BOSTON REGION METROPOLITAN PLANNING ORGANIZATION

Richard A. Davey, MassDOT Secretary and CEO and MPO Chairman
Karl H. Quackenbush, Executive Director, MPO Staff

MEMORANDUM

DATE **June 5, 2014**

TO **Boston Region Metropolitan Planning Organization**

FROM **Mark S. Abbott**
MPO Staff

RE **Safety and Operations Analyses at Selected Boston Region MPO Intersections, FFY 2013: Western Avenue (Route 107) at Washington Street (Route 129) in Lynn**

1 INTRODUCTION

This memorandum summarizes safety and operations analyses and proposes improvement strategies for the intersection of Western Avenue (Route 107) at Washington Street (Route 129) in Lynn. The intersection and its location are shown in Figure 1.

The location was approved for study by the Boston Region MPO following a selection process for four locations from a short list of 21 intersections based on a series of criteria including, high EDPO (Equivalent Property Damage Only) crash rating, the number of pedestrian and bicycle crashes, transit significance, regional significance, and implementation potential.[1]

The four locations approved for study are:

- North/South Franklin Street (Route 37) at Union Street/Plymouth Street (Route 139) in Holbrook
- Western Avenue (Route 107) at Washington Street (Route 129) in Lynn
- Lexington Street at Beaver Street in Waltham
- Franklin Street (Route 37) at West Street in Braintree

This location was one of three intersections in Lynn that met all five criteria in the intersection selection process. In the interest of geographic equity, only one of the three Lynn intersections was selected, and Lynn's preference was to study the intersection of Western Avenue at Washington Street at this time.

[1] Mark Abbott and Chen-Yuan Wang, memorandum to Boston Region MPO, "Safety and Operations Analyses at Selected Intersections—FFY 2013, Task 1: Intersection Selection Procedure," November 1, 2012

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FIGURE 1
Western Avenue (Route 107) at
Washington Street (Route 129), Lynn

Safety and Operations
Analyses at
Selected Intersections

This memo contains the following sections:

- Existing Conditions
- Issues and Concerns
- Crash Data Analysis
- Intersection Capacity Analysis
- Improvement Alternatives
- Recommendations and Discussion

It also includes technical appendices that describe the methods and provide the data that were applied in the study, as well as detailed reports of the intersection capacity analyses.

2 EXISTING CONDITIONS

Western Avenue (Route 107), running in the north-south direction, is an urban principal arterial that runs entirely through the city of Lynn. It is a state-numbered route that is owned by the City of Lynn and has one lane in each direction in the vicinity of the study intersection at Washington Street. However, the southbound approach is being used as a two-lane approach, with a left/through lane and a de facto right-turn lane to Washington Street.

Washington Street (Route 129) is another city-owned roadway that is classified as an urban principal arterial; it runs from Boston Street, west of Western Avenue, to the Lynnway. It is also a one-lane roadway in each direction.

The intersection of Western Avenue and Washington Street is signalized, and it is marked as one travel lane on all approaches, as shown in Figure 2. Pedestrian signals and cross walks are provided on all intersection approaches. There are sidewalks on both sides of Western Avenue and Washington

Northbound Western Avenue approach

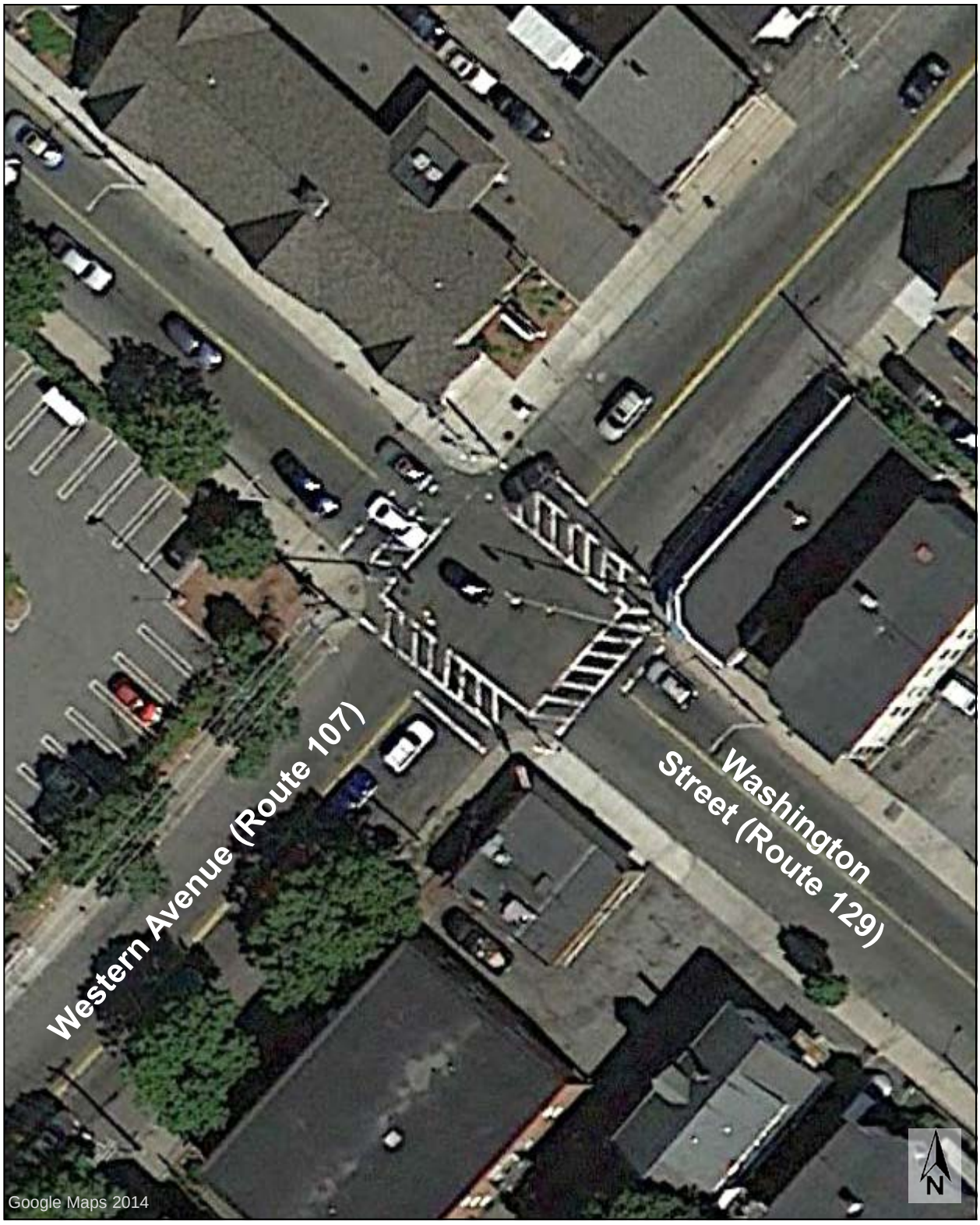

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FIGURE 2
Western Avenue (Route 107) at Washington Street (Route 129), Lynn

Safety and Operations Analyses at Selected Intersections

Street; they are approximately 8-to-10-feet wide in the vicinity of the intersection. Wheelchair ramps are provided at each side of each corner. There are no provisions for bicycles.

The signal heads are all standard three-face signal heads mounted overhead on two mast arms, which are located on the northeast and southwest corners of the intersection. Additional post-mounted signal heads are located on the northwest and southwest corners. There are utility poles on each corner of the intersection, which provide street lighting at the intersection.

The land use at the four corners of the intersection is commercial, with a Stop and Shop plaza located in the southwest quadrant. A sub (sandwich) shop is located on the southeast corner, with its entrance and small parking area located on Washington Street. A small convenience store is located on the northeast corner. A bank is located on the northwest corner, with a driveway located on Washington Street and its drive-through teller exit located on Western Avenue, approximately 35 feet from the stop line (see photo at right).

Bank drive-through teller exit

As you move away from the intersection along both Western Avenue and Washington Street, the land use changes to residential housing, both single-family and multi-family dwellings. The residential nature of both Western Avenue and Washington Street is associated with relatively high pedestrian use of the intersection. Observations of the intersection indicated that a number of

Western Avenue bus shelter

residents cross Western Avenue in order to access the Stop and Shop plaza.

