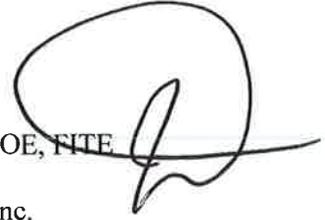


MEMORANDUM



TO: Mr. Jon D. Schneider, Chairman
Zoning Board of Appeals
Public Service Administration
Building
500 Dedham Avenue
Needham, MA 02492

FROM: Jeffrey S. Dirk, P.E., PTOE, FITE
Principal
Vanasse & Associates, Inc.
10 New England Business Center Drive
Suite 314
Andover, MA 01810
(978) 474-8800
jdirk@rdva.com

DATE: October 9, 2013

RE: 6202

SUBJECT: Traffic Signal Warrants Analysis
Needham Mews Residential Community
692 and 744 Greendale Avenue, Needham, Massachusetts

Vanasse & Associates, Inc. (VAI) has completed a detailed Traffic Signal Warrant Analysis (TSWA) for the intersections of Greendale Avenue at Brookline Street and Greendale Avenue at Bird Street/Rybury Hillway in Needham, Massachusetts. This analysis has been prepared as a supplement to our October 2, 2013 *Response to Traffic Review Comments* that was submitted in support of proposed Needham Mews residential community to be located at 692 and 744 Greendale Avenue in Needham, Massachusetts (hereafter referred to as the “Project”), and is responsive to a specific comment raised in the August 5, 2013 *Peer Review of Traffic Impact and Access Study* received from BETA Group, Inc (BETA) concerning their review of the May 2013 *Traffic Impact and Access Study* (the “May 2013 TIAS”) prepared by VAI in support of the Project.

Specifically, BETA requested that a TSWA be performed at “...any of the *unsignalized intersections where levels of operation degrade to unacceptable levels.*” Such conditions (unacceptable levels of operation) were noted to occur at the Greendale Avenue intersections with Brookline Street and Bird Street/Rybury Hillway independent of the Project and, accordingly, a preliminary TSWA was performed at these locations and presented in the October 2, 2013 *Response to Traffic Review Comments*. This analysis presents the results of the formal TSWA, the results of which were found to be consistent with the preliminary assessment, which concluded that the installation of a traffic control signal is warranted at the Greendale Avenue/Brookline Street intersection under 2013 Existing traffic volume conditions independent of the Project; however, the required warrants were not found to be met at the Greendale Avenue/ Bird Street/Rybury Hillway intersection. The following details the methodology and results of the formal TSWA completed for the subject intersections.

TRAFFIC SIGNAL WARRANTS ANALYSIS

In order to determine if the installation of a traffic control signal is justified at the intersections of Greendale Avenue at Brookline Street and Greendale Avenue at Bird Street/Rybury Hillway, a detailed TSWA was completed in accordance with the methodology and procedures outlined in the Manual on Uniform Traffic Control Devices (MUTCD).¹ In brief, The MUTCD establishes nine warrants or criteria to evaluate a location for the installation (or retention) of a traffic signal. At least one of the nine warrants must be satisfied in order to justify the installation or retention of a traffic signal; however, satisfaction of a warrant in and of itself does not necessarily indicate that the installation of a traffic signal is the best traffic control solution. An engineering evaluation of the location in question should indicate that the establishment of traffic signal control will improve the overall safety and/or operation of the intersection. Table 1 lists the nine warrants used to evaluate an intersection for traffic signal control as presented in the MUTCD.

Table 1
TRAFFIC SIGNAL WARRANTS

Warrant No.	Description
1	Eight-Hour Vehicular Volume
2	Four-Hour Vehicular Volume
3	Peak-Hour
4	Pedestrian Volume
5	School Crossing
6	Coordinated Signal System
7	Crash Experience
8	Roadway Network
9	Intersection Near a Grade Crossing

Each of the nine traffic signal warrants listed in Table 1 were evaluated for the Greendale Avenue/Brookline Street and Greendale Avenue/Bird Street/Rybury Hillway intersections based on the current intersection geometry and under 2013 Existing, 2018 No-Build and 2018 Build traffic volume conditions. In order to complete this analysis, 12-hour (7:00 AM to 7:00 PM) manual turning movement and vehicle classification counts conducted at the intersections on Wednesday, October 2, 2013, an average weekday, and were adjusted to reflect the 2018 No-Build and 2018 Build conditions as detailed in the May 2013 TIAS and subsequently refined thereafter in conjunction with the October 2, 2013 *Response to Traffic Review Comments*. Tables 2 and 3 summarize the results of the TSWA for the subject intersections with the detailed TSWA worksheets and supporting materials attached.

¹ *Manual on Uniform Traffic Control Devices (MUTCD)*; Federal Highway Administration; Washington, DC; 2009.

Table 2
TRAFFIC SIGNAL WARRANTS ANALYSIS
GREENDALE AVENUE AT BROOKLINE STREET

Warrant No.	Description	Satisfied?		
		2013 Existing	2018 No-Build	2018 Build
1	Eight-Hour Vehicular Volume	Yes	Yes	Yes
2	Four-Hour Vehicular Volume	Yes	Yes	Yes
3	Peak-Hour	Yes	Yes	Yes
4	Pedestrian Volume	No	No	No
5	School Crossing	No	No	No
6	Coordinated Signal System	No	No	No
7	Crash Experience	No	No	No
8	Roadway Network	No	No	No
9	Intersection Near a Grade Crossing	No	No	No

As can be seen in Table 2, the intersection of Greendale Avenue at Brookline Street was found to satisfy three of the nine warrants justifying the installation of a traffic control signal at the intersection under 2013 Existing conditions independent of the Project, consistent with the findings that were presented in the October 2, 2013 *Response to Traffic Review Comments*. This intersection is expected to continue to satisfy these warrants under 2018 No-Build and 2018 Build conditions, with or without the Kendrick Street interchange project. It should be noted that Warrant 3, *Peak-Hour*, while satisfied, is not applicable to the subject intersection.²

Table 3
TRAFFIC SIGNAL WARRANTS ANALYSIS
GREENDALE AVENUE AT BIRD STREET AND RYBURY HILLWAY

Warrant No.	Description	Satisfied?		
		2013 Existing	2018 No-Build	2018 Build
1	Eight-Hour Vehicular Volume	No	No	No
2	Four-Hour Vehicular Volume	No	No	No
3	Peak-Hour	Yes	Yes	Yes
4	Pedestrian Volume	No	No	No
5	School Crossing	No	No	No
6	Coordinated Signal System	No	No	No
7	Crash Experience	No	No	No
8	Roadway Network	No	No	No
9	Intersection Near a Grade Crossing	No	No	No

²Warrant 3 is applied to locations where an intersection experiences a pronounced increase in traffic during a distinct period of the day that may necessitate the installation of a traffic control signal in order to facilitate the safe and efficient conveyance of traffic. Such conditions are experienced at locations that are shift oriented, such as at hospitals and large industrial or manufacturing facilities, where traffic volumes peak at shift changes; however, during the remainder of the day, traffic volumes would not meet the requisite warrants to justify the installation of a traffic control signal.



As can be seen in Table 3, the intersection of Greendale Avenue at Bird Street and Rybury Hillway was found to satisfy only Warrant 3, a warrant which does not apply to the subject intersection as noted previously for the Greendale Avenue/Brookline Street intersection. Further, no discernible safety deficiencies are apparent at the intersection based on the available motor vehicle crash data (MassDOT and Town of Needham Police Department) and a review of lines of sight at and approaching the intersection, with Project-related impacts shown to be confined to an increase in vehicle queuing of between 0 and 1 vehicle during the peak periods. As such, the installation of a traffic control signal is not justified at the intersection as a potential improvement measure. However, as stated in the May 2013 TIAS, it is recommended that a STOP-sign be installed on the Bird Street approach to Greendale Avenue independent of the Project in order to formalize the assignment of the vehicular right-of-way at the intersection.

SUMMARY

VAI has completed a detailed TSWA as a supplement to our October 2, 2013 *Response to Traffic Review Comments* that was submitted in support of proposed Needham Mews residential community to be located at 692 and 744 Greendale Avenue in Needham, Massachusetts, and as response to a specific comment raised in the August 5, 2013 *Peer Review of Traffic Impact and Access Study* received from BETA concerning their review of the May 2013 TIAS prepared by VAI in support of the Project.

