

Appendix H: Signal Warrant Analysis

Signal Warrant Analysis

Completed in Accordance with the Manual on Uniform Traffic Control Devices

Gray

SR 26 @ Libby Hill Rd

Data Collected:

9/20/2013

Minor Street

Description =

Hannaford Ent
Libby Hill Rd

Direction 1 =
Direction 2 =

East
West

HOUR	LEFT			TOTAL	NO RTS	HOUR	LEFT			TOTAL	NO RTS
	Hannaford Ent	From	East				Libby Hill Rd	From	West		
6	6	0	2	8	6	6	6	0	14	20	6
7	21	24	20	65	45	7	52	11	152	215	63
8	28	4	20	52	32	8	8	1	19	28	9
9	43	3	30	76	46	9	7	6	20	33	13
10	31	6	43	80	37	10	10	5	28	43	15
11	43	9	46	98	52	11	14	8	17	39	22
12	50	3	52	105	53	12	11	4	21	36	15
13	32	8	32	72	40	13	38	9	75	122	47
14	41	10	45	96	51	14	31	13	95	139	44
15	63	6	94	163	69	15	29	10	46	85	39
16	80	7	113	200	87	16	57	21	73	151	78
17	53	12	103	168	65	17	48	24	77	149	72
Total	491	92	600				311	112	637		

Major Street

Description =

SR 26

Direction 1 =
Direction 2 =

North
South

HOUR	LEFT			TOTAL	NO RTS	HOUR	LEFT			TOTAL	NO RTS
	SR 26	From	North				SR 26	From	South		
6	6	687	44	737	693	6	70	169	13	252	239
7	19	671	125	815	690	7	215	252	55	522	467
8	29	523	14	566	552	8	29	313	34	376	342
9	26	430	15	471	456	9	22	331	67	420	353
10	25	363	5	393	388	10	18	359	65	442	377
11	42	420	8	470	462	11	13	443	74	530	456
12	28	345	9	382	373	12	27	337	85	449	364
13	16	303	25	344	319	13	62	359	81	502	421
14	34	389	26	449	423	14	31	438	84	553	469
15	58	373	30	461	431	15	120	606	142	868	726
16	57	457	51	565	514	16	75	708	147	930	783
17	29	336	50	415	365	17	94	768	141	1003	862
Total	369	5297	402				776	5083	988		

SR 26				Hannaford Ent Libby Hill Rd				Not including right turns			
HOUR	South	North	TOTAL	HOUR	East	West	Highest	East	West	Highest	
6	252	737	989	6	8	20	20	6	6	6	
7	522	815	1337	7	65	215	215	45	63	63	
8	376	566	942	8	52	28	52	32	9	32	
9	420	471	891	9	76	33	76	46	13	46	
10	442	393	835	10	80	43	80	37	15	37	
11	530	470	1000	11	98	39	98	52	22	52	
12	449	382	831	12	105	36	105	53	15	53	
13	502	344	846	13	72	122	122	40	47	47	
14	553	449	1002	14	96	139	139	51	44	51	
15	868	461	1329	15	163	85	163	69	39	69	
16	930	565	1495	16	200	151	200	87	78	87	
17	1003	415	1418	17	168	149	168	65	72	72	

For signal warrant purposes, turning movement counts are adjusted by using the Group Factor to estimate turning movements for the average day.

MaineDOT typically discounts right turns from the minor street volumes for signal warrant analysis up to an amount equal to 85% of the unsignalized peak-hour capacity of the lane from which right-turn movements are made.

Lowest shared/right-turn capacity on highest minor approach (4:30-5:30 pm): 517
85% of capacity: 439

Group Factor =

0.91

85% of capacity exceeds hourly right turn volumes. Exclude right turns.

Critical Volumes
Adjusted for the Average Day

Right turns discounted? Yes

HOUR	SR 26	Highest Minor Leg	No Rts	HOUR	SR 26	Highest Minor	No Rts
6	900	18	5	12	756	96	48
7	1217	196	57	13	770	111	43
8	857	47	29	14	912	126	46
9	811	69	42	15	1209	148	63
10	760	73	34	16	1360	182	79
11	910	89	47	17	1290	153	66

Warrant 1:

Eight-Hour Vehicular Volume

This warrant is satisfied when, for each of any 8 hours of an average day, the traffic volumes given under Conditions A, B, or C exist. These conditions are: Conditions A, B, or C exist. These conditions are:

- Condition A: Minimum Vehicular Volume (Warrant 1A)
- Condition B: Interruption of Continuous Traffic (Warrant 1B)
- Condition C: Combination of Conditions A and B (Warrant 1C)

If any one of the conditions is satisfied, Warrant 1 is met.

Warrant 1A: Minimum Vehicular Volume

This warrant is satisfied when, for each of any 8 hours of an average day, the traffic volumes given in the table below exist on the major street (total of both directions) and on the higher-volume minor street approach to the intersection.

Required Volumes Page 4c-3 of MUTCD based on # of Lanes				Adjusted
	SR 26	500		350
	Hannaford Ent	150		105
Is the 70% option used to evaluate this intersection?				Yes

HOUR	SR 26	Hannaford E	Warrant		No Rts	Warrant	
			Met?			Met?	
6	900	18	Minor Fail		5	Minor Fail	
7	1217	196	Met		57	Minor Fail	
8	857	47	Minor Fail		29	Minor Fail	
9	811	69	Minor Fail		42	Minor Fail	
10	760	73	Minor Fail		34	Minor Fail	
11	910	89	Minor Fail		47	Minor Fail	
12	756	96	Minor Fail		48	Minor Fail	
13	770	111	Met		43	Minor Fail	
14	912	126	Met		46	Minor Fail	
15	1209	148	Met		63	Minor Fail	
16	1360	182	Met		79	Minor Fail	
17	1290	153	Met		66	Minor Fail	

Warrant 1A N/A With Right Turns Included on Minor
Warrant 1A Not Met With Right Turns Excluded on Minor

Warrant 1B: Interruption of Continuous Traffic

This warrant is satisfied when, for each of any 8 hours of an average day, the traffic volumes given in the table below exist on the major street (total both directions) and on the higher volume minor street approach to the intersection, and the signal installation will not seriously disrupt progressive traffic flow.

