MEMO

TO: Project Team

FROM: Cindy Costain

SUBJECT: **Alternative Low Carbon Fuel Use at the St Marys Cement, St. Marys Plant – Traffic Impact Study – AM and PM Weekday Peak Hours**

DATE: **March 25, 2022**

INTRODUCTION

St Marys Cement (SMC), a company of Votorantim Cimentos North America (VCNA) is proposing to use Alternative Low Carbon Fuels (ALCFs) as an energy source for their cement plant located at 585 Water Street South in St. Marys, Ontario (the Site). In keeping with best practices implemented around the world, this initiative is part of SMC's strategy to continue reducing greenhouse gas emissions in Ontario while diverting materials from landfills.

SMC has prepared the ALCF Application for a Non-Demonstration (Permanent) Project under Ontario Regulation (O. Reg.) 79/15 (as amended by O. Reg. 54/21 and 824/21) of the Environmental Protection Act for an amendment to Environmental Compliance Approval (ECA) number 4546-AQ9GMB, issued on August 31, 2017 to proceed with regular use of ALCFs at the Site (the Amendment ECA Application).

Golder Associates Ltd (Canada) retained WSP Canada Inc. to undertake a Traffic Impact Study (TIS) related to the initiative of the St Marys Cement Plant. The TIS objective is to evaluate the project's potential impact to traffic on the local roadways on the area immediate to the facility relating to the expected increase in heavy trucks per day and to provide recommended mitigation measures, if needed. The TIS is considered a supplementary technical study as part of the Amendment ECA for the use of alternative low carbon fuels.

As part of the Amendment ECA Application, SMC is requesting approval to support the following:

- Daily throughput of ALCFs at the Site of up to 175 tonnes per day;
- Use ALCFs that may include the following example ALCF materials that are grouped into the associated ALCF material baskets (as noted in parenthesis):
  - Shredded wood from post construction waste (Construction and Demolition By-Products and Biomass Materials baskets);
  - Nested plastics and paper and shredded caps, labels and bags (Non-Recyclable Plastics and Non-Recyclable Paper Fiber/Wood/Plastic Composites baskets);
  - Shredded conveyor belt rubber and shredded conveyor skirt rubber (Rubber materials (non-tire derived) basket);
- Installation of new equipment at the Site to feed ALCFs; and,
- Installation of ALCF storage at the Site using enclosed containers and buildings.

This memorandum summarizes the analysis approach, assumptions and results of the travel demand forecasting and operational analysis undertaken in support of the TIS. Documentation includes summaries of intersection levels of service, queuing and overall traffic assessment findings.

STUDY AREA

The study limits for this assignment were bounded by the intersections within the main access route to the plant, as illustrated in **Figure 1**. Truck deliveries, particularly those that involve heavy trucks, are mandated to use Perth Road 123 and approach the plant from the south side of the facility, mainly along Highway 7. As such, the intersections with the largest potential impact as a result of the increase in truck volumes are noted below:

- Highway 7 and Wellburn Road (unsignalized);
- Highway 7 and Perth Road 123 (unsignalized); and,
- Highway 7 and James Street South / Cobble Hills Road (unsignalized)

Figure 1: Study area

EXISTING CONDITIONS

All traffic analysis was carried out on the basis of available weekday peak hour traffic volumes and mid-block inventory traffic volumes provided by Ontario Ministry of Transportation (MTO). Available data included the following intersection turning movement and inventory counts:

8-hour turning movement counts:

- Highway 7 at James St S / Cobble Hills Rd — Tuesday, July 28, 2015
- Highway 7 at Perth Rd 123 — Thursday, June 8, 2017
- Highway 7 at Wellburn Rd — Thursday, July 30, 2015

Automatic Traffic Recorder (ATR) counts:

- Perth Rd 123 north of Highway 7 — Tuesday, April 6 to Friday, April 9, 2021

A summary of the raw traffic volumes is provided below in **Figure 2**, while the traffic data collected is provided in **Appendix A**.

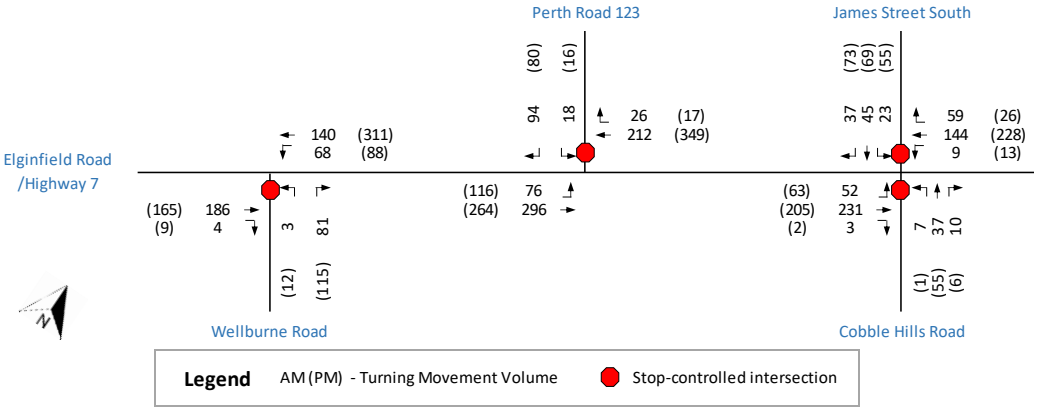


Figure 2: Raw weekday AM and PM peak hour turning movement volumes

The raw 2015 and 2017 turning movement volumes were balanced to the highest volumes within the study area. This procedure was carried out for each of the vehicle classes (passenger vehicles and trucks) separately. As per the information provided by the client (December 21st, 2021 correspondence), the existing traffic volumes assume a maximum total of 20 two-way trips per peak hour by conventional trucks in and out of the Site. The resulting balanced weekday morning and afternoon peak hour turning movement volumes reflect 2017 conditions and are summarized below in **Figure 3**.

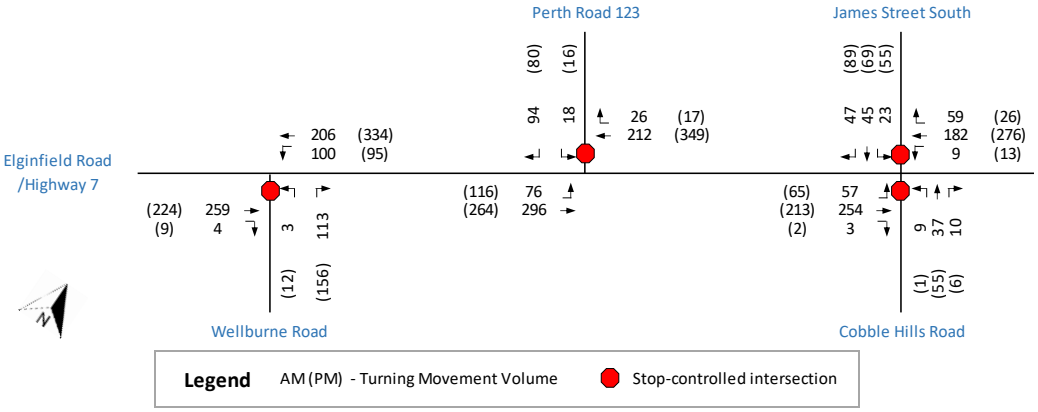


Figure 3: Existing (2017) balanced weekday AM and PM peak hour turning movement volumes

The existing and future traffic operations were analyzed using Synchro 11 software with the evaluation based on the Highway Capacity Manual (HCM) 6th Edition methodology for two-way stop-controlled intersections. The level-of-service (LOS) criteria for two-way stop-controlled intersections are summarized in **Table 1**.

Table 1: LOS criteria for two-way stop-controlled intersections (HCM 6th Edition)

LEVEL OF SERVICE	CONTROL DELAY PER VEHICLE (s/veh)
A	≤ 10
B	> 10 - 15
C	> 15 - 25
D	> 25 - 35
E	> 35 - 50
F	> 50

The average delay and corresponding levels of service, volume-to-capacity ratio (v/c), and 95th percentile queue lengths are summarized for each of the stop-controlled movements at the Highway 7 intersections with each of Wellburn Road, Perth Road 123 and James Street / Cobble Hill Road, below in **Table 2**. The detailed Synchro analysis reports for existing conditions are provided in **Appendix B**. Existing operating performance reflects levels of service C or better for all movements at each of the study area intersections with the exception of an afternoon peak hour southbound movement LOS D at the intersection of Highway 7 and James Street South. The corresponding 95th percentile queue lengths do not exceed a single car length on any of the intersection approaches except for the southbound movement at the intersection of Highway 7 and James Street South during the afternoon peak hour, which has a queue length of approximately 28 metres assuming an average vehicle length of 7 metres.

Table 2: 2017 (Existing) intersection operating performance – AM and PM peak hours

Intersection	Movement	Delay (s)	LOS	v/c ratio	95th Percentile Queue (veh)	Approach Delay (s)	Approach LOS
AM peak hour							
Highway 7 at Wellburn Rd	WBL	8.2	A	0.09	0.0	2.7	-
	NBL	17.8	C	0.01	0.0	17.8	C
Highway 7 at Perth Rd 123	EBL	8.1	A	0.07	0.0	1.7	-
	SBL	17.7	C	0.06	0.0	17.7	C
Highway 7 at James St S / Cobble Hills Rd	EBL	8.1	A	0.05	0.0	1.5	-
	WBL	7.9	A	0.01	0.0	0.3	-
	NBLTR	16.9	C	0.17	1.0	16.9	C
	SBLTR	16.1	C	0.28	1.0	16.1	C
PM peak hour							
Highway 7 at Wellburn Rd	WBL	7.9	A	0.08	0.0	1.8	-
	NBL	17.0	C	0.04	0.0	17.0	C
Highway 7 at Perth Rd 123	EBL	8.5	A	0.11	0.0	2.6	-
	SBL	23.0	C	0.08	0.0	23.0	C
Highway 7 at James St S / Cobble Hills Rd	EBL	8.4	A	0.06	0.0	1.9	-
	WBL	8.1	A	0.01	0.0	0.3	-
	NBLTR	18.1	C	0.20	1.0	18.1	C
	SBLTR	26.2	D	0.59	4.0	26.2	D

FUTURE BACKGROUND CONDITIONS

The operational analysis considered impacts on the basis of forecast 2023 weekday morning and afternoon peak hour travel demand. A review of historical Annual Average Daily Traffic (AADT) and Summer Average Daily Traffic (SADT) growth trends was undertaken as part of the traffic analysis to establish a suitable background traffic growth rate for projecting study area travel demand. A summary of the growth trends for the relevant sections of Highway 7 between Prospect Hill Road and Perth Road 118 is provided in **Figure 4** and **Figure 5**.