Based on this analysis and consistent with the findings that were presented in the October 2, 2013 *Response to Traffic Review Comments*, it has been concluded that the installation of a traffic control signal is warranted at the Greendale Avenue/Brookline Street intersection under 2013 Existing traffic volume conditions independent of the Project; however, the required warrants were not found to be met at the Greendale Avenue/ Bird Street/Rybury Hillway intersection.

Attachments

cc: K. Ho, P.E., PTOE – BETA Group, Inc. (via email)
R. Hewitt – Mill Creek Residential Trust, LLC (via email)
LAS, File

ATTACHMENTS

TRAFFIC COUNT DATA
TRAFFIC SIGNAL WARRANTS ANALYSIS

TRAFFIC COUNT DATA

Accurate Counts
978-664-2565

N/S Street : Greendale Avenue
E/W Street : Brookline Street
City/State : Needham, MA
Weather : Clear

File Name : 62020005
Site Code : 62020005
Start Date : 10/2/2013
Page No : 1

Groups Printed- Cars - Trucks

Start Time	Greendale Ave From North		Greendale Ave From South		Brookline St From West		Int. Total
	Thru	Right	Left	Thru	Left	Right	
07:00 AM	37	10	3	155	40	1	246
07:15 AM	51	10	13	181	40	4	299
07:30 AM	76	9	13	242	39	5	384
07:45 AM	69	12	9	300	41	7	438
Total	233	41	38	878	160	17	1367
08:00 AM	68	13	13	226	42	4	366
08:15 AM	50	15	8	182	36	11	302
08:30 AM	47	15	2	240	45	12	361
08:45 AM	50	13	7	242	24	2	338
Total	215	56	30	890	147	29	1367
09:00 AM	64	8	5	221	27	3	328
09:15 AM	48	15	10	152	21	3	249
09:30 AM	61	12	5	104	24	2	208
09:45 AM	51	10	2	98	27	4	192
Total	224	45	22	575	99	12	977
10:00 AM	56	13	7	82	23	3	184
10:15 AM	40	14	1	58	17	4	134
10:30 AM	53	10	2	62	17	3	147
10:45 AM	68	11	4	55	11	6	155
Total	217	48	14	257	68	16	620
11:00 AM	72	10	4	58	10	5	159
11:15 AM	62	10	3	55	14	3	147
11:30 AM	62	15	2	81	14	6	180
11:45 AM	56	21	4	58	20	5	164
Total	252	56	13	252	58	19	650
12:00 PM	83	20	4	67	10	1	185
12:15 PM	64	11	0	55	20	3	153
12:30 PM	66	17	2	45	10	5	145
12:45 PM	74	20	2	76	14	4	190
Total	287	68	8	243	54	13	673
01:00 PM	83	14	4	52	16	3	172
01:15 PM	79	17	2	43	12	2	155
01:30 PM	70	15	4	46	17	0	152
01:45 PM	80	21	7	56	16	2	182
Total	312	67	17	197	61	7	661
02:00 PM	108	12	1	71	14	5	211
02:15 PM	132	19	6	56	19	7	239
02:30 PM	132	13	4	101	16	8	274
02:45 PM	151	12	3	80	15	9	270
Total	523	56	14	308	64	29	994
03:00 PM	148	30	5	65	25	3	276
03:15 PM	197	25	3	57	18	5	305
03:30 PM	184	15	6	65	19	4	293
03:45 PM	199	32	9	52	23	2	317
Total	728	102	23	239	85	14	1191
04:00 PM	246	27	4	71	22	9	379
04:15 PM	259	37	5	57	7	7	372
04:30 PM	257	41	8	64	12	5	387
04:45 PM	214	40	9	70	15	4	352
Total	976	145	26	262	56	25	1490
05:00 PM	270	47	10	60	15	3	405

Accurate Counts
978-664-2565

N/S Street : Greendale Avenue
E/W Street : Brookline Street
City/State : Needham, MA
Weather : Clear

File Name : 62020005
Site Code : 62020005
Start Date : 10/2/2013
Page No : 2

Groups Printed- Cars - Trucks

Start Time	Greendale Ave From North		Greendale Ave From South			Brookline St From West		Int. Total
	Thru	Right	Left	Thru	Left	Right		
05:15 PM	202	33	3	53	26	3	320	
05:30 PM	226	41	4	45	15	4	335	
05:45 PM	216	39	8	56	18	3	340	
Total	914	160	25	214	74	13	1400	
06:00 PM	173	36	3	42	14	4	272	
06:15 PM	158	34	4	34	9	4	243	
06:30 PM	153	31	7	29	12	2	234	
06:45 PM	141	27	3	36	11	6	224	
Total	625	128	17	141	46	16	973	
Grand Total	5506	972	247	4456	972	210	12363	
Apprch %	85	15	5.3	94.7	82.2	17.8		
Total %	44.5	7.9	2	36	7.9	1.7		
Cars	5469	966	241	4420	965	208	12269	
% Cars	99.3	99.4	97.6	99.2	99.3	99	99.2	
Trucks	37	6	6	36	7	2	94	
% Trucks	0.7	0.6	2.4	0.8	0.7	1	0.8	

Start Time	Greendale Ave From North			Greendale Ave From South			Brookline St From West			Int. Total
	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	
07:30 AM	76	9	85	13	242	255	39	5	44	384
07:45 AM	69	12	81	9	300	309	41	7	48	438
08:00 AM	68	13	81	13	226	239	42	4	46	366
08:15 AM	50	15	65	8	182	190	36	11	47	302
Total Volume	263	49	312	43	950	993	158	27	185	1490
% App. Total	84.3	15.7		4.3	95.7		85.4	14.6		
PHF	865	817	918	827	792	803	940	614	964	850
Cars	258	49	307	42	940	982	158	26	184	1473
% Cars	98.1	100	98.4	97.7	98.9	98.9	100	96.3	99.5	98.9
Trucks	5	0	5	1	10	11	0	1	1	17
% Trucks	1.9	0	1.6	2.3	1.1	1.1	0	3.7	0.5	1.1

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

Peak Hour for Entire Intersection Begins at 07:30 AM

Accurate Counts
978-664-2565

N/S Street : Greendale Avenue
E/W Street : Brookline Street
City/State : Needham, MA
Weather : Clear

File Name : 62020005
Site Code : 62020005
Start Date : 10/2/2013
Page No : 1

Groups Printed- Trucks

Start Time	Greendale Ave From North		Greendale Ave From South		Brookline St From West		Int. Total
	Thru	Right	Left	Thru	Left	Right	
07:00 AM	1	1	0	3	0	0	5
07:15 AM	1	1	0	0	0	0	2
07:30 AM	2	0	0	4	0	0	6
07:45 AM	1	0	0	3	0	0	4
Total	5	2	0	10	0	0	17
08:00 AM	1	0	0	2	0	0	3
08:15 AM	1	0	1	1	0	1	4
08:30 AM	1	0	0	1	0	0	2
08:45 AM	1	1	0	3	1	0	6
Total	4	1	1	7	1	1	15
09:00 AM	0	0	0	1	0	0	1
09:15 AM	0	0	2	0	0	0	2
09:30 AM	0	0	0	1	0	0	1
09:45 AM	0	0	0	1	0	0	1
Total	0	0	2	3	0	0	5
10:00 AM	1	0	0	0	1	0	2
10:15 AM	1	0	0	0	0	0	1
10:30 AM	0	0	0	0	0	0	0
10:45 AM	1	0	1	0	0	0	2
Total	3	0	1	0	1	0	5
11:00 AM	1	0	1	1	0	0	3
11:15 AM	1	0	0	1	0	0	2
11:30 AM	1	0	0	1	0	0	2
11:45 AM	2	0	0	2	1	1	6
Total	5	0	1	5	1	1	13
12:00 PM	0	0	0	1	0	0	1
12:15 PM	1	0	0	0	0	0	1
12:30 PM	0	0	0	1	0	0	1
12:45 PM	0	1	0	1	1	0	3
Total	1	1	0	3	1	0	6
01:00 PM	1	1	1	0	0	0	3
01:15 PM	0	0	0	0	0	0	0
01:30 PM	0	0	0	0	0	0	0
01:45 PM	2	0	0	0	1	0	3
Total	3	1	1	0	1	0	6
02:00 PM	0	1	0	2	2	0	5
02:15 PM	1	0	0	0	0	0	1
02:30 PM	2	0	0	4	0	0	6
02:45 PM	1	0	0	0	0	0	1
Total	4	1	0	6	2	0	13
03:00 PM	2	0	0	0	0	0	2
03:15 PM	2	0	0	0	0	0	2
03:30 PM	0	0	0	0	0	0	0
03:45 PM	0	0	0	1	0	0	1
Total	4	0	0	1	0	0	5
04:00 PM	0	0	0	0	0	0	0
04:15 PM	4	0	0	0	0	0	4
04:30 PM	0	0	0	0	0	0	0
04:45 PM	0	0	0	1	0	0	1
Total	4	0	0	1	0	0	5
05:00 PM	1	0	0	0	0	0	1

