

TRAFFIC IMPACT STUDY

12415 COLERAINE DRIVE ASPHALT PLANT

SEPTEMBER 2017

REPORT PREPARED FOR

DIG-CON INTERNATIONAL
4 HOLLAND DRIVE UNIT 8
BOLTON, ON, L7E 161

REPORT PREPARED BY

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TMIG PROJECT NUMBER 17101



EXECUTIVE SUMMARY

The Municipal Infrastructure Group is pleased to submit the enclosed Transportation Impact Study reviewing the trip generation impacts of the proposed asphalt plant at 12415 Coleraine Drive in the Town of Caledon. This study concludes that the proposed drum plant's site traffic can be accommodated by the adjacent street system without negative impact.

The findings and conclusions of this investigation are summarized as follows:

- The study site is a proposed development of an existing agricultural lot.
- From operational information collected from existing asphalt plants within the GTA owned by the asphalt plant manufacturer, it is expected that the plant has a peak output of 400 tonnes per hour.
- The study site proposes one right-in / right-out / left-in access to Coleraine Drive and two accesses to Simpson road, one restricted to in-only and one restricted to out-only.
- Three generators were factored into the total trip generation. Inbound and outbound asphalt supply trucks, raw material supply trucks and employees. The subject development is expected to generate a total of 31 inbound and 31 outbound trips during the weekday am peak hour and a total of 31 inbound and 49 outbound trips during the weekday pm peak hour.
- The primary site distribution used for the development was based upon information provided by the client and Gencor, the plant manufacturer.
- Based on the results of the Synchro analysis, good queuing, levels of service and operations are expected at the study intersections and proposed accesses.
- Based on swept path analysis, the proposed internal circulation will allow for adequate movement of heavy vehicles into and out of the site via the proposed accesses, as well as, within and through the site.
- Sightline analysis has been performed and confirms that the accesses will have unobstructed sightlines that satisfy TAC requirements.

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1 INTRODUCTION

1.1 Retainer and Objective

The Municipal Infrastructure Group (TMIG) was retained by Dig-Con International to prepare a Transportation Impact Brief to examine site-related vehicular impacts on the abutting roadway system from the proposed development of the asphalt plant located at 12415 Coleraine Drive in the Town of Caledon.

The objective of this study is to estimate the traffic volumes generated by the proposed development during the critical weekday am and weekday pm peak periods; to assess the impact of this traffic on Coleraine Drive and Simpson Road; and to recommend improvements, if needed, to accommodate the projected traffic. Full build-out of the development is anticipated by the end of 2017.

TMIG staff submitted a detailed scope of work to DIG CON INTERNATIONAL Ltd. who liaised with the Town of Caledon and Region of Peel transportation staff in regard to the required content of the traffic study. City and Region staff provided input into the proposed terms of reference which informed the general work program for the enclosed study.

1.2 Development Description

The subject site is currently agricultural. The planned development is an office building and asphalt plant with an annual output of roughly 300,000 tonnes per year.

1.3 Study Team

The TMIG team involved in the preparation of this study are:

- Kevin Morris, C.E.T., LEL, Project Manager
- Sophie Xiong, E.I.T., Engineer in Training
- J.A. (Jim) Bacchus, B.A., MITE, Director of Transportation Services

2 STUDY AREA

2.1 Site Environs

In the vicinity of the proposed redevelopment, the surrounding land uses consist of industrial and commercial-retail uses. **Figure 2-1** shows the site location and study site intersections.

Figure 2-1 Site Location



2.2 Study Intersections

As agreed with City Transportation staff through pre-consultation, this study reviews operations at the following intersections:

- Coleraine Drive / George Bolton Parkway
- George Bolton Parkway / Simpson Road
- Right-In /Right-out / Left In Access on Coleraine Drive
- North Inbound Access to Simpson Road
- South Outbound Access to Simpson Road

2.3 Proposed site plan

Figure 2-2 on the following page shows the proposed site plan. The asphalt plant is on the east side of the site, with the office near the west accesses.

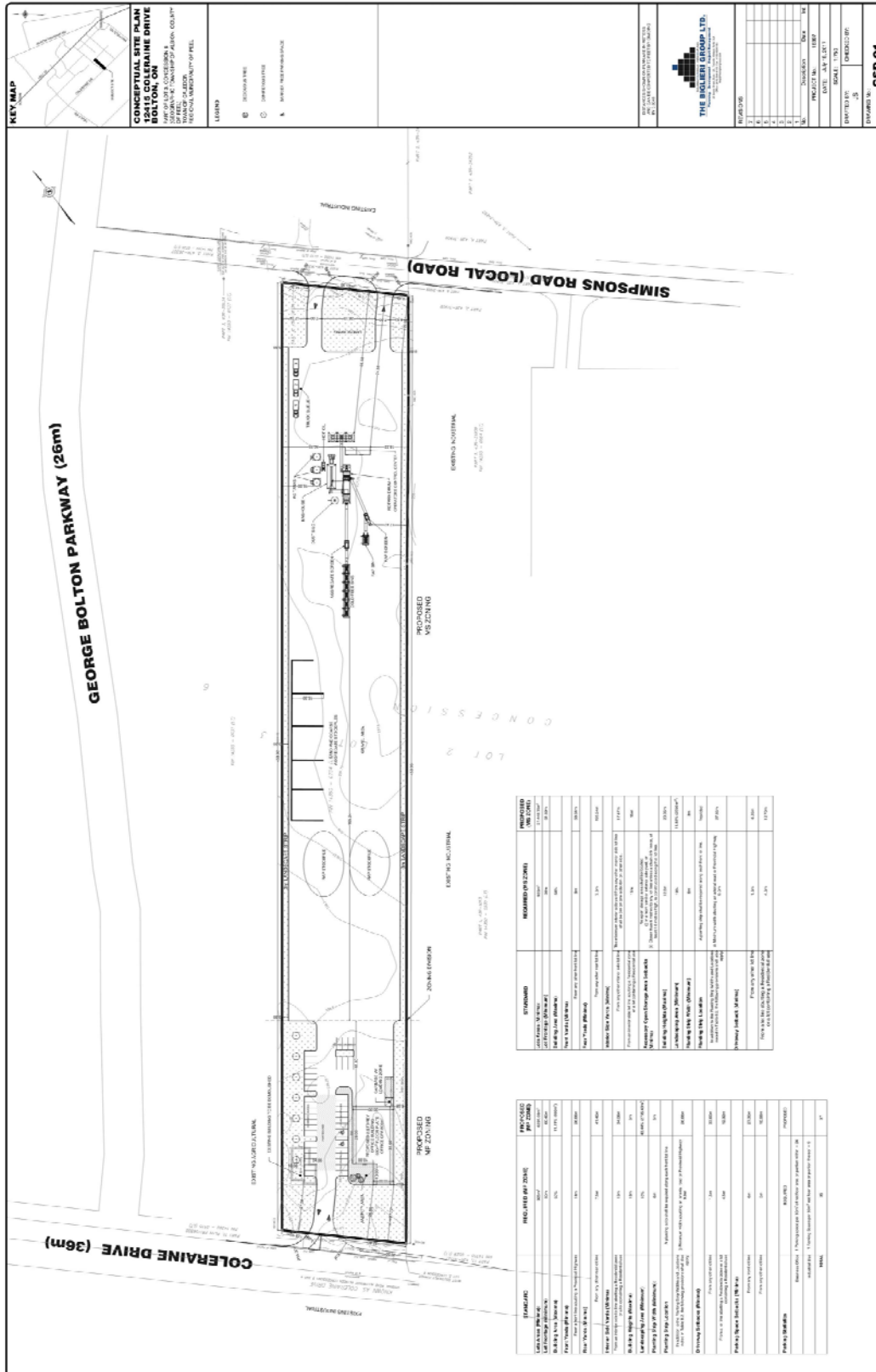
2.4 Site and Access Description

The proposed development is an asphalt plant and will also include loading areas, storage areas for aggregate and a 2 storey office building.

Access to the subject site is proposed on Coleraine Drive via a right-in, left-in / right-out driveway for passenger cars (employees) located approximately midway along the west frontage of the subject site.

There are also 2 proposed full moves accesses on the east frontage on Simpson Road to facilitate the movement of heavy vehicles and minimize interactions with passenger vehicles. The north access will be ingress only and the south access will function as egress only.

Figure 2-2 Proposed Site Plan



3 EXISTING CONDITIONS

3.1 Existing Road Network

Coleraine Drive: is a north-south 'industrial' collector roadway abutting the west side of the subject site. It has an urban four lane cross-section with two lanes of travel in each direction and a posted speed limit of 70 km/h in the vicinity of the site. The roadway is under the jurisdiction of the Region of Peel.

George Bolton Parkway: is an east-west 'industrial' collector roadway to the north of the site. It has an urban two lane cross-section with one lane of travel in each direction and an unposted statutory speed limit of 50 km/h. George Bolton Parkway currently has unsignalized intersections at Coleraine Drive and Simpson Road. The roadway is under the jurisdiction of the Town of Caledon.

Simpson Road: is a north-south industrial roadway abutting the east side of the subject site. It has an urban two lane cross-section with two lanes of travel in each direction and an unposted statutory speed limit of 50 km/h. The roadway is under the jurisdiction of the Town of Caledon.

3.2 Existing Traffic Data

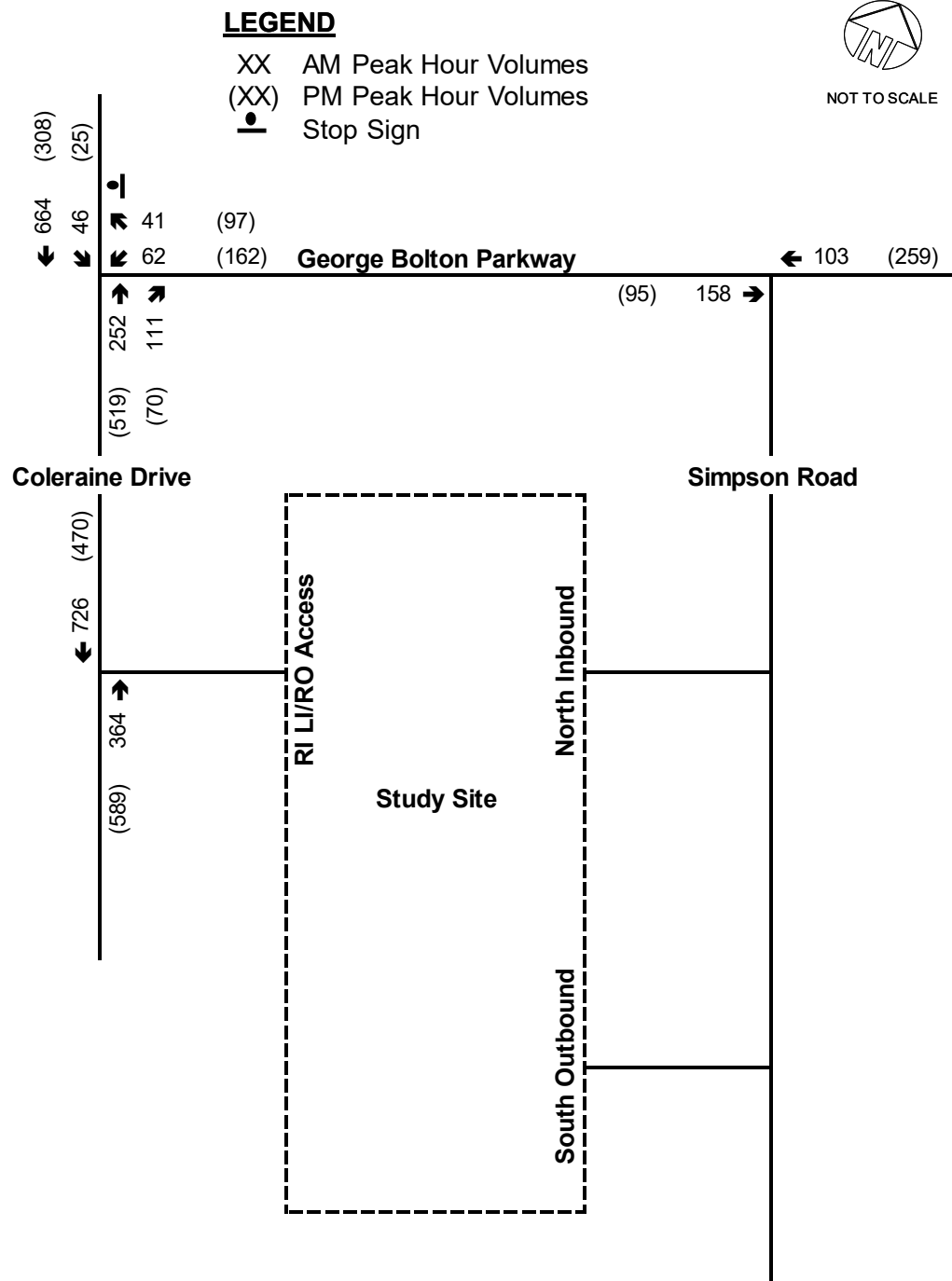
Turning movement counts dated November 2016, were provided by the Town of Caledon for the intersection of Coleraine Drive and George Bolton Parkway. The raw traffic data is contained in **Appendix A**.

As the traffic counts provided were completed in November of 2016, an annual growth rate of 3% (provided by the Region of Peel) was applied to adjust volumes for the 2017 baseline condition. Refer to section 4.2 for discussion of growth rate.

It is noted that at the time of the report, the intersection of Coleraine Drive and George Bolton Parkway is an unsignalized t- intersection. In the future condition, an additional leg will be added and the intersection will be signalized.

Baseline conditions are shown on the following page in **Figure 3-1**.

Figure 3-1 2017 Existing Traffic Volumes



4 BACKGROUND CONDITIONS

4.1 Study Horizon Years

As per typical industry practice, a 5 year planning horizon of 2022 (five years beyond full build-out in 2017) was assumed.

4.2 Background Growth

As instructed by transportation staff at the Region of Peel, growth rate of 3.0% per year (compounded) was applied to the existing traffic volumes to derive estimates of 2022 background traffic volumes. This results in a compounded growth of 1.16% from the date the counts were taken in 2016 to the horizon year of 2022.

4.3 Study Area Road Network Improvements

There will be several changes to the study area road network in the near future. The unsignalized 3-way intersection of Coleraine Drive and George Bolton Parkway will add an additional leg and will be signalised. Additionally, a fourth leg will be added to connect Simpson Road to the north. At the time of this writing, the south leg of Simpson Road at George Bolton Parkway has been constructed but is not open to traffic.

4.4 Background Studies

Following correspondence with the Region of Peel, the following background developments and studies have been identified to contribute traffic volumes to the study road system within the 2022 planning horizon:

Bolton Distribution Centre, Transportation Considerations completed in December 2011 by BA Consulting Group Ltd., proposes a relocation of a distribution centre to a new location in the Town of Caledon on the west side of Coleraine Drive, Between Healey Road and Holland Drive to the northwest of the study site. The development will contribute north-south traffic to Coleraine Drive and site trips generated along this corridor have been considered in the background traffic of our analysis.

12300, 12400 & 12724 Coleraine Drive Proposed Industrial Developments, Urban Transportation Considerations completed in March 2015 by BA Consulting Group Ltd., provides analysis of traffic impacts of 3 industrial sites along Coleraine Road in the vicinity of our site. The development will contribute north-south traffic to Coleraine Drive and east-west traffic through George Bolton Parkway.

Simpson Road Completion Transportation and Traffic Analysis Report completed in November 2012, prepared by Paradigm Transportation Solutions Ltd. forecasts traffic with completion of the Simpson Road Extension across George Bolton Parkway. These volumes were used to build a future total condition on Simpson Road.

