

APPENDIX A

Public Participation

1. Letter from Town of Westwood
2. Advisory Task Force
3. Comments from Advisory Task Force and MassDOT Highway Division District 6



TOWN OF WESTWOOD

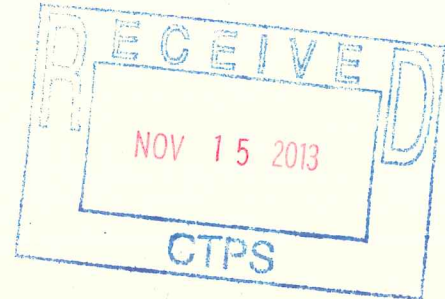
COMMONWEALTH OF MASSACHUSETTS
BOARD OF SELECTMEN

Nancy C. Hyde, Chairman
Philip N. Shapiro, Clerk
Patrick J. Ahearn, Third Member

Michael A. Jaillet, Town Administrator
Pamela M. Dukeman, Finance Director
Christine E. McCarthy, Executive Assistant

November 12, 2013

Karl Quackenbush, Executive Director
Central Transportation Planning Staff
10 Park Plaza, Suite 2150
Boston, MA 02116-3968



Dear Karl:

The Board of Selectmen, the Planning Board, the DPW, the Police Department, and the Pedestrian/Bicycle Safety Committee of the Town of Westwood have recently reviewed the list of problem intersections in Westwood. The following intersections have all been suggested by Town representatives in the past as being in need of study to address existing safety and congestion problems. The Town desires to make this list available to CTPS so that these problem intersections may be considered by MPO staff when selecting intersections or corridor segments for study under various UPWP studies, such as *Safety and Operations Analyses at Selected Intersections – FFY 2014*.

The purpose of this letter is to reaffirm that these intersections are in need of study, and to express the Town's intention to cooperate with and support the MPO in any MPO planning effort. The Town will strive to implement improvements recommended by any such studies, given the appropriateness of the improvements and the Town's ability to fund them.

The intersections are as follows:

- High Street (Route 109) and Nahatan Street – safety/congestion
- High Street (Route 109) and Pond Street - safety
- Washington Street (Route 1A) and Everett Street/Clapboardtree Street safety and congestion
- Washington Street (Route 1A), East Street and School Street – safety and congestion
- High Street (Route 109) and Summer Street – congestion
- Winter Street and Clapboardtree Street - safety

The intersection of Nahatan Street and Clapboardtree Street has been previously listed as a problem intersection, but planning for improvements to this intersection is being pursued by local means at this time, and so it no longer needs to be considered for MPO study.

Sincerely,

Michael Jaillet
Town Administrator

Westwood Town Hall • 580 High Street • Westwood, MA 02090 ☎ (781) 326-6450 • Fax: (781) 329-8030

Study Advisory Task Force

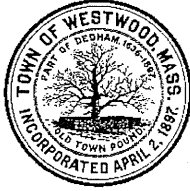
Michael Jaillet, Town Administrator

Todd Korchin, DPW Director

Jeffrey Bina, Town Engineer

Paul Sicard, Westwood Police Department

Steve Olanoff, Westwood Pedestrian and Bicycle Committee



TOWN OF WESTWOOD
COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF PUBLIC WORKS

TODD KORCHIN, *DPW DIRECTOR*
BRENDAN RYAN, *STREETS & GROUNDS SUPERINTENDENT*

JEFFREY BINA, P.E., *TOWN ENGINEER*

October 10, 2014

Seth A. Asante, P.E.
Principal Transportation Planner
Central Transportation Planning Staff
10 Park Plaza, Suite 2150
Boston, MA 02116

Re: Review Comments, Safety and Operations Analysis in Westwood, MA at,
High Street (Route 109) at Nahatan Street and,
High Street (Route 109) at Pond Street

Dear Mr. Asante,

Thank you for coming on September 29, 2014 to present your findings on the analysis of the above referenced intersections. We have summarized the items we discussed in order to further the development of proposed improvements at those intersections.

High Street at Nahatan Street

Of the options presented the group agreed to the dedicated lanes on High St. NB for the right turn onto Nahatan Street and the dedicated lane for vehicles coming onto High St. NB from Nahatan St. This configuration was shown on Fig. 4 of the analysis. The group also recommended a new curbing layout that would be installed in the locations that show the white pavement marking gore lines on that same Fig. 4. One modification to that layout was the addition of the stop sign and curbing relocation recommended in Fig. 5 for the vehicles approaching High St. NB from Nahatan St.

High Street at Pond Street

Both the short and medium term strategy presented emphasize increasing the visibility of the movement at the intersection. This would obviously help with the driver approaching the intersection however, the group was concerned that neither of them addressed the main concern of pedestrian safety. The consensus was that vehicles traveling High St. NB turning onto Pond St. would enter the turn at a high rate of speed thereby making the pedestrian crossing undesirable. A better alternative suggested was to decrease the radius of the curve along the curb at the High St. NB/Nahatan St. right turn. This would serve two purposes: 1—shorten the distance pedestrians would have to travel and 2 – cause vehicles to decrease their speed to negotiate the sharper turn onto Pond St.

Very truly yours,

A handwritten signature in black ink, appearing to read "Jeffrey J. Bina". The signature is written in a cursive, somewhat stylized font.

Jeffrey J. Bina, PE

Town Engineer

cc: Michael Jaillet, Town Administrator
Todd Korchin, DPW director
Paul Sicard, Westwood Police Department
Steve Olanoff, Westwood Pedestrian and Bicycle Committee

Seth Asante

From: Lipton, Amitai (DOT)
Sent: Thursday, December 11, 2014 2:29 PM
To: 'Seth Asante'
Cc: Kulen, Raj (DOT)
Subject: RE: Safety and Operations Analyses at Selected Intersections: Westwood Intersections

Hi Seth,

The District 6 Traffic section has reviewed the CTPS memorandum dated 11/20/2014 regarding two intersections in the Town of Westwood, and offers the following comments:

1. Table 4 - LOS F at stop-controlled approaches is very common, and does not necessarily constitute an unacceptable situation. The queues on Nahatan St do not exceed 6 vehicles (150 ft), indicating that there may not be severe congestion. However, the longer queues on Pond St (14 vehicles) and excessive control delay (2 minutes or more) could be considered unacceptable.

2. Section 7.1 - Other short- and long-term alternatives should be considered. From aerial photography, it appears that inconsistent and/or confusing signage and pavement markings in the existing condition may be a contributing factor to the safety problem. A short-term measure could include replacing signs and markings with a clearer design.

It is not clear, given the geometry, that drivers would take heed of a STOP sign (Alt. 1). A PHB or RRFB may be appropriate at the existing CW in front of the church (Alt. 2), but the proximity of driveways should be taken into account. It is not clear what the benefit of adding STOP control to High St would be (Alt. 3). Alternatives 4, 5, and particularly 6 appear to have merit, although Alt. 4 might be modified to tighten up the entire intersection. For all alternatives, the intersection design should consider a 4-legged intersection, with the driveway as the fourth leg. Visibility screening, while typically used for approaches to circular intersections, may be an effective tool in lowering speeds on the Nahatan St RT approach, and may also reduce the incidence of rear-end collisions.

3. Figure 6 - We do not agree with the concept plan of installing STOP control at an added-lane condition. We also do not agree with placing a crosswalk before a stop line. If the desire is to improve pedestrian safety, the angle of a right-turn channelized lane should be no less than 70 degrees.

4. Figure 9 - This concept plan appears to provide a good solution to the safety and operational concerns at this location. It also has the added benefit of providing an opportunity for adjacent Pond St traffic to effectively turn left onto High St, a movement that is not allowed at the existing intersection. Certain modified design features should be considered: (a) SB approach having L+TR lanes, with only 1 departing lane to the south; (b) spiral lane design; (c) 70 degree channelized turn lane for NB approach; and (d) Danish-style crossing on southerly and possibly easterly leg of the roundabout.

5. Section 7.2 - The R10-15 signs are intended solely for use at signalized intersection, and should not be used at unsignalized locations, nor in advance of an intersection. An interim option for enhanced visibility STOP signs would be to install red reflective stripe on the sign post. As a short-term measure, additional advance signage on High St (D3-2, W2-2, W2-3, W16-8P, etc.) would notify drivers of an approaching intersection. An additional alternative scenario should consider whether a roundabout would be appropriate at this location.

6. Figure 11 - A crosswalk should also be provided across High St.

If you have any questions, or would like further information about these comments, please do not hesitate to contact me.

Amitai Lipton
District 6 Traffic Engineer
MassDOT Highway Division
185 Kneeland St
Boston MA 02111
amitai.lipton@state.ma.us
857.368.6313 (office)
617.892.3171 (mobile)

APPENDIX B

Turning-Movement Count Data

Central Transportation Planning Staff
 High St (Rte 109) at Nahatan St
 04/08/14

File Name : Nahatan AM+MID+PM
 Site Code : 04081422
 Start Date : 4/8/2014
 Page No : 1

Groups Printed- Autos - Heavy Vehicle - Bicycles

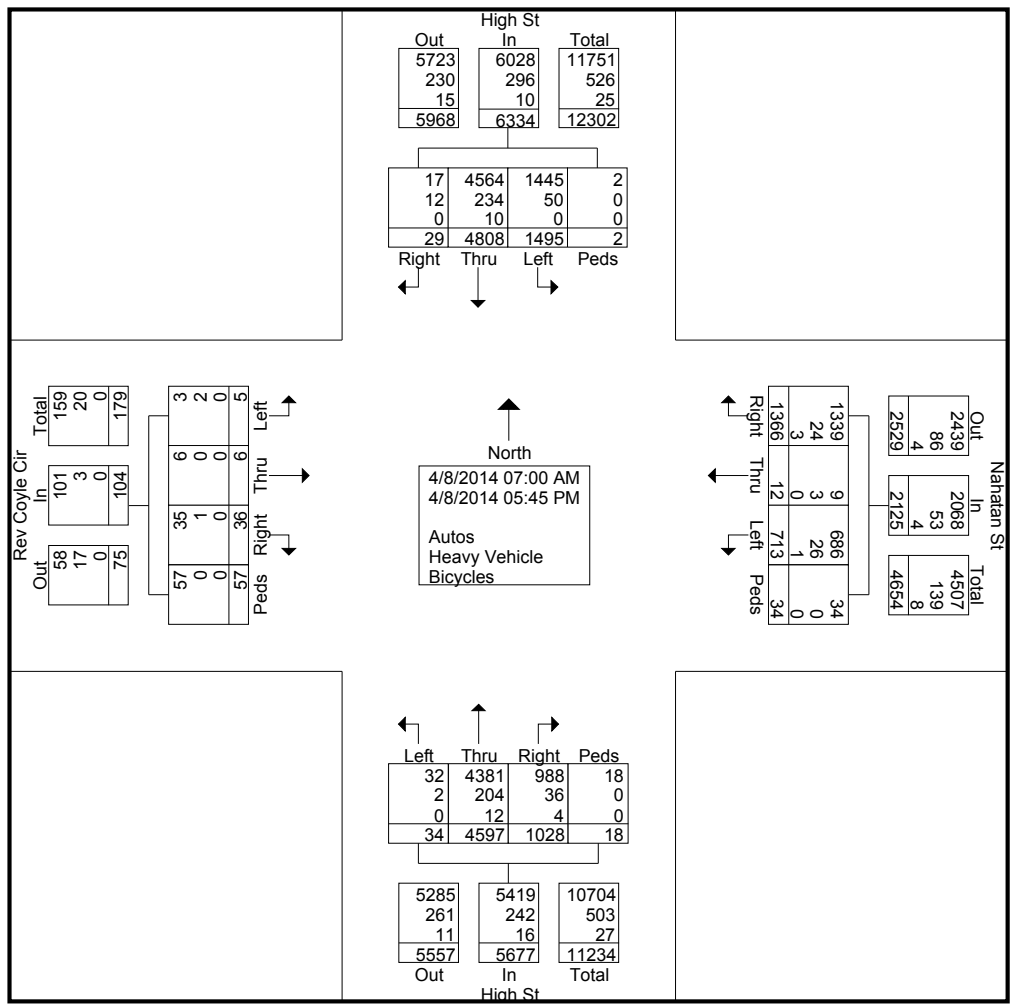
Start Time	High St From North					Nahatan St From East					High St From South					Rev Coyle Cir From West					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
07:00 AM	5	93	64	0	162	25	0	16	0	41	81	184	0	0	265	0	0	0	1	1	469
07:15 AM	0	83	77	0	160	62	0	30	1	93	81	177	0	0	258	1	0	0	0	1	512
07:30 AM	1	111	67	0	179	54	0	27	1	82	91	181	1	0	273	0	0	0	11	11	545
07:45 AM	0	87	37	0	124	46	2	22	0	70	60	165	0	0	225	0	0	0	0	0	419
Total	6	374	245	0	625	187	2	95	2	286	313	707	1	0	1021	1	0	0	12	13	1945
08:00 AM	0	91	21	0	112	42	0	8	0	50	39	193	0	0	232	1	0	0	0	1	395
08:15 AM	0	119	43	0	162	41	0	16	0	57	34	187	3	0	224	0	0	0	0	0	443
08:30 AM	2	99	32	0	133	29	0	14	0	43	55	205	1	0	261	1	0	0	2	3	440
08:45 AM	4	84	37	0	125	37	2	18	0	57	33	225	0	0	258	1	0	0	4	5	445
Total	6	393	133	0	532	149	2	56	0	207	161	810	4	0	975	3	0	0	6	9	1723
*** BREAK ***																					
11:00 AM	1	98	36	0	135	24	1	22	0	47	16	109	1	3	129	1	0	0	2	3	314
11:15 AM	0	115	23	0	138	26	2	11	0	39	24	135	1	2	162	0	1	0	0	1	340
11:30 AM	3	134	45	1	183	50	0	14	0	64	29	138	1	0	168	1	1	0	0	2	417
11:45 AM	1	126	73	0	200	35	0	18	0	53	64	127	2	1	194	0	1	0	1	2	449
Total	5	473	177	1	656	135	3	65	0	203	133	509	5	6	653	2	3	0	3	8	1520
12:00 PM	0	131	58	0	189	65	0	48	3	116	22	137	0	0	159	0	0	0	2	2	466
12:15 PM	1	138	38	0	177	53	0	22	0	75	18	139	0	0	157	0	0	1	0	1	410
12:30 PM	1	121	41	0	163	42	0	12	5	59	25	137	0	2	164	0	0	0	2	2	388
12:45 PM	1	151	47	0	199	30	0	13	0	43	24	139	0	0	163	0	0	0	0	0	405
Total	3	541	184	0	728	190	0	95	8	293	89	552	0	2	643	0	0	1	4	5	1669
01:00 PM	1	111	32	1	145	70	1	25	0	96	17	109	0	0	126	0	0	0	1	1	368
01:15 PM	0	114	35	0	149	27	0	10	4	41	16	113	0	0	129	0	0	1	0	1	320
01:30 PM	3	133	32	0	168	42	0	19	0	61	12	152	1	0	165	1	0	0	4	5	399
01:45 PM	2	155	31	0	188	37	0	16	0	53	10	124	0	0	134	0	0	1	1	2	377
Total	6	513	130	1	650	176	1	70	4	251	55	498	1	0	554	1	0	2	6	9	1464
*** BREAK ***																					
03:00 PM	0	202	47	0	249	41	1	16	0	58	15	122	1	2	140	0	0	1	5	6	453
03:15 PM	0	202	58	0	260	50	0	22	6	78	31	144	0	5	180	1	0	0	1	2	520
03:30 PM	0	174	60	0	234	38	0	29	1	68	33	134	1	3	171	0	0	0	1	1	474
03:45 PM	1	195	57	0	253	43	1	14	0	58	31	134	7	0	172	1	0	0	1	2	485
Total	1	773	222	0	996	172	2	81	7	262	110	534	9	10	663	2	0	1	8	11	1932
04:00 PM	0	188	35	0	223	35	1	24	3	63	29	131	4	0	164	5	1	0	8	14	464
04:15 PM	0	200	46	0	246	46	0	24	1	71	9	128	1	0	138	1	0	0	0	1	456
04:30 PM	0	211	56	0	267	42	0	26	0	68	22	122	0	0	144	0	1	0	2	3	482

Central Transportation Planning Staff
 High St (Rte 109) at Nahatan St
 04/08/14

File Name : Nahatan AM+MID+PM
 Site Code : 04081422
 Start Date : 4/8/2014
 Page No : 2

Groups Printed- Autos - Heavy Vehicle - Bicycles

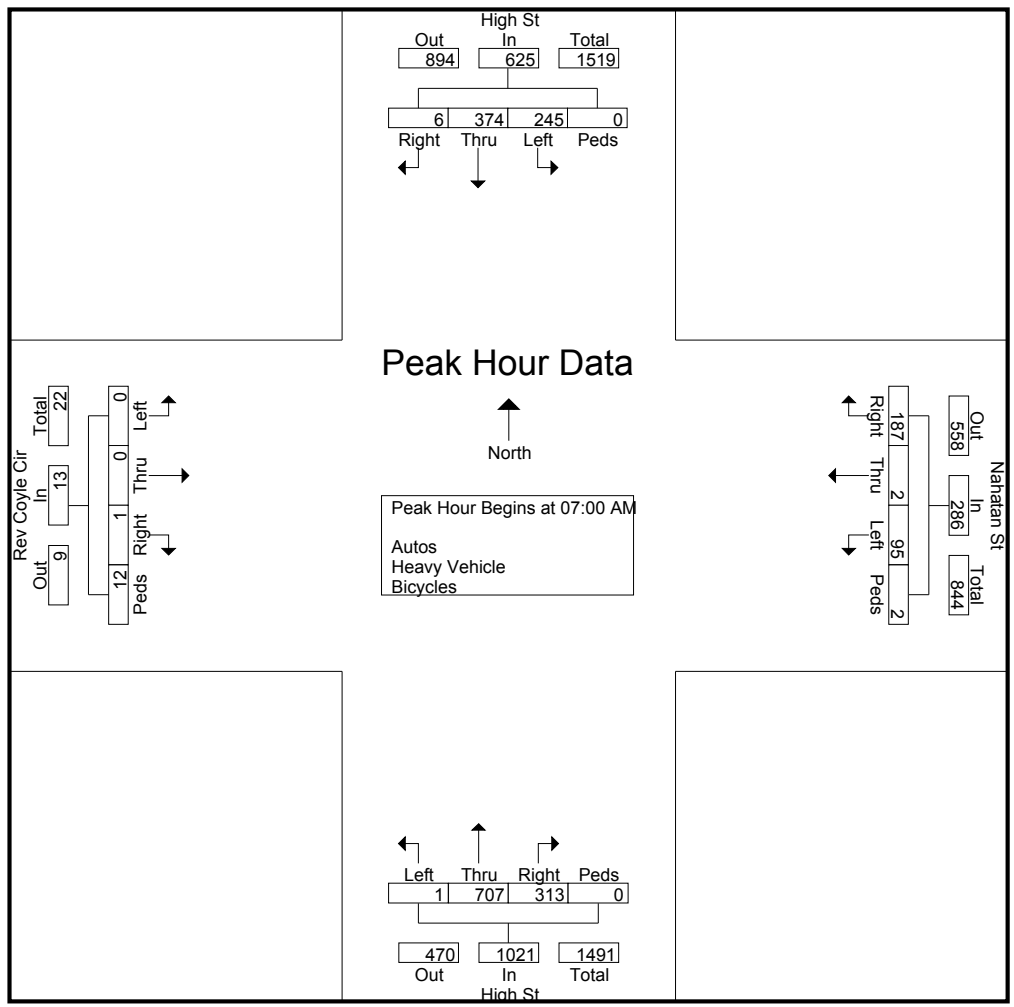
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04:45 PM	2	231	56	0	289	54	0	36	3	93	24	114	7	0	145	3	0	0	1	4	531
Total	2	830	193	0	1025	177	1	110	7	295	84	495	12	0	591	9	2	0	11	22	1933
05:00 PM	0	224	54	0	278	49	1	31	0	81	22	126	2	0	150	18	1	1	0	20	529
05:15 PM	0	216	48	0	264	46	0	34	3	83	20	135	0	0	155	0	0	0	0	0	502
05:30 PM	0	233	49	0	282	56	0	47	1	104	23	122	0	0	145	0	0	0	6	6	537
05:45 PM	0	238	60	0	298	29	0	29	2	60	18	109	0	0	127	0	0	0	1	1	486
Total	0	911	211	0	1122	180	1	141	6	328	83	492	2	0	577	18	1	1	7	27	2054
Grand Total	29	4808	1495	2	6334	1366	12	713	34	2125	1028	4597	34	18	5677	36	6	5	57	104	14240
Apprch %	0.5	75.9	23.6	0		64.3	0.6	33.6	1.6		18.1	81	0.6	0.3		34.6	5.8	4.8	54.8		
Total %	0.2	33.8	10.5	0	44.5	9.6	0.1	5	0.2	14.9	7.2	32.3	0.2	0.1	39.9	0.3	0	0	0.4	0.7	
Autos	17	4564	1445	2	6028	1339	9	686	34	2068	988	4381	32	18	5419	35	6	3	57	101	13616
% Autos	58.6	94.9	96.7	100	95.2	98	75	96.2	100	97.3	96.1	95.3	94.1	100	95.5	97.2	100	60	100	97.1	95.6
Heavy Vehicle	12	234	50	0	296	24	3	26	0	53	36	204	2	0	242	1	0	2	0	3	594
% Heavy Vehicle	41.4	4.9	3.3	0	4.7	1.8	25	3.6	0	2.5	3.5	4.4	5.9	0	4.3	2.8	0	40	0	2.9	4.2
Bicycles	0	10	0	0	10	3	0	1	0	4	4	12	0	0	16	0	0	0	0	0	30
% Bicycles	0	0.2	0	0	0.2	0.2	0	0.1	0	0.2	0.4	0.3	0	0	0.3	0	0	0	0	0	0.2