Accurate Counts
978-664-2565

N/S Street : Greendale Avenue
E/W Street : Brookline Street
City/State : Needham, MA
Weather : Clear

File Name : 62020005
Site Code : 62020005
Start Date : 10/2/2013
Page No : 2

Groups Printed- Trucks

Start Time	Greendale Ave From North		Greendale Ave From South		Brookline St From West		Int. Total
	Thru	Right	Left	Thru	Left	Right	
05:15 PM	1	0	0	0	0	0	1
05:30 PM	1	0	0	0	0	0	1
05:45 PM	0	0	0	0	0	0	0
Total	3	0	0	0	0	0	3
06:00 PM	0	0	0	0	0	0	0
06:15 PM	1	0	0	0	0	0	1
06:30 PM	0	0	0	0	0	0	0
06:45 PM	0	0	0	0	0	0	0
Total	1	0	0	0	0	0	1
Grand Total	37	6	6	36	7	2	94
Apprch %	86	14	14.3	85.7	77.8	22.2	
Total %	39.4	6.4	6.4	38.3	7.4	2.1	

Start Time	Greendale Ave From North			Greendale Ave From South			Brookline St From West			Int. Total
	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	
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	1	1	2	0	3	3	0	0	0	5
07:15 AM	1	1	2	0	0	0	0	0	0	2
07:30 AM	2	0	2	0	4	4	0	0	0	6
07:45 AM	1	0	1	0	3	3	0	0	0	4
Total Volume	5	2	7	0	10	10	0	0	0	17
% App. Total	71.4	28.6		0	100		0	0		
PHF	.625	.500	.875	.000	.625	.625	.000	.000	.000	.708

Accurate Counts
978-664-2565

N/S Street : Greendale Avenue
E/W Street : Brookline Street
City/State : Needham, MA
Weather : Clear

File Name : 62020005
Site Code : 62020005
Start Date : 10/2/2013
Page No : 1

Groups Printed- Bikes Peds

Start Time	Greendale Ave From North			Greendale Ave From South			Brookline St From West			Exclu. Total	Inclu. Total	Int. Total
	Thru	Right	Peds	Left	Thru	Peds	Left	Right	Peds			
07:00 AM	2	0	0	0	0	0	0	0	1	1	2	3
07:15 AM	9	0	0	0	1	0	0	0	0	0	10	10
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	1	0	0	0	1	0	0	0	1	1	2	3
Total	12	0	0	0	2	0	0	0	2	2	14	16
08:00 AM	1	0	0	0	0	0	0	0	3	3	1	4
08:15 AM	0	0	0	0	8	0	0	0	0	0	8	8
08:30 AM	0	0	0	0	1	0	0	0	0	0	1	1
08:45 AM	0	0	0	0	2	0	0	0	2	2	2	4
Total	1	0	0	0	11	0	0	0	5	5	12	17
09:00 AM	2	0	0	0	0	0	0	0	1	1	2	3
09:15 AM	1	0	0	0	0	0	0	0	2	2	1	3
09:30 AM	3	0	0	0	1	0	0	0	3	3	4	7
09:45 AM	0	0	0	0	0	0	0	0	3	3	0	3
Total	6	0	0	0	1	0	0	0	9	9	7	16
10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
10:15 AM	2	0	0	0	0	0	1	0	1	1	3	4
10:30 AM	3	0	0	0	1	0	0	0	1	1	4	5
10:45 AM	4	0	0	0	0	0	0	0	2	2	4	6
Total	9	0	0	0	1	0	1	0	4	4	11	15
11:00 AM	1	0	0	0	3	0	0	0	0	0	4	4
11:15 AM	0	0	0	0	1	0	0	0	1	1	1	2
11:30 AM	0	0	0	0	4	0	0	0	1	1	4	5
11:45 AM	0	0	0	0	0	0	0	1	1	1	1	2
Total	1	0	0	0	8	0	0	1	3	3	10	13
12:00 PM	3	0	0	0	0	0	0	0	0	0	3	3
12:15 PM	4	0	0	0	2	0	0	0	1	1	6	7
12:30 PM	3	0	0	0	1	0	0	0	8	8	4	12
12:45 PM	1	0	0	0	0	0	0	0	1	1	1	2
Total	11	0	0	0	3	0	0	0	10	10	14	24
01:00 PM	2	0	0	0	1	0	0	0	0	0	3	3
01:15 PM	1	0	0	0	0	0	0	0	0	0	1	1
01:30 PM	1	0	0	0	1	0	0	0	0	0	2	2
01:45 PM	1	0	0	0	2	0	1	0	2	2	4	6
Total	5	0	0	0	4	0	1	0	2	2	10	12
02:00 PM	2	0	0	0	4	0	0	0	1	1	6	7
02:15 PM	2	0	0	0	0	0	0	0	0	0	2	2
02:30 PM	0	0	0	0	1	0	0	0	0	0	1	1
02:45 PM	1	0	0	0	1	0	0	0	0	0	2	2
Total	5	0	0	0	6	0	0	0	1	1	11	12
03:00 PM	1	0	0	0	1	0	0	0	0	0	2	2
03:15 PM	1	0	0	0	1	0	0	0	0	0	2	2
03:30 PM	5	0	0	0	3	0	0	0	0	0	8	8
03:45 PM	3	0	0	1	0	0	0	0	0	0	4	4
Total	10	0	0	1	5	0	0	0	0	0	16	16
04:00 PM	0	0	0	0	1	0	0	0	1	1	1	2
04:15 PM	4	0	0	0	0	0	0	0	5	5	4	9
04:30 PM	3	0	0	0	0	0	0	0	0	0	3	3
04:45 PM	2	0	0	0	0	0	0	1	1	1	3	4
Total	9	0	0	0	1	0	0	1	7	7	11	18
05:00 PM	2	0	0	0	3	0	0	0	1	1	5	6

Accurate Counts
978-664-2565

N/S Street : Greendale Avenue
E/W Street : Brookline Street
City/State : Needham, MA
Weather : Clear

File Name : 62020005
Site Code : 62020005
Start Date : 10/2/2013
Page No : 2

Groups Printed- Bikes Peds

Start Time	Greendale Ave From North			Greendale Ave From South			Brookline St From West			Exclu. Total	Inclu. Total	Int. Total
	Thru	Right	Peds	Left	Thru	Peds	Left	Right	Peds			
05:15 PM	2	0	0	0	6	0	0	0	0	0	8	8
05:30 PM	2	0	0	0	3	0	0	0	1	1	5	6
05:45 PM	0	0	0	0	4	0	0	0	0	0	4	4
Total	6	0	0	0	16	0	0	0	2	2	22	24
06:00 PM	1	0	0	0	0	0	0	0	0	0	1	1
06:15 PM	1	0	0	0	2	0	0	0	2	2	3	5
06:30 PM	0	0	0	0	1	0	0	0	0	0	1	1
06:45 PM	0	0	0	0	0	0	0	0	0	0	0	0
Total	2	0	0	0	3	0	0	0	2	2	5	7
Grand Total	77	0	0	1	61	0	2	2	47	47	143	190
Apprch %	100	0		1.6	98.4		50	50				
Total %	53.8	0		0.7	42.7		1.4	1.4		24.7	75.3	

Start Time	Greendale Ave From North			Greendale Ave From South			Brookline St From West			Int. Total
	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	
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	2	0	2	0	0	0	0	0	0	2
07:15 AM	9	0	9	0	1	1	0	0	0	10
07:30 AM	0	0	0	0	0	0	0	0	0	0
07:45 AM	1	0	1	0	1	1	0	0	0	2
Total Volume	12	0	12	0	2	2	0	0	0	14
% App. Total	100	0	100	0	100	100	0	0	0	100
PHF	.333	.000	.333	.000	.500	.500	.000	.000	.000	.350

Accurate Counts
978-664-2565

N/S Street : Greendale Avenue
E/W Street : Bird Street
City/State : Needham, MA
Weather : Clear

