



Ministry of Transportation, Ontario

**HIGHWAY 407 TRANSITWAY:  
TRANSPORTATION STUDY FOR PROPOSED GO BARRIE  
(CONCORD) STATION**

---

FINAL REPORT

DECEMBER, 2010





## TABLE OF CONTENTS

<b>1.</b>	<b>INTRODUCTION .....</b>	<b>1</b>
1.1	Report Outline .....	1
1.2	Key Issues.....	2
<b>2.</b>	<b>THE PROPOSED DEVELOPMENT .....</b>	<b>3</b>
2.1	Station Location .....	3
2.2	Site Plan .....	4
<b>3.</b>	<b>STUDY SCOPE .....</b>	<b>6</b>
3.1	Study Area .....	6
3.2	Guidelines and Standards .....	6
3.3	Horizon Years and Analysis Periods .....	6
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
<b>4.</b>	<b>EXISTING CONDITIONS .....</b>	<b>10</b>
4.1	Area Road Network .....	10
4.2	Lane Configurations .....	12
4.3	Transit Services and Operations .....	12
4.4	Existing Condition (2010) Traffic Volumes and Operations .....	12
	4.4.1 Capacity and Level of Service .....	16
	4.4.2 Queue Lengths .....	17
<b>5.</b>	<b>FUTURE BACKGROUND CONDITION.....</b>	<b>19</b>
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 .....	22
<b>6.</b>	<b>GO BARRIE (CONCORD) STATION RELATED TRAFFIC .....</b>	<b>24</b>
6.1	Passenger Flow Projections .....	24

## TABLE OF CONTENTS

6.2	GO Barrie (Concord) Station Trip Generation .....	24
6.2.1	Assumptions .....	24
6.2.2	Generated Trips .....	24
6.3	Future Bus Transit Volumes.....	25
6.4	GO Barrie (Concord) Trip Distribution .....	25
6.5	Trip Assignment.....	25
<b>7.</b>	<b>FUTURE TOTAL CONDITION .....</b>	<b>27</b>
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.....	31
7.6.1	Capacity and Level of Service .....	31
7.6.2	Queue Lengths .....	32
<b>8.</b>	<b>SUMMARY AND CONCLUSIONS.....</b>	<b>34</b>
<b>A.</b>	<b>2010 EXISTING CONDITION SYNCHRO SUMMARY OUTPUTS.....</b>	<b>1</b>
<b>B.</b>	<b>2031 BACKGROUND CONDITION SYNCHRO SUMMARY OUTPUTS .....</b>	<b>1</b>
<b>C.</b>	<b>2031 FUTURE CONDITION SYNCHRO SUMMARY OUTPUTS.....</b>	<b>1</b>

## TABLE OF CONTENTS (CONT'D)

### APPENDICES

<b>A. 2010 EXISTING CONDITION SYNCHRO SUMMARY OUTPUTS .....</b>	<b>A-1</b>
<b>B. 2031 BACKGROUND CONDITION SYNCHRO SUMMARY OUTPUTS.....</b>	<b>B-1</b>
<b>C. 2031 FUTURE CONDITION SYNCHRO SUMMARY OUTPUTS .....</b>	<b>C-1</b>

### LIST OF EXHIBITS

<b>Exhibit 1-1 Aerial View of GO Barrie (Concord) Station Site .....</b>	<b>1</b>
<b>Exhibit 2-1: Proposed GO Barrie (Concord) Site and Vacinity.....</b>	<b>3</b>
<b>Exhibit 2-2: GO Barrie (Concord) Preferred Option Schematic Concept (December 2010).....</b>	<b>5</b>
<b>Exhibit 3-1: List of Intersections Analyzed.....</b>	<b>6</b>
<b>Exhibit 3-2: Study Area of Transportation Study.....</b>	<b>7</b>
<b>Exhibit 4-1: Existing Study Area Lane Configurations .....</b>	<b>13</b>
<b>Exhibit 4-2: Transit Services in the Study Area .....</b>	<b>14</b>
<b>Exhibit 4-3: 2010 Existing Condition Traffic Volumes.....</b>	<b>15</b>
<b>Exhibit 4-4: Existing Condition (2010) Intersection Operations.....</b>	<b>16</b>
<b>Exhibit 4-5: Existing Condition (2010) Turning Movement Queue Lengths.....</b>	<b>17</b>
<b>Exhibit 5-1: 2031 Background Condition Traffic Volumes.....</b>	<b>20</b>
<b>Exhibit 5-2: Background Condition (2031) Compared with Existing Condition (2010) Intersection Operations .....</b>	<b>21</b>
<b>Exhibit 5-3: Background Condition (2031) Compared with Existing Condition (2010) Turning Movement Queue Lengths .....</b>	<b>23</b>
<b>Exhibit 6-1: Trips Rates and Splits for Park-and-Ride with PPUDO Facility.....</b>	<b>24</b>
<b>Exhibit 6-2: Estimated Trip Generation for GO Barrie (Concord) Station .....</b>	<b>24</b>
<b>Exhibit 6-3: Distribution of Park-and-Ride Traffic .....</b>	<b>25</b>
<b>Exhibit 6-4: 2031 Site Generated Traffic Volumes .....</b>	<b>26</b>
<b>Exhibit 7-1: Future Study Area Recommended Lane and Geometrical Configurations .....</b>	<b>29</b>
<b>Exhibit 7-2: 2031 Future Total Traffic Volumes.....</b>	<b>30</b>
<b>Exhibit 7-3: Future Total Condition (2031) Compared With Background Condition (2031) Intersection Operations.....</b>	<b>31</b>
<b>Exhibit 7-4: Future Total Condition (2031) Compared with Background Condition (2031) Turning Movement Queue Lengths .....</b>	<b>32</b>



## 1. INTRODUCTION

This transportation study report presents the preliminary findings of traffic analysis of the proposed 407 Transitway GO Barrie (Concord) Station. The station will be located on Highway 7, approximately 350 metres east of Bowes Road / Baldwin Street. The analysis assesses the ability of the preferred alternative geometric layouts to accommodate projected traffic volumes.

**Exhibit 1-1 Aerial View of GO Barrie (Concord) 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 GO Barrie (Concord) 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 report include the following:

- The existing and background traffic conditions at Study Area intersections;
- Background traffic growth due to both corridor growth and area specific development such as the Concord GO Centre planned on the north of Highway 7, across from the proposed GO Barrie (Concord) Station;
- The estimate of traffic generated by the proposed GO Barrie (Concord) 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.



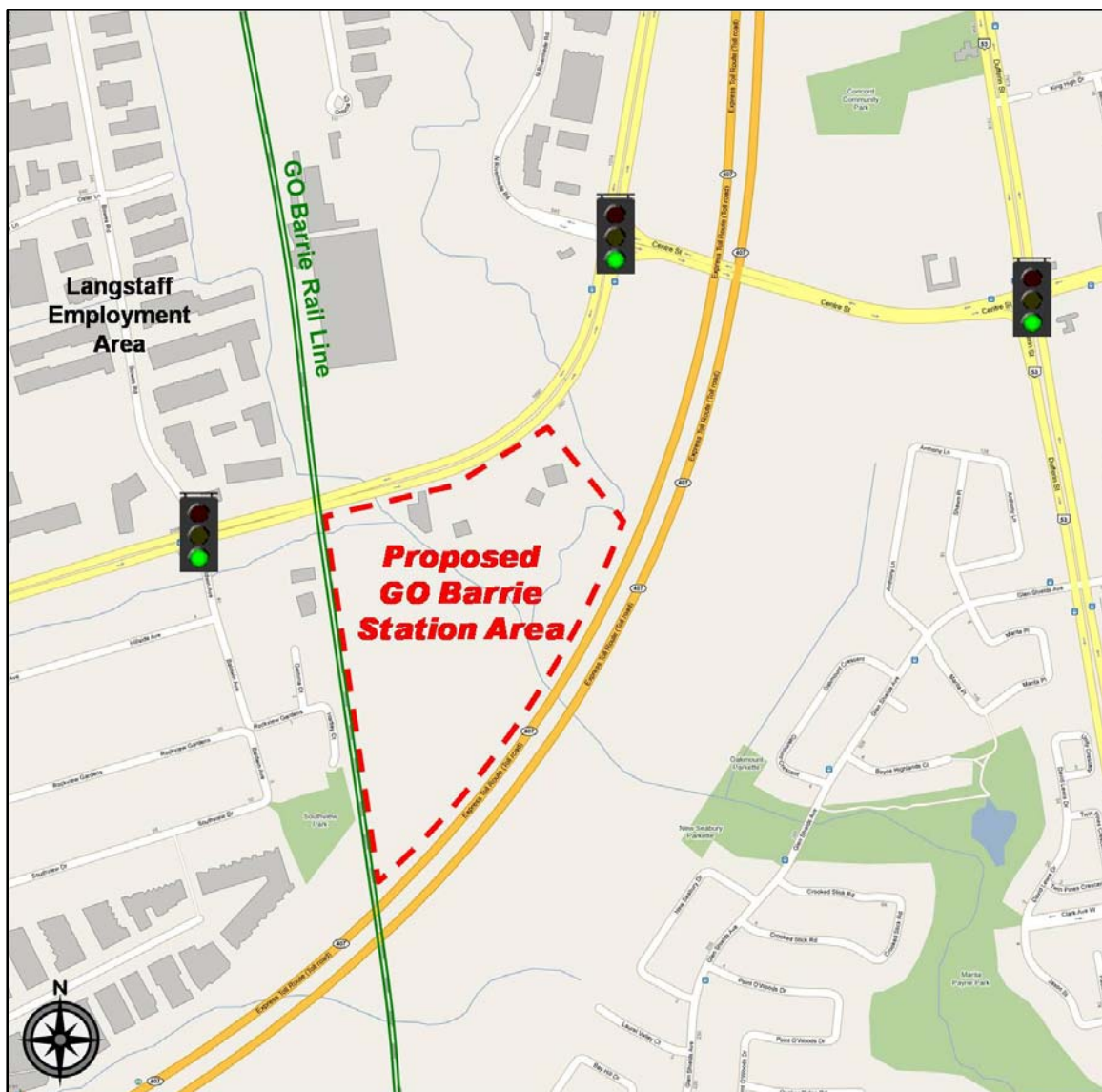
## 2. THE PROPOSED DEVELOPMENT

### 2.1 Station Location

The proposed 407 Transitway GO Barrie (Concord) Station ("Proposed Station") will be located on a parcel of land ("Subject Site") on the south side of Highway 7 just east of the GO Barrie rail line. The Subject Site is located in the City of Vaughan and is currently partially occupied by several land uses including a plant nursery and camping centre.

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

**Exhibit 2-1: Proposed GO Barrie (Concord) Site and Vicinity**



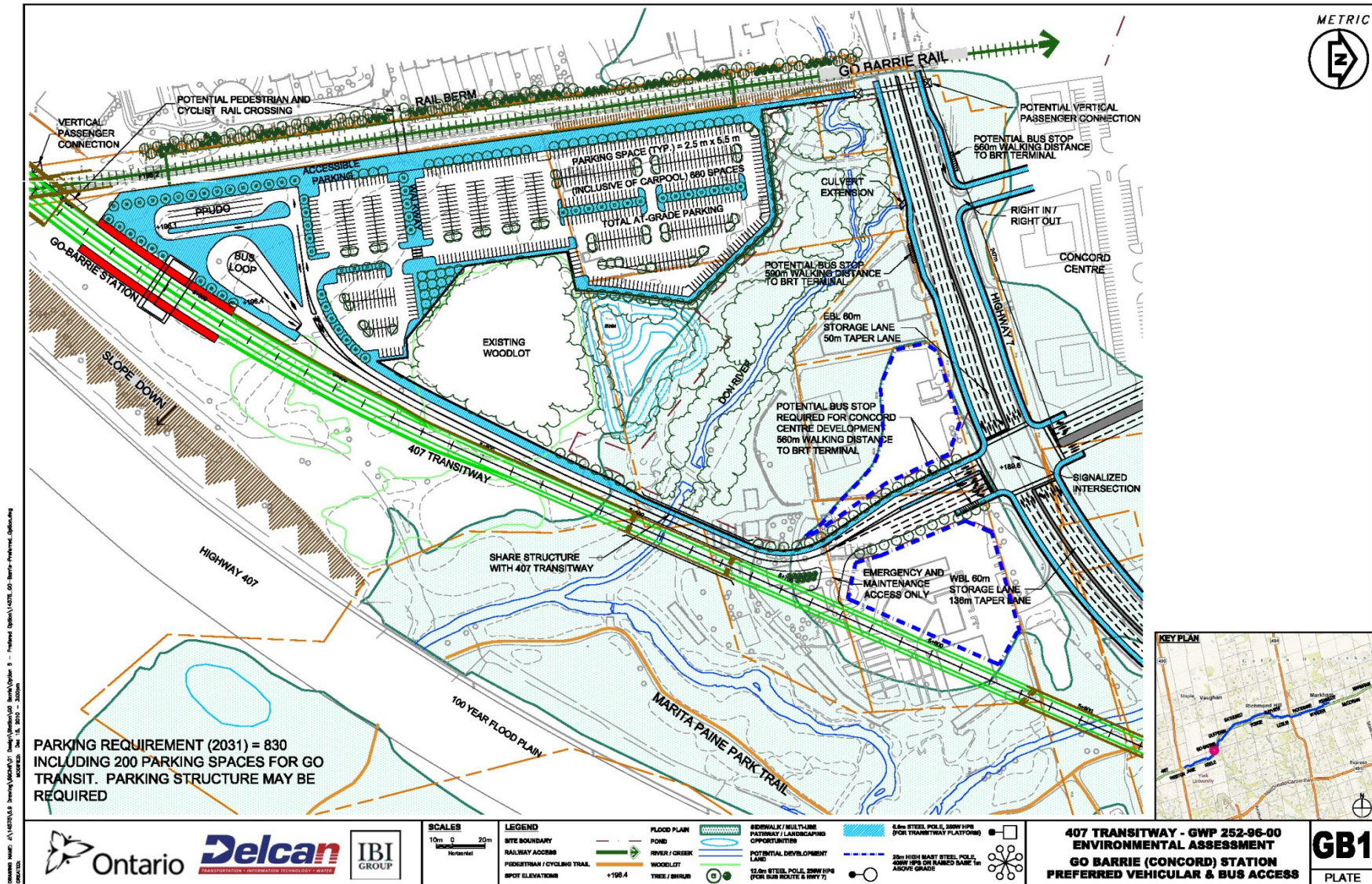
## 2.2 Site Plan

A site plan for the preferred option schematic concept is shown in **Exhibit 2-2**. The proposed GO Barrie (Concord) Station will serve as a regional intermodal station for passengers transferring between the proposed 407 Transitway, GO Transit rail service and various bus services including Viva, YRT and GO Transit. The Don River creek divides the Subject Site into two distinct parcels. Located on the western parcel will be a transit bus loop, passenger pick-up and drop-off (PPUDO) area, and two parking areas – one for 407 Transitway users (489 parking spaces) and for carpool users (200 parking spaces). The proposed GO Barrie (Concord) Station will be located south of the transit bus loop.

Pedestrian and bicycle connections are also planned with several crossings planned across the GO rail tracks and to provide active transportation access to the adjacent neighbourhoods. Currently, multi-use bicycle trails connect both sides of Highway 407 corridor with nearby Marita Payne Park to the southeast.



Exhibit 2-2: GO Barrie (Concord) Preferred Option Schematic Concept (December 2010)



### 3. STUDY SCOPE

#### 3.1 Study Area

The Study Area for the transportation study is generally bounded by Highway 7 to the north, Highway 407 to the south, North Rivermede Road / Centre Street to the east, and Bowes Road / Baldwin Avenue to the west. A list of Study Area intersections is shown in **Exhibit 3-1** and a map of the Leslie Station Study Area is shown in **Exhibit 3-2**.

**Exhibit 3-1: List of Intersections Analyzed**

No.	East-West Street	North-South Street	Intersection Type
1	Highway 7	Bowes Road / Baldwin Avenue	Signalized
2	North Rivermede Road / Centre Street	Highway 7	Signalized
3	Highway 7	Concord Land Access Road / 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*.

#### 3.3 Horizon Years and Analysis Periods

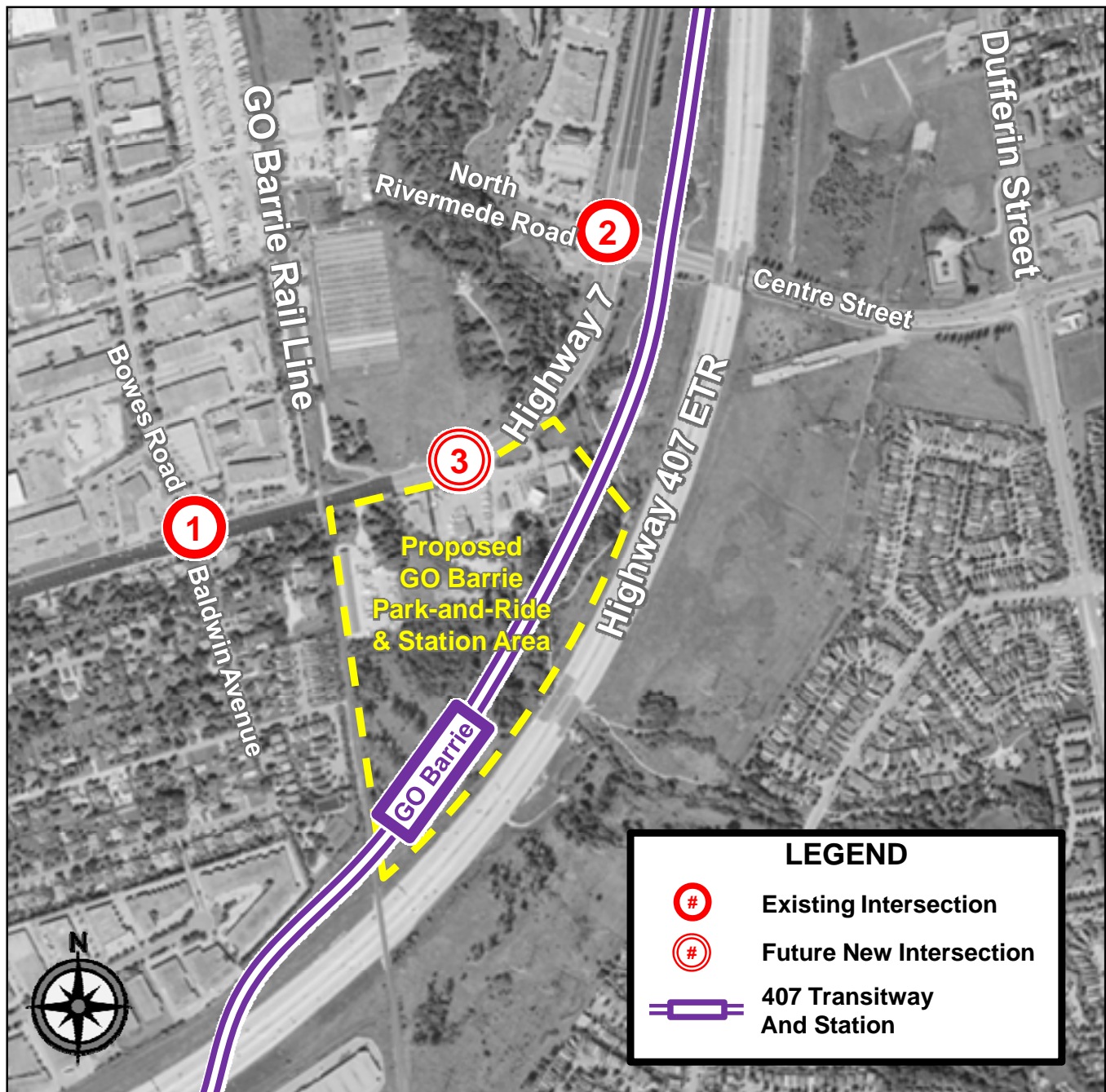
Based on these guidelines and proposed construction and operational dates for the 407 Transitway, the following existing and future horizon periods (conditions) were established as part of this study:

- 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 GO Barrie (Concord) Station.



**Exhibit 3-2: Study Area of Transportation Study**



## 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 CONDITIONS

### 4.1 Area Road Network

Major roadways in the Study Area include the following:

- Highway 7 – Regional (Arterial) Road;
- Bowes Road / Baldwin Avenue – Urban (Local) Roads;
- Centre Street – Regional (Arterial) Road; and
- North Rivermede Road – Urban (Local) Road;

These are described in further detail below.

**Highway 7** is a 6-lane east-west arterial road under the jurisdiction of York Region, and classified as a “Regional Primary Arterial” road. According to 2003 York Region ATR counts, Highway 7 carries approximately 47,000 to 59,000 vehicles per day within the Study Area road network. There are two traffic signals along the nearly one kilometre stretch of roadway between Bowes Road / Baldwin Avenue and North Rivermede Road / Centre Street. Within the Study Area the maximum posted speed is 70 km/h.