Central Transportation Planning Staff
 High St (Rte 109) at Nahatan St
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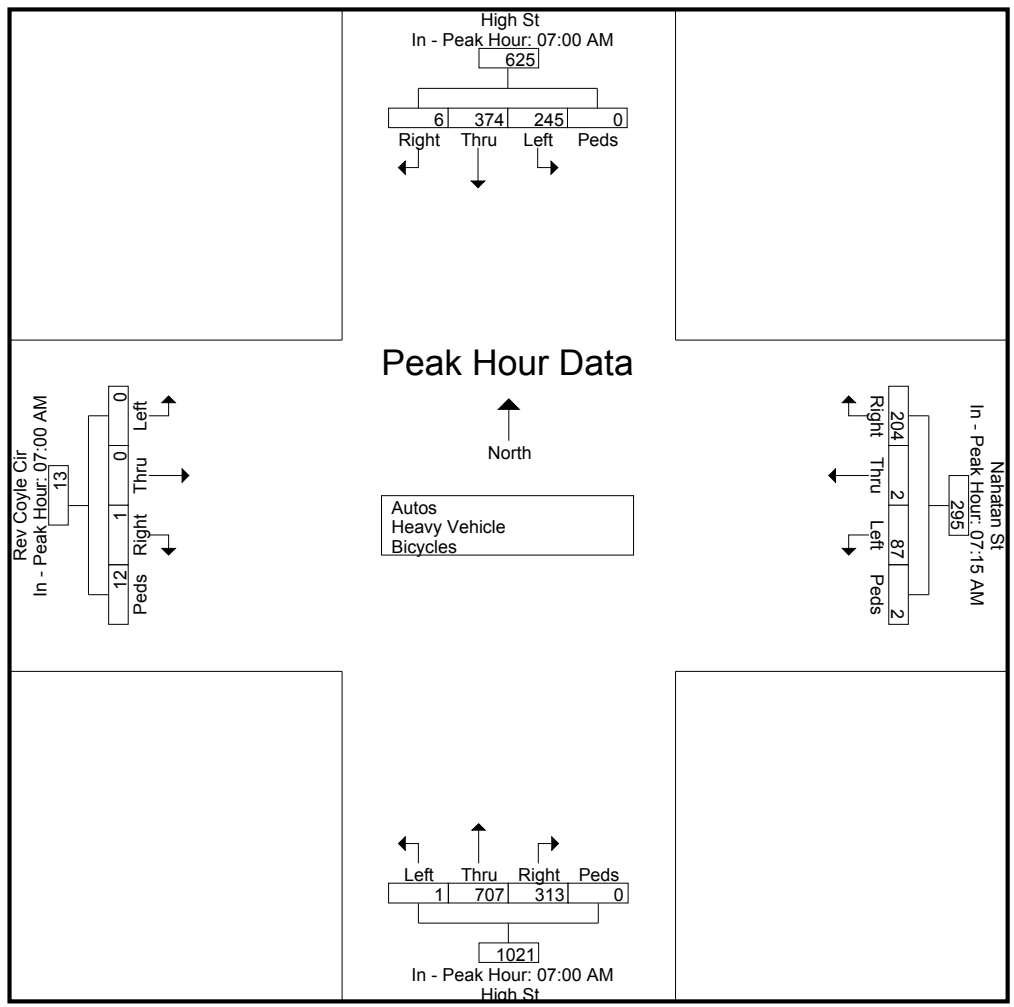
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Peak Hour Analysis From 07:00 AM to 09:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	5	93	64	0	162	25	0	16	0	41	81	184	0	0	265	0	0	0	1	1	469
07:15 AM	0	83	77	0	160	62	0	30	1	93	81	177	0	0	258	1	0	0	0	1	512
07:30 AM	1	111	67	0	179	54	0	27	1	82	91	181	1	0	273	0	0	0	11	11	545
07:45 AM	0	87	37	0	124	46	2	22	0	70	60	165	0	0	225	0	0	0	0	0	419
Total Volume	6	374	245	0	625	187	2	95	2	286	313	707	1	0	1021	1	0	0	12	13	1945
% App. Total	1	59.8	39.2	0		65.4	0.7	33.2	0.7		30.7	69.2	0.1	0		7.7	0	0	92.3		
PHF	.300	.842	.795	.000	.873	.754	.250	.792	.500	.769	.860	.961	.250	.000	.935	.250	.000	.000	.273	.295	.892



Central Transportation Planning Staff
 High St (Rte 109) at Nahatan St
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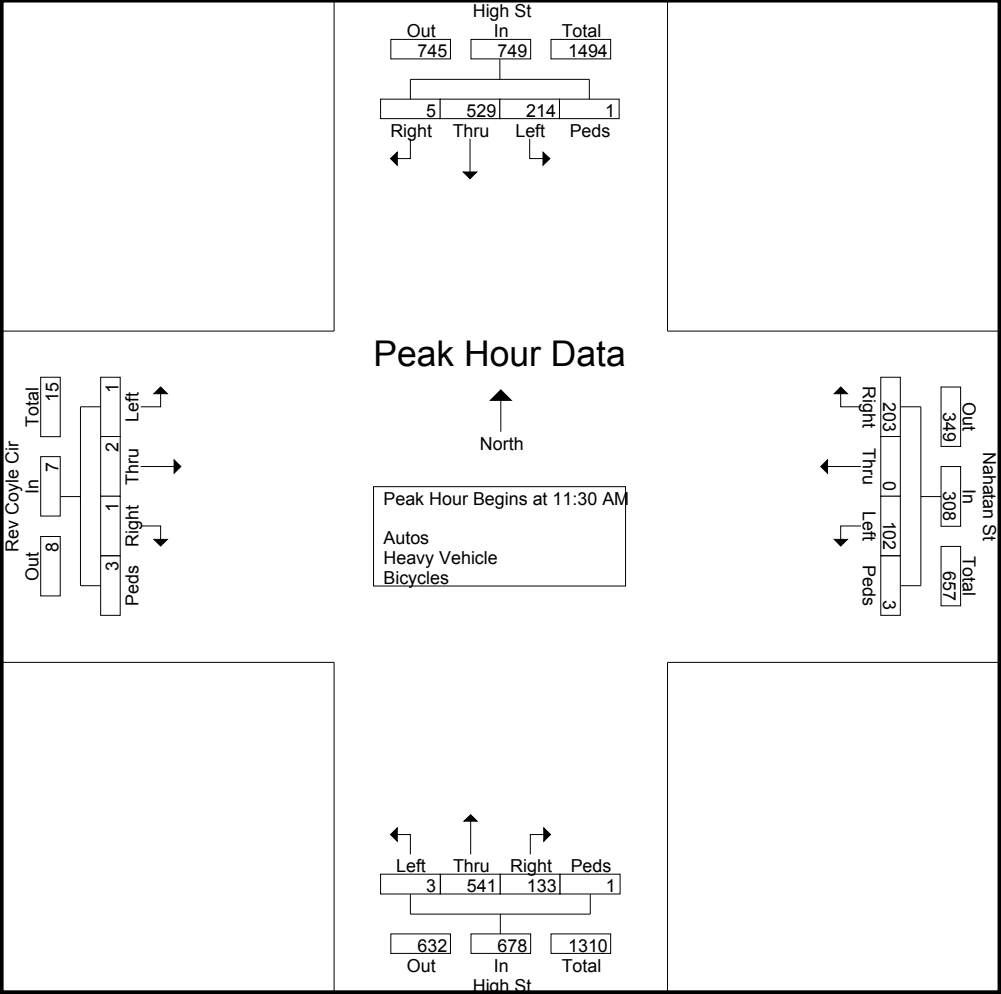
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Peak Hour for Each Approach Begins at:																					
	07:00 AM					07:15 AM					07:00 AM					07:00 AM					
+0 mins.	5	93	64	0	162	62	0	30	1	93	81	184	0	0	265	0	0	0	1	1	
+15 mins.	0	83	77	0	160	54	0	27	1	82	81	177	0	0	258	1	0	0	0	1	
+30 mins.	1	111	67	0	179	46	2	22	0	70	91	181	1	0	273	0	0	0	11	11	
+45 mins.	0	87	37	0	124	42	0	8	0	50	60	165	0	0	225	0	0	0	0	0	
Total Volume	6	374	245	0	625	204	2	87	2	295	313	707	1	0	1021	1	0	0	12	13	
% App. Total	1	59.8	39.2	0		69.2	0.7	29.5	0.7		30.7	69.2	0.1	0		7.7	0	0	92.3		
PHF	.300	.842	.795	.000	.873	.823	.250	.725	.500	.793	.860	.961	.250	.000	.935	.250	.000	.000	.273	.295	



Central Transportation Planning Staff
 High St (Rte 109) at Nahatan St
 04/08/14

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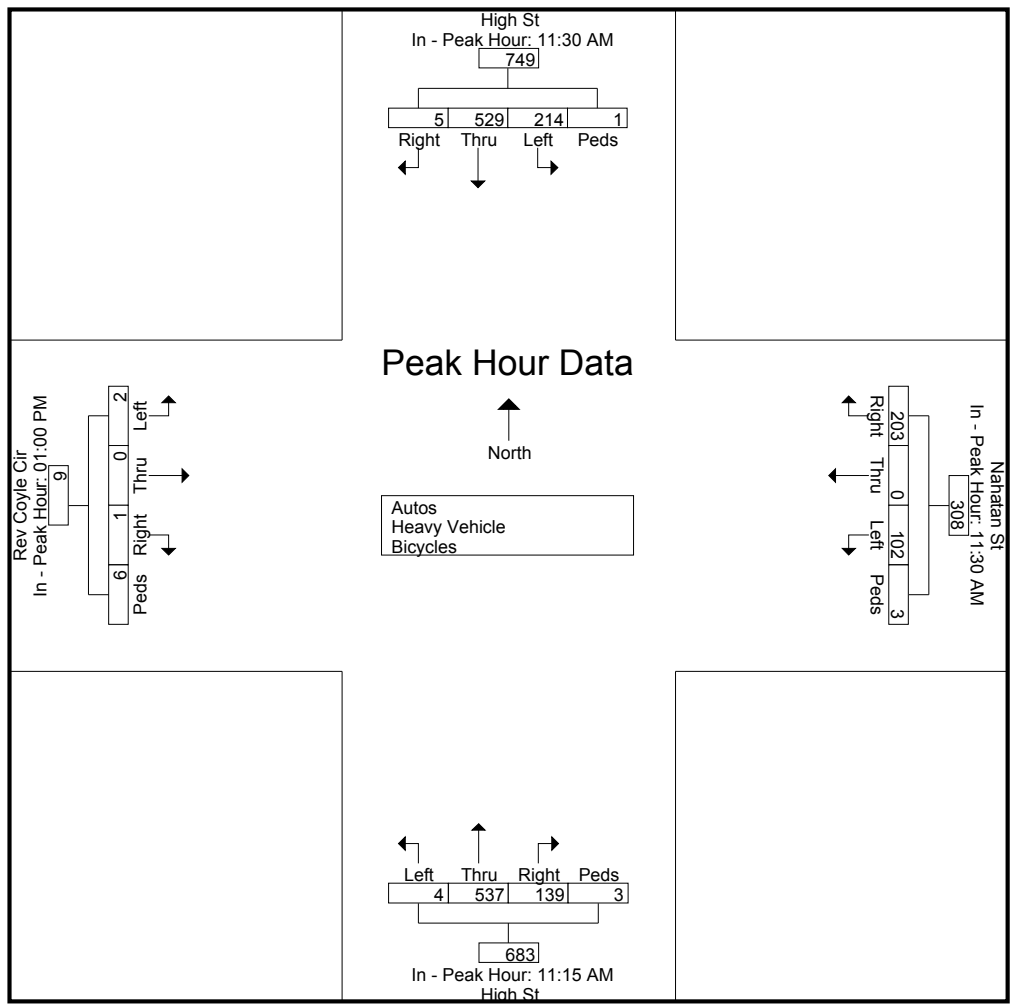
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Peak Hour for Entire Intersection Begins at 11:30 AM																					
11:30 AM	3	134	45	1	183	50	0	14	0	64	29	138	1	0	168	1	1	0	0	2	417
11:45 AM	1	126	73	0	200	35	0	18	0	53	64	127	2	1	194	0	1	0	1	2	449
12:00 PM	0	131	58	0	189	65	0	48	3	116	22	137	0	0	159	0	0	0	2	2	466
12:15 PM	1	138	38	0	177	53	0	22	0	75	18	139	0	0	157	0	0	1	0	1	410
Total Volume	5	529	214	1	749	203	0	102	3	308	133	541	3	1	678	1	2	1	3	7	1742
% App. Total	0.7	70.6	28.6	0.1		65.9	0	33.1	1		19.6	79.8	0.4	0.1		14.3	28.6	14.3	42.9		
PHF	.417	.958	.733	.250	.936	.781	.000	.531	.250	.664	.520	.973	.375	.250	.874	.250	.500	.250	.375	.875	.935



Central Transportation Planning Staff
 High St (Rte 109) at Nahatan St
 04/08/14

File Name : Nahatan AM+MID+PM
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 Start Date : 4/8/2014
 Page No : 14

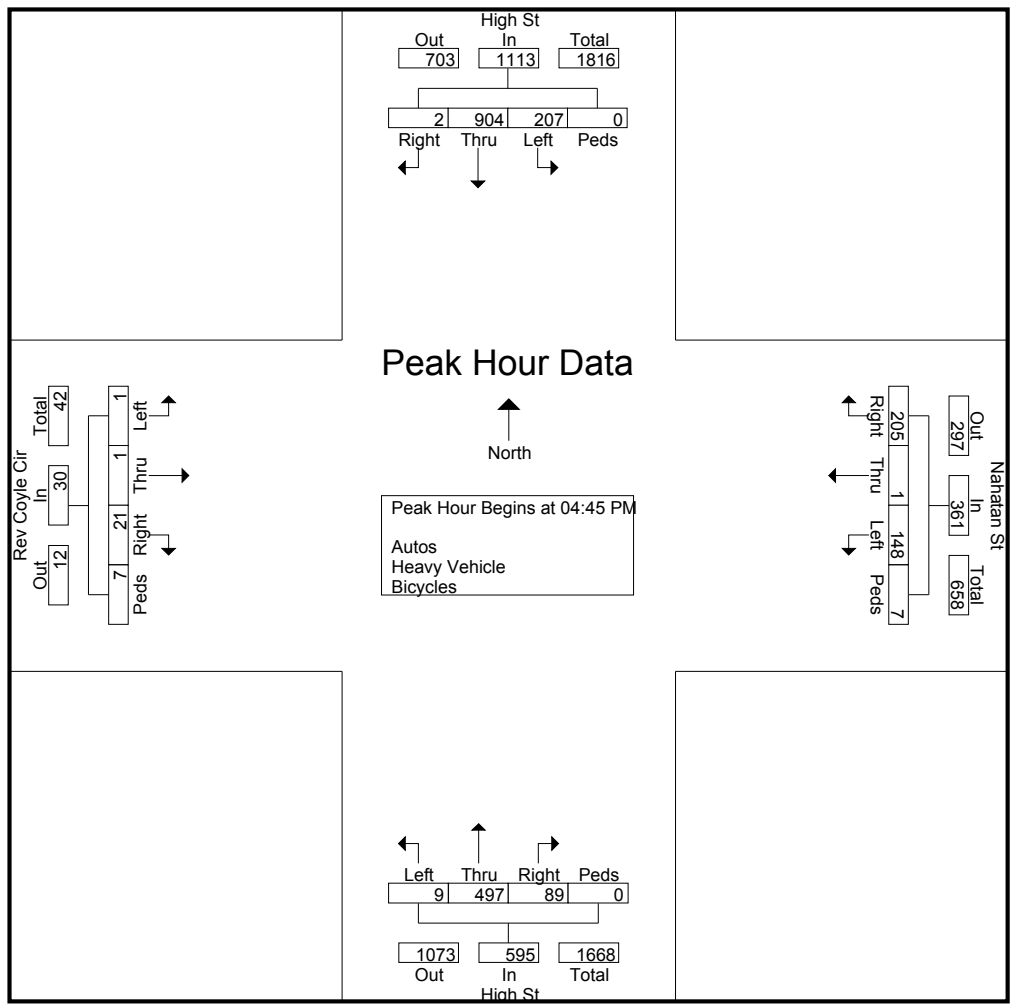
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+0 mins.	3	134	45	1	183	50	0	14	0	64	24	135	1	2	162	0	0	0	1	1	
+15 mins.	1	126	73	0	200	35	0	18	0	53	29	138	1	0	168	0	0	1	0	1	
+30 mins.	0	131	58	0	189	65	0	48	3	116	64	127	2	1	194	1	0	0	4	5	
+45 mins.	1	138	38	0	177	53	0	22	0	75	22	137	0	0	159	0	0	1	1	2	
Total Volume	5	529	214	1	749	203	0	102	3	308	139	537	4	3	683	1	0	2	6	9	
% App. Total	0.7	70.6	28.6	0.1		65.9	0	33.1	1		20.4	78.6	0.6	0.4		11.1	0	22.2	66.7		
PHF	.417	.958	.733	.250	.936	.781	.000	.531	.250	.664	.543	.973	.500	.375	.880	.250	.000	.500	.375	.450	



Central Transportation Planning Staff
 High St (Rte 109) at Nahatan St
 04/08/14

File Name : Nahatan AM+MID+PM
 Site Code : 04081422
 Start Date : 4/8/2014
 Page No : 17