There are a number of Massachusetts Bay Transportation Authority (MBTA) bus routes that travel through the intersection. MBTA bus Routes 424, 434, and 450 travel north-south along Western Avenue. The bus stop in the northbound direction is located at the southeast corner of the intersection. Even though the bus stop is located at the intersection, it does not interfere significantly with traffic operations, since the approach is wide enough to allow vehicles to move around the stopped buses. The southbound bus stop on Western Avenue is located approximately 125 feet south of the intersection. There is a bus shelter at that stop. There is also a bus route on Washington Street, MBTA Route 435, which travels through the intersection. The two closest bus stops for Route 435 are located approximately 150 feet east of the intersection and 180 feet west of the intersection. The current locations of the bus stops do not impact the safe operations of the intersection, roadway, or buses.

3 ISSUES AND CONCERNS

Two major issues, probably related, were identified for the intersection. First, it has a high number of crashes and a relatively high number of pedestrian and bicycle crashes. Second, the intersection is very congested during the AM and PM peak hours.

Based on the field observations and crash and traffic data analyses, the issues and concerns for the intersection can be summarized as:

- High number of crashes and high crash rate
- High number of pedestrian and bicycle crashes
- Poor traffic operations
- Traffic congestion in the peak hours
- No bicycle travel accommodation on either street

4 CRASH DATA ANALYSIS

Table 1 summarizes the crash statistics at the intersection based on the MassDOT Registry of Motor Vehicles (RMV) 2007–11 crash data. On average, approximately 21 crashes occurred at the intersection each year. About 26 percent of the total crashes (for the five-year period) resulted in personal injuries. Crash types consist of 38 percent angle collisions, 24 percent rear-end collisions, 16 percent single-vehicle collisions, 15 percent sideswipe collisions, 4 percent head-on collisions, and 2 percent unknown.

In the five-year period, there were five pedestrian crashes and five bicycle crashes.

About 35 percent of the total crashes occurred during peak periods, which indicates that many of the crashes might be related to stop-and-go traffic conditions at the intersection. Analyzing crash rates[2] is another effective tool for examining the relative safety of a location. Based on the crash data and the turning-movement counts collected in the fall of 2012 by MPO staff, the crash rate for this intersection was calculated as 2.42 (see Appendix A). This is much higher than the average crash rate for signalized locations in MassDOT Highway Division District 4, which is estimated to be 0.77.[3]

TABLE 1
Western Avenue at Washington Street—Crash Summary

	2007	2008	2009	2010	2011	Total	Average
Crash severity							
Property damage only	12	17	13	12	13	**67**	13.4
Personal injury	7	12	4	2	2	**27**	5.4
Fatality	0	0	0	0	0	**0**	0
Collision type							
Not reported	3	1	2	2	1	**9**	1.8
Angle	7	14	5	6	8	**40**	8.0
Rear-end	4	8	3	6	4	**25**	5.0
Side-swipe	2	3	4	4	3	**16**	3.2
Head-on	1	1	0	1	1	**4**	0.8
Single-vehicle	6	4	6	1	0	**17**	3.4
Roadway conditions							
Not reported	2	0	0	0	0	**2**	0.4
Wet or icy pavement	3	7	10	4	3	**27**	5.4
Weather conditions							
Dark/light	10	17	7	3	5	**42**	8.4
Clear	13	22	7	12	13	**67**	13.4
Cloudy	7	4	7	1	1	**20**	4.0
Rain	2	4	4	1	2	**13**	2.6
Snow	1	0	1	2	0	**4**	0.8
Crashes during weekday peak periods[1]	5	8	11	6	6	**36**	7.2
Crashes involving pedestrian(s)	1	2	2	0	0	**5**	1.0
Crashes involving bicyclist(s)	1	1	2	1	0	**5**	1.0
Total crashes	**23**	**30**	**19**	**16**	**16**	**104**	**20.8**

[2] Crash rates are estimated based on crash frequency (crashes per year) and vehicle exposure (traffic volumes or miles traveled). Per MassDOT guidance, crash rates are expressed as "crashes per million entering vehicles" for intersection locations and as "crashes per million miles traveled" for roadway segments.

[3] The average crash rates estimated by the MassDOT Highway Division (as of January 23, 2013) are based on a database that contains intersection crash rates submitted to MassDOT as part of the review process for an Environmental Impact Report or Functional Design Report.

[1] Peak periods are defined as 7:00–10:00 AM and 3:30–6:30 PM.

5 INTERSECTION CAPACITY ANALYSIS

MPO staff collected turning-movement counts at the intersection on Thursday, October 25, 2012. The weather was cloudy and chilly with no rain during the counts. The data were recorded in 15-minute intervals during peak traffic periods in the morning, from 7:00 to 9:00, and in the evening, from 4:00 to 6:00.

The peak-hour traffic volumes in each of the two periods were then determined, and the associated turning movements and pedestrian crossings were used for the intersection's capacity analysis.

Figure 3 shows the observed vehicular turning-movement counts for the AM and PM peak hours. The intersection carried about 2,460 vehicles in the AM peak hour, from 7:15 to 8:15, and about 2,120 vehicles in the PM peak hour, from 4:45 to 5:45 (see Appendix B for detailed 15-minute breakdowns for passenger vehicles, various heavy vehicles, pedestrians, and bicycles in the peak periods and the peak hours).

There were 70 and 149 pedestrians crossing the intersection during the AM and PM peak hours, respectively. The highest number of pedestrian crossings occurred on the northbound approach, crossing Western Avenue to and from the Stop and Shop plaza. The next-highest occurred on the westbound approach across Washington Street, also to and from the Stop and Shop plaza.

Heavy vehicles accounted for about 3.4 percent of the total entry traffic in the AM peak hour and about 1.1 percent in the PM peak hour. The through movements on the northbound and southbound Western Avenue approaches carried the highest percentage of heavy-vehicle traffic at the intersection.

Based on the counts and manual traffic signal timing, the intersection was modeled as a fully actuated isolated intersection. Table 2 summarizes Synchro[4] analysis results for existing conditions in the AM and PM peak hours. In the existing conditions, the southbound Western Avenue approach was analyzed with a de facto right-turn lane.

[4] Synchro Version 8 is developed and distributed by Trafficware Ltd. The software can perform capacity analyses and traffic simulation (when combined with SimTraffic) for an individual intersection or for a series of intersections.