Daily traffic volumes have fluctuated considerably based on the available summaries through 2016. The linear trend reflects average annual growth of 1.1% to 1.2% relative to the estimated 2017 daily traffic volumes in the Highway 7 section between Prospect Hill Road and Perth Road 123, while average annual growth of 0.5% to 0.9% relative to the estimated 2017 travel demand is reflected by the trend in the Highway 7 section between Perth Road 123 and Perth Road 118.

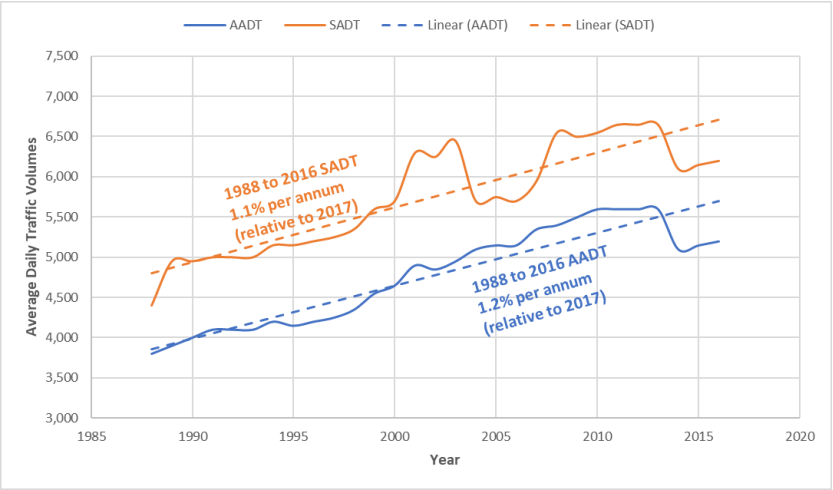


Figure 4: Highway 7 historical daily traffic growth trend from Prospect Hill Rd to Perth Rd 123

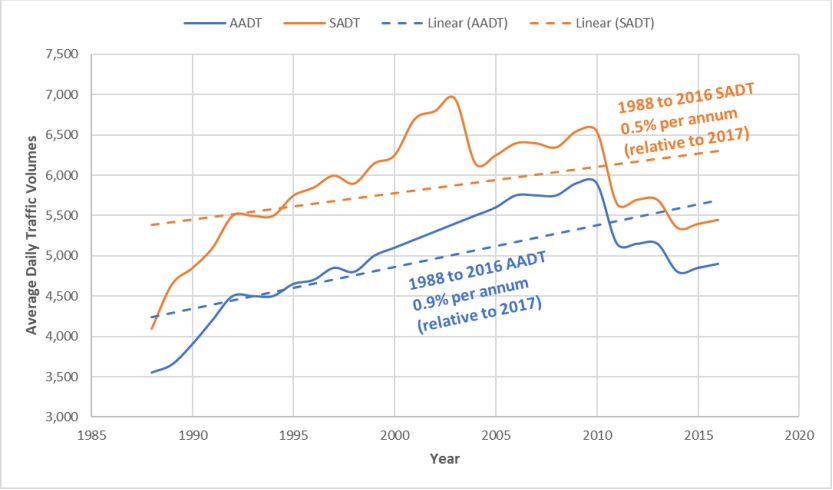


Figure 5: Highway 7 historical daily traffic growth trend from Perth Rd 123 to Perth Rd 118

The future year planning horizon turning movement volume projections were established based on a conservative assumption of 1.2% growth annually to 2023. These forecasts are illustrated below in **Figure 6**.

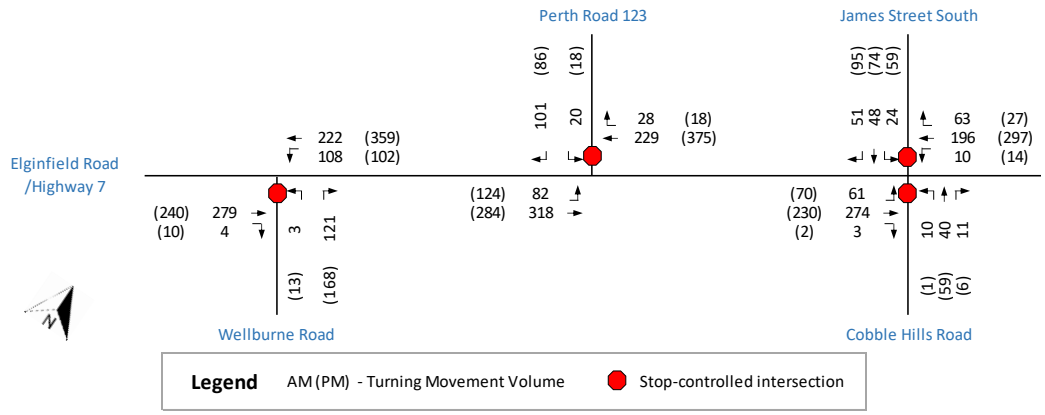


Figure 6: Future Background (2023) weekday AM and PM peak hour turning movement volumes

The future background traffic operation conditions during both morning and afternoon peak hours does not significantly vary relative to existing conditions. Delay times and v/c ratios slightly increase due to the traffic growth to 2023; however, the overall intersection performance does not change. All intersection approaches would continue to operate similar to existing conditions at LOS C or better in both time periods except for the southbound movement at Highway 7 and James Street South which operates at LOS D during the afternoon peak hour. The future background morning and afternoon peak hour traffic operations are summarized in **Table 3**. The detailed Synchro analysis reports for future background conditions are provided in **Appendix B**.

Table 3: 2023 future background intersection operating performance – AM and PM peak hours

Intersection	Movement	Delay (s)	LOS	v/c ratio	95th Percentile Queue (veh)	Approach Delay (s)	Approach LOS
AM peak hour							
Highway 7 at Wellburn Rd	WBL	8.2	A	0.09	0.0	2.7	-
	NBL	18.5	C	0.01	0.0	18.5	C
Highway 7 at Perth Rd 123	EBL	8.2	A	0.07	0.0	1.7	-
	SBL	18.3	C	0.07	0.0	18.3	C
Highway 7 at James St S / Cobble Hills Rd	EBL	8.1	A	0.05	0.0	1.5	-
	WBL	8.0	A	0.01	0.0	0.3	-
	NBLTR	17.6	C	0.18	1.0	17.6	C
	SBLTR	16.7	C	0.30	1.0	16.7	C
PM peak hour							
Highway 7 at Wellburn Rd	WBL	8.0	A	0.08	0.0	1.8	-
	NBL	17.7	C	0.05	0.0	17.7	C
Highway 7 at Perth Rd 123	EBL	8.6	A	0.11	0.0	2.6	-
	SBL	24.4	C	0.09	0.0	24.4	C
Highway 7 at James St S / Cobble Hills Rd	EBL	8.4	A	0.07	0.0	2.0	-
	WBL	8.1	A	0.01	0.0	0.3	-
	NBLTR	19.1	C	0.21	1.0	19.1	C
	SBLTR	29.8	D	0.64	4.0	29.8	D

FUTURE TOTAL CONDITIONS

The sources of Alternative Low Carbon Fuels were being finalized at the time of the TIS preparation; however, potential sources include the following:

- Northeast of the Site;
- Sarnia; and/or,
- Greater Toronto Area

Notwithstanding the fuel source based on the latter, the ALCF trucks will be mandated to approach the plant from the south side through Highway 7 and Perth Road 123, following the same routes that the conventional trucks use in existing conditions. The daily throughput of ALCFs in 2023 at the Site is estimated at 175 tonnes per day which translates into a heavy truck volume increase of approximately 9 two-way trucks per day in and out of the Site. Trucks will be distributed throughout the day in three time periods:

- 7:00 to 19:00 – 5 trucks
- 19:00 to 23:00 – 2 trucks
- 23:00 to 7:00 – 2 trucks

For the purpose of the TIS assessment, which is based on morning and afternoon peak hours, it was assumed that there would be an additional 2 two-way trucks in and out of the Site during both peak hours. The remaining 1 daytime ALCF truck will be assumed to arrive and exit the cement plant in the off-peak hours during the daytime period. The additional peak hour ALCF trucks were assigned to the road network following the existing truck proportions. Under the future total conditions scenario, turning movement volumes were estimated by adding the demand from the future background condition and the additional number of heavy vehicle trips generated due to the proposed use of ALCFs. The total future condition forecast volumes are illustrated in **Figure 7**.