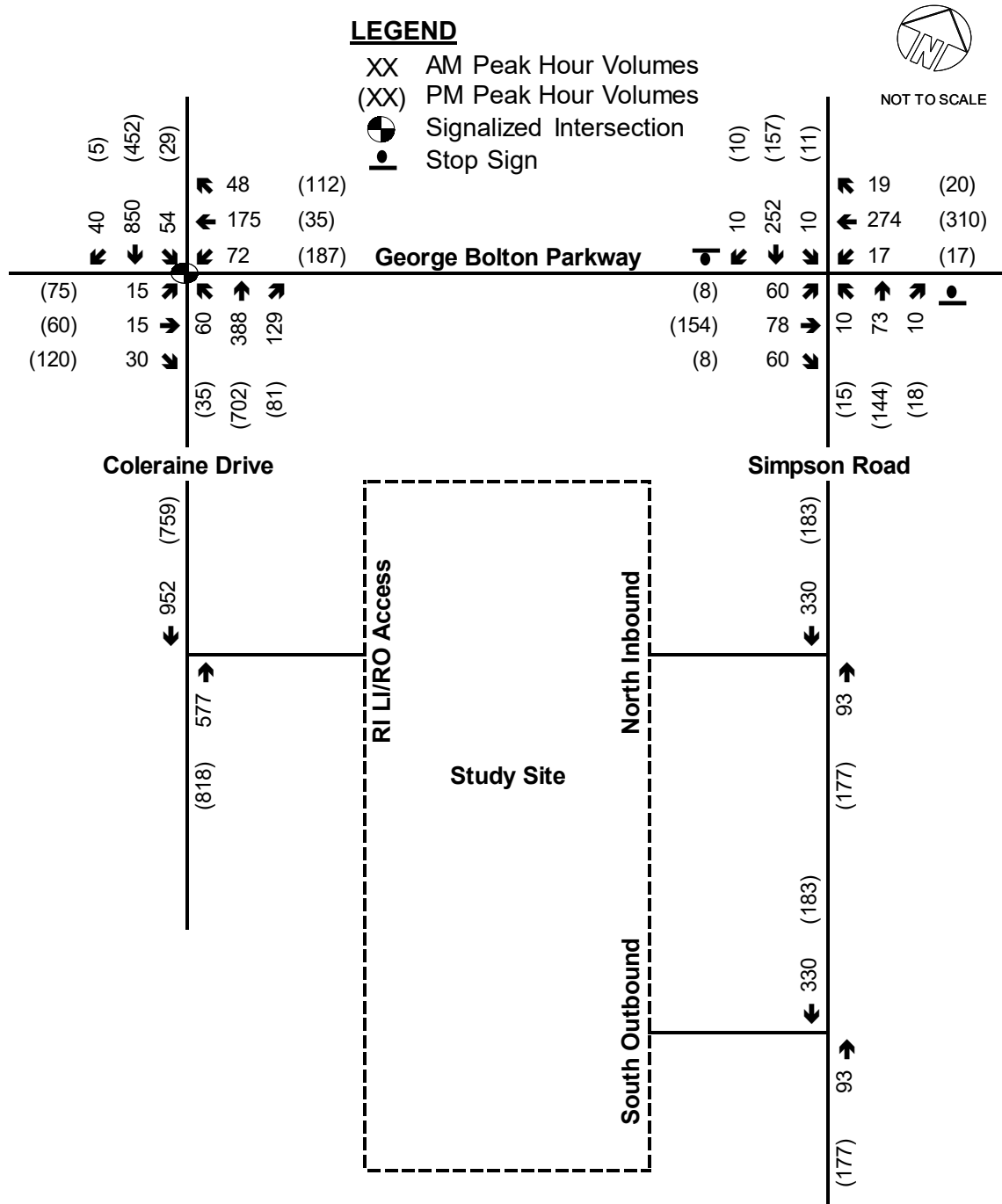
Site trip figures from the aforementioned background developments can be found in **Appendix B**.

4.5 Background Traffic Volumes

Because there is no existing traffic on Simpson Road through George Bolton Parkway as the extension is not built yet, the future total volumes were adopted from the Simpson Road Completion Transportation and Traffic Analysis Report prepared by Paradigm Traffic Solutions Ltd. as attached in **Appendix C**. Additionally, the future distribution of the east-west traffic turning movements at George Bolton Parkway and Simpson Road was informed by the distribution forecasted by the report.

The total future (2022) background traffic resulting from corridor growth and other area developments for the weekday am and pm peak hours is presented in **Figure 4-1** on the following page.

Figure 4-1 2022 Total Background Traffic Volumes



5 SITE GENERATED TRAFFIC

5.1 Site Trip Generation

The client has provided current data on operations of an existing asphalt plant as a proxy for the expected generation of the subject site. The expected annual output has been estimated as 300,000 tonnes considering peak demand and output, seasonal variation and the times of operation of the plant. The peak output of the plant is 400 tonnes per hour, although it is not expected to operate at or near peak during normal operation.

In order to generate the estimated truck traffic associated with the application, the following assumptions and base data have been adopted based on the proposed Operation Plan dated November 2016 and information based on existing asphalt operations provided by the client. A maximum output of 400 tonnes / hour has been provided by the client and has been used to model the peak possible traffic generated by the plant.

- Plant maximum output = 400 tonnes / hour
- Truck capacity = 20 tonnes

$$\frac{400 \text{ tonnes/hour}}{20 \text{ tonnes/truck}} = 20 \text{ trucks/hour}$$

This maximum output is used to represent the highest volume shipping possible as a conservative measure.

Additionally, there is expected to be 10 delivery aggregate delivery trucks a day and 1 asphalt cement truck.

The number of employees of the plant and office are at most 18, with a minimum of 11. As a conservative measure, it was assumed that all employees generated an inbound trip at 6:30 AM and an outbound trip at 5:30 PM. Because of the start time of these employees, the inbound trips were not included in the AM site traffic as it falls outside the peak hours.

Table 5-1 summarizes the anticipated future site trip generation.

Table 5-1 Trip Generation Summary

Generator	Weekday AM Peak			Weekday PM Peak		
	In	Out	Total	In	Out	Total
Asphalt Trucks	20	20	40	20	20	40
Office Employees	0	0	0	0	18	18
Supply Trucks	11	11	22	11	11	22
Total Future Site Trips	31	31	62	31	49	80

As illustrated in **Table 5-1**, the subject development is expected to generate a total of 31 inbound and 31 outbound trips in the weekday a.m. peak hour and a total of 31 inbound and 49 outbound trips during the weekday p.m. peak hour.

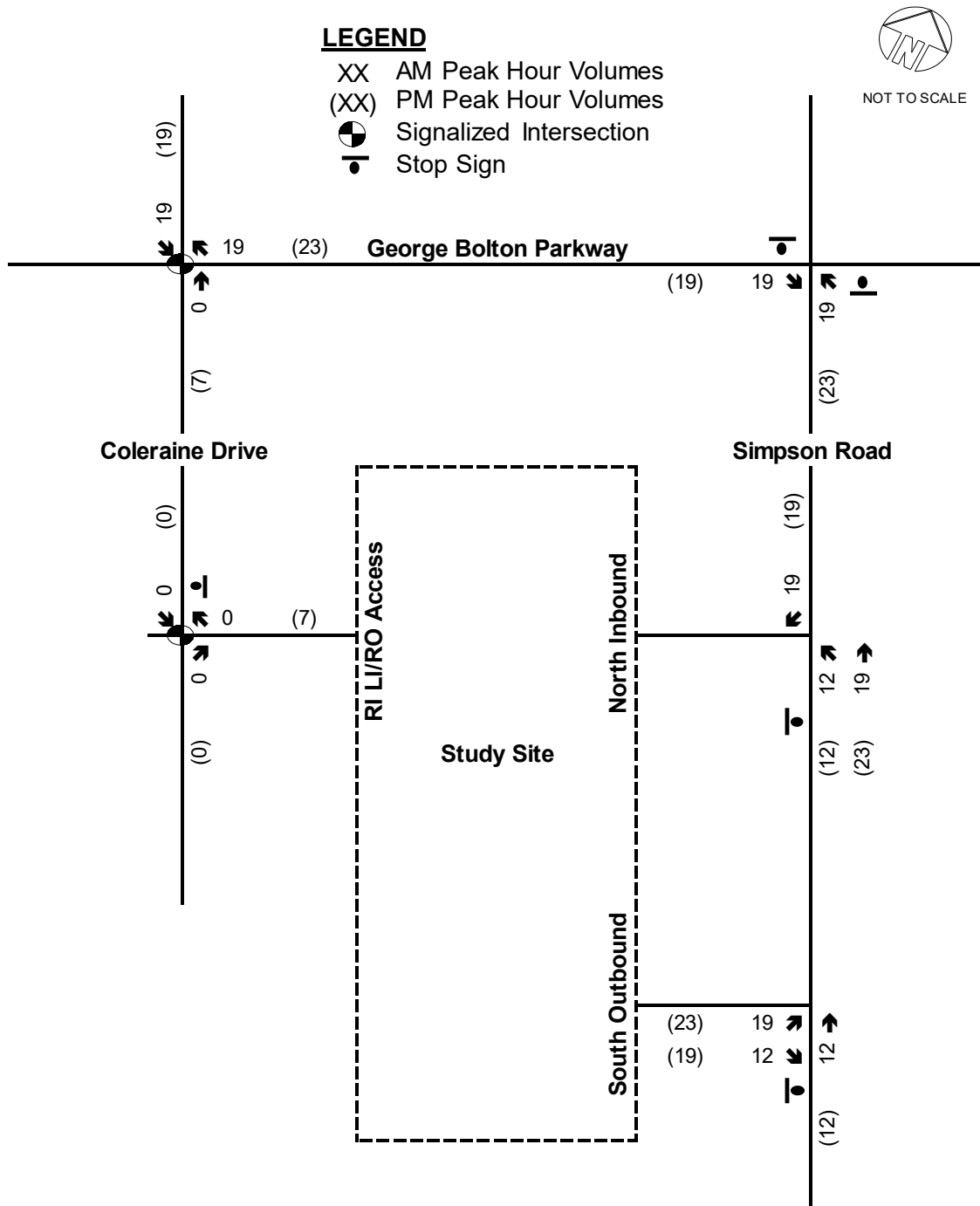
5.2 Site Trip Distribution and Assignment

Asphalt truck movement will be restricted to the full moves accesses on Simpson Road and trucks will head either north or south depending on where deliveries are needed. We have relied upon information from the client on existing traffic patterns to inform the site trip distribution for the subject development in regard to truck traffic. Gencor staff indicated that truck trips are generally evenly distributed with slightly more travelling north to Bolton so we have assigned 60% of the truck trips to/from the north via Simpson Road and 40% to/from the south on via Simpson Road.

The same distribution has been applied to supplier and employee Trips. Supply trucks will similarly be restricted to Simpson Road but employee vehicles will be able to use the right-in / right-out / left-in access to Coleraine Drive.

The total future site traffic volumes are illustrated in **Figure 5-1**. These volumes take into consideration the combined asphalt and supplier truck trips and employee trips.

Figure 5-1 2022 Total Site Traffic Volumes

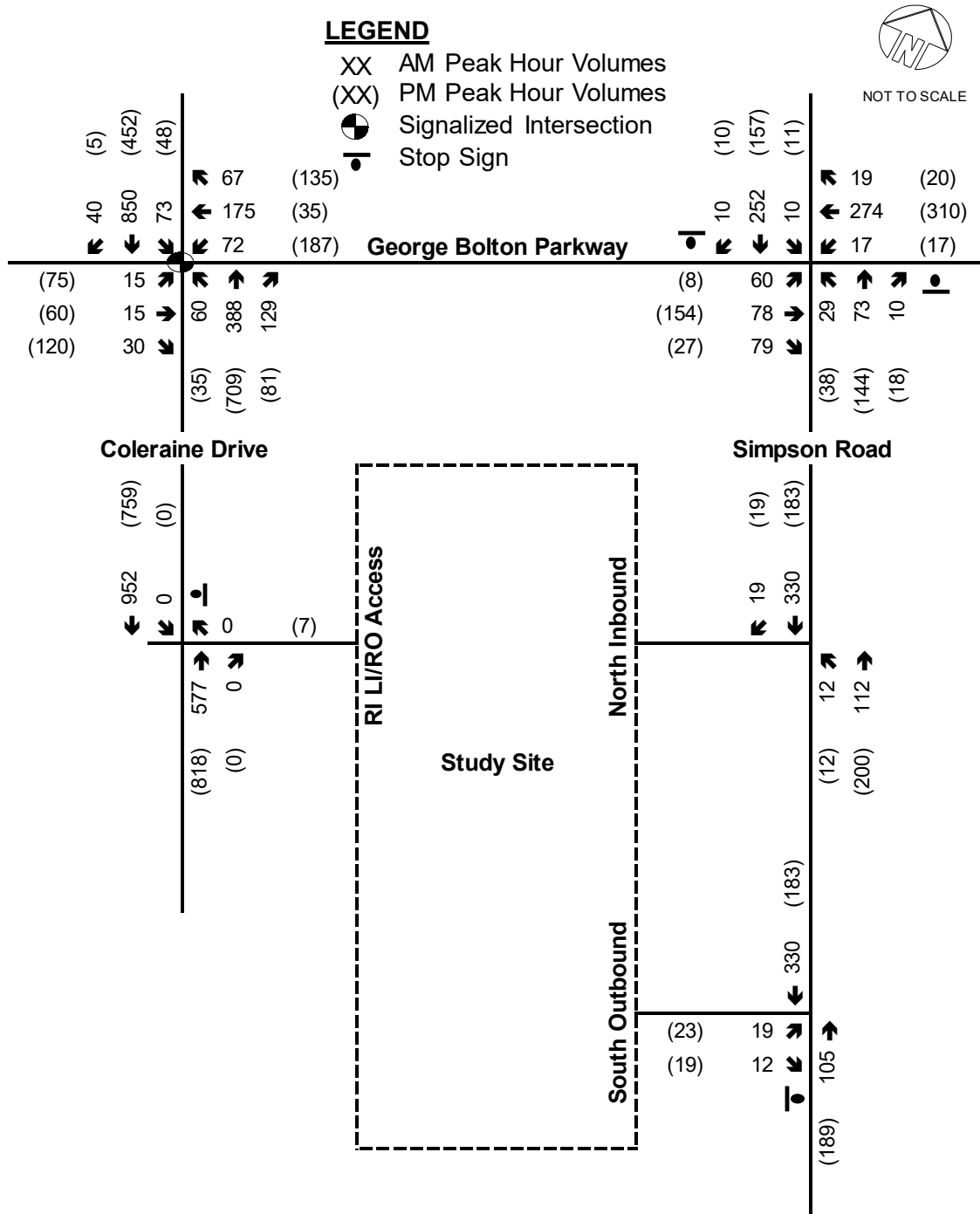


6 TOTAL TRAFFIC

The future total traffic conditions for the peak study hours for the 2022 planning horizon was derived by combining the projected future background traffic with the corresponding estimate of the total site generated traffic.

Figure 6-1 below summarizes the future total traffic volumes for the 2022 planning horizon during the weekday a.m. and p.m. peak hours.

Figure 6-1 2022 Total Traffic Volumes



7 CAPACITY ANALYSIS

This section presents the traffic impact analysis and summarizes the operations of the study area street network under existing and future total conditions (after the introduction of the estimated subject site generated traffic).

The effectiveness of an intersection's operations is measured in terms of the volume to capacity ratio (v/c), and vehicle queuing, all generally distilled down to a Level-of-Service (LOS), ranging from LOS 'A' to LOS 'F'. LOS 'A' is the 'best' level of operation for an intersection representing little or no delay and generally free flow conditions where the general level of comfort and convenience experienced by motorists is excellent. At the other end of the spectrum LOS 'F' represents an at-capacity condition usually associated with heavy congestion, and occasionally severe delays and queuing. It should be noted that operations up to and including LOS-E are considered 'acceptable' in most urban (and in even rural) environments. A full description of all Levels of Service (A through F) is included in **Appendix D**.

