

Ref: 8587

January 29, 2021

Mr. Richard S. Novak, Chair
Zoning Board of Appeals
Town of Sherborn
19 Washington Street
Sherborn, MA 01770

Re: Response to Peer Review of Transportation Impact Assessments
The Pines – 41 North Main Street (Route 27)
Sherborn, Massachusetts

Dear Chair Novak and Members of the Zoning Board of Appeals:

Vanasse & Associates, Inc. (VAI) is providing responses to the comments that were raised in the January 11, 2021 *Peer Review of Transportation Impact Assessments* prepared by Professional Services Corporation, PC (PSC) in reference to their review of the October 2020 *Transportation Impact Assessment* (the “October 2020 TIA”) prepared by VAI in support of the proposed The Pines multifamily residential community to be located at 41 North Main Street (Route 27) in Sherborn, Massachusetts (hereafter referred to as the “Project”). Listed below are each of the comments pertaining to the October 2020 TIA identified in the subject letter followed by our response on behalf of the Applicant. Responses to the remaining comments will be provided by others under separate cover.

Comment 1: *Provide a copy of the 2016 ATR count on North Main Street north of Eliot St.*

Response: The requested information is attached.

Comment 2: *The 2020 Existing Traffic Volumes were adjusted upward from the volumes counted in 2016. Document the 2016 vs 2020 volume adjustment which are greater than 1.5% per year.*

Response: As documented in the October 2020 TIA, the traffic volume data that was collected as a part of the automatic traffic recorder (ATR) count on Route 27 in 2020 (attached) were compared to the December 2016 traffic volumes that were collected at the same location. The April and December traffic volumes were both adjusted to average-month conditions and the 2016 traffic volumes were expanded to 2020 by applying a background traffic growth rate of 1.5 percent per year (documented in the October 2020 TIA) in order to allow for a comparison of the data. Based on this pre and post COVID-19 traffic count data comparison, the 2020 traffic volume data that was collected as a part of the October 2020 TIA was adjusted upward by 60 percent in order to account for the reduced traffic volumes resulting from the phased “Reopening Massachusetts” plan and the absence of school related traffic. The COVID-19 adjustment factor calculations and supporting data are attached.

The 2016 turning movement counts were not subject to the 60 percent adjustment as they were not impacted by the restrictions associated with the COVID-19 pandemic, and were adjusted to 2020 traffic volume conditions by applying the 1.5 percent per year compounded annual background traffic growth rate (after being seasonally adjusted to average-month conditions).

Comment 3: *Provide copies of any 2020 TMCs.*

Response: Manual Turning Movement counts (TMCs) were not conducted in 2020.

Comment 4: *Verify that the 2020 ATR count of 17,375 (adjusted?) on North Main Street north of Eliot St. is 234% of the actual counted 2020 volume.*

Response: In order to verify the average weekday traffic volumes on North Main Street (Route 27) that was presented in the October 2020 TIA, traffic volume data was obtained from a 2019 automatic traffic recorder count that was conducted by MassDOT on Route 27 south of Elliot Street. The subject data was collected on June 3rd (Monday) and 4th (Tuesday) in 2019 and reported an average daily traffic volume of 24,462 vehicles and 25,041 vehicles, respectively, over a 24-hour period. The December 2016 ATR that was conducted on Route 27 and was the basis of the average weekday traffic volume that was presented in the October 2020 TIA indicated weekday traffic volumes of approximately 15,155 vehicles per day on a weekday which, when seasonally adjusted and expanded to 2020 by applying the 1.5 percent per year compounded annual background traffic and the seasonal adjustment, would represent approximately 17,375 vehicles per day.

Comment 5: *The TIA should be revised to discuss delays for left turns exiting from Powderhouse Lane due to blockage of the intersection by vehicle queues from the Eliot Street (Rte. 16)/North Main Street (Rte. 27) Intersection.*

Response: During the weekday morning peak-hour, both the average and 95th percentile vehicle queues on the Route 27 northbound approach to Route 16 will extend past Powderhouse Lane, which is located approximately 315 feet south of Route 16; the predicted vehicle queues do not block the roadway during the weekday evening peak-hour. Table 9R (attached), which reflects the requested revisions to the traffic volume projections for the Apple Hill Estates project, indicates that all movements exiting from Powderhouse Lane to Route 27 currently operate at or over capacity (i.e., level-of-service (LOS) "E" or "F") independent of the Project due to delays resulting from the volume of traffic on Route 27. During those distinct periods within the weekday morning peak-hour when vehicle queues from the Route 27/Route 16 intersection block Powderhouse Lane, motorist delays and the resulting residual vehicle queuing may be longer than predicted by the analysis model; however, the queue can be contained along Powderhouse Lane without impeding the movement of vehicles, pedestrians and bicyclists along Route 27.



In conjunction with the Project, the Applicant has committed to design and implement an optimal traffic signal timing and phasing plan for the intersection subject to receipt of all necessary rights, permits and approvals, with the goal of reducing motorist delays and vehicle queuing.

As identified above, the traffic operations analysis for the Project has been revised to reflect the use of higher trips rates for the Apple Hills Estates project, which was included as a background development and included in both the 2027 No-Build and 2027 Build condition analyses. The revised 2027 No-Build and 2027 Build condition traffic volume networks are attached along with the associated traffic operations analyses, the results of which are summarized in Tables 9R and 10R. A review of operating conditions at the study area intersections in relation to those that were reported in Tables 9 and 10 of the October 2020 TIA indicates that the relative impact of the Project in relation to 2027 No-Build conditions did not change, with the most notable difference being that all movements from the Hunting Lane approach to Route 27 were shown to operate at LOS E during the weekday morning peak-hour under both 2027 No-Build and 2027 Build conditions.

Comment 6: *The TIA should also estimate the duration queues long enough to block the intersection.*

Response: Vehicle queues from the Route 27/Route 16 intersection are predicted to extend past Powderhouse Lane during specific periods within the weekday morning peak period (7-9 AM) and are primarily related to traffic associated with the student drop-off period at the Pine Hill Elementary School. Outside of this distinct period, vehicle queues do not extend past Powderhouse Lane.

Comment 7: *The TIA should also address potential blockage of southbound vehicles by vehicles trapped in the intersection.*

Response: Vehicles exiting Powderhouse Lane destined to the south on Route 27 and southbound vehicles on Route 27 destined to Powderhouse Lane will not be blocked by vehicle queues from the Route 27/Route 16 intersection. When a left-turning vehicle is exiting Powderhouse Lane and the vehicle queue on the Route 27 northbound approach to Route 16 extends past Powderhouse Lane, right-turning vehicles destined to Route 27 south of Powderhouse Lane will be delayed.

Comment 8: *Revise the TIA to provide a Construction Phase TDM Plan.*

Response: A draft Construction Management Plan (CMP) is attached and will be refined in consultation with the Police Department and the Department of Public Works as the Site Plans are advanced.

Comment 9: *Provide an order of magnitude estimate of heavy vehicle trips required to complete earthwork shown on the current site plan grading.*

Response: Response to be provided by others under separate cover.



Mr. Richard S. Novak, Chair
Zoning Board of Appeals
Town of Sherborn
January 29, 2021
Page 4 of 4

Comment 10: *Develop alternative parking layouts for 5 and 31 Powderhouse Lane and seek the cooperation of the impacted property owners in modifying the parking layouts. Upon review, the Zoning Board of Appeals will determine, the Applicant's specific responsibilities to implement these parking changes.*

Response: Response to be provided by others under separate cover.

Comment 11: *Provide a swept vehicle path plan showing Fire Department apparatus access including the ability of the hammerhead turning areas to accommodate turns at the terminus or each parking field. The plan should also show maneuvers by vehicles servicing the dumpster.*

Response: Response to be provided by others under separate cover.

Comment 12: *Adjust the site plan as required to accommodate designated Fire Lanes in compliance with Fire Department requirements.*

Response: Response to be provided by others under separate cover.

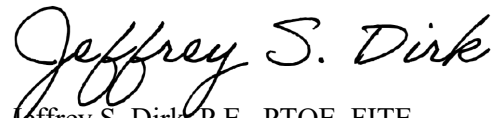
Comment 13: *Obtain a letter of concurrence from the Fire Department.*

Response: Response to be provided by others under separate cover.

We trust that this information is responsive to the comments that were raised in the January 11, 2021 *Peer Review of Transportation Impact Assessments* prepared by PSC pertaining to the October 2020 TIA. If you should have any questions or would like to discuss our responses in more detail, please feel free to contact me.

Sincerely,

VANASSE & ASSOCIATES, INC.



Jeffrey S. Dirk, P.E., PTOE, FITE
Managing partner

Professional Engineer in CT, MA, ME, NH, RI and VA

JSD/jsd

Attachments

cc: G. Barsky - Barsky Estate Realty Trust
L. Sweet – LDS Consulting Group (via email)
File



ATTACHMENTS

AUTOMATIC TRAFFIC RECORDER COUNT DATA
COVID-19 ADJUSTMENT DATA
TRAFFIC OPERATIONS ANALYSIS SUMMARY TABLES
TRAFFIC VOLUME NETWORKS
CAPACITY ANALYSIS WORKSHEETS
DRAFT CONSTRUCTION MANAGEMENT PLAN



AUTOMATIC TRAFFIC RECORDER COUNT DATA





PRECISION
D A T A
INDUSTRIES, LLC

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

North Main Street (Route 27)
north of Eliot Street (Route 16)
City, State: Sherborn, MA
Client: Green International/ J. Sobel
NB

165403 A Class
Site Code: TBA

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Total
12/06/1														
6	0	8	1	0	0	0	0	1	0	0	0	0	0	10
01:00	0	5	2	1	0	1	0	0	0	0	0	0	0	9
02:00	0	6	0	0	0	0	0	0	0	0	0	0	0	6
03:00	0	14	3	0	1	0	0	0	0	0	0	0	0	18
04:00	0	31	6	0	4	0	0	0	0	0	0	0	0	41
05:00	0	156	35	0	3	1	0	0	1	0	0	0	0	196
06:00	2	453	104	2	19	3	2	2	0	1	0	0	0	588
07:00	4	573	100	8	18	7	7	3	2	0	0	0	0	722
08:00	2	708	92	10	19	4	4	3	5	0	0	0	0	847
09:00	1	515	89	0	18	6	7	0	1	0	0	0	0	637
10:00	3	445	96	3	14	8	2	2	3	0	0	0	0	576
11:00	1	369	69	11	15	3	5	2	1	0	0	0	0	476
12 PM	4	375	63	1	13	6	2	2	1	0	0	0	0	467
13:00	2	282	65	1	10	4	4	3	2	0	0	0	0	373
14:00	5	317	61	1	12	10	2	0	3	0	0	0	0	411
15:00	8	295	54	5	4	4	0	0	0	0	0	0	0	370
16:00	7	287	46	0	9	3	0	0	1	0	0	0	0	353
17:00	3	320	38	1	5	2	0	0	1	0	0	0	0	370
18:00	6	264	29	2	2	2	0	0	1	0	0	0	0	306
19:00	2	169	22	0	4	0	0	0	0	0	0	0	0	197
20:00	0	135	17	1	1	1	0	0	0	0	0	0	0	155
21:00	0	118	9	0	1	0	0	0	0	0	0	0	0	128
22:00	0	67	3	0	2	0	0	0	0	0	0	0	0	72
23:00	0	33	3	0	0	0	0	0	0	0	0	0	0	36
Percent	0.7%	80.7%	13.7%	0.6%	2.4%	0.9%	0.5%	0.2%	0.3%	0.0%	0.0%	0.0%	0.0%	
AM Peak	07:00	08:00	06:00	11:00	06:00	10:00	07:00	07:00	08:00	06:00				08:00
Vol.	4	708	104	11	19	8	7	3	5	1				847
PM Peak	15:00	12:00	13:00	15:00	12:00	14:00	13:00	13:00	14:00					12:00
Vol.	8	375	65	5	13	10	4	3	3					467