File Name : 62020002
Site Code : 62020002
Start Date : 10/2/2013
Page No : 1

Groups Printed- Cars - Trucks

Start Time	Greendale Ave From North		Greendale Ave From South		Bird St From West		Int. Total
	Thru	Right	Left	Thru	Left	Right	
07:00 AM	35	7	1	138	14	2	197
07:15 AM	50	13	2	155	26	1	247
07:30 AM	89	19	0	248	27	4	387
07:45 AM	62	25	2	257	39	1	386
Total	236	64	5	798	106	8	1217
08:00 AM	61	20	3	263	24	2	373
08:15 AM	59	14	2	167	28	3	273
08:30 AM	40	8	2	176	27	8	261
08:45 AM	52	14	0	208	16	6	296
Total	212	56	7	814	95	19	1203
09:00 AM	45	11	2	211	13	1	283
09:15 AM	41	7	1	151	10	1	211
09:30 AM	50	9	1	96	10	1	167
09:45 AM	50	8	0	91	12	1	162
Total	186	35	4	549	45	4	823
10:00 AM	45	6	0	70	9	0	130
10:15 AM	42	3	4	62	8	1	120
10:30 AM	40	11	0	43	8	2	104
10:45 AM	55	13	3	54	6	2	133
Total	182	33	7	229	31	5	487
11:00 AM	67	11	2	48	9	1	138
11:15 AM	47	8	0	45	13	6	119
11:30 AM	65	10	1	49	20	0	145
11:45 AM	56	8	3	52	8	1	128
Total	235	37	6	194	50	8	530
12:00 PM	61	12	1	50	12	1	137
12:15 PM	60	8	2	40	9	3	122
12:30 PM	68	5	2	41	8	3	127
12:45 PM	66	11	0	66	7	0	150
Total	255	36	5	197	36	7	536
01:00 PM	77	8	1	37	10	2	135
01:15 PM	54	11	1	43	5	1	115
01:30 PM	65	12	0	38	8	2	125
01:45 PM	62	16	0	50	6	0	134
Total	258	47	2	168	29	5	509
02:00 PM	56	8	1	54	9	0	128
02:15 PM	95	22	4	57	8	4	190
02:30 PM	103	7	2	52	17	4	185
02:45 PM	109	16	2	51	13	1	192
Total	363	53	9	214	47	9	695
03:00 PM	129	13	1	71	22	2	238
03:15 PM	157	14	5	63	18	2	259
03:30 PM	133	10	3	52	18	1	217
03:45 PM	172	11	3	57	8	1	252
Total	591	48	12	243	66	6	966
04:00 PM	190	11	0	61	8	1	271
04:15 PM	177	13	1	53	10	4	258
04:30 PM	213	21	1	56	11	0	302
04:45 PM	224	22	1	60	10	1	318
Total	804	67	3	230	39	6	1149
05:00 PM	232	24	1	59	12	3	331

Accurate Counts
978-664-2565

N/S Street : Greendale Avenue
E/W Street : Bird Street
City/State : Needham, MA
Weather : Clear

File Name : 62020002
Site Code : 62020002
Start Date : 10/2/2013
Page No : 2

Groups Printed- Cars - Trucks

Start Time	Greendale Ave From North		Greendale Ave From South		Bird St From West		Int. Total
	Thru	Right	Left	Thru	Left	Right	
05:15 PM	185	26	0	60	11	1	283
05:30 PM	227	28	1	62	7	0	325
05:45 PM	175	30	2	43	15	3	268
Total	819	108	4	224	45	7	1207
06:00 PM	134	23	3	33	9	1	203
06:15 PM	153	18	1	39	6	0	217
06:30 PM	132	20	2	52	8	1	215
06:45 PM	129	14	2	41	4	0	190
Total	548	75	8	165	27	2	825
Grand Total	4689	659	72	4025	616	86	10147
Apprch %	87.7	12.3	1.8	98.2	87.7	12.3	
Total %	46.2	6.5	0.7	39.7	6.1	0.8	
Cars	4640	654	71	3978	610	84	10037
% Cars	99	99.2	98.6	98.8	99	97.7	98.9
Trucks	49	5	1	47	6	2	110
% Trucks	1	0.8	1.4	1.2	1	2.3	1.1

Start Time	Greendale Ave From North			Greendale Ave From South			Bird St From West			Int. Total
	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	
Peak Hour Analysis From 07:00 AM to 09:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:30 AM										
07:30 AM	89	19	108	0	248	248	27	4	31	387
07:45 AM	62	25	87	2	257	259	39	1	40	386
08:00 AM	61	20	81	3	263	266	24	2	26	373
08:15 AM	59	14	73	2	167	169	28	3	31	273
Total Volume	271	78	349	7	935	942	118	10	128	1419
% App. Total	77.7	22.3		0.7	99.3		92.2	7.8		
PHF	.761	.780	.808	.583	.889	.885	.756	.625	.800	.917
Cars	265	77	342	7	925	932	116	10	126	1400
% Cars	97.8	98.7	98.0	100	98.9	98.9	98.3	100	98.4	98.7
Trucks	6	1	7	0	10	10	2	0	2	19
% Trucks	2.2	1.3	2.0	0	1.1	1.1	1.7	0	1.6	1.3

Accurate Counts
978-664-2565

N/S Street : Greendale Avenue
E/W Street : Bird Street
City/State : Needham, MA
Weather : Clear

File Name : 62020002
Site Code : 62020002
Start Date : 10/2/2013
Page No : 1

Groups Printed- Trucks

Start Time	Greendale Ave From North		Greendale Ave From South		Bird St From West		Int. Total
	Thru	Right	Left	Thru	Left	Right	
07:00 AM	1	0	1	4	0	0	6
07:15 AM	7	1	0	0	0	0	8
07:30 AM	1	0	0	4	0	0	5
07:45 AM	1	1	0	3	1	0	6
Total	10	2	1	11	1	0	25
08:00 AM	1	0	0	2	1	0	4
08:15 AM	3	0	0	1	0	0	4
08:30 AM	0	1	0	2	0	0	3
08:45 AM	2	0	0	3	0	1	6
Total	6	1	0	8	1	1	17
09:00 AM	1	0	0	0	0	0	1
09:15 AM	0	0	0	2	0	0	2
09:30 AM	0	0	0	1	0	0	1
09:45 AM	0	0	0	1	0	0	1
Total	1	0	0	4	0	0	5
10:00 AM	0	0	0	1	0	0	1
10:15 AM	1	0	0	0	0	0	1
10:30 AM	1	0	0	0	0	0	1
10:45 AM	0	0	0	1	0	0	1
Total	2	0	0	2	0	0	4
11:00 AM	1	0	0	1	1	0	3
11:15 AM	1	0	0	0	1	0	2
11:30 AM	0	1	0	3	0	0	4
11:45 AM	4	0	0	1	0	0	5
Total	6	1	0	5	2	0	14
12:00 PM	0	0	0	1	0	0	1
12:15 PM	1	0	0	0	0	0	1
12:30 PM	0	0	0	1	0	0	1
12:45 PM	0	0	0	1	0	0	1
Total	1	0	0	3	0	0	4
01:00 PM	0	0	0	1	0	0	1
01:15 PM	1	0	0	0	0	0	1
01:30 PM	0	0	0	0	0	0	0
01:45 PM	2	0	0	0	0	0	2
Total	3	0	0	1	0	0	4
02:00 PM	0	0	0	1	0	0	1
02:15 PM	2	0	0	2	1	1	6
02:30 PM	1	0	0	1	1	0	3
02:45 PM	1	0	0	1	0	0	2
Total	4	0	0	5	2	1	12
03:00 PM	2	0	0	3	0	0	5
03:15 PM	1	0	0	2	0	0	3
03:30 PM	3	0	0	0	0	0	3
03:45 PM	3	0	0	0	0	0	3
Total	9	0	0	5	0	0	14
04:00 PM	0	0	0	0	0	0	0
04:15 PM	0	0	0	1	0	0	1
04:30 PM	0	0	0	0	0	0	0
04:45 PM	4	0	0	0	0	0	4
Total	4	0	0	1	0	0	5
05:00 PM	1	0	0	0	0	0	1

Accurate Counts
978-664-2565

N/S Street : Greendale Avenue
E/W Street : Bird Street
City/State : Needham, MA
Weather : Clear

File Name : 62020002
Site Code : 62020002
Start Date : 10/2/2013
Page No : 2

Groups Printed- Trucks

Start Time	Greendale Ave From North		Greendale Ave From South		Bird St From West		Int. Total
	Thru	Right	Left	Thru	Left	Right	
05:15 PM	1	0	0	0	0	0	1
05:30 PM	0	1	0	1	0	0	2
05:45 PM	0	0	0	0	0	0	0
Total	2	1	0	1	0	0	4
06:00 PM	1	0	0	0	0	0	1
06:15 PM	0	0	0	1	0	0	1
06:30 PM	0	0	0	0	0	0	0
06:45 PM	0	0	0	0	0	0	0
Total	1	0	0	1	0	0	2
Grand Total	49	5	1	47	6	2	110
Apprch %	90.7	9.3	2.1	97.9	75	25	
Total %	44.5	4.5	0.9	42.7	5.5	1.8	

