

1357 Belle Aire Beach Road

Town of Innisfil

Traffic Impact Study for Belle Aire Investment Corp.

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Executive Summary

This report summarizes the traffic impact study prepared for the proposed residential development on a site municipally known as 1357 Belle Aire Beach Road, located south of Belle Aire Beach Road west of the GO Transit railway corridor, in the community of Lefroy, Town of Innisfil [Town], County of Simcoe [County]. The report assesses the impact of traffic related to the development on the adjacent roadway and provides recommendations to accommodate this traffic in a safe and efficient manner.

It is anticipated that the proposed development will be completely built-out and occupied by 2020.

The proposed development includes 93 residential townhouse units and will have two full-movement access driveways [West Access and East Access] onto Belle Aire Beach Road.

The scope of this analysis includes a review of the following intersections:

- Belle Aire Beach Road & 5th Line / 20th Sideroad;
- East Access / Belle Aire Beach Road; and
- West Access / Belle Aire Beach Road.

Conclusions

1. The proposed development is expected to generate a total of 45 AM and 55 PM peak hour trips.
2. Detailed turning movement counts, completed on Thursday, May 4, 2017, were obtained from the Town for the intersection of Belle Aire Beach Road & 5th Line / 20th Sideroad.
3. An intersection operation analysis was completed at the study area intersections, using the existing (2018) and background (2025 and 2030) traffic volumes, with the adjacent development traffic and without the proposed development traffic. This enabled a review of existing and future traffic deficiencies that would be present without the influence of the proposed development. The following transportation infrastructure improvements are recommended within the study area:

Background (2025)

Belle Aire Beach Road & 5th Line / 20th Sideroad

- Signalization of intersection
4. An estimate of the amount of traffic that would be generated by the Subject Site was prepared and assigned to the study area streets and intersections.
 5. An intersection operation analysis was completed under total (2025 and 2030) traffic volumes with the proposed development operational at the study area intersections. No additional geometric lane improvements or traffic signal improvements are recommended within the study area.
 6. The proposed West Access and East Access driveways will operate efficiently with one-way stop control for northbound traffic. A single lane for ingress and egress movements at each intersection will provide the necessary capacity to convey the traffic volume generated by the proposed development.
 7. The sight distance available for the proposed East Access and West Access driveways meet the minimum stopping sight distance requirements. Installation of a "Hidden Driveway" sign is recommended on Belle Aire Beach Road to advise eastbound traffic of the potential for vehicles entering at the West Access.

8. In summary, the proposed development will not cause any operational issues and will not add significant delay or congestion to the local roadway network.

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1 Introduction

1.1 Background

Belle Aire Investment Corp. [The Developer] is proposing a residential development on a site municipally known as 1357 Belle Aire Beach Road, located south of Belle Aire Beach Road west of the GO Transit railway corridor, in the community of Lefroy, Town of Innisfil [Town], County of Simcoe [County]. The proposed residential development includes 93 residential townhouse units.

It is anticipated that the proposed development will be completely built-out and occupied by 2020.

The proposed development will have two full-movement access driveways [East Access and West Access] onto Belle Aire Beach Road.

The Developer has retained **JD Northcote Engineering Inc.** [JD Engineering] to prepare this traffic impact study in support of the proposed development.

1.2 Study Area

Figure 1 shows the location of the subject site and study area intersections in relation to the surrounding area. The Site Plan by Innovative Planning Solutions is provided in **Appendix A**.

The subject site is bound by existing residential lands to the west, Belle Aire Beach Road to the north and undeveloped lands to the south and east.

Through consultation with the Town, the following intersections are included in the traffic impact study:

- Belle Aire Beach Road & 5th Line / 20th Sideroad;
- East Access / Belle Aire Beach Road; and
- West Access / Belle Aire Beach Road.

Figure 1 – Proposed Site Location and Study Area



1.3 Study Scope and Objectives

The purpose of this study is to identify the potential impacts to traffic flow at the site access driveways and on the surrounding roadway network. The study analysis includes the following tasks:

- Consult with the Town to address any traffic-related issues or concerns they have with the proposed development;
- Determine existing traffic volumes and circulation patterns;
- Estimate future traffic volumes if the proposed development was not constructed, including the impact of additional proposed developments in the area;
- Complete level-of-service [LOS] analysis of horizon year (without the proposed development) traffic conditions and identify operational deficiencies;
- Estimate the amount of traffic that would be generated by the proposed development and assign to the roadway network;
- Complete LOS analysis of horizon year (with the proposed development) traffic conditions and identify additional operational deficiencies;
- Identify improvement options to address operational deficiencies;
- Review the available sight distance at the proposed West Access and East Access driveways onto Belle Aire Beach Road; and
- Document findings and recommendations in a final report.

1.4 Horizon Year and Analysis Periods

Traffic scenarios for the existing year (2018), 5-year post-buildout (2025) horizon year and 10-year post-buildout (2030) horizon year were selected for analysis of traffic operations in the study area. The weekday morning [AM] and weekday afternoon [PM] peak hours have been selected as the analysis periods for this study.

2 Information Gathering

2.1 Street and Intersection Characteristics

20th Sideroad is a two-lane arterial road with a rural cross-section with no sidewalks within the study area. The posted speed limit on 20th Sideroad transitions from an 80km/h zone to a 60km/h zone (north to south) within the study area. The posted speed limit on 20th Sideroad is 80km/h through the intersection of Belle Aire Beach Road in the southbound direction and 60km/h through the intersection of Belle Aire Beach Road in the northbound direction. 20th Sideroad is under the jurisdiction of the Town within the study area.

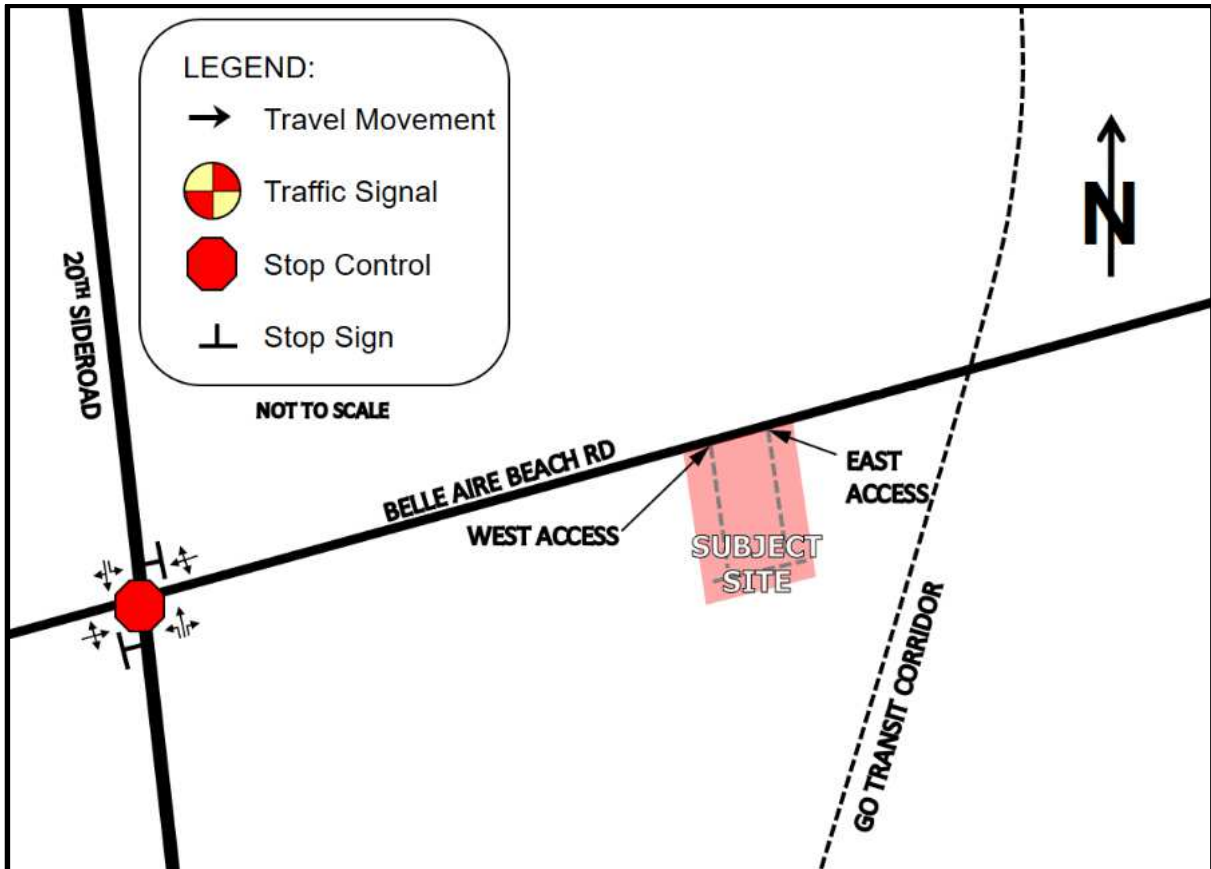
There is an existing multi-use trail on the east side of 20th Sideroad from roughly midblock between Belle Aire Beach Road and Killarney Beach Road to approximately 100 metres south of Belle Aire Beach Road.

20th Sideroad has paved one metre shoulders through the intersection of Belle Aire Beach Road, adjacent to the existing auxiliary turn lanes.

Belle Aire Beach Road (5th Line) is a two-lane major collector road east of 20th Sideroad and a two-lane local road west of 20th Sideroad. Belle Aire Beach Road has a posted speed limit of 80km/h and a rural cross-section with no sidewalks within the study area. Belle Aire Beach Road is under the jurisdiction of the Town, within the study area.

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

Figure 2 – Existing (2018) Intersection Spacing and Lane Configuration with in Study Area



2.2 Local Transportation Infrastructure Improvements

Based on the Town's Transportation Master Plan (August 2013) [Town TMP], the following road improvements are anticipated to be completed prior to 2023:

- 20th Sideroad (within study area);
 - Construction of paved shoulders;

Based on the Town TMP, the following road improvements are anticipated to be completed prior to 2031:

- Belle Aire Beach Road (east of 20th Sideroad within study area);
 - Urbanization of roadway;
- 20th Sideroad / Belle Aire Beach Road intersection
 - Signalization of Intersection;

2.3 Transit Access

There is no municipal transit service currently available within the study area. It is noted that the Town TMP identifies a potential GO Station location on Belle Aire Beach Drive, east of 20th Sideroad; however, this potential location was identified in 2005 and since that time, the Ontario Growth Plan

amendment for the Simcoe area in 2012 necessitates a review of the station location as per the Town TMP.

2.4 Other Developments within the Study Area

The Town has identified a number of other developments in the area that will impact the traffic generation rates. A majority of these developments are located within the Lefroy Settlement Area (most notably the development of the Lefroy Settlement Area Management Inc. [LASMI] properties), Alcona South Existing Settlement Area [Alcona Existing] and the Alcona South Expansion Area [Alcona Expansion]. The traffic generation from the following areas and developments has been included within the background traffic volume for this study:

- LSAMI;
- Alcona Existing;
- Alcona Expansion;
- 1303 Belle Aire Beach Road; and
- 2272565 Ontario Inc. Residential Development.

Figure 3 shows the location of the above noted adjacent areas and developments in relation to the subject site.

There is some uncertainty with respect to the build-out timelines and phasing for the above-noted areas and developments. For the purpose of our analysis, it is assumed that 80% and 100% of the traffic generated from the above-noted areas and developments will be completed prior to the 2025 and 2030 horizon years respectively.

Figure 3 – Adjacent Developments within Study Area



2.4.1 Traffic Generation for Adjacent Developments

Traffic impact studies are not available for some of the above-noted local developments. Consequently, the traffic generation for these proposed developments have 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 uses have been applied to estimate the traffic from the adjacent developments:

- ITE land use 210 (Single-Family Detached Housing) – General Urban / Suburban Setting
- ITE land use 220 (Multifamily Housing (Low-Rise)) – General Urban / Suburban Setting

The AM and PM peak hour traffic generation for the adjacent developments do not exactly align with the AM and PM peak hour in the traffic counts; consequently, we have applied the peak hour of adjacent street traffic values provided in the ITE Trip Generation Manual.

2.4.2 Traffic Assignment for Adjacent Developments

The ITE data provides the anticipated percentage of new traffic entering and exiting during the peak hour.

The distribution of traffic for LSAMI and 1303 Belle Aire Beach Road has been calculated based on the 2011 Transportation Tomorrow Survey [TTS] data for traffic zone 8594 retrieved using the TTS Internet Data Retrieval System [IDRS] (output attached as **Appendix H**). The distribution of traffic for the Alcona Existing and the Alcona Expansion has been calculated based on the TTS data for traffic zones 8559 and 8595 retrieved using the TTS Internet Data Retrieval System [IDRS] (output attached as **Appendix H**). TTS data provides historical origin and destination trip percentages for specific areas within the Town and the Greater Toronto and Hamilton Area [GTHA].

Traffic distribution for the trips generated by all the adjacent developments are 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.

Using the methodology outlined above, the distribution of trips for P2, P3 and P4 from the LSAMI Parcels, the Alcona Existing, the Alcona Expansion and 1357 Belle Aire Beach Road have been calculated based on the location of the development. The main access to each development is listed below:

- LSAMI Parcel P2 – via 20th Sideroad;
- LSAMI Parcel P3 – via Killarney Beach Road;
- LSAMI Parcel P4 – via 20th Sideroad and Killarney Beach Road; and
- 1303 Belle Aire Beach Road – via Belle Aire Beach Road.

Generally speaking, access to future development within Alcona Existing and Alcona Expansion would be via 20th Sideroad, north of the subject site. The distribution of trips for the adjacent developments is illustrated in **Table 1**.

Table 1 – Adjacent Development Traffic Distribution within Study Area

Travel Direction (to / from)	Percentage of Total Traffic Generation				
	LSAMI Parcel P2	LSAMI Parcel P3	LSAMI Parcel P4	1303 Belle Aire Beach Road	Alcona Existing and Alcona Expansion
North via 20 th Sideroad	37%	19%	28%	25%	17%
South via 20 th Sideroad	-	-	-	16%	-
East via Belle Aire Beach Road	-	-	-	58%	-
West via Belle Aire Beach Road	10%	-	-	1%	2%
Outside Study Area	53%	81%	72%	-	-
TOTAL	100%	100%	100%	100%	100%

2.4.3 LSAMI

The LSAMI development area consists of four land Parcels; P1, P2, P3 and P4. An excerpt from the Lefroy Development Guidelines in **Appendix B** illustrates the location of these four land parcels within the LSAMI development area.

A summary of the statistics and current status of the four land parcels is illustrated below in **Table 2**.

Table 2 – LSAMI Summary

Parcel	Size	Access	Status
P1	Phase 1 – 195 units Phase 2 – 100 units Phase 3 – 99 units Phase 4 – 150 units Phase 5 – 101 units	via Lormel Gate Avenue	Phase 1 – occupied Phase 2 – occupied Phase 3 – built but not occupied Phase 4 – not built Phase 5 – not built
P2	125 single detached units	via Lormel Gate Avenue (south)	not built
P3	125 single detached units 80 apartment units	via Killarney Beach Road	not built
P4	300 single detached units 100 townhouse units	via 20 th Sideroad and Killarney Beach Road	not built

2.4.3.1 Parcel P1

The Parcel P1 Development is located at the southeast corner of the Belle Aire Beach Road & 5th Line / 20th Sideroad intersection. Phase 1 and Phase 2 of P1 are occupied, Phase 3 is built but not yet occupied and Phase 4 and Phase 5 are yet to be built. It is anticipated that P1 will be fully occupied by 2019.

Traffic generated by the Phases 3, 4 and 5 of P1 have been estimated based on the Lormel Homes Ltd. LSAMI Parcel 1 – Phase 4/5 by The Municipal Infrastructure Group Ltd. (May 2017) [P1 TIS] (excerpts provided in **Appendix B**). **Figure A** in **Appendix C** illustrates the traffic within the study area, as generated by Phase 3, 4 and 5 of Parcel P1 development. It is noted that the P1 TIS only includes Phases 4 and 5; however, an adjustment to the traffic generation has been made to account for the units in Phase 3.

2.4.3.2 Parcel P2

The Parcel P2 Development is located at the northeast corner of the Killarney Beach Road / 20th Sideroad intersection.

The estimated trip generation of the Parcel P2 Development is illustrated below in **Table 3**.

Table 3 – Estimated Traffic Generation – Parcel P2 Development

Land Use	Size	AM Peak Hour			PM Peak Hour		
		IN	OUT	TOTAL	IN	OUT	TOTAL
Single-Family Detached Housing ITE Land Use:210	125 units	24	70	94	79	47	126

Using the traffic distribution pattern noted in Section 2.4.2, the Parcel P2 Development traffic assignment was calculated for the AM and PM peak hour and is illustrated in **Figure B** in **Appendix C**.

2.4.3.3 Parcel P3

The Parcel P3 Development is located at the southeast corner of the Killarney Beach Road / 20th Sideroad intersection.

The estimated trip generation of the Parcel P3 Development is illustrated below in **Table 4**.

Table 4 – Estimated Traffic Generation – Parcel P3 Development

Land Use	Size	AM Peak Hour			PM Peak Hour		
		IN	OUT	TOTAL	IN	OUT	TOTAL
Single-Family Detached Housing ITE Land Use:210	120 units	23	67	90	76	45	121
Multifamily Housing (Low-Rise) ITE Land Use: 220	80 units	9	30	39	30	18	48
TOTAL TRIP GENERATION		32	97	129	106	63	169

Using the traffic distribution pattern noted in Section 2.4.2, the Parcel P3 Development traffic assignment was calculated for the AM and PM peak hour and is illustrated in **Figure C** in **Appendix C**.

2.4.3.4 Parcel P4

The Parcel P4 Development is located at the southwest corner of the Killarney Beach Road / Pine Avenue intersection.

The estimated trip generation of the Parcel P4 Development is illustrated below in **Table 5**.

Table 5 – Estimated Traffic Generation – Parcel P4 Development

Land Use	Size	AM Peak Hour			PM Peak Hour		
		IN	OUT	TOTAL	IN	OUT	TOTAL
Single-Family Detached Housing ITE Land Use:210	300 units	55	163	218	184	108	292
Multifamily Housing (Low-Rise) ITE Land Use: 220	100 units	11	37	48	37	22	59
TOTAL TRIP GENERATION		66	200	266	221	130	351

Using the traffic distribution pattern noted in Section 2.4.2, the Parcel P4 Development traffic assignment was calculated for the AM and PM peak hour and is illustrated in **Figure D** in **Appendix C**.

2.4.4 Alcona Existing and Alcona Expansion

There is a significant number of developments that are anticipated in the Alcona Existing and the Alcona Expansion. Rather than calculating the traffic generation for each development, we have used the Alcona Existing and the Alcona Expansion population projections for 2031 in the Town TMP and determined the anticipated traffic generated as a result of this increase in population.

Through correspondence with the Town, there are currently 4,250 existing residential units south of Innisfil Beach Road (excerpt provided in **Appendix B**) resulting in a population of the 11,263¹ residents. The 2031 population projections per the Town TMP identify 16,925 residents south of Innisfil Beach Road (Alcona South Existing Settlement and Alcona South Expansion Area) resulting in an increase of 2,137 residential units within the Alcona Existing and the Alcona Expansion by 2031.

The estimated trip generation of this increase in residential units is illustrated below in **Table 6** with the assumption that 60% of the units will be single detached units and 40% will be residential townhouses.

Table 6 – Estimated Traffic Generation – Parcel P4 Development

Land Use	Size	AM Peak Hour			PM Peak Hour		
		IN	OUT	TOTAL	IN	OUT	TOTAL
Single-Family Detached Housing ITE Land Use:210	1282 units	229	686	915	741	435	1176
Multifamily Housing (Low-Rise) ITE Land Use: 220	855 units	84	282	366	251	148	399
TOTAL TRIP GENERATION		313	968	1281	992	583	1575

Using the traffic distribution pattern noted in Section 2.4.2, the Alcona Existing and the Alcona Expansion additional traffic assignment was calculated for the AM and PM peak hour and is illustrated in **Figure E** in **Appendix C**.

2.4.5 1303 Belle Aire Beach Road Residential Development

The 1303 Belle Aire Beach Road residential development is a proposed residential development located south of Belle Aire Beach Road, east of the subject site consisting of 181 townhouse units.

The estimated trip generation of the 1303 Belle Aire Beach Road residential development is illustrated below in **Table 7**.

Table 7 – Estimated Traffic Generation – 1303 Belle Aire Beach Road

Land Use	Size	AM Peak Hour			PM Peak Hour		
		IN	OUT	TOTAL	IN	OUT	TOTAL
Multifamily Housing (Low-Rise) ITE Land Use:220	181 units	19	65	84	63	37	100

¹ It has been assumed that there are 2.65 residents per unit as per the Town TMP.

Using the traffic distribution pattern noted in Section 2.4.2, the 1303 Belle Aire Beach Road traffic assignment was calculated for the AM and PM peak hour and is illustrated in **Figure F** in **Appendix C**.

2.4.6 2272565 Ontario Inc. Residential Development

The 2272565 Ontario Inc. Residential Development [2272565] is located east of 20th Sideroad approximately midway between Killarney Beach Road and Belle Aire Beach Road and consists of 18 townhouse units. It is anticipated that the 2272565 development will be fully occupied by 2018.

Traffic generated by the 2272565 development has been estimated based on the August 2017 Traffic Operations Assessment titled 2272565 development by The Municipal Infrastructure Group Ltd. [2272565 TIS] (excerpts provided in **Appendix B**).