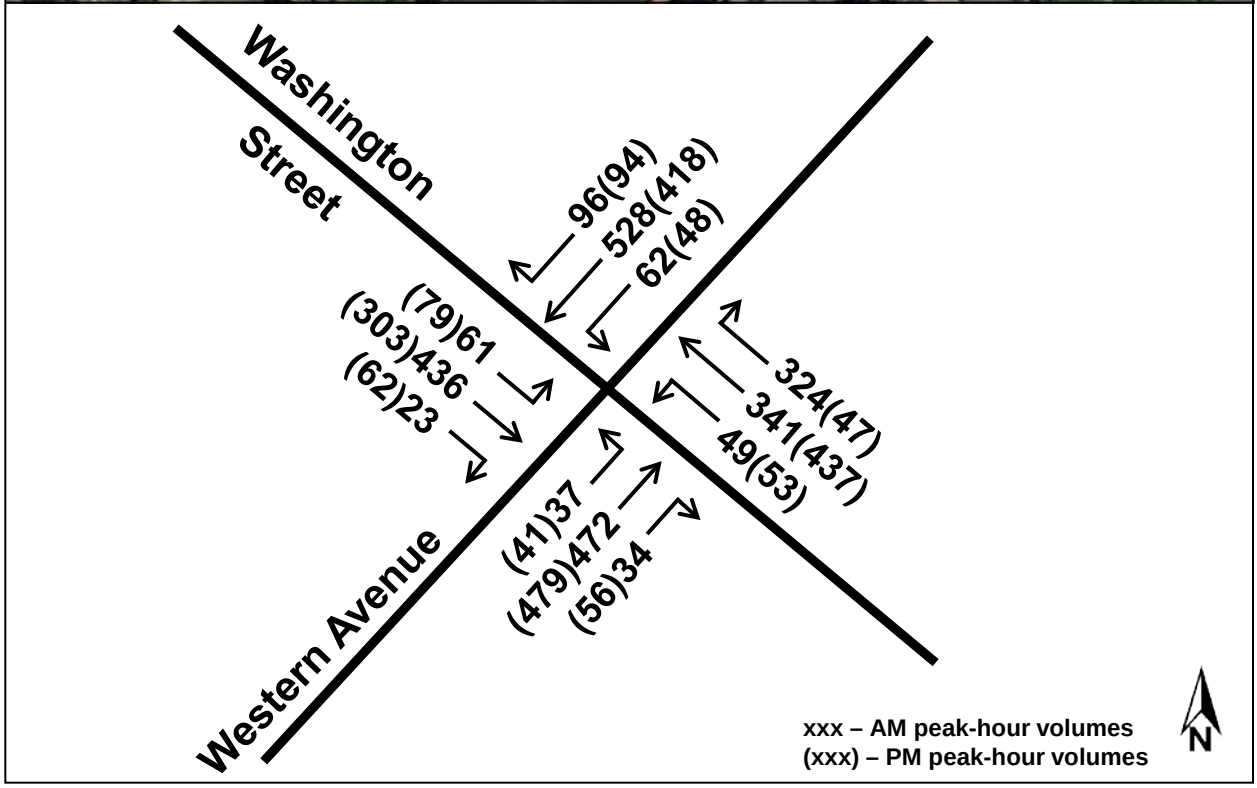

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FIGURE 3
Western Avenue (Route 107) at Washington Street (Route 129), Lynn – Traffic Volumes

Safety and Operations Analyses at Selected Intersections

TABLE 2
Intersection Capacity Analysis of Existing Conditions

Street Name	Approach/Movement	LOS[1]	Delay per Vehicle
Western Avenue	NB – Left/through/right	B (C)	19.7 (30.1)
Western Avenue	SB – Left/through	C (C)	23.3 (22.6)
Western Avenue	SB – Right	A (A)	5.8 (7.0)
Washington Street	EB – Left/through/right	F (F)	315.5 (147.1)
Washington Street	WB – Left/through/right	F (F)	133.2 (112.9)
Overall		**F (E)**	**112.9 (73.0)**

[1] LOS = level of service. The LOS for the AM peak hour is the first letter. The LOS for the PM peak hour is in parentheses.

The analysis indicates that the intersection operates at a level of service (LOS) F in the AM peak hour, with an average delay of nearly two minutes per vehicle. In the PM peak hour, the intersection is estimated to operate at LOS E, with an average delay of more than a minute per vehicle. Under existing conditions at the intersection, the Washington Street approaches operate with a failing level of service of LOS F in both peak hours. Detailed analysis parameters and results for the AM and PM peak hours are in Appendix C.

6 IMPROVEMENT ALTERNATIVES

The intersection's signal equipment is fairly updated; however, there are a few opportunities to improve existing operations using the current intersection approach widths.

MPO staff tested a number of traffic signal alternatives with various layout modifications, including one with no changes. To simplify the analysis, this memo presents only two alternatives: one with no layout changes and one with modifications that are considered to be able to provide substantial operational improvements with the least impact to the surroundings of the alternatives considered.

The two alternatives are:

- Alternative 1: Retime the traffic signal and signal phasing using the existing intersection geometry. The primary change is the addition of a short protected-permitted advance phase for the Washington Street eastbound approach.
- Alternative 2: Retime the traffic signal and signal phasing and implement new lane striping on the Western Avenue southbound approach and Washington Street eastbound approach. As was recommended in Alternative 1, an advance Washington Street phase is added, and the

Western Avenue southbound approach is restriped to include a left/through lane and an exclusive right-turn lane. This striping is done within the existing approach lane, which is approximately 24 feet in width. The eastbound Washington Street approach is also restriped to two lanes, one exclusive left-turn lane and a through/right-turn lane. This is accomplished within the existing lane width, which is approximately 22 feet.

Tables 3 and 4 summarize the capacity analyses for existing conditions and for two improvement alternatives, in both the AM and PM peak hours. Using Synchro's signal optimization function, MPO staff identified that there should be a cycle length of 120 seconds, including an exclusive 20-second pedestrian signal phase. This 20-second exclusive pedestrian phase should help to improve pedestrian safety, as it would provide adequate walk and clearance time for crossing the intersection. Figure 4 shows the existing and proposed signal timings and phasing for the intersection, and Table 5 provides a description of the movements and phases.

TABLE 3
Intersection Capacity Analysis of Level-of-Service for Existing Conditions and Alternatives

		Existing Conditions	Alternative 1	Alternative 2
Street Name	**Approach**	**LOS[1]**	**LOS**	**LOS**
Western Avenue	NB – Left/through/right	B(C)	E(E)	E(E)
Western Avenue	SB – Left/through	C(C)	D(D)	D(D)
Western Avenue	SB – Right	A(A)	B(A)	B(A)
Washington Street	EB – Left	N/A	N/A	C(C)
Washington Street	EB – Through/right	F(F)	D(E)	C(E)
Washington Street	WB – Left/through/right	F(F)	E(E)	E(E)
Overall		**F(E)**	**E(D)**	**D(D)**

[1] LOS = level of service. The LOS for the AM peak hour is the first letter. The LOS for the PM peak hour is in parentheses.

TABLE 4
Intersection Capacity Analysis of Delay for
Existing Conditions and Alternatives

		Existing Conditions	Alternative 1	Alternative 2
Street Name	**Approach**	**Delay[1]**	**Delay**	**Delay**
Western Avenue	NB – Left/through/right	19.7 (30.1)	73.7 (65.3)	64.9 (70.3)
Western Avenue	SB – Left/through	23.3 (22.6)	46.9 (37.4)	43.9 (38.4)
Western Avenue	SB – Right	5.8 (7.0)	18.2 (8.6)	18.1 (8.9)
Washington Street	EB – Left	N/A	Na	23.7 (29.0)
Western Avenue	EB – Through/right	315.5 (147.1)	67.2 (66.0)	37.6 (31.3)
Washington Street	WB – Left/through/right	133.2 (112.9)	37.6 (57.3)	74.4 (79.2)
Overall		**112.9 (73.0)**	**55.4 (54.7)**	**52.0 (54.5)**

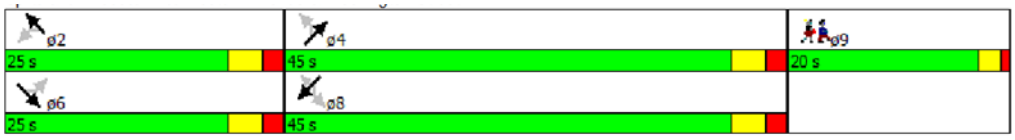
[1] The delay for the AM peak hour is the first number. The delay for the PM peak hour is in parentheses.