Required Volumes Page 4c-4 of MUTCD based on # of Lanes				Adjusted
	SR 26	750		525
	Hannaford E	75		53
Is the 70% option used to evaluate this intersection?				Yes

HOUR	SR 26	Hannaford E	Warrant		No Rts	Warrant	
			Met?			Met?	
6	900	18	Minor Fail		5	Minor Fail	
7	1217	196	Met		57	Met	
8	857	47	Minor Fail		29	Minor Fail	
9	811	69	Met		42	Minor Fail	
10	760	73	Met		34	Minor Fail	
11	910	89	Met		47	Minor Fail	
12	756	96	Met		48	Minor Fail	
13	770	111	Met		43	Minor Fail	
14	912	126	Met		46	Minor Fail	
15	1209	148	Met		63	Met	
16	1360	182	Met		79	Met	
17	1290	153	Met		66	Met	

Warrant 1B N/A With Right Turns Included on Minor
Warrant 1B Not Met With Right Turns Excluded on Minor

Warrant 1C: Combination of Warrants 1A and 1B

With this warrant, signal consideration is occasionally justified where no single warrant is satisfied but where Warrants 1A and 1B are satisfied to the extent of 80 percent of the stated values. Remedial measures which cause less delay and inconvenience to traffic should be tried prior to installation of a signal when this warrant is used.

Required Volumes Page 4c-3,4 of MUTCD based on # of Lanes							Warrant 1A	Warrant 1B	Adjusted Warrant 1A	Adjusted Warrant 1B
							350	525	280	420
							105	53	84	42
HOUR	SR 26	Iannafor	Er	Warrant 1A		No Rts	Right Turns Excluded		Warrant 1A	Warrant 1B
				Met?	Met?		Met?	Met?		

6	900	18	Minor Fail	Minor Fail	5	Minor Fail	Minor Fail
7	1217	196	Met	Met	57	Minor Fail	Met
8	857	47	Minor Fail	Met	29	Minor Fail	Minor Fail
9	811	69	Minor Fail	Met	42	Minor Fail	Minor Fail
10	760	73	Minor Fail	Met	34	Minor Fail	Minor Fail
11	910	89	Met	Met	47	Minor Fail	Met
12	756	96	Met	Met	48	Minor Fail	Met
13	770	111	Met	Met	43	Minor Fail	Met
14	912	126	Met	Met	46	Minor Fail	Met
15	1209	148	Met	Met	63	Minor Fail	Met
16	1360	182	Met	Met	79	Minor Fail	Met
17	1290	153	Met	Met	66	Minor Fail	Met

Warrant 1C
Warrant 1C

N/A With Right Turns Included on Minor
Not Met With Right Turns Excluded on Minor

Warrant 2: Four-Hour Vehicular Volume

This warrant is satisfied when each of any four hours of an average day the plotted points representing the vehicles per hour of the major street (total of both approaches) and the corresponding vehicles per hour on the higher volume minor street (one direction only) all fall above the curve based on Graph Data for the existing combination of approach lanes.

HOUR	SR 26	Hannaford Ent	No Rts	(fill out manually)	
				With Rts	No Rts
6	900	18	5	no	no
7	1217	196	57	yes	no
8	857	47	29	no	no
9	811	69	42	no	no
10	760	73	34	yes	no
11	910	89	47	yes	no
12	756	96	48	yes	no
13	770	111	43	no	no
14	912	126	46	yes	no
15	1209	148	63	yes	no
16	1360	182	79	yes	no
17	1290	153	66	yes	no
				8	0

Warrant 2:
Warrant 2:

N/A With Right Turns Included on Minor
Not Met With Right Turns Excluded on Minor

Warrant 3A: Peak Hour Delay

This warrant is intended for application when the traffic conditions are such that for one hour of the day minor street traffic suffers undue delay in entering or crossing the major street. The peak hour delay warrant is satisfied when the conditions given below exist for one hour (any four consecutive 15-minute periods) of an average weekday.

The peak hour delay warrant is met when:

1. The total delay experienced by the traffic on one minor street approach (one direction only) controlled by a STOP sign equals or exceeds 4.0 vehicle-hours for a one lane approach and 5 vehicle hours for a two-lane approach, and

Volume	63 left	10 thru	117 right	Minor Approach Delay
Delay	139 sec/veh	136.8 sec/veh	35.4 sec/veh	3.96 veh-hrs
2. The volume on the same minor street approach (one direction only) equals or exceeds 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes, and
3. Total entering volume serviced during the hour equals or exceeds 800 vehicles per hour for intersections with four (or more) approaches or 650 vehicles per hour with three approaches.

Warrant 3A:

Marginal

Warrant 3B: Peak Hour Volume

This warrant is satisfied when the plotted point representing the vehicles per hour on the major street (total both directions) and the corresponding vehicles per hour of the higher volume minor street approach (one direction only) for one hour (any four consecutive 15-minute periods) of an average day falls above the appropriate curve in the figure based on Graph Data for existing combination of approach lanes.

