Nitsch Engineering

Concord Schools Bus Depot
Acton, MA

Quantitative Traffic Assessment

June, 2014

Prepared for:

Concord Public Schools
120 Meriam Road, Ripley Building
Concord, MA 01742

Submitted by:

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Boston, MA 02108

Nitsch Project #10079.1

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1 INTRODUCTION

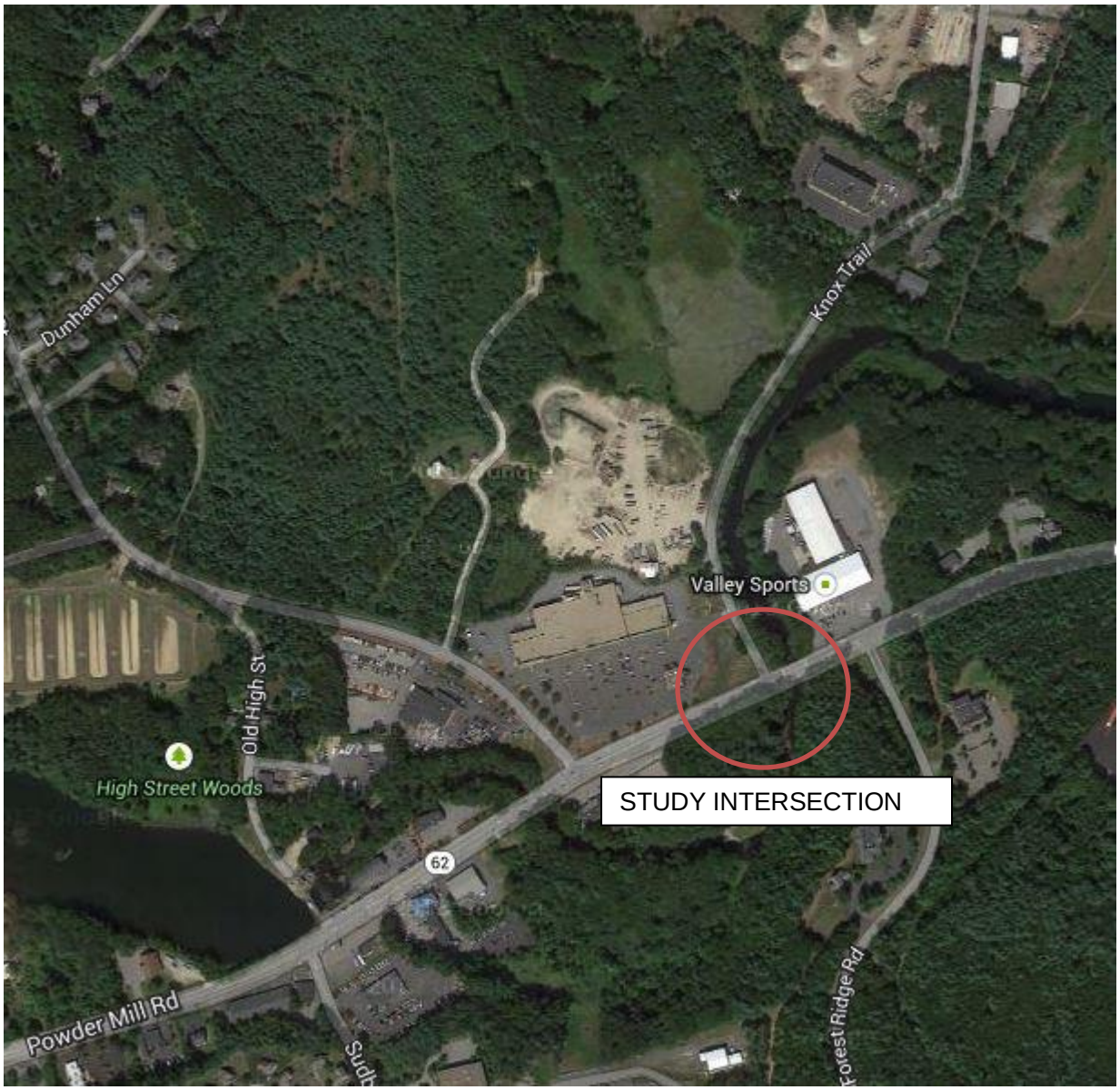
1.1 General/Site Location

Nitsch Engineering has been retained by Concord Public Schools to prepare a qualitative assessment of safety, and traffic access/egress, associated with the proposed Concord-Carlisle schools bus depot relocation in Acton, Massachusetts. This study is a summary of the existing conditions and evaluation of the traffic impacts after the proposed relocation.

The Project includes relocation of the Concord-Carlisle Regional High School (CCRHS) bus depot from the Concord-Carlisle High School to the Knox Trail site located in Acton, Massachusetts.

As seen in Figure 1, the major access roads within the study area are Powder Mill Road (Route 62) and Knox Trail. Powder Mill Road (Route 62) extends from Main Street in Concord to Waltham Street in Acton and runs in the east/west directions. Knox Trail extends from Powder Mill Road to the industrial park, and runs in the southwest/northeast directions.

Figure 1 – Locus Map



2 EXISTING CONDITIONS

2.1 Field Reconnaissance

Nitsch Engineering conducted field reconnaissance on Tuesday, June 3, 2014 to observe traffic operations, geometric conditions, parking activity, pedestrian accommodations, signing, pavement markings, and overall roadway and intersection conditions at the intersection of Powder mill Road (Route 62) at Knox Trail.

Powder Mill Road (Route 62) at Knox Trail
Knox Trail and Powder Mill Road (Route 62) create three-legged unsignalized intersection with Powder Mill Road (Route 62) approaching from the east and west, and Knox Trail approaching from the north. Powder Mill Road (Route 62) consists of one general travel lane in each direction, separated by double yellow center line. Knox Trail consists of one lane in the northbound and southbound directions. There is no pavement marking present at Knox Trail. A sidewalk is present along the southerly side of Powder Mill Road. The posted speed limit on Powder Mill Road is 35 mph. Powder Mill Road operates as the free movement, and the Knox Trail operates under “STOP” control.

Powder Mill Road Facing West

Powder Mill Road Facing East

Knox Trail Facing North

2.2 Site Distance

Stopping sight distance (SSD) is defined as the distance needed for drivers to see an object on the roadway ahead and bring their vehicles to a safe stop before colliding with the object. The distances are derived for various design speeds based on assumptions for driver reaction time, the braking ability of most vehicles under wet pavement conditions, and the friction provided by most pavement surfaces, assuming good tires. Based on American Association of State Highway and Transportation Officials (AASHTO) Design Guidelines, the minimum SSD for 35 mph roadway is 250 feet, which is available at the intersection.

Intersection site distance (ISD) was also observed during the site visit. ISD refers to the line of sight between a driver on a roadway and a vehicle attempting to enter from a side street or driveway. This value is critical in determining where driveways or other access points should be located, or what traffic control devices are necessary, to ensure that adequate ISD is provided. When approaching Powder Mill Road on Knox Trail looking left you can only see 100 feet to the east on Powder Mill Road because of overgrown vegetation and roadway geometry, which is below the required minimum of 390 feet for a 35 mph roadway. However, if you pull the vehicle past the stop sign and closer to the intersection, you can see beyond the required site distance before entering Powder Mill Road.

2.3 Crash Data

Nitsch Engineering analyzed crash data for the study area intersections. Massachusetts Department of Transportation (MassDOT) requires that the crash data reviewed for a project include the latest three years of available data to identify safety deficiencies. Accordingly, we queried MassDOT's crash record database for the Towns of Acton and Concord from 2010 to 2012, and identified 2 crashes in 2010, 2 crashes in 2011, and 1 crashes in 2012 in the vicinity of the study area. None of the crashes occurred during the peak hours, and 20% of them occurred under wet or icy conditions. This does not indicate a significant safety problem at the intersection, and during inclement weather.

Table 1 - Crash Summary

Location	Number of Crashes			Severity				Type					Percent During	
	Year	Total	Ave per Year	PD[a]	PI[b]	NR[j]	F[c]	CM[d]	RE[e]	HO[f]	Ped[g]	Other[h]	Peak Hours	Wet/Icy Conditions
Powder Mill Road at Knox Trail	2010	2		2				1	1				0	50%
	2011	2		1	1			1				1	0	0
	2012	1		1				1					0	0
Total		**5**		**4**	**4**			**3**	**1**			**1**	**0**	**20%**

aProperty Damage Only; bPersonal Injury; cFatality; dCross Movement (or angle); eRear End; Head On; gPedestrian, jnot reported or unknown in term of severity; hsideswipe, opposite direction; sideswipe, same direction, single vehicle crash, not eported, unknown etc.