TABLE 5
Intersection Signal Phasing for
Existing Conditions and Alternatives

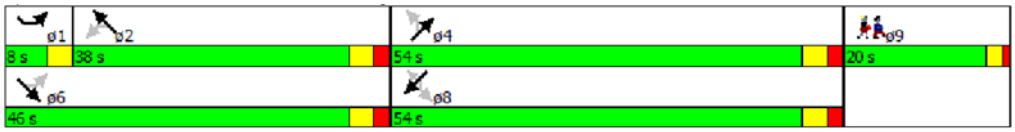
		Existing Conditions	Alternative 1
Street Name	**Approach**	**Phases**	**Phases**
Western Ave	NB - All	4	4
Western Ave	SB - All	8	8
Washington St	EB – Left	-	1
Washington St	EB - All	6	6
Washington St	WB - All	2	2
Pedestrian	All	9	9

FIGURE 4
Intersection Signal Timings and Phasing for Existing Conditions and Alternatives

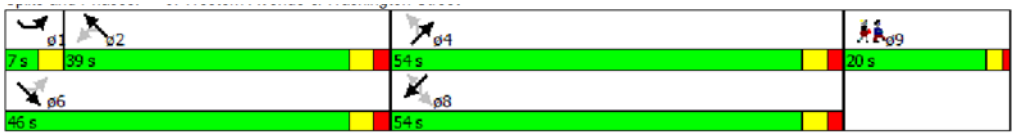
AM Peak Hour - Existing



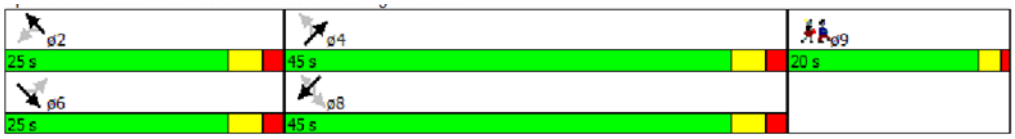
AM Peak Hour – Alternative 1



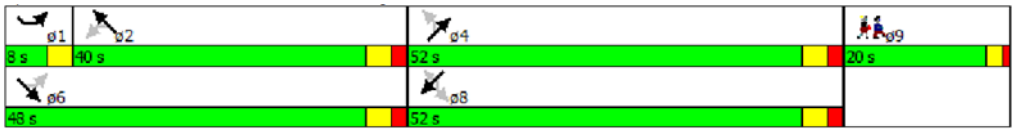
AM Peak Hour – Alternative 2



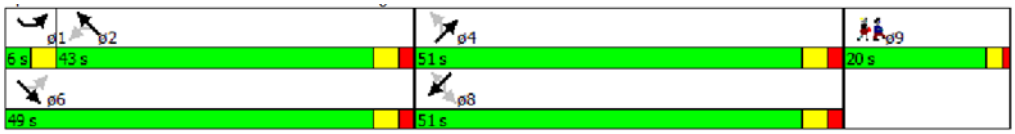
PM Peak Hour – Existing



PM Peak Hour – Alternative 1



PM Peak Hour – Alternative 2



Alternative 1, retiming the signal using the existing geometry, would improve the overall LOS E and LOS D in the AM and PM peak hours, respectively. However, this would cause increased delays on the Western Avenue

approaches, but it would be necessary in order to improve the Washington Street approaches.

Alternative 2, which includes the retiming and restriping of the Western Avenue southbound approach and the Washington Street eastbound approach, would improve the operations to LOS D in both peak hours. It would also reduce the overall delays to less than one minute per vehicle and would not impact the Western Avenue approaches as severely as Alternative 1.

Detailed signal timing settings and analysis results for the two alternatives in both the AM and PM peak hours are shown in Appendices D and E.

7 RECOMMENDATIONS AND DISCUSSION

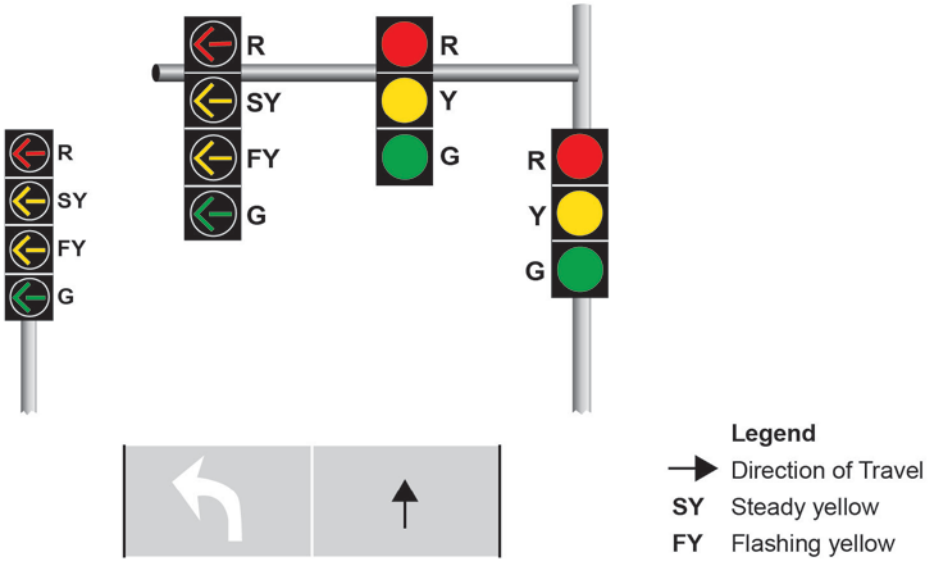
The study intersection has a high number of crashes and is very congested during the peak hours. The above analyses indicate that many crashes cold be related to the congested conditions at the intersection.

Nevertheless, the congestion at the intersection is not easy to mitigate at one approach without impacting one of the other approaches. Because of this, MPO staff recommend a comprehensive approach to improving the intersection's safety and operations based on the signal improvements in Alternative 2, described and analyzed in Section 6.

The intersection upgrade in Alternative 2 should include the following items:

- Restripe the Western Avenue southbound approach to two lanes—one exclusive right-turn lane and one through/left-turn lane, since this is how this approach is being used by vehicles today.
- Restripe the Washington Street eastbound approach to two lanes—one exclusive left-turn lane and one through/right-turn lane. With this improvement, a five-section or the new four-section (which includes the flashing yellow arrow shown in Figure 5) signal should be installed for the left-turn protected-permitted phase as described in Alternative 2. Because of the possible changes to the signal heads, the existing mast arms should be examined to assess whether they could handle if additional loads. are required.
- Install back plates on the Washington Street approach signal heads to help alleviate sun glare and to ensure signal visibility.
- Ensure that the pedestrian timing is included in the signal operations plan.

FIGURE 5
Proposed Four-Section Signal Head with Flashing Yellow Arrow for Left-Turn Protected-Permitted Operation



Source: FHWA, MUTCD, 2009.

- Replace the current pedestrian signal heads to the newer countdown signal head.
- Install the MUTCD (Manual on Uniform Traffic Control Devices) “Turning vehicles yield to pedestrians” sign (R10-15, see Figure 6) about 50 feet before the intersection on all approaches.[5]
- A possible long-term solution to improve safety at the intersection would be the eliminating left turns from certain approaches and accommodating them through other adjacent streets. To effectively evaluate this solution would require a thorough examination of the adjacent streets and traffic volumes to determine if they could accommodate the additional vehicles and if there might be benefits from rerouting the left turns.

[5] Federal Highway Administration (FHWA), Manual on Uniform Traffic Control Devices (MUTCD), 2009.

FIGURE 6
MUTCD Sign R10-15: Turning Vehicles Yield to Pedestrians

Source: FHWA, MUTCD, 2009.

- Include bicycle accommodations, which would be limited by the narrow street widths, but which could include bicycle signal detection with appropriate signage. The bicycle detection would ensure that bicyclists could activate the green phases on their approaches. It would also be possible to include sharrow bicycle markings along Western Avenue and Washington Street, since the current travel lane widths are adequate to accommodate their use.
- Consider installing Opticom Signal equipment for public safety vehicles.
- A longer-term improvement for pedestrians would be reconstructing the wheelchair ramps on each corner to meet current ADA (Americans with Disabilities Act) standards, with detectable warning pads on the ramps.

All of the improvements recommended above, except for the wheelchair ramp reconstruction, could be considered low-cost short-term improvements. These improvements should improve operations and safety at the intersection, not only for vehicles but also for pedestrians and bicyclists.

