



# Reid Road Reservoir Quarry Transportation Impact Study (Updated)



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## Reid Road Reservoir Quarry Transportation Impact Study (Update)



Signature

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# Executive Summary

## Content

This report summarizes the Traffic Impact Study for the proposed Reid Road Reservoir Quarry located on Part of Lot 7, Concession 2 Town of Milton, Regional Municipality of Halton.

This report update addresses the Transportation comments received from the Joint Agency Review Team (JART).

This report documents the forecast traffic estimated to occur because of the operation and estimates the impact on the surrounding road network. The findings, conclusions, and recommendations of this study are summarized below and outlined in detail in the body of the report.

## Key Assumptions

The Reid Road Reservoir Quarry is proposed to be licensed for an annual shipping rate of 990,000 tonnes per year. The material will be shipped to/from the east via Highway 401. Vehicle access to the site is proposed by the existing driveway to Reid Sideroad that previously served the former Pit operation. The driveway forms the west leg to the Reid Sideroad intersection with Twiss Road.

The heavy vehicle trips associated with hauling of the material have been converted to Passenger Car Equivalents (PCE). As directed by JART comments, loaded trips use a PCE factor of 3.0. Empty trips use a PCE factor of 2.0. Heavy vehicles documented on the existing road network use a PCE of 3.0.

## Conclusions

The main findings and conclusions of this study are as follows:

- ▶ **Existing Traffic Conditions:** All study area intersections are operating with acceptable levels of service. No movements are considered critical.
- ▶ **Site Generated Traffic:** The maximum amount of material shipped to market is expected to be 990,000 tonnes per year. The shipping of material from the subject site is forecast to generate approximately 16 inbound and 16 outbound truck trips per hour during the AM peak hour. During the PM peak hour, the subject site is estimated to generate approximately 3 inbound and 3 outbound truck trips per hour.



Converting the truck trips to PCE and accounting for approximately 10% of inbound trucks containing recycled material, the AM peak hour PCE trip generation is 34 inbound and 48 outbound. The PM peak hour PCE trip generation is estimated to be 7 inbound and 9 outbound.

- ▶ **Haul Route:** The haul route utilized by traffic generated by the subject site is east/west along Reid Sideroad to the Provincial Highway, Highway 401.

The material will be shipped to/from the east via Highway 401. The applicant does not intend to ship material to/from the west as an alternative source location is better suited to meet market demands west of the site.

- ▶ **Forecast Traffic:** The forecast background traffic volumes near the subject site have been assessed for three horizon years. Namely the anticipated opening date of the proposed Reid Road Reservoir Quarry (2020) and five-year (2025) and ten-year (2030) horizons following the opening date. The likely future traffic volumes are estimated to consist of generalized background traffic growth.

- ▶ **Future Traffic Conditions:** The capacity deficiencies identified under the existing conditions will continue to occur with the addition of background traffic and site generated traffic. The capacity deficiencies are not directly related to the operation of the subject site. To improve the operations, changes to the existing form of stop control could be considered.

- ▶ **Remedial Measures:** The existing form of traffic control at the Highway 401 Eastbound and Westbound Off-Ramps requires improvement regardless of the proposed quarry operation.

The forecast traffic volumes do not satisfy the OTM Book 12 signal warrant requirements. Unwarranted traffic control signals could be considered by the MTO for implementation.

The introduction of unwarranted traffic control signals provides the additional capacity necessary to accommodate both non-site growth in traffic and traffic generated by the subject site.

As concluded by the safety report, an unwarranted traffic signal, if installed, at the intersection Reid Sideroad and the Highway 401 ramps would result in an additional crash every 18 to 23 years. The lifespan of the subject site is estimated to be about 20 years. The decision to implement an unwarranted signal is a policy decision to be made by the MTO. In any event, signalization is not an antecedent to opening the [subject site], from a safety perspective.





## Recommendations

Based on the findings of this study, if a Licence is issued by the Province, it is recommended that:

- ▶ The MTO consider implementing unwarranted traffic control signals at the Reid Sideroad and Guelph Line Off-Ramp with the Highway 401 to accommodate the existing and forecast background and total traffic volumes. The design of the signalized intersection at Reid Sideroad may require additional storage for the westbound right-turn movement.
- ▶ The applicant coordinate with the Halton Region and Town of Milton to install advance warning signage on the Reid Sideroad approaches to Milton Fire Station 2. The advance warning signage should indicate an EMS entrance ahead. Supplementary pavement markings should also be considered.

Based on the findings of this study, no other roadway or traffic control improvements are required or recommended to accommodate the future traffic within the study area.



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# 1 Introduction

## 1.1 Overview

James Dick Construction Limited (JDCL) retained Paradigm Transportation Solutions Limited (Paradigm) to carry out this Traffic Impact Study (TIS) for the proposed Reid Road Reservoir Quarry.

This report update addresses the Transportation comments received from the Joint Agency Review Team (JART) comments date January 2020 and May 2020.

The quarry is located on Part of Lot 7, Concession 2 Town of Milton, Regional Municipality of Halton. The subject site is zoned Extractive Industrial (MX)1 in the Town of Milton's zoning by-law 144-2003.

This study determines the impacts of additional traffic on the surrounding road network, and the remedial measures necessary (if any) to accommodate future traffic in a satisfactory manner. The scope of the study includes:

- ▶ assessment of the current traffic and site conditions within the study area;
- ▶ estimates of background traffic growth;
- ▶ estimates of additional traffic generated by the operations of the proposed Reid Road Reservoir Quarry;
- ▶ analyses of the impact of the future traffic on the surrounding road network; and
- ▶ recommendations necessary to mitigate this future traffic in a satisfactory manner.

The lands were formerly occupied by the Springbank Pit. The pit was estimated to generate approximately 130 trucks per day<sup>2</sup>. A portion of the site is currently used as a storage and construction yard in association with Highway 401 construction north of the site.

Materials shipped to market will travel east to/from the Greater Toronto Area (GTA) via Highway 401. The applicant does not intend to ship material to/from the west as an alternative source location is better suited to meet market demands.

<sup>1</sup> Town of Milton Zoning By-law 144-2003 (Rural Area), April 2016 Consolidation

<sup>2</sup> RE Springbank Sand and Gravel Ltd. B.E. Smith and H.E. Steward – February 16, 1976 Ontario Municipal Board Reports.



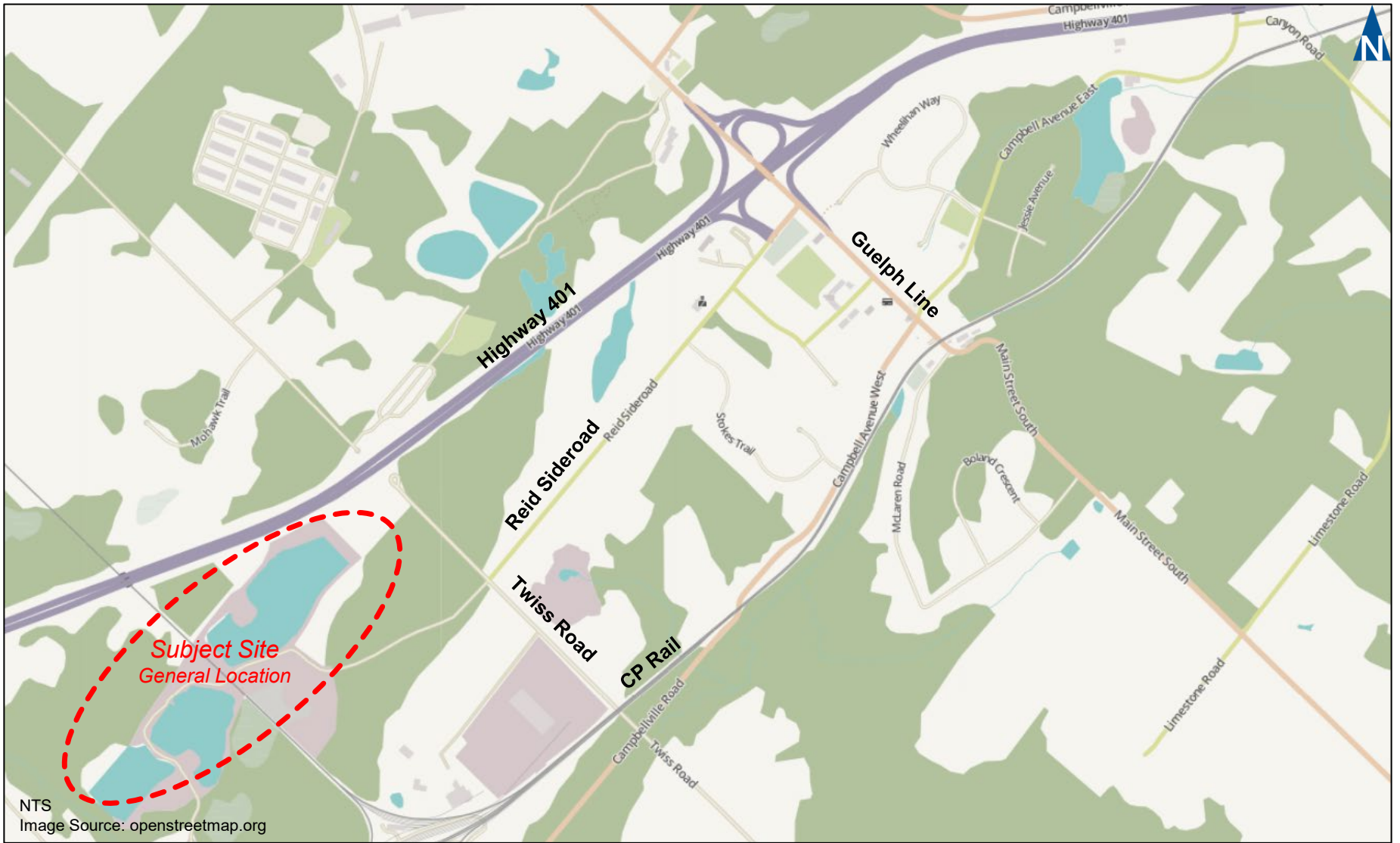
**Figure 1.1** illustrates the general location of the subject site. The licensed area measures approximately 29 hectares.

## 1.2 Study Area

The haul route intersections assessed in this study include:

- ▶ Guelph Line & Highway 401 North Ramp;
- ▶ Guelph Line & Reid Sideroad;
- ▶ Reid Sideroad & Highway 401 South Ramp;
- ▶ Reid Sideroad & Carpool Lot; and
- ▶ Reid Sideroad & Twiss Road.





## Location of Subject Site



## 2 Existing Conditions

### 2.1 Road Network

The roadways of interest within the study area include:

- ▶ **Highway 401**, an east/west 400-series highway that provides interregional travel between Windsor and the Ontario-Quebec border. Within the immediate study area, the highway has a 6-lane cross section with a posted speed limit of 100 km/h. A partial interchange is provided to Reid Sideroad and Guelph Line. The ramp terminal approaches operate under stop control.
- ▶ **Guelph Line**, a north/south major arterial Regional roadway with a two-lane cross-section. The intersection with Reid Sideroad is signalized. Auxiliary left-turn and right-turn lanes are provided on all approaches to the Reid Sideroad intersection. The posted speed limit within the study area is 50 km/h. Sidewalk facilities are present along the west side of this roadway from south of Reid Sideroad to the Highway 401 bridge.
- ▶ **Reid Sideroad**, an east/west local roadway. The roadway was constructed in conjunction with the approval of the former Springbank Pit in the late 1970's. The posted speed limit from Guelph Line to approximately 400 m west of Guelph Line is 60 km/h. Beyond this location, the posted speed limit is 70 km/h. The intersection with Twiss Road operates under two-way stop control for the eastbound and westbound approaches. No visible pedestrian or cycling infrastructure is noted along this roadway.

As per Schedule 26, By-Law No. 1984-1, heavy vehicles are restricted on this roadway west of the Highway 401 ramp. However, local deliveries are permitted, and the road accommodates trucks from the Campbellville Industrial Park.

Milton Fire Station 2 is located approximately 420 m west of Guelph Line at 2665 Reid Sideroad. The station operates with two driveways to Reid Sideroad with the western most driveway functioning as an outbound approach for emergency response vehicles.

- ▶ **Twiss Road**, a north/south rural local roadway. The speed limit is posted at 70 km/h. No visible pedestrian or cycling infrastructure is noted along this roadway. Heavy vehicles are restricted south of the entrance to the Campbellville Industrial Park located approximately 220 m south of Reid Sideroad. Twiss Road was recently reconstructed between the entrance to



the industrial park and Reid Sideroad to improve safety, structural and pavement deficiencies and to accommodate heavy truck traffic.

## 2.2 Existing Traffic Volumes

### 2.2.1 Turning Movement Count Data

**Table 2.1** summarizes location and date of the existing turning movement count (TMC) data collected using Miovision Scout Unit technology. TMC data was collected during February 2017.

**Appendix A** contains the detailed existing count data.

**TABLE 2.1: EXISTING COUNT DATA SUMMARY**

Intersection	Date	Peak Hour	
		AM	PM
Guelph Line & Highway 401 WB Ramp	Tuesday, 7 February, 2017	07:15	16:30
Guelph Line & Reid Sideroad	Wednesday, 8 February, 2017	07:30	-
	Thursday, 16 February, 2017	-	16:30
Guelph Line & Highway 401 EB Ramp	Tuesday, 7 February, 2017	07:30	16:30
Reid Sideroad & Highway 401 EB Ramp	Tuesday, 7 February, 2017	07:15	16:45
Reid Sideroad & Carpool Lot	Tuesday, 7 February, 2017	07:15	16:15
Reid Sideroad & Twiss Rd	Tuesday, 7 February, 2017	07:30	16:15

### 2.2.2 Winter Average Daily Traffic Adjustments

The collected TMC data represents Winter Average Daily Traffic (WADT) conditions. These volumes have been factored to a Summer Average Daily Traffic (SADT) condition using a factor of 1.25 (SADT/WADT) derived from historical traffic volumes for Highway 401<sup>3</sup>. The site's shipping activity is expected to peak during the summer months (see **Table 3.1**). The use of SADT volumes reflects a peak condition for the site and the adjacent major roadways.

**Appendix A** contains the historical traffic volumes for Highway 401.

<sup>3</sup> Provincial Highway Traffic Volumes 1988-2016, (401 Guelph Line IC-312-Halton Road 1-Milton)



### 2.2.3 Passenger Car Units (PCE) Factor

The heavy vehicles documented in the existing count data have been converted to passenger car units (PCE) using a factor of 2.0 PCE per vehicle.

A PCE is used for more conservative analyses, as it accounts for the relative performance of vehicles. Heavy vehicles take up more time and space. More importantly they have lower acceleration/deceleration rates.

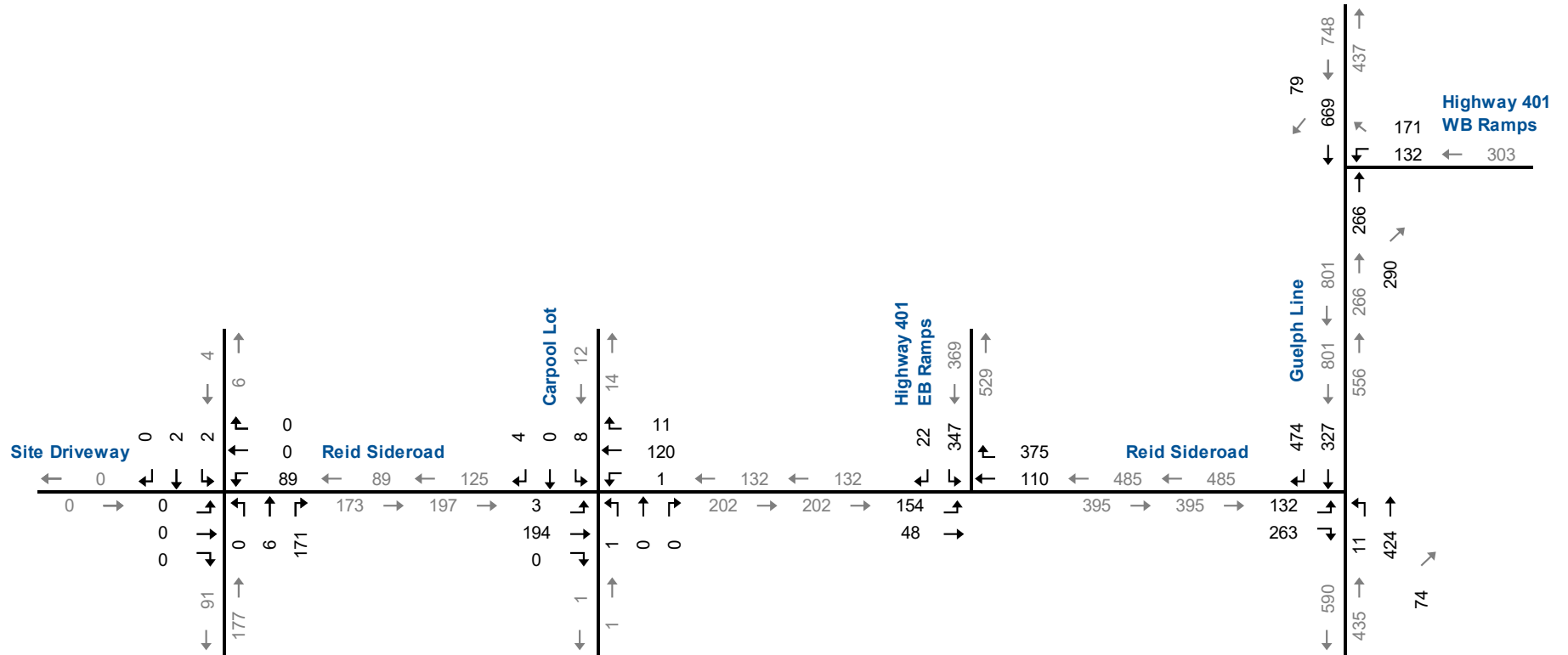
The heavy vehicle trips associated with hauling of the material from the subject site have been converted to Passenger Car Equivalents (PCE). As directed by JART comments, loaded trips use a PCE factor of 3.0 and empty trips use a PCE factor of 2.0.

**Figure 2.1A** and **Figure 2.1B** illustrate the existing AM and PM peak hour traffic volumes (PCE's). Volumes along Guelph Line between Reid Sideroad and the Highway 401 westbound ramp are balance to ensure reasonable traffic volumes are maintained between intersections. The following traffic characteristics are noted:

- ▶ The AM peak hour of the adjacent roadways occurs generally between 07:15-08:15 and 07:30-08:30;
- ▶ The PM peak hour of the adjacent roadways occurs generally between 16:15-17:15 and 16:45-17:45; and
- ▶ Little pedestrian traffic was observed at the study area intersections.
- ▶ Traffic volumes are highest along the Guelph Line corridor and along Reid Sideroad between the Highway 401 ramps and Guelph Line.
- ▶ Observed heavy vehicle percentages on study area roadways include:
  - Reid Sideroad west of Carpool Lot – 4% AM, 8% PM;
  - Twiss Road south of Reid Sideroad – 5% AM, 8% PM;
  - Guelph Line north of Reid Sideroad – 4% AM, 2% PM;
  - Guelph Line south of Reid Sideroad – 5% AM, 1% PM;
  - Highway 401 North Ramps – 7% AM, 1% PM; and
  - Highway 401 South Ramps – 5% AM, 2% PM.

**Appendix G** contains the design-hour detailed vehicle classifications breakdown by horizon year.

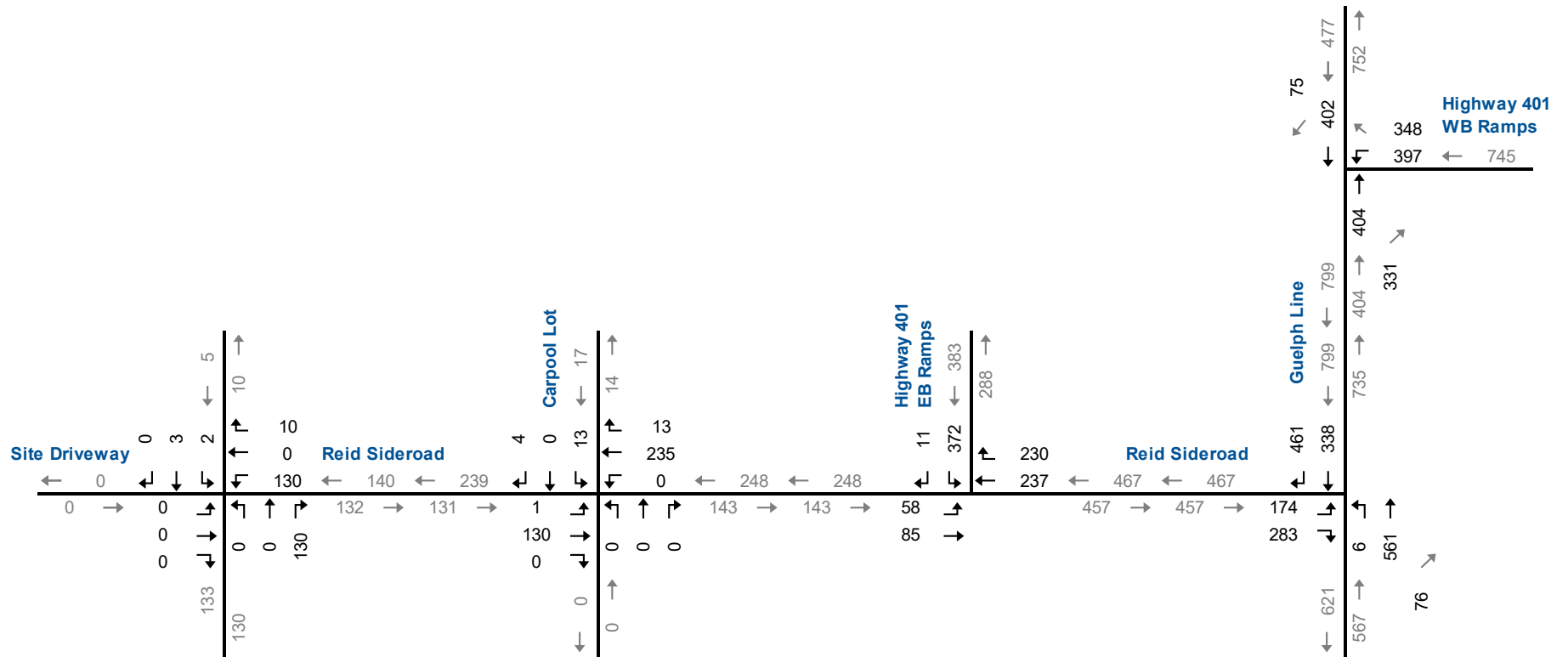




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## Existing Traffic (PCE) – AM Peak Hour



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## Existing Traffic (PCE) – PM Peak Hour

## 2.3 Existing Traffic Operations

Intersection level of service (LOS) is a recognized method of quantifying the efficiency of traffic flow at intersections. It is based on the delay experienced by individual vehicles executing the various movements. The delay is related to the number of vehicles wanting to make a movement, compared to the estimated capacity for that movement. The capacity is based on several criteria related to the opposing traffic flows. The highest possible rating is LOS A, under which the average total delay is equal or less than 10.0 seconds per vehicle. When the average delay exceeds 80 seconds at signalized intersections (50 seconds at unsignalized), the movement is considered to have a LOS F and remedial measures are usually implemented if they are feasible.

The operations of the intersections in the study area were evaluated using the existing lane configuration and traffic control along with the existing AM and PM peak hour traffic volumes which have been converted to PCE, as noted in **Section 2.2**. The signal timings at Guelph Line and Reid Sideroad were optimized. The intersection analysis considered three separate measures of performance:

- ▶ The LOS for each turning movement;
- ▶ The volume to capacity ratio (v/c) for each movement; and
- ▶ The 95th percentile queue lengths estimated using ten 60-minute simulations of SimTraffic.

The level of service conditions on the existing road network have been assessed using Synchro 9 with HCM 2000 procedures.

Under the Halton Region TIS<sup>4</sup> Guidelines and the Town of Milton TIS Guidelines<sup>5</sup>, the operational analysis must include identification of signalized and unsignalized intersections where:

- ▶ Volume to Capacity ratios (v/c) for overall intersection operations, through movements, or shared through / turning movements increase to 0.85 or above for signalized intersections;
- ▶ V/C ratios for exclusive turning movements increase to 0.95 or above for signalized intersections;

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<sup>4</sup> Halton Region Transportation Impact Study Guidelines, January 2015

<sup>5</sup> Town of Milton Engineering and Parks Standards Appendix A Transportation Impact Study Guidelines



- ▶ Queues for an individual movement are projected to exceed available turning lane storage for signalized and unsignalized intersections; and
- ▶ LOS, based on average delay per vehicle on individual movements, exceeds LOS D for unsignalized intersections.

Under the Ontario Ministry of Transportation (MTO)<sup>6</sup> TIS Guidelines, the operational analysis must include identification of signalized and unsignalized intersections where:

- ▶ Volume to Capacity ratios (v/c) for movements increase to 0.85 or greater; and
- ▶ V/C ratios for provincial highway terminal ramp approaches increase to 0.75 or above.

**Table 2.2** summarizes the level of service conditions and the following is noted:

- ▶ During the PM peak hour, the Highway 401 Westbound Off-Ramp approach to Guelph Line is operating with high levels of delay. Delays are classified as LOS F and the v/c ratios are greater than 1.00.
- ▶ During the AM and PM peak hours the Highway 401 Eastbound Off-Ramp approach to Reid Sideroad is operating with high levels of delay. Delays are classified as LOS F and the v/c ratios are greater than 1.00.
- ▶ All other intersections in the study area are operating with satisfactory levels of service during the AM and PM peak hours.

**Appendix B** contains the Synchro 9 and SimTraffic reports.

The above noted capacity deficiencies are not related, nor a result of the subject site.

To improve capacity operations at the two Highway 401 off-ramps, improvements to the existing form of traffic control should be considered.

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<sup>6</sup> Traffic Impact Study Guidelines, Ontario Ministry of Transportation, September 2014.







## 3 Development Concept

### 3.1 Operational Description

The proposed Reid Road Reservoir Quarry located on Part of Lot 7, Concession 2 (former Geographic Township of Nassagaweya), Town of Milton, Regional Municipality of Halton. **Figure 3.1** illustrates the site layout.

#### Overview:

- ▶ The proposed Reid Road Reservoir Quarry will be operated by James Dick Construction Limited (JDCL). The lifespan of the quarry is expected to be about 20 years.

#### Proposed Maximum Shipped Tonnage:

- ▶ 990,000 tonnes per year<sup>7</sup>;
- ▶ JDCL estimates that recycling material will account for approximately 10% of returning truck trips. All other trips are assumed to be empty trucks.

#### Proposed Hours of Operation:

- ▶ Monday to Saturday (depending upon demand);
  - Site operations 07:00 to 19:00 – 12 hours per day; and
  - Shipping from 06:00-18:00 – 12 hours per day.

#### Site Access:

- ▶ Vehicular access is proposed as the fourth leg to the existing Reid Sideroad intersection with Twiss Road (existing entrance that served the former Pit operation). All vehicles will enter and exit the site in a forward motion. No trucks will back onto a municipal right-of-way.
- ▶ The site driveway approach will operate under stop control with a single travel lane in each direction.

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<sup>7</sup> The maximum potential shipping tonnage is proposed to be capped at 990,000 tonnes per year. The shipping tonnage limit is a composite of material extracted above water table, material extracted below water table, shot rock plant feed extracted in previous years, inventory and material to be recycled that is received and shipped at the site. (The anticipated rate of extraction from below the water table is less than the tonnage shipped and related to water table levels that are expected to fluctuate as rock is removed from below the water.)



- ▶ The internal haul route (private road) measures approximately 700 m and will be designed to accommodate heavy vehicle traffic in both directions. No heavy vehicle queuing or parking will occur on Reid Sideroad or at the Twiss Road intersection. **Appendix H** contains documentation of the existing internal haul route width. Any deficiencies in the internal haul route will be addressed by the applicant to support the intended operation. This includes any additional widening to the service road and on-going maintenance of the roadway. At internal bends along the internal haul route, larger radii will be used to allow for unimpeded flow in site traffic.
- ▶ No access is proposed to Highway 401, First Line Nassagaweya, or Campbellville Road.

### Haul Route:

Materials shipped to market will travel east to/from the GTA via Highway 401. The applicant does not intend to ship material to/from the west as an alternative source location is better suited to meet market demands west of the site. **Figure 3.2** illustrates the site's haul route.

Empty vehicles will return to the site via Highway 401 and the interchange at Guelph Line. For analysis purposes, it is assumed that all trips site-generated are two-way trips. The return trip occurs during the same peak hour.

Heavy vehicles are restricted at all times on Reid Sideroad west of the Highway 401 ramp. This regulation comes with a necessary exemption that stipulates the prohibition does not apply to any vehicle engaged in making a delivery or a collection from a premises that cannot be reached except by way of a road or portion of road where heavy trucks are prohibited. These vehicles may only travel on that road to the extent that is unavoidable in getting to/from that premises.

Trucks making collections / deliveries to / from the Reid Road Reservoir Quarry (if a Licence is issued by the Province) would fall under this exemption. JDCL actively enforces haul route compliance with its operators and private operators.

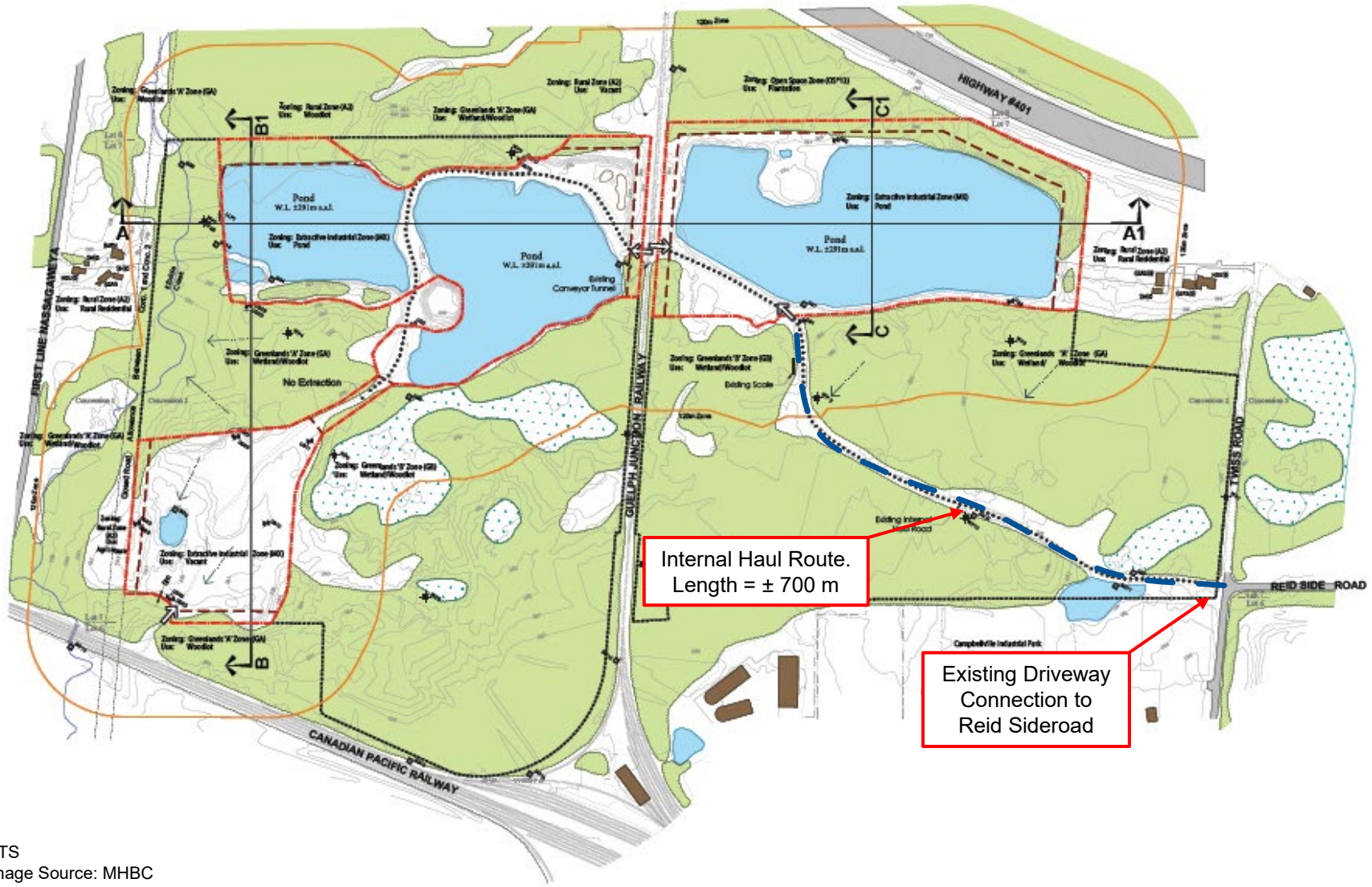
If a Licence is issued by the Province the applicant will coordinate with Halton Region and the Town of Milton to install advance warning signage on the Reid Sideroad approaches to Milton Fire Station 2. The advance warning signage should indicate an EMS entrance ahead.



Supplementary pavement markings will also denote areas of pavement where vehicles should not stop to allow for emergency response vehicles to exit the station without delay.

Signage and pavement markings can be designed like the markings present at Oakville Fire Station 7 located at 2010 Joshuas Creek Drive in the Town of Oakville. Oakville Fire Station 7 is also operated by Halton Region.



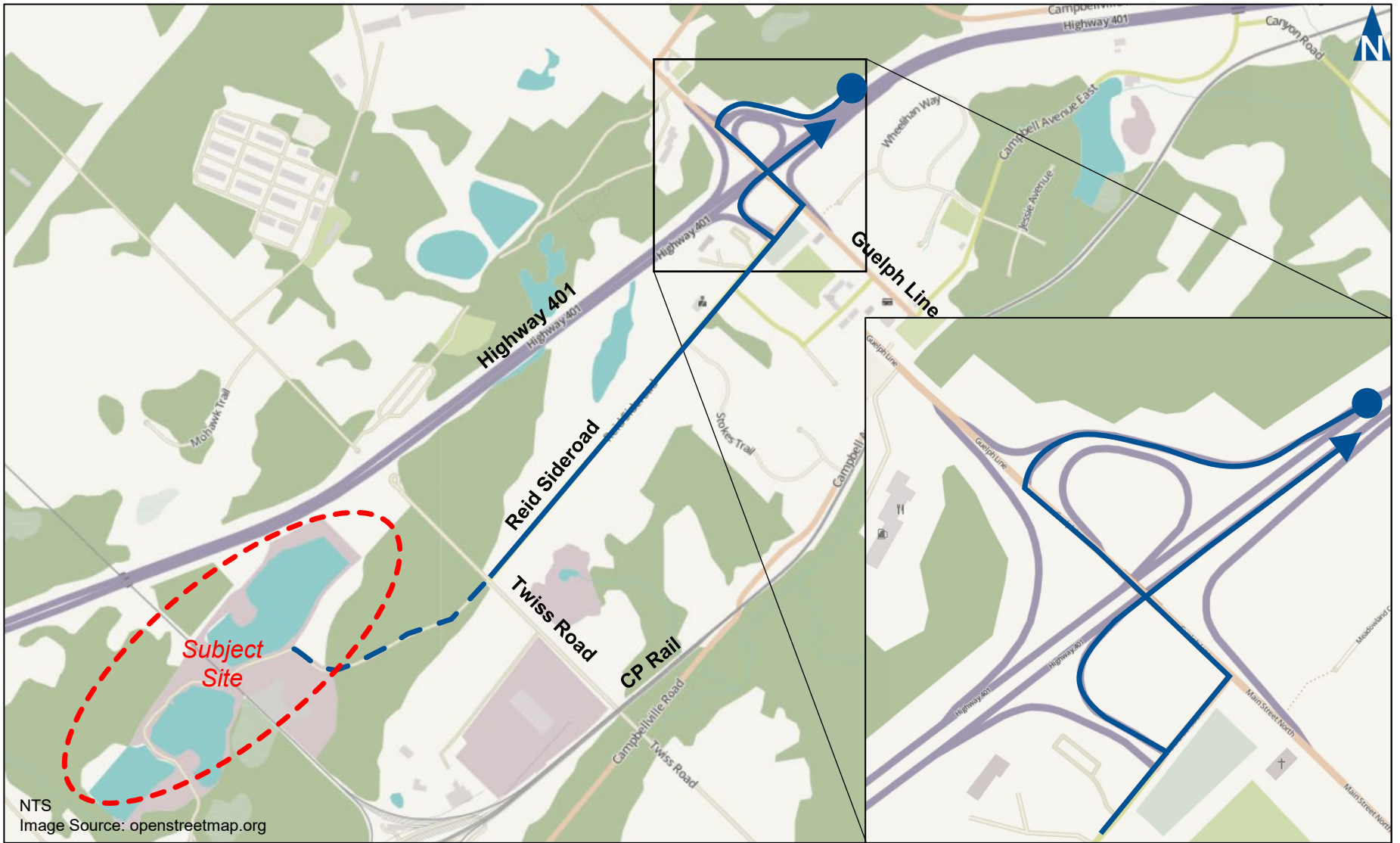


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Image Source: MHBC



## Site Layout





## Haul Route

Figure 3.2

## 3.2 Forecast Site Activity

JDCL has provided operational information for an existing operation. The daily and hourly distribution of truck trips was previously utilized for JDCL in other quarry Traffic Impact Study<sup>8</sup>.

JDCL anticipates that the proposed Reid Road Reservoir Quarry is likely to operate with similar characteristics as their existing Erin Pit.

The Erin Pit has a comparable size licence of 925,000 tonnes per year.

The comparison is also relevant due to its proximity to market and both sites focus on similar market segments (ready mix concrete, hot mix asphalt and road construction products).

Delivery of product to market is expected to utilize the same distribution of truck sizes and have similar shipping times during the day and annual seasonal activity.

### 3.2.1 Site Activity – Monthly Variation

JDCL provided five-years of monthly data for the Erin Pit. The data were expressed as a percentage of licenced annual tonnage. **Table 3.1** summarizes the data and estimates the monthly tonnage for a subject site and notes:

- ▶ The amount of material shipped is capped by the licenced annual tonnage;
- ▶ The amount of material shipped is dictated by market conditions;
- ▶ The six-month period of June to November accounts for approximately 2/3 of all shipping activity; and
- ▶ Peak monthly shipping is estimated to be approximately 12% of the license limit.

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<sup>8</sup> James Dick Construction Limited Revised Traffic Impact Study Eramosa Quarry, Township of Guelph-Eramosa, Cole Engineering Group Ltd. April 2016 Project Tr12-0013.



**TABLE 3.1: HISTORICAL MONTHLY SHIPPING ACTIVITY – ESTIMATED PERCENT OF LICENCE**

Month	Percent of License Limit. 5-Year Average	Extrapolated to Subject site (Tonnes*)
January	3.18	31,480
February	2.60	25,780
March	4.47	44,215
April	6.64	65,735
May	9.02	89,300
<b>June</b>	<b>11.63</b>	<b>115,115</b>
July	11.11	110,010
August	11.09	109,790
September	10.86	107,535
October	10.48	103,730
November	11.43	113,175
December	7.49	74,135
<b>Total</b>	<b>100.00</b>	<b>990,000</b>

\* Round to nearest 5 tonnes

### 3.2.2 Site Activity – Daily Variation

JDCL also provided 23 days of hourly shipping activity data from August 2011, representing the peak month of that year. **Table 3.2** summarizes the hourly shipping activity and highlights the adjacent roadway peak hours. **Figure 3.3** illustrates the average temporal distribution; the following is noted:

- ▶ The amount of material shipped is primarily dictated by market conditions.
- ▶ Shipping activity generally peaks during the AM hours and tapers off towards the end of the day. The AM peak hour of the adjacent roadways coincides with the peaking of shipping activity. The PM peak hour of the adjacent roadways occurs when site activity is generally low.

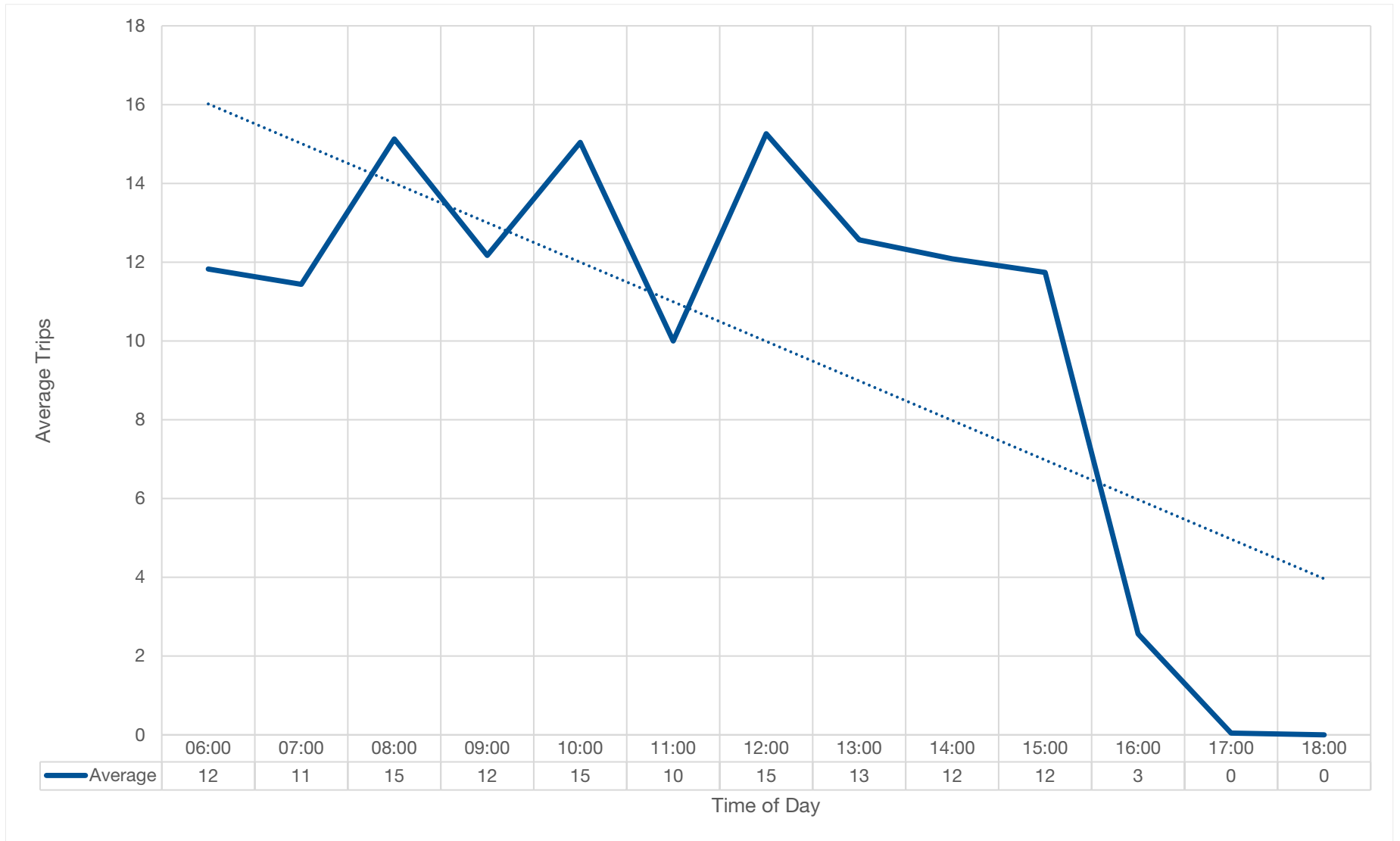


**TABLE 3.2: HISTORICAL DAILY SHIPPING ACTIVITY BY HOUR**

Day/Time	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	Total
Day 1	14	21	20	12	20	16	16	20	8	17	2	0	0	166
Day 2	10	4	7	5	5	4	7	5	10	6	1	0	0	64
Day 3	12	14	12	16	16	12	19	16	22	14	2	0	0	155
Day 4	10	12	13	17	13	8	17	12	10	11	0	0	0	123
Day 5	12	8	12	10	16	5	22	12	17	13	1	0	0	128
Day 6	8	14	13	10	5	4	7	5	5	1	1	0	0	73
Day 7	6	13	13	7	17	7	13	8	11	11	0	0	0	106
Day 8	5	15	7	18	14	10	12	11	5	3	2	0	0	102
Day 9	13	15	14	13	20	7	17	8	12	8	2	0	0	129
Day 10	6	2	5	4	2	3	0	0	0	0	0	0	0	22
Day 11	13	7	24	17	21	14	22	14	18	19	1	0	0	170
Day 12	11	8	11	8	24	6	15	17	11	14	1	0	0	126
Day 13	17	14	19	13	22	16	16	17	15	18	5	0	0	172
Day 14	21	16	23	18	12	17	19	20	16	20	2	0	0	184
Day 15	12	14	17	15	11	5	19	12	13	16	2	0	0	136
Day 16	13	13	22	13	22	8	23	18	20	17	4	1	0	174
Day 17	10	10	12	10	11	4	16	5	12	5	6	0	0	101
Day 18	9	12	15	10	7	17	11	22	13	13	9	0	0	138
Day 19	19	12	20	14	24	15	21	11	15	10	1	0	0	162
Day 20	13	10	19	12	15	8	18	12	13	13	7	0	0	140
Day 21	16	12	13	14	15	14	14	13	15	12	7	0	0	145
Day 22	16	12	20	13	22	18	16	19	10	21	2	0	0	169
Day 23	16	5	17	11	12	12	11	12	7	8	1	0	0	112
<b>Total</b>	<b>282</b>	<b>263</b>	<b>348</b>	<b>280</b>	<b>346</b>	<b>230</b>	<b>351</b>	<b>289</b>	<b>278</b>	<b>270</b>	<b>59</b>	<b>1</b>	<b>0</b>	<b>2,997</b>
<b>Average</b>	<b>12</b>	<b>11</b>	<b>15</b>	<b>12</b>	<b>15</b>	<b>10</b>	<b>15</b>	<b>13</b>	<b>12</b>	<b>12</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>130</b>
<b>Percent</b>	<b>9%</b>	<b>9%</b>	<b>12%</b>	<b>9%</b>	<b>12%</b>	<b>8%</b>	<b>12%</b>	<b>10%</b>	<b>9%</b>	<b>9%</b>	<b>2%</b>	<b>0%</b>	<b>0%</b>	<b>100%</b>
<b>Road Peak</b>			<b>± AM</b>								<b>± PM</b>			







## Average Hourly Temporal Distribution of Shipping Activity

### 3.3 Site Trip Generation

Traffic related to the proposed Reid Road Reservoir Quarry were estimated for AM and PM peak hours using a series of assumptions related to the operation of the site. JDCL provided the assumptions and include the following:

- ▶ The maximum amount of material shipped is expected to be 990,000 tonnes per year.
- ▶ The shipping/processing of material will typically occur for approximately 12 hours per day with activity sustained for approximately 303 days per year.
- ▶ Traffic generated by the site is related to the weight of trucks being loaded at the site. The applicant currently operates a fleet of approximately 85 vehicles including:
  - 21 Tri-Axel Straight Trucks – 22.7 tonne payload
  - 18 Tri-Axle Tractor Trailers – 35.1 tonne payload
  - 16 Quad-Axle Tractor Trailers – 39.1 tonne payload
  - 30 Tri-Axel Pony Pub Combinations – 41.4 tonne payload

The total payload for the fleet is 2,976 tonnes with an average payload of 35 tonnes per vehicle. To be conservative, a load size of 33 tonnes per truck was assumed in the trip generation calculations.

**Table 3.3** summarizes the trip generation estimates and highlights the adjacent roadway peak hours. During peak operation, these estimates indicate that the subject site could potentially generate approximately 16 inbound and 16 outbound truck trips during the AM peak hour. During the PM peak hour, the subject site is estimated to generate approximately 3 inbound and 3 outbound truck trips.

The Reid Road Reservoir Quarry will reveal efficiency in the market for high quality limestone resources. The material extracted and shipped from the lands will be closer to market vs. similar sites located in other parts of Ontario.

The lifespan of the quarry is expected to be about 20 years. After the material is exhausted, the site is not expected to generate new truck trips.

Converting the truck trips to PCE and accounting for approximately 10% of inbound trucks containing recycled material, the AM peak hour PCE trip generation is 34 inbound and 48 outbound. The PM peak hour PCE trip generation is estimated to be 7 inbound and 9 outbound.

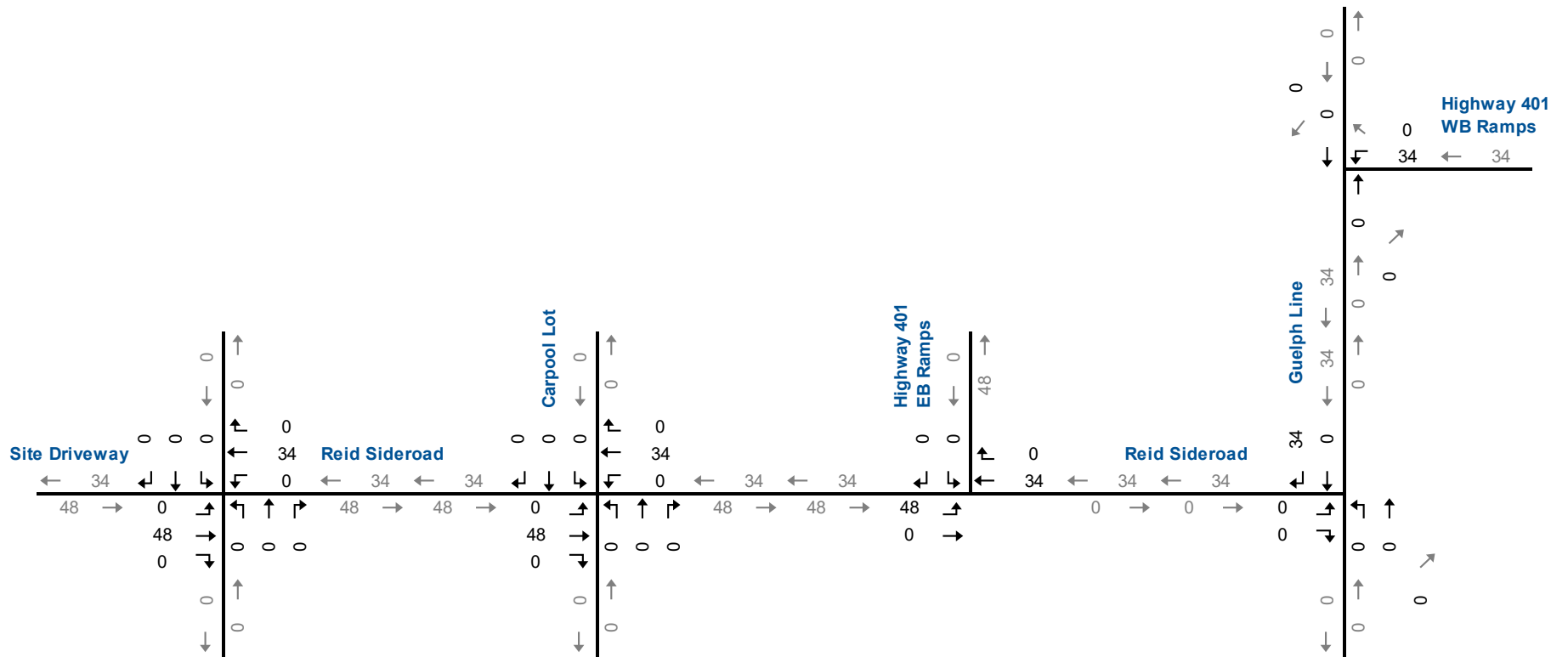


The site-generate trips assigned to the road network follow the proposed haul route (**Figure 3.2**). **Figure 3.4A** and **Figure 3.4B** illustrate the site generated traffic assignment.

**TABLE 3.3: ESTIMATED TRIP GENERATION**

Measure	Units	Input	Calculation		
Annual Rate of Extraction	Tonnes/Year	990,000			
Peak Extraction	Tonnes/Month	June	115,115		
Days of Operation	Days/Month	25			
Tonnes Per Day	Tonnes/Day		4,605		
Average Load per Truck	Tonnes/Truck	33			
Average Trucks per Day	Trucks/Day		140		
Estimated Distribution of Trips by Time	Trucks/Hour		In		Out
			Loaded	Empty	Loaded
	06:00	9%	2	11	13
	07:00	9%	2	10	12
<b>Road Peak 07:15 ~ 07:30</b>	<b>08:00</b>	<b>12%</b>	<b>2</b>	<b>14</b>	<b>16</b>
	09:00	9%	2	11	13
	10:00	12%	2	14	16
	11:00	8%	2	9	11
	12:00	12%	2	14	16
	13:00	10%	2	12	14
	14:00	9%	2	11	13
	15:00	9%	2	11	13
<b>Road Peak 16:15 ~ 16:45</b>	<b>16:00</b>	<b>2%</b>	<b>1</b>	<b>2</b>	<b>3</b>
	17:00	0%	0	0	0
	18:00	0%	0	0	0
Passenger Car Equivalent	PCE's/Truck		In		Out
			3	2	3
	06:00	9%	6	22	39
	07:00	0%	6	20	36
<b>Road Peak 07:15 ~ 07:30</b>	<b>08:00</b>	<b>0%</b>	<b>6</b>	<b>28</b>	<b>48</b>
	09:00	0%	6	22	39
	10:00	0%	6	28	48
	11:00	0%	6	18	33
	12:00	0%	6	28	48
	13:00	0%	6	24	42
	14:00	0%	6	22	39
	15:00	0%	6	22	39
<b>Road Peak 16:15 ~ 16:45</b>	<b>16:00</b>	<b>0%</b>	<b>3</b>	<b>4</b>	<b>9</b>
	17:00	0%	0	0	0
	18:00	0%	0	0	0

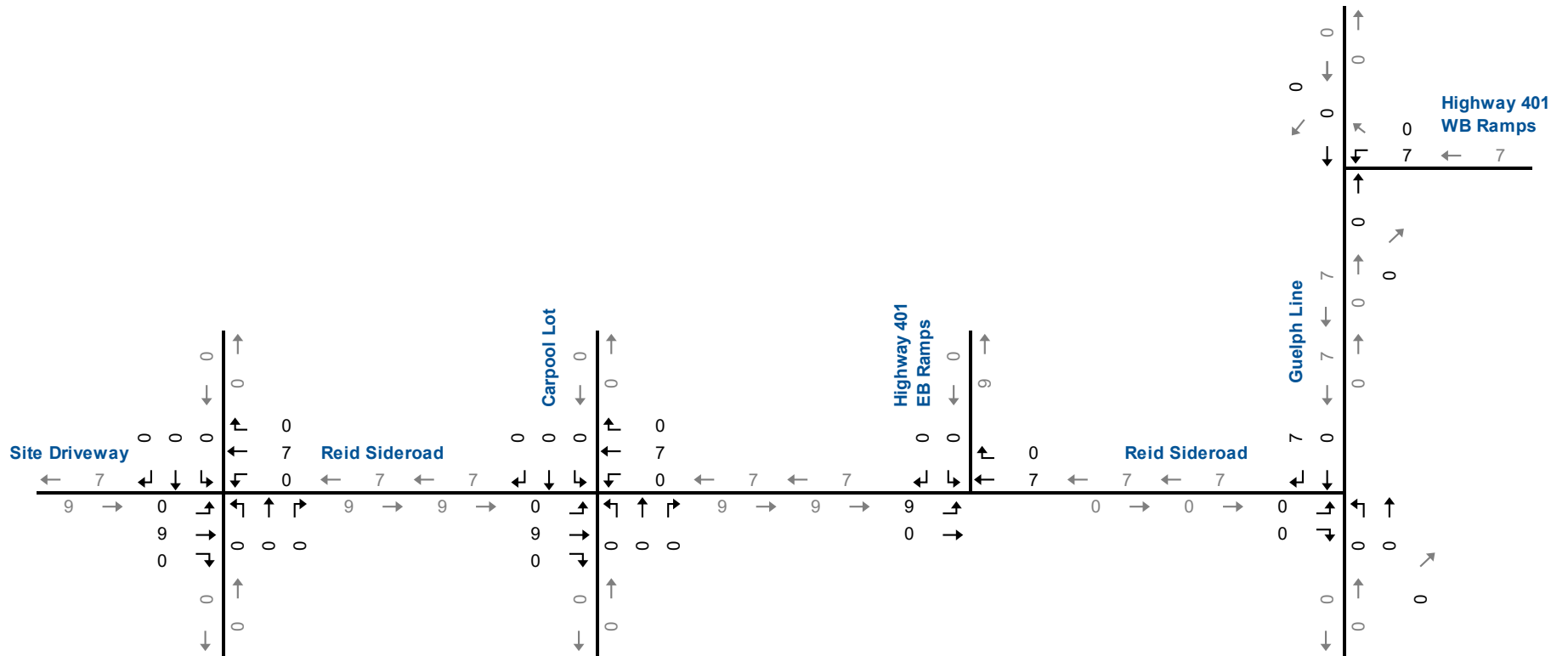




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## Estimated Site Generated Traffic (PCE) – AM Peak Hour



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## Estimated Site Generated Traffic (PCE) – PM Peak Hour

## 4 Future Conditions

The assessment of the future traffic conditions contained in this section includes the future background traffic forecasts as well as the level of service analysis.

### 4.1 Future Background Traffic Forecasts

Three horizons have been assessed to determine the impact of the subject site:

- ▶ The anticipated opening date (2020);
- ▶ Five years after opening (2025 Horizon); and
- ▶ Ten years after opening (2030 Horizon).

The likely future traffic volumes near the subject site are estimated to consist of:

- ▶ Increased non-site traffic (generalized background traffic growth); and
- ▶ Traffic generated by the subject site.

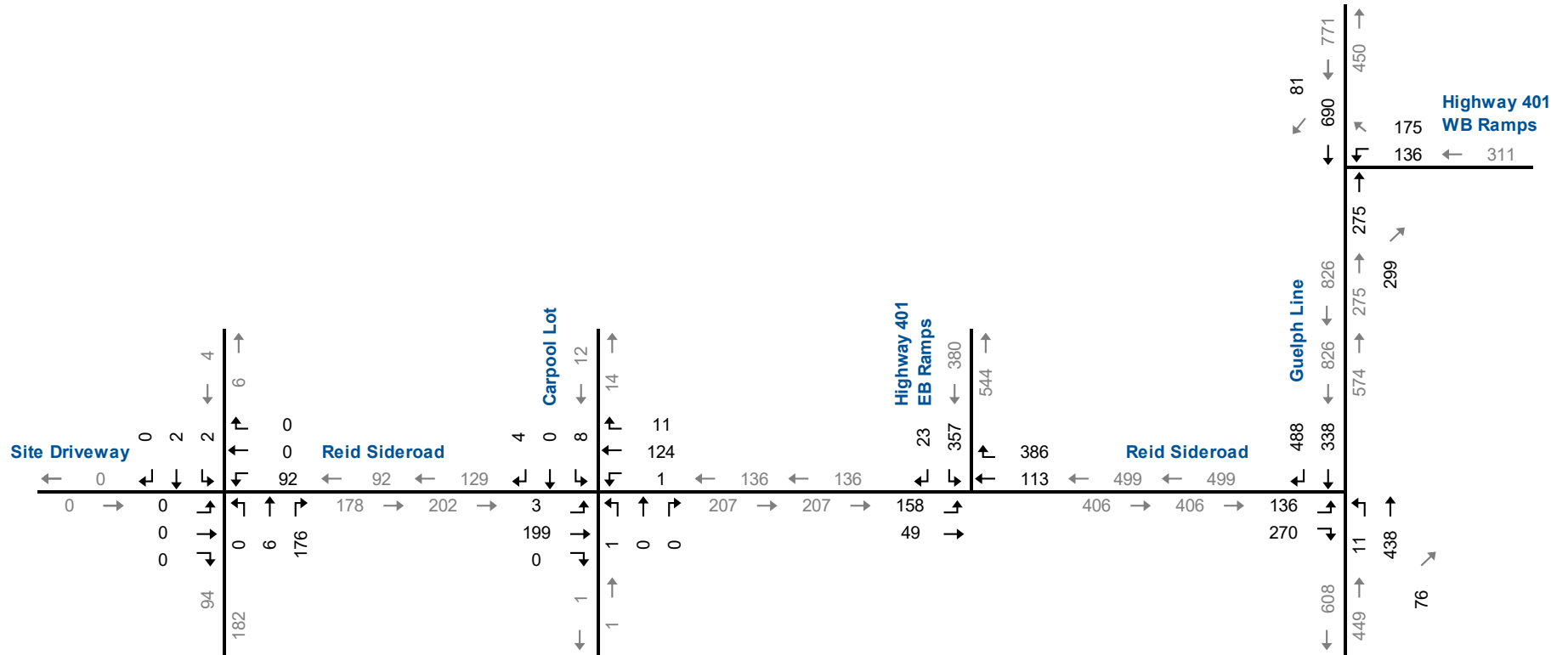
The generalized background traffic growth forecast to occur assumes an annual growth rate of 1%. Historical growth in traffic along the Highway 401 corridor (**Appendix A**) between 2006 and 2016<sup>9</sup> was 0.95% per year, lower than the assumed rate.

**Figure 4.1A** and **Figure 4.1B** illustrates the forecast Opening Date Background Traffic volumes. **Figure 4.2A** and **Figure 4.2B** illustrates the forecast Five-Year (2025) Background Traffic volumes. **Figure 4.3A** and **Figure 4.3B** illustrates the forecast Ten-Year (2030) Background Traffic volumes.

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<sup>9</sup> Provincial Highway Traffic Volumes 1988-2016, (401 Guelph Line IC-312-Halton Road 1-Milton)

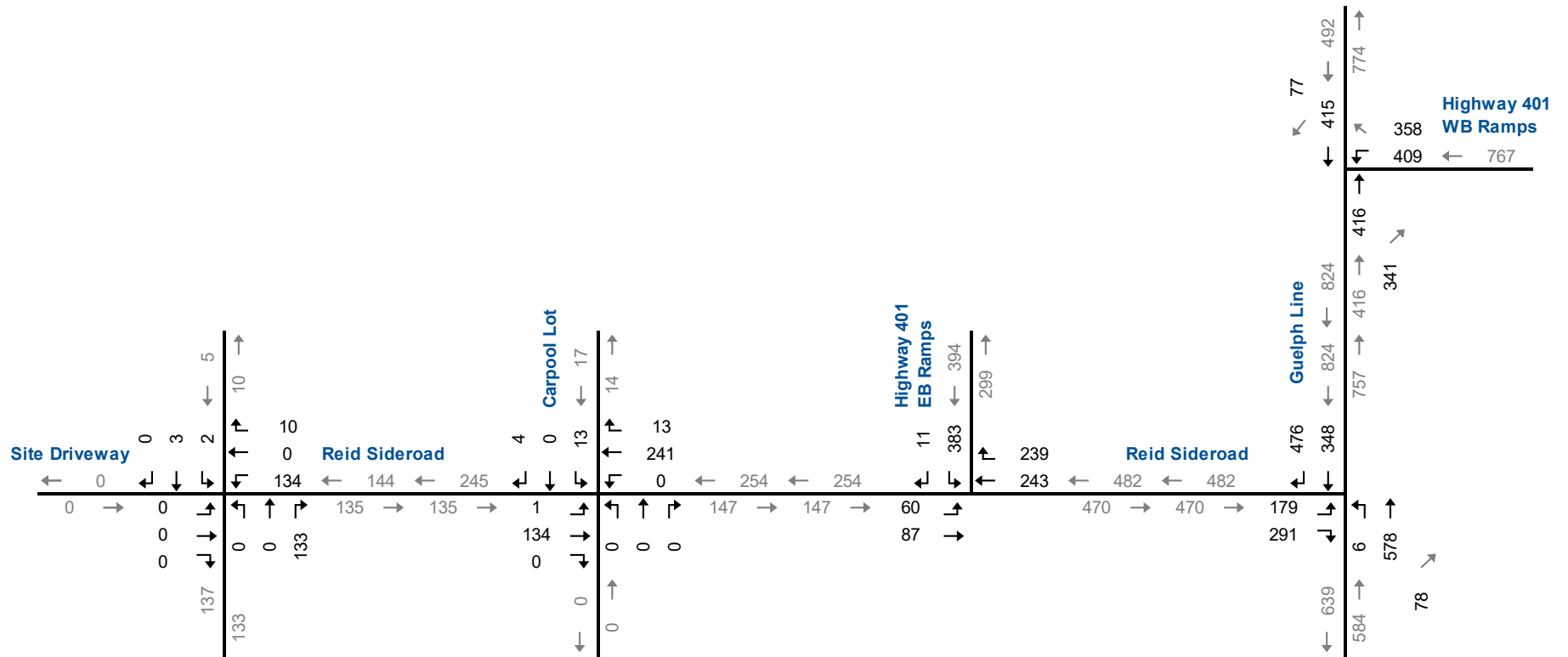




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## Background Opening Date Horizon (PCE) – AM Peak Hour

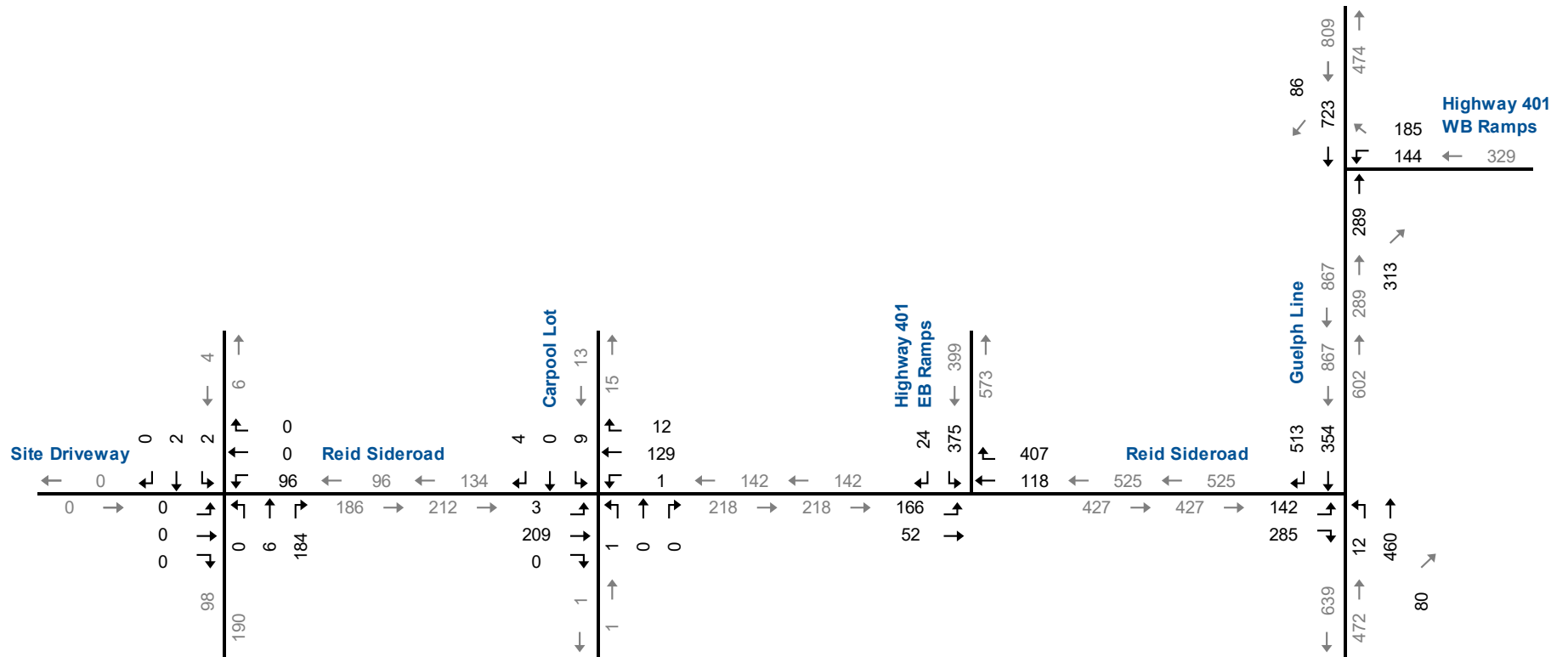


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## Background Opening Date Horizon (PCE) – PM Peak Hour

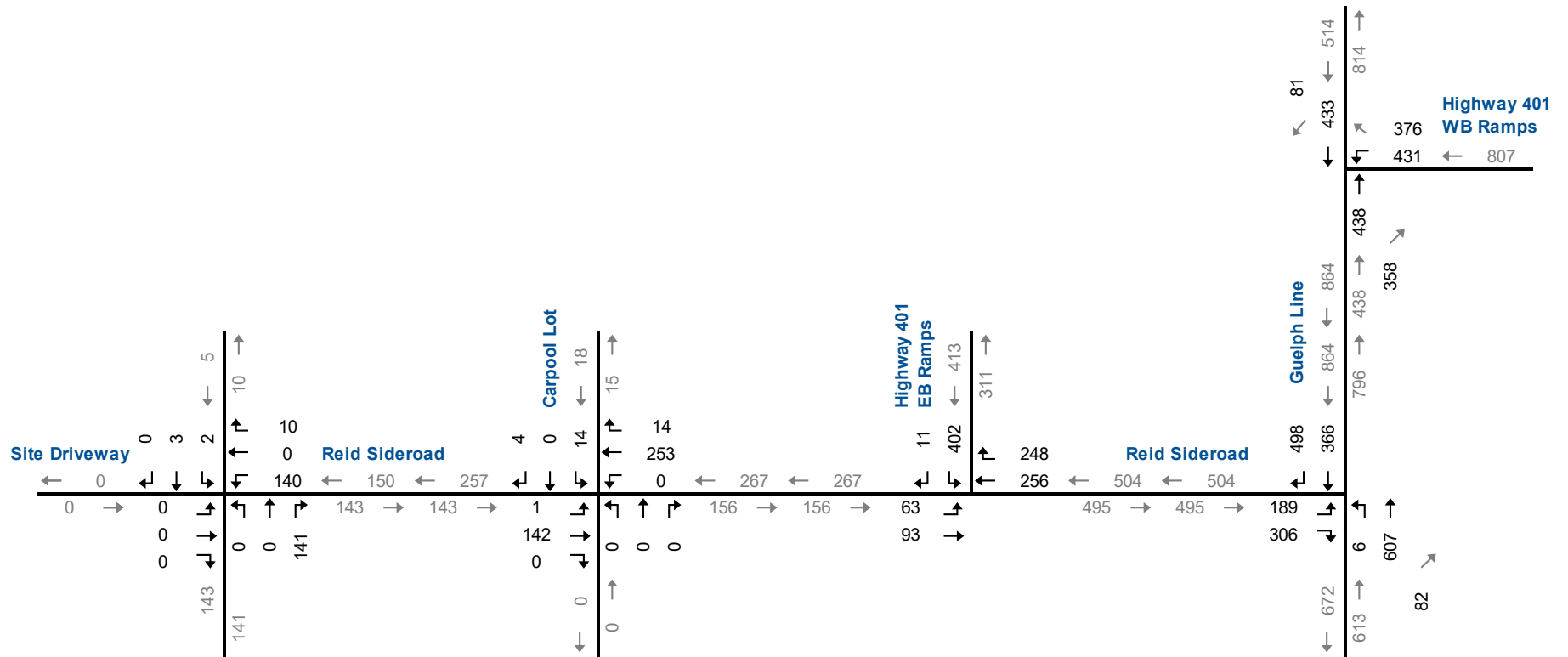




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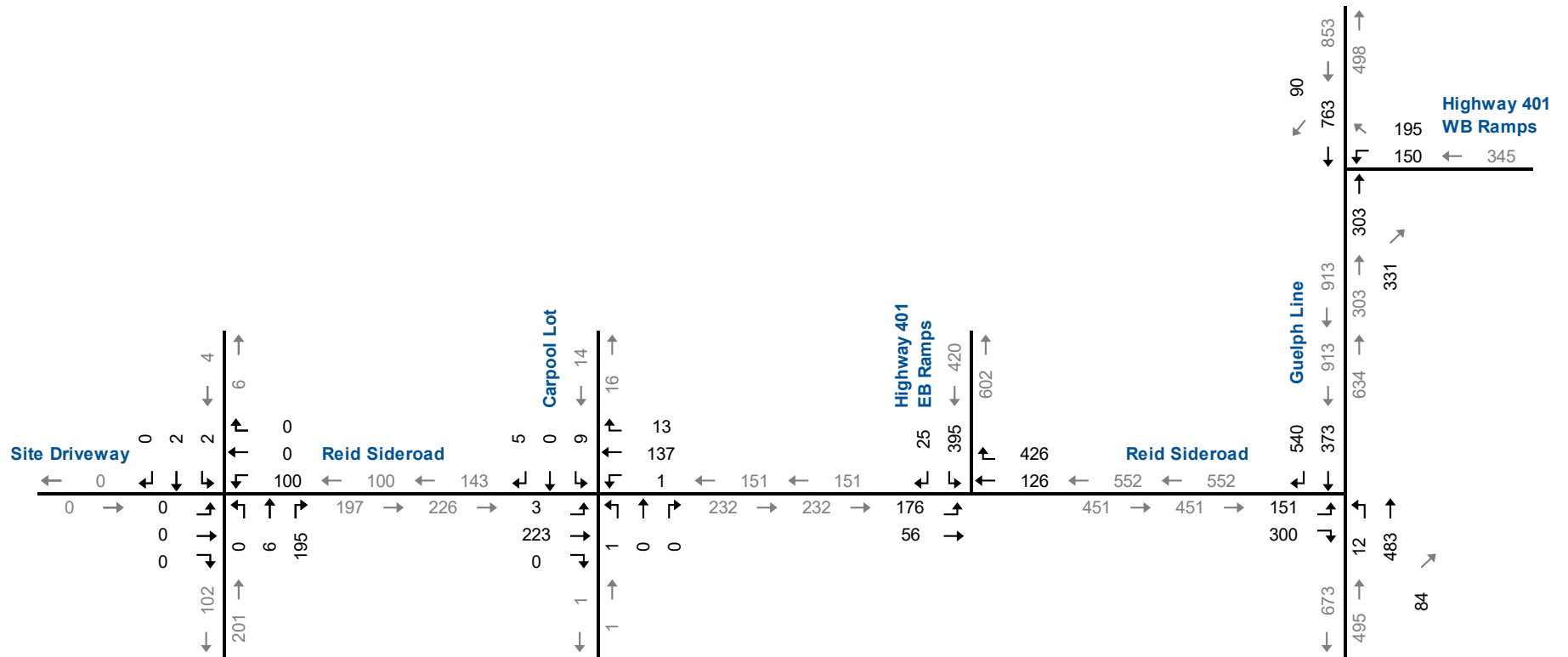
## Background Five-Year Horizon (PCE) – AM Peak Hour



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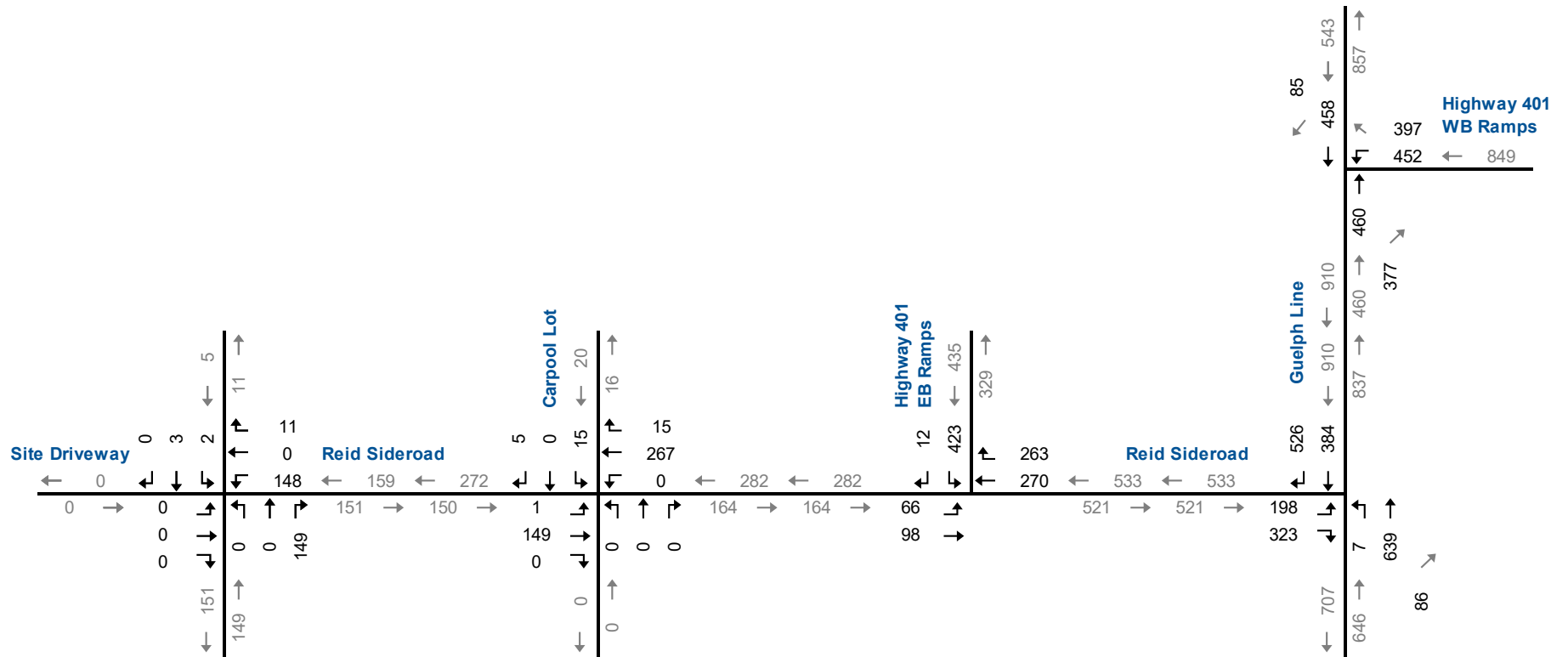
## Background Five-Year Horizon (PCE) – PM Peak Hour



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## Background Ten-Year Horizon (PCE) – AM Peak Hour



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## Background Ten-Year Horizon (PCE) – PM Peak Hour

## 4.2 Background Traffic Operations

### 4.2.1 Background Opening Date Horizon Operations

The study area intersection operations analyses followed the same methodology used for previous horizon years. No geometric improvements have been assumed. **Table 4.1** summarizes the level of service conditions and the following is noted:

- ▶ The study area intersections are forecast to operate with similar levels of service to the existing conditions.
- ▶ During the AM peak hour, the Highway 401 Westbound Off-Ramp approach to Guelph Line is forecast to operate with delays in the LOS D range with a v/c ratio are greater than 0.75.
- ▶ During the PM peak hour, the Highway 401 Westbound Off-Ramp approach to Guelph Line is forecast to operate with high levels of delay. Delays are classified as LOS F and the v/c ratios are greater than 1.00.
- ▶ During the AM and PM peak hours the Highway 401 Eastbound Off-Ramp approach to Reid Sideroad is forecast to operate with high levels of delay. Delays are classified as LOS F and the v/c ratios are greater than 1.00.
- ▶ All other intersections in the study area are forecast to operate with satisfactory levels of service during the AM and PM peak hours.

**Appendix C1** contains the Synchro 9 and SimTraffic reports.

The above noted capacity deficiencies will occur under future conditions without the development. As no site related traffic has been included under the future background conditions, these deficiencies are not related, nor a result of the subject site.

To improve capacity operations at the two Highway 401 off-ramps, improvements to the existing form of traffic control should be considered.