2.4 Traffic Volume Data

Nitsch Engineering completed a data collection effort for the study intersections on May 22, 2014. Data collected included Turning Movement Counts (TMCs) for cars, and heavy vehicles over a twelve hour period from 6:00 AM to 6:00 PM. Based on the counts, the AM peak hour is from 7:45 AM to 8:45 AM and the PM peak hour is from 5:00 PM to 6:00 PM. However, our analysis focused on the following three time periods:

Weekday Morning (6:00 – 700 AM)	*Every day the 29 school buses depart the proposed bus depot between 6:00 AM and 7:00 AM for morning student pick-up.*
Weekday Mid-Morning (8:45 - 9:15 AM)	*The buses return to the depot between 8:45 AM and 9:15 AM.*
Weekday Afternoon (1:45 - 12:15 PM)	*Every afternoon the buses depart between 1:45 PM and 2:15 PM.*

2.5 Intersection Operations

Level of Service (LOS) is a qualitative measure describing operational conditions within a traffic stream. Six (6) LOS criteria are used to describe the quality of traffic flow for any type of facility controls. LOS-A represents the best operating conditions and LOSF represents the worst operating conditions. LOS for signalized intersections is calculated using the operational analysis methodology of the Highway Capacity Manual (HCM). The methodology for signalized intersections assesses the effects of signal type, timing, phasing, progression, vehicle mix, and geometrics on average control delay. Control delay includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. Table 3 summarizes the relationship between LOS and average control delay for signalized intersections.

Table 2 – Level of Service Criteria for Signalized Intersections

Level of Service[1]	Control Delay per Vehicle[1] (Seconds)
A	0 to 10
B	>10 to 20
C	>20 to 35
D	>35 to 55
E	>55 to 80
F	Over 80
[1]Reference: 2010 Highway Capacity Manual, TRB	

2.6 2014 Existing Traffic Operations

Nitsch Engineering analyzed the existing year 2014 traffic operations at the study intersections. Table 3 summarizes the 2014 existing condition traffic operations.

Table 3 - Level of Service Summary – 2014 Existing Conditions

	INTERSECTION	MOVEMENT	V/C[1]	DELAY[2]	LOS[3]	50th Q[4]	95th Q[5]
WEEKDAY MORNING	Powder Mill Road (Route 62) @ Knox Trail	Knox Trail SB - RL	0.12	13.1	B	-	10
		Powder Mill Road (Route 62) EB - LT	0.02	0.7	A	-	2
		Powder Mill Road (Route 62) WB - TR	0.08	0	A	-	0
		Intersection	**0.12**	**1.5**	**A**		
WEEKDAY MID-MORNING	INTERSECTION	MOVEMENT	V/C[1]	DELAY[2]	LOS[3]	50th Q[4]	95th Q[5]
	Powder Mill Road (Route 62) @ Knox Trail	Knox Trail SB - RL	0.05	11.5	B	-	4
		Powder Mill Road (Route 62) EB - LT	0.02	0.6	A	-	1
		Powder Mill Road (Route 62) WB - TR	0.12	0	A	-	0
		Intersection	**0.12**	**0.9**	**A**		
WEEKDAY AFTERNOON	INTERSECTION	MOVEMENT	V/C[1]	DELAY[2]	LOS[3]	50th Q[4]	95th Q[5]
	Powder Mill Road (Route 62) @ Knox Trail	Knox Trail SB - RL	0.16	13.1	B	-	14
		Powder Mill Road (Route 62) EB - LT	0.04	1.4	A	-	3
		Powder Mill Road (Route 62) WB - TR	0.19	0	A	-	0
		Intersection	**0.19**	**2.1**	**A**		

[1] Volume to Capacity Ratio; [2] Vehicle Delay, measured in seconds; [3] Level Of Service; [4] 50th Percentile Queue (in feet); [5] 95th Percentile Queue (in feet) based upon 22 feet per vehicle; # = volume exceeds capacity, queue may be longer; m = 95th percentile queue is metered by upstream intersection

Table 3 shows that under the existing conditions, the intersection of Powder Mill Road (Route 62) and Knox Trail operates at LOS A during all three periods of analysis. All individual approaches at the intersection operate at LOS B or better. **Figure 2** shows the 2014 existing traffic volumes used in the traffic analyses.

Figure 2 - 2014 Existing Traffic Volumes

3 2014 FUTURE TRAFFIC OPERATIONS

Nitsch Engineering performed the analysis to compare traffic operations with the proposed relocation of the bus depot. Since the relocation is intended to be implemented on August 2014, We used the existing year, 2014 volumes for the analysis. Table 4 summarizes the result of the 2014 Future traffic analyses.

Table 4 - Level of Service Summary – 2014 Future Conditions

	INTERSECTION	MOVEMENT	V/C[1]	DELAY[2]	LOS[3]	50th Q[4]	95th Q[5]
WEEKDAY MORNING	Powder Mill Road (Route 62) @ Knox Trail	Knox Trail SB - RL	0.21	15.1	C	-	19
		Powder Mill Road (Route 62) EB - LT	0.02	0.7	A	-	2
		Powder Mill Road (Route 62) WB - TR	0.08	0	A	-	0
		Intesection	0.21	2.2	A		
WEEKDAY MID-MORNING	INTERSECTION	MOVEMENT	V/C[1]	DELAY[2]	LOS[3]	50th Q[4]	95th Q[5]
	Powder Mill Road (Route 62) @ Knox Trail	Knox Trail SB - RL	0.05	11.7	B	-	4
		Powder Mill Road (Route 62) EB - LT	0.02	0.6	A	-	1
		Powder Mill Road (Route 62) WB - TR	0.14	0	A	-	0
		Intesection	0.14	0.9	A		
WEEKDAY AFTERNOON	INTERSECTION	MOVEMENT	V/C[1]	DELAY[2]	LOS[3]	50th Q[4]	95th Q[5]
	Powder Mill Road (Route 62) @ Knox Trail	Knox Trail SB - RL	0.24	14.5	B	-	23
		Powder Mill Road (Route 62) EB - LT	0.04	1.4	A	-	3
		Powder Mill Road (Route 62) WB - TR	0.19	0	A	-	0
		Intesection	0.19	2.1	A		

[1] Volume to Capacity Ratio; [2] Vehicle Delay, measured in seconds; [3] Level Of Service; [4] 50th Percentile Queue (in feet); [5] 95th Percentile Queue (in feet) based upon 22 feet per vehicle; # = volume exceeds capacity, queue may be longer; m = 95th percentile queue is metered by upstream intersection

Table 4 shows that under Future conditions, all of the approaches operate at the same LOS as under existing conditions; with the exception of the Knox Trail southbound movement at the intersection that degrades from a LOS B to a LOS C during the morning peak hour.

Figure 3 shows the 2014 Future volumes used in the traffic analyses.

Figure 3 - 2014 Future Traffic Volumes

3.1 Warrant Analyses

Nitsch Engineering performed signal warrant analyses at the intersection of Powder Mill Road (Route 62)/Knox Trail, based on the standard procedures outlined in the Manual for Uniform Traffic Control Devices (MUTCD). The MUTCD lists eight warrants, one or more of which should be met to justify installation of a signal.

	Warrant	Description
1	Eight-Hour Vehicular Volume	Traffic volume for 8 hours of an average day exceed the threshold given in the MUTCD.
2	Four-Hour Vehicular Volume.	Traffic volume for 4 hours of an average day exceed the threshold given in the MUTCD.
3	Peak Hour	Traffic volume for 1 hour of an average day exceed the threshold given in the MUTCD.
4	Pedestrian Volume	Pedestrian volume exceed the threshold given in the MUTCD.
5	School Crossing	School children cross the major street.
6	Coordinated Signal System	Insuring progressive movement in a coordinated system.
7	Crash Experience	Severety and frequency of crashes exceed the threshold given in the MUTCD.
8	Roadway Network.	Encourages concentration and organization of traffic flow on a roadway network.

The analyses were performed based on Future 2014 volumes as they represent the projected increase in traffic from additional bus activity to determine whether there was a need for a signal as a method of traffic control at the study intersection. Based on the volumes, the intersection did not meet the signal warrants.

4 CONCLUSIONS AND RECOMMENDATIONS

The intersection of Powder Mill Road/Knox Trail operates at acceptable level of service (LOS), and the analysis indicate that after the relocation of the bus depot and based on the number of buses that are proposed to be used by Concord-Carlisle school system, the Intersection will continue to operate at LOS A during all three periods of analysis with no significant delay.

The Intersection experiences a poor Intersection site distance (ISD) due to the existing roadway geometry and overgrown vegetation at the northeasterly corner of the intersection.

Nitsch Engineering makes the following recommendations for improvement at the intersection after the bus depot relocation is implemented:

- Provide pavement markings (double yellow center line and stop line) at the Knox Trail approach to the Intersection; and

- Trim the overgrown vegetation at the northeasterly corner of the inter section for a better ISD.

