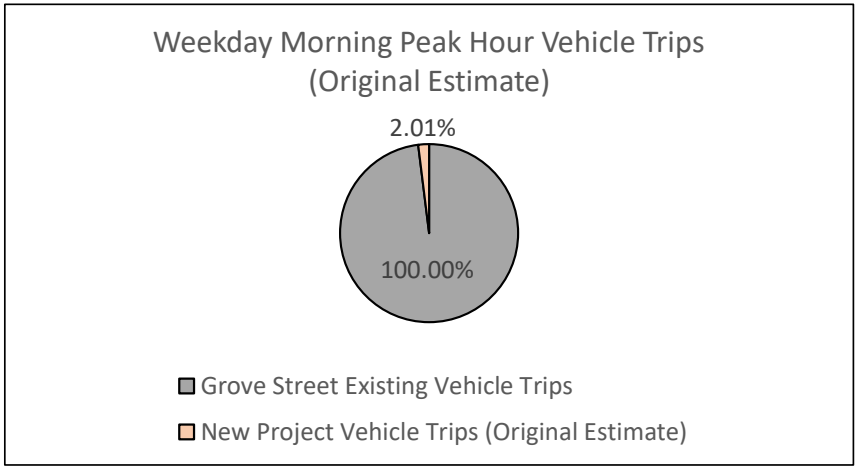
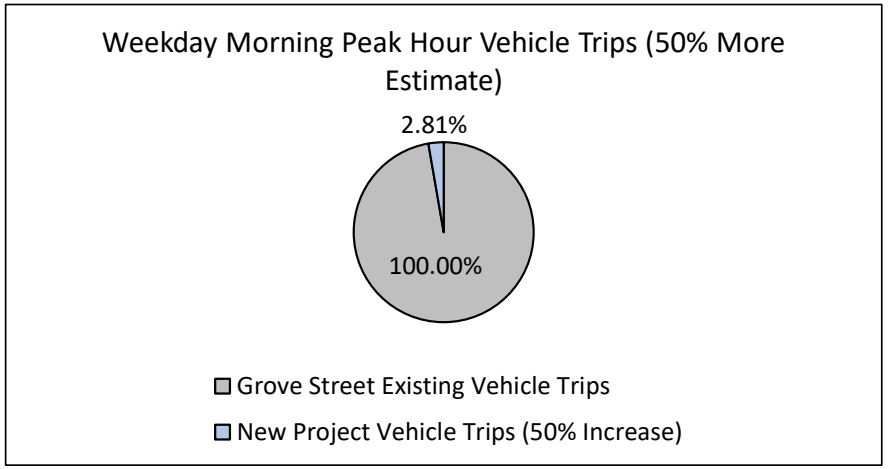
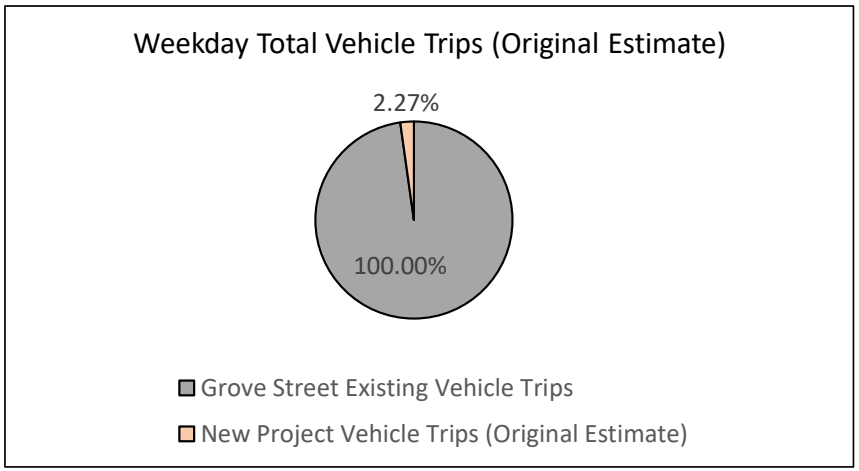
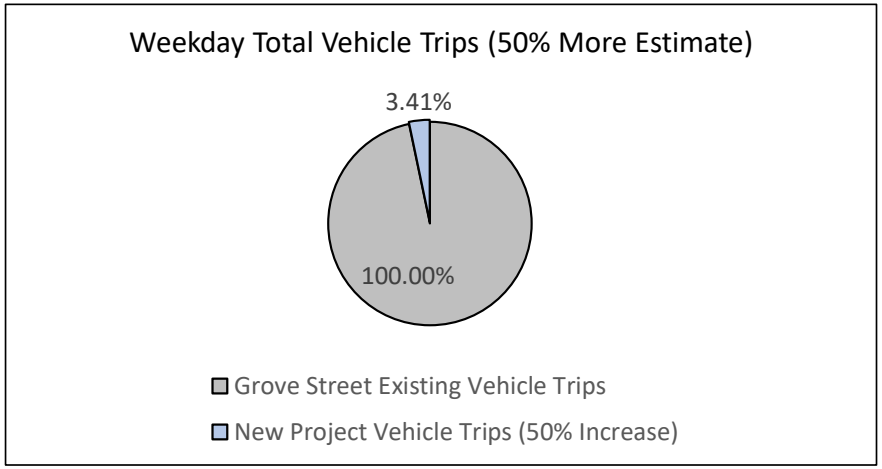
176-210 Grove Street - Revised Traffic Study Analysis (Traffic Estimate Increased by 50%)

	Grove Street (North of Old Grove Street) Existing Vehicles	New Project Vehicle Trips North of Old Grove Street (Original Estimate)	Percent of Existing	New Project Vehicle Trips North of Old Grove Street (50% Increase)	Percent of Existing
Weekday Morning Peak Hour	748	15	2.01%	21	2.81%
Weekday Evening Peak Hour	777	17	2.19%	25	3.22%
Weekday Total Vehicle Trips	6,866	156	2.27%	234	3.41%









MEMORANDUM

TO:	Levi Reilly Principal, Director of Development Marcus Partners, Inc. 260 Franklin Street, Suite 620 Boston, MA - 02110	**FROM:**	Mr. F. Giles Ham, P.E Vanasse & Associates, Inc. 35 New England Business Center Drive Suite 140 Andover, MA 01810-1066
DATE:	July 7, 2020	**RE:**	8515
SUBJECT:	Trip Generation Sensitive Analysis Proposed Warehouse/Distribution Building 176-210 Grove Street - Franklin, Massachusetts		

Vanasse & Associates, Inc. (VAI) has prepared this Technical Memorandum in order to address comments raised by the Town of Franklin Planning Board associated with a proposed Warehouse/Distribution building to be located at 176-210 Grove Street in Franklin, Massachusetts (the "Project"). Specifically, the Planning Board requested a sensitive analysis with respect to a 50% increase in the projected trip generation as presented in the February 2020 *Transportation Impact Assessment* (TIA). ***Based upon the analysis presented below a 50% increase in the projected vehicle trip generation will have no impact on operating conditions and the February 2020 TIA findings and recommendations remain valid.***

PROJECT-GENERATED TRAFFIC

The Project, consistent with the February 2020 TIA, entails the development of a proposed 150,000 sf warehouse/distribution building. In the TIA, trip-generation statistics published by the Institute of Transportation Engineers (ITE) for LUC 150, *Warehousing* were used to estimate the anticipated traffic characteristics. Trip generation calculations were performed for a typical weekday, as well as the weekday morning and weekday evening peak hours, the critical time periods for project-related traffic activity.

In order to address the concerns stated by the Planning Board, the previous trip generation projections were increased by 50% to provide a sensitive analysis of operating conditions within the study area. A summary of the expected vehicle trip generation is summarized in Table 1.

Table 1
TRIP GENERATION SUMMARY

Time Period/ Directional Distribution	February TIA Vehicle Trips (150,000 sf)[a]	50% Increase	Total Vehicle Trips
Weekday Daily	282	142	424
Weekday Morning Peak Hour:			
Entering	20	10	30
Exiting	6	3	9
Total	26	13	39
Weekday Evening Peak Hour:			
Entering	8	4	12
Exiting	21	11	32
Total	29	15	44

[a]Based on ITE LUC 150 – Warehouse

As shown in Table 1, after applying the 50% increase to the trip generation estimates, an additional 13 vehicle trips (10 entering and 3 exiting) during the weekday morning peak-hour and an additional 15 vehicle trips (4 entering and 11 exiting) during the weekday evening peak-hour could be expected. Daily increases to the trip generation would be an additional 142 vehicle trips (71 entering and 71 exiting).

TRIP DISTRIBUTION AND ASSIGNMENT

As described in the February 2020 TIA, the directional distribution of the site-generated trips were determined based on a review of existing travel patterns at the existing site. Consistent with that report, it is expected that 55 percent of the site traffic will enter and exit from Grove Street to the north and 45 percent of the site traffic will enter and exit from the south along Grove Street. The increased weekday morning and weekday evening peak-hour traffic volumes were assigned onto the study area roadway network as shown on Figures 1 and 2. The revised 2027 Build weekday morning and weekday evening peak-hour traffic volume networks are graphically depicted on Figures 3 and 4.

TRAFFIC INCREASES

Traffic increases were calculated along Grove Street north and south of the project site. The incremental change associated with the 50% increase is depicted in Figures 5 and 6. Figure 7 summarizes the traffic increases north and south of the project site. As a result of the project and utilizing the traffic generation presented in the original TIA traffic increases estimated during the peak hour are between 11 and 17 vehicles or 1.4 and 2.1 percent. This equates to maximum of approximately 1 vehicle every 3 ½ minutes. The 50% increase in traffic will add an additional 6-8 vehicles (Figures 5 and 6). Overall, even with the 150% trip generation estimates traffic increases will range between 18 and 25 vehicles or 2.2 to 3.0 percent.

These traffic increases are relatively low and will not change operating conditions along the corridor.

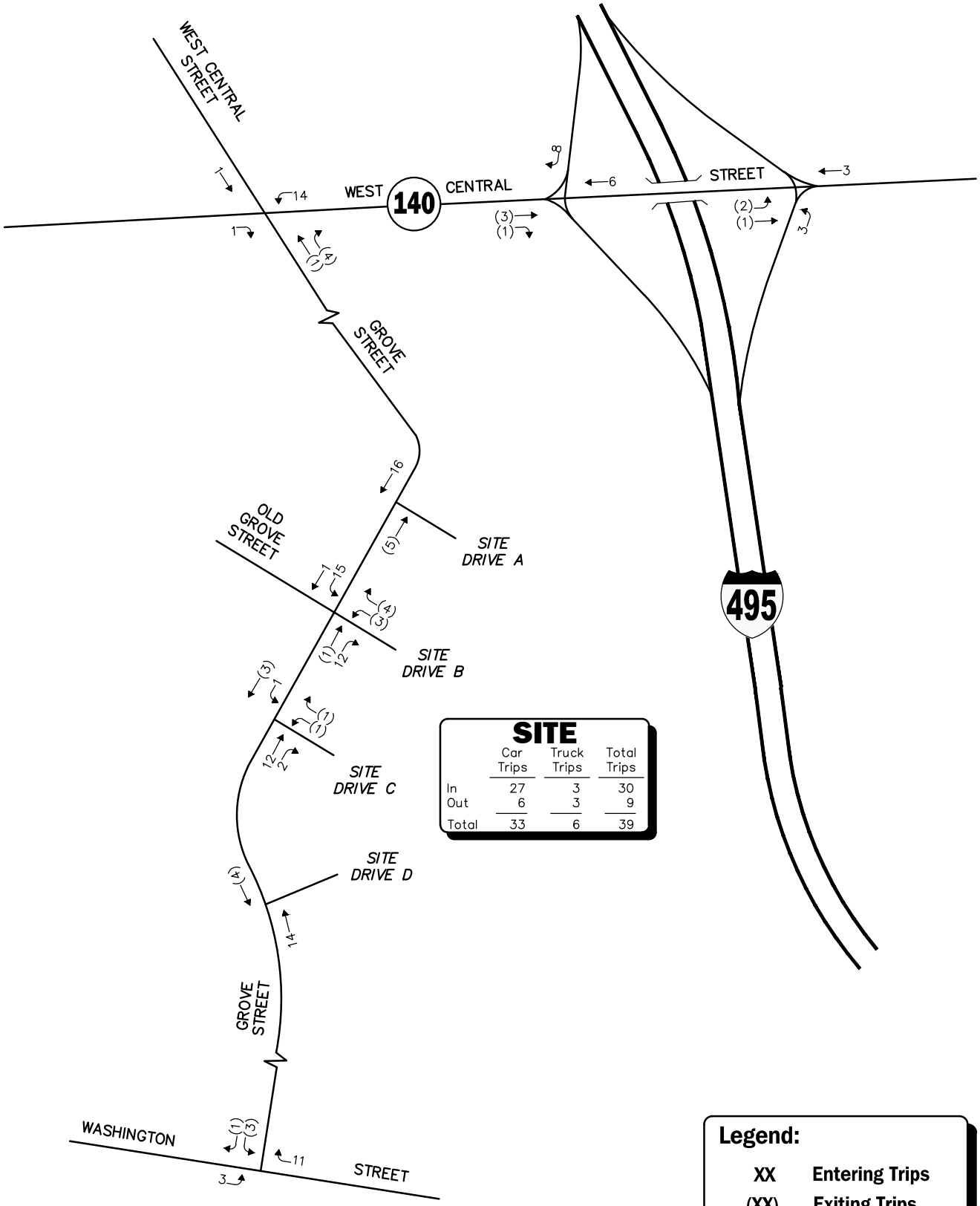


Figure 1

Project Generated (50% increase)
Weekday Morning
Peak Hour Traffic Volumes

Vanasse & Associates inc

R:\8515\July 2020\8515nt1.dwg, 7/7/2020 11:59:35 AM

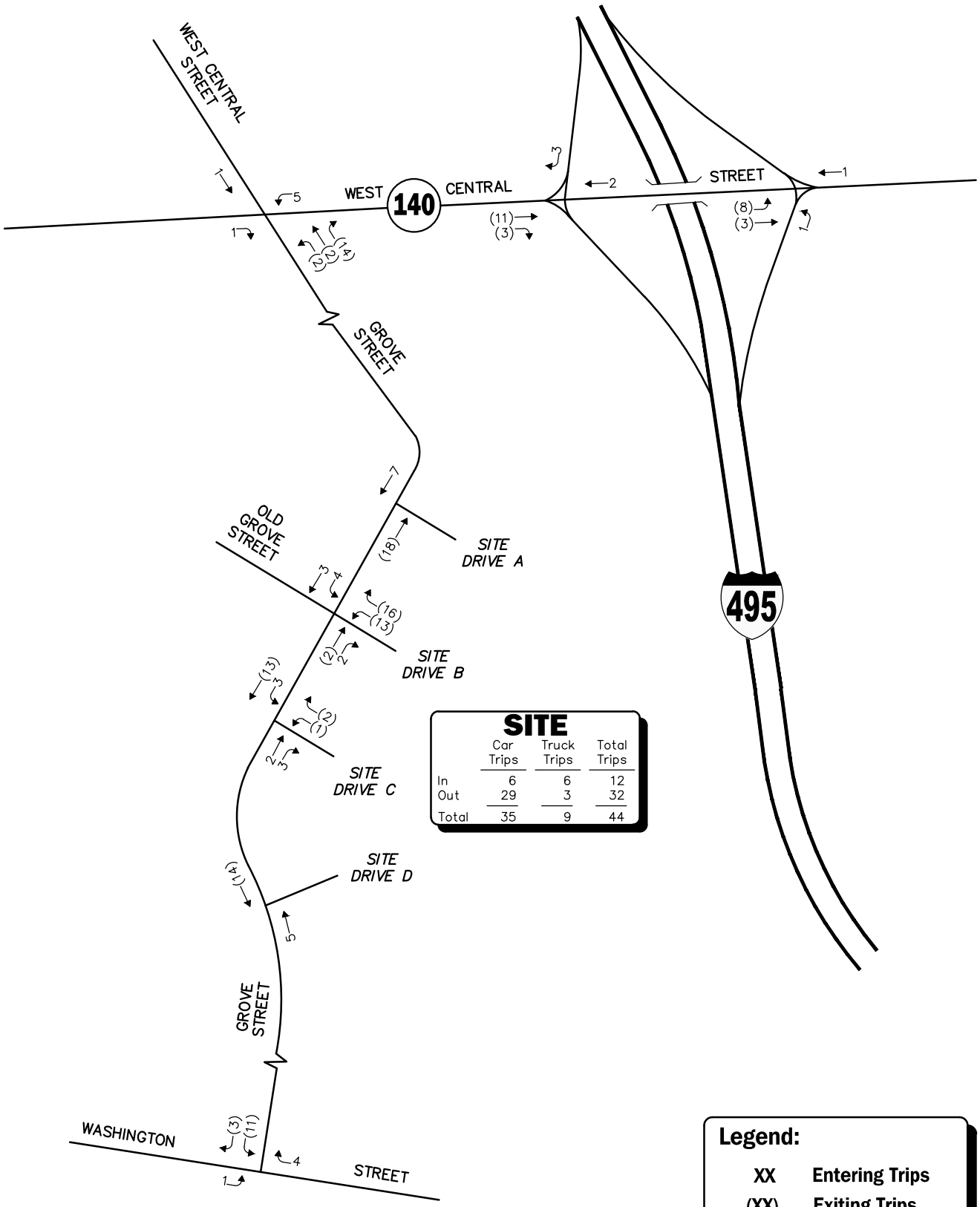
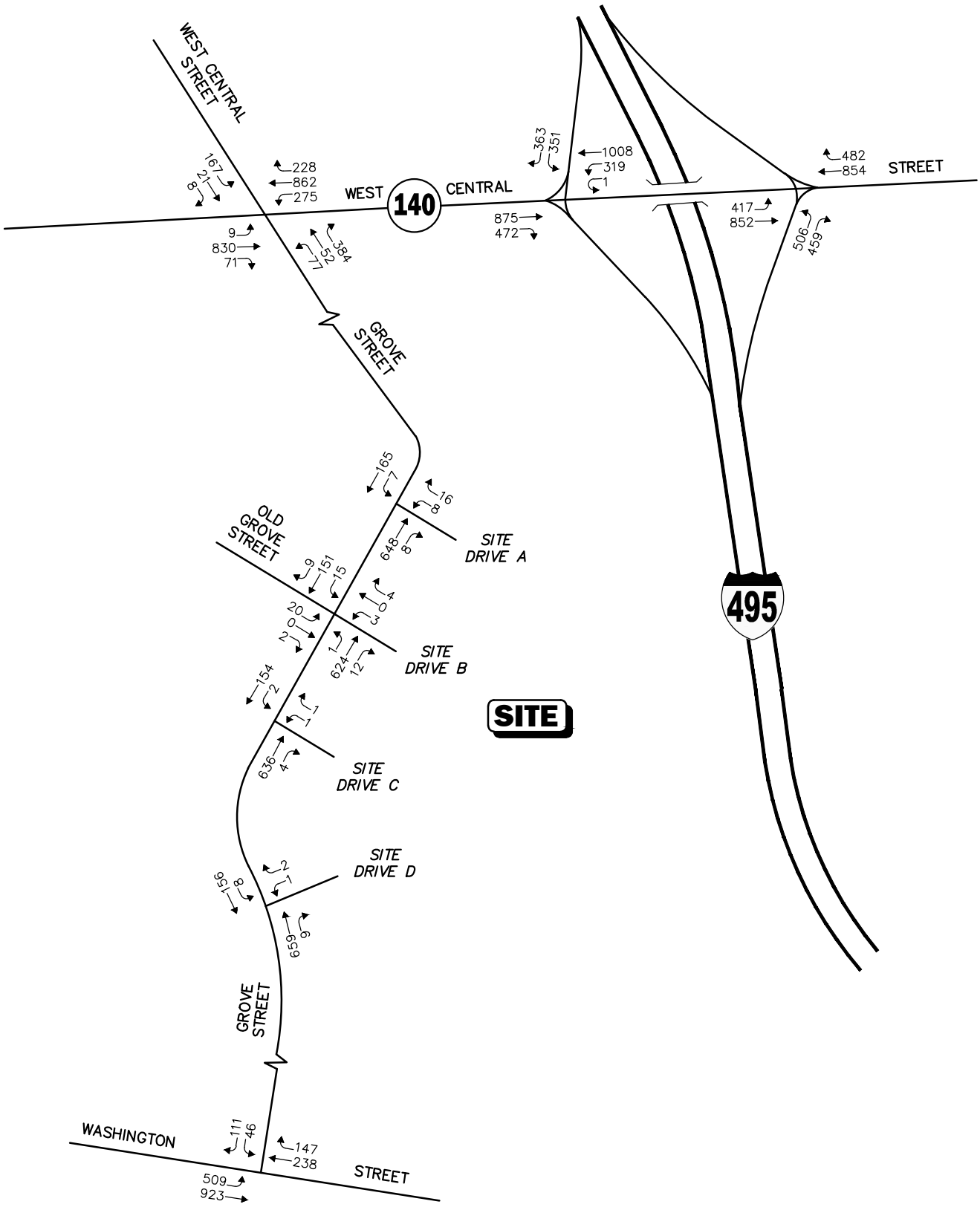


Figure 2

Project Generated (50% increase)
Weekday Evening
Peak Hour Traffic Volumes

Vanasse & Associates inc

R:\8515\July 2020\8515nt1.dwg, 7/7/2020 11:59:50 AM

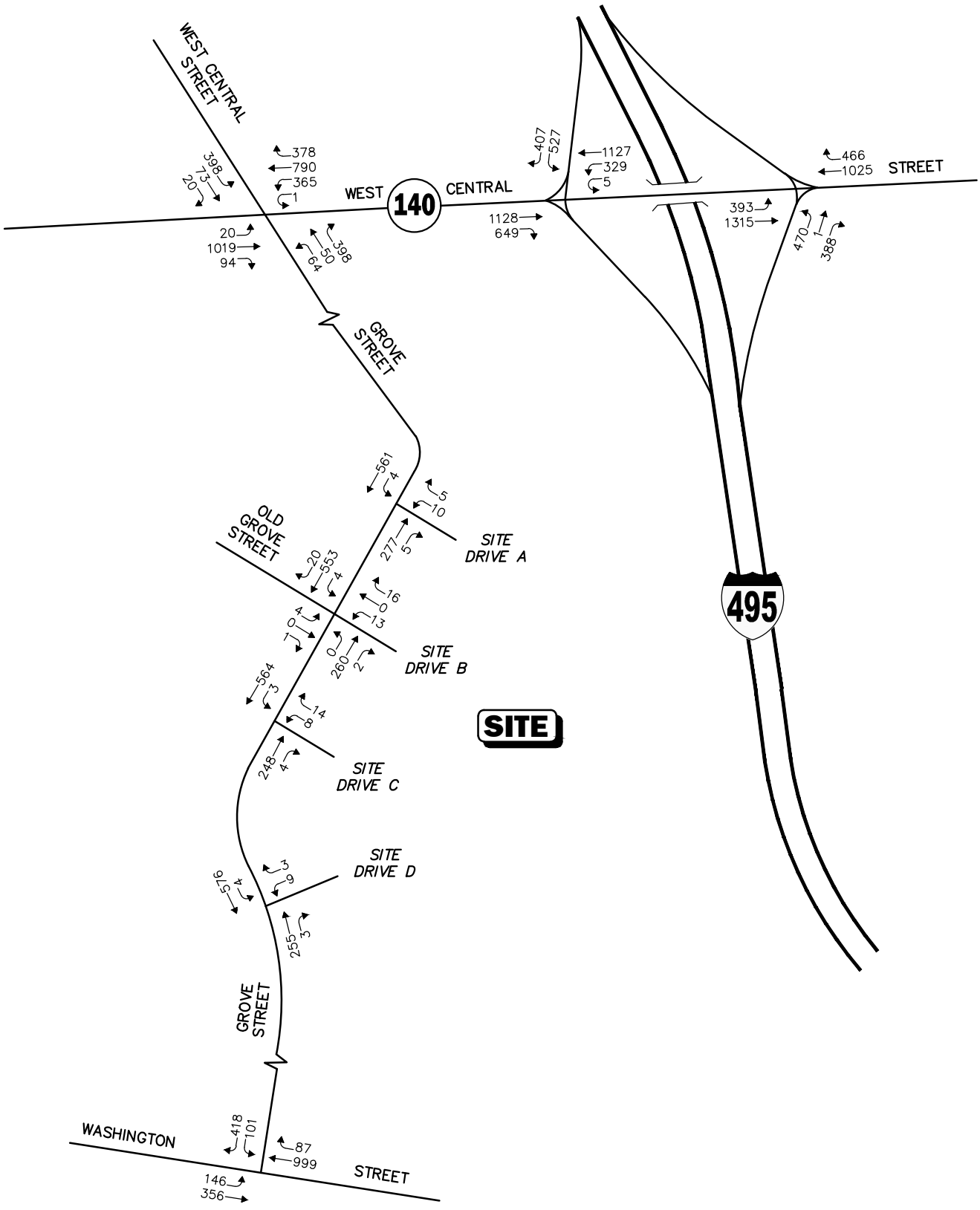


Note: **Imbalances exist due to numerous curb cuts and side streets that are not shown.**