**TABLE 4.1: BACKGROUND TRAFFIC OPERATIONAL CONDITIONS – OPENING DATE HORIZON**

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																OVERALL		
				Eastbound				Westbound				Northbound				Southbound						
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach			
AM Peak Hour	Guelph Line & Highway 401 WB Ramp	TWSC	LOS Delay V/C 95th Ex. Avail.					D 28					D 28					A 0	A 0	A 0	A 0	
	Guelph Line & Reid Sideroad	TCS	LOS Delay V/C 95th Ex. Avail.	B 17 0.42 29 100 71		B 16											A 4 0.04 9 80 71	A 7 0.41 40 - -	A 6	A 6 0.34 37 65 34	A 6	A 9 0.41
	Reid Sideroad & Highway 401 EB Ramp	TWSC	LOS Delay V/C 95th Ex. Avail.	A 10 0.21 24 80 56	A 0 0.04	A 8		A 0	A 0 0.09 100 100	A 0									F 130 1.16 111 400 289	>	F 130	
	Reid Sideroad & Carpool Lot	TWSC	LOS Delay V/C 95th Ex. Avail.	A 8 0.00 1 30 29	A 0 > 0 > 105 >	A 0		<	A 0 > > > >	A 0		<	B 12 > > > >	B 12		<	B 11 > > > >	<	0.03 9 45 36	>	B 11	
	Reid Sideroad & Twiss Rd	TWSC	LOS Delay V/C 95th Ex. Avail.					A 10 0.14 12 935 923						A 10		>	A 0 > > > >	A 0	<	A 4 0.01 2 400 398	>	A 4
PM Peak Hour	Guelph Line & Highway 401 WB Ramp	TWSC	LOS Delay V/C 95th Ex. Avail.					F 205					F 205					A 0	A 0 0.27 0 90 115		A 0	
	Guelph Line & Reid Sideroad	TCS	LOS Delay V/C 95th Ex. Avail.	B 19 0.53 35 100 65		B 18											A 5 0.02 7 80 73	A 9 0.58 53 - -	A 9	A 6 0.34 33 27 65 38	A 6	B 10 0.57
	Reid Sideroad & Highway 401 EB Ramp	TWSC	LOS Delay V/C 95th Ex. Avail.	A 9 0.08 15 80 65	A 0 0.09	A 3		A 0	A 0 0.16 100 100	A 0									F 136 1.19 85 400 315	>	F 136	
	Reid Sideroad & Carpool Lot	TWSC	LOS Delay V/C 95th Ex. Avail.	A 8 0.00 0 30 30	A 0 > 0 > 105 >	A 0		<	A 0 > > > >	A 0		<	A 0 > > > >	A 0		<	B 12 > > > >	<	0.06 11 45 34	>	B 12	
	Reid Sideroad & Twiss Rd	TWSC	LOS Delay V/C 95th Ex. Avail.					B 10 0.20 13 935 922						B 10		>	A 0 > > > >	A 0	<	A 3 0.01 0 400 400	>	A 3

MOE - Measure of Effectiveness  
TCS - Traffic Control Signal  
TWSC - Two-Way Stop Control  
LOS - Level of Service  
Ex. - Existing Turn Lane Storage or Distance to Upstream Intersection (m)  
V/C - Volume to Capacity Ratio  
95th - 95th Percentile Queue Length (m)  
Avail. - Available Storage (m)  
< - Shared Left-Turn Lane  
> - Shared Right-Turn Lane



## 4.2.2 Background Five-Year Horizon Operations

The study area intersection operations analyses followed the same methodology used for previous horizon years. No geometric improvements have been assumed. **Table 4.2** summarizes the level of service conditions and the following is noted:

- ▶ The study area intersections are forecast to operate with similar levels of service to the background opening date horizon conditions.
- ▶ During the AM peak hour, the Highway 401 Westbound Off-Ramp approach to Guelph Line is forecast to operate with delays in the LOS E range with a v/c ratio are greater than 0.85.
- ▶ During the PM peak hour, the Highway 401 Westbound Off-Ramp approach to Guelph Line is forecast to operate with high levels of delay. Delays are classified as LOS F and the v/c ratios are greater than 1.00.
- ▶ During the AM and PM peak hours the Highway 401 Eastbound Off-Ramp approach to Reid Sideroad is forecast to operate with high levels of delay. Delays are classified as LOS F and the v/c ratios are greater than 1.00.
- ▶ All other intersections in the study area are forecast to operate with satisfactory levels of service during the AM and PM peak hours.

**Appendix C2** contains the Synchro 9 and SimTraffic reports.

The above noted capacity deficiencies will occur under future conditions without the development. As no site related traffic has been included under the future background conditions, these deficiencies are not related, nor a result of the subject site.

To improve capacity operations at the two Highway 401 off-ramps, improvements to the existing form of traffic control should be considered.



**TABLE 4.2: BACKGROUND TRAFFIC OPERATIONAL CONDITIONS – FIVE-YEAR HORIZON**

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach														OVERALL											
				Eastbound				Westbound				Northbound				Southbound													
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through		Right	Approach									
AM Peak Hour	Guelph Line & Highway 401 WB Ramp	TWSC	LOS Delay V/C 95th Ex. Avail.					E 37 0.86 31 515 484					F 37					A 0 0 0.18 0 90 90					A 0 0 0.48 0 115 115					A 0	
	Guelph Line & Reid Sideroad	TCS	LOS Delay V/C 95th Ex. Avail.	B 18 0.43 31 100 69	A 0 0.22 34 100 66		B 17										A 4 0.04 10 80 70	A 7 0.43 48 - -					A 6 0.36 37 65 32	A 6 0.36 33 65 32	A 6	A 9 0.43			
	Reid Sideroad & Highway 401 EB Ramp	TWSC	LOS Delay V/C 95th Ex. Avail.	A 10 0.23 25 80 55	A 0 0.04 0 80 80		A 8					A 0										F 182 1.29 119 400 281					F 182		
	Reid Sideroad & Carpool Lot	TWSC	LOS Delay V/C 95th Ex. Avail.	A 8 0.00 1 30 29	A 0 0.16 0 105 105		A 0					A 0										B 12 0.01 3 75 72					B 12		
	Reid Sideroad & Twiss Rd	TWSC	LOS Delay V/C 95th Ex. Avail.					B 10 0.15 12 935 923					B 10										A 0 0.15 1 215 214					A 0	
PM Peak Hour	Guelph Line & Highway 401 WB Ramp	TWSC	LOS Delay V/C 95th Ex. Avail.					F 280 1.56 271 515 244					F 280					A 0 0.28 0 90 90					A 0 0.29 0 115 115					A 0	
	Guelph Line & Reid Sideroad	TCS	LOS Delay V/C 95th Ex. Avail.	B 20 0.55 35 100 65	A 17 0.22 31 100 69		B 18										A 5 0.02 7 80 73	A 10 0.62 60 - -					A 7 0.36 27 65 38	A 7 0.36 27 65 38	A 7	B 11 0.60			
	Reid Sideroad & Highway 401 EB Ramp	TWSC	LOS Delay V/C 95th Ex. Avail.	A 9 0.09 15 80 65	A 0 0.10 0 80 80		A 3					A 0										F 187 1.32 100 400 300					F 187		
	Reid Sideroad & Carpool Lot	TWSC	LOS Delay V/C 95th Ex. Avail.	A 8 0.00 1 30 29	A 0 0.11 0 105 105		A 0					A 0										A 0 0.00 0 75 75					A 0		
	Reid Sideroad & Twiss Rd	TWSC	LOS Delay V/C 95th Ex. Avail.					B 10 0.21 14 935 921					B 10										A 0 0.11 0 215 215					A 0	

MOE - Measure of Effectiveness  
 TCS - Traffic Control Signal  
 TWSC - Two-Way Stop Control  
 LOS - Level of Service  
 Ex. - Existing Turn Lane Storage or Distance to Upstream Intersection (m)  
 V/C - Volume to Capacity Ratio  
 95th - 95th Percentile Queue Length (m)  
 Avail. - Available Storage (m)  
 < - Shared Left-Turn Lane  
 > - Shared Right-Turn Lane





### 4.2.3 Background Ten-Year Horizon Operations

The study area intersection operations analyses followed the same methodology used for previous horizon years. No geometric improvements have been assumed. **Table 4.3** summarizes the level of service conditions and the following is noted:

- ▶ The study area intersections are forecast to operate with similar levels of service to the background five-year horizon conditions.
- ▶ During the AM peak hour, the Highway 401 Westbound Off-Ramp approach to Guelph Line is forecast to operate with delays in the LOS F range with a v/c ratio are greater than 0.95.
- ▶ During the PM peak hour, the Highway 401 Westbound Off-Ramp approach to Guelph Line is forecast to operate high levels of delay. Delays are classified as LOS F and the v/c ratios are greater than 1.00.
- ▶ During the AM and PM peak hours the Highway 401 Eastbound Off-Ramp approach to Reid Sideroad is forecast to operate with high levels of delay. Delays are classified as LOS F and the v/c ratios are greater than 1.00.
- ▶ All other intersections in the study area are forecast to operate with satisfactory levels of service during the AM and PM peak hours.

**Appendix C3** contains the Synchro 9 and SimTraffic reports.

The above noted capacity deficiencies will occur under future conditions without the development. As no site related traffic has been included under the future background conditions, these deficiencies are not related, nor a result of the subject site.

To improve capacity operations at the two Highway 401 off-ramps, improvements to the existing form of traffic control should be considered.



**TABLE 4.3: BACKGROUND TRAFFIC OPERATIONAL CONDITIONS – TEN-YEAR HORIZON**

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																OVERALL									
				Eastbound				Westbound				Northbound				Southbound													
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach										
AM Peak Hour	Guelph Line & Highway 401 WB Ramp	TWSC	LOS Delay V/C 95th Ex. Avail.					F 51					F 51					A 0					A 0						
	Guelph Line & Reid Sideroad	TCS	LOS Delay V/C 95th Ex. Avail.	B 18		B 16	B 17											A 5	A 7				A 7					A 9	0.45
	Reid Sideroad & Highway 401 EB Ramp	TWSC	LOS Delay V/C 95th Ex. Avail.	B 10	A 0		A 8		A 0	A 0			A 0										F 262					F 262	
	Reid Sideroad & Carpool Lot	TWSC	LOS Delay V/C 95th Ex. Avail.	A 8	A 0	>	A 0	<	A 0	>			A 0	<				<	B 13	>			<	B 13	>			B 11	
	Reid Sideroad & Twiss Rd	TWSC	LOS Delay V/C 95th Ex. Avail.					B 10					B 10					A 0					<	A 4	>			A 4	
PM Peak Hour	Guelph Line & Highway 401 WB Ramp	TWSC	LOS Delay V/C 95th Ex. Avail.					F 367					F 367					A 0					A 0					A 0	
	Guelph Line & Reid Sideroad	TCS	LOS Delay V/C 95th Ex. Avail.	C 21		B 17	B 19											A 5	A 10				A 10					A 7	B 11
	Reid Sideroad & Highway 401 EB Ramp	TWSC	LOS Delay V/C 95th Ex. Avail.	A 9	A 0		A 3		A 0	A 0			A 0										F 248					F 248	
	Reid Sideroad & Carpool Lot	TWSC	LOS Delay V/C 95th Ex. Avail.	A 8	A 0	>	A 0	<	A 0	>			A 0	<				<	A 0	>			<	B 13	>			B 13	
	Reid Sideroad & Twiss Rd	TWSC	LOS Delay V/C 95th Ex. Avail.					B 10					B 10					A 0					<	A 3	>			A 3	

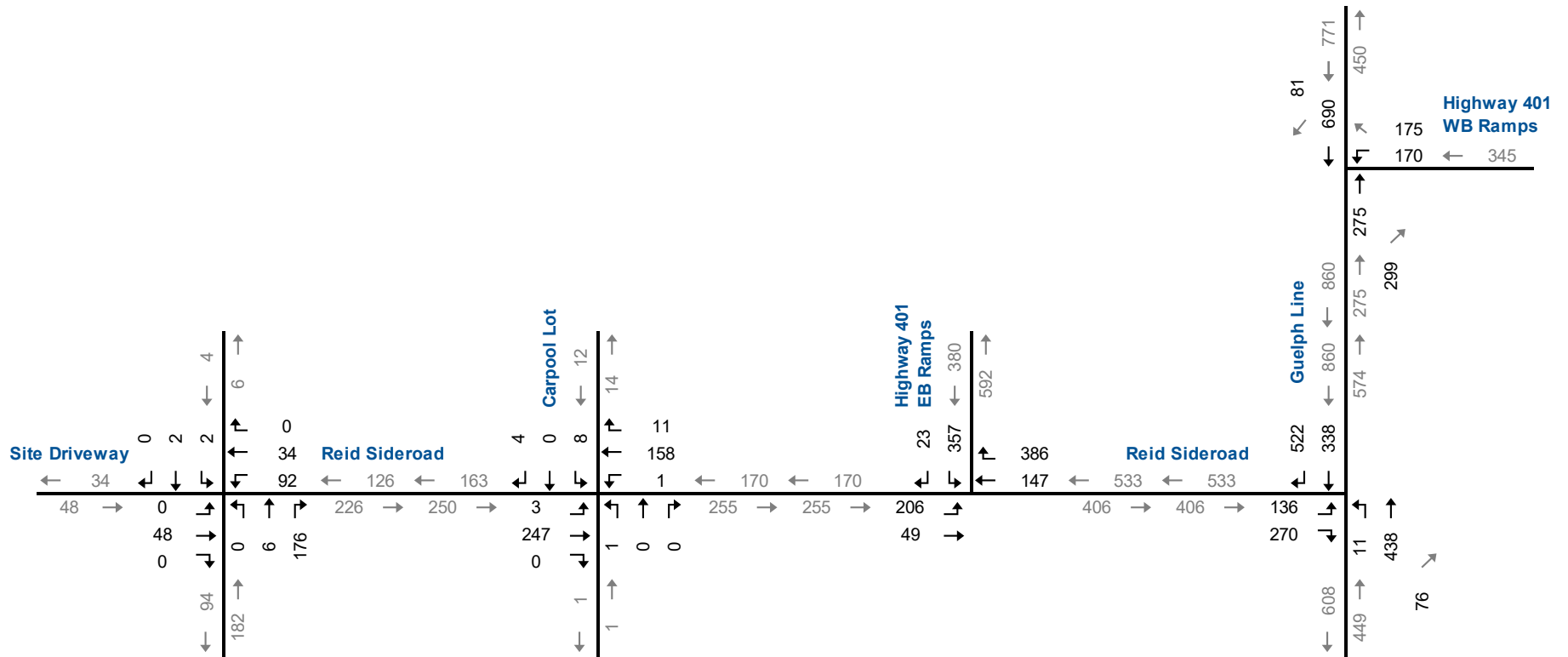
MOE - Measure of Effectiveness  
 TCS - Traffic Control Signal  
 TWSC - Two-Way Stop Control  
 LOS - Level of Service  
 Ex. - Existing Turn Lane Storage or Distance to Upstream Intersection (m)  
 V/C - Volume to Capacity Ratio  
 95th - 95th Percentile Queue Length (m)  
 Avail. - Available Storage (m)  
 < - Shared Left-Turn Lane  
 > - Shared Right-Turn Lane



### 4.3 Future Total Traffic Forecasts

**Figure 4.4A** and **Figure 4.4B** illustrates the forecast Opening Date Total Traffic volumes. **Figure 4.5A** and **Figure 4.5B** illustrates the forecast Five-Year (2025) Total Traffic volumes. **Figure 4.6A** and **Figure 4.6B** illustrates the forecast Ten-Year (2030) Total Traffic volumes.

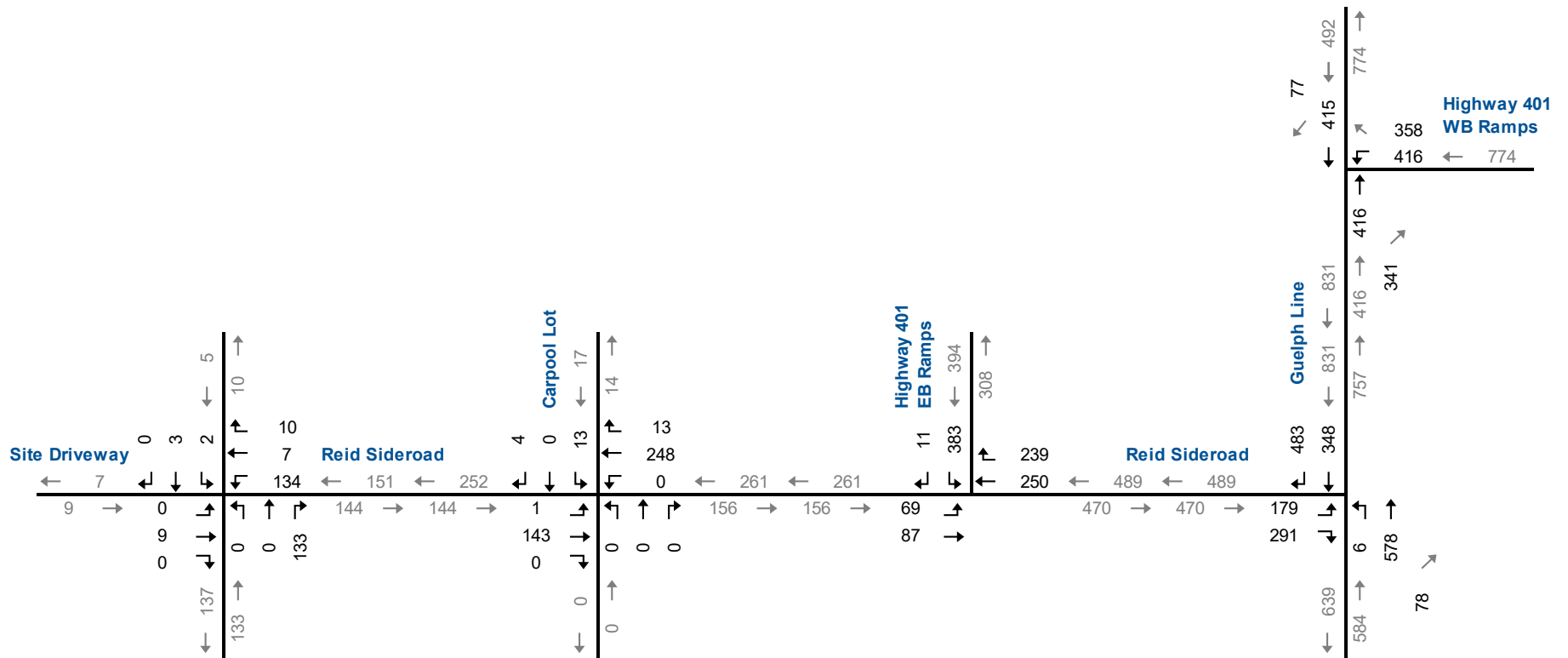




NTS



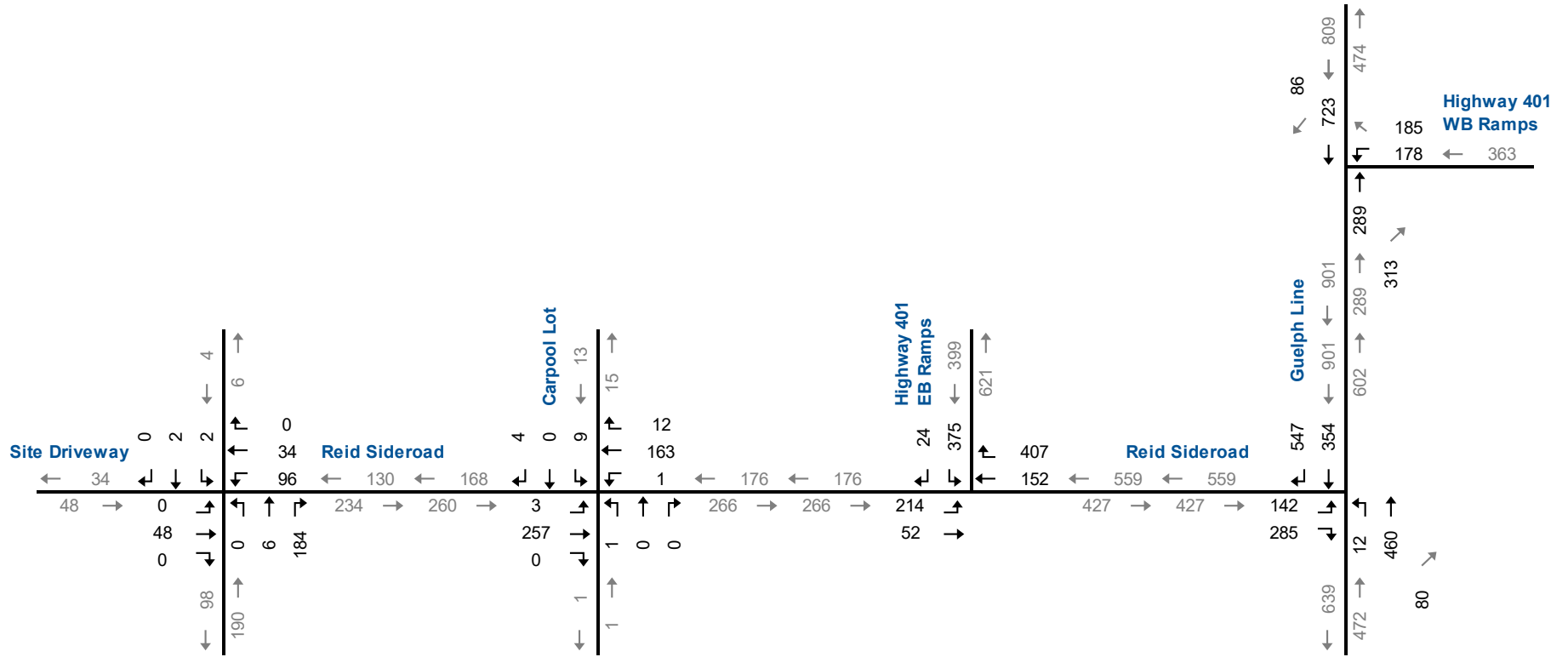
## Total Opening Date Horizon (PCE) – AM Peak Hour



NTS



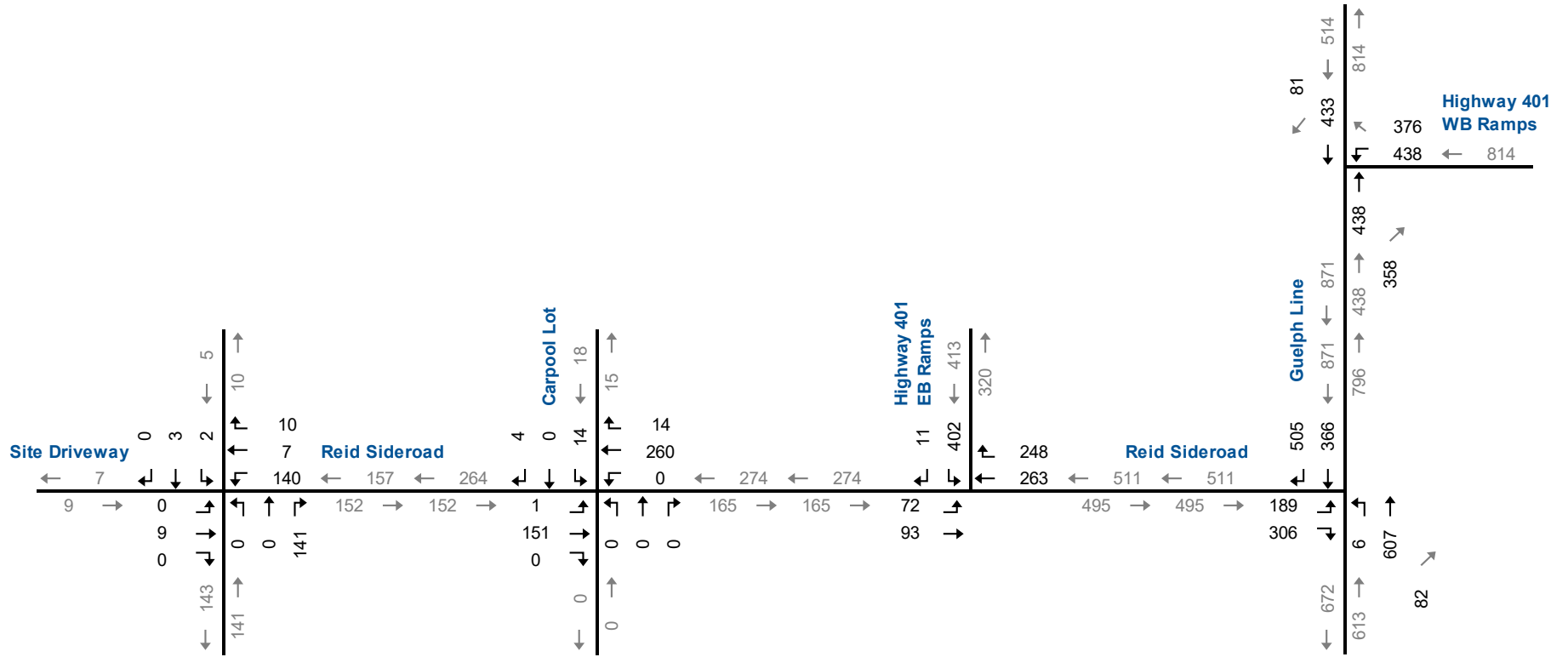
## Total Opening Date Horizon (PCE) – PM Peak Hour



NTS



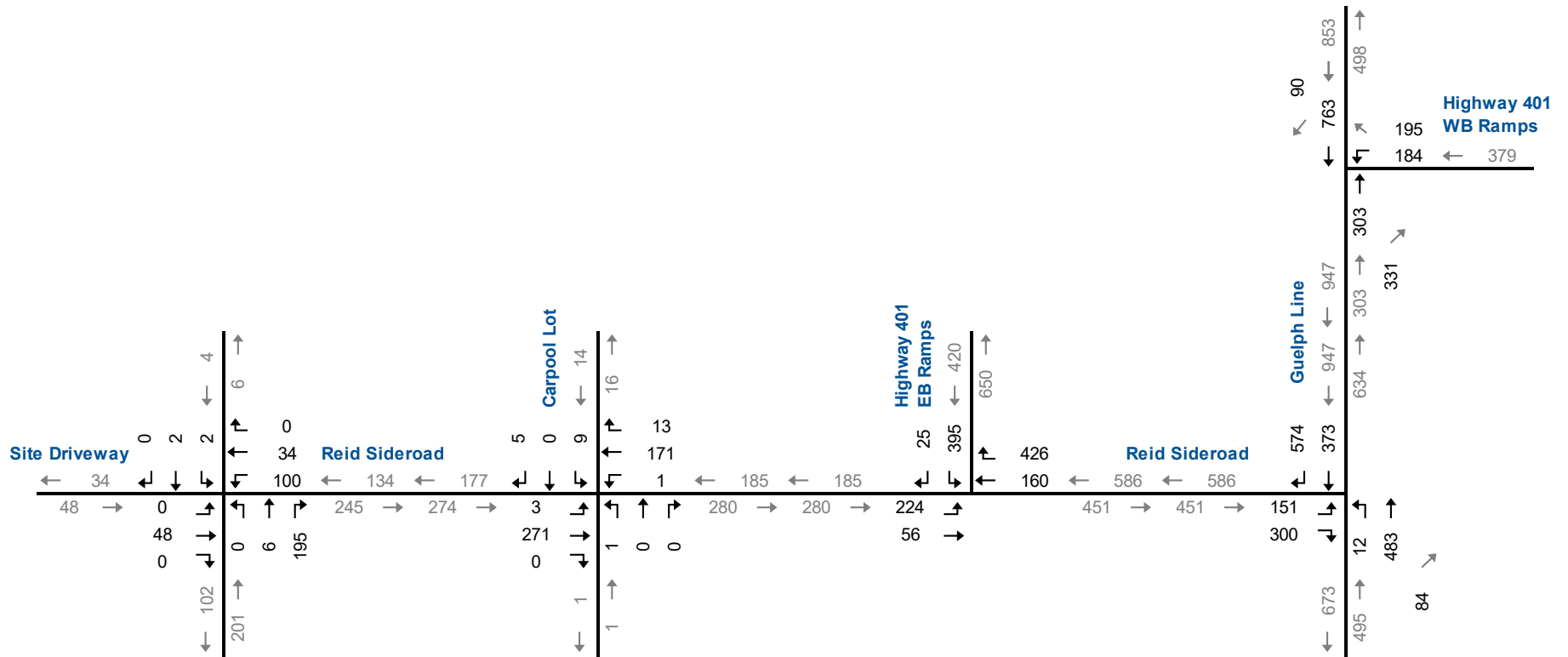
## Total Five-Year Horizon (PCE) – AM Peak Hour



NTS



## Total Five-Year Horizon (PCE) – PM Peak Hour

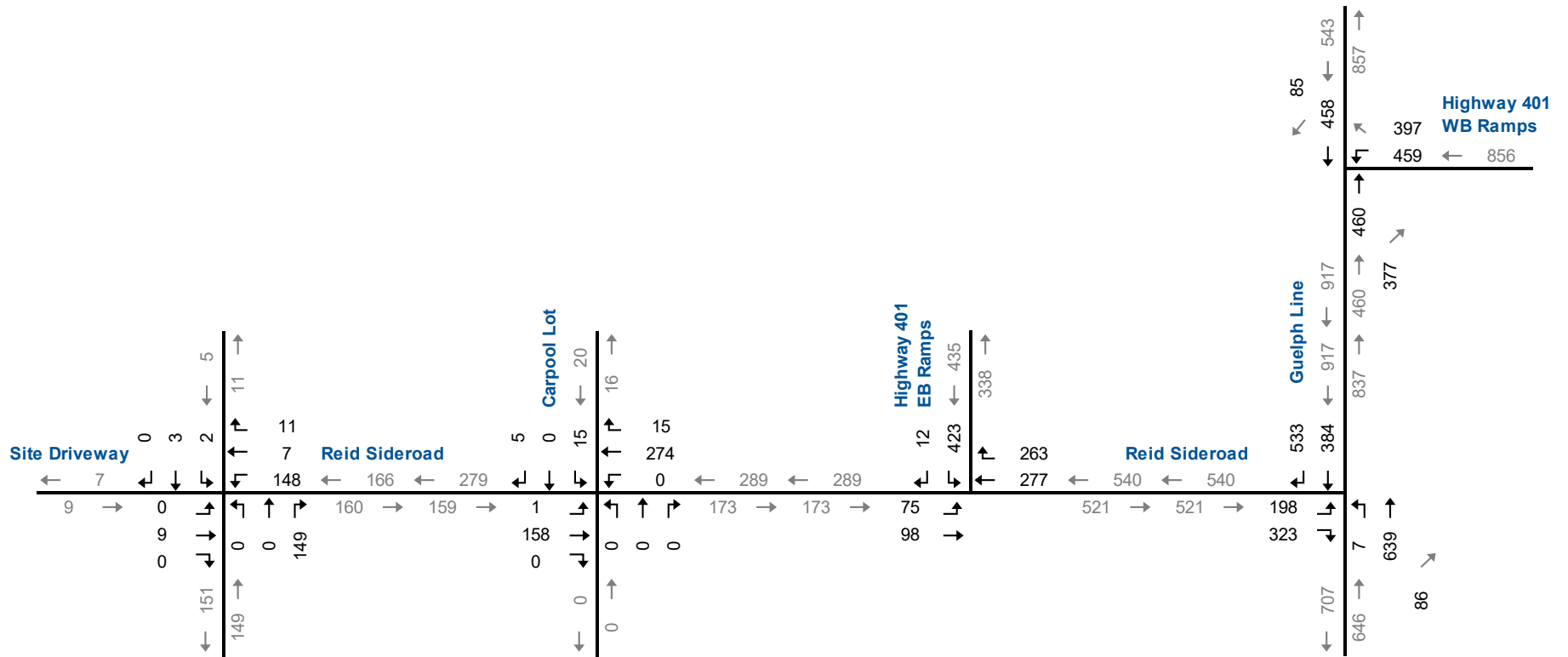


NTS



## Total Ten-Year Horizon (PCE) – AM Peak Hour





NTS



## Total Ten-Year Horizon (PCE) – PM Peak Hour

## 4.4 Future Total Traffic Operations

### 4.4.1 Total Opening Date Horizon Operations

The operations of the study area intersections were evaluated using the same analytical approach that was used for the background traffic operations along with the forecast total traffic volumes. No geometric improvements have been assumed. **Table 4.4** summarizes the level of service conditions and the following is noted:

- ▶ The study area intersections are forecast to operate with similar levels of service to the background conditions.
- ▶ During the AM peak hour, the Highway 401 Westbound Off-Ramp approach to Guelph Line is forecast to operate with delays in the LOS E range with a v/c ratio of 0.95.
- ▶ During the PM peak hour, the Highway 401 Westbound Off-Ramp approach to Guelph Line is forecast to operate with high levels of delay. Delays are classified as LOS F and the v/c ratios are greater than 1.00.
- ▶ During the AM and PM peak hours the Highway 401 Eastbound Off-Ramp approach to Reid Sideroad is forecast to operate with high levels of delay. Delays are classified as LOS F and the v/c ratios are greater than 1.00.
- ▶ The site driveway approach to Twiss Road is forecast to operate with delays in the LOS B range with a v/c ratio of less than 0.10. Queues on the driveway approach are forecast to be less than 15 m.
- ▶ All other intersections in the study area are forecast to operate with satisfactory levels of service during the AM and PM peak hours.

**Appendix D1** contains the Synchro 9 and SimTraffic reports.

The above noted capacity deficiencies are forecast to occur under background traffic conditions without site-specific traffic. The study area intersections are forecast to operate with similar levels of service as documented for the background conditions.

To improve capacity operations at the two Highway 401 off-ramps, improvements to the existing form of traffic control should be considered.





#### 4.4.2 Total Five-Year Horizon Operations

The operations of the study area intersections were evaluated using the same analytical approach that was used for the background traffic operations along with the forecast total traffic volumes. No geometric improvements have been assumed. **Table 4.5** summarizes the level of service conditions and the following is noted:

- ▶ The study area intersections are forecast to operate with similar levels of service to the background conditions.
- ▶ During the AM and PM peak hours the Highway 401 Westbound Off-Ramp approach to Guelph Line is forecast to operate with high levels of delay. Delays are classified as LOS F and the v/c ratios are greater than 1.00.
- ▶ During the AM and PM peak hours the Highway 401 Eastbound Off-Ramp approach to Reid Sideroad is forecast to operate with high levels of delay. Delays are classified as LOS F and the v/c ratios are greater than 1.00.
- ▶ The site driveway approach to Twiss Road is forecast to operate with delays in the LOS B range with a v/c ratio of less than 0.10. Queues on the driveway approach are forecast to be less than 15 m.
- ▶ All other intersections in the study area are forecast to operate with satisfactory levels of service during the AM and PM peak hours.

**Appendix D2** contains the Synchro 9 and SimTraffic reports.

The above noted capacity deficiencies are forecast to occur under background traffic conditions without site-specific traffic. The study area intersections are forecast to operate with similar levels of service as documented for the background conditions.

To improve capacity operations at the two Highway 401 off-ramps, improvements to the existing form of traffic control should be considered.



**TABLE 4.5: TOTAL TRAFFIC OPERATIONAL CONDITIONS – FIVE-YEAR HORIZON**

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																OVERALL											
				Eastbound				Westbound				Northbound				Southbound															
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach												
AM Peak Hour	Guelph Line & Highway 401 WB Ramp	TWSC	LOS Delay V/C 95th Ex. Avail.					F 67	1.07	41	515	474					F 67		A 0	0.18	0	0	115	115		A 0					
	Guelph Line & Reid Sideroad	TCS	LOS Delay V/C 95th Ex. Avail.	B 18		B 16	B 17											A 4	A 7	0.04	0.43	11	45	80	69		A 6	A 9	0.43		
	Reid Sideroad & Highway 401 EB Ramp	TWSC	LOS Delay V/C 95th Ex. Avail.	B 11	A 0		A 9		A 0	A 0	0.27	1	13	100	20			A 0								F 409					
	Reid Sideroad & Carpool Lot	TWSC	LOS Delay V/C 95th Ex. Avail.	A 8	A 0	>	A 0	<	A 0	>		<	0.00	>	<	1	>	A 0	<	B 14	>	<	0.01	>	<	3	>	<	9	>	B 12
	Reid Sideroad & Twiss Rd	TWSC	LOS Delay V/C 95th Ex. Avail.	<	B 11	>	B 11	<	B 11	>		<	0.22	>	<	14	>	B 11	<	A 0	>	<	0.00	>	<	2	>	<	1	>	A 4
PM Peak Hour	Guelph Line & Highway 401 WB Ramp	TWSC	LOS Delay V/C 95th Ex. Avail.					F 291	1.58	281	515	234					F 291		A 0	0.28	0	0	90	90		A 0					
	Guelph Line & Reid Sideroad	TCS	LOS Delay V/C 95th Ex. Avail.	B 20		B 17	B 18											A 5	A 10	0.02	0.62	8	59	80	72		A 7	B 11	0.60		
	Reid Sideroad & Highway 401 EB Ramp	TWSC	LOS Delay V/C 95th Ex. Avail.	A 9	A 0		A 3		A 0	A 0	0.17	0	6	100	20	100	14	A 0								F 220					
	Reid Sideroad & Carpool Lot	TWSC	LOS Delay V/C 95th Ex. Avail.	A 8	A 0	>	A 0	<	A 0	>		<	0.00	>	<	0	>	A 0	<	B 13	>	<	0.07	>	<	11	>	<	45	>	B 13
	Reid Sideroad & Twiss Rd	TWSC	LOS Delay V/C 95th Ex. Avail.	<	B 10	>	B 10	<	B 11	>		<	0.22	>	<	14	>	B 11	<	A 0	>	<	0.00	>	<	2	>	<	2	>	A 3

MOE - Measure of Effectiveness  
TCS - Traffic Control Signal  
TWSC - Two-Way Stop Control  
LOS - Level of Service  
Ex. - Existing Turn Lane Storage or Distance to Upstream Intersection (m)  
V/C - Volume to Capacity Ratio  
95th - 95th Percentile Queue Length (m)  
Avail. - Available Storage (m)  
< - Shared Left-Turn Lane  
> - Shared Right-Turn Lane



### 4.4.3 Total Ten-Year Horizon Operations

The operations of the study area intersections were evaluated using the same analytical approach that was used for the background traffic operations along with the forecast total traffic volumes. No geometric improvements have been assumed. **Table 4.6** summarizes the level of service conditions and the following is noted:

- ▶ The study area intersections are forecast to operate with similar levels of service to the background conditions.
- ▶ During the AM and PM peak hours the Highway 401 Westbound Off-Ramp approach to Guelph Line is forecast to operate with high levels of delay. Delays are classified as LOS F and the v/c ratios are greater than 1.00.
- ▶ During the AM and PM peak hours the Highway 401 Eastbound Off-Ramp approach to Reid Sideroad is forecast to operate with high levels of delay. Delays are classified as LOS F and the v/c ratios are greater than 1.00.
- ▶ The site driveway approach to Twiss Road is forecast to operate with delays in the LOS B range with a v/c ratio of less than 0.10. Queues on the driveway approach are forecast to be less than 15 m.
- ▶ All other intersections in the study area are forecast to operate with satisfactory levels of service during the AM and PM peak hours.

**Appendix D3** contains the Synchro 9 and SimTraffic reports.

The above noted capacity deficiencies are forecast to occur under background traffic conditions without site-specific traffic. The study area intersections are forecast to operate with similar levels of service as documented for the background conditions.

To improve capacity operations at the two Highway 401 off-ramps, improvements to the existing form of traffic control should be considered.



**TABLE 4.6: TOTAL TRAFFIC OPERATIONAL CONDITIONS – TEN-YEAR HORIZON**

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																OVERALL			
				Eastbound				Westbound				Northbound				Southbound							
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach				
AM Peak Hour	Guelph Line & Highway 401 WB Ramp	TWSC	LOS Delay V/C 95th Ex. Avail.					F 142					F 142					A 0	A 0	A 0	A 0		
	Guelph Line & Reid Sideroad	TCS	LOS Delay V/C 95th Ex. Avail.	B 18 0.45 28 100 72	A 16 0.23 29 100 71		B 17										A 5 0.05 10 80 70	A 7 0.45 45 -	A 7 -	A 7 0.38 36 -	A 7 0.40 35 65 30	A 9 0.45	
	Reid Sideroad & Highway 401 EB Ramp	TWSC	LOS Delay V/C 95th Ex. Avail.	B 11 0.33 32 80 48	A 0 0.04 0 80 80		A 9	A 0	A 0.28	A 13	A 20	A 0								F 535 2.08 97 400 303	F 535		
	Reid Sideroad & Carpool Lot	TWSC	LOS Delay V/C 95th Ex. Avail.	A 8 0.00 2 30 29	A 0 0.21 0 105 105		A 0	< 0	A 0	> 3	> 80	A 0	< 0	B 14	> 0.01	> 3	< 75	> 72	B 14	< 12	> 0.04	> 45	B 12
	Reid Sideroad & Twiss Rd	TWSC	LOS Delay V/C 95th Ex. Avail.	< 11 < 0.08 < 14 < 200 < 186	B 11 > 0.23 > 14 > 200 > 186		B 11	< 12	> 0.23	> 14	> 925	B 12	< 0	A 0	> 0.00	> 2	< 215	> 213	A 0	< 4	> 0.01	> 400	A 4
PM Peak Hour	Guelph Line & Highway 401 WB Ramp	TWSC	LOS Delay V/C 95th Ex. Avail.					F 379					F 379					A 0	A 0	A 0	A 0		
	Guelph Line & Reid Sideroad	TCS	LOS Delay V/C 95th Ex. Avail.	C 21 0.58 39 100 61	B 17 0.23 32 100 68		B 19						A 5 0.02 8 80 72	A 10 0.64 65 -				A 7 0.36 36 -	A 7 0.38 29 65 37	B 11 0.62			
	Reid Sideroad & Highway 401 EB Ramp	TWSC	LOS Delay V/C 95th Ex. Avail.	A 9 0.11 17 80 64	A 0 0.10 2 80 78		A 3	A 0	A 0.18	A 5	A 15	A 0								F 285 1.55 115 400 285	F 285		
	Reid Sideroad & Carpool Lot	TWSC	LOS Delay V/C 95th Ex. Avail.	A 8 0.00 1 30 29	A 0 0.13 0 105 105		A 0	< 0	A 0	> 0	> 80	A 0	< 0	A 0	> 0.00	> 0	< 75	> 75	A 0	< 13	> 0.08	> 45	B 13
	Reid Sideroad & Twiss Rd	TWSC	LOS Delay V/C 95th Ex. Avail.	< 11 < 0.01 < 8 < 200 < 192	B 11 > 0.23 > 14 > 200 > 186		B 11	< 11	> 0.24	> 14	> 925	B 11	< 0	A 0	> 0.00	> 1	< 215	> 214	A 0	< 3	> 0.01	> 400	A 3

MOE - Measure of Effectiveness  
TCS - Traffic Control Signal  
TWSC - Two-Way Stop Control  
LOS - Level of Service  
Ex. - Existing Turn Lane Storage or Distance to Upstream Intersection (m)  
V/C - Volume to Capacity Ratio  
95th - 95th Percentile Queue Length (m)  
Avail. - Available Storage (m)  
< - Shared Left-Turn Lane  
> - Shared Right-Turn Lane



## 5 Assessment of Site

The following section discusses the potential remedial measures that could be considered to accommodate the forecast traffic volumes at the study area intersections.

To accommodate the forecast traffic volumes, improvements to the existing form of traffic control could be considered.

### 5.1 Traffic Control Improvements

To address the existing and future background and total traffic capacity related deficiencies at the Highway 401 interchanges with Reid Sideroad and Guelph Line the ramp terminal intersections have been assessed using the OTM Book 12 signal warrant guidelines<sup>10</sup>. The Ministry of Transportation Ontario (MTO) generally does not support the installation of unwarranted traffic control signals.

**Table 5.1** summarizes the signal warrant analyses. **Appendix E** contains the warrants

The forecast traffic volumes at the Highway 401 Off-Ramp intersections with Reid Sideroad and Guelph Line do not satisfy the OTM warrant criteria.

Maintaining the existing form of traffic control is forecast to result in high levels of delay on the Highway 401 Eastbound and Westbound off-ramp approaches. High level of delay is forecast to occur with or without site-specific traffic.

Under existing conditions, both the eastbound and westbound off-ramp approaches are considered critical movements under the MTO guidelines. Volume to capacity ratios are forecast to be greater than 1.00. During the AM peak hour, the westbound off-ramp is operating with a v/c ratio of slightly less than 0.75. The generalized increase in traffic volumes related to opening date background traffic growth is forecast to increase the v/c ratio to be greater than 0.75 during the AM peak hour. With the introduction of site generated traffic, the v/c ratio for the westbound off-ramp is forecast to increase to 0.95.

Site generated traffic does not contribute any traffic volumes to the critical movement at the eastbound Highway 401 intersection. Site traffic only contributes to the eastbound left-turn movement (outbound trips) and the westbound through movement (inbound trips). Both

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<sup>10</sup> Ontario Traffic Manual – Book 12 Traffic Signals





movements are free flow with the eastbound left-turn movement required to yield to opposing traffic.

During the AM peak hour site generated traffic is expected to result in approximately 16 truck trips for the eastbound left-turn movement and 16 truck trips the westbound through movement. During the PM peak hour site generated traffic is expected to result in approximately 3 truck trips for the eastbound left-turn movement and 3 truck trips the westbound through movement.

**TABLE 5.1: OTM WARRANT SUMMARY**

Intersection	Horizon Year	OTM Warrant				Warranted
		1A	1B	2A	2B	
Guelph Line & Highway 401 WB Ramp	Existing Traffic	94%	100%	58%	171%	No
	Background Traffic - Opening Date	97%	103%	60%	177%	No
	Background Traffic - Five-Year Horizon	101%	108%	63%	186%	No
	Background Traffic - Ten-Year Horizon	107%	113%	67%	195%	No
	Total Traffic - Opening Date	97%	104%	60%	183%	No
	Total Traffic - Five-Year Horizon	102%	110%	63%	192%	No
	Total Traffic - Ten-Year Horizon	107%	115%	67%	201%	No
Reid Sideroad & Highway 401 EB Ramp	Existing Traffic	69%	72%	43%	234%	No
	Background Traffic - Opening Date	71%	74%	45%	241%	No
	Background Traffic - Five-Year Horizon	74%	77%	47%	253%	No
	Background Traffic - Ten-Year Horizon	78%	82%	49%	266%	No
	Total Traffic - Opening Date	72%	74%	46%	241%	No
	Total Traffic - Five-Year Horizon	76%	77%	48%	253%	No
	Total Traffic - Ten-Year Horizon	80%	82%	51%	266%	No

Justification 1 – Minimum Vehicle Volumes    Justification 2 – Delay to Cross Traffic

The MTO should consider implementing unwarranted traffic control signals at the Reid Sideroad and Guelph Line Off-Ramps to address existing capacity deficiencies.

Intus Road Safety Engineering Incorporated prepared the supportive Road Safety Impact Study for the subject site<sup>11</sup>. The safety impact study concluded that *“an unwarranted traffic signal, if installed, at the intersection Reid Sideroad and the Highway 401 ramps would result in an additional crash every 18 to 23 years. This is considered a low crash risk and does not preclude the installation of a traffic signal if significant operational benefits are attained via signalization. The decision to implement an unwarranted signal is a policy decision to be made by the MTO. In any event, signalization is not an antecedent to opening the [subject site], from a safety perspective.”*

<sup>11</sup> Road Safety Impact Study Final Report Proposed Reid Road Reservoir Quarry Haul Route Milton, Ontario, Canada. Intus Road Safety Engineering Incorporated



### 5.1.1 Total Ten-Year Horizon Operations with Remedial Measures

**Table 5.2** summarizes the operations of the study area intersections with the introduction of unwarranted traffic control signals and the following is noted:

- ▶ The Highway 401 ramp approach capacity issues for the eastbound and westbound ramps are mitigated with the introduction of traffic control signals. The introduction of signals provides the additional capacity necessary to accommodate both non-site growth in traffic and traffic generated by the subject site.
- ▶ Queuing conditions on the Highway 401 Off-Ramps are not forecast to extend beyond the length of the Off-Ramps and are unlikely to impact mainline operations on Highway 401.
- ▶ The westbound right-turn movement onto Highway 401 eastbound is forecast to operate with a queue length greater than the current available storage the available storage for the movement is approximately 20 m. To accommodate the estimated queue length, the turn lane should be design with a least 30 metres of storage.

**Appendix F** contains the Synchro 9 and SimTraffic reports.

To implement traffic control signals at the two Highway 401 ramp intersections additional detailed design work will be needed to identify an appropriate signal layout. No additional right-of-way is expected to be required to signalize the intersections. After implementation signal timing adjustments can be made to optimize timings to avoid signal starvation and potential queue spillback. Optimized signal timings suggest a cycle length of between 60 and 80 seconds. Timing plans should be based on actual conditions, not forecast conditions as travel patterns/demands could change in ten-years.



**TABLE 5.2: TOTAL TRAFFIC OPERATIONAL CONDITIONS – TEN-YEAR HORIZON WITH REMEDIAL MEASURES**

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																OVERALL						
				Eastbound				Westbound				Northbound				Southbound										
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach							
AM Peak Hour	Guelph Line & Highway 401 WB Ramp	TCS	LOS Delay V/C 95th Ex. Avail.					C 33		C 26		C 29		A 5		A 5		B 10		B 10		B 14.6		0.67		
	Guelph Line & Reid Sideroad	TCS	LOS Delay V/C 95th Ex. Avail.	B 17		A 9	B 12							A 4	A 6		A 6		A 5	A 5		A 4		A 7	0.43	
	Reid Sideroad & Highway 401 EB Ramp	TCS	LOS Delay V/C 95th Ex. Avail.	B 15	B 11		B 14		C 22	A 5	B 10							C 25				C 25		B 15.7	0.62	
	Reid Sideroad & Carpool Lot	TWSC	LOS Delay V/C 95th Ex. Avail.	A 8	A 0	>	A 0	<	A 0	>	A 0	<	B 14	>	B 14	>	B 14	<	B 12	>	B 12	>	B 12			
	Reid Sideroad & Twiss Rd	TWSC	LOS Delay V/C 95th Ex. Avail.	<	B 11	>	B 11	<	B 12	>	B 12	>	B 12	<	A 0	>	A 0	<	A 4	>	A 4	>	A 4			
PM Peak Hour	Guelph Line & Highway 401 WB Ramp	TCS	LOS Delay V/C 95th Ex. Avail.					B 20		B 15		B 17		A 10		A 10		B 13		B 13		B 13		B 14.1	0.62	
	Guelph Line & Reid Sideroad	TCS	LOS Delay V/C 95th Ex. Avail.	B 15		B 13	B 14							A 4	A 9		A 9		A 5	B 10		A 8		A 10	0.62	
	Reid Sideroad & Highway 401 EB Ramp	TCS	LOS Delay V/C 95th Ex. Avail.	B 13	B 11		B 12		B 18	A 1	A 9							C 22				C 22		B 14.5	0.64	
	Reid Sideroad & Carpool Lot	TWSC	LOS Delay V/C 95th Ex. Avail.	A 8	A 0	>	A 0	<	A 0	>	A 0	<	B 14	>	A 0	>	A 0	<	B 13	>	B 13	>	B 13			
	Reid Sideroad & Twiss Rd	TWSC	LOS Delay V/C 95th Ex. Avail.	<	B 11	>	B 11	<	B 11	>	B 11	>	B 11	<	A 0	>	A 0	<	A 3	>	A 3	>	A 3			

MOE - Measure of Effectiveness  
 TCS - Traffic Control Signal  
 TWSC - Two-Way Stop Control  
 LOS - Level of Service  
 Ex. - Existing Turn Lane Storage or Distance to Upstream Intersection (m)  
 V/C - Volume to Capacity Ratio  
 95th - 95th Percentile Queue Length (m)  
 Avail. - Available Storage (m)  
 < - Shared Left-Turn Lane  
 > - Shared Right-Turn Lane



## 5.2 Site Traffic Impacts

### 5.2.1 Heavy Vehicle Trip Generation

**Table 5.3** and **Table 5.4** summarizes the percentage of heavy vehicles attributed by the subject site to the study area intersections:

- ▶ At Guelph Line and the Highway 401 Westbound Ramp, site-generated vehicles are forecast to be approximately 2% of all vehicles serviced by the intersection during the AM peak hour. During the PM peak hour, site-generated traffic comprises less than 1%;
- ▶ At Guelph Line and Reid Sideroad, site-generated vehicles are forecast to be approximately 1% of all vehicles serviced by the intersection during the AM peak hour. During the PM peak hour, site-generated traffic comprises less than 1%;
- ▶ At Reid Sideroad and Highway 401 Eastbound Ramp, site-generated vehicles are forecast to be approximately 4% of all vehicles serviced by the intersection during the AM peak hour. During the PM peak hour, site-generated vehicles are estimated to be approximately 1% of all vehicles serviced by the intersection;
- ▶ At Reid Sideroad and Carpool Lot, site-generated vehicles are forecast to be approximately 10% of all vehicles serviced by the intersection during the AM peak hour. During the PM peak hour, site-generated vehicles are forecast to be approximately 2% of all vehicles serviced by the intersection;
- ▶ At Reid Sideroad and Twiss Road, site-generated vehicles are forecast to be approximately 12% of all vehicles serviced by the intersection during the AM peak hour. During the PM peak hour, site-generated vehicles are forecast to be approximately 3% of all vehicles serviced by the intersection.

The site's location is intended to supply material to market areas east of the site. New truck trips will be oriented towards the Provincial Highway network. Heavy vehicle trips will be directed to use Reid Sideroad and Guelph Line to make all trips to/from the subject site.

The Reid Road Reservoir Quarry will reveal efficiency in the market for high quality limestone resources. The material extracted and shipped from the lands will be closer to market vs. similar sites located in other parts of Ontario.



**TABLE 5.3: HEAVY VEHICLE PERCENTAGES – AM PEAK HOUR**

Intersection	Vehicle Type	Intersection Turning Movements					
		Approach				Total	
		EB	WB	NB	SB	VPH	%
Guelph Line & Highway 401 WB Ramp	Passenger Vehicles		299	257	719	1,275	94%
	Non-Site Traffic - Heavy Vehicles*		23	23	22	68	5%
	Site Traffic - Heavy Vehicles**		16	0	0	16	1%
	<b>Total Vehicles</b>		<b>338</b>	<b>280</b>	<b>741</b>	<b>1,359</b>	<b>100%</b>
	Overall Heavy Vehicle Percent	0%	12%	8%	3%	6%	-
	Site Traffic Heavy Vehicle Percent	0%	5%	0%	0%	1%	-
Guelph Line & Reid Sideroad	Passenger Vehicles	411		447	853	1,711	95%
	Non-Site Traffic - Heavy Vehicles*	20		24	30	74	4%
	Site Traffic - Heavy Vehicles**	0		0	16	16	1%
	<b>Total Vehicles</b>	<b>431</b>		<b>471</b>	<b>899</b>	<b>1,801</b>	<b>100%</b>
	Overall Heavy Vehicle Percent	5%	0%	5%	5%	5%	-
	Site Traffic Heavy Vehicle Percent	0%	0%	0%	2%	1%	-
Reid Sideroad & Highway 401 EB Ramp	Passenger Vehicles	214	520		386	1,120	94%
	Non-Site Traffic - Heavy Vehicles*	9	16		17	42	4%
	Site Traffic - Heavy Vehicles**	16	16		0	32	3%
	<b>Total Vehicles</b>	<b>239</b>	<b>552</b>		<b>403</b>	<b>1,194</b>	<b>100%</b>
	Overall Heavy Vehicle Percent	10%	6%	0%	4%	6%	-
	Site Traffic Heavy Vehicle Percent	7%	3%	0%	0%	3%	-
Reid Sideroad & Carpool Lot	Passenger Vehicles	208	135	1	14	358	88%
	Non-Site Traffic - Heavy Vehicles*	9	8	0	0	17	4%
	Site Traffic - Heavy Vehicles**	16	16	0	0	32	8%
	<b>Total Vehicles</b>	<b>233</b>	<b>159</b>	<b>1</b>	<b>14</b>	<b>407</b>	<b>100%</b>
	Overall Heavy Vehicle Percent	11%	15%	0%	0%	12%	-
	Site Traffic Heavy Vehicle Percent	7%	10%	0%	0%	8%	-
Reid Sideroad & Twiss Rd	Passenger Vehicles	0	94	181	0	275	85%
	Non-Site Traffic - Heavy Vehicles*	0	3	10	2	15	5%
	Site Traffic - Heavy Vehicles**	16	16	0	0	32	10%
	<b>Total Vehicles</b>	<b>16</b>	<b>113</b>	<b>191</b>	<b>2</b>	<b>322</b>	<b>100%</b>
	Overall Heavy Vehicle Percent	100%	17%	5%	100%	15%	-
	Site Traffic Heavy Vehicle Percent	100%	14%	0%	0%	10%	-

\*Heavy vehicle traffic in background traffic forecast

\*\* Site Generated Traffic - Section 3 of Report



**TABLE 5.4: HEAVY VEHICLE PERCENTAGES – PM PEAK HOUR**

Intersection	Vehicle Type	Intersection Turning Movements					
		Approach				Total	
		EB	WB	NB	SB	VPH	%
Guelph Line & Highway 401 WB Ramp	Passenger Vehicles		821	444	432	1,697	98%
	Non-Site Traffic - Heavy Vehicles*		14	8	13	35	2%
	Site Traffic - Heavy Vehicles**		3	0	0	3	0%
	<b>Total Vehicles</b>		<b>838</b>	<b>452</b>	<b>445</b>	<b>1,735</b>	<b>100%</b>
	Overall Heavy Vehicle Percent	0%	2%	2%	3%	2%	-
	Site Traffic Heavy Vehicle Percent	0%	0%	0%	0%	0%	-
Guelph Line & Reid Sideroad	Passenger Vehicles	495		634	866	1,995	98%
	Non-Site Traffic - Heavy Vehicles*	13		6	22	41	2%
	Site Traffic - Heavy Vehicles**	0		0	3	3	0%
	<b>Total Vehicles</b>	<b>508</b>		<b>640</b>	<b>891</b>	<b>2,039</b>	<b>100%</b>
	Overall Heavy Vehicle Percent	3%	0%	1%	3%	2%	-
	Site Traffic Heavy Vehicle Percent	0%	0%	0%	0%	0%	-
Reid Sideroad & Highway 401 EB Ramp	Passenger Vehicles	142	491		423	1,056	96%
	Non-Site Traffic - Heavy Vehicles*	11	21		6	38	3%
	Site Traffic - Heavy Vehicles**	3	3		0	6	1%
	<b>Total Vehicles</b>	<b>156</b>	<b>515</b>		<b>429</b>	<b>1,100</b>	<b>100%</b>
	Overall Heavy Vehicle Percent	9%	5%	0%	1%	4%	-
	Site Traffic Heavy Vehicle Percent	2%	1%	0%	0%	1%	-
Reid Sideroad & Carpool Lot	Passenger Vehicles	128	248	0	20	396	92%
	Non-Site Traffic - Heavy Vehicles*	11	17	0	0	28	7%
	Site Traffic - Heavy Vehicles**	3	3	0	0	6	1%
	<b>Total Vehicles</b>	<b>142</b>	<b>268</b>	<b>0</b>	<b>20</b>	<b>430</b>	<b>100%</b>
	Overall Heavy Vehicle Percent	10%	7%	0%	0%	8%	-
	Site Traffic Heavy Vehicle Percent	2%	1%	0%	0%	1%	-
Reid Sideroad & Twiss Rd	Passenger Vehicles	0	139	123	3	265	90%
	Non-Site Traffic - Heavy Vehicles*	0	10	13	1	24	8%
	Site Traffic - Heavy Vehicles**	3	3	0	0	6	2%
	<b>Total Vehicles</b>	<b>3</b>	<b>152</b>	<b>136</b>	<b>4</b>	<b>295</b>	<b>100%</b>
	Overall Heavy Vehicle Percent	100%	9%	10%	25%	10%	-
	Site Traffic Heavy Vehicle Percent	100%	2%	0%	0%	2%	-

\*Heavy vehicle traffic in background traffic forecast

\*\* Site Generated Traffic - Section 3 of Report



## 5.2.2 LOS Summary by Site Generated Traffic Movement

**Tables 5.5, Table 5.6, and Table 5.7** details the study area intersection operational conditions for the specific turning movements anticipated to be utilized by site generated traffic (haul route).

The tables detail the background traffic operations (without site generated traffic) and the total traffic operations (with site traffic) for the horizon years and analysis periods assessed.

Materials shipped to market will travel east to/from the GTA via Highway 401. JDCL actively enforces haul route compliance with its operators and private operators.

The turning movements impacted by site traffic are limited to the following:

- ▶ Guelph Line & Hwy 401 Westbound Ramp – westbound left-turn (inbound);
- ▶ Guelph Line & Reid Sideroad – Southbound right-turn (inbound);
- ▶ Reid Sideroad & Hwy 401 EB Ramp – westbound through (inbound) and eastbound left turn (outbound);
- ▶ Reid Sideroad & Carpool Lot – eastbound through (outbound) and westbound through (inbound);
- ▶ Reid Sideroad & Twiss Road – eastbound through (outbound) and westbound through (inbound);

Overall, the traffic generated by the subject site is forecast to have minor impacts to the turning movements used by site traffic. Inbound truck trips (10% loaded) are delayed at the Highway 401 Westbound ramp intersection during the AM and PM peak hours. The westbound left-turn movement is forecast to be a critical movement by the MTO's guidelines under the existing horizon and opening date background traffic horizon. During the PM peak hour under existing conditions, the two Highway 401 ramp approaches are operating with delays in the LOS F range with v/c ratios greater than 1.00. The westbound left-turn movement becomes a critical movement during the AM peak hour, with a v/c ratio greater than 0.75 under the forecast opening date horizon.

All other inbound and outbound turning movements are forecast to operate with minimal delay and low v/c ratios.



**TABLE 5.5: INTERSECTION OPERATIONAL SUMMARY – OPENING DATE HORIZON  
SITE TRAFFIC TURNING MOVEMENTS**

Peak Hour	Direction	Intersection	Movement	Background Traffic				Total Traffic			
				LOS	Delay	V/C	95th	LOS	Delay	V/C	95th
AM	IN	Guelph Line & Hwy 401 WB Ramp	WB Left	D	28	0.76	25	E	48	0.95	31
		Guelph Line & Reid Sideroad	SB Right	A	6	0.34	32	A	6	0.36	31
		Reid Sideroad & Hwy 401 EB Ramp	WB Thru	A	0	0.09	0	A	0	0.11	0
		Reid Sideroad & Carpool Lot	WB Thru	A	0	0.00	1	A	0	0.00	1
		Reid Sideroad & Twiss Road	WB Thru	A	10	0.14	12	B	11	0.21	14
	OUT	Reid Sideroad & Twiss Road	EB Thru	0	0	0.00	0	B	11	0.08	14
		Reid Sideroad & Carpool Lot	EB Thru	A	0	0.15	0	A	0	0.19	0
		Reid Sideroad & Hwy 401 EB Ramp	EB Left	A	10	0.21	24	B	10	0.29	32
	PM	IN	Guelph Line & Hwy 401 WB Ramp	WB Left	F	205	1.38	219	F	215	1.41
Guelph Line & Reid Sideroad			SB Right	A	7	0.34	27	A	6	0.35	26
Reid Sideroad & Hwy 401 EB Ramp			WB Thru	A	0	0.16	0	A	0	0.16	0
Reid Sideroad & Carpool Lot			WB Thru	A	0	0.00	0	A	0	0.00	0
Reid Sideroad & Twiss Road			WB Thru	B	10	0.20	13	B	10	0.21	14
OUT		Reid Sideroad & Twiss Road	EB Thru	0	0	0.00	0	B	10	0.01	9
		Reid Sideroad & Carpool Lot	EB Thru	A	0	0.11	0	A	0	0.12	0
		Reid Sideroad & Hwy 401 EB Ramp	EB Left	A	9	0.08	15	A	9	0.09	16





**TABLE 5.6: INTERSECTION OPERATIONAL SUMMARY – FIVE-YEAR HORIZON SITE TRAFFIC TURNING MOVEMENTS**

Peak Hour	Direction	Intersection	Movement	Background Traffic				Total Traffic			
				LOS	Delay	V/C	95th	LOS	Delay	V/C	95th
AM	IN	Guelph Line & Hwy 401 WB Ramp	WB Left	E	37	0.86	31	F	67	1.07	41
		Guelph Line & Reid Sideroad	SB Right	A	6	0.36	33	A	7	0.38	33
		Reid Sideroad & Hwy 401 EB Ramp	WB Thru	A	0	0.09	1	A	0	0.12	1
		Reid Sideroad & Carpool Lot	WB Thru	A	0	0.00	0	A	0	0.00	1
		Reid Sideroad & Twiss Road	WB Thru	B	10	0.15	12	B	11	0.22	14
	OUT	Reid Sideroad & Twiss Road	EB Thru	0	0	0.00	0	B	11	0.08	14
		Reid Sideroad & Carpool Lot	EB Thru	A	0	0.16	0	A	0	0.20	0
		Reid Sideroad & Hwy 401 EB Ramp	EB Left	A	10	0.23	25	B	11	0.30	32
	PM	IN	Guelph Line & Hwy 401 WB Ramp	WB Left	F	280	1.56	271	F	291	1.58
Guelph Line & Reid Sideroad			SB Right	A	7	0.36	27	A	7	0.36	27
Reid Sideroad & Hwy 401 EB Ramp			WB Thru	A	0	0.17	0	A	0	0.17	0
Reid Sideroad & Carpool Lot			WB Thru	A	0	0.00	0	A	0	0.00	0
Reid Sideroad & Twiss Road			WB Thru	B	10	0.21	14	B	11	0.22	14
OUT		Reid Sideroad & Twiss Road	EB Thru	0	0	0.00	0	B	10	0.01	8
		Reid Sideroad & Carpool Lot	EB Thru	A	0	0.11	0	A	0	0.12	0
		Reid Sideroad & Hwy 401 EB Ramp	EB Left	A	9	0.09	15	A	9	0.10	17



**TABLE 5.7: INTERSECTION OPERATIONAL SUMMARY – TEN-YEAR HORIZON SITE TRAFFIC TURNING MOVEMENTS**

Peak Hour	Direction	Intersection	Movement	Background Traffic				Total Traffic			
				LOS	Delay	V/C	95th	LOS	Delay	V/C	95th
AM	IN	Guelph Line & Hwy 401 WB Ramp	WB Left	F	51	0.98	31	F	142	1.20	42
		Guelph Line & Reid Sideroad	SB Right	A	7	0.38	35	A	7	0.40	35
		Reid Sideroad & Hwy 401 EB Ramp	WB Thru	A	0	0.10	0	A	0	0.12	1
		Reid Sideroad & Carpool Lot	WB Thru	A	0	0.00	2	A	0	0.00	3
		Reid Sideroad & Twiss Road	WB Thru	B	10	0.16	12	B	12	0.23	14
	OUT	Reid Sideroad & Twiss Road	EB Thru	0	0	0.00	0	B	11	0.08	14
		Reid Sideroad & Carpool Lot	EB Thru	A	0	0.17	0	A	0	0.21	0
		Reid Sideroad & Hwy 401 EB Ramp	EB Left	B	10	0.25	27	B	11	0.33	32
	PM	IN	Guelph Line & Hwy 401 WB Ramp	WB Left	F	367	1.75	265	F	379	1.78
Guelph Line & Reid Sideroad			SB Right	A	7	0.38	27	A	7	0.38	29
Reid Sideroad & Hwy 401 EB Ramp			WB Thru	A	0	0.18	0	A	0	0.18	0
Reid Sideroad & Carpool Lot			WB Thru	A	0	0.00	0	A	0	0.00	0
Reid Sideroad & Twiss Road			WB Thru	B	10	0.22	13	B	11	0.24	14
OUT		Reid Sideroad & Twiss Road	EB Thru	0	0	0.00	0	B	11	0.01	8
		Reid Sideroad & Carpool Lot	EB Thru	A	0	0.12	0	A	0	0.13	0
		Reid Sideroad & Hwy 401 EB Ramp	EB Left	A	9	0.09	15	A	9	0.11	17



### 5.3 Intersection Queuing

The intersection analysis contained in **Section 2.3**, **Section 4.2**, **Section 4.4**, and **Section 5.1.1** estimated the 95th percentile queue lengths for each movement at the study area intersections. Queue lengths are estimated using ten 60-minute simulations of SimTraffic. In addition to queue length, LOS and v/c ratios are also provided.

**Table 5.8** and **Table 5.9** summarizes the 95<sup>th</sup> percentile queue lengths for the study area intersections for the horizon years and analysis periods assessed.

The only queue issue estimated to occur is under the ten-year total traffic conditions with remedial measures. The operation of a traffic control signal at the Highway 401 Eastbound ramp intersection with Reid Sideroad is estimated to result in a queueing issue for the westbound right-turn movement. The queue length is forecast to be approximately 30 m. The current available storage is about 20 m.

The queueing of vehicles along Reid Sideroad at the Carpool Lot and at the Highway 403 Eastbound ramp intersections are not anticipated to extend into the operational area of the upstream Milton Fire Station driveway. Queue lengths are estimated to be less than 50 m. The Milton Fire Station driveway is located approximately 245 m from the Highway 401 Eastbound Ramp intersection.



**TABLE 5.8: QUEUE LENGTH SUMMARY – PART 1**

Intersection	Peak	Horizon	EB			WB			NB			SB		
			EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Guelph Line & Highway 401 WB Ramp (TWSC)	AM	Existing				25				0			0	
		Background Opening				25				0			0	
		Background Five-year				31				0			0	
		Background Ten-Year				31				0			0	
		Total Opening				31				0			0	
		Total Five-Year				41				0			0	
		Total Ten-Year				42				0			0	
		Total Ten-Year (Remedial)				51				40			65	
	PM	Existing				186				0			0	
		Background Opening				219				0			0	
		Background Five-year				271				0			0	
		Background Ten-Year				265				0			0	
		Total Opening				214				0			0	
		Total Five-Year				281				0			0	
Total Ten-Year					278				0			0		
Total Ten-Year (Remedial)					83				47			59		
Guelph Line & Reid Sideroad (TWSC)	AM	Existing	29		28				9	41			34	31
		Background Opening	29		30				9	40			37	32
		Background Five-year	31		34				10	48			37	33
		Background Ten-Year	31		34				11	49			38	35
		Total Opening	29		31				10	40			37	31
		Total Five-Year	29		30				11	45			36	33
		Total Ten-Year	28		29				10	45			36	35
		Total Ten-Year (Remedial)	37		43				10	54			37	33
	PM	Existing	34		28				7	52			33	27
		Background Opening	35		30				7	53			33	27
		Background Five-year	35		31				7	60			35	27
		Background Ten-Year	20		35				8	61			37	27
		Total Opening	37		31				7	57			34	26
		Total Five-Year	37		32				8	59			35	27
Total Ten-Year		39		32				8	65			36	29	
Total Ten-Year (Remedial)		41		35				8	4			43	38	
Reid Sideroad & Highway 401 EB Ramp (TWSC)	AM	Existing	23	0			0	10		0		102		>
		Background Opening	24	0			0	11		0		111		>
		Background Five-year	25	0			1	13		0		119		>
		Background Ten-Year	27	0			0	12		0		12		>
		Total Opening	32	1			0	13		0		118		>
		Total Five-Year	32	1			1	13		0		103		>
		Total Ten-Year	32	0			1	13		0		97		>
		Total Ten-Year (Remedial)	43	17			34	29		0		84		>
	PM	Existing	15	0			0	5		0		73		>
		Background Opening	15	0			0	5		0		85		>
		Background Five-year	15	0			0	5		0		100		>
		Background Ten-Year	15	1			0	5		0		113		>
		Total Opening	16	0			0	5		0		94		>
		Total Five-Year	17	1			0	6		0		105		>
Total Ten-Year		17	2			0	5		0		115		>	
Total Ten-Year (Remedial)		21	22			49	23		0		65		>	



**TABLE 5.9: QUEUE LENGTH SUMMARY – PART 2**

Intersection	Peak	Horizon	EB			WB			NB			SB		
			EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Reid Sideroad & Carpool Lot (TWSC)	AM	Existing	1	0	>	<	0	>	<	3	>	<	9	>
		Background Opening	1	0	>	<	1	>	<	3	>	<	9	>
		Background Five-year	1	0	>	<	0	>	<	3	>	<	10	>
		Background Ten-Year	1	0	>	<	2	>	<	3	>	<	10	>
		Total Opening	1	0	>	<	1	>	<	3	>	<	10	>
		Total Five-Year	1	0	>	<	1	>	<	3	>	<	9	>
		Total Ten-Year	2	0	>	<	3	>	<	3	>	<	10	>
		Total Ten-Year (Remedial)	2	0	>	<	3	>	<	3	>	<	10	>
	PM	Existing	0	0	>	<	0	>	<	0	>	<	11	>
		Background Opening	0	0	>	<	0	>	<	0	>	<	11	>
		Background Five-year	1	0	>	<	0	>	<	0	>	<	12	>
		Background Ten-Year	0	0	>	<	0	>	<	0	>	<	12	>
		Total Opening	1	0	>	<	0	>	<	0	>	<	11	>
		Total Five-Year	2	0	>	<	0	>	<	0	>	<	11	>
Total Ten-Year		1	0	>	<	0	>	<	0	>	<	11	>	
Total Ten-Year (Remedial)		1	0	>	<	0	>	<	0	>	<	11	>	
Reid Sideroad & Twiss Rd (TWSC)	AM	Existing				12		>		1	>	<	2	
		Background Opening				12		>		1	>	<	2	
		Background Five-year				12		>		1	>	<	2	
		Background Ten-Year				12		>		0	>	<	2	
		Total Opening	<	14	>	<	14	>	<	2	>	<	1	>
		Total Five-Year	<	14	>	<	14	>	<	2	>	<	1	>
		Total Ten-Year	<	14	>	<	14	>	<	2	>	<	2	>
		Total Ten-Year (Remedial)	<	14	>	<	17	>	<	2	>	<	2	>
	PM	Existing				13		>		0	>	<	0	
		Background Opening				13		>		0	>	<	0	
		Background Five-year				14		>		0	>	<	0	
		Background Ten-Year				13		>		0	>	<	1	
		Total Opening	<	9	>	<	14	>	<	1	>	<	1	>
		Total Five-Year	<	8	>	<	14	>	<	0	>	<	2	>
Total Ten-Year		<	8	>	<	14	>	<	1	>	<	1	>	
Total Ten-Year (Remedial)		<	8	>	<	18	>	<	0	>	<	1	>	



## 5.4 Road Safety Impact Study

Intus Road Safety Engineering Incorporated prepared the supportive Road Safety Impact Study for the subject site<sup>12</sup>. The study's conclusions have been included verbatim as requested by the JART:

- ▶ James Dick Construction Ltd. is proposing to develop a quarry on a site located west of Twiss Road approximately opposite Reid Sideroad in the Town of Milton that would extract a maximum of 990,000 tonnes of aggregate material annually.
- ▶ The material will be shipped off-site via Reid Sideroad to Highway 401, with an estimated 100 percent of the product travelling east on Highway 401. The proposed haul route includes Reid Sideroad from Twiss Road to Guelph Line and Guelph Line from Reid Sideroad to the E-S ramp of Highway 401.
- ▶ Reid Sideroad and Guelph Line are owned, operated, and maintained by the Town of Milton and Halton Region, respectively.
- ▶ The collision data indicate that the existing safety performance of the proposed haul is as expected or better than expected for similar facilities, except for the intersection of Twiss Road at Reid Sideroad. At this intersection, truck traffic does not appear to be contributing to the elevated crash risk and the [site] will not exacerbate the elevated collision risk. The rate of involvement of trucks in collisions along the proposed haul route is lower than the provincial average during the analysis period. This suggests that trucks are not currently creating any undue crash risk on the proposed haul route. There were no pedestrian-involved, cyclist involved, or fatal crashes along the proposed haul route during the analysis period.
- ▶ The risk of collisions presented by the R3Q is expected to be low. Furthermore, the R3Q traffic is not expected to change the crash risk profile of facilities along the proposed haul route at the 10-year planning horizon. No remedial measures are required to accommodate the [site], from a road safety perspective.
- ▶ A safe systems assessment of the proposed haul route indicates that ongoing annual maintenance and some minor traffic signing changes would enhance the safety performance

<sup>12</sup> Road Safety Impact Study Final Report Proposed Reid Road Reservoir Quarry Haul Route Milton, Ontario, Canada. Intus Road Safety Engineering Incorporated



of the proposed haul route. None of these changes are antecedent to opening the [site].

- ▶ Given the low demand, and the lack of pedestrian and cyclist generators in the area, pedestrians and cyclists are safely accommodated on the existing facilities. SHARE THE ROAD signs and sharrow pavement markings may be used highlight that the proposed haul route is accommodating cyclists and motorized traffic.
- ▶ Based on the prevailing guidelines, the speed limit of Reid Sideroad may be lowered by 10 km/h along its length.
- ▶ An unwarranted traffic signal, if installed, at the intersection Reid Sideroad and the Highway 401 ramps would result in an additional crash every 18 to 23 years. This is considered a low crash risk and does not preclude the installation of a traffic signal if significant operational benefits are attained via signalization. The decision to implement an unwarranted signal is a policy decision to be made by the MTO. In any event, signalization is not an antecedent to opening the [subject site], from a safety perspective.
- ▶ Emergency response times are not expected to materially change as a result of the [site-]generated traffic.
- ▶ It is not expected that the [site-]generated traffic will result in an elevated crash risk because of risky driver behaviours resulting from increased congestion along the proposed haul route. Furthermore, it is unlikely that safety will be unduly affected by trucks deviating from the proposed haul route during times that Highway 401 is congested.



## 6 Conclusions and Recommendations

### 6.1 Conclusions

The main findings and conclusions of this study are as follows:

- ▶ **Existing Traffic Conditions:** All study area intersections are operating with acceptable levels of service. No movements are considered critical.
- ▶ **Site Generated Traffic:** The maximum amount of material shipped to market is expected to be 990,000 tonnes per year. The shipping of material from the subject site is forecast to generate approximately 16 inbound and 16 outbound truck trips per hour during the AM peak hour. During the PM peak hour, the subject site is estimated to generate approximately 3 inbound and 3 outbound truck trips per hour.

Converting the truck trips to PCE and accounting for approximately 10% of inbound trucks containing recycled material, the AM peak hour PCE trip generation is 34 inbound and 48 outbound. The PM peak hour PCE trip generation is estimated to be 7 inbound and 9 outbound.

- ▶ **Haul Route:** The haul route utilized by traffic generated by the subject site is east/west along Reid Sideroad to the Provincial Highway, Highway 401.

The material will be shipped to/from the east via Highway 401. The applicant does not intend to ship material to/from the west as an alternative source location is better suited to meet market demands west of the site.

- ▶ **Forecast Traffic:** The forecast background traffic volumes near the subject site have been assessed for three horizon years. Namely the anticipated opening date of the proposed Reid Road Reservoir Quarry (2020) and five-year (2025) and ten-year (2030) horizons following the opening date. The likely future traffic volumes are estimated to consist of generalized background traffic growth.
- ▶ **Future Traffic Conditions:** The capacity deficiencies identified under the existing conditions will continue to occur with the addition of background traffic and site generated traffic. The capacity deficiencies are not directly related to the operation of the subject site. To improve the operations, changes to the existing form of stop control could be considered.





- ▶ **Remedial Measures:** The existing form of traffic control at the Highway 401 Eastbound and Westbound Off-Ramps requires improvement regardless of the proposed quarry operation.

The forecast traffic volumes do not satisfy the OTM Book 12 signal warrant requirements. Unwarranted traffic control signals could be considered by the MTO for implementation.

The introduction of unwarranted traffic control signals provides the additional capacity necessary to accommodate both non-site growth in traffic and traffic generated by the subject site.

As concluded by the safety report, an unwarranted traffic signal, if installed, at the intersection Reid Sideroad and the Highway 401 ramps would result in an additional crash every 18 to 23 years. The lifespan of the subject site is estimated to be about 20 years. The decision to implement an unwarranted signal is a policy decision to be made by the MTO. In any event, signalization is not an antecedent to opening the [subject site], from a safety perspective.

## 6.2 Recommendations

Based on the findings of this study, if a Licence is issued by the Province, it is recommended that:

- ▶ The MTO consider implementing unwarranted traffic control signals at the Reid Sideroad and Guelph Line Off-Ramp with the Highway 401 to accommodate the existing and forecast background and total traffic volumes. The design of the signalized intersection at Reid Sideroad may require additional storage for the westbound right-turn movement.
- ▶ The applicant coordinate with the Halton Region and Town of Milton to install advance warning signage on the Reid Sideroad approaches to Milton Fire Station 2. The advance warning signage should indicate an EMS entrance ahead. Supplementary pavement markings should also be considered.

Based on the findings of this study, no other roadway or traffic control improvements are required or recommended to accommodate the future traffic within the study area.