Volume to capacity (v/c) ratios provide an additional performance measure of how specific movements (as well as overall signalized intersections) are operating in relation to their theoretically calculated capacity. A ratio of 1.0 represents an at-capacity condition (demand = capacity), and could have characteristics similar to those described in the above paragraph for LOS 'F'. Anything below a v/c ratio of 0.9 is typically considered to be acceptable and even ratios between 0.9 and 1.0, can be acceptable to drivers in many circumstances.

Measures and estimates of vehicle queuing provides yet another layer of information with which to assess future operations. In areas where there is tight spacing of intersections or otherwise limited space, even though acceptable LOS and v/c ratios might be evident, vehicle queuing might suggest operational problems (or vice-versa). Queuing results, and the way in which they are interpreted, are therefore very case-sensitive and should be viewed specific to study context.

The enclosed capacity analyses are based on the methodology contained in the 2000 Highway Capacity Manual, which assigns an intersection Level of Service (LOS) based on the average control delay experienced by each vehicle passing through that intersection. Synchro version 9.0 was utilized to conduct the analysis. The traffic signal timings were taken from the Bolton Industrial TIS from BA Group (2015).

Tables 7-1, 7-2 and 7-3 below display the existing, background total and future total operating conditions of the study intersections and site accesses.

Table 7-1 Capacity Analysis of Coleraine Drive and George Bolton Parkway

Traffic Condition	Movement v/c (LOS) 95 th Percentile Queue, Delay in Seconds	
	AM Peak Hour	PM Peak Hour
Baseline 2017	WBL: 0.42 (D) 15m SBL: 0.04 (A) 1 veh.	WBL: 0.00 (D) 20m WBR: 0.01 (B) 1 veh. SBL: 0.74 (A) 1 veh.
Future Background 2022	<u>Overall: v/c 0.42 LOS A</u> EBL: 0.09 (C) 1 veh. EBTR: 0.06 (C) 10m WBL: 0.30 (C) 15m WBTR: 0.60 (C) 40m NBL: 0.15 (A) 10m NBTR: 0.25 (A) 20m SBL: 0.10 (A) 1 veh. SBT: 0.38 (A) 40m SBR: 0.03 (A) 1 veh	<u>Overall: v/c 0.47 LOS B</u> EBL: 0.26 (C) 15m EBTR: 0.22 (C) 20m WBL: 0.73 (D) 35m WBTR: 0.17 (C) 15m NBL: 0.06 (A) 1 veh. NBTR: 0.37 (A) 40m SBL: 0.09 (A) 1 veh. SBT: 0.23 (A) 25m SBR: 0.00 (A) 1 veh
Future Total 2022	<u>Overall: v/c 0.42 LOS A</u> EBL: 0.10 (C) 1 veh. EBTR: 0.06 (C) 10m WBL: 0.29 (C) 15m WBTR: 0.61 (C) 40m NBL: 0.15 (A) 10m NBTR: 0.25 (A) 20m SBL: 0.14 (A) 10m SBT: 0.38 (A) 40m SBR: 0.02 (A) 1 veh	<u>Overall: v/c 0.47 LOS B</u> EBL: 0.28 (C) 15m EBTR: 0.22 (C) 20m WBL: 0.73 (D) 35m WBTR: 0.18 (C) 15m NBL: 0.06 (A) 1 veh. NBTR: 0.38 (A) 40m SBL: 0.16 (A) 1 veh. SBT: 0.23 (A) 25m SBR: 0.00 (A) 1 veh

Under 2017 existing conditions, this unsignalized intersection has good operational characteristics during both weekday peak hours. There are no critical movements or queuing issues to report.

In 2022, the intersection becomes signalized. Under future background 2022 traffic conditions, with the addition of background traffic, the overall operations can be expected to remain satisfactory during both study peak hours, operating at a v/c of 0.42 and LOS 'A' in the a.m. peak and a v/c/ of 0.47 and LOS 'B' respectively for the a.m. and p.m. peak hours.

Under the future total 2022 traffic conditions the impact of the added site traffic is only marginally apparent during the study peak hours with no increase in overall v/c or LOS. There are no critical movements or queuing issues to report, and there are no improvements required to accommodate the incremental site traffic in either of the peak study hours.

Table 7-2 Capacity Analysis of George Bolton Parkway and Simpson Road

Traffic Condition	Movement v/c (LOS) 95 th Percentile Queue, Delay in Seconds	
	AM Peak Hour	PM Peak Hour
Future Background 2022	EBLTR: 0.05 (A) 1 veh. WBLTR: 0.01 (A) 1 veh. NBLTR: 0.24 (C) 1 veh. SBLTR: 0.67 (D) 35m	EBLTR: 0.01 (A) 1 veh. WBLTR: 0.01 (A) 1 veh. NBLTR: 0.40 (C) 15m SBLTR: 0.40 (C) 15m
Future Total 2022	EBLTR: 0.05 (A) 1 veh. WBLTR: 0.01 (A) 1 veh. NBLTR: 0.36 (C) 10m. SBLTR: 0.68 (D) 35m	EBLTR: 0.01 (A) 1 veh. WBLTR: 0.01 (A) 1 veh. NBLTR: 0.49 (C) 15m SBLTR: 0.41 (C) 15m

The future north south stop controlled intersection of George Bolton Parkway and Simpson Road is expected to operate with excellent v/c ratios and LOS during both the a.m. and p.m. peak hours under future background and total 2022 traffic conditions.

Table 8-3 Capacity Analysis of Site Accesses - Future Total Condition

Access	Movement v/c (LOS) 95 th Percentile Queue, Delay in Seconds	
	AM Peak Hour	PM Peak Hour
Right-In / Right-Out / Left-In To Coleraine Drive	WBTLR: 0.00 (A) 1 veh.	WBTLR: 0.01 (B) 1 veh.
North Full Moves In To Simpson Road	EBLR: 0.03 (B) 1 veh. NBLT: 0.01 (A) 1 veh.	EBLR: 0.03 (B) 1 veh. NBLT: 0.01 (A) 1 veh.
South Full Moves Out To Simpson Road	EBLR: 0.06 (B) 1 veh.	EBLR: 0.09 (B) 1 veh.

Under future total 2022 conditions during the weekday am and weekday pm peak hours, all movements at all three site access driveway are expected to operate with good levels of service, v/c ratios and minimal delays. Queue lengths are expected to be limited to one vehicle.

8 SWEPT PATH ANALYSIS

A swept path analysis utilizing Vehicle Tracking software was conducted to examine the manoeuvring needs of an aggregate hauler. The standard vehicle templates provided in the Vehicle Tracking software do not contain the aforementioned design vehicle. As such, a WB-19 tractor trailer was used to represent the largest of aggregate haulers which represents a worst case scenario in regard to turning movements (some aggregate vehicles use articulated trailers, which do not have as wide turning radii as a WB-19).

Based on the analysis, the proposed site plan layout will allow for adequate movement of the design vehicle into and out of the site accesses, as well as, within and through the site. Detailed diagrams are contained in **Appendix E**.

We acknowledge that based on the turning radius of the WB-19, for the northbound exit movement from the site access, it will be necessary for the vehicle to encroach into the opposing lane of traffic. However, this is not unusual in this type of environment and truck drivers will wait to make their manoeuvre while another truck is entering or exiting the site.

9 SIGHTLINE ANALYSIS

An assessment of available sightlines at the accesses to the proposed developments from both Coleraine Drive and Simpson Road have been performed. At the location of the access to Coleraine Drive, the road is straight and there is a posted speed limit of 70 km/h. The proposed access has a right-in / right-out / left-in configuration with a dividing island and a right turn lane approaching the access. This access is also restricted for passenger vehicles only. All heavy vehicle traffic must enter and exit through Simpson Road accesses. A design speed of 90 km/h on Coleraine Drive has been adopted for sightline analysis.

Appendix F shows a TAC passenger vehicle stopped at the uncontrolled access to Coleraine Drive, exiting the site. The referenced driver's eye position has been located approximately 2.0 metres behind the front bumper. There is no sidewalk at this location but the vehicle has been positioned beside the dividing island.

A minimum 160 metre stopping sight distance is based on the stopping sight distance for a 90km/h design speed. Based on the proposed access location, the sightlines are unobstructed for the minimum stopping sight distance and fulfill TAC requirements.

At Simpson Road at the location of the site accesses, the road is also straight and has a posted speed limit of 50 km/h. There are two accesses at Simpson Road and they both allow truck traffic, however there will only be egress allowed through the south access. A design speed of 60 km/h has been adopted for sightline Analysis.

Appendix F shows a TAC WB-20 truck stopped at the uncontrolled south access to Simpson Road, existing the site. The referenced driver's eye position has been located approximately 3.0 metres behind the front bumper. A minimum 85 metre stopping sight distance is based on the stopping sight distance for a 60 km/h design speed. Based on the proposed access location, the sightlines are unobstructed for the minimum stopping sight distance and fulfill TAC requirements.

APPENDIX A

Traffic Data



Turning Movement Count
Location Name: COLERAINE DR & GEORGE BOLTON PKWY
Date: Wed, Nov 09, 2016 Deployment Lead: Chris Koukaras

Peel Region
10 Peel Centre Drive
Suite B - 4th Floor
Brampton ON, Canada, L6T 4B9

Turning Movement Count (14 . COLERAINE DR & GEORGE BOLTON PKWY) CustID: 15004390 MioID: 363763

Start Time	Southbound COLERAINE DR					Westbound GEORGE BOLTON PKWY					Northbound COLERAINE DR					Int. Total (15 min)	Int. Total (1 hr)
	Left	Thru	U-Turn	Peds	Approach Total	Left	Right	U-Turn	Peds	Approach Total	Thru	Right	U-Turn	Peds	Approach Total		
07:00:00	8	176	0	0	184	9	7	0	0	16	62	30	0	0	92	292	
07:15:00	5	162	0	0	167	26	8	0	0	34	62	16	0	0	78	279	
07:30:00	8	172	0	0	180	4	8	0	0	12	56	27	0	0	83	275	
07:45:00	15	131	0	0	146	9	10	0	0	19	73	33	0	0	106	271	1117
08:00:00	17	181	0	0	198	21	14	0	0	35	54	32	0	0	86	319	1144
08:15:00	14	129	0	0	143	5	12	0	0	17	69	37	0	0	106	266	1131
08:30:00	13	109	0	0	122	11	5	0	0	16	61	17	0	0	78	216	1072
08:45:00	13	110	0	0	123	7	5	0	0	12	75	23	0	0	98	233	1034

BREAK

11:00:00	6	59	0	0	65	11	2	0	0	13	36	16	0	0	52	130	
11:15:00	4	45	0	0	49	14	11	0	0	25	32	11	0	0	43	117	
11:30:00	5	54	0	0	59	15	9	0	0	24	45	12	0	0	57	140	
11:45:00	9	48	0	0	57	12	7	0	0	19	58	13	0	0	71	147	534
12:00:00	6	50	0	0	56	12	9	0	0	21	36	9	0	0	45	122	526
12:15:00	5	60	0	0	65	19	8	0	0	27	51	6	0	0	57	149	558
12:30:00	5	36	0	0	41	11	11	0	0	22	51	16	0	0	67	130	548
12:45:00	2	42	0	0	44	9	10	0	0	19	42	5	0	0	47	110	511
13:00:00	10	43	0	0	53	11	16	0	0	27	51	12	0	0	63	143	532
13:15:00	7	46	0	0	53	8	15	0	0	23	56	18	0	0	74	150	533
13:30:00	8	59	0	0	67	18	10	0	0	28	49	11	0	0	60	155	558
13:45:00	8	43	0	0	51	14	17	0	0	31	55	15	0	0	70	152	600

BREAK

15:00:00	4	65	0	0	69	33	8	0	0	41	86	16	0	0	102	212	
15:15:00	7	75	0	0	82	22	9	0	0	31	98	12	0	0	110	223	

Turning Movement Count



Turning Movement Count
Location Name: COLERAINE DR & GEORGE BOLTON PKWY
Date: Wed, Nov 09, 2016 Deployment Lead: Chris Koukaras

Peel Region
10 Peel Centre Drive
Suite B - 4th Floor
Brampton ON, Canada, L6T 4B9

15:30:00	11	85	0	0	0	96	31	16	0	0	47	112	14	0	0	126	269	
15:45:00	6	72	0	0	0	78	19	16	0	0	35	98	14	0	0	112	225	929
16:00:00	8	89	0	0	0	97	43	18	0	0	61	91	18	0	0	109	267	984
16:15:00	10	71	0	0	0	81	34	25	0	0	59	110	18	0	0	128	268	1029
16:30:00	5	75	0	0	0	80	36	17	0	0	53	122	15	0	0	137	270	1030
16:45:00	6	55	0	0	0	61	25	20	0	0	45	131	18	0	0	149	255	1060
17:00:00	3	98	0	0	0	101	62	32	0	0	94	141	17	0	0	158	353	1146
17:15:00	2	64	0	0	0	66	28	17	0	0	45	136	17	0	0	153	264	1142
17:30:00	6	55	0	0	0	61	18	12	0	0	30	125	23	0	0	148	239	1111
17:45:00	10	52	0	0	0	62	22	15	0	0	37	110	12	0	0	122	221	1077
Grand Total	246	2611	0	0	0	2857	619	399	0	0	1018	2434	553	0	0	2987	6862	-

Approach%	8.6%	91.4%	0%			-	60.8%	39.2%	0%		-	81.5%	18.5%	0%		-	-	-
Totals %	3.6%	38.1%	0%			41.6%	9%	5.8%	0%		14.8%	35.5%	8.1%	0%		43.5%	-	-
Heavy	40	493	0			-	79	39	0		-	476	107	0		-	-	-
Heavy %	16.3%	18.9%	0%			-	12.8%	9.8%	0%		-	19.6%	19.3%	0%		-	-	-
Bicycles	0	0	0			-	0	0	0		-	1	0	0		-	-	-
Bicycle %	0%	0%	0%			-	0%	0%	0%		-	0%	0%	0%		-	-	-



Peak Hour: 07:15 AM - 08:15 AM Weather: Mostly Cloudy (3.2 °C)

Start Time	Southbound COLERAINE DR					Westbound GEORGE BOLTON PKWY					Northbound COLERAINE DR					Int. Total (15 min)
	Left		Thru		Approach Total	Left		Right		Approach Total	Thru		Right		Approach Total	
07:15:00	5	162	0	0	167	26	8	0	0	34	62	16	0	0	78	279
07:30:00	8	172	0	0	180	4	8	0	0	12	56	27	0	0	83	275
07:45:00	15	131	0	0	146	9	10	0	0	19	73	33	0	0	106	271
08:00:00	17	181	0	0	198	21	14	0	0	35	54	32	0	0	86	319
Grand Total	45	646	0	0	691	60	40	0	0	100	245	108	0	0	353	1144
Approach%	6.5%	93.5%	0%		-	60%	40%	0%		-	69.4%	30.6%	0%		-	-
Totals %	3.9%	56.5%	0%		60.4%	5.2%	3.5%	0%		8.7%	21.4%	9.4%	0%		30.9%	-
PHF	0.66	0.89	0		0.87	0.58	0.71	0		0.71	0.84	0.82	0		0.83	-
Heavy	5	66	0		71	7	1	0		8	67	8	0		75	-
Heavy %	11.1%	10.2%	0%		10.3%	11.7%	2.5%	0%		8%	27.3%	7.4%	0%		21.2%	-
Lights	40	580	0		620	53	39	0		92	178	100	0		278	-
Lights %	88.9%	89.8%	0%		89.7%	88.3%	97.5%	0%		92%	72.7%	92.6%	0%		78.8%	-
Single-Unit Trucks	2	33	0		35	3	0	0		3	32	3	0		35	-
Single-Unit Trucks %	4.4%	5.1%	0%		5.1%	5%	0%	0%		3%	13.1%	2.8%	0%		9.9%	-
Buses	0	0	0		0	0	0	0		0	5	0	0		5	-
Buses %	0%	0%	0%		0%	0%	0%	0%		0%	2%	0%	0%		1.4%	-
Articulated Trucks	3	33	0		36	4	1	0		5	30	5	0		35	-
Articulated Trucks %	6.7%	5.1%	0%		5.2%	6.7%	2.5%	0%		5%	12.2%	4.6%	0%		9.9%	-
Bicycles on Road	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	-
Bicycles on Road%	-	-	-	%		-	-	-	%		-	-	-	%		-



