HCM Volume to Capacity ratio			0.62			
Actuated Cycle Length (s)			120.0		Sum of lost time (s)	4.0
Intersection Capacity Utilization			76.7%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						

2031 Future - Weekday PM Peak Hour
2: Hwy 407 Eastbound Off-ramp & Woodbine Avenue

Queues
407 Transitway: Woodbine / Rodick Station



Lane Group	EBL	EBR	NBT	SBT
Lane Configurations	WY	Y	AAA	AAA
Volume (vph)	142	50	3176	1987
Lane Group Flow (vph)	142	50	3176	1987
Turn Type	Free			
Protected Phases	4		2	6
Permitted Phases	Free			
Detector Phases	4		2	6
Minimum Initial (s)	10.0		15.0	15.0
Minimum Split (s)	26.0		26.0	26.0
Total Split (s)	36.0	0.0	84.0	84.0
Total Split (%)	30.0%	0.0%	70.0%	70.0%
Yellow Time (s)	5.0		5.0	5.0
All-Red Time (s)	2.0		2.0	2.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	None		C-Max	C-Max
v/c Ratio	0.32	0.04	0.82	0.50
Control Delay	48.6	0.0	9.6	4.6
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	48.6	0.0	9.6	4.6
Queue Length 50th (m)	14.5	0.0	118.2	42.5
Queue Length 95th (m)	22.9	0.0	155.7	56.2
Internal Link Dist (m)	638.1		55.3	98.5
Turn Bay Length (m)	150.0			
Base Capacity (vph)	897	1411	3874	3948
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.16	0.04	0.82	0.50

Intersection Summary

Cycle Length: 120

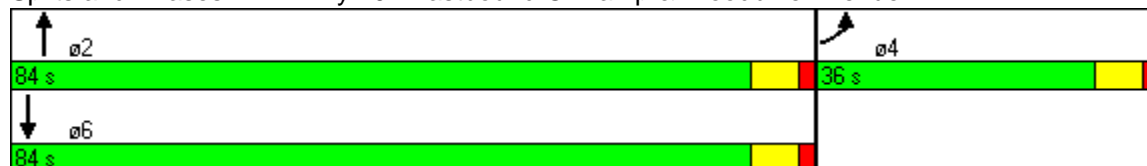
Actuated Cycle Length: 120

Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Splits and Phases: 2: Hwy 407 Eastbound Off-ramp & Woodbine Avenue























Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97	0.91		0.91	0.91	
Frt	1.00	0.85		1.00	1.00	
Flt Protected	0.95	1.00		1.00	1.00	
Satd. Flow (prot)	3362	1411		4839	4932	
Flt Permitted	0.95	1.00		1.00	1.00	
Satd. Flow (perm)	3362	1411		4839	4932	
Volume (vph)	142	50	0	3176	1987	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	142	50	0	3176	1987	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	142	50	0	3176	1987	0
Heavy Vehicles (%)	3%	3%	2%	6%	4%	2%
Turn Type	Free					
Protected Phases	4			2	6	
Permitted Phases	Free					
Actuated Green, G (s)	12.9	120.0		93.1	93.1	
Effective Green, g (s)	15.9	120.0		96.1	96.1	
Actuated g/C Ratio	0.13	1.00		0.80	0.80	
Clearance Time (s)	7.0			7.0	7.0	
Vehicle Extension (s)	6.0			6.0	3.0	
Lane Grp Cap (vph)	445	1411		3875	3950	
v/s Ratio Prot	c0.04			c0.66	0.40	
v/s Ratio Perm		0.04				
v/c Ratio	0.32	0.04		0.82	0.50	
Uniform Delay, d1	47.1	0.0		6.9	4.0	
Progression Factor	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.2	0.0		2.1	0.5	
Delay (s)	48.3	0.0		9.0	4.4	
Level of Service	D	A		A	A	
Approach Delay (s)	35.7			9.0	4.4	
Approach LOS	D			A	A	
Intersection Summary						
HCM Average Control Delay			8.3		HCM Level of Service	A
HCM Volume to Capacity ratio			0.75			
Actuated Cycle Length (s)			120.0		Sum of lost time (s)	8.0
Intersection Capacity Utilization			76.4%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						