# Appendix A

## Traffic Data





Paradigm Transportation Solutions Limited  
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8  
519-896-3163 cbowness@pts.com

Count Name: Guelph Line & Highway 401 WB  
Ramp  
Site Code:  
Start Date: 02/07/2017  
Page No: 1

### Turning Movement Data

Start Time	Highway 401 WB Ramp Westbound					Guelph Line Northbound					Guelph Line Southbound				Int. Total	
	Left	Right	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	U-Turn	Peds		App. Total
7:00 AM	17	0	0	0	17	30	43	0	0	73	0	86	0	0	86	176
7:15 AM	16	0	0	0	16	42	52	0	0	94	0	103	0	0	103	213
7:30 AM	16	1	0	0	17	35	45	0	0	80	0	110	0	0	110	207
7:45 AM	27	0	0	0	27	37	42	0	0	79	0	119	0	0	119	225
Hourly Total	76	1	0	0	77	144	182	0	0	326	0	418	0	0	418	821
8:00 AM	21	0	0	0	21	40	41	0	0	81	0	86	0	0	86	188
8:15 AM	24	0	0	0	24	20	39	0	0	59	0	76	0	0	76	159
8:30 AM	13	0	0	0	13	22	39	0	0	61	0	78	0	0	78	152
8:45 AM	26	0	0	0	26	21	25	0	0	46	0	72	0	0	72	144
Hourly Total	84	0	0	0	84	103	144	0	0	247	0	312	0	0	312	643
9:00 AM	22	0	0	0	22	33	26	0	0	59	0	65	0	0	65	146
9:15 AM	13	0	0	0	13	27	15	0	0	42	0	59	0	0	59	114
9:30 AM	22	0	0	0	22	23	12	0	0	35	0	50	0	0	50	107
9:45 AM	12	0	0	0	12	32	5	0	0	37	0	44	0	0	44	93
Hourly Total	69	0	0	0	69	115	58	0	0	173	0	218	0	0	218	460
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11:00 AM	12	0	0	0	12	24	11	0	0	35	0	60	0	0	60	107
11:15 AM	10	1	0	0	11	39	20	0	0	59	0	40	0	0	40	110
11:30 AM	17	0	0	0	17	36	17	0	0	53	0	36	0	0	36	106
11:45 AM	15	1	0	0	16	22	6	0	0	28	0	57	0	0	57	101
Hourly Total	54	2	0	0	56	121	54	0	0	175	0	193	0	0	193	424
12:00 PM	24	0	0	0	24	36	6	0	0	42	0	56	0	0	56	122
12:15 PM	26	0	0	0	26	20	6	0	0	26	0	47	0	0	47	99
12:30 PM	14	0	0	0	14	34	5	0	0	39	0	45	0	0	45	98
12:45 PM	22	0	0	0	22	26	7	0	0	33	0	38	0	0	38	93
Hourly Total	86	0	0	0	86	116	24	0	0	140	0	186	0	0	186	412
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3:00 PM	34	0	0	0	34	38	23	0	0	61	0	41	0	0	41	136
3:15 PM	30	0	0	0	30	37	20	0	0	57	0	42	0	0	42	129
3:30 PM	62	0	0	0	62	48	28	0	0	76	0	48	0	0	48	186
3:45 PM	43	0	0	0	43	44	38	0	0	82	0	46	0	0	46	171
Hourly Total	169	0	0	0	169	167	109	0	0	276	0	177	0	0	177	622
4:00 PM	40	0	0	0	40	49	28	0	0	77	0	52	0	0	52	169
4:15 PM	45	0	0	0	45	49	39	0	0	88	0	51	0	0	51	184
4:30 PM	45	1	0	0	46	53	43	0	0	96	0	53	0	0	53	195
4:45 PM	50	0	0	0	50	56	33	0	0	89	0	41	0	0	41	180
Hourly Total	180	1	0	0	181	207	143	0	0	350	0	197	0	0	197	728
5:00 PM	50	0	0	0	50	59	56	0	0	115	0	47	0	0	47	212

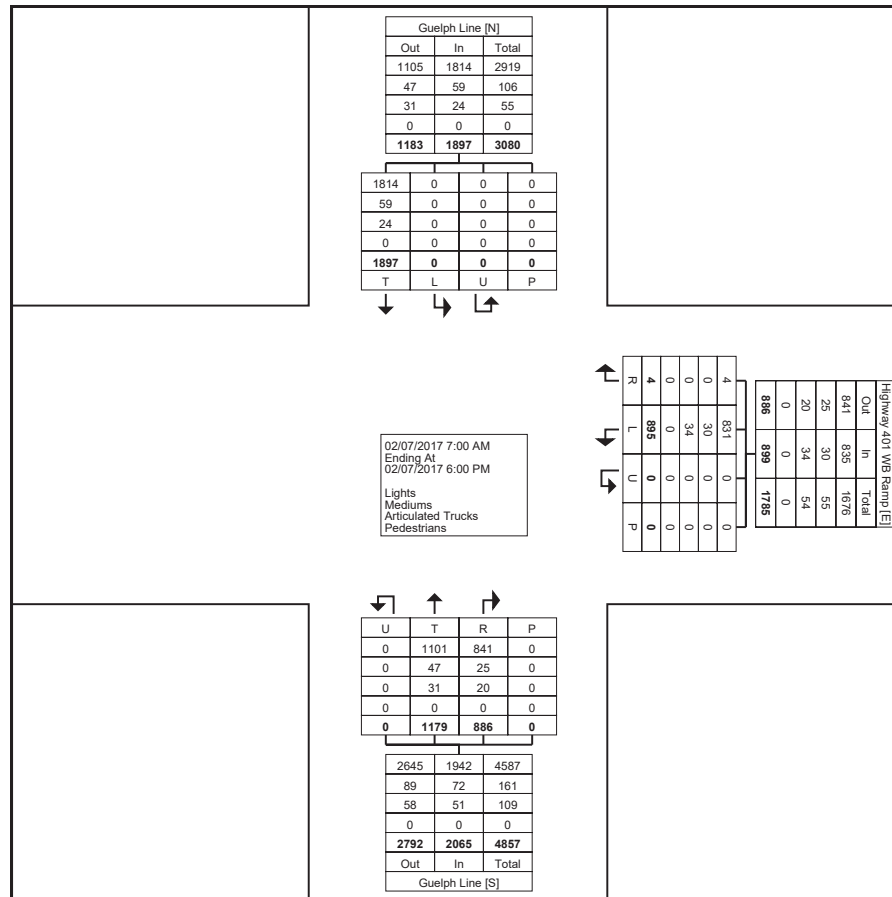




Paradigm Transportation Solutions Limited  
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Count Name: Guelph Line & Highway 401 WB Ramp  
Site Code:  
Start Date: 02/07/2017  
Page No: 3



Turning Movement Data Plot

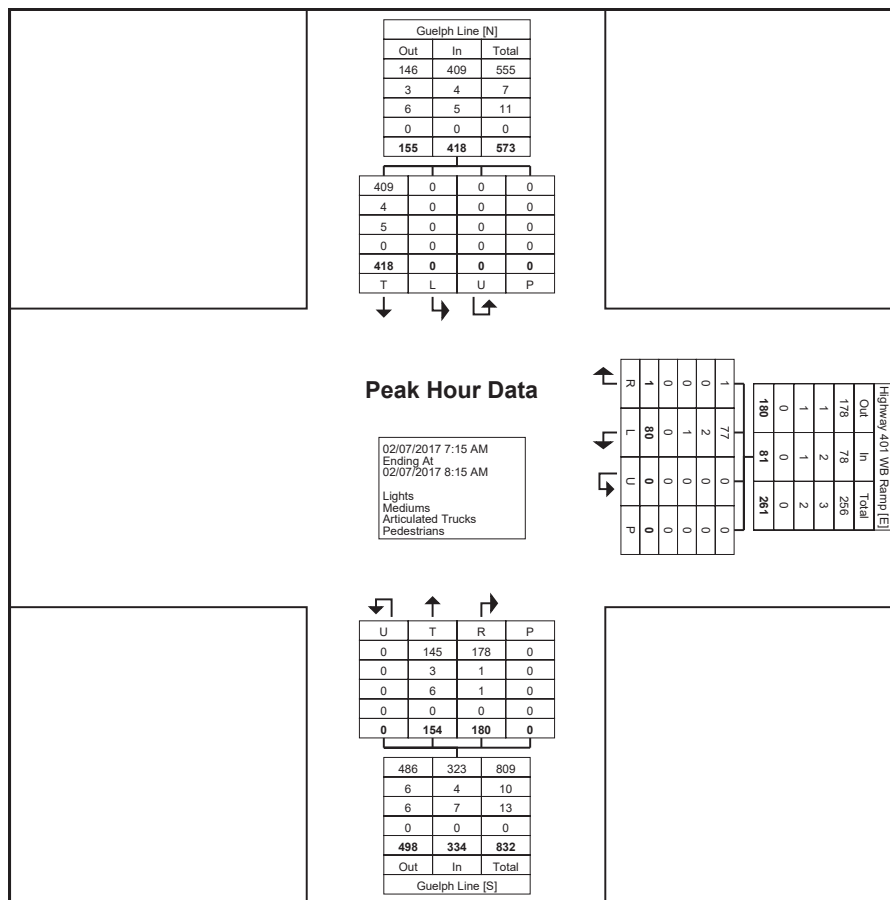




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Count Name: Guelph Line & Highway 401 WB  
Ramp  
Site Code:  
Start Date: 02/07/2017  
Page No: 5



Turning Movement Peak Hour Data Plot (7:15 AM)



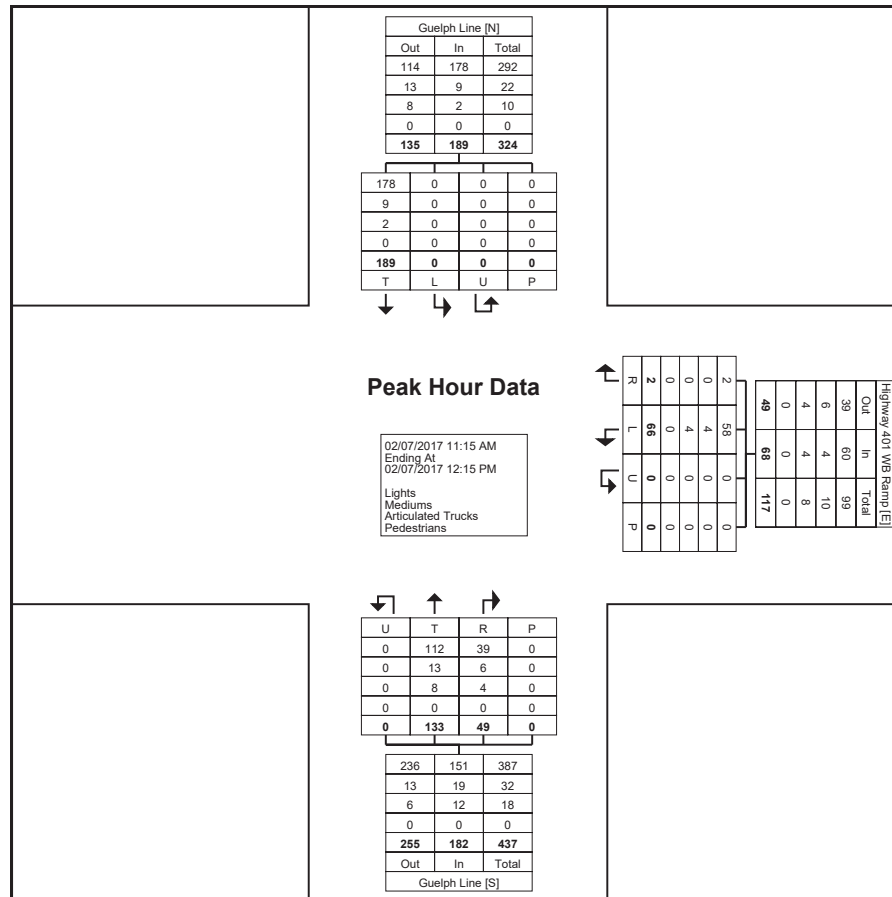




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Count Name: Guelph Line & Highway 401 WB  
Ramp  
Site Code:  
Start Date: 02/07/2017  
Page No: 7



Turning Movement Peak Hour Data Plot (11:15 AM)

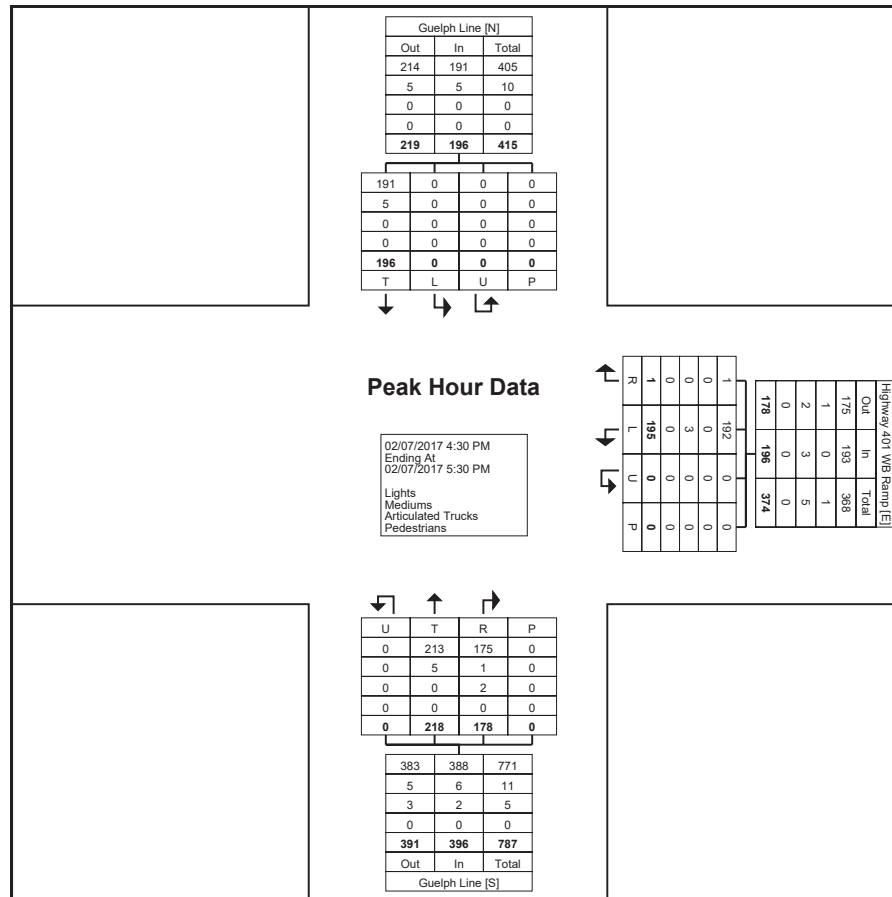




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Count Name: Guelph Line & Highway 401 WB  
Ramp  
Site Code:  
Start Date: 02/07/2017  
Page No: 9



Turning Movement Peak Hour Data Plot (4:30 PM)



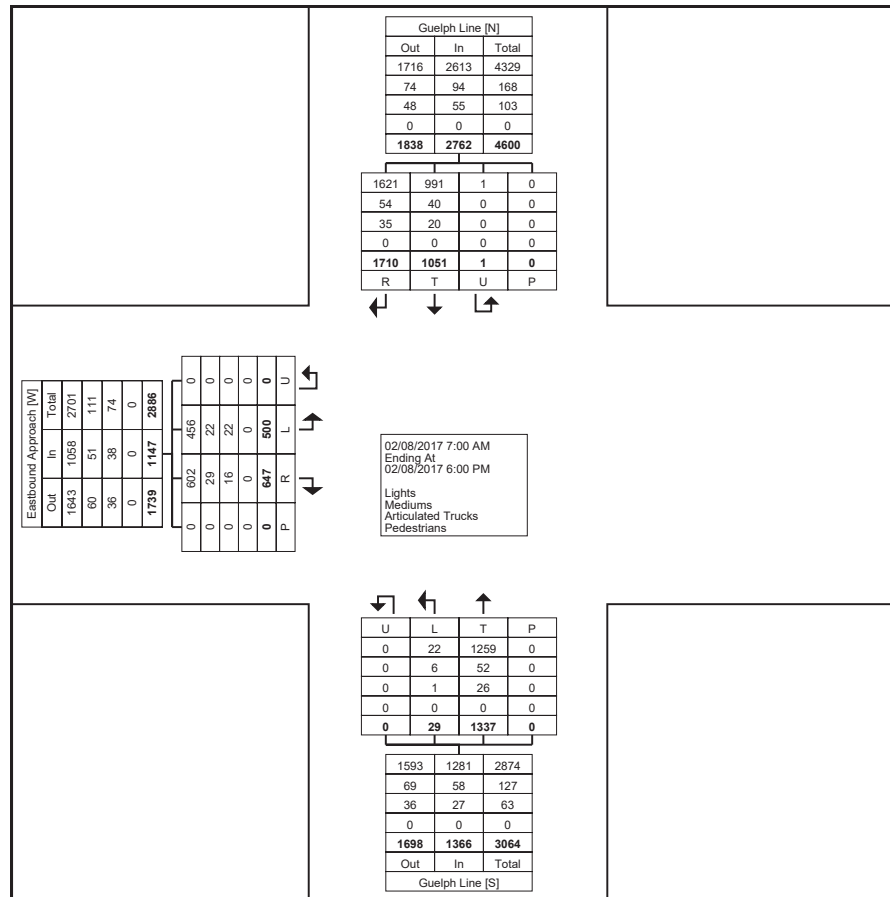




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Count Name: Reid Sideroad & Guelph Line  
Site Code:  
Start Date: 02/08/2017  
Page No: 3



Turning Movement Data Plot

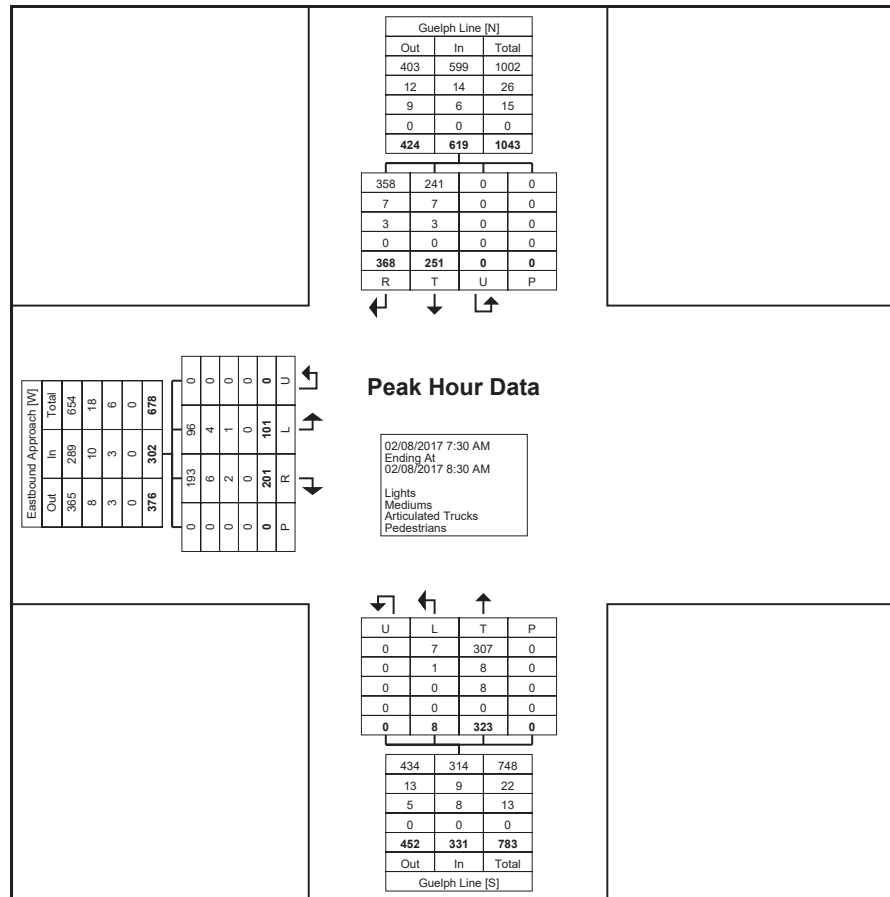




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Count Name: Reid Sideroad & Guelph Line  
Site Code:  
Start Date: 02/08/2017  
Page No: 5



Turning Movement Peak Hour Data Plot (7:30 AM)



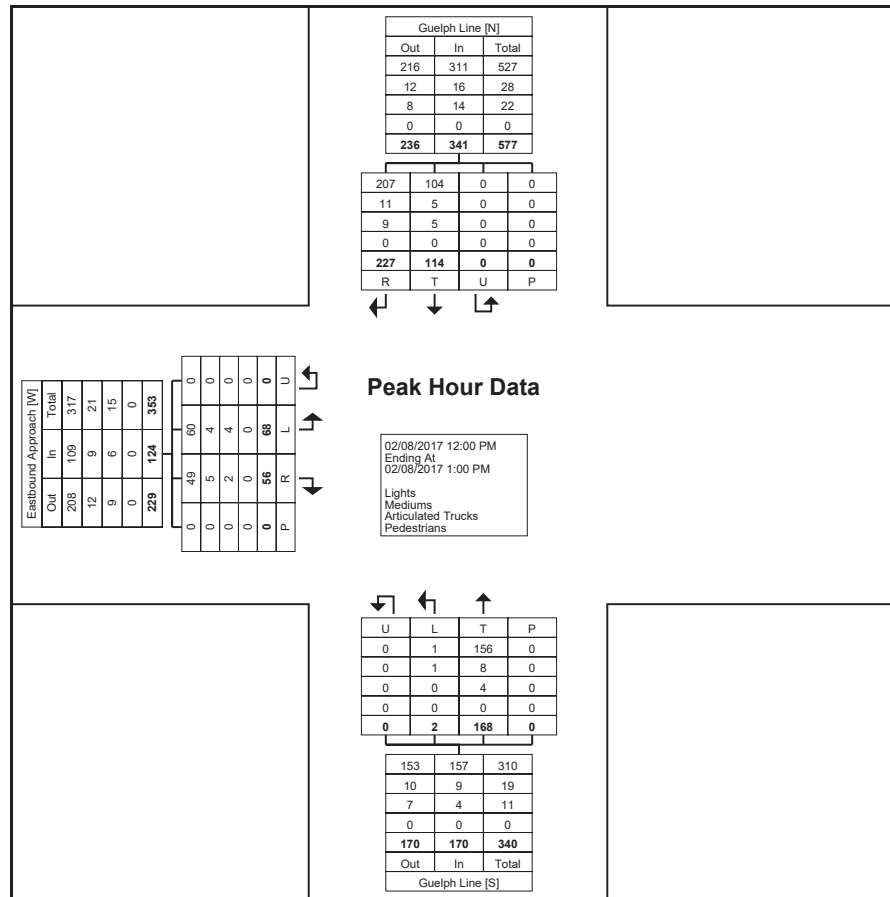




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Count Name: Reid Sideroad & Guelph Line  
Site Code:  
Start Date: 02/08/2017  
Page No: 7



Turning Movement Peak Hour Data Plot (12:00 PM)

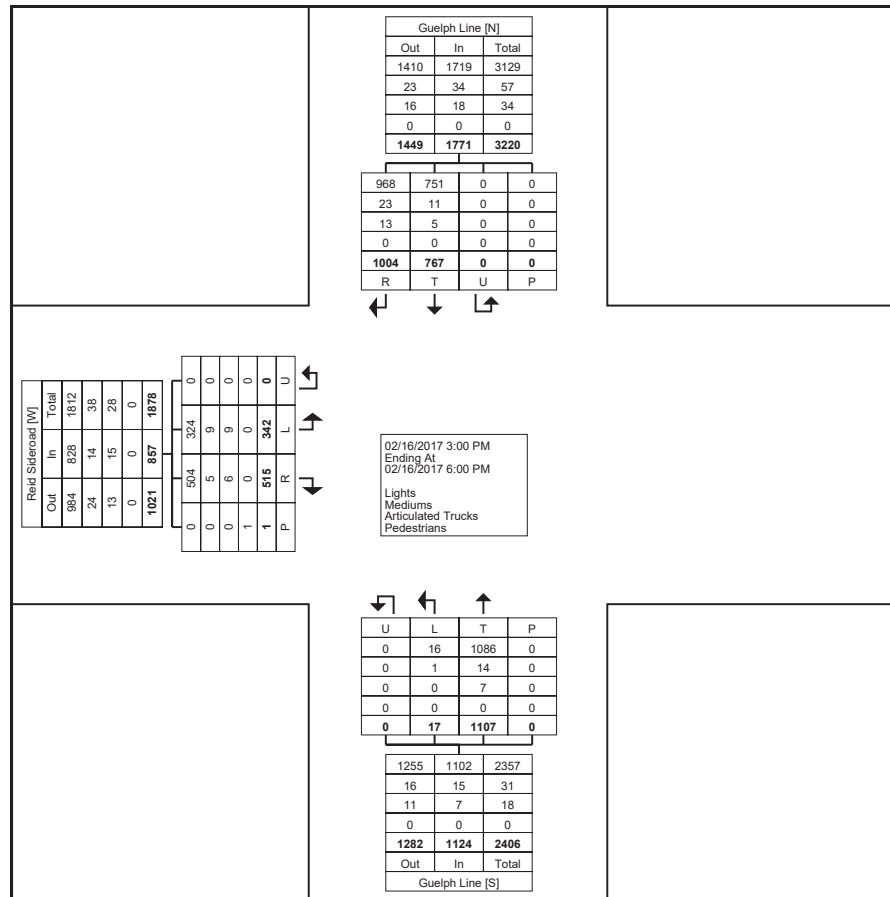




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Count Name: Reid Sideroad & Guelph Line -  
Evening  
Site Code:  
Start Date: 02/16/2017  
Page No: 2



Turning Movement Data Plot

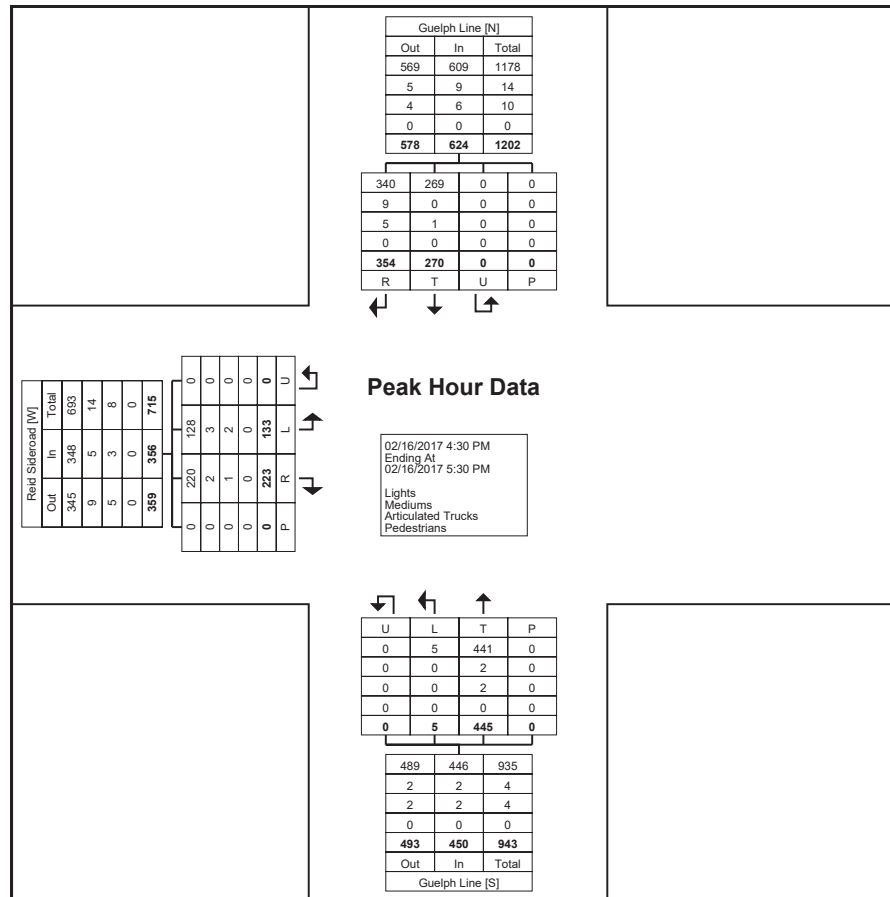




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Count Name: Reid Sideroad & Guelph Line -  
Evening  
Site Code:  
Start Date: 02/16/2017  
Page No: 4



Turning Movement Peak Hour Data Plot (4:30 PM)



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Count Name: Reid Sideroad & Highway 401 EB  
Ramps  
Site Code:  
Start Date: 02/07/2017  
Page No: 1

### Turning Movement Data

Start Time	Reid Sideroad Eastbound					Reid Sideroad Westbound					EB Ramps Southbound					Int. Total
	Left	Thru	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Left	Right	U-Turn	Peds	App. Total	
7:00 AM	30	6	0	0	36	12	66	0	0	78	41	3	0	0	44	158
7:15 AM	26	8	0	0	34	12	70	0	0	82	51	6	0	0	57	173
7:30 AM	40	6	0	0	46	21	75	0	0	96	56	2	0	0	58	200
7:45 AM	30	9	0	0	39	25	77	0	0	102	51	4	0	0	55	196
Hourly Total	126	29	0	0	155	70	288	0	0	358	199	15	0	0	214	727
8:00 AM	24	6	0	0	30	18	49	0	0	67	61	5	0	0	66	163
8:15 AM	25	6	0	0	31	15	41	0	0	56	49	2	0	0	51	138
8:30 AM	25	5	0	0	30	12	51	0	0	63	30	2	1	0	33	126
8:45 AM	16	6	0	0	22	15	41	0	0	56	32	4	0	0	36	114
Hourly Total	90	23	0	0	113	60	182	0	0	242	172	13	1	0	186	541
9:00 AM	15	5	0	0	20	12	37	0	0	49	22	2	1	0	25	94
9:15 AM	14	2	0	0	16	9	39	0	0	48	36	1	0	0	37	101
9:30 AM	9	6	0	0	15	14	34	0	0	48	19	4	0	0	23	86
9:45 AM	8	5	0	0	13	8	28	0	0	36	19	3	0	0	22	71
Hourly Total	46	18	0	0	64	43	138	0	0	181	96	10	1	0	107	352
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11:00 AM	4	6	0	0	10	11	41	0	0	52	16	2	0	0	18	80
11:15 AM	8	10	0	0	18	5	25	0	0	30	17	2	0	0	19	67
11:30 AM	7	8	0	0	15	10	20	0	0	30	18	2	0	0	20	65
11:45 AM	13	4	0	0	17	7	36	0	0	43	15	1	0	0	16	76
Hourly Total	32	28	0	0	60	33	122	0	0	155	66	7	0	0	73	288
12:00 PM	13	12	0	0	25	12	34	0	0	46	17	2	0	0	19	90
12:15 PM	9	7	0	0	16	16	26	0	0	42	23	6	0	0	29	87
12:30 PM	8	11	0	0	19	8	24	0	0	32	16	1	0	0	17	68
12:45 PM	6	5	0	0	11	11	29	0	0	40	16	1	0	0	17	68
Hourly Total	36	35	0	0	71	47	113	0	0	160	72	10	0	0	82	313
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3:00 PM	10	9	0	0	19	16	22	0	0	38	23	3	0	0	26	83
3:15 PM	10	5	0	0	15	14	21	0	0	35	45	1	0	0	46	96
3:30 PM	15	10	0	0	25	39	19	0	0	58	27	5	0	0	32	115
3:45 PM	9	7	0	0	16	27	27	0	0	54	26	0	0	0	26	96
Hourly Total	44	31	0	0	75	96	89	0	0	185	121	9	0	0	130	390
4:00 PM	11	15	0	0	26	20	31	0	0	51	31	6	0	0	37	114
4:15 PM	14	17	0	0	31	29	25	0	0	54	32	0	0	0	32	117
4:30 PM	13	14	0	0	27	26	32	0	0	58	39	0	1	0	40	125
4:45 PM	10	6	0	0	16	31	28	0	0	59	41	3	0	0	44	119
Hourly Total	48	52	0	0	100	106	116	0	0	222	143	9	1	0	153	475
5:00 PM	16	19	0	0	35	30	26	0	0	56	37	1	1	0	39	130







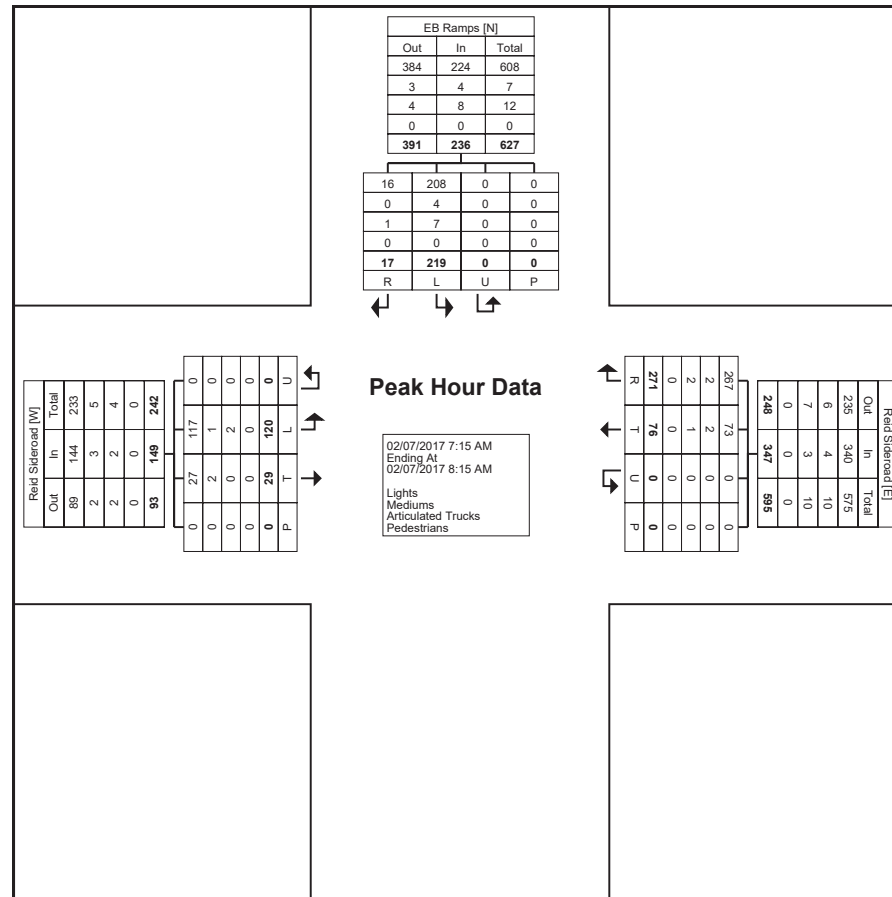




Paradigm Transportation Solutions Limited  
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Count Name: Reid Sideroad & Highway 401 EB  
 Ramps  
 Site Code:  
 Start Date: 02/07/2017  
 Page No: 5



Turning Movement Peak Hour Data Plot (7:15 AM)











Paradigm Transportation Solutions Limited  
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8  
519-896-3163 cbowness@ptsl.com

Count Name: Reid Sideroad & Carpool Lot  
Site Code:  
Start Date: 02/07/2017  
Page No: 1

### Turning Movement Data

Start Time	Reid Sideroad Eastbound						Reid Sideroad Westbound						Park Driveway Northbound						Carpool Lot Southbound						Int. Total	
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total		
7:00 AM	0	35	0	0	0	35	0	13	2	0	0	15	0	0	0	0	0	0	1	0	0	0	0	0	1	51
7:15 AM	1	32	0	0	0	33	0	15	3	0	0	18	0	0	0	0	0	0	2	0	0	0	0	0	2	53
7:30 AM	0	46	0	0	0	46	0	19	2	1	0	22	0	0	0	0	0	0	2	0	1	0	0	0	3	71
7:45 AM	1	35	0	0	0	36	1	26	2	0	0	29	0	0	0	0	0	0	1	0	1	0	0	0	2	67
Hourly Total	2	148	0	0	0	150	1	73	9	1	0	84	0	0	0	0	0	0	6	0	2	0	0	0	8	242
8:00 AM	0	29	0	0	0	29	0	22	1	0	0	23	1	0	0	0	0	1	1	0	1	0	0	0	2	55
8:15 AM	0	31	0	0	0	31	0	15	2	0	0	17	0	0	0	0	0	0	1	0	0	0	0	0	1	49
8:30 AM	0	29	0	0	0	29	0	14	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	43
8:45 AM	0	20	0	0	0	20	0	16	3	0	0	19	0	0	0	0	0	0	2	0	0	0	0	0	2	41
Hourly Total	0	109	0	0	0	109	0	67	6	0	0	73	1	0	0	0	0	1	4	0	1	0	0	0	5	188
9:00 AM	0	20	0	0	0	20	0	13	1	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	34
9:15 AM	0	15	1	0	0	16	0	10	0	0	0	10	0	0	1	0	0	1	0	0	0	0	0	0	0	27
9:30 AM	0	16	0	0	0	16	0	18	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0	34
9:45 AM	0	13	0	0	0	13	0	11	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	24
Hourly Total	0	64	1	0	0	65	0	52	1	0	0	53	0	0	1	0	0	1	0	0	0	0	0	0	0	119
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11:00 AM	0	10	0	0	0	10	0	11	2	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	23
11:15 AM	0	12	0	0	0	12	0	5	2	0	0	7	0	0	0	0	0	0	5	0	0	0	0	0	5	24
11:30 AM	0	13	0	0	0	13	0	12	2	0	0	14	0	0	0	0	0	0	2	0	1	0	0	0	3	30
11:45 AM	0	16	0	0	0	16	0	8	0	0	0	8	0	0	0	0	0	0	1	0	0	0	0	0	1	25
Hourly Total	0	51	0	0	0	51	0	36	6	0	0	42	0	0	0	0	0	0	8	0	1	0	0	0	9	102
12:00 PM	0	25	0	0	0	25	0	13	1	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	39
12:15 PM	1	12	0	0	0	13	0	16	5	0	0	21	0	0	0	0	0	0	4	0	0	0	0	0	4	38
12:30 PM	0	16	0	0	0	16	0	9	0	1	0	10	0	0	0	0	0	0	2	0	0	0	0	0	2	28
12:45 PM	0	10	1	0	0	11	0	11	0	1	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	23
Hourly Total	1	63	1	0	0	65	0	49	6	2	0	57	0	0	0	0	0	0	6	0	0	0	0	0	6	128
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3:00 PM	1	15	0	0	0	16	0	15	5	0	0	20	0	0	0	0	0	0	4	0	1	0	0	0	5	41
3:15 PM	0	13	0	0	0	13	0	13	1	0	0	14	0	0	0	0	0	0	2	0	0	0	0	0	2	29
3:30 PM	0	17	0	0	0	17	1	39	4	0	0	44	0	0	0	0	0	0	8	0	0	0	0	0	8	69
3:45 PM	0	14	0	0	0	14	0	25	2	0	0	27	0	0	1	0	0	1	1	0	1	0	0	0	2	44
Hourly Total	1	59	0	0	0	60	1	92	12	0	0	105	0	0	1	0	0	1	15	0	2	0	0	0	17	183
4:00 PM	0	23	0	0	0	23	1	25	0	0	0	26	0	0	1	0	0	1	1	0	1	0	0	0	2	52
4:15 PM	1	28	0	0	0	29	0	26	3	0	0	29	0	0	0	0	0	0	5	0	1	0	0	0	6	64
4:30 PM	0	24	0	0	0	24	0	24	2	0	0	26	0	0	0	0	0	0	3	0	1	0	0	0	4	54
4:45 PM	0	15	0	0	0	15	0	33	1	0	0	34	0	0	0	0	0	0	2	0	1	0	0	0	3	52
Hourly Total	1	90	0	0	0	91	1	108	6	0	0	115	0	0	1	0	0	1	11	0	4	0	0	0	15	222



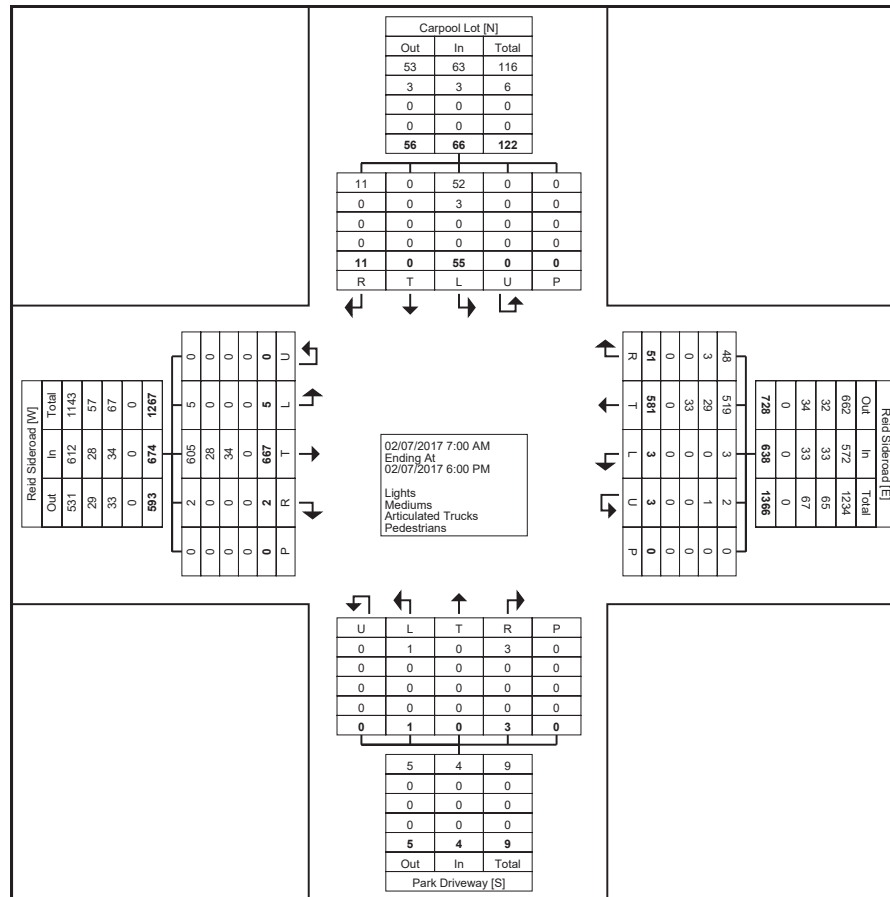




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Count Name: Reid Sideroad & Carpool Lot  
Site Code:  
Start Date: 02/07/2017  
Page No: 3



Turning Movement Data Plot

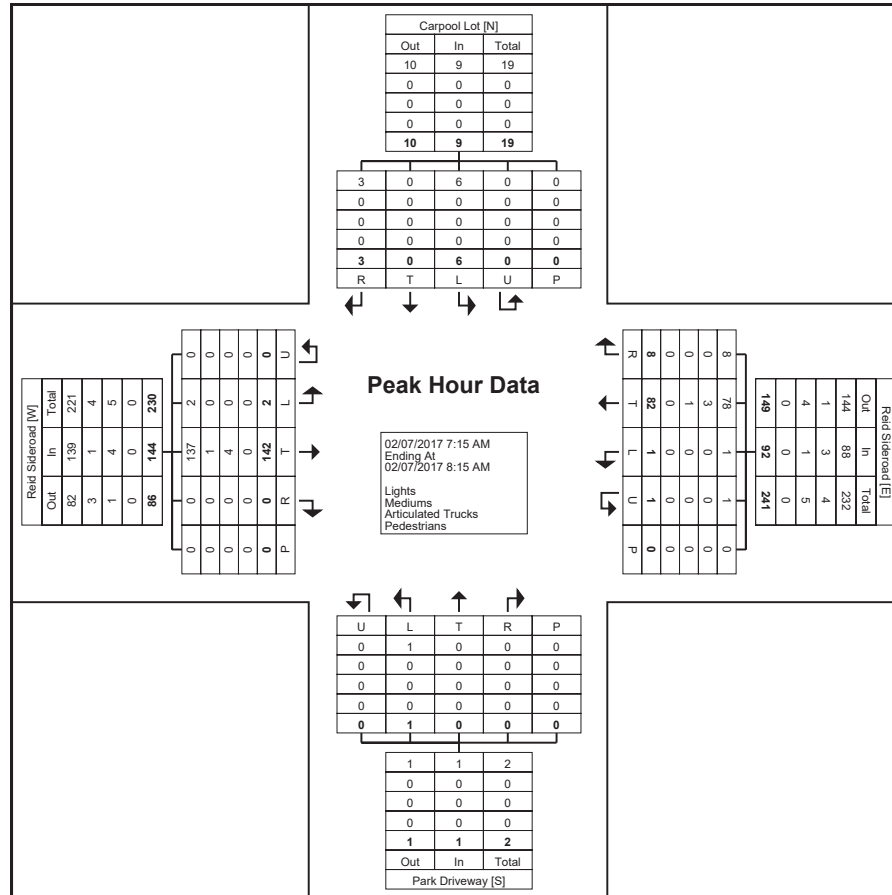




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Count Name: Reid Sideroad & Carpool Lot  
Site Code:  
Start Date: 02/07/2017  
Page No: 5



Turning Movement Peak Hour Data Plot (7:15 AM)



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Count Name: Reid Sideroad & Carpool Lot  
Site Code:  
Start Date: 02/07/2017  
Page No: 6

### Turning Movement Peak Hour Data (11:30 AM)

Start Time	Reid Sideroad Eastbound						Reid Sideroad Westbound						Park Driveway Northbound						Carpool Lot Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
11:30 AM	0	13	0	0	0	13	0	12	2	0	0	14	0	0	0	0	0	0	2	0	1	0	0	3	30
11:45 AM	0	16	0	0	0	16	0	8	0	0	0	8	0	0	0	0	0	0	1	0	0	0	0	1	25
12:00 PM	0	25	0	0	0	25	0	13	1	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	39
12:15 PM	1	12	0	0	0	13	0	16	5	0	0	21	0	0	0	0	0	0	4	0	0	0	0	4	38
<b>Total</b>	<b>1</b>	<b>66</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>67</b>	<b>0</b>	<b>49</b>	<b>8</b>	<b>0</b>	<b>0</b>	<b>57</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>7</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>8</b>	<b>132</b>
Approach %	1.5	98.5	0.0	0.0	-	-	0.0	86.0	14.0	0.0	-	-	NaN	NaN	NaN	NaN	-	-	87.5	0.0	12.5	0.0	-	-	-
Total %	0.8	50.0	0.0	0.0	-	50.8	0.0	37.1	6.1	0.0	-	43.2	0.0	0.0	0.0	0.0	-	0.0	5.3	0.0	0.8	0.0	-	6.1	-
PHF	0.250	0.660	0.000	0.000	-	0.670	0.000	0.766	0.400	0.000	-	0.679	0.000	0.000	0.000	0.000	-	0.000	0.438	0.000	0.250	0.000	-	0.500	0.846
Lights	1	57	0	0	-	58	0	38	8	0	-	46	0	0	0	0	-	0	7	0	1	0	-	8	112
% Lights	100.0	86.4	-	-	-	86.6	-	77.6	100.0	-	-	80.7	-	-	-	-	-	-	100.0	-	100.0	-	-	100.0	84.8
Mediums	0	4	0	0	-	4	0	9	0	0	-	9	0	0	0	0	-	0	0	0	0	0	-	0	13
% Mediums	0.0	6.1	-	-	-	6.0	-	18.4	0.0	-	-	15.8	-	-	-	-	-	-	0.0	-	0.0	-	-	0.0	9.8
Articulated Trucks	0	5	0	0	-	5	0	2	0	0	-	2	0	0	0	0	-	0	0	0	0	0	-	0	7
% Articulated Trucks	0.0	7.6	-	-	-	7.5	-	4.1	0.0	-	-	3.5	-	-	-	-	-	-	0.0	-	0.0	-	-	0.0	5.3
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-





Paradigm Transportation Solutions Limited  
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Count Name: Reid Sideroad & Carpool Lot  
Site Code:  
Start Date: 02/07/2017  
Page No: 8

### Turning Movement Peak Hour Data (4:15 PM)

Start Time	Reid Sideroad Eastbound						Reid Sideroad Westbound						Park Driveway Northbound						Carpool Lot Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
4:15 PM	1	28	0	0	0	29	0	26	3	0	0	29	0	0	0	0	0	0	5	0	1	0	0	6	64
4:30 PM	0	24	0	0	0	24	0	24	2	0	0	26	0	0	0	0	0	0	3	0	1	0	0	4	54
4:45 PM	0	15	0	0	0	15	0	33	1	0	0	34	0	0	0	0	0	0	2	0	1	0	0	3	52
5:00 PM	0	35	0	0	0	35	0	31	0	0	0	31	0	0	0	0	0	0	0	0	0	0	0	0	66
Total	1	102	0	0	0	103	0	114	6	0	0	120	0	0	0	0	0	0	10	0	3	0	0	13	236
Approach %	1.0	99.0	0.0	0.0	-	-	0.0	95.0	5.0	0.0	-	-	NaN	NaN	NaN	NaN	-	-	76.9	0.0	23.1	0.0	-	-	-
Total %	0.4	43.2	0.0	0.0	-	43.6	0.0	48.3	2.5	0.0	-	50.8	0.0	0.0	0.0	0.0	-	0.0	4.2	0.0	1.3	0.0	-	5.5	-
PHF	0.250	0.729	0.000	0.000	-	0.736	0.000	0.864	0.500	0.000	-	0.882	0.000	0.000	0.000	0.000	-	0.000	0.500	0.000	0.750	0.000	-	0.542	0.894
Lights	1	91	0	0	-	92	0	105	6	0	-	111	0	0	0	0	-	0	10	0	3	0	-	13	216
% Lights	100.0	89.2	-	-	-	89.3	-	92.1	100.0	-	-	92.5	-	-	-	-	-	-	100.0	-	100.0	-	-	100.0	91.5
Mediums	0	5	0	0	-	5	0	6	0	0	-	6	0	0	0	0	-	0	0	0	0	0	-	0	11
% Mediums	0.0	4.9	-	-	-	4.9	-	5.3	0.0	-	-	5.0	-	-	-	-	-	-	0.0	-	0.0	-	-	0.0	4.7
Articulated Trucks	0	6	0	0	-	6	0	3	0	0	-	3	0	0	0	0	-	0	0	0	0	0	-	0	9
% Articulated Trucks	0.0	5.9	-	-	-	5.8	-	2.6	0.0	-	-	2.5	-	-	-	-	-	-	0.0	-	0.0	-	-	0.0	3.8
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-







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Count Name: Reid Sideroad & Twiss Road  
Site Code:  
Start Date: 02/07/2017  
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### Turning Movement Data

Start Time	Driveway Eastbound						Reid Sideroad Westbound					Twiss Road Northbound					Twiss Road Southbound					Int. Total			
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right		U-Turn	Peds	App. Total
7:00 AM	0	0	0	0	0	0	13	0	0	0	0	13	0	0	33	0	0	33	0	0	0	0	0	0	46
7:15 AM	0	0	0	0	0	0	10	0	0	0	0	10	0	0	28	0	0	28	0	0	0	0	0	0	38
7:30 AM	0	0	0	0	0	0	15	0	0	0	0	15	0	1	43	0	0	44	0	0	0	0	0	0	59
7:45 AM	0	0	0	0	0	0	18	0	0	0	0	18	0	0	35	0	0	35	1	1	0	0	0	2	55
Hourly Total	0	0	0	0	0	0	56	0	0	0	0	56	0	1	139	0	0	140	1	1	0	0	0	2	198
8:00 AM	0	0	0	0	0	0	22	0	0	0	0	22	0	0	25	0	0	25	0	0	0	0	0	0	47
8:15 AM	0	0	0	0	0	0	13	0	0	1	0	14	0	1	29	0	0	30	0	0	0	0	0	0	44
8:30 AM	0	0	0	0	0	0	15	0	1	0	0	16	0	0	24	0	0	24	0	1	0	0	0	1	41
8:45 AM	0	0	0	0	0	0	10	0	0	0	0	10	0	1	18	0	0	19	1	0	0	0	0	1	30
Hourly Total	0	0	0	0	0	0	60	0	1	1	0	62	0	2	96	0	0	98	1	1	0	0	0	2	162
9:00 AM	0	0	0	0	0	0	12	0	0	0	0	12	0	0	16	0	0	16	0	0	0	0	0	0	28
9:15 AM	0	0	0	0	0	0	10	0	0	0	0	10	0	0	16	0	0	16	0	0	0	0	0	0	26
9:30 AM	0	0	0	0	0	0	15	0	1	0	0	16	0	1	12	0	0	13	0	0	0	0	0	0	29
9:45 AM	0	0	0	0	0	0	7	0	0	0	0	7	0	0	10	0	0	10	0	2	0	0	0	2	19
Hourly Total	0	0	0	0	0	0	44	0	1	0	0	45	0	1	54	0	0	55	0	2	0	0	0	2	102
10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00 AM	0	0	0	0	0	0	6	0	0	0	0	6	0	0	7	0	0	7	0	0	0	0	0	0	13
11:15 AM	0	0	0	0	0	0	6	0	0	0	0	6	0	0	10	0	0	10	0	0	0	0	0	0	16
11:30 AM	0	0	0	0	0	0	4	0	0	1	0	5	0	0	9	0	0	9	0	0	0	0	0	0	14
11:45 AM	0	0	0	0	0	0	9	0	0	0	0	9	0	0	17	0	0	17	0	0	0	0	0	0	26
Hourly Total	0	0	0	0	0	0	25	0	0	1	0	26	0	0	43	0	0	43	0	0	0	0	0	0	69
12:00 PM	0	0	0	0	0	0	10	0	0	0	0	10	0	0	25	0	0	25	0	0	0	0	0	0	35
12:15 PM	0	0	0	0	0	0	15	0	0	0	0	15	0	0	8	0	0	8	0	0	0	0	0	0	23
12:30 PM	0	0	0	0	0	0	12	0	0	0	0	12	0	0	18	0	0	18	0	0	0	0	0	0	30
12:45 PM	0	0	0	0	0	0	11	0	1	0	0	12	0	0	14	0	0	14	0	0	0	0	0	0	26
Hourly Total	0	0	0	0	0	0	48	0	1	0	0	49	0	0	65	0	0	65	0	0	0	0	0	0	114
1:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:00 PM	0	0	0	0	0	0	16	0	0	0	0	16	0	1	14	0	0	15	1	0	0	0	0	1	32
3:15 PM	0	0	0	0	0	0	13	0	1	0	0	14	0	0	12	0	0	12	0	0	0	0	0	0	26
3:30 PM	0	0	0	0	0	0	36	0	0	0	0	36	0	0	9	0	0	9	0	0	0	0	0	0	45
3:45 PM	0	0	0	0	0	0	25	0	0	0	0	25	0	1	11	0	0	12	0	1	0	0	0	1	38
Hourly Total	0	0	0	0	0	0	90	0	1	0	0	91	0	2	46	0	0	48	1	1	0	0	0	2	141
4:00 PM	0	0	0	0	0	0	28	0	0	0	0	28	0	0	23	0	0	23	0	0	0	0	0	0	51







Paradigm Transportation Solutions Limited  
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Count Name: Reid Sideroad & Twiss Road  
Site Code:  
Start Date: 02/07/2017  
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### Turning Movement Peak Hour Data (7:30 AM)

Start Time	Driveway Eastbound						Reid Sideroad Westbound						Twiss Road Northbound						Twiss Road Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
7:30 AM	0	0	0	0	0	0	15	0	0	0	0	15	0	1	43	0	0	44	0	0	0	0	0	0	59
7:45 AM	0	0	0	0	0	0	18	0	0	0	0	18	0	0	35	0	0	35	1	1	0	0	0	2	55
8:00 AM	0	0	0	0	0	0	22	0	0	0	0	22	0	0	25	0	0	25	0	0	0	0	0	0	47
8:15 AM	0	0	0	0	0	0	13	0	0	1	0	14	0	1	29	0	0	30	0	0	0	0	0	0	44
<b>Total</b>	0	0	0	0	0	0	68	0	0	1	0	69	0	2	132	0	0	134	1	1	0	0	0	2	205
Approach %	NaN	NaN	NaN	NaN	-	-	98.6	0.0	0.0	1.4	-	-	0.0	1.5	98.5	0.0	-	-	50.0	50.0	0.0	0.0	-	-	-
Total %	0.0	0.0	0.0	0.0	-	0.0	33.2	0.0	0.0	0.5	-	33.7	0.0	1.0	64.4	0.0	-	65.4	0.5	0.5	0.0	0.0	-	1.0	-
PHF	0.000	0.000	0.000	0.000	-	0.000	0.773	0.000	0.000	0.250	-	0.784	0.000	0.500	0.767	0.000	-	0.761	0.250	0.250	0.000	0.000	-	0.250	0.869
Lights	0	0	0	0	-	0	66	0	0	1	-	67	0	0	127	0	-	127	0	0	0	0	-	0	194
% Lights	-	-	-	-	-	-	97.1	-	-	100.0	-	97.1	-	0.0	96.2	-	-	94.8	0.0	0.0	-	-	-	0.0	94.6
Mediums	0	0	0	0	-	0	1	0	0	0	-	1	0	2	3	0	-	5	1	1	0	0	-	2	8
% Mediums	-	-	-	-	-	-	1.5	-	-	0.0	-	1.4	-	100.0	2.3	-	-	3.7	100.0	100.0	-	-	-	100.0	3.9
Articulated Trucks	0	0	0	0	-	0	1	0	0	0	-	1	0	0	2	0	-	2	0	0	0	0	-	0	3
% Articulated Trucks	-	-	-	-	-	-	1.5	-	-	0.0	-	1.4	-	0.0	1.5	-	-	1.5	0.0	0.0	-	-	-	0.0	1.5
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-





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### Turning Movement Peak Hour Data (11:45 AM)

Start Time	Driveway Eastbound						Reid Sideroad Westbound						Twiss Road Northbound						Twiss Road Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
11:45 AM	0	0	0	0	0	0	9	0	0	0	0	9	0	0	17	0	0	17	0	0	0	0	0	0	26
12:00 PM	0	0	0	0	0	0	10	0	0	0	0	10	0	0	25	0	0	25	0	0	0	0	0	0	35
12:15 PM	0	0	0	0	0	0	15	0	0	0	0	15	0	0	8	0	0	8	0	0	0	0	0	0	23
12:30 PM	0	0	0	0	0	0	12	0	0	0	0	12	0	0	18	0	0	18	0	0	0	0	0	0	30
<b>Total</b>	0	0	0	0	0	0	46	0	0	0	0	46	0	0	68	0	0	68	0	0	0	0	0	0	114
Approach %	NaN	NaN	NaN	NaN	-	-	100.0	0.0	0.0	0.0	-	-	0.0	0.0	100.0	0.0	-	-	NaN	NaN	NaN	NaN	-	-	-
Total %	0.0	0.0	0.0	0.0	-	0.0	40.4	0.0	0.0	0.0	-	40.4	0.0	0.0	59.6	0.0	-	59.6	0.0	0.0	0.0	0.0	-	0.0	-
PHF	0.000	0.000	0.000	0.000	-	0.000	0.767	0.000	0.000	0.000	-	0.767	0.000	0.000	0.680	0.000	-	0.680	0.000	0.000	0.000	0.000	-	0.000	0.814
Lights	0	0	0	0	-	0	40	0	0	0	-	40	0	0	62	0	-	62	0	0	0	0	-	0	102
% Lights	-	-	-	-	-	-	87.0	-	-	-	-	87.0	-	-	91.2	-	-	91.2	-	-	-	-	-	-	89.5
Mediums	0	0	0	0	-	0	4	0	0	0	-	4	0	0	0	0	-	0	0	0	0	0	-	0	4
% Mediums	-	-	-	-	-	-	8.7	-	-	-	-	8.7	-	-	0.0	-	-	0.0	-	-	-	-	-	-	3.5
Articulated Trucks	0	0	0	0	-	0	2	0	0	0	-	2	0	0	6	0	-	6	0	0	0	0	-	0	8
% Articulated Trucks	-	-	-	-	-	-	4.3	-	-	-	-	4.3	-	-	8.8	-	-	8.8	-	-	-	-	-	-	7.0
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-





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Start Date: 02/07/2017  
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### Turning Movement Peak Hour Data (4:15 PM)

Start Time	Driveway Eastbound						Reid Sideroad Westbound						Twiss Road Northbound						Twiss Road Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
4:15 PM	0	0	0	0	0	0	23	0	1	0	0	24	0	0	25	1	0	26	0	0	0	0	0	0	50
4:30 PM	0	0	0	0	0	0	19	0	2	0	0	21	0	0	23	0	0	23	0	2	0	0	0	0	46
4:45 PM	0	0	0	0	0	0	29	0	2	0	0	31	0	0	15	0	0	15	0	0	0	0	0	0	46
5:00 PM	0	0	0	0	0	0	28	0	0	0	0	28	0	0	32	0	0	32	1	0	0	0	0	0	61
<b>Total</b>	0	0	0	0	0	0	99	0	5	0	0	104	0	0	95	1	0	96	1	2	0	0	0	3	203
Approach %	NaN	NaN	NaN	NaN	-	-	95.2	0.0	4.8	0.0	-	-	0.0	0.0	99.0	1.0	-	-	33.3	66.7	0.0	0.0	-	-	-
Total %	0.0	0.0	0.0	0.0	-	0.0	48.8	0.0	2.5	0.0	-	51.2	0.0	0.0	46.8	0.5	-	47.3	0.5	1.0	0.0	0.0	-	1.5	-
PHF	0.000	0.000	0.000	0.000	-	0.000	0.853	0.000	0.625	0.000	-	0.839	0.000	0.000	0.742	0.250	-	0.750	0.250	0.250	0.000	0.000	-	0.375	0.832
Lights	0	0	0	0	-	0	94	0	3	0	-	97	0	0	86	1	-	87	0	2	0	0	-	2	186
% Lights	-	-	-	-	-	-	94.9	-	60.0	-	-	93.3	-	-	90.5	100.0	-	90.6	0.0	100.0	-	-	-	66.7	91.6
Mediums	0	0	0	0	-	0	1	0	2	0	-	3	0	0	3	0	-	3	1	0	0	0	-	1	7
% Mediums	-	-	-	-	-	-	1.0	-	40.0	-	-	2.9	-	-	3.2	0.0	-	3.1	100.0	0.0	-	-	-	33.3	3.4
Articulated Trucks	0	0	0	0	-	0	4	0	0	0	-	4	0	0	6	0	-	6	0	0	0	0	-	0	10
% Articulated Trucks	-	-	-	-	-	-	4.0	-	0.0	-	-	3.8	-	-	6.3	0.0	-	6.3	0.0	0.0	-	-	-	0.0	4.9
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

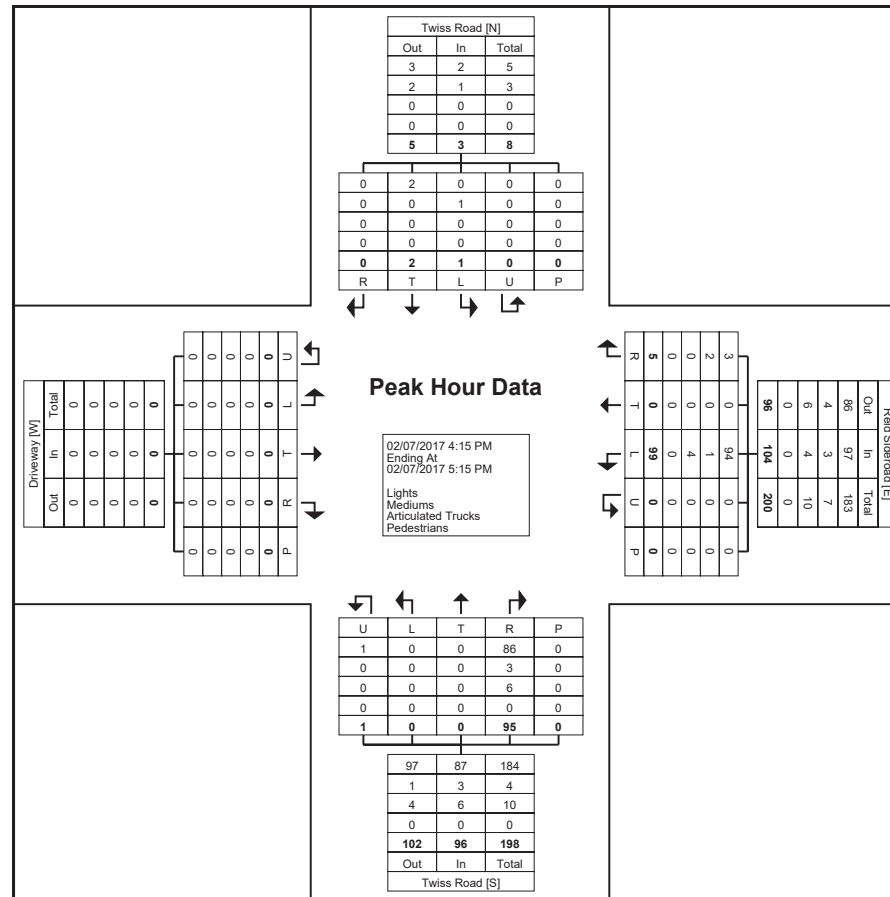




Paradigm Transportation Solutions Limited  
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8  
519-896-3163 cbowness@ptsl.com

Count Name: Reid Sideroad & Twiss Road  
Site Code:  
Start Date: 02/07/2017  
Page No: 9



Turning Movement Peak Hour Data Plot (4:15 PM)

### Highway 401 Westbound Ramps

Date: Tuesday, February 7, 2017

Caputred by: Miovosion

Processed by: CB

Peak Hour	Time	ON Ramp			Off Ramp		
		Car	HV	SUM	Car	HV	SUM
AM Peak Hour	7:15-7:30	13	1	14	17	1	18
	7:30-7:45	11	1	12	32	0	32
	7:45-8:00	14	3	17	31	6	37
	8:00-8:15	12	1	13	36	3	39
	<b>Total</b>	<b>50</b>	<b>6</b>	<b>56</b>	<b>116</b>	<b>10</b>	<b>126</b>
	<b>HV%</b>			<b>11%</b>			<b>8%</b>
	<b>PHF</b>	<b>0.89</b>	<b>0.50</b>	<b>0.82</b>	<b>0.81</b>	<b>0.42</b>	<b>0.81</b>
	11:15-11:30	11	1	12	24	7	31
	11:30-11:45	4	0	4	17	0	17
	11:45-12:00	8	0	8	24	4	28
12:00-12:15	7	5	12	32	3	35	
<b>Total</b>	<b>30</b>	<b>6</b>	<b>36</b>	<b>97</b>	<b>14</b>	<b>111</b>	
<b>HV%</b>			<b>17%</b>			<b>13%</b>	
<b>PHF</b>	<b>0.68</b>	<b>0.30</b>	<b>0.75</b>	<b>0.76</b>	<b>0.50</b>	<b>0.79</b>	
Mid-Day Peak Hour	4:30-4:45	19	0	19	71	0	71
	4:45-5:00	17	0	17	69	0	69
	5:00-5:15	13	0	13	64	1	65
	5:15-5:30	11	0	11	68	2	70
	<b>Total</b>	<b>60</b>	<b>0</b>	<b>60</b>	<b>272</b>	<b>3</b>	<b>275</b>
<b>HV%</b>			<b>0%</b>			<b>1%</b>	
<b>PHF</b>	<b>0.79</b>	<b>#DIV/0!</b>	<b>0.79</b>	<b>0.96</b>	<b>0.38</b>	<b>0.97</b>	
PM Peak Hour	7:15-7:30	13	1	14	17	1	18
	7:30-7:45	11	1	12	32	0	32
	7:45-8:00	14	3	17	31	6	37
	8:00-8:15	12	1	13	36	3	39
	<b>Total</b>	<b>50</b>	<b>6</b>	<b>56</b>	<b>116</b>	<b>10</b>	<b>126</b>
<b>HV%</b>			<b>11%</b>			<b>8%</b>	
<b>PHF</b>	<b>0.89</b>	<b>0.50</b>	<b>0.82</b>	<b>0.81</b>	<b>0.42</b>	<b>0.81</b>	
11:15-11:30	11	1	12	24	7	31	
11:30-11:45	4	0	4	17	0	17	
11:45-12:00	8	0	8	24	4	28	
12:00-12:15	7	5	12	32	3	35	
<b>Total</b>	<b>30</b>	<b>6</b>	<b>36</b>	<b>97</b>	<b>14</b>	<b>111</b>	
<b>HV%</b>			<b>17%</b>			<b>13%</b>	
<b>PHF</b>	<b>0.68</b>	<b>0.30</b>	<b>0.75</b>	<b>0.76</b>	<b>0.50</b>	<b>0.79</b>	
4:30-4:45	19	0	19	71	0	71	
4:45-5:00	17	0	17	69	0	69	
5:00-5:15	13	0	13	64	1	65	
5:15-5:30	11	0	11	68	2	70	
<b>Total</b>	<b>60</b>	<b>0</b>	<b>60</b>	<b>272</b>	<b>3</b>	<b>275</b>	
<b>HV%</b>			<b>0%</b>			<b>1%</b>	
<b>PHF</b>	<b>0.79</b>	<b>#DIV/0!</b>	<b>0.79</b>	<b>0.96</b>	<b>0.38</b>	<b>0.97</b>	

### Highway 401 Eastbound On-Ramp

Date: Tuesday, February 7, 2017

Caputred by: Miovision

Processed by: CB

Peak Hour	Time	ON Ramp		
		Car	HV	SUM
AM Peak Hour	7:15-7:30	7	0	7
	7:30-7:45	16	0	16
	7:45-8:00	18	0	18
	8:00-8:15	18	0	18
	<b>Total</b>	<b>59</b>	<b>0</b>	<b>59</b>
	<b>HV%</b>			<b>0%</b>
	<b>PHF</b>	<b>0.82</b>	<b>0.00</b>	<b>0.82</b>
	11:15-11:30	7	1	8
	11:30-11:45	14	0	14
	11:45-12:00	14	0	14
Mid-Day Peak Hour	12:00-12:15	6	0	6
	<b>Total</b>	<b>41</b>	<b>1</b>	<b>42</b>
	<b>HV%</b>			<b>2%</b>
	<b>PHF</b>	<b>0.73</b>	<b>0.25</b>	<b>0.75</b>
	4:30-4:45	13	1	14
	4:45-5:00	11	1	12
PM Peak Hour	5:00-5:15	13	0	13
	5:15-5:30	19	0	19
	<b>Total</b>	<b>56</b>	<b>2</b>	<b>58</b>
	<b>HV%</b>			<b>3%</b>
	<b>PHF</b>	<b>0.74</b>	<b>0.50</b>	<b>0.76</b>



Ministry of  
Transportation

Highway  
Standards  
Branch

Traffic  
Office

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## **Provincial Highways**

## **Traffic Volumes**

**1988-2016**

King's Highways / Secondary Highways / Tertiary Roads

### **Ministry Contact:**

Traffic Office (905)-704-2960

### **Abstract:**

This annual publication contains averaged traffic volume information and accident rate information for each of the sections of highway under MTO jurisdiction.

### **Key Words:**

Annual Average Daily Traffic volume (AADT), Summer Average Daily Traffic volume (SADT), Summer Average Weekday Traffic volume (SAWDT), Winter Average Daily Traffic volume (WADT), Accident Rate (AR)

## PREFACE

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Traffic volume information is used by many people to assist them in assessing the viability of business proposals, land use options, marketing, advertising, and a host of other activities. This publication, **Provincial Highways Traffic Volumes 1988-2016**, provides traffic volumes on an annual and seasonal average basis for selected links in the provincial highway network. The traffic pattern type and accident rates on the selected links are also indicated.

Some highway routes which have not yet been assigned an official highway number, are included under the title Selected 7000 Series Highways. **The Highway 407 ETR is maintained by 407 ETR Concession Company Ltd. and is not included in this publication. For information contact the 407 ETR Traffic**

**Department at (905) 265-4070.** Site or time specific information not contained herein may be obtained from the Ministry of Transportation's Regional Traffic Sections, located in London, Toronto, Kingston, North Bay and Thunder Bay. Contact MTO INFO at 1-800-268-4686 for the appropriate regional phone number.

The statistics contained herein have been prepared based on data (both electronic and otherwise) obtained from sources considered to be reliable. The Ministry makes no representation or warranty, expressed or implied with respect to its accuracy or completeness. This publication also supersedes any previously published publications.

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	- The 400 series (Highways 400 to Highway 427)	941
The Secondary Highways	- Highway 502 to Highway 673	1250
The Tertiary Roads	- Highway 802 to Highway 811	1484
Selected 7000 Series Highways	- Highway 7025 to Highway 7910	1489

## **INTRODUCTION**

This publication contains information pertaining to traffic volumes on roads under Provincial jurisdiction as of December 31, 2016. The publication is divided into two parts.

## **OVERALL SYSTEM SUMMARIES**

The information in this section is included for policy analysis and program planning purposes. It includes summaries about the overall Provincial Highways system. The system indicators are developed from travel experience, accident data and highway geometrics.

## **TRAFFIC VOLUME INFORMATION**

A detailed listing outlining the 26 year history (1988-2013) of traffic volumes on Provincial Highways (King's, Secondary, Tertiary Roads and the 7000 series highways) is provided.

The highway network is divided into approximately 1831 sections for reporting purposes. Seasonal traffic volume variations are estimated for each section reported. Although local conditions cause variations in the volume within the sections, the volumes shown are considered to adequately represent the section.

On highways that overlap another highway, for instance Highway 35 and Highway 115, the volume information is referenced to the lower number highway. When an overlap occurs between a freeway and non-freeway, reference is made to the freeway route number. The freeways are Highway 400 to Highway 427 and the QEW.

The following are definitions to reading the listings:

**Location Description:** A statement identifying the start or ending point of a section. Some frequently used abbreviations include:

<b>BDY</b>	boundary
<b>BR</b>	bridge
<b>C</b>	concession
<b>CTY</b>	county
<b>DIST</b>	district
<b>KM</b>	kilometres
<b>AVE</b>	avenue
<b>REG</b>	regional
<b>HWY</b>	highway
<b>IC</b>	interchange
<b>JCT</b>	junction
<b>L</b>	lot
<b>LN</b>	line
<b>LTS</b>	limits
<b>NA</b>	non assumed*
<b>OH</b>	overhead
<b>OP</b>	overpass
<b>PKWY</b>	parkway
<b>R</b>	river
<b>RD</b>	road
<b>ST</b>	street
<b>TWP</b>	township
<b>UP</b>	underpass

\*Non Assumed – indicates that the roadway is not under provincial jurisdiction therefore contact the corresponding regional municipality for traffic volume information.

### Distance (KM)

The length of the section in kilometres reported to one decimal place.

### Pattern Type

One of 14 pattern types that represent the seasonal variation of the traffic flow on the section indicated. A graphical presentation of these pattern types has been included on the following page.

The 14 pattern types represent the traffic flow variation on the whole network. They include:

### Variation Types

<b>LOW</b>	<b>UC</b>	urban commuter
	<b>SC</b>	suburban commuter
	<b>C</b>	commuter
<b>INTER</b>	<b>IC</b>	intermediate commuter
	<b>CR</b>	commuter recreation
	<b>IR</b>	intermediate recreation
	<b>CTR</b>	commuter tourist recreation
	<b>IT</b>	intermediate tourist
<b>HIGH</b>	<b>LT</b>	low tourist
	<b>T</b>	tourist
	<b>HT</b>	high tourist
	<b>LR</b>	low recreation
	<b>R</b>	recreation
	<b>HR</b>	high recreation
	<b>UNKN</b>	unknown
	<b>UNCL</b>	unclassified
	<b>NEW</b>	new volume section

The first three are generally referred to as Low Variation Curves (or commuter travel); the next five as Intermediate Variation Curves

(a blend of all types of traffic); and the last six as High Variation Curves. For the last group, the first three represent tourist travel and the second three, recreational travel; this sub-grouping is distinguished by the relationship of weekend to weekday traffic.

There are two additional codes in the pattern type column. "UNC" indicates that the AADT was calculated using adjustment factors from an unclassified (i.e. new) permanent counting station. "NEW" indicates that this is a new volume section and there is insufficient data to assign a pattern type.

### AADT

Annual Average Daily Traffic; defined as the average twenty four hour, two way traffic for the period January 1<sup>st</sup> to December 31<sup>st</sup>.

### SADT

Summer Average Daily Traffic; defined as the average twenty four hour, two way traffic for the period July 1<sup>st</sup> to August 31<sup>st</sup> including weekends.

### SAWDT

Summer Average Weekday Traffic; defined as the average twenty four hour, two way traffic for the period July 1<sup>st</sup> to August 31<sup>st</sup>, excluding weekends.

### WADT

Winter Average Daily Traffic; defined as the average twenty four hour, two way traffic for the period January 1<sup>st</sup> to March 31<sup>st</sup>, plus December 1<sup>st</sup> to December 31<sup>st</sup>, including weekends.



## **NOTES:**

(a) The user of this publication should realize that the reported data are 'estimated values'. Since traffic volumes are not static, direct field measurements are accurate only for the time of the count. Also, the size of the Provincial Highway network makes it impractical to measure each section annually. Thus, approximately one third of the reported sections are counted each year. The following three methods of measuring traffic volumes are employed:

1. Permanent Counting Stations: At designated locations across the Province counts are taken for each hour of the year.
2. Inventory Counting Stations: Each unique volume section has a set location where traffic volumes are sampled on a cyclical basis by season and year.
3. Request Counting Stations: Traffic volumes are measured at random locations as needed to address operational or planning concerns.

Using the available traffic volume information and historical trends, estimates are made for each highway section.

- (b) The abbreviation "N/A" (Not Available) refers to a new volume section or where no data is available. Data for these sections should be available in future publication once collected.
- (c) There may be some missing or incorrect traffic sections, and distances, due to highway realignment, highway transfers, renumbering, or sections which have been recently built.

## **AR**

Accident Rate is defined as the number of reportable accidents occurring annually on a particular highway section for every million vehicle kilometres (MVKM) travelled on that section during the same period. "Reportable Accidents" are those causing any death, injury or property damage exceeding a certain established amount.

The accident rate is calculated as follows:

**AR** = the number of accidents for a given year divided by the MVKM, noting the following:

$$= \frac{\text{The MVKM is calculated as follows: AADT x 365 x Section Length (DIST-km)}}{1,000,000}$$

## **Notes:**

- (a) Multiple vehicle collisions (i.e., chain reactions are generally considered as one accident unless the reporting police officer decides otherwise).
- (b) Accidents on freeway ramps are totally excluded from sectional and total system accident rate calculations. After 1996, highway ramps have also been excluded.
- (c) If no accidents have occurred on a given section, the accident rate is shown as zero.

## **TRAFFIC VOLUME INFORMATION**

The King's Highways	- Queen Elizabeth Way (Q.E.W.) - Highway 2 to Highway 148 - The 400 series (Highway 400 to Highway 427)
The Secondary Highways	- Highway 502 to Highway 673
The Tertiary Roads	- Highway 802 to Highway 811
Selected 7000 Series Highways	- Highway 7025 to Highway 7910

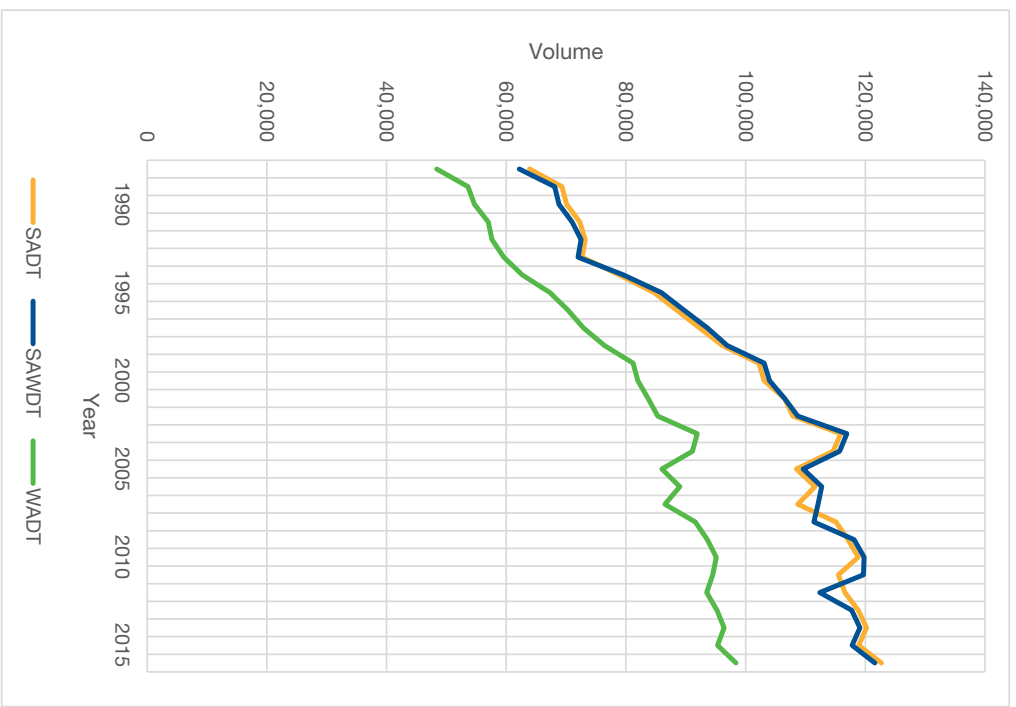
## **NOTE:**

Highway 407 ETR is maintained by 407 ETR Concession Company Ltd. For information contact the 407 ETR Traffic Department at (905) 265-4070.

