



Ref.: 19046

September 21, 2020

Mr. Anthony Guba
A.L. Prime Energy Consultant, Inc.
18 Lark Avenue
Saugus, MA 01906

Reg.: Response to Traffic Peer Review Comments
Gas Station Development, 23 Central Street, Byfield, MA

Dear Tony:

Ron Müller & Associates (RMA) has prepared this letter to respond to the traffic peer review comments by Stantec Consulting Services, Inc. (Stantec) in their letter to the Town of Newbury Planning Board dated August 27, 2020. The Stantec letter provided comments on the Traffic Assessment¹ prepared by this office for the above-referenced project. In addition, this response letter describes the proponent's commitments to mitigate the impacts of the project and provides arguments for why the site layout as designed is the safest from a site circulation and pedestrian safety perspective.

Response to Peer Review Comments

Stantec requested that the project's impacts on the Central Street intersections with Fruit Street and with Central Court be evaluated as well as the proposed site driveway operations. RMA accordingly conducted traffic counts at these locations on September 9 and 10, 2020 during the weekday AM peak period (7:00 to 9:00 AM) and the weekday PM peak period (4:00 to 6:00 PM). The traffic count data are attached to this letter. Since traffic in general is being influenced by the current coronavirus pandemic and area schools have not yet opened and may not open to in-class instruction for some time, these counts were compared with the automatic traffic recorder counts conducted in November 2019. This comparison, which is attached to this letter for reference,

¹ *Traffic Assessment, Gas Station/Convenience Store, Byfield, MA*; prepared for A.L. Prime Energy Consultants, Inc.; prepared by Ron Müller & Associates; March 11, 2020.

shows that weekday AM peak hour volumes in 2019 were 158 percent higher than current volumes and weekday PM peak hour volumes were 115 percent higher. Accordingly, all turning movements through these intersections were increased by a factor of 1.58 for the AM peak hour and a factor of 1.15 for the PM peak hour. Traffic flow networks showing the counted and adjusted existing-conditions volumes through these intersections are attached to this letter.

Level-of-service (LOS) analyses were conducted at these intersections under existing and projected volume conditions based on the concepts and procedures in the *Highway Capacity Manual*² (HCM) and using the Synchro analysis program. Vehicle queue analyses were conducted using the SimTraffic micro-simulation model as this program produces more realistic results for unsignalized intersections. The results of these analyses are summarized in Table 1 and the analysis worksheets are attached to this letter.

It should be noted that the analyses were conducted assuming the directional distribution suggested by Stantec with 92 percent of the site traffic diverted from I-95 and 4 percent each from Central Street east and west. No pass-by trips were assumed in these analyses to present conservative analytical results. Furthermore, the analyses assume that the east site driveway will be an enter-only driveway and the west site driveway an exit-only driveway as recommended by Stantec and further discussed later in this response letter.

No changes to the trip generation estimates from our original study were made. Stantec cautioned that the trip estimates may be on the low side as the Institute of Transportation Engineers (ITE) land use code used to produce these estimates does not specifically mention that a coffee/donut shop with drive-through use is included in these trip rates. Over the years, RMA has collected trip data at nine existing gas station and convenience store sites with similar number of fueling positions and convenience store sizes as the proposed development. All sites contained a coffee/donut shop with drive-through window. A summary of the trip rates per vehicle fueling position for each of these sites is attached to this letter. Applying the weighted empirical data average to the proposed 12 vehicle fueling positions shows that the resulting trip generation is very similar to the estimates used in our study (339 AM peak hour trips vs. 337 trips used in the study and 232 PM peak hour trips vs. 276 trips used in the study).

As shown in Table 1, based on the above assumptions, all study intersections including the proposed site driveways operate at acceptable levels of service (LOS A to C) under both existing and future volume conditions. The volume-to-capacity ratios for all movements are very low, indicating that ample capacity remains at all study locations including the proposed site driveways. The analyses also show that left turns into the proposed site driveway will operate with little delay at LOS A with left-turning vehicles experiencing a maximum of one to two vehicles in queue during peak hours. These analyses assume that a left-turn bypass lane is constructed as discussed later in this letter.

² *Highway Capacity Manual 2010*; Transportation Research Board; Washington, DC; 2010.

Table 1
Level-of-Service Analysis Summary

Location/Peak Hour/Movement	Existing Pre-COVID Conditions					Future Build Conditions				
	V/C ^a	Delay ^b	LOS ^c	50 Q ^d	95 Q ^e	V/C	Delay	LOS	50 Q	95 Q
Central Street at Fruit Street										
<i>Weekday AM Peak Hour</i>										
Central St. EB Left	0.04	8.3	A	19	65	0.05	8.9	A	19	65
Fruit Street	0.12	14.1	B	41	79	0.18	18.9	C	43	88
<i>Weekday PM Peak Hour</i>										
Central St. EB Left	0.03	8.1	A	21	55	0.04	8.5	A	24	76
Fruit Street	0.12	12.0	B	32	63	0.15	14.3	B	44	78
Central Street at Central Court and Enter-Only Site Drive										
<i>Weekday AM Peak Hour</i>										
Central Court	0.07	15.0	C	9	23	0.13	24.8	C	11	31
Central St. EB Left	--	--	--	--	--	0.15	8.5	A	20	40
Central St. WB Left	0.00	8.2	A	0	0	0.00	8.1	A	0	0
<i>Weekday PM Peak Hour</i>										
Central Court	0.03	11.8	B	2	12	0.03	14.4	B	7	22
Central St. EB Left	--	--	--	--	--	0.11	8.3	A	17	34
Central St. WB Left	0.00	8.0	A	0	0	0.00	8.0	A	0	0
Central Street at Exit-Only Site Drive										
<i>Weekday AM Peak Hour</i>										
Site Exit Drive	--	--	--	--	--	0.28	12.9	B	43	65
<i>Weekday PM Peak Hour</i>										
Site Exit Drive	--	--	--	--	--	0.21	11.7	B	36	53

^a Volume-to-capacity ratio;

^b Average control delay in seconds per vehicle;

^c Level of service;

^d 50th percentile queue in feet, assuming 25 feet per vehicle.

^e 95th percentile queue in feet, assuming 25 feet per vehicle.

Commitments to Mitigation

Stantec made several recommendations to mitigate the impacts of the project. These include making the east site drive entrance-only, the west site drive exit-only, creation of a bypass opportunity for through traffic on Central Street to bypass any vehicles waiting to turn left into the site, construction of a sidewalk to connect the Central Street crosswalk at Fruit Street with the site, and providing on-site bike storage for at least two bicycles.

The proponent has agreed to modify the site driveways as recommended by Stantec. The easterly site driveway will be made an entrance-only driveway and the westerly driveway will be made an exit-only driveway to promote counterclockwise circulation through the site. This allows for a reduction in the driveway widths to the greatest extent feasible while still allowing tractor-trailer truck access and egress, eliminates the potential sight line issue mentioned in the Stantec review, and maximizes the separation and queue storage distance between the site entrance and Fruit Street. The modified driveways are shown on the revised site plan prepared by A.L. Prime Energy Consultant, Inc. attached to this letter.

The proponent has also agreed to widen Central Street to create a bypass area to assure that eastbound through vehicles on Central Street are not blocked by any vehicles waiting to turn left into the site. The proposed design, which is also shown on the revised site plan, is generally consistent with Option C as prepared by Stantec. This design is preferable as it provides the least amount of centerline shift for through traffic on Central Street. Options A and B as presented by Stantec would introduce a significant shift in the Central Street centerline that could lead to head-on collisions. As shown on the revised site plan, the proposed widening will create 4-foot wide shoulders on both sides of the road that will improve bicycle safety while allowing sufficient room for through vehicles to bypass left-turning vehicles. This design is also most compatible with the rural character of the road. In addition to this widening, the proponent has agreed to modify the alignment of Central Court to create more of a 90-degree intersection with Central Street, as shown on the revised site plans. This was a comment by concerned neighbors attending the recent Planning Board meeting and is also shown on the Stantec design options.

Finally, the proponent has agreed to construct a 5-foot wide asphalt sidewalk along the north side of Central Street between Fruit Street and the site, as shown on the revised site plan. The sidewalk will start at the existing crosswalk across Central Street and run easterly to the west site drive. In addition, the proponent has agreed to install a bicycle rack on site to accommodate at least two bicycles.

Site Layout and Circulation

The Planning Board suggested the possibility of locating the proposed building near Central Street and the gas pumps to the rear of the site. Stantec noted that this may have some benefits such as increasing the drive-through queue storage area, improving pedestrian/bicycle access to the building, and reducing speeds on Central Street. We have numerous concerns with such a site design including the following:

- The drive-through queue lane would have to go around the gas pumps, which would make it very difficult for gas customers to exit through the queue, especially with the one-way site circulation.

- Alternatively, if the drive-through queue lane is located between the fueling area and the building, it would be too short to accommodate the maximum queue and introduce conflicts for pedestrians walking between the fueling area and the store.
- The drive-up window would be very close to the street, creating a conflict between drive-through traffic and other customer traffic exiting the site at the same time (e.g. if a drive-through customer wants to exit right and a gas customer wants to exit left, it would create a weaving conflict in a very short distance).
- Most drive-through customers want to take their time after leaving the pick-up window to get their things in order. Having the pick-up window so close to the street would not allow for that, or cause additional delay in the drive-through lane.
- We counted only one pedestrian walking along the south side of Central Street during the AM and PM peak periods. Such a low volume of pedestrians does not justify putting the building up front to improve pedestrian access.
- The biggest vehicle-pedestrian conflict with developments like this occurs in the area between the gas pumps and the store entrance. This situation would not change putting the building up front.
- Given the zoning setback requirement of 25 feet from the front property line, the store would be located more than 50 feet back from the Central Street travelled way. Such a building setback would not have any impact on slowing traffic on Central Street.