*Highway 7 Looking East*



**Bowes Road / Baldwin Avenue** are north-south urban local roadways that connect through Highway 7 as a signalized intersection. Bowes Road extends from CN Rail Yards in the northwest with Highway 7 in the southeast. Baldwin Avenue extends from Southview Drive in the south with Highway 7 in the north.



*Baldwin Avenue Looking North*

**Centre Street** is a 4-lane east-west arterial roadway that connects with North Rivermede Road through Highway 7 as a signalized intersection. Centre Street extends from Yonge Street in the east with Highway 7 in the west.



*Centre Street Looking Northwest*

**North Rivermede Road** is a primarily east-west urban local roadway that connects with Centre Street through Highway 7 as a signalized intersection. North Rivermede Road extends from Langstaff Road in the north with Highway 7 in the south.



*North Rivermede Road Looking Southeast*

## 4.2 Lane Configurations

A map shown existing Study Area roadway lane configurations is shown in **Exhibit 4-1**. Through the Study Area, Highway 7 consists of three eastbound and three westbound travel lanes with dedicated left-turn lanes at key signalized intersections. Baldwin Avenue has one northbound left / through / right-turn lane and Bowes Road has one dedicated southbound left-turn lane and one shared through / right-turn lane. Centre Street has two eastbound and two westbound travel lanes and North Rivermede Road has two eastbound travel lanes and one westbound travel lanes.

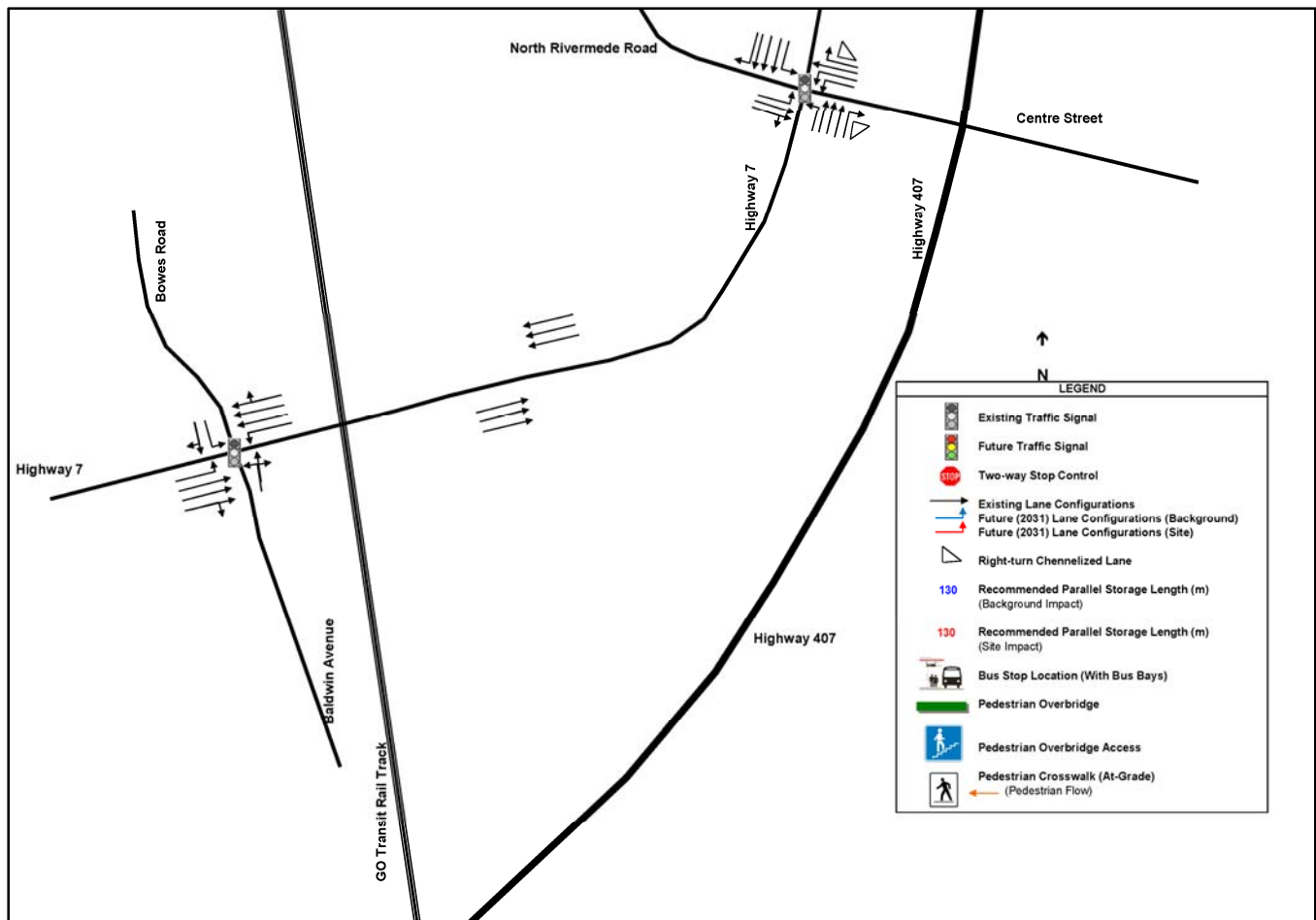
## 4.3 Transit Services and Operations

**Exhibit 4-2** shows the existing transit routes in the Study Area. In the vicinity of the Subject Site, transit bus routes include Viva Purple and YRT bus route #77 on Highway 7, and TTC's Keele bus route #107 on Keele Street (not shown). The peak hour headways for these routes are 15 minutes for Viva Purple service and 10 minutes for YRT bus route #77. A total of approximately 10 buses in each direction along Highway 7 are estimated to pass the Subject Site during the weekday am peak period (7:00 to 9:00 am) and pm peak period (4:00 to 6:00 pm), respectively.

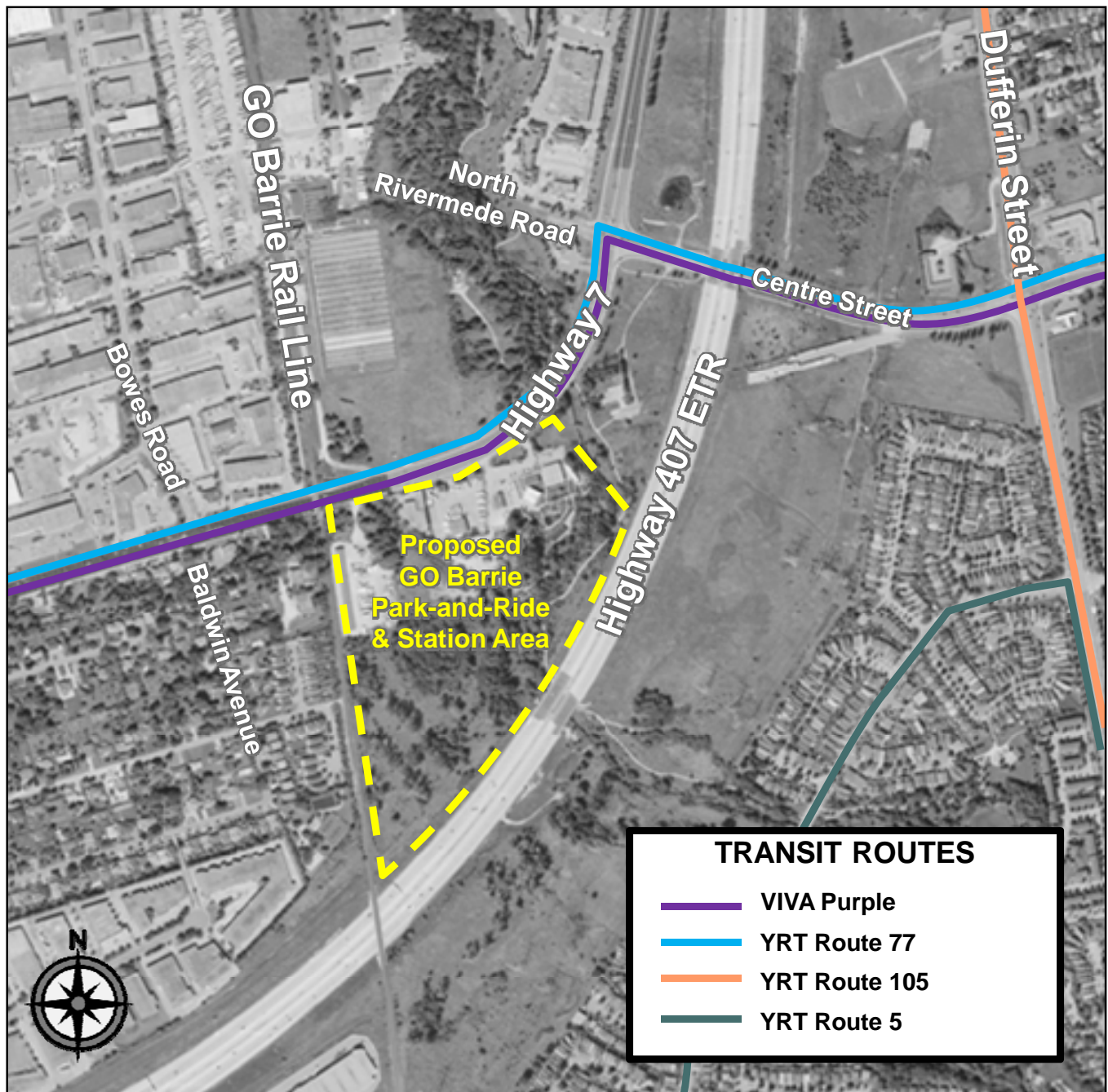
## 4.4 Existing Condition (2010) Traffic Volumes and Operations

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**.

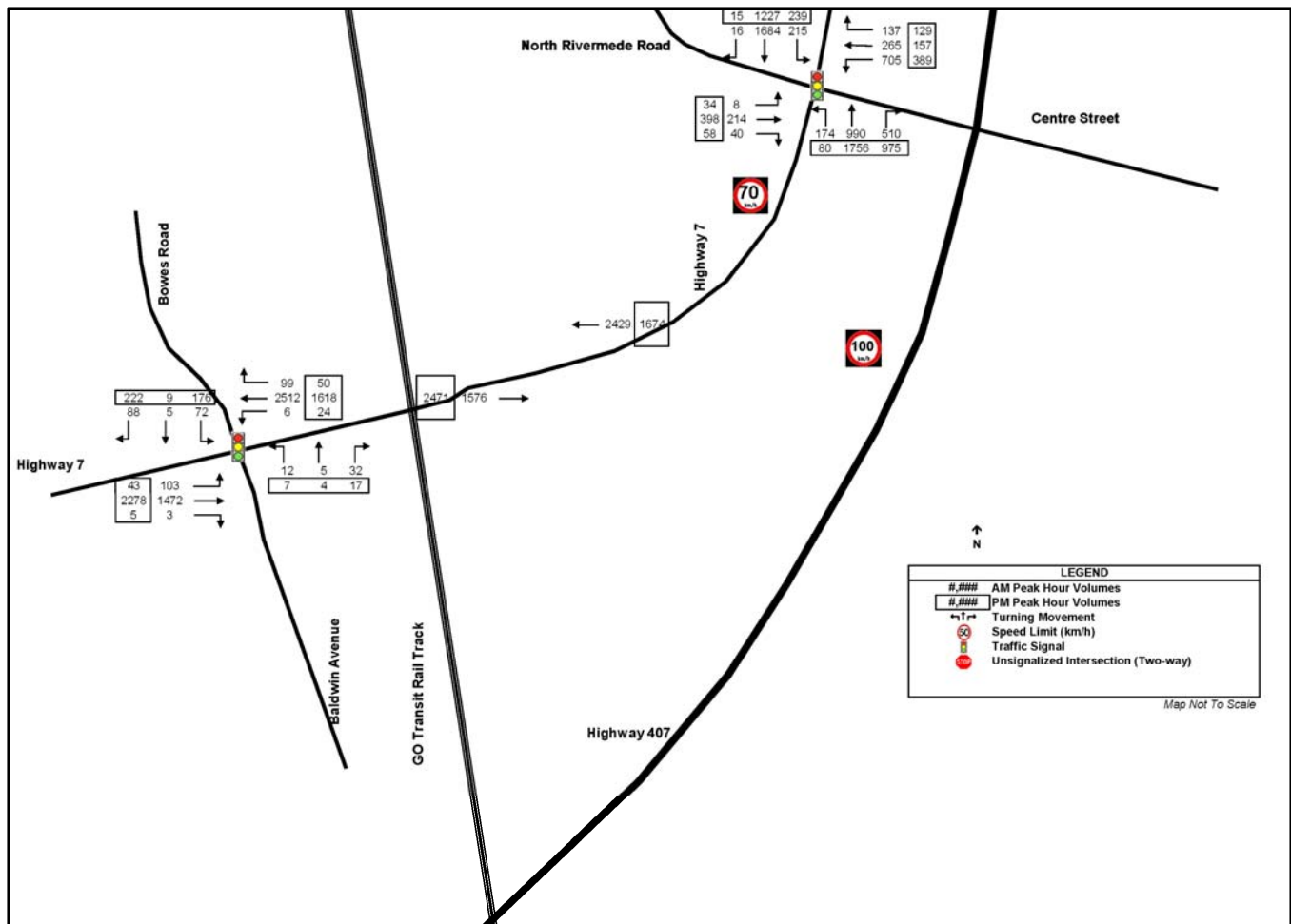
**Exhibit 4-1: Existing Study Area Lane Configurations**



**Exhibit 4-2: Transit Services in the Study Area**



**Exhibit 4-3: 2010 Existing Condition Traffic Volumes**





#### 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**.

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

Intersection		Peak Hour	Movement	Existing Condition (2010)		
				V/C	Delay	LOS
Signalized Intersections						
1	Bowes Road / Baldwin Avenue @ Highway 7	am	Overall	0.71	28	C
			EBL	0.74	48	D
			WBT	0.96	36	D
		pm	Overall	0.70	22	C
			EBT	0.81	22	C
			WBT	0.64	18	B
2	North Rivermede Road / Centre Street @ Highway 7	am	Overall	0.82	42	D
			WBL	0.77	71	E
			NBL	0.76	42	D
			SBL	0.75	32	C
			SBT	0.94	48	D
		pm	Overall	0.82	35	C
			EBT	0.91	70	E
			NBT	0.98	54	D
3	Station Access Road / Concord Access Road @ Highway 7	am	Overall	No Intersection Under Existing Conditions		
			EBT			
			WBL			
			WBT			
		pm	Overall			
			EBT			

Notes:

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

Overall, the two existing signalized intersections in the Study Area operate at acceptable levels of service (LOS 'C' 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 0.82 during the weekday am peak hour, and from 0.70 to 0.82 during the weekday pm peak hour.

However, the southbound and northbound through movements at the North Rivermede Road / Centre Street @ Highway 7 intersection experiences delays close to one minute during both am and pm peak hours. This delay is primarily caused due to high volume of commuter traffic that is destined to and from local residential neighbourhoods and Highway 400 to the west. During the pm peak hour, the northbound through and westbound left-turn movements compete for the green signal time, which leads to near capacity conditions. Similar conditions are also occurring at the

westbound through movement of the Bowes Road / Baldwin Avenue @ Highway 7 intersection during the weekday am peak hour.

#### 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	Bowes Road / Baldwin Avenue @ Highway 7	am	EBL	EBL = 30; SBL = 40;	12	39
			SBL		14	26
		pm	EBL		4	8
			SBL		33	54
2	North Rivermede Road / Centre Street @ Highway 7	am	WBL	WBL = 80; NBL = 70; SBL = 90;	86	103
			NBL		26	72
			SBL		28	69
		pm	WBL		47	61
			NBL		8	17
			SBL		35	75
3	Station Access Road / Concord Access Road @ Highway 7	am	EBL	.	No Intersection Under Existing Conditions	
			EBR			
			WBL			
			WBR			
			NBL			
			NBR			
			SBL			
		pm	EBL			
			EBR			
			WBL			
			WBR			
			NBL			
			NBR			
			SBL			

At the Bowes Road / Baldwin Avenue @ Highway 7 intersection, during the am peak hour, the eastbound left-turn movement experiences queuing spillbacks, where the queued vehicles exceed the available storage space. The southbound left-turn movement experiences queuing spillbacks during the pm peak hour.

At the North Rivermede Road / Centre Street @ Highway 7 intersection, both the westbound left-turn and northbound left-turn movements currently experiences queuing spillbacks during the am peak hour.

There are no queuing issues at other Study Area intersection turning movements.



## 5. FUTURE BACKGROUND CONDITION

### 5.1 Proposed Transit Services

Under the *York Region Transportation Master Plan Update Final Report (2009)* and the *Metrolinx Regional Transportation Plan*, Centre Street and Highway 7 (from Bathurst Street west to Peel Region) has been identified as a future rapid transit corridor and Keele Street has been identified for (from Steeles Street north to Major Mackenzie Road) has been identified for transit priority improvements.

VivaNext is the next phase of the Viva Rapid Transit System and includes the construction of rapidways along several major corridors in York Region including Highway 7. The segment of the Highway 7 rapidway from Yonge Street west to Creditstone Road is expected to be constructed between 2016 and 2020 and has been taken into account in this transportation study. Future local transit improvements are also proposed along the Highway 7 corridor and have been reflected in this transportation study.

### 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 Highway 7 corridor.

### 5.3 Future Background Developments

Allowances also have been made for traffic generated by planned developments north of Highway 7 – the Concord GO Centre mixed-use development. According to the *Concord GO Centre Tertiary Plan (October 2007)* and other documents, the Concord GO Centre mixed-use development will consist of 510 residential units and 91,000 m<sup>2</sup> (976,516 ft<sup>2</sup>) of retail and commercial space.

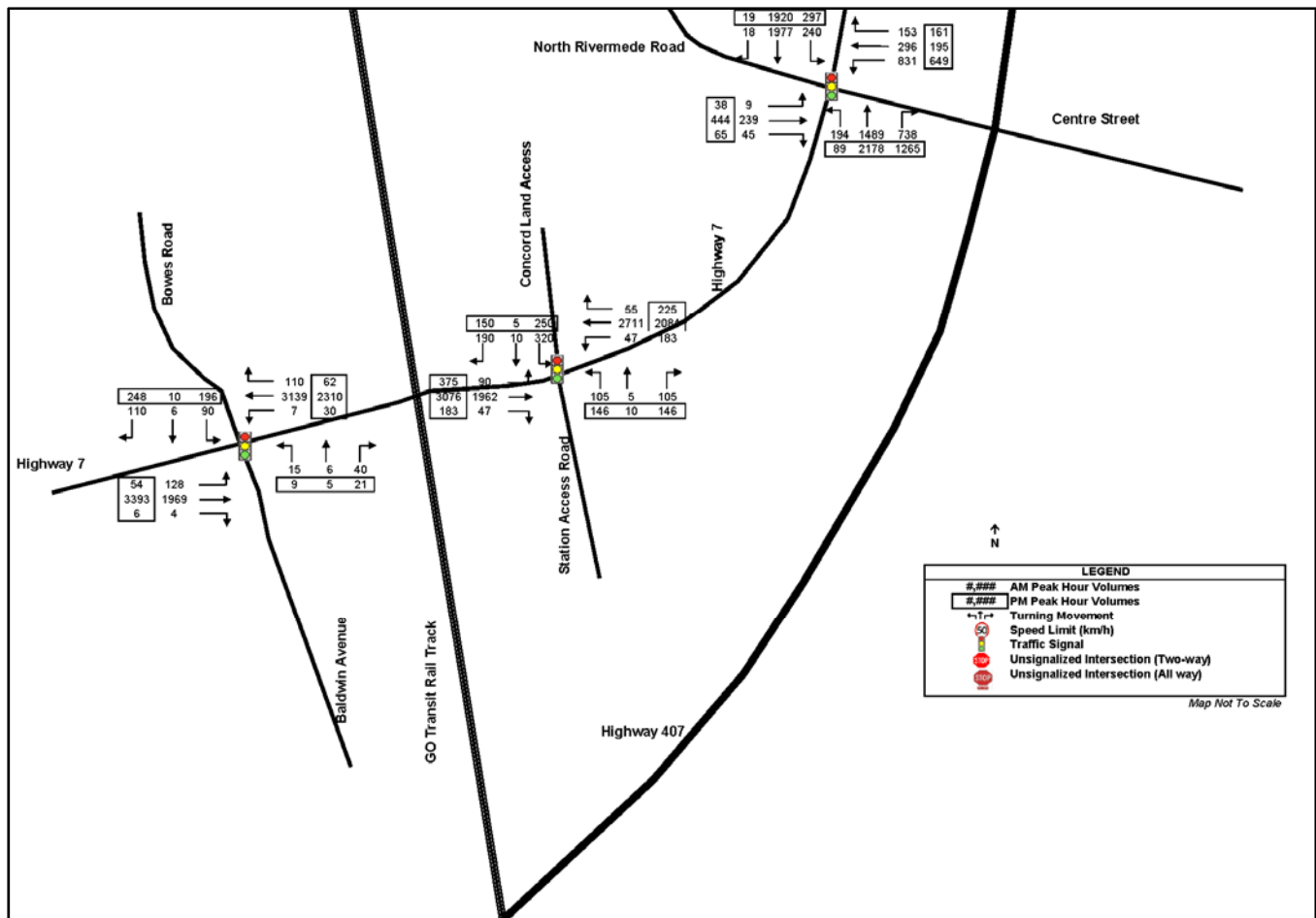
Using the *Institute of Transportation Engineers (ITE) Trip Generation Manual, 8th Edition* and including reductions for transit and non-auto modes (10% for residential and 30% for commercial), the estimated auto trips generated by the Concord GO Centre are as follows:

- Residential: 202 am peak hour trips (16% inbound and 84% outbound) and 239 pm peak hour trips (67% inbound and 33% outbound); and
- Commercial 102 am peak hour trips (61% inbound and 39% outbound) and 418 pm peak hour trips (49% inbound and 51% outbound).