Highway	Location Description	Dist. (KM)	Year	Pattern Type	AADT	SADT	SAWDT	WADT	AR
			2015	IC	111,400	123,700	122,500	99,100	N/A
			2016	IC	113,000	125,400	124,300	100,600	N/A
401	GUELPH LINE IC-312-HALTON RD 1-MILTON	4.4	1988	IC	55,100	63,900	62,200	48,400	0.9
			1989	IC	60,300	69,300	68,100	53,600	0.9
			1990	IC	61,500	70,100	68,800	54,700	0.8
			1991	IC	64,100	72,300	71,000	57,000	0.6
			1992	IC	64,800	73,200	72,500	57,600	0.7
			1993	IC	65,500	72,700	72,000	59,600	0.8
			1994	IC	70,800	78,900	79,600	62,700	1.0
			1995	IC	76,000	84,700	85,900	67,300	0.7
			1996	IC	79,400	88,500	89,700	70,300	0.4
			1997	IC	82,800	92,300	93,600	72,900	0.3
			1998	IC	86,200	96,100	96,900	76,400	0.3
			1999	IC	91,700	102,200	103,100	81,200	0.4
			2000	IC	92,500	103,100	104,000	82,000	0.5
			2001	IC	95,100	106,500	106,500	83,700	0.5
			2002	IC	96,800	107,900	108,700	85,300	0.4
			2003	IC	104,400	115,900	116,900	91,900	0.5
			2004	IC	102,800	114,600	115,700	91,100	0.7
			2005	IC	97,600	108,500	109,600	86,000	0.7
			2006	IC	100,500	111,600	112,700	89,000	0.4
			2007	IC	97,900	108,700	112,100	86,500	0.6
			2008	IC	103,900	115,100	111,400	91,600	0.8
			2009	IC	104,500	117,100	118,100	93,600	0.6
			2010	IC	104,000	118,800	119,800	95,100	0.3
			2011	IC	105,000	115,500	119,700	94,500	N/A
			2012	IC	105,000	116,600	112,400	93,500	N/A
			2013	IC	107,000	118,800	117,700	95,200	N/A
			2014	IC	108,300	120,200	119,100	96,400	N/A
			2015	IC	107,100	118,900	117,800	95,300	N/A
			2016	IC	110,500	122,700	121,600	98,400	N/A
401	MILTON W LTS	7.3	1988	CTR	55,100	63,900	62,200	48,400	0.9
			1989	CTR	60,300	69,300	68,100	53,600	0.9

Provincial Highway Traffic Volumes 1988-2016

401 - Guelph Line GUELPH LINE IC-312-HALTON RD 1- MILTON						
Year	Pattern Type	AADT	SADT	SAWDT	WADT	AR
1988	IC	55,100	63,900	62,200	48,400	0.9
1989	IC	60,300	69,300	68,100	53,600	0.9
1990	IC	61,500	70,100	68,800	54,700	0.8
1991	IC	64,100	72,300	71,000	57,000	0.6
1992	IC	64,800	73,200	72,500	57,600	0.7
1993	IC	65,500	72,700	72,000	59,600	0.8
1994	IC	70,800	78,900	79,600	62,700	1.0
1995	IC	76,000	84,700	85,900	67,300	0.7
1996	IC	79,400	88,500	89,700	70,300	0.4
1997	IC	82,800	92,300	93,600	72,900	0.3
1998	IC	86,200	96,100	96,900	76,400	0.3
1999	IC	91,700	102,200	103,100	81,200	0.4
2000	IC	92,500	103,100	104,000	82,000	0.5
2001	IC	95,100	106,500	106,500	83,700	0.5
2002	IC	96,800	107,900	108,700	85,300	0.4
2003	IC	104,400	115,900	116,900	91,900	0.5
2004	IC	102,800	114,600	115,700	91,100	0.7
2005	IC	97,600	108,500	109,600	86,000	0.7
<b>2006</b>	<b>IC</b>	<b>100,500</b>	<b>111,600</b>	<b>112,700</b>	<b>89,000</b>	<b>0.4</b>
2007	IC	97,900	108,700	112,100	86,500	0.6
2008	IC	103,900	115,100	111,400	91,600	0.8
2009	IC	104,500	117,100	118,100	93,600	0.6
2010	IC	104,000	118,800	119,800	95,100	0.3
<b>2011</b>	<b>IC</b>	<b>105,000</b>	<b>115,500</b>	<b>119,700</b>	<b>94,500</b>	<b>N/A</b>
2012	IC	105,000	116,600	112,400	93,500	N/A
2013	IC	107,000	118,800	117,700	95,200	N/A
2014	IC	108,300	120,200	119,100	96,400	N/A
2015	IC	107,100	118,900	117,800	95,300	N/A
<b>2016</b>	<b>IC</b>	<b>110,500</b>	<b>122,700</b>	<b>121,600</b>	<b>98,400</b>	<b>N/A</b>



Growth Rate	AADT	SADT	SAWDT	WADT
10 Year Average	0.95%	0.95%	0.76%	1.01%
5 Year Average	1.03%	1.22%	0.32%	0.81%
	2006		1.25	
	2007		1.26	
	2008		1.26	
	2009		1.25	
	2010		1.25	
	2011		1.22	
	2012		1.25	
	2013		1.25	
	2014		1.25	
	2015		1.25	
	2016		1.25	

**WADT to SADT Factor**

2013	1.25
2014	1.25
2015	1.25
2016	1.25

# Appendix B

## Existing Operational Conditions



HCM Unsignalized Intersection Capacity Analysis  
1: Guelph Line & Highway 401 WB Ramp

Existing AM

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔	↔	↑			↑
Traffic Volume (veh/h)	132	171	266	0	0	669
Future Volume (Veh/h)	132	171	266	0	0	669
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.74	0.81	0.92	0.87	0.25	0.88
Hourly flow rate (vph)	178	211	289	0	0	760
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)		11				
Median type			None			None
Median storage (veh)						
Upstream signal (m)			341			
pX, platoon unblocked						
vC, conflicting volume	1049	289			289	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1049	289			289	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	*0.1			2.2	
p0 queue free %	30	99			100	
cM capacity (veh/h)	254	21973			1284	
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	389	289	760			
Volume Left	178	0	0			
Volume Right	211	0	0			
cSH	555	1700	1700			
Volume to Capacity	0.70	0.17	0.45			
Queue Length 95th (m)	44.3	0.0	0.0			
Control Delay (s)	24.2	0.0	0.0			
Lane LOS	C					
Approach Delay (s)	24.2	0.0	0.0			
Approach LOS	C					
<b>Intersection Summary</b>						
Average Delay			6.5			
Intersection Capacity Utilization		49.2%		ICU Level of Service		A
Analysis Period (min)		15				
* User Entered Value						

Synchro 9 Report

Timings  
2: Guelph Line & Reid Sideroad

Existing AM

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↑	↑	↔
Traffic Volume (vph)	132	263	11	424	327	474
Future Volume (vph)	132	263	11	424	327	474
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Detector Phase	4	4	2	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	23.0	23.0	23.0	23.0
Total Split (s)	24.0	24.0	36.0	36.0	36.0	36.0
Total Split (%)	40.0%	40.0%	60.0%	60.0%	60.0%	60.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Max	Max	Max	Max
Act Effct Green (s)	12.4	12.4	32.3	32.3	32.3	32.3
Actuated g/C Ratio	0.24	0.24	0.61	0.61	0.61	0.61
v/c Ratio	0.42	0.52	0.04	0.39	0.33	0.45
Control Delay	20.1	5.7	5.3	7.0	6.5	2.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.1	5.7	5.3	7.0	6.5	2.0
LOS	C	A	A	A	A	A
Approach Delay	10.7			6.9	3.9	
Approach LOS	B			A	A	
<b>Intersection Summary</b>						
Cycle Length: 60						
Actuated Cycle Length: 52.7						
Natural Cycle: 45						
Control Type: Semi Act-Uncoord						
Maximum v/c Ratio: 0.52						
Intersection Signal Delay: 6.4					Intersection LOS: A	
Intersection Capacity Utilization 40.2%					ICU Level of Service A	
Analysis Period (min) 15						
Splits and Phases: 2: Guelph Line & Reid Sideroad						

Synchro 9 Report

HCM Signalized Intersection Capacity Analysis  
2: Guelph Line & Reid Sideroad

Existing AM

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↖	↖	↗	↗
Traffic Volume (vph)	132	263	11	424	327	474
Future Volume (vph)	132	263	11	424	327	474
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.3	3.6	3.6	3.5
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1745	1597	1745	1900	1900	1597
Flt Permitted	0.95	1.00	0.51	1.00	1.00	1.00
Satd. Flow (perm)	1745	1597	941	1900	1900	1597
Peak-hour factor, PHF	0.77	0.82	0.50	0.94	0.86	0.90
Adj. Flow (vph)	171	321	22	451	380	527
RTOR Reduction (vph)	0	246	0	0	0	204
Lane Group Flow (vph)	171	75	22	451	380	323
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4		2		6	
Permitted Phases	4		2		6	
Actuated Green, G (s)	10.4	10.4	30.4	30.4	30.4	30.4
Effective Green, g (s)	12.4	12.4	32.4	32.4	32.4	32.4
Actuated g/C Ratio	0.23	0.23	0.61	0.61	0.61	0.61
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	409	375	577	1165	1165	979
v/s Ratio Prot	c0.10		c0.24		0.20	
v/s Ratio Perm	0.05		0.02		0.20	
v/c Ratio	0.42	0.20	0.04	0.39	0.33	0.33
Uniform Delay, d1	17.1	16.2	4.0	5.2	4.9	4.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.3	0.1	1.0	0.7	0.9
Delay (s)	17.8	16.5	4.2	6.1	5.7	5.8
Level of Service	B	B	A	A	A	A
Approach Delay (s)	17.0		6.0		5.8	
Approach LOS	B		A		A	
<b>Intersection Summary</b>						
HCM 2000 Control Delay	8.8		HCM 2000 Level of Service		A	
HCM 2000 Volume to Capacity ratio	0.40					
Actuated Cycle Length (s)	52.8		Sum of lost time (s)		8.0	
Intersection Capacity Utilization	40.2%		ICU Level of Service		A	
Analysis Period (min)	15					
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis  
3: Reid Sideroad & Highway 401 EB Ramp

Existing AM

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↖	↖	↖	↖	↖
Traffic Volume (veh/h)	154	48	110	375	347	22
Future Volume (Veh/h)	154	48	110	375	347	22
Sign Control	Free		Free		Stop	
Grade	0%		0%		0%	
Peak Hour Factor	0.75	0.81	0.76	0.88	0.90	0.71
Hourly flow rate (vph)	205	59	145	426	386	31
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage (veh)						
Upstream signal (m)	131					
pX, platoon unblocked						
vC, conflicting volume	571				614 145	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	571				614 145	
IC, single (s)	4.1				6.4 6.2	
IC, 2 stage (s)						
IF (s)	2.2				3.5 3.3	
p0 queue free %	80				0 97	
cM capacity (veh/h)	1012				366 908	
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>WB 1</b>	<b>WB 2</b>	<b>SB 1</b>	
Volume Total	205	59	145	426	417	
Volume Left	205	0	0	0	386	
Volume Right	0	0	0	426	31	
cSH	1012	1700	1700	1700	383	
Volume to Capacity	0.20	0.03	0.09	0.25	1.09	
Queue Length 95th (m)	6.1	0.0	0.0	0.0	118.7	
Control Delay (s)	9.5	0.0	0.0	0.0	105.5	
Lane LOS	A				F	
Approach Delay (s)	7.3		0.0		105.5	
Approach LOS	B				F	
<b>Intersection Summary</b>						
Average Delay	36.7					
Intersection Capacity Utilization	42.4%		ICU Level of Service		A	
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis  
4: Carpool Lot & Reid Sideroad

Existing AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔		↔	↔		↔	↔	
Traffic Volume (veh/h)	3	194	0	1	120	11	1	0	0	8	0	4
Future Volume (Veh/h)	3	194	0	1	120	11	1	0	0	8	0	4
Sign Control	Free			Free			Stop			Stop		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.50	0.77	0.25	0.25	0.79	0.67	0.25	0.25	0.25	0.75	0.25	0.75
Hourly flow rate (vph)	6	252	0	4	152	16	4	0	0	11	0	5
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)	212											
pX, platoon unblocked												
vC, conflicting volume	168			252			437	440	252	432	432	160
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	168			252			437	440	252	432	432	160
IC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
IC, 2 stage (s)												
IF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			99	100	100	98	100	99
cM capacity (veh/h)	1422			1325			527	510	792	534	516	890
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1							
Volume Total	6	252	172	4	16							
Volume Left	6	0	4	4	11							
Volume Right	0	0	16	0	5							
cSH	1422	1700	1325	527	611							
Volume to Capacity	0.00	0.15	0.00	0.01	0.03							
Queue Length 95th (m)	0.1	0.0	0.1	0.2	0.6							
Control Delay (s)	7.5	0.0	0.2	11.9	11.1							
Lane LOS	A		A	B	B							
Approach Delay (s)	0.2	0.2	11.9	11.1								
Approach LOS			B	B								
Intersection Summary												
Average Delay	0.7											
Intersection Capacity Utilization	20.2%			ICU Level of Service			A					
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis  
5: Twiss Rd & Reid Sideroad

Existing AM

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔		↔		↔	↔
Traffic Volume (veh/h)	89	0	6	171	2	2
Future Volume (Veh/h)	89	0	6	171	2	2
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.77	0.25	0.50	0.77	0.25	0.25
Hourly flow rate (vph)	116	0	12	222	8	8
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	147	123			234	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	147	123			234	
IC, single (s)	6.4	6.2			4.1	
IC, 2 stage (s)						
IF (s)	3.5	3.3			2.2	
p0 queue free %	86	100			99	
cM capacity (veh/h)	845	933			1345	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	116	234	16			
Volume Left	116	0	8			
Volume Right	0	222	0			
cSH	845	1700	1345			
Volume to Capacity	0.14	0.14	0.01			
Queue Length 95th (m)	3.8	0.0	0.1			
Control Delay (s)	9.9	0.0	3.9			
Lane LOS	A		A			
Approach Delay (s)	9.9	0.0	3.9			
Approach LOS	A					
Intersection Summary						
Average Delay	3.3					
Intersection Capacity Utilization	22.5%			ICU Level of Service		
Analysis Period (min)	15			A		

Queuing and Blocking Report

Existing AM

Intersection: 1: Guelph Line & Highway 401 WB Ramp

Movement	WB
Directions Served	L
Maximum Queue (m)	30.0
Average Queue (m)	15.0
95th Queue (m)	24.9
Link Distance (m)	211.6
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (m)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 2: Guelph Line & Reid Sideroad

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	R
Maximum Queue (m)	36.8	34.7	11.1	50.0	42.3	39.9
Average Queue (m)	16.3	16.9	2.5	22.5	19.0	19.1
95th Queue (m)	29.3	28.3	9.4	40.6	33.5	31.0
Link Distance (m)	102.7	102.7		309.5	324.2	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (m)			80.0		65.0	
Storage Blk Time (%)				0		
Queuing Penalty (veh)				0		

Intersection: 3: Reid Sideroad & Highway 401 EB Ramp

Movement	EB	WB	SB
Directions Served	L	R	LR
Maximum Queue (m)	28.4	14.7	95.6
Average Queue (m)	12.9	3.1	56.7
95th Queue (m)	23.1	10.0	101.7
Link Distance (m)	58.9		91.0
Upstream Blk Time (%)			11
Queuing Penalty (veh)			0
Storage Bay Dist (m)		20.0	
Storage Blk Time (%)		0	
Queuing Penalty (veh)		0	

Queuing and Blocking Report

Existing AM

Intersection: 4: Carpool Lot & Reid Sideroad

Movement	EB	NB	SB
Directions Served	L	LTR	LTR
Maximum Queue (m)	1.8	7.0	8.6
Average Queue (m)	0.1	0.4	2.7
95th Queue (m)	1.4	3.2	9.2
Link Distance (m)		37.4	41.5
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)	30.0		
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 5: Twiss Rd & Reid Sideroad

Movement	WB	NB	SB
Directions Served	LR	TR	LT
Maximum Queue (m)	11.8	0.7	3.1
Average Queue (m)	8.0	0.0	0.1
95th Queue (m)	11.8	0.7	1.7
Link Distance (m)	1100.5	141.7	144.2
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 0



HCM Unsignalized Intersection Capacity Analysis  
1: Guelph Line & Highway 401 WB Ramp

Existing PM

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↘	↗	↑			↑
Traffic Volume (veh/h)	397	348	404	0	0	402
Future Volume (Veh/h)	397	348	404	0	0	402
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.98	0.97	0.92	0.80	0.25	0.89
Hourly flow rate (vph)	405	359	439	0	0	452
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)		11				
Median type			None			None
Median storage (veh)						
Upstream signal (m)			341			
pX, platoon unblocked						
vC, conflicting volume	891	439			439	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	891	439			439	
IC, single (s)	6.4	6.2			4.1	
IC, 2 stage (s)						
IF (s)	3.5	*0.1			2.2	
p0 queue free %	0	98			100	
cM capacity (veh/h)	315	17006			1132	
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	764	439	452			
Volume Left	405	0	0			
Volume Right	359	0	0			
cSH	590	1700	1700			
Volume to Capacity	1.29	0.26	0.27			
Queue Length 95th (m)	247.8	0.0	0.0			
Control Delay (s)	166.4	0.0	0.0			
Lane LOS	F					
Approach Delay (s)	166.4	0.0	0.0			
Approach LOS	F					
<b>Intersection Summary</b>						
Average Delay			76.8			
Intersection Capacity Utilization			49.9%		ICU Level of Service	A
Analysis Period (min)			15			
* User Entered Value						

Timings  
2: Guelph Line & Reid Sideroad

Existing PM

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↘	↗	↘	↑	↑	↗
Traffic Volume (vph)	174	283	6	561	338	461
Future Volume (vph)	174	283	6	561	338	461
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Detector Phase	4	4	2	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	23.0	23.0	23.0	23.0
Total Split (s)	21.0	21.0	39.0	39.0	39.0	39.0
Total Split (%)	35.0%	35.0%	65.0%	65.0%	65.0%	65.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Max	Max	Max	Max
Act Effct Green (s)	14.0	14.0	35.1	35.1	35.1	35.1
Actuated g/C Ratio	0.25	0.25	0.61	0.61	0.61	0.61
v/c Ratio	0.53	0.51	0.02	0.56	0.31	0.45
Control Delay	23.5	5.7	5.3	9.4	6.7	2.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.5	5.7	5.3	9.4	6.7	2.0
LOS	C	A	A	A	A	A
Approach Delay	13.0			9.3	3.9	
Approach LOS	B			A	A	
<b>Intersection Summary</b>						
Cycle Length: 60						
Actuated Cycle Length: 57.1						
Natural Cycle: 45						
Control Type: Semi Act-Uncoord						
Maximum v/c Ratio: 0.56						
Intersection Signal Delay: 8.0					Intersection LOS: A	
Intersection Capacity Utilization 45.8%					ICU Level of Service A	
Analysis Period (min) 15						
<b>Splits and Phases: 2: Guelph Line &amp; Reid Sideroad</b>						

HCM Signalized Intersection Capacity Analysis  
2: Guelph Line & Reid Sideroad

Existing PM

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↕	↕	↕
Traffic Volume (vph)	174	283	6	561	338	461
Future Volume (vph)	174	283	6	561	338	461
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.3	3.6	3.6	3.5
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1745	1597	1745	1900	1900	1597
Flt Permitted	0.95	1.00	0.52	1.00	1.00	1.00
Satd. Flow (perm)	1745	1597	957	1900	1900	1597
Peak-hour factor, PHF	0.77	0.87	0.63	0.86	0.93	0.87
Adj. Flow (vph)	226	325	10	652	363	530
RTOR Reduction (vph)	0	246	0	0	0	204
Lane Group Flow (vph)	226	79	10	652	363	326
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2		6
Permitted Phases		4	2			6
Actuated Green, G (s)	11.9	11.9	33.1	33.1	33.1	33.1
Effective Green, g (s)	13.9	13.9	35.1	35.1	35.1	35.1
Actuated g/C Ratio	0.24	0.24	0.62	0.62	0.62	0.62
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	425	389	589	1170	1170	983
v/s Ratio Prot	c0.13			c0.34		0.19
v/s Ratio Perm		0.05	0.01			0.20
v/c Ratio	0.53	0.20	0.02	0.56	0.31	0.33
Uniform Delay, d1	18.7	17.1	4.3	6.4	5.2	5.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.3	0.3	0.1	1.9	0.7	0.9
Delay (s)	20.0	17.4	4.3	8.3	5.9	6.2
Level of Service	C	B	A	A	A	A
Approach Delay (s)	18.5			8.3	6.1	
Approach LOS	B			A	A	
<b>Intersection Summary</b>						
HCM 2000 Control Delay			10.0		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.55			
Actuated Cycle Length (s)			57.0		Sum of lost time (s)	8.0
Intersection Capacity Utilization			45.8%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

Synchro 9 Report

HCM Unsignalized Intersection Capacity Analysis  
3: Reid Sideroad & Highway 401 EB Ramp

Existing PM

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↔	↕	↕	↕	↕	↕
Traffic Volume (veh/h)	58	85	237	230	372	11
Future Volume (Veh/h)	58	85	237	230	372	11
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.72	0.55	0.90	0.85	0.76	0.50
Hourly flow rate (vph)	81	155	263	271	489	22
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)			131			
pX, platoon unblocked						
vC, conflicting volume	534				580	263
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	534				580	263
IC, single (s)	4.1				6.4	6.2
IC, 2 stage (s)						
IF (s)	2.2				3.5	3.3
p0 queue free %	92				0	97
cM capacity (veh/h)	1044				443	781
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>WB 1</b>	<b>WB 2</b>	<b>SB 1</b>	
Volume Total	81	155	263	271	511	
Volume Left	81	0	0	0	489	
Volume Right	0	0	0	271	22	
cSH	1044	1700	1700	1700	451	
Volume to Capacity	0.08	0.09	0.15	0.16	1.13	
Queue Length 95th (m)	2.0	0.0	0.0	0.0	144.7	
Control Delay (s)	8.7	0.0	0.0	0.0	113.3	
Lane LOS	A				F	
Approach Delay (s)	3.0		0.0		113.3	
Approach LOS					F	
<b>Intersection Summary</b>						
Average Delay			45.8			
Intersection Capacity Utilization			47.1%		ICU Level of Service	A
Analysis Period (min)			15			

Synchro 9 Report

HCM Unsignalized Intersection Capacity Analysis  
4: Carpool Lot & Reid Sideroad

Existing PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔			↔			↔			↔	
Traffic Volume (veh/h)	1	130	0	0	235	13	0	0	0	13	0	4
Future Volume (Veh/h)	1	130	0	0	235	13	0	0	0	13	0	4
Sign Control	Free			Free			Stop			Stop		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.25	0.73	0.25	0.25	0.86	0.50	0.25	0.25	0.25	0.50	0.25	0.75
Hourly flow rate (vph)	4	178	0	0	273	26	0	0	0	26	0	5
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)	212											
pX, platoon unblocked												
vC, conflicting volume	299			178			477	485	178	472	472	286
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	299			178			477	485	178	472	472	286
IC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
IC, 2 stage (s)												
IF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	95	100	99
cM capacity (veh/h)	1274			1410			497	483	870	504	492	758
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>							
Volume Total	4	178	299	0	31							
Volume Left	4	0	0	0	26							
Volume Right	0	0	26	0	5							
cSH	1274	1700	1410	1700	533							
Volume to Capacity	0.00	0.10	0.00	0.00	0.06							
Queue Length 95th (m)	0.1	0.0	0.0	0.0	1.5							
Control Delay (s)	7.8	0.0	0.0	0.0	12.2							
Lane LOS	A			A	B							
Approach Delay (s)	0.2		0.0	0.0	12.2							
Approach LOS			A		B							
<b>Intersection Summary</b>												
Average Delay	0.8											
Intersection Capacity Utilization	23.2%			ICU Level of Service			A					
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis  
5: Twiss Rd & Reid Sideroad

Existing PM

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔	↔	↔			↔
Traffic Volume (veh/h)	130	10	0	130	2	3
Future Volume (Veh/h)	130	10	0	130	2	3
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.85	0.63	0.25	0.74	0.25	0.25
Hourly flow rate (vph)	153	16	0	176	8	12
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	116	88			176	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	116	88			176	
IC, single (s)	6.4	6.2			4.1	
IC, 2 stage (s)						
IF (s)	3.5	3.3			2.2	
p0 queue free %	83	98			99	
cM capacity (veh/h)	880	976			1412	
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	169	176	20			
Volume Left	153	0	8			
Volume Right	16	176	0			
cSH	888	1700	1412			
Volume to Capacity	0.19	0.10	0.01			
Queue Length 95th (m)	5.6	0.0	0.1			
Control Delay (s)	10.0	0.0	3.1			
Lane LOS	B		A			
Approach Delay (s)	10.0	0.0	3.1			
Approach LOS	B					
<b>Intersection Summary</b>						
Average Delay	4.8					
Intersection Capacity Utilization	22.5%			ICU Level of Service		
Analysis Period (min)	15			A		

Queuing and Blocking Report

Existing PM

Intersection: 1: Guelph Line & Highway 401 WB Ramp

Movement	WB	WB
Directions Served	L	R
Maximum Queue (m)	145.9	73.7
Average Queue (m)	77.0	22.1
95th Queue (m)	185.9	87.1
Link Distance (m)	211.6	
Upstream Blk Time (%)	12	
Queuing Penalty (veh)	0	
Storage Bay Dist (m)		85.0
Storage Blk Time (%)	16	0
Queuing Penalty (veh)	56	1

Intersection: 2: Guelph Line & Reid Sideroad

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	R
Maximum Queue (m)	38.2	35.8	9.9	61.9	38.3	32.3
Average Queue (m)	20.0	17.4	1.5	31.1	19.6	17.2
95th Queue (m)	33.9	28.4	7.0	51.9	32.9	26.9
Link Distance (m)	102.7	102.7		309.5	324.2	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (m)			80.0		65.0	
Storage Blk Time (%)				0		
Queuing Penalty (veh)				0		

Intersection: 3: Reid Sideroad & Highway 401 EB Ramp

Movement	EB	WB	SB
Directions Served	L	R	LR
Maximum Queue (m)	16.0	9.4	87.0
Average Queue (m)	6.3	1.0	39.3
95th Queue (m)	14.7	5.3	72.8
Link Distance (m)	58.9		91.0
Upstream Blk Time (%)			1
Queuing Penalty (veh)			0
Storage Bay Dist (m)		20.0	
Storage Blk Time (%)		0	
Queuing Penalty (veh)		0	

Queuing and Blocking Report

Existing PM

Intersection: 4: Carpool Lot & Reid Sideroad

Movement	SB
Directions Served	LTR
Maximum Queue (m)	10.8
Average Queue (m)	4.0
95th Queue (m)	11.2
Link Distance (m)	41.5
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (m)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 5: Twiss Rd & Reid Sideroad

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (m)	16.1	0.8
Average Queue (m)	9.1	0.0
95th Queue (m)	13.0	0.8
Link Distance (m)	1100.5	144.2
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 15: Bend

Movement	NB	NB
Directions Served	T	
Maximum Queue (m)	9.7	5.2
Average Queue (m)	0.4	0.2
95th Queue (m)	3.8	2.4
Link Distance (m)	76.3	76.3
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 57
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# Appendix C1

## Background Traffic Conditions – Opening Date Horizon



HCM Unsignalized Intersection Capacity Analysis  
1: Guelph Line & Highway 401 WB Ramp

Background Opening Date AM

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↘	↗	↑			↑
Traffic Volume (veh/h)	136	175	275	0	0	690
Future Volume (Veh/h)	136	175	275	0	0	690
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.74	0.81	0.92	0.87	0.25	0.88
Hourly flow rate (vph)	184	216	299	0	0	784
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)		11				
Median type			None			None
Median storage (veh)						
Upstream signal (m)			341			
pX, platoon unblocked						
vC, conflicting volume	1083	299			299	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1083	299			299	
IC, single (s)	6.4	6.2			4.1	
IC, 2 stage (s)						
IF (s)	3.5	*0.1			2.2	
p0 queue free. %	24	99			100	
cM capacity (veh/h)	243	21601			1274	
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	400	299	784			
Volume Left	184	0	0			
Volume Right	216	0	0			
cSH	527	1700	1700			
Volume to Capacity	0.76	0.18	0.46			
Queue Length 95th (m)	53.2	0.0	0.0			
Control Delay (s)	28.1	0.0	0.0			
Lane LOS	D					
Approach Delay (s)	28.1	0.0	0.0			
Approach LOS	D					
<b>Intersection Summary</b>						
Average Delay		7.6				
Intersection Capacity Utilization		50.5%		ICU Level of Service	A	
Analysis Period (min)		15				
* User Entered Value						

Timings  
2: Guelph Line & Reid Sideroad

Background Opening Date AM

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↘	↗	↘	↑	↑	↗
Traffic Volume (vph)	136	270	11	438	338	488
Future Volume (vph)	136	270	11	438	338	488
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Detector Phase	4	4	2	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	23.0	23.0	23.0	23.0
Total Split (s)	25.0	25.0	35.0	35.0	35.0	35.0
Total Split (%)	41.7%	41.7%	58.3%	58.3%	58.3%	58.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Max	Max	Max	Max
Act Effct Green (s)	12.6	12.6	31.3	31.3	31.3	31.3
Actuated g/C Ratio	0.24	0.24	0.60	0.60	0.60	0.60
v/c Ratio	0.42	0.52	0.04	0.41	0.34	0.46
Control Delay	19.4	5.5	5.6	7.5	6.9	2.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	19.4	5.5	5.6	7.5	6.9	2.2
LOS	B	A	A	A	A	A
Approach Delay	10.4			7.4	4.2	
Approach LOS	B			A	A	
<b>Intersection Summary</b>						
Cycle Length: 60						
Actuated Cycle Length: 51.9						
Natural Cycle: 45						
Control Type: Semi Act-Uncoord						
Maximum v/c Ratio: 0.52						
Intersection Signal Delay: 6.6					Intersection LOS: A	
Intersection Capacity Utilization 41.2%					ICU Level of Service A	
Analysis Period (min) 15						
<b>Splits and Phases: 2: Guelph Line &amp; Reid Sideroad</b>						

HCM Signalized Intersection Capacity Analysis  
2: Guelph Line & Reid Sideroad

Background Opening Date AM

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	136	270	11	438	338	488
Future Volume (vph)	136	270	11	438	338	488
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.3	3.6	3.6	3.5
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1745	1597	1745	1900	1900	1597
Flt Permitted	0.95	1.00	0.50	1.00	1.00	1.00
Satd. Flow (perm)	1745	1597	919	1900	1900	1597
Peak-hour factor, PHF	0.77	0.82	0.50	0.94	0.86	0.90
Adj. Flow (vph)	177	329	22	466	393	542
RTOR Reduction (vph)	0	249	0	0	0	216
Lane Group Flow (vph)	177	80	22	466	393	326
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2		6
Permitted Phases		4	2			6
Actuated Green, G (s)	10.6	10.6	29.2	29.2	29.2	29.2
Effective Green, g (s)	12.6	12.6	31.2	31.2	31.2	31.2
Actuated g/C Ratio	0.24	0.24	0.60	0.60	0.60	0.60
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	424	388	553	1144	1144	961
v/s Ratio Prot	c0.10			c0.25		0.21
v/s Ratio Perm		0.05	0.02			0.20
v/c Ratio	0.42	0.21	0.04	0.41	0.34	0.34
Uniform Delay, d1	16.5	15.6	4.2	5.4	5.2	5.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.3	0.1	1.1	0.8	1.0
Delay (s)	17.2	15.9	4.3	6.5	6.0	6.1
Level of Service	B	B	A	A	A	A
Approach Delay (s)	16.3			6.4	6.1	
Approach LOS	B			A	A	
<b>Intersection Summary</b>						
HCM 2000 Control Delay			8.8	HCM 2000 Level of Service		A
HCM 2000 Volume to Capacity ratio			0.41			
Actuated Cycle Length (s)			51.8	Sum of lost time (s)		8.0
Intersection Capacity Utilization			41.2%	ICU Level of Service		A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis  
3: Reid Sideroad & Highway 401 EB Ramp

Background Opening Date AM

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔
Traffic Volume (veh/h)	158	49	113	386	357	23
Future Volume (Veh/h)	158	49	113	386	357	23
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.75	0.81	0.76	0.88	0.90	0.71
Hourly flow rate (vph)	211	60	149	439	397	32
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)			131			
pX, platoon unblocked						
vC, conflicting volume	588				631	149
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	588				631	149
IC, single (s)	4.1				6.4	6.2
IC, 2 stage (s)						
IF (s)	2.2				3.5	3.3
p0 queue free %	79				0	96
cM capacity (veh/h)	997				353	903
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>WB 1</b>	<b>WB 2</b>	<b>SB 1</b>	
Volume Total	211	60	149	439	429	
Volume Left	211	0	0	0	397	
Volume Right	0	0	0	439	32	
cSH	997	1700	1700	1700	370	
Volume to Capacity	0.21	0.04	0.09	0.26	1.16	
Queue Length 95th (m)	6.4	0.0	0.0	0.0	135.1	
Control Delay (s)	9.6	0.0	0.0	0.0	130.2	
Lane LOS	A				F	
Approach Delay (s)	7.5		0.0		130.2	
Approach LOS					F	
<b>Intersection Summary</b>						
Average Delay			44.9			
Intersection Capacity Utilization			43.3%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
4: Carpool Lot & Reid Sideroad

Background Opening Date AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔			↔		↔	↔	
Traffic Volume (veh/h)	3	199	0	1	124	11	1	0	0	8	0	4
Future Volume (Veh/h)	3	199	0	1	124	11	1	0	0	8	0	4
Sign Control	Free			Free			Stop			Stop		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.50	0.77	0.25	0.25	0.79	0.67	0.25	0.25	0.25	0.75	0.25	0.75
Hourly flow rate (vph)	6	258	0	4	157	16	4	0	0	11	0	5
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)	212											
pX, platoon unblocked												
vC, conflicting volume	173			258			448	451	258	443	443	165
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	173			258			448	451	258	443	443	165
IC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
IC, 2 stage (s)												
IF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			99	100	100	98	100	99
cM capacity (veh/h)	1416			1318			519	503	786	525	508	885
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>							
Volume Total	6	258	177	4	16							
Volume Left	6	0	4	4	11							
Volume Right	0	0	16	0	5							
cSH	1416	1700	1318	519	602							
Volume to Capacity	0.00	0.15	0.00	0.01	0.03							
Queue Length 95th (m)	0.1	0.0	0.1	0.2	0.7							
Control Delay (s)	7.6	0.0	0.2	12.0	11.1							
Lane LOS	A		A	B	B							
Approach Delay (s)	0.2		0.2	12.0	11.1							
Approach LOS			B	B								
<b>Intersection Summary</b>												
Average Delay				0.7								
Intersection Capacity Utilization				20.5%	ICU Level of Service	A						
Analysis Period (min)				15								

HCM Unsignalized Intersection Capacity Analysis  
5: Twiss Rd & Reid Sideroad

Background Opening Date AM

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔
Traffic Volume (veh/h)	92	0	6	176	2	2
Future Volume (Veh/h)	92	0	6	176	2	2
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.77	0.25	0.50	0.77	0.25	0.25
Hourly flow rate (vph)	119	0	12	229	8	8
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	150	126			241	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	150	126			241	
IC, single (s)	6.4	6.2			4.1	
IC, 2 stage (s)						
IF (s)	3.5	3.3			2.2	
p0 queue free %	86	100			99	
cM capacity (veh/h)	841	929			1337	
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	119	241	16			
Volume Left	119	0	8			
Volume Right	0	229	0			
cSH	841	1700	1337			
Volume to Capacity	0.14	0.14	0.01			
Queue Length 95th (m)	3.9	0.0	0.1			
Control Delay (s)	10.0	0.0	3.9			
Lane LOS	A		A			
Approach Delay (s)	10.0	0.0	3.9			
Approach LOS	A					
<b>Intersection Summary</b>						
Average Delay				3.3		
Intersection Capacity Utilization				23.0%	ICU Level of Service	A
Analysis Period (min)				15		



Queuing and Blocking Report

Background Opening Date AM

Intersection: 1: Guelph Line & Highway 401 WB Ramp

Movement	WB
Directions Served	L
Maximum Queue (m)	28.5
Average Queue (m)	15.1
95th Queue (m)	25.4
Link Distance (m)	211.6
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (m)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 2: Guelph Line & Reid Sideroad

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	R
Maximum Queue (m)	32.2	36.5	10.6	45.1	50.2	39.6
Average Queue (m)	16.4	18.2	2.6	22.6	20.2	19.5
95th Queue (m)	28.7	30.1	9.2	40.0	37.4	31.5
Link Distance (m)	102.7	102.7		309.5	324.2	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (m)			80.0		65.0	
Storage Blk Time (%)					0	
Queuing Penalty (veh)					0	

Intersection: 3: Reid Sideroad & Highway 401 EB Ramp

Movement	EB	WB	SB
Directions Served	L	R	LR
Maximum Queue (m)	29.7	14.2	95.6
Average Queue (m)	12.9	3.5	63.9
95th Queue (m)	23.8	10.6	110.9
Link Distance (m)	58.9		91.0
Upstream Blk Time (%)			25
Queuing Penalty (veh)			0
Storage Bay Dist (m)		20.0	
Storage Blk Time (%)		0	
Queuing Penalty (veh)		0	

Queuing and Blocking Report

Background Opening Date AM

Intersection: 4: Carpool Lot & Reid Sideroad

Movement	EB	WB	NB	SB
Directions Served	L	LTR	LTR	LTR
Maximum Queue (m)	1.7	0.9	6.9	10.0
Average Queue (m)	0.1	0.0	0.3	2.7
95th Queue (m)	1.4	0.9	3.0	9.3
Link Distance (m)		58.9	37.4	41.5
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)	30.0			
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: Twiss Rd & Reid Sideroad

Movement	WB	NB	SB
Directions Served	LR	TR	LT
Maximum Queue (m)	14.0	0.7	3.9
Average Queue (m)	8.2	0.0	0.2
95th Queue (m)	12.3	0.7	1.9
Link Distance (m)	1100.5	141.7	144.2
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 15: Bend

Movement	NB
Directions Served	
Maximum Queue (m)	1.1
Average Queue (m)	0.0
95th Queue (m)	0.8
Link Distance (m)	76.3
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (m)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Network Summary

Network wide Queuing Penalty: 0

HCM Unsignalized Intersection Capacity Analysis  
1: Guelph Line & Highway 401 WB Ramp

Background Opening Date PM

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↘	↗	↕			↕
Traffic Volume (veh/h)	409	358	416	0	0	415
Future Volume (Veh/h)	409	358	416	0	0	415
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.98	0.97	0.92	0.80	0.25	0.89
Hourly flow rate (vph)	417	369	452	0	0	466
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)		11				
Median type			None			None
Median storage (veh)						
Upstream signal (m)			341			
pX, platoon unblocked						
vC, conflicting volume	918	452			452	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	918	452			452	
IC, single (s)	6.4	6.2			4.1	
IC, 2 stage (s)						
IF (s)	3.5	*0.1			2.2	
p0 queue free %	0	98			100	
cM capacity (veh/h)	304	16632			1119	
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	786	452	466			
Volume Left	417	0	0			
Volume Right	369	0	0			
cSH	568	1700	1700			
Volume to Capacity	1.38	0.27	0.27			
Queue Length 95th (m)	284.5	0.0	0.0			
Control Delay (s)	204.6	0.0	0.0			
Lane LOS	F					
Approach Delay (s)	204.6	0.0	0.0			
Approach LOS	F					
<b>Intersection Summary</b>						
Average Delay		94.4				
Intersection Capacity Utilization		51.2%		ICU Level of Service	A	
Analysis Period (min)		15				
* User Entered Value						

Timings  
2: Guelph Line & Reid Sideroad

Background Opening Date PM

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↘	↗	↘	↕	↕	↗
Traffic Volume (vph)	179	291	6	578	348	476
Future Volume (vph)	179	291	6	578	348	476
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Detector Phase	4	4	2	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	23.0	23.0	23.0	23.0
Total Split (s)	22.0	22.0	38.0	38.0	38.0	38.0
Total Split (%)	36.7%	36.7%	63.3%	63.3%	63.3%	63.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Max	Max	Max	Max
Act Effct Green (s)	14.2	14.2	34.1	34.1	34.1	34.1
Actuated g/C Ratio	0.25	0.25	0.61	0.61	0.61	0.61
v/c Ratio	0.53	0.51	0.02	0.58	0.33	0.46
Control Delay	22.7	5.5	5.7	10.1	7.0	2.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.7	5.5	5.7	10.1	7.0	2.1
LOS	C	A	A	B	A	A
Approach Delay	12.5			10.0	4.1	
Approach LOS	B			B	A	
<b>Intersection Summary</b>						
Cycle Length: 60						
Actuated Cycle Length: 56.3						
Natural Cycle: 45						
Control Type: Semi Act-Uncoord						
Maximum v/c Ratio: 0.58						
Intersection Signal Delay: 8.2					Intersection LOS: A	
Intersection Capacity Utilization 47.0%					ICU Level of Service A	
Analysis Period (min) 15						
<b>Splits and Phases: 2: Guelph Line &amp; Reid Sideroad</b>						
↖ Ø2	38 s			22 s		
↘ Ø6	38 s					

HCM Signalized Intersection Capacity Analysis  
2: Guelph Line & Reid Sideroad

Background Opening Date PM

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↕	↕	↕
Traffic Volume (vph)	179	291	6	578	348	476
Future Volume (vph)	179	291	6	578	348	476
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.3	3.6	3.6	3.5
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1745	1597	1745	1900	1900	1597
Flt Permitted	0.95	1.00	0.51	1.00	1.00	1.00
Satd. Flow (perm)	1745	1597	937	1900	1900	1597
Peak-hour factor, PHF	0.77	0.87	0.63	0.86	0.93	0.87
Adj. Flow (vph)	232	334	10	672	374	547
RTOR Reduction (vph)	0	250	0	0	0	216
Lane Group Flow (vph)	232	84	10	672	374	331
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2		6
Permitted Phases		4	2			6
Actuated Green, G (s)	12.2	12.2	32.1	32.1	32.1	32.1
Effective Green, g (s)	14.2	14.2	34.1	34.1	34.1	34.1
Actuated g/C Ratio	0.25	0.25	0.61	0.61	0.61	0.61
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	440	402	567	1150	1150	967
v/s Ratio Prot	c0.13			c0.35		0.20
v/s Ratio Perm		0.05	0.01			0.21
v/c Ratio	0.53	0.21	0.02	0.58	0.33	0.34
Uniform Delay, d1	18.2	16.6	4.4	6.8	5.5	5.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1	0.3	0.1	2.2	0.8	1.0
Delay (s)	19.3	16.9	4.5	8.9	6.2	6.5
Level of Service	B	B	A	A	A	A
Approach Delay (s)	17.9			8.9	6.4	
Approach LOS	B			A	A	
<b>Intersection Summary</b>						
HCM 2000 Control Delay			10.2		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.57			
Actuated Cycle Length (s)			56.3		Sum of lost time (s)	8.0
Intersection Capacity Utilization			47.0%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis  
3: Reid Sideroad & Highway 401 EB Ramp

Background Opening Date PM

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↔	↕	↕	↕	↕	↕
Traffic Volume (veh/h)	60	87	243	239	383	11
Future Volume (Veh/h)	60	87	243	239	383	11
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.72	0.55	0.90	0.85	0.76	0.50
Hourly flow rate (vph)	83	158	270	281	504	22
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)			131			
pX, platoon unblocked						
vC, conflicting volume	551				594	270
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	551				594	270
IC, single (s)	4.1				6.4	6.2
IC, 2 stage (s)						
IF (s)	2.2				3.5	3.3
p0 queue free %	92				0	97
cM capacity (veh/h)	1029				433	774
<b>Direction, Lane #</b>						
Volume Total	83	158	270	281	526	
Volume Left	83	0	0	0	504	
Volume Right	0	0	0	281	22	
cSH	1029	1700	1700	1700	441	
Volume to Capacity	0.08	0.09	0.16	0.17	1.19	
Queue Length 95th (m)	2.1	0.0	0.0	0.0	162.5	
Control Delay (s)	8.8	0.0	0.0	0.0	135.5	
Lane LOS	A				F	
Approach Delay (s)	3.0		0.0		135.5	
Approach LOS					F	
<b>Intersection Summary</b>						
Average Delay			54.6			
Intersection Capacity Utilization			48.0%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
4: Carpool Lot & Reid Sideroad

Background Opening Date PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔			↕			↕			↕	
Traffic Volume (veh/h)	1	134	0	0	241	13	0	0	0	13	0	4
Future Volume (Veh/h)	1	134	0	0	241	13	0	0	0	13	0	4
Sign Control	Free			Free			Stop			Stop		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.25	0.73	0.25	0.25	0.86	0.50	0.25	0.25	0.25	0.50	0.25	0.75
Hourly flow rate (vph)	4	184	0	0	280	26	0	0	0	26	0	5
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)	212											
pX, platoon unblocked												
vC, conflicting volume	306			184			490	498	184	485	485	293
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	306			184			490	498	184	485	485	293
IC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
IC, 2 stage (s)												
IF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	95	100	99
cM capacity (veh/h)	1266			1403			487	475	864	494	483	751
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1							
Volume Total	4	184	306	0	31							
Volume Left	4	0	0	0	26							
Volume Right	0	0	26	0	5							
cSH	1266	1700	1403	1700	523							
Volume to Capacity	0.00	0.11	0.00	0.00	0.06							
Queue Length 95th (m)	0.1	0.0	0.0	0.0	1.5							
Control Delay (s)	7.9	0.0	0.0	0.0	12.3							
Lane LOS	A			A	B							
Approach Delay (s)	0.2			0.0	12.3							
Approach LOS				A	B							
<b>Intersection Summary</b>												
Average Delay			0.8									
Intersection Capacity Utilization			23.5%	ICU Level of Service	A							
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis  
5: Twiss Rd & Reid Sideroad

Background Opening Date PM

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔	↔	↕	↕	↕	↕
Traffic Volume (veh/h)	134	10	0	133	2	3
Future Volume (Veh/h)	134	10	0	133	2	3
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.85	0.63	0.25	0.74	0.25	0.25
Hourly flow rate (vph)	158	16	0	180	8	12
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	118	90			180	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	118	90			180	
IC, single (s)	6.4	6.2			4.1	
IC, 2 stage (s)						
IF (s)	3.5	3.3			2.2	
p0 queue free %	82	98			99	
cM capacity (veh/h)	878	973			1408	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	174	180	20			
Volume Left	158	0	8			
Volume Right	16	180	0			
cSH	886	1700	1408			
Volume to Capacity	0.20	0.11	0.01			
Queue Length 95th (m)	5.8	0.0	0.1			
Control Delay (s)	10.1	0.0	3.1			
Lane LOS	B			A		
Approach Delay (s)	10.1	0.0	3.1			
Approach LOS	B					
<b>Intersection Summary</b>						
Average Delay			4.8			
Intersection Capacity Utilization			22.9%	ICU Level of Service	A	
Analysis Period (min)			15			

Queuing and Blocking Report

Background Opening Date PM

Intersection: 1: Guelph Line & Highway 401 WB Ramp

Movement	WB	WB
Directions Served	L	R
Maximum Queue (m)	177.0	74.0
Average Queue (m)	98.6	34.5
95th Queue (m)	219.2	108.2
Link Distance (m)	211.6	
Upstream Blk Time (%)	19	
Queuing Penalty (veh)	0	
Storage Bay Dist (m)		85.0
Storage Blk Time (%)	26	0
Queuing Penalty (veh)	94	2

Intersection: 2: Guelph Line & Reid Sideroad

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	R
Maximum Queue (m)	41.8	39.1	9.8	63.6	36.6	33.5
Average Queue (m)	20.4	18.2	1.5	31.2	19.9	18.1
95th Queue (m)	35.0	30.1	7.1	53.2	32.7	27.3
Link Distance (m)	102.7	102.7		309.5	324.2	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (m)			80.0		65.0	
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 3: Reid Sideroad & Highway 401 EB Ramp

Movement	EB	WB	SB
Directions Served	L	R	LR
Maximum Queue (m)	16.5	7.6	93.3
Average Queue (m)	6.7	0.8	45.8
95th Queue (m)	14.7	4.6	85.3
Link Distance (m)	58.9		91.0
Upstream Blk Time (%)			5
Queuing Penalty (veh)			0
Storage Bay Dist (m)		20.0	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Queuing and Blocking Report

Background Opening Date PM

Intersection: 4: Carpool Lot & Reid Sideroad

Movement	SB
Directions Served	LTR
Maximum Queue (m)	10.8
Average Queue (m)	3.9
95th Queue (m)	11.1
Link Distance (m)	41.5
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (m)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 5: Twiss Rd & Reid Sideroad

Movement	WB
Directions Served	LR
Maximum Queue (m)	16.0
Average Queue (m)	9.2
95th Queue (m)	13.0
Link Distance (m)	1100.5
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (m)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 15: Bend

Movement	NB	NB
Directions Served	T	
Maximum Queue (m)	7.4	2.3
Average Queue (m)	0.4	0.1
95th Queue (m)	3.7	1.6
Link Distance (m)	76.3	76.3
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 96
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# Appendix C2

## Background Traffic Conditions – Five-Year Horizon



HCM Unsignalized Intersection Capacity Analysis  
1: Guelph Line & Highway 401 WB Ramp

Background 5yr AM

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖	↗	↖			↖
Traffic Volume (veh/h)	144	185	289	0	0	723
Future Volume (Veh/h)	144	185	289	0	0	723
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.74	0.81	0.92	0.87	0.25	0.88
Hourly flow rate (vph)	195	228	314	0	0	822
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)		11				
Median type			None			None
Median storage (veh)						
Upstream signal (m)			341			
pX, platoon unblocked						
vC, conflicting volume	1136	314			314	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1136	314			314	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	*0.1			2.2	
p0 queue free %	14	99			100	
cM capacity (veh/h)	225	21054			1258	
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	423	314	822			
Volume Left	195	0	0			
Volume Right	228	0	0			
cSH	489	1700	1700			
Volume to Capacity	0.86	0.18	0.48			
Queue Length 95th (m)	73.0	0.0	0.0			
Control Delay (s)	37.4	0.0	0.0			
Lane LOS	E					
Approach Delay (s)	37.4	0.0	0.0			
Approach LOS	E					
<b>Intersection Summary</b>						
Average Delay			10.1			
Intersection Capacity Utilization			52.7%		ICU Level of Service	A
Analysis Period (min)			15			
* User Entered Value						

Timings  
2: Guelph Line & Reid Sideroad

Background 5yr AM

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↖	↖	↖	↖
Traffic Volume (vph)	142	285	12	460	354	513
Future Volume (vph)	142	285	12	460	354	513
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Detector Phase	4	4	2	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	23.0	23.0	23.0	23.0
Total Split (s)	24.0	24.0	36.0	36.0	36.0	36.0
Total Split (%)	40.0%	40.0%	60.0%	60.0%	60.0%	60.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Max	Max	Max	Max
Act Effct Green (s)	12.9	12.9	32.1	32.1	32.1	32.1
Actuated g/C Ratio	0.24	0.24	0.60	0.60	0.60	0.60
v/c Ratio	0.43	0.53	0.04	0.43	0.36	0.48
Control Delay	20.1	5.6	5.8	7.7	7.1	2.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.1	5.6	5.8	7.7	7.1	2.2
LOS	C	A	A	A	A	A
Approach Delay	10.6			7.6	4.3	
Approach LOS	B			A	A	
<b>Intersection Summary</b>						
Cycle Length: 60						
Actuated Cycle Length: 53.1						
Natural Cycle: 45						
Control Type: Semi Act-Uncoord						
Maximum v/c Ratio: 0.53						
Intersection Signal Delay: 6.8					Intersection LOS: A	
Intersection Capacity Utilization 42.9%					ICU Level of Service A	
Analysis Period (min) 15						
Splits and Phases: 2: Guelph Line & Reid Sideroad						

HCM Signalized Intersection Capacity Analysis  
2: Guelph Line & Reid Sideroad

Background 5yr AM

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↖	↖	↖	↖
Traffic Volume (vph)	142	285	12	460	354	513
Future Volume (vph)	142	285	12	460	354	513
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.3	3.6	3.6	3.5
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1745	1597	1745	1900	1900	1597
Flt Permitted	0.95	1.00	0.48	1.00	1.00	1.00
Satd. Flow (perm)	1745	1597	891	1900	1900	1597
Peak-hour factor, PHF	0.77	0.82	0.50	0.94	0.86	0.90
Adj. Flow (vph)	184	348	24	489	412	570
RTOR Reduction (vph)	0	263	0	0	0	225
Lane Group Flow (vph)	184	85	24	489	412	345
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4		2		6	
Permitted Phases	4		2		6	
Actuated Green, G (s)	10.9	10.9	30.1	30.1	30.1	30.1
Effective Green, g (s)	12.9	12.9	32.1	32.1	32.1	32.1
Actuated g/C Ratio	0.24	0.24	0.61	0.61	0.61	0.61
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	424	388	539	1150	1150	967
v/s Ratio Prot	c0.11		c0.26		0.22	
v/s Ratio Perm	0.05		0.03		0.22	
v/c Ratio	0.43	0.22	0.04	0.43	0.36	0.36
Uniform Delay, d1	17.0	16.0	4.2	5.6	5.3	5.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.3	0.2	1.2	0.9	1.0
Delay (s)	17.7	16.3	4.4	6.7	6.1	6.3
Level of Service	B	B	A	A	A	A
Approach Delay (s)	16.8		6.6		6.2	
Approach LOS	B		A		A	
<b>Intersection Summary</b>						
HCM 2000 Control Delay	9.1		HCM 2000 Level of Service		A	
HCM 2000 Volume to Capacity ratio	0.43					
Actuated Cycle Length (s)	53.0		Sum of lost time (s)		8.0	
Intersection Capacity Utilization	42.9%		ICU Level of Service		A	
Analysis Period (min)	15					
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis  
3: Reid Sideroad & Highway 401 EB Ramp

Background 5yr AM

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↖	↖	↖	↖	↖
Traffic Volume (veh/h)	166	52	118	407	375	24
Future Volume (Veh/h)	166	52	118	407	375	24
Sign Control	Free		Free		Stop	
Grade	0%		0%		0%	
Peak Hour Factor	0.75	0.81	0.76	0.88	0.90	0.71
Hourly flow rate (vph)	221	64	155	463	417	34
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage (veh)						
Upstream signal (m)	131					
pX, platoon unblocked						
vC, conflicting volume	618				661 155	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	618				661 155	
IC, single (s)	4.1				6.4 6.2	
IC, 2 stage (s)						
IF (s)	2.2				3.5 3.3	
p0 queue free %	77				0 96	
cM capacity (veh/h)	972				333 896	
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>WB 1</b>	<b>WB 2</b>	<b>SB 1</b>	
Volume Total	221	64	155	463	451	
Volume Left	221	0	0	0	417	
Volume Right	0	0	0	463	34	
cSH	972	1700	1700	1700	349	
Volume to Capacity	0.23	0.04	0.09	0.27	1.29	
Queue Length 95th (m)	7.0	0.0	0.0	0.0	166.7	
Control Delay (s)	9.8	0.0	0.0	0.0	182.4	
Lane LOS	A				F	
Approach Delay (s)	7.6		0.0		182.4	
Approach LOS	B		A		F	
<b>Intersection Summary</b>						
Average Delay	62.4					
Intersection Capacity Utilization	44.8%		ICU Level of Service		A	
Analysis Period (min)	15					



HCM Unsignalized Intersection Capacity Analysis  
4: Carpool Lot & Reid Sideroad

Background 5yr AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔			↔		↔	↔	
Traffic Volume (veh/h)	3	209	0	1	129	12	1	0	0	9	0	4
Future Volume (Veh/h)	3	209	0	1	129	12	1	0	0	9	0	4
Sign Control	Free			Free			Stop			Stop		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.50	0.77	0.25	0.25	0.79	0.67	0.25	0.25	0.25	0.75	0.25	0.75
Hourly flow rate (vph)	6	271	0	4	163	18	4	0	0	12	0	5
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)	212											
pX, platoon unblocked												
vC, conflicting volume	181			271			468	472	271	463	463	172
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	181			271			468	472	271	463	463	172
IC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
IC, 2 stage (s)												
IF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			99	100	100	98	100	99
cM capacity (veh/h)	1407			1304			503	490	773	510	495	877
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>							
Volume Total	6	271	185	4	17							
Volume Left	6	0	4	4	12							
Volume Right	0	0	18	0	5							
cSH	1407	1700	1304	503	581							
Volume to Capacity	0.00	0.16	0.00	0.01	0.03							
Queue Length 95th (m)	0.1	0.0	0.1	0.2	0.7							
Control Delay (s)	7.6	0.0	0.2	12.2	11.4							
Lane LOS	A		A	B	B							
Approach Delay (s)	0.2		0.2	12.2	11.4							
Approach LOS			B	B								
<b>Intersection Summary</b>												
Average Delay				0.7								
Intersection Capacity Utilization				21.0%			ICU Level of Service			A		
Analysis Period (min)				15								

HCM Unsignalized Intersection Capacity Analysis  
5: Twiss Rd & Reid Sideroad

Background 5yr AM

Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations	↔		↔		↔	↔	
Traffic Volume (veh/h)	96	0	6	184	2	2	
Future Volume (Veh/h)	96	0	6	184	2	2	
Sign Control	Stop		Free		Free		
Grade	0%		0%		0%		
Peak Hour Factor	0.77	0.25	0.50	0.77	0.25	0.25	
Hourly flow rate (vph)	125	0	12	239	8	8	
Pedestrians							
Lane Width (m)							
Walking Speed (m/s)							
Percent Blockage							
Right turn flare (veh)							
Median type	None			None			
Median storage (veh)							
Upstream signal (m)							
pX, platoon unblocked							
vC, conflicting volume	156	132			251		
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	156	132			251		
IC, single (s)	6.4	6.2			4.1		
IC, 2 stage (s)							
IF (s)	3.5	3.3			2.2		
p0 queue free %	85	100			99		
cM capacity (veh/h)	836	923			1326		
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>				
Volume Total	125	251	16				
Volume Left	125	0	8				
Volume Right	0	239	0				
cSH	836	1700	1326				
Volume to Capacity	0.15	0.15	0.01				
Queue Length 95th (m)	4.2	0.0	0.1				
Control Delay (s)	10.1	0.0	3.9				
Lane LOS	B		A				
Approach Delay (s)	10.1	0.0	3.9				
Approach LOS	B						
<b>Intersection Summary</b>							
Average Delay				3.4			
Intersection Capacity Utilization				23.7%		ICU Level of Service	A
Analysis Period (min)				15			

Queuing and Blocking Report

Background 5yr AM

Intersection: 1: Guelph Line & Highway 401 WB Ramp

Movement	WB
Directions Served	L
Maximum Queue (m)	39.8
Average Queue (m)	16.8
95th Queue (m)	30.6
Link Distance (m)	211.6
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (m)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 2: Guelph Line & Reid Sideroad

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	R
Maximum Queue (m)	37.7	42.6	13.8	60.7	43.2	39.7
Average Queue (m)	17.2	19.5	2.7	26.1	21.1	20.3
95th Queue (m)	30.7	33.6	10.2	47.5	37.0	32.9
Link Distance (m)	102.7	102.7		309.5	324.2	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (m)			80.0		65.0	
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 3: Reid Sideroad & Highway 401 EB Ramp

Movement	EB	WB	WB	SB
Directions Served	L	T	R	LR
Maximum Queue (m)	31.3	0.6	15.5	95.6
Average Queue (m)	14.2	0.0	4.7	82.2
95th Queue (m)	25.3	0.6	12.7	119.0
Link Distance (m)	58.9	102.7		91.0
Upstream Blk Time (%)				56
Queuing Penalty (veh)				0
Storage Bay Dist (m)			20.0	
Storage Blk Time (%)			0	
Queuing Penalty (veh)			0	

Queuing and Blocking Report

Background 5yr AM

Intersection: 4: Carpool Lot & Reid Sideroad

Movement	EB	NB	SB
Directions Served	L	LTR	LTR
Maximum Queue (m)	1.6	6.9	10.0
Average Queue (m)	0.1	0.3	3.0
95th Queue (m)	1.2	2.7	9.8
Link Distance (m)		37.4	41.5
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)	30.0		
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 5: Twiss Rd & Reid Sideroad

Movement	WB	NB	SB
Directions Served	LR	TR	LT
Maximum Queue (m)	14.4	0.7	3.1
Average Queue (m)	8.2	0.0	0.1
95th Queue (m)	12.0	0.7	1.8
Link Distance (m)	1100.5	141.7	144.2
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 0
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HCM Unsignalized Intersection Capacity Analysis  
1: Guelph Line & Highway 401 WB Ramp

Background 5yr PM

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖	↗	↕			↕
Traffic Volume (veh/h)	431	376	438	0	0	433
Future Volume (Veh/h)	431	376	438	0	0	433
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.98	0.97	0.92	0.80	0.25	0.89
Hourly flow rate (vph)	440	388	476	0	0	487
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)		11				
Median type			None			None
Median storage (veh)						
Upstream signal (m)			341			
pX, platoon unblocked						
vC, conflicting volume	963	476			476	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	963	476			476	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	*0.1			2.2	
p0 queue free %	0	98			100	
cM capacity (veh/h)	286	15964			1097	
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	828	476	487			
Volume Left	440	0	0			
Volume Right	388	0	0			
cSH	532	1700	1700			
Volume to Capacity	1.56	0.28	0.29			
Queue Length 95th (m)	352.2	0.0	0.0			
Control Delay (s)	279.5	0.0	0.0			
Lane LOS	F					
Approach Delay (s)	279.5	0.0	0.0			
Approach LOS	F					
<b>Intersection Summary</b>						
Average Delay		129.2				
Intersection Capacity Utilization		53.6%		ICU Level of Service	A	
Analysis Period (min)		15				
* User Entered Value						

Timings  
2: Guelph Line & Reid Sideroad

Background 5yr PM

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↖	↕	↕	↗
Traffic Volume (vph)	189	306	6	607	366	498
Future Volume (vph)	189	306	6	607	366	498
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Detector Phase	4	4	2	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	23.0	23.0	23.0	23.0
Total Split (s)	22.0	22.0	38.0	38.0	38.0	38.0
Total Split (%)	36.7%	36.7%	63.3%	63.3%	63.3%	63.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Max	Max	Max	Max
Act Effct Green (s)	14.6	14.6	34.1	34.1	34.1	34.1
Actuated g/C Ratio	0.26	0.26	0.60	0.60	0.60	0.60
v/c Ratio	0.55	0.52	0.02	0.62	0.34	0.48
Control Delay	23.1	5.5	5.7	10.8	7.3	2.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.1	5.5	5.7	10.8	7.3	2.2
LOS	C	A	A	B	A	A
Approach Delay	12.7			10.8	4.3	
Approach LOS	B			B	A	
<b>Intersection Summary</b>						
Cycle Length: 60						
Actuated Cycle Length: 56.7						
Natural Cycle: 50						
Control Type: Semi Act-Uncoord						
Maximum v/c Ratio: 0.62						
Intersection Signal Delay: 8.5					Intersection LOS: A	
Intersection Capacity Utilization 49.1%					ICU Level of Service A	
Analysis Period (min) 15						
Splits and Phases: 2: Guelph Line & Reid Sideroad						

HCM Signalized Intersection Capacity Analysis  
2: Guelph Line & Reid Sideroad

Background 5yr PM

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	189	306	6	607	366	498
Future Volume (vph)	189	306	6	607	366	498
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.3	3.6	3.6	3.5
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1745	1597	1745	1900	1900	1597
Flt Permitted	0.95	1.00	0.49	1.00	1.00	1.00
Satd. Flow (perm)	1745	1597	907	1900	1900	1597
Peak-hour factor, PHF	0.77	0.87	0.63	0.86	0.93	0.87
Adj. Flow (vph)	245	352	10	706	394	572
RTOR Reduction (vph)	0	262	0	0	0	227
Lane Group Flow (vph)	245	90	10	706	394	345
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2		6
Permitted Phases		4	2			6
Actuated Green, G (s)	12.5	12.5	32.1	32.1	32.1	32.1
Effective Green, g (s)	14.5	14.5	34.1	34.1	34.1	34.1
Actuated g/C Ratio	0.26	0.26	0.60	0.60	0.60	0.60
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	447	409	546	1144	1144	962
v/s Ratio Prot	c0.14			c0.37		0.21
v/s Ratio Perm		0.06	0.01			0.22
v/c Ratio	0.55	0.22	0.02	0.62	0.34	0.36
Uniform Delay, d1	18.2	16.6	4.5	7.1	5.6	5.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.4	0.3	0.1	2.5	0.8	1.0
Delay (s)	19.6	16.9	4.6	9.6	6.5	6.7
Level of Service	B	B	A	A	A	A
Approach Delay (s)	18.0			9.5		6.6
Approach LOS	B			A		A
<b>Intersection Summary</b>						
HCM 2000 Control Delay			10.5		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.60			
Actuated Cycle Length (s)			56.6		Sum of lost time (s)	8.0
Intersection Capacity Utilization			49.1%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis  
3: Reid Sideroad & Highway 401 EB Ramp

Background 5yr PM

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔
Traffic Volume (veh/h)	63	93	256	248	402	11
Future Volume (Veh/h)	63	93	256	248	402	11
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.72	0.55	0.90	0.85	0.76	0.50
Hourly flow rate (vph)	88	169	284	292	529	22
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)			131			
pX, platoon unblocked						
vC, conflicting volume	576				629	284
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	576				629	284
IC, single (s)	4.1				6.4	6.2
IC, 2 stage (s)						
IF (s)	2.2				3.5	3.3
p0 queue free %	91				0	97
cM capacity (veh/h)	1007				410	760
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>WB 1</b>	<b>WB 2</b>	<b>SB 1</b>	
Volume Total	88	169	284	292	551	
Volume Left	88	0	0	0	529	
Volume Right	0	0	0	292	22	
cSH	1007	1700	1700	1700	418	
Volume to Capacity	0.09	0.10	0.17	0.17	1.32	
Queue Length 95th (m)	2.3	0.0	0.0	0.0	199.5	
Control Delay (s)	8.9	0.0	0.0	0.0	186.6	
Lane LOS	A				F	
Approach Delay (s)	3.1		0.0		186.6	
Approach LOS					F	
<b>Intersection Summary</b>						
Average Delay			74.9			
Intersection Capacity Utilization			49.9%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
4: Carpool Lot & Reid Sideroad

Background 5yr PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	↔	↔			↔			↔			↔		
Traffic Volume (veh/h)	1	142	0	0	253	14	0	0	0	14	0	4	
Future Volume (Veh/h)	1	142	0	0	253	14	0	0	0	14	0	4	
Sign Control	Free			Free			Stop			Stop			
Grade	0%			0%			0%			0%			
Peak Hour Factor	0.25	0.73	0.25	0.25	0.86	0.50	0.25	0.25	0.25	0.50	0.25	0.75	
Hourly flow rate (vph)	4	195	0	0	294	28	0	0	0	28	0	5	
Pedestrians													
Lane Width (m)													
Walking Speed (m/s)													
Percent Blockage													
Right turn flare (veh)													
Median type	None			None									
Median storage (veh)													
Upstream signal (m)	212												
pX, platoon unblocked													
vC, conflicting volume	322		195			516		525		195		511	
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	322		195			516		525		195		511	
IC, single (s)	4.1		4.1			7.1		6.5		6.2		7.1	
IC, 2 stage (s)													
IF (s)	2.2		2.2			3.5		4.0		3.3		3.5	
p0 queue free %	100		100			100		100		94		100	
cM capacity (veh/h)	1249		1390			468		459		851		475	
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1								
Volume Total	4	195	322	0	33								
Volume Left	4	0	0	0	28								
Volume Right	0	0	28	0	5								
cSH	1249	1700	1390	1700	502								
Volume to Capacity	0.00	0.11	0.00	0.00	0.07								
Queue Length 95th (m)	0.1	0.0	0.0	0.0	1.7								
Control Delay (s)	7.9	0.0	0.0	0.0	12.7								
Lane LOS	A		A			B							
Approach Delay (s)	0.2		0.0			0.0		12.7					
Approach LOS	A		A			B							
Intersection Summary													
Average Delay	0.8												
Intersection Capacity Utilization	24.2%			ICU Level of Service			A						
Analysis Period (min)	15												

HCM Unsignalized Intersection Capacity Analysis  
5: Twiss Rd & Reid Sideroad

Background 5yr PM

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔
Traffic Volume (veh/h)	140	10	0	141	2	3
Future Volume (Veh/h)	140	10	0	141	2	3
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.85	0.63	0.25	0.74	0.25	0.25
Hourly flow rate (vph)	165	16	0	191	8	12
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	124		96		191	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	124		96		191	
IC, single (s)	6.4		6.2		4.1	
IC, 2 stage (s)						
IF (s)	3.5		3.3		2.2	
p0 queue free %	81		98		99	
cM capacity (veh/h)	871		967		1395	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	181	191	20			
Volume Left	165	0	8			
Volume Right	16	191	0			
cSH	879	1700	1395			
Volume to Capacity	0.21	0.11	0.01			
Queue Length 95th (m)	6.2	0.0	0.1			
Control Delay (s)	10.2	0.0	3.1			
Lane LOS	B		A			
Approach Delay (s)	10.2		0.0		3.1	
Approach LOS	B		A			
Intersection Summary						
Average Delay	4.8					
Intersection Capacity Utilization	23.8%			ICU Level of Service		
Analysis Period (min)	15			A		

Queuing and Blocking Report

Background 5yr PM

Intersection: 1: Guelph Line & Highway 401 WB Ramp

Movement	WB	WB
Directions Served	L	R
Maximum Queue (m)	200.6	92.3
Average Queue (m)	148.5	61.3
95th Queue (m)	270.6	133.3
Link Distance (m)	211.6	
Upstream Blk Time (%)	39	
Queuing Penalty (veh)	0	
Storage Bay Dist (m)		85.0
Storage Blk Time (%)	51	1
Queuing Penalty (veh)	190	3

Intersection: 2: Guelph Line & Reid Sideroad

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	R
Maximum Queue (m)	40.5	39.4	9.3	69.4	38.2	33.5
Average Queue (m)	21.5	18.7	1.5	35.0	21.5	17.8
95th Queue (m)	35.4	31.4	6.8	59.7	34.8	26.9
Link Distance (m)	102.7	102.7		309.5	324.2	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (m)			80.0		65.0	
Storage Blk Time (%)				0		
Queuing Penalty (veh)				0		

Intersection: 3: Reid Sideroad & Highway 401 EB Ramp

Movement	EB	WB	SB
Directions Served	L	R	LR
Maximum Queue (m)	15.3	7.7	94.1
Average Queue (m)	6.6	0.9	55.6
95th Queue (m)	14.6	4.7	100.3
Link Distance (m)	58.9		91.0
Upstream Blk Time (%)			14
Queuing Penalty (veh)			0
Storage Bay Dist (m)		20.0	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Queuing and Blocking Report

Background 5yr PM

Intersection: 4: Carpool Lot & Reid Sideroad

Movement	EB	SB
Directions Served	L	LTR
Maximum Queue (m)	0.8	12.3
Average Queue (m)	0.0	4.1
95th Queue (m)	0.8	11.5
Link Distance (m)		41.5
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)	30.0	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: Twiss Rd & Reid Sideroad

Movement	WB
Directions Served	LR
Maximum Queue (m)	16.2
Average Queue (m)	9.4
95th Queue (m)	13.6
Link Distance (m)	1100.5
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (m)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 15: Bend

Movement	NB	NB
Directions Served	T	
Maximum Queue (m)	11.6	5.2
Average Queue (m)	0.6	0.3
95th Queue (m)	5.0	3.3
Link Distance (m)	76.3	76.3
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 193
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# Appendix C3

## Background Traffic Conditions – Ten-Year Horizon



HCM Unsignalized Intersection Capacity Analysis  
1: Guelph Line & Highway 401 WB Ramp

Background 10yr AM

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↘	↗	↕			↕
Traffic Volume (veh/h)	150	195	303	0	0	763
Future Volume (Veh/h)	150	195	303	0	0	763
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.74	0.81	0.92	0.87	0.25	0.88
Hourly flow rate (vph)	203	241	329	0	0	867
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)		11				
Median type			None			None
Median storage (veh)						
Upstream signal (m)			341			
pX, platoon unblocked						
vC, conflicting volume	1196	329			329	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1196	329			329	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	*0.1			2.2	
p0 queue free %	2	99			100	
cM capacity (veh/h)	208	20522			1242	
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	444	329	867			
Volume Left	203	0	0			
Volume Right	241	0	0			
cSH	454	1700	1700			
Volume to Capacity	0.98	0.19	0.51			
Queue Length 95th (m)	98.4	0.0	0.0			
Control Delay (s)	50.8	0.0	0.0			
Lane LOS	F					
Approach Delay (s)	50.8	0.0	0.0			
Approach LOS	F					
<b>Intersection Summary</b>						
Average Delay			13.7			
Intersection Capacity Utilization			55.1%		ICU Level of Service	B
Analysis Period (min)			15			
* User Entered Value						

Timings  
2: Guelph Line & Reid Sideroad

Background 10yr AM

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↘	↗	↘	↕	↕	↗
Traffic Volume (vph)	151	300	12	483	373	540
Future Volume (vph)	151	300	12	483	373	540
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Detector Phase	4	4	2	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	23.0	23.0	23.0	23.0
Total Split (s)	24.0	24.0	36.0	36.0	36.0	36.0
Total Split (%)	40.0%	40.0%	60.0%	60.0%	60.0%	60.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Max	Max	Max	Max
Act Effct Green (s)	13.3	13.3	32.1	32.1	32.1	32.1
Actuated g/C Ratio	0.25	0.25	0.60	0.60	0.60	0.60
v/c Ratio	0.45	0.54	0.05	0.45	0.38	0.50
Control Delay	20.3	5.5	5.9	8.2	7.5	2.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.3	5.5	5.9	8.2	7.5	2.4
LOS	C	A	A	A	A	A
Approach Delay	10.7			8.1	4.5	
Approach LOS	B			A	A	
<b>Intersection Summary</b>						
Cycle Length: 60						
Actuated Cycle Length: 53.5						
Natural Cycle: 45						
Control Type: Semi Act-Uncoord						
Maximum v/c Ratio: 0.54						
Intersection Signal Delay: 7.0					Intersection LOS: A	
Intersection Capacity Utilization 44.9%					ICU Level of Service A	
Analysis Period (min) 15						
<b>Splits and Phases: 2: Guelph Line &amp; Reid Sideroad</b>						
↖ Ø2	36 s			↗ Ø4	24 s	
↘ Ø6	36 s					



HCM Signalized Intersection Capacity Analysis  
2: Guelph Line & Reid Sideroad

Background 10yr AM

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↖	↗	↗	↖
Traffic Volume (vph)	151	300	12	483	373	540
Future Volume (vph)	151	300	12	483	373	540
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.3	3.6	3.6	3.5
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1745	1597	1745	1900	1900	1597
Flt Permitted	0.95	1.00	0.47	1.00	1.00	1.00
Satd. Flow (perm)	1745	1597	856	1900	1900	1597
Peak-hour factor, PHF	0.77	0.82	0.50	0.94	0.86	0.90
Adj. Flow (vph)	196	366	24	514	434	600
RTOR Reduction (vph)	0	275	0	0	0	239
Lane Group Flow (vph)	196	91	24	514	434	361
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4		2		6	
Permitted Phases	4		2		6	
Actuated Green, G (s)	11.3	11.3	30.1	30.1	30.1	30.1
Effective Green, g (s)	13.3	13.3	32.1	32.1	32.1	32.1
Actuated g/C Ratio	0.25	0.25	0.60	0.60	0.60	0.60
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	434	397	514	1142	1142	959
v/s Ratio Prot	c0.11		c0.27		0.23	
v/s Ratio Perm	0.06		0.03		0.23	
v/c Ratio	0.45	0.23	0.05	0.45	0.38	0.38
Uniform Delay, d1	17.0	16.0	4.4	5.8	5.5	5.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.3	0.2	1.3	1.0	1.1
Delay (s)	17.7	16.3	4.5	7.1	6.5	6.6
Level of Service	B	B	A	A	A	A
Approach Delay (s)	16.8		7.0		6.6	
Approach LOS	B		A		A	
<b>Intersection Summary</b>						
HCM 2000 Control Delay	9.4		HCM 2000 Level of Service		A	
HCM 2000 Volume to Capacity ratio	0.45					
Actuated Cycle Length (s)	53.4		Sum of lost time (s)		8.0	
Intersection Capacity Utilization	44.9%		ICU Level of Service		A	
Analysis Period (min)	15					
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis  
3: Reid Sideroad & Highway 401 EB Ramp

Background 10yr AM

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↗	↗	↗	↖	↖
Traffic Volume (veh/h)	176	56	126	426	395	25
Future Volume (Veh/h)	176	56	126	426	395	25
Sign Control	Free		Free		Stop	
Grade	0%		0%		0%	
Peak Hour Factor	0.75	0.81	0.76	0.88	0.90	0.71
Hourly flow rate (vph)	235	69	166	484	439	35
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage (veh)						
Upstream signal (m)	131					
pX, platoon unblocked						
vC, conflicting volume	650				705 166	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	650				705 166	
IC, single (s)	4.1				6.4 6.2	
IC, 2 stage (s)						
IF (s)	2.2				3.5 3.3	
p0 queue free %	75				0 96	
cM capacity (veh/h)	946				305 884	
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>WB 1</b>	<b>WB 2</b>	<b>SB 1</b>	
Volume Total	235	69	166	484	474	
Volume Left	235	0	0	0	439	
Volume Right	0	0	0	484	35	
cSH	946	1700	1700	1700	320	
Volume to Capacity	0.25	0.04	0.10	0.28	1.48	
Queue Length 95th (m)	7.8	0.0	0.0	0.0	208.2	
Control Delay (s)	10.1	0.0	0.0	0.0	262.3	
Lane LOS	B				F	
Approach Delay (s)	7.8		0.0		262.3	
Approach LOS	B				F	
<b>Intersection Summary</b>						
Average Delay	88.7					
Intersection Capacity Utilization	49.8%		ICU Level of Service		A	
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis  
4: Carpool Lot & Reid Sideroad

Background 10yr AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗	↖		↖	↗	↖	↗	↖
Traffic Volume (veh/h)	3	223	0	1	137	13	1	0	0	9	0	5
Future Volume (Veh/h)	3	223	0	1	137	13	1	0	0	9	0	5
Sign Control	Free			Free			Stop			Stop		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.50	0.77	0.25	0.25	0.79	0.67	0.25	0.25	0.25	0.75	0.25	0.75
Hourly flow rate (vph)	6	290	0	4	173	19	4	0	0	12	0	7
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)	212											
pX, platoon unblocked												
vC, conflicting volume	192			290			500	502	290	492	492	182
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	192			290			500	502	290	492	492	182
IC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
IC, 2 stage (s)												
IF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			99	100	100	98	100	99
cM capacity (veh/h)	1394			1283			478	471	754	487	477	865
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1							
Volume Total	6	290	196	4	19							
Volume Left	6	0	4	4	12							
Volume Right	0	0	19	0	7							
cSH	1394	1700	1283	478	581							
Volume to Capacity	0.00	0.17	0.00	0.01	0.03							
Queue Length 95th (m)	0.1	0.0	0.1	0.2	0.8							
Control Delay (s)	7.6	0.0	0.2	12.6	11.4							
Lane LOS	A		A	B	B							
Approach Delay (s)	0.2		0.2	12.6	11.4							
Approach LOS			B	B								
Intersection Summary												
Average Delay				0.7								
Intersection Capacity Utilization				21.7%	ICU Level of Service	A						
Analysis Period (min)				15								

HCM Unsignalized Intersection Capacity Analysis  
5: Twiss Rd & Reid Sideroad

Background 10yr AM

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖	↗	↖	↗	↖	↗
Traffic Volume (veh/h)	100	0	6	195	2	2
Future Volume (Veh/h)	100	0	6	195	2	2
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.77	0.25	0.50	0.77	0.25	0.25
Hourly flow rate (vph)	130	0	12	253	8	8
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	162	138			265	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	162	138			265	
IC, single (s)	6.4	6.2			4.1	
IC, 2 stage (s)						
IF (s)	3.5	3.3			2.2	
p0 queue free %	84	100			99	
cM capacity (veh/h)	828	915			1311	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	130	265	16			
Volume Left	130	0	8			
Volume Right	0	253	0			
cSH	828	1700	1311			
Volume to Capacity	0.16	0.16	0.01			
Queue Length 95th (m)	4.4	0.0	0.1			
Control Delay (s)	10.2	0.0	3.9			
Lane LOS	B		A			
Approach Delay (s)	10.2	0.0	3.9			
Approach LOS	B					
Intersection Summary						
Average Delay				3.4		
Intersection Capacity Utilization				24.6%	ICU Level of Service	A
Analysis Period (min)				15		

Queuing and Blocking Report

Background 10yr AM

Intersection: 1: Guelph Line & Highway 401 WB Ramp

Movement	WB
Directions Served	L
Maximum Queue (m)	39.2
Average Queue (m)	17.3
95th Queue (m)	31.3
Link Distance (m)	211.6
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (m)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 2: Guelph Line & Reid Sideroad

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	R
Maximum Queue (m)	35.3	42.2	14.4	59.3	44.8	41.8
Average Queue (m)	17.9	19.5	2.8	28.2	21.8	21.8
95th Queue (m)	31.2	33.9	10.5	49.1	37.8	35.2
Link Distance (m)	102.7	102.7		309.5	324.2	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (m)			80.0			65.0
Storage Blk Time (%)				0	0	0
Queuing Penalty (veh)				0	0	0

