



May 7, 2019

JDE Project 19019

Sean Mason Homes

369 Essa Road
Barrie, ON L4N 9C8

RE: Traffic Letter
341 Veteran's Drive, City of Barrie

On behalf of **Sean Mason Homes** [the Developer], **JD Northcote Engineering Inc.** [JD Engineering] is pleased to submit the following Traffic Letter in support of the proposed residential development located in the southeast corner of the Veteran's Drive / Montserrand Street intersection in the City of Barrie [City].

1.0 Project Background

The subject site is municipally known as 341 Veteran's Drive. The subject site is bound by Montserrand Street and existing residential lands to the north, Veteran's Drive to the west and existing residential lands to the south and east. Veteran's Lane bisects the subject site.

Figure 1 illustrates the location of the subject site in relation to the surrounding area. The proposed development is anticipated to include 32 townhouse units east of Veteran's Lane and a 4-storey building with 16 residential units west of Veteran's Lane.

The subject site is anticipated to include a full-movement driveway [Site Access] onto Veteran's Lane for the townhouse units. The subject site is also anticipated to include parking along the west side of Veteran's Lane for the 4-storey building.

The Site Plan for the proposed development is provided in the **Appendix**.

The Developer has retained JD Engineering to prepare this Traffic Letter in support of the proposed development.

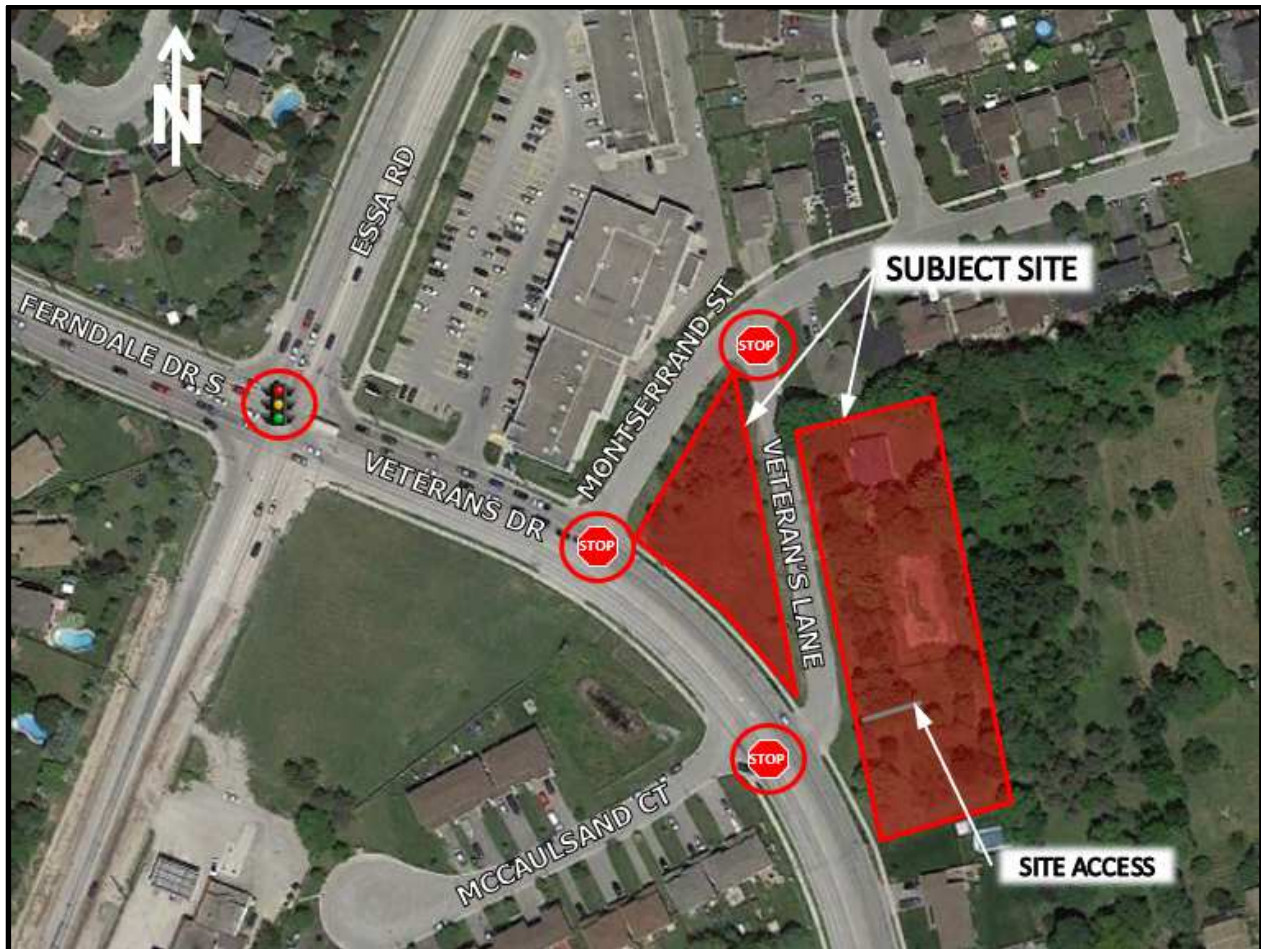
The scope of the Traffic Letter is limited to a high-level review of the traffic generated by the proposed development at the following intersections:

- Veteran's Drive / Montserrand Street; and
- Veteran's Drive / Veteran's Lane.



JD Engineering Inc.
Phone: 705.725.4035
Email: Info@JDEngineering.ca

Figure 1 – Site Location and Study Area



2.0 Street and Intersection Characteristics

Veteran's Drive is a five-lane arterial road with an urban cross-section and a sidewalk on both sides of the road within the study area. Veteran's Drive transitions from a posted 50 km/h speed limit north of Montserrand Street to a posted speed limit of 60km/h south of Veteran's Lane. Veteran's Drive is under the jurisdiction of the City within the study area.