Figure G in **Appendix C** illustrates the 2272565 traffic within the study area.

2.5 Traffic Counts

Detailed turning movement traffic and pedestrian counts were obtained from the Town for the Belle Aire Beach Road & 5th Line / 20th Sideroad intersection.

Table 8 summarizes the traffic count data collection information.

Table 8 – Traffic Count Data

Intersection (E-W Street / N-S Street)	Count Date	AM Peak Hour	PM Peak Hour	Source
Belle Aire Beach Road & 5 th Line / 20 th Sideroad	Thursday, May 4 th , 2017	07:15 – 08:15	17:00 – 18:00	Town

Detailed traffic count data can be found in **Appendix D**. The peak hours of traffic generation for the study area intersections generally aligned with the anticipated peak hour of traffic generation by the proposed development.

Heavy vehicle percentages from the traffic count data have also been included in the Synchro analysis.

Through discussions with the Town, no additional background growth rate, above and beyond the adjacent developments, was applied to the study area intersections. Consequently, no background growth rate has been applied to the 2017 traffic volumes in order to convert them into the existing (2018) traffic volumes. **Figure H** in **Appendix C** illustrates the existing (2018) AM and PM peak hour traffic volumes within the study area.

2.6 Horizon Year Traffic Volumes

Figures I and **J** in **Appendix C** illustrate the background traffic volumes without the proposed development traffic volumes for horizon years 2025 and 2030.

As noted in Section 2.4, it is assumed that 80% and 100% of the traffic generated from the adjacent development traffic will be completed prior to the 2025 and 2030 horizon years respectively. No additional background growth rate, above and beyond the adjacent developments, was applied to the study area intersections.

3 Intersection Operation without Proposed Development

3.1 Introduction

Existing year operational conditions were established to determine how the street network within the study area is currently functioning without the proposed development. This provides a base case scenario to compare with future development scenarios. Traffic operations within the study area were evaluated using the 2018 traffic volumes with the existing road configuration and traffic control. The intersection performance was measured using the traffic analysis software, Synchro 9, a deterministic model that employs Highway Capacity Manual and Intersection Capacity Utilization methodologies for analyzing intersection operations. These procedures are accepted by provincial and municipal agencies throughout North America.

Synchro 9 enables the study area to be graphically defined in terms of streets and intersections, along with their geometric and traffic control characteristics. The user is able to evaluate both signalized and unsignalized intersections in relation to each other, thus not only providing level of service for the individual intersections, but also enabling an assessment of the impact the various intersections in a network have on each other in terms of spacing, traffic congestion, delay, and queuing.

Individual turning movements with a volume-to-capacity [V/C] ratio of 0.85 or greater are considered to be critical movements and have been highlighted in the LOS tables.

The intersection operations were also evaluated in terms of the LOS. LOS is a common measure of the quality of performance at an intersection and is defined in terms of vehicular delay. This delay includes deceleration delay, queue move-up time, stopped delay, and acceleration delay. LOS is expressed on a scale of A through F, where LOS A represents very little delay (i.e. less than 10 seconds per vehicle) and LOS F represents very high delay (i.e. greater than 50 seconds per vehicle for a stop sign controlled intersection and greater than 80 seconds per vehicle for a signalized intersection).

The LOS criteria for signalized and stop sign controlled intersections are shown in **Table 9**. A description of traffic performance characteristics is included for each LOS.

Table 9 – Level of Service Criteria for Intersections

LOS	LOS Description	Control Delay (seconds per vehicle)	
		Signalized Intersections	Stop Controlled Intersections
A	Very low delay; most vehicles do not stop (Excellent)	less than 10.0	less than 10.0
B	Higher delay; more vehicles stop (Very Good)	between 10.0 and 20.0	between 10.0 and 15.0
C	Higher level of congestion; number of vehicles stopping is significant, although many still pass through intersection without stopping (Good)	between 20.0 and 35.0	between 15.0 and 25.0
D	Congestion becomes noticeable; vehicles must sometimes wait through more than one red light; many vehicles stop (Satisfactory)	between 35.0 and 55.0	between 25.0 and 35.0
E	Vehicles must often wait through more than one red light; considered by many agencies to be the limit of acceptable delay	between 55.0 and 80.0	between 35.0 and 50.0
F	This level is considered to be unacceptable to most drivers; occurs when arrival flow rates exceed the capacity of the intersection (Unacceptable)	greater than 80.0	greater than 50.0

3.2 Existing (2018) Intersection Operation

The results of the LOS analysis under existing (2018) traffic volumes during the AM and PM peak hour can be found below in **Table 10**. Existing intersection geometry and traffic control have been utilized for this scenario. Detailed output of the Synchro analysis can be found in **Appendix E**.

Table 10 – Existing (2018) LOS

Location (E-W Street / N-S Street)	Weekday AM Peak Hour			Weekday PM Peak Hour		
	V/C	Delay (s)	LOS	V/C	Delay (s)	LOS
Belle Aire Beach Road & 5 th Line / 20 th Sideroad (unsignalized)	-	0.9	A	-	0.9	A
EB	0.04	13.8	B	0.06	13.6	B
WB	0.03	12.0	B	0.03	12.3	B

The results of the LOS analysis indicate that the Belle Aire Beach Road & 5th Line / 20th Sideroad intersection is operating within the typical design limits noted in Section 3.1.

The existing storage length for all auxiliary turn lanes can accommodate the anticipated 95th percentile queue length for the associated turning movement.

The criterion outlined in Section E.7 of the Ontario Ministry of Transportation Geometric Design Standards for Ontario Highways [MTO GDSOH] (60vph minimum right turn volume warrant) has been used to assess whether an auxiliary right turn lane is required at the Belle Aire Beach Road & 5th Line / 20th Sideroad intersection. Our analysis indicates that no additional right turn lane is warranted.

Based on the Ontario Traffic Manual Book 12 *Signal Justification*, traffic signals are not warranted at the Belle Aire Beach Road & 5th Line / 20th Sideroad intersection (results are provided in **Appendix F**).

No infrastructure improvements are recommended within the study area to accommodate the existing traffic volume.

3.3 Background (2025) Intersection Operation

The results of the LOS analysis under background (2025) traffic volumes during the AM and PM peak hour can be found below in **Table 11**. Existing intersection geometry and traffic control have been utilized for this scenario. Detailed output of the Synchro analysis can be found in **Appendix G**.

Table 11 – Background (2025) LOS

Location (E-W Street / N-S Street)	Weekday AM Peak Hour			Weekday PM Peak Hour		
	V/C	Delay (s)	LOS	V/C	Delay (s)	LOS
Belle Aire Beach Road & 5 th Line / 20 th Sideroad (unsignalized)	-	3.4	A	-	5.7	A
EB	0.18	27.2	D	0.62	60.2	F
WB	0.34	24.9	C	0.28	34.4	D

The results of the LOS analysis indicate that the eastbound movement at Belle Aire Beach Road & 5th Line / 20th Sideroad intersection is operating outside the typical design limits noted in Section 3.1 during the PM peak hour. Based on the Ontario Traffic Manual Book 12 *Signal Justification*, traffic signals are not warranted at the Belle Aire Beach Road & 5th Line / 20th Sideroad intersection (results are provided in **Appendix F**); however, due to the anticipated control delay for the eastbound movement at this intersection, it is recommended that the Town plan to install traffic signals at this intersection prior to 2025.

The results of the Synchro analysis with the above-noted improvement can be found below in **Table 12**. Detailed output of the Synchro analysis can be found in **Appendix G**.

Table 12 – Background (2025) LOS with Improvements

Location (E-W Street / N-S Street)	Weekday AM Peak Hour					Weekday PM Peak Hour				
	V/C	Delay (s)	LOS	95 th % Queue (m)		V/C	Delay (s)	LOS	95 th % Queue (m)	
				Model	Actual				Model	Actual
Belle Aire Beach Road & 5 th Line / 20 th Sideroad (signalized)	0.44	10.0	B	-	-	0.54	11.1	B	-	-
EB	0.13	24.1	C	-	-	0.25	24.5	C	-	-
WB	0.26	25.0	C	-	-	0.10	23.5	C	-	-
NBL	0.04	5.4	A	3.7	110.0	0.03	5.3	A	3.5	110.0
NBT	0.28	6.8	A	-	-	0.63	11.1	B	-	-
NBR	0.01	5.1	A	0.0	110.0	0.01	5.2	A	0.8	110.0
SBL	0.03	5.3	A	3.8	40.0	0.12	6.3	A	7.2	40.0
SBTR	0.50	8.9	A	-	-	0.37	7.6	A	-	-

The results of the LOS analysis indicate that the Belle Aire Beach Road & 5th Line / 20th Sideroad intersection is operating within the typical design limits noted in Section 3.1.

The existing storage length for all auxiliary turn lanes can accommodate the anticipated 95th percentile queue length for the associated turning movement.

No additional infrastructure improvements are recommended within the study area for this analysis scenario.

3.4 Background (2030) Intersection Operation

The results of the LOS analysis under background (2030) traffic volumes during the AM and PM peak hour can be found below in **Table 13**. The recommended intersection geometry and traffic control identified in Section 3.3 has been utilized for this scenario. Detailed output of the Synchro analysis can be found in **Appendix G**.

Table 13 – Background (2030) LOS

Location (E-W Street / N-S Street)	Weekday AM Peak Hour					Weekday PM Peak Hour				
	V/C	Delay (s)	LOS	95 th % Queue (m)		V/C	Delay (s)	LOS	95 th % Queue (m)	
				Model	Actual				Model	Actual
Belle Aire Beach Road & 5 th Line / 20 th Sideroad (signalized)	0.49	10.7	B	-	-	0.59	12.0	B	-	-
EB	0.15	23.8	C	-	-	0.30	24.4	C	-	-
WB	0.33	25.1	C	-	-	0.12	23.1	C	-	-
NBL	0.05	5.5	A	4.0	110.0	0.03	5.4	A	3.7	110.0
NBT	0.32	7.2	A	-	-	0.69	12.4	B	-	-
NBR	0.01	5.2	A	0.1	110.0	0.01	5.3	A	1.5	110.0
SBL	0.04	5.4	A	4.1	40.0	0.17	7.2	A	9.0	40.0
SBTR	0.54	9.6	A	-	-	0.43	8.3	A	-	-

The results of the LOS analysis indicate that the Belle Aire Beach Road & 5th Line / 20th Sideroad intersection is operating within the typical design limits noted in Section 3.1.

The existing storage length for all auxiliary turn lanes can accommodate the anticipated 95th percentile queue length for the associated turning movement.

No additional infrastructure improvements are recommended within the study area for this analysis scenario.

4 Proposed Development Traffic Generation and Assignment

4.1 Traffic Generation

The traffic generation for the subject site has been based on the 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 of the proposed development is illustrated below in **Table 14**. The AM and PM peak traffic generation for the proposed development does not exactly align with the AM and PM peak hour in the traffic counts; consequently, we have applied the peak hour of adjacent street traffic values provided in the ITE Trip Generation Manual.

Table 14 – 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	93 units	10	35	45	35	20	55

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

4.2 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 distribution of traffic for the proposed development is assumed to follow the trip distribution calculated for 1303 Belle Aire Beach Road, as illustrated in Table 1 in Section 2.4.2.

Using the traffic distribution pattern noted in Section 2.4.2, the proposed development traffic assignment was calculated for the AM and PM peak hour and is illustrated in **Figure K** in **Appendix C**.

4.3 Total Horizon Year Traffic Volumes with the Proposed Development

For the total (2025 and 2030) horizon year traffic volumes, the proposed development traffic was added to the background (2025 and 2030) traffic volumes. The resulting total (2025 and 2030) horizon year traffic volume for the AM and PM peak hour are illustrated in **Figure L** and **M** in **Appendix C**.

5 Intersection Operation with Proposed Development

5.1 Total (2025) Intersection Operation

The results of the LOS analysis under total (2025) traffic volumes during the AM and PM peak hour can be found below in **Table 15**. The recommended intersection geometry and traffic control identified in Section 3.3 has been utilized for this scenario. Detailed output of the Synchro analysis can be found in **Appendix I**.

Table 15 – Total (2025) LOS

Location (E-W Street / N-S Street)	Weekday AM Peak Hour					Weekday PM Peak Hour				
	V/C	Delay (s)	LOS	95 th % Queue (m)		V/C	Delay (s)	LOS	95 th % Queue (m)	
				Model	Actual				Model	Actual
Belle Aire Beach Road & 5 th Line / 20 th Sideroad (signalized)	0.47	10.8	B	-	-	0.55	11.6	B	-	-
EB	0.16	23.3	C	-	-	0.30	24.0	C	-	-
WB	0.39	25.1	C	-	-	0.15	22.9	C	-	-
NBL	0.04	5.5	A	3.7	110.0	0.03	5.4	A	3.5	110.0
NBT	0.29	7.0	A	-	-	0.64	11.5	B	-	-
NBR	0.01	5.3	A	0.1	110.0	0.02	5.3	A	2.0	110.0
SBL	0.03	5.4	A	4.1	40.0	0.14	6.7	A	8.3	40.0
SBTR	0.50	9.2	A	-	-	0.38	7.8	A	-	-
West Access / Belle Aire Beach Road (unsignalized)	-	1.2	A	-	-	-	0.6	A	-	-
NB	0.02	9.3	A	-	-	0.01	9.3	A	-	-
East Access / Belle Aire Beach Road (unsignalized)	-	1.3	A	-	-	-	0.7	A	-	-
NB	0.02	9.1	A	-	-	0.01	9.2	A	-	-

The results of the LOS analysis indicate that all study area intersections are operating within the typical design limits noted in Section 3.1.

The criterion outlined in Section E.7 of the MTO GDSOH (60vph minimum right turn volume warrant) has been used to assess whether an auxiliary right turn lane is required at the Belle Aire Beach Road / West Access and Belle Aire Beach Road / East Access intersections. Our analysis indicates that no additional right turn lane is warranted.

An analysis was completed for left turn movements at the Belle Aire Beach Road / West Access and Belle Aire Beach Road / East Access intersections, based on the criteria outlined in Section E.9.1 of the MTO GDSOH. Based on the low volume of left turn movements, no additional left turn lane is warranted.

Based on the Ontario Traffic Manual Book 12 *Signal Justification*, traffic signals are not warranted at the Belle Aire Beach Road / West Access and Belle Aire Beach Road / East Access intersections (results are provided in **Appendix F**).

The existing storage length for all auxiliary turn lanes can accommodate the anticipated 95th percentile queue length for the associated turning movement.

No additional infrastructure improvements are recommended within the study area for this analysis scenario.

5.2 Total (2030) Intersection Operation

The results of the LOS analysis under total (2030) traffic volumes during the AM and PM peak hour can be found below in **Table 16**. The recommended intersection geometry and traffic control identified in Section 3.3 has been utilized for this scenario. Detailed output of the Synchro analysis can be found in **Appendix I**.

Table 16 – Total (2030) LOS

Location (E-W Street / N-S Street)	Weekday AM Peak Hour					Weekday PM Peak Hour				
	V/C	Delay (s)	LOS	95 th % Queue (m)		V/C	Delay (s)	LOS	95 th % Queue (m)	
				Model	Actual				Model	Actual
Belle Aire Beach Road & 5 th Line / 20 th Sideroad (signalized)	0.53	11.3	B	-	-	0.61	12.6	B	-	-
EB	0.17	22.9	C	-	-	0.35	23.9	C	-	-
WB	0.45	25.3	C	-	-	0.16	22.5	C	-	-
NBL	0.05	5.7	A	4.0	110.0	0.03	5.6	A	3.7	110.0
NBT	0.33	7.4	A	-	-	0.70	13.0	B	-	-
NBR	0.01	5.4	A	0.3	110.0	0.02	5.5	A	2.6	110.0
SBL	0.04	5.6	A	4.3	40.0	0.20	7.9	A	10.2	40.0
SBTR	0.55	10.0	A	-	-	0.44	8.6	A	-	-
West Access / Belle Aire Beach Road (unsignalized)	-	1.1	A	-	-	-	0.5	A	-	-
NB	0.02	9.4	A	-	-	0.01	9.4	A	-	-
East Access / Belle Aire Beach Road (unsignalized)	-	1.1	A	-	-	-	0.6	A	-	-
NB	0.02	9.2	A	-	-	0.01	9.3	A	-	-

The results of the LOS analysis indicate that all study area intersections are operating within the typical design limits noted in Section 3.1.

The criterion outlined in Section E.7 of the MTO GDSOH (60vph minimum right turn volume warrant) has been used to assess whether an auxiliary right turn lane is required at the Belle Aire Beach Road / West Access and Belle Aire Beach Road / East Access intersections. Our analysis indicates that no additional right turn lane is warranted.

An analysis was completed for left turn movements at the Belle Aire Beach Road / West Access and Belle Aire Beach Road / East Access intersections, based on the criteria outlined in Section E.9.1 of the MTO GDSOH. Based on the low volume of left turn movements, no additional left turn lane is warranted.

Based on the Ontario Traffic Manual Book 12 *Signal Justification*, traffic signals are not warranted at the Belle Aire Beach Road / West Access and Belle Aire Beach Road / East Access intersections (results are provided in **Appendix F**).

The existing storage length for all auxiliary turn lanes can accommodate the anticipated 95th percentile queue length for the associated turning movement.

No additional infrastructure improvements are recommended within the study area for this analysis scenario.

5.3 Site Access

The West Access will operate efficiently as a full-movement access with one-way stop control for the northbound movements at Belle Aire Beach Road. No lane improvements are recommended on Belle Aire Beach Road at the West Access. A single northbound and southbound lane at the West Access driveway will provide the necessary capacity to service the proposed development.

The East Access will operate efficiently as a full-movement access with one-way stop control for the northbound movements at Belle Aire Beach Road. No lane improvements are recommended on Belle Aire Beach Road at the East Access. A single northbound and southbound lane at the East Access driveway will provide the necessary capacity to service the proposed development.

The proposed spacing between the East Access and the West Access (measured edge to edge of driveways) is 52 metres, which is in excess of the suggested minimum corner clearance requirements for a driveway as identified in the Transportation Association of Canada *Design Guide for Canadian Roads* (2011) [TAC Guidelines] – Figure 8.8.2 (Suggested Minimum Corner Clearances to Accesses or Public Lanes at Major Intersections) – 20 metres for unsignalized condition.

5.4 Sight Distance Review

A review of the available sight distance for the proposed East Access and West Access was completed as part of this analysis.

The sight distance east and west of the West Access (is greater than the minimum stopping sight distance requirements as identified in the TAC Guidelines for a design speed of 100km/h (185 meters).

The sight distance east of the East Access is greater than the minimum stopping sight distance requirements as identified in the TAC Guidelines for a design speed of 100km/h (185 meters).

The sight distance west of the East Access does not meet the minimum stopping sight distance requirements as identified in the TAC Guidelines for a design speed of 100km/h (185 meters); however, it does meet the minimum stopping sight distance requirements for a design speed of 90km/h (160 metres). It is recommended that a “hidden driveway” warning sign is installed on Belle Aire Beach Road to advise eastbound traffic of the potential for vehicles entering at the West Access.

With the above-noted signage improvements, there are no issues with the sight distance available for the proposed East Access and West Access.

6 Summary

Belle Aire Investment Corp. retained **JD Engineering** to prepare this traffic impact study in support of the proposed 1357 Belle Aire Beach Road residential development in the Town of Innisfil, County of Simcoe. The proposed Site Plan is shown in **Appendix A**. This chapter summarizes the conclusions and recommendations from the study.

The proposed residential development includes 93 residential townhouse units.

1. The proposed development is expected to generate a total of 45 AM and 55 PM peak hour trips.
2. Detailed turning movement counts, completed on Thursday, May 4, 2017, were obtained from the Town for the intersection of Belle Aire Beach Road & 5th Line / 20th Sideroad.
3. An intersection operation analysis was completed at the study area intersections, using the existing (2018) and background (2025 and 2030) traffic volumes, with the adjacent development traffic and without the proposed development traffic. This enabled a review of existing and future traffic deficiencies that would be present without the influence of the proposed development. The following transportation infrastructure improvements are recommended within the study area:

Background (2025)

Belle Aire Beach Road & 5th Line / 20th Sideroad

- Signalization of intersection
4. An estimate of the amount of traffic that would be generated by the Subject Site was prepared and assigned to the study area streets and intersections.
 5. An intersection operation analysis was completed under total (2025 and 2030) traffic volumes with the proposed development operational at the study area intersections. No additional geometric lane improvements or traffic signal improvements are recommended within the study area.
 6. The proposed West Access and East Access driveways will operate efficiently with one-way stop control for northbound traffic. A single lane for ingress and egress movements at each intersection will provide the necessary capacity to convey the traffic volume generated by the proposed development.
 7. The sight distance available for the proposed East Access and West Access driveways meet the minimum stopping sight distance requirements. Installation of a "Hidden Driveway" sign is recommended on Belle Aire Beach Road to advise eastbound traffic of the potential for vehicles entering at the West Access.
 8. In summary, the proposed development will not cause any operational issues and will not add significant delay or congestion to the local roadway network.