### 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**.

**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	Bowes Road / Baldwin Avenue @ Highway 7	am	Overall	0.71	28	C	0.84	18	B
			EBL	0.74	48	D	0.84	69	E
			WBT	0.96	36	D	1.01	19	B
		pm	Overall	0.70	22	C	0.84	25	C
			EBT	0.81	22	C	0.94	24	C
			WBT	0.64	18	B	0.74	21	C
2	North Rivermede Road / Centre Street @ Highway 7	am	Overall	0.82	42	D	0.85	42	D
			WBL	0.77	71	E	0.84	24	C
			NBL	0.76	42	D	0.90	71	E
			SBL	0.75	32	C	0.92	69	E
			SBT	0.94	48	D	1.01	60	E
		pm	Overall	0.82	35	C	0.90	44	D
			EBT	0.91	70	E	0.92	72	E
			NBT	0.98	54	D	1.03	75	E
3	Station Access Road / Concord Access Road @ Highway 7	am	Overall	No Intersection Under Existing Conditions			0.88	16	B
			EBT				0.61	10	A
			WBL				0.51	10	A
			WBT				0.94	12	B
		pm	Overall				0.89	18	B
			EBT				0.94	17	B

*Notes:*

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

The future total background traffic analysis results indicate that there is considerable deterioration in traffic operations at key intersections along the Highway 7 corridor (assuming there are no road improvements under the future background condition).

Background traffic is projected to increase the overall V/C ratios by 3% and 7% at the North Rivermede Road / Centre Street @ Highway 7 intersection during the weekday am and pm peak hours, respectively. Conversely, the Bowes Road / Baldwin Avenue @ Highway 7 intersection will also experience approximately 13% to 14% increases in overall V/C ratios during weekday am and pm peak hours.

To address identified deficiencies, cumulative operational changes/improvements (i.e. signal timing optimization) were implemented sequentially to signalized intersections along the Highway 7 corridor. The results of these operational changes are that V/C ratios for the northbound and southbound through movements at the North Rivermede Road / Centre Street @ Highway 7 intersection are projected to approach 1.0. The Concord Access Road for the planned Concord GO Centre development will operate with good levels-of-service (LOS B) during am and pm peak hours.

#### 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**.

At the Bowes Road / Baldwin Avenue @ Highway 7 intersection, the eastbound left-turn movement and southbound left-turn movement are projected to continue to experience queuing issues during the am and pm peak hours, respectively.

At the North Rivermede Road / Centre Street @ Highway 7 intersection, both the westbound left-turn and northbound left-turn movements are projected to continue to experience queuing issues during the am peak hour. The northbound right-turn movement is also projected to experience queuing spillbacks during the pm peak hour.

There are no queuing issues projected at other Study Area intersection turning movements.

At Study Area intersections it is recommended that consideration be given to increase the storage length at several turning lanes to achieve satisfactory queuing space.

**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	Bowes Road / Baldwin Avenue @ Highway 7	am	EBL	EBL = 30; SBL = 40;	12	39	16	48
			SBL		14	26	17	32
		pm	EBL		4	8	4	12
			SBL		33	54	39	63
2	North Rivermede Road / Centre Street @ Highway 7	am	WBL	WBL = 80; NBL = 70; SBL = 90;	86	103	64	94
			NBL		26	72	35	71
			SBL		28	69	38	83
		pm	WBL		47	61	50	63
			NBL		8	17	17	19
			SBL		35	75	40	83
3	Station Access Road / Concord Access Road @ Highway 7	am	EBL	.	No Intersection Under Existing Conditions		9	30
			WBL				4	4
			NBL				17	29
			SBL				57	83
		pm	EBL				22	28
			WBL				22	37
			NBL				27	45
			SBL				50	82

Notes:

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

## 6. GO BARRIE (CONCORD) 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 initially include 489 parking spaces for 407 Transitway users and 200 spaces for carpoolers by the year 2031. Vehicle access to and from the parking lot can be achieved through single access from Highway 7 only. Other regional transit buses could share the same access.

### 6.2 GO Barrie (Concord) 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	489	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 GO Barrie (Concord) Station is summarized in **Exhibit 6-2**. The park-and-ride facility will generate approximately 496 and 427 two-way trips during the am and pm peak hours, respectively.

**Exhibit 6-2: Estimated Trip Generation for GO Barrie (Concord) 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	489	81%	19%	23%	77%	285	67	352	70	233	303
Carpool	200	81%	19%	23%	77%	117	27	144	29	95	124
<b>Total Trips</b>						<b>402</b>	<b>94</b>	<b>496</b>	<b>98</b>	<b>329</b>	<b>427</b>

## 6.3 Future Bus Transit Volumes

In terms of bus traffic accessing the proposed GO Barrie (Concord) Station, it was assumed the frequency of future express and local feeder buses (including Viva and YRT) would increase by more than 100 percent. Therefore, a total of 48 buses (24 in each direction) will stop on Highway 7 or enter the station in both directions during the weekday am and pm 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 transportation study.

## 6.4 GO Barrie (Concord) 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**

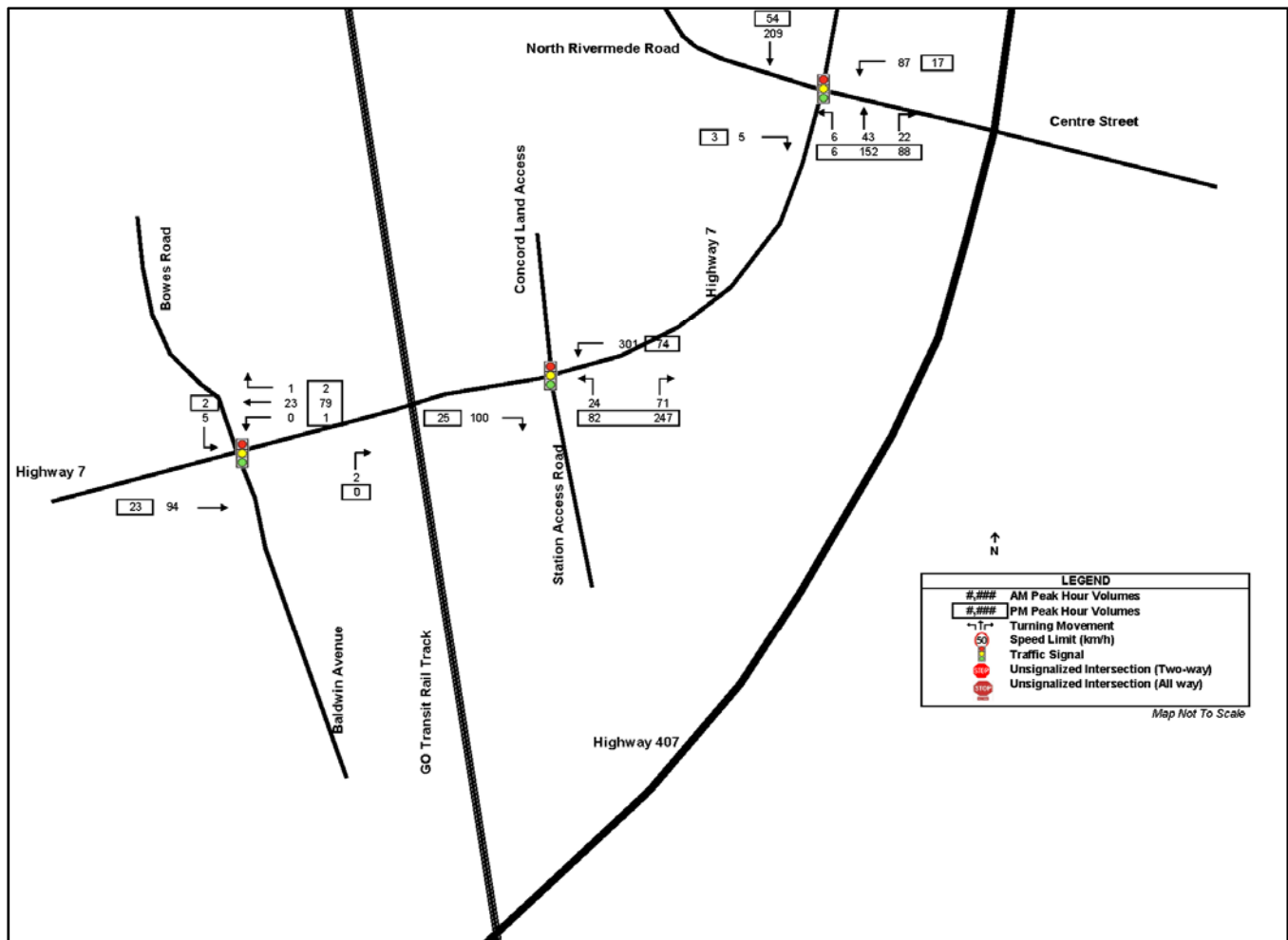
To / From	Am Peak Hour		Pm Peak Hour	
	IN	OUT	IN	OUT
Highway 7 (East)	75%	75%	75%	75%
Highway 7 (West)	25%	25%	25%	25%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

The source of the trip distribution is associated with Transportation Tomorrow Survey (TTS) data. As indicated in the TTS data, it is expected that the Highway 7 east approach will provide the most inbound traffic to the Subject Site during the am and pm peak hours – 75%. Minor differences for inbound and outbound trips patterns reflect the relative convenience of alternative trip routings afforded by the Study Area and larger 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 GO Barrie (Concord) Station. The following can be concluded for future transit operations:

- In order to accommodate future Viva and YRT operations, on-street transit stops with bus bays were identified. Providing on-street bus stops on Highway 7 will reduce the number of transit traffic inside the proposed GO Barrie (Concord) Station will reduce bus service running time and the turning movement delays at the new signalized Station Access Road;
- The approximate distances between the transit stops on Highway 7 and the 407 Transitway platforms are approximately 400 metres (i.e. less than 10 min walking distance);
- It is assumed that the majority of local YRT and Viva transit services and Viva express route will utilize the on-street transit stops on Highway 7;
- A dedicated northbound left-turn lane is assumed for transit operation; and
- Transit priority measures such as queue jump operation is recommended to improve the traffic operation during commuter peak hours.

### 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:

- A walking path along Highway 7 to facilitate pedestrian access to the GO Barrie (Concord) Station;
- A pedestrian and bicycle connection to the west of GO Barrie (Concord) Station is planned to provide access to residential neighbourhoods west of the rail tracks;
- A multi-use overpass across Highway 7 (next to rail track ) is recommended to promote walking and cycling to between the proposed Concord GO Centre development and the GO Barrie (Concord) Station; 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 Highway 7 corridor and at the Station Access Road intersection. These assumed improvements include:

- The signalization of the new Station Access Road intersection;

- The introduction of a westbound left-turn lane and eastbound left-turn lane along Highway 7 at the signalized site access (i.e. two inbound lanes); and
- The addition of three outbound lanes and one transit priority left-turn lane for the northbound approach.

The total signalized intersection spacing on Highway 7, between Baldwin Avenue and the Centre Street, is approximately 870 metres. This spacing is sufficient for the installation of a new signalized intersection along this corridor. Based on comments from the City of Vaughan and York Region regarding the Concord GO Centre development study report, it was determined that the provision of one mid-block signalized intersection to be acceptable.

The new signalized Station Access Road / Concord Access Road @ Highway 7 intersection will be established approximately 370 metres east of the Bowes Road / Baldwin Avenue @ Highway 7 intersection, which also ensures a satisfactory distance of approximately 250 metres east from the rail overpass. The introduction of eastbound left- and right-turn lanes (and its storage spaces) at the Station Access Road / Concord Access Road @ Highway 7 intersection requires a maximum of 200 metres distance from the rail overpass. However, due to a substantial curvature to the east of the new traffic signal location on Highway 7, a sight-line survey and corresponding analysis should be conducted to achieve satisfactory line of sight for the westbound vehicles.

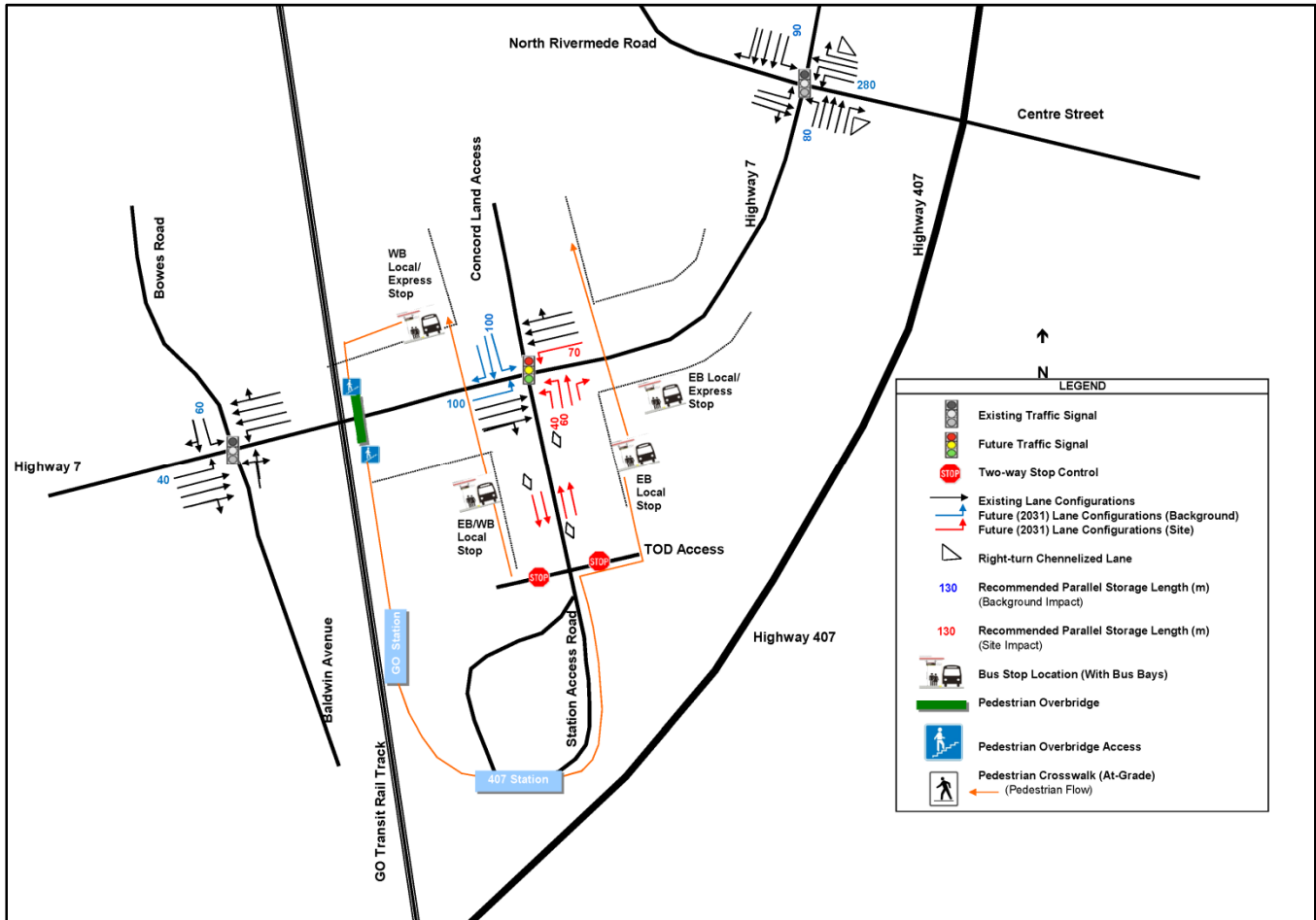
## 7.4 Future Traffic Control and Lane Configurations

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.

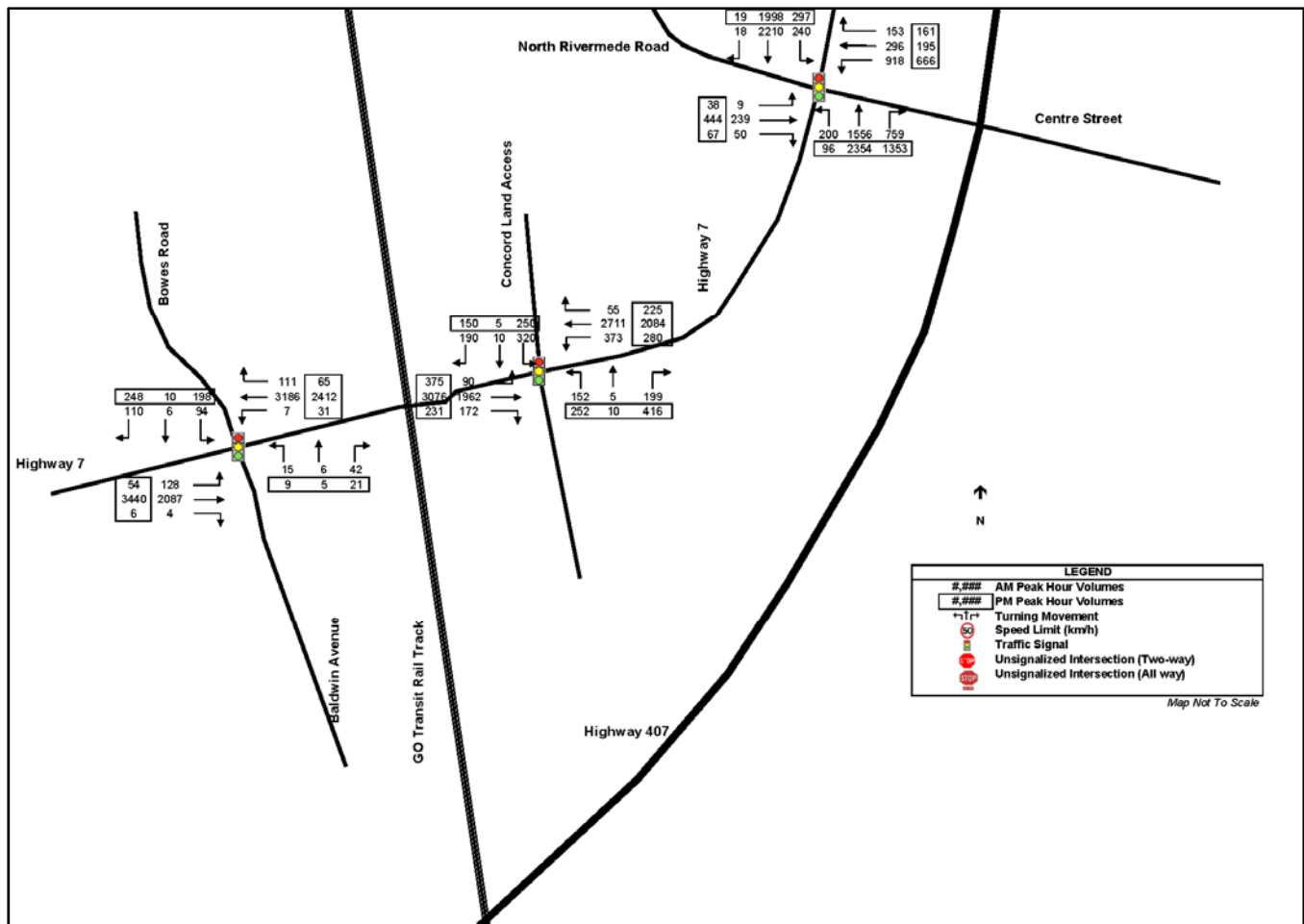
## 7.5 Future Total Traffic Volumes

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**.

