

High Level Traffic Evaluation

Hardy, Hunnewell, Upham Elementary Schools



February 2nd 2017

Overview

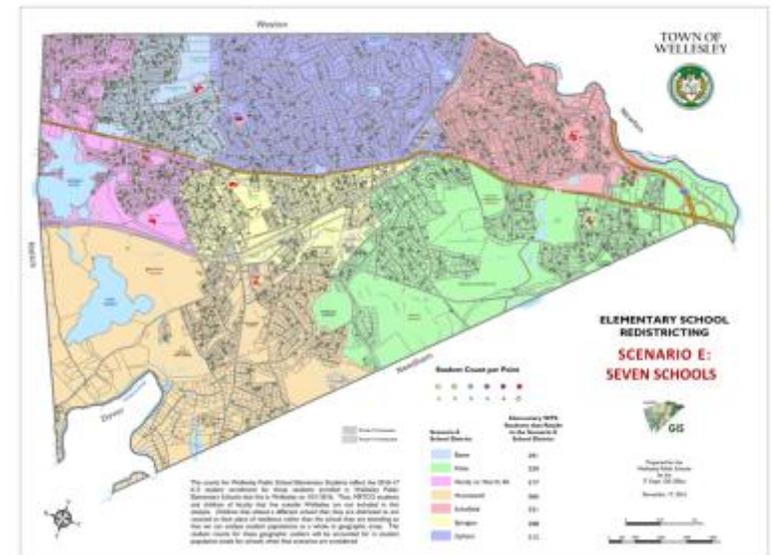
BETA was tasked with providing a high level traffic analysis for four potential redistricting/School Consolidation scenarios.

§ Scenario A – Hunnewell and Upham

§ Scenario B – Hardy and Hunnewell

§ Scenario D – Hardy and Hunnewell

§ Scenario E – Seven Schools



Evaluation Methodology

The high level traffic evaluation consisted of three primary tasks:

1. Data Compilation

§ Observe Existing Conditions at five elementary schools

§ Collect Turning Movement Counts at 21 intersections

2. Trip Generation and Distribution

§ How many cars are displaced & re-distributed as a result of redistricting/school consolidation?

§ Where do they go?

3. Traffic Analysis – What are the traffic impacts?

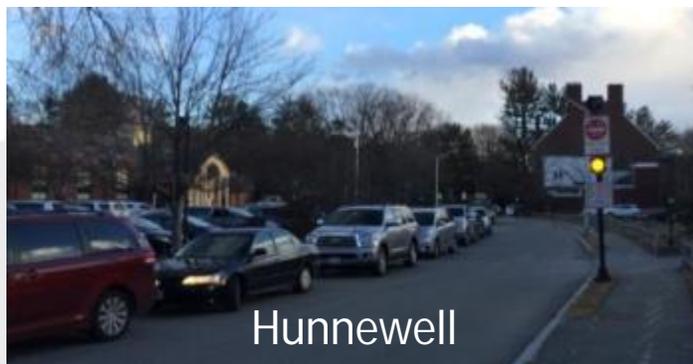
1. 2016 Existing

2. 2022 No-Build

3. 2022 Build (for 4 Scenarios)

School Observations

Existing school operations were observed during drop off and pick up:



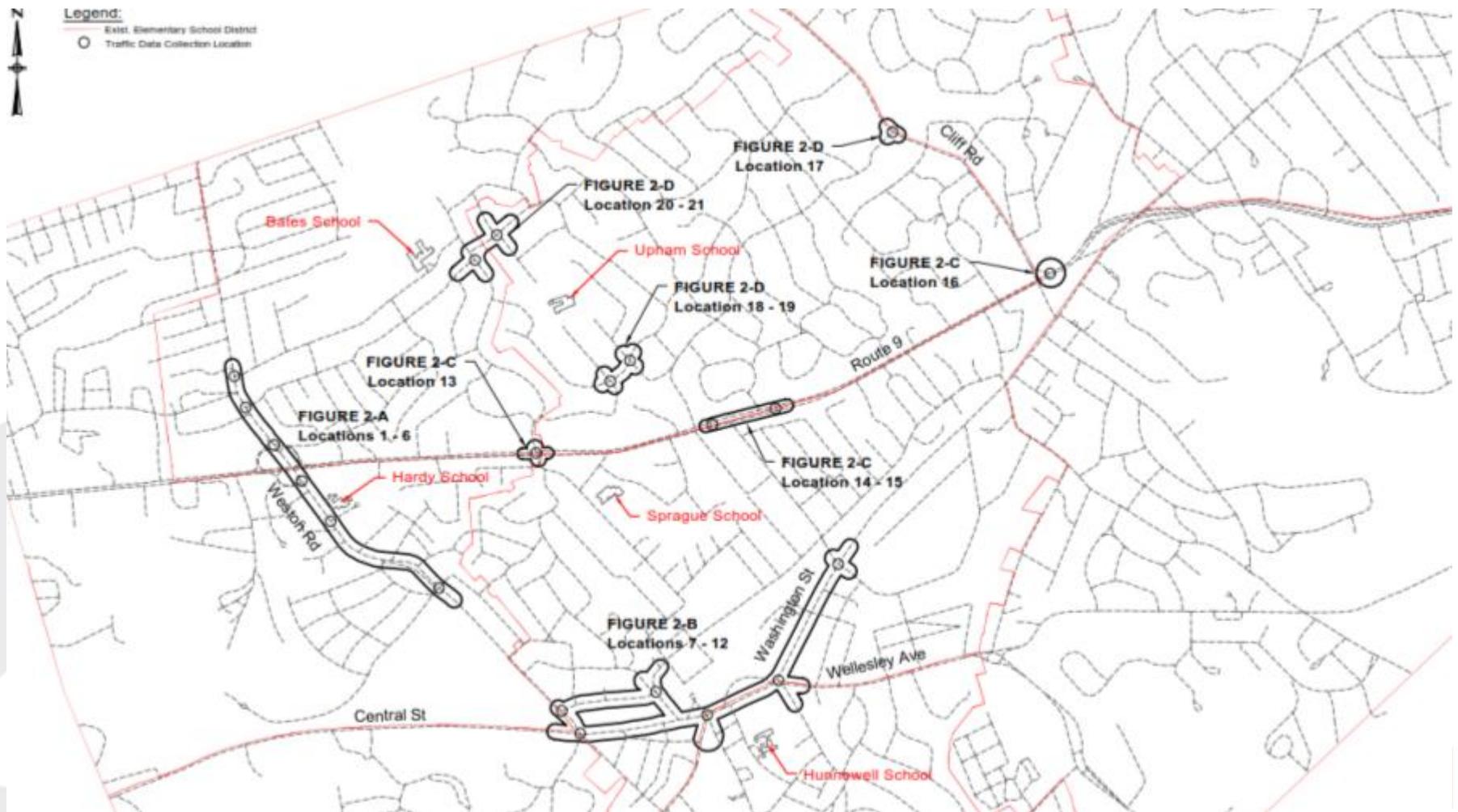
Turning Movement Counts

Turning Movement Counts (TMC) were collected for the 21 intersections:

1. Weston Road at Elmwood Road
2. Weston Road at Pilgrim Road
3. Weston Road at Cleveland Road & Route 9 Westbound Ramps
4. Weston Road at Route 9 Eastbound Ramp
5. Weston Road at Hardy Road
6. Weston Road at Avon Road & Turner Road
7. Weston Road at Linden Street
8. Central Street (Rte 135) at Weston Road
9. Linden Street at Crest Road
10. Central Street (Rte 135) at Grove Street & Washington Street (Rte 16)
11. Washington Street (Rte 16/135) at Wellesley Avenue (Rte 135) & Brook Road
12. Washington Street (Rte 16) at State Street & Kingsbury Street
13. Rte 9 at Westgate Road & Oak Street
14. Rte 9 at Westbound U-Turn
15. Rte 9 at Eastbound U-Turn
16. Rte 9 at Cliff Road
17. Cliff Road at Lowell Road
18. Bristol Road at Lowell Road
19. Bristol Road at Wynnewood Road & Oakridge Road
20. Suffolk Road at Dukes Road & Bucknell Road
21. Westgate Road at Pilgrim Road

Turning Movement Counts

All locations were summarized into groups summarized in volume figures.



