



BURNSIDE

**Puslinch Industrial Development
(Lambda Properties)**

**Traffic Impact Study for Rezoning
Application
c/o Black, Shoemaker, Robinson &
Donaldson Ltd.**

**R.J. Burnside & Associates Limited
292 Speedvale Avenue West Unit 20
Guelph ON N1H 1C4 CANADA**

**November 2014
300032929.0000**

Record of Revisions

Revision	Date	Description
0	May 27, 2013	Initial Submission to client for review
1	November 13, 2014	Final Submission

Executive Summary

This study has been completed to assess the traffic impacts associated with the development of approximately 29.4 hectares of industrial lands (17.8 hectares developable) on McLean Road. This Traffic Impact Study (TIS) is in support of an application to rezone these lands from agricultural to rural industrial zoning.

Based on the analysis completed, the main conclusions and recommendations of this study are summarized as follows:

- The proposed development is forecast to generate total traffic (two-way) of 330 vehicles per hour (vph) in the a.m. peak hour and 319 vph in the p.m. peak hour.
- All accesses are forecast to operate acceptably through horizon year 2020 under Total Traffic conditions (i.e., including growth in background traffic, traffic from external developments and traffic from the site development).
- It is forecast that the Ministry of Transportation warrants for a westbound left turn lane (15 metres storage) will be met during the a.m. peak hour at Access No. 3, under total traffic conditions in 2015 and 2020 and during the a.m. peak hour at Access No. 2 under total traffic conditions in 2020. However, final access locations and lot sizes and uses are still subject to change, and the requirement for turning lanes should be further considered as final concepts are developed.
- Sight distances are acceptable at all of the conceptual access locations, with the exception of Access No. 1. The sight distance to the west at Access No. 1, for large trucks turning to the west, does not meet Transportation Association of Canada (TAC) criteria. However the available sight distance does provide the recommended stopping sight distance and therefore the available sight distance is considered to be acceptable, given the low traffic volumes anticipated to use this movement.

Table of Contents

Record of Revisions

Record of Revisions	i
---------------------------	---

Executive Summary	ii
-------------------------	----

1.0 Introduction.....	1
1.1 Study Purpose	1
1.2 Background Information	1
1.3 Site Description.....	1
1.4 Proposed Development Concept	2
2.0 Existing Roads and Access	3
3.0 Traffic Forecasts	4
3.1 Analysis Period	4
3.2 Background Traffic.....	4
3.3 Site Generated Traffic Volumes	5
3.4 Total Traffic Forecasts	6
4.0 Traffic Impact Analysis.....	7
4.1 Analysis Criteria and Approach	7
4.2 Turning Lane Considerations	7
4.3 Intersection Operations	8
4.4 Sight Distances at Accesses	9
5.0 Conclusions and Recommendations	12

Table of Contents (Continued)

Tables

Table 3.1 – Trip Generation From Proposed Development*	5
Table 4.1 – Left Turn Lane Warrants for Accesses (Total Traffic)	8
Table 4.2 – Level of Service Definitions for Unsignalized Accesses	8
Table 4.3 – Access Operations (Total Traffic).....	9
Table 4.2 – Stopping Sight Distance (Passenger Cars and Trucks).....	9
Table 4.3 – Turning Sight Distance (Passenger Cars)	10
Table 4.4 – Turning Sight Distance (Trucks).....	10

Appendices

A	Figures
A1	Site Location
A2	Concept Plan
A3	Lane Configuration
A4	Background Traffic (2015)
A5	Background Traffic including External Development (2020)
A6	Total Traffic (2015)
A7	Total Traffic (2020)
B	Traffic Count Data
C	Left Turn Lane Warrants
D	Total Traffic (2015) Synchro Analysis
E	Total Traffic (2020) Synchro Analysis

1.0 Introduction

1.1 Study Purpose

R. J. Burnside & Associates Limited was retained by Lambda Properties to prepare a Traffic Impact Study (TIS) in support of an application to rezone an agricultural parcel to rural industrial zoning. The site is located on McLean Road West, between Kerr Crescent and Concession Road 7, in the Township of Puslinch.

The purpose of this TIS is to assess the traffic impacts/mitigation requirements associated with the proposed development, particularly at the proposed accesses onto McLean Road.

1.2 Background Information

The following reports were reviewed in the preparation of this TIS:

- Functional Servicing Report for Lambda Properties; dated February 2013; prepared by R. J. Burnside & Associates Limited
- Puslinch Township Zoning By-Law 19/85; July 1985, September 2012 Consolidation; Township of Puslinch
- Wellington County Official Plan, Last Revision February 2011; County of Wellington
- Development Charges Background Study, County of Wellington; April 2012; prepared by Watson & Associates Ltd.
- Proposed Industrial Traffic Impact Study, 340268 Ontario Limited; December 2010; prepared by Paradigm Transportation Solutions Limited.

1.3 Site Description

The site is located on the northeast half of Lot 26, Concession 7, Township of Puslinch, County of Wellington, as shown on Figure A1 (Appendix A). The site is located in Special Policy Area 7-1 (Schedule A7, Wellington County Official Plan), known as the Puslinch Economic Development Area. This is an area intended to service the Township by providing locations for economic activity and employment opportunities.

For the purposes of this study, Mclean Road is considered to run east-west and Wellington Road 46 is considered to run north-south.

The adjacent land uses are industrial to the east (Aberfoyle Industrial Area), resource extraction to the north, and Highway 401 to the south and west.

The site is approximately 29.4 hectares, although only 17.8 hectares are developable, with the remaining 11.6 hectares being designated for possible highway expansion. The majority of the site is farmland, with a small gravel pit and sparsely-wooded area along the east limit. The site is currently vacant and was historically used for agricultural purposes and aggregate extraction.

1.4 Proposed Development Concept

The site is proposed to be rezoned to rural industrial, which have the following allowable land uses, under the Township's zoning by-law:

- Body Shop
- Building or construction contractor's yard
- Business office
- Concrete plant
- Factory outlet
- Feed mill
- Grain Storing, weighing and drying operation
- Fuel depot
- Home occupation accessory; to a permitted existing single dwelling
- Industrial use
- Public use, including Municipal Airport and related activities
- Retail lumber and building supply yard
- Restaurant
- Sawmill
- Service trade
- Transport terminal
- Warehouse

For the purposes of this study, a conceptual plan has been developed that includes three lots, as shown in Figure A2 (Appendix A). However, since no end users have yet been confirmed for the site, these are concepts only, subject to changes at the Site Plan Approval stage, once the lands are marketed.

The preliminary concepts assume typical "dry industry" development on the subject lands, with assumed maximum building coverage of 40%, along with sufficient parking area to meet the Township's Zoning By-Law 19/85 (Section 3, Subsection 16). Based on the preliminary development concept the following parking would apply (based on an industrial use at 1 parking space per 100 sq.m of net floor area):

- Lot 1 – 41,200 sq.m. building – 412 parking spaces.
- Lot 2 – 21,600 sq.m. building – 216 parking spaces
- Lot 3 – 8,000 sq.m. building – 80 parking spaces.

The final lot configurations will be developed at the Site Plan Approval stage and therefore these preliminary concepts are subject to change.

For the purposes of this study it is assumed that the site will be occupied by horizon year 2015.

2.0 Existing Roads and Access

The preliminary concepts include provision for an access to each lot from McLean Road (i.e. total of three accesses). The location of these accesses have been assumed for the purposes of this study, as shown on Figure A3 (Appendix A), but are subject to change at the Site Plan Approval stage.

McLean Road is a local road, with two travel lanes and a posted speed of 60 km/h, under the jurisdiction of the Township of Puslinch. This road primarily services the existing rural industrial development in this area, including gravel extraction operations.

McLean Road connects to Wellington Road 46, about 1.0 km to the east of the site, which provides the major north-south connection between Guelph and Highway 401.

To the east McLean Road connects to Concession Road 7, which also serves a number of gravel extraction operations, with ultimate connection to Wellington Road 34 and the Hanlon Expressway.

3.0 Traffic Forecasts

3.1 Analysis Period

A horizon period of five (5) years after occupancy has been considered in this study, in accordance with typical traffic impact study guidelines for land development. The periods considered for analysis include the a.m. peak hour and the p.m. peak hour of the adjacent road.

3.2 Background Traffic

Background traffic counts on McLean Road were obtained by our sub-consultant, Ontario Traffic Inc, as follows:

- Automatic Traffic Recorder counts taken for a 72 hour period from May 14, 2013 through May 16, 2013, inclusive.

The traffic count data is summarized in Appendix B.

Based on historical traffic growth rates, the development Charges Background Study for the County of Wellington (Watson & Associates Ltd, 2012) forecasts aggregate growth rates of traffic volumes on Wellington County Roads to be 1.75% per annum, broken down as follows:

- 0.66% per annum, attributable to growth external to the County
- 1.09% per annum, attributable to population / employment growth in the County.

The study also forecasts population and employment growth rates in the County to be in the order of 1.3% per annum.

Given the local industrial function of this road, traffic growth along this corridor is expected to primarily be impacted by land development in the immediate study area, rather than generalized population growth in the broader area. For the purposes of this study a nominal growth rate of 1.75% per annum has been applied to the background traffic counts, to estimate the background traffic volumes in the five year horizon period. This is considered to be a conservative growth rate, since traffic from development (i.e. from both the site development and from other external developments in the area) is also added to the traffic forecasts.

The forecast (2015) a.m. and p.m. peak hour background traffic volumes on McLean Road are shown on Figure A4 (Appendix A), based on a 1.75% per annum increase to the traffic counts.

For the purposes of this study, traffic from a number of other industrial developments (active and proposed) has also been added to the forecast background traffic in the five year horizon period. The traffic generated from these other developments is based on the forecasts provided in the report “340268 Ontario Limited Proposed Industrial Traffic Impact Study,” (Paradigm Transportation Solutions Limited, December 2010) and includes the following:

- 28.2 hectares of light industrial development, located to the east of the intersection of Wellington Road 46 / McLean Road.
- Expanded operations of the GO Bus facility located at the southeast corner of the intersection of Wellington Road 46 / McLean Road.

The forecast (2020) a.m. and p.m. peak hour background traffic volumes on McLean Road are shown on Figure A5 (Appendix A). This background traffic is inclusive of the traffic from the other external developments noted above, assumed to occur in the 2015 to 2020 timeframe.

3.3 Site Generated Traffic Volumes

Site generated traffic volumes have been estimated based on the trip rate information contained in the Institute of Transportation Engineers (ITE) Trip Generation Manual (9th Edition). For the purposes of this study we have assumed a Light Industrial land use (ITE Code 110) , using the average trip rates provided in the ITE manual, with the number of acres as the independent variable. This is considered to be a worst case scenario, since other potential land uses (e.g. warehouse or distribution center) would be expected to generate less traffic, and the traffic peaks would be outside of the peak periods of the adjacent road for these other uses. However, considering that the operations of industrial facilities can vary widely, we suggest that the designs be based on updated site-specific traffic forecasts, once the end user has been confirmed.

The resulting trip generation for the site is summarized in the following table:

Table 3.1 – Trip Generation From Proposed Development*

Access	Lot Area (Acres)	a.m. Peak Hour (vph)		p.m. Peak Hour (vph)	
		In	Out	In	Out
Access No. 1 (West Lot)	4.9	31	6	8	28
Access No. 2 (Centre Lot)	13.4	84	17	22	76
Access No. 3 (East Lot)	25.5	160	32	41	144

Access	Lot Area (Acres)	a.m. Peak Hour (vph)		p.m. Peak Hour (vph)	
		In	Out	In	Out
Total	43.8	275	55	71	248

*Based on Light Industrial Use (ITE Code 110)

Based on the above table, the proposed development is forecast to generate a total (two-way) of 330 vph in the a.m. peak hour and 319 vph in the p.m. peak hour.

The assumed distribution of the trips generated by the development is based on the existing traffic flows in the broader area, as well as origin/destination considerations, as follows:

- 25% to/from the west on McLean Road
- 75% to/from the east on McLean Road

3.4 Total Traffic Forecasts

The development traffic is added to the background traffic (including growth in background traffic and traffic from external developments) to obtain the total traffic volumes at the site accesses. The total traffic volumes are shown in Figures A6 and A7 (Appendix A), for horizon years 2015 and 2020 respectively.

4.0 Traffic Impact Analysis

4.1 Analysis Criteria and Approach

The traffic operations at the subject accesses have been assessed based on the following criteria:

- Turning lane considerations based on Ministry of Transportation (MTO) warrant graphs and criteria.
- Level of Service (LOS) and volume/capacity (v/c) ratios for egress turning movements, based on criteria in the Highway Capacity Manual, analyzed using Synchro Software. Movements are considered critical where:
 - Levels of Service exceed LOS E, based on average delay per vehicle, and insufficient gaps exist in the traffic on the adjacent street to allow for safe egress movements, or
 - v/c is greater than 1.0, indicating over-capacity conditions.
- Availability of sufficient stopping sight distances and turning sight distances at the accesses.