Intersection: 3: Reid Sideroad & Highway 401 EB Ramp

Movement	EB	WB	SB
Directions Served	L	R	LR
Maximum Queue (m)	33.3	16.4	95.6
Average Queue (m)	14.8	4.6	89.5
95th Queue (m)	26.5	12.1	115.0
Link Distance (m)	58.9		91.0
Upstream Blk Time (%)			74
Queuing Penalty (veh)			0
Storage Bay Dist (m)		20.0	
Storage Blk Time (%)		0	
Queuing Penalty (veh)		0	

Queuing and Blocking Report

Background 10yr AM

Intersection: 4: Carpool Lot & Reid Sideroad

Movement	EB	WB	NB	SB
Directions Served	L	LTR	LTR	LTR
Maximum Queue (m)	1.7	2.5	6.0	9.4
Average Queue (m)	0.1	0.1	0.3	3.4
95th Queue (m)	1.4	1.5	2.8	10.3
Link Distance (m)		58.9	37.4	41.5
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)	30.0			
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: Twiss Rd & Reid Sideroad

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (m)	14.3	2.3
Average Queue (m)	8.3	0.1
95th Queue (m)	12.3	1.7
Link Distance (m)	1100.5	144.2
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 0

HCM Unsignalized Intersection Capacity Analysis  
1: Guelph Line & Highway 401 WB Ramp

Background 10yr PM

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖	↗	↖		↖	↗
Traffic Volume (veh/h)	452	397	460	0	0	458
Future Volume (Veh/h)	452	397	460	0	0	458
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.98	0.97	0.92	0.80	0.25	0.89
Hourly flow rate (vph)	461	409	500	0	0	515
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)		11				
Median type			None		None	
Median storage (veh)						
Upstream signal (m)			341			
pX, platoon unblocked						
vC, conflicting volume	1015	500			500	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1015	500			500	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	*0.1			2.2	
p0 queue free %	0	97			100	
cM capacity (veh/h)	266	15323			1075	
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	870	500	515			
Volume Left	461	0	0			
Volume Right	409	0	0			
cSH	497	1700	1700			
Volume to Capacity	1.75	0.29	0.30			
Queue Length 95th (m)	422.7	0.0	0.0			
Control Delay (s)	366.7	0.0	0.0			
Lane LOS	F					
Approach Delay (s)	366.7	0.0	0.0			
Approach LOS	F					
<b>Intersection Summary</b>						
Average Delay		169.2				
Intersection Capacity Utilization		55.9%	ICU Level of Service	B		
Analysis Period (min)		15				
* User Entered Value						

Timings  
2: Guelph Line & Reid Sideroad

Background 10yr PM

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↖	↖	↗	↗
Traffic Volume (vph)	198	323	7	639	384	526
Future Volume (vph)	198	323	7	639	384	526
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Detector Phase	4	4	2	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	23.0	23.0	23.0	23.0
Total Split (s)	21.0	21.0	39.0	39.0	39.0	39.0
Total Split (%)	35.0%	35.0%	65.0%	65.0%	65.0%	65.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Max	Max	Max	Max
Act Effct Green (s)	14.6	14.6	35.1	35.1	35.1	35.1
Actuated g/C Ratio	0.25	0.25	0.61	0.61	0.61	0.61
v/c Ratio	0.58	0.55	0.02	0.64	0.36	0.50
Control Delay	24.7	5.7	5.4	11.1	7.2	2.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.7	5.7	5.4	11.1	7.2	2.2
LOS	C	A	A	B	A	A
Approach Delay	13.5			11.0	4.3	
Approach LOS	B			B	A	
<b>Intersection Summary</b>						
Cycle Length: 60						
Actuated Cycle Length: 57.7						
Natural Cycle: 50						
Control Type: Semi Act-Uncoord						
Maximum v/c Ratio: 0.64						
Intersection Signal Delay: 8.8					Intersection LOS: A	
Intersection Capacity Utilization 51.3%					ICU Level of Service A	
Analysis Period (min) 15						
Splits and Phases: 2: Guelph Line & Reid Sideroad						

HCM Signalized Intersection Capacity Analysis  
2: Guelph Line & Reid Sideroad

Background 10yr PM

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↖	↖	↖	↖
Traffic Volume (vph)	198	323	7	639	384	526
Future Volume (vph)	198	323	7	639	384	526
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.3	3.6	3.6	3.5
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1745	1597	1745	1900	1900	1597
Flt Permitted	0.95	1.00	0.48	1.00	1.00	1.00
Satd. Flow (perm)	1745	1597	881	1900	1900	1597
Peak-hour factor, PHF	0.77	0.87	0.63	0.86	0.93	0.87
Adj. Flow (vph)	257	371	11	743	413	605
RTOR Reduction (vph)	0	277	0	0	0	237
Lane Group Flow (vph)	257	94	11	743	413	368
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2		6
Permitted Phases		4	2			6
Actuated Green, G (s)	12.6	12.6	33.1	33.1	33.1	33.1
Effective Green, g (s)	14.6	14.6	35.1	35.1	35.1	35.1
Actuated g/C Ratio	0.25	0.25	0.61	0.61	0.61	0.61
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	441	404	535	1155	1155	971
v/s Ratio Prot	c0.15			c0.39		0.22
v/s Ratio Perm		0.06	0.01			0.23
v/c Ratio	0.58	0.23	0.02	0.64	0.36	0.38
Uniform Delay, d1	18.9	17.1	4.5	7.3	5.7	5.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.0	0.3	0.1	2.8	0.9	1.1
Delay (s)	20.8	17.4	4.6	10.0	6.5	6.9
Level of Service	C	B	A	B	A	A
Approach Delay (s)	18.8			10.0	6.7	
Approach LOS	B			A	A	
<b>Intersection Summary</b>						
HCM 2000 Control Delay			10.9		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.62			
Actuated Cycle Length (s)			57.7		Sum of lost time (s)	8.0
Intersection Capacity Utilization			51.3%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis  
3: Reid Sideroad & Highway 401 EB Ramp

Background 10yr PM

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↖	↖	↖	↖	↖
Traffic Volume (veh/h)	66	98	270	263	423	12
Future Volume (Veh/h)	66	98	270	263	423	12
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.72	0.55	0.90	0.85	0.76	0.50
Hourly flow rate (vph)	92	178	300	309	557	24
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)			131			
pX, platoon unblocked						
vC, conflicting volume	609				662	300
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	609				662	300
IC, single (s)	4.1				6.4	6.2
IC, 2 stage (s)						
IF (s)	2.2				3.5	3.3
p0 queue free %	91				0	97
cM capacity (veh/h)	979				390	744
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>WB 1</b>	<b>WB 2</b>	<b>SB 1</b>	
Volume Total	92	178	300	309	581	
Volume Left	92	0	0	0	557	
Volume Right	0	0	0	309	24	
cSH	979	1700	1700	1700	397	
Volume to Capacity	0.09	0.10	0.18	0.18	1.46	
Queue Length 95th (m)	2.5	0.0	0.0	0.0	241.4	
Control Delay (s)	9.1	0.0	0.0	0.0	247.5	
Lane LOS	A				F	
Approach Delay (s)	3.1		0.0		247.5	
Approach LOS					F	
<b>Intersection Summary</b>						
Average Delay			99.1			
Intersection Capacity Utilization			52.0%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
4: Carpool Lot & Reid Sideroad

Background 10yr PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔			↔			↔			↔	
Traffic Volume (veh/h)	1	149	0	0	267	15	0	0	0	15	0	5
Future Volume (Veh/h)	1	149	0	0	267	15	0	0	0	15	0	5
Sign Control	Free			Free			Stop			Stop		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.25	0.73	0.25	0.25	0.86	0.50	0.25	0.25	0.25	0.50	0.25	0.75
Hourly flow rate (vph)	4	204	0	0	310	30	0	0	0	30	0	7
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)	212											
pX, platoon unblocked												
vC, conflicting volume	340			204			544	552	204	537	537	325
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	340			204			544	552	204	537	537	325
IC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
IC, 2 stage (s)												
IF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	93	100	99
cM capacity (veh/h)	1230			1380			447	443	842	457	452	721
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1							
Volume Total	4	204	340	0	37							
Volume Left	4	0	0	0	30							
Volume Right	0	0	30	0	7							
cSH	1230	1700	1380	1700	491							
Volume to Capacity	0.00	0.12	0.00	0.00	0.08							
Queue Length 95th (m)	0.1	0.0	0.0	0.0	1.9							
Control Delay (s)	7.9	0.0	0.0	0.0	12.9							
Lane LOS	A			A	B							
Approach Delay (s)	0.2			0.0	12.9							
Approach LOS				A	B							
Intersection Summary												
Average Delay				0.9								
Intersection Capacity Utilization				25.0%	ICU Level of Service	A						
Analysis Period (min)				15								

HCM Unsignalized Intersection Capacity Analysis  
5: Twiss Rd & Reid Sideroad

Background 10yr PM

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔
Traffic Volume (veh/h)	148	11	0	149	2	3
Future Volume (Veh/h)	148	11	0	149	2	3
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.85	0.63	0.25	0.74	0.25	0.25
Hourly flow rate (vph)	174	17	0	201	8	12
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	128	100			201	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	128	100			201	
IC, single (s)	6.4	6.2			4.1	
IC, 2 stage (s)						
IF (s)	3.5	3.3			2.2	
p0 queue free %	80	98			99	
cM capacity (veh/h)	866	960			1383	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	191	201	20			
Volume Left	174	0	8			
Volume Right	17	201	0			
cSH	873	1700	1383			
Volume to Capacity	0.22	0.12	0.01			
Queue Length 95th (m)	6.7	0.0	0.1			
Control Delay (s)	10.3	0.0	3.1			
Lane LOS	B			A		
Approach Delay (s)	10.3	0.0	3.1			
Approach LOS	B					
Intersection Summary						
Average Delay				4.9		
Intersection Capacity Utilization				24.8%	ICU Level of Service	A
Analysis Period (min)				15		

Queuing and Blocking Report

Background 10yr PM

Intersection: 1: Guelph Line & Highway 401 WB Ramp

Movement	WB	WB
Directions Served	L	R
Maximum Queue (m)	216.2	92.5
Average Queue (m)	204.5	88.5
95th Queue (m)	264.5	119.5
Link Distance (m)	211.6	
Upstream Blk Time (%)	79	
Queuing Penalty (veh)	0	
Storage Bay Dist (m)		85.0
Storage Blk Time (%)	80	1
Queuing Penalty (veh)	318	5

Intersection: 2: Guelph Line & Reid Sideroad

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	R
Maximum Queue (m)	47.0	46.2	9.8	70.0	43.3	31.4
Average Queue (m)	23.1	20.4	1.8	37.0	21.7	18.2
95th Queue (m)	39.8	35.2	7.6	60.5	36.9	26.8
Link Distance (m)	102.7	102.7		309.5	324.2	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (m)			80.0		65.0	
Storage Blk Time (%)				0		
Queuing Penalty (veh)				0		

Intersection: 3: Reid Sideroad & Highway 401 EB Ramp

Movement	EB	EB	WB	SB
Directions Served	L	T	R	LR
Maximum Queue (m)	15.9	0.9	7.7	95.6
Average Queue (m)	7.0	0.0	1.0	66.2
95th Queue (m)	15.0	0.9	5.1	113.1
Link Distance (m)	58.9	58.9		91.0
Upstream Blk Time (%)				29
Queuing Penalty (veh)				0
Storage Bay Dist (m)			20.0	
Storage Blk Time (%)			0	
Queuing Penalty (veh)			0	

Queuing and Blocking Report

Background 10yr PM

Intersection: 4: Carpool Lot & Reid Sideroad

Movement	SB
Directions Served	LTR
Maximum Queue (m)	13.0
Average Queue (m)	4.5
95th Queue (m)	12.0
Link Distance (m)	41.5
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (m)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 5: Twiss Rd & Reid Sideroad

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (m)	16.2	0.8
Average Queue (m)	9.3	0.0
95th Queue (m)	12.7	0.8
Link Distance (m)	1100.5	144.2
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 15: Bend

Movement	NB	NB
Directions Served	T	
Maximum Queue (m)	16.0	9.8
Average Queue (m)	0.9	0.6
95th Queue (m)	6.9	4.7
Link Distance (m)	76.3	76.3
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 323
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# Appendix D1

## Total Traffic Conditions – Opening Date Horizon





HCM Unsignalized Intersection Capacity Analysis  
1: Guelph Line & Highway 401 WB Ramp

Total Opening Date AM

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖	↗	↖			↖
Traffic Volume (veh/h)	170	175	275	0	0	690
Future Volume (Veh/h)	170	175	275	0	0	690
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.74	0.81	0.92	0.87	0.25	0.88
Hourly flow rate (vph)	230	216	299	0	0	784
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)		11				
Median type			None			None
Median storage (veh)						
Upstream signal (m)			341			
pX, platoon unblocked						
vC, conflicting volume	1083	299			299	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1083	299			299	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	*0.1			2.2	
p0 queue free %	5	99			100	
cM capacity (veh/h)	243	21601			1274	
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	446	299	784			
Volume Left	230	0	0			
Volume Right	216	0	0			
cSH	470	1700	1700			
Volume to Capacity	0.95	0.18	0.46			
Queue Length 95th (m)	92.0	0.0	0.0			
Control Delay (s)	48.2	0.0	0.0			
Lane LOS	E					
Approach Delay (s)	48.2	0.0	0.0			
Approach LOS	E					
<b>Intersection Summary</b>						
Average Delay			14.1			
Intersection Capacity Utilization		52.4%		ICU Level of Service		A
Analysis Period (min)		15				
* User Entered Value						

Timings  
2: Guelph Line & Reid Sideroad

Total Opening Date AM

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↖	↖	↖	↖
Traffic Volume (vph)	136	270	11	438	338	522
Future Volume (vph)	136	270	11	438	338	522
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Detector Phase	4	4	2	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	23.0	23.0	23.0	23.0
Total Split (s)	24.0	24.0	36.0	36.0	36.0	36.0
Total Split (%)	40.0%	40.0%	60.0%	60.0%	60.0%	60.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Max	Max	Max	Max
Act Effct Green (s)	12.7	12.7	32.3	32.3	32.3	32.3
Actuated g/C Ratio	0.24	0.24	0.61	0.61	0.61	0.61
v/c Ratio	0.42	0.52	0.04	0.40	0.34	0.48
Control Delay	20.0	5.6	5.5	7.4	6.8	2.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.0	5.6	5.5	7.4	6.8	2.2
LOS	C	A	A	A	A	A
Approach Delay	10.7			7.3	4.1	
Approach LOS	B			A	A	
<b>Intersection Summary</b>						
Cycle Length: 60						
Actuated Cycle Length: 53						
Natural Cycle: 45						
Control Type: Semi Act-Uncoord						
Maximum v/c Ratio: 0.52						
Intersection Signal Delay: 6.6					Intersection LOS: A	
Intersection Capacity Utilization 42.3%					ICU Level of Service A	
Analysis Period (min) 15						
Splits and Phases: 2: Guelph Line & Reid Sideroad						

HCM Signalized Intersection Capacity Analysis  
2: Guelph Line & Reid Sideroad

Total Opening Date AM

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↖	↖	↖	↖
Traffic Volume (vph)	136	270	11	438	338	522
Future Volume (vph)	136	270	11	438	338	522
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.3	3.6	3.6	3.5
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1745	1597	1745	1900	1900	1597
Flt Permitted	0.95	1.00	0.50	1.00	1.00	1.00
Satd. Flow (perm)	1745	1597	919	1900	1900	1597
Peak-hour factor, PHF	0.77	0.82	0.50	0.94	0.86	0.90
Adj. Flow (vph)	177	329	22	466	393	580
RTOR Reduction (vph)	0	250	0	0	0	227
Lane Group Flow (vph)	177	79	22	466	393	353
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4		2		6	
Permitted Phases	4		2		6	
Actuated Green, G (s)	10.7	10.7	30.2	30.2	30.2	30.2
Effective Green, g (s)	12.7	12.7	32.2	32.2	32.2	32.2
Actuated g/C Ratio	0.24	0.24	0.61	0.61	0.61	0.61
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	418	383	559	1156	1156	972
v/s Ratio Prot	c0.10		c0.25		0.21	
v/s Ratio Perm	0.05		0.02		0.22	
v/c Ratio	0.42	0.21	0.04	0.40	0.34	0.36
Uniform Delay, d1	17.0	16.1	4.1	5.4	5.1	5.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.3	0.1	1.0	0.8	1.1
Delay (s)	17.7	16.3	4.3	6.4	5.9	6.3
Level of Service	B	B	A	A	A	A
Approach Delay (s)	16.8		6.3		6.1	
Approach LOS	B		A		A	
<b>Intersection Summary</b>						
HCM 2000 Control Delay	8.9		HCM 2000 Level of Service		A	
HCM 2000 Volume to Capacity ratio	0.41					
Actuated Cycle Length (s)	52.9		Sum of lost time (s)		8.0	
Intersection Capacity Utilization	42.3%		ICU Level of Service		A	
Analysis Period (min)	15					
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis  
3: Reid Sideroad & Highway 401 EB Ramp

Total Opening Date AM

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↖	↖	↖	↖	↖
Traffic Volume (veh/h)	206	49	147	386	357	23
Future Volume (Veh/h)	206	49	147	386	357	23
Sign Control	Free		Free		Stop	
Grade	0%		0%		0%	
Peak Hour Factor	0.75	0.81	0.76	0.88	0.90	0.71
Hourly flow rate (vph)	275	60	193	439	397	32
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage (veh)						
Upstream signal (m)	131					
pX, platoon unblocked						
vC, conflicting volume	632				803	193
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	632				803	193
IC, single (s)	4.1				6.4	6.2
IC, 2 stage (s)						
IF (s)	2.2				3.5	3.3
p0 queue free %	71				0	96
cM capacity (veh/h)	960				254	854
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>WB 1</b>	<b>WB 2</b>	<b>SB 1</b>	
Volume Total	275	60	193	439	429	
Volume Left	275	0	0	0	397	
Volume Right	0	0	0	439	32	
cSH	960	1700	1700	1700	268	
Volume to Capacity	0.29	0.04	0.11	0.26	1.60	
Queue Length 95th (m)	9.5	0.0	0.0	0.0	210.2	
Control Delay (s)	10.2	0.0	0.0	0.0	321.5	
Lane LOS	B				F	
Approach Delay (s)	8.4		0.0		321.5	
Approach LOS	B				F	
<b>Intersection Summary</b>						
Average Delay	100.8					
Intersection Capacity Utilization	50.3%		ICU Level of Service		A	
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis  
4: Carpool Lot & Reid Sideroad

Total Opening Date AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔			↔		↔	↔	
Traffic Volume (veh/h)	3	247	0	1	158	11	1	0	0	8	0	4
Future Volume (Veh/h)	3	247	0	1	158	11	1	0	0	8	0	4
Sign Control	Free			Free			Stop			Stop		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.50	0.77	0.25	0.25	0.79	0.67	0.25	0.25	0.25	0.75	0.25	0.75
Hourly flow rate (vph)	6	321	0	4	200	16	4	0	0	11	0	5
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)	212											
pX, platoon unblocked												
vC, conflicting volume	216	321			554			557	321	549	549	208
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	216	321			554			557	321	549	549	208
IC, single (s)	4.1	4.1			7.1			6.5	6.2	7.1	6.5	6.2
IC, 2 stage (s)												
IF (s)	2.2	2.2			3.5			4.0	3.3	3.5	4.0	3.3
p0 queue free %	100	100			99			100	100	98	100	99
cM capacity (veh/h)	1366	1250			441			438	724	447	443	837
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1							
Volume Total	6	321	220	4	16							
Volume Left	6	0	4	4	11							
Volume Right	0	0	16	0	5							
cSH	1366	1700	1250	441	523							
Volume to Capacity	0.00	0.19	0.00	0.01	0.03							
Queue Length 95th (m)	0.1	0.0	0.1	0.2	0.8							
Control Delay (s)	7.6	0.0	0.2	13.2	12.1							
Lane LOS	A	A		B	B							
Approach Delay (s)	0.1	0.2		13.2	12.1							
Approach LOS	B			B	B							
<b>Intersection Summary</b>												
Average Delay	0.6											
Intersection Capacity Utilization	23.0%			ICU Level of Service			A					
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis  
5: Twiss Rd & Reid Sideroad

Total Opening Date AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (veh/h)	0	48	0	92	34	0	0	6	176	2	2	0
Future Volume (Veh/h)	0	48	0	92	34	0	0	6	176	2	2	0
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.92	0.92	0.92	0.77	0.92	0.25	0.92	0.50	0.77	0.25	0.25	0.92
Hourly flow rate (vph)	0	52	0	119	37	0	0	12	229	8	8	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type							None			None		
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	169	265	8	176	150	126	8				241	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	169	265	8	176	150	126	8				241	
IC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1				4.1	
IC, 2 stage (s)												
IF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
p0 queue free %	100	92	100	84	95	100	100				99	
cM capacity (veh/h)	765	640	1080	738	740	929	1625				1337	
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	52	156	241	16								
Volume Left	0	119	0	8								
Volume Right	0	0	229	0								
cSH	640	738	1625	1337								
Volume to Capacity	0.08	0.21	0.00	0.01								
Queue Length 95th (m)	2.1	6.4	0.0	0.1								
Control Delay (s)	11.1	11.2	0.0	3.9								
Lane LOS	B	B	A	A								
Approach Delay (s)	11.1	11.2	0.0	3.9								
Approach LOS	B	B										
<b>Intersection Summary</b>												
Average Delay	5.1											
Intersection Capacity Utilization	31.4%			ICU Level of Service			A					
Analysis Period (min)	15											

Queuing and Blocking Report

Total Opening Date AM

Intersection: 1: Guelph Line & Highway 401 WB Ramp

Movement	WB
Directions Served	L
Maximum Queue (m)	38.1
Average Queue (m)	18.0
95th Queue (m)	30.9
Link Distance (m)	211.6
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (m)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 2: Guelph Line & Reid Sideroad

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	R
Maximum Queue (m)	32.5	39.8	11.8	50.3	45.6	36.0
Average Queue (m)	15.8	18.3	3.1	22.9	20.1	19.4
95th Queue (m)	28.7	30.6	10.4	40.2	36.8	30.8
Link Distance (m)	102.7	102.7		309.5	324.2	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (m)			80.0		65.0	
Storage Blk Time (%)					0	
Queuing Penalty (veh)					0	

Intersection: 3: Reid Sideroad & Highway 401 EB Ramp

Movement	EB	EB	WB	SB
Directions Served	L	T	R	LR
Maximum Queue (m)	42.6	0.9	16.4	95.6
Average Queue (m)	16.9	0.0	4.8	87.8
95th Queue (m)	32.1	0.9	12.6	117.5
Link Distance (m)	58.9	58.9		91.0
Upstream Blk Time (%)	0			75
Queuing Penalty (veh)	0			0
Storage Bay Dist (m)			20.0	
Storage Blk Time (%)			0	
Queuing Penalty (veh)			0	

Queuing and Blocking Report

Total Opening Date AM

Intersection: 4: Carpool Lot & Reid Sideroad

Movement	EB	WB	NB	SB
Directions Served	L	LTR	LTR	LTR
Maximum Queue (m)	0.8	0.8	7.1	10.0
Average Queue (m)	0.0	0.0	0.4	2.8
95th Queue (m)	0.8	0.8	3.2	9.5
Link Distance (m)		58.9	37.4	41.5
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)	30.0			
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: Twiss Rd & Reid Sideroad

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (m)	14.9	16.3	2.9	0.7
Average Queue (m)	7.1	9.4	0.1	0.0
95th Queue (m)	13.9	14.4	1.5	0.8
Link Distance (m)	69.4	1100.4	142.4	142.3
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 0

HCM Unsignalized Intersection Capacity Analysis  
1: Guelph Line & Highway 401 WB Ramp

Total Opening Date PM

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↘	↗	↕			↕
Traffic Volume (veh/h)	416	358	416	0	0	415
Future Volume (Veh/h)	416	358	416	0	0	415
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.98	0.97	0.92	0.80	0.25	0.89
Hourly flow rate (vph)	424	369	452	0	0	466
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)		11				
Median type			None			None
Median storage (veh)						
Upstream signal (m)			341			
pX, platoon unblocked						
vC, conflicting volume	918	452			452	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	918	452			452	
IC, single (s)	6.4	6.2			4.1	
IC, 2 stage (s)						
IF (s)	3.5	*0.1			2.2	
p0 queue free %	0	98			100	
cM capacity (veh/h)	304	16632			1119	
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	793	452	466			
Volume Left	424	0	0			
Volume Right	369	0	0			
cSH	563	1700	1700			
Volume to Capacity	1.41	0.27	0.27			
Queue Length 95th (m)	294.4	0.0	0.0			
Control Delay (s)	214.8	0.0	0.0			
Lane LOS	F					
Approach Delay (s)	214.8	0.0	0.0			
Approach LOS	F					
<b>Intersection Summary</b>						
Average Delay			99.6			
Intersection Capacity Utilization		51.6%		ICU Level of Service		A
Analysis Period (min)		15				
* User Entered Value						

Timings  
2: Guelph Line & Reid Sideroad

Total Opening Date PM

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↘	↗	↘	↕	↕	↗
Traffic Volume (vph)	179	291	6	578	348	483
Future Volume (vph)	179	291	6	578	348	483
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Detector Phase	4	4	2	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	23.0	23.0	23.0	23.0
Total Split (s)	21.0	21.0	39.0	39.0	39.0	39.0
Total Split (%)	35.0%	35.0%	65.0%	65.0%	65.0%	65.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Max	Max	Max	Max
Act Effct Green (s)	14.1	14.1	35.1	35.1	35.1	35.1
Actuated g/C Ratio	0.25	0.25	0.61	0.61	0.61	0.61
v/c Ratio	0.54	0.52	0.02	0.58	0.32	0.47
Control Delay	23.7	5.6	5.3	9.7	6.8	2.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.7	5.6	5.3	9.7	6.8	2.1
LOS	C	A	A	A	A	A
Approach Delay	13.0			9.7	4.0	
Approach LOS	B			A	A	
<b>Intersection Summary</b>						
Cycle Length: 60						
Actuated Cycle Length: 57.2						
Natural Cycle: 45						
Control Type: Semi Act-Uncoord						
Maximum v/c Ratio: 0.58						
Intersection Signal Delay: 8.1					Intersection LOS: A	
Intersection Capacity Utilization 47.0%					ICU Level of Service A	
Analysis Period (min) 15						
<b>Splits and Phases: 2: Guelph Line &amp; Reid Sideroad</b>						
↖ Ø2	39 s			21 s		
↘ Ø6	39 s					

HCM Signalized Intersection Capacity Analysis  
2: Guelph Line & Reid Sideroad

Total Opening Date PM

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↖	↖	↗	↗
Traffic Volume (vph)	179	291	6	578	348	483
Future Volume (vph)	179	291	6	578	348	483
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.3	3.6	3.6	3.5
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1745	1597	1745	1900	1900	1597
Flt Permitted	0.95	1.00	0.51	1.00	1.00	1.00
Satd. Flow (perm)	1745	1597	940	1900	1900	1597
Peak-hour factor, PHF	0.77	0.87	0.63	0.86	0.93	0.87
Adj. Flow (vph)	232	334	10	672	374	555
RTOR Reduction (vph)	0	252	0	0	0	214
Lane Group Flow (vph)	232	82	10	672	374	341
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2		6
Permitted Phases		4	2			6
Actuated Green, G (s)	12.1	12.1	33.1	33.1	33.1	33.1
Effective Green, g (s)	14.1	14.1	35.1	35.1	35.1	35.1
Actuated g/C Ratio	0.25	0.25	0.61	0.61	0.61	0.61
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	430	393	576	1165	1165	979
v/s Ratio Prot	c0.13			c0.35		0.20
v/s Ratio Perm		0.05	0.01			0.21
v/c Ratio	0.54	0.21	0.02	0.58	0.32	0.35
Uniform Delay, d1	18.7	17.1	4.3	6.6	5.3	5.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.3	0.3	0.1	2.1	0.7	1.0
Delay (s)	20.0	17.4	4.4	8.7	6.0	6.4
Level of Service	C	B	A	A	A	A
Approach Delay (s)	18.5			8.6	6.3	
Approach LOS	B			A	A	
<b>Intersection Summary</b>						
HCM 2000 Control Delay			10.2		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.57			
Actuated Cycle Length (s)			57.2		Sum of lost time (s)	8.0
Intersection Capacity Utilization			47.0%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis  
3: Reid Sideroad & Highway 401 EB Ramp

Total Opening Date PM

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↖	↖	↖	↖	↖
Traffic Volume (veh/h)	69	87	250	239	383	11
Future Volume (Veh/h)	69	87	250	239	383	11
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.72	0.55	0.90	0.85	0.76	0.50
Hourly flow rate (vph)	96	158	278	281	504	22
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)			131			
pX, platoon unblocked						
vC, conflicting volume	559				628	278
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	559				628	278
IC, single (s)	4.1				6.4	6.2
IC, 2 stage (s)						
IF (s)	2.2				3.5	3.3
p0 queue free %	91				0	97
cM capacity (veh/h)	1022				408	766
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>WB 1</b>	<b>WB 2</b>	<b>SB 1</b>	
Volume Total	96	158	278	281	526	
Volume Left	96	0	0	0	504	
Volume Right	0	0	0	281	22	
cSH	1022	1700	1700	1700	416	
Volume to Capacity	0.09	0.09	0.16	0.17	1.26	
Queue Length 95th (m)	2.5	0.0	0.0	0.0	180.2	
Control Delay (s)	8.9	0.0	0.0	0.0	165.3	
Lane LOS	A				F	
Approach Delay (s)	3.4		0.0		165.3	
Approach LOS					F	
<b>Intersection Summary</b>						
Average Delay			65.6			
Intersection Capacity Utilization			48.9%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
4: Carpool Lot & Reid Sideroad

Total Opening Date PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR		
Lane Configurations	↔	↔			↔			↔			↔			
Traffic Volume (veh/h)	1	143	0	0	248	13	0	0	0	13	0	4		
Future Volume (Veh/h)	1	143	0	0	248	13	0	0	0	13	0	4		
Sign Control	Free			Free			Stop			Stop				
Grade	0%			0%			0%			0%				
Peak Hour Factor	0.25	0.73	0.25	0.25	0.86	0.50	0.25	0.25	0.25	0.50	0.25	0.75		
Hourly flow rate (vph)	4	196	0	0	288	26	0	0	0	26	0	5		
Pedestrians														
Lane Width (m)														
Walking Speed (m/s)														
Percent Blockage														
Right turn flare (veh)														
Median type	None			None										
Median storage (veh)														
Upstream signal (m)	212													
pX, platoon unblocked														
vC, conflicting volume	314				196				510	518	196	505	505	301
vC1, stage 1 conf vol														
vC2, stage 2 conf vol														
vCu, unblocked vol	314				196				510	518	196	505	505	301
IC, single (s)	4.1				4.1				7.1	6.5	6.2	7.1	6.5	6.2
IC, 2 stage (s)														
IF (s)	2.2				2.2				3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100				100				100	100	100	95	100	99
cM capacity (veh/h)	1258				1389				473	463	850	480	471	743
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1									
Volume Total	4	196	314	0	31									
Volume Left	4	0	0	0	26									
Volume Right	0	0	26	0	5									
cSH	1258	1700	1389	1700	509									
Volume to Capacity	0.00	0.12	0.00	0.00	0.06									
Queue Length 95th (m)	0.1	0.0	0.0	0.0	1.6									
Control Delay (s)	7.9	0.0	0.0	0.0	12.5									
Lane LOS	A				A				B					
Approach Delay (s)	0.2			0.0	12.5									
Approach LOS				A	B									
Intersection Summary														
Average Delay				0.8										
Intersection Capacity Utilization				23.8%	ICU Level of Service	A								
Analysis Period (min)				15										

HCM Unsignalized Intersection Capacity Analysis  
5: Twiss Rd & Reid Sideroad

Total Opening Date PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↔			↔			↔			↔		
Traffic Volume (veh/h)	0	9	0	134	7	10	0	0	133	2	3	0	
Future Volume (Veh/h)	0	9	0	134	7	10	0	0	133	2	3	0	
Sign Control	Stop			Stop			Free			Free			
Grade	0%			0%			0%			0%			
Peak Hour Factor	0.92	0.92	0.92	0.85	0.92	0.63	0.92	0.25	0.74	0.25	0.25	0.92	
Hourly flow rate (vph)	0	10	0	158	8	16	0	0	180	8	12	0	
Pedestrians													
Lane Width (m)													
Walking Speed (m/s)													
Percent Blockage													
Right turn flare (veh)													
Median type							None			None			
Median storage (veh)													
Upstream signal (m)													
pX, platoon unblocked													
vC, conflicting volume	138	208	12	123	118	90	12						180
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	138	208	12	123	118	90	12						180
IC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1						4.1
IC, 2 stage (s)													
IF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2						2.2
p0 queue free %	100	99	100	81	99	98	100						99
cM capacity (veh/h)	813	688	1074	843	772	973	1620						1408
Direction, Lane #	EB 1	WB 1	NB 1	SB 1									
Volume Total	10	182	180	20									
Volume Left	0	158	0	8									
Volume Right	0	16	180	0									
cSH	688	850	1620	1408									
Volume to Capacity	0.01	0.21	0.00	0.01									
Queue Length 95th (m)	0.4	6.5	0.0	0.1									
Control Delay (s)	10.3	10.4	0.0	3.1									
Lane LOS	B	B	A										
Approach Delay (s)	10.3	10.4	0.0	3.1									
Approach LOS	B	B											
Intersection Summary													
Average Delay				5.2									
Intersection Capacity Utilization				30.0%	ICU Level of Service	A							
Analysis Period (min)				15									

Queuing and Blocking Report

Total Opening Date PM

Intersection: 1: Guelph Line & Highway 401 WB Ramp

Movement	WB	WB
Directions Served	L	R
Maximum Queue (m)	200.0	92.5
Average Queue (m)	99.7	38.4
95th Queue (m)	214.0	113.5
Link Distance (m)	211.6	
Upstream Blk Time (%)	15	
Queuing Penalty (veh)	0	
Storage Bay Dist (m)		85.0
Storage Blk Time (%)	27	0
Queuing Penalty (veh)	96	2

Intersection: 2: Guelph Line & Reid Sideroad

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	R
Maximum Queue (m)	42.4	37.4	9.0	70.3	37.9	28.1
Average Queue (m)	21.6	18.1	1.4	32.0	20.7	17.7
95th Queue (m)	36.6	30.7	6.9	56.5	34.1	26.1
Link Distance (m)	102.7	102.7		309.5	324.2	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (m)			80.0		65.0	
Storage Blk Time (%)				0		
Queuing Penalty (veh)				0		

Intersection: 3: Reid Sideroad & Highway 401 EB Ramp

Movement	EB	WB	SB
Directions Served	L	R	LR
Maximum Queue (m)	20.2	8.5	95.3
Average Queue (m)	7.2	1.1	52.3
95th Queue (m)	16.1	5.4	94.4
Link Distance (m)	58.9		91.0
Upstream Blk Time (%)			7
Queuing Penalty (veh)			0
Storage Bay Dist (m)		20.0	
Storage Blk Time (%)		0	
Queuing Penalty (veh)		0	

Queuing and Blocking Report

Total Opening Date PM

Intersection: 4: Carpool Lot & Reid Sideroad

Movement	EB	SB
Directions Served	L	LTR
Maximum Queue (m)	1.5	10.1
Average Queue (m)	0.1	3.8
95th Queue (m)	1.1	10.9
Link Distance (m)		41.5
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)	30.0	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: Twiss Rd & Reid Sideroad

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (m)	8.9	16.4	0.6	2.1
Average Queue (m)	2.5	9.7	0.0	0.1
95th Queue (m)	8.9	14.1	0.6	1.4
Link Distance (m)	69.4	1100.4	142.4	142.3
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 15: Bend

Movement	NB	NB
Directions Served	T	
Maximum Queue (m)	11.8	4.6
Average Queue (m)	0.7	0.2
95th Queue (m)	5.5	2.4
Link Distance (m)	76.3	76.3
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 98
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# Appendix D2

## Total Traffic Conditions – Five-Year Horizon



HCM Unsignalized Intersection Capacity Analysis  
1: Guelph Line & Highway 401 WB Ramp

Total 5yr AM

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↘	↗	↕			↕
Traffic Volume (veh/h)	178	185	289	0	0	723
Future Volume (Veh/h)	178	185	289	0	0	723
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.74	0.81	0.92	0.87	0.25	0.88
Hourly flow rate (vph)	241	228	314	0	0	822
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)		11				
Median type			None			None
Median storage (veh)						
Upstream signal (m)			341			
pX, platoon unblocked						
vC, conflicting volume	1136	314			314	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1136	314			314	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	*0.1			2.2	
p0 queue free %	0	99			100	
cM capacity (veh/h)	225	21054			1258	
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	469	314	822			
Volume Left	241	0	0			
Volume Right	228	0	0			
cSH	439	1700	1700			
Volume to Capacity	1.07	0.18	0.48			
Queue Length 95th (m)	122.3	0.0	0.0			
Control Delay (s)	67.0	0.0	0.0			
Lane LOS	F					
Approach Delay (s)	67.0	0.0	0.0			
Approach LOS	F					
<b>Intersection Summary</b>						
Average Delay		19.6				
Intersection Capacity Utilization		54.6%		ICU Level of Service	A	
Analysis Period (min)		15				
* User Entered Value						

Timings  
2: Guelph Line & Reid Sideroad

Total 5yr AM

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↘	↗	↘	↕	↕	↗
Traffic Volume (vph)	142	285	12	460	354	547
Future Volume (vph)	142	285	12	460	354	547
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Detector Phase	4	4	2	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	23.0	23.0	23.0	23.0
Total Split (s)	24.0	24.0	36.0	36.0	36.0	36.0
Total Split (%)	40.0%	40.0%	60.0%	60.0%	60.0%	60.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Max	Max	Max	Max
Act Effct Green (s)	12.9	12.9	32.1	32.1	32.1	32.1
Actuated g/C Ratio	0.24	0.24	0.60	0.60	0.60	0.60
v/c Ratio	0.43	0.53	0.04	0.43	0.36	0.50
Control Delay	20.1	5.6	5.8	7.7	7.1	2.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.1	5.6	5.8	7.7	7.1	2.3
LOS	C	A	A	A	A	A
Approach Delay	10.6			7.6	4.3	
Approach LOS	B			A	A	
<b>Intersection Summary</b>						
Cycle Length: 60						
Actuated Cycle Length: 53.1						
Natural Cycle: 45						
Control Type: Semi Act-Uncoord						
Maximum v/c Ratio: 0.53						
Intersection Signal Delay: 6.7					Intersection LOS: A	
Intersection Capacity Utilization 43.9%					ICU Level of Service A	
Analysis Period (min) 15						
<b>Splits and Phases: 2: Guelph Line &amp; Reid Sideroad</b>						
↖ Ø2	36 s			↗ Ø4	24 s	
↘ Ø6	36 s					

HCM Signalized Intersection Capacity Analysis  
2: Guelph Line & Reid Sideroad

Total 5yr AM

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	142	285	12	460	354	547
Future Volume (vph)	142	285	12	460	354	547
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.3	3.6	3.6	3.5
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1745	1597	1745	1900	1900	1597
Flt Permitted	0.95	1.00	0.48	1.00	1.00	1.00
Satd. Flow (perm)	1745	1597	891	1900	1900	1597
Peak-hour factor, PHF	0.77	0.82	0.50	0.94	0.86	0.90
Adj. Flow (vph)	184	348	24	489	412	608
RTOR Reduction (vph)	0	263	0	0	0	240
Lane Group Flow (vph)	184	85	24	489	412	368
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2		6
Permitted Phases		4	2			6
Actuated Green, G (s)	10.9	10.9	30.1	30.1	30.1	30.1
Effective Green, g (s)	12.9	12.9	32.1	32.1	32.1	32.1
Actuated g/C Ratio	0.24	0.24	0.61	0.61	0.61	0.61
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	424	388	539	1150	1150	967
v/s Ratio Prot	c0.11			c0.26		0.22
v/s Ratio Perm		0.05	0.03			0.23
v/c Ratio	0.43	0.22	0.04	0.43	0.36	0.38
Uniform Delay, d1	17.0	16.0	4.2	5.6	5.3	5.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.3	0.2	1.2	0.9	1.1
Delay (s)	17.7	16.3	4.4	6.7	6.1	6.5
Level of Service	B	B	A	A	A	A
Approach Delay (s)	16.8			6.6	6.3	
Approach LOS	B			A	A	
<b>Intersection Summary</b>						
HCM 2000 Control Delay			9.1	HCM 2000 Level of Service		A
HCM 2000 Volume to Capacity ratio			0.43			
Actuated Cycle Length (s)			53.0	Sum of lost time (s)		8.0
Intersection Capacity Utilization			43.9%	ICU Level of Service		A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis  
3: Reid Sideroad & Highway 401 EB Ramp

Total 5yr AM

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔
Traffic Volume (veh/h)	214	52	152	407	375	24
Future Volume (Veh/h)	214	52	152	407	375	24
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.75	0.81	0.76	0.88	0.90	0.71
Hourly flow rate (vph)	285	64	200	463	417	34
<b>Pedestrians</b>						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)			131			
pX, platoon unblocked						
vC, conflicting volume	663				834	200
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	663				834	200
IC, single (s)	4.1				6.4	6.2
IC, 2 stage (s)						
IF (s)	2.2				3.5	3.3
p0 queue free %	70				0	96
cM capacity (veh/h)	935				237	846
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>WB 1</b>	<b>WB 2</b>	<b>SB 1</b>	
Volume Total	285	64	200	463	451	
Volume Left	285	0	0	0	417	
Volume Right	0	0	0	463	34	
cSH	935	1700	1700	1700	251	
Volume to Capacity	0.30	0.04	0.12	0.27	1.80	
Queue Length 95th (m)	10.4	0.0	0.0	0.0	244.7	
Control Delay (s)	10.5	0.0	0.0	0.0	409.1	
Lane LOS	B				F	
Approach Delay (s)	8.6		0.0		409.1	
Approach LOS					F	
<b>Intersection Summary</b>						
Average Delay			128.2			
Intersection Capacity Utilization			52.1%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
4: Carpool Lot & Reid Sideroad

Total 5yr AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔			↔		↔	↔	
Traffic Volume (veh/h)	3	257	0	1	163	12	1	0	0	9	0	4
Future Volume (Veh/h)	3	257	0	1	163	12	1	0	0	9	0	4
Sign Control	Free			Free			Stop			Stop		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.50	0.77	0.25	0.25	0.79	0.67	0.25	0.25	0.25	0.75	0.25	0.75
Hourly flow rate (vph)	6	334	0	4	206	18	4	0	0	12	0	5
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)	212											
pX, platoon unblocked												
vC, conflicting volume	224			334			574	578	334	569	569	215
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	224			334			574	578	334	569	569	215
IC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
IC, 2 stage (s)												
IF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			99	100	100	97	100	99
cM capacity (veh/h)	1357			1237			428	426	712	433	431	830
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1							
Volume Total	6	334	228	4	17							
Volume Left	6	0	4	4	12							
Volume Right	0	0	18	0	5							
cSH	1357	1700	1237	428	504							
Volume to Capacity	0.00	0.20	0.00	0.01	0.03							
Queue Length 95th (m)	0.1	0.0	0.1	0.2	0.8							
Control Delay (s)	7.7	0.0	0.2	13.5	12.4							
Lane LOS	A			A	B	B						
Approach Delay (s)	0.1			0.2	13.5	12.4						
Approach LOS				B	B							
<b>Intersection Summary</b>												
Average Delay				0.6								
Intersection Capacity Utilization				23.5%	ICU Level of Service	A						
Analysis Period (min)				15								

HCM Unsignalized Intersection Capacity Analysis  
5: Twiss Rd & Reid Sideroad

Total 5yr AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (veh/h)	0	48	0	96	34	0	0	6	184	2	2	0
Future Volume (Veh/h)	0	48	0	96	34	0	0	6	184	2	2	0
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.92	0.92	0.92	0.77	0.92	0.25	0.92	0.50	0.77	0.25	0.25	0.92
Hourly flow rate (vph)	0	52	0	125	37	0	0	12	239	8	8	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type							None			None		
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	174	275	8	182	156	132	8			251		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	174	275	8	182	156	132	8			251		
IC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
IC, 2 stage (s)												
IF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	92	100	83	95	100	100			99		
cM capacity (veh/h)	759	632	1080	732	736	923	1625			1326		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	52	162	251	16								
Volume Left	0	125	0	8								
Volume Right	0	0	239	0								
cSH	632	733	1625	1326								
Volume to Capacity	0.08	0.22	0.00	0.01								
Queue Length 95th (m)	2.1	6.7	0.0	0.1								
Control Delay (s)	11.2	11.3	0.0	3.9								
Lane LOS	B	B	A	A								
Approach Delay (s)	11.2	11.3	0.0	3.9								
Approach LOS	B	B										
<b>Intersection Summary</b>												
Average Delay				5.1								
Intersection Capacity Utilization				32.1%	ICU Level of Service	A						
Analysis Period (min)				15								

Queuing and Blocking Report

Total 5yr AM

Intersection: 1: Guelph Line & Highway 401 WB Ramp

Movement	WB
Directions Served	L
Maximum Queue (m)	50.0
Average Queue (m)	21.7
95th Queue (m)	41.0
Link Distance (m)	211.6
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (m)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 2: Guelph Line & Reid Sideroad

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	R
Maximum Queue (m)	34.7	36.8	13.0	54.3	43.7	39.9
Average Queue (m)	15.8	17.9	3.5	25.2	20.0	20.9
95th Queue (m)	29.2	29.9	11.2	45.3	35.7	33.2
Link Distance (m)	102.7	102.7		309.5	324.2	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (m)			80.0		65.0	
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 3: Reid Sideroad & Highway 401 EB Ramp

Movement	EB	EB	WB	WB	SB
Directions Served	L	T	T	R	LR
Maximum Queue (m)	42.3	0.9	0.7	15.5	95.6
Average Queue (m)	17.3	0.0	0.0	5.3	95.0
95th Queue (m)	32.2	0.9	0.7	12.8	102.6
Link Distance (m)	58.9	58.9	102.7		91.0
Upstream Blk Time (%)	0				95
Queuing Penalty (veh)	0				0
Storage Bay Dist (m)				20.0	
Storage Blk Time (%)				0	
Queuing Penalty (veh)				0	

Queuing and Blocking Report

Total 5yr AM

Intersection: 4: Carpool Lot & Reid Sideroad

Movement	EB	WB	NB	SB
Directions Served	L	LTR	LTR	LTR
Maximum Queue (m)	0.8	0.8	6.1	8.6
Average Queue (m)	0.0	0.0	0.3	2.8
95th Queue (m)	0.7	0.8	3.0	9.4
Link Distance (m)		58.9	37.4	41.5
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)	30.0			
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: Twiss Rd & Reid Sideroad

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (m)	13.8	16.2	3.6	1.4
Average Queue (m)	7.2	9.5	0.2	0.1
95th Queue (m)	13.7	14.1	1.7	1.1
Link Distance (m)	69.4	1100.4	142.4	142.3
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 0

HCM Unsignalized Intersection Capacity Analysis  
1: Guelph Line & Highway 401 WB Ramp

Total 5yr PM

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔	↔	↑			↑
Traffic Volume (veh/h)	438	376	438	0	0	433
Future Volume (Veh/h)	438	376	438	0	0	433
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.98	0.97	0.92	0.80	0.25	0.89
Hourly flow rate (vph)	447	388	476	0	0	487
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)		11				
Median type			None			None
Median storage (veh)						
Upstream signal (m)			341			
pX, platoon unblocked						
vC, conflicting volume	963	476			476	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	963	476			476	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	*0.1			2.2	
p0 queue free. %	0	98			100	
cM capacity (veh/h)	286	15964			1097	
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	835	476	487			
Volume Left	447	0	0			
Volume Right	388	0	0			
cSH	528	1700	1700			
Volume to Capacity	1.58	0.28	0.29			
Queue Length 95th (m)	362.1	0.0	0.0			
Control Delay (s)	290.5	0.0	0.0			
Lane LOS	F					
Approach Delay (s)	290.5	0.0	0.0			
Approach LOS	F					
<b>Intersection Summary</b>						
Average Delay		134.9				
Intersection Capacity Utilization		54.0%		ICU Level of Service	A	
Analysis Period (min)		15				
* User Entered Value						

Timings  
2: Guelph Line & Reid Sideroad

Total 5yr PM

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↑	↑	↔
Traffic Volume (vph)	189	306	6	607	366	505
Future Volume (vph)	189	306	6	607	366	505
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Detector Phase	4	4	2	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	23.0	23.0	23.0	23.0
Total Split (s)	22.0	22.0	38.0	38.0	38.0	38.0
Total Split (%)	36.7%	36.7%	63.3%	63.3%	63.3%	63.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Max	Max	Max	Max
Act Effct Green (s)	14.6	14.6	34.1	34.1	34.1	34.1
Actuated g/C Ratio	0.26	0.26	0.60	0.60	0.60	0.60
v/c Ratio	0.55	0.52	0.02	0.62	0.34	0.49
Control Delay	23.1	5.5	5.7	10.8	7.3	2.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.1	5.5	5.7	10.8	7.3	2.2
LOS	C	A	A	B	A	A
Approach Delay	12.7			10.8	4.3	
Approach LOS	B			B	A	
<b>Intersection Summary</b>						
Cycle Length: 60						
Actuated Cycle Length: 56.7						
Natural Cycle: 50						
Control Type: Semi Act-Uncoord						
Maximum v/c Ratio: 0.62						
Intersection Signal Delay: 8.5					Intersection LOS: A	
Intersection Capacity Utilization 49.1%					ICU Level of Service A	
Analysis Period (min) 15						
Splits and Phases: 2: Guelph Line & Reid Sideroad						

HCM Signalized Intersection Capacity Analysis  
2: Guelph Line & Reid Sideroad

Total 5yr PM

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↖	↖	↖	↖
Traffic Volume (vph)	189	306	6	607	366	505
Future Volume (vph)	189	306	6	607	366	505
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.3	3.6	3.6	3.5
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1745	1597	1745	1900	1900	1597
Flt Permitted	0.95	1.00	0.49	1.00	1.00	1.00
Satd. Flow (perm)	1745	1597	907	1900	1900	1597
Peak-hour factor, PHF	0.77	0.87	0.63	0.86	0.93	0.87
Adj. Flow (vph)	245	352	10	706	394	580
RTOR Reduction (vph)	0	262	0	0	0	231
Lane Group Flow (vph)	245	90	10	706	394	349
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2		6
Permitted Phases		4	2			6
Actuated Green, G (s)	12.5	12.5	32.1	32.1	32.1	32.1
Effective Green, g (s)	14.5	14.5	34.1	34.1	34.1	34.1
Actuated g/C Ratio	0.26	0.26	0.60	0.60	0.60	0.60
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	447	409	546	1144	1144	962
v/s Ratio Prot	c0.14			c0.37		0.21
v/s Ratio Perm		0.06	0.01			0.22
v/c Ratio	0.55	0.22	0.02	0.62	0.34	0.36
Uniform Delay, d1	18.2	16.6	4.5	7.1	5.6	5.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.4	0.3	0.1	2.5	0.8	1.1
Delay (s)	19.6	16.9	4.6	9.6	6.5	6.8
Level of Service	B	B	A	A	A	A
Approach Delay (s)	18.0			9.5		6.7
Approach LOS	B			A		A
<b>Intersection Summary</b>						
HCM 2000 Control Delay			10.5		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.60			
Actuated Cycle Length (s)			56.6		Sum of lost time (s)	8.0
Intersection Capacity Utilization			49.1%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis  
3: Reid Sideroad & Highway 401 EB Ramp

Total 5yr PM

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↖	↖	↖	↖	↖
Traffic Volume (veh/h)	72	93	263	248	402	11
Future Volume (Veh/h)	72	93	263	248	402	11
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.72	0.55	0.90	0.85	0.76	0.50
Hourly flow rate (vph)	100	169	292	292	529	22
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)			131			
pX, platoon unblocked						
vC, conflicting volume	584				661	292
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	584				661	292
IC, single (s)	4.1				6.4	6.2
IC, 2 stage (s)						
IF (s)	2.2				3.5	3.3
p0 queue free %	90				0	97
cM capacity (veh/h)	1001				387	752
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>WB 1</b>	<b>WB 2</b>	<b>SB 1</b>	
Volume Total	100	169	292	292	551	
Volume Left	100	0	0	0	529	
Volume Right	0	0	0	292	22	
cSH	1001	1700	1700	1700	395	
Volume to Capacity	0.10	0.10	0.17	0.17	1.39	
Queue Length 95th (m)	2.7	0.0	0.0	0.0	216.8	
Control Delay (s)	9.0	0.0	0.0	0.0	219.5	
Lane LOS	A				F	
Approach Delay (s)	3.3		0.0		219.5	
Approach LOS					F	
<b>Intersection Summary</b>						
Average Delay			86.8			
Intersection Capacity Utilization			50.8%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
4: Carpool Lot & Reid Sideroad

Total 5yr PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR		
Lane Configurations	↔	↔			↔			↔			↔			
Traffic Volume (veh/h)	1	151	0	0	260	14	0	0	0	14	0	4		
Future Volume (Veh/h)	1	151	0	0	260	14	0	0	0	14	0	4		
Sign Control	Free			Free			Stop			Stop				
Grade	0%			0%			0%			0%				
Peak Hour Factor	0.25	0.73	0.25	0.25	0.86	0.50	0.25	0.25	0.25	0.50	0.25	0.75		
Hourly flow rate (vph)	4	207	0	0	302	28	0	0	0	28	0	5		
Pedestrians														
Lane Width (m)														
Walking Speed (m/s)														
Percent Blockage														
Right turn flare (veh)														
Median type	None			None										
Median storage (veh)														
Upstream signal (m)	212													
pX, platoon unblocked														
vC, conflicting volume	330				207				536	545	207	531	531	316
vC1, stage 1 conf vol														
vC2, stage 2 conf vol														
vCu, unblocked vol	330				207				536	545	207	531	531	316
IC, single (s)	4.1				4.1				7.1	6.5	6.2	7.1	6.5	6.2
IC, 2 stage (s)														
IF (s)	2.2				2.2				3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100				100				100	100	100	94	100	99
cM capacity (veh/h)	1241				1376				454	447	839	461	455	729
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1									
Volume Total	4	207	330	0	33									
Volume Left	4	0	0	0	28									
Volume Right	0	0	28	0	5									
cSH	1241	1700	1376	1700	488									
Volume to Capacity	0.00	0.12	0.00	0.00	0.07									
Queue Length 95th (m)	0.1	0.0	0.0	0.0	1.7									
Control Delay (s)	7.9	0.0	0.0	0.0	12.9									
Lane LOS	A				A				B					
Approach Delay (s)	0.1			0.0	12.9									
Approach LOS				A	B									
Intersection Summary														
Average Delay				0.8										
Intersection Capacity Utilization				24.5%	ICU Level of Service	A								
Analysis Period (min)				15										

HCM Unsignalized Intersection Capacity Analysis  
5: Twiss Rd & Reid Sideroad

Total 5yr PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↔			↔			↔			↔		
Traffic Volume (veh/h)	0	9	0	140	7	10	0	0	141	2	3	0	
Future Volume (Veh/h)	0	9	0	140	7	10	0	0	141	2	3	0	
Sign Control	Stop			Stop			Free			Free			
Grade	0%			0%			0%			0%			
Peak Hour Factor	0.92	0.92	0.92	0.85	0.92	0.63	0.92	0.25	0.74	0.25	0.25	0.92	
Hourly flow rate (vph)	0	10	0	165	8	16	0	0	191	8	12	0	
Pedestrians													
Lane Width (m)													
Walking Speed (m/s)													
Percent Blockage													
Right turn flare (veh)													
Median type							None			None			
Median storage (veh)													
Upstream signal (m)													
pX, platoon unblocked													
vC, conflicting volume	144	219	12	128	124	96	12				191		
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	144	219	12	128	124	96	12				191		
IC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1				4.1		
IC, 2 stage (s)													
IF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2		
p0 queue free %	100	99	100	80	99	98	100				99		
cM capacity (veh/h)	807	679	1074	836	766	967	1620				1395		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1									
Volume Total	10	189	191	20									
Volume Left	0	165	0	8									
Volume Right	0	16	191	0									
cSH	679	842	1620	1395									
Volume to Capacity	0.01	0.22	0.00	0.01									
Queue Length 95th (m)	0.4	6.9	0.0	0.1									
Control Delay (s)	10.4	10.5	0.0	3.1									
Lane LOS	B	B	B	A									
Approach Delay (s)	10.4	10.5	0.0	3.1									
Approach LOS	B	B											
Intersection Summary													
Average Delay				5.2									
Intersection Capacity Utilization				30.8%	ICU Level of Service	A							
Analysis Period (min)				15									



Queuing and Blocking Report

Total 5yr PM

Intersection: 1: Guelph Line & Highway 401 WB Ramp

Movement	WB	WB
Directions Served	L	R
Maximum Queue (m)	209.2	92.5
Average Queue (m)	167.2	72.1
95th Queue (m)	280.8	135.3
Link Distance (m)	211.6	
Upstream Blk Time (%)	49	
Queuing Penalty (veh)	0	
Storage Bay Dist (m)		85.0
Storage Blk Time (%)	60	1
Queuing Penalty (veh)	227	4

Intersection: 2: Guelph Line & Reid Sideroad

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	R
Maximum Queue (m)	42.2	38.3	11.3	72.8	41.9	29.9
Average Queue (m)	21.9	18.9	1.7	34.5	21.2	18.2
95th Queue (m)	36.5	31.8	7.8	58.9	35.0	26.7
Link Distance (m)	102.7	102.7		309.5	324.2	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (m)			80.0		65.0	
Storage Blk Time (%)				0		
Queuing Penalty (veh)				0		

Intersection: 3: Reid Sideroad & Highway 401 EB Ramp

Movement	EB	EB	WB	SB
Directions Served	L	T	R	LR
Maximum Queue (m)	20.4	0.7	8.4	93.8
Average Queue (m)	7.9	0.0	1.2	61.6
95th Queue (m)	16.7	0.6	5.6	105.2
Link Distance (m)	58.9	58.9		91.0
Upstream Blk Time (%)				14
Queuing Penalty (veh)				0
Storage Bay Dist (m)			20.0	
Storage Blk Time (%)			0	
Queuing Penalty (veh)			0	

Queuing and Blocking Report

Total 5yr PM

Intersection: 4: Carpool Lot & Reid Sideroad

Movement	EB	SB
Directions Served	L	LTR
Maximum Queue (m)	1.7	11.5
Average Queue (m)	0.1	3.9
95th Queue (m)	1.5	11.2
Link Distance (m)		41.5
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)	30.0	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: Twiss Rd & Reid Sideroad

Movement	EB	WB	SB
Directions Served	LTR	LTR	LTR
Maximum Queue (m)	8.9	16.3	2.9
Average Queue (m)	2.2	9.8	0.1
95th Queue (m)	8.4	14.4	1.5
Link Distance (m)	69.4	1100.4	142.3
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 15: Bend

Movement	NB	NB
Directions Served	T	
Maximum Queue (m)	12.8	6.3
Average Queue (m)	0.8	0.4
95th Queue (m)	6.1	3.2
Link Distance (m)	76.3	76.3
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 232
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# Appendix D3

## Total Traffic Conditions – Ten-Year Horizon



HCM Unsignalized Intersection Capacity Analysis  
1: Guelph Line & Highway 401 WB Ramp

Total 10yr AM

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔	↔	↕			↕
Traffic Volume (veh/h)	184	195	303	0	0	763
Future Volume (Veh/h)	184	195	303	0	0	763
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.74	0.81	0.92	0.87	0.25	0.88
Hourly flow rate (vph)	249	241	329	0	0	867
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)		11				
Median type			None			None
Median storage (veh)						
Upstream signal (m)			341			
pX, platoon unblocked						
vC, conflicting volume	1196	329			329	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1196	329			329	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	*0.1			2.2	
p0 queue free %	0	99			100	
cM capacity (veh/h)	208	20522			1242	
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	490	329	867			
Volume Left	249	0	0			
Volume Right	241	0	0			
cSH	408	1700	1700			
Volume to Capacity	1.20	0.19	0.51			
Queue Length 95th (m)	157.1	0.0	0.0			
Control Delay (s)	141.8	0.0	0.0			
Lane LOS	F					
Approach Delay (s)	141.8	0.0	0.0			
Approach LOS	F					
<b>Intersection Summary</b>						
Average Delay			41.2			
Intersection Capacity Utilization		57.0%		ICU Level of Service		B
Analysis Period (min)		15				
* User Entered Value						

Timings  
2: Guelph Line & Reid Sideroad

Total 10yr AM

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↕	↕	↕
Traffic Volume (vph)	151	300	12	483	373	574
Future Volume (vph)	151	300	12	483	373	574
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Detector Phase	4	4	2	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	23.0	23.0	23.0	23.0
Total Split (s)	24.0	24.0	36.0	36.0	36.0	36.0
Total Split (%)	40.0%	40.0%	60.0%	60.0%	60.0%	60.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Max	Max	Max	Max
Act Effct Green (s)	13.3	13.3	32.1	32.1	32.1	32.1
Actuated g/C Ratio	0.25	0.25	0.60	0.60	0.60	0.60
v/c Ratio	0.45	0.54	0.05	0.45	0.38	0.53
Control Delay	20.3	5.5	5.9	8.2	7.5	2.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.3	5.5	5.9	8.2	7.5	2.5
LOS	C	A	A	A	A	A
Approach Delay	10.7			8.1	4.5	
Approach LOS	B			A	A	
<b>Intersection Summary</b>						
Cycle Length: 60						
Actuated Cycle Length: 53.5						
Natural Cycle: 45						
Control Type: Semi Act-Uncoord						
Maximum v/c Ratio: 0.54						
Intersection Signal Delay: 7.0					Intersection LOS: A	
Intersection Capacity Utilization 45.5%					ICU Level of Service A	
Analysis Period (min) 15						
<b>Splits and Phases: 2: Guelph Line &amp; Reid Sideroad</b>						
↕ Ø2	36 s			24 s		
↕ Ø6	36 s					

HCM Signalized Intersection Capacity Analysis  
2: Guelph Line & Reid Sideroad

Total 10yr AM

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↖	↖	↖	↖
Traffic Volume (vph)	151	300	12	483	373	574
Future Volume (vph)	151	300	12	483	373	574
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.3	3.6	3.6	3.5
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1745	1597	1745	1900	1900	1597
Flt Permitted	0.95	1.00	0.47	1.00	1.00	1.00
Satd. Flow (perm)	1745	1597	856	1900	1900	1597
Peak-hour factor, PHF	0.77	0.82	0.50	0.94	0.86	0.90
Adj. Flow (vph)	196	366	24	514	434	638
RTOR Reduction (vph)	0	275	0	0	0	254
Lane Group Flow (vph)	196	91	24	514	434	384
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4		2		6	
Permitted Phases	4		2		6	
Actuated Green, G (s)	11.3	11.3	30.1	30.1	30.1	30.1
Effective Green, g (s)	13.3	13.3	32.1	32.1	32.1	32.1
Actuated g/C Ratio	0.25	0.25	0.60	0.60	0.60	0.60
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	434	397	514	1142	1142	959
v/s Ratio Prot	c0.11		c0.27		0.23	
v/s Ratio Perm	0.06		0.03		0.24	
v/c Ratio	0.45	0.23	0.05	0.45	0.38	0.40
Uniform Delay, d1	17.0	16.0	4.4	5.8	5.5	5.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.3	0.2	1.3	1.0	1.2
Delay (s)	17.7	16.3	4.5	7.1	6.5	6.8
Level of Service	B	B	A	A	A	A
Approach Delay (s)	16.8		7.0		6.7	
Approach LOS	B		A		A	
<b>Intersection Summary</b>						
HCM 2000 Control Delay	9.4		HCM 2000 Level of Service		A	
HCM 2000 Volume to Capacity ratio	0.45					
Actuated Cycle Length (s)	53.4		Sum of lost time (s)		8.0	
Intersection Capacity Utilization	45.5%		ICU Level of Service		A	
Analysis Period (min)	15					
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis  
3: Reid Sideroad & Highway 401 EB Ramp

Total 10yr AM

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↖	↖	↖	↖	↖
Traffic Volume (veh/h)	224	56	160	426	395	25
Future Volume (Veh/h)	224	56	160	426	395	25
Sign Control	Free		Free		Stop	
Grade	0%		0%		0%	
Peak Hour Factor	0.75	0.81	0.76	0.88	0.90	0.71
Hourly flow rate (vph)	299	69	211	484	439	35
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage (veh)						
Upstream signal (m)	131					
pX, platoon unblocked						
vC, conflicting volume	695				878 211	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	695				878 211	
IC, single (s)	4.1				6.4 6.2	
IC, 2 stage (s)						
IF (s)	2.2				3.5 3.3	
p0 queue free %	67				0 96	
cM capacity (veh/h)	910				216 834	
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>WB 1</b>	<b>WB 2</b>	<b>SB 1</b>	
Volume Total	299	69	211	484	474	
Volume Left	299	0	0	0	439	
Volume Right	0	0	0	484	35	
cSH	910	1700	1700	1700	228	
Volume to Capacity	0.33	0.04	0.12	0.28	2.08	
Queue Length 95th (m)	11.5	0.0	0.0	0.0	285.7	
Control Delay (s)	10.9	0.0	0.0	0.0	534.7	
Lane LOS	B				F	
Approach Delay (s)	8.8		0.0		534.7	
Approach LOS	B				F	
<b>Intersection Summary</b>						
Average Delay	167.0					
Intersection Capacity Utilization	54.2%		ICU Level of Service		A	
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis  
4: Carpool Lot & Reid Sideroad

Total 10yr AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔			↔		↔	↔	
Traffic Volume (veh/h)	3	271	0	1	171	13	1	0	0	9	0	5
Future Volume (Veh/h)	3	271	0	1	171	13	1	0	0	9	0	5
Sign Control	Free			Free			Stop			Stop		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.50	0.77	0.25	0.25	0.79	0.67	0.25	0.25	0.25	0.75	0.25	0.75
Hourly flow rate (vph)	6	352	0	4	216	19	4	0	0	12	0	7
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)	212											
pX, platoon unblocked												
vC, conflicting volume	235	352			604	607	352	598	598	226		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	235	352			604	607	352	598	598	226		
IC, single (s)	4.1	4.1			7.1	6.5	6.2	7.1	6.5	6.2		
IC, 2 stage (s)												
IF (s)	2.2	2.2			3.5	4.0	3.3	3.5	4.0	3.3		
p0 queue free %	100	100			99	100	100	97	100	99		
cM capacity (veh/h)	1344	1218			407	410	696	415	415	819		
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1							
Volume Total	6	352	239	4	19							
Volume Left	6	0	4	4	12							
Volume Right	0	0	19	0	7							
cSH	1344	1700	1218	407	507							
Volume to Capacity	0.00	0.21	0.00	0.01	0.04							
Queue Length 95th (m)	0.1	0.0	0.1	0.2	0.9							
Control Delay (s)	7.7	0.0	0.2	13.9	12.4							
Lane LOS	A	A		B	B							
Approach Delay (s)	0.1	0.2	13.9	12.4								
Approach LOS	B			B								
Intersection Summary												
Average Delay	0.6											
Intersection Capacity Utilization	24.3%			ICU Level of Service			A					
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis  
5: Twiss Rd & Reid Sideroad

Total 10yr AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔		↔	↔	
Traffic Volume (veh/h)	0	48	0	100	34	0	0	6	195	2	2	0
Future Volume (Veh/h)	0	48	0	100	34	0	0	6	195	2	2	0
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.92	0.92	0.92	0.77	0.92	0.25	0.92	0.50	0.77	0.25	0.25	0.92
Hourly flow rate (vph)	0	52	0	130	37	0	0	12	253	8	8	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type							None			None		
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	181	289	8	188	162	138	8	265				
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	181	289	8	188	162	138	8	265				
IC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1	4.1				
IC, 2 stage (s)												
IF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2	2.2				
p0 queue free %	100	92	100	82	95	100	100	99				
cM capacity (veh/h)	751	621	1080	723	729	915	1625	1311				
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	52	167	265	16								
Volume Left	0	130	0	8								
Volume Right	0	0	253	0								
cSH	621	724	1625	1311								
Volume to Capacity	0.08	0.23	0.00	0.01								
Queue Length 95th (m)	2.2	7.1	0.0	0.1								
Control Delay (s)	11.3	11.5	0.0	3.9								
Lane LOS	B	B	A	A								
Approach Delay (s)	11.3	11.5	0.0	3.9								
Approach LOS	B	B										
Intersection Summary												
Average Delay	5.1											
Intersection Capacity Utilization	33.0%			ICU Level of Service			A					
Analysis Period (min)	15											

Queuing and Blocking Report

Total 10yr AM

Intersection: 1: Guelph Line & Highway 401 WB Ramp

Movement	WB
Directions Served	L
Maximum Queue (m)	51.5
Average Queue (m)	22.5
95th Queue (m)	41.6
Link Distance (m)	211.6
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (m)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 2: Guelph Line & Reid Sideroad

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	R
Maximum Queue (m)	32.4	37.5	13.5	53.9	43.2	42.1
Average Queue (m)	14.8	17.1	3.0	25.4	20.4	21.5
95th Queue (m)	28.1	29.2	10.4	45.2	36.4	35.3
Link Distance (m)	102.7	102.7		309.5	324.2	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (m)			80.0		65.0	
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 3: Reid Sideroad & Highway 401 EB Ramp

Movement	EB	WB	WB	SB
Directions Served	L	T	R	LR
Maximum Queue (m)	38.7	0.6	16.3	95.6
Average Queue (m)	18.3	0.0	5.7	95.5
95th Queue (m)	31.9	0.6	13.4	96.6
Link Distance (m)	58.9	102.7		91.0
Upstream Blk Time (%)				100
Queuing Penalty (veh)				0
Storage Bay Dist (m)			20.0	
Storage Blk Time (%)			0	
Queuing Penalty (veh)			0	

Queuing and Blocking Report

Total 10yr AM

Intersection: 4: Carpool Lot & Reid Sideroad

Movement	EB	WB	NB	SB
Directions Served	L	LTR	LTR	LTR
Maximum Queue (m)	1.7	3.1	7.1	10.1
Average Queue (m)	0.1	0.2	0.4	3.1
95th Queue (m)	1.5	2.8	3.4	9.9
Link Distance (m)		58.9	37.4	41.5
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)	30.0			
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: Twiss Rd & Reid Sideroad

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (m)	14.0	16.4	3.9	2.9
Average Queue (m)	7.5	9.5	0.2	0.1
95th Queue (m)	13.7	14.1	2.2	1.5
Link Distance (m)	69.4	1100.4	142.4	142.3
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 15: Bend

Movement	NB	NB
Directions Served	T	
Maximum Queue (m)	2.1	1.5
Average Queue (m)	0.1	0.1
95th Queue (m)	1.5	1.1
Link Distance (m)	76.3	76.3
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 0
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HCM Unsignalized Intersection Capacity Analysis  
1: Guelph Line & Highway 401 WB Ramp

Total 10yr PM

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖	↗	↖			↖
Traffic Volume (veh/h)	459	397	460	0	0	458
Future Volume (Veh/h)	459	397	460	0	0	458
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.98	0.97	0.92	0.80	0.25	0.89
Hourly flow rate (vph)	468	409	500	0	0	515
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)		11				
Median type			None		None	
Median storage (veh)						
Upstream signal (m)			341			
pX, platoon unblocked						
vC, conflicting volume	1015	500			500	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1015	500			500	
IC, single (s)	6.4	6.2			4.1	
IC, 2 stage (s)						
IF (s)	3.5	*0.1			2.2	
p0 queue free. %	0	97			100	
cM capacity (veh/h)	266	15323			1075	
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	877	500	515			
Volume Left	468	0	0			
Volume Right	409	0	0			
cSH	493	1700	1700			
Volume to Capacity	1.78	0.29	0.30			
Queue Length 95th (m)	432.5	0.0	0.0			
Control Delay (s)	378.5	0.0	0.0			
Lane LOS	F					
Approach Delay (s)	378.5	0.0	0.0			
Approach LOS	F					
<b>Intersection Summary</b>						
Average Delay		175.4				
Intersection Capacity Utilization		56.3%		ICU Level of Service	B	
Analysis Period (min)		15				
* User Entered Value						

Timings  
2: Guelph Line & Reid Sideroad

Total 10yr PM

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↖	↖	↖	↖
Traffic Volume (vph)	198	323	7	639	384	533
Future Volume (vph)	198	323	7	639	384	533
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Detector Phase	4	4	2	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	23.0	23.0	23.0	23.0
Total Split (s)	21.0	21.0	39.0	39.0	39.0	39.0
Total Split (%)	35.0%	35.0%	65.0%	65.0%	65.0%	65.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Max	Max	Max	Max
Act Effct Green (s)	14.6	14.6	35.1	35.1	35.1	35.1
Actuated g/C Ratio	0.25	0.25	0.61	0.61	0.61	0.61
v/c Ratio	0.58	0.55	0.02	0.64	0.36	0.51
Control Delay	24.7	5.7	5.4	11.1	7.2	2.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.7	5.7	5.4	11.1	7.2	2.3
LOS	C	A	A	B	A	A
Approach Delay	13.5			11.0	4.3	
Approach LOS	B			B	A	
<b>Intersection Summary</b>						
Cycle Length: 60						
Actuated Cycle Length: 57.7						
Natural Cycle: 50						
Control Type: Semi Act-Uncoord						
Maximum v/c Ratio: 0.64						
Intersection Signal Delay: 8.8					Intersection LOS: A	
Intersection Capacity Utilization 51.3%					ICU Level of Service A	
Analysis Period (min) 15						
Splits and Phases: 2: Guelph Line & Reid Sideroad						

HCM Signalized Intersection Capacity Analysis  
2: Guelph Line & Reid Sideroad

Total 10yr PM

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↖	↖	↗	↗
Traffic Volume (vph)	198	323	7	639	384	533
Future Volume (vph)	198	323	7	639	384	533
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.3	3.6	3.6	3.5
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1745	1597	1745	1900	1900	1597
Flt Permitted	0.95	1.00	0.48	1.00	1.00	1.00
Satd. Flow (perm)	1745	1597	881	1900	1900	1597
Peak-hour factor, PHF	0.77	0.87	0.63	0.86	0.93	0.87
Adj. Flow (vph)	257	371	11	743	413	613
RTOR Reduction (vph)	0	277	0	0	0	240
Lane Group Flow (vph)	257	94	11	743	413	373
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	12.6	12.6	33.1	33.1	33.1	33.1
Effective Green, g (s)	14.6	14.6	35.1	35.1	35.1	35.1
Actuated g/C Ratio	0.25	0.25	0.61	0.61	0.61	0.61
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	441	404	535	1155	1155	971
v/s Ratio Prot	c0.15			c0.39	0.22	
v/s Ratio Perm		0.06	0.01			0.23
v/c Ratio	0.58	0.23	0.02	0.64	0.36	0.38
Uniform Delay, d1	18.9	17.1	4.5	7.3	5.7	5.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.0	0.3	0.1	2.8	0.9	1.2
Delay (s)	20.8	17.4	4.6	10.0	6.5	6.9
Level of Service	C	B	A	B	A	A
Approach Delay (s)	18.8			10.0	6.8	
Approach LOS	B			A	A	
<b>Intersection Summary</b>						
HCM 2000 Control Delay			10.9		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.62			
Actuated Cycle Length (s)			57.7		Sum of lost time (s)	8.0
Intersection Capacity Utilization			51.3%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis  
3: Reid Sideroad & Highway 401 EB Ramp

Total 10yr PM

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↖	↖	↖	↖	↖
Traffic Volume (veh/h)	75	98	277	263	423	12
Future Volume (Veh/h)	75	98	277	263	423	12
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.72	0.55	0.90	0.85	0.76	0.50
Hourly flow rate (vph)	104	178	308	309	557	24
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)			131			
pX, platoon unblocked						
vC, conflicting volume	617				694	308
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	617				694	308
IC, single (s)	4.1				6.4	6.2
IC, 2 stage (s)						
IF (s)	2.2				3.5	3.3
p0 queue free %	89				0	97
cM capacity (veh/h)	973				368	737
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>WB 1</b>	<b>WB 2</b>	<b>SB 1</b>	
Volume Total	104	178	308	309	581	
Volume Left	104	0	0	0	557	
Volume Right	0	0	0	309	24	
cSH	973	1700	1700	1700	376	
Volume to Capacity	0.11	0.10	0.18	0.18	1.55	
Queue Length 95th (m)	2.9	0.0	0.0	0.0	259.2	
Control Delay (s)	9.1	0.0	0.0	0.0	285.4	
Lane LOS	A				F	
Approach Delay (s)	3.4		0.0		285.4	
Approach LOS					F	
<b>Intersection Summary</b>						
Average Delay			112.7			
Intersection Capacity Utilization			52.9%		ICU Level of Service	A
Analysis Period (min)			15			



HCM Unsignalized Intersection Capacity Analysis  
4: Carpool Lot & Reid Sideroad

Total 10yr PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔			↔			↔			↔	
Traffic Volume (veh/h)	1	158	0	0	274	15	0	0	0	15	0	5
Future Volume (Veh/h)	1	158	0	0	274	15	0	0	0	15	0	5
Sign Control	Free			Free			Stop			Stop		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.25	0.73	0.25	0.25	0.86	0.50	0.25	0.25	0.25	0.50	0.25	0.75
Hourly flow rate (vph)	4	216	0	0	319	30	0	0	0	30	0	7
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)	212											
pX, platoon unblocked												
vC, conflicting volume	349			216			565	573	216	558	558	334
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	349			216			565	573	216	558	558	334
IC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
IC, 2 stage (s)												
IF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	93	100	99
cM capacity (veh/h)	1221			1366			433	431	829	442	440	712
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1							
Volume Total	4	216	349	0	37							
Volume Left	4	0	0	0	30							
Volume Right	0	0	30	0	7							
cSH	1221	1700	1366	1700	476							
Volume to Capacity	0.00	0.13	0.00	0.00	0.08							
Queue Length 95th (m)	0.1	0.0	0.0	0.0	2.0							
Control Delay (s)	8.0	0.0	0.0	0.0	13.2							
Lane LOS	A			A	B							
Approach Delay (s)	0.1		0.0	0.0	13.2							
Approach LOS			A		B							
<b>Intersection Summary</b>												
Average Delay	0.9											
Intersection Capacity Utilization	25.3%			ICU Level of Service			A					
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis  
5: Twiss Rd & Reid Sideroad

Total 10yr PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (veh/h)	0	9	0	148	7	11	0	0	149	2	3	0
Future Volume (Veh/h)	0	9	0	148	7	11	0	0	149	2	3	0
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.92	0.92	0.92	0.85	0.92	0.63	0.92	0.25	0.74	0.25	0.25	0.92
Hourly flow rate (vph)	0	10	0	174	8	17	0	0	201	8	12	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type							None			None		
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	150	229	12	134	128	100	12			201		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	150	229	12	134	128	100	12			201		
IC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
IC, 2 stage (s)												
IF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	99	100	79	99	98	100			99		
cM capacity (veh/h)	798	670	1074	830	761	960	1620			1383		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	10	199	201	20								
Volume Left	0	174	0	8								
Volume Right	0	17	201	0								
cSH	670	836	1620	1383								
Volume to Capacity	0.01	0.24	0.00	0.01								
Queue Length 95th (m)	0.4	7.4	0.0	0.1								
Control Delay (s)	10.5	10.6	0.0	3.1								
Lane LOS	B	B	A									
Approach Delay (s)	10.5	10.6	0.0	3.1								
Approach LOS	B	B										
<b>Intersection Summary</b>												
Average Delay	5.3											
Intersection Capacity Utilization	31.8%			ICU Level of Service			A					
Analysis Period (min)	15											

Queuing and Blocking Report

Total 10yr PM

Intersection: 1: Guelph Line & Highway 401 WB Ramp

Movement	WB	WB
Directions Served	L	R
Maximum Queue (m)	216.2	92.5
Average Queue (m)	195.6	83.8
95th Queue (m)	278.2	128.2
Link Distance (m)	211.6	
Upstream Blk Time (%)	74	
Queuing Penalty (veh)	0	
Storage Bay Dist (m)		85.0
Storage Blk Time (%)	75	1
Queuing Penalty (veh)	298	5

Intersection: 2: Guelph Line & Reid Sideroad

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	R
Maximum Queue (m)	45.2	38.6	11.2	76.3	38.2	31.2
Average Queue (m)	23.2	19.7	1.9	36.7	21.9	18.7
95th Queue (m)	39.1	32.4	8.2	64.6	35.6	28.5
Link Distance (m)	102.7	102.7		309.5	324.2	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (m)			80.0		65.0	
Storage Blk Time (%)				0		
Queuing Penalty (veh)				0		

Intersection: 3: Reid Sideroad & Highway 401 EB Ramp

Movement	EB	EB	WB	SB
Directions Served	L	T	R	LR
Maximum Queue (m)	19.3	2.6	7.9	95.6
Average Queue (m)	7.7	0.1	1.1	71.3
95th Queue (m)	16.5	1.9	5.3	114.6
Link Distance (m)	58.9	58.9		91.0
Upstream Blk Time (%)				30
Queuing Penalty (veh)				0
Storage Bay Dist (m)			20.0	
Storage Blk Time (%)				
Queuing Penalty (veh)				