Peak Hour Volume (FROM PEAK HOUR SHEET INBOUND EACH LEG)

	Combined	Highest	Highest		
HOUR	SR 26	Hannaford Ent	No Rts		
3:45 PM	1378	203	98		
6:45 AM	1394	55	41		
Adjusted for Average Day (PM)	1254	185	89	(PLOT THESE POINTS)	Need min of 75 vehicles
Adjusted for Average Day (AM)	1269	50	37		
Warrant 3B:	N/A	With Right Turns Included on Minor		(fill out manually)	Yes
Warrant 3B:	Met	With Right Turns Excluded on Minor		(fill out manually)	No

Warrant 4A: Four-Hour Pedestrian Volume

This warrant deals with the number of pedestrians and the number of gaps in the traffic stream available to them at an intersection or mid-block location. This warrant is satisfied when each of any four hours of an average day the plotted points representing the vehicles per hour of the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of both directions) all fall above the curve based on Graph Data from Figures 4C-5 and 4C-6 of the 2009 MUTCD.

Is the 70% option used to evaluate this location? Yes

(fill out manually)

HOUR	Pedestrian Movements Across Major St	Major St Approach Volume	Warrant Met?
6	0	900	Yes
7	0	1217	No
8	0	857	No
9	1	811	No
10	0	760	No
11	3	910	No
12	1	756	No
13	1	770	No
14	15	912	No
15	2	1209	No
16	3	1360	No
17	3	1290	No
	29		1

Warrant 4A: Not Met

Warrant 4B: Peak-Hour Pedestrian Volume

This warrant deals with the number of pedestrians and the number of gaps in the traffic stream available to them at an intersection or mid-block location. This warrant is satisfied when for a peak hour of an average day the plotted point representing the vehicles per hour of the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of both directions) all fall above the curve based on Graph Data from Figures 4C-7 and 4C-8 of the 2009 MUTCD.

Is the 70% option used to evaluate this location?

Yes

Peak-Hour Volumes	
vehicles	pedestrians
1360	15

Warrant 4B: Not Met (fill out manually)

Warrant 5 School Crossing

This warrant deals with the adequacy of gaps in the vehicular traffic stream and the number and size of groups of school children at an established school crossing.

Warrant 5 N/A

Warrant 6 Coordinated Signal System

This warrant deals with the maintenance of proper platooning of vehicles between signals for interconnected signal systems.

The Progressive Movement warrant is satisfied when:

1. On a one-way street or a street which has predominantly unidirectional traffic, the adjacent signals are so far apart that they do not provide the necessary degree of vehicle platooning and speed control, or
2. On a two-way street, adjacent signals do not provide the necessary degree of platooning and speed control and the proposed and adjacent signals could constitute a progressive signal system.

The installation of a signal according to this warrant should not be considered where the resultant signal spacing would be less than 1000 feet.

Warrant 6 Not Met (fill out manually)

Warrant 7 Crash Experience - Correctable by Signallization

This warrant deals with an intersection that is experiencing an abnormal crash pattern. For the warrant to be met, 5 or more crashes that can be corrected by traffic signal control have occurred in a 12 month period; and other less restrictive measures to correct the problem have been tried and have failed to reduce accidents; and there exist a volume of vehicular and pedestrian traffic not less than 80 percent of the requirements specified either in the Minimum Vehicular Volume warrant (1A), the Interruption of Continuous Traffic warrant (1B), or the Pedestrian Volume warrant (4); and the signal installation will not seriously disrupt progressive traffic flow.

Other alternatives failed? Yes

	correctable	total
Crashes correctable	2010	0
by Signal Installation	2011	0
	2012	0

Five or more correctable crashes in one year? No

Required Volumes Page 4c-3,4 of MUTCD based on # of Lanes

Warrant 1A	Warrant 1B	Adjusted Warrant 1A	Adjusted Warrant 1B
350	525	280	420
105	53	84	42

Does the intersection qualify with > 5 crashes in 12 months? Yes

HOUR	SR 26	Hannaford Ent	Warrant 1A Met?	Warrant 1B Met?	No Rts	Warrant 1A Met?	Warrant 1B Met?
6	900	18	Minor Fail	Minor Fail	5	Minor Fail	Minor Fail
7	1217	196	Met	Met	57	Minor Fail	Met
8	857	47	Minor Fail	Met	29	Minor Fail	Minor Fail
9	811	69	Minor Fail	Met	42	Minor Fail	Minor Fail
10	760	73	Minor Fail	Met	34	Minor Fail	Minor Fail
11	910	89	Met	Met	47	Minor Fail	Met
12	756	96	Met	Met	48	Minor Fail	Met
13	770	111	Met	Met	43	Minor Fail	Met
14	912	126	Met	Met	46	Minor Fail	Met
15	1209	148	Met	Met	63	Minor Fail	Met
16	1360	182	Met	Met	79	Minor Fail	Met
17	1290	153	Met	Met	66	Minor Fail	Met

Warrant 7
Warrant 7

N/A With Right Turns Included on Minor
Not Met With Right Turns Excluded on Minor

Warrant 8 Roadway Network

This warrant deals with the common intersection of two or more major routes: (1) has a total existing, or immediately projected, entering volume of at least 1000 vehicles during the peak hour of a typical weekday and has five year projected traffic volumes, based on an engineering study, which meet one or more of Warrants 1, 2, and 3 during an average weekday; or (2) has a total existing or immediately projected entering volume of at least 1000 vehicles for each of any five hours of a Saturday and/or Sunday.