Figure 3

Vanasse & Associates inc

2027 Build
w/ 50% Trip Generation Increase
Weekday Morning
Peak Hour Traffic Volume



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

Figure 4

Vanasse & Associates inc

2027 Build
w/ 50% Trip Generation Increase
Weekday Evening
Peak Hour Traffic Volume

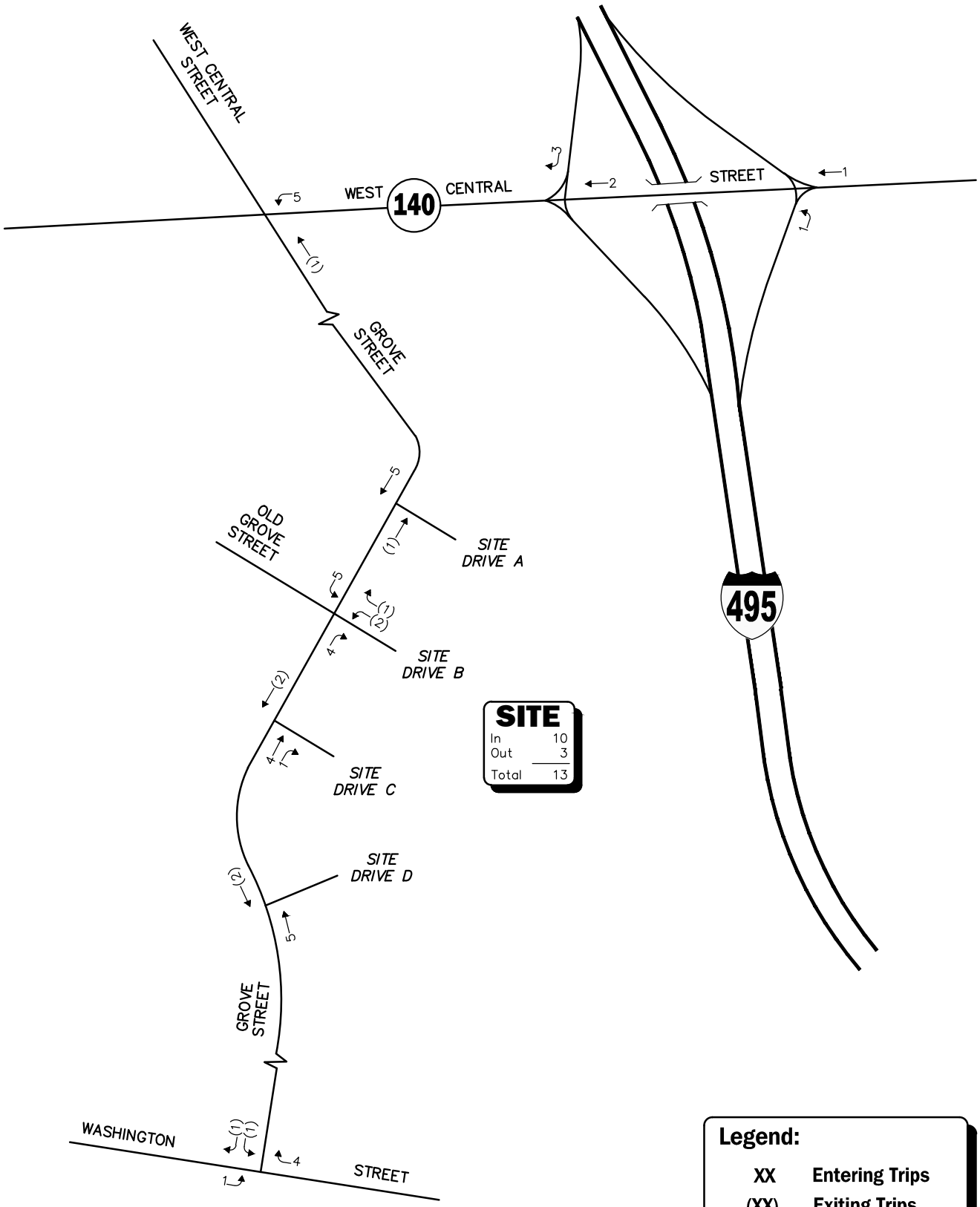


Figure 5

Traffic Increases
Weekday Morning
Peak Hour Traffic Volumes

Vanasse & Associates inc

R:\8515\July 2020\8515nt1.dwg, 7/7/2020 12:00:42 PM

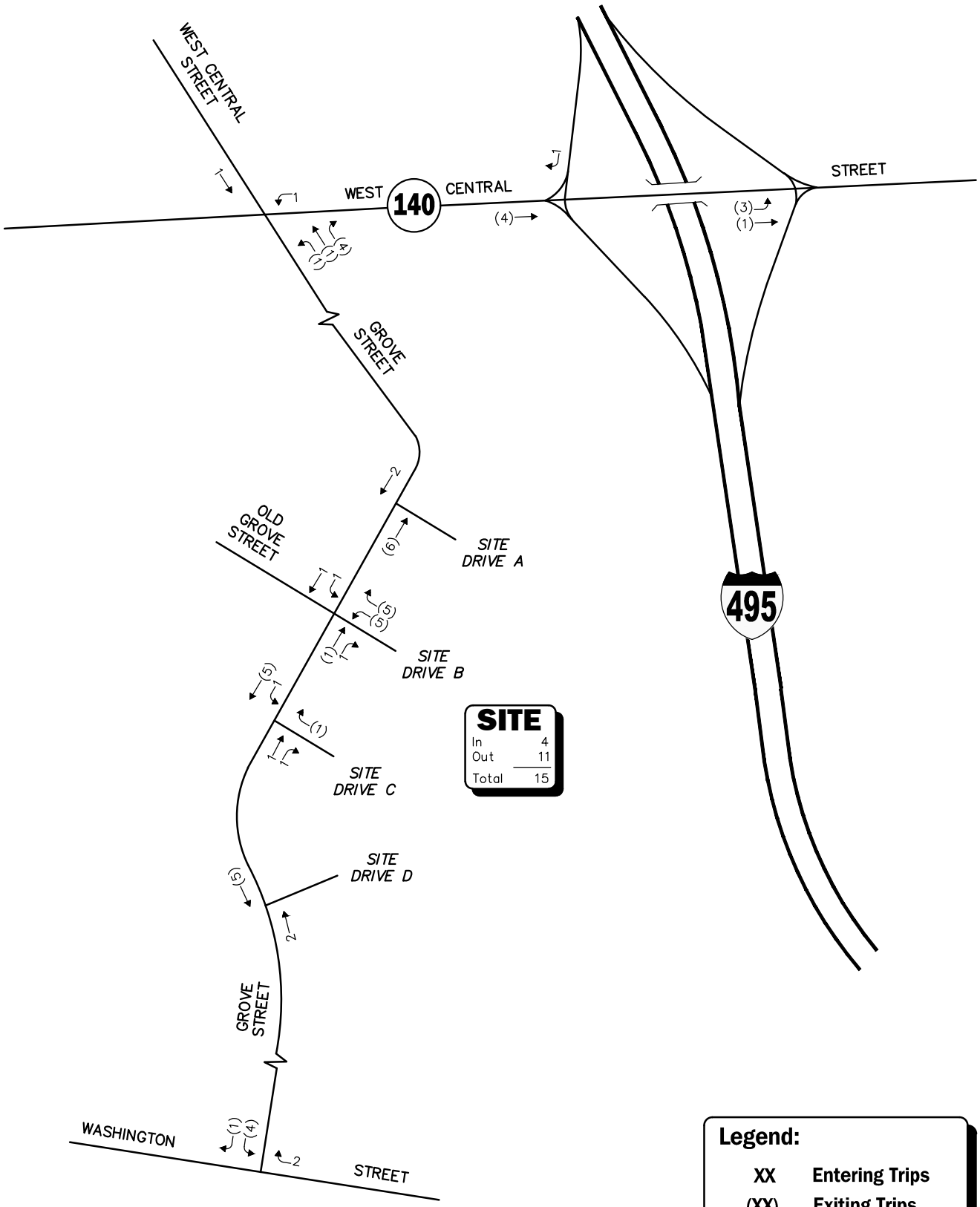


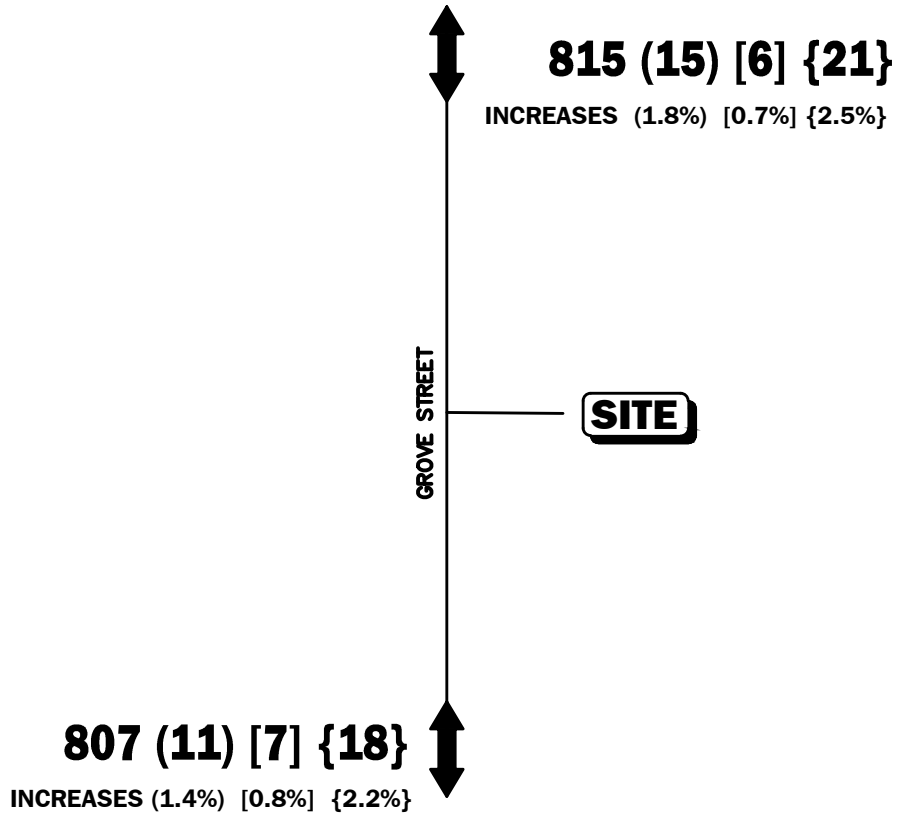
Figure 6

Traffic Increases
Weekday Evening
Peak Hour Traffic Volumes

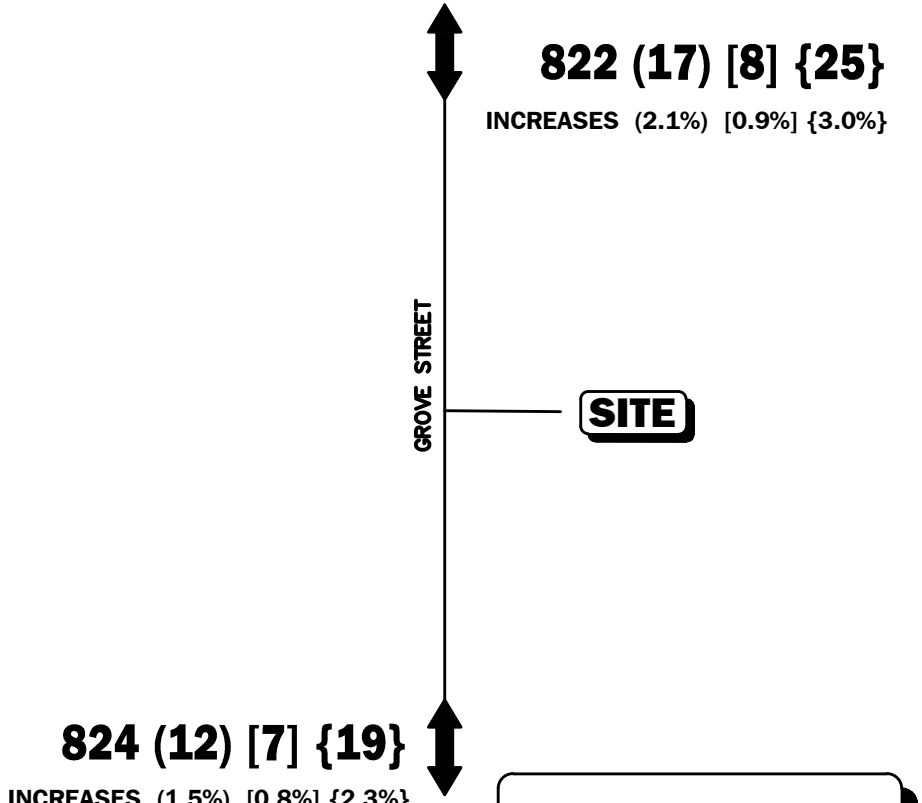
Vanasse & Associates inc

R:\8515\July 2020\8515nt1.dwg, 7/7/2020 12:00:58 PM

WEEKDAY MORNING PEAK HOUR



WEEKDAY EVENING PEAK HOUR



Legend:

XX	2027 No-Build
(XX)	100% Trip Generation
[XX]	50% Increase
{XX}	150% Trip Generation

Not to Scale

Vanasse & Associates inc

Figure 7

Trip Increases
Grove Street north and south of Site Driveway
Peak Hour Traffic Volumes

R:\8515\8515trip companbnn50up.dwg, 7/7/2020 12:01:17 PM

ANALYSIS RESULTS

Level-of-service and vehicle queue analyses were conducted for the revised 2027 Build conditions utilizing the same procedures as laid out in the February 2020 TIA. In brief, the adjustments described in this memo have not resulted in a significant change to the findings reported in the February 2020 TIA. The results of the intersection capacity and vehicle queue analyses are summarized for signalized intersections in Table 2 and for unsignalized intersections in Table 3 (including the 2027 No Build and 2027 Build conditions as reported in the February 2020 TIA), with the detailed analysis results presented as an attachment. The following is a summary of the level-of-service and delay analyses for the intersections within the study area:

Signalized Intersections

West Central Street (Route 140) at I-495 NB On/Off Ramps

Under all conditions, this signalized intersection will operate at an overall Level-of-Service (LOS) B during both weekday morning and evening peak hours.

West Central Street (Route 140) at I-495 SB On/Off Ramps

Under all conditions, this signalized intersection will operate at an overall LOS B during both weekday morning and evening peak hours.

West Central Street (Route 140) at Grove Street

Under future conditions, this intersection will operate at an overall LOS C during the weekday morning peak-hour and an overall LOS D during the weekday evening peak-hour. The proposed project will not change traffic operations at this location.

Unsignalized Intersections

Grove Street at Site Driveways

Under all conditions, the critical movements at these unsignalized intersections are expected to operate at LOS C or better during the weekday morning and evening peak hours. These operating conditions are a direct result of the large volume of cut through traffic traveling along Grove Street. Vehicle queues at the site driveways were shown to range from 0 to 1 vehicle during the peak periods.

Washington Street at Grove Street

Under all conditions, the critical movements at this unsignalized intersection are expected to operate at LOS F during the weekday morning and evening peak hours. The operating conditions (LOS F) are a direct result of the large volume of cut through traffic traveling along Grove Street. The project impact at this location will be minimal.

Table 2
SIGNALIZED INTERSECTION LEVEL-OF-SERVICE SUMMARY

	2027 No-Build				2027 Build (Original Study)[e]				2027 Build (with 50% Trip Generation Increase)[e]			
Signalized Intersection/Peak Hour	V/C[a]	Delay[b]	LOS[c]	Queues[d]	V/C	Delay	LOS	Queues	V/C	Delay	LOS	Queues
West Central Street (Route 140) at I-495 NB On/Off Ramps												
Weekday Morning:												
West Central Street (Route 140) EB LT	0.78	32.7	C	63/123	0.78	33.0	C	63/124	0.78	33.0	C	63/124
West Central Street (Route 140) EB TH	0.39	4.9	A	51/75	0.39	5.0	A	51/75	0.39	5.0	A	51/75
West Central Street (Route 140) WB TH	0.75	16.9	B	126/164	0.75	17.0	B	127/164	0.75	17.0	B	127/164
West Central Street (Route 140) WB RT	0.32	0.5	A	0/0	0.32	0.5	A	0/0	0.32	0.5	A	0/0
I - 495 NB On/Off Ramps NB LT	0.80	40.6	D	80/191	0.80	40.9	D	81/192	0.80	40.9	D	81/192
I - 495 NB On/Off Ramps NB RT	0.28	0.4	A	0/0	0.28	0.4	A	0/0	0.28	0.4	A	0/0
Overall	--	**14.7**	**B**	--	--	**14.8**	**B**	--	--	**14.8**	**B**	--
Weekday Evening:												
West Central Street (Route 140) EB LT	0.73	30.0	C	59/113	0.74	30.6	C	60/116	0.75	30.9	C	60/117
West Central Street (Route 140) EB TH	0.60	6.6	A	98/142	0.60	6.7	A	98/143	0.60	6.7	A	98/143
West Central Street (Route 140) WB TH	0.76	17.2	B	134/196	0.76	17.2	B	135/196	0.76	17.2	B	135/196
West Central Street (Route 140) WB RT	0.27	0.4	A	0/0	0.27	0.4	A	0/0	0.27	0.4	A	0/0
I - 495 NB On/Off Ramps NB LT	0.77	38.1	D	74/178	0.77	38.3	D	75/178	0.77	38.3	D	75/180
I - 495 NB On/Off Ramps NB RT	0.23	0.3	A	0/0	0.23	0.3	A	0/0	0.23	0.3	A	0/0
Overall	--	**13.9**	**B**	--	--	**14.0**	**B**	--	--	**14.0**	**B**	--
West Central Street (Route 140) at I-495 SB On/Off Ramps												
Weekday Morning:												
West Central Street (Route 140) EB TH	0.65	15.3	B	115/179	0.66	15.4	B	116/180	0.66	15.4	B	116/180
West Central Street (Route 140) EB RT	0.54	3.9	A	0/48	0.54	3.9	A	0/48	0.54	3.9	A	0/48
West Central Street (Route 140) WB LT	0.79	38.5	D	59/118	0.79	38.5	D	60/120	0.79	38.5	D	59/118
West Central Street (Route 140) WB TH	0.54	7.0	A	90/135	0.54	7.1	A	90/135	0.54	7.1	A	91/136
I - 495 SB On/Off Ramps SB LT	0.61	28.5	C	57/113	0.61	28.5	C	57/113	0.61	28.5	C	57/113
I - 495 SB On/Off Ramps SB RT	0.26	0.4	A	0/0	0.26	0.4	A	0/0	0.26	0.4	A	0/0
Overall	--	**13.0**	**B**	--	--	**13.0**	**B**	--	--	**13.0**	**B**	--
Weekday Evening:												
West Central Street (Route 140) EB TH	0.83	21.5	C	178/291	0.84	21.7	C	180/294	0.84	21.9	C	181/296
West Central Street (Route 140) EB RT	0.66	4.6	A	0/55	0.66	4.7	A	0/55	0.66	4.7	A	0/55
West Central Street (Route 140) WB LT	0.79	38.5	D	59/117	0.78	38.8	D	59/118	0.79	38.5	D	59/117
West Central Street (Route 140) WB TH	0.56	7.7	A	106/151	0.56	7.7	A	106/151	0.56	7.7	A	106/151
I - 495 SB On/Off Ramps SB LT	0.82	42.0	D	95/210	0.82	42.0	D	95/210	0.82	42.0	D	95/210
I - 495 SB On/Off Ramps SB RT	0.29	0.5	A	0/0	0.29	0.5	A	0/0	0.29	0.5	A	0/0
Overall	--	**16.3**	**B**	--	--	**16.3**	**B**	--	--	**16.4**	**B**	--

See notes at end of table.

Table 2 (Continued)
SIGNALIZED INTERSECTION LEVEL-OF-SERVICE SUMMARY

	2027 No-Build				2027 Build (ITE Trip Generation Rate)[e]				2027 Build (with 50% Trip Generation Increase)[e]			
Signalized Intersection/Peak Hour	V/C[a]	Delay[b]	LOS[c]	Queues[d]	V/C	Delay	LOS	Queues	V/C	Delay	LOS	Queues
West Central Street (Route 140) at Grove Street												
Weekday Morning:												
West Central Street (Route 140) EB LT	0.05	33.9	C	4/18	0.05	33.9	C	4/18	0.05	33.9	C	4/18
West Central Street (Route 140) EB TH RT	0.76	26.2	C	205/275	0.76	26.2	C	205/275	0.76	26.2	C	205/275
West Central Street (Route 140) WB LT	0.71	44.0	D	75/121	0.74	45.4	D	78/127	0.75	46.2	D	80/131
West Central Street (Route 140) WB TH	0.58	16.1	B	155/268	0.58	16.0	B	155/268	0.58	16.0	B	155/268
West Central Street (Route 140) WB RT	0.28	2.8	A	0/38	0.28	2.8	A	0/38	0.28	2.8	A	0/38
Grove Street SB LT	0.45	22.7	C	77/121	0.45	22.7	C	77/121	0.45	22.8	C	77/121
Grove Street SB TH	0.03	16.4	B	8/21	0.04	16.4	B	8/21	0.04	16.4	B	8/21
Grove Street SB RT	0.01	0.0	A	0/0	0.01	0.0	A	0/0	0.01	0.0	A	0/0
Grove Street NB LT	0.25	18.7	B	51/90	0.25	18.7	B	51/90	0.25	18.7	B	51/90
Grove Street NB RT	0.48	10.3	B	93/156	0.48	10.5	B	97/162	0.48	10.5	B	97/161
Overall	**--**	**20.2**	**C**	--	--	**20.4**	**C**	--	**--**	**20.5**	**C**	--
Weekday Evening:												
West Central Street (Route 140) EB LT	0.15	35.6	D	12/31	0.15	35.6	D	12/31	0.15	35.6	D	12/31
West Central Street (Route 140) EB TH RT	1.02	56.8	E	370/428	1.02	57.0	E	371/428	1.02	57.0	E	371/428
West Central Street (Route 140) WB LT	0.93	67.7	E	99/181	0.94	69.6	E	101/184	0.95	70.0	E	101/185
West Central Street (Route 140) WB TH	0.50	16.2	B	123/226	0.50	16.2	B	123/226	0.50	16.2	B	123/226
West Central Street (Route 140) WB RT	0.40	3.2	A	0/51	0.40	3.2	A	0/51	0.40	3.2	A	0/51
Grove Street SB LT	1.05	83.8	F	276/378	1.06	85.2	F	277/379	1.06	85.9	F	278/380
Grove Street SB TH	0.13	17.4	B	29/53	0.13	17.4	B	29/53	0.13	17.4	B	30/53
Grove Street SB RT	0.04	0.1	A	0/0	0.04	0.1	A	0/0	0.04	0.1	A	0/0
Grove Street NB LT	0.20	18.5	B	39/76	0.21	18.5	B	40/77	0.21	18.6	B	41/78
Grove Street NB RT	0.45	10.1	B	82/149	0.47	10.4	B	86/155	0.47	10.4	B	88/158
Overall	**--**	**40.7**	**D**	--	--	**41.1**	**D**	--	**--**	**41.2**	**D**	--

[a]Volume-to-capacity ratio.
[b]Control (signal) delay per vehicle in seconds.
[c]Level-of-Service.
[d]Queue length in feet.
[e]Including short-term improvements.
NB = northbound; SB = southbound; EB = eastbound; WB = westbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.

Table 3
UNSIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Unsignalized Intersection/ Peak Hour/Movement	2027 No-Build				2027 Build (ITE Trip Generation Rate)				2027 Build (with 50% Trip Generation Increase)			
	Demand[a]	Delay[b]	LOS[c]	Queue 95th Percentile	Demand	Delay	LOS	Queue 95th Percentile	Demand	Delay	LOS	Queue 95th Percentile
Grove Street at 276 Grove Street - Site Driveway A												
Weekday Morning:												
Site Drive A WB LT RT	24	22.1	C	0.7	24	22.6	C	0.8	24	22.9	C	0.8
Weekday Evening:												
Site Drive A WB LT RT	15	15.7	B	0.2	15	16.0	C	0.2	15	16.1	C	0.2
Grove Street at Old Grove Street - Site Driveway B												
Weekday Morning:												
Old Grove Street WB LT RT	22	19.6	C	0.4	22	20.9	C	0.4	22	21.6	C	0.4
Site Drive B EB LT RT	--	--	--	--	4	15.0	C	0.0	8	15.3	C	0.1
Weekday Evening:												
Old Grove Street WB LT RT	5	18	C	0.1	5	18.6	C	0.1	5	18.9	C	0.1
Site Drive B EB LT RT	--	--	--	--	19	14.3	B	0.2	29	15.0	C	0.3
Grove Street at 210 Grove Street - Site Driveway C												
Weekday Morning:												
Site Drive C WB LT RT	0	0	A	0.0	2	19.6	C	0.0	2	19.7	C	0.0
Weekday Evening:												
Site Drive C WB LT RT	19	12.5	B	0.2	21	12.8	B	0.2	22	12.7	B	0.2
Grove Street at 210 Grove Street - Site Driveway D												
Weekday Morning:												
Site Drive D WB LT RT	3	14.3	B	0.0	3	14.4	B	0.0	3	14.5	B	0.0
Weekday Evening:												
Site Drive D WB LT RT	12	16.4	C	0.1	12	16.6	C	0.2	12	16.7	C	0.2
Washington Street at Grove Street												
Weekday Morning:												
Washington Street WB LT	506	10.7	B	2.4	508	10.7	B	2.4	509	10.8	B	2.5
Grove Street SB LT RT	153	>50.0	F	18.3	155	>50.0	F	19.1	157	>50.0	F	19.4
Weekday Evening:												
Washington Street WB LT	145	13.0	B	1.1	146	13.0	B	1.1	146	13.0	B	1.1
Grove Street SB LT RT	505	>50.0	F	50.6	514	>50.0	F	60.7	519	>50.0	F	61.7

[a]Volume-to-capacity ratio.
[b]Control (signal) delay per vehicle in seconds.
[c]Level-of-Service.
[d]Queue length in vehicle.
NB = northbound; SB = southbound; EB = eastbound; WB = westbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.

CONCLUSIONS

There were no significant changes in the study area analysis between the February 2020 TIA and the revised trip generation sensitive analysis described in this memorandum. As presented in the February 2020 TIA the proposed Project will not have a significant impact on overall traffic operations. The following recommendations were part of the original TIA and remain valid.

Project Access

As previously stated, access and egress to the parcels at 176, 200, and 210 Grove Street are provided via four (4) driveways. The north driveway provides access and egress to 176 Grove Street and the two southern driveways provide access and egress to 210 Grove Street. The middle driveway is currently closed and will be reopened as part of the site development. All driveways should be placed under STOP-Sign control with a painted STOP-Bar. In addition, the following is recommended:

- All signs and pavement markings to be installed within the Project site shall conform to the applicable standards of the current Manual on Uniform Traffic Devices (MUTCD).[1]

- Signs and landscaping adjacent to the Project site driveway intersections will be designed and maintained so as not to restrict lines of sight.

The project proponent will continue to work with the Town to address the incremental impacts along Grove Street.

[1] *Manual on Uniform Traffic Control Devices (MUTCD); Federal Highway Administration; Washington, D.C.; 2009*

ATTACHMENTS

CAPACITY ANALYSIS

CAPACITY ANALYSIS

West Central Street (Route 140) at I-495 NB ramps
West Central Street (Route 140) at I-495 SB ramps
West Central Street (Route 140) at Grove Street
Grove Street at 200 Grove Street Driveway
Grove Street at Old Grove Street/Gated Driveway
Grove Street at 210 Grove Street Driveway 1
Grove Street at 210 Grove Street Driveway 2
Washington Street at Grove Street

West Central Street (Route 140) at I-495 NB ramps

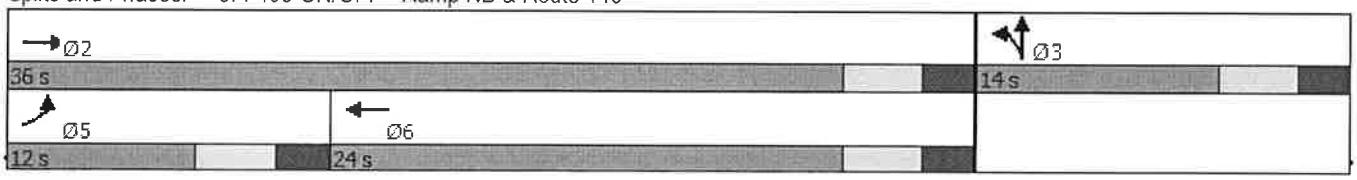
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	415	851	0	0	851	482	503	0	459	0	0	0
Future Volume (vph)	415	851	0	0	851	482	503	0	459	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	16	12	12	16	12	12	12
Storage Length (ft)	300		0	0		0	200		200	0		0
Storage Lanes	2		0	0		1	1		1	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt						0.850			0.850			
Flt Protected	0.950						0.950	0.950				
Satd. Flow (prot)	3367	3574	0	0	3539	1812	1665	1665	1760	0	0	0
Flt Permitted	0.950						0.950	0.950				
Satd. Flow (perm)	3367	3574	0	0	3539	1812	1665	1665	1760	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						581			415			
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		749			751			506			441	
Travel Time (s)		12.8			12.8			8.6			7.5	
Peak Hour Factor	0.97	0.97	0.97	0.83	0.83	0.83	0.93	0.93	0.93	0.75	0.75	0.75
Heavy Vehicles (%)	4%	1%	0%	0%	2%	1%	3%	0%	4%	0%	0%	0%
Adj. Flow (vph)	428	877	0	0	1025	581	541	0	494	0	0	0
Shared Lane Traffic (%)							50%					
Lane Group Flow (vph)	428	877	0	0	1025	581	270	271	494	0	0	0
Number of Detectors	1	2			2	1	1	2	1			
Detector Template	Left	Thru			Thru	Right	Left	Thru	Right			
Leading Detector (ft)	20	100			100	20	20	100	20			
Trailing Detector (ft)	0	0			0	0	0	0	0			
Detector 1 Position(ft)	0	0			0	0	0	0	0			
Detector 1 Size(ft)	20	6			6	20	20	6	20			
Detector 1 Type	Cl+Ex	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	0.0			
Detector 1 Queue (s)	0.0	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	0.0			
Detector 2 Position(ft)		94			94			94				
Detector 2 Size(ft)		6			6			6				
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				
Turn Type	Prot	NA			NA	Free	custom	NA	Free			
Protected Phases	5	2			6		3	3				
Permitted Phases						Free	3		Free			
Detector Phase	5	2			6		3	3				
Switch Phase												
Minimum Initial (s)	5.0	5.0			5.0		5.0	5.0				
Minimum Split (s)	10.5	23.5			23.5		10.5	10.5				
Total Split (s)	12.0	36.0			24.0		14.0	14.0				
Total Split (%)	24.0%	72.0%			48.0%		28.0%	28.0%				

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Maximum Green (s)	7.0	31.0			19.0		9.0	9.0				
Yellow Time (s)	3.0	3.0			3.0		3.0	3.0				
All-Red Time (s)	2.0	2.0			2.0		2.0	2.0				
Lost Time Adjust (s)	-1.0	-1.0			-1.0		-1.0	-1.0				
Total Lost Time (s)	4.0	4.0			4.0		4.0	4.0				
Lead/Lag	Lead				Lag							
Lead-Lag Optimize?	Yes				Yes							
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				
Recall Mode	None	None			None		None	None				
Walk Time (s)		7.0			7.0							
Flash Dont Walk (s)		11.0			11.0							
Pedestrian Calls (#/hr)		0			0							
Act Effct Green (s)	8.0	31.1			19.0	49.1	10.0	10.0	49.1			
Actuated g/C Ratio	0.16	0.63			0.39	1.00	0.20	0.20	1.00			
v/c Ratio	0.78	0.39			0.75	0.32	0.79	0.80	0.28			
Control Delay	32.7	4.9			16.9	0.5	40.3	40.6	0.4			
Queue Delay	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Total Delay	32.7	4.9			16.9	0.5	40.3	40.6	0.4			
LOS	C	A			B	A	D	D	A			
Approach Delay		14.1			11.0			21.3				
Approach LOS		B			B			C				
Queue Length 50th (ft)	63	51			126	0	80	80	0			
Queue Length 95th (ft)	#123	75			164	0	#190	#191	0			
Internal Link Dist (ft)		669			671			426			361	
Turn Bay Length (ft)	300						200		200			
Base Capacity (vph)	549	2333			1444	1812	340	340	1760			
Starvation Cap Reductn	0	0			0	0	0	0	0			
Spillback Cap Reductn	0	0			0	0	0	0	0			
Storage Cap Reductn	0	0			0	0	0	0	0			
Reduced v/c Ratio	0.78	0.38			0.71	0.32	0.79	0.80	0.28			

Intersection Summary

Area Type: Other
Cycle Length: 50
Actuated Cycle Length: 49.1
Natural Cycle: 55
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 14.7 — Intersection LOS: B
Intersection Capacity Utilization 59.7% — ICU Level of Service B
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 9: I-495 ON/OFF - Ramp NB & Route 140



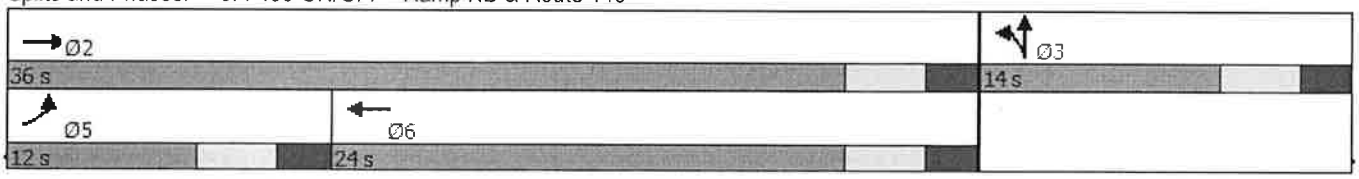
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	385	1312	0	0	1024	466	470	0	388	0	0	0
Future Volume (vph)	385	1312	0	0	1024	466	470	0	388	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	16	12	12	16	12	12	12
Storage Length (ft)	300		0	0		0	200		200	0		0
Storage Lanes	2		0	0		1	1		1	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt						0.850			0.850			
Flt Protected	0.950						0.950	0.950				
Satd. Flow (prot)	3400	3610	0	0	3610	1830	1649	1649	1830	0	0	0
Flt Permitted	0.950						0.950	0.950				
Satd. Flow (perm)	3400	3610	0	0	3610	1830	1649	1649	1830	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						491			326			
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		749			751			506			441	
Travel Time (s)		12.8			12.8			8.6			7.5	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.92	0.92	0.92	0.75	0.75	0.75
Heavy Vehicles (%)	3%	0%	0%	0%	0%	0%	4%	0%	0%	0%	0%	0%
Adj. Flow (vph)	405	1381	0	0	1078	491	511	0	422	0	0	0
Shared Lane Traffic (%)							50%					
Lane Group Flow (vph)	405	1381	0	0	1078	491	255	256	422	0	0	0
Number of Detectors	1	2			2	1	1	2	1			
Detector Template	Left	Thru			Thru	Right	Left	Thru	Right			
Leading Detector (ft)	20	100			100	20	20	100	20			
Trailing Detector (ft)	0	0			0	0	0	0	0			
Detector 1 Position(ft)	0	0			0	0	0	0	0			
Detector 1 Size(ft)	20	6			6	20	20	6	20			
Detector 1 Type	Cl+Ex	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	0.0			
Detector 1 Queue (s)	0.0	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	0.0			
Detector 2 Position(ft)		94			94			94				
Detector 2 Size(ft)		6			6			6				
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				
Turn Type	Prot	NA			NA	Free	custom	NA	Free			
Protected Phases	5	2			6		3	3				
Permitted Phases						Free	3		Free			
Detector Phase	5	2			6		3	3				
Switch Phase												
Minimum Initial (s)	5.0	5.0			5.0		5.0	5.0				
Minimum Split (s)	10.5	23.5			23.5		10.5	10.5				
Total Split (s)	12.0	36.0			24.0		14.0	14.0				
Total Split (%)	24.0%	72.0%			48.0%		28.0%	28.0%				