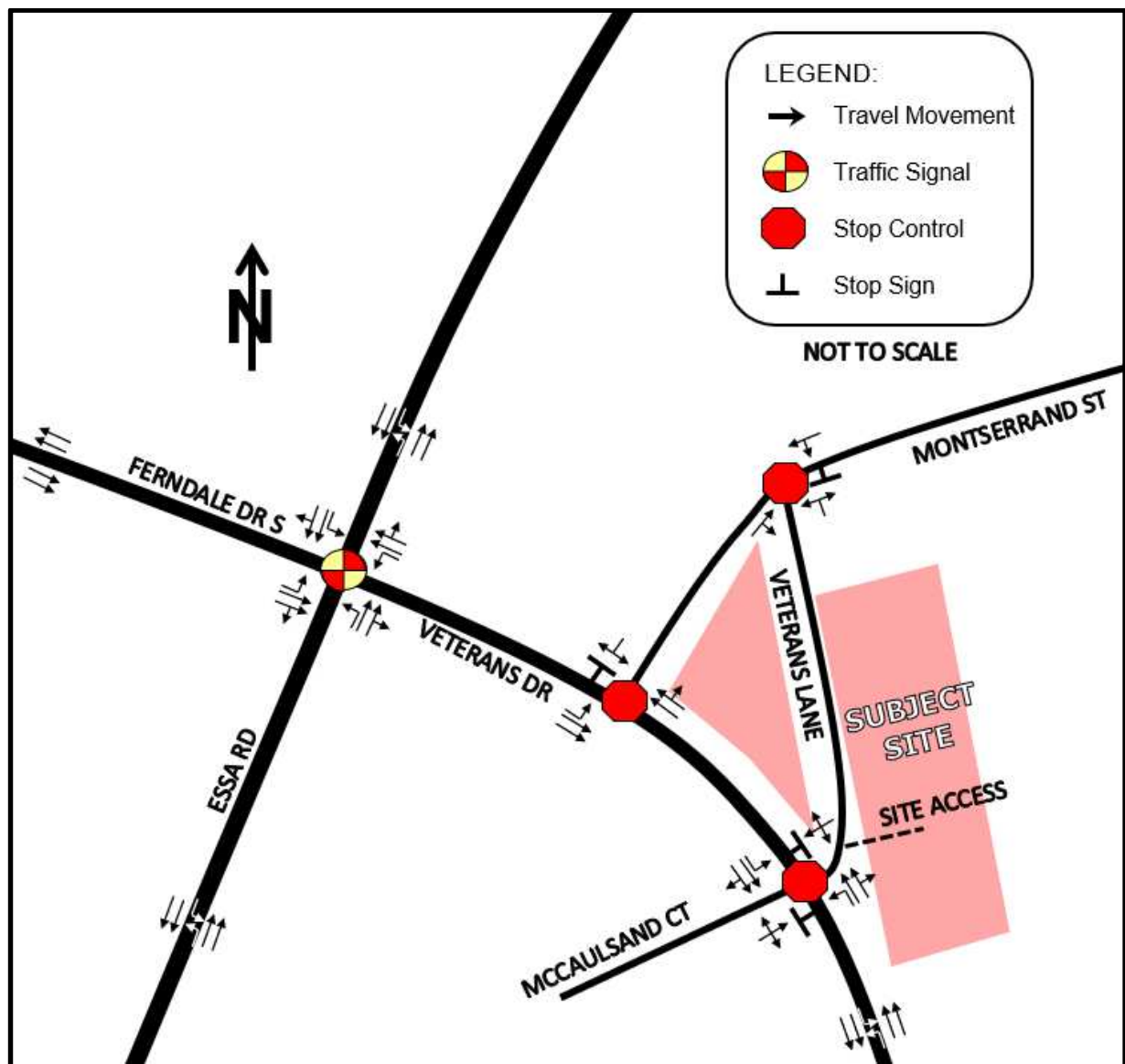
Veteran's Lane is a two-lane local road with a rural cross-section and no sidewalks. Veteran's Lane has an assumed (unposted) speed limit of 50 km/h and is under the jurisdiction of the City.

Montserrand Street is a two-lane local road with an urban cross-section and a sidewalk on the north side of the road. Montserrand Street has an assumed (unposted) speed limit of 50 km/h and is under the jurisdiction of the City.

It is noted that the existing configuration of Veteran's Lane was created when Veteran's Drive was realigned in 2002.

The existing lane configuration within the study area is illustrated in **Figure 2**.

Figure 2 – Existing Lane Configuration within Study Area



3.0 Local Transportation Infrastructure Improvements

Based on a review of the City's Multi-Modal Active Transportation Master Plan [MMATMP], the following infrastructure improvements are proposed in the area:

- The existing painted bike lanes on Veterans Drive between Essa Road and Harvie Road are to be upgraded to buffered bike lanes in the 2016 horizon year. It is noted that the City does not currently have this improvement identified in their 10-year Capital Budget. No additional motor vehicle lanes are currently planned.
- The extension of Bryne Drive from north of Harvie Road to north of Caplan Avenue is in the 2016 horizon year. It is noted that the City currently has this project scheduled for construction in 2021 – 2022 in their Capital Budget.
- The Harvie Road / Big Bay Point Road crossing is in the 2016 horizon year. Construction of the crossing is currently underway with completion scheduled for the fall of 2020.
- The Essa Road / Highway 400 interchange is proposed for reconstruction in 2021, according to the Capital Budget.

In addition to the above-noted infrastructure improvements planned to be completed by the City, a connection between Beacon Road and Harvie Road is expected to be completed as part of the future development of the adjacent to the designated road allowance.

4.0 Other developments in the Study Area

Based on a review of the City's Active Developments Applications Map, there are a number of adjacent developments in the area that will impact the traffic generation within the study area, specifically:

- 1) 40 Harvie Road;
- 2) 368 -378 Essa Road;
- 3) 390 Essa Road;
- 4) 401 Essa Road;
- 5) 405 Essa Road; and
- 6) 430 Essa Road.

4.1 40 Harvie Road

The 40 Harvie Road Development is an industrial / commercial development located at the east end of Harvie Road at Highway 400 consisting of 38.06 hectares of developable land.

The 40 Harvie Road Development is draft plan approved. It is not anticipated that this development will be constructed by the full occupancy of the proposed development.

4.2 368-378 Essa Road

The 368-378 Essa Road development is a residential development located in the south quadrant of the Essa Road / Beacon Road intersection consisting of a 6 storey apartment building with 57 units.

The site plan application of the 368-378 Essa Road development is under review.

4.3 390 Essa Road

The 390 Essa Road development is a residential development located south of Essa Road, midblock between Veteran's Drive and Beacon Road consisting of a 6 storey apartment building with 74 units.

The official plan amendment and zoning by-law application for the 390 Essa Road development is under review.