Peak Hour: 01:00 PM - 02:00 PM Weather: Mostly Cloudy (3.4 °C)

Start Time	Southbound COLERAINE DR					Westbound GEORGE BOLTON PKWY					Northbound COLERAINE DR					Int. Total (15 min)									
	Left		Thru		U-Turn	Peds		Approach Total	Left		Right		U-Turn	Peds			Approach Total	Thru		Right		U-Turn	Peds		Approach Total
13:00:00		10	43	0	0	0	53		11	16	0	0	27		51	12	0	0	63						143
13:15:00		7	46	0	0	53		8	15	0	0	23		56	18	0	0	74							150
13:30:00		8	59	0	0	67		18	10	0	0	28		49	11	0	0	60							155
13:45:00		8	43	0	0	51		14	17	0	0	31		55	15	0	0	70							152
Grand Total		33	191	0	0	224		51	58	0	0	109		211	56	0	0	267							600
Approach%		14.7%	85.3%	0%		-		46.8%	53.2%	0%		-		79%	21%	0%		-							-
Totals %		5.5%	31.8%	0%		37.3%		8.5%	9.7%	0%		18.2%		35.2%	9.3%	0%		44.5%							-
PHF		0.83	0.81	0		0.84		0.71	0.85	0		0.88		0.94	0.78	0		0.9							-
Heavy		3	70	0		73		14	5	0		19		67	15	0		82							-
Heavy %		9.1%	36.6%	0%		32.6%		27.5%	8.6%	0%		17.4%		31.8%	26.8%	0%		30.7%							-
Lights		30	121	0		151		37	53	0		90		144	41	0		185							-
Lights %		90.9%	63.4%	0%		67.4%		72.5%	91.4%	0%		82.6%		68.2%	73.2%	0%		69.3%							-
Single-Unit Trucks		0	27	0		27		10	2	0		12		32	8	0		40							-
Single-Unit Trucks %		0%	14.1%	0%		12.1%		19.6%	3.4%	0%		11%		15.2%	14.3%	0%		15%							-
Buses		0	0	0		0		1	0	0		1		1	0	0		1							-
Buses %		0%	0%	0%		0%		2%	0%	0%		0.9%		0.5%	0%	0%		0.4%							-
Articulated Trucks		3	43	0		46		3	3	0		6		34	7	0		41							-
Articulated Trucks %		9.1%	22.5%	0%		20.5%		5.9%	5.2%	0%		5.5%		16.1%	12.5%	0%		15.4%							-
Bicycles on Road		0	0	0		-		0	0	0		-		0	0	0		-							-
Bicycles on Road%		-	-	-	%			-	-	-	%			-	-	-	%								-

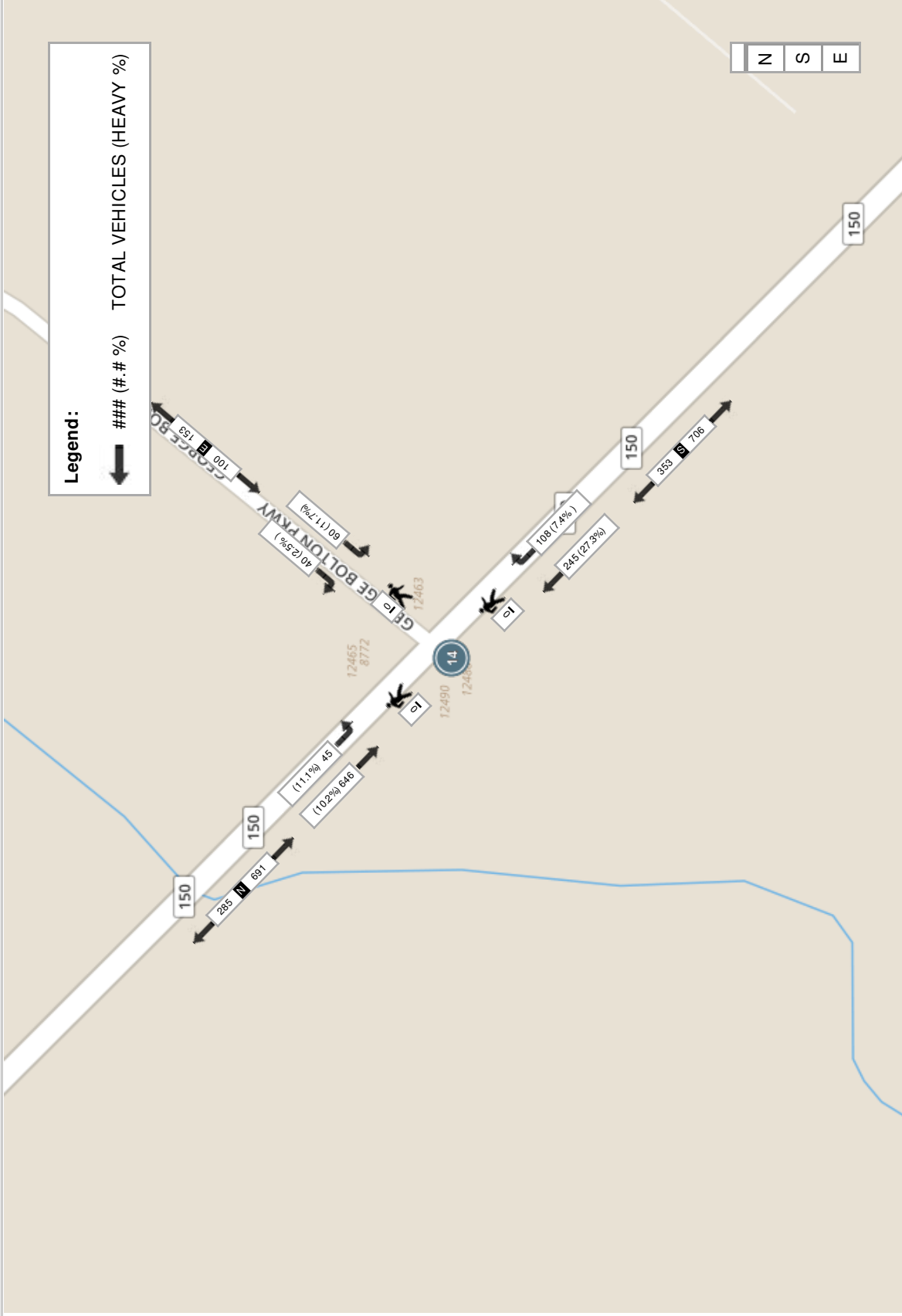


Peak Hour: 04:15 PM - 05:15 PM Weather: Mostly Cloudy (5.8 °C)

Start Time	Southbound COLERAINE DR					Westbound GEORGE BOLTON PKWY					Northbound COLERAINE DR					Int. Total (15 min)	
	Left		Thru		U-Turn	Peds	Approach Total		Left		Right		U-Turn	Peds	Approach Total		
16:15:00	10	71	0	0	0	81	34	25	0	0	59	110	18	0	0	128	268
16:30:00	5	75	0	0	0	80	36	17	0	0	53	122	15	0	0	137	270
16:45:00	6	55	0	0	0	61	25	20	0	0	45	131	18	0	0	149	255
17:00:00	3	98	0	0	0	101	62	32	0	0	94	141	17	0	0	158	353
Grand Total	24	299	0	0	0	323	157	94	0	0	251	504	68	0	0	572	1146
Approach%	7.4%	92.6%	0%			-	62.5%	37.5%	0%		-	88.1%	11.9%	0%		-	-
Totals %	2.1%	26.1%	0%			28.2%	13.7%	8.2%	0%		21.9%	44%	5.9%	0%		49.9%	-
PHF	0.6	0.76	0			0.8	0.63	0.73	0		0.67	0.89	0.94	0		0.91	-
Heavy	7	57	0			64	4	9	0		13	46	11	0		57	-
Heavy %	29.2%	19.1%	0%			19.8%	2.5%	9.6%	0%		5.2%	9.1%	16.2%	0%		10%	-
Lights	17	242	0			259	153	85	0		238	458	57	0		515	-
Lights %	70.8%	80.9%	0%			80.2%	97.5%	90.4%	0%		94.8%	90.9%	83.8%	0%		90%	-
Single-Unit Trucks	5	26	0			31	3	4	0		7	37	8	0		45	-
Single-Unit Trucks %	20.8%	8.7%	0%			9.6%	1.9%	4.3%	0%		2.8%	7.3%	11.8%	0%		7.9%	-
Buses	1	0	0			1	0	2	0		2	0	0	0		0	-
Buses %	4.2%	0%	0%			0.3%	0%	2.1%	0%		0.8%	0%	0%	0%		0%	-
Articulated Trucks	1	31	0			32	1	3	0		4	9	3	0		12	-
Articulated Trucks %	4.2%	10.4%	0%			9.9%	0.6%	3.2%	0%		1.6%	1.8%	4.4%	0%		2.1%	-
Bicycles on Road	0	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	-
Bicycles on Road%	-	-	-	%	%		-	-	-	%		-	-	-	%		-

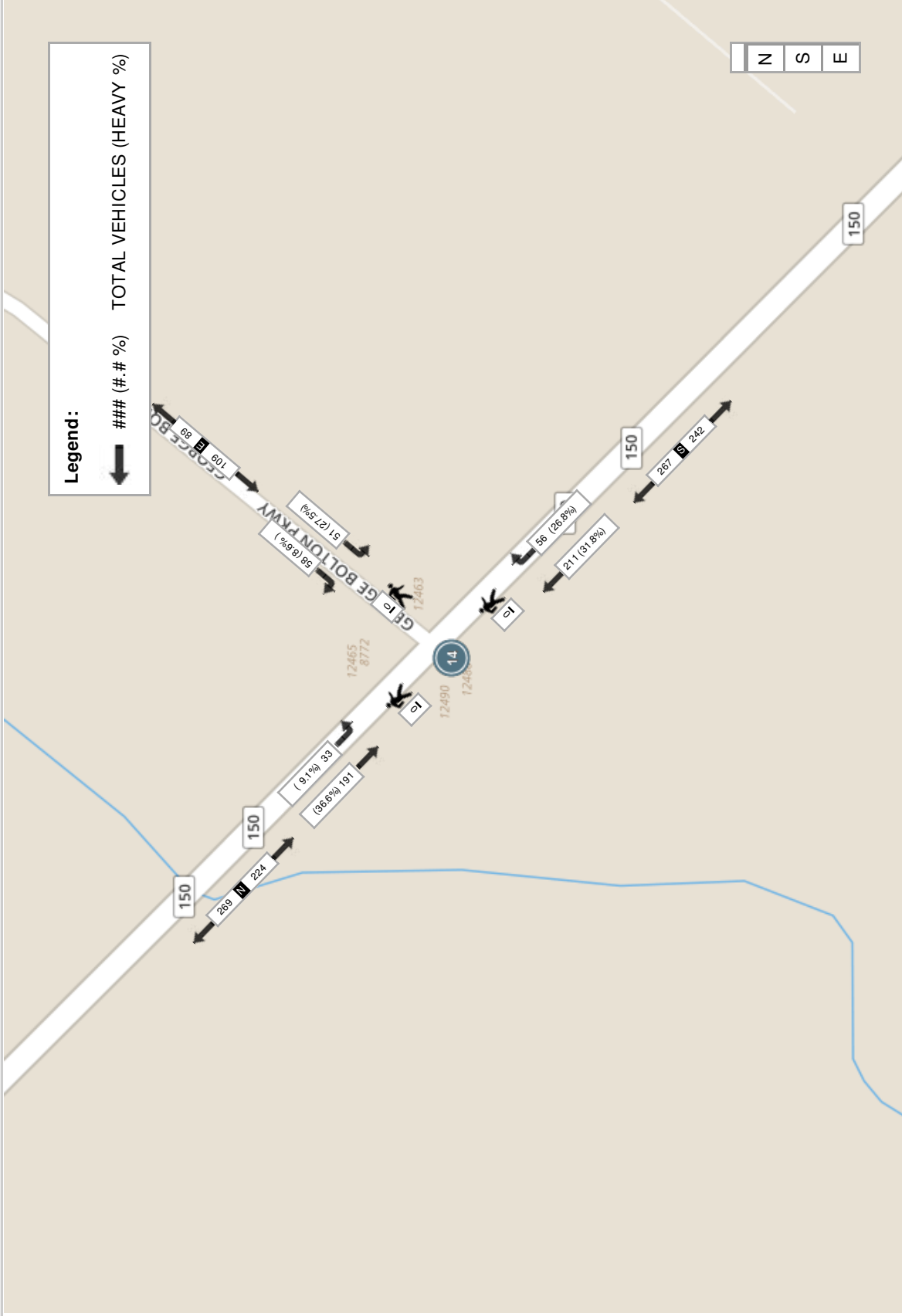


Peak Hour: 07:15 AM - 08:15 AM Weather: Mostly Cloudy (3.2 °C)



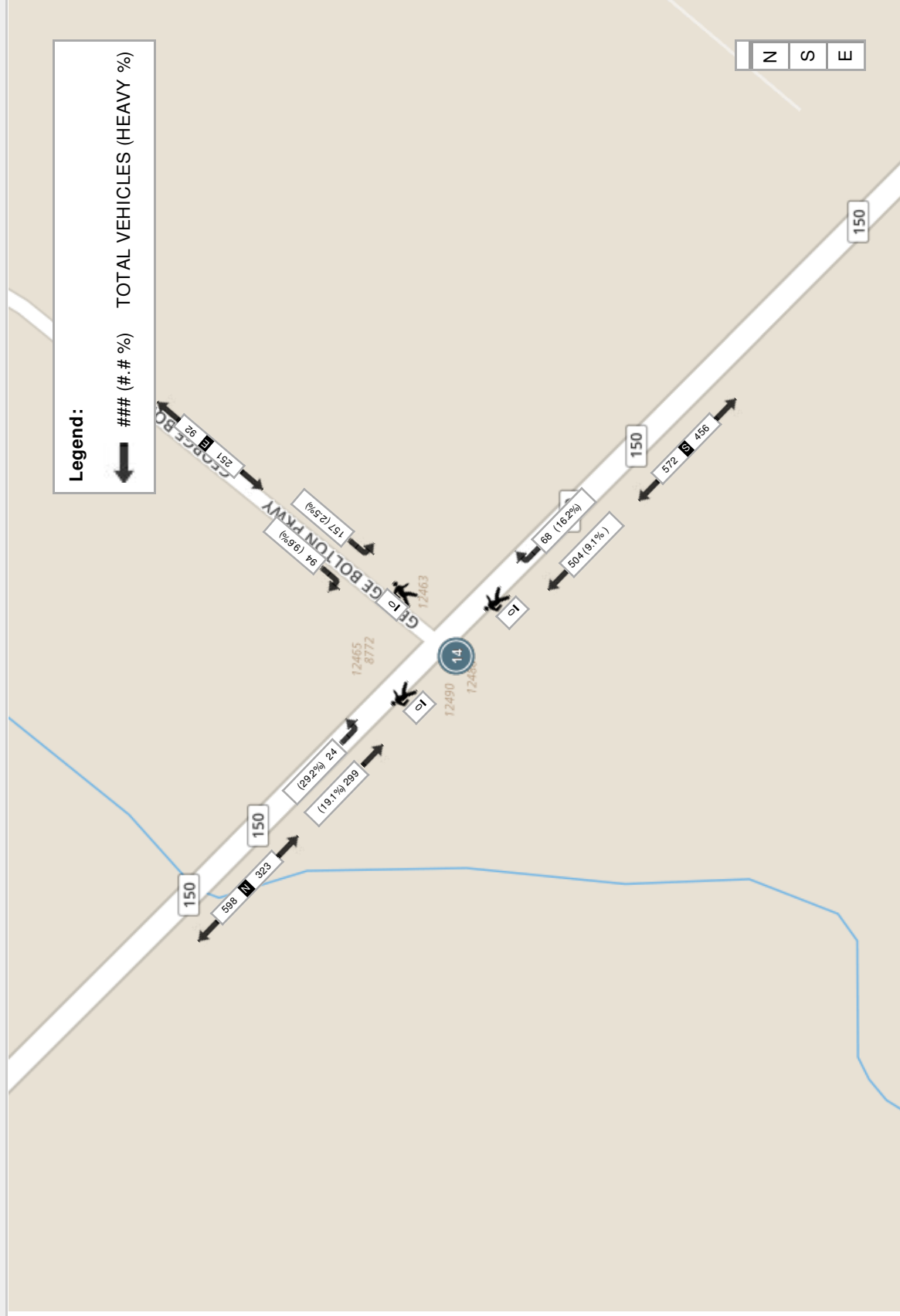


Peak Hour: 01:00 PM - 02:00 PM Weather: Mostly Cloudy (3.4 °C)



