

MEMORANDUM

To: Stephen O' Connell, PE
From: Jennifer Conley, PE, PTOE
Date: June 2, 2016
Project Name: Norfolk Traffic Impact Analysis
Project Number: 52779B
Subject: Study Findings

WSP|Parsons Brinckerhoff (PB) accessed the traffic impacts associated with the development of the 40 unit townhouse project proposed at 84 Cleveland Street in Norfolk, Massachusetts. The townhouses will be accessed via a new driveway that will intersect Cleveland Street at an unsignalized intersection.

The following traffic analysis concentrates on the weekday AM (7:00 AM to 9:00 AM) and weekday PM (4:00 PM to 6:00 PM) commuter peak periods, the critical time periods for a residential development. The analysis focuses on the intersection of Cleveland Street at Fruit Street and Cleveland Street and the proposed site driveway.

EXISTING CONDITIONS

As indicated above, the townhouses will be accessed via a single driveway that will intersect Cleveland Street from the south. In the vicinity of the site, Cleveland Street consists of a single lane in each direction separated by a double yellow center line.

Cleveland Street intersects Fruit Street forming a four-way intersection. At its intersection with Cleveland Street, Fruit Street is controlled by stop signs. Fruit Street consists of a single lane in each direction separated by a double yellow center line.

PB collected traffic volume data in May of 2016. An Automatic Traffic Recorder (ATR) collected traffic volumes for a 24-hour period on Wednesday, May 25, 2016 near the proposed site location. According to the ATR 2,560 vehicles passed by the proposed site (1,250 westbound and 1,310 eastbound). The weekday AM peak hour occurred from 7:00 to 8:00 AM when approximately 280 vehicles passed by the proposed site (45 westbound and 235 eastbound). The weekday PM peak hour occurred from 5:00 to 6:00 PM when approximately 240 vehicles passed by the proposed site (160 westbound and 80 eastbound). During the morning, the majority of traffic (80 percent) on Cleveland Street proceeded eastbound. During the evening, following commuting traffic patterns, the traffic reversed direction and the majority of traffic (65 percent proceeded westbound).

Turning Movement Counts (TMCs) were conducted at the intersection of Cleveland Street at Fruit Street during the AM peak (7:00 to 9:00 AM) and weekday PM (4:00 to 6:00 PM) peak periods. Data collected indicated that the weekday AM peak occurred between 7:00 to 8:00 AM and the weekday PM peak hour occurred between 5:00 to 6:00 PM.

In addition to traffic volume data, the ATR collected speed information. The 85th percentile speed or prevailing speed on Cleveland Street, was 41 mph from both the east and the west. The posted speed limit on Cleveland Street is 35 mph.

The traffic volumes collected in May 2016 were evaluated to determine monthly traffic variations. PB researched traffic volume data from MassDOT permanent count stations within the area to determine an appropriate seasonal traffic volume adjustment. Continuous counting data were taken from the closest permanent count stations; 6126, located on Interstate 495 in Franklin just south of Route 140 and 6127, located on Interstate 495 in Wrentham just north of Route 1A. Based on information from count station 6126, May traffic volumes are historically 2 percent higher than average month volumes. Based on 6127, May traffic volumes are historically 3 percent higher than average month volumes. To be conservative, no seasonal adjustment was made to the May traffic volumes. The 2016 Existing weekday AM and PM peak traffic volumes are included in the Appendix.

SITE RELATED TRAFFIC

PB calculated the net increase in traffic expected as a result of the proposed townhouse development. The trips associated with the proposed 40 townhouse units were calculated using the Institute of Transportation Engineer’s (ITE) Trip Generation Manual, 9th Edition, rates for Land Use Code (LUC) 230, Residential Condominium/Townhouse.

Table 1: ITE Trip Generation Summary – 40 Homes

Time Period	In	Out	Total
Weekday Daily	115	115	230
Weekday AM Peak Hour	3	15	18
Weekday PM Peak Hour	14	7	21

Note: Trip generation based on Trip Generation, 9th Edition, published by Institute of Transportation Engineers, 2012. Assumes 40 units of LUC 230, Residential Condominium/Townhouse.

As shown in Table 1, the proposed homes are expected to generation 230 vehicle trips over the course of a weekday. The project is anticipated to generate 18 vehicles trips (3 in and 15 out) during the weekday AM peak hour and 21 vehicles trips (14 in and 7 out) during the weekday PM peak hour.

The trip generation of the proposed subdivision was distributed through the study area based on existing traffic patterns, US Census Journey to Work information, and engineering judgment. Approximately 30 percent of the site traffic is expected to travel to and from points west of the site along Cleveland Street and the remaining 70 percent of the site traffic is expected to travel to and from points east of the site. The trip generation associated with the proposed residential development was added to the 2016 Existing condition peak hour traffic volumes to determine the 2016 Build condition peak hour traffic volumes. The 2016 Build weekday AM and weekday PM peak hours can be found in the Appendix.

INTERSECTION OPERATIONS

The traffic operations of the study area intersections were determined. Analysis was based on methodologies outlined in the Highway Capacity Manual (HCM). Level of Service (LOS) and delays were calculated and are summarized below.

LOS is a calculation of control delay for an intersection. It is an indication of driver discomfort, frustration, fuel consumption, and lost time. LOS is defined by an index from A (free flow) to F (long delays). LOS control delay values are given in Table 2.

For unsignalized intersections, delay values apply only to the controlled movements since the main street movements are not restricted. Control delay is the elapsed time for deceleration, queue time, stopped delay, and final acceleration. Average control delay for unsignalized intersections is a function of the capacity of the approach and the degree of saturation. Synchro 9 software was used as the analysis tool for determining the unsignalized LOS at the study area intersections. Synchro implements the methods of the Highway Capacity Manual to analyze intersection capacity and determine LOS.

Table 2: Level of Service Criteria

Level of Service	Average Delay (seconds)
	Unsignalized Intersections
A	≤ 10
B	>10 and ≤ 15
C	>15 and ≤ 25
D	>25 and ≤ 35
E	>35 and ≤ 50
F	>50

Source: Highway Capacity Manual

The LOS procedures described above were used to determine peak operating LOS at the study area intersections. The existing intersections and future site driveway intersection were analyzed. All backup calculations are provided in the Appendix.

The operations of the unsignalized intersections were determined. Table 3 summarizes the LOS and average delay per vehicle at the stop controlled approaches to unsignalized intersections.

Table 3: Unsignalized Intersections Operations Analysis Summary

	2016 Existing		2016 Build	
	LOS	Delay	LOS	Delay
Cleveland Street at Fruit Street				
Eastbound Left Turn				
AM Peak Hour	A	7.3	A	7.3
PM Peak Hour	A	7.5	A	7.6
Westbound Left Turn				
AM Peak Hour	A	7.9	A	7.9
PM Peak Hour	A	7.3	A	7.3
Southbound Approach				
AM Peak Hour	B	11.0	B	11.1
PM Peak Hour	B	10.7	B	10.8
Northbound Approach				
AM Peak Hour	B	11.5	B	11.6
PM Peak Hour	B	11.3	B	11.5
Cleveland Street at Site Drive				
Northbound Approach				
AM Peak Hour	N/A	N/A	B	10.0
PM Peak Hour	N/A	N/A	A	9.2
Westbound Left Turn				
AM Peak Hour	N/A	N/A	A	7.9
PM Peak Hour	N/A	N/A	A	7.4

LOS is Level of Service
 Delay is in seconds per vehicle

Following HCM guidelines, intersection operations analysis was performed at the intersection of Cleveland Street at Fruit Street and at Cleveland Street at the site access. The intersection of Cleveland Street at Fruit Street currently operates at LOS B or better during the weekday AM and weekday PM peak hours. With the addition of site related traffic, the intersection is anticipated to continue operating at LOS B or better with a less than one second increase in delay. The site access approach to Cleveland Street will operate at LOS B or better during the weekday AM and weekday PM peak hours.

STOPPING SIGHT DISTANCE

PB has reviewed the available sight lines approaching the proposed driveway to access the residential development and compared them to industry standards. PB measured the available sight lines approaching the site driveway.

The American Association of State Highway and Transportation Officials (AASHTO) calculates the requirements for Stopping Sight Distance (SSD). SSD is the critical measurement of sight lines as the distance a vehicle needs to come to a complete stop to avoid a collision when traveling at a certain speed. For a posted speed of 35 mph, the required SSD is 250 feet and for a speed of 40 mph, the required SSD is 305 feet.

Approaching the driveway from the east along Cleveland Street, a motorist can see an object on the site driveway from approximately 485 feet away. Approaching the driveway from the west along Cleveland Street, a motorist can see an object on the site driveway from approximately 398 feet away. The available SSD meets the 250 feet required approaching the site driveway based on the 35 mph speed limit from either direction.