Based on the above, from a traffic circulation and pedestrian safety standpoint, putting the building closer to the street would seem to create more issues than it would solve and is accordingly not recommended for this site. We hope the above adequately address the comments of the traffic peer reviewer and provide appropriate commitments to mitigate the traffic impacts of the project.

Sincerely,

Ron Müller & Associates



Ronald Müller, P.E.
Principal

Attachments

Ron Müller & Associates

Traffic Engineering and Consulting Services

E-W Street: Central Street

N-S Street: Fruit Street

File Name : 19046 Central St-Fruit St AM

Site Code : 19046

Start Date : 9/10/2020

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Groups Printed- Cars - Trucks

Start Time	Fruit Street From North				Central Street From East				Central Street From West				Int. Total
	Left	Right	Peds	App. Total	Thru	Right	Peds	App. Total	Left	Thru	Peds	App. Total	
07:00 AM	0	3	0	3	40	3	0	43	6	36	0	42	88
07:15 AM	3	6	0	9	47	5	0	52	5	49	0	54	115
07:30 AM	2	9	0	11	56	1	0	57	2	67	0	69	137
07:45 AM	2	6	0	8	50	3	0	53	7	72	0	79	140
Total	7	24	0	31	193	12	0	205	20	224	0	244	480
08:00 AM	1	7	0	8	57	2	0	59	8	40	0	48	115
08:15 AM	3	3	0	6	54	4	0	58	10	58	0	68	132
08:30 AM	4	5	0	9	45	4	0	49	6	31	0	37	95
08:45 AM	5	14	0	19	45	3	0	48	7	36	0	43	110
Total	13	29	0	42	201	13	0	214	31	165	0	196	452
Grand Total	20	53	0	73	394	25	0	419	51	389	0	440	932
Apprch %	27.4	72.6	0		94	6	0		11.6	88.4	0		
Total %	2.1	5.7	0	7.8	42.3	2.7	0	45	5.5	41.7	0	47.2	
Cars	18	36	0	54	374	21	0	395	42	357	0	399	848
% Cars	90	67.9	0	74	94.9	84	0	94.3	82.4	91.8	0	90.7	91
Trucks	2	17	0	19	20	4	0	24	9	32	0	41	84
% Trucks	10	32.1	0	26	5.1	16	0	5.7	17.6	8.2	0	9.3	9

E-W Street: Central Street

N-S Street: Fruit Street

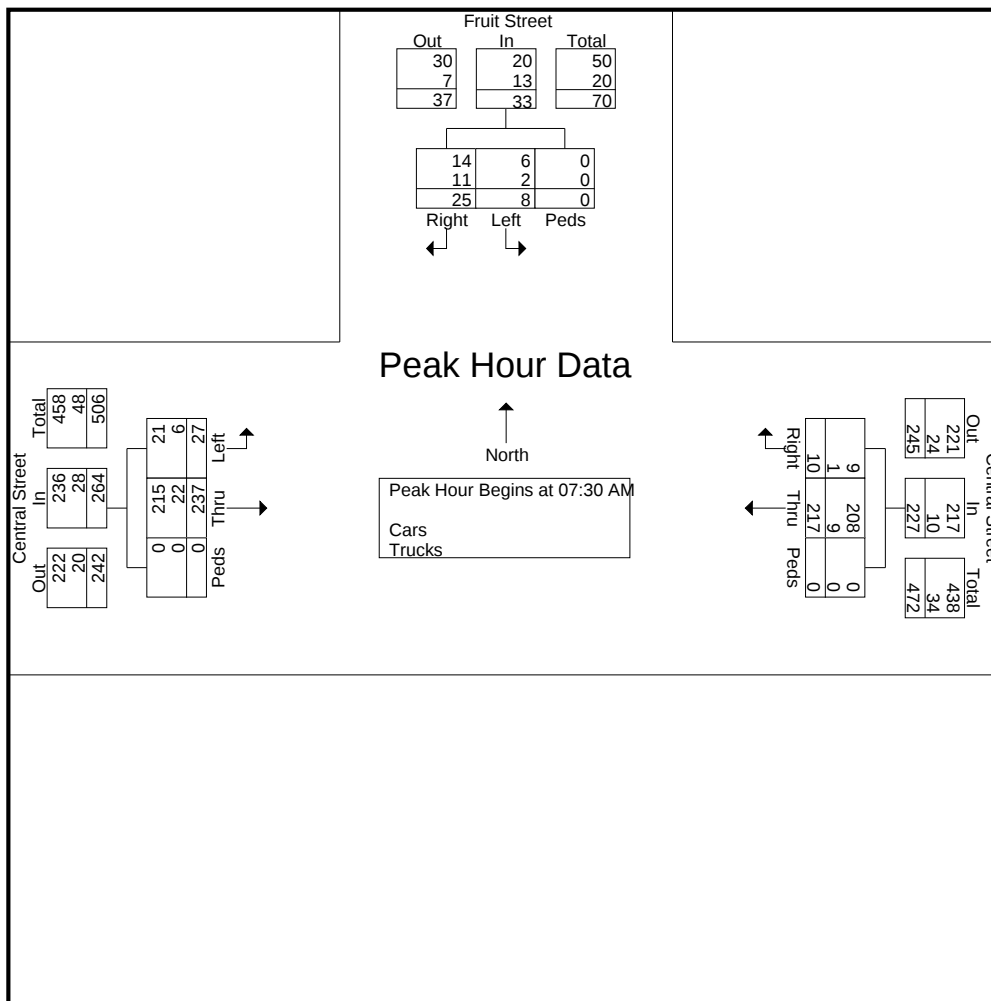
File Name : 19046 Central St-Fruit St AM

Site Code : 19046

Start Date : 9/10/2020

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	Fruit Street From North				Central Street From East				Central Street From West				
Start Time	Left	Right	Peds	App. Total	Thru	Right	Peds	App. Total	Left	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:30 AM													
07:30 AM	2	9	0	11	56	1	0	57	2	67	0	69	137
07:45 AM	2	6	0	8	50	3	0	53	7	72	0	79	140
08:00 AM	1	7	0	8	57	2	0	59	8	40	0	48	115
08:15 AM	3	3	0	6	54	4	0	58	10	58	0	68	132
Total Volume	8	25	0	33	217	10	0	227	27	237	0	264	524
% App. Total	24.2	75.8	0		95.6	4.4	0		10.2	89.8	0		
PHF	.667	.694	.000	.750	.952	.625	.000	.962	.675	.823	.000	.835	.936
Cars	6	14	0	20	208	9	0	217	21	215	0	236	473
% Cars	75.0	56.0	0	60.6	95.9	90.0	0	95.6	77.8	90.7	0	89.4	90.3
Trucks	2	11	0	13	9	1	0	10	6	22	0	28	51
% Trucks	25.0	44.0	0	39.4	4.1	10.0	0	4.4	22.2	9.3	0	10.6	9.7



Ron Müller & Associates

Traffic Engineering and Consulting Services

E-W Street: Central Street

N-S Street: Fruit Street

File Name : 19046 Central St-Fruit St PM

Site Code : 19046

Start Date : 9/9/2020

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Groups Printed- Cars - Trucks

	Fruit Street From North				Central Street From East				Central Street From West				
Start Time	Left	Right	Peds	App. Total	Thru	Right	Peds	App. Total	Left	Thru	Peds	App. Total	Int. Total
04:00 PM	3	6	0	9	65	5	3	73	11	58	0	69	151
04:15 PM	2	3	0	5	53	2	3	58	9	68	0	77	140
04:30 PM	4	15	0	19	55	5	0	60	3	69	0	72	151
04:45 PM	4	14	0	18	65	4	2	71	5	71	0	76	165
Total	13	38	0	51	238	16	8	262	28	266	0	294	607
05:00 PM	0	13	0	13	75	4	0	79	10	63	0	73	165
05:15 PM	2	5	0	7	73	7	0	80	16	63	0	79	166
05:30 PM	5	5	0	10	55	6	0	61	14	50	0	64	135
05:45 PM	3	12	0	15	44	11	0	55	15	62	0	77	147
Total	10	35	0	45	247	28	0	275	55	238	0	293	613
Grand Total	23	73	0	96	485	44	8	537	83	504	0	587	1220
Apprch %	24	76	0		90.3	8.2	1.5		14.1	85.9	0		
Total %	1.9	6	0	7.9	39.8	3.6	0.7	44	6.8	41.3	0	48.1	
Cars	21	62	0	83	468	40	8	516	77	494	0	571	1170
% Cars	91.3	84.9	0	86.5	96.5	90.9	100	96.1	92.8	98	0	97.3	95.9
Trucks	2	11	0	13	17	4	0	21	6	10	0	16	50
% Trucks	8.7	15.1	0	13.5	3.5	9.1	0	3.9	7.2	2	0	2.7	4.1