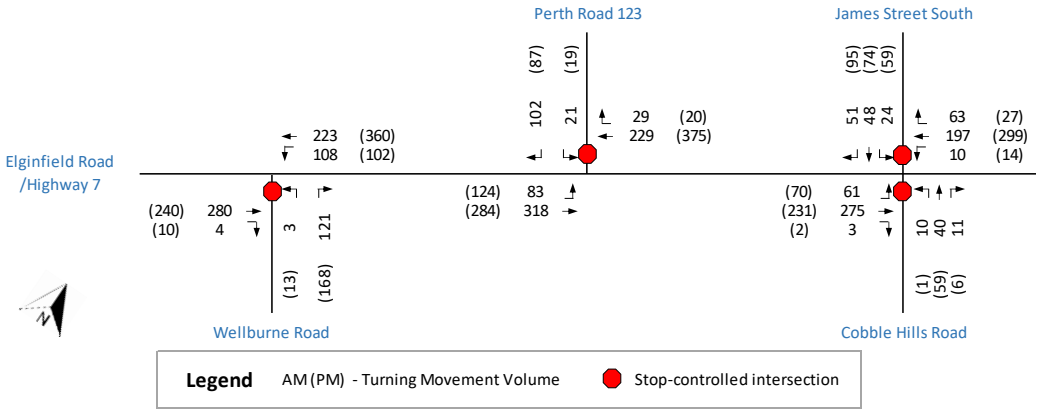


Figure 7: Future Total (2023) weekday AM and PM peak hour turning movement volumes

Table 4: 2023 total future intersection operating performance – AM and PM peak hours

Intersection	Movement	Delay (s)	LOS	v/c ratio	95th Percentile Queue (veh)	Approach Delay (s)	Approach LOS
AM peak hour							
Highway 7 at Wellburn Rd	WBL	8.2	A	0.09	0.0	2.7	-
	NBL	18.5	C	0.01	0.0	18.5	C
Highway 7 at Perth Rd 123	EBL	8.2	A	0.07	0.0	1.7	-
	SBL	18.5	C	0.08	0.0	18.5	C
Highway 7 at James St S / Cobble Hills Rd	EBL	8.1	A	0.05	0.0	1.5	-
	WBL	8.0	A	0.01	0.0	0.3	-
	NBLTR	17.7	C	0.19	1.0	17.7	C
	SBLTR	16.7	C	0.30	1.0	16.7	C
PM peak hour							
Highway 7 at Wellburn Rd	WBL	8.0	A	0.08	0.0	1.8	-
	NBL	17.7	C	0.05	0.0	17.7	C
Highway 7 at Perth Rd 123	EBL	8.6	A	0.12	0.0	2.6	-
	SBL	24.8	C	0.10	0.0	24.8	C
Highway 7 at James St S / Cobble Hills Rd	EBL	8.4	A	0.07	0.0	1.9	-
	WBL	8.1	A	0.01	0.0	0.3	-
	NBLTR	19.2	C	0.22	1.0	19.2	C
	SBLTR	30.2	D	0.64	4.0	30.2	D

The assessment of the future total conditions during both morning and afternoon peak hours shows little to no change in the traffic conditions at the study area intersections as compared to those in the future background conditions. The main variations are shown for delay times and v/c ratios that slightly increase at the stop-controlled approaches; however, the largest delay time change

experienced does not exceed 1 second. All intersection approaches would continue to operate similar to the future background conditions at LOS C or better in both time periods except for the southbound movement at Highway 7 and James Street South which operates at LOS D during the afternoon peak hour.

The future total morning and afternoon peak hour traffic operations are summarized in **Table 4**. The detailed Synchro analysis reports for future total conditions are provided in **Appendix B**.

FINDINGS AND RECOMMENDATIONS

- The additional heavy vehicle volumes to be generated as a result of the expanded use of ALCFs at the Site represents only a small percentage of the overall total traffic volumes (approximately less than 1%) with traffic performance expected to remain unchanged between existing and future conditions even with the increase in ALCF trucks during both peak hours.
- Both existing and projected 2023 total future operating performance reflects levels of service C or better for all movements and both peak hours at each of the study area intersections with the exception of an afternoon peak hour southbound movement level of service D at Highway 7 and James Street South.
- Given that overall traffic performance remains unchanged in the future relative to existing conditions, mitigation measures are not required.

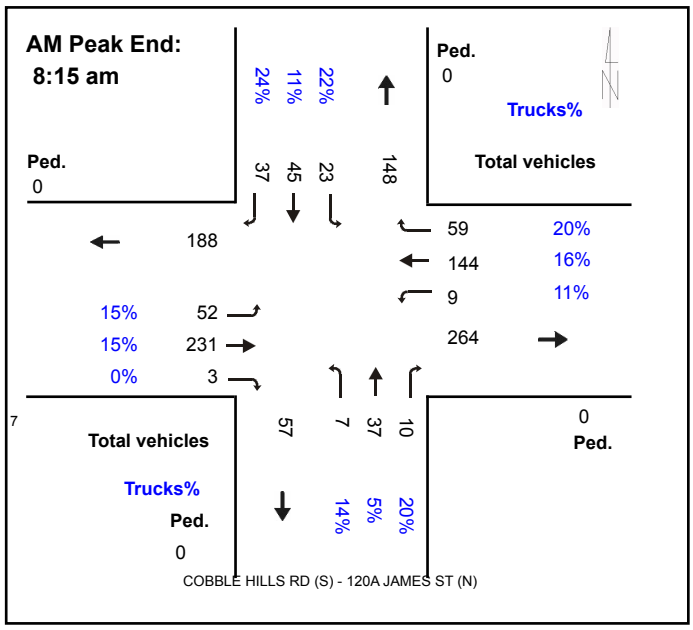
APPENDIX A

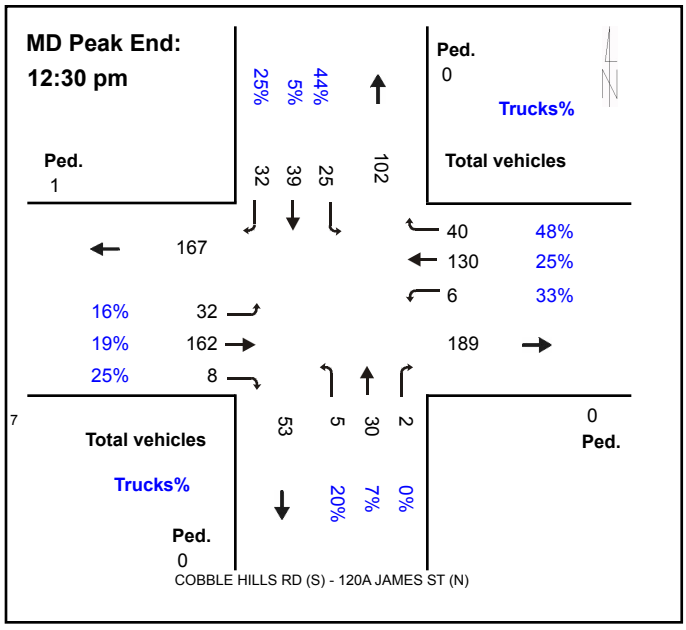
TRAFFIC DATA COLLECTED

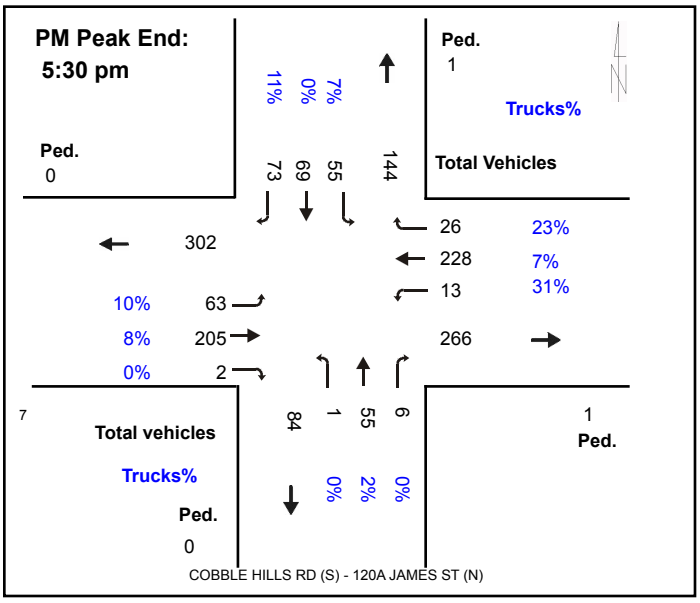
HWY 7 @ COBBLE HILLS RD (S) - 120A JAMES ST (N)