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Maximum Green (s)	7.0	31.0			19.0		9.0	9.0				
Yellow Time (s)	3.0	3.0			3.0		3.0	3.0				
All-Red Time (s)	2.0	2.0			2.0		2.0	2.0				
Lost Time Adjust (s)	-1.0	-1.0			-1.0		-1.0	-1.0				
Total Lost Time (s)	4.0	4.0			4.0		4.0	4.0				
Lead/Lag	Lead				Lag							
Lead-Lag Optimize?	Yes				Yes							
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				
Recall Mode	None	None			None		None	None				
Walk Time (s)		7.0			7.0							
Flash Dont Walk (s)		11.0			11.0							
Pedestrian Calls (#/hr)		0			0							
Act Effct Green (s)	8.0	31.4			19.3	49.3	9.9	9.9	49.3			
Actuated g/C Ratio	0.16	0.64			0.39	1.00	0.20	0.20	1.00			
v/c Ratio	0.73	0.60			0.76	0.27	0.77	0.77	0.23			
Control Delay	30.0	6.6			17.2	0.4	38.1	38.3	0.3			
Queue Delay	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Total Delay	30.0	6.6			17.2	0.4	38.1	38.3	0.3			
LOS	C	A			B	A	D	D	A			
Approach Delay		11.9			11.9			21.1				
Approach LOS		B			B			C				
Queue Length 50th (ft)	59	98			134	0	74	75	0			
Queue Length 95th (ft)	#113	142			196	0	#178	#178	0			
Internal Link Dist (ft)		669			671			426			361	
Turn Bay Length (ft)	300						200		200			
Base Capacity (vph)	552	2346			1466	1830	334	334	1830			
Starvation Cap Reductn	0	0			0	0	0	0	0			
Spillback Cap Reductn	0	0			0	0	0	0	0			
Storage Cap Reductn	0	0			0	0	0	0	0			
Reduced v/c Ratio	0.73	0.59			0.74	0.27	0.76	0.77	0.23			

Intersection Summary

Area Type: Other
Cycle Length: 50
Actuated Cycle Length: 49.3
Natural Cycle: 55
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.77
Intersection Signal Delay: 13.9 Intersection LOS: B
Intersection Capacity Utilization 75.8% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 9: I-495 ON/OFF - Ramp NB & Route 140



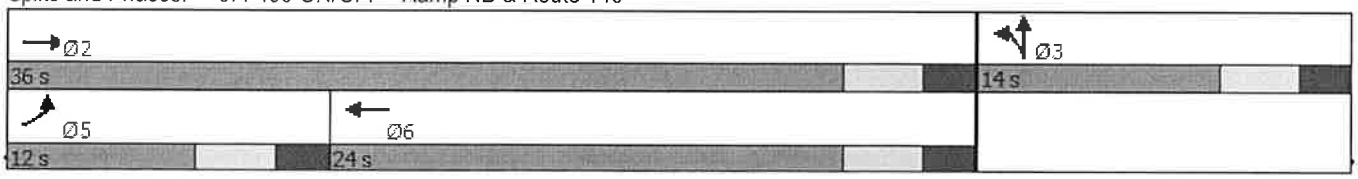
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	417	852	0	0	853	482	505	0	459	0	0	0
Future Volume (vph)	417	852	0	0	853	482	505	0	459	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	16	12	12	16	12	12	12
Storage Length (ft)	300		0	0		0	200		200	0		0
Storage Lanes	2		0	0		1	1		1	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt						0.850			0.850			
Flt Protected	0.950						0.950	0.950				
Satd. Flow (prot)	3367	3574	0	0	3539	1812	1665	1665	1760	0	0	0
Flt Permitted	0.950						0.950	0.950				
Satd. Flow (perm)	3367	3574	0	0	3539	1812	1665	1665	1760	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						581			415			
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		749			751			506			441	
Travel Time (s)		12.8			12.8			8.6			7.5	
Peak Hour Factor	0.97	0.97	0.97	0.83	0.83	0.83	0.93	0.93	0.93	0.75	0.75	0.75
Heavy Vehicles (%)	4%	1%	0%	0%	2%	1%	3%	0%	4%	0%	0%	0%
Adj. Flow (vph)	430	878	0	0	1028	581	543	0	494	0	0	0
Shared Lane Traffic (%)							50%					
Lane Group Flow (vph)	430	878	0	0	1028	581	271	272	494	0	0	0
Number of Detectors	1	2			2	1	1	2	1			
Detector Template	Left	Thru			Thru	Right	Left	Thru	Right			
Leading Detector (ft)	20	100			100	20	20	100	20			
Trailing Detector (ft)	0	0			0	0	0	0	0			
Detector 1 Position(ft)	0	0			0	0	0	0	0			
Detector 1 Size(ft)	20	6			6	20	20	6	20			
Detector 1 Type	Cl+Ex	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	0.0			
Detector 1 Queue (s)	0.0	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	0.0			
Detector 2 Position(ft)		94			94			94				
Detector 2 Size(ft)		6			6			6				
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				
Turn Type	Prot	NA			NA	Free	custom	NA	Free			
Protected Phases	5	2			6		3	3				
Permitted Phases						Free	3		Free			
Detector Phase	5	2			6		3	3				
Switch Phase												
Minimum Initial (s)	5.0	5.0			5.0		5.0	5.0				
Minimum Split (s)	10.5	23.5			23.5		10.5	10.5				
Total Split (s)	12.0	36.0			24.0		14.0	14.0				
Total Split (%)	24.0%	72.0%			48.0%		28.0%	28.0%				

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Maximum Green (s)	7.0	31.0			19.0		9.0	9.0				
Yellow Time (s)	3.0	3.0			3.0		3.0	3.0				
All-Red Time (s)	2.0	2.0			2.0		2.0	2.0				
Lost Time Adjust (s)	-1.0	-1.0			-1.0		-1.0	-1.0				
Total Lost Time (s)	4.0	4.0			4.0		4.0	4.0				
Lead/Lag	Lead				Lag							
Lead-Lag Optimize?	Yes				Yes							
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				
Recall Mode	None	None			None		None	None				
Walk Time (s)		7.0			7.0							
Flash Dont Walk (s)		11.0			11.0							
Pedestrian Calls (#/hr)		0			0							
Act Effct Green (s)	8.0	31.1			19.0	49.1	10.0	10.0	49.1			
Actuated g/C Ratio	0.16	0.63			0.39	1.00	0.20	0.20	1.00			
v/c Ratio	0.78	0.39			0.75	0.32	0.80	0.80	0.28			
Control Delay	33.0	5.0			17.0	0.5	40.6	40.9	0.4			
Queue Delay	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Total Delay	33.0	5.0			17.0	0.5	40.6	40.9	0.4			
LOS	C	A			B	A	D	D	A			
Approach Delay		14.2			11.0			21.5				
Approach LOS		B			B			C				
Queue Length 50th (ft)	63	51			127	0	80	81	0			
Queue Length 95th (ft)	#124	75			164	0	#191	#192	0			
Internal Link Dist (ft)		669			671			426			361	
Turn Bay Length (ft)	300						200		200			
Base Capacity (vph)	549	2333			1444	1812	340	340	1760			
Starvation Cap Reductn	0	0			0	0	0	0	0			
Spillback Cap Reductn	0	0			0	0	0	0	0			
Storage Cap Reductn	0	0			0	0	0	0	0			
Reduced v/c Ratio	0.78	0.38			0.71	0.32	0.80	0.80	0.28			

Intersection Summary

Area Type: Other
Cycle Length: 50
Actuated Cycle Length: 49.1
Natural Cycle: 55
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 14.8 Intersection LOS: B
Intersection Capacity Utilization 59.9% ICU Level of Service B
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 9: I-495 ON/OFF - Ramp NB & Route 140



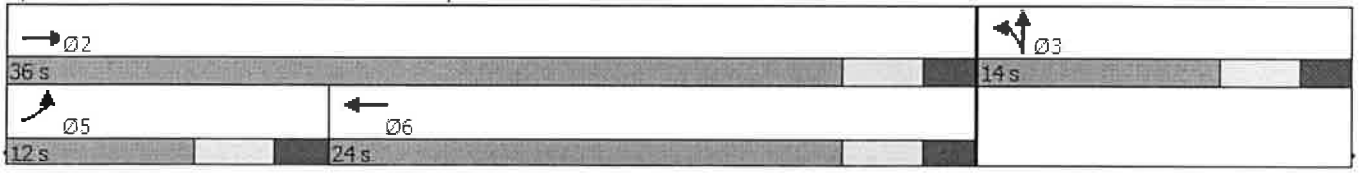
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	390	1314	0	0	1025	466	471	0	388	0	0	0
Future Volume (vph)	390	1314	0	0	1025	466	471	0	388	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	16	12	12	16	12	12	12
Storage Length (ft)	300		0	0		0	200		200	0		0
Storage Lanes	2		0	0		1	1		1	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt						0.850			0.850			
Flt Protected	0.950						0.950	0.950				
Satd. Flow (prot)	3400	3610	0	0	3610	1830	1649	1649	1830	0	0	0
Flt Permitted	0.950						0.950	0.950				
Satd. Flow (perm)	3400	3610	0	0	3610	1830	1649	1649	1830	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						491			326			
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		749			751			506			441	
Travel Time (s)		12.8			12.8			8.6			7.5	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.92	0.92	0.92	0.75	0.75	0.75
Heavy Vehicles (%)	3%	0%	0%	0%	0%	0%	4%	0%	0%	0%	0%	0%
Adj. Flow (vph)	411	1383	0	0	1079	491	512	0	422	0	0	0
Shared Lane Traffic (%)							50%					
Lane Group Flow (vph)	411	1383	0	0	1079	491	256	256	422	0	0	0
Number of Detectors	1	2			2	1	1	2	1			
Detector Template	Left	Thru			Thru	Right	Left	Thru	Right			
Leading Detector (ft)	20	100			100	20	20	100	20			
Trailing Detector (ft)	0	0			0	0	0	0	0			
Detector 1 Position(ft)	0	0			0	0	0	0	0			
Detector 1 Size(ft)	20	6			6	20	20	6	20			
Detector 1 Type	Cl+Ex	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	0.0			
Detector 1 Queue (s)	0.0	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	0.0			
Detector 2 Position(ft)		94			94			94				
Detector 2 Size(ft)		6			6			6				
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				
Turn Type	Prot	NA			NA	Free	custom	NA	Free			
Protected Phases	5	2			6		3	3				
Permitted Phases						Free	3		Free			
Detector Phase	5	2			6		3	3				
Switch Phase												
Minimum Initial (s)	5.0	5.0			5.0		5.0	5.0				
Minimum Split (s)	10.5	23.5			23.5		10.5	10.5				
Total Split (s)	12.0	36.0			24.0		14.0	14.0				
Total Split (%)	24.0%	72.0%			48.0%		28.0%	28.0%				

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Maximum Green (s)	7.0	31.0			19.0		9.0	9.0				
Yellow Time (s)	3.0	3.0			3.0		3.0	3.0				
All-Red Time (s)	2.0	2.0			2.0		2.0	2.0				
Lost Time Adjust (s)	-1.0	-1.0			-1.0		-1.0	-1.0				
Total Lost Time (s)	4.0	4.0			4.0		4.0	4.0				
Lead/Lag	Lead				Lag							
Lead-Lag Optimize?	Yes				Yes							
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				
Recall Mode	None	None			None		None	None				
Walk Time (s)		7.0			7.0							
Flash Dont Walk (s)		11.0			11.0							
Pedestrian Calls (#/hr)		0			0							
Act Effct Green (s)	8.0	31.4			19.3	49.3	9.9	9.9	49.3			
Actuated g/C Ratio	0.16	0.64			0.39	1.00	0.20	0.20	1.00			
v/c Ratio	0.74	0.60			0.76	0.27	0.77	0.77	0.23			
Control Delay	30.6	6.7			17.2	0.4	38.3	38.3	0.3			
Queue Delay	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Total Delay	30.6	6.7			17.2	0.4	38.3	38.3	0.3			
LOS	C	A			B	A	D	D	A			
Approach Delay		12.1			11.9			21.1				
Approach LOS		B			B			C				
Queue Length 50th (ft)	60	98			135	0	75	75	0			
Queue Length 95th (ft)	#116	143			196	0	#178	#178	0			
Internal Link Dist (ft)		669			671			426			361	
Turn Bay Length (ft)	300						200		200			
Base Capacity (vph)	552	2346			1466	1830	334	334	1830			
Starvation Cap Reductn	0	0			0	0	0	0	0			
Spillback Cap Reductn	0	0			0	0	0	0	0			
Storage Cap Reductn	0	0			0	0	0	0	0			
Reduced v/c Ratio	0.74	0.59			0.74	0.27	0.77	0.77	0.23			

Intersection Summary

Area Type: Other
Cycle Length: 50
Actuated Cycle Length: 49.3
Natural Cycle: 55
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.77
Intersection Signal Delay: 14.0 — Intersection LOS: B
Intersection Capacity Utilization 76.0% — ICU Level of Service D
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 9: I-495 ON/OFF - Ramp NB & Route 140



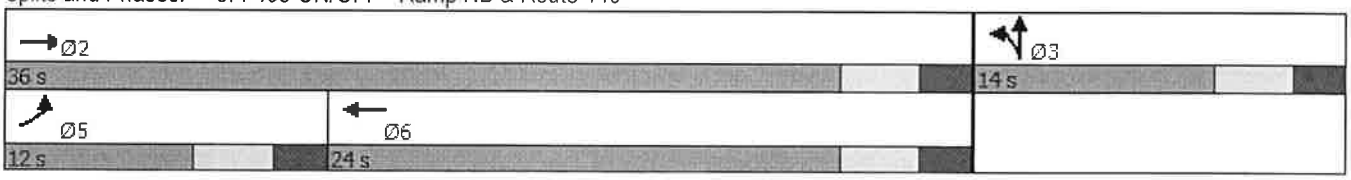
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	417	852	0	0	854	482	506	0	459	0	0	0
Future Volume (vph)	417	852	0	0	854	482	506	0	459	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	16	12	12	16	12	12	12
Storage Length (ft)	300		0	0		0	200		200	0		0
Storage Lanes	2		0	0		1	1		1	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt						0.850			0.850			
Flt Protected	0.950						0.950	0.950				
Satd. Flow (prot)	3367	3574	0	0	3539	1812	1665	1665	1760	0	0	0
Flt Permitted	0.950						0.950	0.950				
Satd. Flow (perm)	3367	3574	0	0	3539	1812	1665	1665	1760	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						581			415			
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		749			751			506			441	
Travel Time (s)		12.8			12.8			8.6			7.5	
Peak Hour Factor	0.97	0.97	0.97	0.83	0.83	0.83	0.93	0.93	0.93	0.75	0.75	0.75
Heavy Vehicles (%)	4%	1%	0%	0%	2%	1%	3%	0%	4%	0%	0%	0%
Adj. Flow (vph)	430	878	0	0	1029	581	544	0	494	0	0	0
Shared Lane Traffic (%)							50%					
Lane Group Flow (vph)	430	878	0	0	1029	581	272	272	494	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	Prot	NA			NA	Free	custom	NA	Free			
Protected Phases	5	2			6		3	3				
Permitted Phases						Free	3		Free			
Detector Phase	5	2			6		3	3				
Switch Phase												
Minimum Initial (s)	5.0	5.0			5.0		5.0	5.0				
Minimum Split (s)	10.5	23.5			23.5		10.5	10.5				
Total Split (s)	12.0	36.0			24.0		14.0	14.0				
Total Split (%)	24.0%	72.0%			48.0%		28.0%	28.0%				
Maximum Green (s)	7.0	31.0			19.0		9.0	9.0				
Yellow Time (s)	3.0	3.0			3.0		3.0	3.0				
All-Red Time (s)	2.0	2.0			2.0		2.0	2.0				
Lost Time Adjust (s)	-1.0	-1.0			-1.0		-1.0	-1.0				
Total Lost Time (s)	4.0	4.0			4.0		4.0	4.0				
Lead/Lag	Lead				Lag							
Lead-Lag Optimize?	Yes				Yes							
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Recall Mode	None	None			None		None	None				
Walk Time (s)		7.0			7.0							
Flash Dont Walk (s)		11.0			11.0							
Pedestrian Calls (#/hr)		0			0							
Act Effct Green (s)	8.0	31.1			19.0	49.1	10.0	10.0	49.1			
Actuated g/C Ratio	0.16	0.63			0.39	1.00	0.20	0.20	1.00			
v/c Ratio	0.78	0.39			0.75	0.32	0.80	0.80	0.28			
Control Delay	33.0	5.0			17.0	0.5	40.9	40.9	0.4			
Queue Delay	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Total Delay	33.0	5.0			17.0	0.5	40.9	40.9	0.4			
LOS	C	A			B	A	D	D	A			
Approach Delay		14.2			11.1			21.6				
Approach LOS		B			B			C				
Queue Length 50th (ft)	63	51			127	0	81	81	0			
Queue Length 95th (ft)	#124	75			164	0	#192	#192	0			
Internal Link Dist (ft)		669			671			426			361	
Turn Bay Length (ft)	300						200		200			
Base Capacity (vph)	549	2333			1444	1812	340	340	1760			
Starvation Cap Reductn	0	0			0	0	0	0	0			
Spillback Cap Reductn	0	0			0	0	0	0	0			
Storage Cap Reductn	0	0			0	0	0	0	0			
Reduced v/c Ratio	0.78	0.38			0.71	0.32	0.80	0.80	0.28			

Intersection Summary

Area Type: Other
Cycle Length: 50
Actuated Cycle Length: 49.1
Natural Cycle: 55
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 14.8 Intersection LOS: B
Intersection Capacity Utilization 59.7% ICU Level of Service B
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 9: I-495 ON/OFF - Ramp NB & Route 140



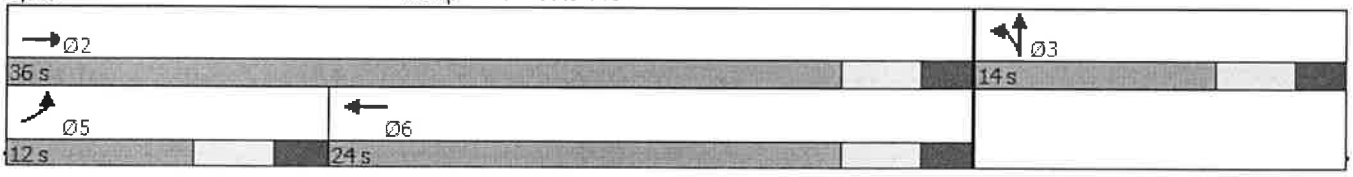
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	393	1315	0	0	1025	466	470	1	388	0	0	0
Future Volume (vph)	393	1315	0	0	1025	466	470	1	388	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	16	12	12	16	12	12	12
Storage Length (ft)	300		0	0		0	200		200	0		0
Storage Lanes	2		0	0		1	1		1	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt						0.850			0.850			
Flt Protected	0.950						0.950	0.953				
Satd. Flow (prot)	3400	3610	0	0	3610	1830	1649	1654	1830	0	0	0
Flt Permitted	0.950						0.950	0.953				
Satd. Flow (perm)	3400	3610	0	0	3610	1830	1649	1654	1830	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						491			325			
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		749			751			506			441	
Travel Time (s)		12.8			12.8			8.6			7.5	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.92	0.92	0.92	0.75	0.75	0.75
Heavy Vehicles (%)	3%	0%	0%	0%	0%	0%	4%	0%	0%	0%	0%	0%
Adj. Flow (vph)	414	1384	0	0	1079	491	511	1	422	0	0	0
Shared Lane Traffic (%)							50%					
Lane Group Flow (vph)	414	1384	0	0	1079	491	255	257	422	0	0	0
Number of Detectors	1	2			2	1	1	2	1			
Detector Template	Left	Thru			Thru	Right	Left	Thru	Right			
Leading Detector (ft)	20	100			100	20	20	100	20			
Trailing Detector (ft)	0	0			0	0	0	0	0			
Detector 1 Position(ft)	0	0			0	0	0	0	0			
Detector 1 Size(ft)	20	6			6	20	20	6	20			
Detector 1 Type	Cl+Ex	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	0.0			
Detector 1 Queue (s)	0.0	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	0.0			
Detector 2 Position(ft)		94			94			94				
Detector 2 Size(ft)		6			6			6				
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				
Turn Type	Prot	NA			NA	Free	custom	NA	Free			
Protected Phases	5	2			6		3	3				
Permitted Phases						Free	3		Free			
Detector Phase	5	2			6		3	3				
Switch Phase												
Minimum Initial (s)	5.0	5.0			5.0		5.0	5.0				
Minimum Split (s)	10.5	23.5			23.5		10.5	10.5				
Total Split (s)	12.0	36.0			24.0		14.0	14.0				
Total Split (%)	24.0%	72.0%			48.0%		28.0%	28.0%				

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Maximum Green (s)	7.0	31.0			19.0		9.0	9.0				
Yellow Time (s)	3.0	3.0			3.0		3.0	3.0				
All-Red Time (s)	2.0	2.0			2.0		2.0	2.0				
Lost Time Adjust (s)	-1.0	-1.0			-1.0		-1.0	-1.0				
Total Lost Time (s)	4.0	4.0			4.0		4.0	4.0				
Lead/Lag	Lead				Lag							
Lead-Lag Optimize?	Yes				Yes							
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				
Recall Mode	None	None			None		None	None				
Walk Time (s)		7.0			7.0							
Flash Dont Walk (s)		11.0			11.0							
Pedestrian Calls (#/hr)		0			0							
Act Effct Green (s)	8.0	31.4			19.3	49.3	9.9	9.9	49.3			
Actuated g/C Ratio	0.16	0.64			0.39	1.00	0.20	0.20	1.00			
v/c Ratio	0.75	0.60			0.76	0.27	0.77	0.77	0.23			
Control Delay	30.9	6.7			17.2	0.4	38.1	38.3	0.3			
Queue Delay	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Total Delay	30.9	6.7			17.2	0.4	38.1	38.3	0.3			
LOS	C	A			B	A	D	D	A			
Approach Delay		12.2			11.9			21.1				
Approach LOS		B			B			C				
Queue Length 50th (ft)	60	98			135	0	74	75	0			
Queue Length 95th (ft)	#117	143			196	0	#178	#180	0			
Internal Link Dist (ft)		669			671			426			361	
Turn Bay Length (ft)	300						200		200			
Base Capacity (vph)	552	2346			1466	1830	334	335	1830			
Starvation Cap Reductn	0	0			0	0	0	0	0			
Spillback Cap Reductn	0	0			0	0	0	0	0			
Storage Cap Reductn	0	0			0	0	0	0	0			
Reduced v/c Ratio	0.75	0.59			0.74	0.27	0.76	0.77	0.23			

Intersection Summary

Area Type: Other
Cycle Length: 50
Actuated Cycle Length: 49.3
Natural Cycle: 50
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.77
Intersection Signal Delay: 14.0 Intersection LOS: B
Intersection Capacity Utilization 76.0% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 9: I-495 ON/OFF - Ramp NB & Route 140



West Central Street (Route 140) at I-495 SB ramps

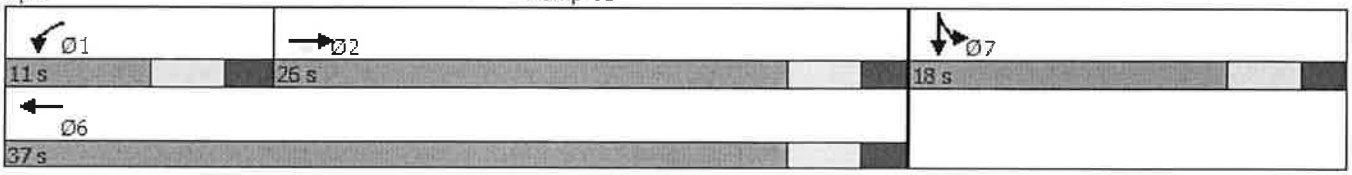
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	872	471	320	1002	0	0	0	0	351	0	355
Future Volume (vph)	0	872	471	320	1002	0	0	0	0	351	0	355
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	300		0	0		0	200		200
Storage Lanes	0		1	2		0	0		0	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	1.00	1.00	1.00	0.95	0.95	1.00
Frt			0.850									0.850
Flt Protected				0.950						0.950	0.950	
Satd. Flow (prot)	0	3539	1553	3400	3505	0	0	0	0	1698	1698	1509
Flt Permitted				0.950						0.950	0.950	
Satd. Flow (perm)	0	3539	1553	3400	3505	0	0	0	0	1698	1698	1509
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			501									386
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		481			749			416			580	
Travel Time (s)		8.2			12.8			7.1			9.9	
Peak Hour Factor	0.94	0.94	0.94	0.86	0.86	0.86	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	2%	4%	3%	3%	0%	0%	0%	0%	1%	0%	7%
Adj. Flow (vph)	0	928	501	372	1165	0	0	0	0	382	0	386
Shared Lane Traffic (%)										50%		
Lane Group Flow (vph)	0	928	501	372	1165	0	0	0	0	191	191	386
Number of Detectors		2	1	1	2					1	2	1
Detector Template		Thru	Right	Left	Thru					Left	Thru	Right
Leading Detector (ft)		100	20	20	100					20	100	20
Trailing Detector (ft)		0	0	0	0					0	0	0
Detector 1 Position(ft)		0	0	0	0					0	0	0
Detector 1 Size(ft)		6	20	20	6					20	6	20
Detector 1 Type		Cl+Ex	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	0.0
Detector 1 Queue (s)		0.0	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	0.0
Detector 2 Position(ft)		94			94						94	
Detector 2 Size(ft)		6			6						6	
Detector 2 Type		Cl+Ex			Cl+Ex						Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0						0.0	
Turn Type		NA	Perm	Prot	NA					custom	NA	Free
Protected Phases		2		1	6					7	7	
Permitted Phases			2							7		Free
Detector Phase		2	2	1	6					7	7	
Switch Phase												
Minimum Initial (s)		5.0	5.0	5.0	5.0					5.0	5.0	
Minimum Split (s)		23.0	23.0	10.0	23.0					10.0	10.0	
Total Split (s)		26.0	26.0	11.0	37.0					18.0	18.0	
Total Split (%)		47.3%	47.3%	20.0%	67.3%					32.7%	32.7%	
Maximum Green (s)		21.0	21.0	6.0	32.0					13.0	13.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Yellow Time (s)		3.0	3.0	3.0	3.0					3.0	3.0	
All-Red Time (s)		2.0	2.0	2.0	2.0					2.0	2.0	
Lost Time Adjust (s)		-1.0	-1.0	-1.0	-1.0					-1.0	1.0	
Total Lost Time (s)		4.0	4.0	4.0	4.0					4.0	6.0	
Lead/Lag		Lag	Lag	Lead								
Lead-Lag Optimize?		Yes	Yes	Yes								
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	
Recall Mode		None	None	None	None					None	None	
Walk Time (s)		7.0	7.0		7.0							
Flash Dont Walk (s)		11.0	11.0		11.0							
Pedestrian Calls (#/hr)		0	0		0							
Act Effct Green (s)		20.5	20.5	7.1	31.6					11.4	9.4	51.1
Actuated g/C Ratio		0.40	0.40	0.14	0.62					0.22	0.18	1.00
v/c Ratio		0.65	0.54	0.79	0.54					0.50	0.61	0.26
Control Delay		15.3	3.9	38.5	7.0					22.8	28.5	0.4
Queue Delay		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Total Delay		15.3	3.9	38.5	7.0					22.8	28.5	0.4
LOS		B	A	D	A					C	C	A
Approach Delay		11.3			14.6						13.0	
Approach LOS		B			B						B	
Queue Length 50th (ft)		115	0	59	90					54	57	0
Queue Length 95th (ft)		179	48	#118	135					108	113	0
Internal Link Dist (ft)		401			669			336			500	
Turn Bay Length (ft)				300						200		200
Base Capacity (vph)		1536	957	469	2283					469	402	1509
Starvation Cap Reductn		0	0	0	0					0	0	0
Spillback Cap Reductn		0	0	0	0					0	0	0
Storage Cap Reductn		0	0	0	0					0	0	0
Reduced v/c Ratio		0.60	0.52	0.79	0.51					0.41	0.48	0.26

Intersection Summary

Area Type: Other
Cycle Length: 55
Actuated Cycle Length: 51.1
Natural Cycle: 50
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.79
Intersection Signal Delay: 13.0 Intersection LOS: B
Intersection Capacity Utilization 59.7% ICU Level of Service B
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 6: Route 140 & I-495 ON/OFF - Ramp SB



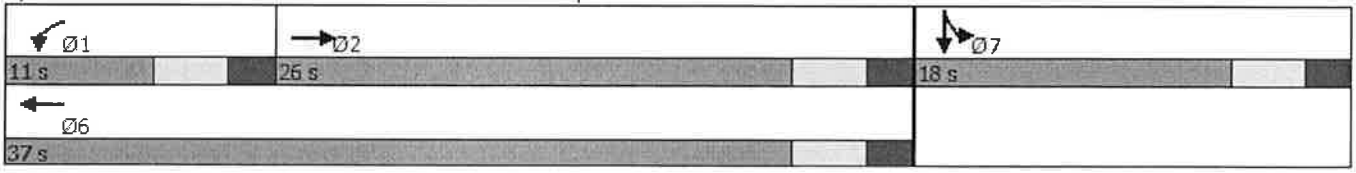
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	1117	646	334	1125	0	0	0	0	527	0	404
Future Volume (vph)	0	1117	646	334	1125	0	0	0	0	527	0	404
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	300		0	0		0	200		200
Storage Lanes	0		1	2		0	0		0	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	1.00	1.00	1.00	0.95	0.95	1.00
Frt			0.850									0.850
Flt Protected				0.950						0.950	0.950	
Satd. Flow (prot)	0	3574	1599	3502	3539	0	0	0	0	1715	1715	1553
Flt Permitted				0.950						0.950	0.950	
Satd. Flow (perm)	0	3574	1599	3502	3539	0	0	0	0	1715	1715	1553
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			695									406
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		481			749			416			580	
Travel Time (s)		8.2			12.8			7.1			9.9	
Peak Hour Factor	0.93	0.93	0.93	0.94	0.94	1.00	0.92	0.92	0.92	0.90	0.90	0.90
Heavy Vehicles (%)	0%	1%	1%	0%	2%	0%	0%	0%	0%	0%	0%	4%
Adj. Flow (vph)	0	1201	695	355	1197	0	0	0	0	586	0	449
Shared Lane Traffic (%)										50%		
Lane Group Flow (vph)	0	1201	695	355	1197	0	0	0	0	293	293	449
Number of Detectors		2	1	1	2					1	2	1
Detector Template		Thru	Right	Left	Thru					Left	Thru	Right
Leading Detector (ft)		100	20	20	100					20	100	20
Trailing Detector (ft)		0	0	0	0					0	0	0
Detector 1 Position(ft)		0	0	0	0					0	0	0
Detector 1 Size(ft)		6	20	20	6					20	6	20
Detector 1 Type		Cl+Ex	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	0.0
Detector 1 Queue (s)		0.0	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	0.0
Detector 2 Position(ft)		94			94						94	
Detector 2 Size(ft)		6			6						6	
Detector 2 Type		Cl+Ex			Cl+Ex						Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0						0.0	
Turn Type		NA	Perm	Prot	NA					custom	NA	Free
Protected Phases		2		1	6					7	7	
Permitted Phases			2							7		Free
Detector Phase		2	2	1	6					7	7	
Switch Phase												
Minimum Initial (s)		5.0	5.0	5.0	5.0					5.0	5.0	
Minimum Split (s)		23.0	23.0	10.0	23.0					10.0	10.0	
Total Split (s)		26.0	26.0	11.0	37.0					18.0	18.0	
Total Split (%)		47.3%	47.3%	20.0%	67.3%					32.7%	32.7%	
Maximum Green (s)		21.0	21.0	6.0	32.0					13.0	13.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Yellow Time (s)		3.0	3.0	3.0	3.0					3.0	3.0	
All-Red Time (s)		2.0	2.0	2.0	2.0					2.0	2.0	
Lost Time Adjust (s)		-1.0	-1.0	-1.0	-1.0					-1.0	1.0	
Total Lost Time (s)		4.0	4.0	4.0	4.0					4.0	6.0	
Lead/Lag		Lag	Lag	Lead								
Lead-Lag Optimize?		Yes	Yes	Yes								
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	
Recall Mode		None	None	None	None					None	None	
Walk Time (s)		7.0	7.0		7.0							
Flash Dont Walk (s)		11.0	11.0		11.0							
Pedestrian Calls (#/hr)		0	0		0							
Act Effct Green (s)		22.0	22.0	7.0	33.0					13.3	11.3	54.3
Actuated g/C Ratio		0.41	0.41	0.13	0.61					0.24	0.21	1.00
v/c Ratio		0.83	0.66	0.79	0.56					0.70	0.82	0.29
Control Delay		21.5	4.6	38.5	7.7					29.4	42.0	0.5
Queue Delay		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Total Delay		21.5	4.6	38.5	7.7					29.4	42.0	0.5
LOS		C	A	D	A					C	D	A
Approach Delay		15.3			14.7						20.4	
Approach LOS		B			B						C	
Queue Length 50th (ft)		178	0	59	106					90	95	0
Queue Length 95th (ft)		#291	55	#117	151					#187	#210	0
Internal Link Dist (ft)		401			669			336			500	
Turn Bay Length (ft)				300						200		200
Base Capacity (vph)		1447	1061	451	2150					442	379	1553
Starvation Cap Reductn		0	0	0	0					0	0	0
Spillback Cap Reductn		0	0	0	0					0	0	0
Storage Cap Reductn		0	0	0	0					0	0	0
Reduced v/c Ratio		0.83	0.66	0.79	0.56					0.66	0.77	0.29