As outlined above, the 85th percentile speed for vehicles approaching the site driveway is 41 mph from the east along Cleveland Street and 41 mph from the west along Cleveland Street. As indicted above, The SSD for vehicle traveling 41 mph is 316 feet. The available SSD meets the 316 feet required for vehicles approaching the site driveway at the prevailing speed of 41 mph in either direction.

CONCLUSIONS

The 40 townhouse development proposed on Cleveland Street will generate 18 trips during the weekday AM peak hour and 21 trips during the weekday PM peak hour. Although the posted speed was 35 mph, the prevailing travel speed was observed to be 41 miles per hour in both the directions. The stopping sight distance required for a vehicle to stop to avoid a collision is met at the proposed driveway location for both the posted and prevailing speed.

The site roadway intersection with Cleveland Street will operate at LOS B or better with ten seconds or less of delay for vehicles exiting the driveway. The intersection of Cleveland Street at Fruit Street currently operates at LOS B or better. With the addition of site related traffic the intersection is anticipated continue operating at LOS B or better with a less than one second increase in delay. Traffic along Cleveland Street will continue to operate with free flowing conditions.



PRECISION
D A T A
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Cleveland Street (near #84)
west of Fruit Street
City, State: Norfolk, MA
Client: WSP/Parsons Brinkerhoff/ A. Dally

165111 A Volume
Site Code: 52779B

Start Time	WB		EB		Combin ed		25-May- 16 Wed				
	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.					
12:00	3	24	1	18	4	42					
12:15	0	17	0	10	0	27					
12:30	3	17	0	12	3	29					
12:45	2	12	1	20	3	32	130				
01:00	0	13	0	16	0	29					
01:15	2	15	0	16	2	31					
01:30	1	14	0	9	1	23					
01:45	0	25	0	14	0	39	122				
02:00	0	14	0	15	0	29					
02:15	0	23	0	3	0	26					
02:30	0	22	0	19	0	41					
02:45	0	24	0	20	0	44	140				
03:00	0	29	0	17	0	46					
03:15	0	20	0	21	0	41					
03:30	0	31	0	13	0	44					
03:45	0	36	0	11	0	47	178				
04:00	0	35	1	10	1	45					
04:15	1	29	2	26	3	55					
04:30	0	26	2	21	2	47					
04:45	0	34	2	21	2	55	202				
05:00	0	39	3	16	3	55					
05:15	3	36	6	19	9	55					
05:30	1	31	9	23	10	54					
05:45	2	51	12	22	14	73	237				
06:00	3	30	15	17	18	47					
06:15	1	40	17	27	18	67					
06:30	6	36	48	11	54	47					
06:45	7	28	47	10	54	38	199				
07:00	10	21	64	8	74	29					
07:15	11	15	69	8	80	23					
07:30	9	20	53	6	62	26					
07:45	13	16	48	234	16	38	61	277	32	110	
08:00	19	18	46	14	65	32					
08:15	11	9	32	11	43	20					
08:30	20	10	31	9	51	19					
08:45	17	11	48	29	138	8	42	46	205	19	90
09:00	18	9	27	5	45	14					
09:15	23	8	23	3	46	11					
09:30	11	8	23	1	34	9					
09:45	14	8	33	17	90	2	11	31	156	10	44
10:00	8	1	24	4	32	5					
10:15	10	2	16	0	26	2					
10:30	11	6	16	0	27	6					
10:45	17	4	13	21	77	2	6	38	123	6	19
11:00	16	7	8	1	24	8					
11:15	19	5	11	2	30	7					
11:30	8	1	13	1	21	2					
11:45	16	1	14	13	45	4	8	29	104	5	22
Total	316	931	750	562	1066	1493					
Percent	29.6%	62.4%	70.4%	37.6%							
Day Total		1247		1312		2559					
Peak	08:30	-	05:00	-	07:00	-	05:30	-	-	-	-
Vol.	78	-	157	-	234	-	89	-	277	-	241
P.H.F.	0.848	-	0.770	-	0.848	-	0.824	-	0.866	-	0.825



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Cleveland Street (near #84)
west of Fruit Street
City, State: Norfolk, MA
Client: WSP/Parsons Brinkerhoff/ A. Dally

165111 A Class
Site Code: 52779B

WB	Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Total
	05/25/1														
	6	0	7	1	0	0	0	0	0	0	0	0	0	0	8
	01:00	0	3	0	0	0	0	0	0	0	0	0	0	0	3
	02:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	03:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	04:00	0	0	1	0	0	0	0	0	0	0	0	0	0	1
	05:00	0	4	2	0	0	0	0	0	0	0	0	0	0	6
	06:00	1	9	5	1	1	0	0	0	0	0	0	0	0	17
	07:00	0	28	11	1	2	1	0	0	0	0	0	0	0	43
	08:00	0	46	14	1	6	0	0	0	0	0	0	0	0	67
	09:00	1	41	16	1	3	1	1	2	0	0	0	0	0	66
	10:00	1	29	9	1	3	3	0	0	0	0	0	0	0	46
	11:00	0	37	17	1	4	0	0	0	0	0	0	0	0	59
	12 PM	1	46	17	0	5	1	0	0	0	0	0	0	0	70
	13:00	1	48	17	0	1	0	0	0	0	0	0	0	0	67
	14:00	1	50	26	2	2	0	0	2	0	0	0	0	0	83
	15:00	0	75	24	4	12	0	0	1	0	0	0	0	0	116
	16:00	4	88	25	1	6	0	0	0	0	0	0	0	0	124
	17:00	1	120	31	0	4	0	0	1	0	0	0	0	0	157
	18:00	4	98	29	0	3	0	0	0	0	0	0	0	0	134
	19:00	0	57	9	0	6	0	0	0	0	0	0	0	0	72
	20:00	0	39	7	0	2	0	0	0	0	0	0	0	0	48
	21:00	0	30	1	0	2	0	0	0	0	0	0	0	0	33
	22:00	0	13	0	0	0	0	0	0	0	0	0	0	0	13
	23:00	0	14	0	0	0	0	0	0	0	0	0	0	0	14
	Total	15	882	262	13	62	6	1	6	0	0	0	0	0	1247
	Percent	1.2%	70.7%	21.0%	1.0%	5.0%	0.5%	0.1%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	
	AM Peak	06:00	08:00	11:00	06:00	08:00	10:00	09:00	09:00						08:00
	Vol.	1	46	17	1	6	3	1	2						67
	PM Peak	16:00	17:00	17:00	15:00	15:00	12:00		14:00						17:00
	Vol.	4	120	31	4	12	1		2						157



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Cleveland Street (near #84)
west of Fruit Street
City, State: Norfolk, MA
Client: WSP/Parsons Brinkerhoff/ A. Dally

165111 A Class
Site Code: 52779B

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Total
05/25/1														
6	0	2	0	0	0	0	0	0	0	0	0	0	0	2
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00	0	5	2	0	0	0	0	0	0	0	0	0	0	7
05:00	0	25	5	0	0	0	0	0	0	0	0	0	0	30
06:00	0	99	23	1	4	0	0	0	0	0	0	0	0	127
07:00	0	197	30	1	3	0	0	3	0	0	0	0	0	234
08:00	2	105	23	3	4	1	0	0	0	0	0	0	0	138
09:00	0	70	15	1	2	2	0	0	0	0	0	0	0	90
10:00	0	56	15	0	4	2	0	0	0	0	0	0	0	77
11:00	0	36	8	0	1	0	0	0	0	0	0	0	0	45
12 PM	0	42	15	0	2	0	0	1	0	0	0	0	0	60
13:00	0	42	12	0	1	0	0	0	0	0	0	0	0	55
14:00	0	47	9	0	0	1	0	0	0	0	0	0	0	57
15:00	1	45	13	0	3	0	0	0	0	0	0	0	0	62
16:00	2	59	16	0	1	0	0	0	0	0	0	0	0	78
17:00	2	65	12	0	0	0	0	1	0	0	0	0	0	80
18:00	0	53	10	0	1	0	0	1	0	0	0	0	0	65
19:00	1	34	3	0	0	0	0	0	0	0	0	0	0	38
20:00	0	35	6	0	1	0	0	0	0	0	0	0	0	42
21:00	0	9	2	0	0	0	0	0	0	0	0	0	0	11
22:00	0	5	1	0	0	0	0	0	0	0	0	0	0	6
23:00	0	7	1	0	0	0	0	0	0	0	0	0	0	8
Total	8	1038	221	6	27	6	0	6	0	0	0	0	0	1312
Percent	0.6%	79.1%	16.8%	0.5%	2.1%	0.5%	0.0%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	
AM Peak	08:00	07:00	07:00	08:00	06:00	09:00		07:00						07:00
Vol.	2	197	30	3	4	2		3						234
PM Peak	16:00	17:00	16:00		15:00	14:00		12:00						17:00
Vol.	2	65	16		3	1		1						80