PRECISION
D A T A
INDUSTRIES, LLC

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

North Main Street (Route 27)
north of Eliot Street (Route 16)
City, State: Sherborn, MA
Client: Green International/ J. Sobel
NB

165403 A Class
Site Code: TBA

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Total
12/07/1														
6	0	15	3	0	0	0	0	0	0	0	0	0	0	18
01:00	0	8	1	1	0	0	0	0	0	0	0	0	0	10
02:00	0	6	1	0	0	0	0	0	0	0	0	0	0	7
03:00	0	9	0	0	0	0	0	0	0	0	0	0	0	9
04:00	0	28	6	0	3	0	0	0	0	0	0	0	0	37
05:00	1	155	38	0	3	1	0	0	0	0	0	0	0	198
06:00	0	489	112	2	20	3	0	1	1	0	0	0	0	628
07:00	4	578	112	2	17	5	3	2	2	0	0	0	0	725
08:00	3	692	98	14	12	10	3	3	0	0	0	0	0	835
09:00	1	585	69	1	10	10	3	1	1	0	0	0	0	681
10:00	2	415	71	1	20	3	1	0	1	0	0	0	0	514
11:00	3	443	72	2	15	4	2	2	2	0	0	1	0	546
12 PM	3	394	65	2	17	8	6	1	0	0	0	0	0	496
13:00	7	315	63	2	16	7	7	5	0	1	0	0	0	423
14:00	2	311	54	4	11	6	0	0	1	0	0	0	0	389
15:00	5	321	46	1	10	5	0	1	0	0	0	0	0	389
16:00	8	310	50	2	8	4	0	1	2	0	0	0	0	385
17:00	9	327	45	1	3	1	0	0	0	0	0	0	0	386
18:00	7	261	28	0	3	0	0	0	0	0	0	0	0	299
19:00	0	196	23	1	2	0	0	0	0	0	0	0	0	222
20:00	1	125	15	0	0	0	0	0	0	0	0	0	0	141
21:00	0	140	15	1	3	1	0	0	0	0	0	0	0	160
22:00	0	73	6	0	2	0	0	0	1	0	0	0	0	82
23:00	0	21	5	0	2	0	0	0	0	0	0	0	0	28
Percent	0.7%	81.7%	13.1%	0.5%	2.3%	0.9%	0.3%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	
AM Peak	07:00	08:00	06:00	08:00	06:00	08:00	07:00	08:00	07:00			11:00		08:00
Vol.	4	692	112	14	20	10	3	3	2			1		835
PM Peak	17:00	12:00	12:00	14:00	12:00	12:00	13:00	13:00	16:00	13:00				12:00
Vol.	9	394	65	4	17	8	7	5	2	1				496



PRECISION
D A T A
INDUSTRIES, LLC

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

North Main Street (Route 27)
north of Eliot Street (Route 16)
City, State: Sherborn, MA
Client: Green International/ J. Sobel
SB

165403 A Class
Site Code: TBA

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Total
12/06/1														
6	0	26	3	0	1	0	0	1	0	0	0	0	0	31
01:00	0	4	4	0	1	0	0	0	0	0	0	0	0	9
02:00	0	1	0	0	0	0	0	0	0	0	0	0	0	1
03:00	0	0	0	0	0	1	0	0	0	0	0	0	0	1
04:00	0	11	3	0	0	0	0	0	0	0	0	0	0	14
05:00	0	41	14	0	0	0	0	0	1	0	0	0	0	56
06:00	2	155	44	1	7	5	0	0	3	0	0	0	0	217
07:00	4	375	42	0	5	4	1	0	1	1	0	0	0	433
08:00	1	321	41	1	8	11	0	1	1	0	0	0	0	385
09:00	4	259	44	1	9	10	0	1	3	0	0	0	0	331
10:00	1	236	53	3	8	11	1	1	0	0	0	0	0	314
11:00	3	293	48	1	11	9	0	1	2	0	0	0	0	368
12 PM	0	359	45	2	6	4	0	0	2	0	0	0	0	418
13:00	3	431	69	5	7	4	0	1	2	0	0	0	0	522
14:00	8	506	66	2	16	3	1	1	2	0	0	0	0	605
15:00	10	563	70	2	7	9	0	2	1	0	0	0	0	664
16:00	11	612	56	0	7	6	2	1	0	0	0	0	0	695
17:00	14	611	44	1	1	2	1	0	0	0	0	0	0	674
18:00	5	567	30	2	1	2	0	1	0	0	0	0	0	608
19:00	0	399	19	0	1	0	0	0	0	0	0	0	0	419
20:00	0	303	20	2	0	0	0	0	0	0	0	0	0	325
21:00	0	245	15	0	2	0	0	1	0	0	0	0	0	263
22:00	0	126	9	1	1	0	0	0	0	0	0	0	0	137
23:00	0	67	5	0	0	0	0	0	0	0	0	0	0	72
Percent	0.9%	86.1%	9.8%	0.3%	1.3%	1.1%	0.1%	0.2%	0.2%	0.0%	0.0%	0.0%	0.0%	
AM Peak	07:00	07:00	10:00	10:00	11:00	08:00	07:00	00:00	06:00	07:00				07:00
Vol.	4	375	53	3	11	11	1	1	3	1				433
PM Peak	17:00	16:00	15:00	13:00	14:00	15:00	16:00	15:00	12:00					16:00
Vol.	14	612	70	5	16	9	2	2	2					695



PRECISION
D A T A
INDUSTRIES, LLC

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

North Main Street (Route 27)
north of Eliot Street (Route 16)
City, State: Sherborn, MA
Client: Green International/ J. Sobel
SB

165403 A Class
Site Code: TBA

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Total
12/07/1														
6	0	26	3	0	1	0	0	1	0	0	0	0	0	31
01:00	0	6	1	0	0	0	0	0	0	0	0	0	0	7
02:00	0	11	2	0	0	0	0	0	0	0	0	0	0	13
03:00	1	3	0	0	0	1	0	0	0	0	0	0	0	5
04:00	0	12	5	0	0	0	0	0	0	0	0	0	0	17
05:00	0	46	8	0	0	0	0	0	0	0	0	0	0	54
06:00	2	162	32	5	0	4	0	0	1	0	0	0	0	206
07:00	2	351	57	0	5	4	0	1	0	0	0	0	0	420
08:00	1	318	50	2	2	6	0	0	2	0	0	0	0	381
09:00	1	271	53	0	10	6	0	0	1	0	0	0	0	342
10:00	0	249	46	0	4	8	1	1	1	0	0	0	0	310
11:00	0	364	53	1	12	7	0	1	0	0	0	0	0	438
12 PM	1	396	55	1	9	6	0	1	2	0	0	0	0	471
13:00	1	418	55	0	7	13	0	2	1	0	0	0	0	497
14:00	2	526	64	1	12	14	2	1	2	0	0	0	0	624
15:00	6	631	84	0	2	5	0	0	0	0	0	0	0	728
16:00	9	598	48	0	3	4	1	0	0	0	0	0	0	663
17:00	12	600	50	0	1	2	1	0	0	0	0	0	0	666
18:00	8	597	37	0	2	2	0	0	0	0	0	0	0	646
19:00	2	375	28	0	1	0	0	0	0	0	0	0	0	406
20:00	1	349	7	0	0	0	0	0	0	0	0	0	0	357
21:00	1	264	19	0	0	0	0	0	0	0	0	0	0	284
22:00	0	115	7	0	0	0	0	0	0	0	0	0	0	122
23:00	0	72	8	0	0	0	0	0	0	0	0	0	0	80
Percent	0.6%	87.0%	9.9%	0.1%	0.9%	1.1%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	
AM Peak	06:00	11:00	07:00	06:00	11:00	10:00	10:00	00:00	08:00					11:00
Vol.	2	364	57	5	12	8	1	1	2					438
PM Peak	17:00	15:00	15:00	12:00	14:00	14:00	14:00	13:00	12:00					15:00
Vol.	12	631	84	1	12	14	2	2	2					728



PRECISION
D A T A
INDUSTRIES, LLC

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

North Main Street (Route 27)
north of Eliot Street (Route 16)
City, State: Sherborn, MA
Client: Green International/ J. Sobel
NB

165403 A Speed
Site Code: TBA

Start Time	1 14	15 19	20 24	25 29	30 34	35 39	40 44	45 49	50 54	55 59	60 64	65 69	70 9999	Total	85th % ile	Ave Speed
12/06/ 16	0	0	0	1	4	4	1	0	0	0	0	0	0	10	38	35
01:00	0	0	0	1	3	4	1	0	0	0	0	0	0	9	38	35
02:00	0	0	0	1	0	3	2	0	0	0	0	0	0	6	41	37
03:00	0	1	0	0	8	8	1	0	0	0	0	0	0	18	37	34
04:00	0	0	0	2	10	18	9	2	0	0	0	0	0	41	41	37
05:00	0	0	1	7	81	86	21	0	0	0	0	0	0	196	38	35
06:00	1	2	1	38	252	256	36	2	0	0	0	0	0	588	38	34
07:00	4	8	26	91	320	231	38	2	1	0	0	0	1	722	37	33
08:00	6	6	20	132	325	306	49	3	0	0	0	0	0	847	37	33
09:00	1	3	5	76	231	259	55	5	2	0	0	0	0	637	38	34
10:00	5	11	18	57	181	222	76	5	0	0	0	1	0	576	38	34
11:00	4	4	3	36	188	178	59	3	0	0	0	1	0	476	38	35
12 PM	5	8	6	22	157	225	43	1	0	0	0	0	0	467	38	34
13:00	5	7	18	34	106	158	38	6	1	0	0	0	0	373	38	34
14:00	10	4	29	90	132	117	28	1	0	0	0	0	0	411	37	32
15:00	8	11	57	88	128	63	14	1	0	0	0	0	0	370	35	30
16:00	10	18	60	87	137	38	3	0	0	0	0	0	0	353	33	28
17:00	11	22	80	102	121	32	1	1	0	0	0	0	0	370	33	27
18:00	13	7	42	60	117	60	7	0	0	0	0	0	0	306	35	29
19:00	4	6	4	26	77	62	18	0	0	0	0	0	0	197	38	33
20:00	2	3	1	10	53	70	14	2	0	0	0	0	0	155	38	34
21:00	3	6	1	4	48	54	11	0	1	0	0	0	0	128	38	34
22:00	0	0	1	4	17	41	8	1	0	0	0	0	0	72	38	36
23:00	0	1	1	1	5	18	10	0	0	0	0	0	0	36	41	36
Total	92	128	374	970	2701	2513	543	35	5	0	0	2	1	7364		
%	1.2%	1.7%	5.1%	13.2%	36.7%	34.1%	7.4%	0.5%	0.1%	0.0%	0.0%	0.0%	0.0%			
AM Peak	08:00	10:00	07:00	08:00	08:00	08:00	10:00	09:00	09:00			10:00	07:00	08:00		
Vol.	6	11	26	132	325	306	76	5	2			1	1	847		
PM Peak	18:00	17:00	17:00	17:00	12:00	12:00	12:00	13:00	13:00					12:00		
Vol.	13	22	80	102	157	225	43	6	1					467		

Stats

15th Percentile : 26 MPH
50th Percentile : 32 MPH
85th Percentile : 37 MPH
95th Percentile : 40 MPH

Mean Speed(Average) : 33 MPH
10 MPH Pace Speed : 30-39 MPH
Number in Pace : 5214
Percent in Pace : 70.8%
Number of Vehicles > 35 MPH : 2596
Percent of Vehicles > 35 MPH : 35.3%