Start Time	Greendale Ave From North			Greendale Ave From South			Bird St From West			Int. Total
	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	
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	1	0	1	1	4	5	0	0	0	6
07:15 AM	7	1	8	0	0	0	0	0	0	8
07:30 AM	1	0	1	0	4	4	0	0	0	5
07:45 AM	1	1	2	0	3	3	1	0	1	6
Total Volume	10	2	12	1	11	12	1	0	1	25
% App. Total	83.3	16.7		8.3	91.7		100	0		
PHF	.357	.500	.375	.250	.688	.600	.250	.000	.250	.781

Accurate Counts
978-664-2565

N/S Street : Greendale Avenue
E/W Street : Bird Street
City/State : Needham, MA
Weather : Clear

File Name : 62020002
Site Code : 62020002
Start Date : 10/2/2013
Page No : 1

Groups Printed- Bikes Peds

Start Time	Greendale Ave From North			Greendale Ave From South			Bird St From West			Exclu. Total	Inclu. Total	Int. Total
	Thru	Right	Peds	Left	Thru	Peds	Left	Right	Peds			
07:00 AM	1	0	0	0	0	0	0	0	0	0	1	1
07:15 AM	3	0	0	0	0	0	0	0	1	1	3	4
07:30 AM	0	1	0	0	0	0	1	0	1	1	2	3
07:45 AM	0	0	0	0	0	0	1	0	0	0	1	1
Total	4	1	0	0	0	0	2	0	2	2	7	9
08:00 AM	2	0	0	0	0	0	0	0	1	1	2	3
08:15 AM	0	0	0	0	8	0	0	0	0	0	8	8
08:30 AM	1	0	0	0	0	0	0	0	1	1	1	2
08:45 AM	0	0	0	0	2	0	0	0	3	3	2	5
Total	3	0	0	0	10	0	0	0	5	5	13	18
09:00 AM	2	0	0	0	0	0	0	0	0	0	2	2
09:15 AM	1	0	0	0	0	0	0	0	1	1	1	2
09:30 AM	3	0	0	0	1	0	0	0	4	4	4	8
09:45 AM	0	0	0	0	0	0	0	0	6	6	0	6
Total	6	0	0	0	1	0	0	0	11	11	7	18
10:00 AM	0	0	0	0	0	0	0	0	1	1	0	1
10:15 AM	2	0	0	0	0	0	0	0	1	1	2	3
10:30 AM	1	0	0	0	0	0	1	0	2	2	2	4
10:45 AM	5	0	0	0	0	0	0	0	1	1	5	6
Total	8	0	0	0	0	0	1	0	5	5	9	14
11:00 AM	2	0	0	0	1	0	3	0	0	0	6	6
11:15 AM	0	0	0	0	4	0	0	0	0	0	4	4
11:30 AM	0	0	0	0	0	0	0	0	2	2	0	2
11:45 AM	0	0	0	0	0	0	0	0	2	2	0	2
Total	2	0	0	0	5	0	3	0	4	4	10	14
12:00 PM	3	0	0	0	2	0	0	0	0	0	5	5
12:15 PM	2	0	0	0	1	0	0	0	0	0	3	3
12:30 PM	5	0	0	0	0	0	0	0	1	1	5	6
12:45 PM	2	0	0	0	1	0	0	0	1	1	3	4
Total	12	0	0	0	4	0	0	0	2	2	16	18
01:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
01:15 PM	3	0	0	0	0	0	0	0	0	0	3	3
01:30 PM	1	0	0	0	3	0	1	0	0	0	5	5
01:45 PM	0	1	0	0	1	0	0	0	0	0	2	2
Total	4	1	0	0	4	0	1	0	0	0	10	10
02:00 PM	3	0	0	0	1	0	0	0	1	1	4	5
02:15 PM	2	0	0	0	0	0	0	0	0	0	2	2
02:30 PM	3	0	0	0	1	0	0	0	0	0	4	4
02:45 PM	0	0	0	0	2	0	0	0	2	2	2	4
Total	8	0	0	0	4	0	0	0	3	3	12	15
03:00 PM	1	0	0	0	1	0	1	0	1	1	3	4
03:15 PM	1	0	0	0	1	0	1	0	0	0	3	3
03:30 PM	1	0	0	0	1	0	0	0	0	0	2	2
03:45 PM	3	0	0	0	2	0	0	0	2	2	5	7
Total	6	0	0	0	5	0	2	0	3	3	13	16
04:00 PM	2	0	0	0	1	0	2	0	1	1	5	6
04:15 PM	2	0	0	0	1	0	0	0	1	1	3	4
04:30 PM	4	0	0	0	0	0	0	0	2	2	4	6
04:45 PM	2	0	0	0	0	0	0	0	5	5	2	7
Total	10	0	0	0	2	0	2	0	9	9	14	23
05:00 PM	3	0	0	0	0	0	0	0	1	1	3	4

Accurate Counts

978-664-2565

N/S Street : Greendale Avenue
 E/W Street : Bird Street
 City/State : Needham, MA
 Weather : Clear

File Name : 62020002
 Site Code : 62020002
 Start Date : 10/2/2013
 Page No : 2

Groups Printed- Bikes Peds

Start Time	Greendale Ave From North			Greendale Ave From South			Bird St From West			Exclu. Total	Inclu. Total	Int. Total
	Thru	Right	Peds	Left	Thru	Peds	Left	Right	Peds			
05:15 PM	1	0	0	0	4	0	0	0	4	4	5	9
05:30 PM	0	0	0	0	6	0	0	0	1	1	6	7
05:45 PM	1	2	0	0	1	0	0	0	1	1	4	5
Total	5	2	0	0	11	0	0	0	7	7	18	25
06:00 PM	0	0	0	0	0	0	0	0	1	1	0	1
06:15 PM	0	0	0	0	0	0	0	0	0	0	0	0
06:30 PM	1	1	0	0	0	0	0	0	1	1	2	3
06:45 PM	0	0	0	0	0	0	0	0	0	0	0	0
Total	1	1	0	0	0	0	0	0	2	2	2	4
Grand Total	69	5	0	0	46	0	11	0	53	53	131	184
Apprch %	93.2	6.8		0	100		100	0				
Total %	52.7	3.8		0	35.1		8.4	0		28.8	71.2	

Start Time	Greendale Ave From North			Left	Greendale Ave From South		Left	Bird St From West		Int. Total
	Thru	Right	App. Total		Thru	App. Total		Right	App. Total	
Peak Hour Analysis From 07:00 AM to 09:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:30 AM										
07:30 AM	0	1	1	0	0	0	1	0	1	2
07:45 AM	0	0	0	0	0	0	1	0	1	1
08:00 AM	2	0	2	0	0	0	0	0	0	2
08:15 AM	0	0	0	0	8	8	0	0	0	8
Total Volume	2	1	3	0	8	8	2	0	2	13
% App. Total	66.7	33.3		0	100		100	0		
PHF	.250	.250	.375	.000	.250	.250	.500	.000	.500	.406

Accurate Counts
978-664-2565

N/S Street : Greendale Avenue
E/W Street : Rybury Hillway
City/State : Needham, MA
Weather : Clear