2031 Future - Weekday PM Peak Hour
3: Burncrest Road & Woodbine Avenue

Queues
407 Transitway: Woodbine / Rodick Station

									
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	59	39	51	55	404	37	3494	101	1907
Lane Group Flow (vph)	59	67	51	55	404	37	3517	101	1936
Turn Type	Perm		Perm		Perm	Perm		pm+pt	
Protected Phases		4		8			2	1	6
Permitted Phases	4		8		8	2		6	
Detector Phases	4	4	8	8	8	2	2	1	6
Minimum Initial (s)	30.0	30.0	30.0	30.0	30.0	10.0	10.0	7.0	10.0
Minimum Split (s)	37.0	37.0	37.0	37.0	37.0	35.0	35.0	11.0	35.0
Total Split (s)	36.0	36.0	36.0	36.0	36.0	74.0	74.0	10.0	84.0
Total Split (%)	30.0%	30.0%	30.0%	30.0%	30.0%	61.7%	61.7%	8.3%	70.0%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	3.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.0	2.0
Lead/Lag						Lag	Lag	Lead	
Lead-Lag Optimize?						Yes	Yes	Yes	
Recall Mode	None	None	None	None	None	C-Max	C-Max	None	C-Max
v/c Ratio	0.60	0.19	0.28	0.20	0.89	0.33	1.10	0.49	0.54
Control Delay	65.3	25.4	40.3	36.5	56.0	23.2	74.6	18.2	11.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	65.3	25.4	40.3	36.5	56.0	23.2	74.6	18.2	11.1
Queue Length 50th (m)	11.2	7.4	8.8	9.3	68.0	3.9	~288.5	3.6	66.4
Queue Length 95th (m)	#29.5	18.3	19.6	19.6	#120.9	12.6	#308.3	9.0	75.6
Internal Link Dist (m)		121.6		315.2			437.2		29.5
Turn Bay Length (m)	50.0		60.0					120.0	
Base Capacity (vph)	99	360	179	278	453	111	3208	208	3596
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	0.60	0.19	0.28	0.20	0.89	0.33	1.10	0.49	0.54

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 145

Control Type: Actuated-Coordinated






~ 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: 3: Burncrest Road & Woodbine Avenue

		
ø1	ø2	ø4
10 s	74 s	36 s
		
ø6		ø8
84 s		36 s

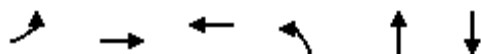
2031 Future - Weekday PM Peak Hour
3: Burncrest Road & Woodbine Avenue

HCM Signalized Intersection Capacity Analysis
407 Transitway: Woodbine / Rodick Station