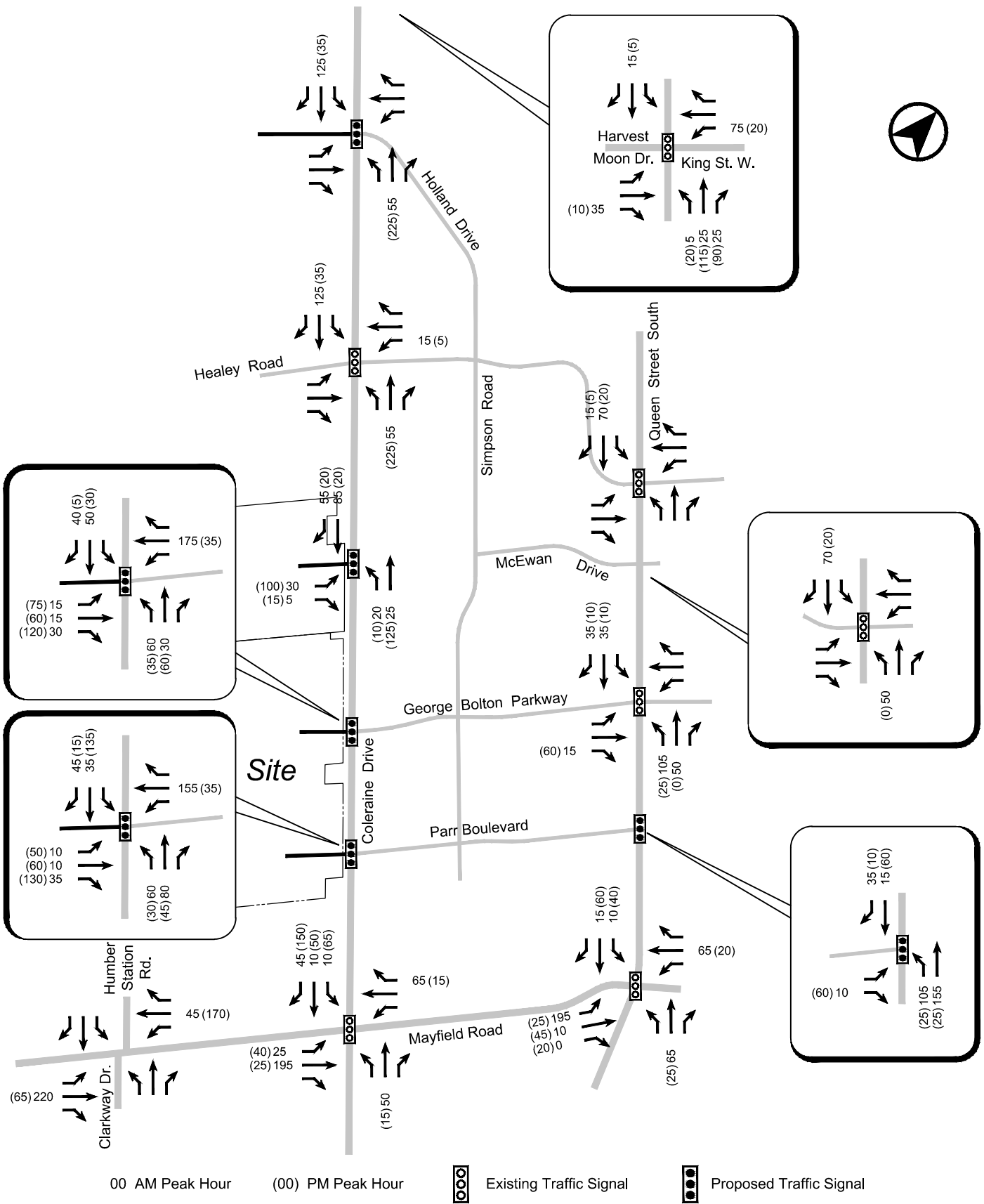


Peak Hour: 04:15 PM - 05:15 PM Weather: Mostly Cloudy (5.8 °C)



APPENDIX B

Background Studies

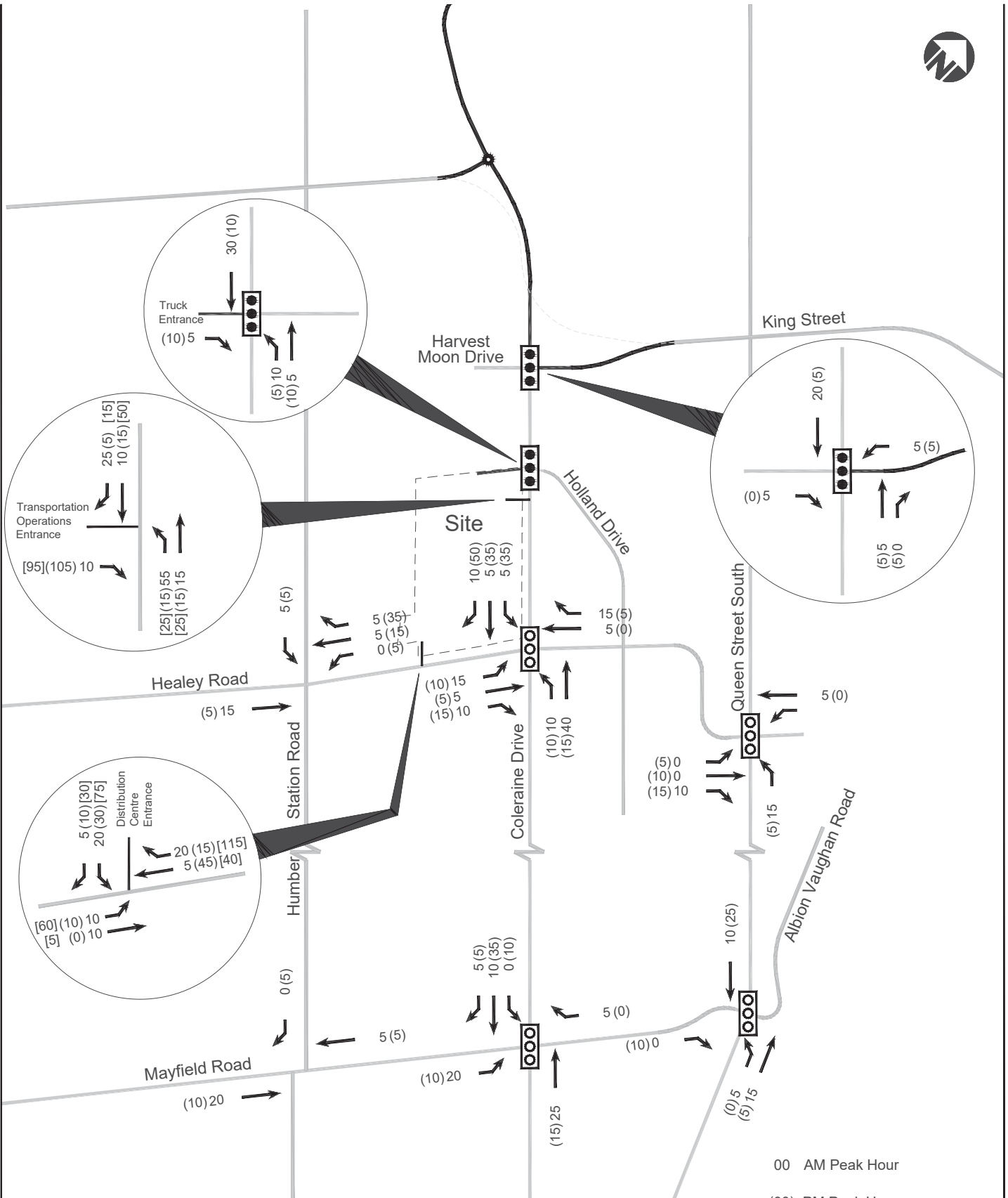


SITE TOTAL 2021 TRAFFIC VOLUMES
3 Million Sq. Ft.



DRAWING FILENAME: P:\57\67\38\Graphics\Fig07-03.dwg

DATE PLOTTED: November 29, 2011



EMPLOYEE SITE TRAFFIC VOLUMES (Transportation & Operations Building - PCU Volumes)

Figure 7





DRAWING FILENAME: P:\57\67\38\Graphics\Fig08-03.dwg

DATE PLOTTED: November 29, 2011

TRUCK & TRACTOR / BOBTAIL SITE TRAFFIC VOLUMES (PCU Volumes)

B GROUP Bolton Distribution Centre
5767-38, December 2011

- 00 AM Peak Hour
- (00) PM Peak Hour
- [00] PM Site Peak Hour
-  Existing Traffic Signal
-  Proposed Traffic Signal

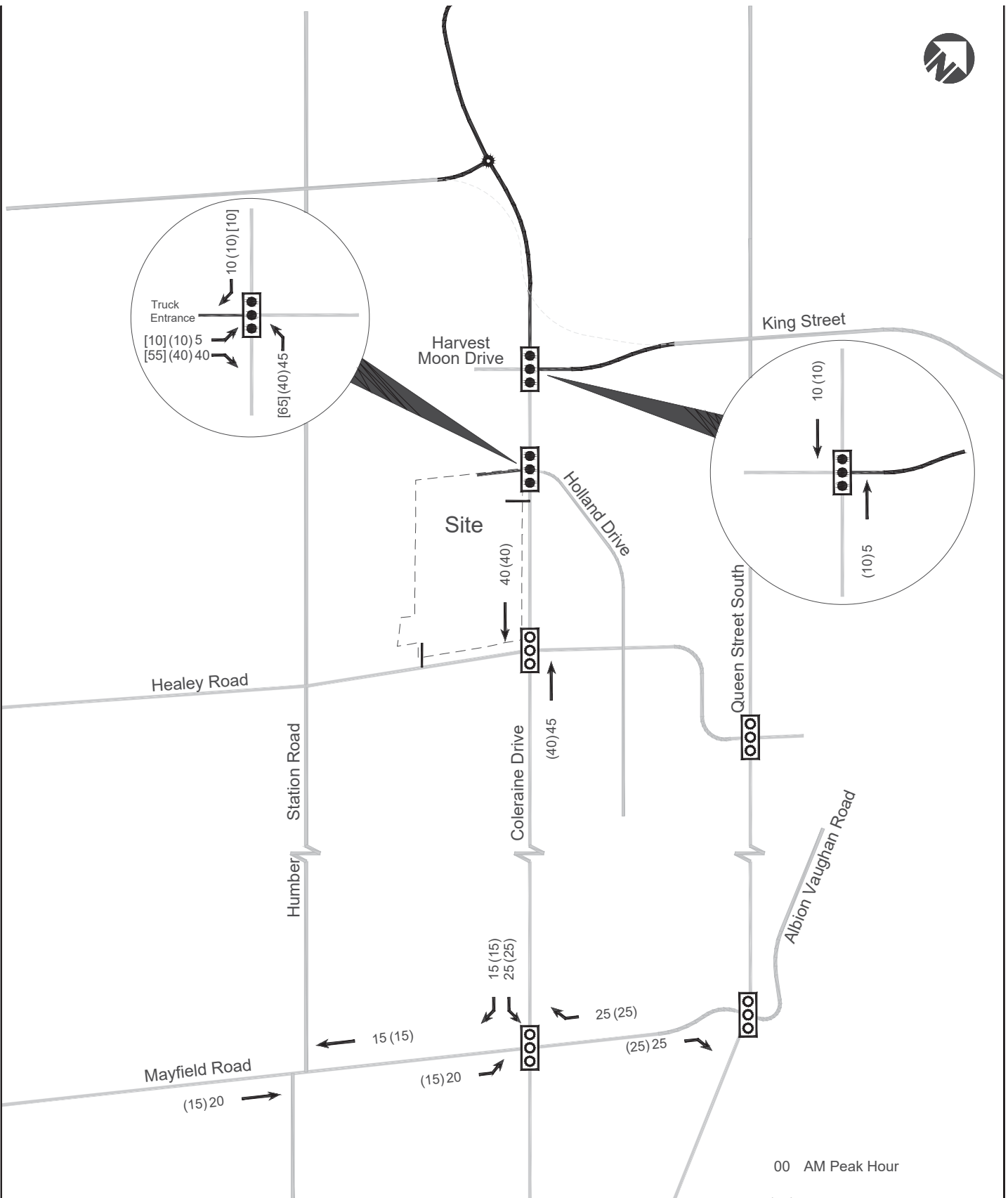


Figure 8



Simpson Road Transportation Assessment

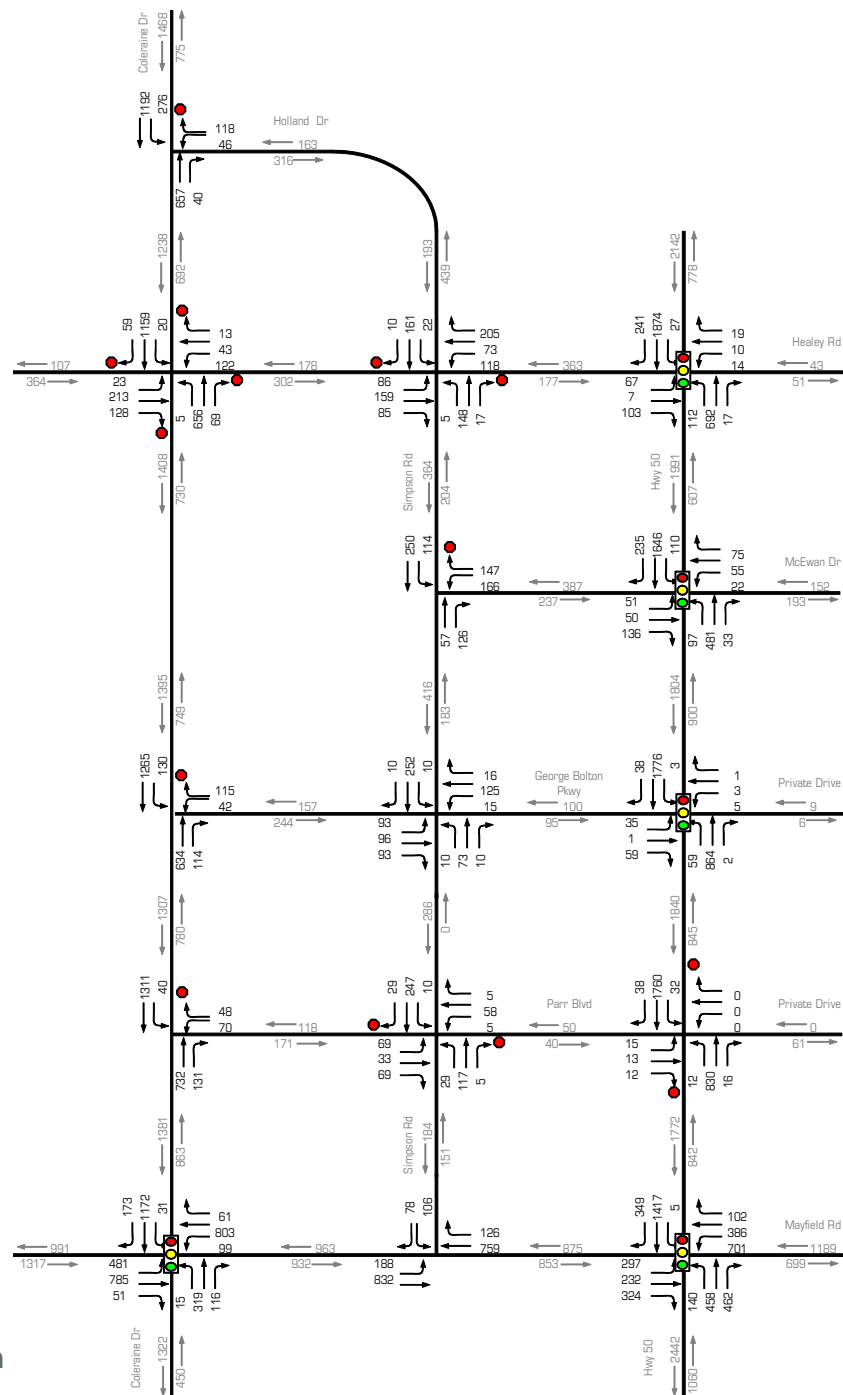


Figure 5.4a
Ultimate 2031 Total AM Peak
Hour Traffic Volumes -
with Simpson Road Completion



