

APPENDIX A

Public Participation

**Safety and Operations Analyses of Selected Intersection—FFY 2014
Washington Street (Route 53) and Broad Street Intersection**

Weymouth Town Hall
75 Middle Street

Name	Affiliation	Email
Seth Asante	Boston Region MPO (CTPS)	sasante@ctps.org
Nick Bulens	Weymouth Planning	nbulens@weymouth.ma.us
Owen MacDonald	" "	omacdonald@weymouth.ma.us
Greg Hayford	Weymouth PD	ghayford@weymouth.ma.us
JIM CLARKE	PLANNING	JCLARKE@WEYMOUTH.MA.US
CHIP FONTAINE	TOWN ENGINEER	CFONTAINE " " " "
Keith Stark	Fire Chief	KSTARK@WEYMOUTH.MA.US

Seth Asante

Subject: Washington Street (Route 53)/ Broad Street: Proposed Intersection Improvements
Location: Town Hall, 75 Middle St.; Room TBA

Start: Tue 12/2/2014 11:00 AM
End: Tue 12/2/2014 12:00 PM

Recurrence: (none)

Meeting Status: Accepted

Organizer: omacdonald@weymouth.ma.us

When: Tuesday, December 02, 2014 11:00 AM-12:00 PM (GMT-05:00) Eastern Time (US & Canada).

Where: Town Hall, 75 Middle St.; Room TBA

Note: The GMT offset above does not reflect daylight saving time adjustments.

~~*~*~*~*~*~*~*~*

Meeting postponed due to schedule conflicts. Please respond to new date.

The Central Transportation Planning Staff (CTPS) has prepared a study of the subject intersection. Seth Asante, CTPS Project Manager, will present the findings.

Please respond.

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Town of Weymouth, 75 Middle Street, Weymouth, MA, 02189
www.weymouth.ma.us

Seth Asante

From: OMacDonald@weymouth.ma.us
Sent: Thursday, December 04, 2014 3:17 PM
To: Seth Asante
Cc: JClarke@weymouth.ma.us; GHayford@weymouth.ma.us; cfontaine@weymouth.ma.us; KStark@weymouth.ma.us; NBulens@weymouth.ma.us
Subject: Weymouth: Rte. 53 (Washington St.)/ Broad St. Proposed Intersection Improvements

Seth,

Thank you again for the presentation.

Comments as I remember them (**other recipients – please add as needed**):

- **Planning Director:** Surprised at the difference between AM Peak Hour southbound through volume and PM Peak Hour Northbound through volume.
- **Police:** Would exclusive protected left turn for Washington Street southbound be superior to Protected – Permissive?
- **Fire:** Concerned that tightening the curb radius on the southeast corner (adjacent to Union Towers) would impede fire apparatus turning.
- **Engineering:** Parking would need to be prohibited on Washington Street northbound for a short distance north of the intersection to allow traffic on the 2-lane northbound intersection approach to merge.
- **Traffic Engineer:**
 - Please check the westbound 2 lane Broad St. approach as through – left and through – right (Base case is through – left and exclusive right).
 - Please send a copy of SYNCHRO outputs.

Owen

Town of Weymouth, Department of Planning and Community Development

Owen J. MacDonald, P.E., PTOE

Traffic Engineer

75 Middle Street

East Weymouth, MA 02189-1359

781-340-5015

OMacDonald@weymouth.ma.us

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Town of Weymouth, 75 Middle Street, Weymouth, MA, 02189

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Seth Asante

From: OMacDonald@weymouth.ma.us
Sent: Wednesday, January 14, 2015 10:34 AM
To: Seth Asante
Cc: JClarke@weymouth.ma.us; GHayford@weymouth.ma.us; cfontaine@weymouth.ma.us; KStark@weymouth.ma.us; NBulens@weymouth.ma.us
Subject: RE: Washington Street and Broad Street Intersection Study

Seth,

Traffic Engineer Comments:

- Concur that intersection reconstruction, substantially as proposed, is the optimum means to address the existing deficiencies, and that higher visibility crosswalk markings and curb ramps rebuilt to standards, and possibly an advance warning sign facing northbound traffic, would be good short term solutions. We are concerned, however, that adding any wind load to old, Type I aluminum mast arms would not be feasible.
- Synchro:
 - Would prefer to see the more complete output, including the lane and phasing data, as well as the volume and timing data.
 - If alternatives have been analyzed (i.e.: protected vs. protected – permissive southbound left), would like to see all alternatives shown.

Other Town recipients – please add as appropriate.

Thank you.

Owen
Town of Weymouth, Department of Planning and Community Development

Owen J. MacDonald, P.E., PTOE
Traffic Engineer
75 Middle Street
East Weymouth, MA 02189-1359
781-340-5015
OMacDonald@weymouth.ma.us

APPENDIX 6

Turning-Movement Count Data

Washington Street and Broad Street
Turning Movement Counts
05/20/14 AM and PM

File Name : Washington_Broad AM+PM
Site Code : 05201411
Start Date : 5/20/2014
Page No : 1

Groups Printed- Autos - Trucks - Bicycles

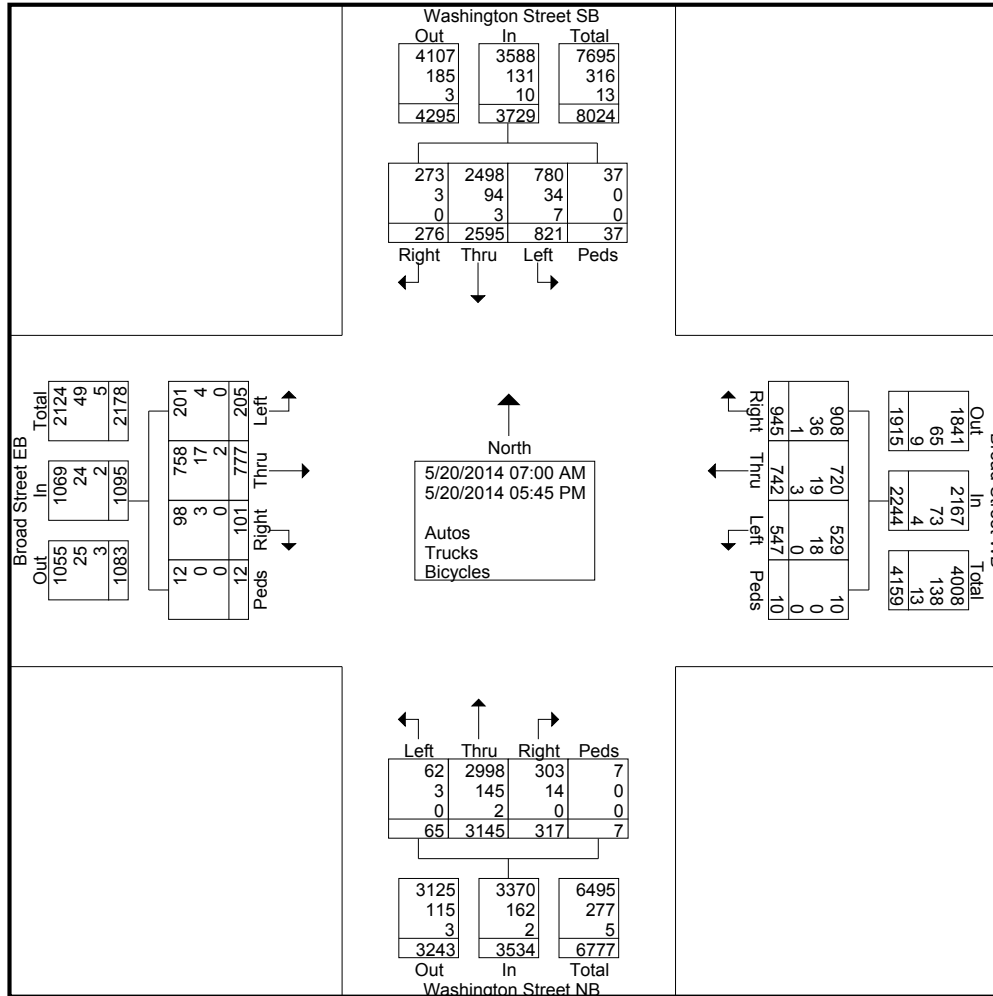
Start Time	Washington Street SB From North					Broad Street WB From East					Washington Street NB From South					Broad Street EB From West					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
07:00 AM	9	84	28	1	122	71	40	28	0	139	5	155	1	1	162	2	12	4	0	18	441
07:15 AM	21	54	23	0	98	58	46	23	0	127	7	193	4	0	204	11	32	15	0	58	487
07:30 AM	13	71	25	3	112	61	65	24	1	151	10	167	1	0	178	1	44	8	0	53	494
07:45 AM	6	76	33	1	116	67	42	27	1	137	9	164	3	0	176	0	31	9	0	40	469
Total	49	285	109	5	448	257	193	102	2	554	31	679	9	1	720	14	119	36	0	169	1891
08:00 AM	14	79	32	0	125	52	52	19	1	124	11	166	0	0	177	4	22	11	2	39	465
08:15 AM	9	90	21	1	121	54	31	22	1	108	9	164	0	0	173	1	14	12	1	28	430
08:30 AM	16	94	31	0	141	57	33	32	0	122	11	161	1	0	173	3	28	19	0	50	486
08:45 AM	11	96	30	2	139	48	36	23	0	107	13	158	4	1	176	4	34	12	1	51	473
Total	50	359	114	3	526	211	152	96	2	461	44	649	5	1	699	12	98	54	4	168	1854