Appendix A – Site Plan



ZONING TABLE - RT		
PROVISION	REQUIRED	PROVIDED
LOT AREA	180m² (INT)/ 270 m² (EXT)	142m² (INT)/ 198 m² (EXT)
LOT FRONTAGE	6.0m (INT)/ 9.0m (EXT)	5.6m (INT)/ 7.0m (EXT)
SETBACKS		
FRONT YARD	4.5m	6.0m
INTERIOR SIDE YARD	0.0m/ 1.2m	0.0m/ 1.2m
EXTERIOR SIDE YARD		1.2m (after RW & trail)
REAR YARD	7.5m	7.5m
LANDSCAPED OPEN SPACE	35%	44.89%
LOT COVERAGE	50%	31.8%
BUILDING HEIGHT	11.0m	11.0m
PARKING SPACES	2/unit incl. 24 non-tandem visitor spaces	2/unit + 21 non-tandem visitor parking (3 sp. deficient)
AMENITY AREA	-	579m² (6.2m²/unit)
DENSITY	-	49 upha

- LEGEND
- SUBJECT LANDS
(1.96 ha / 4.84 ac)
 - TOWNHOMES
(0.62 ha / 1.54 ac)
 - AMENITY AREA
(579 m²)
 - PARKING SPACES
REQUIRED = 2.0/UNIT + 0.25 VISITOR SPACES (210)
PROVIDED = 2.0/UNIT + 0.22 VISITOR SPACES (207)

CONCEPTUAL SITE PLAN

PART OF THE NORTH HALF OF LOT 22, CONCESSION 4

MUNICIPALLY KNOWN AS
1357 BELLE AIRE BEACH ROAD

IN THE
TOWN OF INNISFIL
COUNTY OF SIMCOE

2018

Scale 1:300

Source: Survey prepared by Rudy Mak Surveying, dated 2016.
Note: Information shown in approximate and subject to change.

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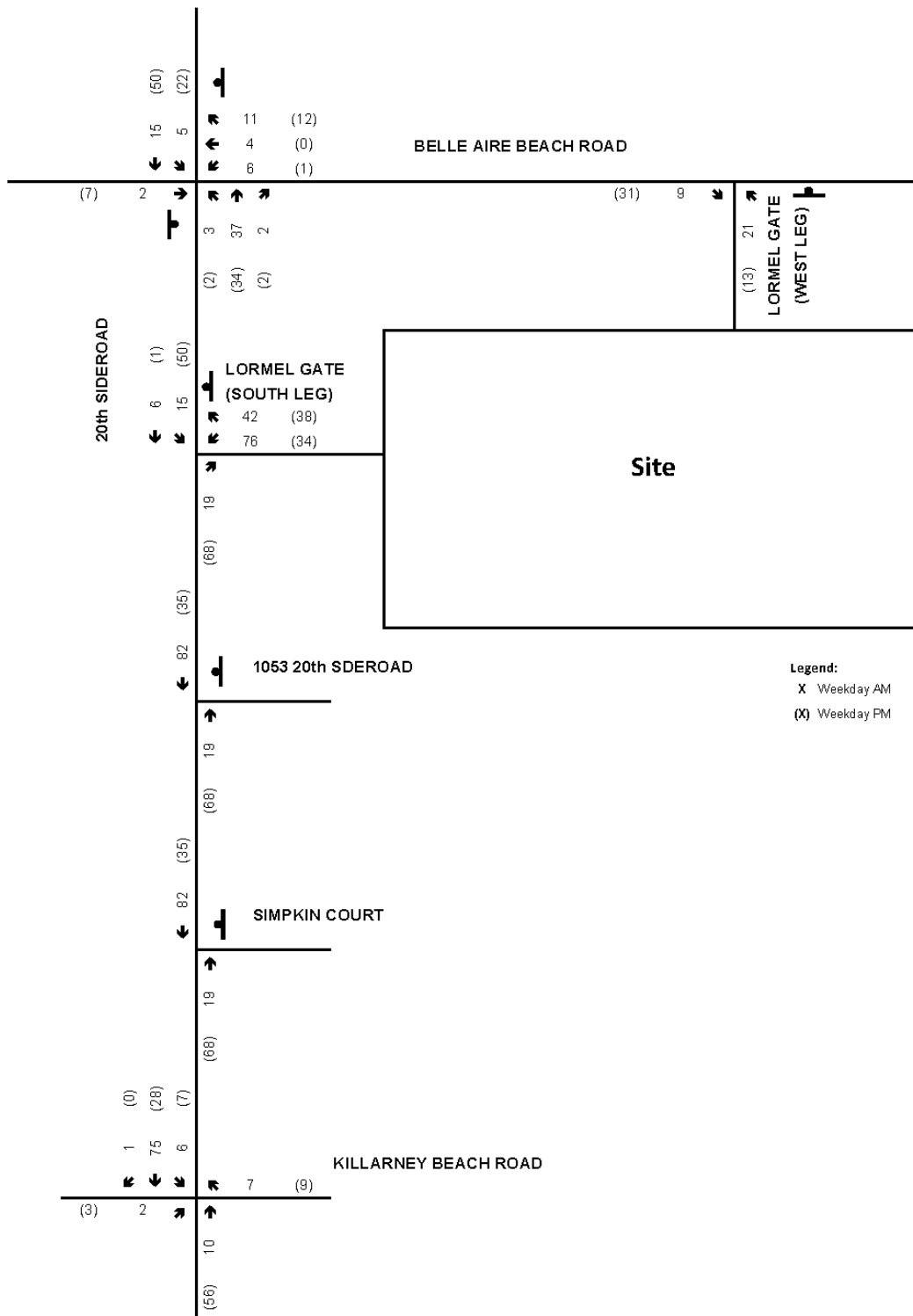
Date: March 01, 2018 Drawn By: VL
File: 17-668 Checked: SN

Appendix B – Adjacent Development excerpt

FIG 1.0: CONTEXT PLAN



Figure 2-12 Subject Site Traffic Volumes



turning movement counts, which reflect the actual observed travel patterns emerging from the built areas of the LSAMI Parcel 1.

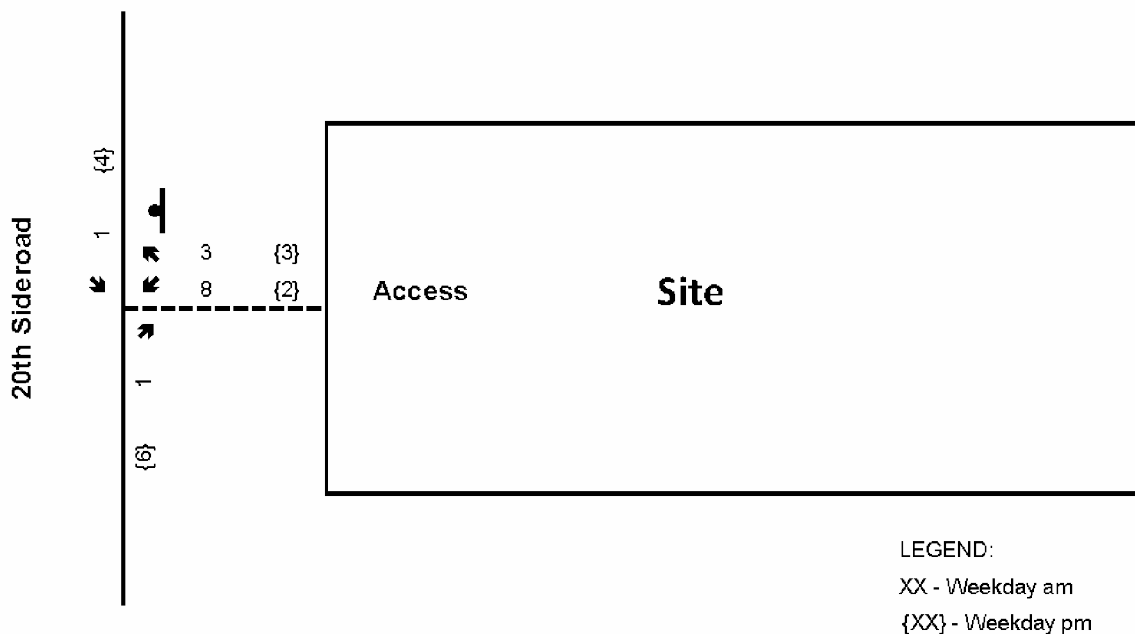
Table 3 summarizes the inbound and outbound site trip distribution adopted in the study to assign site trips to 20th Sideroad for the weekday am and pm peak hours.

Table 3: Site Trip Distribution

Travel Orientation (To / From)	Weekday AM		Weekday PM	
	Percent Inbound	Percent Outbound	Percent Inbound	Percent Outbound
North on 20th Sideroad	45	27	42	52
South on 20th Sideroad	55	73	58	48
Total	100	100	100	100

Figure 2-5 shows the resulting site trips generated by the subject development as assigned to the nearby road network for the weekday am and weekday pm peak hours.

Figure 2-5 Subject Site Traffic Volumes



2.6 Total (2028) Traffic Conditions

In order to determine the future operations of the study area intersections and to determine the incremental impacts due to the introduction of the anticipated subject site trips, the total background traffic volumes shown in **Figure 2-4** were combined with the estimated subject site trips shown in Figure 2-5 to develop the total future weekday am and weekday pm traffic volumes.

The total traffic volumes for the weekday am and weekday pm peak hours are illustrated in **Figure 2-6**.

Appendix C – Traffic Volume Figures

FIGURE INDEX:

FIGURE A	LSAMI Parcel P1 Peak Hour Traffic Volumes within Study Area
FIGURE B	LSAMI Parcel P2 Peak Hour Traffic Volumes within Study Area
FIGURE C	LSAMI Parcel P3 Peak Hour Traffic Volumes within Study Area
FIGURE D	LSAMI Parcel P4 Peak Hour Traffic Volumes within Study Area
FIGURE E	Alcona Existing and Alcona Expansion Additional Peak Hour Traffic Volumes within Study Area
FIGURE F	1303 Belle Aire Beach Road Peak Hour Traffic Volumes within Study Area
FIGURE G	2272565 Ontario Inc. Residential Development Peak Hour Traffic Volumes within Study Area
FIGURE H	Existing (2018) Peak Hour Traffic Volumes
FIGURE I	Background (2025) Peak Hour Traffic Volumes
FIGURE J	Background (2030) Peak Hour Traffic Volumes
FIGURE K	Site Traffic Assignment
FIGURE L	Total (2025) Peak Hour Traffic Volumes
FIGURE M	Total (2030) Peak Hour Traffic Volumes