Simpson Road Transportation Assessment

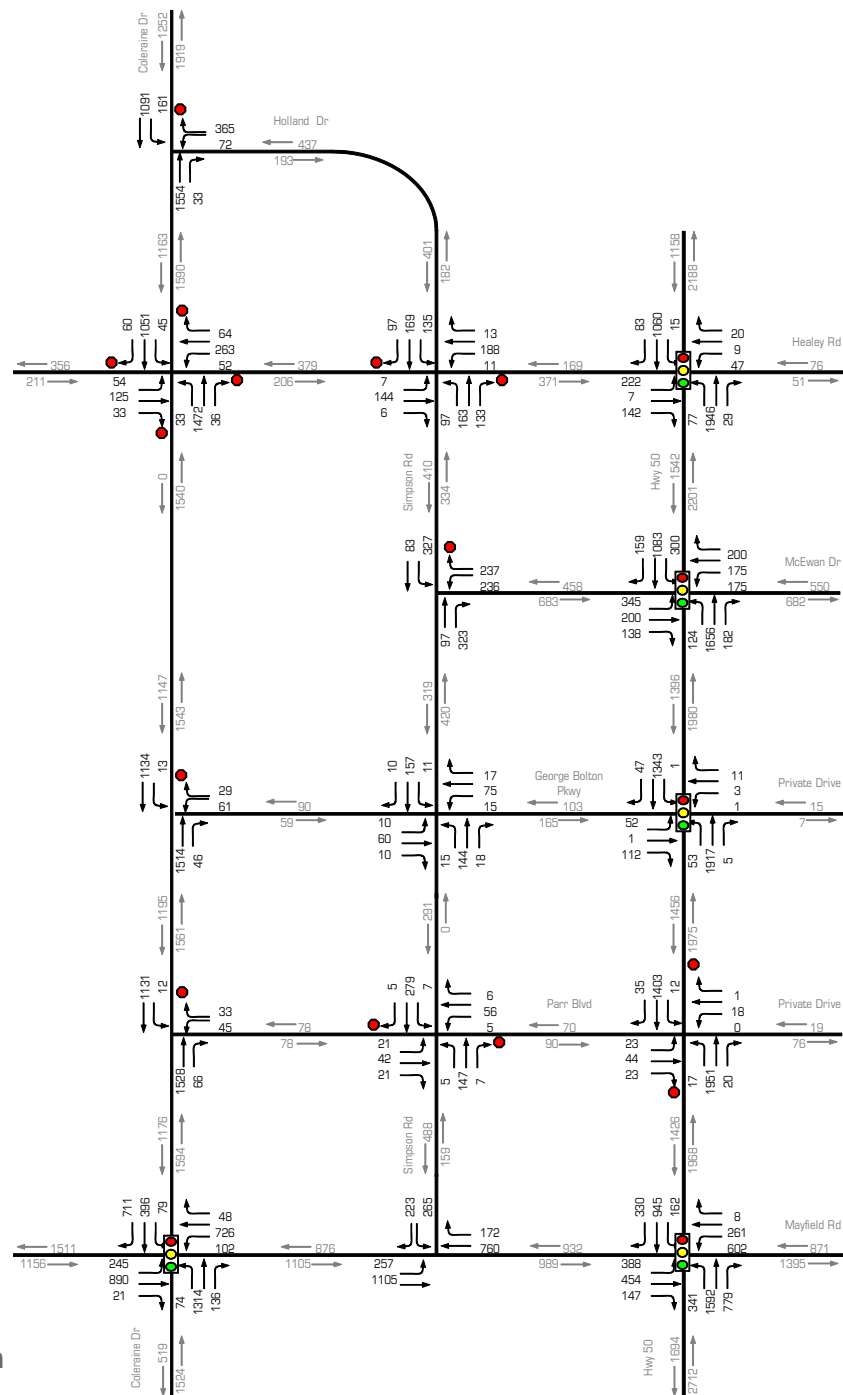


Figure 5.4b
Ultimate 2031 Total PM Peak
Hour Traffic Volumes -
with Simpson Road Completion

APPENDIX C

HISTORICAL OPERATIONS DATA

Kevin Morris

From: Melinda Holland <mholland@thebiglierigroup.com>
Sent: Thursday, April 13, 2017 9:11 AM
To: Kevin Morris
Subject: Re: 12415 Coleraine Drive - Asphalt Plant Production Capacity

Hi Kevin,

Please see our client's responses to your questions below in red:

- What are the targets for asphalt production for the plant per year? (Gencor has informed me that the plant could produce roughly 200,000 tonnes per year) **200,000**
- Hours and days of operation? **Monday to Saturday 7am to 5pm**
- Number of employees (office and plant individually)? **Office- 5-8 plant- 6-10**
- Employee arrival and departure times? **6:30am to 5:30pm**
- If available, specific information on the arrival and departure times of the delivery trucks. For example, we've had instances where trucks are lined up to enter the facility first thing in the morning and then there are few or sporadic truck trips during the day or during peak hours. **Most likely 6:30am to 5:30pm**
- Any data on which direction trucks and employees will likely be coming from, and if possible, where trucks will be heading once loaded; I realize outbound truck trips are dependent on where job sites are located so I'm not expecting too much information to be available in this regard but it doesn't hurt to ask. **All depends on deliveries and job sites. Employees will likely be from Bolton, Brampton, Vaughan vicinity.**
- Do the drivers arrive in their personal vehicles, park, and pick up a delivery vehicle on site, or do the delivery vehicles arrive independently? **Either or. We will have our trucks delivering as well as pickups from other contractors**
- Statistics from an operating site would be far more accurate than from a proxy survey and will provide very defensible data for our study. Is there one that can be used as an example? **You can see if you can get any data from cox construction, unless Gencor has any data**

I have followed up with Gencor, the plant manufacturer, in regards to an operating site that we can use as a reference. Please let me know if you require any additional information. I will be out of office next week, but please do not hesitate to contact our client's assistant, Jodi Sirai, directly at 905-951-1616 or ea@dig-con.com

Best,

On Thu, Apr 6, 2017 at 2:40 PM, Melinda Holland <mholland@thebiglierigroup.com> wrote:

Hi Kevin,

I am seeing our client tomorrow and will review this information with him. I will provide a response once I have more information.

Best,

On Thu, Apr 6, 2017 at 9:45 AM, Kevin Morris <kmorris@tmig.ca> wrote:

Hi Melinda,

We'll also need some detailed information on future operations of the site:

- Hours and days of operation
- Number of employees
- Employee arrival and departure times
- If available, specific information on the arrival and departure times of the delivery trucks. For example, we've had instances where trucks are lined up to enter the facility first thing in the morning and then there are few or sporadic truck trips during the day or during peak hours.
- Any data on which direction trucks and employees will likely be coming from, and if possible, where trucks will be heading once loaded; I realize outbound truck trips are dependent on where job sites are located so I'm not expecting too much information to be available in this regard but it doesn't hurt to ask.
- Do the drivers arrive in their personal vehicles, park, and pick up a delivery vehicle on site, or do the delivery vehicles arrive independently?

If the client can provide information from one of their other sites in regard to the above that would be very helpful. Statistics from an operating site would be far more accurate than from a proxy survey and will provide very defensible data for our study.

I've purchased the traffic counts from the Region and have spoken with Planning to nail down some of the study requirements. I've also been in touch with BA Group to get some of the background data the Region is requesting be included in our study. I haven't called traffic staff at the Region yet to discuss their comments because I will need to be able to answer any questions regarding future operations that may come up, so the sooner I can get answers to the above the better.

Thanks,

Kevin

Kevin Morris, C.E.T., LEL
Project Manager

TMIG | The Municipal Infrastructure Group Ltd.
110 Scotia Court, Unit 27 | Whitby, Ontario L1N 8Y7
c: [905.442.8616](tel:905.442.8616) | tmig.ca



Dionne Bacchus and Associates Consulting Engineers Ltd. is pleased to announce our acquisition to The Municipal Infrastructure Group Ltd. (TMIG), expanding our services to include linear infrastructure engineering, vertical infrastructure engineering, water resource engineering, and land development engineering, for both the public and private sectors. This merger brings high level, professional services that fully complement each other's range of practice areas, and establishes a Whitby-based TMIG office.

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From: Melinda Holland [mailto:mholland@thebiglierigroup.com]
Sent: Tuesday, April 4, 2017 2:03 PM
To: Kevin Morris <kmorris@tmig.ca>
Subject: 12415 Coleraine Drive - Asphalt Plant Production Capacity

Hi Kevin,

In regards to our discussion about the total number of trips to be generated from the proposed asphalt plant, I have received some preliminary information from Gencor, the asphalt plant manufacturer. I am awaiting confirmation from our client on his targets for asphalt production which will allow us to confirm the total number of trips to and from the site.

I have copied the information below that my client is currently reviewing to keep you in the loop on production capacity. I will provide you with an update as soon as my client confirms.

Our traffic consultant will require some detailed information on the capacity of the asphalt plant for the Traffic Impact Study. We will need to know how many truck trips will be made to and from the plant per day. In order to calculate this, we will require more information on how much asphalt is planned to be produced daily, weekly, monthly or annually.

I spoke with Mark Howard from Gencor who informed me that the plant is capable of 400 tonnes per hour, however most times the contractor does not run at full capacity. Therefore, he said that we will need a sense of what the goals will be in terms of production annually. We can then average this number out over 7-8 months, as they usually do not produce asphalt during December, January, February or March.

Mark Howard suggested that the average truck will carry 20-25 tonnes, some more some less. He also said that his estimate would be that the plant could produce roughly 200,000 tonnes per year.

We were hoping that you could clarify if you will have any targets for production so that we can make our assumptions accordingly.

Let me know if you require any additional information.

Best,

--

Melinda Holland
Planner



20 Leslie Street, Suite 121
Toronto, Ontario M4M 3L4

Phone: [\(416\) 693-9155](tel:4166939155)

Mobile: [\(647\) 388-8396](tel:6473888396)

Fax: [\(416\) 693-9133](tel:4166939133)

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Melinda Holland
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APPENDIX D

Capacity Analysis

HCM Unsignalized Intersection Capacity Analysis

4: Coleraine Drive & George Bolton Parkway

















2017 Baseline Traffic
AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	62	41	252	111	46	664
Future Volume (Veh/h)	62	41	252	111	46	664
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	67	45	274	121	50	722
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	1156	198			395	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1156	198			395	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	63	94			96	
cM capacity (veh/h)	182	811			1160	
Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	112	183	212	50	722	
Volume Left	67	0	0	50	0	
Volume Right	45	0	121	0	0	
cSH	264	1700	1700	1160	1700	
Volume to Capacity	0.42	0.11	0.12	0.04	0.42	
Queue Length 95th (m)	15.2	0.0	0.0	1.0	0.0	
Control Delay (s)	28.4	0.0	0.0	8.2	0.0	
Lane LOS	D			A		
Approach Delay (s)	28.4	0.0		0.5		
Approach LOS	D					
Intersection Summary						
Average Delay			2.8			
Intersection Capacity Utilization			47.6%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

5: Simpson Road & George Bolton Parkway












2017 Baseline Traffic
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	158	0	0	103	0	0	0	0	0	0	0
Future Volume (Veh/h)	0	158	0	0	103	0	0	0	0	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	172	0	0	112	0	0	0	0	0	0	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	56	0	0	86	0	0	0			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	56	0	0	86	0	0	0			0		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	81	100	100	87	100	100			100		
cM capacity (veh/h)	851	896	1085	767	896	1085	1623			1623		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	172	112	0	0								
Volume Left	0	0	0	0								
Volume Right	0	0	0	0								
cSH	896	896	1700	1700								
Volume to Capacity	0.19	0.13	0.00	0.00								
Queue Length 95th (m)	5.4	3.2	0.0	0.0								
Control Delay (s)	10.0	9.6	0.0	0.0								
Lane LOS	A	A										
Approach Delay (s)	10.0	9.6	0.0	0.0								
Approach LOS	A	A										
Intersection Summary												
Average Delay			9.8									
Intersection Capacity Utilization			11.6%		ICU Level of Service					A		
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

4: Coleraine Drive & George Bolton Parkway

















2017 Baseline Traffic
PM Peak Hour

							
Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations							
Traffic Volume (veh/h)	162	97	519	70	25	308	
Future Volume (Veh/h)	162	97	519	70	25	308	
Sign Control	Stop		Free			Free	
Grade	0%		0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly flow rate (vph)	162	97	519	70	25	308	
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	758	294			589		
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	758	294			589		
tC, single (s)	6.8	7.1			4.7		
tC, 2 stage (s)							
tF (s)	3.5	3.4			2.5		
p0 queue free %	51	86			97		
cM capacity (veh/h)	333	679			819		
Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	162	97	346	243	25	154	154
Volume Left	162	0	0	0	25	0	0
Volume Right	0	97	0	70	0	0	0
cSH	333	679	1700	1700	819	1700	1700
Volume to Capacity	0.49	0.14	0.20	0.14	0.03	0.09	0.09
Queue Length 95th (m)	19.3	3.8	0.0	0.0	0.7	0.0	0.0
Control Delay (s)	25.7	11.2	0.0	0.0	9.5	0.0	0.0
Lane LOS	D	B			A		
Approach Delay (s)	20.3		0.0		0.7		
Approach LOS	C						
Intersection Summary							
Average Delay			4.6				
Intersection Capacity Utilization			36.4%		ICU Level of Service		A
Analysis Period (min)			15				