*** BREAK ***

03:00 PM	18	129	52	0	199	26	34	29	0	89	28	120	6	0	154	9	31	9	1	50	492
03:15 PM	14	154	37	3	208	49	29	29	0	107	26	118	6	1	151	5	45	12	0	62	528
03:30 PM	14	135	40	1	190	46	31	33	1	111	29	109	2	0	140	4	41	10	0	55	496
03:45 PM	16	161	51	2	230	46	39	39	1	125	25	117	4	0	146	5	45	9	0	59	560
Total	62	579	180	6	827	167	133	130	2	432	108	464	18	1	591	23	162	40	1	226	2076
04:00 PM	9	162	58	1	230	37	37	30	0	104	16	171	2	0	189	6	56	9	1	72	595
04:15 PM	13	152	44	3	212	47	30	25	1	103	13	172	6	0	191	2	34	5	0	41	547
04:30 PM	18	153	47	7	225	32	29	28	0	89	12	149	4	0	165	8	46	10	2	66	545
04:45 PM	15	182	44	3	244	38	39	26	0	103	17	185	1	1	204	6	51	13	1	71	622
Total	55	649	193	14	911	154	135	109	1	399	58	677	13	1	749	22	187	37	4	250	2309
05:00 PM	13	183	55	1	252	37	36	33	1	107	19	176	3	1	199	7	61	14	0	82	640
05:15 PM	15	175	60	4	254	46	26	34	1	107	19	166	4	1	190	10	57	7	1	75	626
05:30 PM	19	182	53	2	256	36	37	23	0	96	19	173	2	1	195	6	51	8	1	66	613
05:45 PM	13	183	57	2	255	37	30	20	1	88	19	161	11	0	191	7	42	9	1	59	593
Total	60	723	225	9	1017	156	129	110	3	398	76	676	20	3	775	30	211	38	3	282	2472
Grand Total	276	2595	821	37	3729	945	742	547	10	2244	317	3145	65	7	3534	101	777	205	12	1095	10602
Aprch %	7.4	69.6	22	1		42.1	33.1	24.4	0.4		9	89	1.8	0.2		9.2	71	18.7	1.1		
Total %	2.6	24.5	7.7	0.3	35.2	8.9	7	5.2	0.1	21.2	3	29.7	0.6	0.1	33.3	1	7.3	1.9	0.1	10.3	
Autos	273	2498	780	37	3588	908	720	529	10	2167	303	2998	62	7	3370	98	758	201	12	1069	10194
% Autos	98.9	96.3	95	100	96.2	96.1	97	96.7	100	96.6	95.6	95.3	95.4	100	95.4	97	97.6	98	100	97.6	96.2
Trucks	3	94	34	0	131	36	19	18	0	73	14	145	3	0	162	3	17	4	0	24	390
% Trucks	1.1	3.6	4.1	0	3.5	3.8	2.6	3.3	0	3.3	4.4	4.6	4.6	0	4.6	3	2.2	2	0	2.2	3.7
Bicycles	0	3	7	0	10	1	3	0	0	4	0	2	0	0	2	0	2	0	0	2	18
% Bicycles	0	0.1	0.9	0	0.3	0.1	0.4	0	0	0.2	0	0.1	0	0	0.1	0	0.3	0	0	0.2	0.2

Washington Street and Broad Street
 Turning Movement Counts
 05/20/14 AM and PM

File Name : Washington_Broad AM+PM
 Site Code : 05201411
 Start Date : 5/20/2014
 Page No : 2



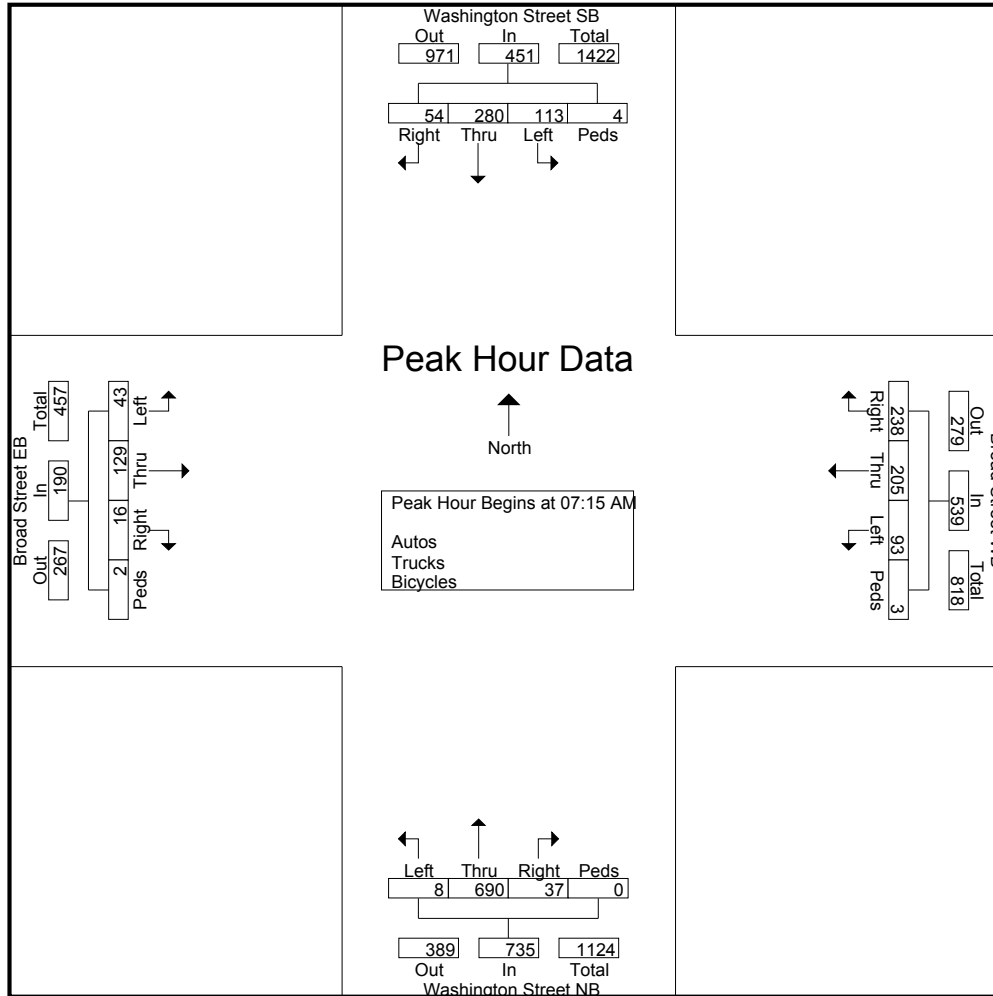
Washington Street and Broad Street
 Turning Movement Counts
 05/20/14 AM and PM

File Name : Washington_Broad AM+PM
 Site Code : 05201411
 Start Date : 5/20/2014
 Page No : 4

Start Time	Washington Street SB From North					Broad Street WB From East					Washington Street NB From South					Broad Street EB From West					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15 AM																					
07:15 AM	21	54	23	0	98	58	46	23	0	127	7	193	4	0	204	11	32	15	0	58	487
07:30 AM	13	71	25	3	112	61	65	24	1	151	10	167	1	0	178	1	44	8	0	53	494
07:45 AM	6	76	33	1	116	67	42	27	1	137	9	164	3	0	176	0	31	9	0	40	469
08:00 AM	14	79	32	0	125	52	52	19	1	124	11	166	0	0	177	4	22	11	2	39	465
Total Volume	54	280	113	4	451	238	205	93	3	539	37	690	8	0	735	16	129	43	2	190	1915
% App. Total	12	62.1	25.1	0.9		44.2	38	17.3	0.6		5	93.9	1.1	0		8.4	67.9	22.6	1.1		
PHF	.643	.886	.856	.333	.902	.888	.788	.861	.750	.892	.841	.894	.500	.000	.901	.364	.733	.717	.250	.819	.969

Washington Street and Broad Street
 Turning Movement Counts
 05/20/14 AM and PM

File Name : Washington_Broad AM+PM
 Site Code : 05201411
 Start Date : 5/20/2014
 Page No : 5