The analysis has considered the a.m. and p.m. weekday peak hour of the traffic on McLean Road, including the following:

- Future total traffic conditions (2015), including background growth and site development.
- Future total traffic conditions (2020), including background growth, external development and site development.

4.2 Turning Lane Considerations

The warrants for exclusive left turn lanes were considered at the site accesses. Left turn lane warrants have been assessed for total traffic in horizon years 2015 and 2020, based on the MTO warrant graphs, as shown in Appendix C. The results of the left turn lane warrant analysis are summarized in the following table:

Table 4.1 – Left Turn Lane Warrants for Accesses (Total Traffic)

Access	Direction	Horizon Year	Left Turn Storage For Weekday a.m. Peak Hour (m)	Left Turn Storage For Weekday p.m. Peak Hour (m)
Access No. 1	Westbound	2015	Not required	Not required
		2020	Not required	Not required
Access No. 2	Westbound	2015	Not required	Not required
		2020	15	Not required
Access No. 3	Westbound	2015	15	Not required
		2020	15	Not required

The traffic volumes are forecast to meet the warrant requirements for an exclusive left turn lane at Access No. 3 during the a.m. peak hour by horizon years 2015 and 2020, and Access No. 2 during the a.m. peak hour by horizon year 2020. However, recognizing that the final lot configurations may change during the planning approval process, we recommend that this requirement be revisited, once additional details of the development have been finalized.

MTO guidelines (Geometric Design Standards For Ontario Highways) note that right turn lanes may be considered where right turn volumes exceed 60 vph, or where right turning vehicles create a hazard or reduce capacity at the intersection. The right turn movements at the accesses are forecast to have right turn volumes that are substantially below this threshold and therefore right turn lanes/tapers are not required.

4.3 Intersection Operations

The accesses within the study area have been analyzed using Synchro Software, which uses methodologies based on the Highway Capacity Manual. The Levels of Service (LOS) and volume-to-capacity (v/c) ratios were determined for egress left turning movements at the accesses (i.e. critical movement for unsignalized intersection). The LOS is a measure qualifying the amount of delay experienced by motorists. The delays associated with various LOS are summarized in the following table.

Table 4.2 – Level of Service Definitions for Unsignalized Accesses

Level of Service	Control Delay Per Vehicle Unsignalized Intersection (sec/veh)
A	≤ 10
B	> 10 and ≤ 15
C	> 15 and ≤ 25
D	> 25 and ≤ 35

Level of Service	Control Delay Per Vehicle Unsignalized Intersection (sec/veh)
E	> 35 and <= 50
F	>50

The Synchro analyses for the subject accesses are included in Appendix D (Total Traffic Conditions, 2015) and Appendix E (Total Traffic Conditions, 2020), and select results are summarized in the following table for the horizon periods considered.

Table 4.3 – Access Operations (Total Traffic)

Access	Horizon Year	Movement	Level of Service / Delay (volume/capacity)	
			a.m. peak hour	p.m. peak hour
Access No. 1	2015	NB-L	B (0.01)	A (0.04)
	2020	NB-L	B (0.01)	B (0.04)
Access No. 2	2015	NB-L	B (0.03)	B (0.10)
	2020	NB-L	B (0.03)	B (0.12)
Access No. 3	2015	NB-L	B (0.07)	B (0.21)
	2020	NB-L	B (0.08)	B (0.25)

As shown in the above table, the accesses are forecast to operate with a good LOS (short delays) and significant reserve capacity through horizon year 2020.

4.4 Sight Distances at Accesses

Sight distances at the conceptual accesses are limited by vertical curves and/or horizontal curves on McLean Road. The available sight distances are compared to the minimum sight distance criteria specified by the Transportation Association of Canada (TAC), as summarized in the following tables:

Table 4.2 – Stopping Sight Distance (Passenger Cars and Trucks)

Access	Required Stopping Sight Distance (TAC Criteria*) (m)	Available Stopping Sight Distance From West (m)	Available Stopping Sight Distance From East (m)
Access No. 1	110	200	390
Access No. 2	110	390	135
Access No. 3	110	430	120

*based on 70 km/h design speed, height of driver's eye = 1.05 m, height of taillight = 0.38 m.

Table 4.3 – Turning Sight Distance (Passenger Cars)

Access	Desirable Turning Sight Distance to West (TAC Criteria*) (m)	Available Turning Sight Distance to West (m)	Desirable Turning Sight Distance to East (TAC Criteria*) (m)	Available Turning Sight Distance to East (m)
Access No. 1	135	200	145	>400
Access No. 2	135	390	145	180
Access No. 3	135	430	145	>230

* based on 70 km/h design speed, height of driver's eye = 1.05 m, height of approaching car = 1.3 m.

The available sight distances, at the three conceptual access locations considered, meet the required minimum requirements for passenger cars, for both stopping sight distance and for turning sight distance. However, if the traffic from these industrial sites is to include a high percentage of long trucks (e.g. WB-20 combination trucks), then further considerations may apply, as reviewed further below.

The criteria for stopping sight distance for trucks, in areas of vertical curve constraints, is the same as for cars, due to the higher height of the driver's eye (i.e. typically 2.3 metres). Therefore sufficient stopping sight distances are available for trucks as well as for cars.

The criteria for turning sight distances for large trucks is more stringent than for cars, due to the longer acceleration time required for the turning movement. The available sight distances for trucks are compared to the minimum sight distance criteria specified by the Transportation Association of Canada, as summarized in the following table:

Table 4.4 – Turning Sight Distance (Trucks)

Access	Desirable Turning Sight Distance to West (TAC Criteria*) (m)	Available Turning Sight Distance to West (m)	Desirable Turning Sight Distance to East (TAC Criteria*) (m)	Available Turning Sight Distance to East (m)
Access No. 1	270	200	205	>460
Access No. 2	270	390	205	>270
Access No. 3	270	430	205	>230

* based on 70 km/h design speed, height of driver's eye = 2.3 m, height of approaching car = 1.3 m.

The available sight distances, at the three conceptual access locations considered, meet the required minimum requirements for large trucks (WB-20), with the exception of the westerly sight distance at Access No. 1. The horizontal curve on McLean Road limits the westerly sight distance to about 200 metres at Access No. 1, whereas a TAC criteria

recommend a sight distance of 270 metres for trucks turning at this location. However, the available sight distance significantly exceeds the required stopping sight distance from the west (i.e. 110 metres), and therefore this deficiency is considered to be tolerable. In addition, it is expected that there will be few, if any, large trucks that turn left from Access No. 1. It is recommended that sight line constraints be reviewed further at the Site Plan Approval stage, once the final locations of the accesses have been confirmed.

Departure sight triangles are not typically a requirement of private accesses, due to their low traffic volumes, and therefore none are recommended at the driveways under consideration.

5.0 Conclusions and Recommendations

Based on the analysis completed, the main conclusions and recommendations of this study are summarized as follows:

- The proposed development is forecast to generate total traffic (two-way) of 330 vehicles per hour (vph) in the a.m. peak hour and 319 vph in the p.m. peak hour.
- All accesses are forecast to operate acceptably through horizon year 2020 under Total Traffic conditions (i.e., including growth in background traffic, traffic from external developments and traffic from the site development).
- It is forecast that the Ministry of Transportation warrants for a westbound left turn lane (15 metres storage) will be met during the a.m. peak hour at Access No. 3, under total traffic conditions in 2015 and 2020 and during the a.m. peak hour at Access No. 2 under total traffic conditions in 2020. However, final access locations and lot sizes and uses are still subject to change, and the requirement for turning lanes should be further considered as final concepts are developed.
- Sight distances are acceptable at all of the conceptual access locations, with the exception of Access No. 1. The sight distance to the west at Access No. 1, for large trucks turning to the west, does not meet Transportation Association of Canada (TAC) criteria. However the available sight distance does provide the recommended stopping sight distance and therefore the sight distance is considered to be acceptable, given the low traffic volumes anticipated to use this movement.

Prepared By:

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Henry B. Centen, P. Eng.
Senior Transportation Engineer