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								  		 	  	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	*1.00		0.97	*1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.94		1.00	1.00	0.85	1.00	1.00		1.00	1.00	
Flt Protected	1.00	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1866	1289		892	1044	1450	1683	5498		2439	5390	
Flt Permitted	0.20	1.00		0.71	1.00	1.00	0.11	1.00		0.05	1.00	
Satd. Flow (perm)	373	1289		670	1044	1450	191	5498		139	5390	
Volume (vph)	59	39	28	51	55	404	37	3494	23	101	1907	29
Peak-hour factor, PHF	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. Flow (vph)	59	39	28	51	55	404	37	3494	23	101	1907	29
RTOR Reduction (vph)	0	16	0	0	0	66	0	0	0	0	1	0
Lane Group Flow (vph)	59	51	0	51	55	338	37	3517	0	101	1935	0
Confl. Peds. (#/hr)	6					6	2		1	1		2
Heavy Vehicles (%)	0%	60%	4%	100%	80%	8%	6%	2%	64%	42%	4%	24%
Turn Type	Perm			Perm			Perm	Perm		pm+pt		
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)	29.0	29.0		29.0	29.0	29.0	67.0	67.0		77.0	77.0	
Effective Green, g (s)	32.0	32.0		32.0	32.0	32.0	70.0	70.0		80.0	80.0	
Actuated g/C Ratio	0.27	0.27		0.27	0.27	0.27	0.58	0.58		0.67	0.67	
Clearance Time (s)	7.0	7.0		7.0	7.0	7.0	7.0	7.0		4.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	99	344		179	278	387	111	3207		208	3593	
v/s Ratio Prot		0.04			0.05			0.64		0.02	0.36	
v/s Ratio Perm	0.16			0.08		0.23	0.19			0.30		
v/c Ratio	0.60	0.15		0.28	0.20	0.87	0.33	1.10		0.49	0.54	
Uniform Delay, d1	38.4	33.6		34.9	34.1	42.1	12.9	25.0		56.5	10.4	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	9.3	0.2		0.9	0.4	19.0	7.9	49.1		1.8	0.6	
Delay (s)	47.7	33.8		35.8	34.4	61.1	20.8	74.1		58.3	11.0	
Level of Service	D	C		D	C	E	C	E		E	B	
Approach Delay (s)		40.3			55.7			73.5			13.3	
Approach LOS		D			E			E			B	
Intersection Summary												
HCM Average Control Delay		51.7					HCM Level of Service			D		
HCM Volume to Capacity ratio		1.01										
Actuated Cycle Length (s)		120.0					Sum of lost time (s)			12.0		
Intersection Capacity Utilization		128.7%					ICU Level of Service			H		
Analysis Period (min)		15										
c Critical Lane Group												

2031 Future - Weekday PM Peak Hour
4: Miller Avenue & Rodick Road

Queues
407 Transitway: Woodbine / Rodick Station



Lane Group	EBL	EBT	WBT	NBL	NBT	SBT
Lane Configurations						
Volume (vph)	157	11	17	349	171	205
Lane Group Flow (vph)	157	168	17	349	171	283
Turn Type	Perm		Perm			
Protected Phases		4	8		2	6
Permitted Phases	4			2		
Detector Phases	4	4	8	2	2	6
Minimum Initial (s)	10.0	10.0	10.0	15.0	15.0	15.0
Minimum Split (s)	25.0	25.0	24.0	24.0	24.0	25.0
Total Split (s)	30.0	30.0	30.0	60.0	60.0	60.0
Total Split (%)	33.3%	33.3%	33.3%	66.7%	66.7%	66.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	None	C-Min	C-Min	C-Min
v/c Ratio	0.63	0.40	0.05	0.45	0.07	0.11
Control Delay	40.4	6.5	28.2	7.9	4.1	3.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.4	6.5	28.2	7.9	4.1	3.1
Queue Length 50th (m)	16.2	0.0	2.2	19.4	3.5	4.3
Queue Length 95th (m)	35.8	1.1	6.7	41.5	7.2	9.0
Internal Link Dist (m)		265.1	220.8		155.3	258.3
Turn Bay Length (m)	40.0			70.0		
Base Capacity (vph)	397	569	532	776	2551	2467
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	0.40	0.30	0.03	0.45	0.07	0.11

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 60




















Control Type: Actuated-Coordinated

Splits and Phases: 4: Miller Avenue & Rodick Road

	ø2		ø4
60 s		30 s	
	ø6		ø8
60 s		30 s	

2031 Future - Weekday PM Peak Hour
4: Miller Avenue & Rodick Road

HCM Signalized Intersection Capacity Analysis
407 Transitway: Woodbine / Rodick Station