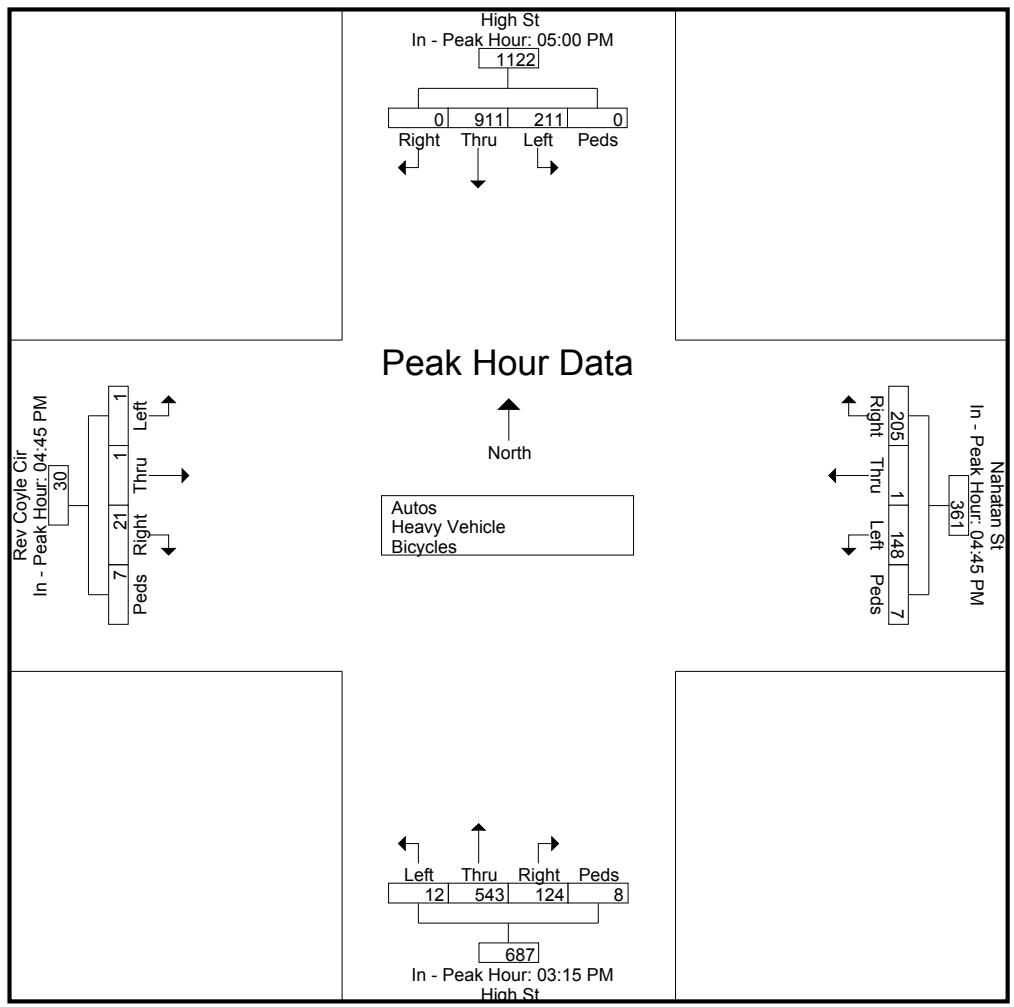
Start Time	High St From North					Nahatan St From East					High St From South					Rev Coyle Cir From West					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 02:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	2	231	56	0	289	54	0	36	3	93	24	114	7	0	145	3	0	0	1	4	531
05:00 PM	0	224	54	0	278	49	1	31	0	81	22	126	2	0	150	18	1	1	0	20	529
05:15 PM	0	216	48	0	264	46	0	34	3	83	20	135	0	0	155	0	0	0	0	0	502
05:30 PM	0	233	49	0	282	56	0	47	1	104	23	122	0	0	145	0	0	0	6	6	537
Total Volume	2	904	207	0	1113	205	1	148	7	361	89	497	9	0	595	21	1	1	7	30	2099
% App. Total	0.2	81.2	18.6	0		56.8	0.3	41	1.9		15	83.5	1.5	0		70	3.3	3.3	23.3		
PHF	.250	.970	.924	.000	.963	.915	.250	.787	.583	.868	.927	.920	.321	.000	.960	.292	.250	.250	.292	.375	.977



Central Transportation Planning Staff
 High St (Rte 109) at Nahatan St
 04/08/14

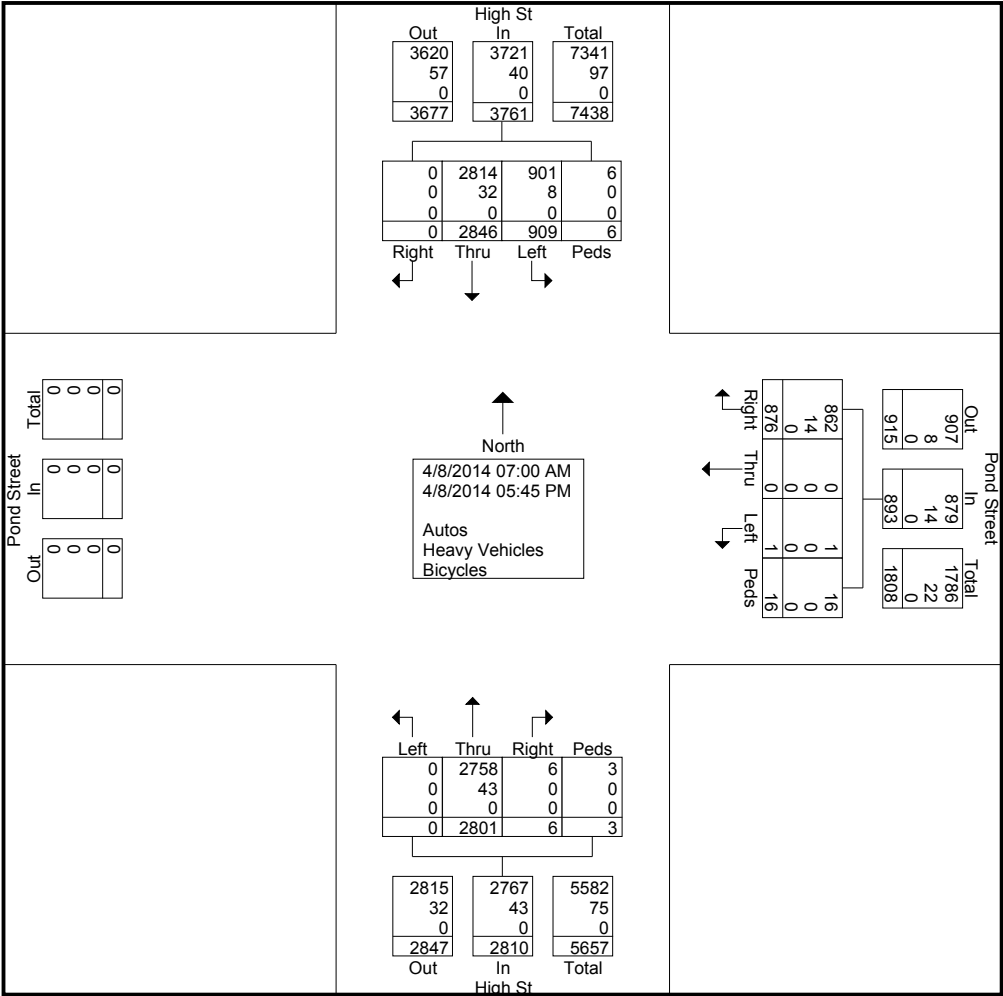
File Name : Nahatan AM+MID+PM
 Site Code : 04081422
 Start Date : 4/8/2014
 Page No : 20

Start Time	High St From North					Nahatan St From East					High St From South					Rev Coyle Cir From West					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 02:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Each Approach Begins at:																					
	05:00 PM					04:45 PM					03:15 PM					04:45 PM					
+0 mins.	0	224	54	0	278	54	0	36	3	93	31	144	0	5	180	3	0	0	1	4	
+15 mins.	0	216	48	0	264	49	1	31	0	81	33	134	1	3	171	18	1	1	0	20	
+30 mins.	0	233	49	0	282	46	0	34	3	83	31	134	7	0	172	0	0	0	0	0	
+45 mins.	0	238	60	0	298	56	0	47	1	104	29	131	4	0	164	0	0	0	6	6	
Total Volume	0	911	211	0	1122	205	1	148	7	361	124	543	12	8	687	21	1	1	7	30	
% App. Total	0	81.2	18.8	0		56.8	0.3	41	1.9		18	79	1.7	1.2		70	3.3	3.3	23.3		
PHF	.000	.957	.879	.000	.941	.915	.250	.787	.583	.868	.939	.943	.429	.400	.954	.292	.250	.250	.292	.375	



Central Transportation Planning Staff
 High St (Rte 109) at Pond St (near Nahatan St)
 04/08/14 PM and 04/17/14 AM

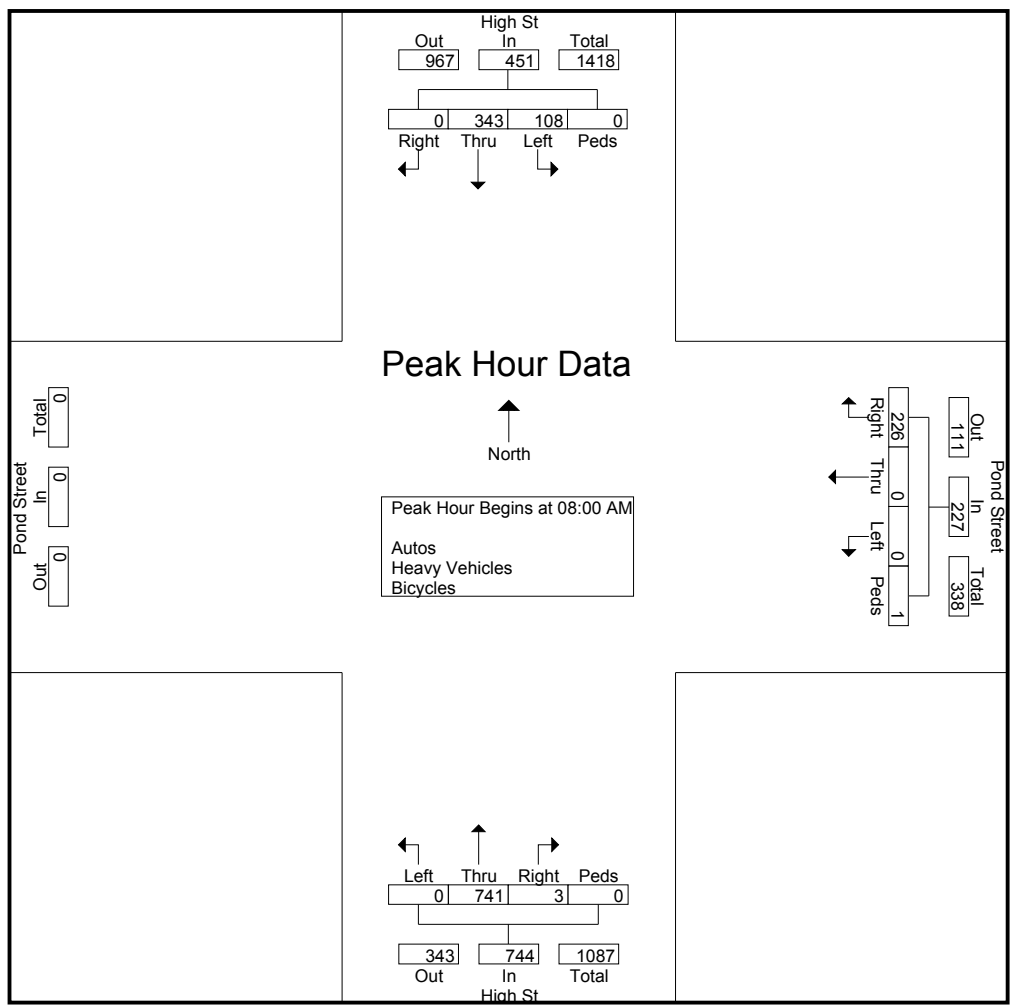
File Name : Pond near Nahatan AM and PM
 Site Code : 04081423
 Start Date : 4/8/2014
 Page No : 2



Central Transportation Planning Staff
 High St (Rte 109) at Pond St (near Nahatan St)
 04/08/14 PM and 04/17/14 AM

File Name : Pond near Nahatan AM and PM
 Site Code : 04081423
 Start Date : 4/8/2014
 Page No : 4

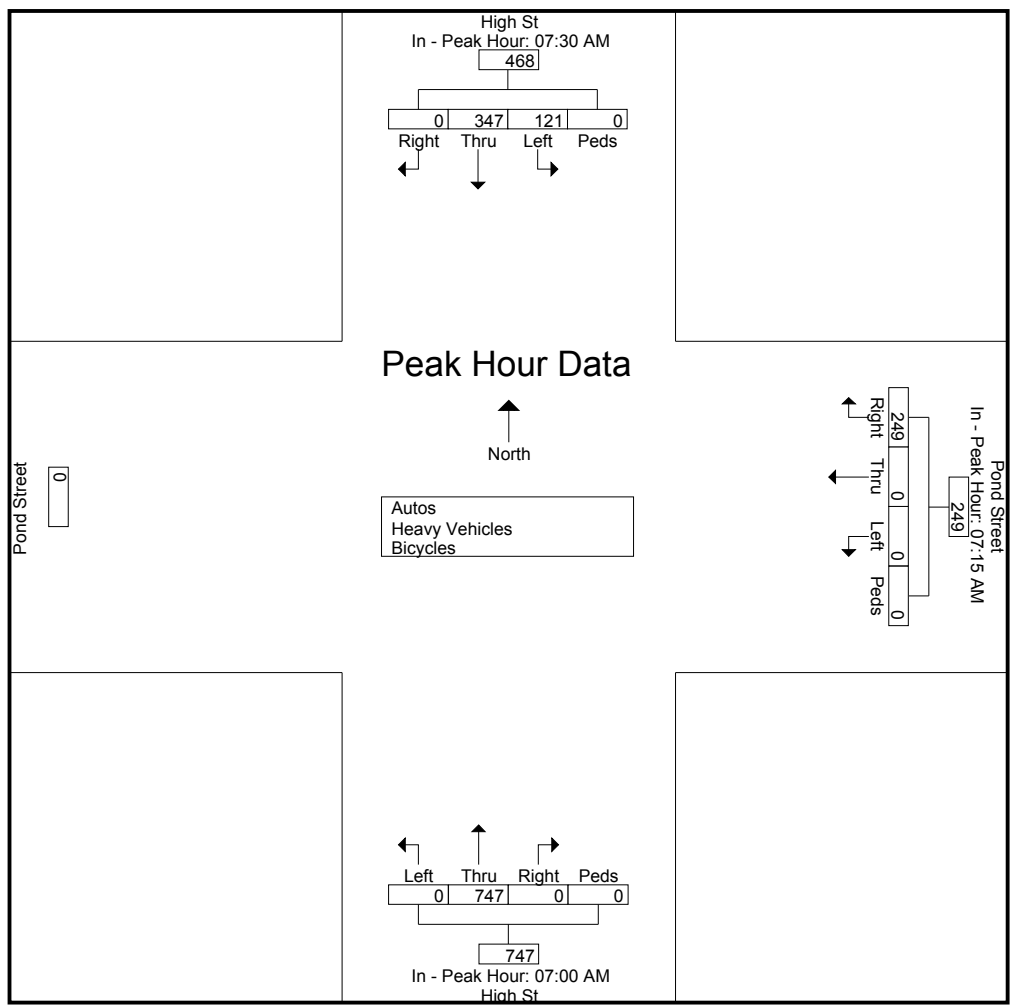
Start Time	High St From North					Pond Street From East					High St From South					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																
Peak Hour for Entire Intersection Begins at 08:00 AM																
08:00 AM	0	82	18	0	100	63	0	0	0	63	0	169	0	0	169	332
08:15 AM	0	95	42	0	137	46	0	0	1	47	0	172	0	0	172	356
08:30 AM	0	82	26	0	108	72	0	0	0	72	3	182	0	0	185	365
08:45 AM	0	84	22	0	106	45	0	0	0	45	0	218	0	0	218	369
Total Volume	0	343	108	0	451	226	0	0	1	227	3	741	0	0	744	1422
% App. Total	0	76.1	23.9	0		99.6	0	0	0.4		0.4	99.6	0	0		
PHF	.000	.903	.643	.000	.823	.785	.000	.000	.250	.788	.250	.850	.000	.000	.853	.963



Central Transportation Planning Staff
 High St (Rte 109) at Pond St (near Nahatan St)
 04/08/14 PM and 04/17/14 AM

File Name : Pond near Nahatan AM and PM
 Site Code : 04081423
 Start Date : 4/8/2014
 Page No : 7

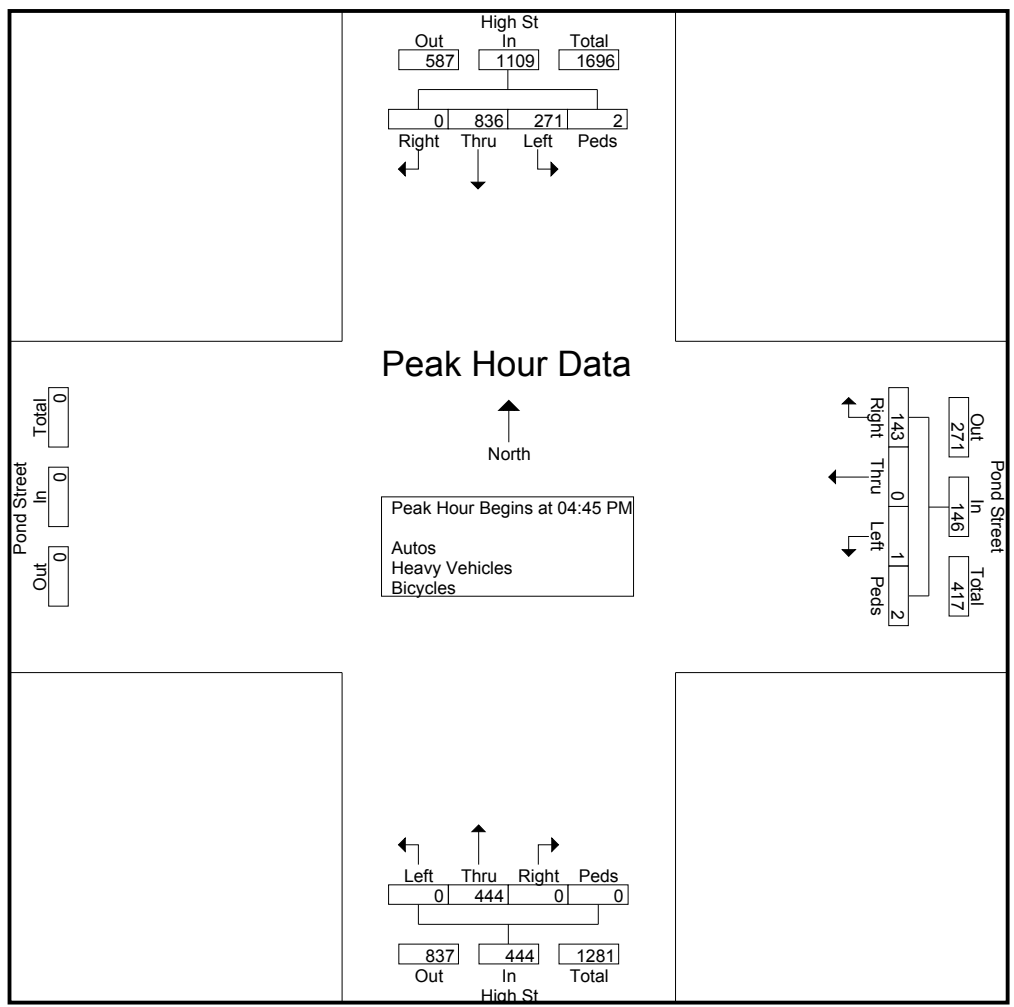
Start Time	High St From North					Pond Street From East					High St From South					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																
Peak Hour for Each Approach Begins at:																
	07:30 AM					07:15 AM					07:00 AM					
+0 mins.	0	89	33	0	122	70	0	0	0	70	0	219	0	0	219	
+15 mins.	0	81	28	0	109	71	0	0	0	71	0	176	0	0	176	
+30 mins.	0	82	18	0	100	45	0	0	0	45	0	188	0	0	188	
+45 mins.	0	95	42	0	137	63	0	0	0	63	0	164	0	0	164	
Total Volume	0	347	121	0	468	249	0	0	0	249	0	747	0	0	747	
% App. Total	0	74.1	25.9	0		100	0	0	0		0	100	0	0		
PHF	.000	.913	.720	.000	.854	.877	.000	.000	.000	.877	.000	.853	.000	.000	.853	