2016 Existing TMC

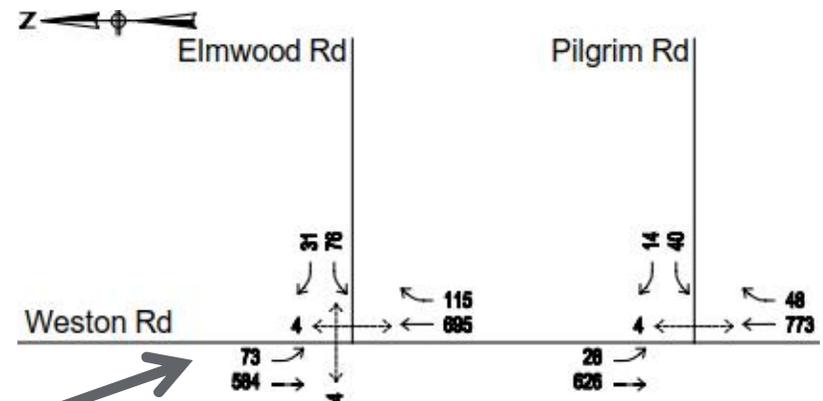


- § Traffic recorded with cameras
- § Volumes recorded in 15 minute intervals
 - § Peak Hour = Highest volume in four consecutive 15 minute intervals
- § Peak Hours may vary from intersection to intersection

Legend:

- Vehicle (Bike) Travel
- ↔ Pedestrian Travel - Crosswalk
- ←→ Pedestrian Travel - No Crosswalk

Count Dates: Thursday, December 15, 2016



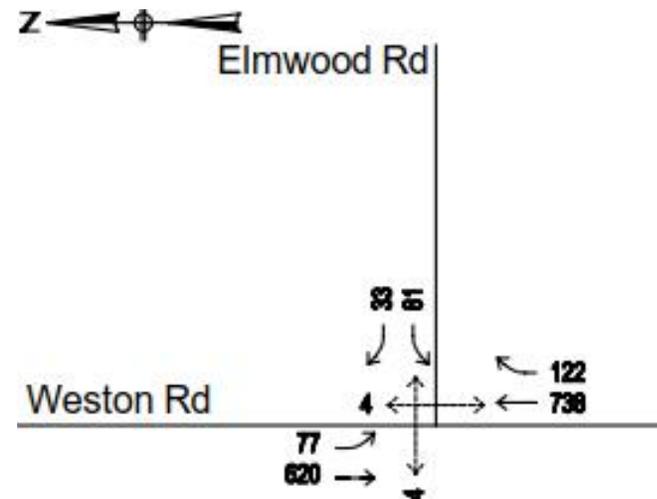
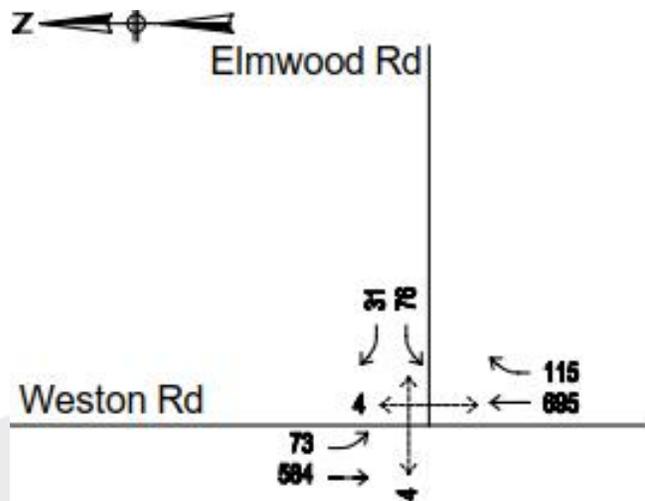
AM PEAK HOUR 7:45 AM to 8:45 AM PHF HV %	Weston Road Northbound				Weston Road Southbound				Eastbound				Elmwood Road Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	0	695	115	0	73	584	0	0	0	0	0	0	76	0	31
	0.94				0.95				0.00				0.59			
	0.0%	0.0%	1.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.2%

2016 Existing Volumes Summarized in Figure 2A-2D



2022 No-Build TMC

Existing traffic volumes increased by 1.0% per year for 6 years:



Legend:

- Vehicle (Bike) Travel
- ↔ Pedestrian Travel - Crosswalk
- ↔ Pedestrian Travel - No Crosswalk

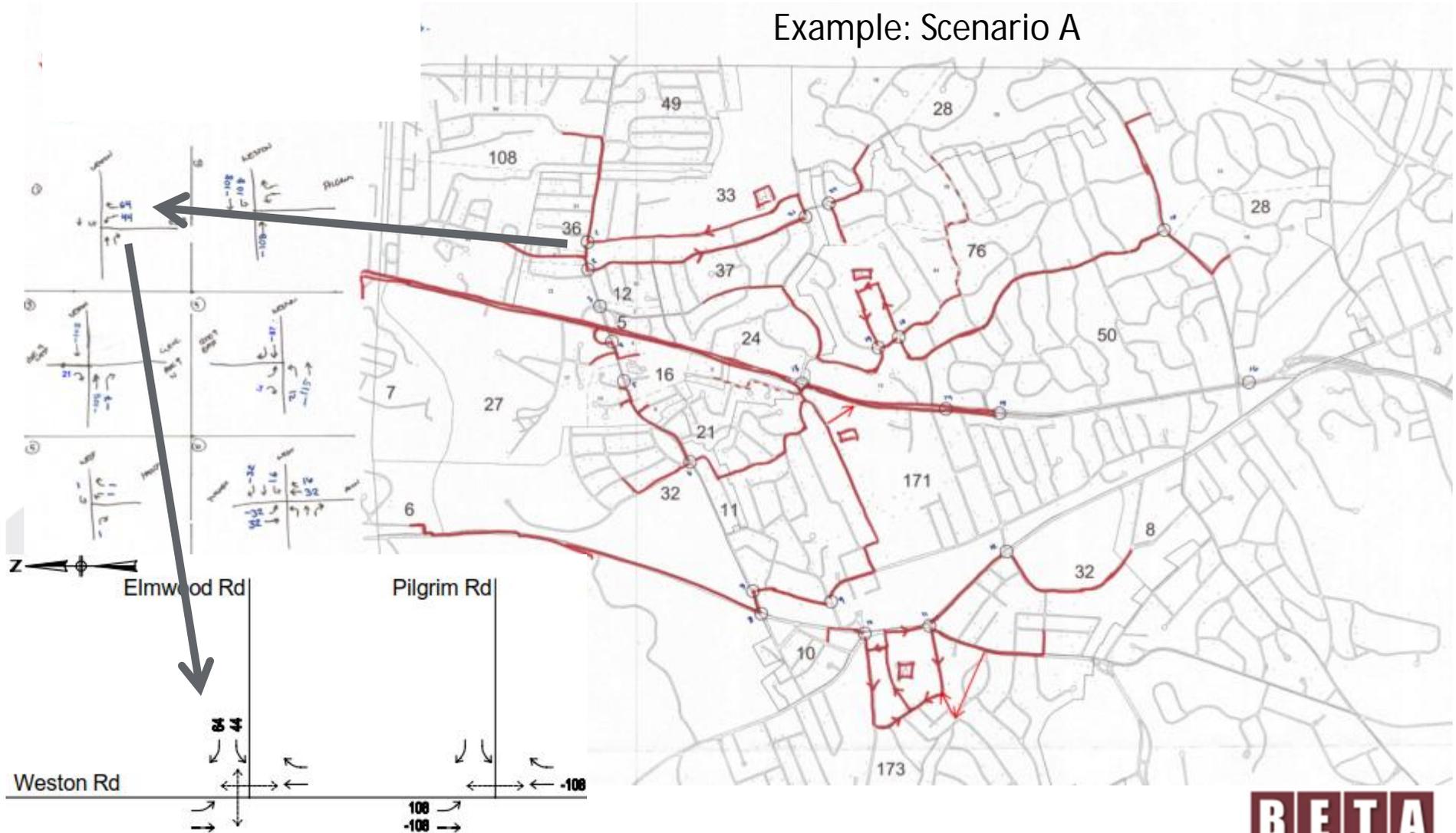
Count Dates: Thursday, December 15, 2016