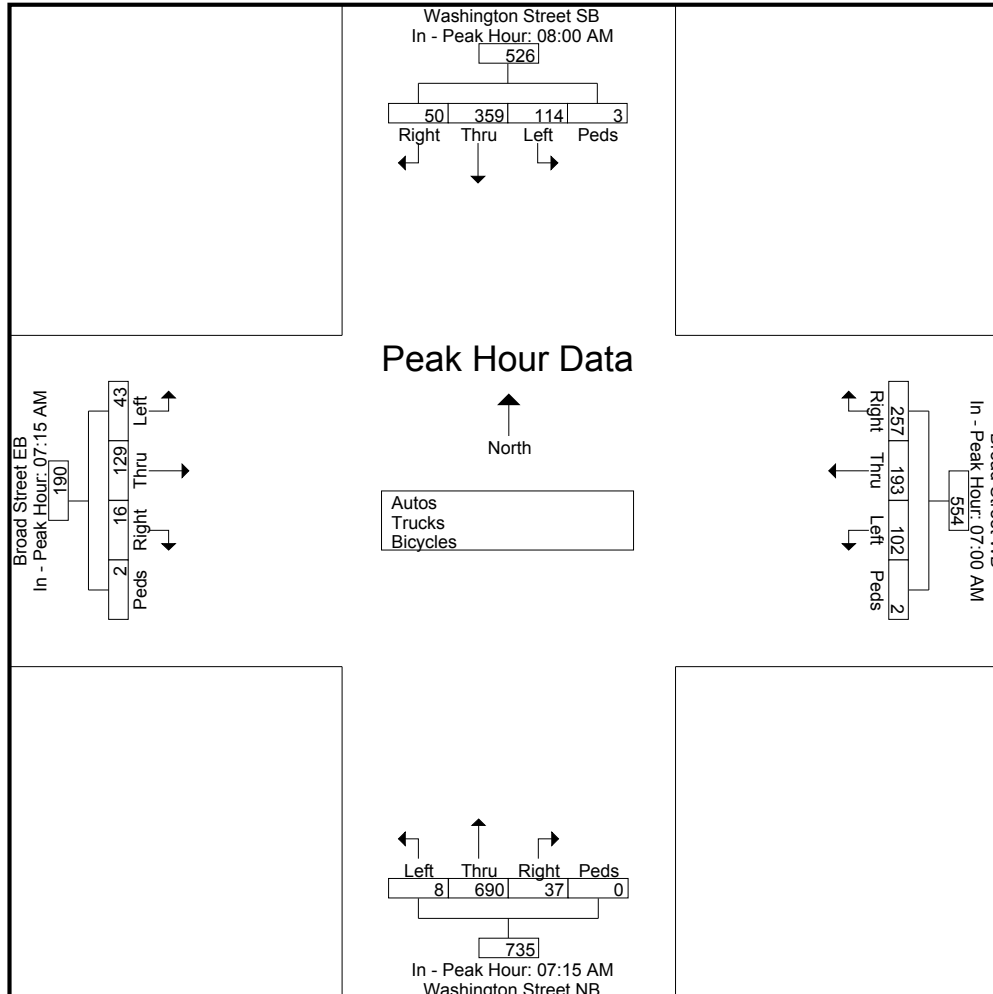
Washington Street and Broad Street
 Turning Movement Counts
 05/20/14 AM and PM

File Name : Washington_Broad AM+PM
 Site Code : 05201411
 Start Date : 5/20/2014
 Page No : 7

Start Time	Washington Street SB From North					Broad Street WB From East					Washington Street NB From South					Broad Street EB From West					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																					
Peak Hour for Each Approach Begins at:																					
	08:00 AM					07:00 AM					07:15 AM					07:15 AM					
+0 mins.	14	79	32	0	125	71	40	28	0	139	7	193	4	0	204	11	32	15	0	58	
+15 mins.	9	90	21	1	121	58	46	23	0	127	10	167	1	0	178	1	44	8	0	53	
+30 mins.	16	94	31	0	141	61	65	24	1	151	9	164	3	0	176	0	31	9	0	40	
+45 mins.	11	96	30	2	139	67	42	27	1	137	11	166	0	0	177	4	22	11	2	39	
Total Volume	50	359	114	3	526	257	193	102	2	554	37	690	8	0	735	16	129	43	2	190	
% App. Total	9.5	68.3	21.7	0.6		46.4	34.8	18.4	0.4		5	93.9	1.1	0		8.4	67.9	22.6	1.1		
PHF	.781	.935	.891	.375	.933	.905	.742	.911	.500	.917	.841	.894	.500	.000	.901	.364	.733	.717	.250	.819	

Washington Street and Broad Street
 Turning Movement Counts
 05/20/14 AM and PM

File Name : Washington_Broad AM+PM
 Site Code : 05201411
 Start Date : 5/20/2014
 Page No : 8



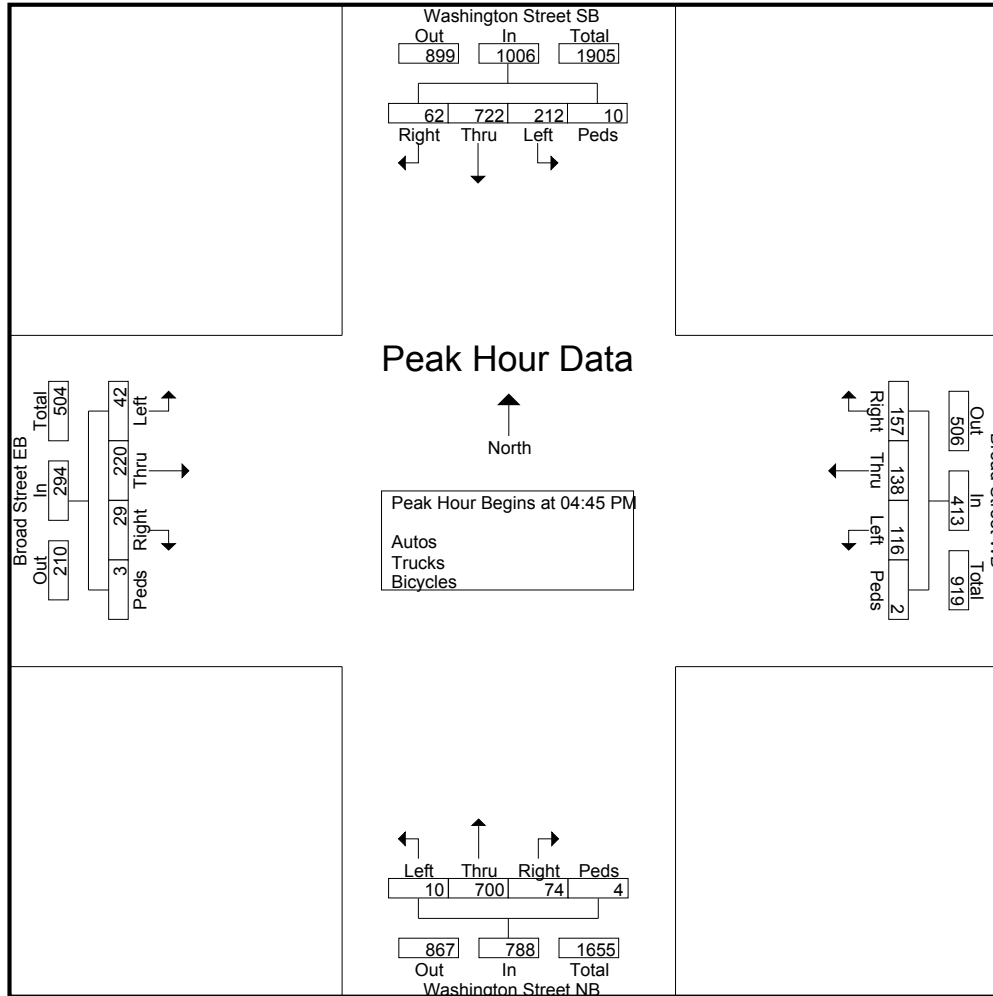
Washington Street and Broad Street
 Turning Movement Counts
 05/20/14 AM and PM

File Name : Washington_Broad AM+PM
 Site Code : 05201411
 Start Date : 5/20/2014
 Page No : 10

Start Time	Washington Street SB From North					Broad Street WB From East					Washington Street NB From South					Broad Street EB From West					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	15	182	44	3	244	38	39	26	0	103	17	185	1	1	204	6	51	13	1	71	622
05:00 PM	13	183	55	1	252	37	36	33	1	107	19	176	3	1	199	7	61	14	0	82	640
05:15 PM	15	175	60	4	254	46	26	34	1	107	19	166	4	1	190	10	57	7	1	75	626
05:30 PM	19	182	53	2	256	36	37	23	0	96	19	173	2	1	195	6	51	8	1	66	613
Total Volume	62	722	212	10	1006	157	138	116	2	413	74	700	10	4	788	29	220	42	3	294	2501
% App. Total	6.2	71.8	21.1	1		38	33.4	28.1	0.5		9.4	88.8	1.3	0.5		9.9	74.8	14.3	1		
PHF	.816	.986	.883	.625	.982	.853	.885	.853	.500	.965	.974	.946	.625	1.00	.966	.725	.902	.750	.750	.896	.977

Washington Street and Broad Street
 Turning Movement Counts
 05/20/14 AM and PM

File Name : Washington_Broad AM+PM
 Site Code : 05201411
 Start Date : 5/20/2014
 Page No : 11