PRECISION
D A T A
INDUSTRIES, LLC

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

North Main Street (Route 27)
north of Eliot Street (Route 16)
City, State: Sherborn, MA
Client: Green International/ J. Sobel
NB

165403 A Speed
Site Code: TBA

Start Time	1 14	15 19	20 24	25 29	30 34	35 39	40 44	45 49	50 54	55 59	60 64	65 69	70 9999	Total	85th % ile	Ave Speed
12/07/16	0	0	0	1	3	9	4	1	0	0	0	0	0	18	41	37
01:00	0	0	0	2	2	4	1	1	0	0	0	0	0	10	41	36
02:00	0	0	0	0	1	2	3	1	0	0	0	0	0	7	43	40
03:00	0	0	0	0	4	3	1	1	0	0	0	0	0	9	42	36
04:00	0	0	0	0	5	13	16	3	0	0	0	0	0	37	43	39
05:00	0	0	1	4	50	101	39	1	2	0	0	0	0	198	40	37
06:00	0	4	6	72	231	264	48	3	0	0	0	0	0	628	38	34
07:00	6	8	31	89	321	232	35	3	0	0	0	0	0	725	37	33
08:00	2	8	25	102	330	310	53	4	0	0	0	0	1	835	37	33
09:00	1	4	13	55	201	313	90	4	0	0	0	0	0	681	38	35
10:00	3	13	6	25	187	223	50	7	0	0	0	0	0	514	38	34
11:00	7	7	6	56	211	195	57	5	1	0	0	0	1	546	38	34
12 PM	6	8	21	56	230	148	25	1	1	0	0	0	0	496	37	33
13:00	3	1	11	46	181	147	33	1	0	0	0	0	0	423	37	34
14:00	8	5	22	55	167	101	28	2	1	0	0	0	0	389	37	32
15:00	10	7	45	76	159	78	14	0	0	0	0	0	0	389	36	30
16:00	15	12	79	113	132	32	2	0	0	0	0	0	0	385	33	28
17:00	9	7	88	123	134	22	3	0	0	0	0	0	0	386	32	28
18:00	7	2	39	55	123	66	7	0	0	0	0	0	0	299	36	30
19:00	1	1	1	21	99	85	13	1	0	0	0	0	0	222	37	34
20:00	0	2	2	6	61	60	9	1	0	0	0	0	0	141	38	34
21:00	0	4	1	10	52	76	16	1	0	0	0	0	0	160	38	35
22:00	0	2	1	4	28	29	17	1	0	0	0	0	0	82	40	35
23:00	0	0	0	1	9	14	4	0	0	0	0	0	0	28	38	36
Total	78	95	398	972	2921	2527	568	42	5	0	0	0	2	7608		
%	1.0%	1.2%	5.2%	12.8%	38.4%	33.2%	7.5%	0.6%	0.1%	0.0%	0.0%	0.0%	0.0%			
AM Peak	11:00	10:00	07:00	08:00	08:00	09:00	09:00	10:00	05:00				08:00	08:00		
Vol.	7	13	31	102	330	313	90	7	2				1	835		
PM Peak	16:00	16:00	17:00	17:00	12:00	12:00	13:00	14:00	12:00					12:00		
Vol.	15	12	88	123	230	148	33	2	1					496		

Stats

15th Percentile :	26 MPH
50th Percentile :	32 MPH
85th Percentile :	37 MPH
95th Percentile :	41 MPH
Mean Speed(Average) :	33 MPH
10 MPH Pace Speed :	30-39 MPH
Number in Pace :	5448
Percent in Pace :	71.6%
Number of Vehicles > 35 MPH :	2639
Percent of Vehicles > 35 MPH :	34.7%



PRECISION
D A T A
INDUSTRIES, LLC

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

North Main Street (Route 27)
north of Eliot Street (Route 16)
City, State: Sherborn, MA
Client: Green International/ J. Sobel
SB

165403 A Speed
Site Code: TBA

Start Time	1 14	15 19	20 24	25 29	30 34	35 39	40 44	45 49	50 54	55 59	60 64	65 69	70 9999	Total	85th % ile	Ave Speed
12/06/ 16	0	0	0	7	13	8	3	0	0	0	0	0	0	31	37	33
01:00	0	0	0	3	5	1	0	0	0	0	0	0	0	9	33	31
02:00	0	0	0	0	1	0	0	0	0	0	0	0	0	1	33	32
03:00	0	0	0	1	0	0	0	0	0	0	0	0	0	1	28	27
04:00	1	1	0	2	7	3	0	0	0	0	0	0	0	14	35	30
05:00	0	0	3	17	26	8	2	0	0	0	0	0	0	56	35	31
06:00	0	2	10	65	109	30	1	0	0	0	0	0	0	217	33	31
07:00	24	19	43	132	185	28	2	0	0	0	0	0	0	433	33	28
08:00	12	27	45	114	132	50	5	0	0	0	0	0	0	385	33	28
09:00	10	8	28	85	142	54	4	0	0	0	0	0	0	331	34	30
10:00	6	4	9	77	161	56	1	0	0	0	0	0	0	314	34	31
11:00	2	5	11	85	187	76	2	0	0	0	0	0	0	368	35	31
12 PM	2	9	20	88	211	82	6	0	0	0	0	0	0	418	35	31
13:00	6	13	41	167	219	74	2	0	0	0	0	0	0	522	33	30
14:00	56	54	104	191	168	29	3	0	0	0	0	0	0	605	32	25
15:00	274	150	161	51	28	0	0	0	0	0	0	0	0	664	23	16
16:00	329	176	182	8	0	0	0	0	0	0	0	0	0	695	21	14
17:00	308	187	170	9	0	0	0	0	0	0	0	0	0	674	21	14
18:00	159	107	159	93	76	13	1	0	0	0	0	0	0	608	28	20
19:00	2	13	29	154	196	24	1	0	0	0	0	0	0	419	33	29
20:00	0	2	9	114	167	33	0	0	0	0	0	0	0	325	33	30
21:00	0	1	2	60	156	42	2	0	0	0	0	0	0	263	34	32
22:00	0	0	3	37	78	19	0	0	0	0	0	0	0	137	33	31
23:00	0	4	2	9	25	28	4	0	0	0	0	0	0	72	37	33
Total	1191	782	1031	1569	2292	658	39	0	0	0	0	0	0	7562		
%	15.7%	10.3%	13.6%	20.7%	30.3%	8.7%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	07:00	08:00	08:00	07:00	11:00	11:00	08:00							07:00		
Vol.	24	27	45	132	187	76	5							433		
PM Peak	16:00	17:00	16:00	14:00	13:00	12:00	12:00							16:00		
Vol.	329	187	182	191	219	82	6							695		

Stats

15th Percentile :	13 MPH
50th Percentile :	26 MPH
85th Percentile :	33 MPH
95th Percentile :	36 MPH
Mean Speed(Average) :	25 MPH
10 MPH Pace Speed :	25-34 MPH
Number in Pace :	3861
Percent in Pace :	51.1%
Number of Vehicles > 35 MPH :	565
Percent of Vehicles > 35 MPH :	7.5%



PRECISION
D A T A
INDUSTRIES, LLC

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

North Main Street (Route 27)
north of Eliot Street (Route 16)
City, State: Sherborn, MA
Client: Green International/ J. Sobel
SB

165403 A Speed
Site Code: TBA

Start Time	1 14	15 19	20 24	25 29	30 34	35 39	40 44	45 49	50 54	55 59	60 64	65 69	70 9999	Total	85th % ile	Ave Speed
12/07/																
16	0	0	1	11	13	4	2	0	0	0	0	0	0	31	35	31
01:00	0	0	0	4	3	0	0	0	0	0	0	0	0	7	32	29
02:00	0	0	0	3	7	2	0	1	0	0	0	0	0	13	36	33
03:00	0	0	0	4	0	1	0	0	0	0	0	0	0	5	35	29
04:00	0	1	1	5	4	5	1	0	0	0	0	0	0	17	37	31
05:00	0	1	3	16	25	8	1	0	0	0	0	0	0	54	34	31
06:00	1	3	14	62	99	27	0	0	0	0	0	0	0	206	33	30
07:00	49	7	26	138	180	20	0	0	0	0	0	0	0	420	32	27
08:00	2	9	31	141	159	36	3	0	0	0	0	0	0	381	33	29
09:00	6	6	21	118	148	42	1	0	0	0	0	0	0	342	33	30
10:00	1	5	21	85	157	41	0	0	0	0	0	0	0	310	33	30
11:00	4	17	43	124	202	47	1	0	0	0	0	0	0	438	33	29
12 PM	4	9	52	163	209	33	1	0	0	0	0	0	0	471	33	29
13:00	10	23	69	166	186	42	1	0	0	0	0	0	0	497	33	28
14:00	15	41	94	246	208	20	0	0	0	0	0	0	0	624	32	27
15:00	198	189	207	99	32	3	0	0	0	0	0	0	0	728	25	18
16:00	261	175	211	14	2	0	0	0	0	0	0	0	0	663	22	15
17:00	288	196	163	18	1	0	0	0	0	0	0	0	0	666	21	14
18:00	193	115	122	108	93	15	0	0	0	0	0	0	0	646	29	19
19:00	0	1	20	171	199	15	0	0	0	0	0	0	0	406	32	30
20:00	0	1	32	139	156	29	0	0	0	0	0	0	0	357	33	30
21:00	0	1	7	85	162	29	0	0	0	0	0	0	0	284	33	31
22:00	0	0	2	35	70	13	2	0	0	0	0	0	0	122	33	31
23:00	0	0	2	18	38	20	2	0	0	0	0	0	0	80	36	32
Total	1032	800	1142	1973	2353	452	15	1	0	0	0	0	0	7768		
%	13.3%	10.3%	14.7%	25.4%	30.3%	5.8%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	07:00	11:00	11:00	08:00	11:00	11:00	08:00	02:00						11:00		
Vol.	49	17	43	141	202	47	3	1						438		
PM Peak	17:00	17:00	16:00	14:00	12:00	13:00	22:00							15:00		
Vol.	288	196	211	246	209	42	2							728		

Stats

15th Percentile :	14 MPH
50th Percentile :	26 MPH
85th Percentile :	32 MPH
95th Percentile :	34 MPH
Mean Speed(Average) :	25 MPH
10 MPH Pace Speed :	25-34 MPH
Number in Pace :	4326
Percent in Pace :	55.7%
Number of Vehicles > 35 MPH :	378
Percent of Vehicles > 35 MPH :	4.9%



PRECISION
D A T A
INDUSTRIES, LLC

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

North Main Street (Route 27)
north of Eliot Street (Route 16)
City, State: Sherborn, MA
Client: Green International/ J. Sobel