Queuing and Blocking Report

Total 10yr PM

Intersection: 4: Carpool Lot & Reid Sideroad

Movement	EB	SB
Directions Served	L	LTR
Maximum Queue (m)	2.3	11.5
Average Queue (m)	0.1	3.9
95th Queue (m)	1.3	11.3
Link Distance (m)		41.5
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)	30.0	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: Twiss Rd & Reid Sideroad

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (m)	8.9	16.8	0.6	1.4
Average Queue (m)	2.1	9.5	0.0	0.0
95th Queue (m)	8.2	13.8	0.6	1.0
Link Distance (m)	69.4	1100.4	142.4	142.3
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 15: Bend

Movement	NB	NB
Directions Served	T	
Maximum Queue (m)	10.8	7.5
Average Queue (m)	0.5	0.3
95th Queue (m)	5.1	3.3
Link Distance (m)	76.3	76.3
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 303
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# Appendix E

## OTM Signal Warrants



# Signal Justification Calculation for Forecasted Volumes (OTM Book 12 - Justification 7)



Horizon Year: Existing Traffic  
Region/City/Township: MTO

Major Street: Guelph Line North/South: Y  
Minor Street: Highway 401 WB Ramp

Number of Approach Lanes: 1  
Tee Intersection? Y  
Flow Conditions: Restricted

Warrant Results		
150% Satisfied	No	Justification for new intersections with forecast traffic
120% Satisfied	No	Justification for existing intersections with forecast traffic

PM Forecast Only? N

Time Period	Major Street Guelph Line						Minor Street Highway 401 WB Ramp						Peds Crossing Main Road	
	Northbound			Southbound			Eastbound			Westbound				
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		
AM Peak Hour	0	246	0	0	650	0	0	0	0	0	125	0	158	0
PM Peak Hour	0	397	0	0	391	0	0	0	0	0	389	0	344	0
Average Hourly Volume	0	161	0	0	260	0	0	0	0	0	129	0	126	0

## Warrant 1 - Minimum Vehicular Volume

Warrant	AHV
1A - All	675
1B - Minor	254
2A - Major	421
2B - Cross	129

1A	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
	All Approaches	480	720	600	900	
					% Fulfilled	93.8%

1B	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
	Minor Street Approaches	180	255	180	255	
					% Fulfilled	99.6%

## Warrant 2 - Delay To Cross Traffic

2A	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
	Major Street Approaches	480	720	600	900	
					% Fulfilled	58.5%

2B	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
	Traffic Crossing Major Street	50	75	50	75	
					% Fulfilled	171.3%

# Signal Justification Calculation for Forecasted Volumes (OTM Book 12 - Justification 7)



Horizon Year: Background - Opening Date  
 Region/City/Township: MTO

Major Street: Guelph Line North/South: Y  
 Minor Street: Highway 401 WB Ramp

Number of Approach Lanes: 1  
 Tee Intersection? Y  
 Flow Conditions: Restricted

Warrant Results		
150% Satisfied	<b>No</b>	Justification for new intersections with forecast traffic
120% Satisfied	<b>No</b>	Justification for existing intersections with forecast traffic

PM Forecast Only? N

Time Period	Major Street Guelph Line						Minor Street Highway 401 WB Ramp						Peds Crossing Main Road	
	Northbound			Southbound			Eastbound			Westbound				
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		
AM Peak Hour	0	254	0	0	670	0	0	0	0	0	129	0	162	0
PM Peak Hour	0	409	0	0	403	0	0	0	0	0	401	0	354	0
Average Hourly Volume	0	166	0	0	268	0	0	0	0	0	133	0	129	0

## Warrant 1 - Minimum Vehicular Volume

Warrant	AHV
1A - All	696
1B - Minor	262
2A - Major	434
2B - Cross	133

1A	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	All Approaches	480	720	600	900		696
						<b>% Fulfilled</b>	<b>96.6%</b>

1B	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Minor Street Approaches	180	255	180	255		262
						<b>% Fulfilled</b>	<b>102.5%</b>

## Warrant 2 - Delay To Cross Traffic

2A	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Major Street Approaches	480	720	600	900		434
						<b>% Fulfilled</b>	<b>60.3%</b>

2B	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Traffic Crossing Major Street	50	75	50	75		133
						<b>% Fulfilled</b>	<b>176.7%</b>

# Signal Justification Calculation for Forecasted Volumes (OTM Book 12 - Justification 7)



Horizon Year: Background - Five-Year Horizon  
 Region/City/Township: MTO

Major Street: Guelph Line North/South: Y  
 Minor Street: Highway 401 WB Ramp

Number of Approach Lanes: 1  
 Tee Intersection? Y  
 Flow Conditions: Restricted

Warrant Results		
150% Satisfied	<b>No</b>	Justification for new intersections with forecast traffic
120% Satisfied	<b>No</b>	Justification for existing intersections with forecast traffic

PM Forecast Only? N

Time Period	Major Street Guelph Line						Minor Street Highway 401 WB Ramp						Peds Crossing Main Road	
	Northbound			Southbound			Eastbound			Westbound				
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		
AM Peak Hour	0	267	0	0	703	0	0	0	0	0	136	0	171	0
PM Peak Hour	0	430	0	0	422	0	0	0	0	0	422	0	372	0
<b>Average Hourly Volume</b>	<b>0</b>	<b>174</b>	<b>0</b>	<b>0</b>	<b>281</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>140</b>	<b>0</b>	<b>136</b>	<b>0</b>

### Warrant 1 - Minimum Vehicular Volume

Warrant	AHV
1A - All	731
1B - Minor	275
2A - Major	456
2B - Cross	140

1A	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
	All Approaches	480	720	600	900	
<b>% Fulfilled</b>						<b>101.5%</b>

1B	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
	Minor Street Approaches	180	255	180	255	
<b>% Fulfilled</b>						<b>107.9%</b>

### Warrant 2 - Delay To Cross Traffic

2A	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
	Major Street Approaches	480	720	600	900	
<b>% Fulfilled</b>						<b>63.3%</b>

2B	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
	Traffic Crossing Major Street	50	75	50	75	
<b>% Fulfilled</b>						<b>186.0%</b>

# Signal Justification Calculation for Forecasted Volumes (OTM Book 12 - Justification 7)



Horizon Year: Background - Ten-Year Horizon  
 Region/City/Township: MTO

Major Street: Guelph Line North/South: Y  
 Minor Street: Highway 401 WB Ramp

Number of Approach Lanes: 1  
 Tee Intersection? Y  
 Flow Conditions: Restricted

Warrant Results		
150% Satisfied	<b>No</b>	Justification for new intersections with forecast traffic
120% Satisfied	<b>No</b>	Justification for existing intersections with forecast traffic

PM Forecast Only? N

Time Period	Major Street Guelph Line						Minor Street Highway 401 WB Ramp						Peds Crossing Main Road	
	Northbound			Southbound			Eastbound			Westbound				
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		
AM Peak Hour	0	280	0	0	741	0	0	0	0	0	142	0	180	0
PM Peak Hour	0	452	0	0	445	0	0	0	0	0	443	0	392	0
Average Hourly Volume	0	183	0	0	297	0	0	0	0	0	146	0	143	0

## Warrant 1 - Minimum Vehicular Volume

1A	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
	All Approaches	480	720	600	900	
					<b>% Fulfilled</b>	<b>106.8%</b>

1B	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
	Minor Street Approaches	180	255	180	255	
					<b>% Fulfilled</b>	<b>113.4%</b>

Warrant	AHV
1A - All	769
1B - Minor	289
2A - Major	480
2B - Cross	146

## Warrant 2 - Delay To Cross Traffic

2A	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
	Major Street Approaches	480	720	600	900	
					<b>% Fulfilled</b>	<b>66.6%</b>

2B	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
	Traffic Crossing Major Street	50	75	50	75	
					<b>% Fulfilled</b>	<b>195.0%</b>

# Signal Justification Calculation for Forecasted Volumes (OTM Book 12 - Justification 7)



Horizon Year: Total Traffic - Opening Date  
 Region/City/Township: MTO

Major Street: Guelph Line North/South: Y  
 Minor Street: Highway 401 WB Ramp

Number of Approach Lanes: 1  
 Tee Intersection? Y  
 Flow Conditions: Restricted

Warrant Results		
150% Satisfied	<b>No</b>	Justification for new intersections with forecast traffic
120% Satisfied	<b>No</b>	Justification for existing intersections with forecast traffic

PM Forecast Only? N

Time Period	Major Street Guelph Line						Minor Street Highway 401 WB Ramp						Peds Crossing Main Road	
	Northbound			Southbound			Eastbound			Westbound				
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		
AM Peak Hour	0	254	0	0	670	0	0	0	0	0	145	0	162	0
PM Peak Hour	0	409	0	0	403	0	0	0	0	0	404	0	354	0
Average Hourly Volume	0	166	0	0	268	0	0	0	0	0	137	0	129	0

## Warrant 1 - Minimum Vehicular Volume

Warrant	AHV
1A - All	700
1B - Minor	266
2A - Major	434
2B - Cross	137

1A	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	All Approaches	480	720	600	900		700
						<b>% Fulfilled</b>	<b>97.3%</b>

1B	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Minor Street Approaches	180	255	180	255		266
						<b>% Fulfilled</b>	<b>104.4%</b>

## Warrant 2 - Delay To Cross Traffic

2A	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Major Street Approaches	480	720	600	900		434
						<b>% Fulfilled</b>	<b>60.3%</b>

2B	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Traffic Crossing Major Street	50	75	50	75		137
						<b>% Fulfilled</b>	<b>183.0%</b>



# Signal Justification Calculation for Forecasted Volumes (OTM Book 12 - Justification 7)



Horizon Year: Total Traffic - Five-Year Horizon  
 Region/City/Township: MTO

Major Street: Guelph Line North/South: Y  
 Minor Street: Highway 401 WB Ramp

Number of Approach Lanes: 1  
 Tee Intersection? Y  
 Flow Conditions: Restricted

Warrant Results		
150% Satisfied	<b>No</b>	Justification for new intersections with forecast traffic
120% Satisfied	<b>No</b>	Justification for existing intersections with forecast traffic

PM Forecast Only? N

Time Period	Major Street Guelph Line						Minor Street Highway 401 WB Ramp						Peds Crossing Main Road	
	Northbound			Southbound			Eastbound			Westbound				
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		
AM Peak Hour	0	267	0	0	703	0	0	0	0	0	152	0	171	0
PM Peak Hour	0	430	0	0	422	0	0	0	0	0	425	0	372	0
Average Hourly Volume	0	174	0	0	281	0	0	0	0	0	144	0	136	0

## Warrant 1 - Minimum Vehicular Volume

1A	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
	All Approaches	480	720	600	900	
					<b>% Fulfilled</b>	<b>102.2%</b>

1B	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
	Minor Street Approaches	180	255	180	255	
					<b>% Fulfilled</b>	<b>109.8%</b>

Warrant	AHV
1A - All	736
1B - Minor	280
2A - Major	456
2B - Cross	144

## Warrant 2 - Delay To Cross Traffic

2A	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
	Major Street Approaches	480	720	600	900	
					<b>% Fulfilled</b>	<b>63.3%</b>

2B	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
	Traffic Crossing Major Street	50	75	50	75	
					<b>% Fulfilled</b>	<b>192.3%</b>

# Signal Justification Calculation for Forecasted Volumes (OTM Book 12 - Justification 7)



Horizon Year: Total Traffic - Ten-Year Horioozn  
 Region/City/Township: MTO

Major Street: Guelph Line North/South: Y  
 Minor Street: Highway 401 WB Ramp

Number of Approach Lanes: 1  
 Tee Intersection? Y  
 Flow Conditions: Restricted

Warrant Results		
150% Satisfied	<b>No</b>	Justification for new intersections with forecast traffic
120% Satisfied	<b>No</b>	Justification for existing intersections with forecast traffic

PM Forecast Only? N

Time Period	Major Street Guelph Line						Minor Street Highway 401 WB Ramp						Peds Crossing Main Road	
	Northbound			Southbound			Eastbound			Westbound				
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		
AM Peak Hour	0	280	0	0	741	0	0	0	0	0	158	0	180	0
PM Peak Hour	0	452	0	0	445	0	0	0	0	0	446	0	392	0
Average Hourly Volume	0	183	0	0	297	0	0	0	0	0	151	0	143	0

### Warrant 1 - Minimum Vehicular Volume

Warrant	AHV
1A - All	774
1B - Minor	294
2A - Major	480
2B - Cross	151

1A	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	All Approaches	480	720	600	900		774
						<b>% Fulfilled</b>	<b>107.4%</b>

1B	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Minor Street Approaches	180	255	180	255		294
						<b>% Fulfilled</b>	<b>115.3%</b>

### Warrant 2 - Delay To Cross Traffic

2A	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Major Street Approaches	480	720	600	900		480
						<b>% Fulfilled</b>	<b>66.6%</b>

2B	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Traffic Crossing Major Street	50	75	50	75		151
						<b>% Fulfilled</b>	<b>201.3%</b>

# Signal Justification Calculation for Forecasted Volumes (OTM Book 12 - Justification 7)



Horizon Year: Existing Traffic  
Region/City/Township: MTO

Major Street: Reid Sideroad North/South: N  
Minor Street: Highway 401 EB Ramp

Number of Approach Lanes: 1  
Tee Intersection? Y  
Flow Conditions: Restricted

Warrant Results		
150% Satisfied	No	Justification for new intersections with forecast traffic
120% Satisfied	No	Justification for existing intersections with forecast traffic

PM Forecast Only? N

Time Period	Major Street Reid Sideroad						Minor Street Highway 401 EB Ramp						Peds Crossing Main Road
	Eastbound			Westbound			Northbound			Southbound			
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
AM Peak Hour	150	45	0	0	104	367	0	0	0	333	0	21	0
PM Peak Hour	57	77	0	0	225	224	0	0	0	369	0	8	0
<b>Average Hourly Volume</b>	<b>52</b>	<b>31</b>	<b>0</b>	<b>0</b>	<b>82</b>	<b>148</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>176</b>	<b>0</b>	<b>7</b>	<b>0</b>

### Warrant 1 - Minimum Vehicular Volume

Warrant	AHV
1A - All	495
1B - Minor	183
2A - Major	312
2B - Cross	176

1A	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	All Approaches	480	720	600	900		495
						<b>% Fulfilled</b>	<b>68.8%</b>

1B	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Minor Street Approaches	180	255	180	255		183
						<b>% Fulfilled</b>	<b>71.7%</b>

### Warrant 2 - Delay To Cross Traffic

2A	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Major Street Approaches	480	720	600	900		312
						<b>% Fulfilled</b>	<b>43.4%</b>

2B	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Traffic Crossing Major Street	50	75	50	75		176
						<b>% Fulfilled</b>	<b>234.0%</b>

# Signal Justification Calculation for Forecasted Volumes (OTM Book 12 - Justification 7)



Horizon Year: Background - Opening Date  
 Region/City/Township: MTO

Major Street: Reid Sideroad North/South: N  
 Minor Street: Highway 401 EB Ramp

Number of Approach Lanes: 1  
 Tee Intersection? Y  
 Flow Conditions: Restricted

Warrant Results		
150% Satisfied	<b>No</b>	Justification for new intersections with forecast traffic
120% Satisfied	<b>No</b>	Justification for existing intersections with forecast traffic

PM Forecast Only? N

Time Period	Major Street Reid Sideroad						Minor Street Highway 401 EB Ramp						Peds Crossing Main Road
	Eastbound			Westbound			Northbound			Southbound			
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
AM Peak Hour	154	46	0	0	107	378	0	0	0	343	0	22	0
PM Peak Hour	59	79	0	0	231	232	0	0	0	380	0	8	0
Average Hourly Volume	53	31	0	0	85	153	0	0	0	181	0	8	0

### Warrant 1 - Minimum Vehicular Volume

Warrant	AHV
1A - All	510
1B - Minor	188
2A - Major	322
2B - Cross	181

1A	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	All Approaches	480	720	600	900		510
						<b>% Fulfilled</b>	<b>70.8%</b>

1B	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Minor Street Approaches	180	255	180	255		188
						<b>% Fulfilled</b>	<b>73.8%</b>

### Warrant 2 - Delay To Cross Traffic

2A	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Major Street Approaches	480	720	600	900		322
						<b>% Fulfilled</b>	<b>44.7%</b>

2B	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Traffic Crossing Major Street	50	75	50	75		181
						<b>% Fulfilled</b>	<b>241.0%</b>

# Signal Justification Calculation for Forecasted Volumes (OTM Book 12 - Justification 7)



Horizon Year: Background - Five-Year Horizon  
 Region/City/Township: MTO

Major Street: Reid Sideroad North/South: N  
 Minor Street: Highway 401 EB Ramp

Number of Approach Lanes: 1  
 Tee Intersection? Y  
 Flow Conditions: Restricted

Warrant Results		
150% Satisfied	<b>No</b>	Justification for new intersections with forecast traffic
120% Satisfied	<b>No</b>	Justification for existing intersections with forecast traffic

PM Forecast Only? N

Time Period	Major Street Reid Sideroad						Minor Street Highway 401 EB Ramp						Peds Crossing Main Road
	Eastbound			Westbound			Northbound			Southbound			
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
AM Peak Hour	162	49	0	0	112	398	0	0	0	360	0	23	0
PM Peak Hour	62	84	0	0	243	242	0	0	0	399	0	8	0
Average Hourly Volume	56	33	0	0	89	160	0	0	0	190	0	8	0

## Warrant 1 - Minimum Vehicular Volume

1A	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	All Approaches	480	720	600	900		536
						<b>% Fulfilled</b>	<b>74.4%</b>

1B	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Minor Street Approaches	180	255	180	255		198
						<b>% Fulfilled</b>	<b>77.5%</b>

Warrant	AHV
1A - All	536
1B - Minor	198
2A - Major	338
2B - Cross	190

## Warrant 2 - Delay To Cross Traffic

2A	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Major Street Approaches	480	720	600	900		338
						<b>% Fulfilled</b>	<b>46.9%</b>

2B	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Traffic Crossing Major Street	50	75	50	75		190
						<b>% Fulfilled</b>	<b>253.0%</b>

# Signal Justification Calculation for Forecasted Volumes (OTM Book 12 - Justification 7)



Horizon Year: Background - Ten-Year Horizon  
 Region/City/Township: MTO

Major Street: Reid Sideroad North/South: N  
 Minor Street: Highway 401 EB Ramp

Number of Approach Lanes: 1  
 Tee Intersection? Y  
 Flow Conditions: Restricted

Warrant Results		
150% Satisfied	<b>No</b>	Justification for new intersections with forecast traffic
120% Satisfied	<b>No</b>	Justification for existing intersections with forecast traffic

PM Forecast Only? N

Time Period	Major Street Reid Sideroad						Minor Street Highway 401 EB Ramp						Peds Crossing Main Road	
	Eastbound			Westbound			Northbound			Southbound				
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		
AM Peak Hour	171	52	0	0	119	417	0	0	0	0	379	0	24	0
PM Peak Hour	65	88	0	0	256	256	0	0	0	0	420	0	9	0
Average Hourly Volume	59	35	0	0	94	168	0	0	0	0	200	0	8	0

### Warrant 1 - Minimum Vehicular Volume

Warrant	AHV
1A - All	564
1B - Minor	208
2A - Major	356
2B - Cross	200

1A	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	All Approaches	480	720	600	900		564
						<b>% Fulfilled</b>	<b>78.3%</b>

1B	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Minor Street Approaches	180	255	180	255		208
						<b>% Fulfilled</b>	<b>81.6%</b>

### Warrant 2 - Delay To Cross Traffic

2A	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Major Street Approaches	480	720	600	900		356
						<b>% Fulfilled</b>	<b>49.4%</b>

2B	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Traffic Crossing Major Street	50	75	50	75		200
						<b>% Fulfilled</b>	<b>266.3%</b>

# Signal Justification Calculation for Forecasted Volumes (OTM Book 12 - Justification 7)



Horizon Year: Total Traffic - Openign Date  
 Region/City/Township: MTO

Major Street: Reid Sideroad North/South: N  
 Minor Street: Highway 401 EB Ramp

Number of Approach Lanes: 1  
 Tee Intersection? Y  
 Flow Conditions: Restricted

Warrant Results		
150% Satisfied	<b>No</b>	Justification for new intersections with forecast traffic
120% Satisfied	<b>No</b>	Justification for existing intersections with forecast traffic

PM Forecast Only? N

Time Period	Major Street Reid Sideroad						Minor Street Highway 401 EB Ramp						Peds Crossing Main Road	
	Eastbound			Westbound			Northbound			Southbound				
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		
AM Peak Hour	170	46	0	0	123	378	0	0	0	0	343	0	22	0
PM Peak Hour	62	79	0	0	234	232	0	0	0	0	380	0	8	0
Average Hourly Volume	58	31	0	0	89	153	0	0	0	0	181	0	8	0

### Warrant 1 - Minimum Vehicular Volume

Warrant	AHV
1A - All	519
1B - Minor	188
2A - Major	331
2B - Cross	181

1A	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	All Approaches	480	720	600	900		519
						<b>% Fulfilled</b>	<b>72.1%</b>

1B	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Minor Street Approaches	180	255	180	255		188
						<b>% Fulfilled</b>	<b>73.8%</b>

### Warrant 2 - Delay To Cross Traffic

2A	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Major Street Approaches	480	720	600	900		331
						<b>% Fulfilled</b>	<b>46.0%</b>

2B	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Traffic Crossing Major Street	50	75	50	75		181
						<b>% Fulfilled</b>	<b>241.0%</b>

# Signal Justification Calculation for Forecasted Volumes (OTM Book 12 - Justification 7)



Horizon Year: Total Traffic - Five-Year Horizon  
 Region/City/Township: MTO

Major Street: Reid Sideroad North/South: N  
 Minor Street: Highway 401 EB Ramp

Number of Approach Lanes: 1  
 Tee Intersection? Y  
 Flow Conditions: Restricted

Warrant Results		
150% Satisfied	<b>No</b>	Justification for new intersections with forecast traffic
120% Satisfied	<b>No</b>	Justification for existing intersections with forecast traffic

PM Forecast Only? N

Time Period	Major Street Reid Sideroad						Minor Street Highway 401 EB Ramp						Peds Crossing Main Road	
	Eastbound			Westbound			Northbound			Southbound				
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		
AM Peak Hour	178	49	0	0	128	398	0	0	0	0	360	0	23	0
PM Peak Hour	65	84	0	0	246	242	0	0	0	0	399	0	8	0
<b>Average Hourly Volume</b>	<b>61</b>	<b>33</b>	<b>0</b>	<b>0</b>	<b>94</b>	<b>160</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>190</b>	<b>0</b>	<b>8</b>	<b>0</b>

### Warrant 1 - Minimum Vehicular Volume

Warrant	AHV
1A - All	545
1B - Minor	198
2A - Major	348
2B - Cross	190

1A	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	All Approaches	480	720	600	900		545
						<b>% Fulfilled</b>	<b>75.7%</b>

1B	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Minor Street Approaches	180	255	180	255		198
						<b>% Fulfilled</b>	<b>77.5%</b>

### Warrant 2 - Delay To Cross Traffic

2A	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Major Street Approaches	480	720	600	900		348
						<b>% Fulfilled</b>	<b>48.3%</b>

2B	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Traffic Crossing Major Street	50	75	50	75		190
						<b>% Fulfilled</b>	<b>253.0%</b>



# Signal Justification Calculation for Forecasted Volumes (OTM Book 12 - Justification 7)



Horizon Year: Total Traffic - Ten-Year Horizon  
 Region/City/Township: MTO

Major Street: Reid Sideroad North/South: N  
 Minor Street: Highway 401 EB Ramp

Number of Approach Lanes: 1  
 Tee Intersection? Y  
 Flow Conditions: Restricted

Warrant Results		
150% Satisfied	<b>No</b>	Justification for new intersections with forecast traffic
120% Satisfied	<b>No</b>	Justification for existing intersections with forecast traffic

PM Forecast Only? N

Time Period	Major Street Reid Sideroad						Minor Street Highway 401 EB Ramp						Peds Crossing Main Road	
	Eastbound			Westbound			Northbound			Southbound				
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		
AM Peak Hour	187	52	0	0	135	417	0	0	0	0	379	0	24	0
PM Peak Hour	68	88	0	0	259	256	0	0	0	0	420	0	9	0
Average Hourly Volume	64	35	0	0	99	168	0	0	0	0	200	0	8	0

### Warrant 1 - Minimum Vehicular Volume

Warrant	AHV
1A - All	574
1B - Minor	208
2A - Major	366
2B - Cross	200

1A	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	All Approaches	480	720	600	900		574
						<b>% Fulfilled</b>	<b>79.7%</b>

1B	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Minor Street Approaches	180	255	180	255		208
						<b>% Fulfilled</b>	<b>81.6%</b>

### Warrant 2 - Delay To Cross Traffic

2A	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Major Street Approaches	480	720	600	900		366
						<b>% Fulfilled</b>	<b>50.8%</b>

2B	Approach Lanes	1		2 or more		Average Hourly Volume	
	Flow Conditions	Free	Restricted	Free	Restricted		
	Traffic Crossing Major Street	50	75	50	75		200
						<b>% Fulfilled</b>	<b>266.3%</b>

# Appendix F

## Total Traffic Conditions Remedial Measures – Ten-Year Horizon

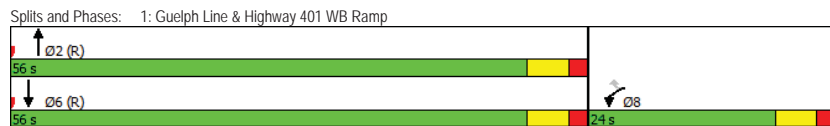


Timings

Total 10yr AM - Remedial

Lane Group	WBL	WBR	NBT	SBT
Lane Configurations	↔	↔	↕	↕
Traffic Volume (vph)	184	195	303	763
Future Volume (vph)	184	195	303	763
Turn Type	Prot	Perm	NA	NA
Protected Phases	8		2	6
Permitted Phases		8		
Detector Phase	8	8	2	6
Switch Phase				
Minimum Initial (s)	4.0	4.0	4.0	4.0
Minimum Split (s)	24.0	24.0	22.0	22.0
Total Split (s)	24.0	24.0	56.0	56.0
Total Split (%)	30.0%	30.0%	70.0%	70.0%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	None	None	C-Max	C-Max
Act Effct Green (s)	17.4	17.4	54.6	54.6
Actuated g/C Ratio	0.22	0.22	0.68	0.68
v/c Ratio	0.66	0.45	0.25	0.67
Control Delay	36.9	6.6	5.1	11.3
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	36.9	6.6	5.1	11.3
LOS	D	A	A	B
Approach Delay	22.0		5.1	11.3
Approach LOS	C		A	B

Intersection Summary	
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	44 (55%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	60
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.67
Intersection Signal Delay:	13.2
Intersection Capacity Utilization:	57.0%
Analysis Period (min):	15
Intersection LOS:	B
ICU Level of Service:	B



HCM Signalized Intersection Capacity Analysis

Total 10yr AM - Remedial

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔	↔	↕			↕
Traffic Volume (vph)	184	195	303	0	0	763
Future Volume (vph)	184	195	303	0	0	763
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.6	3.5	3.3	3.6
Total Lost time (s)	4.0	4.0	4.0			4.0
Lane Util. Factor	1.00	1.00	1.00			1.00
Frt	1.00	0.85	1.00			1.00
Flt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	1745	1597	1900			1900
Flt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	1745	1597	1900			1900
Peak-hour factor, PHF	0.74	0.81	0.92	0.87	0.25	0.88
Adj. Flow (vph)	249	241	329	0	0	867
RTOR Reduction (vph)	0	189	0	0	0	0
Lane Group Flow (vph)	249	52	329	0	0	867
Turn Type	Prot	Perm	NA			NA
Protected Phases	8		2			6
Permitted Phases		8				
Actuated Green, G (s)	15.4	15.4	52.6			52.6
Effective Green, g (s)	17.4	17.4	54.6			54.6
Actuated g/C Ratio	0.22	0.22	0.68			0.68
Clearance Time (s)	6.0	6.0	6.0			6.0
Vehicle Extension (s)	3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	379	347	1296			1296
v/s Ratio Prot	c0.14		0.17			c0.46
v/s Ratio Perm		0.03				
v/c Ratio	0.66	0.15	0.25			0.67
Uniform Delay, d1	28.6	25.3	4.9			7.4
Progression Factor	1.00	1.00	0.86			1.00
Incremental Delay, d2	4.1	0.2	0.4			2.8
Delay (s)	32.7	25.5	4.7			10.2
Level of Service	C	C	A			B
Approach Delay (s)	29.1		4.7			10.2
Approach LOS	C		A			B

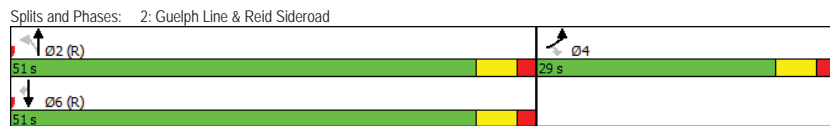
Intersection Summary			
HCM 2000 Control Delay	14.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	57.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Timings

Total 10yr AM - Remedial

	↖	↗	↙	↘	↕	↖
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↙	↘	↕	↖
Traffic Volume (vph)	151	300	12	483	373	574
Future Volume (vph)	151	300	12	483	373	574
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Detector Phase	4	4	2	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	23.0	23.0	23.0	23.0
Total Split (s)	29.0	29.0	51.0	51.0	51.0	51.0
Total Split (%)	36.3%	36.3%	63.8%	63.8%	63.8%	63.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	C-Max	C-Max	C-Max	C-Max
Act Effct Green (s)	16.4	16.4	55.6	55.6	55.6	55.6
Actuated g/C Ratio	0.20	0.20	0.70	0.70	0.70	0.70
v/c Ratio	0.55	0.59	0.04	0.39	0.33	0.49
Control Delay	19.9	4.6	5.2	6.9	4.6	1.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	19.9	4.6	5.2	6.9	4.6	1.5
LOS	B	A	A	A	A	A
Approach Delay	9.9			6.8	2.7	
Approach LOS	A			A	A	

**Intersection Summary**  
 Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 63 (79%), Referenced to phase 2:NBT and 6:SBT, Start of Green  
 Natural Cycle: 45  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.59  
 Intersection Signal Delay: 5.6      Intersection LOS: A  
 Intersection Capacity Utilization 45.5%      ICU Level of Service A  
 Analysis Period (min) 15



HCM Signalized Intersection Capacity Analysis

Total 10yr AM - Remedial

	↖	↗	↙	↘	↕	↖
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↙	↘	↕	↖
Traffic Volume (vph)	151	300	12	483	373	574
Future Volume (vph)	151	300	12	483	373	574
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.3	3.6	3.6	3.5
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Fit Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1745	1597	1745	1900	1900	1597
Fit Permitted	0.95	1.00	0.48	1.00	1.00	1.00
Satd. Flow (perm)	1745	1597	874	1900	1900	1597
Peak-hour factor, PHF	0.77	0.82	0.50	0.94	0.86	0.90
Adj. Flow (vph)	196	366	24	514	434	638
RTOR Reduction (vph)	0	291	0	0	0	195
Lane Group Flow (vph)	196	75	24	514	434	443
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	14.4	14.4	53.6	53.6	53.6	53.6
Effective Green, g (s)	16.4	16.4	55.6	55.6	55.6	55.6
Actuated g/C Ratio	0.20	0.20	0.70	0.70	0.70	0.70
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	357	327	607	1320	1320	1109
v/s Ratio Prot	c0.11			0.27	0.23	
v/s Ratio Perm		0.05	0.03			c0.28
v/c Ratio	0.55	0.23	0.04	0.39	0.33	0.40
Uniform Delay, d1	28.5	26.5	3.8	5.1	4.8	5.2
Progression Factor	0.54	0.33	1.00	1.00	0.73	0.71
Incremental Delay, d2	1.5	0.3	0.1	0.9	0.5	0.8
Delay (s)	16.7	9.0	3.9	6.0	4.0	4.5
Level of Service	B	A	A	A	A	A
Approach Delay (s)	11.7			5.9	4.3	
Approach LOS	B			A	A	

**Intersection Summary**  
 HCM 2000 Control Delay 6.6      HCM 2000 Level of Service A  
 HCM 2000 Volume to Capacity ratio 0.43  
 Actuated Cycle Length (s) 80.0      Sum of lost time (s) 8.0  
 Intersection Capacity Utilization 45.5%      ICU Level of Service A  
 Analysis Period (min) 15  
 c Critical Lane Group

Timings

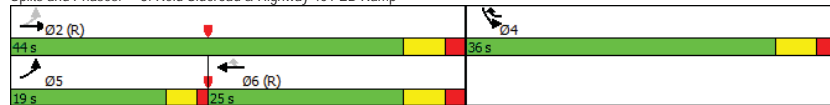
Total 10yr AM - Remedial

Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations					
Traffic Volume (vph)	224	56	160	426	395
Future Volume (vph)	224	56	160	426	395
Turn Type	pm+pt	NA	NA	pm+ov	Prot
Protected Phases	5	2	6	4	4
Permitted Phases	2			6	
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	8.0	22.0	22.0	22.0	22.0
Total Split (s)	19.0	44.0	25.0	36.0	36.0
Total Split (%)	23.8%	55.0%	31.3%	45.0%	45.0%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	Max	Max
Act Effct Green (s)	40.0	40.0	23.1	59.1	32.0
Actuated g/C Ratio	0.50	0.50	0.29	0.74	0.40
v/c Ratio	0.54	0.07	0.39	0.38	0.68
Control Delay	16.2	10.7	23.4	1.8	25.5
Queue Delay	0.0	0.0	0.0	0.3	0.0
Total Delay	16.2	10.7	23.4	2.1	25.5
LOS	B	B	C	A	C
Approach Delay		15.1	8.6		25.5
Approach LOS		B	A		C

Intersection Summary

Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 76 (95%), Referenced to phase 2:EBTL and 6:WBT, Start of Green  
 Natural Cycle: 60  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.68  
 Intersection Signal Delay: 15.4  
 Intersection Capacity Utilization 54.2%  
 Intersection LOS: B  
 ICU Level of Service A  
 Analysis Period (min) 15

Splits and Phases: 3: Reid Sideroad & Highway 401 EB Ramp



HCM Signalized Intersection Capacity Analysis

Total 10yr AM - Remedial

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	224	56	160	426	395	25
Future Volume (vph)	224	56	160	426	395	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.6	3.5	3.3	3.5
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.99	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1745	1900	1900	1597	1738	
Flt Permitted	0.44	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	804	1900	1900	1597	1738	
Peak-hour factor, PHF	0.75	0.81	0.76	0.88	0.90	0.71
Adj. Flow (vph)	299	69	211	484	439	35
RTOR Reduction (vph)	0	0	0	106	4	0
Lane Group Flow (vph)	299	69	211	378	470	0
Turn Type	pm+pt	NA	NA	pm+ov	Prot	
Protected Phases	5	2	6	4	4	
Permitted Phases	2			6		
Actuated Green, G (s)	38.0	38.0	21.1	51.1	30.0	
Effective Green, g (s)	38.0	40.0	23.1	55.1	32.0	
Actuated g/C Ratio	0.48	0.50	0.29	0.69	0.40	
Clearance Time (s)	4.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	533	950	548	1179	695	
v/s Ratio Prot	c0.09	0.04	0.11	0.13	c0.27	
v/s Ratio Perm	c0.18			0.11		
v/c Ratio	0.56	0.07	0.39	0.32	0.68	
Uniform Delay, d1	13.8	10.4	22.8	5.0	19.7	
Progression Factor	1.00	1.00	0.90	0.83	1.00	
Incremental Delay, d2	1.4	0.1	1.9	0.7	5.2	
Delay (s)	15.1	10.5	22.2	4.8	25.0	
Level of Service	B	B	C	A	C	
Approach Delay (s)		14.3	10.1		25.0	
Approach LOS		B	B		C	

Intersection Summary

HCM 2000 Control Delay 15.7  
 HCM 2000 Volume to Capacity ratio 0.62  
 Actuated Cycle Length (s) 80.0  
 Intersection Capacity Utilization 54.2%  
 Analysis Period (min) 15  
 HCM 2000 Level of Service B  
 Sum of lost time (s) 12.0  
 ICU Level of Service A  
 Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis Total 10yr AM - Remedial

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔			↔		↔	↔	
Traffic Volume (veh/h)	3	271	0	1	171	13	1	0	0	9	0	5
Future Volume (Veh/h)	3	271	0	1	171	13	1	0	0	9	0	5
Sign Control	Free			Free			Stop			Stop		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.50	0.77	0.25	0.25	0.79	0.67	0.25	0.25	0.25	0.75	0.25	0.75
Hourly flow rate (vph)	6	352	0	4	216	19	4	0	0	12	0	7
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)	81											
pX, platoon unblocked	0.91				0.91	0.91			0.91	0.91		
vC, conflicting volume	235	352			604	607	352	598	598	226		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	114	352			519	522	352	512	512	104		
IC, single (s)	4.1	4.1			7.1	6.5	6.2	7.1	6.5	6.2		
IC, 2 stage (s)												
IF (s)	2.2	2.2			3.5	4.0	3.3	3.5	4.0	3.3		
p0 queue free %	100	100			99	100	100	97	100	99		
cM capacity (veh/h)	1358	1218			424	419	696	432	424	873		
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1							
Volume Total	6	352	239	4	19							
Volume Left	6	0	4	4	12							
Volume Right	0	0	19	0	7							
cSH	1358	1700	1218	424	531							
Volume to Capacity	0.00	0.21	0.00	0.01	0.04							
Queue Length 95th (m)	0.1	0.0	0.1	0.2	0.9							
Control Delay (s)	7.7	0.0	0.2	13.6	12.0							
Lane LOS	A	A		B	B							
Approach Delay (s)	0.1	0.2		13.6	12.0							
Approach LOS	B			B								
<b>Intersection Summary</b>												
Average Delay	0.6											
Intersection Capacity Utilization	24.3%			ICU Level of Service	A							
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis Total 10yr AM - Remedial

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (veh/h)	0	48	0	100	34	0	0	6	195	2	2	0
Future Volume (Veh/h)	0	48	0	100	34	0	0	6	195	2	2	0
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.92	0.92	0.92	0.77	0.92	0.25	0.92	0.50	0.77	0.25	0.25	0.92
Hourly flow rate (vph)	0	52	0	130	37	0	0	12	253	8	8	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type							None			None		
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	181	289	8	188	162	138	8			265		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	181	289	8	188	162	138	8			265		
IC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
IC, 2 stage (s)												
IF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	92	100	82	95	100	100			99		
cM capacity (veh/h)	751	621	1080	723	729	915	1625			1311		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	52	167	265	16								
Volume Left	0	130	0	8								
Volume Right	0	0	253	0								
cSH	621	724	1625	1311								
Volume to Capacity	0.08	0.23	0.00	0.01								
Queue Length 95th (m)	2.2	7.1	0.0	0.1								
Control Delay (s)	11.3	11.5	0.0	3.9								
Lane LOS	B	B	A									
Approach Delay (s)	11.3	11.5	0.0	3.9								
Approach LOS	B	B										
<b>Intersection Summary</b>												
Average Delay	5.1											
Intersection Capacity Utilization	33.0%			ICU Level of Service	A							
Analysis Period (min)	15											

Queuing and Blocking Report

Total 10yr AM - Remedial

Intersection: 1: Guelph Line & Highway 401 WB Ramp

Movement	WB	NB	SB
Directions Served	L T	T	T
Maximum Queue (m)	60.9	53.7	76.7
Average Queue (m)	30.5	18.9	38.0
95th Queue (m)	50.9	40.0	64.9
Link Distance (m)	211.6	324.2	76.3
Upstream Blk Time (%)			0
Queuing Penalty (veh)			0
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 2: Guelph Line & Reid Sideroad

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L R	R	L T	T	T	R
Maximum Queue (m)	45.9	54.5	12.7	58.6	44.4	41.4
Average Queue (m)	18.5	22.7	3.0	28.0	17.7	18.4
95th Queue (m)	37.0	43.2	10.2	53.7	36.9	33.0
Link Distance (m)	102.7	102.7		309.5	324.2	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (m)			80.0			65.0
Storage Blk Time (%)				0		0
Queuing Penalty (veh)				0		0

Intersection: 3: Reid Sideroad & Highway 401 EB Ramp

Movement	EB	EB	WB	WB	SB
Directions Served	L T	T	T R	R	LR
Maximum Queue (m)	48.8	22.0	37.8	36.7	93.8
Average Queue (m)	25.1	6.7	19.8	16.2	50.9
95th Queue (m)	42.8	16.9	33.7	29.7	84.0
Link Distance (m)	58.9	58.9	102.7		91.0
Upstream Blk Time (%)	0				1
Queuing Penalty (veh)	0				0
Storage Bay Dist (m)				20.0	
Storage Blk Time (%)			11	2	
Queuing Penalty (veh)			46	4	

Queuing and Blocking Report

Total 10yr AM - Remedial

Intersection: 4: Carpool Lot & Reid Sideroad

Movement	EB	WB	NB	SB
Directions Served	L	LTR	LTR	LTR
Maximum Queue (m)	3.4	5.7	7.1	10.1
Average Queue (m)	0.1	0.2	0.4	3.1
95th Queue (m)	1.9	3.1	3.4	9.9
Link Distance (m)		58.9	37.4	41.5
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)	30.0			
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: Twiss Rd & Reid Sideroad

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (m)	14.6	18.4	3.9	2.9
Average Queue (m)	7.5	11.1	0.2	0.1
95th Queue (m)	13.8	17.4	2.4	1.5
Link Distance (m)	69.4	1100.4	142.4	142.3
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 15: Bend

Movement	NB
Directions Served	T
Maximum Queue (m)	0.6
Average Queue (m)	0.0
95th Queue (m)	0.6
Link Distance (m)	76.3
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (m)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Network Summary

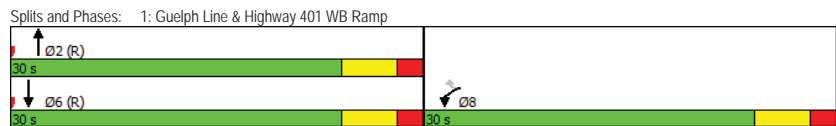
Network wide Queuing Penalty: 50

Timings

Total 10yr PM - Remedial

Lane Group	WBL	WBR	NBT	SBT
Lane Configurations	↖	↗	↕	↘
Traffic Volume (vph)	459	397	460	458
Future Volume (vph)	459	397	460	458
Turn Type	Prot	Perm	NA	NA
Protected Phases	8		2	6
Permitted Phases		8		
Detector Phase	8	8	2	6
Switch Phase				
Minimum Initial (s)	4.0	4.0	4.0	4.0
Minimum Split (s)	24.0	24.0	22.0	22.0
Total Split (s)	30.0	30.0	30.0	30.0
Total Split (%)	50.0%	50.0%	50.0%	50.0%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	None	None	C-Max	C-Max
Act Effct Green (s)	22.4	22.4	29.6	29.6
Actuated g/C Ratio	0.37	0.37	0.49	0.49
v/c Ratio	0.72	0.55	0.53	0.55
Control Delay	22.4	8.3	10.8	14.5
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	22.4	8.3	10.8	14.5
LOS	C	A	B	B
Approach Delay	15.8		10.8	14.5
Approach LOS	B		B	B

Intersection Summary			
Cycle Length:	60		
Actuated Cycle Length:	60		
Offset:	27 (45%), Referenced to phase 2:NBT and 6:SBT, Start of Green		
Natural Cycle:	50		
Control Type:	Actuated-Coordinated		
Maximum v/c Ratio:	0.72		
Intersection Signal Delay:	14.1	Intersection LOS: B	
Intersection Capacity Utilization	56.3%	ICU Level of Service B	
Analysis Period (min)	15		



HCM Signalized Intersection Capacity Analysis

Total 10yr PM - Remedial

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖	↗	↕			↘
Traffic Volume (vph)	459	397	460	0	0	458
Future Volume (vph)	459	397	460	0	0	458
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.6	3.5	3.3	3.6
Total Lost time (s)	4.0	4.0	4.0			4.0
Lane Util. Factor	1.00	1.00	1.00			1.00
Fr't	1.00	0.85	1.00			1.00
Flt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	1745	1597	1900			1900
Flt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	1745	1597	1900			1900
Peak-hour factor, PHF	0.98	0.97	0.92	0.80	0.25	0.89
Adj. Flow (vph)	468	409	500	0	0	515
RTOR Reduction (vph)	0	152	0	0	0	0
Lane Group Flow (vph)	468	257	500	0	0	515
Turn Type	Prot	Perm	NA			NA
Protected Phases	8		2			6
Permitted Phases		8				
Actuated Green, G (s)	20.4	20.4	27.6			27.6
Effective Green, g (s)	22.4	22.4	29.6			29.6
Actuated g/C Ratio	0.37	0.37	0.49			0.49
Clearance Time (s)	6.0	6.0	6.0			6.0
Vehicle Extension (s)	3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	651	596	937			937
v/s Ratio Prot	c0.27		0.26			c0.27
v/s Ratio Perm		0.16				
v/c Ratio	0.72	0.43	0.53			0.55
Uniform Delay, d1	16.1	14.0	10.5			10.6
Progression Factor	1.00	1.00	0.75			1.00
Incremental Delay, d2	3.8	0.5	1.7			2.3
Delay (s)	19.9	14.5	9.6			12.9
Level of Service	B	B	A			B
Approach Delay (s)	17.4		9.6			12.9
Approach LOS	B		A			B

Intersection Summary			
HCM 2000 Control Delay	14.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



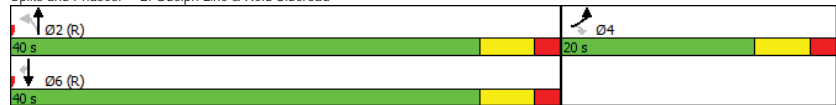
Timings

Total 10yr PM - Remedial

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	198	323	7	639	384	533
Future Volume (vph)	198	323	7	639	384	533
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Detector Phase	4	4	2	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	23.0	23.0	23.0	23.0
Total Split (s)	20.0	20.0	40.0	40.0	40.0	40.0
Total Split (%)	33.3%	33.3%	66.7%	66.7%	66.7%	66.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	C-Max	C-Max	C-Max	C-Max
Act Effct Green (s)	14.5	14.5	37.5	37.5	37.5	37.5
Actuated g/C Ratio	0.24	0.24	0.62	0.62	0.62	0.62
v/c Ratio	0.61	0.56	0.02	0.63	0.35	0.50
Control Delay	18.4	4.4	5.0	10.4	5.9	2.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.4	4.4	5.0	10.4	5.9	2.4
LOS	B	A	A	B	A	A
Approach Delay	10.1			10.3	3.8	
Approach LOS	B			B	A	

**Intersection Summary**  
 Cycle Length: 60  
 Actuated Cycle Length: 60  
 Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green  
 Natural Cycle: 50  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.63  
 Intersection Signal Delay: 7.5 Intersection LOS: A  
 Intersection Capacity Utilization 51.3% ICU Level of Service A  
 Analysis Period (min) 15

Splits and Phases: 2: Guelph Line & Reid Sideroad



HCM Signalized Intersection Capacity Analysis

Total 10yr PM - Remedial

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	198	323	7	639	384	533
Future Volume (vph)	198	323	7	639	384	533
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.3	3.6	3.6	3.5
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Fit Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1745	1597	1745	1900	1900	1597
Fit Permitted	0.95	1.00	0.48	1.00	1.00	1.00
Satd. Flow (perm)	1745	1597	887	1900	1900	1597
Peak-hour factor, PHF	0.77	0.87	0.63	0.86	0.93	0.87
Adj. Flow (vph)	257	371	11	743	413	613
RTOR Reduction (vph)	0	281	0	0	0	230
Lane Group Flow (vph)	257	90	11	743	413	383
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	12.5	12.5	35.5	35.5	35.5	35.5
Effective Green, g (s)	14.5	14.5	37.5	37.5	37.5	37.5
Actuated g/C Ratio	0.24	0.24	0.62	0.62	0.62	0.62
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	421	385	554	1187	1187	998
v/s Ratio Prot	c0.15			c0.39	0.22	
v/s Ratio Perm		0.06	0.01			0.24
v/c Ratio	0.61	0.23	0.02	0.63	0.35	0.38
Uniform Delay, d1	20.2	18.3	4.3	6.9	5.4	5.6
Progression Factor	0.66	0.67	1.00	1.00	0.87	1.68
Incremental Delay, d2	2.0	0.2	0.1	2.5	0.7	0.9
Delay (s)	15.4	12.5	4.3	9.4	5.4	10.3
Level of Service	B	B	A	A	A	B
Approach Delay (s)	13.7			9.4	8.3	
Approach LOS	B			A	A	

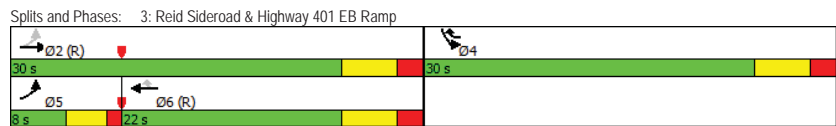
**Intersection Summary**  
 HCM 2000 Control Delay 10.0 HCM 2000 Level of Service B  
 HCM 2000 Volume to Capacity ratio 0.62  
 Actuated Cycle Length (s) 60.0 Sum of lost time (s) 8.0  
 Intersection Capacity Utilization 51.3% ICU Level of Service A  
 Analysis Period (min) 15  
 c Critical Lane Group

Timings

Total 10yr PM - Remedial

Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations					
Traffic Volume (vph)	75	98	277	263	423
Future Volume (vph)	75	98	277	263	423
Turn Type	pm+pt	NA	NA	pm+ov	Prot
Protected Phases	5	2	6	4	4
Permitted Phases	2			6	
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	8.0	22.0	22.0	22.0	22.0
Total Split (s)	8.0	30.0	22.0	30.0	30.0
Total Split (%)	13.3%	50.0%	36.7%	50.0%	50.0%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	Max	Max
Act Effct Green (s)	26.0	26.0	19.6	50.4	26.0
Actuated g/C Ratio	0.43	0.43	0.33	0.84	0.43
v/c Ratio	0.30	0.22	0.50	0.22	0.77
Control Delay	12.8	11.5	17.8	0.3	23.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	12.8	11.5	17.8	0.3	23.1
LOS	B	B	B	A	C
Approach Delay		12.0	9.1		23.1
Approach LOS		B	A		C

**Intersection Summary**  
 Cycle Length: 60  
 Actuated Cycle Length: 60  
 Offset: 2 (3%), Referenced to phase 2:EBTL and 6:WBT, Start of Green  
 Natural Cycle: 60  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.77  
 Intersection Signal Delay: 15.1  
 Intersection Capacity Utilization 52.9%  
 Analysis Period (min) 15  
 Intersection LOS: B  
 ICU Level of Service A



HCM Signalized Intersection Capacity Analysis

Total 10yr PM - Remedial

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	75	98	277	263	423	12
Future Volume (vph)	75	98	277	263	423	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.6	3.5	3.3	3.5
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.99	
Flt Protected	0.95	1.00	1.00	1.00	0.95	
Satd. Flow (prot)	1745	1900	1900	1597	1743	
Flt Permitted	0.34	1.00	1.00	1.00	0.95	
Satd. Flow (perm)	622	1900	1900	1597	1743	
Peak-hour factor, PHF	0.72	0.55	0.90	0.85	0.76	0.50
Adj. Flow (vph)	104	178	308	309	557	24
RTOR Reduction (vph)	0	0	0	78	3	0
Lane Group Flow (vph)	104	178	308	231	578	0
Turn Type	pm+pt	NA	NA	pm+ov	Prot	
Protected Phases	5	2	6	4	4	
Permitted Phases	2			6		
Actuated Green, G (s)	24.0	24.0	16.8	40.8	24.0	
Effective Green, g (s)	24.0	26.0	18.8	44.8	26.0	
Actuated g/C Ratio	0.40	0.43	0.31	0.75	0.43	
Clearance Time (s)	4.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	308	823	595	1298	755	
v/s Ratio Prot	c0.02	0.09	c0.16	0.08	c0.33	
v/s Ratio Perm	0.12			0.07		
v/c Ratio	0.34	0.22	0.52	0.18	0.77	
Uniform Delay, d1	12.2	10.6	16.9	2.2	14.4	
Progression Factor	1.00	1.00	0.87	0.11	1.00	
Incremental Delay, d2	0.7	0.6	2.8	0.3	7.3	
Delay (s)	12.8	11.2	17.5	0.5	21.7	
Level of Service	B	B	B	A	C	
Approach Delay (s)		11.8	9.0		21.7	
Approach LOS		B	A		C	

**Intersection Summary**  
 HCM 2000 Control Delay 14.5  
 HCM 2000 Volume to Capacity ratio 0.64  
 Actuated Cycle Length (s) 60.0  
 Intersection Capacity Utilization 52.9%  
 Analysis Period (min) 15  
 HCM 2000 Level of Service B  
 Sum of lost time (s) 12.0  
 ICU Level of Service A  
 Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis Total 10yr PM - Remedial

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔			↔			↔			↔	
Traffic Volume (veh/h)	1	158	0	0	274	15	0	0	0	15	0	5
Future Volume (Veh/h)	1	158	0	0	274	15	0	0	0	15	0	5
Sign Control	Free			Free			Stop			Stop		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.25	0.73	0.25	0.25	0.86	0.50	0.25	0.25	0.25	0.50	0.25	0.75
Hourly flow rate (vph)	4	216	0	0	319	30	0	0	0	30	0	7
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)	81											
pX, platoon unblocked	0.87				0.87	0.87			0.87	0.87		
vC, conflicting volume	349	216			565	573	216	558	558	334		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	169	216			419	428	216	411	411	152		
IC, single (s)	4.1	4.1			7.1	6.5	6.2	7.1	6.5	6.2		
IC, 2 stage (s)												
IF (s)	2.2	2.2			3.5	4.0	3.3	3.5	4.0	3.3		
p0 queue free %	100	100			100	100	100	94	100	99		
cM capacity (veh/h)	1229	1366			469	450	829	479	460	778		
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>							
Volume Total	4	216	349	0	37							
Volume Left	4	0	0	0	30							
Volume Right	0	0	30	0	7							
cSH	1229	1700	1366	1700	516							
Volume to Capacity	0.00	0.13	0.00	0.00	0.07							
Queue Length 95th (m)	0.1	0.0	0.0	0.0	1.8							
Control Delay (s)	7.9	0.0	0.0	0.0	12.5							
Lane LOS	A	A			B							
Approach Delay (s)	0.1	0.0	0.0	12.5								
Approach LOS	A			B								
<b>Intersection Summary</b>												
Average Delay	0.8											
Intersection Capacity Utilization	25.3%			ICU Level of Service	A							
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis Total 10yr PM - Remedial

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↔			↔			↔			↔		
Traffic Volume (veh/h)	0	9	0	148	7	11	0	0	149	2	3	0	
Future Volume (Veh/h)	0	9	0	148	7	11	0	0	149	2	3	0	
Sign Control	Stop			Stop			Free			Free			
Grade	0%			0%			0%			0%			
Peak Hour Factor	0.92	0.92	0.92	0.85	0.92	0.63	0.92	0.25	0.74	0.25	0.25	0.92	
Hourly flow rate (vph)	0	10	0	174	8	17	0	0	201	8	12	0	
Pedestrians													
Lane Width (m)													
Walking Speed (m/s)													
Percent Blockage													
Right turn flare (veh)													
Median type							None			None			
Median storage (veh)													
Upstream signal (m)													
pX, platoon unblocked													
vC, conflicting volume	150	229	12	134	128	100	12						201
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	150	229	12	134	128	100	12						201
IC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1						4.1
IC, 2 stage (s)													
IF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2						2.2
p0 queue free %	100	99	100	79	99	98	100						99
cM capacity (veh/h)	798	670	1074	830	761	960	1620						1383
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>									
Volume Total	10	199	201	20									
Volume Left	0	174	0	8									
Volume Right	0	17	201	0									
cSH	670	836	1620	1383									
Volume to Capacity	0.01	0.24	0.00	0.01									
Queue Length 95th (m)	0.4	7.4	0.0	0.1									
Control Delay (s)	10.5	10.6	0.0	3.1									
Lane LOS	B	B	A										
Approach Delay (s)	10.5	10.6	0.0	3.1									
Approach LOS	B	B											
<b>Intersection Summary</b>													
Average Delay	5.3												
Intersection Capacity Utilization	31.8%			ICU Level of Service	A								
Analysis Period (min)	15												

Queuing and Blocking Report

Total 10yr PM - Remedial

Intersection: 1: Guelph Line & Highway 401 WB Ramp

Movement	WB	WB	NB	SB
Directions Served	L	R	T	T
Maximum Queue (m)	95.4	46.2	56.8	72.6
Average Queue (m)	54.5	2.5	26.9	34.5
95th Queue (m)	82.5	27.0	46.6	59.0
Link Distance (m)	211.6		324.2	76.3
Upstream Blk Time (%)				0
Queuing Penalty (veh)				0
Storage Bay Dist (m)		85.0		
Storage Blk Time (%)	1	0		
Queuing Penalty (veh)	2	0		

Intersection: 2: Guelph Line & Reid Sideroad

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	R
Maximum Queue (m)	53.2	42.6	10.5	74.8	46.9	42.2
Average Queue (m)	21.2	20.6	1.9	36.8	24.8	24.0
95th Queue (m)	40.6	35.4	7.9	63.9	43.1	37.5
Link Distance (m)	102.7	102.7		309.5	324.2	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (m)			80.0		65.0	
Storage Blk Time (%)				0		
Queuing Penalty (veh)				0		

Intersection: 3: Reid Sideroad & Highway 401 EB Ramp

Movement	EB	EB	WB	WB	SB
Directions Served	L	T	T	R	LR
Maximum Queue (m)	24.1	24.6	59.2	32.8	77.4
Average Queue (m)	11.4	10.6	27.1	9.3	40.5
95th Queue (m)	21.1	22.4	48.5	23.3	64.8
Link Distance (m)	58.9	58.9	102.7		91.0
Upstream Blk Time (%)					0
Queuing Penalty (veh)					0
Storage Bay Dist (m)				20.0	
Storage Blk Time (%)			15	0	
Queuing Penalty (veh)			38	0	

Queuing and Blocking Report

Total 10yr PM - Remedial

Intersection: 4: Carpool Lot & Reid Sideroad

Movement	EB	SB
Directions Served	L	LTR
Maximum Queue (m)	0.8	11.5
Average Queue (m)	0.0	3.9
95th Queue (m)	0.8	11.3
Link Distance (m)		41.5
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)	30.0	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: Twiss Rd & Reid Sideroad

Movement	EB	WB	SB
Directions Served	LTR	LTR	LTR
Maximum Queue (m)	9.5	19.7	1.4
Average Queue (m)	2.1	11.5	0.0
95th Queue (m)	8.4	18.1	1.0
Link Distance (m)	69.4	1100.4	142.3
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 15: Bend

Movement	NB	NB
Directions Served	T	
Maximum Queue (m)	20.0	13.7
Average Queue (m)	3.3	1.2
95th Queue (m)	13.9	6.8
Link Distance (m)	76.3	76.3
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 41

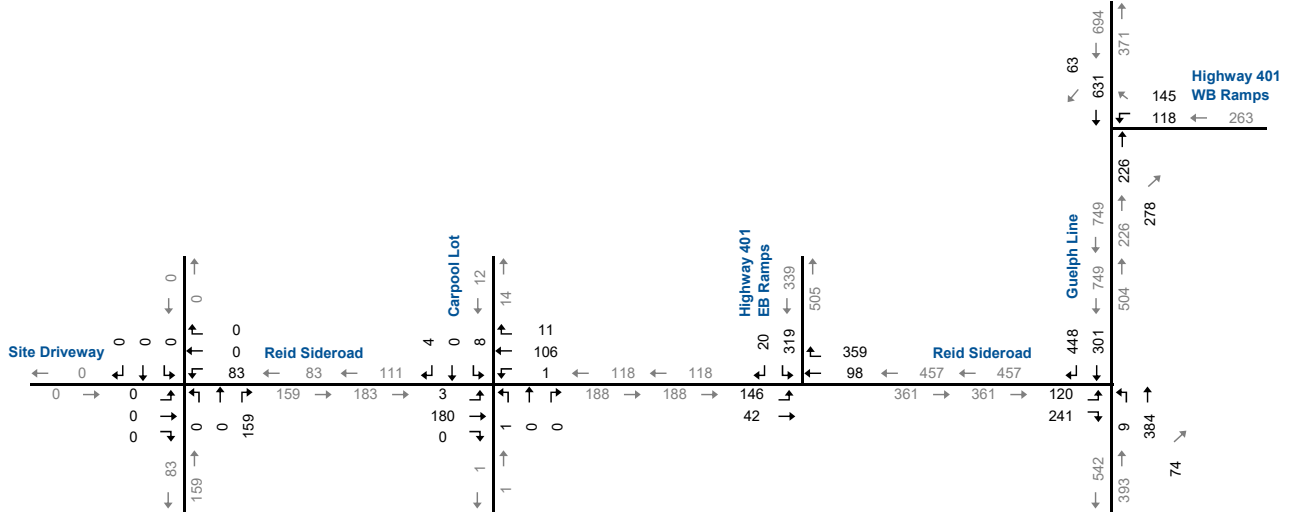
# Appendix G

## Detailed Traffic Forecast

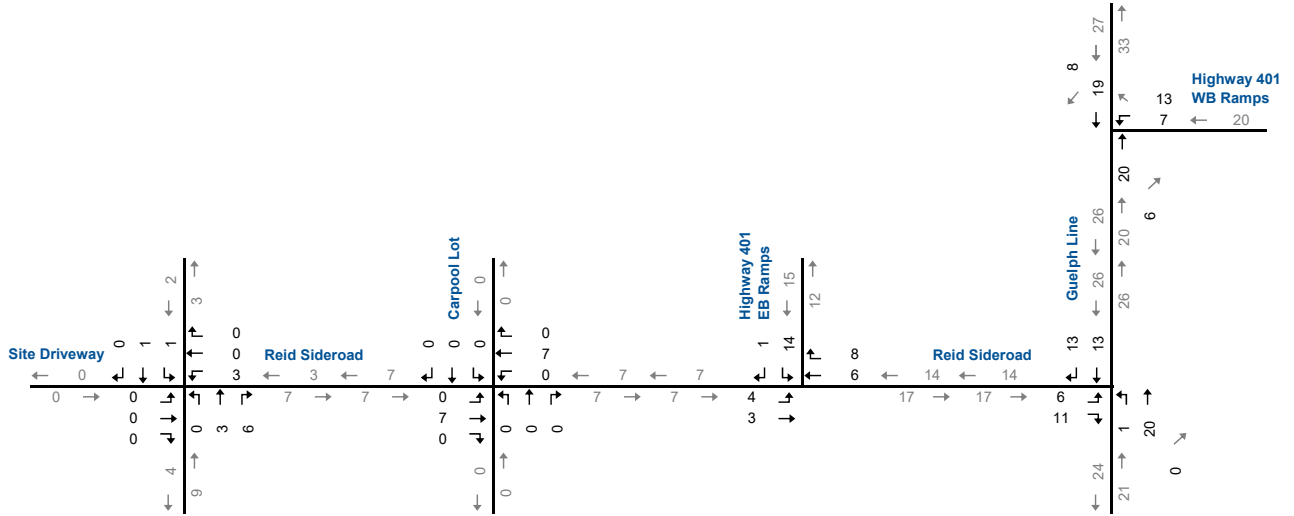


Base Year - AM Peak Hour

Passenger Cars

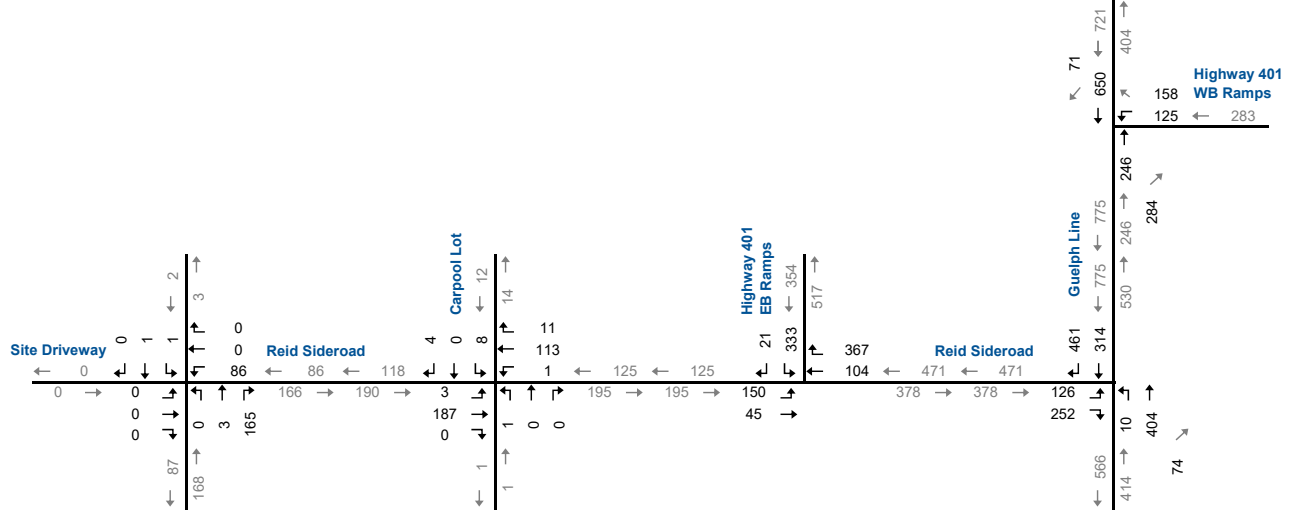


Heavy Vehicles



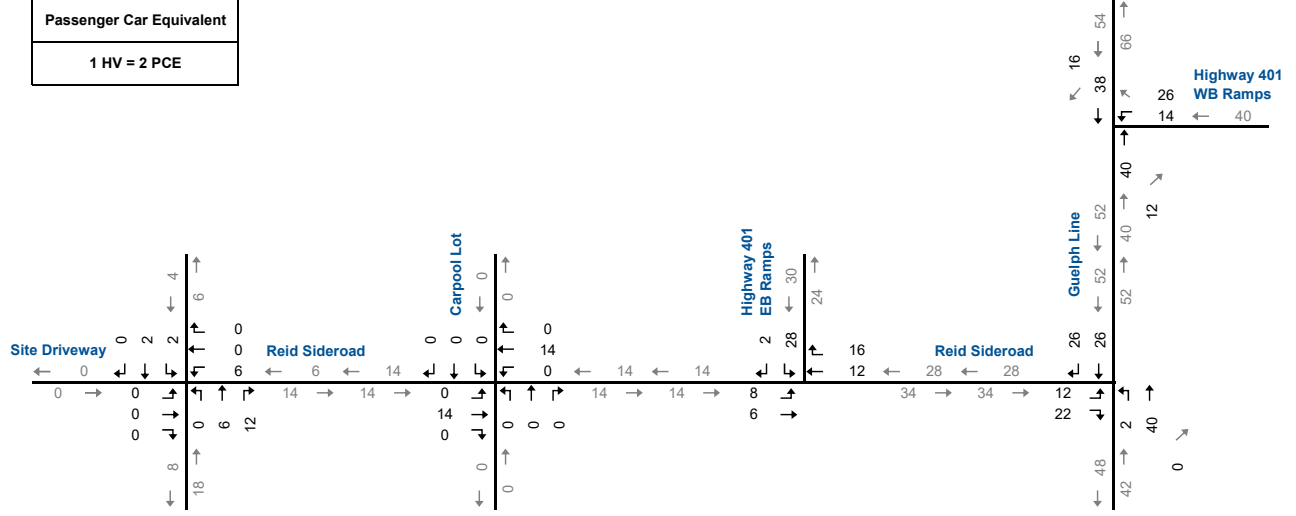
Base Year - AM Peak Hour

Total Count Volume



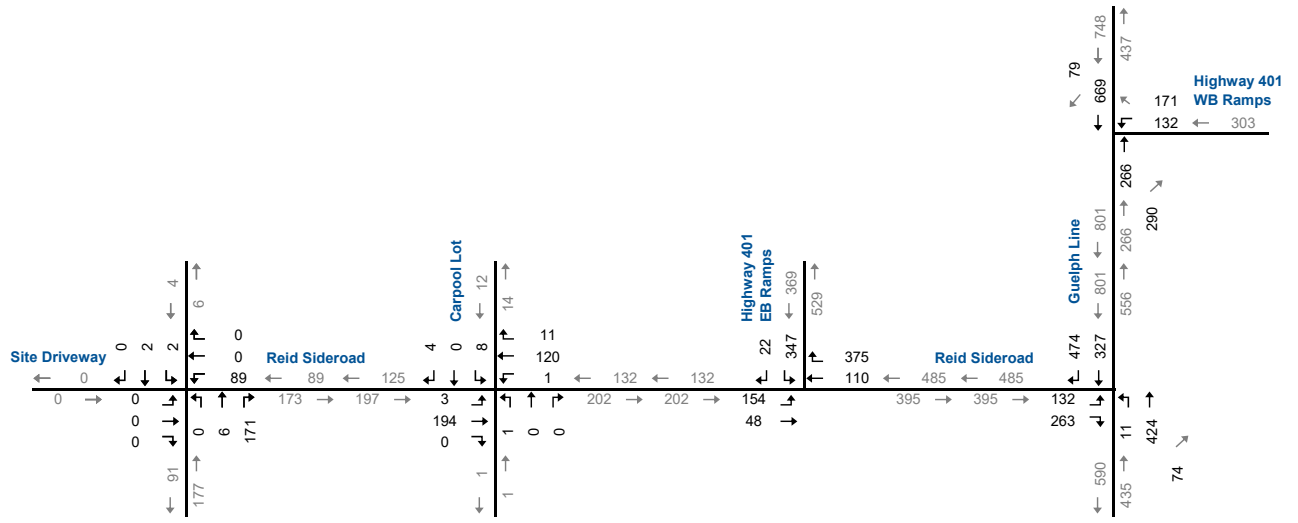
Passenger Car Equivalent (PCE) Units

Passenger Car Equivalent  
1 HV = 2 PCE



Base Year - AM Peak Hour

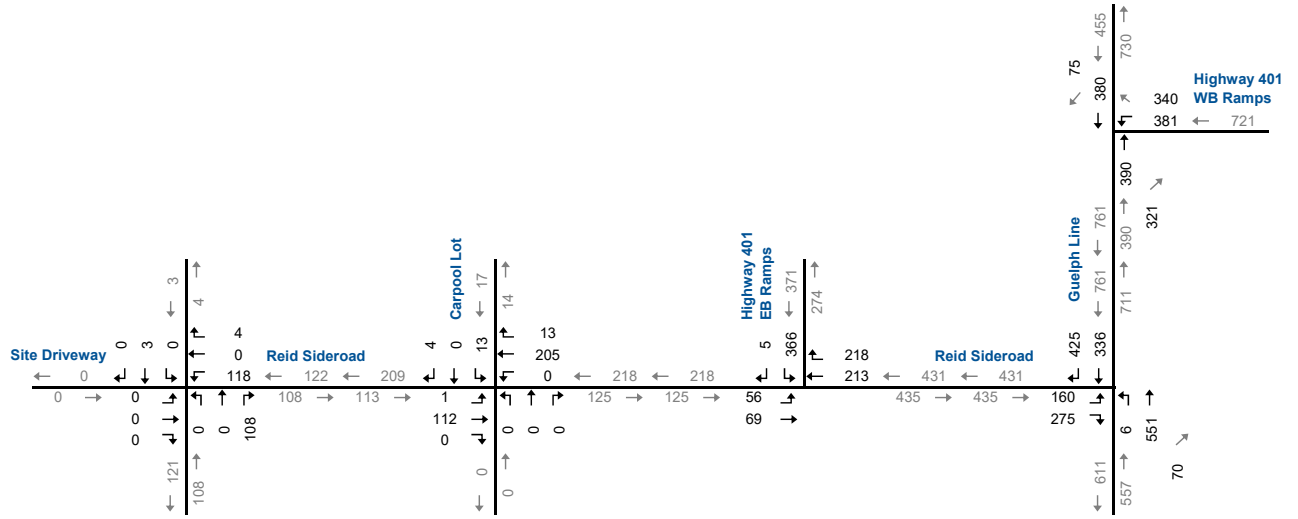
Total Passenger Car Volume



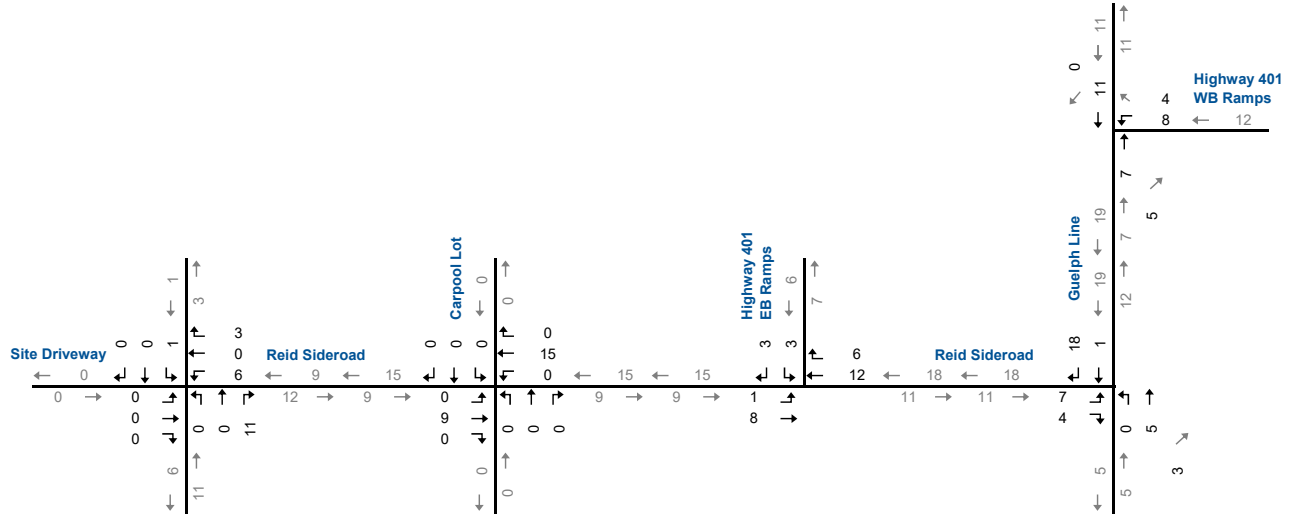


Base Year - PM Peak Hour

Passenger Cars

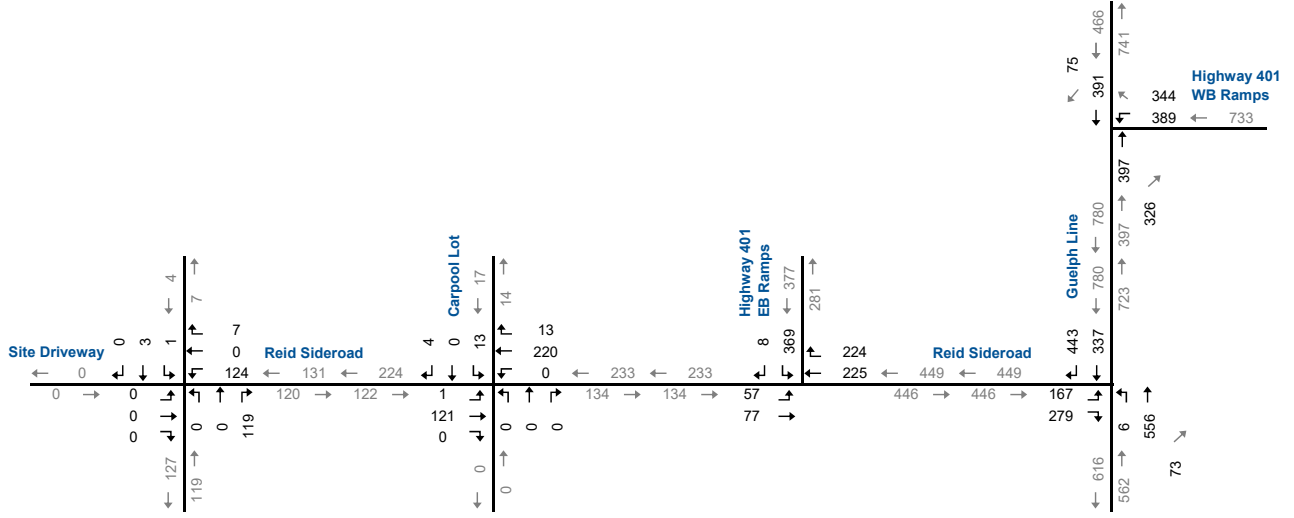


Heavy Vehicles



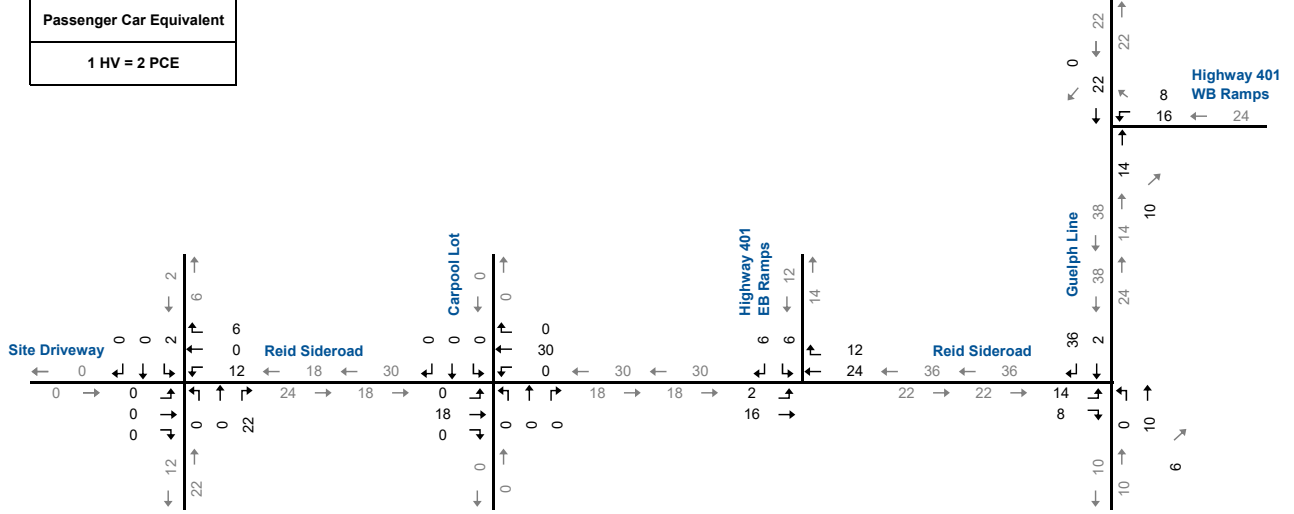
Base Year - PM Peak Hour

Total Count Volume

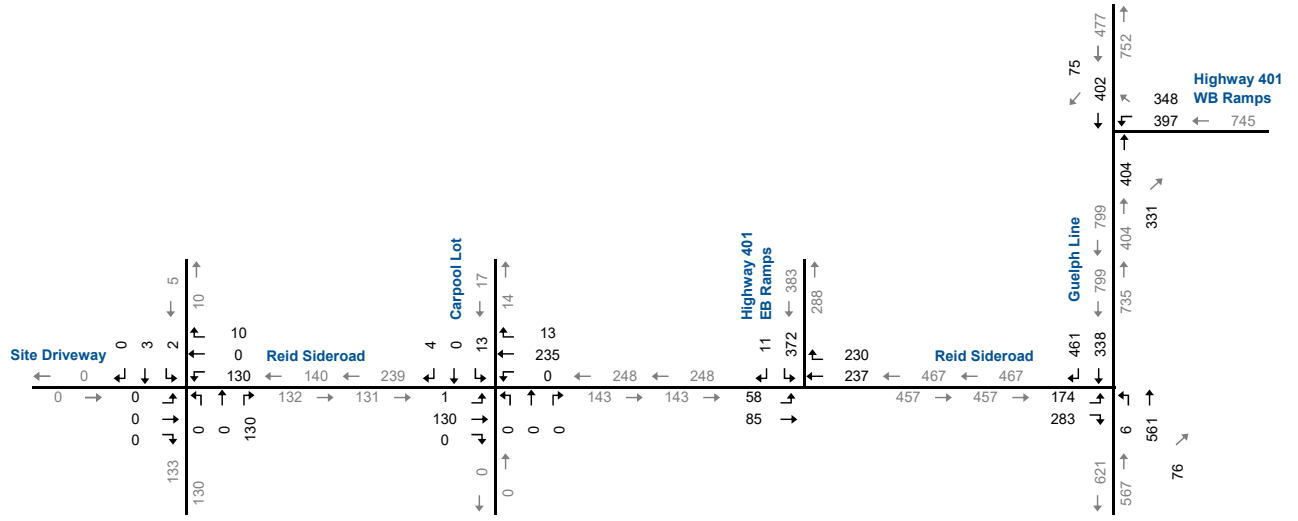


Passenger Car Equivalent (PCE) Units

Passenger Car Equivalent  
1 HV = 2 PCE

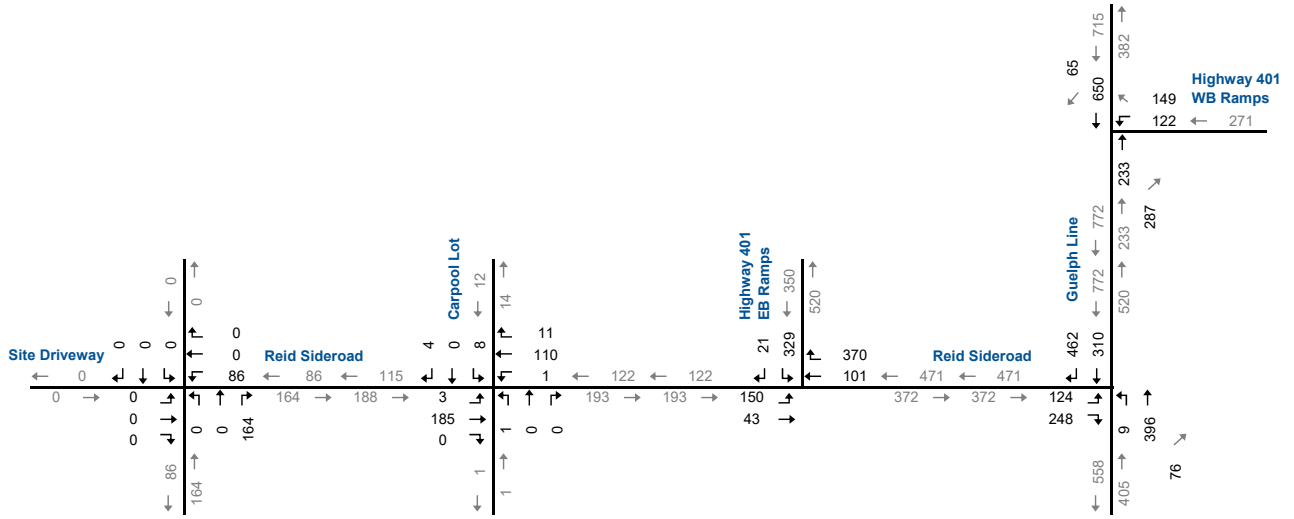


Total Passenger Car Volume

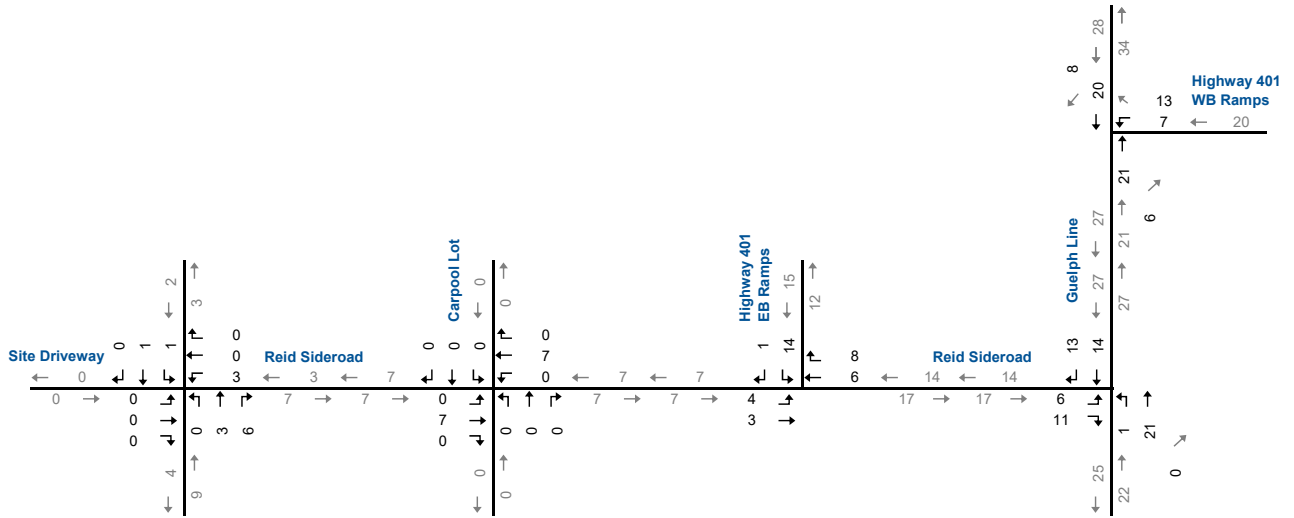


**Background Traffic Forecast - Opening Date Horizon AM Peak Hour**

**Passenger Cars**

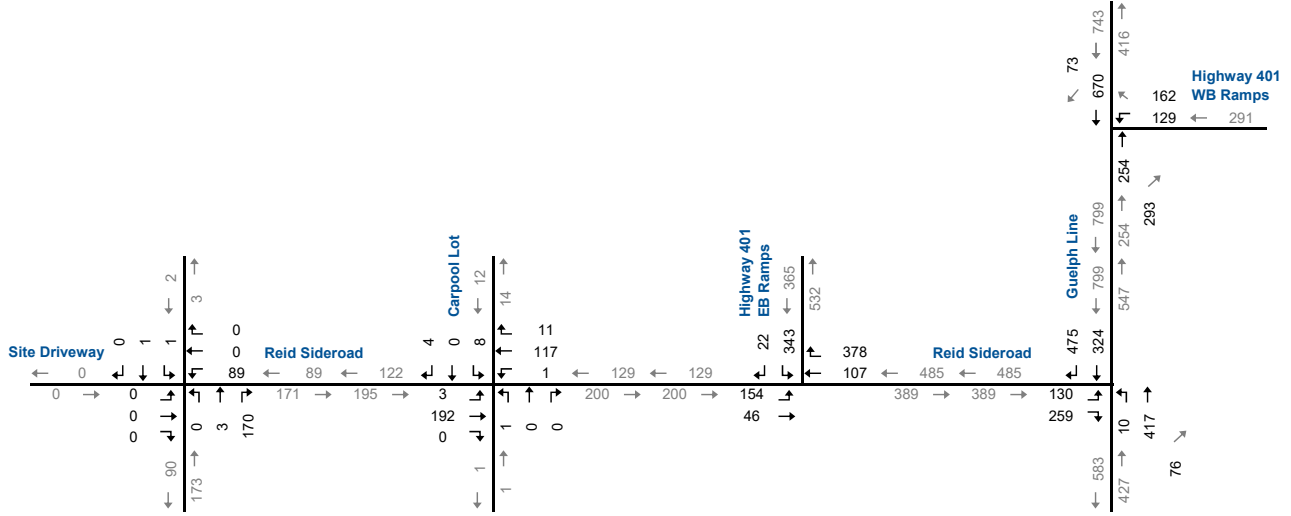


**Heavy Vehicles**



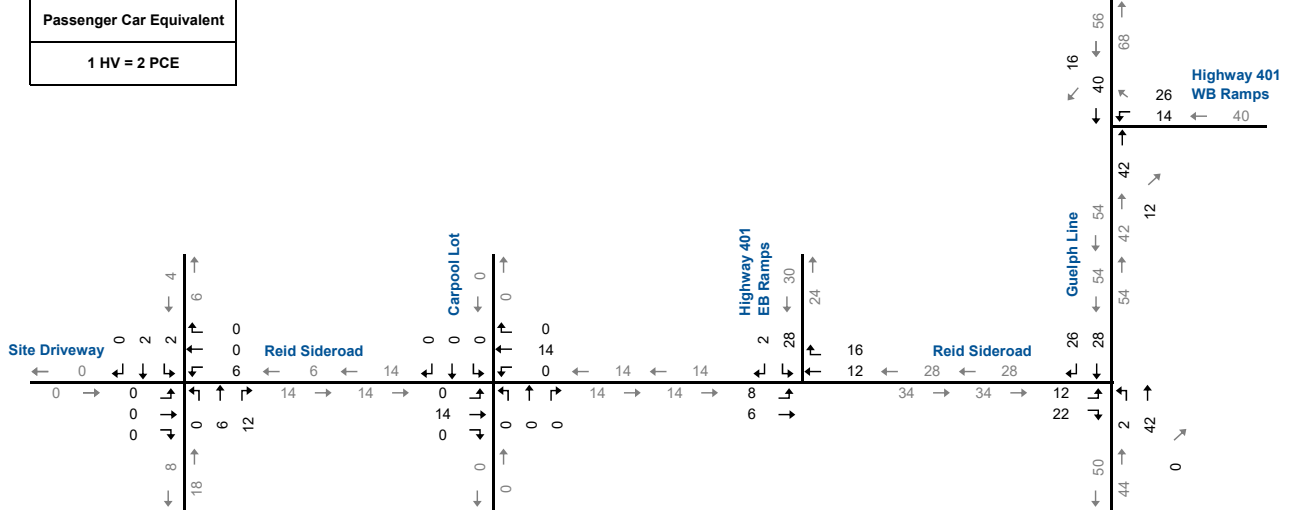
**Background Traffic Forecast - Opening Date Horizon AM Peak Hour**