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0			4.0	
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95			0.95	
Frt	1.00	0.86			1.00		1.00	1.00			0.96	
Flt Protected	0.95	1.00			1.00		0.95	1.00			1.00	
Satd. Flow (prot)	1750	1584			1842		1750	3500			3355	
Flt Permitted	0.75	1.00			1.00		0.58	1.00			1.00	
Satd. Flow (perm)	1375	1584			1842		1065	3500			3355	
Volume (vph)	157	11	157	0	17	0	349	171	0	0	205	78
Peak-hour factor, PHF	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. Flow (vph)	157	11	157	0	17	0	349	171	0	0	205	78
RTOR Reduction (vph)	0	128	0	0	0	0	0	0	0	0	21	0
Lane Group Flow (vph)	157	40	0	0	17	0	349	171	0	0	262	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	14.4	14.4			14.4		63.6	63.6			63.6	
Effective Green, g (s)	16.4	16.4			16.4		65.6	65.6			65.6	
Actuated g/C Ratio	0.18	0.18			0.18		0.73	0.73			0.73	
Clearance Time (s)	6.0	6.0			6.0		6.0	6.0			6.0	
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)	251	289			336		776	2551			2445	
v/s Ratio Prot		0.03			0.01			0.05			0.08	
v/s Ratio Perm	c0.11						c0.33					
v/c Ratio	0.63	0.14			0.05		0.45	0.07			0.11	
Uniform Delay, d1	34.0	30.9			30.4		4.9	3.5			3.6	
Progression Factor	0.88	0.59			1.00		1.00	1.00			1.00	
Incremental Delay, d2	4.8	0.2			0.1		1.9	0.1			0.1	
Delay (s)	34.5	18.4			30.4		6.8	3.5			3.7	
Level of Service	C	B			C		A	A			A	
Approach Delay (s)		26.2			30.4			5.7			3.7	
Approach LOS		C			C			A			A	
Intersection Summary												
HCM Average Control Delay			11.4				HCM Level of Service				B	
HCM Volume to Capacity ratio			0.48									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			8.0		
Intersection Capacity Utilization			57.2%				ICU Level of Service			B		
Analysis Period (min)			15									
c Critical Lane Group												

2031 Future - Weekday PM Peak Hour
5: Miller Avenue & Transit Access

HCM Unsignalized Intersection Capacity Analysis
407 Transitway: Woodbine / Rodick Station



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	14	166	506	4	4	4
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	14	166	506	4	4	4
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (m)		339	181			
pX, platoon unblocked	0.92				0.92	0.92
vC, conflicting volume	510				619	255
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	378				497	101
tC, single (s)	6.1				8.8	8.9
tC, 2 stage (s)						
tF (s)	3.2				4.5	4.3
p0 queue free %	98				99	99
cM capacity (veh/h)	641				286	636
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	14	83	83	337	173	8
Volume Left	14	0	0	0	0	4
Volume Right	0	0	0	0	4	4
cSH	641	1700	1700	1700	1700	395
Volume to Capacity	0.02	0.05	0.05	0.20	0.10	0.02
Queue Length 95th (m)	0.5	0.0	0.0	0.0	0.0	0.4
Control Delay (s)	10.7	0.0	0.0	0.0	0.0	14.3
Lane LOS	B					B
Approach Delay (s)	0.8			0.0		14.3
Approach LOS						B
Intersection Summary						
Average Delay			0.4			
Intersection Capacity Utilization			24.1%		ICU Level of Service	A
Analysis Period (min)			15			