Nitsch Engineering

Concord Schools Bus Depot
Acton, MA

Technical Appendix

June, 2014

Prepared for:

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CONTENTS

Section Number	DESCRIPTION
A-1	Turning Movement Counts (TMCs)
A-2	Crash Data
A-3	Capacity Analysis

Section A-1

Turning Movement Counts (TMCs)

PRECISION DATA INDUSTRIES, LLC
Office: 508.481.3999 Fax: 508.545.1234
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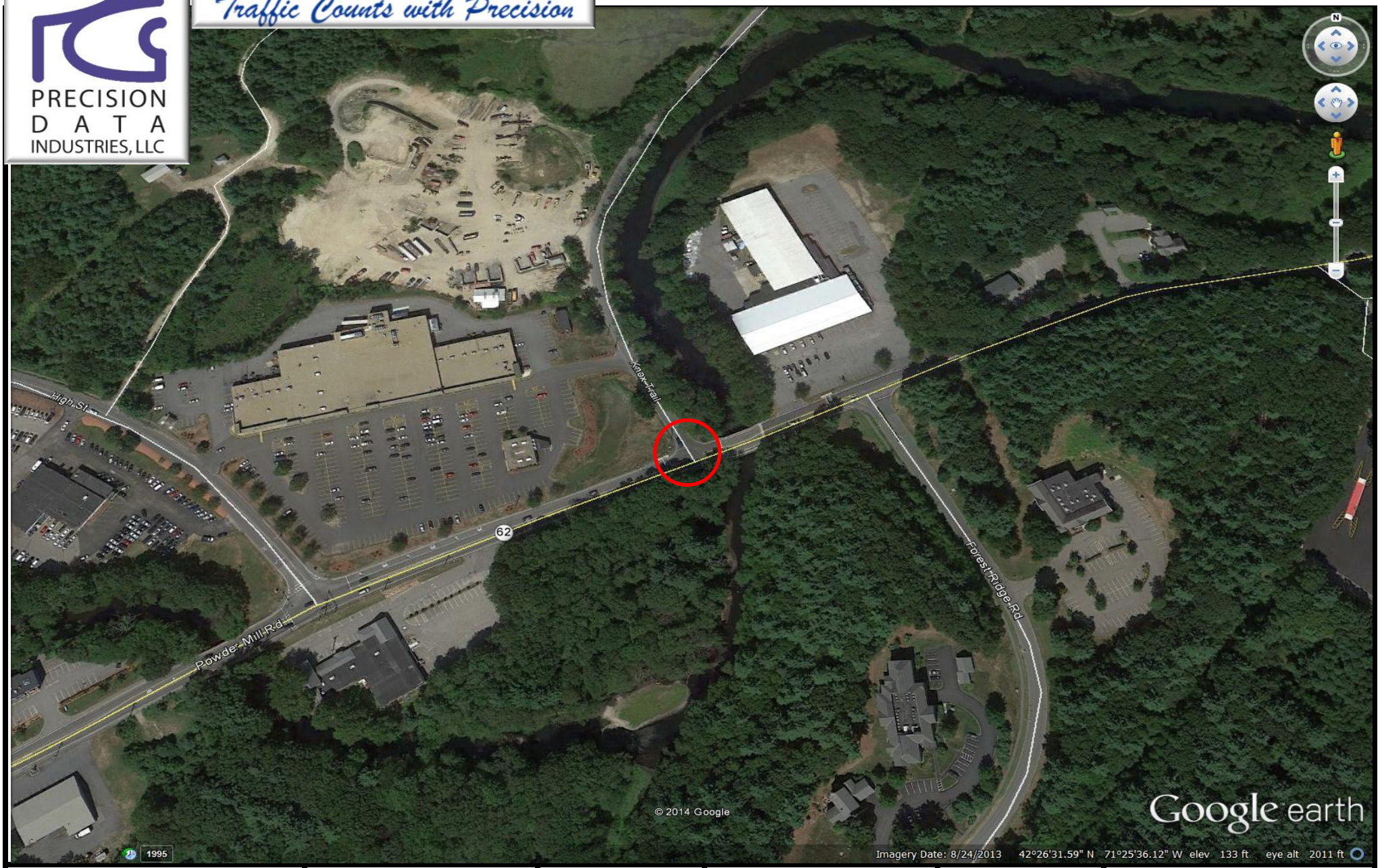
Traffic Counts with Precision



Client:	Engineer:	Site Code:	Date:	PDI Job Number:	City, State:
Nitsch Engineering	N. Havan	мллтф	Thursday 5/22/2014	143908	Concord, MA

N: Knox Trail
E/W: Powder Mill Road (Route 62)
City, State: Concord, MA
Client: Nitsch Engineering/ N. Havan

PRECISION DATA INDUSTRIES, LLC
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Email: datarequests@pdillc.com

File Name : 143908 A
Site Code : 10079
Start Date : 5/22/2014
Page No : 1

Groups Printed- Cars - Heavy Vehicles

	Knox Tral From North			Powder Mill Road (Route 62) From East			Powder Mill Road (Route 62) From West			
Start Time	Right	Left	U-Turn	Right	Thru	U-Turn	Thru	Left	U-Turn	Int. Total
06:00 AM	6	3	0	3	16	0	89	3	0	120
06:15 AM	4	1	0	8	18	0	121	8	0	160
06:30 AM	4	14	0	5	31	0	147	4	0	205
06:45 AM	11	14	0	5	39	0	153	16	0	238
Total	25	32	0	21	104	0	510	31	0	723
07:00 AM	11	3	0	10	45	0	191	8	0	268
07:15 AM	8	8	0	4	50	0	210	8	0	288
07:30 AM	8	7	0	7	61	0	155	12	0	250
07:45 AM	15	10	0	10	57	0	192	15	0	299
Total	42	28	0	31	213	0	748	43	0	1105
08:00 AM	7	14	0	8	58	0	176	6	0	269
08:15 AM	8	14	0	10	68	0	219	11	0	330
08:30 AM	2	11	0	15	66	0	152	5	0	251
08:45 AM	8	6	0	15	71	0	178	9	0	287
Total	25	45	0	48	263	0	725	31	0	1137
09:00 AM	3	9	0	22	86	0	140	10	0	270
09:15 AM	12	8	0	20	89	0	115	13	0	257
09:30 AM	10	12	0	17	80	0	105	13	0	237
09:45 AM	15	13	0	16	76	0	98	11	0	229
Total	40	42	0	75	331	0	458	47	0	993
10:00 AM	9	12	0	21	71	0	83	5	0	201
10:15 AM	9	12	0	17	66	0	102	10	0	216
10:30 AM	10	15	0	18	106	0	95	8	0	252
10:45 AM	11	14	0	24	89	0	80	8	0	226
Total	39	53	0	80	332	0	360	31	0	895
11:00 AM	8	14	0	17	93	0	73	3	0	208
11:15 AM	15	13	0	19	74	0	92	9	0	222
11:30 AM	6	14	0	23	95	0	88	8	0	234
11:45 AM	9	26	0	22	73	0	87	5	0	222
Total	38	67	0	81	335	0	340	25	0	886
12:00 PM	8	15	0	16	93	0	82	12	0	226
12:15 PM	12	13	0	10	101	0	104	10	0	250
12:30 PM	13	13	0	19	92	0	75	11	0	223
12:45 PM	12	13	0	12	90	0	82	7	0	216
Total	45	54	0	57	376	0	343	40	0	915
01:00 PM	14	20	0	17	92	0	102	9	0	254
01:15 PM	10	20	0	16	105	0	77	8	0	236
01:30 PM	10	10	0	22	80	0	88	9	0	219
01:45 PM	10	9	0	19	85	0	94	17	0	234
Total	44	59	0	74	362	0	361	43	0	943
02:00 PM	11	18	0	18	81	0	79	11	0	218
02:15 PM	17	13	0	19	72	0	83	12	0	216
02:30 PM	18	11	0	29	85	0	75	9	0	227
02:45 PM	19	12	0	15	95	0	90	9	0	240
Total	65	54	0	81	333	0	327	41	0	901
03:00 PM	15	9	0	22	86	0	96	15	0	243
03:15 PM	11	16	0	13	107	0	83	5	0	235
03:30 PM	19	11	0	30	120	0	88	11	0	279
03:45 PM	11	17	0	29	127	0	96	11	0	291
Total	56	53	0	94	440	0	363	42	0	1048

N: Knox Trail
E/W: Powder Mill Road (Route 62)
City, State: Concord, MA
Client: Nitsch Engineering/ N. Havan

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File Name : 143908 A
Site Code : 10079
Start Date : 5/22/2014
Page No : 2

Groups Printed- Cars - Heavy Vehicles

	Knox Tral From North			Powder Mill Road (Route 62) From East			Powder Mill Road (Route 62) From West			
Start Time	Right	Left	U-Turn	Right	Thru	U-Turn	Thru	Left	U-Turn	Int. Total
04:00 PM	17	13	0	26	133	0	74	8	0	271
04:15 PM	11	8	0	25	133	0	81	7	0	265
04:30 PM	13	25	0	27	135	0	88	8	0	296
04:45 PM	13	14	0	25	162	0	102	7	0	323
Total	54	60	0	103	563	0	345	30	0	1155
05:00 PM	17	21	0	22	171	0	97	11	1	340
05:15 PM	13	18	0	22	144	0	97	13	0	307
05:30 PM	15	18	0	21	163	0	92	6	0	315
05:45 PM	17	11	0	22	167	0	118	6	0	341
Total	62	68	0	87	645	0	404	36	1	1303
Grand Total	535	615	0	832	4297	0	5284	440	1	12004
Apprch %	46.5	53.5	0	16.2	83.8	0	92.3	7.7	0	
Total %	4.5	5.1	0	6.9	35.8	0	44	3.7	0	
Cars	431	547	0	757	4190	0	5165	320	1	11411
% Cars	80.6	88.9	0	91	97.5	0	97.7	72.7	100	95.1
Heavy Vehicles	104	68	0	75	107	0	119	120	0	593
% Heavy Vehicles	19.4	11.1	0	9	2.5	0	2.3	27.3	0	4.9