Central Transportation Planning Staff
 High St (Rte 109) at Pond St (near Nahatan St)
 04/08/14 PM and 04/17/14 AM

File Name : Pond near Nahatan AM and PM
 Site Code : 04081423
 Start Date : 4/8/2014
 Page No : 10

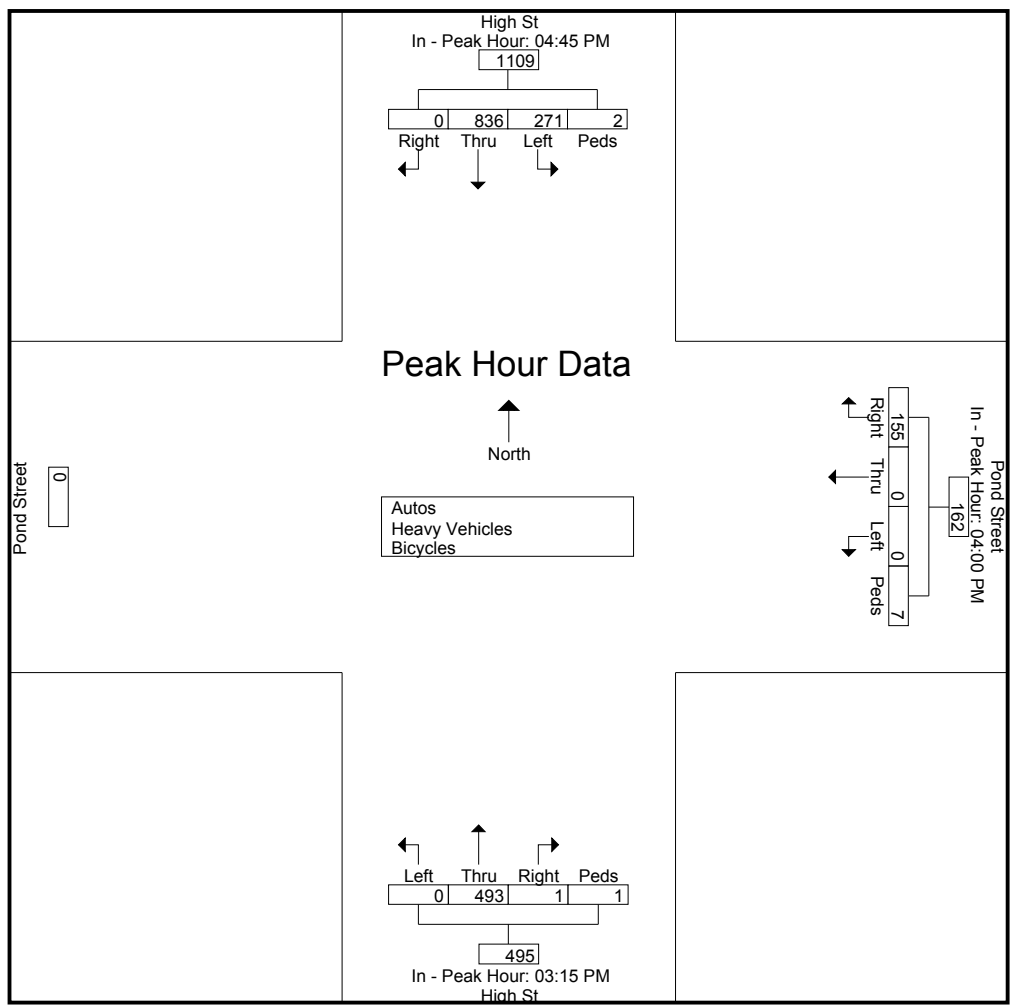
Start Time	High St From North					Pond Street From East					High St From South					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1																
Peak Hour for Entire Intersection Begins at 04:45 PM																
04:45 PM	0	226	56	0	282	46	0	0	0	46	0	105	0	0	105	433
05:00 PM	0	195	90	1	286	35	0	1	1	37	0	117	0	0	117	440
05:15 PM	0	192	57	0	249	34	0	0	1	35	0	114	0	0	114	398
05:30 PM	0	223	68	1	292	28	0	0	0	28	0	108	0	0	108	428
Total Volume	0	836	271	2	1109	143	0	1	2	146	0	444	0	0	444	1699
% App. Total	0	75.4	24.4	0.2		97.9	0	0.7	1.4		0	100	0	0		
PHF	.000	.925	.753	.500	.949	.777	.000	.250	.500	.793	.000	.949	.000	.000	.949	.965



Central Transportation Planning Staff
 High St (Rte 109) at Pond St (near Nahatan St)
 04/08/14 PM and 04/17/14 AM

File Name : Pond near Nahatan AM and PM
 Site Code : 04081423
 Start Date : 4/8/2014
 Page No : 13

Start Time	High St From North					Pond Street From East					High St From South					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1																
Peak Hour for Each Approach Begins at:																
	04:45 PM					04:00 PM					03:15 PM					
+0 mins.	0	226	56	0	282	36	0	0	2	38	0	119	0	0	119	
+15 mins.	0	195	90	1	286	36	0	0	3	39	0	126	0	0	126	
+30 mins.	0	192	57	0	249	37	0	0	2	39	1	122	0	1	124	
+45 mins.	0	223	68	1	292	46	0	0	0	46	0	126	0	0	126	
Total Volume	0	836	271	2	1109	155	0	0	7	162	1	493	0	1	495	
% App. Total	0	75.4	24.4	0.2		95.7	0	0	4.3		0.2	99.6	0	0.2		
PHF	.000	.925	.753	.500	.949	.842	.000	.000	.583	.880	.250	.978	.000	.250	.982	

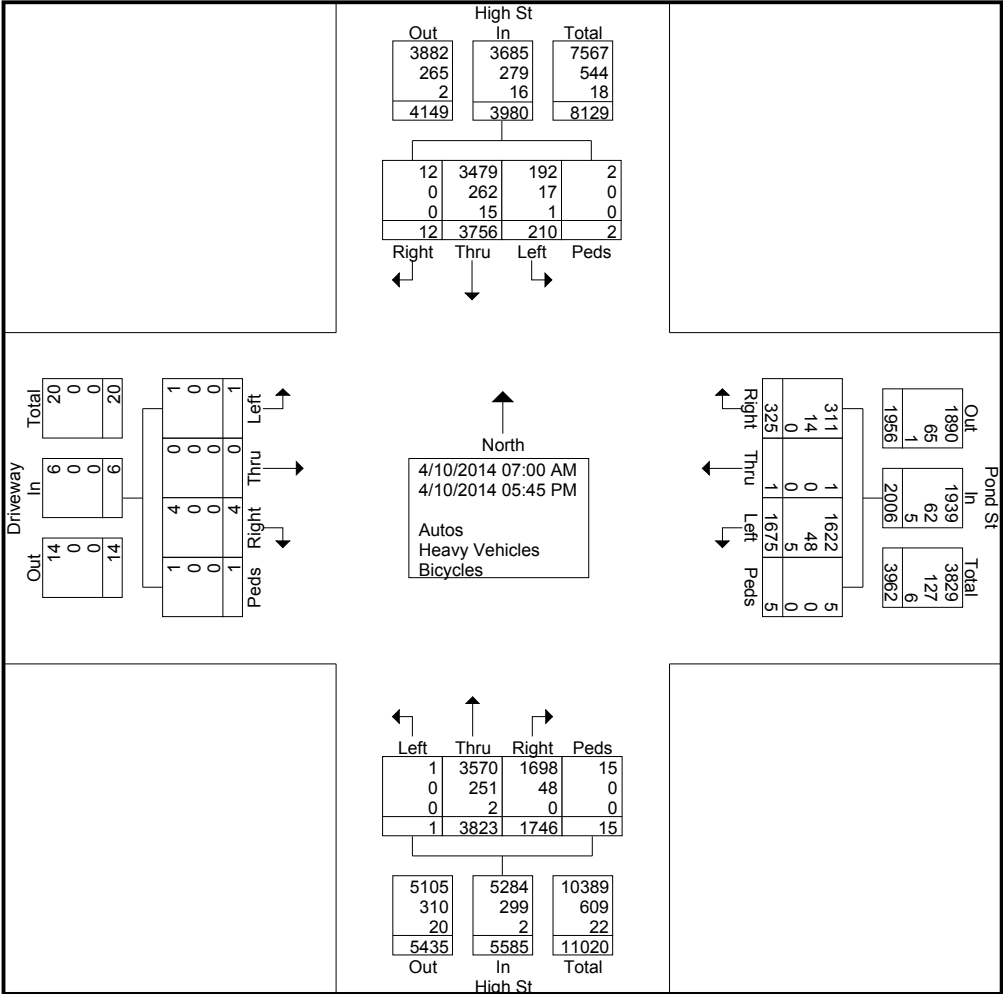


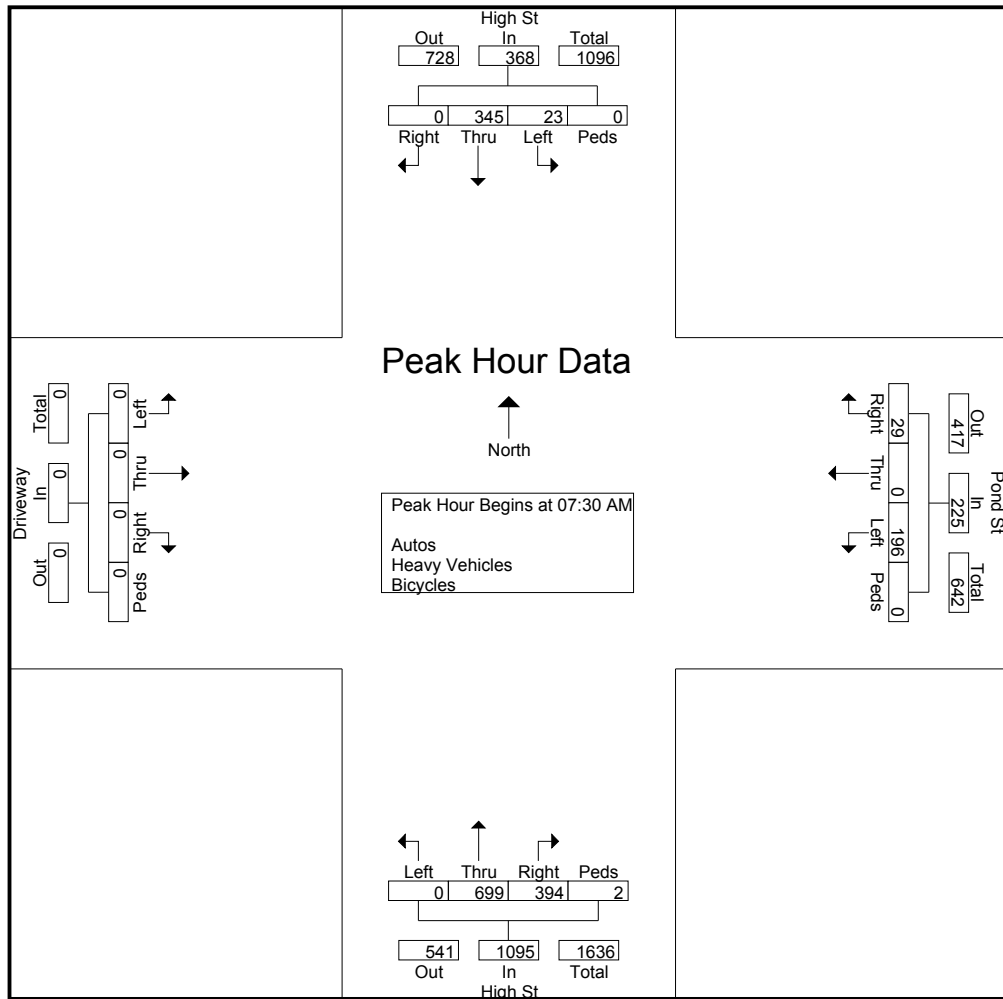
Central Transportation Planning Staff
 High St (Rte 109) at Pond St (Sheehan School)
 04/10/14

File Name : Pond near Sheehan AM+MID+PM
 Site Code : 04101402
 Start Date : 4/10/2014
 Page No : 1

Groups Printed- Autos - Heavy Vehicles - Bicycles

Start Time	High St From North					Pond St From East					High St From South					Driveway From West					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
07:00 AM	1	67	2	0	70	9	0	36	0	45	75	195	0	0	270	0	0	1	0	1	386
07:15 AM	0	59	2	0	61	6	0	48	0	54	99	181	0	0	280	0	0	0	0	0	395
07:30 AM	0	89	3	0	92	5	0	49	0	54	99	185	0	0	284	0	0	0	0	0	430
07:45 AM	0	94	7	0	101	5	0	59	0	64	110	173	0	1	284	0	0	0	0	0	449
Total	1	309	14	0	324	25	0	192	0	217	383	734	0	1	1118	0	0	1	0	1	1660
08:00 AM	0	86	8	0	94	11	0	48	0	59	91	164	0	0	255	0	0	0	0	0	408
08:15 AM	0	76	5	0	81	8	0	40	0	48	94	177	0	1	272	0	0	0	0	0	401
08:30 AM	0	64	18	0	82	29	0	58	0	87	103	148	0	0	251	1	0	0	0	1	421
08:45 AM	0	77	7	0	84	26	0	38	0	64	85	175	0	1	261	0	0	0	0	0	409
Total	0	303	38	0	341	74	0	184	0	258	373	664	0	2	1039	1	0	0	0	1	1639
*** BREAK ***																					
11:00 AM	0	87	3	0	90	7	0	36	0	43	36	94	0	1	131	0	0	0	0	0	264
11:15 AM	0	75	6	0	81	6	0	29	0	35	31	92	0	0	123	0	0	0	0	0	239
11:30 AM	0	94	4	0	98	9	0	27	0	36	25	119	0	0	144	0	0	0	0	0	278
11:45 AM	0	99	4	0	103	6	0	30	0	36	35	112	0	0	147	0	0	0	0	0	286
Total	0	355	17	0	372	28	0	122	0	150	127	417	0	1	545	0	0	0	0	0	1067
12:00 PM	0	110	3	0	113	8	0	35	0	43	38	118	0	0	156	0	0	0	0	0	312
12:15 PM	0	101	7	0	108	1	0	28	0	29	28	114	0	0	142	0	0	0	0	0	279
12:30 PM	0	104	4	0	108	8	0	24	0	32	38	104	0	0	142	0	0	0	0	0	282
12:45 PM	0	92	11	1	104	7	0	42	0	49	40	81	0	0	121	0	0	0	0	0	274
Total	0	407	25	1	433	24	0	129	0	153	144	417	0	0	561	0	0	0	0	0	1147
01:00 PM	0	96	4	0	100	7	0	39	0	46	32	88	0	0	120	0	0	0	0	0	266
01:15 PM	0	89	3	0	92	10	0	40	0	50	26	79	0	2	107	0	0	0	0	0	249
01:30 PM	0	100	8	0	108	9	0	45	0	54	51	115	0	0	166	0	0	0	0	0	328
01:45 PM	0	104	6	1	111	7	0	30	0	37	49	94	0	0	143	0	0	0	0	0	291
Total	0	389	21	1	411	33	0	154	0	187	158	376	0	2	536	0	0	0	0	0	1134
*** BREAK ***																					
03:00 PM	0	141	6	0	147	10	0	60	0	70	41	108	0	0	149	0	0	0	0	0	366
03:15 PM	1	141	9	0	151	14	1	69	0	84	34	107	0	0	141	1	0	0	0	1	377
03:30 PM	2	159	4	0	165	10	0	58	0	68	40	127	1	0	168	0	0	0	0	0	401
03:45 PM	0	148	6	0	154	10	0	65	0	75	43	89	0	0	132	0	0	0	0	0	361
Total	3	589	25	0	617	44	1	252	0	297	158	431	1	0	590	1	0	0	0	1	1505
04:00 PM	1	140	11	0	152	17	0	82	2	101	50	88	0	0	138	0	0	0	0	0	391
04:15 PM	0	170	7	0	177	15	0	87	2	104	49	101	0	8	158	0	0	0	0	0	439
04:30 PM	1	189	10	0	200	8	0	77	0	85	52	111	0	0	163	2	0	0	0	2	450
04:45 PM	1	197	5	0	203	12	0	65	0	77	36	95	0	0	131	0	0	0	0	0	411
Total	3	696	33	0	732	52	0	311	4	367	187	395	0	8	590	2	0	0	0	2	1691





Central Transportation Planning Staff
 High St (Rte 109) at Pond St (Sheehan School)
 04/10/14

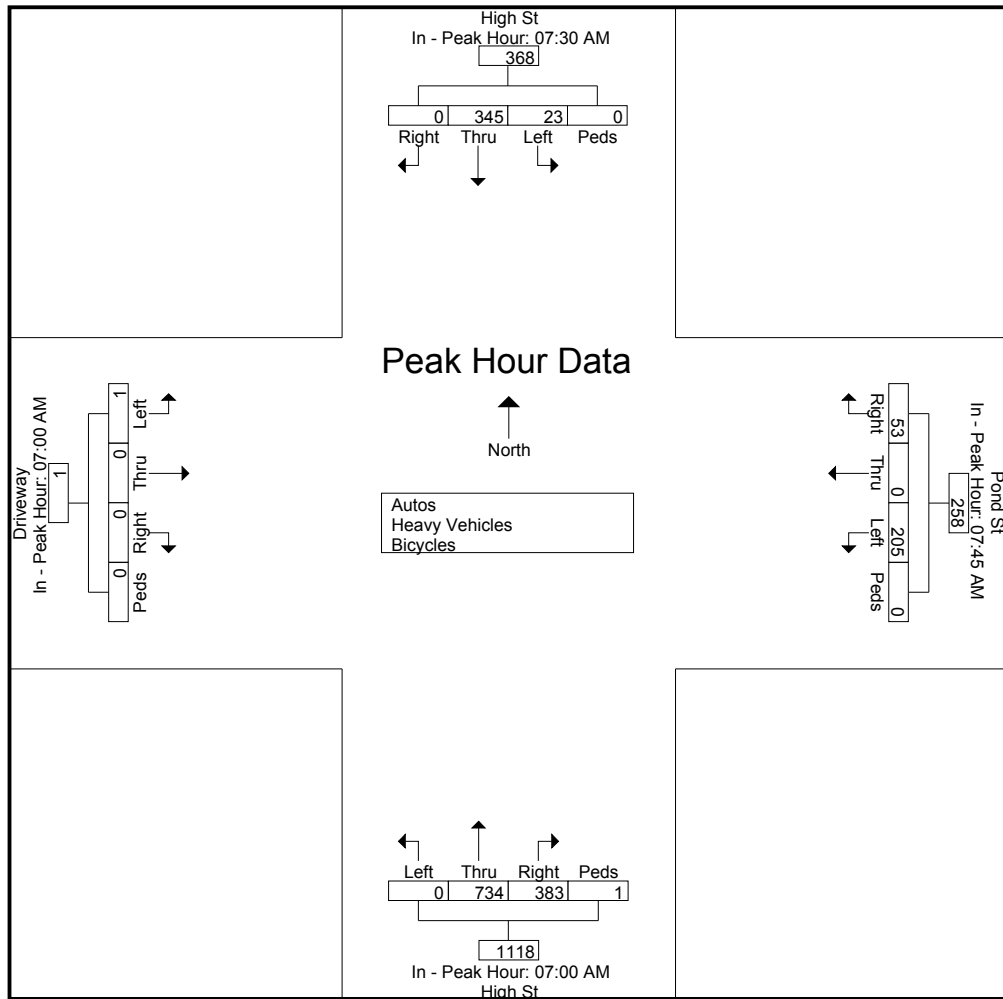
File Name : Pond near Sheehan AM+MID+PM
 Site Code : 04101402
 Start Date : 4/10/2014
 Page No : 8