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



**Exhibit 7-2: 2031 Future Total Traffic Volumes**



## 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 7-3: 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	Bowes Road / Baldwin Avenue @ Highway 7	am	Overall	0.84	18	B	0.85	18	B
			EBL	0.84	69	E	0.84	70	E
			WBT	1.01	19	B	1.01	20	C
		pm	Overall	0.84	25	C	0.85	23	C
			EBT	0.94	24	C	0.95	26	C
			WBT	0.74	21	C	0.77	13	B
2	North Rivermede Road / Centre Street @ Highway 7	am	Overall	0.85	42	D	0.90	50	D
			WBL	0.84	24	C	0.99	47	D
			NBL	0.90	71	E	0.78	69	E
			SBL	0.92	69	E	0.93	72	E
			SBT	1.01	60	E	1.03	65	E
		pm	Overall	0.90	44	D	0.95	45	D
			EBT	0.92	72	E	0.93	73	E
			NBT	1.03	75	E	1.04	76	E
SBL	0.85	55	E	0.84	56	E			
3	Station Access Road / Concord Access Road @ Highway 7	am	Overall	0.88	16.0	B	0.90	19	B
			EBT	0.61	9.9	A	0.75	18	B
			WBL	0.51	9.6	A	0.81	24	C
			WBT	0.94	12.3	B	0.96	10	B
		pm	Overall	0.89	18	B	0.99	32	C
			EBT	0.94	17	B	1.04	38	D

**Notes:**

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

The addition of site traffic will moderately affect future operations at Study Area signalized intersections. Changes to the overall V/C ratio are in the range of 1% to 10% during the weekday peak hours. The addition of park-and-ride and bus transit traffic to the northbound approach of the Station Access Road / Concord Access Road @ Highway 7 intersection will increase the overall V/C ratio by 2% and 10% during the weekday am and pm peak hours, respectively. Based on implementation of the several traffic control and physical road improvements at the site accesses, overall satisfactory level-of-service will be maintained under future traffic conditions (LOS 'D' or better).

### 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**.

**Exhibit 7-4: Future Total Condition (2031) Compared with Background Condition (2031)  
Turning Movement Queue Lengths**

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	Bowes Road / Baldwin Avenue @ Highway 7	am	EBL	EBL = 30; SBL = 40;	16	48	16	48
			SBL		17	32	18	33
		pm	EBL		4	12	4	12
			SBL		39	63	40	64
2	North Rivermede Road / Centre Street @ Highway 7	am	WBL	WBL = 80; NBL = 70; SBL = 90;	64	94	75	140
			NBL		35	71	38	53
			SBL		38	83	38	83
		pm	WBL		50	63	53	75
			NBL		17	19	17	18
			SBL		40	83	38	71
			3		Station Access Road / Concord Access Road @ Highway 7	am	EBL	.
WBL	4	4		32			31	
NBL	17	29		31			51	
SBL	57	83		58			103	
pm	EBL	22		28		39	43	
	WBL	22		37		30	29	
	NBL	27		45		48	76	
	SBL	50		82		55	103	

**Notes:**

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

At the Bowes Road / Baldwin Avenue @ Highway 7 intersection, the eastbound left-turn movement and southbound left-turn movement are projected to continue to experience queuing issues during the am and pm peak hours, respectively.

At the North Rivermede Road / Centre Street @ Highway 7 intersection, both the westbound left-turn and northbound left-turn movements are projected to continue to experience queuing issues during the am peak hour and the northbound right-turn movement is projected to continue to experience queuing issues during the pm peak hour.

At the Station Access Road / Concord Access Road @ Highway 7 intersection, both the northbound left-turn and southbound left-turn movements are projected to experience queuing issues during the

am and pm peak hours. The southbound left-turn movement is projected to experience queuing issues during the am peak hour.

There are no queuing issues projected at other Study Area intersection turning movements.

## 8. SUMMARY AND CONCLUSIONS

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

- The preferred transit scenario for the proposed GO Barrie (Concord) Station is for a shared on-site auto and transit vehicle access along with bus stops located on the street. GO buses will enter the station area while Viva and YRT buses will stop on Highway 7;
- Several transit priority measures and dedicated transit lanes are proposed to accommodate future YRT and Viva transit operations. Transit stops with passenger amenities and exclusive bus bays are proposed near Highway 7 @ Concord Land Access Road / Station Access Road intersection. On-street Viva bus operations are desirable in order to mitigate the constraints of intersection geometric configurations and reduce transit vehicle movements inside the proposed GO Barrie (Concord) Station;
- A new mid-block traffic signal is proposed to provide vehicular access for park-and-ride traffic and transit vehicles to the proposed GO Barrie (Concord) Station. In order to avoid potential interference with the traffic operations of Highway 7 @ Bowes Road / Baldwin Avenue intersection, the new traffic signal should be installed at least 370 meters east of this intersection;
- With regards to intersection sight-lines, further study and investigation is recommended to address grade variation and curvature issues at new traffic signal on Highway 7;
- Several pedestrian and bicycle connections are recommended to connect the proposed GO Barrie (Concord) Station with surrounding residential neighbourhoods and to promote sustainable transportation use within the Study Area;
- A separate pedestrian structure adjacent to existing rail track is also recommended to provide active transportation connections to the proposed Concord Centre development on the north side of Highway 7;
- The preliminary traffic analysis projects that the Highway 7 @ Concord Land Access Road / Station Access Road intersection will operate acceptable levels of service; and
- While transit vehicle movements in and out of the proposed GO Barrie (Concord) Station is projected to be low (i.e. 4 per hour), a northbound left-turn queue jump lane is recommended to give priority to outbound transit movements. Conversely, the introduction of northbound queue jump lane will reduce the overall intersection capacity and creates an extra pressure on Highway 7 through traffic operations.

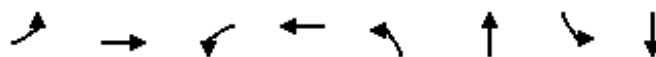


## APPENDIX A

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### 2010 EXISTING CONDITION SYNCHRO SUMMARY OUTPUTS





Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	103	1472	6	2512	12	5	72	5
Lane Group Flow (vph)	113	1552	7	2753	0	53	79	102
Turn Type	pm+pt		Perm		Perm		Perm	
Protected Phases	7	4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phases	7	4	8	8	2	2	6	6
Minimum Initial (s)	7.0	29.0	29.0	29.0	10.0	10.0	10.0	10.0
Minimum Split (s)	11.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
Total Split (s)	12.0	81.0	69.0	69.0	39.0	39.0	39.0	39.0
Total Split (%)	10.0%	67.5%	57.5%	57.5%	32.5%	32.5%	32.5%	32.5%
Yellow Time (s)	3.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lead/Lag	Lead		Lag	Lag				
Lead-Lag Optimize?	Yes		Yes	Yes				
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.74	0.53	0.05	0.96		0.12	0.24	0.26
Control Delay	50.0	12.5	14.5	36.4		15.5	34.9	8.9
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	50.0	12.5	14.5	36.4		15.5	34.9	8.9
Queue Length 50th (m)	11.9	61.8	0.7	182.1		2.8	13.1	0.8
Queue Length 95th (m)	#38.3	72.4	3.0	#210.3		11.7	25.2	12.7
Internal Link Dist (m)		152.2		240.8		300.0		342.5
Turn Bay Length (m)	30.0		30.0				40.0	
Base Capacity (vph)	153	2939	131	2866		426	326	389
Starvation Cap Reductn	0	0	0	0		0	0	0
Spillback Cap Reductn	0	0	0	0		0	0	0
Storage Cap Reductn	0	0	0	0		0	0	0
Reduced v/c Ratio	0.74	0.53	0.05	0.96		0.12	0.24	0.26

**Intersection Summary**

Cycle Length: 120

Actuated Cycle Length: 120

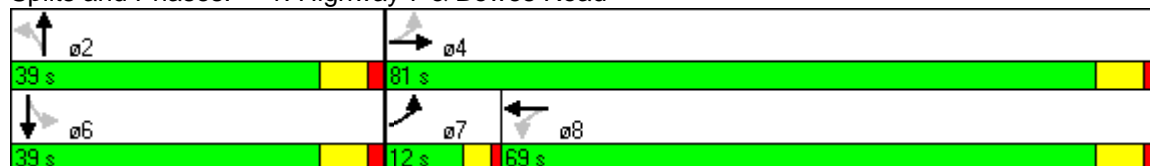
Offset: 47 (39%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 105

Control Type: Actuated-Coordinated

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























Queue shown is maximum after two cycles.

**Splits and Phases: 1: Highway 7 & Bowes Road**

2010 Existing - Weekday AM Peak Hour  
1: Highway 7 & Bowes Road

HCM Signalized Intersection Capacity Analysis  
Highway 407 Transitway: GO Barrie (Concord) 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	
Lane Util. Factor	1.00	0.91		1.00	*1.00			1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00			0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00		1.00	1.00	
Frt	1.00	1.00		1.00	0.99			0.91		1.00	0.86	
Flt Protected	0.95	1.00		0.95	1.00			0.99		0.95	1.00	
Satd. Flow (prot)	1500	4579		1593	5284			1454		1415	1098	
Flt Permitted	0.06	1.00		0.14	1.00			0.93		0.75	1.00	
Satd. Flow (perm)	92	4579		242	5284			1376		1118	1098	
Volume (vph)	103	1472	3	6	2512	99	12	5	32	72	5	88
Peak-hour factor, PHF	0.91	0.95	0.91	0.91	0.95	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	113	1549	3	7	2644	109	13	5	35	79	5	97
RTOR Reduction (vph)	0	0	0	0	4	0	0	25	0	0	69	0
Lane Group Flow (vph)	113	1552	0	7	2749	0	0	28	0	79	33	0
Confl. Peds. (#/hr)			1	1			2		1	1		2
Heavy Vehicles (%)	19%	12%	0%	12%	6%	7%	43%	0%	7%	26%	20%	46%
Turn Type	pm+pt			Perm			Perm			Perm		
Protected Phases	7	4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	74.0	74.0		62.0	62.0			32.0		32.0	32.0	
Effective Green, g (s)	77.0	77.0		65.0	65.0			35.0		35.0	35.0	
Actuated g/C Ratio	0.64	0.64		0.54	0.54			0.29		0.29	0.29	
Clearance Time (s)	4.0	7.0		7.0	7.0			7.0		7.0	7.0	
Vehicle Extension (s)	3.0	5.0		5.0	5.0			3.0		3.0	3.0	
Lane Grp Cap (vph)	153	2938		131	2862			401		326	320	
v/s Ratio Prot	c0.05	0.34			c0.52						0.03	
v/s Ratio Perm	0.43			0.03			0.02			c0.07		
v/c Ratio	0.74	0.53		0.05	0.96		0.07			0.24	0.10	
Uniform Delay, d1	30.6	11.7		13.0	26.3		30.7			32.4	31.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00			1.00	1.00	
Incremental Delay, d2	16.9	0.3		0.4	9.5		0.3			1.8	0.7	
Delay (s)	47.5	12.0		13.3	35.8		31.1			34.2	31.7	
Level of Service	D	B		B	D		C			C	C	
Approach Delay (s)		14.4			35.8		31.1				32.8	
Approach LOS		B			D		C				C	
<b>Intersection Summary</b>												
HCM Average Control Delay			28.0			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.71									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)			12.0			
Intersection Capacity Utilization			90.7%			ICU Level of Service			E			
Analysis Period (min)			15									
c Critical Lane Group												

											
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	8	214	705	265	137	174	990	510	215	1684	16
Lane Group Flow (vph)	8	265	734	276	143	181	1031	531	224	1754	17
Turn Type	Split		Split		Free	pm+pt		Free	pm+pt		pm+ov
Protected Phases	4	4	8	8		5	2		1	6	4
Permitted Phases					Free	2		Free	6		6
Detector Phases	4	4	8	8		5	2		1	6	4
Minimum Initial (s)	10.0	10.0	10.0	10.0		7.0	15.0		7.0	15.0	10.0
Minimum Split (s)	22.0	22.0	37.0	37.0		11.0	37.0		11.0	37.0	22.0
Total Split (s)	22.0	22.0	40.0	40.0	0.0	12.0	46.0	0.0	12.0	46.0	22.0
Total Split (%)	18.3%	18.3%	33.3%	33.3%	0.0%	10.0%	38.3%	0.0%	10.0%	38.3%	18.3%
Yellow Time (s)	4.0	4.0	5.0	5.0		3.0	5.0		3.0	5.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lead/Lag						Lead	Lag		Lead	Lag	
Lead-Lag Optimize?						Yes	Yes		Yes	Yes	
Recall Mode	None	None	None	None		None	C-Max		None	C-Max	None
v/c Ratio	0.04	0.60	0.77	0.56	0.09	0.76	0.56	0.37	0.77	0.94	0.02
Control Delay	44.5	51.9	71.5	67.0	0.1	48.3	32.4	0.8	42.4	48.6	5.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.5	51.9	71.5	67.0	0.1	48.3	32.4	0.8	42.4	48.6	5.7
Queue Length 50th (m)	1.5	27.1	85.5	63.9	0.0	25.1	63.8	0.0	27.8	130.1	0.0
Queue Length 95th (m)	5.7	39.3m	102.2	m84.9	m0.0	#71.6	76.5	0.0	#68.6	#159.6	3.2
Internal Link Dist (m)		189.3		627.9			578.0			181.4	
Turn Bay Length (m)	90.0		80.0		55.0	70.0		60.0	90.0		90.0
Base Capacity (vph)	237	503	1054	547	1517	238	1825	1420	291	1865	807
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.03	0.53	0.70	0.50	0.09	0.76	0.56	0.37	0.77	0.94	0.02

**Intersection Summary**

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 105 (88%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 110







Control Type: Actuated-Coordinated

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

Queue shown is maximum after two cycles.
























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

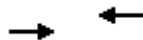
Splits and Phases: 2: North Rivermede Road &amp; Highway 7

			
ø1	ø2	ø4	ø8
12 s	46 s	22 s	40 s
			
ø5	ø6		
12 s	46 s		

2010 Existing - Weekday AM Peak Hour  
2: North Rivermede Road & Highway 7

HCM Signalized Intersection Capacity Analysis  
Highway 407 Transitway: GO Barrie (Concord) 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	4.0	4.0
Lane Util. Factor	1.00	0.95		*1.00	1.00	1.00	1.00	*0.95	1.00	1.00	*0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		1.00	1.00	1.00	0.97	1.00	1.00	0.97	1.00	1.00
Satd. Flow (prot)	1580	3268		3512	1824	1517	1688	5005	1420	1769	5199	1569
Flt Permitted	0.95	1.00		1.00	1.00	1.00	0.09	1.00	1.00	0.18	1.00	1.00
Satd. Flow (perm)	1580	3268		3512	1824	1517	159	5005	1420	336	5199	1569
Volume (vph)	8	214	40	705	265	137	174	990	510	215	1684	16
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	8	223	42	734	276	143	181	1031	531	224	1754	17
RTOR Reduction (vph)	0	13	0	0	0	0	0	0	0	0	0	9
Lane Group Flow (vph)	8	252	0	734	276	143	181	1031	531	224	1754	8
Confl. Peds. (#/hr)	1		4	4		1	2		4	4		2
Heavy Vehicles (%)	13%	7%	3%	7%	3%	4%	8%	7%	11%	3%	3%	0%
Turn Type	Split			Split		Free pm+pt			Free pm+pt		pm+ov	
Protected Phases	4	4		8	8		5	2		1	6	4
Permitted Phases						Free	2		Free	6		6
Actuated Green, G (s)	13.8	13.8		29.5	29.5	120.0	53.4	40.7	120.0	52.0	40.0	53.8
Effective Green, g (s)	15.8	15.8		32.5	32.5	120.0	56.4	43.7	120.0	55.0	43.0	58.8
Actuated g/C Ratio	0.13	0.13		0.27	0.27	1.00	0.47	0.36	1.00	0.46	0.36	0.49
Clearance Time (s)	6.0	6.0		7.0	7.0		4.0	7.0		4.0	7.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	5.0		3.0	5.0	3.0
Lane Grp Cap (vph)	208	430		951	494	1517	237	1823	1420	297	1863	821
v/s Ratio Prot	0.01	c0.08		c0.21	0.15		c0.08	0.21		0.08	c0.34	0.00
v/s Ratio Perm						0.09	0.28		c0.37	0.27		0.00
v/c Ratio	0.04	0.59		0.77	0.56	0.09	0.76	0.57	0.37	0.75	0.94	0.01
Uniform Delay, d1	45.5	49.0		40.3	37.6	0.0	28.8	30.5	0.0	21.7	37.3	15.7
Progression Factor	1.00	1.00		1.69	1.72	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	2.0		2.5	0.9	0.1	13.6	1.3	0.8	10.4	11.0	0.0
Delay (s)	45.5	51.1		70.6	65.5	0.1	42.4	31.8	0.8	32.1	48.3	15.7
Level of Service	D	D		E	E	A	D	C	A	C	D	B
Approach Delay (s)		50.9			60.6			23.5			46.2	
Approach LOS		D			E			C			D	
<b>Intersection Summary</b>												
HCM Average Control Delay			42.0			HCM Level of Service				D		
HCM Volume to Capacity ratio			0.82									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)				16.0		
Intersection Capacity Utilization			86.0%			ICU Level of Service				E		
Analysis Period (min)			15									
c Critical Lane Group												



Lane Group	EBT	WBT	ø2
Lane Configurations	↑↑↑	↑↑↑	
Volume (vph)	1576	2429	
Lane Group Flow (vph)	1713	2640	
Turn Type			
Protected Phases	4	8	2
Permitted Phases			
Minimum Split (s)	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0
Total Split (%)	50.0%	50.0%	50%
Yellow Time (s)	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5
Lead/Lag			
Lead-Lag Optimize?			
v/c Ratio	0.89	1.38	
Control Delay	19.8	191.0	
Queue Delay	0.0	0.0	
Total Delay	19.8	191.0	
Queue Length 50th (m)	34.2	~86.3	
Queue Length 95th (m)	#59.7	#109.8	
Internal Link Dist (m)	240.8	578.0	
Turn Bay Length (m)			
Base Capacity (vph)	1918	1918	
Starvation Cap Reductn	0	0	
Spillback Cap Reductn	0	0	
Storage Cap Reductn	0	0	
Reduced v/c Ratio	0.89	1.38	

## Intersection Summary

Cycle Length: 40

Actuated Cycle Length: 40

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

Natural Cycle: 60

Control Type: Pretimed

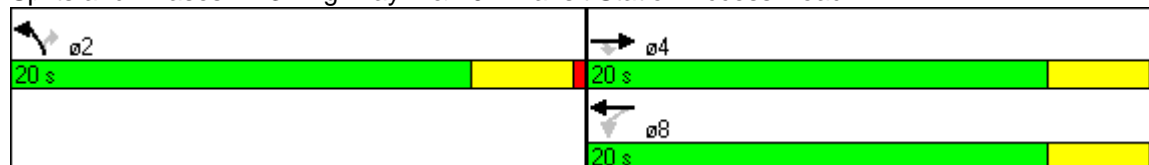
~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

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

Queue shown is maximum after two cycles.