File Name : 62020007
Site Code : 62020007
Start Date : 9/12/2013
Page No : 1

Groups Printed- Cars - Trucks

Start Time	Greendale Ave From North		Greendale Ave From South		Rybury Hillway From West			Int. Total
	Thru	Right	Left	Thru	Left	Right		
07:00 AM	0	0	2	0	1	2	5	
07:15 AM	0	1	2	0	1	7	11	
07:30 AM	0	1	3	0	2	7	13	
07:45 AM	0	0	0	0	1	2	3	
Total	0	2	7	0	5	18	32	
08:00 AM	0	1	5	0	1	1	8	
08:15 AM	0	0	5	0	1	13	19	
08:30 AM	0	2	6	0	0	2	10	
08:45 AM	0	3	3	0	0	5	11	
Total	0	6	19	0	2	21	48	
09:00 AM	0	0	6	0	1	2	9	
09:15 AM	0	3	1	0	0	1	5	
09:30 AM	0	0	1	0	1	3	5	
09:45 AM	0	2	1	0	0	3	6	
Total	0	5	9	0	2	9	25	
10:00 AM	0	0	0	0	0	1	1	
10:15 AM	0	1	0	0	1	0	2	
10:30 AM	0	3	1	0	2	1	7	
10:45 AM	0	0	1	0	0	3	4	
Total	0	4	2	0	3	5	14	
11:00 AM	0	1	5	0	0	0	6	
11:15 AM	0	1	1	0	0	2	4	
11:30 AM	0	1	1	0	2	1	5	
11:45 AM	0	0	2	0	1	6	9	
Total	0	3	9	0	3	9	24	
12:00 PM	0	1	1	0	1	2	5	
12:15 PM	0	1	2	0	0	2	5	
12:30 PM	0	0	1	0	0	4	5	
12:45 PM	0	0	3	0	0	3	6	
Total	0	2	7	0	1	11	21	
01:00 PM	0	1	1	0	2	1	5	
01:15 PM	0	0	2	0	0	2	4	
01:30 PM	0	0	3	0	0	1	4	
01:45 PM	0	3	2	0	1	7	13	
Total	0	4	8	0	3	11	26	
02:00 PM	0	2	2	0	0	2	6	
02:15 PM	0	0	5	0	0	6	11	
02:30 PM	0	1	6	0	1	2	10	
02:45 PM	0	1	2	0	0	3	6	
Total	0	4	15	0	1	13	33	
03:00 PM	0	1	2	0	1	4	8	
03:15 PM	0	0	2	0	0	4	6	
03:30 PM	0	2	0	0	2	3	7	
03:45 PM	0	2	5	0	1	2	10	
Total	0	5	9	0	4	13	31	
04:00 PM	0	1	1	0	0	1	3	
04:15 PM	0	1	2	0	1	1	5	
04:30 PM	0	1	9	0	0	1	11	
04:45 PM	0	0	3	0	0	2	5	
Total	0	3	15	0	1	5	24	
05:00 PM	0	1	7	0	0	1	9	

Accurate Counts
978-664-2565

N/S Street : Greendale Avenue
E/W Street : Rybury Hillway
City/State : Needham, MA
Weather : Clear

File Name : 62020007
Site Code : 62020007
Start Date : 9/12/2013
Page No : 2

Groups Printed- Cars - Trucks

Start Time	Greendale Ave From North		Greendale Ave From South		Rybury Hillway From West		Int. Total
	Thru	Right	Left	Thru	Left	Right	
05:15 PM	0	1	1	0	2	4	8
05:30 PM	0	1	3	0	0	1	5
05:45 PM	0	2	6	0	1	1	10
Total	0	5	17	0	3	7	32
06:00 PM	0	1	3	0	1	4	9
06:15 PM	0	2	5	0	0	2	9
06:30 PM	0	1	3	0	1	2	7
06:45 PM	0	1	4	0	0	1	6
Total	0	5	15	0	2	9	31
Grand Total	0	48	132	0	30	131	341
Apprch %	0	100	100	0	18.6	81.4	
Total %	0	14.1	38.7	0	8.8	38.4	
Cars	0	48	132	0	26	131	337
% Cars	0	100	100	0	86.7	100	98.8
Trucks	0	0	0	0	4	0	4
% Trucks	0	0	0	0	13.3	0	1.2

Start Time	Greendale Ave From North			Greendale Ave From South			Rybury Hillway From West			Int. Total
	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	
08:15 AM	0	0	0	5	0	5	1	13	14	19
08:30 AM	0	2	2	6	0	6	0	2	2	10
08:45 AM	0	3	3	3	0	3	0	5	5	11
09:00 AM	0	0	0	6	0	6	1	2	3	9
Total Volume	0	5	5	20	0	20	2	22	24	49
% App. Total	0	100	100	100	0	100	8.3	91.7	95.8	98.0
PHF	.000	.417	.417	.833	.000	.833	.500	.423	.429	.645
Cars	0	5	5	20	0	20	1	22	23	48
% Cars	0	100	100	100	0	100	50.0	100	95.8	98.0
Trucks	0	0	0	0	0	0	1	0	1	1
% Trucks	0	0	0	0	0	0	50.0	0	4.2	2.0

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

Peak Hour for Entire Intersection Begins at 08:15 AM

Accurate Counts
978-664-2565

N/S Street : Greendale Avenue
E/W Street : Rybury Hillway
City/State : Needham, MA
Weather : Clear

File Name : 62020007
Site Code : 62020007
Start Date : 9/12/2013
Page No : 1

Groups Printed- Trucks

Start Time	Greendale Ave From North		Greendale Ave From South		Rybury Hillway From West		Int. Total
	Thru	Right	Left	Thru	Left	Right	
07:00 AM	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	1	0	1
08:30 AM	0	0	0	0	0	0	0
08:45 AM	0	0	0	0	0	0	0
Total	0	0	0	0	1	0	1
09:00 AM	0	0	0	0	0	0	0
09:15 AM	0	0	0	0	0	0	0
09:30 AM	0	0	0	0	0	0	0
09:45 AM	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
10:00 AM	0	0	0	0	0	0	0
10:15 AM	0	0	0	0	0	0	0
10:30 AM	0	0	0	0	0	0	0
10:45 AM	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
11:00 AM	0	0	0	0	0	0	0
11:15 AM	0	0	0	0	0	0	0
11:30 AM	0	0	0	0	0	0	0
11:45 AM	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
12:00 PM	0	0	0	0	0	0	0
12:15 PM	0	0	0	0	0	0	0
12:30 PM	0	0	0	0	0	0	0
12:45 PM	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
01:00 PM	0	0	0	0	0	0	0
01:15 PM	0	0	0	0	0	0	0
01:30 PM	0	0	0	0	0	0	0
01:45 PM	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
02:00 PM	0	0	0	0	0	0	0
02:15 PM	0	0	0	0	0	0	0
02:30 PM	0	0	0	0	1	0	1
02:45 PM	0	0	0	0	0	0	0
Total	0	0	0	0	1	0	1
03:00 PM	0	0	0	0	0	0	0
03:15 PM	0	0	0	0	0	0	0
03:30 PM	0	0	0	0	1	0	1
03:45 PM	0	0	0	0	0	0	0
Total	0	0	0	0	1	0	1
04:00 PM	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
05:00 PM	0	0	0	0	0	0	0

Accurate Counts
978-664-2565

N/S Street : Greendale Avenue
E/W Street : Rybury Hillway
City/State : Needham, MA
Weather : Clear

File Name : 62020007
Site Code : 62020007
Start Date : 9/12/2013
Page No : 2

Groups Printed- Trucks

Start Time	Greendale Ave From North		Greendale Ave From South		Rybury Hillway From West		Int. Total
	Thru	Right	Left	Thru	Left	Right	
05:15 PM	0	0	0	0	1	0	1
05:30 PM	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0
Total	0	0	0	0	1	0	1
06:00 PM	0	0	0	0	0	0	0
06:15 PM	0	0	0	0	0	0	0
06:30 PM	0	0	0	0	0	0	0
06:45 PM	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Grand Total	0	0	0	0	4	0	4
Apprch %	0	0	0	0	100	0	
Total %	0	0	0	0	100	0	

Start Time	Greendale Ave From North			Greendale Ave From South			Rybury Hillway From West			Int. Total
	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	
Peak Hour Analysis From 07:00 AM to 09:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:30 AM										
07:30 AM	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	1	0	1	1
Total Volume	0	0	0	0	0	0	1	0	1	1
% App. Total	0	0	0	0	0	0	100	0		
PHF	.000	.000	.000	.000	.000	.000	.250	.000	.250	.250

Accurate Counts
978-664-2565

N/S Street : Greendale Avenue
E/W Street : Rybury Hillway
City/State : Needham, MA
Weather : Clear

File Name : 62020007
Site Code : 62020007
Start Date : 9/12/2013
Page No : 2

Groups Printed- Bikes Peds

Start Time	Greendale Ave From North			Greendale Ave From South			Rybury Hillway From West			Exclu. Total	Inclu. Total	Int. Total
	Thru	Right	Peds	Left	Thru	Peds	Left	Right	Peds			
05:15 PM	0	0	0	0	0	0	0	0	4	4	0	4
05:30 PM	0	0	0	0	0	0	0	0	1	1	0	1
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	5	5	0	5
06:00 PM	0	0	0	0	0	0	0	0	1	1	0	1
06:15 PM	0	0	0	0	0	0	0	0	0	0	0	0
06:30 PM	0	0	0	0	0	0	0	0	1	1	0	1
06:45 PM	0	0	0	0	0	0	0	0	1	1	0	1
Total	0	0	0	0	0	0	0	0	3	3	0	3
Grand Total	0	0	0	1	0	0	0	0	58	58	1	59
Apprch %	0	0		100	0		0	0				
Total %	0	0		100	0		0	0		98.3	1.7	