2031 Future - Weekday PM Peak Hour
6: Miller Avenue & P&R Access

Queues
407 Transitway: Woodbine / Rodick Station



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	36	135	390	54	180	120
Lane Group Flow (vph)	36	135	390	54	180	120
Turn Type	Perm		pm+ov		Perm	
Protected Phases		4	8	6	6	
Permitted Phases	4			8		6
Detector Phases	4	4	8	6	6	6
Minimum Initial (s)	15.0	15.0	15.0	10.0	10.0	10.0
Minimum Split (s)	25.0	25.0	25.0	25.0	25.0	25.0
Total Split (s)	58.0	58.0	58.0	32.0	32.0	32.0
Total Split (%)	64.4%	64.4%	64.4%	35.6%	35.6%	35.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	None	C-Min	C-Min	C-Min
v/c Ratio	0.20	0.21	0.58	0.03	0.14	0.10
Control Delay	33.3	31.3	32.1	0.0	4.4	1.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.3	31.3	32.1	0.0	4.4	1.0
Queue Length 50th (m)	4.9	9.6	30.3	0.0	7.4	0.0
Queue Length 95th (m)	12.3	16.4	40.2	0.0	14.1	4.0
Internal Link Dist (m)		157.2	265.1		96.6	
Turn Bay Length (m)				40.0		
Base Capacity (vph)	569	1983	2080	1566	1256	1158
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	0.06	0.07	0.19	0.03	0.14	0.10

Intersection Summary

Cycle Length: 90

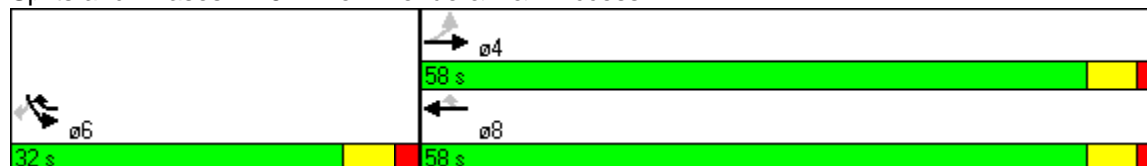
Actuated Cycle Length: 90

Offset: 0 (0%), Referenced to phase 2: and 6:SBL, Start of Green

Natural Cycle: 50

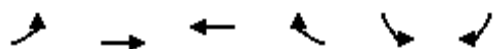
Control Type: Actuated-Coordinated

Splits and Phases: 6: Miller Avenue & P&R Access



2031 Future - Weekday PM Peak Hour
6: Miller Avenue & P&R Access

HCM Signalized Intersection Capacity Analysis
407 Transitway: Woodbine / Rodick Station



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1750	3305	3466	1566	1750	1566
Flt Permitted	0.36	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	665	3305	3466	1566	1750	1566
Volume (vph)	36	135	390	54	180	120
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	36	135	390	54	180	120
RTOR Reduction (vph)	0	0	0	0	0	34
Lane Group Flow (vph)	36	135	390	54	180	86
Heavy Vehicles (%)	2%	8%	3%	2%	2%	2%
Turn Type	Perm		pm+ov		Perm	
Protected Phases		4	8	6	6	
Permitted Phases	4		8		6	
Actuated Green, G (s)	15.4	15.4	15.4	78.0	62.6	62.6
Effective Green, g (s)	17.4	17.4	17.4	82.0	64.6	64.6
Actuated g/C Ratio	0.19	0.19	0.19	0.91	0.72	0.72
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	129	639	670	1566	1256	1124
v/s Ratio Prot		0.04	c0.11	0.02	c0.10	
v/s Ratio Perm	0.05			0.01		0.06
v/c Ratio	0.28	0.21	0.58	0.03	0.14	0.08
Uniform Delay, d1	31.0	30.5	33.0	0.4	4.0	3.8
Progression Factor	1.00	1.00	0.86	1.00	1.00	1.00
Incremental Delay, d2	1.2	0.2	1.2	0.0	0.2	0.1
Delay (s)	32.1	30.7	29.7	0.4	4.2	3.9
Level of Service	C	C	C	A	A	A
Approach Delay (s)		31.0	26.1		4.1	
Approach LOS		C	C		A	
Intersection Summary						
HCM Average Control Delay			19.8		HCM Level of Service	B
HCM Volume to Capacity ratio			0.24			
Actuated Cycle Length (s)			90.0		Sum of lost time (s)	8.0
Intersection Capacity Utilization			45.0%		ICU Level of Service	A
Analysis Period (min)			15			

c Critical Lane Group