Intersection Summary

Area Type: Other
Cycle Length: 55
Actuated Cycle Length: 54.3
Natural Cycle: 55
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 16.3 Intersection LOS: B
Intersection Capacity Utilization 75.8% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 6: Route 140 & I-495 ON/OFF - Ramp SB



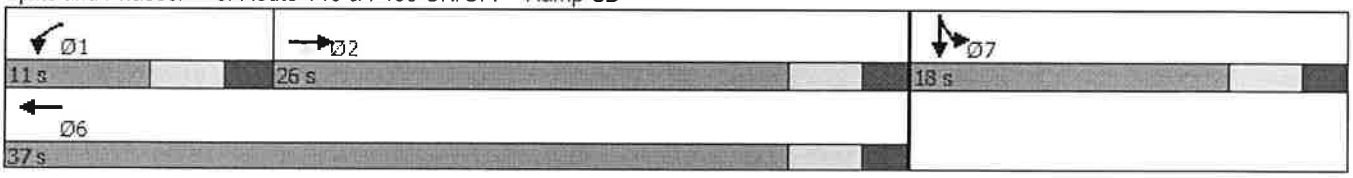
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↱	↰↰	↑↑					↰	↰↑	↱
Traffic Volume (vph)	0	875	472	320	1006	0	0	0	0	351	0	360
Future Volume (vph)	0	875	472	320	1006	0	0	0	0	351	0	360
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	300		0	0		0	200		200
Storage Lanes	0		1	2		0	0		0	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	1.00	1.00	1.00	0.95	0.95	1.00
Frt			0.850									0.850
Flt Protected				0.950						0.950	0.950	
Satd. Flow (prot)	0	3539	1553	3400	3505	0	0	0	0	1698	1698	1509
Flt Permitted				0.950						0.950	0.950	
Satd. Flow (perm)	0	3539	1553	3400	3505	0	0	0	0	1698	1698	1509
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			502									391
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		481			749			416			580	
Travel Time (s)		8.2			12.8			7.1			9.9	
Peak Hour Factor	0.94	0.94	0.94	0.86	0.86	0.86	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	2%	4%	3%	3%	0%	0%	0%	0%	1%	0%	7%
Adj. Flow (vph)	0	931	502	372	1170	0	0	0	0	382	0	391
Shared Lane Traffic (%)										50%		
Lane Group Flow (vph)	0	931	502	372	1170	0	0	0	0	191	191	391
Number of Detectors		2	1	1	2					1	2	1
Detector Template		Thru	Right	Left	Thru					Left	Thru	Right
Leading Detector (ft)		100	20	20	100					20	100	20
Trailing Detector (ft)		0	0	0	0					0	0	0
Detector 1 Position(ft)		0	0	0	0					0	0	0
Detector 1 Size(ft)		6	20	20	6					20	6	20
Detector 1 Type		Cl+Ex	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	0.0
Detector 1 Queue (s)		0.0	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	0.0
Detector 2 Position(ft)		94			94						94	
Detector 2 Size(ft)		6			6						6	
Detector 2 Type		Cl+Ex			Cl+Ex						Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0						0.0	
Turn Type		NA	Perm	Prot	NA					custom	NA	Free
Protected Phases		2		1	6					7	7	
Permitted Phases			2							7		Free
Detector Phase		2	2	1	6					7	7	
Switch Phase												
Minimum Initial (s)		5.0	5.0	5.0	5.0					5.0	5.0	
Minimum Split (s)		23.0	23.0	10.0	23.0					10.0	10.0	
Total Split (s)		26.0	26.0	11.0	37.0					18.0	18.0	
Total Split (%)		47.3%	47.3%	20.0%	67.3%					32.7%	32.7%	
Maximum Green (s)		21.0	21.0	6.0	32.0					13.0	13.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Yellow Time (s)		3.0	3.0	3.0	3.0					3.0	3.0	
All-Red Time (s)		2.0	2.0	2.0	2.0					2.0	2.0	
Lost Time Adjust (s)		-1.0	-1.0	-1.0	-1.0					-1.0	1.0	
Total Lost Time (s)		4.0	4.0	4.0	4.0					4.0	6.0	
Lead/Lag		Lag	Lag	Lead								
Lead-Lag Optimize?		Yes	Yes	Yes								
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	
Recall Mode		None	None	None	None					None	None	
Walk Time (s)		7.0	7.0		7.0							
Flash Dont Walk (s)		11.0	11.0		11.0							
Pedestrian Calls (#/hr)		0	0		0							
Act Effct Green (s)		20.5	20.5	7.1	31.6					11.4	9.4	51.1
Actuated g/C Ratio		0.40	0.40	0.14	0.62					0.22	0.18	1.00
v/c Ratio		0.66	0.54	0.79	0.54					0.50	0.61	0.26
Control Delay		15.4	3.9	38.5	7.1					22.8	28.5	0.4
Queue Delay		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Total Delay		15.4	3.9	38.5	7.1					22.8	28.5	0.4
LOS		B	A	D	A					C	C	A
Approach Delay		11.4			14.6						12.9	
Approach LOS		B			B						B	
Queue Length 50th (ft)		116	0	59	90					54	57	0
Queue Length 95th (ft)		180	48	#118	136					108	113	0
Internal Link Dist (ft)		401			669			336			500	
Turn Bay Length (ft)				300						200		200
Base Capacity (vph)		1536	958	469	2283					469	402	1509
Starvation Cap Reductn		0	0	0	0					0	0	0
Spillback Cap Reductn		0	0	0	0					0	0	0
Storage Cap Reductn		0	0	0	0					0	0	0
Reduced v/c Ratio		0.61	0.52	0.79	0.51					0.41	0.48	0.26

Intersection Summary

Area Type: Other
Cycle Length: 55
Actuated Cycle Length: 51.1
Natural Cycle: 50
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.79
Intersection Signal Delay: 13.0 Intersection LOS: B
Intersection Capacity Utilization 59.7% ICU Level of Service B
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 6: Route 140 & I-495 ON/OFF - Ramp SB



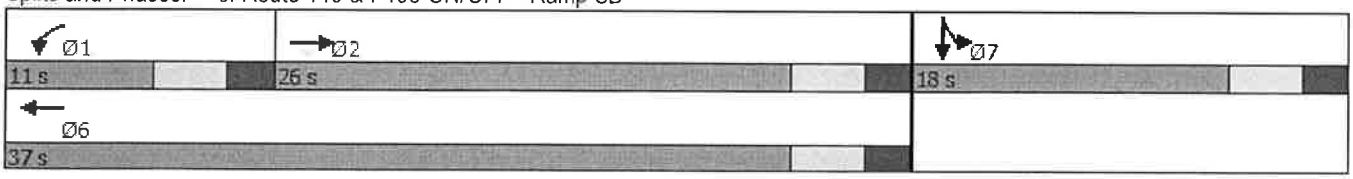
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↱	↰↰	↑↑					↰	↰↑	↱
Traffic Volume (vph)	0	1124	649	329	1125	0	0	0	0	527	0	406
Future Volume (vph)	0	1124	649	329	1125	0	0	0	0	527	0	406
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	300		0	0		0	200		200
Storage Lanes	0		1	2		0	0		0	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	1.00	1.00	1.00	0.95	0.95	1.00
Frt			0.850									0.850
Flt Protected				0.950						0.950	0.950	
Satd. Flow (prot)	0	3574	1599	3502	3539	0	0	0	0	1715	1715	1553
Flt Permitted				0.950						0.950	0.950	
Satd. Flow (perm)	0	3574	1599	3502	3539	0	0	0	0	1715	1715	1553
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			698									406
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		481			749			416			580	
Travel Time (s)		8.2			12.8			7.1			9.9	
Peak Hour Factor	0.93	0.93	0.93	0.94	0.94	1.00	0.92	0.92	0.92	0.90	0.90	0.90
Heavy Vehicles (%)	0%	1%	1%	0%	2%	0%	0%	0%	0%	0%	0%	4%
Adj. Flow (vph)	0	1209	698	350	1197	0	0	0	0	586	0	451
Shared Lane Traffic (%)										50%		
Lane Group Flow (vph)	0	1209	698	350	1197	0	0	0	0	293	293	451
Number of Detectors		2	1	1	2					1	2	1
Detector Template		Thru	Right	Left	Thru					Left	Thru	Right
Leading Detector (ft)		100	20	20	100					20	100	20
Trailing Detector (ft)		0	0	0	0					0	0	0
Detector 1 Position(ft)		0	0	0	0					0	0	0
Detector 1 Size(ft)		6	20	20	6					20	6	20
Detector 1 Type		Cl+Ex	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	0.0
Detector 1 Queue (s)		0.0	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	0.0
Detector 2 Position(ft)		94			94						94	
Detector 2 Size(ft)		6			6						6	
Detector 2 Type		Cl+Ex			Cl+Ex						Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0						0.0	
Turn Type		NA	Perm	Prot	NA					custom	NA	Free
Protected Phases		2		1	6					7	7	
Permitted Phases			2							7		Free
Detector Phase		2	2	1	6					7	7	
Switch Phase												
Minimum Initial (s)		5.0	5.0	5.0	5.0					5.0	5.0	
Minimum Split (s)		23.0	23.0	10.0	23.0					10.0	10.0	
Total Split (s)		26.0	26.0	11.0	37.0					18.0	18.0	
Total Split (%)		47.3%	47.3%	20.0%	67.3%					32.7%	32.7%	
Maximum Green (s)		21.0	21.0	6.0	32.0					13.0	13.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Yellow Time (s)		3.0	3.0	3.0	3.0					3.0	3.0	
All-Red Time (s)		2.0	2.0	2.0	2.0					2.0	2.0	
Lost Time Adjust (s)		-1.0	-1.0	-1.0	-1.0					-1.0	1.0	
Total Lost Time (s)		4.0	4.0	4.0	4.0					4.0	6.0	
Lead/Lag		Lag	Lag	Lead								
Lead-Lag Optimize?		Yes	Yes	Yes								
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	
Recall Mode		None	None	None	None					None	None	
Walk Time (s)		7.0	7.0		7.0							
Flash Dont Walk (s)		11.0	11.0		11.0							
Pedestrian Calls (#/hr)		0	0		0							
Act Effct Green (s)		22.0	22.0	7.0	33.0					13.3	11.3	54.3
Actuated g/C Ratio		0.41	0.41	0.13	0.61					0.24	0.21	1.00
v/c Ratio		0.84	0.66	0.78	0.56					0.70	0.82	0.29
Control Delay		21.7	4.7	37.7	7.7					29.4	42.0	0.5
Queue Delay		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Total Delay		21.7	4.7	37.7	7.7					29.4	42.0	0.5
LOS		C	A	D	A					C	D	A
Approach Delay		15.5			14.5						20.4	
Approach LOS		B			B						C	
Queue Length 50th (ft)		180	0	58	106					90	95	0
Queue Length 95th (ft)		#294	55	#115	151					#187	#210	0
Internal Link Dist (ft)		401			669			336			500	
Turn Bay Length (ft)				300						200		200
Base Capacity (vph)		1447	1063	451	2150					442	379	1553
Starvation Cap Reductn		0	0	0	0					0	0	0
Spillback Cap Reductn		0	0	0	0					0	0	0
Storage Cap Reductn		0	0	0	0					0	0	0
Reduced v/c Ratio		0.84	0.66	0.78	0.56					0.66	0.77	0.29

Intersection Summary

Area Type: Other
Cycle Length: 55
Actuated Cycle Length: 54.3
Natural Cycle: 55
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.84
Intersection Signal Delay: 16.3 — Intersection LOS: B
Intersection Capacity Utilization 75.8% — ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 6: Route 140 & I-495 ON/OFF - Ramp SB



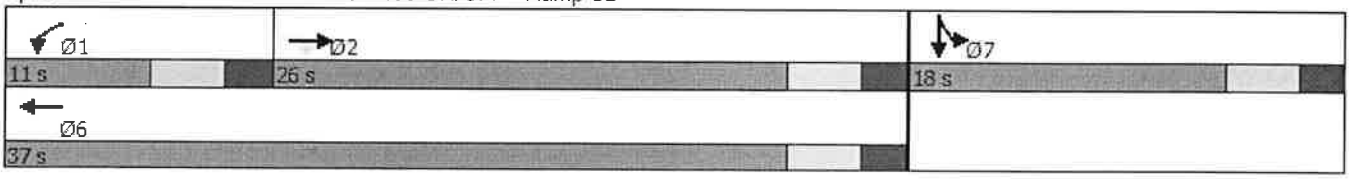
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↱	↰↰	↑↑					↰	↕	↱
Traffic Volume (vph)	0	875	472	320	1008	0	0	0	0	351	0	363
Future Volume (vph)	0	875	472	320	1008	0	0	0	0	351	0	363
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	300		0	0		0	200		200
Storage Lanes	0		1	2		0	0		0	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	1.00	1.00	1.00	0.95	0.95	1.00
Frt			0.850									0.850
Flt Protected				0.950						0.950	0.950	
Satd. Flow (prot)	0	3539	1553	3400	3505	0	0	0	0	1698	1698	1509
Flt Permitted				0.950						0.950	0.950	
Satd. Flow (perm)	0	3539	1553	3400	3505	0	0	0	0	1698	1698	1509
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			502									395
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		481			749			416			580	
Travel Time (s)		8.2			12.8			7.1			9.9	
Peak Hour Factor	0.94	0.94	0.94	0.86	0.86	0.86	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	2%	4%	3%	3%	0%	0%	0%	0%	1%	0%	7%
Adj. Flow (vph)	0	931	502	372	1172	0	0	0	0	382	0	395
Shared Lane Traffic (%)										50%		
Lane Group Flow (vph)	0	931	502	372	1172	0	0	0	0	191	191	395
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type		NA	Perm	Prot	NA					custom	NA	Free
Protected Phases		2		1	6					7	7	
Permitted Phases			2							7		Free
Detector Phase		2	2	1	6					7	7	
Switch Phase												
Minimum Initial (s)		5.0	5.0	5.0	5.0					5.0	5.0	
Minimum Split (s)		23.0	23.0	10.0	23.0					10.0	10.0	
Total Split (s)		26.0	26.0	11.0	37.0					18.0	18.0	
Total Split (%)		47.3%	47.3%	20.0%	67.3%					32.7%	32.7%	
Maximum Green (s)		21.0	21.0	6.0	32.0					13.0	13.0	
Yellow Time (s)		3.0	3.0	3.0	3.0					3.0	3.0	
All-Red Time (s)		2.0	2.0	2.0	2.0					2.0	2.0	
Lost Time Adjust (s)		-1.0	-1.0	-1.0	-1.0					-1.0	1.0	
Total Lost Time (s)		4.0	4.0	4.0	4.0					4.0	6.0	
Lead/Lag		Lag	Lag	Lead								
Lead-Lag Optimize?		Yes	Yes	Yes								
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	
Recall Mode		None	None	None	None					None	None	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Walk Time (s)		7.0	7.0		7.0							
Flash Dont Walk (s)		11.0	11.0		11.0							
Pedestrian Calls (#/hr)		0	0		0							
Act Effct Green (s)		20.5	20.5	7.1	31.6					11.4	9.4	51.1
Actuated g/C Ratio		0.40	0.40	0.14	0.62					0.22	0.18	1.00
v/c Ratio		0.66	0.54	0.79	0.54					0.50	0.61	0.26
Control Delay		15.4	3.9	38.5	7.1					22.8	28.5	0.4
Queue Delay		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Total Delay		15.4	3.9	38.5	7.1					22.8	28.5	0.4
LOS		B	A	D	A					C	C	A
Approach Delay		11.4			14.6						12.8	
Approach LOS		B			B						B	
Queue Length 50th (ft)		116	0	59	91					54	57	0
Queue Length 95th (ft)		180	48	#118	136					108	113	0
Internal Link Dist (ft)		401			669			336			500	
Turn Bay Length (ft)				300						200		200
Base Capacity (vph)		1536	958	469	2283					469	402	1509
Starvation Cap Reductn		0	0	0	0					0	0	0
Spillback Cap Reductn		0	0	0	0					0	0	0
Storage Cap Reductn		0	0	0	0					0	0	0
Reduced v/c Ratio		0.61	0.52	0.79	0.51					0.41	0.48	0.26

Intersection Summary

Area Type: Other
Cycle Length: 55
Actuated Cycle Length: 51.1
Natural Cycle: 50
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.79
Intersection Signal Delay: 13.0 Intersection LOS: B
Intersection Capacity Utilization 59.7% ICU Level of Service B
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 6: Route 140 & I-495 ON/OFF - Ramp SB



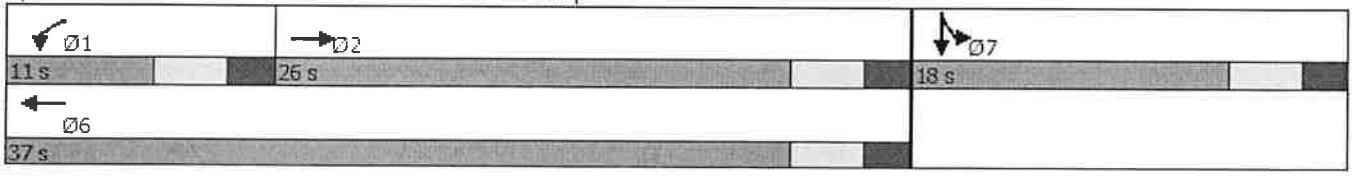
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	1128	649	334	1127	0	0	0	0	527	0	407
Future Volume (vph)	0	1128	649	334	1127	0	0	0	0	527	0	407
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	300		0	0		0	200		200
Storage Lanes	0		1	2		0	0		0	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	1.00	1.00	1.00	0.95	0.95	1.00
Frt			0.850									0.850
Flt Protected				0.950						0.950	0.950	
Satd. Flow (prot)	0	3574	1599	3502	3539	0	0	0	0	1715	1715	1553
Flt Permitted				0.950						0.950	0.950	
Satd. Flow (perm)	0	3574	1599	3502	3539	0	0	0	0	1715	1715	1553
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			698									406
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		481			749			416			580	
Travel Time (s)		8.2			12.8			7.1			9.9	
Peak Hour Factor	0.93	0.93	0.93	0.94	0.94	1.00	0.92	0.92	0.92	0.90	0.90	0.90
Heavy Vehicles (%)	0%	1%	1%	0%	2%	0%	0%	0%	0%	0%	0%	4%
Adj. Flow (vph)	0	1213	698	355	1199	0	0	0	0	586	0	452
Shared Lane Traffic (%)										50%		
Lane Group Flow (vph)	0	1213	698	355	1199	0	0	0	0	293	293	452
Number of Detectors		2	1	1	2					1	2	1
Detector Template		Thru	Right	Left	Thru					Left	Thru	Right
Leading Detector (ft)		100	20	20	100					20	100	20
Trailing Detector (ft)		0	0	0	0					0	0	0
Detector 1 Position(ft)		0	0	0	0					0	0	0
Detector 1 Size(ft)		6	20	20	6					20	6	20
Detector 1 Type		Cl+Ex	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	0.0
Detector 1 Queue (s)		0.0	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	0.0
Detector 2 Position(ft)		94			94						94	
Detector 2 Size(ft)		6			6						6	
Detector 2 Type		Cl+Ex			Cl+Ex						Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0						0.0	
Turn Type		NA	Perm	Prot	NA					custom	NA	Free
Protected Phases		2		1	6					7	7	
Permitted Phases			2							7		Free
Detector Phase		2	2	1	6					7	7	
Switch Phase												
Minimum Initial (s)		5.0	5.0	5.0	5.0					5.0	5.0	
Minimum Split (s)		23.0	23.0	10.0	23.0					10.0	10.0	
Total Split (s)		26.0	26.0	11.0	37.0					18.0	18.0	
Total Split (%)		47.3%	47.3%	20.0%	67.3%					32.7%	32.7%	
Maximum Green (s)		21.0	21.0	6.0	32.0					13.0	13.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Yellow Time (s)		3.0	3.0	3.0	3.0					3.0	3.0	
All-Red Time (s)		2.0	2.0	2.0	2.0					2.0	2.0	
Lost Time Adjust (s)		-1.0	-1.0	-1.0	-1.0					-1.0	1.0	
Total Lost Time (s)		4.0	4.0	4.0	4.0					4.0	6.0	
Lead/Lag		Lag	Lag	Lead								
Lead-Lag Optimize?		Yes	Yes	Yes								
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	
Recall Mode		None	None	None	None					None	None	
Walk Time (s)		7.0	7.0		7.0							
Flash Dont Walk (s)		11.0	11.0		11.0							
Pedestrian Calls (#/hr)		0	0		0							
Act Effct Green (s)		22.0	22.0	7.0	33.0					13.3	11.3	54.3
Actuated g/C Ratio		0.41	0.41	0.13	0.61					0.24	0.21	1.00
v/c Ratio		0.84	0.66	0.79	0.56					0.70	0.82	0.29
Control Delay		21.9	4.7	38.5	7.7					29.4	42.0	0.5
Queue Delay		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Total Delay		21.9	4.7	38.5	7.7					29.4	42.0	0.5
LOS		C	A	D	A					C	D	A
Approach Delay		15.6			14.8						20.4	
Approach LOS		B			B						C	
Queue Length 50th (ft)		181	0	59	106					90	95	0
Queue Length 95th (ft)		#296	55	#117	151					#187	#210	0
Internal Link Dist (ft)		401			669			336			500	
Turn Bay Length (ft)				300						200		200
Base Capacity (vph)		1447	1063	451	2150					442	379	1553
Starvation Cap Reductn		0	0	0	0					0	0	0
Spillback Cap Reductn		0	0	0	0					0	0	0
Storage Cap Reductn		0	0	0	0					0	0	0
Reduced v/c Ratio		0.84	0.66	0.79	0.56					0.66	0.77	0.29

Intersection Summary

Area Type: Other
Cycle Length: 55
Actuated Cycle Length: 54.3
Natural Cycle: 55
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.84
Intersection Signal Delay: 16.4 Intersection LOS: B
Intersection Capacity Utilization 76.0% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 6: Route 140 & I-495 ON/OFF - Ramp SB



West Central Street (Route 140) at Grove Street

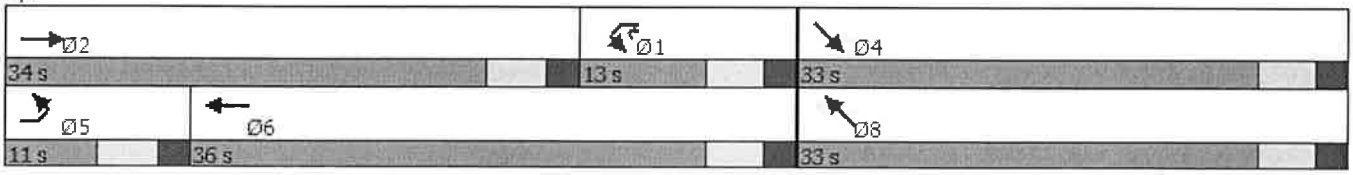
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	9	830	70	261	862	228	167	20	8	77	51	380
Future Volume (vph)	9	830	70	261	862	228	167	20	8	77	51	380
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	300		0	200		100	0		300
Storage Lanes	1		0	2		1	1		1	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	0.95	0.97	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.988				0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950				0.971	
Satd. Flow (prot)	1805	3427	0	3433	3406	1615	1787	1900	1615	0	1823	1583
Flt Permitted	0.950			0.950			0.636				0.826	
Satd. Flow (perm)	1805	3427	0	3433	3406	1615	1196	1900	1615	0	1551	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		13				262			184			109
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		552			481			583			666	
Travel Time (s)		9.4			8.2			9.9			11.4	
Peak Hour Factor	0.95	0.95	0.95	0.87	0.87	0.87	0.81	0.81	0.81	0.87	0.87	0.87
Heavy Vehicles (%)	0%	4%	5%	2%	6%	0%	1%	0%	0%	2%	0%	2%
Adj. Flow (vph)	9	874	74	300	991	262	206	25	10	89	59	437
Shared Lane Traffic (%)												
Lane Group Flow (vph)	9	948	0	300	991	262	206	25	10	0	148	437
Number of Detectors	1	2		1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100		20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0		0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0		0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6		20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	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	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	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	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	pm+ov
Protected Phases	5	2		1	6			4			8	1
Permitted Phases						6	4		4	8		8
Detector Phase	5	2		1	6	6	4	4	4	8	8	1
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.5	23.5		10.5	23.5	23.5	25.0	25.0	25.0	25.0	25.0	10.5
Total Split (s)	11.0	34.0		13.0	36.0	36.0	33.0	33.0	33.0	33.0	33.0	13.0
Total Split (%)	13.8%	42.5%		16.3%	45.0%	45.0%	41.3%	41.3%	41.3%	41.3%	41.3%	16.3%
Maximum Green (s)	5.5	28.5		7.5	30.5	30.5	27.5	27.5	27.5	27.5	27.5	7.5

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0		2.0	2.0	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	-2.0	-2.0	-2.0		-2.0	-2.0
Total Lost Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5		3.5	3.5
Lead/Lag	Lead	Lead		Lag	Lag	Lag						Lag
Lead-Lag Optimize?		Yes		Yes								Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None	None	Max	Max	Max	Max	Max	None
Walk Time (s)		7.0			7.0	7.0	7.0	7.0	7.0	7.0	7.0	
Flash Dont Walk (s)		11.0			11.0	11.0	11.0	11.0	11.0	11.0	11.0	
Pedestrian Calls (#/hr)		0			0	0	0	0	0	0	0	
Act Effct Green (s)	7.5	27.9		9.5	38.8	38.8	29.6	29.6	29.6		29.6	42.6
Actuated g/C Ratio	0.10	0.36		0.12	0.50	0.50	0.38	0.38	0.38		0.38	0.55
v/c Ratio	0.05	0.76		0.71	0.58	0.28	0.45	0.03	0.01		0.25	0.48
Control Delay	33.9	26.2		44.0	16.1	2.8	22.7	16.4	0.0		18.7	10.3
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Total Delay	33.9	26.2		44.0	16.1	2.8	22.7	16.4	0.0		18.7	10.3
LOS	C	C		D	B	A	C	B	A		B	B
Approach Delay		26.3			19.2			21.1			12.4	
Approach LOS		C			B			C			B	
Queue Length 50th (ft)	4	205		75	155	0	77	8	0		51	93
Queue Length 95th (ft)	18	275		#121	268	38	121	21	0		90	156
Internal Link Dist (ft)		472			401			503			586	
Turn Bay Length (ft)	100			300			200		100			300
Base Capacity (vph)	175	1360		421	1704	938	456	725	729		591	919
Starvation Cap Reductn	0	0		0	0	0	0	0	0		0	0
Spillback Cap Reductn	0	0		0	0	0	0	0	0		0	0
Storage Cap Reductn	0	0		0	0	0	0	0	0		0	0
Reduced v/c Ratio	0.05	0.70		0.71	0.58	0.28	0.45	0.03	0.01		0.25	0.48

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 77.5
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.76
Intersection Signal Delay: 20.2 — Intersection LOS: C
Intersection Capacity Utilization 68.0% — ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Grove Street & Route 140



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	20	1019	93	361	790	378	398	72	20	62	48	384
Future Volume (vph)	20	1019	93	361	790	378	398	72	20	62	48	384
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	300		0	200		100	0		300
Storage Lanes	1		0	2		1	1		1	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	0.95	0.97	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.987				0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950				0.973	
Satd. Flow (prot)	1805	3496	0	3467	3471	1615	1805	1900	1615	0	1849	1599
Flt Permitted	0.950			0.950			0.676				0.817	
Satd. Flow (perm)	1805	3496	0	3467	3471	1615	1284	1900	1615	0	1552	1599
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		14				402			184			109
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		552			481			583			666	
Travel Time (s)		9.4			8.2			9.9			11.4	
Peak Hour Factor	0.81	0.81	0.81	0.94	0.94	0.94	0.80	0.80	0.80	0.94	0.94	0.94
Heavy Vehicles (%)	0%	2%	1%	1%	4%	0%	0%	0%	0%	0%	0%	1%
Adj. Flow (vph)	25	1258	115	384	840	402	498	90	25	66	51	409
Shared Lane Traffic (%)												
Lane Group Flow (vph)	25	1373	0	384	840	402	498	90	25	0	117	409
Number of Detectors	1	2		1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100		20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0		0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0		0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6		20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	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	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	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	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	pm+ov
Protected Phases	5	2		1	6			4			8	1
Permitted Phases						6	4		4	8		8
Detector Phase	5	2		1	6	6	4	4	4	8	8	1
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.5	23.5		10.5	23.5	23.5	25.0	25.0	25.0	25.0	25.0	10.5
Total Split (s)	11.0	34.0		13.0	36.0	36.0	33.0	33.0	33.0	33.0	33.0	13.0
Total Split (%)	13.8%	42.5%		16.3%	45.0%	45.0%	41.3%	41.3%	41.3%	41.3%	41.3%	16.3%
Maximum Green (s)	5.5	28.5		7.5	30.5	30.5	27.5	27.5	27.5	27.5	27.5	7.5