2022 No-Build Volumes Summarized in Figures 3A-3D



Trip Distribution + Assignment

Example: Scenario A

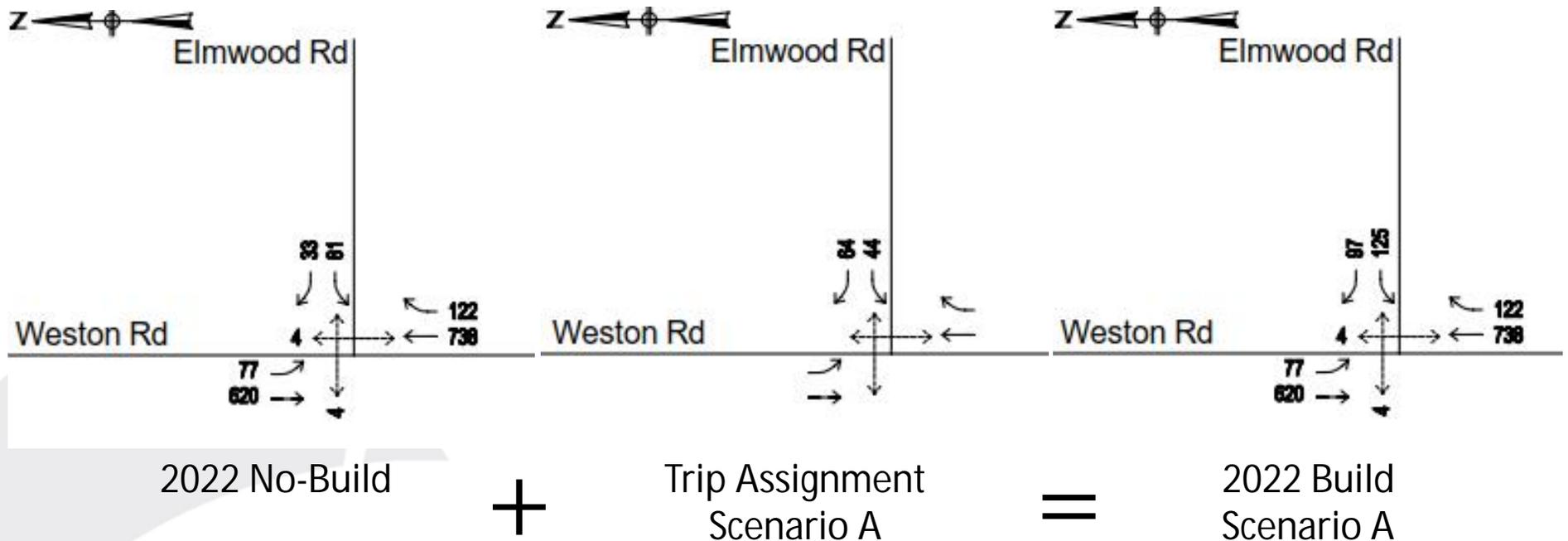


Trip Assignment summarized in Figures 4A-5D



2022 Build TMC

Trip Assignment for each Scenario is added to 2022 No-Build to obtain 2022 Build Volumes for each intersection.



2022 Build volumes are shown in Figures 6A-9D

Traffic Analysis

Traffic analysis based on Level of Service (LOS), delays, v/c, and queues.

§ **LOS** – Letter scale based on average delay (seconds) per vehicle

§ **A** = Free Flow (desirable)

§ **F** = Traffic Jam (undesirable)

§ **Delay** – The amount of time a car has to wait

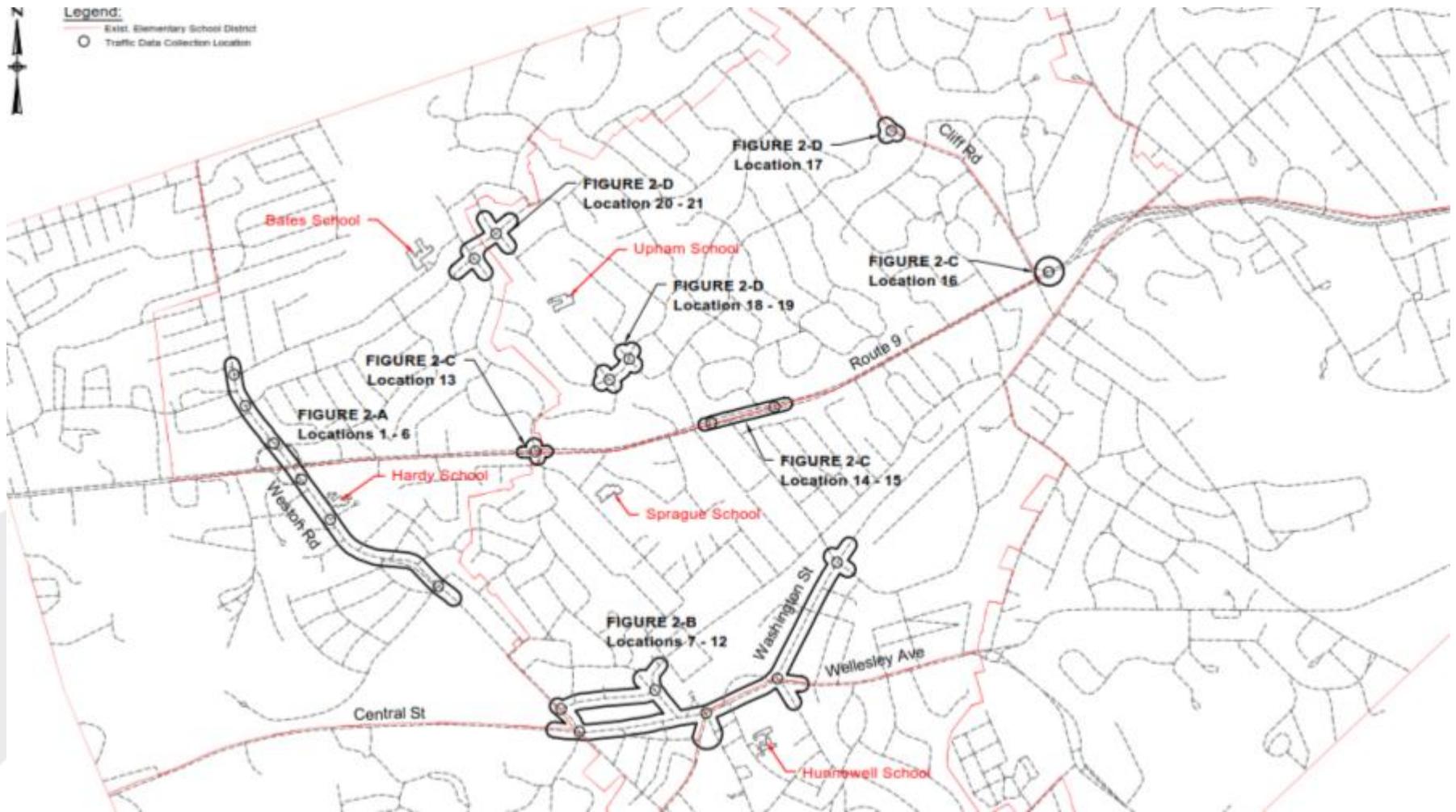
LOS	Unsignalized Average Total Delay	Signalized Average Total Delay	General Description
A	< 10.0	< 10.0	Free Flow
B	10.1 to 15.0	10.1 to 20.0	Stable flow
C	15.1 to 25.0	20.1 to 35.0	Stable flow
D	25.1 to 35.0	35.1 to 55.0	Approaching unstable flow
E	35.1 to 50.0	55.1 to 80.0	Unstable flow
F	> 50.0	> 80.0	Jammed