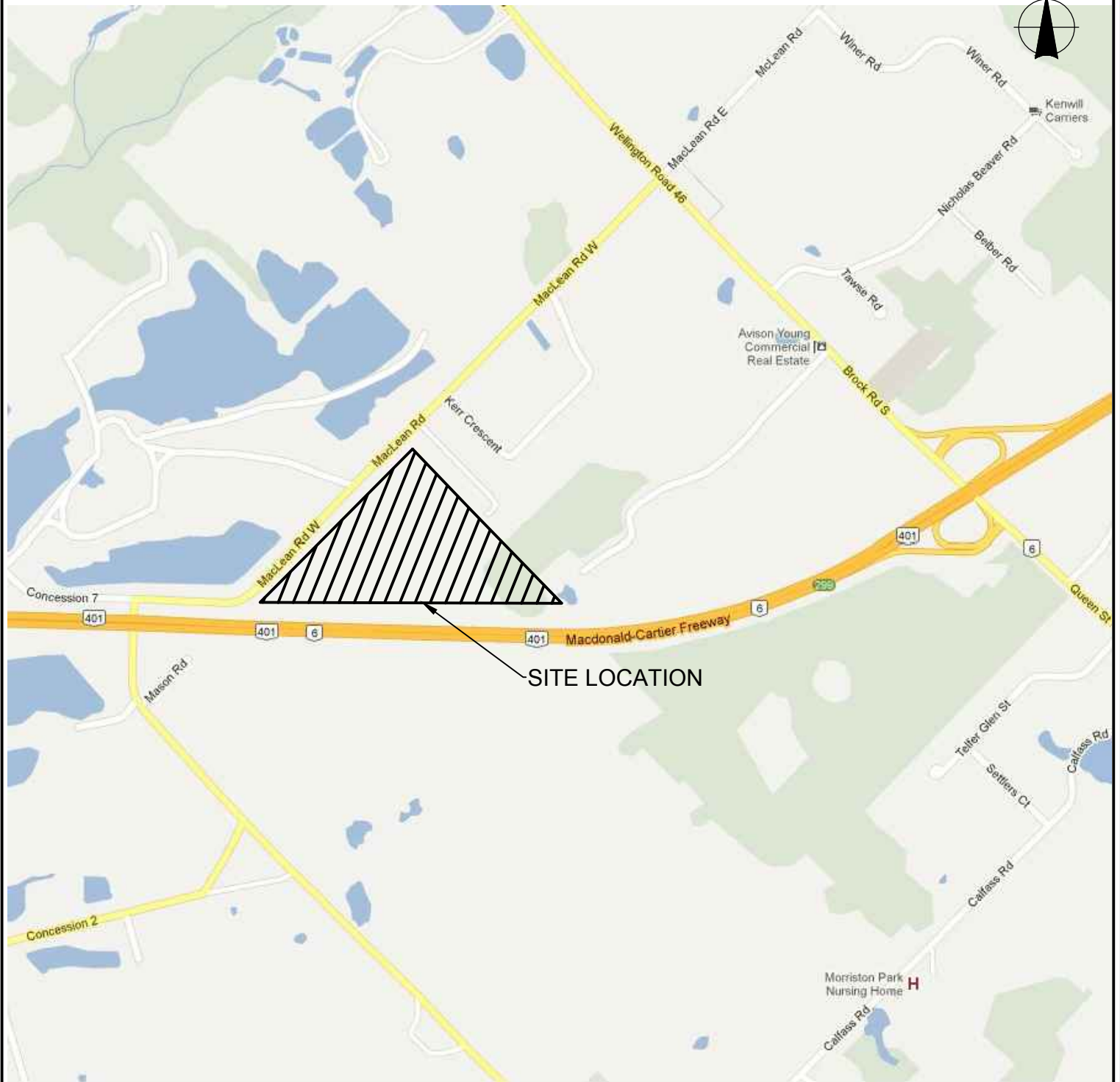


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Appendix A

Figures



SITE LOCATION



Figure Title

TRAFFIC IMPACT STUDY

SITE LOCATION

Client

LAMBDA PROPERTIES

Drawn

BL

Checked

HC

Date

13/05/24

Scale

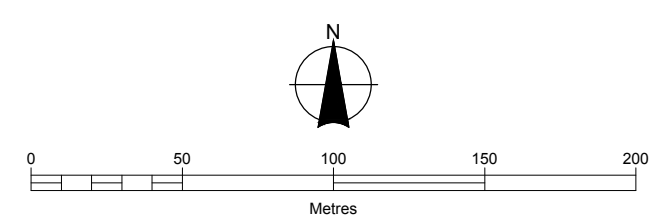
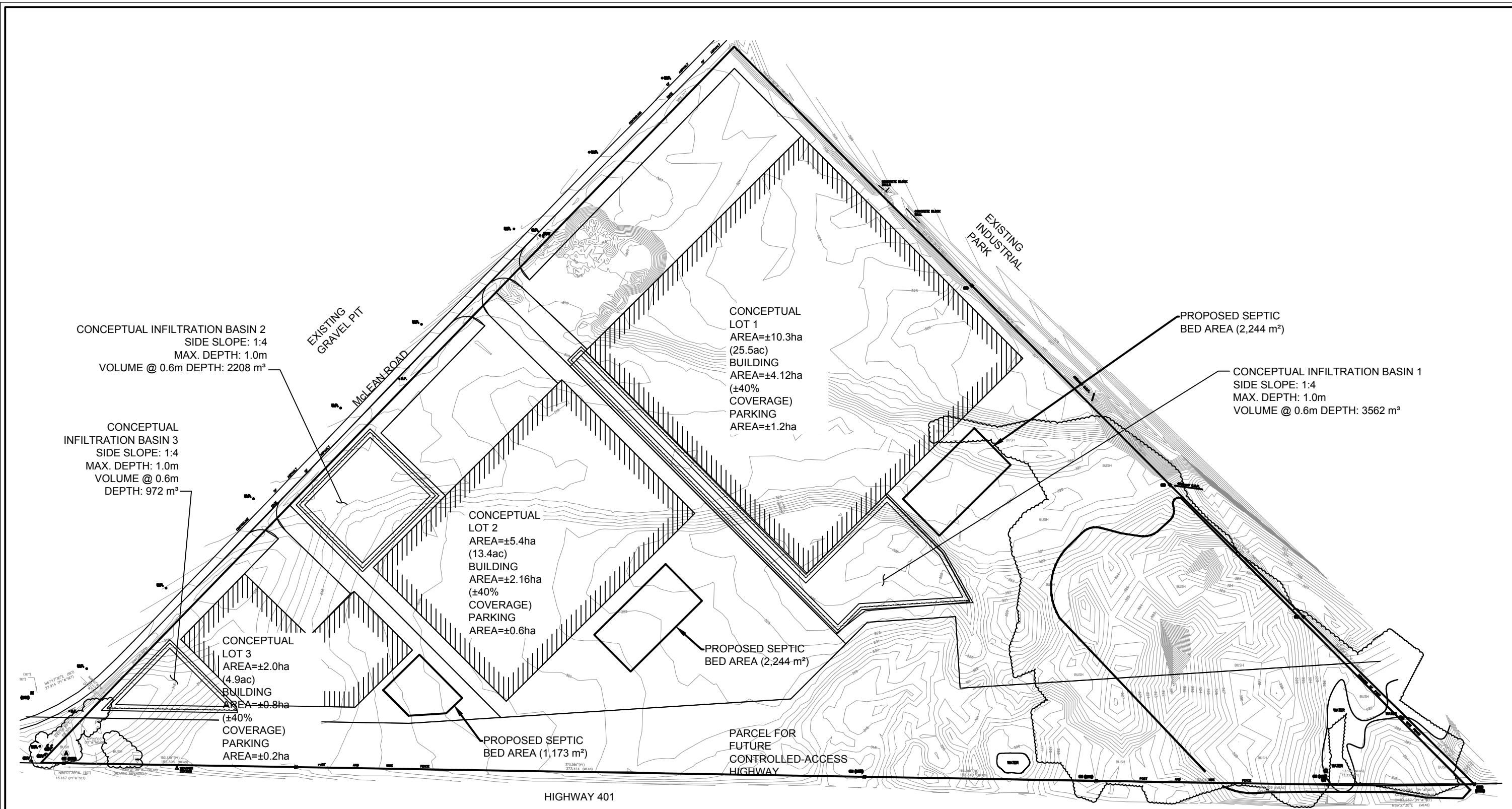
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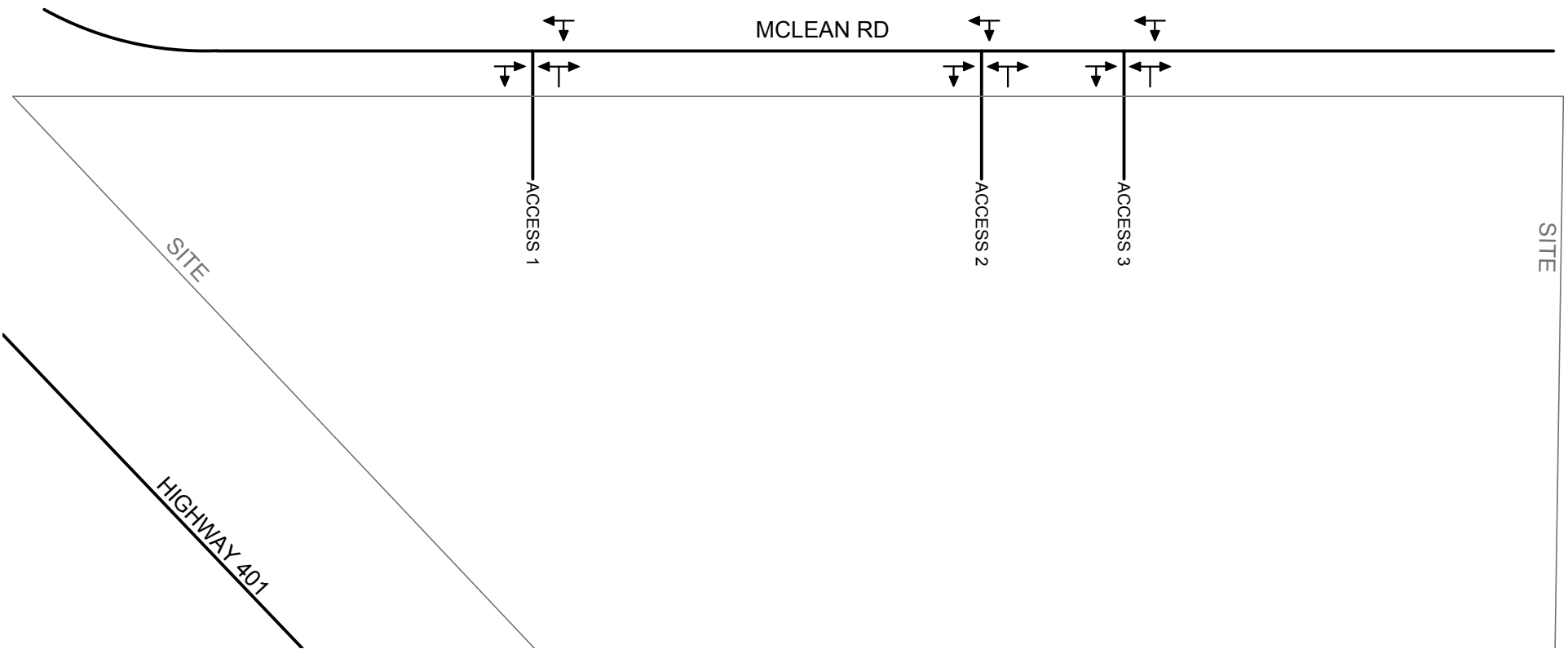
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Figure No.





A1



		Figure Title CONCEPT PLAN		
Client LAMBDA PROPERTIES	Drawn FSR	Checked	Date 13/03/14	Figure No. A2
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LEGEND

-  RIGHT TURN TAPER
-  RIGHT TURN LANE
-  THROUGH LANE
-  LEFT TURN LANE



Client

LAMBDA PROPERTIES

Figure Title

TRAFFIC IMPACT STUDY

LANE CONFIGURATION

Drawn

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Scale

NTS

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Date

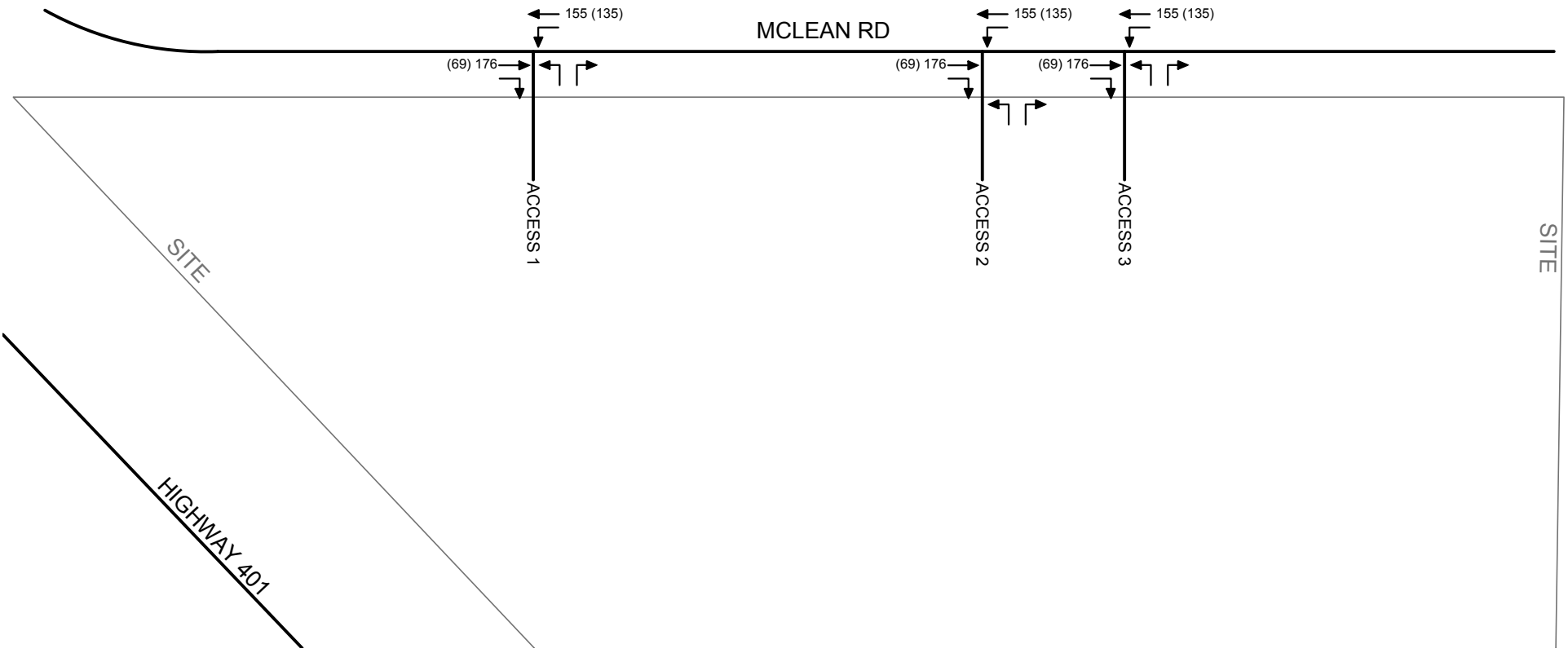
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Project No.

300032929

Figure No.

A3



LEGEND

100 - AM PEAK HOUR (ph)
(100) - PM PEAK HOUR (ph)



Figure Title

TRAFFIC IMPACT STUDY

BACKGROUND TRAFFIC (2015)

Client

LAMBDA PROPERTIES

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Scale

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Checked

HC

Date

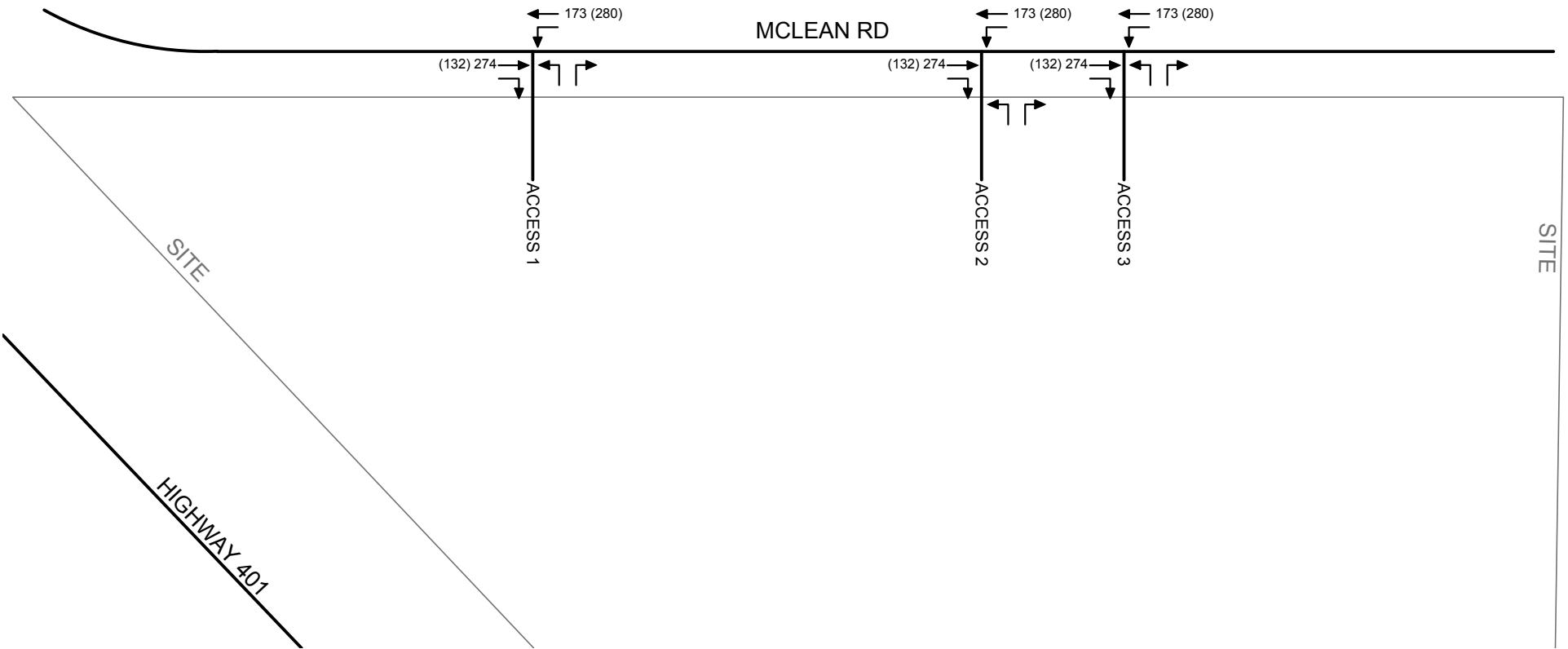
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Project No.