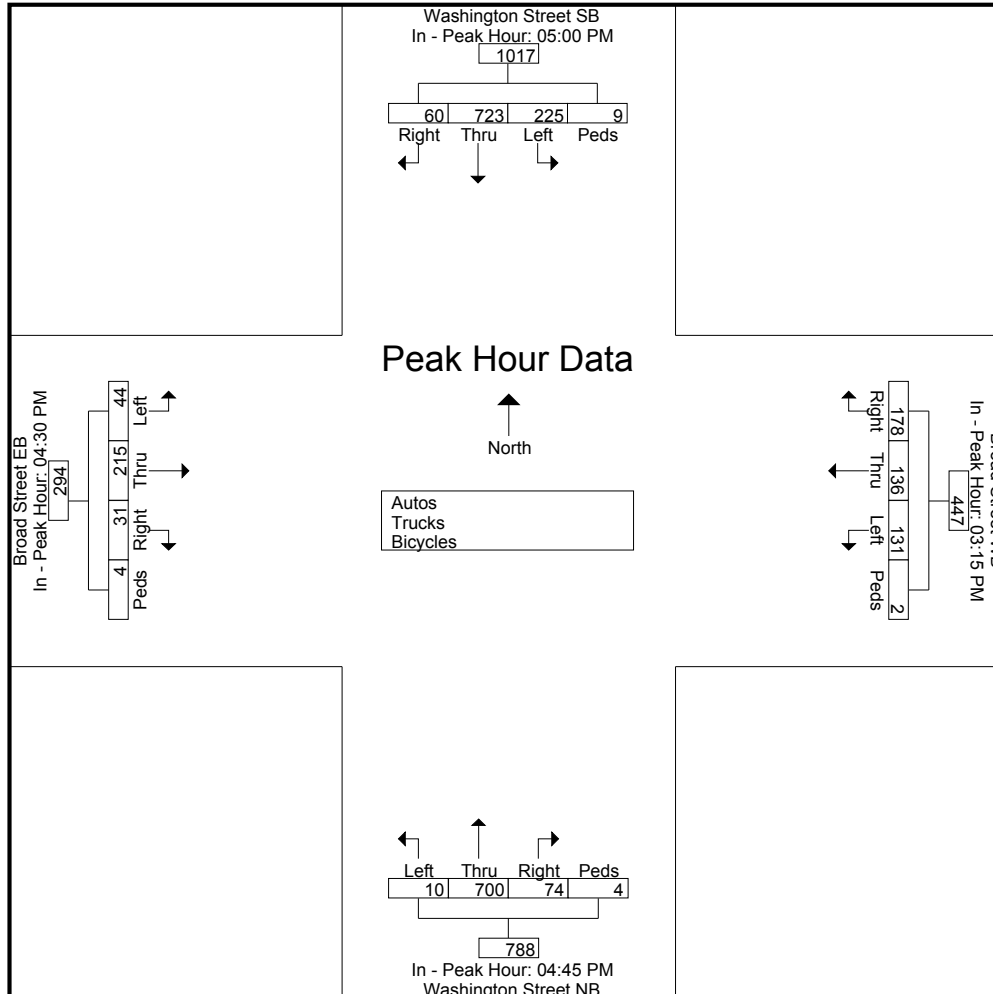
Washington Street and Broad Street
 Turning Movement Counts
 05/20/14 AM and PM

File Name : Washington_Broad AM+PM
 Site Code : 05201411
 Start Date : 5/20/2014
 Page No : 13

Start Time	Washington Street SB From North					Broad Street WB From East					Washington Street NB From South					Broad Street EB From West					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Each Approach Begins at:																					
	05:00 PM					03:15 PM					04:45 PM					04:30 PM					
+0 mins.	13	183	55	1	252	49	29	29	0	107	17	185	1	1	204	8	46	10	2	66	
+15 mins.	15	175	60	4	254	46	31	33	1	111	19	176	3	1	199	6	51	13	1	71	
+30 mins.	19	182	53	2	256	46	39	39	1	125	19	166	4	1	190	7	61	14	0	82	
+45 mins.	13	183	57	2	255	37	37	30	0	104	19	173	2	1	195	10	57	7	1	75	
Total Volume	60	723	225	9	1017	178	136	131	2	447	74	700	10	4	788	31	215	44	4	294	
% App. Total	5.9	71.1	22.1	0.9		39.8	30.4	29.3	0.4		9.4	88.8	1.3	0.5		10.5	73.1	15	1.4		
PHF	.789	.988	.938	.563	.993	.908	.872	.840	.500	.894	.974	.946	.625	1.000	.966	.775	.881	.786	.500	.896	

Washington Street and Broad Street
 Turning Movement Counts
 05/20/14 AM and PM

File Name : Washington_Broad AM+PM
 Site Code : 05201411
 Start Date : 5/20/2014
 Page No : 14



APPENDIX 7

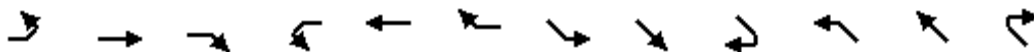
Crash Data

Crash Data
Washington Street and Broad Street Intersection

Crash ID	Crash Number	Crash Time	Crash Date	Crash Time1	Crash_Severity	Manner of Collision	Vehicle Travel Directions	Road Surface Condition	Ambient Light	Weather Condition	At Roadway Intersection	Non Motorist Type	Bike Ped	VehicleAction Prior to Crash
1	2484271	9:12 PM	01-May-2009	9:12 PM	Non-fatal injury	Angle	V1:Southbound / V2:Eastbound	Dry	Dark - lighted roadway	Clear	WASHINGTON STREET Rte 53 S / BROAD STREET			V1: Travelling straight ahead / V2:Travelling straight ahead
2	2484393	1:58 PM	12-May-2009	1:58 PM	Property damage only (non-fatal)	Angle	V1:Southbound / V2:Northbound	Dry	Daylight	Clear	WASHINGTON STREET / BROAD STREET			V1: Travelling straight ahead / V2:Turning left
3	2484427	1:20 PM	14-May-2009	1:20 PM	Non-fatal injury	Rear-end	V1:Northbound / V2:Northbound	Dry	Daylight	Clear				V1: Slowing or stopped in traffic / V2:Travelling straight ahead
4	2484423	7:28 PM	14-May-2009	7:28 PM	Property damage only (non-fatal)	Angle	V1:Southbound / V2:Northbound	Wet	Dusk	Cloudy/Rain	WASHINGTON STREET Rte 53 / BROAD STREET			V1: Travelling straight ahead / V2:Turning left
5	2504398	10:17 PM	23-Jun-2009	10:17 PM	Property damage only (non-fatal)	Sideswipe, same direction	V1:Southbound / V2:Southbound	Wet	Dark - lighted roadway	Cloudy/Rain				V1: Travelling straight ahead / V2:Travelling straight ahead
6	2541791	3:03 PM	10-Oct-2009	3:03 PM	Property damage only (non-fatal)	Rear-end	V1:Northbound / V2:Northbound	Dry	Daylight	Clear	WASHINGTON STREET Rte 53 / BROAD STREET			V1: Travelling straight ahead / V2:Slowing or stopped in traffic
7	2541973	8:29 AM	20-Oct-2009	8:29 AM	Property damage only (non-fatal)	Sideswipe, same direction	V1:Southbound / V2:Southbound	Dry	Daylight	Clear	BROAD STREET / WASHINGTON STREET			V1: Turning right / V2:Turning right
8	2546060	11:20 PM	27-Nov-2009	11:20 PM	Property damage only (non-fatal)	Angle	V1:Northbound / V2:Eastbound	Wet	Dark - lighted roadway	Rain	WASHINGTON STREET / BROAD STREET			V1: Travelling straight ahead / V2:Turning left
9	2551469	5:53 PM	08-Dec-2009	5:53 PM	Non-fatal injury	Angle	V1:Southbound / V2:Northbound	Dry	Dark - lighted roadway	Clear	WASHINGTON STREET / BROAD STREET			V1: Turning left / V2:Travelling straight ahead
10	2591289	9:07 AM	04-Feb-2010	9:07 AM	Property damage only (non-fatal)	Angle	V1:Westbound / V2:Northbound	Dry	Daylight	Clear	WASHINGTON STREET Rte 53 N / BROAD STREET			V1: Travelling straight ahead / V2:Travelling straight ahead
11	2570952	8:59 AM	29-Jan-2010	8:59 AM	Property damage only (non-fatal)	Angle	V1:Southbound / V2:Eastbound	Dry	Daylight	Clear	BROAD STREET / WASHINGTON STREET			V1: Travelling straight ahead / V2:Turning left
12	2571003	8:38 PM	03-Jan-2010	8:38 PM	Property damage only (non-fatal)	Angle	V1:Southbound / V2:Northbound	Snow	Dark - lighted roadway	Cloudy/Snow	WASHINGTON STREET / BROAD STREET			V1: Turning left / V2:Travelling straight ahead
13	2571033	11:14 PM	07-Jan-2010	11:14 PM	Non-fatal injury	Angle	V1:Northbound / V2:Southbound	Dry	Dark - lighted roadway	Cloudy	BROAD STREET / WASHINGTON STREET			V1: Turning right / V2:Slowing or stopped in traffic
14	2571297	7:29 AM	21-Jan-2010	7:29 AM	Non-fatal injury	Rear-end	V1:Northbound / V2:Northbound	Dry	Daylight	Clear				V1: Parked / V2:Travelling straight ahead
15	2570842	6:38 PM	24-Jan-2010	6:38 PM	Non-fatal injury	Rear-end	V1:Southbound / V2:Southbound	Dry	Dark - lighted roadway	Clear	WASHINGTON STREET / BROAD STREET			V1: Slowing or stopped in traffic / V2:Slowing or stopped in traffic
16	2590334	5:55 PM	07-Feb-2010	5:55 PM	Non-fatal injury	Rear-end	V1:Northbound / V2:Northbound	Dry	Dark - lighted roadway	Clear	WASHINGTON STREET / BROAD STREET			V1: Slowing or stopped in traffic / V2:Travelling straight ahead
17	2589594	5:54 PM	12-Feb-2010	5:54 PM	Property damage only (non-fatal)	Angle	V1:Northbound / V2:Eastbound	Dry	Dark - lighted roadway	Clear	WASHINGTON ST Rte 53 / BROAD ST			V1: Turning right / V2:Travelling straight ahead
18	2614905	2:50 PM	09-Apr-2010	2:50 PM	Non-fatal injury	Sideswipe, opposite direction	V1:Southbound / V2:Southbound / V3:Northbound	Wet	Daylight	Rain				V1: Slowing or stopped in traffic / V2:Slowing or stopped in traffic
19	2622725	1:43 PM	18-Jun-2010	1:43 PM	Property damage only (non-fatal)	Single vehicle crash	V1:Southbound / V2:Northbound	Dry	Daylight	Clear	WASHINGTON STREET / BROAD STREET			V1: Turning left / V2:Travelling straight ahead
20	2642984	7:37 PM	01-Jul-2010	7:37 PM	Non-fatal injury	Rear-end	V1:Southbound / V2:Southbound	Dry	Daylight	Clear				V1: Slowing or stopped in traffic / V2:Slowing or stopped in traffic
21	2643292	5:04 PM	03-Jul-2010	5:04 PM	Property damage only (non-fatal)	Angle	V1:Eastbound / V2:Southbound	Dry	Daylight	Clear	WASHINGTON STREET / BROAD STREET			V1: Travelling straight ahead / V2:Travelling straight ahead
22	2643012	11:33 PM	14-Jul-2010	11:33 PM	Property damage only (non-fatal)	Angle	V1:Northbound / V2:Northbound	Dry	Dark - lighted roadway	Cloudy	WASHINGTON ST / BROAD ST			V1: Travelling straight ahead / V2:Slowing or stopped in traffic
23	2662756	8:08 PM	23-Sep-2010	8:08 PM	Property damage only (non-fatal)	Sideswipe, same direction	V1:Southbound / V2:Southbound	Dry	Dark - lighted roadway	Cloudy	WASHINGTON ST / BROAD ST			V1: Slowing or stopped in traffic / V2:Travelling straight ahead
24	2715087	7:41 PM	03-Feb-2011	7:41 PM	Not Reported	Angle	V1:Not reported	Snow	Daylight	Snow				V1: Parked
25	2721716	8:03 AM	04-Mar-2011	8:03 AM	Property damage only (non-fatal)	Rear-end	V1:Southbound / V2:Southbound	Dry	Daylight	Clear	WASHINGTON ST / BROAD ST			V1: Slowing or stopped in traffic / V2:Travelling straight ahead
26	2737631	12:28 PM	08-May-2011	12:28 PM	Property damage only (non-fatal)	Rear-end	V1:Northbound / V2:Northbound	Dry	Daylight	Clear				V1: Travelling straight ahead / V2:Slowing or stopped in traffic
27	2739167	8:09 AM	06-Jun-2011	8:09 AM	Property damage only (non-fatal)	Rear-end	V1:Northbound / V2:Northbound	Dry	Daylight	Clear	BROAD STREET / WASHINGTON STREET			V1: Slowing or stopped in traffic / V2:Travelling straight ahead
28	2759595	1:53 AM	09-Aug-2011	1:53 AM	Unknown	Single vehicle crash	V1:Northbound	Dry	Dark - lighted roadway	Clear	WASHINGTON STREET / BROAD STREET			V1: Other
29	2759437	6:04 PM	11-Aug-2011	6:04 PM	Property damage only (non-fatal)	Sideswipe, same direction	V1:Southbound / V2:Southbound	Dry	Daylight	Clear	WASHINGTON ST Rte 53 S / BROAD ST			V1: Slowing or stopped in traffic / V2:Leaving traffic
30	2759473	4:09 PM	31-Aug-2011	4:09 PM	Property damage only (non-fatal)	Angle	V1:Westbound / V2:Eastbound	Dry	Daylight	Clear	WASHINGTON ST / BROAD ST			V1: Turning left / V2:Travelling straight ahead
31	2784389	5:21 PM	06-Sep-2011	5:21 PM	Property damage only (non-fatal)	Angle	V1:Southbound / V2:Eastbound / V3:Northbound	Wet	Daylight	Cloudy/Rain	WASHINGTON STREET / BROAD STREET			V1: Travelling straight ahead / V2:Slowing or stopped in traffic
32	3293754	10:19 AM	10-Oct-2012	10:19 AM	Non-fatal injury	Angle	V1:Eastbound	Wet	Daylight	Cloudy/Rain	BROAD ST / WASHINGTON ST Rte 53	Pedalcyclist	cyc	V1: Travelling straight ahead
33	3293845	7:10 AM	19-Oct-2012	7:10 AM	Non-fatal injury	Single vehicle crash	V1:Eastbound	Wet	Daylight	Cloudy				V1: Turning left
34	3302129	2:36 PM	09-Nov-2012	2:36 PM	Property damage only (non-fatal)	Single vehicle crash	V1:Westbound	Dry	Daylight	Clear		Pedestrian	ped	V1: Travelling straight ahead