	Knox Tral From North				Powder Mill Road (Route 62) From East				Powder Mill Road (Route 62) From West				
Start Time	Right	Left	U-Turn	App. Total	Right	Thru	U-Turn	App. Total	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 12:00 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:45 AM													
07:45 AM	**15**	10	0	**25**	10	57	0	67	192	**15**	0	207	299
08:00 AM	7	**14**	0	21	8	58	0	66	176	6	0	182	269
08:15 AM	8	14	0	22	10	**68**	0	78	**219**	11	0	**230**	**330**
08:30 AM	2	11	0	13	**15**	66	0	**81**	152	5	0	157	251
Total Volume	32	49	0	81	43	249	0	292	739	37	0	776	1149
% App. Total	39.5	60.5	0		14.7	85.3	0		95.2	4.8	0		
PHF	.533	.875	.000	.810	.717	.915	.000	.901	.844	.617	.000	.843	.870
Cars	28	39	0	67	37	238	0	275	721	27	0	748	1090
% Cars	87.5	79.6	0	82.7	86.0	95.6	0	94.2	97.6	73.0	0	96.4	94.9
Heavy Vehicles	4	10	0	14	6	11	0	17	18	10	0	28	59
% Heavy Vehicles	12.5	20.4	0	17.3	14.0	4.4	0	5.8	2.4	27.0	0	3.6	5.1
Peak Hour Analysis From 12:15 PM to 05:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 05:00 PM													
05:00 PM	**17**	**21**	0	**38**	**22**	**171**	0	**193**	97	11	**1**	109	340
05:15 PM	13	18	0	31	22	144	0	166	97	**13**	0	110	307
05:30 PM	15	18	0	33	21	163	0	184	92	6	0	98	315
05:45 PM	17	11	0	28	22	167	0	189	**118**	6	0	**124**	**341**
Total Volume	62	68	0	130	87	645	0	732	404	36	1	441	1303
% App. Total	47.7	52.3	0		11.9	88.1	0		91.6	8.2	0.2		
PHF	.912	.810	.000	.855	.989	.943	.000	.948	.856	.692	.250	.889	.955
Cars	61	66	0	127	87	642	0	729	395	33	1	429	1285
% Cars	98.4	97.1	0	97.7	100	99.5	0	99.6	97.8	91.7	100	97.3	98.6
Heavy Vehicles	1	2	0	3	0	3	0	3	9	3	0	12	18
% Heavy Vehicles	1.6	2.9	0	2.3	0	0.5	0	0.4	2.2	8.3	0	2.7	1.4

N: Knox Trail
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City, State: Concord, MA
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	Knox Tral From North			Powder Mill Road (Route 62) From East			Powder Mill Road (Route 62) From West			
Start Time	Right	Left	U-Turn	Right	Thru	U-Turn	Thru	Left	U-Turn	Int. Total
06:00 AM	4	2	0	3	14	0	86	3	0	112
06:15 AM	2	1	0	8	18	0	120	8	0	157
06:30 AM	3	5	0	5	30	0	144	4	0	191
06:45 AM	9	11	0	5	38	0	153	16	0	232
Total	18	19	0	21	100	0	503	31	0	692
07:00 AM	5	3	0	7	43	0	190	7	0	255
07:15 AM	6	8	0	3	50	0	210	6	0	283
07:30 AM	3	6	0	6	60	0	152	8	0	235
07:45 AM	15	9	0	9	54	0	189	12	0	288
Total	29	26	0	25	207	0	741	33	0	1061
08:00 AM	5	10	0	6	56	0	173	4	0	254
08:15 AM	6	12	0	8	64	0	213	8	0	311
08:30 AM	2	8	0	14	64	0	146	3	0	237
08:45 AM	4	5	0	14	68	0	176	8	0	275
Total	17	35	0	42	252	0	708	23	0	1077
09:00 AM	3	8	0	22	84	0	139	8	0	264
09:15 AM	12	7	0	18	85	0	115	12	0	249
09:30 AM	7	11	0	16	78	0	103	8	0	223
09:45 AM	9	10	0	9	75	0	94	8	0	205
Total	31	36	0	65	322	0	451	36	0	941
10:00 AM	7	9	0	20	69	0	78	3	0	186
10:15 AM	7	10	0	15	66	0	101	4	0	203
10:30 AM	8	14	0	16	105	0	94	4	0	241
10:45 AM	8	11	0	22	83	0	80	7	0	211
Total	30	44	0	73	323	0	353	18	0	841
11:00 AM	7	14	0	15	89	0	69	1	0	195
11:15 AM	12	11	0	17	72	0	88	5	0	205
11:30 AM	3	10	0	18	90	0	83	5	0	209
11:45 AM	9	24	0	18	69	0	82	5	0	207
Total	31	59	0	68	320	0	322	16	0	816
12:00 PM	5	15	0	15	93	0	78	8	0	214
12:15 PM	10	10	0	9	96	0	103	7	0	235
12:30 PM	8	13	0	18	87	0	74	8	0	208
12:45 PM	12	12	0	11	85	0	78	4	0	202
Total	35	50	0	53	361	0	333	27	0	859
01:00 PM	10	16	0	14	88	0	99	4	0	231
01:15 PM	5	19	0	13	103	0	73	6	0	219
01:30 PM	6	10	0	22	77	0	84	8	0	207
01:45 PM	5	9	0	14	83	0	91	8	0	210
Total	26	54	0	63	351	0	347	26	0	867
02:00 PM	10	18	0	15	80	0	77	8	0	208
02:15 PM	12	12	0	16	69	0	80	6	0	195
02:30 PM	15	10	0	25	82	0	73	7	0	212
02:45 PM	17	11	0	14	92	0	85	5	0	224
Total	54	51	0	70	323	0	315	26	0	839
03:00 PM	13	8	0	22	83	0	95	8	0	229
03:15 PM	9	14	0	13	105	0	82	2	0	225
03:30 PM	16	10	0	28	117	0	85	9	0	265
03:45 PM	10	17	0	27	127	0	93	8	0	282
Total	48	49	0	90	432	0	355	27	0	1001

N: Knox Trail
E/W: Powder Mill Road (Route 62)
City, State: Concord, MA
Client: Nitsch Engineering/ N. Havea

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File Name : 143908 A
Site Code : 10079
Start Date : 5/22/2014

Groups Printed- Cars

	Knox Tral From North			Powder Mill Road (Route 62) From East			Powder Mill Road (Route 62) From West			
Start Time	Right	Left	U-Turn	Right	Thru	U-Turn	Thru	Left	U-Turn	Int. Total
04:00 PM	15	12	0	25	129	0	73	7	0	261
04:15 PM	10	8	0	25	133	0	81	4	0	261
04:30 PM	13	24	0	25	134	0	88	7	0	291
04:45 PM	13	14	0	25	161	0	100	6	0	319
Total	51	58	0	100	557	0	342	24	0	1132
05:00 PM	17	20	0	22	170	0	90	11	1	331
05:15 PM	12	18	0	22	143	0	96	12	0	303
05:30 PM	15	17	0	21	163	0	91	5	0	312
05:45 PM	17	11	0	22	166	0	118	5	0	339
Total	61	66	0	87	642	0	395	33	1	1285
Grand Total	431	547	0	757	4190	0	5165	320	1	11411
Apprch %	44.1	55.9	0	15.3	84.7	0	94.1	5.8	0	
Total %	3.8	4.8	0	6.6	36.7	0	45.3	2.8	0	

	Knox Tral From North				Powder Mill Road (Route 62) From East				Powder Mill Road (Route 62) From West				
Start Time	Right	Left	U-Turn	App. Total	Right	Thru	U-Turn	App. Total	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 12:00 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:45 AM													
07:45 AM	**15**	9	0	**24**	9	54	0	63	189	**12**	0	201	288
08:00 AM	5	10	0	15	6	56	0	62	173	4	0	177	254
08:15 AM	6	**12**	0	18	8	**64**	0	72	**213**	8	0	**221**	**311**
08:30 AM	2	8	0	10	**14**	64	0	**78**	146	3	0	149	237
Total Volume	28	39	0	67	37	238	0	275	721	27	0	748	1090
% App. Total	41.8	58.2	0		13.5	86.5	0		96.4	3.6	0		
PHF	.467	.813	.000	.698	.661	.930	.000	.881	.846	.563	.000	.846	.876
Peak Hour Analysis From 12:15 PM to 05:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 05:00 PM													
05:00 PM	**17**	**20**	0	**37**	**22**	**170**	0	**192**	90	11	**1**	102	331
05:15 PM	12	18	0	30	22	143	0	165	96	**12**	0	108	303
05:30 PM	15	17	0	32	21	163	0	184	91	5	0	96	312
05:45 PM	17	11	0	28	22	166	0	188	**118**	5	0	**123**	**339**
Total Volume	61	66	0	127	87	642	0	729	395	33	1	429	1285
% App. Total	48	52	0		11.9	88.1	0		92.1	7.7	0.2		
PHF	.897	.825	.000	.858	.989	.944	.000	.949	.837	.688	.250	.872	.948