300032929

Figure No.

A4



LEGEND

100 - AM PEAK HOUR (ph)
(100) - PM PEAK HOUR (ph)



BURNSIDE

Client

LAMBDA PROPERTIES

Figure Title

TRAFFIC IMPACT STUDY

BACKGROUND TRAFFIC INCLUDING EXTERNAL
DEVELOPMENT (2020)

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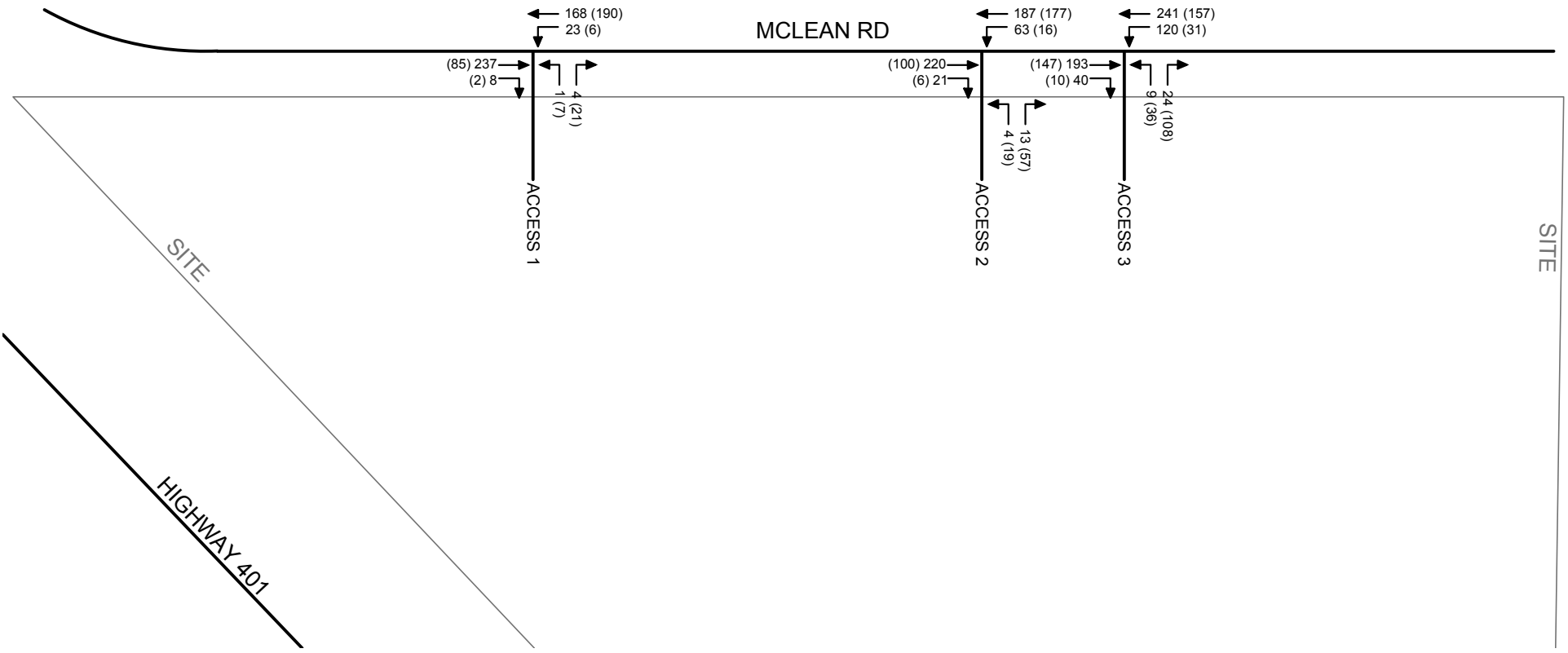
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Project No.

300032929

Figure No.

A5



LEGEND

100 - AM PEAK HOUR (ph)
(100) - PM PEAK HOUR (ph)



BURNSIDE

Figure Title

TRAFFIC IMPACT STUDY

TOTAL TRAFFIC (2015)

Client

LAMBDA PROPERTIES

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Date

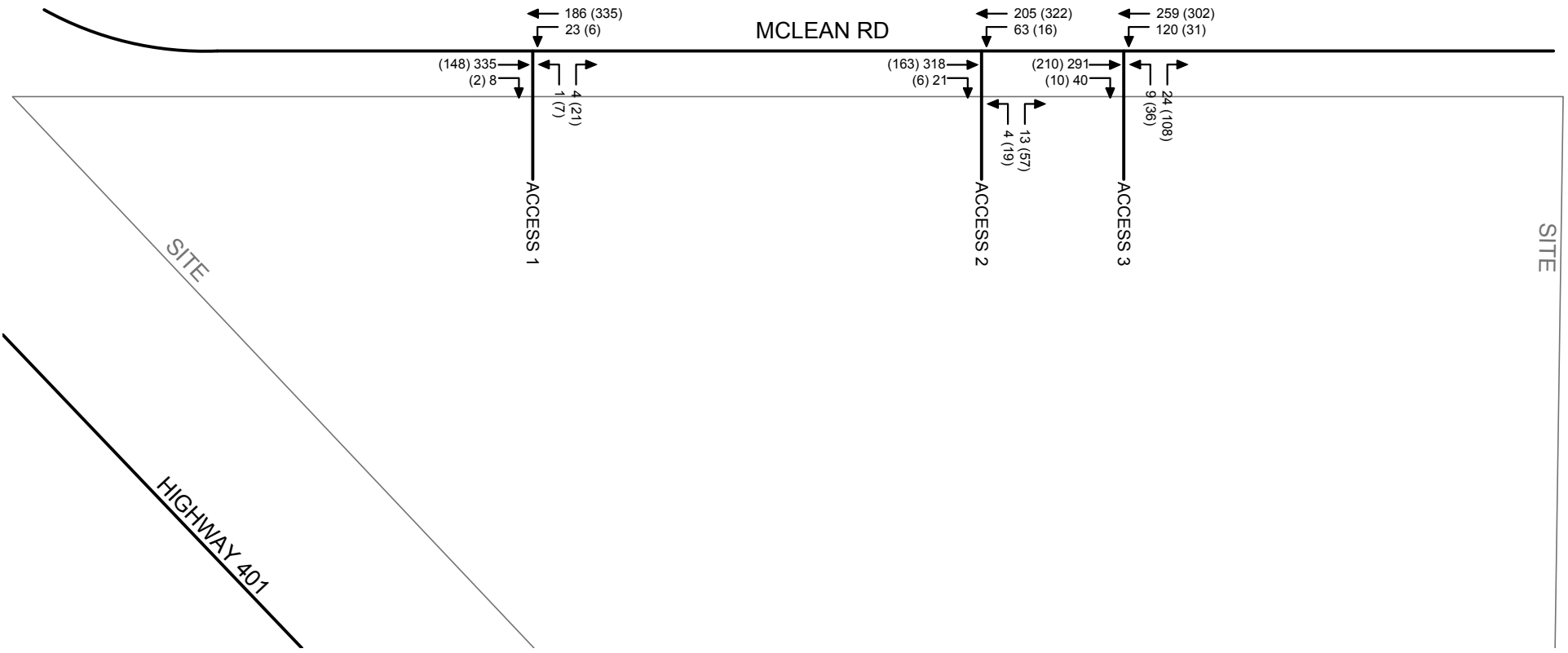
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Project No.

300032929

Figure No.

A6



LEGEND

100 - AM PEAK HOUR (ph)
(100) - PM PEAK HOUR (ph)



Client

LAMBDA PROPERTIES

Figure Title

TRAFFIC IMPACT STUDY

TOTAL TRAFFIC (2020)

Drawn

BL

Scale

NTS

Checked

HC

Date

13/05/24

Project No.

300032929

Figure No.

A7



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Appendix B

Traffic Count Data

Ontario Traffic Inc.
17705 Leslie St., Unit 6
Newmarket, Ontario L3Y 3E3
Tel: (905) 878-7711 Fax: (905) 898-3664

Site Code: 1
Station ID: T29
McLean Rd west of quarry access

Date Start: 14-May-13

Date End: 16-May-13

EB

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Total
05/14/13	0	1	3	0	0	0	0	0	1	1	0	0	0	6
01:00	0	2	0	0	0	0	0	0	1	0	0	0	0	3
02:00	0	1	2	0	0	0	0	0	1	0	0	0	0	4
03:00	0	7	3	0	0	1	0	0	0	0	0	0	0	11
04:00	0	8	7	0	1	2	0	0	0	0	0	0	0	18
05:00	1	35	19	0	4	1	0	2	2	4	0	0	1	69
06:00	4	131	40	1	4	3	0	3	4	20	0	0	5	215
07:00	3	84	26	4	8	3	0	5	3	6	0	0	1	143
08:00	1	89	30	2	12	6	0	6	7	16	0	0	1	170
09:00	4	67	21	0	4	3	0	9	7	11	0	0	4	130
10:00	3	34	13	1	7	8	0	5	1	17	0	0	4	93
11:00	0	63	23	2	4	1	0	7	7	15	0	0	4	126
12 PM	2	57	19	2	3	6	0	8	4	17	0	0	4	122
13:00	4	52	21	1	4	5	0	3	2	11	0	1	2	106
14:00	4	66	23	3	3	3	0	8	3	13	0	0	2	128
15:00	1	44	11	1	3	3	0	5	7	9	0	0	2	86
16:00	2	36	11	4	3	2	0	3	6	0	0	0	0	67
17:00	1	27	8	1	1	2	0	1	3	1	0	0	0	45
18:00	0	46	6	0	1	1	0	0	11	1	0	0	0	66
19:00	0	20	9	1	0	1	0	0	0	0	0	0	0	31
20:00	0	6	1	0	1	1	0	0	7	0	0	0	1	17
21:00	2	8	1	0	1	2	0	0	3	1	0	0	0	18
22:00	1	17	2	0	1	1	0	0	2	0	0	0	0	24
23:00	0	4	2	0	0	2	0	0	1	0	0	0	0	9
Day Total	33	905	301	23	65	57	0	65	83	143	0	1	31	1707
Percent	1.9%	53.0%	17.6%	1.3%	3.8%	3.3%	0.0%	3.8%	4.9%	8.4%	0.0%	0.1%	1.8%	
AM Peak	06:00	06:00	06:00	07:00	08:00	10:00		09:00	08:00	06:00			06:00	06:00
Vol.	4	131	40	4	12	8		9	7	20			5	215
PM Peak	13:00	14:00	14:00	16:00	13:00	12:00		12:00	18:00	12:00		13:00	12:00	14:00
Vol.	4	66	23	4	4	6		8	11	17		1	4	128

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McLean Rd west of quarry access