APPENDIX 8

Level of Service Analysis

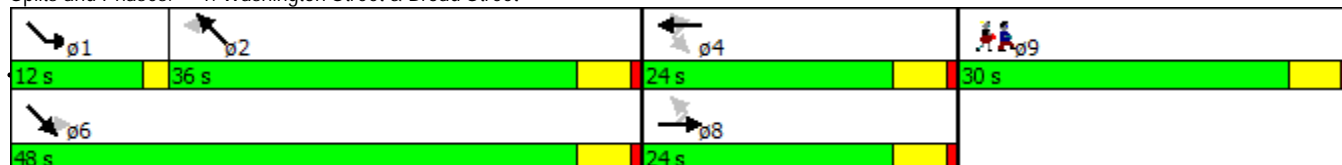


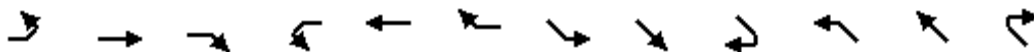
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↕			↕	↗		↕			↕	
Volume (vph)	45	130	20	95	205	240	115	280	55	10	690	40
Satd. Flow (prot)	0	1938	0	0	1821	1583	0	3292	0	0	3330	0
Flt Permitted		*0.605			*0.772			0.636			0.949	
Satd. Flow (perm)	0	1185	0	0	1428	1583	0	2122	0	0	3163	0
Satd. Flow (RTOR)												
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	3%	2%	0%	4%	2%	2%	4%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	201	0	0	309	247	0	465	0	0	762	0
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA		Perm	NA	
Protected Phases		8			4			1	6			2
Permitted Phases	8			4		4	6			2		
Total Split (s)	24.0	24.0		24.0	24.0	24.0	12.0	48.0		36.0	36.0	
Total Lost Time (s)		5.0			5.0	5.0		5.0			5.0	
Act Effct Green (s)		19.4			19.4	19.4		43.8			43.8	
Actuated g/C Ratio		0.25			0.25	0.25		0.56			0.56	
v/c Ratio		0.68			0.87	0.63		0.39			0.43	
Control Delay		42.8			55.9	36.9		12.8			12.6	
Queue Delay		0.0			0.0	0.0		0.0			0.0	
Total Delay		42.8			55.9	36.9		12.8			12.6	
LOS		D			E	D		B			B	
Approach Delay		42.8			47.5			12.8			12.6	
Approach LOS		D			D			B			B	
Queue Length 50th (ft)		79			129	95		50			84	
Queue Length 95th (ft)		#262			#404	#286		162			250	
Internal Link Dist (ft)		493			473			154			136	
Turn Bay Length (ft)						50						
Base Capacity (vph)		294			354	393		1194			1780	
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		0.68			0.87	0.63		0.39			0.43	

Intersection Summary

Cycle Length: 102
 Actuated Cycle Length: 77.8
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.87
 Intersection Signal Delay: 25.5
 Intersection LOS: C
 Intersection Capacity Utilization 76.7%
 ICU Level of Service D
 Analysis Period (min) 15
 * User Entered Value
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 1: Washington Street & Broad Street



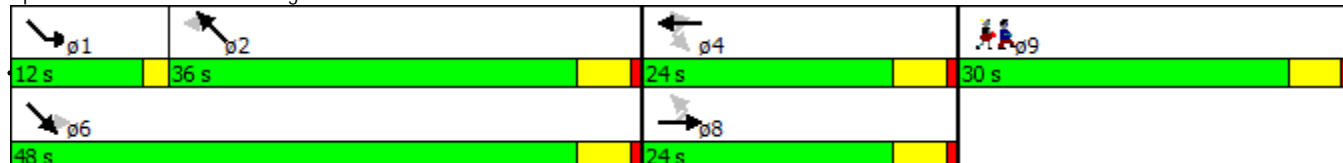


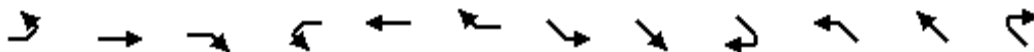
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↕			↕	↗		↕			↕	
Volume (vph)	45	220	30	120	140	160	215	725	65	10	700	75
Satd. Flow (prot)	0	1943	0	0	1810	1583	0	3317	0	0	3312	0
Flt Permitted		*0.781			*0.781			0.600			0.940	
Satd. Flow (perm)	0	1530	0	0	1447	1583	0	2012	0	0	3116	0
Satd. Flow (RTOR)												
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	3%	2%	0%	4%	2%	2%	4%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	301	0	0	265	163	0	1025	0	0	801	0
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA		Perm	NA	
Protected Phases		8			4			6			2	
Permitted Phases	8			4		4	6			2		
Total Split (s)	24.0	24.0		24.0	24.0	24.0	12.0	48.0		36.0	36.0	
Total Lost Time (s)		5.0			5.0	5.0		5.0			5.0	
Act Effct Green (s)		19.5			19.5	19.5		44.2			44.2	
Actuated g/C Ratio		0.23			0.23	0.23		0.53			0.53	
v/c Ratio		0.84			0.79	0.44		0.96			0.49	
Control Delay		56.6			51.8	35.5		43.8			16.5	
Queue Delay		0.0			0.0	0.0		0.0			0.0	
Total Delay		56.6			51.8	35.5		43.8			16.5	
LOS		E			D	D		D			B	
Approach Delay		56.6			45.6			43.8			16.5	
Approach LOS		E			D			D			B	
Queue Length 50th (ft)		122			106	59		175			91	
Queue Length 95th (ft)		#378			#333	163		#551			267	
Internal Link Dist (ft)		446			477			154			136	
Turn Bay Length (ft)						50						
Base Capacity (vph)		357			337	369		1063			1646	
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		0.84			0.79	0.44		0.96			0.49	