Cleveland Street (near #84)
 west of Fruit Street
 City, State: Norfolk, MA
 Client: WSP/Parsons Brinkerhoff/ A. Dally



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165111 A Speed
 Site Code: 52779B

WB	Start Time	14	15	19	20	24	25	29	30	34	35	39	40	44	45	49	50	54	55	59	60	64	65	69	70	9999	Total	85th % ile	Ave Speed	
05/25/	16	0	0	0	0	0	0	0	0	2	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	43	41	
	01:00	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	3	56	42	
	02:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	*	
	03:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	*	
	04:00	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	43	42	
	05:00	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	42	40	
	06:00	0	0	0	2	0	3	10	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	38	35	
	07:00	0	0	0	0	1	14	15	10	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43	42	37	
	08:00	0	1	1	6	17	30	10	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	67	39	35	
	09:00	0	0	1	7	15	29	13	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	66	40	36	
	10:00	0	3	0	3	13	21	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46	38	34	
	11:00	0	1	1	5	16	29	6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	59	38	35	
	12 PM	1	1	3	2	18	34	10	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	70	39	35	
	13:00	0	0	1	4	16	31	10	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	67	41	36	
	14:00	0	0	0	0	16	48	15	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	83	41	37	
	15:00	0	0	2	5	32	47	24	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	116	41	36	
	16:00	0	1	1	1	19	71	24	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	124	41	37	
	17:00	0	0	0	5	38	77	34	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	157	40	37	
	18:00	0	0	2	2	20	78	26	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	134	41	37	
	19:00	0	0	0	4	17	32	14	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	72	41	37	
	20:00	0	1	0	2	12	23	8	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	48	40	36	
	21:00	0	0	1	0	4	21	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	41	37	
	22:00	0	0	1	0	2	5	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	46	39	
	23:00	0	0	0	0	4	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	41	37	
	Total	1	8	16	47	277	612	232	51	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1247			
	%	0.1%	0.6%	1.3%	3.8%	22.2%	49.1%	18.6%	4.1%	0.1%	0.1%	0.0%	0.0%	0.1%																
AM Peak			10:00	06:00	09:00	08:00	08:00	09:00	07:00																			08:00		
Vol.			3	2	7	17	30	13	3																			67		
PM Peak	12:00	12:00	12:00	15:00	17:00	18:00	17:00	16:00	22:00																		13:00	17:00		
Vol.	1	1	3	5	38	78	34	7	1																		1	157		

Stats

15th Percentile : 31 MPH
 50th Percentile : 36 MPH
 85th Percentile : 41 MPH
 95th Percentile : 43 MPH

Mean Speed(Average) : 37 MPH
 10 MPH Pace Speed : 30-39 MPH
 Number in Pace : 889
 Percent in Pace : 71.3%
 Number of Vehicles > 35 MPH : 776
 Percent of Vehicles > 35 MPH : 62.2%



PRECISION
D A T A
INDUSTRIES, LLC

46 Morton Street, Framingham, MA 01702
Office: 508-875-0100 Fax: 508-875-0118
Email: datarequests@pdillc.com

Cleveland Street (near #84)
west of Fruit Street
City, State: Norfolk, MA
Client: WSP/Parsons Brinkerhoff/ A. Dally

165111 A Speed
Site Code: 52779B

Start Time	1	15	20	25	30	35	40	45	50	55	60	65	70	Total	85th %ile	Ave Speed
	14	19	24	29	34	39	44	49	54	59	64	69	9999			
05/25/																
16	0	0	0	0	0	2	0	0	0	0	0	0	0	2	38	37
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	*
02:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	*
03:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	*
04:00	0	0	0	0	1	3	0	2	1	0	0	0	0	7	48	41
05:00	0	0	0	0	6	13	10	1	0	0	0	0	0	30	42	38
06:00	0	0	0	1	23	61	37	5	0	0	0	0	0	127	42	38
07:00	0	0	2	6	45	111	66	4	0	0	0	0	0	234	41	37
08:00	0	0	0	9	37	57	33	2	0	0	0	0	0	138	41	36
09:00	0	0	2	6	25	39	15	3	0	0	0	0	0	90	40	36
10:00	0	1	5	4	22	37	7	1	0	0	0	0	0	77	38	34
11:00	0	0	1	3	12	18	9	2	0	0	0	0	0	45	41	36
12 PM	0	0	2	0	22	28	7	1	0	0	0	0	0	60	38	35
13:00	0	0	1	1	15	24	11	3	0	0	0	0	0	55	41	37
14:00	0	0	0	2	16	28	10	0	1	0	0	0	0	57	40	36
15:00	0	0	1	2	17	25	16	1	0	0	0	0	0	62	41	37
16:00	0	0	0	5	20	42	11	0	0	0	0	0	0	78	38	36
17:00	0	1	0	4	15	36	20	3	1	0	0	0	0	80	41	37
18:00	0	0	0	8	16	32	7	2	0	0	0	0	0	65	38	35
19:00	0	0	1	2	10	15	9	1	0	0	0	0	0	38	41	36
20:00	0	0	0	3	14	20	5	0	0	0	0	0	0	42	38	35
21:00	0	0	0	1	2	7	1	0	0	0	0	0	0	11	38	36
22:00	0	0	0	0	2	2	1	1	0	0	0	0	0	6	44	38
23:00	0	0	0	0	5	2	1	0	0	0	0	0	0	8	38	35
Total	0	2	15	57	325	602	276	32	3	0	0	0	0	1312		
%	0.0%	0.2%	1.1%	4.3%	24.8%	45.9%	21.0%	2.4%	0.2%	0.0%	0.0%	0.0%	0.0%			
AM Peak		10:00	10:00	08:00	07:00	07:00	07:00	06:00	04:00					07:00		
Vol.		1	5	9	45	111	66	5	1					234		
PM Peak		17:00	12:00	18:00	12:00	16:00	17:00	13:00	14:00					17:00		
Vol.		1	2	8	22	42	20	3	1					80		

Stats

15th Percentile : 30 MPH
 50th Percentile : 36 MPH
 85th Percentile : 41 MPH
 95th Percentile : 43 MPH

Mean Speed(Average) : 36 MPH
 10 MPH Pace Speed : 30-39 MPH
 Number in Pace : 927
 Percent in Pace : 70.7%
 Number of Vehicles > 35 MPH : 793
 Percent of Vehicles > 35 MPH : 60.4%



PRECISION
D A T A
INDUSTRIES, LLC

46 Morton Street, Framingham, MA 01702
Office: 508-875-0100 Fax: 508-875-0118
Email: datarequests@pdilic.com

N/S: Friut Street
E/W: Cleveland Street
City, State: Norfolk, MA
Client: WSP/Parsons Brinckerhoff/A.Dally

File Name : 165111 A
Site Code : 52779B
Start Date : 5/25/2016
Page No : 1

Groups Printed- Cars - Heavy Vehicles

Start Time	Fruit Street From North				Cleveland Street From East				Fruit Street From South				Cleveland Street From West				Int. Total
	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	
07:00 AM	5	15	1	0	0	4	0	0	0	7	0	0	3	57	1	0	93
07:15 AM	3	9	1	0	0	6	0	0	0	2	1	0	6	63	2	0	93
07:30 AM	5	7	2	0	0	5	0	0	0	3	0	0	6	48	2	0	78
07:45 AM	5	7	0	1	1	6	0	0	0	6	2	0	1	43	5	0	77
Total	18	38	4	1	1	21	0	0	0	18	3	0	16	211	10	0	341
08:00 AM	5	8	3	0	1	12	0	0	1	2	2	0	1	41	2	0	78
08:15 AM	5	10	3	0	0	6	0	0	0	4	1	0	4	23	8	0	64
08:30 AM	4	13	1	0	0	13	0	0	0	5	1	0	3	24	6	0	70
08:45 AM	7	9	1	0	0	9	0	0	0	2	0	0	2	20	6	0	56
Total	21	40	8	0	1	40	0	0	1	13	4	0	10	108	22	0	268
Grand Total	39	78	12	1	2	61	0	0	1	31	7	0	26	319	32	0	609
Apprch %	30	60	9.2	0.8	3.2	96.8	0	0	2.6	79.5	17.9	0	6.9	84.6	8.5	0	
Total %	6.4	12.8	2	0.2	0.3	10	0	0	0.2	5.1	1.1	0	4.3	52.4	5.3	0	
Cars	36	76	12	1	0	60	0	0	1	28	7	0	26	313	29	0	589
% Cars	92.3	97.4	100	100	0	98.4	0	0	100	90.3	100	0	100	98.1	90.6	0	96.7
Heavy Vehicles	3	2	0	0	2	1	0	0	0	3	0	0	0	6	3	0	20
% Heavy Vehicles	7.7	2.6	0	0	100	1.6	0	0	0	9.7	0	0	0	1.9	9.4	0	3.3