Is the total peak hour entering volume for an average day > than 1000 vph? No
Is the volume projected to meet Warrants 1, 2, or 3 in the next five years? No
Is the roadway designated as major route or integral part of the transportation system? No

Warrant 8 Not Met

Warrant 9 Railroad Crossing N/A

Signal Warrant Analysis

Completed in Accordance with the Manual on Uniform Traffic Control Devices

Gray

SR 26 @ N Raymond Rd

September 26, 2012 data

Minor Street

Description =

N Raymond Rd

Direction 1 =

East

Comment: Right turns discounted.

Direction 2 =

West

LEFT THRU RIGHT			TOTAL	NO RTS	LEFT THRU RIGHT			TOTAL	NO RTS	
HOUR	Raymond	From East			HOUR	From West				
6	0	0	0	0	6	64	0	291	355	64
7	0	0	0	0	7	123	0	323	446	123
8	0	0	0	0	8	63	0	237	300	63
9	0	0	0	0	9	37	0	124	161	37
10	0	0	0	0	10	30	0	104	134	30
11	0	0	0	0	11	42	0	111	153	42
12	0	0	0	0	12	31		103	134	31
13	0	0	0	0	13	35	0	110	145	35
14	0	0	0	0	14	40	0	112	152	40
15	0	0	0	0	15	38	0	122	160	38
16	0	0	0	0	16	44	0	132	176	44
17	0	0	0	0	17	56	0	134	190	56

Major Street

Description =

SR 26

Direction 1 =

North

Direction 2 =

South

HOUR	LEFT THRU RIGHT			TOTAL	NO RTS	HOUR	LEFT THRU RIGHT			TOTAL	NO RTS
	SR 26	From	North				SR 26	From	South		
6	0	487	36	523	487	6	30	127	0	157	157
7	0	400	39	439	400	7	53	214	0	267	267
8	0	369	28	397	369	8	68	203	0	271	271
9	0	296	26	322	296	9	64	228	0	292	292
10	0	237	25	262	237	10	82	244	0	326	326
11	0	273	23	296	273	11	95	267	0	362	362
12	0	257	28	285	257	12	113	289	0	402	402
13	0	270	31	301	270	13	104	278	0	382	382
14	0	292	48	340	292	14	123	339	0	462	462
15	0	312	68	380	312	15	191	407	0	598	598
16	0	332	69	401	332	16	300	555	0	855	855
17	0	300	100	400	300	17	408	582	0	990	990

SR 26				N Raymond Rd				Not including right turns			
HOUR	South	North	TOTAL	HOUR	East	West	Highest	East	West	Highest	
6	157	523	680	6	0	355	355	0	64	64	
7	267	439	706	7	0	446	446	0	123	123	
8	271	397	668	8	0	300	300	0	63	63	
9	292	322	614	9	0	161	161	0	37	37	
10	326	262	588	10	0	134	134	0	30	30	
11	362	296	658	11	0	153	153	0	42	42	
12	402	285	687	12	0	134	134	0	31	31	
13	382	301	683	13	0	145	145	0	35	35	
14	462	340	802	14	0	152	152	0	40	40	
15	598	380	978	15	0	160	160	0	38	38	
16	855	401	1256	16	0	176	176	0	44	44	
17	990	400	1390	17	0	190	190	0	56	56	

Critical Volumes Adjusted for the Average Day

Lowest shared/right-turn capacity on highest minor approach (5-6 pm):

85% of capacity:

85% of capacity exceeds most hourly right turn volumes. Discount

Group Factor =

0.91

HOUR	SR 26	Highest Minor Leg	Rights Discounted
6	619	323	182
7	642	406	112
8	608	273	57
9	559	147	34
10	535	122	27
11	599	139	38

HOUR	SR 26	Highest Minor	Rights Discounted
12	625	122	28
13	622	132	32
14	730	138	36
15	890	146	35
16	1143	160	40
17	1265	173	51

Warrant 1:

Eight-Hour Vehicular Volume

This warrant is satisfied when, for each of any 8 hours of an average day, the traffic volumes given under Conditions A, B, or C exist. These conditions are:

Condition A: Minimum Vehicular Volume (Warrant 1A)

Condition B: Interruption of Continuous Traffic (Warrant 1B)

Condition C: Combination of Conditions A and B (Warrant 1C)

If any one of the conditions is satisfied, Warrant 1 is met.

Warrant 1A: Minimum Vehicular Volume

This warrant is satisfied when, for each of any 8 hours of an average day, the traffic volumes given in the table below exist on the major street (total of both directions) and on the higher-volume minor street approach to the intersection.

Required Volumes Page 4c-3 of MUTCD based on # of Lanes

SR 26	500	Adjusted 350
N Raymond	150	105

Is the 70% option used to evaluate this intersection?

Yes

HOUR	SR 26	Raymond f	Warrant Met?	Discount Rts	Warrant Met?
6	619	323	Met	182	Met
7	642	406	Met	112	Met
8	608	273	Met	57	Minor Fail
9	559	147	Met	34	Minor Fail
10	535	122	Met	27	Minor Fail
11	599	139	Met	38	Minor Fail
12	625	122	Met	28	Minor Fail
13	622	132	Met	32	Minor Fail
14	730	138	Met	36	Minor Fail
15	890	146	Met	35	Minor Fail
16	1143	160	Met	40	Minor Fail
17	1265	173	Met	51	Minor Fail

Warrant 1A **Met** With Right Turns Included on Minor
Warrant 1A **Not Met** With Right Turns Discounted on Minor

Warrant 1B: Interruption of Continuous Traffic

This warrant is satisfied when, for each of any 8 hours of an average day, the traffic volumes given in the table below exist on the major street (total both directions) and on the higher volume minor street approach to the intersection, and the signal installation will not seriously disrupt progressive traffic flow.