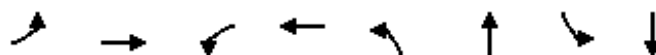
Splits and Phases: 3: Highway 7 &amp; 407 Transit Station Access Road



2010 Existing - Weekday AM Peak Hour HCM Signalized Intersection Capacity Analysis  
3: Highway 7 & 407 Transit Station Access Road Highway 407 Transitway: GO Barrie (Concord) Station

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑	↗	↘	↑↑↑	↗	↘
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0		
Lane Util. Factor	0.91			0.91		
Frt	1.00			1.00		
Flt Protected	1.00			1.00		
Satd. Flow (prot)	4794			4794		
Flt Permitted	1.00			1.00		
Satd. Flow (perm)	4794			4794		
Volume (vph)	1576	0	0	2429	0	0
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1713	0	0	2640	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	1713	0	0	2640	0	0
Heavy Vehicles (%)	7%	0%	0%	7%	0%	0%
Turn Type		Perm	Perm		Perm	
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	16.0			16.0		
Effective Green, g (s)	16.0			16.0		
Actuated g/C Ratio	0.40			0.40		
Clearance Time (s)	4.0			4.0		
Lane Grp Cap (vph)	1918			1918		
v/s Ratio Prot	0.36			c0.55		
v/s Ratio Perm						
v/c Ratio	0.89			1.38		
Uniform Delay, d1	11.2			12.0		
Progression Factor	1.00			1.00		
Incremental Delay, d2	6.9			172.8		
Delay (s)	18.1			184.8		
Level of Service	B			F		
Approach Delay (s)	18.1			184.8	0.0	
Approach LOS	B			F	A	
<b>Intersection Summary</b>						
HCM Average Control Delay		119.2		HCM Level of Service		F
HCM Volume to Capacity ratio		1.38				
Actuated Cycle Length (s)		40.0		Sum of lost time (s)		24.0
Intersection Capacity Utilization		50.3%		ICU Level of Service		A
Analysis Period (min)		15				
c Critical Lane Group						





Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↰	↰↰↰	↰	↰↰↰		↰↰	↰	↰
Volume (vph)	43	2278	24	1618	7	4	176	9
Lane Group Flow (vph)	45	2378	25	1737	0	29	183	240
Turn Type	pm+pt		pm+pt		Perm		Perm	
Protected Phases	7	4	3	8		2		6
Permitted Phases	4		8		2		6	
Detector Phases	7	4	3	8	2	2	6	6
Minimum Initial (s)	7.0	29.0	7.0	29.0	10.0	10.0	10.0	10.0
Minimum Split (s)	11.0	36.0	11.0	36.0	36.0	36.0	36.0	36.0
Total Split (s)	12.0	69.0	12.0	69.0	39.0	39.0	39.0	39.0
Total Split (%)	10.0%	57.5%	10.0%	57.5%	32.5%	32.5%	32.5%	32.5%
Yellow Time (s)	3.0	5.0	3.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0
Lead/Lag	Lead	Lag	Lead	Lag				
Lead-Lag Optimize?	Yes	Yes	Yes	Yes				
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.30	0.81	0.17	0.65		0.06	0.47	0.46
Control Delay	13.3	23.5	10.4	19.7		17.5	39.8	17.5
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	13.3	23.5	10.4	19.7		17.5	39.8	17.5
Queue Length 50th (m)	3.4	155.7	1.8	93.2		1.7	32.6	16.9
Queue Length 95th (m)	7.3	177.2	4.7	110.3		8.3	53.3	38.7
Internal Link Dist (m)		195.5		227.2		276.1		214.7
Turn Bay Length (m)	30.0		30.0				40.0	
Base Capacity (vph)	157	2920	164	2688		472	388	526
Starvation Cap Reductn	0	0	0	0		0	0	0
Spillback Cap Reductn	0	0	0	0		0	0	0
Storage Cap Reductn	0	0	0	0		0	0	0
Reduced v/c Ratio	0.29	0.81	0.15	0.65		0.06	0.47	0.46

**Intersection Summary**

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 32 (27%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 95




















Control Type: Actuated-Coordinated






















**Splits and Phases: 1: Highway 7 & Bowes Road**

↰ ø2	↰ ø3	↰ ø4
39 s	12 s	69 s
↰ ø6	↰ ø7	↰ ø8
39 s	12 s	69 s

2010 Existing - Weekday PM Peak Hour  
1: Highway 7 & Bowes Road

HCM Signalized Intersection Capacity Analysis  
Highway 407 Transitway: GO Barrie (Concord) 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	
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00			0.99		1.00	0.97	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00		1.00	1.00	
Frt	1.00	1.00		1.00	1.00			0.92		1.00	0.86	
Flt Protected	0.95	1.00		0.95	1.00			0.99		0.95	1.00	
Satd. Flow (prot)	1417	4976		1594	4744			1681		1710	1468	
Flt Permitted	0.08	1.00		0.06	1.00			0.93		0.74	1.00	
Satd. Flow (perm)	119	4976		98	4744			1575		1329	1468	
Volume (vph)	43	2278	5	24	1618	50	7	4	17	176	9	222
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	45	2373	5	25	1685	52	7	4	18	183	9	231
RTOR Reduction (vph)	0	0	0	0	3	0	0	13	0	0	100	0
Lane Group Flow (vph)	45	2378	0	25	1734	0	0	16	0	183	140	0
Confl. Peds. (#/hr)	5		1	1		5	12		3	3		12
Heavy Vehicles (%)	26%	3%	20%	12%	7%	25%	0%	0%	0%	4%	0%	7%
Turn Type	pm+pt			pm+pt			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	73.3	67.4		69.9	65.7			30.4		30.4	30.4	
Effective Green, g (s)	76.3	70.4		72.9	68.7			33.4		33.4	33.4	
Actuated g/C Ratio	0.64	0.59		0.61	0.57			0.28		0.28	0.28	
Clearance Time (s)	4.0	7.0		4.0	7.0			7.0		7.0	7.0	
Vehicle Extension (s)	3.0	5.0		3.0	5.0			3.0		3.0	3.0	
Lane Grp Cap (vph)	139	2919		112	2716			438		370	409	
v/s Ratio Prot	c0.02	c0.48		0.01	0.37						0.10	
v/s Ratio Perm	0.19			0.13				0.01		c0.14		
v/c Ratio	0.32	0.81		0.22	0.64			0.04		0.49	0.34	
Uniform Delay, d1	11.9	19.6		17.1	17.3			31.6		36.2	34.5	
Progression Factor	1.00	1.00		1.00	1.00			1.00		1.00	1.00	
Incremental Delay, d2	1.4	2.1		1.0	0.7			0.2		4.7	2.3	
Delay (s)	13.2	21.7		18.1	18.0			31.7		40.9	36.8	
Level of Service	B	C		B	B			C		D	D	
Approach Delay (s)		21.6			18.0			31.7			38.6	
Approach LOS		C			B			C			D	
<b>Intersection Summary</b>												
HCM Average Control Delay			21.8			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.70									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)			12.0			
Intersection Capacity Utilization			75.0%			ICU Level of Service			D			
Analysis Period (min)			15									
c Critical Lane Group												

											
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	34	398	389	157	129	80	1756	975	239	1227	15
Lane Group Flow (vph)	35	475	405	164	134	83	1888	1016	249	1278	16
Turn Type	Split		Split		Free	pm+pt		Free	pm+pt		Perm
Protected Phases	4	4	8	8		5	2		1	6	
Permitted Phases					Free	2		Free	6		6
Detector Phases	4	4	8	8		5	2		1	6	6
Minimum Initial (s)	10.0	10.0	10.0	10.0		7.0	15.0		7.0	15.0	15.0
Minimum Split (s)	22.0	22.0	37.0	37.0		11.0	37.0		11.0	37.0	37.0
Total Split (s)	22.0	22.0	40.0	40.0	0.0	12.0	46.0	0.0	12.0	46.0	46.0
Total Split (%)	18.3%	18.3%	33.3%	33.3%	0.0%	10.0%	38.3%	0.0%	10.0%	38.3%	38.3%
Yellow Time (s)	4.0	4.0	5.0	5.0		3.0	5.0		3.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lead/Lag						Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?						Yes	Yes		Yes	Yes	Yes
Recall Mode	None	None	None	None		None	C-Max		None	C-Max	C-Max
v/c Ratio	0.14	0.91	0.66	0.46	0.09	0.42	0.98	0.66	0.65	0.50	0.02
Control Delay	46.1	71.8	38.8	35.7	0.1	21.4	54.3	2.2	34.2	23.9	9.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.1	71.8	38.8	35.7	0.1	21.4	54.3	2.2	34.2	23.9	9.5
Queue Length 50th (m)	6.7	52.8	46.1	36.1	0.0	7.9	133.8	0.0	34.1	63.9	0.0
Queue Length 95th (m)	15.5	#80.6	60.4	55.6	m0.0	16.5	#163.0	0.0	#74.6	85.2	4.1
Internal Link Dist (m)		190.6		633.5			581.9			486.0	
Turn Bay Length (m)	90.0		80.0		55.0	70.0		60.0	90.0		90.0
Base Capacity (vph)	246	522	962	558	1521	203	1934	1545	386	2567	646
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.14	0.91	0.42	0.29	0.09	0.41	0.98	0.66	0.65	0.50	0.02

## Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 71 (59%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 120







Control Type: Actuated-Coordinated

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

Queue shown is maximum after two cycles.
























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

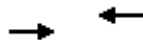
Splits and Phases: 2: North Rivermede Road &amp; Highway 7

			
ø1	ø2	ø4	ø8
12 s	46 s	22 s	40 s
			
ø5	ø6		
12 s	46 s		

2010 Existing - Weekday PM Peak Hour  
2: North Rivermede Road & Highway 7

HCM Signalized Intersection Capacity Analysis  
Highway 407 Transitway: GO Barrie (Concord) 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	4.0	4.0
Lane Util. Factor	1.00	0.95		0.97	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	0.99	1.00	1.00	0.95
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00
Satd. Flow (prot)	1638	3419		3206	1860	1521	1732	5526	1545	1824	5420	1346
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.22	1.00	1.00	0.09	1.00	1.00
Satd. Flow (perm)	1638	3419		3206	1860	1521	405	5526	1545	159	5420	1346
Volume (vph)	34	398	58	389	157	129	80	1756	975	239	1227	15
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.93	0.96	0.96	0.96	0.96
Adj. Flow (vph)	35	415	60	405	164	134	83	1888	1016	249	1278	16
RTOR Reduction (vph)	0	9	0	0	0	0	0	0	0	0	0	9
Lane Group Flow (vph)	35	466	0	405	164	134	83	1888	1016	249	1278	7
Confl. Peds. (#/hr)	23		18	18		23	14		4	4		14
Heavy Vehicles (%)	9%	1%	9%	8%	1%	3%	3%	2%	2%	3%	4%	13%
Turn Type	Split			Split		Free pm+pt			Free pm+pt			Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						Free	2		Free	6		6
Actuated Green, G (s)	16.0	16.0		19.9	19.9	120.0	46.0	39.0	120.0	64.1	53.1	53.1
Effective Green, g (s)	18.0	18.0		22.9	22.9	120.0	49.0	42.0	120.0	67.1	56.1	56.1
Actuated g/C Ratio	0.15	0.15		0.19	0.19	1.00	0.41	0.35	1.00	0.56	0.47	0.47
Clearance Time (s)	6.0	6.0		7.0	7.0		4.0	7.0		4.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	5.0		3.0	5.0	5.0
Lane Grp Cap (vph)	246	513		612	355	1521	243	1934	1545	382	2534	629
v/s Ratio Prot	0.02	c0.14		0.13	0.09		0.02	c0.34		0.11	0.24	
v/s Ratio Perm						0.09	0.12		c0.66	0.25		0.01
v/c Ratio	0.14	0.91		0.66	0.46	0.09	0.34	0.98	0.66	0.65	0.50	0.01
Uniform Delay, d1	44.3	50.2		45.0	43.1	0.0	22.1	38.5	0.0	30.5	22.3	17.1
Progression Factor	1.00	1.00		0.76	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	19.7		2.4	0.8	0.1	0.8	15.6	2.2	4.0	0.7	0.0
Delay (s)	44.6	69.9		36.6	33.2	0.1	22.9	54.1	2.2	34.5	23.0	17.1
Level of Service	D	E		D	C	A	C	D	A	C	C	B
Approach Delay (s)		68.1			28.9			35.6			24.8	
Approach LOS		E			C			D			C	
<b>Intersection Summary</b>												
HCM Average Control Delay			34.7			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.82									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)			8.0			
Intersection Capacity Utilization			90.1%			ICU Level of Service			E			
Analysis Period (min)			15									
c Critical Lane Group												



Lane Group	EBT	WBT	ø2
Lane Configurations	↑↑↑	↑↑↑	
Volume (vph)	2471	1674	
Lane Group Flow (vph)	2686	1820	
Turn Type			
Protected Phases	4	8	2
Permitted Phases			
Minimum Split (s)	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0
Total Split (%)	50.0%	50.0%	50%
Yellow Time (s)	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5
Lead/Lag			
Lead-Lag Optimize?			
v/c Ratio	1.33	0.93	
Control Delay	172.2	23.3	
Queue Delay	0.0	0.0	
Total Delay	172.2	23.3	
Queue Length 50th (m)	~86.3	37.2	
Queue Length 95th (m)#	109.9	64.7	
Internal Link Dist (m)	227.2	581.9	
Turn Bay Length (m)			
Base Capacity (vph)	2012	1954	
Starvation Cap Reductn	0	0	
Spillback Cap Reductn	0	0	
Storage Cap Reductn	0	0	
Reduced v/c Ratio	1.33	0.93	

## Intersection Summary

Cycle Length: 40

Actuated Cycle Length: 40

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

Natural Cycle: 60

Control Type: Pretimed

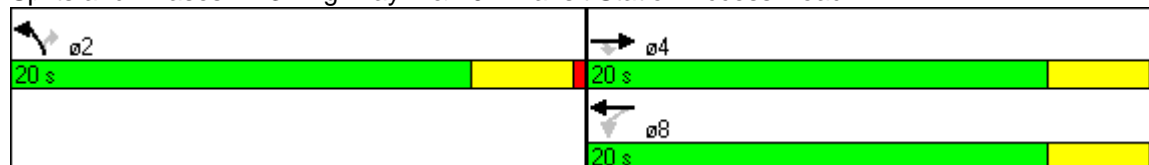
~ Volume exceeds capacity, queue is theoretically infinite.

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: Highway 7 &amp; 407 Transit Station Access Road



	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑	↑	↑	↑↑↑	↑	↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0		
Lane Util. Factor	0.91			0.91		
Frt	1.00			1.00		
Flt Protected	1.00			1.00		
Satd. Flow (prot)	5029			4885		
Flt Permitted	1.00			1.00		
Satd. Flow (perm)	5029			4885		
Volume (vph)	2471	0	0	1674	0	0
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2686	0	0	1820	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	2686	0	0	1820	0	0
Heavy Vehicles (%)	2%	0%	0%	5%	0%	0%
Turn Type		Perm	Perm		Perm	
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	16.0			16.0		
Effective Green, g (s)	16.0			16.0		
Actuated g/C Ratio	0.40			0.40		
Clearance Time (s)	4.0			4.0		
Lane Grp Cap (vph)	2012			1954		
v/s Ratio Prot	0.53			0.37		
v/s Ratio Perm						
v/c Ratio	1.33			0.93		
Uniform Delay, d1	12.0			11.5		
Progression Factor	1.00			1.00		
Incremental Delay, d2	154.2			9.6		
Delay (s)	166.2			21.0		
Level of Service	F			C		
Approach Delay (s)	166.2			21.0	0.0	
Approach LOS	F			C	A	
<b>Intersection Summary</b>						
HCM Average Control Delay		107.6		HCM Level of Service		F
HCM Volume to Capacity ratio		1.34				
Actuated Cycle Length (s)		40.0		Sum of lost time (s)		24.0
Intersection Capacity Utilization		51.1%		ICU Level of Service		A
Analysis Period (min)		15				
c Critical Lane Group						

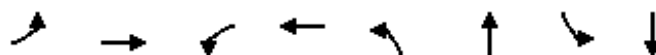
## APPENDIX B

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### 2031 BACKGROUND CONDITION SYNCHRO SUMMARY OUTPUTS







Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↰	↑↑↑	↰	↑↑↑		↑↓	↰	↑↓
Volume (vph)	128	1969	7	3139	15	6	90	6
Lane Group Flow (vph)	128	1973	7	3249	0	61	90	116
Turn Type	pm+pt		Perm		Perm		Perm	
Protected Phases	7	4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phases	7	4	8	8	2	2	6	6
Minimum Initial (s)	7.0	29.0	29.0	29.0	10.0	10.0	10.0	10.0
Minimum Split (s)	11.0	36.0	36.0	36.0	30.0	30.0	30.0	30.0
Total Split (s)	12.0	89.0	77.0	77.0	31.0	31.0	31.0	31.0
Total Split (%)	10.0%	74.2%	64.2%	64.2%	25.8%	25.8%	25.8%	25.8%
Yellow Time (s)	3.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lead/Lag	Lead		Lag	Lag				
Lead-Lag Optimize?	Yes		Yes	Yes				
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.84	0.61	0.08	1.01		0.19	0.37	0.35
Control Delay	66.0	9.9	4.1	21.2		26.0	44.5	11.2
Queue Delay	0.0	0.0	0.0	6.0		0.0	0.0	0.0
Total Delay	66.0	9.9	4.1	27.2		26.0	44.5	11.2
Queue Length 50th (m)	15.4	71.5	0.2	~33.1		6.3	16.6	1.0
Queue Length 95th (m)	#47.1	82.6	m0.3	#266.6		16.9	31.3	15.3
Internal Link Dist (m)		152.2		240.8		300.0		342.5
Turn Bay Length (m)	30.0		30.0				40.0	
Base Capacity (vph)	153	3245	90	3221		325	244	333
Starvation Cap Reductn	0	0	0	58		0	0	0
Spillback Cap Reductn	0	0	0	0		0	0	0
Storage Cap Reductn	0	0	0	0		0	0	0
Reduced v/c Ratio	0.84	0.61	0.08	1.03		0.19	0.37	0.35

## Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 15 (13%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 110

Control Type: Actuated-Coordinated

~ Volume exceeds capacity, queue is theoretically infinite.

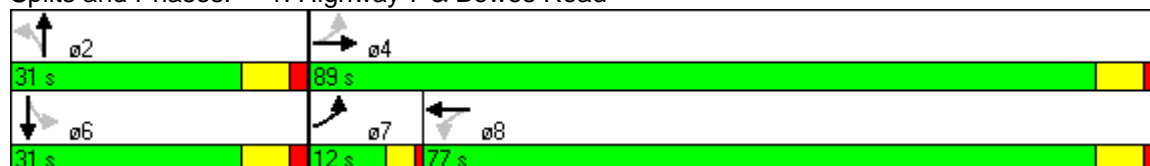
Queue shown is maximum after two cycles.

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

Queue shown is maximum after two cycles.

























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























## Splits and Phases: 1: Highway 7 &amp; Bowes Road



2031 Background - Weekday AM Peak Hour  
1: Highway 7 & Bowes Road

HCM Signalized Intersection Capacity Analysis  
Highway 407 Transitway: GO Barrie (Concord) 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	
Lane Util. Factor	1.00	0.91		1.00	*1.00			1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00			0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00		1.00	1.00	
Frt	1.00	1.00		1.00	0.99			0.91		1.00	0.86	
Flt Protected	0.95	1.00		0.95	1.00			0.99		0.95	1.00	
Satd. Flow (prot)	1500	4579		1593	5289			1455		1415	1098	
Flt Permitted	0.05	1.00		0.09	1.00			0.92		0.73	1.00	
Satd. Flow (perm)	82	4579		147	5289			1360		1084	1098	
Volume (vph)	128	1969	4	7	3139	110	15	6	40	90	6	110
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)	128	1969	4	7	3139	110	15	6	40	90	6	110
RTOR Reduction (vph)	0	0	0	0	4	0	0	19	0	0	85	0
Lane Group Flow (vph)	128	1973	0	7	3245	0	0	42	0	90	31	0
Confl. Peds. (#/hr)			1	1			2		1	1		2
Heavy Vehicles (%)	19%	12%	0%	12%	6%	7%	43%	0%	7%	26%	20%	46%
Turn Type	pm+pt			Perm			Perm			Perm		
Protected Phases	7	4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	82.0	82.0		70.0	70.0			24.0		24.0	24.0	
Effective Green, g (s)	85.0	85.0		73.0	73.0			27.0		27.0	27.0	
Actuated g/C Ratio	0.71	0.71		0.61	0.61			0.22		0.22	0.22	
Clearance Time (s)	4.0	7.0		7.0	7.0			7.0		7.0	7.0	
Vehicle Extension (s)	3.0	5.0		5.0	5.0			3.0		3.0	3.0	
Lane Grp Cap (vph)	153	3243		89	3217			306		244	247	
v/s Ratio Prot	c0.06	0.43			c0.61						0.03	
v/s Ratio Perm	0.54			0.05				0.03		c0.08		
v/c Ratio	0.84	0.61		0.08	1.01			0.14		0.37	0.12	
Uniform Delay, d1	38.2	9.0		9.7	23.5			37.2		39.3	37.1	
Progression Factor	1.00	1.00		0.31	0.23			1.00		1.00	1.00	
Incremental Delay, d2	30.9	0.5		0.4	13.9			0.9		4.2	1.0	
Delay (s)	69.0	9.4		3.4	19.3			38.1		43.5	38.1	
Level of Service	E	A		A	B			D		D	D	
Approach Delay (s)		13.1			19.3			38.1			40.5	
Approach LOS		B			B			D			D	
<b>Intersection Summary</b>												
HCM Average Control Delay			18.0			HCM Level of Service				B		
HCM Volume to Capacity ratio			0.84									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)			12.0			
Intersection Capacity Utilization			99.4%			ICU Level of Service			F			
Analysis Period (min)			15									
c Critical Lane Group												

											
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	9	239	831	296	153	194	1489	738	240	1977	18
Lane Group Flow (vph)	9	284	831	296	153	194	1489	738	240	1977	18
Turn Type	Split		Split		Free	pm+pt		Free	pm+pt		pm+ov
Protected Phases	4	4	8	8		5	2		1	6	4
Permitted Phases					Free	2		Free	6		6
Detector Phases	4	4	8	8		5	2		1	6	4
Minimum Initial (s)	10.0	10.0	10.0	10.0		7.0	15.0		7.0	15.0	10.0
Minimum Split (s)	22.0	22.0	37.0	37.0		11.0	37.0		11.0	37.0	22.0
Total Split (s)	22.0	22.0	37.0	37.0	0.0	14.0	44.0	0.0	17.0	47.0	22.0
Total Split (%)	18.3%	18.3%	30.8%	30.8%	0.0%	11.7%	36.7%	0.0%	14.2%	39.2%	18.3%
Yellow Time (s)	4.0	4.0	5.0	5.0		3.0	5.0		3.0	5.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lead/Lag						Lead	Lag		Lead	Lag	
Lead-Lag Optimize?						Yes	Yes		Yes	Yes	
Recall Mode	None	None	None	None		None	C-Max		None	C-Max	None
v/c Ratio	0.04	0.62	0.84	0.58	0.10	0.89	0.87	0.52	0.92	1.01	0.02
Control Delay	44.4	52.6	26.2	20.4	0.1	70.5	49.5	1.5	69.9	60.0	5.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.4	52.6	26.2	20.4	0.1	70.5	49.5	1.5	69.9	60.0	5.3
Queue Length 50th (m)	1.7	29.1	63.1	42.9	0.0	34.1	96.6	3.1	37.9	~144.3	0.0
Queue Length 95th (m)	6.1	42.0	#94.0	m64.9	m0.0	m#70.4	111.7	5.4	#82.4	#174.4	3.1
Internal Link Dist (m)		189.3		627.9			578.0			181.4	
Turn Bay Length (m)	90.0		80.0		55.0	70.0		60.0	90.0		90.0
Base Capacity (vph)	237	503	988	513	1517	217	1707	1420	260	1967	809
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.04	0.56	0.84	0.58	0.10	0.89	0.87	0.52	0.92	1.01	0.02

**Intersection Summary**

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 45 (38%), Referenced to phase 2:NBTL and 6:SBTL, 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.