N: Knox Trail
E/W: Powder Mill Road (Route 62)
City, State: Concord, MA
Client: Nitsch Engineering/ N. Havan

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File Name : 143908 A
Site Code : 10079
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Groups Printed- Heavy Vehicles

	Knox Tral From North			Powder Mill Road (Route 62) From East			Powder Mill Road (Route 62) From West			
Start Time	Right	Left	U-Turn	Right	Thru	U-Turn	Thru	Left	U-Turn	Int. Total
06:00 AM	2	1	0	0	2	0	3	0	0	8
06:15 AM	2	0	0	0	0	0	1	0	0	3
06:30 AM	1	9	0	0	1	0	3	0	0	14
06:45 AM	2	3	0	0	1	0	0	0	0	6
Total	7	13	0	0	4	0	7	0	0	31
07:00 AM	6	0	0	3	2	0	1	1	0	13
07:15 AM	2	0	0	1	0	0	0	2	0	5
07:30 AM	5	1	0	1	1	0	3	4	0	15
07:45 AM	0	1	0	1	3	0	3	3	0	11
Total	13	2	0	6	6	0	7	10	0	44
08:00 AM	2	4	0	2	2	0	3	2	0	15
08:15 AM	2	2	0	2	4	0	6	3	0	19
08:30 AM	0	3	0	1	2	0	6	2	0	14
08:45 AM	4	1	0	1	3	0	2	1	0	12
Total	8	10	0	6	11	0	17	8	0	60
09:00 AM	0	1	0	0	2	0	1	2	0	6
09:15 AM	0	1	0	2	4	0	0	1	0	8
09:30 AM	3	1	0	1	2	0	2	5	0	14
09:45 AM	6	3	0	7	1	0	4	3	0	24
Total	9	6	0	10	9	0	7	11	0	52
10:00 AM	2	3	0	1	2	0	5	2	0	15
10:15 AM	2	2	0	2	0	0	1	6	0	13
10:30 AM	2	1	0	2	1	0	1	4	0	11
10:45 AM	3	3	0	2	6	0	0	1	0	15
Total	9	9	0	7	9	0	7	13	0	54
11:00 AM	1	0	0	2	4	0	4	2	0	13
11:15 AM	3	2	0	2	2	0	4	4	0	17
11:30 AM	3	4	0	5	5	0	5	3	0	25
11:45 AM	0	2	0	4	4	0	5	0	0	15
Total	7	8	0	13	15	0	18	9	0	70
12:00 PM	3	0	0	1	0	0	4	4	0	12
12:15 PM	2	3	0	1	5	0	1	3	0	15
12:30 PM	5	0	0	1	5	0	1	3	0	15
12:45 PM	0	1	0	1	5	0	4	3	0	14
Total	10	4	0	4	15	0	10	13	0	56
01:00 PM	4	4	0	3	4	0	3	5	0	23
01:15 PM	5	1	0	3	2	0	4	2	0	17
01:30 PM	4	0	0	0	3	0	4	1	0	12
01:45 PM	5	0	0	5	2	0	3	9	0	24
Total	18	5	0	11	11	0	14	17	0	76
02:00 PM	1	0	0	3	1	0	2	3	0	10
02:15 PM	5	1	0	3	3	0	3	6	0	21
02:30 PM	3	1	0	4	3	0	2	2	0	15
02:45 PM	2	1	0	1	3	0	5	4	0	16
Total	11	3	0	11	10	0	12	15	0	62
03:00 PM	2	1	0	0	3	0	1	7	0	14
03:15 PM	2	2	0	0	2	0	1	3	0	10
03:30 PM	3	1	0	2	3	0	3	2	0	14
03:45 PM	1	0	0	2	0	0	3	3	0	9
Total	8	4	0	4	8	0	8	15	0	47

N: Knox Trail
E/W: Powder Mill Road (Route 62)
City, State: Concord, MA
Client: Nitsch Engineering/ N. Havan

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File Name : 143908 A
Site Code : 10079
Start Date : 5/22/2014
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Groups Printed- Heavy Vehicles

	Knox Tral From North			Powder Mill Road (Route 62) From East			Powder Mill Road (Route 62) From West			
Start Time	Right	Left	U-Turn	Right	Thru	U-Turn	Thru	Left	U-Turn	Int. Total
04:00 PM	2	1	0	1	4	0	1	1	0	10
04:15 PM	1	0	0	0	0	0	0	3	0	4
04:30 PM	0	1	0	2	1	0	0	1	0	5
04:45 PM	0	0	0	0	1	0	2	1	0	4
Total	3	2	0	3	6	0	3	6	0	23
05:00 PM	0	1	0	0	1	0	7	0	0	9
05:15 PM	1	0	0	0	1	0	1	1	0	4
05:30 PM	0	1	0	0	0	0	1	1	0	3
05:45 PM	0	0	0	0	1	0	0	1	0	2
Total	1	2	0	0	3	0	9	3	0	18
Grand Total	104	68	0	75	107	0	119	120	0	593
Apprch %	60.5	39.5	0	41.2	58.8	0	49.8	50.2	0	
Total %	17.5	11.5	0	12.6	18	0	20.1	20.2	0	

	Knox Tral From North				Powder Mill Road (Route 62) From East				Powder Mill Road (Route 62) From West				
Start Time	Right	Left	U-Turn	App. Total	Right	Thru	U-Turn	App. Total	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 12:00 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 10:45 AM													
10:45 AM	**3**	3	0	6	2	**6**	0	8	0	1	0	1	15
11:00 AM	1	0	0	1	2	4	0	6	4	2	0	6	13
11:15 AM	3	2	0	5	2	2	0	4	4	**4**	0	**8**	17
11:30 AM	3	**4**	0	**7**	**5**	5	0	**10**	**5**	3	0	8	**25**
Total Volume	10	9	0	19	11	17	0	28	13	10	0	23	70
% App. Total	52.6	47.4	0		39.3	60.7	0		56.5	43.5	0		
PHF	.833	.563	.000	.679	.550	.708	.000	.700	.650	.625	.000	.719	.700
Peak Hour Analysis From 12:15 PM to 05:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 01:00 PM													
01:00 PM	4	**4**	0	**8**	3	**4**	0	**7**	3	5	0	8	23
01:15 PM	**5**	1	0	6	3	2	0	5	**4**	2	0	6	17
01:30 PM	4	0	0	4	0	3	0	3	4	1	0	5	12
01:45 PM	5	0	0	5	**5**	2	0	7	3	**9**	0	**12**	**24**
Total Volume	18	5	0	23	11	11	0	22	14	17	0	31	76
% App. Total	78.3	21.7	0		50	50	0		45.2	54.8	0		
PHF	.900	.313	.000	.719	.550	.688	.000	.786	.875	.472	.000	.646	.792

N: Knox Trail
E/W: Powder Mill Road (Route 62)
City, State: Concord, MA
Client: Nitsch Engineering/ N. Havan

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File Name : 143908 A
Site Code : 10079
Start Date : 5/22/2014
Page No : 1

Groups Printed- Peds and Bicycles

	Knox Tral From North			Powder Mill Road (Route 62) From East			Powder Mill Road (Route 62) From West			
Start Time	Right	Left	Peds	Right	Thru	Peds	Thru	Left	Peds	Int. Total
06:00 AM	0	0	0	0	0	0	0	0	0	0
06:15 AM	0	0	0	0	0	0	0	0	0	0
06:30 AM	0	0	0	0	0	0	0	0	0	0
06:45 AM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0
07:00 AM	0	0	1	0	0	0	0	0	0	1
07:15 AM	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	1	0	0	0	0	1
Total	0	0	1	0	1	0	0	0	0	2
08:00 AM	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	1	0	0	1
08:30 AM	0	0	0	0	0	0	0	0	0	0
08:45 AM	0	0	0	0	0	0	1	0	0	1
Total	0	0	0	0	0	0	2	0	0	2
09:00 AM	0	0	0	0	0	0	0	0	0	0
09:15 AM	0	0	0	0	0	0	0	0	0	0
09:30 AM	0	0	0	0	0	0	0	0	0	0
09:45 AM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0
10:00 AM	0	0	0	0	0	0	1	0	0	1
10:15 AM	0	0	0	0	1	0	0	0	0	1
10:30 AM	0	0	0	0	0	0	0	0	0	0
10:45 AM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	1	0	1	0	0	2
11:00 AM	0	0	0	0	0	0	0	0	0	0
11:15 AM	0	0	0	0	0	0	0	0	0	0
11:30 AM	0	0	0	0	1	0	0	0	0	1
11:45 AM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	1	0	0	0	0	1
12:00 PM	0	0	0	0	0	0	0	0	0	0
12:15 PM	0	0	0	0	0	0	0	0	0	0
12:30 PM	0	0	0	0	0	0	1	0	0	1
12:45 PM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	1	0	0	1
01:00 PM	0	0	0	0	0	0	0	0	0	0
01:15 PM	0	0	0	0	0	0	0	0	0	0
01:30 PM	0	0	0	0	0	0	0	0	0	0
01:45 PM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0
02:00 PM	0	0	0	0	0	0	0	0	0	0
02:15 PM	0	0	0	0	0	0	0	0	0	0
02:30 PM	0	0	0	0	0	0	0	0	0	0
02:45 PM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0
03:00 PM	0	0	0	0	0	0	0	0	0	0
03:15 PM	0	0	0	0	0	0	0	0	0	0
03:30 PM	0	0	0	0	0	0	0	0	0	0
03:45 PM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0