Required Volumes Page 4c-4 of MUTCD based on # of Lanes

SR 26	750	Adjusted 525
N Raymond	75	53

Is the 70% option used to evaluate this intersection?

Yes

HOUR	SR 26	Raymond f	Warrant Met?	Discount Rights	Warrant Met?
6	619	323	Met	182	Met
7	642	406	Met	112	Met
8	608	273	Met	57	Met
9	559	147	Met	34	Minor Fail
10	535	122	Met	27	Minor Fail
11	599	139	Met	38	Minor Fail
12	625	122	Met	28	Minor Fail
13	622	132	Met	32	Minor Fail
14	730	138	Met	36	Minor Fail
15	890	146	Met	35	Minor Fail
16	1143	160	Met	40	Minor Fail
17	1265	173	Met	51	Minor Fail

Warrant 1B **Met** With Right Turns Included on Minor
Warrant 1B **Not Met** With Right Turns Discounted on Minor

Warrant 1C: Combination of Warrants 1A and 1B

With this warrant, signal consideration is occasionally justified where no single warrant is satisfied but where Warrants 1A and 1B are satisfied to the extent of 80 percent of the stated values. Remedial measures which cause less delay and inconvenience to traffic should be tried prior to installation of a signal when this warrant is used.

Required Volumes Page 4c-3,4 of MUTCD based on # of Lanes	Warrant 1A	Warrant 1B	Adjusted Warrant 1A	Adjusted Warrant 1B
	350	525	280	420
	105	53	84	42

HOUR	SR 26	I Raymond R	Warrant 1A Met?	Warrant 1B Met?	No Rts	Warrant 1A Met?	Warrant 1B Met?
6	619	323	Met	Met	182	Met	Met
7	642	406	Met	Met	112	Met	Met
8	608	273	Met	Met	57	Minor Fail	Met
9	559	147	Met	Met	34	Minor Fail	Minor Fail
10	535	122	Met	Met	27	Minor Fail	Minor Fail
11	599	139	Met	Met	38	Minor Fail	Minor Fail
12	625	122	Met	Met	28	Minor Fail	Minor Fail
13	622	132	Met	Met	32	Minor Fail	Minor Fail
14	730	138	Met	Met	36	Minor Fail	Minor Fail
15	890	146	Met	Met	35	Minor Fail	Minor Fail
16	1143	160	Met	Met	40	Minor Fail	Minor Fail
17	1265	173	Met	Met	51	Minor Fail	Met

Warrant 1C **Met** With Right Turns Included on Minor
Warrant 1C **Not Met** With Right Turns Discounted on Minor

Warrant 2: Four-Hour Vehicular Volume

This warrant is satisfied when each of any four hours of an average day the plotted points representing the vehicles per hour of the major street (total of both approaches) and the corresponding vehicles per hour on the higher volume minor street (one direction only) all fall above the curve shown in the following graph for the existing combination of approach lanes.

HOUR	SR 26	Raymond I	Discount Rts
6	619	323	182
7	642	406	112
8	608	273	57
9	559	147	34
10	535	122	27
11	599	139	38
12	625	122	28
13	622	132	32
14	730	138	36
15	890	146	35
16	1143	160	40
17	1265	173	51

Warrant 2: **Met** With Right Turns Included on Minor
Warrant 2: **Not Met** With Right Turns Discounted on Minor

Warrant 3A: Peak Hour Delay

This warrant is intended for application when the traffic conditions are such that for one hour of the day minor street traffic suffers undue delay in entering or crossing the major street. The peak hour delay warrant is satisfied when the conditions given below exist for one hour (any four consecutive 15-minute periods) of an average weekday.

The peak hour delay warrant is met when:

1. The total delay experienced by the traffic on one minor street approach (one direction only) controlled by a STOP sign equals or exceeds 4.0 vehicle-hours for a one lane approach and 5 vehicle hours for a two-lane approach, and

Volume	56 left	0 thru	134 right	Minor Approach Delay
Delay	52.6 sec/veh	0.0 sec/veh	9.6 sec/veh	1.18 veh-hrs
2. The volume on the same minor street approach (one direction only) equals or exceeds 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes, and
3. Total entering volume serviced during the hour equals or exceeds 800 vehicles per hour for intersections with four (or more) approaches or 650 vehicles per hour with three approaches.

Warrant 3A: N/A With Right Turns Included on Minor
Warrant 3A: Not Met With Right Turns Discounted on Minor

Warrant 3B: Peak Hour Volume

This warrant is satisfied when the plotted point representing the vehicles per hour on the major street (total both directions) and the corresponding vehicles per hour of the higher volume minor street approach (one direction only) for one hour (any four consecutive 15-minute periods) of an average day falls above the appropriate curve in the figure below for existing combination of approach lanes.