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

Splits and Phases: 2: North Rivermede Road &amp; Highway 7

			
ø1	ø2	ø4	ø8
17 s	44 s	22 s	37 s
			
ø5	ø6		
14 s	47 s		

























2031 Background - Weekday AM Peak Hour  
2: North Rivermede Road & Highway 7

HCM Signalized Intersection Capacity Analysis  
Highway 407 Transitway: GO Barrie (Concord) 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	4.0	4.0
Lane Util. Factor	1.00	0.95		*1.00	1.00	1.00	1.00	*0.95	1.00	1.00	*1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Satd. Flow (prot)	1580	3268		3512	1824	1517	1740	5005	1420	1824	5472	1569
Flt Permitted	0.95	1.00		1.00	1.00	1.00	0.10	1.00	1.00	0.09	1.00	1.00
Satd. Flow (perm)	1580	3268		3512	1824	1517	170	5005	1420	169	5472	1569
Volume (vph)	9	239	45	831	296	153	194	1489	738	240	1977	18
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)	9	239	45	831	296	153	194	1489	738	240	1977	18
RTOR Reduction (vph)	0	13	0	0	0	0	0	0	0	0	0	9
Lane Group Flow (vph)	9	271	0	831	296	153	194	1489	738	240	1977	9
Confl. Peds. (#/hr)	1		4	4		1	2		4	4		2
Heavy Vehicles (%)	13%	7%	3%	7%	3%	4%	8%	7%	11%	3%	3%	0%
Turn Type	Split			Split		Free pm+pt			Free pm+pt		pm+ov	
Protected Phases	4	4		8	8		5	2		1	6	4
Permitted Phases						Free	2		Free	6		6
Actuated Green, G (s)	14.2	14.2		30.8	30.8	120.0	48.8	37.9	120.0	53.2	40.1	54.3
Effective Green, g (s)	16.2	16.2		33.8	33.8	120.0	51.8	40.9	120.0	56.2	43.1	59.3
Actuated g/C Ratio	0.13	0.13		0.28	0.28	1.00	0.43	0.34	1.00	0.47	0.36	0.49
Clearance Time (s)	6.0	6.0		7.0	7.0		4.0	7.0		4.0	7.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	5.0		3.0	5.0	3.0
Lane Grp Cap (vph)	213	441		989	514	1517	216	1706	1420	260	1965	828
v/s Ratio Prot	0.01	0.08		c0.24	0.16		0.08	0.30		c0.10	c0.36	0.00
v/s Ratio Perm						0.10	0.31		c0.52	0.33		0.00
v/c Ratio	0.04	0.61		0.84	0.58	0.10	0.90	0.87	0.52	0.92	1.01	0.01
Uniform Delay, d1	45.2	49.0		40.6	37.0	0.0	31.6	37.1	0.0	33.6	38.4	15.4
Progression Factor	1.00	1.00		0.46	0.45	1.00	1.32	1.18	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	2.5		5.0	1.2	0.1	29.4	5.3	1.1	35.7	21.8	0.0
Delay (s)	45.2	51.5		23.8	17.7	0.1	71.0	49.0	1.1	69.2	60.2	15.4
Level of Service	D	D		C	B	A	E	D	A	E	E	B
Approach Delay (s)		51.3			19.6			36.2			60.8	
Approach LOS		D			B			D			E	
<b>Intersection Summary</b>												
HCM Average Control Delay			42.3			HCM Level of Service				D		
HCM Volume to Capacity ratio			0.85									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)				8.0		
Intersection Capacity Utilization			96.4%			ICU Level of Service				F		
Analysis Period (min)			15									
c Critical Lane Group												

2031 Background - Weekday AM Peak Hour  
3: Highway 7 & Concord Land Access Road

Queues  
Highway 407 Transitway: GO Barrie (Concord) Station

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	1962	47	47	2711	55	105	5	105	320	10	190
Lane Group Flow (vph)	90	1962	47	47	2711	55	105	5	105	320	10	190
Turn Type	pm+pt		Perm	Perm		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phases	7	4	4	8	8	8	5	2	2	1	6	6
Minimum Initial (s)	4.0	29.0	29.0	29.0	29.0	29.0	6.0	10.0	10.0	6.0	10.0	10.0
Minimum Split (s)	8.0	36.0	36.0	36.0	36.0	36.0	10.0	29.0	29.0	11.0	29.0	29.0
Total Split (s)	8.0	77.0	77.0	69.0	69.0	69.0	10.0	31.0	31.0	12.0	33.0	33.0
Total Split (%)	6.7%	64.2%	64.2%	57.5%	57.5%	57.5%	8.3%	25.8%	25.8%	10.0%	27.5%	27.5%
Yellow Time (s)	3.0	5.0	5.0	5.0	5.0	5.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	2.0	2.0	2.0	1.0	2.0	2.0	1.0	2.0	2.0
Lead/Lag	Lead			Lag	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes			Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Min	Min	Min	Min	Min	None	C-Max	C-Max	None	C-Max	C-Max
v/c Ratio	0.74	0.61	0.05	0.51	0.94	0.06	0.26	0.01	0.28	0.74	0.02	0.50
Control Delay	56.9	10.3	1.9	15.4	13.1	1.8	32.0	36.4	30.7	46.7	35.1	44.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	56.9	10.3	1.9	15.4	13.1	1.8	32.0	36.4	30.7	46.7	35.1	44.7
Queue Length 50th (m)	8.9	42.5	0.0	3.4	64.7	0.8	16.3	0.9	13.9	56.5	1.7	35.7
Queue Length 95th (m)	m#29.0	46.4	m1.3	m3.5	m65.5	m0.8	28.7	4.0	28.3	82.6	5.7	57.1
Internal Link Dist (m)		240.8			578.0			61.8			124.6	
Turn Bay Length (m)			50.0	60.0								
Base Capacity (vph)	122	3205	970	92	2881	885	399	414	373	435	445	378
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.74	0.61	0.05	0.51	0.94	0.06	0.26	0.01	0.28	0.74	0.02	0.50

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 12 (10%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 105

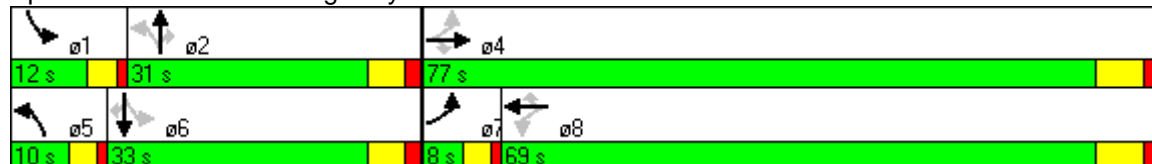
Control Type: Actuated-Coordinated

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

Queue shown is maximum after two cycles.

























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

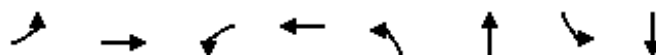
Splits and Phases: 3: Highway 7 & Concord Land Access Road



2031 Background - Weekday AM Peak Hour  
3: Highway 7 & Concord Land Access Road

HCM Signalized Intersection Capacity Analysis  
Highway 407 Transitway: GO Barrie (Concord) 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	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	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00
Satd. Flow (prot)	1785	5268	1566	1750	5318	1597	1750	1842	1566	1842	1842	1566
Flt Permitted	0.06	1.00	1.00	0.09	1.00	1.00	0.75	1.00	1.00	0.70	1.00	1.00
Satd. Flow (perm)	109	5268	1566	170	5318	1597	1384	1842	1566	1294	1842	1566
Volume (vph)	90	1962	47	47	2711	55	105	5	105	320	10	190
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)	90	1962	47	47	2711	55	105	5	105	320	10	190
RTOR Reduction (vph)	0	0	18	0	0	20	0	0	21	0	0	0
Lane Group Flow (vph)	90	1962	29	47	2711	35	105	5	84	320	10	190
Heavy Vehicles (%)	0%	7%	2%	2%	6%	0%	2%	2%	2%	2%	2%	2%
Turn Type	pm+pt		Perm	Perm		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	70.0	70.0	70.0	62.0	62.0	62.0	31.0	25.0	25.0	35.0	27.0	27.0
Effective Green, g (s)	73.0	73.0	73.0	65.0	65.0	65.0	33.0	27.0	27.0	37.0	29.0	29.0
Actuated g/C Ratio	0.61	0.61	0.61	0.54	0.54	0.54	0.28	0.22	0.22	0.31	0.24	0.24
Clearance Time (s)	4.0	7.0	7.0	7.0	7.0	7.0	4.0	6.0	6.0	4.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	5.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	122	3205	953	92	2881	865	399	414	352	436	445	378
v/s Ratio Prot	0.02	c0.37			c0.51		0.01	0.00		c0.05	0.01	
v/s Ratio Perm	0.42		0.02	0.28		0.02	0.06		0.05	c0.18		0.12
v/c Ratio	0.74	0.61	0.03	0.51	0.94	0.04	0.26	0.01	0.24	0.73	0.02	0.50
Uniform Delay, d1	25.0	14.7	9.4	17.4	25.7	12.9	33.6	36.1	38.1	36.5	34.7	39.3
Progression Factor	2.21	0.65	0.61	0.38	0.37	0.36	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	17.1	0.4	0.0	3.0	2.7	0.0	0.4	0.1	1.6	6.3	0.1	4.7
Delay (s)	72.4	9.9	5.8	9.6	12.3	4.6	33.9	36.2	39.7	42.8	34.8	44.0
Level of Service	E	A	A	A	B	A	C	D	D	D	C	D
Approach Delay (s)		12.5			12.1			36.8			43.1	
Approach LOS		B			B			D			D	
<b>Intersection Summary</b>												
HCM Average Control Delay			16.0				HCM Level of Service			B		
HCM Volume to Capacity ratio			0.88									
Actuated Cycle Length (s)			120.0				Sum of lost time (s)			16.0		
Intersection Capacity Utilization			96.5%				ICU Level of Service			F		
Analysis Period (min)			15									
c Critical Lane Group												



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↰	↱↱↱	↰	↱↱↱		↱↱	↰	↱
Volume (vph)	54	3393	30	2310	9	5	196	10
Lane Group Flow (vph)	54	3399	30	2372	0	35	196	258
Turn Type	pm+pt		pm+pt		Perm		Perm	
Protected Phases	7	4	3	8		2		6
Permitted Phases	4		8		2		6	
Detector Phases	7	4	3	8	2	2	6	6
Minimum Initial (s)	7.0	29.0	7.0	29.0	10.0	10.0	10.0	10.0
Minimum Split (s)	11.0	36.0	11.0	36.0	30.0	30.0	30.0	30.0
Total Split (s)	11.0	79.0	11.0	79.0	30.0	30.0	30.0	30.0
Total Split (%)	9.2%	65.8%	9.2%	65.8%	25.0%	25.0%	25.0%	25.0%
Yellow Time (s)	3.0	5.0	3.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0
Lead/Lag	Lead	Lag	Lead	Lag				
Lead-Lag Optimize?	Yes	Yes	Yes	Yes				
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.41	0.94	0.20	0.74		0.10	0.63	0.65
Control Delay	20.6	25.7	14.3	23.3		21.6	53.1	33.8
Queue Delay	0.0	6.4	0.0	0.0		0.0	0.0	0.0
Total Delay	20.6	32.1	14.3	23.3		21.6	53.1	33.8
Queue Length 50th (m)	3.1	227.2	3.0	108.6		2.4	38.9	30.7
Queue Length 95th (m)	11.9	#274.1	m4.7	132.0		10.3	62.3	57.7
Internal Link Dist (m)		195.5		227.2		276.1		214.7
Turn Bay Length (m)	30.0		30.0				40.0	
Base Capacity (vph)	133	3620	150	3192		346	309	398
Starvation Cap Reductn	0	0	0	0		0	0	0
Spillback Cap Reductn	0	222	0	0		1	0	0
Storage Cap Reductn	0	0	0	0		0	0	0
Reduced v/c Ratio	0.41	1.00	0.20	0.74		0.10	0.63	0.65

## Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 97 (81%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 110

Control Type: Actuated-Coordinated

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

Queue shown is maximum after two cycles.

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



























## Splits and Phases: 1: Highway 7 &amp; Bowes Road

↰ ø2	↱ ø3	↱ ø4
30 s	11 s	79 s
↰ ø6	↱ ø7	↱ ø8
30 s	11 s	79 s

























2031 Background - Weekday PM Peak Hour  
1: Highway 7 & Bowes Road

HCM Signalized Intersection Capacity Analysis  
Highway 407 Transitway: GO Barrie (Concord) 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	
Lane Util. Factor	1.00	*1.00		1.00	*0.95			1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00			0.99		1.00	0.97	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00		1.00	1.00	
Frt	1.00	1.00		1.00	1.00			0.92		1.00	0.86	
Flt Protected	0.95	1.00		0.95	1.00			0.99		0.95	1.00	
Satd. Flow (prot)	1417	5469		1594	4959			1684		1709	1463	
Flt Permitted	0.05	1.00		0.05	1.00			0.84		0.80	1.00	
Satd. Flow (perm)	75	5469		86	4959			1438		1432	1463	
Volume (vph)	54	3393	6	30	2310	62	9	5	21	196	10	248
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)	54	3393	6	30	2310	62	9	5	21	196	10	248
RTOR Reduction (vph)	0	0	0	0	2	0	0	17	0	0	82	0
Lane Group Flow (vph)	54	3399	0	30	2370	0	0	18	0	196	176	0
Confl. Peds. (#/hr)	5		1	1		5	12		3	3		12
Heavy Vehicles (%)	26%	3%	20%	12%	7%	25%	0%	0%	0%	4%	0%	7%
Turn Type	pm+pt			pm+pt			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	82.0	76.4		79.2	75.0			21.4		21.4	21.4	
Effective Green, g (s)	85.0	79.4		82.2	78.0			24.4		24.4	24.4	
Actuated g/C Ratio	0.71	0.66		0.68	0.65			0.20		0.20	0.20	
Clearance Time (s)	4.0	7.0		4.0	7.0			7.0		7.0	7.0	
Vehicle Extension (s)	3.0	5.0		3.0	5.0			3.0		3.0	3.0	
Lane Grp Cap (vph)	116	3619		112	3223			292		291	297	
v/s Ratio Prot	c0.02	c0.62		0.01	0.48						0.12	
v/s Ratio Perm	0.31			0.17				0.01		c0.14		
v/c Ratio	0.47	0.94		0.27	0.74			0.06		0.67	0.59	
Uniform Delay, d1	13.3	18.1		24.1	14.1			38.6		44.1	43.3	
Progression Factor	1.00	1.00		2.36	1.45			1.00		1.00	1.00	
Incremental Delay, d2	2.9	5.9		0.9	0.8			0.4		11.8	8.4	
Delay (s)	16.3	24.0		57.8	21.1			39.0		55.9	51.7	
Level of Service	B	C		E	C			D		E	D	
Approach Delay (s)		23.9			21.6			39.0			53.5	
Approach LOS		C			C			D			D	
<b>Intersection Summary</b>												
HCM Average Control Delay			25.2			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.84									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)			8.0			
Intersection Capacity Utilization			91.5%			ICU Level of Service			F			
Analysis Period (min)			15									
c Critical Lane Group												



											
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	38	444	649	195	161	89	2178	1265	297	1920	19
Lane Group Flow (vph)	38	509	649	195	161	89	2178	1265	297	1920	19
Turn Type	Split		Split		Free	pm+pt		Free	pm+pt		pm+ov
Protected Phases	4	4	8	8		5	2		1	6	4
Permitted Phases					Free	2		Free	6		6
Detector Phases	4	4	8	8		5	2		1	6	4
Minimum Initial (s)	10.0	10.0	10.0	10.0		7.0	15.0		7.0	15.0	10.0
Minimum Split (s)	22.0	22.0	37.0	37.0		11.0	37.0		11.0	37.0	22.0
Total Split (s)	22.0	22.0	37.0	37.0	0.0	11.0	50.0	0.0	11.0	50.0	22.0
Total Split (%)	18.3%	18.3%	30.8%	30.8%	0.0%	9.2%	41.7%	0.0%	9.2%	41.7%	18.3%
Yellow Time (s)	4.0	4.0	5.0	5.0		3.0	5.0		3.0	5.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lead/Lag						Lead	Lag		Lead	Lag	
Lead-Lag Optimize?						Yes	Yes		Yes	Yes	
Recall Mode	None	None	None	None		None	C-Max		None	C-Max	None
v/c Ratio	0.15	0.93	0.71	0.40	0.11	0.55	1.03	0.82	0.86	0.89	0.03
Control Delay	46.3	73.2	29.1	24.5	0.1	35.7	72.6	12.5	50.5	40.6	4.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.3	73.2	29.1	24.5	0.1	35.7	72.6	12.5	50.5	40.6	4.8
Queue Length 50th (m)	7.3	53.9	49.3	27.9	0.0	16.3	~165.4	154.2	39.4	131.1	0.0
Queue Length 95th (m)	16.7	#81.7	63.0	43.8	0.0	m18.1	#188.5	m179.5	#82.8	#150.0	3.0
Internal Link Dist (m)		190.6		633.5			581.9			486.0	
Turn Bay Length (m)	90.0		80.0		55.0	70.0		60.0	90.0		90.0
Base Capacity (vph)	246	550	957	512	1521	162	2118	1545	345	2152	755
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.15	0.93	0.68	0.38	0.11	0.55	1.03	0.82	0.86	0.89	0.03

**Intersection Summary**

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 36 (30%), Referenced to phase 2:NBTL and 6:SBTL, 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.
























