

Canadian Surface Combatant Land-Based Test Facility

2403 Shore Road, Eastern Passage

Traffic Impact Statement

March 7, 2023

Prepared for:

Department of National Defence (DND)

Prepared by:

Stantec Consulting Ltd

133432095

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Prepared by (signature)

Alireza Bagheri Chimeh M.Sc., EIT.

Mirhoceini

(signature)

Reviewed and approved by

Arash Mirhoseini M.Sc., P.Eng., PMP.

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INTRODUCTION

1.0 INTRODUCTION

1.1 OVERVIEW

Stantec has been retained by the Department of National Defence (DND) to provide required transportation consultancy services in support of a new facility proposed at 2403 Shore Road in Eastern Passage, Nova Scotia. This new development will be constructed by the Department of National Defence (DND), Canadian Armed Forces (CAF) and Royal Canadian Navy (RCN) at Hartlen Point adjacent the community of Eastern Passage.

Canadian Surface Combatant Land-Based Test Facility (CSC – LBTF) will be accessed through Shore Road. It is estimated that the site at its full capacity will accommodate 120 full-time staff, including members of the Royal Canadian Navy, DND employees, and contractors. The site will be utilized in testing the new CSC ships' combat systems and will ensure the new ships are sea-ready once delivered.

A virtual pre-study conference meeting was held on October 17th, 2022 with the Halifax Regional Municipality (HRM) staff to review the scope and methodology to be used in the study. The agreed upon pre-study minutes has been attached to **Appendix A** for reference. In this pre-study, it was agreed that due to the minor traffic expected from the development and extra capacity in the adjacent road network, a traffic impact statement (TIS) for the development will be required. The main purpose of this TIS is to assess the access road network in the existing conditions and after site full utilization.

As it was agreed in the pre-study, the study area is limited to the unsignalized intersection of Shore Road and Caldwell Road, as shown in **Figure 1**.

1.2 SCOPE

The scope of this Traffic Impact Statement (TIS) is as follows:

- Data Collection: The sources and description of data used as part of this study is provided in **Section 2.0**.
- Existing Conditions: the existing transportation network conditions and traffic operations at the Study Area intersection for the weekday AM and PM peak hours are assessed and presented in **Section 3.0**.
- Proposed Development: **Section 4.0** provides the details and location of the proposed development, including estimated trip generation and trip distribution.
- Future Conditions: **Section 5.0** includes the Future Total traffic operations at the Study Area intersection.



INTRODUCTION

• Conclusion: impacts associated with the proposed development are summarized in **Section 6.0**.



Figure 1: Study Area



DATA COLLECTION

2.0 DATA COLLECTION

The latest available Turning Movement Counts (TMC) at the unsignalized intersection of Shore Road and Caldwell Road (dated July 30th, 2019) was provided by the HRM. The 2019 traffic volumes were used for existing conditions analysis as agreed in pre-consultation meeting. The Existing Conditions traffic volumes are illustrated in **Figure 2** and **Figure 3**. The TMC has been included in **Appendix B**.



DATA COLLECTION



Figure 2: Existing Conditions Traffic Volumes Weekday AM Peak Hour



Figure 3: Existing Conditions Traffic Volumes Weekday PM Peak Hour



EXISTING CONDITIONS

3.0 EXISTING CONDITIONS

3.1 EXISTING TRANSPORTATION NETWORK

3.1.1 Existing Roadways

The characteristics of the main roads within the Study Area are described below.

Shore Road is a collector road with a posted speed limit of 50km/h. This road has a two-lane cross section with unpaved shoulders on both sides of the road. Shore Road is uncontrolled and has free and yield movements at the intersection with Caldwell Road.

Caldwell Road is a collector road with a two-lane cross section and a posted speed limit of 50km/h. Sidewalk is provided on the west sides of the road. Caldwell Road is controlled by a stop sign at the intersection with Shore Road.

3.1.2 Existing Transit

Halifax Transit operates one corridor transit route in proximity to the site. Route 6B, Eastern Passage, travels along Shore Road and Caldwell Road and provides access to higher transit and ferry system at Woodside Ferry Terminal and Alderney Ferry Terminal. The nearest stop to the site is Stop 6346 located on Caldwell Road adjacent to its intersection with Shore Road. The distance will be about 2 kilometers to the site.