**Total Count Volume**



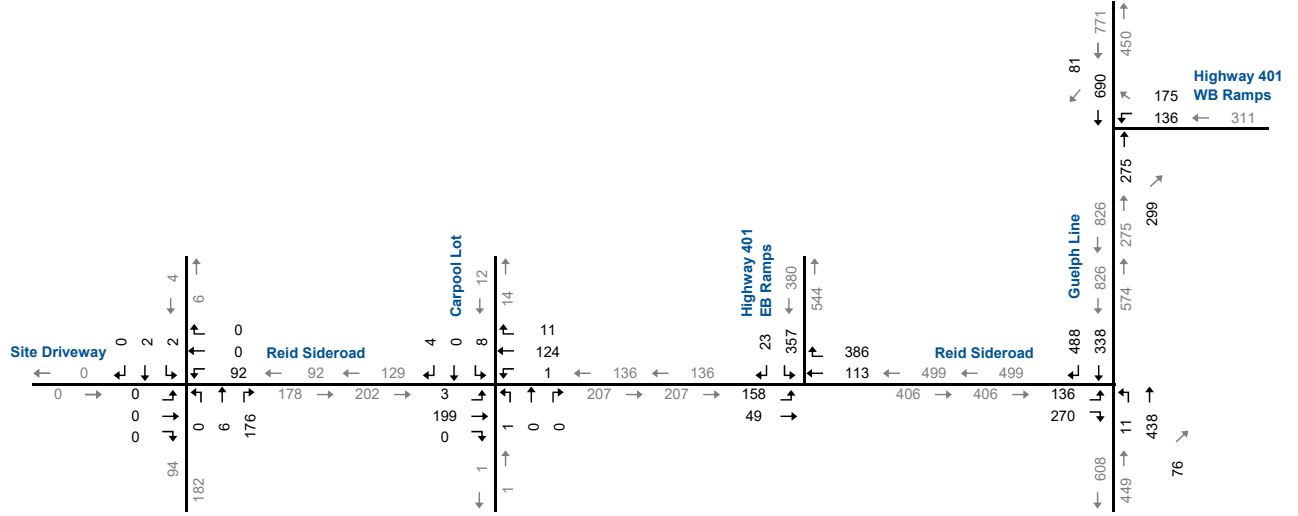
**Passenger Car Equivalent (PCE) Units**

Passenger Car Equivalent  
1 HV = 2 PCE



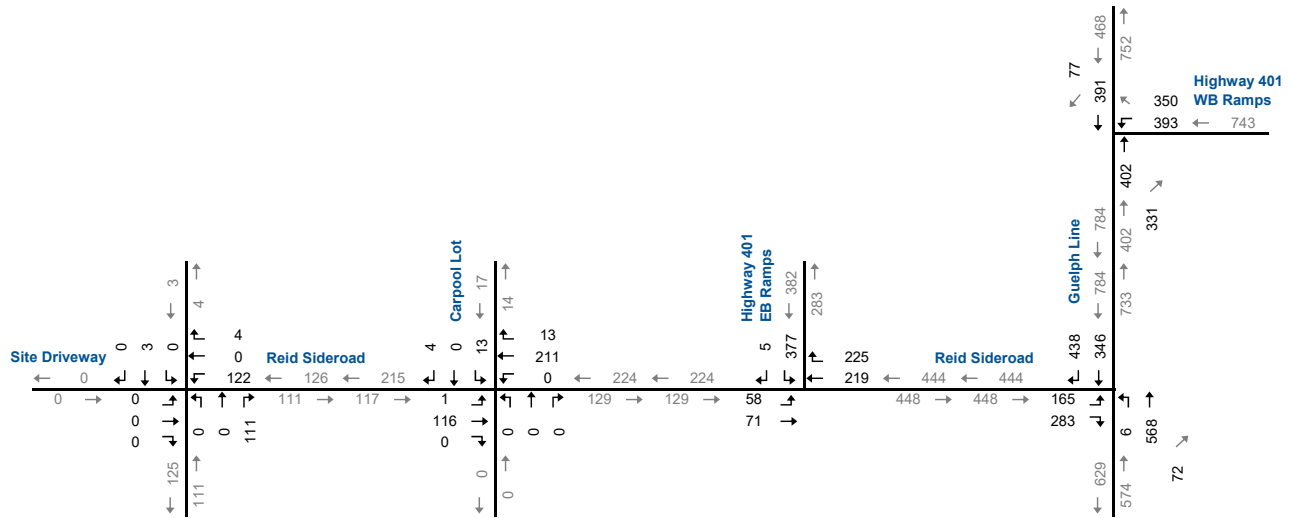
Background Traffic Forecast - Opening Date Horizon AM Peak Hour

Total Passenger Car Volume

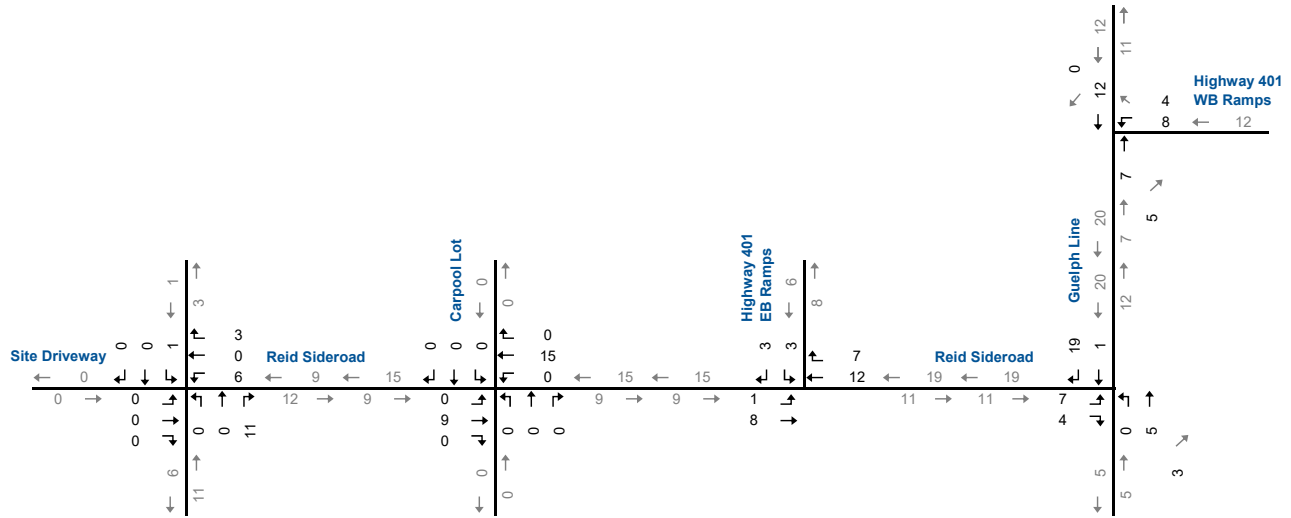


**Background Traffic Forecast - Opening Date Horizon PM Peak Hour**

**Passenger Cars**

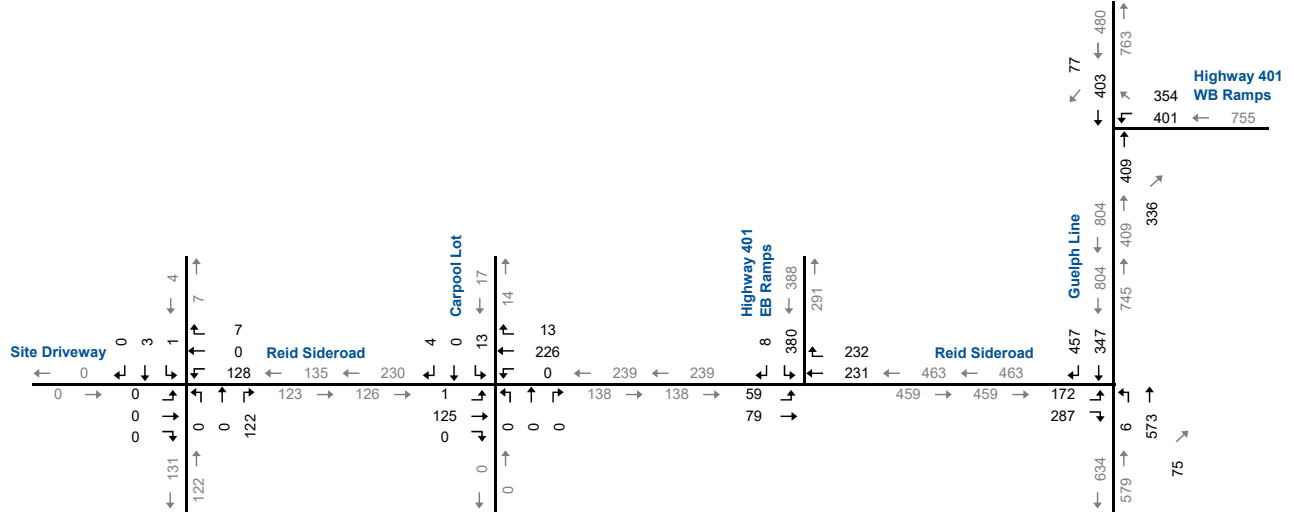


**Heavy Vehicles**



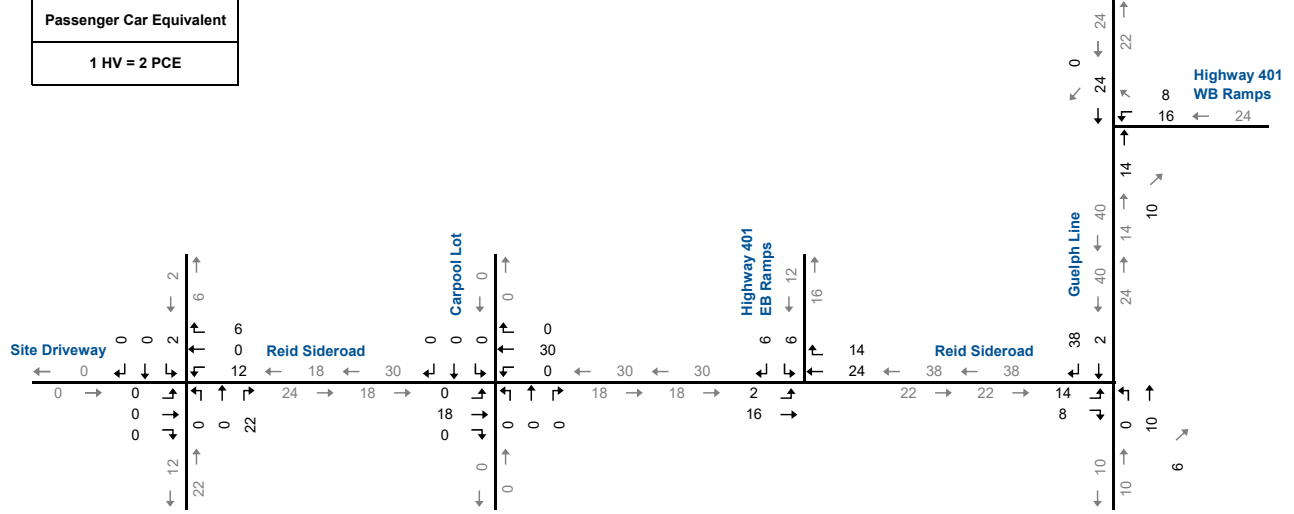
**Background Traffic Forecast - Opening Date Horizon PM Peak Hour**

**Total Count Volume**



Passenger Car Equivalent  
1 HV = 2 PCE

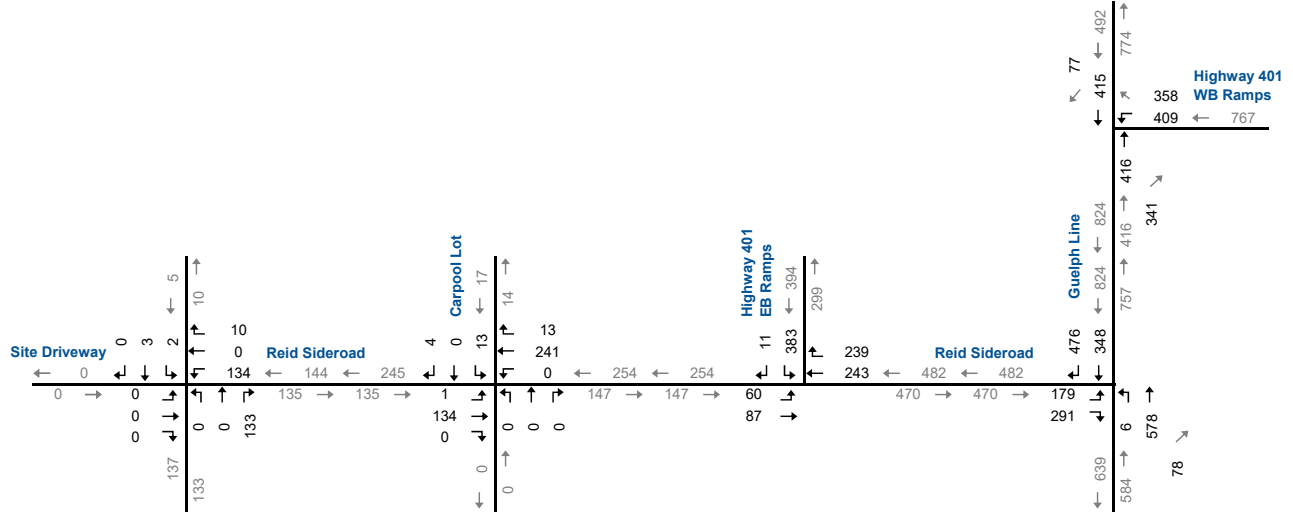
**Passenger Car Equivalent (PCE) Units**





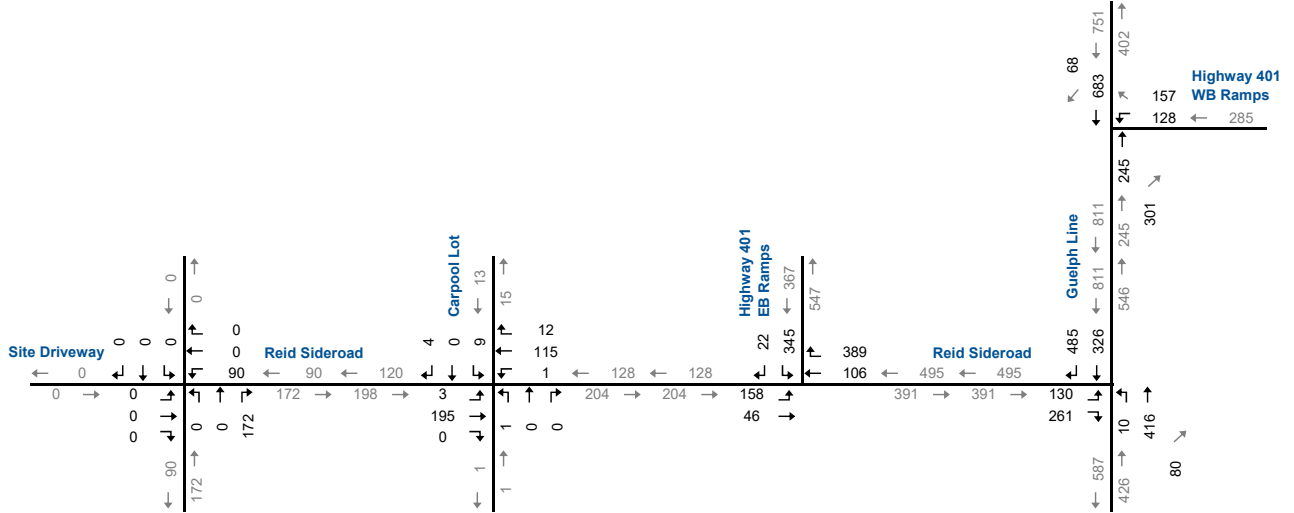
**Background Traffic Forecast - Opening Date Horizon PM Peak Hour**

Total Passenger Car Volume

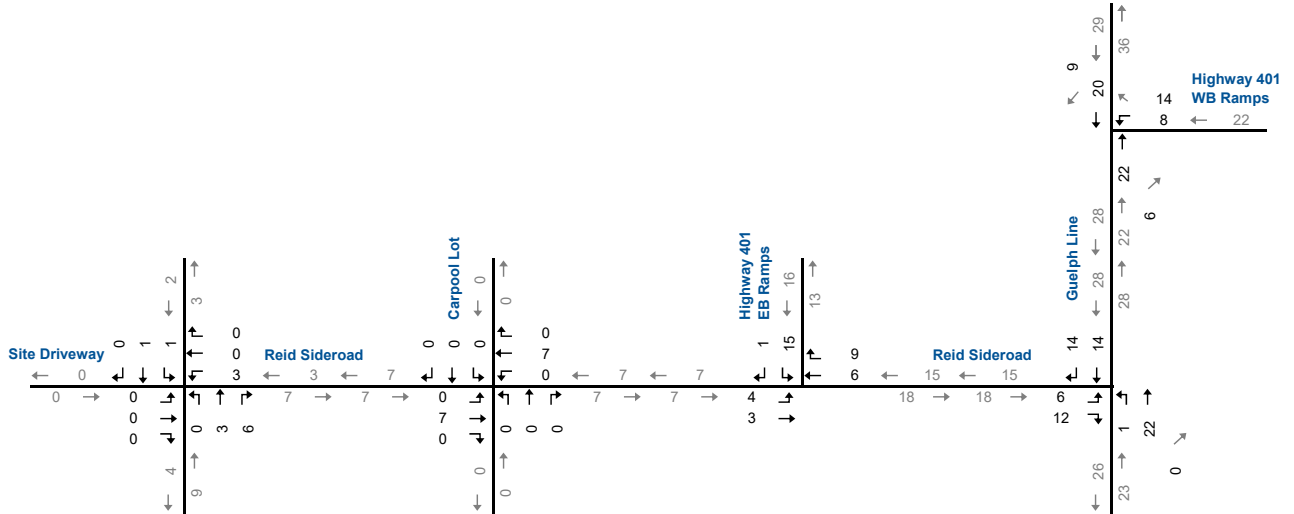


**Background Traffic Forecast - Five-Year Horizon AM Peak Hour**

**Passenger Cars**

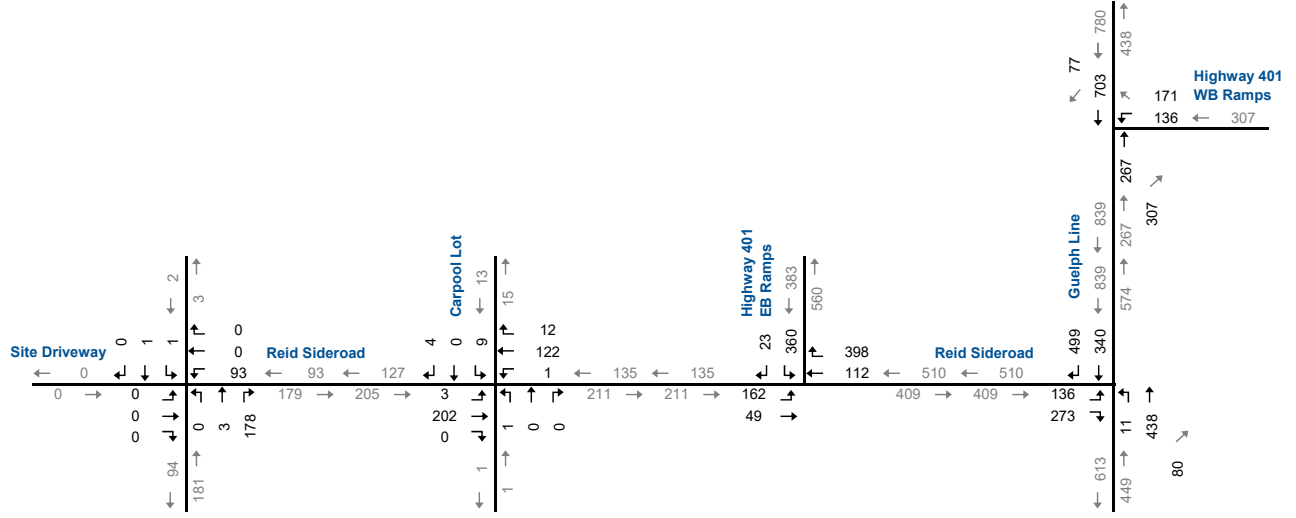


**Heavy Vehicles**



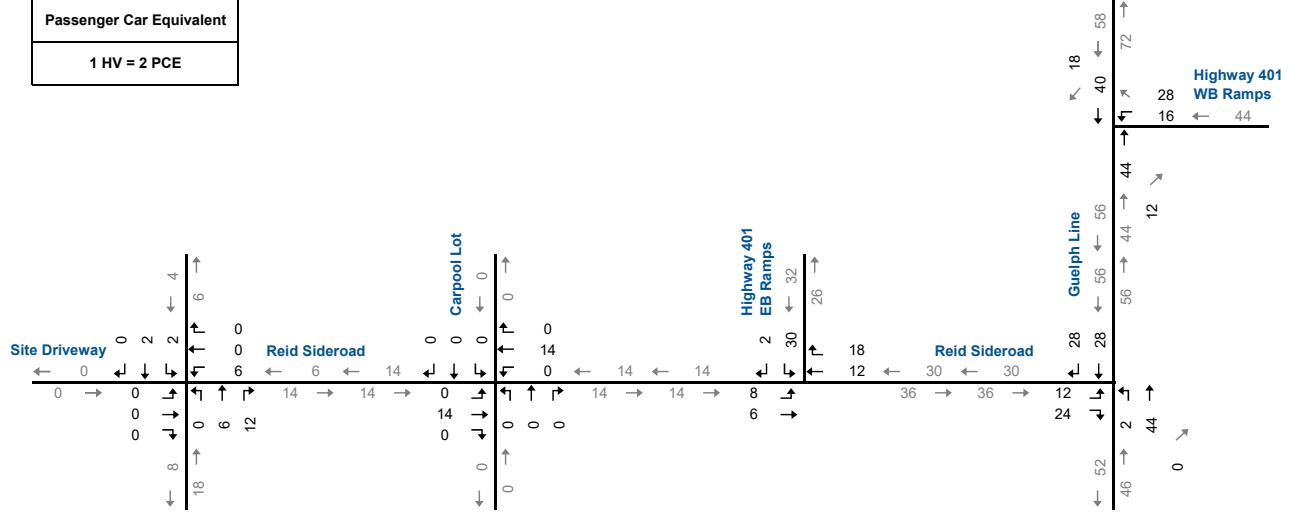
Background Traffic Forecast - Five-Year Horizon AM Peak Hour

Total Count Volume



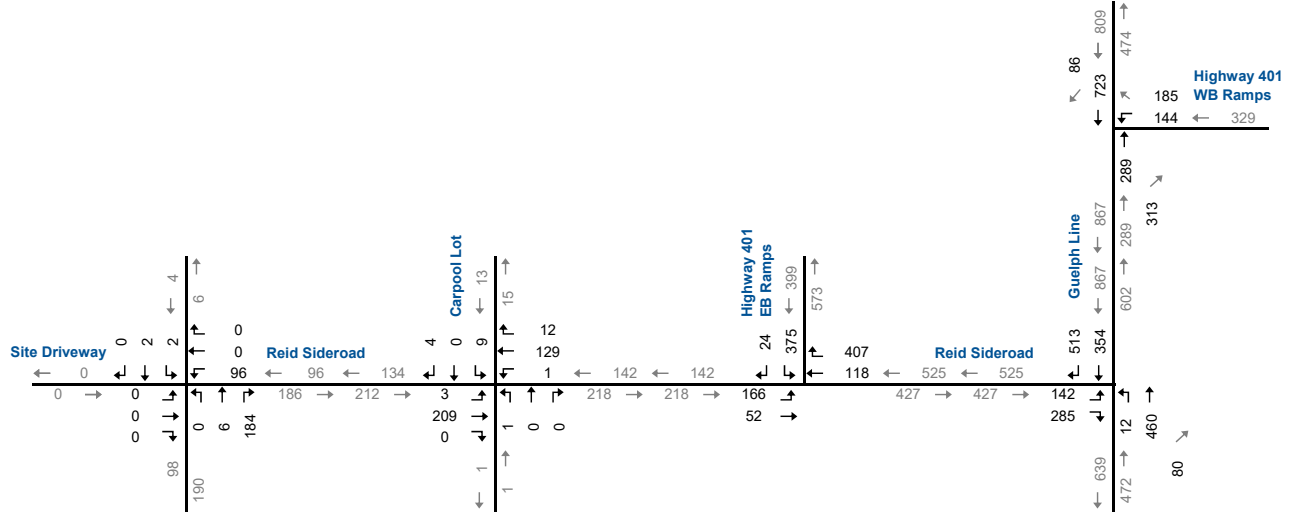
Passenger Car Equivalent (PCE) Units

Passenger Car Equivalent  
1 HV = 2 PCE



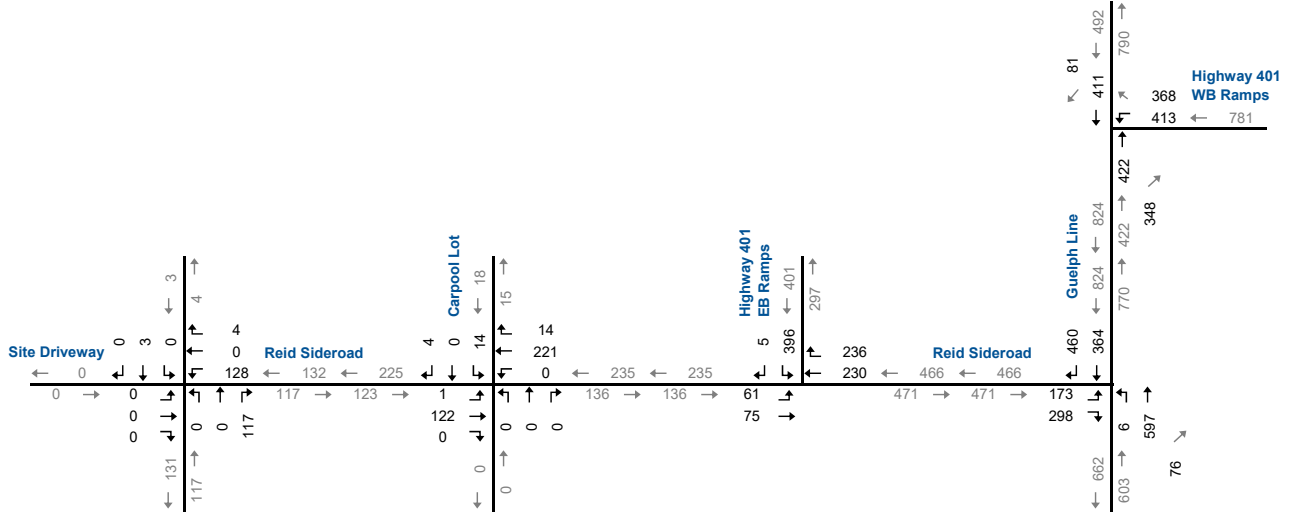
**Background Traffic Forecast - Five-Year Horizon AM Peak Hour**

Total Passenger Car Volume

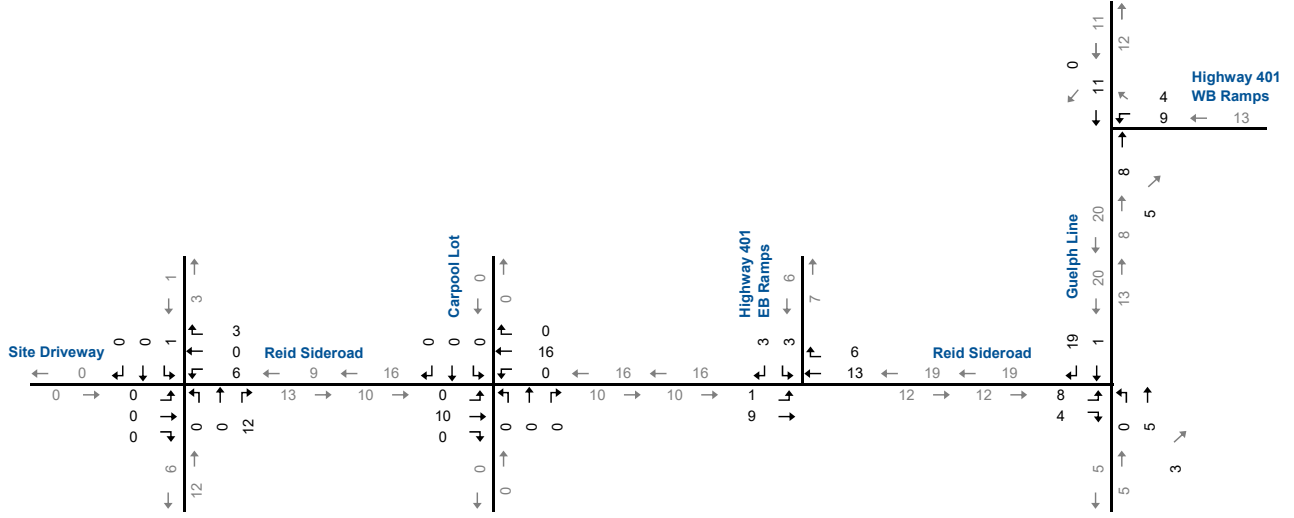


Background Traffic Forecast - Five-Year Horizon PM Peak Hour

Passenger Cars

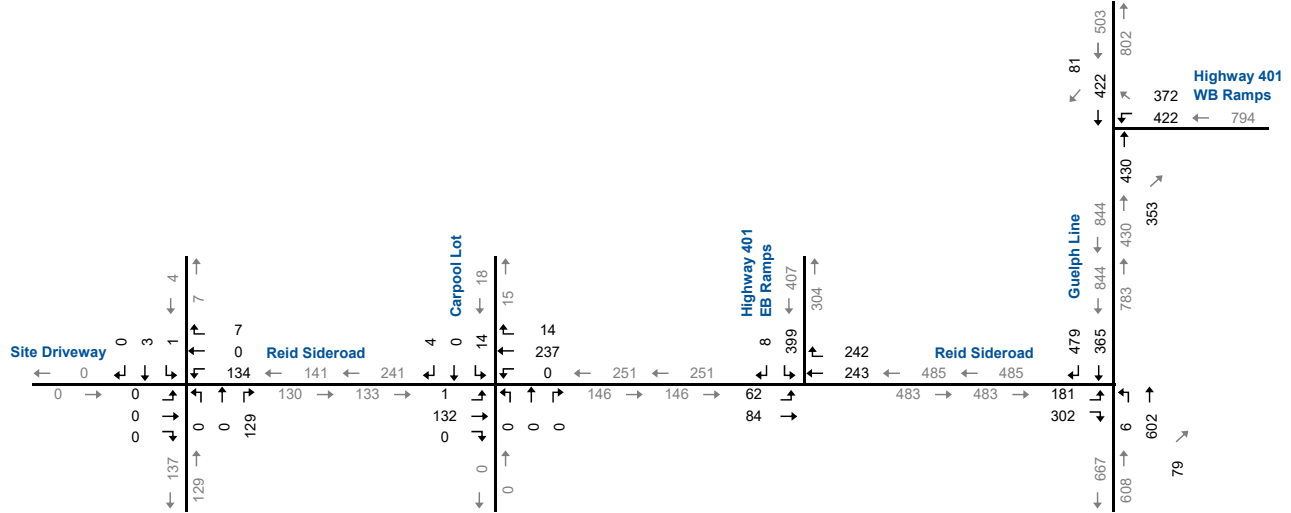


Heavy Vehicles



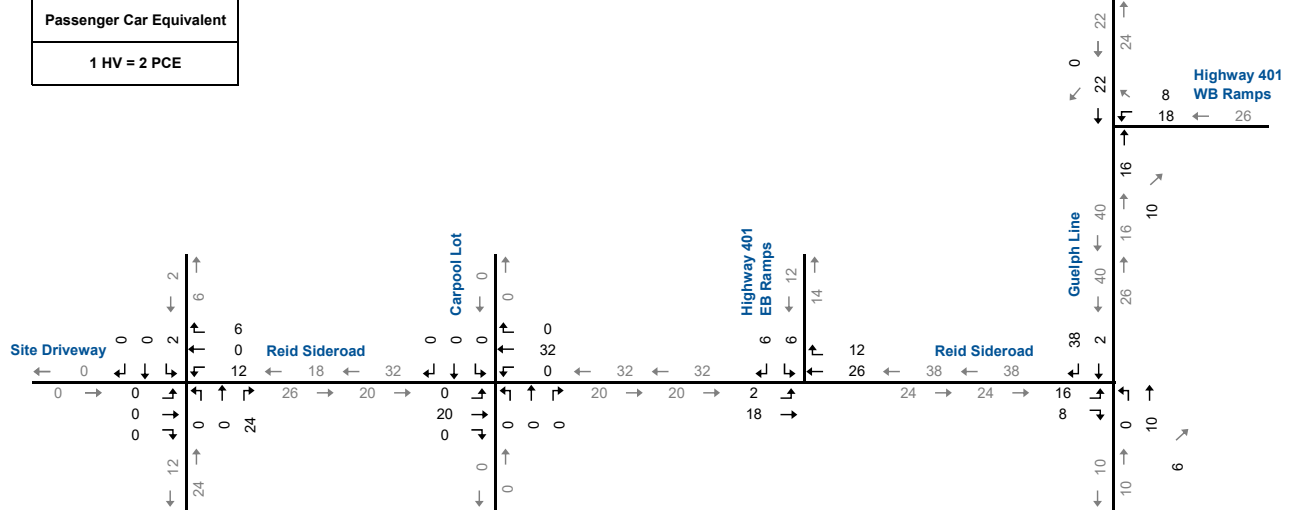
**Background Traffic Forecast - Five-Year Horizon PM Peak Hour**

**Total Count Volume**



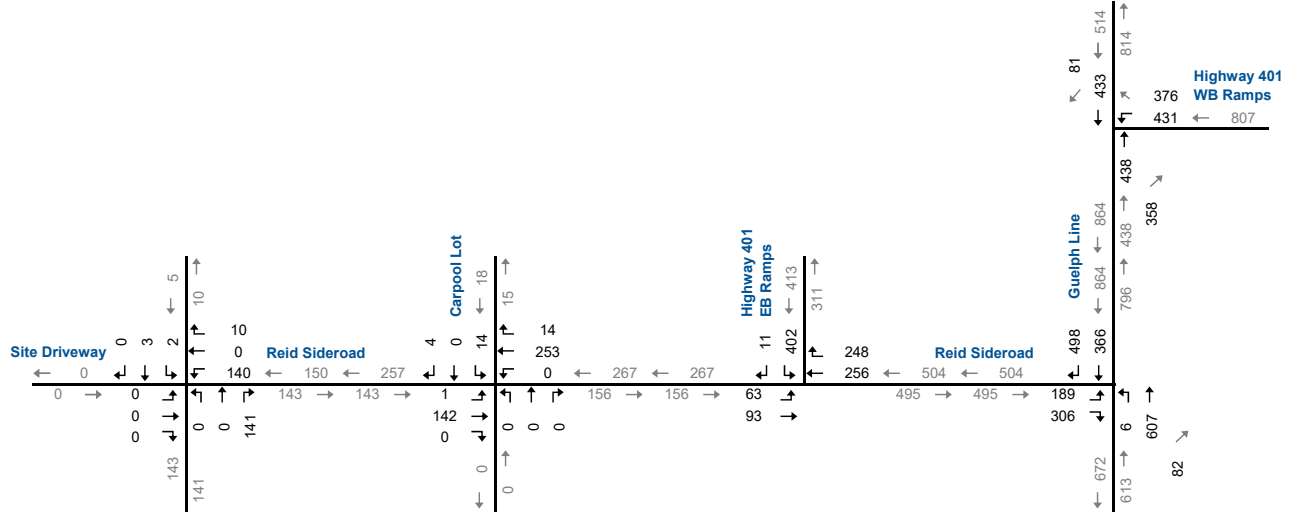
**Passenger Car Equivalent (PCE) Units**

Passenger Car Equivalent  
1 HV = 2 PCE



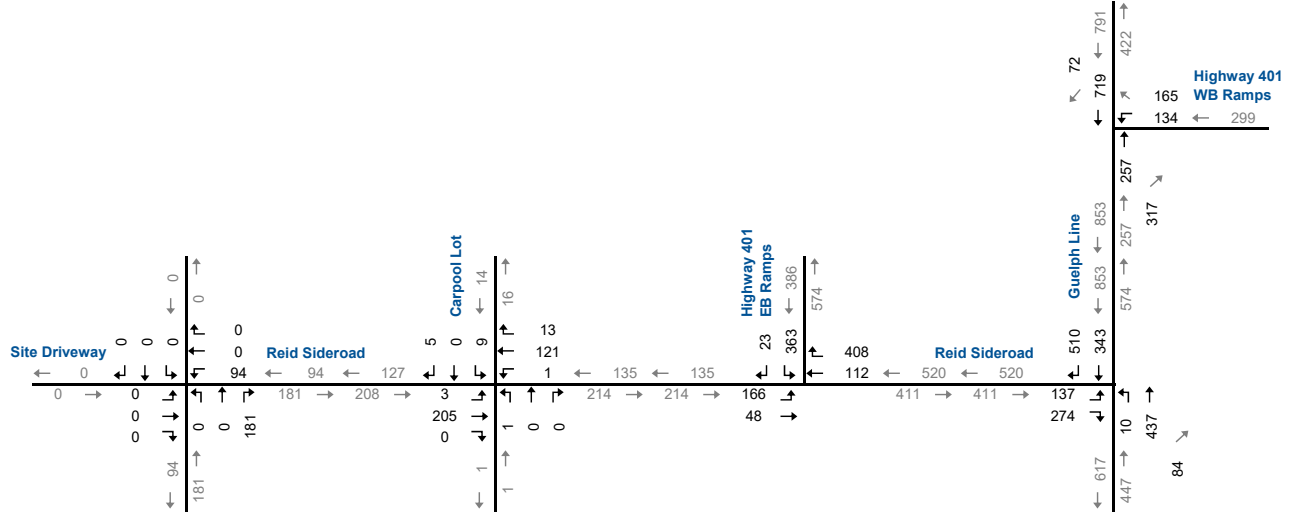
**Background Traffic Forecast - Five-Year Horizon PM Peak Hour**

Total Passenger Car Volume

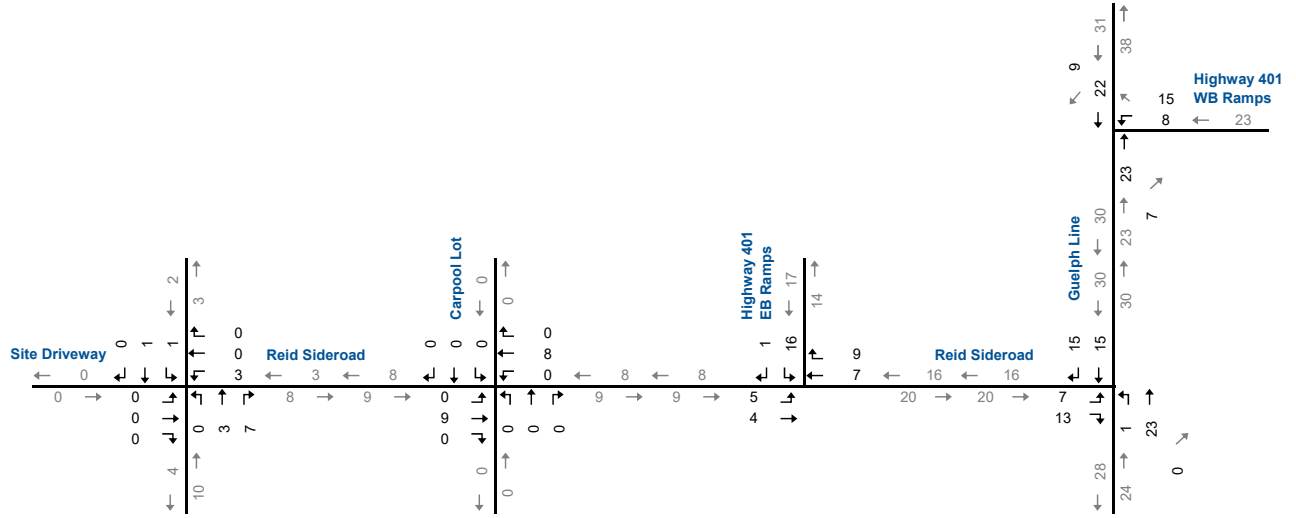


**Background Traffic Forecast - Ten-Year Horizon AM Peak Hour**

**Passenger Cars**



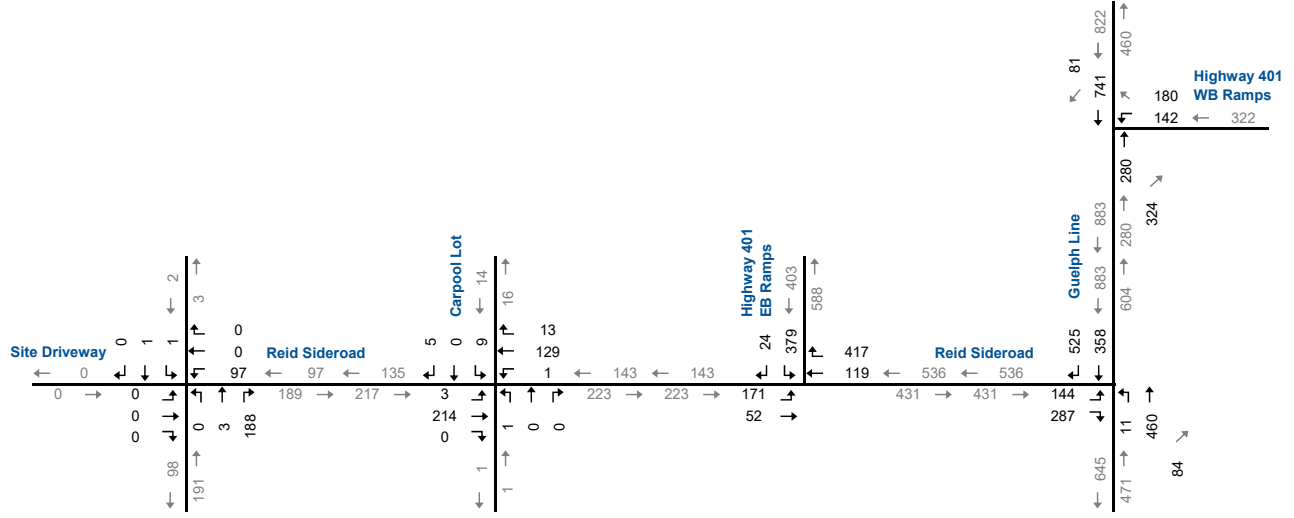
**Heavy Vehicles**





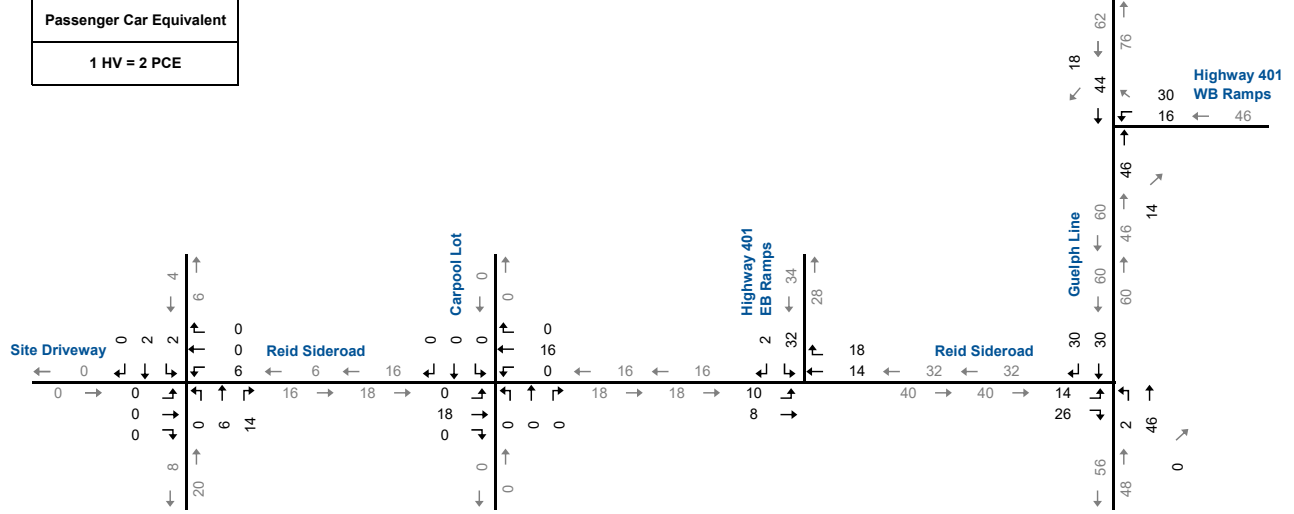
**Background Traffic Forecast - Ten-Year Horizon AM Peak Hour**

**Total Count Volume**



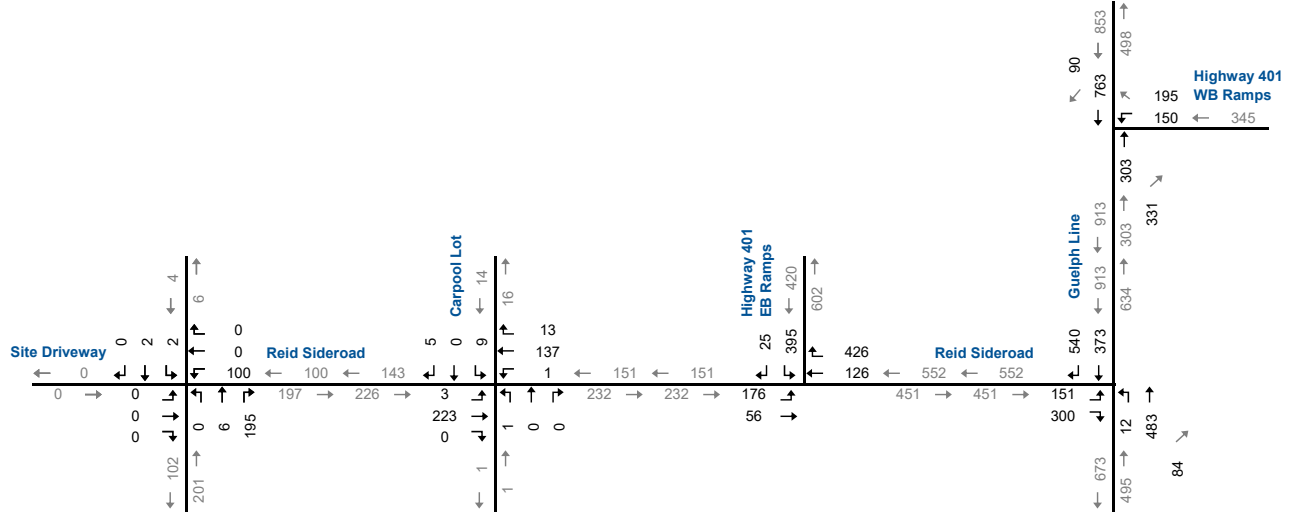
**Passenger Car Equivalent (PCE) Units**

Passenger Car Equivalent  
1 HV = 2 PCE



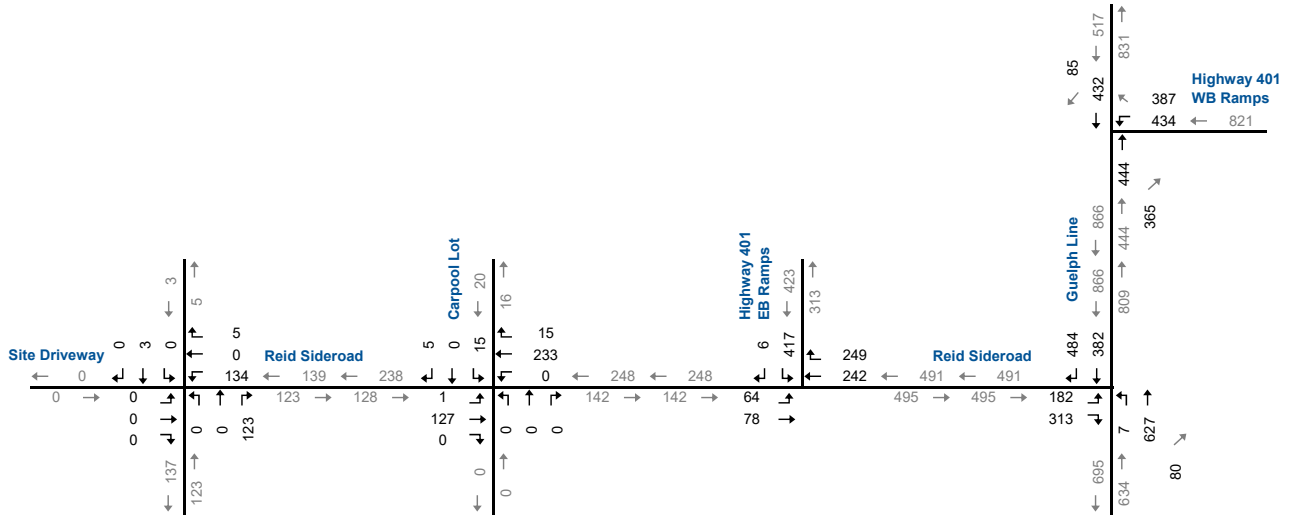
**Background Traffic Forecast - Ten-Year Horizon AM Peak Hour**

Total Passenger Car Volume

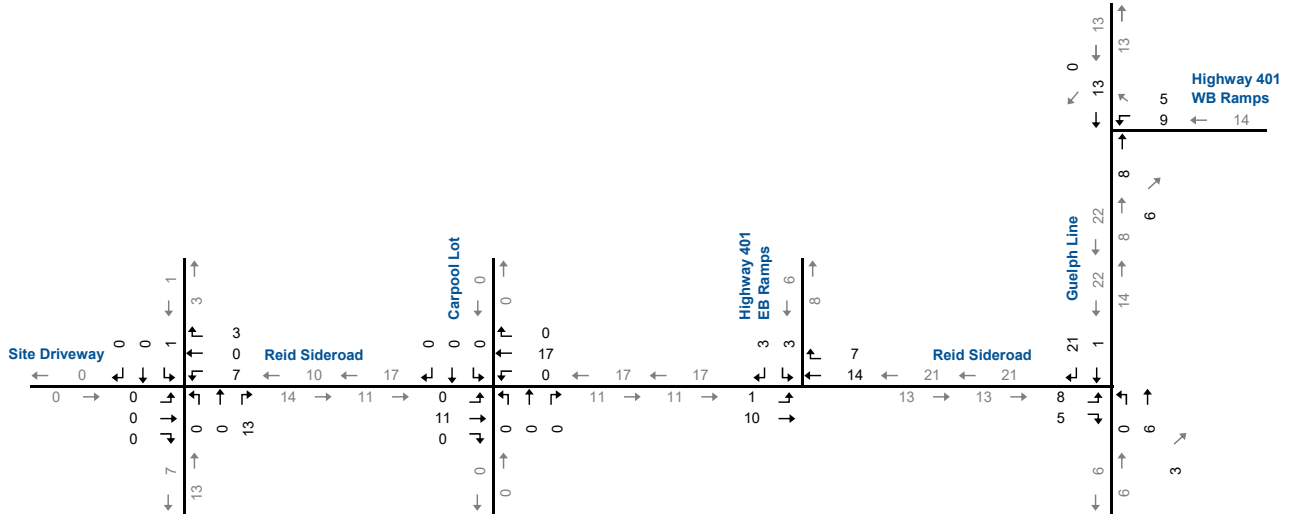


**Background Traffic Forecast - Ten-Year Horizon PM Peak Hour**

**Passenger Cars**

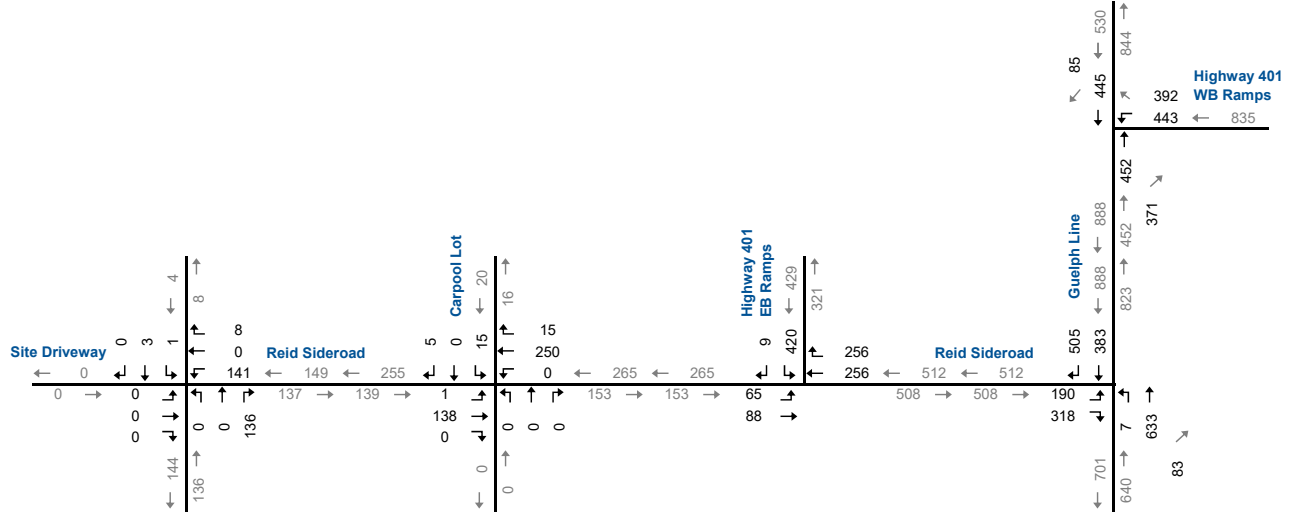


**Heavy Vehicles**



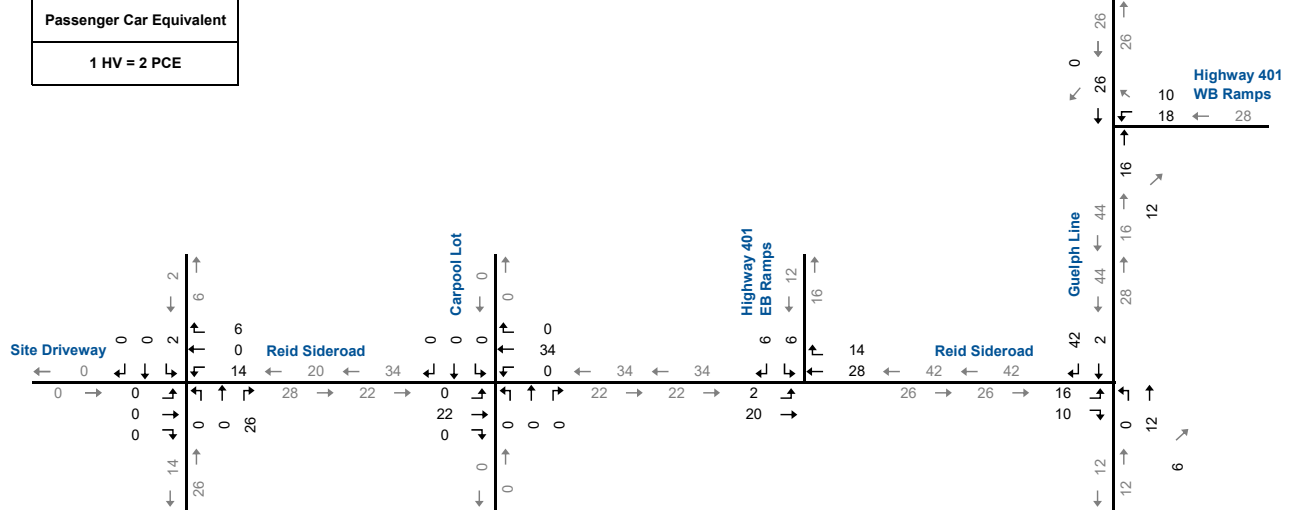
**Background Traffic Forecast - Ten-Year Horizon PM Peak Hour**

**Total Count Volume**



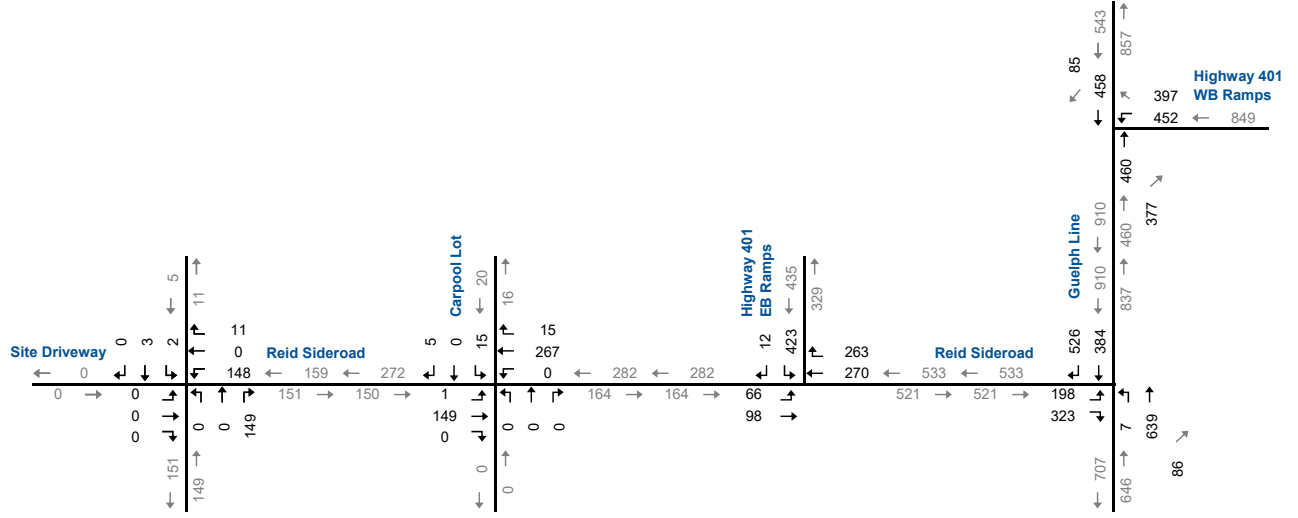
**Passenger Car Equivalent (PCE) Units**

Passenger Car Equivalent  
1 HV = 2 PCE



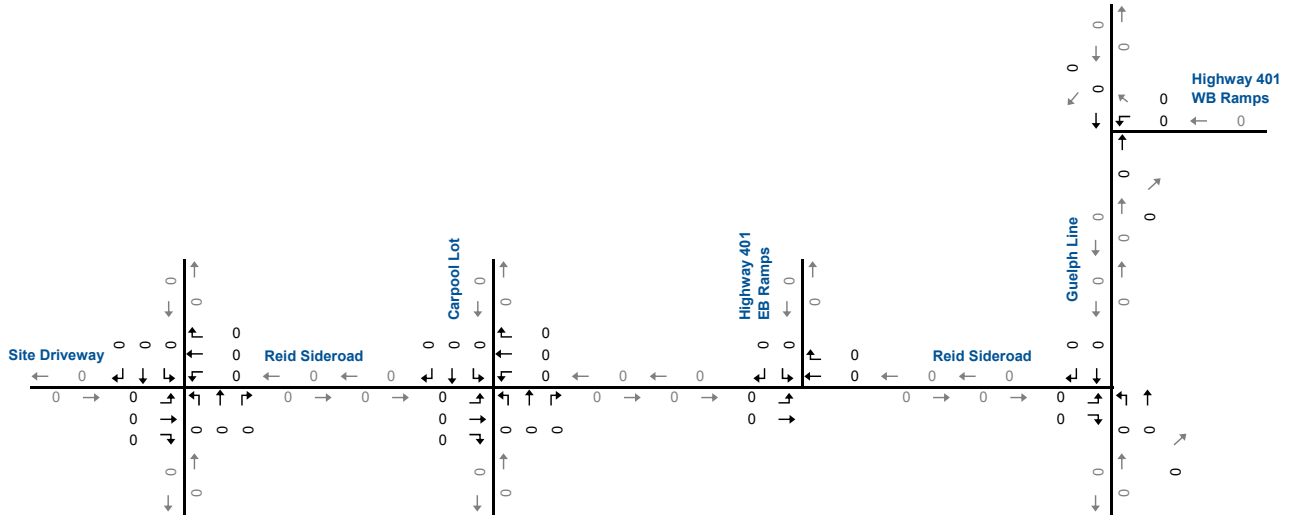
**Background Traffic Forecast - Ten-Year Horizon PM Peak Hour**

Total Passenger Car Volume

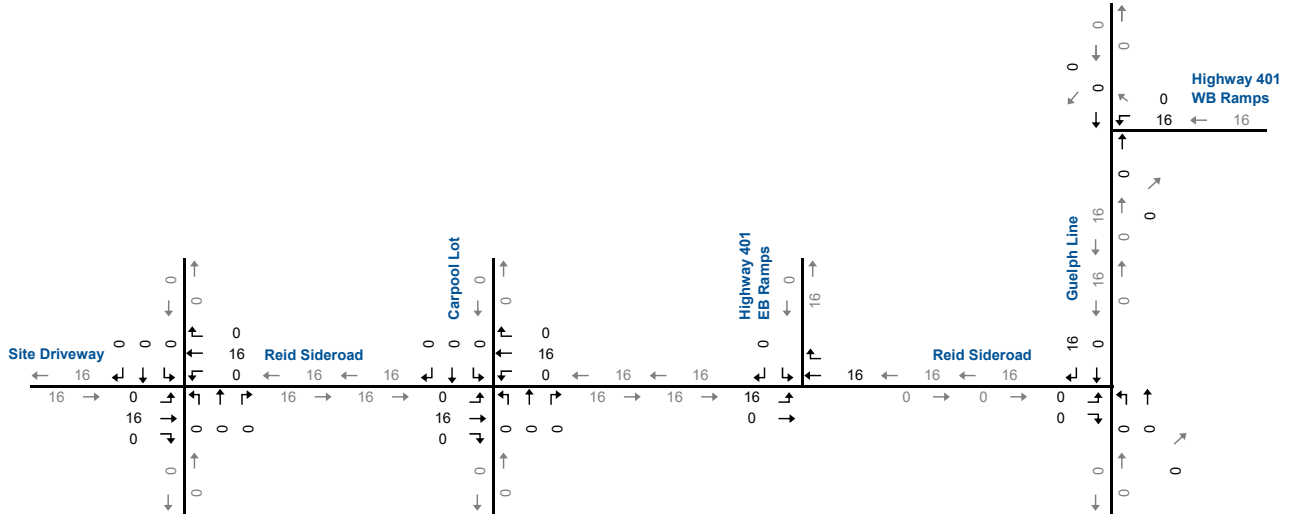


Site Generated Traffic - AM Peak Hour

Passenger Cars

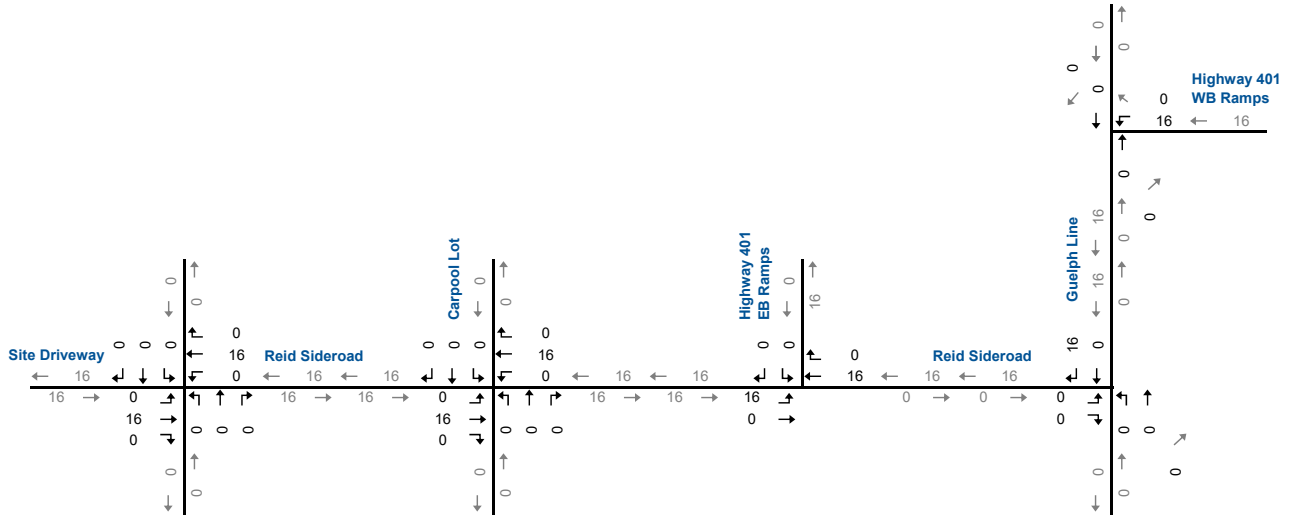


Heavy Vehicles



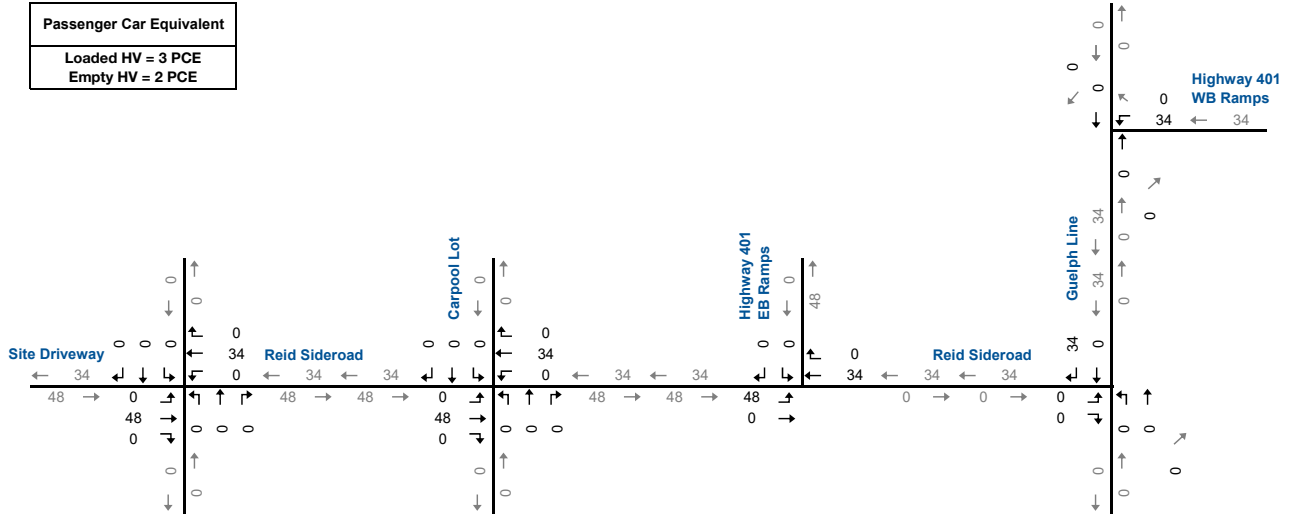
Site Generated Traffic - AM Peak Hour

Total Count Volume



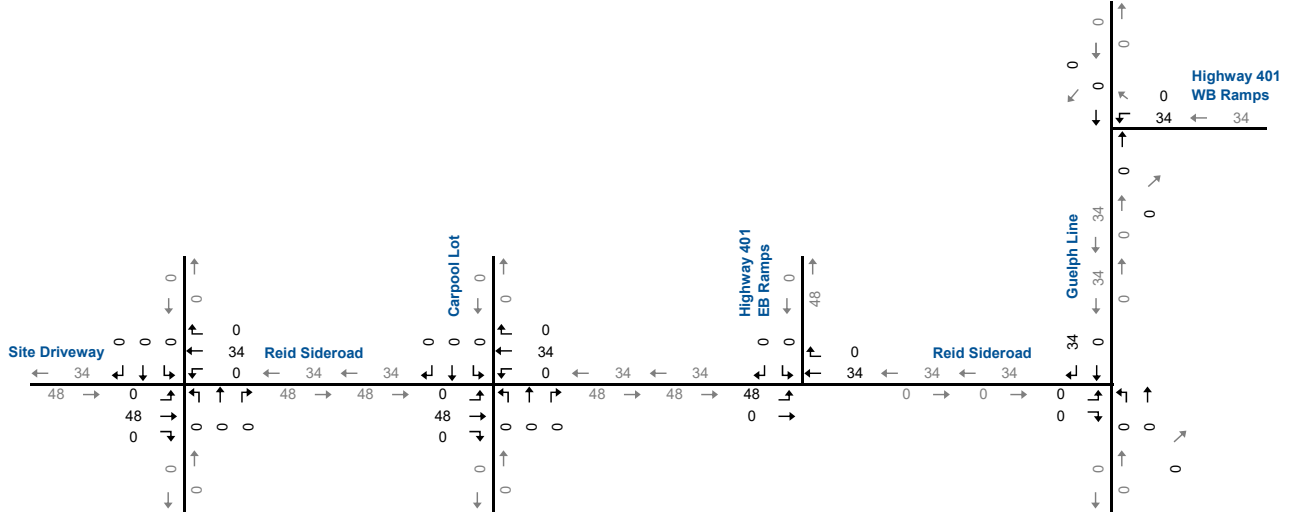
Passenger Car Equivalent
Loaded HV = 3 PCE
Empty HV = 2 PCE