4.4 401 Essa Road

The 401 Essa Road development (owned by the developer) is a residential development located north of Essa Road, midblock between Veteran's Drive and Beacon Road consisting of 45 townhouse units.

The site plan application for the 401 Essa Road development has been registered.

4.5 405 Essa Road

The 405 Essa Road development is a residential development located north of Essa Road, midblock between Veteran's Drive and Beacon Road consisting of 16 townhouse units.

The zoning by-law and draft plan of subdivision application for the 405 Essa Road development is under review.

4.6 430 Essa Road

The 430 Essa Road development is a mixed-use development located in the southeast corner of the Essa Road / Veteran's Drive & Ferndale Drive South intersection consisting of a 4 storey building with 1,153 sq.m. ground floor commercial and 65 residential units.

The site plan application for the 430 Essa Road development is under review.

5.0 Site Access Review

Veteran's Lane currently provides access to a single detached residential unit on the east side of the road. Based on our review, the existing intersection of Veteran's Lane / Veteran's Drive is redundant as Montserrat Street provides municipal access to the local neighbourhood via Veteran's Drive. Based on the proximity between these two streets and the volume of traffic conveyed, a single access onto Veteran's Drive will provide the necessary capacity to service the local neighbourhood. As part of our analysis, access to the neighbourhood via Montserrat

Street and / or Veteran's Lane was reviewed and it is recommended that the Veteran's Lane access onto Veteran's Drive is decommissioned, due to the redundancy and also the traffic safety issues related to the horizontal curve on Veteran's Lane at Veteran's Drive.

6.0 Proposed Development Traffic Generation

The traffic generation for the proposed development has been calculated based on the data provided in the Institute of Transportation Engineers [ITE] *Trip Generation Manual* (10th Edition) [ITE Trip Generation Manual]. The following ITE land use has been applied to estimate the traffic from the proposed development:

- ITE land use 220 (Multifamily housing (Low-Rise)) – General Urban / Suburban Setting

The estimated trip generation for the proposed development is illustrated below in **Table 1**. The AM and PM peak traffic generation for the proposed development does not exactly align with the anticipated AM and PM peak hour in the study area; consequently, we have applied the peak hour of adjacent street traffic values provided in the ITE Trip Generation Manual.

Table 1 – Estimated Traffic Generation of Proposed Development

Land Use	Size	AM Peak Hour			PM Peak Hour		
		IN	OUT	TOTAL	IN	OUT	TOTAL
Multifamily Housing (Low-Rise) ITE Land Use: 220	48 units	6	18	24	20	11	31

No transportation modal split has been applied to the above-noted traffic generation calculation.

7.0 Proposed Development Traffic Assignment

For the purposes of this study, it has been assumed that all traffic generated by the proposed development will be new traffic and would not be in the study area if the development was not constructed.

The ITE data provides the anticipated percentage of new traffic entering and exiting during the peak hour. The distribution of traffic has been calculated based on the 2016 Transportation Tomorrow Survey [TTS] data for traffic zone 8523 retrieved using the TTS Internet Data Retrieval System [IDRS] (output attached in the **Appendix**). TTS data provides historical origin and destination work trip percentages for specific areas within the County and the Greater Toronto and Hamilton Area [GTHA].

Traffic distribution for the trips generated by the subject site during the AM and PM peak hour is expected to generally follow commuter travel patterns. Our analysis is based on egress traffic during the AM peak hour. Logically, the distribution of ingress traffic will follow the inverse of the exiting traffic distribution. For each of the individual areas identified in the TTS data, we

have selected the probable route of travel, assuming that people will select their route primarily based on travel time.

The distribution of trips is illustrated in **Table 2** using the methodology outlined above.

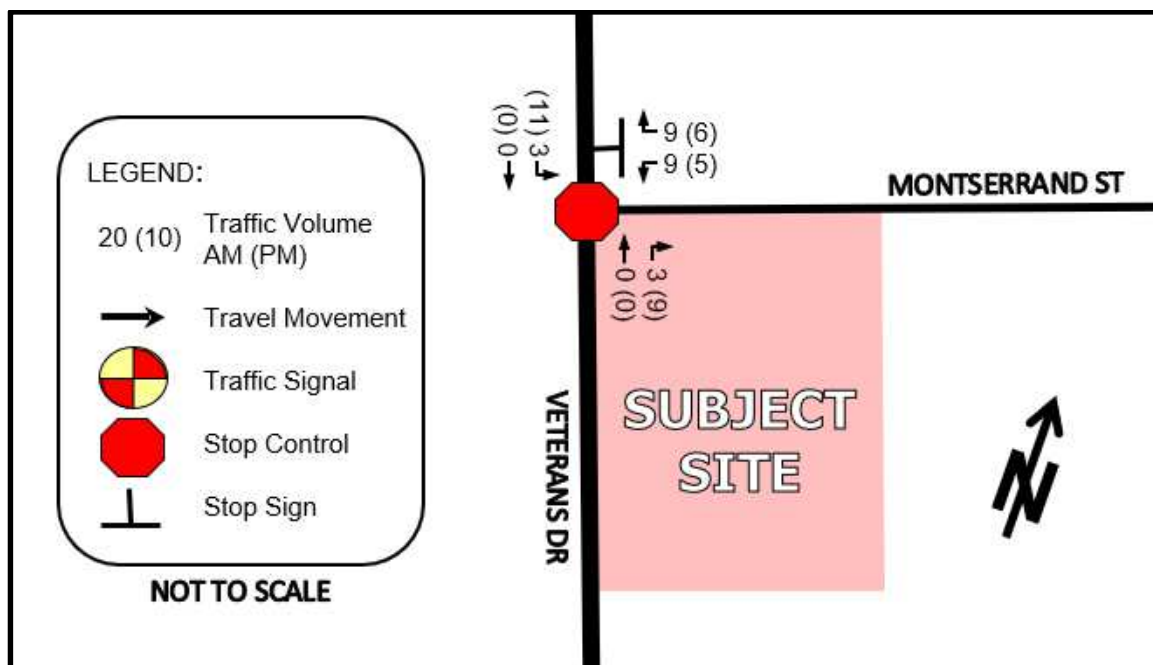
Table 2 – Proposed Development Traffic Distribution

Travel Direction (to / from)	Percentage of Total Traffic Generation
North via Veteran's Drive	51.6%
South via Veteran's Drive	48.4%
TOTAL	100%

Using the traffic distribution pattern noted above, the site traffic assignment for the proposed development was calculated for the AM and PM peak hour and is illustrated in **Figure 3**.