Figure A - LSAMI Parcel P1 Peak Hour Traffic Volumes within Study Area

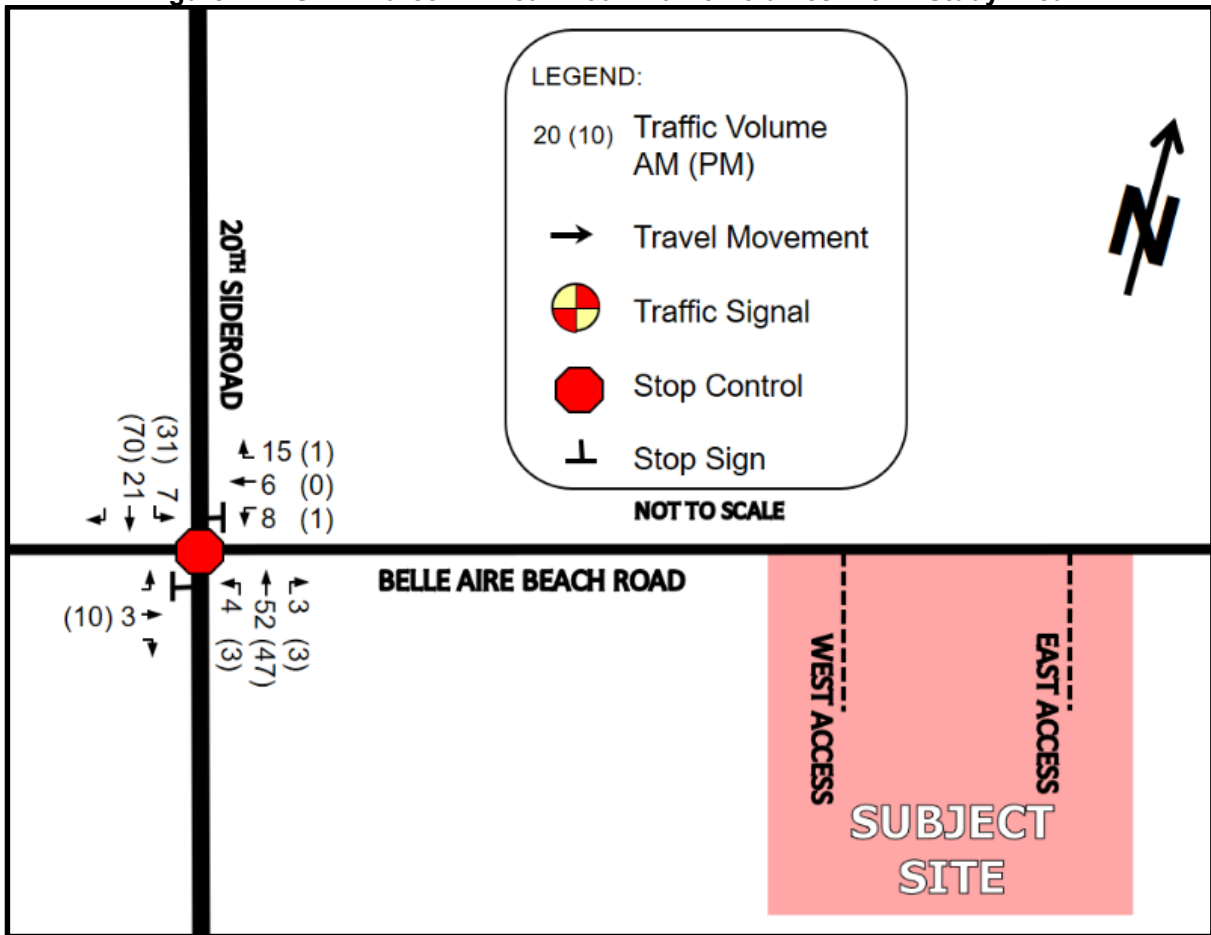


Figure B – LSAMI Parcel P2 Peak Hour Traffic Volumes within Study Area

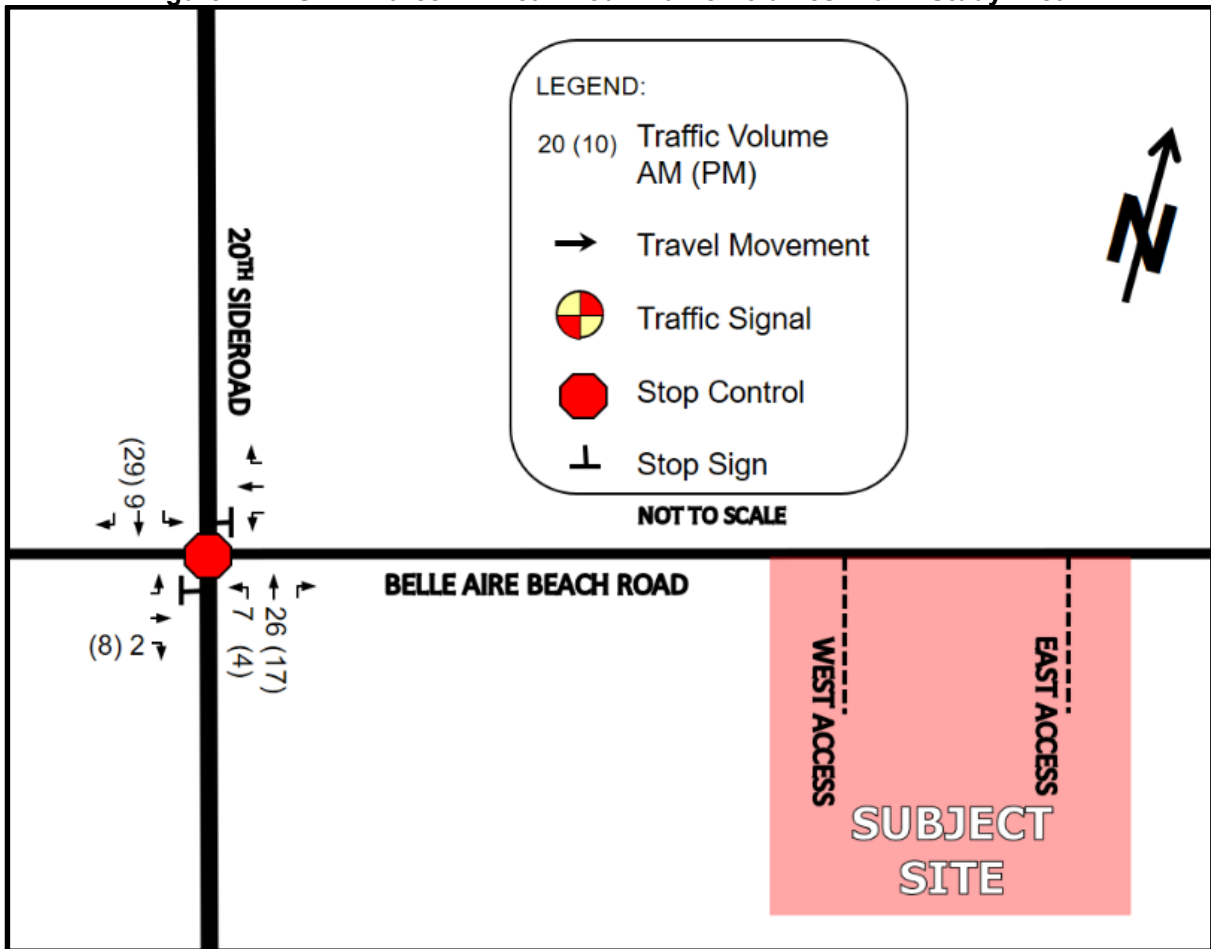


Figure C – LSAMI Parcel P3 Peak Hour Traffic Volumes within Study Area

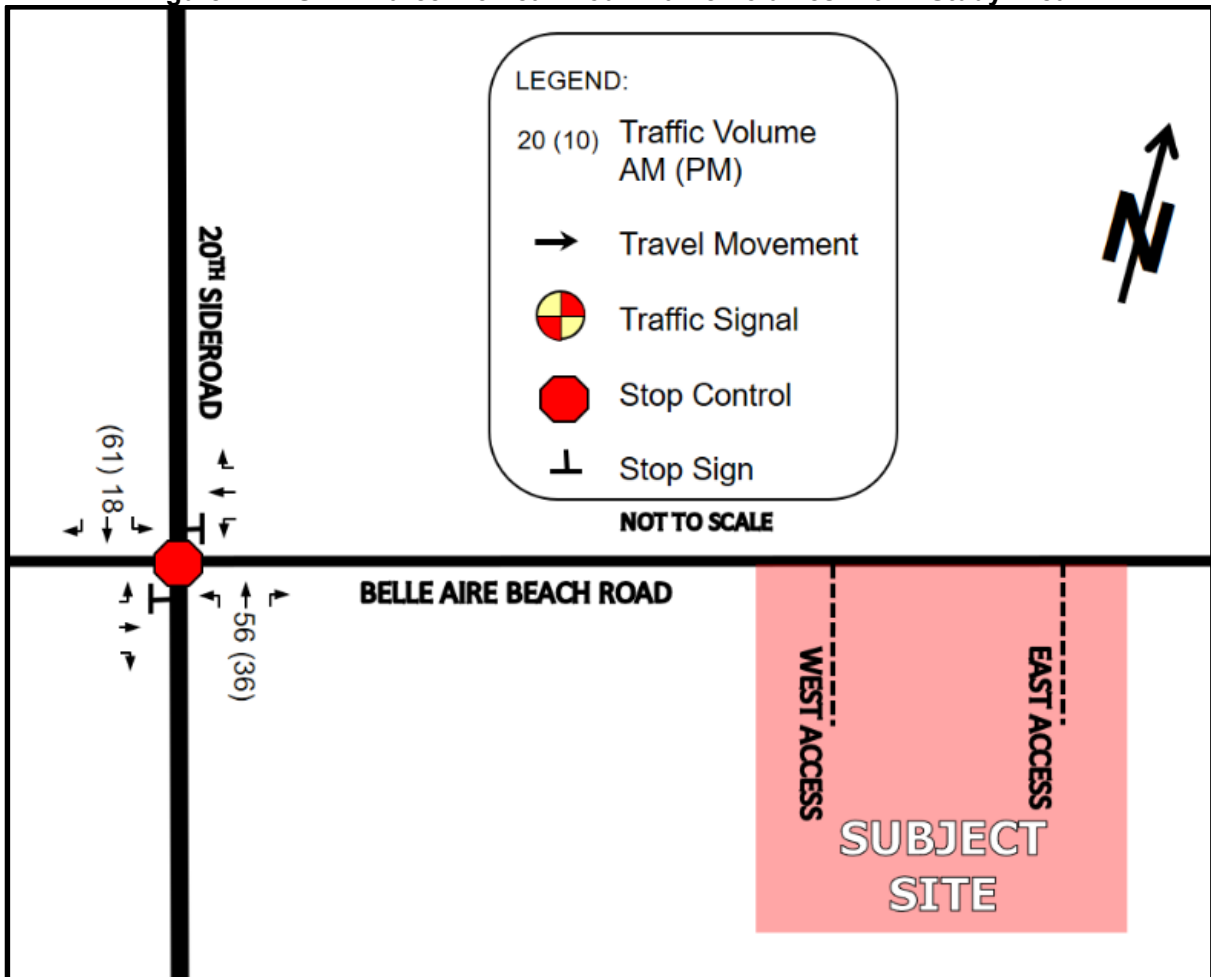


Figure D – LSAMI Parcel P4 Peak Hour Traffic Volumes within Study Area

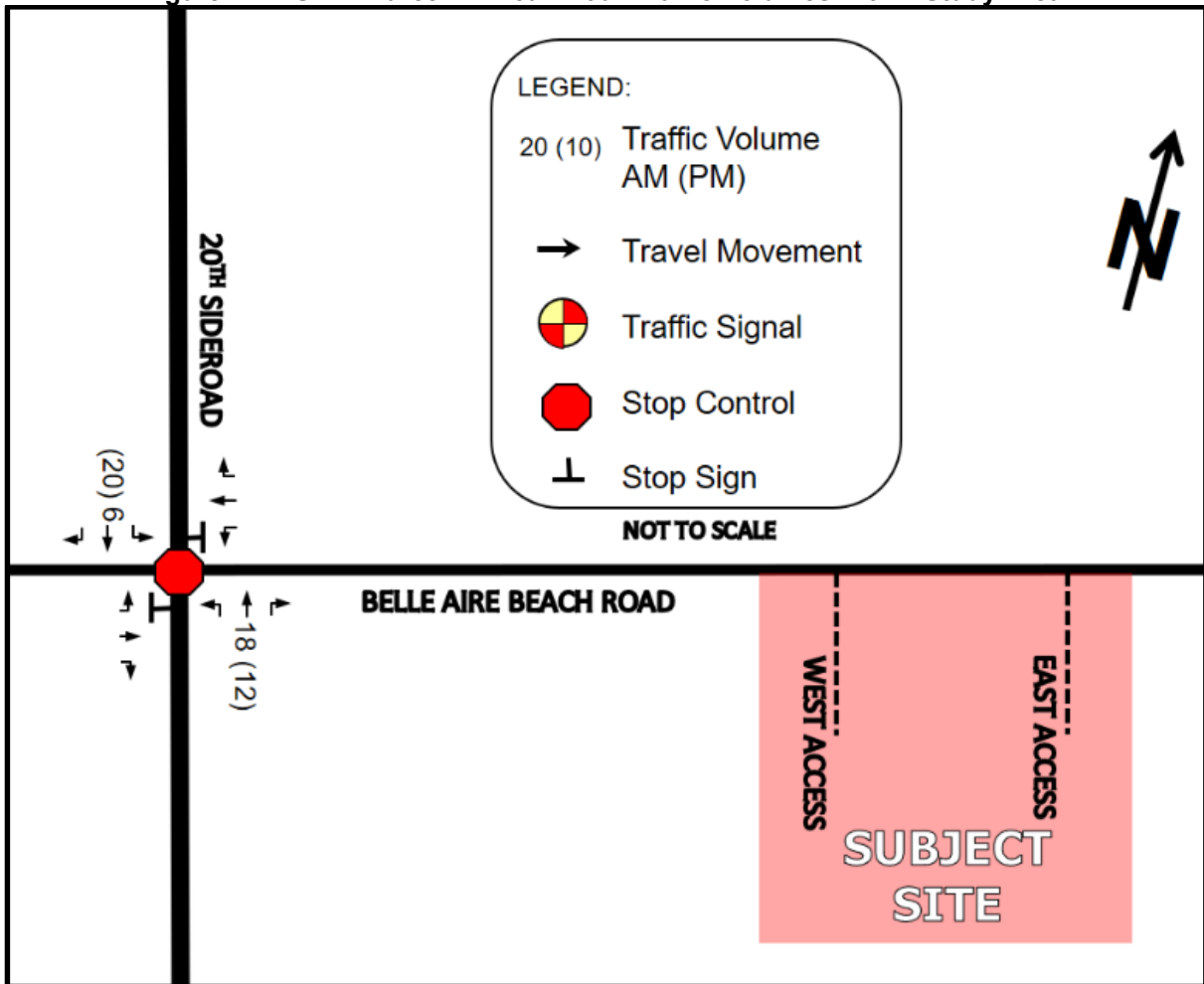


Figure E – Alcona Existing and Alcona Expansion Additional Peak Hour Traffic Volumes within Study Area

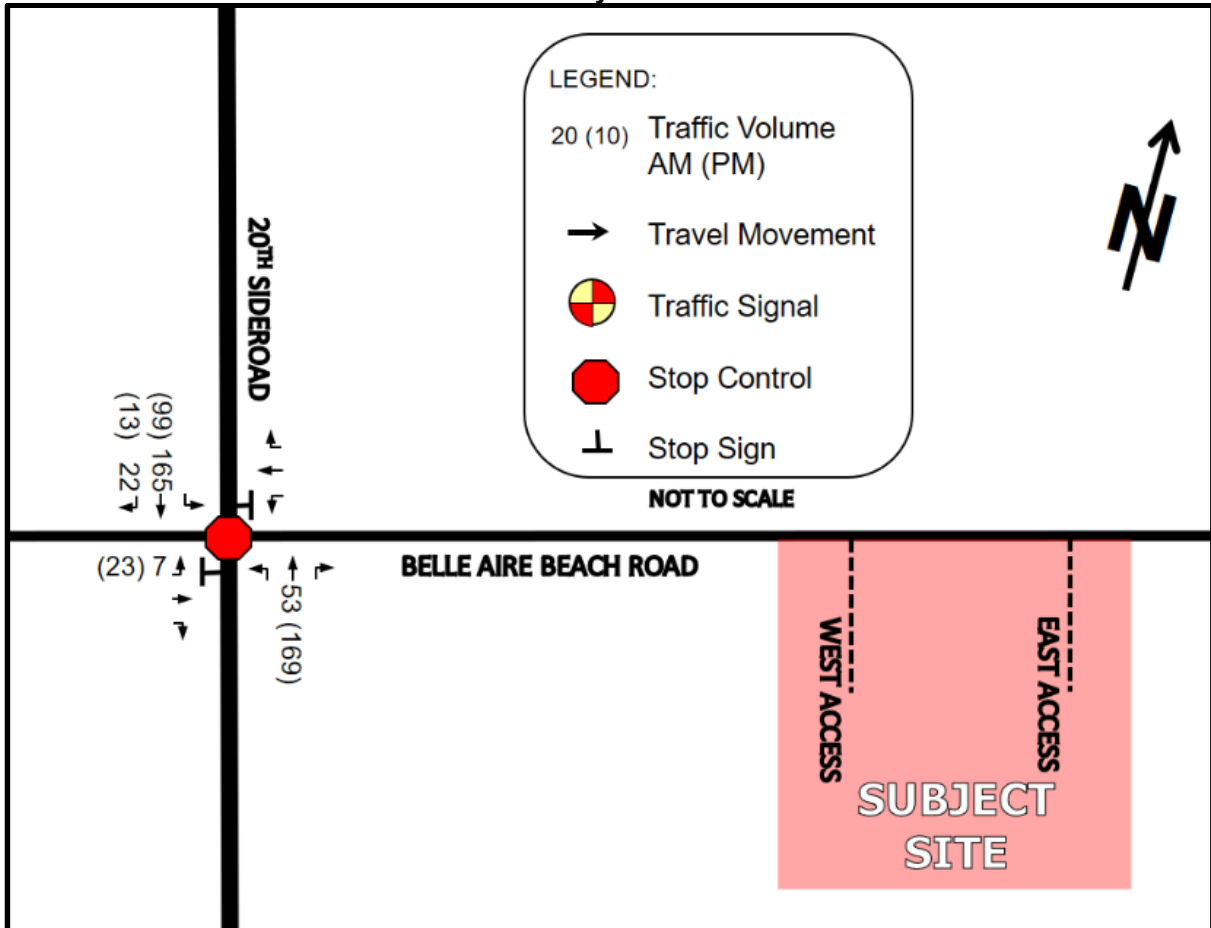


Figure F – 1303 Belle Aire Beach Road Peak Hour Traffic Volumes within Study Area

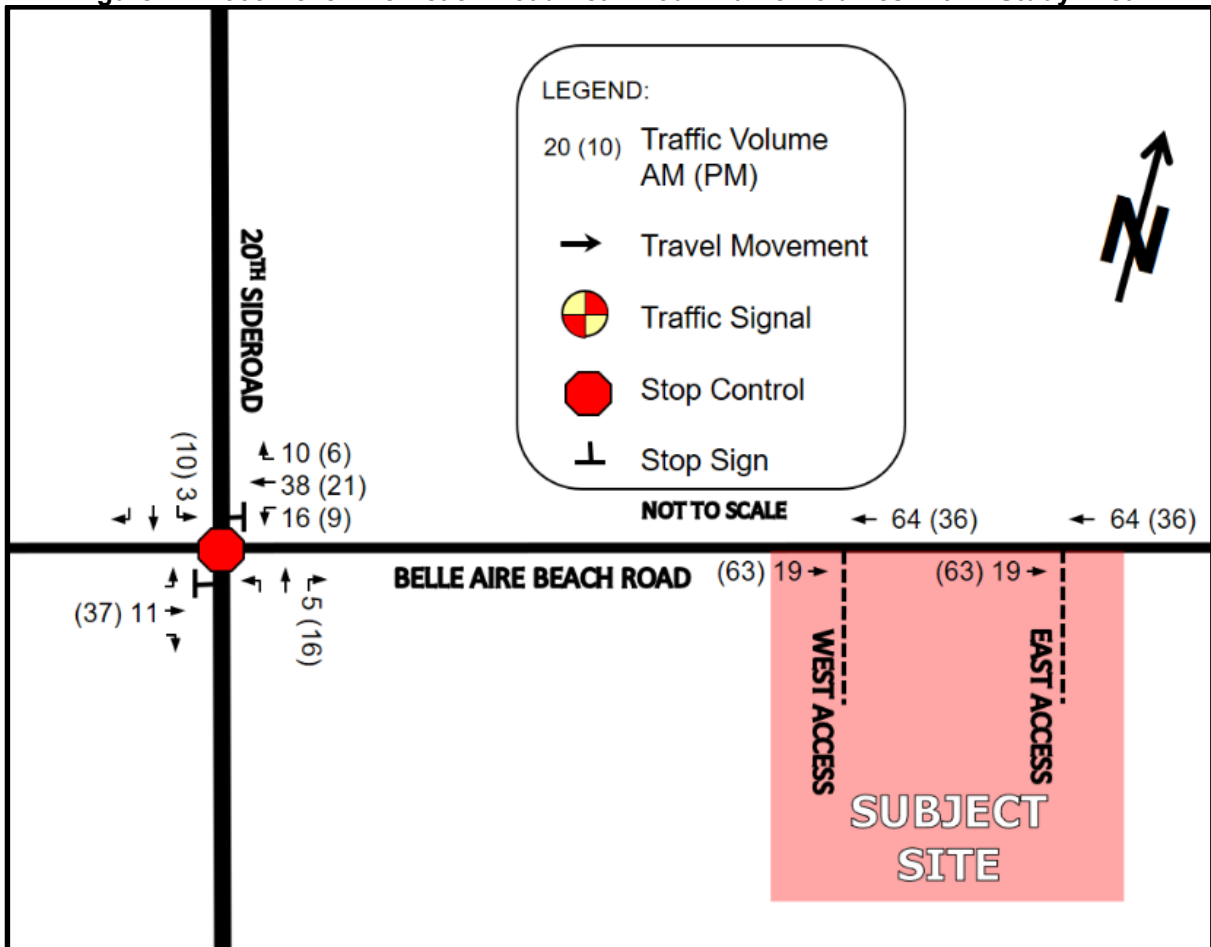


Figure G – 2272565 Ontario Inc. Residential Development Peak Hour Traffic Volumes within Study Area