N: Knox Trail
E/W: Powder Mill Road (Route 62)
City, State: Concord, MA
Client: Nitsch Engineering/ N. Havan

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Groups Printed- Peds and Bicycles

	Knox Tral From North			Powder Mill Road (Route 62) From East			Powder Mill Road (Route 62) From West			
Start Time	Right	Left	Peds	Right	Thru	Peds	Thru	Left	Peds	Int. Total
04:00 PM	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	1	0	0	0	0	1
04:30 PM	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	1	0	0	0	0	1
05:00 PM	0	0	0	0	1	0	0	0	0	1
05:15 PM	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	1	0	0	0	0	1
Grand Total	0	0	1	0	5	0	4	0	0	10
Apprch %	0	0	100	0	100	0	100	0	0	
Total %	0	0	10	0	50	0	40	0	0	

	Knox Tral From North				Powder Mill Road (Route 62) From East				Powder Mill Road (Route 62) From West				
Start Time	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 12:00 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:00 AM													
07:00 AM	0	0	**1**	**1**	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
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	**1**	0	**1**	0	0	0	0	1
Total Volume	0	0	1	1	0	1	0	1	0	0	0	0	2
% App. Total	0	0	100		0	100	0		0	0	0		
PHF	.000	.000	.250	.250	.000	.250	.000	.250	.000	.000	.000	.000	.500
Peak Hour Analysis From 12:15 PM to 05:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 04:15 PM													
04:15 PM	0	0	0	0	0	**1**	0	**1**	0	0	0	0	**1**
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00 PM	0	0	0	0	0	1	0	1	0	0	0	0	1
Total Volume	0	0	0	0	0	2	0	2	0	0	0	0	2
% App. Total	0	0	0		0	100	0		0	0	0		
PHF	.000	.000	.000	.000	.000	.500	.000	.500	.000	.000	.000	.000	.500

N: Knox Trail
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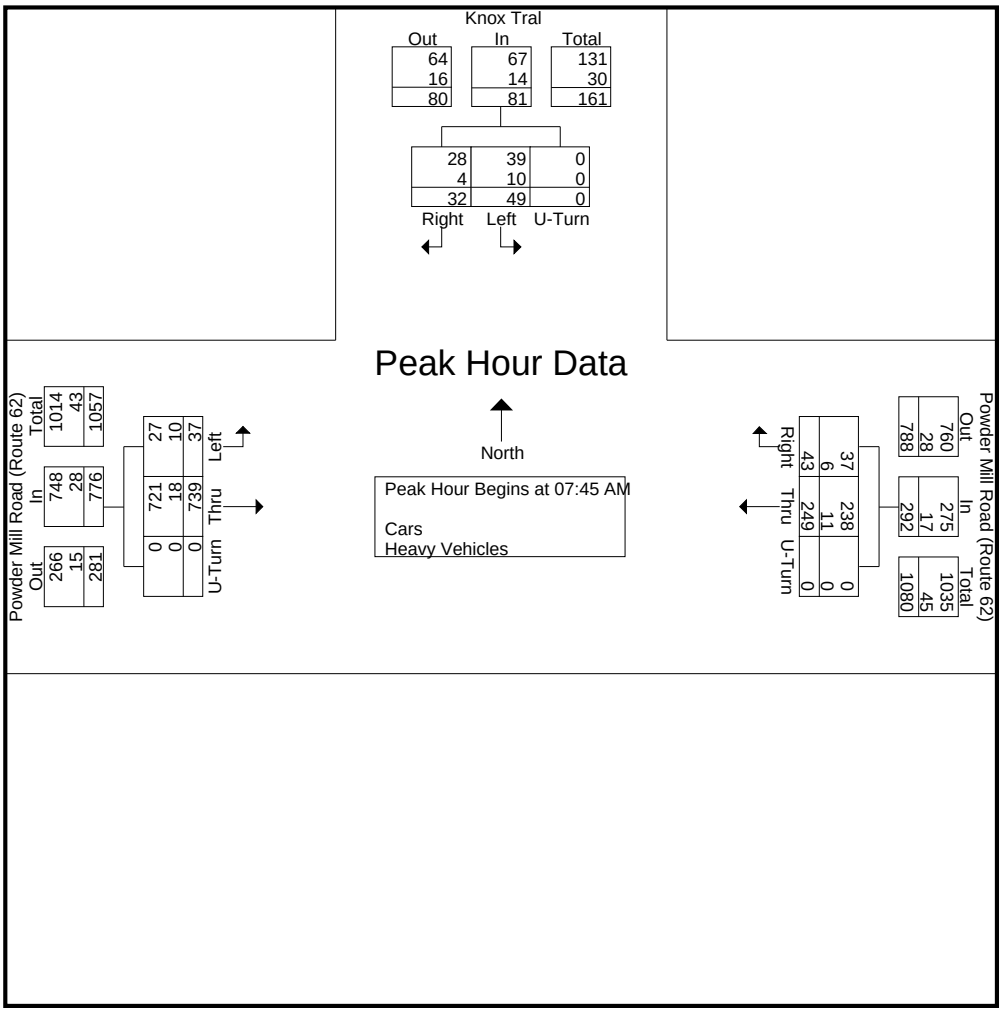
	Knox Tral From North				Powder Mill Road (Route 62) From East				Powder Mill Road (Route 62) From West				
Start Time	Right	Left	U-Turn	App. Total	Right	Thru	U-Turn	App. Total	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 12:00 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:45 AM													
07:45 AM	**15**	10	0	**25**	10	57	0	67	192	**15**	0	207	299
08:00 AM	7	**14**	0	21	8	58	0	66	176	6	0	182	269
08:15 AM	8	14	0	22	10	**68**	0	78	**219**	11	0	**230**	**330**
08:30 AM	2	11	0	13	**15**	66	0	**81**	152	5	0	157	251
Total Volume	32	49	0	81	43	249	0	292	739	37	0	776	1149
% App. Total	39.5	60.5	0		14.7	85.3	0		95.2	4.8	0		
PHF	.533	.875	.000	.810	.717	.915	.000	.901	.844	.617	.000	.843	.870
Cars	28	39	0	67	37	238	0	275	721	27	0	748	1090
% Cars	87.5	79.6	0	82.7	86.0	95.6	0	94.2	97.6	73.0	0	96.4	94.9
Heavy Vehicles	4	10	0	14	6	11	0	17	18	10	0	28	59
% Heavy Vehicles	12.5	20.4	0	17.3	14.0	4.4	0	5.8	2.4	27.0	0	3.6	5.1