Date Start: 14-May-13

Date End: 16-May-13

EB

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Total
05/15/13	1	0	1	0	0	2	0	0	0	1	0	0	0	5
01:00	0	1	1	0	0	0	0	0	1	1	0	0	0	4
02:00	0	1	1	0	0	0	0	0	0	0	0	0	0	2
03:00	0	5	1	0	0	0	0	0	0	0	0	0	0	6
04:00	0	8	7	0	0	2	0	0	1	0	0	0	0	18
05:00	0	38	17	0	4	0	0	1	1	7	0	0	1	69
06:00	0	116	32	0	4	4	0	1	3	23	0	0	0	183
07:00	0	91	29	1	5	3	1	5	5	9	0	0	2	151
08:00	3	92	23	3	9	2	0	7	3	17	0	0	0	159
09:00	0	50	19	1	8	3	0	10	4	12	0	1	0	108
10:00	2	40	22	0	4	3	0	8	14	15	0	0	1	109
11:00	1	65	29	3	2	4	0	5	9	17	0	0	2	137
12 PM	1	39	21	2	5	4	0	7	8	17	0	0	0	104
13:00	0	60	26	2	6	2	0	7	7	15	0	0	0	125
14:00	3	62	21	2	6	2	0	7	8	12	0	0	4	127
15:00	1	56	23	0	5	4	2	5	2	12	0	0	0	110
16:00	1	28	8	1	2	1	0	4	10	5	0	0	0	60
17:00	1	30	8	1	6	1	0	1	5	2	0	0	0	55
18:00	3	23	7	2	0	5	0	0	6	1	0	0	0	47
19:00	1	25	9	0	0	1	0	0	3	1	0	0	0	40
20:00	1	11	6	0	0	0	0	0	5	0	0	0	0	23
21:00	0	8	4	0	0	1	0	0	5	0	0	0	0	18
22:00	0	16	3	0	2	2	0	0	4	0	0	0	0	27
23:00	0	9	3	0	0	0	0	0	2	0	0	0	0	14
Day Total	19	874	321	18	68	46	3	68	106	167	0	1	10	1701
Percent	1.1%	51.4%	18.9%	1.1%	4.0%	2.7%	0.2%	4.0%	6.2%	9.8%	0.0%	0.1%	0.6%	
AM Peak	08:00	06:00	06:00	08:00	08:00	06:00	07:00	09:00	10:00	06:00		09:00	07:00	06:00
Vol.	3	116	32	3	9	4	1	10	14	23		1	2	183
PM Peak	14:00	14:00	13:00	12:00	13:00	18:00	15:00	12:00	16:00	12:00			14:00	14:00
Vol.	3	62	26	2	6	5	2	7	10	17			4	127

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EB

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05/16/13	0	5	1	0	0	0	0	0	2	0	0	0	0	8
01:00	0	1	0	0	0	1	0	0	1	0	0	0	0	3
02:00	0	4	1	0	0	0	0	0	0	0	0	0	0	5
03:00	0	2	2	1	0	0	0	0	0	0	0	0	0	5
04:00	0	11	7	0	0	1	0	0	1	1	0	0	0	21
05:00	0	30	19	0	2	3	0	1	3	5	0	0	3	66
06:00	5	104	38	4	9	2	0	3	4	19	0	0	0	188
07:00	4	118	25	0	8	1	0	3	5	9	0	1	1	175
08:00	2	81	33	3	7	2	0	7	6	12	0	0	1	154
09:00	4	63	26	2	4	1	0	8	5	19	0	0	3	135
10:00	2	47	22	4	6	2	0	6	7	21	0	0	1	118
11:00	2	60	21	0	4	3	0	6	9	10	0	0	2	117
12 PM	4	51	21	0	6	6	0	4	6	16	0	0	2	116
13:00	0	54	20	0	4	3	0	10	5	14	0	0	1	111
14:00	0	49	25	3	5	4	0	8	9	14	0	0	1	118
15:00	0	40	15	3	3	6	0	8	7	13	0	0	0	95
16:00	1	35	7	2	6	2	0	4	6	1	0	0	0	64
17:00	1	30	18	1	5	3	0	0	7	1	0	0	0	66
18:00	0	24	7	0	1	1	0	0	3	2	0	0	0	38
19:00	0	32	7	0	2	2	0	0	5	2	0	0	0	50
20:00	2	25	4	0	1	2	0	0	1	2	0	0	0	37
21:00	1	13	3	0	1	2	0	0	2	1	0	1	0	24
22:00	1	15	4	0	1	1	0	1	2	1	0	0	0	26
23:00	0	4	2	0	0	0	0	1	5	0	0	0	0	12
Day Total	29	898	328	23	75	48	0	70	101	163	0	2	15	1752
Percent	1.7%	51.3%	18.7%	1.3%	4.3%	2.7%	0.0%	4.0%	5.8%	9.3%	0.0%	0.1%	0.9%	
AM Peak Vol.	06:00	07:00	06:00	06:00	06:00	05:00		09:00	11:00	10:00		07:00	05:00	06:00
	5	118	38	4	9	3		8	9	21		1	3	188
PM Peak Vol.	12:00	13:00	14:00	14:00	12:00	12:00		13:00	14:00	12:00		21:00	12:00	14:00
	4	54	25	3	6	6		10	9	16		1	2	118
Grand Total	81	2677	950	64	208	151	3	203	290	473	0	4	56	5160
Percent	1.6%	51.9%	18.4%	1.2%	4.0%	2.9%	0.1%	3.9%	5.6%	9.2%	0.0%	0.1%	1.1%	

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WB

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Total
05/14/13	0	4	1	0	1	0	0	0	2	0	0	0	0	8
01:00	0	0	1	0	1	0	0	0	4	0	0	0	0	6
02:00	0	1	0	1	1	0	0	0	0	1	0	0	0	4
03:00	0	4	2	3	0	0	0	0	0	0	0	0	0	9
04:00	0	4	1	5	0	2	0	0	3	5	0	0	0	20
05:00	0	13	2	12	2	0	0	0	14	8	0	0	0	51
06:00	0	23	3	8	4	0	0	0	11	5	0	0	0	54
07:00	1	30	11	8	9	3	0	2	8	5	0	0	0	77
08:00	0	27	14	32	11	6	0	1	17	9	0	0	0	117
09:00	0	28	6	9	5	2	0	2	7	11	1	0	1	72
10:00	0	32	7	25	11	3	0	2	10	6	0	0	0	96
11:00	1	20	14	17	7	4	0	1	14	7	0	0	1	86
12 PM	0	40	9	21	11	4	0	0	12	7	0	0	2	106
13:00	2	31	11	18	9	4	0	3	9	8	0	0	0	95
14:00	0	34	10	15	5	4	0	0	10	10	0	0	0	88
15:00	1	44	27	8	19	2	0	0	5	0	0	0	3	109
16:00	1	80	30	6	16	3	0	3	3	1	0	0	0	143
17:00	1	69	25	0	13	0	0	0	4	0	0	0	0	112
18:00	0	29	9	2	7	0	0	0	2	1	0	0	0	50
19:00	0	49	26	2	11	2	0	1	9	2	0	0	1	103
20:00	0	14	8	1	3	1	0	0	3	1	0	0	0	31
21:00	0	14	9	0	6	1	0	0	7	1	0	0	0	38
22:00	0	19	1	1	6	0	0	0	6	1	0	1	0	35
23:00	0	38	7	0	6	0	0	0	4	1	0	0	0	56
Day Total	7	647	234	194	164	41	0	15	164	90	1	1	8	1566
Percent	0.4%	41.3%	14.9%	12.4%	10.5%	2.6%	0.0%	1.0%	10.5%	5.7%	0.1%	0.1%	0.5%	
AM Peak	07:00	10:00	08:00	08:00	08:00	08:00		07:00	08:00	09:00	09:00		09:00	08:00
Vol.	1	32	14	32	11	6		2	17	11	1		1	117
PM Peak	13:00	16:00	16:00	12:00	15:00	12:00		13:00	12:00	14:00		22:00	15:00	16:00
Vol.	2	80	30	21	19	4		3	12	10		1	3	143

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WB

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Total
05/15/13	0	10	5	0	3	0	0	0	3	0	0	0	0	21
01:00	0	0	2	0	1	1	0	0	1	1	0	0	0	6
02:00	0	1	0	1	2	0	0	0	1	0	0	0	0	5
03:00	0	5	2	4	0	1	0	0	1	1	0	0	0	14
04:00	0	10	0	6	2	0	0	0	4	4	0	0	0	26
05:00	0	12	1	15	1	0	0	0	8	8	0	0	0	45
06:00	0	28	3	4	5	0	0	1	7	8	0	0	0	56
07:00	1	33	8	9	5	5	0	1	12	10	0	0	0	84
08:00	1	54	22	31	15	3	0	1	13	10	0	0	0	150
09:00	1	30	10	19	11	7	0	1	13	12	0	0	1	105
10:00	1	24	8	22	7	2	0	2	11	8	0	0	0	85
11:00	1	23	16	23	6	3	0	1	8	7	0	0	0	88
12 PM	1	33	13	26	9	5	0	1	11	8	0	0	1	108
13:00	0	32	11	19	5	4	0	0	6	5	0	0	0	82
14:00	2	27	11	21	9	5	0	0	10	8	0	0	0	93
15:00	0	44	30	17	16	3	0	1	7	4	0	0	0	122
16:00	0	63	25	2	21	0	0	1	2	2	0	0	2	118
17:00	0	79	28	0	17	3	0	0	7	0	0	0	0	134
18:00	0	31	17	0	6	1	0	0	4	0	0	0	0	59
19:00	1	80	30	3	17	4	0	3	14	3	0	0	0	155
20:00	0	20	10	0	5	1	0	0	2	0	0	1	0	39
21:00	0	13	7	0	2	0	0	0	10	0	0	0	0	32
22:00	1	16	9	3	3	1	0	0	7	1	0	0	0	41
23:00	2	45	8	0	3	2	0	0	6	0	0	0	0	66
Day Total	12	713	276	225	171	51	0	13	168	100	0	1	4	1734
Percent	0.7%	41.1%	15.9%	13.0%	9.9%	2.9%	0.0%	0.7%	9.7%	5.8%	0.0%	0.1%	0.2%	
AM Peak	07:00	08:00	08:00	08:00	08:00	09:00		10:00	08:00	09:00			09:00	08:00
Vol.	1	54	22	31	15	7		2	13	12			1	150
PM Peak	14:00	19:00	15:00	12:00	16:00	12:00		19:00	19:00	12:00		20:00	16:00	19:00
Vol.	2	80	30	26	21	5		3	14	8		1	2	155

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WB

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05/16/13	0	9	1	0	1	0	0	0	4	1	0	0	0	16
01:00	0	2	1	0	0	0	0	0	1	0	0	0	0	4
02:00	0	2	2	2	3	0	0	0	0	0	0	0	0	9
03:00	0	2	1	1	0	0	0	0	2	1	0	0	0	7
04:00	0	4	0	5	1	2	0	0	4	4	0	0	0	20
05:00	0	10	1	14	1	1	0	0	12	10	0	0	0	49
06:00	1	37	6	8	5	3	0	0	5	12	0	0	0	77
07:00	0	43	7	8	8	2	0	3	11	6	0	0	0	88
08:00	0	24	16	20	8	1	0	1	12	9	0	0	0	91
09:00	0	34	8	11	11	2	0	1	18	12	0	0	0	97
10:00	0	30	12	18	12	5	0	4	19	10	0	0	0	110
11:00	1	31	11	12	8	6	1	0	7	7	0	0	0	84
12 PM	2	33	16	14	11	7	0	1	15	5	0	0	0	104
13:00	0	35	15	24	13	6	0	0	5	6	0	0	1	105
14:00	1	38	14	13	4	4	0	2	10	8	0	0	0	94
15:00	1	45	24	8	14	4	0	2	4	7	0	0	1	110
16:00	1	75	27	5	15	3	0	0	1	1	0	0	0	128
17:00	1	71	18	1	19	2	0	1	4	2	0	0	0	119
18:00	0	33	11	0	7	1	0	2	4	1	0	0	0	59
19:00	1	91	37	0	9	3	0	0	8	3	0	0	0	152
20:00	0	19	3	1	7	1	0	0	2	1	0	0	0	34
21:00	1	21	9	0	1	2	0	1	3	0	0	0	0	38
22:00	1	19	8	0	6	0	0	0	10	2	0	0	0	46
23:00	1	33	5	0	3	3	0	0	2	1	0	0	0	48
Day Total	12	741	253	165	167	58	1	18	163	109	0	0	2	1689
Percent	0.7%	43.9%	15.0%	9.8%	9.9%	3.4%	0.1%	1.1%	9.7%	6.5%	0.0%	0.0%	0.1%	
AM Peak	06:00	07:00	08:00	08:00	10:00	11:00	11:00	10:00	10:00	06:00				10:00
Vol.	1	43	16	20	12	6	1	4	19	12				110
PM Peak	12:00	19:00	19:00	13:00	17:00	12:00		14:00	12:00	14:00			13:00	19:00
Vol.	2	91	37	24	19	7		2	15	8			1	152
Grand Total	31	2101	763	584	502	150	1	46	495	299	1	2	14	4989
Percent	0.6%	42.1%	15.3%	11.7%	10.1%	3.0%	0.0%	0.9%	9.9%	6.0%	0.0%	0.0%	0.3%	