165403 A Volume
Site Code: TBA

Start	NB		SB		Combin		ed		12/6/201	
Time	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	6	Tue
12:00	5	130	12	83	17	213				
12:15	2	113	7	115	9	228				
12:30	2	114	7	115	9	229				
12:45	1	110	5	105	6	215	885			
01:00	1	90	3	122	4	212				
01:15	2	84	3	152	5	236				
01:30	2	105	1	129	3	234				
01:45	4	94	2	119	6	213	895			
02:00	3	94	0	131	3	225				
02:15	2	103	1	159	3	262				
02:30	1	106	0	146	1	252				
02:45	0	108	0	169	0	277	1016			
03:00	2	95	0	175	2	270				
03:15	6	98	1	164	7	262				
03:30	7	89	0	151	7	240				
03:45	3	88	0	174	3	262	1034			
04:00	4	89	2	182	6	271				
04:15	7	84	4	182	11	266				
04:30	16	107	4	167	20	274				
04:45	14	73	4	164	18	237	1048			
05:00	27	92	11	169	38	261				
05:15	37	104	10	167	47	271				
05:30	53	98	17	172	70	270				
05:45	79	76	18	166	97	242	1044			
06:00	106	77	20	176	126	253				
06:15	125	86	59	151	184	237				
06:30	171	65	65	152	236	217				
06:45	186	78	73	129	259	207	914			
07:00	201	56	78	124	279	180				
07:15	167	57	123	110	290	167				
07:30	152	47	116	91	268	138				
07:45	202	37	116	94	318	131	616			
08:00	208	42	101	76	309	118				
08:15	189	40	106	87	295	127				
08:30	238	41	110	86	348	127				
08:45	212	32	68	76	280	108	480			
09:00	203	33	76	70	279	103				
09:15	139	41	92	77	231	118				
09:30	106	28	83	51	189	79				
09:45	189	26	80	65	269	91	391			
10:00	165	20	82	50	247	70				
10:15	134	26	69	39	203	65				
10:30	148	20	78	21	226	41				
10:45	129	6	85	27	214	33	209			
11:00	121	10	80	27	201	37				
11:15	115	7	90	24	205	31				
11:30	127	11	110	8	237	19				
11:45	113	8	88	13	201	21	108			
Total	4126	3238	2160	5402	6286	8640				
Percent	65.6%	37.5%	34.4%	62.5%						
Day Total		7364		7562		14926				
Peak	08:00	-	12:00	-	07:15	-	03:45	-	03:45	-
Vol.	847	-	467	-	456	-	705	-	1073	-
P.H.F.	0.890	-	0.898	-	0.927	-	0.968	-	0.968	-



PRECISION
D A T A
INDUSTRIES, LLC

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

North Main Street (Route 27)
north of Eliot Street (Route 16)
City, State: Sherborn, MA
Client: Green International/ J. Sobel

165403 A Volume
Site Code: TBA

Start	NB				SB				Combin ed		12/7/201 6 Wed			
Time	A.M.		P.M.		A.M.		P.M.		A.M.		P.M.			
12:00	3		125		12		112		15		237			
12:15	3		140		8		117		11		257			
12:30	6		110		3		120		9		230			
12:45	6	18	121	496	8	31	122	471	14	49	243	967		
01:00	2		89		2		126		4		215			
01:15	1		99		5		125		6		224			
01:30	2		122		0		121		2		243			
01:45	5	10	113	423	0	7	125	497	5	17	238	920		
02:00	2		103		4		155		6		258			
02:15	2		86		4		164		6		250			
02:30	2		104		4		144		6		248			
02:45	1	7	96	389	1	13	161	624	2	20	257	1013		
03:00	3		112		2		182		5		294			
03:15	1		102		0		189		1		291			
03:30	2		99		1		165		3		264			
03:45	3	9	76	389	2	5	192	728	5	14	268	1117		
04:00	5		98		0		176		5		274			
04:15	6		102		5		166		11		268			
04:30	11		84		7		156		18		240			
04:45	15	37	101	385	5	17	165	663	20	54	266	1048		
05:00	16		84		8		172		24		256			
05:15	28		106		14		156		42		262			
05:30	71		104		17		166		88		270			
05:45	83	198	92	386	15	54	172	666	98	252	264	1052		
06:00	109		75		35		170		144		245			
06:15	141		69		39		172		180		241			
06:30	187		85		54		172		241		257			
06:45	191	628	70	299	78	206	132	646	269	834	202	945		
07:00	198		71		83		100		281		171			
07:15	131		44		114		109		245		153			
07:30	202		56		100		105		302		161			
07:45	194	725	51	222	123	420	92	406	317	1145	143	628		
08:00	207		32		90		97		297		129			
08:15	214		35		105		80		319		115			
08:30	201		34		83		103		284		137			
08:45	213	835	40	141	103	381	77	357	316	1216	117	498		
09:00	194		44		79		72		273		116			
09:15	178		35		94		85		272		120			
09:30	175		57		78		67		253		124			
09:45	134	681	24	160	91	342	60	284	225	1023	84	444		
10:00	129		22		71		44		200		66			
10:15	128		20		69		36		197		56			
10:30	134		23		79		17		213		40			
10:45	123	514	17	82	91	310	25	122	214	824	42	204		
11:00	149		12		80		23		229		35			
11:15	116		4		122		30		238		34			
11:30	156		9		131		15		287		24			
11:45	125	546	3	28	105	438	12	80	230	984	15	108		
Total	4208		3400		2224		5544		6432		8944			
Percent	65.4%		38.0%		34.6%		62.0%							
Day Total			7608				7768				15376			
Peak	08:00	-	12:00	-	11:00	-	03:00	-	07:30	-	03:00	-	-	-
Vol.	835	-	496	-	438	-	728	-	1235	-	1117	-	-	-
P.H.F.	0.975		0.886		0.836		0.948		0.968		0.950			

COVID-19 ADJUSTMENT DATA



Green ATR

Tue 14,928 $\xrightarrow{\text{Avg}}$ 15,155

Raw
Dec 2016

Wed 15,376

Seasonal Adj. = 1.08

Annual growth = $(1.015)^4$
2016 $\rightarrow$ 2020

$\Rightarrow$ Adjusted to 2020 = $15,155 \times 1.08 \times 1.015^4 = 17,375$

Use 2016
data

Raw
April 2020

VAI

Wed 7,501

Seasonal Adj. = 1.03

Adjusted = $7,501 \times 1.03 = 7,730$

Peak:

2016

NB

SB

389

728

1,117

$\downarrow$

1,206

$\frac{735}{1206} = 0.64$ 60%

2020

NB

SB

408

298

705

$\downarrow$

735

60% lower

TRAFFIC OPERATIONS ANALYSIS SUMMARY TABLES



Table 9R
UNSIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Unsignalized Intersection/ Peak Hour/Movement	2020 Existing				2027 No-Build				2027 Build			
	Demand ^a	Delay ^b	LOS ^c	Queue ^d 95 th	Demand	Delay	LOS	Queue 95 th	Demand	Delay	LOS	Queue 95 th
<i>North Main Street (Route 27)/Hunting Lane:</i>												
<i>Weekday Morning Peak-Hour:</i>												
Hunting Lane EB LT/RT	29	23.3	C	1	50	36.9	E	2	50	37.8	E	2
Route 27 NB LT/TH	953	0.1	A	0	1,063	0.2	A	0	1,071	0.2	A	0
Route 27 SB RT/TH	485	0.0	A	0	547	0.0	A	0	550	0.0	A	0
<i>Weekday Evening Peak-Hour:</i>												
Hunting Lane EB LT/RT	31	24.2	C	1	44	34.0	D	1	45	34.5	D	1
Route 27 NB LT/TH	517	0.3	A	0	587	0.5	A	0	592	0.5	A	0
Route 27 SB RT/TH	786	0.0	A	0	884	0.0	A	0	891	0.0	A	0
<i>North Main Street (Route 27)/Powderhouse Lane:</i>												
<i>Weekday Morning Peak-Hour:</i>												
Powderhouse Lane EB LT/RT	12	46.6	E	1	13	>50.0	F	2	29	>50.0	F	6
Route 27 NB LT/TH	1,521	0.0	A	0	1,692	0.0	A	0	1,693	0.0	A	0
Route 27 SB RT/TH	626	0.0	A	0	704	0.0	A	0	708	0.0	A	0
<i>Weekday Evening Peak-Hour:</i>												
Powderhouse Lane EB LT/RT	41	>50.0	F	4	46	>50.0	F	6	57	>50.0	F	9
Route 27 NB LT/TH	758	0.1	A	0	847	0.1	A	0	851	0.2	A	0
Route 27 SB RT/TH	1,385	0.0	A	0	1,542	0.0	A	0	1,554	0.0	A	0

^aDemand in vehicles per hour.

^bAverage control delay per vehicle (in seconds).

^cLevel-of-Service.

^dQueue length in vehicles.

NB = northbound; SB = southbound; EB = eastbound; WB = westbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.

Table 10R
SIGNALIZED INTERSECTION LEVEL-OF-SERVICE SUMMARY

Signalized Intersection/Peak Hour	2020 Existing				2027 No-Build				2027 Build			
	V/C ^a	Delay ^b	LOS ^c	Queue ^d Avg/95 th	V/C	Delay	LOS	Queue Avg/95 th	V/C	Delay	LOS	Queue Avg/95 th
Route 27/Eliot Street (Route 16):												
<i>Weekday Morning:</i>												
Rte. 16 WB LT	0.58	26.1	C	98/139	0.62	27.1	C	111/110	0.62	27.1	C	111/110
Rte. 16 WB RT	0.04	21.1	C	1/12	0.06	20.9	C	2/12	0.06	20.9	C	2/12
Rte. 27 NB TH	0.82	14.3	B	288/970 ^f	0.92	23.7	C	410/754 ^f	0.93	24.6	C	419/761 ^f
Rte. 27 NB RT	0.35	0.8	A	0/27	0.39	0.8	A	0/0	0.39	0.8	A	0/0
Rte. 27 SB LT/TH	0.56	7.9	A	150/580 ^f	0.95	34.8	C	250/501 ^f	0.92	28.5	C	228/480 ^f
Overall	--	10.8	B	--	--	20.9	C	--	--	19.8	B	--
<i>Weekday Evening:</i>												
Rte. 16 WB LT	1.15	>80.0	F	356 ^e /587	1.41	>80.0	F	463 ^e /664 ^f	1.42	>80.0	F	468 ^e /669 ^f
Rte. 16 WB RT	0.00	16.4	B	0/5	0.02	19.8	B	2/13	0.02	19.8	B	2/13
Rte. 27 NB TH	0.55	9.7	A	140/213	0.57	9.7	A	166/251	0.58	9.7	A	169/255
Rte. 27 NB RT	0.15	0.6	A	0/0	0.17	0.5	A	0/0	0.17	0.5	A	0/0
Rte. 27 SB LT/TH	0.80	16.2	B	264/414	0.84	17.5	B	331/570 ^f	0.85	17.9	B	336/625 ^f
Overall	--	38.4	D	--	--	69.2	E	--	--	70.2	E	--

^aVolume-to-capacity ratio.

^bControl (signal) delay per vehicle in seconds.

^cLevel-of-Service.

^dQueue length in feet.

^eVolume exceeds capacity, queue is theoretically infinite. Queue shown is maximum after two cycles.