Passenger Car Equivalent (PCE) Units



Site Generated Traffic - AM Peak Hour

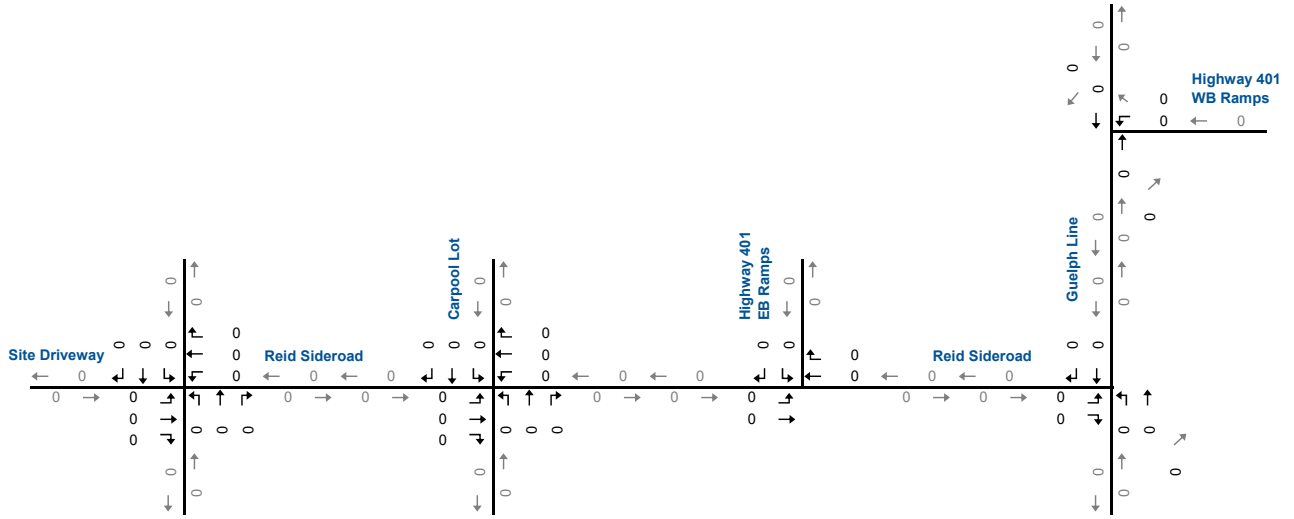
Total Passenger Car Volume



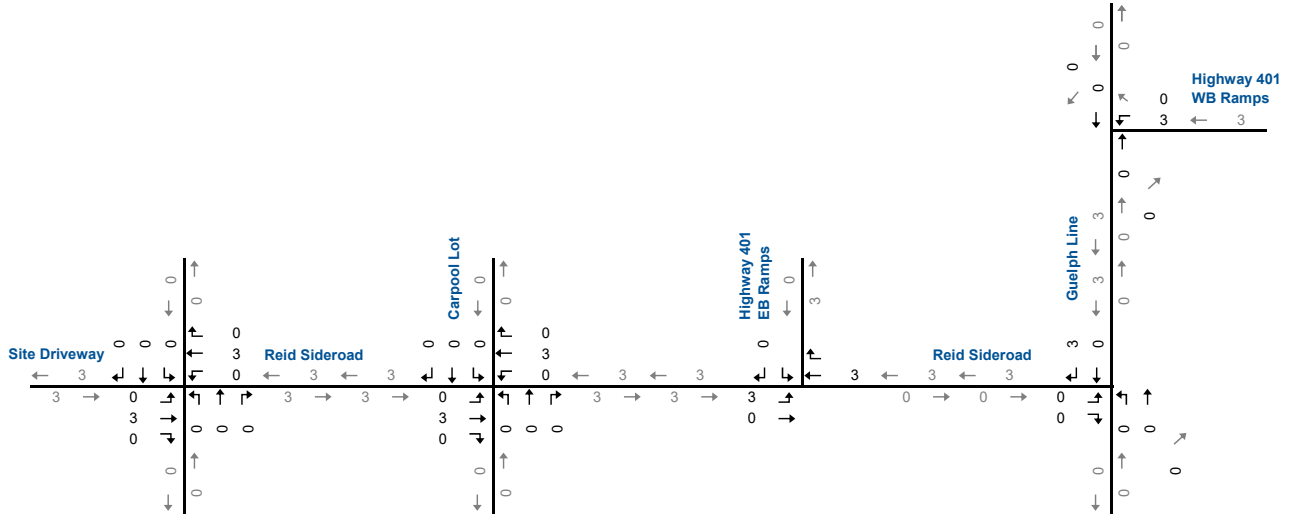


Site Generated Traffic - PM Peak Hour

Passenger Cars

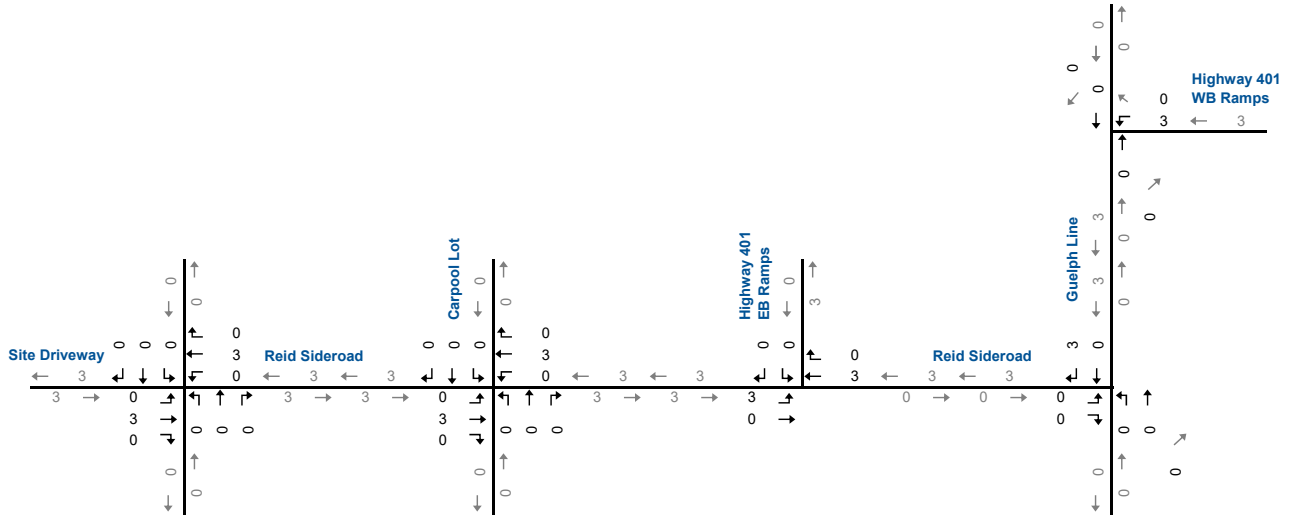


Heavy Vehicles



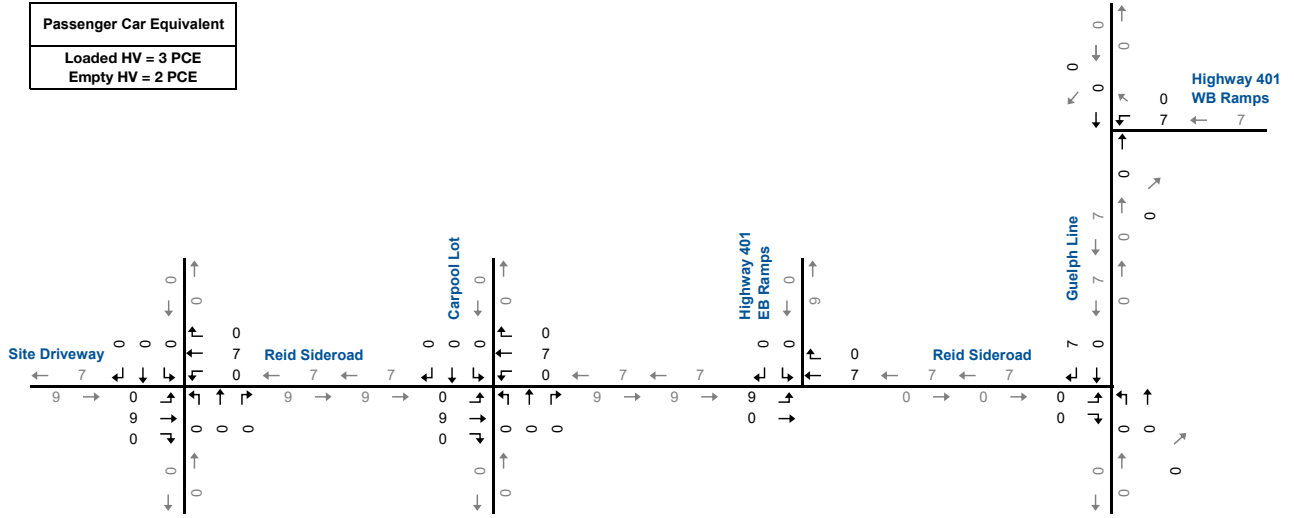
Site Generated Traffic - PM Peak Hour

Total Count Volume



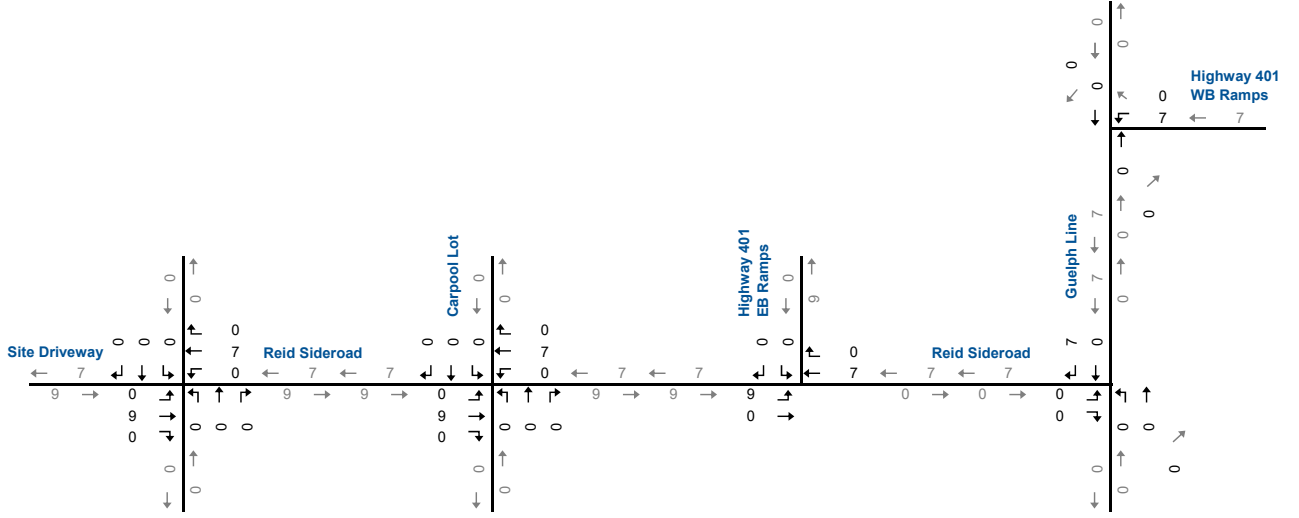
Passenger Car Equivalent
Laded HV = 3 PCE
Empty HV = 2 PCE

Passenger Car Equivalent (PCE) Units



Site Generated Traffic - PM Peak Hour

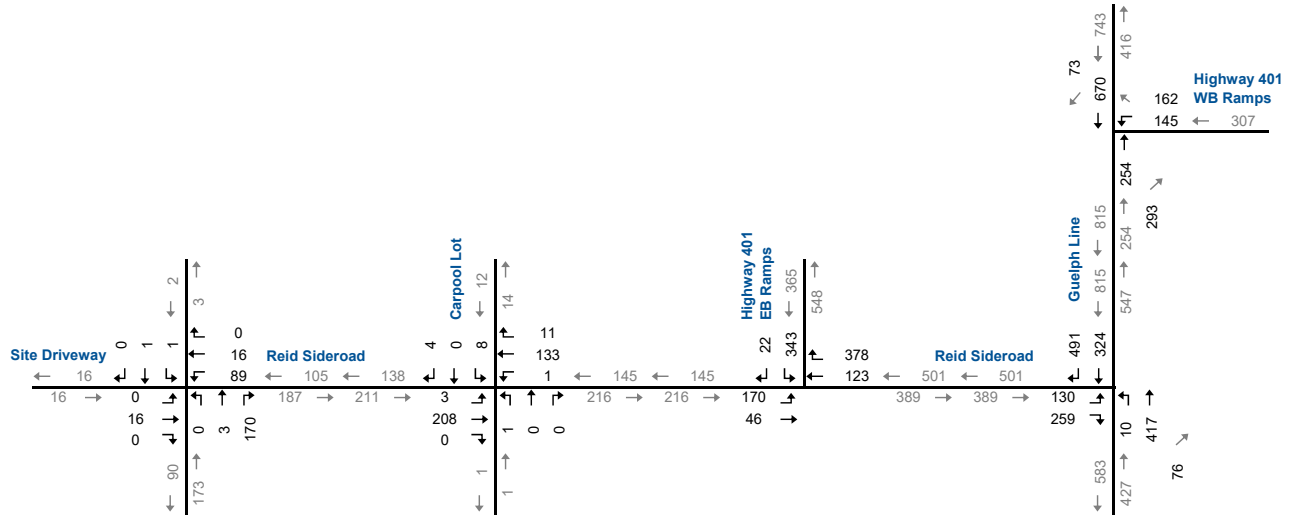
Total Passenger Car Volume





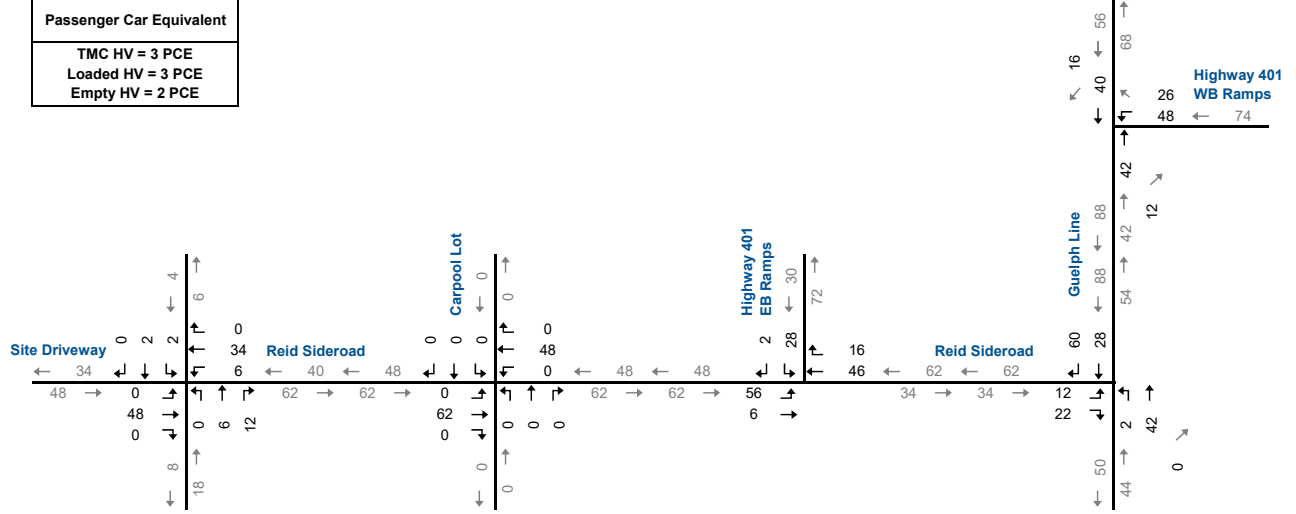
**Total Traffic Forecast - Opening Date Horizon AM Peak Hour**

Total Count Volume



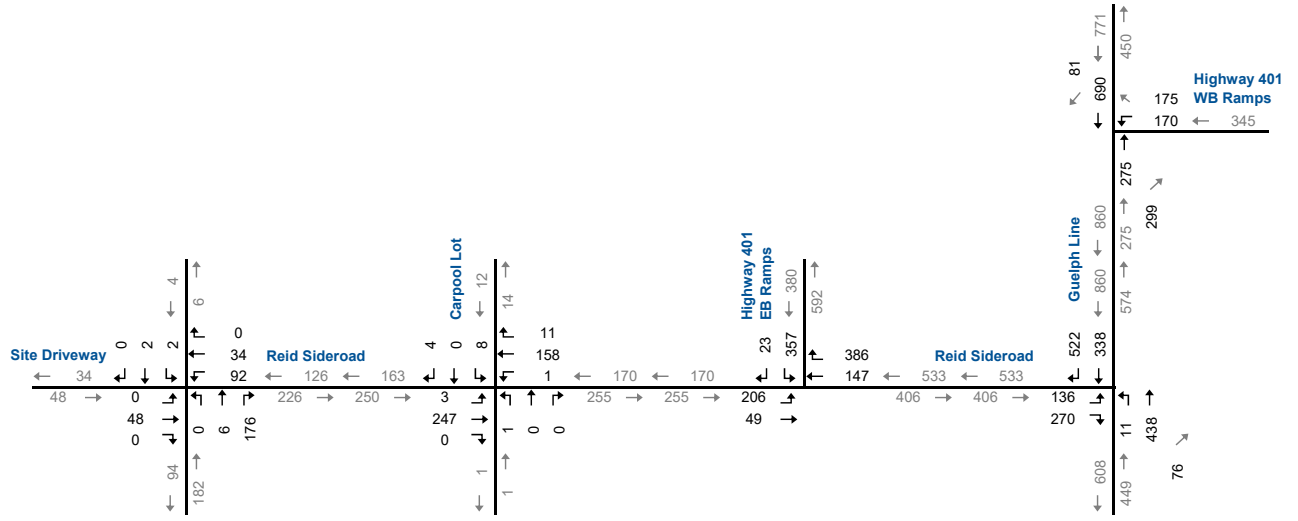
Passenger Car Equivalent (PCE) Units

Passenger Car Equivalent	
TMC HV	= 3 PCE
Loaded HV	= 3 PCE
Empty HV	= 2 PCE



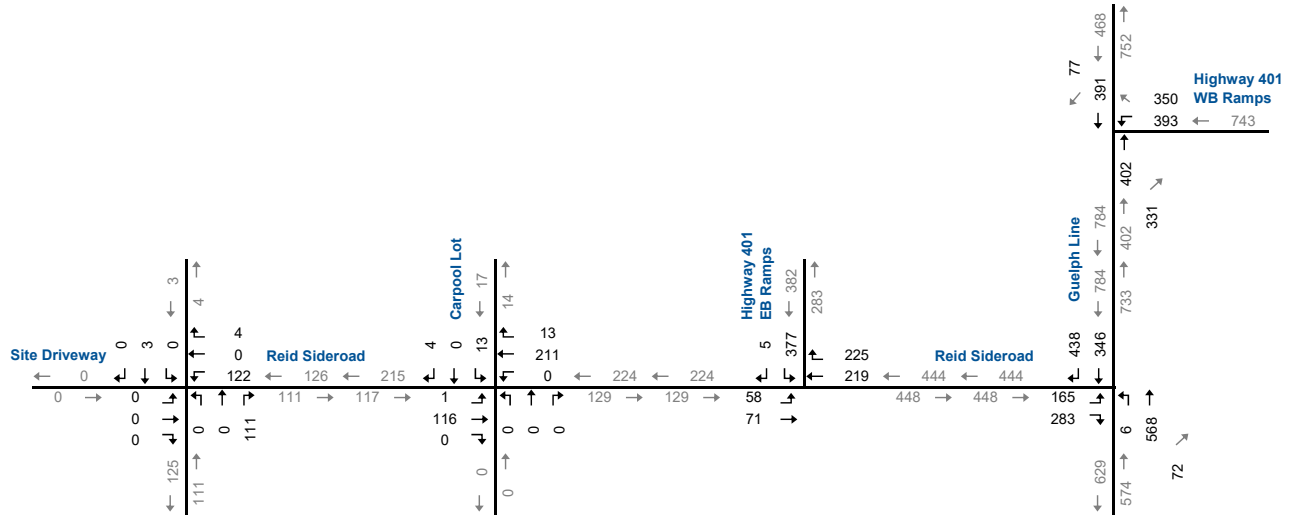
**Total Traffic Forecast - Opening Date Horizon AM Peak Hour**

Total Passenger Car Volume

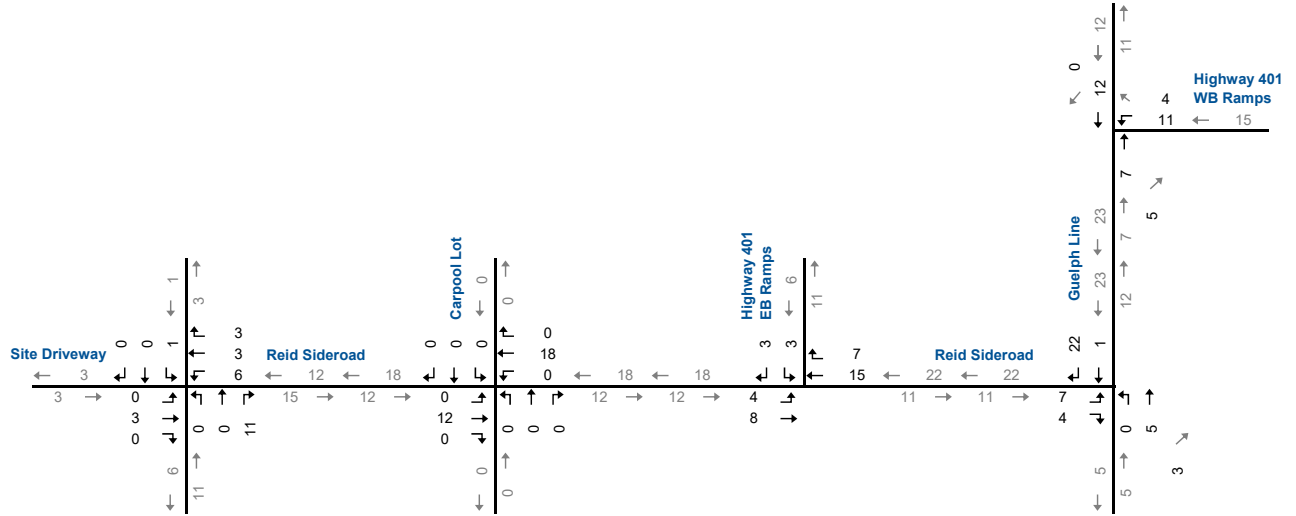


**Total Traffic Forecast - Opening Date Horizon PM Peak Hour**

**Passenger Cars**

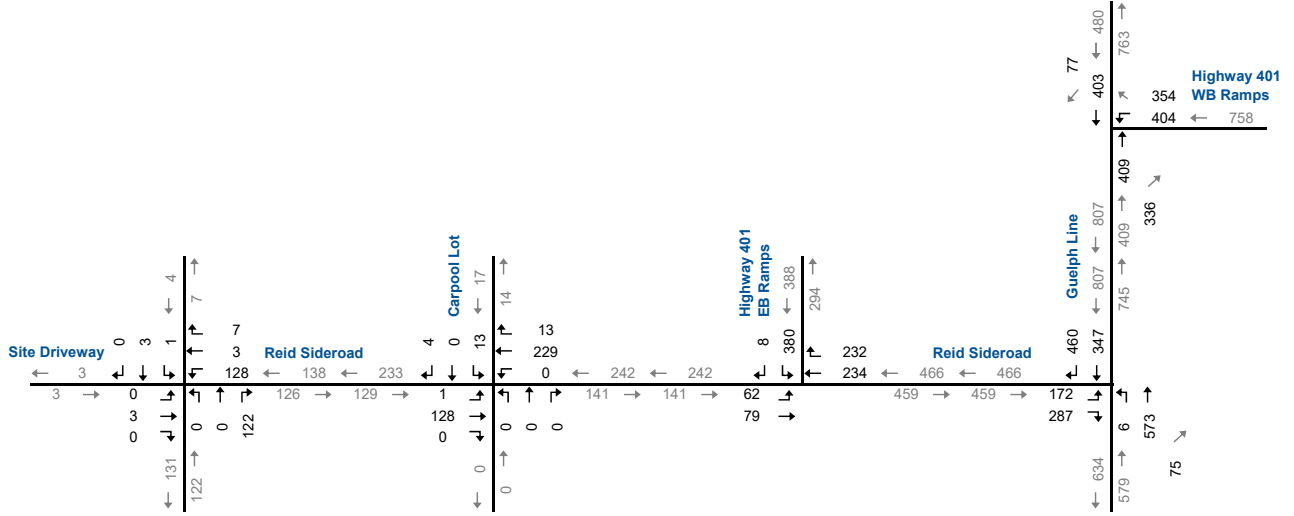


**Heavy Vehicles**



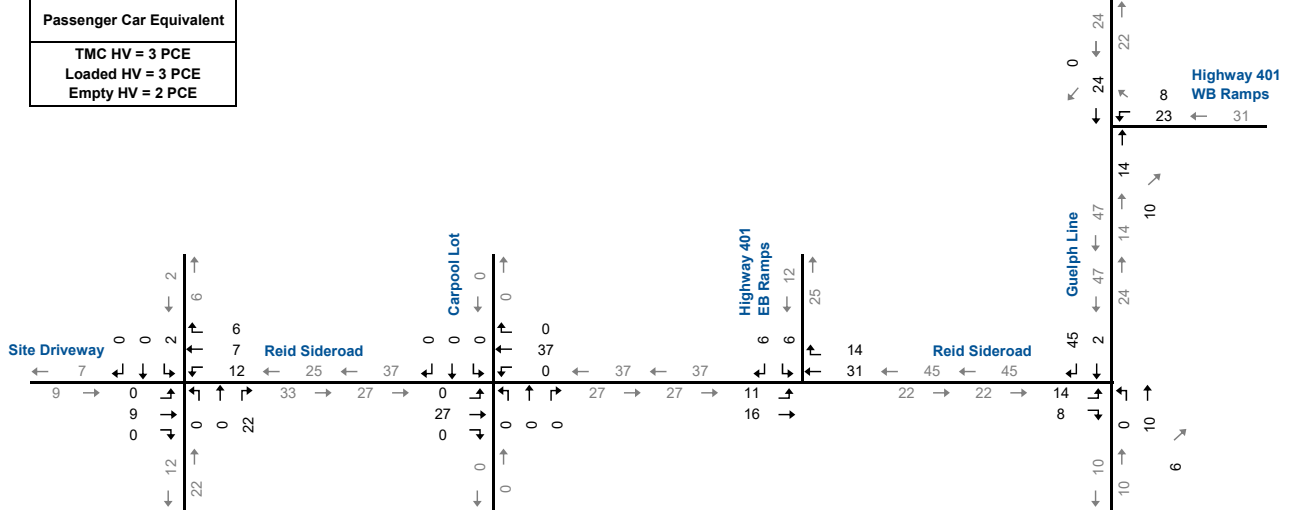
**Total Traffic Forecast - Opening Date Horizon PM Peak Hour**

**Total Count Volume**



**Passenger Car Equivalent (PCE) Units**

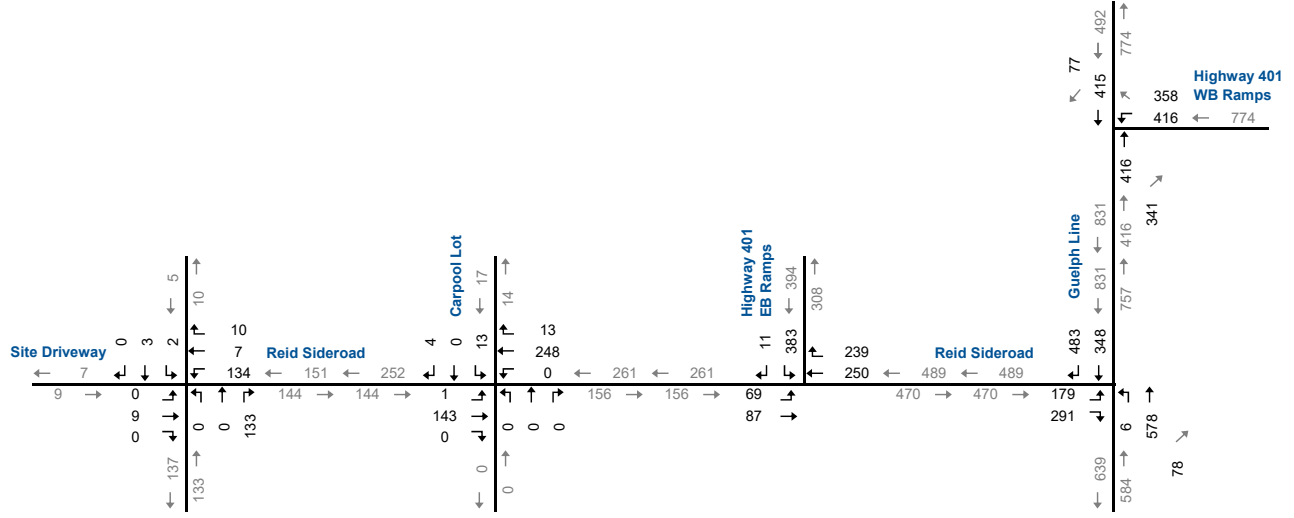
Passenger Car Equivalent	
TMC HV	= 3 PCE
Loaded HV	= 3 PCE
Empty HV	= 2 PCE





**Total Traffic Forecast - Opening Date Horizon PM Peak Hour**

Total Passenger Car Volume

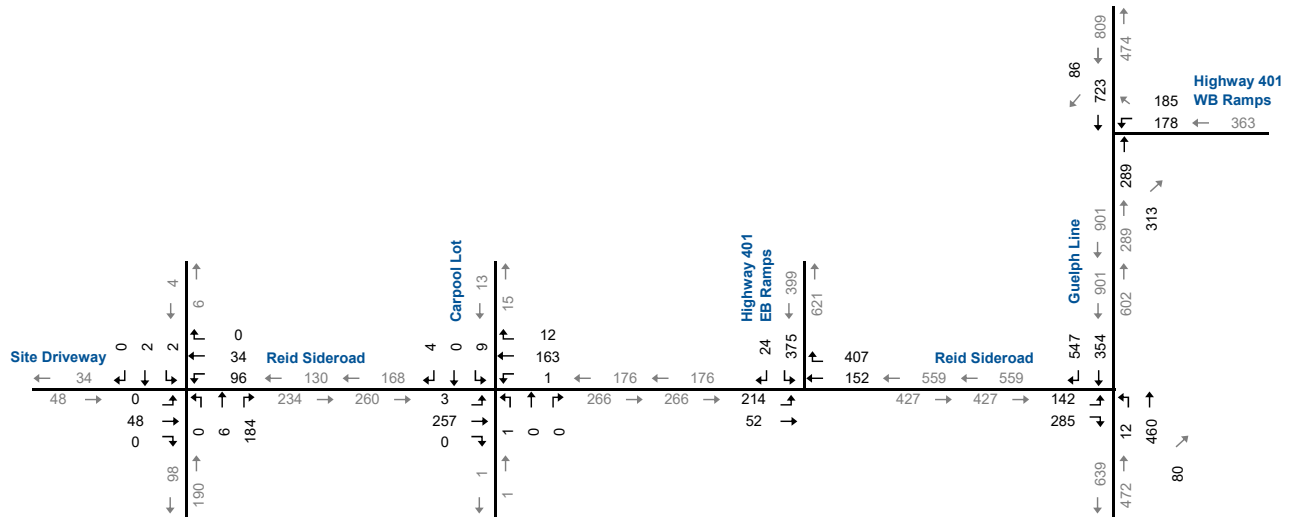






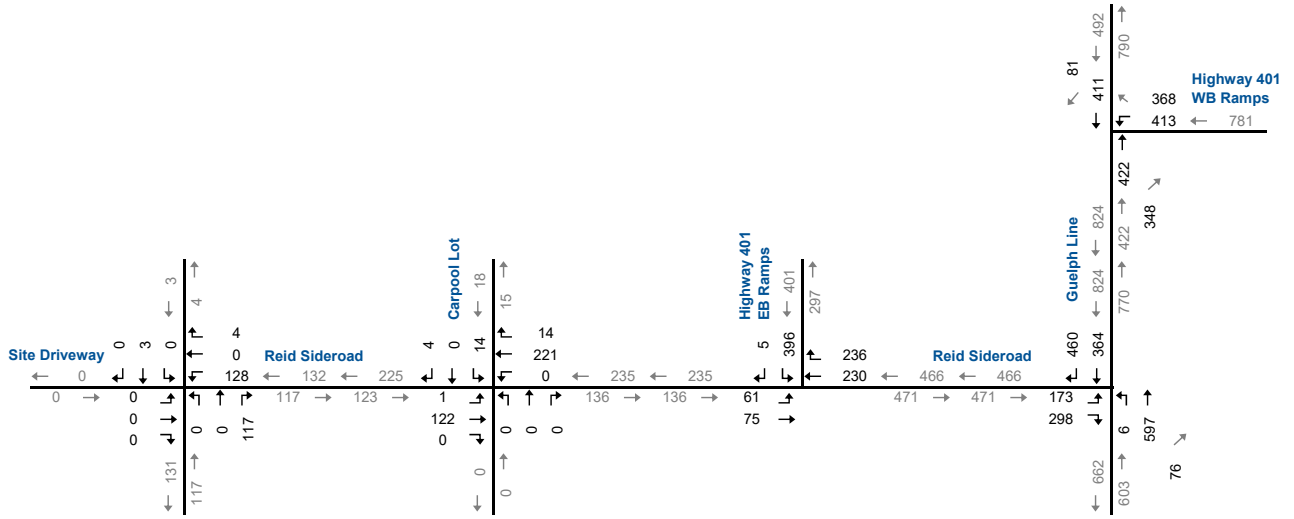
**Total Traffic Forecast - Five-Year Horizon AM Peak Hour**

Total Passenger Car Volume

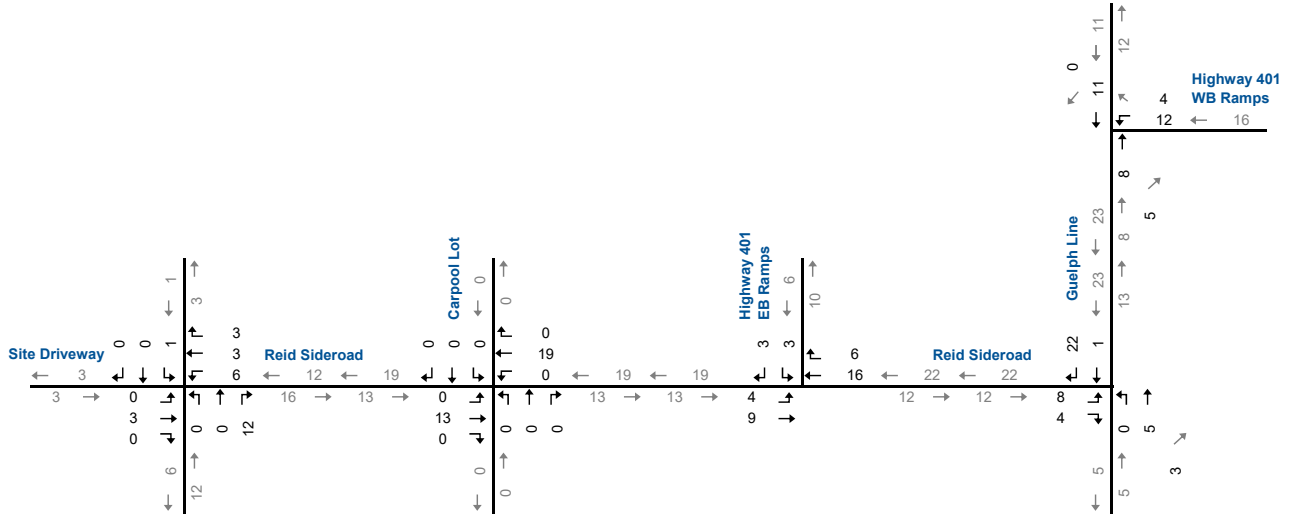


**Total Traffic Forecast - Five-Year Horizon PM Peak Hour**

**Passenger Cars**

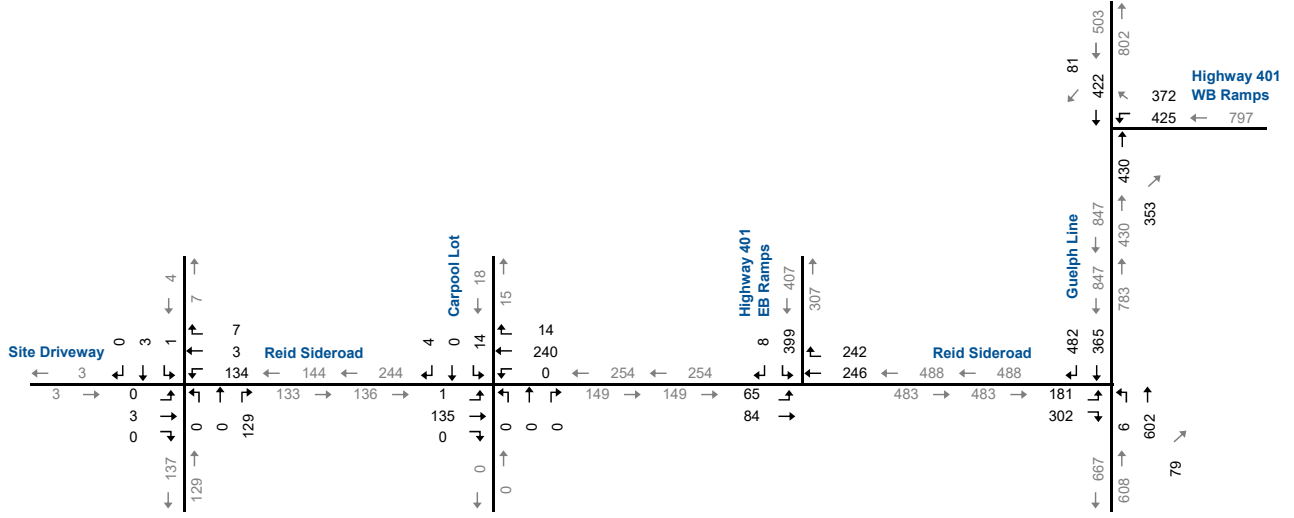


**Heavy Vehicles**



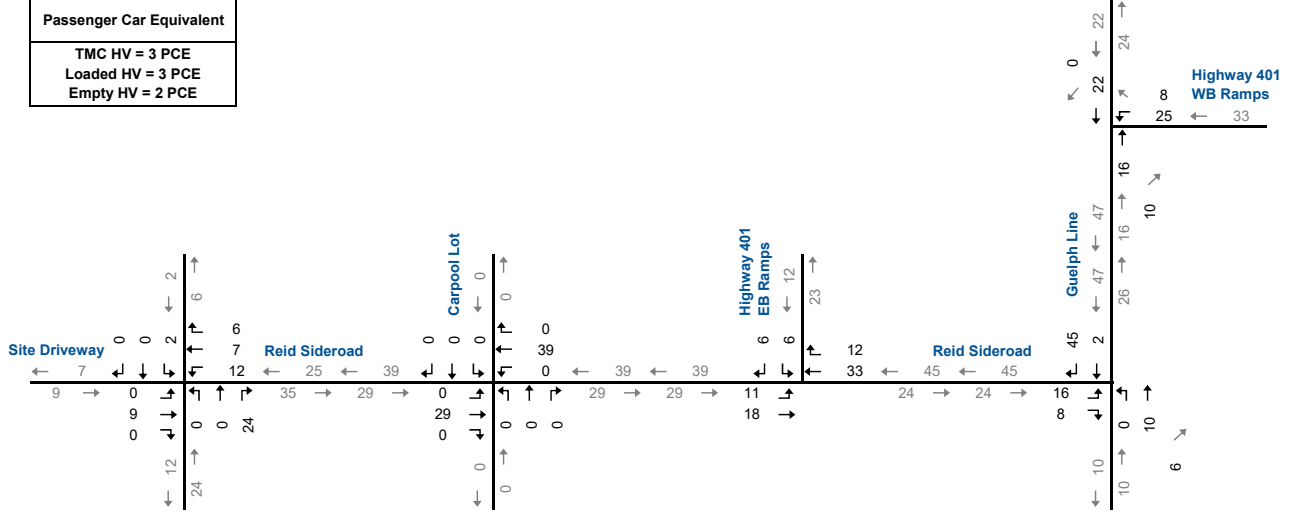
**Total Traffic Forecast - Five-Year Horizon PM Peak Hour**

**Total Count Volume**



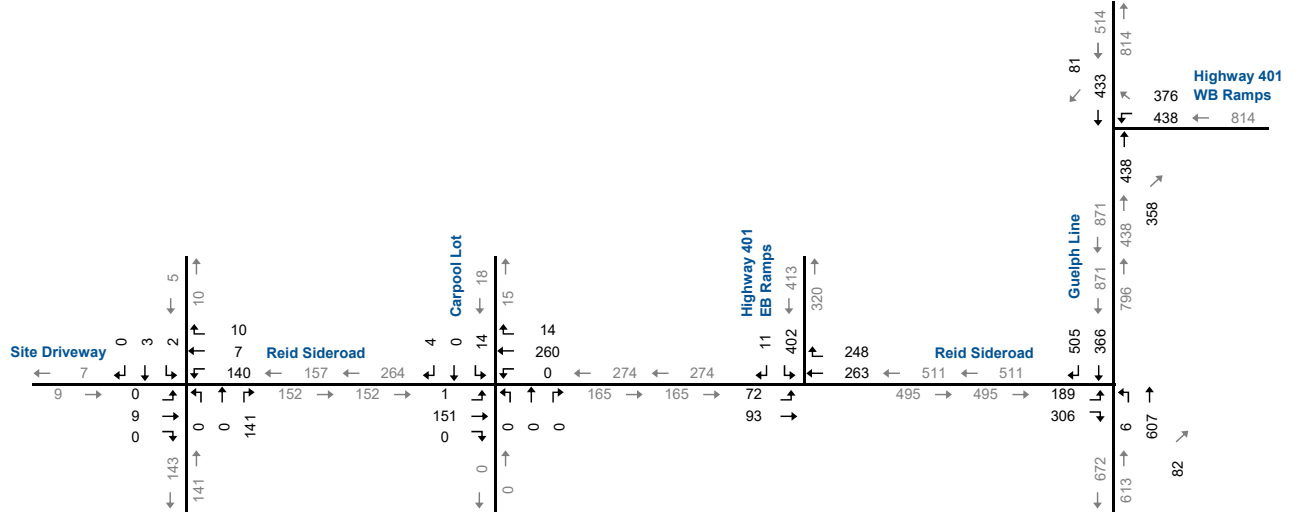
**Passenger Car Equivalent (PCE) Units**

Passenger Car Equivalent
TMC HV = 3 PCE
Loaded HV = 3 PCE
Empty HV = 2 PCE



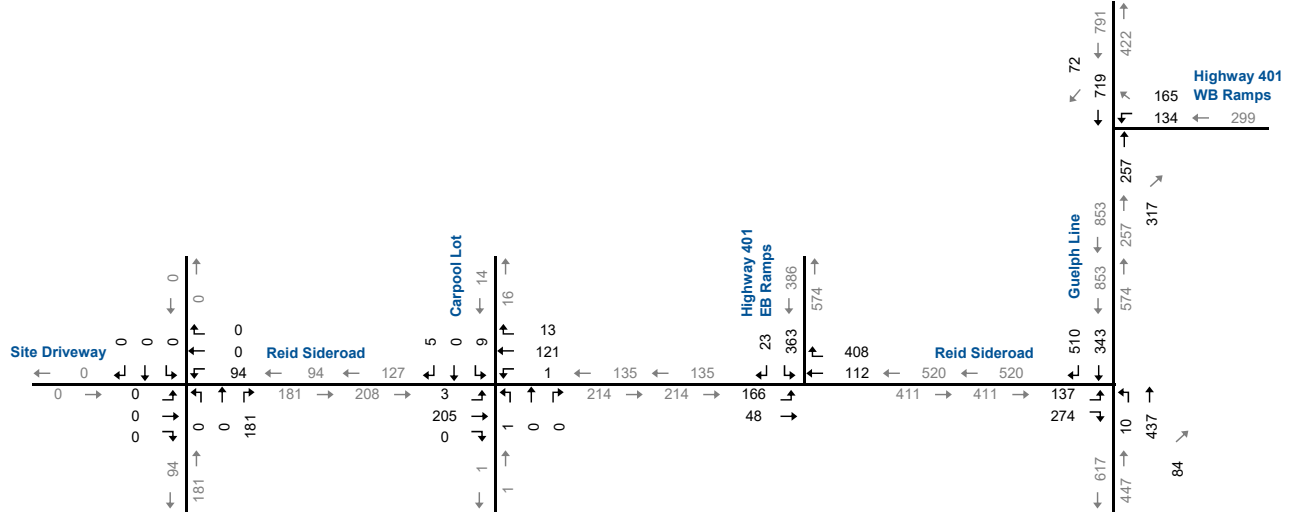
**Total Traffic Forecast - Five-Year Horizon PM Peak Hour**

Total Passenger Car Volume

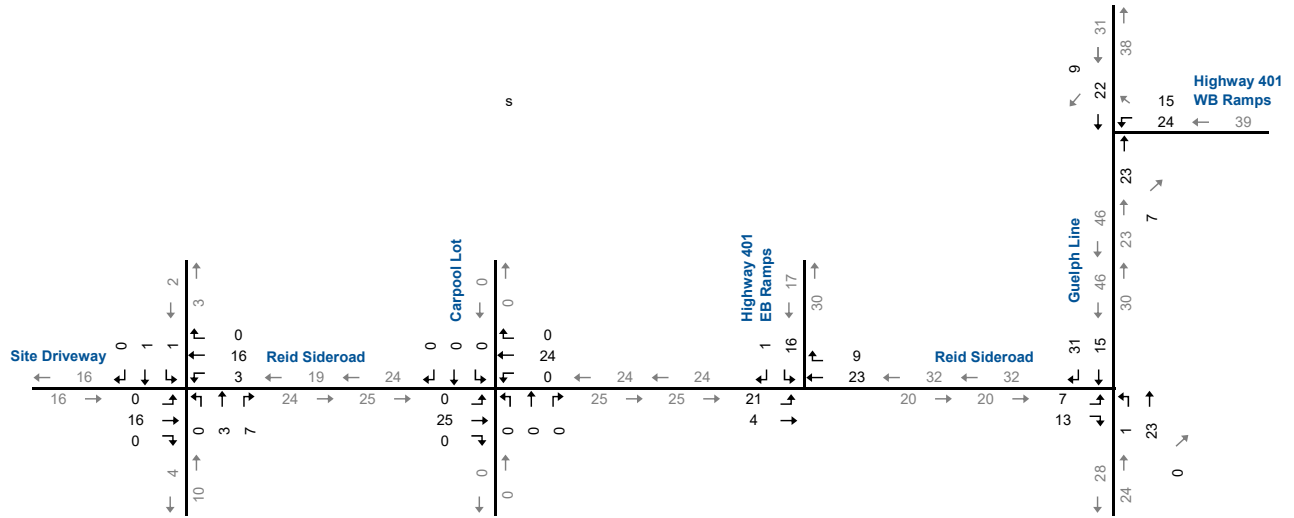


**Total Traffic Forecast - Ten-Year Horizon AM Peak Hour**

**Passenger Cars**



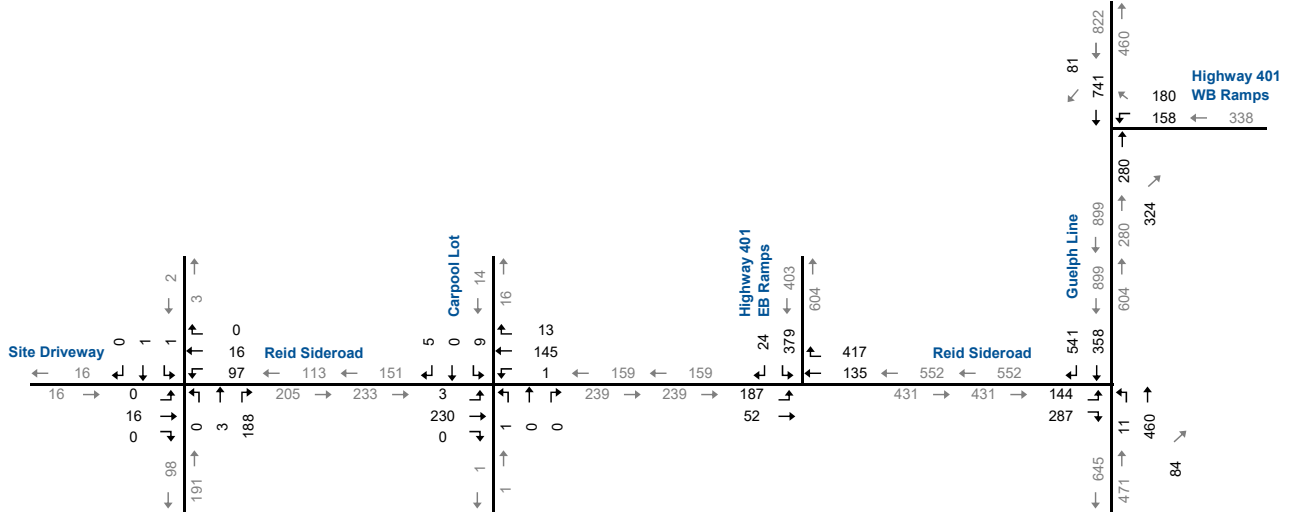
**Heavy Vehicles**





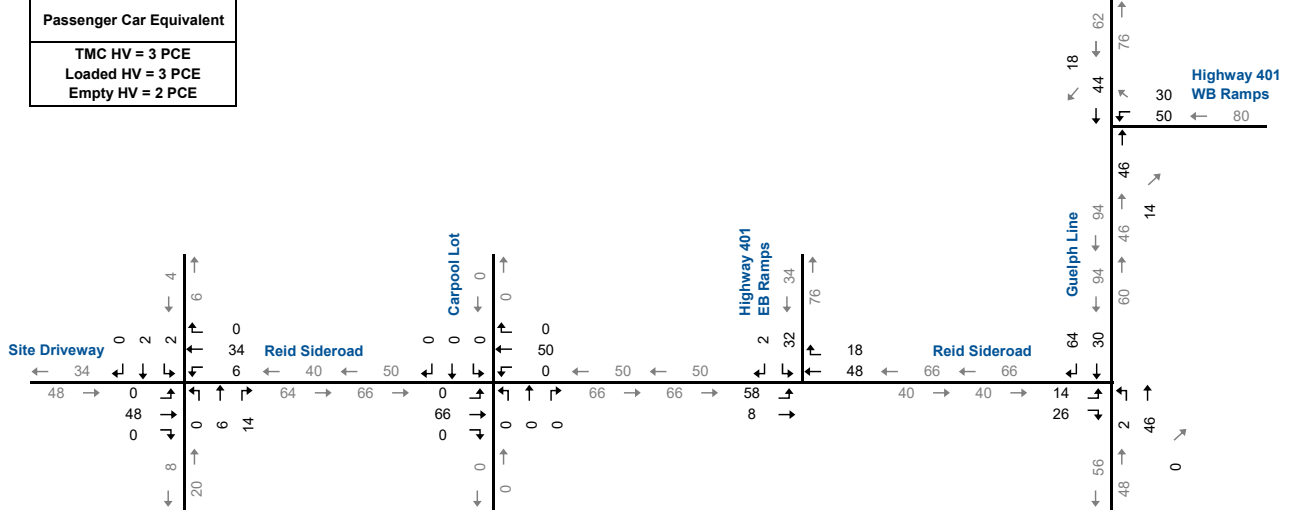
**Total Traffic Forecast - Ten-Year Horizon AM Peak Hour**

**Total Count Volume**



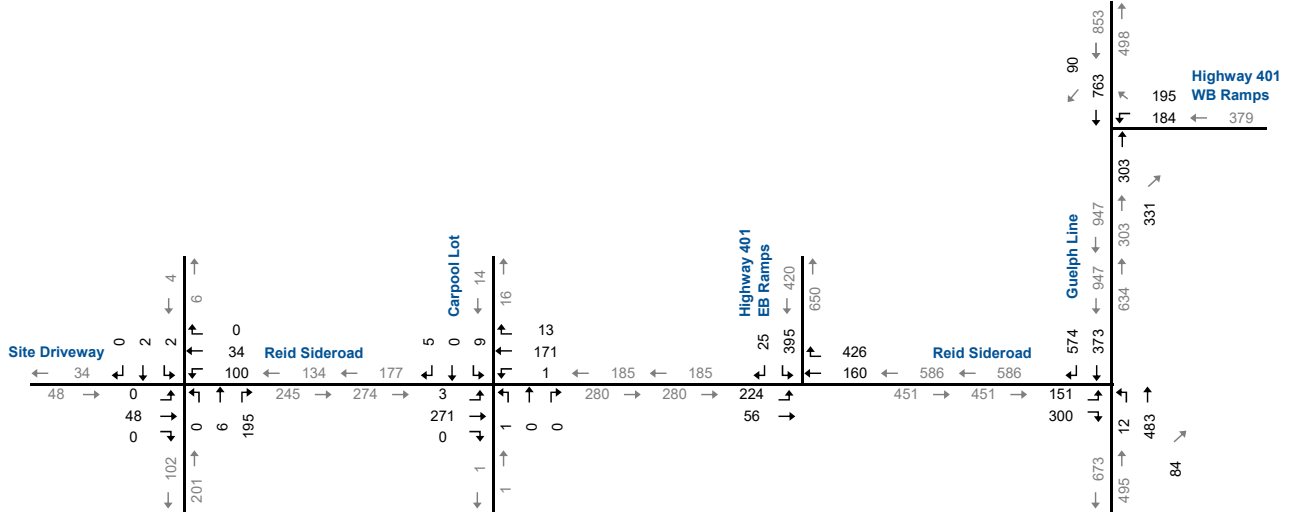
Passenger Car Equivalent
TMC HV = 3 PCE
Loaded HV = 3 PCE
Empty HV = 2 PCE

**Passenger Car Equivalent (PCE) Units**



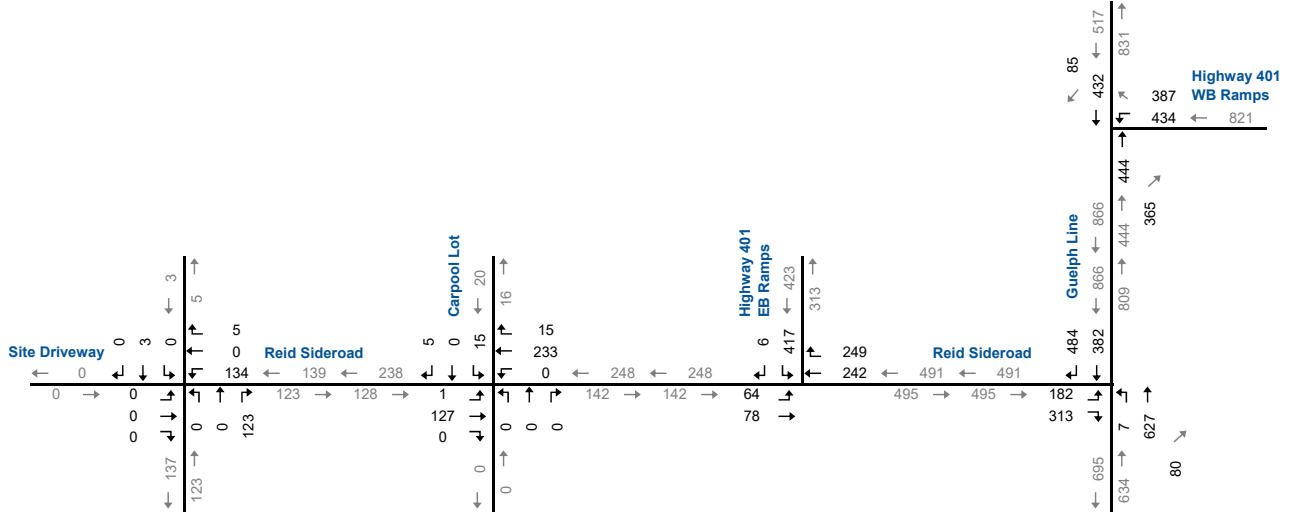
**Total Traffic Forecast - Ten-Year Horizon AM Peak Hour**

Total Passenger Car Volume

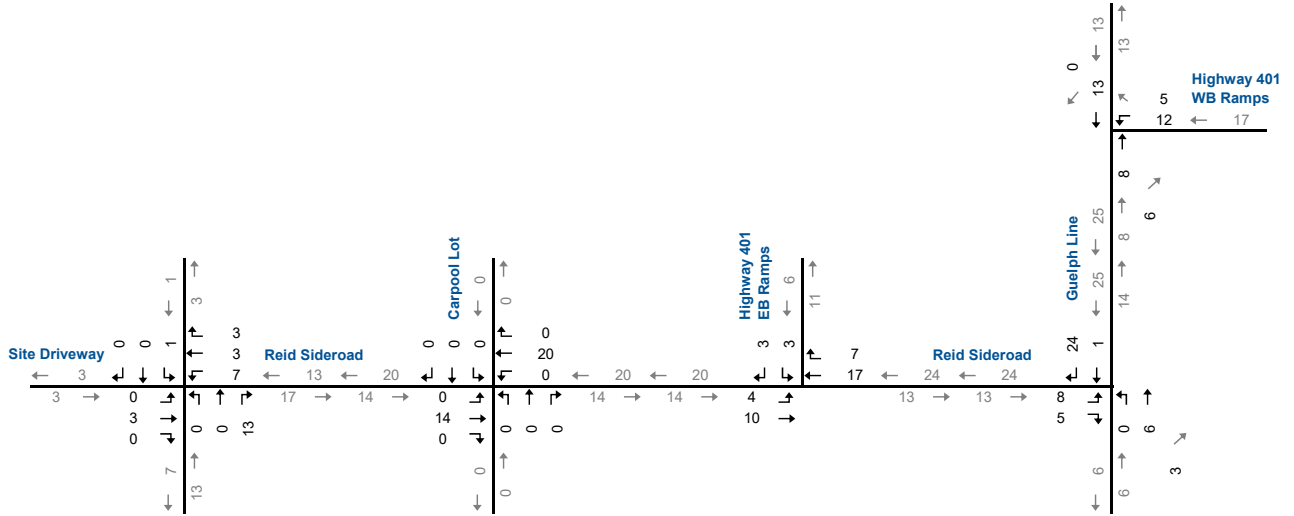


**Total Traffic Forecast - Ten-Year Horizon PM Peak Hour**

**Passenger Cars**

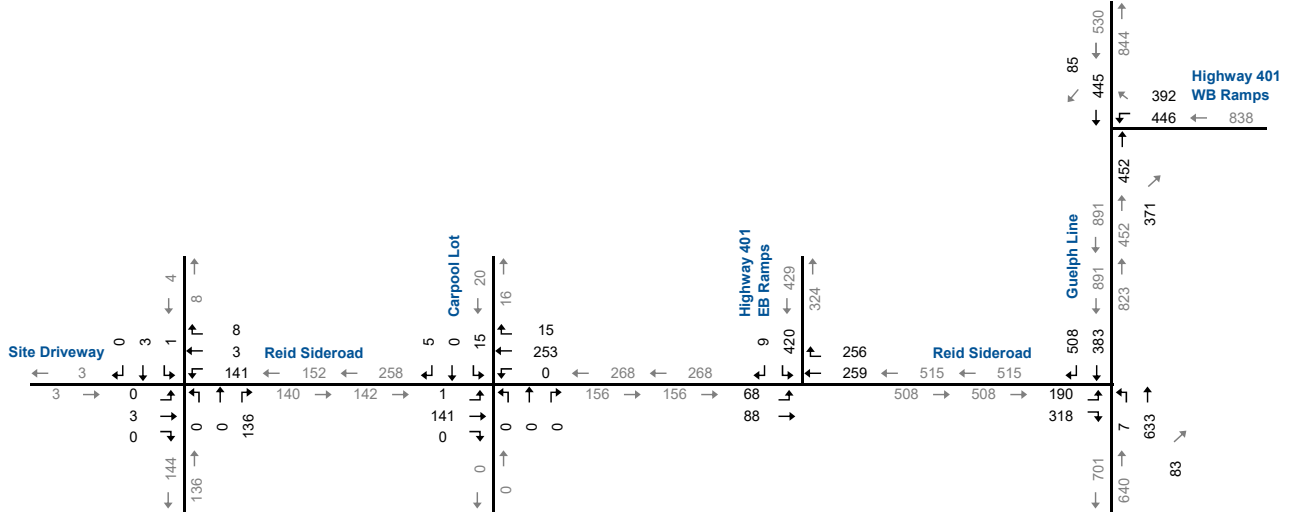


**Heavy Vehicles**



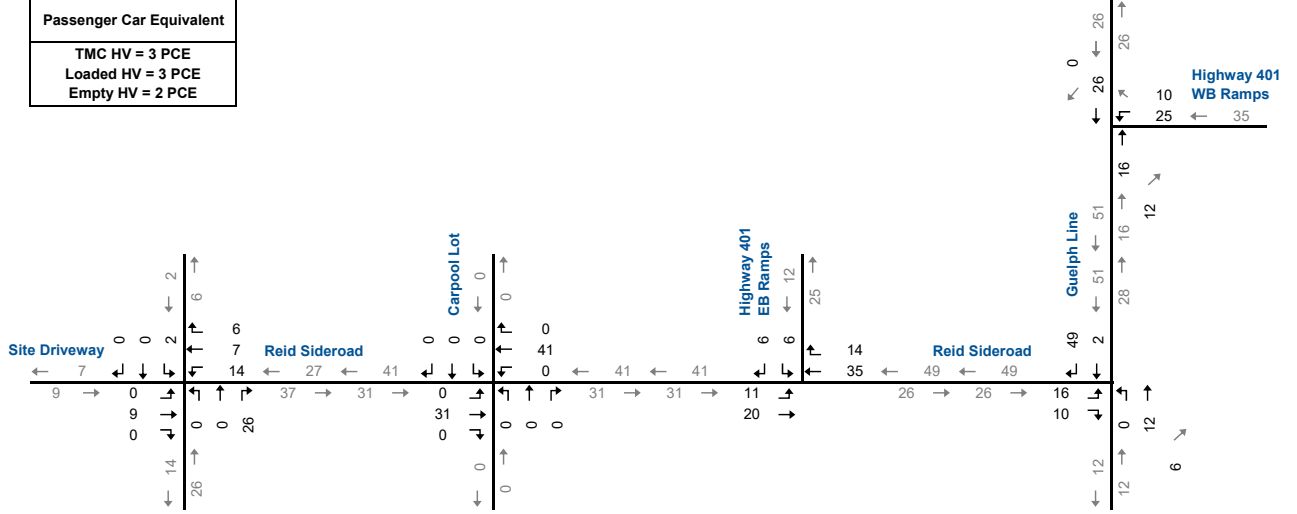
**Total Traffic Forecast - Ten-Year Horizon PM Peak Hour**

**Total Count Volume**



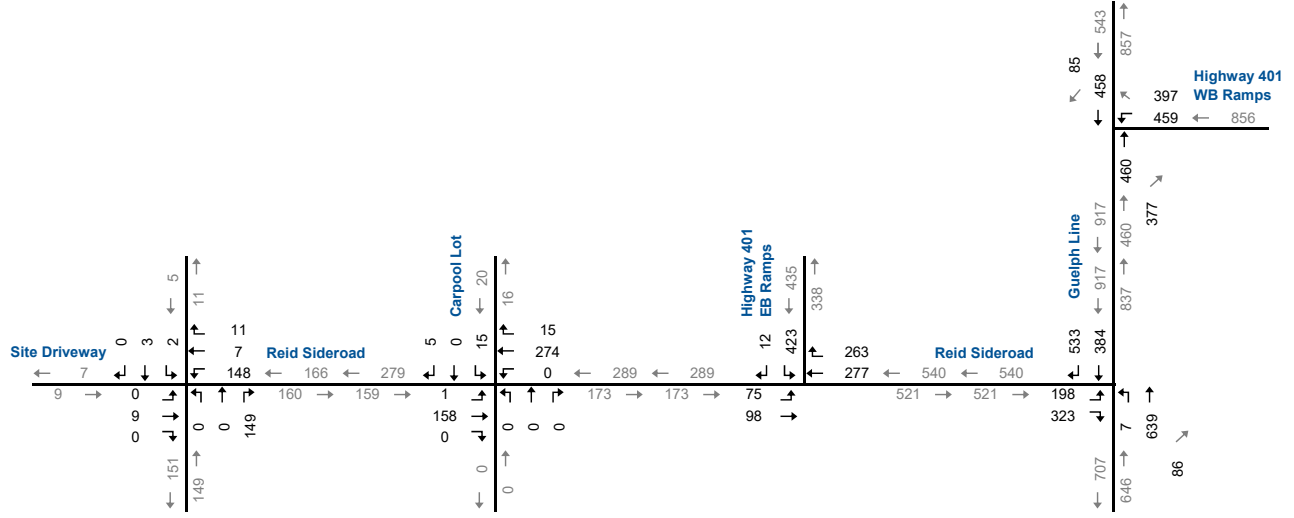
**Passenger Car Equivalent (PCE) Units**

Passenger Car Equivalent	
TMC HV	= 3 PCE
Loaded HV	= 3 PCE
Empty HV	= 2 PCE



**Total Traffic Forecast - Ten-Year Horizon PM Peak Hour**

Total Passenger Car Volume



# Appendix H

## Existing Internal Haul Route Documentation



**JAMES DICK**

**RRRQ Internal Haul Road  
Width Documentation**

RRRQ Internal Haul Route Width Documentation  
JDCL October 2019  
Section Photo Key



HWY 401

Twiss Road

Reid Sideroad

© 2018 Google

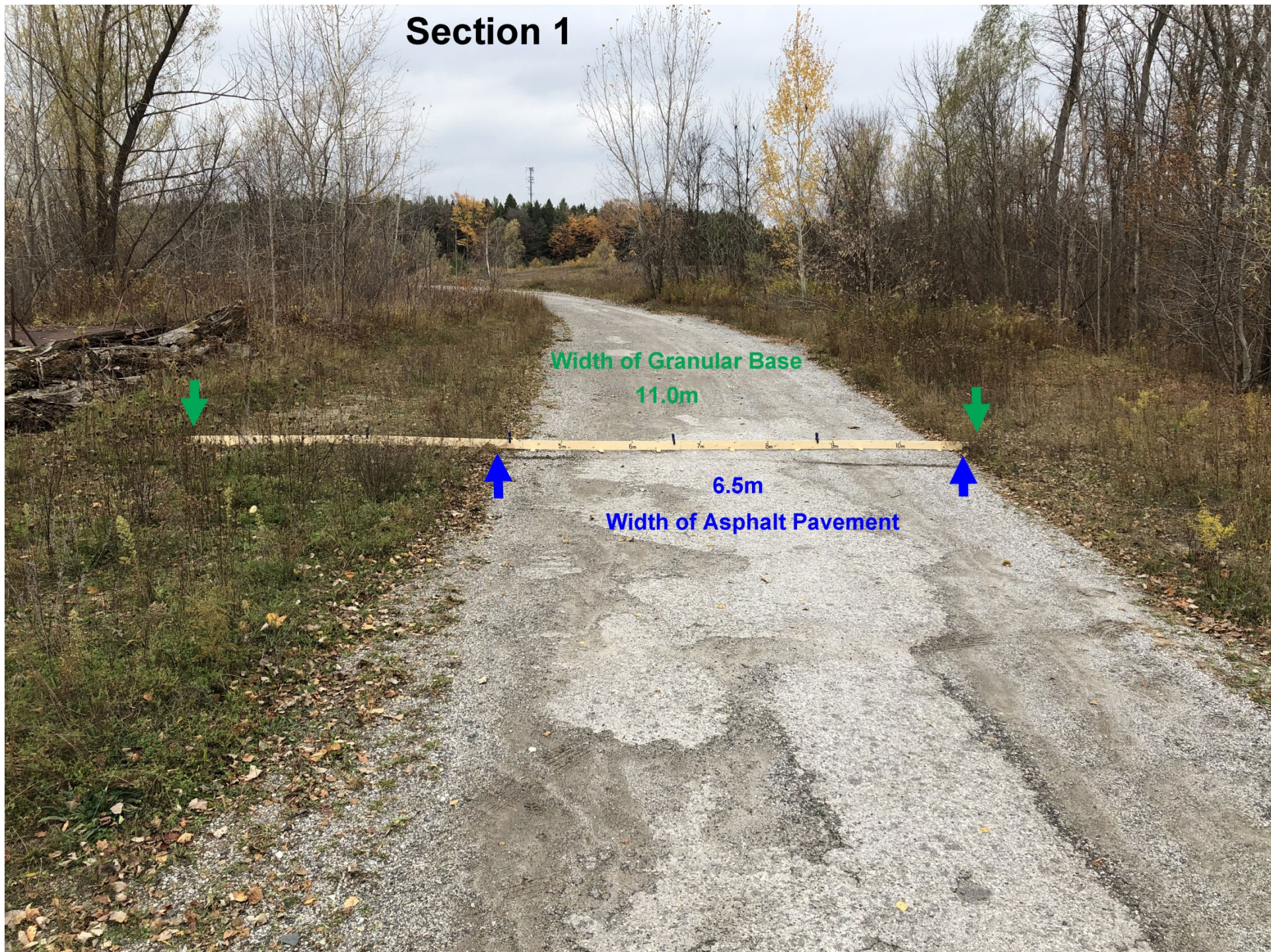
Google



# Section 1

Width of Granular Base  
11.0m

6.5m  
Width of Asphalt Pavement





# Section 2



Width of Granular Base  
8.2m

6.2m  
Width of Asphalt Pavement



# Section 3



Width of Granular Base  
8.0m



5.4m  
Width of Asphalt Pavement





## Section 4

Width of Granular Base  
10.0m

7.0m

Width of Asphalt Pavement

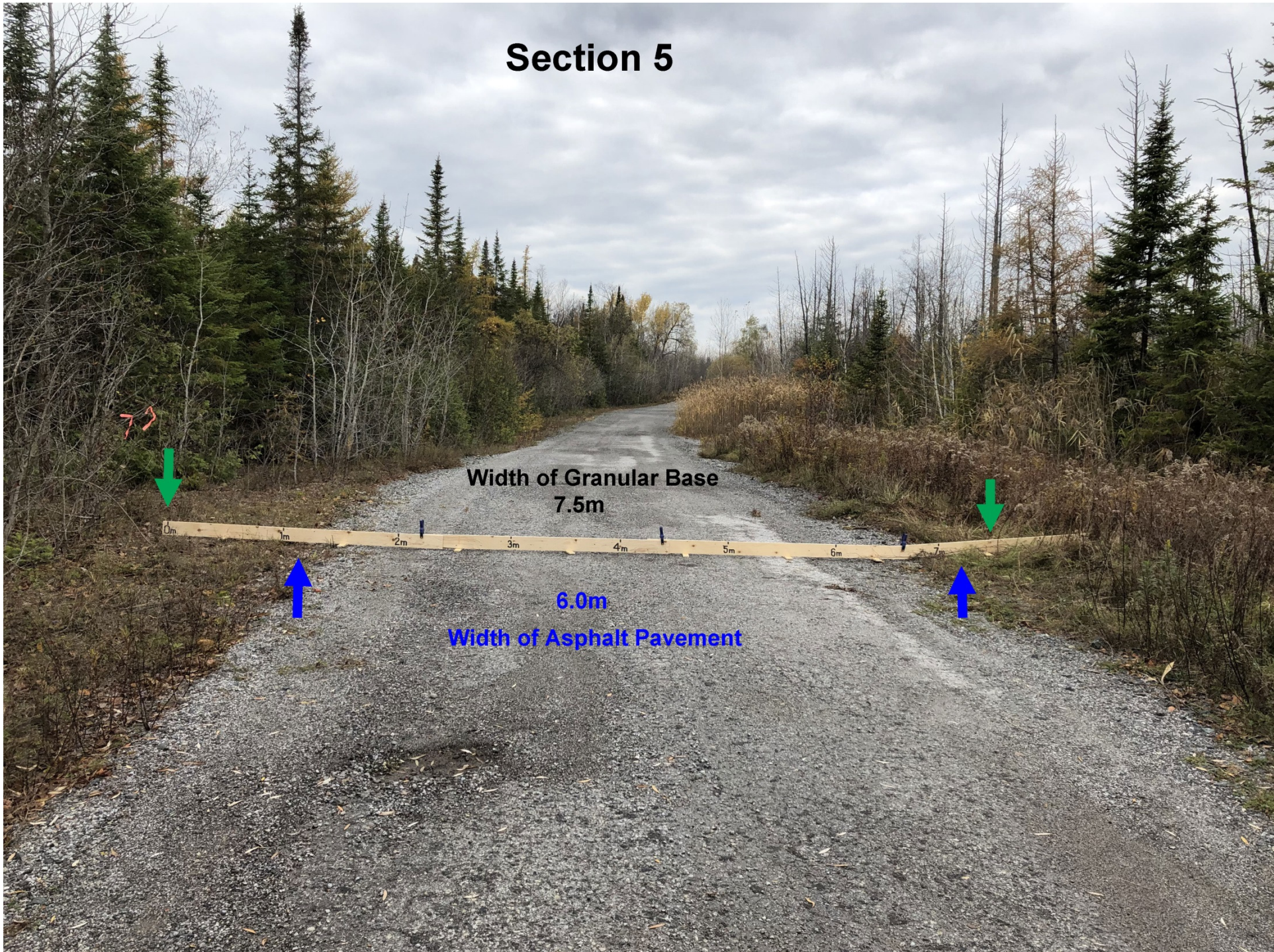




# Section 5

Width of Granular Base  
7.5m

6.0m  
Width of Asphalt Pavement

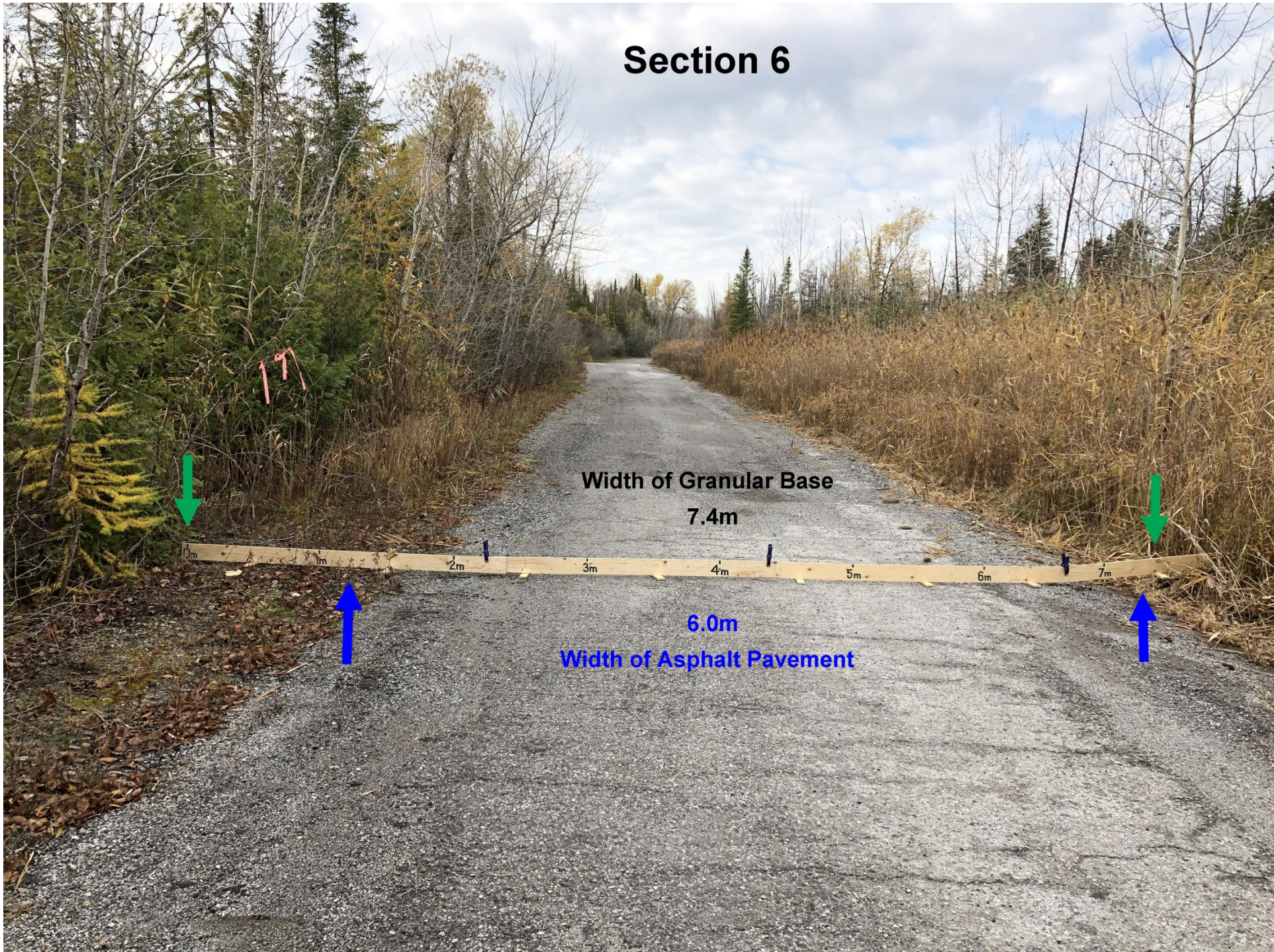




# Section 6

Width of Granular Base  
7.4m

6.0m  
Width of Asphalt Pavement





# Section 7

Width of Granular Base  
6.9m

5.7m

Width of Asphalt Pavement





# Section 8

Width of Granular Base  
7.9m

6.1m

Width of Asphalt Pavement



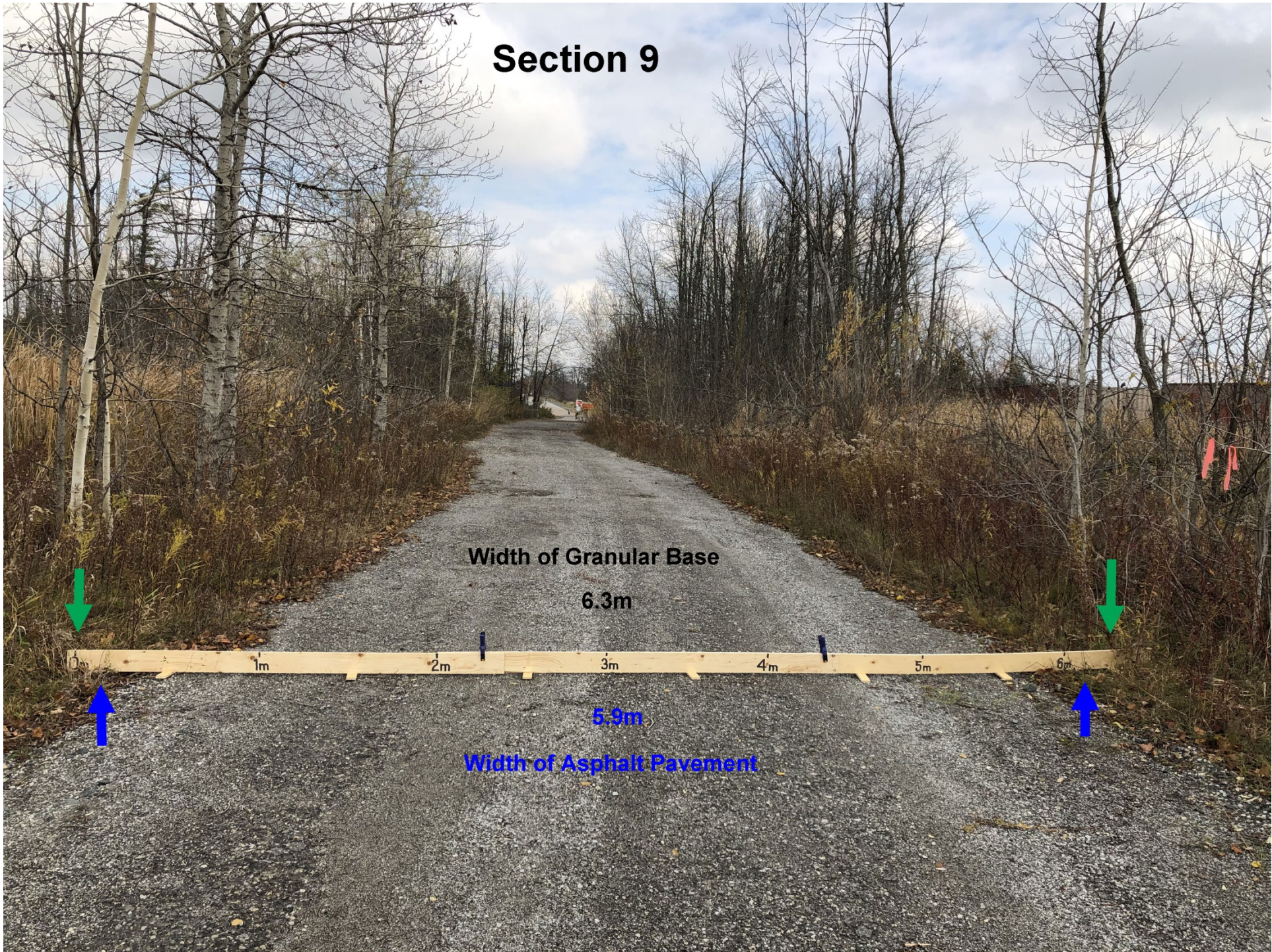


# Section 9

Width of Granular Base  
6.3m

5.9m

Width of Asphalt Pavement





# Section 10



Width of Granular Base  
7.3m

6.4m  
Width of Asphalt Pavement





# Section 11

Width of Granular Base  
8.3m

7.3m  
Width of Asphalt Pavement





# Lane Widths on Public Roads servicing Pits and Quarries (2005 URS Study)

## Other Truck Haul Routes in the GTA

Photo	Haul Route	Location	AADT (Yr)	Truck %	Lane Width (m)	Shoulder Width (m)
1	Burlington - #2 SR	Primary access route of Nelson Crushed Stone. Quarry entrance and a truck are visible in the distance.	280 (2000)	44	3.0	1.0
2	Milton - 6th Line	Primary entrance to the Halton Crushed Stone Quarry. There is a steep grade associated with this route.	2240 (1999)	NA	3.5	1.0-1.5
3	Halton Hills-Dublin Line	Primary entrance to the Dufferin quarry, the largest quarry in Canada.	2299 (1999)	48	3.5	1.0
4	Halton Hills - 22nd SR	One of two access roads from the Blue Circle Quarry near Acton.	584 (2000)	17	3.7	1.0
5	Halton Hills - 4th Line	Other route from Blue Circle Acton Quarry.	1050 (1999)	40	3.3-3.5	1.0
6	Halton Hills - 17th SR	Route used by Blue Circle trucks as they proceed towards Georgetown.	1450 (1999)	30	3.5	1.0
7	Caledon - Miss. Rd.	Looking north south of RR 24. Primary haul route to Town of Caledon's leased pit.	4233 (1998)	1.2	3.5	1.2
8	Adjala - 3rd Line	Primary access route to the James Dick Adjala pit and the Town of Caledon pit in Adjala Township. James Dick pit is on the right and the Town of Caledon pit is on the left.	700 (1996)	NA	3.5	1.5

Reid Sideroad

Primary access to RRRQ

4.0

3.0