Traffic Analysis

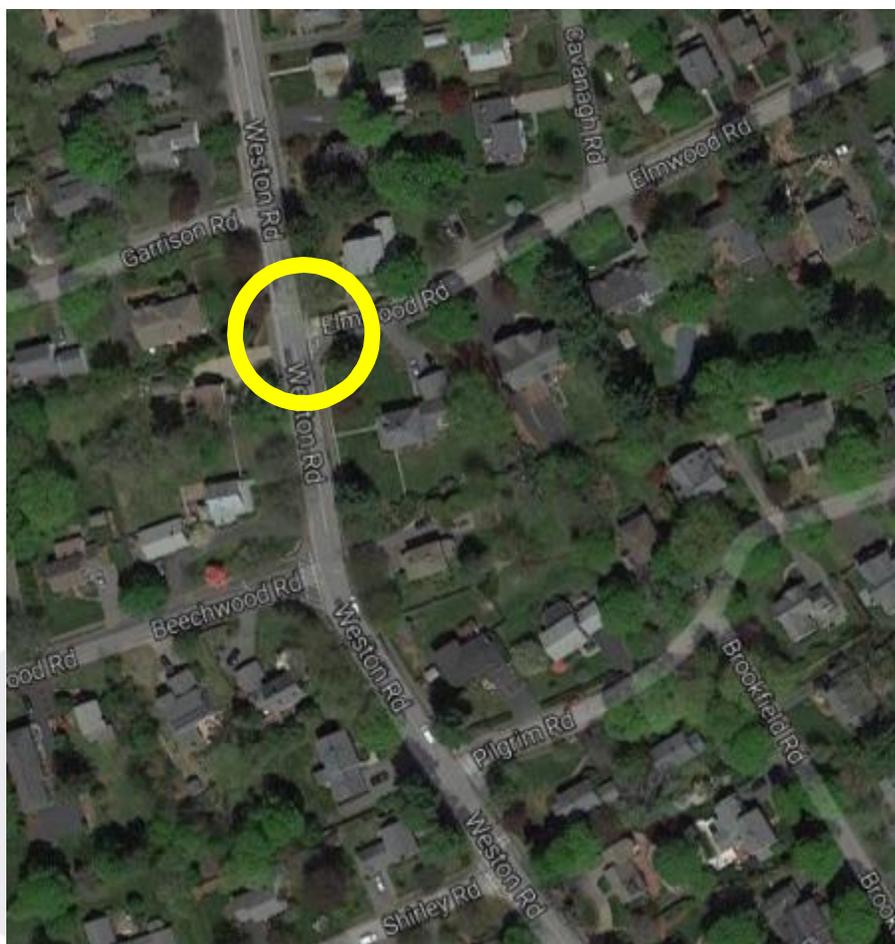
Traffic analysis based on Level of Service (LOS), delays, v/c , and queues.

- § **Volume to Capacity Ratio (v/c)** – A ratio that compares the volume observed with the capacity of an intersection or approach.
- § **$v/c > 1.0$** – The intersection or approach is over capacity and operates with LOS F. Significant delays and queues are expected.
- § **Queue** – Measures traffic backups in feet from the stop line to the end of the queue
 - § **95th Percentile** – Queues expected to reach this length (or shorter) approx. 95% of the peak hour examined.

Analysis Results



Location 1 – Weston at Elmwood



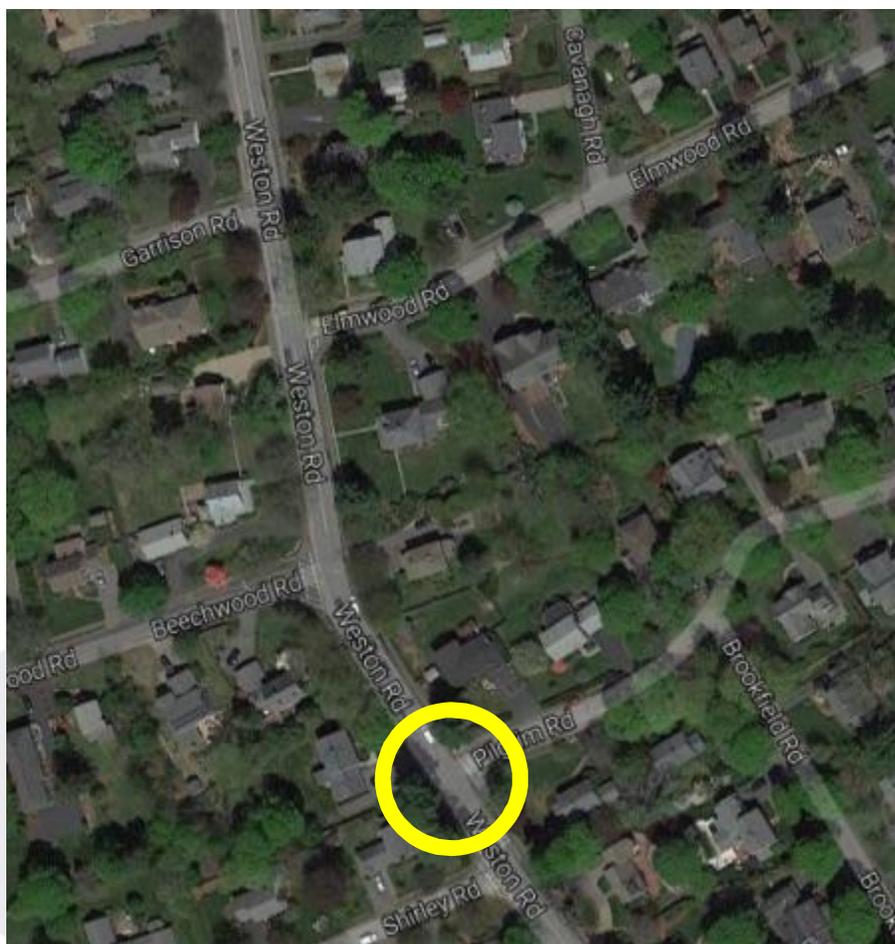
Morning Peak Hour				
		LOS	Delay	Queue
Existing		F	242.3	284
No-Build		F	*	355
Scenario	A	F	*	844
	B	F	256.2	226
	D	F	256.2	226
	E	F	*	355

Afternoon Peak Hour				
		LOS	Delay	Queue
Existing		D	27.6	45
No-Build		D	32.6	57
Scenario	A	F	79.7	201
	B	D	28.9	34
	D	D	28.9	34
	E	D	32.6	57