Peak Hour Volume (FROM PEAK HOUR SHEET INBOUND EACH LEG)

Begin HOUR	Combined SR 26	Highest N Raymond Rd	Highest Discount Rts	
6:00 AM	641		182	Major Leg > 600, Minor Leg > 178
5:00 PM	1265		51	Need min of 75 vehicles
Adjusted for Average Day	583	0	166	(PLOT THESE POINTS)

Warrant 3B: Met With Right Turns Included on Minor
Warrant 3B: Met With Right Turns Discounted on Minor

Signal Warrant Analysis

Completed in Accordance with the Manual on Uniform Traffic Control Devices

Gray SR 26 @ Weymouth Rd Data Collected: 9/20/2013

Minor Street	Description =	Weymouth Rd	Direction 1 =	East
			Direction 2 =	West
HOURLY	LEFT	THRU	RIGHT	TOTAL
	Weymouth Rd	From	East	
6	39	0	1	40
7	44	0	2	46
8	42	0	4	46
9	37	0	6	43
10	30	0	7	37
11	54	0	6	60
12	36	0	2	38
13	36	0	1	37
14	44	0	1	45
15	68	0	4	72
16	81	0	4	85
17	113	0	4	117
Total	624	0	42	
Major Street	Description =	SR 26	Direction 1 =	North
			Direction 2 =	South
HOURLY	LEFT	THRU	RIGHT	TOTAL
	SR 26	From	South	
6	1	401	0	402
7	9	377	0	386
8	4	316	0	320
9	4	284	0	288
10	6	260	0	266
11	6	295	0	301
12	3	275	0	278
13	3	260	0	263
14	9	329	0	338
15	6	358	0	364
16	3	357	0	360
17	4	291	0	295
Total	58	3803	0	

SR 26	Weymouth Rd 0	Not including right turns
HOURLY	HOURLY	HOURLY
South	East	East
6	192	39
7	336	44
8	310	42
9	315	37
10	348	30
11	389	54
12	290	36
13	312	36
14	373	44
15	491	68
16	591	81
17	606	113
Total	5901	606

For signal warrant purposes, turning movement counts are adjusted by using the Group Factor to estimate turning movement for the average day.

Group Factor = 0.91

MaineDOT typically discounts right turns from the minor street volumes for signal warrant analysis up to an amount equal to 85% of the unsignalized peak-hour capacity of the lane from which right-turn movements are made.

Lowest shared/right-turn capacity on highest minor approach (4:30-5:30 pm): 263
85% of capacity: 224

85% of capacity exceeds hourly right turn volumes. Exclude right turns.

Critical Volumes Adjusted for the Average Day

Right turns discounted? Yes

HOURLY	SR 26	Highest Minor Leg	No Rts
6	541	36	35
7	657	42	40
8	573	42	38
9	549	39	34
10	559	34	27
11	628	55	49

Warrant 1: Eight-Hour Vehicular Volume

This warrant is satisfied when, for each of any 8 hours of an average day, the traffic volumes given under Conditions A, B, or C exist. These conditions are: Conditions A, B, or C exist. These conditions are:

Condition A: Minimum Vehicular Volume (Warrant 1A)
 Condition B: Interruption of Continuous Traffic (Warrant 1B)
 Condition C: Combination of Conditions A and B (Warrant 1C)

If any one of the conditions is satisfied, Warrant 1 is met.

Warrant 1A: Minimum Vehicular Volume

This warrant is satisfied when, for each of any 8 hours of an average day, the traffic volumes given in the table below exist on the major street (total of both directions) and on the higher-volume minor street approach to the intersection.

Required Volumes Page 4c-3 of MUTCD based on # of Lanes				Adjusted
	SR 26		500	350
	Weymouth Rd		150	105
Is the 70% option used to evaluate this intersection?				Yes

HOUR	SR 26	Weymouth I	Warrant Met?	No Rts	Warrant Met?
6	541	36	Minor Fail	35	Minor Fail
7	657	42	Minor Fail	40	Minor Fail
8	573	42	Minor Fail	38	Minor Fail
9	549	39	Minor Fail	34	Minor Fail
10	559	34	Minor Fail	27	Minor Fail
11	628	55	Minor Fail	49	Minor Fail
12	517	35	Minor Fail	33	Minor Fail
13	523	34	Minor Fail	33	Minor Fail
14	647	41	Minor Fail	40	Minor Fail
15	778	66	Minor Fail	62	Minor Fail
16	865	77	Minor Fail	74	Minor Fail
17	820	106	Met	103	Minor Fail

Warrant 1A N/A With Right Turns Included on Minor
 Warrant 1A Not Met With Right Turns Excluded on Minor

Warrant 1B: Interruption of Continuous Traffic

This warrant is satisfied when, for each of any 8 hours of an average day, the traffic volumes given in the table below exist on the major street (total both directions) and on the higher volume minor street approach to the intersection, and the signal installation will not seriously disrupt progressive traffic flow.

Required Volumes Page 4c-4 of MUTCD based on # of Lanes				Adjusted
	SR 26		750	525
	Weymouth I		75	53
Is the 70% option used to evaluate this intersection?				Yes

HOUR	SR 26	Weymouth I	Warrant Met?	No Rts	Warrant Met?
6	541	36	Minor Fail	35	Minor Fail
7	657	42	Minor Fail	40	Minor Fail
8	573	42	Minor Fail	38	Minor Fail
9	549	39	Minor Fail	34	Minor Fail
10	559	34	Minor Fail	27	Minor Fail
11	628	55	Met	49	Minor Fail
12	517	35	Major Fail	33	Major Fail
13	523	34	Major Fail	33	Major Fail
14	647	41	Minor Fail	40	Minor Fail
15	778	66	Met	62	Met
16	865	77	Met	74	Met
17	820	106	Met	103	Met

Warrant 1B N/A With Right Turns Included on Minor
 Warrant 1B Not Met With Right Turns Excluded on Minor

Warrant 1C: Combination of Warrants 1A and 1B

With this warrant, signal consideration is occasionally justified where no single warrant is satisfied but where Warrants 1A and 1B are satisfied to the extent of 80 percent of the stated values. Remedial measures which cause less delay and inconvenience to traffic should be tried prior to installation of a signal when this warrant is used.