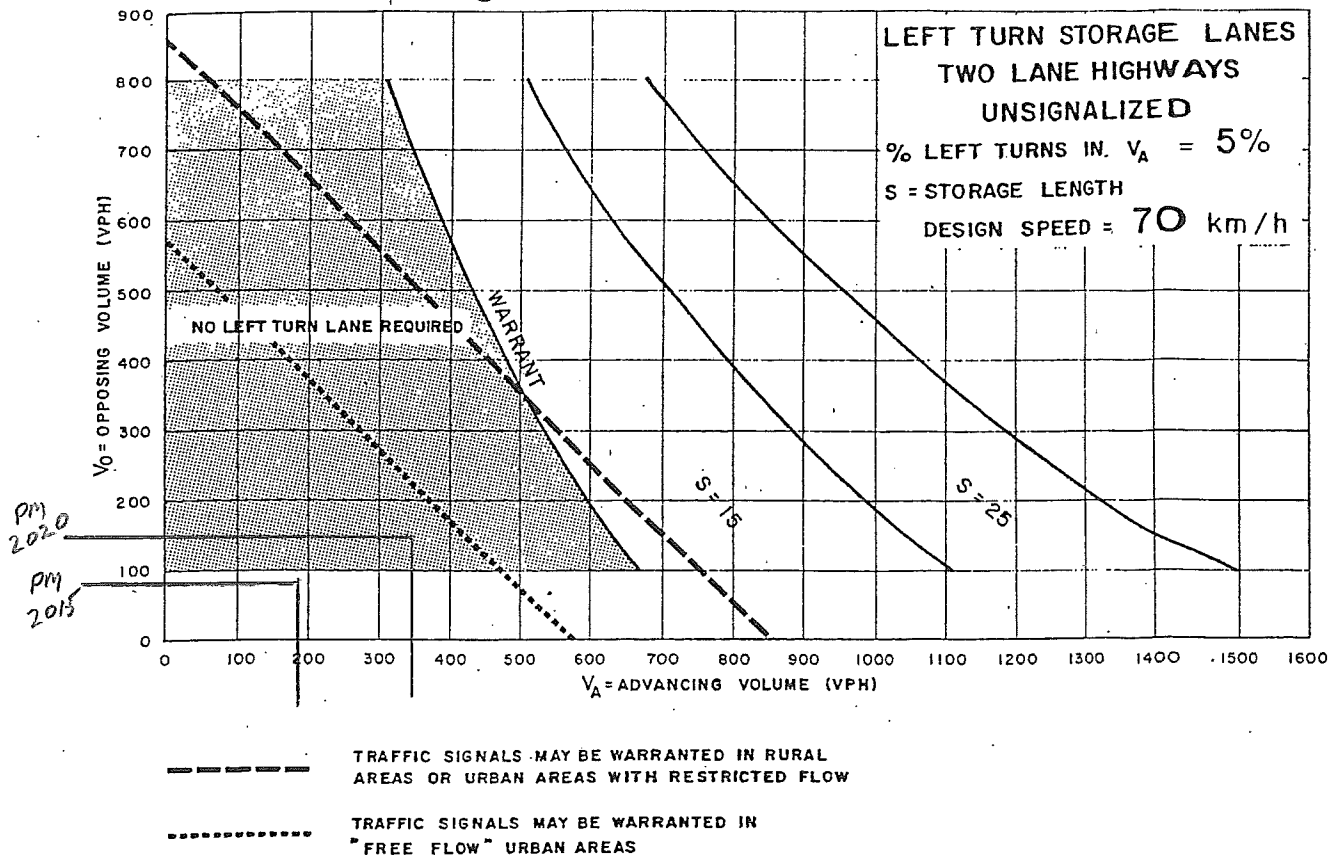
BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