Ron Müller & Associates

Traffic Engineering and Consulting Services

E-W Street: Central Street

N-S Street: Fruit Street

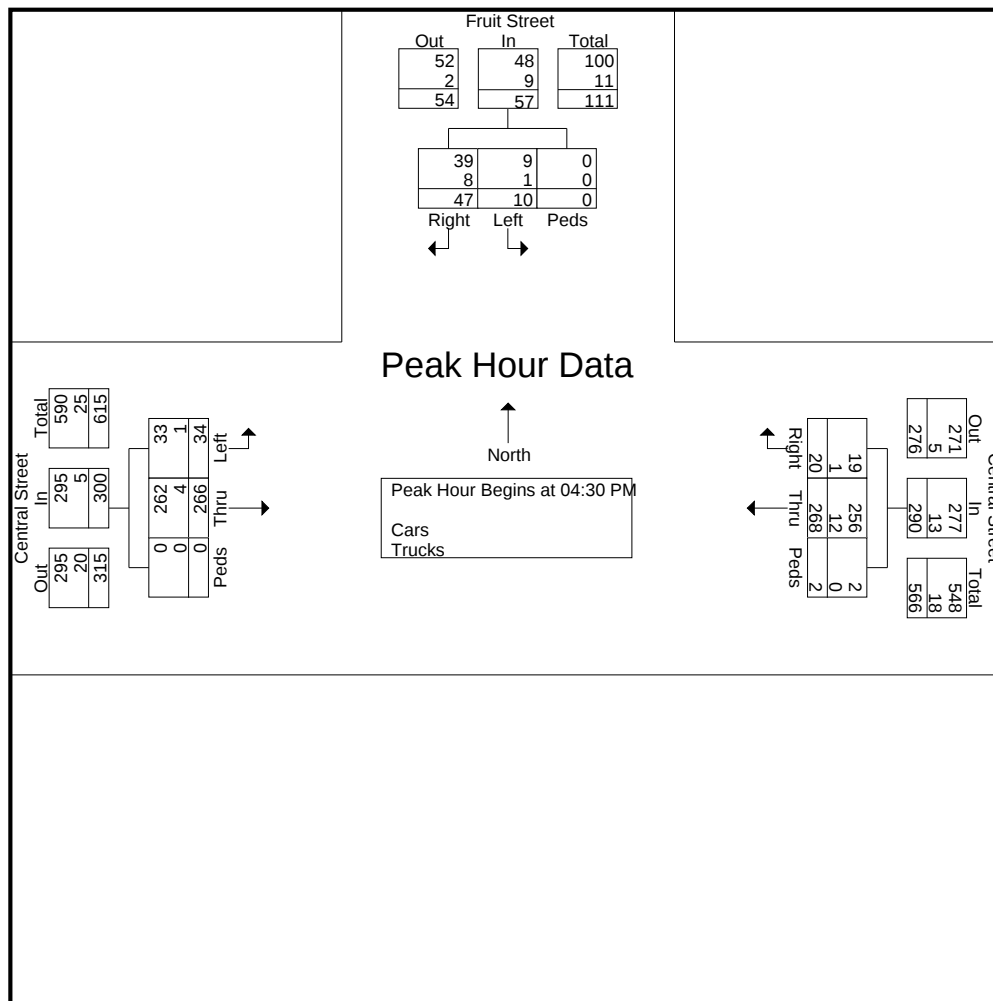
File Name : 19046 Central St-Fruit St PM

Site Code : 19046

Start Date : 9/9/2020

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	Fruit Street From North				Central Street From East				Central Street From West				
Start Time	Left	Right	Peds	App. Total	Thru	Right	Peds	App. Total	Left	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 04:30 PM													
04:30 PM	4	15	0	19	55	5	0	60	3	69	0	72	151
04:45 PM	4	14	0	18	65	4	2	71	5	71	0	76	165
05:00 PM	0	13	0	13	75	4	0	79	10	63	0	73	165
05:15 PM	2	5	0	7	73	7	0	80	16	63	0	79	166
Total Volume	10	47	0	57	268	20	2	290	34	266	0	300	647
% App. Total	17.5	82.5	0		92.4	6.9	0.7		11.3	88.7	0		
PHF	.625	.783	.000	.750	.893	.714	.250	.906	.531	.937	.000	.949	.974
Cars	9	39	0	48	256	19	2	277	33	262	0	295	620
% Cars	90.0	83.0	0	84.2	95.5	95.0	100	95.5	97.1	98.5	0	98.3	95.8
Trucks	1	8	0	9	12	1	0	13	1	4	0	5	27
% Trucks	10.0	17.0	0	15.8	4.5	5.0	0	4.5	2.9	1.5	0	1.7	4.2



Ron Müller & Associates

Traffic Engineering and Consulting Services

E-W Street: Central Street

N-S Street: Central Court

File Name : 19046 Central St-Central Ct AM

Site Code : 19046

Start Date : 9/10/2020

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Groups Printed- Cars - Trucks

Start Time	Central Street From East				Central Court From South				Central Street From West				Int. Total
	Left	Thru	Peds	App. Total	Left	Right	Peds	App. Total	Thru	Right	Peds	App. Total	
07:00 AM	0	38	0	38	2	0	0	2	37	0	0	37	77
07:15 AM	0	50	0	50	2	0	0	2	51	1	0	52	104
07:30 AM	0	56	0	56	3	0	0	3	68	1	0	69	128
07:45 AM	0	52	0	52	1	1	0	2	72	1	0	73	127
Total	0	196	0	196	8	1	0	9	228	3	0	231	436
08:00 AM	0	56	0	56	4	1	0	5	41	0	0	41	102
08:15 AM	0	52	0	52	6	0	0	6	55	4	0	59	117
08:30 AM	0	48	0	48	1	0	0	1	31	4	0	35	84
08:45 AM	0	46	0	46	3	0	0	3	43	0	0	43	92
Total	0	202	0	202	14	1	0	15	170	8	0	178	395
Grand Total	0	398	0	398	22	2	0	24	398	11	0	409	831
Apprch %	0	100	0		91.7	8.3	0		97.3	2.7	0		
Total %	0	47.9	0	47.9	2.6	0.2	0	2.9	47.9	1.3	0	49.2	
Cars	0	375	0	375	22	2	0	24	368	9	0	377	776
% Cars	0	94.2	0	94.2	100	100	0	100	92.5	81.8	0	92.2	93.4
Trucks	0	23	0	23	0	0	0	0	30	2	0	32	55
% Trucks	0	5.8	0	5.8	0	0	0	0	7.5	18.2	0	7.8	6.6

Ron Müller & Associates

Traffic Engineering and Consulting Services

File Name : 19046 Central St-Central Ct AM

Site Code : 19046

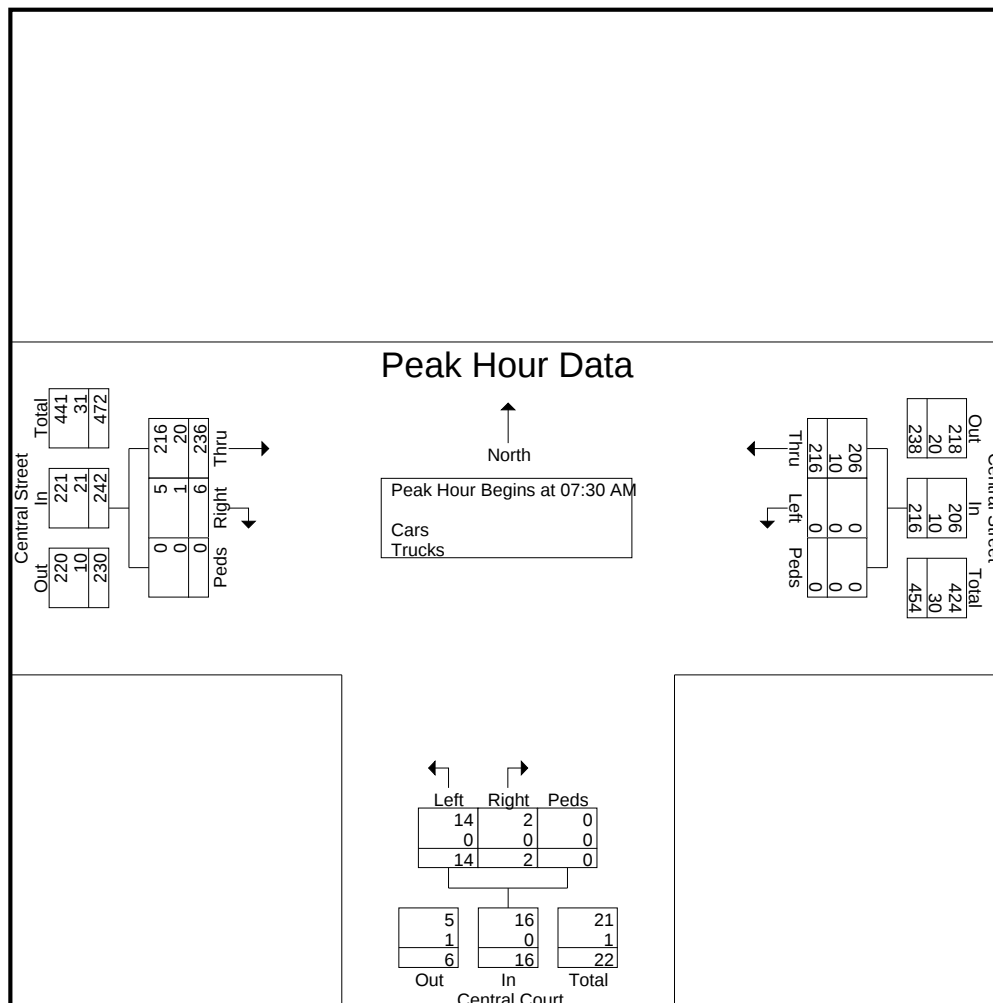
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E-W Street: Central Street