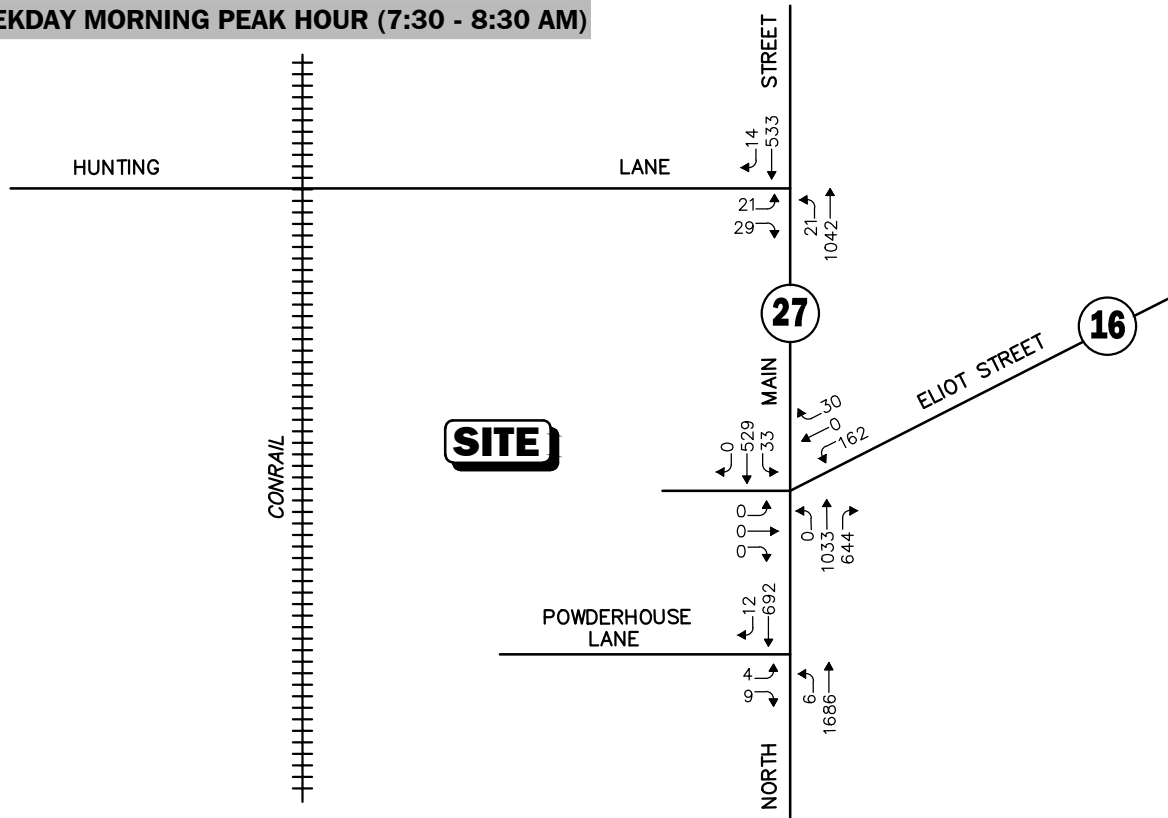
^f95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.

NB = northbound; SB = southbound; EB = eastbound; WB = westbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.

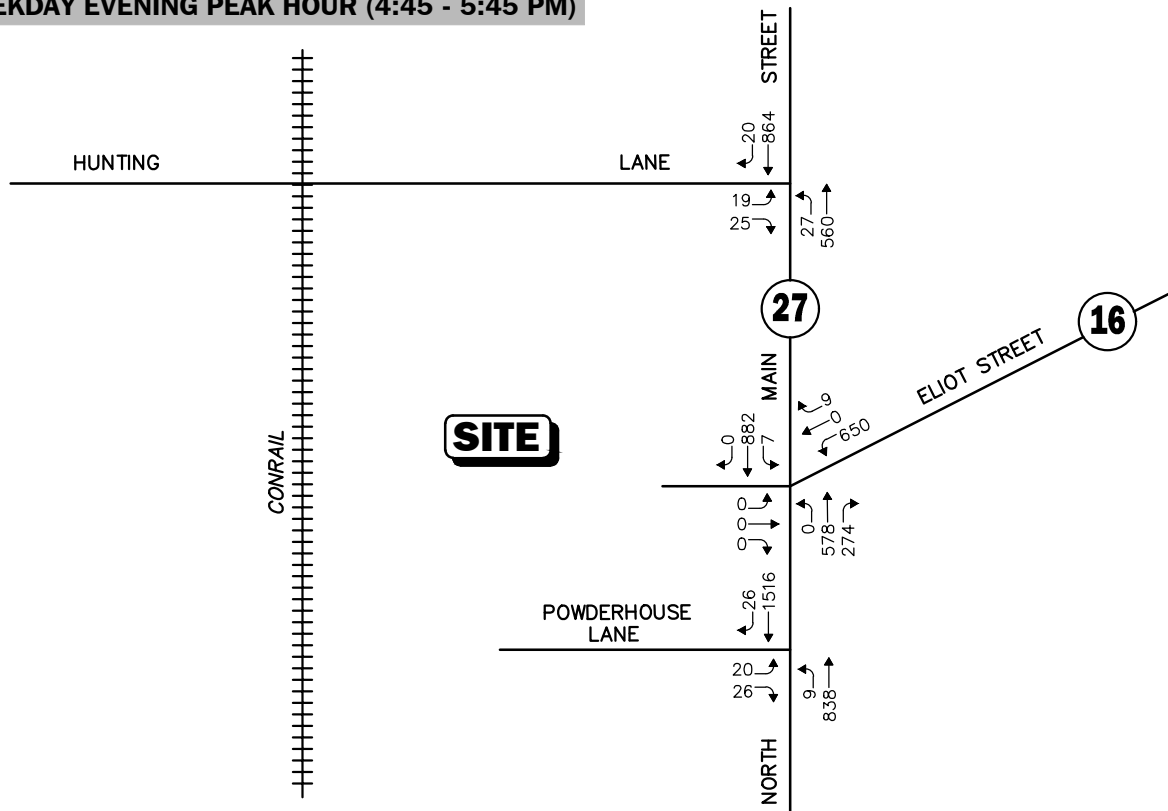
TRAFFIC VOLUME NETWORKS



WEEKDAY MORNING PEAK HOUR (7:30 - 8:30 AM)



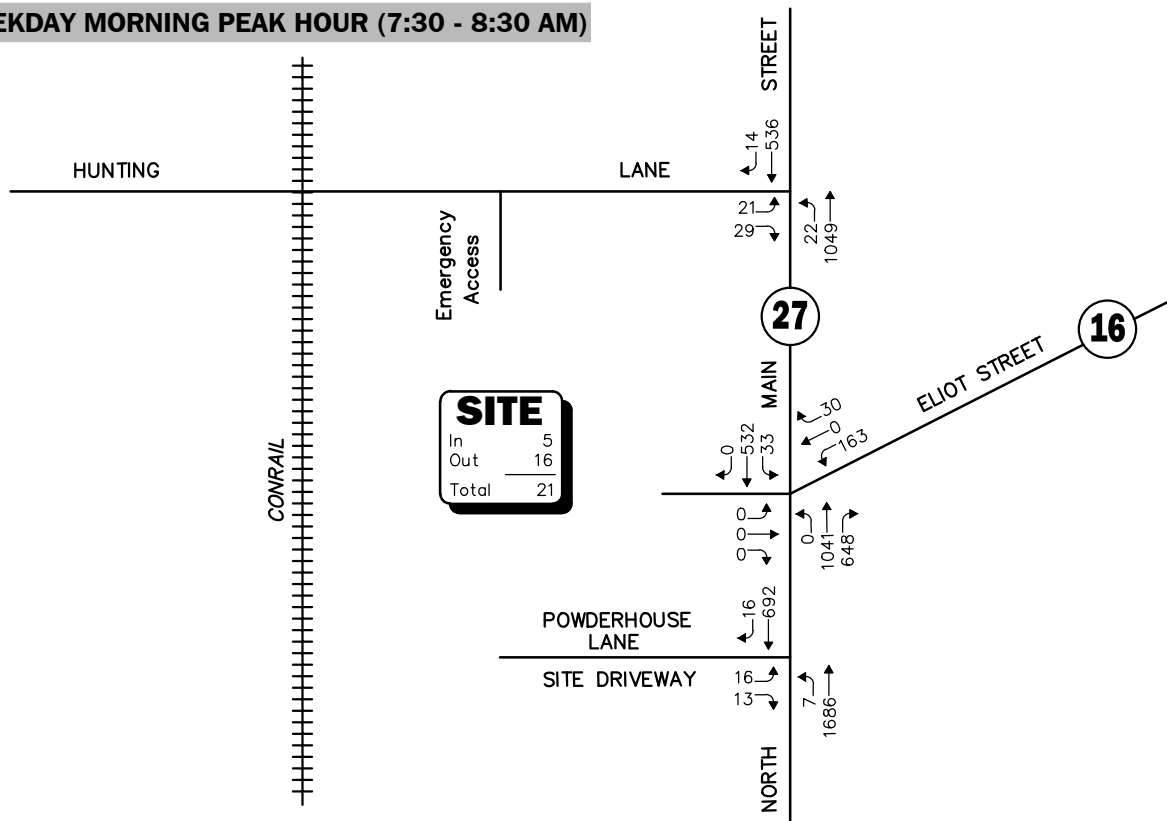
WEEKDAY EVENING PEAK HOUR (4:45 - 5:45 PM)



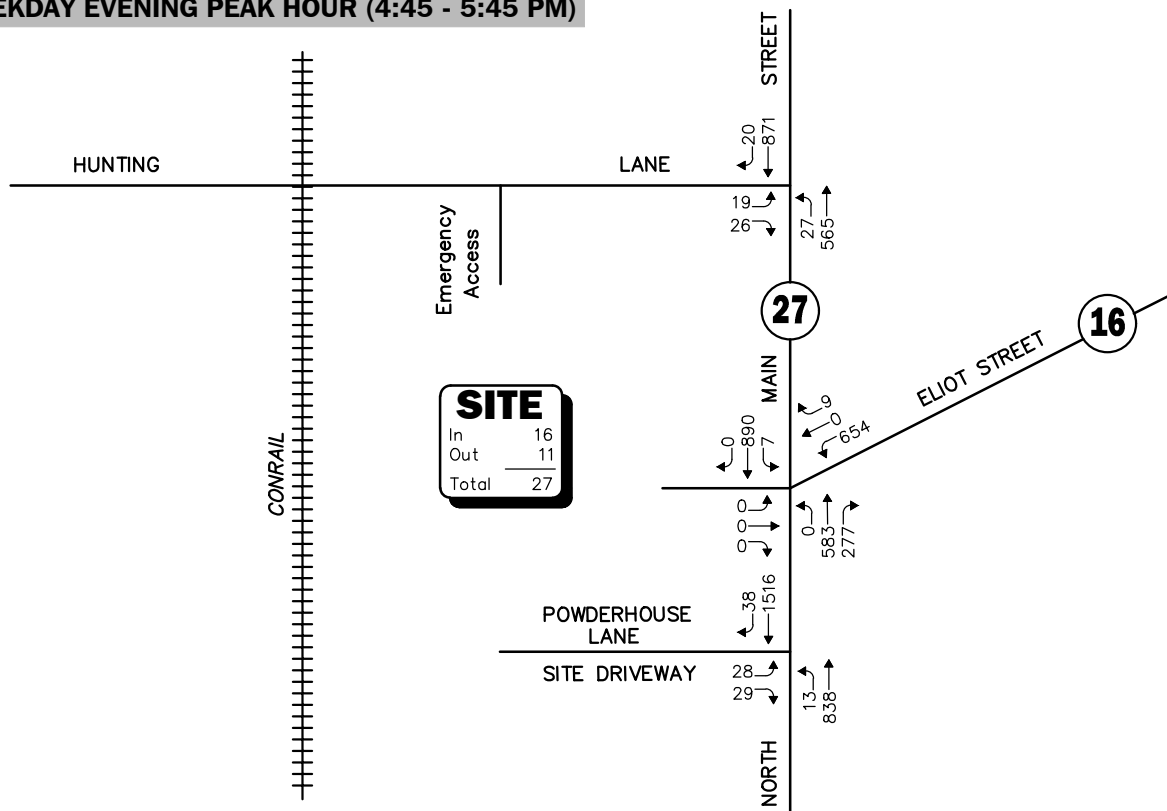
Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.
Not To Scale

Figure 4R

WEEKDAY MORNING PEAK HOUR (7:30 - 8:30 AM)



WEEKDAY EVENING PEAK HOUR (4:45 - 5:45 PM)



Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.