Required Volumes Page 4c-3,4 of MUTCD based on # of Lanes				Adjusted	Adjusted
	Warrant 1A	Warrant 1B	Warrant 1A	Warrant 1B	

350	525	280	420
105	53	84	42

HOUR	SR 26	Weymouth R	Warrant 1A		No Rts	Right Turns Excluded	
			Met?	Met?		Warrant 1A	Warrant 1B
6	541	36	Minor Fail	Minor Fail	35	Minor Fail	Minor Fail
7	657	42	Minor Fail	Minor Fail	40	Minor Fail	Minor Fail
8	573	42	Minor Fail	Minor Fail	38	Minor Fail	Minor Fail
9	549	39	Minor Fail	Minor Fail	34	Minor Fail	Minor Fail
10	559	34	Minor Fail	Minor Fail	27	Minor Fail	Minor Fail
11	628	55	Minor Fail	Met	49	Minor Fail	Met
12	517	35	Minor Fail	Minor Fail	33	Minor Fail	Minor Fail
13	523	34	Minor Fail	Minor Fail	33	Minor Fail	Minor Fail
14	647	41	Minor Fail	Minor Fail	40	Minor Fail	Minor Fail
15	778	66	Minor Fail	Met	62	Minor Fail	Met
16	865	77	Minor Fail	Met	74	Minor Fail	Met
17	820	106	Met	Met	103	Met	Met

Warrant 1C
Warrant 1C

N/A With Right Turns Included on Minor
Not Met With Right Turns Excluded on Minor

Warrant 2: Four-Hour Vehicular Volume

This warrant is satisfied when each of any four hours of an average day the plotted points representing the vehicles per hour of the major street (total of both approaches) and the corresponding vehicles per hour on the higher volume minor street (one direction only) all fall above the curve based on Graph Data for the existing combination of approach lanes.

HOUR	SR 26	Weymouth Rd	No Rts	(fill out manually)	
				With Rts	No Rts
6	541	36	35	no	no
7	657	42	40	no	no
8	573	42	38	no	no
9	549	39	34	no	no
10	559	34	27	no	no
11	628	55	49	no	no
12	517	35	33	no	no
13	523	34	33	no	no
14	647	41	40	no	no
15	778	66	62	no	no
16	865	77	74	no	no
17	820	106	103	no	no
				0	0

Warrant 2:
Warrant 2:

N/A With Right Turns Included on Minor
Not Met With Right Turns Excluded on Minor

Warrant 3A: Peak Hour Delay

This warrant is intended for application when the traffic conditions are such that for one hour of the day minor street traffic suffers undue delay in entering or crossing the major street. The peak hour delay warrant is satisfied when the conditions given below exist for one hour (any four consecutive 15-minute periods) of an average weekday.

The peak hour delay warrant is met when:

1. The total delay experienced by the traffic on one minor street approach (one direction only) controlled by a STOP sign equals or exceeds 4.0 vehicle-hours for a one lane approach and 5 vehicle hours for a two-lane approach, and
Volume 108 left 0 thru 1 right Minor Approach Delay
Delay 25.6 sec/veh 0.0 sec/veh 8.6 sec/veh 0.77 veh-hrs No
2. The volume on the same minor street approach (one direction only) equals or exceeds 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes, and No
3. Total entering volume serviced during the hour equals or exceeds 800 vehicles per hour for intersections with four (or more) approaches or 650 vehicles per hour with three approaches. Yes

Warrant 3A:

Not Met

Warrant 3B:

Peak Hour Volume

This warrant is satisfied when the plotted point representing the vehicles per hour on the major street (total both directions) and the corresponding vehicles per hour of the higher volume minor street approach (one direction only) for one hour (any four consecutive 15-minute periods) of an average day falls above the appropriate curve in the figure based on Graph Data for existing combination of approach lanes.

Peak Hour Volume (FROM PEAK HOUR SHEET INBOUND EACH LEG)

HOUR	Combined SR 26	Highest Weymouth Rd	Highest No Rts		
4:30 PM	978	109	108	Need min of 75 vehicles	
6:45 AM	747	54	54		
Adjusted for Average Day (PM)	890	99	98	(PLOT THESE POINTS)	Yes
Adjusted for Average Day (AM)	680	49	49	(PLOT THESE POINTS)	No
Warrant 3B:	N/A	With Right Turns Included on Minor			(fill out manually)
Warrant 3B:	Met	With Right Turns Excluded on Minor			(fill out manually)

Warrant 4A: Four-Hour Pedestrian Volume

This warrant deals with the number of pedestrians and the number of gaps in the traffic stream available to them at an intersection or mid-block location. This warrant is satisfied when each of any four hours of an average day the plotted points representing the vehicles per hour of the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of both directions) all fall above the curve based on Graph Data from Figures 4C-5 and 4C-6 of the 2009 MUTCD.

Is the 70% option used to evaluate this location? Yes

(fill out manually)

HOUR	Pedestrian Movements Across Major St	Major St Approach Volume	Warrant Met?
6	0	541	No
7	1	657	No
8	1	573	No
9	2	549	No
10	0	559	No
11	0	628	No
12	0	517	No
13	0	523	No
14	2	647	No
15	0	778	No
16	0	865	No
17	0	820	No
	6		0

Warrant 4A: Not Met

Warrant 4B: Peak-Hour Pedestrian Volume

This warrant deals with the number of pedestrians and the number of gaps in the traffic stream available to them at an intersection or mid-block location. This warrant is satisfied when for a peak hour of an average day the plotted point representing the vehicles per hour of the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of both directions) all fall above the curve based on Graph Data from Figures 4C-7 and 4C-8 of the 2009 MUTCD.