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0		2.0	2.0	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	-2.0	-2.0	-2.0		-2.0	-2.0
Total Lost Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5		3.5	3.5
Lead/Lag	Lead	Lead		Lag	Lag	Lag						Lag
Lead-Lag Optimize?		Yes		Yes								Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None	None	Max	Max	Max	Max	Max	None
Walk Time (s)		7.0			7.0	7.0	7.0	7.0	7.0	7.0	7.0	
Flash Dont Walk (s)		11.0			11.0	11.0	11.0	11.0	11.0	11.0	11.0	
Pedestrian Calls (#/hr)		0			0	0	0	0	0	0	0	
Act Effct Green (s)	7.5	30.5		9.5	39.1	39.1	29.5	29.5	29.5		29.5	42.5
Actuated g/C Ratio	0.09	0.38		0.12	0.49	0.49	0.37	0.37	0.37		0.37	0.53
v/c Ratio	0.15	1.02		0.93	0.50	0.40	1.05	0.13	0.04		0.20	0.45
Control Delay	35.6	56.8		67.7	16.2	3.2	83.8	17.4	0.1		18.5	10.1
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Total Delay	35.6	56.8		67.7	16.2	3.2	83.8	17.4	0.1		18.5	10.1
LOS	D	E		E	B	A	F	B	A		B	B
Approach Delay		56.4			25.1			70.6			12.0	
Approach LOS		E			C			E			B	
Queue Length 50th (ft)	12	~370		99	123	0	~276	29	0		39	82
Queue Length 95th (ft)	31	#428		#181	226	51	#378	53	0		76	149
Internal Link Dist (ft)		472			401			503			586	
Turn Bay Length (ft)	100			300			200		100			300
Base Capacity (vph)	169	1341		411	1696	994	473	700	711		572	900
Starvation Cap Reductn	0	0		0	0	0	0	0	0		0	0
Spillback Cap Reductn	0	0		0	0	0	0	0	0		0	0
Storage Cap Reductn	0	0		0	0	0	0	0	0		0	0
Reduced v/c Ratio	0.15	1.02		0.93	0.50	0.40	1.05	0.13	0.04		0.20	0.45

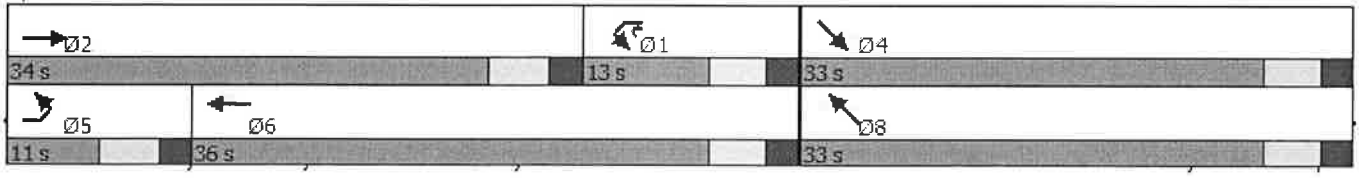
Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Natural Cycle: 75
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.05
Intersection Signal Delay: 40.7 — Intersection LOS: D
Intersection Capacity Utilization 87.0% — ICU Level of Service E
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: 3: Grove Street & Route 140



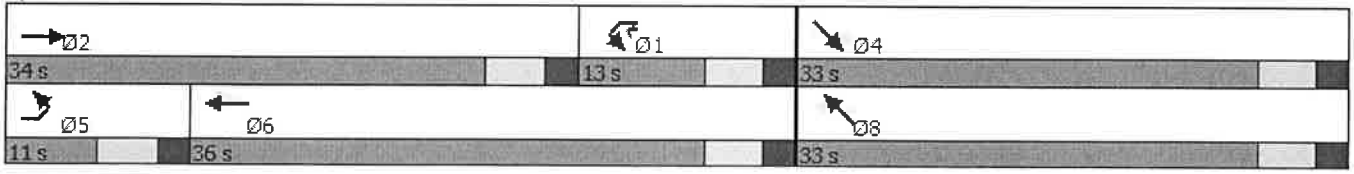
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	9	830	71	270	862	228	167	21	8	77	51	389
Future Volume (vph)	9	830	71	270	862	228	167	21	8	77	51	389
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	300		0	200		100	0		300
Storage Lanes	1		0	2		1	1		1	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	0.95	0.97	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.988				0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950				0.971	
Satd. Flow (prot)	1805	3427	0	3433	3406	1615	1787	1900	1615	0	1823	1583
Flt Permitted	0.950			0.950			0.636				0.826	
Satd. Flow (perm)	1805	3427	0	3433	3406	1615	1196	1900	1615	0	1551	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		13				262			184			109
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		552			481			583			666	
Travel Time (s)		9.4			8.2			9.9			11.4	
Peak Hour Factor	0.95	0.95	0.95	0.87	0.87	0.87	0.81	0.81	0.81	0.87	0.87	0.87
Heavy Vehicles (%)	0%	4%	5%	2%	6%	0%	1%	0%	0%	2%	0%	2%
Adj. Flow (vph)	9	874	75	310	991	262	206	26	10	89	59	447
Shared Lane Traffic (%)												
Lane Group Flow (vph)	9	949	0	310	991	262	206	26	10	0	148	447
Number of Detectors	1	2		1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100		20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0		0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0		0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6		20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	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	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	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	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	pm+ov
Protected Phases	5	2		1	6			4			8	1
Permitted Phases						6	4		4	8		8
Detector Phase	5	2		1	6	6	4	4	4	8	8	1
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.5	23.5		10.5	23.5	23.5	25.0	25.0	25.0	25.0	25.0	10.5
Total Split (s)	11.0	34.0		13.0	36.0	36.0	33.0	33.0	33.0	33.0	33.0	13.0
Total Split (%)	13.8%	42.5%		16.3%	45.0%	45.0%	41.3%	41.3%	41.3%	41.3%	41.3%	16.3%
Maximum Green (s)	5.5	28.5		7.5	30.5	30.5	27.5	27.5	27.5	27.5	27.5	7.5

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0		2.0	2.0	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	-2.0	-2.0	-2.0		-2.0	-2.0
Total Lost Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5		3.5	3.5
Lead/Lag	Lead	Lead		Lag	Lag	Lag						Lag
Lead-Lag Optimize?		Yes		Yes								Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None	None	Max	Max	Max	Max	Max	None
Walk Time (s)		7.0			7.0	7.0	7.0	7.0	7.0	7.0	7.0	
Flash Dont Walk (s)		11.0			11.0	11.0	11.0	11.0	11.0	11.0	11.0	
Pedestrian Calls (#/hr)		0			0	0	0	0	0	0	0	
Act Effct Green (s)	7.5	27.9		9.5	38.8	38.8	29.6	29.6	29.6		29.6	42.6
Actuated g/C Ratio	0.10	0.36		0.12	0.50	0.50	0.38	0.38	0.38		0.38	0.55
v/c Ratio	0.05	0.76		0.74	0.58	0.28	0.45	0.04	0.01		0.25	0.49
Control Delay	33.9	26.2		45.4	16.0	2.8	22.7	16.4	0.0		18.7	10.5
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Total Delay	33.9	26.2		45.4	16.0	2.8	22.7	16.4	0.0		18.7	10.5
LOS	C	C		D	B	A	C	B	A		B	B
Approach Delay		26.3			19.6			21.1			12.5	
Approach LOS		C			B			C			B	
Queue Length 50th (ft)	4	205		78	155	0	77	8	0		51	97
Queue Length 95th (ft)	18	275		#127	268	38	121	21	0		90	162
Internal Link Dist (ft)		472			401			503			586	
Turn Bay Length (ft)	100			300			200		100			300
Base Capacity (vph)	175	1359		421	1704	938	456	724	729		591	919
Starvation Cap Reductn	0	0		0	0	0	0	0	0		0	0
Spillback Cap Reductn	0	0		0	0	0	0	0	0		0	0
Storage Cap Reductn	0	0		0	0	0	0	0	0		0	0
Reduced v/c Ratio	0.05	0.70		0.74	0.58	0.28	0.45	0.04	0.01		0.25	0.49

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 77.5
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.76
Intersection Signal Delay: 20.4 — Intersection LOS: C
Intersection Capacity Utilization 68.5% — ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Grove Street & Route 140



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	20	1019	94	365	790	378	398	72	20	63	49	394
Future Volume (vph)	20	1019	94	365	790	378	398	72	20	63	49	394
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	300		0	200		100	0		300
Storage Lanes	1		0	2		1	1		1	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	0.95	0.97	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.987				0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950				0.973	
Satd. Flow (prot)	1805	3496	0	3467	3471	1615	1805	1900	1615	0	1849	1599
Flt Permitted	0.950			0.950			0.673				0.816	
Satd. Flow (perm)	1805	3496	0	3467	3471	1615	1279	1900	1615	0	1550	1599
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		14				402			184			109
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		552			481			583			666	
Travel Time (s)		9.4			8.2			9.9			11.4	
Peak Hour Factor	0.81	0.81	0.81	0.94	0.94	0.94	0.80	0.80	0.80	0.94	0.94	0.94
Heavy Vehicles (%)	0%	2%	1%	1%	4%	0%	0%	0%	0%	0%	0%	1%
Adj. Flow (vph)	25	1258	116	388	840	402	498	90	25	67	52	419
Shared Lane Traffic (%)												
Lane Group Flow (vph)	25	1374	0	388	840	402	498	90	25	0	119	419
Number of Detectors	1	2		1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100		20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0		0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0		0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6		20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	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	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	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	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	pm+ov
Protected Phases	5	2		1	6			4			8	1
Permitted Phases						6	4		4	8		8
Detector Phase	5	2		1	6	6	4	4	4	8	8	1
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.5	23.5		10.5	23.5	23.5	25.0	25.0	25.0	25.0	25.0	10.5
Total Split (s)	11.0	34.0		13.0	36.0	36.0	33.0	33.0	33.0	33.0	33.0	13.0
Total Split (%)	13.8%	42.5%		16.3%	45.0%	45.0%	41.3%	41.3%	41.3%	41.3%	41.3%	16.3%
Maximum Green (s)	5.5	28.5		7.5	30.5	30.5	27.5	27.5	27.5	27.5	27.5	7.5

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0		2.0	2.0	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	-2.0	-2.0	-2.0		-2.0	-2.0
Total Lost Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5		3.5	3.5
Lead/Lag	Lead	Lead		Lag	Lag	Lag						Lag
Lead-Lag Optimize?		Yes		Yes								Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None	None	Max	Max	Max	Max	Max	None
Walk Time (s)		7.0			7.0	7.0	7.0	7.0	7.0	7.0	7.0	
Flash Dont Walk (s)		11.0			11.0	11.0	11.0	11.0	11.0	11.0	11.0	
Pedestrian Calls (#/hr)		0			0	0	0	0	0	0	0	
Act Effct Green (s)	7.5	30.5		9.5	39.1	39.1	29.5	29.5	29.5		29.5	42.5
Actuated g/C Ratio	0.09	0.38		0.12	0.49	0.49	0.37	0.37	0.37		0.37	0.53
v/c Ratio	0.15	1.02		0.94	0.50	0.40	1.06	0.13	0.04		0.21	0.47
Control Delay	35.6	57.0		69.6	16.2	3.2	85.2	17.4	0.1		18.5	10.4
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Total Delay	35.6	57.0		69.6	16.2	3.2	85.2	17.4	0.1		18.5	10.4
LOS	D	E		E	B	A	F	B	A		B	B
Approach Delay		56.7			25.7			71.8			12.2	
Approach LOS		E			C			E			B	
Queue Length 50th (ft)	12	~371		101	123	0	~277	29	0		40	86
Queue Length 95th (ft)	31	#428		#184	226	51	#379	53	0		77	155
Internal Link Dist (ft)		472			401			503			586	
Turn Bay Length (ft)	100			300			200		100			300
Base Capacity (vph)	169	1341		411	1696	994	471	700	711		571	900
Starvation Cap Reductn	0	0		0	0	0	0	0	0		0	0
Spillback Cap Reductn	0	0		0	0	0	0	0	0		0	0
Storage Cap Reductn	0	0		0	0	0	0	0	0		0	0
Reduced v/c Ratio	0.15	1.02		0.94	0.50	0.40	1.06	0.13	0.04		0.21	0.47

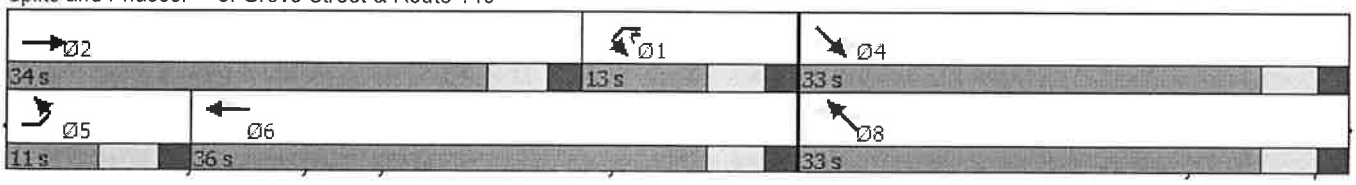
Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.06
Intersection Signal Delay: 41.1 Intersection LOS: D
Intersection Capacity Utilization 87.6% ICU Level of Service E
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: 3: Grove Street & Route 140



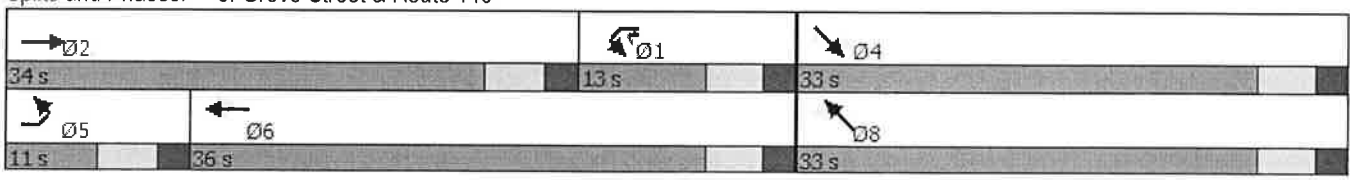
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	9	830	71	275	862	228	167	21	8	78	52	384
Future Volume (vph)	9	830	71	275	862	228	167	21	8	78	52	384
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	300		0	200		100	0		300
Storage Lanes	1		0	2		1	1		1	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	0.95	0.97	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.988				0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950				0.971	
Satd. Flow (prot)	1805	3427	0	3433	3406	1615	1787	1900	1615	0	1823	1583
Flt Permitted	0.950			0.950			0.633				0.826	
Satd. Flow (perm)	1805	3427	0	3433	3406	1615	1191	1900	1615	0	1551	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		13				262			184			109
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		552			481			583			666	
Travel Time (s)		9.4			8.2			9.9			11.4	
Peak Hour Factor	0.95	0.95	0.95	0.87	0.87	0.87	0.81	0.81	0.81	0.87	0.87	0.87
Heavy Vehicles (%)	0%	4%	5%	2%	6%	0%	1%	0%	0%	2%	0%	2%
Adj. Flow (vph)	9	874	75	316	991	262	206	26	10	90	60	441
Shared Lane Traffic (%)												
Lane Group Flow (vph)	9	949	0	316	991	262	206	26	10	0	150	441
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			24			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	pm+ov
Protected Phases	5	2		1	6			4			8	1
Permitted Phases						6	4		4	8		8
Detector Phase	5	2		1	6	6	4	4	4	8	8	1
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.5	23.5		10.5	23.5	23.5	25.0	25.0	25.0	25.0	25.0	10.5
Total Split (s)	11.0	34.0		13.0	36.0	36.0	33.0	33.0	33.0	33.0	33.0	13.0
Total Split (%)	13.8%	42.5%		16.3%	45.0%	45.0%	41.3%	41.3%	41.3%	41.3%	41.3%	16.3%
Maximum Green (s)	5.5	28.5		7.5	30.5	30.5	27.5	27.5	27.5	27.5	27.5	7.5
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0		2.0	2.0	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	-2.0	-2.0	-2.0		-2.0	-2.0
Total Lost Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5		3.5	3.5
Lead/Lag	Lead	Lead		Lag	Lag	Lag						Lag
Lead-Lag Optimize?		Yes		Yes								Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None	None	Max	Max	Max	Max	Max	None

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Walk Time (s)		7.0			7.0	7.0	7.0	7.0	7.0	7.0	7.0	
Flash Dont Walk (s)		11.0			11.0	11.0	11.0	11.0	11.0	11.0	11.0	
Pedestrian Calls (#/hr)		0			0	0	0	0	0	0	0	
Act Effct Green (s)	7.5	27.9		9.5	38.8	38.8	29.6	29.6	29.6		29.6	42.6
Actuated g/C Ratio	0.10	0.36		0.12	0.50	0.50	0.38	0.38	0.38		0.38	0.55
v/c Ratio	0.05	0.76		0.75	0.58	0.28	0.45	0.04	0.01		0.25	0.48
Control Delay	33.9	26.2		46.2	16.0	2.8	22.8	16.4	0.0		18.7	10.4
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Total Delay	33.9	26.2		46.2	16.0	2.8	22.8	16.4	0.0		18.7	10.4
LOS	C	C		D	B	A	C	B	A		B	B
Approach Delay		26.3			19.9			21.1			12.5	
Approach LOS		C			B			C			B	
Queue Length 50th (ft)	4	205		80	155	0	77	8	0		51	95
Queue Length 95th (ft)	18	275		#131	268	38	121	21	0		91	159
Internal Link Dist (ft)		472			401			503			586	
Turn Bay Length (ft)	100			300			200		100			300
Base Capacity (vph)	175	1359		421	1704	938	454	724	729		591	919
Starvation Cap Reductn	0	0		0	0	0	0	0	0		0	0
Spillback Cap Reductn	0	0		0	0	0	0	0	0		0	0
Storage Cap Reductn	0	0		0	0	0	0	0	0		0	0
Reduced v/c Ratio	0.05	0.70		0.75	0.58	0.28	0.45	0.04	0.01		0.25	0.48

Intersection Summary			
Area Type:	Other		
Cycle Length: 80			
Actuated Cycle Length: 77.5			
Natural Cycle: 60			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.76			
Intersection Signal Delay: 20.5		Intersection LOS: C	
Intersection Capacity Utilization 68.2%		ICU Level of Service C	
Analysis Period (min) 15			

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Grove Street & Route 140



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	20	1019	94	366	790	378	398	73	20	64	50	398
Future Volume (vph)	20	1019	94	366	790	378	398	73	20	64	50	398
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	300		0	200		100	0		300
Storage Lanes	1		0	2		1	1		1	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	0.95	0.97	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.987				0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950				0.973	
Satd. Flow (prot)	1805	3496	0	3467	3471	1615	1805	1900	1615	0	1849	1599
Flt Permitted	0.950			0.950			0.671				0.815	
Satd. Flow (perm)	1805	3496	0	3467	3471	1615	1275	1900	1615	0	1548	1599
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		14				402			184			109
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		552			481			583			666	
Travel Time (s)		9.4			8.2			9.9			11.4	
Peak Hour Factor	0.81	0.81	0.81	0.94	0.94	0.94	0.80	0.80	0.80	0.94	0.94	0.94
Heavy Vehicles (%)	0%	2%	1%	1%	4%	0%	0%	0%	0%	0%	0%	1%
Adj. Flow (vph)	25	1258	116	389	840	402	498	91	25	68	53	423
Shared Lane Traffic (%)												
Lane Group Flow (vph)	25	1374	0	389	840	402	498	91	25	0	121	423
Number of Detectors	1	2		1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100		20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0		0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0		0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6		20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	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	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	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	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	pm+ov
Protected Phases	5	2		1	6			4			8	1
Permitted Phases						6	4		4	8		8
Detector Phase	5	2		1	6	6	4	4	4	8	8	1
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.5	23.5		10.5	23.5	23.5	25.0	25.0	25.0	25.0	25.0	10.5
Total Split (s)	11.0	34.0		13.0	36.0	36.0	33.0	33.0	33.0	33.0	33.0	13.0
Total Split (%)	13.8%	42.5%		16.3%	45.0%	45.0%	41.3%	41.3%	41.3%	41.3%	41.3%	16.3%
Maximum Green (s)	5.5	28.5		7.5	30.5	30.5	27.5	27.5	27.5	27.5	27.5	7.5

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0		2.0	2.0	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	-2.0	-2.0	-2.0		-2.0	-2.0
Total Lost Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5		3.5	3.5
Lead/Lag	Lead	Lead		Lag	Lag	Lag						Lag
Lead-Lag Optimize?		Yes		Yes								Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None	None	Max	Max	Max	Max	Max	None
Walk Time (s)		7.0			7.0	7.0	7.0	7.0	7.0	7.0	7.0	
Flash Dont Walk (s)		11.0			11.0	11.0	11.0	11.0	11.0	11.0	11.0	
Pedestrian Calls (#/hr)		0			0	0	0	0	0	0	0	
Act Effct Green (s)	7.5	30.5		9.5	39.1	39.1	29.5	29.5	29.5		29.5	42.5
Actuated g/C Ratio	0.09	0.38		0.12	0.49	0.49	0.37	0.37	0.37		0.37	0.53
v/c Ratio	0.15	1.02		0.95	0.50	0.40	1.06	0.13	0.04		0.21	0.47
Control Delay	35.6	57.0		70.0	16.2	3.2	85.9	17.4	0.1		18.6	10.4
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Total Delay	35.6	57.0		70.0	16.2	3.2	85.9	17.4	0.1		18.6	10.4
LOS	D	E		E	B	A	F	B	A		B	B
Approach Delay		56.7			25.8			72.3			12.3	
Approach LOS		E			C			E			B	
Queue Length 50th (ft)	12	~371		101	123	0	~278	30	0		41	88
Queue Length 95th (ft)	31	#428		#185	226	51	#380	53	0		78	158
Internal Link Dist (ft)		472			401			503			586	
Turn Bay Length (ft)	100			300			200		100			300
Base Capacity (vph)	169	1341		411	1696	994	470	700	711		570	900
Starvation Cap Reductn	0	0		0	0	0	0	0	0		0	0
Spillback Cap Reductn	0	0		0	0	0	0	0	0		0	0
Storage Cap Reductn	0	0		0	0	0	0	0	0		0	0
Reduced v/c Ratio	0.15	1.02		0.95	0.50	0.40	1.06	0.13	0.04		0.21	0.47

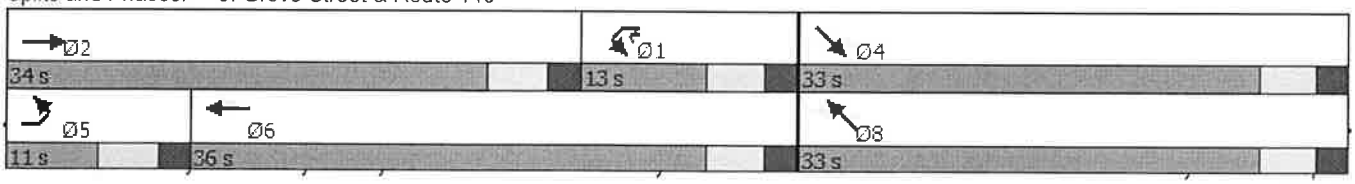
Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.06
Intersection Signal Delay: 41.2 Intersection LOS: D
Intersection Capacity Utilization 87.9% ICU Level of Service E
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: 3: Grove Street & Route 140



Grove Street at 200 Grove Street Driveway

Intersection	
Int Delay, s/veh	1.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	8	16	643	8	7	149
Future Vol, veh/h	8	16	643	8	7	149
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	25	75	92	92	76	76
Heavy Vehicles, %	75	56	1	25	14	6
Mvmt Flow	32	21	699	9	9	196

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	918	704	0	0	708	0
Stage 1	704	-	-	-	-	-
Stage 2	214	-	-	-	-	-
Critical Hdwy	7.15	6.76	-	-	4.24	-
Critical Hdwy Stg 1	6.15	-	-	-	-	-
Critical Hdwy Stg 2	6.15	-	-	-	-	-
Follow-up Hdwy	4.175	3.804	-	-	2.326	-
Pot Cap-1 Maneuver	226	358	-	-	838	-
Stage 1	379	-	-	-	-	-
Stage 2	676	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	223	358	-	-	838	-
Mov Cap-2 Maneuver	223	-	-	-	-	-
Stage 1	379	-	-	-	-	-
Stage 2	668	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	22.1	0	0.4
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	263	838	-
HCM Lane V/C Ratio	-	-	0.203	0.011	-
HCM Control Delay (s)	-	-	22.1	9.3	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.7	0	-

Intersection	
Int Delay, s/veh	0.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	10	5	259	5	4	554
Future Vol, veh/h	10	5	259	5	4	554
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	75	75	92	92	91	91
Heavy Vehicles, %	20	20	2	20	25	1
Mvmt Flow	13	7	282	5	4	609

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	902	285	0	0	287	0
Stage 1	285	-	-	-	-	-
Stage 2	617	-	-	-	-	-
Critical Hdwy	6.6	6.4	-	-	4.35	-
Critical Hdwy Stg 1	5.6	-	-	-	-	-
Critical Hdwy Stg 2	5.6	-	-	-	-	-
Follow-up Hdwy	3.68	3.48	-	-	2.425	-
Pot Cap-1 Maneuver	287	713	-	-	1154	-
Stage 1	724	-	-	-	-	-
Stage 2	505	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	286	713	-	-	1154	-
Mov Cap-2 Maneuver	286	-	-	-	-	-
Stage 1	724	-	-	-	-	-
Stage 2	502	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	15.7	0	0.1
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	357	1154	-
HCM Lane V/C Ratio	-	-	0.056	0.004	-
HCM Control Delay (s)	-	-	15.7	8.1	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0	-

Intersection	
Int Delay, s/veh	1.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	8	16	647	8	7	160
Future Vol, veh/h	8	16	647	8	7	160
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	25	75	92	92	76	76
Heavy Vehicles, %	75	56	1	25	14	6
Mvmt Flow	32	21	703	9	9	211

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	937	708	0	0	712	0
Stage 1	708	-	-	-	-	-
Stage 2	229	-	-	-	-	-
Critical Hdwy	7.15	6.76	-	-	4.24	-
Critical Hdwy Stg 1	6.15	-	-	-	-	-
Critical Hdwy Stg 2	6.15	-	-	-	-	-
Follow-up Hdwy	4.175	3.804	-	-	2.326	-
Pot Cap-1 Maneuver	220	356	-	-	835	-
Stage 1	377	-	-	-	-	-
Stage 2	664	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	217	356	-	-	835	-
Mov Cap-2 Maneuver	217	-	-	-	-	-
Stage 1	377	-	-	-	-	-
Stage 2	656	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	22.6	0	0.4
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	257	835	-
HCM Lane V/C Ratio	-	-	0.208	0.011	-
HCM Control Delay (s)	-	-	22.6	9.4	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.8	0	-

Intersection	
Int Delay, s/veh	0.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	10	5	271	5	4	559
Future Vol, veh/h	10	5	271	5	4	559
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	75	75	92	92	91	91
Heavy Vehicles, %	20	20	2	20	25	1
Mvmt Flow	13	7	295	5	4	614

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	920	298	0	0	300	0
Stage 1	298	-	-	-	-	-
Stage 2	622	-	-	-	-	-
Critical Hdwy	6.6	6.4	-	-	4.35	-
Critical Hdwy Stg 1	5.6	-	-	-	-	-
Critical Hdwy Stg 2	5.6	-	-	-	-	-
Follow-up Hdwy	3.68	3.48	-	-	2.425	-
Pot Cap-1 Maneuver	279	701	-	-	1141	-
Stage 1	714	-	-	-	-	-
Stage 2	502	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	278	701	-	-	1141	-
Mov Cap-2 Maneuver	278	-	-	-	-	-
Stage 1	714	-	-	-	-	-
Stage 2	499	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16	0	0.1
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	348	1141	-
HCM Lane V/C Ratio	-	-	0.057	0.004	-
HCM Control Delay (s)	-	-	16	8.2	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0	-

Intersection	
Int Delay, s/veh	1.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	8	16	649	8	7	165
Future Vol, veh/h	8	16	649	8	7	165
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	25	75	92	92	76	76
Heavy Vehicles, %	75	56	1	25	14	6
Mvmt Flow	32	21	705	9	9	217

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	945	710	0	0	714	0
Stage 1	710	-	-	-	-	-
Stage 2	235	-	-	-	-	-
Critical Hdwy	7.15	6.76	-	-	4.24	-
Critical Hdwy Stg 1	6.15	-	-	-	-	-
Critical Hdwy Stg 2	6.15	-	-	-	-	-
Follow-up Hdwy	4.175	3.804	-	-	2.326	-
Pot Cap-1 Maneuver	217	355	-	-	833	-
Stage 1	376	-	-	-	-	-
Stage 2	659	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	214	355	-	-	833	-
Mov Cap-2 Maneuver	214	-	-	-	-	-
Stage 1	376	-	-	-	-	-
Stage 2	651	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	22.9	0	0.4
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	254	833	-
HCM Lane V/C Ratio	-	-	0.21	0.011	-
HCM Control Delay (s)	-	-	22.9	9.4	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.8	0	-

Intersection	
Int Delay, s/veh	0.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	10	5	277	5	4	561
Future Vol, veh/h	10	5	277	5	4	561
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	75	75	92	92	91	91
Heavy Vehicles, %	20	20	2	20	25	1
Mvmt Flow	13	7	301	5	4	616

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	928	304	0	0	306	0
Stage 1	304	-	-	-	-	-
Stage 2	624	-	-	-	-	-
Critical Hdwy	6.6	6.4	-	-	4.35	-
Critical Hdwy Stg 1	5.6	-	-	-	-	-
Critical Hdwy Stg 2	5.6	-	-	-	-	-
Follow-up Hdwy	3.68	3.48	-	-	2.425	-
Pot Cap-1 Maneuver	276	695	-	-	1135	-
Stage 1	709	-	-	-	-	-
Stage 2	501	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	275	695	-	-	1135	-
Mov Cap-2 Maneuver	275	-	-	-	-	-
Stage 1	709	-	-	-	-	-
Stage 2	498	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.1	0	0.1
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	344	1135	-
HCM Lane V/C Ratio	-	-	0.058	0.004	-
HCM Control Delay (s)	-	-	16.1	8.2	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0	-

Grove Street at Old Grove Street/Gated Driveway

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	20	0	2	0	0	0	1	623	0	0	150	9
Future Vol, veh/h	20	0	2	0	0	0	1	623	0	0	150	9
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	75	75	75	75	75	75	89	89	89	76	76	76
Heavy Vehicles, %	0	0	0	0	0	0	100	1	0	10	14	0
Mvmt Flow	27	0	3	0	0	0	1	700	0	0	197	12