Not To Scale

Figure 7R

CAPACITY ANALYSIS WORKSHEETS

Route 127/Hunting Lane

Route 127/Route 16

Route 127/Powderhouse Lane



Route 127/Hunting Lane



Intersection						
Int Delay, s/veh	1.2					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	21	29	21	1042	533	14
Future Vol, veh/h	21	29	21	1042	533	14
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	23	32	23	1133	579	15
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	1766	587	594	0	-	0
Stage 1	587	-	-	-	-	-
Stage 2	1179	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	92	510	982	-	-	-
Stage 1	556	-	-	-	-	-
Stage 2	292	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	86	510	982	-	-	-
Mov Cap-2 Maneuver	86	-	-	-	-	-
Stage 1	521	-	-	-	-	-
Stage 2	292	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	36.9	0.2		0		
HCM LOS	E					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	982	-	166	-	-	
HCM Lane V/C Ratio	0.023	-	0.327	-	-	
HCM Control Delay (s)	8.8	0	36.9	-	-	
HCM Lane LOS	A	A	E	-	-	
HCM 95th %tile Q(veh)	0.1	-	1.3	-	-	

Intersection						
Int Delay, s/veh	1.2					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	19	25	27	560	864	20
Future Vol, veh/h	19	25	27	560	864	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	21	27	29	609	939	22

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	1617	950	961	0	-	0
Stage 1	950	-	-	-	-	-
Stage 2	667	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	114	315	716	-	-	-
Stage 1	376	-	-	-	-	-
Stage 2	510	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	107	315	716	-	-	-
Mov Cap-2 Maneuver	107	-	-	-	-	-
Stage 1	353	-	-	-	-	-
Stage 2	510	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	34	0.5	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	716	-	171	-	-
HCM Lane V/C Ratio	0.041	-	0.28	-	-
HCM Control Delay (s)	10.2	0	34	-	-
HCM Lane LOS	B	A	D	-	-
HCM 95th %tile Q(veh)	0.1	-	1.1	-	-

Intersection						
Int Delay, s/veh	1.3					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	21	29	22	1049	536	14
Future Vol, veh/h	21	29	22	1049	536	14
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	23	32	24	1140	583	15
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	1779	591	598	0	-	0
Stage 1	591	-	-	-	-	-
Stage 2	1188	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	90	507	979	-	-	-
Stage 1	553	-	-	-	-	-
Stage 2	289	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	84	507	979	-	-	-
Mov Cap-2 Maneuver	84	-	-	-	-	-
Stage 1	516	-	-	-	-	-
Stage 2	289	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	37.8	0.2		0		
HCM LOS	E					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	979	-	163	-	-	
HCM Lane V/C Ratio	0.024	-	0.333	-	-	
HCM Control Delay (s)	8.8	0	37.8	-	-	
HCM Lane LOS	A	A	E	-	-	
HCM 95th %tile Q(veh)	0.1	-	1.4	-	-	

Intersection						
Int Delay, s/veh	1.2					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	19	26	27	565	871	20
Future Vol, veh/h	19	26	27	565	871	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	21	28	29	614	947	22

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	1630	958	969	0	-	0
Stage 1	958	-	-	-	-	-
Stage 2	672	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	112	312	711	-	-	-
Stage 1	373	-	-	-	-	-
Stage 2	508	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	105	312	711	-	-	-
Mov Cap-2 Maneuver	105	-	-	-	-	-
Stage 1	350	-	-	-	-	-
Stage 2	508	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	34.5	0.5	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	711	-	170	-	-
HCM Lane V/C Ratio	0.041	-	0.288	-	-
HCM Control Delay (s)	10.3	0	34.5	-	-
HCM Lane LOS	B	A	D	-	-
HCM 95th %tile Q(veh)	0.1	-	1.1	-	-

Route 127/Route 16



Lanes, Volumes, Timings
5: North Main Street & Eliot Street

2027 no build morning peak hour

01/19/2021

							
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT	Ø9
Lane Configurations							
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Storage Length (ft)	0	90		155	0		
Storage Lanes	1	1		1	0		
Taper Length (ft)	25				25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Frt		0.850		0.850			
Flt Protected	0.950					0.997	
Satd. Flow (prot)	1752	1272	1827	1553	0	1778	
Flt Permitted	0.950					0.586	
Satd. Flow (perm)	1752	1272	1827	1553	0	1045	
Right Turn on Red		Yes		Yes			
Satd. Flow (RTOR)		44		671			
Link Speed (mph)	40		30			30	
Link Distance (ft)	285		314			370	
Travel Time (s)	4.9		7.1			8.4	
Adj. Flow (vph)	275	51	1076	671	37	594	
Lane Group Flow (vph)	275	51	1076	671	0	631	
Number of Detectors	1	1	2	1	1	2	
Detector Template	Left	Right	Thru	Right	Left	Thru	
Leading Detector (ft)	20	20	100	20	20	100	
Trailing Detector (ft)	0	0	0	0	0	0	
Detector 1 Position(ft)	0	0	0	0	0	0	
Detector 1 Size(ft)	20	20	6	20	20	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel							
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)			94			94	
Detector 2 Size(ft)			6			6	
Detector 2 Type			Cl+Ex			Cl+Ex	
Detector 2 Channel							
Detector 2 Extend (s)			0.0			0.0	
Protected Phases	8		2	8		6	9
Permitted Phases	8	8		2	6		
Minimum Initial (s)	1.0	1.0	5.0	1.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	26.0	26.0	51.0	26.0	51.0	51.0	15.0
Total Split (%)	28.3%	28.3%	55.4%	28.3%	55.4%	55.4%	16%
Maximum Green (s)	20.0	20.0	45.0	20.0	45.0	45.0	9.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lead/Lag							
Lead-Lag Optimize?							
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Min	None	None	None	None
Walk Time (s)							7.0
Flash Dont Walk (s)							11.0

Lanes, Volumes, Timings
5: North Main Street & Eliot Street

2027 no build morning peak hour
01/19/2021

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT	Ø9
Pedestrian Calls (#/hr)							0
Act Effct Green (s)	18.7	18.7	47.1	73.8		47.1	
Actuated g/C Ratio	0.25	0.25	0.64	1.00		0.64	
v/c Ratio	0.62	0.14	0.92	0.43		0.95	
Control Delay	31.0	9.4	28.3	0.9		40.8	
Queue Delay	0.0	0.0	0.0	0.0		0.0	
Total Delay	31.0	9.4	28.3	0.9		40.8	
LOS	C	A	C	A		D	
Approach Delay	27.6		17.8			40.8	
Approach LOS	C		B			D	
Queue Length 50th (ft)	111	2	410	0		250	
Queue Length 95th (ft)	110	12	#754	0		#501	
Internal Link Dist (ft)	205		234			290	
Turn Bay Length (ft)		90		155			
Base Capacity (vph)	523	410	1165	1547		666	
Starvation Cap Reductn	0	0	0	0		0	
Spillback Cap Reductn	0	0	0	0		0	
Storage Cap Reductn	0	0	0	0		0	
Reduced v/c Ratio	0.53	0.12	0.92	0.43		0.95	

Intersection Summary

Area Type:	Other
Cycle Length: 92	
Actuated Cycle Length: 73.8	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.95	
Intersection Signal Delay: 24.3	Intersection LOS: C
Intersection Capacity Utilization 76.2%	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.	

HCM Signalized Intersection Capacity Analysis

5: North Main Street & Eliot Street

2027 no build morning peak hour

01/19/2021

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	162	30	1033	644	33	529
Future Volume (vph)	162	30	1033	644	33	529
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0
Lane Util. Factor	1.00	1.00	1.00	1.00		1.00
Frt	1.00	0.85	1.00	0.85		1.00
Flt Protected	0.95	1.00	1.00	1.00		1.00
Satd. Flow (prot)	1752	1272	1827	1553		1778
Flt Permitted	0.95	1.00	1.00	1.00		0.59
Satd. Flow (perm)	1752	1272	1827	1553		1045
Peak-hour factor, PHF	0.59	0.59	0.96	0.96	0.89	0.89
Adj. Flow (vph)	275	51	1076	671	37	594
RTOR Reduction (vph)	0	33	0	73	0	0
Lane Group Flow (vph)	275	18	1076	598	0	631
Heavy Vehicles (%)	3%	27%	4%	4%	15%	6%
Turn Type	Prot	Perm	NA	pm+ov	Perm	NA
Protected Phases	8		2	8		6
Permitted Phases	8	8		2	6	
Actuated Green, G (s)	16.7	16.7	45.1	61.8		45.1
Effective Green, g (s)	18.7	18.7	47.1	65.8		47.1
Actuated g/C Ratio	0.25	0.25	0.64	0.89		0.64
Clearance Time (s)	6.0	6.0	6.0	6.0		6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0
Lane Grp Cap (vph)	443	322	1166	1553		666
v/s Ratio Prot	c0.16		0.59	0.10		
v/s Ratio Perm		0.01		0.29		c0.60
v/c Ratio	0.62	0.06	0.92	0.39		0.95
Uniform Delay, d1	24.4	20.9	11.8	0.7		12.2
Progression Factor	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	2.7	0.1	12.0	0.2		22.5
Delay (s)	27.1	20.9	23.7	0.8		34.8
Level of Service	C	C	C	A		C
Approach Delay (s)	26.1		14.9			34.8
Approach LOS	C		B			C
Intersection Summary						
HCM 2000 Control Delay			20.9		HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.94			
Actuated Cycle Length (s)			73.8		Sum of lost time (s)	14.0
Intersection Capacity Utilization			76.2%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						

Lanes, Volumes, Timings
5: North Main Street & Eliot Street

2027 no build evening peak hour

01/19/2021

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT	Ø9
Lane Configurations							
Traffic Volume (vph)	650	9	578	274	7	882	
Future Volume (vph)	650	9	578	274	7	882	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Storage Length (ft)	0	90		155	0		
Storage Lanes	1	1		1	0		
Taper Length (ft)	25				25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Frt		0.850		0.850			
Flt Protected	0.950						
Satd. Flow (prot)	1752	1615	1863	1615	0	1900	
Flt Permitted	0.950					0.995	
Satd. Flow (perm)	1752	1615	1863	1615	0	1890	
Right Turn on Red		Yes		Yes			
Satd. Flow (RTOR)		3		308			
Link Speed (mph)	40		30			30	
Link Distance (ft)	285		360			370	
Travel Time (s)	4.9		8.2			8.4	
Peak Hour Factor	0.92	0.92	0.89	0.89	0.92	0.92	
Heavy Vehicles (%)	3%	0%	2%	0%	1%	0%	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	707	10	649	308	0	967	
Turn Type	Prot	Perm	NA	pm+ov	Perm	NA	
Protected Phases	8		2	8		6	9
Permitted Phases	8	8		2	6		
Detector Phase	8	8	2	8	6	6	
Switch Phase							
Minimum Initial (s)	1.0	1.0	5.0	1.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	26.0	26.0	51.0	26.0	51.0	51.0	24.0
Total Split (%)	25.7%	25.7%	50.5%	25.7%	50.5%	50.5%	24%
Maximum Green (s)	20.0	20.0	45.0	20.0	45.0	45.0	18.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0		-2.0	
Total Lost Time (s)	4.0	4.0	4.0	4.0		4.0	
Lead/Lag							
Lead-Lag Optimize?							
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Min	None	Min	Min	None
Walk Time (s)							7.0
Flash Dont Walk (s)							11.0
Pedestrian Calls (#/hr)							0
Act Effect Green (s)	22.0	22.0	47.0	77.0		47.0	
Actuated g/C Ratio	0.29	0.29	0.61	1.00		0.61	
v/c Ratio	1.41	0.02	0.57	0.19		0.84	
Control Delay	224.2	17.4	11.5	0.3		20.7	
Queue Delay	0.0	0.0	0.0	0.0		0.0	
Total Delay	224.2	17.4	11.5	0.3		20.7	