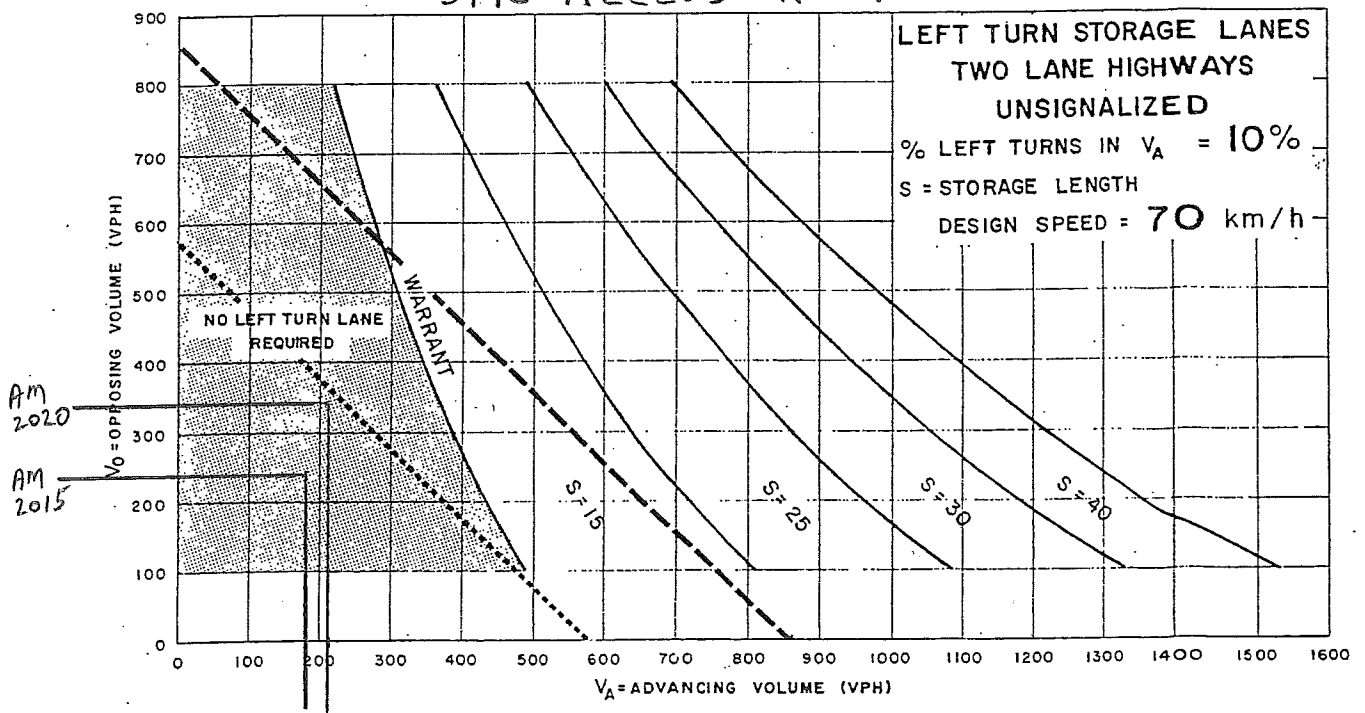
Appendix C

Left Turn Lane Warrants

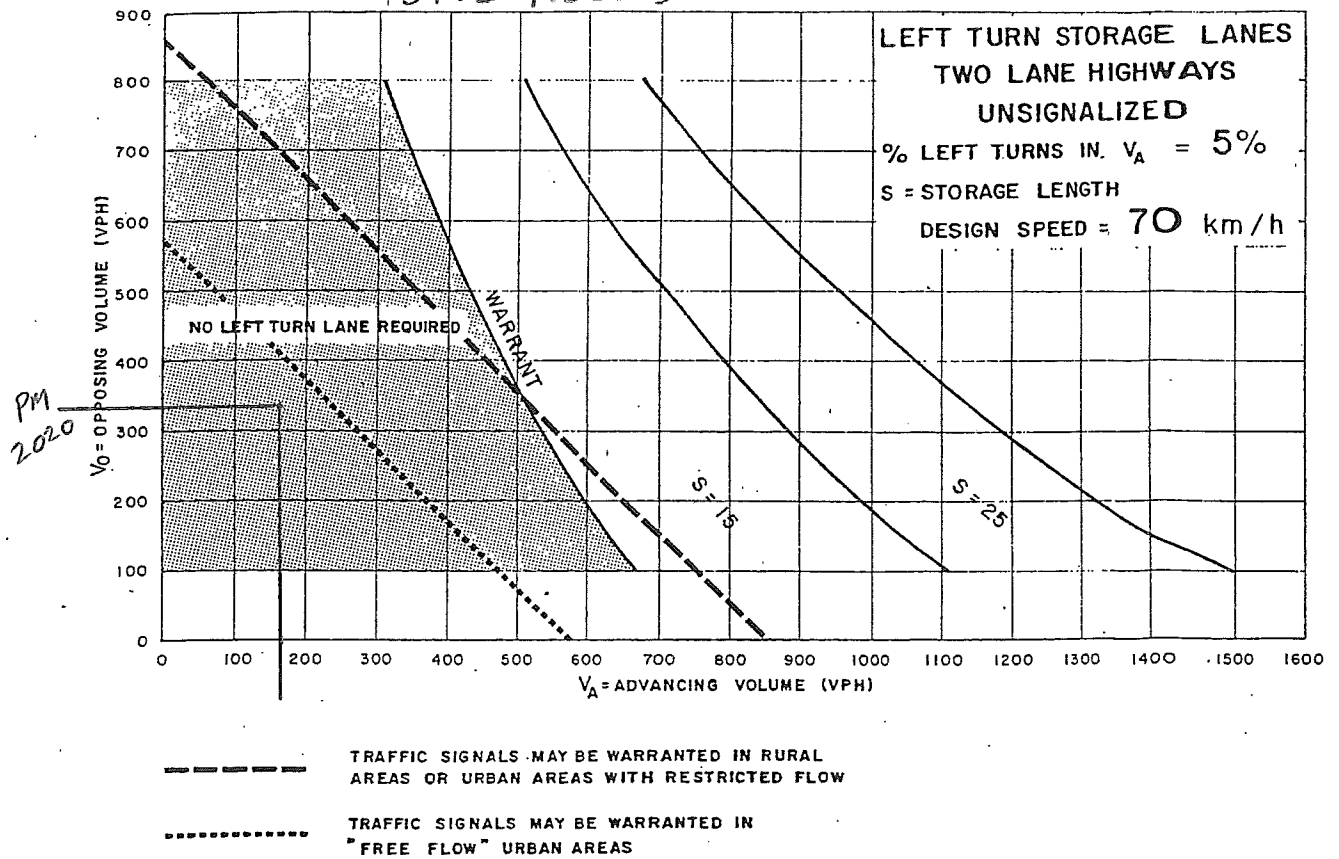
Site Access No. 1



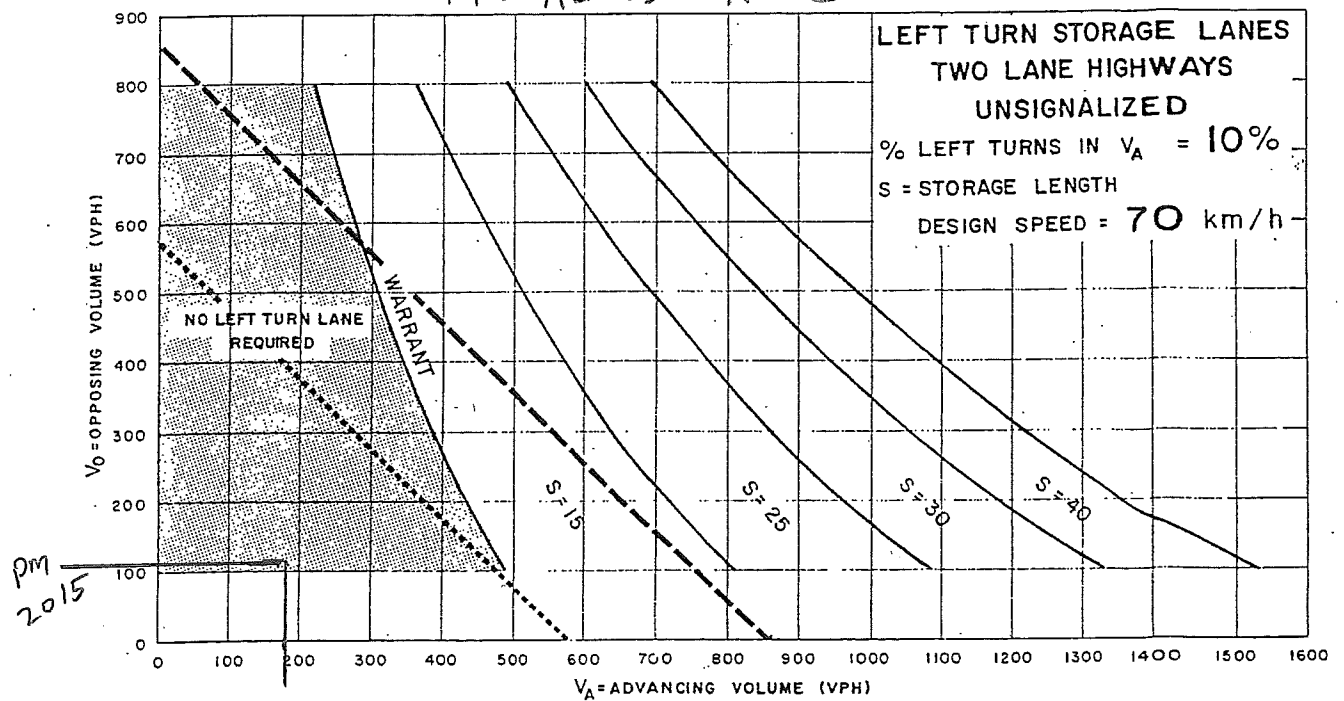
Site Access No. 1



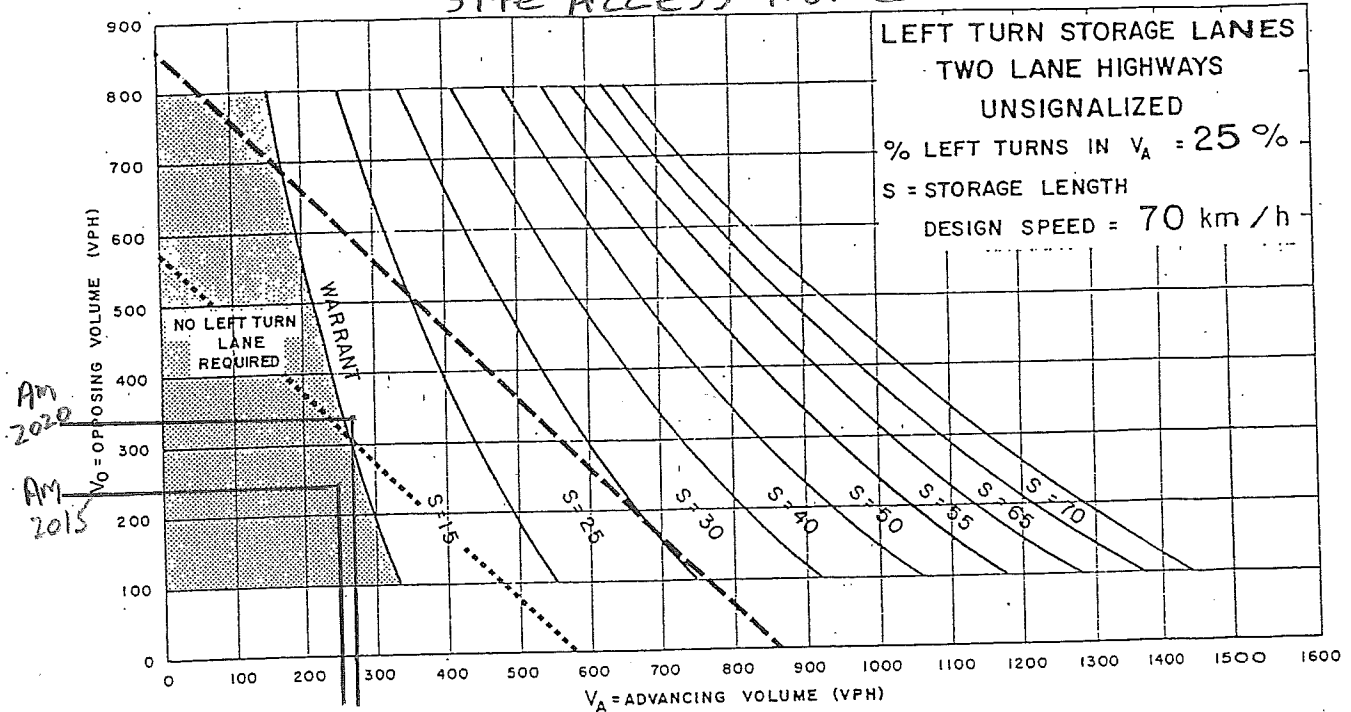
Site Access No. 2



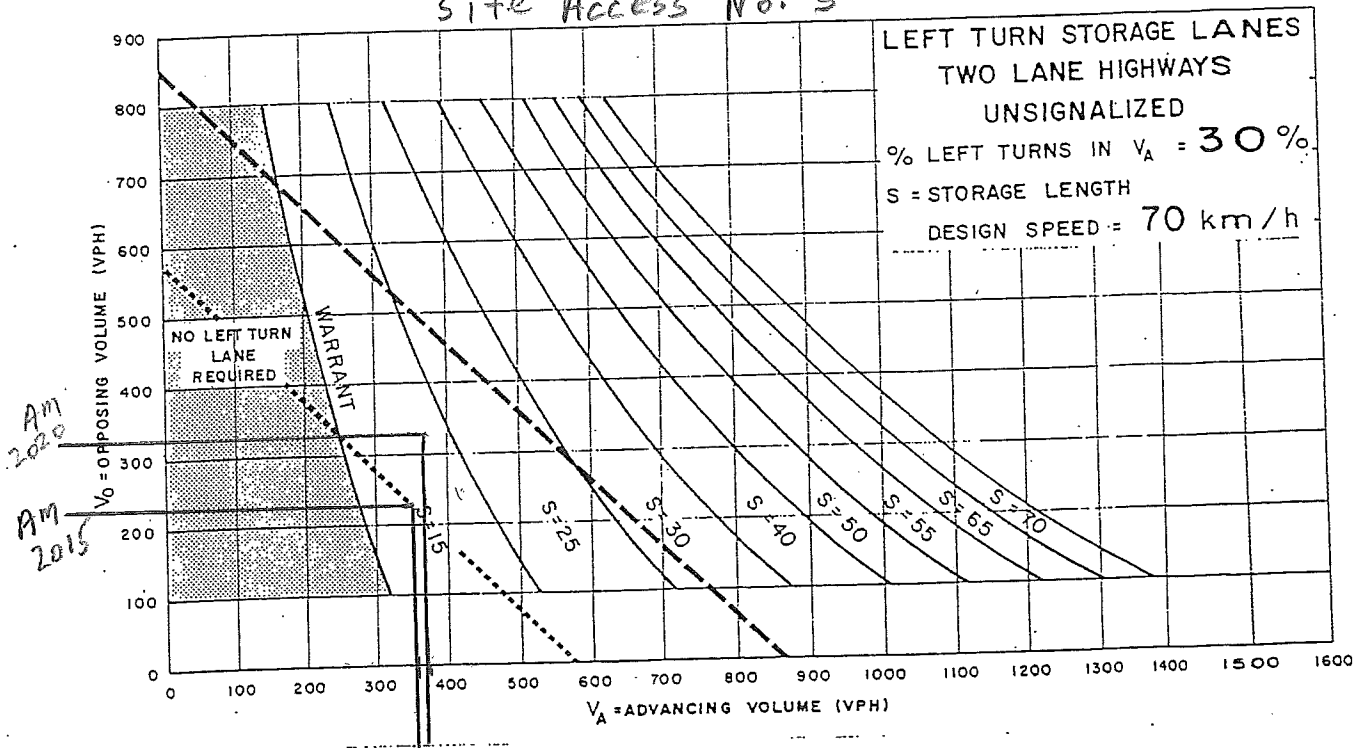
Site Access No. 2



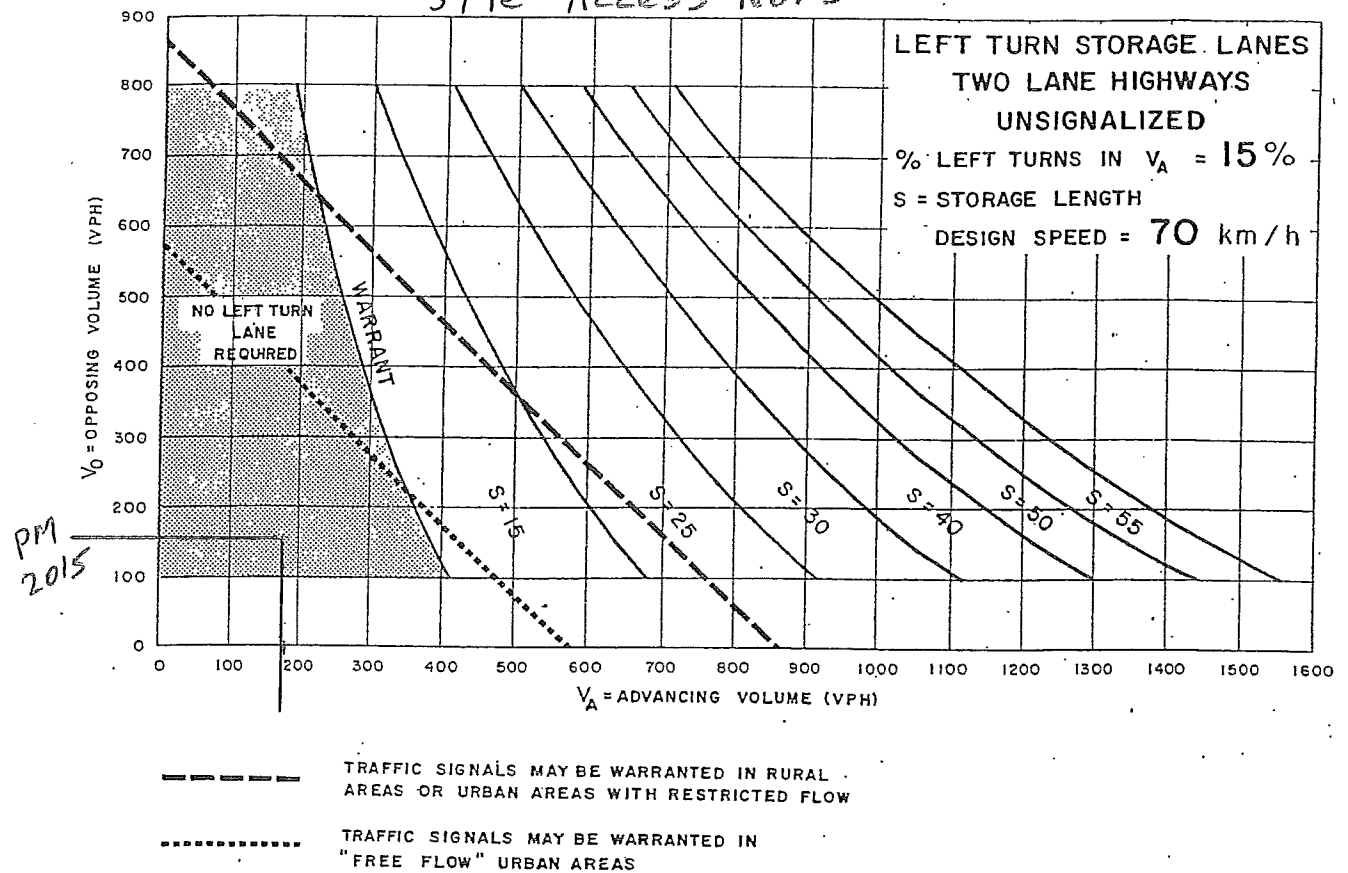
Site Access No. 2



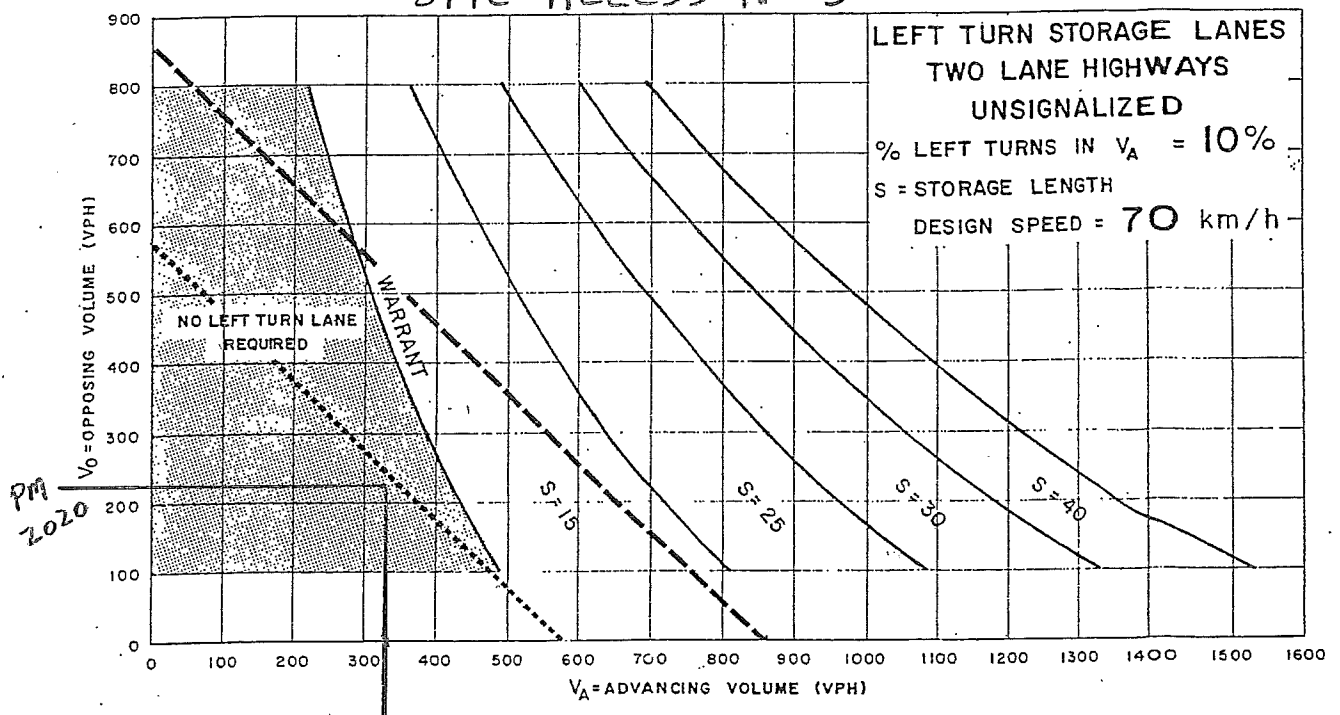
Site Access No. 3



Site Access No. 3



Site Access No. 3





BURNSIDE

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Appendix D










Total Traffic 2015 Synchro Analysis

HCM Unsignalized Intersection Capacity Analysis

1: MCLEAN RD & ACCESS 1

2015 AM TRAFFIC

5/24/2013










						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	237	8	23	168	1	4
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	258	9	25	183	1	4
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)				195		
pX, platoon unblocked						
vC, conflicting volume			266		495	262
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			266		495	262
tC, single (s)			4.3		6.6	6.5
tC, 2 stage (s)						
tF (s)			2.4		3.7	3.5
p0 queue free %			98		100	99
cM capacity (veh/h)			1175		485	724
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	266	208	5			
Volume Left	0	25	1			
Volume Right	9	0	4			
cSH	1700	1175	659			
Volume to Capacity	0.16	0.02	0.01			
Queue Length 95th (m)	0.0	0.5	0.2			
Control Delay (s)	0.0	1.1	10.5			
Lane LOS		A	B			
Approach Delay (s)	0.0	1.1	10.5			
Approach LOS			B			
Intersection Summary						
Average Delay			0.6			
Intersection Capacity Utilization			36.4%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