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	905	905	203	907	911	700	209	0	0	700	0	0
Stage 1	203	203	-	702	702	-	-	-	-	-	-	-
Stage 2	702	702	-	205	209	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	5.1	-	-	4.2	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	3.1	-	-	2.29	-	-
Pot Cap-1 Maneuver	260	278	843	259	276	443	944	-	-	861	-	-
Stage 1	804	737	-	432	443	-	-	-	-	-	-	-
Stage 2	432	443	-	802	733	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	259	277	843	258	275	443	944	-	-	861	-	-
Mov Cap-2 Maneuver	259	277	-	258	275	-	-	-	-	-	-	-
Stage 1	802	737	-	431	442	-	-	-	-	-	-	-
Stage 2	431	442	-	799	733	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	19.6	0	0	0
HCM LOS	C	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	944	-	-	276	-	861	-	-
HCM Lane V/C Ratio	0.001	-	-	0.106	-	-	-	-
HCM Control Delay (s)	8.8	0	-	19.6	0	0	-	-
HCM Lane LOS	A	A	-	C	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.4	-	0	-	-

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	4	0	1	0	0	0	0	258	0	0	550	20
Future Vol, veh/h	4	0	1	0	0	0	0	258	0	0	550	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	75	75	75	75	75	75	95	95	95	88	88	88
Heavy Vehicles, %	0	0	0	0	0	0	0	2	0	0	1	0
Mvmt Flow	5	0	1	0	0	0	0	272	0	0	625	23

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	909	909	637	909	920	272	648	0	0	272	0	0
Stage 1	637	637	-	272	272	-	-	-	-	-	-	-
Stage 2	272	272	-	637	648	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	258	277	481	258	273	772	947	-	-	1303	-	-
Stage 1	469	475	-	738	688	-	-	-	-	-	-	-
Stage 2	738	688	-	469	469	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	258	277	481	257	273	772	947	-	-	1303	-	-
Mov Cap-2 Maneuver	258	277	-	257	273	-	-	-	-	-	-	-
Stage 1	469	475	-	738	688	-	-	-	-	-	-	-
Stage 2	738	688	-	468	469	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	18	0	0	0
HCM LOS	C	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	947	-	-	284	-	1303	-	-
HCM Lane V/C Ratio	-	-	-	0.023	-	-	-	-
HCM Control Delay (s)	0	-	-	18	0	0	-	-
HCM Lane LOS	A	-	-	C	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	-	0	-	-

Intersection	
Int Delay, s/veh	0.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	20	0	2	1	0	3	1	624	8	10	151	9
Future Vol, veh/h	20	0	2	1	0	3	1	624	8	10	151	9
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	75	75	75	75	75	75	89	89	89	76	76	76
Heavy Vehicles, %	0	0	0	0	0	0	100	1	0	10	14	0
Mvmt Flow	27	0	3	1	0	4	1	701	9	13	199	12

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	941	943	205	941	945	706	211	0	0	710	0	0
Stage 1	231	231	-	708	708	-	-	-	-	-	-	-
Stage 2	710	712	-	233	237	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	5.1	-	-	4.2	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	3.1	-	-	2.29	-	-
Pot Cap-1 Maneuver	245	265	841	245	264	439	942	-	-	853	-	-
Stage 1	776	717	-	429	441	-	-	-	-	-	-	-
Stage 2	428	439	-	775	713	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	239	260	841	241	259	439	942	-	-	853	-	-
Mov Cap-2 Maneuver	239	260	-	241	259	-	-	-	-	-	-	-
Stage 1	774	705	-	428	440	-	-	-	-	-	-	-
Stage 2	423	438	-	759	701	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	20.9	15	0	0.5
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	942	-	-	256	364	853	-	-
HCM Lane V/C Ratio	0.001	-	-	0.115	0.015	0.015	-	-
HCM Control Delay (s)	8.8	0	-	20.9	15	9.3	0	-
HCM Lane LOS	A	A	-	C	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.4	0	0	-	-

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	4	0	1	8	0	11	0	259	1	3	552	20
Future Vol, veh/h	4	0	1	8	0	11	0	259	1	3	552	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	75	75	75	75	75	75	95	95	95	88	88	88
Heavy Vehicles, %	0	0	0	0	0	0	0	2	0	0	1	0
Mvmt Flow	5	0	1	11	0	15	0	273	1	3	627	23

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	926	919	639	919	930	274	650	0	0	274	0	0
Stage 1	645	645	-	274	274	-	-	-	-	-	-	-
Stage 2	281	274	-	645	656	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	251	273	480	254	269	770	946	-	-	1301	-	-
Stage 1	464	471	-	736	687	-	-	-	-	-	-	-
Stage 2	730	687	-	464	465	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	245	272	480	252	268	770	946	-	-	1301	-	-
Mov Cap-2 Maneuver	245	272	-	252	268	-	-	-	-	-	-	-
Stage 1	464	469	-	736	687	-	-	-	-	-	-	-
Stage 2	716	687	-	461	463	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	18.6	14.3	0	0
HCM LOS	C	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	946	-	-	272	413	1301	-	-
HCM Lane V/C Ratio	-	-	-	0.025	0.061	0.003	-	-
HCM Control Delay (s)	0	-	-	18.6	14.3	7.8	0	-
HCM Lane LOS	A	-	-	C	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.2	0	-	-

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	20	0	2	3	0	5	1	624	12	15	151	9
Future Vol, veh/h	20	0	2	3	0	5	1	624	12	15	151	9
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	75	75	75	75	75	75	89	89	89	76	76	76
Heavy Vehicles, %	0	0	0	0	0	0	100	1	0	10	14	0
Mvmt Flow	27	0	3	4	0	7	1	701	13	20	199	12

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	958	961	205	957	961	708	211	0	0	714	0	0
Stage 1	245	245	-	710	710	-	-	-	-	-	-	-
Stage 2	713	716	-	247	251	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	5.1	-	-	4.2	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	3.1	-	-	2.29	-	-
Pot Cap-1 Maneuver	239	258	841	239	258	438	942	-	-	850	-	-
Stage 1	763	707	-	428	440	-	-	-	-	-	-	-
Stage 2	426	437	-	761	703	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	230	251	841	233	251	438	942	-	-	850	-	-
Mov Cap-2 Maneuver	230	251	-	233	251	-	-	-	-	-	-	-
Stage 1	761	688	-	427	439	-	-	-	-	-	-	-
Stage 2	419	436	-	738	684	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	21.6	16.3	0	0.8
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	942	-	-	246	329	850	-	-
HCM Lane V/C Ratio	0.001	-	-	0.119	0.032	0.023	-	-
HCM Control Delay (s)	8.8	0	-	21.6	16.3	9.3	0	-
HCM Lane LOS	A	A	-	C	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.4	0.1	0.1	-	-

Intersection	
Int Delay, s/veh	0.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	4	0	1	13	0	16	0	260	2	4	553	20
Future Vol, veh/h	4	0	1	13	0	16	0	260	2	4	553	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	75	75	75	75	75	75	95	95	95	88	88	88
Heavy Vehicles, %	0	0	0	0	0	0	0	2	0	0	1	0
Mvmt Flow	5	0	1	17	0	21	0	274	2	5	628	23

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	936	926	640	925	936	275	651	0	0	276	0	0
Stage 1	650	650	-	275	275	-	-	-	-	-	-	-
Stage 2	286	276	-	650	661	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	247	271	479	252	267	769	945	-	-	1299	-	-
Stage 1	461	468	-	736	686	-	-	-	-	-	-	-
Stage 2	726	685	-	461	463	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	239	269	479	250	265	769	945	-	-	1299	-	-
Mov Cap-2 Maneuver	239	269	-	250	265	-	-	-	-	-	-	-
Stage 1	461	465	-	736	686	-	-	-	-	-	-	-
Stage 2	706	685	-	457	460	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	18.9	15	0	0.1
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	945	-	-	266	398	1299	-	-
HCM Lane V/C Ratio	-	-	-	0.025	0.097	0.003	-	-
HCM Control Delay (s)	0	-	-	18.9	15	7.8	0	-
HCM Lane LOS	A	-	-	C	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.3	0	-	-

Grove Street at 210 Grove Street Driveway 1

Intersection	
Int Delay, s/veh	0

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	0	624	2	1	151
Future Vol, veh/h	0	0	624	2	1	151
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	75	75	89	89	84	84
Heavy Vehicles, %	100	100	1	50	0	11
Mvmt Flow	0	0	701	2	1	180

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	884	702	0	0	703	0
Stage 1	702	-	-	-	-	-
Stage 2	182	-	-	-	-	-
Critical Hdwy	7.4	7.2	-	-	4.1	-
Critical Hdwy Stg 1	6.4	-	-	-	-	-
Critical Hdwy Stg 2	6.4	-	-	-	-	-
Follow-up Hdwy	4.4	4.2	-	-	2.2	-
Pot Cap-1 Maneuver	217	308	-	-	904	-
Stage 1	350	-	-	-	-	-
Stage 2	660	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	217	308	-	-	904	-
Mov Cap-2 Maneuver	217	-	-	-	-	-
Stage 1	350	-	-	-	-	-
Stage 2	659	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	0	0	0.1
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	-	904	-
HCM Lane V/C Ratio	-	-	-	0.001	-
HCM Control Delay (s)	-	-	0	9	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	-	0	-

Intersection	
Int Delay, s/veh	0.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	7	12	246	1	0	551
Future Vol, veh/h	7	12	246	1	0	551
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	75	75	90	90	89	98
Heavy Vehicles, %	14	8	2	0	0	1
Mvmt Flow	9	16	273	1	0	562

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	836	274	0	0	274	0
Stage 1	274	-	-	-	-	-
Stage 2	562	-	-	-	-	-
Critical Hdwy	6.54	6.28	-	-	4.1	-
Critical Hdwy Stg 1	5.54	-	-	-	-	-
Critical Hdwy Stg 2	5.54	-	-	-	-	-
Follow-up Hdwy	3.626	3.372	-	-	2.2	-
Pot Cap-1 Maneuver	322	751	-	-	1301	-
Stage 1	745	-	-	-	-	-
Stage 2	548	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	322	751	-	-	1301	-
Mov Cap-2 Maneuver	322	-	-	-	-	-
Stage 1	745	-	-	-	-	-
Stage 2	548	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.5	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	504	1301	-
HCM Lane V/C Ratio	-	-	0.05	-	-
HCM Control Delay (s)	-	-	12.5	0	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	0.2	0	-

Intersection	
Int Delay, s/veh	0.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	1	1	632	3	2	152
Future Vol, veh/h	1	1	632	3	2	152
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	75	75	89	89	84	84
Heavy Vehicles, %	100	100	1	50	0	11
Mvmt Flow	1	1	710	3	2	181

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	897	712	0	0	713	0
Stage 1	712	-	-	-	-	-
Stage 2	185	-	-	-	-	-
Critical Hdwy	7.4	7.2	-	-	4.1	-
Critical Hdwy Stg 1	6.4	-	-	-	-	-
Critical Hdwy Stg 2	6.4	-	-	-	-	-
Follow-up Hdwy	4.4	4.2	-	-	2.2	-
Pot Cap-1 Maneuver	213	304	-	-	896	-
Stage 1	346	-	-	-	-	-
Stage 2	658	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	213	304	-	-	896	-
Mov Cap-2 Maneuver	213	-	-	-	-	-
Stage 1	346	-	-	-	-	-
Stage 2	657	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	19.6	0	0.1
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	250	896	-
HCM Lane V/C Ratio	-	-	0.011	0.003	-
HCM Control Delay (s)	-	-	19.6	9	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection	
Int Delay, s/veh	0.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	8	13	247	3	2	559
Future Vol, veh/h	8	13	247	3	2	559
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	75	75	90	90	89	98
Heavy Vehicles, %	14	8	2	0	0	1
Mvmt Flow	11	17	274	3	2	570

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	850	276	0	0	277	0
Stage 1	276	-	-	-	-	-
Stage 2	574	-	-	-	-	-
Critical Hdwy	6.54	6.28	-	-	4.1	-
Critical Hdwy Stg 1	5.54	-	-	-	-	-
Critical Hdwy Stg 2	5.54	-	-	-	-	-
Follow-up Hdwy	3.626	3.372	-	-	2.2	-
Pot Cap-1 Maneuver	315	749	-	-	1298	-
Stage 1	744	-	-	-	-	-
Stage 2	540	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	314	749	-	-	1298	-
Mov Cap-2 Maneuver	314	-	-	-	-	-
Stage 1	744	-	-	-	-	-
Stage 2	539	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.8	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	490	1298	-
HCM Lane V/C Ratio	-	-	0.057	0.002	-
HCM Control Delay (s)	-	-	12.8	7.8	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0	-

Intersection	
Int Delay, s/veh	0.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	1	1	636	4	2	154
Future Vol, veh/h	1	1	636	4	2	154
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	75	75	89	89	84	84
Heavy Vehicles, %	100	100	1	50	0	11
Mvmt Flow	1	1	715	4	2	183

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	904	717	0	0	719	0
Stage 1	717	-	-	-	-	-
Stage 2	187	-	-	-	-	-
Critical Hdwy	7.4	7.2	-	-	4.1	-
Critical Hdwy Stg 1	6.4	-	-	-	-	-
Critical Hdwy Stg 2	6.4	-	-	-	-	-
Follow-up Hdwy	4.4	4.2	-	-	2.2	-
Pot Cap-1 Maneuver	211	302	-	-	892	-
Stage 1	343	-	-	-	-	-
Stage 2	656	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	211	302	-	-	892	-
Mov Cap-2 Maneuver	211	-	-	-	-	-
Stage 1	343	-	-	-	-	-
Stage 2	655	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	19.7	0	0.1
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	248	892	-
HCM Lane V/C Ratio	-	-	0.011	0.003	-
HCM Control Delay (s)	-	-	19.7	9	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection	
Int Delay, s/veh	0.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	8	14	248	4	3	564
Future Vol, veh/h	8	14	248	4	3	564
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	75	75	90	90	89	98
Heavy Vehicles, %	14	8	2	0	0	1
Mvmt Flow	11	19	276	4	3	576

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	860	278	0	0	280	0
Stage 1	278	-	-	-	-	-
Stage 2	582	-	-	-	-	-
Critical Hdwy	6.54	6.28	-	-	4.1	-
Critical Hdwy Stg 1	5.54	-	-	-	-	-
Critical Hdwy Stg 2	5.54	-	-	-	-	-
Follow-up Hdwy	3.626	3.372	-	-	2.2	-
Pot Cap-1 Maneuver	311	747	-	-	1294	-
Stage 1	742	-	-	-	-	-
Stage 2	536	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	310	747	-	-	1294	-
Mov Cap-2 Maneuver	310	-	-	-	-	-
Stage 1	742	-	-	-	-	-
Stage 2	534	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.7	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	494	1294	-
HCM Lane V/C Ratio	-	-	0.059	0.003	-
HCM Control Delay (s)	-	-	12.7	7.8	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0	-

Grove Street at 210 Grove Street Driveway 2

Intersection	
Int Delay, s/veh	0.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	1	2	645	9	8	152
Future Vol, veh/h	1	2	645	9	8	152
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	75	75	94	94	88	88
Heavy Vehicles, %	0	0	2	0	0	12
Mvmt Flow	1	3	686	10	9	173

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	882	691	0	0	696	0
Stage 1	691	-	-	-	-	-
Stage 2	191	-	-	-	-	-
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	319	448	-	-	909	-
Stage 1	501	-	-	-	-	-
Stage 2	846	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	315	448	-	-	909	-
Mov Cap-2 Maneuver	315	-	-	-	-	-
Stage 1	501	-	-	-	-	-
Stage 2	837	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	14.3	0	0.5
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	393	909	-
HCM Lane V/C Ratio	-	-	0.01	0.01	-
HCM Control Delay (s)	-	-	14.3	9	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection	
Int Delay, s/veh	0.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	9	3	250	3	4	562
Future Vol, veh/h	9	3	250	3	4	562
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	75	75	85	85	90	90
Heavy Vehicles, %	11	33	2	33	50	0
Mvmt Flow	12	4	294	4	4	624

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	928	296	0	0	298	0
Stage 1	296	-	-	-	-	-
Stage 2	632	-	-	-	-	-
Critical Hdwy	6.51	6.53	-	-	4.6	-
Critical Hdwy Stg 1	5.51	-	-	-	-	-
Critical Hdwy Stg 2	5.51	-	-	-	-	-
Follow-up Hdwy	3.599	3.597	-	-	2.65	-
Pot Cap-1 Maneuver	287	676	-	-	1034	-
Stage 1	735	-	-	-	-	-
Stage 2	513	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	285	676	-	-	1034	-
Mov Cap-2 Maneuver	285	-	-	-	-	-
Stage 1	735	-	-	-	-	-
Stage 2	510	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.4	0	0.1
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	333	1034	-
HCM Lane V/C Ratio	-	-	0.048	0.004	-
HCM Control Delay (s)	-	-	16.4	8.5	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0	-

Intersection	
Int Delay, s/veh	0.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	1	2	654	9	8	154
Future Vol, veh/h	1	2	654	9	8	154
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	75	75	94	94	88	88
Heavy Vehicles, %	0	0	2	0	0	12
Mvmt Flow	1	3	696	10	9	175

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	894	701	0	0	706	0
Stage 1	701	-	-	-	-	-
Stage 2	193	-	-	-	-	-
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	314	442	-	-	902	-
Stage 1	496	-	-	-	-	-
Stage 2	845	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	311	442	-	-	902	-
Mov Cap-2 Maneuver	311	-	-	-	-	-
Stage 1	496	-	-	-	-	-
Stage 2	836	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	14.4	0	0.4
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	388	902	-
HCM Lane V/C Ratio	-	-	0.01	0.01	-
HCM Control Delay (s)	-	-	14.4	9	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection	
Int Delay, s/veh	0.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	9	3	253	3	4	571
Future Vol, veh/h	9	3	253	3	4	571
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	75	75	85	85	90	90
Heavy Vehicles, %	11	33	2	33	50	0
Mvmt Flow	12	4	298	4	4	634

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	942	300	0	0	302	0
Stage 1	300	-	-	-	-	-
Stage 2	642	-	-	-	-	-
Critical Hdwy	6.51	6.53	-	-	4.6	-
Critical Hdwy Stg 1	5.51	-	-	-	-	-
Critical Hdwy Stg 2	5.51	-	-	-	-	-
Follow-up Hdwy	3.599	3.597	-	-	2.65	-
Pot Cap-1 Maneuver	281	672	-	-	1030	-
Stage 1	731	-	-	-	-	-
Stage 2	507	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	279	672	-	-	1030	-
Mov Cap-2 Maneuver	279	-	-	-	-	-
Stage 1	731	-	-	-	-	-
Stage 2	504	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.6	0	0.1
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	327	1030	-
HCM Lane V/C Ratio	-	-	0.049	0.004	-
HCM Control Delay (s)	-	-	16.6	8.5	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0	-

Intersection	
Int Delay, s/veh	0.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	1	2	659	9	8	156
Future Vol, veh/h	1	2	659	9	8	156
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	75	75	94	94	88	88
Heavy Vehicles, %	0	0	2	0	0	12
Mvmt Flow	1	3	701	10	9	177

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	901	706	0	0	711	0
Stage 1	706	-	-	-	-	-
Stage 2	195	-	-	-	-	-
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	311	439	-	-	898	-
Stage 1	493	-	-	-	-	-
Stage 2	843	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	308	439	-	-	898	-
Mov Cap-2 Maneuver	308	-	-	-	-	-
Stage 1	493	-	-	-	-	-
Stage 2	834	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	14.5	0	0.4
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	384	898	-
HCM Lane V/C Ratio	-	-	0.01	0.01	-
HCM Control Delay (s)	-	-	14.5	9.1	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection	
Int Delay, s/veh	0.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	9	3	255	3	4	576
Future Vol, veh/h	9	3	255	3	4	576
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	75	75	85	85	90	90
Heavy Vehicles, %	11	33	2	33	50	0
Mvmt Flow	12	4	300	4	4	640

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	950	302	0	0	304	0
Stage 1	302	-	-	-	-	-
Stage 2	648	-	-	-	-	-
Critical Hdwy	6.51	6.53	-	-	4.6	-
Critical Hdwy Stg 1	5.51	-	-	-	-	-
Critical Hdwy Stg 2	5.51	-	-	-	-	-
Follow-up Hdwy	3.599	3.597	-	-	2.65	-
Pot Cap-1 Maneuver	278	670	-	-	1028	-
Stage 1	730	-	-	-	-	-
Stage 2	504	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	276	670	-	-	1028	-
Mov Cap-2 Maneuver	276	-	-	-	-	-
Stage 1	730	-	-	-	-	-
Stage 2	501	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.7	0	0.1
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	324	1028	-
HCM Lane V/C Ratio	-	-	0.049	0.004	-
HCM Control Delay (s)	-	-	16.7	8.5	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0	-

Washington Street at Grove Street

Intersection	
Int Delay, s/veh	87.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	506	923	238	136	43	110
Future Vol, veh/h	506	923	238	136	43	110
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	200	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	97	97	90	90	85	85
Heavy Vehicles, %	0	1	2	1	25	5
Mvmt Flow	522	952	264	151	51	129

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	415	0	-	0	2336	340
Stage 1	-	-	-	-	340	-
Stage 2	-	-	-	-	1996	-
Critical Hdwy	4.1	-	-	-	6.65	6.25
Critical Hdwy Stg 1	-	-	-	-	5.65	-
Critical Hdwy Stg 2	-	-	-	-	5.65	-
Follow-up Hdwy	2.2	-	-	-	3.725	3.345
Pot Cap-1 Maneuver	1155	-	-	-	~ 34	696
Stage 1	-	-	-	-	672	-
Stage 2	-	-	-	-	100	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1155	-	-	-	~ 19	696
Mov Cap-2 Maneuver	-	-	-	-	~ 19	-
Stage 1	-	-	-	-	368	-
Stage 2	-	-	-	-	100	-

Approach	EB	WB	SB
HCM Control Delay, s	3.8	0	$ 978.1
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1155	-	-	-	63
HCM Lane V/C Ratio	0.452	-	-	-	2.857
HCM Control Delay (s)	10.7	-	-	-	$ 978.1
HCM Lane LOS	B	-	-	-	F
HCM 95th %tile Q(veh)	2.4	-	-	-	18.3

Notes

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

Intersection	
Int Delay, s/veh	326.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	145	356	999	83	90	415
Future Vol, veh/h	145	356	999	83	90	415
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	200	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	89	89	95	95	83	83
Heavy Vehicles, %	2	1	1	3	0	0
Mvmt Flow	163	400	1052	87	108	500

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1139	0	-	0	1822	1096
Stage 1	-	-	-	-	1096	-
Stage 2	-	-	-	-	726	-
Critical Hdwy	4.12	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.218	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	613	-	-	-	~ 86	~ 262
Stage 1	-	-	-	-	323	-
Stage 2	-	-	-	-	483	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	613	-	-	-	~ 63	~ 262
Mov Cap-2 Maneuver	-	-	-	-	~ 63	-
Stage 1	-	-	-	-	237	-
Stage 2	-	-	-	-	483	-

Approach	EB	WB	SB
HCM Control Delay, s	3.8	0	$ 1235.1
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	613	-	-	-	168
HCM Lane V/C Ratio	0.266	-	-	-	3.622
HCM Control Delay (s)	13	-	-	-	$ 1235.1
HCM Lane LOS	B	-	-	-	F
HCM 95th %tile Q(veh)	1.1	-	-	-	58.9

Notes

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

Intersection	
Int Delay, s/veh	100.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	508	923	238	143	45	110
Future Vol, veh/h	508	923	238	143	45	110
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	200	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	97	97	90	90	85	85
Heavy Vehicles, %	0	1	2	1	25	5
Mvmt Flow	524	952	264	159	53	129

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	423	0	-	0	2344	344
Stage 1	-	-	-	-	344	-
Stage 2	-	-	-	-	2000	-
Critical Hdwy	4.1	-	-	-	6.65	6.25
Critical Hdwy Stg 1	-	-	-	-	5.65	-
Critical Hdwy Stg 2	-	-	-	-	5.65	-
Follow-up Hdwy	2.2	-	-	-	3.725	3.345
Pot Cap-1 Maneuver	1147	-	-	-	~ 34	692
Stage 1	-	-	-	-	669	-
Stage 2	-	-	-	-	99	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1147	-	-	-	~ 18	692
Mov Cap-2 Maneuver	-	-	-	-	~ 18	-
Stage 1	-	-	-	-	363	-
Stage 2	-	-	-	-	99	-

Approach	EB	WB	SB
HCM Control Delay, s	3.8	0	$ 1115.6
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1147	-	-	-	58
HCM Lane V/C Ratio	0.457	-	-	-	3.144
HCM Control Delay (s)	10.7	-	-	-	$ 1115.6
HCM Lane LOS	B	-	-	-	F
HCM 95th %tile Q(veh)	2.4	-	-	-	19.1

Notes

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

Intersection	
Int Delay, s/veh	348.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	146	356	999	85	97	417
Future Vol, veh/h	146	356	999	85	97	417
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	200	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	89	89	95	95	83	83
Heavy Vehicles, %	2	1	1	3	0	0
Mvmt Flow	164	400	1052	89	117	502

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1141	0	-	0	1825	1097
Stage 1	-	-	-	-	1097	-
Stage 2	-	-	-	-	728	-
Critical Hdwy	4.12	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.218	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	612	-	-	-	~ 86	~ 262
Stage 1	-	-	-	-	323	-
Stage 2	-	-	-	-	482	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	612	-	-	-	~ 63	~ 262
Mov Cap-2 Maneuver	-	-	-	-	~ 63	-
Stage 1	-	-	-	-	236	-
Stage 2	-	-	-	-	482	-

Approach	EB	WB	SB
HCM Control Delay, s	3.8	0	$ 1305.4
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	612	-	-	-	164
HCM Lane V/C Ratio	0.268	-	-	-	3.776
HCM Control Delay (s)	13	-	-	-	$ 1305.4
HCM Lane LOS	B	-	-	-	F
HCM 95th %tile Q(veh)	1.1	-	-	-	60.7

Notes

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

Intersection	
Int Delay, s/veh	102.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	509	923	238	147	46	111
Future Vol, veh/h	509	923	238	147	46	111
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	200	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	97	97	90	90	85	85
Heavy Vehicles, %	0	1	2	1	25	5
Mvmt Flow	525	952	264	163	54	131

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	427	0	-	0	2348	346
Stage 1	-	-	-	-	346	-
Stage 2	-	-	-	-	2002	-
Critical Hdwy	4.1	-	-	-	6.65	6.25
Critical Hdwy Stg 1	-	-	-	-	5.65	-
Critical Hdwy Stg 2	-	-	-	-	5.65	-
Follow-up Hdwy	2.2	-	-	-	3.725	3.345
Pot Cap-1 Maneuver	1143	-	-	-	~ 34	690
Stage 1	-	-	-	-	668	-
Stage 2	-	-	-	-	99	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1143	-	-	-	~ 18	690
Mov Cap-2 Maneuver	-	-	-	-	~ 18	-
Stage 1	-	-	-	-	361	-
Stage 2	-	-	-	-	99	-

Approach	EB	WB	SB
HCM Control Delay, s	3.8	0	$ 1133.5
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1143	-	-	-	58
HCM Lane V/C Ratio	0.459	-	-	-	3.185
HCM Control Delay (s)	10.8	-	-	-	$ 1133.5
HCM Lane LOS	B	-	-	-	F
HCM 95th %tile Q(veh)	2.5	-	-	-	19.4

Notes

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

Intersection	
Int Delay, s/veh	361.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	146	356	999	87	101	418
Future Vol, veh/h	146	356	999	87	101	418
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	200	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	89	89	95	95	83	83
Heavy Vehicles, %	2	1	1	3	0	0
Mvmt Flow	164	400	1052	92	122	504

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1144	0	-	0	1826	1098
Stage 1	-	-	-	-	1098	-
Stage 2	-	-	-	-	728	-
Critical Hdwy	4.12	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.218	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	611	-	-	-	~ 86	~ 261
Stage 1	-	-	-	-	322	-
Stage 2	-	-	-	-	482	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	611	-	-	-	~ 63	~ 261
Mov Cap-2 Maneuver	-	-	-	-	~ 63	-
Stage 1	-	-	-	-	236	-
Stage 2	-	-	-	-	482	-

Approach	EB	WB	SB
HCM Control Delay, s	3.8	0	$ 1343.5
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	611	-	-	-	162
HCM Lane V/C Ratio	0.268	-	-	-	3.86
HCM Control Delay (s)	13	-	-	-	$ 1343.5
HCM Lane LOS	B	-	-	-	F
HCM 95th %tile Q(veh)	1.1	-	-	-	61.7

Notes

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

IMPROVING COMMUNITIES TOGETHER

June 17, 2020

Mr. Anthony Padula, Chairman
355 East Central Street
Franklin, MA 02038

Re: 176 – 210 Grove Street
Site Plan Peer Review

Dear Mr. Padula:

At the previous public hearing for the subject project a number of issues outlined in BETA's June 4, 2020 review letter were discussed and resolved; however, as the Applicant has not submitted revised plans since the public hearing, BETA recommends for the Board to consider including the following conditions or revisions prior to endorsement:

- External dumpster areas shall be located on concrete pads and provided with enclosures.
- Landscaping plans shall be revised to include the additional screening along the residential property line as depicted on plans presented at the June 8, 2020 public hearing.
- Adequate screening and shielding for sound attenuation shall be provided for external mechanical equipment/HVAC.
- Cape Cod berm shall be revised to vertical granite or vertical reinforced concrete curb.
- Reinforced Concrete Pipe shall be Class V where cover is less than 42".
- Seasonal high groundwater elevations shall be evaluated in the area of Subsurface Infiltration System 2 during construction prior to system installation.

If we can be of any further assistance regarding this matter, please contact us at our office.

Very truly yours,
BETA Group, Inc.

Matthew J. Crowley, PE
Project Manager

cc: Amy Love, Planner

FRANKLIN PLANNING & COMMUNITY DEVELOPMENT
355 EAST CENTRAL STREET
FRANKLIN, MA 02038-1352
TELEPHONE: 508-520-4907
FAX: 508-520-4906

MEMORANDUM

DATE: **July 8, 2020**

TO: **Franklin Planning Board**

FROM: **Department of Planning and Community Development**

RE: **176-210 Grove St**
Site Plan Modification

The DPCD has reviewed the above referenced Site Plan Modification application for the Monday, July 13, 2020 Planning Board meeting and offers the following commentary:

General:

1. The site is located at 176-210 Grove Street in the Industrial Zoning District (Assessors Map 311 Lots 001 & 002).
2. The applicant is proposing to construct 150,000 sq/ft building with parking spaces, drainage and landscaping.

Applicant submitted on July 8, 2020, the following information:

a. Revised Traffic Study
b. Technical Appendix
c. Traffic Study Analysis

DPCD recommends BETA review the revised Traffic Study.

Comments from June 22, 2020 Meeting:

2. There was discussion on the truck traffic and the actual use of the building. The Applicant is not able to provide who the tenant will be. The Applicant agreed to provide further information on the traffic based on what they estimated the use of the building will be. The Planning Board requested a revised traffic study be submitted increasing the traffic by 50%.

3. Applicant has offered to donate $100,000 toward road improvements for Grove Street.

Comments from June 8, 2020 Meeting:

1. The Board requested that traffic be directed North of the site. Signage should be shown on the plans directing the traffic
2. BETA, Jacklyn Centracchio, BETA, has provided a response letter for traffic, which is included in the Agenda.
3. The Board typically requires color renderings of buildings. The Applicant has not submitted any color renderings.
4. Applicant has **not** submitted revised plans from the June 8 meeting. June 8 plans are included for the Board to review.

Recommended Special Conditions:

1. Prior to endorsement, all conditions listed in BETA's letter dated June 17, 2020 shall be complete and revised on the plans.
2. Per Town Engineer, there should be only one domestic water line and one fire protection line connection into the proposed building. The domestic water will need to be metered where the line enters the building. Revise plans prior to endorsement.
3. All curbing shall be reinforced concrete or vertical granite curbing.
4. Prior to Occupancy, the Applicant will file a Limited Site Plan for the use of the building.
5. Signage should be provided on the plans directing the truck traffic north of the site.
6. 81-P ANR plan is required to be filed prior to commencement of construction.
7. Screening along the abutting the property shall be installed at the beginning of construction.
8. The new entrance is to be used only for car traffic. All truck traffic is to use the existing entrances at 176 Grove St and 210 Grove St.

Recommendation:

DPCD has no further comments.

FRANKLIN PLANNING & COMMUNITY DEVELOPMENT
355 EAST CENTRAL STREET, ROOM 120
FRANKLIN, MA 02038-1352
TELEPHONE: 508-520-4907
FAX: 508-520-4906

MEMORANDUM

DATE: **July 8, 2020**

TO: **Franklin Planning Board**

FROM: **Department of Planning and Community Development**

RE: **Maple Hill**
Definitive Subdivision Plan

Traffic discussion continued from June 29, 2020:

- Several residents had their hands raised from the last meeting, and did not have a chance to speak. The following is a list in order of who had raised their hands:
  Chris Peterson
  Angela Snyder
  Stephen Higgins
  Lincoln
  Chris (Patricia)
  Meagan Schiltzer
  Christopher Brady

- Mike Maglio, Town Engineer has provided a comment letter regarding the traffic concerns.
- Below are a list questions that was asked at the last meeting, for the Planning Board's reference.
- The Following are letters received after the meeting and submitted to DPCD to share with the Planning Board:
  - Stephen Dunbar, 30 Madison Ave
  - Lincoln Purdy, 54 Bridle Path
  - Mary & Michael Doherty, 50 Bridle Path
- Following the traffic discussions, DPCD will put together all comments and suggestions for traffic measures. A follow up meeting should be set to decide on the traffic measures that should be enforced.

Questions asked at the June 29, 2020 meeting regarding traffic:

- Crosswalk on Lincoln street - can it be a school crossing?
- Will there be "No through Traffic" signs?
- Do not want the name of Bridle Path used in the Maple Hill Development as Google Maps will send people to Bridle Path off of Lincoln Street. If something else used it would be less likely that Google would route traffic up Bridle Path to get to houses in Maple Hill.
- Will there be signage warning of bump outs?
- How are heavy construction vehicles going to access the site?
- Is Bridle Path going to be ground and repaved?
- Can there be speed bumps installed?
- How are you going to handle the traffic coming out of Maple Hill and onto Bridle Path and Kimberlee?
- Don't give waivers for sidewalks due to increased foot traffic.
- Is the use of a temporary entrance off Maple Street still being considered for construction vehicle entrance?
- What is the increase in construction traffic flow going to do to Bridle Path?
- When are the crosswalk and stop sign and road calming devices going to be put in? Would hope that they are installed prior to end of construction – not the end.
- Can there be street sweeping during construction?

TOWN OF FRANKLIN
DEPARTMENT OF PUBLIC WORKS
Franklin Municipal Building
257 Fisher Street
Franklin, MA 02038-3026

July 6, 2020

Mr. Anthony Padula, Chairman
Members of the Franklin Planning Board
355 East Central Street
Franklin, MA 02038

RE: Definitive Subdivision –Maple Hill, Maple St

Dear Mr. Chairman and Members:

The applicant made a presentation on the traffic impacts of the proposed project at the June 29, 2020 Planning Board meeting. The following comments are based on the information provided at that meeting.

Traffic

1. In addressing the lack of available sight distance at the Maple St and Kimberlee Ave intersection, the applicant proposes to include traffic calming measures along Maple St to reduce speeds from the current observed speeds of 40mph to the posted speed limit of 30 mph.

   While having a lower speed on Maple St will allow for a shorter sight distance, our experience is that these traffic calming measures do not always achieve the desired reduction. That is why we believe the sight distance calculations should be based on the higher observed speeds.

2. Proposed traffic calming measures were outlined for Bridle Path, Kimberlee Ave and Maple St. Those measures should be provided on a conceptual level plan with details so that the DPW can review and comment on the specific measures and locations where they are proposed to be installed.

Should you have any questions or require additional information, please do not hesitate to contact me.

Sincerely,

Michael Maglio, P.E.
Town Engineer

Dunbar Engineering & Management
Professional Engineering and Management Services

June 30, 2020

Mr. Anthony Padula
Planning Board Chair
Franklin Municipal Building
355 East Central Street
Franklin, MA 02038

SUBJECT: Public Hearing, Maple Hill Definitive Subdivision – Traffic Concerns

Dear Mr. Padula:

I am writing to express my new and previously expressed traffic concerns after reviewing the Maple Hill Definitive Plan dated December 15, 2019, Traffic Impact Assessment (TIA) prepared by Vanasse & Associates dated November 2019, Independent Review conducted by BETA Group dated March 15, 2020, and Vanasse & Associates' response to BETA Group's comments dated April 13, 2020. My previous letter to you dated September 16, 2019 is attached. For the safety of the current residents in that area and the new residents who will move into Maple Hill, I am requesting that the Board consider the following in their review before considering approval:

- The BETA Group flagged the significantly less-than-required Stopping Sight Distance (SSD) of 260 feet for a vehicle traveling south on Maple Street towards Kimberlee Avenue compared to the AASHTO minimum SSD of 305 feet for a flat (0% grade) approach. Given that the Google Earth elevation profile of this same distance shows a downgrade of 4.8% (6% in the last 75 feet approaching Kimberlee – see attached), the AASHTO table requires an SSD of 333 feet. Vanasse & Associates dismissed BETA Group's recommendation to regrade this section of Maple Street and proposes curb bump outs, flashing radar warnings, and police speed traps. The first will likely create many minor accidents hitting those curbs, the latter two are a permanent burden on the Town that will likely not be continuously provided.
- The proposed 58-home subdivision converts both Kimberlee Avenue and Bridle Path into Collector Streets as defined by Town of Franklin Zoning By-Law 300-10 A.(1)(a), while neither of these streets meet the Town of Franklin Zoning By-Law minimum width of 32 feet (By-Law 300-10 C.(1)). The proposed "traffic-calming" recommendations of installing medians and speed bumps will be a daily nuisance for residents and a winter nuisance for snow plowers. I am wondering if these are the reasons the median at the end of Southgate Road was removed approximately 5 years ago?
- Town of Franklin Zoning By-Law 300-10 B.(5)(a) states the minimum horizontal center-line radius of any curve on a collector street shall be 200 feet while

Kimberlee Ave has two curves less than 100 feet. This was noted in my previous letter, I recall it was mentioned by Town Engineer Mike Maglio in the previous Planning Board meeting on this project, but it is not mentioned/addressed in the TIA or the review. How is this being addressed?

- The previously submitted open space plan containing 6210 feet of new road was rejected because the Town Engineer and Fire Department did not want to maintain the 400 feet of gravel access road included in that plan for emergency access. The definitive plan introduces 7,281 feet of new road, increasing the Town maintenance requirement by 1,071 feet. The proposed "traffic-calming" measures on Kimberlee Avenue, Bridle Path, and Franklin Springs Road will also require maintenance. As I suggested in my previous letter, please re-consider a plan that provides two access roads to the new development from Maple Street, emergency access only from Kimberlee or Bridle Path, and a Town easement through the Maple Hill Development to accommodate the desired connection of the waterline on Bridle Path to Kimberlee to improve water quality, fire safety and provide redundancy in the water lines.

Thank you for your consideration and for your service to the Town of Franklin.

Respectfully,

Stephen W. Dunbar, P.E., PMP

Dunbar Engineering & Management
Professional Engineering and Management Services

30 Madison Avenue Franklin, MA 02038#
(978) 505-9013
dunbarengineering@comcast.net

Copy Furnished (email only):

Mr. Michael Maglio, Town Engineer
Engineering Department
DPW Administration Building
257 Fisher Street
Franklin 02038

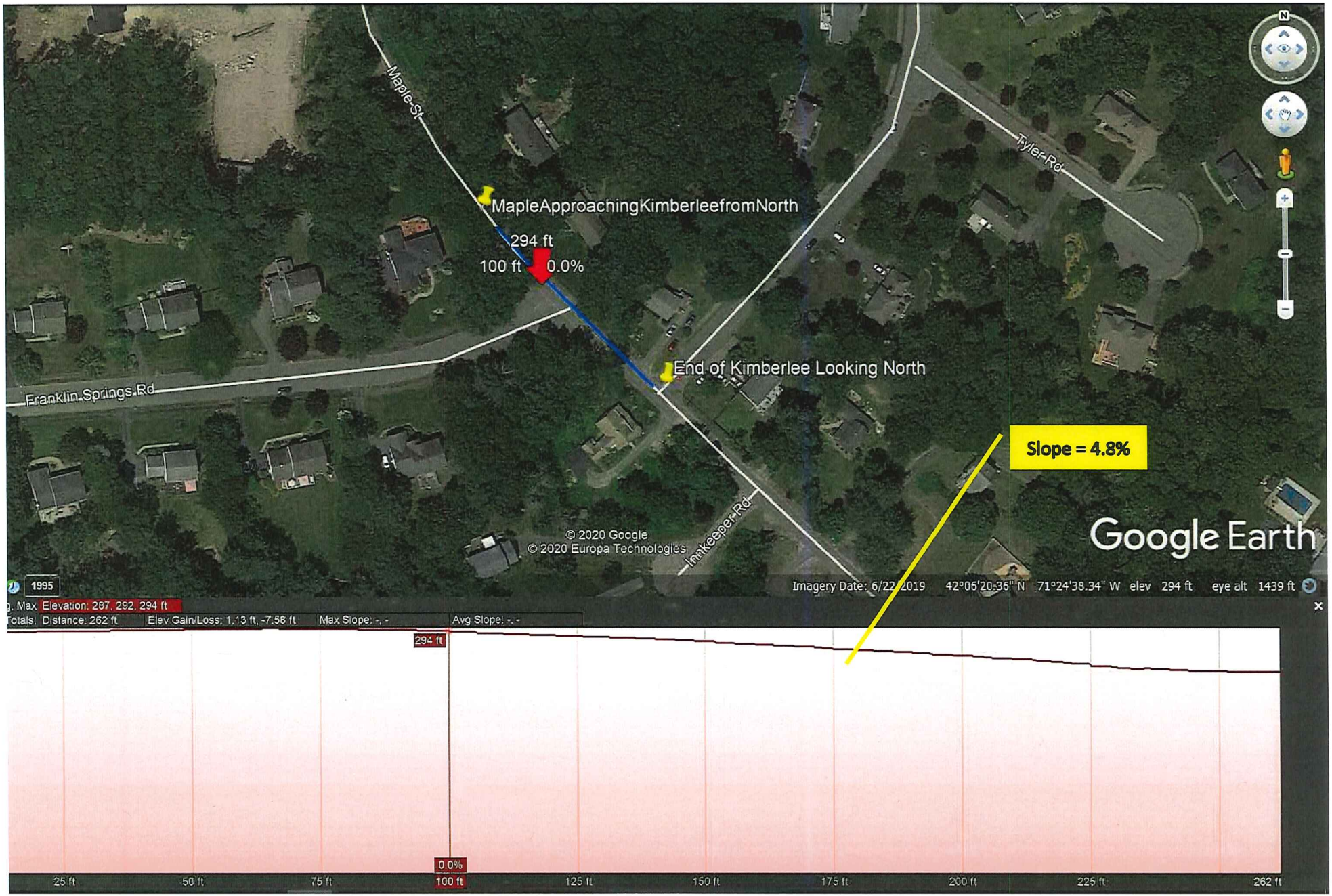
Mr. Joseph Barbieri, Deputy Fire Chief
Franklin Fire Department
40 West Central Street
Franklin, MA 02038

Ms. Amy Love, Town Planner
Franklin Municipal Building
355 East Central Street
Franklin, MA 02038

Mr. William Buckley, P.E.
Bay Colony Group, Inc.
4 School Street
Foxborough, MA 02035

Mr. Michael Doherty , Esq.
Doherty, Dugan, Cannon, Raymond & Weil, P.C.
124 Grove Street, Suite 220
Franklin, MA 02038

Ms. Laura Dombroski
20 Kimberlee Avenue
Franklin, MA 02038



Elevation along 260-foot long blue path (Maple Street) representing sight distance to Kimberlee Avenue. Last 160 feet has an approximate downward slope = 4.8%

Dunbar Engineering & Management
Professional Engineering and Management Services

September 16, 2019

Mr. Anthony Padula
Planning Board Chair
Franklin Municipal Building
355 East Central Street
Franklin, MA 02038

SUBJECT: Safety concerns with the proposed Maple Hill Development

Dear Mr. Padula:

I am writing to reiterate the safety concerns I expressed at the September 9th Planning Board meeting regarding the proposed Maple Hill Development, and my request in that same meeting to ensure those safety concerns are addressed before the Board approves a future submission. As you recall, the Board voted to oppose the submitted open space plan without comment from the public based on a letter from Deputy Fire Chief Joseph Barbieri, addressed to the Planning Board, dated 28 August 2019 and titled "SUBDIVISION PLAN-MAPLE STREET-MAPLE HILL." That letter expressed concerns for maintenance of the gravel access road and the potential for reduced access introduced by a breakaway gate that may not break away during an emergency. The Board's decision was also based on a separate letter from the town engineer, Mr. Mike Maglio, expressing concern for maintenance of the gravel access road (*and low-pressure sewer, not part of my concern*).

Based on the open discussion at the September 9th Planning Board meeting, I am expecting the developer will submit his original conventional plan with connections to Bridal Path and Kimberlee Avenue. For the safety of the current residents in that area and the new residents who will move into Maple Hill, I am requesting that you ask Mr. Barbieri and Mr. Maglio to review the next submission and consider the following in their review before considering approval:

1. The total new road length requiring maintenance on plan that was just rejected, including the approx. 400-foot gravel access road, was 6210 feet. The conventional plan likely to be resubmitted introduces 7,255 feet of new road, increasing the Town maintenance requirement by 1,015 feet.

2. The conventional plan as previously submitted will introduce Town of Franklin Zoning By-Law violations and increased public safety risk <u>every day</u>:

- 300-9 B.(3)(a) Design shall increase to the extent possible, vehicular use of Collector Streets to avoid traffic on streets providing house frontage (*due to the number of homes proposed, the conventional plan converts any street to which it connects, e.g., Kimberlee Ave, into a Collector Street vs rather than avoiding traffic*).

- 300-10 A.(1)(a) Collector: a street which carries traffic equivalent to that generated by 50 dwelling units or more, and therefore:

    - 300-10 B.(1) All streets in the subdivision shall be designed so that, in the opinion of the Board, they will provide safe vehicular and pedestrian travel.

    - 300-10 B.(5)(a) The minimum horizontal center-line radius of any curve on a major or minor street shall be 200 feet on a collector street. (*Kimberlee Ave has two curves less than 100-foot radius – see Attachment 1, I believe Hancock Road does too*).

    - 300-10 B.(6) Sight distances. Sight distance requirements along roadways and at intersections shall be evaluated under two categories as defined by the Massachusetts Highway Department Design Manual. (*At Kimberlee/Maple, Intersection Sight Distance (ISD) marginal and Decision Sight Distance (DSD) inadequate – see Attachment 1*).

    - 300-10 C.(1) Street right-of-way and pavement widths, measured inside curbs or berms, shall be 32 feet for Collector Street (*Kimberlee only 30 feet wide, Deerview 28 feet wide, Hancock also not 32 feet wide*).

If these By-Law violations/safety concerns are not addressed in the next submitted plan, I ask that the Planning Board vote to oppose that plan and have the developer consider a plan that provides two access roads to the new development from Maple Street. It would require two wetland crossings, but the short-term construction impacts on the mostly-dry wetland (*see highlights in Attachment 2*) are negligible compared to the perpetual increased safety risk the By-Laws listed above are intended to prevent.

Lastly, in a letter addressed to you and dated September 14, 2005 (*see Attachment 3*), the previous town engineer expressed interest in connecting waterlines on Bridle Path to Kimberlee "to improve water quality, fire safety and provide redundancy in the water lines." I agree with this statement, but as I suggested at the September 9th Planning Board meeting, this connection can be achieved via an easement through the Maple Hill Development without compromising the safety of the current residents in that area.

Thank you for your consideration and for your service to the Town of Franklin.

Respectfully,

Stephen W. Dunbar, P.E., PMP

Dunbar Engineering & Management
Professional Engineering and Management Services

30 Madison Avenue Franklin, MA 02038
(978) 505-9013
dunbarengineering@comcast.net

Copy Furnished (email only):

Mr. Michael Maglio, Town Engineer
Engineering Department
DPW Administration Building
257 Fisher Street
Franklin 02038

Mr. Joseph Barbieri, Deputy Fire Chief
Franklin Fire Department
40 West Central Street
Franklin, MA 02038

Ms. Amy Love, Town Planner
Franklin Municipal Building
355 East Central Street
Franklin, MA 02038

Mr. William Buckley, P.E.
Bay Colony Group, Inc.
4 School Street
Foxborough, MA 02035

Mr. Michael Doherty , Esq.
Doherty, Dugan, Cannon, Raymond & Weil, P.C.
124 Grove Street, Suite 220
Franklin, MA 02038

Ms. Laura Dombroski
20 Kimberlee Avenue
Franklin, MA 02038

Arguments Against Connection of Kimberlee Ave to Bridle Path

Argument 1: Kimberlee Ave does not meet the criteria for a Collector Street. Adding 58 single family lots will render Kimberlee Ave a **Collector Street** as defined by Town of Franklin, MA Design and Construction Standards (300-10 Streets, A. Classification, (1)(a) Collector: a street which carries traffic equivalent to that generated by 50 dwelling units or more.")

As a Collector Street, Kimberlee does not meet the following width Town of Franklin, MA Design and Construction Standards:

300-10.B.(5)(a) - The minimum horizontal center-line radius of any curve on a major or minor street shall be 150 feet and 200 feet on a collector street. There are two curves on Kimberlee with centerline curve radii less than 100 feet.

300-10.C.(1) - Street pavement widths, measured inside curbs or berms, shall be 32 feet for a Collector Street. Kimberlee Avenue is only 30 feet wide.

Argument 2: Kimberlee Ave does not meet the Mass Highway Department Sight Distance requirements. Town of Franklin, MA Design and Construction Standards 300-10.B.(6) states that a Larger subdivision shall be defined as any proposed development which shall generate in excess of 120 trips per day (easily achieved assuming as least 2 drivers per household x 58 new homes plus existing). As a larger subdivision, Kimberlee Ave must meet the Massachusetts Highway Department specifications for minimum Stopping Sight Distance (SSD), Intersection Sight Distance (ISD) and decision sight distance (DSD).

The following photo map and photos from those positions demonstrate sight distance concerns.

Maple Hill Safety Concerns - Attachment 1

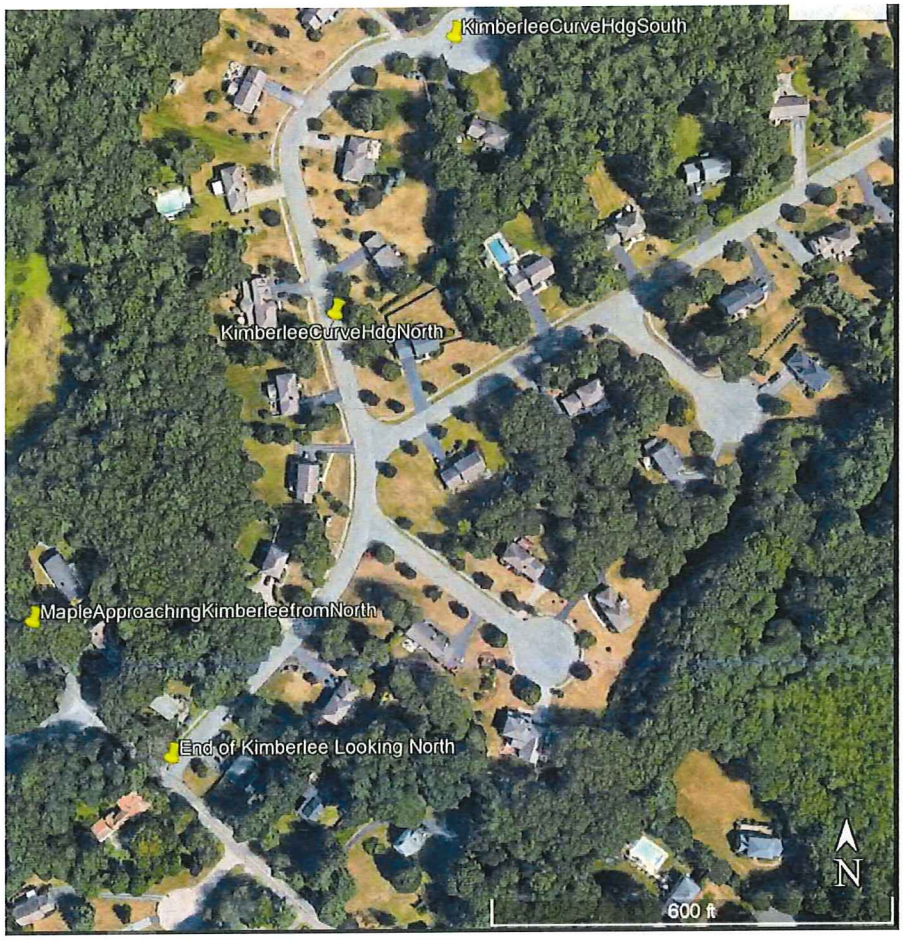


Photo 1: View from End of Kimberlee Looking North up Maple Street (ISD approx. 250 feet)

Photo2: Same view, 6 seconds later - only roof of Jeep can be seen. This photo is from standing position – If I were in the drivers seat the jeep would not be visible.

Photo3: View from Maple Traveling South Towards Intersection with Kimberlee. At 280 feet, you can only see top 2 feet of Kimberlee Street sign (SSD approx.. 250 feet).

MHD 3.7.1.1 Motor Vehicle Stopping Sight Distance - Stopping sight distance is the distance necessary for a vehicle traveling at the design speed to stop before reaching a stationary object in
its path. The sight distance at every point along a roadway should be at least the stopping sight distance.

Exhibit 3-8
Motor Vehicle Stopping Sight Distances

	Stopping Sight Distance (ft) by Percent Grade (%)						
		Downgrade			Upgrade		
Design Speed	0	3	6	9	3	6	9
20	115	116	120	126	109	107	104
25	155	158	165	173	147	143	140
30	200	205	215	227	200	184	179
35	250	257	271	287	237	229	222
40	305	315	333	354	289	278	269
45	360	378	400	427	344	331	320
50	425	446	474	507	405	388	375
55	495	520	553	593	469	450	433
60	570	598	638	686	538	515	495
65	645	682	728	785	612	584	561
70	730	771	825	891	690	658	631
75	820	866	927	1003	772	736	704

Source: A Policy on Geometric Design of Streets and Highways, AASHTO, Washington DC, 2004. Chapter 3 Elements of Design

*SSD for vehicles traveling south on Maple towards Kimberlee (Photo 3) are within the required SSD for the design speed of 30 mph but NOT for the typical speed of 40 mph for most Maple Street travelers (which is why there has been at least one casualty at this intersection).

MHD 3.7.3 Decision Sight Distance - Decision sight distance adds a dimension of time to stopping sight distance to allow a driver to detect and react to an unexpected condition along a roadway. Decision sight distance is suggested when there is evidence that it would be prudent to provide longer sight distance, such as when complex decisions are needed or when information is difficult to
perceive. It is the distance needed for a driver to detect an unexpected or otherwise difficult-to-perceive information source or condition in a roadway environment that may be visually cluttered, recognize the condition or its potential threat, select an appropriate speed and path, and initiate and complete the maneuver safely and efficiently.

Exhibit 3-9
Decision Sight Distances

	Decision Sight Distance (ft)				
	Avoidance Maneuver				
Design Speed	A	B	C	D	E
30	220	490	450	535	620
35	275	590	525	625	720
40	330	690	600	715	825
45	395	800	675	800	930
50	465	910	750	890	1030
55	535	1030	865	980	1135
60	610	1150	990	1125	1280
65	695	1275	1050	1220	1365
70	780	1410	1105	1275	1445
75	875	1545	1180	1365	1545

Avoidance Maneuver A: Stop on rural road: time (t) = 3.0 sec
Avoidance Maneuver B: Stop on urban road: time (t) = 9.1 sec
Avoidance Maneuver C: Speed/path/direction change on rural road: time (t) varies between 10.2 and 11.2 sec
Avoidance Maneuver D: Speed/path/direction change on suburban road: time (t) varies between 12.1 and 12.9 sec
Avoidance Maneuver E: Speed/path/direction change on urban road: t varies between 14.0 and 14.5 sec
Source: *A Policy on Geometric Design of Streets and Highways*, AASHTO, Washington DC, 2004. Chapter 3 Elements of Design

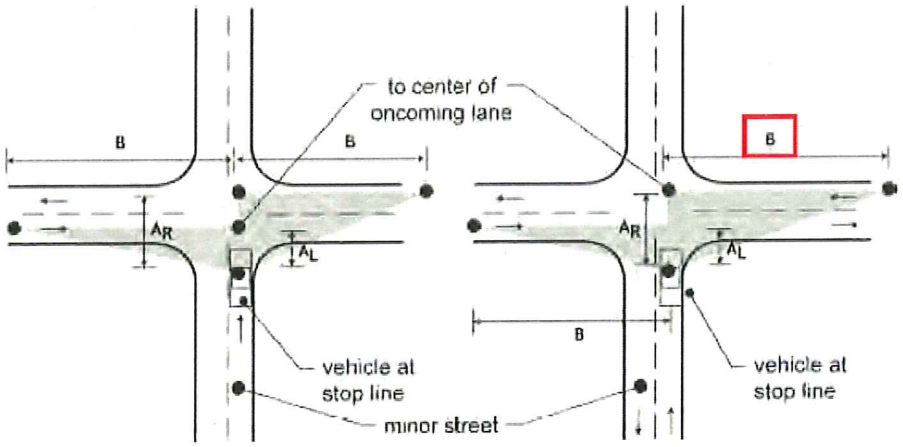
*DSD for vehicles traveling south on Maple towards Kimberlee (Photo 3) are within the required DSD for the design speed of 30 mph but NOT for the typical speed of 40 mph for most Maple Street travelers (which is why there has been at least one casualty at this intersection).

3.7.4 Intersection Sight Distance - Sight distance is provided at intersections to allow drivers to perceive the presence of potentially conflicting vehicles. This should occur in sufficient time for a motorist to stop or adjust their speed, as appropriate, to avoid colliding in the intersection. Sight distance also allows drivers of stopped vehicles with a sufficient view of the intersecting roadway to decide when to enter or cross the intersecting roadway.

Exhibit 3-11

Sight Triangle Case B

Departure Sight Triangles



Sight Triangle Legs: Case B – Stop Control on Cross Street

Major Street Design Speed (mph)	Length of Sight Triangle Legs (feet)			
	Minor Street for Vehicles Approaching From Right (A_R, feet)	Minor Street for Vehicles Approaching From Left (A_L, feet)	Major Street For Left Turns (B, feet)	Major Street for Right Turns or Through (B, feet)
15	32.5	20.5	170	145
20	32.5	20.5	225	195
25	32.5	20.5	280	240
30	32.5	20.5	335	290
35	32.5	20.5	390	335
40	32.5	20.5	445	385
45	32.5	20.5	500	430
50	32.5	20.5	555	480
55	32.5	20.5	610	530
60	32.5	20.5	665	575
65	32.5	20.5	720	625
70	32.5	20.5	775	670
75	32.5	20.5	830	720

Sight triangle legs shown are for passenger car crossing or turning into a two-lane street, with grades (all approaches) 3 percent or less. For other grades and for other major street widths, recalculate using AASHTO *Green Book* formulas.

Source: *A Policy on Geometric Design of Streets and Highways*, AASHTO, Washington DC, 2004. Chapter 3 Elements of Design

*Vehicles stopped at the end of Kimberlee (Photos 1 & 2) attempting to turn left on Maple **DO NOT** have the required ISD of 335 feet for the design speed of 30 mph. Because the ISD cannot be met, additional traffic should not be routed through Kimberlee Ave.

Engineers | Scientists | Planners

PARECORP.COM

PARE CORPORATION

November 22, 2016

Mr. William Buckley, P.E.
Bay Colony Group, Inc.
4 School Street
Foxborough, MA 02035

Re: Wetland Delineation
Maple Street
Assessor's Parcels 235-142 and 234-012
Franklin, MA
Pare Project No. 06170.85

Dear Mr. Buckley,

Pare Corporation (Pare) delineated the wetland resource areas on a 78-acre property located on Maple Street in Franklin. Wetlands were delineated in order to establish the jurisdictional limits (wetland edges, the Town of Franklin 25-foot No Disturb Zone, and 100-foot Buffer Zone) that could potentially affect future development on the property. Pare's investigation and delineation of wetlands were completed on October 18 and 20, 2016.

The subject property consists of two lots (Parcel ID 235-142 and 234-012) located on the east side of Maple Street in Franklin. A majority of the site is undeveloped, consisting of wooded areas. The front (west) portion of Parcel 235-142 contains a single-family house, horse stable, and garage building with surrounding maintained and landscaped areas. The rear (east) section of Parcel 235-142 and the entirety of Parcel 234-012 consist of undeveloped woodland. The property is bordered by Maple Street to the west, and wooded land and residential properties to the north, east, and south. A corridor of wetland associated with an unnamed intermittent stream extends from south to north across the west side of the site. Additional wetlands are located at the northern side of the property.

The following report describes the delineated wetlands, discusses the delineation methodology, and summarizes review of available published mapping for the site. Attached to this report are the following materials: a Site Location Map, an Annotated Aerial Photograph, an excerpt from the FEMA Flood Insurance Rate Map for the area, annotated photographs of the site wetlands, completed BVW Data Forms, and a copy of the USGS StreamStats Analysis for the site.

METHODOLOGY

Wetland edges were delineated in accordance with the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00, referred to herein as the WPA Regulations), and the methodology specified in the publication entitled Delineating Bordering Vegetated Wetlands under the Massachusetts Wetlands Protection Act (Jackson, 1995) and The Regional Supplement to the Corps of Engineers Wetland Delineation Manual: North Central and Northeast Region, Version 2.0 (U.S. Army Corps of Engineers, January 2012).

Pink field flags were placed at appropriate intervals along the wetland/upland borders, and along the banks of intermittent stream channels. Primary parameters evaluated in wetland delineation included vegetation, hydric soil indicators, and visual indicators of wetland hydrology such as water-stained leaves, mound-and-pool microrelief, shallow root systems and buttressed trunks on trees, and saturated soils. Following the delineation, BVW Data Forms were completed for representative plots along the wetland/upland borders.

WETLAND DESCRIPTIONS

Wetlands on the subject property include two intermittent stream channels; several areas of Bordering Vegetated Wetland (BVW); and two isolated wetland areas. According to section 10.02(2)(b) of the WPA Regulations, the Banks and BVW areas have associated **100-foot Buffer Zones.** In addition, the Franklin Conservation Commission Rules and Regulations establish that all freshwater wetlands have an associated **0-25 foot No Disturbance Zone**, a **25-50 foot Buffer Zone**, and a **50-100 foot Buffer Zone**, regardless of size and connectivity to other wetlands. The wetlands delineated on the site are described in the following sections.

Intermittent Streams

Two stream channels were identified and delineated on the subject property. As demonstrated below, both channels appear to qualify as intermittent streams with no associated 200-foot Riverfront Area. In addition, neither appears to qualify as a "river or stream" under the Franklin Wetlands Protection Bylaw, which is defined in Section 184-4 as "*a naturally flowing body of water that empties to any ocean, lake or other river or stream and which flows throughout the year.*" Each of these features is described below.

B-series Stream

A stream channel originates within a wetland complex located offsite to the west on the opposite side of Maple Street, and enters the site via a culvert under the road. The stream channel extends in an easterly direction across the south side of parcel 235-142, ultimately entering the A-series BVW at the south side of the site (described in a later section) where it loses its defined channel.

According to 310 CMR 10.54, the edges of the channel are defined as **Bank**. Flag series B-1 to B-14 defines the northern edge of the channel, beginning at the downstream end of the culvert beneath Maple Street, and ending in the location where the stream channel enters the A-series BVW. Between flags B-1 and B-4, the Bank generally consists of a low break in slope near the tree line bordering maintained fields on the property. Between flags B-4 and B-5, a small culvert conveys flow beneath a field for approximately 100 feet. The remainder of the stream channel passes downslope through a wooded area before entering the A-series BVW.

At the time of delineation, the stream held no flowing or standing water in any location. The stream channel varied in width from about 2 to 4 feet wide along most of its course. The stream has an unconsolidated, stony bottom of sandy mineral sediment along most of its length. The stream banks were colonized by a mixture of trees, shrubs, and herbaceous vegetation, and most of the land within the channel was unvegetated. Species observed along the Banks and within the channel included, but were not limited to, the following:

Common Name	Scientific Name	Indicator Status
Red Maple	*Acer rubrum*	FAC
Yellow Birch	*Betula alleghaniensis*	FAC
Oriental Bittersweet	*Celastrus orbiculatus*	UPL
Raspberry	*Rubus sp.*	FACU
Poison Ivy	*Toxicodendron radicans*	FACU

The stream appears to qualify as an **Intermittent Stream**, as defined under 310 CMR 10.58(2)(a)-(c) which specifies:

> *a. A river or stream shown as perennial on the current United States Geological Survey (USGS) or more recent map provided by the Department is perennial.*
>
> *b. A river or stream shown as intermittent or not shown on the current USGS map or more recent map provided by the Department that has a watershed size greater than or equal to one square mile, is perennial.*
>
> *c. A stream shown as intermittent or not shown on the current USGS map or more recent map provided by the Department, that has a watershed size less than one square mile, is intermittent unless i. The stream has a watershed size of at least one-half (0.50) square mile and has a predicted flow rate greater than or equal to 0.01 cubic feet per second at the 99% flow duration using the USGS Stream Stats method.*

The stream is not shown on the USGS Topographic Quadrangle for the area, nor is it digitized in the USGS StreamStats program. Additionally, the stream appears to have a watershed substantially smaller than one-half square mile. Therefore, based upon the review of the above Regulations, it is Pare's opinion that this unnamed stream does not meet the definition of a "river" per 310 CMR 10.58 and that a 200-foot Riverfront Area is not present.

C-series Stream

According to the USGS Topographic Quadrangle for the area, another intermittent stream channel originates within a ponded area located offsite to the south, and extends north along the western side of the site, ultimately entering Shepard's Brook offsite to the northeast. Based on Pare's field investigations, a majority of the mapped stream corresponds to the interior of a seasonally flooded BVW complex (defined by flag series A and D) where no defined stream channel was observed. However, a short section of defined channel was observed near the south side of the site, where flow enters a culvert beneath a dirt footpath that separates the A and D series BVW areas (which are described in a later section).

According to 310 CMR 10.54, the edges of the channel are defined as **Banks**. Flag series C-1 to C-4 and C-100 to C-105 were placed along the Banks of the channel to the north and south of the footpath, respectively. The Banks correspond to a defined break in slope. At the time of delineation, the stream and surrounding BVW areas held no flowing or standing water in any location. The stream channel was approximately 2 to 3 feet wide and had an unconsolidated bottom of sandy mineral sediment along most of its length. The stream banks were colonized by a mixture of trees, shrubs, and vines, and most of the land within the channel was unvegetated. Species observed along the Banks and within the channel included, but were not limited to, the following:

Common Name	Scientific Name	Indicator Status
Red Maple	*Acer rubrum*	FAC
Highbush Blueberry	*Vaccinium corymbosum*	FACW
Oriental Bittersweet	*Celastrus orbiculatus*	UPL
Greenbrier	*Smilax rotundifolia*	FAC
Poison Ivy	*Toxicodendron radicans*	FACU

The stream appears to qualify as an **Intermittent Stream**, as defined under 310 CMR 10.58(2)(a)-(c) which specifies:

> *a. A river or stream shown as perennial on the current United States Geological Survey (USGS) or more recent map provided by the Department is perennial.*
>
> *b. A river or stream shown as intermittent or not shown on the current USGS map or more recent map provided by the Department that has a watershed size greater than or equal to one square mile, is perennial.*
>
> *c. A stream shown as intermittent or not shown on the current USGS map or more recent map provided by the Department, that has a watershed size less than one square mile, is intermittent unless i. The stream has a watershed size of at least one-half (0.50) square mile and has a predicted flow rate greater than or equal to 0.01 cubic feet per second at the 99% flow duration using the USGS Stream Stats method.*

The stream is shown as intermittent (faint blue line) on the USGS Topographic Quadrangle for the area. According to the USGS StreamStats program, the stream has a watershed size substantially smaller than one half square mile. As shown on the attached StreamStats report, the stream has a watershed of 0.31 square miles at a point located offsite to the north, downstream of the property. Therefore, based upon the review of the above Regulations, it is Pare's opinion that this unnamed stream does not meet the definition of a "river" per 310 CMR 10.58 and that a 200-foot Riverfront Area is not present.

Bordering Vegetated Wetlands

Three BVW areas were delineated on and in the vicinity of the subject property. Each of these areas has an associated **100-foot Buffer Zone** under 310 CMR 10.00. In addition, the Franklin Conservation Commission Rules and Regulations establish that all freshwater wetlands have an associated **0-25 foot No Disturbance Zone**, a **25-50 foot Buffer Zone**, and a **50-100 foot Buffer Zone**. The BVW areas are described in the following sections.

Wetland A

Flag series A-1 to A-38 defines the northern edge of a **BVW** located at the south end of parcel 235-142. This area is part of a larger wetland complex that borders a ponded area located offsite to the south. The wetland edge is generally located along the toe of a well-defined, wooded slope. The B-series intermittent stream enters the northwest side of this wetland between flags A-2 and A-3. The C-series intermittent stream channel originates within the north side of this wetland area and passes through a culvert beneath a dirt footpath, connecting the wetland with the D-series BVW to the north.

The wetland appears to have a seasonally flooded hydrology, as indicated by pronounced mound-and-pool microrelief and water-stained leaves. The wetland appears to be fed by a combination of groundwater and surface runoff. The wetland is dominated by Red Maple trees and has a dense shrub understory in most locations. A majority of the wetland area appears relatively undisturbed, as indicated by a robust community of native wetland vegetation. However, some invasive species were observed along the northwest wetland edge. Vegetation identified within the BVW included, but was not limited to, the following species:

Common Name	Scientific Name	Indicator Status
Red Maple	*Acer rubrum*	FAC
White Pine	*Pinus strobus*	FACU
Yellow Birch	*Betula alleghaniensis*	FAC
Sweet Pepperbush	*Clethra alnifolia*	FAC
Highbush Blueberry	*Vaccinium corymbosum*	FACW
Glossy Buckthorn	*Frangula alnus*	FAC
Japanese Barberry	*Berberis thunbergii*	FACU
Winterberry	*Ilex verticillata*	FACW
Cinnamon Fern	*Osmunda cinnamomea*	FACW
New York Fern	*Thelypteris noveboracensis*	FAC

Wetland D

Flag series D-1 to D-138 define the edges of an extensive forested **BVW** corridor extending across the western side of the site. Flag series D begins at the north boundary of parcel 235-142 and extends south along the western wetland edge, which is located at the toe of a defined slope bordering the maintained fields. The series turns east to border a dirt footpath extending through the south side of the site. A culvert passes the C-series stream channel beneath the dirt path and into the south side of this wetland, connecting the area to the A-series BVW to the south. The series then turns in a northerly direction, generally following the toe of a wooded slope. The series ends at the northwest corner of parcel 234-012, adjacent to Hancock Road.

The wetland appears to have a transitional hydrology, ranging from seasonally saturated areas at the toe of the slope, to semipermanently flooded areas at the wetland interior. A majority of the wetland was dry at the time of delineation; however, indicators of hydrology included pronounced mound-and-pool microrelief, water-stained leaves, water marks on woody vegetation, and hummocks of peat moss (*Sphagnum sp.*). The wetland appears to be fed by a combination of groundwater and surface runoff.

The wetland edges are dominated by Red Maple trees with a dense shrub understory dominated by Sweet Pepperbush in most locations. The wetland interior is variable, ranging from forested areas to wetter areas dominated by shrubs and emergent vegetation. A majority of the wetland area appears relatively undisturbed, as indicated by a robust community of native wetland vegetation. However, as with the A-series BVW, some invasive species were observed along the northwest wetland edge bordering the maintained area. Vegetation identified within the BVW included, but was not limited to, the following species:

Common Name	Scientific Name	Indicator Status
Red Maple	*Acer rubrum*	FAC
White Pine	*Pinus strobus*	FACU
Yellow Birch	*Betula alleghaniensis*	FAC
Gray Birch	*Betula populifolia*	FAC
Tupelo	*Nyssa sylvatica*	FAC
Sweet Pepperbush	*Clethra alnifolia*	FAC
Spicebush	*Lindera benzoin*	FACW
Highbush Blueberry	*Vaccinium corymbosum*	FACW
Glossy Buckthorn	*Frangula alnus*	FAC
Japanese Barberry	*Berberis thunbergii*	FACU

Winterberry	*Ilex verticillata*	FACW
Greenbrier	*Smilax rotundifolia*	FAC
Cinnamon Fern	*Osmunda cinnamomea*	FACW
New York Fern	*Thelypteris noveboracensis*	FAC
Sensitive Fern	*Onoclea sensibiis*	FACW
Royal Fern	*Osmunda regalis*	OBL
Tussock Sedge	*Carex stricta*	OBL
Skunk Cabbage	*Symplocarpus foetidus*	OBL
Peat Moss	*Sphagnum sp.*	OBL

Wetland E

Flag series E-1 to E-16 defines the southern edge of a **BVW** located at the north side of parcel 234-012. This area is part of a larger wetland complex that extends offsite to the north, through the wooded area east of the residences along Hancock Road. A culvert near a bend in Hancock Road connects this area with a larger wetland complex to the northwest of the road, which ultimately borders on a tributary to Shepard's Brook. The wetland edge in the vicinity of the site is generally located along a gradual wooded slope with very rocky soils.

The wetland appears to have a saturated to seasonally flooded hydrology, as indicated by pronounced mound-and-pool microrelief and water-stained leaves. The wetland appears to be fed by a combination of groundwater and surface runoff. The wetland is dominated by Red Maple trees and has a dense shrub understory in most locations. A majority of the wetland area appears relatively undisturbed. Vegetation identified within the wetland area included, but was not limited to, the following species:

Common Name	Scientific Name	Indicator Status
Red Maple	*Acer rubrum*	FAC
White Oak	*Quercus alba*	FACU
Yellow Birch	*Betula populifolia*	FAC
Sweet Pepperbush	*Clethra alnifolia*	FAC
Highbush Blueberry	*Vaccinium corymbosum*	FACW
Witch Hazel	*Hamamelis virginiana*	FAC
Cinnamon Fern	*Osmunda cinnamomea*	FACW

Isolated Vegetated Wetlands

Two isolated wetland areas were identified and delineated within the wooded area at the north side of the site. Both areas appear to be too small to qualify as Isolated Land Subject to Flooding (ILSF) under the 310 CMR 10.57. However, according to the Town of Franklin Wetlands Protection Bylaw, the Town protects all freshwater wetlands, regardless of size or connectivity with other wetlands. In addition, the Conservation Commission Rules and Regulations establish that freshwater wetlands have an associated 0-25 foot No Disturbance Zone, a 25-50 foot Buffer Zone, and a 50-100 foot Buffer Zone. The wetlands also appear to qualify as federally protected isolated freshwater wetlands. Each of these areas are described below.

Wetland F

Flag series F-1 to F-6 defines the perimeter of a small wetland depression approximately 2,510 square feet in size, located at the north side of parcel 234-012. The wetland does not appear to be connected with any other wetlands, and does not appear to be associated with any streams or ponds. The area meets the definition of a federally regulated **Isolated Vegetated Wetland.**

The wetland appears to have a saturated to seasonally flooded hydrology and may hold up to several inches of water, as indicated by pronounced mound-and-pool microrelief and water-stained leaves. The wetland appears to be primarily fed by groundwater. The wetland is dominated by a mixture of deciduous trees, including some upland species with hydromorphic adaptations such as buttressed trunks and shallow root systems. Soils within the area contained a gleyed matrix with pronounced redoximorphic concentrations. A majority of the wetland area appears relatively undisturbed. Vegetation identified within the wetland included, but was not limited to, the following species:

Common Name	Scientific Name	Indicator Status
Red Maple	*Acer rubrum*	FAC
White Pine	*Pinus strobus*	FACU*
Red Oak	*Quercus rubra*	FACU*
Highbush Blueberry	*Vaccinium corymbosum*	FACW
Lowbush Blueberry	*Vaccinium angustifolium*	FACU
Princess Pine	*Lycopodium obscurum*	FACU

*Hydromorphic adaptations to wetland soil conditions were present

Wetland G

Flag series G-1 to G-16 defines the perimeter of a wetland depression approximately 10,105 square feet in size, located at the north side of parcel 234-012. The wetland does not appear to be connected with any other wetlands, and does not appear to be associated with any streams or ponds. The area meets the definition of a federally regulated **Isolated Vegetated Wetland.**

The wetland appears to have a seasonally flooded hydrology and may hold up to a foot of standing water, as indicated by pronounced mound-and-pool microrelief and water-stained leaves. Like Wetland F, the wetland appears to be primarily fed by groundwater. The wetland is dominated by a mixture of deciduous trees, including some upland species with hydromorphic adaptations such as buttressed trunks and shallow root systems. Soils within the area possessed a thick organic layer and contained a gleyed matrix with pronounced redoximorphic concentrations. A majority of the wetland area appears relatively undisturbed. Vegetation identified within the wetland included, but was not limited to, the following species:

Common Name	Scientific Name	Indicator Status
Red Maple	*Acer rubrum*	FAC
White Pine	*Pinus strobus*	FACU*
Red Oak	*Quercus rubra*	FACU*
White Oak	*Quercus alba*	FACU*
Sweet Pepperbush	*Clethra alnifolia*	FAC
Highbush Blueberry	*Vaccinium corymbosum*	FACW
Witch Hazel	*Hamamelis virginiana*	FAC
Cinnamon Fern	*Osmunda cinnamomea*	FACW

*Hydromorphic adaptations to wetland soil conditions were present

Mr. William Buckley (8) November 22, 2016

REVIEW OF PUBLISHED MAPPING

Review of published mapping and the relevant MassGIS data layers on October 17, 2016 revealed the following:

- No Certified Vernal Pools are located on the property (MassGIS CVP_PT.shp).
- Two Potential Vernal Pools (PVPs) are mapped a short distance offsite, as shown on Figure 2. These include the ponded area to the south of the property (PVP ID #8195) within an offsite portion of the A-series BVW, and an area to the west of the property (PVP ID #8193) which appear to fall within an offsite portion of the D-series BVW. Additional investigation would be necessary in order to determine whether the areas meet the physical and biological criteria of certifiable vernal pools. (MassGIS pvpx1.shp).
- The subject property is not located in the vicinity of any Priority or Estimated Habitat of Rare Species (MassGIS ESTHAB_POLY.shp and PRIHAB_POLY.shp - 2008).
- The site is not located within an Area of Critical Environmental Concern (aececs_arc.shp, 2009) or Outstanding Resource Waters (ORW_POLY.shp, 2010).
- According to the FEMA Flood Insurance Rate Map (FIRM) for Norfolk County, Massachusetts (Community Panel No. 25021C0306E revised July 17, 2012), there is no mapped floodplain on or in the vicinity of the site. An area of Zone X (0.2% annual chance flood) extends from south to north across the west side of the site, which appears to correspond to the A and D-series BVW areas. The remainder of the property is located within Areas of Minimal Flooding.

Thank you very much for the opportunity to assist you with this project. If you have any questions regarding project permitting or other issues, or require further assistance, please do not hesitate to call.

Sincerely,

Lauren H. Gluck, P.W.S.
Senior Environmental Scientist

LHG
Attachments

Maple Hill Safety Concerns - Attachment 3

TOWN OF FRANKLIN

DEPARTMENT OF PUBLIC WORKS
Franklin Municipal Building
150 Emmons Street
Franklin, MA 02038-2095

September 14, 2005

Mr. Anthony Padula, Chairman
Members of the Franklin Planning Board
355 East Central Street
Franklin, MA 02038

Re: Kimberlee Estates
Preliminary Subdivision

Dear Mr. Chairman and Members:

The Department of Public Works has reviewed the Preliminary Subdivision Plan dated August 30, 2005. WE have the following comments:

1. The proposed extension of Kimberlee Avenue will result in a dead end street length of over 1800-feet. This waiver is far in excess of anything granted in recent years. Kimberlee Avenue should be connected to Bridle Path. Every effort should be made to purchase the property from the abutting landowners to complete this connection.
2. The water lines on both Kimberlee Avenue and Bridle Path are dead end. Every effort should be made to connect these water lines to improve water quality, fire safety and to provide redundancy in the water lines.
3. A construction grading easement should be provided on Lot 4.

If you require additional information, please contact this office.

Sincerely,

William J. Yadisernia, P.E.
Town Engineer

WJY/pjj

Cc: Engineering files
Guerriere & Halnon, Inc.

Phone: (508) 520-4910 • Fax: (508) 520-4939 • E-mail: DPW@franklin.ma.us

Via Email

Mr. Anthony Padula, Chairman July 7, 2020

Franklin Planning Board

Ms. Amy Love, Town Planner

Town of Franklin

355 East Central Street

Franklin, MA 02038

Re: **Maple Hills**

Dear Mr. Padula, Members of the Planning Board and Ms. Love:

We write to express our concerns regarding the negative impact the Maple Hills subdivision will have on Bridle Path, Kimberlee Ave, Maple Street and Lincoln Street. Specifically, added traffic, related safety issues, noise, dust and damages to the roadway. We have read the traffic study and listen to all of the prior Planning Board meeting on this topic. We support what our neighbors said at the last meeting and will not repeat their statements.

1. **The Traffic Study Missed key issues**

The Traffic study fails to address the added cut though traffic that connecting Bridle Path to Kimberlee Ave and thereby connecting Maple Street and Lincoln Street will cause. There is no doubt that if the proposed Maple Hills subdivision is built, many people will use it as a short cut to drive from the Maple Street area to the Lincoln Street area. Among other destinations, the new subdivision will be used by people on Oak Street, including those living in Charles River Farms and other subdivisions with access to Maple Street to drive on Kimberlee and Bridle Path to access the Keller / Sullivan School, Dacey Field, Village Street in Medway, route 109, and the Brook Street short cut to Norfolk and the Norfolk MBTA station. Similarly, Kimberlee and Bridle Path will be used by people living on and off of Lincoln Street and Brook Street to reach Maple Street, Oak Street, Franklin High School, Pond Street, and the Beech Street short cuts to Bellingham and Milford. Previously, you have received petitions signed by residents and taken testimony on this point. Yet, the traffic study does not appear to address this added traffic.

The Traffic study also fails to address the hill and curve on Bridle Path. The hill adds to the speed of drivers going down and those hitting the gas to climb up the hill. The hill is unfortunately located at the curve in the road which makes a blind curve. The hill and the curve should be addressed in the traffic study.

2. **Calming measures and Stop signs**.

We agree with Chairman Padula that the median is not the best solution to this problem. We ask for the elongated speed bumps that Chairman Padula described (similar to those at the Highschool) to help reduce speed.

Please also require STOP signs at the intersections of Bridle Path with Steeplechase Lane, Phaeton Lane and Surry Way. In addition, a STOP sign at both entrances of the circle at the current end of Bridle Path where the connection is proposed should be installed. Kindly ask that new plans be drawn showing the locations of the signs and calming measures so that the residents can review them and have input.

3. **Temporary construction road**

Please ask the developer for a temporary construction road across the LaBastie land so that neither Bridle Path nor Kimberlee Ave are used for the heavy construction vehicles. There is a culvert on the LaBastie land that has been used in the past to access the land where the proposed subdivision will be built. Carrol Construction clearly has a business relationship with the LaBastie family such that we hope this temporary access could be used instead of the residential streets where children ride bikes and people walk. Carrol Construction will avoid numerous complaints and headaches if the construction equipment is not driven on Bridle Path. If the temporary construction road is not built, we ask that the town collect funds to rebuild Bridle Path as it will need to be rebuilt.

4. **No Phasing of new road**

In addition, and quite importantly, we ask that you do not allow the new road to be built in phases. A selling point of the long lop road was that its length and looping would discourage the use of the street as a short cut and keep speeds down. If only a short road is built, all of those benefits are lost. Once the short "Phase One" road is built, there is no guarantee if or when the rest of the road will be built. In the past, the town has been forced to finish subdivisions or the residents forced to suffer, when a developer is unable to complete a subdivision because of economic downturns or other misfortunes. The town should protect itself and the residents by requiring the full road to be built to ensure such problems do not occur here.

5. **A New name for a new road**.

Finally, we request that you do not use Bridle Path or Kimberlee Ave as names for the new road to be built. We do not say this to be petulant but because we agree with our neighbor who explained that continuing the same name on the new road will lead to added unwanted traffic through the use of google maps, Waze and other apps. A new street should have a new name.

Thank you for your time and consideration.

Very truly yours,

Mary & Michael Doherty

50 Bridle Path

Lincoln S. Purdy
54 Bridle Path
Franklin, MA 02038
(508) 520-6646
lsplsp@yahoo.com

July 7, 2020

Mr. Anthony Padula – Chairman
Town of Franklin Planning Board

Re: Proposed Maple Hill Development

Dear Mr. Chairman:

In the event that I am unable to speak during the July 13 hearing on the captioned topic, I am sending you this note to convey my thoughts and questions, to which I hope you will give due consideration.

In no particular order:

1) The Beta traffic study recommends a dozen or more measures be taken in Franklin Woods and on Kimberlee and Maple Streets in order for the developer's planned throughway between Lincoln and Maple Streets to be safe, including narrowing and/or lowering the roadways. That a proposal would require such significant steps to ensure that the safety of *existing* neighborhoods would seem to me that the developer's plan is flawed; especially when one considers that few, if any of these steps would be required if the development were to pass adjacent to the Labastie property at 469 Maple Street and through an emergency access road on Bridle Path.

2) The current and historic access road into the property is via a dirt road adjacent to 469 Maple Street. Notwithstanding that there is wetland, I am at a loss as to why the developer continues to avoid any suggestion to make this access point to Maple Street. I can only conclude that the owner of this property, who is providing the land for the Maple Hill Development, is willing to sacrifice the Kimberlee neighborhood, so that they won't have the road next to their house. That seems hardly fair given that they will receive the windfall from the sale of developed land.

3) It was suggested at a prior Planning Board meeting that all access to the development during construction be via the aforesaid dirt road. I think this is an outstanding idea, regardless of whether Kimberlee ends up being sacrificed or not.

4) Many public commenters have expressed concern that the development, if connected as proposed, will be used as a cut through for cross town travelers between to avoid Downtown Franklin and Route 140. It is unclear whether either of the two traffic studies address these fears and what their findings are.

5) As above, many commenters have raised concerns over the blind curves on Bridle Path in front of Numbers 46-48 and again by 58-60, as well as the very sharp turn in Kimberlee where the

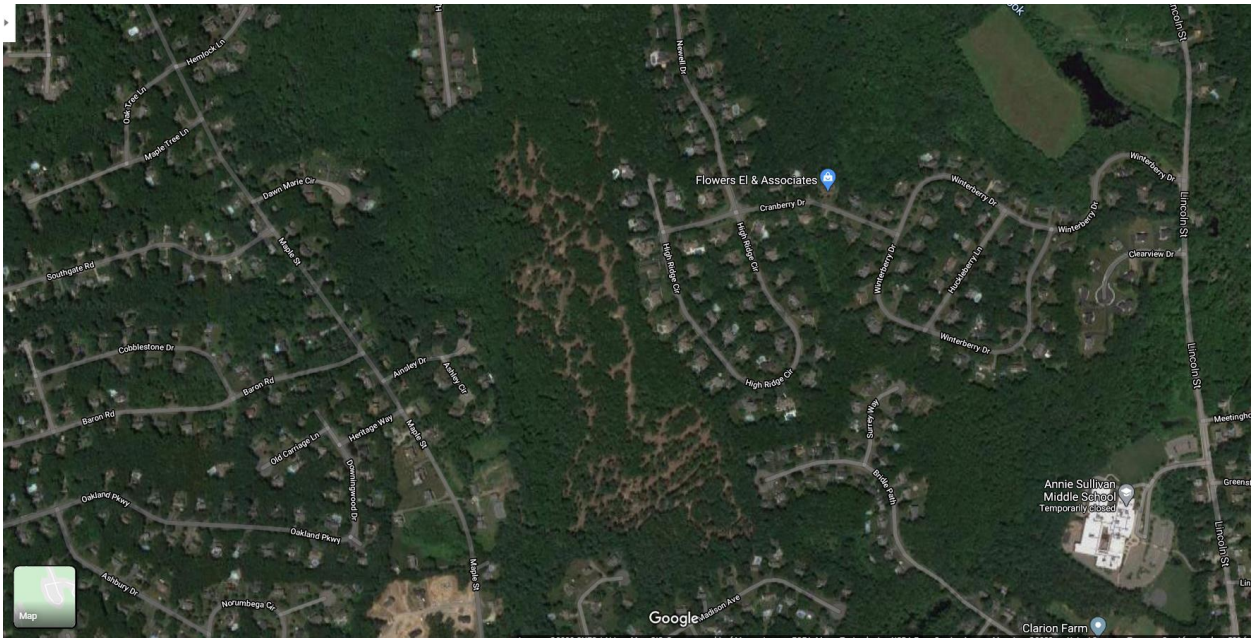
Lincoln S. Purdy
54 Bridle Path
Franklin, MA 02038
(508) 520-6646
lsplsp@yahoo.com

development will join Kimberlee. I could not find any commentary in the traffic studies on these concerns. Both traffic studies omit the fact that a car overturned in front in 49 Bridle Path just a few years ago.

6) If Bridle Path is used as an access to the Maple Hill Development, the chip seal surface of the road, which is already deteriorating after 1 year, will fail sooner than later. If construction trucks are allowed use it for access, it will fail all the sooner. In either event, I think it would be prudent for the Town to require the developer to absorb some, or all of the costs to mill and repave the road.

7) The Fire Chief and the DPW have expressed his objections to an emergency access road at the end of Bridle Path versus an open roadway. However, have they been asked their thoughts on the proposed raised islands and intersections, as well as the safety issues which Beta traffic study notes?

8) As you consider assurance and promises from the developer, please keep in mind that when you view the current Google Map image of the area, their "forest management" as per their 61A application, looks awfully similar to their proposed development.



9) Lastly, as I am sure you have seen, we opponents of this project feel that the traffic impact of this proposed project are being vastly underestimated and it is our families who will pay the price if Maple Hill is passed as proposed. As insurance against such eventuality, I would like to suggest the following:

In addition to the traditional construction bond which you will require from the developer, the Town should require an additional Performance Bond tied to the traffic projections of the developer's traffic study. This way, in the even the traffic through Bridle Path and Kimberlee exceed their projections, which I am confident they will, the bond can be called by the Town to pay for additional traffic mitigation, up to and including the conversion of the end of Bridle Path to an emergency access road.

Lincoln S. Purdy
54 Bridle Path
Franklin, MA 02038
(508) 520-6646
lsplsp@yahoo.com

I have consulted with a construction bond specialist at a leading insurance broker and he assured me that such a bond is easily obtainable.

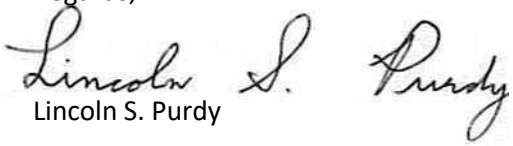
The details are negotiable, but I was thinking something like this:

The Town require Carroll Construction to provide a bond, either as an add-on to their regularly required bond or as an additional bond, that would be called in the event that the traffic volumes on Bridle Path and Kimberlee created by this project exceed Caroll's projections by "X"% over the first 10 years. Any fatal accident or serious bodily injury (to be defined) on Bridle Path, Kimberlee or any intersection thereto during the 10-year period shall automatically trigger the bond.

- Amount of bond: TBD ($250K? $500K?)
- Measurements to be taken 2x per year (at Carroll's expense) bi-annually when schools are in session.
- Measurements to be taken on Bridle Path and Kimberlee
- Proceeds from called bond to be used to pay for additional traffic mitigation including, but not limited to speed bumps, radar, police presence, median/rumble strips at strategic intersections, and the conversion of the Bridle Path/Maple Hills connection to an emergency right of way only.
- 10-year period to begin once the connecting roads have been completed and accepted by the town.

Thank you for your consideration.

Regards,



Lincoln S. Purdy