MSA/msa

APPENDIX A

Crash Rate Worksheet

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Lynn | COUNT DATE : 10/25/2012

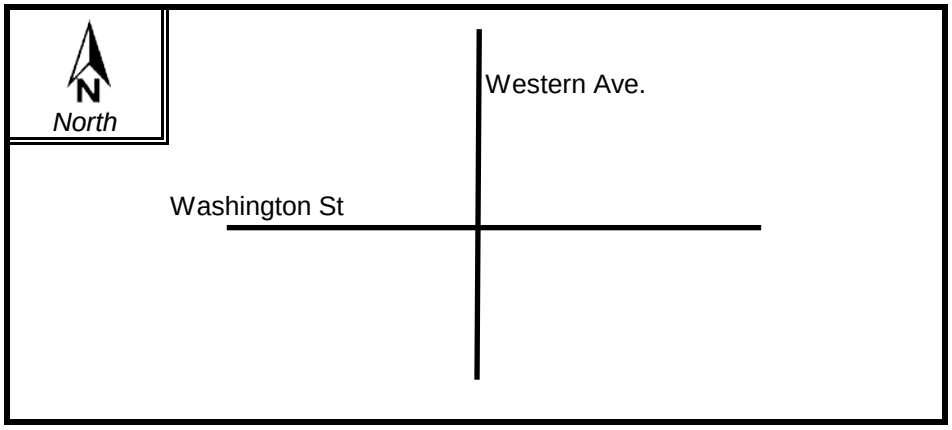
DISTRICT : 4 | UNSIGNALIZED : | SIGNALIZED : X

~ INTERSECTION DATA ~

MAJOR STREET : Western Avenue (Route 107)

MINOR STREET(S) : Washington Street (Route 129)

INTERSECTION DIAGRAM (Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	SB	EB	WB		
PEAK HOURLY VOLUMES (AM/**PM**) :	576	560	444	537		**2,117**

" K " FACTOR : **0.090**

INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **23,522**

TOTAL # OF CRASHES : 104

OF YEARS : 5

AVERAGE # OF CRASHES PER YEAR (**A**) : **20.80**

CRASH RATE CALCULATION : **2.42**

$$\text{RATE} = \frac{(A * 1{,}000{,}000)}{(V * 365)}$$

Comments : District 4 Signalized Ave = 0.78 crashes per million entering vehilces

Project Title & Date: Safety and Operations Analyses at Selected Intersections - Lynn

APPENDIX B

Turning-Movement Count Data

AM Peak Hour
All Vehicles

	Western Ave Northbound				Western Ave Southbound				Washington St Eastbound				Washington St Westbound				
Start Time	**Left**	**Thru**	**Right**	**Peds**	**Left**	**Thru**	**Right**	**Peds**	**Left**	**Thru**	**Right**	**Peds**	**Left**	**Thru**	**Right**	**Peds**	**Vehicle Total**
07:15 AM	8	122	3	10	11	142	23	2	14	106	8	3	8	79	13	13	**537**
07:30 AM	5	121	11	9	18	121	26	1	16	101	3	2	7	97	13	10	**539**
07:45 AM	14	124	12	2	12	121	26	3	17	122	6	0	13	96	15	2	**578**
08:00 AM	10	105	8	3	21	144	21	0	14	107	6	3	4	69	8	7	**517**
Total:	**37**	**472**	**34**	**24**	**62**	**528**	**96**	**6**	**61**	**436**	**23**	**8**	**32**	**341**	**49**	**32**	**2171**
PHF:	**0.66**	**0.95**	**0.71**		**0.74**	**0.92**	**0.92**		**0.90**	**0.89**	**0.72**		**0.62**	**0.88**	**0.82**		**0.94**
Truck%:	**8.11%**	**4.24%**	**8.82%**		**0.00%**	**2.84%**	**6.25%**		**4.92%**	**1.83%**	**0.00%**		**3.13%**	**4.11%**	**2.04%**		**3.41%**

PM Peak Hour
All Vehicles

	Western Ave Northbound				Western Ave Southbound				Washington St Eastbound				Washington St Westbound				
Start Time	**Left**	**Thru**	**Right**	**Peds**	**Left**	**Thru**	**Right**	**Peds**	**Left**	**Thru**	**Right**	**Peds**	**Left**	**Thru**	**Right**	**Peds**	**Vehicle Total**
4:45 PM	11	112	20	12	13	108	23	5	23	83	15	7	8	101	11	8	**528**
5:00 PM	13	130	14	11	11	97	20	10	18	75	20	2	13	114	7	10	**532**
5:15 PM	8	120	13	23	13	109	27	9	18	70	12	8	14	111	13	16	**528**
5:30 PM	9	117	9	9	11	104	24	7	20	75	15	5	18	111	16	7	**529**
Total:	**41**	**479**	**56**	**55**	**48**	**418**	**94**	**31**	**79**	**303**	**62**	**22**	**53**	**437**	**47**	**41**	**2117**
PHF:	**0.79**	**0.92**	**0.70**		**0.92**	**0.96**	**0.87**		**0.86**	**0.91**	**0.78**		**0.74**	**0.96**	**0.73**		**1.00**
Truck%:	**4.88%**	**1.46%**	**1.79%**		**0.00%**	**1.91%**	**1.06%**		**0.00%**	**0.66%**	**0.00%**		**0.00%**	**0.69%**	**0.00%**		**1.13%**

APPENDIX C

SYNCHRO Analysis

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	61	436	23	32	341	49	37	472	34	62	528	96
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	0		0	0		50
Storage Lanes	0		0	0		0	0		0	0		1
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	1635	0	0	1621	0	0	1636	0	0	1652	1270
Flt Permitted		0.757			0.845			0.927			0.900	
Satd. Flow (perm)	0	1245	0	0	1374	0	0	1521	0	0	1492	1233
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		2			7			5				61
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		676			452			375			583	
Travel Time (s)		15.4			10.3			8.5			13.3	
Confl. Peds. (#/hr)	6		24	24		6	8		32	32		8
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Parking (#/hr)									0			0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	553	0	0	449	0	0	577	0	0	628	102
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases		6			2			4			8	
Permitted Phases	6			2			4			8		8
Detector Phase	6	6		2	2		4	4		8	8	8
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	20.0	20.0		20.0	20.0		20.0	20.0		20.0	20.0	20.0
Total Split (s)	25.0	25.0		25.0	25.0		45.0	45.0		45.0	45.0	45.0
Total Split (%)	27.8%	27.8%		27.8%	27.8%		50.0%	50.0%		50.0%	50.0%	50.0%
Yellow Time (s)	3.0	3.0		3.0	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		2.0	2.0	2.0
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	0.0
Total Lost Time (s)		5.0			5.0			5.0			5.0	5.0
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		Min	Min		Min	Min	Min
Act Effct Green (s)		20.2			20.2			40.4			40.4	40.4
Actuated g/C Ratio		0.27			0.27			0.55			0.55	0.55
v/c Ratio		1.62			1.18			0.69			0.77	0.15
Control Delay		315.5			133.2			19.7			23.3	5.8
Queue Delay		0.0			0.0			0.0			0.0	0.0
Total Delay		315.5			133.2			19.7			23.3	5.8
LOS		F			F			B			C	A
Approach Delay		315.5			133.2			19.7			20.8	
Approach LOS		F			F			B			C	
Stops (vph)		392			324			360			401	24
Fuel Used(gal)		38			15			6			8	1
CO Emissions (g/hr)		2677			1029			401			538	48
NOx Emissions (g/hr)		521			200			78			105	9

Lane Group	ø9
Lane Configurations	
Volume (vph)	
Ideal Flow (vphpl)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Parking (#/hr)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	20.0
Total Split (s)	20.0
Total Split (%)	22%
Yellow Time (s)	2.0
All-Red Time (s)	1.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	None
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Stops (vph)	
Fuel Used(gal)	
CO Emissions (g/hr)	
NOx Emissions (g/hr)	

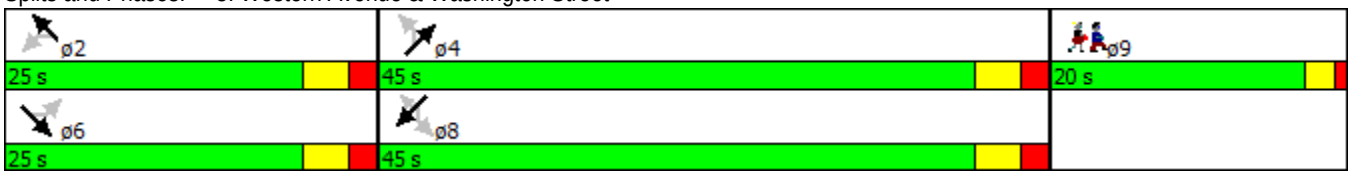
Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
VOC Emissions (g/hr)		621			238			93			125	11
Dilemma Vehicles (#)		0			0			0			0	0
Queue Length 50th (ft)		~348			~229			153			181	7
Queue Length 95th (ft)		#694			#533			#475			#550	42
Internal Link Dist (ft)		596			372			295			503	
Turn Bay Length (ft)												50
Base Capacity (vph)		342			380			834			816	701
Starvation Cap Reductn		0			0			0			0	0
Spillback Cap Reductn		0			0			0			0	0
Storage Cap Reductn		0			0			0			0	0
Reduced v/c Ratio		1.62			1.18			0.69			0.77	0.15