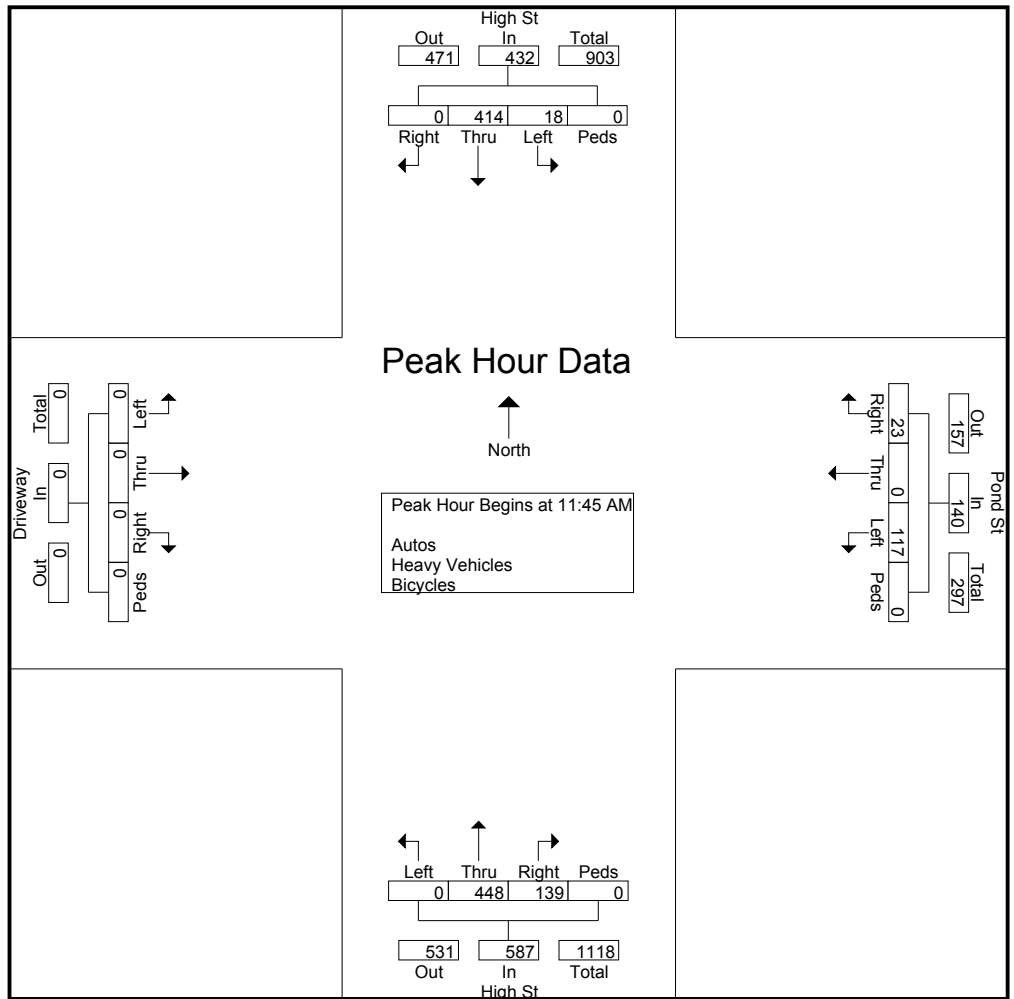
Start Time	High St From North					Pond St From East					High St From South					Driveway From West					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	

Peak Hour Analysis From 07:00 AM to 09:45 AM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

	07:30 AM					07:45 AM					07:00 AM					07:00 AM				
+0 mins.	0	89	3	0	92	5	0	59	0	64	75	195	0	0	270	0	0	1	0	1
+15 mins.	0	94	7	0	101	11	0	48	0	59	99	181	0	0	280	0	0	0	0	0
+30 mins.	0	86	8	0	94	8	0	40	0	48	99	185	0	0	284	0	0	0	0	0
+45 mins.	0	76	5	0	81	29	0	58	0	87	110	173	0	1	284	0	0	0	0	0
Total Volume	0	345	23	0	368	53	0	205	0	258	383	734	0	1	1118	0	0	1	0	1
% App. Total	0	93.8	6.2	0		20.5	0	79.5	0		34.3	65.7	0	0.1		0	0	100	0	
PHF	.000	.918	.719	.000	.911	.457	.000	.869	.000	.741	.870	.941	.000	.250	.984	.000	.000	.250	.000	.250

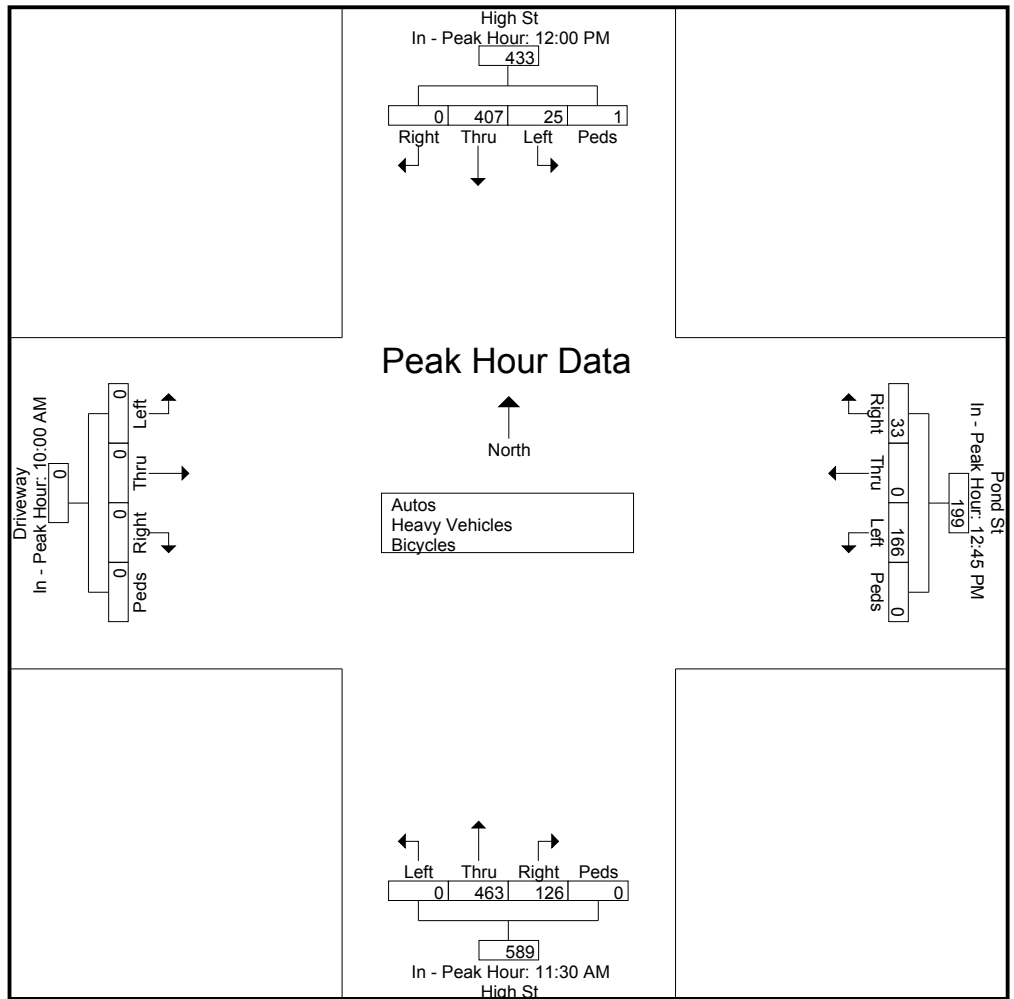




Central Transportation Planning Staff
 High St (Rte 109) at Pond St (Sheehan School)
 04/10/14

File Name : Pond near Sheehan AM+MID+PM
 Site Code : 04101402
 Start Date : 4/10/2014
 Page No : 14

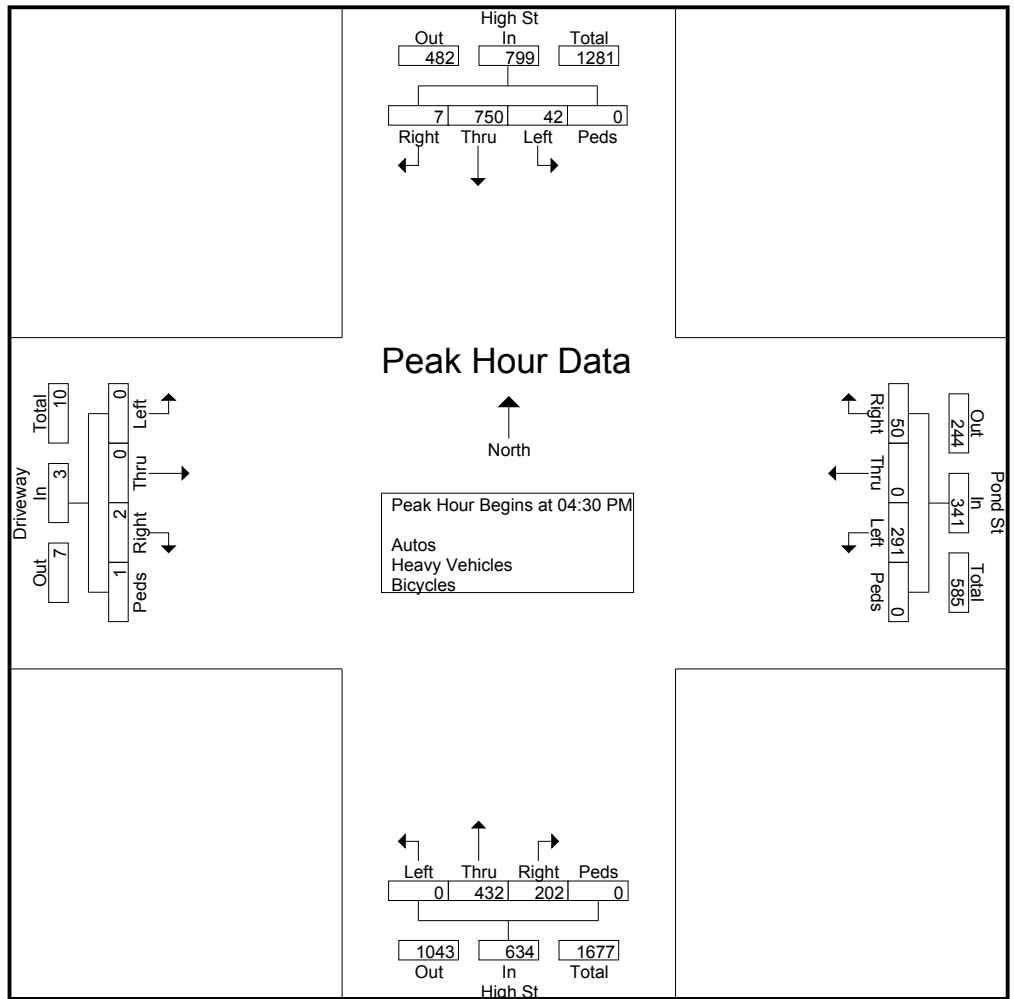
Start Time	High St From North					Pond St From East					High St From South					Driveway From West					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 10:00 AM to 01:45 PM - Peak 1 of 1																					
Peak Hour for Each Approach Begins at:																					
	12:00 PM					12:45 PM					11:30 AM					10:00 AM					
+0 mins.	0	110	3	0	113	7	0	42	0	49	25	119	0	0	144	0	0	0	0	0	
+15 mins.	0	101	7	0	108	7	0	39	0	46	35	112	0	0	147	0	0	0	0	0	
+30 mins.	0	104	4	0	108	10	0	40	0	50	38	118	0	0	156	0	0	0	0	0	
+45 mins.	0	92	11	1	104	9	0	45	0	54	28	114	0	0	142	0	0	0	0	0	
Total Volume	0	407	25	1	433	33	0	166	0	199	126	463	0	0	589	0	0	0	0	0	
% App. Total	0	94	5.8	0.2		16.6	0	83.4	0		21.4	78.6	0	0		0	0	0	0		
PHF	.000	.925	.568	.250	.958	.825	.000	.922	.000	.921	.829	.973	.000	.000	.944	.000	.000	.000	.000	.000	



Central Transportation Planning Staff
 High St (Rte 109) at Pond St (Sheehan School)
 04/10/14

File Name : Pond near Sheehan AM+MID+PM
 Site Code : 04101402
 Start Date : 4/10/2014
 Page No : 17

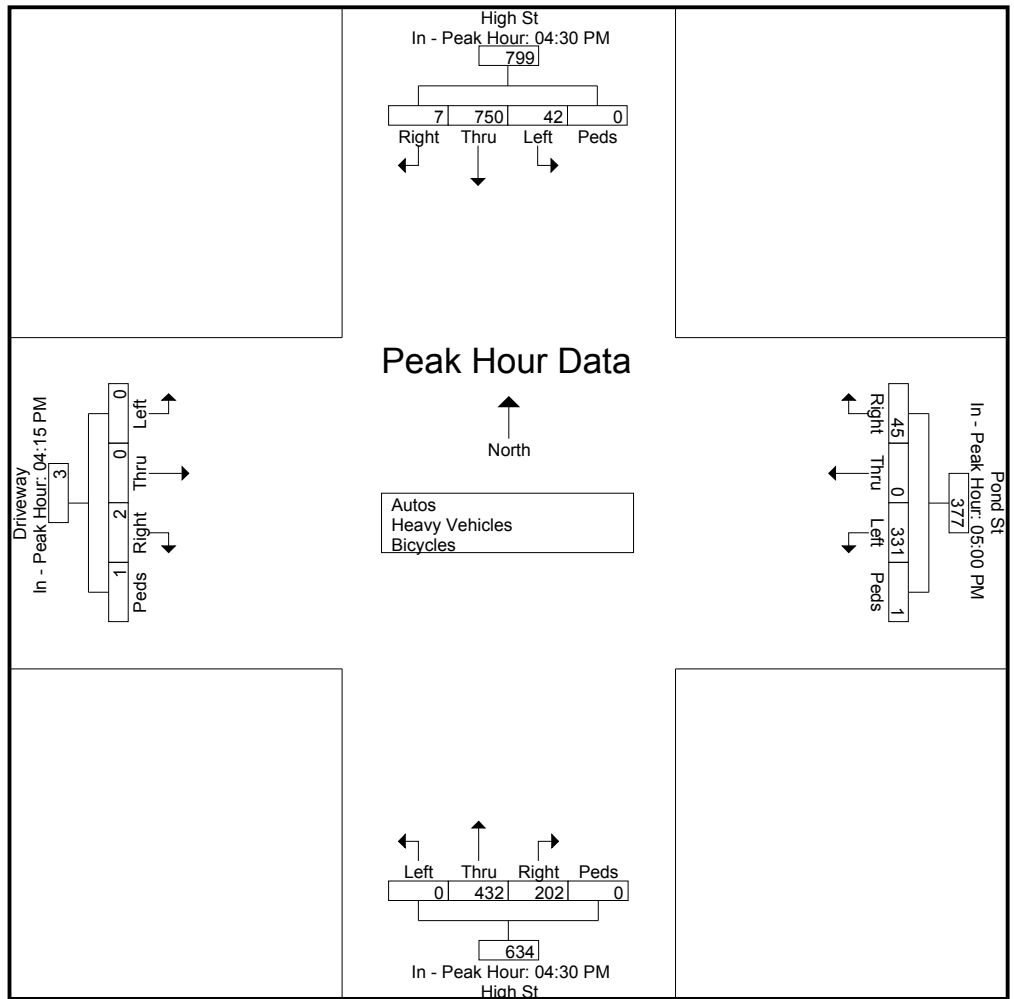
Start Time	High St From North					Pond St From East					High St From South					Driveway From West					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 02:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:30 PM																					
04:30 PM	1	189	10	0	200	8	0	77	0	85	52	111	0	0	163	2	0	0	0	2	450
04:45 PM	1	197	5	0	203	12	0	65	0	77	36	95	0	0	131	0	0	0	0	0	411
05:00 PM	5	186	15	0	206	6	0	67	0	73	59	97	0	0	156	0	0	0	1	1	436
05:15 PM	0	178	12	0	190	24	0	82	0	106	55	129	0	0	184	0	0	0	0	0	480
Total Volume	7	750	42	0	799	50	0	291	0	341	202	432	0	0	634	2	0	0	1	3	1777
% App. Total	0.9	93.9	5.3	0		14.7	0	85.3	0		31.9	68.1	0	0		66.7	0	0	33.3		
PHF	.350	.952	.700	.000	.970	.521	.000	.887	.000	.804	.856	.837	.000	.000	.861	.250	.000	.000	.250	.375	.926



Central Transportation Planning Staff
 High St (Rte 109) at Pond St (Sheehan School)
 04/10/14

File Name : Pond near Sheehan AM+MID+PM
 Site Code : 04101402
 Start Date : 4/10/2014
 Page No : 20

Start Time	High St From North					Pond St From East					High St From South					Driveway From West					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 02:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Each Approach Begins at:																					
	04:30 PM					05:00 PM					04:30 PM					04:15 PM					
+0 mins.	1	189	10	0	200	6	0	67	0	73	52	111	0	0	163	0	0	0	0	0	
+15 mins.	1	197	5	0	203	24	0	82	0	106	36	95	0	0	131	2	0	0	0	2	
+30 mins.	5	186	15	0	206	5	0	82	0	87	59	97	0	0	156	0	0	0	0	0	
+45 mins.	0	178	12	0	190	10	0	100	1	111	55	129	0	0	184	0	0	0	1	1	
Total Volume	7	750	42	0	799	45	0	331	1	377	202	432	0	0	634	2	0	0	1	3	
% App. Total	0.9	93.9	5.3	0		11.9	0	87.8	0.3		31.9	68.1	0	0		66.7	0	0	33.3		
PHF	.350	.952	.700	.000	.970	.469	.000	.828	.250	.849	.856	.837	.000	.000	.861	.250	.000	.000	.250	.375	



APPENDIX C

Crash Data

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Westwood COUNT DATE : 4/10/2014

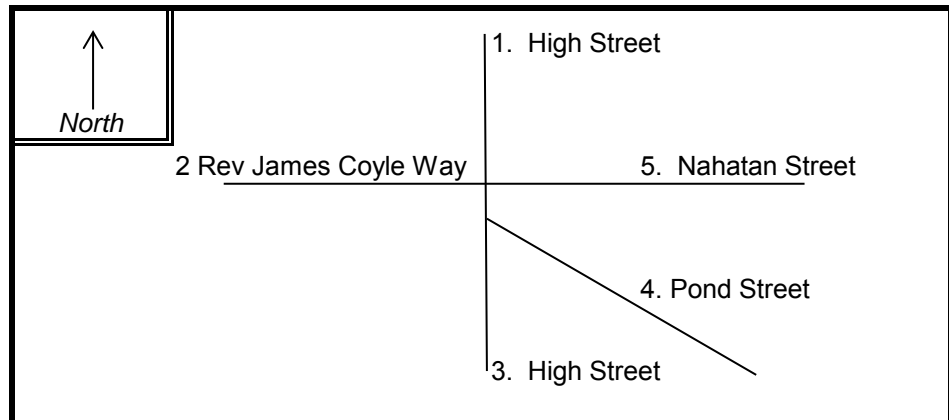
DISTRICT : 3 UNSIGNALIZED : SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : Route 109 (High Street)