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

Splits and Phases: 2: North Rivermede Road &amp; Highway 7

			
ø1	ø2	ø4	ø8
11 s	50 s	22 s	37 s
			
ø5	ø6		
11 s	50 s		

2031 Background - Weekday PM Peak Hour  
2: North Rivermede Road & Highway 7

HCM Signalized Intersection Capacity Analysis  
Highway 407 Transitway: GO Barrie (Concord) 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	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	*1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.99	1.00	1.00	0.97
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00
Satd. Flow (prot)	1638	3597		3479	1860	1521	1733	5526	1545	1824	5420	1365
Flt Permitted	0.95	1.00		1.00	1.00	1.00	0.09	1.00	1.00	0.30	1.00	1.00
Satd. Flow (perm)	1638	3597		3479	1860	1521	159	5526	1545	547	5420	1365
Volume (vph)	38	444	65	649	195	161	89	2178	1265	297	1920	19
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)	38	444	65	649	195	161	89	2178	1265	297	1920	19
RTOR Reduction (vph)	0	10	0	0	0	0	0	0	0	0	0	9
Lane Group Flow (vph)	38	499	0	649	195	161	89	2178	1265	297	1920	10
Confl. Peds. (#/hr)	23		18	18		23	14		4	4		14
Heavy Vehicles (%)	9%	1%	9%	8%	1%	3%	3%	2%	2%	3%	4%	13%
Turn Type	Split			Split		Free pm+pt			Free pm+pt		pm+ov	
Protected Phases	4	4		8	8		5	2		1	6	4
Permitted Phases						Free	2		Free	6		6
Actuated Green, G (s)	16.0	16.0		28.4	28.4	120.0	50.0	43.0	120.0	53.2	44.6	60.6
Effective Green, g (s)	18.0	18.0		31.4	31.4	120.0	53.0	46.0	120.0	56.2	47.6	65.6
Actuated g/C Ratio	0.15	0.15		0.26	0.26	1.00	0.44	0.38	1.00	0.47	0.40	0.55
Clearance Time (s)	6.0	6.0		7.0	7.0		4.0	7.0		4.0	7.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	5.0		3.0	5.0	3.0
Lane Grp Cap (vph)	246	540		910	487	1521	162	2118	1545	348	2150	792
v/s Ratio Prot	0.02	0.14		0.19	0.10		0.03	c0.39		0.06	0.35	0.00
v/s Ratio Perm						0.11	0.21		c0.82	0.34		0.01
v/c Ratio	0.15	0.92		0.71	0.40	0.11	0.55	1.03	0.82	0.85	0.89	0.01
Uniform Delay, d1	44.4	50.3		40.2	36.5	0.0	25.4	37.0	0.0	61.8	33.8	12.4
Progression Factor	1.00	1.00		0.61	0.61	1.00	1.59	1.44	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	21.6		2.6	0.5	0.1	1.7	21.1	2.3	18.0	6.2	0.0
Delay (s)	44.7	71.9		27.1	22.7	0.1	42.3	74.5	2.3	79.8	40.0	12.4
Level of Service	D	E		C	C	A	D	E	A	E	D	B
Approach Delay (s)		70.0			21.9			47.9			45.1	
Approach LOS		E			C			D			D	
<b>Intersection Summary</b>												
HCM Average Control Delay			45.1			HCM Level of Service			D			
HCM Volume to Capacity ratio			0.90									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)			4.0			
Intersection Capacity Utilization			109.7%			ICU Level of Service			H			
Analysis Period (min)			15									
c Critical Lane Group												

# 2031 Background - Weekday PM Peak Hour

## 3: Highway 7 & Concord Land Access Road

# Queues

## Highway 407 Transitway: GO Barrie (Concord) Station

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  			  							
Volume (vph)	375	3076	183	183	2084	225	146	10	146	250	5	150
Lane Group Flow (vph)	375	3076	183	183	2084	225	146	10	146	250	5	150
Turn Type	pm+pt		Perm	pm+pt		Perm	Perm		pm+ov	Perm		pm+ov
Protected Phases	7	4		3	8			2	3		6	7
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phases	7	4	4	3	8	8	2	2	3	6	6	7
Minimum Initial (s)	7.0	29.0	29.0	6.0	29.0	29.0	10.0	10.0	6.0	10.0	10.0	7.0
Minimum Split (s)	11.0	36.0	36.0	10.0	36.0	36.0	29.0	29.0	10.0	29.0	29.0	11.0
Total Split (s)	24.0	76.0	76.0	10.0	62.0	62.0	34.0	34.0	10.0	34.0	34.0	24.0
Total Split (%)	20.0%	63.3%	63.3%	8.3%	51.7%	51.7%	28.3%	28.3%	8.3%	28.3%	28.3%	20.0%
Yellow Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	4.0	4.0	3.0	4.0	4.0	3.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	1.0	2.0	2.0	1.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag			Lead			Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes			Yes			Yes
Recall Mode	None	None	None	None	None	None	C-Max	C-Max	None	None	None	None
v/c Ratio	0.83	0.94	0.18	0.98	0.76	0.25	0.41	0.02	0.27	0.72	0.01	0.23
Control Delay	24.4	17.8	1.3	68.8	10.0	1.5	41.9	34.3	30.9	54.5	34.0	23.2
Queue Delay	0.0	21.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.4	38.9	1.3	68.8	10.0	1.5	41.9	34.3	30.9	54.5	34.0	23.2
Queue Length 50th (m)	22.0	203.9	2.6	21.4	43.8	1.8	26.6	1.7	23.0	49.9	0.8	21.1
Queue Length 95th (m)	m27.7	245.8	m3.0m#36.6	47.2	m2.5	44.9	5.7	38.5	#81.3	3.8	32.1	
Internal Link Dist (m)		227.2			581.9			218.9			114.3	
Turn Bay Length (m)			50.0	60.0								
Base Capacity (vph)	507	3283	1002	187	2747	916	354	461	533	346	461	705
Starvation Cap Reductn	0	336	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.74	1.04	0.18	0.98	0.76	0.25	0.41	0.02	0.27	0.72	0.01	0.21

### Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

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

Natural Cycle: 90

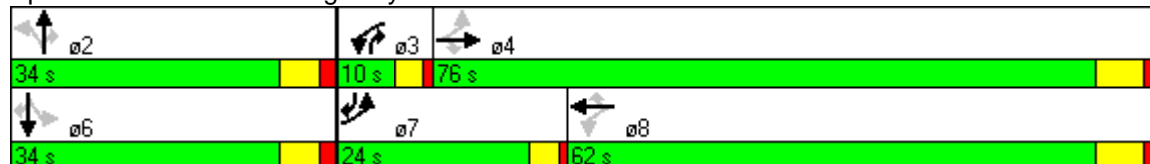
Control Type: Actuated-Coordinated

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

Queue shown is maximum after two cycles.














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

### Splits and Phases: 3: Highway 7 & Concord Land Access Road



2031 Background - Weekday PM Peak Hour  
3: Highway 7 & Concord Land Access Road

HCM Signalized Intersection Capacity Analysis  
Highway 407 Transitway: GO Barrie (Concord) 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	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	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1879	5472	1597	1785	5268	1566	1785	1842	1597	1750	1842	1566
Flt Permitted	0.20	1.00	1.00	0.10	1.00	1.00	0.75	1.00	1.00	0.75	1.00	1.00
Satd. Flow (perm)	376	5472	1597	188	5268	1566	1418	1842	1597	1384	1842	1566
Volume (vph)	375	3076	183	183	2084	225	146	10	146	250	5	150
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)	375	3076	183	183	2084	225	146	10	146	250	5	150
RTOR Reduction (vph)	0	0	44	0	0	99	0	0	1	0	0	0
Lane Group Flow (vph)	375	3076	139	183	2084	126	146	10	145	250	5	150
Heavy Vehicles (%)	0%	3%	0%	0%	7%	2%	0%	2%	0%	2%	2%	2%
Turn Type	pm+pt		Perm		pm+pt		Perm		Perm		pm+ov	
Protected Phases	7	4		3	8			2	3		6	7
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	79.0	69.0	69.0	65.6	59.6	59.6	28.0	28.0	34.0	28.0	28.0	43.4
Effective Green, g (s)	82.0	72.0	72.0	68.6	62.6	62.6	30.0	30.0	36.0	30.0	30.0	45.4
Actuated g/C Ratio	0.68	0.60	0.60	0.57	0.52	0.52	0.25	0.25	0.30	0.25	0.25	0.38
Clearance Time (s)	4.0	7.0	7.0	4.0	7.0	7.0	6.0	6.0	4.0	6.0	6.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	450	3283	958	187	2748	817	355	461	532	346	461	645
v/s Ratio Prot	c0.11	0.56		0.05	0.40			0.01	0.01		0.00	0.03
v/s Ratio Perm	0.46		0.09	c0.51		0.08	0.10		0.08	c0.18		0.07
v/c Ratio	0.83	0.94	0.15	0.98	0.76	0.15	0.41	0.02	0.27	0.72	0.01	0.23
Uniform Delay, d1	17.5	21.9	10.5	25.3	22.7	14.9	37.6	33.9	32.0	41.2	33.8	25.4
Progression Factor	1.43	0.65	0.25	1.31	0.38	0.39	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.4	2.6	0.0	40.3	0.6	0.0	3.5	0.1	0.3	7.3	0.0	0.2
Delay (s)	30.3	17.0	2.7	73.5	9.2	5.8	41.1	34.0	32.3	48.5	33.9	25.6
Level of Service	C	B	A	E	A	A	D	C	C	D	C	C
Approach Delay (s)		17.6			13.7			36.6			39.8	
Approach LOS		B			B			D			D	

Intersection Summary

HCM Average Control Delay	18.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	100.1%	ICU Level of Service	G
Analysis Period (min)	15		

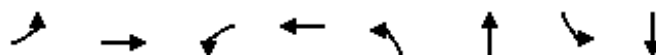
c Critical Lane Group

## APPENDIX C

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### 2031 FUTURE CONDITION SYNCHRO SUMMARY OUTPUTS





Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↰	↱↱↱	↰	↱↱↱		↱↱	↰	↱
Volume (vph)	128	2087	7	3186	15	6	94	6
Lane Group Flow (vph)	128	2091	7	3297	0	63	94	116
Turn Type	pm+pt		Perm		Perm		Perm	
Protected Phases	7	4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phases	7	4	8	8	2	2	6	6
Minimum Initial (s)	7.0	29.0	29.0	29.0	10.0	10.0	10.0	10.0
Minimum Split (s)	11.0	36.0	36.0	36.0	30.0	30.0	30.0	30.0
Total Split (s)	12.0	90.0	78.0	78.0	30.0	30.0	30.0	30.0
Total Split (%)	10.0%	75.0%	65.0%	65.0%	25.0%	25.0%	25.0%	25.0%
Yellow Time (s)	3.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lead/Lag	Lead		Lag	Lag				
Lead-Lag Optimize?	Yes		Yes	Yes				
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.84	0.64	0.09	1.01		0.20	0.40	0.36
Control Delay	66.2	10.0	4.9	22.0		29.1	46.5	11.6
Queue Delay	0.0	0.0	0.0	11.2		0.0	0.0	0.0
Total Delay	66.2	10.0	4.9	33.2		29.1	46.5	11.6
Queue Length 50th (m)	15.4	76.7	0.2	~36.9		7.4	17.6	1.0
Queue Length 95th (m)	#47.1	88.3	m0.3	#274.1		18.7	32.9	15.5
Internal Link Dist (m)		152.2		240.8		300.0		344.2
Turn Bay Length (m)	30.0		30.0				40.0	
Base Capacity (vph)	153	3283	78	3265		312	233	324
Starvation Cap Reductn	0	0	0	100		0	0	0
Spillback Cap Reductn	0	0	0	0		0	0	0
Storage Cap Reductn	0	0	0	0		0	0	0
Reduced v/c Ratio	0.84	0.64	0.09	1.04		0.20	0.40	0.36

**Intersection Summary**

Cycle Length: 120

Actuated Cycle Length: 120

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

Natural Cycle: 110

Control Type: Actuated-Coordinated

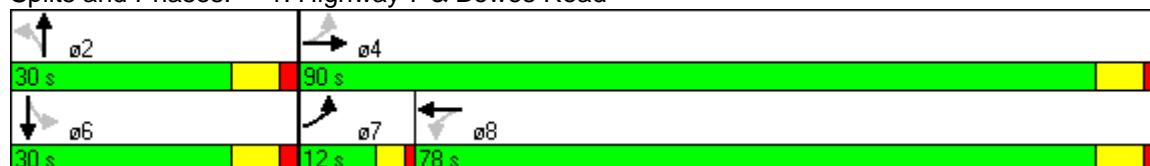
~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

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




















Queue shown is maximum after two cycles.

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

**Splits and Phases: 1: Highway 7 & Bowes Road**

2031 Future - Weekday AM Peak Hour  
1: Highway 7 & Bowes Road























HCM Signalized Intersection Capacity Analysis  
Highway 407 Transitway: GO Barrie (Concord) 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	
Lane Util. Factor	1.00	0.91		1.00	*1.00			1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00			0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00		1.00	1.00	
Frt	1.00	1.00		1.00	0.99			0.91		1.00	0.86	
Flt Protected	0.95	1.00		0.95	1.00			0.99		0.95	1.00	
Satd. Flow (prot)	1500	4579		1594	5289			1456		1415	1098	
Flt Permitted	0.05	1.00		0.08	1.00			0.92		0.72	1.00	
Satd. Flow (perm)	81	4579		126	5289			1362		1075	1098	
Volume (vph)	128	2087	4	7	3186	111	15	6	42	94	6	110
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)	128	2087	4	7	3186	111	15	6	42	94	6	110
RTOR Reduction (vph)	0	0	0	0	3	0	0	16	0	0	86	0
Lane Group Flow (vph)	128	2091	0	7	3294	0	0	47	0	94	30	0
Confl. Peds. (#/hr)			1	1			2		1	1		2
Heavy Vehicles (%)	19%	12%	0%	12%	6%	7%	43%	0%	7%	26%	20%	46%
Turn Type	pm+pt			Perm			Perm			Perm		
Protected Phases	7	4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	83.0	83.0		71.0	71.0			23.0		23.0	23.0	
Effective Green, g (s)	86.0	86.0		74.0	74.0			26.0		26.0	26.0	
Actuated g/C Ratio	0.72	0.72		0.62	0.62			0.22		0.22	0.22	
Clearance Time (s)	4.0	7.0		7.0	7.0			7.0		7.0	7.0	
Vehicle Extension (s)	3.0	5.0		5.0	5.0			3.0		3.0	3.0	
Lane Grp Cap (vph)	153	3282		78	3262			295		233	238	
v/s Ratio Prot	c0.06	0.46			c0.62						0.03	
v/s Ratio Perm	0.55			0.06			0.03			c0.09		
v/c Ratio	0.84	0.64		0.09	1.01		0.16			0.40	0.13	
Uniform Delay, d1	38.6	8.9		9.3	23.0		38.1			40.3	37.8	
Progression Factor	1.00	1.00		0.35	0.27		1.00			1.00	1.00	
Incremental Delay, d2	30.9	0.6		0.6	13.9		1.1			5.1	1.1	
Delay (s)	69.5	9.4		3.8	20.2		39.3			45.5	38.9	
Level of Service	E	A		A	C		D			D	D	
Approach Delay (s)		12.9			20.1		39.3				41.9	
Approach LOS		B			C		D				D	
<b>Intersection Summary</b>												
HCM Average Control Delay			18.4			HCM Level of Service				B		
HCM Volume to Capacity ratio			0.85									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)			12.0			
Intersection Capacity Utilization			100.3%			ICU Level of Service			G			
Analysis Period (min)			15									
c Critical Lane Group												



2031 Future - Weekday AM Peak Hour  
2: North Rivermede Road & Highway 7

Queues  
Highway 407 Transitway: GO Barrie (Concord) Station

											
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	9	239	918	296	153	200	1556	759	240	2210	18
Lane Group Flow (vph)	9	289	918	296	153	200	1556	759	240	2210	18
Turn Type	Split		Split		Free pm+pt			Free pm+pt			pm+ov
Protected Phases	4	4	8	8		5	2		1	6	4
Permitted Phases					Free	2		Free	6		6
Detector Phases	4	4	8	8		5	2		1	6	4
Minimum Initial (s)	10.0	10.0	10.0	10.0		7.0	15.0		7.0	15.0	10.0
Minimum Split (s)	22.0	22.0	37.0	37.0		11.0	37.0		11.0	37.0	22.0
Total Split (s)	22.0	22.0	34.0	34.0	0.0	13.0	47.0	0.0	17.0	51.0	22.0
Total Split (%)	18.3%	18.3%	28.3%	28.3%	0.0%	10.8%	39.2%	0.0%	14.2%	42.5%	18.3%
Yellow Time (s)	4.0	4.0	5.0	5.0		3.0	5.0		3.0	5.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lead/Lag						Lead	Lag		Lead	Lag	
Lead-Lag Optimize?						Yes	Yes		Yes	Yes	
Recall Mode	None	None	None	None		None	C-Max		None	C-Max	None
v/c Ratio	0.04	0.63	0.99	0.61	0.10	0.78	0.82	0.53	0.93	1.03	0.02
Control Delay	44.4	52.4	50.1	25.7	0.1	53.3	60.3	3.5	72.1	64.2	4.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.4	52.4	50.1	25.7	0.1	53.3	60.3	3.5	72.1	64.2	4.6
Queue Length 50th (m)	1.7	29.4	~74.5	44.5	0.0	38.0	119.8	11.5	38.0	~171.2	0.0
Queue Length 95th (m)	6.1	42.5	#139.4	m70.9	m0.0	m52.2	132.9	m75.9	#82.5	#195.4	2.9
Internal Link Dist (m)		189.3		627.9			578.0			181.4	
Turn Bay Length (m)	90.0		80.0		55.0	70.0		60.0	90.0		90.0
Base Capacity (vph)	237	504	928	482	1517	255	1888	1420	258	2143	858
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.04	0.57	0.99	0.61	0.10	0.78	0.82	0.53	0.93	1.03	0.02

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 42 (35%), Referenced to phase 2:NBTL and 6:SBTL, 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.
























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

Splits and Phases: 2: North Rivermede Road & Highway 7

			
ø1	ø2	ø4	ø8
17 s	47 s	22 s	34 s
			
ø5	ø6		
13 s	51 s		






























2031 Future - Weekday AM Peak Hour  
2: North Rivermede Road & Highway 7

HCM Signalized Intersection Capacity Analysis  
Highway 407 Transitway: GO Barrie (Concord) 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	4.0	4.0
Lane Util. Factor	1.00	0.95		*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	0.99	1.00	1.00	0.99	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		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	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Satd. Flow (prot)	1580	3261		3512	1824	1517	1740	5268	1420	1824	5472	1569
Flt Permitted	0.95	1.00		1.00	1.00	1.00	0.20	1.00	1.00	0.09	1.00	1.00
Satd. Flow (perm)	1580	3261		3512	1824	1517	348	5268	1420	155	5472	1569
Volume (vph)	9	239	50	918	296	153	200	1556	759	240	2210	18
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)	9	239	50	918	296	153	200	1556	759	240	2210	18
RTOR Reduction (vph)	0	15	0	0	0	0	0	0	0	0	0	9
Lane Group Flow (vph)	9	274	0	918	296	153	200	1556	759	240	2210	9
Confl. Peds. (#/hr)	1		4	4		1	2		4	4		2
Heavy Vehicles (%)	13%	7%	3%	7%	3%	4%	8%	7%	11%	3%	3%	0%
Turn Type	Split			Split		Free pm+pt			Free pm+pt		pm+ov	
Protected Phases	4	4		8	8		5	2		1	6	4
Permitted Phases						Free	2		Free	6		6
Actuated Green, G (s)	14.3	14.3		28.7	28.7	120.0	49.0	40.0	120.0	57.0	44.0	58.3
Effective Green, g (s)	16.3	16.3		31.7	31.7	120.0	52.0	43.0	120.0	60.0	47.0	63.3
Actuated g/C Ratio	0.14	0.14		0.26	0.26	1.00	0.43	0.36	1.00	0.50	0.39	0.53
Clearance Time (s)	6.0	6.0		7.0	7.0		4.0	7.0		4.0	7.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	5.0		3.0	5.0	3.0
Lane Grp Cap (vph)	215	443		928	482	1517	255	1888	1420	258	2143	880
v/s Ratio Prot	0.01	0.08		c0.26	0.16		0.06	0.30		c0.10	c0.40	0.00
v/s Ratio Perm						0.10	0.28		c0.53	0.36		0.00
v/c Ratio	0.04	0.62		0.99	0.61	0.10	0.78	0.82	0.53	0.93	1.03	0.01
Uniform Delay, d1	45.1	48.9		44.0	38.8	0.0	29.4	35.1	0.0	34.2	36.5	13.5
Progression Factor	1.00	1.00		0.54	0.53	1.00	1.99	1.62	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	2.6		23.3	1.8	0.1	10.3	2.9	1.0	37.6	28.0	0.0
Delay (s)	45.1	51.5		47.0	22.3	0.1	68.7	59.9	1.0	71.8	64.5	13.5
Level of Service	D	D		D	C	A	E	E	A	E	E	B
Approach Delay (s)		51.3			36.4			42.8			64.8	
Approach LOS		D			D			D			E	
<b>Intersection Summary</b>												
HCM Average Control Delay			50.1			HCM Level of Service				D		
HCM Volume to Capacity ratio			0.90									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)				8.0		
Intersection Capacity Utilization			103.7%			ICU Level of Service				G		
Analysis Period (min)			15									
c Critical Lane Group												

2031 Future - Weekday AM Peak Hour  
3: Highway 7 & Concord Land Access Road

Queues  
Highway 407 Transitway: GO Barrie (Concord) Station

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  			  			 				
Volume (vph)	90	1962	172	373	2711	55	152	5	199	320	10	190
Lane Group Flow (vph)	90	1962	172	373	2711	55	152	97	107	320	10	190
Turn Type	pm+pt		Perm	pm+pt		pm+ov	Perm		pm+ov	pm+pt		pm+ov
Protected Phases	7	4		3	8	1		2	3	1	6	7
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phases	7	4	4	3	8	1	2	2	3	1	6	7
Minimum Initial (s)	6.0	29.0	29.0	6.0	29.0	6.0	10.0	10.0	6.0	6.0	10.0	6.0
Minimum Split (s)	10.0	36.0	36.0	10.0	36.0	11.0	29.0	29.0	10.0	11.0	29.0	10.0
Total Split (s)	12.0	63.0	63.0	16.0	67.0	12.0	29.0	29.0	16.0	12.0	41.0	12.0
Total Split (%)	10.0%	52.5%	52.5%	13.3%	55.8%	10.0%	24.2%	24.2%	13.3%	10.0%	34.2%	10.0%
Yellow Time (s)	3.0	5.0	5.0	3.0	5.0	3.0	4.0	4.0	3.0	3.0	4.0	3.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	2.0	2.0	1.0	1.0	2.0	1.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lead		Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes
Recall Mode	None	Min	Min	None	Min	None	C-Max	C-Max	None	None	C-Max	None
v/c Ratio	0.53	0.75	0.23	0.81	0.96	0.05	0.59	0.27	0.22	0.86	0.02	0.30
Control Delay	32.5	19.0	4.1	17.8	11.6	2.8	53.7	10.9	24.2	60.9	29.1	25.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.5	19.0	4.1	17.8	11.6	2.8	53.7	10.9	24.2	60.9	29.1	25.8
Queue Length 50th (m)	6.6	94.2	2.8	31.4	64.2	1.4	30.1	0.9	13.8	58.0	1.5	27.4
Queue Length 95th (m)	m18.5	97.3	7.3	m30.1	m63.0	m1.4	50.9	14.4	27.2	#102.6	5.2	43.5
Internal Link Dist (m)		240.8			578.0			61.8			124.6	
Turn Bay Length (m)	50.0		40.0	60.0		40.0	40.0		40.0	90.0		40.0
Base Capacity (vph)	182	2599	750	461	2828	1021	256	362	480	370	568	640
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.49	0.75	0.23	0.81	0.96	0.05	0.59	0.27	0.22	0.86	0.02	0.30

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 12 (10%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 110













Control Type: Actuated-Coordinated

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

Queue shown is maximum after two cycles.

