3.2 EXISTING CONDITIONS TRAFFIC OPERATIONS

The quality of intersection operations at unsignalized intersections is evaluated in terms of level of service (LOS) and volume to capacity (V/C) as defined by the Highway Capacity Manual. LOS is evaluated based on average control delay per vehicle and includes deceleration delay, queue move-up time, stopped delay, and final acceleration delay. Capacity is evaluated in terms of ratio of demand flow to capacity with an at-capacity condition represented by a V/C ratio of 1.00 (i.e. volume demand equals capacity). For unsignalized intersections, the LOS ranges from LOS A for 10 seconds or less average delay to LOS F for average delay greater than 50 seconds.

To assess the existing peak hour traffic conditions, a level of service analysis is undertaken for the Study Area intersection using TrafficWare Synchro 11 Software, which implements the methods of Highway Capacity Manual (HCM 2000). The key parameters used in the analysis include:

- Existing lane configurations;
- Heavy vehicle percentages as derived from traffic count data;



EXISTING CONDITIONS

- Intersection peak hour factors (PHF) derived from traffic count data;
- Synchro default values for all other inputs.

The results of the analysis for the Existing Conditions are summarized for the AM peak hour and PM peak hour in **Table 1** below. The Synchro analysis outputs provided for reference in **Appendix C**.

Under the Existing Conditions, the study intersection operates below capacity and delays on movements reflect LOS A at the intersection of Shore Road and Caldwell Road. The maximum V/C is 0.1 (10%) that illustrates considerable available spare capacity at this intersection for future traffic.

Table 1: Existing Conditions Traffic Operations Analysis

Peak Hour	АМ						РМ	
Movement	V/C	LOS	Delay (s)	Queue 95 th (m)	V/C	LOS	Delay (s)	Queue 95 th (m)
EBLT	0.01	A	2.3	0.3	0.04	A	3.5	0.9
WBTR	0.03	A	0	0	0.05	A	0	0
SBLR	0.07	A	9	1.6	0. 1	A	9.8	2.6

PROPOSED DEVELOPMENT

4.0 PROPOSED DEVELOPMENT

4.1 DEVELOPMENT DESCRIPTION

To help bring the new CSC ships into service and support them throughout their lifecycle, the Department of National Defence (DND) will be building a Land-Based Testing Facility (LBTF) on a portion of DND-owned land at Hartlen Point in Eastern Passage, Nova Scotia. This development will be used to test and integrate the ships' capability systems before being installed on the actual vessels. The LBTF is critical to ensuring the new ships are ready to support members of the Canadian Armed Forces as they protect the sovereignty and security of Canadian waters and contribute to international operations on behalf of all Canadians. The site will be utilized in testing the new CSC ships systems and will ensure the new ships are sea-ready once delivered.

The proposed Canadian Surface Combatant Land-Based Test Facility (CSC – LBTF) will be approximately 11,500 square meters across two floors and will include offices and workshop areas. It is estimated that the site at its full capacity will accommodate 120 full-time staff, including members of the Royal Canadian Navy, DND employees, and contractors. A surface parking lot will be provided near its entrance.

The Concept Plan for the site is shown in **Figure 4**. The site will be accessed through an improved extension to Shore Road as it is shown in this figure.

PROPOSED DEVELOPMENT



Figure 4: LBTF Site Context

4.2 TRIP GENERATION

Trip generation for the site was determined based on trip generation rates outlined in the Institute of Transportation Engineer's (ITE) Manual of Trip Generation, 11th Edition. The trip generation for the Land-Based Test Facility development is calculated based on the following ITE Land Use Code (LUC):

• Office Land Use Group - LUC 760 Research and Development Center: As per ITE, a research and development center is a facility or group of facilities devoted almost exclusively to research and development activities. The range of specific types of businesses contained in this land use category varies significantly. Research and development centers may contain offices and light fabrication areas.

Table 2 summarizes the trip generation rates used and Table 3 outlines the number of trips.