Start Time	Greendale Ave From North			Greendale Ave From South			Rybury Hillway From West			Int. Total
	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	
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	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	1	0	1	0	0	0	1
07:30 AM	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	1	0	1	0	0	0	1
% App. Total	0	0		100	0		0	0		
PHF	.000	.000	.000	.250	.000	.250	.000	.000	.000	.250

TRAFFIC SIGNAL WARRANTS ANALYSIS

**Greendale Avenue at Brookline Street
Traffic Signal Warrant Analysis Summary**

2013 Existing Traffic Volumes

Start Time	Greendale Avenue Volume (Major Street) ^a	Brookline Street Volume (Minor Street) ^b	Warrant 1 Condition A ^c	Warrant 1 Condition B ^d	Warrant 2 ^e	Warrant 3 ^f
7:00	1190	177	Yes	Yes	Yes	Yes
8:00	1191	176	Yes	Yes	Yes	Yes
9:00	866	111	Yes	Yes	Yes	Yes
10:00	536	84	No	Yes	No	No
11:00	573	77	No	Yes	No	No
12:00	606	67	No	Yes	No	No
1:00	593	68	No	Yes	No	No
2:00	901	93	No	Yes	Yes	No
3:00	1092	99	No	Yes	Yes	Yes
4:00	1409	81	No	Yes	Yes	Yes
5:00	1313	87	No	Yes	Yes	Yes
6:00	911	62	No	Yes	Yes	No
Warrant Satisfied?			No	Yes	Yes	Yes

2018 No-Build Volumes (1% Growth/Year)

Start Time	Greendale Avenue Volume (Major Street) ^a	Brookline Street Volume (Minor Street) ^b	Warrant 1 Condition A ^c	Warrant 1 Condition B ^d	Warrant 2 ^e	Warrant 3 ^f
7:00	1251	186	Yes	Yes	Yes	Yes
8:00	1252	185	Yes	Yes	Yes	Yes
9:00	910	117	Yes	Yes	Yes	Yes
10:00	563	88	No	Yes	No	No
11:00	602	81	No	Yes	No	No
12:00	637	70	No	Yes	No	No
1:00	623	71	No	Yes	No	No
2:00	947	98	No	Yes	Yes	Yes
3:00	1148	104	No	Yes	Yes	Yes
4:00	1481	85	No	Yes	Yes	Yes
5:00	1380	91	No	Yes	Yes	Yes
6:00	957	65	No	Yes	Yes	No
Warrant Satisfied?			No	Yes	Yes	Yes

2018 Build Volumes (No-Build plus Project-Generated)

Start Time	Greendale Avenue Volume (Major Street) ^a	Brookline Street Volume (Minor Street) ^b	Warrant 1 Condition A ^c	Warrant 1 Condition B ^d	Warrant 2 ^e	Warrant 3 ^f
7:00	1351	186	Yes	Yes	Yes	Yes
8:00	1360	185	Yes	Yes	Yes	Yes
9:00	972	117	Yes	Yes	Yes	Yes
10:00	620	88	No	Yes	No	No
11:00	667	81	No	Yes	No	No
12:00	703	70	No	Yes	No	No
1:00	684	71	No	Yes	No	No
2:00	1020	98	No	Yes	Yes	Yes
3:00	1220	104	No	Yes	Yes	Yes
4:00	1574	85	No	Yes	Yes	Yes
5:00	1512	91	No	Yes	Yes	Yes
6:00	1085	65	No	Yes	Yes	No
Warrant Satisfied?			No	Yes	Yes	Yes

^aBased on TMC count conducted on Greendale Avenue in October 2013. Volume includes total of both approaches.

^bBased on TMC count conducted on Brookline Street in October 2013. Volume includes eastbound approach.

^cWarrant 1 Condition A - Eight Hour Vehicular Volume, Minimum Vehicular Volume - satisfied when major street volume > 350 and minor street volume > 105. (70% Factors)

^dWarrant 1 Condition B - Eight Hour Vehicular Volume, Interruption of Continuous Traffic - satisfied when major street volume > 525 and minor street volume > 53. (70% Factors)

^eWarrant 2, Four Hour Vehicular Volume (70% Factor) - see Table 4C-2.

^fWarrant 3, Peak Hour (70% Factor) - see Table 4C-4.

**Greendale Avenue at Bird Street
Traffic Signal Warrant Analysis Summary**

2013 Existing Traffic Volumes

Start Time	Greendale Avenue Volume (Major Street) ^a	Bird Street Volume (Minor Street) ^b	Warrant 1 Condition A ^c	Warrant 1 Condition B ^d	Warrant 2 ^e	Warrant 3 ^f
7:00	1103	114	Yes	Yes	Yes	Yes
8:00	1089	114	Yes	Yes	Yes	Yes
9:00	774	49	No	No	No	No
10:00	451	36	No	No	No	No
11:00	472	58	No	No	No	No
12:00	493	43	No	No	No	No
1:00	475	34	No	No	No	No
2:00	639	56	No	Yes	No	No
3:00	894	72	No	Yes	Yes	No
4:00	1104	45	No	No	No	No
5:00	1155	52	No	No	No	No
6:00	796	29	No	No	No	No
Warrant Satisfied?			No	No	No	Yes

2018 No-Build Volumes (1% Growth/Year)

Start Time	Greendale Avenue Volume (Major Street) ^a	Bird Street Volume (Minor Street) ^b	Warrant 1 Condition A ^c	Warrant 1 Condition B ^d	Warrant 2 ^e	Warrant 3 ^f
7:00	1159	120	Yes	Yes	Yes	Yes
8:00	1145	120	Yes	Yes	Yes	Yes
9:00	813	51	No	No	No	No
10:00	474	38	No	No	No	No
11:00	496	61	No	No	No	No
12:00	518	45	No	No	No	No
1:00	499	36	No	No	No	No
2:00	672	59	No	Yes	No	No
3:00	940	76	No	Yes	Yes	No
4:00	1160	47	No	No	No	No
5:00	1214	55	No	No	No	No
6:00	837	30	No	No	No	No
Warrant Satisfied?			No	No	No	Yes

2018 Build Volumes (No-Build plus Project-Generated)

Start Time	Greendale Avenue Volume (Major Street) ^a	Bird Street Volume (Minor Street) ^b	Warrant 1 Condition A ^c	Warrant 1 Condition B ^d	Warrant 2 ^e	Warrant 3 ^f
7:00	1260	120	Yes	Yes	Yes	Yes
8:00	1253	120	Yes	Yes	Yes	Yes
9:00	875	51	No	No	No	No
10:00	530	38	No	No	No	No
11:00	561	61	No	No	No	No
12:00	584	45	No	No	No	No
1:00	560	36	No	No	No	No
2:00	745	59	No	Yes	No	No
3:00	1012	76	No	Yes	Yes	No
4:00	1253	47	No	No	No	No
5:00	1346	55	No	No	No	No
6:00	964	30	No	No	No	No
Warrant Satisfied?			No	No	No	Yes

^aBased on TMC count conducted on Greendale Avenue in October 2013. Volume includes total of both approaches.

^bBased on TMC count conducted on Bird Street in October 2013. Volume includes eastbound approach.