Intersection Summary

Cycle Length: 102
 Actuated Cycle Length: 83.6
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.96
 Intersection Signal Delay: 37.1
 Intersection LOS: D
 Intersection Capacity Utilization 96.9%
 ICU Level of Service F
 Analysis Period (min) 15
 * User Entered Value
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 1: Washington Street & Broad Street



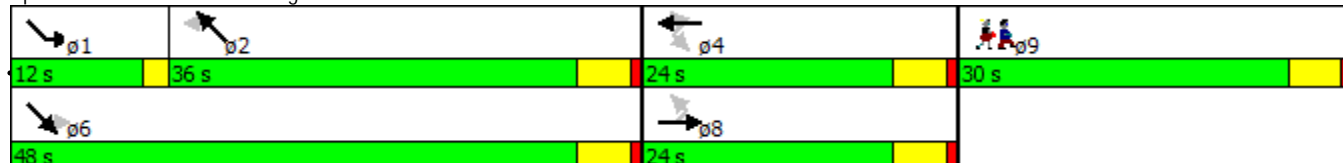


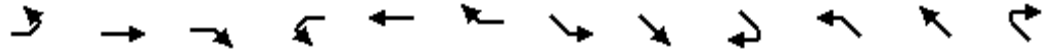
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↕			↕	↗		↕			↕	
Volume (vph)	45	130	20	95	205	240	115	280	55	10	690	40
Satd. Flow (prot)	0	1938	0	0	1821	1583	0	3292	0	0	3330	0
Flt Permitted		*0.605			*0.772			0.619			0.948	
Satd. Flow (perm)	0	1185	0	0	1428	1583	0	2065	0	0	3160	0
Satd. Flow (RTOR)												
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Growth Factor	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Heavy Vehicles (%)	2%	2%	2%	2%	3%	2%	0%	4%	2%	2%	4%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	212	0	0	325	260	0	487	0	0	801	0
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA		Perm	NA	
Protected Phases		8			4		1	6			2	
Permitted Phases	8			4		4	6			2		
Total Split (s)	24.0	24.0		24.0	24.0	24.0	12.0	48.0		36.0	36.0	
Total Lost Time (s)		5.0			5.0	5.0		5.0			5.0	
Act Effct Green (s)		19.4			19.4	19.4		43.8			43.8	
Actuated g/C Ratio		0.25			0.25	0.25		0.56			0.56	
v/c Ratio		0.72			0.92	0.66		0.42			0.45	
Control Delay		45.1			63.0	38.3		13.3			12.9	
Queue Delay		0.0			0.0	0.0		0.0			0.0	
Total Delay		45.1			63.0	38.3		13.3			12.9	
LOS		D			E	D		B			B	
Approach Delay		45.1			52.0			13.3			12.9	
Approach LOS		D			D			B			B	
Queue Length 50th (ft)		84			138	102		53			90	
Queue Length 95th (ft)		#281			#428	#306		173			266	
Internal Link Dist (ft)		493			473			154			136	
Turn Bay Length (ft)						50						
Base Capacity (vph)		294			354	393		1162			1779	
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		0.72			0.92	0.66		0.42			0.45	

Intersection Summary

Cycle Length: 102
 Actuated Cycle Length: 77.8
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.92
 Intersection Signal Delay: 27.2
 Intersection LOS: C
 Intersection Capacity Utilization 79.7%
 ICU Level of Service D
 Analysis Period (min) 15
 * User Entered Value
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 1: Washington Street & Broad Street



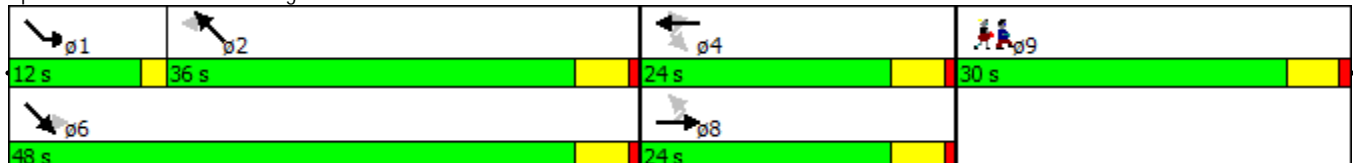


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↕			↕	↗		↕			↕	
Volume (vph)	45	220	30	120	140	160	215	725	65	10	700	75
Satd. Flow (prot)	0	1943	0	0	1810	1583	0	3317	0	0	3312	0
Flt Permitted		*0.781			*0.781			0.589			0.937	
Satd. Flow (perm)	0	1530	0	0	1447	1583	0	1975	0	0	3107	0
Satd. Flow (RTOR)												
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Growth Factor	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Heavy Vehicles (%)	2%	2%	2%	2%	3%	2%	0%	4%	2%	2%	4%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	316	0	0	279	171	0	1077	0	0	841	0
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA		Perm	NA	
Protected Phases		8			4			1			6	
Permitted Phases	8			4		4	6			2		
Total Split (s)	24.0	24.0		24.0	24.0	24.0	12.0	48.0		36.0	36.0	
Total Lost Time (s)		5.0			5.0	5.0		5.0			5.0	
Act Effct Green (s)		19.5			19.5	19.5		44.2			44.2	
Actuated g/C Ratio		0.23			0.23	0.23		0.53			0.53	
v/c Ratio		0.89			0.83	0.46		1.03			0.51	
Control Delay		61.9			55.7	36.0		60.2			16.9	
Queue Delay		0.0			0.0	0.0		0.0			0.0	
Total Delay		61.9			55.7	36.0		60.2			16.9	
LOS		E			E	D		E			B	
Approach Delay		61.9			48.2			60.2			16.9	
Approach LOS		E			D			E			B	
Queue Length 50th (ft)		130			113	63		199			96	
Queue Length 95th (ft)		#402			#354	171		#594			285	
Internal Link Dist (ft)		446			477			154			136	
Turn Bay Length (ft)						50						
Base Capacity (vph)		357			337	369		1043			1642	
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		0.89			0.83	0.46		1.03			0.51	

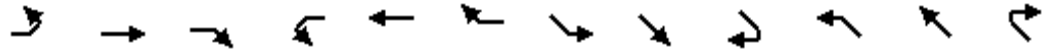
Intersection Summary

Cycle Length: 102
 Actuated Cycle Length: 83.6
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 1.03
 Intersection Signal Delay: 44.9
 Intersection LOS: D
 Intersection Capacity Utilization 101.0%
 ICU Level of Service G
 Analysis Period (min) 15
 * User Entered Value
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 1: Washington Street & Broad Street



2024 AM Retimed with Protected/Permissive Phase for Washington Street Southbound Left Turns

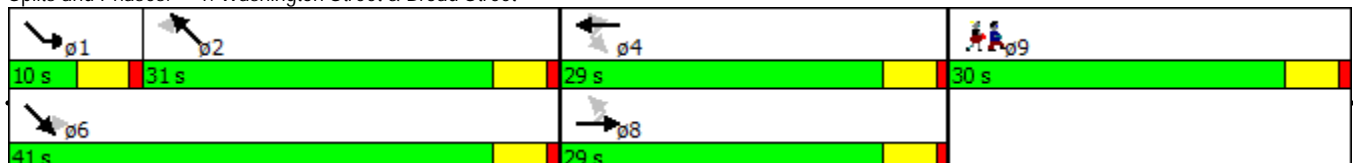


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↕			↕	↗	↗	↗	↗		↕	
Volume (vph)	45	130	20	95	205	240	115	280	55	10	690	40
Satd. Flow (prot)	0	1938	0	0	1821	1583	1745	1727	0	0	3330	0
Flt Permitted		0.787			0.806		0.165				0.949	
Satd. Flow (perm)	0	1542	0	0	1491	1583	303	1727	0	0	3163	0
Satd. Flow (RTOR)												
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Growth Factor	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Heavy Vehicles (%)	2%	2%	2%	2%	3%	2%	0%	4%	2%	2%	4%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	212	0	0	325	260	124	363	0	0	801	0
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA		Perm	NA	
Protected Phases		8			4		1	6			2	
Permitted Phases	8			4		4	6			2		
Total Split (s)	29.0	29.0		29.0	29.0	29.0	10.0	41.0		31.0	31.0	
Total Lost Time (s)		5.0			5.0	5.0	5.0	5.0			5.0	
Act Effct Green (s)		24.6			24.6	24.6	36.0	36.0			25.8	
Actuated g/C Ratio		0.33			0.33	0.33	0.48	0.48			0.34	
v/c Ratio		0.42			0.67	0.50	0.51	0.44			0.74	
Control Delay		25.9			33.1	27.5	24.0	17.5			28.9	
Queue Delay		0.0			0.0	0.0	0.0	0.0			0.0	
Total Delay		25.9			33.1	27.5	24.0	17.5			28.9	
LOS		C			C	C	C	B			C	
Approach Delay		25.9			30.6			19.1			28.9	
Approach LOS		C			C			B			C	
Queue Length 50th (ft)		68			116	86	26	89			148	
Queue Length 95th (ft)		196			#366	241	#118	280			#393	
Internal Link Dist (ft)		686			473			154			136	
Turn Bay Length (ft)						50						
Base Capacity (vph)		502			486	516	242	844			1117	
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		0.42			0.67	0.50	0.51	0.43			0.72	