Lanes, Volumes, Timings
5: North Main Street & Eliot Street

2027 no build evening peak hour

01/19/2021

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT	Ø9
LOS	F	B	B	A		C	
Approach Delay	221.3		7.9			20.7	
Approach LOS	F		A			C	
Queue Length 50th (ft)	~463	2	166	0		331	
Queue Length 95th (ft)	#664	13	251	0		#570	
Internal Link Dist (ft)	205		280			290	
Turn Bay Length (ft)		90		155			
Base Capacity (vph)	500	463	1137	1615		1153	
Starvation Cap Reductn	0	0	0	0		0	
Spillback Cap Reductn	0	0	0	0		0	
Storage Cap Reductn	0	0	0	0		0	
Reduced v/c Ratio	1.41	0.02	0.57	0.19		0.84	

Intersection Summary

Area Type: Other

Cycle Length: 101

Actuated Cycle Length: 77

Natural Cycle: 150

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.41

Intersection Signal Delay: 70.5

Intersection LOS: E

Intersection Capacity Utilization 94.7%

ICU Level of Service F

Analysis Period (min) 15

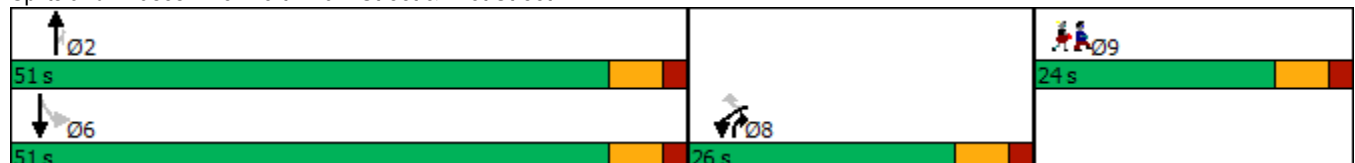
~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 5: North Main Street & Eliot Street



HCM Signalized Intersection Capacity Analysis

5: North Main Street & Eliot Street

2027 no build evening peak hour

01/19/2021

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	650	9	578	274	7	882
Future Volume (vph)	650	9	578	274	7	882
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0
Lane Util. Factor	1.00	1.00	1.00	1.00		1.00
Frt	1.00	0.85	1.00	0.85		1.00
Flt Protected	0.95	1.00	1.00	1.00		1.00
Satd. Flow (prot)	1752	1615	1863	1615		1899
Flt Permitted	0.95	1.00	1.00	1.00		1.00
Satd. Flow (perm)	1752	1615	1863	1615		1890
Peak-hour factor, PHF	0.92	0.92	0.89	0.89	0.92	0.92
Adj. Flow (vph)	707	10	649	308	8	959
RTOR Reduction (vph)	0	2	0	32	0	0
Lane Group Flow (vph)	707	8	649	276	0	967
Heavy Vehicles (%)	3%	0%	2%	0%	1%	0%
Turn Type	Prot	Perm	NA	pm+ov	Perm	NA
Protected Phases	8		2	8		6
Permitted Phases	8	8		2	6	
Actuated Green, G (s)	20.0	20.0	45.0	65.0		45.0
Effective Green, g (s)	22.0	22.0	47.0	69.0		47.0
Actuated g/C Ratio	0.29	0.29	0.61	0.90		0.61
Clearance Time (s)	6.0	6.0	6.0	6.0		6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0
Lane Grp Cap (vph)	500	461	1137	1615		1153
v/s Ratio Prot	c0.40		0.35	0.05		
v/s Ratio Perm		0.00		0.12		c0.51
v/c Ratio	1.41	0.02	0.57	0.17		0.84
Uniform Delay, d1	27.5	19.7	9.0	0.5		12.0
Progression Factor	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	197.9	0.0	0.7	0.1		5.5
Delay (s)	225.4	19.8	9.7	0.5		17.5
Level of Service	F	B	A	A		B
Approach Delay (s)	222.5		6.7			17.5
Approach LOS	F		A			B
Intersection Summary						
HCM 2000 Control Delay			69.2		HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio			1.12			
Actuated Cycle Length (s)			77.0		Sum of lost time (s)	14.0
Intersection Capacity Utilization			94.7%		ICU Level of Service	F
Analysis Period (min)			15			
c Critical Lane Group						

Lanes, Volumes, Timings
5: North Main Street & Eliot Street

2027 build morning peak hour

01/19/2021

							
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT	Ø9
Lane Configurations							
Traffic Volume (vph)	163	30	1041	648	33	532	
Future Volume (vph)	163	30	1041	648	33	532	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Storage Length (ft)	0	90		155	0		
Storage Lanes	1	1		1	0		
Taper Length (ft)	25				25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Frt		0.850		0.850			
Flt Protected	0.950					0.997	
Satd. Flow (prot)	1752	1272	1827	1553	0	1893	
Flt Permitted	0.950					0.572	
Satd. Flow (perm)	1752	1272	1827	1553	0	1086	
Right Turn on Red		Yes		Yes			
Satd. Flow (RTOR)		44		675			
Link Speed (mph)	40		30			30	
Link Distance (ft)	285		359			370	
Travel Time (s)	4.9		8.2			8.4	
Peak Hour Factor	0.59	0.59	0.96	0.96	0.89	0.89	
Heavy Vehicles (%)	3%	27%	4%	4%	1%	0%	
Adj. Flow (vph)	276	51	1084	675	37	598	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	276	51	1084	675	0	635	
Enter Blocked Intersection	No	No	No	No	No	No	
Lane Alignment	Left	Right	Left	Right	Left	Left	
Median Width(ft)	12		0			0	
Link Offset(ft)	0		0			0	
Crosswalk Width(ft)	16		16			16	
Two way Left Turn Lane							
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Turning Speed (mph)	15	9		9	15		
Number of Detectors	1	1	2	1	1	2	
Detector Template	Left	Right	Thru	Right	Left	Thru	
Leading Detector (ft)	20	20	100	20	20	100	
Trailing Detector (ft)	0	0	0	0	0	0	
Detector 1 Position(ft)	0	0	0	0	0	0	
Detector 1 Size(ft)	20	20	6	20	20	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel							
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)			94			94	
Detector 2 Size(ft)			6			6	
Detector 2 Type			Cl+Ex			Cl+Ex	
Detector 2 Channel							
Detector 2 Extend (s)			0.0			0.0	
Turn Type	Prot	Perm	NA	pm+ov	Perm	NA	
Protected Phases	8		2	8		6	9

Lanes, Volumes, Timings
5: North Main Street & Eliot Street

2027 build morning peak hour

01/19/2021

	↖	↗	↑	↘	↙	↓	
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT	Ø9
Permitted Phases	8	8		2	6		
Detector Phase	8	8	2	8	6	6	
Switch Phase							
Minimum Initial (s)	1.0	1.0	5.0	1.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	26.0	26.0	51.0	26.0	51.0	51.0	15.0
Total Split (%)	28.3%	28.3%	55.4%	28.3%	55.4%	55.4%	16%
Maximum Green (s)	20.0	20.0	45.0	20.0	45.0	45.0	9.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0		-2.0	
Total Lost Time (s)	4.0	4.0	4.0	4.0		4.0	
Lead/Lag							
Lead-Lag Optimize?							
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Min	None	Min	Min	None
Walk Time (s)							7.0
Flash Dont Walk (s)							11.0
Pedestrian Calls (#/hr)							0
Act Effect Green (s)	18.7	18.7	47.1	73.9		47.1	
Actuated g/C Ratio	0.25	0.25	0.64	1.00		0.64	
v/c Ratio	0.62	0.14	0.93	0.43		0.92	
Control Delay	31.0	9.4	29.3	0.9		35.0	
Queue Delay	0.0	0.0	0.0	0.0		0.0	
Total Delay	31.0	9.4	29.3	0.9		35.0	
LOS	C	A	C	A		D	
Approach Delay	27.6		18.4			35.0	
Approach LOS	C		B			D	

Intersection Summary

Area Type: Other

Cycle Length: 92

Actuated Cycle Length: 73.9

Natural Cycle: 130

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.93

Intersection Signal Delay: 23.4

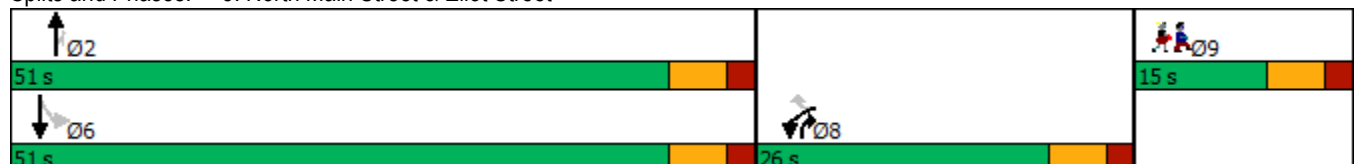
Intersection LOS: C

Intersection Capacity Utilization 76.6%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 5: North Main Street & Eliot Street



HCM Signalized Intersection Capacity Analysis

5: North Main Street & Eliot Street

2027 build morning peak hour

01/19/2021

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	163	30	1041	648	33	532
Future Volume (vph)	163	30	1041	648	33	532
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0
Lane Util. Factor	1.00	1.00	1.00	1.00		1.00
Frt	1.00	0.85	1.00	0.85		1.00
Flt Protected	0.95	1.00	1.00	1.00		1.00
Satd. Flow (prot)	1752	1272	1827	1553		1893
Flt Permitted	0.95	1.00	1.00	1.00		0.57
Satd. Flow (perm)	1752	1272	1827	1553		1087
Peak-hour factor, PHF	0.59	0.59	0.96	0.96	0.89	0.89
Adj. Flow (vph)	276	51	1084	675	37	598
RTOR Reduction (vph)	0	33	0	73	0	0
Lane Group Flow (vph)	276	18	1084	602	0	635
Heavy Vehicles (%)	3%	27%	4%	4%	1%	0%
Turn Type	Prot	Perm	NA	pm+ov	Perm	NA
Protected Phases	8		2	8		6
Permitted Phases	8	8		2	6	
Actuated Green, G (s)	16.7	16.7	45.1	61.8		45.1
Effective Green, g (s)	18.7	18.7	47.1	65.8		47.1
Actuated g/C Ratio	0.25	0.25	0.64	0.89		0.64
Clearance Time (s)	6.0	6.0	6.0	6.0		6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0
Lane Grp Cap (vph)	443	322	1166	1553		693
v/s Ratio Prot	c0.16		c0.59	0.10		
v/s Ratio Perm		0.01		0.29		0.58
v/c Ratio	0.62	0.06	0.93	0.39		0.92
Uniform Delay, d1	24.4	20.9	11.9	0.7		11.6
Progression Factor	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	2.7	0.1	12.7	0.2		16.8
Delay (s)	27.1	20.9	24.6	0.8		28.5
Level of Service	C	C	C	A		C
Approach Delay (s)	26.2		15.5			28.5
Approach LOS	C		B			C
Intersection Summary						
HCM 2000 Control Delay			19.8		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.93			
Actuated Cycle Length (s)			73.8		Sum of lost time (s)	14.0
Intersection Capacity Utilization			76.6%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						