N-S Street: Central Court

	Central Street From East				Central Court From South				Central Street From West				
Start Time	Left	Thru	Peds	App. Total	Left	Right	Peds	App. Total	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:30 AM													
07:30 AM	0	56	0	56	3	0	0	3	68	1	0	69	128
07:45 AM	0	52	0	52	1	1	0	2	72	1	0	73	127
08:00 AM	0	56	0	56	4	1	0	5	41	0	0	41	102
08:15 AM	0	52	0	52	6	0	0	6	55	4	0	59	117
Total Volume	0	216	0	216	14	2	0	16	236	6	0	242	474
% App. Total	0	100	0		87.5	12.5	0		97.5	2.5	0		
PHF	.000	.964	.000	.964	.583	.500	.000	.667	.819	.375	.000	.829	.926
Cars	0	206	0	206	14	2	0	16	216	5	0	221	443
% Cars	0	95.4	0	95.4	100	100	0	100	91.5	83.3	0	91.3	93.5
Trucks	0	10	0	10	0	0	0	0	20	1	0	21	31
% Trucks	0	4.6	0	4.6	0	0	0	0	8.5	16.7	0	8.7	6.5



Ron Müller & Associates

Traffic Engineering and Consulting Services

E-W Street: Central Street

N-S Street: Central Court

File Name : 19046 Central St-Central Ct PM

Site Code : 19046

Start Date : 9/9/2020

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Groups Printed- Cars - Trucks

Start Time	Central Street From East				Central Court From South				Central Street From West				Int. Total
	Left	Thru	Peds	App. Total	Left	Right	Peds	App. Total	Thru	Right	Peds	App. Total	
04:00 PM	0	67	0	67	2	0	0	2	59	2	0	61	130
04:15 PM	3	54	0	57	1	0	0	1	69	2	0	71	129
04:30 PM	0	58	0	58	1	2	0	3	72	3	0	75	136
04:45 PM	1	69	0	70	1	2	0	3	73	1	0	74	147
Total	4	248	0	252	5	4	0	9	273	8	0	281	542
05:00 PM	1	78	0	79	2	1	1	4	60	3	0	63	146
05:15 PM	2	79	0	81	1	1	0	2	63	3	0	66	149
05:30 PM	0	60	0	60	3	1	0	4	52	2	0	54	118
05:45 PM	0	53	0	53	2	2	0	4	62	3	0	65	122
Total	3	270	0	273	8	5	1	14	237	11	0	248	535
Grand Total	7	518	0	525	13	9	1	23	510	19	0	529	1077
Apprch %	1.3	98.7	0		56.5	39.1	4.3		96.4	3.6	0		
Total %	0.6	48.1	0	48.7	1.2	0.8	0.1	2.1	47.4	1.8	0	49.1	
Cars	7	496	0	503	13	9	1	23	501	19	0	520	1046
% Cars	100	95.8	0	95.8	100	100	100	100	98.2	100	0	98.3	97.1
Trucks	0	22	0	22	0	0	0	0	9	0	0	9	31
% Trucks	0	4.2	0	4.2	0	0	0	0	1.8	0	0	1.7	2.9

Ron Müller & Associates

Traffic Engineering and Consulting Services

File Name : 19046 Central St-Central Ct PM

Site Code : 19046

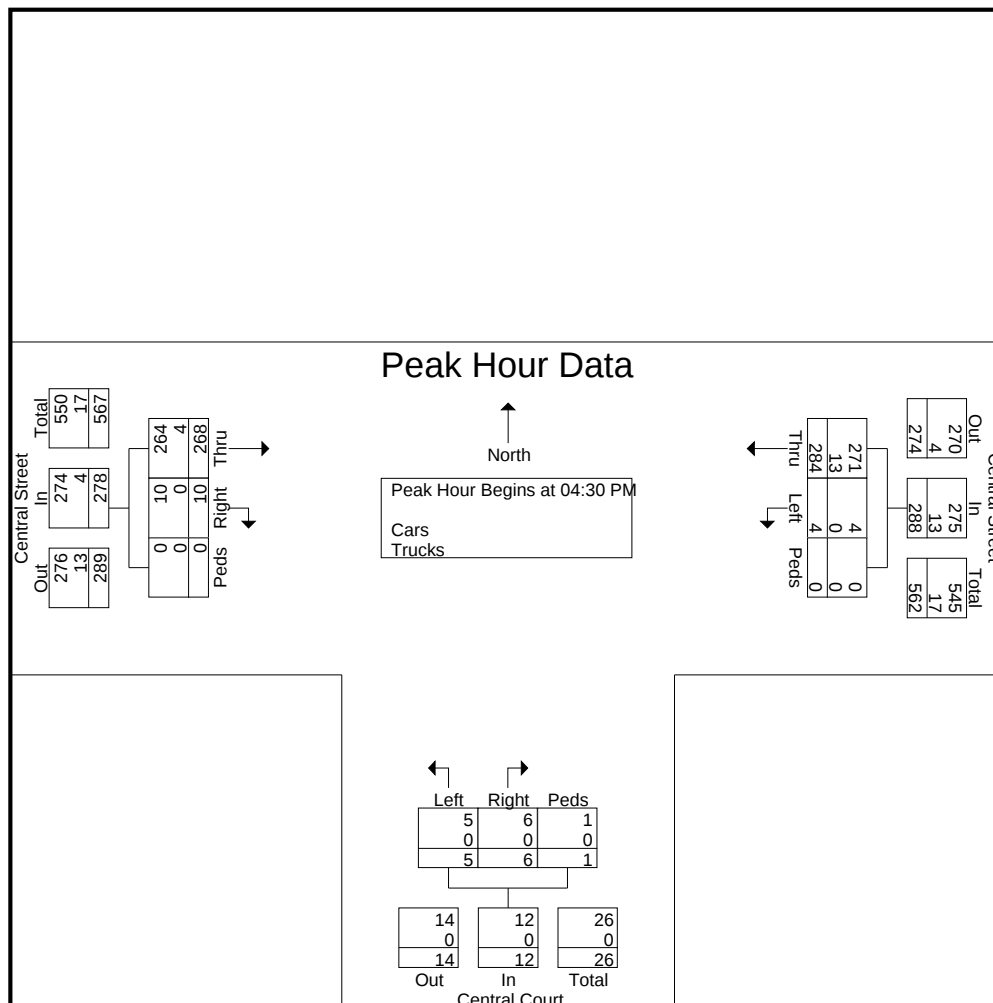
Start Date : 9/9/2020

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E-W Street: Central Street

N-S Street: Central Court

	Central Street From East				Central Court From South				Central Street From West				
Start Time	Left	Thru	Peds	App. Total	Left	Right	Peds	App. Total	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 04:30 PM													
04:30 PM	0	58	0	58	1	2	0	3	72	3	0	75	136
04:45 PM	1	69	0	70	1	2	0	3	73	1	0	74	147
05:00 PM	1	78	0	79	2	1	1	4	60	3	0	63	146
05:15 PM	2	79	0	81	1	1	0	2	63	3	0	66	149
Total Volume	4	284	0	288	5	6	1	12	268	10	0	278	578
% App. Total	1.4	98.6	0		41.7	50	8.3		96.4	3.6	0		
PHF	.500	.899	.000	.889	.625	.750	.250	.750	.918	.833	.000	.927	.970
Cars	4	271	0	275	5	6	1	12	264	10	0	274	561
% Cars	100	95.4	0	95.5	100	100	100	100	98.5	100	0	98.6	97.1
Trucks	0	13	0	13	0	0	0	0	4	0	0	4	17
% Trucks	0	4.6	0	4.5	0	0	0	0	1.5	0	0	1.4	2.9



Location : Central Street
Location : East of Fruit Street
City/State: Byfield, MA