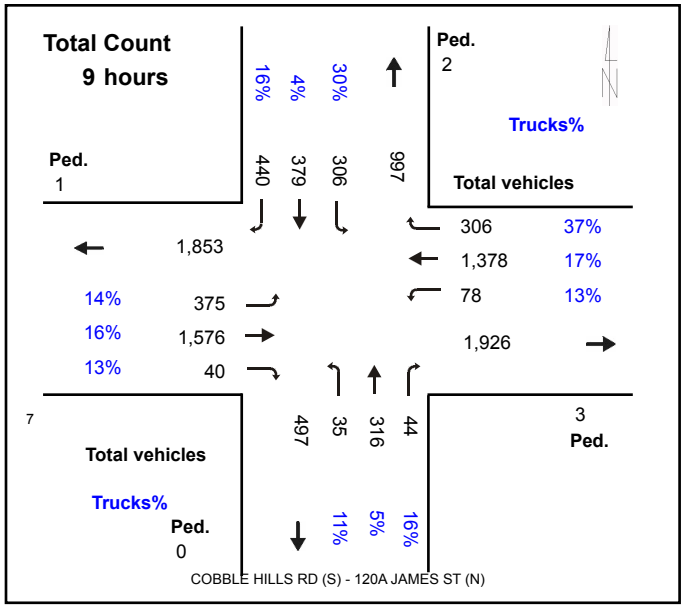
Southwest

Intersection ID:146600410 **Count Day: Tuesday** **Count Date: 28-Jul-2015**









Ontario

Ministry of Transportation

TVIS II - Traffic Volume Information System

AdHoc Turning Movement Total Count and Peak Summary Report

Description: HWY 7 @ PERTH RD 123

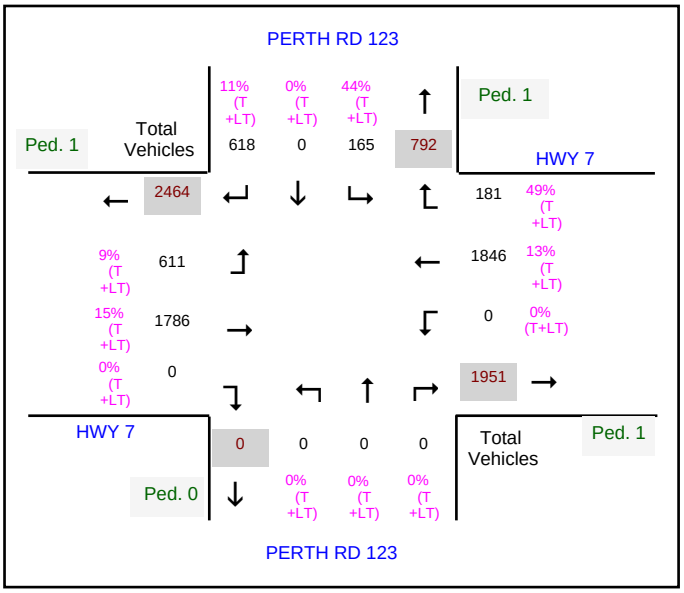
Region: WEST | **Survey Type:** TM – Intersection | **Hwy:** 7

Start Date: 08-Jun-2017 (Thu) | **I/C Side:** | **LHRS:** 14660

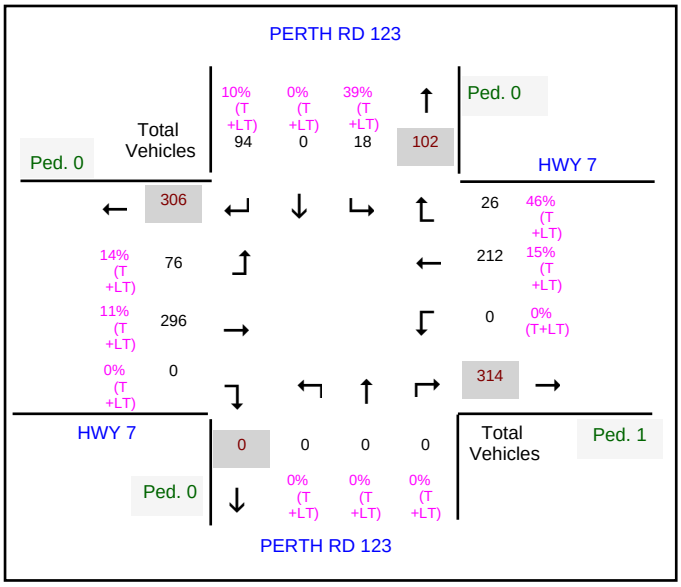
End Date: 08-Jun-2017 (Thu) | **Int. Type:** T - N | **Offset:** 6.400

Schedule Summary: TUES-THURS, 07:00-09:00, 11:00-14:00, 15:00-18:00

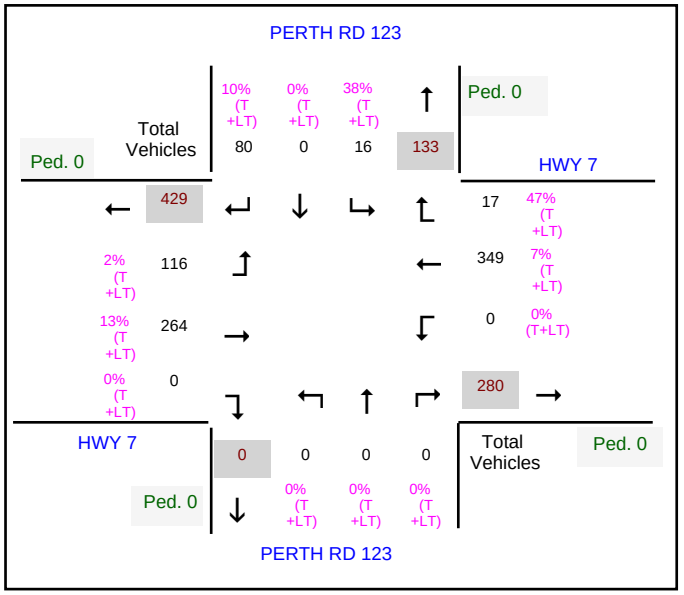
Total Count — Number of hours: 5



AM Peak Hour Report — Start Time: 07:30



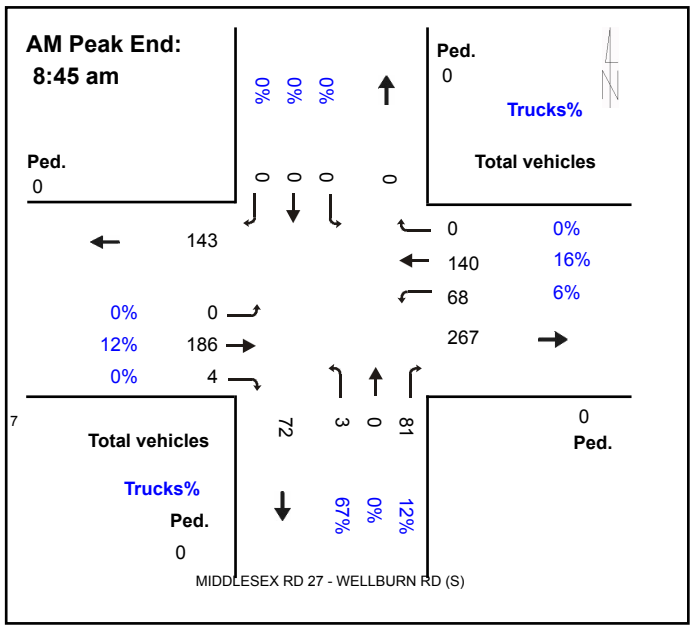
PM Peak Hour Report — Start Time: 16:30

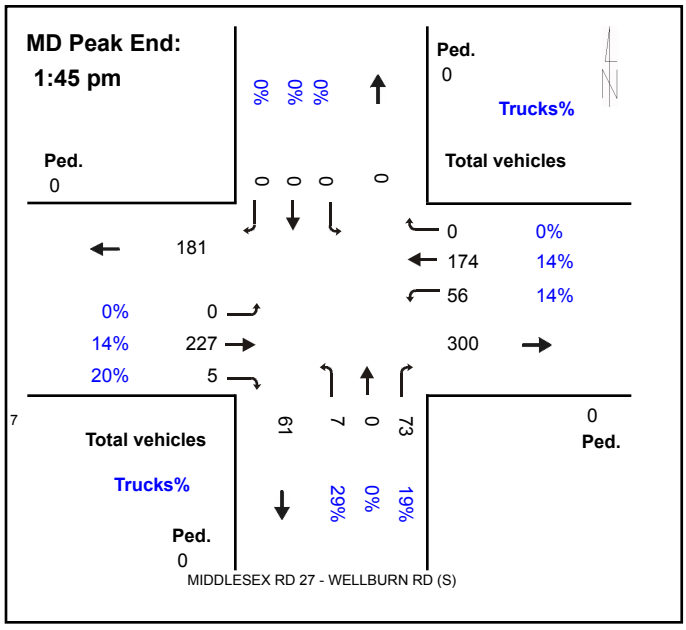


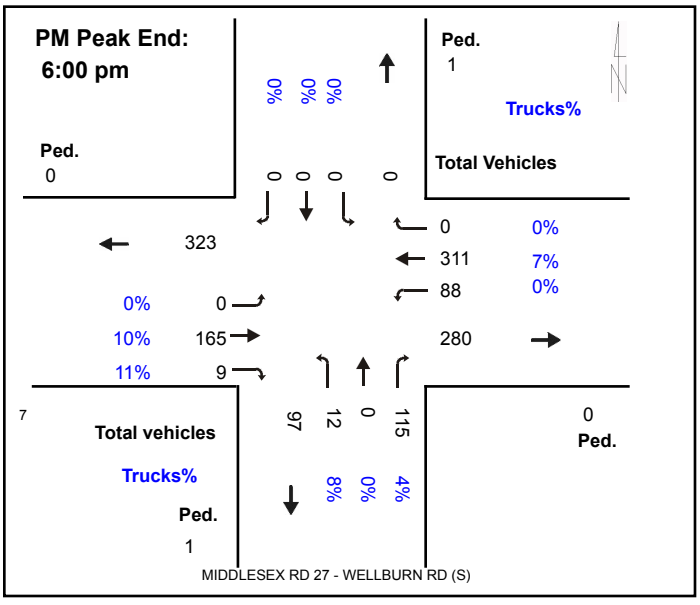
HWY 7 @ MIDDLESEX RD 27 - WELLBURN RD (S)