Start Time	Fruit Street From North					Cleveland Street From East					Fruit Street From South					Cleveland Street From West					Int. Total
	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	
07:00 AM	5	15	1	0	21	0	4	0	0	4	0	7	0	0	7	3	57	1	0	61	93
07:15 AM	3	9	1	0	13	0	6	0	0	6	0	2	1	0	3	6	63	2	0	71	93
07:30 AM	5	7	2	0	14	0	5	0	0	5	0	3	0	0	3	6	48	2	0	56	78
07:45 AM	5	7	0	1	13	1	6	0	0	7	0	6	2	0	8	1	43	5	0	49	77
Total Volume	18	38	4	1	61	1	21	0	0	22	0	18	3	0	21	16	211	10	0	237	341
% App. Total	29.5	62.3	6.6	1.6		4.5	95.5	0	0		0	85.7	14.3	0		6.8	89	4.2	0		
PHF	.900	.633	.500	.250	.726	.250	.875	.000	.000	.786	.000	.643	.375	.000	.656	.667	.837	.500	.000	.835	.917
Cars	17	38	4	1	60	0	20	0	0	20	0	17	3	0	20	16	209	10	0	235	335
% Cars	94.4	100	100	100	98.4	0	95.2	0	0	90.9	0	94.4	100	0	95.2	100	99.1	100	0	99.2	98.2
Heavy Vehicles	1	0	0	0	1	1	1	0	0	2	0	1	0	0	1	0	2	0	0	2	6
% Heavy Vehicles	5.6	0	0	0	1.6	100	4.8	0	0	9.1	0	5.6	0	0	4.8	0	0.9	0	0	0.8	1.8

Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 07:00 AM



PRECISION
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INDUSTRIES, LLC

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N/S: Friut Street
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Client: WSP/Parsons Brinckerhoff/A.Dally

File Name : 165111 A
Site Code : 52779B
Start Date : 5/25/2016
Page No : 1

Groups Printed- Heavy Vehicles

Start Time	Fruit Street From North				Cleveland Street From East				Fruit Street From South				Cleveland Street From West				Int. Total	
	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn		
07:00 AM	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
07:30 AM	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	2
07:45 AM	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	2
Total	1	0	0	0	1	1	0	0	0	1	0	0	0	2	0	0	0	6
08:00 AM	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	3
08:15 AM	0	0	0	0	0	0	0	0	0	1	0	0	0	2	2	0	0	5
08:30 AM	2	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	5
08:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Total	2	2	0	0	1	0	0	0	0	2	0	0	0	4	3	0	0	14
Grand Total	3	2	0	0	2	1	0	0	0	3	0	0	0	6	3	0	0	20
Apprch %	60	40	0	0	66.7	33.3	0	0	0	100	0	0	0	66.7	33.3	0	0	
Total %	15	10	0	0	10	5	0	0	0	15	0	0	0	30	15	0	0	

Start Time	Fruit Street From North					Cleveland Street From East					Fruit Street From South					Cleveland Street From West					Int. Total
	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:45 AM																					
07:45 AM	0	0	0	0	0	1	0	0	0	1	0	1	0	0	1	0	0	0	0	0	2
08:00 AM	0	0	0	0	0	1	0	0	0	1	0	1	0	0	1	0	1	0	0	1	3
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	2	2	0	4	5
08:30 AM	2	2	0	0	4	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	5
Total Volume	2	2	0	0	4	2	0	0	0	2	0	3	0	0	3	0	4	2	0	6	15
% App. Total	50	50	0	0		100	0	0	0		0	100	0	0		0	66.7	33.3	0		
PHF	.250	.250	.000	.000	.250	.500	.000	.000	.000	.500	.000	.750	.000	.000	.750	.000	.500	.250	.000	.375	.750



PRECISION
D A T A
INDUSTRIES, LLC

46 Morton Street, Framingham, MA 01702
Office: 508-875-0100 Fax: 508-875-0118
Email: datarequests@pdillc.com

N/S: Friut Street
E/W: Cleveland Street
City, State: Norfolk, MA
Client: WSP/Parsons Brinckerhoff/A.Dally

File Name : 165111 AA
Site Code : 52779B
Start Date : 5/25/2016
Page No : 1

Groups Printed- Cars - Heavy Vehicles

Start Time	Fruit Street From North				Cleveland Street From East				Fruit Street From South				Cleveland Street From West				Int. Total
	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	
04:00 PM	8	6	1	0	0	26	0	0	0	8	0	0	1	6	3	0	59
04:15 PM	4	6	0	0	1	26	0	0	1	9	0	0	3	14	7	0	71
04:30 PM	4	5	0	0	2	22	0	0	1	4	0	0	1	13	6	0	58
04:45 PM	4	4	1	0	1	25	0	0	0	4	3	0	0	15	7	0	64
Total	20	21	2	0	4	99	0	0	2	25	3	0	5	48	23	0	252
05:00 PM	4	6	1	0	0	33	0	0	0	7	4	0	2	9	3	0	69
05:15 PM	3	6	2	0	3	26	0	0	0	8	2	0	2	12	4	1	69
05:30 PM	7	13	1	0	2	22	0	0	0	5	2	0	2	11	8	0	73
05:45 PM	8	6	2	0	2	35	0	0	0	7	3	0	1	12	9	0	85
Total	22	31	6	0	7	116	0	0	0	27	11	0	7	44	24	1	296
Grand Total	42	52	8	0	11	215	0	0	2	52	14	0	12	92	47	1	548
Apprch %	41.2	51	7.8	0	4.9	95.1	0	0	2.9	76.5	20.6	0	7.9	60.5	30.9	0.7	
Total %	7.7	9.5	1.5	0	2	39.2	0	0	0.4	9.5	2.6	0	2.2	16.8	8.6	0.2	
Cars	41	51	8	0	11	210	0	0	2	51	14	0	12	91	47	1	539
% Cars	97.6	98.1	100	0	100	97.7	0	0	100	98.1	100	0	100	98.9	100	100	98.4
Heavy Vehicles	1	1	0	0	0	5	0	0	0	1	0	0	0	1	0	0	9
% Heavy Vehicles	2.4	1.9	0	0	0	2.3	0	0	0	1.9	0	0	0	1.1	0	0	1.6

Start Time	Fruit Street From North					Cleveland Street From East					Fruit Street From South					Cleveland Street From West					Int. Total
	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	4	6	1	0	11	0	33	0	0	33	0	7	4	0	11	2	9	3	0	14	69
05:15 PM	3	6	2	0	11	3	26	0	0	29	0	8	2	0	10	2	12	4	1	19	69
05:30 PM	7	13	1	0	21	2	22	0	0	24	0	5	2	0	7	2	11	8	0	21	73
05:45 PM	8	6	2	0	16	2	35	0	0	37	0	7	3	0	10	1	12	9	0	22	85
Total Volume	22	31	6	0	59	7	116	0	0	123	0	27	11	0	38	7	44	24	1	76	296
% App. Total	37.3	52.5	10.2	0		5.7	94.3	0	0		0	71.1	28.9	0		9.2	57.9	31.6	1.3		
PHF	.688	.596	.750	.000	.702	.583	.829	.000	.000	.831	.000	.844	.688	.000	.864	.875	.917	.667	.250	.864	.871
Cars	22	31	6	0	59	7	115	0	0	122	0	26	11	0	37	7	44	24	1	76	294
% Cars	100	100	100	0	100	100	99.1	0	0	99.2	0	96.3	100	0	97.4	100	100	100	100	100	99.3
Heavy Vehicles	0	0	0	0	0	0	1	0	0	1	0	1	0	0	1	0	0	0	0	0	2
% Heavy Vehicles	0	0	0	0	0	0	0.9	0	0	0.8	0	3.7	0	0	2.6	0	0	0	0	0	0.7