Time	11/20/2019		11/21/2019		Annual Average (increased by 4%)		Sum	Cum.	Sept. 2020 Counts	Adjustment to Pre-COVID Conditions
	WB	EB	WB	EB	WB	EB				
12:00 AM	1	2	0	5	1	4	5			
12:15 AM	0	2	0	3	0	3	3			
12:30 AM	0	2	1	1	1	2	3			
12:45 AM	0	3	0	2	0	3	3	14		
01:00 AM	1	4	0	2	1	3	4	13		
01:15 AM	0	1	1	2	1	2	3	13		
01:30 AM	0	1	1	0	1	1	2	12		
01:45 AM	0	1	0	0	0	1	1	10		
02:00 AM	4	0	1	1	3	1	4	10		
02:15 AM	1	0	0	1	1	1	2	9		
02:30 AM	0	0	0	1	0	1	1	8		
02:45 AM	0	1	0	0	0	1	1	8		
03:00 AM	2	0	0	1	1	1	2	6		
03:15 AM	2	2	5	1	4	2	6	10		
03:30 AM	1	4	3	2	2	3	5	14		
03:45 AM	0	0	0	3	0	2	2	15		
04:00 AM	1	0	2	0	2	0	2	15		
04:15 AM	2	3	3	3	3	3	6	15		
04:30 AM	4	1	2	0	3	1	4	14		
04:45 AM	9	2	13	6	11	4	15	27		
05:00 AM	18	5	15	6	17	6	23	48		
05:15 AM	18	13	23	4	21	9	30	72		
05:30 AM	27	13	25	13	27	14	41	109		
05:45 AM	22	13	20	28	22	21	43	137		
06:00 AM	43	22	48	20	47	22	69	183		
06:15 AM	43	32	30	27	38	31	69	222		
06:30 AM	48	50	57	41	55	47	102	283		
06:45 AM	50	67	62	69	58	71	129	369		
07:00 AM	68	100	55	79	64	93	157	457		
07:15 AM	96	138	62	129	82	139	221	609		
07:30 AM	94	101	111	89	107	99	206	713		
07:45 AM	72	60	62	94	70	80	150	734		
08:00 AM	88	48	73	113	84	84	168	745	472	1.58
08:15 AM	69	62	61	74	68	71	139	663		
08:30 AM	52	52	67	55	62	56	118	575		
08:45 AM	59	52	58	65	61	61	122	547		
09:00 AM	48	36	51	52	51	46	97	476		
09:15 AM	49	30	57	53	55	43	98	435		
09:30 AM	40	42	55	45	49	45	94	411		
09:45 AM	44	31	63	40	56	37	93	382		
10:00 AM	44	42	65	33	57	39	96	381		
10:15 AM	64	35	47	36	58	37	95	378		
10:30 AM	59	44	37	29	50	38	88	372		
10:45 AM	39	31	44	47	43	41	84	363		
11:00 AM	39	27	42	41	42	35	77	344		
11:15 AM	41	37	51	39	48	40	88	337		
11:30 AM	44	35	53	45	50	42	92	341		
11:45 AM	38	43	46	40	44	43	87	344		
12:00 PM	53	39	44	38	50	40	90	357		
12:15 PM	47	42	41	35	46	40	86	355		
12:30 PM	48	42	48	39	50	42	92	355		
12:45 PM	34	43	32	51	34	49	83	351		
01:00 PM	49	27	36	44	44	37	81	342		
01:15 PM	47	39	47	41	49	42	91	347		
01:30 PM	41	41	54	36	49	40	89	344		
01:45 PM	52	66	45	64	50	68	118	379		
02:00 PM	52	50	54	56	55	55	110	408		
02:15 PM	110	66	101	73	110	72	182	499		
02:30 PM	81	56	84	46	86	53	139	549		
02:45 PM	65	58	70	64	70	63	133	564		
03:00 PM	68	83	84	71	79	80	159	613		
03:15 PM	67	64	84	77	79	73	152	583		
03:30 PM	94	69	110	59	106	67	173	617		
03:45 PM	73	70	88	73	84	74	158	642		
04:00 PM	63	87	91	70	80	82	162	645		
04:15 PM	73	78	85	60	82	72	154	647		
04:30 PM	95	62	84	68	93	68	161	635		
04:45 PM	71	65	74	62	75	66	141	618		
05:00 PM	90	76	113	60	106	71	177	633		
05:15 PM	84	65	103	70	97	70	167	646		
05:30 PM	83	71	84	83	87	80	167	652	567	1.15
05:45 PM	53	70	56	80	57	78	135	646		
06:00 PM	47	57	59	63	55	62	117	586		
06:15 PM	50	46	41	47	47	48	95	514		
06:30 PM	51	60	26	54	40	59	99	446		
06:45 PM	28	48	31	57	31	55	86	397		
07:00 PM	34	23	33	49	35	37	72	352		
07:15 PM	24	32	25	42	25	38	63	320		
07:30 PM	19	36	32	65	27	53	80	301		
07:45 PM	13	32	25	29	20	32	52	267		
08:00 PM	21	33	16	34	19	35	54	249		
08:15 PM	20	25	25	40	23	34	57	243		
08:30 PM	12	32	20	30	17	32	49	212		
08:45 PM	21	17	16	31	19	25	44	204		
09:00 PM	8	20	20	20	15	21	36	186		
09:15 PM	9	18	14	33	12	27	39	168		
09:30 PM	6	13	16	20	11	17	28	147		
09:45 PM	11	12	30	17	21	15	36	139		
10:00 PM	10	10	8	13	9	12	21	124		
10:15 PM	3	8	8	9	6	9	15	100		
10:30 PM	2	2	5	9	4	6	10	82		
10:45 PM	6	4	16	8	11	6	17	63		
11:00 PM	3	8	5	7	4	8	12	54		
11:15 PM	5	11	6	7	6	9	15	54		
11:30 PM	0	5	1	5	1	5	6	50		
11:45 PM	1	3	3	7	2	5	7	40		

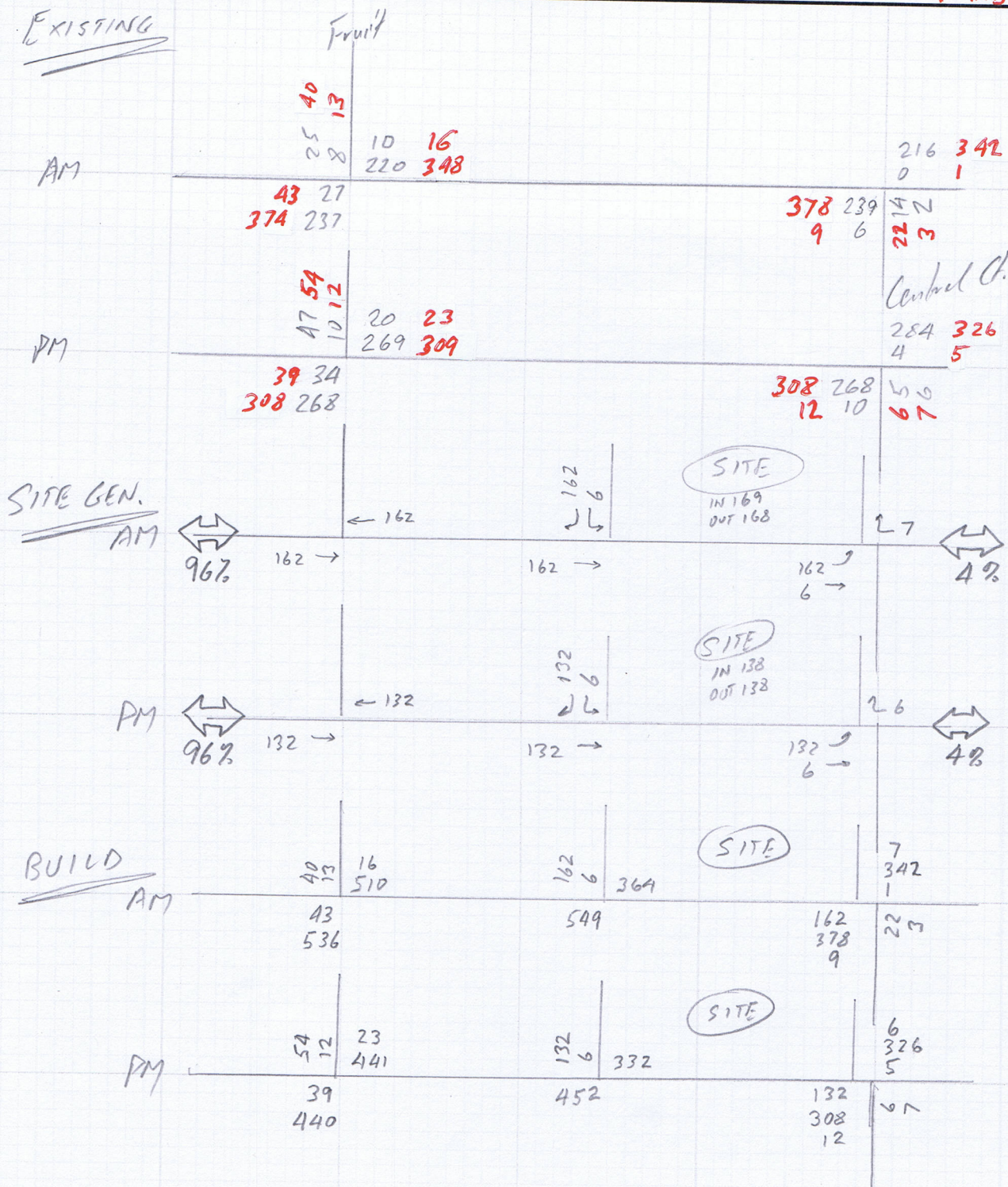
Traffic Engineering and Consulting Services
56 Teresa Road, Hopkinton, MA 01748
Tel. (508) 395-1576

Sheet:

9/10/20

Of:

$xx = \text{Existing Balance}$ $xx = \text{Adjusted to pre-COVID conditions} \begin{pmatrix} \times 1.58 \text{ AM} \\ \times 1.15 \text{ PM} \end{pmatrix}$



Intersection

Int Delay, s/veh	1.3					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	43	374	348	16	13	40
Future Vol, veh/h	43	374	348	16	13	40
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	11	11	4	4	39	39
Mvmt Flow	46	398	370	17	14	43

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	387	0	0	869	379
Stage 1	-	-	-	379	-
Stage 2	-	-	-	490	-
Critical Hdwy	4.21	-	-	6.79	6.59
Critical Hdwy Stg 1	-	-	-	5.79	-
Critical Hdwy Stg 2	-	-	-	5.79	-
Follow-up Hdwy	2.299	-	-	3.851	3.651
Pot Cap-1 Maneuver	1124	-	-	279	593
Stage 1	-	-	-	618	-
Stage 2	-	-	-	546	-
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	1124	-	-	264	593
Mov Cap-2 Maneuver	-	-	-	264	-
Stage 1	-	-	-	585	-
Stage 2	-	-	-	546	-

Approach	EB	WB	SB
HCM Control Delay, s	0.9	0	14.1
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1124	-	-	-	454
HCM Lane V/C Ratio	0.041	-	-	-	0.124
HCM Control Delay (s)	8.3	0	-	-	14.1
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0.4