PROPOSED DEVELOPMENT

Table 2: ITE Trip Generation Rates and Fitted Curve Formula

	Independent	Trip Generation Rates		Directi	ion (%)	Courses	
Land Use	Variable	AM Peak Hour	PM Peak Hour	AM (In/Out)	PM (In/Out)	Source	
Office - Research	Employee	0.40	0.38				
and Development		Ln(T) = 0.82	0.83 Ln(X) +	85%,15%	12%, 88%	ITE LUC 760-	
Center		Ln(X) + 0.25	0.14				

Table 3: Site Trip Generation (Peak Hour of Adjacent Street Traffic)

		Independent	AM Peak Hour			PM Peak Hour		
Land Use	LUC 760 as per	Variable (x)	Total	In	Out	Total	In	Out
	Average Rates	120 Employees	48	41	7	46	5	41
LBTF	Fitted Curve	120 Employees	65	55	10	61	7	54
Maximum for Study			65	55	10	61	7	54

4.3 TRIP DISTRIBUTION AND ASSIGNMENT

The trip distribution for the proposed development has been determined based on a review of the existing turning movement count results at the intersection of Shore Road and Caldwell Road. **Figure 5** to **Figure 8** illustrate site trip distribution percentages and calculated traffic volume values at this intersection for the AM and PM peak hours.

PROPOSED DEVELOPMENT



Figure 5: AM Peak Hour Site Trip Distribution Percentages



Figure 6: PM Peak Hour Site Trip Distribution Percentages



PROPOSED DEVELOPMENT



Figure 7: AM Peak Hour Vehicle Traffic Volumes



Figure 8: PM Peak Hour Vehicle Traffic Volumes



FUTURE CONDITIONS

5.0 FUTURE CONDITIONS

5.1 FUTURE TOTAL TRAFFIC FORECAST

The Future Total traffic volumes at the intersection of Shore Road and Caldwell Road have been determined by adding the proposed development traffic volumes (outlined in **Section 4.0**) on top of the existing conditions traffic volumes projected by applying a 1% annual growth rate for an estimated 5-year horizon.

The Future Total traffic volumes are illustrated in Figure 9 and Figure 10.

FUTURE CONDITIONS



Figure 9: Future Total Traffic Volumes Weekday AM Peak Hour



Figure 10: Future Total Traffic Volumes Weekday PM Peak Hour



FUTURE CONDITIONS

5.2 FUTURE TOTAL TRAFFIC OPERATIONS

The Future Total operations analysis results are provided below for the AM peak hour and PM peak hour in Table 4. Under the Future Total conditions, the Study Area intersection operates considerably below capacity and delays on movements reflect a LOS between A and B.

Overall, both AM and PM peak hour operations are very comparable between the existing conditions and future total conditions scenarios that confirm the development impacts on the road network will be negligible due to the spare capacity available and low generated traffic.

Table 4: Future Total Conditions Traffic Operations Analysis

Peak Hour	АМ			AM PM			РМ	
Movement	V/C	LOS	Delay (s)	Queue 95 th (m)	V/C	LOS	Delay (s)	Queue 95 th (m)
EBLT	0.01	А	1.3	0.5	0.04	А	3.4	1.0
WBTR	0.03	А	0	0	0.09	А	0	0
SBLR	0.10	A	9.5	9.5	0.12	В	10.4	3.1

CONCLUSION

6.0 CONCLUSION

The conclusions of this Traffic Impact Statement are as follows:

- a) The proposed Canadian Surface Combatant Land-Based Test Facility (CSC LBTF) will be approximately 11,500 square meters across two floors and will include offices and workshop areas. It is estimated that the site at its full capacity will accommodate 120 full-time staff, including members of the Royal Canadian Navy, DND employees, and contractors.
- b) The proposed dwelling units will generate 65 trips in the AM peak (55 inbound and 10 outbound) and 61 trips in the PM peak hour (7 inbound and 54 outbound).
- c) The Existing weekday AM and PM peak hour traffic operations at the study intersection are characterized by good levels of service and all movements operating well with LOS A and considerable spare capacity.
- d) The Future Total conditions reflect very similar operational conditions compared to the Existing Conditions. Under this scenario, all traffic movements continue to operate within capacity with delays on movements reflecting a LOS A or B.
- e) Results confirm the development impacts on the road network will be negligible due to the spare capacity available and low generated traffic.