* Delay exceeds 300 seconds

** Volume exceeds capacity.

Location 2 – Weston at Pilgrim

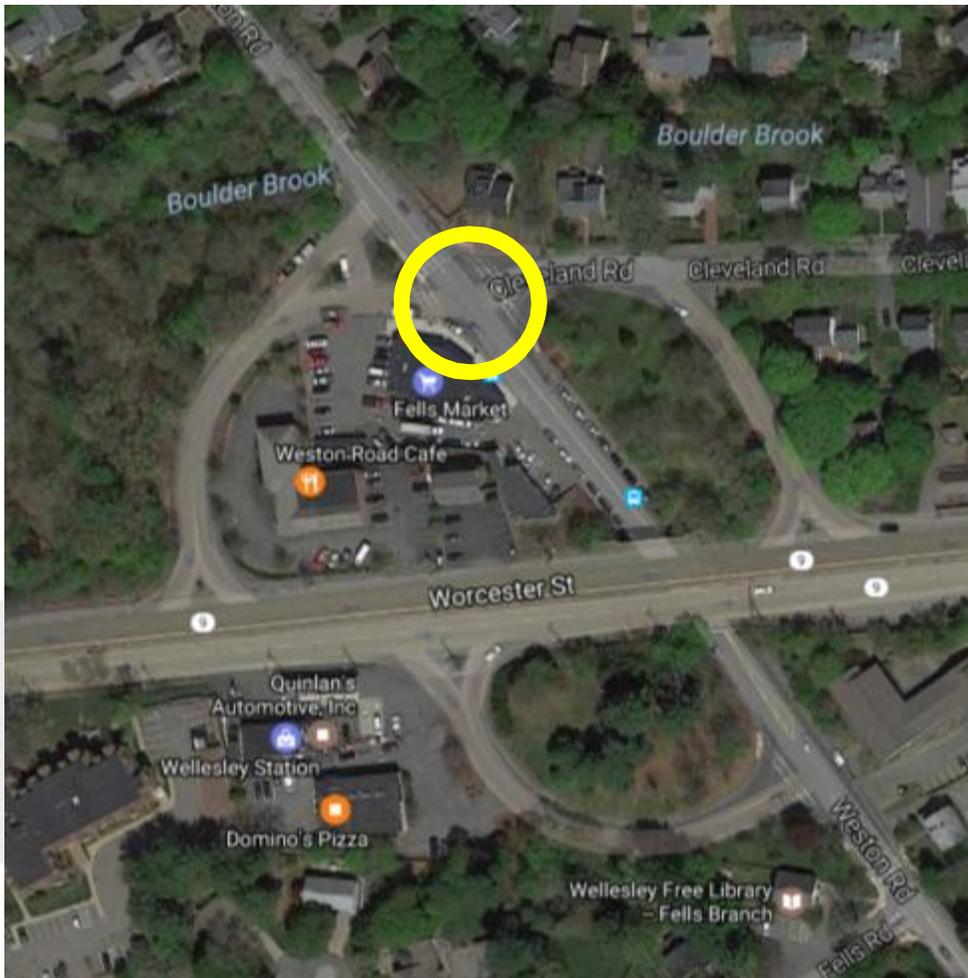


Morning Peak Hour				
		LOS	Delay	Queue
Existing		E	47.3	49
No-Build		F	60.4	63
Scenario	A	F	75.8	74
	B	F	167.9	180
	D	F	70.4	80
	E	F	60.4	63

Afternoon Peak Hour				
		LOS	Delay	Queue
Existing		D	30.2	37
No-Build		E	36.0	47
Scenario	A	E	41.2	53
	B	F	71.3	123
	D	E	39.6	58
	E	E	36.0	47

Location 3 – Weston at Cleveland/Route 9

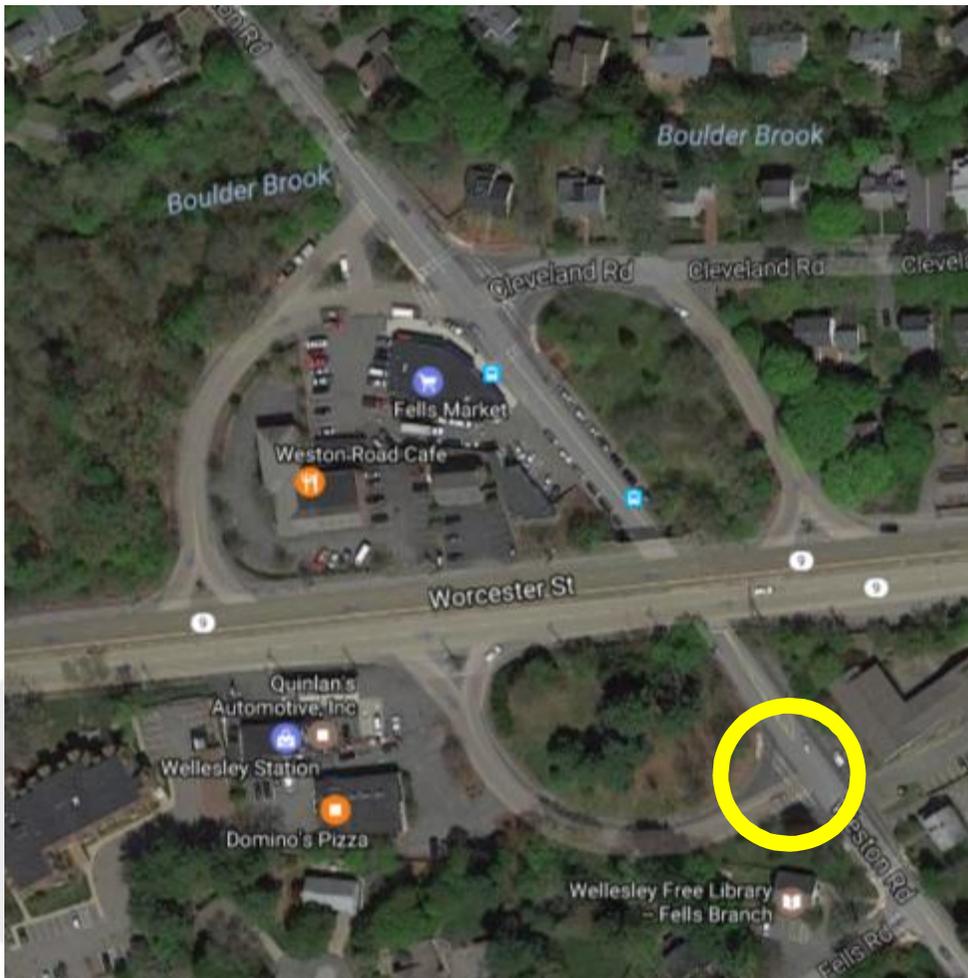
Example: Route 9 Westbound Ramp (Eastbound)



Morning Peak Hour				
		LOS	Delay	Queue
Existing		F	67.4	185
No-Build		F	113.8	255
Scenario	A	F	53.2	183
	B	F	233.1	356
	D	F	168.7	308
	E	F	113.8	255

Afternoon Peak Hour				
		LOS	Delay	Queue
Existing		F	60.6	185
No-Build		F	97.2	200
Scenario	A	E	44.8	138
	B	F	210.7	287
	D	F	147.3	245
	E	F	97.2	200

Location 4 – Weston at Route 9



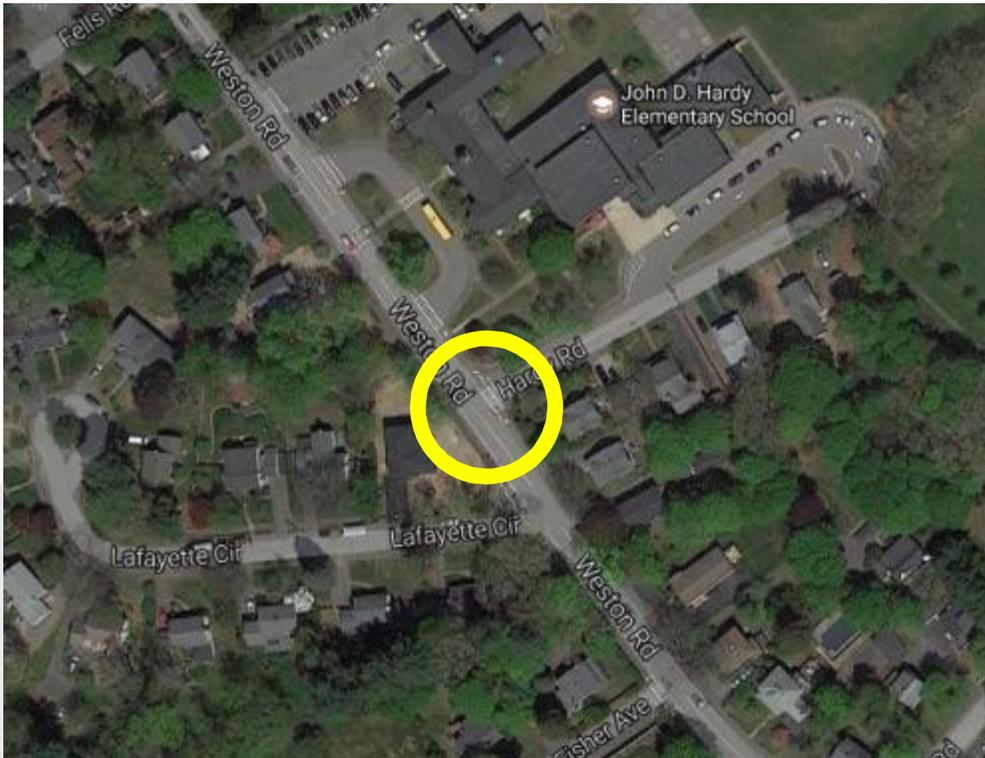
Morning Peak Hour			
	LOS	Delay	Queue
Existing	F	**	**
No-Build	F	**	**
Scenario	A	F	**
	B	F	**
	D	F	**
	E	F	**

Afternoon Peak Hour			
	LOS	Delay	Queue
Existing	F	*	704
No-Build	F	*	831
Scenario	A	F	710
	B	F	**
	D	F	894
	E	F	831

* Delay exceeds 300 seconds

** Volume exceeds capacity.

Location 5 – Weston at Hardy



Morning Peak Hour				
		LOS	Delay	Queue
Existing		F	124.5	261
No-Build		F	167.2	300
Scenario	A	-	-	-
	B	F	**	687
	D	F	239.2	462
	E	F	167.2	300

Afternoon Peak Hour				
		LOS	Delay	Queue
Existing		D	25.4	43
No-Build		D	28.6	49
Scenario	A	-	-	-
	B	F	85.2	271
	D	C	23.6	67
	E	D	28.6	49

* Delay exceeds 300 seconds

** Volume exceeds capacity.

Location 6 – Weston at Turner / Avon

Example: Turner Road (Eastbound)

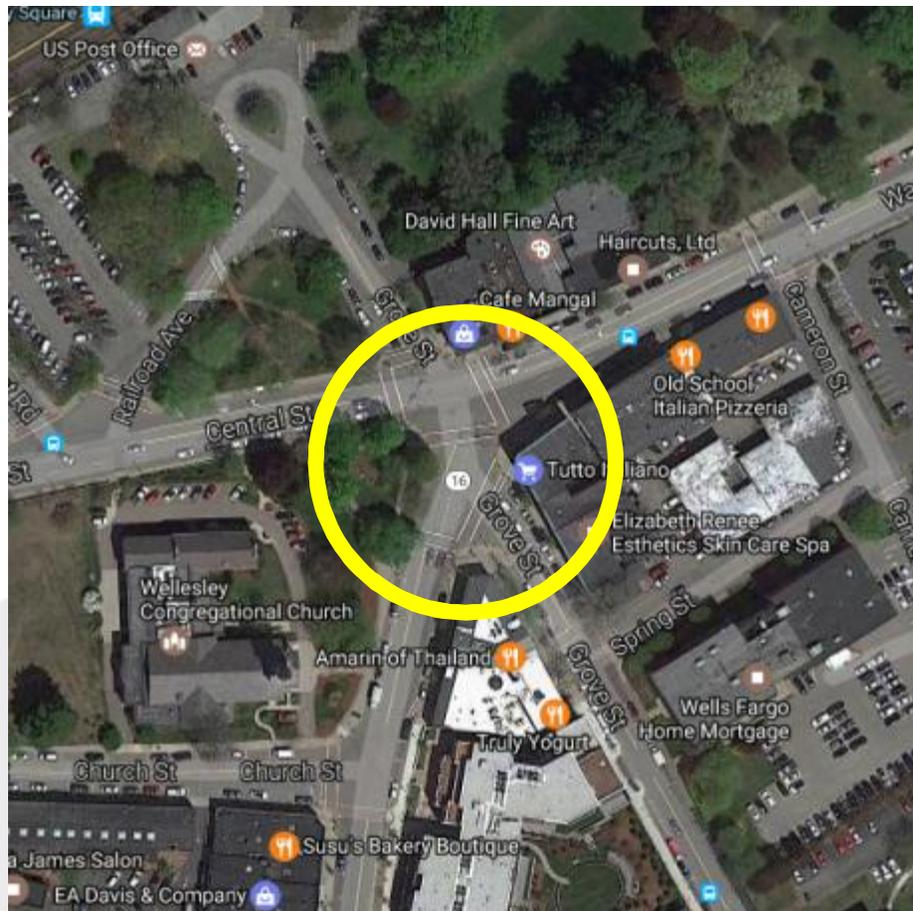


Morning Peak Hour				
		LOS	Delay	Queue
Existing		D	28.1	20
No-Build		D	32.9	25
Scenario	A	F	87.5	94
	B	F	68.2	80
	D	D	31.7	24
	E	D	33.2	26

Afternoon Peak Hour				
		LOS	Delay	Queue
Existing		C	19.8	11
No-Build		C	21.5	13
Scenario	A	F	89.5	103
	B	F	69.7	88
	D	C	20.7	12
	E	C	21.5	13

Location 10 – Washington at Central / Grove

Example: Grove Street (Northbound)



Morning Peak Hour				
		LOS	Delay	Queue
Existing		E	67.7	#430
No-Build		F	87.3	#465
Scenario	A	F	101.8	#488
	B	F	101.8	#488
	D	F	101.8	#488
	E	F	101.8	#488

Afternoon Peak Hour				
		LOS	Delay	Queue
Existing		F	*	#467
No-Build		F	*	#500
Scenario	A	F	*	#519
	B	F	*	#519
	D	F	*	#519
	E	F	*	#519

* Delay exceeds 300 seconds

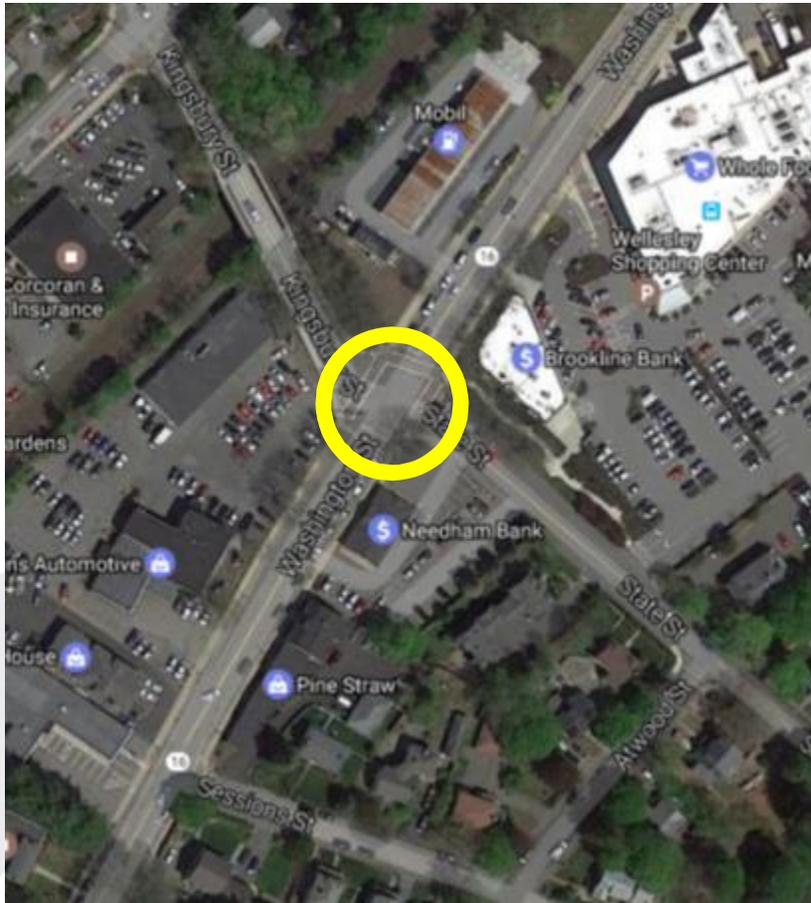
** Volume exceeds capacity.

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



Location 12 – Washington at State / Kingsbury

Example: State Street (Northbound)



Morning Peak Hour				
		LOS	Delay	Queue
Existing		E	64.4	#423
No-Build		F	91.0	#454
Scenario	A	E	70.6	#401
	B	E	70.6	#401
	D	E	70.6	#401
	E	F	91.1	#454

Afternoon Peak Hour				
		LOS	Delay	Queue
Existing		C	26.7	#304
No-Build		C	32.2	#354
Scenario	A	C	29.3	#304
	B	C	29.3	#304
	D	C	29.3	#304
	E	c	32.2	#354

* Delay exceeds 300 seconds

** Volume exceeds capacity.

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

Location 13 – Route 9 at Westgate / Oak

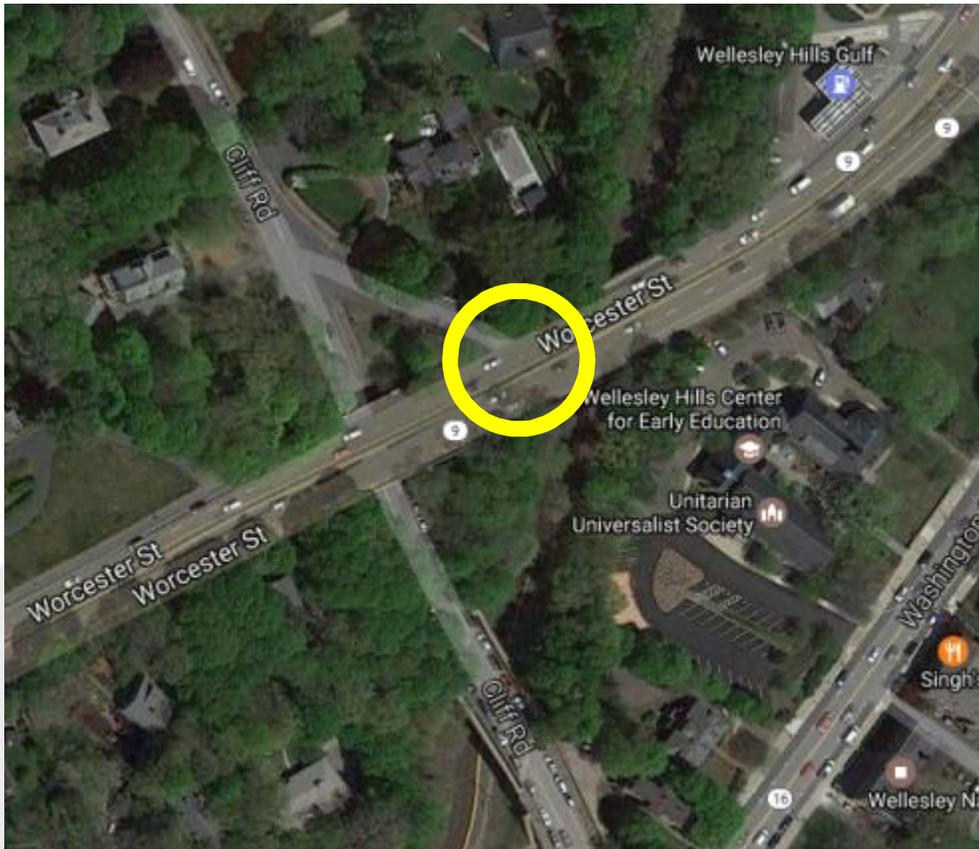
Example: Route 9 Westbound (Left Turn)



Morning Peak Hour				
		LOS	Delay	Queue
Existing		F	52.5	111
No-Build		F	80.1	152
Scenario	A	F	60.5	108
	B	F	80.1	187
	D	F	153.6	264
	E	F	57.0	104

Afternoon Peak Hour				
		LOS	Delay	Queue
Existing		D	32.0	77
No-Build		E	42.2	102
Scenario	A	E	36.0	75
	B	E	42.2	102
	D	F	67.3	176
	E	D	34.4	72

Location 16 – Route 9 at Cliff

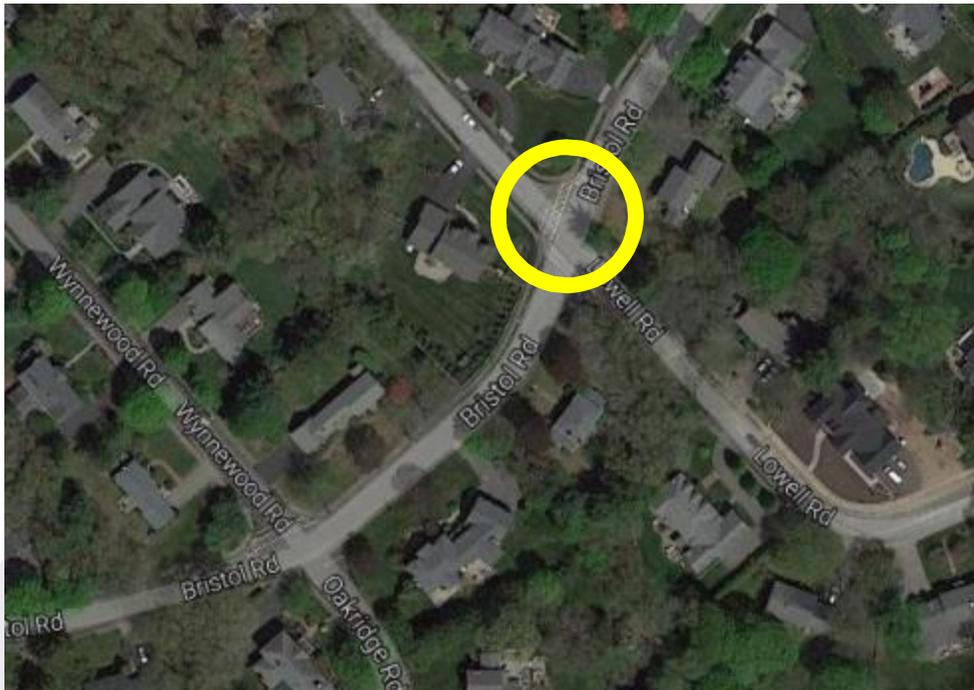


Morning Peak Hour				
		LOS	Delay	Queue
Existing		E	38.7	64
No-Build		E	49.2	82
Scenario	A	E	36.6	47
	B	E	49.2	82
	D	F	50.7	84
	E	E	36.6	47

Afternoon Peak Hour				
		LOS	Delay	Queue
Existing		F	162.8	229
No-Build		F	250.9	290
Scenario	A	F	164.8	211
	B	F	250.9	290
	D	F	260.7	295
	E	F	164.8	211

Location 18 – Bristol at Lowell

Example: Bristol Road (Eastbound)

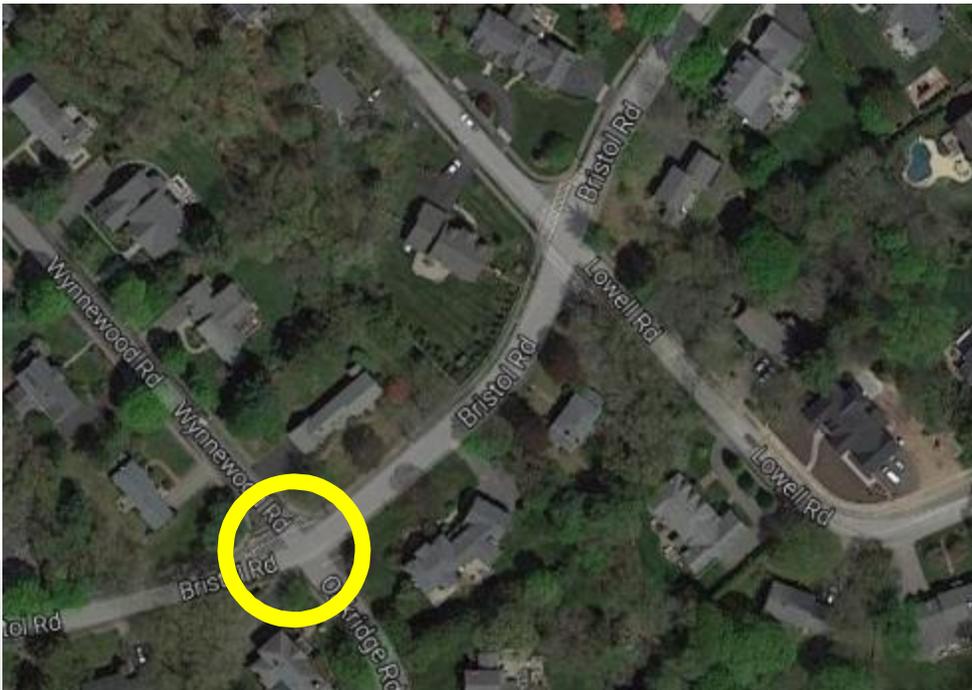


Morning Peak Hour				
		LOS	Delay	Queue
Existing		A	8.4	28
No-Build		A	8.6	30
Scenario	A	A	10.5	60
	B	A	8.6	30
	D	A	8.0	20
	E	A	8.7	33

Afternoon Peak Hour				
		LOS	Delay	Queue
Existing		A	8.6	33
No-Build		F	8.8	38
Scenario	A	E	12.5	95
	B	A	8.7	33
	D	A	8.0	20
	E	A	9.0	40

Location 19 – Bristol at Wynnewood

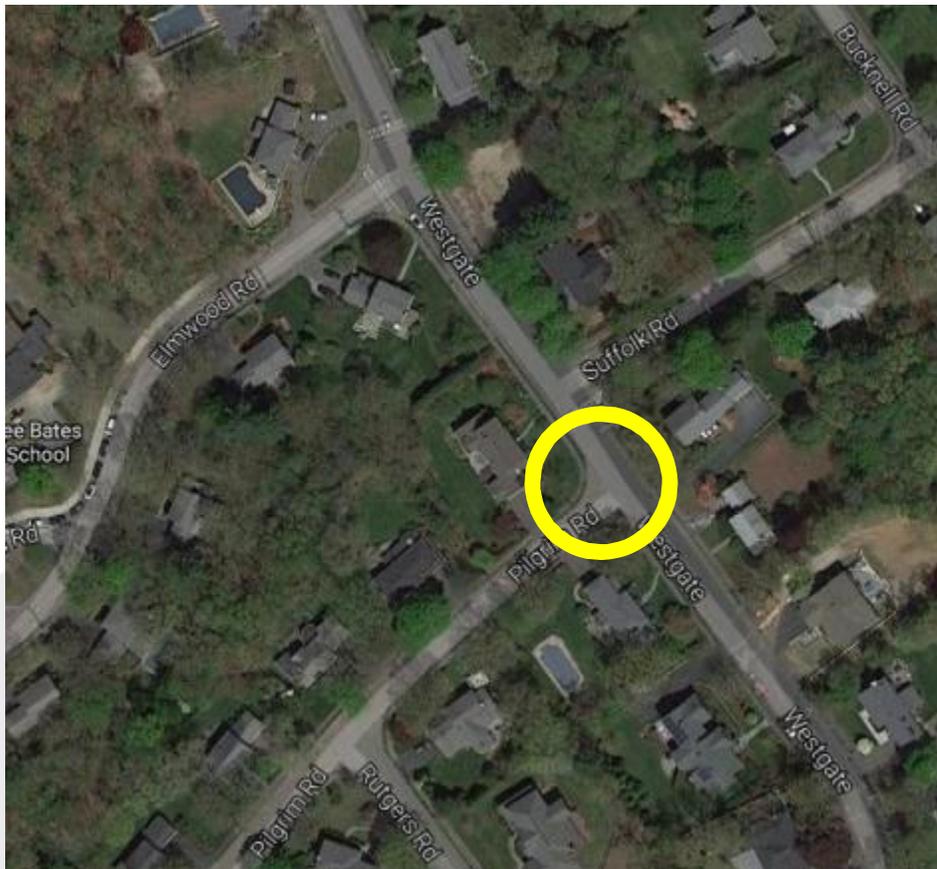
Example: Wynnewood Road (Southbound)



Morning Peak Hour				
		LOS	Delay	Queue
Existing		B	11.7	27
No-Build		B	12.0	30
Scenario	A	C	18.5	95
	B	B	10.8	5
	D	B	10.4	7
	E	B	12.2	32

Afternoon Peak Hour				
		LOS	Delay	Queue
Existing		B	12.5	46
No-Build		B	13.0	51
Scenario	A	D	30.8	223
	B	B	12.1	12
	D	B	11.0	13
	E	B	13.3	56

Location 21 – Westgate at Pilgrim



Morning Peak Hour				
		LOS	Delay	Queue
Existing		A	9.7	12
No-Build		B	9.8	13
Scenario	A	B	10.2	22
	B	A	9.6	17
	D	A	9.9	16
	E	A	9.6	9

Afternoon Peak Hour				
		LOS	Delay	Queue
Existing		A	10.5	13
No-Build		B	10.7	14
Scenario	A	B	11.6	30
	B	A	10.0	19
	D	B	10.6	19
	E	D	10.3	9

Analysis Summary

Overall traffic analysis summarized into three colors: Green, Yellow, Red.

- § Scenario A – Improves the most intersections
- § Scenario B and Scenario D - Degrade more intersections with fewer improved
- § Scenario E – No significant difference from existing conditions

Green = Improvement, Yellow = No Significant Change, Red = Degradation

Scenario	Green	Yellow	Red
A	6	13	4
B	2	16	5
D	2	17	4
E	2	21	0