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

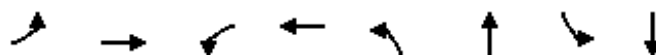
Splits and Phases: 3: Highway 7 & Concord Land Access Road

					
ø1	ø2		ø3	ø4	
12 s	29 s		16 s	63 s	
					
ø6		ø7	ø8		
41 s		12 s	67 s		

2031 Future - Weekday AM Peak Hour  
3: Highway 7 & Concord Land Access Road

HCM Signalized Intersection Capacity Analysis  
Highway 407 Transitway: GO Barrie (Concord) 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	4.0	4.0	4.0
Lane Util. Factor	1.00	*1.00	1.00	1.00	*1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00
Satd. Flow (prot)	1785	5268	1413	1789	5318	1597	1552	1385	1367	1842	1842	1566
Flt Permitted	0.07	1.00	1.00	0.30	1.00	1.00	0.75	1.00	1.00	0.55	1.00	1.00
Satd. Flow (perm)	127	5268	1413	537	5318	1597	1227	1385	1367	1022	1842	1566
Volume (vph)	90	1962	172	373	2711	55	152	5	199	320	10	190
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)	90	1962	172	373	2711	55	152	5	199	320	10	190
RTOR Reduction (vph)	0	0	53	0	0	13	0	73	14	0	0	1
Lane Group Flow (vph)	90	1962	119	373	2711	42	152	24	93	320	10	189
Heavy Vehicles (%)	0%	7%	13%	5%	6%	0%	15%	2%	11%	2%	2%	2%
Turn Type	pm+pt		Perm	pm+pt		pm+ov	Perm		pm+ov	pm+pt		pm+ov
Protected Phases	7	4		3	8	1		2	3	1	6	7
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	63.4	56.2	56.2	72.0	60.8	68.8	23.0	23.0	34.8	35.0	35.0	42.2
Effective Green, g (s)	66.4	59.2	59.2	75.0	63.8	71.8	25.0	25.0	36.8	37.0	37.0	44.2
Actuated g/C Ratio	0.55	0.49	0.49	0.62	0.53	0.60	0.21	0.21	0.31	0.31	0.31	0.37
Clearance Time (s)	4.0	7.0	7.0	4.0	7.0	4.0	6.0	6.0	4.0	4.0	6.0	4.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	170	2599	697	459	2827	1009	256	289	465	370	568	629
v/s Ratio Prot	0.03	0.37		c0.08	c0.51	0.00		0.02	0.02	c0.06	0.01	0.02
v/s Ratio Perm	0.26		0.08	0.43		0.02	0.12		0.05	c0.21		0.10
v/c Ratio	0.53	0.75	0.17	0.81	0.96	0.04	0.59	0.08	0.20	0.86	0.02	0.30
Uniform Delay, d1	23.7	24.5	16.8	18.0	26.8	9.9	42.9	38.3	30.7	38.8	28.9	26.9
Progression Factor	1.52	0.70	0.49	1.31	0.34	0.62	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.3	1.2	0.2	1.1	1.2	0.0	9.8	0.6	0.2	18.5	0.1	0.3
Delay (s)	38.4	18.4	8.4	24.6	10.4	6.2	52.7	38.8	30.9	57.4	28.9	27.2
Level of Service	D	B	A	C	B	A	D	D	C	E	C	C
Approach Delay (s)		18.4			12.0			42.4			45.8	
Approach LOS		B			B			D			D	
<b>Intersection Summary</b>												
HCM Average Control Delay			18.8				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			93.0%				ICU Level of Service			F		
Analysis Period (min)			15									
c Critical Lane Group												



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	←	↑↑↑	←	↑↑↑		↑	←	↑
Volume (vph)	54	3440	31	2412	9	5	199	10
Lane Group Flow (vph)	54	3446	31	2477	0	35	199	258
Turn Type	pm+pt		pm+pt		Perm		Perm	
Protected Phases	7	4	3	8		2		6
Permitted Phases	4		8		2		6	
Detector Phases	7	4	3	8	2	2	6	6
Minimum Initial (s)	7.0	29.0	7.0	29.0	10.0	10.0	10.0	10.0
Minimum Split (s)	11.0	36.0	11.0	36.0	30.0	30.0	30.0	30.0
Total Split (s)	11.0	79.0	11.0	79.0	30.0	30.0	30.0	30.0
Total Split (%)	9.2%	65.8%	9.2%	65.8%	25.0%	25.0%	25.0%	25.0%
Yellow Time (s)	3.0	5.0	3.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0
Lead/Lag	Lead	Lag	Lead	Lag				
Lead-Lag Optimize?	Yes	Yes	Yes	Yes				
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.41	0.95	0.21	0.78		0.10	0.64	0.65
Control Delay	20.6	27.2	13.3	14.4		21.6	53.6	34.3
Queue Delay	0.0	15.4	0.0	0.0		0.0	0.0	0.0
Total Delay	20.6	42.6	13.3	14.4		21.6	53.6	34.3
Queue Length 50th (m)	3.1	~240.7	1.8	67.0		2.4	39.6	31.2
Queue Length 95th (m)	11.9	#281.0	m2.9	86.6		10.3	63.1	58.1
Internal Link Dist (m)		195.5		227.2		276.1		214.7
Turn Bay Length (m)	30.0		30.0				40.0	
Base Capacity (vph)	133	3620	150	3192		346	309	396
Starvation Cap Reductn	0	0	0	0		0	0	0
Spillback Cap Reductn	0	277	0	0		1	0	0
Storage Cap Reductn	0	0	0	0		0	0	0
Reduced v/c Ratio	0.41	1.03	0.21	0.78		0.10	0.64	0.65

**Intersection Summary**

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 117 (98%), Referenced to phase 2:NBTL and 6:SBTL, 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.



























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























**Splits and Phases: 1: Highway 7 & Bowes Road**

↑ ø2	↙ ø3	→ ø4
30 s	11 s	79 s
↓ ø6	↘ ø7	← ø8
30 s	11 s	79 s

2031 Future - Weekday PM Peak Hour  
1: Highway 7 & Bowes Road

HCM Signalized Intersection Capacity Analysis  
Highway 407 Transitway: GO Barrie (Concord) 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	
Lane Util. Factor	1.00	*1.00		1.00	*0.95			1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00			0.99		1.00	0.97	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00		1.00	1.00	
Frt	1.00	1.00		1.00	1.00			0.92		1.00	0.86	
Flt Protected	0.95	1.00		0.95	1.00			0.99		0.95	1.00	
Satd. Flow (prot)	1417	5469		1594	4959			1684		1709	1463	
Flt Permitted	0.05	1.00		0.05	1.00			0.84		0.80	1.00	
Satd. Flow (perm)	75	5469		86	4959			1438		1432	1463	
Volume (vph)	54	3440	6	31	2412	65	9	5	21	199	10	248
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)	54	3440	6	31	2412	65	9	5	21	199	10	248
RTOR Reduction (vph)	0	0	0	0	2	0	0	17	0	0	80	0
Lane Group Flow (vph)	54	3446	0	31	2475	0	0	18	0	199	178	0
Confl. Peds. (#/hr)	5		1	1		5	12		3	3		12
Heavy Vehicles (%)	26%	3%	20%	12%	7%	25%	0%	0%	0%	4%	0%	7%
Turn Type	pm+pt			pm+pt			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	82.0	76.4		79.2	75.0			21.4		21.4	21.4	
Effective Green, g (s)	85.0	79.4		82.2	78.0			24.4		24.4	24.4	
Actuated g/C Ratio	0.71	0.66		0.68	0.65			0.20		0.20	0.20	
Clearance Time (s)	4.0	7.0		4.0	7.0			7.0		7.0	7.0	
Vehicle Extension (s)	3.0	5.0		3.0	5.0			3.0		3.0	3.0	
Lane Grp Cap (vph)	116	3619		112	3223			292		291	297	
v/s Ratio Prot	c0.02	c0.63		0.01	0.50						0.12	
v/s Ratio Perm	0.31			0.18				0.01		c0.14		
v/c Ratio	0.47	0.95		0.28	0.77			0.06		0.68	0.60	
Uniform Delay, d1	14.4	18.6		25.4	14.7			38.6		44.2	43.3	
Progression Factor	1.00	1.00		2.20	0.82			1.00		1.00	1.00	
Incremental Delay, d2	2.9	7.1		0.8	0.9			0.4		12.3	8.6	
Delay (s)	17.4	25.6		56.7	12.9			39.0		56.5	51.9	
Level of Service	B	C		E	B			D		E	D	
Approach Delay (s)		25.5			13.5			39.0			53.9	
Approach LOS		C			B			D			D	
<b>Intersection Summary</b>												
HCM Average Control Delay			22.9			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.85									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)			8.0			
Intersection Capacity Utilization			92.4%			ICU Level of Service			F			
Analysis Period (min)			15									
c Critical Lane Group												

											
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	38	444	666	195	161	96	2354	1353	297	1998	19
Lane Group Flow (vph)	38	511	666	195	161	96	2354	1353	297	1998	19
Turn Type	Split		Split		Free	pm+pt		Free	pm+pt		pm+ov
Protected Phases	4	4	8	8		5	2		1	6	4
Permitted Phases					Free	2		Free	6		6
Detector Phases	4	4	8	8		5	2		1	6	4
Minimum Initial (s)	10.0	10.0	10.0	10.0		6.0	15.0		6.0	15.0	10.0
Minimum Split (s)	22.0	22.0	36.0	36.0		10.0	37.0		10.0	37.0	22.0
Total Split (s)	22.0	22.0	34.0	34.0	0.0	10.0	53.0	0.0	11.0	54.0	22.0
Total Split (%)	18.3%	18.3%	28.3%	28.3%	0.0%	8.3%	44.2%	0.0%	9.2%	45.0%	18.3%
Yellow Time (s)	4.0	4.0	5.0	5.0		3.0	5.0		3.0	5.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lead/Lag						Lead	Lag		Lead	Lag	
Lead-Lag Optimize?						Yes	Yes		Yes	Yes	
Recall Mode	None	None	None	None		None	C-Max		None	C-Max	None
v/c Ratio	0.15	0.93	0.77	0.42	0.11	0.64	1.04	0.88	0.83	0.88	0.02
Control Delay	46.3	73.7	35.0	27.9	0.1	36.8	73.7	15.5	44.0	38.0	4.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.3	73.7	35.0	27.9	0.1	36.8	73.7	15.5	44.0	38.0	4.1
Queue Length 50th (m)	7.3	54.1	53.0	29.3	0.0	16.8	~181.4	197.8	37.3	131.2	0.0
Queue Length 95th (m)	16.7	#82.3	74.5	45.3	0.0	m17.7	#167.3m	191.6	#70.5	149.2	2.8
Internal Link Dist (m)		190.6		633.5			581.9			486.0	
Turn Bay Length (m)	90.0		180.0		55.0	70.0		60.0	90.0		90.0
Base Capacity (vph)	246	550	870	465	1521	151	2256	1545	356	2263	782
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.15	0.93	0.77	0.42	0.11	0.64	1.04	0.88	0.83	0.88	0.02

## Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 40 (33%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 125

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.

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
























Splits and Phases: 2: Centre street &amp; Highway 7

											
11 s	53 s		22 s	34 s							
											
10 s	54 s										



2031 Future - Weekday PM Peak Hour  
2: Centre street & Highway 7































HCM Signalized Intersection Capacity Analysis  
Highway 407 Transitway: GO Barrie (Concord) 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	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	*1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.99	1.00	1.00	0.97
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00
Satd. Flow (prot)	1638	3594		3479	1860	1521	1733	5526	1545	1824	5420	1364
Flt Permitted	0.95	1.00		1.00	1.00	1.00	0.08	1.00	1.00	0.32	1.00	1.00
Satd. Flow (perm)	1638	3594		3479	1860	1521	149	5526	1545	584	5420	1364
Volume (vph)	38	444	67	666	195	161	96	2354	1353	297	1998	19
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)	38	444	67	666	195	161	96	2354	1353	297	1998	19
RTOR Reduction (vph)	0	11	0	0	0	0	0	0	0	0	0	8
Lane Group Flow (vph)	38	500	0	666	195	161	96	2354	1353	297	1998	11
Confl. Peds. (#/hr)	23		18	18		23	14		4	4		14
Heavy Vehicles (%)	9%	1%	9%	8%	1%	3%	3%	2%	2%	3%	4%	13%
Turn Type	Split			Split		Free pm+pt			Free pm+pt		pm+ov	
Protected Phases	4	4		8	8		5	2		1	6	4
Permitted Phases						Free	2		Free	6		6
Actuated Green, G (s)	16.0	16.0		26.7	26.7	120.0	52.2	46.0	120.0	54.4	47.1	63.1
Effective Green, g (s)	18.0	18.0		29.7	29.7	120.0	55.2	49.0	120.0	57.4	50.1	68.1
Actuated g/C Ratio	0.15	0.15		0.25	0.25	1.00	0.46	0.41	1.00	0.48	0.42	0.57
Clearance Time (s)	6.0	6.0		7.0	7.0		4.0	7.0		4.0	7.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	5.0		3.0	5.0	3.0
Lane Grp Cap (vph)	246	539		861	460	1521	150	2256	1545	355	2263	820
v/s Ratio Prot	0.02	0.14		0.19	0.10		0.03	c0.43		0.05	0.37	0.00
v/s Ratio Perm						0.11	0.26		c0.88	0.35		0.01
v/c Ratio	0.15	0.93		0.77	0.42	0.11	0.64	1.04	0.88	0.84	0.88	0.01
Uniform Delay, d1	44.4	50.4		42.0	38.0	0.0	25.0	35.5	0.0	63.2	32.2	11.3
Progression Factor	1.00	1.00		0.67	0.65	1.00	1.65	1.45	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	22.2		4.2	0.6	0.1	3.0	24.5	2.6	15.6	5.4	0.0
Delay (s)	44.7	72.5		32.5	25.5	0.1	44.4	76.0	2.6	78.8	37.7	11.3
Level of Service	D	E		C	C	A	D	E	A	E	D	B
Approach Delay (s)		70.6			26.1			49.1			42.7	
Approach LOS		E			C			D			D	
<b>Intersection Summary</b>												
HCM Average Control Delay			45.7			HCM Level of Service				D		
HCM Volume to Capacity ratio			0.95									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)				4.0		
Intersection Capacity Utilization			113.6%			ICU Level of Service				H		
Analysis Period (min)			15									
c Critical Lane Group												



2031 Future - Weekday PM Peak Hour  
3: Highway 7 & Concord Land Access

Queues  
Highway 407 Transitway: GO Barrie (Concord) Station

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  			  			 			 	
Volume (vph)	375	3076	231	280	2084	225	252	10	416	250	5	150
Lane Group Flow (vph)	375	3076	231	280	2084	225	252	218	208	250	5	150
Turn Type	pm+pt		Perm	pm+pt		Perm	Perm		pm+ov	Perm		pm+ov
Protected Phases	7	4		3	8			2	3		6	7
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phases	7	4	4	3	8	8	2	2	3	6	6	7
Minimum Initial (s)	7.0	29.0	29.0	6.0	29.0	29.0	10.0	10.0	6.0	10.0	10.0	7.0
Minimum Split (s)	11.0	36.0	36.0	10.0	36.0	36.0	29.0	29.0	10.0	29.0	29.0	11.0
Total Split (s)	23.0	69.0	69.0	12.0	57.0	57.0	39.0	39.0	12.0	39.0	39.0	23.0
Total Split (%)	19.2%	57.5%	57.5%	10.0%	47.5%	47.5%	32.5%	32.5%	10.0%	32.5%	32.5%	19.2%
Yellow Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	4.0	4.0	3.0	4.0	4.0	3.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	1.0	2.0	2.0	1.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag			Lead			Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes			Yes			Yes
Recall Mode	None	None	None	None	None	None	C-Max	C-Max	None	None	None	None
v/c Ratio	0.88	1.04	0.28	0.99	0.82	0.28	0.66	0.42	0.37	1.00	0.01	0.21
Control Delay	35.2	39.1	3.2	56.5	13.2	3.5	47.2	16.2	28.3	99.2	30.4	19.8
Queue Delay	0.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.2	40.8	3.2	56.5	13.2	3.5	47.2	16.2	28.3	99.2	30.4	19.8
Queue Length 50th (m)	38.1	~235.9	2.3	29.1	47.6	5.9	48.0	14.6	33.3	54.2	0.8	18.6
Queue Length 95th (m)	m42.8	#257.5	m2.6	m#28.9	m84.9	m7.2	75.4	35.7	52.8	#102.7	3.6	29.7
Internal Link Dist (m)		227.2			581.9			218.9			114.3	
Turn Bay Length (m)	50.0		40.0	60.0		40.0	40.0		40.0	90.0		40.0
Base Capacity (vph)	479	2964	832	284	2544	818	379	520	566	251	537	758
Starvation Cap Reductn	0	13	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.78	1.04	0.28	0.99	0.82	0.28	0.66	0.42	0.37	1.00	0.01	0.20

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

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

Natural Cycle: 120

Control Type: Actuated-Coordinated

~ Volume exceeds capacity, queue is theoretically infinite.

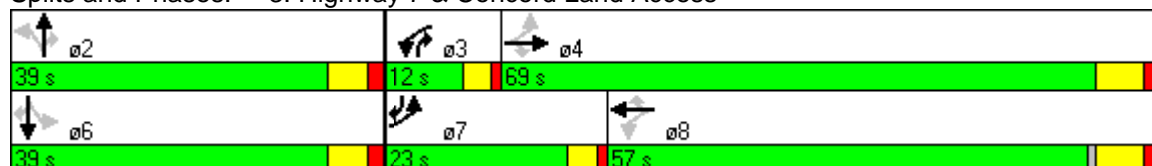
Queue shown is maximum after two cycles.

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

Queue shown is maximum after two cycles.































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

Splits and Phases: 3: Highway 7 & Concord Land Access



2031 Future - Weekday PM Peak Hour  
3: Highway 7 & Concord Land Access

HCM Signalized Intersection Capacity Analysis  
Highway 407 Transitway: GO Barrie (Concord) 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	4.0	4.0	4.0
Lane Util. Factor	1.00	*1.00	1.00	1.00	*1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86	0.85	1.00	1.00	0.85
Flt Protected	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1879	5472	1452	1740	5268	1566	1638	1459	1445	1750	1842	1566
Flt Permitted	0.20	1.00	1.00	0.20	1.00	1.00	0.75	1.00	1.00	0.47	1.00	1.00
Satd. Flow (perm)	376	5472	1452	348	5268	1566	1301	1459	1445	861	1842	1566
Volume (vph)	375	3076	231	280	2084	225	252	10	416	250	5	150
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)	375	3076	231	280	2084	225	252	10	416	250	5	150
RTOR Reduction (vph)	0	0	45	0	0	62	0	94	0	0	0	1
Lane Group Flow (vph)	375	3076	186	280	2084	163	252	124	208	250	5	149
Heavy Vehicles (%)	0%	3%	10%	8%	7%	2%	9%	2%	5%	2%	2%	2%
Turn Type	pm+pt		Perm	pm+pt		Perm	Perm		pm+ov	Perm		pm+ov
Protected Phases	7	4		3	8			2	3		6	7
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	74.0	62.0	62.0	62.9	54.9	54.9	33.0	33.0	41.0	33.0	33.0	48.1
Effective Green, g (s)	77.0	65.0	65.0	65.9	57.9	57.9	35.0	35.0	43.0	35.0	35.0	50.1
Actuated g/C Ratio	0.64	0.54	0.54	0.55	0.48	0.48	0.29	0.29	0.36	0.29	0.29	0.42
Clearance Time (s)	4.0	7.0	7.0	4.0	7.0	7.0	6.0	6.0	4.0	6.0	6.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	430	2964	787	284	2542	756	379	426	566	251	537	706
v/s Ratio Prot	c0.11	c0.56		0.07	0.40			0.08	0.02		0.00	0.03
v/s Ratio Perm	0.45		0.13	0.48		0.10	0.19		0.12	c0.29		0.07
v/c Ratio	0.87	1.04	0.24	0.99	0.82	0.22	0.66	0.29	0.37	1.00	0.01	0.21
Uniform Delay, d1	19.7	27.5	14.5	34.4	26.6	17.9	37.3	32.9	28.5	42.4	30.2	22.3
Progression Factor	1.88	0.57	0.35	1.44	0.42	0.34	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.4	21.8	0.1	33.3	1.1	0.1	8.9	1.7	0.4	55.3	0.0	0.1
Delay (s)	44.4	37.5	5.1	82.7	12.2	6.2	46.2	34.6	28.9	97.8	30.2	22.5
Level of Service	D	D	A	F	B	A	D	C	C	F	C	C
Approach Delay (s)		36.2			19.3			37.2			69.1	
Approach LOS		D			B			D			E	
<b>Intersection Summary</b>												
HCM Average Control Delay			32.1			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.99									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)			8.0			
Intersection Capacity Utilization			111.2%			ICU Level of Service			H			
Analysis Period (min)			15									
c Critical Lane Group												