PRECISION
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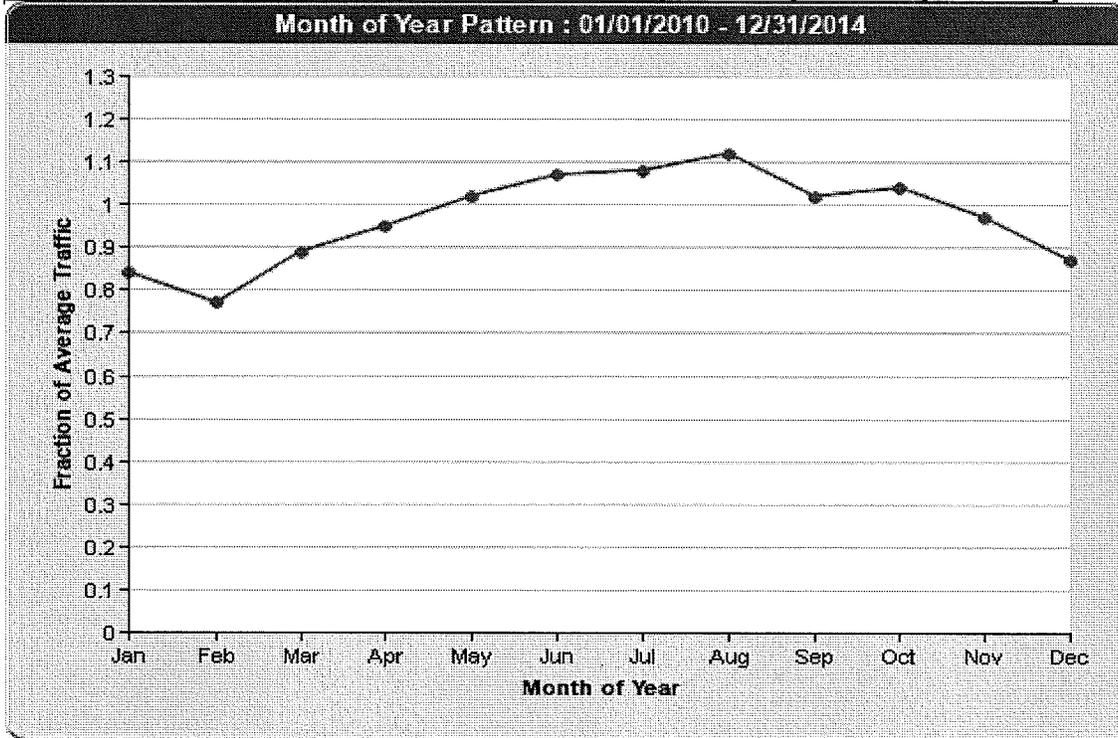
File Name : 165111 AA
Site Code : 52779B
Start Date : 5/25/2016
Page No : 1

Groups Printed- Heavy Vehicles

Start Time	Fruit Street From North				Cleveland Street From East				Fruit Street From South				Cleveland Street From West				Int. Total	
	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn		
04:00 PM	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
04:15 PM	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2
04:30 PM	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Total	1	1	0	0	0	4	0	0	0	0	0	0	0	1	0	0	0	7
05:00 PM	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Total	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	2
Grand Total	1	1	0	0	0	5	0	0	0	0	1	0	0	0	1	0	0	9
Apprch %	50	50	0	0	0	100	0	0	0	0	100	0	0	0	100	0	0	
Total %	11.1	11.1	0	0	0	55.6	0	0	0	0	11.1	0	0	0	11.1	0	0	

Start Time	Fruit Street From North					Cleveland Street From East					Fruit Street From South					Cleveland Street From West					Int. Total
	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:00 PM																					
04:00 PM	1	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	2
04:15 PM	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	2
04:30 PM	0	1	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	2
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
Total Volume	1	1	0	0	2	0	4	0	0	4	0	0	0	0	0	0	1	0	0	1	7
% App. Total	50	50	0	0		0	100	0	0		0	0	0	0		0	100	0	0		
PHF	.250	.250	.000	.000	.500	.000	.500	.000	.000	.500	.000	.000	.000	.000	.000	.000	.250	.000	.000	.250	.875

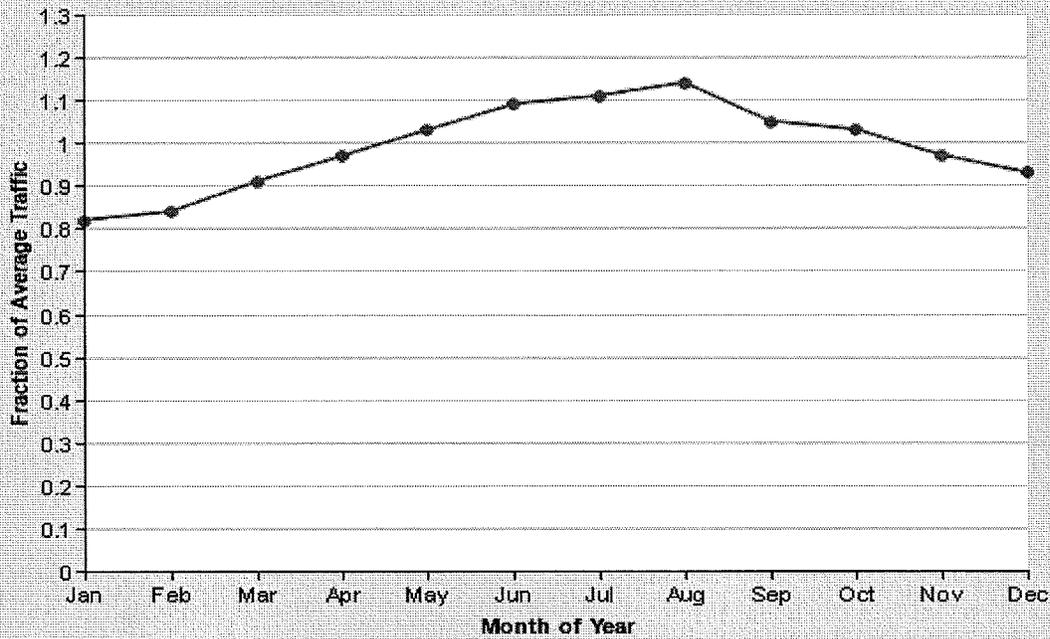
Loc ID	County	Community	On	From	To	At	Dir
6126	NORFOLK	FRANKLIN	INTERSTAT E 495			RAMP-RT 495 NB TO RT 140	2-WAY



Month of Year	Average	Fraction
January	66,944	0.84
February	62,034	0.77
March	71,102	0.89
April	76,171	0.95
May	81,624	1.02
June	85,948	1.07
July	86,427	1.08
August	89,730	1.12
September	81,563	1.02
October	82,934	1.04
November	77,765	0.97
December	69,368	0.87

Loc ID	County	Community	On	From	To	At	Dir
6127	NORFOLK	WRENTHAM	INTERSTAT E 495			RTE.1A	2-WAY

Month of Year Pattern : 01/01/2010 - 12/31/2014



Month of Year	Average	Fraction
January	65,654	0.82
February	67,784	0.84
March	73,111	0.91
April	78,198	0.97
May	82,664	1.03
June	87,447	1.09
July	88,897	1.11
August	91,492	1.14
September	84,454	1.05
October	82,731	1.03
November	78,000	0.97
December	74,274	0.93

TRIP GENERATION WORKSHEET

x= 40 units

LUC: Residential Condominium/Townhouse (230)

WEEKDAY

Average Rate = 5.81
 Total Trips = 232.4

Fitted Curve Equation = $\text{Ln}(T) = 0.870 * \text{Ln}(X) + 2.46$
 Total Trips = 289.84

AM PEAK HOUR of ADJACENT STREET

Average Rate = 0.44
 Total Trips = 17.6
 17% of Trips In = 3
 83% of Trips Out = 15

Fitted Curve Equation = $\text{Ln}(T) = 0.80 * \text{Ln}(X) + 0.26$
 Total Trips = 24.81
 17% of Trips In = 4
 83% of Trips Out = 21

PM PEAK HOUR of ADJACENT STREET

Average Rate = 0.52
 Total Trips = 20.8
 67% of Trips In = 14
 33% of Trips Out = 7

Fitted Curve Equation = $\text{Ln}(T) = 0.82 * \text{Ln}(X) + 0.32$
 Total Trips = 28.36
 67% of Trips In = 19
 33% of Trips Out = 9

AM PEAK HOUR of GENERATOR

Average Rate = 0.44
 Total Trips = 17.6
 19% of Trips In = 3
 81% of Trips Out = 14

Fitted Curve Equation = $\text{Ln}(T) = 0.82 * \text{Ln}(X) + 0.15$
 Total Trips = 23.92
 19% of Trips In = 5
 81% of Trips Out = 19

PM PEAK HOUR of GENERATOR

Average Rate = 0.52
 Total Trips = 20.8
 64% of Trips In = 13
 36% of Trips Out = 7

Fitted Curve Equation = $T = 0.34(X) + 35.87$
 Total Trips = 49.47
 64% of Trips In = 32
 36% of Trips Out = 18

SATURDAY

Average Rate = 5.67
 Total Trips = 226.8

Fitted Curve Equation = $T = 3.62(X) + 427.93$
 Total Trips = 572.73

PEAK HOUR of GENERATOR

Average Rate = 0.47
 Total Trips = 18.8
 54% of Trips In = 10
 46% of Trips Out = 9