MINOR STREET(S) : Nahatan Street, Pond Street and Rev. James Coyle Way

**INTERSECTION
 DIAGRAM
 (Label Approaches)**



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	SB	EB	NB	NWB	WB	
PEAK HOURLY VOLUMES (AM/PM) :	1,113	23	461	143	354	2,094

" K " FACTOR :

0.090	INTERSECTION ADT (V) = TOTAL DAILY APPROACH VOLUME :	23,267
--------------	---	---------------

TOTAL # OF CRASHES :

38	# OF YEARS :	5	AVERAGE # OF CRASHES PER YEAR (A) :	7.80
-----------	-----------------	----------	--	-------------

CRASH RATE CALCULATION :

0.92

$$\text{RATE} = \frac{(A * 1,000,000)}{(V * 365)}$$

Comments : _____

Project Title & Date: Safety and Operations Analyses at Selected Intersections--FFY 2014



INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Westwood COUNTY : _____ COUNT DATE : 4/11/2014

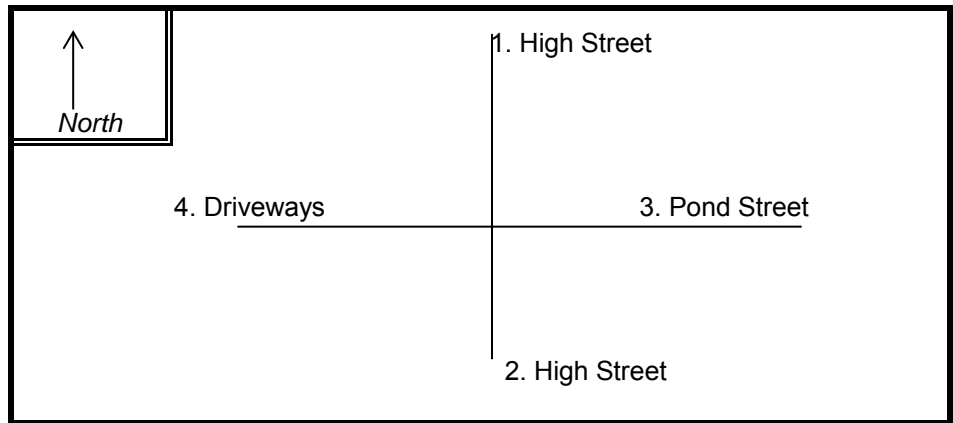
DISTRICT : 3 UNSIGNALIZED : SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : High Street

MINOR STREET(S) : Pond Street

**INTERSECTION
DIAGRAM
(Label Approaches)**



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	SB	NB	WB	EB		
PEAK HOURLY VOLUMES (AM/PM) :	792	634	270	2		1,698

"K" FACTOR : INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME :

TOTAL # OF CRASHES : # OF YEARS : AVERAGE # OF CRASHES PER YEAR (**A**) :

CRASH RATE CALCULATION : RATE =
$$\frac{(A * 1,000,000)}{(V * 365)}$$

Comments : _____

Project Title & Date: _____

ID	Crash Number	Crash Year	Crash Time	Crash Date2	Crash Severity	Total Nonfatal Injury	Total Fatal Injury	Crash Data 2009 to 2013		Weather Condition	Non Motorist Collision	Vehicle Action
								Manner of Collision	Road Surface Condition			
1		2010	9:19 PM	40241	Property damage only	0	0	Angle	Wet	Dark - lighted roadway	Cloudy	V1: Travelling straight ahead / V2:Turning right
2	2607022	2010	2:55 PM	11-May-2010	Property damage only (n	0	0	Rear-end	Dry	Daylight	Clear	V1: Slowing or stopped in traffic / V2:Slowing or st
3	2652305	2010	6:28 PM	04-Oct-2010	Property damage only (n	0	0	Rear-end	Wet	Dark - lighted roadway	Rain	V1: Slowing or stopped in traffic / V2:Travelling stra
4	2683451	2011	2:34 PM	10-Jan-2011	Non-fatal injury	1	0	Single vehicle crash	Dry	Daylight	Clear	P1:Pedestrian V1: Travelling straight ahead
5	2815234	2011	6:44 PM	13-Nov-2011	Non-fatal injury	2	0	Rear-end	Dry	Dark - lighted roadway	Clear	V1: Slowing or stopped in traffic / V2:Travelling stra
6		2012	7:50 PM	07-May-2012	Non-fatal injury	0	0	Rear-end	Dry	Daylight	Clear	V1: Slowing or stopped in traffic / V2:Travelling stra
7		2012	5:29 PM	24-Dec-2012	Property damage only (n	0	0	Rear-end	Dry	Dark - lighted roadway	Clear	V1: Slowing or stopped in traffic / V2:Travelling stra
8		2013	3:39 AM	25-May-2013	Non-fatal injury	1	0	Single vehicle crash	Wet	Dark - lighted roadway	Cloudy	V1: Travelling straight ahead
9		2013	9:07 AM	29-Oct-2013	Non-fatal injury	0	0	Sideswipe, same direction	Dry	Daylight	Rain	V1: Travelling straight ahead / V2:Travelling straigh
10	2478189	2009	11:06 AM	04-Jun-2009	Property damage only (n	0	0	Rear-end	Dry	Daylight	Clear	V1: Entering traffic lane / V2:Entering traffic lane
11	2594527	2009	4:00 PM	24-Aug-2009	Non-fatal injury	1	0	Rear-end	Dry	Daylight	Clear	V1: Entering traffic lane / V2:Entering traffic lane
12	2594648	2010	9:04 PM	16-Feb-2010	Property damage only (n	0	0	Single vehicle crash	Snow	Dark - lighted roadway	Snow	V1: Turning left
13		2013	4:31 PM	16-Oct-2013	Property damage only (n	0	0	Single vehicle crash	Dry	Daylight	Clear	V1: Travelling straight ahead
14	2455419	2009	4:07 PM	08-Apr-2009	Property damage only (n	0	0	Sideswipe, same direction	Dry	Daylight	Cloudy	V1: Travelling straight ahead / V2:Entering traffic la
15	2471063	2009	9:33 PM	15-May-2009	Non-fatal injury	2	0	Rear-end	Dry	Dark - lighted roadway	Clear	V1: Entering traffic lane / V2:Entering traffic lane
16	2594677	2010	2:14 PM	22-Mar-2010	Property damage only (n	0	0	Rear-end	Wet	Daylight	Rain	V1: Travelling straight ahead / V2:Travelling straigh
17	2594686	2010	9:14 AM	14-Apr-2010	Property damage only (n	0	0	Sideswipe, same direction	Dry	Daylight	Clear	V1: Changing lanes / V2:Travelling straight ahead
18	2600078	2010	10:42 AM	07-May-2010	Property damage only (n	0	0	Angle	Dry	Daylight	Clear	V1: Turning left / V2:Turning left
19	2629955	2010	8:22 AM	10-Aug-2010	Property damage only (n	0	0	Angle	Dry	Daylight	Clear	V1: Overtaking/passing / V2:Turning left
20	2652309	2010	8:05 AM	13-Oct-2010	Property damage only (n	0	0	Single vehicle crash	Dry	Daylight	Clear	V1: Travelling straight ahead / V2:Travelling straigh
21	2662471	2010	5:15 PM	08-Nov-2010	Property damage only (n	0	0	Angle	Wet	Dark - lighted roadway	Rain	V1: Turning left / V2:Travelling straight ahead
22	2716642	2011	12:54 PM	18-Apr-2011	Property damage only (n	0	0	Sideswipe, same direction	Dry	Daylight	Clear	V1: Turning right / V2:Travelling straight ahead
23	2740002	2011	9:41 AM	24-Jun-2011	Property damage only (n	0	0	Rear-end	Wet	Daylight	Cloudy	V1: Travelling straight ahead / V2:Slowing or stoppe
24	2649263	2010	2:08 PM	02-Oct-2010	Property damage only (n	0	0	Sideswipe, same direction	Dry	Daylight	Clear	V1: Travelling straight ahead / V2:Travelling straigh
25	2750636	2011	5:42 PM	28-Jul-2011	Property damage only (n	0	0	Angle	Dry	Daylight	Clear	V1: Turning left / V2:Travelling straight ahead
26		2012	6:44 PM	01-Mar-2012	Property damage only (n	0	0	Rear-end	Snow	Dark - lighted roadway	Snow	V1: Travelling straight ahead / V2:Travelling straigh
27		2012	9:32 PM	23-Apr-2012	Property damage only (n	0	0	Sideswipe, same direction	Dry	Dark - lighted roadway	Clear	V1: Changing lanes / V2:Travelling straight ahead
28		2012	8:50 AM	21-May-2012	Property damage only (n	0	0	Angle	Wet	Daylight	Rain	V1: Turning left / V2:Travelling straight ahead
29		2012	2:24 PM	24-May-2012	Property damage only (n	0	0	Rear-end	Dry	Daylight	Clear	V1: Turning right / V2:Turning right
30		2012	2:49 PM	17-Sep-2012	Property damage only (n	0	0	Rear-end	Dry	Daylight	Clear	V1: Turning right / V2:Turning right
31		2012	7:34 AM	21-Sep-2012	Property damage only (n	0	0	Rear-end	Dry	Daylight	Clear	V1: Turning right / V2:Turning right
32		2012	5:44 PM	10-Dec-2012	Property damage only (n	0	0	Angle	Wet	Dark - lighted roadway	Rain	V1: Turning left / V2:Turning left
33		2013	6:44 AM	19-Mar-2013	Property damage only (n	0	0	Rear-end	Snow	Daylight	Snow	V1: Slowing or stopped in traffic / V2:Travelling stra
34		2013	11:00 AM	15-Nov-2013	Non-fatal injury	1	0	Angle	Dry	Daylight	Clear	V1: Travelling straight ahead / V2:Travelling straigh
35		2013	1:03 PM	20-Dec-2013	Non-fatal injury	1	0	Rear-end	Dry	Daylight	Clear	V1: Entering traffic lane / V2:Travelling straight ahe
36		2013	8:36 AM	09-Aug-2013	Property damage only (n	0	0	Single vehicle crash	Dry	Daylight	Clear	V1: Travelling straight ahead
37		2011	5:42 PM	28-Jul-2011	Property damage only (n	0	0	Angle	Dry	Daylight	Clear	V1: Turning left / V2:Travelling straight ahead
38		2010	2:08 PM	02-Oct-2010	Property damage only (n	0	0	Sideswipe, same direction	Dry	Daylight	Clear	V1: Travelling straight ahead / V2:Travelling straigh
39		2010	11:13 PM	10-Feb-2010	Property damage only (n	0	0	Single vehicle crash	Snow	Dark - lighted roadway	Snow	V1: Travelling straight ahead

Crash Data 2009 to 2013
High Street at Pond Street (near Sheehan School)

ID	Crash Number	Crash Year	Crash Time	Crash Date	Crash Severity	Total Nonfatal Injury	Total Fatal Injury	Manner of Collision	Road Surface	Ambient Light	Weather Condition	Vehicle Action
1	2444033	2009	9:51 AM	05-Mar-2009	Property damage only (no	0	0	Angle	Dry	Daylight	Clear	V1: Travelling straight ahead / V2:Turning left
2	2646813	2010	4:14 PM	18-Sep-2010	Property damage only (no	0	0	Angle	Dry	Daylight	Cloudy	V1: Turning left / V2:Turning left
3	2702033	2011	3:08 PM	04-Mar-2011	Property damage only (no	0	0	Angle	Dry	Daylight	Clear	V1: Turning left / V2:Turning left
4	2789517	2011	6:47 PM	06-Oct-2011	Property damage only (no	0	0	Single vehicle crash	Dry	Dark - lighted roadway	Clear	V1: Travelling straight ahead / V2:Travelling straight ah
5		2012	7:43 AM	14-May-2012	Property damage only (no	0	0	Angle	Wet	Daylight	Rain	V1: Turning right / V2:Travelling straight ahead
6		2012	12:23 PM	28-Nov-2012	Property damage only (no	0	0	Angle	Dry	Daylight	Cloudy	V1: Turning left / V2:Turning left
7		2013	4:07 PM	02-Feb-2013	Property damage only (no	0	0	Angle	Dry	Daylight	Clear	V1: Travelling straight ahead / V2:Turning left
8		2013	8:30 PM	17-Apr-2013	Property damage only (no	0	0	Angle	Dry	Dark - lighted roadway	Clear	V1: Turning right / V2:Travelling straight ahead
9	2612528	2010	8:15 AM	10-Jun-2010	Property damage only (no	0	0	Angle	Dry	Daylight	Cloudy	V1: Turning right / V2:Travelling straight ahead

APPENDIX D

Level of Service Analysis

Intersection

Int Delay, s/veh 9.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	707	313	245	374	5	95	2	187	2	1	2
Conflicting Peds, #/hr	0	0	5	0	0	5	10	0	10	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	Free	-	-	None	-	-	Yield	-	-	None
Storage Length	-	-	-	250	-	-	-	-	150	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	786	348	272	416	6	106	2	208	2	1	2

Major/Minor	Major1		Major2		Minor1		Minor2					
Conflicting Flow All	421	0	-	796	0	0	1760	1762	408	1367	1759	418
Stage 1	-	-	-	-	-	-	796	796	-	963	963	-
Stage 2	-	-	-	-	-	-	964	966	-	404	796	-
Critical Hdwy	4.13	-	-	4.16	-	-	7.345	6.545	6.945	7.345	6.545	6.245
Critical Hdwy Stg 1	-	-	-	-	-	-	6.545	5.545	-	6.145	5.545	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.145	5.545	-	6.545	5.545	-
Follow-up Hdwy	2.227	-	-	2.23	-	-	3.5285	4.0285	3.3285	3.5285	4.0285	3.3285
Pot Cap-1 Maneuver	1133	-	0	815	-	-	~ 59	83	591	114	84	631
Stage 1	-	-	0	-	-	-	346	396	-	305	331	-
Stage 2	-	-	0	-	-	-	304	330	-	593	396	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1133	-	-	812	-	-	~ 43	55	584	54	55	631
Mov Cap-2 Maneuver	-	-	-	-	-	-	133	151	-	89	93	-
Stage 1	-	-	-	-	-	-	343	393	-	305	220	-
Stage 2	-	-	-	-	-	-	200	219	-	378	393	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	4.6	42.8	32.4
HCM LOS			E	D

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	133	584	1133	-	812	-	-	137
HCM Lane V/C Ratio	0.81	0.356	-	-	0.335	-	-	0.041
HCM Control Delay (s)	97.5	14.5	0	-	11.7	-	-	32.4
HCM Lane LOS	F	B	A	-	B	-	-	D
HCM 95th %tile Q(veh)	5	1.6	0	-	1.5	-	-	0.1

Notes

-: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection

Int Delay, s/veh 9.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	9	497	98	210	940	2	148	1	205	2	1	2
Conflicting Peds, #/hr	10	0	10	0	0	0	10	0	10	10	0	10
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	Free	-	-	None	-	-	Yield	-	-	None
Storage Length	-	-	-	250	-	-	-	-	150	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	9	518	102	219	979	2	154	1	214	2	1	2

Major/Minor	Major1	Major2	Minor1	Minor2
Conflicting Flow All	991	0	1975	1716
Stage 1	-	-	546	1428
Stage 2	-	-	1429	288
Critical Hdwy	4.13	-	5.3	7.345
Critical Hdwy Stg 1	-	-	5.3	6.145
Critical Hdwy Stg 2	-	-	5.3	6.545
Follow-up Hdwy	2.227	-	2.5	3.5285
Pot Cap-1 Maneuver	694	0	~ 145	64
Stage 1	-	0	774	166
Stage 2	-	0	277	694
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	688	-	~ 116	38
Mov Cap-2 Maneuver	-	-	176	110
Stage 1	-	-	754	162
Stage 2	-	-	213	499

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	1.7	45.5	30.6
HCM LOS			E	D

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	176	803	688	-	1028	-	-	146
HCM Lane V/C Ratio	0.882	0.266	0.014	-	0.213	-	-	0.036
HCM Control Delay (s)	92.8	11.1	10.3	0.1	9.4	-	-	30.6
HCM Lane LOS	F	B	B	A	A	-	-	D
HCM 95th %tile Q(veh)	6.4	1.1	0	-	0.8	-	-	0.1

Notes

-: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection

Int Delay, s/veh 11.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	710	315	245	375	5	95	5	190	2	1	2
Conflicting Peds, #/hr	0	0	5	0	0	5	10	0	10	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	Free	-	-	None	-	-	Yield	-	-	None
Storage Length	-	-	-	250	-	-	-	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	813	360	280	429	6	109	6	217	2	1	2

Major/Minor	Major1		Major2		Minor1		Minor2					
Conflicting Flow All	435	0	-	823	0	0	1818	1819	421	1412	1816	432
Stage 1	-	-	-	-	-	-	823	823	-	993	993	-
Stage 2	-	-	-	-	-	-	995	996	-	419	823	-
Critical Hdwy	4.13	-	-	4.16	-	-	7.345	6.545	6.945	7.345	6.545	6.245
Critical Hdwy Stg 1	-	-	-	-	-	-	6.545	5.545	-	6.145	5.545	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.145	5.545	-	6.545	5.545	-
Follow-up Hdwy	2.227	-	-	2.23	-	-	3.5285	4.0285	3.3285	3.5285	4.0285	3.3285
Pot Cap-1 Maneuver	1119	-	0	796	-	-	~ 54	77	580	106	77	620
Stage 1	-	-	0	-	-	-	333	385	-	293	321	-
Stage 2	-	-	0	-	-	-	292	320	-	581	385	-
Platoon blocked, %		-			-							
Mov Cap-1 Maneuver	1119	-	-	793	-	-	~ 38	49	573	46	49	620
Mov Cap-2 Maneuver	-	-	-	-	-	-	125	143	-	65	81	-
Stage 1	-	-	-	-	-	-	330	382	-	293	208	-
Stage 2	-	-	-	-	-	-	187	207	-	354	382	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	4.7	52.3	40.2
HCM LOS			F	E

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	126	573	1119	-	793	-	-	108
HCM Lane V/C Ratio	0.908	0.379	-	-	0.354	-	-	0.053
HCM Control Delay (s)	123	15.1	0	-	12	-	-	40.2
HCM Lane LOS	F	C	A	-	B	-	-	E
HCM 95th %tile Q(veh)	5.9	1.8	0	-	1.6	-	-	0.2

Notes

-: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection

Int Delay, s/veh 41.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	9	497	98	210	940	2	150	5	205	2	1	2
Conflicting Peds, #/hr	10	0	10	0	0	0	10	0	10	10	0	10
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	Free	-	-	None	-	-	Yield	-	-	None
Storage Length	-	-	-	250	-	-	-	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	3	3	3	3	3	3	2	2	2	0	0	0
Mvmt Flow	10	533	105	225	1009	2	161	5	220	2	1	2