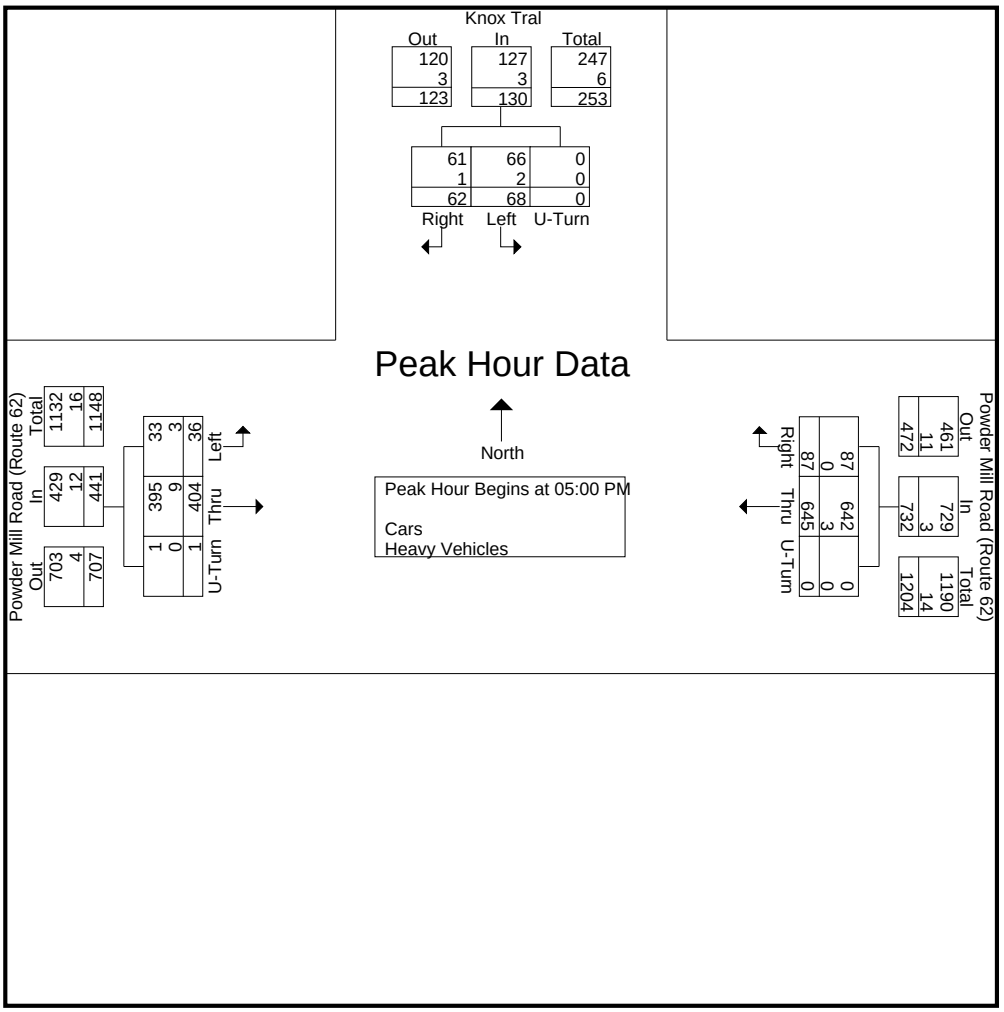


PRECISION DATA INDUSTRIES, LLC
P.O. Box 301 Berlin, MA 01503
Office: 508.481.3999 Fax: 508.545.1234
Email: datarequests@pdillc.com

N: Knox Trail
E/W: Powder Mill Road (Route 62)
City, State: Concord, MA
Client: Nitsch Engineering/ N. Havan

File Name : 143908 A
Site Code : 10079
Start Date : 5/22/2014
Page No : 2

	Knox Tral From North				Powder Mill Road (Route 62) From East				Powder Mill Road (Route 62) From West				
Start Time	Right	Left	U-Turn	App. Total	Right	Thru	U-Turn	App. Total	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 12:15 PM to 05:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 05:00 PM													
05:00 PM	**17**	**21**	0	**38**	**22**	**171**	0	**193**	97	11	**1**	109	340
05:15 PM	13	18	0	31	22	144	0	166	97	**13**	0	110	307
05:30 PM	15	18	0	33	21	163	0	184	92	6	0	98	315
05:45 PM	17	11	0	28	22	167	0	189	**118**	6	0	**124**	**341**
Total Volume	62	68	0	130	87	645	0	732	404	36	1	441	1303
% App. Total	47.7	52.3	0		11.9	88.1	0		91.6	8.2	0.2		
PHF	.912	.810	.000	.855	.989	.943	.000	.948	.856	.692	.250	.889	.955
Cars	61	66	0	127	87	642	0	729	395	33	1	429	1285
% Cars	98.4	97.1	0	97.7	100	99.5	0	99.6	97.8	91.7	100	97.3	98.6
Heavy Vehicles	1	2	0	3	0	3	0	3	9	3	0	12	18
% Heavy Vehicles	1.6	2.9	0	2.3	0	0.5	0	0.4	2.2	8.3	0	2.7	1.4



Section A-2

Crash Data

massDOT

MassDOT Crash Report for ACTON and CONCORD for the year 2010

Crash Number	City/Town Name	Crash Date	Crash Time	Crash Severity	Number of Vehicles	Total Nonfatal Injuries	Total Fatal Injuries	Manner of Collision	Vehicle Action Prior to Crash	Vehicle Travel Directions	Most Harmful Events	Vehicle Configuration	Road Surface Condition	Ambient Light	Weather Condition	At Roadway Intersection
2619145	CONCORD	08-Jul-2010	6:36 PM	Property damage only (none injured)	2	0	0	Rear-end	V1: Travelling straight ahead / V2:Slowing or stopped in traffic	V1:Eastbound / V2:Eastbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2:Light truck(van, mini-van, panel, pickup, sport utility) with only four tires	Dry	Daylight	Clear	
2678193	ACTON	22-Dec-2010	3:35 PM	Property damage only (none injured)	2	0	0	Angle	V1: Travelling straight ahead / V2:Turning right	V1:Westbound / V2:Westbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2:Unknown heavy truck, cannot classify	Wet	Daylight	Snow	POWDER MILL ROAD / KNOX TRAIL

MassDOT Crash Report for ACTON and CONCORD for the year 2011

Crash Number	City/Town Name	Crash Date	Crash Time	Crash Severity	Number of Vehicles	Total Nonfatal Injuries	Total Fatal Injuries	Manner of Collision	Vehicle Action Prior to Crash	Vehicle Travel Directions	Most Harmful Events	Vehicle Configuration	Road Surface Condition	Ambient Light	Weather Condition	At Roadway Intersection
2792390	ACTON	06-Oct-2011	7:32 PM	Property damage only (none injured)	1	0	0	Single vehicle crash	V1: Travelling straight ahead	V1:Southbound	V1: Collision with tree	V1: Passenger car	Dry	Dark - roadway not lighted	Clear	
2808753	CONCORD	21-Nov-2011	6:54 PM	Non-fatal injury	2	1	0	Angle	V1: Travelling straight ahead / V2:Travelling straight ahead	V1:Westbound / V2:Eastbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Motorcycle / V2:Passenger car	Dry	Dark - roadway not lighted	Clear	

MassDOT Crash Report for ACTON and CONCORD for the year 2012

Crash Number	City/Town Name	Crash Date	Crash Time	Crash Severity	Number of Vehicles	Total Nonfatal Injuries	Total Fatal Injuries	Manner of Collision	Vehicle Action Prior to Crash	Vehicle Travel Directions	Most Harmful Events	Vehicle Configuration	Road Surface Condition	Ambient Light	Weather Condition	At Roadway Intersection
3147561	CONCORD	06-Jun-2012	7:58 AM	Property damage only (none injured)	2	0	0	Angle	V1: Travelling straight ahead / V2:Turning left	V1:Westbound / V2:Southbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2:Passenger car	Dry	Daylight	Cloudy	

Section A-3

Capacity Analysis

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	0	0	0	0	0	0
Flt Permitted						
Satd. Flow (perm)	0	0	0	0	0	0
Right Turn on Red	Yes			Yes	Yes	Yes
Satd. Flow (RTOR)						
Link Speed (mph)		30	30		30	
Link Distance (ft)		352	313		352	
Travel Time (s)		8.0	7.1		8.0	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		0	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Turn Type						
Protected Phases						
Permitted Phases						
Minimum Split (s)						
Total Split (s)						
Total Split (%)						
Maximum Green (s)						
Yellow Time (s)						
All-Red Time (s)						
Lost Time Adjust (s)						
Total Lost Time (s)						
Lead/Lag						
Lead-Lag Optimize?						
Act Effct Green (s)						
Actuated g/C Ratio						
v/c Ratio						
Control Delay						
Queue Delay						
Total Delay						
LOS						
Approach Delay						
Approach LOS						
Stops (vph)						

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Fuel Used(gal)						
CO Emissions (g/hr)						
NOx Emissions (g/hr)						
VOC Emissions (g/hr)						
Dilemma Vehicles (#)						
Queue Length 50th (ft)						
Queue Length 95th (ft)						
Internal Link Dist (ft)		272	233		272	
Turn Bay Length (ft)						
Base Capacity (vph)						
Starvation Cap Reductn						
Spillback Cap Reductn						
Storage Cap Reductn						
Reduced v/c Ratio						

Intersection Summary	
Area Type: Other	
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 0 (0%), Referenced to phase 2: and 6:, Start of Green	
Natural Cycle: 40	
Control Type: Pretimed	
Maximum v/c Ratio: 0.00	
Intersection Signal Delay: 0.0	Intersection LOS: A
Intersection Capacity Utilization 0.0%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 3:

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	31	510	104	21	32	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.977		0.941	
Flt Protected		0.997			0.973	
Satd. Flow (prot)	0	1857	1820	0	1706	0
Flt Permitted		0.997			0.973	
Satd. Flow (perm)	0	1857	1820	0	1706	0
Link Speed (mph)		35	35		30	
Link Distance (ft)		456	656		330	
Travel Time (s)		8.9	12.8		7.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	34	554	113	23	35	27
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	588	136	0	62	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 48.6%		ICU Level of Service A	
Analysis Period (min) 15			

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	0	0	0	0	0	0
Flt Permitted						
Satd. Flow (perm)	0	0	0	0	0	0
Right Turn on Red	Yes			Yes	Yes	Yes
Satd. Flow (RTOR)						
Link Speed (mph)		30	30		30	
Link Distance (ft)		352	313		352	
Travel Time (s)		8.0	7.1		8.0	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		0	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Turn Type						
Protected Phases						
Permitted Phases						
Minimum Split (s)						
Total Split (s)						
Total Split (%)						
Maximum Green (s)						
Yellow Time (s)						
All-Red Time (s)						
Lost Time Adjust (s)						
Total Lost Time (s)						
Lead/Lag						
Lead-Lag Optimize?						
Act Effct Green (s)						
Actuated g/C Ratio						
v/c Ratio						
Control Delay						
Queue Delay						
Total Delay						
LOS						
Approach Delay						
Approach LOS						
Stops (vph)						