Fitted Curve Equation = $T = 0.29(X) + 42.63$
 Total Trips = 54.23
 54% of Trips In = 29
 46% of Trips Out = 25

SUNDAY

Average Rate = 4.84
 Total Trips = 193.6

Fitted Curve Equation = $T = 3.13(X) + 357.26$
 Total Trips = 482.46

PEAK HOUR of GENERATOR

Average Rate = 0.45
 Total Trips = 18
 49% of Trips In = 9
 51% of Trips Out = 9

Fitted Curve Equation = $T = 0.23(X) + 50.01$
 Total Trips = 59.21
 49% of Trips In = 29
 51% of Trips Out = 30

ITE TRIP GENERATION

9TH EDITION



**Residence MCD/County to Workplace MCD/County Flows for Massachusetts: 2000
Sorted by Residence State-County, or State-County-County Subdivision (in 12 states)**

Residence State-County-MCD Name	Workplace State-County-MCD Name	Count	Left on Cleveland Street	Right on Cleveland Street
Norfolk town Norfolk Co. MA	Ada Co. ID	6	0	0
Norfolk town Norfolk Co. MA	Prince George's Co. MD	8	0	0
Norfolk town Norfolk Co. MA	Attleboro city Bristol Co. MA	29	15	15
Norfolk town Norfolk Co. MA	Dartmouth town Bristol Co. MA	12	6	6
Norfolk town Norfolk Co. MA	Easton town Bristol Co. MA	7	7	0
Norfolk town Norfolk Co. MA	Fall River city Bristol Co. MA	6	3	3
Norfolk town Norfolk Co. MA	Mansfield town Bristol Co. MA	95	48	48
Norfolk town Norfolk Co. MA	North Attlebor. town Bristol Co. MA	5	3	3
Norfolk town Norfolk Co. MA	Taunton city Bristol Co. MA	6	3	3
Norfolk town Norfolk Co. MA	Andover town Essex Co. MA	5	3	3
Norfolk town Norfolk Co. MA	Lawrence city Essex Co. MA	8	4	4
Norfolk town Norfolk Co. MA	Wenham town Essex Co. MA	14	0	14
Norfolk town Norfolk Co. MA	Bedford town Middlesex Co. MA	46	0	46
Norfolk town Norfolk Co. MA	Billerica town Middlesex Co. MA	6	0	6
Norfolk town Norfolk Co. MA	Burlington town Middlesex Co. MA	25	0	25
Norfolk town Norfolk Co. MA	Cambridge city Middlesex Co. MA	39	0	39
Norfolk town Norfolk Co. MA	Chelmsford town Middlesex Co. MA	4	2	2
Norfolk town Norfolk Co. MA	Concord town Middlesex Co. MA	7	0	7
Norfolk town Norfolk Co. MA	Everett city Middlesex Co. MA	7	0	7
Norfolk town Norfolk Co. MA	Framingham town Middlesex Co. MA	97	49	49
Norfolk town Norfolk Co. MA	Holliston town Middlesex Co. MA	89	89	0
Norfolk town Norfolk Co. MA	Hopkinton town Middlesex Co. MA	37	37	0
Norfolk town Norfolk Co. MA	Lowell city Middlesex Co. MA	12	6	6
Norfolk town Norfolk Co. MA	Malden city Middlesex Co. MA	22	11	11
Norfolk town Norfolk Co. MA	Marlbor. city Middlesex Co. MA	46	46	0
Norfolk town Norfolk Co. MA	Medford city Middlesex Co. MA	7	0	7
Norfolk town Norfolk Co. MA	Natick town Middlesex Co. MA	114	57	57
Norfolk town Norfolk Co. MA	Newton city Middlesex Co. MA	100	0	100
Norfolk town Norfolk Co. MA	Sudbury town Middlesex Co. MA	10	0	10
Norfolk town Norfolk Co. MA	Tewksbury town Middlesex Co. MA	5	3	3
Norfolk town Norfolk Co. MA	Waltham city Middlesex Co. MA	106	0	106
Norfolk town Norfolk Co. MA	Watertown city Middlesex Co. MA	6	0	6
Norfolk town Norfolk Co. MA	Westford town Middlesex Co. MA	14	7	7
Norfolk town Norfolk Co. MA	Weston town Middlesex Co. MA	5	0	5
Norfolk town Norfolk Co. MA	Wilmington town Middlesex Co. MA	5	0	5
Norfolk town Norfolk Co. MA	Woburn city Middlesex Co. MA	8	0	8
Norfolk town Norfolk Co. MA	Nantucket town Nantucket Co. MA	9	5	5
Norfolk town Norfolk Co. MA	Bellingham town Norfolk Co. MA	23	23	0
Norfolk town Norfolk Co. MA	Braintree town Norfolk Co. MA	41	0	41
Norfolk town Norfolk Co. MA	Brookline town Norfolk Co. MA	20	0	20
Norfolk town Norfolk Co. MA	Canton town Norfolk Co. MA	89	0	89
Norfolk town Norfolk Co. MA	Dedham town Norfolk Co. MA	56	0	56
Norfolk town Norfolk Co. MA	Dover town Norfolk Co. MA	28	0	28
Norfolk town Norfolk Co. MA	Foxbor. town Norfolk Co. MA	83	42	42
Norfolk town Norfolk Co. MA	Franklin city Norfolk Co. MA	246	246	0
Norfolk town Norfolk Co. MA	Medfield town Norfolk Co. MA	108	0	108
Norfolk town Norfolk Co. MA	Medway town Norfolk Co. MA	25	13	13
Norfolk town Norfolk Co. MA	Millis town Norfolk Co. MA	59	30	30
Norfolk town Norfolk Co. MA	Milton town Norfolk Co. MA	10	0	10
Norfolk town Norfolk Co. MA	Needham town Norfolk Co. MA	148	0	148

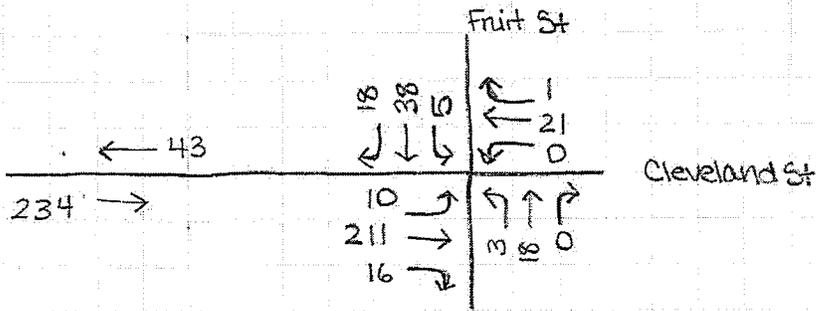
**Residence MCD/County to Workplace MCD/County Flows for Massachusetts: 2000
Sorted by Residence State-County, or State-County-County Subdivision (in 12 states)**

Residence State-County-MCD Name	Workplace State-County-MCD Name	Count	Left on Cleveland Street	Right on Cleveland Street
Norfolk town Norfolk Co. MA	Norfolk town Norfolk Co. MA	635	125	508
Norfolk town Norfolk Co. MA	Norwood town Norfolk Co. MA	226	0	226
Norfolk town Norfolk Co. MA	Plainville town Norfolk Co. MA	18	18	0
Norfolk town Norfolk Co. MA	Quincy city Norfolk Co. MA	52	0	52
Norfolk town Norfolk Co. MA	Randolph town Norfolk Co. MA	18	0	18
Norfolk town Norfolk Co. MA	Sharon town Norfolk Co. MA	24	0	24
Norfolk town Norfolk Co. MA	Stoughton town Norfolk Co. MA	39	0	39
Norfolk town Norfolk Co. MA	Walpole town Norfolk Co. MA	144	0	144
Norfolk town Norfolk Co. MA	Wellesley town Norfolk Co. MA	58	0	58
Norfolk town Norfolk Co. MA	Westwood town Norfolk Co. MA	59	0	59
Norfolk town Norfolk Co. MA	Weymouth town Norfolk Co. MA	25	0	25
Norfolk town Norfolk Co. MA	Wrentham town Norfolk Co. MA	136	68	68
Norfolk town Norfolk Co. MA	Bridgewater town Plymouth Co. MA	19	10	10
Norfolk town Norfolk Co. MA	Brockton city Plymouth Co. MA	22	0	22
Norfolk town Norfolk Co. MA	East Bridgewater town Plymouth Co. MA	9	5	5
Norfolk town Norfolk Co. MA	Kingston town Plymouth Co. MA	10	0	10
Norfolk town Norfolk Co. MA	Lakeville town Plymouth Co. MA	7	4	4
Norfolk town Norfolk Co. MA	Rockland town Plymouth Co. MA	8	0	8
Norfolk town Norfolk Co. MA	Boston city Suffolk Co. MA	629	0	629
Norfolk town Norfolk Co. MA	Chelsea city Suffolk Co. MA	9	0	9
Norfolk town Norfolk Co. MA	Auburn town Worcester Co. MA	8	4	4
Norfolk town Norfolk Co. MA	Fitchburg city Worcester Co. MA	6	6	0
Norfolk town Norfolk Co. MA	Hopedale town Worcester Co. MA	13	13	0
Norfolk town Norfolk Co. MA	Milford town Worcester Co. MA	24	24	0
Norfolk town Norfolk Co. MA	Northbor. town Worcester Co. MA	10	10	0
Norfolk town Norfolk Co. MA	Royalston town Worcester Co. MA	8	8	0
Norfolk town Norfolk Co. MA	Southbor. town Worcester Co. MA	5	5	0
Norfolk town Norfolk Co. MA	Sturbridge town Worcester Co. MA	6	3	3
Norfolk town Norfolk Co. MA	Upton town Worcester Co. MA	6	6	0
Norfolk town Norfolk Co. MA	Westbor. town Worcester Co. MA	20	20	0
Norfolk town Norfolk Co. MA	Winchendon town Worcester Co. MA	11	11	0
Norfolk town Norfolk Co. MA	Worcester city Worcester Co. MA	19	19	0
Norfolk town Norfolk Co. MA	Jackson Co. MO	12	0	0
Norfolk town Norfolk Co. MA	Manhattan bor. New York Co. NY	13	0	0
Norfolk town Norfolk Co. MA	Warwick city Kent Co. RI	13	13	0
Norfolk town Norfolk Co. MA	West Greenwich town Kent Co. RI	19	19	0
Norfolk town Norfolk Co. MA	Lincoln town Providence Co. RI	6	6	0
Norfolk town Norfolk Co. MA	Providence city Providence Co. RI	21	11	11
Norfolk town Norfolk Co. MA	Smithfield town Providence Co. RI	8	8	0
Norfolk town Norfolk Co. MA	Fitchburg city Dane Co. WI	10	0	0

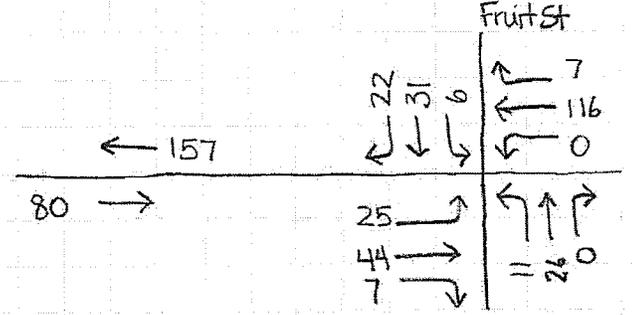
Left	Right	Total
1174	3137	4310
27.23%	72.77%	
27%	73%	

52779 Norfolk

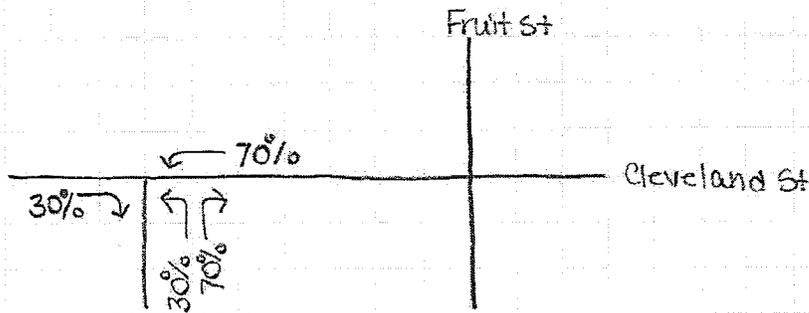
2016 Existing Condition
AM Peak Hour (7:00AM - 8:00AM)



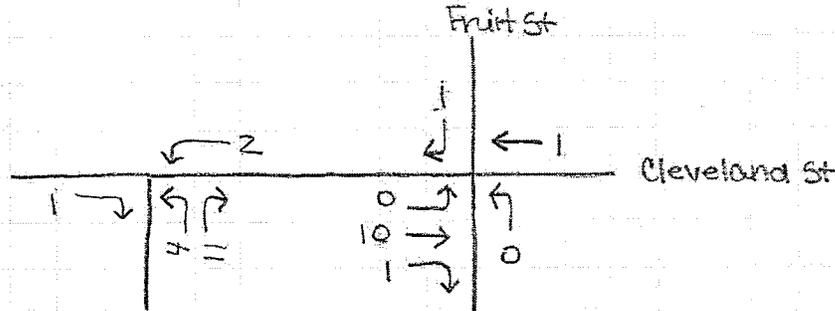
PM Peak Hour (5:00PM to 6:00PM)



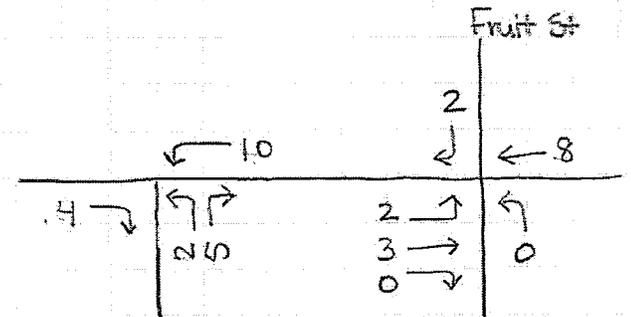
Distribution



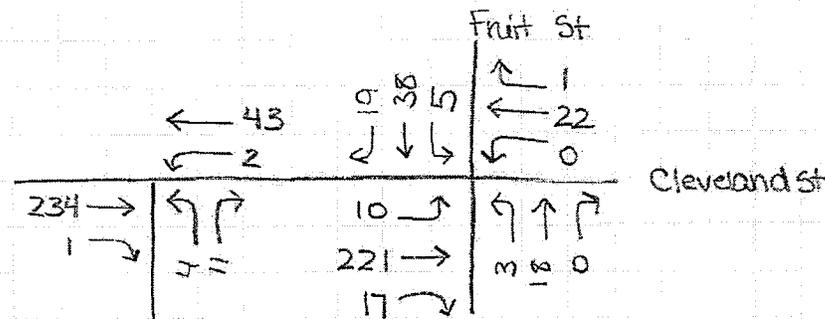
Trip Generation
AM Peak Hour IN 3 OUT 15



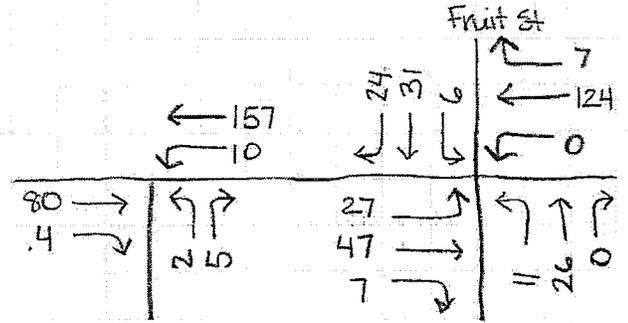
PM Peak Hour IN 14 OUT 7



2016 Build Condition
AM Peak Hour



PM Peak Hour



3: Cleveland Street & Fruit Street
 2016 Existing Condition 6/1/2016 AM Peak Hour

Synchro 9 Report
 HCM 2010 TWSC

Intersection

Int Delay, s/veh 3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	10	211	16	1	21	1	3	18	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	84	84	84	79	79	79	66	66	66
Heavy Vehicles, %	1	1	1	9	9	9	5	5	5
Mvmt Flow	12	251	19	1	27	1	5	27	0

Major/Minor	Major1	Major2	Minor1						
Conflicting Flow All	28	0	0	270	0	0	353	315	261
Stage 1	-	-	-	-	-	-	285	285	-
Stage 2	-	-	-	-	-	-	68	30	-
Critical Hdwy	4.11	-	-	4.19	-	-	7.15	6.55	6.25
Critical Hdwy Stg 1	-	-	-	-	-	-	6.15	5.55	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.15	5.55	-
Follow-up Hdwy	2.209	-	-	2.281	-	-	3.545	4.045	3.345
Pot Cap-1 Maneuver	1592	-	-	1254	-	-	596	596	770
Stage 1	-	-	-	-	-	-	716	670	-
Stage 2	-	-	-	-	-	-	935	864	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1592	-	-	1254	-	-	538	590	770
Mov Cap-2 Maneuver	-	-	-	-	-	-	538	590	-
Stage 1	-	-	-	-	-	-	710	664	-
Stage 2	-	-	-	-	-	-	857	863	-

Approach	EB	WB	NB
HCM Control Delay, s			11.5
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	582	1592	-	-	1254	-	-	677
HCM Lane V/C Ratio	0.055	0.007	-	-	0.001	-	-	0.123
HCM Control Delay (s)	11.5	7.3	0	-	7.9	0	-	11.1
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0

Intersection

Int Delay, s/veh

Movement	SBL	SBT	SBR
Vol, veh/h	5	38	18
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	73	73	73
Heavy Vehicles, %	2	2	2
Mvmt Flow	7	52	25

Major/Minor

	Minor2		
Conflicting Flow All	328	324	27
Stage 1	30	30	-
Stage 2	298	294	-
Critical Hdwy	7.12	6.52	6.22
Critical Hdwy Stg 1	6.12	5.52	-
Critical Hdwy Stg 2	6.12	5.52	-
Follow-up Hdwy	3.518	4.018	3.318
Pot Cap-1 Maneuver	625	594	1048
Stage 1	987	870	-
Stage 2	711	670	-
Platoon blocked, %			
Mov Cap-1 Maneuver	598	588	1048
Mov Cap-2 Maneuver	598	588	-
Stage 1	978	869	-
Stage 2	676	664	-

Approach

	SB
HCM Control Delay, s	11.1
HCM LOS	B

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	3.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	25	44	7	1	116	7	11	26	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	83	83	83	86	86	86
Heavy Vehicles, %	0	0	0	1	1	1	3	3	3
Mvmt Flow	29	51	8	1	140	8	13	30	0

Major/Minor	Major1	Major2	Minor1						
Conflicting Flow All	148	0	0	59	0	0	297	264	55
Stage 1	-	-	-	-	-	-	113	113	-
Stage 2	-	-	-	-	-	-	184	151	-
Critical Hdwy	4.1	-	-	4.11	-	-	7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	6.13	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.13	5.53	-
Follow-up Hdwy	2.2	-	-	2.209	-	-	3.527	4.027	3.327
Pot Cap-1 Maneuver	1446	-	-	1551	-	-	653	640	1009
Stage 1	-	-	-	-	-	-	890	800	-
Stage 2	-	-	-	-	-	-	815	770	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1446	-	-	1551	-	-	587	626	1009
Mov Cap-2 Maneuver	-	-	-	-	-	-	587	626	-
Stage 1	-	-	-	-	-	-	871	783	-
Stage 2	-	-	-	-	-	-	741	769	-

Approach	EB	WB	NB
HCM Control Delay, s			11.3
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	614	1446	-	-	1551	-	-	715
HCM Lane V/C Ratio	0.07	0.02	-	-	0.001	-	-	0.118
HCM Control Delay (s)	11.3	7.5	0	-	7.3	0	-	10.7
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0

Intersection

Int Delay, s/veh

Movement	SBL	SBT	SBR
Vol, veh/h	6	31	22
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	70	70	70
Heavy Vehicles, %	0	0	0
Mvmt Flow	9	44	31

Major/Minor	Minor2		
Conflicting Flow All	274	263	144
Stage 1	146	146	-
Stage 2	128	117	-
Critical Hdwy	7.1	6.5	6.2
Critical Hdwy Stg 1	6.1	5.5	-
Critical Hdwy Stg 2	6.1	5.5	-
Follow-up Hdwy	3.5	4	3.3
Pot Cap-1 Maneuver	683	646	909
Stage 1	861	780	-
Stage 2	881	803	-
Platoon blocked, %			
Mov Cap-1 Maneuver	647	632	909
Mov Cap-2 Maneuver	647	632	-
Stage 1	843	779	-
Stage 2	829	786	-

Approach	SB
HCM Control Delay, s	10.7
HCM LOS	B

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	10	221	17	1	22	1	3	18	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	84	84	84	79	79	79	66	66	66
Heavy Vehicles, %	1	1	1	9	9	9	5	5	5
Mvmt Flow	12	263	20	1	28	1	5	27	0

Major/Minor	Major1	Major2	Minor1						
Conflicting Flow All	29	0	0	283	0	0	367	329	273
Stage 1	-	-	-	-	-	-	297	297	-
Stage 2	-	-	-	-	-	-	70	32	-
Critical Hdwy	4.11	-	-	4.19	-	-	7.15	6.55	6.25
Critical Hdwy Stg 1	-	-	-	-	-	-	6.15	5.55	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.15	5.55	-
Follow-up Hdwy	2.209	-	-	2.281	-	-	3.545	4.045	3.345
Pot Cap-1 Maneuver	1591	-	-	1240	-	-	584	585	759
Stage 1	-	-	-	-	-	-	705	662	-
Stage 2	-	-	-	-	-	-	932	862	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1591	-	-	1240	-	-	526	579	759
Mov Cap-2 Maneuver	-	-	-	-	-	-	526	579	-
Stage 1	-	-	-	-	-	-	699	656	-
Stage 2	-	-	-	-	-	-	853	861	-

Approach	EB	WB	NB
HCM Control Delay, s			11.7
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	571	1591	-	-	1240	-	-	670
HCM Lane V/C Ratio	0.056	0.007	-	-	0.001	-	-	0.127
HCM Control Delay (s)	11.7	7.3	0	-	7.9	0	-	11.2
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0

Intersection

Int Delay, s/veh

Movement	SBL	SBT	SBR
Vol, veh/h	5	38	19
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	73	73	73
Heavy Vehicles, %	2	2	2
Mvmt Flow	7	52	26

Major/Minor	Minor2		
Conflicting Flow All	342	338	28
Stage 1	31	31	-
Stage 2	311	307	-
Critical Hdwy	7.12	6.52	6.22
Critical Hdwy Stg 1	6.12	5.52	-
Critical Hdwy Stg 2	6.12	5.52	-
Follow-up Hdwy	3.518	4.018	3.318
Pot Cap-1 Maneuver	612	583	1047
Stage 1	986	869	-
Stage 2	699	661	-
Platoon blocked, %			
Mov Cap-1 Maneuver	586	577	1047
Mov Cap-2 Maneuver	586	577	-
Stage 1	977	868	-
Stage 2	664	655	-

Approach	SB
HCM Control Delay, s	11.2
HCM LOS	B

Minor Lane/Major Mvmt

Intersection

Int Delay, s/veh 3.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	27	47	7	1	124	7	11	26	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	83	83	83	86	86	86
Heavy Vehicles, %	0	0	0	1	1	1	3	3	3
Mvmt Flow	31	55	8	1	149	8	13	30	0

Major/Minor	Major1	Major2	Minor1						
Conflicting Flow All	158	0	0	63	0	0	317	282	59
Stage 1	-	-	-	-	-	-	122	122	-
Stage 2	-	-	-	-	-	-	195	160	-
Critical Hdwy	4.1	-	-	4.11	-	-	7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	6.13	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.13	5.53	-
Follow-up Hdwy	2.2	-	-	2.209	-	-	3.527	4.027	3.327
Pot Cap-1 Maneuver	1434	-	-	1546	-	-	634	625	1004
Stage 1	-	-	-	-	-	-	880	793	-
Stage 2	-	-	-	-	-	-	804	764	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1434	-	-	1546	-	-	566	611	1004
Mov Cap-2 Maneuver	-	-	-	-	-	-	566	611	-
Stage 1	-	-	-	-	-	-	861	776	-
Stage 2	-	-	-	-	-	-	728	763	-

Approach	EB	WB	NB
HCM Control Delay, s			11.5
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	597	1434	-	-	1546	-	-	704
HCM Lane V/C Ratio	0.072	0.022	-	-	0.001	-	-	0.124
HCM Control Delay (s)	11.5	7.6	0	-	7.3	0	-	10.8
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0

Intersection

Int Delay, s/veh

Movement	SBL	SBT	SBR
Vol, veh/h	6	31	24
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	70	70	70
Heavy Vehicles, %	0	0	0
Mvmt Flow	9	44	34

Major/Minor	Minor2		
Conflicting Flow All	293	282	154
Stage 1	156	156	-
Stage 2	137	126	-
Critical Hdwy	7.1	6.5	6.2
Critical Hdwy Stg 1	6.1	5.5	-
Critical Hdwy Stg 2	6.1	5.5	-
Follow-up Hdwy	3.5	4	3.3
Pot Cap-1 Maneuver	663	630	897
Stage 1	851	772	-
Stage 2	871	796	-
Platoon blocked, %			
Mov Cap-1 Maneuver	627	616	897
Mov Cap-2 Maneuver	627	616	-
Stage 1	832	771	-
Stage 2	819	778	-

Approach	SB
HCM Control Delay, s	10.8
HCM LOS	B

Minor Lane/Major Mvmt

35 mph posted
no shoulder
no sidewalks