HCM Unsignalized Intersection Capacity Analysis

5: Simpson Road & George Bolton Parkway






















2017 Baseline Traffic
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	95	0	0	259	0	0	0	0	0	0	0
Future Volume (Veh/h)	0	95	0	0	259	0	0	0	0	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	95	0	0	259	0	0	0	0	0	0	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	130	0	0	48	0	0	0			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	130	0	0	48	0	0	0			0		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	89	100	100	71	100	100			100		
cM capacity (veh/h)	655	896	1085	876	896	1085	1623			1623		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	95	259	0	0								
Volume Left	0	0	0	0								
Volume Right	0	0	0	0								
cSH	896	896	1700	1700								
Volume to Capacity	0.11	0.29	0.00	0.00								
Queue Length 95th (m)	2.7	9.1	0.0	0.0								
Control Delay (s)	9.5	10.6	0.0	0.0								
Lane LOS	A	B										
Approach Delay (s)	9.5	10.6	0.0	0.0								
Approach LOS	A	B										
Intersection Summary												
Average Delay			10.3									
Intersection Capacity Utilization			17.0%		ICU Level of Service					A		
Analysis Period (min)			15									

Timings

4: Coleraine Drive & George Bolton Parkway






















2022 Background Traffic
AM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	50.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	0		0	1		0	1		1
Taper Length (m)	2.5			50.0			7.6			7.6		
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		131.9			492.0			97.5			253.9	
Travel Time (s)		9.9			36.9			7.3			19.0	
Lane Group Flow (vph)	15	45	0	72	223	0	60	517	0	54	850	40
Act Effct Green (s)	13.3	13.3		13.3	13.3		47.7	47.7		47.7	47.7	47.7
Actuated g/C Ratio	0.19	0.19		0.19	0.19		0.68	0.68		0.68	0.68	0.68
v/c Ratio	0.09	0.13		0.31	0.62		0.15	0.26		0.10	0.38	0.04
Control Delay	22.1	12.0		26.2	30.2		6.3	4.3		5.6	6.0	2.1
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	22.1	12.0		26.2	30.2		6.3	4.3		5.6	6.0	2.1
LOS	C	B		C	C		A	A		A	A	A
Approach Delay		14.5			29.2			4.5			5.8	
Approach LOS		B			C			A			A	
Queue Length 50th (m)	1.6	1.6		8.2	24.4		2.3	8.7		2.0	20.5	0.0
Queue Length 95th (m)	5.6	8.2		16.8	39.6		8.3	18.9		7.1	39.1	3.1
Internal Link Dist (m)		107.9			468.0			73.5			229.9	
Turn Bay Length (m)				50.0								
Base Capacity (vph)	287	588		419	625		400	1995		544	2262	1104
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.05	0.08		0.17	0.36		0.15	0.26		0.10	0.38	0.04
Intersection Summary												
Area Type:	Other											
Cycle Length: 70												
Actuated Cycle Length: 70												
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.62												
Intersection Signal Delay: 9.4	Intersection LOS: A											
Intersection Capacity Utilization 51.4%	ICU Level of Service A											
Analysis Period (min) 15												

HCM Signalized Intersection Capacity Analysis

4: Coleraine Drive & George Bolton Parkway

















2022 Background Traffic
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	15	30	72	175	48	60	388	129	54	850	40
Future Volume (vph)	15	15	30	72	175	48	60	388	129	54	850	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	4.5
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.90		1.00	0.97		1.00	0.96		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1789	1695		1630	1823		1789	2880		1644	3318	1601
Flt Permitted	0.46	1.00		0.73	1.00		0.31	1.00		0.46	1.00	1.00
Satd. Flow (perm)	858	1695		1248	1823		589	2880		798	3318	1601
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	15	15	30	72	175	48	60	388	129	54	850	40
RTOR Reduction (vph)	0	24	0	0	17	0	0	32	0	0	0	13
Lane Group Flow (vph)	15	21	0	72	206	0	60	485	0	54	850	27
Heavy Vehicles (%)	2%	2%	2%	12%	2%	2%	2%	27%	7%	11%	10%	2%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	13.3	13.3		13.3	13.3		47.7	47.7		47.7	47.7	47.7
Effective Green, g (s)	13.3	13.3		13.3	13.3		47.7	47.7		47.7	47.7	47.7
Actuated g/C Ratio	0.19	0.19		0.19	0.19		0.68	0.68		0.68	0.68	0.68
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	163	322		237	346		401	1962		543	2260	1090
v/s Ratio Prot		0.01			c0.11			0.17			c0.26	
v/s Ratio Perm	0.02			0.06			0.10			0.07		0.02
v/c Ratio	0.09	0.06		0.30	0.60		0.15	0.25		0.10	0.38	0.03
Uniform Delay, d1	23.4	23.2		24.4	25.9		4.0	4.3		3.8	4.8	3.6
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.2	0.1		0.7	2.7		0.8	0.3		0.4	0.5	0.0
Delay (s)	23.6	23.3		25.1	28.6		4.7	4.6		4.2	5.3	3.7
Level of Service	C	C		C	C		A	A		A	A	A
Approach Delay (s)		23.4			27.8			4.6			5.1	
Approach LOS		C			C			A			A	
Intersection Summary												
HCM 2000 Control Delay			9.1									
HCM 2000 Volume to Capacity ratio			0.42									
Actuated Cycle Length (s)			70.0									
Intersection Capacity Utilization			51.4%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

5: Simpson Road & George Bolton Parkway






















2022 Background Traffic
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	60	78	60	17	274	19	10	73	10	10	252	10
Future Volume (Veh/h)	60	78	60	17	274	19	10	73	10	10	252	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	60	78	60	17	274	19	10	73	10	10	252	10
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	293			138			682	555	108	592	576	284
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	293			138			682	555	108	592	576	284
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	95			99			94	82	99	97	37	99
cM capacity (veh/h)	1269			1446			173	414	946	342	403	755
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	198	310	93	272								
Volume Left	60	17	10	10								
Volume Right	60	19	10	10								
cSH	1269	1446	380	407								
Volume to Capacity	0.05	0.01	0.24	0.67								
Queue Length 95th (m)	1.1	0.3	7.2	35.8								
Control Delay (s)	2.7	0.5	17.5	29.9								
Lane LOS	A	A	C	D								
Approach Delay (s)	2.7	0.5	17.5	29.9								
Approach LOS			C	D								
Intersection Summary												
Average Delay			12.0									
Intersection Capacity Utilization			53.5%	ICU Level of Service						A		
Analysis Period (min)			15									

Timings

4: Coleraine Drive & George Bolton Parkway






















2022 Background Traffic
PM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	50.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	1		0	1		0	1		1
Taper Length (m)	2.5			50.0			7.6			7.6		
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		162.8			492.0			97.5			253.9	
Travel Time (s)		12.2			36.9			7.3			19.0	
Lane Group Flow (vph)	75	180	0	187	147	0	35	783	0	29	452	5
Act Effct Green (s)	16.3	16.3		16.3	16.3		44.7	44.7		44.7	44.7	44.7
Actuated g/C Ratio	0.23	0.23		0.23	0.23		0.64	0.64		0.64	0.64	0.64
v/c Ratio	0.26	0.37		0.73	0.33		0.06	0.38		0.09	0.23	0.00
Control Delay	22.1	9.8		40.3	8.4		6.9	7.3		7.8	6.7	0.6
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	22.1	9.8		40.3	8.4		6.9	7.3		7.8	6.7	0.6
LOS	C	A		D	A		A	A		A	A	A
Approach Delay		13.4			26.3			7.3			6.7	
Approach LOS		B			C			A			A	
Queue Length 50th (m)	8.0	6.3		22.7	3.6		1.5	21.1		1.3	11.3	0.0
Queue Length 95th (m)	15.6	17.7		37.4	14.1		5.9	41.3		5.7	23.5	0.3
Internal Link Dist (m)		138.8			468.0			73.5			229.9	
Turn Bay Length (m)				50.0								
Base Capacity (vph)	412	648		370	603		590	2083		314	1958	1030
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.18	0.28		0.51	0.24		0.06	0.38		0.09	0.23	0.00
Intersection Summary												
Area Type:	Other											
Cycle Length: 70												
Actuated Cycle Length: 70												
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.73												
Intersection Signal Delay: 11.3	Intersection LOS: B											
Intersection Capacity Utilization 61.2%	ICU Level of Service B											
Analysis Period (min) 15												

HCM Signalized Intersection Capacity Analysis

4: Coleraine Drive & George Bolton Parkway

















2022 Background Traffic
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	75	60	120	187	35	112	35	702	81	29	452	5
Future Volume (vph)	75	60	120	187	35	112	35	702	81	29	452	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	4.5
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.90		1.00	0.89		1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1789	1695		1789	1574		1789	3248		1415	3067	1601
Flt Permitted	0.65	1.00		0.59	1.00		0.49	1.00		0.33	1.00	1.00
Satd. Flow (perm)	1228	1695		1103	1574		925	3248		493	3067	1601
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	75	60	120	187	35	112	35	702	81	29	452	5
RTOR Reduction (vph)	0	92	0	0	86	0	0	10	0	0	0	2
Lane Group Flow (vph)	75	88	0	187	61	0	35	773	0	29	452	3
Heavy Vehicles (%)	2%	2%	2%	2%	2%	10%	2%	10%	16%	29%	19%	2%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	16.3	16.3		16.3	16.3		44.7	44.7		44.7	44.7	44.7
Effective Green, g (s)	16.3	16.3		16.3	16.3		44.7	44.7		44.7	44.7	44.7
Actuated g/C Ratio	0.23	0.23		0.23	0.23		0.64	0.64		0.64	0.64	0.64
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	285	394		256	366		590	2074		314	1958	1022
v/s Ratio Prot		0.05			0.04			c0.24			0.15	
v/s Ratio Perm	0.06			c0.17			0.04			0.06		0.00
v/c Ratio	0.26	0.22		0.73	0.17		0.06	0.37		0.09	0.23	0.00
Uniform Delay, d1	21.9	21.7		24.8	21.4		4.8	6.0		4.9	5.4	4.6
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.5	0.3		10.2	0.2		0.2	0.5		0.6	0.3	0.0
Delay (s)	22.4	22.0		35.0	21.6		4.9	6.5		5.4	5.6	4.6
Level of Service	C	C		D	C		A	A		A	A	A
Approach Delay (s)		22.1			29.1			6.4			5.6	
Approach LOS		C			C			A			A	
Intersection Summary												
HCM 2000 Control Delay			12.4									
HCM 2000 Volume to Capacity ratio			0.47									
Actuated Cycle Length (s)			70.0									
Intersection Capacity Utilization			61.2%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

5: Simpson Road & George Bolton Parkway






















2022 Background Traffic
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	154	8	17	310	20	15	144	18	11	157	10
Future Volume (Veh/h)	8	154	8	17	310	20	15	144	18	11	157	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	8	154	8	17	310	20	15	144	18	11	157	10
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	330			162			616	538	158	618	532	320
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	330			162			616	538	158	618	532	320
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			99			95	67	98	96	65	99
cM capacity (veh/h)	1229			1417			284	442	887	290	445	721
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	170	347	177	178								
Volume Left	8	17	15	11								
Volume Right	8	20	18	10								
cSH	1229	1417	443	440								
Volume to Capacity	0.01	0.01	0.40	0.40								
Queue Length 95th (m)	0.1	0.3	14.3	14.6								
Control Delay (s)	0.4	0.5	18.4	18.6								
Lane LOS	A	A	C	C								
Approach Delay (s)	0.4	0.5	18.4	18.6								
Approach LOS			C	C								
Intersection Summary												
Average Delay			7.8									
Intersection Capacity Utilization			43.5%		ICU Level of Service				A			
Analysis Period (min)			15									

Timings

4: Coleraine Drive & George Bolton Parkway

2022 Future Total Traffic
AM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	50.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	0		0	1		0	1		1
Taper Length (m)	2.5			50.0			7.6			7.6		
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		131.9			492.0			97.5			253.9	
Travel Time (s)		9.9			36.9			7.3			19.0	
Lane Group Flow (vph)	15	45	0	72	242	0	60	517	0	73	850	40
Act Effct Green (s)	13.8	13.8		13.8	13.8		47.2	47.2		47.2	47.2	47.2
Actuated g/C Ratio	0.20	0.20		0.20	0.20		0.67	0.67		0.67	0.67	0.67
v/c Ratio	0.10	0.13		0.29	0.64		0.15	0.26		0.14	0.38	0.04
Control Delay	21.8	11.7		25.4	29.7		6.6	4.5		6.1	6.2	2.2
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	21.8	11.7		25.4	29.7		6.6	4.5		6.1	6.2	2.2
LOS	C	B		C	C		A	A		A	A	A
Approach Delay		14.2			28.7			4.7			6.1	
Approach LOS		B			C			A			A	
Queue Length 50th (m)	1.6	1.6		8.1	25.6		2.4	9.0		2.8	21.1	0.0
Queue Length 95th (m)	5.5	8.0		16.5	41.3		8.6	19.6		9.5	40.5	3.2
Internal Link Dist (m)		107.9			468.0			73.5			229.9	
Turn Bay Length (m)				50.0								
Base Capacity (vph)	266	588		419	625		395	1976		538	2239	1093
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.06	0.08		0.17	0.39		0.15	0.26		0.14	0.38	0.04

Intersection Summary






















Area Type: Other
 Cycle Length: 70
 Actuated Cycle Length: 70
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.64
 Intersection Signal Delay: 9.6
 Intersection Capacity Utilization 52.2%
 Analysis Period (min) 15

Intersection LOS: A
 ICU Level of Service A

HCM Signalized Intersection Capacity Analysis

4: Coleraine Drive & George Bolton Parkway

















2022 Future Total Traffic
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	15	30	72	175	67	60	388	129	73	850	40
Future Volume (vph)	15	15	30	72	175	67	60	388	129	73	850	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	4.5
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.90		1.00	0.96		1.00	0.96		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1789	1695		1630	1805		1789	2880		1644	3318	1601
Flt Permitted	0.42	1.00		0.73	1.00		0.31	1.00		0.46	1.00	1.00
Satd. Flow (perm)	795	1695		1248	1805		586	2880		798	3318	1601
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	15	15	30	72	175	67	60	388	129	73	850	40
RTOR Reduction (vph)	0	24	0	0	24	0	0	33	0	0	0	13
Lane Group Flow (vph)	15	21	0	72	218	0	60	484	0	73	850	27
Heavy Vehicles (%)	2%	2%	2%	12%	2%	2%	2%	27%	7%	11%	10%	2%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	13.8	13.8		13.8	13.8		47.2	47.2		47.2	47.2	47.2
Effective Green, g (s)	13.8	13.8		13.8	13.8		47.2	47.2		47.2	47.2	47.2
Actuated g/C Ratio	0.20	0.20		0.20	0.20		0.67	0.67		0.67	0.67	0.67
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	156	334		246	355		395	1941		538	2237	1079
v/s Ratio Prot		0.01			c0.12			0.17			c0.26	
v/s Ratio Perm	0.02			0.06			0.10			0.09		0.02
v/c Ratio	0.10	0.06		0.29	0.61		0.15	0.25		0.14	0.38	0.02
Uniform Delay, d1	23.0	22.8		23.9	25.7		4.1	4.5		4.1	5.0	3.8
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.3	0.1		0.7	3.1		0.8	0.3		0.5	0.5	0.0
Delay (s)	23.3	22.9		24.6	28.8		5.0	4.8		4.6	5.5	3.8
Level of Service	C	C		C	C		A	A		A	A	A
Approach Delay (s)		23.0			27.8			4.8			5.3	
Approach LOS		C			C			A			A	
Intersection Summary												
HCM 2000 Control Delay			9.4			HCM 2000 Level of Service			A			
HCM 2000 Volume to Capacity ratio			0.43									
Actuated Cycle Length (s)			70.0			Sum of lost time (s)			9.0			
Intersection Capacity Utilization			52.2%			ICU Level of Service			A			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