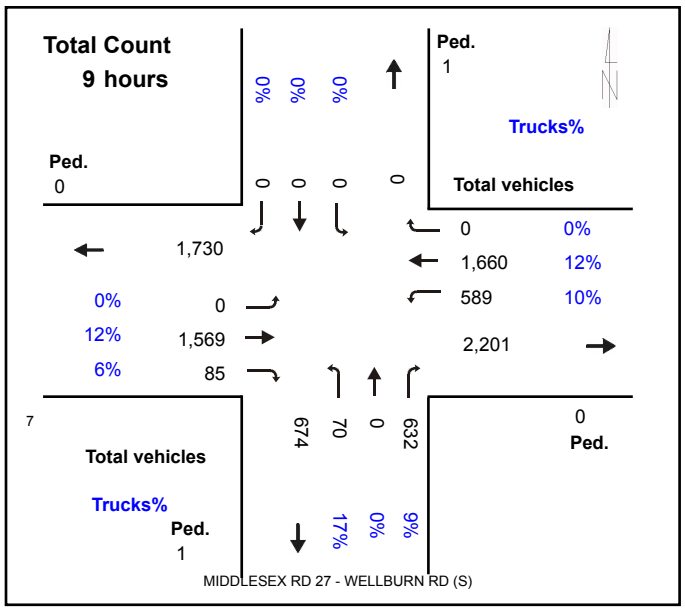
Southwest

Intersection ID:146700000 **Count Day: Thursday** **Count Date: 30-Jul-2015**





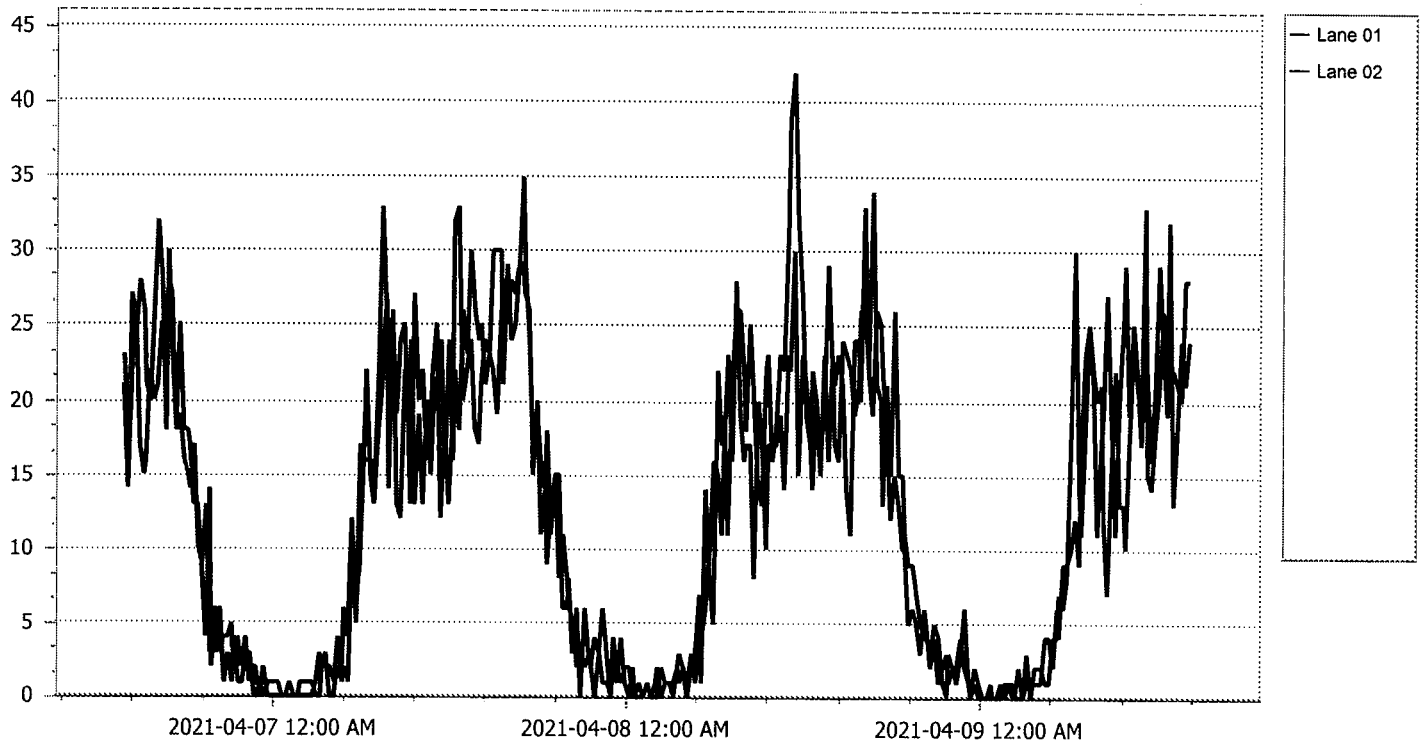




Peek Traffic
5401 N Sam Houston Pkwy W
Houston, Tx 77086
1-800-848-7025

Volume by Lane

Name:	RD_123_STMAR-12301_____1		
Site:	RD-123-STMAR	Station:	12301_____1
Latitude:	0.000000 N	Longitude:	0.000000 E
Started:	2021-04-06 2:00:00 PM	Ended:	2021-04-09 2:29:59 PM



Tuesday, April 06, 2021

Interval	Lane 01	Lane 02	Total
14:00	21	23	44
14:15	14	16	30
14:30	27	23	50
14:45	25	25	50
15:00	17	28	45
15:15	15	26	41
15:30	16	21	37
15:45	22	20	42
16:00	20	26	46
16:15	21	32	53
16:30	25	28	53
16:45	25	18	43
17:00	28	30	58
17:15	27	23	50
17:30	18	18	36
17:45	25	19	44
18:00	18	16	34
18:15	18	15	33
18:30	17	14	31
18:45	13	17	30
19:00	13	10	23
19:15	9	9	18
19:30	4	13	17
19:45	14	3	17
20:00	2	4	6
20:15	6	3	9
20:30	3	6	9
20:45	4	1	5
21:00	4	3	7
21:15	5	1	6
21:30	2	4	6
21:45	4	1	5
22:00	2	1	3
22:15	4	3	7
22:30	1	3	4
22:45	2	0	2
23:00	2	0	2
23:15	0	1	1
23:30	2	0	2
23:45	0	1	1
Daily Total	**495**	**505**	**1000**
AM Peak			
PM Peak	**207 (starting at 16:15:00)**		

Wednesday, April 07, 2021

Interval	Lane 01	Lane 02	Total
00:00	0	1	1
00:15	0	1	1
00:30	0	1	1
00:45	0	0	0
01:00	0	0	0
01:15	1	0	1
01:30	0	0	0
01:45	0	0	0
02:00	0	1	1
02:15	0	1	1
02:30	0	1	1
02:45	0	1	1
03:00	1	0	1
03:15	3	0	3
03:30	2	2	4
03:45	3	2	5
04:00	0	2	2
04:15	0	1	1
04:30	2	4	6
04:45	1	1	2
05:00	6	2	8
05:15	4	1	5
05:30	12	10	22
05:45	6	5	11
06:00	9	17	26
06:15	17	16	33
06:30	22	16	38
06:45	15	16	31
07:00	13	14	27
07:15	18	22	40
07:30	21	33	54
07:45	27	25	52
08:00	23	14	37
08:15	25	26	51
08:30	19	13	32
08:45	24	12	36
09:00	25	22	47
09:15	18	18	36
09:30	13	24	37
09:45	27	13	40
10:00	20	19	39
10:15	22	13	35
10:30	16	20	36
10:45	18	15	33
11:00	22	19	41
11:15	25	21	46
11:30	12	24	36

Wednesday, April 07, 2021

Interval	Lane 01	Lane 02	Total
11:45	18	15	33
12:00	13	24	37
12:15	19	16	35
12:30	32	22	54
12:45	33	18	51
13:00	20	26	46
13:15	22	23	45
13:30	24	30	54
13:45	18	26	44
14:00	17	24	41
14:15	21	25	46
14:30	24	21	45
14:45	23	23	46
15:00	22	30	52
15:15	19	30	49
15:30	25	30	55
15:45	28	21	49
16:00	25	29	54
16:15	28	24	52
16:30	27	25	52
16:45	29	29	58
17:00	29	35	64
17:15	27	29	56
17:30	26	24	50
17:45	15	16	31
18:00	19	20	39
18:15	16	11	27
18:30	14	14	28
18:45	18	9	27
19:00	11	13	24
19:15	15	15	30
19:30	15	8	23
19:45	6	11	17
20:00	6	8	14
20:15	8	6	14
20:30	3	5	8
20:45	6	2	8
21:00	0	3	3
21:15	6	2	8
21:30	3	3	6
21:45	2	2	4
22:00	4	0	4
22:15	3	3	6
22:30	6	1	7
22:45	3	1	4
23:00	0	0	0
23:15	2	4	6

Wednesday, April 07, 2021

Interval	Lane 01	Lane 02	Total
23:30	1	2	3
23:45	4	1	5
Daily Total	**1247**	**1228**	**2475**
AM Peak	**194 (starting at 07:30:00)**		
PM Peak	**230 (starting at 16:30:00)**		

Thursday, April 08, 2021

Interval	Lane 01	Lane 02	Total
00:00	1	2	3
00:15	0	2	2
00:30	2	0	2
00:45	0	0	0
01:00	1	0	1
01:15	0	0	0
01:30	1	1	2
01:45	0	0	0
02:00	0	1	1
02:15	0	2	2
02:30	2	0	2
02:45	1	1	2
03:00	1	1	2
03:15	1	0	1
03:30	2	2	4
03:45	3	1	4
04:00	2	2	4
04:15	0	1	1
04:30	2	3	5
04:45	3	1	4
05:00	7	4	11
05:15	1	4	5
05:30	14	6	20
05:45	8	10	18
06:00	5	16	21
06:15	22	15	37
06:30	17	11	28
06:45	19	17	36
07:00	11	23	34
07:15	21	16	37
07:30	26	28	54
07:45	26	19	45
08:00	22	16	38
08:15	18	17	35
08:30	25	17	42
08:45	20	8	28
09:00	14	20	34
09:15	13	17	30
09:30	22	10	32
09:45	23	17	40
10:00	16	17	33
10:15	18	17	35
10:30	23	19	42
10:45	22	14	36
11:00	31	23	54
11:15	39	22	61
11:30	42	30	72