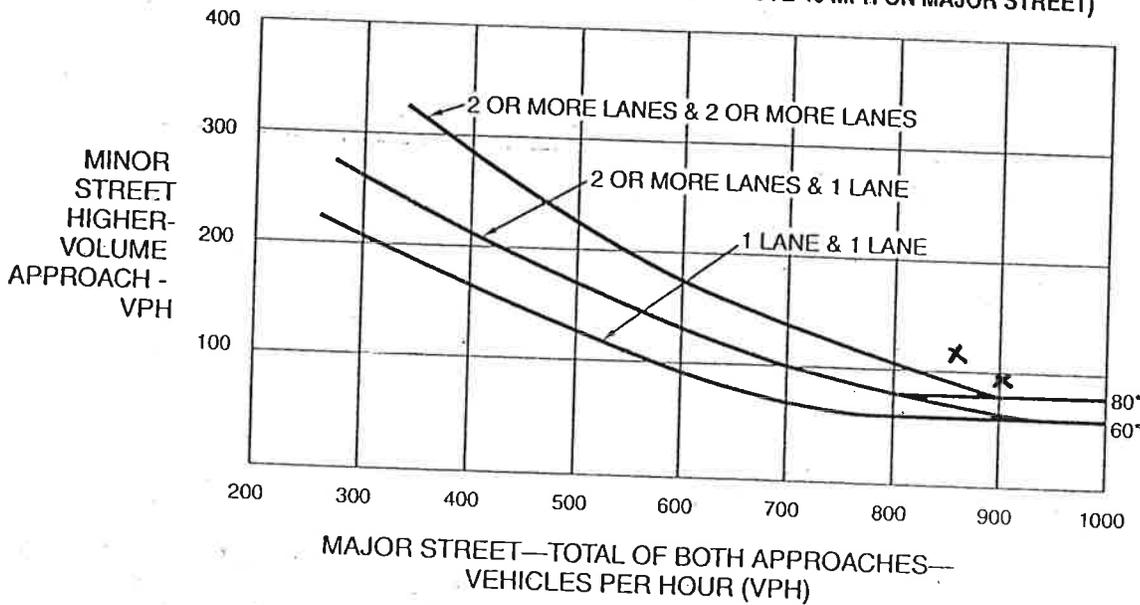
^cWarrant 1 Condition A - Eight Hour Vehicular Volume, Minimum Vehicular Volume - satisfied when major street volume > 350 and minor street volume > 105. (70% Factors)

^dWarrant 1 Condition B - Eight Hour Vehicular Volume, Interruption of Continuous Traffic - satisfied when major street volume > 525 and minor street volume > 53. (70% Factors)

^eWarrant 2, Four Hour Vehicular Volume (70% Factor) - see Table 4C-2.

^fWarrant 3, Peak Hour (70% Factor) - see Table 4C-4.

Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)
 (COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

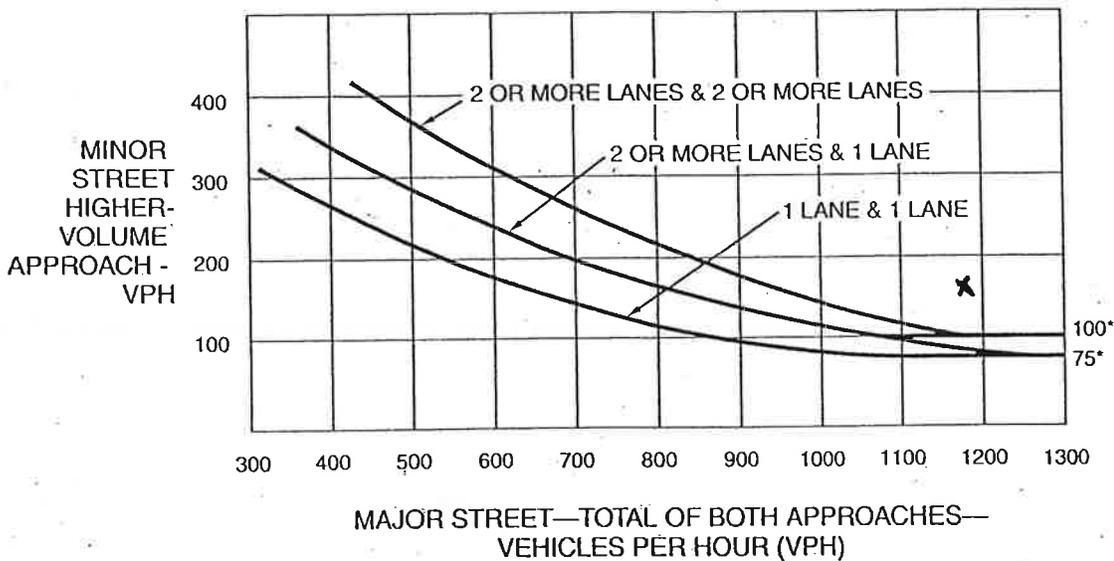
Greendale Avenue at Brookline Street
2013 Existing Conditions

Sect. 4C.04

December 2009

D.

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)
 (COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



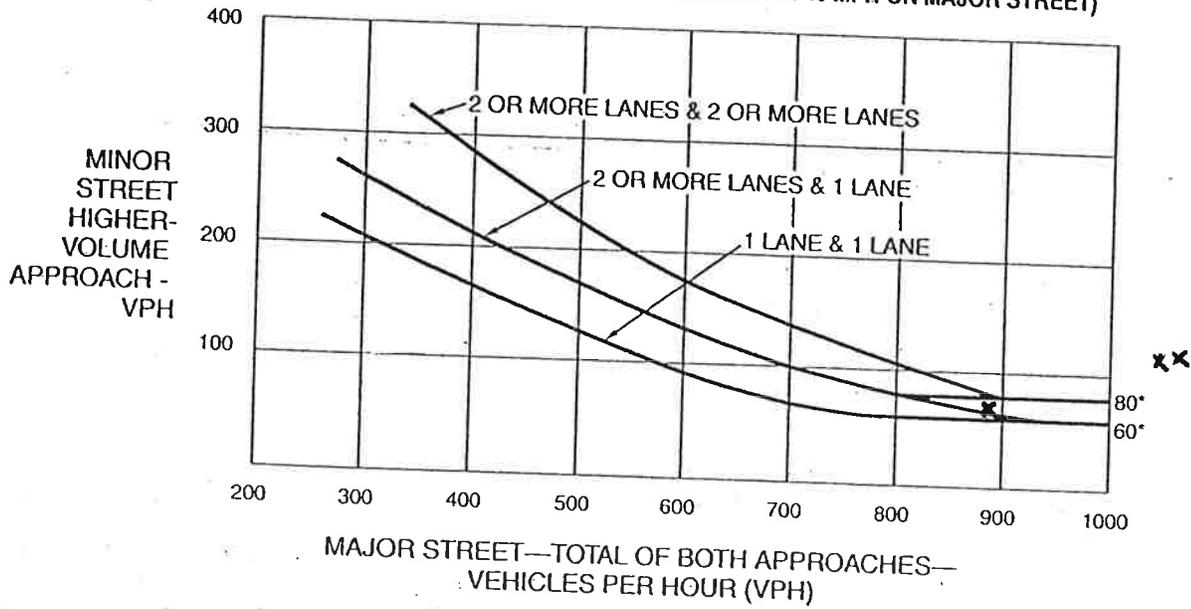
*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

December 2009

Sect. 4C.04

Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

Sect. 4C.04

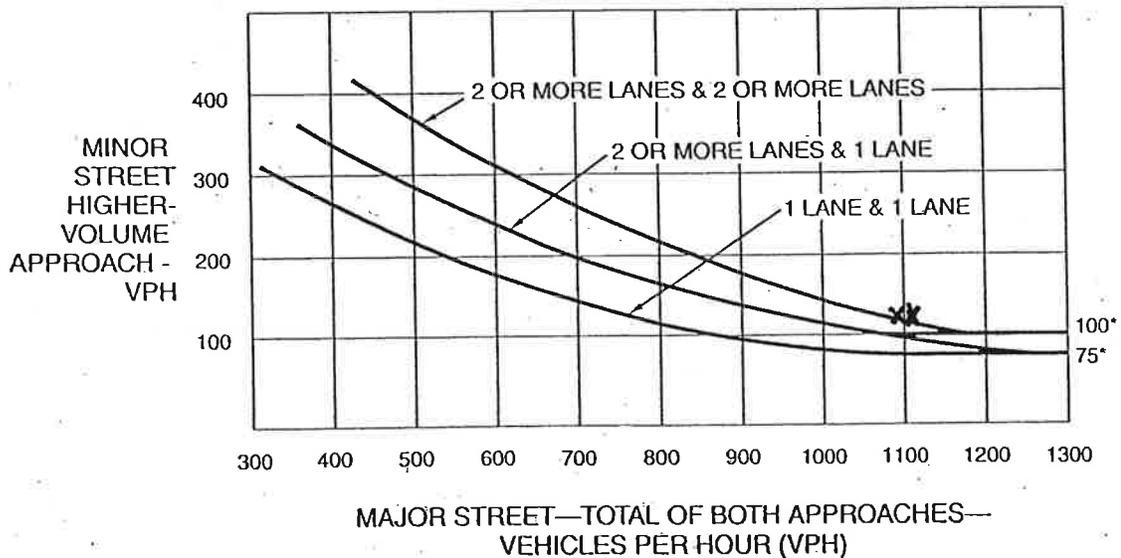
*Greendale Avenue at Bird Street
2013 Existing Conditions*

December 2009

D.

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

December 2009

Sect. 4C.04