5: Simpson Road & George Bolton Parkway










2022 Future Total Traffic
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	60	78	79	17	274	19	29	73	10	10	252	10
Future Volume (Veh/h)	60	78	79	17	274	19	29	73	10	10	252	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	60	78	79	17	274	19	29	73	10	10	252	10
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	293			157			691	564	118	602	594	284
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	293			157			691	564	118	602	594	284
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	95			99			82	82	99	97	36	99
cM capacity (veh/h)	1269			1423			165	409	934	336	393	755
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	217	310	112	272								
Volume Left	60	17	29	10								
Volume Right	79	19	10	10								
cSH	1269	1423	307	398								
Volume to Capacity	0.05	0.01	0.36	0.68								
Queue Length 95th (m)	1.1	0.3	12.3	37.5								
Control Delay (s)	2.5	0.5	23.3	31.5								
Lane LOS	A	A	C	D								
Approach Delay (s)	2.5	0.5	23.3	31.5								
Approach LOS			C	D								
Intersection Summary												
Average Delay			13.0									
Intersection Capacity Utilization			56.9%		ICU Level of Service				B			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

7: Coleraine Drive & RILI-RO Access

2022 Future Total Traffic
AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	0	577	0	0	952
Future Volume (Veh/h)	0	0	577	0	0	952
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	577	0	0	952
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)						98
pX, platoon unblocked	0.89					
vC, conflicting volume	1053	288			577	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	824	288			577	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	278	708			993	
Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	0	385	192	476	476	
Volume Left	0	0	0	0	0	
Volume Right	0	0	0	0	0	
cSH	1700	1700	1700	1700	1700	
Volume to Capacity	0.00	0.23	0.11	0.28	0.28	
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	
Lane LOS	A					
Approach Delay (s)	0.0	0.0		0.0		
Approach LOS	A					
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utilization			29.6%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

9: Simpson Road & Full Moves In Access

2022 Future Total Traffic
AM Peak Hour



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	12	112	330	19
Future Volume (Veh/h)	0	0	12	112	330	19
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	13	122	359	21
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	518	370	380			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	518	370	380			
tC, single (s)	7.4	7.2	5.1			
tC, 2 stage (s)						
tF (s)	4.4	4.2	3.1			
p0 queue free %	100	100	98			
cM capacity (veh/h)	375	504	795			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	0	135	380			
Volume Left	0	13	0			
Volume Right	0	0	21			
cSH	1700	795	1700			
Volume to Capacity	0.00	0.02	0.22			
Queue Length 95th (m)	0.0	0.4	0.0			
Control Delay (s)	0.0	1.1	0.0			
Lane LOS	A	A				
Approach Delay (s)	0.0	1.1	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			0.3			
Intersection Capacity Utilization			21.9%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

11: Simpson Road & Full Moves Out Access

2022 Future Total Traffic
AM Peak Hour
























Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	19	12	0	105	330	0
Future Volume (Veh/h)	19	12	0	105	330	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	21	13	0	114	359	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	473	359	359			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	473	359	359			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	98	100			
cM capacity (veh/h)	550	685	1200			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	34	114	359			
Volume Left	21	0	0			
Volume Right	13	0	0			
cSH	595	1200	1700			
Volume to Capacity	0.06	0.00	0.21			
Queue Length 95th (m)	1.4	0.0	0.0			
Control Delay (s)	11.4	0.0	0.0			
Lane LOS	B					
Approach Delay (s)	11.4	0.0	0.0			
Approach LOS	B					
Intersection Summary						
Average Delay			0.8			
Intersection Capacity Utilization			27.4%	ICU Level of Service		A
Analysis Period (min)			15			

Timings

4: Coleraine Drive & George Bolton Parkway






















2022 Total Traffic
AM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	50.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	1		0	1		0	1		1
Taper Length (m)	2.5			50.0			7.6			7.6		
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		162.8			492.0			97.5			253.9	
Travel Time (s)		12.2			36.9			7.3			19.0	
Lane Group Flow (vph)	75	180	0	187	170	0	35	790	0	48	452	5
Act Effct Green (s)	16.3	16.3		16.3	16.3		44.7	44.7		44.7	44.7	44.7
Actuated g/C Ratio	0.23	0.23		0.23	0.23		0.64	0.64		0.64	0.64	0.64
v/c Ratio	0.28	0.37		0.73	0.36		0.06	0.38		0.15	0.23	0.00
Control Delay	22.7	9.8		40.3	8.1		6.9	7.4		8.5	6.7	0.6
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	22.7	9.8		40.3	8.1		6.9	7.4		8.5	6.7	0.6
LOS	C	A		D	A		A	A		A	A	A
Approach Delay		13.6			25.0			7.3			6.8	
Approach LOS		B			C			A			A	
Queue Length 50th (m)	8.1	6.3		22.7	3.6		1.5	21.4		2.2	11.3	0.0
Queue Length 95th (m)	15.8	17.7		37.4	14.9		5.9	41.7		8.6	23.5	0.3
Internal Link Dist (m)		138.8			468.0			73.5			229.9	
Turn Bay Length (m)				50.0								
Base Capacity (vph)	383	648		370	614		590	2085		311	1958	1030
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.20	0.28		0.51	0.28		0.06	0.38		0.15	0.23	0.00
Intersection Summary												
Area Type:	Other											
Cycle Length: 70												
Actuated Cycle Length: 70												
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.73												
Intersection Signal Delay: 11.3	Intersection LOS: B											
Intersection Capacity Utilization 62.2%	ICU Level of Service B											
Analysis Period (min) 15												

HCM Signalized Intersection Capacity Analysis

4: Coleraine Drive & George Bolton Parkway

















2022 Total Traffic
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	75	60	120	187	35	135	35	709	81	48	452	5
Future Volume (vph)	75	60	120	187	35	135	35	709	81	48	452	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	4.5
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.90		1.00	0.88		1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1789	1695		1789	1562		1789	3249		1415	3067	1601
Flt Permitted	0.61	1.00		0.59	1.00		0.49	1.00		0.33	1.00	1.00
Satd. Flow (perm)	1141	1695		1103	1562		925	3249		489	3067	1601
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	75	60	120	187	35	135	35	709	81	48	452	5
RTOR Reduction (vph)	0	92	0	0	104	0	0	10	0	0	0	2
Lane Group Flow (vph)	75	88	0	187	66	0	35	780	0	48	452	3
Heavy Vehicles (%)	2%	2%	2%	2%	2%	10%	2%	10%	16%	29%	19%	2%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	16.3	16.3		16.3	16.3		44.7	44.7		44.7	44.7	44.7
Effective Green, g (s)	16.3	16.3		16.3	16.3		44.7	44.7		44.7	44.7	44.7
Actuated g/C Ratio	0.23	0.23		0.23	0.23		0.64	0.64		0.64	0.64	0.64
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	265	394		256	363		590	2074		312	1958	1022
v/s Ratio Prot		0.05			0.04			c0.24			0.15	
v/s Ratio Perm	0.07			c0.17			0.04			0.10		0.00
v/c Ratio	0.28	0.22		0.73	0.18		0.06	0.38		0.15	0.23	0.00
Uniform Delay, d1	22.1	21.7		24.8	21.5		4.8	6.0		5.1	5.4	4.6
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.6	0.3		10.2	0.2		0.2	0.5		1.0	0.3	0.0
Delay (s)	22.6	22.0		35.0	21.8		4.9	6.5		6.1	5.6	4.6
Level of Service	C	C		D	C		A	A		A	A	A
Approach Delay (s)		22.2			28.7			6.5			5.7	
Approach LOS		C			C			A			A	
Intersection Summary												
HCM 2000 Control Delay			12.4									
HCM 2000 Volume to Capacity ratio			0.47									
Actuated Cycle Length (s)			70.0									
Intersection Capacity Utilization			62.2%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

5: Simpson Road & George Bolton Parkway










2022 Total Traffic
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	154	27	17	310	20	38	144	18	11	157	10
Future Volume (Veh/h)	8	154	27	17	310	20	38	144	18	11	157	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	8	154	27	17	310	20	38	144	18	11	157	10
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	330			181			626	548	168	628	551	320
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	330			181			626	548	168	628	551	320
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			99			86	67	98	96	64	99
cM capacity (veh/h)	1229			1394			277	436	877	284	434	721
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	189	347	200	178								
Volume Left	8	17	38	11								
Volume Right	27	20	18	10								
cSH	1229	1394	410	430								
Volume to Capacity	0.01	0.01	0.49	0.41								
Queue Length 95th (m)	0.1	0.3	19.8	15.2								
Control Delay (s)	0.4	0.5	21.9	19.2								
Lane LOS	A	A	C	C								
Approach Delay (s)	0.4	0.5	21.9	19.2								
Approach LOS			C	C								
Intersection Summary												
Average Delay			8.8									
Intersection Capacity Utilization			52.2%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

7: Coleraine Drive & RILI-RO Access

2022 Total Traffic
AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	7	818	0	0	759
Future Volume (Veh/h)	0	7	818	0	0	759
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	7	818	0	0	759
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)						98
pX, platoon unblocked	0.96					
vC, conflicting volume	1198	409			818	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1127	409			818	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	99			100	
cM capacity (veh/h)	191	592			806	
Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	7	545	273	253	506	
Volume Left	0	0	0	0	0	
Volume Right	7	0	0	0	0	
cSH	592	1700	1700	806	1700	
Volume to Capacity	0.01	0.32	0.16	0.00	0.30	
Queue Length 95th (m)	0.3	0.0	0.0	0.0	0.0	
Control Delay (s)	11.2	0.0	0.0	0.0	0.0	
Lane LOS	B					
Approach Delay (s)	11.2	0.0		0.0		
Approach LOS	B					
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utilization			32.6%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

9: Simpson Road & Full Moves In Access

2022 Total Traffic
AM Peak Hour



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	12	200	183	19
Future Volume (Veh/h)	0	0	12	200	183	19
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	13	217	199	21
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	452	210	220			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	452	210	220			
tC, single (s)	7.4	7.2	5.1			
tC, 2 stage (s)						
tF (s)	4.4	4.2	3.1			
p0 queue free %	100	100	99			
cM capacity (veh/h)	414	635	933			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	0	230	220			
Volume Left	0	13	0			
Volume Right	0	0	21			
cSH	1700	933	1700			
Volume to Capacity	0.03	0.01	0.13			
Queue Length 95th (m)	0.0	0.3	0.0			
Control Delay (s)	0.0	0.6	0.0			
Lane LOS	A	A				
Approach Delay (s)	0.0	0.6	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			0.3			
Intersection Capacity Utilization			23.7%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

11: Simpson Road & Full Moves Out Access

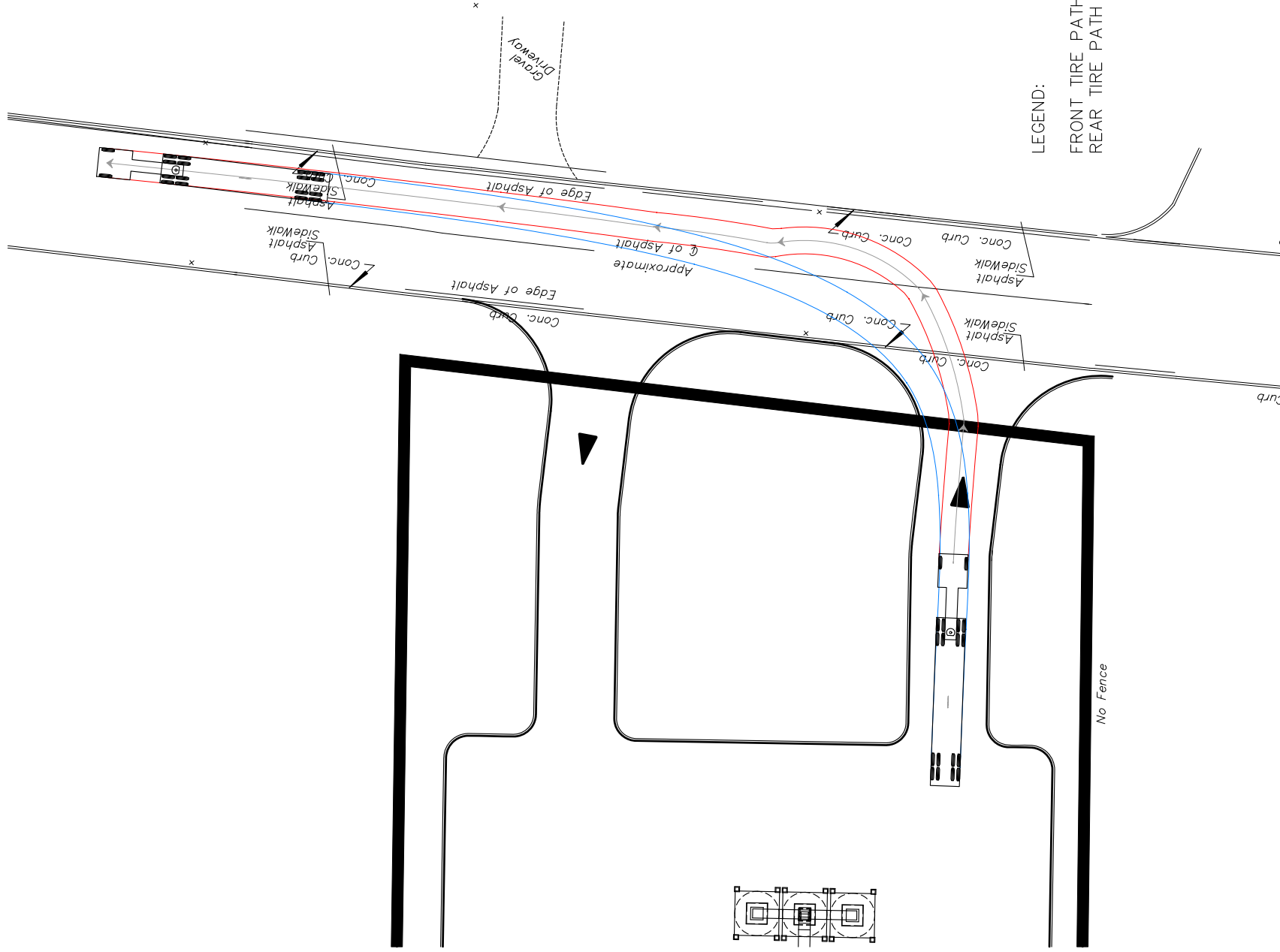
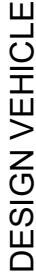
2022 Total Traffic
AM Peak Hour



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	23	19	0	189	183	0
Future Volume (Veh/h)	23	19	0	189	183	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	25	21	0	205	199	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	404	199	199			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	404	199	199			
tC, single (s)	7.4	7.2	5.1			
tC, 2 stage (s)						
tF (s)	4.4	4.2	3.1			
p0 queue free %	94	97	100			
cM capacity (veh/h)	452	645	953			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	46	205	199			
Volume Left	25	0	0			
Volume Right	21	0	0			
cSH	523	953	1700			
Volume to Capacity	0.09	0.00	0.12			
Queue Length 95th (m)	2.2	0.0	0.0			
Control Delay (s)	12.5	0.0	0.0			
Lane LOS	B					
Approach Delay (s)	12.5	0.0	0.0			
Approach LOS	B					
Intersection Summary						
Average Delay			1.3			
Intersection Capacity Utilization			19.9%	ICU Level of Service		A
Analysis Period (min)			15			

APPENDIX E

SWEPT PATH ANALYSIS



COLERAINE ASPHALT PLANT
WB-19 SIMPSON ROAD ACCESS
TO/FROM NORTH

APPENDIX F

SIGHTLINE ANALYSIS

COLERAINE ASPHALT PLANT
SIGHTLINE ANALYSIS

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The Municipal Infrastructure Group Ltd

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DATE:	PROJECT No.:
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SEPT. 2017

SCALE:		DRAWING No.:
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