Appendix A – **PRE-CONSULTATION MEETING NOTES**



Meeting Notes

Pre-Study Consultation Meeting – Draft Notes

Canadian Surface Combatant Land Based Test Facility – Traffic Study / 133432095

Date/Time:	October 17, 2022 / 9:00 AM (ADT)						
Place:	Virtual - Microsoft Tear	ns					
Next Meeting:	TBD						
Attendees:	Paolo Mont	Halifax Regional Municipality					
	Matt Glynn	Halifax Regional Municipality					
	Samantha Trask	Halifax Regional Municipality					
	Bri Benson	Halifax Regional Municipality					
	Peter Sarty	Defence Construction Canada					
	Lorne Oram	Department of National Defence					
	Robert Dumaresq	Stantec					
	John Heseltine	Stantec					
	Arash Mirhoseini	Stantec					

Absentees:	-
Distribution:	Project Team

	Action:
1- Introduction	
The meeting started with a round of introduction. Stantec stated that the goal of the meeting is to understand the HRM requirements for the required traffic study for the proposed Canadian Surface Combatant Land Based Test Facility (CSC-LBTF) at 2403 Shore Road at Hartlen Point adjacent to Eastern Passage community in Halifax, NS.	NA
2- Development Summary	NIA
Stantec presented a brief of the proposed CSC-LBTF development, its location, proposed operations, full capacity and proposed floor area, and adjacent transit network. Further information can be found in slides 3 and 4 of the attached presentation file.	
HRM asked for further information on the planned LBTF operation hours. DND confirmed that while the exact operation hours plan is not finalized yet, it is expected that the site will operate 24 hours a day, 7 days a week (24/7).	
3- Trip Generation Summary	

October 17, 2022 Pre-Study Consultation Meeting – Draft Notes Page 2 of 2

Stantec presented a summary table illustrating the trip generation values calculated for the site based on the proposed CSC-LBTF development number of staff utilizing ITE Trip Generation Manual 11th Edition rates. The table is presented in slide 4 of the attached presentation file. Stantec recommended that based on a review of the CSC-LBTF development expected use, ITE LUC 760 (Research and Development Centre) will be more suitable to be used for this study. It was discussed that the other two land use categories are not suitable as the development will not work as a government office with daily visitors and the military base LUC is also provided for bases with above 2,500 employees and different uses.

4- Guidelines and Standards

HRM confirmed that Guidelines for the Preparation of Transportation Impact Studies, HRM, 8th Revisions dated September 1, 2007 is the latest available guideline for traffic studies.

5- Traffic Study Scope

HRM noted that they reviewed the latest turning movement counts available for the intersection of Shore Road and Caldwell Road from 2019. The data showed that the traffic volumes were low at this intersection. HRM stated that based on the expected low trip generation of the development and spare capacity available at this intersection, the required scope of traffic study will be limited to preparation of a Traffic Impact Statement to document the site trip generation with study area limited to the intersection of Shore Road and Caldwell Road to be reviewed in the existing horizon. HRM confirmed that the extended scope included in the presentation (slides 7,8 and 9) is not required for this study based on the low trips expected from the development.

Stantec will request the TMC for this intersection through <u>trafdata@halifax.ca</u> and will prepare and submit the Traffic Impact Statement for the study.

The meeting adjourned at 9:40 AM

The foregoing is considered to be a true and accurate record of all items discussed. If any discrepancies or inconsistencies are noted, please contact the writer immediately.

Stantec Consulting Ltd.

Arash Mirhoseini

Associate, Transportation Planning and Traffic Engineering Team Lead arash.mirhoseini@stantec.com Phone: 416-722-8270

Attachment: 133432095_CSC-LBTF_Pre-consultation_20221017.pdf

NA

NA

Stantec

Appendix B - TRAFFIC DATA

CODE NO. 19RQ269

MANUAL TRAFFIC COUNTS

INTERSECTION	N:				C	ALDWE	LL RD @ S	SHORE F	۶D					
											WEATH	ER	FO	GGY
DAY	DATE	MONTH	YEAR								RECORI	DER	MICHAE	EL SMITH
TUESDAY	30	JULY	2019											
											-			
STREET:		S	HORE R	D		SHORE R	RD	C	ALDWELL	RD				
TIME:		FRO	M THE E	AST	FRC	M THE V	VEST	FRC	OM THE NO	ORTH	FRO	M THE SC	DUTH	TOTAL
15 MIN INTER	VALS	L	S	R	L	S	R	L	S	R	L	S	R	
07:00:00 AM	07:15:00 AM	\times	11	1	1	6	Х	9	Х	4	\times	\times	\times	32
07:15:00 AM	07:30:00 AM	\times	4	0	1	1	Х	1	Х	8	\times	\times	Х	15
07:30:00 AM	07:45:00 AM	$>\!$	10	1	5	5	\sim	6	$>\!$	6	\sim	\sim	\sim	33
07:45:00 AM	08:00:00 AM	$>\!$	8	3	3	12	\sim	1	\sim	6	\sim	\sim	\sim	33
TOTAL		>	33	5	10	24	\sim	17	\sim	24	\sim	\sim	\sim	113
PEAK			38			34			41					
4(15 MIN PEAK	<)		48			60			52					
PEAK HOUR F	ACTOR		0.79			0.57			0.79					AAWT
TWO WAY TO	TALS		79			91			56					FACTOR
		-												1.01
														114