Intersection Summary			
Area Type:	CBD		
Cycle Length: 90			
Actuated Cycle Length: 73.8			
Natural Cycle: 140			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 1.62			
Intersection Signal Delay: 112.9		Intersection LOS: F	
Intersection Capacity Utilization 118.7%		ICU Level of Service H	
Analysis Period (min) 15			

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

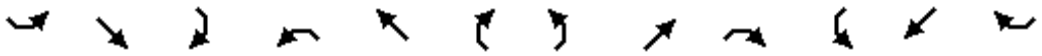
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Western Avenue & Washington Street



Lane Group	ø9
VOC Emissions (g/hr)	
Dilemma Vehicles (#)	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary



Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	79	303	62	53	437	47	41	479	56	48	418	94
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	0		0	0		50
Storage Lanes	0		0	0		0	0		0	0		1
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	1613	0	0	1652	0	0	1654	0	0	1685	1295
Flt Permitted		0.698			0.892			0.945			0.911	
Satd. Flow (perm)	0	1133	0	0	1475	0	0	1568	0	0	1540	1238
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8			5			8				61
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		676			452			375			583	
Travel Time (s)		15.4			10.3			8.5			13.3	
Confl. Peds. (#/hr)	31		55	55		31	22		41	41		22
Peak Hour 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
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Parking (#/hr)									0			0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	444	0	0	537	0	0	576	0	0	466	94
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases		6			2			4			8	
Permitted Phases	6			2			4			8		8
Detector Phase	6	6		2	2		4	4		8	8	8
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	20.0	20.0		20.0	20.0		20.0	20.0		20.0	20.0	20.0
Total Split (s)	25.0	25.0		25.0	25.0		45.0	45.0		45.0	45.0	45.0
Total Split (%)	27.8%	27.8%		27.8%	27.8%		50.0%	50.0%		50.0%	50.0%	50.0%
Yellow Time (s)	3.0	3.0		3.0	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		2.0	2.0	2.0
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	0.0
Total Lost Time (s)		5.0			5.0			5.0			5.0	5.0
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		Min	Min		Min	Min	Min
Act Effct Green (s)		21.4			21.4			29.4			29.4	29.4
Actuated g/C Ratio		0.32			0.32			0.44			0.44	0.44
v/c Ratio		1.22			1.14			0.83			0.69	0.16
Control Delay		147.1			112.9			30.1			22.6	7.0
Queue Delay		0.0			0.0			0.0			0.0	0.0
Total Delay		147.1			112.9			30.1			22.6	7.0
LOS		F			F			C			C	A
Approach Delay		147.1			112.9			30.1			20.0	
Approach LOS		F			F			C			C	
Stops (vph)		288			357			445			345	23
Fuel Used(gal)		17			16			8			6	1
CO Emissions (g/hr)		1204			1133			536			431	48
NOx Emissions (g/hr)		234			220			104			84	9

Lane Group	ø9
Lane Configurations	
Volume (vph)	
Ideal Flow (vphpl)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Parking (#/hr)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	20.0
Total Split (s)	20.0
Total Split (%)	22%
Yellow Time (s)	2.0
All-Red Time (s)	1.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	None
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Stops (vph)	
Fuel Used(gal)	
CO Emissions (g/hr)	
NOx Emissions (g/hr)	

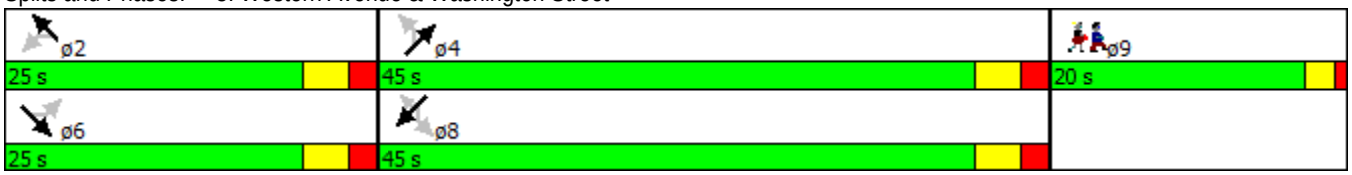
Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
VOC Emissions (g/hr)		279			263			124			100	11
Dilemma Vehicles (#)		0			0			0			0	0
Queue Length 50th (ft)		~182			~207			149			112	6
Queue Length 95th (ft)		#558			#638			#458			313	38
Internal Link Dist (ft)		596			372			295			503	
Turn Bay Length (ft)												50
Base Capacity (vph)		365			472			1000			980	809
Starvation Cap Reductn		0			0			0			0	0
Spillback Cap Reductn		0			0			0			0	0
Storage Cap Reductn		0			0			0			0	0
Reduced v/c Ratio		1.22			1.14			0.58			0.48	0.12

Intersection Summary			
Area Type:	CBD		
Cycle Length: 90			
Actuated Cycle Length: 67.3			
Natural Cycle: 140			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 1.22			
Intersection Signal Delay: 73.0		Intersection LOS: E	
Intersection Capacity Utilization 119.0%		ICU Level of Service H	
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: Western Avenue & Washington Street



Lane Group	ø9
VOC Emissions (g/hr)	
Dilemma Vehicles (#)	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	61	436	23	32	341	49	37	472	34	62	528	96
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	0		0	0		0	0		50
Storage Lanes	0		0	0		0	0		0	0		1
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	1636	0	0	1621	0	0	1636	0	0	1652	1270
Flt Permitted		0.860			0.925			0.723			0.870	
Satd. Flow (perm)	0	1415	0	0	1504	0	0	1186	0	0	1442	1232
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		676			452			375			583	
Travel Time (s)		15.4			10.3			8.5			13.3	
Confl. Peds. (#/hr)	6		24	24		6	8		32	32		8
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Parking (#/hr)									0			0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	553	0	0	449	0	0	577	0	0	628	102
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases	1	6			2			4			8	
Permitted Phases	6			2			4			8		8
Detector Phase	1	6		2	2		4	4		8	8	8
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	8.0	20.0		20.0	20.0		20.0	20.0		20.0	20.0	20.0
Total Split (s)	8.0	46.0		38.0	38.0		54.0	54.0		54.0	54.0	54.0
Total Split (%)	6.7%	38.3%		31.7%	31.7%		45.0%	45.0%		45.0%	45.0%	45.0%
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
All-Red Time (s)	0.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	0.0
Total Lost Time (s)		5.0			5.0			5.0			5.0	5.0
Lead/Lag	Lead			Lag	Lag							
Lead-Lag Optimize?	Yes			Yes	Yes							
Recall Mode	None	None		None	None		Min	Min		Min	Min	Min
Act Effct Green (s)		41.2			41.2			49.2			49.2	49.2
Actuated g/C Ratio		0.40			0.40			0.47			0.47	0.47
v/c Ratio		0.99			0.75			1.03			0.92	0.17
Control Delay		67.2			37.6			73.7			46.9	18.2
Queue Delay		0.0			0.0			0.0			0.0	0.0
Total Delay		67.2			37.6			73.7			46.9	18.2
LOS		E			D			E			D	B
Approach Delay		67.2			37.6			73.7			42.9	
Approach LOS		E			D			E			D	
Stops (vph)		425			337			434			474	54
Fuel Used(gal)		12			7			12			11	1
CO Emissions (g/hr)		853			460			847			764	76
NOx Emissions (g/hr)		166			89			165			149	15