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Fuel Used(gal)						
CO Emissions (g/hr)						
NOx Emissions (g/hr)						
VOC Emissions (g/hr)						
Dilemma Vehicles (#)						
Queue Length 50th (ft)						
Queue Length 95th (ft)						
Internal Link Dist (ft)		272	233		272	
Turn Bay Length (ft)						
Base Capacity (vph)						
Starvation Cap Reductn						
Spillback Cap Reductn						
Storage Cap Reductn						
Reduced v/c Ratio						

Intersection Summary	
Area Type: Other	
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 0 (0%), Referenced to phase 2: and 6:, Start of Green	
Natural Cycle: 40	
Control Type: Pretimed	
Maximum v/c Ratio: 0.00	
Intersection Signal Delay: 0.0	Intersection LOS: A
Intersection Capacity Utilization 0.0%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 3:

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	19	318	157	37	15	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.974		0.942	
Flt Protected		0.997			0.972	
Satd. Flow (prot)	0	1857	1814	0	1706	0
Flt Permitted		0.997			0.972	
Satd. Flow (perm)	0	1857	1814	0	1706	0
Link Speed (mph)		35	35		30	
Link Distance (ft)		456	656		330	
Travel Time (s)		8.9	12.8		7.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	21	346	171	40	16	12
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	367	211	0	28	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 41.6%		ICU Level of Service A	
Analysis Period (min) 15			

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	0	0	0	0	0	0
Flt Permitted						
Satd. Flow (perm)	0	0	0	0	0	0
Right Turn on Red	Yes			Yes	Yes	Yes
Satd. Flow (RTOR)						
Link Speed (mph)		30	30		30	
Link Distance (ft)		352	313		352	
Travel Time (s)		8.0	7.1		8.0	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		0	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Turn Type						
Protected Phases						
Permitted Phases						
Minimum Split (s)						
Total Split (s)						
Total Split (%)						
Maximum Green (s)						
Yellow Time (s)						
All-Red Time (s)						
Lost Time Adjust (s)						
Total Lost Time (s)						
Lead/Lag						
Lead-Lag Optimize?						
Act Effct Green (s)						
Actuated g/C Ratio						
v/c Ratio						
Control Delay						
Queue Delay						
Total Delay						
LOS						
Approach Delay						
Approach LOS						
Stops (vph)						

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Fuel Used(gal)						
CO Emissions (g/hr)						
NOx Emissions (g/hr)						
VOC Emissions (g/hr)						
Dilemma Vehicles (#)						
Queue Length 50th (ft)						
Queue Length 95th (ft)						
Internal Link Dist (ft)		272	233		272	
Turn Bay Length (ft)						
Base Capacity (vph)						
Starvation Cap Reductn						
Spillback Cap Reductn						
Storage Cap Reductn						
Reduced v/c Ratio						

Intersection Summary	
Area Type:	Other
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 0 (0%), Referenced to phase 2: and 6:, Start of Green	
Natural Cycle: 40	
Control Type: Pretimed	
Maximum v/c Ratio: 0.00	
Intersection Signal Delay: 0.0	Intersection LOS: A
Intersection Capacity Utilization 0.0%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 3:

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	40	256	238	56	40	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.974		0.934	
Flt Protected		0.993			0.975	
Satd. Flow (prot)	0	1850	1814	0	1696	0
Flt Permitted		0.993			0.975	
Satd. Flow (perm)	0	1850	1814	0	1696	0
Link Speed (mph)		35	35		30	
Link Distance (ft)		456	656		330	
Travel Time (s)		8.9	12.8		7.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	43	278	259	61	43	41
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	321	320	0	84	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 46.2%		ICU Level of Service A	
Analysis Period (min) 15			

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	0	0	0	0	0	0
Flt Permitted						
Satd. Flow (perm)	0	0	0	0	0	0
Right Turn on Red	Yes			Yes	Yes	Yes
Satd. Flow (RTOR)						
Link Speed (mph)		30	30		30	
Link Distance (ft)		352	313		352	
Travel Time (s)		8.0	7.1		8.0	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		0	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Turn Type						
Protected Phases						
Permitted Phases						
Minimum Split (s)						
Total Split (s)						
Total Split (%)						
Maximum Green (s)						
Yellow Time (s)						
All-Red Time (s)						
Lost Time Adjust (s)						
Total Lost Time (s)						
Lead/Lag						
Lead-Lag Optimize?						
Act Effct Green (s)						
Actuated g/C Ratio						
v/c Ratio						
Control Delay						
Queue Delay						
Total Delay						
LOS						
Approach Delay						
Approach LOS						
Stops (vph)						

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Fuel Used(gal)						
CO Emissions (g/hr)						
NOx Emissions (g/hr)						
VOC Emissions (g/hr)						
Dilemma Vehicles (#)						
Queue Length 50th (ft)						
Queue Length 95th (ft)						
Internal Link Dist (ft)		272	233		272	
Turn Bay Length (ft)						
Base Capacity (vph)						
Starvation Cap Reductn						
Spillback Cap Reductn						
Storage Cap Reductn						
Reduced v/c Ratio						

Intersection Summary	
Area Type:	Other
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 0 (0%), Referenced to phase 2: and 6:, Start of Green	
Natural Cycle: 40	
Control Type: Pretimed	
Maximum v/c Ratio: 0.00	
Intersection Signal Delay: 0.0	Intersection LOS: A
Intersection Capacity Utilization 0.0%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 3:

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	31	510	104	21	61	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.977		0.961	
Flt Protected		0.997			0.966	
Satd. Flow (prot)	0	1857	1820	0	1729	0
Flt Permitted		0.997			0.966	
Satd. Flow (perm)	0	1857	1820	0	1729	0
Link Speed (mph)		35	35		30	
Link Distance (ft)		456	656		330	
Travel Time (s)		8.9	12.8		7.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	34	554	113	23	66	27
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	588	136	0	93	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 50.2%	ICU Level of Service A
Analysis Period (min) 15	

Lanes, Volumes, Timings
3: 6/17/2014

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	0	0	0	0	0	0
Flt Permitted						
Satd. Flow (perm)	0	0	0	0	0	0
Right Turn on Red	Yes			Yes	Yes	Yes
Satd. Flow (RTOR)						
Link Speed (mph)		30	30		30	
Link Distance (ft)		352	313		352	
Travel Time (s)		8.0	7.1		8.0	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		0	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Turn Type						
Protected Phases						
Permitted Phases						
Minimum Split (s)						
Total Split (s)						
Total Split (%)						
Maximum Green (s)						
Yellow Time (s)						
All-Red Time (s)						
Lost Time Adjust (s)						
Total Lost Time (s)						
Lead/Lag						
Lead-Lag Optimize?						
Act Effct Green (s)						
Actuated g/C Ratio						
v/c Ratio						
Control Delay						
Queue Delay						
Total Delay						
LOS						
Approach Delay						
Approach LOS						
Stops (vph)						

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Fuel Used(gal)						
CO Emissions (g/hr)						
NOx Emissions (g/hr)						
VOC Emissions (g/hr)						
Dilemma Vehicles (#)						
Queue Length 50th (ft)						
Queue Length 95th (ft)						
Internal Link Dist (ft)		272	233		272	
Turn Bay Length (ft)						
Base Capacity (vph)						
Starvation Cap Reductn						
Spillback Cap Reductn						
Storage Cap Reductn						
Reduced v/c Ratio						

Intersection Summary	
Area Type: Other	
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 0 (0%), Referenced to phase 2: and 6:, Start of Green	
Natural Cycle: 40	
Control Type: Pretimed	
Maximum v/c Ratio: 0.00	
Intersection Signal Delay: 0.0	Intersection LOS: A
Intersection Capacity Utilization 0.0%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 3:

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	19	318	157	66	15	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.960		0.942	
Flt Protected		0.997			0.972	
Satd. Flow (prot)	0	1857	1788	0	1706	0
Flt Permitted		0.997			0.972	
Satd. Flow (perm)	0	1857	1788	0	1706	0
Link Speed (mph)		35	35		30	
Link Distance (ft)		456	656		330	
Travel Time (s)		8.9	12.8		7.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	21	346	171	72	16	12
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	367	243	0	28	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 42.3%		ICU Level of Service A	
Analysis Period (min) 15			

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	40	256	238	56	69	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.974		0.952	
Flt Protected		0.993			0.969	
Satd. Flow (prot)	0	1850	1814	0	1718	0
Flt Permitted		0.993			0.969	
Satd. Flow (perm)	0	1850	1814	0	1718	0
Link Speed (mph)		35	35		30	
Link Distance (ft)		456	656		330	
Travel Time (s)		8.9	12.8		7.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	43	278	259	61	75	41
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	321	320	0	116	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 47.8%		ICU Level of Service A	
Analysis Period (min) 15			