2: MCLEAN RD & ACCESS 2

2015 AM TRAFFIC

5/24/2013











						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	220	21	63	187	4	13
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	239	23	68	203	4	14
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)				42		
pX, platoon unblocked						
vC, conflicting volume			262		591	251
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			262		591	251
tC, single (s)			4.3		6.6	6.5
tC, 2 stage (s)						
tF (s)			2.4		3.7	3.5
p0 queue free %			94		99	98
cM capacity (veh/h)			1180		409	735
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	262	272	18			
Volume Left	0	68	4			
Volume Right	23	0	14			
cSH	1700	1180	619			
Volume to Capacity	0.15	0.06	0.03			
Queue Length 95th (m)	0.0	1.4	0.7			
Control Delay (s)	0.0	2.5	11.0			
Lane LOS		A	B			
Approach Delay (s)	0.0	2.5	11.0			
Approach LOS			B			
Intersection Summary						
Average Delay		1.6				
Intersection Capacity Utilization		39.5%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

3: MCLEAN RD & ACCESS 3

2015 AM TRAFFIC

5/24/2013











						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	193	140	120	241	9	24
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	210	152	130	262	10	26
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			362		809	286
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			362		809	286
tC, single (s)			4.3		6.6	6.5
tC, 2 stage (s)						
tF (s)			2.4		3.7	3.5
p0 queue free %			88		97	96
cM capacity (veh/h)			1080		282	702
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	362	392	36			
Volume Left	0	130	10			
Volume Right	152	0	26			
cSH	1700	1080	499			
Volume to Capacity	0.21	0.12	0.07			
Queue Length 95th (m)	0.0	3.1	1.8			
Control Delay (s)	0.0	3.8	12.8			
Lane LOS		A	B			
Approach Delay (s)	0.0	3.8	12.8			
Approach LOS			B			
Intersection Summary						
Average Delay			2.4			
Intersection Capacity Utilization			51.4%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

1: MCLEAN RD & ACCESS 1

2015 PM TRAFFIC

5/24/2013











						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	85	2	6	190	7	21
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	92	2	7	207	8	23
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)				195		
pX, platoon unblocked						
vC, conflicting volume			95		313	93
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			95		313	93
tC, single (s)			4.3		6.6	6.5
tC, 2 stage (s)						
tF (s)			2.4		3.7	3.5
p0 queue free %			100		99	97
cM capacity (veh/h)			1367		632	904
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	95	213	30			
Volume Left	0	7	8			
Volume Right	2	0	23			
cSH	1700	1367	816			
Volume to Capacity	0.06	0.00	0.04			
Queue Length 95th (m)	0.0	0.1	0.9			
Control Delay (s)	0.0	0.3	9.6			
Lane LOS		A	A			
Approach Delay (s)	0.0	0.3	9.6			
Approach LOS			A			
Intersection Summary						
Average Delay			1.0			
Intersection Capacity Utilization			24.8%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

2: MCLEAN RD & ACCESS 2

2015 PM TRAFFIC

5/24/2013










						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	100	6	16	177	19	57
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	109	7	17	192	21	62
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)				42		
pX, platoon unblocked						
vC, conflicting volume			115		339	112
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			115		339	112
tC, single (s)			4.3		6.6	6.5
tC, 2 stage (s)						
tF (s)			2.4		3.7	3.5
p0 queue free %			99		97	93
cM capacity (veh/h)			1342		605	882
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	115	210	83			
Volume Left	0	17	21			
Volume Right	7	0	62			
cSH	1700	1342	791			
Volume to Capacity	0.07	0.01	0.10			
Queue Length 95th (m)	0.0	0.3	2.6			
Control Delay (s)	0.0	0.7	10.1			
Lane LOS		A	B			
Approach Delay (s)	0.0	0.7	10.1			
Approach LOS			B			
Intersection Summary						
Average Delay		2.4				
Intersection Capacity Utilization		28.1%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

3: MCLEAN RD & ACCESS 3

2015 PM TRAFFIC

5/24/2013










						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	147	10	31	157	36	108
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	160	11	34	171	39	117
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			171		403	165
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			171		403	165
tC, single (s)			4.3		6.6	6.5
tC, 2 stage (s)						
tF (s)			2.4		3.7	3.5
p0 queue free %			97		93	86
cM capacity (veh/h)			1279		546	823
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	171	204	157			
Volume Left	0	34	39			
Volume Right	11	0	117			
cSH	1700	1279	730			
Volume to Capacity	0.10	0.03	0.21			
Queue Length 95th (m)	0.0	0.6	6.1			
Control Delay (s)	0.0	1.5	11.3			
Lane LOS		A	B			
Approach Delay (s)	0.0	1.5	11.3			
Approach LOS			B			
Intersection Summary						
Average Delay			3.9			
Intersection Capacity Utilization			37.0%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

3: MCLEAN RD & ACCESS 3

2015 PM TRAFFIC

5/24/2013

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	147	10	31	157	36	108
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	160	11	34	171	39	117
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			171		403	165
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			171		403	165
tC, single (s)			4.3		6.6	6.5
tC, 2 stage (s)						
tF (s)			2.4		3.7	3.5
p0 queue free %			97		93	86
cM capacity (veh/h)			1279		546	823
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	171	204	157			
Volume Left	0	34	39			
Volume Right	11	0	117			
cSH	1700	1279	730			
Volume to Capacity	0.10	0.03	0.21			
Queue Length 95th (m)	0.0	0.6	6.1			
Control Delay (s)	0.0	1.5	11.3			
Lane LOS		A	B			
Approach Delay (s)	0.0	1.5	11.3			
Approach LOS			B			
Intersection Summary						
Average Delay			3.9			
Intersection Capacity Utilization			37.0%	ICU Level of Service		A
Analysis Period (min)			15			



BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix E










Total Traffic (2020) Synchro Analysis

HCM Unsignalized Intersection Capacity Analysis

1: MCLEAN RD & ACCESS 1

2020 AM TRAFFIC

5/24/2013











						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	335	8	23	186	1	4
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	364	9	25	202	1	4
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)				195		
pX, platoon unblocked						
vC, conflicting volume			373		621	368
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			373		621	368
tC, single (s)			4.3		6.6	6.5
tC, 2 stage (s)						
tF (s)			2.4		3.7	3.5
p0 queue free %			98		100	99
cM capacity (veh/h)			1070		406	629
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	373	227	5			
Volume Left	0	25	1			
Volume Right	9	0	4			
cSH	1700	1070	567			
Volume to Capacity	0.22	0.02	0.01			
Queue Length 95th (m)	0.0	0.5	0.2			
Control Delay (s)	0.0	1.1	11.4			
Lane LOS		A	B			
Approach Delay (s)	0.0	1.1	11.4			
Approach LOS			B			
Intersection Summary						
Average Delay			0.5			
Intersection Capacity Utilization			39.1%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

2: MCLEAN RD & ACCESS 2

2020 AM TRAFFIC

5/24/2013










						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	318	21	63	205	4	13
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	346	23	68	223	4	14
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)				42		
pX, platoon unblocked						
vC, conflicting volume			368		717	357
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			368		717	357
tC, single (s)			4.3		6.6	6.5
tC, 2 stage (s)						
tF (s)			2.4		3.7	3.5
p0 queue free %			94		99	98
cM capacity (veh/h)			1074		341	638
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	368	291	18			
Volume Left	0	68	4			
Volume Right	23	0	14			
cSH	1700	1074	530			
Volume to Capacity	0.22	0.06	0.03			
Queue Length 95th (m)	0.0	1.6	0.8			
Control Delay (s)	0.0	2.5	12.0			
Lane LOS		A	B			
Approach Delay (s)	0.0	2.5	12.0			
Approach LOS			B			
Intersection Summary						
Average Delay			1.4			
Intersection Capacity Utilization			45.6%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

3: MCLEAN RD & ACCESS 3

2020 AM TRAFFIC

5/24/2013











						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	291	40	120	259	9	24
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	316	43	130	282	10	26
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			360		880	338
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			360		880	338
tC, single (s)			4.3		6.6	6.5
tC, 2 stage (s)						
tF (s)			2.4		3.7	3.5
p0 queue free %			88		96	96
cM capacity (veh/h)			1082		255	655
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	360	412	36			
Volume Left	0	130	10			
Volume Right	43	0	26			
cSH	1700	1082	458			
Volume to Capacity	0.21	0.12	0.08			
Queue Length 95th (m)	0.0	3.1	1.9			
Control Delay (s)	0.0	3.6	13.5			
Lane LOS		A	B			
Approach Delay (s)	0.0	3.6	13.5			
Approach LOS			B			
Intersection Summary						
Average Delay		2.5				
Intersection Capacity Utilization		51.3%	ICU Level of Service	A		
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

1: MCLEAN RD & ACCESS 1

2020 PM TRAFFIC

5/24/2013











						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	148	2	6	335	7	21
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	161	2	7	364	8	23
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)				195		
pX, platoon unblocked						
vC, conflicting volume			163		539	162
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			163		539	162
tC, single (s)			4.3		6.6	6.5
tC, 2 stage (s)						
tF (s)			2.4		3.7	3.5
p0 queue free %			99		98	97
cM capacity (veh/h)			1287		463	826
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	163	371	30			
Volume Left	0	7	8			
Volume Right	2	0	23			
cSH	1700	1287	691			
Volume to Capacity	0.10	0.01	0.04			
Queue Length 95th (m)	0.0	0.1	1.0			
Control Delay (s)	0.0	0.2	10.4			
Lane LOS		A	B			
Approach Delay (s)	0.0	0.2	10.4			
Approach LOS			B			
Intersection Summary						
Average Delay			0.7			
Intersection Capacity Utilization			32.4%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

2: MCLEAN RD & ACCESS 2

2020 PM TRAFFIC

5/24/2013










						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	163	6	16	322	19	57
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	177	7	17	350	21	62
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)				42		
pX, platoon unblocked						
vC, conflicting volume			184		565	180
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			184		565	180
tC, single (s)			4.3		6.6	6.5
tC, 2 stage (s)						
tF (s)			2.4		3.7	3.5
p0 queue free %			99		95	92
cM capacity (veh/h)			1264		443	806
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	184	367	83			
Volume Left	0	17	21			
Volume Right	7	0	62			
cSH	1700	1264	669			
Volume to Capacity	0.11	0.01	0.12			
Queue Length 95th (m)	0.0	0.3	3.2			
Control Delay (s)	0.0	0.5	11.1			
Lane LOS		A	B			
Approach Delay (s)	0.0	0.5	11.1			
Approach LOS			B			
Intersection Summary						
Average Delay			1.7			
Intersection Capacity Utilization			41.2%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

3: MCLEAN RD & ACCESS 3

2020 PM TRAFFIC

5/24/2013

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	210	10	31	302	36	108
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	228	11	34	328	39	117
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			239		629	234
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			239		629	234
tC, single (s)			4.3		6.6	6.5
tC, 2 stage (s)						
tF (s)			2.4		3.7	3.5
p0 queue free %			97		90	84
cM capacity (veh/h)			1204		400	752
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	239	362	157			
Volume Left	0	34	39			
Volume Right	11	0	117			
cSH	1700	1204	616			
Volume to Capacity	0.14	0.03	0.25			
Queue Length 95th (m)	0.0	0.7	7.6			
Control Delay (s)	0.0	1.0	12.8			
Lane LOS		A	B			
Approach Delay (s)	0.0	1.0	12.8			
Approach LOS			B			
Intersection Summary						
Average Delay			3.1			
Intersection Capacity Utilization			47.9%	ICU Level of Service		A
Analysis Period (min)			15			