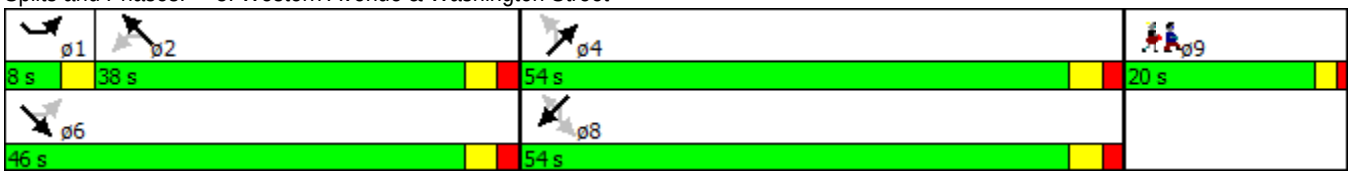
Lane Group	ø9
Lane Configurations	
Volume (vph)	
Ideal Flow (vphpl)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Parking (#/hr)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	20.0
Total Split (s)	20.0
Total Split (%)	17%
Yellow Time (s)	2.0
All-Red Time (s)	1.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	None
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Stops (vph)	
Fuel Used(gal)	
CO Emissions (g/hr)	
NOx Emissions (g/hr)	

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
VOC Emissions (g/hr)		198			107			196			177	18
Dilemma Vehicles (#)		0			0			0			0	0
Queue Length 50th (ft)		334			236			352			348	35
Queue Length 95th (ft)		#712			#508			#752			#756	90
Internal Link Dist (ft)		596			372			295			503	
Turn Bay Length (ft)												50
Base Capacity (vph)		561			596			562			683	584
Starvation Cap Reductn		0			0			0			0	0
Spillback Cap Reductn		0			0			0			0	0
Storage Cap Reductn		0			0			0			0	0
Reduced v/c Ratio		0.99			0.75			1.03			0.92	0.17

Intersection Summary			
Area Type:	CBD		
Cycle Length: 120			
Actuated Cycle Length: 103.8			
Natural Cycle: 140			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 1.03			
Intersection Signal Delay: 55.4		Intersection LOS: E	
Intersection Capacity Utilization 118.7%		ICU Level of Service H	
Analysis Period (min) 15			

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

Splits and Phases: 3: Western Avenue & Washington Street



Lane Group	ø9
VOC Emissions (g/hr)	
Dilemma Vehicles (#)	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	79	303	62	53	437	47	41	479	56	48	418	94
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	0		0	0		50
Storage Lanes	0		0	0		0	0		0	0		1
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	1624	0	0	1654	0	0	1653	0	0	1685	1295
Flt Permitted		0.728			0.901			0.834			0.875	
Satd. Flow (perm)	0	1190	0	0	1491	0	0	1383	0	0	1479	1234
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8			4			5				73
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		676			452			375			583	
Travel Time (s)		15.4			10.3			8.5			13.3	
Confl. Peds. (#/hr)	31		55	55		31	22		41	41		22
Peak Hour 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
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Parking (#/hr)									0			0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	444	0	0	537	0	0	576	0	0	466	94
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases	1	6			2			4			8	
Permitted Phases	6			2			4			8		8
Detector Phase	1	6		2	2		4	4		8	8	8
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	8.0	20.0		20.0	20.0		20.0	20.0		20.0	20.0	20.0
Total Split (s)	8.0	48.0		40.0	40.0		52.0	52.0		52.0	52.0	52.0
Total Split (%)	6.7%	40.0%		33.3%	33.3%		43.3%	43.3%		43.3%	43.3%	43.3%
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
All-Red Time (s)	0.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	0.0
Total Lost Time (s)		5.0			5.0			5.0			5.0	5.0
Lead/Lag	Lead			Lag	Lag							
Lead-Lag Optimize?	Yes			Yes	Yes							
Recall Mode	None	None		None	None		Min	Min		Min	Min	Min
Act Effct Green (s)		43.3			43.3			47.3			47.3	47.3
Actuated g/C Ratio		0.39			0.39			0.42			0.42	0.42
v/c Ratio		0.95			0.92			0.98			0.74	0.17
Control Delay		66.0			57.3			65.3			37.4	8.6
Queue Delay		0.0			0.0			0.0			0.0	0.0
Total Delay		66.0			57.3			65.3			37.4	8.6
LOS		E			E			E			D	A
Approach Delay		66.0			57.3			65.3			32.6	
Approach LOS		E			E			E			C	
Stops (vph)		353			438			454			380	21
Fuel Used(gal)		10			11			12			8	1
CO Emissions (g/hr)		717			739			828			543	50
NOx Emissions (g/hr)		139			144			161			106	10

Lane Group	ø9
Lane Configurations	
Volume (vph)	
Ideal Flow (vphpl)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Parking (#/hr)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	20.0
Total Split (s)	20.0
Total Split (%)	17%
Yellow Time (s)	2.0
All-Red Time (s)	1.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	None
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Stops (vph)	
Fuel Used(gal)	
CO Emissions (g/hr)	
NOx Emissions (g/hr)	

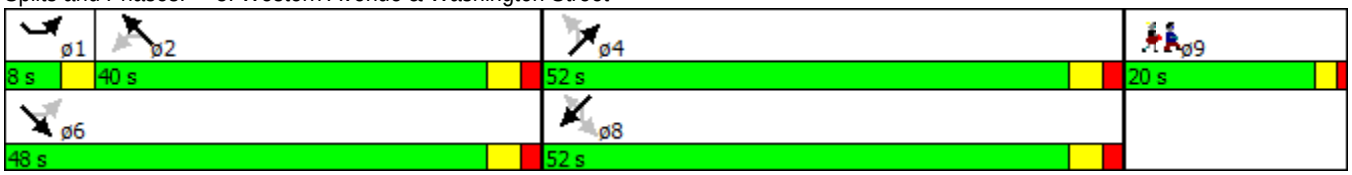
Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
VOC Emissions (g/hr)		166			171			192			126	11
Dilemma Vehicles (#)		0			0			0			0	0
Queue Length 50th (ft)		~358			405			~480			312	10
Queue Length 95th (ft)		#566			#643			#704			#484	45
Internal Link Dist (ft)		596			372			295			503	
Turn Bay Length (ft)												50
Base Capacity (vph)		467			582			590			628	566
Starvation Cap Reductn		0			0			0			0	0
Spillback Cap Reductn		0			0			0			0	0
Storage Cap Reductn		0			0			0			0	0
Reduced v/c Ratio		0.95			0.92			0.98			0.74	0.17

Intersection Summary			
Area Type:	CBD		
Cycle Length: 120			
Actuated Cycle Length: 111.4			
Natural Cycle: 150			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.98			
Intersection Signal Delay: 54.7		Intersection LOS: D	
Intersection Capacity Utilization 119.0%		ICU Level of Service H	
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: Western Avenue & Washington Street



Lane Group	ø9
VOC Emissions (g/hr)	
Dilemma Vehicles (#)	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	61	436	23	32	341	49	37	472	34	62	528	96
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	0		0	0		0	0		50
Storage Lanes	1		0	0		0	0		0	0		1
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1577	1644	0	0	1621	0	0	1636	0	0	1652	1270
Flt Permitted	0.293				0.840			0.735			0.873	
Satd. Flow (perm)	485	1644	0	0	1366	0	0	1206	0	0	1447	1232
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		676			452			375			583	
Travel Time (s)		15.4			10.3			8.5			13.3	
Confl. Peds. (#/hr)	6		24	24		6	8		32	32		8
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Parking (#/hr)									0			0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	65	488	0	0	449	0	0	577	0	0	628	102
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases	1	6			2			4			8	
Permitted Phases	6			2			4			8		8
Detector Phase	1	6		2	2		4	4		8	8	8
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	7.0	20.0		20.0	20.0		20.0	20.0		20.0	20.0	20.0
Total Split (s)	7.0	46.0		39.0	39.0		54.0	54.0		54.0	54.0	54.0
Total Split (%)	5.8%	38.3%		32.5%	32.5%		45.0%	45.0%		45.0%	45.0%	45.0%
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
All-Red Time (s)	0.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0			0.0			0.0			0.0	0.0
Total Lost Time (s)	3.0	5.0			5.0			5.0			5.0	5.0
Lead/Lag	Lead			Lag	Lag							
Lead-Lag Optimize?	Yes			Yes	Yes							
Recall Mode	None	None		None	None		Min	Min		Min	Min	Min
Act Effct Green (s)	41.7	39.7			34.2			49.3			49.3	49.3
Actuated g/C Ratio	0.41	0.39			0.33			0.48			0.48	0.48
v/c Ratio	0.27	0.76			0.98			0.99			0.90	0.17
Control Delay	23.7	37.6			74.4			64.9			43.9	18.1
Queue Delay	0.0	0.0			0.0			0.0			0.0	0.0
Total Delay	23.7	37.6			74.4			64.9			43.9	18.1
LOS	C	D			E			E			D	B
Approach Delay		36.0			74.4			64.9			40.3	
Approach LOS		D			E			E			D	
Stops (vph)	35	370			344			426			468	54
Fuel Used(gal)	1	8			10			11			11	1
CO Emissions (g/hr)	57	558			684			776			737	76
NOx Emissions (g/hr)	11	109			133			151			143	15