Thursday, April 08, 2021

Interval	Lane 01	Lane 02	Total
11:45	32	15	47
12:00	27	23	50
12:15	19	21	40
12:30	17	17	34
12:45	14	22	36
13:00	20	20	40
13:15	17	15	32
13:30	19	23	42
13:45	29	16	45
14:00	22	23	45
14:15	21	17	38
14:30	23	16	39
14:45	21	24	45
15:00	14	23	37
15:15	11	22	33
15:30	24	19	43
15:45	24	21	45
16:00	20	26	46
16:15	33	26	59
16:30	22	22	44
16:45	19	34	53
17:00	26	21	47
17:15	25	20	45
17:30	22	13	35
17:45	18	21	39
18:00	12	15	27
18:15	15	26	41
18:30	13	15	28
18:45	10	15	25
19:00	10	11	21
19:15	5	9	14
19:30	6	9	15
19:45	5	7	12
20:00	3	5	8
20:15	6	4	10
20:30	5	4	9
20:45	2	3	5
21:00	4	5	9
21:15	1	4	5
21:30	2	1	3
21:45	3	0	3
22:00	1	3	4
22:15	2	2	4
22:30	2	1	3
22:45	4	3	7
23:00	2	6	8
23:15	1	1	2

Thursday, April 08, 2021

Interval	Lane 01	Lane 02	Total
23:30	0	0	0
23:45	2	1	3
Daily Total	**1202**	**1123**	**2325**
AM Peak	**234 (starting at 11:00:00)**		
PM Peak	**203 (starting at 16:15:00)**		

Friday, April 09, 2021

Interval	Lane 01	Lane 02	Total
00:00	1	0	1
00:15	0	0	0
00:30	0	0	0
00:45	1	0	1
01:00	0	0	0
01:15	0	0	0
01:30	1	0	1
01:45	0	1	1
02:00	1	1	2
02:15	0	1	1
02:30	0	0	0
02:45	2	0	2
03:00	0	0	0
03:15	3	1	4
03:30	0	1	1
03:45	2	1	3
04:00	2	1	3
04:15	2	1	3
04:30	1	4	5
04:45	1	4	5
05:00	4	2	6
05:15	4	6	10
05:30	7	4	11
05:45	6	9	15
06:00	8	9	17
06:15	18	10	28
06:30	30	12	42
06:45	14	9	23
07:00	11	17	28
07:15	18	23	41
07:30	25	25	50
07:45	21	22	43
08:00	11	20	31
08:15	17	21	38
08:30	19	12	31
08:45	27	7	34
09:00	19	15	34
09:15	11	22	33
09:30	20	13	33
09:45	25	13	38
10:00	29	10	39
10:15	19	17	36
10:30	25	24	49
10:45	22	21	43
11:00	17	19	36
11:15	25	33	58
11:30	21	15	36

Friday, April 09, 2021

Interval	Lane 01	Lane 02	Total
11:45	16	14	30
12:00	21	18	39
12:15	29	21	50
12:30	23	26	49
12:45	19	21	40
13:00	22	32	54
13:15	22	13	35
13:30	21	18	39
13:45	20	24	44
14:00	28	21	49
14:15	28	24	52
Daily Total	**739**	**658**	**1397**
AM Peak	**186 (starting at 10:30:00)**		
PM Peak	**193 (starting at 12:15:00)**		
Average Interval	**13**	**12**	**25**
Maximum in one Interval	**42**	**35**	**72**
Grand Total	**3683**	**3514**	**7197**

APPENDIX B

SYNCHRO REPORTS

Intersection	
Int Delay, s/veh	1.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	259	4	100	206	3	113
Future Vol, veh/h	259	4	100	206	3	113
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	-	158	141	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	13	0	7	17	67	13
Mvmt Flow	282	4	109	224	3	123

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	286	0	724	-
Stage 1	-	-	-	-	282	-
Stage 2	-	-	-	-	442	-
Critical Hdwy	-	-	4.17	-	7.07	-
Critical Hdwy Stg 1	-	-	-	-	6.07	-
Critical Hdwy Stg 2	-	-	-	-	6.07	-
Follow-up Hdwy	-	-	2.263	-	4.103	-
Pot Cap-1 Maneuver	-	-	1248	-	311	0
Stage 1	-	-	-	-	638	0
Stage 2	-	-	-	-	530	0
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1248	-	284	-
Mov Cap-2 Maneuver	-	-	-	-	284	-
Stage 1	-	-	-	-	638	-
Stage 2	-	-	-	-	484	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.7	17.8
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	284	-	-	1248	-
HCM Lane V/C Ratio	0.011	-	-	0.087	-
HCM Control Delay (s)	17.8	-	-	8.2	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	0	-	-	0.3	-

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	76	296	212	26	18	94
Future Vol, veh/h	76	296	212	26	18	94
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	147	-	-	129	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	14	13	15	46	56	12
Mvmt Flow	83	322	230	28	20	102

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	258	0	-	0	718	-
Stage 1	-	-	-	-	230	-
Stage 2	-	-	-	-	488	-
Critical Hdwy	4.24	-	-	-	6.96	-
Critical Hdwy Stg 1	-	-	-	-	5.96	-
Critical Hdwy Stg 2	-	-	-	-	5.96	-
Follow-up Hdwy	2.326	-	-	-	4.004	-
Pot Cap-1 Maneuver	1240	-	-	-	326	0
Stage 1	-	-	-	-	696	0
Stage 2	-	-	-	-	519	0
Platoon blocked, %			-	-	-	
Mov Cap-1 Maneuver	1240	-	-	-	304	-
Mov Cap-2 Maneuver	-	-	-	-	304	-
Stage 1	-	-	-	-	649	-
Stage 2	-	-	-	-	519	-

Approach	EB	WB	SB
HCM Control Delay, s	1.7	0	17.7
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1240	-	-	-	304
HCM Lane V/C Ratio	0.067	-	-	-	0.064
HCM Control Delay (s)	8.1	-	-	-	17.7
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0.2	-	-	-	0.2

Intersection	
Int Delay, s/veh	4.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	57	254	3	9	182	59	9	37	10	23	45	47
Future Vol, veh/h	57	254	3	9	182	59	9	37	10	23	45	47
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	192	-	-	151	-	114	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	16	15	0	11	17	20	11	5	20	22	11	26
Mvmt Flow	62	276	3	10	198	64	10	40	11	25	49	51

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	262	0	0	279	0	0	702	684	278	645	621	198
Stage 1	-	-	-	-	-	-	402	402	-	218	218	-
Stage 2	-	-	-	-	-	-	300	282	-	427	403	-
Critical Hdwy	4.26	-	-	4.21	-	-	7.21	6.55	6.4	7.32	6.61	6.46
Critical Hdwy Stg 1	-	-	-	-	-	-	6.21	5.55	-	6.32	5.61	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.21	5.55	-	6.32	5.61	-
Follow-up Hdwy	2.344	-	-	2.299	-	-	3.599	4.045	3.48	3.698	4.099	3.534
Pot Cap-1 Maneuver	1225	-	-	1234	-	-	341	367	720	359	392	786
Stage 1	-	-	-	-	-	-	607	595	-	741	706	-
Stage 2	-	-	-	-	-	-	690	672	-	568	584	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1225	-	-	1234	-	-	274	345	720	308	369	786
Mov Cap-2 Maneuver	-	-	-	-	-	-	274	345	-	308	369	-
Stage 1	-	-	-	-	-	-	576	565	-	703	700	-
Stage 2	-	-	-	-	-	-	595	667	-	493	554	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.5	0.3	16.9	16.1
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	364	1225	-	-	1234	-	-	448
HCM Lane V/C Ratio	0.167	0.051	-	-	0.008	-	-	0.279
HCM Control Delay (s)	16.9	8.1	-	-	7.9	-	-	16.1
HCM Lane LOS	C	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.6	0.2	-	-	0	-	-	1.1

Intersection	
Int Delay, s/veh	1.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	224	9	95	334	12	156
Future Vol, veh/h	224	9	95	334	12	156
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	-	158	141	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	13	11	0	10	8	5
Mvmt Flow	243	10	103	363	13	170

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	253	0	812	-
Stage 1	-	-	-	-	243	-
Stage 2	-	-	-	-	569	-
Critical Hdwy	-	-	4.1	-	6.48	-
Critical Hdwy Stg 1	-	-	-	-	5.48	-
Critical Hdwy Stg 2	-	-	-	-	5.48	-
Follow-up Hdwy	-	-	2.2	-	3.572	-
Pot Cap-1 Maneuver	-	-	1324	-	340	0
Stage 1	-	-	-	-	784	0
Stage 2	-	-	-	-	555	0
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1324	-	313	-
Mov Cap-2 Maneuver	-	-	-	-	313	-
Stage 1	-	-	-	-	784	-
Stage 2	-	-	-	-	512	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.8	17
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	313	-	-	1324	-
HCM Lane V/C Ratio	0.042	-	-	0.078	-
HCM Control Delay (s)	17	-	-	7.9	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0.3	-

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	116	264	349	17	16	80
Future Vol, veh/h	116	264	349	17	16	80
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	147	-	-	129	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	3	13	7	94	56	14
Mvmt Flow	126	287	379	18	17	87

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	397	0	-	0	918	-
Stage 1	-	-	-	-	379	-
Stage 2	-	-	-	-	539	-
Critical Hdwy	4.13	-	-	-	6.96	-
Critical Hdwy Stg 1	-	-	-	-	5.96	-
Critical Hdwy Stg 2	-	-	-	-	5.96	-
Follow-up Hdwy	2.227	-	-	-	4.004	-
Pot Cap-1 Maneuver	1156	-	-	-	243	0
Stage 1	-	-	-	-	588	0
Stage 2	-	-	-	-	490	0
Platoon blocked, %			-	-	-	
Mov Cap-1 Maneuver	1156	-	-	-	217	-
Mov Cap-2 Maneuver	-	-	-	-	217	-
Stage 1	-	-	-	-	524	-
Stage 2	-	-	-	-	490	-

Approach	EB	WB	SB
HCM Control Delay, s	2.6	0	23
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1156	-	-	-	217
HCM Lane V/C Ratio	0.109	-	-	-	0.08
HCM Control Delay (s)	8.5	-	-	-	23
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0.4	-	-	-	0.3

Intersection	
Int Delay, s/veh	8.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	65	213	2	13	276	26	1	55	6	55	69	89
Future Vol, veh/h	65	213	2	13	276	26	1	55	6	55	69	89
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	192	-	-	151	-	114	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	20	14	0	31	9	23	0	2	0	7	0	16
Mvmt Flow	71	232	2	14	300	28	1	60	7	60	75	97

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	328	0	0	234	0	0	803	731	233	737	704	300
Stage 1	-	-	-	-	-	-	375	375	-	328	328	-
Stage 2	-	-	-	-	-	-	428	356	-	409	376	-
Critical Hdwy	4.3	-	-	4.41	-	-	7.1	6.52	6.2	7.17	6.5	6.36
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.52	-	6.17	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.52	-	6.17	5.5	-
Follow-up Hdwy	2.38	-	-	2.479	-	-	3.5	4.018	3.3	3.563	4	3.444
Pot Cap-1 Maneuver	1137	-	-	1180	-	-	304	349	811	328	364	708
Stage 1	-	-	-	-	-	-	650	617	-	674	651	-
Stage 2	-	-	-	-	-	-	609	629	-	610	620	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1137	-	-	1180	-	-	206	324	811	264	337	708
Mov Cap-2 Maneuver	-	-	-	-	-	-	206	324	-	264	337	-
Stage 1	-	-	-	-	-	-	610	579	-	632	643	-
Stage 2	-	-	-	-	-	-	459	621	-	509	582	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.9	0.3	18.1	26.2
HCM LOS			C	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	341	1137	-	-	1180	-	-	395
HCM Lane V/C Ratio	0.198	0.062	-	-	0.012	-	-	0.586
HCM Control Delay (s)	18.1	8.4	-	-	8.1	-	-	26.2
HCM Lane LOS	C	A	-	-	A	-	-	D
HCM 95th %tile Q(veh)	0.7	0.2	-	-	0	-	-	3.6

Intersection	
Int Delay, s/veh	1.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	279	4	108	222	3	121
Future Vol, veh/h	279	4	108	222	3	121
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	-	158	141	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	13	0	7	18	67	13
Mvmt Flow	294	4	114	234	3	127

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	298	0	756	-
Stage 1	-	-	-	-	294	-
Stage 2	-	-	-	-	462	-
Critical Hdwy	-	-	4.17	-	7.07	-
Critical Hdwy Stg 1	-	-	-	-	6.07	-
Critical Hdwy Stg 2	-	-	-	-	6.07	-
Follow-up Hdwy	-	-	2.263	-	4.103	-
Pot Cap-1 Maneuver	-	-	1235	-	297	0
Stage 1	-	-	-	-	629	0
Stage 2	-	-	-	-	518	0
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1235	-	270	-
Mov Cap-2 Maneuver	-	-	-	-	270	-
Stage 1	-	-	-	-	629	-
Stage 2	-	-	-	-	470	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.7	18.5
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	270	-	-	1235	-
HCM Lane V/C Ratio	0.012	-	-	0.092	-
HCM Control Delay (s)	18.5	-	-	8.2	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	0	-	-	0.3	-

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	82	318	229	28	20	101
Future Vol, veh/h	82	318	229	28	20	101
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	147	-	-	129	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	15	13	15	46	55	12
Mvmt Flow	86	335	241	29	21	106

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	270	0	-	0	748	-
Stage 1	-	-	-	-	241	-
Stage 2	-	-	-	-	507	-
Critical Hdwy	4.25	-	-	-	6.95	-
Critical Hdwy Stg 1	-	-	-	-	5.95	-
Critical Hdwy Stg 2	-	-	-	-	5.95	-
Follow-up Hdwy	2.335	-	-	-	3.995	-
Pot Cap-1 Maneuver	1222	-	-	-	313	0
Stage 1	-	-	-	-	690	0
Stage 2	-	-	-	-	510	0
Platoon blocked, %			-	-	-	
Mov Cap-1 Maneuver	1222	-	-	-	291	-
Mov Cap-2 Maneuver	-	-	-	-	291	-
Stage 1	-	-	-	-	642	-
Stage 2	-	-	-	-	510	-

Approach	EB	WB	SB
HCM Control Delay, s	1.7	0	18.3
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1222	-	-	-	291
HCM Lane V/C Ratio	0.071	-	-	-	0.072
HCM Control Delay (s)	8.2	-	-	-	18.3
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0.2	-	-	-	0.2

Intersection	
Int Delay, s/veh	4.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	61	274	3	10	196	63	10	40	11	24	48	51
Future Vol, veh/h	61	274	3	10	196	63	10	40	11	24	48	51
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	192	-	-	151	-	114	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	16	15	0	10	17	21	10	5	18	21	10	25
Mvmt Flow	64	288	3	11	206	66	11	42	12	25	51	54

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	272	0	0	291	0	0	732	712	290	673	647	206
Stage 1	-	-	-	-	-	-	418	418	-	228	228	-
Stage 2	-	-	-	-	-	-	314	294	-	445	419	-
Critical Hdwy	4.26	-	-	4.2	-	-	7.2	6.55	6.38	7.31	6.6	6.45
Critical Hdwy Stg 1	-	-	-	-	-	-	6.2	5.55	-	6.31	5.6	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.2	5.55	-	6.31	5.6	-
Follow-up Hdwy	2.344	-	-	2.29	-	-	3.59	4.045	3.462	3.689	4.09	3.525
Pot Cap-1 Maneuver	1215	-	-	1226	-	-	327	354	713	344	380	780
Stage 1	-	-	-	-	-	-	597	585	-	734	701	-
Stage 2	-	-	-	-	-	-	680	664	-	557	576	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1215	-	-	1226	-	-	259	332	713	291	356	780
Mov Cap-2 Maneuver	-	-	-	-	-	-	259	332	-	291	356	-
Stage 1	-	-	-	-	-	-	565	554	-	695	695	-
Stage 2	-	-	-	-	-	-	582	658	-	480	545	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.5	0.3	17.6	16.7
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	350	1215	-	-	1226	-	-	435
HCM Lane V/C Ratio	0.183	0.053	-	-	0.009	-	-	0.298
HCM Control Delay (s)	17.6	8.1	-	-	8	-	-	16.7
HCM Lane LOS	C	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.7	0.2	-	-	0	-	-	1.2

Intersection	
Int Delay, s/veh	1.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	240	10	102	359	13	168
Future Vol, veh/h	240	10	102	359	13	168
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	-	158	141	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	13	10	0	11	8	5
Mvmt Flow	253	11	107	378	14	177

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	264	0	845	-
Stage 1	-	-	-	-	253	-
Stage 2	-	-	-	-	592	-
Critical Hdwy	-	-	4.1	-	6.48	-
Critical Hdwy Stg 1	-	-	-	-	5.48	-
Critical Hdwy Stg 2	-	-	-	-	5.48	-
Follow-up Hdwy	-	-	2.2	-	3.572	-
Pot Cap-1 Maneuver	-	-	1312	-	325	0
Stage 1	-	-	-	-	775	0
Stage 2	-	-	-	-	541	0
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1312	-	298	-
Mov Cap-2 Maneuver	-	-	-	-	298	-
Stage 1	-	-	-	-	775	-
Stage 2	-	-	-	-	497	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.8	17.7
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	298	-	-	1312	-
HCM Lane V/C Ratio	0.046	-	-	0.082	-
HCM Control Delay (s)	17.7	-	-	8	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0.3	-

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	124	284	375	18	18	86
Future Vol, veh/h	124	284	375	18	18	86
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	147	-	-	129	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	3	13	7	94	56	14
Mvmt Flow	131	299	395	19	19	91

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	414	0	-	0	956	-
Stage 1	-	-	-	-	395	-
Stage 2	-	-	-	-	561	-
Critical Hdwy	4.13	-	-	-	6.96	-
Critical Hdwy Stg 1	-	-	-	-	5.96	-
Critical Hdwy Stg 2	-	-	-	-	5.96	-
Follow-up Hdwy	2.227	-	-	-	4.004	-
Pot Cap-1 Maneuver	1140	-	-	-	230	0
Stage 1	-	-	-	-	578	0
Stage 2	-	-	-	-	477	0
Platoon blocked, %			-	-	-	
Mov Cap-1 Maneuver	1140	-	-	-	204	-
Mov Cap-2 Maneuver	-	-	-	-	204	-
Stage 1	-	-	-	-	512	-
Stage 2	-	-	-	-	477	-

Approach	EB	WB	SB
HCM Control Delay, s	2.6	0	24.4
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1140	-	-	-	204
HCM Lane V/C Ratio	0.114	-	-	-	0.093
HCM Control Delay (s)	8.6	-	-	-	24.4
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0.4	-	-	-	0.3

Intersection	
Int Delay, s/veh	9.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	70	230	2	14	297	27	1	59	6	59	74	95
Future Vol, veh/h	70	230	2	14	297	27	1	59	6	59	74	95
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	192	-	-	151	-	114	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	20	14	0	29	9	22	0	2	0	7	0	16
Mvmt Flow	74	242	2	15	313	28	1	62	6	62	78	100