Is the 70% option used to evaluate this location? Yes

Peak-Hour Volumes

vehicles 865 pedestrians 2

Warrant 4B: Not Met (fill out manually)

Warrant 5 School Crossing

This warrant deals with the adequacy of gaps in the vehicular traffic stream and the number and size of groups of school children at an established school crossing.

Warrant 5 N/A

Warrant 6 Coordinated Signal System

This warrant deals with the maintenance of proper platooning of vehicles between signals for interconnected signal systems.

The Progressive Movement warrant is satisfied when:

1. On a one-way street or a street which has predominantly unidirectional traffic, the adjacent signals are so far apart that they do not provide the necessary degree of vehicle platooning and speed control, or

2. On a two-way street, adjacent signals do not provide the necessary degree of platooning and speed control and the proposed and adjacent signals could constitute a progressive signal system.

The installation of a signal according to this warrant should not be considered where the resultant signal spacing would be less than 1000 feet.

Warrant 6 **Not Met** (fill out manually)

Warrant 7 Crash Experience - Correctable by Signalization

This warrant deals with an intersection that is experiencing an abnormal crash pattern. For the warrant to be met, 5 or more crashes that can be corrected by traffic signal control have occurred in a 12 month period; and other less restrictive measures to correct the problem have been tried and have failed to reduce accidents; and there exist a volume of vehicular and pedestrian traffic not less than 80 percent of the requirements specified either in the Minimum Vehicular Volume warrant (1A), the Interruption of Continuous Traffic warrant (1B), or the Pedestrian Volume warrant (4); and the signal installation will not seriously disrupt progressive traffic flow.

Other alternatives failed? No

	correctable	total	
Crashes correctable	2010	0	1
by Signal Installation	2011	1	2
	2012	0	0

Five or more correctable crashes in one year? No

Required Volumes Page 4c-3,4 of MUTCD based on # of Lanes

Warrant 1A	Warrant 1B	Adjusted Warrant 1A	Adjusted Warrant 1B
350	525	350	525
105	53	105	53

Does the intersection qualify with > 5 crashes in 12 months? No

HOUR	SR 26	Weymouth Rd	Warrant 1A Met?	Warrant 1B Met?	No Rts	Warrant 1A Met?	Warrant 1B Met?
6	541	36	Minor Fail	Minor Fail	35	Minor Fail	Minor Fail
7	657	42	Minor Fail	Minor Fail	40	Minor Fail	Minor Fail
8	573	42	Minor Fail	Minor Fail	38	Minor Fail	Minor Fail
9	549	39	Minor Fail	Minor Fail	34	Minor Fail	Minor Fail
10	559	34	Minor Fail	Minor Fail	27	Minor Fail	Minor Fail
11	628	55	Minor Fail	Met	49	Minor Fail	Minor Fail
12	517	35	Minor Fail	Major Fail	33	Minor Fail	Major Fail
13	523	34	Minor Fail	Major Fail	33	Minor Fail	Major Fail
14	647	41	Minor Fail	Minor Fail	40	Minor Fail	Minor Fail
15	778	66	Minor Fail	Met	62	Minor Fail	Met
16	865	77	Minor Fail	Met	74	Minor Fail	Met
17	820	106	Met	Met	103	Minor Fail	Met

Warrant 7 **N/A** **With Right Turns Included on Minor**
Warrant 7 **Not Met** **With Right Turns Excluded on Minor**

Warrant 8 Roadway Network

This warrant deals with the common intersection of two or more major routes: (1) has a total existing, or immediately projected, entering volume of at least 1000 vehicles during the peak hour of a typical weekday and has five year projected traffic volumes, based on an engineering study, which meet one or more of Warrants 1, 2, and 3 during an average weekday; or (2) has a total existing or immediately projected entering volume of at least 1000 vehicles for each of any five hours of a Saturday and/or Sunday.

Is the total peak hour entering volume for an average day > than 1000 vph?	No
Is the volume projected to meet Warrants 1, 2, or 3 in the next five years?	No
Is the roadway designated as major route or integral part of the transportation system?	No

Warrant 8 **Not Met**

Warrant 9 Railroad Crossing **N/A**

Summary **Gray** **SR 26 @ Weymouth Rd**
September 20, 2013 TM Counts Adjusted for Average Day

Right Turn Treatment
Discounted All Included

Warrant 1 Eight-Hour Vehicle Volume

Warrant 1A **Not Met** **N/A**

Warrant 1B	Not Met	N/A
Warrant 1C	Not Met	N/A
Warrant 2 Four-Hour Vehicle Volume	Not Met	N/A
Warrant 3 Peak Hour		
Warrant 3 A (delay) All three conditions need to be met.		Not Met
1. Delay on minor street	No	
2. Entering volume on minor street	No	
3. Entering volume for intersection	Yes	
Warrant 3 B (volume - a.m. or p.m.)	Met	N/A
Warrant 4 Pedestrian Volume		
Warrant 4A (four-hour)	Not Met	
Warrant 4B (peak-hour)	Not Met	
Warrant 5 School Crossing		N/A
Warrant 6 Coordinated Signal System	Not Met	
Warrant 7 Crash Experience	Not Met	N/A
Warrant 7 All Three Conditions need to be met		
1. Adequate trials of safety alternatives	No	
2. Five or more crashes in 1 yr correctable by signal	No	
3. 80% of Warrant 1 A or Warrant 1B or Warrant 4	No	
Warrant 8 Roadway Network - N/A		Not Met
1. 1000 or more entering volume at intersection	No	
2. Warrants 1, 2, or 3 in five years	No	
3. Major route / integral to transportation system	No	
Warrant 9 Intersection near a RR Xing - N/A		N/A