It is noted that we have assumed all traffic will utilize Montserrand Street for the reasons outlined in Section 5.0.

Figure 3 – Traffic Assignment for Proposed Development



8.0 Traffic impact analysis

A Synchro analysis was completed at the intersection of Essa Road / Veteran's Drive & Ferndale Drive South for the critical weekday AM and PM peak hour, based on detailed turning movement traffic and pedestrian counts obtained from the City dated Thursday, February 14,

2019 (provided in the **Appendix**). Based on our review of the Synchro model results and our site review of the existing traffic operations during the critical PM peak hour, the following local operational constraints were noted:

- 1) Queuing of westbound traffic at the intersection of Essa Road / Veteran's Drive & Ferndale Drive South periodically extends beyond the Montserrand Street / Veteran's Drive intersection. This temporarily blocks ingress and egress turning movements at Montserrand Street. The delay was observed to be relatively short during the critical period. Although the movements at Montserrand Street were temporarily blocked, the intended movements were safely completed once the queue on Veteran's Drive cleared, which occurred at each cycle of the traffic signals at the Essa Road / Veteran's Drive & Ferndale Drive intersection.
 - It is our expectation that the proposed extension of Bryne Drive, the Harvie Road / Big Bay Point Road overpass and the extension of Beacon Road to Harvie Road will all improve the queuing on Veteran's Drive by providing alternative routes for traffic in the surrounding area.
- 2) During our site visit, vehicles were observed using Veteran's Lane to get to Montserrand Street. The majority of the trips were approaching via Veteran's Drive from the south. There were also some vehicles travelling to Veteran's Drive (southbound).
- 3) During our site visit, some cut-through traffic was observed along Beacon Road and Montserrand Street. Traffic calming (speed cushion) is provided on Montserrand Street, adjacent to the park. The City and the local residents may consider implementing additional traffic calming measures to address this existing issue. In the short-term, the City may consider providing "No Through Traffic" signage at Veteran's Drive and Essa Road, to deter cut-through traffic.
- 4) During our site visit, one vehicle was observed to partially block the second eastbound lane on Veteran's Drive, when making an eastbound left turn movement into Montserrand Street. The City may consider removing 10 metres of the existing centre median on Veteran's Drive to provide additional space for eastbound vehicles to access the two-way left-turn lane on Veteran's Drive at Montserrand Street.

The proposed development is estimated to generate an additional 24 AM peak hour trips and 31 PM peak hour trips. Based on our review, and accounting for the recommended decommissioning of Veteran's Lane at Veteran's Drive, there is sufficient capacity in the surrounding road network to accommodate the additional traffic generated by the proposed development.

Site Access

It is recommended that the Site Access onto Veteran's Lane is shifted north to allow for the necessary decommissioning of the Veteran's Lane / Veteran's Drive intersection. The minimum spacing between the Site Access and Montserrand Street (measured edge to edge of driveway) is 11 metres, per the suggested minimum corner clearance requirements for a driveway as

identified in the TAC Guidelines – Figure 8.9.2 (Driveway Spacing Guidelines – Locals and Collectors).

In consideration of the above-noted adjustments, the proposed Site Access configuration will provide sufficient capacity to service the townhouse component of the proposed development.

The Site Access will operate efficiently as a full-movement driveway with one-way stop control for westbound movements. No infrastructure improvements are recommended on Veteran's Lane at the Site Access. A single eastbound lane and westbound lane at the Site Access driveway will provide the necessary capacity to service the townhouse component of the proposed development.

9.0 Conclusion

This chapter summarizes the conclusions and recommendations from the study.

- 1) It is recommended that the Veteran's Lane access onto Veteran's Drive is decommissioned to remove the redundancy with having both the Veteran's Drive / Veteran's Lane and Veteran's Drive / Montserrat Street intersection.
- 2) The configuration of the proposed Site Access driveway will provide the necessary capacity to service the proposed development.
- 3) The additional traffic generated by the proposed development is expected to have a negligible impact on the existing traffic operations in the study area.
- 4) No infrastructure improvements are required within the study area as a result of the proposed development.

We trust you will find this submission acceptable. Should you have any questions or concerns or require any additional information in this regard, please contact our office.

Yours truly,
JD Northcote Engineering Inc.

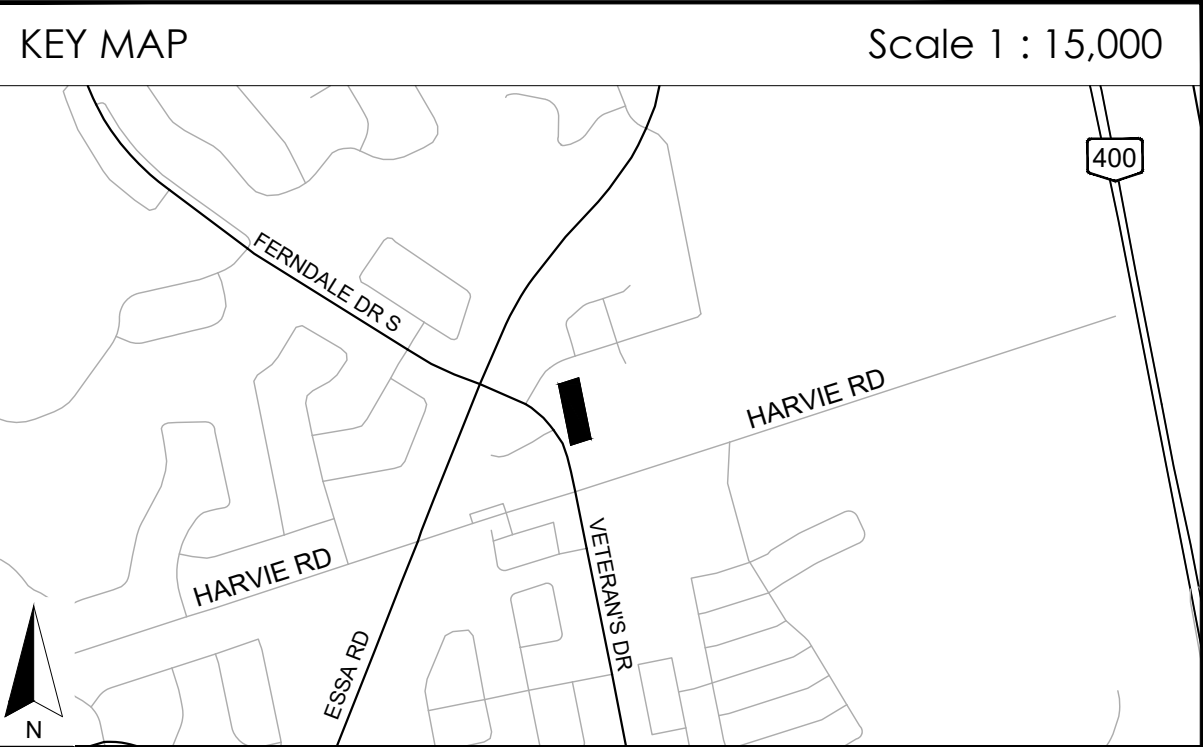
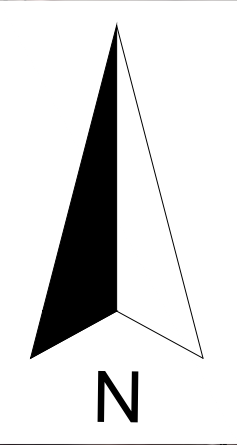