Major/Minor

	Major1		Major2		Minor1		Minor2					
Conflicting Flow All	1021	0	-	543	0	0	2035	2034	277	1769	2033	1030
Stage 1	-	-	-	-	-	-	563	563	-	1470	1470	-
Stage 2	-	-	-	-	-	-	1472	1471	-	299	563	-
Critical Hdwy	4.13	-	-	4.16	-	-	7.33	6.53	6.93	7.3	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.53	5.53	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.13	5.53	-	6.5	5.5	-
Follow-up Hdwy	2.227	-	-	2.23	-	-	3.519	4.019	3.319	3.5	4	3.3
Pot Cap-1 Maneuver	676	-	0	1015	-	-	~ 37	57	721	60	58	286
Stage 1	-	-	0	-	-	-	479	508	-	160	193	-
Stage 2	-	-	0	-	-	-	~ 157	190	-	691	512	-
Platoon blocked, %		-			-							
Mov Cap-1 Maneuver	670	-	-	1015	-	-	~ 29	43	715	32	43	281
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 88	110	-	100	105	-
Stage 1	-	-	-	-	-	-	465	493	-	155	149	-
Stage 2	-	-	-	-	-	-	~ 119	147	-	463	497	-

Approach

	EB		WB		NB		SB
HCM Control Delay, s	0.3		1.7		226.4		32.6
HCM LOS					F		D

Minor Lane/Major Mvmt

	NBLn1	NBLn2	EBL	EBT	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	89	715	670	-	1015	-	-	136
HCM Lane V/C Ratio	1.869	0.308	0.014	-	0.222	-	-	0.039
HCM Control Delay (s)	\$ 509.6	12.3	10.5	0.1	9.6	-	-	32.6
HCM Lane LOS	F	B	B	A	A	-	-	D
HCM 95th %tile Q(veh)	14.1	1.3	0	-	0.8	-	-	0.1

Notes

~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

High Street at Nahatan St
2024 AM Alternative 3 Reconfigure Lanes and Tighten Curb Line

12/30/2014
Synchro 8 Report

Intersection

Int Delay, s/veh 7.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	707	313	245	374	5	95	2	187	2	1	2
Conflicting Peds, #/hr	0	0	5	0	0	5	10	0	10	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	Yield	-	-	None	-	-	Free	-	-	None
Storage Length	-	-	0	250	-	-	-	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	809	358	280	428	6	109	2	214	2	1	2

Major/Minor	Major1	Major2	Minor1	Minor2
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Conflicting Flow All	434	0	0	819	0	0	1812	1814	-	1812	1811	436
Stage 1	-	-	-	-	-	-	819	819	-	992	992	-
Stage 2	-	-	-	-	-	-	993	995	-	820	819	-
Critical Hdwy	4.13	-	-	4.13	-	-	7.13	6.53	-	7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Follow-up Hdwy	2.227	-	-	2.227	-	-	3.527	4.027	-	3.527	4.027	3.327
Pot Cap-1 Maneuver	1120	-	-	805	-	-	~ 60	78	0	60	78	618
Stage 1	-	-	-	-	-	-	368	388	0	295	322	-
Stage 2	-	-	-	-	-	-	294	321	0	368	388	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1115	-	-	802	-	-	~ 43	50	-	43	50	615
Mov Cap-2 Maneuver	-	-	-	-	-	-	131	144	-	71	83	-
Stage 1	-	-	-	-	-	-	365	385	-	295	210	-
Stage 2	-	-	-	-	-	-	189	209	-	364	385	-

Approach	EB	WB	NB	SB
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HCM Control Delay, s	0	4.7	106.1	37.9
HCM LOS			F	E

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
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Capacity (veh/h)	131	-	1115	-	-	802	-	-	115
HCM Lane V/C Ratio	0.847	-	-	-	-	0.35	-	-	0.05
HCM Control Delay (s)	106.1	0	0	-	-	11.9	-	-	37.9
HCM Lane LOS	F	A	A	-	-	B	-	-	E
HCM 95th %tile Q(veh)	5.3	-	0	-	-	1.6	-	-	0.2

Notes

-: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

High St at Nahatan St
2024 PM Alternative 3 Reconfigure Lanes and Tighten Curb Line

12/30/2014
Synchro 8 Report

Intersection

Int Delay, s/veh 46.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	497	98	210	940	2	148	1	205	2	1	2
Conflicting Peds, #/hr	0	0	5	0	0	5	10	0	10	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	Yield	-	-	None	-	-	Free	-	-	None
Storage Length	-	-	0	250	-	-	-	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	569	112	240	1076	2	169	1	235	2	1	2

Major/Minor	Major1	Major2	Minor1	Minor2								
Conflicting Flow All	1078	0	0	579	0	0	2138	2138	-	2137	2137	1082
Stage 1	-	-	-	-	-	-	579	579	-	1558	1558	-
Stage 2	-	-	-	-	-	-	1559	1559	-	579	579	-
Critical Hdwy	4.13	-	-	4.13	-	-	7.13	6.53	-	7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Follow-up Hdwy	2.227	-	-	2.227	-	-	3.527	4.027	-	3.527	4.027	3.327
Pot Cap-1 Maneuver	643	-	-	990	-	-	~ 35	49	0	35	49	263
Stage 1	-	-	-	-	-	-	499	499	0	140	172	-
Stage 2	-	-	-	-	-	-	~ 140	172	0	499	499	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	640	-	-	986	-	-	~ 28	37	-	28	37	262
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 85	104	-	94	93	-
Stage 1	-	-	-	-	-	-	495	495	-	140	130	-
Stage 2	-	-	-	-	-	-	~ 104	130	-	496	495	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	1.8	\$ 572.9	34.9
HCM LOS			F	D

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	85	-	640	-	-	986	-	-	126
HCM Lane V/C Ratio	2.006	-	-	-	-	0.244	-	-	0.045
HCM Control Delay (s)	\$ 572.9	0	0	-	-	9.8	-	-	34.9
HCM Lane LOS	F	A	A	-	-	A	-	-	D
HCM 95th %tile Q(veh)	15	-	0	-	-	1	-	-	0.1

Notes

-: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection

Int Delay, s/veh 11.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	710	315	245	375	5	95	5	190	2	1	2
Conflicting Peds, #/hr	0	0	5	0	0	5	10	0	10	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	Free	-	-	None	-	-	Yield	-	-	None
Storage Length	-	-	-	250	-	-	-	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	813	360	280	429	6	109	6	217	2	1	2

Major/Minor	Major1		Major2		Minor1		Minor2					
Conflicting Flow All	435	0	-	823	0	0	1818	1819	421	1412	1816	432
Stage 1	-	-	-	-	-	-	823	823	-	993	993	-
Stage 2	-	-	-	-	-	-	995	996	-	419	823	-
Critical Hdwy	4.13	-	-	4.16	-	-	7.345	6.545	6.945	7.345	6.545	6.245
Critical Hdwy Stg 1	-	-	-	-	-	-	6.545	5.545	-	6.145	5.545	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.145	5.545	-	6.545	5.545	-
Follow-up Hdwy	2.227	-	-	2.23	-	-	3.5285	4.0285	3.3285	3.5285	4.0285	3.3285
Pot Cap-1 Maneuver	1119	-	0	796	-	-	~ 54	77	580	106	77	620
Stage 1	-	-	0	-	-	-	333	385	-	293	321	-
Stage 2	-	-	0	-	-	-	292	320	-	581	385	-
Platoon blocked, %		-			-							
Mov Cap-1 Maneuver	1119	-	-	793	-	-	~ 38	49	573	46	49	620
Mov Cap-2 Maneuver	-	-	-	-	-	-	125	143	-	65	81	-
Stage 1	-	-	-	-	-	-	330	382	-	293	208	-
Stage 2	-	-	-	-	-	-	187	207	-	354	382	-

Approach	EB		WB		NB		SB
HCM Control Delay, s	0		4.7		52.3		40.2
HCM LOS					F		E

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	126	573	1119	-	793	-	-	108
HCM Lane V/C Ratio	0.908	0.379	-	-	0.354	-	-	0.053
HCM Control Delay (s)	123	15.1	0	-	12	-	-	40.2
HCM Lane LOS	F	C	A	-	B	-	-	E
HCM 95th %tile Q(veh)	5.9	1.8	0	-	1.6	-	-	0.2

Notes

-: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection

Int Delay, s/veh 41.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	9	497	98	210	940	2	150	5	205	2	1	2
Conflicting Peds, #/hr	10	0	10	0	0	0	10	0	10	10	0	10
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	Free	-	-	None	-	-	Yield	-	-	None
Storage Length	-	-	-	250	-	-	-	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	3	3	3	3	3	3	2	2	2	0	0	0
Mvmt Flow	10	533	105	225	1009	2	161	5	220	2	1	2

Major/Minor

	Major1		Major2		Minor1		Minor2					
Conflicting Flow All	1021	0	-	543	0	0	2035	2034	277	1769	2033	1030
Stage 1	-	-	-	-	-	-	563	563	-	1470	1470	-
Stage 2	-	-	-	-	-	-	1472	1471	-	299	563	-
Critical Hdwy	4.13	-	-	4.16	-	-	7.33	6.53	6.93	7.3	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.53	5.53	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.13	5.53	-	6.5	5.5	-
Follow-up Hdwy	2.227	-	-	2.23	-	-	3.519	4.019	3.319	3.5	4	3.3
Pot Cap-1 Maneuver	676	-	0	1015	-	-	~ 37	57	721	60	58	286
Stage 1	-	-	0	-	-	-	479	508	-	160	193	-
Stage 2	-	-	0	-	-	-	~ 157	190	-	691	512	-
Platoon blocked, %		-			-							
Mov Cap-1 Maneuver	670	-	-	1015	-	-	~ 29	43	715	32	43	281
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 88	110	-	100	105	-
Stage 1	-	-	-	-	-	-	465	493	-	155	149	-
Stage 2	-	-	-	-	-	-	~ 119	147	-	463	497	-

Approach

	EB		WB		NB		SB
HCM Control Delay, s	0.3		1.7		226.4		32.6
HCM LOS					F		D

Minor Lane/Major Mvmt

	NBLn1	NBLn2	EBL	EBT	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	89	715	670	-	1015	-	-	136
HCM Lane V/C Ratio	1.869	0.308	0.014	-	0.222	-	-	0.039
HCM Control Delay (s)	\$ 509.6	12.3	10.5	0.1	9.6	-	-	32.6
HCM Lane LOS	F	B	B	A	A	-	-	D
HCM 95th %tile Q(veh)	14.1	1.3	0	-	0.8	-	-	0.1

Notes

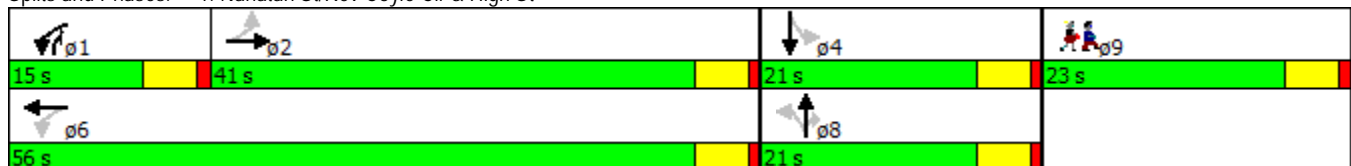
-: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	710	315	245	375	5	95	5	190	2	1	2
Satd. Flow (prot)	0	3311	0	1752	1840	0	0	1762	1568	0	1710	0
Flt Permitted				0.111				0.734			0.883	
Satd. Flow (perm)	0	3311	0	205	1840	0	0	1330	1525	0	1541	0
Satd. Flow (RTOR)					1						2	
Adj. Flow (vph)	0	813	360	280	429	6	109	6	217	2	1	2
Lane Group Flow (vph)	0	1173	0	280	435	0	0	115	217	0	5	0
Turn Type		NA		pm+pt	NA		Perm	NA	pm+ov	Perm	NA	
Protected Phases		2		1	6			8	1		4	
Permitted Phases	2			6			8		8	4		
Total Split (s)	41.0	41.0		15.0	56.0		21.0	21.0	15.0	21.0	21.0	
Total Lost Time (s)		5.0		5.0	5.0			5.0	5.0		5.0	
Act Effct Green (s)		36.1		51.8	53.3			11.4	19.8		11.0	
Actuated g/C Ratio		0.49		0.70	0.72			0.15	0.27		0.15	
v/c Ratio		0.72		0.77	0.33			0.56	0.52		0.02	
Control Delay		21.6		32.2	8.3			43.4	22.2		27.0	
Queue Delay		0.0		0.0	0.0			0.0	0.0		0.0	
Total Delay		21.6		32.2	8.3			43.4	22.2		27.0	
LOS		C		C	A			D	C		C	
Approach Delay		21.6			17.7			29.6			27.0	
Approach LOS		C			B			C			C	
Queue Length 50th (ft)		202		61	61			48	70		1	
Queue Length 95th (ft)		#536		#308	251			127	114		12	
Internal Link Dist (ft)		226			305			1179			272	
Turn Bay Length (ft)				250					150			
Base Capacity (vph)		1696		364	1333			302	417		352	
Starvation Cap Reductn		0		0	0			0	0		0	
Spillback Cap Reductn		0		0	0			0	0		0	
Storage Cap Reductn		0		0	0			0	0		0	
Reduced v/c Ratio		0.69		0.77	0.33			0.38	0.52		0.01	

Intersection Summary

Cycle Length: 100
 Actuated Cycle Length: 73.6
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.77
 Intersection Signal Delay: 21.5
 Intersection LOS: C
 Intersection Capacity Utilization 75.7%
 ICU Level of Service D
 Analysis Period (min) 15
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 1: Nahatan St/Rev Coyle Cir & High St



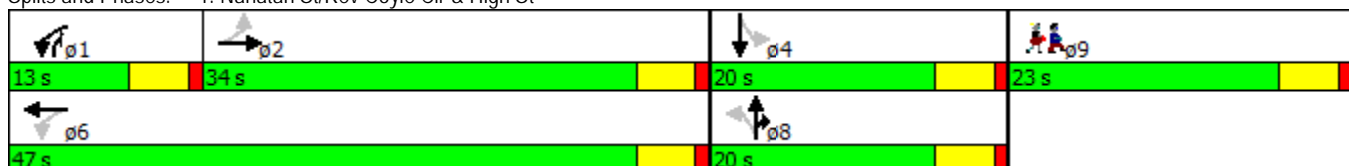


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕		↖	↗			↕	↖		↕↕	
Volume (vph)	10	500	90	210	940	5	150	5	205	2	1	2
Satd. Flow (prot)	0	3402	0	1752	1843	0	0	1760	1568	0	1690	0
Flt Permitted		0.861		0.289				0.729			0.900	
Satd. Flow (perm)	0	2932	0	533	1843	0	0	1321	1568	0	1544	0
Satd. Flow (RTOR)												
Adj. Flow (vph)	11	536	97	225	1009	5	161	5	220	2	1	2
Lane Group Flow (vph)	0	644	0	225	1014	0	0	166	220	0	5	0
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	pt+ov	Perm	NA	
Protected Phases		2		1	6			8	8		4	
Permitted Phases	2			6			8			4		
Total Split (s)	34.0	34.0		13.0	47.0		20.0	20.0		20.0	20.0	
Total Lost Time (s)		5.0		5.0	5.0			5.0			5.0	
Act Effct Green (s)		29.8		42.8	42.8			13.1	25.4		13.1	
Actuated g/C Ratio		0.43		0.61	0.61			0.19	0.36		0.19	
v/c Ratio		0.51		0.48	0.90			0.67	0.39		0.02	
Control Delay		18.6		12.6	26.9			43.0	16.4		26.6	
Queue Delay		0.0		0.0	0.0			0.0	0.0		0.0	
Total Delay		18.6		12.6	26.9			43.0	16.4		26.6	
LOS		B		B	C			D	B		C	
Approach Delay		18.6			24.3			27.8			26.6	
Approach LOS		B			C			C			C	
Queue Length 50th (ft)		94		33	287			61	59		2	
Queue Length 95th (ft)		227		124	#933			#191	98		12	
Internal Link Dist (ft)		256			298			1197			272	
Turn Bay Length (ft)				250					150			
Base Capacity (vph)		1251		469	1131			289	546		338	
Starvation Cap Reductn		0		0	0			0	0		0	
Spillback Cap Reductn		0		0	0			0	0		0	
Storage Cap Reductn		0		0	0			0	0		0	
Reduced v/c Ratio		0.51		0.48	0.90			0.57	0.40		0.01	

Intersection Summary

Cycle Length: 90
 Actuated Cycle Length: 69.7
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.90
 Intersection Signal Delay: 23.3
 Intersection LOS: C
 Intersection Capacity Utilization 96.9%
 ICU Level of Service F
 Analysis Period (min) 15
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 1: Nahatan St/Rev Coyle Cir & High St



MOVEMENT SUMMARY

 Site: High St at Nahatan St AM

Single Lane Roundabout
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: High St											
3	L2	1	3.0	0.961	45.1	LOS E	21.4	548.8	1.00	1.31	21.2
8	T1	777	3.0	0.961	45.1	LOS E	21.4	548.8	1.00	1.31	21.2
18	R2	345	3.0	0.212	0.0	LOS A	0.0	0.0	0.00	0.00	36.5
Approach		1123	3.0	0.961	31.3	LOS D	21.4	548.8	0.69	0.91	24.3
East: Nahatan St											
1	L2	104	3.0	0.309	16.2	LOS C	1.3	33.3	0.76	0.77	27.7
6	T1	5	0.0	0.309	16.2	LOS C	1.3	33.3	0.76	0.77	27.8
16	R2	208	2.0	0.127	0.0	LOS A	0.0	0.0	0.00	0.00	36.5
Approach		318	2.3	0.309	5.6	LOS A	1.3	33.3	0.26	0.26	32.8
North: High St											
7	L2	268	3.0	0.358	7.6	LOS A	2.0	51.5	0.37	0.22	31.2
4	T1	410	3.0	0.358	7.6	LOS A	2.0	51.5	0.37	0.22	32.5
14	R2	5	3.0	0.358	7.6	LOS A	2.0	51.5	0.37	0.22	32.0
Approach		683	3.0	0.358	7.6	LOS A	2.0	51.5	0.37	0.22	32.0
West: Rev Coyle Cir											
5	L2	2	0.0	0.011	7.7	LOS A	0.0	0.9	0.59	0.50	31.9
2	T1	1	0.0	0.011	7.7	LOS A	0.0	0.9	0.59	0.50	32.0
12	R2	2	0.0	0.011	7.7	LOS A	0.0	0.9	0.59	0.50	31.4
Approach		5	0.0	0.011	7.7	LOS A	0.0	0.9	0.59	0.50	31.7
All Vehicles		2129	2.9	0.961	19.8	LOS C	21.4	548.8	0.52	0.59	27.5

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

Roundabout Capacity Model: US HCM 2010.

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

 Site: High St at Nahatan St PM

Single Lane Roundabout
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: High St											
3	L2	11	0.0	0.827	29.7	LOS D	8.3	213.6	0.90	1.10	24.8
8	T1	547	3.0	0.827	29.7	LOS D	8.3	213.6	0.90	1.10	24.8
18	R2	99	3.0	0.061	0.0	LOS A	0.0	0.0	0.00	0.00	36.5
Approach		657	2.9	0.827	25.3	LOS D	8.3	213.6	0.76	0.94	26.0
East: Nahatan St											
1	L2	165	3.0	0.275	9.4	LOS A	1.0	25.9	0.58	0.58	30.1
6	T1	5	0.0	0.275	9.4	LOS A	1.0	25.9	0.58	0.58	30.3
16	R2	224	3.0	0.138	0.0	LOS A	0.0	0.0	0.00	0.00	36.5
Approach		394	3.0	0.275	4.1	LOS A	1.0	25.9	0.25	0.25	33.4
North: High St											
7	L2	230	3.0	0.694	15.6	LOS C	6.2	155.6	0.65	0.54	28.7
4	T1	1028	3.0	0.694	15.9	LOS C	6.2	155.6	0.64	0.53	29.0
14	R2	5	0.0	0.694	16.1	LOS C	5.7	147.9	0.62	0.52	28.6
Approach		1264	3.0	0.694	15.9	LOS C	6.2	155.6	0.64	0.53	29.0
West: Rev Coyle Cir											
5	L2	2	0.0	0.020	14.2	LOS B	0.1	1.5	0.77	0.77	29.3
2	T1	1	0.0	0.020	14.2	LOS B	0.1	1.5	0.77	0.77	29.4
12	R2	2	0.0	0.020	14.2	LOS B	0.1	1.5	0.77	0.77	28.8
Approach		5	0.0	0.020	14.2	LOS B	0.1	1.5	0.77	0.77	29.1
All Vehicles		2320	3.0	0.827	16.5	LOS C	8.3	213.6	0.61	0.60	28.7

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

Roundabout Capacity Model: US HCM 2010.