Intersection

Int Delay, s/veh 0.5

Movement EBT EBR WBL WBT NBL NBR

Lane Configurations   

Traffic Vol, veh/h 378 9 1 342 22 3

Future Vol, veh/h 378 9 1 342 22 3

Conflicting Peds, #/hr 0 0 0 0 0 0

Sign Control Free Free Free Free Stop Stop

RT Channelized - None - None - None

Storage Length - - - - 0 -

Veh in Median Storage, # 0 - - 0 0 -

Grade, % 0 - - 0 0 -

Peak Hour Factor 93 93 93 93 93 93

Heavy Vehicles, % 9 9 5 5 0 0

Mvmt Flow 406 10 1 368 24 3

Major/Minor Major1 Major2 Minor1

Conflicting Flow All 0 0 416 0 781 411

Stage 1 - - - - 411 -

Stage 2 - - - - 370 -

Critical Hdwy - - 4.15 - 6.4 6.2

Critical Hdwy Stg 1 - - - - 5.4 -

Critical Hdwy Stg 2 - - - - 5.4 -

Follow-up Hdwy - - 2.245 - 3.5 3.3

Pot Cap-1 Maneuver - - 1127 - 366 645

Stage 1 - - - - 674 -

Stage 2 - - - - 703 -

Platoon blocked, % - - - - -

Mov Cap-1 Maneuver - - 1127 - 366 645

Mov Cap-2 Maneuver - - - - 366 -

Stage 1 - - - - 674 -

Stage 2 - - - - 702 -

Approach EB WB NB

HCM Control Delay, s 0 0 15

HCM LOS C

Minor Lane/Major Mvmt NBLn1 EBT EBR WBL WBT

Capacity (veh/h) 386 - - 1127 -

HCM Lane V/C Ratio 0.07 - - 0.001 -

HCM Control Delay (s) 15 - - 8.2 0

HCM Lane LOS C - - A A

HCM 95th %tile Q(veh) 0.2 - - 0 -

Queuing and Blocking Report

Baseline

09/11/2020

Intersection: 4: Central St. & Fruit St.

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	97	89
Average Queue (ft)	19	41
95th Queue (ft)	65	79
Link Distance (ft)	398	202
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: Central Ct. & Central St.

Movement	NB
Directions Served	LR
Maximum Queue (ft)	18
Average Queue (ft)	9
95th Queue (ft)	23
Link Distance (ft)	258
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Network Summary

Network wide Queuing Penalty: 0

Intersection

Int Delay, s/veh	1.5					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	39	308	309	23	12	54
Future Vol, veh/h	39	308	309	23	12	54
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	5	5	16	16
Mvmt Flow	40	318	319	24	12	56

Major/Minor	Major1	Major2		Minor2	
Conflicting Flow All	343	0	-	0	729
Stage 1	-	-	-	-	331
Stage 2	-	-	-	-	398
Critical Hdwy	4.12	-	-	-	6.56
Critical Hdwy Stg 1	-	-	-	-	5.56
Critical Hdwy Stg 2	-	-	-	-	5.56
Follow-up Hdwy	2.218	-	-	-	3.644
Pot Cap-1 Maneuver	1216	-	-	-	370
Stage 1	-	-	-	-	697
Stage 2	-	-	-	-	649
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1216	-	-	-	355
Mov Cap-2 Maneuver	-	-	-	-	355
Stage 1	-	-	-	-	669
Stage 2	-	-	-	-	649

Approach	EB	WB	SB
HCM Control Delay, s	0.9	0	12
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1216	-	-	-	583
HCM Lane V/C Ratio	0.033	-	-	-	0.117
HCM Control Delay (s)	8.1	0	-	-	12
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0.4

Intersection

Int Delay, s/veh 0.3

Movement EBT EBR WBL WBT NBL NBR

Lane Configurations   

Traffic Vol, veh/h 308 12 5 326 6 7

Future Vol, veh/h 308 12 5 326 6 7

Conflicting Peds, #/hr 0 0 0 0 0 0

Sign Control Free Free Free Free Stop Stop

RT Channelized - None - None - None

Storage Length - - - - 0 -

Veh in Median Storage, # 0 - - 0 0 -

Grade, % 0 - - 0 0 -

Peak Hour Factor 97 97 97 97 97 97

Heavy Vehicles, % 2 2 5 5 0 0

Mvmt Flow 318 12 5 336 6 7

Major/Minor Major1 Major2 Minor1

Conflicting Flow All 0 0 330 0 670 324

Stage 1 - - - - 324 -

Stage 2 - - - - 346 -

Critical Hdwy - - 4.15 - 6.4 6.2

Critical Hdwy Stg 1 - - - - 5.4 -

Critical Hdwy Stg 2 - - - - 5.4 -

Follow-up Hdwy - - 2.245 - 3.5 3.3

Pot Cap-1 Maneuver - - 1213 - 425 722

Stage 1 - - - - 738 -

Stage 2 - - - - 721 -

Platoon blocked, % - - - - -

Mov Cap-1 Maneuver - - 1213 - 423 722

Mov Cap-2 Maneuver - - - - 423 -

Stage 1 - - - - 738 -

Stage 2 - - - - 717 -

Approach EB WB NB

HCM Control Delay, s 0 0.1 11.8

HCM LOS B

Minor Lane/Major Mvmt NBLn1 EBT EBR WBL WBT

Capacity (veh/h) 544 - - 1213 -

HCM Lane V/C Ratio 0.025 - - 0.004 -

HCM Control Delay (s) 11.8 - - 8 0

HCM Lane LOS B - - A A

HCM 95th %tile Q(veh) 0.1 - - 0 -

Queuing and Blocking Report

Existing PM

09/11/2020

Intersection: 4: Central St. & Fruit St.

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	67	80
Average Queue (ft)	21	32
95th Queue (ft)	55	63
Link Distance (ft)	398	202
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: Central Ct. & Central St.

Movement	NB
Directions Served	LR
Maximum Queue (ft)	18
Average Queue (ft)	2
95th Queue (ft)	12
Link Distance (ft)	259
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Network Summary

Network wide Queuing Penalty: 0

Intersection

Int Delay, s/veh 1.2

Movement EBL EBT WBT WBR SBL SBR

Lane Configurations

Traffic Vol, veh/h 43 536 510 16 13 40

Future Vol, veh/h 43 536 510 16 13 40

Conflicting Peds, #/hr 0 0 0 0 0 0

Sign Control Free Free Free Free Stop Stop

RT Channelized - None - None - None

Storage Length - - - - 0 -

Veh in Median Storage, # - 0 0 - 0 -

Grade, % - 0 0 - 0 -

Peak Hour Factor 94 94 94 94 94 94

Heavy Vehicles, % 11 11 4 4 39 39

Mvmt Flow 46 570 543 17 14 43

Major/Minor Major1 Major2 Minor2

Conflicting Flow All 560 0 - 0 1214 552

Stage 1 - - - - 552 -

Stage 2 - - - - 662 -

Critical Hdwy 4.21 - - - 6.79 6.59

Critical Hdwy Stg 1 - - - - 5.79 -

Critical Hdwy Stg 2 - - - - 5.79 -

Follow-up Hdwy 2.299 - - - 3.851 3.651

Pot Cap-1 Maneuver 968 - - - 169 469

Stage 1 - - - - 509 -

Stage 2 - - - - 450 -

Platoon blocked, % - - - -

Mov Cap-1 Maneuver 968 - - - 157 469

Mov Cap-2 Maneuver - - - - 157 -

Stage 1 - - - - 473 -

Stage 2 - - - - 450 -

Approach EB WB SB

HCM Control Delay, s 0.7 0 18.9

HCM LOS C

Minor Lane/Major Mvmt EBL EBT WBT WBR SBLn1

Capacity (veh/h) 968 - - - 315

HCM Lane V/C Ratio 0.047 - - - 0.179

HCM Control Delay (s) 8.9 0 - - 18.9

HCM Lane LOS A A - - C

HCM 95th %tile Q(veh) 0.1 - - - 0.6

Intersection

Int Delay, s/veh	2.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	162	378	9	1	342	7	22	0	3	0	0	0
Future Vol, veh/h	162	378	9	1	342	7	22	0	3	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	25	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	-	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	92	93	93	93	93
Heavy Vehicles, %	0	9	0	0	5	0	2	0	2	0	0	0
Mvmt Flow	174	406	10	1	368	8	24	0	3	0	0	0

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	376	0	0	416	0	0	1133	1137	411
Stage 1	-	-	-	-	-	-	759	759	-
Stage 2	-	-	-	-	-	-	374	378	-
Critical Hdwy	4.1	-	-	4.1	-	-	6.42	6.5	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	5.42	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.42	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.518	4	3.318
Pot Cap-1 Maneuver	1194	-	-	1154	-	-	224	203	641
Stage 1	-	-	-	-	-	-	462	418	-
Stage 2	-	-	-	-	-	-	696	619	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1194	-	-	1154	-	-	191	0	641
Mov Cap-2 Maneuver	-	-	-	-	-	-	191	0	-
Stage 1	-	-	-	-	-	-	395	0	-
Stage 2	-	-	-	-	-	-	695	0	-

Approach	EB	WB	NB
HCM Control Delay, s	2.5	0	24.8
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR
Capacity (veh/h)	209	1194	-	-	1154	-	-
HCM Lane V/C Ratio	0.129	0.146	-	-	0.001	-	-
HCM Control Delay (s)	24.8	8.5	-	-	8.1	0	-
HCM Lane LOS	C	A	-	-	A	A	-
HCM 95th %tile Q(veh)	0.4	0.5	-	-	0	-	-

Intersection

Int Delay, s/veh

2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
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Lane Configurations

Traffic Vol, veh/h	0	549	364	0	6	162
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Future Vol, veh/h	0	549	364	0	6	162
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Conflicting Peds, #/hr	0	0	0	0	0	0
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Sign Control	Free	Free	Free	Free	Stop	Stop
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RT Channelized	-	None	-	None	-	None
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Storage Length	-	-	-	-	0	-
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Veh in Median Storage, #	-	0	0	-	0	-
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Grade, %	-	0	0	-	0	-
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Peak Hour Factor	94	94	94	94	94	94
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Heavy Vehicles, %	0	11	4	0	0	0
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Mvmt Flow	0	584	387	0	6	172
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Major/Minor	Major1	Major2	Minor2
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Conflicting Flow All	-	0	0	971	387
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Stage 1	-	-	-	387	-
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Stage 2	-	-	-	584	-
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Critical Hdwy	-	-	-	6.4	6.2
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Critical Hdwy Stg 1	-	-	-	5.4	-
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Critical Hdwy Stg 2	-	-	-	5.4	-
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Follow-up Hdwy	-	-	-	3.5	3.3
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Pot Cap-1 Maneuver	0	-	-	0	283	665
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Stage 1	0	-	-	0	691	-
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Stage 2	0	-	-	0	561	-
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Platoon blocked, %	-	-	-	-	-	-
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Mov Cap-1 Maneuver	-	-	-	-	283	665
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Mov Cap-2 Maneuver	-	-	-	-	283	-
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Stage 1	-	-	-	-	691	-
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Stage 2	-	-	-	-	561	-
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Approach	EB	WB	SB
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HCM Control Delay, s	0	0	12.9
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HCM LOS			B
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Minor Lane/Major Mvmt	EBT	WBT	SBLn1
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Capacity (veh/h)	-	-	634
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HCM Lane V/C Ratio	-	-	0.282
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HCM Control Delay (s)	-	-	12.9
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HCM Lane LOS	-	-	B
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HCM 95th %tile Q(veh)	-	-	1.2
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Queuing and Blocking Report

Build AM

09/17/2020

Intersection: 4: Central St. & Fruit St.

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (ft)	78	54	119
Average Queue (ft)	18	4	43
95th Queue (ft)	58	25	88
Link Distance (ft)	398	74	201
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 5: Central Ct./Entrance Dr. & Central St.

Movement	EB	NB
Directions Served	L	LTR
Maximum Queue (ft)	46	42
Average Queue (ft)	20	11
95th Queue (ft)	40	31
Link Distance (ft)		260
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	25	
Storage Blk Time (%)	5	
Queuing Penalty (veh)	20	

Intersection: 8: Exit Dr.

Movement	WB	SB
Directions Served	T	LR
Maximum Queue (ft)	30	78
Average Queue (ft)	1	43
95th Queue (ft)	10	65
Link Distance (ft)	83	153
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 20

Intersection

Int Delay, s/veh 1.3

Movement EBL EBT WBT WBR SBL SBR

Lane Configurations

Traffic Vol, veh/h 39 440 441 23 12 54

Future Vol, veh/h 39 440 441 23 12 54

Conflicting Peds, #/hr 0 0 0 0 0 0

Sign Control Free Free Free Free Stop Stop

RT Channelized - None - None - None

Storage Length - - - - 0 -

Veh in Median Storage, # - 0 0 - 0 -

Grade, % - 0 0 - 0 -

Peak Hour Factor 97 97 97 97 97 97

Heavy Vehicles, % 2 2 5 5 16 16

Mvmt Flow 40 454 455 24 12 56

Major/Minor Major1 Major2 Minor2

Conflicting Flow All 479 0 - 0 1001 467

Stage 1 - - - - 467 -

Stage 2 - - - - 534 -

Critical Hdwy 4.12 - - - 6.56 6.36

Critical Hdwy Stg 1 - - - - 5.56 -

Critical Hdwy Stg 2 - - - - 5.56 -

Follow-up Hdwy 2.218 - - - 3.644 3.444

Pot Cap-1 Maneuver 1083 - - - 254 568

Stage 1 - - - - 603 -

Stage 2 - - - - 561 -

Platoon blocked, % - - - -

Mov Cap-1 Maneuver 1083 - - - 242 568

Mov Cap-2 Maneuver - - - - 242 -

Stage 1 - - - - 573 -

Stage 2 - - - - 561 -

Approach EB WB SB

HCM Control Delay, s 0.7 0 14.3

HCM LOS B

Minor Lane/Major Mvmt EBL EBT WBT WBR SBLn1

Capacity (veh/h) 1083 - - - 456

HCM Lane V/C Ratio 0.037 - - - 0.149

HCM Control Delay (s) 8.5 0 - - 14.3

HCM Lane LOS A A - - B

HCM 95th %tile Q(veh) 0.1 - - - 0.5

Intersection

Int Delay, s/veh	1.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	132	308	12	5	326	6	6	0	7	0	0	0
Future Vol, veh/h	132	308	12	5	326	6	6	0	7	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	25	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	-	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	97	97	97	97	97	97	97	97	97	97	97	97
Heavy Vehicles, %	0	2	2	5	5	0	0	0	0	0	0	0
Mvmt Flow	136	318	12	5	336	6	6	0	7	0	0	0

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	342	0	0	330	0	0	945	948	324
Stage 1	-	-	-	-	-	-	596	596	-
Stage 2	-	-	-	-	-	-	349	352	-
Critical Hdwy	4.1	-	-	4.15	-	-	6.4	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	5.4	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.4	5.5	-
Follow-up Hdwy	2.2	-	-	2.245	-	-	3.5	4	3.3
Pot Cap-1 Maneuver	1228	-	-	1213	-	-	293	263	722
Stage 1	-	-	-	-	-	-	554	495	-
Stage 2	-	-	-	-	-	-	719	635	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1228	-	-	1213	-	-	259	0	722
Mov Cap-2 Maneuver	-	-	-	-	-	-	259	0	-
Stage 1	-	-	-	-	-	-	493	0	-
Stage 2	-	-	-	-	-	-	715	0	-

Approach	EB	WB	NB
HCM Control Delay, s	2.4	0.1	14.4
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR
Capacity (veh/h)	396	1228	-	-	1213	-	-
HCM Lane V/C Ratio	0.034	0.111	-	-	0.004	-	-
HCM Control Delay (s)	14.4	8.3	-	-	8	0	-
HCM Lane LOS	B	A	-	-	A	A	-
HCM 95th %tile Q(veh)	0.1	0.4	-	-	0	-	-

Intersection

Int Delay, s/veh 1.8

Movement EBL EBT WBT WBR SBL SBR

Lane Configurations 

Traffic Vol, veh/h 0 452 332 0 6 132

Future Vol, veh/h 0 452 332 0 6 132

Conflicting Peds, #/hr 0 0 0 0 0 0

Sign Control Free Free Free Free Stop Stop

RT Channelized - None - None - None

Storage Length - - - - 0 -

Veh in Median Storage, # - 0 0 - 0 -

Grade, % - 0 0 - 0 -

Peak Hour Factor 97 97 97 97 97 97

Heavy Vehicles, % 0 2 5 0 0 0

Mvmt Flow 0 466 342 0 6 136

Major/Minor Major1 Major2 Minor2

Conflicting Flow All - 0 - 0 808 342

Stage 1 - - - - 342 -

Stage 2 - - - - 466 -

Critical Hdwy - - - - 6.4 6.2

Critical Hdwy Stg 1 - - - - 5.4 -

Critical Hdwy Stg 2 - - - - 5.4 -

Follow-up Hdwy - - - - 3.5 3.3

Pot Cap-1 Maneuver 0 - - 0 353 705

Stage 1 0 - - 0 724 -

Stage 2 0 - - 0 636 -

Platoon blocked, % - -

Mov Cap-1 Maneuver - - - - 353 705

Mov Cap-2 Maneuver - - - - 353 -

Stage 1 - - - - 724 -

Stage 2 - - - - 636 -

Approach EB WB SB

HCM Control Delay, s 0 0 11.7

HCM LOS B

Minor Lane/Major Mvmt EBT WBT SBLn1

Capacity (veh/h) - - 676

HCM Lane V/C Ratio - - 0.21

HCM Control Delay (s) - - 11.7

HCM Lane LOS - - B

HCM 95th %tile Q(veh) - - 0.8

Queuing and Blocking Report

Build PM

09/17/2020

Intersection: 4: Central St. & Fruit St.

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (ft)	99	53	95
Average Queue (ft)	24	4	44
95th Queue (ft)	76	25	78
Link Distance (ft)	398	74	201
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 5: Central Ct./Entrance Dr. & Central St.

Movement	EB	NB
Directions Served	L	LTR
Maximum Queue (ft)	40	20
Average Queue (ft)	17	7
95th Queue (ft)	34	22
Link Distance (ft)		260
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	25	
Storage Blk Time (%)	3	
Queuing Penalty (veh)	11	

Intersection: 8: Exit Dr.