DAY DATE MONTH YEAR TUESDAY 30 JULY 2019

TIME:	FROM	M THE E	AST	FRC	M THE V	VEST	FRC	M THE NC	RTH	FRO	M THE S	OUTH	TOTAL
15 MIN INTERVALS	L	S	R	L	S	R	L	S	R	L	S	R	
08:00:00 AM 08:15:00 AM	Х	7	3	1	10	Х	4	Х	5	Х	\times	\geq	30
08:15:00 AM 08:30:00 AM	Х	8	2	3	6	Х	3	Х	5	Х	\times	\times	27
08:30:00 AM 08:45:00 AM	Х	7	2	7	6	Х	5	Х	11	Х	\times	\times	38
08:45:00 AM 09:00:00 AM	Х	5	0	6	10	Х	3	Х	6	Х	Х	\times	30
TOTAL	\times	27	7	17	32	Х	15	Х	27	X	Х	\times	125
PEAK		34			49			42					
4(15 MIN PEAK)		40			64			64					
PEAK HOUR FACTOR		0.85			0.77			0.66					AAWT
TWO WAY TOTALS		81			103			66					FACTOR
													1.01
													126

Intersection Peak Hour

		5	SHORE R	D	5	SHORE R	D	CA	LDWELL	RD		N/A		Total
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Total
	Car	0	30	9	14	33	0	13	0	25	0	0	0	124
07:45 - 08:45	Truck	0	0	1	0	1	0	0	0	2	0	0	0	4
	Bicycle	0	0	1	0	0	0	1	0	0	0	0	0	2
	Vehicle Total	0	30	11	14	34	0	14	0	27	0	0	0	130
	Approach Factor		0.93			0.8			0.64			0		FACTOR
														1.01
														131

Peak Hour Pedestrians

07:45 - 08:45 Left Right Total Left Right Total Left Right Total Left Right Total Second				NE			NW			sw			SE		Total
Pedestrians 0 2 2 0 0 0 0 0 0 0 3 3 5	07:45 - 08:45		Left	Right	Total	Total									
		Pedestrians	0	2	2	0	0	0	0	0	0	0	3	3	5

Car traffic

Interval starts	5	SHORE R	D	5	SHORE R	D	CA	LDWELL	RD		N/A		Total
intervar starts	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Totai
7:00	0	11	1	1	6	0	9	0	3	0	0	0	31
7:15	0	4	0	1	1	0	1	0	8	0	0	0	15
7:30	0	10	1	5	5	0	6	0	5	0	0	0	32
7:45	0	8	2	3	11	0	1	0	6	0	0	0	31
8:00	0	7	3	1	10	0	4	0	4	0	0	0	29
8:15	0	8	2	3	6	0	3	0	5	0	0	0	27
8:30	0	7	2	7	6	0	5	0	10	0	0	0	37
8:45	0	4	0	6	10	0	3	0	6	0	0	0	29
TOTAL	0	59	11	27	55	0	32	0	47	0	0	0	231

Truck traffic

Interval starts	5	SHORE R	D		SHORE R	D	CA	LDWELL	RD		N/A		Total
intervar starts	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Total
7:00	0	0	0	0	0	0	0	0	1	0	0	0	1
7:15	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30	0	0	0	0	0	0	0	0	1	0	0	0	1
7:45	0	0	1	0	1	0	0	0	0	0	0	0	2
8:00	0	0	0	0	0	0	0	0	1	0	0	0	1
8:15	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30	0	0	0	0	0	0	0	0	1	0	0	0	1
8:45	0	1	0	0	0	0	0	0	0	0	0	0	1
TOTAL	0	1	1	0	1	0	0	0	4	0	0	0	7
				-		-	-			-			