Lanes, Volumes, Timings
5: North Main Street & Eliot Street

2027 build evening peak hour

01/19/2021

							
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT	Ø9
Lane Configurations							
Traffic Volume (vph)	654	9	583	277	7	890	
Future Volume (vph)	654	9	583	277	7	890	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Storage Length (ft)	0	90		155	0		
Storage Lanes	1	1		1	0		
Taper Length (ft)	25				25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Frt		0.850		0.850			
Flt Protected	0.950						
Satd. Flow (prot)	1752	1615	1863	1615	0	1900	
Flt Permitted	0.950					0.995	
Satd. Flow (perm)	1752	1615	1863	1615	0	1890	
Right Turn on Red		Yes		Yes			
Satd. Flow (RTOR)		3		311			
Link Speed (mph)	40		30			30	
Link Distance (ft)	285		311			370	
Travel Time (s)	4.9		7.1			8.4	
Lane Group Flow (vph)	711	10	655	311	0	975	
Turn Type	Prot	Perm	NA	pm+ov	Perm	NA	
Protected Phases	8		2	8		6	9
Permitted Phases	8	8		2	6		
Detector Phase	8	8	2	8	6	6	
Switch Phase							
Minimum Initial (s)	1.0	1.0	5.0	1.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	26.0	26.0	51.0	26.0	51.0	51.0	15.0
Total Split (%)	28.3%	28.3%	55.4%	28.3%	55.4%	55.4%	16%
Maximum Green (s)	20.0	20.0	45.0	20.0	45.0	45.0	9.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0		-2.0	
Total Lost Time (s)	4.0	4.0	4.0	4.0		4.0	
Lead/Lag							
Lead-Lag Optimize?							
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Min	None	Min	Min	None
Walk Time (s)							7.0
Flash Dont Walk (s)							11.0
Pedestrian Calls (#/hr)							0
Act Effct Green (s)	22.0	22.0	47.0	77.0		47.0	
Actuated g/C Ratio	0.29	0.29	0.61	1.00		0.61	
v/c Ratio	1.42	0.02	0.58	0.19		0.85	
Control Delay	227.5	17.4	11.6	0.3		21.1	
Queue Delay	0.0	0.0	0.0	0.0		0.0	
Total Delay	227.5	17.4	11.6	0.3		21.1	
LOS	F	B	B	A		C	
Approach Delay	224.6		7.9			21.1	
Approach LOS	F		A			C	

Lanes, Volumes, Timings
5: North Main Street & Eliot Street

2027 build evening peak hour

01/19/2021

	↖	↗	↑	↘	↙	↓	
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT	Ø9
Queue Length 50th (ft)	~468	2	169	0		336	
Queue Length 95th (ft)	#669	13	255	0		#625	
Internal Link Dist (ft)	205		231			290	
Turn Bay Length (ft)		90		155			
Base Capacity (vph)	500	463	1137	1615		1153	
Starvation Cap Reductn	0	0	0	0		0	
Spillback Cap Reductn	0	0	0	0		0	
Storage Cap Reductn	0	0	0	0		0	
Reduced v/c Ratio	1.42	0.02	0.58	0.19		0.85	

Intersection Summary

Area Type: Other

Cycle Length: 92

Actuated Cycle Length: 77

Natural Cycle: 150

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.42

Intersection Signal Delay: 71.5

Intersection LOS: E

Intersection Capacity Utilization 95.3%

ICU Level of Service F

Analysis Period (min) 15

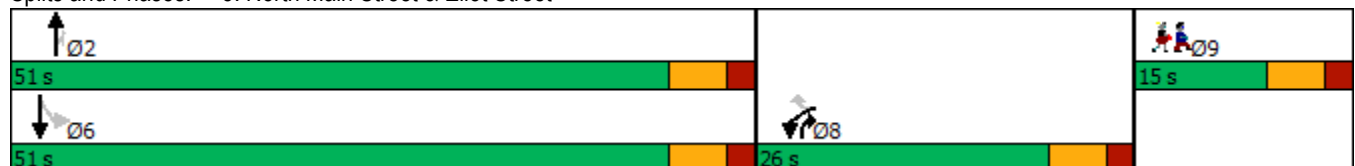
~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 5: North Main Street & Eliot Street



HCM Signalized Intersection Capacity Analysis

5: North Main Street & Eliot Street

2027 build evening peak hour

01/19/2021

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	654	9	583	277	7	890
Future Volume (vph)	654	9	583	277	7	890
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0
Lane Util. Factor	1.00	1.00	1.00	1.00		1.00
Frt	1.00	0.85	1.00	0.85		1.00
Flt Protected	0.95	1.00	1.00	1.00		1.00
Satd. Flow (prot)	1752	1615	1863	1615		1899
Flt Permitted	0.95	1.00	1.00	1.00		1.00
Satd. Flow (perm)	1752	1615	1863	1615		1890
Peak-hour factor, PHF	0.92	0.92	0.89	0.89	0.92	0.92
Adj. Flow (vph)	711	10	655	311	8	967
RTOR Reduction (vph)	0	2	0	32	0	0
Lane Group Flow (vph)	711	8	655	279	0	975
Heavy Vehicles (%)	3%	0%	2%	0%	1%	0%
Turn Type	Prot	Perm	NA	pm+ov	Perm	NA
Protected Phases	8		2	8		6
Permitted Phases	8	8		2	6	
Actuated Green, G (s)	20.0	20.0	45.0	65.0		45.0
Effective Green, g (s)	22.0	22.0	47.0	69.0		47.0
Actuated g/C Ratio	0.29	0.29	0.61	0.90		0.61
Clearance Time (s)	6.0	6.0	6.0	6.0		6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0
Lane Grp Cap (vph)	500	461	1137	1615		1153
v/s Ratio Prot	c0.41		0.35	0.05		
v/s Ratio Perm		0.00		0.12		c0.52
v/c Ratio	1.42	0.02	0.58	0.17		0.85
Uniform Delay, d1	27.5	19.7	9.0	0.5		12.1
Progression Factor	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	201.3	0.0	0.7	0.1		5.9
Delay (s)	228.8	19.8	9.7	0.5		17.9
Level of Service	F	B	A	A		B
Approach Delay (s)	225.9		6.8			17.9
Approach LOS	F		A			B
Intersection Summary						
HCM 2000 Control Delay			70.2		HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio			1.13			
Actuated Cycle Length (s)			77.0		Sum of lost time (s)	14.0
Intersection Capacity Utilization			95.3%		ICU Level of Service	F
Analysis Period (min)			15			
c Critical Lane Group						

Route 127/Powderhouse Lane



Intersection						
Int Delay, s/veh	0.8					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	4	9	6	1686	692	12
Future Vol, veh/h	4	9	6	1686	692	12
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	55	55	97	97	91	91
Heavy Vehicles, %	0	0	20	4	6	10
Mvmt Flow	7	16	6	1738	760	13

Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	2517	767	773	0	-	0
Stage 1	767	-	-	-	-	-
Stage 2	1750	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.3	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.38	-	-	-
Pot Cap-1 Maneuver	31	405	767	-	-	-
Stage 1	462	-	-	-	-	-
Stage 2	155	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	24	405	767	-	-	-
Mov Cap-2 Maneuver	24	-	-	-	-	-
Stage 1	357	-	-	-	-	-
Stage 2	155	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	82.2	0	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	767	-	69	-	-
HCM Lane V/C Ratio	0.008	-	0.343	-	-
HCM Control Delay (s)	9.7	0	82.2	-	-
HCM Lane LOS	A	A	F	-	-
HCM 95th %tile Q(veh)	0	-	1.3	-	-

Intersection						
Int Delay, s/veh	9.8					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	20	26	9	838	1516	26
Future Vol, veh/h	20	26	9	838	1516	26
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	69	69	87	87	96	96
Heavy Vehicles, %	0	0	0	1	2	0
Mvmt Flow	29	38	10	963	1579	27

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2576	1593	1606	0	-	0
Stage 1	1593	-	-	-	-	-
Stage 2	983	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	29	133	412	-	-	-
Stage 1	185	-	-	-	-	-
Stage 2	366	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 27	133	412	-	-	-
Mov Cap-2 Maneuver	~ 27	-	-	-	-	-
Stage 1	175	-	-	-	-	-
Stage 2	366	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	386.7	0.1	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	412	-	49	-	-
HCM Lane V/C Ratio	0.025	-	1.361	-	-
HCM Control Delay (s)	14	0	386.7	-	-
HCM Lane LOS	B	A	F	-	-
HCM 95th %tile Q(veh)	0.1	-	6.2	-	-

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

Intersection						
Int Delay, s/veh	8.4					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	16	13	7	1686	692	16
Future Vol, veh/h	16	13	7	1686	692	16
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	55	55	97	97	91	91
Heavy Vehicles, %	0	0	20	4	6	0
Mvmt Flow	29	24	7	1738	760	18
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	2521	769	778	0	-	0
Stage 1	769	-	-	-	-	-
Stage 2	1752	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.3	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.38	-	-	-
Pot Cap-1 Maneuver	31	404	764	-	-	-
Stage 1	461	-	-	-	-	-
Stage 2	155	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 23	404	764	-	-	-
Mov Cap-2 Maneuver	~ 23	-	-	-	-	-
Stage 1	338	-	-	-	-	-
Stage 2	155	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s\$	408.5	0		0		
HCM LOS	F					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	764	-	40	-	-	
HCM Lane V/C Ratio	0.009	-	1.318	-	-	
HCM Control Delay (s)	9.8	0\$ 408.5		-	-	
HCM Lane LOS	A	A	F	-	-	
HCM 95th %tile Q(veh)	0	-	5.3	-	-	
Notes						
~: Volume exceeds capacity		\$: Delay exceeds 300s		+: Computation Not Defined		*: All major volume in platoon

Intersection						
Int Delay, s/veh	19					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	28	29	13	838	1516	38
Future Vol, veh/h	28	29	13	838	1516	38
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	69	69	87	87	96	96
Heavy Vehicles, %	0	0	0	1	2	0
Mvmt Flow	41	42	15	963	1579	40

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2592	1599	1619	0	-	0
Stage 1	1599	-	-	-	-	-
Stage 2	993	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	~ 28	132	408	-	-	-
Stage 1	184	-	-	-	-	-
Stage 2	362	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 26	132	408	-	-	-
Mov Cap-2 Maneuver	~ 26	-	-	-	-	-
Stage 1	169	-	-	-	-	-
Stage 2	362	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	\$ 613	0.2	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	408	-	44	-	-
HCM Lane V/C Ratio	0.037	-	1.877	-	-
HCM Control Delay (s)	14.2	0	\$ 613	-	-
HCM Lane LOS	B	A	F	-	-
HCM 95th %tile Q(veh)	0.1	-	8.5	-	-

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

DRAFT CONSTRUCTION MANAGEMENT PLAN



**CONSTRUCTION MANAGEMENT PLAN
THE PINES
41 NORTH MAIN STREET (ROUTE 27)
SHERBORN, MASSACHUSETTS**

The Project proponent will implement a Construction Management Plan (CMP) in coordination with Town of Sherborn in order to facilitate safe and efficient access to the Project site and travel along Hunting Lane during construction activities. Summarized below are several measures which will be undertake during the construction phase of the Project.

- Prior to construction activities, a Temporary Traffic Control Plan (TTCP) will be submitted to the Department of Public Works (DPW) and the Police Department for review and approval. The TTCP will depict the location of the construction entrance, traffic and sediment control measures, traffic control devices and the location of any construction activities that will occur with the public right-of-way.
- A pre-construction meeting will be held with the DPW and the Police Department prior to the initiation of construction activities.
- The contact information for the general contractor or construction superintendent will be provided to the DPW and the Police Department.
- Hours of construction will be as defined by the Zoning By Laws of the Town or as established in the Comprehensive Permit Decision.
- Police details will be used when construction activities will occur that may disrupt travel within the public way.
- All contractors will be required to access the project site by way of Route 27 and Powderhouse Lane. This required access route will be included in all construction contracts and materials suppliers will also be informed of the required travel route to access the project site.
- Employees will be encouraged to car/vanpool in order to reduce construction-related traffic.
- Secure on-site storage will be provided for tools and equipment in an effort to minimize construction-related vehicle trips to the site.
- Full or partial street closures will be avoided to the extent possible. Should a partial street closure be necessary in order to off-load construction materials and/or complete construction-related activities, the closure will be limited to off-peak periods as defined by the DPW and the Police Department so as to minimize the impact of vehicular and pedestrian flow.
- Construction worker parking will be expressly prohibited along Powderhouse Lane and Route 27. Construction contracts for the project will include notification of this prohibition.