John Northcote, P.Eng.
President



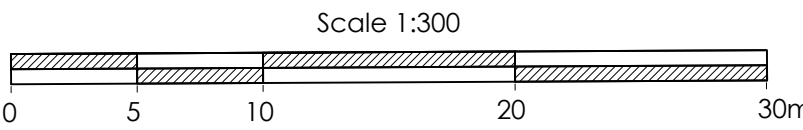
APPENDIX

Site Plan



CONCEPTUAL SITE PLAN

PART LOTS 6, CONCESSION 13
339 & 341 VETERAN'S DRIVE
IN THE
CITY OF BARRIE



LEGEND

- SUBJECT LANDS**
339 Veterans Drive 1,484.8m²
341 Veterans Drive 5,237.6m²
- TOWNHOMES (7.0x9.75m)
12 Units - 3 Storeys
 - TOWNHOMES (4.57x10.9m min)
22 Units - 3 Storeys
 - WALK-UP BUILDING
12 Units - 3 Storeys
 - LANDSCAPED OPEN SPACE
 - BALCONIES
 - ROAD WIDENING

ZONING TABLE - RM2 339 Veteran's Drive		
PROVISION	REQUIRED	PROVIDED
LOT AREA	720m² (min)	1,484.4m² (0.366ac)
ROAD WIDENING		177.5m²
LOT FRONTAGE	21m (min)	52.29m (Montserrat St)
SETBACKS		
FRONT YARD	7.0m (min)	1.2m
INTERIOR SIDE YARD	1.8m (min)	n/a
EXTERIOR SIDE YARD	3.0m (min)	1.2m (Veterans Drive)
REAR YARD	7.0m (min)	1.1m (Veterans Lane)
DWELLING UNIT FLOOR AREA	45m² / 1 Bdrm 55m² / 2 Bdrm (min)	45m² / 1 Bdrm 55m² / 2 Bdrm (min)
LOT COVERAGE	35% (max)	32.5%
GROSS FLOOR AREA	60% of lot area (max)	97.5%
BUILDING HEIGHT	10m (max)	11.0 m
LANDSCAPED OPEN SPACE	35% (min)	50.8%
AMENITY AREA	144m² (12m²/unit min)	200m²
AMENITY AREA	Consolidated	Consolidated
PARKING SPACES	18 (1.5/unit min)	15 with 2 BF (1.2/unit)
TANDEM PARKING SPACES	Not permitted	Not Permitted
DENSITY	40 u/ha (max)	81 u/ha
SETBACK TO SECONDARY MEANS OF ACCESS	7.0m	2m

ZONING TABLE - RM2 341 Veteran's Drive		
PROVISION	REQUIRED	PROVIDED
LOT AREA	720m² (min)	5,237.6m² (1.29ac)
LOT FRONTAGE	21m (min)	123.6m
SETBACKS		
FRONT YARD	7.0m (min)	3m
INTERIOR SIDE YARD	1.8m (min)	1.8m
EXTERIOR SIDE YARD	3.0m (min)	n/a
REAR YARD	7.0m (min)	6m
DWELLING UNIT FLOOR AREA	45m² / 1 Bdrm 55m² / 2 Bdrm (min)	45m² / 1 Bdrm 55m² / 2 Bdrm (min)
LOT COVERAGE	35% (max)	46%
GROSS FLOOR AREA	60% of lot area (max)	105%
BUILDING HEIGHT	10m (max)	11.0 m
LANDSCAPED OPEN SPACE	35% (min)	35%
AMENITY AREA	408m² (12m²/unit min)	Unconsolidated Only
PARKING SPACES	51 (1.5/unit min)	68 (2/unit)
TANDEM PARKING SPACES	Not permitted	Permitted
DENSITY	40 u/ha (max)	65 u/ha
SETBACK TO SECONDARY MEANS OF ACCESS	7.0m	6m
LANDSCAPED STRIP TO RESIDENTIAL	3.0m	2.8m along north 1.4m along south

Source: Simcoe County Interactive Map.
Note: This drawing is for discussion purposes only.
Property boundary to be verified by an O.L.S.
Balconies on 7x9.75m townhomes are less than 1.8m above grade.

CONCEPTUAL SITE PLAN - 46 UNITS

VETERAN'S DRIVE - CITY OF BARRIE

RESIDENTIAL

CURRENT OP DESIGNATION

RH - 339
R1 - 341

CURRENT ZONE

SCHEDULE OF REVISIONS			
No.	Date	Description	By

IPS INNOVATIVE PLANNING SOLUTIONS
PLANNERS • PROJECT MANAGERS • LAND DEVELOPERS
150 DUNLOP STREET EAST, SUITE 201, BARRIE, ONTARIO L4M 1B1
Tel: 705 • 812 • 3281 fax: 705 • 812 • 3438 e: info@ipsconsultinginc.com www.ipsconsultinginc.com

Date:	April 1, 2019	Drawn By:	VS
File:	Veteran's Lane	Reviewed By:	