Movement	SB
Directions Served	LR
Maximum Queue (ft)	74
Average Queue (ft)	36
95th Queue (ft)	53
Link Distance (ft)	153
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Network Summary

Network wide Queuing Penalty: 11

Trip Rates for Sites Containing: Convenience Store, Gasoline Pumps, and a Donut Shop with Drive-Through Window

Average Vehicle Trips Ends vs. Number of Vehicle Fueling Positions (vfps)

Proposed Development vfps: 12

Peak Hour/Direction	Dec-98 Plymouth, MA ^a	Mar-98 Manchester, NH ^b	Jun-00 W. Bridgewater, MA ^c	Sep-00 Worcester, MA ^d	Mar-01 W. Bridgewater, MA ^c	Mar-01 Worcester, MA ^d	May-01 Londonderry, NH ^e	Sep-10 Kingston, MA ^f	Feb-13 Spencer, MA ^g	Weighted Empirical Data Average	Proposed Site
Weekday AM:											
Enter	14.30	--	13.13	14.25	11.50	16.50	14.75	16.58	13.25	14.45	173
Exit	14.20	--	12.50	14.38	11.25	16.63	12.75	15.83	13.00	13.82	166
Total	28.50	--	25.63	28.63	22.75	33.13	27.50	32.41	26.25	28.27	339
Weekday PM:											
Enter	9.70	12.80	8.88	12.00	9.88	12.13	8.75	8.42	9.88	10.09	121
Exit	8.30	14.10	9.38	10.13	9.25	10.00	6.81	7.42	10.00	9.23	111
Total	18.00	26.90	18.26	22.13	19.13	22.13	15.56	15.84	19.88	19.32	232
Saturday Midday:											
Enter	12.10	16.50	11.88	12.50	--	--	7.88	--	11.38	11.63	140
Exit	12.40	15.90	11.88	11.88	--	--	7.56	--	11.88	11.48	138
Total	24.50	32.40	23.76	24.38	--	--	15.44	--	23.26	23.11	277

^aContains a Gibbs station with 10 vfps, a 2,000 sf convenience store, and a Honey Dew Donuts with drive-through window located on Route 44 in Plymouth, MA.

^bContains a CITGO station with 10 vfps, a convenience store, and a Dunkin' Donuts with drive-through window located on Brown Avenue in Manchester, NH.

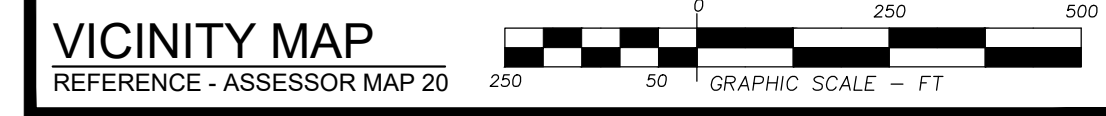
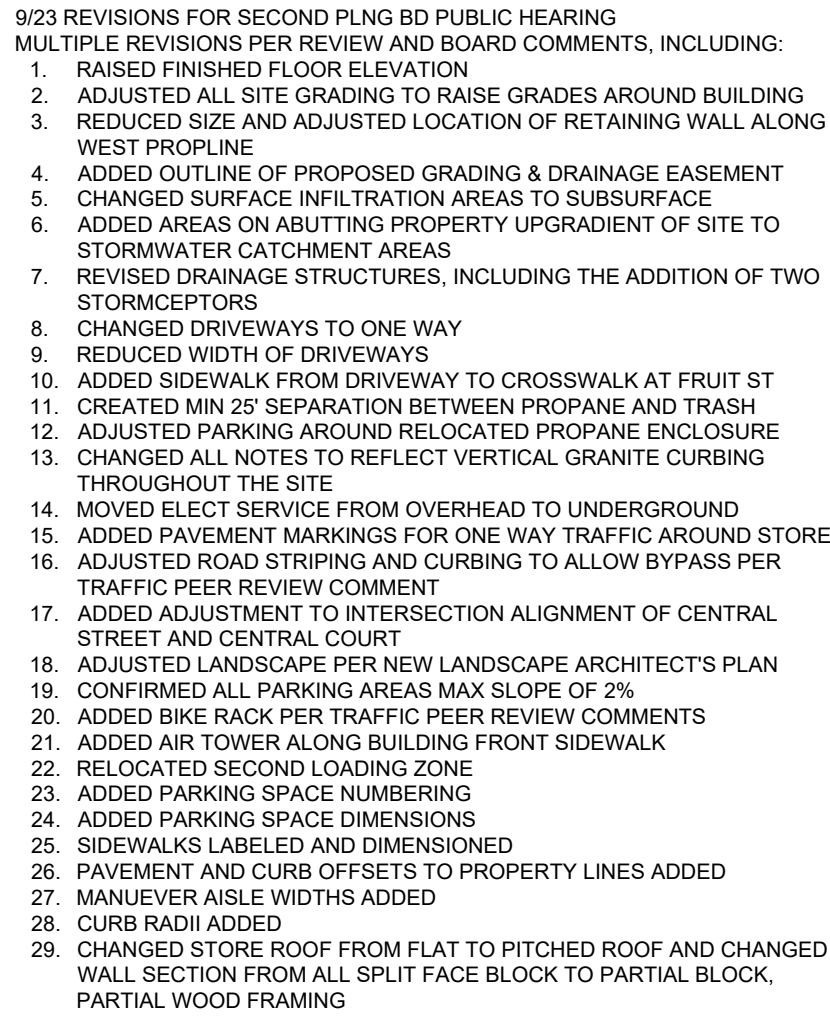
^cContains a Shell station with 8 vfps, a 1,000 sf convenience store, a Dunkin' Donuts with drive-through window, and a car wash located on Route 106 in West Bridgewater, MA.

^dContains a Mobil station with 8 vfps, a 2,981 sf convenience store, a Honey Dew Donuts with drive-through window, and a D'Angelo's located on Route 20 in Worcester, MA.

^eContains a Sunoco station with 16 vfps, a 3,422 sf convenience store, a Dunkin' Donuts with drive-through window, a truck parking area, and an ATM located on Route 28 in Londonderry, NH.

^fContains a Gulf station with 12 vfps, a 1,200 sf convenience store and a Dunkin' Donuts with drive-through window on Route 3A/53 in Kingston, MA.

^gContains a Sunoco station with 8 vfps, a 4,000 sf convenience store with liquor sales, a Dunkin' Donuts with drive-through window, and an 820 sf second floor office (not used in calcs.) located on Route 9 in Spencer, MA.



PROPOSED USES:
RETAIL MOTOR FUEL - PERMITTED BY SPECIAL PERMIT
RETAIL CONVENIENCE STORE - PERMITTED
FOOD SERVICE - PERMITTED BY SPECIAL PERMIT

PARKING SPACES (MIN 9.0'x18') -RETAIL - 3ea / 1,000 * 3,000 GFA = 9 -FOOD - 0.3ea / 12 SEATS = 4	13	4	18	NONE
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1. THE GENERAL PURPOSE OF THIS WORK IS TO REMOVE THE EXISTING RESIDENTIAL USE AND IMPROVEMENTS AND CONSTRUCT A NEW GAS STATION AND CONVENIENCE STORE WITH DRIVE-THRU
2. THE PROSPECTIVE PROPERTY OWNER WILL OBTAIN ANY APPLICABLE BOARD AND STATE APPROVALS AND GENERAL BUILDING PERMIT. THE CONTRACTOR WILL BE RESPONSIBLE FOR PERMITS FROM THE LOCAL FIRE MARSHALL'S OFFICE AND TRADE OR BUILDING PERMITS FROM THE LOCAL DIG AND ERECTION PERMITS DIVISIONS AND PROTECTION REQUIREMENTS.
3. THE CONTRACTOR SHALL CONTACT DIG-SAFE OFFICE TO ANY CONSTRUCTION EXCAVATION (811 IN MA)
4. PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL FIELD VERIFY:
 - 4.1. PROPERTY BOUNDARIES, EASEMENTS, AND RIGHT OF WAYS.
 - 4.2. EXISTG STRUCTURES, BUILDINGS, AND DRIVEWAYS
 - 4.3. LOCATIONS, SIZES, DEPTHS AND TYPES OF EXISTING PIPING, STRUCTURES, TANKS, ETC.
 - 4.4. ALL EXISTD AND PROPOSED CRITICAL ELEVATIONS
5. WHERE CONFLICTS ARISE BETWEEN THE FIELD CONDITIONS & PROPOSED CONSTRUCTION, OR THE CONTRACTOR HAS ANY CONCERN BETWEEN THE FIELD REGMENTS AND PROPOSED PLANS, THE CONTRACTOR SHALL NOTIFY OWNER'S REP PRIOR TO CONTINUANCE OF THE WORK.
6. PROPOSED WORK INCLUDES:
 - 6.1. PREP SITE PER ANY CONDITIONS OF SITE APPROVALS FROM ZONING, PLANNING, CONSERVATION COMMISSION, OR ANY OTHER APPLICABLE BODY
 - 6.2. RAZE AND REMOVE ALL EXISTING IMPROVEMENTS
 - 6.3. REPLACE ALL UTILITIES AND CONDUITS TO NEW WATER/WASTE MANAGEMENT STRUCTURES
 - 6.4. INSTALL NEW UNDERGROUND STORAGE TANKS
 - 6.5. CONSTRUCT NEW STORE, GAS STATION ISLANDS & CANOPIES
 - 6.6. INSTALL PAVEMENT & CURBING INCLUDING DRIVEWAYS, MATCH GRADE ALONG ALL PROP. LINES
 - 6.7. INSTALL SIGNAGE (ANY SIGNAGE APPROVALS)
 - 6.8. INSTALL LANDSCAPING AND FENCING PER APPROVED SITE PLAN AS WELL AS SCREENED TRASH ENCLOSURE

[illegible]