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Intersection

Int Delay, s/veh 17.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	700	400	25	345	196	30
Conflicting Peds, #/hr	0	2	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Free	-	Free	-	None
Storage Length	-	-	-	-	50	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	4	4	4	4	2	2
Mvmt Flow	745	426	27	367	209	32

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	-	745
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.14
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.236
Pot Cap-1 Maneuver	-	0	854
Stage 1	-	0	-
Stage 2	-	0	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	854
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.6	101.2
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	WBL	WBT
Capacity (veh/h)	206	414	-	854	-
HCM Lane V/C Ratio	1.012	0.077	-	0.031	-
HCM Control Delay (s)	114.5	14.4	-	9.4	0
HCM Lane LOS	F	B	-	A	A
HCM 95th %tile Q(veh)	9	0.2	-	0.1	-

Notes

-: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection

Int Delay, s/veh 28.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	435	200	45	760	290	50
Conflicting Peds, #/hr	0	2	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Free	-	Free	-	None
Storage Length	-	-	-	-	50	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	4	4	4	4	2	2
Mvmt Flow	463	213	48	809	309	53

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	-	463
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.14
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.236
Pot Cap-1 Maneuver	-	0	1088
Stage 1	-	0	-
Stage 2	-	0	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1088
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.5	131.9
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	WBL	WBT
Capacity (veh/h)	262	798	-	1088	-
HCM Lane V/C Ratio	1.178	0.067	-	0.044	-
HCM Control Delay (s)	152.9	9.8	-	8.5	0
HCM Lane LOS	F	A	-	A	A
HCM 95th %tile Q(veh)	14	0.2	-	0.1	-

Notes

-: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection

Int Delay, s/veh 23.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	700	400	25	345	200	30
Conflicting Peds, #/hr	0	2	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Free	-	Free	-	None
Storage Length	-	-	-	-	50	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	4	4	4	4	2	2
Mvmt Flow	767	438	27	378	219	33

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	-	767
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.14
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.236
Pot Cap-1 Maneuver	-	0	838
Stage 1	-	0	-
Stage 2	-	0	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	838
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.6	132.1
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	WBL	WBT
Capacity (veh/h)	196	402	-	838	-
HCM Lane V/C Ratio	1.118	0.082	-	0.033	-
HCM Control Delay (s)	149.7	14.8	-	9.4	0
HCM Lane LOS	F	B	-	A	A
HCM 95th %tile Q(veh)	10.6	0.3	-	0.1	-

Notes

-: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

High St at Pond St
2024 PM Alternative 2 Tighten Curb Radii for Right Turns

12/30/2014
Synchro 8 Report

Intersection

Int Delay, s/veh 34.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	435	200	45	750	290	50
Conflicting Peds, #/hr	0	2	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Free	-	Free	-	None
Storage Length	-	-	-	-	50	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	4	4	4	4	2	2
Mvmt Flow	477	219	49	822	318	55

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	-	477
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.14
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.236
Pot Cap-1 Maneuver	-	0	1075
Stage 1	-	0	-
Stage 2	-	0	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1075
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.5	159.7
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	WBL	WBT
Capacity (veh/h)	252	786	-	1075	-
HCM Lane V/C Ratio	1.261	0.07	-	0.046	-
HCM Control Delay (s)	185.5	9.9	-	8.5	0
HCM Lane LOS	F	A	-	A	A
HCM 95th %tile Q(veh)	15.8	0.2	-	0.1	-

Notes

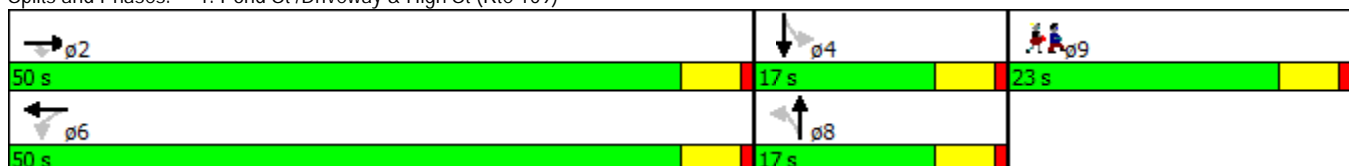
-: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	700	400	25	345	0	200	0	30	2	2	2
Satd. Flow (prot)	0	1827	1553	1736	1827	0	1770	1583	0	0	1750	0
Flt Permitted				0.173			0.754				0.939	
Satd. Flow (perm)	0	1827	1519	316	1827	0	1405	1583	0	0	1670	0
Satd. Flow (RTOR)			228					414			2	
Adj. Flow (vph)	0	767	438	27	378	0	219	0	33	2	2	2
Lane Group Flow (vph)	0	767	438	27	378	0	219	33	0	0	6	0
Turn Type		NA	Perm	Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8				4
Permitted Phases			2	6			8			4		
Total Split (s)		50.0	50.0	50.0	50.0		17.0	17.0		17.0	17.0	
Total Lost Time (s)		5.0	5.0	5.0	5.0		5.0	5.0			5.0	
Act Effct Green (s)		32.4	32.4	32.4	32.4		12.8	12.8			12.8	
Actuated g/C Ratio		0.55	0.55	0.55	0.55		0.22	0.22			0.22	
v/c Ratio		0.76	0.47	0.16	0.38		0.72	0.05			0.02	
Control Delay		18.0	6.1	11.2	9.8		42.6	0.1			24.2	
Queue Delay		0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Total Delay		18.0	6.1	11.2	9.8		42.6	0.1			24.2	
LOS		B	A	B	A		D	A			C	
Approach Delay		13.7			9.9			37.1			24.2	
Approach LOS		B			A			D			C	
Queue Length 50th (ft)		147	27	3	53		65	0			1	
Queue Length 95th (ft)		#590	145	26	198		#290	0			13	
Internal Link Dist (ft)		548			727			534			42	
Turn Bay Length (ft)			100	75			50					
Base Capacity (vph)		1467	1265	254	1467		306	668			365	
Starvation Cap Reductn		0	0	0	0		0	0			0	
Spillback Cap Reductn		0	0	0	0		0	0			0	
Storage Cap Reductn		0	0	0	0		0	0			0	
Reduced v/c Ratio		0.52	0.35	0.11	0.26		0.72	0.05			0.02	

Intersection Summary

Cycle Length: 90
 Actuated Cycle Length: 58.9
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.76
 Intersection Signal Delay: 16.0
 Intersection LOS: B
 Intersection Capacity Utilization 64.4%
 ICU Level of Service C
 Analysis Period (min) 15
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 1: Pond St /Driveway & High St (Rte 109)

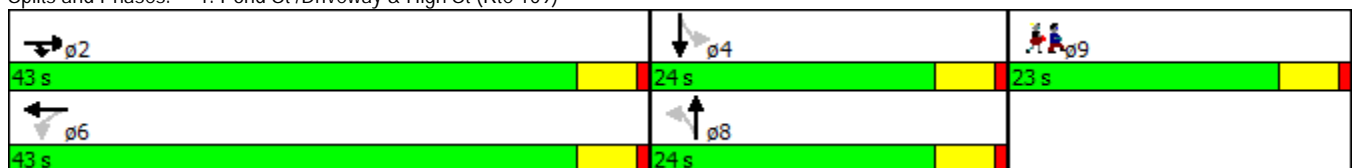


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	430	200	45	750	5	290	1	50	2	2	2
Satd. Flow (prot)	0	1827	1553	1736	1825	0	1770	1589	0	0	1750	0
Flt Permitted				0.388			0.754				0.951	
Satd. Flow (perm)	0	1827	1553	709	1825	0	1405	1589	0	0	1692	0
Satd. Flow (RTOR)			161					55			2	
Adj. Flow (vph)	0	471	219	49	822	5	318	1	55	2	2	2
Lane Group Flow (vph)	0	471	219	49	827	0	318	56	0	0	6	0
Turn Type		NA	Prot	Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2	2		6			8				4
Permitted Phases				6			8			4		
Total Split (s)		43.0	43.0	43.0	43.0		24.0	24.0		24.0	24.0	
Total Lost Time (s)		5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
Act Effct Green (s)		38.5	38.5	38.5	38.5		19.3	19.3		19.3	19.3	
Actuated g/C Ratio		0.54	0.54	0.54	0.54		0.27	0.27		0.27	0.27	
v/c Ratio		0.48	0.24	0.13	0.84		0.84	0.12		0.12	0.01	
Control Delay		14.2	4.6	12.1	26.1		48.5	8.8		20.8	20.8	
Queue Delay		0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay		14.2	4.6	12.1	26.1		48.5	8.8		20.8	20.8	
LOS		B	A	B	C		D	A		C	C	
Approach Delay		11.1			25.3			42.5			20.8	
Approach LOS		B			C			D			C	
Queue Length 50th (ft)		102	10	8	242		120	0			1	
Queue Length 95th (ft)		305	63	42	#750		#365	31			12	
Internal Link Dist (ft)		545			749			514			42	
Turn Bay Length (ft)			100	75			50					
Base Capacity (vph)		983	910	381	982		378	468			456	
Starvation Cap Reductn		0	0	0	0		0	0			0	
Spillback Cap Reductn		0	0	0	0		0	0			0	
Storage Cap Reductn		0	0	0	0		0	0			0	
Reduced v/c Ratio		0.48	0.24	0.13	0.84		0.84	0.12			0.01	

Intersection Summary

Cycle Length: 90
 Actuated Cycle Length: 71.6
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.84
 Intersection Signal Delay: 23.6
 Intersection LOS: C
 Intersection Capacity Utilization 72.5%
 ICU Level of Service C
 Analysis Period (min) 15
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 1: Pond St /Driveway & High St (Rte 109)



APPENDIX E

**MassDOT Highway Division
Project Development Process**

Overview of the Project Development Process

Transportation decision making is complex and can be influenced by legislative mandates, environmental regulations, financial limitations, agency programmatic commitments, and partnering opportunities. Decision makers and reviewing agencies, when consulted early and often throughout the project development process, can ensure that all participants understand the potential impact these factors can have on project implementation. Project development is the process that takes a transportation improvement from concept through construction.

The MassDOT Highway Division has developed a comprehensive project-development process, which is contained in Chapter 2 of the *MassDOT Highway Division's Project Development and Design Guide*. The eight-step process covers a range of activities extending from identification of a project need, through completion of a set of finished contract plans, to construction of the project. The sequence of decisions made through the project-development process progressively narrows the project focus and, ultimately, leads to a project that addresses the identified needs. The descriptions provided below are focused on the process for a highway project, but the same basic process will need to be followed for non-highway projects as well.

1. Needs Identification

For each of the locations at which an improvement is to be implemented, MassDOT leads an effort to define the problem, establishes project goals and objectives, and defines the scope of the planning needed for implementation. To that end, it has to complete a Project Need Form (PNF), which states in general terms the deficiencies or needs related to the transportation facility or location. The PNF documents the problems and explains why corrective action is needed. For this study, the information defining the need for the project will be drawn primarily, perhaps exclusively, from the present report. Also, at this point in the process, MassDOT meets with potential participants, such as the Metropolitan Planning Organization (MPO) and community members, to allow for an informal review of the project.

The PNF is reviewed by the MassDOT Highway Division district office whose jurisdiction includes the location of the proposed project. MassDOT also sends the PNF to the MPO, for informational purposes. The outcome of this step determines whether the project requires further planning, whether it is already well supported by prior planning studies, and, therefore, whether it is ready to move forward into the design phase, or whether it should be dismissed from further consideration.

2. Planning

This phase will likely not be required for the implementation of the improvements proposed in this planning study, as this planning report should constitute the outcome of this step. However, in general, the purpose of this implementation step is for the project proponent to identify issues, impacts, and approvals that may need to be obtained, so that the subsequent design and permitting processes are understood.

The level of planning needed will vary widely, based on the complexity of the project. Typical tasks include: define the existing context, confirm project need, establish goals and objectives, initiate public outreach, define the project, collect data, develop and analyze alternatives, make recommendations, and provide documentation. Likely outcomes include consensus on the project definition to enable it to move forward into environmental documentation (if needed) and design, or a recommendation to delay the project or dismiss it from further consideration.

3. Project Initiation

At this point in the process, the proponent, MassDOT Highway Division, fills out a Project Initiation Form (PIF) for each improvement, which is reviewed by its Project Review Committee (PRC) and the MPO. The PRC is composed of the Chief Engineer, each District Highway Director, and representatives of the Project Management, Environmental, Planning, Right-of-Way, Traffic, and Bridge departments, and the MassDOT Federal Aid Program Office (FAPO). The PIF documents the project type and description, summarizes the project planning process, identifies likely funding and project management responsibility, and defines a plan for interagency and public participation. First the PRC reviews and evaluates the proposed project based on the MassDOT's statewide priorities and criteria. If the result is positive, MassDOT Highway Division moves the project forward to the design phase and to programming review by the MPO. The PRC may provide a Project Management Plan to define roles and responsibilities for subsequent steps. The MPO review includes project evaluation based on the MPO's regional priorities and criteria. The MPO may assign project evaluation criteria score, a Transportation Improvement Program (TIP) year, a tentative project category, and a tentative funding category.

4. Environmental Permitting, Design, and Right-of-Way Process

This step has four distinct but closely integrated elements: public outreach, environmental documentation and permitting (if required), design, and right-of-way acquisition (if required). The outcome of this step is a fully designed and permitted project ready for construction. However, a project does not have to be fully designed in order for the MPO to program it in the TIP. The sections below provide more detailed information on the four elements of this step of the project development process.

Public Outreach

Continued public outreach in the design and environmental process is essential to maintain public support for the project and to seek meaningful input on the design elements. The public outreach is often in the form of required public hearings, but can also include less formal dialogues with those interested in and affected by a proposed project.

Environmental Documentation and Permitting

The project proponent, in coordination with the Environmental Services section of the MassDOT Highway Division, will be responsible for identifying and complying with all applicable federal, state, and local environmental laws and requirements. This includes determining the appropriate project category for both the Massachusetts Environmental Protection Act (MEPA) and the National Environmental Protection Act (NEPA).

Environmental documentation and permitting is often completed in conjunction with the Preliminary Design phase described below.

Design

There are three major phases of design. The first is **Preliminary Design**, which also is referred to as the 25-percent submission. The major components of this phase include full survey of the project area, preparation of base plans, development of basic geometric layout, development of preliminary cost estimates, and submission of a functional design report. Preliminary Design, although not required to be, often is completed in conjunction with the Environmental Documentation and Permitting. The next phase is **Final Design**, which also is referred to as the 75-percent and 100-percent submission. The major components of this phase include preparation of a subsurface exploratory plan (if required), coordination of utility relocations, development of traffic management plans through construction zones, development of final cost estimates, and refinement and finalization of the construction plans. Once Final Design is complete, a full set of **Plans, Specifications, and Estimates (PS&E)** is developed for the project.

Right-of-Way Acquisition

A separate set of Right-of-Way plans are required for any project that requires land acquisition or easements. The plans must identify the existing and proposed layout lines, easements, property lines, names of property owners, and the dimensions and areas of estimated takings and easements.

5. Programming (Identification of Funding)

Programming, which typically begins during the design phase, can actually occur at any time during the process, from planning to design. In this step, which is distinct from project initiation, the proponent requests that the MPO place the project in the region's Transportation Improvement Program (TIP). The proponent requesting the project's listing on the TIP can be the community or it can be one of the MPO member agencies

(the Regional Planning Agency, MassDOT, and the Regional Transit Authority). The MPO then considers the project in terms of state and regional needs, evaluation criteria, and compliance with the regional Transportation Plan and decides whether to place it in the draft TIP for public review and then in the final TIP.

6. Procurement

Following project design and programming of a highway project, the MassDOT Highway Division publishes a request for proposals. It then reviews the bids and awards the contract to the qualified bidder with the lowest bid.

7. Construction

After a construction contract is awarded, MassDOT Highway Division and the contractor develop a public participation plan and a management plan for the construction process.

8. Project Assessment

The purpose of this step is to receive constituents' comments on the project development process and the project's design elements. MassDOT Highway Division can apply what is learned in this process to future projects.

Project Development Schematic Timetable

Step	Schedule Influence	Typical Duration
<p>Step I: Problem/Need/Opportunity Identification</p> <p>The proponent completes a PNF. This form is reviewed by the MassDOT district office, which guides the proponent in subsequent steps of the process.</p>	<p>The PNF may be prepared quickly by the proponent to include any readily available supporting data. The district office will return comments to the proponent within one month of receiving the PNF.</p>	<p>One-to-three months</p>
<p>Step II: Planning</p> <p>Project planning can range from agreeing on a clear solution to a detailed analysis of alternatives and their impacts.</p>	<p>For some projects, no planning beyond preparation of the PNF is required. Some projects require a planning study centered on specific issues associated with a proposed solution or a narrow family of alternatives. Complex projects likely would require a detailed alternatives analysis.</p>	<p>Project Planning Report: three-to-24+ months</p>
<p>Step III: Project Initiation</p> <p>The proponent prepares and submits a PIF and a TEC form. The MPO and MassDOT district office informally review the PIF and TEC; and the PRC formally reviews them.</p>	<p>The PIF includes refinement of the preliminary information contained in the PNF. Additional information summarizing the results of the planning process, such as the project planning report, is included with the PIF and TEC. The schedule is determined by PRC staff (depending on project complexity) and meeting schedule.</p>	<p>One-to-four months</p>
<p>Step IV: Design, Environmental, and Right-of-Way</p> <p>The proponent completes the project design. Concurrently, the proponent completes necessary environmental permitting analyses and files permit applications. Any right-of-way needed for the project is identified and the acquisition process begins.</p>	<p>The schedule depends upon the size of the project and the complexity of the design, permitting, and right-of-way issues. The MassDOT district and appropriate sections complete the design review.</p>	<p>Three- to-48+ months</p>
<p>Step V: Programming</p> <p>The MPO considers the project in terms of its regional priorities and determines whether to include the project in the draft TIP, which is made available for public comment, and includes a project description and funding source.</p>	<p>The schedule for this step is subject to each MPO's programming cycle and meeting schedule. It is possible that the MPO will not include a project in its draft TIP based on its review and approval procedures.</p>	<p>Three-to-12+ months</p>

Step	Schedule Influence	Typical Duration
<p>Step VI: Procurement</p> <p>The project is advertised for construction and a contract is awarded.</p>	<p>Administration of competing projects can influence the advertising schedule.</p>	<p>One-to-12 months</p>
<p>Step VII: Construction</p> <p>The construction process is initiated including public notification and any anticipated public involvement. Construction continues to project completion.</p>	<p>The duration of this step is entirely dependent upon project complexity and phasing.</p>	<p>Three-to-60+ months</p>
<p>Step VIII: Project Assessment</p> <p>The construction period is complete and project elements and processes are evaluated on a voluntary basis.</p>	<p>The duration of this step is dependent upon the proponent's approach and any required follow-up.</p>	<p>One month</p>

Source: MassDOT Highway Division Project Development and Design Guide.