TRANSPORTATION TOMORROW SURVEY EXCERPT



s Tabulation

Tabulation Query Form - Trip - 2016 v1.1

Variables

district of destination (Optional) Table Attribute

Attributes

Column Grouping Table Grouping
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on Query Form - Trip - 2016 v1.1

district of destination - pd_dest
GTA zone of household - gta06_hhld

of household - gta06_hhld In 8523

trip - start_time In 700-900

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2006 GTA zone of household

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Unfiltered table

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on Query Form - Trip - 2016 v1.1
District of destination - pd_dest
GTA zone of household - gta06_hhld

of household - gta06_hhld In 8523
trip - start_time In 700-900
F destination - purp_dest In w, r)

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o,68
o,39
o,65
co,24
33

Swillimbury,29
174



Tabulation

Tabulation Query Form - Trip - 2016 v1.1

Variables

Zone of destination 2006 GTA zone of household (Optional) Table Attribute

Attributes

Column Grouping Table Grouping

Choose File No file chosen

Selection +

2006 GTA zone of household	In	8523
Start time of trip	In	700-900
Trip purpose of destination	In	w, r
Planning district of destination	In	81,

Unlimited table ☐ Column format ☐ Expansion Factor On

Select All

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on Query Form - Trip - 2016 v1.1

Zone of destination - gta06_dest
GTA zone of household - gta06_hhld

of household - gta06_hhld In 8523

trip - start_time In 700-900

2006 GTA zone of household

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8523

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Select All

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9 13:49:37 GMT-0400 (Eastern Daylight Time) - Run Time: 2196ms

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zone of destination - gta06_dest
TA zone of household - gta06_hhld

of household - gta06_hhld In 8523

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TRAFFIC COUNTS

Site ID Code:	Essa Road & Ferndale Road / Veterans Drive
Intersection Location:	Barrie, Ontario
Municipality:	Thursday February 14, 2019
Count Date:	Partly Cloudy, -1 Degree
Weather and Temperature:	TP
Surveyor:	



Turning Movement Count Diagram

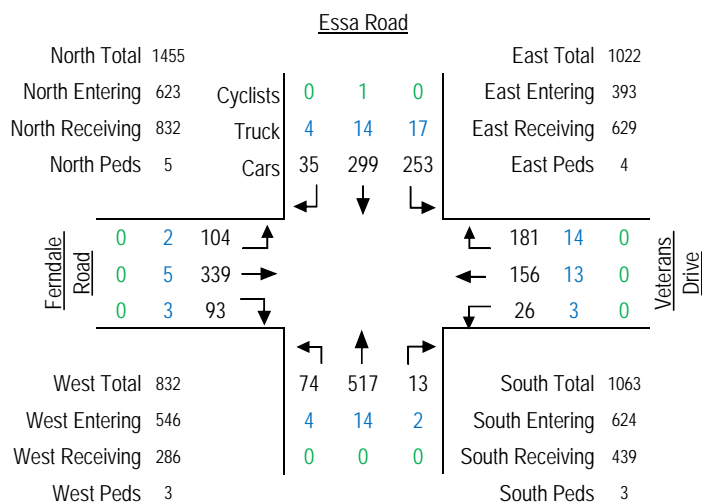
Intersection: Essa Road & Ferndale Road / Veterans Drive

Municipality: Barrie, Ontario

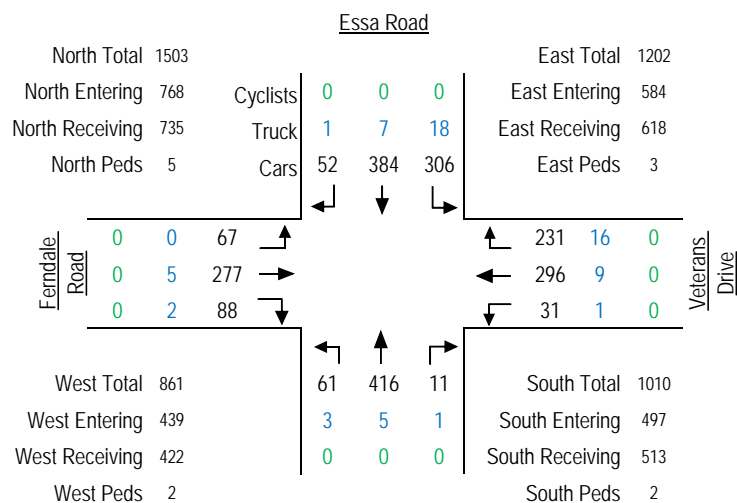
Intersection ID:

Date: Thursday February 14, 2019

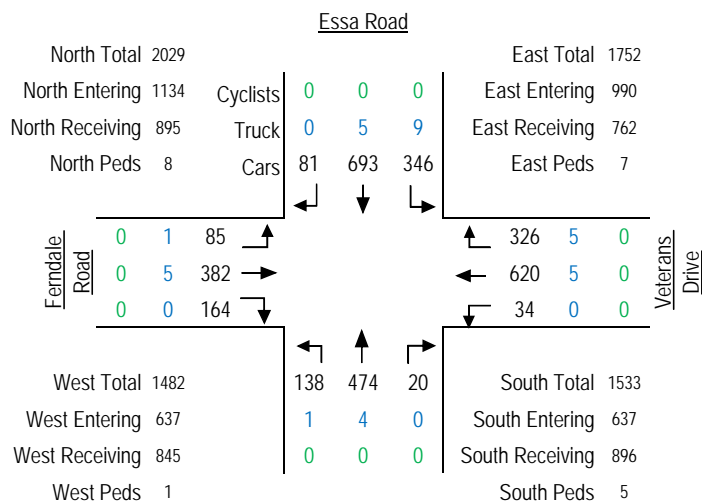
AM Peak Hour: 8:00 to 9:00



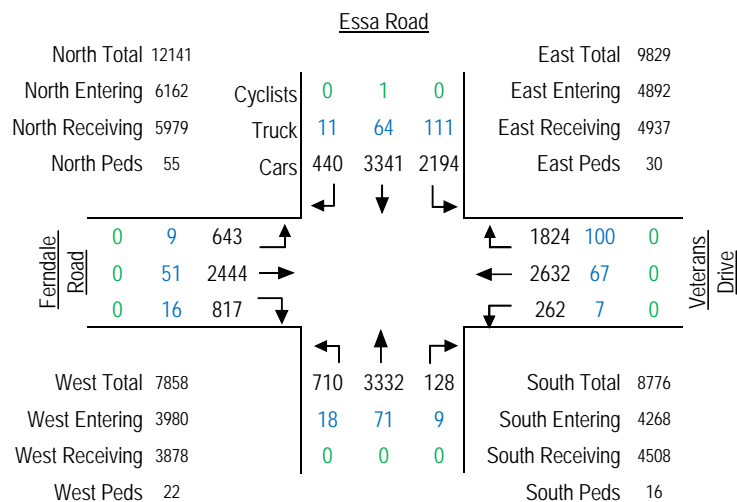
MD Peak Hour: 12:15 to 13:15



PM Peak Hour: 16:30 to 17:30



Total 8-Hour Count



April 26, 2019

File: T07-SI

John Northcote
JD Engineering
86 Cumberland Street
Barrie, ON L4N 2P6

Dear Mr. Northcote,

RE: Traffic Signal Timings

With respect to your inquiry on April 23, 2019, attached are the Signal Timings for the intersection of Essa Road & Veterans Drive/Ferndale Drive.

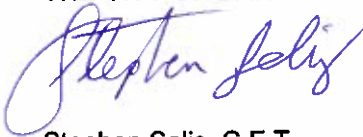
The side street phases are actuated; meaning a vehicle or pedestrian must be present on the side street before the side street is given a green indication. Actuation at this intersection occurs in two ways: first, for vehicles a loop detector is imbedded into the roadway at the painted stop bar; and secondly, pushbuttons are located on all corners for pedestrians to activate their movement. Vehicle presence only on the side street would result in a possible green time of between the minimum and maximum times noted below, depending on demand.

Pedestrian "Walk" and "Flashing Don't Walk" times on the side street as noted would be used in the event that the pedestrian push button was activated. Should there be no demand on the actuated phases; the signals would rest in a green indication for the main street.

If you require any further information please feel free to contact me at (705) 739-4220 ext. 4937.

Sincerely,

THE CITY OF BARRIE



Stephen Salis, C.E.T.
Transportation Systems Technologist

Essa Road & Veterans Drive/Ferndale Drive – FREE PLAN (NO COORDINATION)

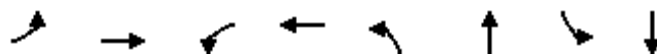
Roadway	Direction	Vehicular Indications				Pedestrian Indications	
		Minimum Green	Maximum Green	Amber	All Red	Walk	Flashing Don't Walk
Essa Road (main street)	Advanced Eastbound Left Turn	7	7	3	1	N/A	N/A
Essa Road (main street)	Advanced Westbound Left Turn	7	15	3	1	N/A	N/A
Essa Road (main street)	Eastbound	44	44	4	2	19	15
Essa Road (main street)	Westbound	44	44	4	2	19	15
Veterans Drive (side street)	Advanced Northbound Left Turn	7	7	3	1	N/A	N/A
Ferndale Drive (side street)	Advanced Southbound Left Turn	7	7	3	1	N/A	N/A
Veterans Drive (side street)	Northbound	10	44	4	2	10	14
Ferndale Drive (side street)	Southbound	10	44	4	2	10	14

NOTE: All times are recorded in seconds, based on full demand.

SYNCHRO ANALYSIS OUTPUT – EXISTING TRAFFIC VOLUMES

341 Veteran's Dr
1: Essa Rd & Ferndale Rd/Veterans Dr

Queues
Existing (2019) AM Peak Hour



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	106	344	29	169	78	531	270	314
Future Volume (vph)	106	344	29	169	78	531	270	314
Lane Group Flow (vph)	108	449	30	371	80	557	276	359
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	3	8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	3	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	7.0	10.0	7.0	10.0	7.0	44.0	7.0	44.0
Minimum Split (s)	11.0	38.0	11.0	38.0	11.0	50.0	11.0	50.0
Total Split (s)	11.0	50.0	11.0	50.0	11.0	50.0	11.0	50.0
Total Split (%)	9.0%	41.0%	9.0%	41.0%	9.0%	41.0%	9.0%	41.0%
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	4.0	6.0	4.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	None	Max	None	None	None	None
v/c Ratio	0.25	0.33	0.08	0.30	0.18	0.45	0.85	0.28
Control Delay	20.2	25.2	18.3	13.2	19.4	31.1	50.3	26.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.2	25.2	18.3	13.2	19.4	31.1	50.3	26.9
Queue Length 50th (m)	14.3	38.1	3.8	14.5	10.5	53.0	41.2	31.0
Queue Length 95th (m)	25.2	51.8	9.2	26.1	19.6	68.9	#79.4	43.1
Internal Link Dist (m)		324.2		451.4		205.5		257.2
Turn Bay Length (m)	30.0		50.0		40.0		60.0	
Base Capacity (vph)	430	1364	390	1217	445	1242	326	1266
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.33	0.08	0.30	0.18	0.45	0.85	0.28

Intersection Summary

Cycle Length: 122

Actuated Cycle Length: 122

Natural Cycle: 110

Control Type: Semi Act-Uncoord

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

Queue shown is maximum after two cycles.





















Splits and Phases: 1: Essa Rd & Ferndale Rd/Veterans Dr

	Ø1		Ø2		Ø3		Ø4
11 s		50 s		11 s		50 s	
	Ø5		Ø6		Ø7		Ø8
11 s		50 s		11 s		50 s	

341 Veteran's Dr
1: Essa Rd & Ferndale Rd/Veterans Dr

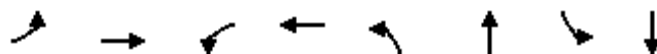
HCM Signalized Intersection Capacity Analysis

Existing (2019) AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	106	344	96	29	169	195	78	531	15	270	314	39
Future Volume (vph)	106	344	96	29	169	195	78	531	15	270	314	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.92		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1747	3391		1621	3023		1698	3441		1683	3323	
Flt Permitted	0.46	1.00		0.46	1.00		0.52	1.00		0.34	1.00	
Satd. Flow (perm)	848	3391		791	3023		923	3441		600	3323	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	1.00
Adj. Flow (vph)	108	351	98	30	172	199	80	542	15	276	320	39
RTOR Reduction (vph)	0	20	0	0	126	0	0	1	0	0	8	0
Lane Group Flow (vph)	108	429	0	30	245	0	80	556	0	276	351	0
Confl. Peds. (#/hr)	5		3	3		5	3		4	4		1
Confl. Bikes (#/hr)			3									
Heavy Vehicles (%)	2%	1%	3%	10%	8%	7%	5%	3%	13%	6%	5%	10%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	55.4	48.4		49.8	45.6		50.4	44.8		53.2	46.2	
Effective Green, g (s)	55.4	48.4		49.8	45.6		50.4	44.8		53.2	46.2	
Actuated g/C Ratio	0.45	0.39		0.40	0.37		0.41	0.36		0.43	0.37	
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	428	1319		344	1108		408	1239		317	1234	
v/s Ratio Prot	c0.01	c0.13		0.00	0.08		0.01	0.16		c0.05	0.11	
v/s Ratio Perm	0.10			0.03			0.07			c0.32		
v/c Ratio	0.25	0.33		0.09	0.22		0.20	0.45		0.87	0.28	
Uniform Delay, d1	20.6	26.6		22.8	27.2		23.1	30.4		31.7	27.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	0.7		0.1	0.5		0.2	0.3		22.0	0.1	
Delay (s)	20.9	27.2		22.9	27.6		23.3	30.6		53.6	27.6	
Level of Service	C	C		C	C		C	C		D	C	
Approach Delay (s)		26.0			27.3			29.7			38.9	
Approach LOS		C			C			C			D	
Intersection Summary												
HCM 2000 Control Delay			31.0			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.61									
Actuated Cycle Length (s)			124.4			Sum of lost time (s)			20.0			
Intersection Capacity Utilization			94.2%			ICU Level of Service			F			
Analysis Period (min)			15									
c Critical Lane Group												

341 Veteran's Dr
1: Essa Rd & Ferndale Rd/Veterans Dr

Queues
Existing (2019) PM Peak Hour



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	86	387	34	625	139	478	355	698
Future Volume (vph)	86	387	34	625	139	478	355	698
Lane Group Flow (vph)	88	562	35	976	142	508	362	793
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	3	8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	3	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	7.0	10.0	7.0	10.0	7.0	24.0	7.0	24.0
Minimum Split (s)	11.0	30.0	11.0	30.0	11.0	30.0	11.0	30.0
Total Split (s)	11.0	48.0	11.0	48.0	15.0	33.0	30.0	48.0
Total Split (%)	9.0%	39.3%	9.0%	39.3%	12.3%	27.0%	24.6%	39.3%
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	4.0	6.0	4.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	None	Max	None	None	None	None
v/c Ratio	0.44	0.42	0.10	0.81	0.54	0.67	0.82	0.73
Control Delay	25.3	25.2	18.8	36.7	27.9	46.5	37.6	38.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.3	25.2	18.8	36.7	27.9	46.5	37.6	38.5
Queue Length 50th (m)	10.8	45.4	4.2	97.2	18.7	56.7	55.5	84.2
Queue Length 95th (m)	21.9	65.8	10.7	#133.8	30.9	77.1	#86.1	106.5
Internal Link Dist (m)		324.2		451.4		205.5		257.2
Turn Bay Length (m)	30.0		50.0		40.0		60.0	
Base Capacity (vph)	201	1336	338	1210	280	819	489	1241
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.44	0.42	0.10	0.81	0.51	0.62	0.74	0.64

Intersection Summary

Cycle Length: 122

Actuated Cycle Length: 114

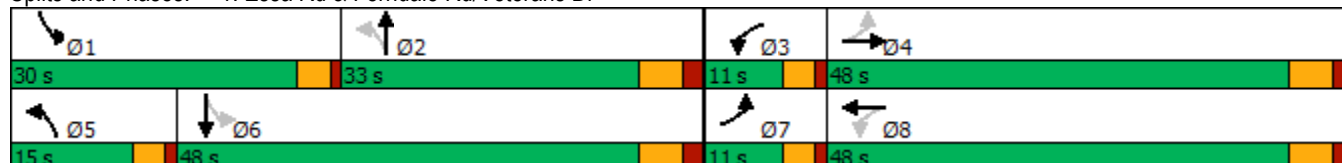
Natural Cycle: 85

Control Type: Semi Act-Uncoord

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

Queue shown is maximum after two cycles.





















Splits and Phases: 1: Essa Rd & Ferndale Rd/Veterans Dr



341 Veteran's Dr
1: Essa Rd & Ferndale Rd/Veterans Dr

HCM Signalized Intersection Capacity Analysis

Existing (2019) PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	86	387	164	34	625	331	139	478	20	355	698	81
Future Volume (vph)	86	387	164	34	625	331	139	478	20	355	698	81
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.95		1.00	0.99		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1750	3337		1621	3118		1700	3429		1683	3327	
Flt Permitted	0.13	1.00		0.37	1.00		0.27	1.00		0.24	1.00	
Satd. Flow (perm)	245	3337		638	3118		487	3429		433	3327	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	1.00
Adj. Flow (vph)	88	395	167	35	638	338	142	488	20	362	712	81
RTOR Reduction (vph)	0	36	0	0	54	0	0	2	0	0	7	0
Lane Group Flow (vph)	88	526	0	35	922	0	142	506	0	362	786	0
Confl. Peds. (#/hr)	8		5	5		8	1		7	7		1
Confl. Bikes (#/hr)			3									
Heavy Vehicles (%)	2%	1%	3%	10%	8%	7%	5%	3%	13%	6%	5%	10%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	49.9	44.5		47.1	43.1		35.1	25.1		51.1	37.1	
Effective Green, g (s)	49.9	44.5		47.1	43.1		35.1	25.1		51.1	37.1	
Actuated g/C Ratio	0.43	0.38		0.41	0.37		0.30	0.22		0.44	0.32	
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	176	1284		293	1162		252	744		429	1067	
v/s Ratio Prot	c0.02	0.16		0.00	c0.30		0.05	0.15		c0.16	0.24	
v/s Ratio Perm	0.19			0.04			0.12			c0.21		
v/c Ratio	0.50	0.41		0.12	0.79		0.56	0.68		0.84	0.74	
Uniform Delay, d1	22.7	26.0		20.9	32.3		30.8	41.6		24.4	34.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.2	1.0		0.2	5.6		2.9	2.5		14.1	2.7	
Delay (s)	25.0	26.9		21.1	37.9		33.6	44.0		38.4	37.6	
Level of Service	C	C		C	D		C	D		D	D	
Approach Delay (s)		26.7			37.3			41.8			37.9	
Approach LOS		C			D			D			D	
Intersection Summary												
HCM 2000 Control Delay			36.3			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			0.83									
Actuated Cycle Length (s)			115.6			Sum of lost time (s)			20.0			
Intersection Capacity Utilization			90.3%			ICU Level of Service			E			
Analysis Period (min)			15									
c Critical Lane Group												