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	341	0	0	244	0	0	837	762	243	768	735	313
Stage 1	-	-	-	-	-	-	391	391	-	343	343	-
Stage 2	-	-	-	-	-	-	446	371	-	425	392	-
Critical Hdwy	4.3	-	-	4.39	-	-	7.1	6.52	6.2	7.17	6.5	6.36
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.52	-	6.17	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.52	-	6.17	5.5	-
Follow-up Hdwy	2.38	-	-	2.461	-	-	3.5	4.018	3.3	3.563	4	3.444
Pot Cap-1 Maneuver	1124	-	-	1179	-	-	288	335	801	312	349	696
Stage 1	-	-	-	-	-	-	637	607	-	662	641	-
Stage 2	-	-	-	-	-	-	595	620	-	597	610	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1124	-	-	1179	-	-	189	309	801	247	322	696
Mov Cap-2 Maneuver	-	-	-	-	-	-	189	309	-	247	322	-
Stage 1	-	-	-	-	-	-	595	567	-	618	633	-
Stage 2	-	-	-	-	-	-	441	612	-	493	570	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	2	0.3	19.1	29.8
HCM LOS			C	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	324	1124	-	-	1179	-	-	377
HCM Lane V/C Ratio	0.214	0.066	-	-	0.012	-	-	0.637
HCM Control Delay (s)	19.1	8.4	-	-	8.1	-	-	29.8
HCM Lane LOS	C	A	-	-	A	-	-	D
HCM 95th %tile Q(veh)	0.8	0.2	-	-	0	-	-	4.2

Intersection	
Int Delay, s/veh	1.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	280	4	108	223	3	121
Future Vol, veh/h	280	4	108	223	3	121
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	-	158	141	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	13	0	7	18	67	13
Mvmt Flow	295	4	114	235	3	127

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	299	0	758	-
Stage 1	-	-	-	-	295	-
Stage 2	-	-	-	-	463	-
Critical Hdwy	-	-	4.17	-	7.07	-
Critical Hdwy Stg 1	-	-	-	-	6.07	-
Critical Hdwy Stg 2	-	-	-	-	6.07	-
Follow-up Hdwy	-	-	2.263	-	4.103	-
Pot Cap-1 Maneuver	-	-	1234	-	296	0
Stage 1	-	-	-	-	628	0
Stage 2	-	-	-	-	517	0
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1234	-	269	-
Mov Cap-2 Maneuver	-	-	-	-	269	-
Stage 1	-	-	-	-	628	-
Stage 2	-	-	-	-	469	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.7	18.5
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	269	-	-	1234	-
HCM Lane V/C Ratio	0.012	-	-	0.092	-
HCM Control Delay (s)	18.5	-	-	8.2	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	0	-	-	0.3	-

Intersection	
Int Delay, s/veh	1.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	83	318	229	29	21	102
Future Vol, veh/h	83	318	229	29	21	102
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	147	-	-	129	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	16	13	15	48	57	13
Mvmt Flow	87	335	241	31	22	107

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	272	0	-	0	750	-
Stage 1	-	-	-	-	241	-
Stage 2	-	-	-	-	509	-
Critical Hdwy	4.26	-	-	-	6.97	-
Critical Hdwy Stg 1	-	-	-	-	5.97	-
Critical Hdwy Stg 2	-	-	-	-	5.97	-
Follow-up Hdwy	2.344	-	-	-	4.013	-
Pot Cap-1 Maneuver	1215	-	-	-	310	0
Stage 1	-	-	-	-	686	0
Stage 2	-	-	-	-	505	0
Platoon blocked, %			-	-	-	
Mov Cap-1 Maneuver	1215	-	-	-	288	-
Mov Cap-2 Maneuver	-	-	-	-	288	-
Stage 1	-	-	-	-	637	-
Stage 2	-	-	-	-	505	-

Approach	EB	WB	SB
HCM Control Delay, s	1.7	0	18.5
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1215	-	-	-	288
HCM Lane V/C Ratio	0.072	-	-	-	0.077
HCM Control Delay (s)	8.2	-	-	-	18.5
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0.2	-	-	-	0.2

Intersection	
Int Delay, s/veh	4.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	61	275	3	10	197	63	10	40	11	24	48	51
Future Vol, veh/h	61	275	3	10	197	63	10	40	11	24	48	51
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	192	-	-	151	-	114	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	16	15	0	10	18	21	10	5	18	21	10	25
Mvmt Flow	64	289	3	11	207	66	11	42	12	25	51	54

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	273	0	0	292	0	0	734	714	291	675	649	207
Stage 1	-	-	-	-	-	-	419	419	-	229	229	-
Stage 2	-	-	-	-	-	-	315	295	-	446	420	-
Critical Hdwy	4.26	-	-	4.2	-	-	7.2	6.55	6.38	7.31	6.6	6.45
Critical Hdwy Stg 1	-	-	-	-	-	-	6.2	5.55	-	6.31	5.6	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.2	5.55	-	6.31	5.6	-
Follow-up Hdwy	2.344	-	-	2.29	-	-	3.59	4.045	3.462	3.689	4.09	3.525
Pot Cap-1 Maneuver	1214	-	-	1225	-	-	326	353	712	343	379	779
Stage 1	-	-	-	-	-	-	596	585	-	733	700	-
Stage 2	-	-	-	-	-	-	679	664	-	556	576	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1214	-	-	1225	-	-	258	331	712	291	356	779
Mov Cap-2 Maneuver	-	-	-	-	-	-	258	331	-	291	356	-
Stage 1	-	-	-	-	-	-	564	554	-	694	694	-
Stage 2	-	-	-	-	-	-	581	658	-	479	545	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.5	0.3	17.7	16.7
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	348	1214	-	-	1225	-	-	435
HCM Lane V/C Ratio	0.185	0.053	-	-	0.009	-	-	0.298
HCM Control Delay (s)	17.7	8.1	-	-	8	-	-	16.7
HCM Lane LOS	C	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.7	0.2	-	-	0	-	-	1.2

Intersection	
Int Delay, s/veh	1.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	240	10	102	360	13	168
Future Vol, veh/h	240	10	102	360	13	168
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	-	158	141	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	13	10	0	11	8	5
Mvmt Flow	253	11	107	379	14	177

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	264	0	846	-
Stage 1	-	-	-	-	253	-
Stage 2	-	-	-	-	593	-
Critical Hdwy	-	-	4.1	-	6.48	-
Critical Hdwy Stg 1	-	-	-	-	5.48	-
Critical Hdwy Stg 2	-	-	-	-	5.48	-
Follow-up Hdwy	-	-	2.2	-	3.572	-
Pot Cap-1 Maneuver	-	-	1312	-	325	0
Stage 1	-	-	-	-	775	0
Stage 2	-	-	-	-	541	0
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1312	-	298	-
Mov Cap-2 Maneuver	-	-	-	-	298	-
Stage 1	-	-	-	-	775	-
Stage 2	-	-	-	-	497	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.8	17.7
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	298	-	-	1312	-
HCM Lane V/C Ratio	0.046	-	-	0.082	-
HCM Control Delay (s)	17.7	-	-	8	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0.3	-

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	124	284	375	20	19	87
Future Vol, veh/h	124	284	375	20	19	87
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	147	-	-	129	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	3	13	7	95	58	15
Mvmt Flow	131	299	395	21	20	92

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	416	0	-	0	956	-
Stage 1	-	-	-	-	395	-
Stage 2	-	-	-	-	561	-
Critical Hdwy	4.13	-	-	-	6.98	-
Critical Hdwy Stg 1	-	-	-	-	5.98	-
Critical Hdwy Stg 2	-	-	-	-	5.98	-
Follow-up Hdwy	2.227	-	-	-	4.022	-
Pot Cap-1 Maneuver	1138	-	-	-	228	0
Stage 1	-	-	-	-	574	0
Stage 2	-	-	-	-	474	0
Platoon blocked, %			-	-	-	
Mov Cap-1 Maneuver	1138	-	-	-	202	-
Mov Cap-2 Maneuver	-	-	-	-	202	-
Stage 1	-	-	-	-	508	-
Stage 2	-	-	-	-	474	-

Approach	EB	WB	SB
HCM Control Delay, s	2.6	0	24.8
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1138	-	-	-	202
HCM Lane V/C Ratio	0.115	-	-	-	0.099
HCM Control Delay (s)	8.6	-	-	-	24.8
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0.4	-	-	-	0.3

Intersection	
Int Delay, s/veh	9.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	70	231	2	14	299	27	1	59	6	59	74	95
Future Vol, veh/h	70	231	2	14	299	27	1	59	6	59	74	95
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	192	-	-	151	-	114	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	20	15	0	29	10	22	0	2	0	7	0	16
Mvmt Flow	74	243	2	15	315	28	1	62	6	62	78	100

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	343	0	0	245	0	0	840	765	244	771	738	315
Stage 1	-	-	-	-	-	-	392	392	-	345	345	-
Stage 2	-	-	-	-	-	-	448	373	-	426	393	-
Critical Hdwy	4.3	-	-	4.39	-	-	7.1	6.52	6.2	7.17	6.5	6.36
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.52	-	6.17	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.52	-	6.17	5.5	-
Follow-up Hdwy	2.38	-	-	2.461	-	-	3.5	4.018	3.3	3.563	4	3.444
Pot Cap-1 Maneuver	1122	-	-	1178	-	-	287	333	800	311	348	694
Stage 1	-	-	-	-	-	-	637	606	-	660	640	-
Stage 2	-	-	-	-	-	-	594	618	-	597	609	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1122	-	-	1178	-	-	188	307	800	246	321	694
Mov Cap-2 Maneuver	-	-	-	-	-	-	188	307	-	246	321	-
Stage 1	-	-	-	-	-	-	595	566	-	616	632	-
Stage 2	-	-	-	-	-	-	440	610	-	493	569	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.9	0.3	19.2	30.2
HCM LOS			C	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	322	1122	-	-	1178	-	-	375
HCM Lane V/C Ratio	0.216	0.066	-	-	0.013	-	-	0.64
HCM Control Delay (s)	19.2	8.4	-	-	8.1	-	-	30.2
HCM Lane LOS	C	A	-	-	A	-	-	D
HCM 95th %tile Q(veh)	0.8	0.2	-	-	0	-	-	4.3