Bicycle traffic

Interval starts		SHORE R	D	S	SHORE R	D	CA	LDWELL	RD		N/A		Total
intervar starts	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Total
7:00	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00	0	0	0	0	0	0	1	0	0	0	0	0	1
8:15	0	0	1	0	0	0	0	0	0	0	0	0	1
8:30	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	1	0	0	0	1	0	0	0	0	0	2

Pedestrian volumes

Interval starts		NE			NW			SW			SE		Total
interval starts	Left	Right	Total	TOLAI									
7:00	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30	0	0	0	1	0	1	0	0	0	0	0	0	1
7:45	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15	0	1	1	0	0	0	0	0	0	0	2	2	3
8:30	0	1	1	0	0	0	0	0	0	0	1	1	2
8:45	0	0	0	1	2	3	0	0	0	0	0	0	3
TOTAL	0	2	2	2	2	4	0	0	0	0	3	3	9

VEHICULAR GRAPHIC SUMMARY SHEET





CALDWELL RD @ SHORE RD

CODE NO. 19RQ269

MANUAL TRAFFIC COUNTS

INTERSECTIO	N:				C	ALDWEI	LL RD @ S	SHORE F	۶D				1	
											WEATH	ER	SL	INNY
DAY	DATE	MONTH	YEAR								RECORI	DER	MICHA	EL SMITH
TUESDAY	30	JULY	2019											
														_
STREET:		S	HORE R	D	5	SHORE R	D	C	ALDWELL	RD				
TIME:		FRO	M THE E	AST	FRC	M THE V	VEST	FRC	M THE NO	DRTH	FRO	M THE S	OUTH	TOTAL
15 MIN INTER	VALS	L	S	R	L	S	R	L	S	R	L	S	R	
04:00:00 PM	04:15:00 PM	\sim	15	7	9	12	\times	6	\sim	9	\sim	\sim	\sim	58
04:15:00 PM	04:30:00 PM	\sim	8	6	6	14	\times	7	\sim	14	\sim	\sim	\sim	55
04:30:00 PM	04:45:00 PM	\sim	13	6	14	13	\geq	10	\sim	9	\sim	\sim	\sim	65
04:45:00 PM	05:00:00 PM	Х	17	2	16	17	Х	3	Х	5	X	\geq	\geq	60
												-	-	
TOTAL		\times	53	21	45	56	Х	26	Х	37	X	\geq	\geq	238
PEAK			74			101			63					
4(15 MIN PEA	K)		88			132			84					
PEAK HOUR I	ACTOR		0.84			0.77			0.75					AAWT
TWO WAY TO	TALS		156			191			129					FACTOR
		-												1.01
														240

DAY DATE MONTH YEAR TUESDAY 30 JULY 2019

TIME:	FRO	M THE E	AST	FRO	M THE V	VEST	FRC	M THE NO	RTH	FRO	M THE S	OUTH	TOTAL
15 MIN INTERVALS	L	S	R	L	S	R	L	S	R	L	S	R	
05:00:00 PM 05:15:00 PM	Х	9	5	10	14	Х	3	X	9	Х	\times	\geq	50
05:15:00 PM 05:30:00 PM	Х	7	5	16	9	Х	3	X	7	Х	\times	\geq	47
05:30:00 PM 05:45:00 PM	Х	10	8	14	15	Х	8	X	9	Х	\times	\times	64
05:45:00 PM 06:00:00 PM	Х	13	4	11	13	Х	6	X	3	Х	\times	\times	50
TOTAL	\times	39	22	51	51	Х	20	X	28	Х	\times	$^{\sim}$	211
PEAK		61			102			48					
4(15 MIN PEAK)		72			116			68					
PEAK HOUR FACTOR		0.85			0.88			0.71					AAWT
TWO WAY TOTALS		132			169			121					FACTOR
													1.01
													213

Intersection Peak Hour

		5	HORE R	D	5	SHORE R	D	CA	LDWELL	RD		N/A		Total
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Total
	Car	1	53	21	44	56	0	25	0	35	0	0	0	235
16:00 - 17:00	Truck	0	0	0	1	0	0	1	0	2	0	0	0	4
	Bicycle	0	0	0	0	0	0	0	0	0	0	0	0	0
	Vehicle Total	1	53	21	45	56	0	26	0	37	0	0	0	239
	Approach Factor		0.85			0.77			0.75			0		FACTOR
														1.01
														241