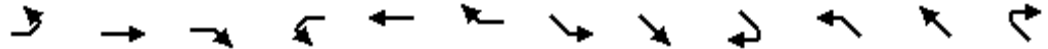
Intersection Summary

Cycle Length: 100
 Actuated Cycle Length: 75.3
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.74
 Intersection Signal Delay: 26.8
 Intersection LOS: C
 Intersection Capacity Utilization 85.2%
 ICU Level of Service E
 Analysis Period (min) 15
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 1: Washington Street & Broad Street



2024 PM Retimed with Protected/Permissive Phase for Washington Street Southbound Left Turns



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↕			↕	↗	↗	↗	↗		↕	
Volume (vph)	45	220	30	120	140	160	215	725	65	10	700	75
Satd. Flow (prot)	0	1943	0	0	1810	1583	1745	1748	0	0	3312	0
Flt Permitted		0.823			*0.630		0.182	*0.630			0.877	
Satd. Flow (perm)	0	1612	0	0	1167	1583	334	1101	0	0	2908	0
Satd. Flow (RTOR)												
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Growth Factor	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Heavy Vehicles (%)	2%	2%	2%	2%	3%	2%	0%	4%	2%	2%	4%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	48	236	32	129	150	171	230	777	70	11	750	80
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	316	0	0	279	171	230	847	0	0	841	0
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA		Perm	NA	
Protected Phases		8			4		1	6			2	
Permitted Phases	8			4		4	6			2		
Total Split (s)	26.0	26.0		26.0	26.0	26.0	10.0	44.0		34.0	34.0	
Total Lost Time (s)		5.0			5.0	5.0	4.0	5.0			5.0	
Act Effct Green (s)		21.4			21.4	21.4	40.8	39.8			29.6	
Actuated g/C Ratio		0.28			0.28	0.28	0.54	0.52			0.39	
v/c Ratio		0.70			0.85	0.38	0.79	0.93			0.74	
Control Delay		36.6			52.8	27.7	35.4	36.7			27.2	
Queue Delay		0.0			0.0	0.0	0.0	0.0			0.0	
Total Delay		36.6			52.8	27.7	35.4	36.7			27.2	
LOS		D			D	C	D	D			C	
Approach Delay		36.6			43.2			36.4			27.2	
Approach LOS		D			D			D			C	
Queue Length 50th (ft)		117			109	57	44	286			151	
Queue Length 95th (ft)		#364			#370	165	#256	#907			#415	
Internal Link Dist (ft)		436			474			165			126	
Turn Bay Length (ft)						50						
Base Capacity (vph)		454			329	446	292	915			1132	
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		0.70			0.85	0.38	0.79	0.93			0.74	

Intersection Summary

Cycle Length: 100

Actuated Cycle Length: 76

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.93

Intersection Signal Delay: 34.7

Intersection LOS: C

Intersection Capacity Utilization 115.4%

ICU Level of Service H

Analysis Period (min) 15

* User Entered Value

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

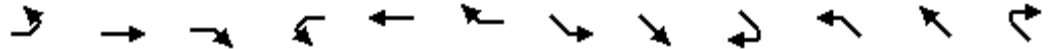
Queue shown is maximum after two cycles.

Splits and Phases: 1: Washington Street & Broad Street

10 s	34 s	26 s	30 s
44 s		26 s	

Washington Street and Broad Street
 2024 Build AM Retimed with Protected-Only Phase for Washington Street Southbound Left Turns

2/17/2015

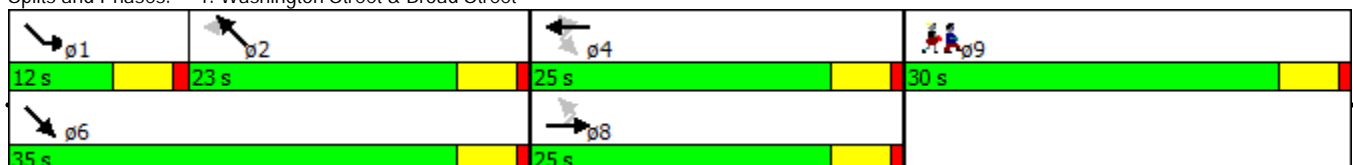


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↕			↕	↗	↗	↗	↗		↕	
Volume (vph)	45	130	20	95	205	240	115	280	55	10	690	40
Satd. Flow (prot)	0	1938	0	0	1821	1583	1745	1727	0	0	3330	0
Flt Permitted		0.776			0.806		0.950				0.948	
Satd. Flow (perm)	0	1520	0	0	1491	1583	1745	1727	0	0	3160	0
Satd. Flow (RTOR)												
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Growth Factor	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Heavy Vehicles (%)	2%	2%	2%	2%	3%	2%	0%	4%	2%	2%	4%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	212	0	0	325	260	124	363	0	0	801	0
Turn Type	Perm	NA		Perm	NA	Perm	Prot	NA		Perm	NA	
Protected Phases		8			4		1	6			2	
Permitted Phases	8			4		4				2		
Total Split (s)	25.0	25.0		25.0	25.0	25.0	12.0	35.0		23.0	23.0	
Total Lost Time (s)		5.0			5.0	5.0	5.0	5.0			5.0	
Act Effct Green (s)		20.5			20.5	20.5	7.2	30.8			18.5	
Actuated g/C Ratio		0.31			0.31	0.31	0.11	0.47			0.28	
v/c Ratio		0.45			0.70	0.53	0.66	0.45			0.91	
Control Delay		24.7			33.0	26.6	49.8	16.8			40.6	
Queue Delay		0.0			0.0	0.0	0.0	0.0			0.0	
Total Delay		24.7			33.0	26.6	49.8	16.8			40.6	
LOS		C			C	C	D	B			D	
Approach Delay		24.7			30.1			25.2			40.6	
Approach LOS		C			C			C			D	
Queue Length 50th (ft)		58			98	73	44	77			141	
Queue Length 95th (ft)		185			#354	#250	#177	267			#421	
Internal Link Dist (ft)		686			473			154			136	
Turn Bay Length (ft)						50						
Base Capacity (vph)		472			464	492	189	805			885	
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		0.45			0.70	0.53	0.66	0.45			0.91	

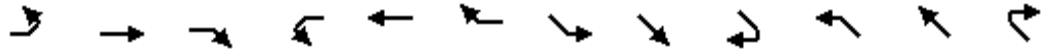
Intersection Summary

Cycle Length: 90
 Actuated Cycle Length: 66
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.91
 Intersection Signal Delay: 32.5
 Intersection LOS: C
 Intersection Capacity Utilization 85.2%
 ICU Level of Service E
 Analysis Period (min) 15
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 1: Washington Street & Broad Street



2024 PM Retimed with Protected-Only Phase for Washington Street Southbound Left Turns



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↕			↕	↗	↗	↗	↗		↕	
Volume (vph)	45	220	30	120	140	160	215	725	65	10	700	75
Satd. Flow (prot)	0	1943	0	0	1810	1583	1745	1748	0	0	3312	0
Flt Permitted		0.804			*0.630		0.950	*0.630			0.864	
Satd. Flow (perm)	0	1575	0	0	1167	1583	1745	1101	0	0	2864	0
Satd. Flow (RTOR)												
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Growth Factor	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Heavy Vehicles (%)	2%	2%	2%	2%	3%	2%	0%	4%	2%	2%	4%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	48	236	32	129	150	171	230	777	70	11	750	80
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	316	0	0	279	171	230	847	0	0	841	0
Turn Type	Perm	NA		Perm	NA	Perm	Prot	NA		Perm	NA	
Protected Phases		8			4		1	6			2	
Permitted Phases	8			4		4				2		
Total Split (s)	22.0	22.0		22.0	22.0	22.0	15.0	38.0		23.0	23.0	
Total Lost Time (s)		5.0			5.0	5.0	5.0	5.0			5.0	
Act Effct Green (s)		17.5			17.5	17.5	10.3	33.9			18.5	
Actuated g/C Ratio		0.27			0.27	0.27	0.16	0.51			0.28	
v/c Ratio		0.76			0.91	0.41	0.85	0.94			1.05	
Control Delay		39.0			60.8	26.4	58.8	38.5			72.2	
Queue Delay		0.0			0.0	0.0	0.0	0.0			0.0	
Total Delay		39.0			60.8	26.4	58.8	38.5			72.2	
LOS		D			E	C	E	D			E	
Approach Delay		39.0			47.8			42.9			72.2	
Approach LOS		D			D			D			E	
Queue Length 50th (ft)		102			94	49	81	240			156	
Queue Length 95th (ft)		#361			#356	156	#301	#854			#467	
Internal Link Dist (ft)		436			474			165			126	
Turn Bay Length (ft)						50						
Base Capacity (vph)		416			308	418	271	897			802	
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		0.76			0.91	0.41	0.85	0.94			1.05	

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 66

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.05

Intersection Signal Delay: 52.4

Intersection LOS: D

Intersection Capacity Utilization 115.4%

ICU Level of Service H

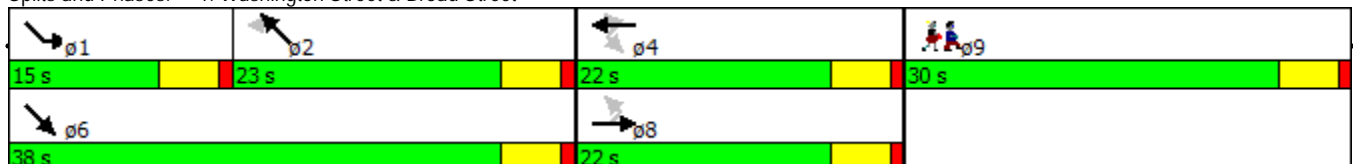
Analysis Period (min) 15

* User Entered Value

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

Queue shown is maximum after two cycles.