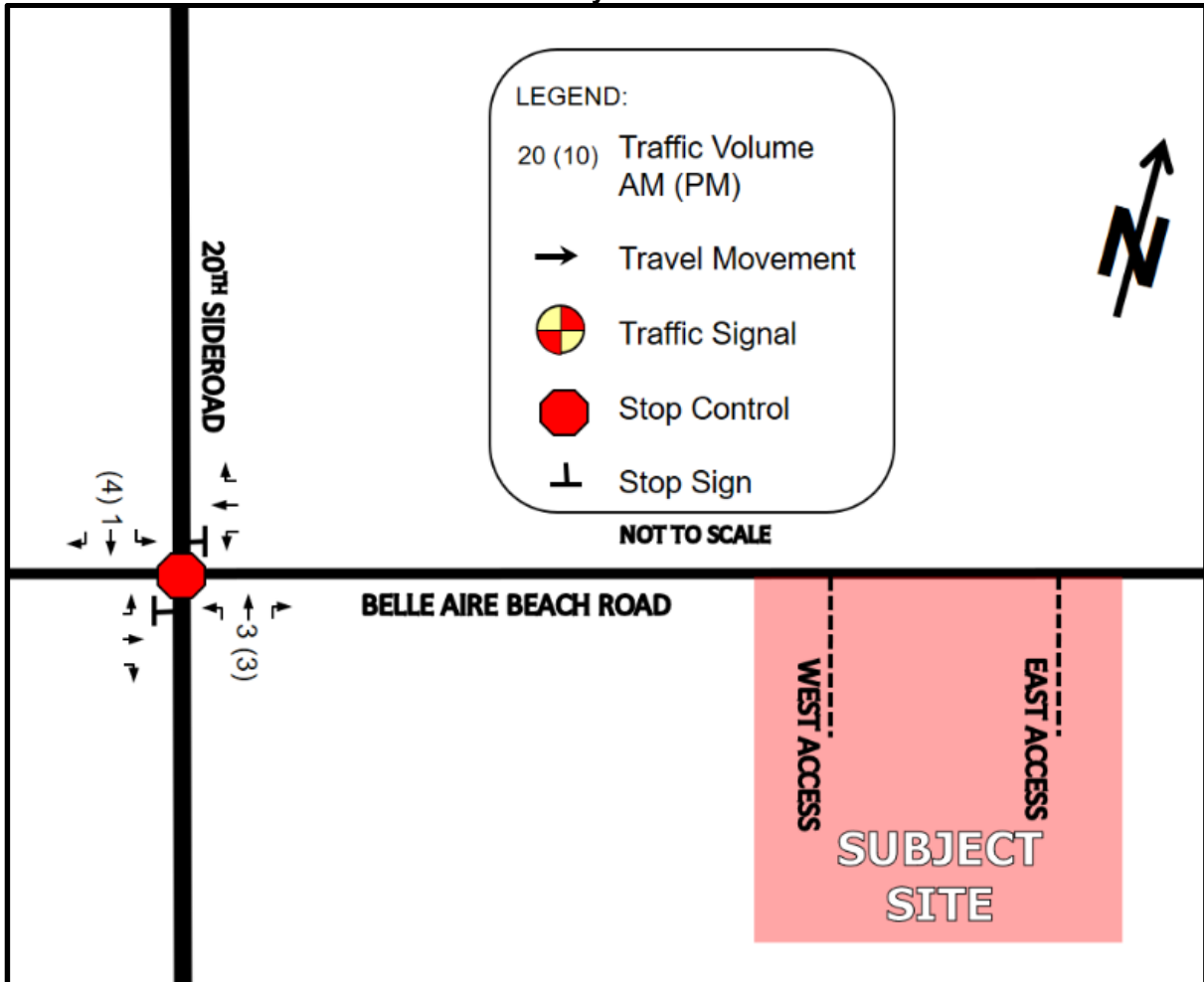


Figure H – Existing (2018) Peak Hour Traffic Volumes

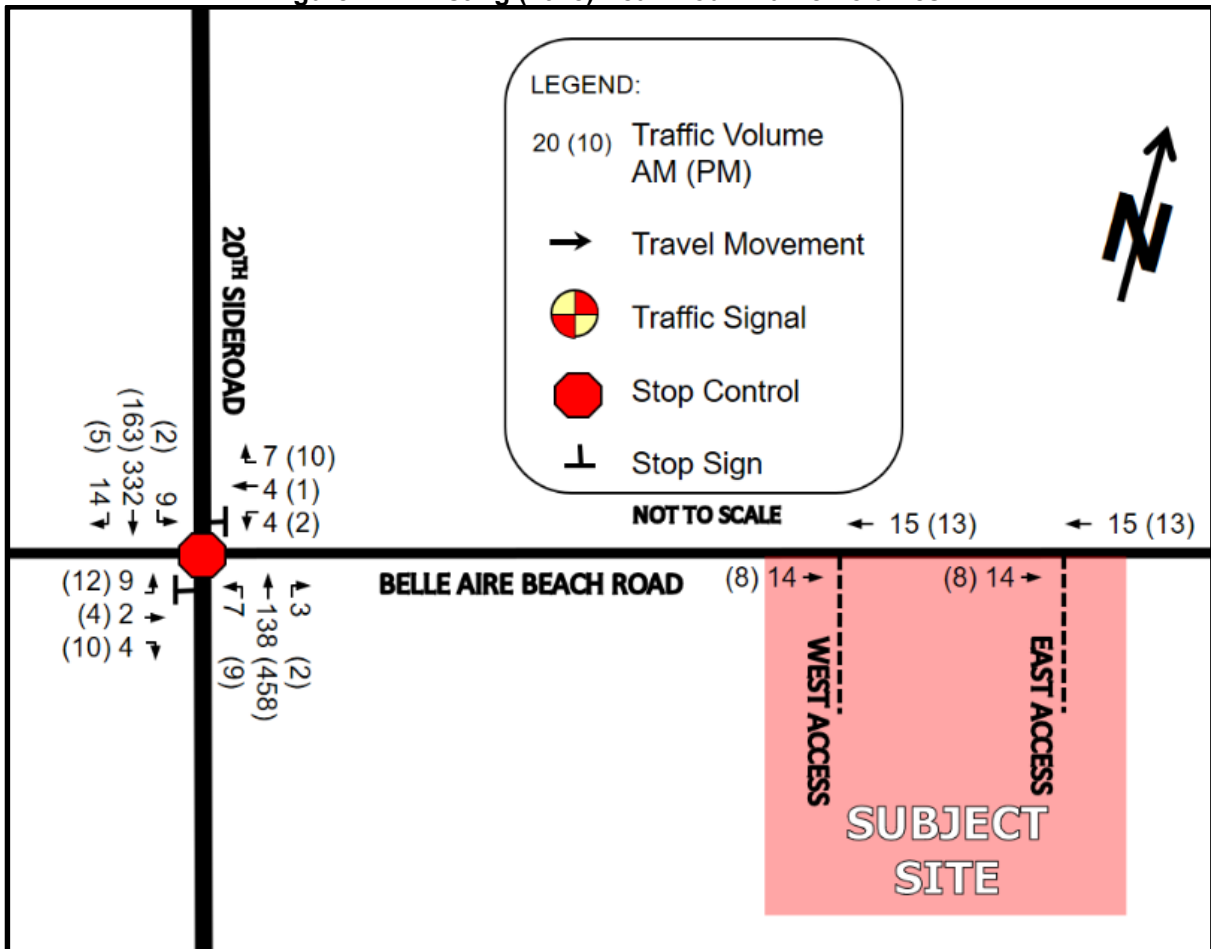


Figure I – Background (2025) Peak Hour Traffic Volumes

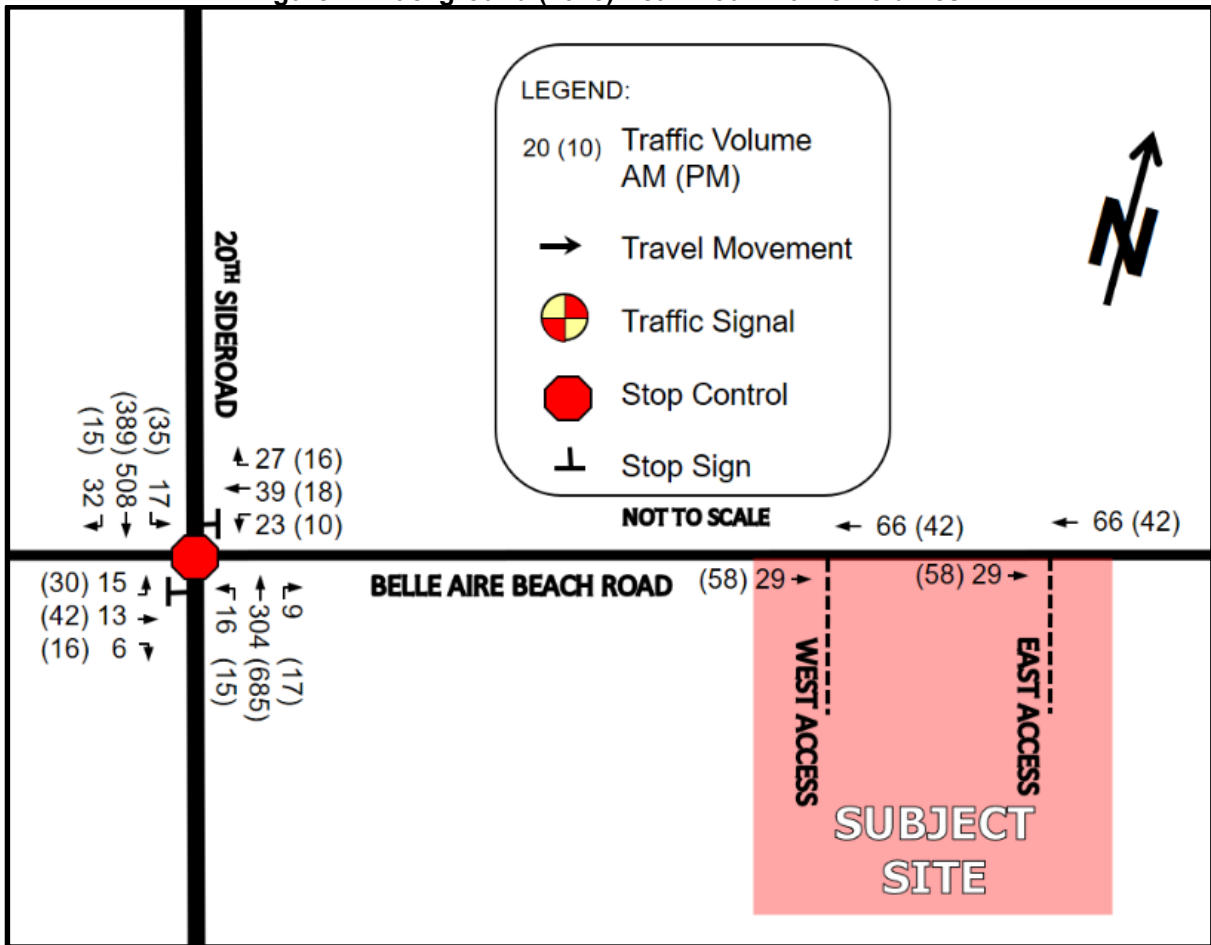


Figure J – Background (2030) Peak Hour Traffic Volumes

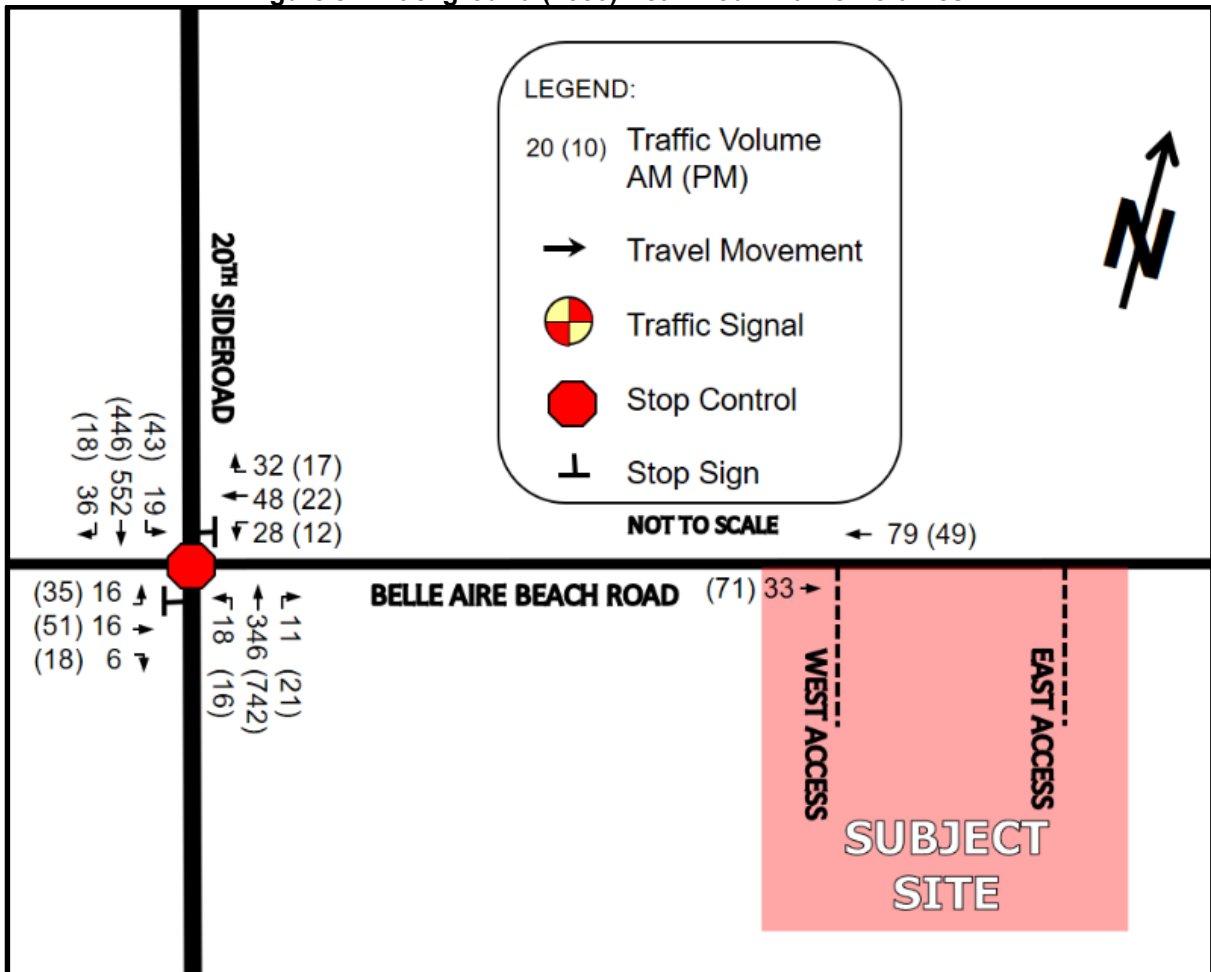


Figure K – Site Traffic Assignment

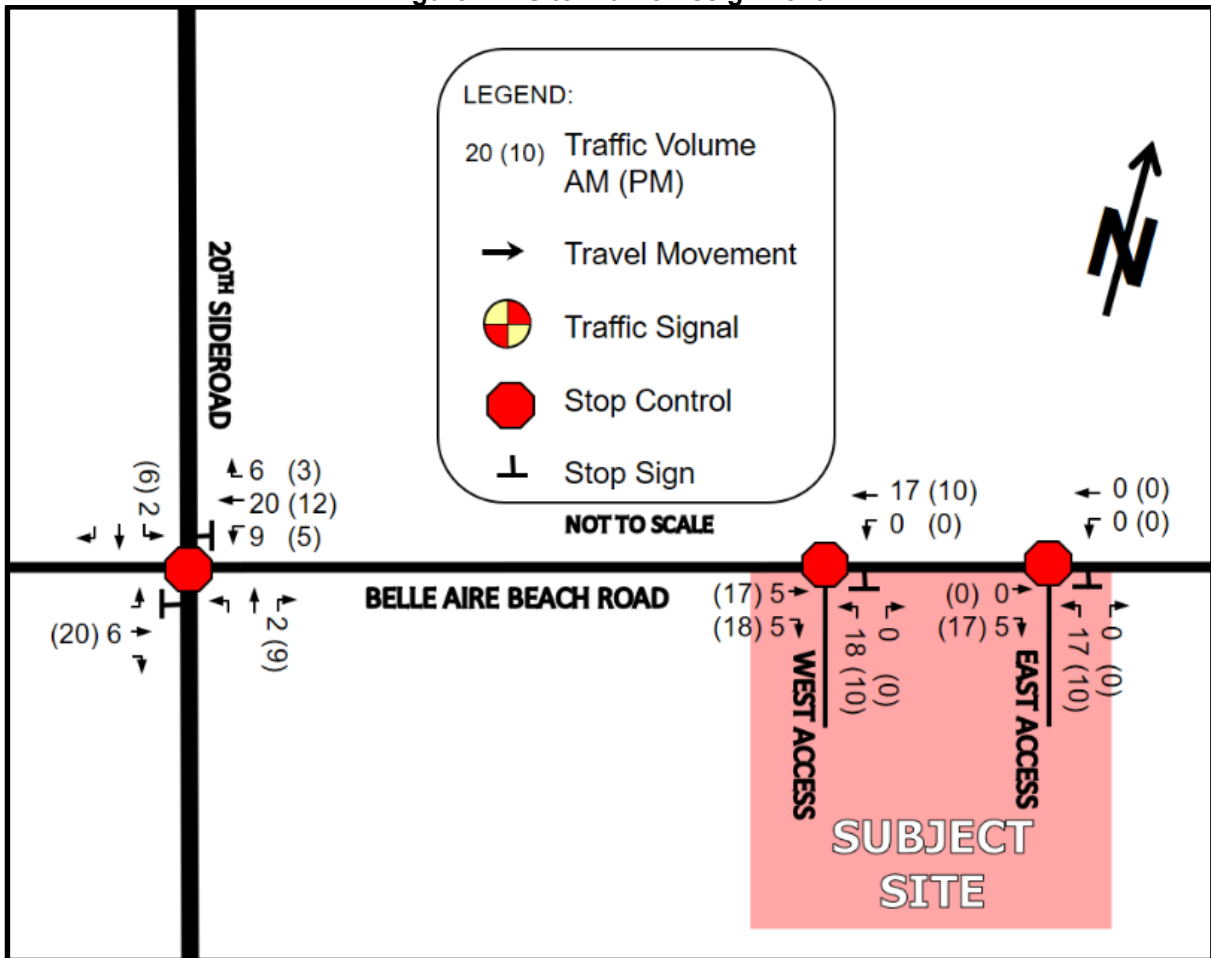


Figure L – Total (2025) Peak Hour Traffic Volumes

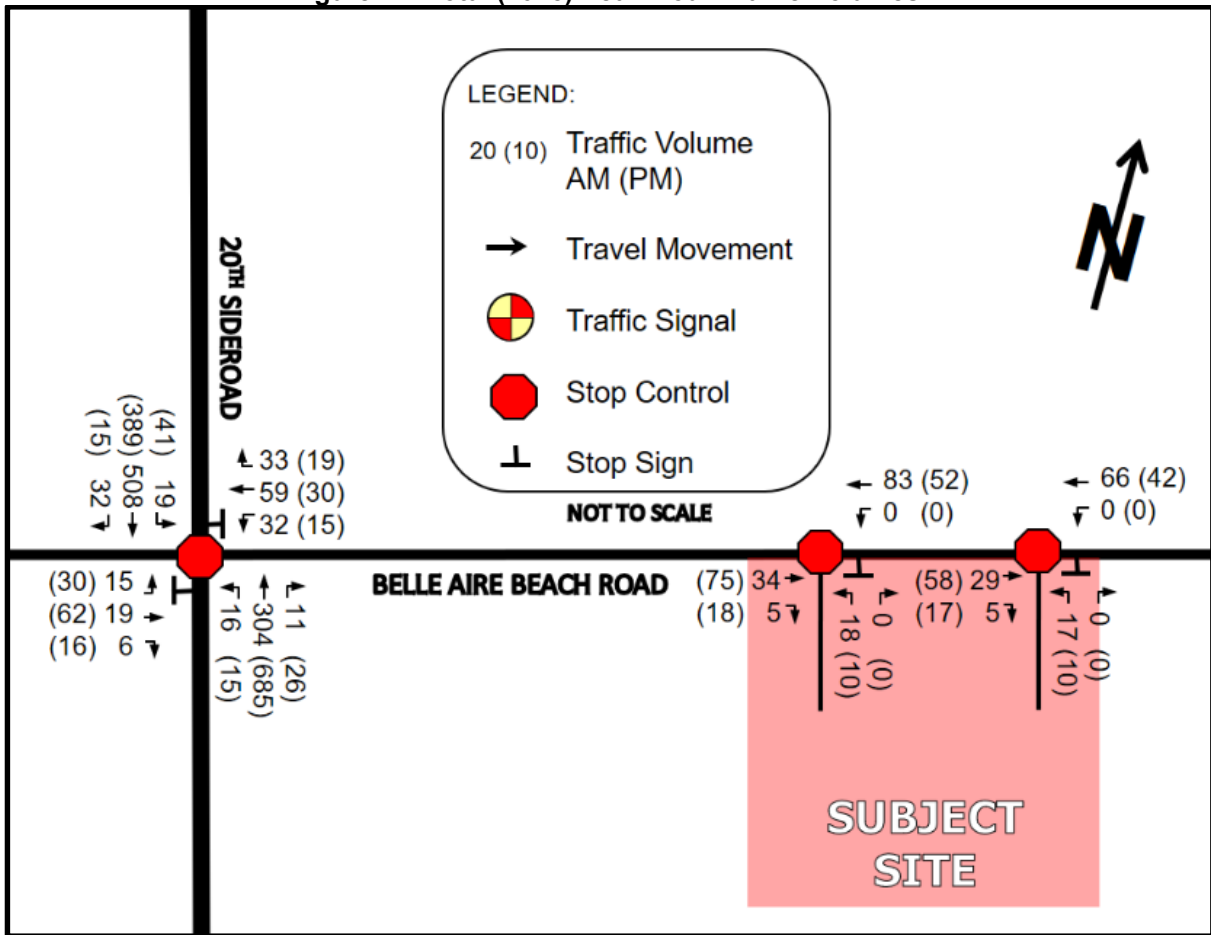
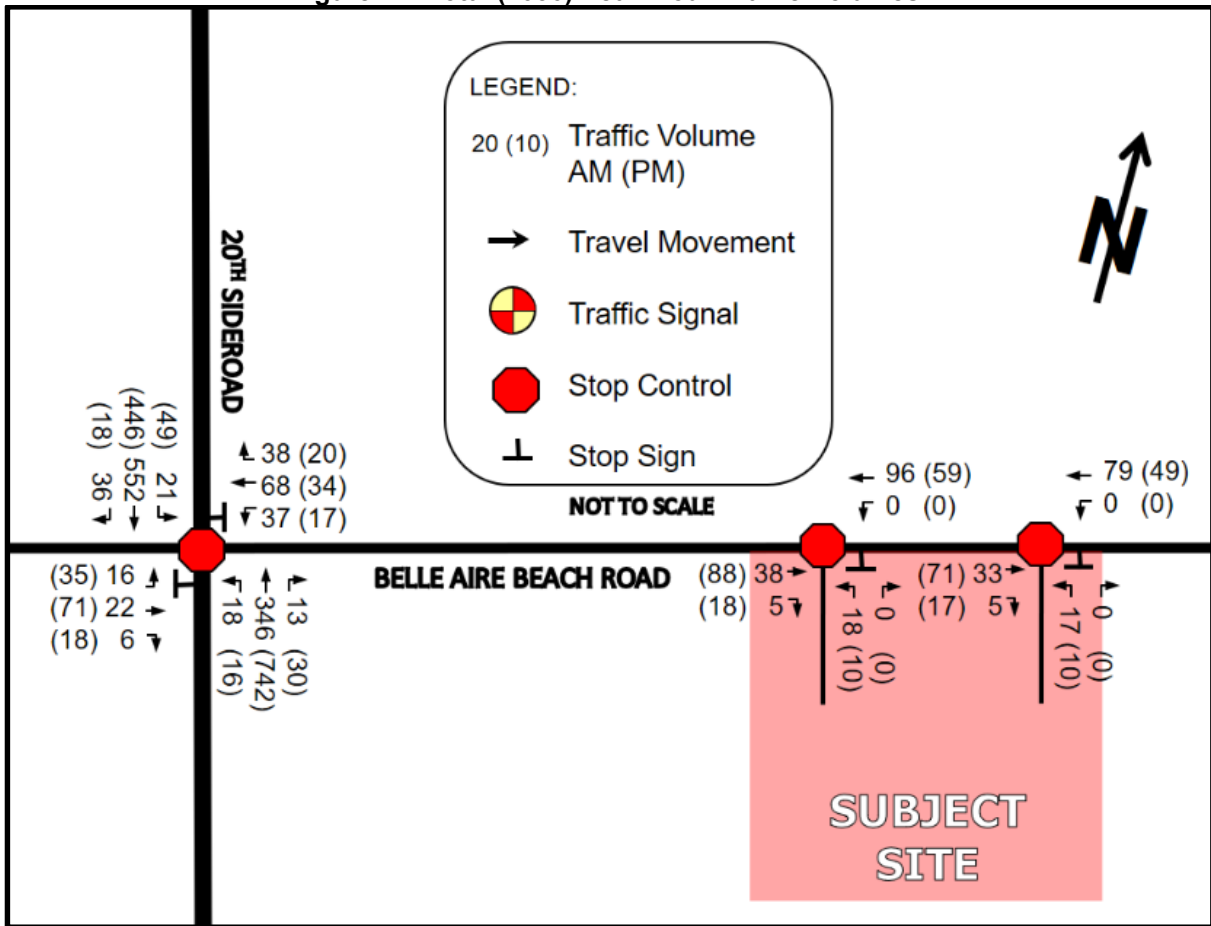


Figure M - Total (2030) Peak Hour Traffic Volumes



Appendix D – Traffic Count Data

Ontario Traffic Inc

Morning Peak Diagram

Specified Period

From: 6:30:00

To: 9:30:00

One Hour Peak

From: 7:15:00

To: 8:15:00

Municipality: Innisfil

Site #: 1712800013

Intersection: 20th Sideroad & 5th Line-Belle Aire

TFR File #: 14

Count date: 4-May-17

Weather conditions:

Person(s) who counted:

**** Non-Signalized Intersection ****

Major Road: 20th Sideroad runs N/S

North Leg Total: 509

North Entering: 355

North Peds: 0

Peds Cross: \nless

Heavys	0	0	0	0
Trucks	2	7	1	10
Cars	12	325	8	345
Totals	14	332	9	



Heavys 0

Trucks 11

Cars 143

Totals 154

East Leg Total: 29

East Entering: 15

East Peds: 0

Peds Cross: \nless

Heavys	Trucks	Cars	Totals
0	2	23	25

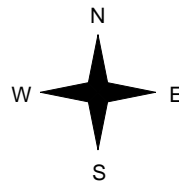


5th Line

Heavys	Trucks	Cars	Totals
0	3	6	9
0	1	1	2
0	2	2	4
0	6	9	



20th Sideroad



Cars	Trucks	Heavys	Totals
4	3	0	7
4	0	0	4
2	2	0	4
10	5	0	

Belle Aire Beach Rd



Cars	Trucks	Heavys	Totals
11	3	0	14

Peds Cross: \nless

West Peds: 0

West Entering: 15

West Leg Total: 40

Cars	329
Trucks	11
Heavys	0
Totals	340



Cars	7	133	2	142
Trucks	0	5	1	6
Heavys	0	0	0	0
Totals	7	138	3	

Peds Cross: \nless

South Peds: 0

South Entering: 148

South Leg Total: 488

Comments

Ontario Traffic Inc

Afternoon Peak Diagram

Specified Period

From: 15:30:00

To: 18:30:00

One Hour Peak

From: 17:00:00

To: 18:00:00

Municipality: Innisfil

Site #: 1712800013

Intersection: 20th Sideroad & 5th Line-Belle Aire

TFR File #: 14

Count date: 4-May-17

Weather conditions:

Person(s) who counted:

**** Non-Signalized Intersection ****

Major Road: 20th Sideroad runs N/S

North Leg Total: 650

North Entering: 170

North Peds: 0

Peds Cross: \nlessgtr

Heavys	0	0	0	0
Trucks	0	1	0	1
Cars	5	162	2	169
Totals	5	163	2	



Heavys 0

Trucks 4

Cars 476

Totals 480

East Leg Total: 21

East Entering: 13

East Peds: 0

Peds Cross: \nlessgtr

Heavys	Trucks	Cars	Totals
0	0	15	15

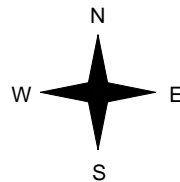


5th Line

Heavys	Trucks	Cars	Totals
0	0	12	12
0	0	4	4
0	1	9	10
0	1	25	



20th Sideroad



Cars	Trucks	Heavys	Totals
10	0	0	10
1	0	0	1
2	0	0	2
13	0	0	

Belle Aire Beach Rd



Cars	Trucks	Heavys	Totals
8	0	0	8

Peds Cross: \nlessgtr

West Peds: 0

West Entering: 26

West Leg Total: 41

Cars 173

Trucks 2

Heavys 0

Totals 175



Cars	9	454	2	465
Trucks	0	4	0	4
Heavys	0	0	0	0
Totals	9	458	2	

Peds Cross: \nlessgtr

South Peds: 0

South Entering: 469

South Leg Total: 644

Comments

Ontario Traffic Inc

Total Count Diagram

Municipality: Innisfil
Site #: 1712800013
Intersection: 20th Sideroad & 5th Line-Belle Aire
TFR File #: 14
Count date: 4-May-17

Weather conditions:
Person(s) who counted:

**** Non-Signalized Intersection ****

Major Road: 20th Sideroad runs N/S

North Leg Total: 3072
 North Entering: 1426
 North Peds: 1
 Peds Cross: \nlessgtr

	Heavys	Trucks	Cars	Totals
0	0	0	0	0
4	35	4	43	
66	1283	34	1383	
Totals	70	1318	38	



	Heavys	Trucks	Cars	Totals
0	0	43	1603	
Totals			1646	

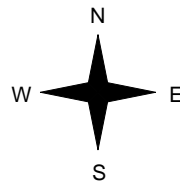
East Leg Total: 137
 East Entering: 76
 East Peds: 0
 Peds Cross: \nlessgtr

Heavys	Trucks	Cars	Totals
0	11	124	135



5th Line

Heavys	Trucks	Cars	Totals
0	8	53	61
0	3	12	15
0	7	54	61
0	18	119	



20th Sideroad



Cars	Trucks	Heavys	Totals
34	8	0	42
14	3	0	17
12	5	0	17
60	16	0	

Belle Aire Beach Rd



Cars	Trucks	Heavys	Totals
52	9	0	61

Peds Cross: \nlessgtr
 West Peds: 0
 West Entering: 137
 West Leg Total: 272

Cars	Trucks	Heavys	Totals
1349	47	0	1396



Cars	Trucks	Heavys	Totals
44	4	0	48
1516	27	0	1543
6	2	0	8
1566	33	0	

Peds Cross: \nlessgtr
 South Peds: 0
 South Entering: 1599
 South Leg Total: 2995





















Comments

Appendix E – Synchro Analysis Output – Existing Traffic Volumes

1357 Belle Aire Beach Road
1: 20th Sideroad & 5th Line

HCM Unsignalized Intersection Capacity Analysis





















Existing (2018) AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	9	2	4	4	4	7	7	138	3	9	332	14
Future Volume (Veh/h)	9	2	4	4	4	7	7	138	3	9	332	14
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	10	2	4	4	4	7	7	147	3	10	353	15
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	550	544	360	539	549	147	368			150		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	550	544	360	539	549	147	368			150		
tC, single (s)	7.4	7.0	6.7	7.6	6.5	6.6	4.1			4.2		
tC, 2 stage (s)												
tF (s)	3.8	4.5	3.8	4.0	4.0	3.7	2.2			2.3		
p0 queue free %	97	99	99	99	99	99	99			99		
cM capacity (veh/h)	391	381	589	379	440	802	1202			1378		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2					
Volume Total	16	15	7	147	3	10	368					
Volume Left	10	4	7	0	0	10	0					
Volume Right	4	7	0	0	3	0	15					
cSH	425	529	1202	1700	1700	1378	1700					
Volume to Capacity	0.04	0.03	0.01	0.09	0.00	0.01	0.22					
Queue Length 95th (m)	0.9	0.7	0.1	0.0	0.0	0.2	0.0					
Control Delay (s)	13.8	12.0	8.0	0.0	0.0	7.6	0.0					
Lane LOS	B	B	A			A						
Approach Delay (s)	13.8	12.0	0.4			0.2						
Approach LOS	B	B										
Intersection Summary												
Average Delay			0.9									
Intersection Capacity Utilization			28.3%		ICU Level of Service				A			
Analysis Period (min)			15									

1357 Belle Aire Beach Road
1: 20th Sideroad & 5th Line

HCM Unsignalized Intersection Capacity Analysis

Existing (2018) PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	12	4	10	2	1	10	9	458	2	2	163	5
Future Volume (Veh/h)	12	4	10	2	1	10	9	458	2	2	163	5
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)	13	4	11	2	1	11	10	498	2	2	177	5
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None								None			
Median storage veh												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	713	704	180	712	704	498	182	500				
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	713	704	180	712	704	498	182	500				
tC, single (s)	7.1	6.5	6.3	7.1	6.5	6.2	4.1	4.1				
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.4	3.5	4.0	3.3	2.2	2.2				
p0 queue free %	96	99	99	99	100	98	99	100				
cM capacity (veh/h)	340	361	843	340	361	576	1405	1075				
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2					
Volume Total	28	14	10	498	2	2	182					
Volume Left	13	2	10	0	0	2	0					
Volume Right	11	11	0	0	2	0	5					
cSH	449	505	1405	1700	1700	1075	1700					
Volume to Capacity	0.06	0.03	0.01	0.29	0.00	0.00	0.11					
Queue Length 95th (m)	1.6	0.7	0.2	0.0	0.0	0.0	0.0					
Control Delay (s)	13.6	12.3	7.6	0.0	0.0	8.4	0.0					
Lane LOS	B	B	A	A								
Approach Delay (s)	13.6	12.3	0.1	0.1								
Approach LOS	B	B										
Intersection Summary												
Average Delay			0.9									
Intersection Capacity Utilization			34.3%	ICU Level of Service					A			
Analysis Period (min)			15									

Appendix F – OTM Signal Justification Sheets

Justification No. 7 - 2030 Total Traffic (Critical Case)

20th Sideroad / Belle Aire Beach Road

Justification	Description		Compliance			Signal Warrant	Underground Provisions Warrant
			Sectional		Entire %		
			Free Flow	Numerical			
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	480	667	139%	66%	YES	YES
	B. Vehicle volume, along minor streets (average hour)	120	96	80%		NO	NO
2. Delay to cross traffic	A. Vehicle volume, major street (average hour)	480	548	114%	86%	NO	YES
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	52	104%		NO	YES

Justification No. 7 - 2030 Total Traffic (Critical Case)

West Access / Belle Aire Beach Road

Justification	Description		Compliance			Signal Warrant	Underground Provisions Warrant
			Sectional		Entire %		
			Free Flow	Numerical			
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	480	83	17%	3%	NO	NO
	B. Vehicle volume, along minor streets (average hour)	180	7	4%		NO	NO
2. Delay to cross traffic	A. Vehicle volume, major street (average hour)	480	70	15%	9%	NO	NO
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	7	14%		NO	NO

Justification No. 7 - 2030 Total Traffic (Critical Case)

East Access / Belle Aire Beach Road





















Justification	Description		Compliance			Signal Warrant	Underground Provisions Warrant
			Sectional		Entire %		
			Free Flow	Numerical			
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	480	70	15%	3%	NO	NO
	B. Vehicle volume, along minor streets (average hour)	180	7	4%		NO	NO
2. Delay to cross traffic	A. Vehicle volume, major street (average hour)	480	58	12%	8%	NO	NO
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	7	14%		NO	NO

Appendix G – Synchro Analysis Output – Background Traffic Volumes

1357 Belle Aire Beach Road
1: 20th Sideroad & 5th Line

HCM Unsignalized Intersection Capacity Analysis





















Background (2025) AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	15	13	6	23	39	27	16	304	9	17	508	32
Future Volume (Veh/h)	15	13	6	23	39	27	16	304	9	17	508	32
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	16	14	6	24	41	29	17	323	10	18	540	34
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None								None			
Median storage veh												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1000	960	557	946	967	323	574	333				
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1000	960	557	946	967	323	574	333				
tC, single (s)	7.4	7.0	6.7	7.6	6.5	6.6	4.1	4.2				
tC, 2 stage (s)												
tF (s)	3.8	4.5	3.8	4.0	4.0	3.7	2.2	2.3				
p0 queue free %	90	93	99	87	83	95	98	98				
cM capacity (veh/h)	159	207	449	182	248	633	1009	1178				
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2					
Volume Total	36	94	17	323	10	18	574					
Volume Left	16	24	17	0	0	18	0					
Volume Right	6	29	0	0	10	0	34					
cSH	198	274	1009	1700	1700	1178	1700					
Volume to Capacity	0.18	0.34	0.02	0.19	0.01	0.02	0.34					
Queue Length 95th (m)	5.2	11.8	0.4	0.0	0.0	0.4	0.0					
Control Delay (s)	27.2	24.9	8.6	0.0	0.0	8.1	0.0					
Lane LOS	D	C	A	A								
Approach Delay (s)	27.2	24.9	0.4	0.2								
Approach LOS	D	C										
Intersection Summary												
Average Delay			3.4									
Intersection Capacity Utilization			40.9%	ICU Level of Service					A			
Analysis Period (min)			15									

1357 Belle Aire Beach Road
1: 20th Sideroad & 5th Line

HCM Unsignalized Intersection Capacity Analysis

















Background (2025) PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	42	16	10	18	16	15	685	17	35	389	15
Future Volume (Veh/h)	30	42	16	10	18	16	15	685	17	35	389	15
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)	33	46	17	11	20	17	16	745	18	38	423	16
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	1311	1302	431	1316	1292	745	439			763		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1311	1302	431	1316	1292	745	439			763		
tC, single (s)	7.1	6.5	6.3	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.4	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	71	70	97	89	87	96	99			96		
cM capacity (veh/h)	113	153	608	97	155	417	1132			859		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2					
Volume Total	96	48	16	745	18	38	439					
Volume Left	33	11	16	0	0	38	0					
Volume Right	17	17	0	0	18	0	16					
cSH	155	170	1132	1700	1700	859	1700					
Volume to Capacity	0.62	0.28	0.01	0.44	0.01	0.04	0.26					
Queue Length 95th (m)	26.9	8.8	0.3	0.0	0.0	1.1	0.0					
Control Delay (s)	60.2	34.4	8.2	0.0	0.0	9.4	0.0					
Lane LOS	F	D	A			A						
Approach Delay (s)	60.2	34.4	0.2			0.7						
Approach LOS	F	D										
Intersection Summary												
Average Delay			5.7									
Intersection Capacity Utilization			50.4%		ICU Level of Service				A			
Analysis Period (min)			15									

1357 Belle Aire Beach Road
1: 20th Sideroad & 5th Line

Queues

Background (2025) AM Peak Hour with Imp.

									
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	15	13	23	39	16	304	9	17	508
Future Volume (vph)	15	13	23	39	16	304	9	17	508
Lane Group Flow (vph)	0	36	0	94	17	323	10	18	574
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	Perm	NA
Protected Phases		4		8		2			6
Permitted Phases	4		8		2		2	6	
Detector Phase	4	4	8	8	2	2	2	6	6
Switch Phase									
Minimum Initial (s)	20.0	20.0	20.0	20.0	16.0	16.0	16.0	16.0	16.0
Minimum Split (s)	26.0	26.0	26.0	26.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	26.0	26.0	26.0	26.0	44.0	44.0	44.0	44.0	44.0
Total Split (%)	37.1%	37.1%	37.1%	37.1%	62.9%	62.9%	62.9%	62.9%	62.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	Max	Max	Max	Max	Max
v/c Ratio		0.11		0.24	0.04	0.27	0.01	0.03	0.47
Control Delay		18.4		17.3	7.7	8.5	0.0	7.5	10.7
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		18.4		17.3	7.7	8.5	0.0	7.5	10.7
Queue Length 50th (m)		3.5		7.9	1.0	22.6	0.0	1.1	47.7
Queue Length 95th (m)		9.6		17.6	3.7	37.9	0.0	3.8	76.2
Internal Link Dist (m)		311.9		639.0		443.9			552.9
Turn Bay Length (m)					110.0		110.0	40.0	
Base Capacity (vph)		318		392	481	1208	818	639	1214
Starvation Cap Reductn		0		0	0	0	0	0	0
Spillback Cap Reductn		0		0	0	0	0	0	0
Storage Cap Reductn		0		0	0	0	0	0	0
Reduced v/c Ratio		0.11		0.24	0.04	0.27	0.01	0.03	0.47

Intersection Summary

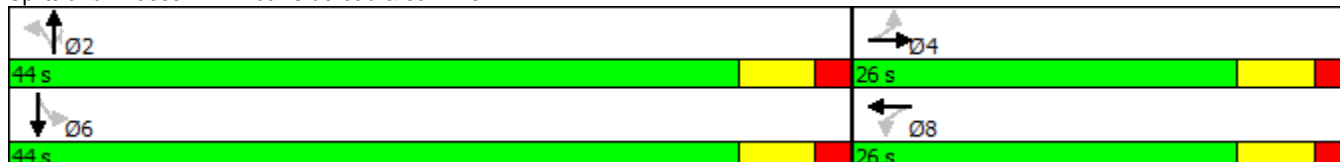
Cycle Length: 70

Actuated Cycle Length: 72.6

Natural Cycle: 55

Control Type: Semi Act-Uncoord




















Splits and Phases: 1: 20th Sideroad & 5th Line



1357 Belle Aire Beach Road
1: 20th Sideroad & 5th Line

HCM Signalized Intersection Capacity Analysis

















Background (2025) AM Peak Hour with Imp.

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	13	6	23	39	27	16	304	9	17	508	32
Future Volume (vph)	15	13	6	23	39	27	16	304	9	17	508	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0		6.0	6.0	6.0	6.0	6.0	
Lane Util. Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Frt		0.98			0.96		1.00	1.00	0.85	1.00	0.99	
Flt Protected		0.98			0.99		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1275			1427		1805	1827	1214	1626	1833	
Flt Permitted		0.86			0.92		0.38	1.00	1.00	0.57	1.00	
Satd. Flow (perm)		1123			1329		727	1827	1214	967	1833	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	16	14	6	24	41	29	17	323	10	18	540	34
RTOR Reduction (vph)	0	5	0	0	23	0	0	0	4	0	3	0
Lane Group Flow (vph)	0	31	0	0	71	0	17	323	6	18	571	0
Heavy Vehicles (%)	33%	50%	50%	50%	0%	43%	0%	4%	33%	11%	2%	14%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		15.4			15.4		46.5	46.5	46.5	46.5	46.5	
Effective Green, g (s)		15.4			15.4		46.5	46.5	46.5	46.5	46.5	
Actuated g/C Ratio		0.21			0.21		0.63	0.63	0.63	0.63	0.63	
Clearance Time (s)		6.0			6.0		6.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		234			276		457	1149	763	608	1153	
v/s Ratio Prot								0.18			c0.31	
v/s Ratio Perm		0.03			c0.05		0.02		0.01	0.02		
v/c Ratio		0.13			0.26		0.04	0.28	0.01	0.03	0.50	
Uniform Delay, d1		23.8			24.5		5.2	6.2	5.1	5.2	7.4	
Progression Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.3			0.5		0.2	0.6	0.0	0.1	1.5	
Delay (s)		24.1			25.0		5.4	6.8	5.1	5.3	8.9	
Level of Service		C			C		A	A	A	A	A	
Approach Delay (s)		24.1			25.0			6.7			8.8	
Approach LOS		C			C			A			A	
Intersection Summary												
HCM 2000 Control Delay			10.0		HCM 2000 Level of Service					B		
HCM 2000 Volume to Capacity ratio			0.44									
Actuated Cycle Length (s)			73.9		Sum of lost time (s)					12.0		
Intersection Capacity Utilization			58.3%		ICU Level of Service					B		
Analysis Period (min)			15									
c Critical Lane Group												

1357 Belle Aire Beach Road
1: 20th Sideroad & 5th Line

Queues

Background (2025) PM Peak Hour with Imp.

									
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	30	42	10	18	15	685	17	35	389
Future Volume (vph)	30	42	10	18	15	685	17	35	389
Lane Group Flow (vph)	0	96	0	48	16	745	18	38	439
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	Perm	NA
Protected Phases		4		8		2			6
Permitted Phases	4		8		2		2	6	
Detector Phase	4	4	8	8	2	2	2	6	6
Switch Phase									
Minimum Initial (s)	20.0	20.0	20.0	20.0	16.0	16.0	16.0	16.0	16.0
Minimum Split (s)	26.0	26.0	26.0	26.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	26.0	26.0	26.0	26.0	44.0	44.0	44.0	44.0	44.0
Total Split (%)	37.1%	37.1%	37.1%	37.1%	62.9%	62.9%	62.9%	62.9%	62.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	Max	Max	Max	Max	Max
v/c Ratio		0.21		0.10	0.03	0.60	0.02	0.11	0.36
Control Delay		19.2		14.7	7.6	13.2	0.7	8.9	9.3
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		19.2		14.7	7.6	13.2	0.7	8.9	9.3
Queue Length 50th (m)		9.4		3.5	1.0	71.3	0.0	2.4	32.8
Queue Length 95th (m)		19.3		10.4	3.5	113.4	0.8	7.2	52.8
Internal Link Dist (m)		311.9		639.0		443.9			552.9
Turn Bay Length (m)					110.0		110.0	40.0	
Base Capacity (vph)		464		485	596	1237	1078	339	1233
Starvation Cap Reductn		0		0	0	0	0	0	0
Spillback Cap Reductn		0		0	0	0	0	0	0
Storage Cap Reductn		0		0	0	0	0	0	0
Reduced v/c Ratio		0.21		0.10	0.03	0.60	0.02	0.11	0.36

Intersection Summary

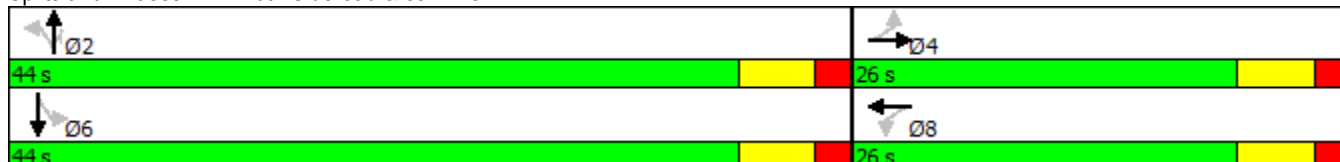
Cycle Length: 70

Actuated Cycle Length: 72

Natural Cycle: 60

Control Type: Semi Act-Uncoord




















Splits and Phases: 1: 20th Sideroad & 5th Line



1357 Belle Aire Beach Road
1: 20th Sideroad & 5th Line

















HCM Signalized Intersection Capacity Analysis

Background (2025) PM Peak Hour with Imp.

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	30	42	16	10	18	16	15	685	17	35	389	15
Future Volume (vph)	30	42	16	10	18	16	15	685	17	35	389	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0		6.0	6.0	6.0	6.0	6.0	
Lane Util. Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Frt		0.98			0.95		1.00	1.00	0.85	1.00	0.99	
Flt Protected		0.98			0.99		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1792			1789		1805	1881	1615	1805	1872	
Flt Permitted		0.88			0.93		0.48	1.00	1.00	0.27	1.00	
Satd. Flow (perm)		1609			1678		905	1881	1615	515	1872	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	33	46	17	11	20	17	16	745	18	38	423	16
RTOR Reduction (vph)	0	12	0	0	13	0	0	0	7	0	1	0
Lane Group Flow (vph)	0	84	0	0	35	0	16	745	11	38	438	0
Heavy Vehicles (%)	0%	0%	10%	0%	0%	0%	0%	1%	0%	0%	1%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		15.4			15.4		45.9	45.9	45.9	45.9	45.9	
Effective Green, g (s)		15.4			15.4		45.9	45.9	45.9	45.9	45.9	
Actuated g/C Ratio		0.21			0.21		0.63	0.63	0.63	0.63	0.63	
Clearance Time (s)		6.0			6.0		6.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		338			352		566	1177	1011	322	1172	
v/s Ratio Prot								c0.40			0.23	
v/s Ratio Perm		c0.05			0.02		0.02		0.01	0.07		
v/c Ratio		0.25			0.10		0.03	0.63	0.01	0.12	0.37	
Uniform Delay, d1		24.1			23.3		5.2	8.5	5.2	5.5	6.7	
Progression Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.4			0.1		0.1	2.6	0.0	0.7	0.9	
Delay (s)		24.5			23.5		5.3	11.1	5.2	6.3	7.6	
Level of Service		C			C		A	B	A	A	A	
Approach Delay (s)		24.5			23.5			10.8			7.5	
Approach LOS		C			C			B			A	
Intersection Summary												
HCM 2000 Control Delay			11.1			HCM 2000 Level of Service				B		
HCM 2000 Volume to Capacity ratio			0.54									
Actuated Cycle Length (s)			73.3			Sum of lost time (s)				12.0		
Intersection Capacity Utilization			62.7%			ICU Level of Service				B		
Analysis Period (min)			15									
c Critical Lane Group												

1357 Belle Aire Beach Road
1: 20th Sideroad & 5th Line

Queues
Background (2030) AM Peak Hour

									
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	16	16	28	48	18	346	11	19	552
Future Volume (vph)	16	16	28	48	18	346	11	19	552
Lane Group Flow (vph)	0	40	0	115	19	368	12	20	625
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	Perm	NA
Protected Phases		4		8		2			6
Permitted Phases	4		8		2		2	6	
Detector Phase	4	4	8	8	2	2	2	6	6
Switch Phase									
Minimum Initial (s)	20.0	20.0	20.0	20.0	16.0	16.0	16.0	16.0	16.0
Minimum Split (s)	26.0	26.0	26.0	26.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	26.0	26.0	26.0	26.0	44.0	44.0	44.0	44.0	44.0
Total Split (%)	37.1%	37.1%	37.1%	37.1%	62.9%	62.9%	62.9%	62.9%	62.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	Max	Max	Max	Max	Max
v/c Ratio		0.12		0.29	0.04	0.31	0.01	0.03	0.52
Control Delay		18.4		18.2	7.9	9.0	0.0	7.7	11.6
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		18.4		18.2	7.9	9.0	0.0	7.7	11.6
Queue Length 50th (m)		3.8		9.8	1.1	26.6	0.0	1.2	54.2
Queue Length 95th (m)		10.5		21.5	4.0	43.7	0.1	4.1	86.4
Internal Link Dist (m)		311.9		639.0		443.9			552.9
Turn Bay Length (m)					110.0		110.0	40.0	
Base Capacity (vph)		320		395	432	1198	812	595	1204
Starvation Cap Reductn		0		0	0	0	0	0	0
Spillback Cap Reductn		0		0	0	0	0	0	0
Storage Cap Reductn		0		0	0	0	0	0	0
Reduced v/c Ratio		0.13		0.29	0.04	0.31	0.01	0.03	0.52

Intersection Summary

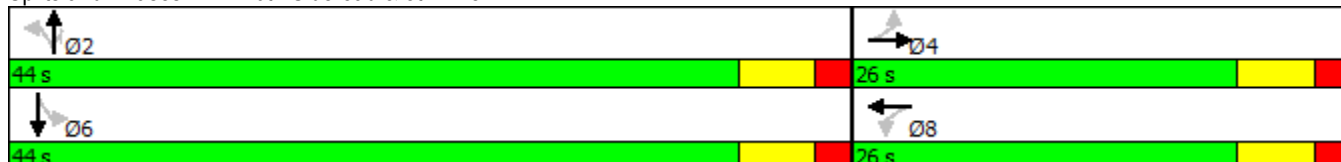
Cycle Length: 70

Actuated Cycle Length: 71.7

Natural Cycle: 60

Control Type: Semi Act-Uncoord

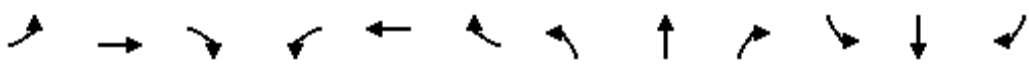
Splits and Phases: 1: 20th Sideroad & 5th Line



1357 Belle Aire Beach Road
1: 20th Sideroad & 5th Line

















HCM Signalized Intersection Capacity Analysis

Background (2030) AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↗	↑	↖	↗	↖	↗
Traffic Volume (vph)	16	16	6	28	48	32	18	346	11	19	552	36
Future Volume (vph)	16	16	6	28	48	32	18	346	11	19	552	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0		6.0	6.0	6.0	6.0	6.0	
Lane Util. Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Frt		0.98			0.96		1.00	1.00	0.85	1.00	0.99	
Flt Protected		0.98			0.99		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1277			1432		1805	1827	1214	1626	1833	
Flt Permitted		0.86			0.91		0.35	1.00	1.00	0.53	1.00	
Satd. Flow (perm)		1118			1324		660	1827	1214	907	1833	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	17	17	6	30	51	34	19	368	12	20	587	38
RTOR Reduction (vph)	0	5	0	0	24	0	0	0	5	0	3	0
Lane Group Flow (vph)	0	35	0	0	91	0	19	368	7	20	622	0
Heavy Vehicles (%)	33%	50%	50%	50%	0%	43%	0%	4%	33%	11%	2%	14%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		15.4			15.4		45.6	45.6	45.6	45.6	45.6	
Effective Green, g (s)		15.4			15.4		45.6	45.6	45.6	45.6	45.6	
Actuated g/C Ratio		0.21			0.21		0.62	0.62	0.62	0.62	0.62	
Clearance Time (s)		6.0			6.0		6.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		235			279		412	1141	758	566	1144	
v/s Ratio Prot								0.20			c0.34	
v/s Ratio Perm		0.03			c0.07		0.03		0.01	0.02		
v/c Ratio		0.15			0.33		0.05	0.32	0.01	0.04	0.54	
Uniform Delay, d1		23.5			24.4		5.3	6.4	5.2	5.3	7.8	
Progression Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.3			0.7		0.2	0.7	0.0	0.1	1.9	
Delay (s)		23.8			25.1		5.5	7.2	5.2	5.4	9.6	
Level of Service		C			C		A	A	A	A	A	
Approach Delay (s)		23.8			25.1			7.0			9.5	
Approach LOS		C			C			A			A	
Intersection Summary												
HCM 2000 Control Delay		10.7			HCM 2000 Level of Service			B				
HCM 2000 Volume to Capacity ratio		0.49										
Actuated Cycle Length (s)		73.0			Sum of lost time (s)			12.0				
Intersection Capacity Utilization		58.3%			ICU Level of Service			B				
Analysis Period (min)		15										
c Critical Lane Group												

1357 Belle Aire Beach Road
1: 20th Sideroad & 5th Line

Queues
Background (2030) PM Peak Hour

									
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	35	51	12	22	16	742	21	43	446
Future Volume (vph)	35	51	12	22	16	742	21	43	446
Lane Group Flow (vph)	0	113	0	55	17	807	23	47	505
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	Perm	NA
Protected Phases		4		8		2			6
Permitted Phases	4		8		2		2	6	
Detector Phase	4	4	8	8	2	2	2	6	6
Switch Phase									
Minimum Initial (s)	20.0	20.0	20.0	20.0	16.0	16.0	16.0	16.0	16.0
Minimum Split (s)	26.0	26.0	26.0	26.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	26.0	26.0	26.0	26.0	44.0	44.0	44.0	44.0	44.0
Total Split (%)	37.1%	37.1%	37.1%	37.1%	62.9%	62.9%	62.9%	62.9%	62.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	Max	Max	Max	Max	Max
v/c Ratio		0.24		0.11	0.03	0.66	0.02	0.16	0.41
Control Delay		19.5		15.0	7.7	14.9	1.1	10.0	10.1
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		19.5		15.0	7.7	14.9	1.1	10.0	10.1
Queue Length 50th (m)		11.0		4.0	1.0	81.7	0.0	3.0	39.6
Queue Length 95th (m)		22.2		11.5	3.7	#133.3	1.5	9.0	63.0
Internal Link Dist (m)		311.9		639.0		443.9			552.9
Turn Bay Length (m)					110.0		110.0	40.0	
Base Capacity (vph)		466		488	530	1228	1070	286	1223
Starvation Cap Reductn		0		0	0	0	0	0	0
Spillback Cap Reductn		0		0	0	0	0	0	0
Storage Cap Reductn		0		0	0	0	0	0	0
Reduced v/c Ratio		0.24		0.11	0.03	0.66	0.02	0.16	0.41

Intersection Summary

Cycle Length: 70

Actuated Cycle Length: 71.1

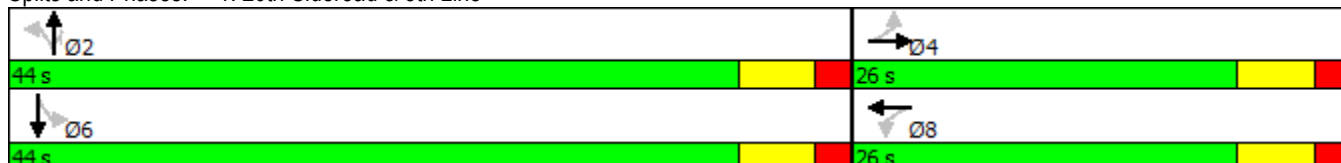
Natural Cycle: 60

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: 20th Sideroad & 5th Line



1357 Belle Aire Beach Road
1: 20th Sideroad & 5th Line

HCM Signalized Intersection Capacity Analysis

Background (2030) PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	35	51	18	12	22	17	16	742	21	43	446	18
Future Volume (vph)	35	51	18	12	22	17	16	742	21	43	446	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0		6.0	6.0	6.0	6.0	6.0	
Lane Util. Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Frt		0.98			0.96		1.00	1.00	0.85	1.00	0.99	
Flt Protected		0.98			0.99		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1792			1795		1805	1881	1615	1805	1871	
Flt Permitted		0.88			0.92		0.43	1.00	1.00	0.23	1.00	
Satd. Flow (perm)		1602			1670		814	1881	1615	438	1871	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	55	20	13	24	18	17	807	23	47	485	20
RTOR Reduction (vph)	0	12	0	0	14	0	0	0	9	0	2	0
Lane Group Flow (vph)	0	101	0	0	41	0	17	807	14	47	503	0
Heavy Vehicles (%)	0%	0%	10%	0%	0%	0%	0%	1%	0%	0%	1%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		15.4			15.4		45.0	45.0	45.0	45.0	45.0	
Effective Green, g (s)		15.4			15.4		45.0	45.0	45.0	45.0	45.0	
Actuated g/C Ratio		0.21			0.21		0.62	0.62	0.62	0.62	0.62	
Clearance Time (s)		6.0			6.0		6.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		340			355		505	1169	1003	272	1162	
v/s Ratio Prot								c0.43			0.27	
v/s Ratio Perm		c0.06			0.02		0.02		0.01	0.11		
v/c Ratio		0.30			0.12		0.03	0.69	0.01	0.17	0.43	
Uniform Delay, d1		24.0			23.0		5.3	9.1	5.2	5.8	7.1	
Progression Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.5			0.1		0.1	3.4	0.0	1.4	1.2	
Delay (s)		24.4			23.1		5.4	12.4	5.3	7.2	8.3	
Level of Service		C			C		A	B	A	A	A	
Approach Delay (s)		24.4			23.1			12.1			8.2	
Approach LOS		C			C			B			A	
Intersection Summary												
HCM 2000 Control Delay			12.0			HCM 2000 Level of Service			B			
HCM 2000 Volume to Capacity ratio			0.59									
Actuated Cycle Length (s)			72.4			Sum of lost time (s)			12.0			
Intersection Capacity Utilization			65.7%			ICU Level of Service			C			
Analysis Period (min)			15									
c Critical Lane Group												

Appendix H – Transportation Tomorrow Survey – Excerpt



TTS Cross Tabulation

Cross Tabulation Query Form - Trip - 2011

Filter Variables

Planning district of dest... X ▼

2006 GTA zone of hous... X ▼

(Optional) Table Attribute ▼

Group Attributes

Row Grouping

Column Grouping

Table Grouping

Grouping file: Choose File No file chosen

Filter Selection +

2006 GTA zone of household

In 8594

And ▼

Start time of trip

In 700-900

And ▼

Trip purpose of destination

In W,

Add

Delete

Output

Comma-delimited table

Column format

Expansion Factor On

Click to Select Load

Load

Add Delete

Output

● Comma-delimited table ● Column format Expansion Factor On

Click to Select Load

Load

Execute Query

Select All

Save As

Mon Oct 30 2017 10:13:43 GMT-0400 (Eastern Daylight Time) - Run Time: 3225ms

Cross Tabulation Query Form - Trip - 2011

Row: Planning district of destination - pd_dest
Column: 2006 GTA zone of household - gta06_hhld

Filters:
(2006 GTA zone of household - gta06_hhld In 8594
and
Start time of trip - start_time In 700-900
and
Trip purpose of destination - purp_dest In W,)

Trip 2011
Table:

,8594
PD 1 of Toronto,26
PD 11 of Toronto,54
East Gwillimbury,17
Neumarket,71
Aurora,17
Barrie,97
Innisfil,88
Bradford-West Gwillimbury,28
Eso,17
Oro-Medonte,26
Orillia,17



TTS Cross Tabulation

Cross Tabulation Query Form - Trip - 2011

Filter Variables

2006 GTA zone of desti... ✕ ▼

2006 GTA zone of hous... ✕ ▼

{Optional} Table Attribute ▼

Group Attributes

Row Grouping

Column Grouping

Table Grouping

Grouping file: Choose file No file chosen

Filter Selection +

2006 GTA zone of household ▼ In ▼ 8594

And ▼

Starttime of trip ▼ In ▼ 700-900

And ▼

Trip purpose of destination ▼ In ▼ W,

Add Delete

Output

Comma-delimited table

Column format

Expansion Factor On

Click to Select Load

Load

Output

● Comma-delimited table ● Column format Expansion Factor On

Click to Select Load

Load

Execute Query

Select All

Save As

Mon Oct 30 2017 10:25:25 GMT-0400 (Eastern Daylight Time) - Run Time: 3325ms

Cross Tabulation Query Form - Trip - 2011

Row: 2006 GTA zone of destination - gta06_dest
Column: 2006 GTA zone of household - gta06_hhld

Filters:

(2006 GTA zone of household - gta06_hhld In 8594
and
start time of trip - start_time In /00-900
and
Trip purpose of destination - purp_dest In W,)

Trip 2011

Table:

,8594
23,26
443,28
463,26
2557,17
2605,28
2613,17
2615,26
2780,17
8503,26
8503,26
8521,45
8553,17
8560,54
8582,26
8591,17
8622,17
8630,28
8684,17



TTS Cross Tabulation

Cross Tabulation Query Form - Trip - 2011

Filter Variables

Planning district of destl... X ▼

2006 GTA zone of hous... X ▼

(Optional) Table Attribute ▼

Group Attributes

Row Grouping

Column Grouping

Table Grouping

Grouping file: Choose File No file chosen

Filter Selection +

2006 GTA zone of household ▼ In ▼ 8595,8559

And ▼

Start time of trip ▼ In ▼ 700-900

And ▼

Trip purpose of destination ▼ In ▼ W.

Add

Delete

Output

● Comma-delimited table ● Column format Expansion Factor On

Execute Query Select All Save As

Click to Select Load

Load

Wed Nov 22 2017 23:15:30 GMT-0500 (Eastern Standard Time) - Run Time: 2797ms

Cross Tabulation Query Form - Trip - 2011

Row: Planning district of destination - pd_dest
Column: 2006 GTA zone of household - gta06_hhid

Filters:
(2006 GTA zone of household - gta06_hhid In 8595,8559
and
start time of trip - start_time In 700-900
and
Trip purpose of destination - purp_dest In W,)

Trip 2011
Table:

,8559,8595
PD 7 of Toronto,17,0
PD 9 of Toronto,17,52
PD 12 of Toronto,0,17
East Gwillimbury,52,45
Newmarket,174,54
Aurora,0,28
Whitchurch-Stouffville,17,0
Markham,28,56
King,17,26
Vaughan,88,69
Caledon,0,43
Mississauga,26,43
Erie,26,0
Barrie,331,424
Innisfil,298,273
Bradford-West Gwillimbury,45,0
New Tecumseth,34,0
Essa,26,26
Penetanguishene,0,26
Orillia,0,28,0



TTS Cross Tabulation

Cross Tabulation Query Form - Trip - 2011

Filter Variables

2006 GTA zone of desti... X ▼

2006 GTA zone of hous... X ▼

(Optional) Table Attribute ▼

Group Attributes

Row Grouping

Column Grouping

Table Grouping

Grouping file: Choose File No file chosen

Filter Selection +

☒ 2006 GTA zone of household ▼ In ▼ 8595,8559

And ▼

☒ Start time of trip ▼ In ▼ 700-900

And ▼

☒ Trip purpose of destination ▼ In ▼ W,

And ▼

☒ Planning district of destination ▼ In ▼ 82,

Add

Delete

Output

● Comma-delimited table

● Column format

Expansion Factor On

Click to Select Load

Load

Execute QuerySelect AllSave As

Wed Nov 22 2017 23:26:28 GMT-0500 (Eastern Standard Time) - Run Time: 2589ms

Cross Tabulation Query Form - Trip - 2011

Row: 2006 GTA zone of destination - gta06_dest
Column: 2006 GTA zone of household - gta06_hhld

Filters:
(2006 GTA zone of household - gta06_hhld In 8595,8559
and
Start time of trip - start_time In 700-900
and
Trip purpose of destination - purp_dest In W,
and
Planning district of destination - pd_dest In 82,)

















Trip 2011
Table:

,8559,8595
8559,17,140
8560,148,0
0500,45,0
8590,26,0
8594,0,26
8595,0,62
8621,17,0
8624,0,28
8627,17,0
8628,0,17
8629,28,0

Appendix I – Synchro Analysis Output – Total Traffic Volumes

1357 Belle Aire Beach Road
1: 20th Sideroad & 5th Line

Queues
Total (2025) AM Peak Hour

									
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	15	19	32	59	16	304	11	19	508
Future Volume (vph)	15	19	32	59	16	304	11	19	508
Lane Group Flow (vph)	0	42	0	132	17	323	12	20	574
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	Perm	NA
Protected Phases		4		8		2			6
Permitted Phases	4		8		2		2	6	
Detector Phase	4	4	8	8	2	2	2	6	6
Switch Phase									
Minimum Initial (s)	20.0	20.0	20.0	20.0	16.0	16.0	16.0	16.0	16.0
Minimum Split (s)	26.0	26.0	26.0	26.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	26.0	26.0	26.0	26.0	44.0	44.0	44.0	44.0	44.0
Total Split (%)	37.1%	37.1%	37.1%	37.1%	62.9%	62.9%	62.9%	62.9%	62.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	Max	Max	Max	Max	Max
v/c Ratio		0.13		0.33	0.04	0.27	0.01	0.03	0.48
Control Delay		18.4		19.5	7.8	8.8	0.0	7.7	11.0
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		18.4		19.5	7.8	8.8	0.0	7.7	11.0
Queue Length 50th (m)		3.9		12.0	1.0	22.6	0.0	1.2	47.7
Queue Length 95th (m)		10.8		25.2	3.7	37.9	0.1	4.1	76.2
Internal Link Dist (m)		311.9		639.0		443.9			552.9
Turn Bay Length (m)					110.0		110.0	40.0	
Base Capacity (vph)		326		402	469	1188	806	629	1195
Starvation Cap Reductn		0		0	0	0	0	0	0
Spillback Cap Reductn		0		0	0	0	0	0	0
Storage Cap Reductn		0		0	0	0	0	0	0
Reduced v/c Ratio		0.13		0.33	0.04	0.27	0.01	0.03	0.48

Intersection Summary

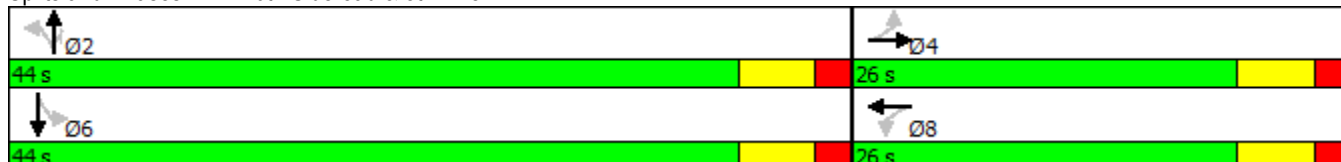
Cycle Length: 70

Actuated Cycle Length: 70.7

Natural Cycle: 55

Control Type: Semi Act-Uncoord

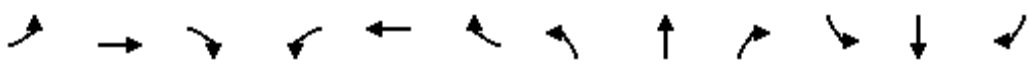
Splits and Phases: 1: 20th Sideroad & 5th Line



1357 Belle Aire Beach Road
1: 20th Sideroad & 5th Line

HCM Signalized Intersection Capacity Analysis

Total (2025) AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↗	↑	↖	↗	↖	↗
Traffic Volume (vph)	15	19	6	32	59	33	16	304	11	19	508	32
Future Volume (vph)	15	19	6	32	59	33	16	304	11	19	508	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0		6.0	6.0	6.0	6.0	6.0	
Lane Util. Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Frt		0.98			0.96		1.00	1.00	0.85	1.00	0.99	
Flt Protected		0.98			0.99		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1274			1455		1805	1827	1214	1626	1833	
Flt Permitted		0.87			0.91		0.38	1.00	1.00	0.57	1.00	
Satd. Flow (perm)		1126			1342		722	1827	1214	967	1833	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	16	20	6	34	63	35	17	323	12	20	540	34
RTOR Reduction (vph)	0	5	0	0	20	0	0	0	5	0	3	0
Lane Group Flow (vph)	0	37	0	0	112	0	17	323	7	20	571	0
Heavy Vehicles (%)	33%	50%	50%	50%	0%	43%	0%	4%	33%	11%	2%	14%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		15.4			15.4		44.6	44.6	44.6	44.6	44.6	
Effective Green, g (s)		15.4			15.4		44.6	44.6	44.6	44.6	44.6	
Actuated g/C Ratio		0.21			0.21		0.62	0.62	0.62	0.62	0.62	
Clearance Time (s)		6.0			6.0		6.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		240			287		447	1131	752	599	1135	
v/s Ratio Prot								0.18			c0.31	
v/s Ratio Perm		0.03			c0.08		0.02		0.01	0.02		
v/c Ratio		0.16			0.39		0.04	0.29	0.01	0.03	0.50	
Uniform Delay, d1		23.0			24.3		5.3	6.3	5.2	5.3	7.6	
Progression Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.3			0.9		0.2	0.6	0.0	0.1	1.6	
Delay (s)		23.3			25.1		5.5	7.0	5.3	5.4	9.2	
Level of Service		C			C		A	A	A	A	A	
Approach Delay (s)		23.3			25.1			6.8			9.0	
Approach LOS		C			C			A			A	
Intersection Summary												
HCM 2000 Control Delay		10.8			HCM 2000 Level of Service			B				
HCM 2000 Volume to Capacity ratio		0.47										
Actuated Cycle Length (s)		72.0			Sum of lost time (s)			12.0				
Intersection Capacity Utilization		58.3%			ICU Level of Service			B				
Analysis Period (min)		15										
c Critical Lane Group												

1357 Belle Aire Beach Road
2: West Access & 5th Line

HCM Unsignalized Intersection Capacity Analysis










Total (2025) AM Peak Hour

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↱	↘↙	
Traffic Volume (veh/h)	34	5	0	83	18	0
Future Volume (Veh/h)	34	5	0	83	18	0
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)	37	5	0	90	20	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			42		130	40
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			42		130	40
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		98	100
cM capacity (veh/h)			1567		865	1032
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	42	90	20			
Volume Left	0	0	20			
Volume Right	5	0	0			
cSH	1700	1567	865			
Volume to Capacity	0.02	0.00	0.02			
Queue Length 95th (m)	0.0	0.0	0.6			
Control Delay (s)	0.0	0.0	9.3			
Lane LOS			A			
Approach Delay (s)	0.0	0.0	9.3			
Approach LOS			A			
Intersection Summary						
Average Delay			1.2			
Intersection Capacity Utilization			14.4%	ICU Level of Service		A
Analysis Period (min)			15			

1357 Belle Aire Beach Road
3: East Access & 5th Line

















HCM Unsignalized Intersection Capacity Analysis

Total (2025) AM Peak Hour

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	29	5	0	66	17	0
Future Volume (Veh/h)	29	5	0	66	17	0
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)	32	5	0	72	18	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			37		106	34
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			37		106	34
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		98	100
cM capacity (veh/h)			1574		891	1039
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	37	72	18			
Volume Left	0	0	18			
Volume Right	5	0	0			
cSH	1700	1574	891			
Volume to Capacity	0.02	0.00	0.02			
Queue Length 95th (m)	0.0	0.0	0.5			
Control Delay (s)	0.0	0.0	9.1			
Lane LOS			A			
Approach Delay (s)	0.0	0.0	9.1			
Approach LOS			A			
Intersection Summary						
Average Delay		1.3				
Intersection Capacity Utilization		13.5%		ICU Level of Service		A
Analysis Period (min)		15				

1357 Belle Aire Beach Road
1: 20th Sideroad & 5th Line

Queues
Total (2025) PM Peak Hour

									
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	30	62	15	30	15	685	26	41	389
Future Volume (vph)	30	62	15	30	15	685	26	41	389
Lane Group Flow (vph)	0	117	0	70	16	745	28	45	439
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	Perm	NA
Protected Phases		4		8		2			6
Permitted Phases	4		8		2		2	6	
Detector Phase	4	4	8	8	2	2	2	6	6
Switch Phase									
Minimum Initial (s)	20.0	20.0	20.0	20.0	16.0	16.0	16.0	16.0	16.0
Minimum Split (s)	26.0	26.0	26.0	26.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	26.0	26.0	26.0	26.0	44.0	44.0	44.0	44.0	44.0
Total Split (%)	37.1%	37.1%	37.1%	37.1%	62.9%	62.9%	62.9%	62.9%	62.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	Max	Max	Max	Max	Max
v/c Ratio		0.24		0.14	0.03	0.61	0.03	0.14	0.36
Control Delay		19.6		15.4	7.7	13.6	1.5	9.4	9.5
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		19.6		15.4	7.7	13.6	1.5	9.4	9.5
Queue Length 50th (m)		11.4		5.1	1.0	71.3	0.0	2.9	32.8
Queue Length 95th (m)		23.5		13.9	3.5	113.4	2.0	8.3	52.8
Internal Link Dist (m)		311.9		639.0		443.9			552.9
Turn Bay Length (m)					110.0		110.0	40.0	
Base Capacity (vph)		481		495	584	1219	1063	327	1214
Starvation Cap Reductn		0		0	0	0	0	0	0
Spillback Cap Reductn		0		0	0	0	0	0	0
Storage Cap Reductn		0		0	0	0	0	0	0
Reduced v/c Ratio		0.24		0.14	0.03	0.61	0.03	0.14	0.36

Intersection Summary

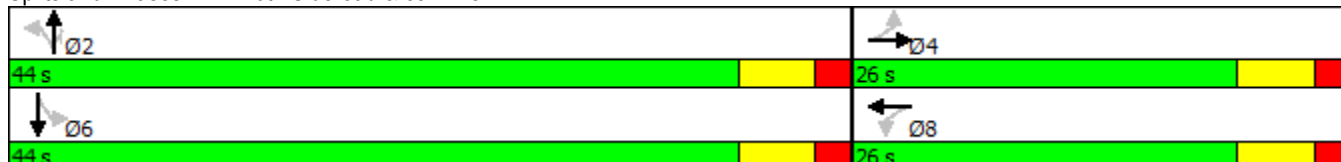
Cycle Length: 70

Actuated Cycle Length: 70.2

Natural Cycle: 60

Control Type: Semi Act-Uncoord

Splits and Phases: 1: 20th Sideroad & 5th Line



1357 Belle Aire Beach Road
1: 20th Sideroad & 5th Line

HCM Signalized Intersection Capacity Analysis

Total (2025) PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↔	↑	↔	↔	↔	↔
Traffic Volume (vph)	30	62	16	15	30	19	15	685	26	41	389	15
Future Volume (vph)	30	62	16	15	30	19	15	685	26	41	389	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0		6.0	6.0	6.0	6.0	6.0	
Lane Util. Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Frt		0.98			0.96		1.00	1.00	0.85	1.00	0.99	
Flt Protected		0.99			0.99		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1811			1802		1805	1881	1615	1805	1872	
Flt Permitted		0.90			0.92		0.48	1.00	1.00	0.27	1.00	
Satd. Flow (perm)		1644			1672		903	1881	1615	506	1872	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	33	67	17	16	33	21	16	745	28	45	423	16
RTOR Reduction (vph)	0	9	0	0	16	0	0	0	11	0	2	0
Lane Group Flow (vph)	0	108	0	0	54	0	16	745	17	45	437	0
Heavy Vehicles (%)	0%	0%	10%	0%	0%	0%	0%	1%	0%	0%	1%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		15.4			15.4		44.0	44.0	44.0	44.0	44.0	
Effective Green, g (s)		15.4			15.4		44.0	44.0	44.0	44.0	44.0	
Actuated g/C Ratio		0.22			0.22		0.62	0.62	0.62	0.62	0.62	
Clearance Time (s)		6.0			6.0		6.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		354			360		556	1159	995	311	1153	
v/s Ratio Prot							c0.40				0.23	
v/s Ratio Perm		c0.07			0.03		0.02		0.01	0.09		
v/c Ratio		0.30			0.15		0.03	0.64	0.02	0.14	0.38	
Uniform Delay, d1		23.5			22.7		5.4	8.7	5.3	5.8	6.9	
Progression Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.5			0.2		0.1	2.7	0.0	1.0	1.0	
Delay (s)		24.0			22.9		5.4	11.5	5.3	6.7	7.8	
Level of Service		C			C		A	B	A	A	A	
Approach Delay (s)		24.0			22.9			11.1			7.7	
Approach LOS		C			C			B			A	
Intersection Summary												
HCM 2000 Control Delay			11.6			HCM 2000 Level of Service			B			
HCM 2000 Volume to Capacity ratio			0.55									
Actuated Cycle Length (s)			71.4			Sum of lost time (s)			12.0			
Intersection Capacity Utilization			62.7%			ICU Level of Service			B			
Analysis Period (min)			15									
c Critical Lane Group												

1357 Belle Aire Beach Road
2: West Access & 5th Line










HCM Unsignalized Intersection Capacity Analysis
Total (2025) PM Peak Hour

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↱	↘↙	
Traffic Volume (veh/h)	75	18	0	52	10	0
Future Volume (Veh/h)	75	18	0	52	10	0
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)	82	20	0	57	11	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			102		149	92
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			102		149	92
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		99	100
cM capacity (veh/h)			1490		843	965
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	102	57	11			
Volume Left	0	0	11			
Volume Right	20	0	0			
cSH	1700	1490	843			
Volume to Capacity	0.06	0.00	0.01			
Queue Length 95th (m)	0.0	0.0	0.3			
Control Delay (s)	0.0	0.0	9.3			
Lane LOS			A			
Approach Delay (s)	0.0	0.0	9.3			
Approach LOS			A			
Intersection Summary						
Average Delay			0.6			
Intersection Capacity Utilization			15.0%	ICU Level of Service	A	
Analysis Period (min)			15			

1357 Belle Aire Beach Road
3: East Access & 5th Line

















HCM Unsignalized Intersection Capacity Analysis

Total (2025) PM Peak Hour

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	58	17	0	42	10	0
Future Volume (Veh/h)	58	17	0	42	10	0
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)	63	18	0	46	11	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			81		118	72
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			81		118	72
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		99	100
cM capacity (veh/h)			1517		878	990
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	81	46	11			
Volume Left	0	0	11			
Volume Right	18	0	0			
cSH	1700	1517	878			
Volume to Capacity	0.05	0.00	0.01			
Queue Length 95th (m)	0.0	0.0	0.3			
Control Delay (s)	0.0	0.0	9.2			
Lane LOS			A			
Approach Delay (s)	0.0	0.0	9.2			
Approach LOS			A			
Intersection Summary						
Average Delay			0.7			
Intersection Capacity Utilization			14.1%	ICU Level of Service	A	
Analysis Period (min)			15			

1357 Belle Aire Beach Road
1: 20th Sideroad & 5th Line

Queues
Total (2030) AM Peak Hour

									
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	16	22	37	68	18	346	13	21	552
Future Volume (vph)	16	22	37	68	18	346	13	21	552
Lane Group Flow (vph)	0	46	0	151	19	368	14	22	625
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	Perm	NA
Protected Phases		4		8		2			6
Permitted Phases	4		8		2		2	6	
Detector Phase	4	4	8	8	2	2	2	6	6
Switch Phase									
Minimum Initial (s)	20.0	20.0	20.0	20.0	16.0	16.0	16.0	16.0	16.0
Minimum Split (s)	26.0	26.0	26.0	26.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	26.0	26.0	26.0	26.0	44.0	44.0	44.0	44.0	44.0
Total Split (%)	37.1%	37.1%	37.1%	37.1%	62.9%	62.9%	62.9%	62.9%	62.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	Max	Max	Max	Max	Max
v/c Ratio		0.14		0.37	0.05	0.31	0.02	0.04	0.53
Control Delay		18.5		20.2	8.0	9.2	0.2	7.8	11.9
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		18.5		20.2	8.0	9.2	0.2	7.8	11.9
Queue Length 50th (m)		4.2		13.8	1.1	26.6	0.0	1.3	54.2
Queue Length 95th (m)		11.6		28.9	4.0	43.7	0.3	4.3	86.4
Internal Link Dist (m)		311.9		639.0		443.9			552.9
Turn Bay Length (m)					110.0		110.0	40.0	
Base Capacity (vph)		328		405	422	1179	800	584	1185
Starvation Cap Reductn		0		0	0	0	0	0	0
Spillback Cap Reductn		0		0	0	0	0	0	0
Storage Cap Reductn		0		0	0	0	0	0	0
Reduced v/c Ratio		0.14		0.37	0.05	0.31	0.02	0.04	0.53

Intersection Summary

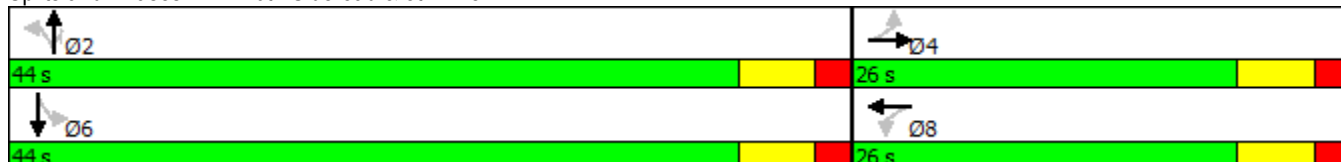
Cycle Length: 70

Actuated Cycle Length: 69.7

Natural Cycle: 60

Control Type: Semi Act-Uncoord

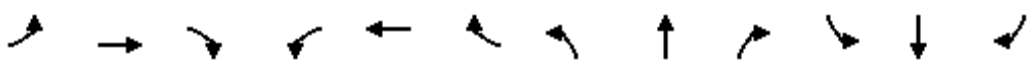
Splits and Phases: 1: 20th Sideroad & 5th Line



1357 Belle Aire Beach Road
1: 20th Sideroad & 5th Line

HCM Signalized Intersection Capacity Analysis

Total (2030) AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↗	↑	↖	↗	↖	
Traffic Volume (vph)	16	22	6	37	68	38	18	346	13	21	552	36
Future Volume (vph)	16	22	6	37	68	38	18	346	13	21	552	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0		6.0	6.0	6.0	6.0	6.0	
Lane Util. Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Frt		0.98			0.96		1.00	1.00	0.85	1.00	0.99	
Flt Protected		0.98			0.99		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1275			1455		1805	1827	1214	1626	1833	
Flt Permitted		0.86			0.91		0.34	1.00	1.00	0.53	1.00	
Satd. Flow (perm)		1121			1336		653	1827	1214	906	1833	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	17	23	6	39	72	40	19	368	14	22	587	38
RTOR Reduction (vph)	0	5	0	0	20	0	0	0	5	0	3	0
Lane Group Flow (vph)	0	41	0	0	131	0	19	368	9	22	622	0
Heavy Vehicles (%)	33%	50%	50%	50%	0%	43%	0%	4%	33%	11%	2%	14%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		15.4			15.4		43.6	43.6	43.6	43.6	43.6	
Effective Green, g (s)		15.4			15.4		43.6	43.6	43.6	43.6	43.6	
Actuated g/C Ratio		0.22			0.22		0.61	0.61	0.61	0.61	0.61	
Clearance Time (s)		6.0			6.0		6.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		243			289		400	1121	745	556	1125	
v/s Ratio Prot								0.20			c0.34	
v/s Ratio Perm		0.04			c0.10		0.03		0.01	0.02		
v/c Ratio		0.17			0.45		0.05	0.33	0.01	0.04	0.55	
Uniform Delay, d1		22.6			24.1		5.4	6.6	5.3	5.4	8.0	
Progression Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.3			1.1		0.2	0.8	0.0	0.1	2.0	
Delay (s)		22.9			25.3		5.7	7.4	5.4	5.6	10.0	
Level of Service		C			C		A	A	A	A	A	
Approach Delay (s)		22.9			25.3			7.3			9.8	
Approach LOS		C			C			A			A	
Intersection Summary												
HCM 2000 Control Delay			11.3			HCM 2000 Level of Service				B		
HCM 2000 Volume to Capacity ratio			0.53									
Actuated Cycle Length (s)			71.0			Sum of lost time (s)			12.0			
Intersection Capacity Utilization			58.3%			ICU Level of Service			B			
Analysis Period (min)			15									
c Critical Lane Group												

1357 Belle Aire Beach Road
2: West Access & 5th Line

HCM Unsignalized Intersection Capacity Analysis

Total (2030) AM Peak Hour

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↱	↘↙	
Traffic Volume (veh/h)	38	5	0	96	18	0
Future Volume (Veh/h)	38	5	0	96	18	0
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)	41	5	0	104	20	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			46		148	44
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			46		148	44
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		98	100
cM capacity (veh/h)			1562		845	1027
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	46	104	20			
Volume Left	0	0	20			
Volume Right	5	0	0			
cSH	1700	1562	845			
Volume to Capacity	0.03	0.00	0.02			
Queue Length 95th (m)	0.0	0.0	0.6			
Control Delay (s)	0.0	0.0	9.4			
Lane LOS			A			
Approach Delay (s)	0.0	0.0	9.4			
Approach LOS			A			
Intersection Summary						
Average Delay			1.1			
Intersection Capacity Utilization			15.1%	ICU Level of Service		A
Analysis Period (min)			15			

















1357 Belle Aire Beach Road
3: East Access & 5th Line

HCM Unsignalized Intersection Capacity Analysis
Total (2030) AM Peak Hour

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↱	↘↙	
Traffic Volume (veh/h)	33	5	0	79	17	0
Future Volume (Veh/h)	33	5	0	79	17	0
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)	36	5	0	86	18	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			41		124	38
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			41		124	38
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		98	100
cM capacity (veh/h)			1568		870	1033
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	41	86	18			
Volume Left	0	0	18			
Volume Right	5	0	0			
cSH	1700	1568	870			
Volume to Capacity	0.02	0.00	0.02			
Queue Length 95th (m)	0.0	0.0	0.5			
Control Delay (s)	0.0	0.0	9.2			
Lane LOS			A			
Approach Delay (s)	0.0	0.0	9.2			
Approach LOS			A			
Intersection Summary						
Average Delay			1.1			
Intersection Capacity Utilization			14.2%	ICU Level of Service		A
Analysis Period (min)			15			

1357 Belle Aire Beach Road
1: 20th Sideroad & 5th Line

Queues
Total (2030) PM Peak Hour

									
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	35	71	17	34	16	742	30	49	446
Future Volume (vph)	35	71	17	34	16	742	30	49	446
Lane Group Flow (vph)	0	135	0	77	17	807	33	53	505
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	Perm	NA
Protected Phases		4		8		2			6
Permitted Phases	4		8		2		2	6	
Detector Phase	4	4	8	8	2	2	2	6	6
Switch Phase									
Minimum Initial (s)	20.0	20.0	20.0	20.0	16.0	16.0	16.0	16.0	16.0
Minimum Split (s)	26.0	26.0	26.0	26.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	26.0	26.0	26.0	26.0	44.0	44.0	44.0	44.0	44.0
Total Split (%)	37.1%	37.1%	37.1%	37.1%	62.9%	62.9%	62.9%	62.9%	62.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	Max	Max	Max	Max	Max
v/c Ratio		0.28		0.15	0.03	0.67	0.03	0.19	0.42
Control Delay		19.8		15.6	7.8	15.4	1.9	10.8	10.3
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		19.8		15.6	7.8	15.4	1.9	10.8	10.3
Queue Length 50th (m)		13.0		5.6	1.0	81.7	0.0	3.5	39.6
Queue Length 95th (m)		26.5		15.1	3.7	#133.3	2.6	10.2	63.0
Internal Link Dist (m)		311.9		639.0		443.9			552.9
Turn Bay Length (m)					110.0		110.0	40.0	
Base Capacity (vph)		485		499	520	1209	1055	273	1204
Starvation Cap Reductn		0		0	0	0	0	0	0
Spillback Cap Reductn		0		0	0	0	0	0	0
Storage Cap Reductn		0		0	0	0	0	0	0
Reduced v/c Ratio		0.28		0.15	0.03	0.67	0.03	0.19	0.42

Intersection Summary

Cycle Length: 70

Actuated Cycle Length: 69.2

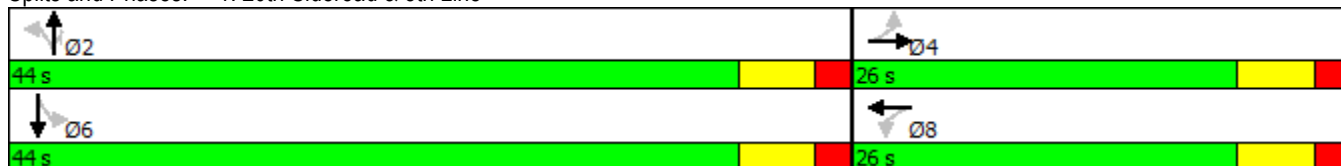
Natural Cycle: 60

Control Type: Semi Act-Uncoord

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

Queue shown is maximum after two cycles.

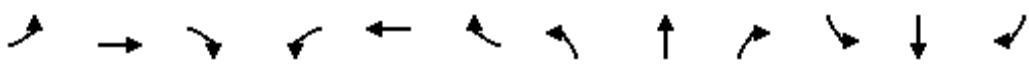
Splits and Phases: 1: 20th Sideroad & 5th Line



1357 Belle Aire Beach Road
1: 20th Sideroad & 5th Line

HCM Signalized Intersection Capacity Analysis

Total (2030) PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↔	↑	↔	↔	↔	↔
Traffic Volume (vph)	35	71	18	17	34	20	16	742	30	49	446	18
Future Volume (vph)	35	71	18	17	34	20	16	742	30	49	446	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0		6.0	6.0	6.0	6.0	6.0	
Lane Util. Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Frt		0.98			0.96		1.00	1.00	0.85	1.00	0.99	
Flt Protected		0.99			0.99		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1809			1806		1805	1881	1615	1805	1871	
Flt Permitted		0.89			0.91		0.43	1.00	1.00	0.22	1.00	
Satd. Flow (perm)		1634			1662		809	1881	1615	426	1871	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	77	20	18	37	22	17	807	33	53	485	20
RTOR Reduction (vph)	0	10	0	0	17	0	0	0	13	0	2	0
Lane Group Flow (vph)	0	125	0	0	60	0	17	807	20	53	503	0
Heavy Vehicles (%)	0%	0%	10%	0%	0%	0%	0%	1%	0%	0%	1%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		15.5			15.5		43.1	43.1	43.1	43.1	43.1	
Effective Green, g (s)		15.5			15.5		43.1	43.1	43.1	43.1	43.1	
Actuated g/C Ratio		0.22			0.22		0.61	0.61	0.61	0.61	0.61	
Clearance Time (s)		6.0			6.0		6.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		358			364		493	1148	985	260	1142	
v/s Ratio Prot							c0.43				0.27	
v/s Ratio Perm		c0.08			0.04		0.02		0.01	0.12		
v/c Ratio		0.35			0.16		0.03	0.70	0.02	0.20	0.44	
Uniform Delay, d1		23.3			22.3		5.5	9.4	5.4	6.1	7.3	
Progression Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.6			0.2		0.1	3.6	0.0	1.8	1.2	
Delay (s)		23.9			22.5		5.6	13.0	5.5	7.9	8.6	
Level of Service		C			C		A	B	A	A	A	
Approach Delay (s)		23.9			22.5			12.6			8.5	
Approach LOS		C			C			B			A	
Intersection Summary												
HCM 2000 Control Delay			12.6			HCM 2000 Level of Service			B			
HCM 2000 Volume to Capacity ratio			0.61									
Actuated Cycle Length (s)			70.6			Sum of lost time (s)			12.0			
Intersection Capacity Utilization			67.4%			ICU Level of Service			C			
Analysis Period (min)			15									
c Critical Lane Group												

1357 Belle Aire Beach Road
2: West Access & 5th Line

HCM Unsignalized Intersection Capacity Analysis

Total (2030) PM Peak Hour

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↱	↘↙	
Traffic Volume (veh/h)	88	18	0	59	10	0
Future Volume (Veh/h)	88	18	0	59	10	0
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)	96	20	0	64	11	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			116		170	106
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			116		170	106
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		99	100
cM capacity (veh/h)			1473		820	948
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	116	64	11			
Volume Left	0	0	11			
Volume Right	20	0	0			
cSH	1700	1473	820			
Volume to Capacity	0.07	0.00	0.01			
Queue Length 95th (m)	0.0	0.0	0.3			
Control Delay (s)	0.0	0.0	9.4			
Lane LOS			A			
Approach Delay (s)	0.0	0.0	9.4			
Approach LOS			A			
Intersection Summary						
Average Delay			0.5			
Intersection Capacity Utilization			15.7%	ICU Level of Service		A
Analysis Period (min)			15			

1357 Belle Aire Beach Road
3: East Access & 5th Line

HCM Unsignalized Intersection Capacity Analysis
Total (2030) PM Peak Hour

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↱	↘↙	
Traffic Volume (veh/h)	71	17	0	49	10	0
Future Volume (Veh/h)	71	17	0	49	10	0
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)	77	18	0	53	11	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			95		139	86
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			95		139	86
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		99	100
cM capacity (veh/h)			1499		854	973
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	95	53	11			
Volume Left	0	0	11			
Volume Right	18	0	0			
cSH	1700	1499	854			
Volume to Capacity	0.06	0.00	0.01			
Queue Length 95th (m)	0.0	0.0	0.3			
Control Delay (s)	0.0	0.0	9.3			
Lane LOS			A			
Approach Delay (s)	0.0	0.0	9.3			
Approach LOS			A			
Intersection Summary						
Average Delay			0.6			
Intersection Capacity Utilization			14.8%	ICU Level of Service		A
Analysis Period (min)			15			