Peak Hour Pedestrians

			NE			NW			SW			SE		Total
16:00 - 17:00		Left	Right	Total	Total									
	Pedestrians	0	0	0	3	2	5	3	0	3	0	0	0	8

Car traffic

Interval starts	5	SHORE R	D	5	SHORE R	D	CA	LDWELL	RD		N/A		Total
liner var Starts	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Totai
16:00	0	15	7	9	12	0	5	0	9	0	0	0	57
16:15	0	8	6	6	14	0	7	0	13	0	0	0	54
16:30	0	13	6	14	13	0	10	0	8	0	0	0	64
16:45	1	17	2	15	17	0	3	0	5	0	0	0	60
17:00	0	9	5	10	14	0	3	0	8	0	0	0	49
17:15	0	7	5	16	9	0	3	0	7	0	0	0	47
17:30	0	10	8	14	15	0	8	0	8	1	0	0	64
17:45	0	13	4	11	13	0	6	0	3	0	0	0	50
TOTAL	1	92	43	95	107	0	45	0	61	1	0	0	445

Truck traffic

Interval starts	5	SHORE R	D	5	SHORE R	D	CA	LDWELL	RD		N/A		Total
intervar starts	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Total
16:00	0	0	0	0	0	0	1	0	0	0	0	0	1
16:15	0	0	0	0	0	0	0	0	1	0	0	0	1
16:30	0	0	0	0	0	0	0	0	1	0	0	0	1
16:45	0	0	0	1	0	0	0	0	0	0	0	0	1
17:00	0	0	0	0	0	0	0	0	1	0	0	0	1
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	1	0	0	0	1
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	1	0	0	1	0	4	0	0	0	6

Bicycle traffic

Interval starts		SHORE R	D	5	SHORE R	D	CA	LDWELL	RD		N/A		Total
intervar starts	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Total
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	1	0	0	0	1
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	1	0	0	0	1

Pedestrian volumes

Intorval starts		NE			NW			SW			SE		Total
Interval Starts	Left	Right	Total	Total									
16:00	0	0	0	0	0	0	1	0	1	0	0	0	1
16:15	0	0	0	0	2	2	0	0	0	0	0	0	2
16:30	0	0	0	3	0	3	2	0	2	0	0	0	5
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	1	0	1	0	0	0	0	1	1	2
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	4	2	6	3	0	3	0	1	1	10

VEHICULAR GRAPHIC SUMMARY SHEET





CALDWELL RD @ SHORE RD

Appendix C - SYNCHRO OUTPUTS

HCM Unsignalized Intersection Capacity Analysis 101: Shore Road & Caldwell Road

	٠	→	-	*	1	~	
Movement	EBL	EBT	WBT	WBR	SBL	SBR	
Lane Configurations		đ	1.		¥		
Traffic Volume (veh/h)	14	34	30	11	14	27	
Future Volume (Veh/h)	14	34	30	11	14	27	
Sign Control		Free	Free		Stop		
Grade		0%	0%		0%		
Peak Hour Factor	0.80	0.80	0.93	0.93	0.64	0.64	
Hourly flow rate (vph)	18	42	32	12	22	42	
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	44				116	38	
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	44				116	38	
tC, single (s)	4.1				6.4	6.3	
tC, 2 stage (s)							
tF (s)	2.2				3.5	3.4	
p0 queue free %	99				97	96	
cM capacity (veh/h)	1577				875	1020	
Direction. Lane #	EB 1	WB 1	SB 1				
Volume Total	60	44	64				
Volume Left	18	0	22				
Volume Right	0	12	42				
cSH	1577	1700	965				
Volume to Capacity	0.01	0.03	0.07				
Queue Length 95th (m)	0.3	0.0	1.6				
Control Delay (s)	2.3	0.0	9.0				
Lane LOS	A		A				
Approach Delay (s)	2.3	0.0	9.0				
Approach LOS			A				
Intersection Summary							
			12				
Intersection Canacity Litilizati	ion		4.Z			of Service	
Analysis Period (min)			19.2 /0				

HCM Unsignalized Intersection Capacity Analysis 101: Shore Road & Caldwell Road

	٠	-	-	*	1	~
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		र्स	ţ,		¥	
Traffic Volume (veh/h)	45	56	53	21	26	37
Future Volume (Veh/h)	45	56	53	21	26	37
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.77	0.77	0.85	0.85	0.75	0.75
Hourly flow rate (vph)	58	73	62	25	35	49
Pedestrians					2	
Lane Width (m)					3.7	
Walking Speed (m/s)					1.1	
Percent Blockage					0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	89				266	76
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	89				266	76
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	96				95	95
cM capacity (veh/h)	1504				690	974
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	131	87	84			
Volume Left	58	0	35			
Volume Right	0	25	49			
cSH	1504	1700	832			
Volume to Canacity	0.04	0.05	0.10			
Queue Length 95th (m)	0.0	0.0	2.6			
Control Delay (s)	3.5	0.0	9.8			
Lane LOS	0.0 A	0.0	0.0 A			
Approach Delay (s)	3.5	0.0	9.8			
Approach LOS	0.0	0.0	0.0 A			
Interception Common						
Intersection Summary			1.0			
Average Delay			4.2			(0 ·
Intersection Capacity Utiliz	ation		22.5%	IC	U Level o	of Service
Analysis Period (min)			15			

	٠	-	+	•	4	1	
Movement	EBL	EBT	WBT	WBR	SBL	SBR	
Lane Configurations		é.	î,		¥		
Traffic Volume (veh/h)	15	75	39	14	31	28	
Future Volume (Veh/h)	15	75	39	14	31	28	
Sign Control		Free	Free		Stop		
Grade		0%	0%		0%		
Peak Hour Factor	0.80	0.80	0.93	0.93	0.64	0.64	
Hourly flow rate (vph)	19	94	42	15	48	44	
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	57				182	50	
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	57				182	50	
tC, single (s)	4.1				6.4	6.3	
tC, 2 stage (s)							
tF (s)	2.2				3.5	3.4	
p0 queue free %	99				94	96	
cM capacity (veh/h)	1560				803	1005	
Direction, Lane #	EB 1	WB 1	SB 1				
Volume Total	113	57	92				
Volume Left	19	0	48				
Volume Right	0	15	44				
cSH	1560	1700	888				
Volume to Capacity	0.01	0.03	0.10				
Queue Length 95th (m)	0.3	0.0	2.6				
Control Delay (s)	1.3	0.0	9.5				
Lane LOS	А		А				
Approach Delay (s)	1.3	0.0	9.5				
Approach LOS			А				
Intersection Summary							
Average Delay			3.9				
Intersection Canacity Utilization	on		21.5%	IC	ULevelo	of Service	
Analysis Period (min)			15	.0			

	٨	-	←	•	4	∢		
Movement	EBL	EBT	WBT	WBR	SBL	SBR		
Lane Configurations		र्स	ţ,		¥			
Traffic Volume (veh/h)	47	64	94	37	30	39		
Future Volume (Veh/h)	47	64	94	37	30	39		
Sign Control		Free	Free		Stop			
Grade		0%	0%		0%			
Peak Hour Factor	0.77	0.77	0.85	0.85	0.75	0.75		
Hourly flow rate (vph)	61	83	111	44	40	52		
Pedestrians					2			
Lane Width (m)					3.7			
Walking Speed (m/s)					1.1			
Percent Blockage					0			
Right turn flare (veh)								
Median type		None	None					
Median storage veh)								
Upstream signal (m)								
pX, platoon unblocked								
vC, conflicting volume	157				340	135		
vC1, stage 1 conf vol								
vC2, stage 2 conf vol								
vCu, unblocked vol	157				340	135		
tC, single (s)	4.1				6.4	6.2		
tC, 2 stage (s)								
tF (s)	2.2				3.5	3.3		
p0 queue free %	96				94	94		
cM capacity (veh/h)	1420				623	904		
Direction. Lane #	.FB 1	WB 1	SB 1					
Volume Total	144	155	92					
Volume Left	61	0	40					
Volume Right	0	44						
cSH	1420	1700	756					
Volume to Canacity	0.04	0.09	0 12					
Queue Length 95th (m)	10	0.00	31					
Control Delay (s)	3.4	0.0	10.4					
	Δ	0.0	R					
Approach Delay (s)	34	0.0	10.4					
Approach I OS	0.4	0.0	R					
			5					
Intersection Summary			0.7					
Average Delay			3.7			(0 ·		
Intersection Capacity Util	Ization		21.1%	IC	U Level o	of Service		
Analysis Period (min)			15					