Splits and Phases: 1: Washington Street & Broad Street



APPENDIX E

**MassDOT Highway Division
Project Development Process**

Overview of the Project Development Process

Transportation decision making is complex and can be influenced by legislative mandates, environmental regulations, financial limitations, agency programmatic commitments, and partnering opportunities. Decision-makers and reviewing agencies, when consulted early and often throughout the project development process, can ensure that all participants understand the potential impact these factors can have on project implementation. Project development is the process that takes a transportation improvement from concept through construction.

The MassDOT Highway Division has developed a comprehensive project development process, which is contained in Chapter 2 of the *MassDOT Highway Division's Project Development and Design Guide*. The eight-step process covers a range of activities extending from identification of a project need, through completion of a set of finished contract plans, to construction of the project. The sequence of decisions made through the project development process progressively narrows the project focus and, ultimately, leads to a project that addresses the identified needs. The descriptions provided below are focused on the process for a highway project, but the same basic process will need to be followed for non-highway projects as well.

1. Needs Identification

For each of the locations at which an improvement is to be implemented, MassDOT leads an effort to define the problem, establishes project goals and objectives, and defines the scope of the planning needed for implementation. To that end, it has to complete a Project Need Form (PNF), which states in general terms the deficiencies or needs related to the transportation facility or location. The PNF documents the problems and explains why corrective action is needed. For this study, the information defining the need for the project will be drawn primarily, perhaps exclusively, from the present report. Also, at this point in the process, MassDOT meets with potential participants, such as the Metropolitan Planning Organization (MPO) and community members, to allow for an informal review of the project.

The PNF is reviewed by the MassDOT Highway Division district office whose jurisdiction includes the location of the proposed project. MassDOT also sends the PNF to the MPO, for informational purposes. The outcome of this step determines whether the project requires further planning, whether it is already well supported by prior planning studies, and, therefore, whether it is ready to move forward into the design phase, or whether it should be dismissed from further consideration.

2. Planning

This phase will likely not be required for the implementation of the improvements proposed in this planning study, as this planning report should constitute the outcome of this step. However, in general, the purpose of this implementation step is for the project

proponent to identify issues, impacts, and approvals that may need to be obtained, so that the subsequent design and permitting processes are understood.

The level of planning needed will vary widely, based on the complexity of the project. Typical tasks include: define the existing context, confirm project need, establish goals and objectives, initiate public outreach, define the project, collect data, develop and analyze alternatives, make recommendations, and provide documentation. Likely outcomes include consensus on the project definition to enable it to move forward into environmental documentation (if needed) and design, or a recommendation to delay the project or dismiss it from further consideration.

3. Project Initiation

At this point in the process, the proponent, MassDOT Highway Division, fills out a Project Initiation Form (PIF) for each improvement, which is reviewed by its Project Review Committee (PRC) and the MPO. The PRC is composed of the Chief Engineer, each District Highway Director, and representatives of the Project Management, Environmental, Planning, Right-of-Way, Traffic, and Bridge departments, and the MassDOT Federal Aid Program Office (FAPO). The PIF documents the project type and description, summarizes the project planning process, identifies likely funding and project management responsibility, and defines a plan for interagency and public participation. First the PRC reviews and evaluates the proposed project based on the MassDOT's statewide priorities and criteria. If the result is positive, MassDOT Highway Division moves the project forward to the design phase and to programming review by the MPO. The PRC may provide a Project Management Plan to define roles and responsibilities for subsequent steps. The MPO review includes project evaluation based on the MPO's regional priorities and criteria. The MPO may assign project evaluation criteria score, a Transportation Improvement Program (TIP) year, a tentative project category, and a tentative funding category.

4. Environmental Permitting, Design, and Right-of-Way Process

This step has four distinct but closely integrated elements: public outreach, environmental documentation and permitting (if required), design, and right-of-way acquisition (if required). The outcome of this step is a fully designed and permitted project ready for construction. However, a project does not have to be fully designed in order for the MPO to program it in the TIP. The sections below provide more detailed information on the four elements of this step of the project development process.

Public Outreach

Continued public outreach in the design and environmental process is essential to maintain public support for the project and to seek meaningful input on the design elements. The public outreach is often in the form of required public hearings, but can

also include less formal dialogues with those interested in and affected by a proposed project.

Environmental Documentation and Permitting

The project proponent, in coordination with the Environmental Services section of the MassDOT Highway Division, will be responsible for identifying and complying with all applicable federal, state, and local environmental laws and requirements. This includes determining the appropriate project category for both the Massachusetts Environmental Protection Act (MEPA) and the National Environmental Protection Act (NEPA).

Environmental documentation and permitting is often completed in conjunction with the Preliminary Design phase described below.

Design

There are three major phases of design. The first is Preliminary Design, which is also referred to as the 25-percent submission. The major components of this phase include full survey of the project area, preparation of base plans, development of basic geometric layout, development of preliminary cost estimates, and submission of a functional design report. Preliminary Design, although not required to, is often completed in conjunction with the Environmental Documentation and Permitting. The next phase is Final Design, which is also referred to as the 75-percent and 100-percent submission. The major components of this phase include preparation of a subsurface exploratory plan (if required), coordination of utility relocations, development of traffic management plans through construction zones, development of final cost estimates, and refinement and finalization of the construction plans. Once Final Design is complete, a full set of Plans, Specifications, and Estimates (PS&E) is developed for the project.

Right-of-Way Acquisition

A separate set of Right-of-Way plans are required for any project that requires land acquisition or easements. The plans must identify the existing and proposed layout lines, easements, property lines, names of property owners, and the dimensions and areas of estimated takings and easements.

5. Programming (Identification of Funding)

Programming, which typically begins during the design phase, can actually occur at any time during the process, from planning to design. In this step, which is distinct from project initiation, the proponent requests that the MPO place the project in the region's Transportation Improvement Program (TIP). The proponent requesting the project's listing on the TIP can be the community or it can be one of the MPO member agencies (the Regional Planning Agency, MassDOT, and the Regional Transit Authority). The MPO then considers the project in terms of state and regional needs, evaluation criteria,

and compliance with the regional Transportation Plan and decides whether to place it in the draft TIP for public review and then in the final TIP.

6. Procurement

Following project design and programming of a highway project, the MassDOT Highway Division publishes a request for proposals. It then reviews the bids and awards the contract to the qualified bidder with the lowest bid.

7. Construction

After a construction contract is awarded, MassDOT Highway Division and the contractor develop a public participation plan and a management plan for the construction process.

8. Project Assessment

The purpose of this step is to receive constituents' comments on the project development process and the project's design elements. MassDOT Highway Division can apply what is learned in this process to future projects. Table 8 gives the schematic timetable of the project development process.

Project Development Schematic Timetable

Step	Schedule Influence	Typical Duration
<p>Step I: Problem/Need/Opportunity Identification</p> <p>The proponent completes a PNF. This form is reviewed by the MassDOT district office, which guides the proponent in subsequent steps of the process.</p>	<p>The PNF may be prepared quickly by the proponent to include any readily available supporting data. The district office will return comments to the proponent within one month of receiving the PNF.</p>	<p>One-to-three months</p>
<p>Step II: Planning</p> <p>Project planning can range from agreeing on a clear solution to a detailed analysis of alternatives and their impacts.</p>	<p>For some projects, no planning beyond preparation of the PNF is required. Some projects require a planning study centered on specific issues associated with a proposed solution or a narrow family of alternatives. Complex projects likely would require a detailed alternatives analysis.</p>	<p>Project Planning Report: three-to-24+ months</p>
<p>Step III: Project Initiation</p> <p>The proponent prepares and submits a PIF and a TEC form. The MPO and MassDOT district office informally review the PIF and TEC; and the PRC formally reviews them.</p>	<p>The PIF includes refinement of the preliminary information contained in the PNF. Additional information summarizing the results of the planning process, such as the project planning report, is included with the PIF and TEC. The schedule is determined by PRC staff (depending on project complexity) and meeting schedule.</p>	<p>One-to-four months</p>
<p>Step IV: Design, Environmental, and Right-of-Way</p> <p>The proponent completes the project design. Concurrently, the proponent completes necessary environmental permitting analyses and files permit applications. Any right-of-way needed for the project is identified and the acquisition process begins.</p>	<p>The schedule depends upon the size of the project and the complexity of the design, permitting, and right-of-way issues. The MassDOT district and appropriate sections complete the design review.</p>	<p>Three- to-48+ months</p>
<p>Step V: Programming</p> <p>The MPO considers the project in terms of its regional priorities and determines whether to include the project in the draft TIP, which is made available for public comment, and includes a project description and funding source.</p>	<p>The schedule for this step is subject to each MPO's programming cycle and meeting schedule. It is possible that the MPO will not include a project in its draft TIP based on its review and approval procedures.</p>	<p>Three-to-12+ months</p>

Step	Schedule Influence	Typical Duration
<p>Step VI: Procurement</p> <p>The project is advertised for construction and a contract is awarded.</p>	<p>Administration of competing projects can influence the advertising schedule.</p>	<p>One-to-12 months</p>
<p>Step VII: Construction</p> <p>The construction process is initiated including public notification and any anticipated public involvement. Construction continues to project completion.</p>	<p>The duration of this step is entirely dependent upon project complexity and phasing.</p>	<p>Three-to-60+ months</p>
<p>Step VIII: Project Assessment</p> <p>The construction period is complete and project elements and processes are evaluated on a voluntary basis.</p>	<p>The duration of this step is dependent upon the proponent's approach and any required follow-up.</p>	<p>One month</p>

Source: MassDOT Highway Division Project Development and Design Guide.