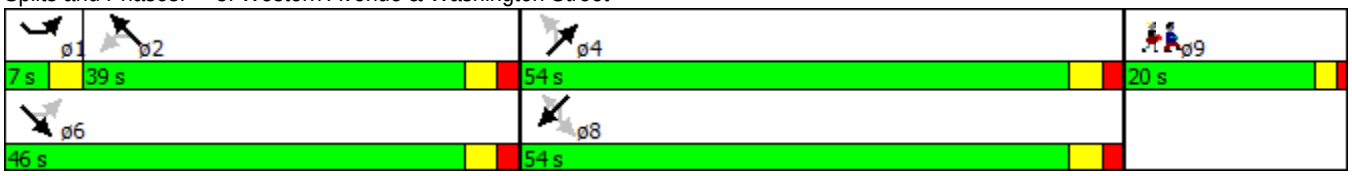
Lane Group	ø9
Lane Configurations	
Volume (vph)	
Ideal Flow (vphpl)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Parking (#/hr)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	20.0
Total Split (s)	20.0
Total Split (%)	17%
Yellow Time (s)	2.0
All-Red Time (s)	1.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	None
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Stops (vph)	
Fuel Used(gal)	
CO Emissions (g/hr)	
NOx Emissions (g/hr)	

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
VOC Emissions (g/hr)	13	129			158			180			171	18
Dilemma Vehicles (#)	0	0			0			0			0	0
Queue Length 50th (ft)	24	256			279			346			347	35
Queue Length 95th (ft)	65	#537			#610			#746			#754	90
Internal Link Dist (ft)		596			372			295			503	
Turn Bay Length (ft)	100											50
Base Capacity (vph)	240	662			456			580			697	593
Starvation Cap Reductn	0	0			0			0			0	0
Spillback Cap Reductn	0	0			0			0			0	0
Storage Cap Reductn	0	0			0			0			0	0
Reduced v/c Ratio	0.27	0.74			0.98			0.99			0.90	0.17

Intersection Summary			
Area Type:	CBD		
Cycle Length: 120			
Actuated Cycle Length: 102.4			
Natural Cycle: 140			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.99			
Intersection Signal Delay: 52.0		Intersection LOS: D	
Intersection Capacity Utilization 125.7%		ICU Level of Service H	
Analysis Period (min) 15			

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

Splits and Phases: 3: Western Avenue & Washington Street



Lane Group	ø9
VOC Emissions (g/hr)	
Dilemma Vehicles (#)	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	79	303	62	53	437	47	41	479	56	48	418	94
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	0		0	0		50
Storage Lanes	1		0	0		0	0		0	0		1
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1608	1625	0	0	1654	0	0	1653	0	0	1685	1295
Flt Permitted	0.265				0.919			0.825			0.871	
Satd. Flow (perm)	443	1625	0	0	1521	0	0	1368	0	0	1472	1233
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		10			4			5				73
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		676			452			375			583	
Travel Time (s)		15.4			10.3			8.5			13.3	
Confl. Peds. (#/hr)	31		55	55		31	22		41	41		22
Peak Hour 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
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Parking (#/hr)									0			0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	79	365	0	0	537	0	0	576	0	0	466	94
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases	1	6			2			4			8	
Permitted Phases	6			2			4			8		8
Detector Phase	1	6		2	2		4	4		8	8	8
Switch Phase												
Minimum Initial (s)	3.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	6.0	20.0		20.0	20.0		20.0	20.0		20.0	20.0	20.0
Total Split (s)	6.0	49.0		43.0	43.0		51.0	51.0		51.0	51.0	51.0
Total Split (%)	5.0%	40.8%		35.8%	35.8%		42.5%	42.5%		42.5%	42.5%	42.5%
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
All-Red Time (s)	0.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0			0.0			0.0			0.0	0.0
Total Lost Time (s)	3.0	5.0			5.0			5.0			5.0	5.0
Lead/Lag	Lead			Lag	Lag							
Lead-Lag Optimize?	Yes			Yes	Yes							
Recall Mode	None	None		None	None		Min	Min		Min	Min	Min
Act Effct Green (s)	45.1	43.1			38.4			46.5			46.5	46.5
Actuated g/C Ratio	0.41	0.39			0.35			0.42			0.42	0.42
v/c Ratio	0.37	0.57			1.01			0.99			0.75	0.17
Control Delay	29.0	31.3			79.2			70.3			38.4	8.9
Queue Delay	0.0	0.0			0.0			0.0			0.0	0.0
Total Delay	29.0	31.3			79.2			70.3			38.4	8.9
LOS	C	C			E			E			D	A
Approach Delay		30.9			79.2			70.3			33.5	
Approach LOS		C			E			E			C	
Stops (vph)	47	274			420			443			379	21
Fuel Used(gal)	1	6			13			12			8	1
CO Emissions (g/hr)	80	403			899			865			549	50
NOx Emissions (g/hr)	16	78			175			168			107	10

Lane Group	ø9
Lane Configurations	
Volume (vph)	
Ideal Flow (vphpl)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Parking (#/hr)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	20.0
Total Split (s)	20.0
Total Split (%)	17%
Yellow Time (s)	2.0
All-Red Time (s)	1.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	None
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Stops (vph)	
Fuel Used(gal)	
CO Emissions (g/hr)	
NOx Emissions (g/hr)	

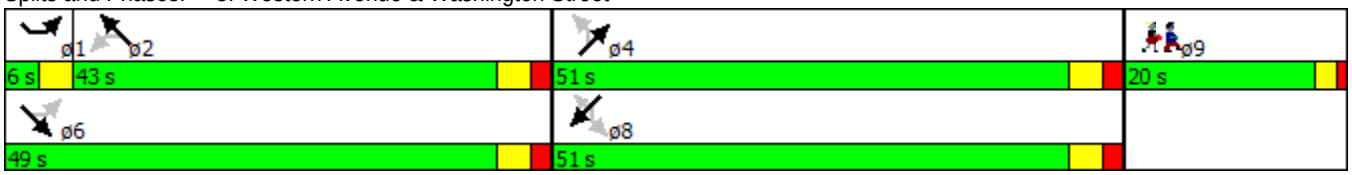
Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
VOC Emissions (g/hr)	18	93			208			201			127	12
Dilemma Vehicles (#)	0	0			0			0			0	0
Queue Length 50th (ft)	39	219			~467			~494			317	10
Queue Length 95th (ft)	73	323			#686			#718			#496	46
Internal Link Dist (ft)		596			372			295			503	
Turn Bay Length (ft)												50
Base Capacity (vph)	213	661			532			579			621	562
Starvation Cap Reductn	0	0			0			0			0	0
Spillback Cap Reductn	0	0			0			0			0	0
Storage Cap Reductn	0	0			0			0			0	0
Reduced v/c Ratio	0.37	0.55			1.01			0.99			0.75	0.17

Intersection Summary			
Area Type:	CBD		
Cycle Length: 120			
Actuated Cycle Length: 110.2			
Natural Cycle: 150			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 1.01			
Intersection Signal Delay: 54.5		Intersection LOS: D	
Intersection Capacity Utilization 133.5%		ICU Level of Service H	
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: Western Avenue & Washington Street



Lane Group	ø9
VOC Emissions (g/hr)	
Dilemma Vehicles (#)	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary